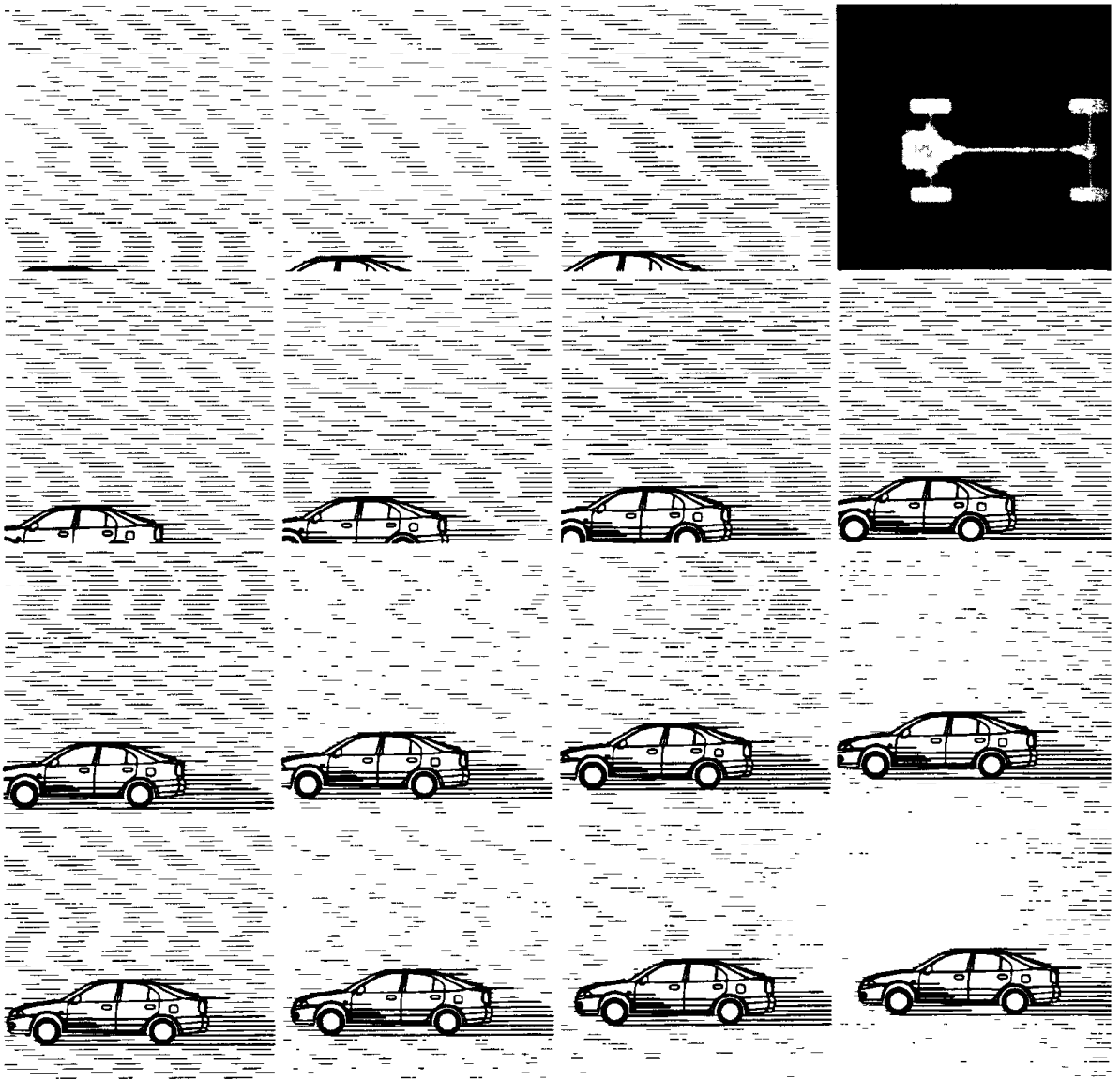




Workshop Manual

chassis SUPPLEMENT

CARISMA '97



Pub. No. PWDE9502-A

CARISMA

WORKSHOP MANUAL SUPPLEMENT

FOREWORD

This manual outlines changes in servicing procedures related to the chassis including vehicle inspections, adjustments and improvements in the newly equipped models. Use the following manuals in combination with this manual as required.

TECHNICAL INFORMATION MANUAL	PYGE95E1 PYGE95E1-A (Supplement)
WORKSHOP MANUAL	
ENGINE GROUP	PWEE□□□□ (Looseleaf edition)
CHASSIS GROUP	PWDE9502
ELECTRICAL WIRING	PHDE9501 PHDE9501-A (Supplement)
BODY REPAIR MANUAL	PBGE95E1 PBGE95E1-A (Supplement)
PARTS CATALOGUE	N606C006D□

All information, illustrations and product descriptions contained in this manual are current as at the time of publication. We, however, reserve the right to make changes at any time without prior notice or obligation.



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GENERAL

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HOW TO USE THIS MANUAL

MODEL INDICATIONS

The following abbreviations are used in this manual for classification of model types.

1600: Indicates models equipped with the 1,597 mℓ <4G92> petrol engine.

1800: Indicates models equipped with the 1,834 mℓ <4G93> petrol engine.

1900D: Indicates models equipped with the 1,870 mℓ <F8QT> diesel engine.

MPI: Indicates the multipoint injection, or engines equipped with the multipoint injection.

SOHC: Indicates an engine with the single overhead camshaft, or a model equipped with such an engine.

DOHC: Indicates an engine with the double overhead camshaft, or a model equipped with such an engine.

M/T: Indicates the manual transmission, or models equipped with the manual transmission.

A/T: Indicates the automatic transmission, or models equipped with the automatic transmission.

A/C: Indicates the air conditioner.

ECU: Indicates the electronic control unit.

VEHICLE IDENTIFICATION

MODELS

<HATCHBACK>

Model code		Engine model	Transmission model	Fuel supply system
DA1A	LNDEL6/R6	4G92-SOHC (1,597 ml)	F5MR1 (2WD-5M/T)	MPI
	LNDEL6/R6			
	LRDEL6/R6		F4A41 (2WD-4A/T)	
	LNJEL6/R6		F5MR1 (2WD-5M/T)	
	LRJEL6/R6		F4A41 (2WD-4A/T)	
DA2A	LNJEL6/R6	4G93-SOHC (1,834 ml)	F5MR2 (2WD-5M/T)	
	LRJEL6/R6		F4A42 (2WD-4A/T)	
	LNPEL6/R6		F5MR2 (2WD-5M/T)	
	LRPEL6/R6		F4A42 (2WD-4A/T)	
	LNGML6	4G93-DOHC (1,834 ml)	F5MR2 (2WD-5M/T)	
DA4A	LNDFL6/R6	F8QT (1,870 ml)	F5MR3 (2WD-5M/T)	Fuel injection pump
	LNJFL6/R6			
	LNPFL6/R6			

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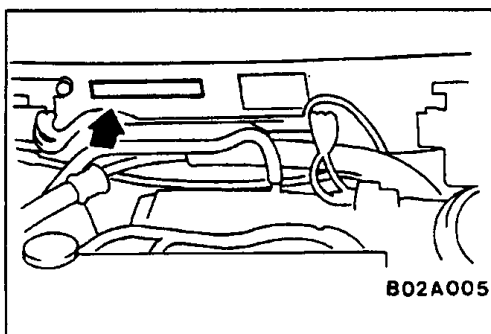
Model code		Engine model	Transmission model	Fuel supply system
DA1A	SNMEL6/R6	4G92-SOHC (1,597 ml)	F5MR1 (2WD-5M/T)	MPI
	SNMVL6B			
	SNDEL6/R6			
	SNDVL6B			
	SRDEL6/R6		F4A41 (2WD-4A/T)	
	SRDVL6B			
	SNJEL6/R6		F5MR1 (2WD-5M/T)	
	SNJVL6B			
	SRJEL6/R6		F4A41 (2WD-4A/T)	
	SRJVL6B			
DA2A	SNJEL6/R6	4G93-SOHC (1,834 ml)	F5MR2 (2WD-5M/T)	
	SRJEL6/R6		F4A42 (2WD-4A/T)	
	SNPEL6/R6		F5MR2 (2WD-5M/T)	
	SRPEL6/R6		F4A42 (2WD-4A/T)	
	SNGML6	4G93-DOHC (1,834 ml)	F5MR2 (2WD-5M/T)	
DA4A	SNDFL6/R6	F8QT (1,870 ml)	F5MR3 (2WD-5M/T)	Fuel injection pump
	SNJFL6/R6			
	SNPFL6/R6			

D	A	1	A	L	N	J	E	L	6
1	2	3	4	5	6	7	8	9	

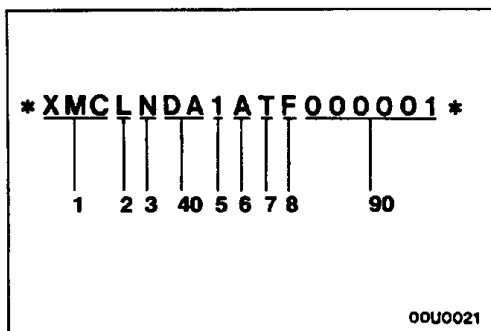
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MODEL CODE

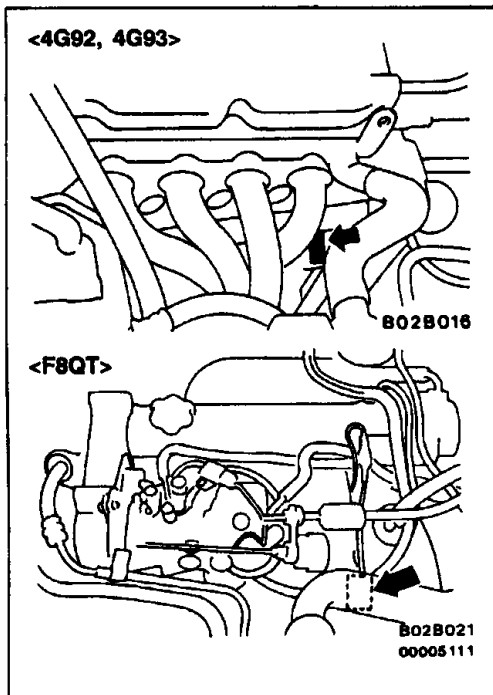
No.	Items	Contents
1	Development	DA: MITSUBISHI CARISMA
2	Engine type	1: 1,597 ml petrol engine
		2: 1,834 ml petrol engine
		4: 1,870 ml diesel engine
3	Sort	A: Passenger car
4	Body style	S: 4-door sedan
		L: 5-door hatchback
5	Transmission type	N: 5-speed manual transmission
		R: 4-speed automatic transmission
6	Trim level	M: EL
		D: GL
		J: GLX
		P: GLS
		G: MSX
7	Specified engine feature	E or V: MPI-SOHC
		M: MPI-DOHC
		F: Turbocharger with intercooler
8	Steering wheel location	L: Left hand
		R: Right hand
9	Destination	6: For Europe

**CHASSIS NUMBER**

The chassis number is stamped on the toeboard inside the engine compartment.



No.	Items		Contents
1	Steering wheel location	XMC	Left hand drive
		XMD	Right hand drive
2	Body style	S	4-door sedan
		L	5-door hatchback
3	Transmission type	N	5-speed manual transmission
		R	4-speed automatic transmission
4	Vehicle line	DA	CARISMA
5	Development order	1	1,597 ml petrol engine
		2	1,834 ml petrol engine
		4	1,870 ml diesel engine
6	Sort	A	Passenger car
7	Model year	V	1997
8	Factory code	F	Netherlands Car B.V.
9	Serial number	-	-

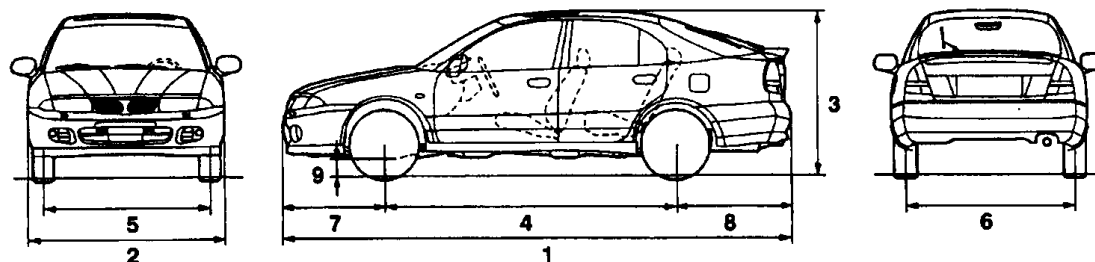
**ENGINE MODEL NUMBER**

The engine model number is stamped at the cylinder block as shown in the following.

Engine model	Engine displacement
4G92	1,597
4G93	1,834
F8QT	1,870

MAJOR SPECIFICATIONS

HATCHBACK



00U0005

<DA1A>

Items			DA1A LNMEL6, LNMER6	DA1A LNDEL6, LNDER6	DA1A LRDEL6, LRDER6	DA1A LNJEL6, LNJER6	DA1A LRJEL6, LRJER6
Vehicle dimensions mm	Overall length	1	4,435	4,435	4,435	4,435	4,435
	Overall width	2	1,695	1,695	1,695	1,695	1,695
	Overall height (unladen)	3	1,405	1,405	1,405	1,405	1,405
	Wheelbase	4	2,550	2,550	2,550	2,550	2,550
	Track-front	5	1,455	1,455	1,455	1,455	1,455
	Track-rear	6	1,475	1,475	1,475	1,475	1,475
	Overhang-front	7	880	880	880	880	880
	Overhang-rear	8	1,005	1,005	1,005	1,005	1,005
	Ground clearance (unladen)	9	155	155	150	155	150
Vehicle weight kg	Kerb weight		1,105	1,105	1,135	1,110	1,140
	Max. gross vehicle weight rating		1,630	1,630	1,660	1,630	1,660
	Max. axle weight rating-front		900	900	900	900	900
	Max. axle weight rating-rear		865	865	865	865	865
Seating capacity			5				
Engine	Model No.		4G92				
	Total displacement ml		1,597				
Transmis- sion	Model No.		F5MR1		F4A41	F5MR1	F4A41
	Type		5-speed manual		4-speed automatic	5-speed manual	4-speed automatic
Fuel system	Fuel supply system		Electronic control multipoint fuel injection				

<DA2A, DA4A>

Items			DA2A LNJEL6, LNJER6	DA2A LRJEL6, LRJER6	DA2A LNPEL6, LNPER6	DA2A LRPEL6, LRPER6	DA2A LNGML6	DA4A LNDFL6, LNDFR6	DA4A LNJFL6, LNJFR6	DA4A LNPFL6, LNPFR6
Vehicle dimen- sions mm	Overall length	1	4,435	4,435	4,435	4,435	4,435	4,445	4,445	4,445
	Overall width	2	1,695	1,695	1,695	1,695	1,695	1,695	1,695	1,695
	Overall height (unladen)	3	1,405	1,405	1,405	1,405	1,405	1,405	1,405	1,405
	Wheelbase	4	2,550	2,550	2,550	2,550	2,550	2,550	2,550	2,550
	Track-front	5	1,455	1,455	1,455	1,455	1,455	1,455	1,455	1,455
	Track-rear	6	1,475	1,475	1,475	1,475	1,475	1,475	1,475	1,475
	Overhang-front	7	880	880	880	880	880	890	890	890
	Overhang-rear	8	1,005	1,005	1,005	1,005	1,005	1,005	1,005	1,005
	Ground clearance (unladen)	9	155	150	155	150	155	155	155	155
Vehicle weight kg	Kerb weight		1,130	1,160	1,135	1,165	1,175	1,155	1,165	1,170
	Max. gross vehicle weight rating		1,660	1,690	1,660	1,690	1,685	1,695	1,695	1,695
	Max. axle weight rating-front		900	900	900	900	900	900	900	900
	Max. axle weight rating-rear		875	875	875	875	880	870	870	870
Seating capacity			5							
Engine	Model No.		4G93					F8QT		
	Total displacement m ³		1,834					1,870		
Trans- mission	Model No.		F5MR2	F4A42	F5MR2	F4A42	F5MR2	F5MR3		
	Type		5-speed manual	4-speed auto- matic	5-speed manual	4-speed auto- matic	5-speed manual	5-speed manual		
Fuel system	Fuel supply system		Electronic control multipoint fuel injection					Fuel injection pump		

Technical drawing of a car showing three views: front, side, and rear. The front view shows a width of 5 and a wheelbase of 2. The side view shows a wheelbase of 7, a total length of 4, and a rear wheel offset of 8. The rear view shows a width of 6. A height dimension of 3 is indicated on the side view.

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Items			DA1A SNMEL6, SNMER6	DA1A SNMVL6B	DA1A SNDEL6, SNDER6	DA1A SNDVL6B	DA1A SRDEL6, SRDER6	DA1A SRDVL6B
Vehicle dimensions mm	Overall length	1	4,435	4,435	4,435	4,435	4,435	4,435
	Overall width	2	1,695	1,695	1,695	1,695	1,695	1,695
	Overall height (unladen)	3	1,405	1,420	1,405	1,420	1,405	1,420
	Wheelbase	4	2,550	2,550	2,550	2,550	2,550	2,550
	Track-front	5	1,455	1,455	1,455	1,455	1,455	1,455
	Trakt-rear	6	1,475	1,475	1,475	1,475	1,475	1,475
	Overhang-front	7	880	880	880	880	880	880
	Overhang-rear	8	1,005	1,005	1,005	1,005	1,005	1,005
	Ground clearance (unladen)	9	155	170	155	170	150	165
Vehicle weight kg	Kerb weight		1,080	1,100	1,080	1,100	1,110	1,125
	Max. gross vehicle weight rating		1,610	1,610	1,610	1,610	1,640	1,640
	Max. axle weight rating-front		900	900	900	900	900	900
	Max. axle weight rating-rear		840	840	840	840	840	840
Seating capacity			5					
Engine	Model No.	4G92						
	Total displacement ml	1,597						
Transmis- sion	Model No.	F5MR1					F4A41	
	Type	5-speed manual					4-speed automatic	
Fuel system	Fuel supply system	Electronic control multipoint fuel injection						

Items			DA1A SNJEL6, SNJER6	DA1A SNJVL6B	DA1A SRJEL6, SRJER6	DA1A SRJVL6B
Vehicle dimensions mm	Overall length	1	4,435	4,435	4,435	4,435
	Overall width	2	1,695	1,695	1,695	1,695
	Overall height (unladen)	3	1,405	1,420	1,405	1,420
	Wheelbase	4	2,550	2,550	2,550	2,550
	Track-front	5	1,455	1,455	1,455	1,455
	Track-rear	6	1,475	1,475	1,475	1,475
	Overhang-front	7	880	880	880	880
	Overhang-rear	8	1,005	1,005	1,005	1,005
	Ground clearance (unladen)	9	155	170	150	165
Vehicle weight kg	Kerb weight		1,090	1,110	1,120	1,140
	Max. gross vehicle weight rating		1,610	1,610	1,640	1,640
	Max. axle weight rating-front		900	900	900	900
	Max. axle weight rating-rear		840	840	840	840
Seating capacity			5			
Engine	Model No.		4G92			
	Total displacement ml		1,597			
Transmis- sion	Model No.		F5MR1		F4A41	
	Type		5-speed manual		4-speed automatic	
Fuel system	Fuel supply system		Electronic control multipoint fuel injection			

<DA2A, DA4A>

Items			DA2A SNJEL6, SNJER6	DA2A SRJEL6, SRJER6	DA2A SNPEL6, SNPER6	DA2A SRPEL6, SRPER6	DA2A SNGML6	DA4A SNDFL6, SNDFR6	DA4A SNJFL6, SNJFR6	DA4A SNPFL6, SNPFR6
Vehicle dimen- sions mm	Overall length	1	4,435	4,435	4,435	4,435	4,435	4,445	4,445	4,445
	Overall width	2	1,695	1,695	1,695	1,695	1,695	1,695	1,695	1,695
	Overall height (unladen)	3	1,405	1,405	1,405	1,405	1,405	1,405	1,405	1,405
	Wheelbase	4	2,550	2,550	2,550	2,550	2,550	2,550	2,550	2,550
	Track-front	5	1,455	1,455	1,455	1,455	1,455	1,455	1,455	1,455
	Track-rear	6	1,475	1,475	1,475	1,475	1,475	1,475	1,475	1,475
	Overhang-front	7	880	880	880	880	880	890	890	890
	Overhang-rear	8	1,005	1,005	1,005	1,005	1,005	1,005	1,005	1,005
	Ground clearance (unladen)	9	155	150	155	150	155	155	155	155
Vehicle weight kg	Kerb weight		1,110	1,140	1,115	1,145	1,155	1,130	1,145	1,150
	Max. gross vehicle weight rating		1,640	1,670	1,640	1,670	1,665	1,675	1,675	1,675
	Max. axle weight rating-front		900	900	900	900	900	900	900	900
	Max. axle weight rating-rear		850	850	850	850	855	845	845	845
Seating capacity			5							
Engine	Model No.		4G93					F8QT		
	Total displacement mℓ		1,834					1,870		
Trans- mission	Model No.		F5MR2	F4A42	F5MR2	F4A42	F5MR2	F5MR3		
	Type		5-speed manual	4-speed auto- matic	5-speed manual	4-speed auto- matic	5-speed manual	5-speed manual		
Fuel system	Fuel supply system		Electronic control multipoint fuel injection					Fuel injection pump		

ENGINE

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F8QT ENGINE	11B

4G9 ENGINE

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GENERAL**OUTLINE OF CHANGES**

- The 6B model specification has been added as one of the 4G92 engines.
 - The ignition timing for the SOHC engine has been changed.
 - The ignition timing adjustment connector has been abolished.
- The following service procedures have been added to correspond to the changes above.

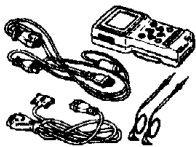
GENEAL INFORMATION

Items			4G92 (6B models)
Valve timing	Intake	Opening	14°
		Closing	58°
	Exhaust	Opening	52°
		Closing	16°

SERVICE SPECIFICATIONS

Items		Standard value
Basic ignition timing	SOHC	5° BTDC ± 3°
Idle speed r/min	4G92-SOHC (6B models)	800 ± 100

SPECIAL TOOL

Tool	Number	Name	Use
	MB991502	MUT-II sub assembly	• Basic ignition timing check • Idle speed check

ON-VEHICLE SERVICE

IGNITION TIMING CHECK AND ADJUSTMENT

1. Set the vehicle to the pre-inspection conditions.
2. Connect the MUT-II to the diagnosis connector.
3. Connect a timing light.
4. Start the engine and let it at idle.
5. Read out engine speed by using the MUT-II, and check that the idle speed is at approx. 750 r/min <4G92-SOHC> or approx. 800 r/min <4G92-SOHC (6B models), 4G93-SOHC, 4G93-DOHC>.
6. Select No. 17 (actuator test function) from the MUT-II items, and set ignition timing to the basic ignition timing.
7. Check the basic ignition timing.

Standard value: 5° BTDC ± 3°

8. If it is not within the standard value, check the MPI system by referring to GROUP 13A – Troubleshooting.
9. Press the clear key on the MUT-II to release the basic ignition timing set mode by means of the actuator test function.

Caution

If it can not be released, the basic Ignition timing set mode will continue for 27 minutes, causing the engine to be damaged.

10. Check that the ignition timing is at the standard value.

Standard value:

4G92-SOHC, 4G93-DOHC approx. 8° BTDC

4G93-SOHC approx. 10° BTDC

NOTE

The ignition timing may fluctuate within approx. ±7°. However, this is normal.

F8QT ENGINE

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Valve Clearance Check and Adjustment	8	TIMING BELT	30
Injection Timing Check and Adjustment	10	ENGINE ASSEMBLY	32
Idle Speed Check and Adjustment	12		
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GENERAL**OUTLINE OF CHANGES**

- The following service procedures have been added to correspond to the addition of the diesel-powered vehicle.

Applicable models: 1900D

1. On-vehicle Service
2. Removal and installation of the crankshaft pulley
3. Removal and installation of the camshaft and camshaft oil seal
4. Removal and installation of the oil pan
5. Removal and installation of the crankshaft oil seal
6. Removal and installation of the cylinder head gasket
7. Removal and installation of the timing belt
8. Removal and installation of the engine assembly

GENERAL INFORMATION

Items			Specification
Total displacement cm ³			1,870
Bore × Stroke mm			80 × 93
Compression ratio			21
Combustion chamber			Swirl chamber
Camshaft arrangement			SOHC
Number of valve	Intake		4
	Exhaust		4
Valve timing	Intake	Opening	0° BTDC
		Closing	18° ABDC
	Exhaust	Opening	41° BBDC
		Closing	0° ATDC
Fuel system			Distribution type injection pump

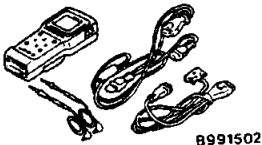
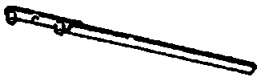
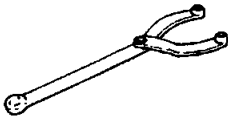
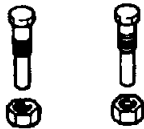
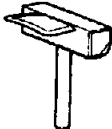
SERVICE SPECIFICATIONS

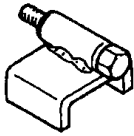
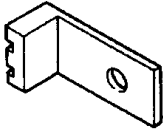
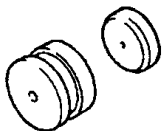
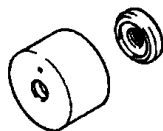
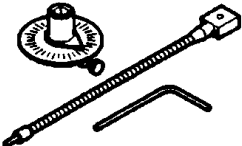
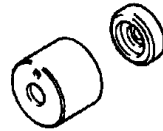
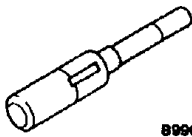
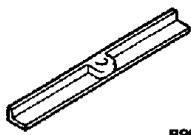
Items		Standard value	Limit
Alternator drive belt defection amount mm		When checked	3.5
		When a used belt is installed	3.0
		When a new belt is installed	2.0 – 3.0
Valve clearance (at cold) mm	When checking	Intake valve	0.15 – 0.25
		Exhaust valve	0.35 – 0.45
	When adjusting	Intake valve	0.20
		Exhaust valve	0.40
Idle speed r/min		825 ± 25	–
Idle up speed r/min		900 ± 50	–
Compression pressure (250 – 400 r/min) kPa		–	min. 2,000
Compression pressure difference of all cylinder kPa		–	max. 400

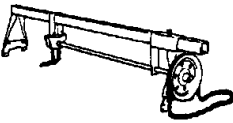
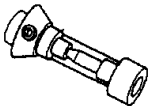
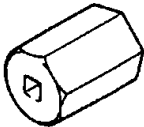
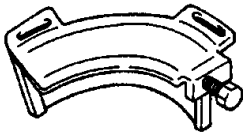
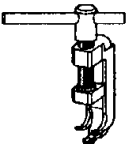
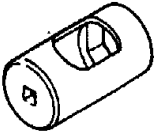
SEALANT

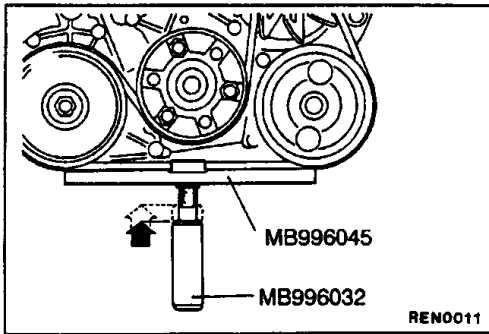
Item	Specified sealant	Remark
Oil pan	MITSUBISHI GENUINE PART MD970389 or equivalent	Semi-drying sealant
Cam cap (No.1 and No.5)		
Fly wheel bolt, Crankshaft pulley bolt	3M stud locking 4170 or equivalent	Anaerobic sealant

SPECIAL TOOLS

Tool	Number	Name	Use
 8991502	MB991502	MUT-II sub assembly	Checking of idle speed
	MD998747	Crankshaft pulley holder	Holding the crankshaft pulley
	MB990767	End yoke holder	Holding the camshaft sprocket
	MD998715 or MD998754	Crankshaft pulley holder pin	
	MD998727	Oil pan remover	Removal of oil pan
	MB996042	Oil seal installer	Installation of camshaft oil seal

Tool	Number	Name	Use
	MB996034	Sprocket stopper	Removal of intermediate shaft sprocket
	MB996015	Flywheel stopper	Locking the flywheel
	MB996038	Oil seal installer	Installation of the crankshaft rear oil seal
	MB996040	Oil seal installer	Installation of the crankshaft front oil seal
	MB991614	Angle gauge	Tightening of the cylinder head bolts
	MB996039	Oil seal installer	Installation of the intermediate shaft oil seal
 8996032	MB996032	Tension gauge	• Adjustment of drive belt tension • Adjustment of timing belt tension
 8996033	MB996033	Tension gauge	Adjustment of timing belt tension

Tool	Number	Name	Use
 Z203827	GENERAL SERVICE TOOL MZ203827	Engine lifter	Supporting the engine assembly during removal and installation of the transmission
 MB996030	MB996030	Measuring device adapter	Adjustment of injection timing
	MB996036	Hexagon socket	
 MB996037	MB996037	Sprocket adapter	
	MB996043	Sprocket stopper	
 MB996035	MB996035	Valve lifter	Adjustment of valve clearance
	MB996041	Special socket	Removal of fuel injector
 MB996045	MB996045	Tension gauge	Checking of drive belt tension



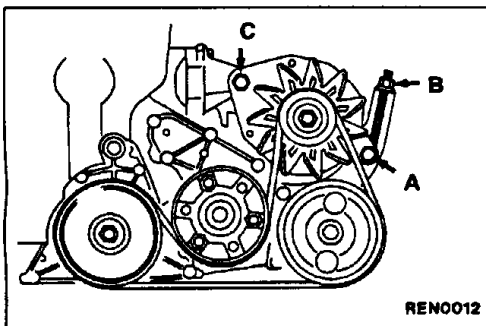
ON-VEHICLE SERVICE

DRIVE BELT TENSION CHECK AND ADJUSTMENT <ONLY VEHICLES WITH A/C>

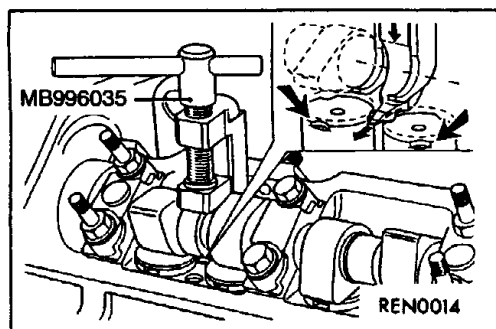
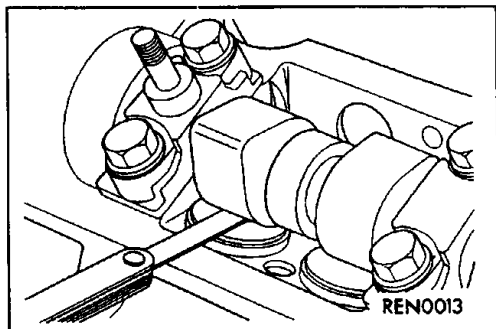
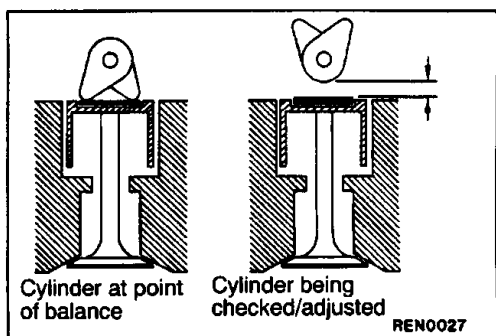
1. Fit special tools on the belt.
2. Slide the O-ring of the measuring tool under the graduated scale.
3. Locate the measuring tool and push it in as far as is shown in the drawing.
4. This position can also be felt (with the thumb) because the measuring pin is then flush with the top of the measuring tool.
5. Carefully remove the measuring tool and read off the belt tension (in mm).

Standard value:

Item	When checked	When a used belt is installed	When a new belt is installed
Tension mm	3.5	3.0	2.0 – 3.0



6. If the tension is not at the standard value, loosen the alternator mounting bolt and nut, and turn the adjusting nut to adjust the tension.
7. Tighten the alternator mounting bolt and nut.



VALVE CLEARANCE CHECK AND ADJUSTMENT

1. The valve clearances have to be checked/adjusted in the following sequence:

Cylinder at point of balance	Cylinder being checked/adjusted
1	4
2	3
3	2
4	1

2. Measure the valve clearance.

Standard value (cold engine):

Intake valve: 0.15 - 0.25 mm

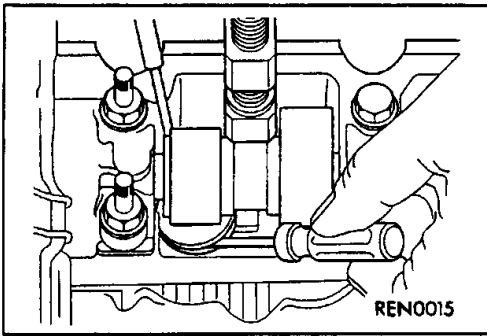
Exhaust valve: 0.35 - 0.45 mm

3. If the valve clearance is outside the standard value, adjust by replacing the tappet pads using the following procedure.

4. Unscrew the base of special tool a distance of 6 mm.
5. Turn the slots in the tappet to the correct position; see the illustration.
6. Position special tool with the base in the slots of the tappets and then push the tool forwards as far as possible.
7. Depress the tappets.

Caution

When changing tappet pads the piston must not be at TDC. The crankshaft must be turned on to bring it just past TDC, otherwise the valves may strike the piston when the tappets are depressed.



8. Use a small screwdriver to remove the tappet pad.
9. Select tappet pads which will bring the valve clearance to the standard value.

Standard value (cold engine):

Intake valve: 0.20 mm

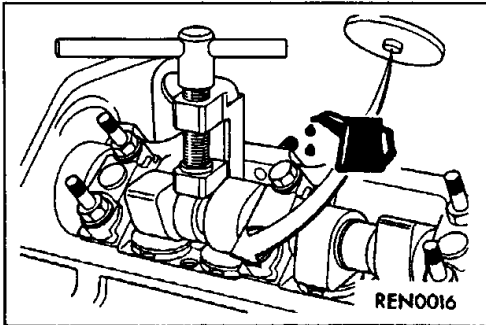
Exhaust valve: 0.40 mm

Example

If the measured valve clearance is 0.25 mm and the required valve clearance is 0.40 mm, then the old tappet pad must be replaced by a new pad which is 0.15 mm thinner.

NOTE

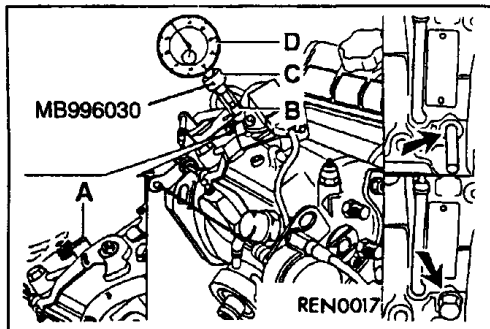
1. Measure the thickness of the tappet pad with a micrometer.
2. Always use new tappet pads.
3. Tappet pads are available in thicknesses from 3.25 mm to 4.25 mm, increasing by increments of 0.05 mm; and in thicknesses from 4.30 to 4.50 mm, increasing by increments of 0.10 mm.



10. The tappet pad must be lubricated with oil and installed with the projection facing towards the tappet.

INJECTION TIMING CHECK AND ADJUSTMENT

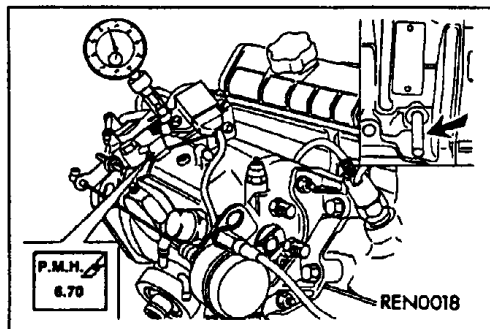
1. Turn the crankshaft clockwise to set the No.1 cylinder to top dead compression centre.
2. Turn the crankshaft 1 3/4 revolutions in its normal direction of rotation.
3. Remove the plug (A).



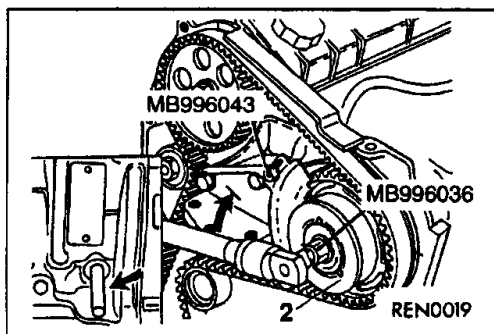
4. Fit special tool:
 - Locate the guide bush in the pump.
 - Slide the measuring pin (B), which is part of the special tool, into the guideway of the pump.
 - Locate and secure the holder (C).
 - Position the clock gauge (D) and make sure that the plunger is pressed in at least 0.2 mm. Secure the clock gauge and set it at zero.

NOTE

The measuring pin and guide bush can only be supplied and used as a set.



5. Turn the crankshaft in its normal direction of rotation until the clock gauge indicates approximately 5.00 mm.
6. Apply pressure on the locking pin and turn the crankshaft in its normal direction of rotation until the locking pin engages the recess in the crankshaft web.
7. Read off the value on the clock gauge.
8. The reference value for checking purposes is approximately 0.02 mm; this is shown on the pump control arm.
9. If the reference value is not obtained, the pump will have to be adjusted.

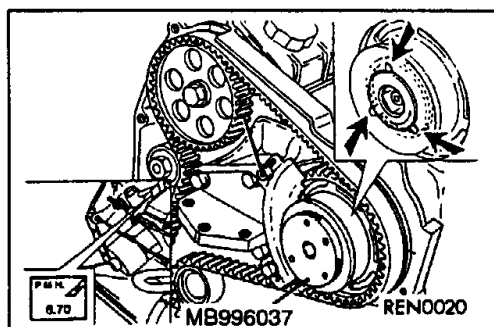


10. Locate special tool (sprocket stopper) between the pump bracket and the sprocket. Secure the tool with the bolt supplied with the set.
11. Insert special tool (hexagon socket) in the screwed sleeve and nut assembly. Back off (turning clockwise) the screwed sleeve and nut assembly one eighth of a turn. It should now be possible to move the flange (2).
12. Remove special tool (sprocket stopper), the locking pin and the clock gauge.

Caution

The plunger is not spring-mounted! When turning over the engine it is possible to break the clock gauge.

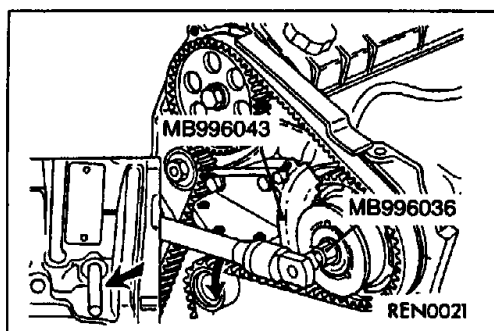
13. Turn the crankshaft 1 3/4 revolutions further, locate the clock gauge and make sure that the plunger is pressed in at least 0.2 mm. Check and adjust the injection timing.



14. Fit special tool in the three holes of the flange.
15. Turn the tool with the flange until the jaws of the tool engage the three internal recesses of the sprocket.
16. Turn the tool with the flange clockwise until the backlash in the pump is eliminated and then turn it to 0.5 mm below the adjustment reference value.
17. Now turn the tool with the flange counter-clockwise until the adjustment reference value is obtained as shown on the pump ± 0.02 mm.
18. Locate special tool (sprocket stopper) and secure it with the bolt supplied with the set.
19. Turn the bracket with the bolt (F) so that the bracket is free from play.

Caution

The pump sprocket must not be displaced (the pointer of the micrometer must not move).



20. Insert special tool (hexagon socket) in the screwed sleeve and nut assembly and tighten the assembly steadily (turning counter-clockwise) to the specified torque.
21. Remove special tool (sprocket stopper), the locking pin and the clock gauge.

22. Turn the crankshaft 1 3/4 revolutions further, locate the clock gauge and make sure that the plunger is pressed in at least 0.2 mm.
23. Check the injection timing.
24. Remove special tool together with the clock gauge and measuring pin. Fit the plug with a new O-ring.
25. Tighten the plug to the specified torque.

Specified torque: 10 Nm

26. Remove the locking pin and fit the plug with a new sealing washer.
27. Tighten the plug to the specified torque.

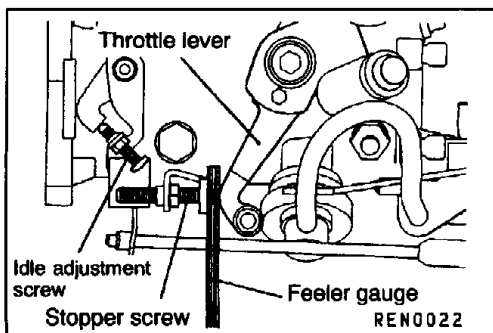
Specified torque: 20 Nm

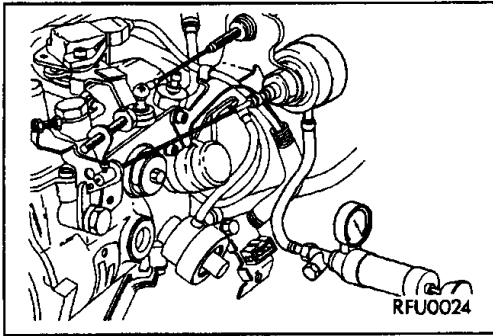
IDLE SPEED CHECK AND ADJUSTMENT

1. Before inspection, set the vehicle to the pre-inspection condition.
2. Connect the MUT-II to the diagnosis connector.
3. Check the idle speed.

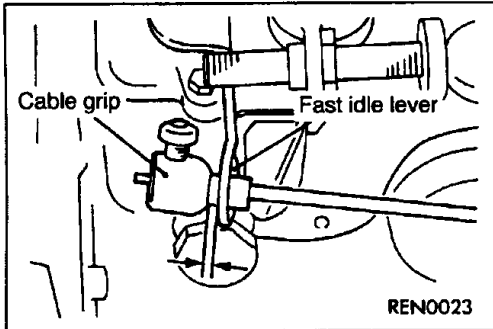
Standard value: 825 ± 25 r/min

4. If the idle speed is outside the standard value range, adjust by the following procedure.
5. Loosen the lock nut, and then turn the idle adjustment screw to adjust the idle speed to the standard value.
6. Tighten the lock nut to secure the idle adjustment screw.
7. Insert a feeler gauge with a thickness of 4 mm between the throttle elver and the stopper screw.
8. Check that the idle speed is at 1,250 ± 100 r/min. If the idle speed is outside this range, adjust by turning the stopper screw.
9. Tighten the lock nut to secure the stopper screw.
10. Remove the feeler gauge.
11. Check that the idle speed is within the standard value range. If the idle speed is outside the standard value range, repeat the adjustment procedure from step 5.
12. Disconnect the MUT-II.



**FAST IDLE SPEED CHECK AND ADJUSTMENT**

1. Disconnect the vacuum hose from idle up actuator.
2. Connect a hand vacuum pump to the idle up actuator nipple.
3. Connect the MUT-II to the diagnosis connector.
4. Start the engine and run at idle.
5. Check the idle speed and adjust necessary.
6. Stop the engine.



7. Adjust the clearance between the cable grip and the first idle lever so that it is at the standard value.

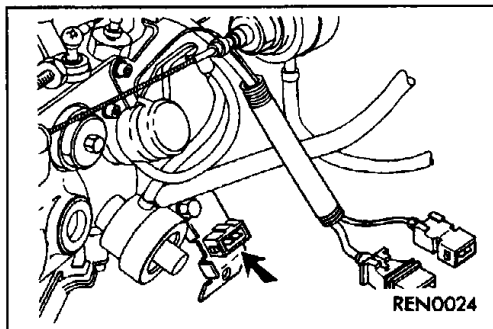
Standard value: 2 ± 1 mm

8. Start the engine and check the engine speed when negative pressure (27 kPa or more) is applied to the idle up actuator using the hand vacuum pump.

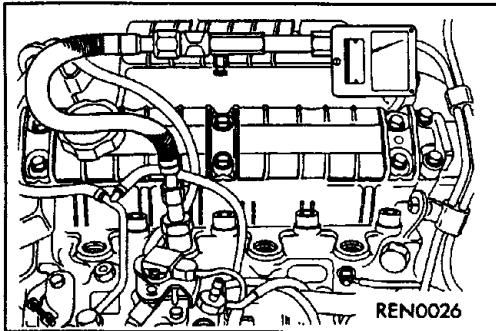
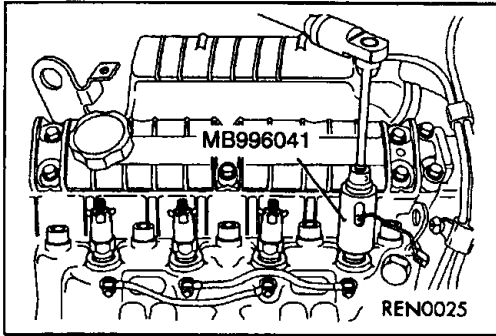
Standard value: 900 ± 50 r/min

NOTE

The fast idle speed valve cannot be directly adjusted; it is adjusted using an injection test bench.

**COMPRESSION PRESSURE CHECK**

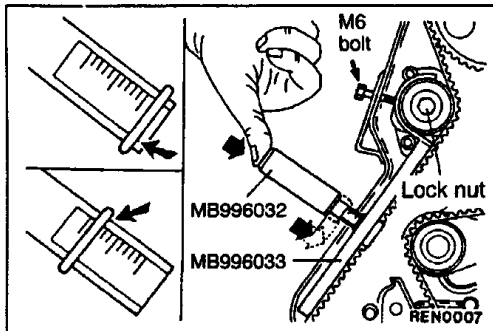
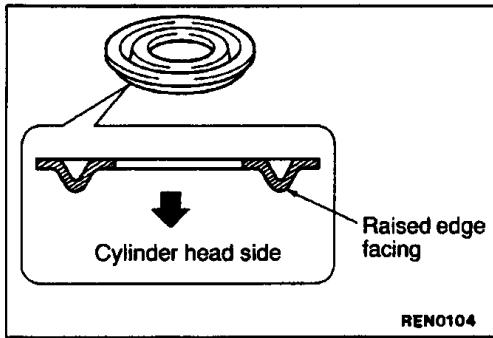
1. Before inspection, check that the engine oil, starter and battery are normal. In addition, set the vehicle to the pre-inspection condition.
2. Disconnect the fuel cut solenoid valve (immobilizer) connector.
3. Remove the fuel injection pipes. Plug all the connections.
4. Disconnect the needle lift sensor connector.
5. Remove the fuel return hoses and plug the connections.



6. Use the special tool to remove the injection nozzle.
7. Remove the heat shield.
8. Cover the injection nozzle holes with a rag etc., and after the engine has been cranked, check that no foreign material is adhering to the rag.

Caution

1. When you crank the engine, keep away from the injection nozzle mounting holes.
 2. If a compression measurement is performed with water, oil, fuel, etc. in the cylinder due to the cracks in the cylinders, these substances heated to a very high temperature will blow off the injection nozzle mounting holes and could be dangerous.
9. Install the heat shield and sealing ring to the cylinder head.
 10. Connect the compression gauge to the special tool.
 11. Crank the engine and measure the compression pressure.
- Limit: 2,000 kPa**
12. Measure the compression for all the cylinders, and check that the pressure differences of the cylinders are below the limit.
- Limit: Max. 400 kPa**
13. If there is a cylinder with compression or a compression difference that is outside the limit, pour a small amount of engine oil through the injection nozzle hole, and repeat the operations in steps 12 and 13.
 - (1) If the compression increases after oil is added, the cause of the malfunction is a worn or damaged piston ring and/or cylinder inner surface.
 - (2) If the compression does not rise after oil is added, the cause is a burnt or defective valve or pressure is leaking from the gasket.
 14. Remove the compression gauge.



15. Fit new heat shield in the cylinder head with the raised edge facing towards the swirl chamber.
16. Attach the special tool to the injection nozzle hole and tighten it to the specified torque.

Specified torque: 70 Nm

17. Install the fuel return hoses.
18. Connect the needle lift sensor connector.
19. Connect the fuel injection pipe.
20. Connect fuel cut solenoid valve (immobilizer) connector.
21. Erase the diagnosis code using the MUT-II if the engine warning lamp illuminate.

TIMING BELT TENSION ADJUSTMENT

1. Remove the timing belt cover.
2. Turn the crankshaft clockwise to set the No.1 cylinder to top dead compression centre.
3. Slacken the lock nut of the timing belt tensioner.
4. Fit the special tool on the timing belt and the timing belt tensioner.
5. Tension the timing belt with the aid of an M6 bolt.

Standard value: 7.5 mm

6. Tighten the lock nut to the specified torque.

Specified torque: 50 Nm

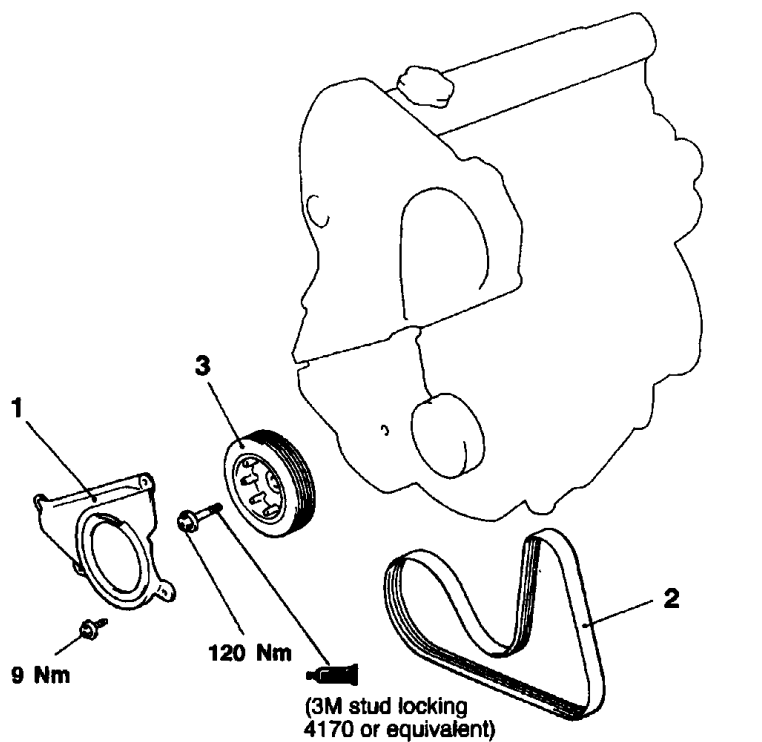
7. Install the timing belt cover.

CRANKSHAFT PULLEY**REMOVAL AND INSTALLATION****Pre-removal Operation**

- Under Cover Removal

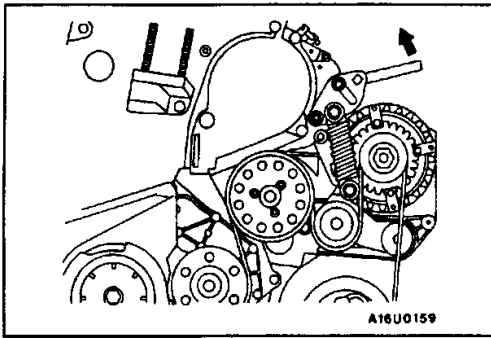
Post-installation Operation

- Drive Belt Tension Adjustment
- Under Cover Installation

**Removal steps**

1. Timing belt front cover C
2. Drive belt
3. Crankshaft pulley

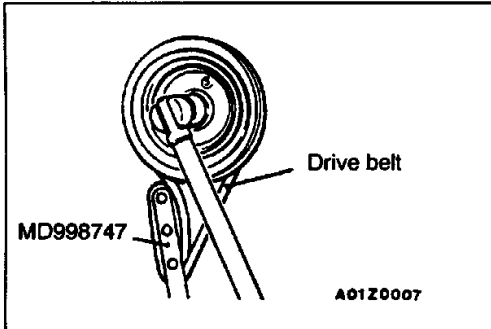




REMOVAL SERVICE POINTS

◀A▶ DRIVE BELT REMOVAL <Vehicles with A/C>

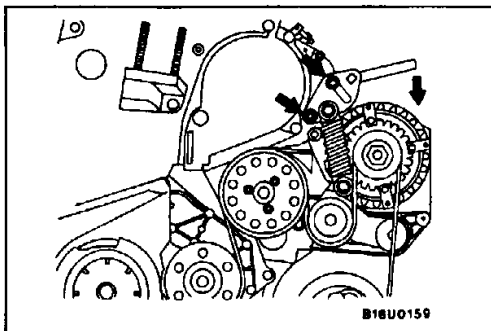
1. Place a ratchet spanner in the alternator brace.
2. Maintain pressure on the ratchet spanner and slacken the bolts.
3. Slowly reduce the drive belt tension and then remove the belt.



◀B▶ CRANKSHAFT PULLEY REMOVAL

Caution

1. This drive belt will get damaged. Do not use the engine's drive belt.
2. Never use a damaged drive belt.



INSTALLATION SERVICE POINT

▶A◀ DRIVE BELT INSTALLATION <Vehicles with A/C>

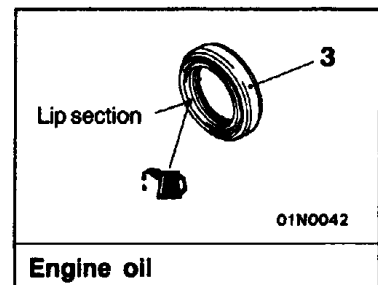
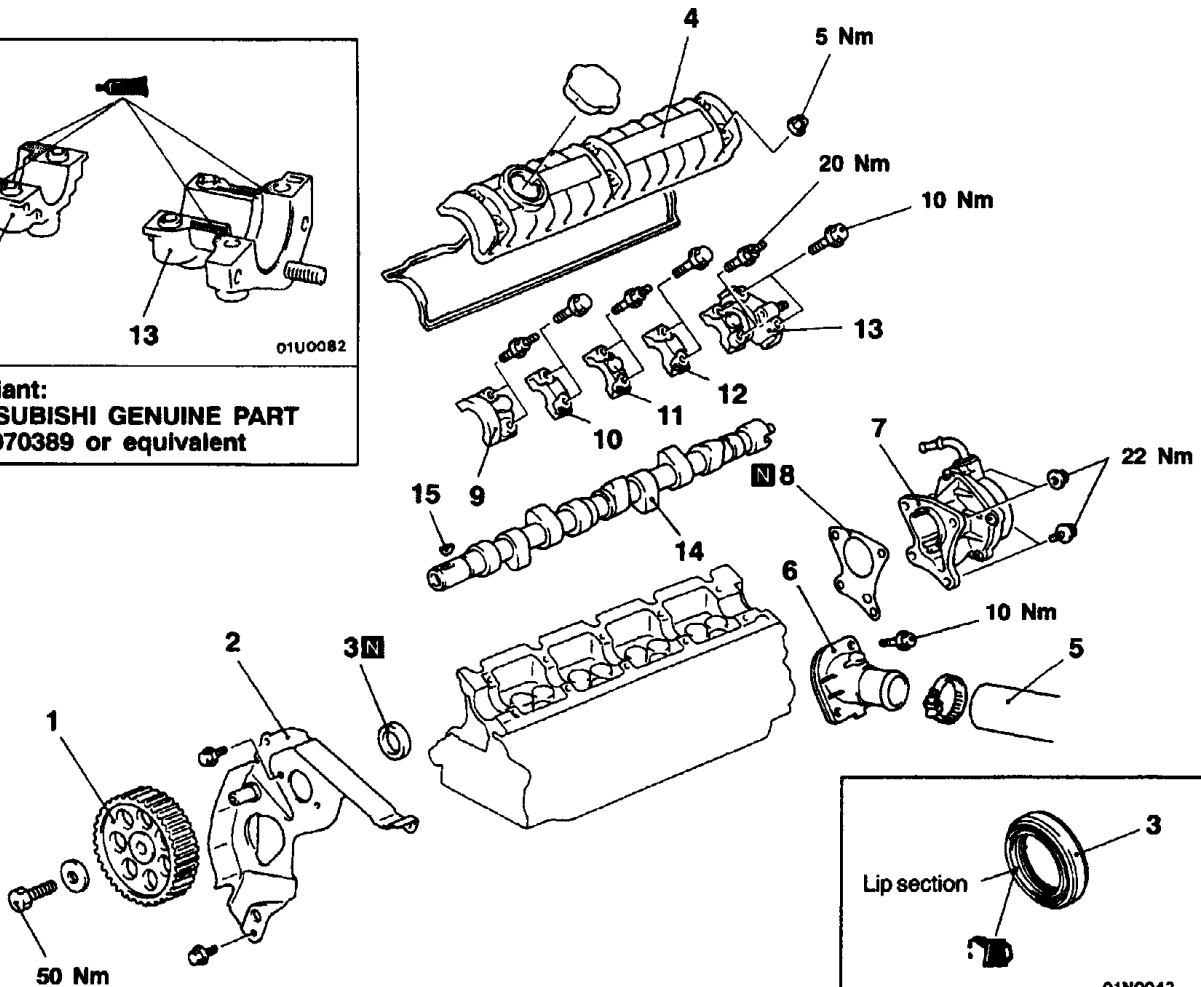
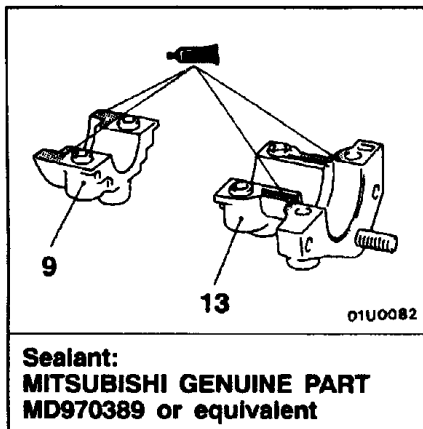
1. Place the drive belt around the pulleys.
2. Insert the ratchet spanner in the alternator brace and tension the drive belt, checking that the belt is properly fitted in the grooves.
3. Tighten the two bolts.

CAMSHAFT AND CAMSHAFT OIL SEAL

REMOVAL AND INSTALLATION

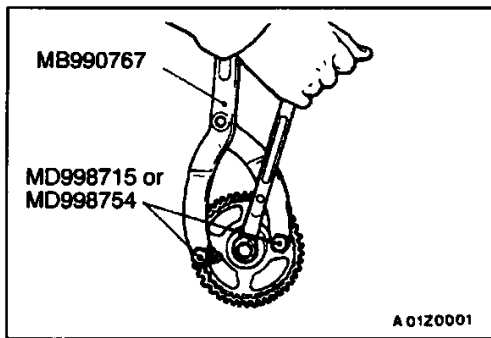
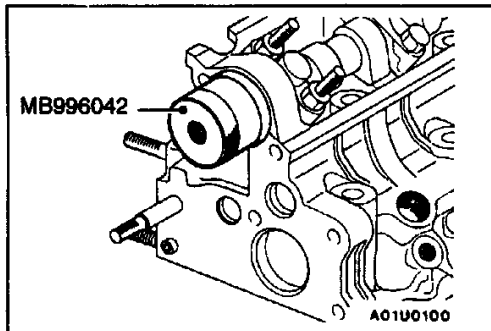
Pre-removal and Post-installation Operation

- (1) Engine Coolant Draining and Supplying
- (2) Timing Belt Removal and Installation (Refer to P.11B-30.)

**Removal steps**

1. Camshaft sprocket
2. Timing belt under cover upper
3. Camshaft oil seal
4. Rocker cover
5. Radiator upper hose connection
6. Water inlet fitting
7. Vacuum pump
8. Gasket

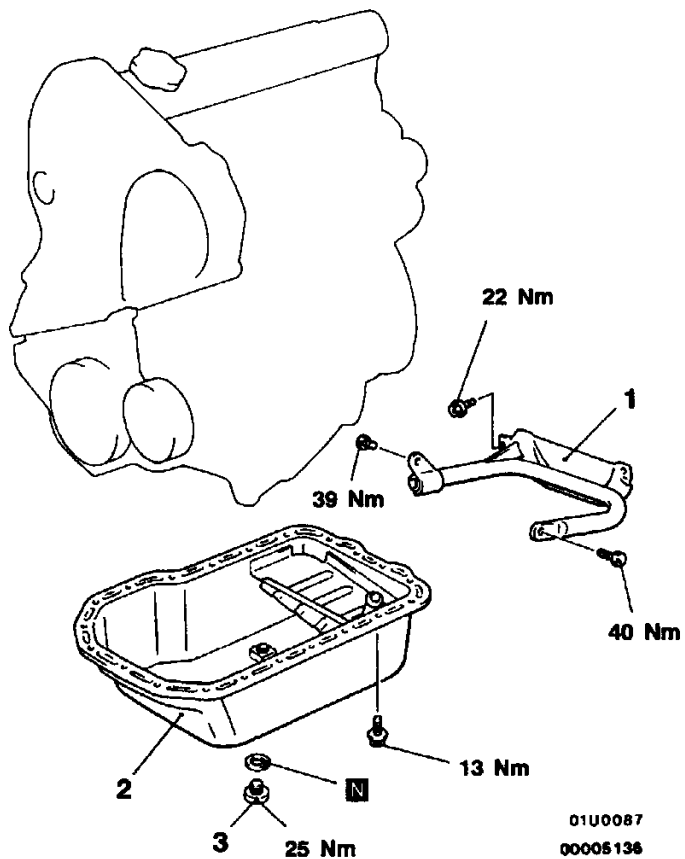
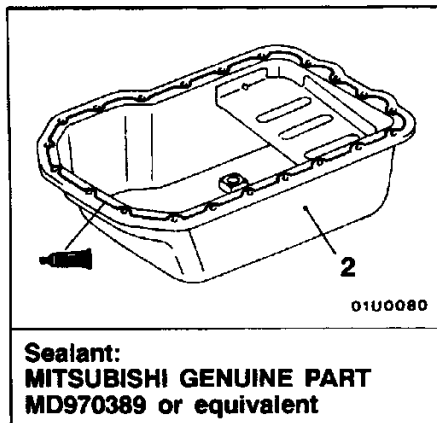
9. No.1 camshaft bearing cap
10. No.2 camshaft bearing cap
11. No.3 camshaft bearing cap
12. No.4 camshaft bearing cap
13. No.5 camshaft bearing cap
14. Camshaft
15. Key

**REMOVAL SERVICE POINT****◀A▶ CAMSHAFT SPROCKET REMOVAL****INSTALLATION SERVICE POINT****▶A◀ CAMSHAFT OIL SEAL INSTALLATION**

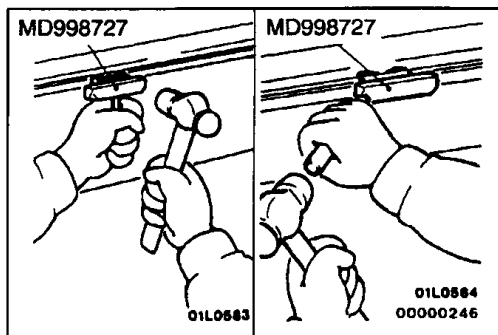
1. Coat the lip of the oil seal with a thin layer of engine oil.
2. Tape off the camshaft.
3. Locate the oil seal over the camshaft.
4. Fit the oil seal with the special tool.

OIL PAN**REMOVAL AND INSTALLATION****Pre-removal and Post-installation Operation**

- (1) Engine Oil Draining and Supplying
- (2) Oil Level Gauge Removal and Installation
- (3) Under Cover Removal and Installation
- (4) Drive Shaft (RH) Removal and Installation

**Removal steps**

- ◀A▶ ▶A▶
1. Bending strut
 2. Oil pan
 3. Drain plug



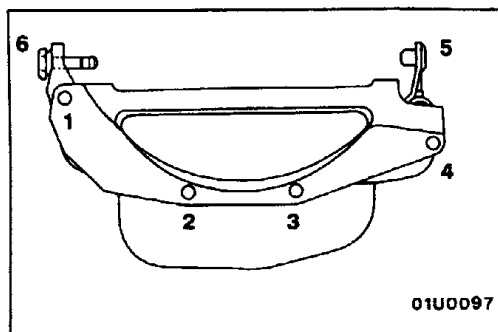
REMOVAL SERVICE POINT

◀A▶ OIL PAN REMOVAL

After removing the oil pan mounting bolts, remove the oil pan with the special tool and a brass bar.

Caution

Perform this slowly to avoid deformation of the oil pan flange.

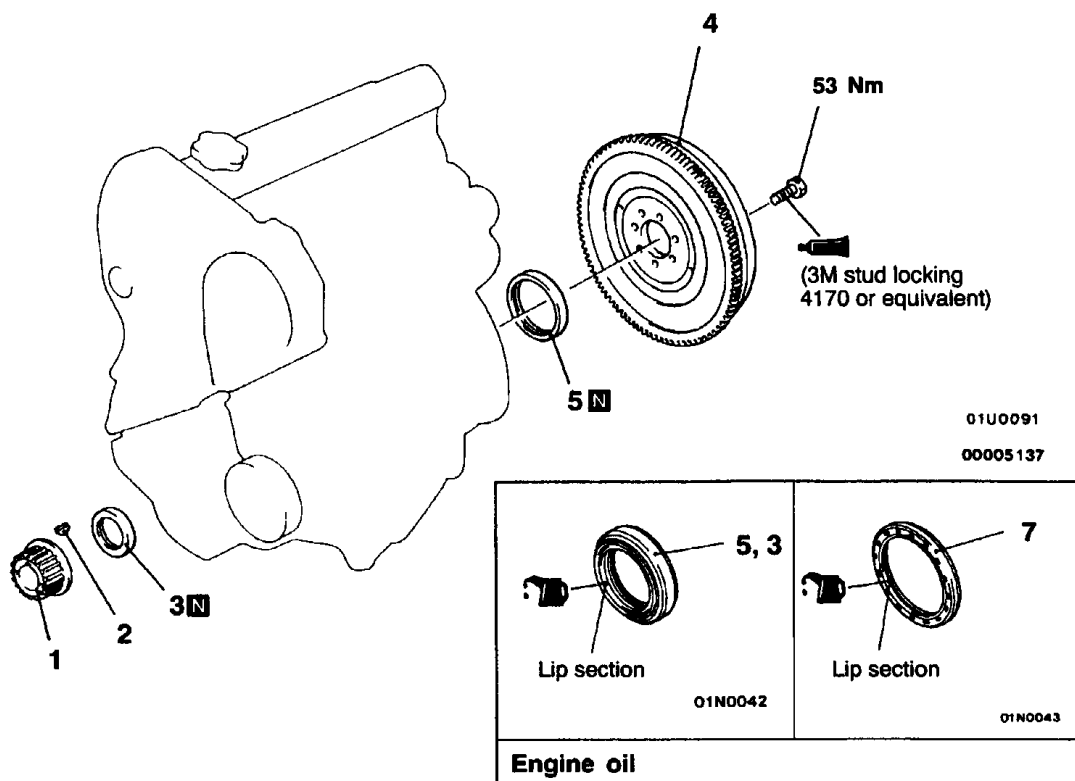


INSTALLATION SERVICE POINT

▶A◀ BENDING STRUT INSTALLATION

1. Provisionally tighten the bending strut mounting screws in the order 1, 2, 3, 4, 5 and 6.
2. After the screws have been provisionally tightened, tighten them to the specified torque in the order 5, 1, 2, 3, 4 and 6.

CRANKSHAFT OIL SEAL REMOVAL AND INSTALLATION



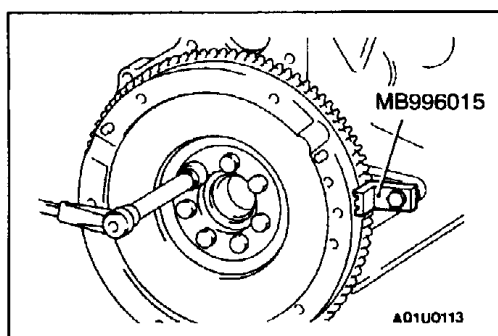
Crankshaft front oil seal removal steps

- Timing belt (Refer to P.11B-30.)
- 1. Crankshaft sprocket
- 2. Key
- 3. Crankshaft front oil seal



Crankshaft rear oil seal removal steps

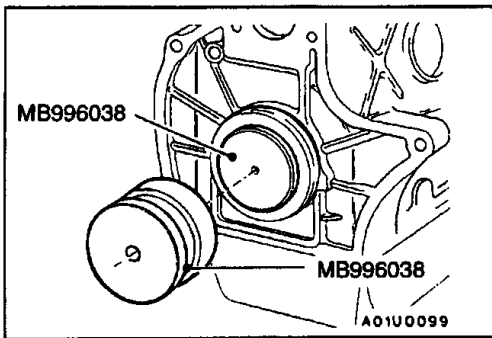
- Transmission assembly (Refer to GROUP 22.)
- Clutch cover and disc
- 4. Flywheel assembly
- 5. Crankshaft rear oil seal



REMOVAL SERVICE POINT

◀B▶ FLYWHEEL ASSEMBLY REMOVAL

Use the special tool to secure the flywheel and remove the bolts.

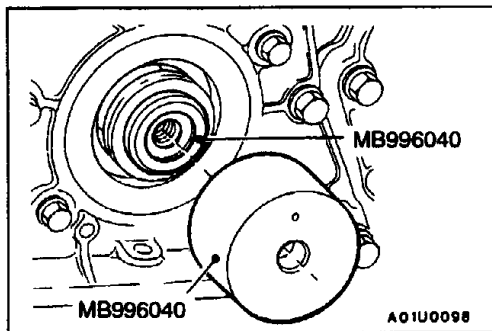
**INSTALLATION SERVICE POINTS****►A◄ CRANKSHAFT REAR OIL SEAL INSTALLATION**

1. Coat the lip of the oil seal with a thin layer of engine oil.
2. Locate the special tool (installer guide) over the crankshaft.
3. Locate the oil seal over the guide.
4. Fit the oil seal with special tool (installer).

►B◄ FLYWHEEL ASSEMBLY INSTALLATION

1. Clean off all sealant, oil and other substances which are adhering to the threaded bolts, crankshaft thread holes and the flywheel.
2. Apply sealant to the threaded mounting bolts.
Specified sealant: 3M Stud locking 4170 or equivalent
3. Use the special tool to secure the flywheel, and then tighten the bolts to the specified torque.

Tightening torque: 53 Nm

**►C◄ CRANKSHAFT FRONT OIL SEAL INSTALLATION**

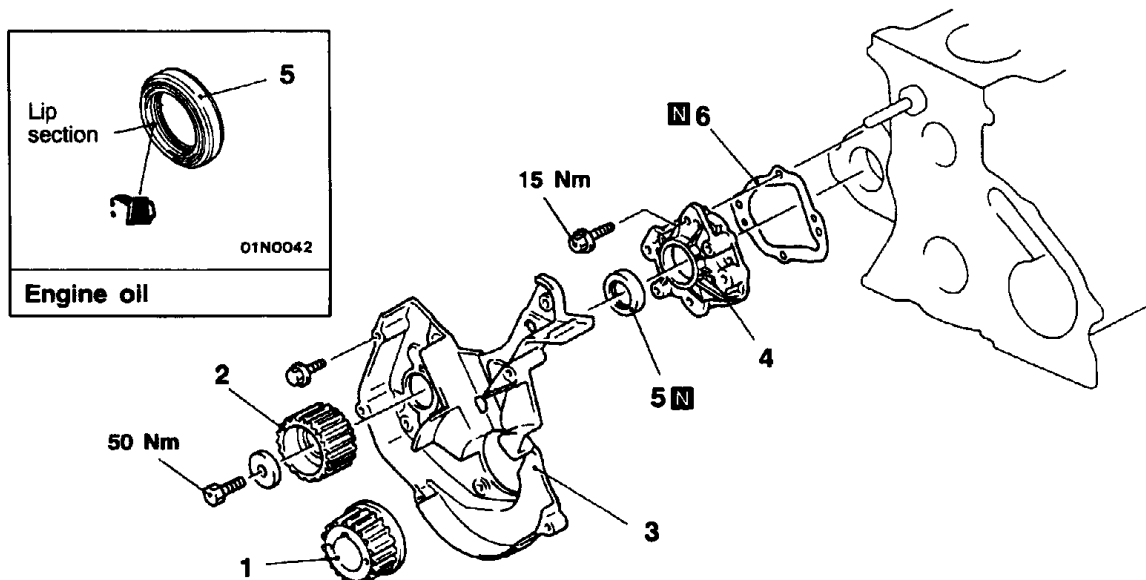
1. Coat the lip of the oil seal with a thin layer of engine oil.
2. Locate the special tool (installer guide) over the crankshaft.
3. Locate the oil seal over the guide.
4. Fit the oil seal with special tool (installer).

INTERMEDIATE SHAFT OIL SEAL

REMOVAL AND INSTALLATION

Pre-removal and Post-Installation Operation

- Timing Belt Removal and Installation (Refer to P.11B-30.)



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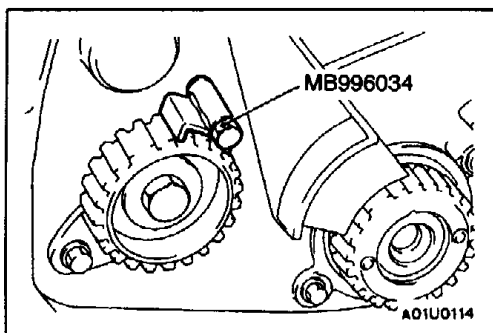
Removal steps



1. Crankshaft sprocket
2. Intermediate shaft sprocket
3. Timing belt under cover lower



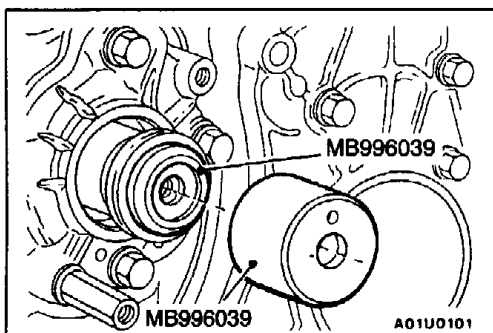
4. Intermediate shaft housing
5. Intermediate shaft oil seal
6. Gasket



REMOVAL SERVICE POINT

◀A▶ INTERMEDIATE SHAFT SPROCKET REMOVAL

Remove the timing sprocket from the intermediate shaft using the special tool.



INSTALLATION SERVICE POINT

▶A◀ INTERMEDIATE SHAFT OIL SEAL INSTALLATION

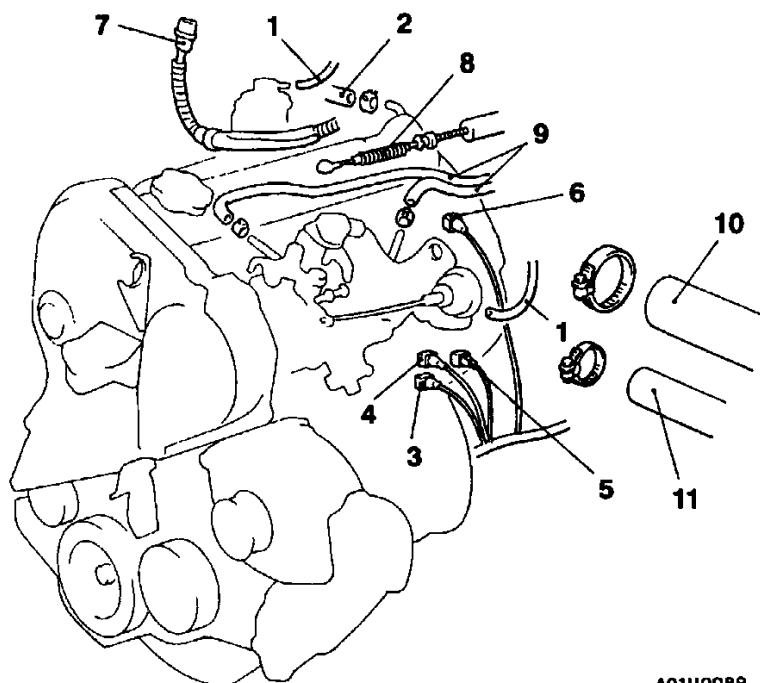
1. Coat the lip of the oil seal with a thin layer of engine oil.
2. Locate the special tool (installer guide) over the intermediate shaft.
3. Locate the oil seal over the installer.
4. Fit the oil seal with special tool (installer).

CYLINDER HEAD GASKET**REMOVAL AND INSTALLATION****Pre-removal Operation**

- (1) Engine Coolant Draining
- (2) Air Cleaner and Air Intake Hose Removal
- (3) Downpipe Assembly Removal (Refer to GROUP 15.)

Post-Installation Operation

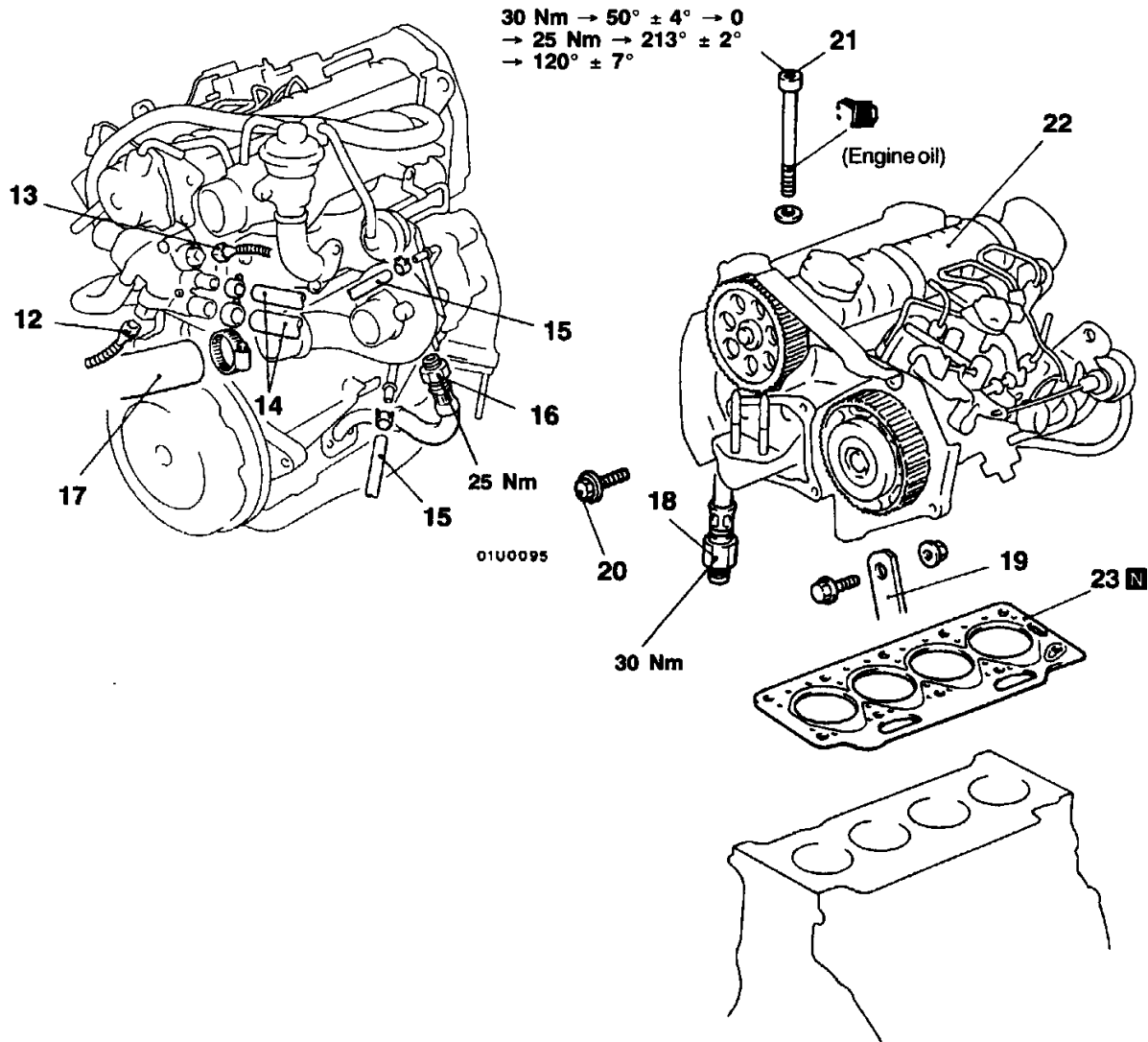
- (1) Downpipe Assembly Installation (Refer to GROUP 15.)
- (2) Throttle Cable Adjustment (Refer to GROUP 17 – Accelerator Cable and Pedal.)
- (3) Air Cleaner and Air Intake Hose Installation
- (4) Engine Coolant Refilling
- (5) Fuel line air bleeding (Refer to GROUP 13E – On-vehicle Service.)



A01U0089

Removal steps

1. Vacuum hoses connection
2. Brake booster vacuum hose connection
3. Load lever sensor connector
4. Proportional solenoid connector
5. Immobilizer connector
6. Needle lift sensor connector
7. Glow plug relay connector
8. Throttle cable connection
9. Fuel hoses connection
10. Radiator upper hose connection
11. Water hose connection

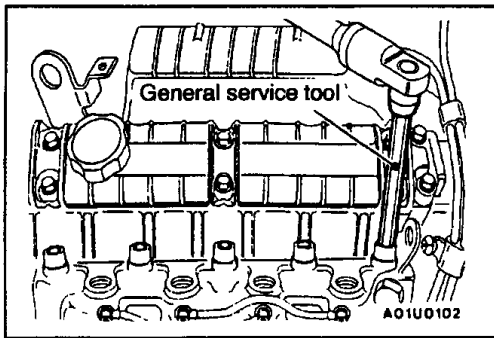


01U0093
 00005130

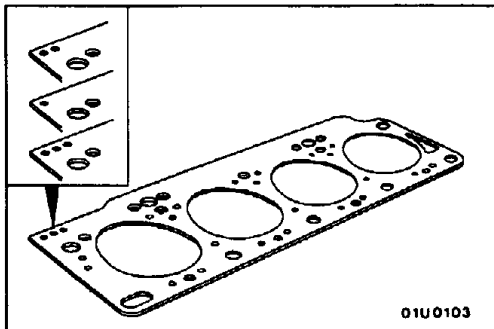
- 12. Engine coolant temperature gauge unit connector
- 13. Engine coolant temperature sensor connector
- 14. Heater hoses connection
- 15. Engine coolant hoses connection
- 16. Oil return pipe assembly connection
- 17. Air hose A connection

- 18. Oil pipe assembly connection
- 19. Turbo support bracket connection
- Timing belt (Refer to P.11B-30.)
- 20. Timing belt under cover mounting bolt

- ◀A▶ ▶C◀ 21. Cylinder head bolt
- ▶B◀ 22. Cylinder head assembly
- ◀B▶ ▶A◀ 23. Cylinder head gasket

**REMOVAL SERVICE POINTS****◀A▶ CYLINDER HEAD BOLT REMOVAL****◀B▶ CYLINDER HEAD GASKET REMOVAL****Caution**

When removing the cylinder head gasket, take care not to scratch the cylinder head or cylinder block gasket faces.

**INSTALLATION SERVICE POINTS****▶A◀ CYLINDER HEAD GASKET INSTALLATION**

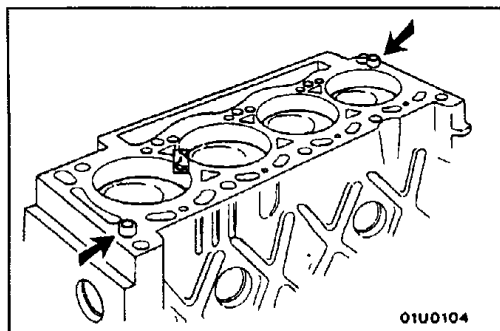
Select a cylinder head gasket of the correct thickness according to the projecting height of the pistons. The available cylinder head gaskets are shown in the table below. The thickness of the gasket is indicated by the number of holes near the end of the gasket (see the illustration). Measure the projecting height of the pistons and calculate the average height. Then select a cylinder head gasket of the correct thickness from the table shown below.

Piston height above cylinder block (mm)	Number of holes	Gasket thickness (mm)
0.073 or less	2	1.40
0.073 – 0.206	1	1.50
0.206 or more	3	1.60

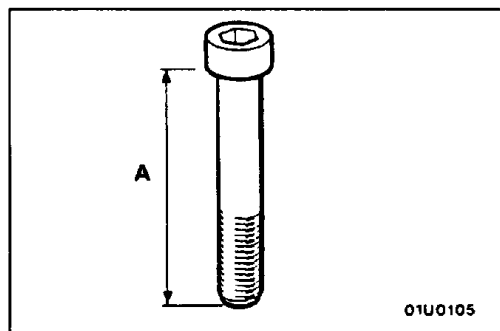
If it is only a question of fitting a new gasket, check the hole pattern on the old gasket and select a gasket with the same number of holes.

Caution

If a piston or connecting rod, etc. has been replaced, always measure the projecting height of the pistons because this may have changed after replacing these parts.

**►B◄ CYLINDER HEAD ASSEMBLY INSTALLATION**

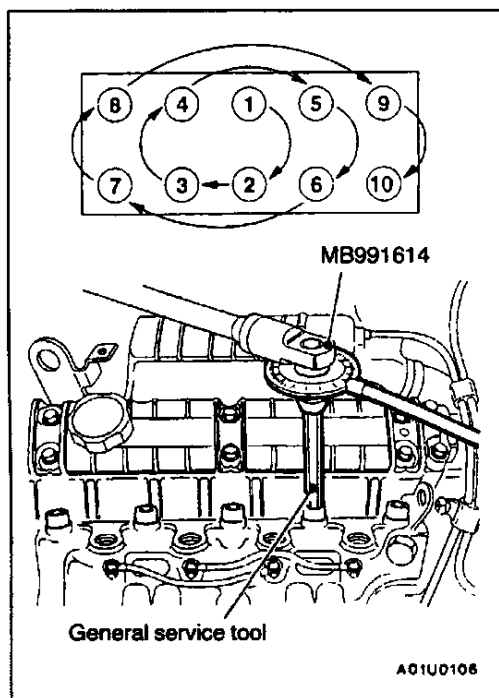
1. Rotate the crankshaft so that the piston of No.1 cylinder is positioned a quarter-stroke past TDC.
2. Fit the cylinder head over the locating dowels.

**►C◄ CYLINDER HEAD BOLT INSTALLATION**

1. When installing the cylinder head bolts, check that the length of the shank of each bolt (without the washer) is within the limit value. All the cylinder head bolts must be renewed as soon as any of them exceeds the permitted length.

Limit (A): max. 120.5 mm

2. Fit the washers.
3. Lubricate the bolt threads and washers with engine oil.

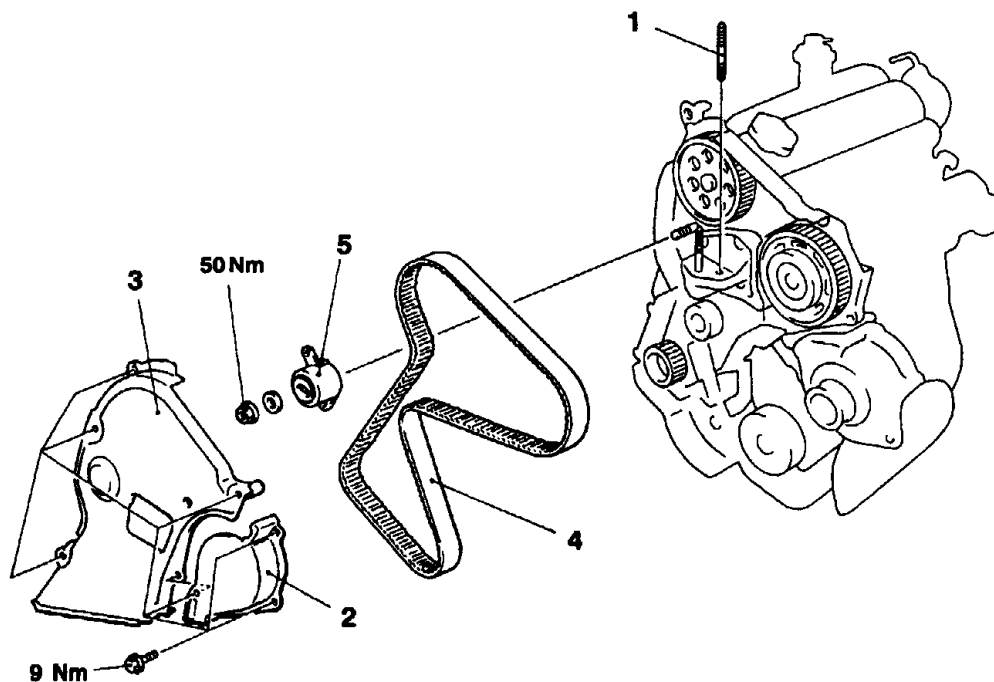


4. Tighten the bolts by the following procedure.

Step	Operation	Remarks
1	Tighten to 30 Nm.	Carry out in the order shown in the illustration.
2	Tighten $50^\circ \pm 4^\circ$ of a turn.	Using the special tool, carry out in the order shown in the illustration.
3	Wait for a minimum of 3 minutes.	-
4	Fully loosen.	Carry out in the reverse order of that shown in the illustration.
5	Tighten to 25 Nm.	Carry out in the order shown in the illustration.
6	Tighten $213^\circ \pm 2^\circ$ of a turn.	Using the special tool, carry out in the order shown in the illustration.
7	Tighten $120^\circ \pm 7^\circ$ of a turn.	After the engine has warmed up, wait until it cools down and then tighten further in the order shown in the illustration.

TIMING BELT**REMOVAL AND INSTALLATION****Pre-removal and Post-installation Operation**

- (1) Under Cover (R.H.) Removal and Installation
- (2) Engine Mount Bracket Removal and Installation
(Refer to GROUP 32.)
- (3) Crankshaft Pulley Removal and Installation (Refer to P.11B-16.)

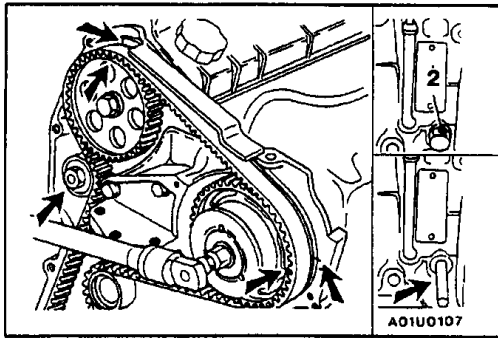


A01U0092

Removal steps

1. Stud bolt
2. Timing belt front cover B
3. Timing belt front cover A
4. Timing belt
5. Tensioner roller

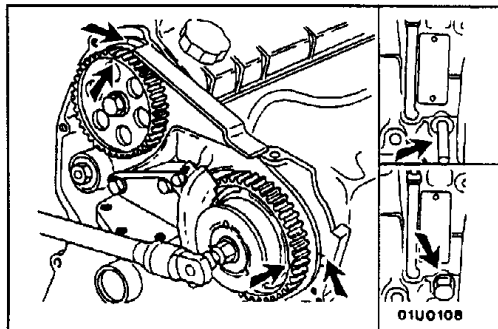




REMOVAL SERVICE POINTS

◀A▶ TIMING BELT REMOVAL

1. Turn the crankshaft clockwise so that the piston of No.1 cylinder (flywheel end) is at TDC, with the following marks in line with each other:
 - flywheel/clutch housing;
 - rear guard plate/camshaft sprocket.
 Scribe a mark on the injection pump mounting bracket.
2. Insert an 8 mm diameter locking pin in the threaded hole of bolt 2 so that it engages the recess in the crankshaft web.
3. Slacken the lock nut of the timing belt tensioner.
4. Remove the timing belt.



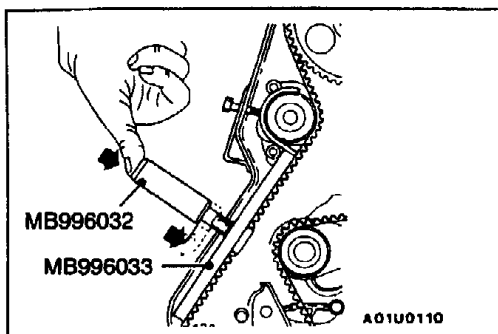
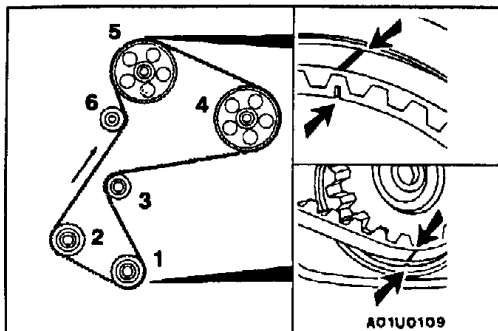
INSTALLATION SERVICE POINTS

▶A◀ TIMING BELT INSTALLATION

1. Turn the camshaft clockwise until the mark on the camshaft sprocket is opposite the mark on the guard plate.
2. Turn the crankshaft 1/4 revolution counter-clockwise from the TDC position of No.1 cylinder and insert the 8 mm diameter locking pin in the recess in the crankshaft web.
3. Align the mark on the injection pump sprocket with the mark on the mounting bracket (turn clockwise).
4. Fit the timing belt so that the lines on the belt are aligned with the marks on the crankshaft and camshaft sprockets and the injection pump sprocket.

When fitting the belt, note:

- the direction of rotation of the belt (see the arrows on the belt);
- the sequence in which the belt is fitted around the sprockets.



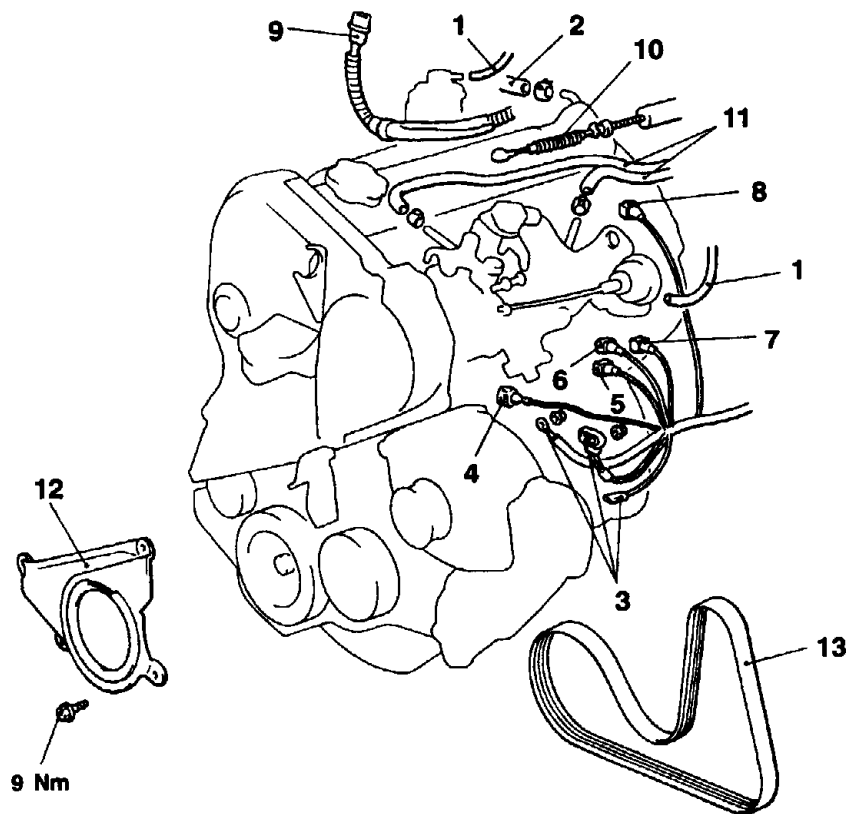
5. Fit the special tool on the timing belt and the timing belt tensioner.
6. Tension the timing belt with the aid of an M6 bolt.
Standard value: 7.5 mm
7. Tighten the lock nut to the specified torque.

ENGINE ASSEMBLY**REMOVAL AND INSTALLATION****Pre-removal Operations**

- (1) Hood Removal
- (2) Air Cleaner and Air Intake Hose Removal
- (3) Intercooler Hose Removal (Refer to GROUP 15.)
- (4) Radiator Assembly Removal (Refer to GROUP 14.)
- (5) Under Cover Removal
- (6) Downpipe Assembly Removal (Refer to GROUP 15.)

Post-installation Operations

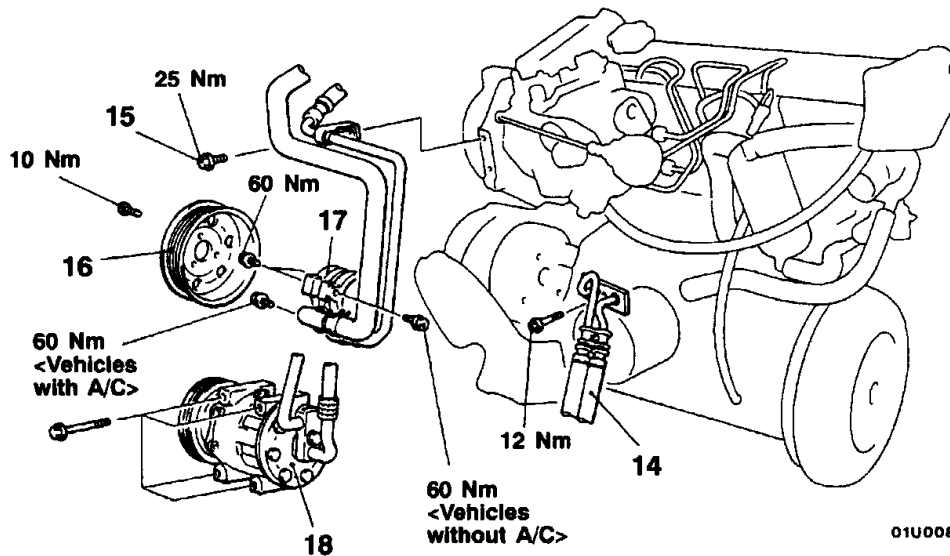
- (1) Downpipe Assembly Installation (Refer to GROUP 15.)
- (2) Under Cover Installation
- (3) Radiator Assembly Installation (Refer to GROUP 14.)
- (4) Throttle Cable Adjustment (Refer to GROUP 17 – Accelerator Cable and Pedal.)
- (5) Intercooler Hose Installation (Refer to GROUP 15.)
- (6) Air Cleaner and Air Intake Hose Installation
- (7) Hood Installation
- (8) Evacuation of Air from Fuel Line (Refer to GROUP 13E – On-vehicle Service.)



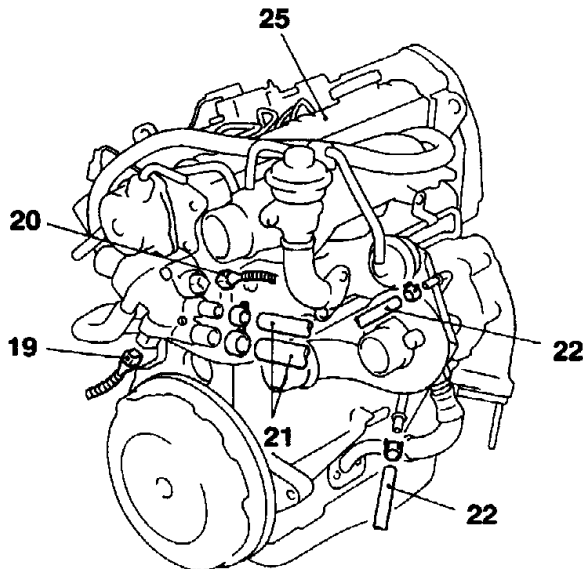
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Removal steps

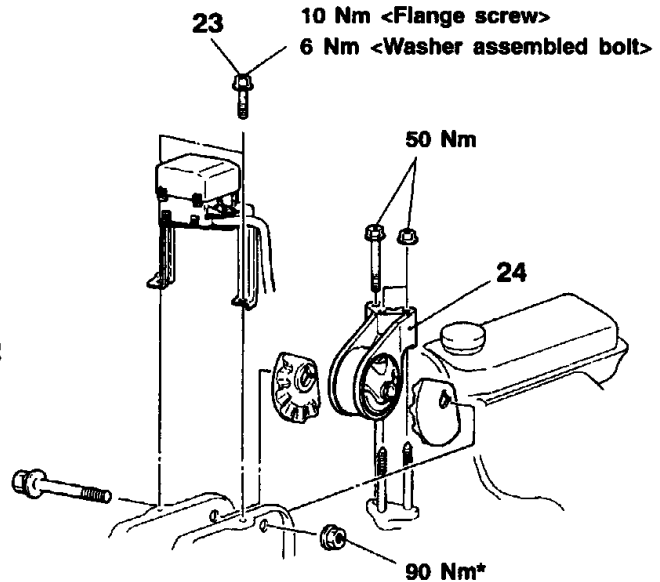
1. Vacuum hoses connection
2. Brake booster vacuum hose connection
3. Alternator connector
4. Oil pressure switch connector
5. Load lever sensor connector
6. Proportional solenoid connector
7. Immobilizer connector
8. Needle lift sensor connector
9. Glow plug relay connector
10. Throttle cable connection
11. Fuel hoses connection
12. Timing belt front cover C
 - Drive belt tension adjustment (Refer to P.11B-7.)
13. Drive belt (Refer to P.11B-16.)



01U0084



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00005141

14. Engine oil cooler hose connection
<vehicles with A/C>
15. Bolt <vehicles without A/C>
16. Power steering pump pulley
17. Power steering oil pump
18. A/C compressor
19. Engine coolant temperature gauge
unit connector
20. Engine coolant temperature sensor
connector
21. Heater hoses connection
22. Engine coolant hoses connection

- Transmission assembly (Refer to
GROUP 22.)

23. Bolts <vehicles with A/C>

24. Engine mount bracket

25. Engine assembly



Caution

Mounting locations marked by * should be provisionally tightened, and then fully tightened when the body is supporting the full weight of the engine.

REMOVAL SERVICE POINTS**◀A▶ POWER STEERING OIL PUMP REMOVAL**

Remove the power steering oil pump from the bracket with the hose attached.

NOTE

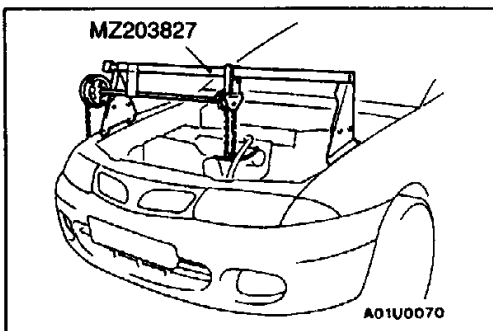
Place the removed power steering oil pump where it will not be a hindrance when removing and installing the engine assembly, and tie it with a cord.

◀B▶ A/C COMPRESSOR REMOVAL

Disconnect the A/C compressor connector and remove the compressor from the compressor bracket with the hose still attached.

NOTE

Place the removed A/C compressor where it will not be a hindrance when removing and installing the engine assembly, and tie it with a cord.

**◀C▶ ENGINE MOUNT BRACKET REMOVAL**

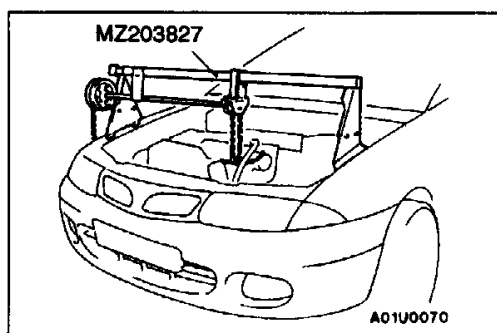
1. Support the engine with a garage jack.
2. Remove the special tool which was attached when the transmission assembly was removed.
3. Hold the engine assembly with a chain block or similar tool.
4. Place a garage jack against the engine oil pan with a piece of wood in between, jack up the engine so that the weight of the engine is no longer being applied to the engine mount bracket, and then remove the engine mount bracket.

◀D▶ ENGINE ASSEMBLY REMOVAL

After checking that all cables, hoses and harness connectors, etc., are disconnected from the engine, lift the chain block slowly to remove the engine assembly upward from the engine compartment.

INSTALLATION SERVICE POINTS**▶A◀ ENGINE ASSEMBLY INSTALLATION**

Install the engine assembly, checking that the cables, hoses, and harness connectors are not clamped.

**▶B◀ ENGINE MOUNT BRACKET INSTALLATION**

1. Place a garage jack against the engine oil pan with a piece of wood in between, and install the engine mount bracket while adjusting the position of the engine.
2. Support the engine with the garage jack.
3. Remove the chain block and support the engine assembly with the special tool.

GROUP 12

ENGINE LUBRICATION

GENERAL

OUTLINE OF CHANGES

- The service procedures have been added to correspond to the addition of diesel-powered vehicle.
Applicable models: 1900D
 1. On-vehicle Service
 2. Removal and installation of the engine oil cooler <Vehicles with A/C>

LUBRICANTS

Items		Engine oil	Quantity ℓ
Oil filter		CCMC classification FOR SERVICE PD2 or higher	0.35
Engine oil cooler <Vehicles with A/C>			0.4
Total quantity	Vehicles without A/C		5.1
	Vehicles with A/C		5.5

ON-VEHICLE SERVICE

ENGINE OIL INSPECTION

1. Pull out the level gauge slowly and check the oil level.
2. Check that the oil is not excessively dirty, that there is no coolant or fuel mixed in, and that it has sufficient viscosity.

ENGINE OIL REPLACEMENT

1. Start the engine and allow it to warm up until the temperature of the coolant reaches 80°C to 90°C.
2. Remove the engine oil filler cap.
3. Remove the drain plug to drain oil.

Caution

Use care as oil could be hot.

4. Fit the drain plug after oil has been drained completely.

NOTE

Tightening torque: 25 Nm

5. Refill with specified quantity of oil.

Specified Engine Oil:

CCMC classification FOR SERVICE PD2 or higher

Total quantity (Includes volume inside oil filter):

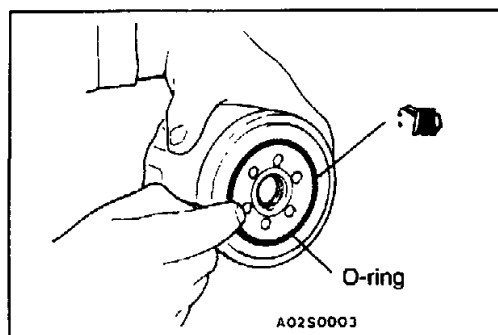
5.1 ℓ <Vehicles without A/C>

5.5 ℓ <Vehicles with A/C>

6. Install the engine oil filler cap.
7. Check oil level.

OIL FILTER REPLACEMENT

1. After removing the engine oil filler cap, remove the engine oil drain plug to drain the engine oil.
2. Use the oil filter wrench to remove the engine oil filter from the underside of the vehicle.
3. Clean the cylinder block side mounting surface.



4. Apply a small amount of engine oil to the O-ring of the new oil filter.
5. Use the oil filter wrench to install the engine oil filter.

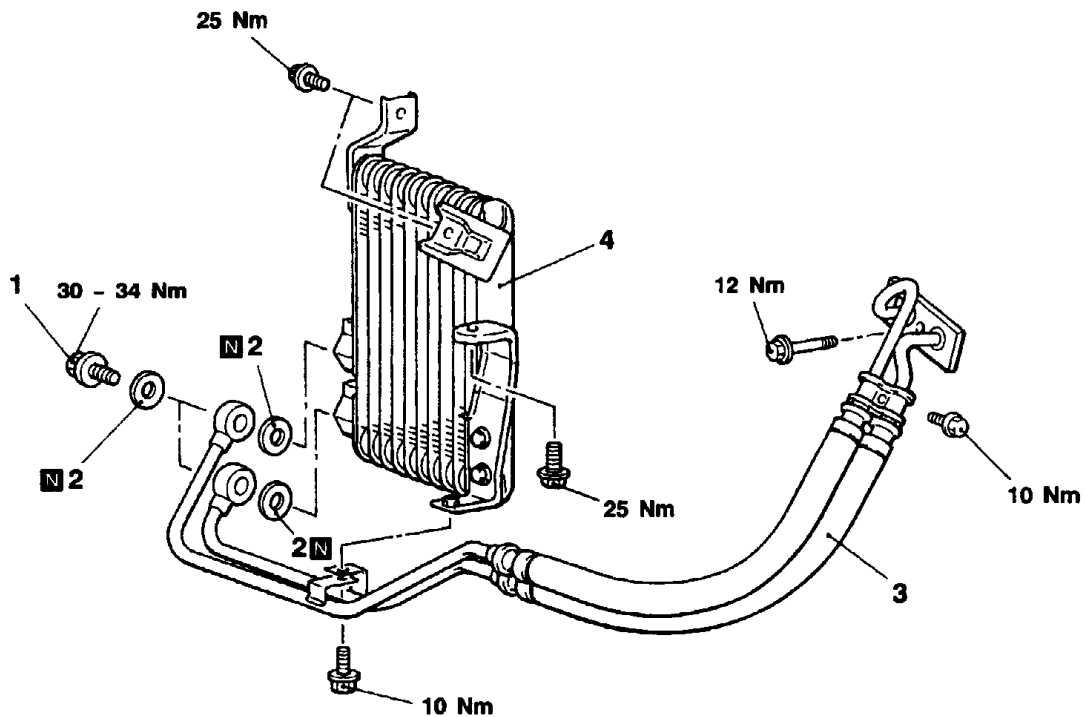
NOTE

Tightening torque: 10 – 14 Nm

6. Fill with engine oil.
7. Race the engine 2 – 3 times, and check to be sure that no engine oil leaks from installation section of the oil filter.

ENGINE OIL COOLER**REMOVAL AND INSTALLATION****Pre-removal and Post-installation Operation**

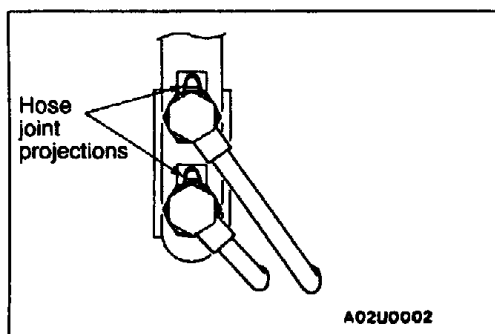
- (1) Engine Oil Draining and Supplying
- (2) Front Bumper Removal and Installation



A02U0001

Removal steps

1. Eye bolt
2. Gasket
- ▶A◀ 3. Oil cooler hose assembly
4. Engine oil cooler



A02U0002

INSTALLATION SERVICE POINT**▶A◀ OIL COOLER HOSE ASSEMBLY INSTALLATION**

Insert the hose joint projections into the pin hole of the engine oil cooler, and install the oil cooler hose assembly.

FUEL

CONTENTS

MULTIPOINT FUEL INJECTION (MPI)	13A
ELECTRONIC CONTROL TYPE CARBURETTOR	13B
CONVENTIONAL TYPE CARBURETTOR	13C
VARIABLE VENTURI TYPE CARBURETTOR	13D
DIESEL FUEL	13E
FUEL SUPPLY	13F
AUTO-CRUISE CONTROL SYSTEM	Refer to GROUP 17
TRACTION CONTROL SYSTEM (TCL)	13H

NOTE

THE GROUPS MARKED BY ARE NOT IN THIS MANUAL

MULTIPOINT FUEL INJECTION (MPI)

CONTENTS

GENERAL	3	ON-VEHICLE SERVICE	65
Outline of Changes	3	Basic Idle Speed Adjustment	65
GENERAL INFORMATION	3	Component Location	67
SERVICE SPECIFICATIONS	6	Control Relay and Fuel Pump Relay	
TROUBLESHOOTING	6	Continuity Check	68

GENERAL

OUTLINE OF CHANGES

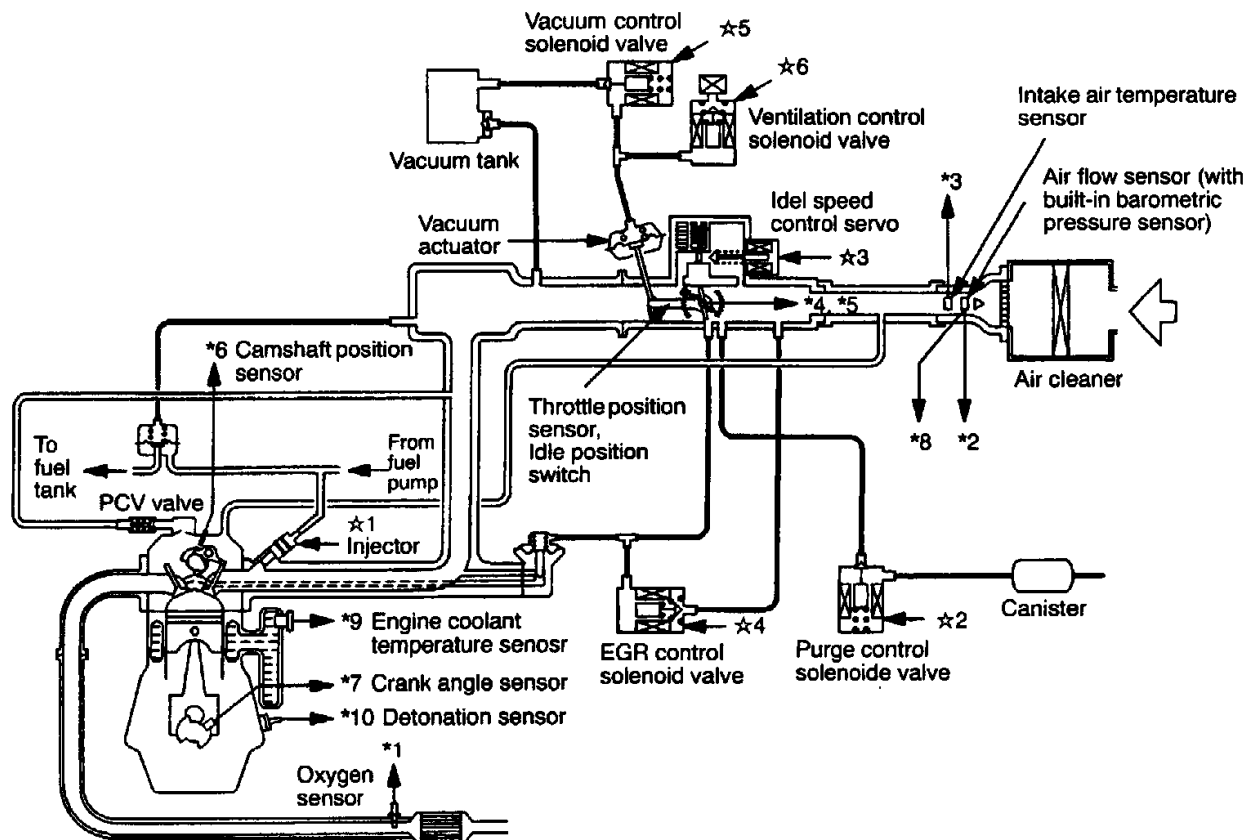
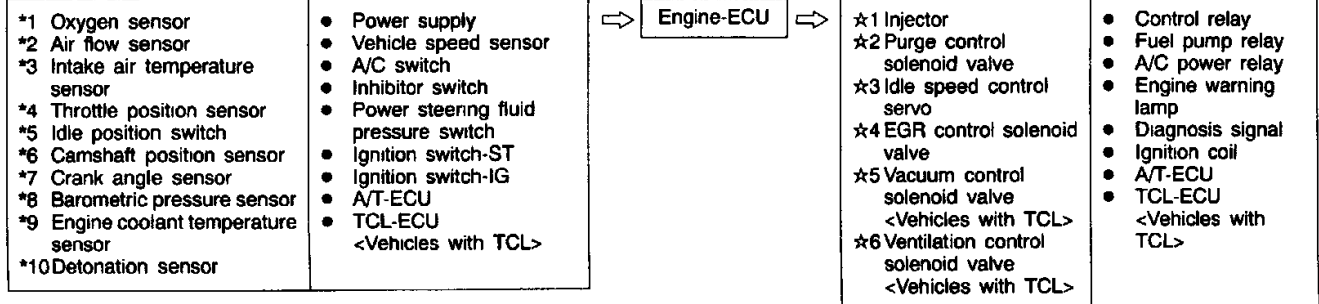
- The 6B model specification has been added as one of the 4G92 engines.
- The distributorless low-voltage distribution method has been used for the SOHC engine.
- The crank angle sensor, which detects the crank angle directly from the crankshaft, has been used for the SOHC engine.
- A new stick-type camshaft position sensor has been used.
- The ignition timing adjustment connector has been abolished.

GENERAL INFORMATION

Items		Specifications
Engine-ECU	Identification model No.	E2T63285 <4G92> E2T63284 <4G92 (6B models)> E2T63286 <4G93-SOHC (Vehicles without TCL)> E2T63287 <4G93-SOHC (Vehicles with TCL)> E2T63288 <4G93-DOHC>

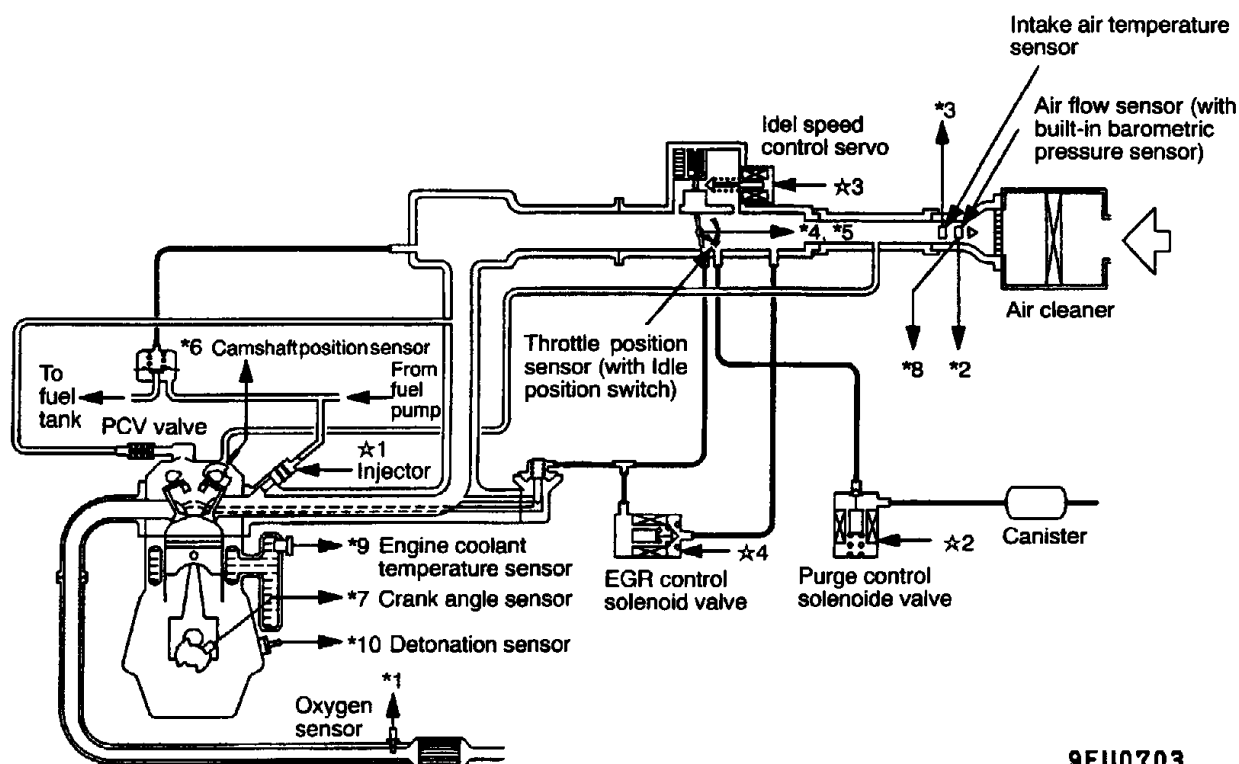
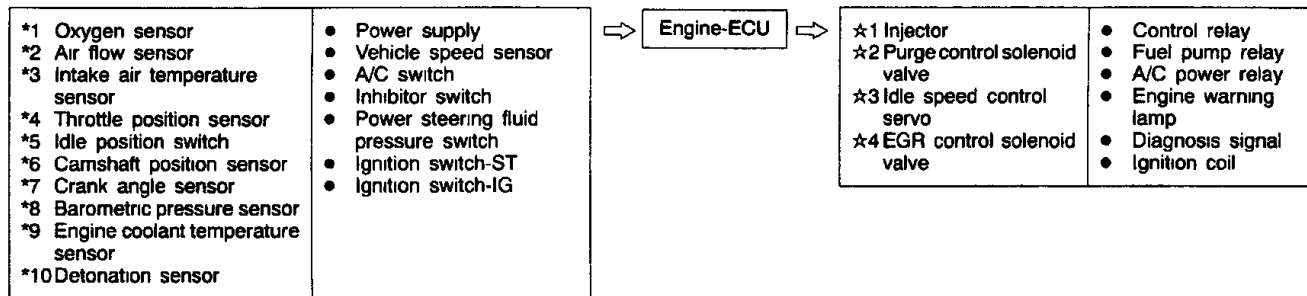
MULTI POINT FUEL INJECTION SYSTEM DIAGRAM

<4G92, 4G93-SOHC>



9FU0702

<4G93-DOHC>



9FU0703

SERVICE SPECIFICATIONS

Items	4G92 (6B models)
Basic idle speed r/min	800 ± 50

TROUBLESHOOTING**DIAGNOSIS FUNCTION****ENGINE WARNING LAMP (CHECK ENGINE LAMP)**

The ignition timing adjustment signal has been abolished from the previous check items. In addition, the following check items have been added for the SOHC engine. The other items are the same as before.

Camshaft position sensor
Ignition coil, power transistor

FAIL-SAFE FUNCTION REFERENCE TABLE

The following malfunctions have been added for the SOHC engine. In addition, the top dead centre sensor has been abolished to correspond to the use of the camshaft position sensor. The other items are the same as before.

Malfunctioning	Control contents during malfunction
Camshaft position sensor	Cuts off the fuel supply 4 seconds after a problem is detected. (However, after the ignition switch is turned to ON, the No.1 cylinder top dead centre is not detected at all.)
Ignition coil, power transistor	Cuts off the fuel supply to cylinders with an abnormal ignition.

INSPECTION CHART FOR DIAGNOSIS CODES

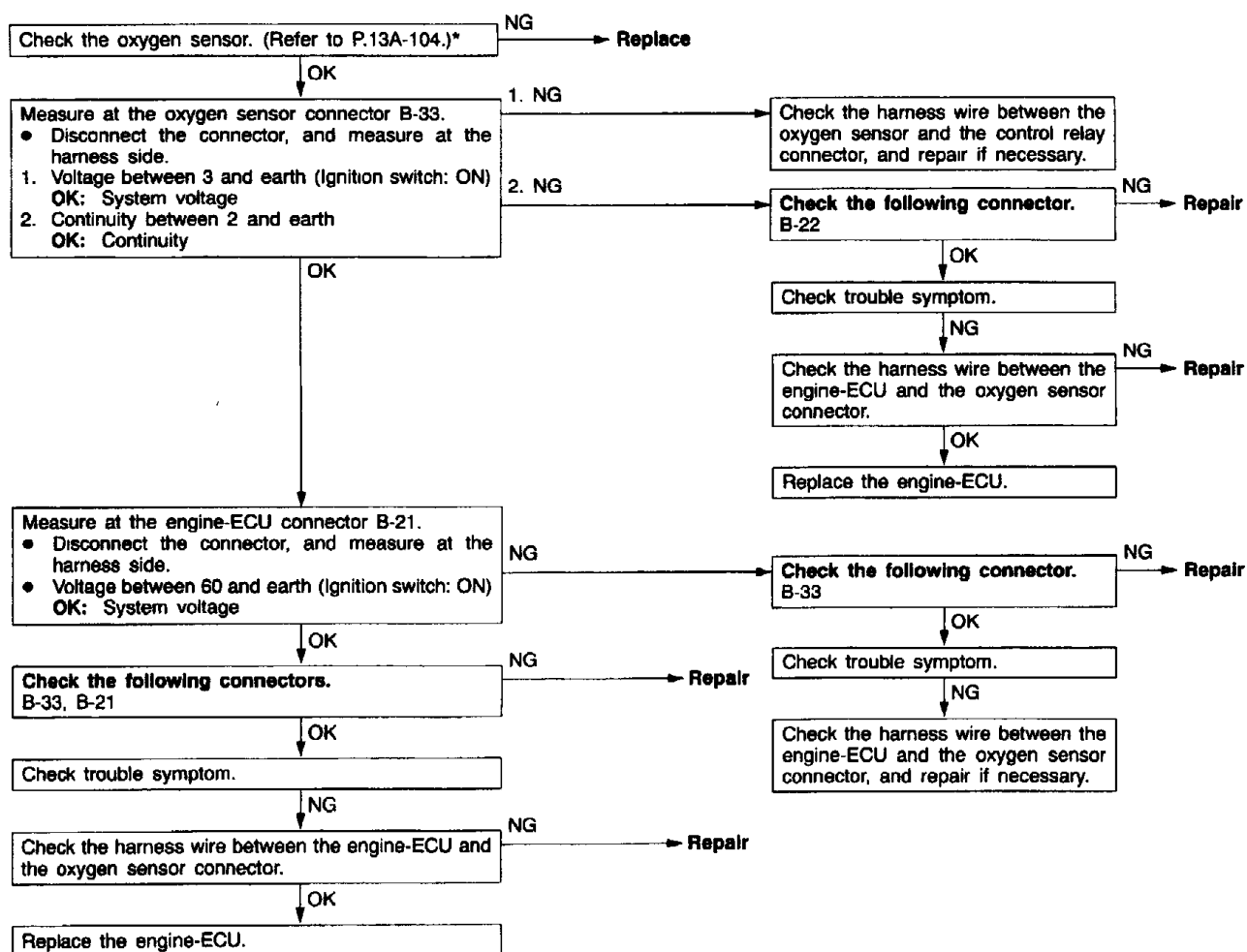
Code No.	Diagnosis item	Reference page
11	Oxygen sensor system	13A-8
12	Air flow sensor system	13A-9
13	Intake air temperature sensor system	13A-9
14	Throttle position sensor system	13A-10
21	Engine coolant temperature sensor system	13A-11
22	Crank angle sensor system	13A-12
23	Camshaft position sensor system	13A-13
24	Vehicle speed sensor system	13A-14
25	Barometric pressure sensor system	13A-15
31	Detonation sensor system	13A-16
41	Injector system	13A-16
44	Ignition coil and power transistor unit system	13A-17
54*	Immobilizer system	GROUP 54 – Ignition key and Immobilizer
61	Communication wire with A/T-ECU system <A/T>	13A-18
71	Vacuum control solenoid valve system <Vehicles with TCL>	13A-19
72	Ventilation control solenoid valve system <Vehicles with TCL>	13A-20

NOTE

*: Refer to GROUP 54 – Ignition key and Immobilizer-Troubleshooting.

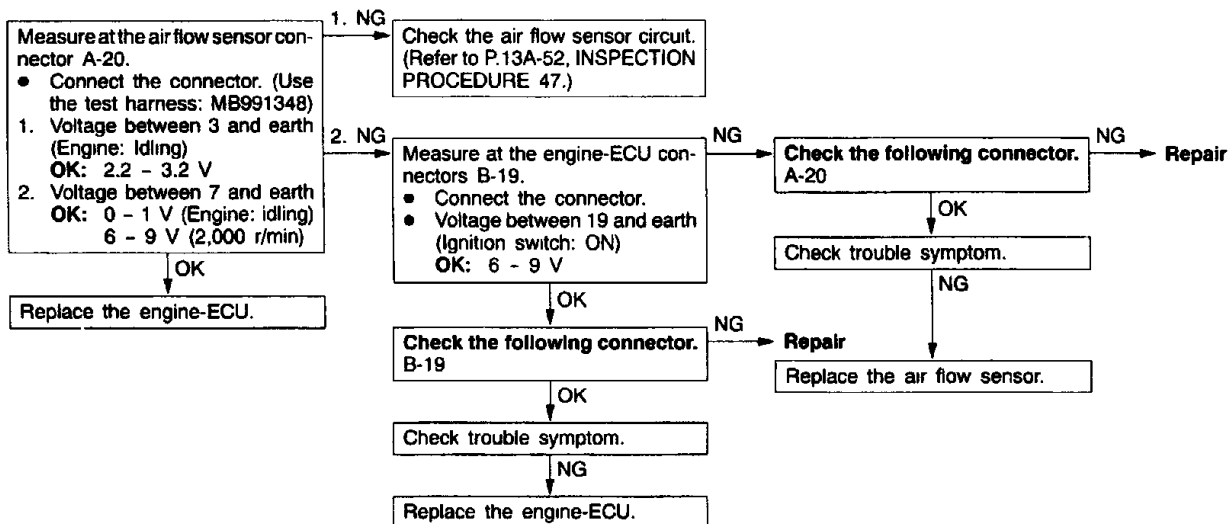
INSPECTION PROCEDURE FOR DIAGNOSIS CODES

Code No. 11 Oxygen sensor system	Probable cause
Range of Check 3 minutes have passed after engine was started. - Engine coolant temperature is approx. 80°C or more. - Intake air temperature is 20 - 50°C. - Engine speed is approx. 2,000 - 3,000 r/min - Vehicle is moving at constant speed on a flat, level road surface Set conditions - The oxygen sensor output voltage is around 0.6 V for 30 seconds (does not cross 0.6 V for 30 seconds). - When the range of check operations given above which accompany starting of the engine are carried out four time in succession, a problem is detected after each operation.	- Malfunction of the oxygen sensor - Improper connector contact, open circuit or short-circuited harness wire - Malfunction of the engine-ECU

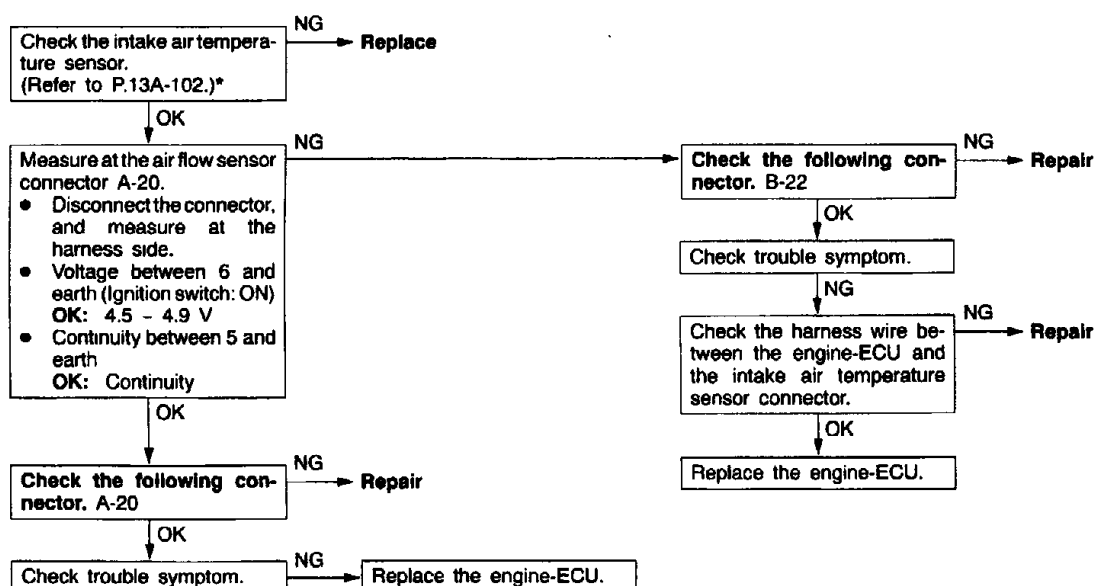


*: Refer to '96 CARISMA Workshop Manual (Pub. No.PWDE9502).

Code No. 12 Air flow sensor system	Probable cause
Range of Check - Engine speed is 500 r/min or more. Set conditions - Sensor output frequency is 3 Hz or less for 4 seconds.	- Malfunction of the air flow sensor - Improper connector contact, open circuit or short-circuited harness wire of the air flow sensor - Malfunction of the engine-ECU

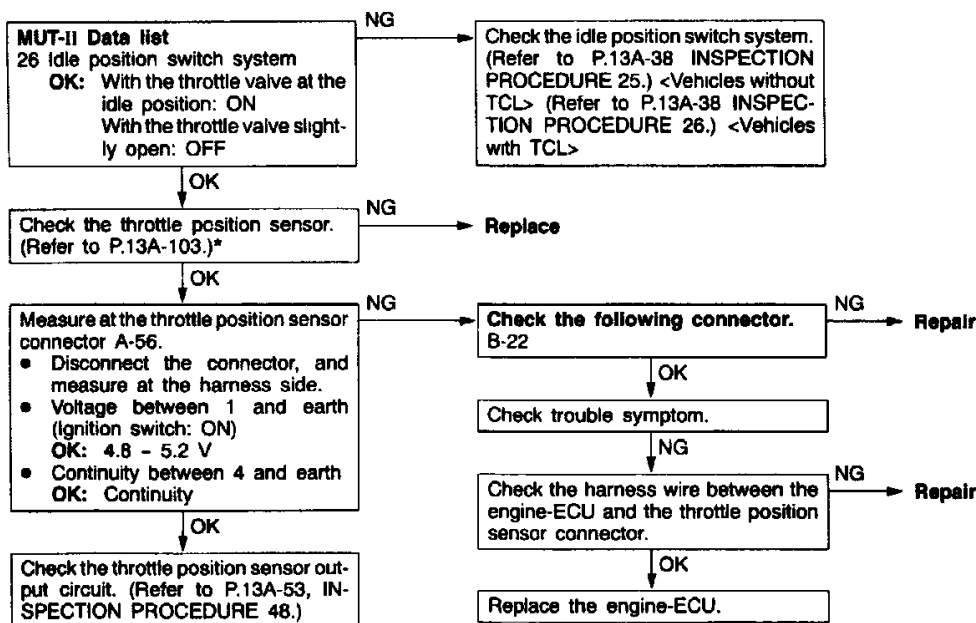


Code No. 13 Intake air temperature sensor system	Probable cause
Range of Check - Ignition switch: ON - Excluding 60 seconds after the ignition switch is turned to ON or immediately after the engine starts. Set conditions - Sensor output voltage is 4.6 V or more (corresponding to an intake air temperature of -45°C or less) for 4 seconds. or - Sensor output voltage is 0.2V or less (corresponding to an intake air temperature of 125°C or more) for 4 seconds.	- Malfunction of the intake air temperature sensor - Improper connector contact, open circuit or short-circuited harness wire of the intake air temperature sensor circuit - Malfunction of the engine-ECU



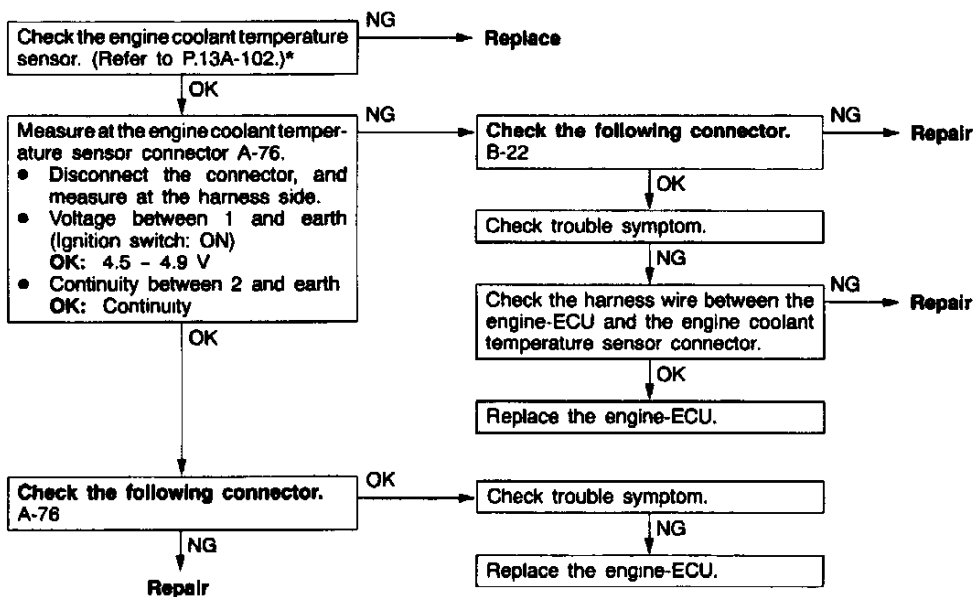
*: Refer to '96 CARISMA Workshop Manual (Pub. No.PWDE9502).

Code No. 14 Throttle position sensor system	Probable cause
Range of Check - Ignition switch: ON - Excluding 60 seconds after the ignition switch is turned to ON or immediately after the engine starts. Set conditions - When the idle position switch is ON, the sensor output voltage is 2 V or more for 4 seconds. or - The sensor output voltage is 0.2 V or less for 4 seconds.	- Malfunction of the throttle position sensor or maladjustment - Improper connector contact, open circuit or short-circuited harness wire of the throttle position sensor circuit - Improper "ON" state of idle position switch - Short circuit of the idle position switch signal line - Malfunction of the engine-ECU



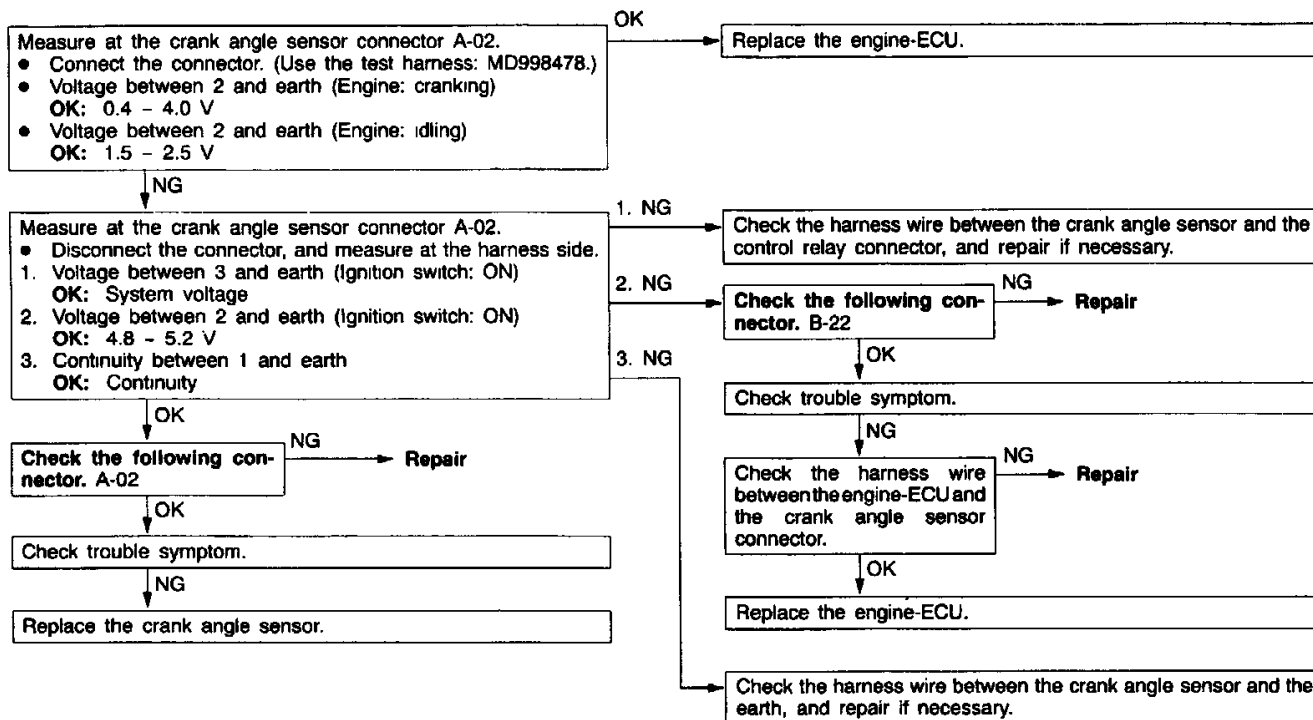
*: Refer to '96 CARISMA Workshop Manual (Pub. No.PWDE9502).

Code No. 21 Engine coolant temperature sensor system	Probable cause
Range of Check - Ignition switch: ON - Excluding 60 seconds after the ignition switch is turned to ON or immediately after the engine starts. Set conditions - Sensor output voltage is 4.6 V or more (corresponding to an engine coolant temperature of -45°C or less) for 4 seconds. or - Sensor output voltage is 0.1 V or less (corresponding to an engine coolant temperature of 140°C or more) for 4 seconds. Range of Check - Ignition switch: ON - Engine speed is approx. 50 r/min or more Set conditions - The sensor output voltage increases from 1.6 V or less (corresponding to an engine coolant temperature of 40°C or more) to 1.6 V or more (corresponding to an engine coolant temperature of 40°C or less). - After this, the sensor output voltage is 1.6 V or more for 5 minutes.	- Malfunction of the engine coolant temperature sensor - Improper connector contact, open circuit or short-circuited harness wire of the engine coolant temperature sensor circuit - Malfunction of the engine-ECU

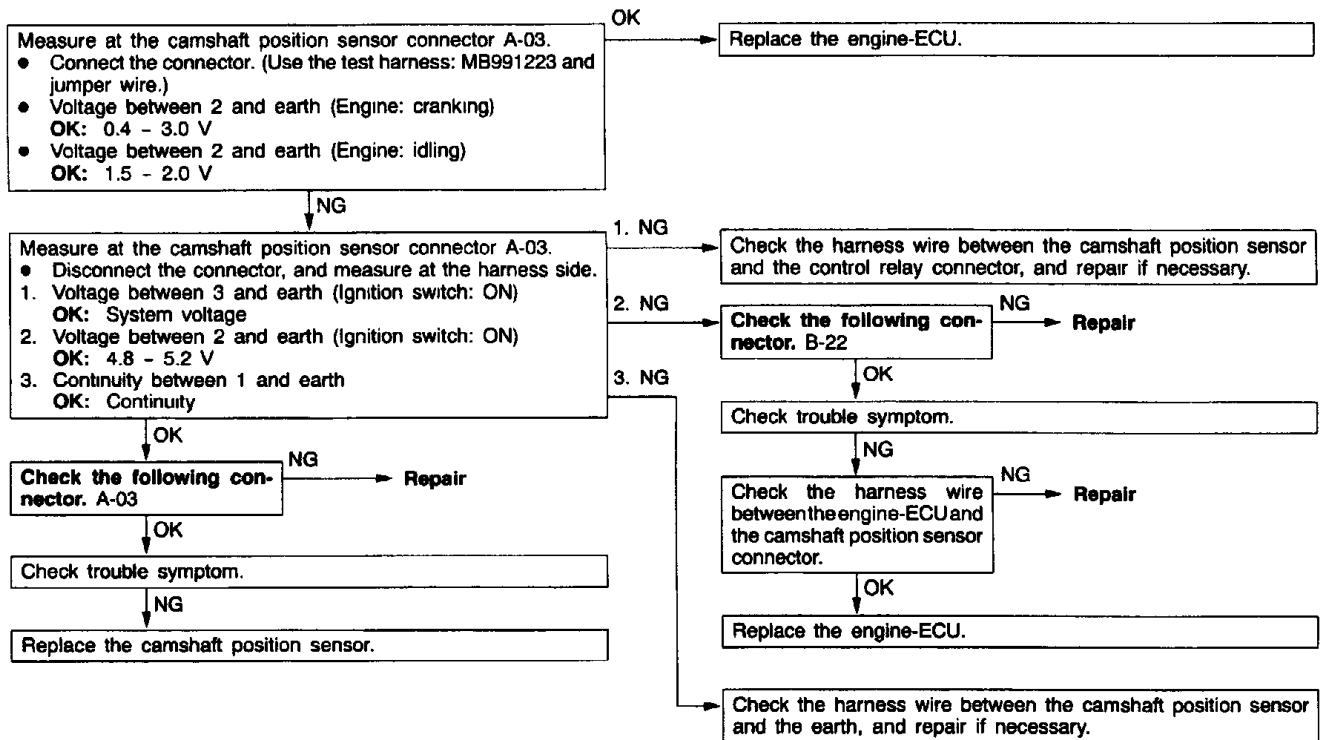


*: Refer to '96 CARISMA Workshop Manual (Pub. No.PWDE9502).

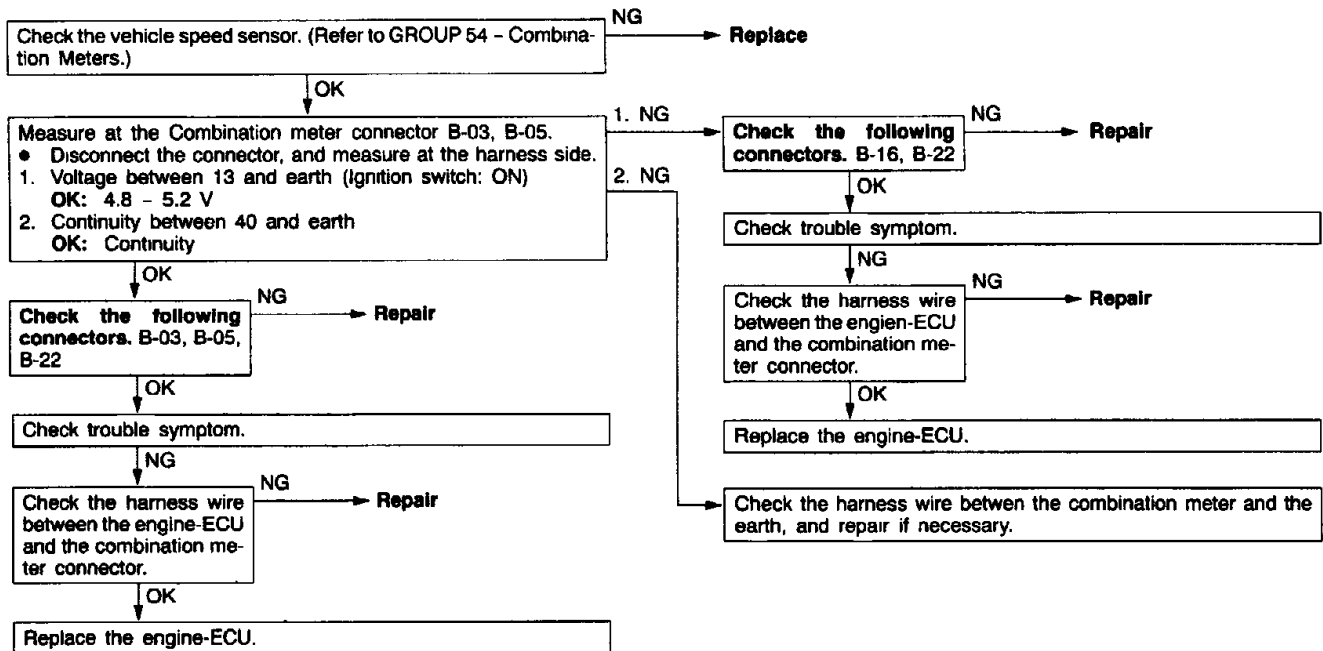
Code No. 22 Crank angle sensor system	Probable cause
Range of Check • Engine is cranking. Set conditions • Sensor output voltage does not change for 4 seconds (no pulse signal input.)	• Malfunction of the crank angle sensor • Improper connector contact, open circuit or short-circuited harness wire of the crank angle sensor • Malfunction of the engine-ECU



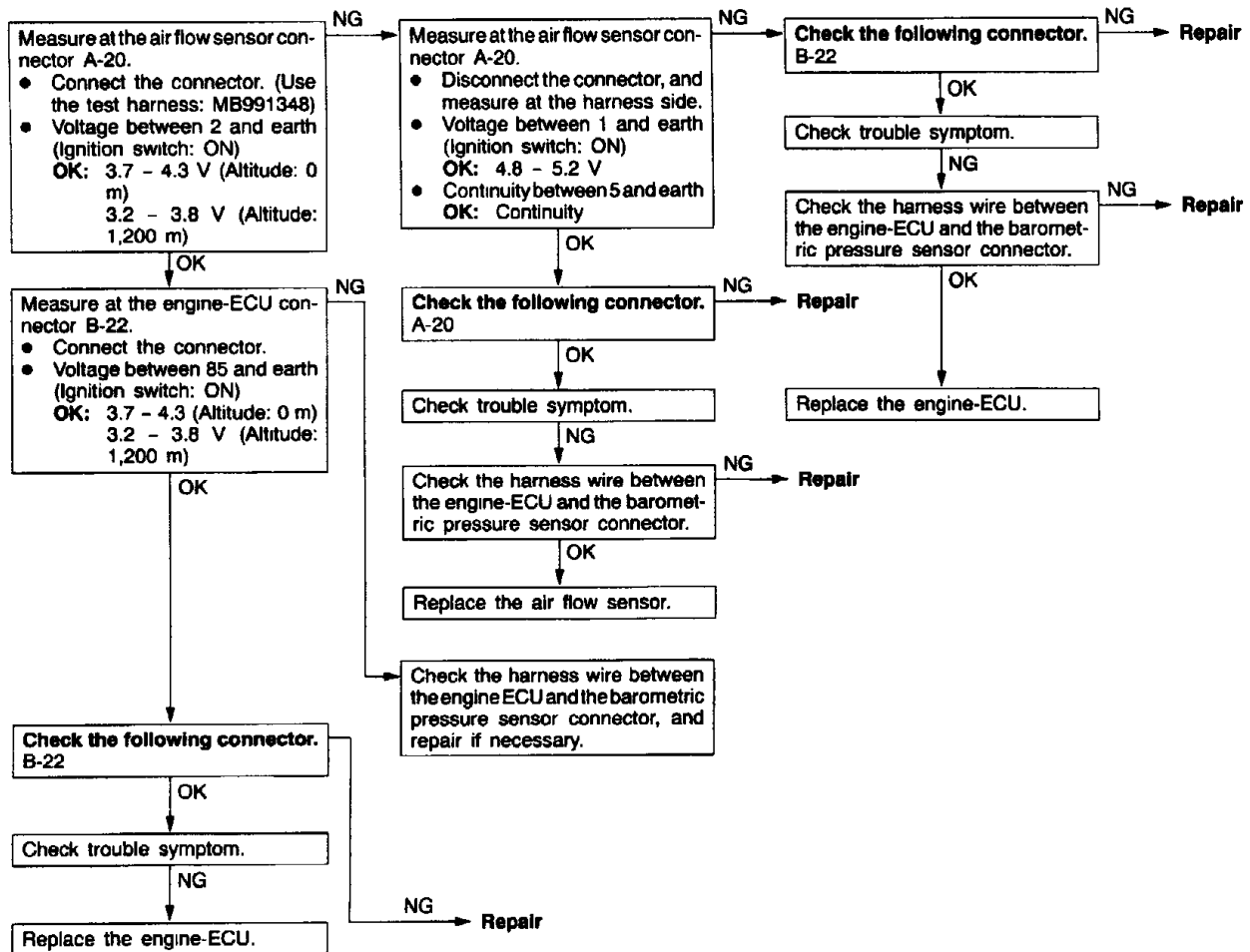
Code No. 23 Camshaft position sensor system	Probable cause
Range of Check • Ignition switch: ON • Engine speed is approx. 50 r/min or more. Set conditions • Sensor output voltage does not change for 4 seconds (no pulse signal input.)	• Malfunction of the camshaft position sensor • Improper connector contact, open circuit or short-circuited harness wire of the camshaft position sensor circuit • Malfunction of the engine-ECU



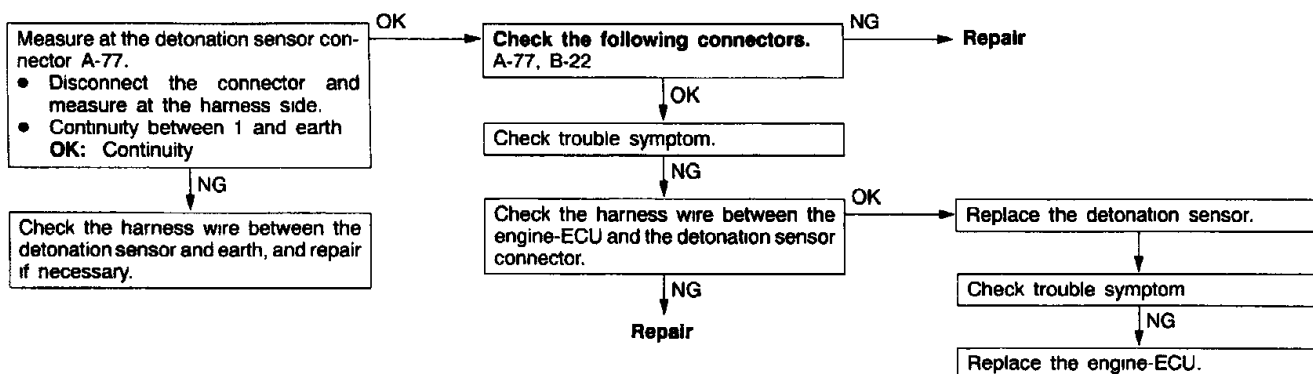
Code No. 24 Vehicles speed sensor system	Probable cause
Range of check - Ignition switch: ON - Excluding 60 seconds after the ignition switch is turned to ON or immediately after the engine starts. - Idle position switch: OFF - Engine speed is 3,000 r/min or more. - Driving under high engine load conditions. Set conditions - Sensor output voltage does not change for 4 seconds (no pulse signal input).	- Malfunction of the vehicle speed sensor - Improper connector contact, open circuit or short-circuited harness wire of the vehicle speed sensor circuit - Malfunction of the engine-ECU



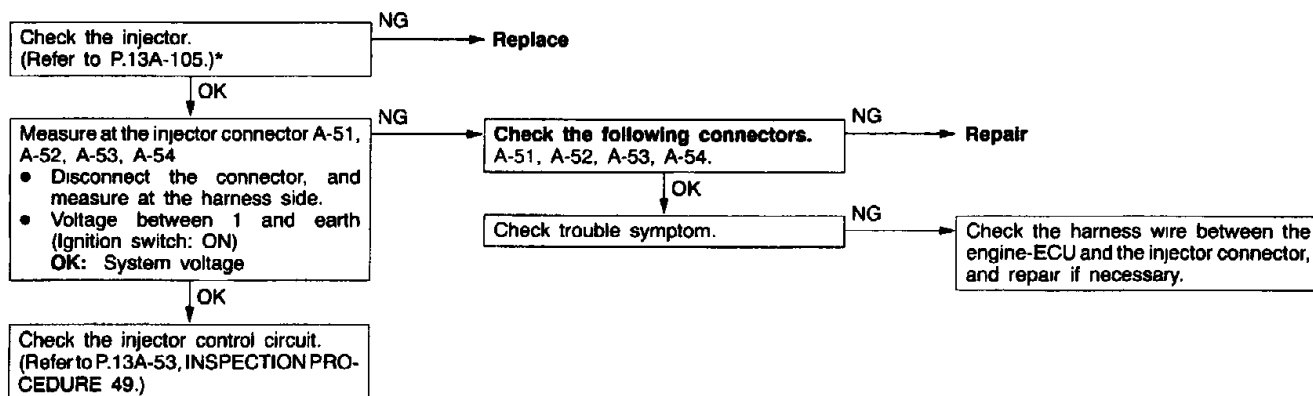
Code No. 25 Barometric pressure sensor system	Probable cause
Range of Check - Ignition switch: ON - Excluding 60 seconds after the ignition switch is turned to ON or immediately after the engine starts. - Battery voltage is 8 V or more. Set conditions - Sensor output voltage is 4.5 V or more (corresponding to a barometric pressure of 114 kPa or more) for 4 seconds. or - Sensor output voltage is 0.2 V or less (corresponding to a barometric pressure of 5.33 kPa or less) for 4 seconds.	- Malfunction of the barometric pressure sensor - Improper connector contact, open circuit or short-circuited harness wire of the barometric pressure sensor circuit - Malfunction of the engine-ECU



Code No. 31 Detonation sensor system	Probable cause
Range of Check - Ignition switch: ON - Excluding 60 seconds after the ignition switch is turned to ON or immediately after the engine starts. - Engine speed is approx. 5,000 r/min or more Set conditions The change in the detonation sensor output voltage (detonation sensor peak voltage at each 1/2 revolution of the crankshaft) is less than 0.06 V for 200 times in succession.	- Malfunction of the detonation sensor - Improper connector contact, open circuit or short-circuited harness wire of the detonation sensor circuit - Malfunction of the engine-ECU

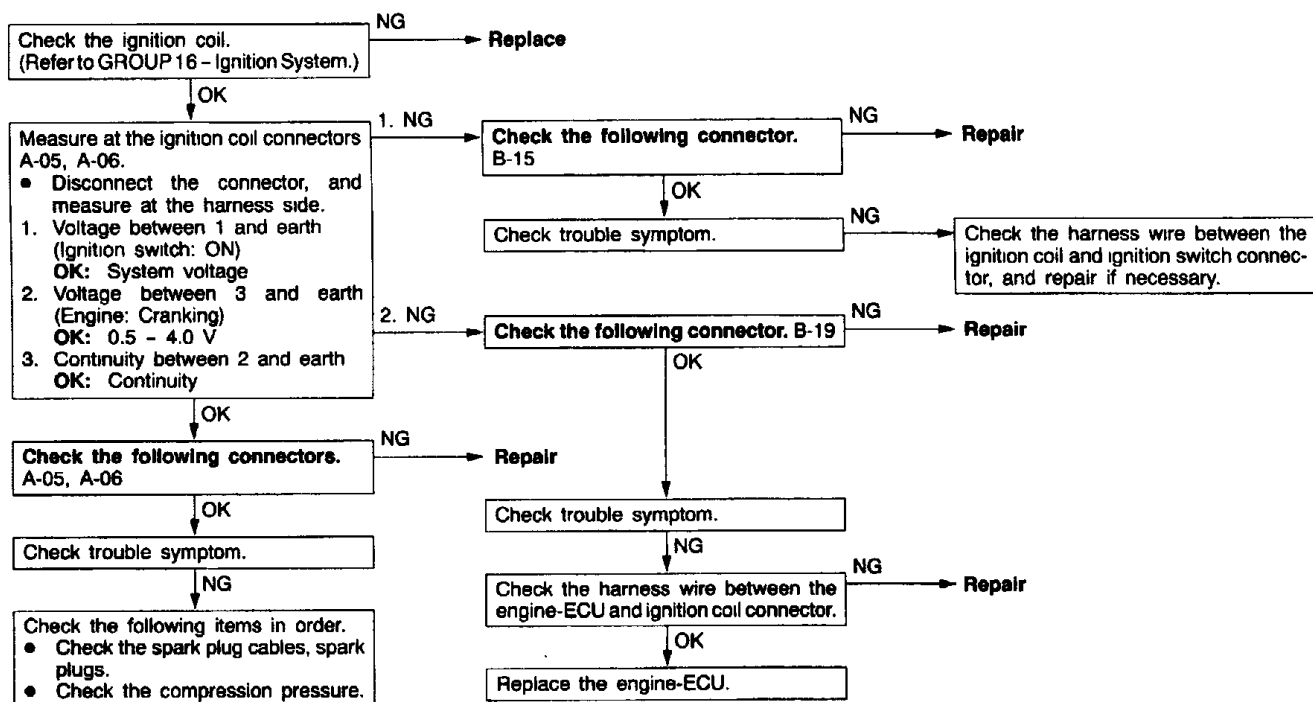


Code No. 41 Injector system	Probable cause
Range of Check - Engine speed is approx. 50 – 1,000 r/min - The throttle position sensor output voltage is 1.15 V or less. - Actuator test by MUT-II is not carried out. Set conditions - Surge voltage of injector coil is not detected for 4 seconds.	- Malfunction of the injector - Improper connector contact, open circuit or short-circuited harness wire of the injector circuit - Malfunction of the engine-ECU



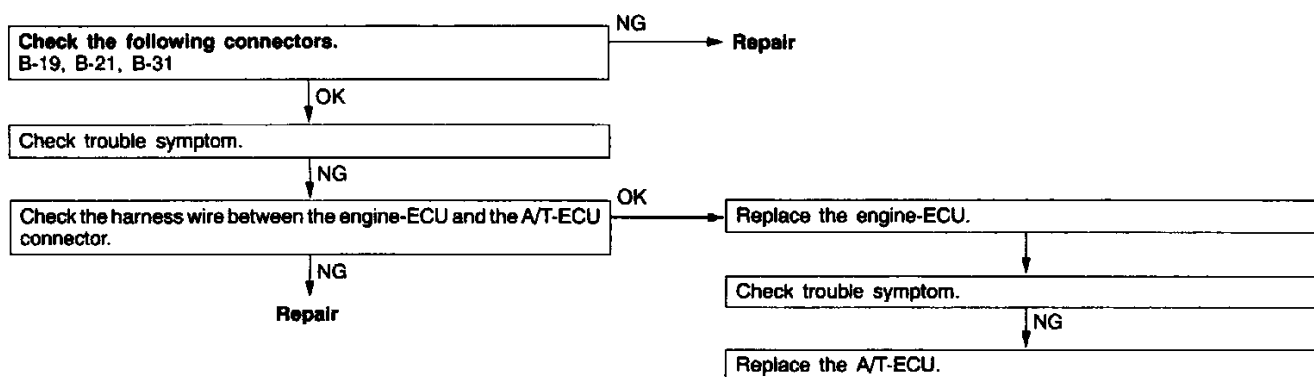
*: Refer to '96 CARISMA Workshop Manual (Pub. No.PWDE9502).

Code No. 44 Ignition coil and power transistor unit system	Probable cause
Range of Check - Engine speed is approx. 50 - 4,000 r/min - Engine is not cranking. Set conditions - The ignition signal from the same coil is not input for 4 seconds. However, this excludes cases where no ignition signal is input from any coils.	- Malfunction of the ignition coil - Improper connector contact, open circuit or short-circuited harness wire of the ignition primary circuit - Malfunction of the engine-ECU

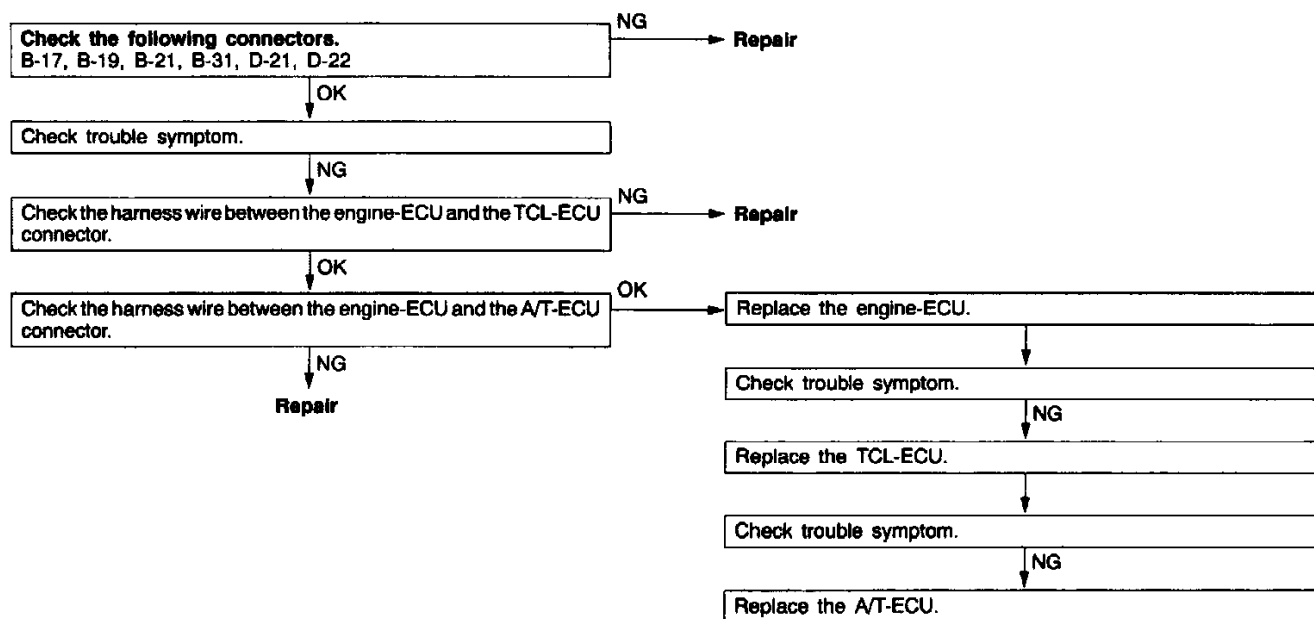


Code No. 61 Communication wire with A/T-ECU system <A/T>	Probable cause
Range of Check • 60 seconds or more have passed immediately after engine was started. • Engine speed is approx. 50 r/min or more Set conditions The voltage of the torque reduction request signal from the A/T-ECU is LOW for 1.5 seconds or more.	• Malfunction of the harness wire and the connector • Malfunction of the engine ECU • Malfunction of the A/T-ECU • Malfunction of the TCL-ECU <Vehicles with TCL>

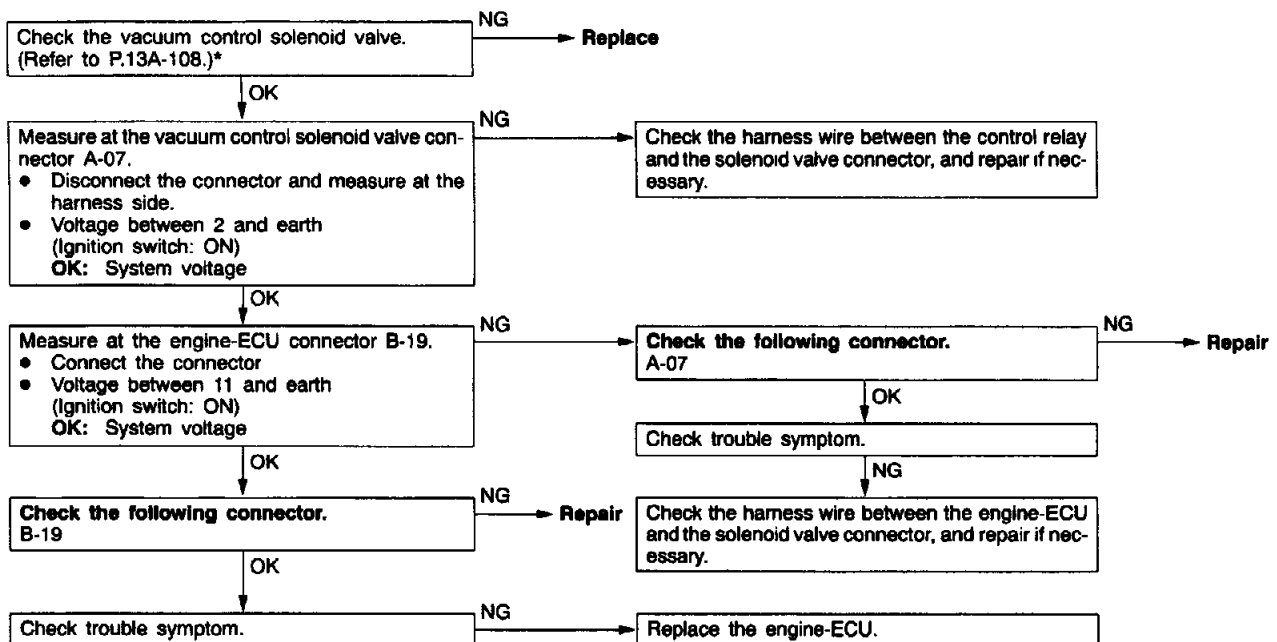
<Vehicles without TCL>



<Vehicles with TCL>

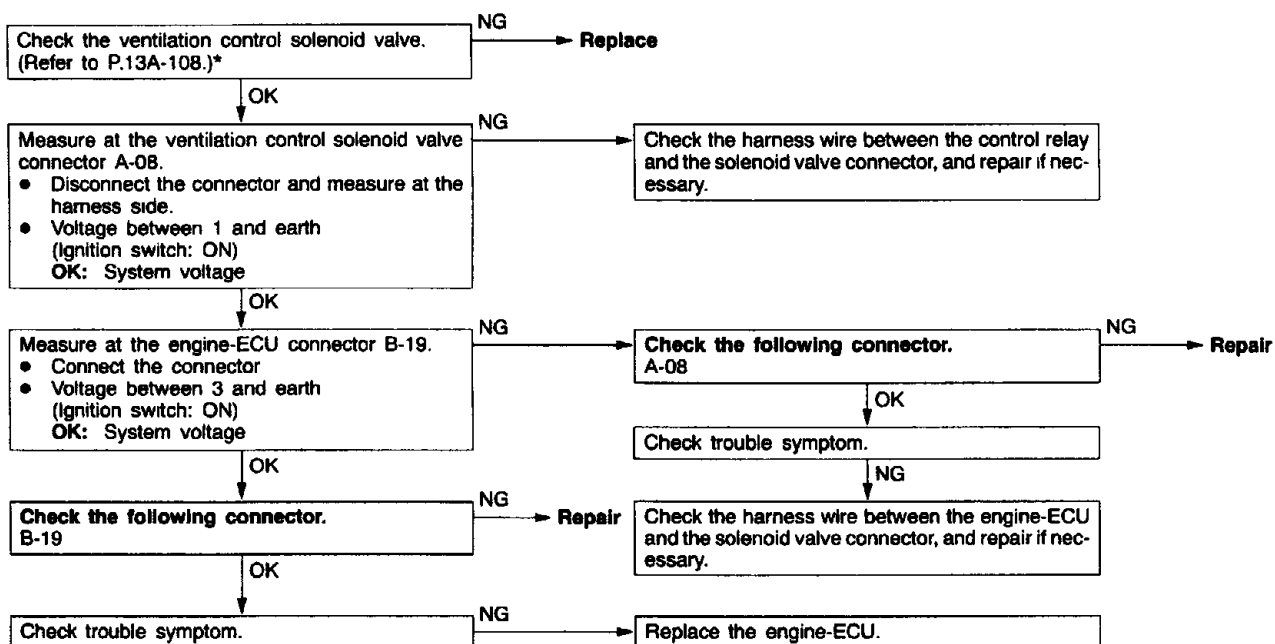


Code No. 71 Vacuum control solenoid valve system Probable cause <Vehicles with TCL>	
Range of Check • Ignition switch: ON • Excluding 60 seconds immediately after the engine starts. • Battery voltage is 10 V or more. • Forced actuation by means of MUT-II is not being carried out. Set condition Solenoid valve drive or non-drive instruction and energized condition of solenoid coil are different.	• Malfunction of the vacuum control solenoid valve • Improper connector contact, open circuit or short-circuited harness wire of the vacuum control solenoid valve • Malfunction of the engine-ECU



*: Refer to '96 CARISMA Workshop Manual (Pub. No.PWDE9502).

Code No. 72 Ventilation control solenoid valve system <Vehicles with TCL>	Probable cause
Range of Check • Ignition switch: ON • Excluding 60 seconds immediately after the engine starts. • Battery voltage is 10 V or more. • Forced actuation by means of MUT-II is not being carried out. Set condition Solenoid valve drive or non-drive instruction and energized condition of solenoid coil are different.	• Malfunction of the ventilation control solenoid valve • Improper connector contact, open circuit or short-circuited harness wire of the ventilation control solenoid valve • Malfunction of the engine-ECU



*: Refer to '96 CARISMA Workshop Manual (Pub. No.PWDE9502).

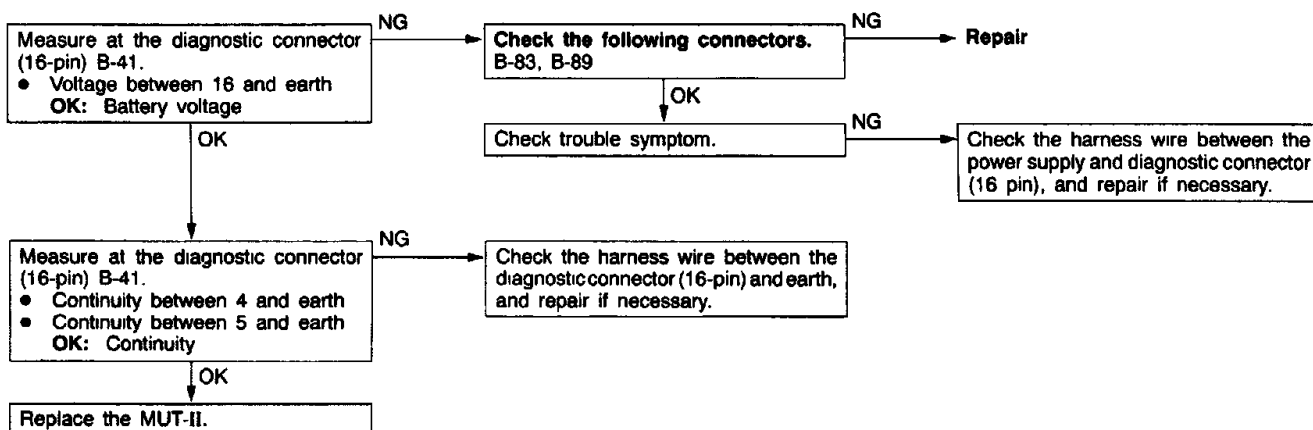
INSPECTION CHART FOR TROUBLE SYMPTOMS

Trouble symptom		Inspection procedure No.	Reference page
Communication with MUT-II is impossible.	Communication with all systems is not possible.	1	13A-22
	Communication with engine ECU only is not possible.	2	13A-22
Engine warning lamp and related parts	The engine warning lamp does not illuminate right after the ignition switch is turned to the ON position.	3	13A-23
	The engine warning lamp remains illuminating and never goes out.	4	13A-23
Starting	No initial combustion (starting impossible)	5	13A-24
	Initial combustion but no complete combustion (starting impossible)	6	13A-25
	Long time to start (improper starting)	7	13A-26
Idling stability (Improper idling)	Unstable idling (Rough idling, hunting)	8	13A-27
	Idling speed is high. (Improper idling speed)	9	13A-28
	Idling speed is low. (Improper idling speed)	10	13A-29
Idling stability (Engine stalls)	When the engine is cold, it stalls at idling. (Die out)	11	13A-30
	When the engine becomes hot, it stalls at idling. (Die out)	12	13A-31
	The engine stalls when starting the car. (Pass out)	13	13A-32
	The engine stalls when decelerating.	14	13A-32
Driving	Hesitation, sag or stumble	15	13A-33
	The feeling of impact or vibration when accelerating	16	13A-33
	The feeling of impact or vibration when decelerating	17	13A-34
	Poor acceleration	18	13A-34
	Surge	19	13A-35
	Knocking	20	13A-35
Dieseling		21	13A-35
Too high CO and HC concentration when idling		22	13A-36

INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS

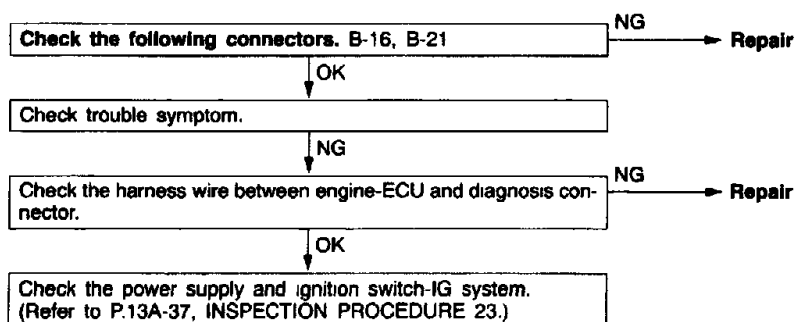
INSPECTION PROCEDURE 1

Communication with MUT-II is not possible. (Communication with all systems is not possible.)	Probable cause
The cause is probably a defect in the power supply system (including earth) for the diagnosis line.	• Malfunction of the connector • Malfunction of the harness wire



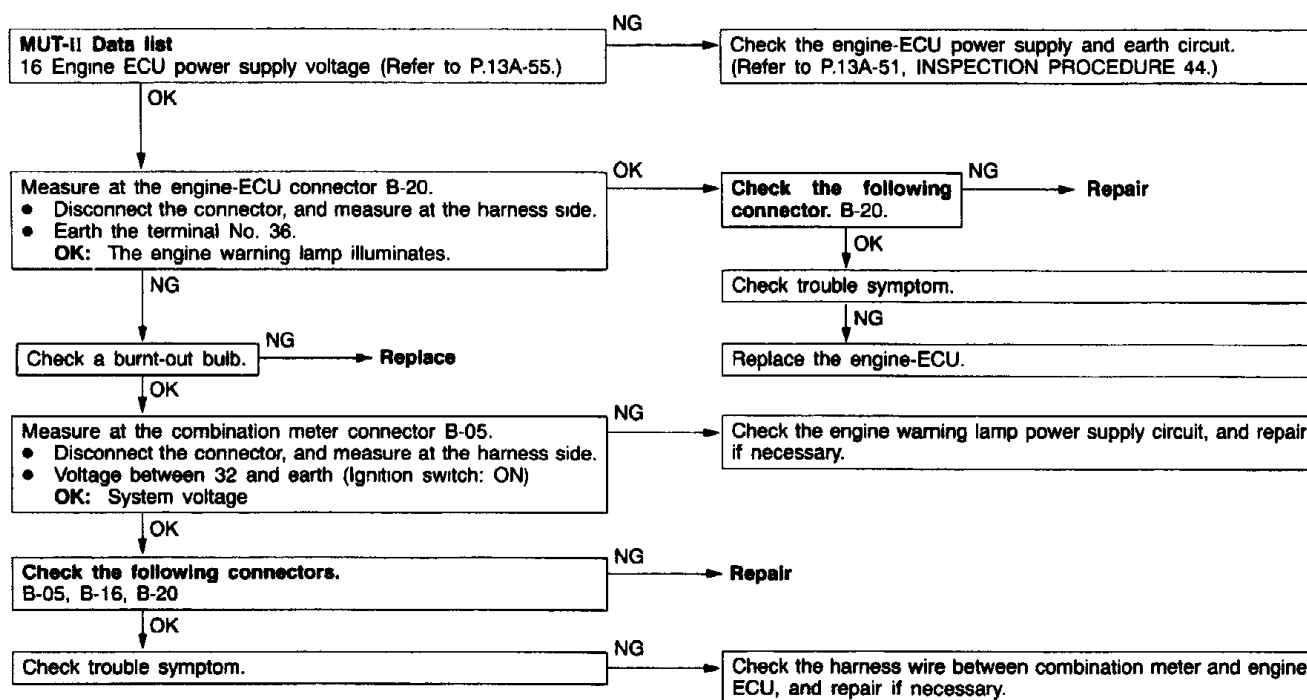
INSPECTION PROCEDURE 2

MUT-II communication with engine ECU is impossible.	Probable cause
One of the following causes may be suspected. • No power supply to engine-ECU • Defective earth circuit of engine-ECU • Defective engine-ECU • Improper communication line between engine-ECU and MUT-II	• Malfunction of engine-ECU power supply circuit • Malfunction of the engine-ECU • Open circuit between engine-ECU and diagnosis connector



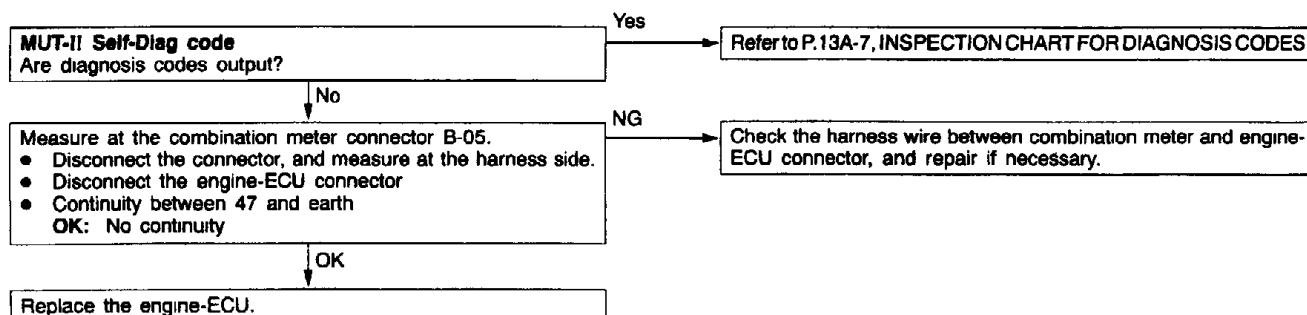
INSPECTION PROCEDURE 3

The engine warning lamp does not illuminate right after the ignition switch is turned to the ON position.	Probable cause
Because there is a burnt-out bulb, the engine-ECU causes the engine warning lamp to illuminate for five seconds immediately after the ignition switch is turned to ON. If the engine warning lamp does not illuminate immediately after the ignition switch is turned to ON, one of the malfunctions listed at right has probably occurred.	• Burnt-out bulb • Defective warning lamp circuit • Malfunction of the engine-ECU



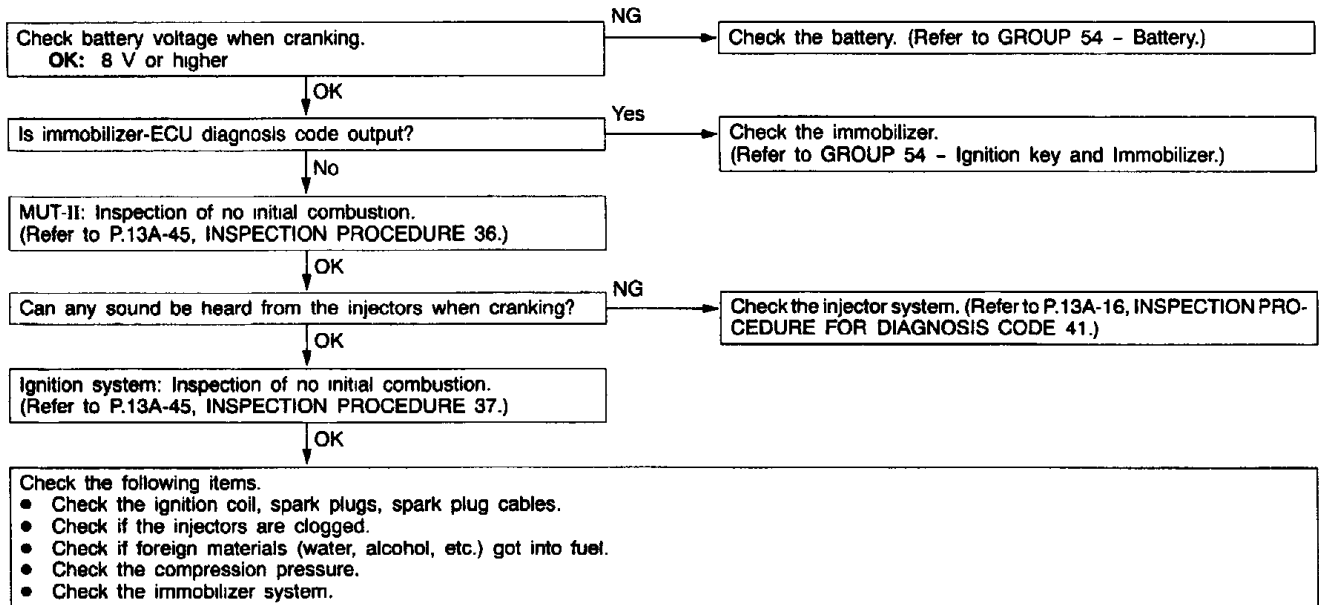
INSPECTION PROCEDURE 4

The engine warning lamp remains illuminating and never goes out.	Probable cause
In cases such as the above, the cause is probably that the engine-ECU is detecting a problem in a sensor or actuator, or that one of the malfunctions listed at right has occurred.	• Short-circuit between the engine warning lamp and engine-ECU • Malfunction of the engine-ECU



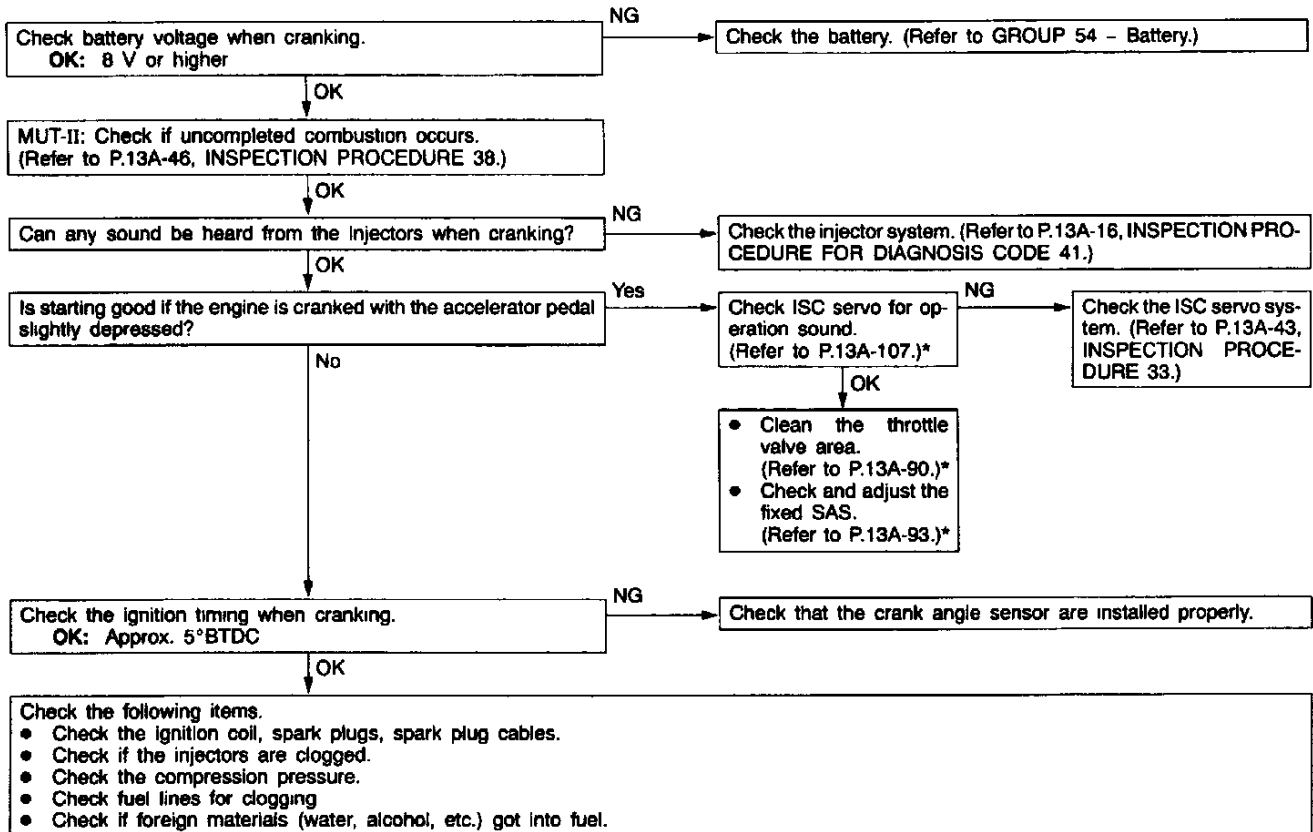
INSPECTION PROCEDURE 5

No initial combustion (starting impossible)	Probable cause
In cases such as the above, the cause is probably that a spark plug is defective, or that the supply of fuel to the combustion chamber is defective. In addition, foreign materials (water, kerosene, etc.) may be mixed with the fuel.	• Malfunction of the ignition system • Malfunction of the fuel pump system • Malfunction of the injectors • Malfunction of the engine-ECU • Malfunction of the immobilizer system • Foreign materials in fuel



INSPECTION PROCEDURE 6

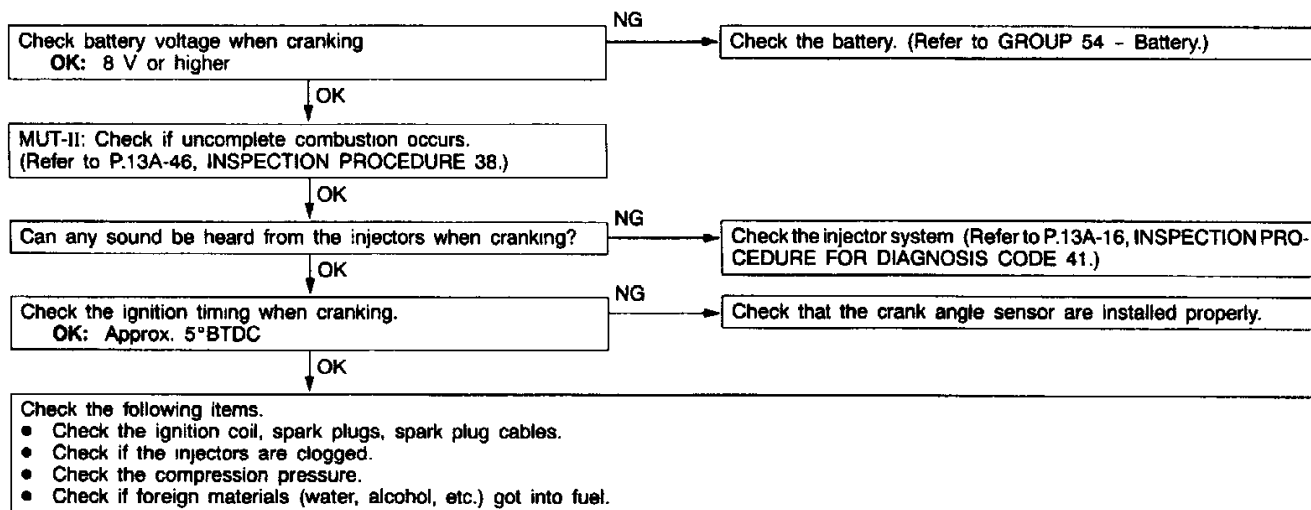
Initial combustion but no complete combustion (starting impossible)	Probable cause
In such cases as the above, the cause is probably that the spark plugs are generating sparks but the sparks are weak, or the initial mixture for starting is not appropriate.	• Malfunction of the ignition system • Malfunction of the injector system • Foreign materials in fuel • Poor compression • Malfunction of the engine-ECU



*: Refer to '96 CARISMA Workshop Manual (Pub. No.PWDE9502).

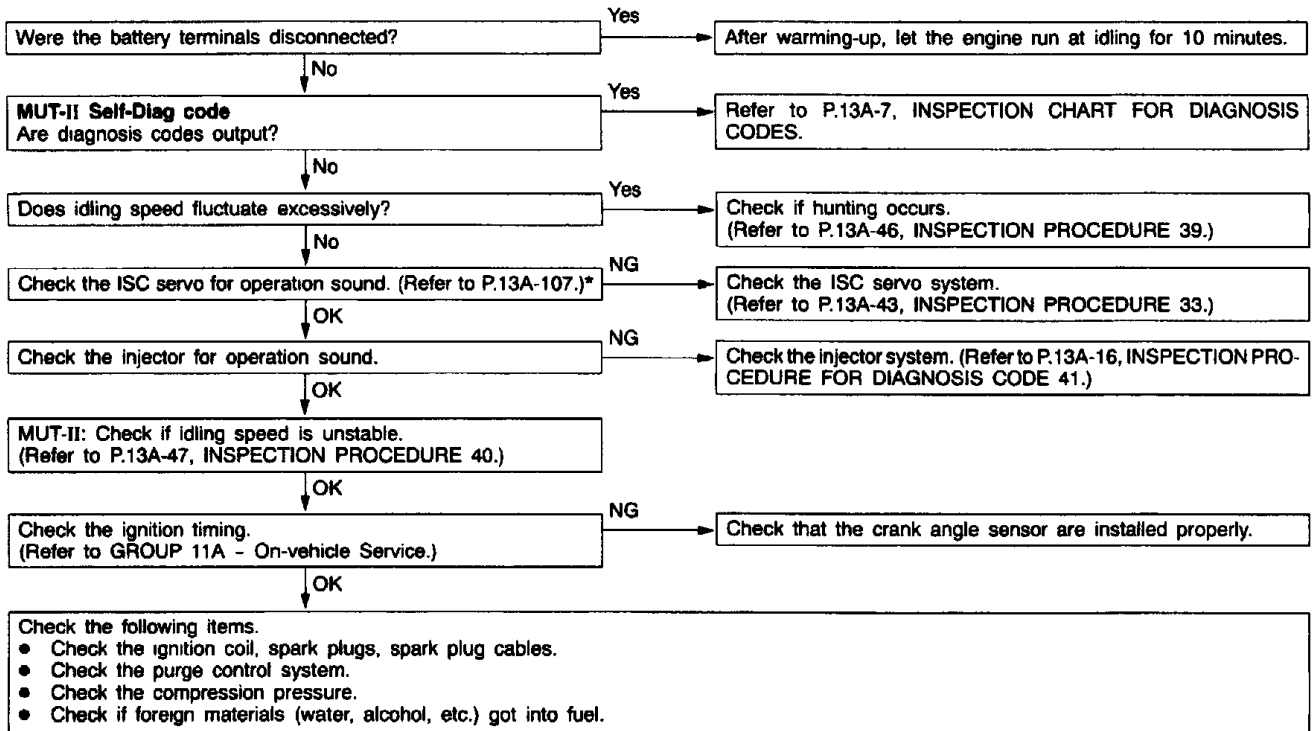
INSPECTION PROCEDURE 7

In takes too long time to start. (Incorrect starting)	Probable cause
In cases such as the above, the cause is probably that the spark is weak and ignition is difficult, the initial mixture for starting is not appropriate, or sufficient compression pressure is not being obtained.	• Malfunction of the ignition system • Malfunction of the injector system • Inappropriate gasoline use • Poor compression



INSPECTION PROCEDURE 8

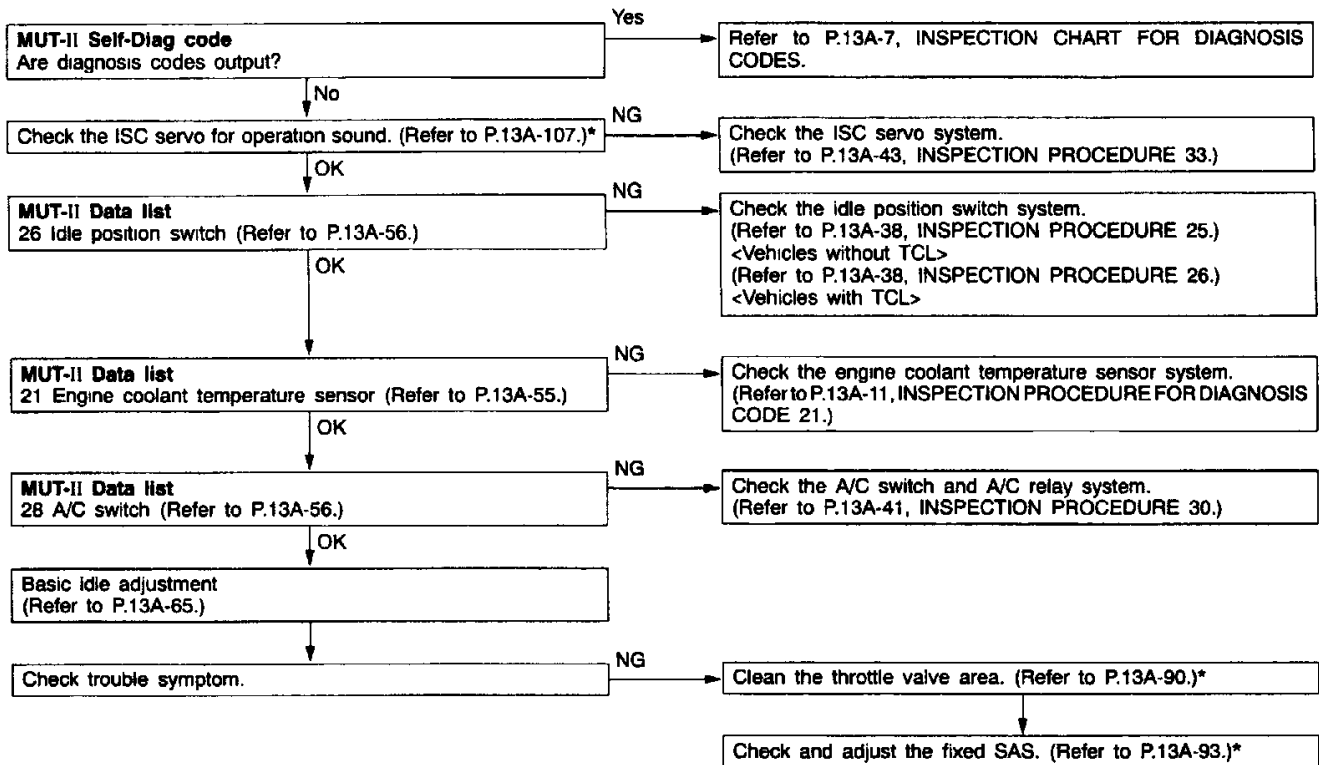
Unstable idling (Rough idling, hunting)	Probable cause
In cases as the above, the cause is probably that the ignition system, air/fuel mixture, idle speed control (ISC) or compression pressure is defective. Because the range of possible causes is broad, inspection is narrowed down to simple items.	● Malfunction of the ignition system ● Malfunction of air-fuel ratio control system ● Malfunction of the ISC system ● Malfunction of the purge control solenoid valve system ● Poor compression ● Drawing air into exhaust system



*: Refer to '96 CARISMA Workshop Manual (Pub. No.PWDE9502).

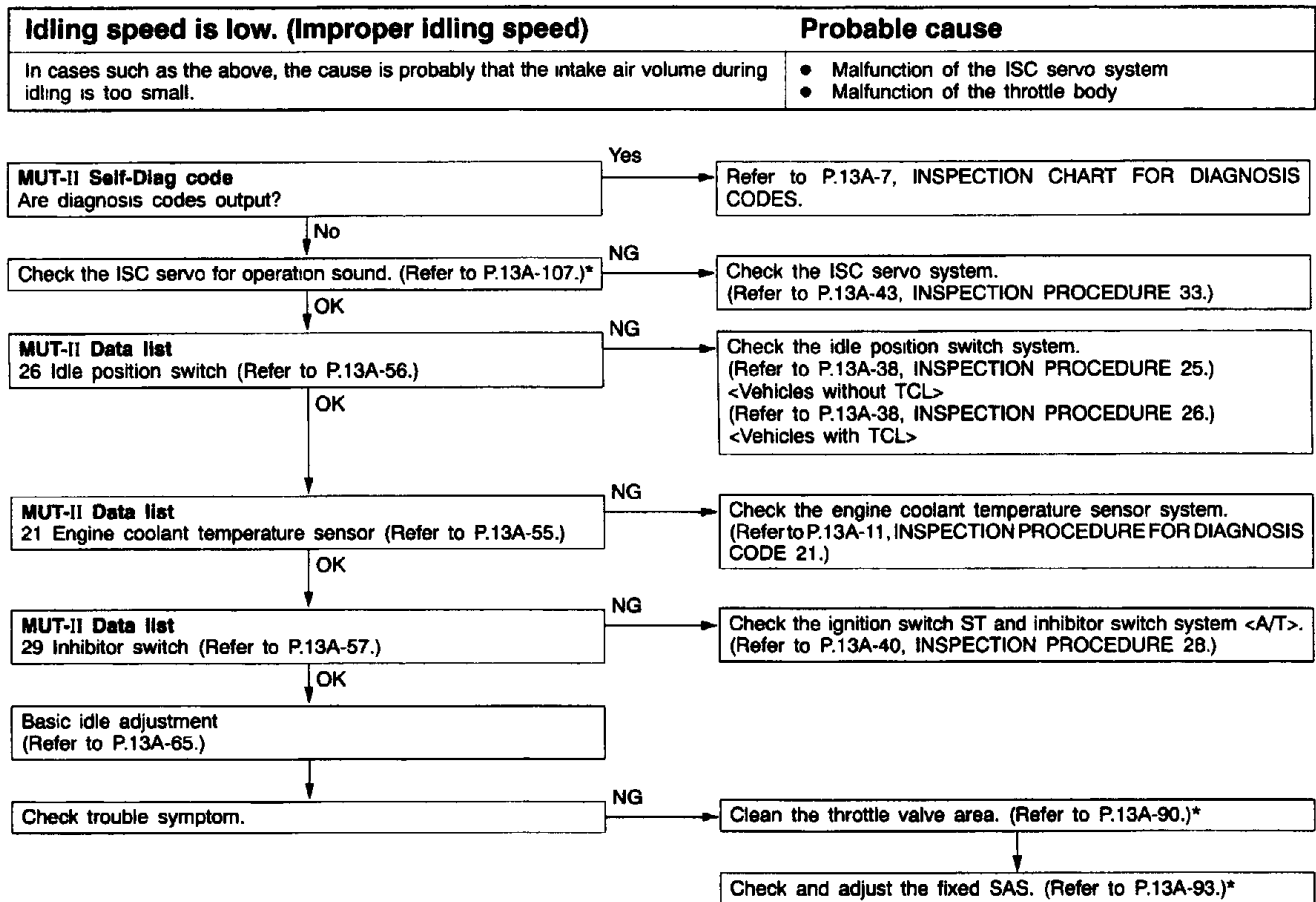
INSPECTION PROCEDURE 9

Idling speed is high. (Improper idling speed)	Probable cause
In such cases as the above, the cause is probably that the intake air volume during idling is too great.	• Malfunction of the ISC servo system • Malfunction of the throttle body



*: Refer to '96 CARISMA Workshop Manual (Pub. No.PWDE9502).

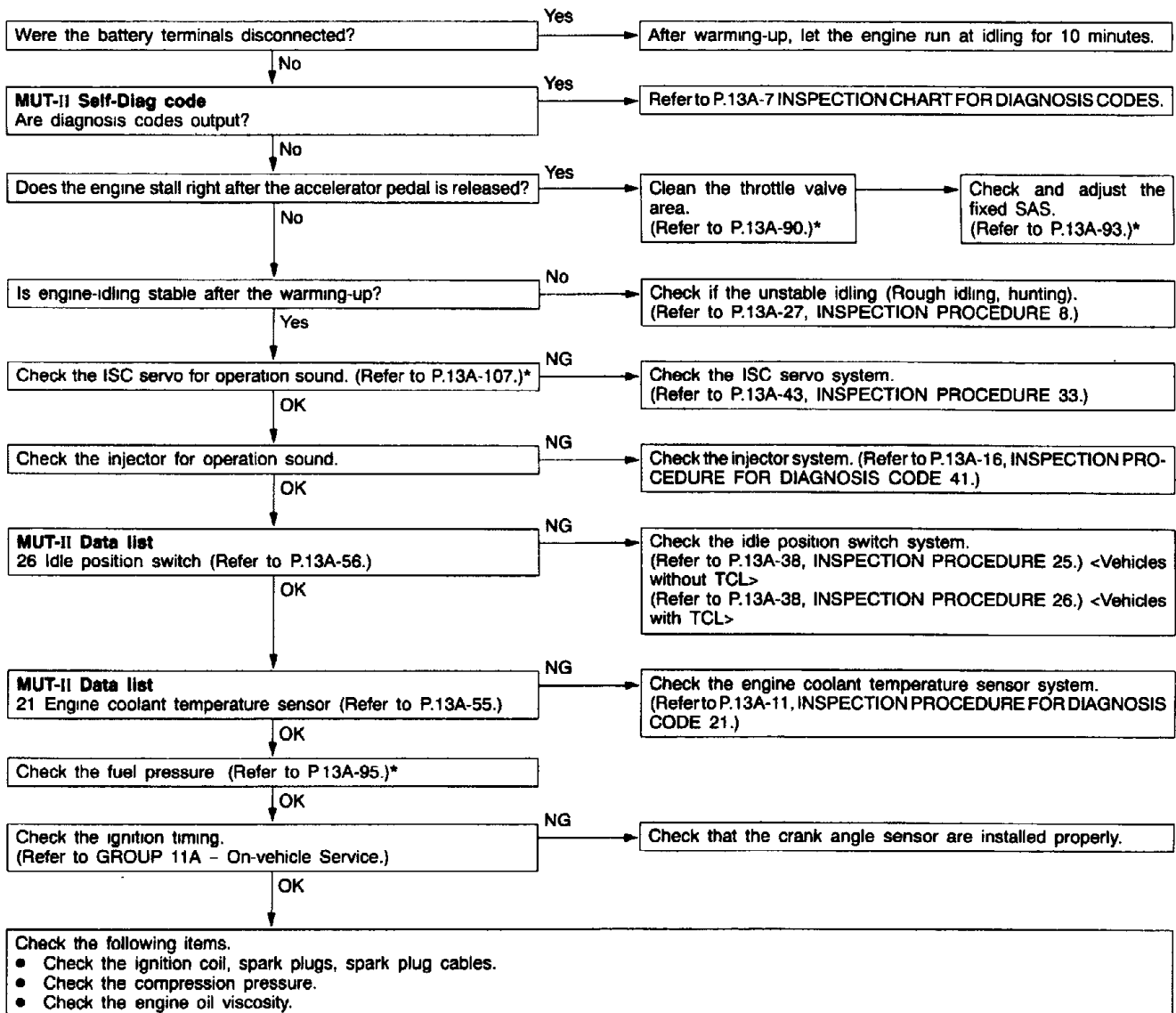
INSPECTION PROCEDURE 10



*: Refer to '96 CARISMA Workshop Manual (Pub. No.PWDE9502).

INSPECTION PROCEDURE 11

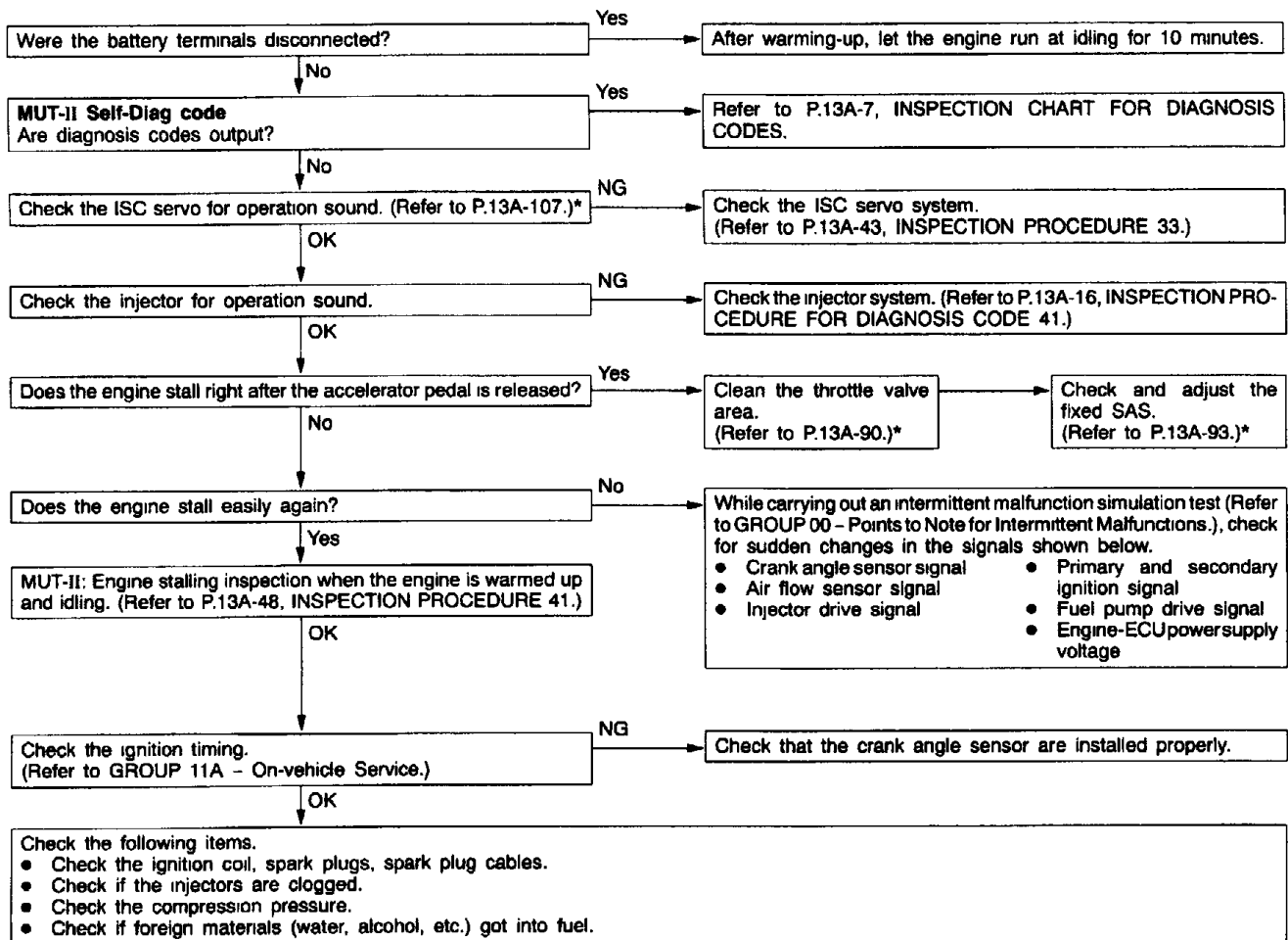
When the engine is cold, it stalls at idling. (Die out)	Probable cause
In such cases as the above, the cause is probably that the air/fuel mixture is inappropriate when the engine is cold, or that the intake air volume is insufficient.	• Malfunction of the ISC servo system • Malfunction of the throttle body • Malfunction of the injector system • Malfunction of the ignition system



*: Refer to '96 CARISMA Workshop Manual (Pub. No.PWDE9502).

INSPECTION PROCEDURE 12

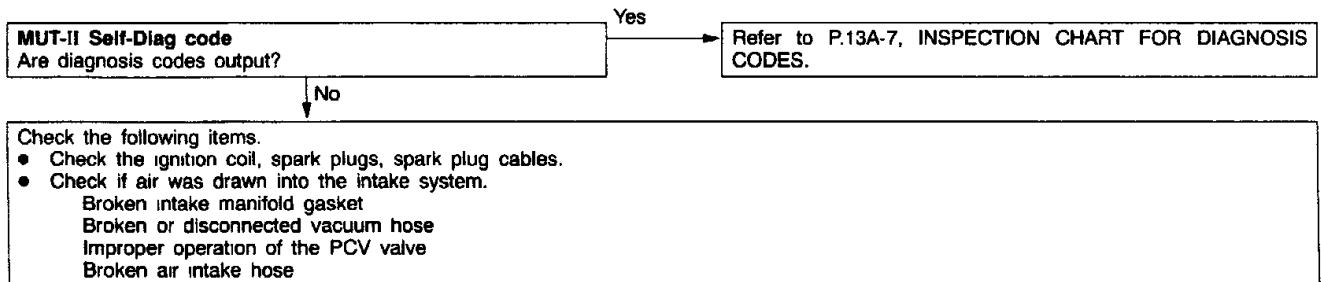
When the engine is hot, it stalls at idling. (Die out)	Probable cause
In such cases as the above, the cause is probably that ignition system, air/fuel mixture, idle speed control (ISC) or compression pressure is defective. In addition, if the engine suddenly stalls, the cause may also be a defective connector contact.	● Malfunction of the ignition system ● Malfunction of air-fuel ratio control system ● Malfunction of the ISC system ● Drawing air into intake system ● Improper connector contact



*: Refer to '96 CARISMA Workshop Manual (Pub. No.PWDE9502).

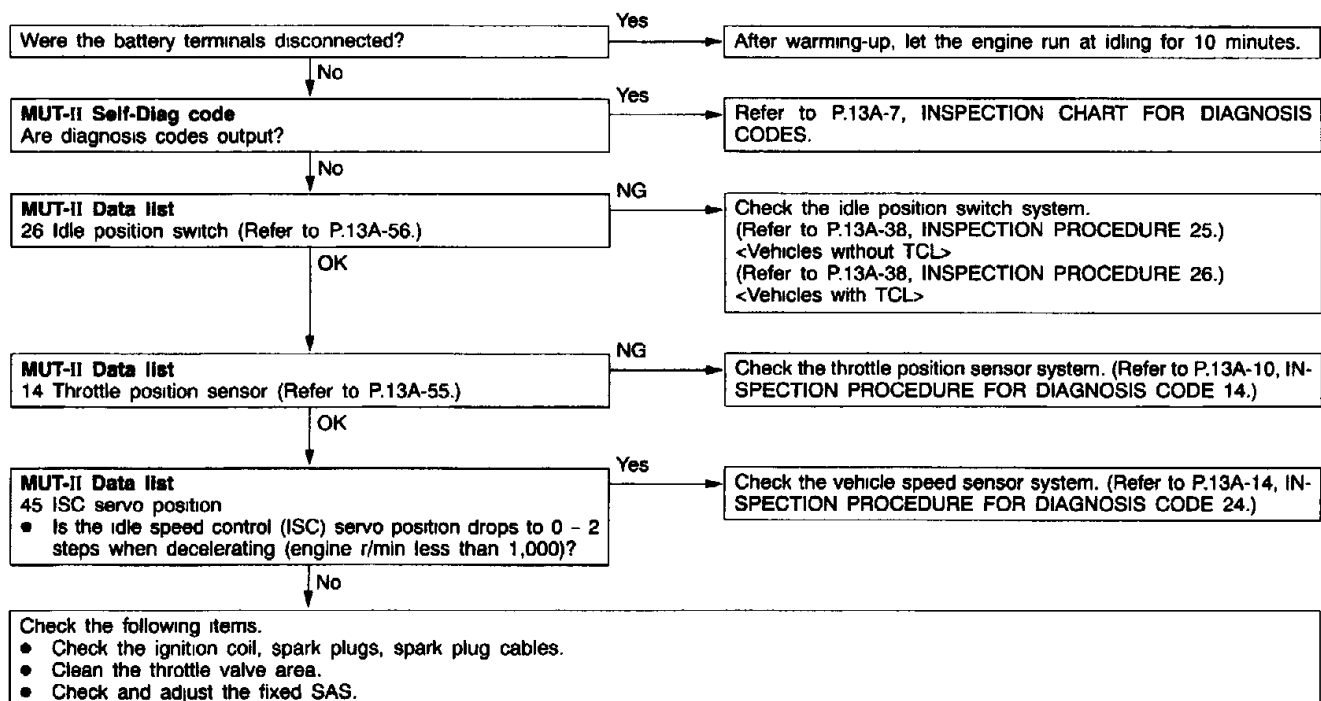
INSPECTION PROCEDURE 13

The engine stalls when starting the car. (Pass out)	Probable cause
In cases such as the above, the cause is probably misfiring due to a weak spark, or an inappropriate air/fuel mixture when the accelerator pedal is depressed.	• Drawing air into intake system • Malfunction of the ignition system



INSPECTION PROCEDURE 14

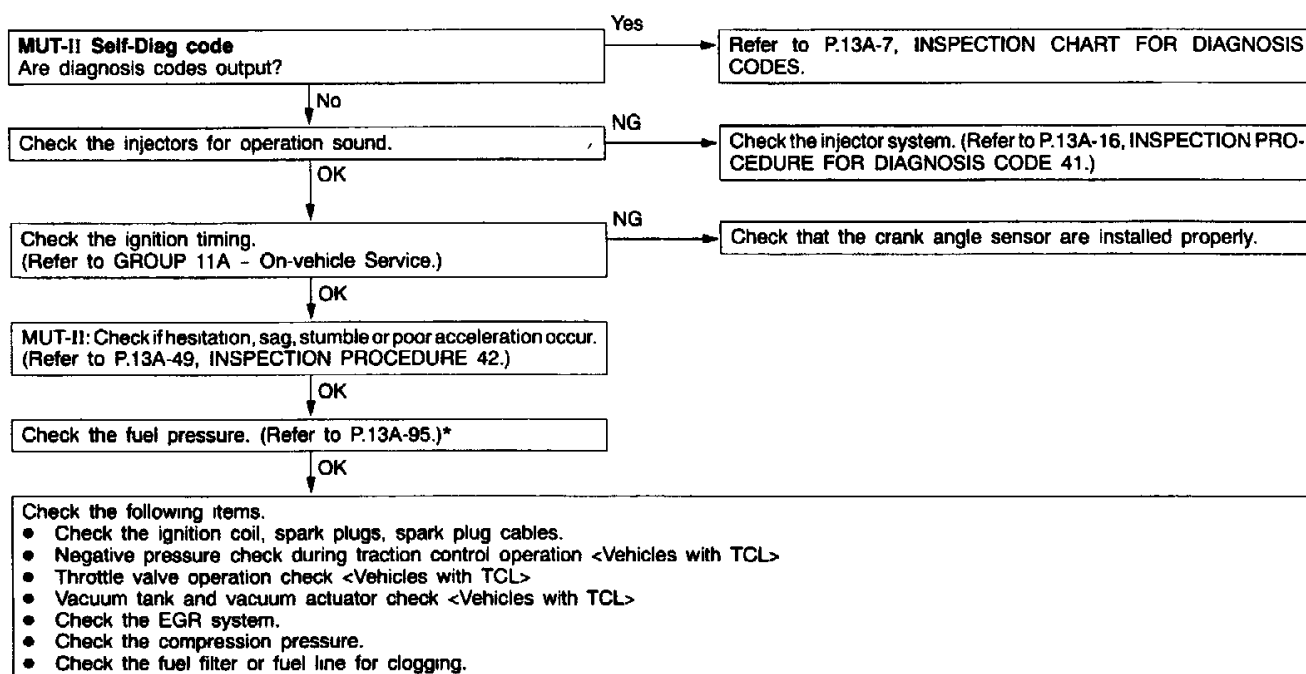
The engine stalls when decelerating.	Probable cause
In cases such as the above, the cause is probably that the intake air volume is insufficient due to a defective idle speed control (ISC) servo system.	• Malfunction of the ISC system



*: Refer to '96 CARISMA Workshop Manual (Pub. No.PWDE9502).

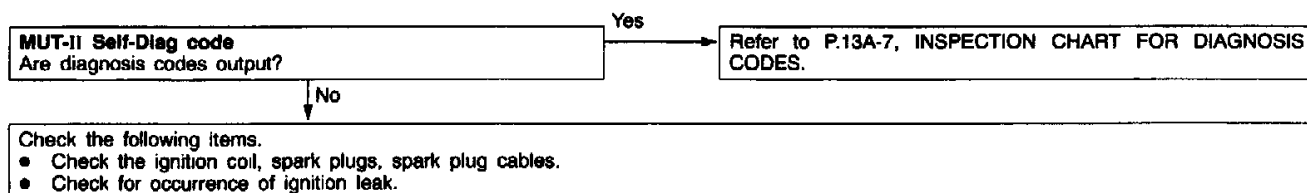
INSPECTION PROCEDURE 15

Hesitation, sag or stumble	Probable cause
In cases such as the above, the cause is probably that ignition system, air/fuel mixture or compression pressure is defective.	• Malfunction of the ignition system • Malfunction of air-fuel ratio control system • Malfunction of the fuel supply system • Malfunction of the EGR control solenoid valve system • Poor compression



INSPECTION PROCEDURE 16

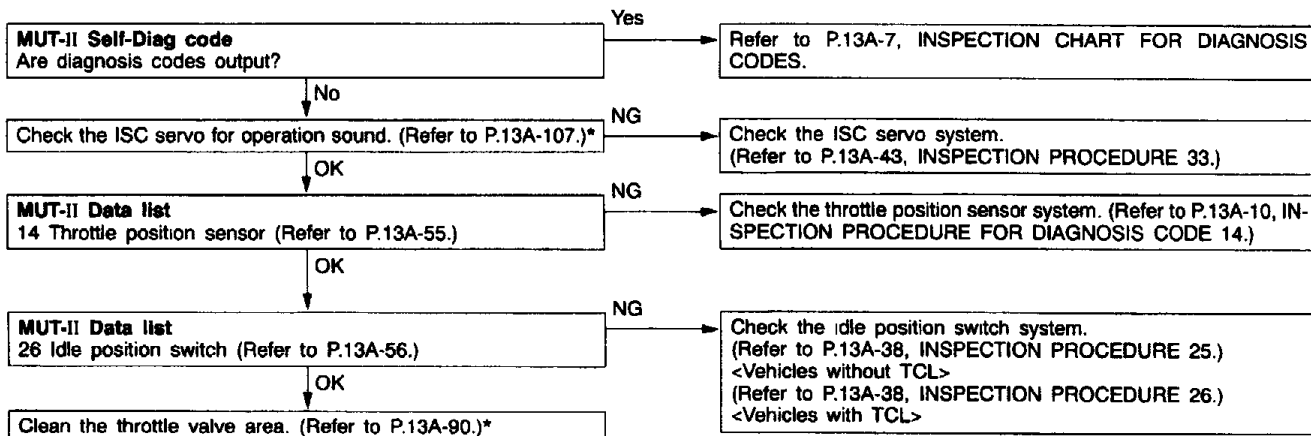
The feeling of impact or vibration when accelerating	Probable cause
In cases such as the above, the cause is probably that there is an ignition leak accompanying the increase in the spark plug demand voltage during acceleration.	• Malfunction of the ignition system



*: Refer to '96 CARISMA Workshop Manual (Pub. No.PWDE9502).

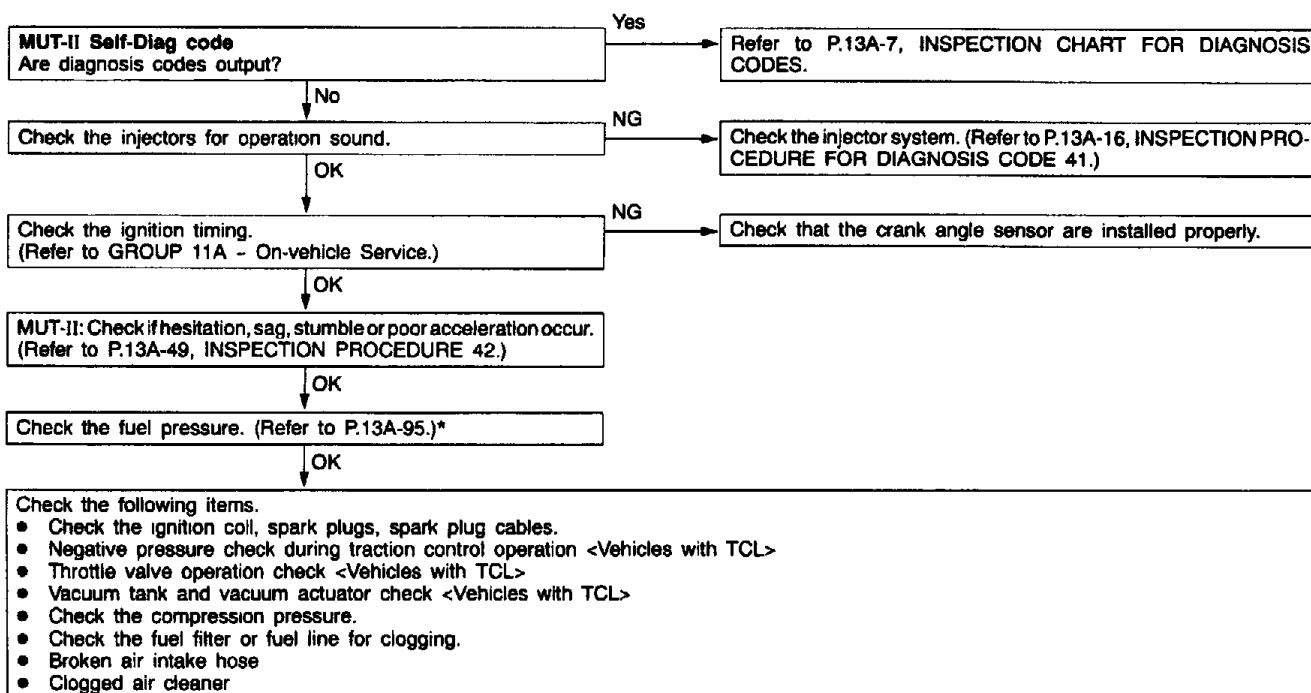
INSPECTION PROCEDURE 17

The feeling of impact or vibration when decelerating.	Probable cause
Malfunction of the ISC system is suspected.	Malfunction of the ISC system



INSPECTION PROCEDURE 18

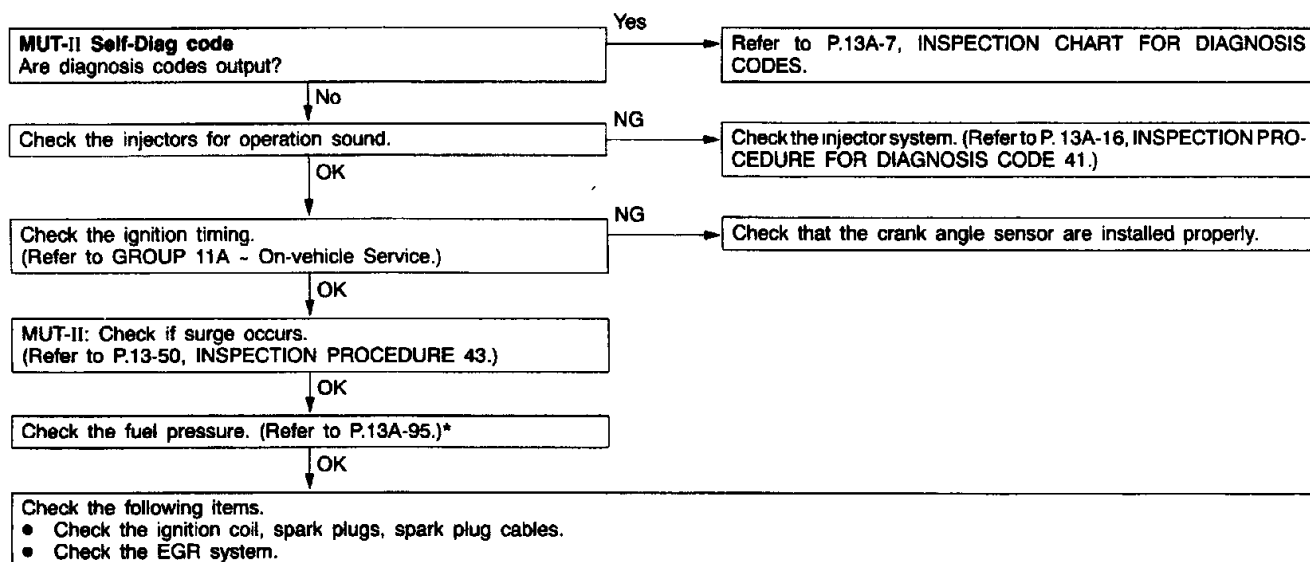
Poor acceleration	Probable cause
Defective ignition system, abnormal air-fuel ratio, poor compression pressure, etc. are suspected.	- Malfunction of the ignition system - Malfunction of air-fuel ratio control system - Malfunction of the fuel supply system - Poor compression pressure - Clogged exhaust system



*: Refer to '96 CARISMA Workshop Manual (Pub. No.PWDE9502).

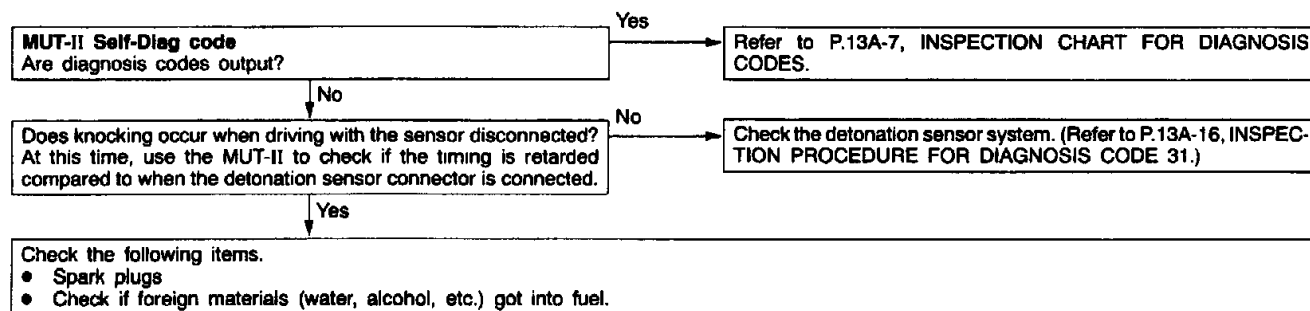
INSPECTION PROCEDURE 19

Surge	Probable cause
Defective ignition system, abnormal air-fuel ratio, etc. are suspected.	• Malfunction of the ignition system • Malfunction of air-fuel ratio control system • Malfunction of the EGR control solenoid valve system



INSPECTION PROCEDURE 20

Knocking	Probable cause
In cases as the above, the cause is probably that the detonation control is defective or the heat value of the spark plug is inappropriate.	• Defective detonation sensor • Inappropriate heat value of the spark plug



INSPECTION PROCEDURE 21

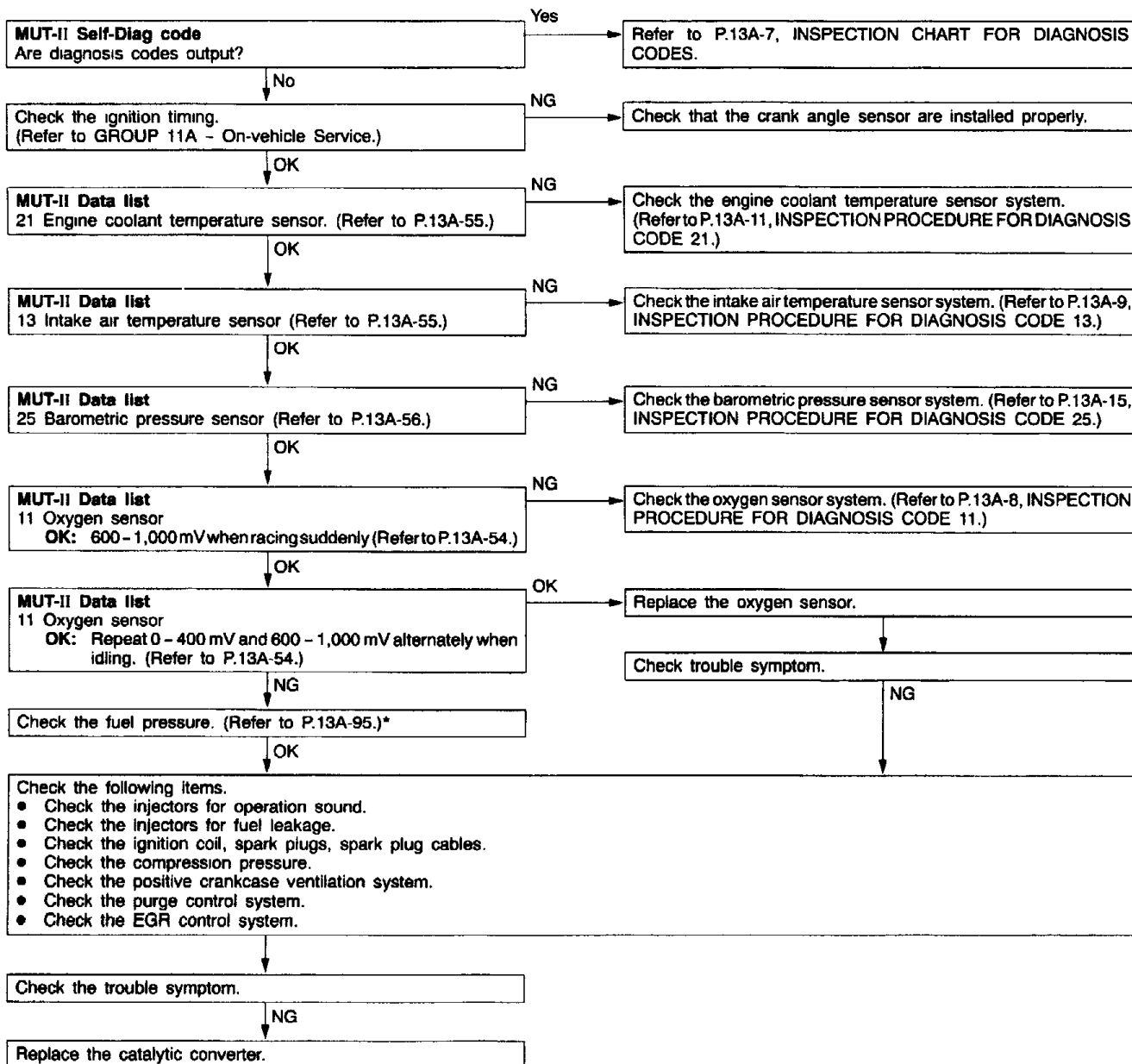
Dieseling	Probable cause
Fuel leakage from injectors is suspected.	• Fuel leakage from injectors

Check the injectors for fuel leakage.

*: Refer to '96 CARISMA Workshop Manual (Pub. No.PWDE9502).

INSPECTION PROCEDURE 22

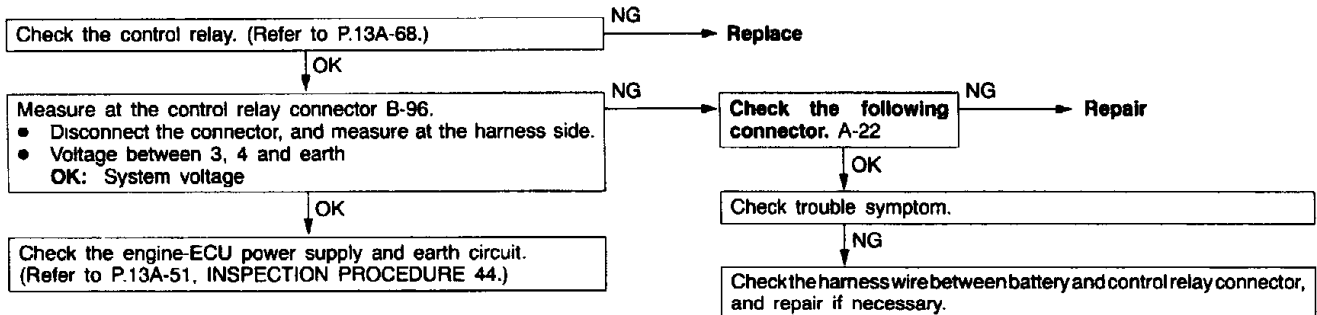
Too high CO and HC concentration when idling	Probable cause
Abnormal air-fuel ratio is suspected.	- Malfunction of the air-fuel ratio control system - Deteriorated catalyst



*: Refer to '96 CARISMA Workshop Manual (Pub. No.PWDE9502).

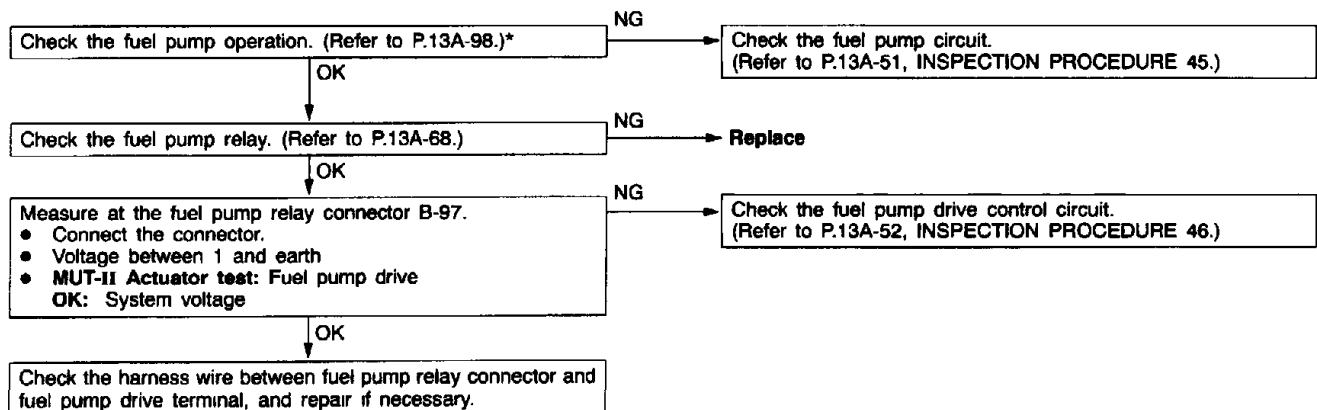
INSPECTION PROCEDURE 23

Power supply system and ignition switch-IG system	Probable cause
When an ignition switch ON signal is input to the engine ECU, the engine ECU turns the control relay ON. This causes battery voltage to be supplied to the engine ECU, injectors and air flow sensor.	• Malfunction of the ignition switch • Malfunction of the control relay • Improper connector contact, open circuit or short-circuited harness wire • Disconnected engine-ECU earth wire • Malfunction of the engine-ECU



INSPECTION PROCEDURE 24

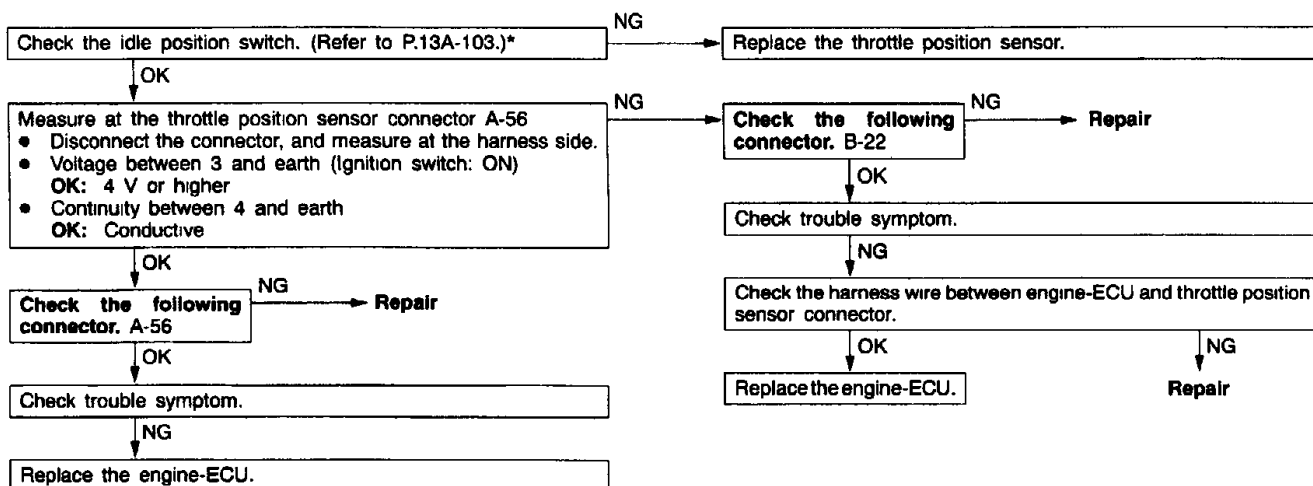
Fuel pump system	Probable cause
The engine-ECU turns the control relay ON when the engine is cranking or running, and this supplies power to drive the fuel pump.	• Malfunction of the fuel pump relay • Malfunction of the fuel pump • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the engine-ECU



*: Refer to '96 CARISMA Workshop Manual (Pub. No.PWDE9502).

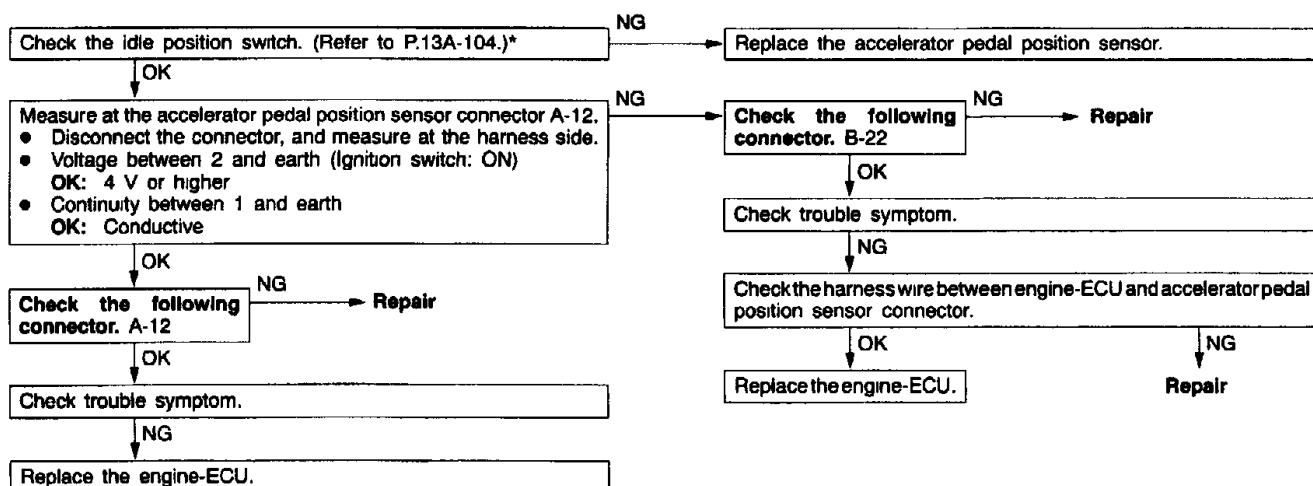
INSPECTION PROCEDURE 25

Idle position switch system <Vehicles without TCL>	Probable cause
The idle position switch inputs the condition of the accelerator pedal, i.e. whether it is depressed or released (HIGH/LOW), to the engine-ECU. The engine-ECU controls the idle speed control servo based on this input.	• Maladjustment of the accelerator pedal • Maladjustment of the fixed SAS • Maladjustment of the idle position switch and throttle position sensor • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the engine-ECU



INSPECTION PROCEDURE 26

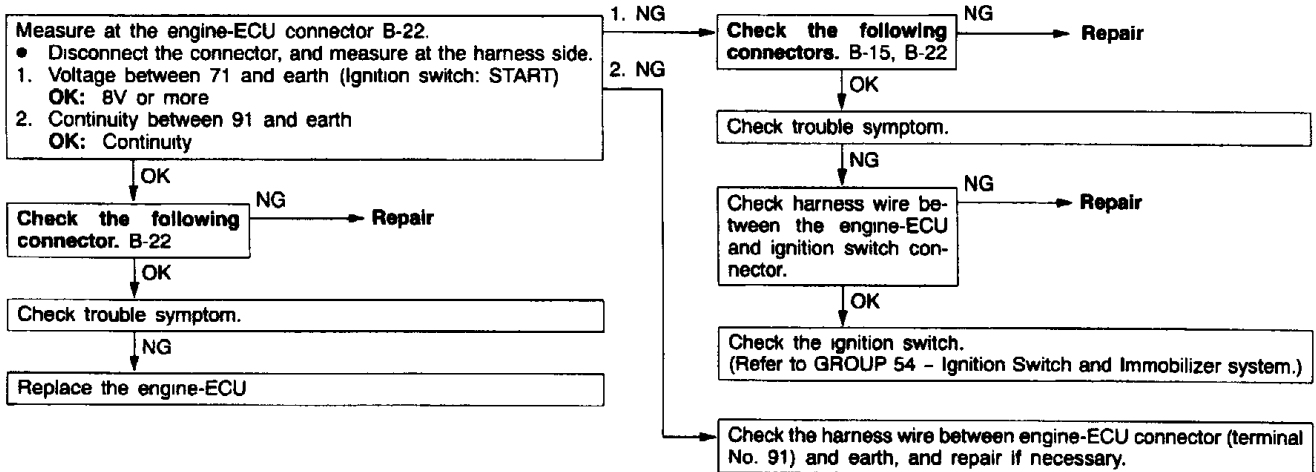
Idle position switch system <Vehicles with TCL>	Probable cause
The idle position switch inputs the condition of the accelerator pedal, i.e. whether it is depressed or released (HIGH/LOW), to the engine-ECU. The engine-ECU controls the idle speed control servo based on this input.	• Maladjustment of the accelerator pedal • Maladjustment of the fixed SAS • Maladjustment of the idle position switch and accelerator pedal position sensor • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the engine-ECU



*: Refer to '96 CARISMA Workshop Manual (Pub. No.PWDE9502).

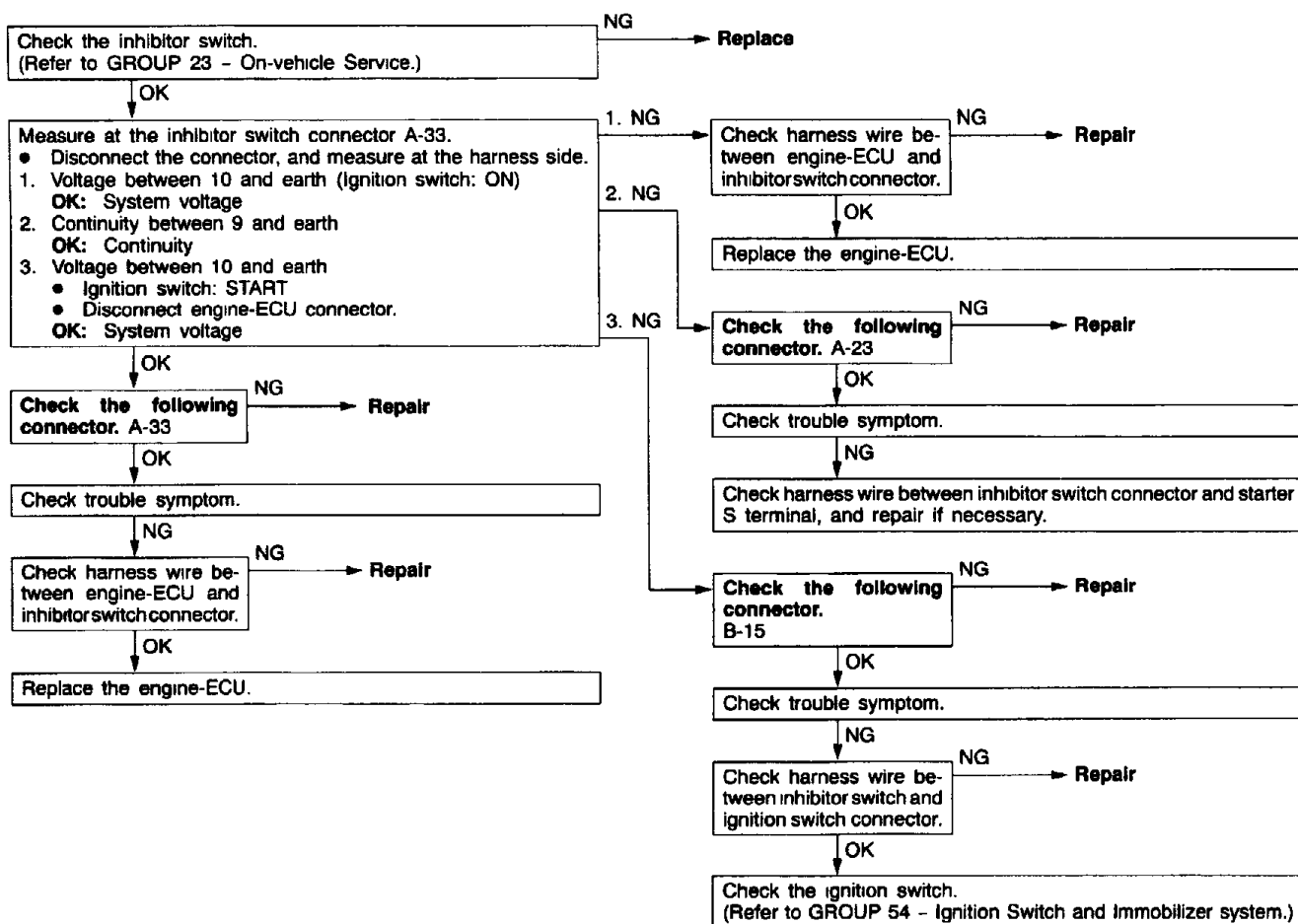
INSPECTION PROCEDURE 27

Ignition switch-ST system <M/T>	Probable cause
The ignition switch-ST inputs a HIGH signal to the engine-ECU while the engine is cranking. The engine-ECU controls fuel injection, etc. during starting based on this input.	- Malfunction of ignition switch - Improper connector contact, open circuit or short-circuited harness wire - Malfunction of the engine-ECU



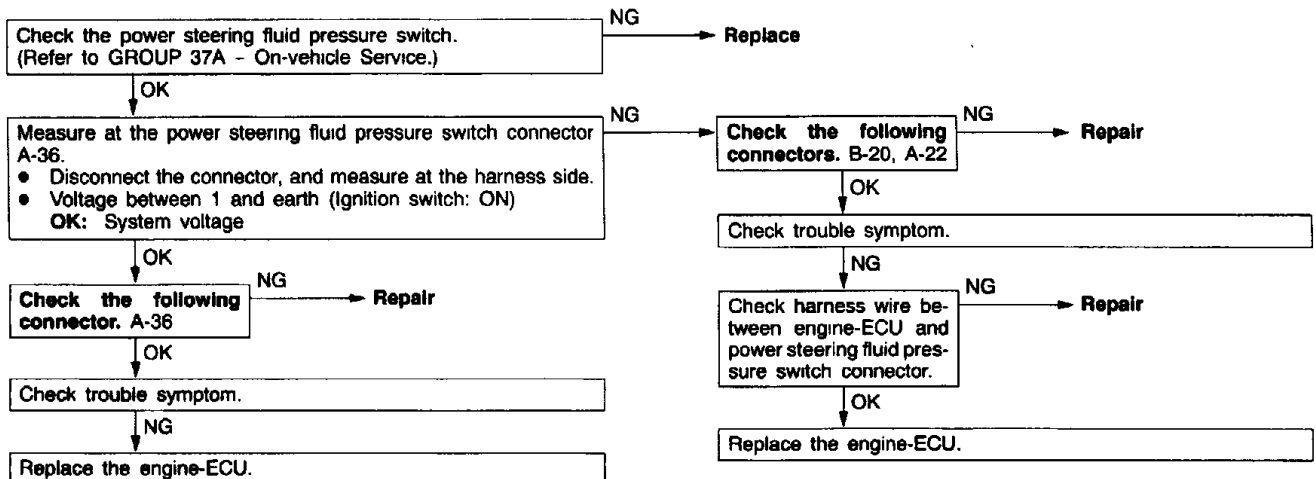
INSPECTION PROCEDURE 28

Ignition switch-ST and Inhibitor switch system <A/T>	Probable cause
- The ignition switch-ST inputs a HIGH signal to the engine-ECU while the engine is cranking. - The engine-ECU controls fuel injection, etc. during starting based on this input. - The inhibitor switch inputs the condition of the select lever, i.e. whether it is in P or N range or in some other range, to the engine-ECU. - The engine-ECU controls the idle speed control (ISC) servo based on this input.	- Malfunction of ignition switch - Malfunction of inhibitor switch - Improper connector contact, open circuit or short-circuited harness wire - Malfunction of the engine-ECU.



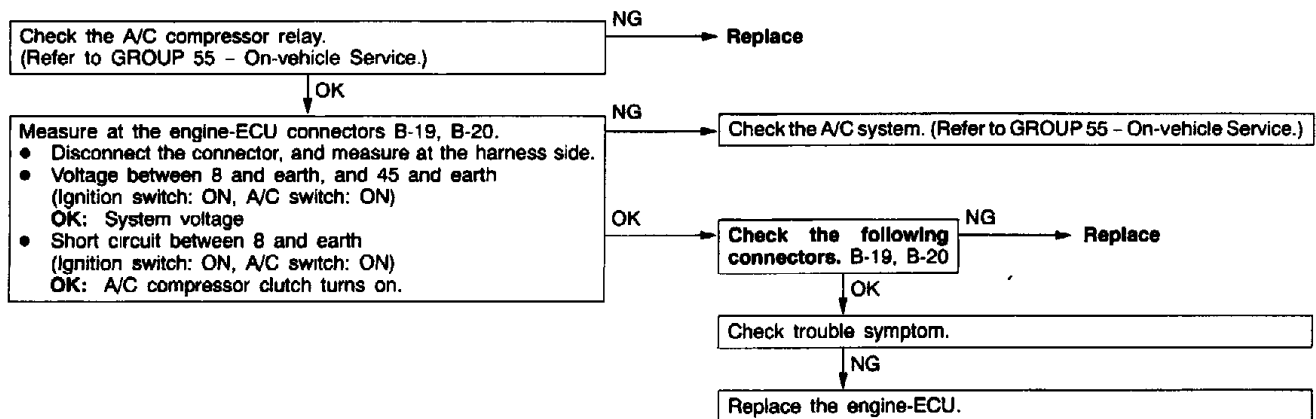
INSPECTION PROCEDURE 29

Power steering fluid pressure switch system	Probable cause
The presence or absence of power steering load is input to the engine-ECU. The engine-ECU controls the idle speed control (ISC) servo based on this input.	• Malfunction of power steering fluid pressure switch • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the engine-ECU



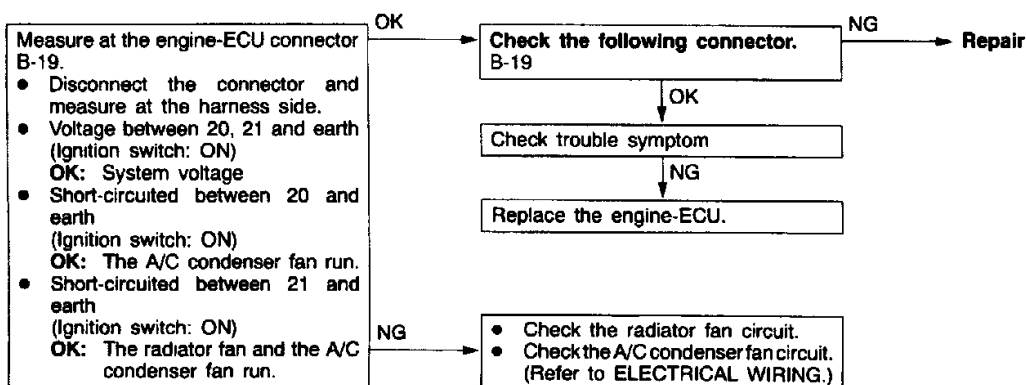
INSPECTION PROCEDURE 30

A/C switch and A/C relay system	Probable cause
When an A/C ON signal is input to the engine-ECU, the engine-ECU carries out control of the idle speed control (ISC) servo, and also operates the A/C compressor magnetic clutch.	• Malfunction of A/C control system • Malfunction of A/C switch • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the engine-ECU



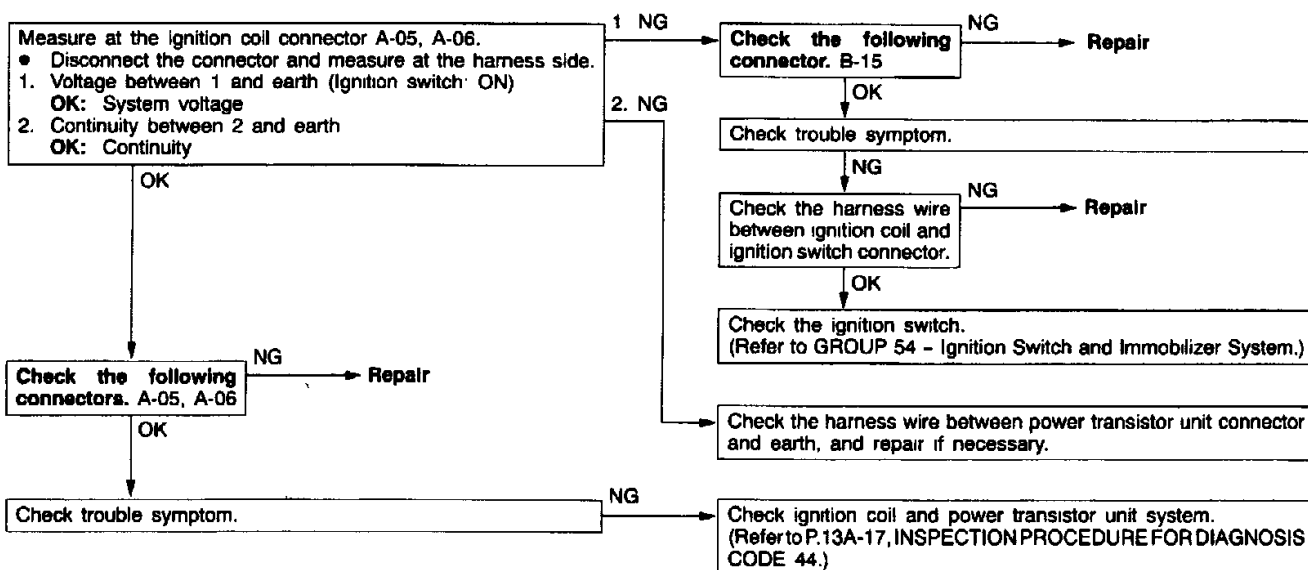
INSPECTION PROCEDURE 31

Fan motor relay (Radiator fan, A/C condenser fan) system	Probable cause
The fan motor relay is controlled by the power transistor inside the engine-ECU turning ON and OFF.	• Malfunction of the fan motor relay • Malfunction of the fan motor • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the engine-ECU



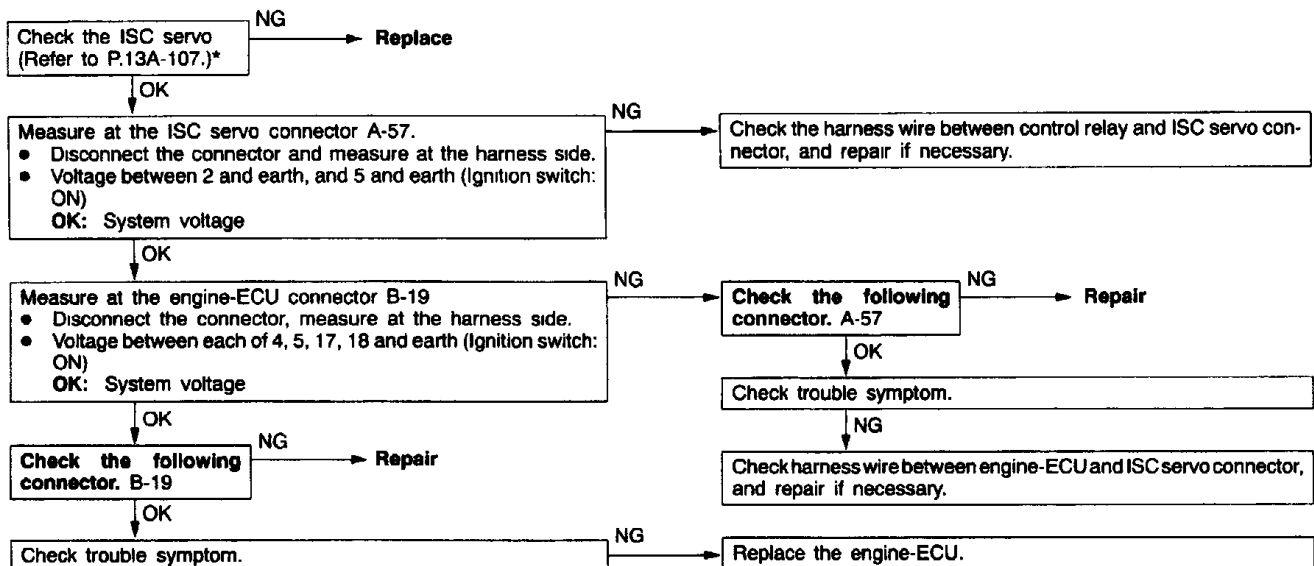
INSPECTION PROCEDURE 32

Ignition circuit system	Probable cause
The engine-ECU interrupts the ignition coil primary current by turning the power transistor inside the engine-ECU ON and OFF.	• Malfunction of ignition switch. • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the engine-ECU



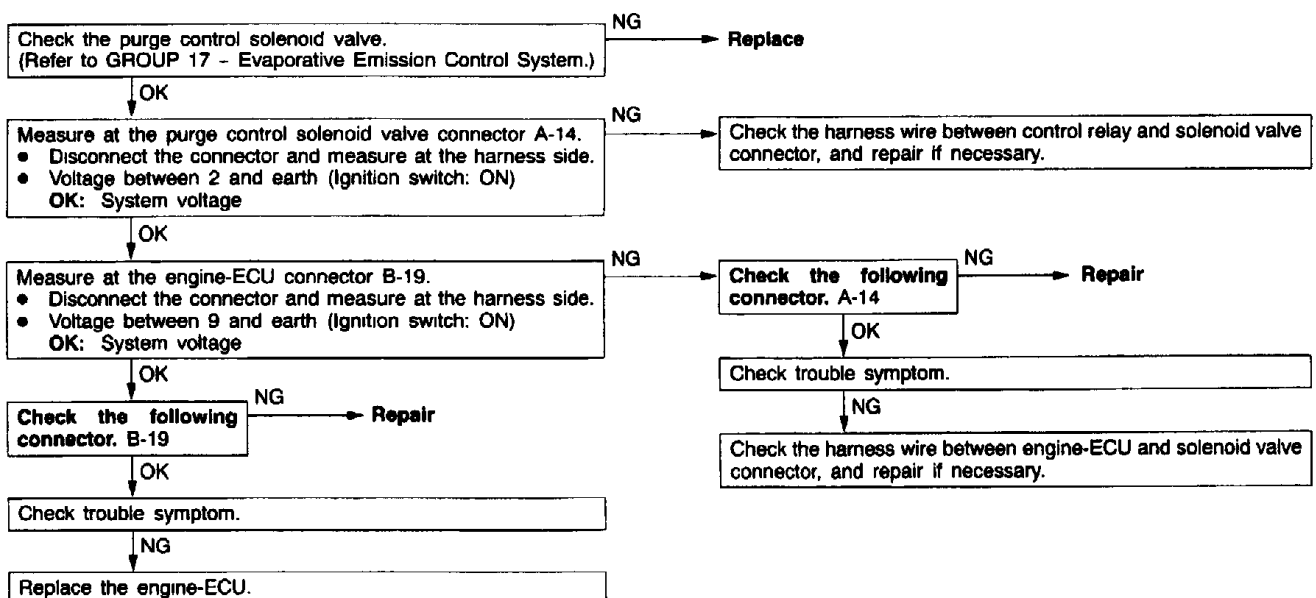
INSPECTION PROCEDURE 33

Idle speed control (ISC) servo (Stepper motor) system	Probable cause
The engine ECU controls the intake air volume during idling by opening and closing the servo valve located in the bypass air passage.	• Malfunction of ISC servo • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the engine-ECU



INSPECTION PROCEDURE 34

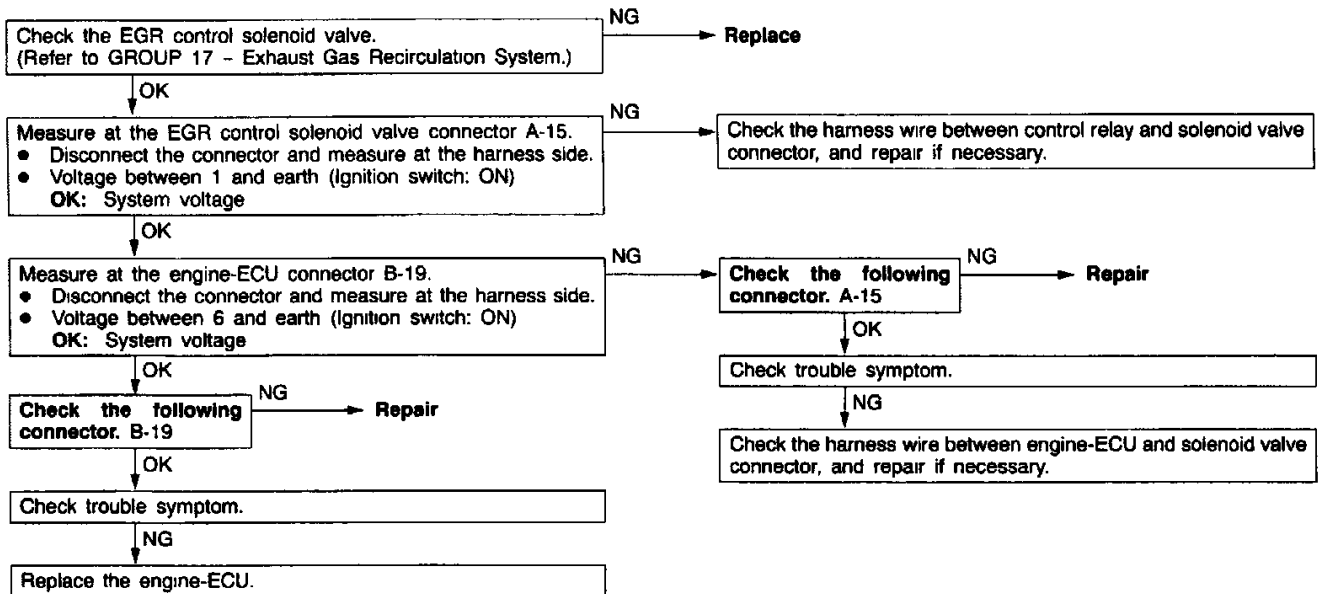
Purge control solenoid valve system	Probable cause
The purge control solenoid valve controls the purging of air from the canister located inside the intake manifold.	• Malfunction of solenoid valve • Improper connector contact, open circuit or short-circuited harness wire. • Malfunction of the engine-ECU



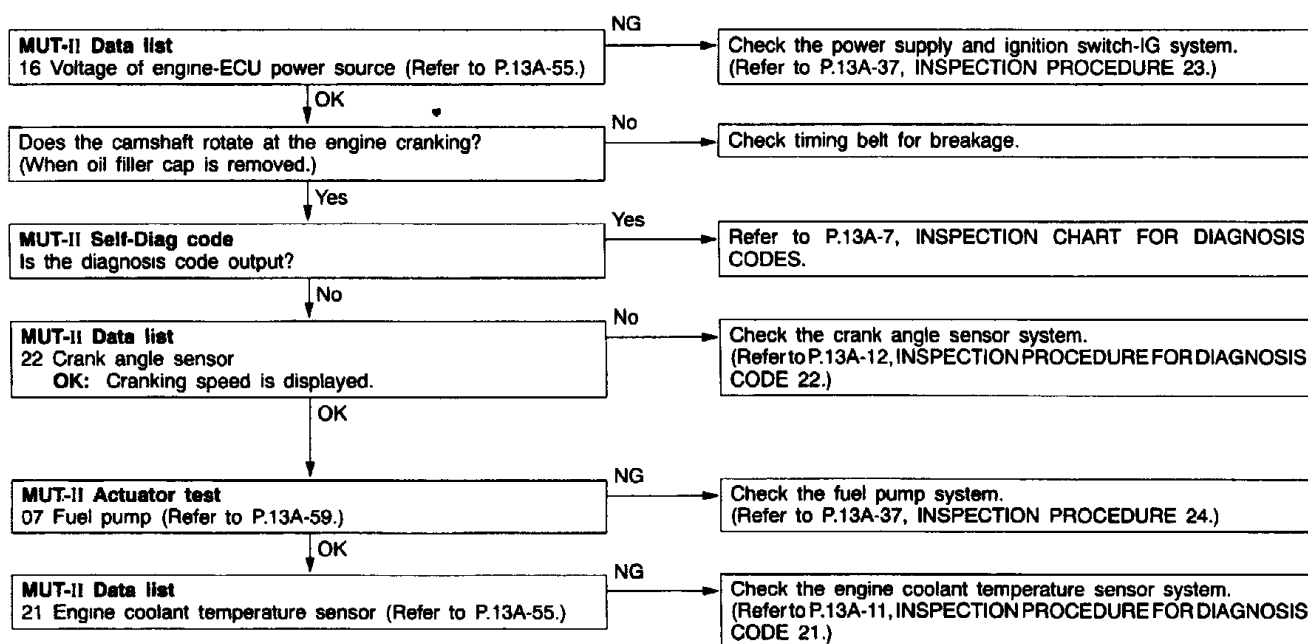
*: Refer to '96 CARISMA Workshop Manual (Pub. No.PWDE9502).

INSPECTION PROCEDURE 35

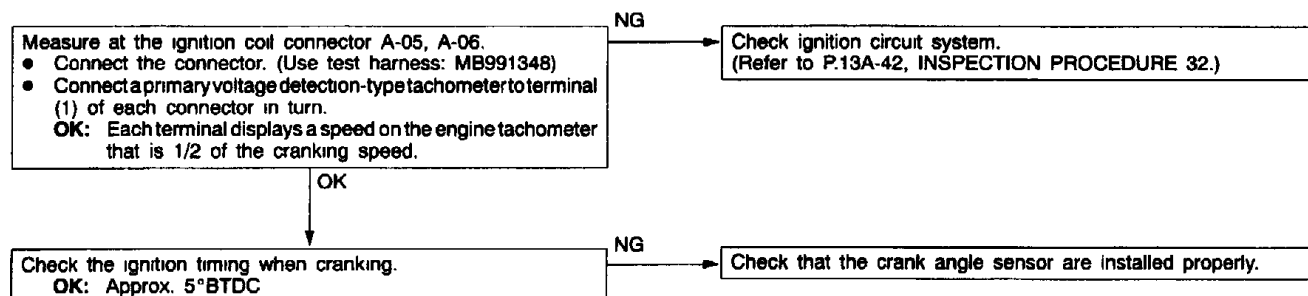
EGR control solenoid valve system	Probable cause
The EGR control solenoid valve is controlled by the negative pressure resulting from EGR operation leaking to port "A" of the throttle body.	• Malfunction of solenoid valve • Improper connector contact, open circuit or short-circuited harness wire. • Malfunction of the engine-ECU



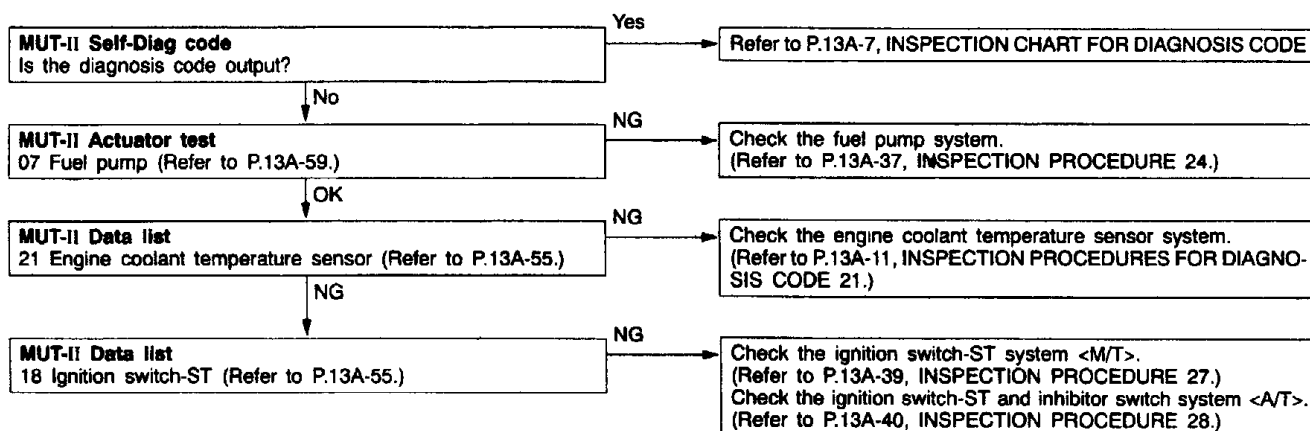
INSPECTION PROCEDURE 36

MUT-II: Inspection of no initial combustion

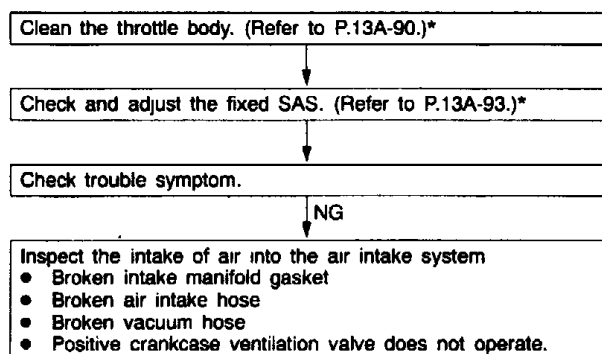
INSPECTION PROCEDURE 37

Ignition system: Inspection of no initial combustion.

INSPECTION PROCEDURE 38

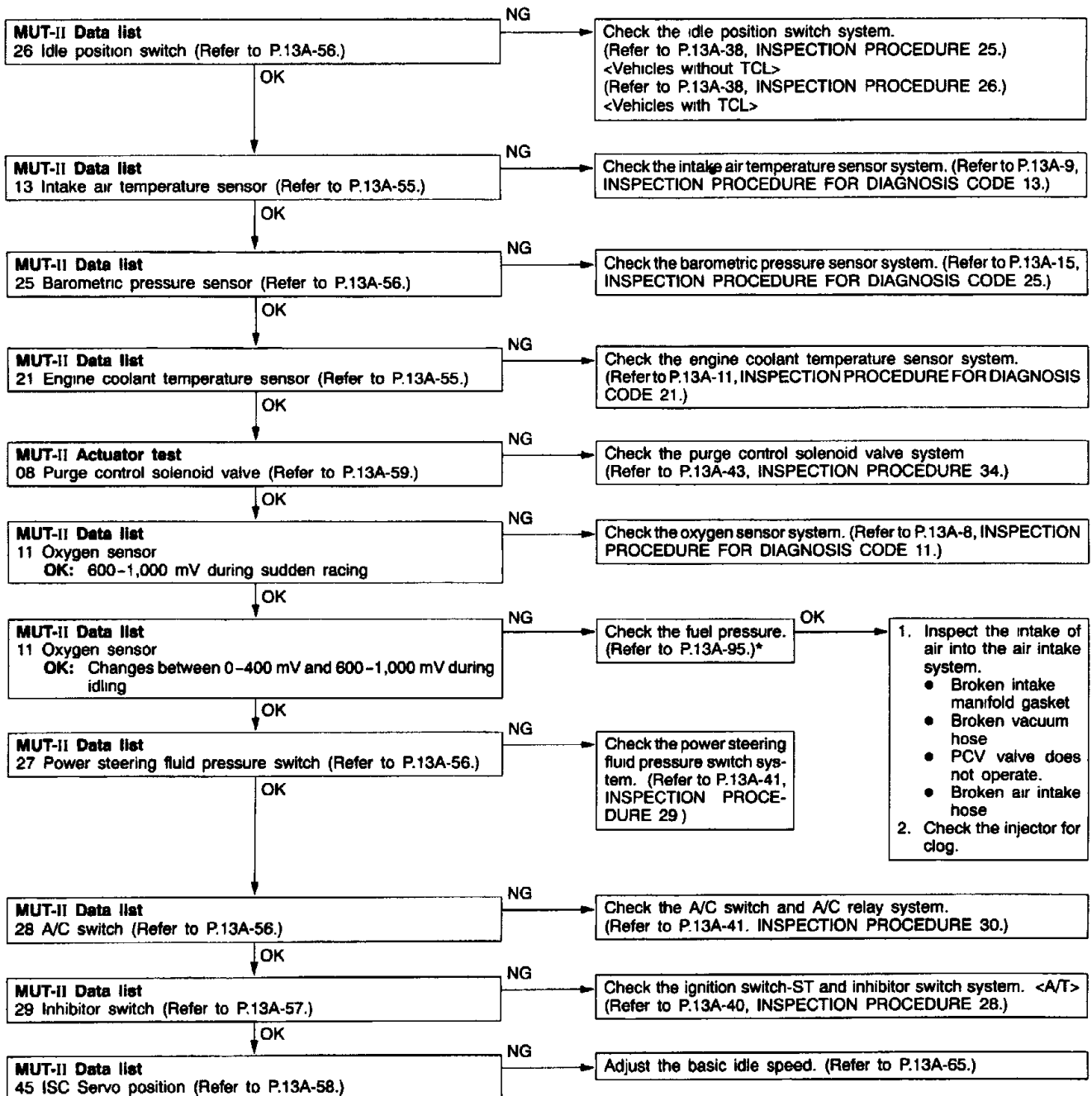
MUT-II: Check if incomplete combustion occurs.

INSPECTION PROCEDURE 39

Check if hunting occurs.

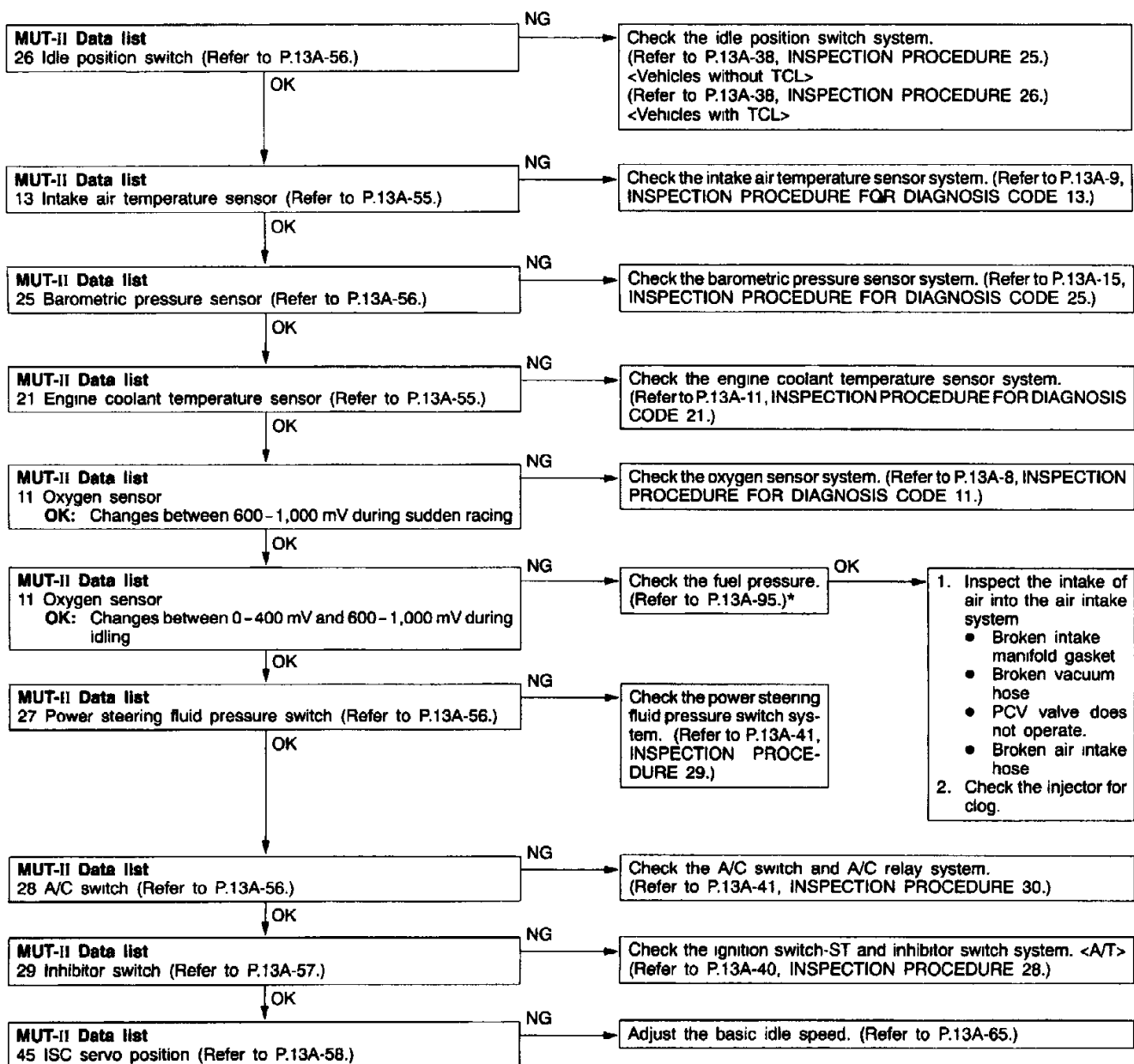
*: Refer to '96 CARISMA Workshop Manual (Pub. No.PWDE9502).

INSPECTION PROCEDURE 40

MUT-II: Check if idling speed is unstable.

*: Refer to '96 CARISMA Workshop Manual (Pub. No.PWDE9502).

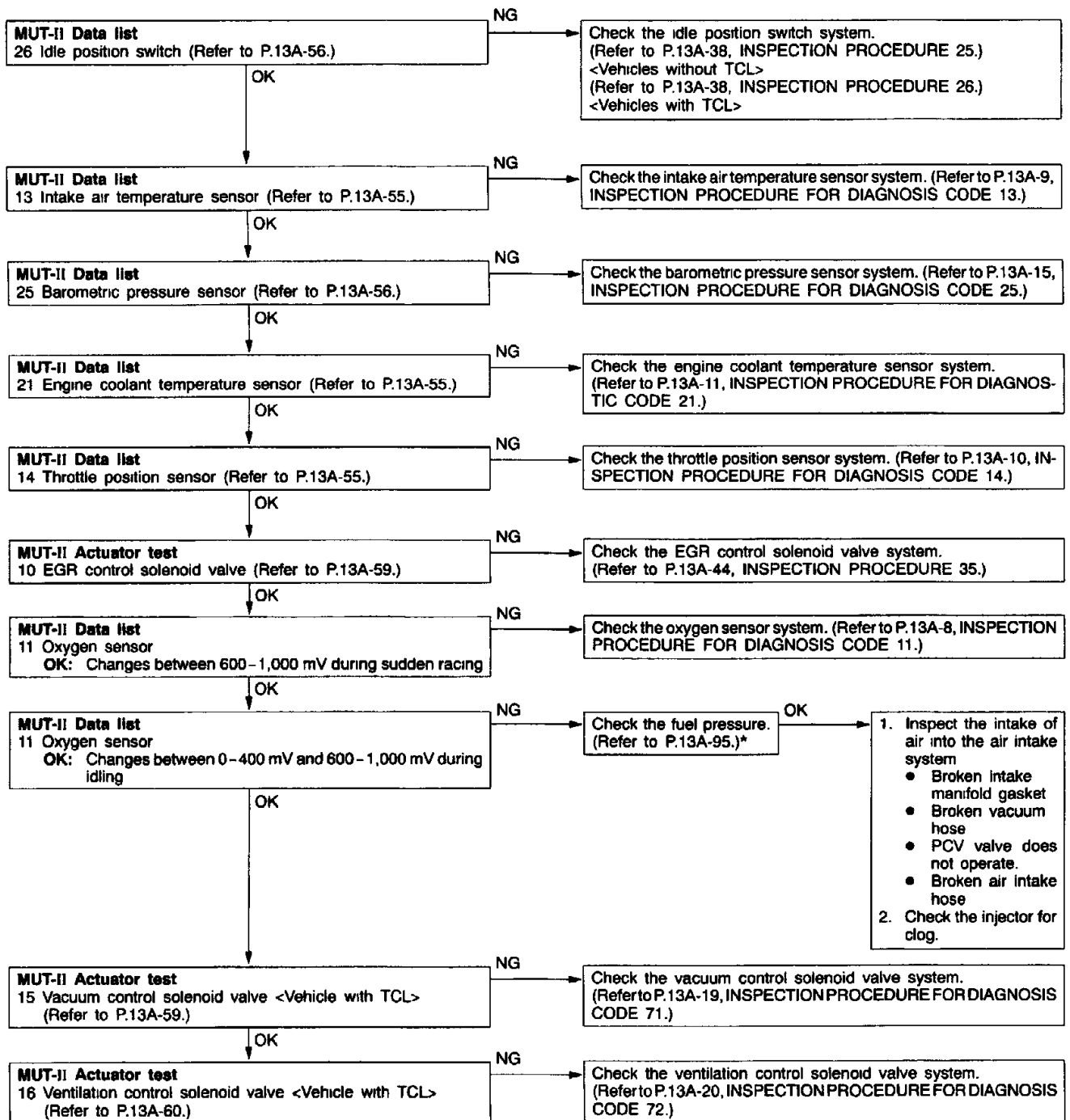
INSPECTION PROCEDURE 41

MUT-II: Engine stalling inspection when the engine is warmed up and idling.

*: Refer to '96 CARISMA Workshop Manual (Pub. No.PWDE9502).

INSPECTION PROCEDURE 42

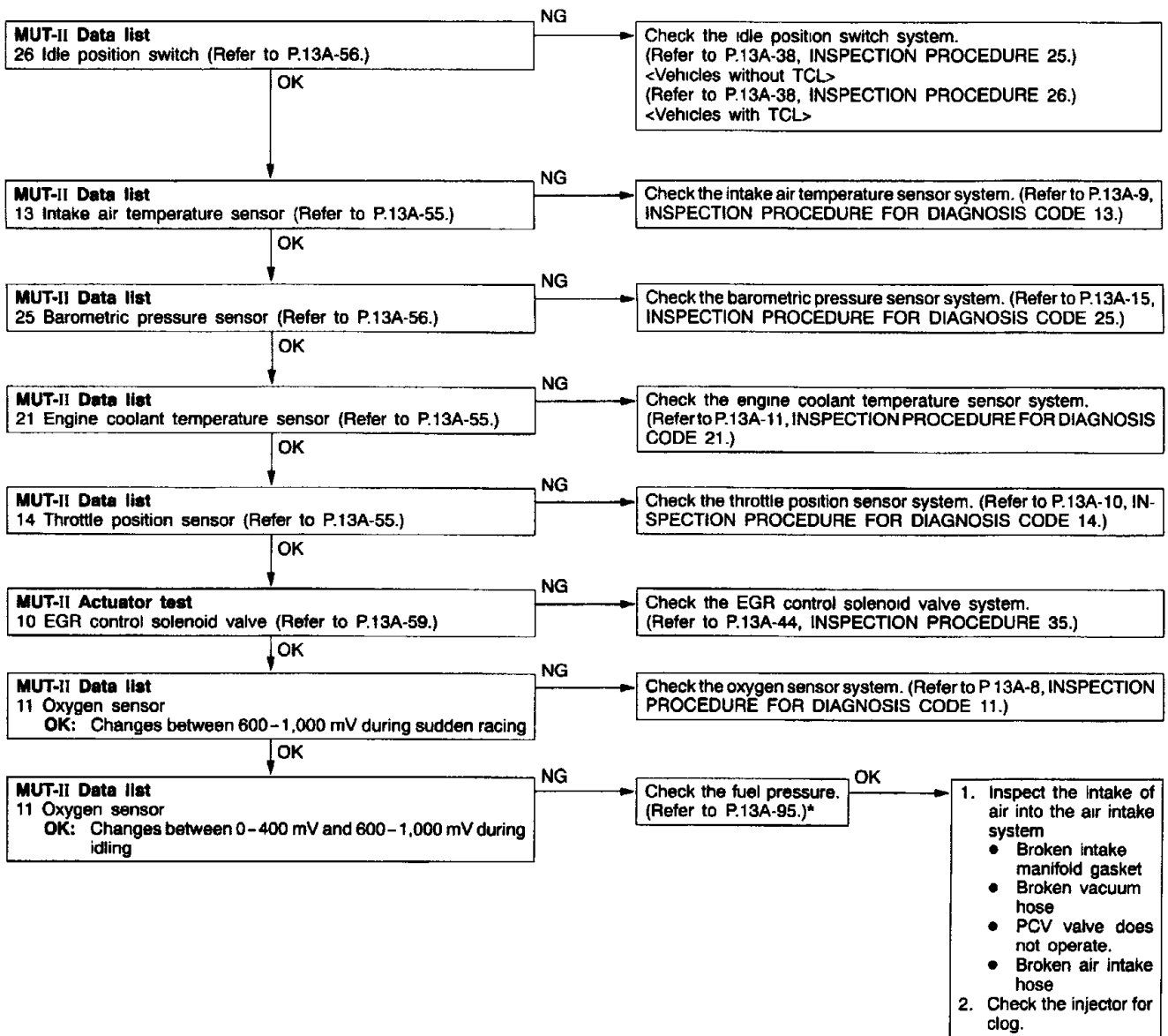
MUT-II: Check if hesitation, sug, stumble or poor acceleration occurs.



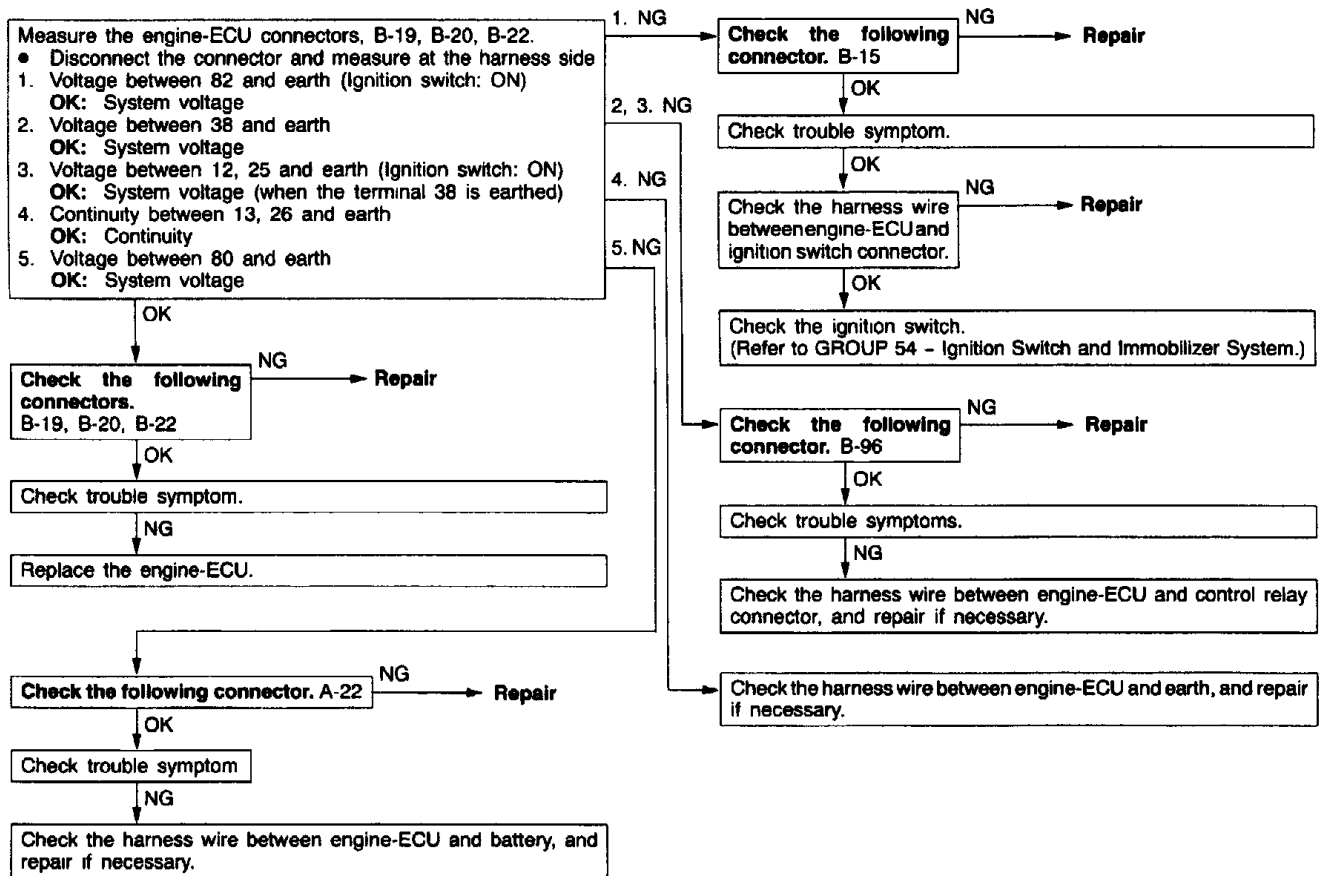
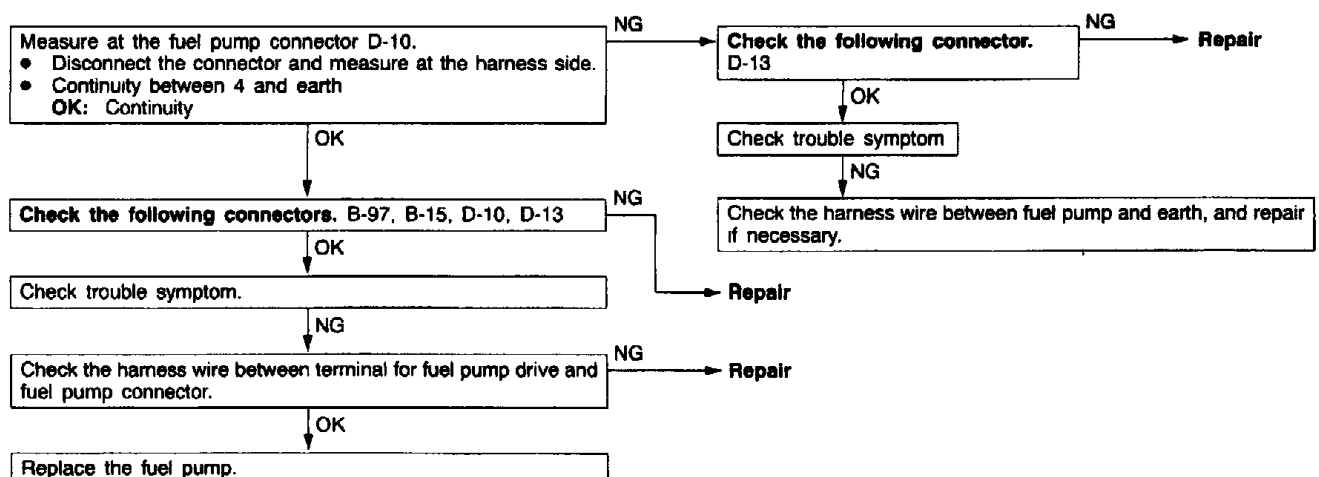
*: Refer to '96 CARISMA Workshop Manual (Pub. No. PWDE9502).

INSPECTION PROCEDURE 43

MUT-II Check if surge occurs.

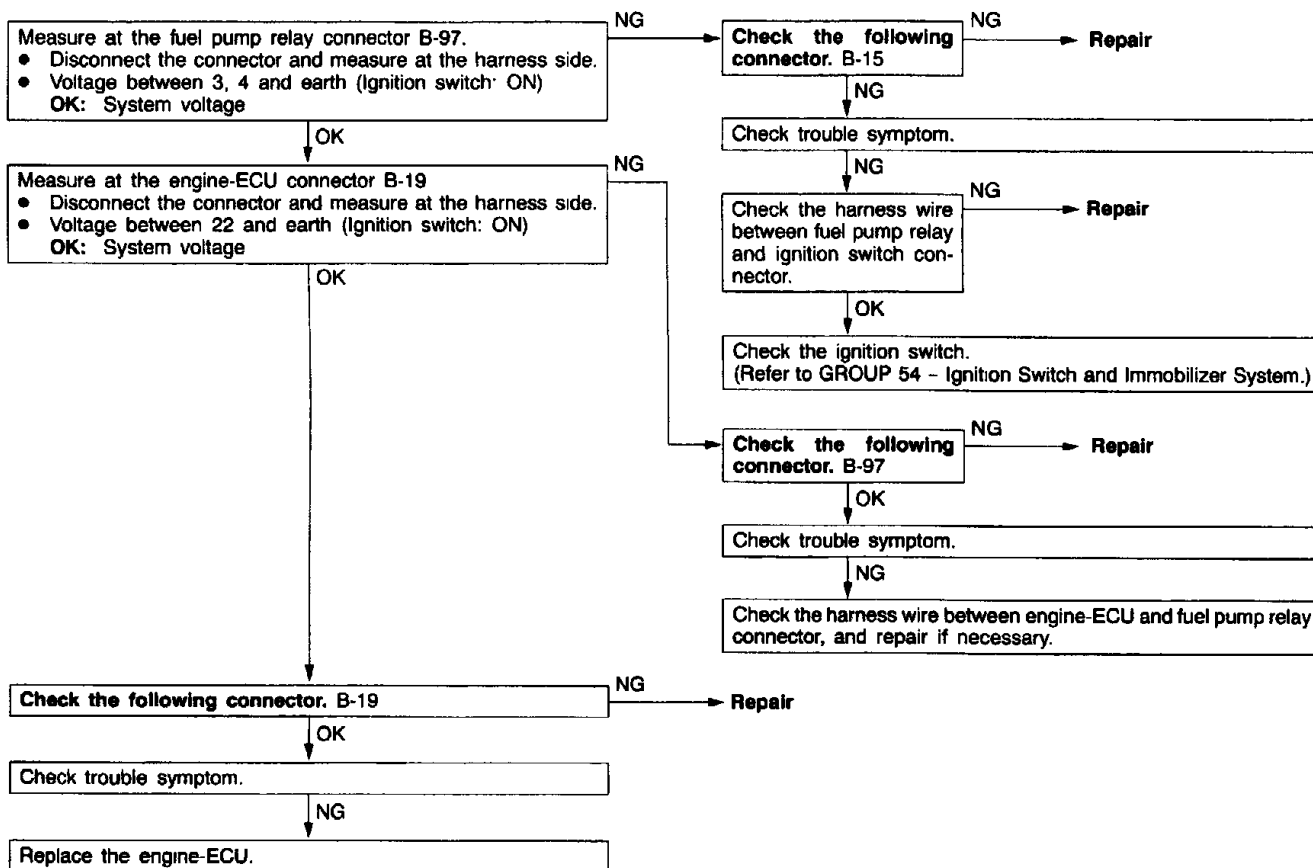


*: Refer to '96 CARISMA Workshop Manual (Pub. No.PWDE9502).

INSPECTION PROCEDURE 44**Check the engine-ECU power supply and earth circuit.****INSPECTION PROCEDURE 45****Check fuel pump circuit.**

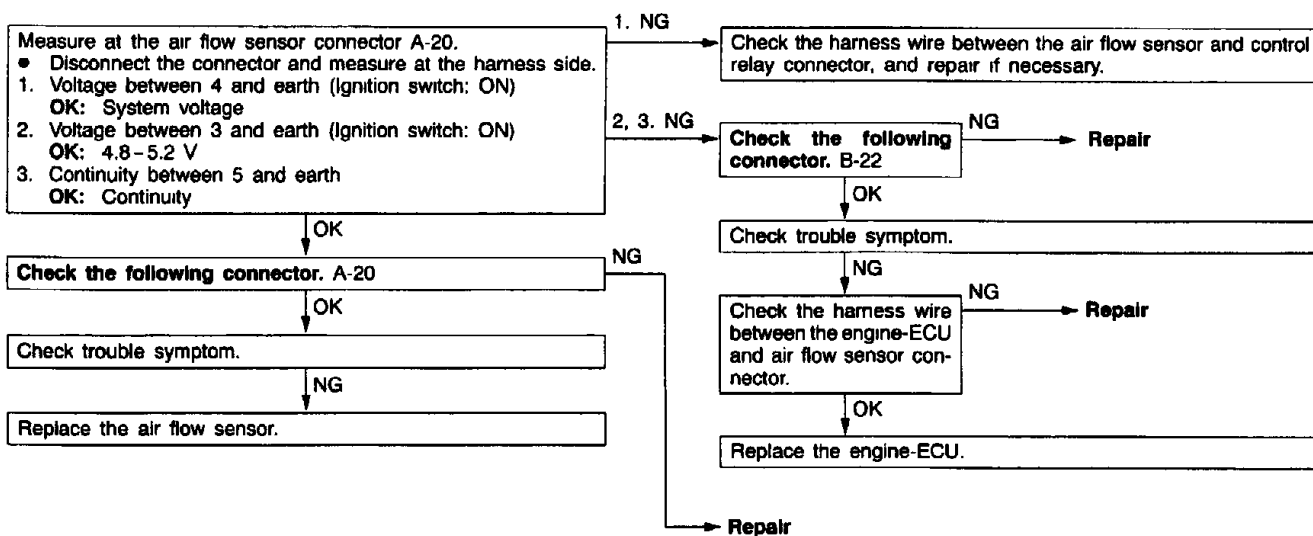
INSPECTION PROCEDURE 46

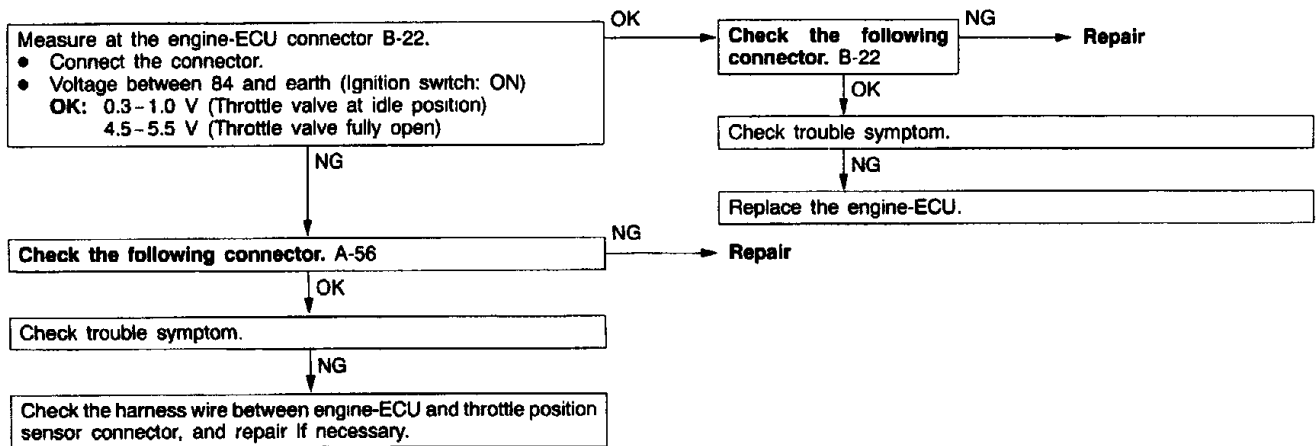
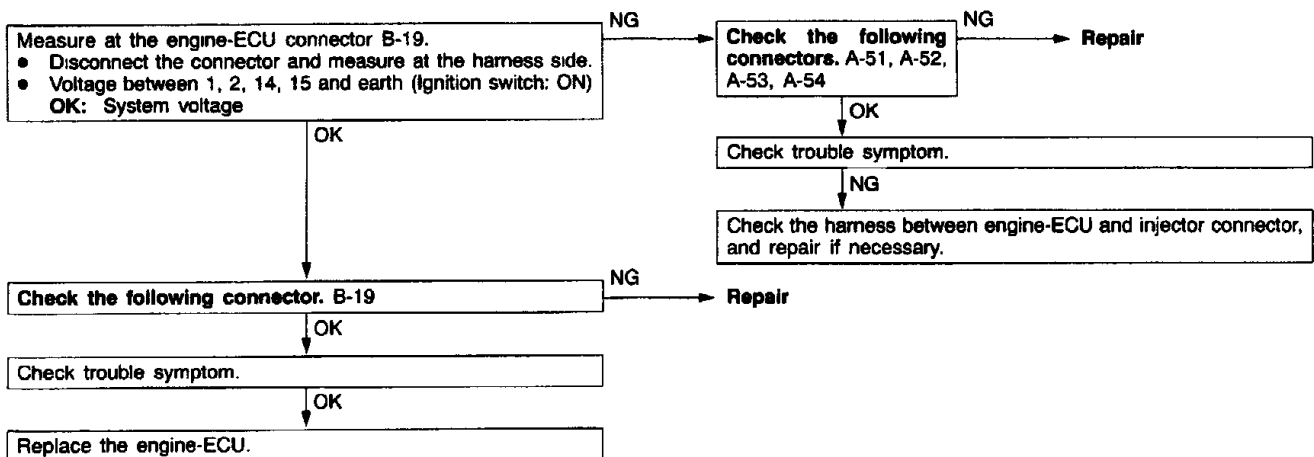
Check the fuel pump drive control circuit.



INSPECTION PROCEDURE 47

Check air flow sensor (AFS) control circuit.



INSPECTION PROCEDURE 48**Check throttle position sensor (TPS) output circuit.****INSPECTION PROCEDURE 49****Check injector control circuit**

DATA LIST REFERENCE TABLE

Caution

When shifting the select lever to D range, the brakes should be applied so that the vehicle does not move forward.

NOTE

- *1. In a new vehicle [driven approximately 500 km or less], the air flow sensor output frequency is sometimes 10% higher than the standard frequency.
- *2. The injector drive time represents the time when the cranking speed is at 250 r/min or below when the power supply voltage is 11 V.
- *3. In a new vehicle [driven approximately 500 km or less], the injector drive time is sometimes 10% longer than the standard time.
- *4. In a new vehicle [driven approximately 500 km or less], the step of the stepper motor is sometimes 30 steps greater than the standard value.
- *5. The idle position switch normally turns off when the voltage of the throttle position sensor is 50 – 100 mV higher than the voltage at the idle position. If the throttle position switch turns back on after the throttle position sensor voltage has risen by 100 mV and the throttle valve has opened, the idle position switch and the throttle position sensor need to be adjusted.

Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.	Reference page
11	Oxygen sensor	Engine:After having warmed up Air/fuel mixture is made leaner when decelerating, and is made richer when racing.	When at 4,000 r/min, engine is suddenly decelerated	200 mV or less	Code No. 11	13A-8
			When engine is suddenly raced	600 – 1,000 mV		
		Engine:After having warmed up The oxygen sensor signal is used to check the air/fuel mixture ratio, and control condition is also checked by the ECU.	Engine is idling	400 mV or less (Changes)		
			2,500 r/min	600 – 1,000 mV		
12	Air flow sensor*1	• Engine coolant temperature: 80 – 95°C • Lamps and all accessories: OFF • Transmission: Neutral (A/T: P range)	Engine is idling	25 – 51 Hz <Except (4G92 (6B model))> 18 – 44 Hz <4G92 (6B model))>	–	–
			2,500 r/min	80 – 120 Hz <4G92> 74 – 114 Hz <4G93-SOHC> 55 – 95 Hz <4G92 (6B model), 4G93-DOHC>		
			Engine is raced	Frequency increases in response to racing		

Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.	Reference page
13	Intake air temperature sensor	Ignition switch: ON or with engine running	When intake air temperature is -20°C	-20°C	Code No. 13	13A-9
			When intake air temperature is 0°C	0°C		
			When intake air temperature is 20°C	20°C		
			When intake air temperature is 40°C	40°C		
			When intake air temperature is 80°C	80°C		
14	Throttle position sensor	Ignition switch: ON	Set to idle position	300 – 1,000 mV	Code No. 14	13A-10
			Gradually open	Increases in proportion to throttle opening angle		
			Open fully	4,500 – 5,500 mV		
16	Power supply voltage	Ignition switch: ON		System voltage	Procedure No. 23	13A-37
18	Cranking signal (ignition switch-ST)	Ignition switch: ON	Engine: Stopped	OFF	Procedure No. 27 <M/T>	13A-39 13A-40
			Engine: Cranking	ON	Procedure No. 28 <A/T>	
21	Engine coolant temperature sensor	Ignition switch: ON or with engine running	When engine coolant temperature is -20°C	-20°C	Code No. 21	13A-11
			When engine coolant temperature is 0°C	0°C		
			When engine coolant temperature is 20°C	20°C		
			When engine coolant temperature is 40°C	40°C		
			When engine coolant temperature is 80°C	80°C		

Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.	Reference page
22	Crank angle sensor	- Engine: Cranking - Tachometer: Connected	Compare the engine speed readings on the tachometer and the MUT-II.	Accord	Code No. 22	13A-12
		- Engine: Idling - Idle position switch: ON	When engine coolant temperature is -20°C	1,400 - 1,600 r/min		
			When engine coolant temperature is 0°C	1,350 - 1,550 r/min		
			When engine coolant temperature is 20°C	1,300 - 1,500 r/min <4G92, 4G93-DOHC> 1,250 - 1,200 r/min <4G93-SOHC>		
			When engine coolant temperature is 40°C	1,100 - 1,300 r/min <4G92, 4G93-DOHC> 1,000 - 1,200 r/min <4G93-SOHC>		
			When engine coolant temperature is 80°C	650 - 850 r/min <4G92> 700 - 900 r/min <4G93>		
25	Barometric pressure sensor	Ignition switch: ON	At altitude of 0 m	101 kPa	Code No. 25	13A-15
			At altitude of 600 m	95 kPa		
			At altitude of 1,200 m	88 kPa		
			At altitude of 1,800 m	81 kPa		
26	Idle position switch	Ignition switch: ON Check by operating accelerator pedal repeatedly	Throttle valve: Set to idle position	ON	Procedure No. 25 <Vehicles without TCL> Procedure No. 26 <Vehicles with TCL>	13A-38
			Throttle valve: Slightly open	OFF*5		
27	Power steering fluid pressure switch	Engine: Idling	Steering wheel stationary	OFF	Procedure No. 29	13A-41
			Steering wheel turning	ON		
28	A/C switch	Engine: Idling (when A/C switch is ON, A/C compressor should be operating.)	A/C switch: OFF	OFF	Procedure No. 30	13A-41
			A/C switch: ON	ON		

Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.	Reference page
29	Inhibitor switch <A/T>	Ignition switch: ON	P or N	P or N	Procedure No. 28	13A-40
			D, 2, L or R	D, 2, L or R		
41	Injectors *2	Engine: Cranking	When engine coolant temperature is 0°C (Injection is carried out for all cylinders simultaneously)	13 – 19 ms <4G92> 15 – 22 ms <4G93-SOHC> 12 – 18 ms <4G93-DOHC>	-	-
			When engine coolant temperature is 20°C	27 – 40 ms <4G92> 31 – 46 ms <4G93-SOHC> 25 – 38 ms <4G93-DOHC>		
			When engine coolant temperature is 80°C	5.9 – 8.9 ms <Except 4G92 (6B model)> 6.4 – 9.6 ms <4G92 (6B model)> 7.2 – 10.8 ms <4G93-SOHC> 6.0 – 9.0 ms <4G93-DOHC>		
	Injectors*3	- Engine coolant temperature: 80 – 95°C - Lamps and all accessories: OFF - Transmission: Neutral (A/T : P range)	Engine is idling	1.7 – 2.9 ms <Except 4G92 (6B model)> 1.4 – 2.6 ms <4G92 (6B model)> 2.2 – 3.4 ms <4G93-SOHC> 2.0 – 3.2 ms <4G93-DOHC>		
			2,500 r/min	1.4 – 2.6 ms <Except 4G92 (6B model), 4G93-DOHC> 1.2 – 2.4 ms <4G92 (6B model)> 2.0 – 3.2 ms <4G93-DOHC>		
			When engine is suddenly raced	Increases		

Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.	Reference page
44	Ignition coils and power transistors	● Engine: After having warmed up ● Timing lamp is set. (The timing lamp is set in order to check actual ignition timing.)	Engine is idling	2 – 18 °BTDC <Except 4G92 (6B model), 4G93-DOHC> 0 – 16 °BTDC <4G92 (6B model), 4G93-SOHC>	-	-
			2,500 r/min	30 – 50 °BTDC <4G92> 22 – 42 °BTDC <4G93>		
45	ISC (stepper) motor position *4	● Engine coolant temperature: 80 – 95°C ● Lamps and all accessories: OFF ● Transmission: Neutral (A/T : P range) ● Idle position switch: ON ● Engine: Idling ● When A/C switch is ON, A/C compressor should be operating	A/C switch: OFF	2 – 25 STEP		
			A/C switch: OFF → ON	Increases by 10 – 70 steps		
			● A/C switch: OFF ● Select lever: N range → D range	Increases by 5 – 50 steps		
49	A/C relay	Engine: After having warmed up/Engine is idling	A/C switch: OFF	OFF (Compressor clutch is not operating)	Procedure No. 30	13A-41
			A/C switch: ON	ON (Compressor clutch is operating)		

ACTUATOR TEST REFERENCE TABLE

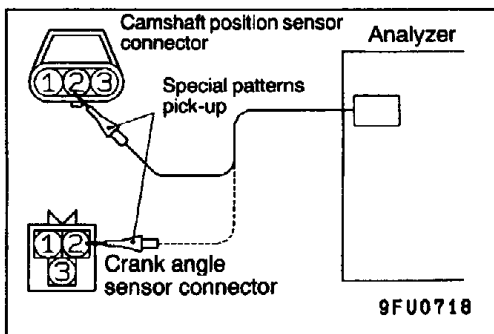
Item No.	Inspection item	Drive contents	Inspection contents		Normal condition	Inspection procedure No.	Reference page
01	Injectors	Cut fuel to No. 1 injector	Engine: After having warmed up/Engine is idling (Cut the fuel supply to each injector in turn and check cylinders which don't affect idling.)		Idling condition becomes different (becomes unstable).	Code No. 41	13A-16
02		Cut fuel to No. 2 injector					
03		Cut fuel to No. 3 injector					
04		Cut fuel to No. 4 injector					
07	Fuel pump	Fuel pump operates and fuel is recirculated.	- Engine: Cranking - Fuel pump: Forced driving Inspect according to both the above conditions.	Pinch the return hose with fingers to feel the pulse of the fuel being recirculated. Listen near the fuel tank for the sound of fuel pump operation.	Pulse is felt. Sound of operation is heard.	Procedure No. 24	13A-37
08	Purge control solenoid valve	Solenoid valve turns from OFF to ON.	Ignition switch: ON		Sound of operation can be heard when solenoid valve is driven.	Procedure No. 34	13A-43
10	EGR control solenoid valve	Solenoid valve turns from OFF to ON.	Ignition switch: ON		Sound of operation can be heard when solenoid valve is driven.	Procedure No. 35	13A-44
15	Vacuum control solenoid valve <Vehicles with TCL>	Solenoid valve turns from OFF to ON.	Ignition switch: ON		Sound of operation can be heard when solenoid valve is driven.	Code No. 71	13A-19

Item No.	Inspection item	Drive contents	Inspection contents	Normal condition	Inspection procedure No.	Reference page
16	Ventilation control solenoid valve <Vehicles with TCL>	Solenoid valve turns from OFF to ON.	Ignition switch: ON	Sound of operation can be heard when solenoid valve is driven.	Code No. 72	13A-20
17	Basic ignition timing	Set to ignition timing adjustment mode	Engine: Idling Timing light is set	5° BTDC	–	–
20	Condenser fan	Drive the fan motors (condenser)	• Ignition switch: ON • A/C switch: ON	Fan motor operates	Procedure No. 31	13A-42
21	Radiator fan and Condenser fan	Drive the fan motors (radiator and condenser).	Ignition switch: ON A/C switch: ON	Fan motor operates	Procedure No. 31	13A-42

CHECK AT THE ENGINE-ECU TERMINALS**TERMINAL VOLTAGE CHECK CHART**

The ignition timing adjustment terminal has been deleted from the previous check items. In addition, the following check items have been added or changed for the SOHC engine. The other items are the same as before.

Terminal No. <SOHC>	Check item	Check condition (Engine condition)	Normal condition
10	Ignition coil-No.1, No.4 (power transistor)	Engine r/min: 3000 r/min	0.3 – 3.0 V
23	Ignition coil-No.2, No.3 (power transistor)		
58	Engine ignition signal	Engine r/min: 3000 r/min	0.3 – 3.0 V
88	Camshaft position sensor	Engine: Cranking	0.4 – 3.0 V
		Engine: Idle speed	0.5 – 2.0 V

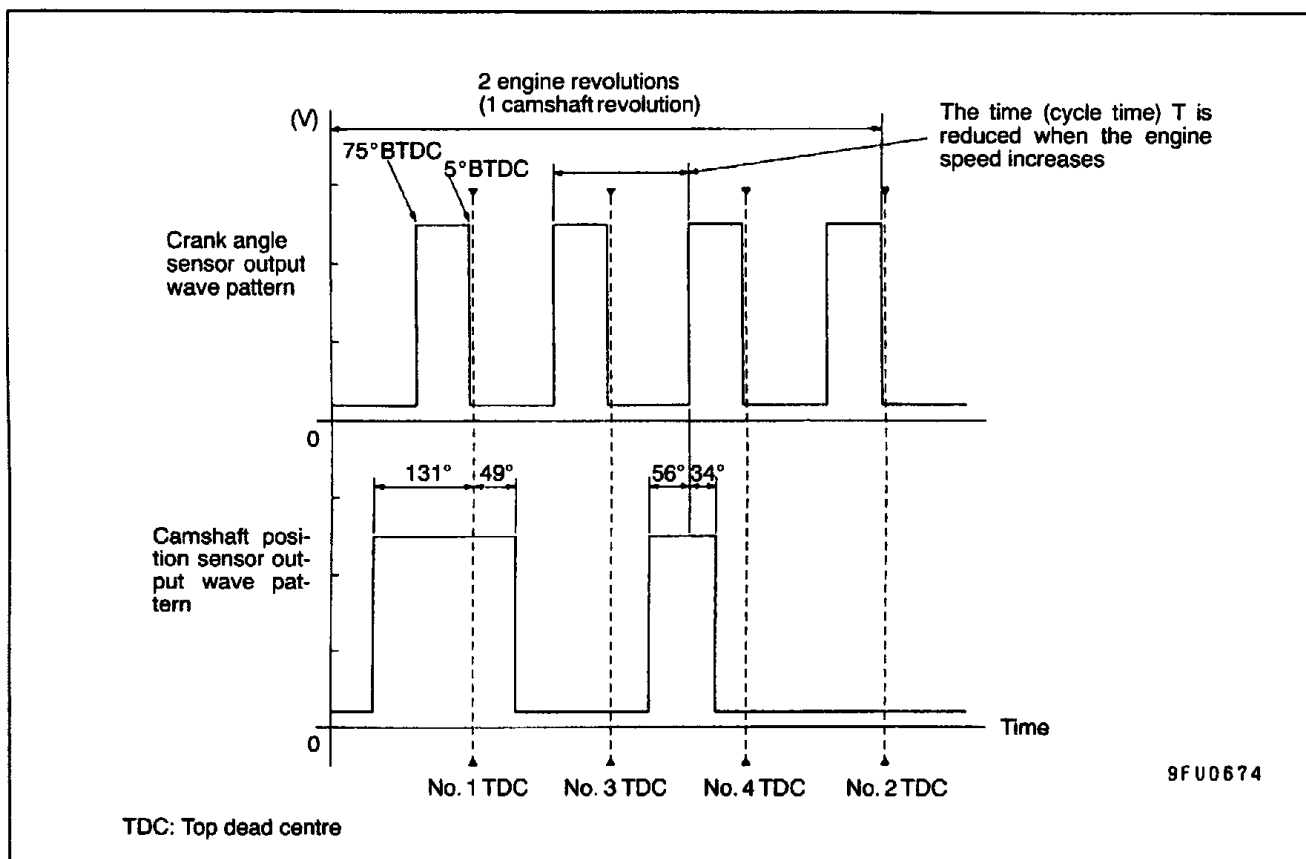
**INSPECTION PROCEDURE USING AN ANALYZER****CAMSHAFT POSITION SENSOR AND CRANK ANGLE SENSOR****Measurement Method**

1. Disconnect the camshaft position sensor connector and connect the special tool (test harness: MB991223) and jumper wire in between. (All terminals should be connected.)
2. Connect the analyzer special patterns pickup to camshaft position sensor terminal 2.
3. Disconnect the crank angle sensor connector and connect the special tool (test harness: MD998478) in between.
4. Connect the analyzer special patterns pickup to crank angle sensor terminal 2.

Alternate Method (Test harness not available)

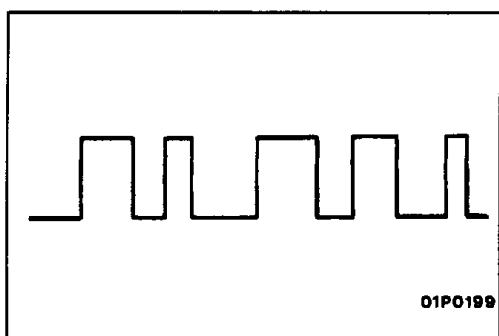
1. Connect the analyzer special patterns pickup to engine-ECU terminal 88. (When checking the camshaft position sensor signal wave pattern.)
2. Connect the analyzer special patterns pickup to engine-ECU terminal 89. (When checking the crank angle sensor signal wave pattern.)

Standard wave pattern



Wave Pattern Observation Points

Check that cycle time T becomes shorter when the engine speed increases.



Examples of Abnormal Wave Patterns

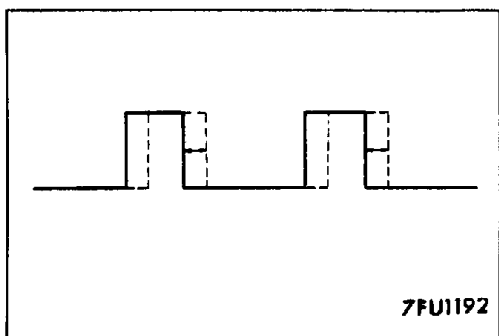
● Example 1

Cause of problem

Sensor interface malfunction

Wave pattern characteristics

Rectangular wave pattern is output even when the engine is not started.



● Example 2

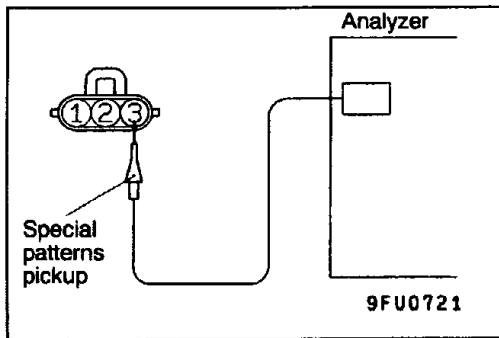
Cause of problem

Loose timing belt

Abnormality in sensor disk

Wave pattern characteristics

Wave pattern is displaced to the left or right.

**IGNITION COIL AND POWER TRANSISTOR**

- Ignition coil primary signal
Refer to GROUP 16 – Ignition System.
- Power transistor control signal

Measurement Method

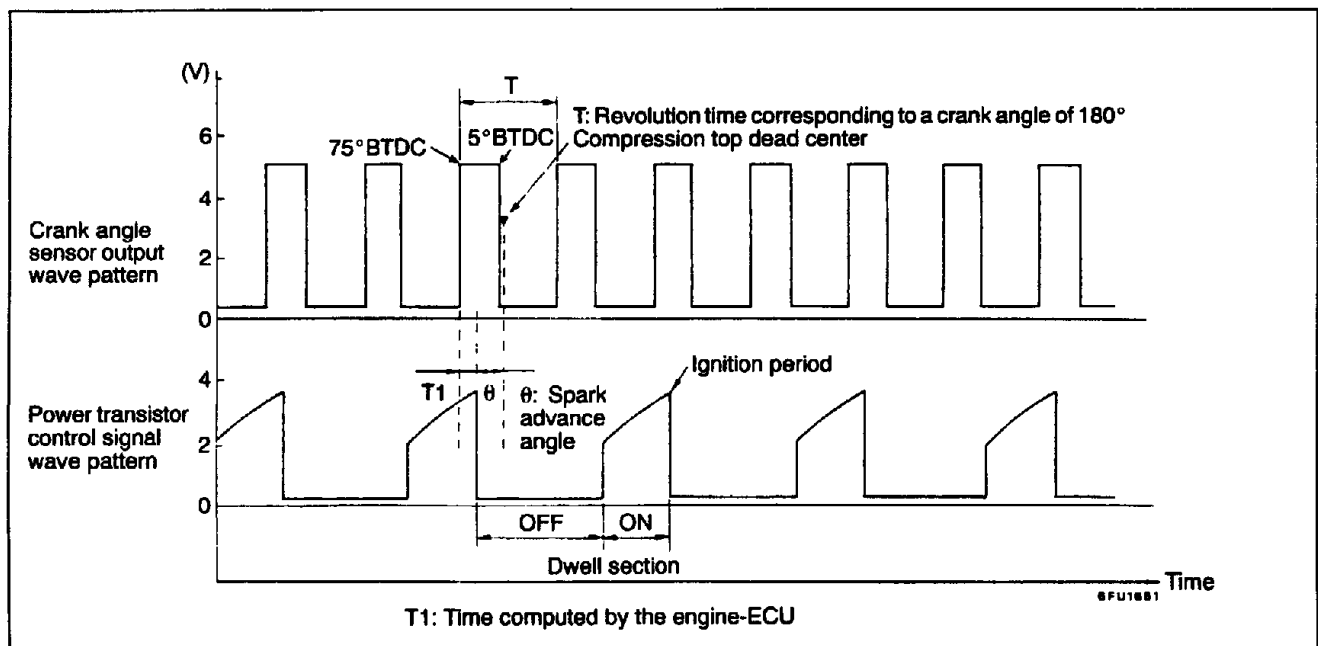
1. Disconnect the ignition coil connector, and connect the special tool (test harness: MB991348) in between. (All terminals should be connected.)
2. Connect the analyzer special patterns pickup to terminal (3) of each ignition coil connector in turn.

Alternate Method (Test harness not available)

1. Connect the analyzer special patterns pickup to engine-ECU terminal 10 (No. 1 – No. 4), terminal 23 (No. 2 – No. 3) respectively.

Standard Wave Pattern**Observation condition**

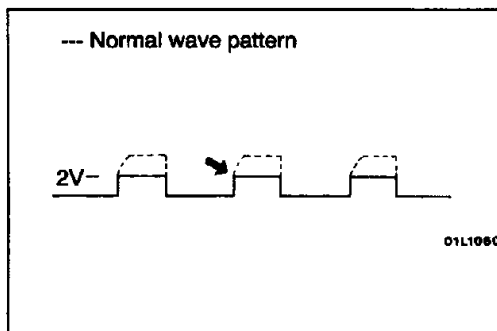
Function	Special patterns
Pattern height	Low
Pattern selector	Display
Engine r/min	Approx. 1,200 r/min

Standard wave pattern

Wave Pattern Observation Points

Point: Condition of wave pattern build-up section and maximum voltage (Refer to abnormal wave pattern examples 1 and 2.)

Condition of wave pattern build-up section and maximum voltage	Probable cause
Rises from approx. 2V to approx. 4.5V at the top-right	Normal
2V rectangular wave	Open-circuit in ignition primary circuit
Rectangular wave at power voltage	Power transistor malfunction

**Examples of Abnormal Wave Patterns**

- Example 1

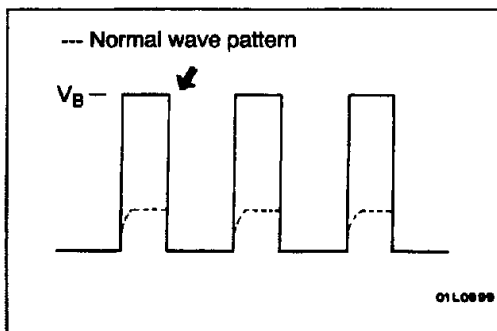
Wave pattern during engine cranking

Cause of problem

Open-circuit in ignition primary circuit

Wave pattern characteristics

Top-right part of the build-up section cannot be seen, and voltage value is approximately 2V too low.



- Example 2

Wave pattern during engine cranking

Cause of problem

Malfunction in power transistor

Wave pattern characteristics

Power voltage results when the power transistor is ON.

ON-VEHICLE SERVICE

BASIC IDLE SPEED ADJUSTMENT

NOTE

1. The standard idling speed has been adjusted, by the speed adjusting screw (SAS), by the manufacturer, and there should usually be no need for readjustment.
 2. If the adjustment has been changed by mistake, the idle speed may become too high or the idle speed may drop too low when loads from components such as the A/C are placed on the engine. If this occurs, adjust by the following procedure.
 3. The adjustment, if made, should be made after first confirming that the spark plugs, the injectors, the idle speed control servo, the compression pressure, etc., are all normal.
1. Before inspection and adjustment, set the vehicle to the pre-inspection condition.
 2. Connect the MUT-II to the diagnosis connector (16-pin).

NOTE

When the MUT-II is connected, the diagnosis control terminal should be earthed.

3. Start the engine and run at idle.
4. Select the item No.30 of the MUT-II Actuator test.

NOTE

This holds the ISC servo at the basic step to adjust the basic idle speed.

5. Check the idle speed.

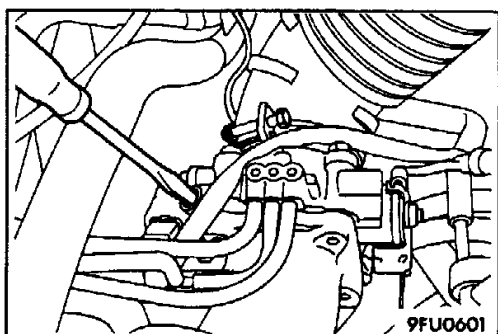
Standard value:

750 ± 50 r/min <Except 4G92 (6B model)>
800 ± 50 r/min <4G92 (6B models), 4G93>

NOTE

1. The engine speed may be 20 to 100 r/min lower than indicated above for a new vehicle [driven approximately 500 km or less], but no adjustment is necessary.
2. If the engine stalls or the engine speed is low even though the vehicle has been driven approximately 500 km or more, it is probable that deposits are adhered to the throttle valve, so clean it. (Refer to P.13A-90.)*

*: Refer to '96 CARISMA Workshop Manual (Pub. No.PWDE9502).



6. If not within the standard value range, turn the speed adjusting screw (SAS) to make the necessary adjustment.

NOTE

If the idling speed is higher than the standard value range even when the SAS is fully closed, check whether or not there is any indication that the fixed SAS has been moved. If there is an indication that it has been moved, adjust the fixed SAS.

7. Press the MUT-II clear key, and release the ISC servo from the Actuator test mode.

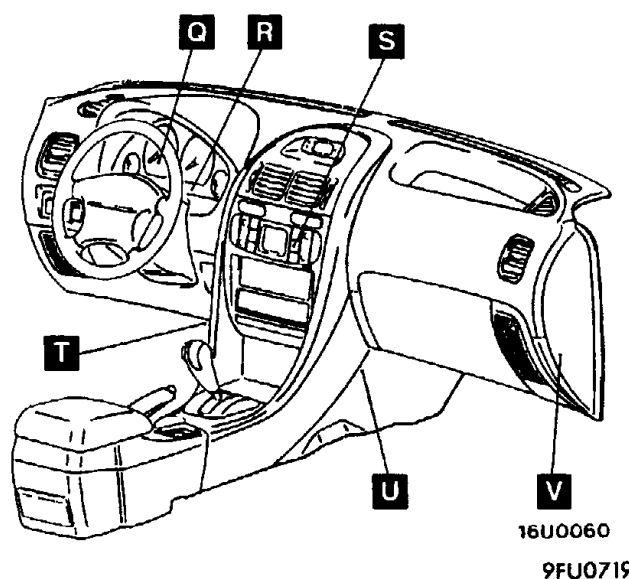
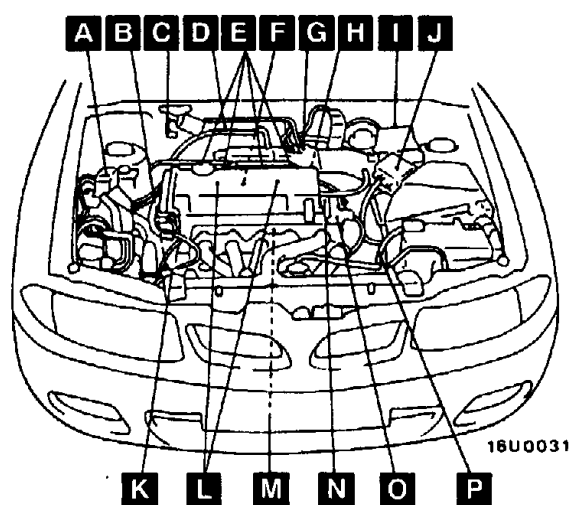
NOTE

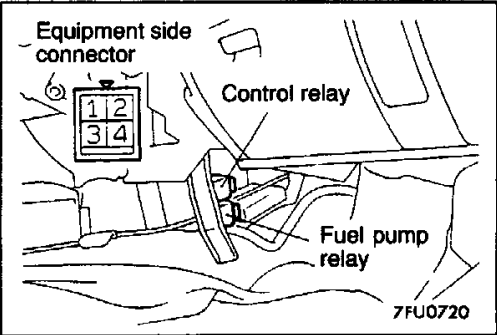
Unless the ISC servo is released, the Actuator test mode will continue 27 minutes.

8. Switch OFF the ignition switch.
9. Disconnect the MUT-II.
10. Start the engine again and let it run at idle speed for about 10 minutes; check that the idling condition is normal.

COMPONENT LOCATION

Name	Symbol	Name	Symbol
Accelerator pedal position sensor (with idle position switch) <SOHC-vehicles with TCL>	H	Fuel pump relay	U
A/C relay	A	Idle speed control servo	H
A/C switch	S	Ignition coil	L
Air flow sensor (with intake air temperature sensor and barometric pressure sensor)	J	Inhibitor switch <A/T>	P
Camshaft position sensor	N	Injector	E
Control relay	U	Oxygen sensor	M
Crank angle sensor	B	Power steering fluid pressure switch	K
Detonation sensor	F	Purge control solenoid valve <SOHC-L.H. drive vehicles, DOHC>	I
Diagnosis connector	T	Purge control solenoid valve <SOHC-R.H. drive vehicles>	C
EGR control solenoid valve <SOHC-L.H. drive vehicles, DOHC>	I	Throttle position sensor <SOHC-vehicles with TCL>	G
EGR control solenoid valve <SOHC-R.H. drive vehicles>	C	Throttle position sensor (with idle position switch) <SOHC-vehicles without TCL, DOHC>	G
Engine coolant temperature sensor	O	Vacuum control solenoid valve <SOHC-vehicles with TCL>	D
Engine-ECU	V	Vehicle speed sensor	Q
Engine warning lamp (check engine lamp)	R	Ventilation control solenoid valve <SOHC-vehicles with TCL>	D
Fuel pump check terminal	D		





**CONTROL RELAY AND FUEL PUMP RELAY
CONTINUITY CHECK**

Battery voltage	Terminal No.			
	1	2	3	4
Not supplied		○	○	○
Supplied	○	⊖	○	⊕

DIESEL FUEL

CONTENTS

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GENERAL

OUTLINE OF CHANGE

The following maintenance service points have been established to correspond to the adoption of the F8QT engine.

Applicable models: 1900D

GENERAL INFORMATION

The electronically-controlled injection pump system consists of sensors which detect the condition of the diesel engine, an engine-ECU which controls the system based on signals from these sensors, and actuators which operate according to control commands from the engine-ECU.

FUEL INJECTION TIMING CONTROL

The position of the injection pump timer piston is controlled so that fuel injection is carried out at the optimum timing in accordance with the engine running condition.

SELF-DIAGNOSIS FUNCTION

- When an abnormality is detected in any of the sensors or actuators, the engine warning lamp illuminates to warn the driver.
- When an abnormality is detected in any of the sensors or actuators, a diagnosis code number corresponding to the problem which occurred is output.

OTHER CONTROL FUNCTIONS

1. A/C Relay Control
Turns the compressor clutch of the A/C ON and OFF.
2. Glow Control
Refer to GROUP 16.

The engine-ECU carries out operations such as fuel injection timing control and idle up control. In addition, the engine-ECU is equipped with several self-diagnosis functions which make troubleshooting easier in the event that a problem develops.

The timer piston position is determined by the timing control solenoid valve which is located in the high-pressure chamber of the timer piston.

- The RAM data relating to the sensors and actuators which is stored in the engine-ECU can be read using the MUT-II. In addition, the actuators can be force-driven under certain conditions.

3. EGR Control
Refer to GROUP 17.
4. Idle up Control
The idle up control is performed when the engine is cold or the A/C is ON.

DIESEL FUEL SYSTEM DIAGRAM

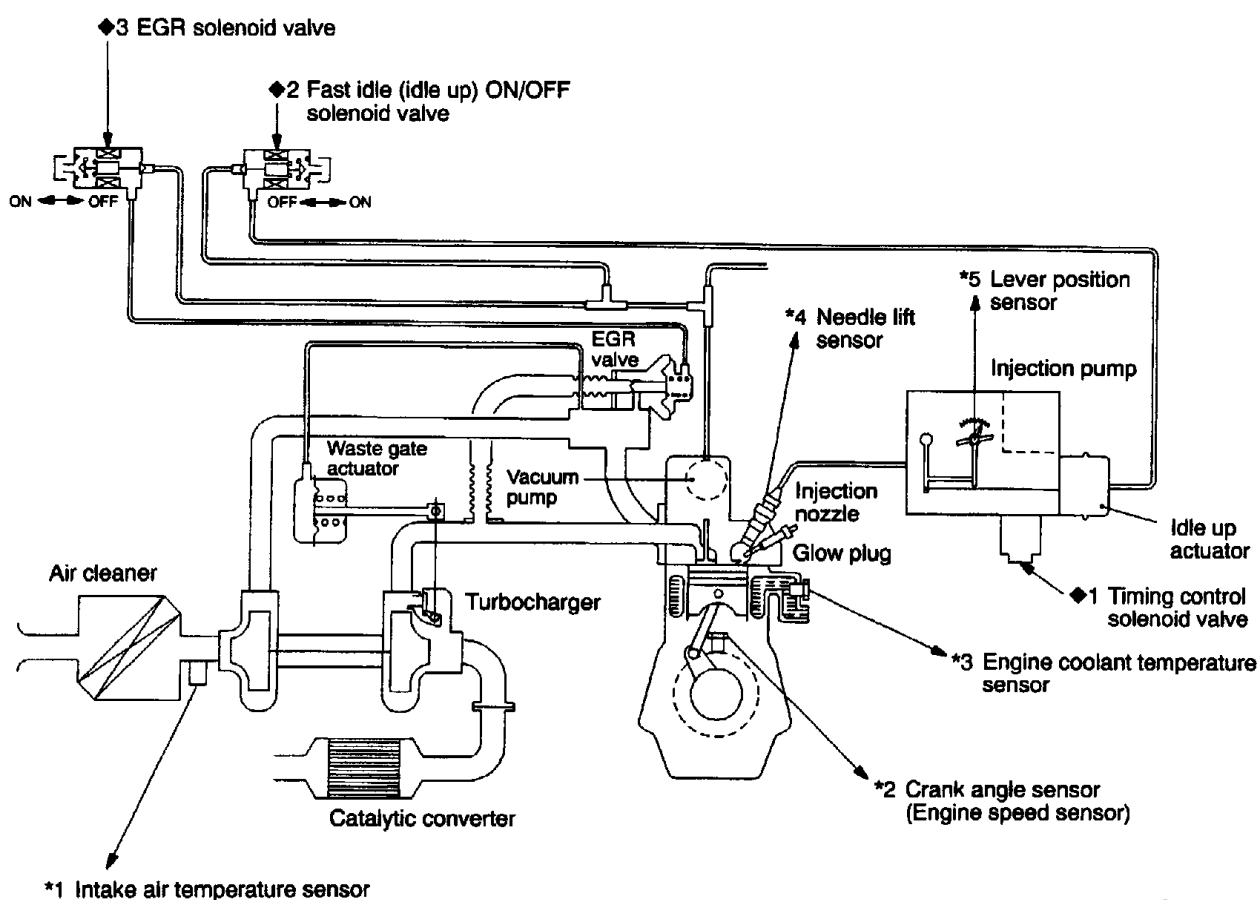
- *1 Intake air temperature sensor
- *2 Crank angle sensor (Engine speed sensor)
- *3 Engine coolant temperature sensor
- *4 Needle lift sensor
- *5 Lever position sensor

- Power supply voltage
- Vehicle speed sensor
- A/C switch
- Power steering fluid pressure switch

⇒ Engine-ECU ⇒

- ◆1 Timing control solenoid valve
- ◆2 Fast idle (idle up) ON/OFF solenoid valve
- ◆3 EGR solenoid valve

- A/C power relay
- Engine warning lamp
- Glow indicator lamp
- Diagnosis signal
- Glow relay box (glow plug relay 1, glow plug relay 2)

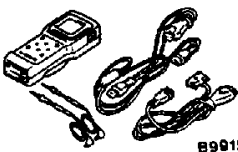
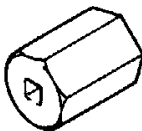
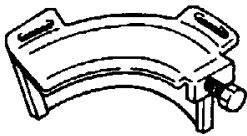
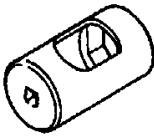


RFU0001

SERVICE SPECIFICATIONS

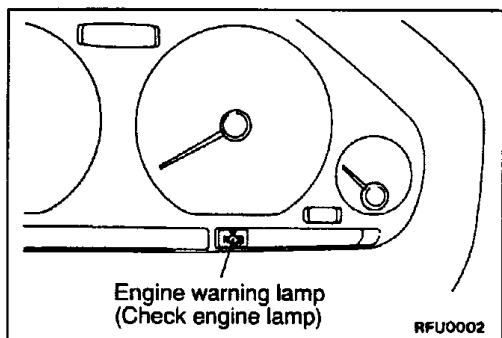
Items		Specifications
Intake air temperature sensor resistance k Ω	At 20°C	3.3 – 3.8
	At 80°C	0.32 – 0.35
Engine coolant temperature sensor resistance k Ω	At 20°C	3.3 – 3.8
	At 80°C	0.32 – 0.35
Resistance between lever position sensor terminals (1) – (3) k Ω		3.3 – 5.0
Resistance between lever position sensor terminals (1) – (2) k Ω	Throttle lever idle position	1.5 – 3.5
	Throttle lever full open	4.1 – 7.1
Crank angle sensor output voltage mV (AC voltage)		300 or more
Crank angle sensor resistance Ω		200 – 270
Needle lift sensor resistance Ω		95 – 125
Timing control solenoid valve coil resistance Ω		10.5 – 13.5
Fast idle ON/OFF solenoid valve coil resistance Ω		27 – 31 (at 23°C)
Fuel injection initial pressure kPa		13,000

SPECIAL TOOLS

Tool	Number	Name	Use
 MB991502	MB991502	MUT-II sub assembly	• Reading diagnosis code • Checking the electronic control fuel injection pump system
	MB996036	Hexagon socket	• Removal of screwed sleeve and nut assembly
	MB996043	Sprocket stopper	• Locking the injection pump socket
	MB996041	Special socket	• Removal of the fuel injectors

TROUBLESHOOTING**DIAGNOSIS TROUBLESHOOTING FLOW**

Refer to '96 CARISMA Workshop Manual (Pub. No. PWDE9502), GROUP 00 – How to Use Troubleshooting/Inspection Service Points.



DIAGNOSIS FUNCTION

ENGINE WARNING LAMP (CHECK ENGINE LAMP)

If an abnormality occurs in any of the following items related to the electronic controlled injection timing system, the engine warning lamp will illuminate.

If the lamp remains illuminated or if the lamp illuminates while the engine is running, check the diagnosis code output.

Engine warning lamp inspection items

Engine coolant temperature sensor
Lever position sensor
Needle lift sensor
Timing control solenoid valve
Crank angle sensor

NOTE

When the ignition switch is ON, the engine warning lamp illuminates as checking of the engine warning lamp circuit and the bulb, and then the warning lamp is extinguished when the engine is start.

METHOD OF READING AND ERASING DIAGNOSIS CODES

Refer to '96 CARISMA Workshop Manual (Pub. No. PWDE9502), GROUP 00 – How to Use Troubleshooting/Inspection Service Points.

INSPECTION USING MUT-II DATA LIST AND ACTUATOR TESTING

1. Carry out inspection by means of the data list and the actuator test function.
If there is an abnormality, check and repair the chassis harnesses and components.
2. After repairing, re-check using the MUT-II and check that the abnormal input and output have returned to normal as a result of the repairs.
3. Erase the diagnosis code memory.
4. Remove the MUT-II.
5. Start the engine again and carry out a road test to confirm that the problem has disappeared.

FAIL-SAFE FUNCTION REFERENCE TABLE

Malfunctioning item	Fuel injection timing control	Glow control	EGR control	Idle up control	Air condition control
Engine coolant temperature sensor	Sets a pseudo coolant temperature based on the cumulative engine speed since the engine was started. -20 ≤ t°C ≤ 80	<Pre-glow> Approx. 14-second control is carried out as if the engine coolant temperature is -30°C. <After glow> Control is carried out as if the engine coolant temperature is 60°C.	Carry out control as if the water temperature is 0°C.	Sets a pseudo coolant temperature based on the cumulative engine speed since the engine was started. -20 ≤ t°C ≤ 80	ON/OFF control is carried out using only the vehicle speed sensor signal.
Lever position sensor	Carry out control as if the lever opening angle is approx. 50%.	Carry out control as if the lever opening angle is approx. 50%.	EGR control is stopped.	–	Carry out control as if the lever opening angle is approx. 30%.
Barometric pressure sensor	Carry out control as if the altitude is 900 m.	Carry out control as if the altitude is 900 m.	EGR control is stopped.	–	–
Intake air temperature sensor	Carry out control as if the intake air temperature is 22°C.	–	EGR control is stopped.	–	–
Battery voltage	Carry out control as if the battery voltage is 13.5 V.	Glow control is stopped.	–	–	–
Crank angle sensor (Engine speed sensor)	Carry out fully-advanced control.	<Pre-glow> – <After glow> The control time is set to 210 seconds.	EGR control is stopped.	Idle up control is not carried out as if the engine speed is 2,000 r/min.	The engine speed is set to 2,000 r/min.

Malfunctioning item	Fuel injection timing control	Glow control	EGR control	Idle up control	Air condition control
Needle lift sensor	Does not carry out feedback control. (OPEN LOOP)	-	-	-	-
Vehicle speed sensor	-	-	The vehicle speed is set to 175 km/h.	The vehicle speed is set to 175 km/h.	The vehicle speed is set to 175 km/h.
EGR solenoid valve	-	-	EGR control is stopped.	-	-
Glow indicator lamp	-	Glow indicator lamp does not illuminate.	-	-	-
Glow plug relay 1	-	The functioning of glow plug relay 2 is stopped.	-	-	-
Glow plug relay 2	-	The functioning of glow plug relay 1 is stopped.	-	-	-
Fast idle ON/OFF solenoid valve	-	-	-	Idle up control is stopped.	-
Engine warning lamp	Engine warning lamp does not illuminate.	Engine warning lamp does not illuminate.	Engine warning lamp does not illuminate.	Engine warning lamp does not illuminate.	Engine warning lamp does not illuminate.

INSPECTION CHART FOR DIAGNOSIS CODES**Caution**

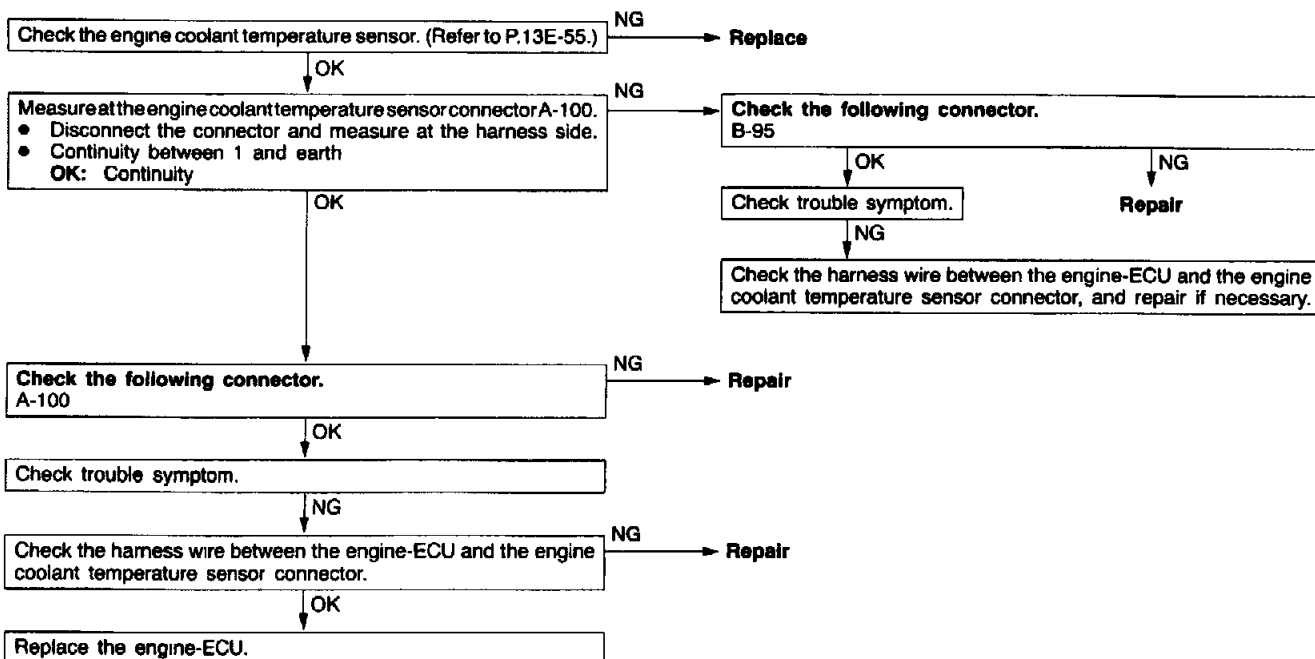
Check that the engine-ECU earth circuit is normal before checking for the cause of the problem.

Code No.	Diagnosis item	Reference page
11	Physical engine coolant temperature under range	13E-10
12	Lever position under range	13E-11
13	Physical barometric pressure under range	13E-11
14	Physical intake air temperature under range	13E-12
15	Battery voltage under range	13E-13
16	Engine speed (crank angle sensor)	13E-14
17	Needle lift	13E-15
18	Vehicle speed input stuck low	13E-16
21	Timing control solenoid valve drive stuck low	13E-17
22	EGR solenoid valve drive stuck low	13E-18
23	Glow indicator lamp drive stuck low	13E-19
24	Glow plug relay 1 drive stuck low	13E-20
25	Glow plug relay 2 drive stuck low	13E-21
26	Fast idle ON/OFF solenoid valve drive stuck low	13E-22
28	Engine warning lamp drive stuck low	13E-23
31	Physical engine coolant temperature over range	13E-24
32	Lever position over range	13E-25
33	Physical barometric pressure over range	13E-25
34	Physical intake air temperature over range	13E-26
35	Battery voltage over range	13E-26
38	Vehicle speed input stuck high	13E-27
41	Timing control solenoid valve drive stuck high	13E-28
42	EGR solenoid valve drive stuck high	13E-28
43	Glow indicator lamp drive stuck high	13E-28
44	Glow plug relay 1 drive stuck high	13E-29
45	Glow plug relay 2 drive stuck high	13E-29

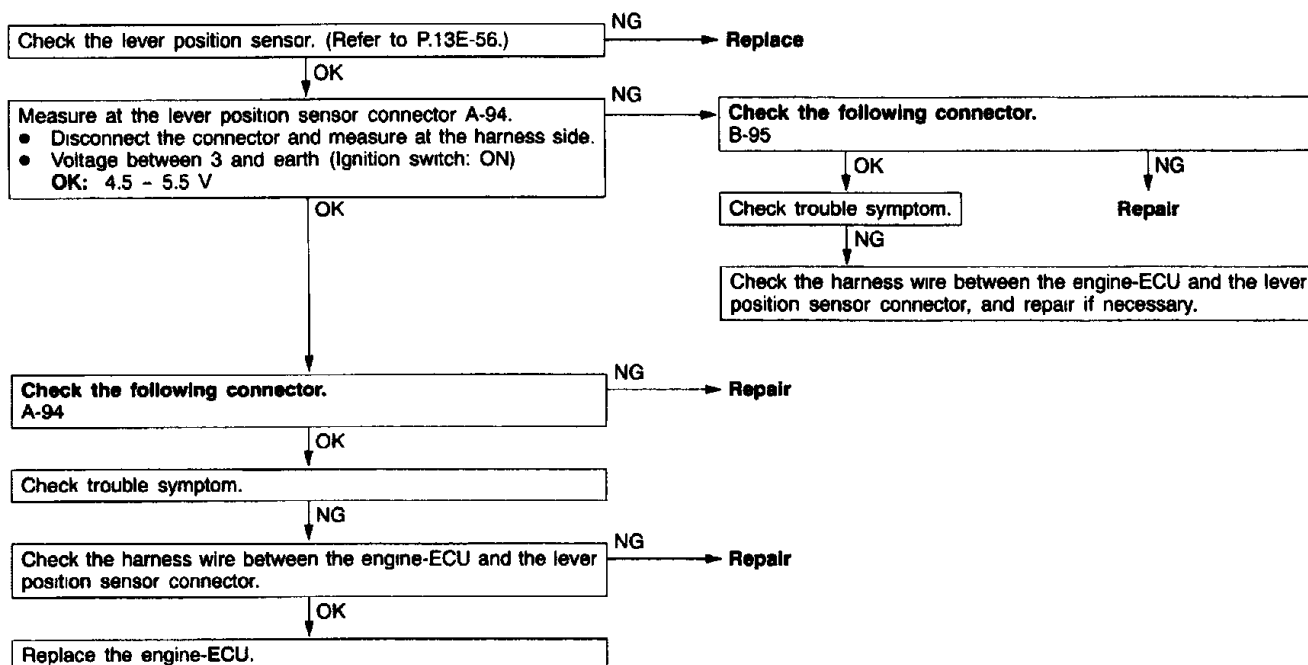
Code No.	Diagnosis item	Reference page
46	Fast idle ON/OFF solenoid valve drive stuck high	13E-30
47	Air conditioning drive stuck high	13E-30
48	Engine warning lamp drive stuck high	13E-31
51	Timing control fault	13E-32
53	Glow plug 1 (No.1, No.3 cylinder) voltage monitor fault.	13E-33
54	Glow plug 2 (No.2, No.4 cylinder) voltage monitor fault.	13E-33
55	Sensor supply voltage under range	13E-34

INSPECTION PROCEDURE FOR DIAGNOSIS CODES

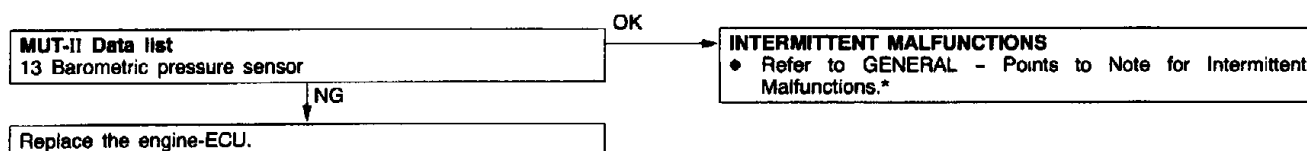
Code No.11 Physical engine coolant temperature under range	Probable cause
Range of Check - Ignition switch: ON Set Conditions - Engine coolant temperature sensor output voltage is 4.96 V or more (corresponding to an engine coolant temperature of -45°C or less).	- Malfunction of the engine coolant temperature sensor - Open circuit in engine coolant temperature sensor or poor connector contact - Malfunction of the engine-ECU



Code No.12 Lever position under range	Probable cause
Range of Check - Ignition switch: ON Set Conditions - Lever position sensor output voltage is 0.2 V or less.	- Malfunction of the lever position sensor - Short-circuit in lever position sensor signal line - Open circuit in lever position sensor power supply line - Malfunction of the engine-ECU

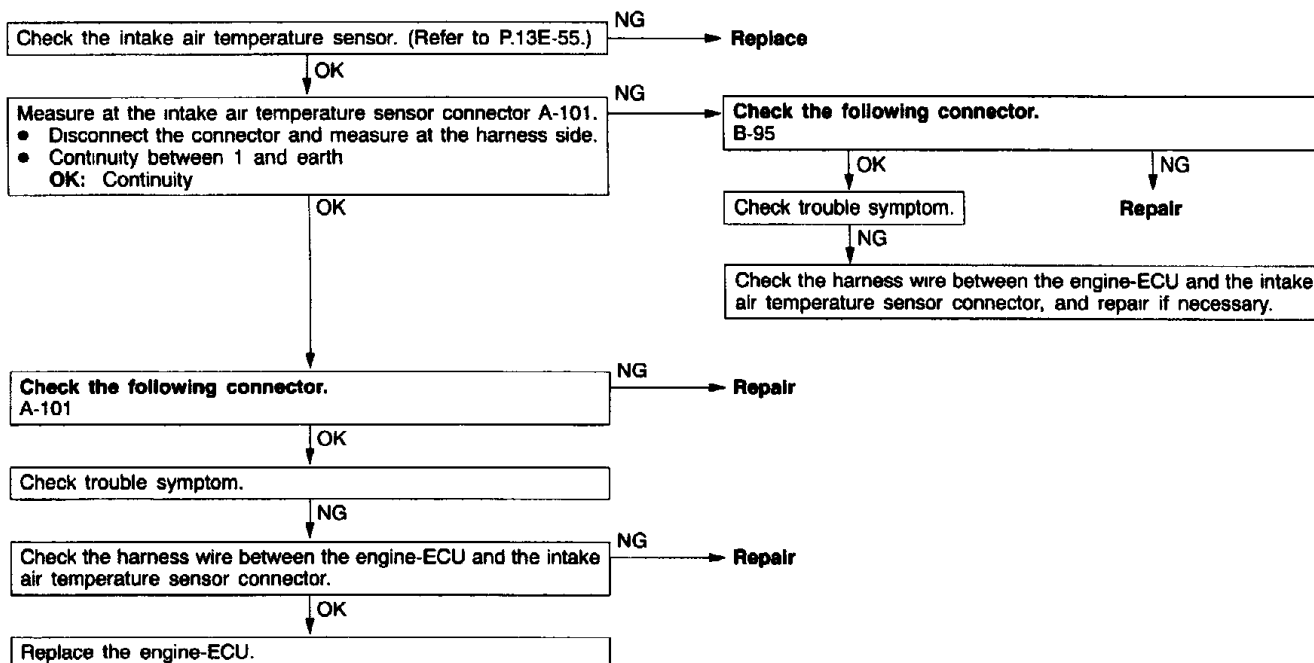


Code No.13 Physical barometric pressure under range	Probable cause
Range of Check - Ignition switch: ON Set Conditions - Barometric pressure sensor output pressure is 18 kPa or less. - or - Sensor is not carrying out electrical control.	- Malfunction of the barometric pressure sensor (built into engine-ECU) - Malfunction of the engine-ECU

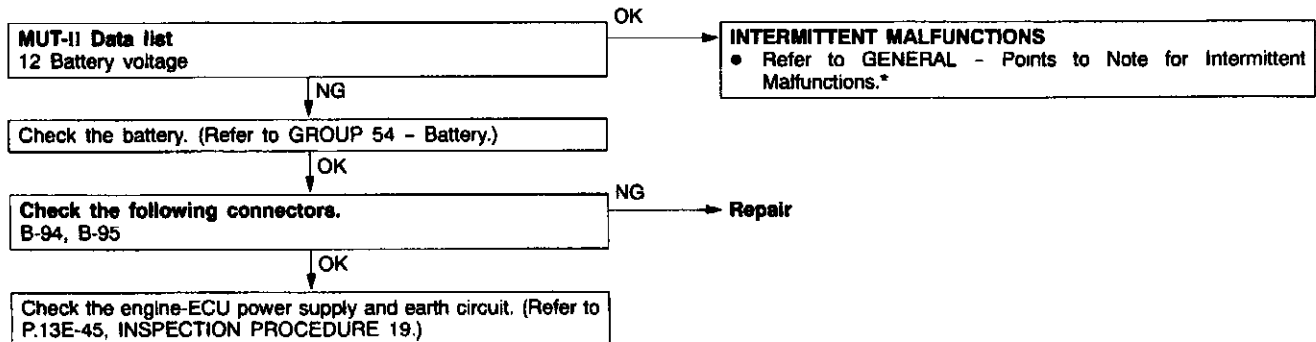


*: Refer to '96 CARISMA Workshop Manual (Pub. No. PWDE9502).

Code No.14 Physical intake air temperature under range	Probable cause
Range of Check - Ignition switch: ON Set Conditions - Intake air temperature sensor output voltage is 4.96 V or more. (corresponding to an intake air temperature of -45°C or less)	- Malfunction of the intake air temperature sensor - Open circuit in intake air temperature sensor circuit or poor connector contact - Malfunction of the engine-ECU

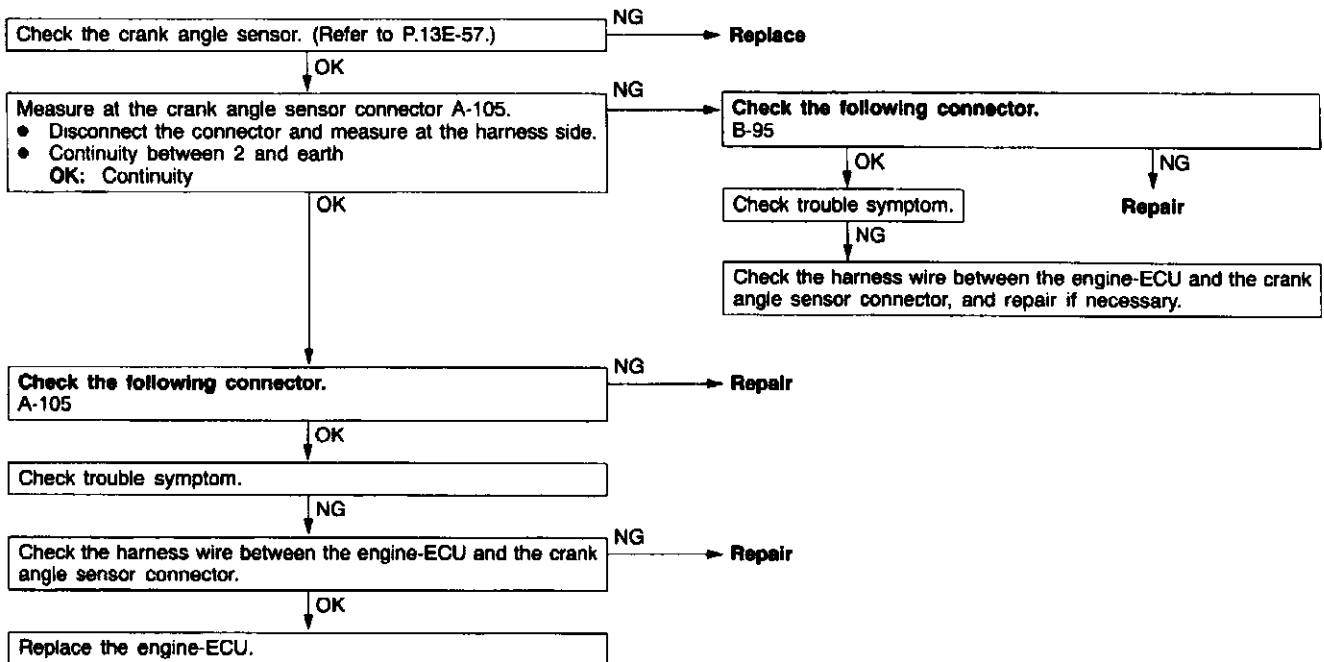


Code No.15 Battery voltage under range	Probable cause
Range of Check - Ignition switch: ON Set Conditions - Battery voltage is 6 V or less	- Insufficient battery charge or malfunction of the battery - Malfunction of the engine-ECU power supply line - Malfunction of the engine-ECU earth line - Malfunction of the engine-ECU

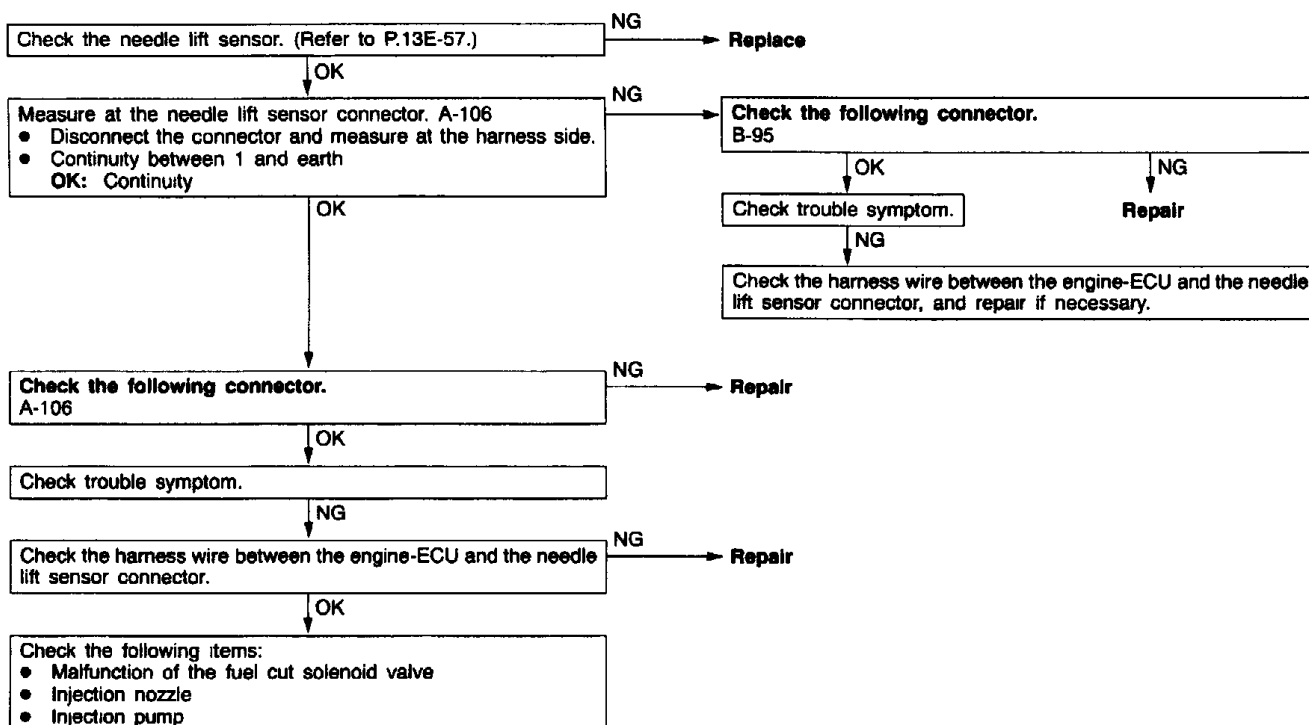


*: Refer to '96 CARISMA Workshop Manual (Pub. No. PWDE9502).

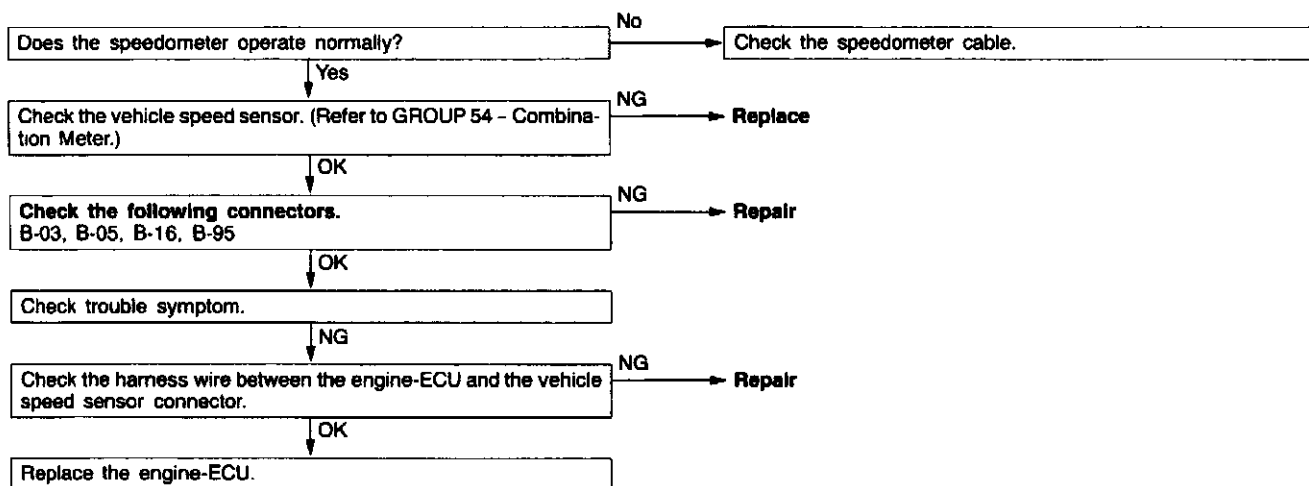
Code No.16 Engine speed (crank angle sensor)	Probable cause
Range of Check - During engine running Set Conditions - No crank angle sensor pulse signal is input during two successive needle lift sensor pulse signal inputs. or - The needle lift sensor signals and crank angle sensor signals are not synchronized.	- Malfunction of the crank angle sensor - Open circuit or short-circuit in crank angle sensor circuit or poor connector contact - Malfunction of the engine-ECU



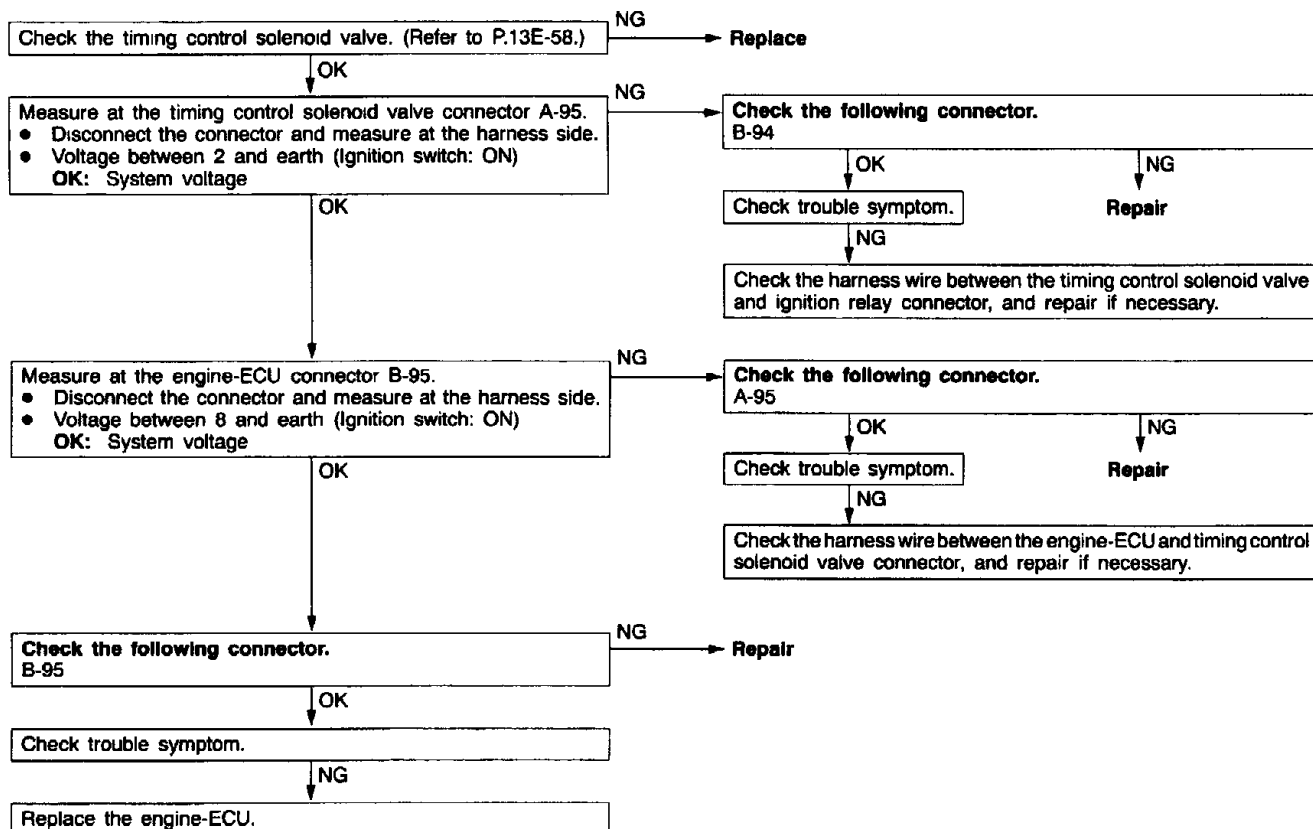
Code No.17 Needle lift	Probable cause
Range of Check - During engine running Set Conditions - No needle lift sensor pulse signal is input during eight successive crank angle sensor pulse signal inputs. or - Noise detected in needle lift sensor signal. or - The crank angle sensor signals and needle lift sensor signals are not of synchronizer.	- Malfunction of the needle lift sensor - Open circuit or short-circuit in needle lift sensor circuit or poor connector contact - Malfunction of the engine-ECU - Malfunction of the fuel cut solenoid valve



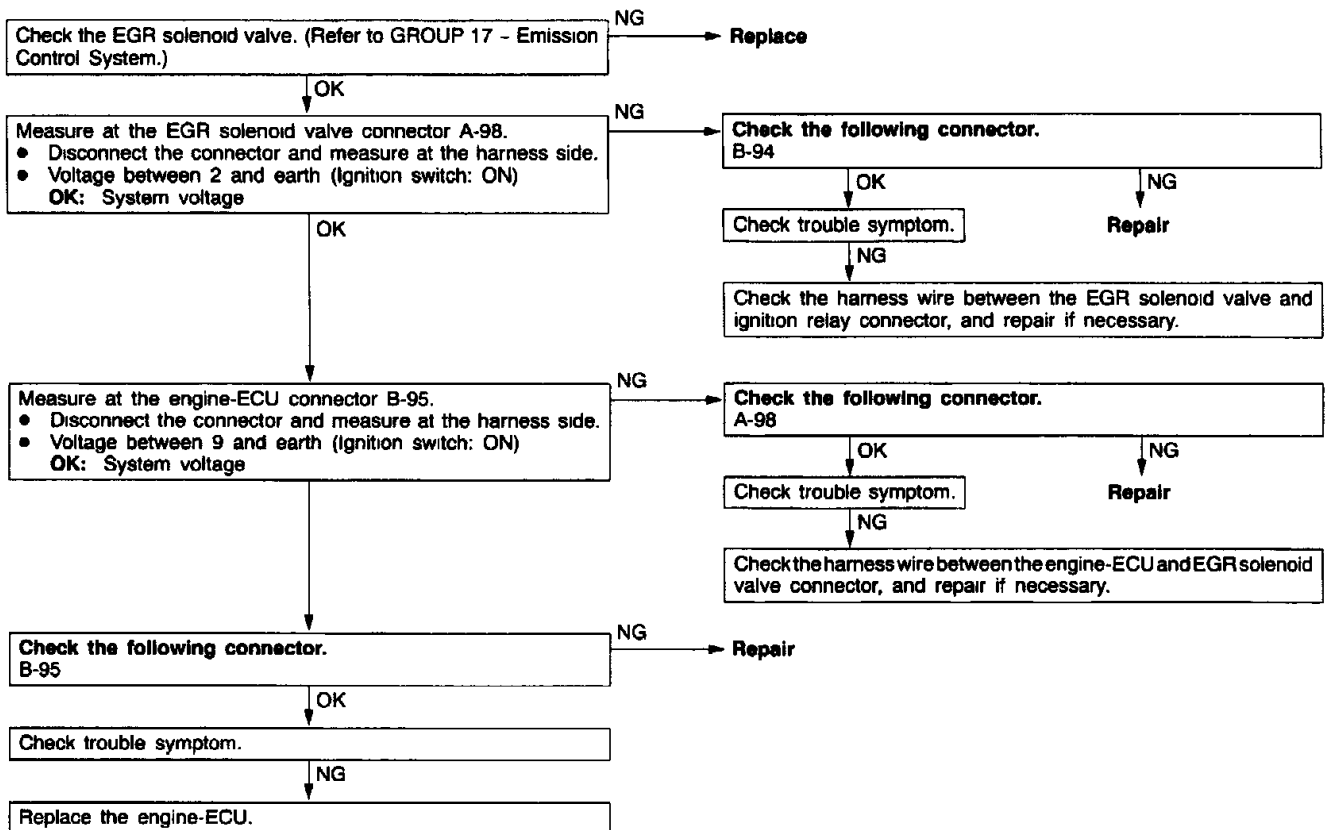
Code No.18 Vehicle speed input stuck low	Probable cause
Range of Check • Ignition switch: ON • Engine speed: 1,000 – 2,800 r/min • Lever position sensor opening angle: 50 – 78% Set Conditions • Vehicle speed sensor signal stays at the low level and does not change.	• Malfunction of the vehicle speed sensor • Short-circuit in vehicle speed sensor circuit • Malfunction of the engine-ECU



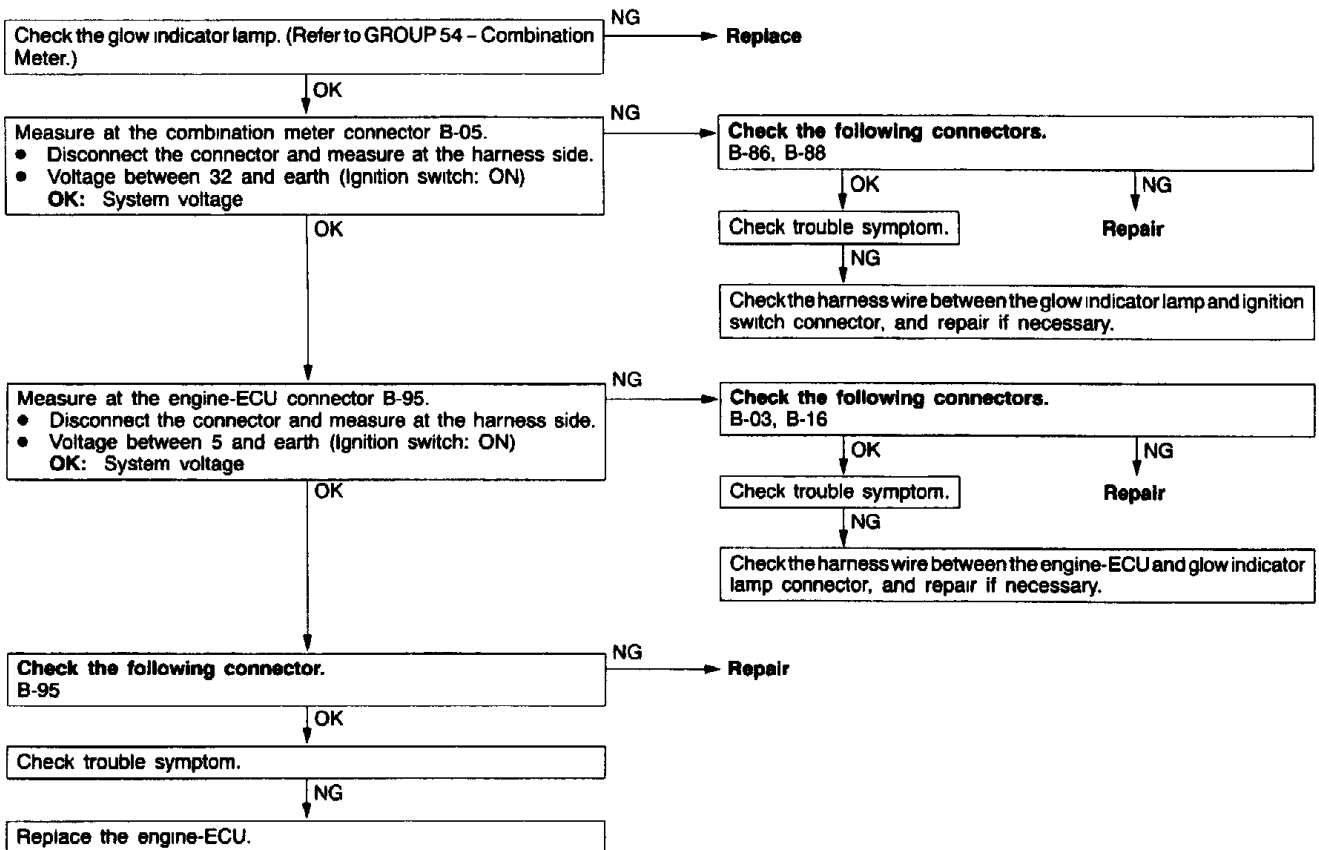
Code No.21 Timing control solenoid valve drive stuck low	Probable cause
Range of Check - When timing control solenoid valve is being driven. Set Conditions - Engine-ECU output command is different from timing control solenoid valve drive condition.	- Malfunction of the timing control solenoid valve - Open circuit or short-circuit in timing control solenoid valve circuit or poor connector contact - Malfunction of the engine-ECU



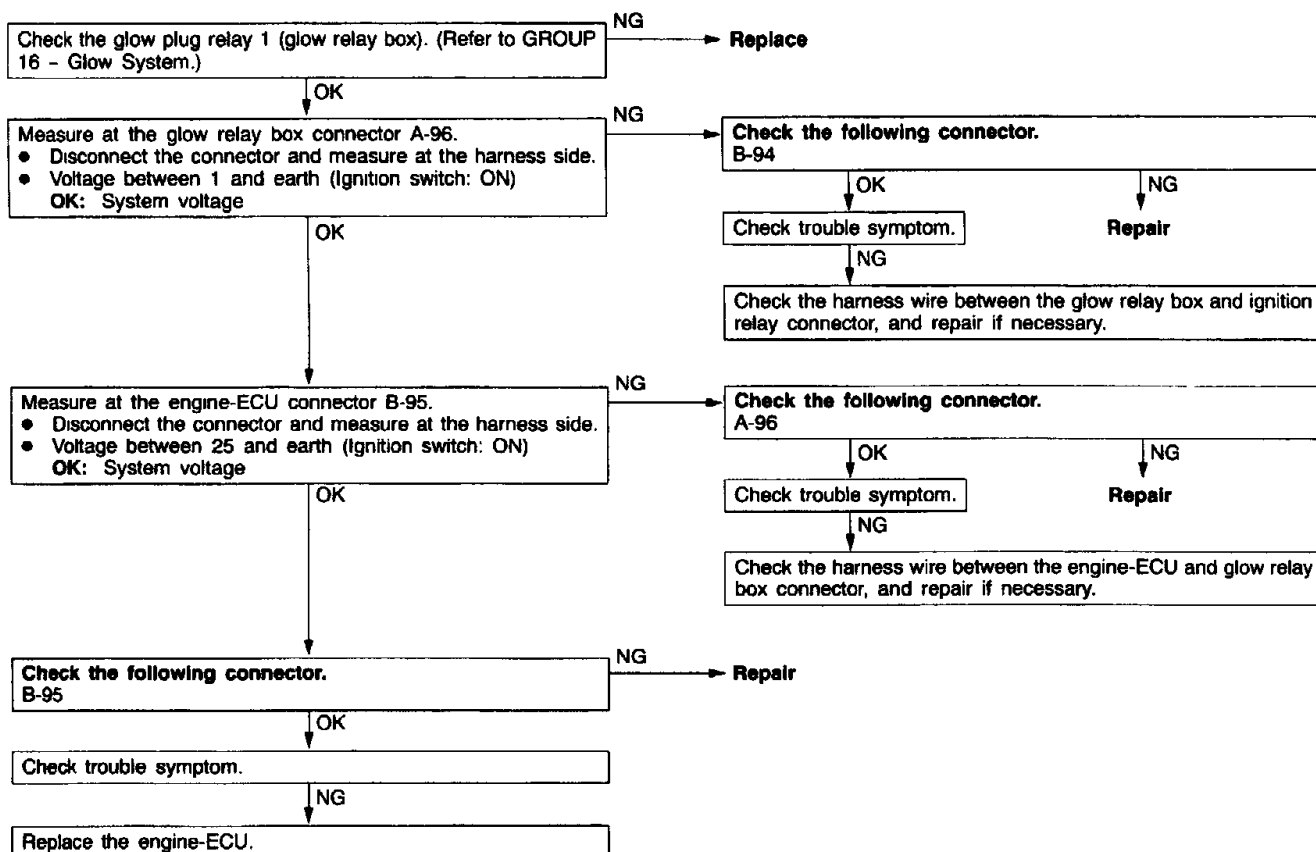
Code No.22 EGR Solenoid valve drive stuck low	Probable cause
Range of Check - When solenoid valve is being driven. Set Conditions - Engine-ECU output command is different from solenoid valve drive condition.	- Malfunction of the EGR solenoid valve - Open circuit or short-circuit in EGR solenoid valve circuit or poor connector contact - Malfunction of the engine-ECU



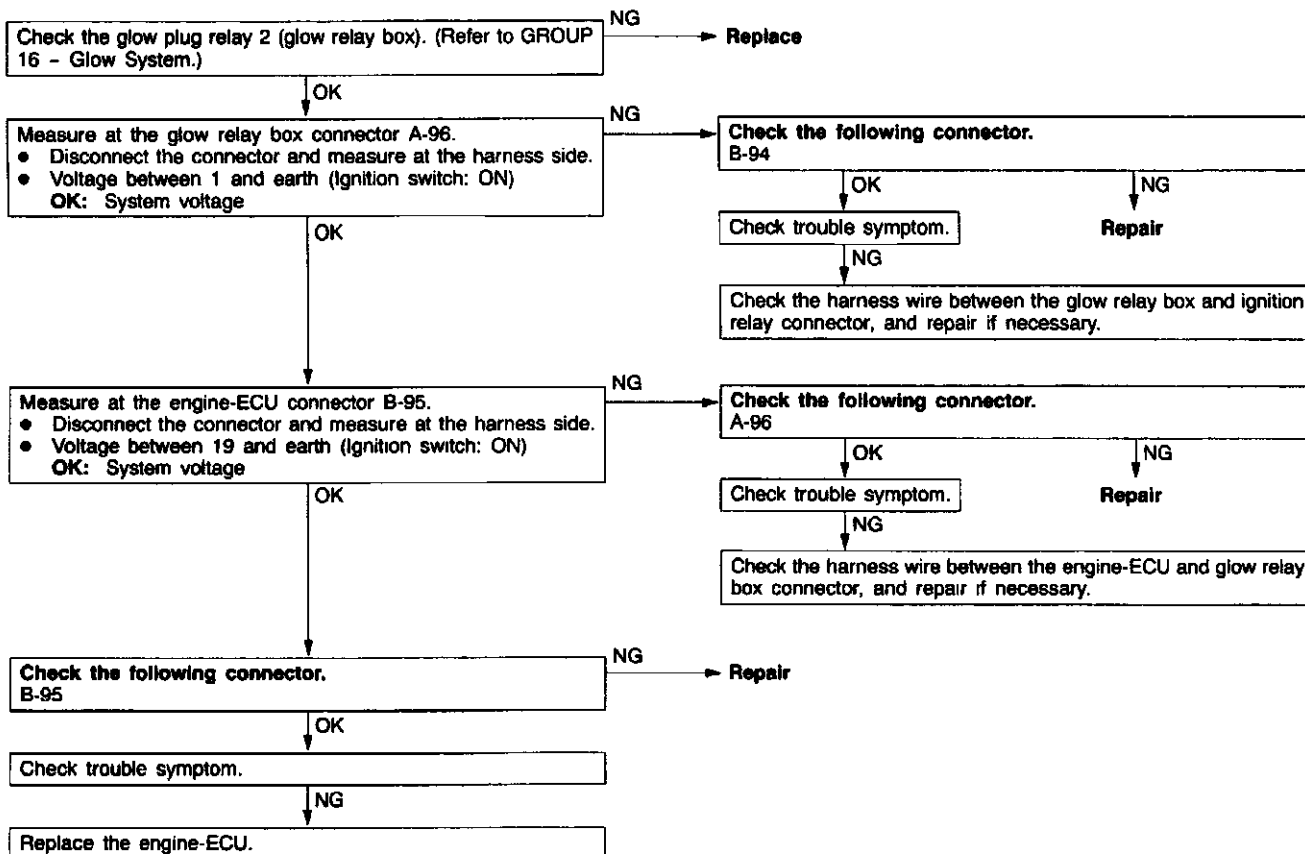
Code No.23 Glow indicator lamp drive stuck low	Probable cause
Range of Check - When glow indicator lamp is being driven. Set Conditions - Engine-ECU output command is different from glow indicator lamp drive condition.	- Malfunction of the glow indicator lamp - Open circuit or short-circuit in glow indicator lamp circuit or poor connector contact - Malfunction of the engine-ECU



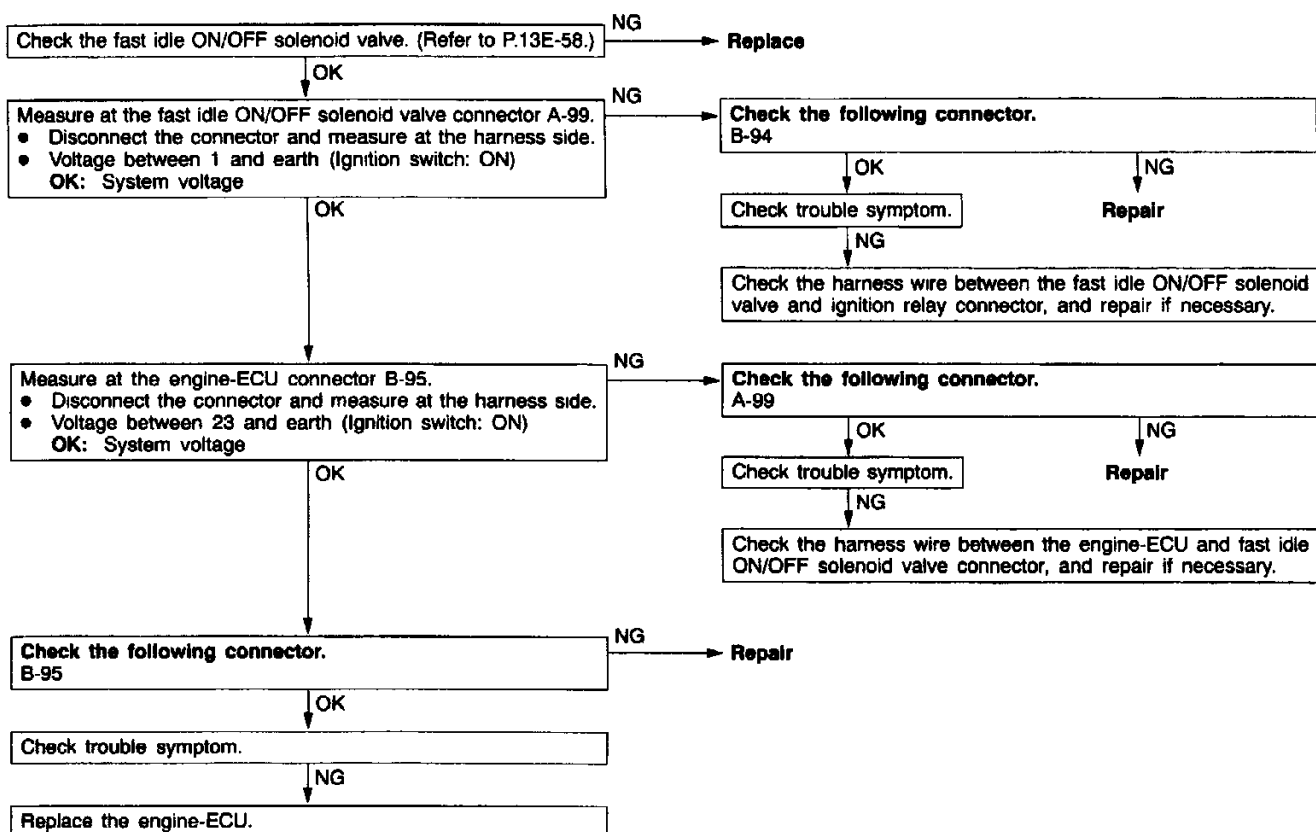
Code No.24 Glow plug relay 1 drive stuck low	Probable cause
Range of Check - When glow plug relay 1 is being driven Set Conditions - Engine-ECU output command is different from glow plug relay 1 drive condition	- Malfunction of the glow plug relay 1 - Open circuit or short-circuit in glow plug relay 1 circuit or poor connector contact - Malfunction of the engine-ECU



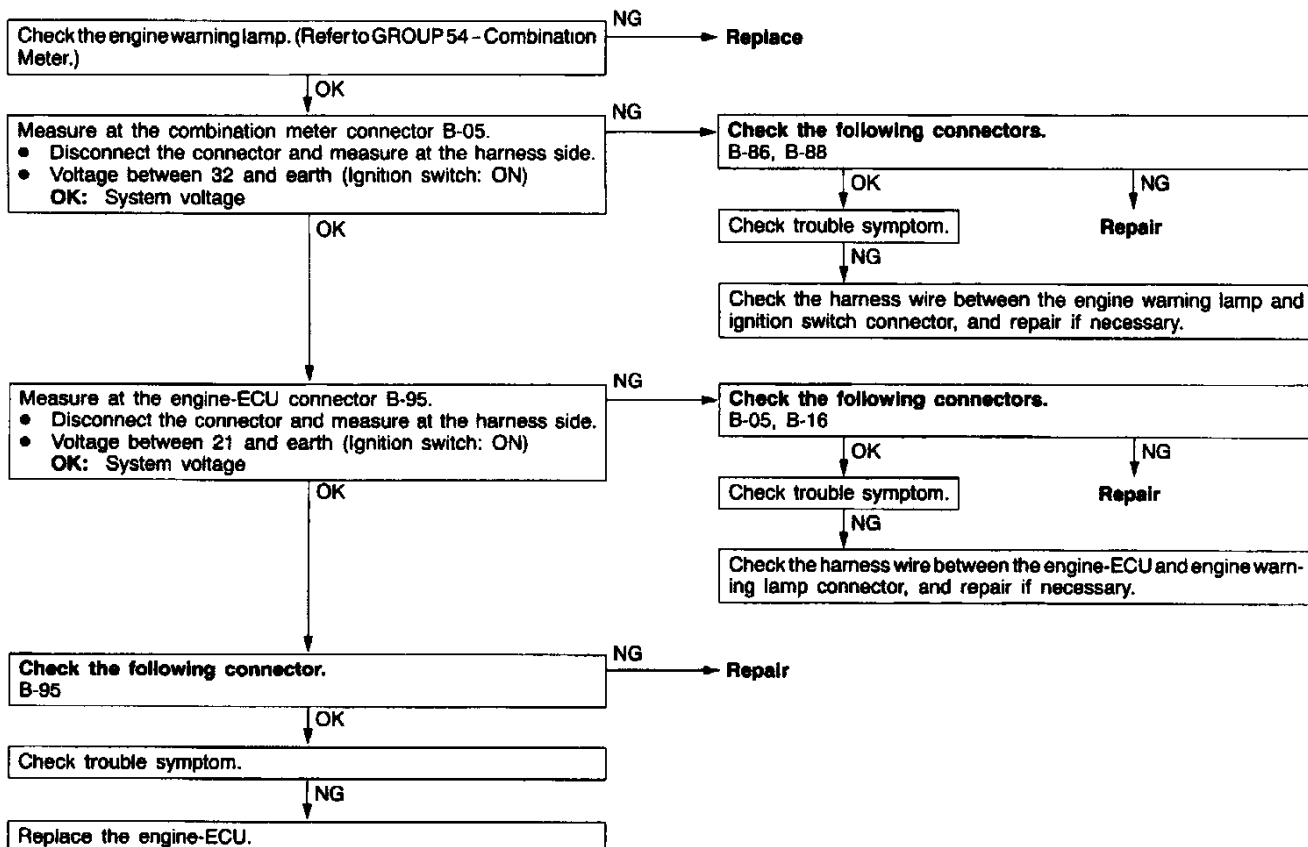
Code No.25 Glow plug relay 2 drive stuck low	Probable cause
Range of Check - When glow plug relay 2 is being driven Set Conditions - Engine-ECU output command is different from glow plug relay 2 drive condition	- Malfunction of the glow plug relay 2 - Open circuit or short-circuit in glow plug relay 2 circuit or poor connector contact - Malfunction of the engine-ECU



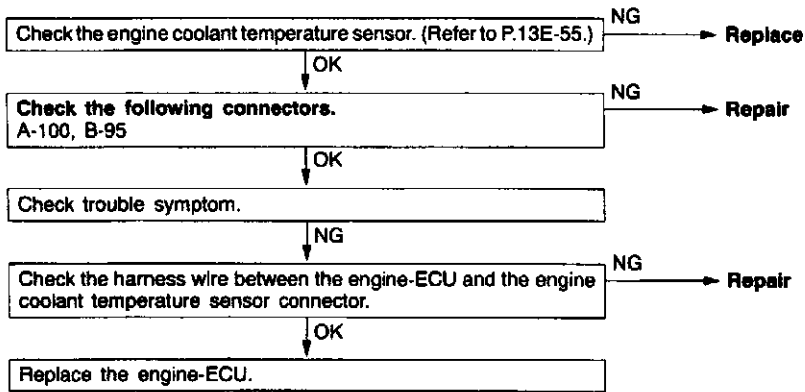
Code No.26 Fast Idle ON/OFF solenoid valve drive stuck low	Probable cause
Range of Check - When solenoid valve is being driven Set Conditions - Engine-ECU output command is different from solenoid valve drive condition	- Malfunction of the fast idle ON/OFF solenoid valve - Open circuit or short-circuit in fast idle ON/OFF solenoid valve circuit or poor connector contact - Malfunction of the engine-ECU



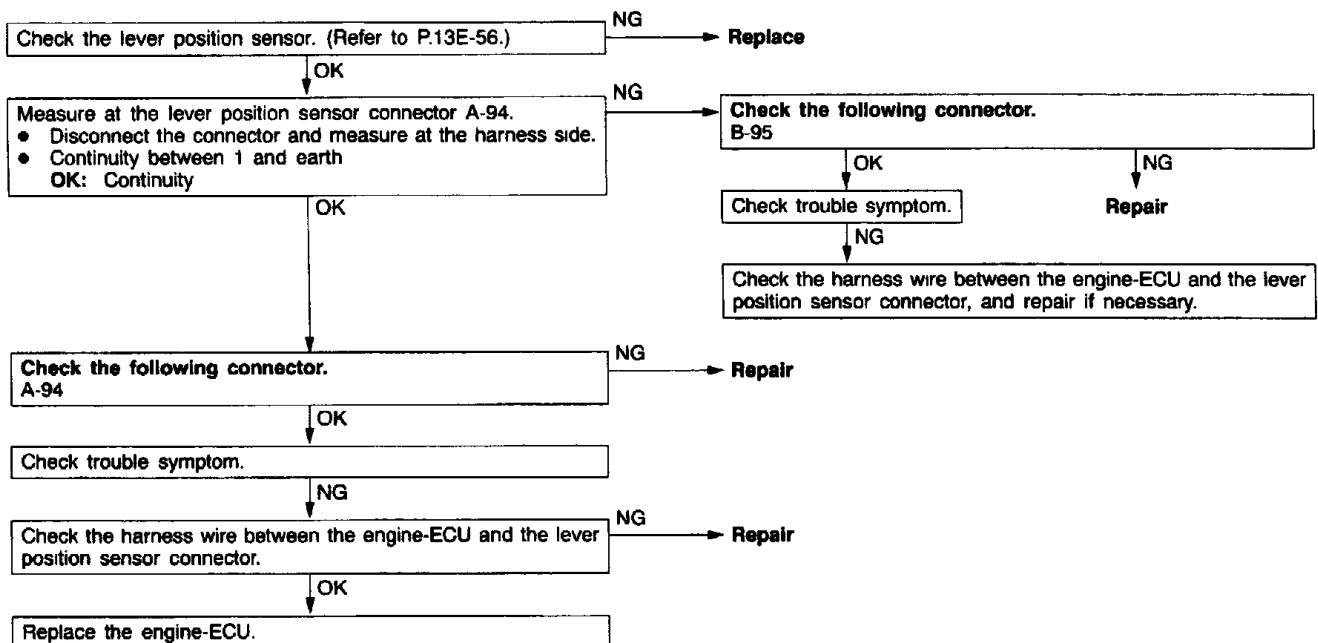
Code No.28 Engine warning lamp drive stuck low	Probable cause
Range of Check - When engine warning lamp is being driven Set Conditions - Engine-ECU output command is different from engine warning lamp drive condition	- Malfunction of the engine warning lamp - Open circuit or short-circuit in engine warning lamp circuit or poor connector contact - Malfunction of the engine-ECU



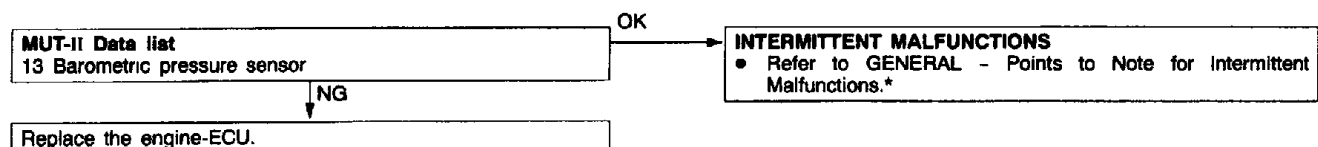
Code No.31 Physical engine coolant temperature over range	Probable cause
Range of Check - Ignition switch: ON Set Conditions - Engine coolant temperature sensor output voltage is 0.3 V or less (corresponding to an engine coolant temperature of 135°C or more)	- Malfunction of the engine coolant temperature sensor - Short-circuit in engine coolant temperature sensor circuit - Malfunction of the engine-ECU



Code No.32 Lever position over range	Probable cause
Range of Check - Ignition switch: ON Set Conditions - Lever position sensor output voltage is 4.9 V or more	- Malfunction of the lever position sensor - Open circuit in lever position sensor earth line - Malfunction of the engine-ECU

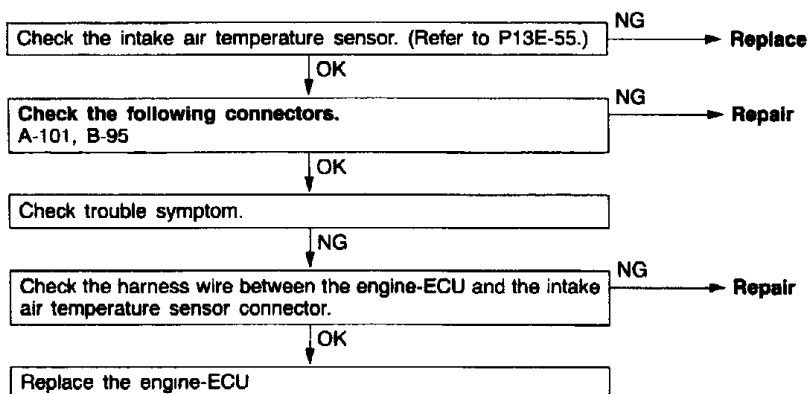


Code No.33 Physical barometric pressure over range	Probable cause
Range of Check - Ignition switch: ON Set Conditions - Barometric pressure sensor output pressure is 105 kPa or more or - Sensor is not carrying out electrical control.	- Malfunction of the barometric pressure sensor (built into engine-ECU) - Malfunction of the engine-ECU

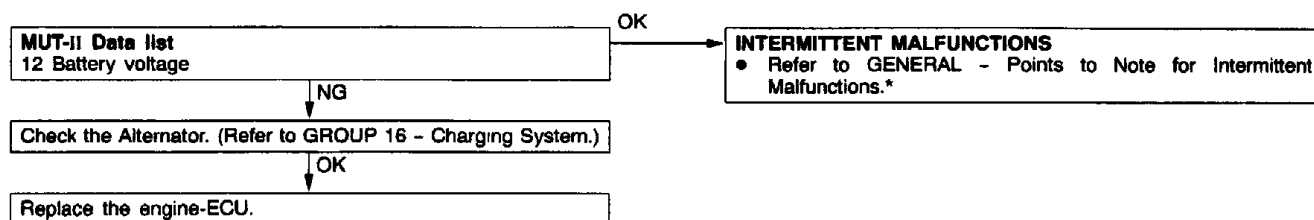


*: Refer to '96 CARISMA Workshop Manual (Pub. No. PWDE9502).

Code No.34 Physical intake air temperature over range	Probable cause
Range of Check - Ignition switch: ON Set Conditions - Intake air temperature sensor output voltage is 0.3 V or less (corresponding to an intake air temperature of 135°C or more)	- Malfunction of the intake air temperature sensor - Short-circuit in intake air temperature sensor circuit - Malfunction of the engine-ECU

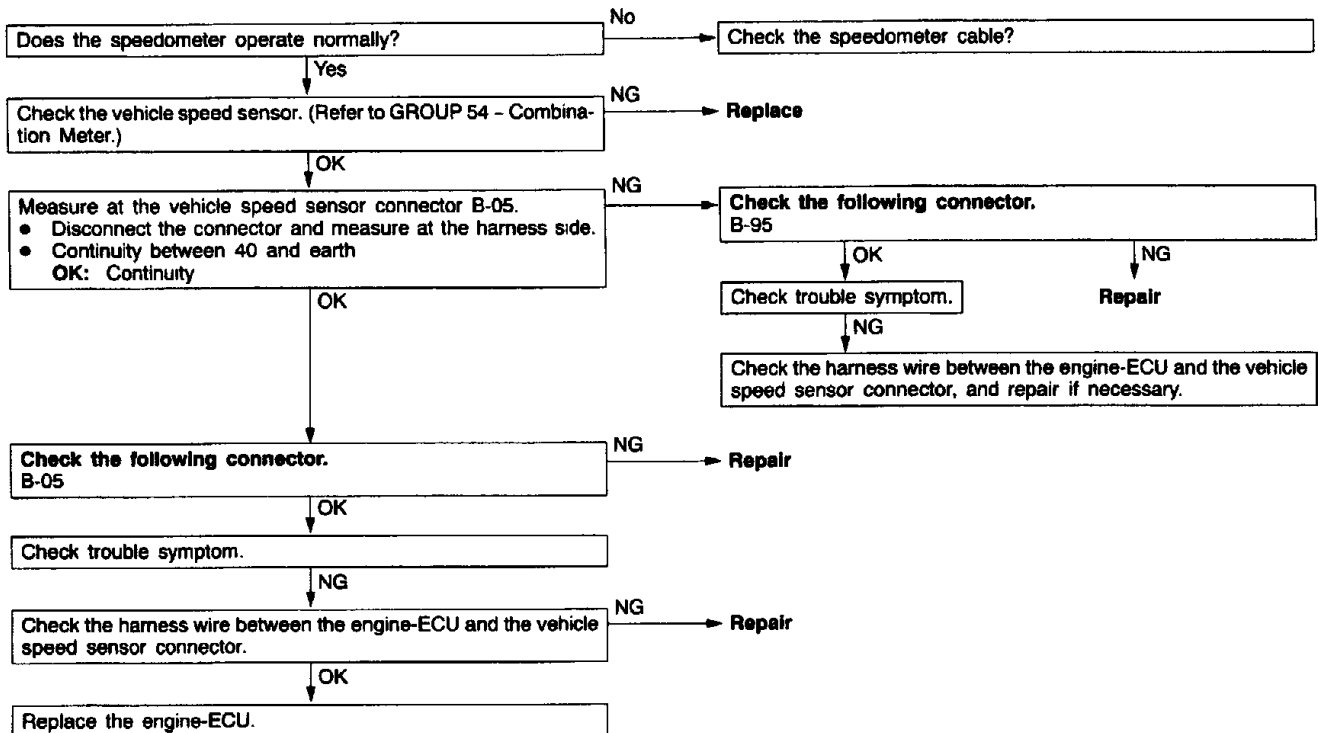


Code No.35 Battery voltage over range	Probable cause
Range of Check - Ignition switch: ON Set Conditions - Battery voltage is 16 V or more	Malfunction of the engine-ECU

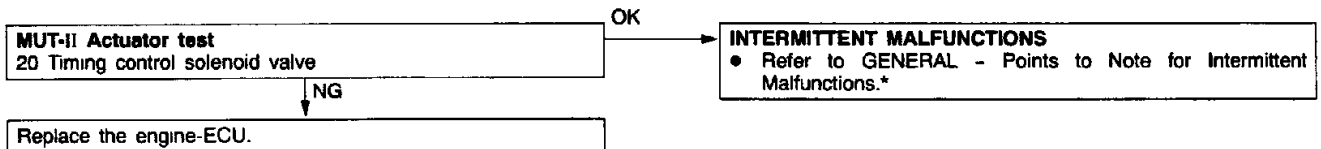


*: Refer to '96 CARISMA Workshop Manual (Pub. No. PWDE9502).

Code No.38 Vehicle speed input stuck high	Probable cause
Range of Check - Ignition switch: ON - Engine speed: 1,000 - 2,800 r/min - Lever position sensor opening angle: 50 - 78% Set Conditions - Vehicle speed sensor signal stays at the high level and does not change.	- Malfunction of the vehicle speed sensor - Open circuit in vehicle speed sensor circuit or poor connector contact - Malfunction of the engine-ECU

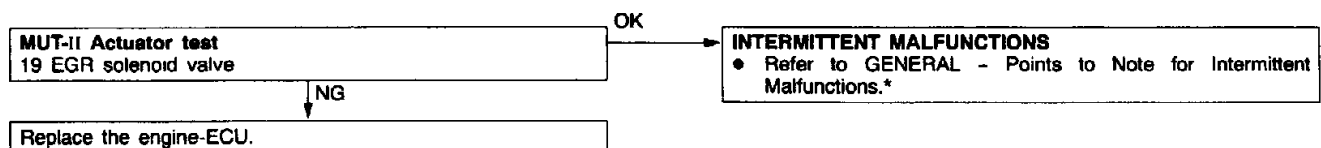


Code No.41 Timing control solenoid valve drive stuck high	Probable cause
Range of Check - When timing control solenoid valve is being driven Set Conditions - Engine-ECU output command is different from timing control solenoid valve drive condition	Malfunction of the engine-ECU



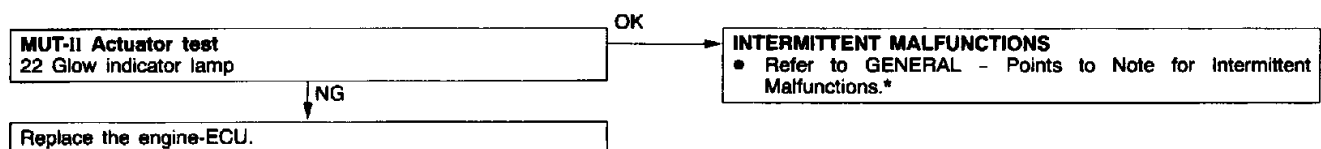
*: Refer to '96 CARISMA Workshop Manual (Pub. No. PWDE9502).

Code No.42 EGR solenoid valve drive stuck high	Probable cause
Range of Check - When solenoid valve is being driven Set Conditions - Engine-ECU output command is different from solenoid valve drive condition.	Malfunction of the engine-ECU



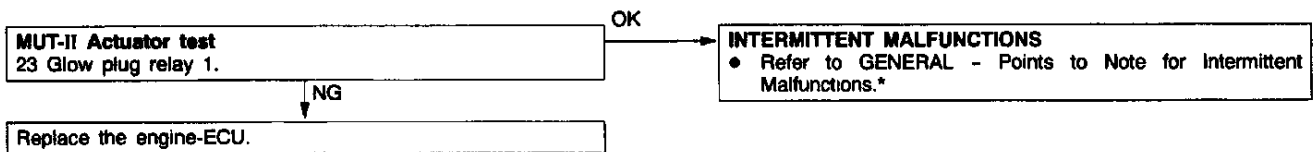
*: Refer to '96 CARISMA Workshop Manual (Pub. No. PWDE9502).

Code No.43 Glow indicator lamp drive stuck high	Probable cause
Range of Check - When glow indicator lamp is being driven. Set Conditions - Engine-ECU output command is different from glow indicator lamp drive condition.	Malfunction of the engine-ECU



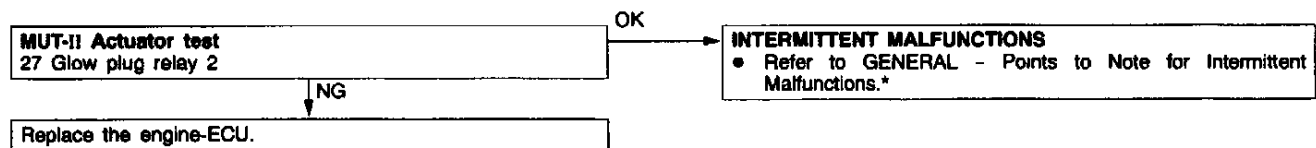
*: Refer to '96 CARISMA Workshop Manual (Pub. No. PWDE9502).

Code No.44 Glow plug relay 1 drive stuck high	Probable cause
Range of Check - When glow plug relay 1 is being driven Set Conditions - Engine-ECU output command is different from glow plug relay 1 drive condition	Malfunction of the engine-ECU



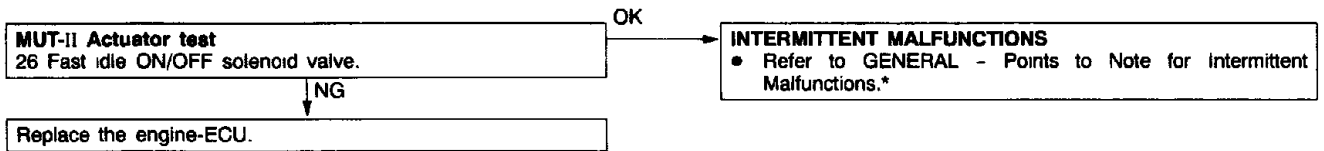
*: Refer to '96 CARISMA Workshop Manual (Pub. No. PWDE9502).

Code No. 45 Glow plug relay 2 drive stuck high	Probable cause
Range of Check - When glow plug relay 2 is being driven Set Conditions - Engine-ECU output command is different from glow plug relay 2 drive condition	Malfunction of the engine-ECU



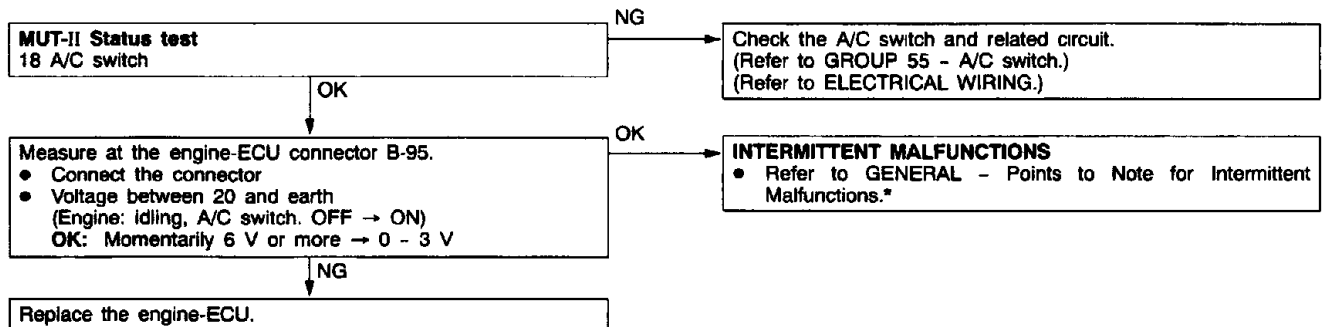
*: Refer to '96 CARISMA Workshop Manual (Pub. No. PWDE9502).

Code No.46 Fast Idle ON/OFF solenoid valve drive stuck high	Probable cause
Range of Check - When solenoid valve is being driven Set Conditions - Engine-ECU output command is different from solenoid valve drive condition.	Malfunction of the engine-ECU



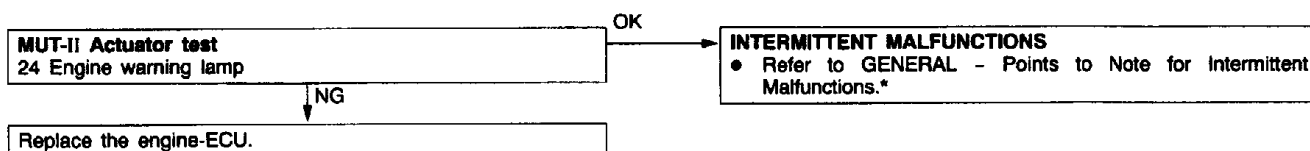
*: Refer to '96 CARISMA Workshop Manual (Pub. No. PWDE9502).

Code No.47 Air conditioning drive stuck high	Probable cause
Range of Check - When A/C relay is being driven Set Conditions - Engine-ECU output command is different from A/C relay drive condition	Malfunction of the engine-ECU



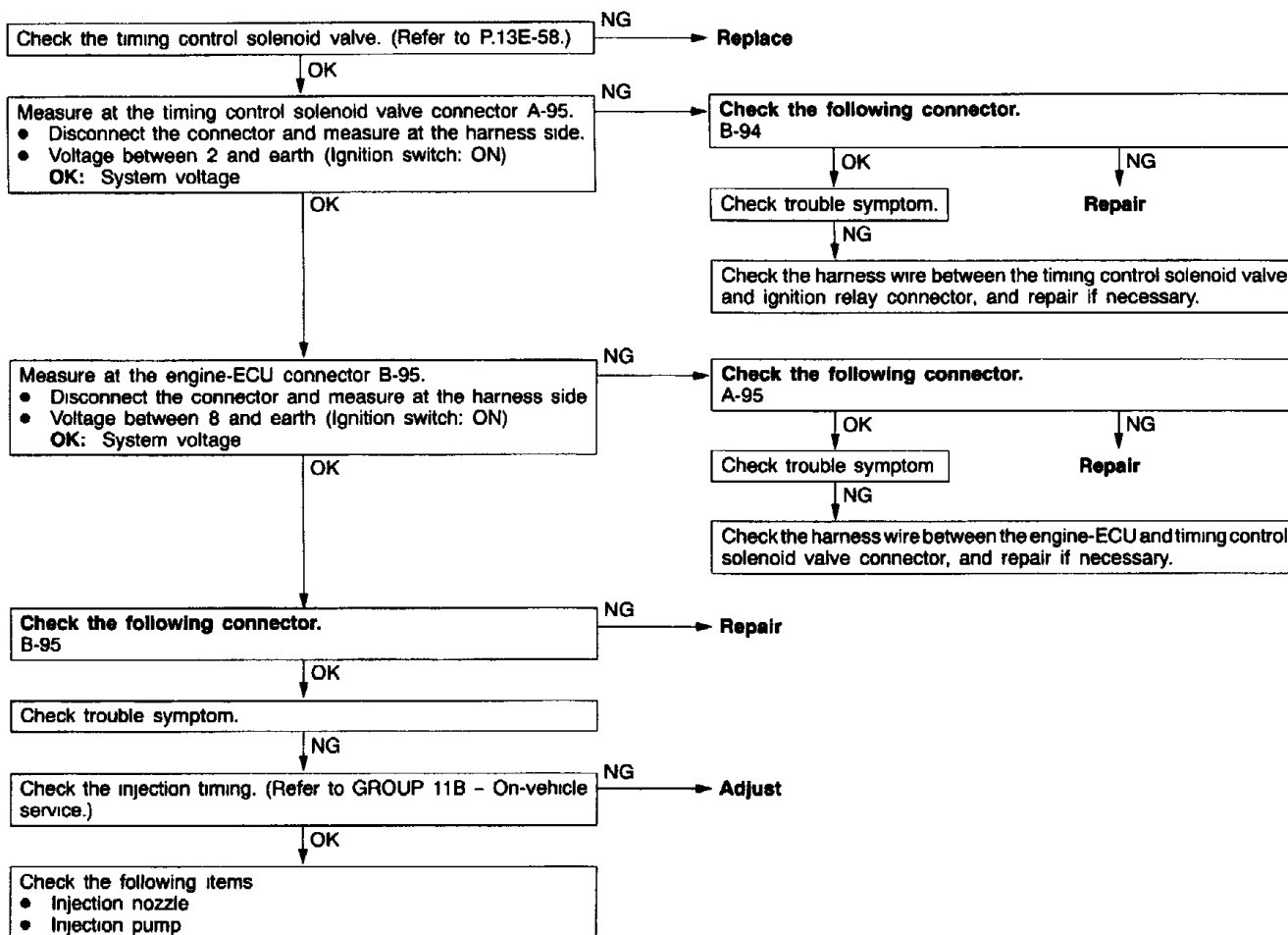
*: Refer to '96 CARISMA Workshop Manual (Pub. No. PWDE9502).

Code No.48 Engine warning lamp drive stuck high	Probable cause
Range of Check • When engine warning lamp is being driven Set Conditions • Engine-ECU output command is different from engine warning lamp drive condition.	• Malfunction of the engine-ECU



*: Refer to '96 CARISMA Workshop Manual (Pub. No. PWDE9502).

Code No.51 Timing control fault	Probable cause
Range of Check - During engine running Set Conditions - Target engine-ECU advance value differs greatly from actual engine-ECU advance value.	- Malfunction of the timing control solenoid valve - Open circuit or short-circuit in timing control solenoid valve circuit or poor connector contact - Incorrect injection timing adjustment - Malfunction of the injection pump - Malfunction of the engine-ECU



Code No.53 Glow plug 1 (No.1, No.3 cylinder) voltage monitor fault**Probable cause****Range of Check**

- When the glow plug 1 is ON, except during cranking

Set Conditions

- Glow plug 1 applied voltage (system voltage) falls by 4 V or more when glow plug 1 is caused to be ON.

- Insufficient battery charge or malfunction of the battery
- Malfunction of the No.1 glow plug
- Malfunction of the No.3 glow plug

Check the battery. (Refer to GROUP 54 - Battery.)

OK

Check the glow plug 1 (for No.1, No.3 cylinder). (Refer to GROUP 16 - Glow System.)

NG

→ Replace

OK

- Check the wiring harness between the battery and glow plug relay.
- Check the wiring harness between the glow plug relay and glow plug.

Code No.54 Glow plug 2 (No.2, No.4 cylinder) voltage monitor fault**Probable cause****Range of Check**

- When the glow plug 2 is ON, except during cranking

Set Conditions

- Glow plug 2 applied voltage (system voltage) falls by 4 V or more when glow plug 2 is caused to be ON.

- Insufficient battery charge or malfunction of the battery
- Malfunction of the No.2 glow plug
- Malfunction of the No.4 glow plug

Check the battery. (Refer to GROUP 54 - Battery.)

OK

Check the glow plug 2. (for No.2, No.4 cylinder) (Refer to GROUP 16 - Glow System.)

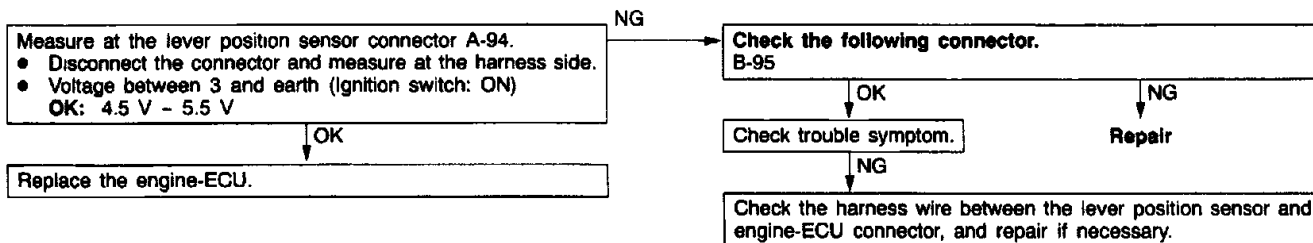
NG

→ Replace

OK

- Check the wiring harness between the battery and glow plug relay.
- Check the wiring harness between the glow plug relay and glow plug.

Code No.55 Sensor supply voltage under range	Probable cause
Range of Check • Ignition switch: ON Set Conditions • Sensor supply voltage is 4.5 V or less	• Short-circuit in sensor supply voltage circuit • Malfunction of the engine-ECU



INSPECTION CHART FOR TROUBLE SYMPTOMS**Caution**

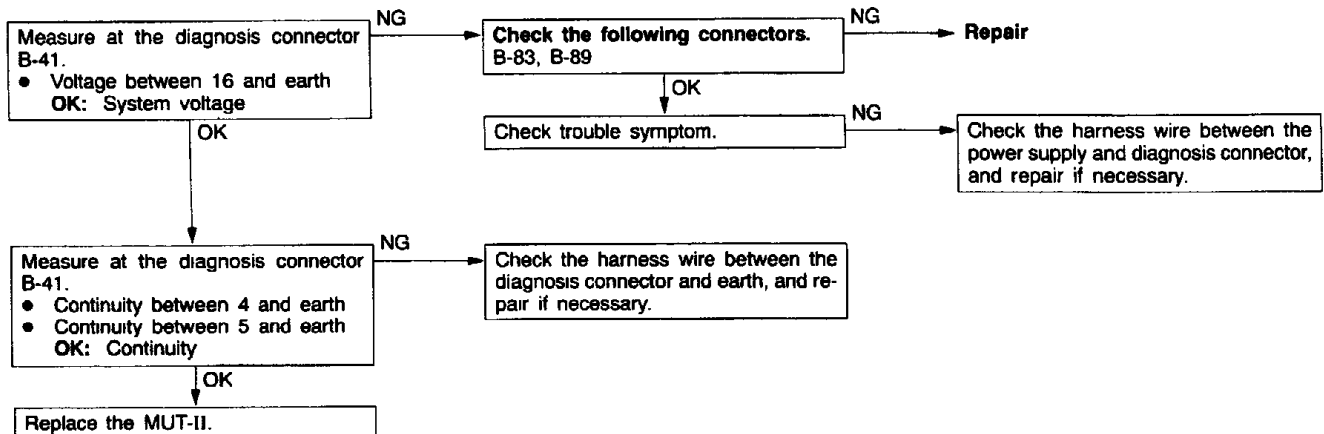
Check that the engine-ECU earth circuit is normal before checking for the cause of the problem.

Trouble symptoms		Inspection procedure No.	Reference page
Communication with MUT-II is impossible	Communication with all systems is not possible.	1	13E-36
	Communication with engine-ECU only is not possible.	2	13E-36
Engine warning lamp and related parts	The engine warning lamp does not illuminate right after the ignition switch is turned to the ON position	3	13E-37
	The engine warning lamp remains illuminating and never goes out.	4	13E-38
Starting	No initial combustion (Starting not possible)	5	13E-38
	Poor startability when engine is cold (Poor starting)	6	13E-39
	Poor startability when engine is cold or warm (Poor starting)	7	13E-39
Idling stability (Improper idling)	Idle speed is low when engine is cold (Improper idling speed)	8	13E-40
	Idling speed is high (Improper idling speed)	9	13E-40
	Idling speed is low (Improper idling speed)	10	13E-41
	Idle speed is unstable (Rough idling, hunting)	11	13E-41
Idling stability (Engine stalls)	Engine stops soon after starting	12	13E-42
	Engine stops during idling	13	13E-42
Driving	Engine output is too low	14	13E-43
	Abnormal engine knocking occurs	15	13E-43
	Abnormally black smoke	16	13E-44
	Abnormally white smoke	17	13E-44
	Hunting occurs while driving	18	13E-45

INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS

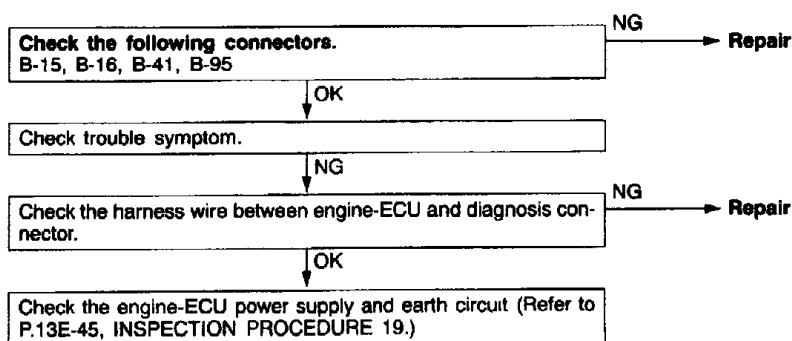
INSPECTION PROCEDURE 1

Communication with MUT-II is not possible (Communication with all systems is not possible)	Probable cause
The cause is probably a defect in the power supply system (including earth) for the diagnosis line.	• Malfunction of the connector • Malfunction of the harness wire



INSPECTION PROCEDURE 2

MUT-II communication with engine-ECU is impossible.	Probable cause
One of the following causes may be suspected. • No power supply to engine-ECU • Defective earth circuit of engine-ECU • Defective engine-ECU • Improper communication line between engine-ECU and MUT-II	• Malfunction of engine-ECU power supply circuit • Malfunction of the engine-ECU • Open circuit between engine-ECU and diagnosis connector

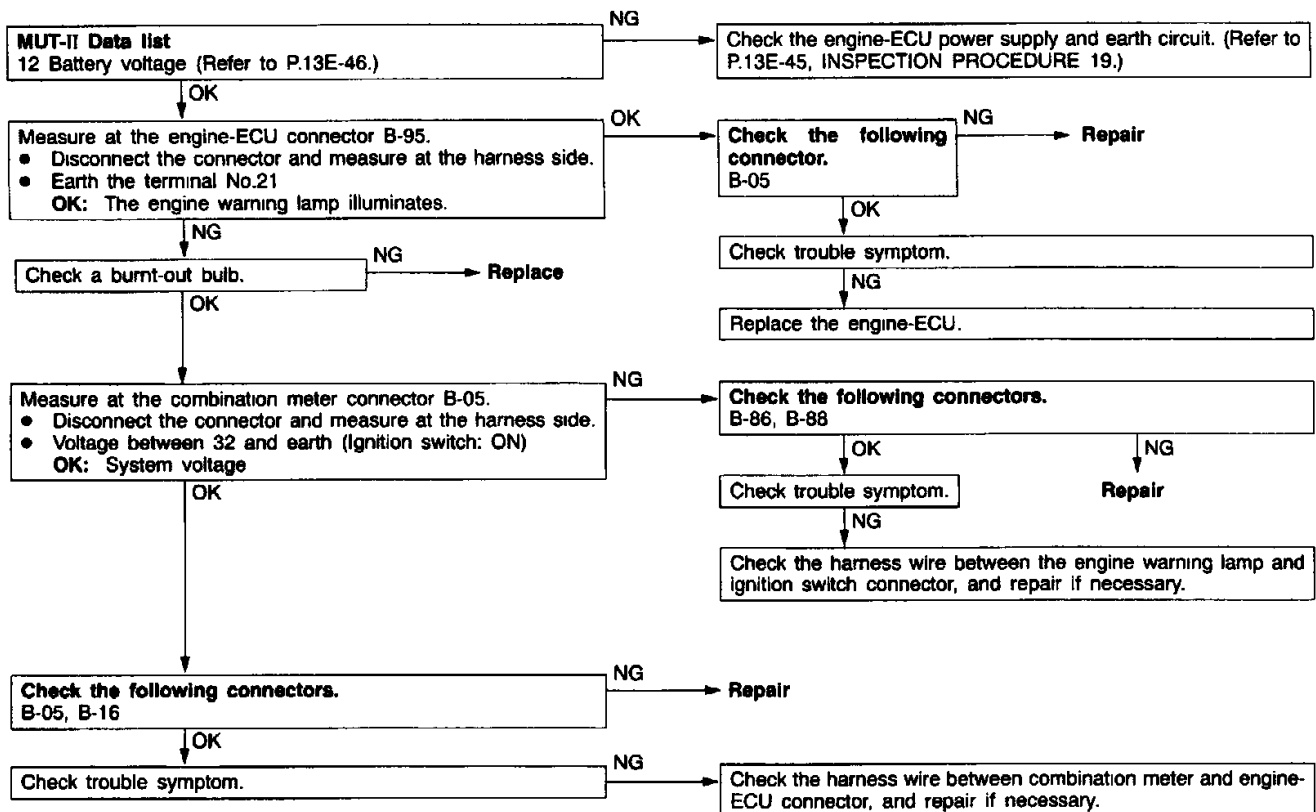


INSPECTION PROCEDURE 3

The engine warning lamp does not illuminate right after the ignition switch is turned to the ON position
Probable cause

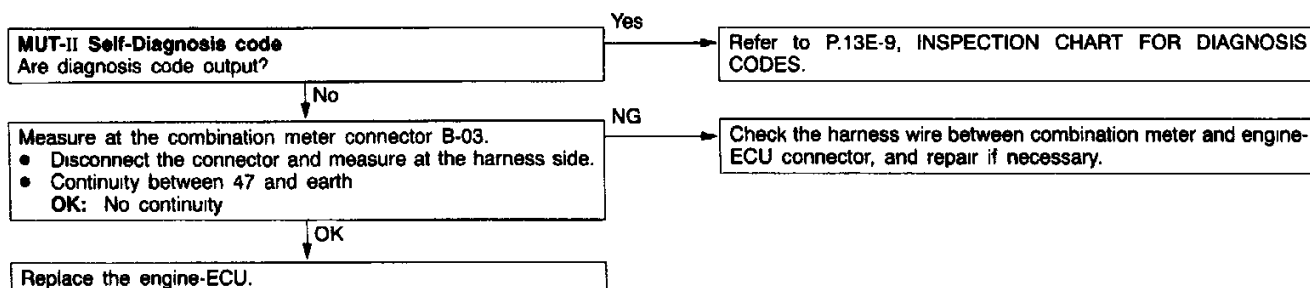
Because there is a burnt-out bulb, the engine-ECU causes the engine warning lamp to illuminate immediately after the ignition switch is turned to ON. If the engine warning lamp does not illuminate immediately after the ignition switch is turned to ON, one of the malfunctions listed at right has probably occurred.

- Burnt-out bulb
- Defective warning lamp circuit
- Malfunction of the engine-ECU



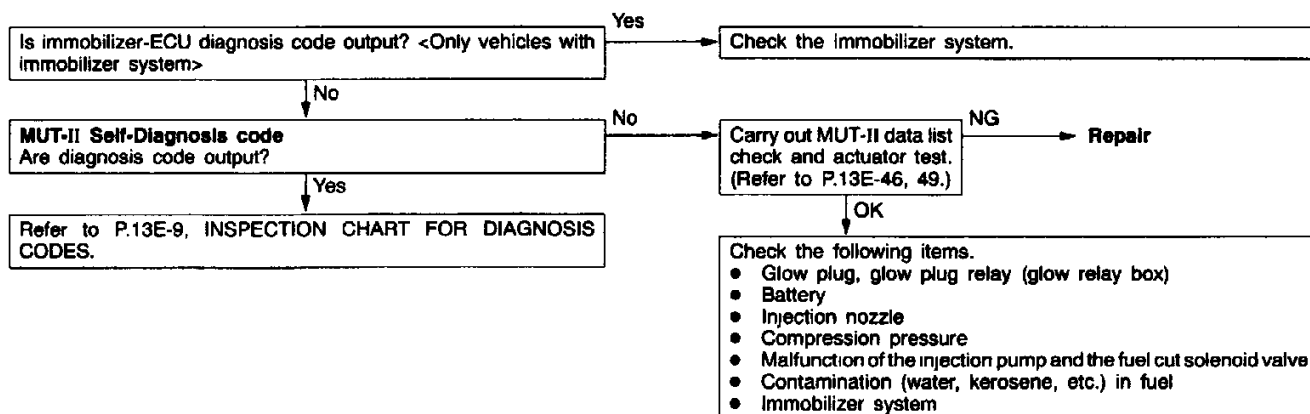
INSPECTION PROCEDURE 4

The engine warning lamp remains illuminating and never goes out	Probable cause
In cases such as the above, the cause is probably that the engine-ECU is detecting a problem in a sensor or actuator, or that one of the malfunctions listed at right has occurred.	• Short-circuit between the engine warning lamp and engine-ECU • Malfunction of the engine-ECU



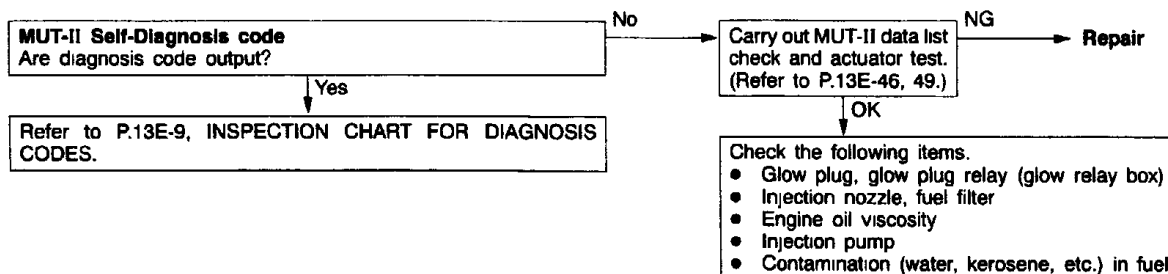
INSPECTION PROCEDURE 5

No initial combustion (Starting not possible)	Probable cause
The cause is probably a malfunction of the control system, injection pump, glow system or power supply.	• Malfunction of the control system • Malfunction of the injection pump • Malfunction of the glow system • Malfunction of the immobilizer system • Malfunction of the engine-ECU



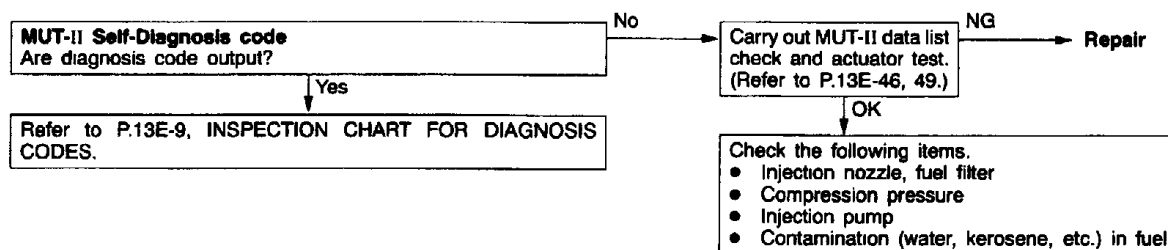
INSPECTION PROCEDURE 6

Poor startability when engine is cold (Poor starting)	Probable cause
The cause is probably a malfunction of the control system, injection pump, fuel system or glow system.	• Malfunction of the control system • Malfunction of the injection pump • Malfunction of the fuel system • Malfunction of the glow system • Malfunction of the engine-ECU



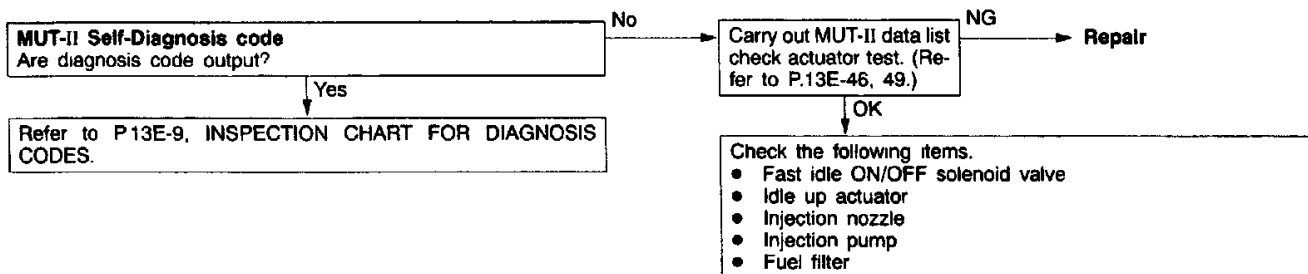
INSPECTION PROCEDURE 7

Poor startability when engine is both cold and warm (Poor starting)	Probable cause
The cause is probably a malfunction of the control system, injection pump or fuel system.	• Malfunction of the control system • Malfunction of the injection pump • Malfunction of the fuel system • Malfunction of the engine-ECU



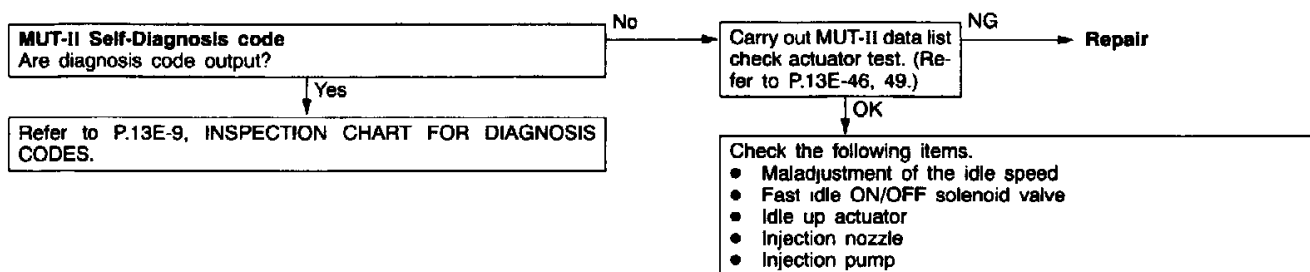
INSPECTION PROCEDURE 8

Idle speed is low when engine is cold (Improper idling speed)	Probable cause
The cause is probably a malfunction of the fast idle system, control system, injection pump or fuel system.	• Malfunction of the fast idle system • Malfunction of the control system • Malfunction of the injection pump • Malfunction of the fuel system • Malfunction of the engine-ECU



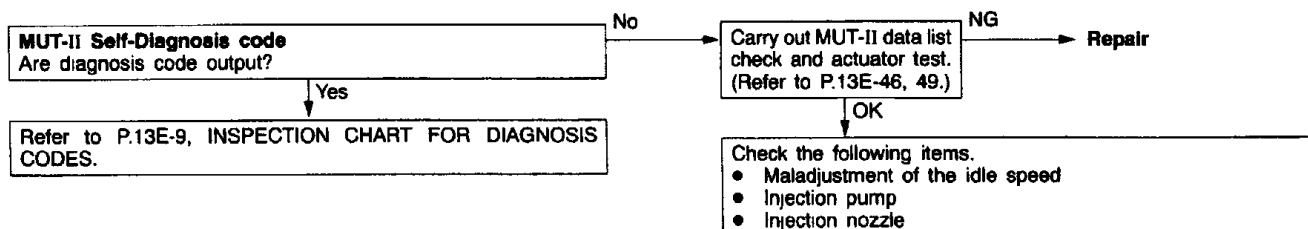
INSPECTION PROCEDURE 9

Idle speed is high (Improper idling speed)	Probable cause
The cause is probably a malfunction of the control system, injection nozzle, injection pump or fast idle system.	• Malfunction of the control system • Malfunction of the injection nozzle • Malfunction of the injection pump • Malfunction of the fast idle system • Malfunction of the engine-ECU



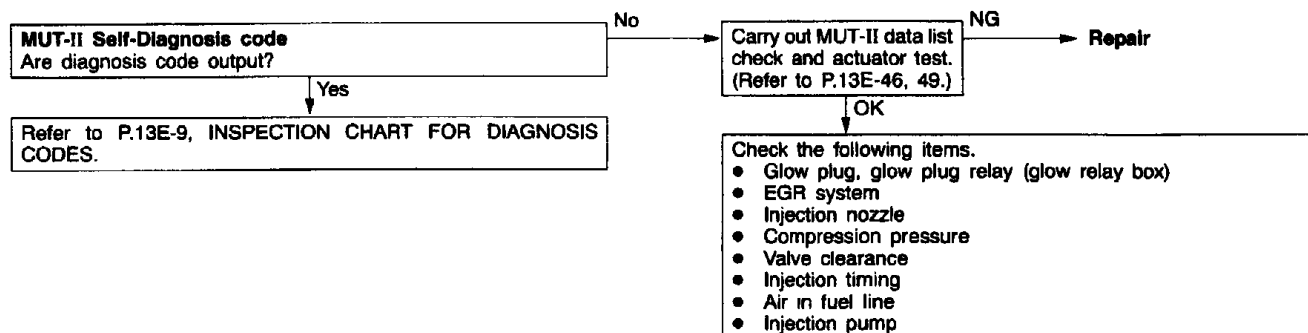
INSPECTION PROCEDURE 10

Idle speed is low (Improper idling speed)	Probable cause
The cause is probably a malfunction of the control system, injection pump or fuel system.	• Malfunction of the control system • Malfunction of the injection pump • Malfunction of the fuel system • Malfunction of the engine-ECU



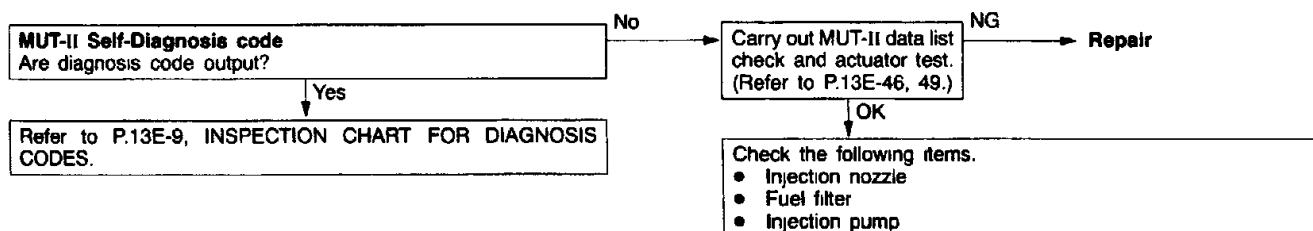
INSPECTION PROCEDURE 11

Idle speed is unstable (Rough idling, hunting)	Probable cause
The cause is probably a malfunction of the control system, injection pump, fuel system or glow system.	• Malfunction of the control system • Malfunction of the injection pump • Malfunction of the fuel system • Malfunction of the glow system • Malfunction of the EGR system • Malfunction of the engine-ECU



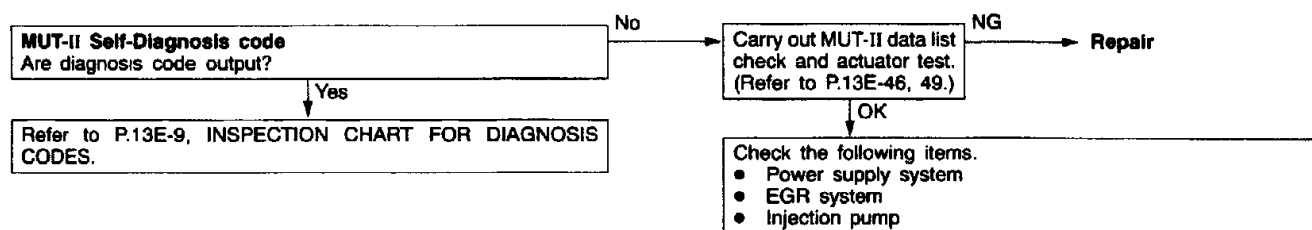
INSPECTION PROCEDURE 12

Engine stops soon after starting	Probable cause
The cause is probably a malfunction of the control system, injection pump or fuel system.	● Malfunction of the control system ● Malfunction of the injection pump ● Malfunction of the fuel system ● Malfunction of the engine-ECU



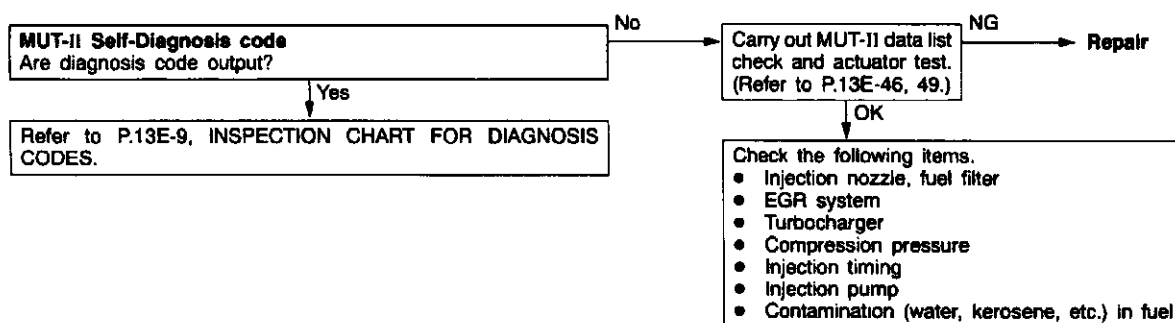
INSPECTION PROCEDURE 13

Engine stops during idling	Probable cause
The cause is probably a malfunction of the control system, injection pump or power supply system.	● Malfunction of the control system ● Malfunction of the injection pump ● Malfunction of the EGR system ● Malfunction of the engine-ECU



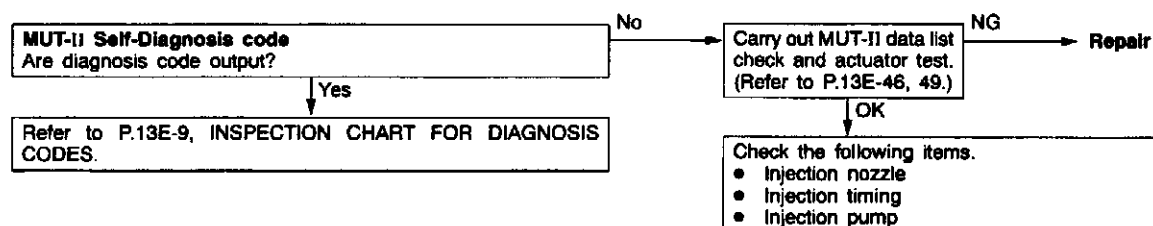
INSPECTION PROCEDURE 14

Engine output is too low	Probable cause
The cause is probably a malfunction of the control system, injection pump, fuel system or EGR system.	• Malfunction of the control system • Malfunction of the injection pump • Malfunction of the fuel system • Malfunction of the EGR system • Malfunction of the engine-ECU



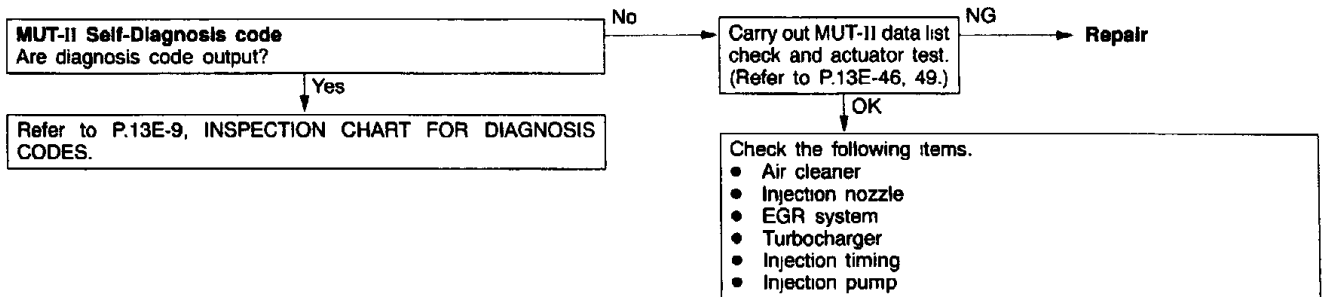
INSPECTION PROCEDURE 15

Abnormal engine knocking occurs	Probable cause
The cause is probably a malfunction of the control system, injection pump or fuel system.	• Malfunction of the control system • Malfunction of the injection pump • Malfunction of the fuel system • Malfunction of the engine-ECU



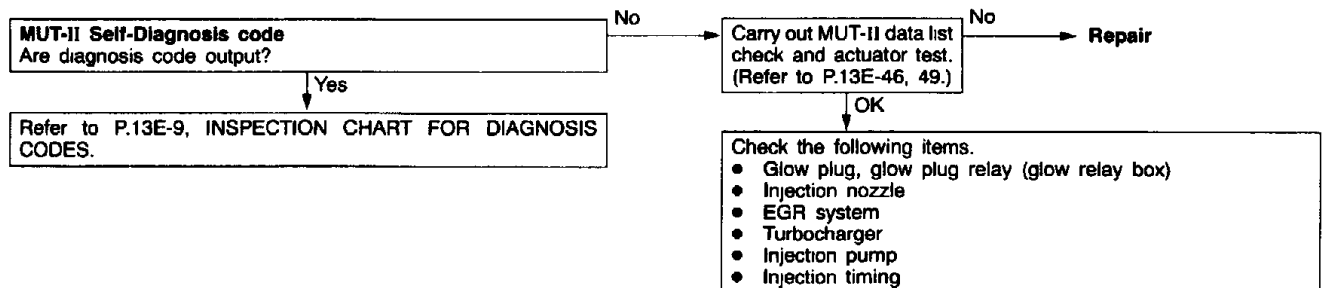
INSPECTION PROCEDURE 16

Abnormally black smoke	Probable cause
The cause is probably a malfunction of the control system, injection pump, fuel system or EGR system.	• Malfunction of the control system • Malfunction of the injection pump • Malfunction of the fuel system • Malfunction of the EGR system • Malfunction of the engine-ECU



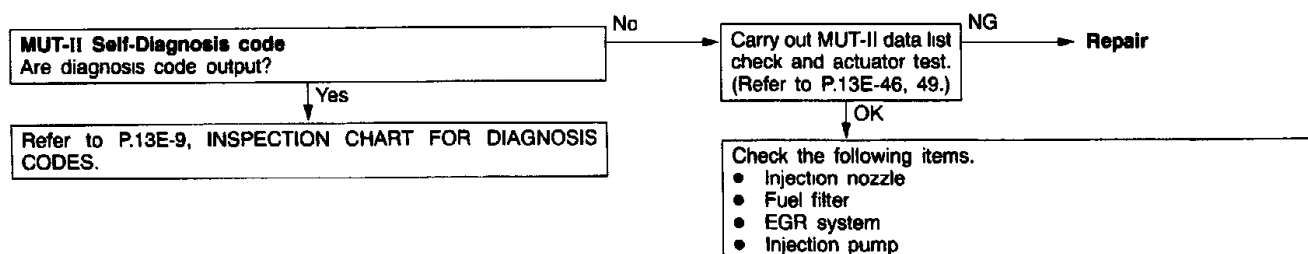
INSPECTION PROCEDURE 17

Abnormally white smoke	Probable cause
The cause is probably a malfunction of the control system, injection pump, fuel system, EGR system or glow system.	• Malfunction of the control system • Malfunction of the injection pump • Malfunction of the fuel system • Malfunction of the EGR system • Malfunction of the glow system • Malfunction of the engine-ECU



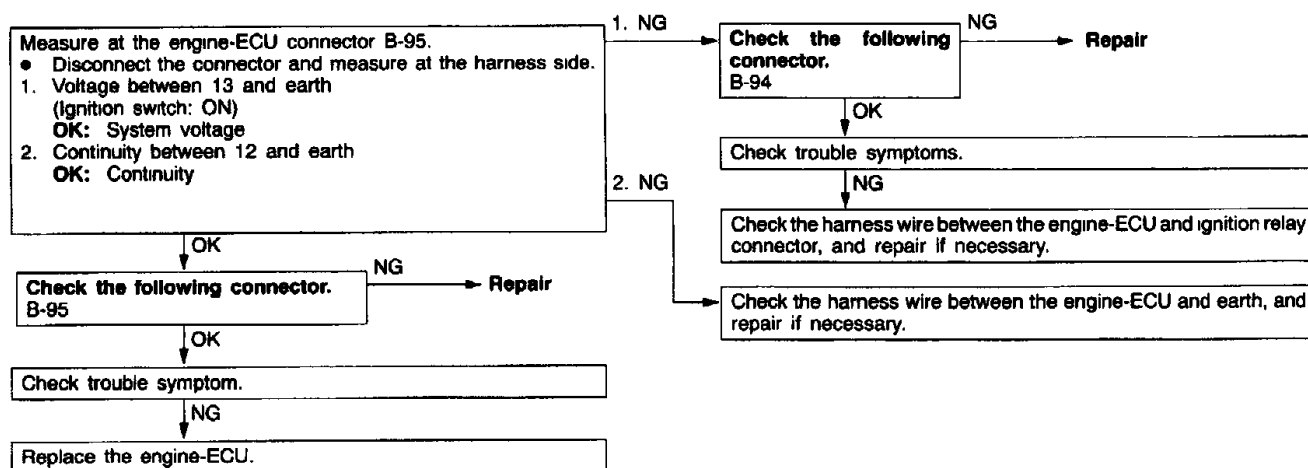
INSPECTION PROCEDURE 18

Hunting occurs while driving	Probable cause
The cause is probably a malfunction of the control system, injection pump or fuel system.	• Malfunction of the control system • Malfunction of the injection pump • Malfunction of the fuel system • Malfunction of the engine-ECU



INSPECTION PROCEDURE 19

Check the engine-ECU power supply and earth circuit



DATA LIST REFERENCE TABLE

Caution

Driving tests always need another personnel.

Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.	Reference page
10	Engine coolant temperature sensor	Ignition switch: ON or with engine running	Engine coolant temperature is -20°C	-20°C	Code No.11, 31	13E-10, 24
			Engine coolant temperature is 0°C	0°C		
			Engine coolant temperature is 20°C	20°C		
			Engine coolant temperature is 40°C	40°C		
			Engine coolant temperature is 80°C	80°C		
11	Intake air temperature sensor	Ignition switch: ON or with engine running	Intake air temperature is -20°C	-20°C	Code No.14, 34	13E-12, 26
			Intake air temperature is 0°C	0°C		
			Intake air temperature is 20°C	20°C		
			Intake air temperature is 40°C	40°C		
			Intake air temperature is 80°C	80°C		
12	Battery voltage	Ignition switch: ON		11 – 13	Code No.15, 35	13E-13, 26
		Engine: 2500 r/min		13 – 15		

Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.	Reference page
13	Barometric pressure sensor	Ignition switch: ON	At altitude of 0 m	101 kPa	Code No.13, 33	13E-11, 25
			At altitude of 600 m	95 kPa		
			At altitude of 1200 m	88 kPa		
			At altitude of 1800 m	81 kPa		
14	Lever position sensor	Ignition switch: ON	Set to idle position	10 – 30%	Code No.12, 32	13E-11, 25
			Gradually open	Increases in proportion to lever opening angle		
			Open fully	70 – 90%		
15	Crank angle sensor (Engine speed sensor)	- Engine: Cranking - Tachometer: Connected		Engine speeds displayed on the MUT-II and tachometer are identical.	Code No.16	13E-14
		Engine: Idle	Fast idle ON/OFF solenoid valve: OFF	800 – 850 r/min		
			Fast idle ON/OFF solenoid valve: ON	850 – 950 r/min		
16	EGR ratio	- Engine: Warm, idle - Altitude: 500 m or less - Intake air temperature: 10°C or less		40 – 60% (immediately after engine is started)	–	–
17	Vehicle speed sensor	Drive at 40 km/h		Approx. 40 km/h	Code No.18, 38	13E-16, 27

STATUS TEST REFERENCE TABLE

Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.	Reference page
18	A/C switch	Engine: Idle (When A/C switch is ON, A/C compressor should be operating)	A/C switch: OFF	OFF	-	-
			A/C switch: ON	ON		
19	EGR solenoid valve	- Engine coolant temperature: 60°C or more - Engine: Idle	For approx. 3 seconds immediately after engine is started	INACTIVE	-	-
			From approx. 3 seconds or more after engine is started	ACTIVE		
20	Timing control solenoid valve	Ignition switch: ON (Engine does not start)		ACTIVE	-	-
21	Tachometer	Ignition switch: ON (Engine does not start)		ACTIVE	-	-
22	Glow indicator (preheating) lamp ^{*1}	Engine: Stopped	From 2 - 20 seconds after ignition switch is turned to ON	OFF	-	-
23	Glow plug relay 1 ^{*1}	- Engine coolant temperature: 60°C or less - Engine: Stopped	For 10 - 28 seconds immediately after ignition switch is turned to ON	ACTIVE	-	-
			For 10 - 28 seconds after ignition switch is turned to ON	INACTIVE		
24	Engine warning lamp	- Ignition switch: ON - Engine: Stopped		ON	-	-
		Engine: Started		OFF		
25	A/C relay	Engine: Warm, idle		ACTIVE	-	-
		Rapid racing		INACTIVE		

NOTE

^{*1}: It depends on engine coolant temperature and altitude at engine starting how long the glow indicator lamp is illuminated.

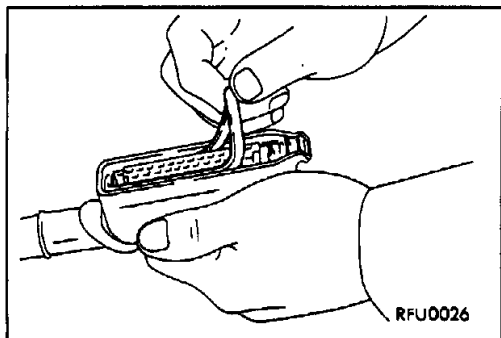
Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.	Reference page
26	Fast idle ON/OFF solenoid valve	Engine coolant temperature: 15°C or less	Engine: Idle	ACTIVE	-	-
			Engine: 1000 r/min	INACTIVE		
27	Glow plug relay 2 ^{*1}	Engine coolant temperature: 60°C or less	For 10 – 28 seconds immediately after ignition switch is turned to ON	ACTIVE	-	-
		Engine: Stopped	From 10 – 28 seconds after ignition switch is turned to ON	INACTIVE		

NOTE

*1: It depends of engine coolant temperature and altitude at engine starting how long the glow indicator lamp is illuminated.

ACTUATOR TEST REFERENCE TABLE

Item No.	Inspection item	Drive contents	Inspection contents	Normal condition	Inspection procedure No.	Reference page
01	Glow plug relay 1	Glow plug relay 1 turns from OFF to ON.	Ignition switch: ON (except during pre-glow)	Operating sound can be heard	Code No.24, 44	13E-20, 29
02	Glow plug relay 2	Glow plug relay 2 turns from OFF to ON.	Ignition switch: ON (except during pre-glow)	Operating sound can be heard	Code No.25, 45	13E-21, 29
03	Fast idle ON/OFF solenoid valve	Solenoid valve turns from OFF to ON.	Ignition switch: ON	Clicks when solenoid valve is driven.	Code No.26, 46	13E-22, 30
04	Glow indicator lamp	Causes glow indicator lamp to illuminate.	Ignition switch: ON	Glow indicator lamp illuminates.	Code No.23, 43	13E-19, 28
05	Engine warning lamp	Causes engine warning lamp to illuminate.	Ignition switch: ON	Engine warning lamp extinguish provisionally.	Code No.28, 48	13E-23, 31



CHECK AT THE ENGINE-ECU TERMINALS

TERMINAL VOLTAGE CHECK CHART

1. Disconnect the connector from the engine-ECU.
2. Remove the cover mounting screw from the connector.
3. Remove the packing from the connector.
4. With the cover removed from the connector, connect the connector to the engine-ECU.
5. Connect a needle-nosed wire probe (paper clip) to a voltmeter probe.
6. Insert the needle-nosed wire probe into each of the engine-ECU connector terminals from the wire side, and measure the voltage while referring to the check chart.

NOTE

1. Measure voltage with the engine-ECU connectors connected.
2. Pull out the engine-ECU, and it is easier to reach the connector terminals.
3. Checks don't have to be carried out in the order given in the chart.

Caution

Short-circuiting the positive (+) probe between a connector terminal and ground could damage any one of the vehicle wiring, the sensor, engine-ECU, or all three. Be careful not to damage these.

7. If voltmeter shows any division from standard value, check the corresponding sensor, actuator and related electrical wiring, then repair or replace.
8. After repair or replacement, recheck with the voltmeter to confirm that the problem has been corrected.
9. Disconnect the connector from the engine-ECU.
10. Install the packing and the cover to the connector, and then re-connect the connector to the engine-ECU.

Engine-ECU Connector Terminal Arrangement

1	2	3	4	5	6	7	8	9	10	11	12	13
14	15	16	17	18	19	20	21	22	23	24	25	

RFU0003

Caution

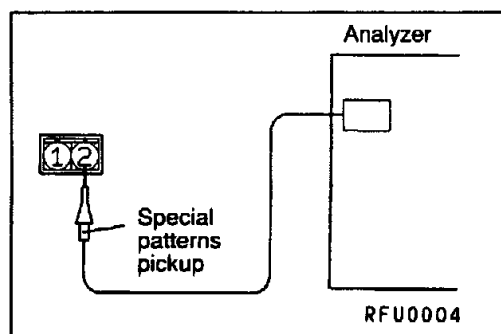
Do not measure the terminal voltages of the needle lift sensor and crank angle sensor, as this may cause damage to the engine-ECU.

NOTE

*1: Varies depending on the engine coolant temperature and altitude when the engine is started.

Terminal No.	Check item	Check condition (Engine condition)		Normal condition
2	Vehicle speed sensor	- Ignition switch: ON - Move the vehicle slowly forward		0 ↔ Approx.12 V (Changes repeatedly)
3	A/C switch	Engine: Idle speed	Turn the A/C switch: OFF	0 – 3 V
			Turn the A/C switch: ON (A/C compressor is operating)	System voltage
5	Glow indicator lamp	- Engine coolant temperature: 60°C or less - Ignition switch: OFF → ON		0 – 3 V → System voltage (after 2 – 20 seconds have passed)*1
8	Timing control solenoid valve	Ignition switch: ON		System voltage
		Engine: Idle speed		8 – 12
9	EGR solenoid valve	Ignition switch: ON		System voltage
		Engine: Started, idle speed		From system voltage, drops after approx.3 seconds have passed
10	Lever position sensor power supply	Ignition switch: ON		4.5 – 5.5 V
13	Power supply	Ignition switch: ON		System voltage
14	Engine coolant temperature sensor	Ignition switch: ON	Engine coolant temperature: 20°C or less	3.6 – 4.2 V
			Engine coolant temperature: 80°C or less	0.9 – 1.5 V
15	Intake air temperature sensor	Ignition switch: ON	Intake air temperature: 20°C	3.6 – 4.2 V
			Intake air temperature: 80°C	0.9 – 1.5 V

Terminal No.	Check item	Check condition (Engine condition)		Normal condition
16	Lever position sensor	Ignition switch: ON	Set to idle position	0.5 - 1.5 V
			Open fully	4.5 - 5.5 V
19	Glow plug relay 2	- Engine coolant temperature: 60°C or less - Ignition switch: OFF → ON		0 - 3 V → System voltage (after approx. 8 seconds or more have passed the glow lamp switched off)
20	A/C relay	- Engine: Idle speed - A/C switch: OFF → ON		Momentarily 6 V or more → 0 - 3 V
21	Engine warning lamp	Ignition switch: ON → ST		0 - 3 V → System voltage (After engine has started)
23	Fast idle ON/OFF solenoid valve	Engine coolant temperature: 15°C or less	Engine: Idle	0 - 3 V
			Engine: 1000 r/min	System voltage
25	Glow plug relay 1	- Engine coolant temperature: 60°C or less - Ignition switch: OFF → ON		0 - 3 V → System voltage (after approx. 8 seconds or more have passed the glow lamp switched off)



INSPECTION PROCEDURE USING AN ANALYZER

CRANK ANGLE SENSOR

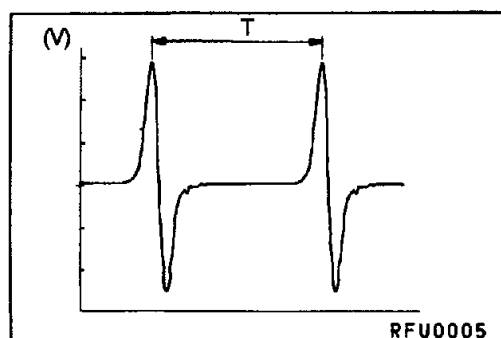
Measurement Method

1. Disconnect the crank angle sensor connector, and connect the special tool (test harness: MB991348) in between. (All terminals should be connected.)
2. Connect the analyzer special patterns pickup to crank angle sensor connector 2.

Standard Wave Pattern

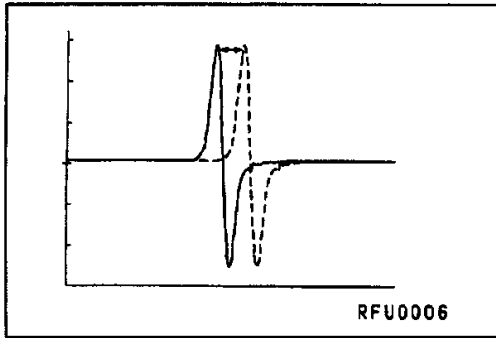
Observation conditions

Function	Special patterns
Pattern height	Variable
Variable knob	Adjust while viewing the wave pattern
Pattern selector	Display
Engine r/min	Idle speed



Wave Pattern Observation Points

Check to be sure that cycle time T becomes shorter when the engine speed increased.



Examples of Abnormal Wave Patterns

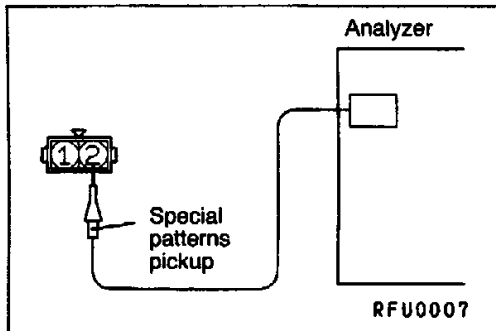
- **Example**

Cause of problem

Loose timing belt

Wave pattern characteristics

Wave pattern is displaced to the left or right.



NEEDLE LIFT SENSOR

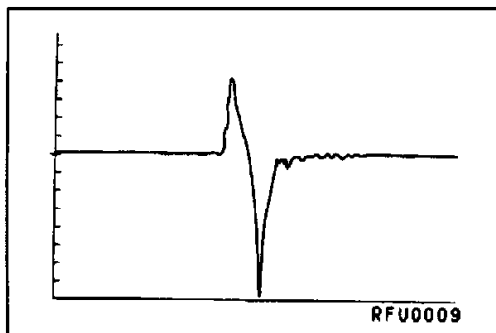
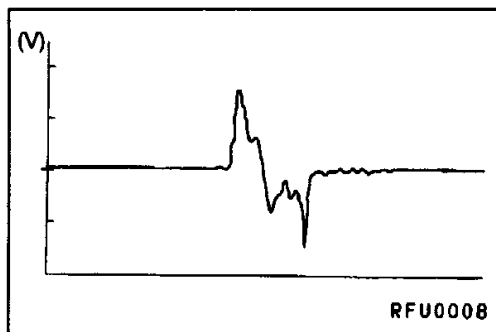
Measurement Method

1. Disconnect the needle lift sensor connector, and connect the special tool (test harness: MB991348) in between. (All terminals should be connected.)
2. Connect the analyzer special patterns pickup to needle lift sensor connector 2.

Standard Wave Pattern

Observation conditions

Function	Special patterns
Pattern height	Variable
Variable knob	Adjust while viewing the wave pattern
Pattern selector	Display
Engine r/min	Idle speed



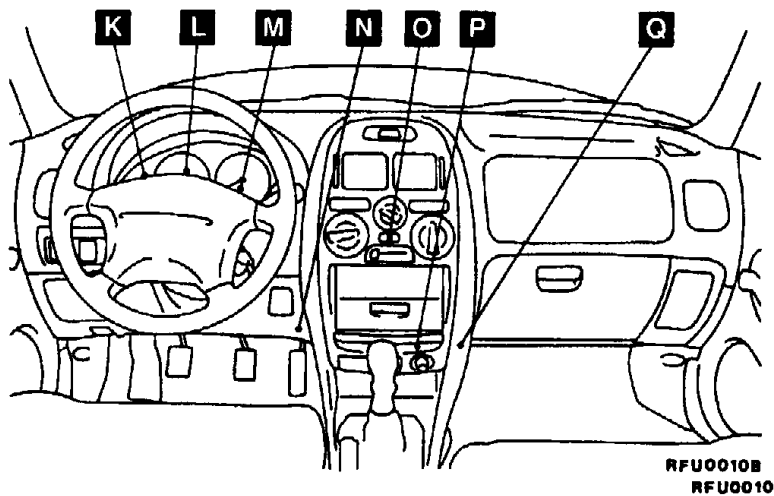
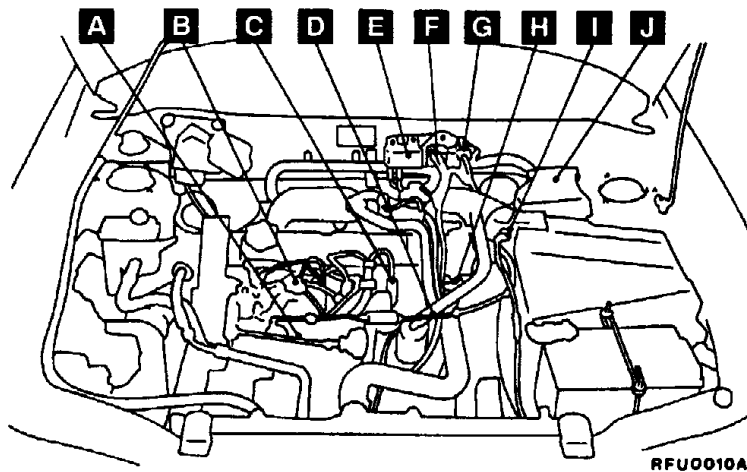
Wave Pattern Observation Points

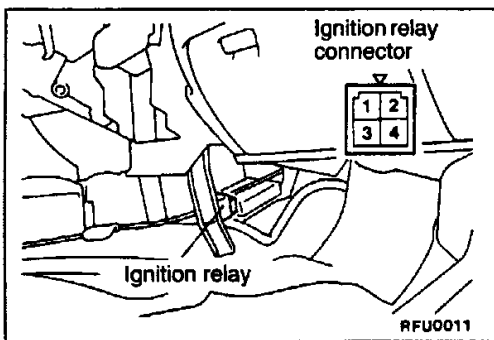
Point: Injector nozzle drive time

- When the engine is raced until 2500 r/min, the wave pattern is displayed as shown in the illustration. (The voltage width is extended and the pulse time is reduced.)

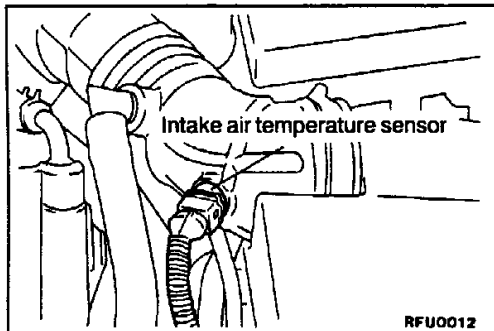
ON-VEHICLE SERVICE**COMPONENT LOCATION**

Name	Symbol	Name	Symbol
A/C relay	J	Glow relay box	E
A/C switch	O	Fast idle ON/OFF solenoid valve	G
Crank angle sensor (Engine speed sensor)	D	Ignition relay	Q
Diagnosis connector	N	Intake air temperature sensor	I
EGR solenoid valve	F	Lever position sensor	B
Engine coolant temperature sensor	H	Needle lift sensor	C
Engine-ECU	P	Timing control solenoid valve	A
Engine warning lamp (check engine lamp)	M	Vehicle speed sensor	L
Glow indicator lamp	K		



**IGNITION RELAY CONTINUITY CHECK**

Battery voltage	Terminal No.			
	1	2	3	4
Not supplied		○	○	○
Supplied	○	⊖	○	⊕

**INTAKE AIR TEMPERATURE SENSOR CHECK**

1. Disconnect the intake air temperature sensor connector.
2. Measure resistance between terminals.

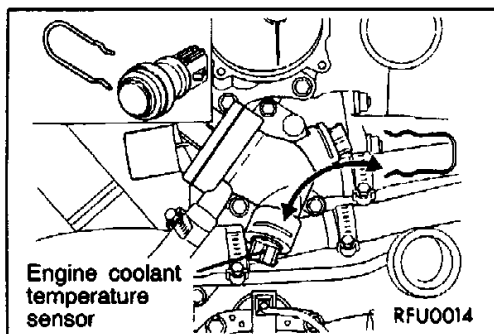
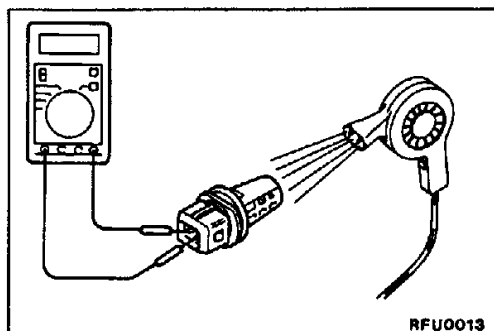
Standard value:3.3 - 3.8 k Ω (at 20°C)0.32 - 0.35 k Ω (at 80°C)

3. Remove intake air temperature sensor.
4. Measure resistance while heating the sensor using a hair drier.

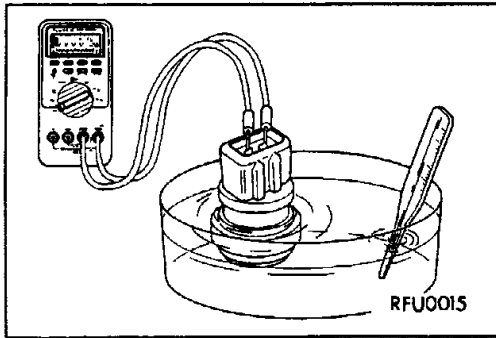
Normal condition:

Temperature (°C)	Resistance (k Ω)
Higher	Smaller

5. If the value deviates from the standard value or the resistance remains unchanged, replace the intake air temperature sensor.

**ENGINE COOLANT TEMPERATURE SENSOR CHECK**

1. Disconnect the engine coolant temperature sensor connector.
2. Remove engine coolant temperature sensor.



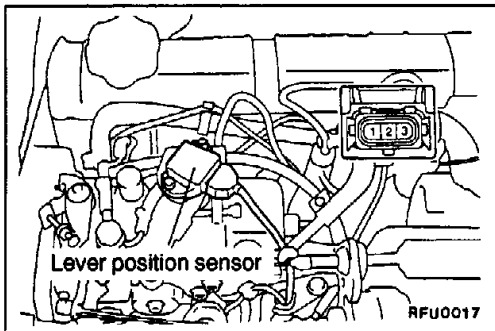
3. With temperature sensing portion of engine coolant temperature sensor immersed in hot water, check resistance.

Standard value:

3.3 – 3.8 k Ω (at 20°C)

0.32 – 0.35 k Ω (at 80°C)

4. If the resistance deviates from the standard value greatly, replace the sensor.
5. Install the new O-ring to the engine coolant temperature sensor.
6. Install engine coolant temperature sensor and fasten harness connector.



LEVER POSITION SENSOR CHECK

1. Disconnect the lever position sensor connector.
2. Measure resistance between terminals 1 and 3.

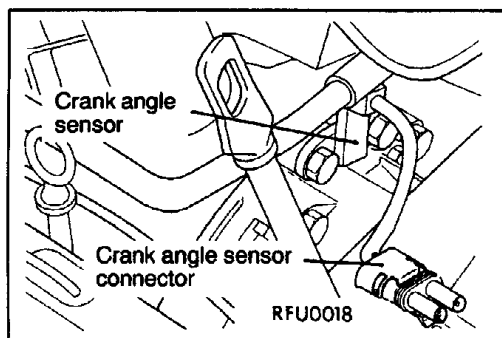
Standard value: 3.3 – 5.0 k Ω

3. Measure resistance between terminals 1 and 2.

Standard value:

Throttle lever	Resistance (k Ω)
Idle position	1.5 – 3.5
Full open	4.1 – 7.1

4. If the resistance is outside the standard value, or if it doesn't change smoothly, replace the injection pump assembly.



CRANK ANGLE SENSOR (ENGINE SPEED SENSOR) CHECK

NOTE

Do not bring the crank angle sensor within 30 cm of any magnetic material.

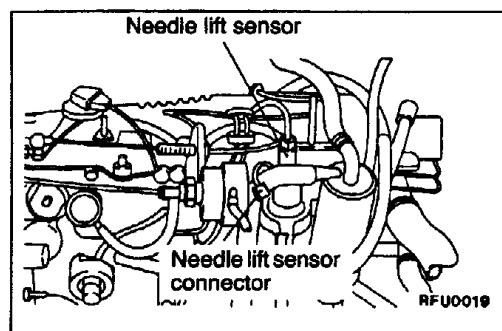
1. Disconnect the crank angle sensor connector.
2. Connect a voltage meter between the crank angle sensor connector terminals.
3. Crank the engine and measure the voltage.

Standard value: 150 mV or more (AC voltage)

4. If the voltage is outside the standard value, check that the crank angle sensor is correctly installed.
5. If no voltage appears, measure the resistance between the terminals.

Standard value: 200 – 270 Ω

6. If the resistance is at the standard value, check the flywheel.
7. If the engine warning lamp illuminates after inspection, use the MUT-II to erase the diagnosis code.

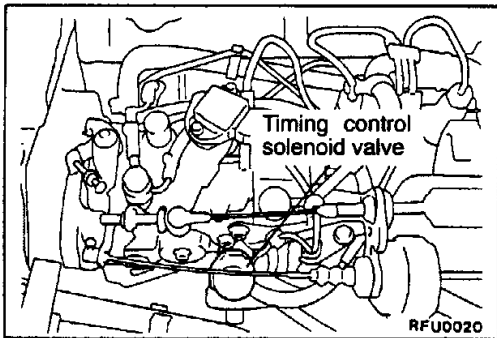


NEEDLE LIFT SENSOR CHECK

1. Disconnect the needle lift sensor connector.
2. Measure resistance between terminals.

Standard value: 95 – 125 Ω

3. If the resistance is outside the standard value, replace the No.1 injection nozzle assembly.

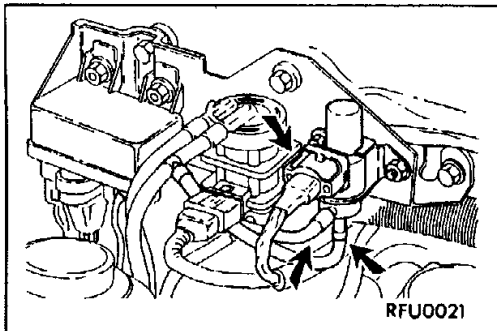


TIMING CONTROL SOLENOID VALVE CHECK

1. Check that the solenoid valve operation sound can be heard when the ignition switch is ON.
2. Disconnect the timing control solenoid valve connector.
3. Measure resistance between terminals.

Standard value: 10.5 - 13.5 Ω

4. If the resistance is outside the standard value, replace the injection pump assembly.

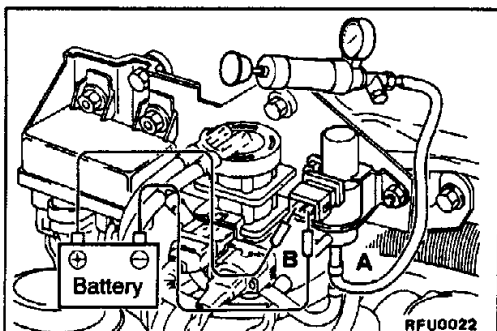


FAST IDLE ON/OFF SOLENOID VALVE CHECK

NOTE

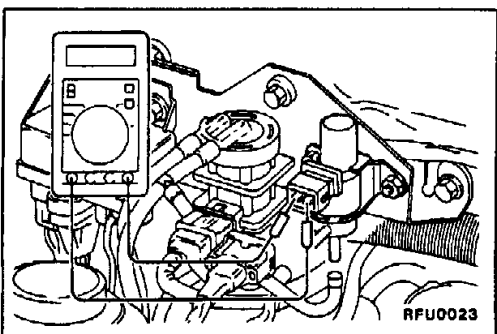
When disconnecting the vacuum hose, always make a mark so that it can be reconnected at original position.

1. Disconnect the vacuum hose from the solenoid valve.
2. Disconnect the harness connector.



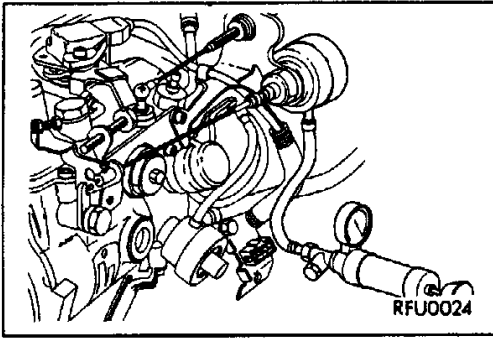
3. Connect a hand vacuum pump to the nipple A.
4. Check air-tightness by applying a vacuum with voltage applied directly from the battery to the solenoid valve and without applying voltage.

Battery voltage	Nipple B condition	Normal condition
Applied	Open	Vacuum leaks
	Closed	Vacuum maintained
Not applied	Closed	Vacuum maintained

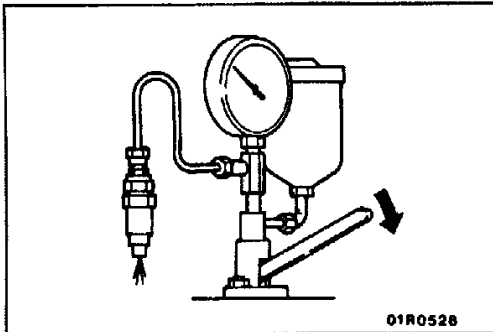


5. Measure the resistance between the terminals of the solenoid valve.

Standard value: 27 - 31 Ω (at 23°C)

**IDLE UP ACTUATOR CHECK**

1. Disconnect the vacuum hose from the idle up actuator.
2. Connect a hand vacuum pump to nipple of idle up actuator.
3. Apply 53 kPa of vacuum, and check that the vacuum is maintained.

**INJECTION NOZZLE CHECK****FUEL INJECTION INITIAL PRESSURE CHECK****Caution**

Never touch the injection spray that is injected from the nozzle.

1. Remove the injection nozzle. (Refer to P.13E-62.)
2. Install the injection nozzle to a nozzle tester.
3. Move the lever of the nozzle tester 2 - 3 times to inject fuel and to bleed the air.
4. Gently press down the lever of the nozzle tester, and take a reading of the indication valve on the pressure gauge at the point where the needle slowly rises and then suddenly drops.

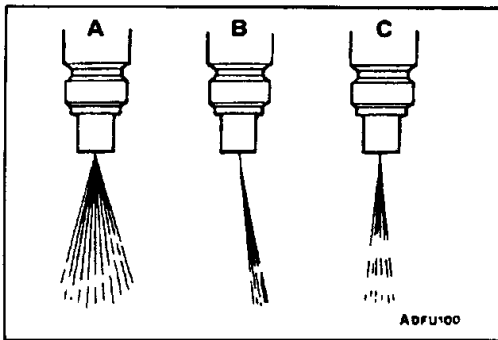
Standard value:

13000 kPa (Fuel Injection Initial pressure)

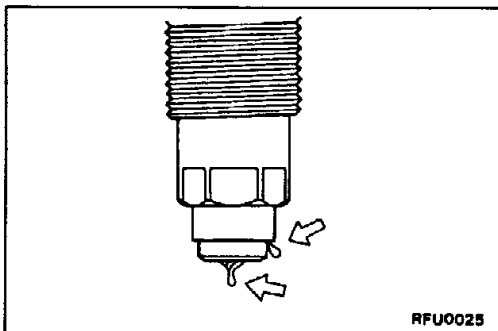
5. If the fuel injection initial pressure is outside the standard value, disassemble the injection nozzle to clean it, and then change the thickness of the shim to adjust the fuel injection initial pressure.

NOTE

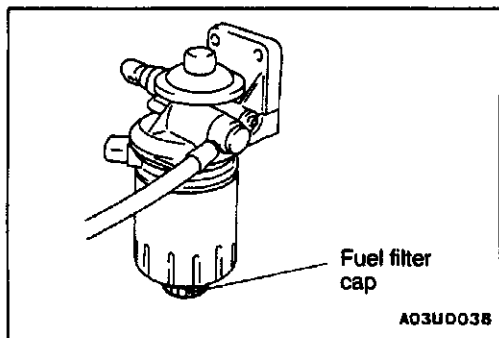
1. For disassembly, reassembly and adjustment of the injection nozzle, refer to the Engine Workshop Manual.
2. The adjustment shim thicknesses vary from 1.00 mm to 1.95 mm in steps of 0.05 mm.
3. When the shim thickness is increased by 0.05 mm, the fuel injection initial pressure increases by 500 kPa.

**INJECTION SPRAY CONDITION CHECK**

1. Move the lever of the nozzle tester rapidly (4 – 6 times per second) to eject the fuel continuously. Check to be sure that the injection spray comes out evenly in a straight, thin line (angle of spray is zero). The injection spray patterns shown in the illustration at left are wrong.
 - A. Injection angle is too large
 - B. Bias
 - C. Intermittent fuel injection
2. Check to be sure that no fuel drips after injection is completed.
3. If there are any drips, disassemble the injection nozzle, clean it and reinspect, or replace the injection nozzle.

**NOZZLE FUEL-TIGHT CHECK**

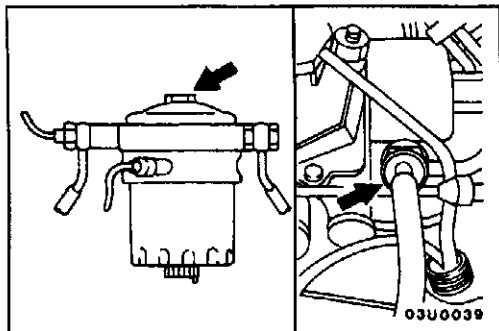
1. Gently raise the lever of the nozzle tester until the pressure inside the injection nozzle (value displayed on pressure gauge) becomes 11,000 kPa, and after holding this pressure for approximately 10 seconds, check to be sure that there are no fuel leaks from the injection nozzle.
2. If there are any leaks, disassemble the injection nozzle, clean it and re-inspect, or replace the injection nozzle.



EVACUATION OF WATER FROM FUEL FILTER

Evacuate water by the following procedures.

1. Remove the air cleaner assembly.
2. Remove the fuel filter cap.
3. Use a manual pump to remove any water, and then attach the fuel filter cap.



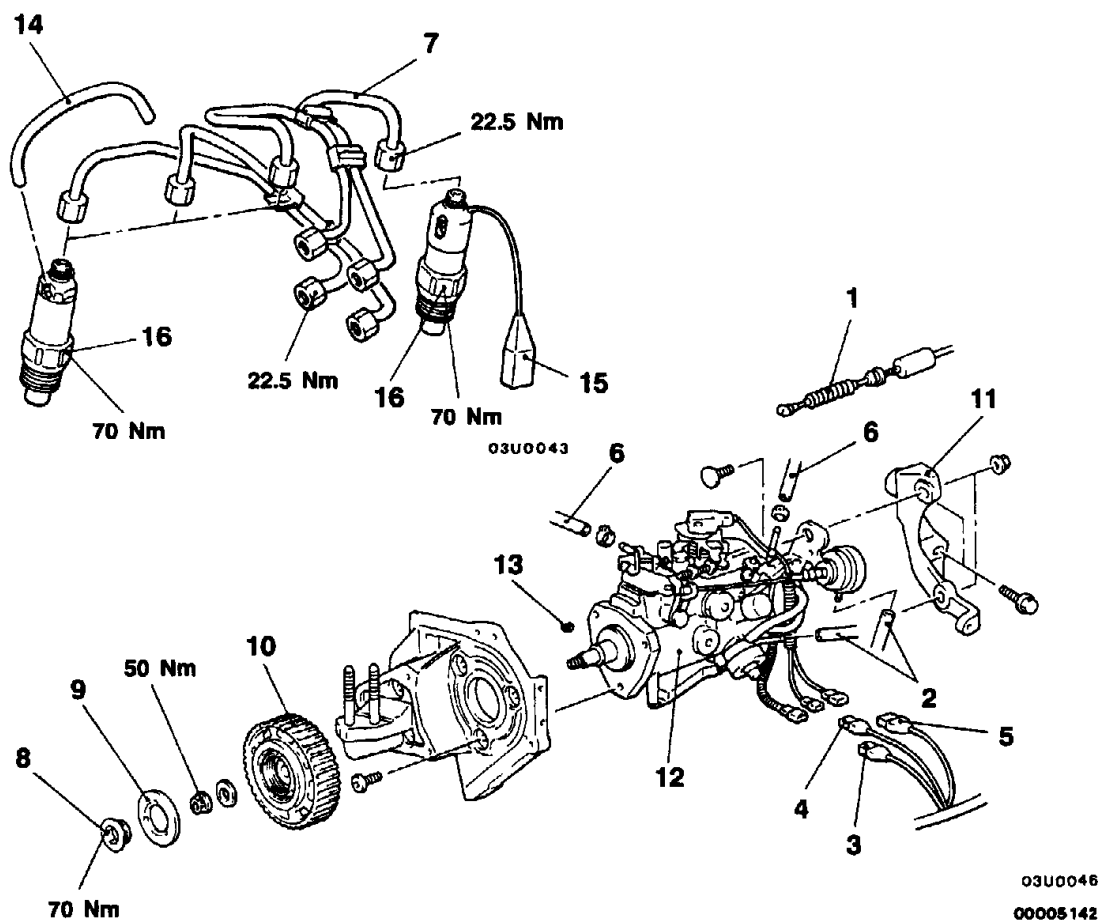
EVACUATION OF AIR FROM FUEL LINE

Bleed the air from the fuel line after refilling the fuel:

- When fuel is drained for service.
 - When fuel filter is replaced.
 - When main fuel line is removed.
1. Connect a long piece of tubing to the bleedscrew of the fuel injection pump with its open end in a drip tray.
 2. Open the bleedscrew and operate the pump on the fuel filter until clear fuel flows out of the bleedscrew.
 3. Close the bleedscrew and remove the tubing.
 4. Turn the ignition switch to the "ON" position.
 5. Now pump a few more times until resistance is felt; then pump five more strokes to pressurize the system.
 6. Start the engine and check for leakage.

INJECTION PUMP AND NOZZLE

REMOVAL AND INSTALLATION

**Fuel injection pump removal steps**

- Injection timing adjustment (Refer to GROUP 11B - On-vehicle Service.)
- Timing belt (Refer to GROUP 11B.)
- Throttle cable adjustment (Refer to GROUP 13F - Accelerator Cable and Pedal.)

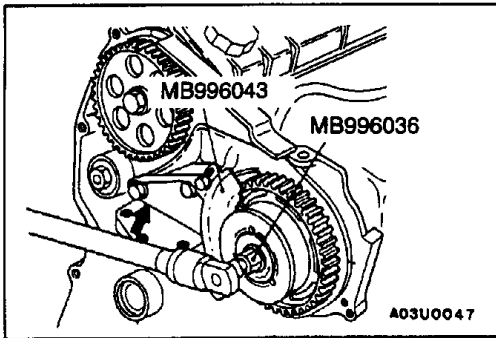
1. Throttle cable connection
2. Vacuum hoses connection
3. Load lever sensor connector
4. Proportional solenoid connector
5. Immobilizer connector
6. Fuel hoses connection
7. Fuel injection pipe

- ◀A▶ ▶A▶ 8. Screwed sleeve and nut assembly
- ◀A▶ ▶A▶ 9. Flange
- ◀A▶ ▶A▶ 10. Fuel injection pump sprocket

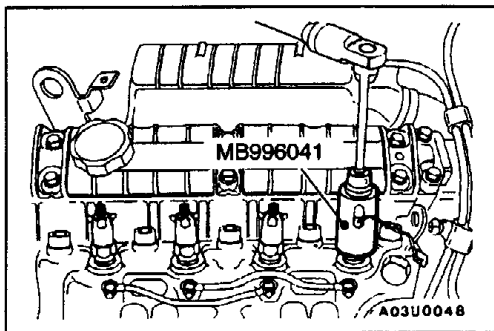
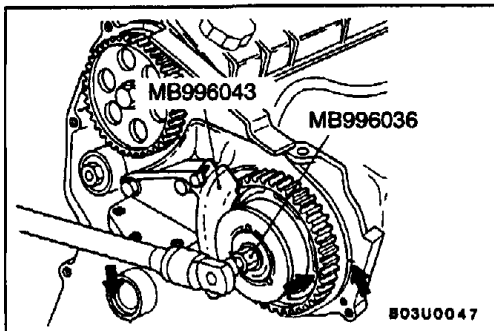
11. Rear pump support
12. Fuel injection pump
13. Key

Fuel injection nozzle removal steps

7. Fuel injection pipe
14. Fuel return hose
15. Needle lift sensor connector (No.1 only)
16. Fuel injection nozzle

**REMOVAL SERVICE POINT****◀A▶ SCREWED SLEEVE AND NUT ASSEMBLY/FUEL INJECTION PUMP SPROCKET REMOVAL**

1. Locate the special tool between the pump bracket and the sprocket. Fasten the tool with the bolts supplied with the set.
2. Remove the screwed sleeve and nut assembly with special tool (release by turning clockwise).
3. Remove the nut.
4. Pull the sprocket off the shaft with a gear puller.

**◀B▶ FUEL INJECTION NOZZLE REMOVAL****INSTALLATION SERVICE POINT****▶A◀ FUEL INJECTION PUMP SPROCKET/SCREWED SLEEVE AND NUT ASSEMBLY INSTALLATION**

1. Align the sprocket with the mark opposite the pump bracket.
2. Locate the special tool between the pump bracket and the sprocket. Fasten the tool with the bolt supplied with the set.
3. Fit and tighten the nut to the specified torque.
4. Locate the flange with the screwed sleeve and nut assembly and tighten to the specified torque with special tool.

GROUP 13F

FUEL SUPPLY

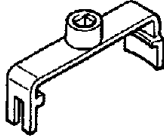
GENERAL

OUTLINE OF CHANGES

- The following service procedures have been added to the addition of the diesel-powered vehicle.
Applicable models: 1900D
 1. Removal and installation of the fuel tank
 2. Removal and installation of the fuel filter

FUEL TANK

SPECIAL TOOL

Tool	Number	Name	Use
	MB996009	Tank cap wrench	Installation of tank cap

FUEL TANK

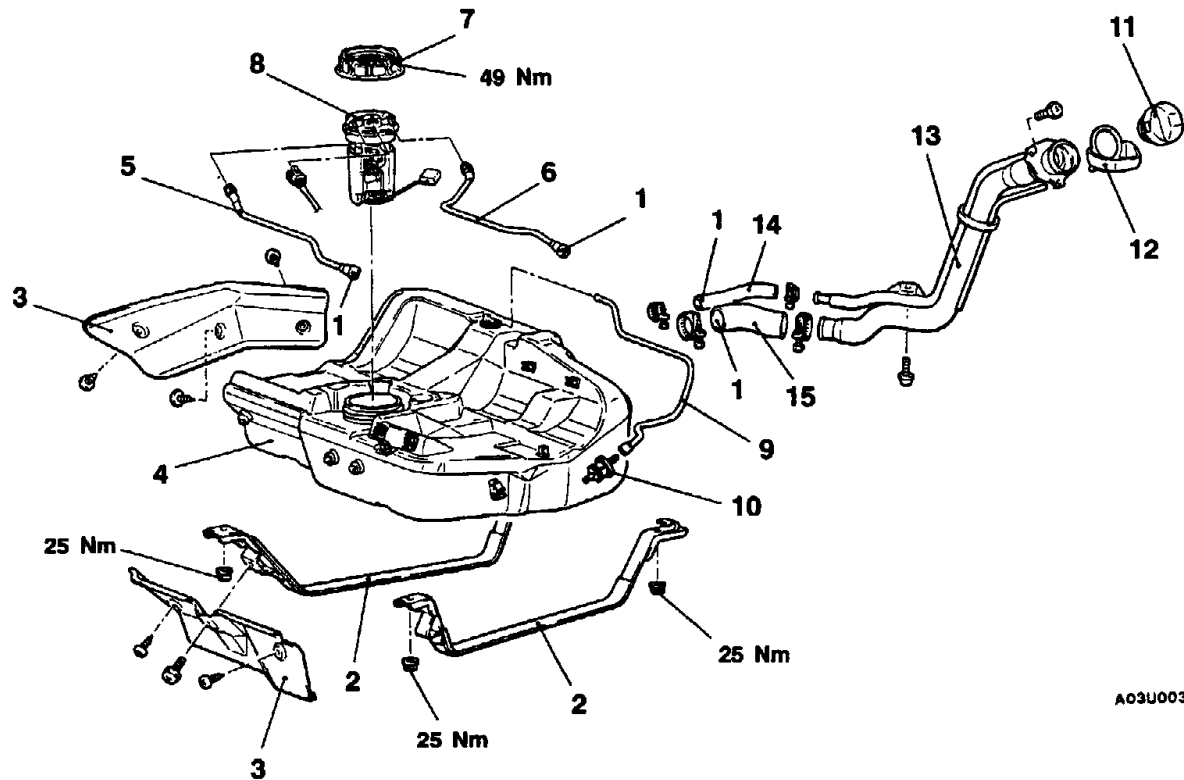
REMOVAL AND INSTALLATION

Pre-removal Operation

- (1) Draining the Fuel
- (2) Removal of the Centre Exhaust Pipe

Post-installation Operation

- (1) Installation of Exhaust Pipe
- (2) Refilling the Fuel
- (3) Checking for Fuel Leaks



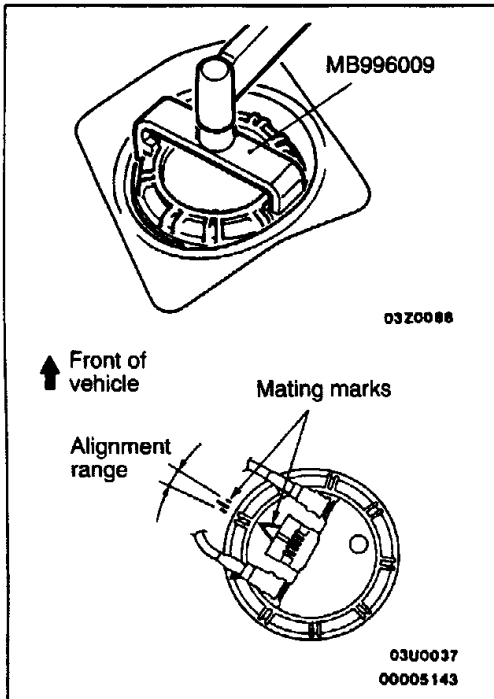
A03U0036

Removal steps

1. Hoses connection
2. Band
3. Protector
4. Fuel tank assembly
5. Fuel main hose
6. Fuel return hose
7. Cap



8. Fuel pipe and gauge assembly
9. Fuel vapor hose
10. 2 way valve
11. Fuel filler cap
12. Fuel rubber drain
13. Filler neck assembly
14. Leveling hose
15. Filler hose

**INSTALLATION SERVICE POINT****▶A◀CAP INSTALLATION**

Use the special tool to align the mating marks on the fuel tank and the fuel pipe and gauge assembly, and tighten the cap to the specified torque.

Caution

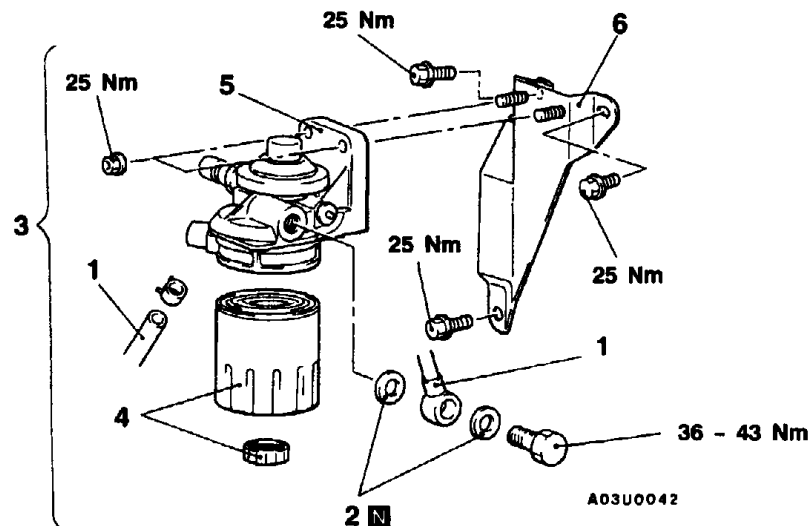
When tightening, be careful not to let the fuel pipe and gauge assembly turn together with the cap. If the mating marks are misaligned, the float may measure a remaining amount of fuel incorrectly, causing the low fuel warning lamp to malfunction.

FUEL FILTER

REMOVAL AND INSTALLATION

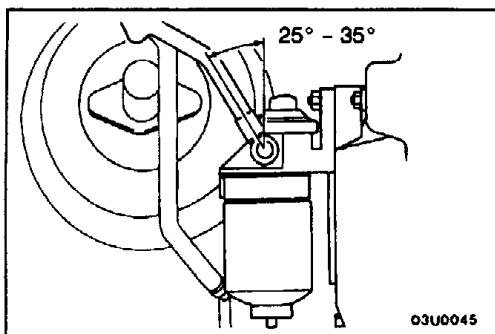
Pre-removal and Post-Installation Operation

- Air Cleaner Assembly Removal and Installation



Removal steps

- A◄
1. Fuel hose assembly connection
 2. Gasket
 3. Fuel filter assembly
 4. Fuel filter cartridge
 5. Fuel filter pump body
 6. Fuel filter bracket



INSTALLATION SERVICE POINT

►A◄ FUEL HOSE ASSEMBLY INSTALLATION

Install the fuel hose assembly as shown in the illustration.

INSPECTION**FUEL FILTER REPLACEMENT**

1. Remove the fuel tank to release the vacuum in the fuel tank.
2. Remove the air cleaner assembly.
3. Disconnect the connector and the fuel hose assembly from the fuel filter pump body to remove the fuel filter assembly from the bracket.
4. Remove the fuel filter cartridge from the fuel filter pump body.

Caution

Cover the cartridge with a rag to prevent fuel from gushing out.

5. Install a new filter, and bleed air from the fuel lines.
6. Start the engine, and check that there is no fuel leak.

GROUP 14

ENGINE COOLING

GENERAL

OUTLINE OF CHANGES

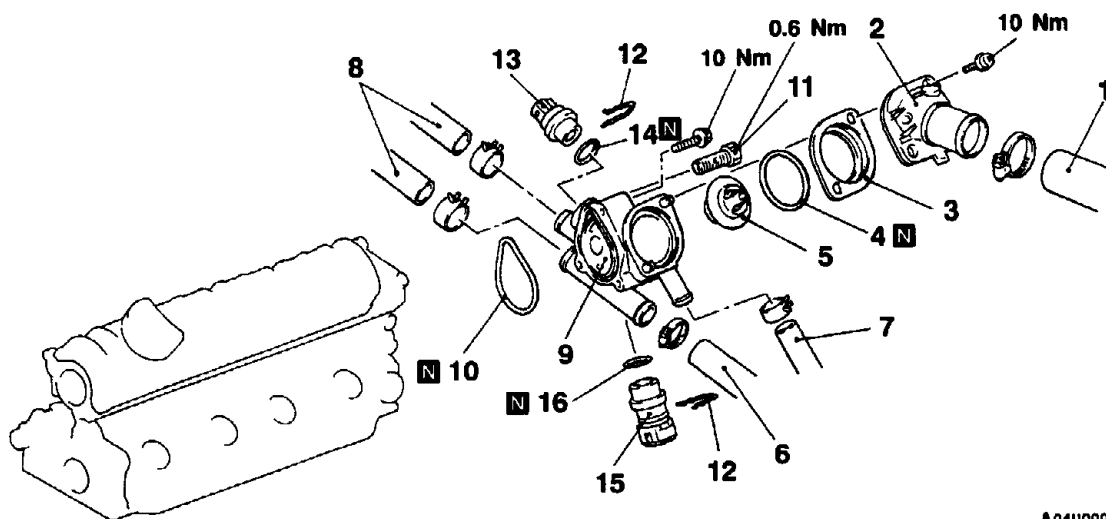
- The following service procedures have been added to correspond to the addition of the diesel-powered vehicle.
Applicable models: 1900D
 1. Removal and installation of the thermostat
 2. Removal and installation of the water pump
 3. Removal and installation of the radiator

THERMOSTAT

REMOVAL AND INSTALLATION

Pre-removal and Post-Installation Operation

- (1) Engine Coolant Draining and Supplying
- (2) Air Cleaner Assembly Removal and Installation



A04U0009

Removal steps


1. Radiator upper hose connection
2. Water inlet fitting
3. Plate
4. O-ring
5. Thermostat
6. Water hose connection
7. Radiator lower hose connection
8. Heater hoses connection
9. Thermostat housing

10. O-ring
11. Bleed screw
12. Clip
13. Engine coolant temperature sensor
14. O-ring
15. Engine coolant temperature gauge unit
16. O-ring

REMOVAL SERVICE POINT
◀▶ RADIATOR UPPER HOSE DISCONNECTION

After making mating marks on the radiator hose and the hose clamp, disconnect the radiator hose.

INSTALLATION SERVICE POINT
▶◀ RADIATOR UPPER HOSE CONNECTION

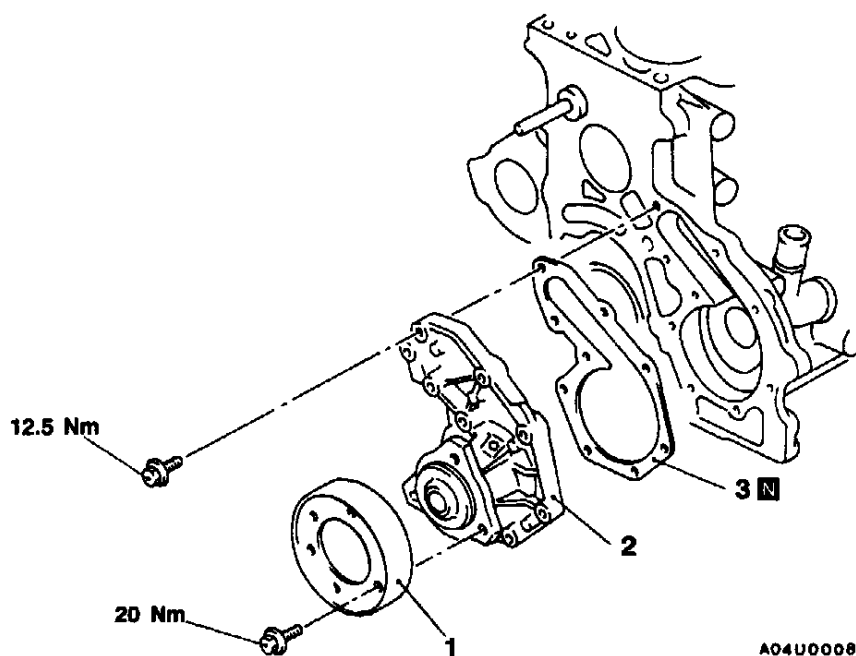
Align the mating marks on the radiator hose and hose clamp, and then connect the radiator hose.

WATER PUMP

REMOVAL AND INSTALLATION

Pre-removal and Post-Installation Operation

- (1) Engine Coolant Draining and Supplying
- (2) Timing Belt Under Cover Lower Removal and Installation (Refer to GROUP 11B – Intermediate Shaft Oil Seal.)

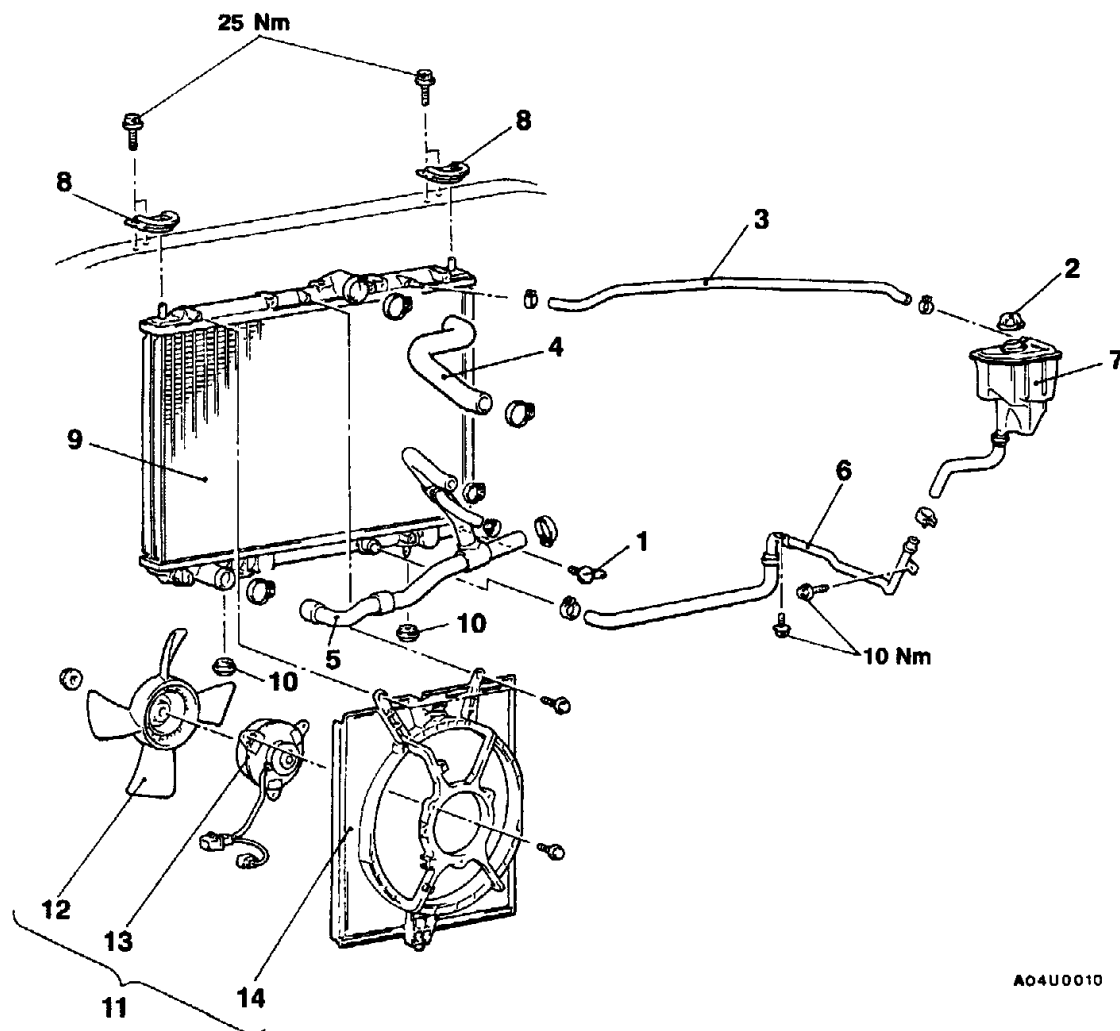
**Removal steps**

1. Water pump pulley
2. Water pump
3. Gasket

RADIATOR

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
 • Engine Coolant Draining and Supplying



A04U0010

Radiator removal steps

1. Drain plug
2. Pressure cap
3. Hotwater hose
4. Radiator upper hose
5. Radiator lower hose
6. Filter pipe assembly
7. Hot bottle tank
8. Upper insulator
9. Radiator assembly

10. Lower insulator
11. Radiator fan motor assembly

Radiator fan motor removal steps

11. Radiator fan motor assembly
12. Fan
13. Radiator fan motor
14. Shroud

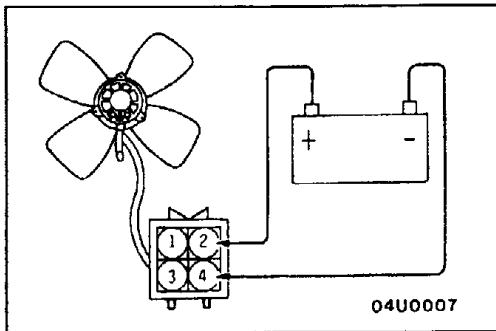


REMOVAL SERVICE POINT**◀A▶ RADIATOR UPPER HOSE/RADIATOR LOWER HOSE DISCONNECTION**

After making mating marks on the radiator hose and the hose clamp, disconnect the radiator hose.

INSTALLATION SERVICE POINT**▶A◀ RADIATOR LOWER HOSE/RADIATOR UPPER HOSE CONNECTION**

Align the mating marks on the radiator hose and hose clamp, and then connect the radiator hose.

**INSPECTION****RADIATOR FAN MOTOR CHECK**

1. Check to be sure that the radiator fan rotates when battery voltage is applied between terminals (as shown in the figure).
2. Check to see that abnormal noises are not produced, while motor is turning.

GROUP 15

INTAKE AND EXHAUST

GENERAL

OUTLINE OF CHANGES

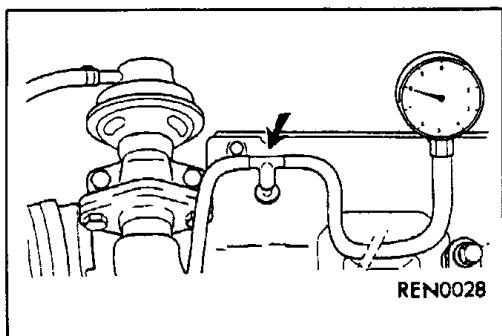
- The following service procedures have been added to correspond to the addition of the diesel-powered vehicle.

Applicable models: 1900D

1. On-vehicle Service
2. Removal and installation of the intercooler
3. Removal and installation of the intake manifold
4. Removal and installation of the exhaust manifold
5. Removal and installation of the turbocharger
6. Removal and installation of the exhaust pipe and main muffler

SERVICE SPECIFICATIONS

Items		Standard value
Supercharging pressure kPa	at 2,000 r/min	60 – 80
	at 2,500 r/min	80 – 95
	at 3,000 r/min	80 – 95
Waste gate actuator rod movement amount mm	at 102 – 110 kPa	0.38
	at 117 – 123 kPa	4.0



ON-VEHICLE SERVICE

TURBOCHARGER SUPERCHARGING PRESSURE CHECK

Caution

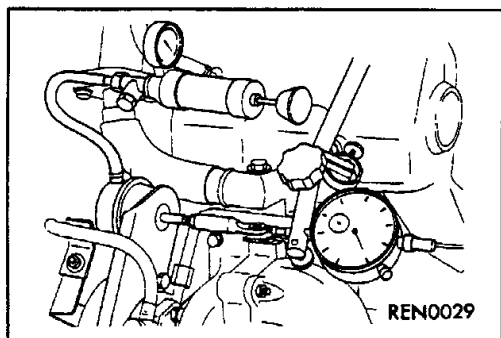
Conduct the driving test in a location where driving at full acceleration can be done with safety. Two persons should be in the vehicle when the test is conducted; the person in the passenger seat should read the indications shown by the pressure meter.

1. Disconnect the boost hose from the supercharging pressure release nipple of the intake manifold, and then connect a pressure gauge to the nipple as shown in the illustration.
2. Drive the vehicle with the engine under load (driving uphill) and with the transmission in 5th gear.
3. At an engine speed of 2,000 r/min, accelerate to full throttle and check the supercharging pressure.

Standard value:

Engine speed r/min	Supercharging pressure kPa
2000 ± 100	60 – 80
2500 ± 100	80 – 95
3000 ± 100	80 – 95

4. If the pressure is outside the standard value range, adjust using the wast gate actuator rod.

**WASTE GATE ACTUATOR CHECK**

1. Disconnect the boost hose from the waste gate actuator nipple.
2. Connect a manual pump (pressure-application type) to the nipple.
3. Gradually apply pressure and check the amount of movement of the rod.

Standard value:

Pressure kPa	Rod movement amount mm
102 – 110	0.38
117 – 123	4.0

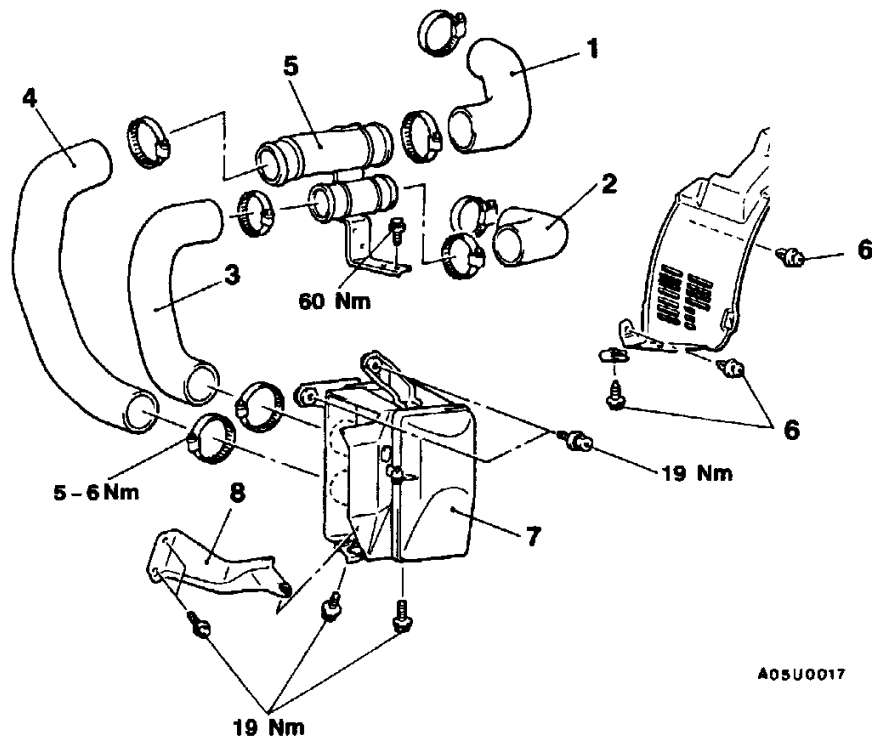
4. If the amount of movement is not at the standard value, adjust the waste gate actuator rod.

INTERCOOLER

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operations

- (1) Air Cleaner Assembly Removal and Installation
- (2) Battery and Battery Tray Removal and Installation
- (3) Under Cover Removal and Installation



A05U0017

Removal steps

1. Air hose D
2. Air hose A
3. Air hose B
4. Air hose C

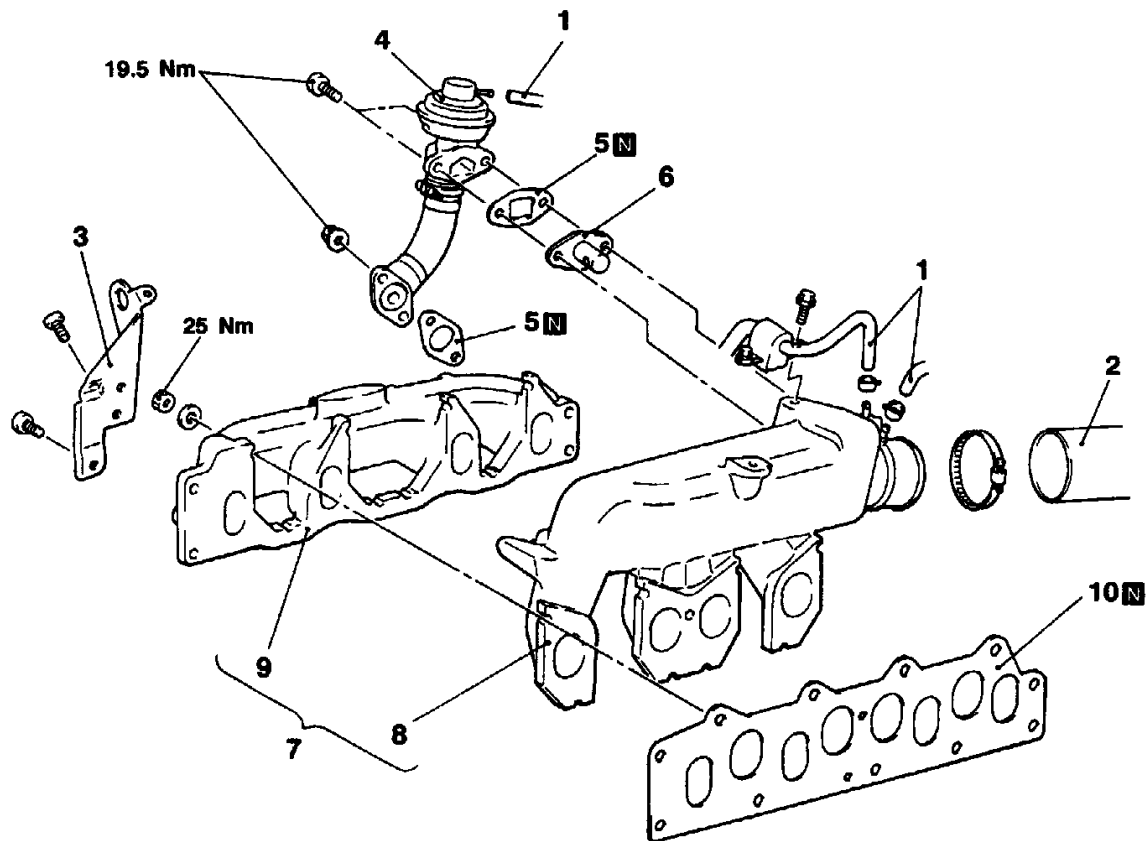
5. Air pipe
6. Clip and screw
7. Intercooler assembly
8. Intercooler stay

INTAKE MANIFOLD AND EXHAUST MANIFOLD

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation

- Turbocharger Assembly Removal and Installation
(Refer to P.15-5.)



A05U0015

Removal steps

1. Vacuum hoses connection
2. Air hose D connection
3. Engine hanger
4. EGR valve and pipe assembly
5. Gasket
6. Spacer

7. Intake and Exhaust manifold assembly
8. Intake manifold
9. Exhaust manifold
10. Intake and exhaust manifold gasket

TURBOCHARGER

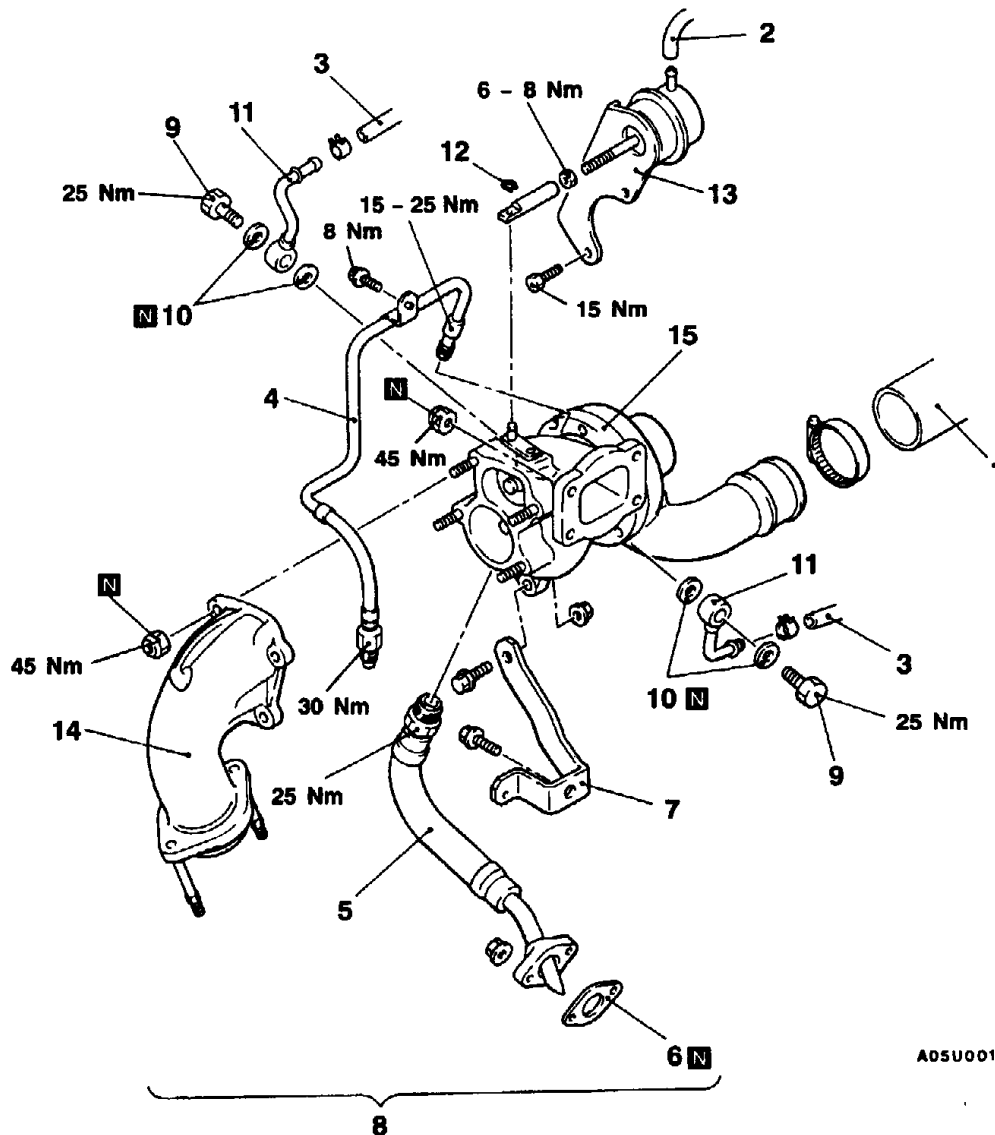
REMOVAL AND INSTALLATION

Pre-removal Operation

- (1) Engine Coolant Draining
- (2) Air Cleaner and Air Intake Hose Removal
- (3) Downpipe Assembly Removal (Refer to P.15-6.)

Post-installation Operation

- (1) Downpipe Assembly Installation (Refer to P.15-6.)
- (2) Air Cleaner and Air Intake Hose Installation
- (3) Engine Coolant Supplying
- (4) Engine Oil Check and Topping-up



A05U0016

Removal steps

1. Air hose A connection
2. Vacuum hose connection
3. Engine coolant hoses connection
4. Oil pipe assembly
5. Oil return pipe assembly
6. Gasket
7. Turbo support bracket
8. Turbocharger assembly

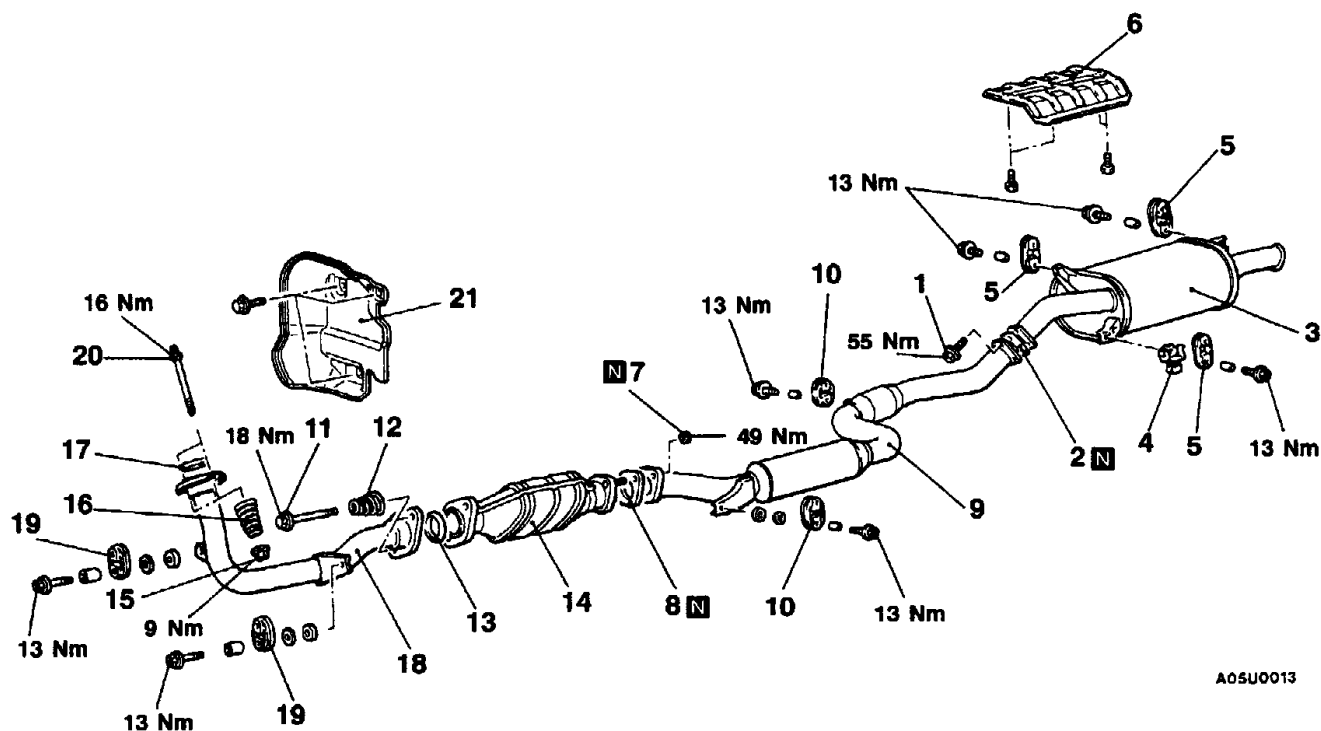
9. Eye bolt
10. Gasket
11. Water pipe
12. Circlip
13. Westegate assembly
14. Exhaust fitting
15. Turbocharger

EXHAUST PIPE AND MAIN MUFFLER

REMOVAL AND INSTALLATION

Pre-removal and Post-Installation Operation

- Under Cover Removal and Installation



A05U0013

Main muffler removal steps

1. Bolt
2. Gasket
3. Main muffler
4. Dynamic damper
5. Hanger
6. Rear floor heat protector panel

Center exhaust pipe removal steps

1. Bolt
2. Gasket
7. Self locking nuts
8. Gasket
9. Center exhaust pipe
10. Hanger
11. Flanged shoulder bolts
12. Conical spring
13. Sealing ring
14. Catalytic converter

Downpipe assembly removal steps

11. Flanged shoulder bolts
12. Conical spring
13. Sealing ring
15. Flange nuts
16. Spring
17. Sealing ring
18. Downpipe assembly
19. Hanger
20. Stud
21. Dash heat protector panel

ENGINE ELECTRICAL

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CHARGING SYSTEM

GENERAL

OUTLINE OF CHANGES

- The 6B model specifications have been added as one of the 4G92-SOHC engines.
- The service procedure for the alternator has been added to correspond to the addition of the diesel-powered vehicle.

Applicable models: 1900D

GENERAL INFORMATION

ALTERNATOR SPECIFICATIONS

<Petrol-powered vehicle>

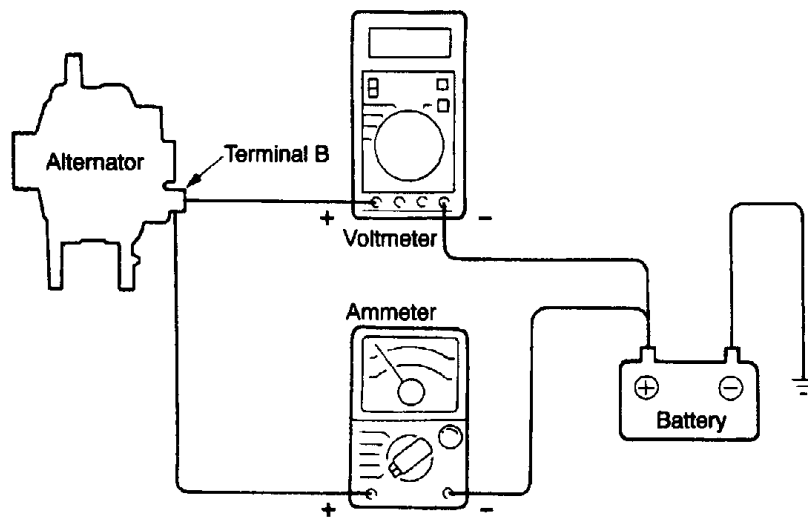
Items	1600-M/T <Except cold area for Europe>	1600-M/T <Cold area for Europe>, 1600 <6B model>, 1800
Type	Battery voltage sensing	Battery voltage sensing
Rated output V/A	12/70	12/90
Voltage regulator	Electronic built-in type	Electronic built-in type

<Diesel-powered vehicle>

Items	Diesel engine without A/C	Diesel engine with A/C
Type	Battery voltage sensing	Battery voltage sensing
Rated output V/A	12/80	12/110
Voltage regulator	Electronic built-in type	Electronic built-in type

SERVICE SPECIFICATIONS

Items		Standard value	Limit
Alternator output line voltage drop (at 30A) V		-	max. 0.3
Regulated voltage ambient temp. at voltage regulator V	-20°C	14.7 - 15.3	-
	20°C	14.4 - 14.7	-
	60°C	13.9 - 14.4	-
	80°C	13.7 - 14.2	-
Output current		-	70% of normal output current

ON-VEHICLE SERVICE <Diesel-powered vehicle>**ALTERNATOR OUTPUT LINE VOLTAGE DROP TEST**

SELO015

This test determines whether the wiring from the alternator "B" terminal to the battery (+) terminal (including the fusible line) is in a good condition or not.

- (1) Always be sure to check the following before the test.
 - Alternator installation
 - Alternator drive belt tension (Refer to GROUP 11B - On-vehicle Service.)
 - Fusible link
 - Abnormal noise from the alternator while the engine is running
- (2) Turn the ignition switch off.
- (3) Disconnect the negative battery cable.
- (4) Disconnect the alternator output wire from the alternator "B" terminal and connect a DC test ammeter with a range of 0-100 A in series between the "B" terminal and the disconnected

output wire. (Connect the (+) lead of the ammeter to the "B" terminal, and then connect the (-) lead of the ammeter to the disconnected output wire.)

NOTE

An inductive-type ammeter which enables measurements to be taken without disconnecting the alternator output wire should be recommended. Using this equipment will lessen the possibility of a voltage drop caused by a loose "B" terminal connection.

- (5) Connect a digital-type voltmeter between the alternator "B" terminal and the battery (+) terminal. (Connect the (+) lead of the voltmeter to the "B" terminal and the connect the (-) lead of the voltmeter to the battery (+) cable.)

- (6) Connect a tachometer.
- (7) Reconnect the negative battery cable.
- (8) Leave the hood open.
- (9) Start the engine.
- (10) With the engine running at 2,500 r/min, turn the headlamps and other lamps on and off to adjust the alternator load so that the value displayed on the ammeter is slightly above 30 A.
Adjust the engine speed by gradually decreasing it until the value displayed on the ammeter is 30 A. Take a reading of the value displayed on the voltmeter at this time.

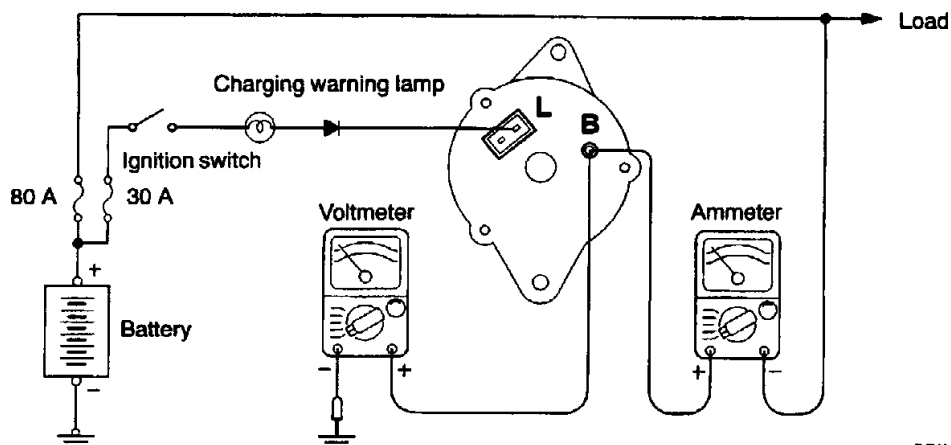
Limit: max. 0.3 V

NOTE

When the alternator output is high and the value displayed on the ammeter does not decrease until 30 A, set the value to 40 A. Read the value displayed on the voltmeter at this time.

- (11) If the value displayed on the voltmeter is above the limit value, there is probably a malfunction in the alternator output wire, so check the wiring between the alternator "B" terminal and the battery (+) terminal (including fusible link). If a terminal is not sufficiently tight or if the harness has become discolored due to overheating, repair and then test again.
- (12) After the test, run the engine at idle.
- (13) Turn all lamps and the ignition at idle.
- (14) Disconnect the negative battery cable.
- (15) Disconnect the ammeter, voltmeter and tachometer.
- (16) Connect the alternator output wire to the alternator "B" terminal.
- (17) Connect the negative battery cable.

OUTPUT CURRENT TEST



REN0141

This test determines whether the alternator output current is normal.

- (1) Before the test, always be sure to check the following.
 - Alternator installation
 - Battery (Refer to GROUP 54 - Battery.)

NOTE

The used battery should be slightly discharged. The load needed by a fully-charged battery is insufficient for an accurate test.

- Alternator drive belt tension (Refer to GROUP 11B - On-vehicle Service.)
- Fusible link
- Abnormal noise from the alternator while the engine is running.

- (2) Turn the ignition switch off.
- (3) Disconnect the negative battery cable.
- (4) Disconnect the alternator output wire from the alternator "B" terminal. Connect a DC test ammeter with a range of 0–100 A in series between the "B" terminal and the disconnected output wire. (Connect the (+) lead of the ammeter to the "B" terminal. Connect the (–) lead of the ammeter to the disconnected output wire.)

Caution

Never use clips but tighten bolts and nuts to connect the line. Otherwise loose connections (e.g. using clips) will lead to a serious accident because of high current.

NOTE

An inductive-type ammeter which enables measurements to be taken without disconnecting the alternator output wire should be recommended.

- (5) Connect a voltmeter with a range of 0–20 V between the alternator "B" terminal and the earth. (Connect the (+) lead of the voltmeter to the "B" terminal, and then connect the (–) lead of the voltmeter to the earth.)
- (6) Connect a tachometer.
- (7) Connect the negative battery cable.
- (8) Leave the hood open.
- (9) Check that the reading on the voltmeter is equal to the battery voltage.

NOTE

If the voltage is 0 V, the cause is probably an open circuit in the wire or fusible link between the alternator "B" terminal and the battery (+) terminal.

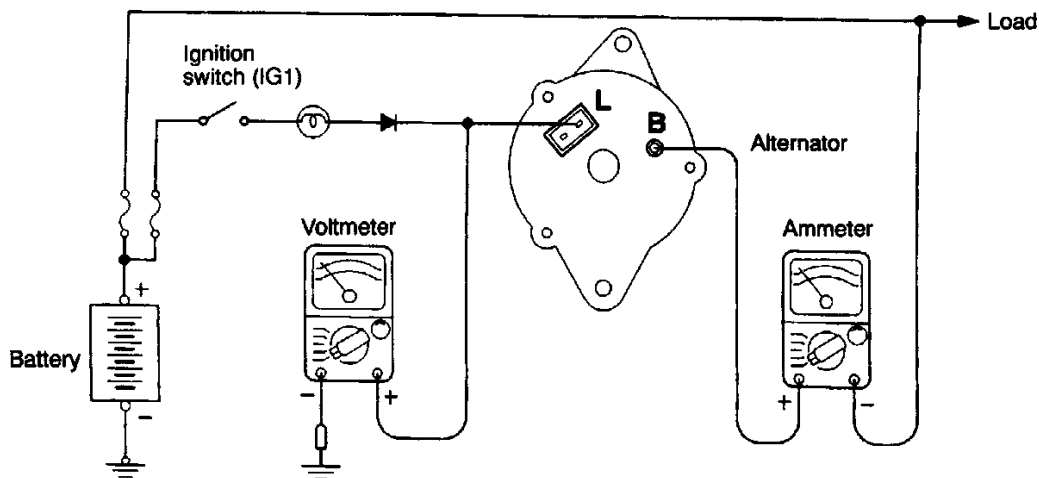
- (10) Turn the light switch on to turn on headlamps and then start the engine.
- (11) Immediately after setting the headlamps to high beam and turning the heater blower switch to the high revolution position, increase the engine speed to 2,500 r/min and read the maximum current output value displayed on the ammeter.

Limit: 70% of normal current output

NOTE

- For the nominal current output, refer to the Alternator Specifications.
 - Because the current from the battery will soon drop after the engine is started, the above step should be carried out as quickly as possible in order to obtain the maximum current output value.
 - The current output value will depend on the electrical load and the temperature of the alternator body.
 - If the electrical load is small while testing, the specified level of current may not be output even though the alternator is normal. In such cases, increase the electrical load by leaving the headlamps turned on for some time to discharge the battery or by using the lighting system in another vehicle, and then test again.
 - The specified level of current also may not be output if the temperature of the alternator body or the ambient temperature is too high. In such cases, cool the alternator and then test again.
- (12) The reading on the ammeter should be above the limit value. If the reading is below the limit value and the alternator output wire is normal, remove the alternator from the engine and check the alternator.
 - (13) Run the engine at idle after the test.
 - (14) Turn the ignition switch off.
 - (15) Disconnect the negative battery cable.
 - (16) Disconnect the ammeter, voltmeter and tachometer.
 - (17) Connect the alternator output wire to the alternator "B" terminal.
 - (18) Connect the negative battery cable.

REGULATED VOLTAGE TEST



REN0142

This test determines whether the voltage regulator is correctly controlling the alternator output voltage.

(1) Always be sure to check the following before the test.

- Alternator installation
- Check that the battery installed in the vehicle is fully charged. (Refer to GROUP 54 – Battery.)
- Alternator drive belt tension (Refer to GROUP 11B – On-vehicle Service.)
- Fusible link
- Abnormal noise from the alternator while the engine is running

(2) Turn the ignition switch to the OFF position.

(3) Disconnect the negative battery cable.

(4) Connect a digital-type voltmeter between the alternator "L" terminal and the earth. (Connect the (+) lead of the voltmeter to the "L" terminal, and then connect the (–) lead of the voltmeter to a secure earth or to the battery (–) terminal.)

(5) Disconnect the alternator output wire from the alternator "B" terminal.

(6) Connect a DC test ammeter with a range of 0–100 A in series between the "B" terminal and the disconnected output wire. (Connect the (+) lead of the ammeter to the "B" terminal. Connect the (–) lead of the ammeter to the disconnected output wire.)

(7) Connect a tachometer.

(8) Reconnect the negative battery cable.

(9) Turn the ignition switch to the ON position and check that the reading on the voltmeter is 2 – 5 V.

NOTE

If the voltage is 0 V, the cause is probably an open circuit in the wire or fusible link between the alternator "L" terminal and the battery (+) terminal.

(10) Turn all lamps and accessories off.

(11) Start the engine.

(12) Increase the engine speed to 2,500 r/min.

(13) Read the value displayed on the voltmeter when the alternator output current alternator becomes 10 A or less.

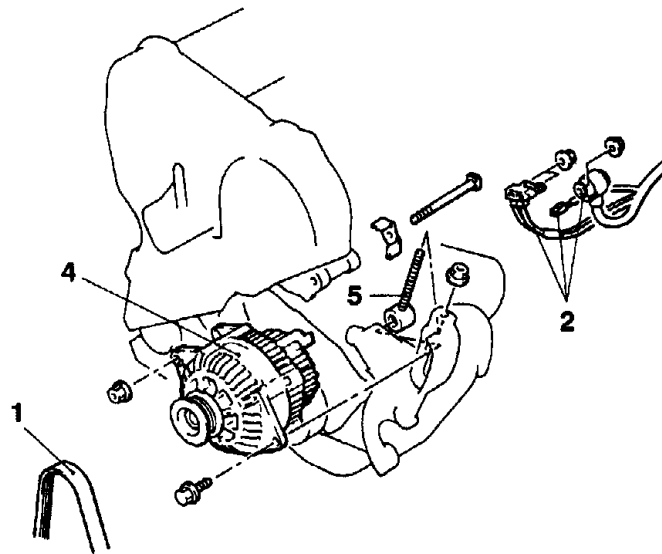
- (14) If the voltage reading conforms to the value in the voltage regulation, then the voltage regulator is operating normally.
If the voltage is not within the standard value, there is a malfunction of the voltage regulator or of the alternator.
- (15) After the test, lower the engine speed to the idle speed.
- (16) Turn the ignition switch off.
- (17) Disconnect the negative battery cable.
- (18) Disconnect the ammeter, voltmeter and tachometer.
- (19) Connect the alternator output wire to the alternator "B" terminal.
- (20) Connect the negative battery cable.

Voltage Regulation Table**Standard value:**

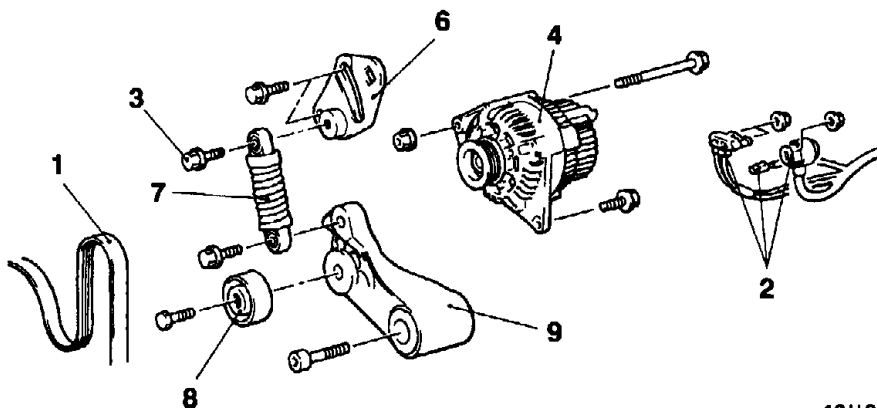
Inspection terminal	Voltage regulator ambient temperature °C	Voltage V
Terminal "L"	-20	14.7 - 15.3
	20	14.4 - 14.7
	60	13.9 - 14.4
	80	13.7 - 14.2

ALTERNATOR**REMOVAL AND INSTALLATION****Post-Installation Operation**

- Drive Belt Tension Adjustment
(Refer to GROUP 11B - On-vehicle Service.)

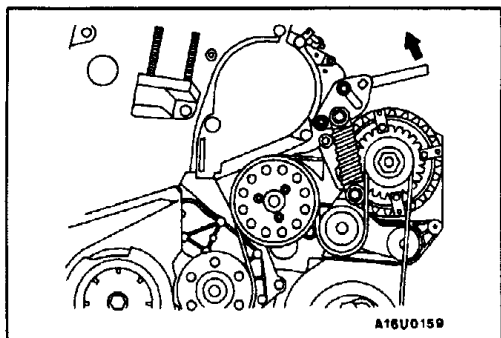
Vehicles without A/C

16U0161

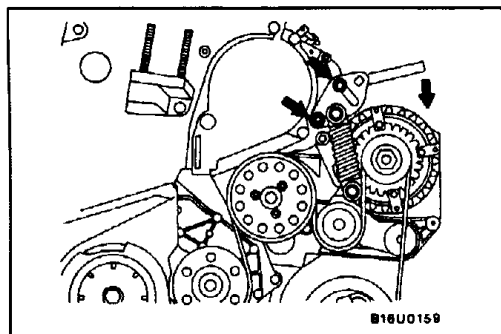
Vehicles with A/C16U0162
00005144**Removal steps**

1. Drive belt
2. Alternator connector
3. Bolt
4. Alternator
5. Bolt

6. Alternator brace
7. Spring
8. Pulley
9. Tensioner

**REMOVAL SERVICE POINT****◀A▶ DRIVE BELT REMOVAL <Vehicles with A/C>**

- (1) Place a ratchet spanner in the alternator brace.
- (2) Maintain pressure on the ratchet spanner and slacken the bolts.
- (3) Slowly reduce the drive belt tension and then remove the belt.

**INSTALLATION SERVICE POINT****▶A◀ DRIVE BELT INSTALLATION <Vehicles with A/C>**

- (1) Place the drive belt around the pulleys.
- (2) Insert the ratchet spanner in the alternator brace and tension the drive belt, checking that the belt is properly fitted in the grooves.
- (3) Tighten the two bolts.

IGNITION SYSTEM

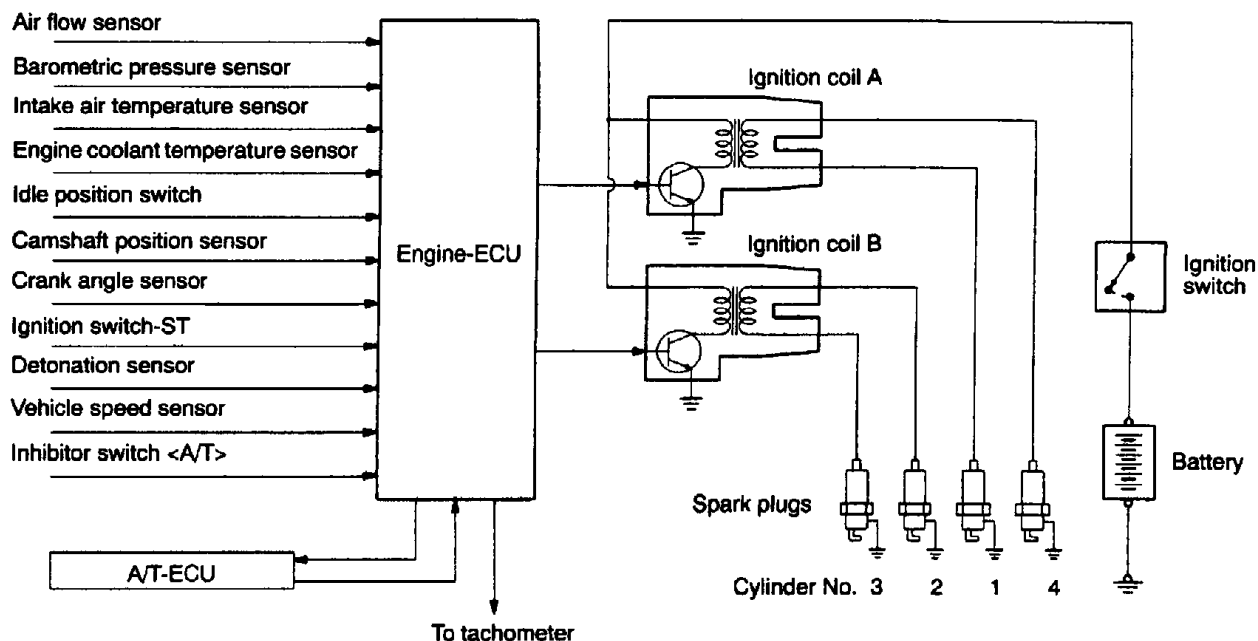
GENERAL

OUTLINE OF CHANGES

- The following service procedures have been added to correspond to the use of the distributorless 2-coil ignition distribution method.
Applicable models: 1600, 1800-SOHC
 1. General information
 2. On-vehicle Service
 3. Removal and installation of the ignition coil
 4. Removal and installation of the cam position sensor
 5. Removal and installation of the crank angle sensor
- The following service procedures have been changed to correspond to the change of the cam position sensor.
Applicable models: 1800-DOHC
 1. Removal and installation of the cam position sensor
 2. Removal and installation of the crank angle sensor

GENERAL INFORMATION

SYSTEM DIAGRAM



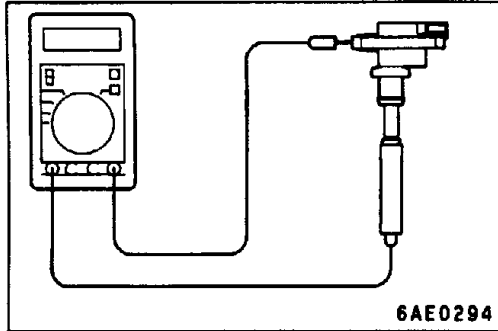
9FU0629

IGNITION COIL SPECIFICATIONS

Items	SOHC, DOHC
Type	Molded 2-coil

SERVICE SPECIFICATIONS**IGNITION COIL**

Items	SOHC	DOHC
Secondary coil resistance k Ω	15 - 21	17 - 23

**ON-VEHICLE SERVICE****IGNITION COIL (WITH BUILT-IN POWER TRANSISTOR) CHECK**

Check by the following procedure, and replace if there is a malfunction.

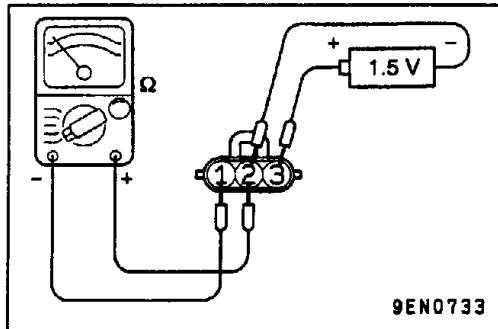
SECONDARY COIL RESISTANCE CHECK

Measure the resistance between the high-voltage terminals of the ignition coil.

Standard value:

15 - 21 k Ω <SOHC>

17 - 23 k Ω <DOHC>

**PRIMARY COIL AND POWER TRANSISTOR CONTINUITY CHECK****NOTE**

An analog-type circuit tester should be used.

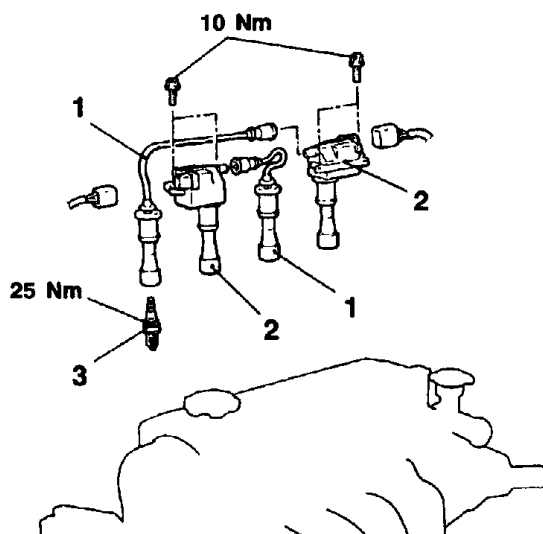
Voltage: 1.5 V	Terminal No.		
	1	2	3
When current is flowing	○	⊖	⊕
When current is not flowing			

WAVEFORM CHECK USING AN ANALYZER**Ignition Secondary Voltage Check**

The checking procedure for the SOHC engine has become the same as for the DOHC engine.

Ignition Primary Voltage Waveform Check

The checking procedure for the SOHC engine has been deleted.

IGNITION SYSTEM**REMOVAL AND INSTALLATION**

A16U0153

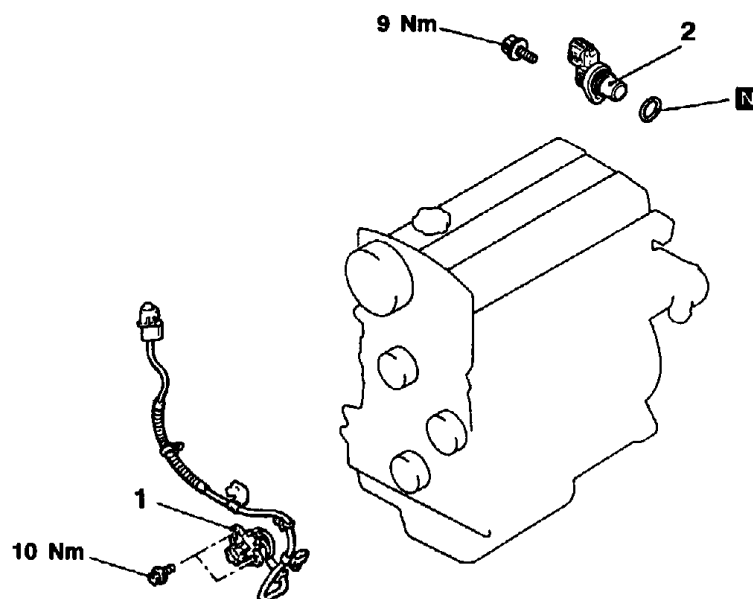
Removal steps

1. Spark plug cable assembly
2. Ignition coil assembly
3. Spark plug

CAMSHAFT POSITION SENSOR AND CRANK ANGLE SENSOR**REMOVAL AND INSTALLATION**

Pre-removal and Post-Installation Operation

- Timing Belt Removal and Installation



A16U0154

1. Crank angle sensor
2. Camshaft position sensor

GLOW SYSTEM

GENERAL

OUTLINE OF CHANGE

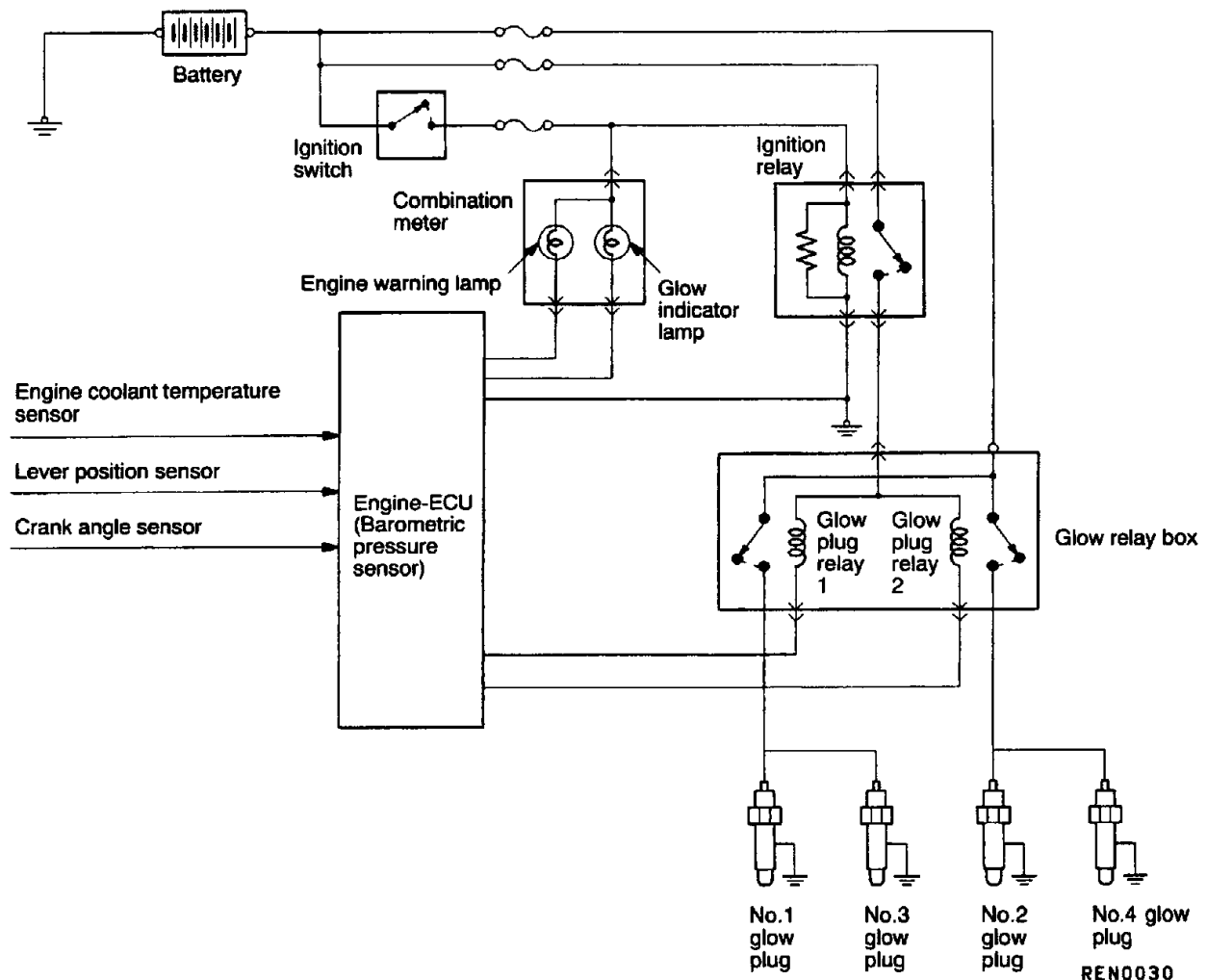
- The following service procedures have been added to correspond to the adoption of the F8QT engine.
Applicable models: 1900D

GENERAL INFORMATION

The glow system reduces the time required for starting at low temperatures to provide a degree of starting and operation that is identical to petrol-engine vehicles by pre-heating the glow plugs at super-quick speed.

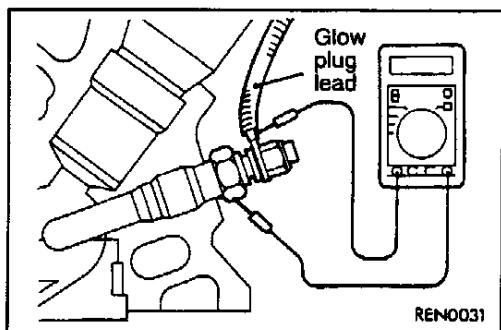
The engine-ECU controls both the time during which current is supplied to the glow plugs after the ignition switch is turned to the ON position and also the glow indicator lamp illumination time in accordance with the engine coolant temperature.

SYSTEM DIAGRAM



SERVICE SPECIFICATION

Items		Standard value
Resistance between glow plug lead and glow plug body (parallel resistance for 2 glow plugs) Ω		Approx. 0.3
Voltage between glow plug lead and glow body V	Immediately after ignition switch is turned to ON (without starting the engine)	9 - 11 (Drops to 0 V after 11 - 22 seconds have passed)
	While engine is cranking	6 or more
	While engine is warming up	12 - 15 (Drops to 0 V when if 10 - 220 seconds have passed since the engine was started)
Glow plug resistance Ω		0.45 - 0.55
Glow plug relay coil resistance Ω		27 - 35



ON-VEHICLE SERVICE

GLOW SYSTEM CHECK

1. Check that battery voltage is 11 - 13 V.
2. Check that the engine coolant temperature is 40°C or less.
3. Measure the resistance between the glow plug lead and the glow plug body (earth).

Standard value: Approx. 0.3

NOTE

The resistance value is the parallel resistance value for the two plugs (No.1 - No.3 or No.2 - No.4).

4. Check the voltages on the side of glow plug relay 1 (No.1 – No.3 glow plug) and on the side of glow plug relay 2 (No.2 – No.4 glow plug).
 - When checking the side of glow plug relay 1, connect the ohmmeter between the glow plug lead on the side of No.3 cylinder and No.3 glow plug body (earth).
 - When checking the side of glow plug relay 2, connect the ohmmeter between the glow plug lead on the side of No.4 cylinder and No.4 glow plug body (earth).
5. Measure the voltage immediately after the ignition switch is turned to ON (without starting the engine).

Standard value:

9 – 11 V (Drops to 0 V after 11 – 22 seconds have passed)

In addition, check to be sure that the glow indicator lamp illuminates immediately after the ignition switch is turned to ON.

NOTE

The voltage generated time (continuity time) varies depending on the engine coolant temperature when the ignition switch is ON.

6. Measure the voltage while the engine is cranking.

Standard value: 6 V or more

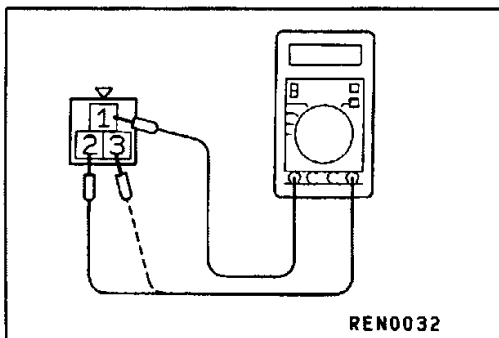
7. Start the engine and measure the voltage while the engine is warming up.

The voltage always drops to 0 V when 10 – 220 seconds have passed after starting the engine.

Standard value: 12 – 15 V

NOTE

The voltage generated time (continuity time) varies depending on the engine coolant temperature when the ignition switch is ON.



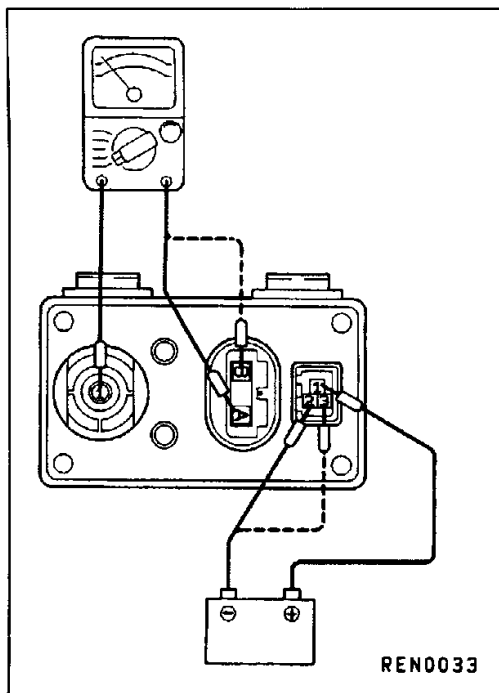
GLOW PLUG RELAY (GLOW RELAY BOX) CHECK

1. Disconnect the glow plug leads and all connectors from the glow plug relay.
2. Measure the resistance between terminals 1 - 2 and 1 - 3 of the glow plug relay 3 pin connector.

Standard value: 27 - 35 Ω

NOTE

- 1 - 2: Side of glow plug relay 1 (No.1 - No.3 glow plug)
1 - 3: Side of glow plug relay 2 (No.2 - No.4 glow plug)

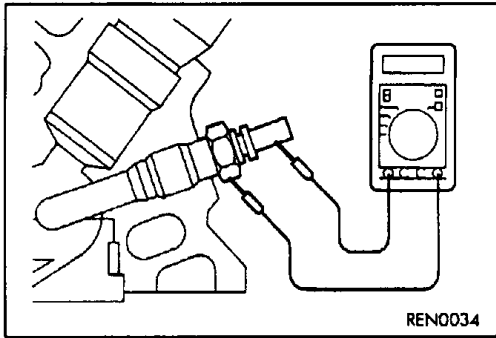


3. Check the operation of the glow plug relay.
 - When checking the side of glow plug relay 1, connect the battery (+) terminal to terminal 1 of the 3-pin connector, and connect the battery (-) terminal to terminal 2.
 - When checking the side of glow plug relay 2, connect the battery (+) terminal to terminal 1 of the 3-pin connector, and connect the battery (-) terminal to terminal 3.

Caution

1. The terminals of the disconnected harness must not be shorted to earth.
2. When connecting the jumper cables, be very careful not to make a mistake in connecting the terminals, as this will cause damage to the relay.
4. Check the continuity between each terminal when the jumper cable of the battery (+) terminal side is connected, and then when it is disconnected.
 - When checking the side of glow plug relay 1, connect the ohmmeter between terminals 1 and A (No.1 - No.3 glow plug leads) of the 1-pin connector.
 - When checking the side of glow plug relay 2, connect the ohmmeter between terminals 1 and B (No.2 - No.4 glow plug leads) of the 1-pin connector.

Cable at battery (+) terminal	Continuity between terminal
Connected	Continuity (0 Ω)
Disconnected	No continuity

**GLOW PLUG CHECK**

1. Remove the glow plug leads.
2. Measure the resistance between the glow plug terminals and the body.

Standard value: 0.45 – 0.55 Ω

CHECK AT THE ENGINE-ECU TERMINALS**TERMINAL VOLTAGE CHECK CHART**

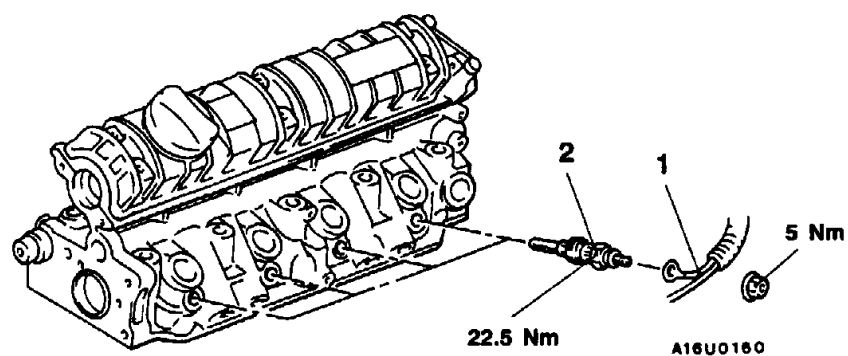
Refer to GROUP 13E – Troubleshooting.

GLOW PLUG

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation

- Fuel Injection Nozzle Removal and Installation
(Refer to GROUP 13E.)

**Removal steps**

1. Harness connector
2. Glow plug

ENGINE AND EMISSION CONTROL

CONTENTS

ENGINE CONTROL SYSTEM	2	SERVICE SPECIFICATIONS	4
GENERAL	2	EXHAUST GAS RECIRCULATION (EGR)	
Outline of Change	2	SYSTEM	5
ACCELERATOR CABLE AND PEDAL	2	General Information	5
EMISSION CONTROL SYSTEM	4	Exhaust Gas Recirculation (EGR) Control	
GENERAL	4	System Check	6
Outline of Change	4	EGR Valve Check	6
GENERAL INFORMATION	4	EGR Solenoid Valve Check	7
		Check At The Engine-ECU Terminals	7
		CATALYTIC CONVERTER	8

ENGINE CONTROL SYSTEM

GENERAL

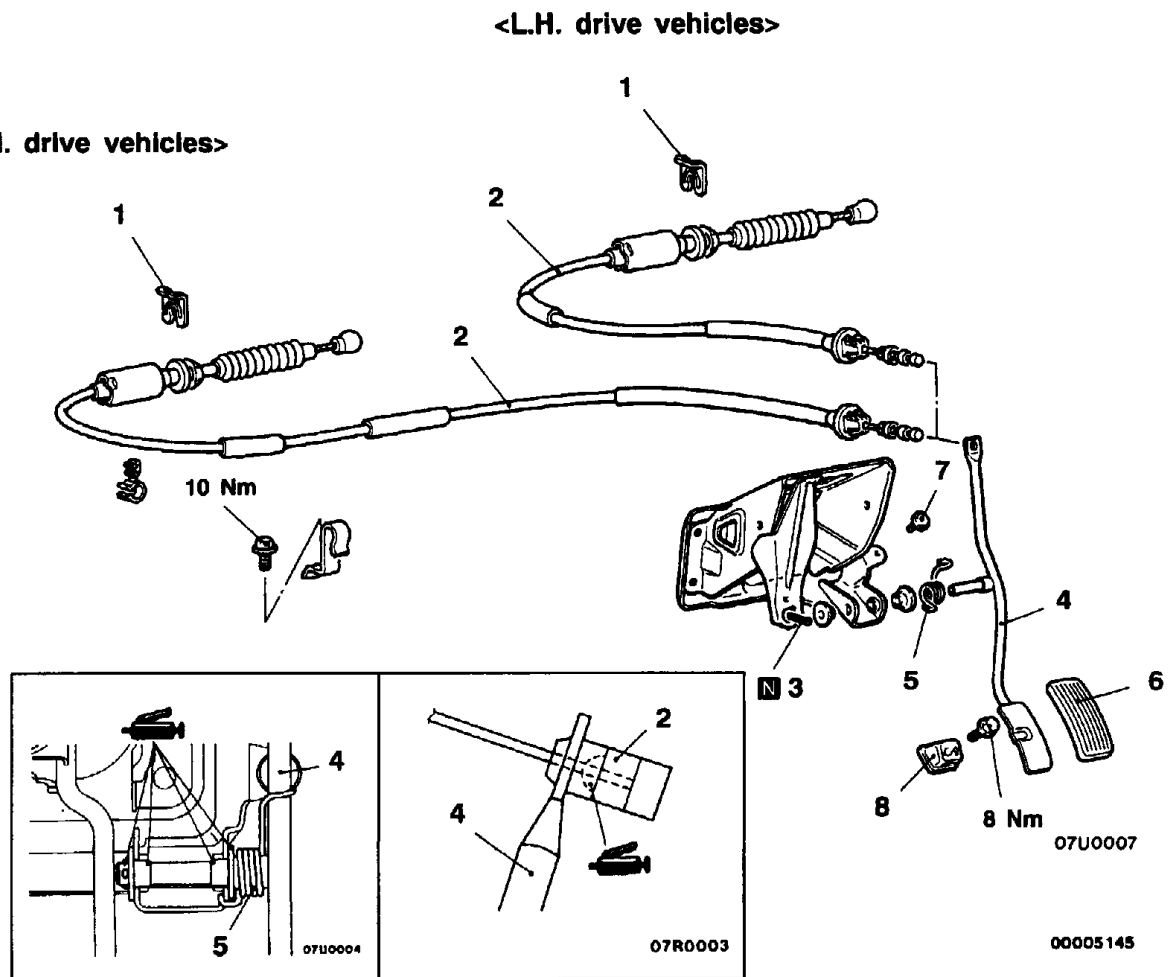
OUTLINE OF CHANGE

- The service procedure for the throttle cable has been added to correspond to the addition of the diesel-powered vehicle.

Applicable models: 1900D

ACCELERATOR CABLE AND PEDAL

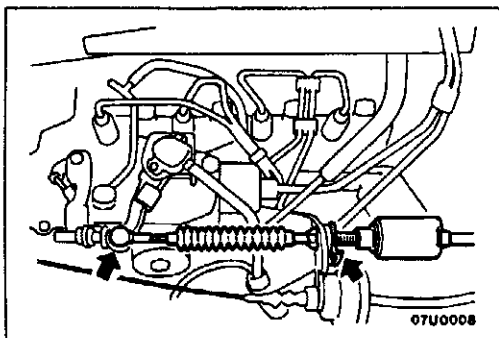
REMOVAL AND INSTALLATION



Removal steps

- A◄
1. Clip
 2. Throttle cable
 3. Split pin
 4. Accelerator pedal

5. Spring
6. Pedal pad
7. Stopper
8. Accelerator pedal stopper

**INSTALLATION SERVICE POINT****►A◄ THROTTLE CABLE INSTALLATION**

- (1) Press the throttle cable over the ball of the lever.
- (2) Tension the cable until it has a clearance of about 1 mm and then fit the retaining clip.

EMISSION CONTROL SYSTEM

GENERAL

OUTLINE OF CHANGE

The following maintenance service points have been established to correspond to the adoption of the F8QT engine.

Applicable models: 1900D

GENERAL INFORMATION

The electronically-controlled EGR system and the electronically-controlled fuel injection timing control system reduce the level of exhaust gases (NO_x).

Items	Name	Specification
Exhaust emission control system	Exhaust gas recirculation system • EGR valve • EGR solenoid valve	Electronically-controlled EGR system Single type Duty cycle solenoid valve

SERVICE SPECIFICATIONS

Items	Standard value
EGR solenoid valve resistance (at 23°C) Ω	5 – 6

EXHAUST GAS RECIRCULATION (EGR) SYSTEM

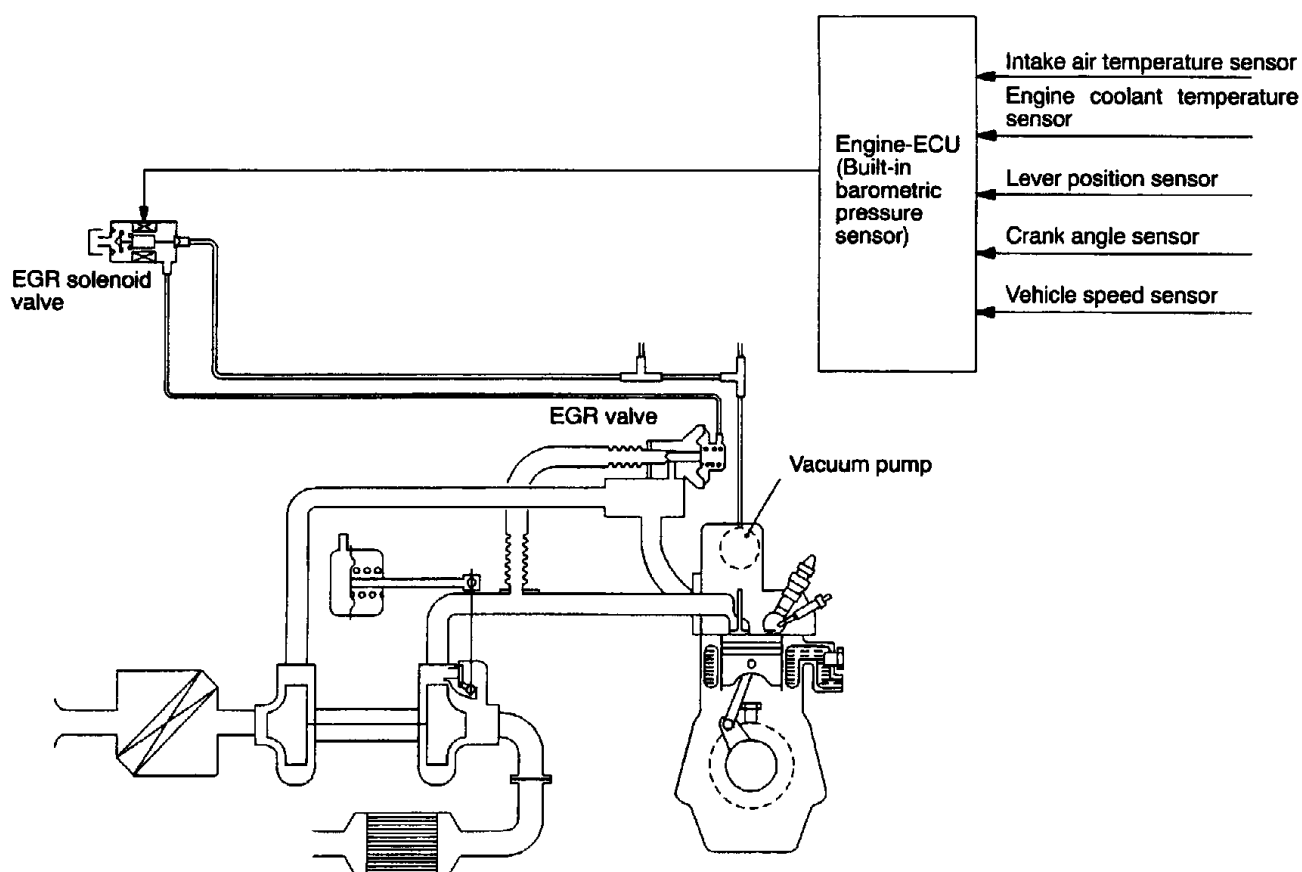
GENERAL INFORMATION

The electronically-controlled EGR system consists of an EGR valve, vacuum pump, EGR solenoid valve, engine-ECU and various sensors.

The EGR valve is controlled by the negative pressure inside the valve, which is controlled by EGR solenoid valve.

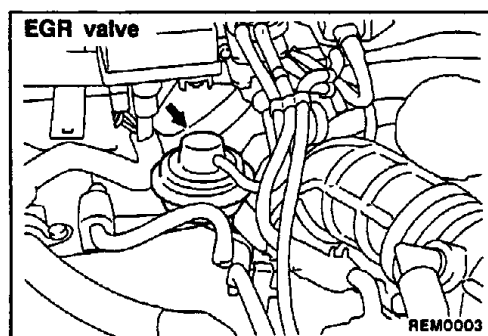
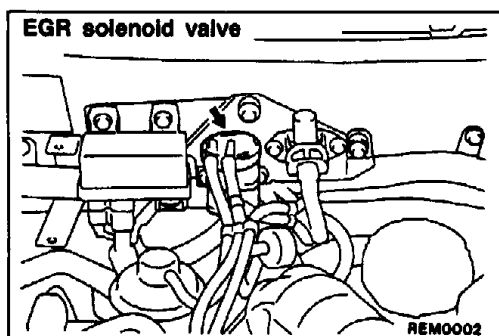
The EGR solenoid valve is optimally controlled by the engine-ECU in response to the engine operation conditions, based on data input from each of the sensors. In this way, the EGR valve is controlled to reduce NOx emissions while maintaining good engine performance.

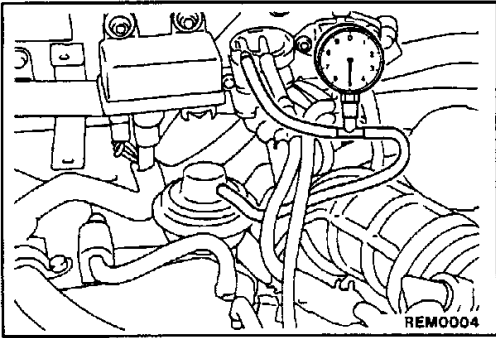
SYSTEM DIAGRAM



REM0001

COMPONENT LOCATION





EXHAUST GAS RECIRCULATION (EGR) CONTROL SYSTEM CHECK

1. Disconnect the vacuum hose from the EGR valve, and then connect a hand vacuum pump via the three-way terminal.
2. When the engine is cold and hot, check the condition of vacuum.

When engine is cold

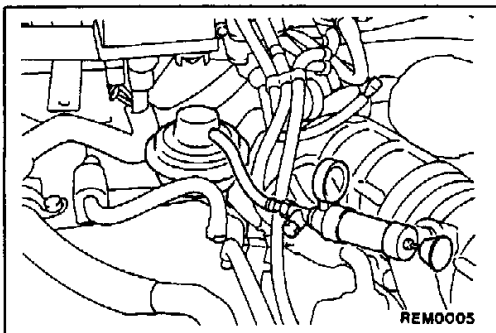
(Engine coolant temperature: 30°C or less)

Engine condition	Normal vacuum condition
Idling	No vacuum will generate
2,500 r/min	

When engine is hot

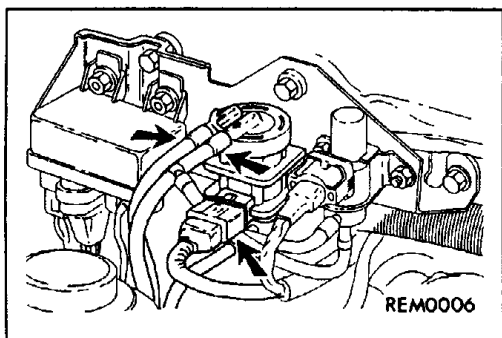
(Engine coolant temperature: 80°C or higher)

Engine condition	Normal vacuum condition
Idling	Approx. 75 kPa of negative pressure is generated
2,500 r/min	Negative pressure momentarily drops

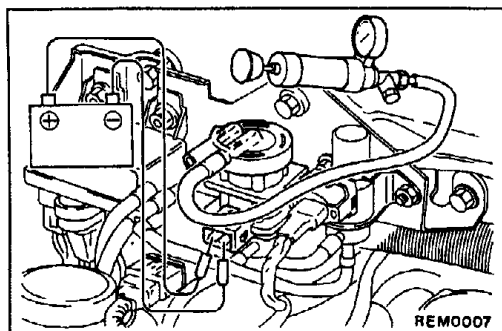


EGR VALVE CHECK

1. Connect a hand vacuum pump to the EGR valve nipple.
2. Apply 53 kPa of vacuum, and check that the vacuum is maintained.
If the vacuum is not maintained, replace the EGR valve.
3. Check that the sound of the valve closing can be heard when a vacuum leaks.
4. If no sound can heard, remove and inspect the EGR valve.

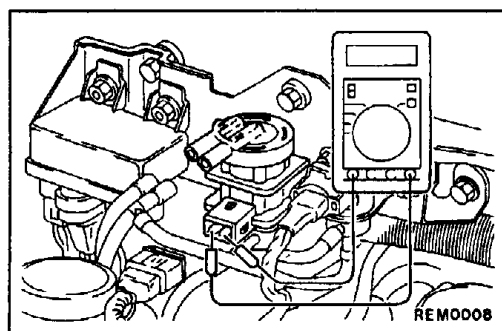
**EGR SOLENOID VALVE CHECK**

1. Disconnect the vacuum hose from the solenoid valve.
2. Disconnect the harness connector.



3. Connect a hand vacuum pump to the nipple A.
4. Check air-tightness by applying a vacuum with voltage applied directly from the battery to the EGR solenoid valve and without applying voltage.

Battery voltage	Normal condition
Applied	Vacuum leaks
Not applied	Vacuum maintained



5. Measure the resistance between the terminals of the solenoid valve.

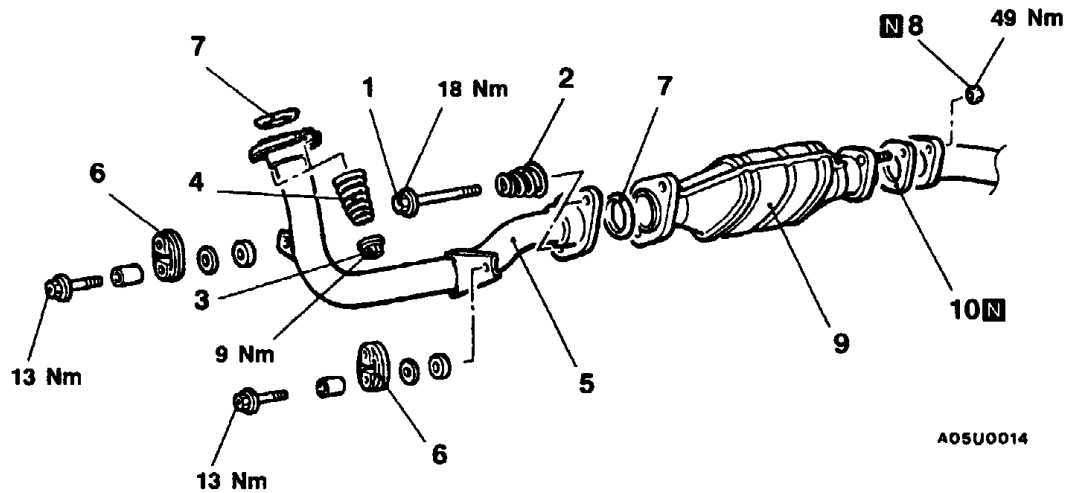
Standard value: 5 – 6 Ω (at 23°C)

CHECK AT THE ENGINE-ECU TERMINALS
TERMINAL VOLTAGE CHECK CHART

Refer to GROUP 13E – Troubleshooting.

CATALYTIC CONVERTER

REMOVAL AND INSTALLATION



Removal steps

1. Flanged shoulder bolts
2. Conical spring
3. Flange nuts
4. Spring
5. Downpipe assembly

6. Hanger
7. Sealing ring
8. Self locking nuts
9. Catalytic converter
10. Gasket

GROUP 22

MANUAL TRANSMISSION

GENERAL

OUTLINE OF CHANGES

- The general information and service procedures for the transmission have been added to correspond to the addition of the diesel-powered vehicle.
Applicable models: 1900D

GENERAL INFORMATION

The F5MR3 transmission has been used for the F8QT engine.

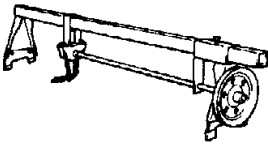
The service procedures are the same for F5MR1, F5MR2 manual transmission.

Items		Specifications
Model		F5MR3
Type		Manual, 5-speed, Front wheel drive
Gear ratio	1st	3.727
	2nd	2.047
	3rd	1.321
	4th	0.971
	5th	0.756
	Reverse	3.545
Final reduction ratio		3.437

SEALANT

Item	Specified sealant	Remark
Spring pin	MITSUBISHI GENUINE PART MD970389 or equivalent	Semi-drying sealant

SPECIAL TOOLS

Tool	Number	Name	Use
	MB990635 or MB991113	Steering linkage puller	Tie rod end and lower arm disconnection
	GENERAL SERVICE TOOL MZ203827	Engine lifter	Supporting the engine assembly during removal and installation of the transmission

TRANSMISSION ASSEMBLY

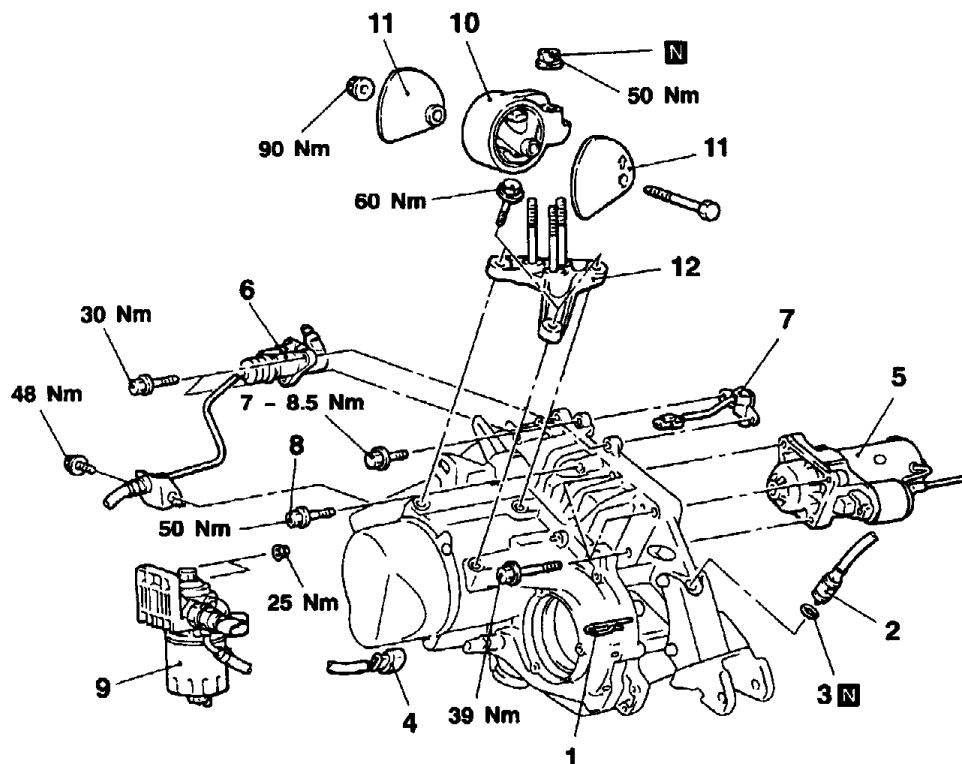
REMOVAL AND INSTALLATION

Pre-removal Operation

- (1) Air Cleaner Assembly Removal
- (2) Battery and Battery Tray Removal
- (3) Intercooler Hose Removal
(Refer to GROUP 15.)
- (4) Under Cover Removal
- (5) Shift Rod Assembly Removal
- (6) Transmission Oil Draining

Post-installation Operation

- (1) Shift Rod Assembly Installation
- (2) Under Cover Installation
- (3) Transmission Oil Supplying
- (4) Intercooler Hose Installation
(Refer to GROUP 15.)
- (5) Battery and Battery Tray Installation
- (6) Air Cleaner Assembly Installation
- (7) Shift Lever Operation Check
- (8) Speedometer Operation Check



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Removal steps

1. Retainer pin
2. Speedometer cable connection
3. O-ring
4. Backup lamp switch connector
5. Starter motor
6. Clutch release cylinder connection
7. Engine speed sensor
8. Transmission assembly upper part coupling bolts

◀C▶

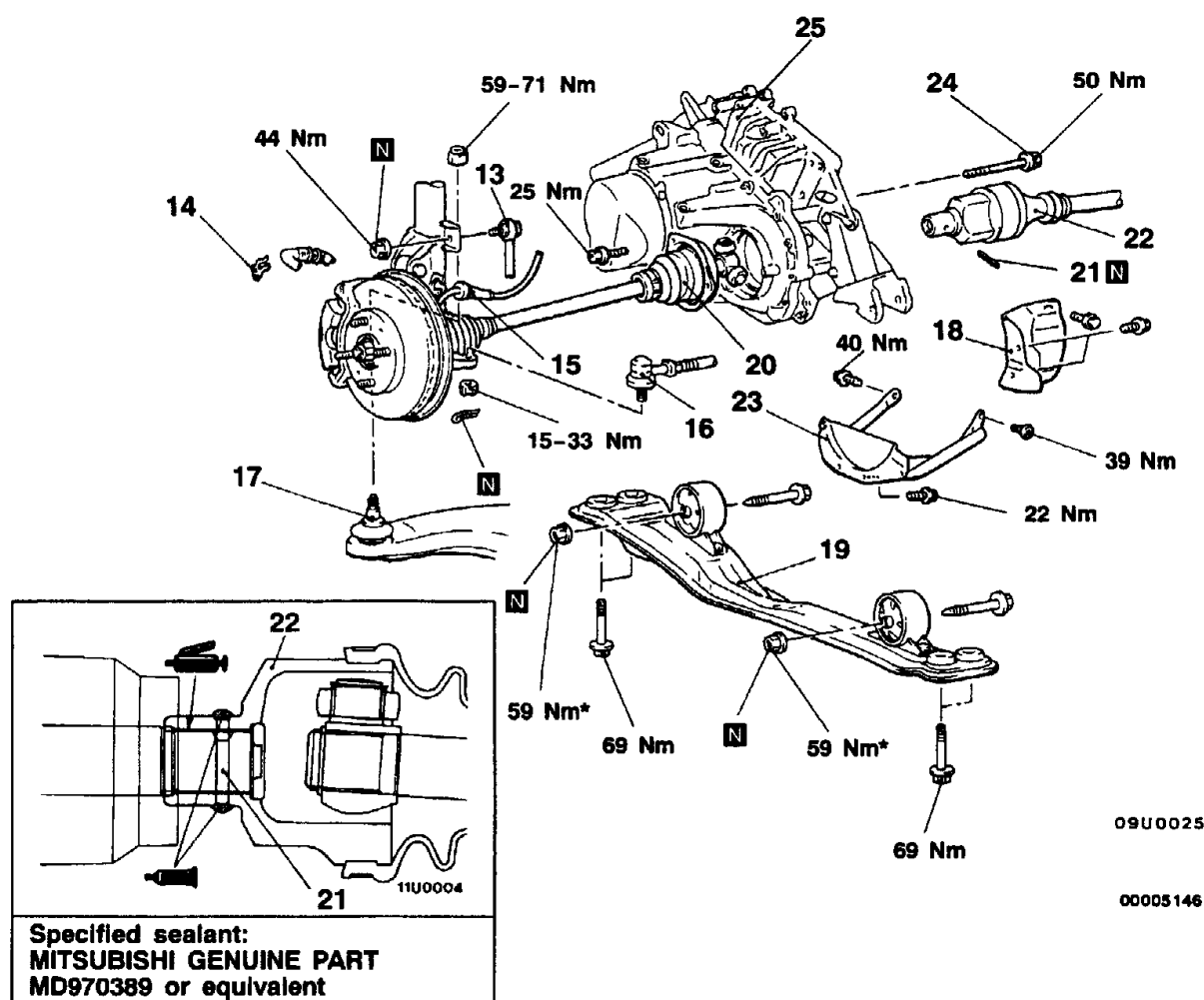
◀D▶

▶B◀

◀E▶

9. Fuel filter assembly
10. Transmission mount bracket
11. Transmission mount stopper
12. Transmission mount lower bracket
- Engine assembly supporting

◀A▶
◀B▶

**Lifting up of the vehicle**

- 13. Stabilizer link connection
- 14. Brake hose clamp
- 15. Speed sensor cable connection
<Vehicles with ABS>
- 16. Tie rod end connection
- 17. Lower arm ball joint connection
- 18. Heat protector
- 19. Centermember assembly
- 20. Drive shaft <L.H.> connection
- 21. Spring pin
- 22. Drive shaft <R.H.> connection

- 23. Bending strut
- 24. Transmission assembly lower part coupling bolts
- 25. Transmission assembly

Caution

*: Indicates parts which should be temporarily tightened, and then fully tightened with the vehicle on the ground in the unladen condition.

REMOVAL SERVICE POINTS**STARTER MOTOR REMOVAL**

Remove the starter motor with the starter motor harness still connected and secure it inside the engine compartment.

◀B▶ CLUTCH RELEASE CYLINDER REMOVAL

Remove the clutch release cylinder without disconnecting the oil line connection, and fix it to the vehicle chassis.

◀C▶ FUEL FILTER ASSEMBLY REMOVAL

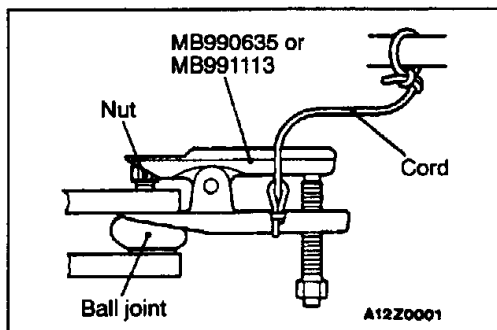
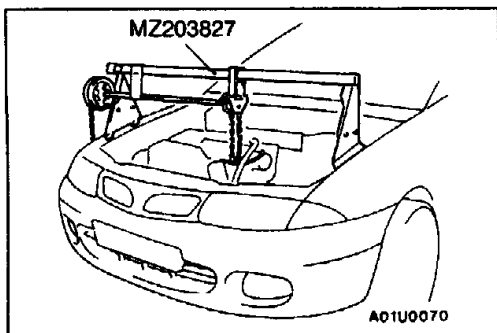
Detach the fuel filter assembly from the vehicle body without disconnecting the fuel lines, but do not remove the filter assembly.

◀D▶ TRANSMISSION MOUNT BRACKET REMOVAL

Jack up the transmission assembly gently with a garage jack, and then remove the transmission mount bracket.

◀E▶ ENGINE ASSEMBLY SUPPORTING

Set the special tool to the vehicle to support the engine assembly.

**◀F▶ TIE ROD END/LOWER ARM BALL JOINT DISCONNECTION****Caution**

1. Use the special tool to loosen the tie-rod end mounting nut. Only loosen the nut; do not remove it from the ball joint.
2. Support the special tool with a cord, etc. not to let it come off.

◀G▶ DRIVE SHAFT <L.H.> REMOVAL

1. Remove the drive shaft with the hub and knuckle, etc., still attached.
2. Suspend the removed drive shaft inside the wheel housing with wire so that there are no sharp bends in any of the joints.

INSTALLATION SERVICE POINTS**►A◄ DRIVE SHAFT <R.H.>/SPRING PIN INSTALLATION**

1. After applying multipurpose grease to the transmission-side spline of the drive shaft, align the spring pin hole at the end of the drive shaft with the spring pin hole at the end of the shaft at the transmission side, and then install the drive shaft.
If the spring pin hole is slightly off-line, turn the drive shaft 180° and then install it again.

NOTE

Because there are an odd number of splines on the drive shaft, the pin hole will be off-line by half the width of the hole if the drive shaft is turned 180°.

2. Apply specified sealant to the spring pin, and then insert it into the drive shaft.

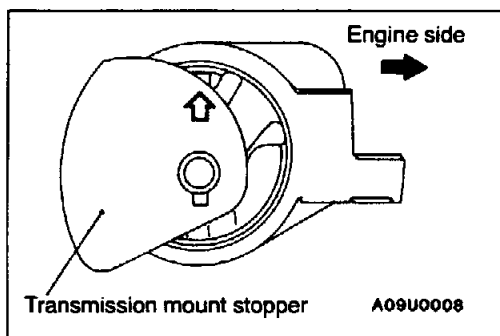
Specified sealant:

MITSUBISHI GENUINE PART MD970389 or equivalent

3. After inserting the pin, apply sealant to both ends of the pin hole to fully seal the hole.

Specified sealant:

MITSUBISHI GENUINE PART MD970389 or equivalent

**►B◄ TRANSMISSION MOUNT STOPPER INSTALLATION**

Install the transmission mount stopper so that the arrow points as shown in the illustration.

GROUP 26

FRONT AXLE

GENERAL

OUTLINE OF CHANGES

- The disassembly and reassembly procedures for the axle hub have been added to correspond to the addition of the diesel-powered vehicle. In addition, the procedures are the same as for 1600 models.

Applicable models: 1900D

GROUP 27

REAR AXLE

GENERAL

OUTLINE OF CHANGES

- The service procedures for the rear axle hub have been changed to correspond to the change of the rear wheel-speed sensor.
Applicable models: Vehicles with rear disc brake
- The service procedures for the rear axle hub have been added, because the rear drum brakes have had the ABS system.

Applicable models: Vehicles with rear drum brake and ABS

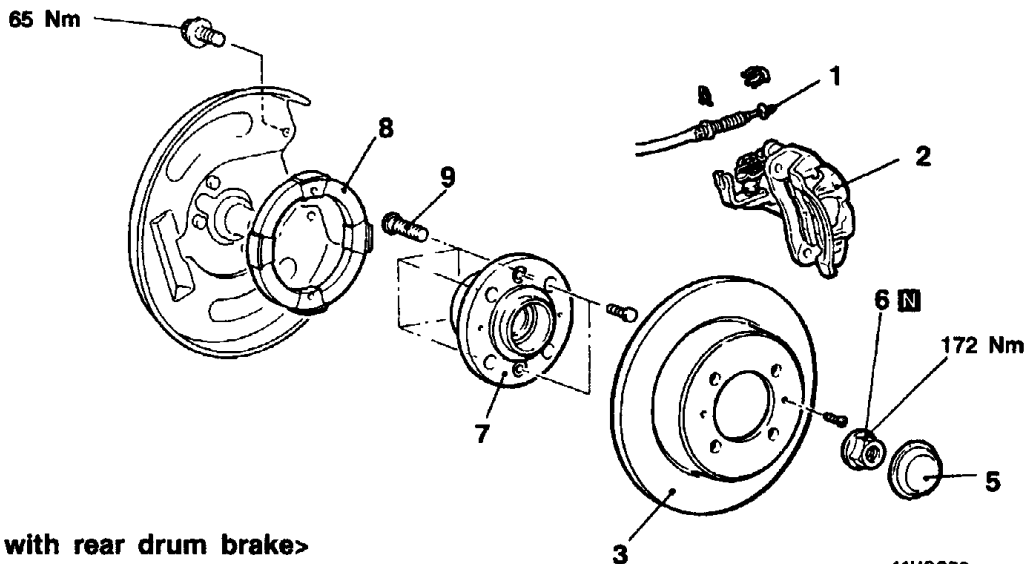
REAR AXLE HUB

REMOVAL AND INSTALLATION

Post-Installation Operation

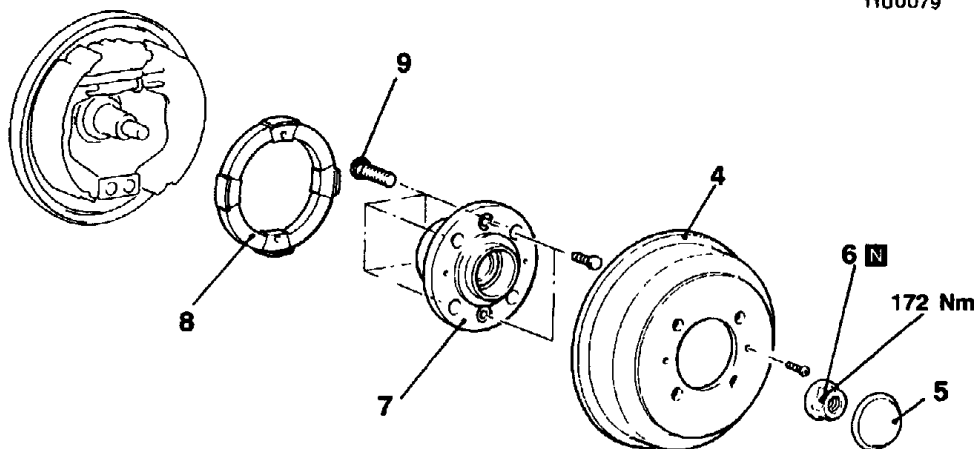
- Adjustment of Parking Brake
<Vehicles with rear disc brake>

<Vehicles with rear disc brake>



11U0079

<Vehicles with rear drum brake>

11M0002
00005096

Removal steps

1. Parking brake cable connection
2. Caliper assembly
3. Brake disc
4. Brake drum
5. Hub cap
6. Flange nut
7. Rear hub assembly
8. Rotor <Vehicles with ABS>
9. Hub bolt

Caution

- (1) The rear hub unit bearing should not be dismantled.

When removing the rear hub assembly, the wheelbearing inner race may be left at the spindle side.

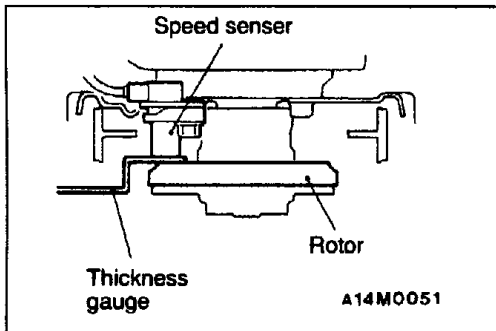
In this case, always replace the rear hub assembly, otherwise the hub will damage the oil seal, causing oil leaks or excessive play.

- (2) Care must be taken not to scratch or otherwise damage the teeth of the rotor. The rotor must never be dropped. If the teeth of the rotor are chipped, resulting in a deformation of the rotor, it will not be able to accurately detect the wheel rotation speed, and the system will not function normally.

REMOVAL SERVICE POINT

◀A▶ CALIPER ASSEMBLY REMOVAL

Remove the caliper assembly and suspend it.



INSTALLATION SERVICE POINT

▶A◀ REAR HUB ASSEMBLY INSTALLATION <VEHICLES WITH ABS>

Caution

Be careful that the pole piece at the end of the speed sensor and the rotor teeth do not become damaged by striking them against the metal parts.

Insert a thickness gauge into the space between the speed sensor's pole piece and the rotor's toothed surface, and check the clearance is the standard value all around.

Standard value: 0.1 – 1.9 mm

INSPECTION

- Check the oil seal for crack or damage.
- Check the rear hub unit bearing for wear or damage.
- Check the rear rotor for chipped teeth.

GROUP 32

POWER PLANT MOUNT

GENERAL

OUTLINE OF CHANGE

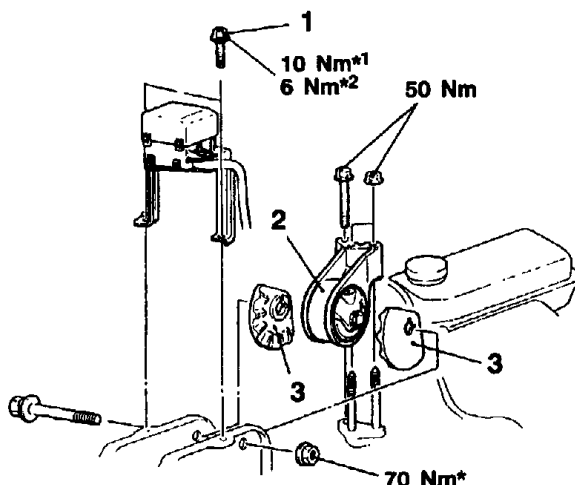
- The service procedures for the engine mounting have been added to correspond to the addition of the diesel-powered vehicle.
Applicable models: 1900D

ENGINE MOUNTING

REMOVAL AND INSTALLATION

Pre-removal Operation

- Jack Up the Engine and Transmission Assembly Until There is no Weight on the Engine Mount Bracket Insulator.



Removal steps

1. Bolts <Vehicles with A/C>
2. Engine mount bracket
3. Engine mount stopper



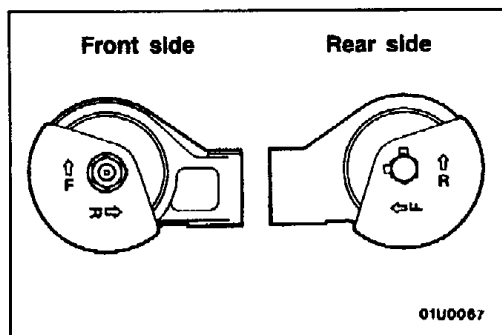
Caution

- Mounting locations marked by * should be provisionally tightened, and then fully tightened when the body is supporting the full weight of the engine.

NOTE

*1: Flange screw

*2: Washer assembled bolt



INSTALLATION SERVICE POINT

▶A◀ENGINE MOUNT STOPPER INSTALLATION

- (1) At the front, install so that the arrow with the "F" mark is facing upward.
- (2) At the rear, install so that the arrow with the "R" mark is facing upward.

GROUP 34

REAR SUSPENSION

GENERAL

OUTLINE OF CHANGES

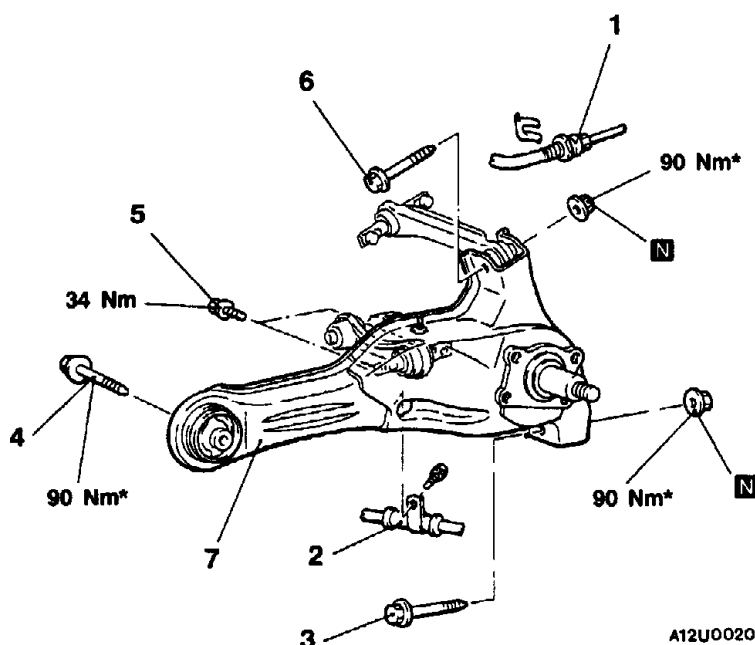
- The service procedures for the trailing arm have been changed to correspond to the change of the rear speed sensors.
Applicable models: Vehicles with ABS

TRAILING ARM

REMOVAL AND INSTALLATION

Pre-removal and Post-Installation Operation

- Backing Plate or Disc Brake Adapter Removal and Installation (Refer to GROUP 35B – Rear Drum Brake or Rear Disc Brake.)



A12U0020

Removal steps

- Lifting point
- 1. Brake hose
- 2. Parking brake cable
- 3. Lower arm and trailing arm connection
- 4. Trailing arm and body connection
- 5. Control link and trailing arm connection
- 6. Upper link and trailing arm connection
- 7. Trailing arm

Caution

- * Indicates parts which should be temporarily tightened, and then fully tightened with the vehicles on the ground in the unladen condition.

NOTE

For each service point, refer to Basic Manual.

SERVICE BRAKES

CONTENTS

BASIC BRAKE SYSTEM	35A
ANTI-SKID BRAKING SYSTEM (ABS) <2WD>	35B

GROUP 35A

BASIC BRAKE SYSTEM

GENERAL

OUTLINE OF CHANGES

- The specifications of the proportioning valve have been changed.
Applicable models: All models
- The checking procedure for the brake disc thickness has been added to correspond to the addition of the diesel-powered vehicle. In addition, the procedure is the same as for 1600 models.
Applicable models: 1900D
- The service procedures for the master cylinder and brake booster have been added to correspond to the addition of the diesel-powered vehicle.
Applicable models: 1900D

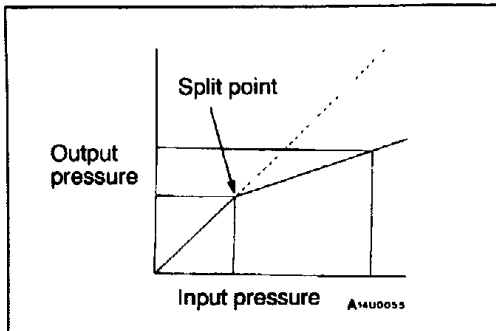
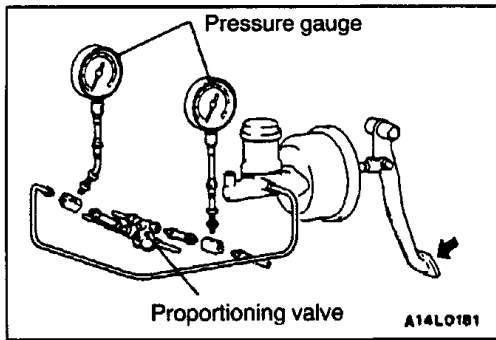
SERVICE SPECIFICATIONS

PROPORTIONING VALVE

Items			Standard value	Limit
Split point Mpa	Hatchback	1600, 1900D, 1800-DOHC	3.43 ± 0.25	-
		1800-SOHC	3.92 ± 0.25	-
	Sedan	1600, 1900D, 1800-DOHC	2.94 ± 0.25	-
		1800-SOHC	3.43 ± 0.25	-
Output fluid pressure (Input fluid pressure) MPa	Hatchback	1600, 1900D, 1800-DOHC	5.03 ± 0.4 (9.81)	-
		1800-SOHC	5.39 ± 0.4 (9.81)	-
	Sedan	1600, 1900D, 1800-DOHC	4.66 ± 0.4 (9.81)	-
		1800-SOHC	5.03 ± 0.4 (9.81)	-
Output fluid pressure difference between left and right MPa			-	0.8

FRONT DISC BRAKE <1900D>

Item	Standard value	Limit
Disc thickness mm	18.0	16.4



ON-VEHICLE SERVICE

PROPORTIONING VALVE FUNCTION TEST

1. Connect two pressure gauges, one each to the input side and output side of the proportioning valve, as shown.
2. Bleed the air in the brake line and the pressure gauge.
3. While gradually depressing the brake pedal, make the following measurements and check to be sure that the measured values are within the allowable range.

- (1) Output pressure begins to drop relative to input pressure (split point).

Standard value:

MPa

Items	1600, 1900D, 1800-DOHC	1800-SOHC
Hatchback	3.43 ± 0.25	3.92 ± 0.25
Sedan	2.94 ± 0.25	3.43 ± 0.25

- (2) Check to be sure that the output fluid pressure is at the standard value when the pedal depression force is increased so that the input fluid pressure is at the values shown in the table below.

Standard value:

MPa

Items		1600, 1900D, 1800-DOHC	1800-SOHC
Output fluid pressure (Input fluid pressure)	Hatchback	5.03 ± 0.4 (9.81)	5.39 ± 0.4 (9.81)
	Sedan	4.66 ± 0.4 (9.81)	5.03 ± 0.4 (9.81)

- (3) Output pressure difference between left and right brake lines.

Limit: 0.8 MPa

4. If the measured pressures are not within the permissible ranges, replace the proportioning valve.

BRAKE DISC THICKNESS CHECK <1900D>

For the checking procedure, refer to the basic manual.

Brake disc thickness

Standard value: 18.0 mm

Limit: 16.4 mm

MASTER CYLINDER AND BRAKE BOOSTER

REMOVAL AND INSTALLATION

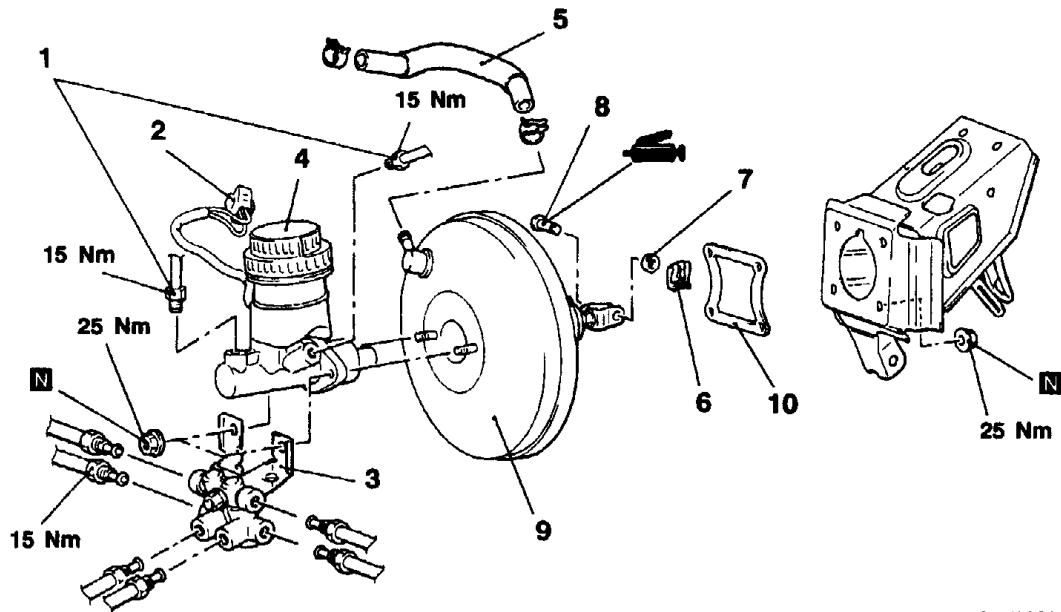
<L.H. drive vehicles>

Pre-removal Operation

- Brake Fluid Draining

Post-Installation Operation

- Brake Fluid Supplying
- Brake Line Bleeding
- Brake Pedal Adjustment



A14U0098

Removal steps

1. Brake pipe connection
2. Brake fluid level sensor connector
3. Proportioning valve bracket
4. Master cylinder assembly
 - Clearance adjustment between brake booster push rod and primary piston
5. Vacuum hose (With built-in check valve)
6. Retaining clip
7. Washer
8. Retaining ring bolt
9. Brake booster
10. Sealer



NOTE

For each service point, refer to Basic Manual.

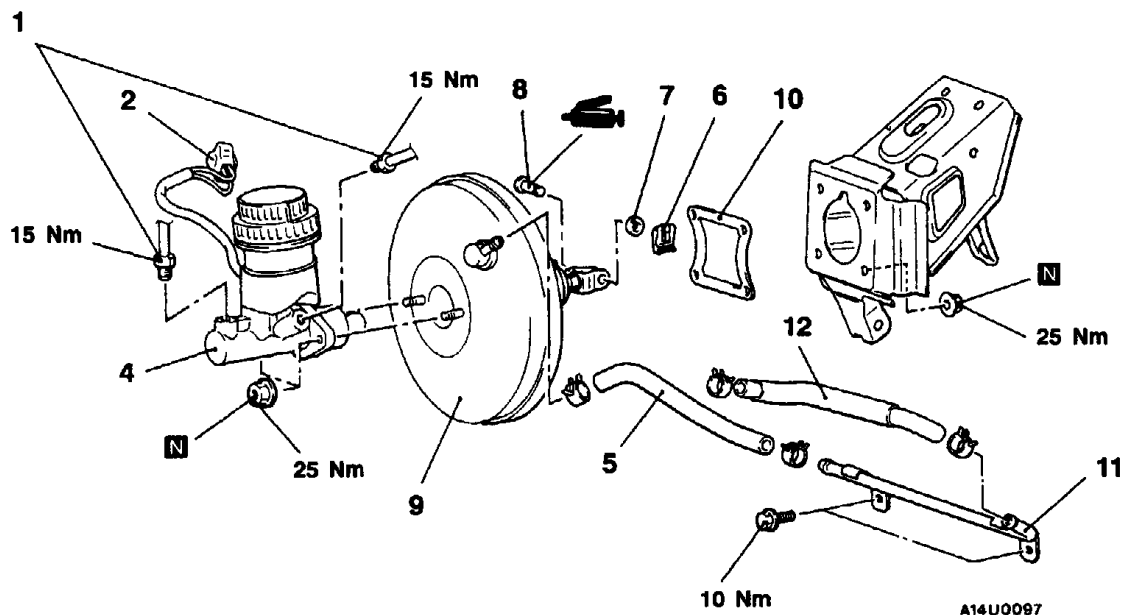
<R.H. drive vehicles>

Pre-removal Operation

- Brake Fluid Draining

Post-Installation Operation

- Brake Fluid Supplying
- Brake Line Bleeding
- Brake Pedal Adjustment

**Removal Steps**

1. Brake pipe connection
2. Brake fluid level sensor connector
4. Master cylinder assembly
 - Clearance adjustment between brake booster push rod and primary piston
5. Vacuum hose (With built-in check valve)
6. Retaining clip
7. Washer
8. Retaining ring bolt
9. Brake booster
10. Sealer
11. Vacuum pipe
12. Vacuum hose

NOTE

For each service point, refer to Basic Manual.

GROUP 35B

ANTI-SKID BRAKING SYSTEM (ABS) <2WD>

GENERAL

OUTLINE OF CHANGES

- The specifications of the proportioning valve have been changed.
Applicable models: All models
- The service procedures for the master cylinder and brake booster have been added to correspond to the addition of the diesel-powered vehicle.
Applicable models: 1900D
- The following service procedures have been added, because the rear drum brakes have had the ABS system.
Applicable models: 1600, 1800-SOHC, 1900D
 1. Removal and installation of the rear drum brakes
 2. Removal and installation of the wheel-speed sensor
- The following service procedures have been changed to correspond to the change of the rear wheel-speed sensor.
Applicable models: 1800-DOHC
 1. Removal and installation of the rear disc brakes
 2. Removal and installation of the wheel-speed sensor

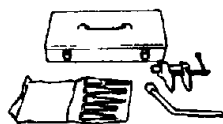
SERVICE SPECIFICATIONS

Items	Standard value
Clearance between rear speed sensor pole piece and rotor mm	0.1 – 1.9
Wheel speed sensor's internal resistance k Ω	1.28 – 1.92
Wheel speed sensor insulation resistance k Ω	100 or more

LUBRICANTS

Items	Specified Lubricant
Brake fluid	DOT3 or DOT4
Wheel cylinder body inner surfaces	Repair kit grease
Rear brake shoe and backing plate contact surfaces	Brake grease SAE J310, NLGI No.1
Shoe assembly and auto adjuster assembly contact surfaces	
Shoe and lever assembly and auto adjuster assembly contact surfaces	

SPECIAL TOOL

Tool	Number	Name	Use
	MB990964 MB990773	Brake tool set	Installation of drum brake wheel cylinder piston cup

ON-VEHICLE SERVICE**PROPORTIONING VALVE FUNCTION TEST**

The testing procedures are the same as for non-ABS vehicles.
Refer to GROUP 35A - On-vehicle Service.

MASTER CYLINDER AND BRAKE BOOSTER**REMOVAL AND INSTALLATION**

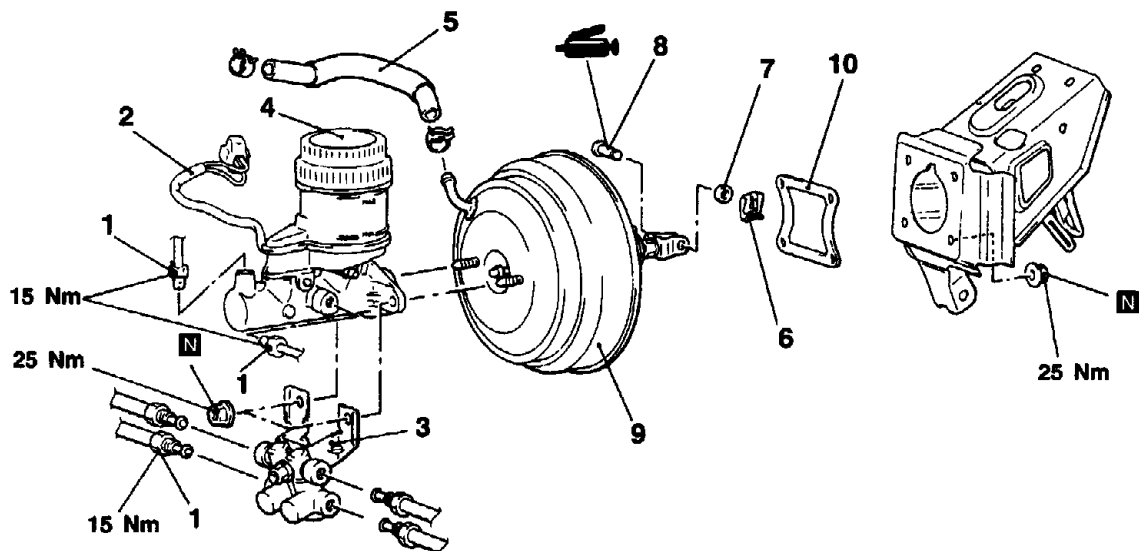
<L.H. drive vehicles>

Pre-removal Operation

- Brake Fluid Draining

Post-installation Operation

- Brake Fluid Supplying
- Brake Line Bleeding
- Brake Pedal Adjustment



A14U0099

Removal steps

1. Brake pipe connection
 2. Brake fluid level sensor connector
 3. Proportioning valve bracket
 4. Master cylinder assembly
 - Clearance adjustment between brake booster push rod and primary piston
 5. Vacuum hose (With built-in check valve)
- B◀
- A◀

6. Retaining clip
7. Washer
8. Retaining ring bolt
9. Brake booster
10. Sealer

NOTE

For each service point, refer to Basic Manual.

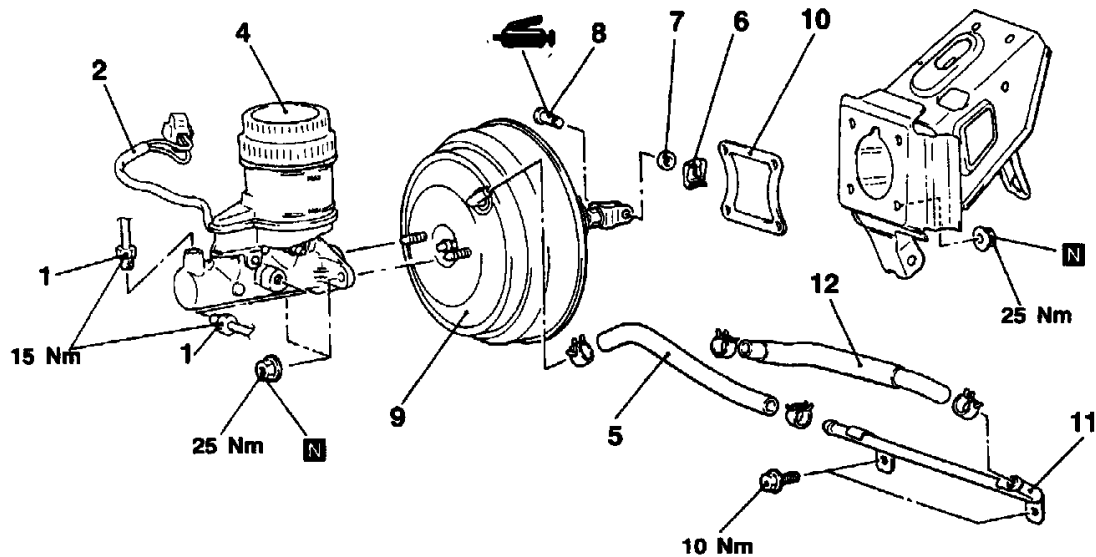
<R.H. drive vehicles>

Pre-removal Operation

- Brake Fluid Draining

Post-Installation Operation

- Brake Fluid Supplying
- Brake Line Bleeding
- Brake Pedal Adjustment

**Removal steps**

1. Brake pipe connection
2. Brake fluid level sensor connector
4. Master cylinder assembly
 - Clearance adjustment between brake booster push rod and primary piston
5. Vacuum hose (With built-in check valve)
6. Retaining clip
7. Washer
8. Retaining ring bolt
9. Brake booster
10. Sealer
11. Vacuum pipe
12. Vacuum hose

NOTE

For each service point, refer to Basic Manual.

REAR DRUM BRAKE

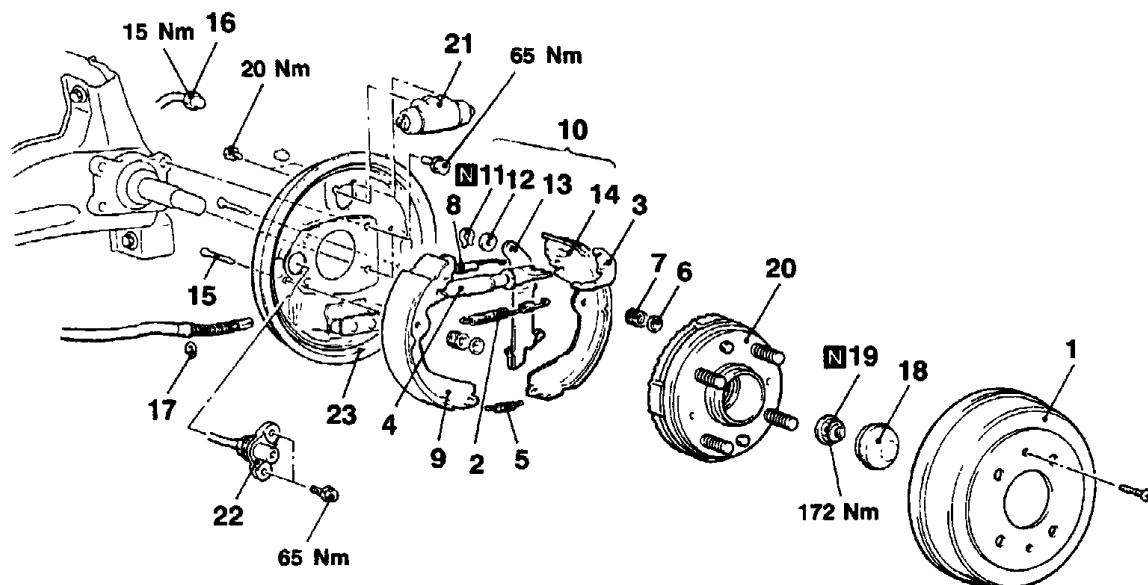
REMOVAL AND INSTALLATION

Pre-removal Operation

- Loosening the Parking Brake Cable Adjusting Nut.
- Brake Fluid Draining

Post-installation Operation

- Brake Line Bleeding
- Parking Brake Lever Stroke Adjustment



A14M0055

Rear drum brake removal steps

1. Brake drum
2. Shoe-to-lever spring
3. Adjuster lever
4. Auto adjuster assembly
5. Retainer spring
6. Shoe hold-down cup
7. Shoe hold-down spring
8. Shoe-to-shoe spring
9. Shoe and lining assembly
10. Shoe, lining and lever assembly
11. Retainer
12. Wave washer
13. Parking lever
14. Shoe and lining assembly
15. Shoe hold-down pin
16. Brake pipe connection
17. Snap ring
18. Hub cap
19. Flange nut
20. Rear hub and rotor assembly
21. Wheel cylinder
22. Speed sensor
23. Backing plate

Wheel cylinder removal steps

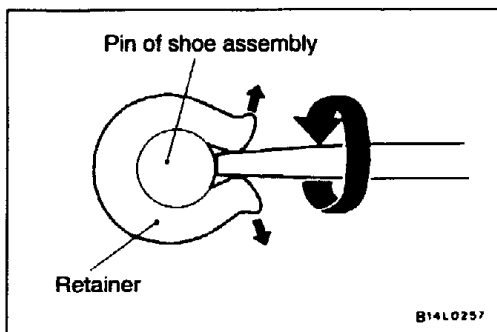
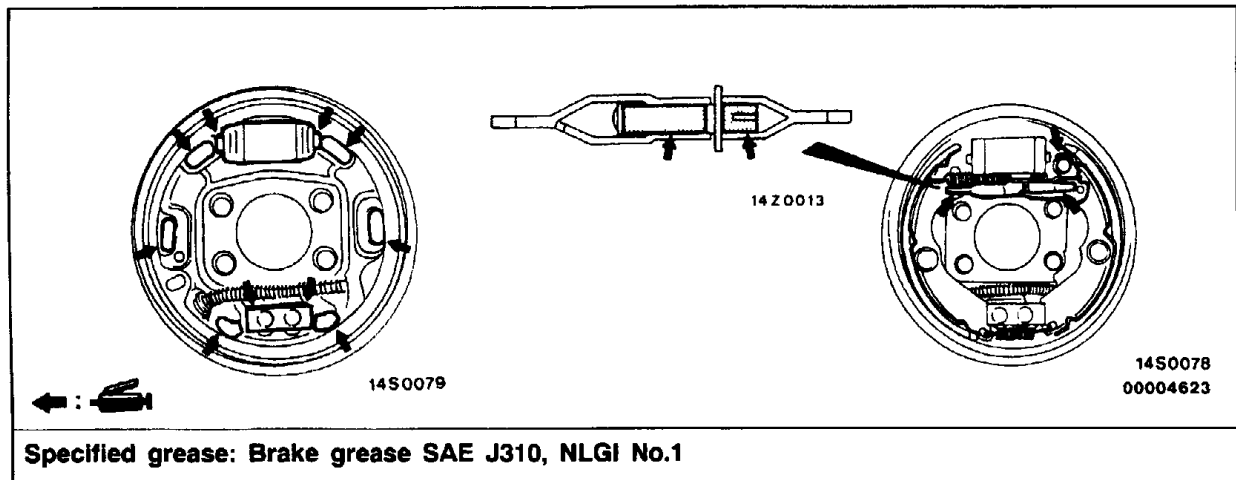
1. Brake drum
2. Shoe-to-lever spring
8. Shoe-to-shoe spring
16. Brake pipe connection
21. Wheel cylinder

Caution

1. Be careful when handling the pole piece at the tip of the speed sensor and the toothed edge of the rotor so as not to damage them by striking against other parts.
2. When removing the rear hub assembly, the wheel bearing inner race may be left at the spindle side. In this case, always replace the rear hub assembly, otherwise the hub will damage the oil seal, causing oil leaks or excessive play.



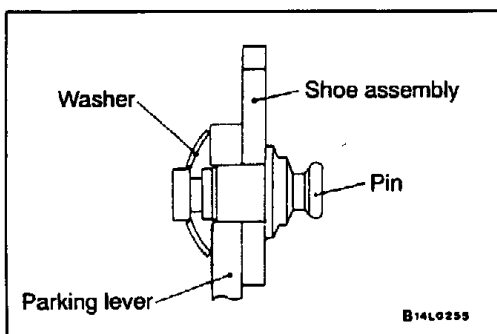
LUBRICATION POINTS



REMOVAL SERVICE POINT

◀A▶ RETAINER REMOVAL

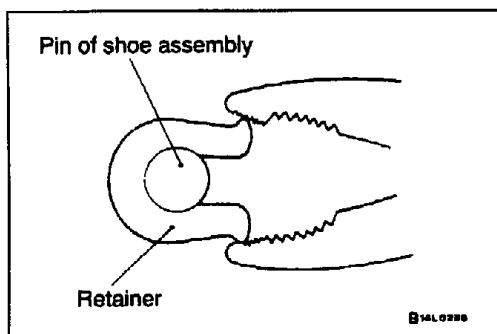
Use a flat-tipped screwdriver or the like to open up the retainer joint, and remove retainer.



INSTALLATION SERVICE POINTS

▶A◀ WAVE WASHER INSTALLATION

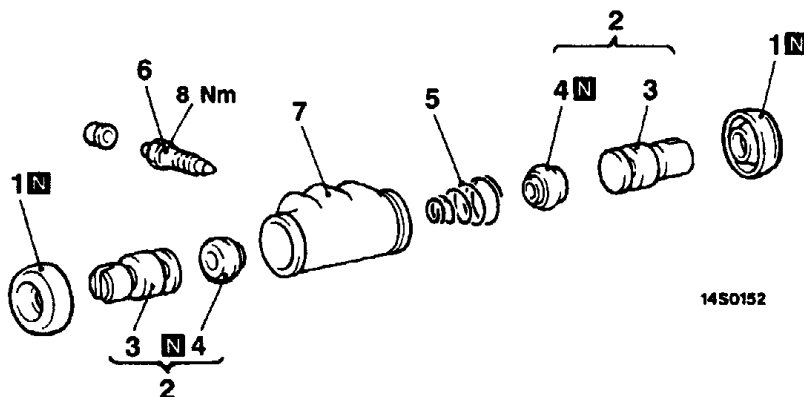
Install the washer in the direction shown in the illustration.



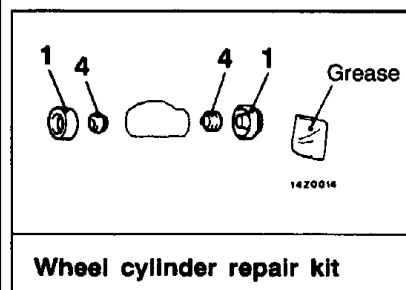
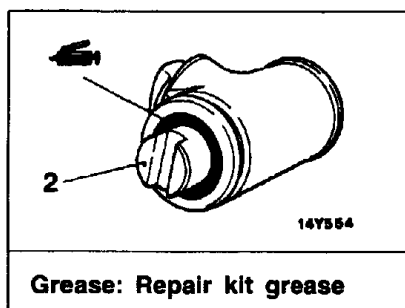
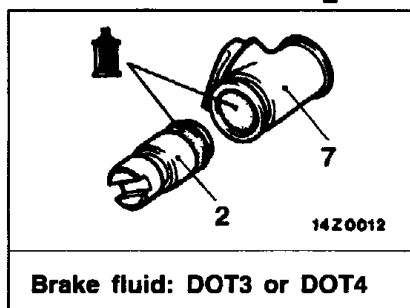
▶B◀ RETAINER INSTALLATION

Use pliers or the like to install the retainer or the pin positively.

WHEEL CYLINDER DISASSEMBLY AND REASSEMBLY



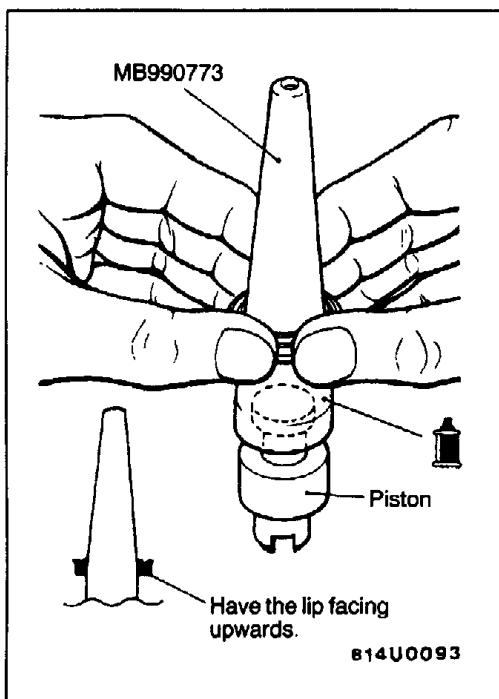
00003584



Disassembly steps

1. Boots
2. Piston assembly
3. Pistons
4. Piston cups

5. Spring
6. Bleeder
7. Wheel cylinder body



REASSEMBLY SERVICE POINT

►A◄ PISTON CUP/PISTON REASSEMBLY

- (1) Use alcohol or specified brake fluid to clean the wheel cylinder and the piston.
- (2) Apply the specified brake fluid to the piston cups and the special tool.

Specified brake fluid: DOT3 or DOT4

- (3) Set the piston cup on the special tool with the lip of the cup facing up, fit the cup onto the special tool, and then slide it down the outside of the tool into the piston groove.

Caution

In order to keep the piston cup from becoming twisted or slanted, slide the piston cup down the tool slowly and carefully, without stopping.

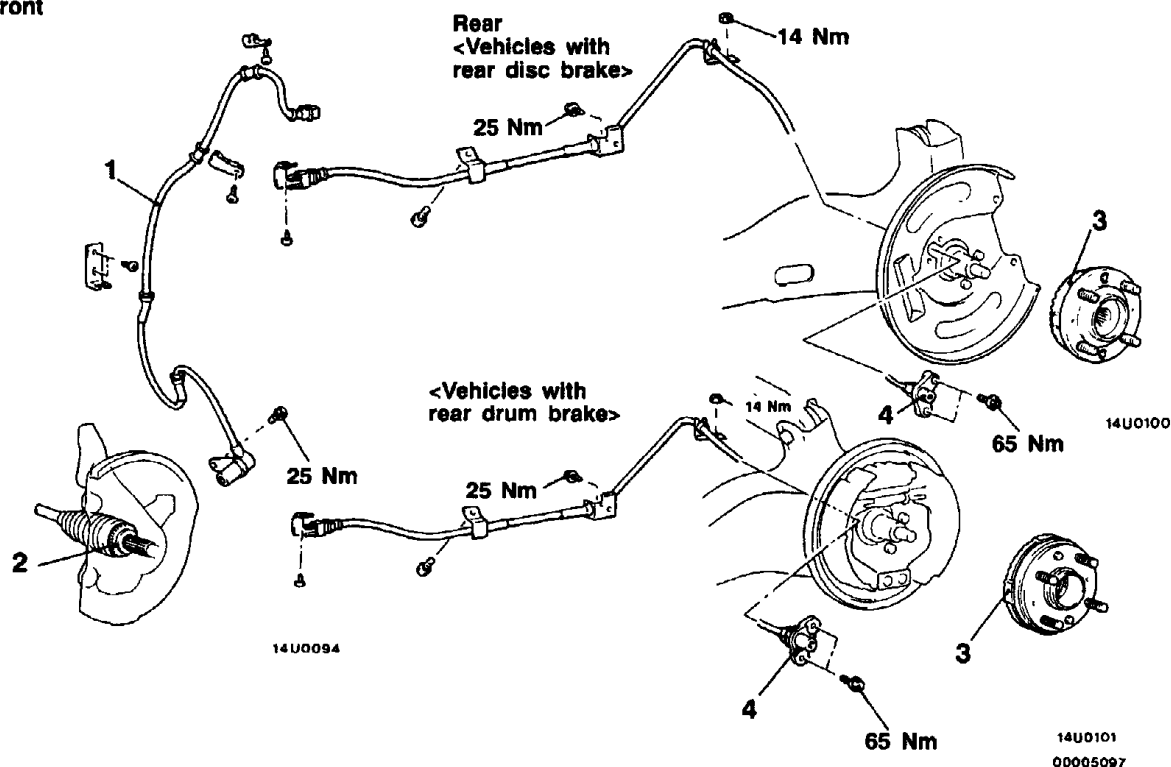
WHEEL SPEED SENSOR

REMOVAL AND INSTALLATION

Post-installation Operation

- Wheel Speed Sensor Output Voltage Check

Front



Front speed sensor removal steps

1. Front speed sensor
2. Front rotor
(Refer to Basic Manual.)

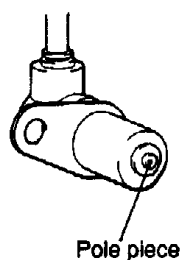
Rear speed sensor removal steps

3. Rear rotor
(Refer to GROUP 27 - Rear Axle Hub.)

4. Rear speed sensor

NOTE

The front rotor is integrated with the drive shaft and is not disassembled.



REMOVAL SERVICE POINT

FRONT SPEED SENSOR/REAR SPEED SENSOR REMOVAL

Caution

Be careful when handling the pole piece at the tip of the speed sensor and the toothed edge of the rotor so as not to damage them by striking against other parts.

INSPECTION

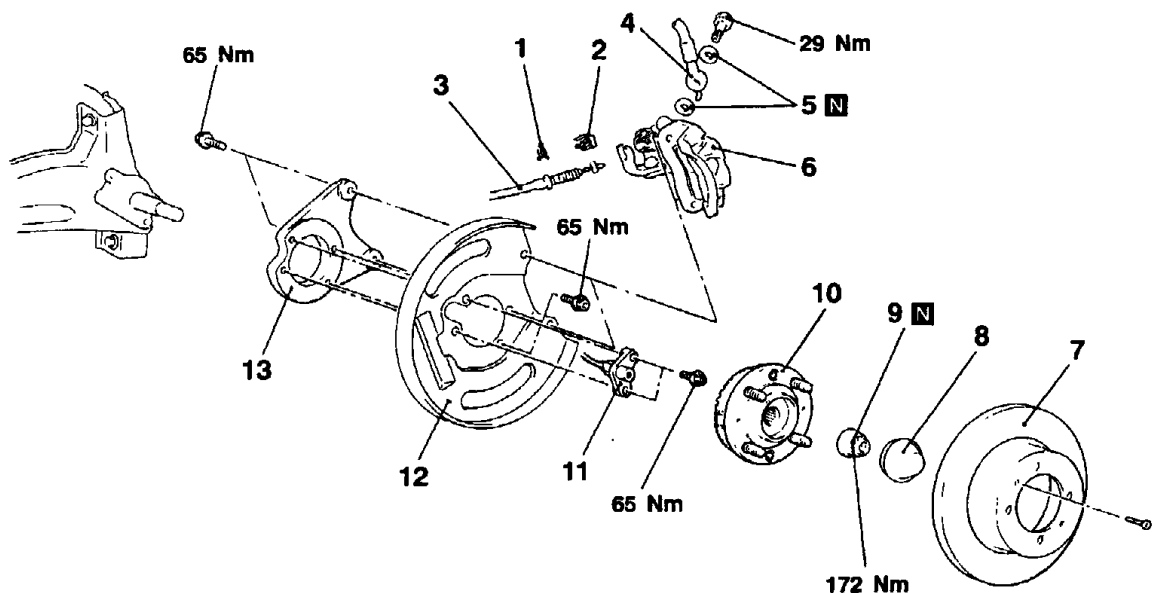
Check the piston and wheel cylinder walls for rust or damage, and if there is any abnormality, replace the entire wheel cylinder assembly.

REAR DISC BRAKE**REMOVAL AND INSTALLATION****Pre-removal Operation**

- Brake Fluid Draining

Post-installation Operation

- Brake Fluid Supplying
- Brake Line Bleeding



A14M0081

Removal steps

1. Clip
2. Retainer spring
3. Parking brake cable connection
4. Brake hose connection
5. Gasket
6. Disc brake assembly
7. Brake disc
8. Hub cap



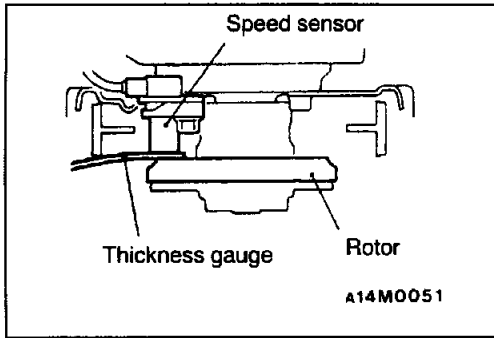
9. Self locking nut
10. Rear hub and rotor assembly
11. Rear speed sensor
12. Dust shield
13. Disc brake adapter

NOTE

For service point, refer to Basic Manual.

DISASSEMBLY AND REASSEMBLY

Refer to Basic Manual.



INSTALLATION SERVICE POINT

►A◄ REAR SPEED SENSOR INSTALLATION

Caution

Be careful that the pole piece at the end of the speed sensor and the rotor teeth do not become damaged by striking them against the metal parts.

Insert a thickness gauge into the space between the speed sensor's pole piece and the rotor's toothed surface, and check the clearance is the standard value all around.

Standard value: 0.1 - 1.9 mm

INSPECTION

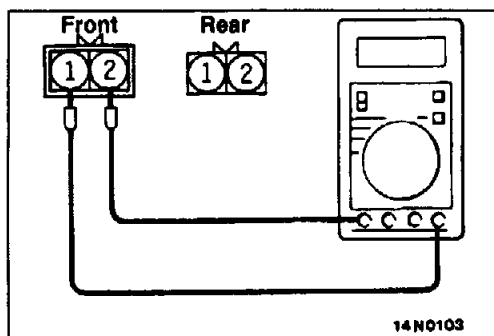
SPEED SENSOR

- (1) Check whether any metallic foreign material has adhered to the pole piece at the speed sensor tip, and if so, remove it.

Also check whether the pole piece is damaged, and if so, replace it with a new one.

NOTE

The pole piece can become magnetized because of the magnet built in the speed sensor, with the result that metallic foreign material easily adheres to it. Moreover, the pole piece may not be able to function to correctly sense the wheel rotation speed if it is damaged.



- (2) Measure the resistance between the speed sensor terminals.

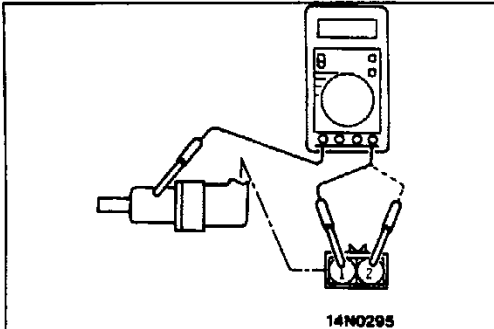
Standard value: 1.28 - 1.92 k Ω

If the internal resistance of the speed sensor is not within the standard value, replace with a new speed sensor.

- (3) Check the speed sensor cable for breakage, damage or disconnection; replace with a new one if a problem is found.

NOTE

When checking for cable damage, remove the cable clamp part from the body and then bend and pull the cable near the clamp to check whether or not temporary disconnection occurs.

**SPEED SENSOR INSULATION INSPECTION**

- (1) Remove all connections from the speed sensor, and then measure the resistance between terminals (1) and (2) and the body of the speed sensor.

Standard value: 100 k Ω or more

- (2) If the speed sensor insulation resistance is outside the standard value range, replace with a new speed sensor.

TOOTHED ROTOR

Check whether rotor teeth are broken or deformed, and, if so, replace the rotor.

GROUP 37A

STEERING

GENERAL

OUTLINE OF CHANGES

- The following service procedures have been added to the addition of the diesel-powered vehicle.
Applicable models: 1900D
 - Removal and installation of the power steering oil pump
 - Removal and installation of the power steering hoses

POWER STEERING OIL PUMP

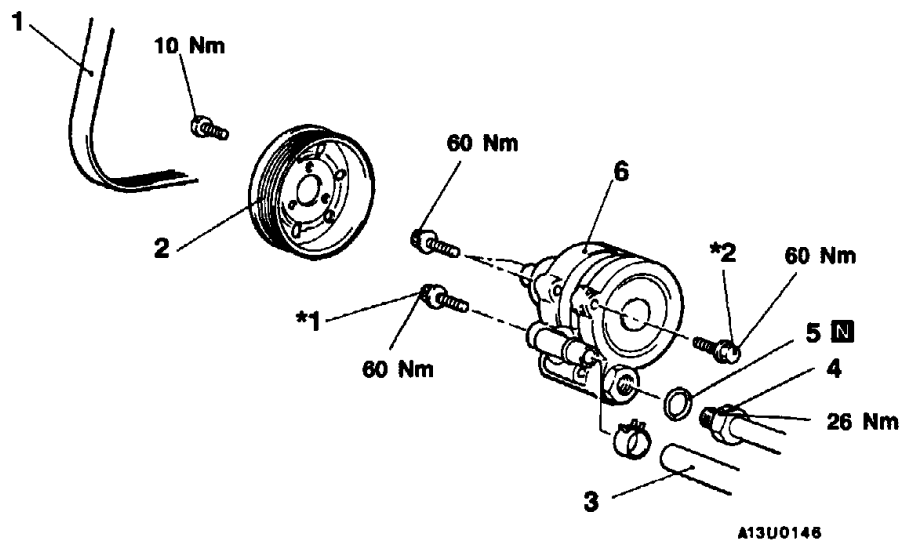
REMOVAL AND INSTALLATION

Pre-removal Operation

- Power Steering Fluid Draining
- Timing Belt Lower Cover Removal (Refer to GROUP 11 – Crankshaft Pulley.)

Post-Installation Operation

- Power Steering Fluid Supplying
- Drive-belt Tension Adjusting
- Power Steering Fluid Line Bleeding
- Oil Pump Pressure Check
- Timing Belt Lower Cover Installation (Refer to GROUP 11 – Crankshaft Pulley.)



Removal steps

- Drive belt
- Power steering pump pulley
- Suction hose connection
- Pressure hose connection
- O-ring

6. Oil pump

NOTE

- *1: Vehicles with A/C
*2: Vehicles without A/C

INSPECTION

Check the drive-belt for cracks.
Check the pulley assembly for uneven rotation.

POWER STEERING HOSES

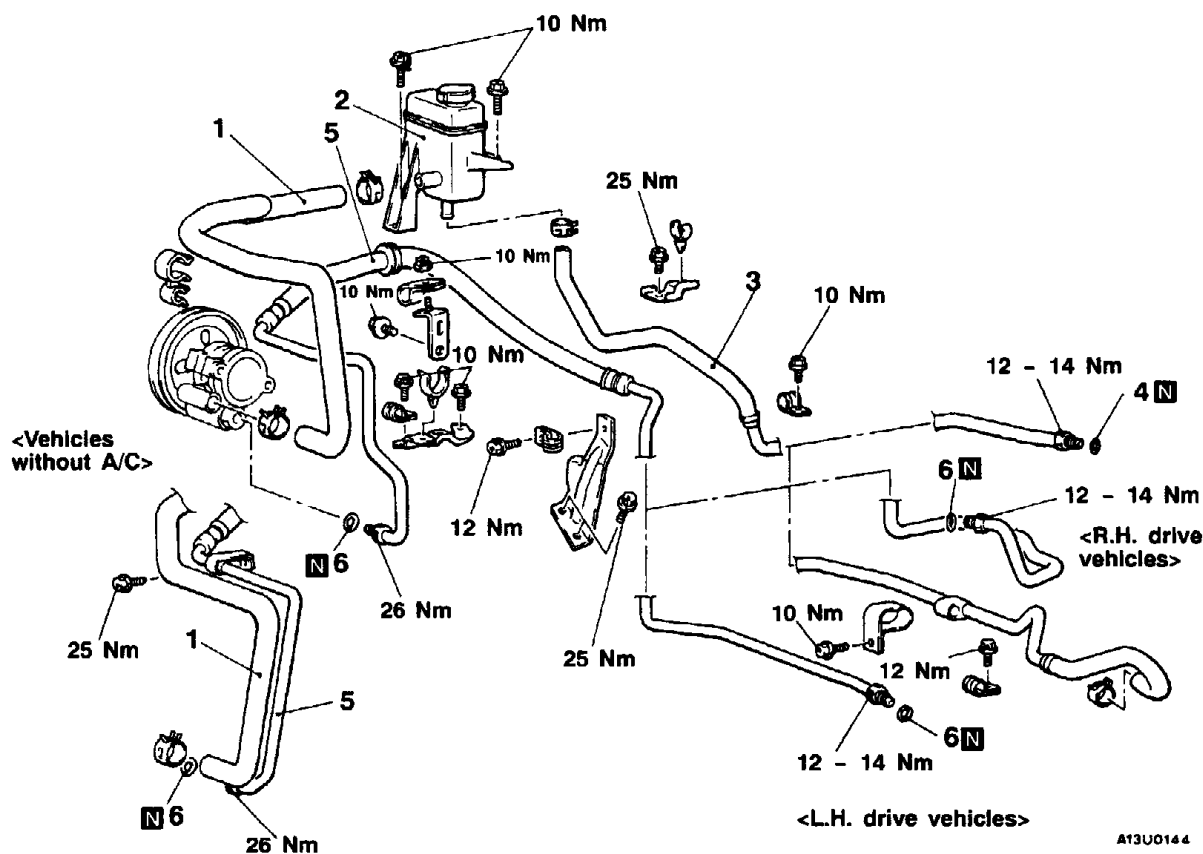
REMOVAL AND INSTALLATION

Pre-removal Operation

- Power Steering Fluid Draining

Post-installation Operation

- Power Steering Fluid Supplying
- Power Steering Fluid Line Bleeding

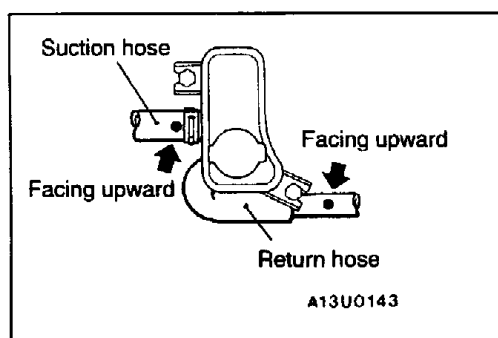


A13U0144

Removal steps

- ▶A◀ 1. Suction hose
- ▶A◀ 2. Oil reservoir
- ▶A◀ 3. Return hose

- 4. O-ring
- 5. Pressure hose
- 6. O-ring



A13U0143

INSTALLATION SERVICE POINT**▶A◀ RETURN HOSE/SUCTION HOSE INSTALLATION**

Connect the hose so that the marking is facing upwards.

GROUP 42

BODY

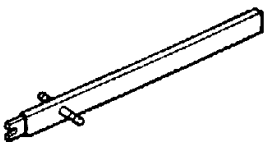
GENERAL

OUTLINE OF CHANGES

- The following service procedures have been added to correspond to the addition of the 4-door sedan.
Applicable models: 4-door sedan
 1. Removal and installation of the trunk lid
 2. Removal and installation of the trunk lid latch
 3. Removal and installation of the rear window glass
- The service procedure for the tailgate trim has been changed to correspond to the change of the pull-down strap assembly.
Applicable models: 4-door hatchback
- The service procedure for the keyless entry receiver-ECU has been changed, because the location of the keyless entry receiver-ECU has been changed.
Applicable models: Vehicles with keyless entry system

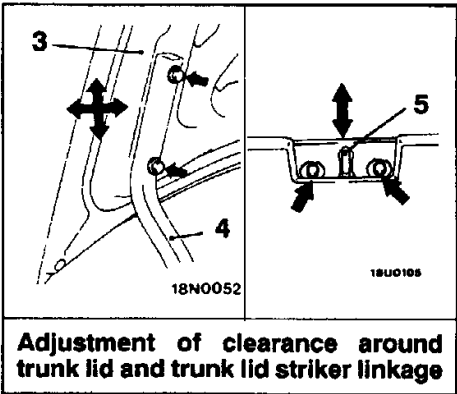
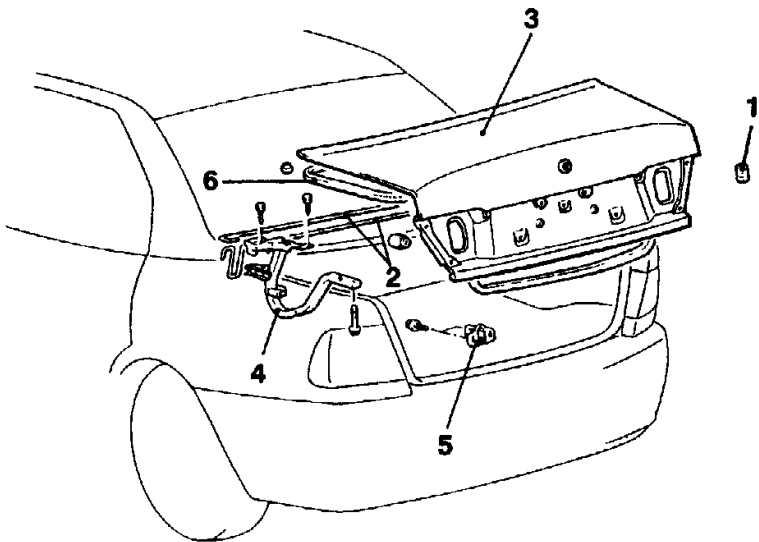
TRUNK LID

SPECIAL TOOL

Tool	Number	Name	Use
	MB991244	Torsion bar remover and installer	Removal and installation of trunk lid torsion bar

TRUNK LID

REMOVAL AND INSTALLATION



18U0442
00005098

Trunk lid panel removal steps

- Licence plate lamp
 - Rear lid lamp
 - Rear panel garnish
1. Bumper
2. Trunk lid torsion bar
3. Trunk lid panel



Trunk lid hinge removal steps

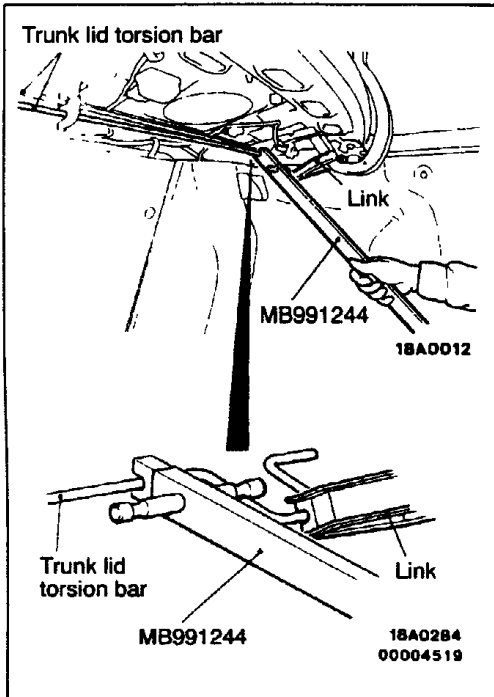
- Rear shelf trim (Refer to GROUP 52A.)
3. Trunk lid panel assembly
4. Trunk lid hinge

Trunk lid striker removal steps

- Rear end trim (Refer to GROUP 52A.)
5. Trunk lid striker

Trunk lid weatherstrip removal

6. Trunk lid weatherstrip



REMOVAL SERVICE POINT

◀A▶ TRUNK LID TORSION BAR REMOVAL

1. Disconnect the body harness and the harness connector of the rear shelf lower panel.
2. Install the special tool as shown in the illustration, and then remove the torsion bar from the link while pushing the special tool downwards. Next, repeat the procedure from the other side.

Caution

Be sure to attach the special tool properly, as the body or parts could be damaged when the torsion bar is removed from the special tool.

INSTALLATION SERVICE POINTS

▶A◀ TRUNK LID WEATHER STRIP INSTALLATION

Install the trunk lid weatherstrip so that the marking and the joint are aligned with the body centre line.

▶B◀ TRUNK LID TORSION BAR INSTALLATION

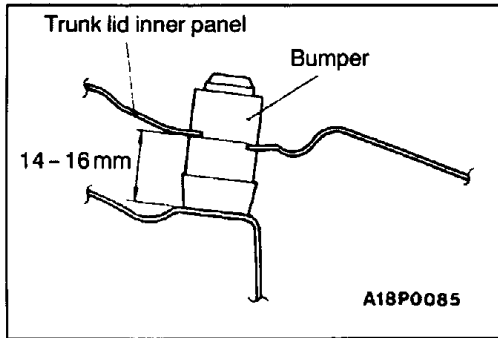
1. Check the colour of the identification mark at the middle of the torsion bars to make sure that the correct torsion bars are being used.

Torsion bar	Identification colour	
	Vehicles without rear spoiler	Vehicles with rear spoiler
L.H.	–	Blue
R.H.	White	Red

2. Insert the end of the torsion bar through the link side mating hole.
3. Install the special tool in the same way as when removing the torsion bar, and then twist the torsion bar while hooking it onto the link. After this, hook the torsion bar onto the holder.

Caution

Be sure to attach the special tool properly, as the body or parts could be damaged when the torsion bar is removed from the special tool.

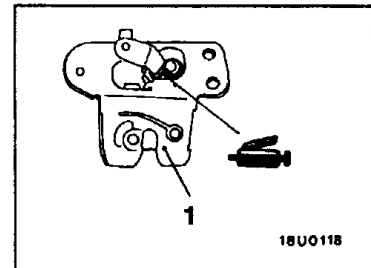
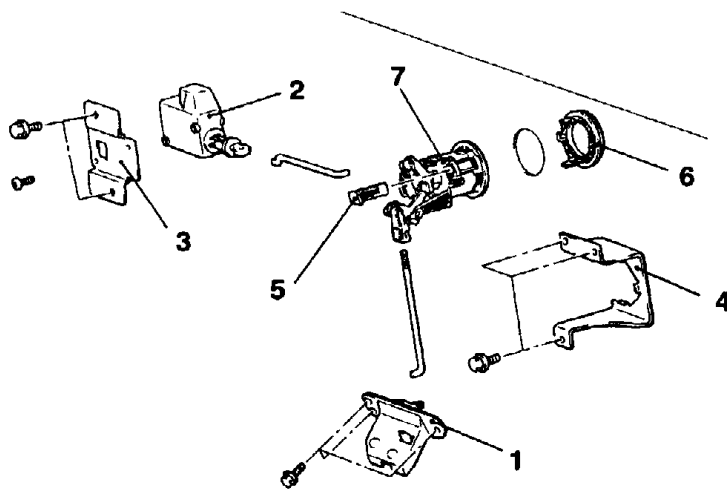


►C◄ BUMPER INSTALLATION

Install the bumper as shown in the figure.

TRUNK LID LATCH

REMOVAL AND INSTALLATION



18U0449

00005099

Removal steps

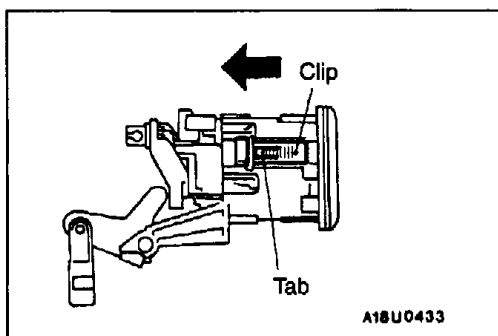
1. Trunk lid latch
2. Trunk lid lock actuator
3. Trunk lid lock actuator bracket
4. Trunk lid lock cylinder support bracket
5. Clip
6. Trunk lid cylinder cap
7. Trunk lid lock cylinder

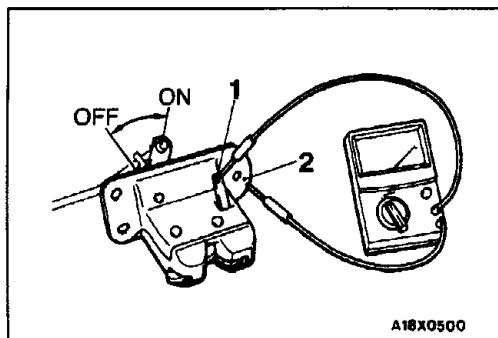


REMOVAL SERVICE POINT

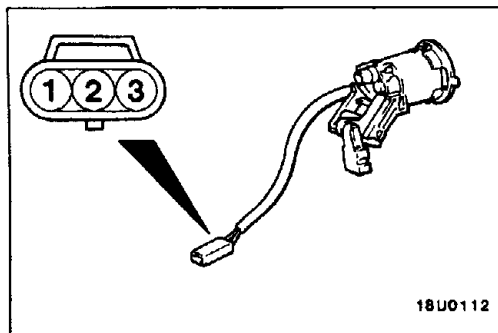
◄A► CLIP/TRUNK LID CYLINDER CAP REMOVAL

1. Press the tab of the clip to slide it in the direction shown. Then remove the clip.
2. Rotate the trunk lid cylinder cap clockwise until it stops. Then remove the cap.

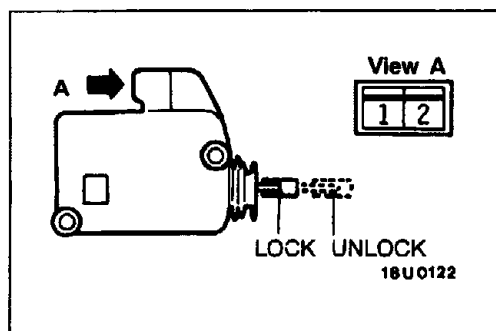


**INSPECTION****TRUNK LID SWITCH CONTINUITY CHECK**

Switch position	Terminal No.	
	1	2
ON (Latch open)		
OFF (Latch shut)		

**TRUNK LID LOCK KEY CYLINDER SWITCH CONTINUITY CHECK**

Switch position	Terminal No.		
	1	2	3
LOCK			
Neutral (OFF)			
UNLOCK			

**TRUNK LID LOCK ACTUATOR CHECK**

Rod position	Terminal No.		Rod operation
	1	2	
LOCK			LOCK position → UNLOCK position
UNLOCK			UNLOCK position → LOCK position

WINDOW GLASS**ADHESIVES**

Items	Specified adhesives
Rear window glass	3M ATD Part No. 8609 Super Fast Urethane Auto Glass Sealants or equivalent

SPECIAL TOOLS

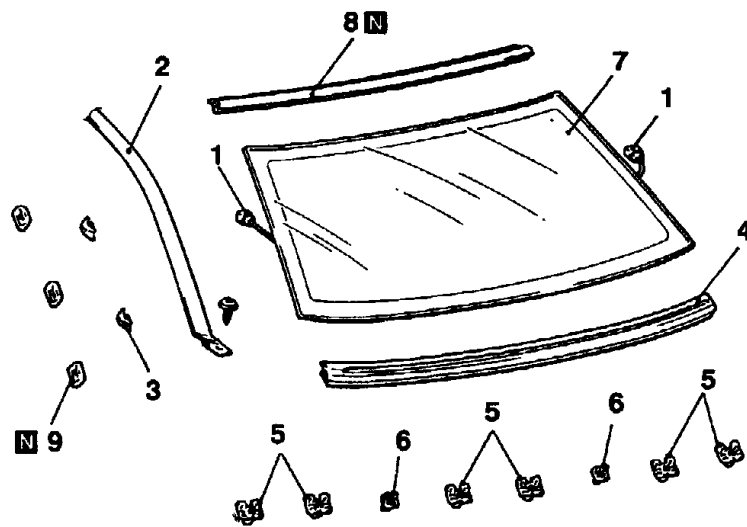
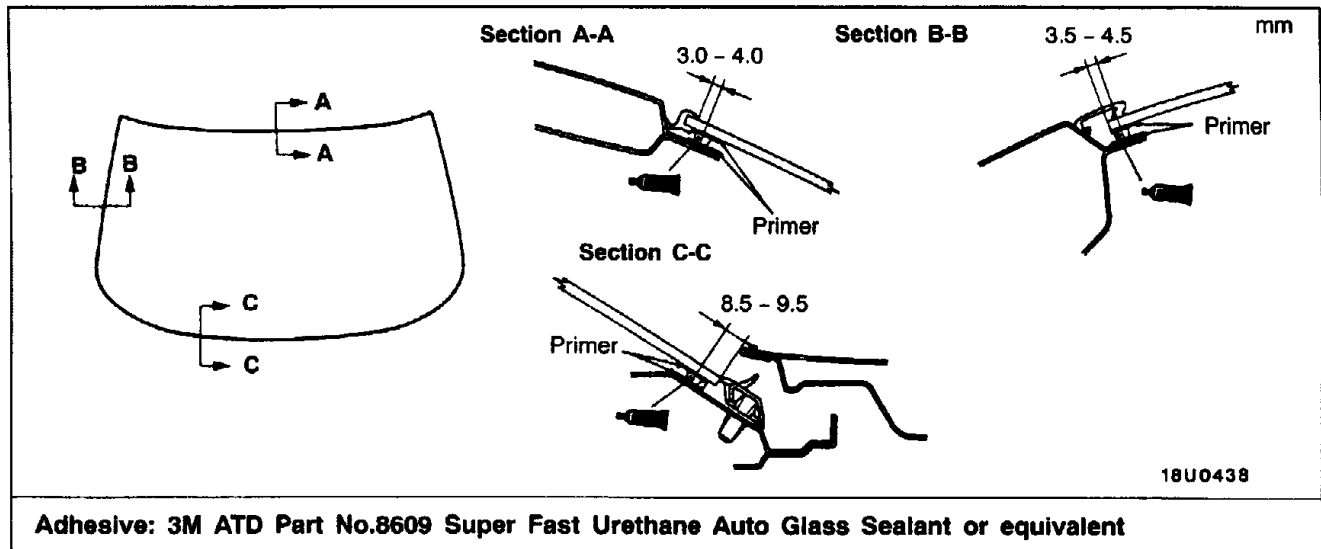
Tool	Number	Name	Use
	MB990449	Window moulding remover	Removal of roof drip moulding and rear window lower moulding

REAR WINDOW GLASS

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation

- | | |
|---|---|
| (1) High Mounted Stop Lamp Removal and Installation
(Refer to GROUP 54.) | (3) Headlining Removal and Installation |
| (2) Rear Pillar Trim Removal and Installation (Refer to
GROUP 52A.) | |



00005 100

Removal steps

◀A▶

1. Harness connector
2. Roof drip moulding

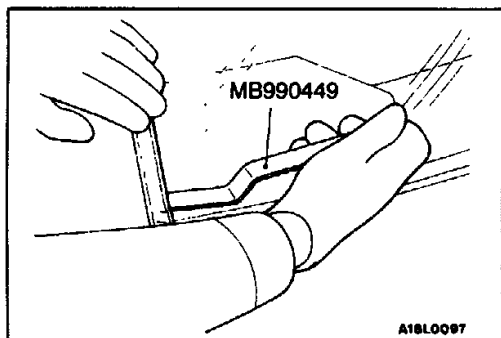
◀A▶

3. Clip
4. Rear window lower moulding
5. Grommet clip

◀B▶ ▶A▶

▶A▶

6. Rear window spacer
7. Rear window glass
8. Rear window upper moulding
9. Clip



REMOVAL SERVICE POINTS

◀A▶ ROOF DRIP MOULDING/ REAR WINDOW LOWER MOULDING REMOVAL

Use the special tool to lever out the moulding.

Caution

If the moulding has become warped, it should not be reused.

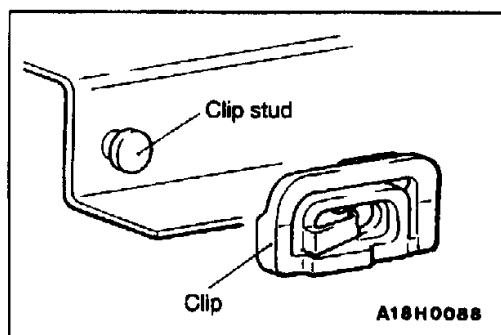
◀B▶ REAR WINDOW GLASS REMOVAL

Remove the rear window glass by the same procedure as for the windshield. (Refer to Basic Manual.)

INSTALLATION SERVICE POINT

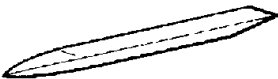
▶A◀ CLIP/REAR WINDOW GLASS INSTALLATION

1. Use isopropyl alcohol to degrease the inside and outside edges of the rear window glass and the surface of the body flange.
2. Place the clips onto the clip studs.
3. Apply primer and adhesive. (Refer to P.42-6.)
4. Install the glass in the same way as for the windshield. (Refer to Basic Manual.)



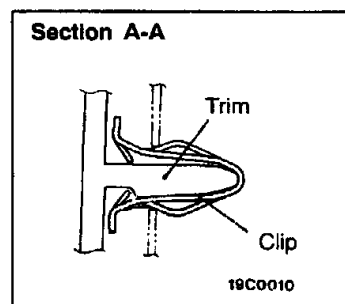
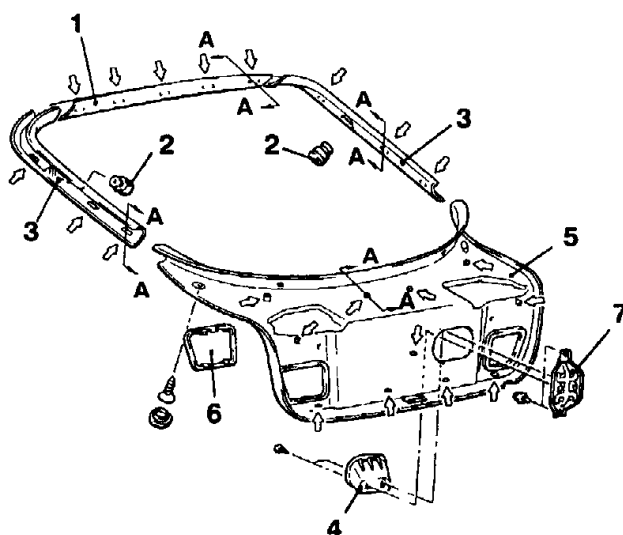
TAILGATE

SPECIAL TOOL

Tool	Number	Name	Use
	MB990784	Ornament remover	Removal of the tailgate trim

TAILGATE TRIM

REMOVAL AND INSTALLATION



18U0448

00005101

NOTE

↔ : metal clip position

Removal steps

1. Tailgate upper trim
2. Tailgate trim hook
3. Tailgate side trim

4. Tailgate grip box
5. Tailgate lower trim
6. Lid
7. Tailgate grip bracket

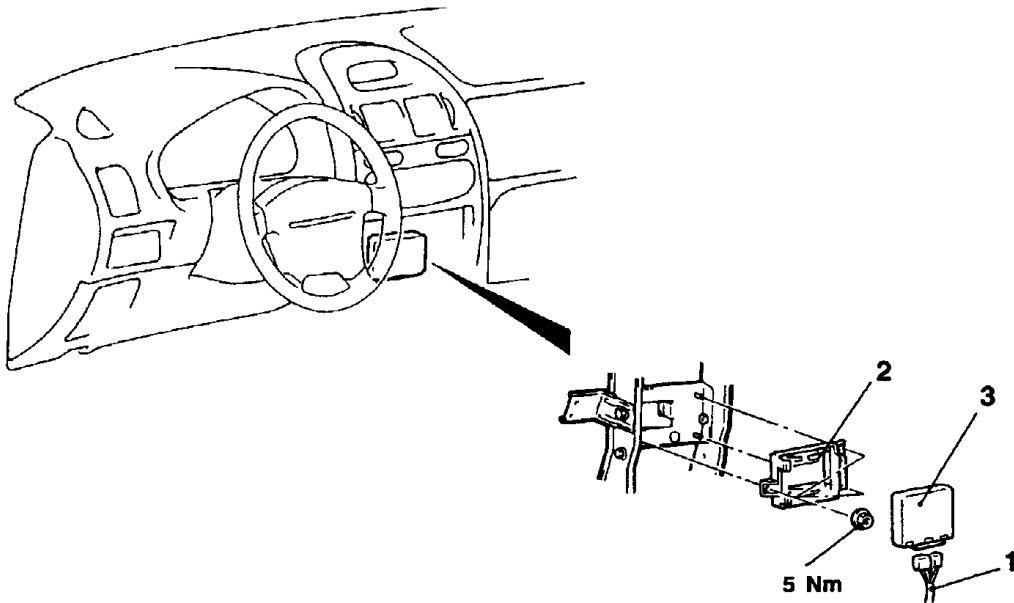
KEYLESS ENTRY SYSTEM

KEYLESS ENTRY RECEIVER-ECU

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation

- Front Floor Console Assembly Removal and Installation



A18U0443

Removal steps

1. Harness connector
2. Keyless entry receiver bracket
3. Keyless entry receiver-ECU

GROUP 51

EXTERIOR

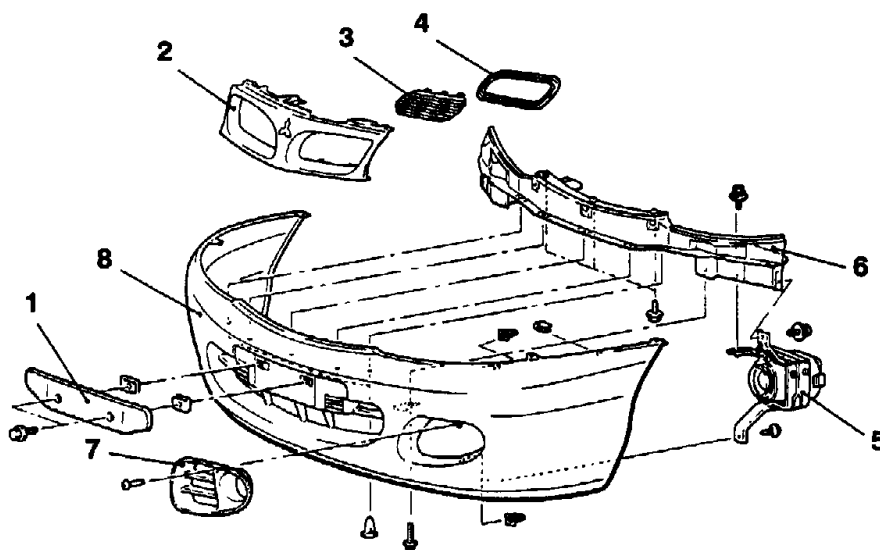
GENERAL

OUTLINE OF CHANGES

- The service procedure for the front bumper has been added to correspond to the use of the licence plate bracket.
Applicable models: 1900D
- The following procedure has been added to correspond to the addition of the 4-door sedan.
Applicable models: 4-door sedan
 1. Removal and installation of the drip moulding
 2. Removal and installation of the marks
- The following procedure has been added to correspond to the use of the rear spoiler.
Applicable models: 4-door sedan <1800-DOHC>
- The grade marks have been added to correspond to the addition of the diesel-powered vehicle.
Applicable models: 4-door hatchback <1900D>

FRONT BUMPER

DISASSEMBLY AND REASSEMBLY



A18U0444

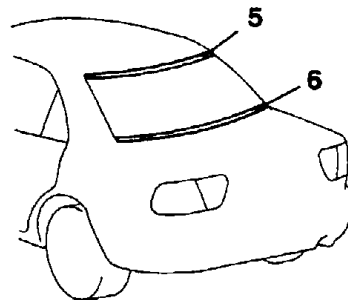
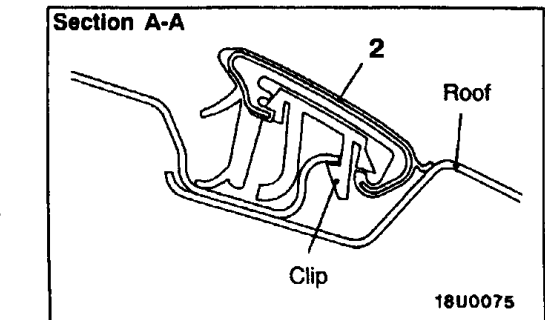
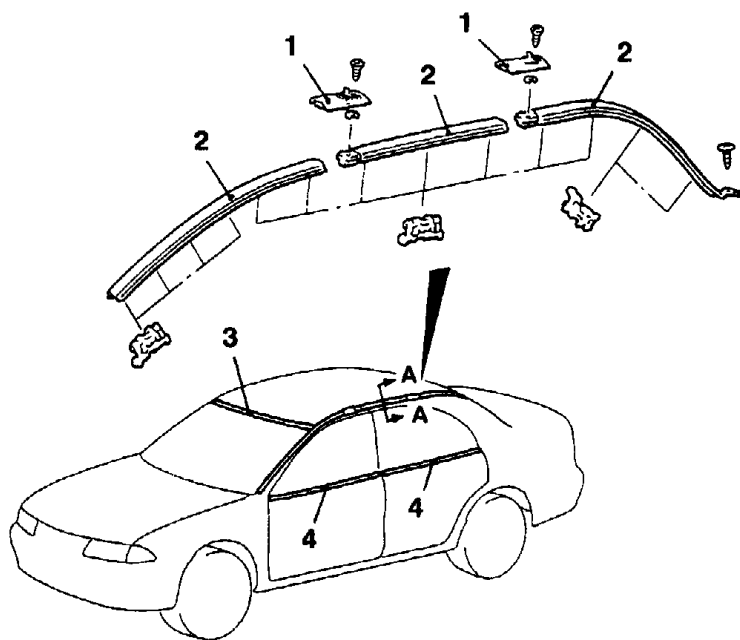
Disassembly steps

1. Licence plate bracket
2. Radiator grille, outer
3. Radiator grille, inner
4. Radiator grille cover
5. Front fog lamp
6. Bumper reinforcement

7. Fog lamp cover
8. Bumper face

NOTE

For removal and installation of the bumper assembly, refer to the basic manual.

MOULDINGS**REMOVAL AND INSTALLATION**

18U0446
00005102



1. Roof carrier caps
2. Roof drip moulding
3. Windshield upper moulding
4. Belt line moulding
5. Rear window upper moulding
(Refer to GROUP 42 - Window Glass.)

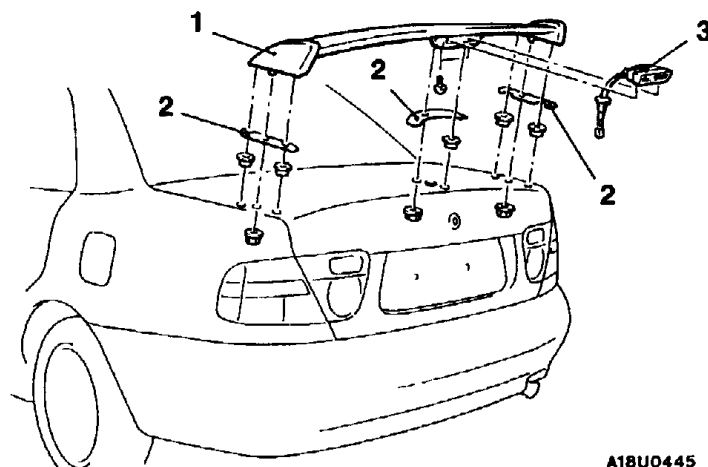
6. Rear window lower moulding
(Refer to GROUP 42 - Window Glass.)

NOTE

For service point, refer to Basic Manual.

AERO PARTS**REMOVAL AND INSTALLATION**

<Rear spoiler>



A18U0445

Removal steps

1. Rear spoiler
2. Packing

3. High mounted stop lamp assembly

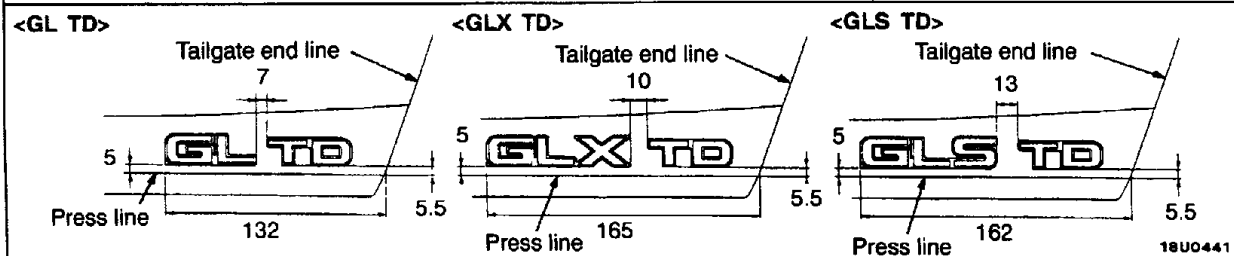
MARKS

REMOVAL AND INSTALLATION

HATCHBACK

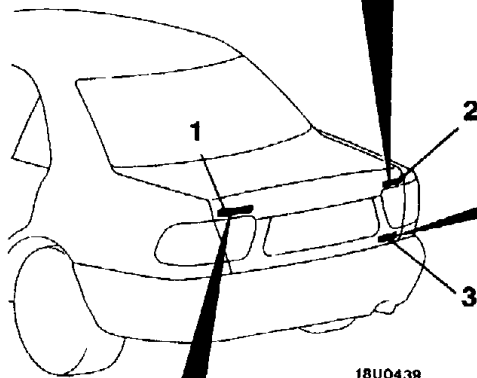
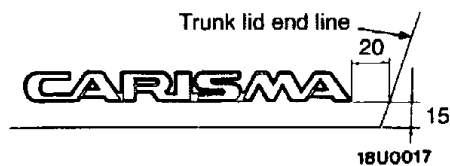
Unit: mm

GRADE MARK

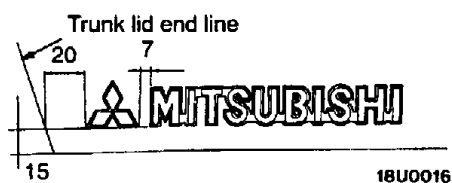


SEDAN

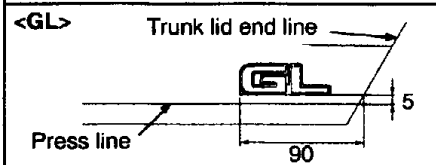
CARISMA MARK



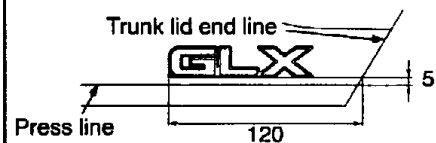
MITSUBISHI MARK



GRADE MARK

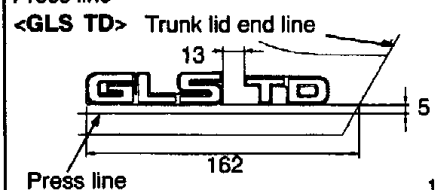
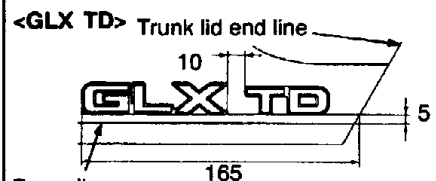
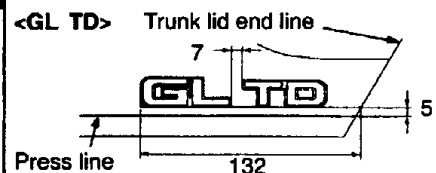


<GLX, GLS, MSX>



NOTE

The installation dimensions of GLS and MSX are the same as GLX.



1. MITSUBISHI MARK
2. CARISMA MARK
3. GRADE MARK

GROUP 52A INTERIOR

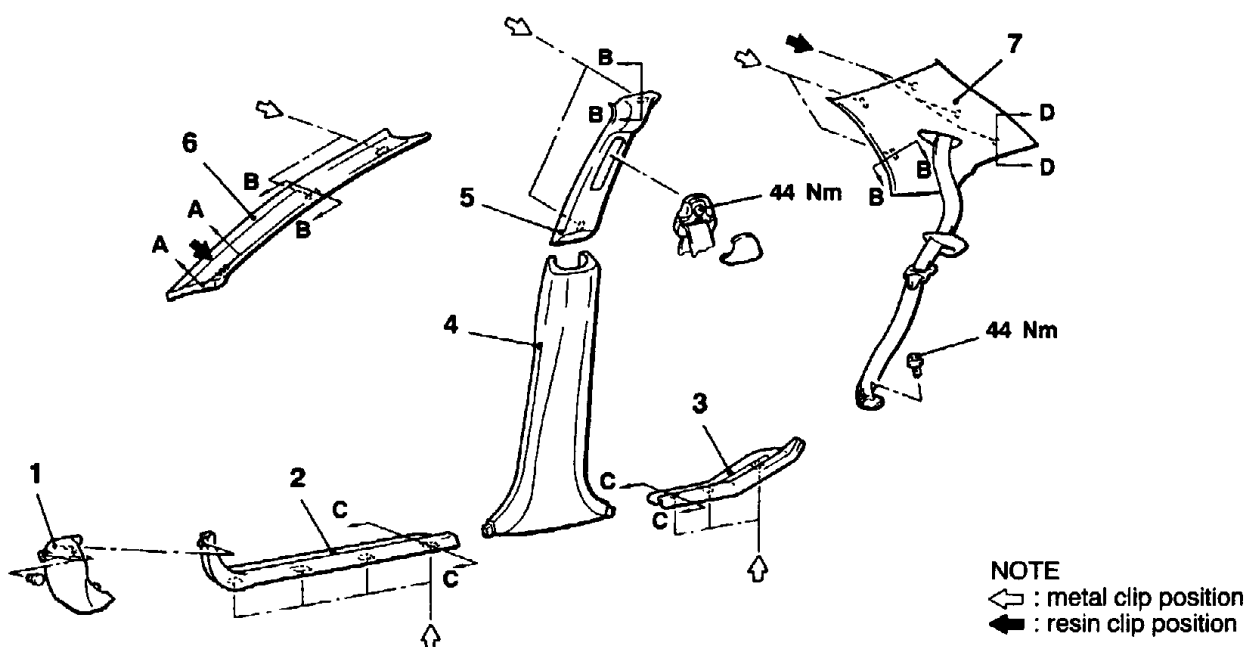
GENERAL

OUTLINE OF CHANGES

- The following service procedures have been added to correspond to the addition of the 4-door sedan.
Applicable models: 4-door sedan
 - Removal and installation of the trims
 - Removal and installation of the rear seat

TRIMS

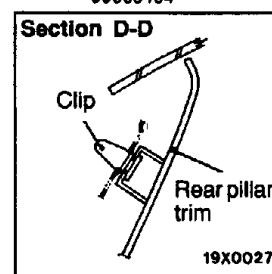
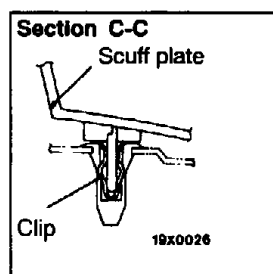
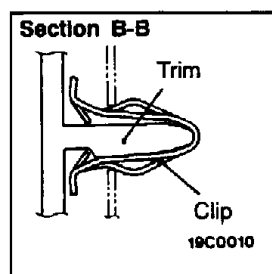
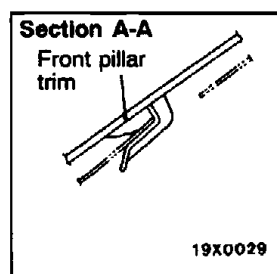
REMOVAL AND INSTALLATION



NOTE
 ⇨ : metal clip position
 ⇦ : resin clip position

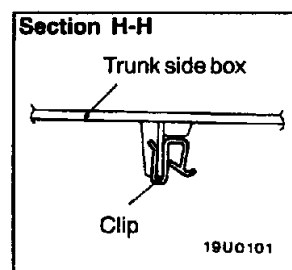
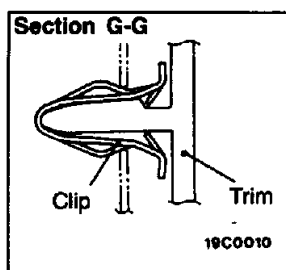
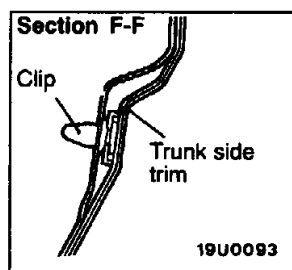
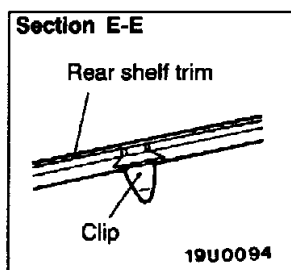
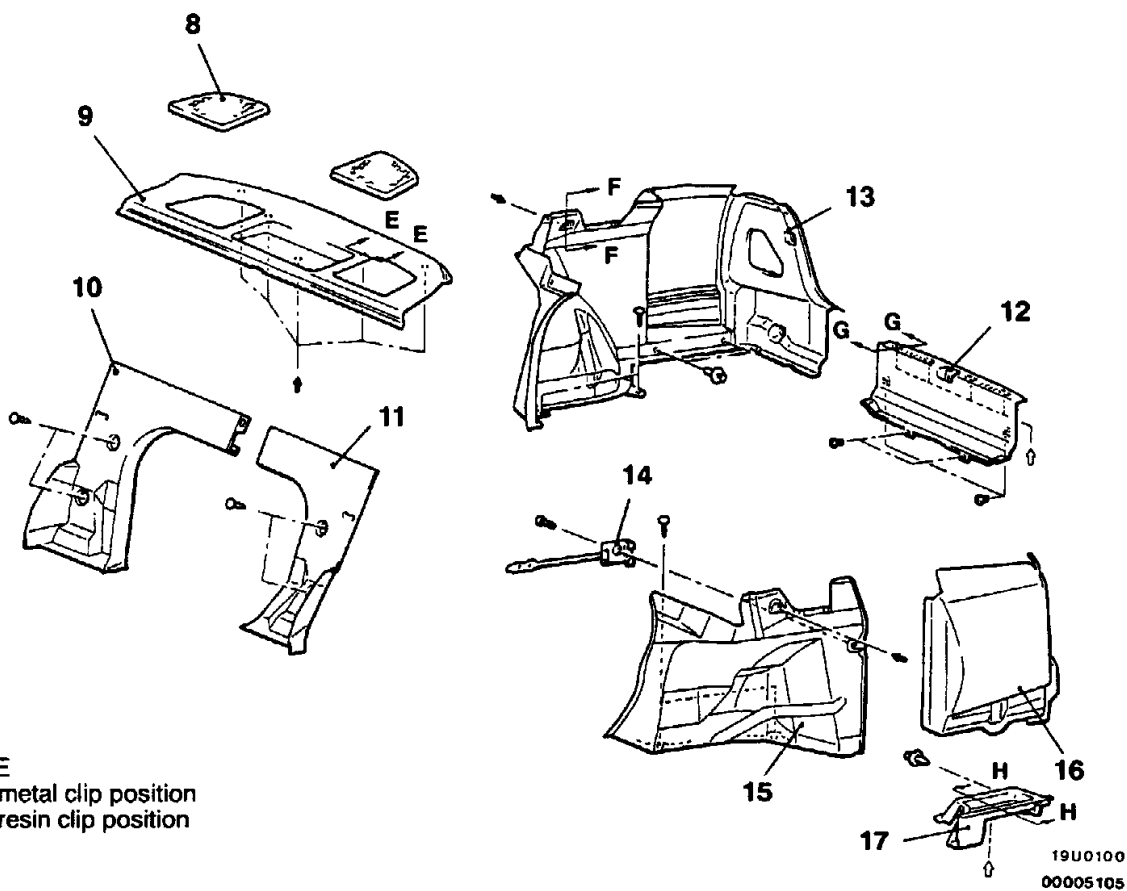
19U0097

00005104



- Cowl side trim
- Front scuff plate
- Rear scuff plate
- Center pillar lower trim

- Center pillar upper trim
- Front pillar trim
- Rear pillar trim



- 8. Rear speaker garnish
- 9. Rear shelf trim
- 10. Shelf front cover (RH) or trunk front trim
- 11. Shelf front cover (LH)
- 12. Rear end trim

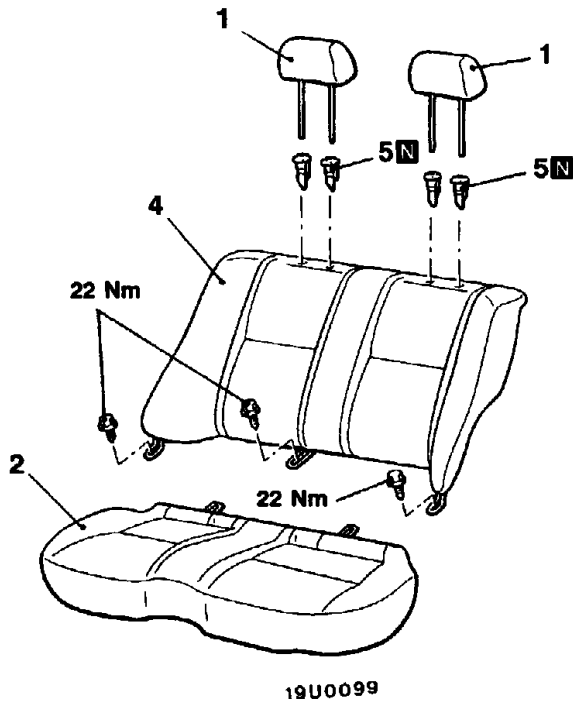
- 13. Trunk side trim (RH)
- 14. Hook assembly
- 15. Trunk side trim (LH)
- 16. Trunk rear trim
- 17. Trunk side box

SEAT

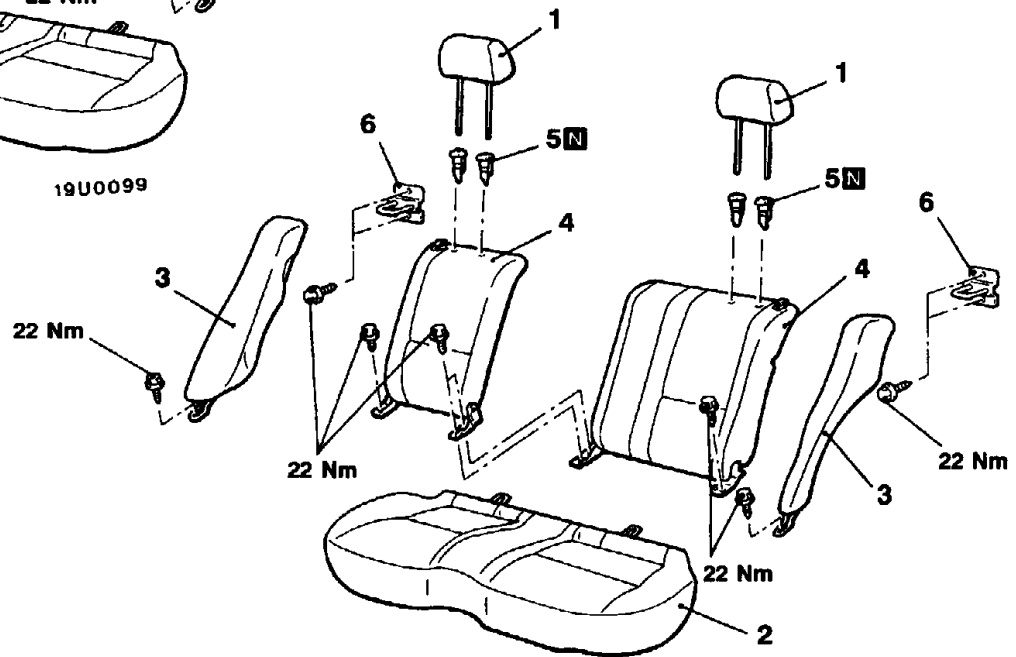
REAR SEAT

REMOVAL AND INSTALLATION

LOW BACK BENCH SEAT



LOW BACK SPLIT SEAT



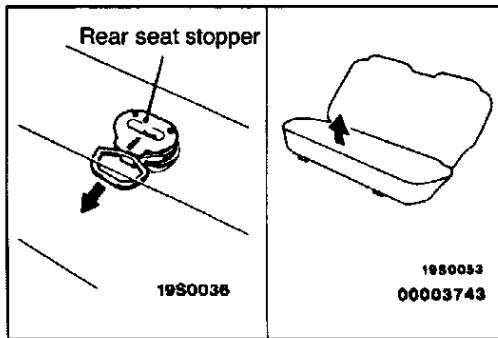
19U0098

00005106

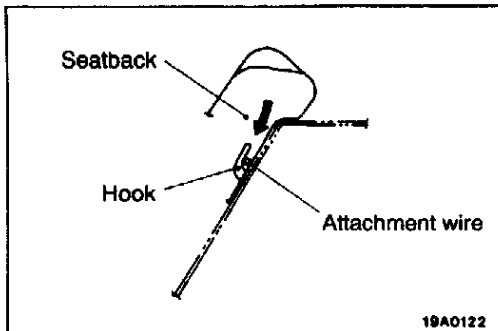
Removal steps

- ◀A▶ ▶B▶
 ▶A▶
 1. Headrest
 2. Seat cushion
 3. Side seatback assembly

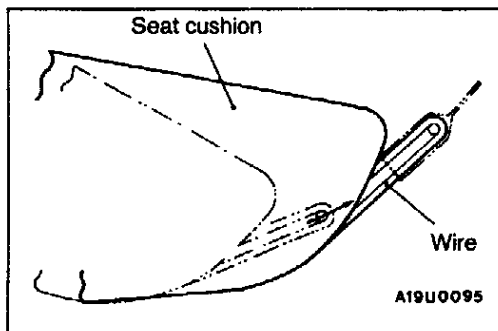
- ▶A▶
 4. Rear seatback assembly
 5. Headrest guide
 6. Rear seat striker

**REMOVAL SERVICE POINT****◀A▶ SEAT CUSHION REMOVAL**

While keeping the rear seat stopper pulled, lift up the seat cushion to remove it.

**INSTALLATION SERVICE POINTS****▶A◀ REAR SEATBACK ASSEMBLY/SIDE SEATBACK ASSEMBLY INSTALLATION**

Push the rear seatback assembly or side seatback assembly in the direction indicated in the illustration; then securely attach the attachment wire to the body side hook and install the rear seatback assembly or side seatback assembly.

**▶B◀ SEAT CUSHION INSTALLATION**

Insert the wire of the seat cushion into the body hole to install the seat cushion.

GROUP 54

CHASSIS ELECTRICAL

GENERAL

OUTLINE OF CHANGES

- The removal service point for the headlamp (L.H.) has been added to correspond to the addition of the diesel-powered vehicle.
Applicable models: 1900D <Vehicles with air conditioner>
- The troubleshooting for the immobilizer system has been added to correspond to the addition of the diesel-powered vehicle.
Applicable models: 1900D
- The following service procedures have been added to correspond to the addition of the 4-door sedan.
 1. Removal and installation of the rear combination lamp and rear lid lamp
 2. Removal and installation of the high-mounted stop lamp
 3. Removal and installation of the rear speakers
- The troubleshooting section has been changed to correspond to the addition of the diagnosis code No.33 to the immobilizer system.
Applicable models: Petrol-powered vehicles

HEADLAMP

REMOVAL SERVICE POINT

Observe the following procedure to remove the headlamp (L.H.) on vehicles with air conditioner.

1. Remove the upper insulator of the radiator.
2. Move the upper part of the radiator towards the rear of the vehicle to remove the headlamp (L.H.) mounting nut.

IMMOBILIZER SYSTEM

TROUBLESHOOTING

<Petrol-powered vehicles>

INSPECTION CHART FOR DIAGNOSIS CODES

Diagnosis code No.	Inspection items	Reference page
11*	Transponder communication system	-
12*	ID code are not the same or are not registered	-
21	Communication system between immobilizer-ECU and engine-ECU	-
31	EEPROM abnormality inside immobilizer-ECU	-
33*	Starting prevention system activated due to incorrect operation	54-2

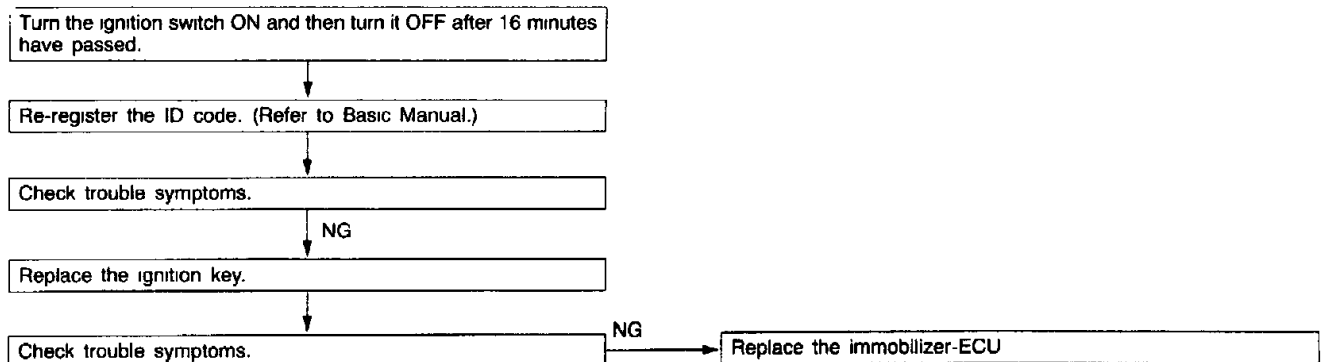
NOTE

(1) *: Diagnosis codes No.11, No.12 and No.33 are not recorded.

(2) Refer to the Basic Manual for the inspection procedures of diagnosis code Nos.11, 12, 21 and 31.

INSPECTION PROCEDURE FOR DIAGNOSIS CODES

Code No.33 Starting prevention system activated due to Incorrect operation	Probable cause
If the transponder ID code mismatches five times in succession, this code will be output. This code can be canceled by turning the ignition switch ON, and then turning it OFF after 16 minutes have passed.	• Malfunction of the immobilizer-ECU • Malfunction of the transponder



INSPECTION CHART FOR TROUBLE SYMPTOMS

Refer to Basic Manual.

INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS

Refer to Basic Manual.

<Diesel-powered vehicles>

INSPECTION CHART FOR DIAGNOSIS CODES

Diagnosis code No.	Inspection items	Reference page
11*	Transponder communication system	-
12*	ID code are not the same or are not registered	-
21	Communication system between immobilizer-ECU and fuel injection pump	54-3
31	EEPROM abnormality inside immobilizer-ECU	-
33*	Starting prevention system activated due to incorrect operation	54-4

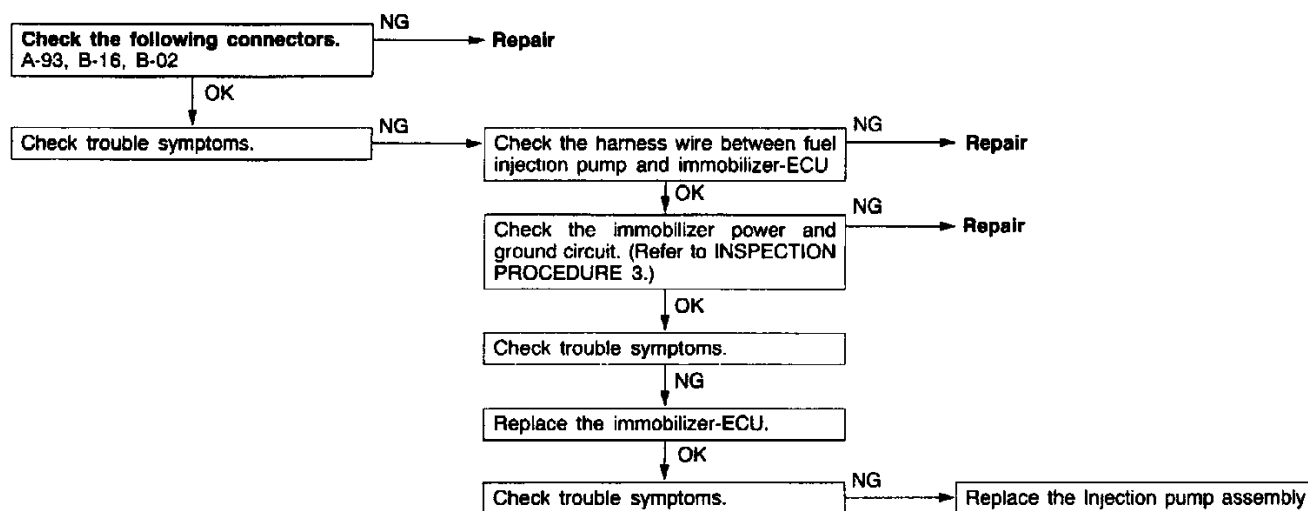
NOTE

(1) *: Diagnosis codes No.11, No.12 and No.33 are not recorded.

(2) Refer to the Basic Manual for the inspection procedures of diagnosis code Nos.11, 12 and 31.

INSPECTION PROCEDURE FOR DIAGNOSIS CODES

Code No.21 Communication system between immobilizer-ECU and fuel injection pump	Probable cause
After the ignition switch is turned to the ON position, the confirmation code is not received from the fuel injection pump within the allowable time, or an abnormal code is received.	• Malfunction of harness or connector • Malfunction of the fuel injection pump • Malfunction of the immobilizer-ECU



Code No.33 Starting prevention system activated due to incorrect operation	Probable cause
--	----------------

If the transponder ID code mismatches five times in succession, this code will be output. This code can be canceled by turning the ignition switch ON, and then turning it OFF after 16 minutes have passed.	
--	--

- | | |
|--|---|
| | <ul style="list-style-type: none">• Malfunction of the immobilizer-ECU• Malfunction of the transponder |
|--|---|

Turn the ignition switch ON and then turn it OFF after 16 minutes have passed.

Re-register the ID code. (Refer to Basic Manual.)

Check trouble symptoms.

NG

Replace the ignition key.

Check trouble symptoms.

NG

Replace the immobilizer-ECU

INSPECTION CHART FOR TROUBLE SYMPTOMS

Trouble symptom	Inspection procedure No.	Reference page
Communication with MUT-II is impossible.	1	54-5
ID code cannot be registered using the MUT-II.*	-	-
Engine does not start (Cranking but no initial combustion).	2	54-6
Malfunction of the immobilizer-ECU power source and earth circuit*	-	-

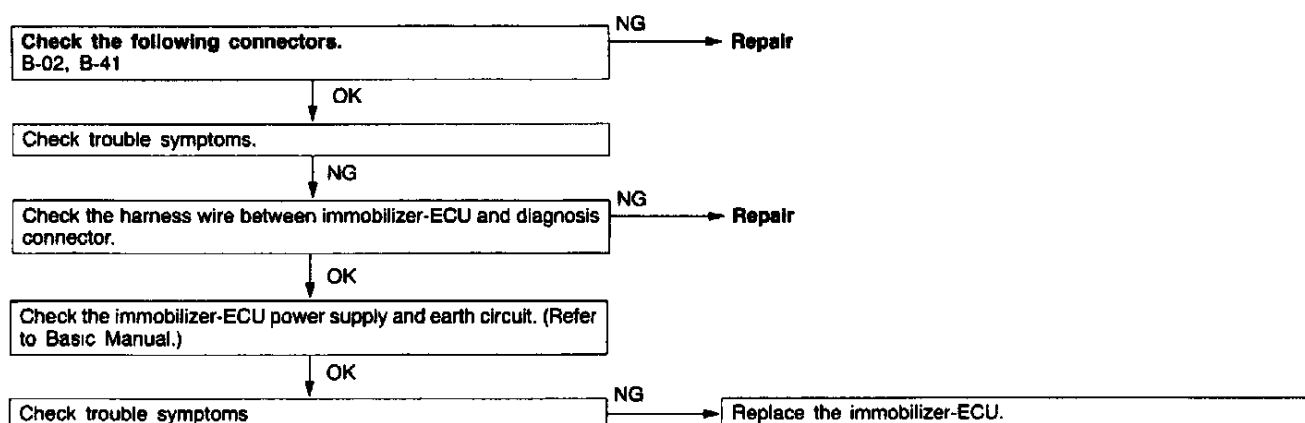
NOTE

For the inspection procedures marked by *, refer to the basic manual.

INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS

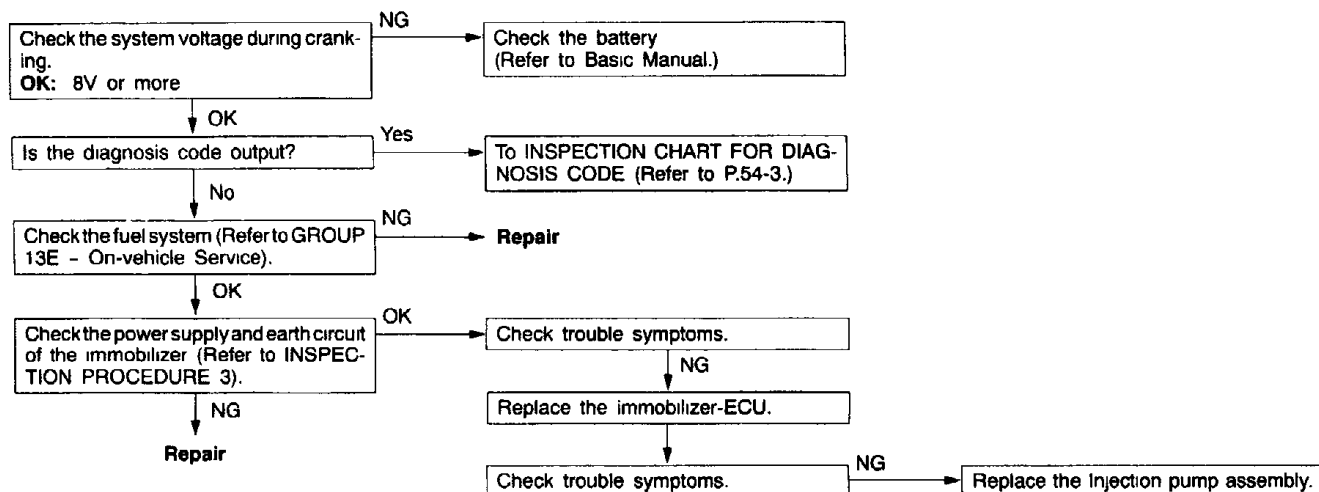
Inspection Procedure 1

Communication with MUT-II is impossible.	Probable cause
The cause is probably that a malfunction of the diagnosis line or the immobilizer-ECU is not functioning.	• Malfunction of the diagnosis line • Malfunction of harness or connector • Malfunction of the immobilizer-ECU



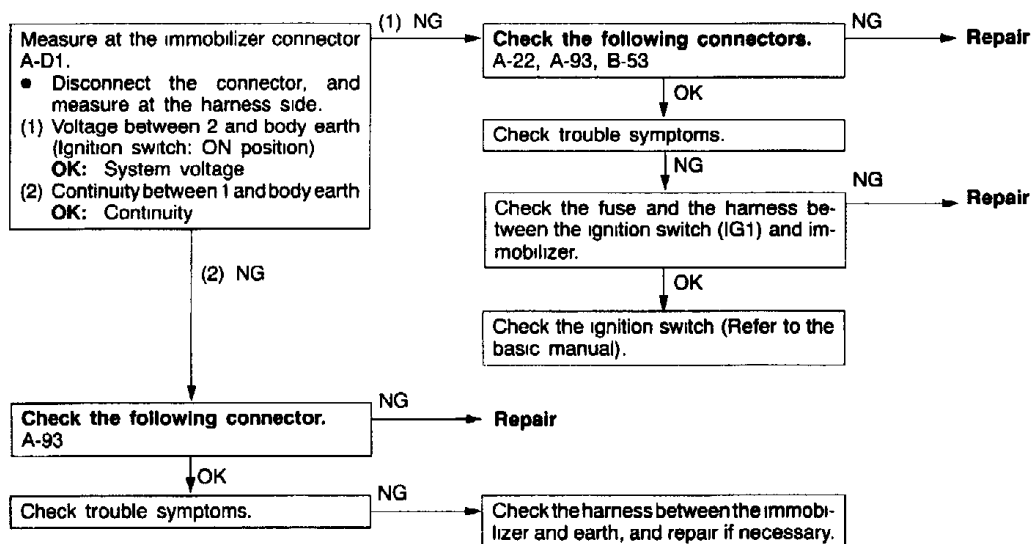
Inspection Procedure 2

Engine does not start (cranking but no initial combustion).	Probable cause
If the fuel injectors are not operating, there might be a problem with the fuel system in addition to a malfunction of the immobilizer system. It is normal for this to occur if an attempt is made to start the engine using a key that has not been properly registered.	• Malfunction of the fuel system • Malfunction of the immobilizer system



Inspection Procedure 3

Check the power supply and earth circuit of the immobilizer



REAR COMBINATION LAMP, REAR LID LAMP

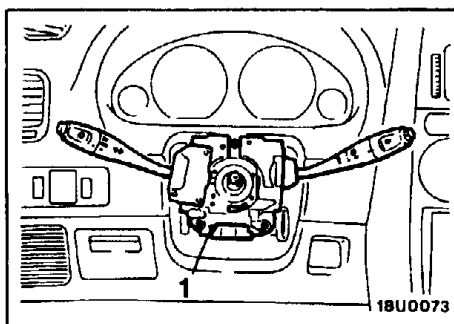
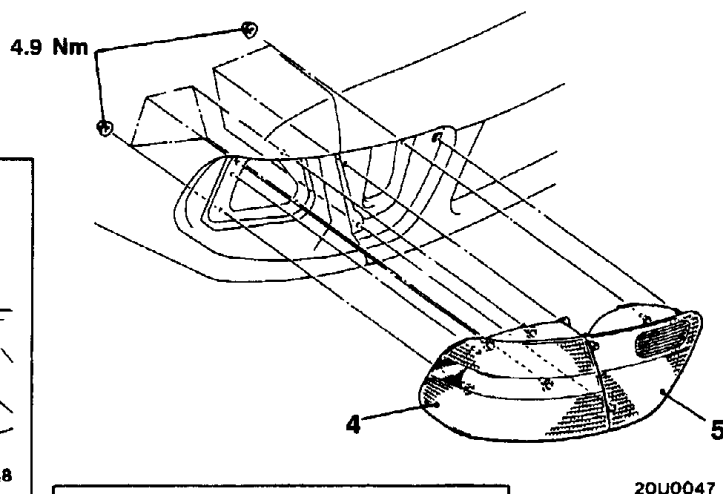
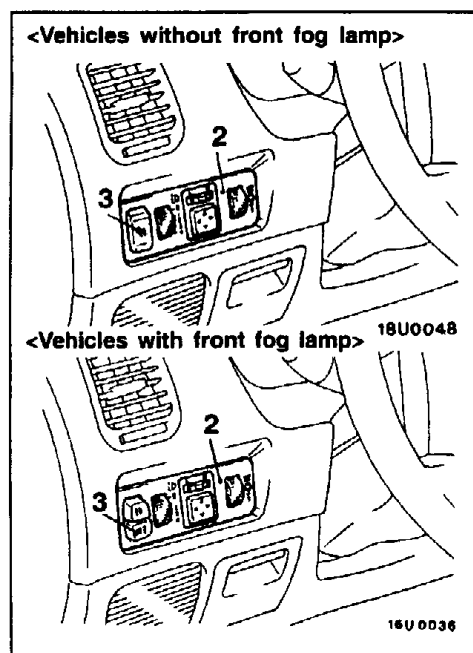
SPECIAL TOOL

Tool	Number	Name	Use
	MB990784	Ornament remover	Removal of switch garnish

REAR COMBINATION LAMP, REAR LID LAMP

REMOVAL AND INSTALLATION

Caution: SRS
Before removal of air bag module and clock spring, refer to Basic Manual GROUP 52B – SRS Service Precautions and Air Bag Module and Clock Spring.



00005107

1. Column switch <Lighting switch and turn-signal lamp switch>

Rear fog lamp switch removal steps

2. Switch garnish
3. Rear fog lamp switch

Rear combination lamp removal

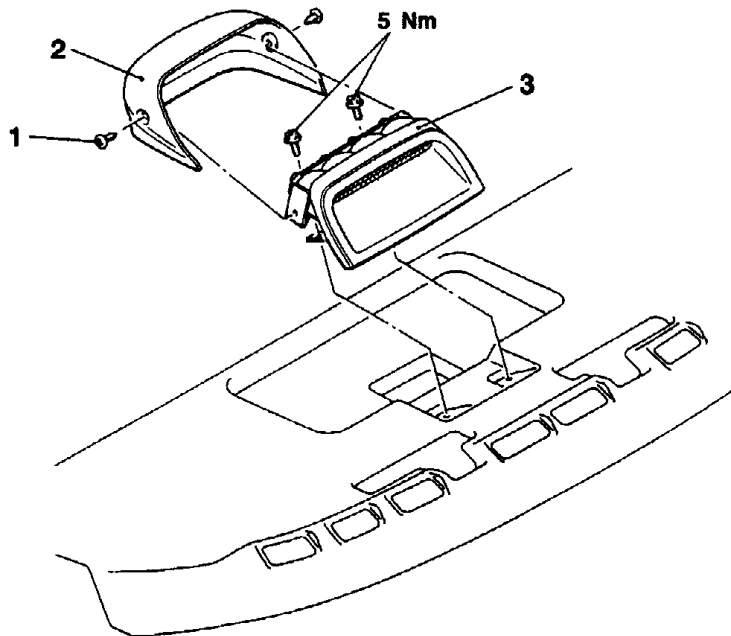
4. Rear combination lamp assembly

Rear lid lamp removal

5. Rear lid lamp assembly

HIGH MOUNTED STOP LAMP

REMOVAL AND INSTALLATION



A20U0048

Removal steps

1. Clip
2. High mounted stop lamp cover
3. High mounted stop lamp assembly

NOTE

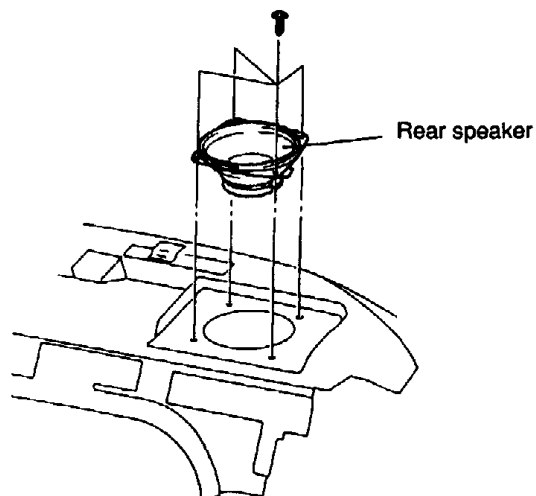
For the stop lamp on the rear spoiler, refer to GROUP 51 - Aero Parts.

SPEAKER

REMOVAL AND INSTALLATION

Pre-removal and post-Installation Operation

- Rear Speaker Garnish Removal and Installation (Refer to GROUP 52A - Trims.)



A19U0096

GROUP 55

HEATER, AIR CONDITIONER AND VENTILATION

GENERAL

OUTLINE OF CHANGES

- The following service procedures have been added to correspond to the addition of the diesel-powered vehicle.

Applicable models: 1900D

1. Removal and installation of the compressor
2. Removal and installation of the refrigerant lines
3. Removal and installation of the condenser and condenser fan motor

LUBRICANTS

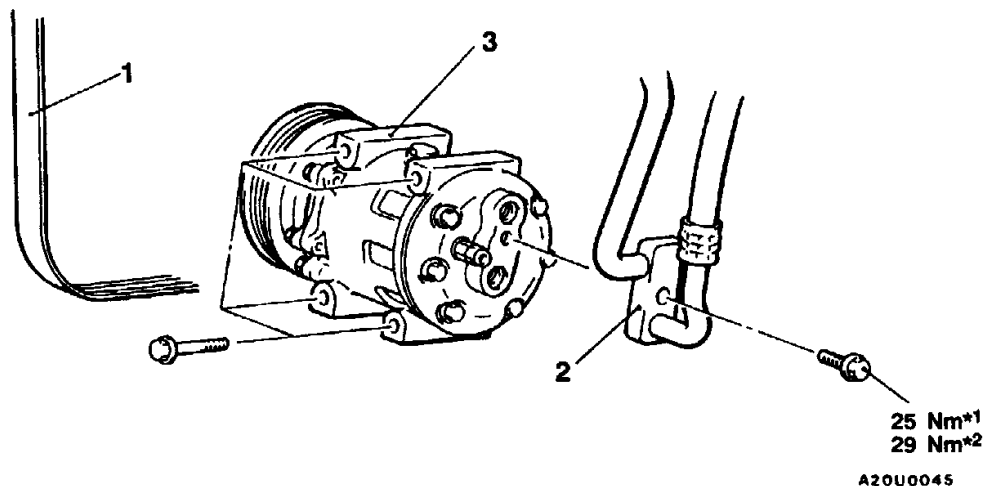
Items	Specified lubricants	Quantity
Each connection of refrigerant line	SP-20	As required
Compressor refrigerant unit lubricant ml	SP-20	135

COMPRESSOR**REMOVAL AND INSTALLATION****Pre-removal Operation**

- Discharging of Refrigerant
- Under Cover Removal (R.H. side)

Post-Installation Operation

- Charging of Refrigerant
- Under Cover Installation (R.H. side)
- Drive Belt Tension Adjustment (Refer to GROUP 11A - On-vehicle Service.)

**Removal Steps**

◀A▶

1. Drive belt

◀B▶ ▶A▶

2. A/C flexible hose assembly connection

3. Compressor

NOTE

(1) *1: Indicates flange bolt

(2) *2: indicates bolt and washer assembly

REMOVAL SERVICE POINTS**◀A▶ A/C FLEXIBLE HOSE ASSEMBLY CONNECTION**

Plug the disconnected hose and the compressor nipple not to let foreign matter get into them.

Caution

Seal the hoses completely. Otherwise, the compressor oil and receiver will absorb water vapour easily.

◀B▶ COMPRESSOR REMOVAL

When doing this work, be careful not to spill the compressor oil.

INSTALLATION SERVICE POINT

►A◄ COMPRESSOR INSTALLATION

If a new compressor is installed, first adjust the amount of oil according to the procedures described below, and then install the compressor.

- (1) Measure the amount (X mℓ) of oil within the removed compressor.
- (2) Drain (from the new compressor) the amount of oil calculated according to the following formula, and then install the new compressor.

New compressor oil amount

$$135 \text{ mℓ} - X \text{ mℓ} = Y \text{ mℓ}$$

NOTE

- (1) Y mℓ indicates the amount of oil in the refrigerant line, the condenser, the evaporator etc.
- (2) When replacing the following parts at the same times as the compressor, subtract the rated oil amount of the each part from Y mℓ and discharge from the new compressor.

Quantity

Evaporator: 60 mℓ

Condenser: 15 mℓ

A/C flexible hose: 10 mℓ

Receiver: 10 mℓ

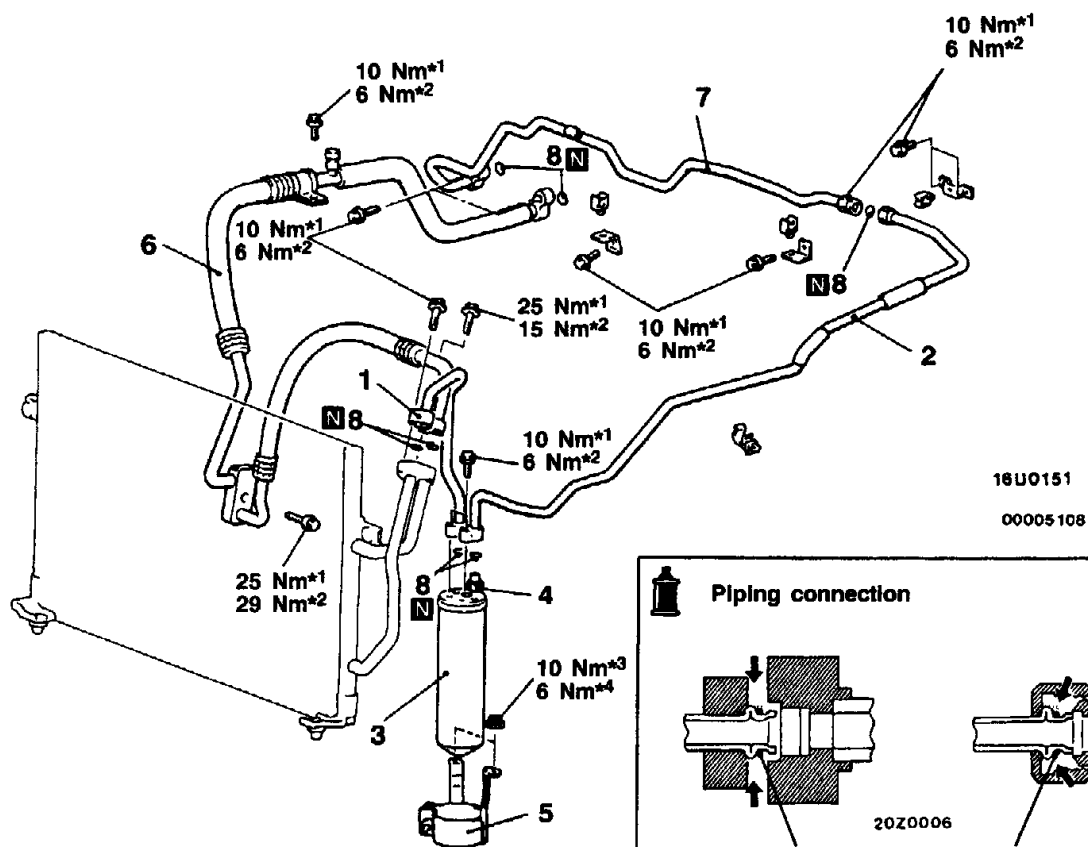
REFRIGERANT LINE

REMOVAL AND INSTALLATION

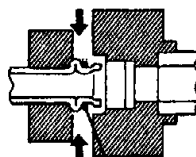
<L.H. DRIVE VEHICLES>

Pre-removal Operation

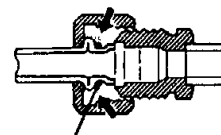
- Discharging and Charging of Refrigerant



Piping connection



O-ring



O-ring

Compressor oil: SP-20

Removal steps

1. Liquid pipe A
2. Liquid pipe B
- ▶◀ 3. Receiver assembly
- ▶◀ 4. Dual pressure switch
- ▶◀ 5. Receiver bracket
- ▶◀ 6. A/C flexible hose assembly
7. Liquid pipe C
8. O-ring

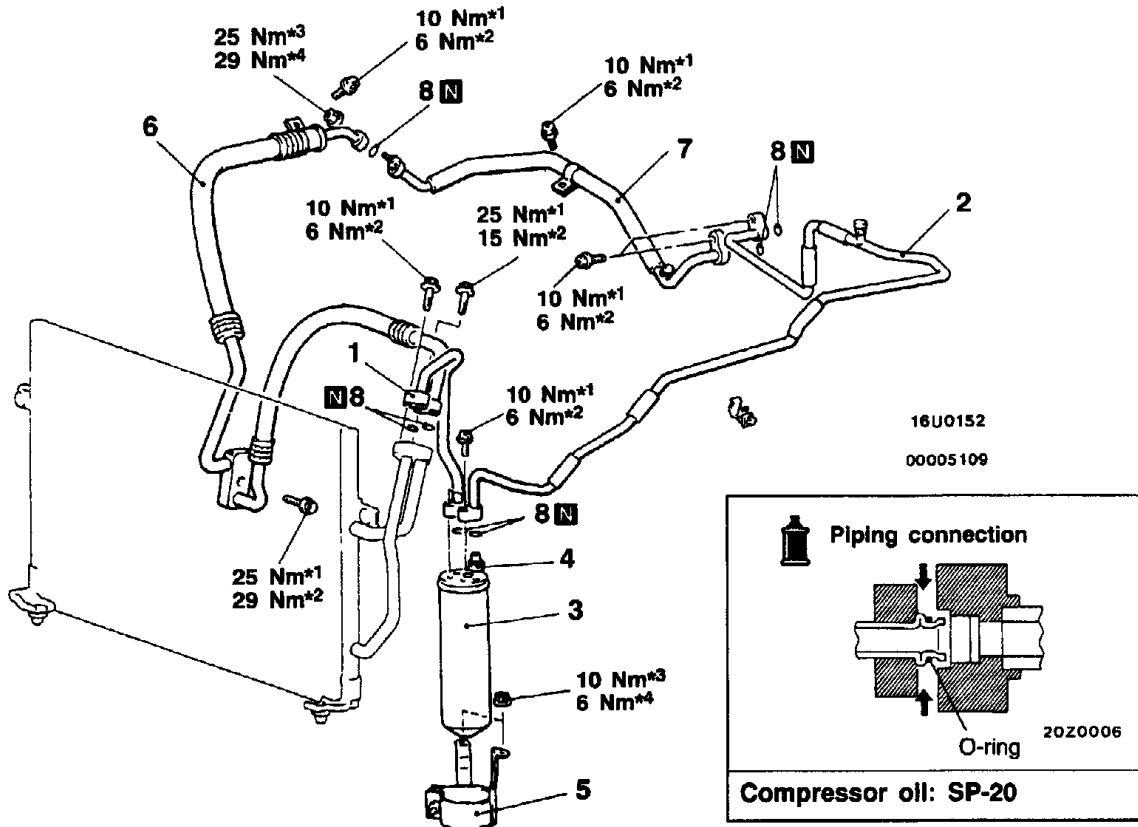
NOTE

- (1) *1: indicates flange bolt
- (2) *2: indicates bolt and washer assembly
- (3) *3: indicates flange nut
- (4) *4: indicates nut and washer assembly

<R.H. DRIVE VEHICLES>

Pre-removal Operation

- Discharging and Charging of Refrigerant



Removal steps

- ▶A◀ 1. Liquid pipe A
- ▶A◀ 2. Liquid pipe B
- ▶A◀ 3. Receiver assembly
- ▶A◀ 4. Dual pressure switch
- ▶A◀ 5. Receiver bracket
- ▶A◀ 6. A/C flexible hose assembly
- ▶A◀ 7. Suction pipe
- ▶A◀ 8. O-ring

NOTE

- (1) *1: indicates flange bolt
- (2) *2: indicates bolt and washer assembly
- (3) *3: indicates flange nut
- (4) *4: indicates nut and washer assembly

INSTALLATION SERVICE POINT

▶A◀ A/C FLEXIBLE HOSE ASSEMBLY/RECEIVER ASSEMBLY INSTALLATION

When replacing the A/C flexible hose assembly or receiver assembly, refill them with a specified amount of compressor oil, and then install them.

Compressor oil: SP-20

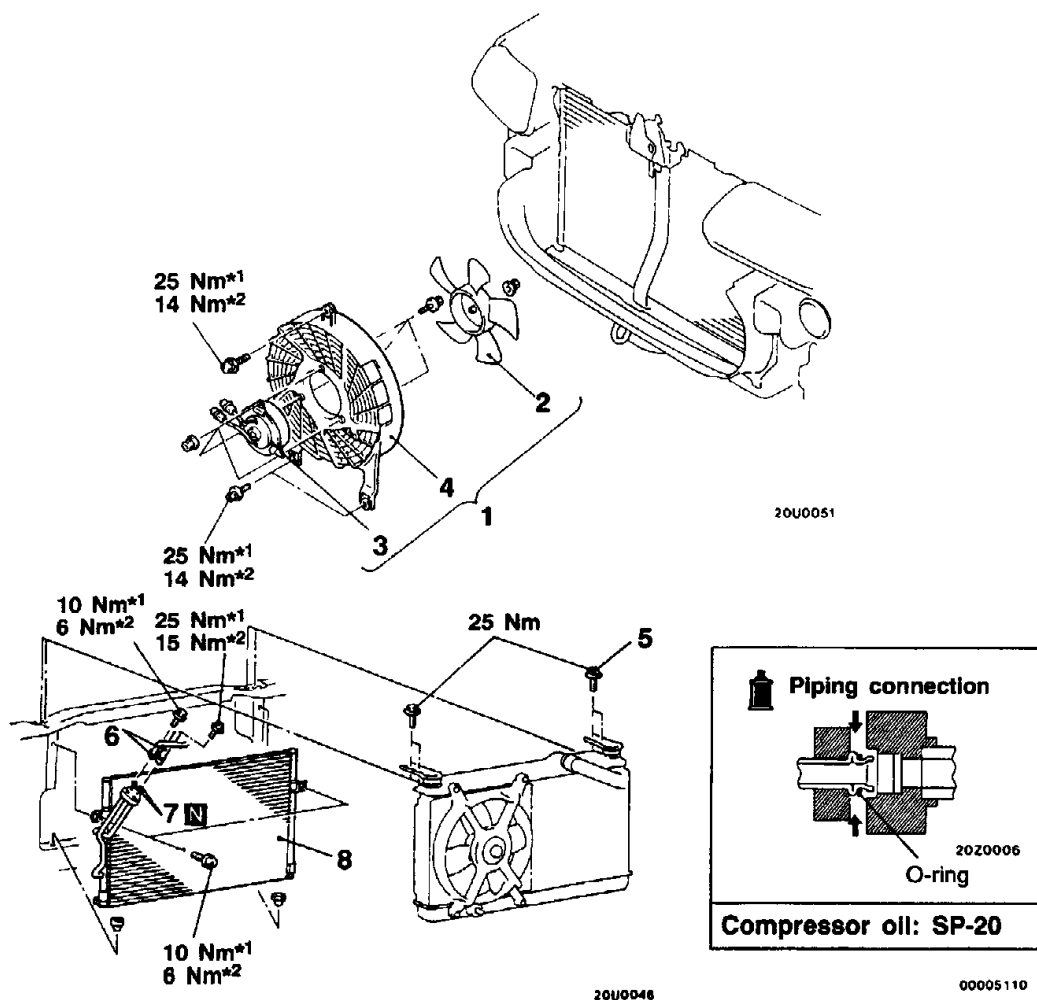
Quantity:

A/C flexible hose assembly: 10 ml

Receiver assembly: 10 ml

CONDENSER AND CONDENSER FAN MOTOR**REMOVAL AND INSTALLATION****Pre-removal Operation**

- Discharging and Charging of Refrigerant

**Condenser fan motor removal steps**

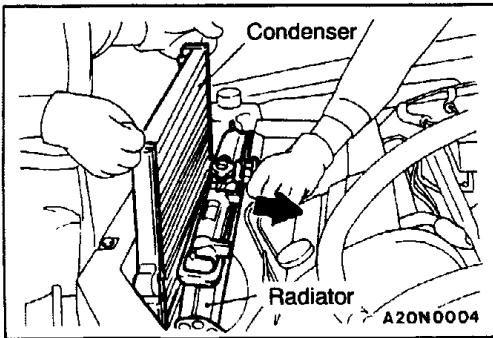
- Front bumper
- 1. Fan motor and shroud assembly
- 2. Fan
- 3. Motor assembly
- 4. Fan shroud

Condenser removal steps

- 5. Upper insulator installation bolt
- 6. A/C flexible hose assembly connection
- 7. O-ring
- 8. Condenser

**NOTE**

- (1) *1: indicates flange bolt
- (2) *2: indicates bolt and washer assembly



REMOVAL SERVICE POINT

◀A▶ CONDENSER REMOVAL

Move the radiator to the engine side and then lift up the condenser to remove it.

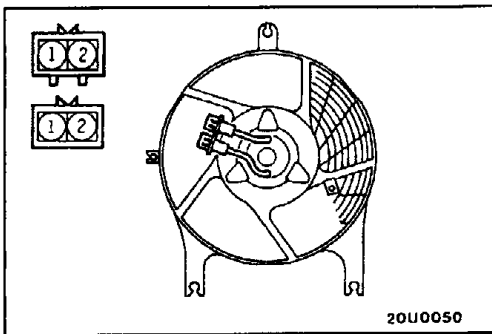
INSTALLATION SERVICE POINT

▶A◀ CONDENSER INSTALLATION

When replacing the condenser, refill it with a specified amount of compressor oil and install it. (to the vehicle).

Compressor oil: SP-20

Quantity: 15 ml



INSPECTION

CONDENSER FAN MOTOR CHECK

Concerning the two connectors, check that the motor runs when battery voltage is applied to the terminal 1 with the terminal 2 earthed.