2.4L 4-CYL VIN [G]

1998 Mitsubishi Galant

1997-98 ENGINES
Mitsubishi 2.4L 4-Cylinder

Eclipse Spyder GS, Galant

* PLEASE READ THIS FIRST *

NOTE: For engine repair procedures not covered in this article, see ENGINE OVERHAUL PROCEDURES - GENERAL INFORMATION article in the GENERAL INFORMATION section.

ENGINE IDENTIFICATION

Vehicle Identification Number (VIN) is stamped on a metal plate located at upper left corner of instrument panel, near windshield. The eighth character of VIN identifies engine, and tenth character identifies model year ("V" for 1997; "W" for 1998). Engine model code and serial number are stamped on right front side of cylinder block.

ENGINE IDENTIFICATION CODES

Application	Engine Model	Engine Code
SOHC (16-Valve)	4G64	G

ADJUSTMENTS

VALVE CLEARANCE ADJUSTMENT

Hydraulic lash adjusters are used. Valve adjustment is not required.

REMOVAL & INSTALLATION

* PLEASE READ THIS FIRST *

CAUTION: When battery is disconnected, vehicle computer and memory systems may lose memory data. Driveability problems may exist until computer systems have completed a relearn cycle.

NOTE: For reassembly reference, label all electrical connectors, vacuum hoses and fuel lines before removal. Also place mating marks on engine hood and other major assemblies before removal.

FUEL PRESSURE RELEASE

Remove rear seat cushion and raise carpet. Disconnect fuel pump connector near fuel tank. Start engine, and allow to idle until engine stalls. Turn ignition off. Reconnect fuel pump connector. Disconnect negative battery cable before disconnecting fuel lines.

ENGINE

CAUTION: To prevent fire hazard, release residual pressure in fuel system before disconnecting fuel lines.

Removal

1) Drain cooling system. Remove hood. Release fuel pressure from fuel system. See FUEL PRESSURE RELEASE.

2) Drain engine oil and transaxle oil. Remove transaxle. On M/T models, see CLUTCH article in the POWERTRAIN category. On A/T models, see TRANSMISSION REMOVAL & INSTALLATION - A/T article in AUTOMATIC TRANSMISSION SERVICING.

3) On all models, remove radiator and cooling fan assembly. Disconnect all necessary electrical connectors, vacuum hoses, fuel hoses and cables. Leaving hoses connected, remove power steering pump and A/C compressor, and support aside.

4) Disconnect exhaust pipe from exhaust manifold. Using lifting device, support weight of engine. Remove upper engine mount bracket assembly. Raise engine slightly. Ensure all cables, hoses and electrical harnesses are disconnected from engine. Lift engine upward from engine compartment.

Installation

To install, reverse removal procedure. Ensure all hoses and wires are cleared when lowering engine assembly into engine compartment. Perform final tightening of mounting bolts and nuts with weight of engine on insulators. See TORQUE SPECIFICATIONS. Refill all fluids, and adjust all cables and linkages.

INTAKE MANIFOLD

Removal

1) Release fuel pressure from fuel system. See FUEL PRESSURE RELEASE. Disconnect negative battery cable. Disconnect air intake hose from air intake pipe.

2) Drain cooling system. Disconnect all necessary electrical connectors, vacuum hoses, coolant hoses, fuel hoses and cables from intake manifold, injectors and throttle body. See Fig. 1.

3) Remove air intake pipe and throttle body. Remove air intake plenum from intake manifold. Remove fuel delivery pipe with fuel injectors and pressure regulator attached. DO NOT allow fuel injectors to fall from delivery pipe during removal.

4) Remove intake manifold-to-cylinder block support brace. Remove intake manifold-to-cylinder head bolts. Remove intake manifold and gasket. If necessary, remove remaining components from intake manifold.

Installation

To install, reverse removal procedure. Use NEW gaskets, fuel injector insulators and "O" rings. Adjust all control cables. Fill cooling system.

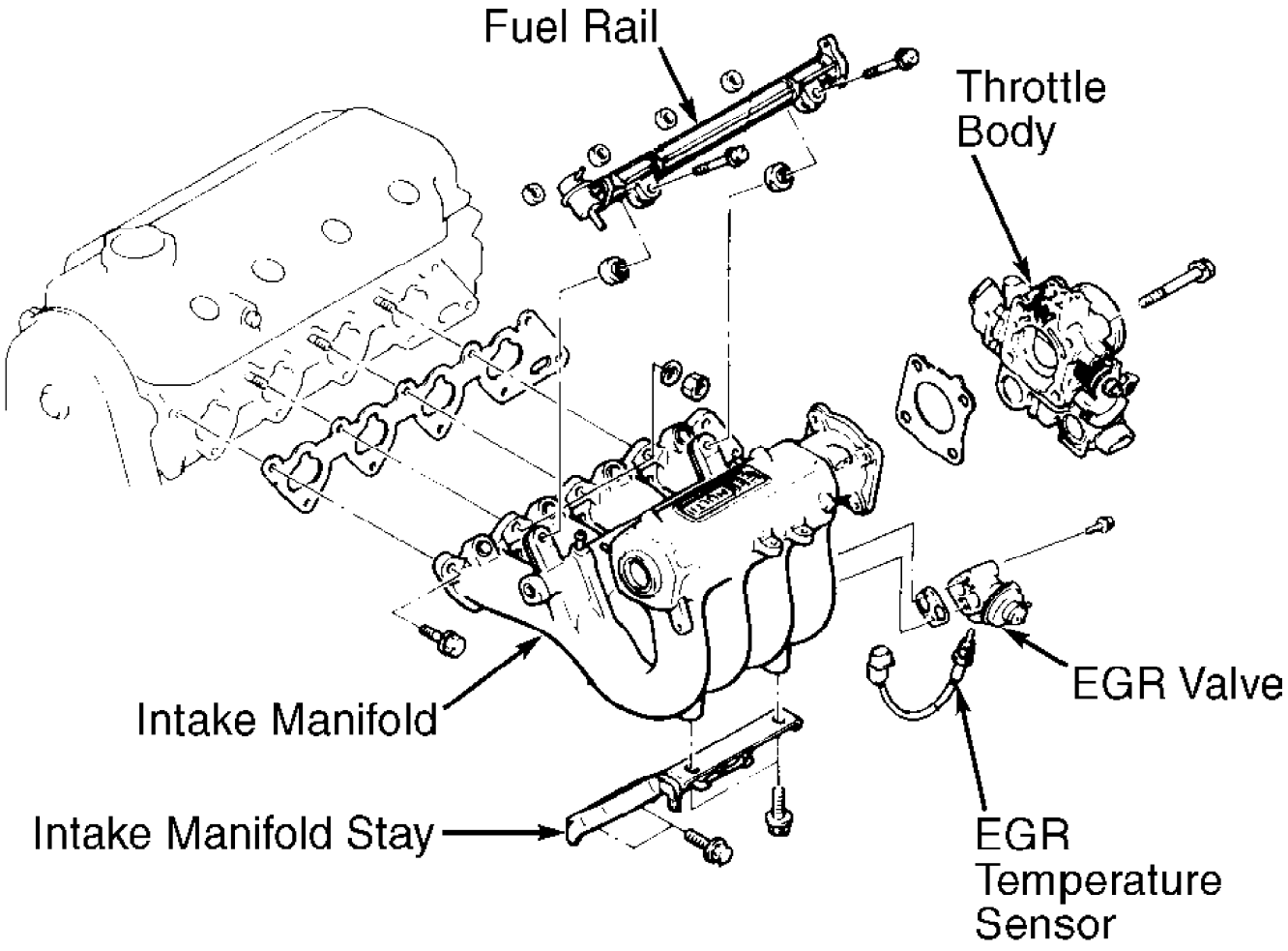


Fig. 1: Exploded View Of Intake Manifold & Related Components
Courtesy of Mitsubishi Motor Sales of America.

EXHAUST MANIFOLD

Removal

Remove exhaust manifold heat shield. Disconnect exhaust pipe and gasket from manifold. Remove oxygen sensor. Remove exhaust manifold.

Installation

To install, reverse removal procedure. Use NEW gaskets and exhaust pipe-to-manifold nuts.

CYLINDER HEAD

Removal

1) Release fuel pressure from fuel system. See FUEL PRESSURE RELEASE.

2) Drain cooling system. Drain engine oil. Remove air intake hose and pipe from top of rocker cover. Disconnect all necessary electrical connectors, vacuum hoses, coolant hoses, fuel hoses and cables.

3) Remove power steering and A/C pumps (with hoses connected if possible), and support aside. Disconnect exhaust pipe from exhaust

manifold. Remove upper front timing belt cover.

4) Turn crankshaft to TDC of compression stroke on cylinder No. 1 by aligning mark on cylinder head with mark on camshaft sprocket. See Fig. 2. Remove rocker cover.

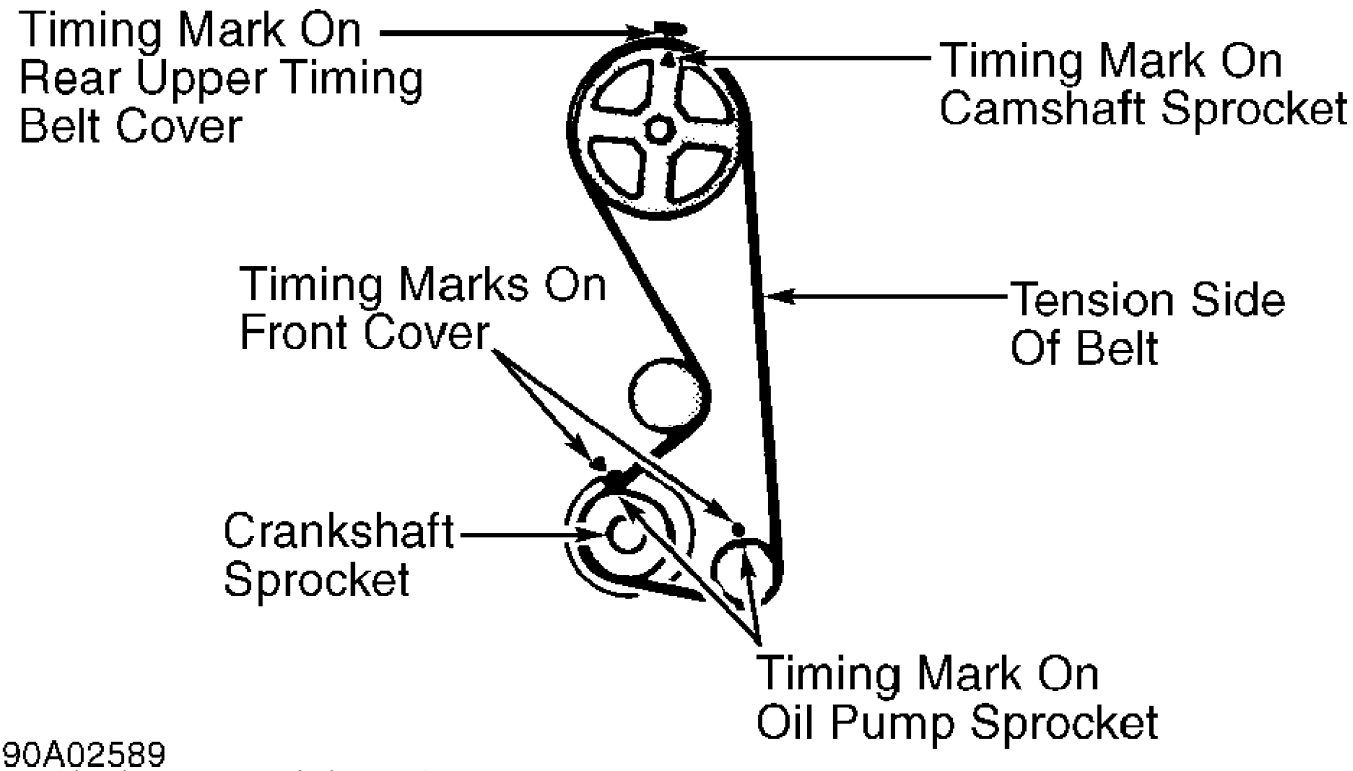


Fig. 2: Aligning Front Timing Belt
Courtesy of Mitsubishi Motor Sales of America.

5) Remove distributor cap. Mark rotor-to-distributor position. Mark distributor-to-cylinder head position. Remove distributor. Mark timing belt in alignment with timing mark on camshaft sprocket. Secure timing belt to camshaft sprocket with plastic tie-wraps to maintain correct position. Remove camshaft sprocket bolt.

6) Slide camshaft sprocket (with belt attached) off camshaft. DO NOT turn crankshaft. Loosen cylinder head bolts in 2-3 steps, in proper sequence. See Fig. 3. Remove cylinder head and gasket.

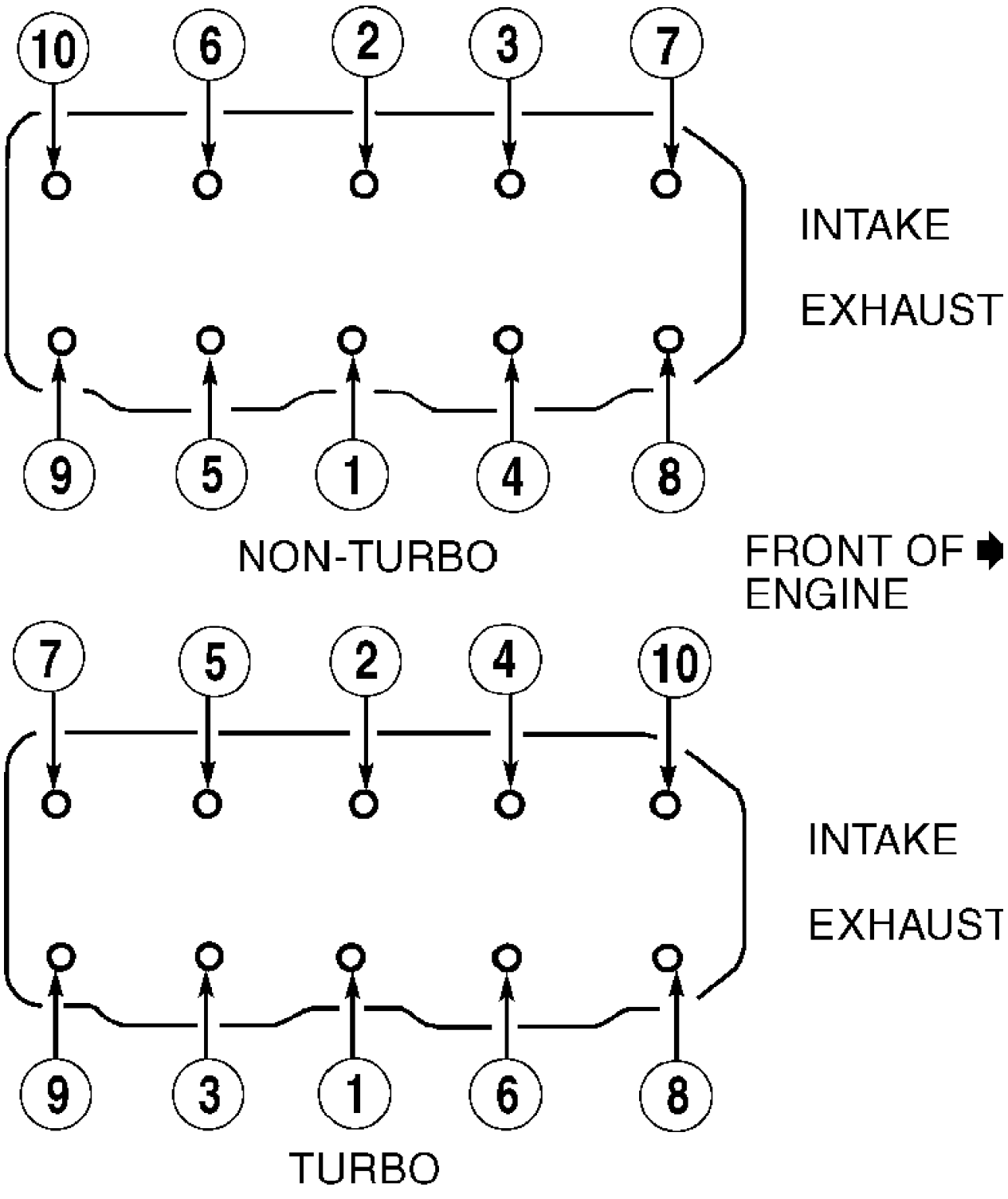


Fig. 3: Cylinder Head Bolt Removal & Installation Sequence
Courtesy of Mitsubishi Motor Sales of America.

Inspection
Inspect cylinder head for warpage at deck surface. Resurface

cylinder head if warpage exceeds specification. See CYLINDER HEAD table under ENGINE SPECIFICATIONS.

Installation

1) Install cylinder head using NEW gasket. Ensure identification mark at timing belt end of gasket faces upward. DO NOT apply sealant to head gasket. Apply engine oil to cylinder head bolt threads and washers. Install and tighten cylinder head bolts in 2-3 steps, to specification in proper sequence. See Fig. 3. See TORQUE SPECIFICATIONS.

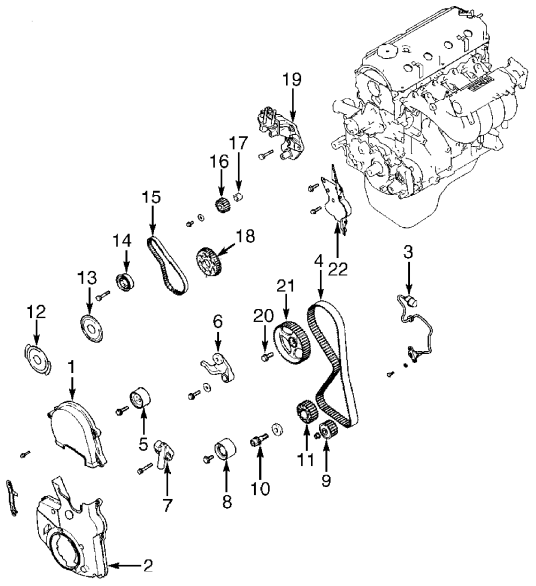
2) To complete installation, reverse removal procedure. Apply sealant to contact surfaces of semi-circular packing. Adjust all control cables. Fill cooling system. Refill with engine oil

FRONT COVER OIL SEAL

NOTE: Front cover refers to cover at front of cylinder block. Cover contains oil pump and front cover oil seal (crankshaft front seal). Manufacturer lists oil seal removal procedure with front cover removed from engine. See OIL PUMP & FRONT COVER under ENGINE OILING.

TIMING BELT

CAUTION: To prevent engine damage, DO NOT rotate crankshaft counterclockwise (as viewed from timing belt end of engine).



1. Timing Belt Upper Cover
2. Timing Belt Lower Cover
3. Crankshaft Angle Sensor
4. Timing Belt
5. Tensioner Pulley
6. Tensioner Arm
7. Auto Tensioner
8. Idler Pulley
9. Oil Pump Sprocket
10. Crankshaft Bolt
11. Crankshaft Sprocket
12. Crankshaft Sensing Blade
13. Flange
14. Tensioner "B"
15. Timing Belt "B"
16. Counterbalance Shaft Sprocket
17. Spacer
18. Crankshaft Sprocket "B"
19. Engine Support Bracket
20. Camshaft Sprocket Bolt
21. Camshaft Sprocket
22. Timing Belt Rear Cover

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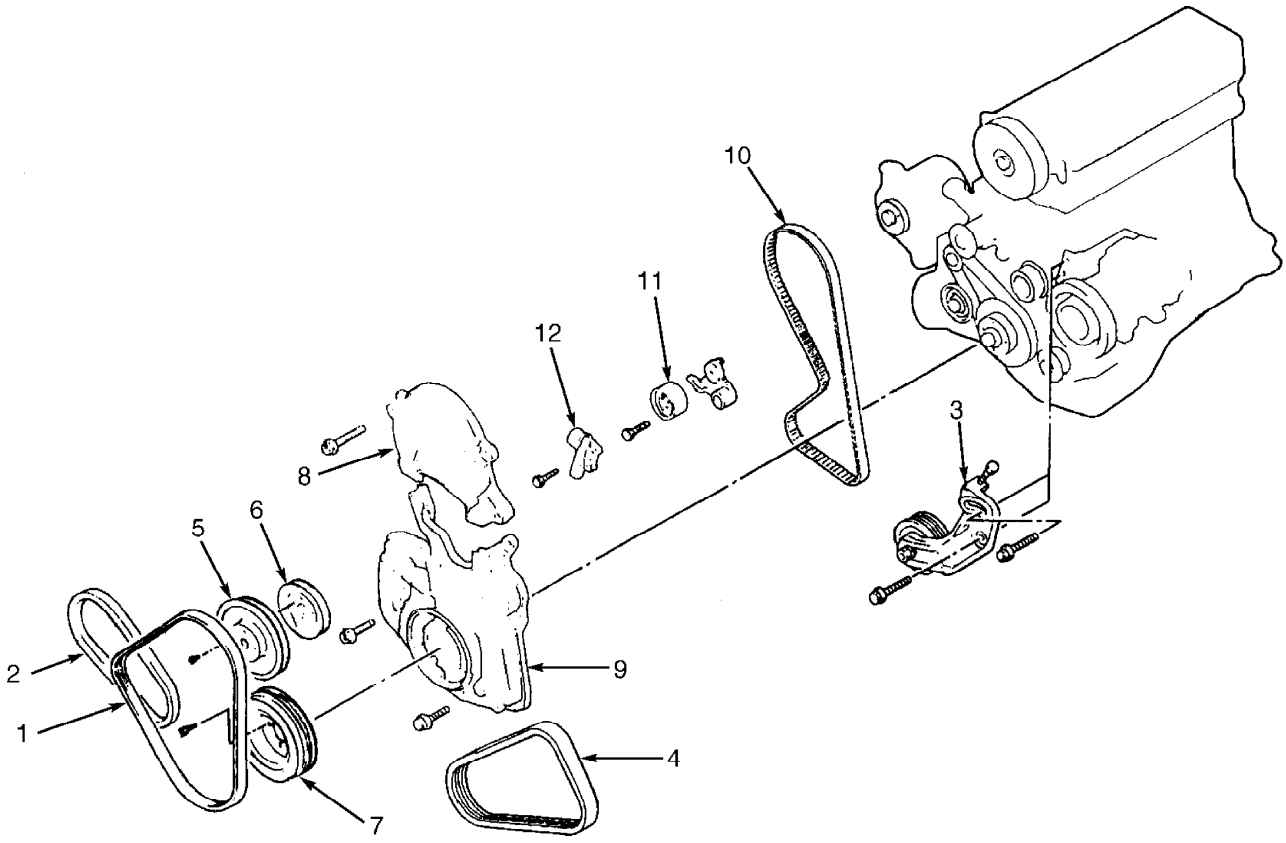
Fig. 4: Exploded View Of Timing Belts & Related Components
Courtesy of Mitsubishi Motor Sales of America.

Removal

1) Remove A/C and power steering hose mounting bracket, and

oxygen sensor connector bracket from upper engine mount. Remove all drive belts and drive pulleys from crankshaft and water pump. See Figs. 4 and 5.



1. Drive Belt (Water Pump)
2. Drive Belt (Generator)
3. Tensioner Pulley Bracket
4. Drive Belt (A/C)
5. Water Pump Pulley
6. Power Steering Pulley
7. Crankshaft Pulley
8. Timing Belt Front Upper Cover
9. Timing Belt Front Lower Cover
10. Timing Belt
11. Tension Pulley
12. Auto Tensioner

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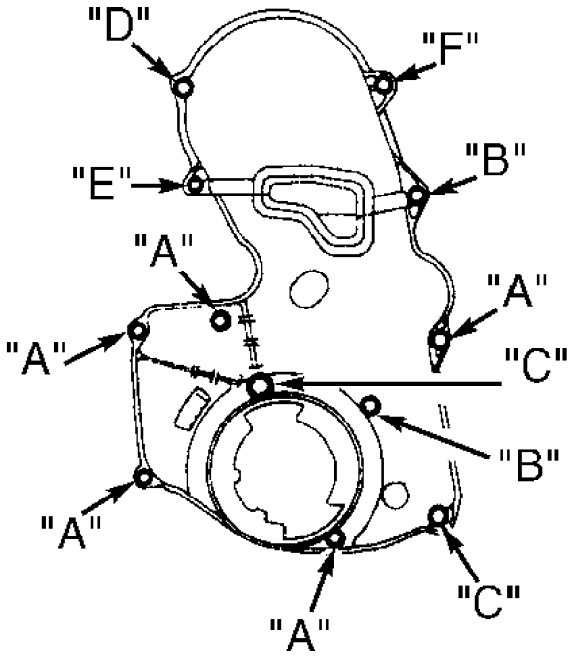
Fig. 5: Exploded View Of Drive Belts & Pulleys
Courtesy of Mitsubishi Motor Sales of America.

2) Remove drive belt tensioner. Remove upper and lower timing belt covers. Note bolt lengths and locations. See Figs. 4 and 6. Remove crankshaft sprocket bolt access cover, crankshaft sprocket bolt and washer.



Bolt	Size (mm)
"A"	6 x 18 (Flange Bolt)
"B"	6 x 25 (Flange Bolt)
"C"	6 x 25 (Loose Washer)
"D"	8 x 50 (Flange Bolt)
"E"	8 x 35 (Flange Bolt)
"F"	8 x 28 (Flange Bolt)

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Fig. 6: Locating Timing Cover Bolts
Courtesy of Mitsubishi Motor Sales of America.

3) Rotate crankshaft clockwise (as viewed from timing belt end of engine) until cylinder No. 1 is at TDC of compression stroke. Align timing mark on camshaft sprocket with timing mark on cylinder head. See Fig. 2. Loosen timing belt tensioner bolt, and move tensioner toward water pump. Tighten bolt to secure tensioner. Remove front timing belt and camshaft sprocket.

CAUTION: DO NOT rotate crankshaft counterclockwise (as viewed from timing belt end of engine). If timing belt is to be reused, mark direction of rotation with chalk before removing.

4) If oil pump sprocket removal is necessary, remove left silent shaft access plug from cylinder block. Insert a .31" (8 mm) diameter Phillips screwdriver to block left silent shaft. Ensure screwdriver can be inserted at least 2.36" (59.9 mm). DO NOT remove screwdriver until timing belt is installed. See Fig. 7. Remove oil pump sprocket nut and sprocket.

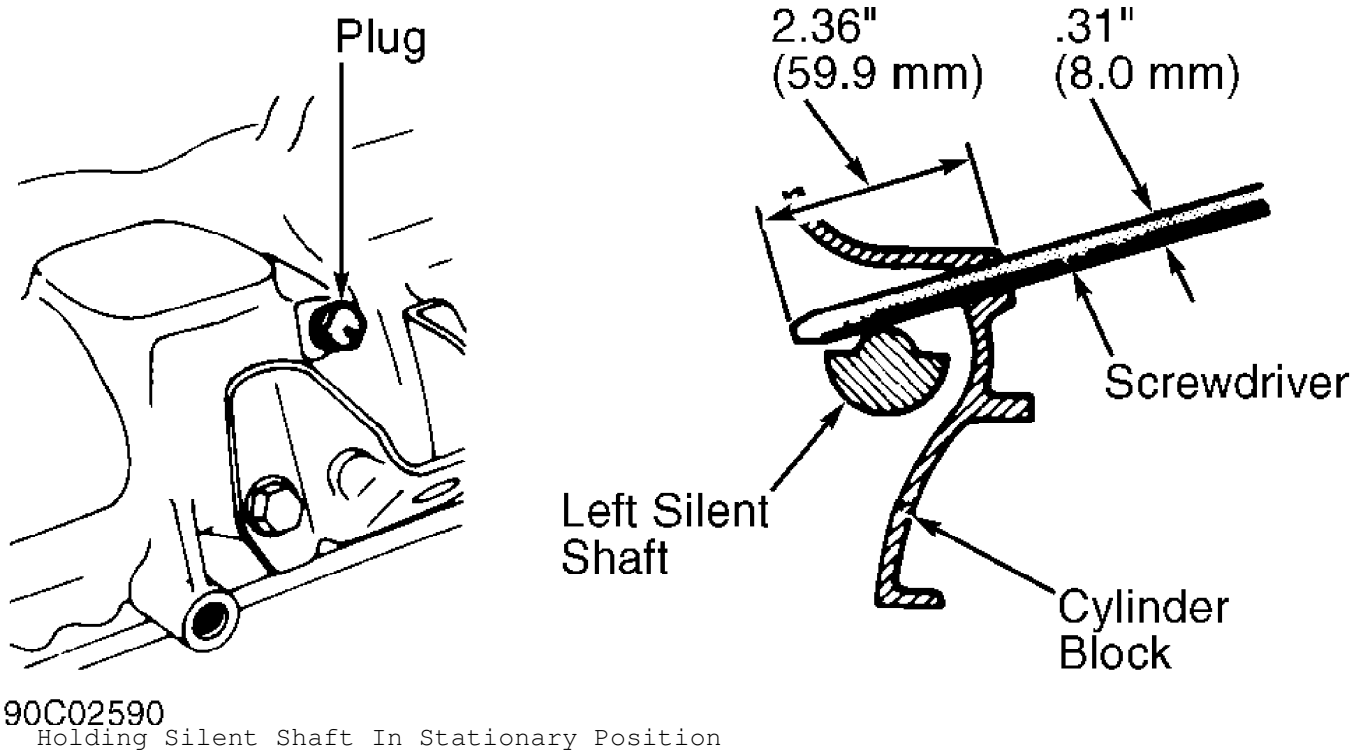


Fig. 7: Holding Silent Shaft In Stationary Position
Courtesy of Mitsubishi Motor Sales of America.

5) Remove front crankshaft sprocket and crankshaft sensing blade. Note direction and order of installation. See Fig. 8. Remove rear timing belt tensioner assembly. Remove rear timing belt.

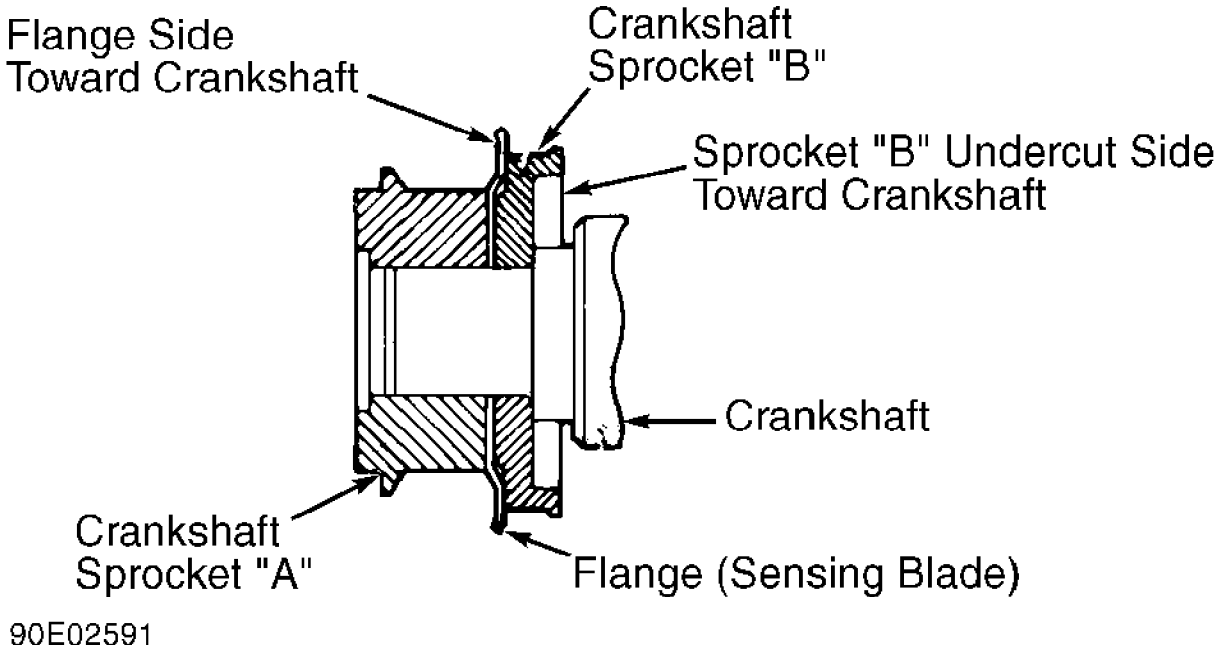


Fig. 8: Locating Crankshaft Sprockets & Sensing Blade
Courtesy of Mitsubishi Motor Sales of America.

Inspection
Check belt teeth for cracks, damage and contamination.

Inspect sprockets for damage. Check belt tensioner for leakage or roughness in rotation. Using a vise, slowly force push rod of auto tensioner shaft into tensioner until a set pin can be passed through pin holes to lock rod into tensioner. See Fig. 9. Replace components as necessary.

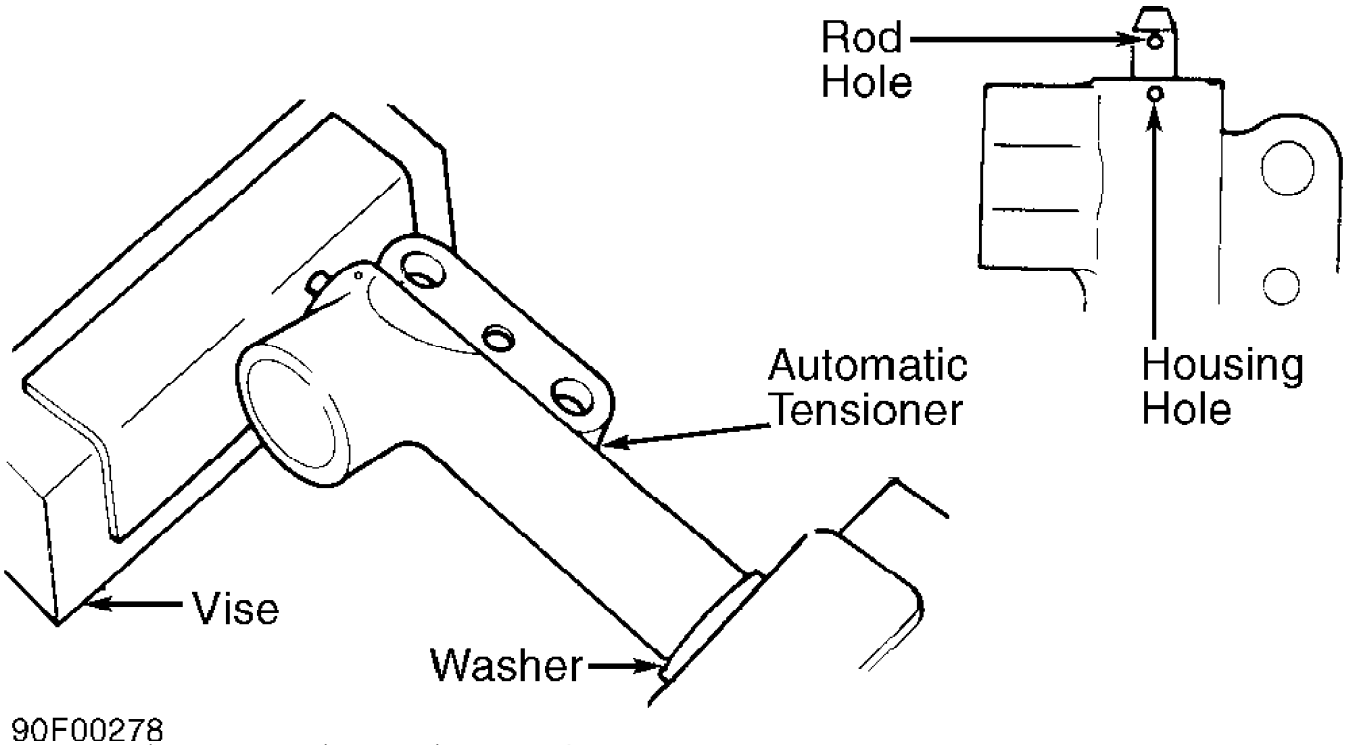


Fig. 9: Retracting Automatic Tensioner Rod
Courtesy of Mitsubishi Motor Sales of America.

Installation

1) Install rear crankshaft sprocket and flange (sensing blade) onto crankshaft. See Fig. 8. Lubricate and install right silent shaft spacer and sprocket. Ensure chamfered side of spacer is installed into silent shaft seal. If reused, install rear timing belt in original direction of rotation. Ensure timing marks are aligned. See Fig. 10.

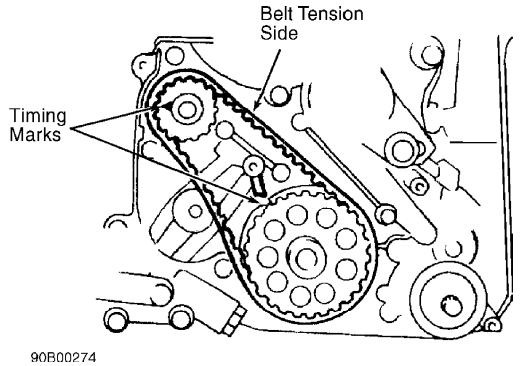


Fig. 10: Aligning Rear Timing Belt
Courtesy of Mitsubishi Motor Sales of America.

2) Install rear timing belt tensioner. Hold tensioner tightly against belt while tightening bolt. Depress belt between sprockets to

ensure deflection is .20-28" (5-7 mm). See Fig. 11. Adjust as necessary.

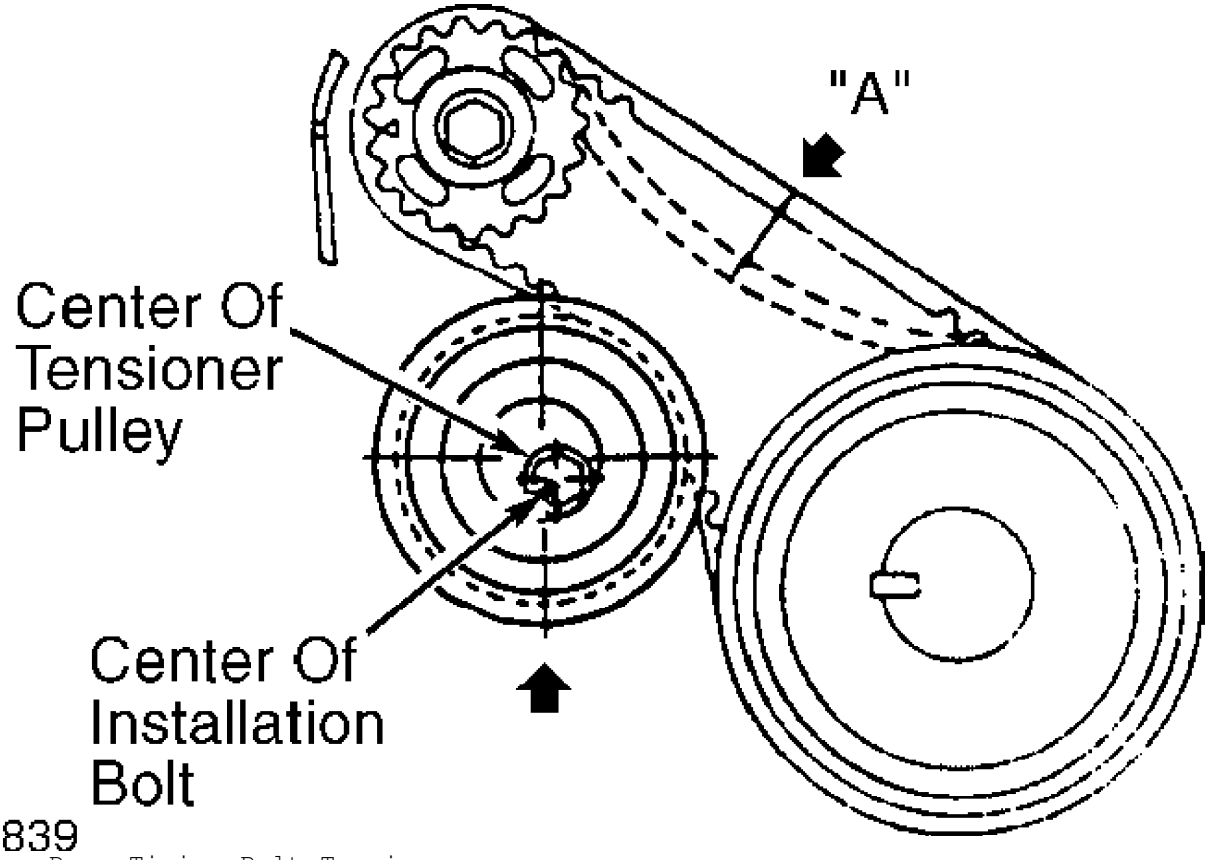


Fig. 11: Checking Rear Timing Belt Tension
Courtesy of Mitsubishi Motor Sales of America.

3) Install crankshaft front sprocket. Install oil pump sprocket. Hold left silent shaft using a .31" (8 mm) diameter Phillips screwdriver through access hole. See Fig. 7. Ensure screwdriver can be inserted at least 2.36" (59.9 mm).

4) Remove screwdriver if it cannot be inserted at least 2.36" (59.9 mm), and rotate oil pump sprocket one revolution. Align timing mark. Insert screwdriver, and ensure it can be inserted at least 2.36" (59.9 mm).

5) DO NOT remove screwdriver until timing belt is installed. Install camshaft sprocket. Tighten bolts to specification. See TORQUE SPECIFICATIONS.

6) Align timing marks on camshaft sprocket, crankshaft sprocket and oil pump sprocket. Install timing belt to crankshaft sprocket, oil pump sprocket and camshaft sprocket in that order, so there is no slack in belt tension. If belt is reused, ensure original direction of rotation is maintained.

7) Set tension pulley with pin holes at bottom. Press tension pulley lightly against timing belt and lightly tighten fixing bolt. Install a long set screw into left engine support bracket until screw end makes contact with tensioner arm. At that point, turn set screw in more, and then remove set pin locking auto tensioner. Remove set screw from engine support. Tighten center bolt to 35 ft. lbs. (48 N.m). See Fig. 12.

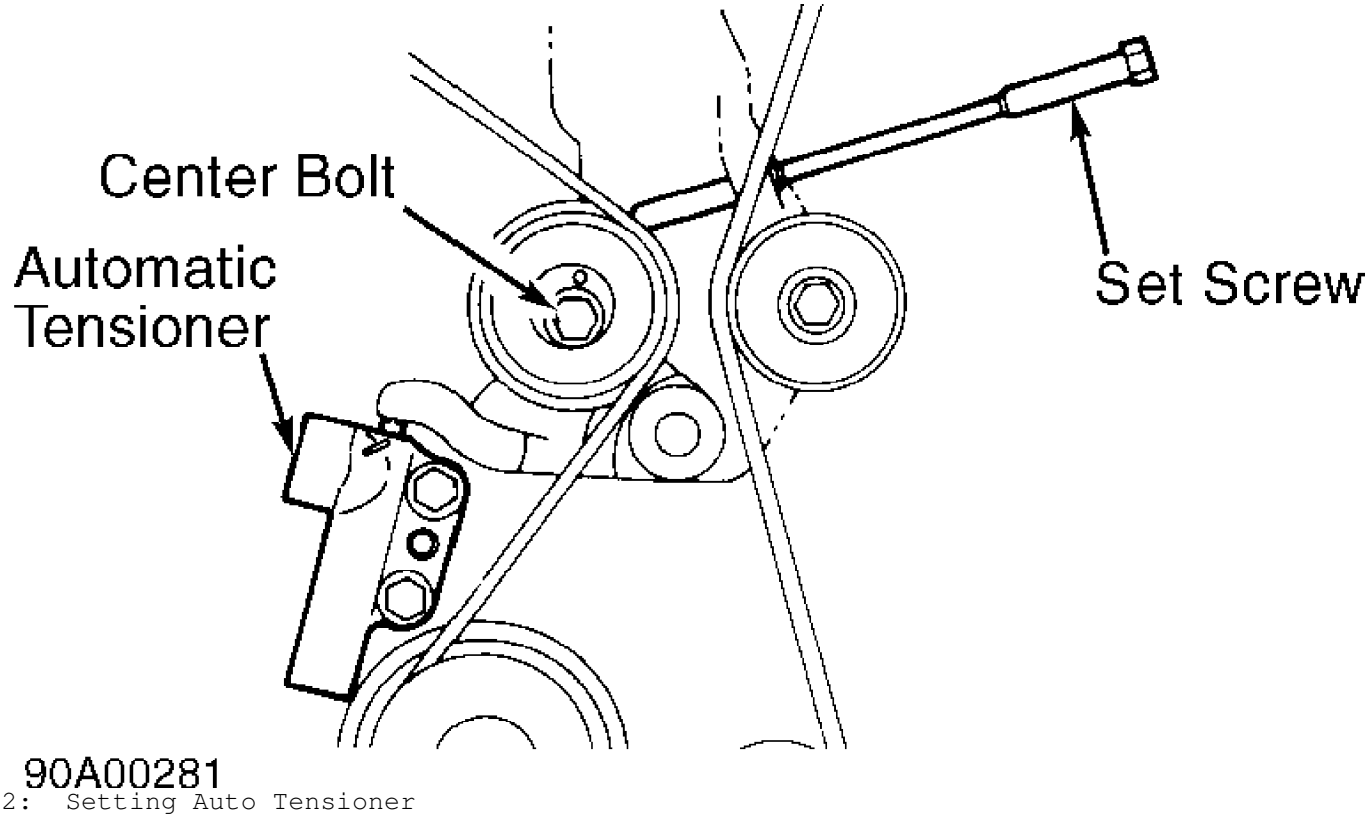


Fig. 12: Setting Auto Tensioner
Courtesy of Mitsubishi Motor Sales of America.

8) After turning crankshaft 1/4 revolution in counterclockwise direction, turn crankshaft in clockwise direction until timing marks are aligned. Loosen tension pulley bolt. Using Special Tool (MD998767) and a torque wrench, apply 31 INCH lbs. (3.5 N.m) of tension to belt in a counterclockwise direction. Tighten pulley bolt to 35 ft. lbs. (48 N.m) while applying tension to timing belt. See Fig. 13.

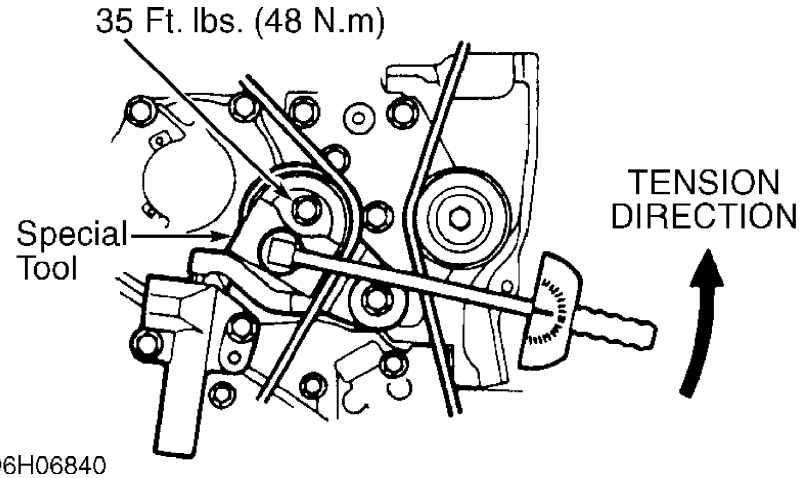


Fig. 13: Checking Front Timing Belt Tension
Courtesy of Mitsubishi Motor Sales of America.

CAUTION: When tightening pulley bolt, ensure tension pulley does not turn with bolt.

9) Turn crankshaft in clockwise direction 2 revolutions until timing marks are aligned. Let engine stand 15 minutes and then measure protrusion of auto-tensioner rod. If protrusion is not .150-.177" (3.8-4.5 mm), repeat steps 8) and 9). Ensure timing marks of all sprockets are aligned properly. To complete installation, reverse removal procedure.

ROCKER ARM & VALVE LASH ADJUSTER

CAUTION: DO NOT rotate crankshaft if timing belt has been removed. DO NOT rotate crankshaft counterclockwise (as viewed from timing belt end of engine).

Removal

1) Remove valve cover. Remove upper front timing belt cover. Rotate crankshaft clockwise (as viewed from timing belt end of engine) until cylinder No. 1 is at TDC of compression stroke and timing mark on camshaft sprocket aligns with timing mark on cylinder head. See Fig. 2.

2) Mark timing belt in alignment with timing mark on camshaft sprocket. Secure belt to sprocket with plastic tie-wraps. Remove camshaft sprocket bolt. Slide camshaft sprocket and belt off camshaft.

NOTE: Check lash adjuster free play before rocker arm removal. See INSPECTION procedure.

3) Install Lash Adjuster Retainer (MD998443) on rocker arm to prevent adjuster from falling out of rocker arm. See Fig. 14. Uniformly loosen rocker shaft mounting bolts, and remove rocker shaft assembly. Remove camshaft and oil seal. If removing lash adjusters from rocker arms, mark for installation reference.

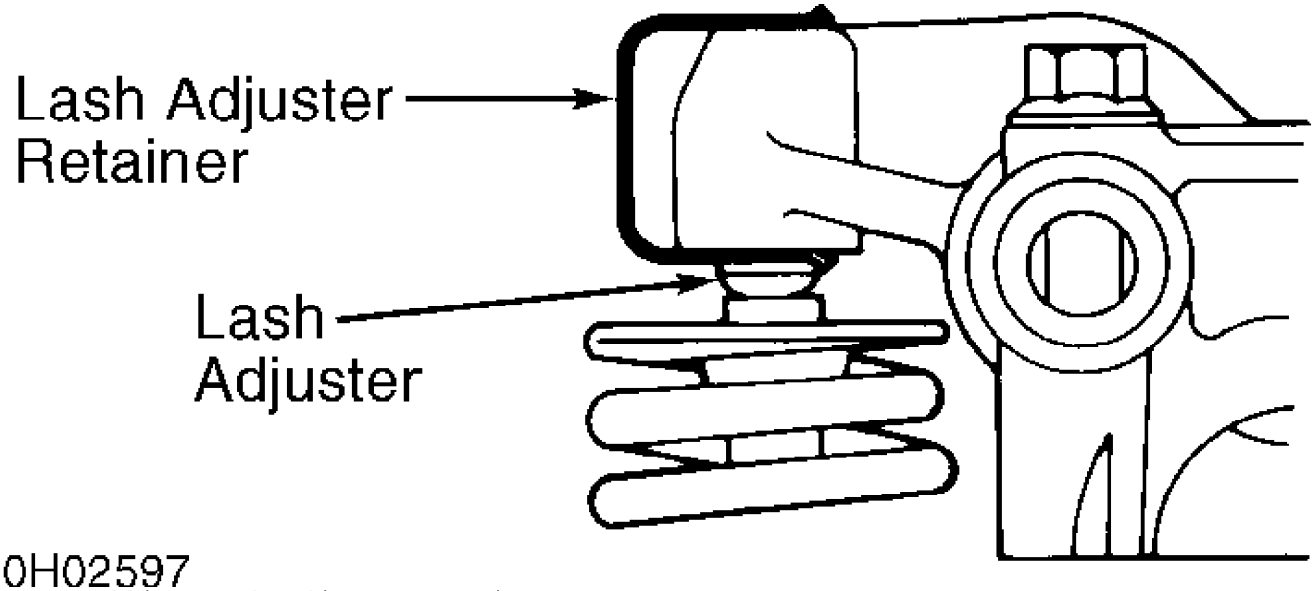


Fig. 14: Installing Lash Adjuster Retainers
Courtesy of Mitsubishi Motor Sales of America.

Inspection

1) Before removing rocker arms from engine, insert a small wire through rocker arm bleed hole and into lash adjuster. With wire lightly holding lash adjuster internal check ball down, move rocker arm up and down to check for free play. If no free play is present,

replace adjuster.

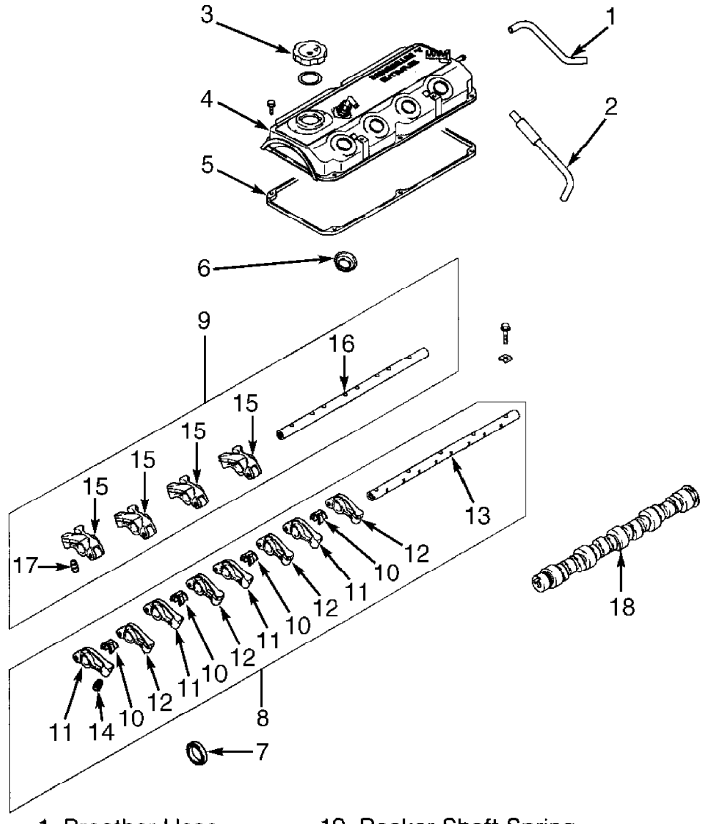
2) Inspect rocker arms and shafts for wear and damage. Check distributor drive for tooth damage and wear. Replace components as necessary.

3) Check camshaft journal diameter and lobe height. Replace camshaft if journal diameter and lobe height are not within specification. See CAMSHAFT table under ENGINE SPECIFICATIONS.

Installation

1) Lubricate camshaft lobes and camshaft bearing journals, and install camshaft into cylinder head. Install lash adjusters in rocker arms (if removed). Install lash adjuster retainers.

2) Ensure rocker arm components are installed in original location. Ensure notch in each rocker shaft is positioned outboard. Fit intake rocker shaft springs at right angles to spark plug guides before installing exhaust rocker shaft. See Fig. 15 To complete installation, reverse removal procedure.



1. Breather Hose	10. Rocker Shaft Spring
2. PCV Hose	11. Rocker Arm "A"
3. Oil Filler Cap	12. Rocker Arm "B"
4. Rocker Cover	13. Rocker Arm Shaft (Intake)
5. Rocker Cover Gasket	14. Lash Adjuster
6. Oil Seal	15. Rocker Arm "C"
7. Oil Seal	16. Rocker Arm Shaft (Exhaust)
8. Rocker Arms & Shaft	17. Lash Adjuster
9. Rocker Arms & Shaft	18. Camshaft

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Fig. 15: Identifying Rocker Arm Shaft Components
Courtesy of Mitsubishi Motor Sales of America.

CAMSHAFT

Removal & Installation

1) Remove accelerator cable, connection for breather hose and connection for PCV hose. Remove spark plug loom and rocker cover. Remove distributor. Remove timing belt. See TIMING BELT.

2) Remove camshaft sprocket. Remove camshaft oil seal. Remove intake and exhaust rocker arm and shaft assemblies. See ROCKER ARM & VALVE LASH ADJUSTER. Remove camshaft from head. To install, reverse removal procedure.

SILENT SHAFTS & BEARINGS

Removal

Remove front cover and oil pump. See OIL PUMP & FRONT COVER under ENGINE OILING. Remove silent shafts from cylinder block.

NOTE: Rear bearing(s) cannot be removed unless front bearings have been removed from block.

Inspection

1) Inspect silent shaft and bearings for damage. Check oil holes for clogging. Check silent shaft journal for signs of seizure or damage. Replace components as necessary.

2) If bearings need replacing, use indicated puller. See SILENT SHAFT BEARING TOOL table.

NOTE: Install rear bearings before installing front bearings.

Installation

1) Coat bearing outer area with engine oil before installing. Mount rear silent shaft bearing on indicated installer. See SILENT SHAFT BEARING TOOL table.

2) Ensure oil hole in bearing aligns with oil hole in cylinder block. Note left rear bearing does not have oil hole. Install rear bearings in cylinder block.

3) Repeat procedure for front bearings. Install front bearing on bearing installer. Ensure ratchet ball on bearing installer engages in oil hole of bearing. Coat outer area of bearing with engine oil.

4) Place bearing installer over guide pins, and drive bearing into cylinder block. Install balance shafts in original location. To complete installation, reverse removal procedure.

SILENT SHAFT BEARING TOOL

Application	Tool No.
Remover	MIT304204
Front Bearing Adapter	MD998371
Rear Bearing Adapter	MD998372
Installer	MD991603
Front & Rear Bearing Adapter	MD998705

REAR CRANKSHAFT OIL SEAL

Removal

1) Remove transaxle. On M/T models, see CLUTCH article in the POWERTRAIN category. On A/T models, see TRANSMISSION REMOVAL & INSTALLATION - A/T article in AUTOMATIC TRANSMISSION SERVICING.

2) On all models, remove flywheel or drive plate. Remove rear main oil seal case and gasket from rear of cylinder block. Remove oil seal from seal case.

Installation

Coat seal lip with oil. Using Seal Installer (MD998776), install seal in seal case until it bottoms. Install seal case and gasket. Install flywheel or drive plate. To complete installation, reverse removal procedure.

WATER PUMP

CAUTION: Note length and location of bolts during removal. Different length bolts are used and must be installed in original location.

Removal

Drain cooling system. Remove necessary coolant hoses. Remove timing belt. See TIMING BELT. Remove water pump mounting bolts. Note bolt length and location. Remove water pump.

Installation

To install, reverse removal procedure using NEW gasket and "O" ring. Install "O" ring on coolant pipe, and apply water to "O" ring. DO NOT apply grease or oil to "O" ring. Ensure bolts are installed in original location.

OIL PAN

Removal

Drain engine oil. Disconnect exhaust pipe at manifold. Remove oil pan bolts. Using Gasket Cutter (MD998727), cut gasket along sealing surface of cylinder block. Remove oil pan and gasket. Clean oil pan and block gasket surfaces.

Installation

To install, apply sealant to oil pan flange at timing chain case and rear seal case areas. Install oil pan and gaskets. To complete installation, reverse removal procedure. Tighten bolts to specification. See TORQUE SPECIFICATIONS.

OVERHAUL

CYLINDER HEAD

Cylinder Head

Inspect cylinder head for warpage at deck surface. Resurface cylinder head if warpage exceeds specification. See CYLINDER HEAD table under ENGINE SPECIFICATIONS.

Valve Springs

Inspect valve spring free length, out-of-square and installed height. Replace valve spring if not within specification. See VALVES & VALVE SPRINGS table under ENGINE SPECIFICATIONS. Install all valve springs with painted area toward rocker arm.

Valve Stem Oil Seals

DO NOT reuse oil seals. Install valve spring seat before installing oil seals. To provide proper positioning of oil seal, install NEW oil seals using Valve Seal Installer (MD998774).

Valve Guides

Ensure valve stem diameter is within specification. Check valve stem clearance. Clearance should be within specification. See VALVES & VALVE SPRINGS and CYLINDER HEAD tables under ENGINE SPECIFICATIONS. If clearance

exceeds service limits, replace valve guide with an oversized valve guide.

Valves

Ensure valve stem diameter and margin are within specification. See VALVES & VALVE SPRINGS table under ENGINE SPECIFICATIONS.

Valve Seat

See ENGINE OVERHAUL PROCEDURES - GENERAL INFORMATION article in the GENERAL INFORMATION section.

Valve Seat Correction Angles

See ENGINE OVERHAUL PROCEDURES - GENERAL INFORMATION article in the GENERAL INFORMATION section.

VALVE TRAIN

Rocker Arm Shaft Assembly

1) For reassembly reference, note location and order of assembly for all components. Remove bolts from shafts, and separate components.

2) Inspect components for wear and damage. Install components in original location when assembling shaft assembly. See Fig. 15. Tighten rocker arm assembly bolts to specification. See TORQUE SPECIFICATIONS.

Lash Adjusters

Before installing lash adjuster, submerge lash adjuster in oil. Use a small wire to hold down internal check valve. Pump plunger up and down 4 or 5 times to bleed air from lash adjuster.

CYLINDER BLOCK ASSEMBLY

Piston & Rod Assembly

1) Mark piston and rod assembly with corresponding cylinder number before removing. Center piston pin in piston. Measure and record piston pin installation depth. Use Piston Pin Removal and Installation Set (MD998780) with hydraulic press to remove piston pin.

2) Piston pin should be easily pushed into piston. If looseness or resistance is encountered, replace piston and pin as a set. Check connecting rod for damage and excessive bend and twist. See CONNECTING RODS table under ENGINE SPECIFICATIONS.

3) Position piston, piston pin and rod on press. Ensure front mark on piston will face timing belt side of engine when installed. Using piston pin removal and installation set, install piston pin into piston and rod to depth recorded in step 1). Ensure piston pin is centered in piston.

Fitting Pistons

1) Measure piston skirt diameter at 90-degree angle to piston pin. If piston diameter is not within specification, replace piston. See PISTONS, PINS & RINGS table under ENGINE SPECIFICATIONS.

2) Measure cylinder bore diameter at 3 places: near top of bore, bottom of bore and center of bore. If cylinder bore diameter or taper is not within specification, machine cylinder bore. See CYLINDER BLOCK table under ENGINE SPECIFICATIONS.

3) If piston-to-cylinder bore clearance is not within specification, replace piston and/or machine cylinder bore. See PISTONS, PINS & RINGS table under ENGINE SPECIFICATIONS.

Piston Rings

Ensure ring end gap and side clearance are within

specification. See PISTONS, PINS & RINGS table under ENGINE SPECIFICATIONS. DO NOT use a ring expander to install oil ring side rails. Properly position ring end gaps around circumference of piston before installing. See Fig. 16.

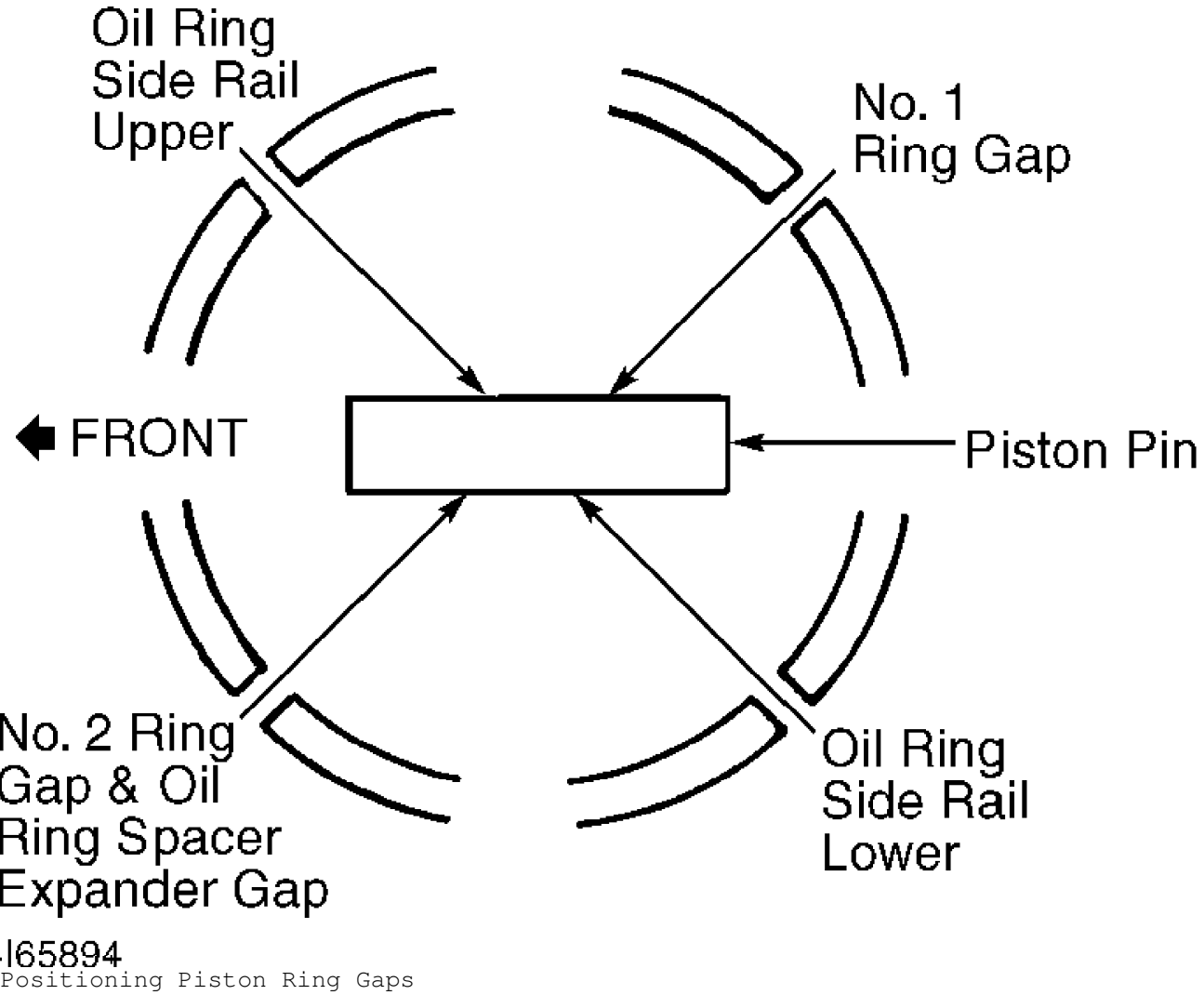

Fig. 16: Positioning Piston Ring Gaps
Courtesy of Mitsubishi Motor Sales of America.

Rod Bearings

Note position of connecting rod in relation to bearing cap before removing. Ensure bearing oil clearance and side play are within specification. See CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS and CONNECTING RODS tables under ENGINE SPECIFICATIONS.

Crankshaft & Main Bearings

Check diameter of crankshaft main bearing journals and connecting rod bearing journals. Check journals for taper and out-of-round. Check crankshaft end play. See CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS table under ENGINE SPECIFICATIONS.

Thrust Bearing

Replace thrust bearing if crankshaft end play is not within specification. See CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS table

under ENGINE SPECIFICATIONS.

Cylinder Block

1) Check cylinder block head surface for warpage. If warpage exceeds specification, machine surface. See CYLINDER BLOCK table under ENGINE SPECIFICATIONS. DO NOT remove more than a combined total .008" (0.20 mm) material from original surfaces of cylinder head or cylinder block.

2) Check cylinder bore wear and taper. Measure cylinder bore diameter at 3 places: near top of bore, bottom of bore and center of bore. If cylinder bore diameter or taper is not within specification, machine cylinder bore to next oversize. See CYLINDER BLOCK table under ENGINE SPECIFICATIONS.

ENGINE OILING

ENGINE LUBRICATION SYSTEM

Oil pressure is provided by a front cover mounted oil pump, driven by the left silent shaft. Pressure relief valve is not adjustable, and is located either in filter bracket. See Fig. 17.

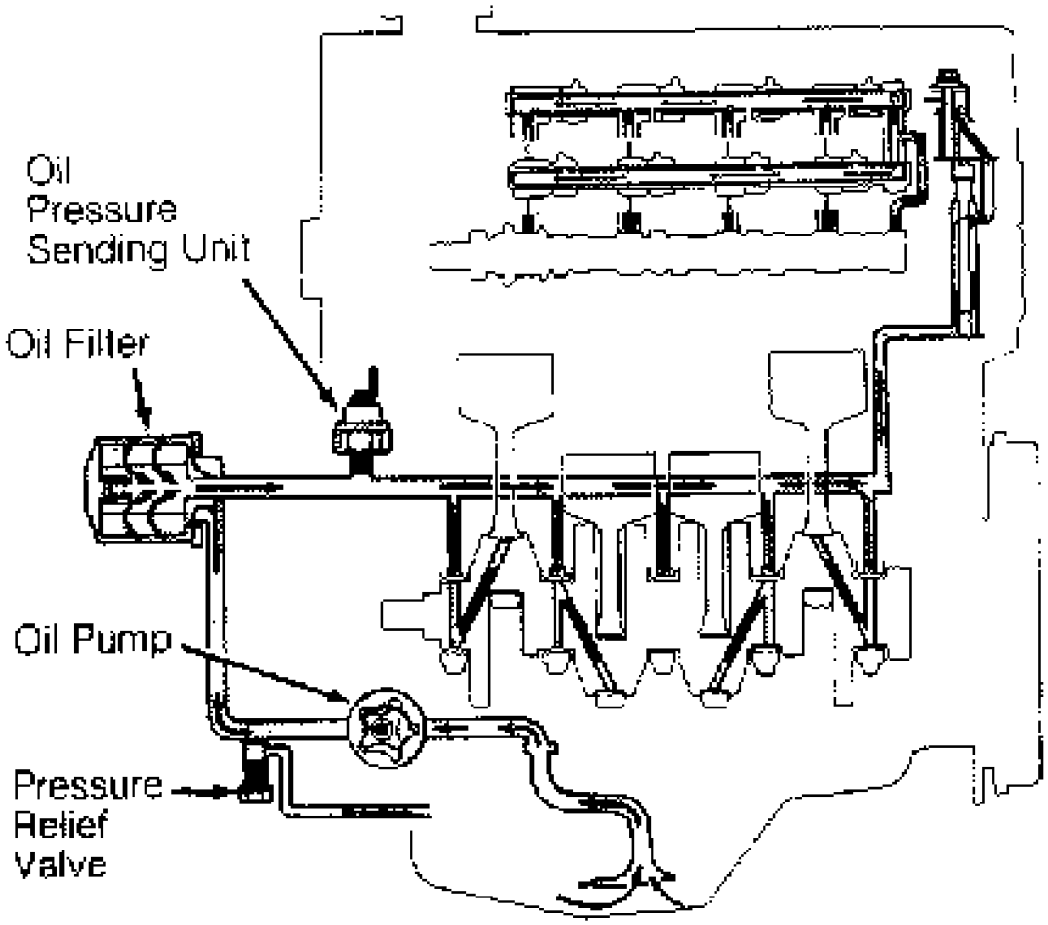

Fig. 17: Engine Oiling System
Courtesy of Mitsubishi Motor Sales of America.

CRANKCASE CAPACITY SPECIFICATIONS

Application	(1) Qts. (L)
SOHC 16 Valve	4.5 (4.3)

(1) - Includes oil filter.

Oil Pressure

Oil pressure should be at least 11.4 psi (.80 kg/cm²) at curb idle, and oil temperature should be 167-194°F (75-90°C).

OIL PUMP & FRONT COVER

Removal & Disassembly

1) Remove timing belt and crankshaft sprocket. See TIMING BELT under REMOVAL & INSTALLATION. Remove oil filter, oil pressure switch, oil pan and oil screen.

2) Remove oil filter bracket, front cover and oil pump assembly. Using Plug Cap Wrench (MD998162), remove plug cap located on front of front cover. Remove rear cover. Mark direction of oil pump gear installation for reassembly reference.

Inspection

1) Place straightedge across front cover housing and measure side clearance between each gear and straightedge. Check clearance between tip of gear teeth of both gears and front cover.

2) Ensure pressure relief valve moves without restriction in bore. Replace components if damaged or not within specification. See OIL PUMP SPECIFICATIONS table.

OIL PUMP SPECIFICATIONS

Application	Specification
Gear Side Clearance	
Drive Gear	.0031-.0055" (.080-.140 mm)
Driven Gear	.0024-.0047" (.060-.120 mm)
Gear-To-Front Cover Clearance	
Drive Gear	.0031-.0055" (.080-.140 mm)
Driven Gear	.0024-.0047" (.060-.120 mm)

Reassembly & Installation

1) Lubricate oil pump gears with engine oil, and install. Ensure timing marks are aligned. Install oil pump cover, and tighten bolts to specification. See TORQUE SPECIFICATIONS.

2) If crankshaft oil seal was removed, use Seal Installer (MD998375) to install seal in front cover. Use a socket of proper diameter to install silent shaft oil seals.

3) Position Oil Seal Guide (MD998285) over front of crankshaft. Lubricate crankshaft oil seal and oil seal guide with engine oil. Install front cover with NEW gasket, and temporarily tighten bolts. Install oil filter bracket. Ensure correct length bolts are installed.

4) To complete installation, reverse removal procedure. Install plug cap using NEW "O" ring, and tighten to specification. Apply thread sealant to oil pressure switch threads before installing. Tighten all bolts to specification. See TORQUE SPECIFICATIONS.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
A/C Tensioner Pulley Bracket Bolt	17-20 (23-27)
Camshaft Sprocket Bolt	66 (90)
Connecting Rod Nut	14.5 + 90° (20 + 90°)
Crankshaft Pulley Bolt	18 (25)
Crankshaft Sprocket Bolt	89 (120)
Cylinder Head Bolt	(1)
Engine Support Bracket Bolt	33 (45)
Exhaust Manifold Nut	
M8	21 (28)
M10	22 (30)
Exhaust Pipe-To-Manifold Nut	36 (49)
Flywheel/Drive Plate Bolt	100 (135)
Front Cover Bolt	18 (24)
Intake Manifold Bolt/Nut	13 (18)
Intake Manifold Stay Bolt	23 (31)
Main Bearing Cap Bolt	18 + 90° (25 + 90°)
Oil Filter Bracket Bolt	14 (19)
Oil Pump Cover Bolt	13 (17)
Oil Pump Pick-Up Tube Bolt	14 (19)
Oil Pump Sprocket Nut	41 (55)
Oxygen Sensor	41 (55)
Plug Cap	18 (24)
Power Steering Pump Bolts	30 (40)
Rear Tensioner Retaining Bolt	14 (19)
Rocker Arm Assembly Bolts	29 (32)
Silent Shaft Sprocket Bolt	34 (46)
Throttle Body Bolt	14 (19)
Timing Belt Cover Bolt	
M8 Flange	10 (14)
Timing Belt Tensioner Bolt	35 (47)
Water Pump Bolt	10 (14)
	INCH Lbs. (N.m)
Crankshaft Position Sensor Nut	89 (10)
Distributor Nut	97 (11)
Fuel Rail Bolt	97 (11)
Oil Pan Bolt	62 (7)
Oil Pressure Switch	62 (7)
Oil Pump Cover Screw	89 (10)
Rear Crankshaft Oil Seal Case Bolt	97 (11)
Throttle Body Bolt	97 (11)
Timing Belt Cover Bolt	
M6 Flange	97 (11)
M6 Loose Washer	89 (10)
Valve Cover Bolt	29 (3.3)
Water Pump Pulley Bolt	71 (8)

(1) - Tighten head bolts to 58 ft. lbs. (78 N.m), in correct sequence. See Fig. 3. Completely loosen head bolts and then tighten in sequence to 15 ft. lbs. (20 N.m). Next, tighten in sequence an added 90-degrees. Then, in sequence, tighten another 90-degrees.

ENGINE SPECIFICATIONS

GENERAL SPECIFICATIONS

GENERAL SPECIFICATIONS

Application	Specification
Displacement	143.4 Cu. In. (2.4L)
Bore	3.41" (86.5 mm)
Stroke	3.94" (100.0 mm)
Compression Ratio	9.5:1
Fuel System	MFI
Horsepower @ RPM	
California	138 @ 5500
Federal	141 @ 5500
Torque Ft. Lbs. @ RPM	
California	148 @ 3000
Federal	148 @ 3000

CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS

CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS

Application	In. (mm)
Crankshaft End Play	
Standard	.0020-.0071 (.050-.180)
Wear Limit	.0098 (.25)
Main Bearings	
Journal Diameter	2.24 (57.0)
Oil Clearance	
Standard	.0008-.0016 (.020-.040)
Wear Limit	.004 (.10)
Connecting Rod Bearings	
Journal Diameter	1.77 (45.0)
Oil Clearance	
Standard	.0008-.0016 (.020-.040)
Wear Limit	.004 (.10)

CONNECTING RODS

CONNECTING RODS

Application	In. (mm)
Side Play	
Standard	.0039-.0098 (.010-.250)
Wear Limit	.016 (.40)

PISTONS, PINS & RINGS

PISTONS, PINS & RINGS

Application	In. (mm)
Pistons	
Clearance	.0008-.0016 (.020-.040)
Diameter	3.4051 (86.490)
Pins	
Rod Fit	(1)
Rings	
No. 1	
End Gap	

Standard	.0098-.0138 (.250-.350)
Wear Limit	.031 (.79)
Side Clearance	
Standard	.0012-.0028 (.030-.070)
Wear Limit	.004 (.10)
No. 2	
End Gap	
Standard	.0157-.0217 (.400-.550)
Wear Limit	.031 (.79)
Side Clearance	
Standard	.0012-.0028 (.030-.070)
Wear Limit	.004 (.10)
No. 3 (Oil)	
End Gap	
Standard	.0039-.0157 (.100-.400)
Wear Limit	.039 (.99)

(1) - Press fit with load of 1653-3858 lbs. (750-1750 kg).

CYLINDER BLOCK

CYLINDER BLOCK

Application	In. (mm)
Cylinder Bore	
Standard Diameter	3.41 (86.5)
Maximum Taper	.0004 (.010)
Maximum Out-Of-Round	.0004 (.010)
Deck Height	11.41-11.42 (289.9-290.1)
Maximum Deck Warpage	(1) .002 (.05)

(1) - Combined maximum total resurface limit of cylinder head and cylinder block is .008" (.20 mm).

VALVES & VALVE SPRINGS

VALVES & VALVE SPRINGS

Application	Specification
Intake Valves	
Face Angle	45-45.5°
Minimum Margin	
Standard	.039" (1.00 mm)
Wear Limit	.020" (.50 mm)
Stem Diameter	.236" (6.0 mm)
Exhaust Valves	
Face Angle	45-45.5°
Minimum Margin	
Standard	.047" (1.20 mm)
Wear Limit	.028" (0.70 mm)
Stem Diameter	.232" (5.9 mm)
Valve Springs	
Free Length	2.01" (51.0 mm)
Installed Height	1.74" (44.2 mm)
Out-Of-Square	
Standard	Less Than 2°
Wear Limit	4°

CYLINDER HEAD

CYLINDER HEAD

Application	Specification
Cylinder Head Height	4.720-4.728" (119.90-120.10 mm)
Maximum Warpage	(1) .0020" (.050 mm)
Valve Seats	
Intake Valve	
Seat Angle	45-45.5°
Seat Width	.035-.051" (.90-1.30 mm)
Exhaust Valve	
Seat Angle	45-45.5°
Seat Width	.035-.051" (.90-1.30 mm)
Valve Guides	
Valve Stem-To-Guide Oil Clearance	
Intake Valve	
Standard	0008-.0020" (.020-.050 mm)
Wear Limit	.0040" (.10 mm)
Exhaust Valve	
Standard	.001-.003" (.030-.070 mm)
Wear Limit	.006" (.15 mm)

(1) - Combined maximum total grind limit of cylinder head and cylinder block is .008" (.20 mm).

CAMSHAFT

CAMSHAFT (1)

Application	In. (mm)
Journal Diameter	1.77 (44.93)
Lobe Height	
Intake Valve ID Mark	
1 & 2	1.452-1.472 (36.89-37.39)
Exhaust Valve ID Mark	
1 & 2	1.46-1.48 (36.97-37.47)

(1) - Camshaft identification (ID) mark is stamped on end opposite camshaft sprocket.

ABBREVIATIONS

1998 Mitsubishi Galant

GENERAL INFORMATION

COMMONLY USED ABBREVIATION

"A" ABBREVIATION TABLE

"A" ABBREVIATION TABLE

ABBREVIATION	DEFINITION
A	Amperes
A/C	Air Conditioning
A/T	Automatic Transmission/Transaxle
AAP	Auxiliary Accelerator Pump
AB	Air Bleed
ABCV	Air Bleed Control Valve
ABDC	After Bottom Dead Center
ABRS	Air Bag Restraint System
ABS	Anti-Lock Brake System
AC	Alternating Current
ACC	A/C Clutch Compressor
ACCS	A/C Cycling Switch
ACCUM	Accumulator
ACCY	Accessory
ACT	Air Charge Temperature Sensor
ACV	Thermactor Air Control Valve
ADJ	Adjust or Adjustable
ADV	Advance
AFS	Airflow Sensor
AI	Air Injection
AIR or A.I.R.	Air Injection Reactor
AIS	Air Injection System
ALCL	Assembly Line Communications Link
ALDL	Assembly Line Diagnostic Link
ARC	Automatic Ride Control
ASCD	Automatic Speed Control Device
ASCS	Air Suction Control Solenoid
ASD	Auto Shutdown
ASDM	Air Bag System Diagnostic Module
ASV	Air Suction Valve
ATC	Automatic Temperature Control
ATDC	After Top Dead Center
ATF	Automatic Transmission Fluid
ATS	Air Temperature Sensor
AXOD	Automatic Transaxle Overdrive
Abs.	Absolute
Accy.	Accessory
Alt.	Alternator or Altitude
Amp.	Ampere
Assy.	Assembly
Auto.	Automatic
Aux.	Auxiliary
Avg.	Average

"B" ABBREVIATION TABLE

"B" ABBREVIATION TABLE

ABBREVIATION	DEFINITION
B/P	Backpressure
BAC	By-Pass Air Control
BAP	Barometric Absolute Pressure Sensor
BARO	Barometric
BBDC	Before Bottom Dead Center
BCM	Body Control Module
BDC	Bottom Dead Center
BHP	Brake Horsepower
BLK	Black
BLU	Blue
BMAP	Barometric & Manifold Absolute Pressure Sensor
BOO	Brake On-Off Switch
BP	Barometric Pressure sensor
BPS	Barometric Pressure Sensor
BPT	Backpressure Transducer
BRN	Brown
BTDC	Before Top Dead Center
BTU	British Thermal Unit
BVSV	Bimetallic Vacuum Switching Valve
Baro.	Barometric
Batt.	Battery
Bbl.	Barrel (Example: 4-Bbl.)
Blst.	Ballast
Blwr.	Blower
Brkr.	Breaker

"C" ABBREVIATION TABLE

"C" ABBREVIATION TABLE

ABBREVIATION	DEFINITION
° C	Celsius (Degrees)
C(3) I	Computer Controlled Coil Ignition
C(4)	Computer Controlled Catalytic Converter
CANP	Canister Purge solenoid
CARB	California Air Resources Board
CAT	Catalytic Converter
CB	Circuit Breaker
CBD	Closed Bowl Distributor
CBVV	Carburetor Bowl Vent Valve
cc	Cubic Centimeter
CCC	Computer Command Control
CCD	Computer Controlled Dwell
CCM	Central Control Module
CCO	Converter Clutch Override
CCOT	Cycling Clutch Orifice Tube
CCW	Counterclockwise
CDI	Capacitor Discharge Ignition
CEC	Computerized Engine Control
CFI	Central Fuel Injection
CID	Cubic Inch Displacement
CID	Cylinder Identification sensor
CIS	Continuous Injection System
CIS-E	Continuous Injection System-Electronic
CKT	Circuit
CLR	Clear
CNG	Compressed Natural Gas

CO	Carbon Monoxide
CO2	Carbon Dioxide
CONV	Convertible
CP	Canister Purge
CPA	Connector Position Assurance
CPS	Crank Position Sensor
CTS	Coolant Temperature Sensor
CV	Check Valve or Constant Velocity
CVC	Constant Vacuum Control
CW	Clockwise
CYL or Cyl.	Cylinder
Calif.	California
Carb.	Carburetor
Chrg.	Charging
Circ.	Circuit
Cntrl.	Control
Comp.	Compressor or Compartment
Conn.	Connector
Cont.	Continued
Conv.	Convertible or Converter
Cu. In.	Cubic Inch
Cyl.	Cylinder

"D" ABBREVIATION TABLE

"D" ABBREVIATION TABLE

ABBREVIATION	DEFINITION
"D"	Drive
DBC	Dual Bed Catalyst
DC	Direct Current or Discharge
DDD	Dual Diaphragm Distributor
DERM	Diagnostic Energy Reserve Module
DFI	Digital Fuel Injection
DIC	Driver Information Center
DIS	Direct Ignition System
DIS	Distributorless Ignition System
DIST	Distribution
DISTR	Distributor
DK BLU	Dark Blue
DK GRN	Dark Green
DME	Digital Motor Electronics (Motronic System)
DOHC	Double Overhead Cam
DOT	Department of Transportation
DP	Dashpot
DRB-II	Diagnostic Readout Box
DVOM	Digital Volt/Ohm Meter (see VOM)
Def.	Defogger or Defroster
Def.	Defrost
Defog.	Defogger
Diag.	Diagnostic
Dist.	Distributor or Distribution
Dr.	Door

"E" ABBREVIATION TABLE

"E" ABBREVIATION TABLE

ABBREVIATION	DEFINITION

EAC	Electric Assist Choke
EACV	Electric Air Control Valve
EBCM	Electronic Brake Control Module
ECA	Electronic Control Assembly
ECAT	Electronically Controlled Automatic Transaxle
ECM	Electronic Control Module
ECT	Engine Coolant Temperature Sensor
ECU	Electronic Control Unit or Engine Control Unit
EDF	Electric Drive Fan relay assembly
EDIS	Electronic Distributorless Ignition System
EEC	Electronic Engine Control
EECS	Evaporative Emission Control System
EEPROM	Electronically Erasable PROM
EFE	Early Fuel Evaporation
EFI	Electronic Fuel Injection
EGO	Exhaust Gas Oxygen sensor (see HEGO)
EGR	Exhaust Gas Recirculation system
EGRC	EGR Control solenoid or system
EGRV	EGR Vent solenoid or system
EMR	Emission Maintenance Reminder Module
ESA	Electronic Spark Advance
ESC	Electronic Spark Control
EST	Electronic Spark Timing
ETR	Emergency Tensioning Retractor
EVAP	Fuel Evaporative System
EVIC	Electronic Vehicle Information Center
EVO	Electronic Variable Orifice
EVP	EGR Valve Position Sensor
EVR	EGR Valve Regulator
EVRV	Electronic Vacuum Regulator Valve
Elect.	Electronic
Eng.	Engine
Evap.	Evaporative
Exc.	Except

"F" ABBREVIATION TABLE

"F" ABBREVIATION TABLE

ABBREVIATION	DEFINITION
° F	Fahrenheit (Degrees)
F/B	Fuse Block
FBC	Feedback Carburetor
FI	Fuel Injector or Fuel Injection
FICD	Fast Idle Control Device
FIPL	Fuel Injector Pump Lever
FP	Fuel Pump
FPM	Fuel Pump Monitor
FPR-VSV	Fuel Pressure Regulator Vacuum Switching Valve
FWD	Front Wheel Drive
Fed.	Federal
Ft. Lbs.	Foot Pounds

"G" ABBREVIATION TABLE

"G" ABBREVIATION TABLE

ABBREVIATION	DEFINITION

g	grams
GND or GRND	Ground
GRN	Green
GRY	Gray
Ga.	Gauge
Gals.	gallons
Gov.	Governor

"H" ABBREVIATION TABLE

"H" ABBREVIATION TABLE

ABBREVIATION	DEFINITION
H/D	Heavy Duty
HAC	High Altitude Compensation
HC	Hydrocarbons
HEDF	High Speed Electro Drive Fan relay or circuit
HEGO	Heated Exhaust Gas Oxygen Sensor
HEGOG	HEGO Ground circuit
HEI	High Energy Ignition
HLDT	Headlight
HO	High Output
HP	High Performance
HSC	High Swirl Combustion
HSO	High Specific Output
HTR	Heater
HVAC	Heating
Headlt.	Headlight
Hg	Mercury
Hgt.	Height
Htr.	Heater
Hz	Hertz (Cycles Per Second)

"I" ABBREVIATION TABLE

"I" ABBREVIATION TABLE

ABBREVIATION	DEFINITION
I.D.	Inside Diameter
IAC	Idle Air Control
IACV	Idle Air Control Valve
IC	Integrated Circuit
ID	Identification
IDM	Ignition Diagnostic Monitor
IGN	Ignition system or circuit
ILC	Idle Load Compensator
In. Hg	Inches of Mercury
INCH Lbs.	Inch Pounds
INFL REST	Inflatable Restraint
INJ	Injector or Injection
IP	Instrument Panel
IPC	Instrument Panel Cluster
ISA	Idle Speed Actuator
ISC	Idle Speed Control
ISS	Idle Stop Solenoid
ITS	Idle Tracking Switch
IVSV	Idle Vacuum Switching Valve

Ign.	Ignition
In.	Inches
Inj.	Injector

"J" ABBREVIATION TABLE

"J" ABBREVIATION TABLE

ABBREVIATION	DEFINITION
J/B	Junction Block

"K" ABBREVIATION TABLE

"K" ABBREVIATION TABLE

ABBREVIATION	DEFINITION
k/ohms	1000 ohms (kilo as in k/ohms)
kg	Kilograms (weight)
kg/cm²	Kilograms Per Square Centimeter
KAM	Keep Alive Memory
KAPWR	Keep Alive Power
KM/H	Kilometers Per Hour
KOEO	Key On Engine Off
KOER	Key On Engine Running
KS	Knock Sensor

"L" ABBREVIATION TABLE

"L" ABBREVIATION TABLE

ABBREVIATION	DEFINITION
L	Liter(s)
L/D	Light Duty
LCD	Liquid Crystal Display
LED	Light Emitting Diode
LH	Left Hand
LOS	Limited Operation Strategy
LT BLU	Light Blue
LT GRN	Light Green
LUS	Lock-Up Solenoid
Lbs.	Pounds
Lt(s).	Light(s)
Lugg.	Luggage

"M" ABBREVIATION TABLE

"M" ABBREVIATION TABLE

ABBREVIATION	DEFINITION
mA	Milliamps
mV	Millivolts
mfd.	Microfarads

mm	Millimeters
M/T	Manual Transaxle or Transmission
MA PFI	Mass Air Sequential Port Fuel Injection system
MA or MAF	Mass Airflow
MAF	Mass Air Flow sensor
MAFS	Mass Airflow Sensor
MAP	Manifold Absolute Pressure sensor
MAT	Manifold Air Temperature
MCU	Microprocessor Control Unit
MCV	Mixture Control Valve
MEM-CAL	Memory Calibration Chip
MFI	Multiport Fuel Injection
MIL	Malfunction Indicator Light
MLP	Manual Lever Position
MPFI	Multi Point Fuel Injection
MPH	Miles Per Hour
MPI	Multi-Point (Fuel) Injection
Man.	Manual
Mech.	Mechanical
Mem.	Memory
Mtr.	Motor

"N" ABBREVIATION TABLE

"N" ABBREVIATION TABLE

ABBREVIATION	DEFINITION
N.m	Newton-Meter
NA	Not Available
NDS	Neutral Drive Switch
NGS	Neutral Gear Switch
NOx	Oxides of Nitrogen
NPS	Neutral Pressure Switch
No.	Number
Nos.	Numbers

"O" ABBREVIATION TABLE

"O" ABBREVIATION TABLE

ABBREVIATION	DEFINITION
O	Oxygen
O.D.	Outside Diameter
O/S	Oversize
O2	Oxygen
OC	Oxidation Catalyst
OCC	Output Circuit Check
OD	Overdrive
ODO	Odometer
OHC	Overhead Camshaft
ORG	Orange
OSC	Output State Check
Opt.	Option or Optional
oz.	Ounce
ozs.	Ounces

"P" ABBREVIATION TABLE

"P" ABBREVIATION TABLE

ABBREVIATION	DEFINITION
"P"	Park
P/C	Printed Circuit
P/N	Park/Neutral
P/S	Power Steering
PAV	Pulse Air Valve
PC-SOL	Purge Control Solenoid
PCM	Powertrain Control Module
PCS	Purge Control Solenoid
PCSDM	Passenger Compartment Sensor/Diagnostic Module
PCV	Positive Crankcase Ventilation
PFE	Pressure Feedback EGR sensor or circuit
PFI	Port Fuel Injection (see MA SEFI)
PGM-CARB	Programmed Carburetor
PGM-FI	Programmed Fuel Injection
PIP	Profile Ignition Pickup
PNK	Pink
PPL	Purple
PRNDL	Park Reverse Neutral Drive Low
PROM	Programmable Read-Only Memory
psi	Pounds Per Square Inch
PSPS	Power Steering Pressure Switch
PTC	Positive Temperature Coefficient
PTO	Power Take-Off
PWR GND	Power Ground circuit
Pkg.	Package
Press.	Pressure
Prog.	Programmed or Programmable
Pts.	Pints
Pwr.	Power

"Q" ABBREVIATION TABLE

"Q" ABBREVIATION TABLE

ABBREVIATION	DEFINITION
Qts.	Quarts

"R" ABBREVIATION TABLE

"R" ABBREVIATION TABLE

ABBREVIATION	DEFINITION
RABS	Rear Anti-Lock Brake System
RAC	Remote Accessory Control
RAM	Random Access Memory
RAP	Retained Accessory Power
RECIRC	Recirculation
RED	Red
RH	Right Hand
ROM	Read Only Memory
RPM	Revolutions Per Minute

RVB	Rear Vacuum Break
RWAL	Rear Wheel Anti-Lock Brake
RWD	Rear Wheel Drive
Recirc.	Recirculate or Recirculation
Reg.	Regulator
Rly.	Relay

"S" ABBREVIATION TABLE

"S" ABBREVIATION TABLE

ABBREVIATION	DEFINITION
SAW	Spark Angle Word
SBC	Single Bed Converter
SBEC	Single Board Engine Controller
SC	Super Charged
SCC	Spark Control Computer
SCS	Air Suction Control Solenoid
SDM	Supplemental Restraint System Diagnostic Module
SDU	SRS Diagnostic Unit
SEN	Sensor
SES	Service Engine Soon
SFI	Sequential (Port) Fuel Injection
SIG RTN	Signal Return circuit
SIL	Shift Indicator Light
SIR	Supplemental Inflatable Restraint
SMEC	Single Module Engine Controller
SOHC	Single Overhead Cam
SOL or Sol.	Solenoid
SPFI	Sequential Port Fuel Injection
SPK	Spark Control
SPOUT	Spark Output Signal
SRS	Supplemental Restraint System (Air Bag)
SS 3/4-4/3	Shift Solenoid circuit
SSI	Solid State Ignition
STAR	Self-Test Automatic Readout
STI	Self Test Input circuit
STO	Self-Test Output
SUB-O2	Sub Oxygen Sensor
Sen. or Sens.	Sensor
Sol.	Solenoid
Sprchg.	Supercharger
Strg.	Steering
Susp.	Suspension
Sw.	Switch
Sys.	System

"T" ABBREVIATION TABLE

"T" ABBREVIATION TABLE

ABBREVIATION	DEFINITION
T.V.	Throttle Valve
TAB	Thermactor Air By-Pass
TAC	Thermostatic Air Cleaner
TAD	Thermactor Air Diverter
TAN	Tan
TBI	Throttle Body Injection

TCC	Torque Converter Clutch
TCCS	Toyota Computer Control System
TDC	Top Dead Center
TDCL	Total Diagnostic Communication Link
TFI	Thick Film Ignition system
TGS	Top Gear Switch (cancels SIL in top gear)
THERMAC	Thermostatic Air Cleaner
THS	Transmission Hydraulic Switch
TP/TPS	Throttle Position Sensor
TPI	Tuned Port Injection
TPS	Throttle Position Sensor/Switch
TS	Temperature Sensor
TSB	Technical Service Bulletin
TTS	Transmission Temperature Switch
TV	Thermovalve
TWC	Three-Way Catalyst
Temp.	Temperature
Trans.	Transaxle/Transmission

"V" ABBREVIATION TABLE

"V" ABBREVIATION TABLE

ABBREVIATION	DEFINITION
V	Valve
VAF	Vane Air Flow sensor or circuit
VAPS	Variable Assist Power Steering
VAT	Vane Air Temperature
VATS	Vehicle Anti-Theft System
VBATT	Vehicle Battery Voltage
VCC	Viscous Converter Clutch
VIN	Vehicle Identification Number
VIO	Violet
VLR	Volt Loop Reserve
VM	Vacuum Modulator
VM	Vane Meter
VOM	Volt-Ohmmeter (Analog)
VPWR	Vehicle Power supply voltage (10-14 volts)
VREF	Voltage Reference (ECA supplied reference voltage
VRV	Vacuum Regulator Valve
VSC	Vehicle Speed Control sensor or signal
VSS	Vehicle Speed Sensor or signal
VSV	Vacuum Switching Valve
Vac.	Vacuum
Volt.	Voltage

"W" ABBREVIATION TABLE

"W" ABBREVIATION TABLE

ABBREVIATION	DEFINITION
W/	With
W/O	Without
WAC	WOT A/C Cut-off switch or circuit
WAC	Wide Open Throttle A/C Switch
WHT	White
WOT	Wide Open Throttle
YEL	Yellow

A/C COMPRESSOR REFRIGERANT OIL CHECKING

1998 Mitsubishi Galant

1998 A/C SYSTEM GENERAL SERVICING
Mitsubishi - Compressor Refrigerant Oil Checking

Diamante, Eclipse, Galant, Mirage, Montero, Montero Sport & 3000GT

* PLEASE READ THIS FIRST *

NOTE: Always refer to underhood A/C specification label in engine compartment or A/C compressor label while servicing A/C system. If engine compartment/compressor label specifications differ from specifications in this article, use underhood/compressor label specifications.

A/C COMPRESSOR APPLICATIONS

A/C COMPRESSOR APPLICATION TABLE

Application	Compressor
Diamante	Sanden MSC105CVS Scroll
Eclipse	
2.0L Non-Turbo	Nippondenso 10PA17C 10-Cyl.
2.0L Turbo & 2.4L	Sanden MSC105CVS Scroll
Galant	Sanden MSC90C12 Scroll
Mirage	Sanden MSC90 Scroll
Montero	Nippondenso 10PA15 10-Cyl.
Montero Sport	Sanden MSC105C Scroll
3000GT	Sanden MSC105 Scroll

REFRIGERANT OIL & REFRIGERANT CAPACITY SPECIFICATIONS

NOTE: DO NOT exceed A/C system refrigerant oil capacity when servicing system.

REFRIGERANT OIL & R-134a REFRIGERANT CAPACITY TABLE

Application	(1) Oil Ounces	Refrigerant Ounces
Diamante	5.7-6.4	22.9-24.3
Eclipse		
2.0L Non-Turbo	2.7-4.1	24.7-26.1
2.0L Turbo & 2.4L	5.7-6.4	24.7-26.1
Galant	4.1-5.1	22.9-24.3
Mirage	4.1-5.1	19.6-21.0
Montero	(2) 4.1	21.2-22.9
Montero Sport	(2) 5.7	22.9-24.0
3000GT	4.7-6.1	26.1-27.9

(1) - Total system capacity, unless otherwise noted.
(2) - Compressor refrigerant oil capacity.

REFRIGERANT OIL

Only NEW, moisture-free refrigerant oil should be used in the air conditioning system. This oil is highly refined and dehydrated so moisture content is less than 10 parts per million. The oil container must be tightly closed at all times when not in use, or moisture from the air will be absorbed into the refrigerant oil.

SERVICING PRECAUTIONS

DISCHARGING SYSTEM

Discharge A/C system, using approved refrigerant recovery/recycling equipment that meets SAE J2210 requirements. Always follow recovery/recycling equipment manufacturer's instructions. After refrigerant recovery process is completed, replace any refrigerant oil removed with the same amount of NEW refrigerant oil.

DISCONNECTING LINES & FITTINGS

After system is discharged, carefully clean area around all fittings to be opened. Always use 2 wrenches when tightening or loosening fittings. Some refrigerant lines are connected with a coupling. Special tools may be required to disconnect lines. Cap or plug all openings as soon as lines are removed. DO NOT remove shipping caps from replacement components until ready to install.

CONNECTING LINES & FITTINGS

NOTE: Ensure all replacement component connections match connections of system being worked on.

Always use a NEW gasket or "O" ring when connecting lines or fittings. Coat "O" ring with NEW refrigerant oil and ensure it is not twisted during installation. Always use two wrenches to prevent damage to lines and fittings.

PLACING SYSTEM IN OPERATION

After component service or replacement has been completed and all connections have been made, thoroughly evacuate system with a vacuum pump. Charge system with proper amount of refrigerant and perform leak test. See REFRIGERANT OIL & REFRIGERANT SPECIFICATIONS table for system capacities. Ensure there are no leaks at any fitting that has been opened. After system has been leak tested, check system performance.

NIPPONDENSO 10-CYL.

Eclipse 2.0L Non-Turbo & Montero

Replacement compressor is shipped with NEW refrigerant oil. Drain, measure and discard refrigerant oil from old compressor. Drain NEW refrigerant oil from replacement compressor equal to difference between amount drained from old compressor and amount shipped in replacement compressor. If any other components are replaced, add NEW refrigerant oil as specified. See COMPONENT REFRIGERANT OIL CAPACITIES (MITSUBISHI - NIPPONDENSO 10-CYL.) table.

COMPONENT REFRIGERANT OIL CAPACITIES TABLE (NIPPONDENSO)

Component	Ounces
Compressor (1)	

Eclipse 2.0L Non-Turbo	3.4
Montero	4.1
Condenser	1.4
Evaporator	1.4
Receiver-Drier	0.3
Suction Hose	0.3

(1) - If replacement compressor is shipped without refrigerant oil, add same amount of NEW refrigerant oil to replacement compressor that was drained from old compressor.

SANDEN SCROLL

Diamante, Eclipse 2.0L Turbo & 2.4L, Galant, Mirage, Montero Sport and 3000GT

Replacement compressor is shipped with NEW refrigerant oil. Drain, measure and discard refrigerant oil from old compressor. Drain NEW refrigerant oil from replacement compressor equal to difference between amount drained from old compressor and amount shipped in replacement compressor. If any other components are replaced, add NEW refrigerant oil as specified. See COMPONENT REFRIGERANT OIL CAPACITIES (SANDEN SCROLL) table.

COMPONENT REFRIGERANT OIL CAPACITIES TABLE (SANDEN SCROLL)

Component	Ounces
Compressor (1)	
Diamante, Eclipse 2.0L Turbo & 2.4L & Galant	5.7-6.4
Mirage	4.4
3000GT	5.4
Condenser	
Diamante, Eclipse 2.0L Turbo & 2.4L, Galant, Mirage & 3000GT	0.5
Evaporator	
Diamante, Eclipse 2.0L Turbo & 2.4L, Galant, Mirage & 3000GT	2.0
Receiver-Drier	
Diamante, Eclipse 2.0L Turbo & 2.4L, Galant, Mirage & 3000GT	0.3
Refrigerant Lines	
Diamante, Eclipse 2.0L Turbo & 2.4L, Galant, Mirage & 3000GT	0.3

(1) - If replacement compressor is shipped without refrigerant oil, add same amount of NEW refrigerant oil to replacement compressor that was drained from old compressor.

A/C COMPRESSOR SERVICING

1998 Mitsubishi Galant

1998 GENERAL SERVICING
Mitsubishi - Compressor Servicing

Diamante, Eclipse, Galant, Mirage, Montero, Montero Sport & 3000GT

A/C COMPRESSOR APPLICATIONS

A/C COMPRESSOR APPLICATION TABLE

Application	Compressor
Diamante	Sanden MSC105CVS Scroll
Eclipse	
2.0L Non-Turbo	Nippondenso 10PA17C 10-Cyl.
2.0L Turbo & 2.4L	Sanden MSC105CVS Scroll
Galant	Sanden MSC90C12 Scroll
Mirage	Sanden MSC90 Scroll
Montero	Nippondenso 10PA15 10-Cyl.
Montero Sport	Sanden MSC105C Scroll
3000GT	Sanden MSC105 Scroll

NOTE: Due to variety of clutch and shaft seal configurations, obtain appropriate A/C compressor service tools for compressor being serviced. Land Rover and Jaguar compressor service information not available at time of publication.

NIPPONDENSO

CLUTCH COIL

Removal

1) Hold clutch plate stationary. Remove clutch plate center bolt and clutch plate. If clutch plate cannot be removed by hand, tighten an 8-mm or 10-mm bolt into clutch plate center bolt hole to remove clutch plate.

2) Remove shim(s) and pulley snap ring from compressor shaft. Tap pulley using a plastic hammer and remove pulley from compressor shaft. See Fig. 1 or 2. Remove retaining screw for clutch coil lead. Remove clutch coil snap ring and clutch coil.

Installation

1) To install, reverse removal procedure. Ensure clutch coil pin is aligned with hole in compressor housing. Ensure clutch coil lead is positioned properly. Ensure NEW snap rings are installed with beveled side facing out. Tighten shaft bolt to 10-13 ft. lbs. (14-17 N.m).

2) Check air gap between clutch plate and pulley. Position dial indicator on clutch plate. Energize clutch coil and zero dial indicator. De-energize clutch coil and measure air gap (clutch plate movement). Ensure air gap between clutch plate and pulley is 0.014-0.026" (0.35-0.65 mm). If air gap is incorrect, add or remove shim(s) as necessary. Ensure pulley rotates freely.

NOTE: On some compressors, it is necessary to use a dial indicator on clutch plate to check air gap. Energize clutch coil and zero dial indicator. De-energize clutch coil and measure air gap. Ensure air gap is as specified.

SHAFT SEAL

CAUTION: Secure rear housing to compressor body using a vise before removing front housing through-bolts. Compressor rear housing may separate from compressor body, spilling refrigerant oil.

Removal

1) Remove clutch coil. See CLUTCH COIL. See Fig. 1 or 2. Position compressor in a vise so compressor rear housing is secured to compressor body. Remove front housing through-bolts and front housing.

2) Using a flat-blade screwdriver, remove felt retainer and felt from front housing. Remove shaft seal snap ring. Using a flat-blade screwdriver, remove shaft seal and "O" ring. See Fig. 1 or 2.

Installation

1) Inspect compressor shaft and front housing bore for damage and/or excessive wear. Ensure "O" ring and shaft seal seat are clean. Apply NEW refrigerant oil to compressor side of front housing bore. Lubricate "O" ring and shaft seal with NEW refrigerant oil. Using a 21-mm socket, install shaft seal with "O" ring side facing away from compressor. Install shaft seal snap ring. See Fig. 1 or 2.

2) Install felt into felt retainer. Using a 14-mm deep socket, install felt and felt retainer. Lubricate compressor shaft. Install front housing using care not damage shaft seal lip. See Fig. 1 or 2.

3) Alternately tighten front housing through-bolts to 19 ft. lbs. (26 N.m). Install clutch plate center bolt. Using an INCH-lb. torque wrench, ensure compressor breakaway torque is 43 INCH lbs. (4.9 N.m) or less. To complete installation, reverse removal procedures. Ensure air gap between clutch plate and pulley is correct. See CLUTCH COIL.

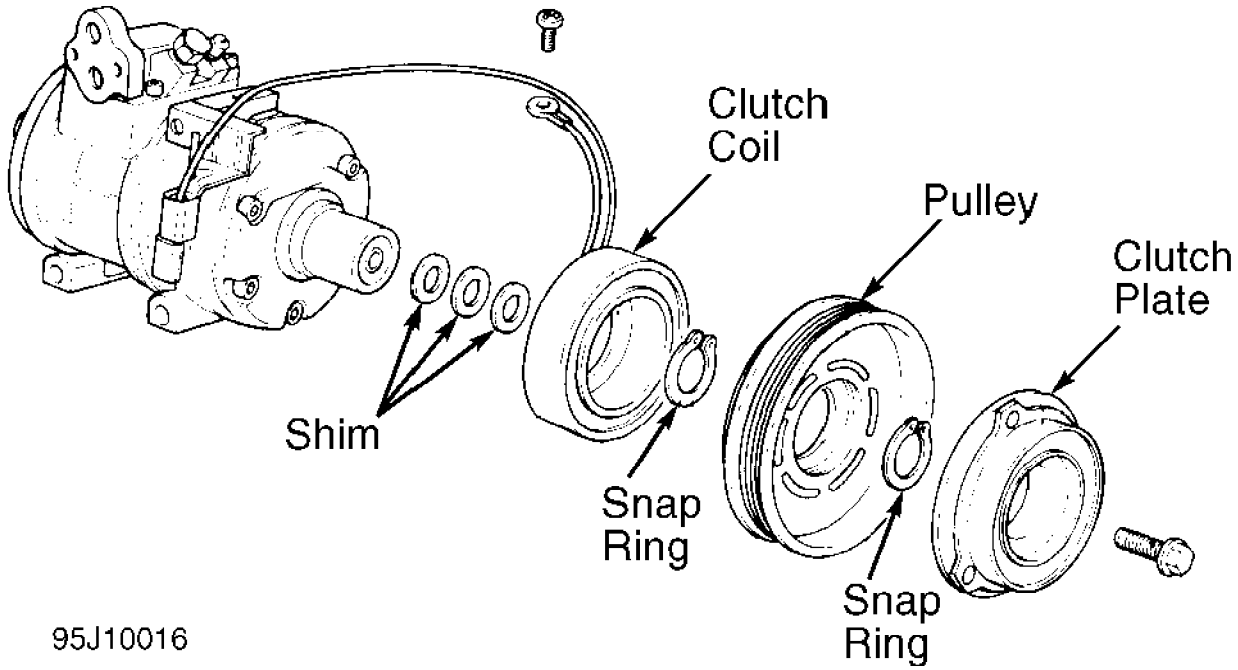

Fig. 1: Exploded View Of Compressor (Nippondenso 10PA17C 10-Cyl.) Courtesy of Toyota Motor Sales, U.S.A., Inc.

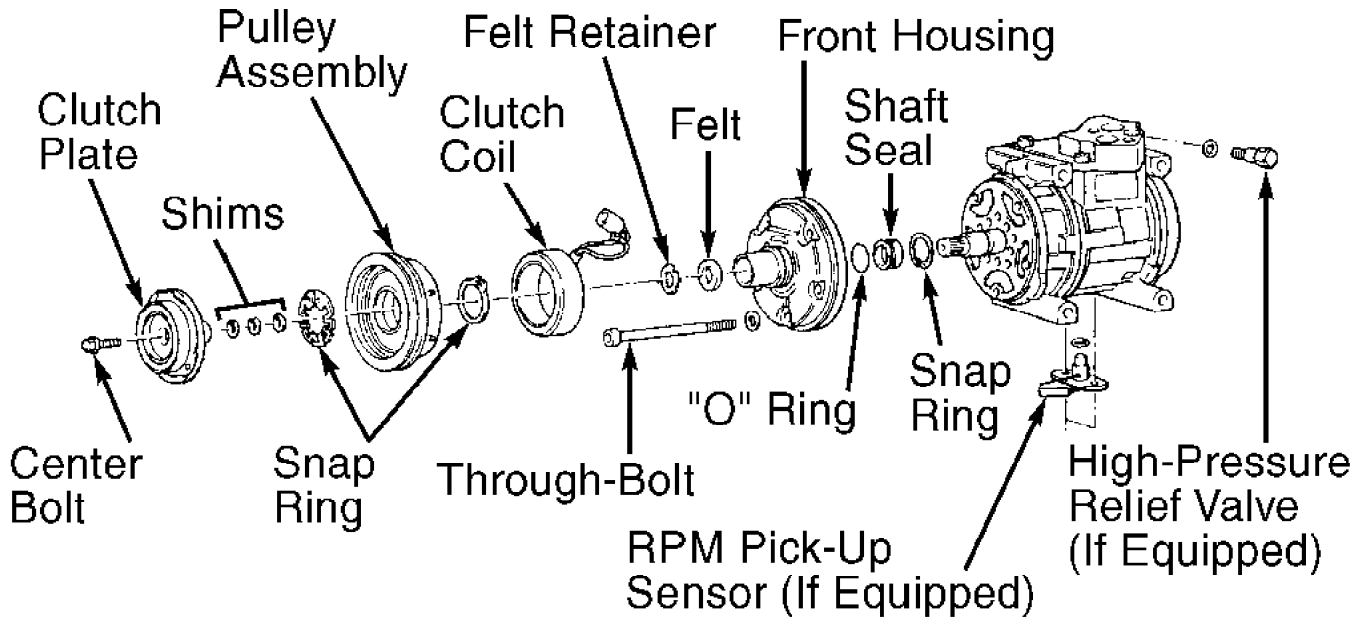

Fig. 2: Exploded View Of Compressor (Typical)
Courtesy of Mitsubishi Motor Sales of America.

SANDEN SCROLL

CLUTCH COIL & SHAFT SEAL

Removal

1) Remove drive belt pulley (if equipped). Hold clutch plate using Pliers (MB991367) and Bolts (MB991386). Use a ratchet and socket to remove clutch hub nut.

2) Remove clutch plate. See Fig. 3 or 4. Remove snap ring with internal snap ring pliers. Remove clutch hub (rotor). Remove snap ring and clutch coil.

3) Using an awl, remove bearing cover and retainer. Using Bearing Remover (MB991456), engage bearing grooves. Place base of bearing remover over remover arms and tighten nut.

4) Tighten bearing remover bolt to withdraw bearing from compressor. Engage grooves of Shaft Seal Remover/Installer (MB991458) and pull straight up on shaft seal.

Installation

1) To install shaft seal, ensure front housing is free of foreign objects. Lubricate Shaft Seal Protector (MB991459) and place over compressor shaft. Lubricate shaft seal and install using shaft seal remover/installer. Remove shaft seal protector.

2) Using a 21-mm socket or Drift (MB991301), carefully press bearing onto compressor shaft. Install clutch coil so that alignment pin is engaged. Install clutch coil snap ring with tapered side facing out.

3) Align armature plate with crankshaft spline. Tighten shaft nut to 12 ft. lbs. (16 N.m). Using feeler gauge, ensure air gap between pressure plate and pulley is 0.02-0.03" (0.5-0.8 mm) on Diamante and 0.016-0.024" (0.4-0.6 mm) on all other models. If air gap is incorrect, add or remove shim(s) as necessary.

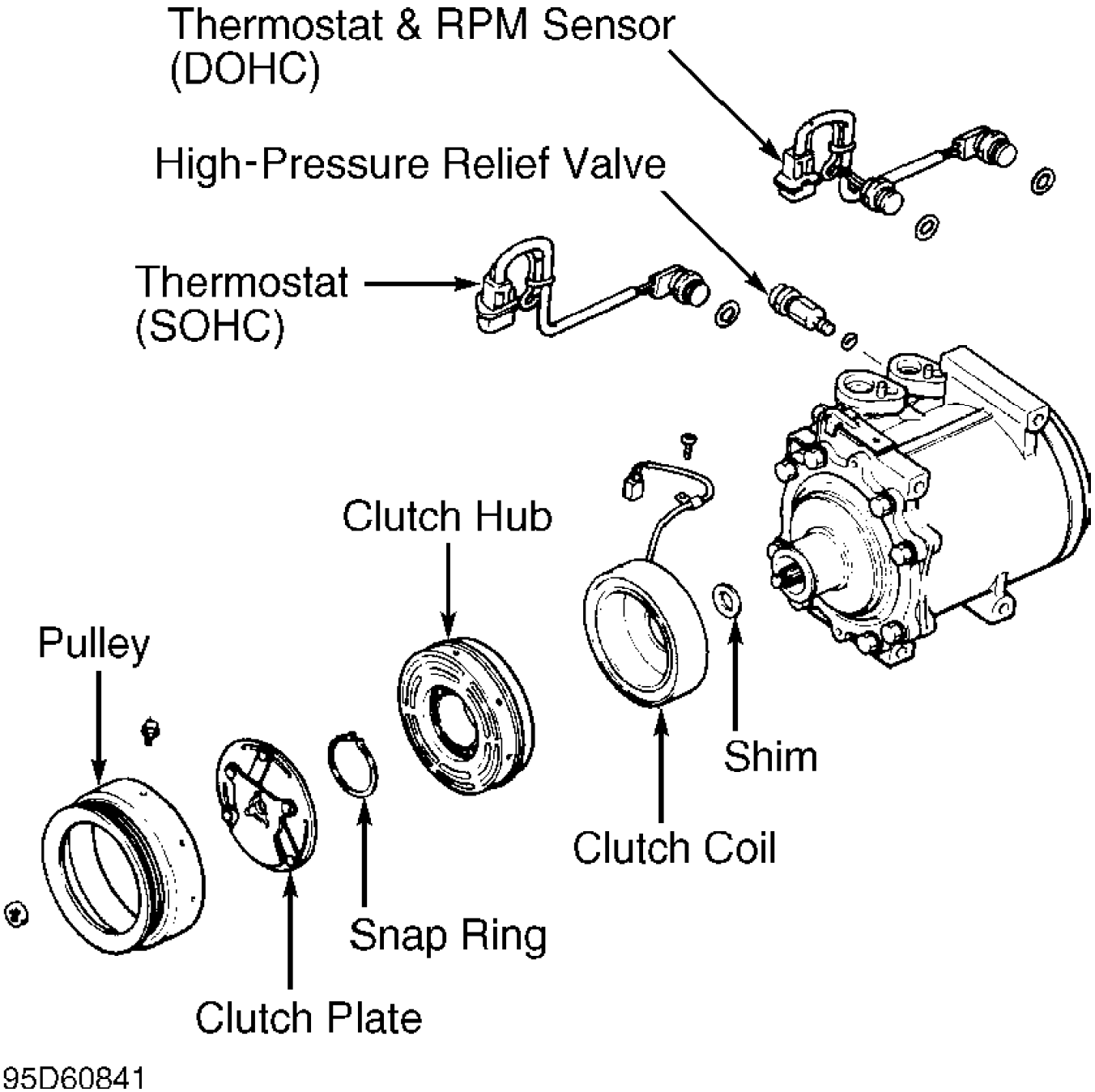

Fig. 3: Exploded View Of Compressor (Sanden Scroll MSC105 Shown; MSC90C Is Similar)
Courtesy of Mitsubishi Motor Sales Of America.

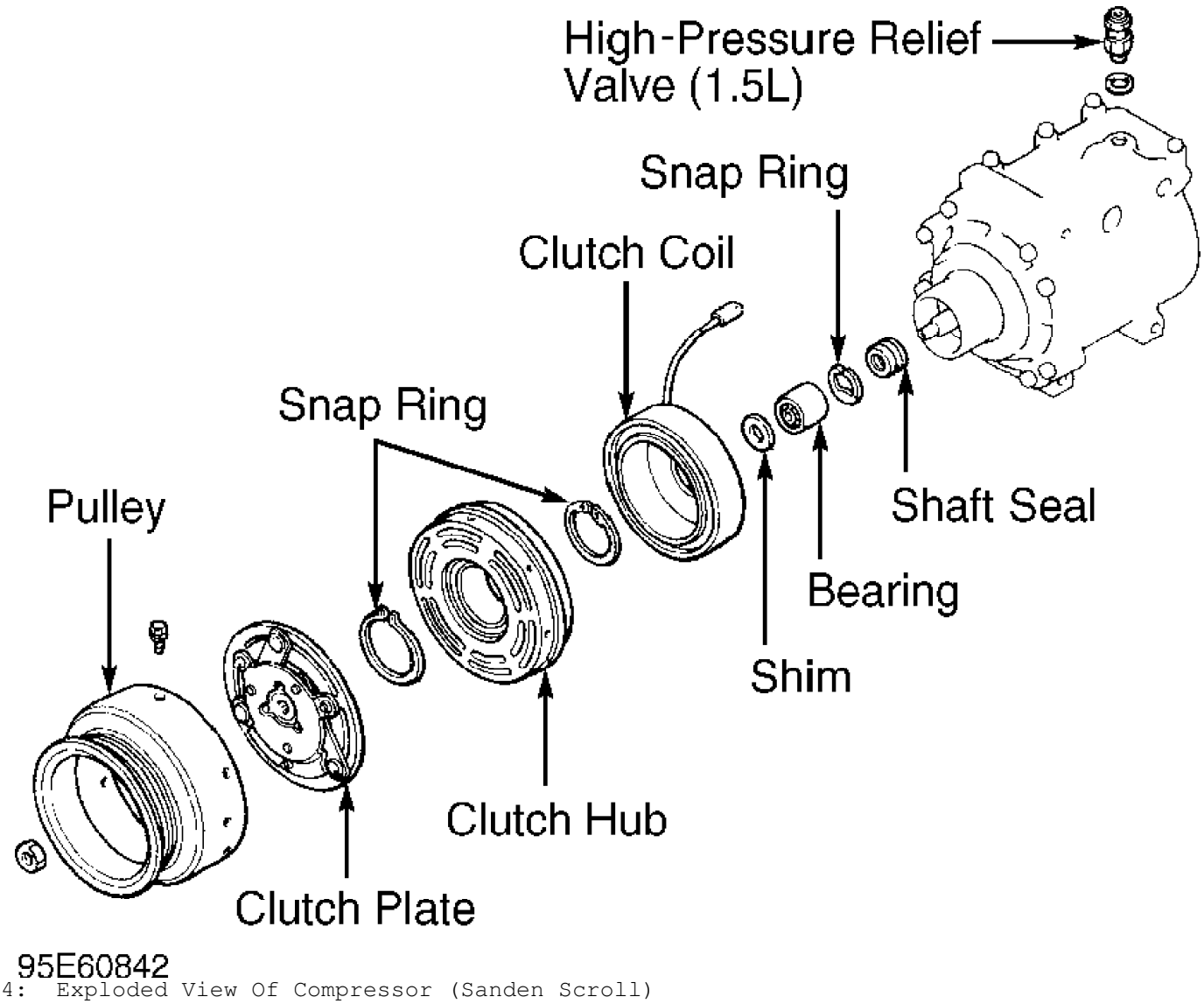

Fig. 4: Exploded View Of Compressor (Sanden Scroll)
Courtesy of Mitsubishi Motor Sales Of America.

A/C-HEATER SYSTEM - AUTOMATIC

1998 Mitsubishi Galant

1998 AIR CONDITIONING & HEAT
Mitsubishi - A/C-Heater System - Automatic

Galant

* PLEASE READ THIS FIRST *

WARNING: To avoid injury from accidental air bag deployment, read and carefully follow all SERVICE PRECAUTIONS and DISABLING & ACTIVATING AIR BAG SYSTEM procedures in AIR BAG RESTRAINT SYSTEM article.

CAUTION: When battery is disconnected, radio will go into anti-theft protection mode. Obtain radio anti-theft protection code from owner prior to servicing vehicle.

A/C SYSTEM SPECIFICATIONS

A/C SYSTEM SPECIFICATIONS TABLE

Application	Specification
Compressor Type	Sanden MSC90C12 Scroll
Compressor Belt Deflection	
New	7/32-15/64" (5.5-6.0 mm)
Used	1/4-19/64" (6.5-7.5 mm)
Compressor Oil Capacity (1)	4.1 ozs.
Refrigerant (R-134a) Capacity	23.0-24.3 ozs.
System Operating Pressures (2)	
High Side	111-139 psi (7.8-9.8 kg/cm²)
Low Side	6-20 psi (0.4-1.4 kg/cm²)

(1) - Use SUN PAG 56 refrigerant oil.
(2) - With ambient temperature at about 77(0)F (25(0)C).

DESCRIPTION

The A/C system can be operated manually or automatically. Selecting the desired temperature and pressing the AUTO button puts system in automatic control. When the AUTO button is pressed, the indicator in the display window illuminates, and airflow source, airflow outlet, blower speed and compressor operation are automatically controlled to maintain temperature at the selected level. See Fig. 1.

The temperature setting is retained in memory even after ignition is turned off, unless battery has been disconnected. When heater is requested, air will be directed to windshield and side windows, and blower will operate in low speed. This prevents cold/unheated air from being directed to vehicle occupants until coolant temperature is sufficiently warm.

OPERATION

A/C CONTROLS

Economy (ECO) Position

The economy position can be obtained by depressing the snowflake button on control panel. With A/C in economy position, control panel display will show ECO, and compressor will only operate when necessary to maintain the temperature selected.

Humidity Position (Snowflake Symbol)
This position can be selected when humidity is high or outside air temperature is very hot. A/C compressor is operated to perform air cooling and dehumidifying.

Maximum Cooling (MAX COOL)
A/C compressor will operate continuously for maximum cooling.

OUTSIDE TEMPERATURE SELECTOR

Pressing outside temperature selector button displays outside air temperature. Illuminated display will show OUTSIDE when mode is selected. If outside air temperature reaches 32°F (0°C), an alarm will sound and outside air temperature will be displayed momentarily.

MODE SELECTOR CONTROL

Press Mode Selector button to scroll through different air flow selections to obtain desired direction.

Face Position
In this position, airflow is directed to upper area of passenger compartment.

Bi-Level Position
In this position, airflow is directed to leg and upper area of passenger compartment.

Foot Position
In this position, airflow is directed to leg area.

Foot/Defrost Position
In this position, airflow is directed to leg area, windshield and door windows.

Defrost Position
In this position, airflow is directed to windshield and door windows.

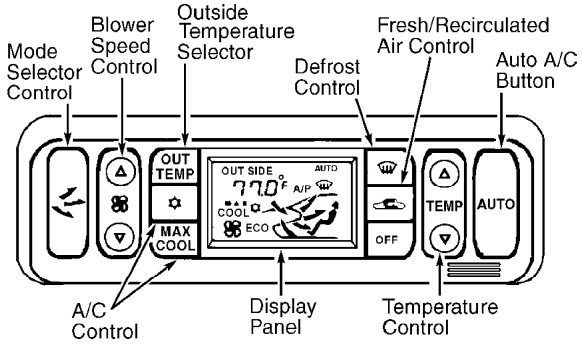

Fig. 1: Identifying A/C ECU Control Panel Controls
Courtesy of Mitsubishi Motor Sales of America.

FRESH/RECIRCULATED AIR CONTROL

Fresh/recirculated air control can be set to inside or outside air position by pressing fresh/recirculated air control button. When outside air position is selected, outside air enters passenger compartment. Outside air position is used to minimize window fogging.

When inside air position is selected, inside air is recirculated in passenger compartment. When driving on dusty roads or if quick cooling or heating is desired, select inside air position to prevent outside air from entering passenger compartment.

TEMPERATURE CONTROL

Temperature control adjusts the desired passenger compartment temperature. Temperature selection range is 65°F (17°C) to 90°F (32°C).

BLOWER SPEED CONTROL

When ignition switch is turned to ON position, blower can be operated to regulate amount of air forced through passenger compartment. Blower speed is indicated by a fan illuminated on the display. With A/C in AUTO position, blower speed is controlled automatically.

DEFROST CONTROLS

Pressing defrost button changes settings to a preprogrammed set of adjustments for maximum defrost. By pressing defrost again, all previous settings return.

TROUBLE SHOOTING

COMPRESSOR DOES NOT OPERATE

Check components in order listed, and repair or replace as necessary: A/C fuse, refrigerant charge, magnetic clutch, compressor relay, dual-pressure switch, wiring harness and connectors, sensors, A/C ECU, and engine control module.

BLOWER MOTOR DOES NOT OPERATE

Check components in order listed, and repair or replace as necessary: A/C fuse, blower motor, blower motor relay, power transistor, wiring harness and connectors, and A/C ECU.

BLOWER MOTOR DOES NOT STOP

Check components in order listed, and repair or replace as necessary: blower motor relay, power transistor, wiring harness and connectors, and A/C ECU.

FRESH/RECIRCULATED AIR SELECTOR DAMPER DOES NOT OPERATE

Check components in order listed, and repair or replace as necessary: fresh/recirculated air damper motor, wiring harness and connectors, and A/C ECU.

INSUFFICIENT/NO HEATING

Check components in order listed, and repair or replace as necessary: check for stored trouble codes, A/C compressor clutch,

fresh/recirculated air damper motor/potentiometer, heater core, thermostat, wiring harness and connectors, and A/C ECU.

INSUFFICIENT/NO COOLING

Check components in order listed, and repair or replace as necessary:A/C fuse, check for stored trouble codes, refrigerant charge, A/C compressor relay, fresh/recirculated air damper motor/potentiometer, wiring harness and connectors, receiver-drier, expansion valve, sensors, A/C compressor clutch, A/C compressor, and A/C ECU.

MODE SELECTION DAMPER DOES NOT OPERATE

Check components in order listed, and repair or replace as necessary: check for stored trouble codes, air outlet changeover damper motor/potentiometer, wiring harness and connectors, and A/C ECU.

CONDENSER FAN DOES NOT OPERATE WHEN A/C IS ACTIVATED

Check components in order listed, and repair or replace as necessary: A/C fuse, condenser fan relay, condenser fan resistor, condenser fan motor, wiring harness and connectors, and A/C ECU.

SELF-DIAGNOSTICS

The self-diagnostic function detects abnormal conditions of A/C ECU, related sensors and wiring. Self-diagnostic function includes an automatic control back-up, which provides substitute values in case of system failure. Data link connector is located under left side of dash. See Fig. 2. Diagnostic Trouble Codes (DTCs) can be accessed by the use of an analog voltmeter.

ACCESSING DIAGNOSTIC TROUBLE CODES (DTCs)

1) Turn ignition off. Using an analog voltmeter and Test Connector Harness (MB991529), connect voltmeter positive lead to data link connector terminal No. 11 and negative lead to terminal No. 4 or 5 (ground). See Fig. 2.

2) Turn ignition on. Signals will appear on voltmeter as long and short 12-volt pulses. Long pulses represent tens, short pulses represent ones. For example, 4 long pulses and one short pulse indicates DTC 41. A constant repetition of short 12-volt pulses indicates DTC 0, system is normal. If more than 2 abnormal conditions are present, DTCs are alternately displayed in numerical order until ignition switch is turned off. See DIAGNOSTIC TROUBLE CODE (DTC) IDENTIFICATION table.

DIAGNOSTIC TROUBLE CODE (DTC) IDENTIFICATION TABLE

DTC	(1) Malfunction
0	Normal
11	In-Car Temp. Sensor Open Circuit
12	In-Car Temp. Sensor Short Circuit
13	Outside Air Temp. Sensor Open Circuit
14	Outside Air Temp. Sensor Short Circuit
15	Water Temp. Sensor Open Circuit
16	Water Temp. Sensor Short Circuit
21	Fin Thermosensor Open Circuit
22	Fin Thermosensor Short Circuit

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31  ..........................  Air Mix Damper Potentiometer
                                          Short Or Open Circuit
32  ............  Air Outlet Changeover Damper Potentiometer
                                          Short Or Open Circuit
41  .........................  Defective Air Mix Damper Motor
42  ..........  Defective Air Outlet Changeover Damper Motor

(1) - Perform appropriate DTC test under TESTING
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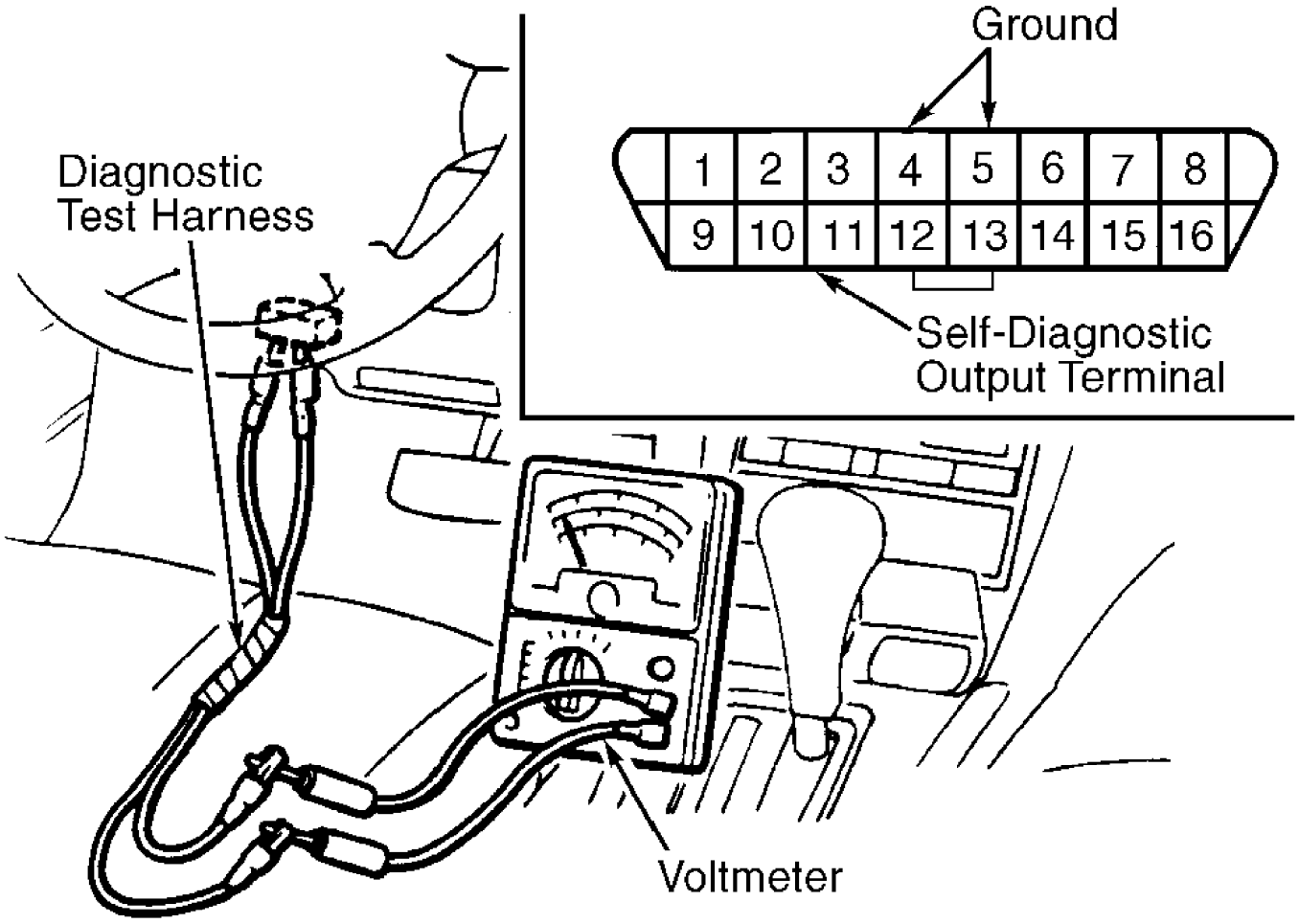


Fig. 2: Identifying Data Link Connector Terminals
Courtesy of Mitsubishi Motor Sales of America.

CLEARING DIAGNOSTIC TROUBLE CODES (DTCs)

To clear DTCs from memory, turn ignition off. Disconnect negative battery cable for at least 10 seconds. Reconnect negative battery cable and recheck codes. See ACCESSING DIAGNOSTIC TROUBLE CODES (DTCs).

TESTING

* PLEASE READ THIS FIRST *

WARNING: To avoid injury from accidental air bag deployment, read and carefully follow all SERVICE PRECAUTIONS and DISABLING & ACTIVATING AIR BAG SYSTEM procedures in AIR BAG RESTRAINT SYSTEM article.

NOTE: For test procedures not covered in this article, see procedures in A/C-HEATER SYSTEM - MANUAL article.

A/C SYSTEM PERFORMANCE

1) Park vehicle out of direct sunlight. Connect manifold gauge set. Start engine and allow it to idle at 1000 RPM. Set A/C controls to recirculate air, panel (vent) mode, full cold, and A/C button on.

2) Set blower/fan on high speed. Close doors and windows. Insert thermometer in center vent. Operate system for 20 minutes to allow system to stabilize. Measure temperature at center vent. Temperature must be 32-39°F (0-4°C), with high side and low side pressures within specification. See A/C SYSTEM SPECIFICATIONS table at beginning of article.

A/C ECU CIRCUIT TEST

Check for voltage between ground and backprobing A/C ECU terminals. See Fig. 3. See A/C ECU TERMINAL TEST table. If voltages are not as specified, replace A/C ECU.

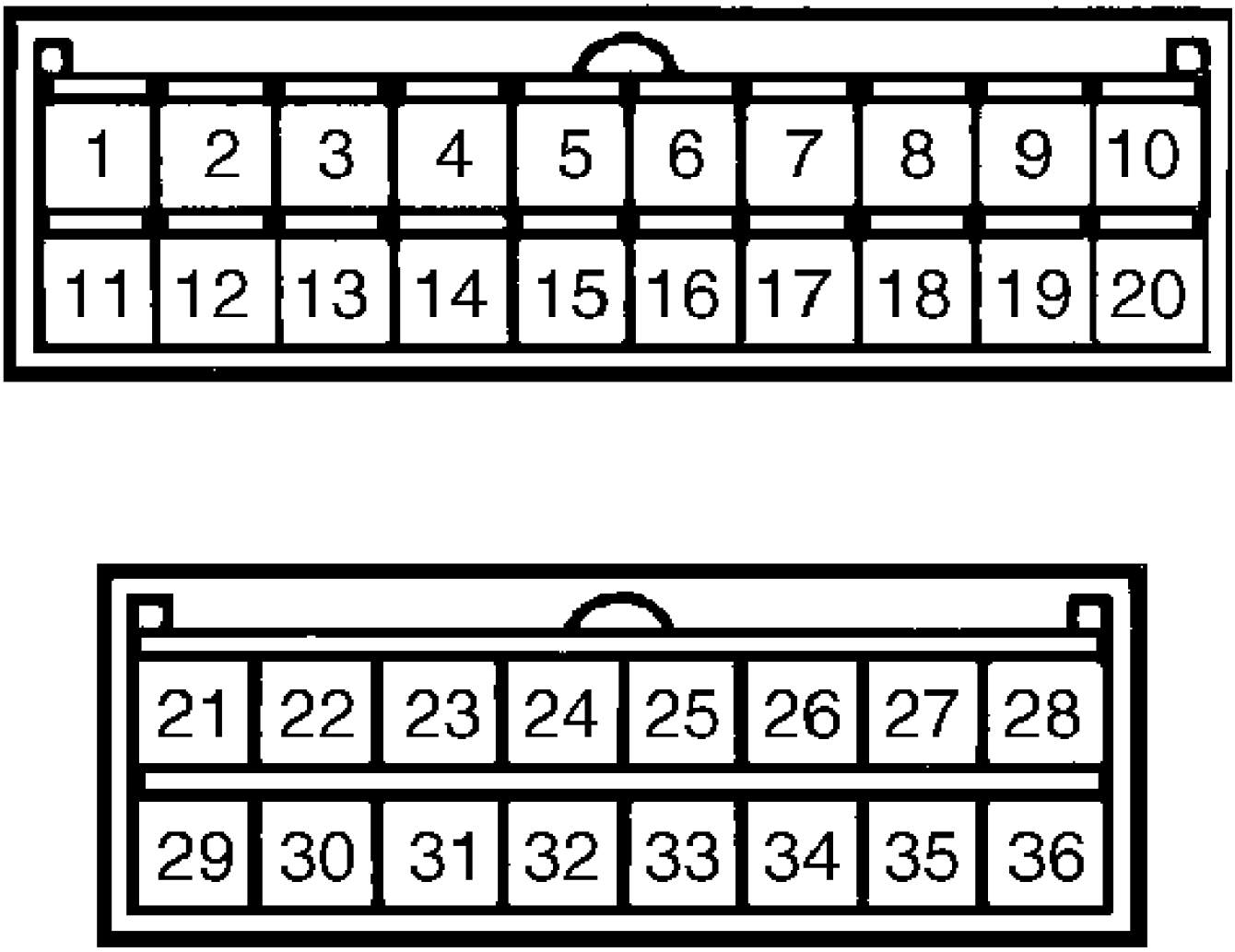
A/C ECU TERMINAL TEST TABLE

Terminal No. (Component/Circuit)	Test Condition	Volts
1 (Power Transistor Collector)	OFF	Battery Voltage
	Low	Approx. 7
	High	Zero
2 (Power Transistor Base)	OFF	Zero
	Low	Approx. 1.3
	High	Approx. 2.5
3 (A/C ECU Back-Up Power)	At All Times	Battery Voltage
4 (Water Temperature Sensor Input)	Sensor Temp. 77°F (25°C)	2.3-2.9
5 (Air Mix Damper Motor Potentiometer)	Maximum Cool Position	0.1-0.3
	Maximum Hot Position	4.7-5.0
6 (Air Outlet Changeover Potentiometer Input)	Mode Selector In Face Position	0.1-0.3
	Mode Selector In Defrost Position	4.8-5.2
7 (Outside Air Temperature Sensor Input)	Sensor Temp. 77°F (25°C)	2.3-2.9

8 (Fin Thermosensor Input)	Sensor Temp. 77°F (25°C)	2.3-2.9
9 (Photo Sensor -)	(1) In Sunlight	-0.1 To -0.2
	(2) In Darkness	Zero
10 (Sensor Power Supply)	At All Times	4.8-5.2
12 (Blower High Relay)	Blower Speed On High	1.5 Or Less
	Blower Speed Not On High	Battery Voltage
13 (Ground)	At All Times	Zero
16 (Ground)	At All Times	Zero
18 (Diagnostic Control Input)	Ignition switch ON	4-5
19 (Photo Sensor +)	At All Times	Zero
20 (Air Mix/Outlet Changeover Damper Potentiometer)	At All Times	Zero
21 (Air Outlet Changeover Motor)	Mode Selector In Face Position	(3) 10
	Mode Selector In Defrost Position	(3) 0.5
22 (Air Mix Damper Motor)	Maximum Cool Position	(3) 10
	Maximum Hot Position	(3) 0.5
23 (Fresh/Recirculated Air Selector Damper Motor)	Recirculation Position	(3) 0.5
	Fresh Air Position	(3) 10
24 (Air Outlet Changeover 0.5 Damper Motor)	Mode Selector In Face Position	(3)
	Mode Selector In Defrost Position	(3) 10
25 (Air Mix Damper Motor)	Maximum Cool Position	(3) 0.5
	Maximum Hot Position	(3) 10
26 (Fresh/Recirculated Air Selector Damper Motor)	Recirculation Position	(3) 10
	Fresh Air Position	(3) 0.5
27 (Ground)	At All Times	Zero
28 (A/C ECU Power Supply)	Ignition Switch ON	Battery Voltage
29 (Illumination Rheostat Ground)	At All Times	Zero
30 (Illumination Power Supply)	Lighting Switch On	Battery Voltage

34 (A/C ECU Power Supply)	Ignition Switch ON	Battery Voltage
35 (Ground)	At All Times	Zero

(1) - Brightness at 100,000 lux or more.
(2) - Brightness at less than 0 lux.
(3) - Output turns off 40 seconds after damper moves to selected air setting.



96G30136

Fig. 3: Identifying A/C ECU Connector Terminals
Courtesy of Mitsubishi Motor Sales of America.

DTC 11 & 12: IN-CAR TEMPERATURE SENSOR OPEN OR SHORT CIRCUIT

In-car temperature sensor is located inside A/C ECU. If either code 11 or 12 is retrieved, A/C ECU is bad and should be replaced.

DTC 13: OUTSIDE AIR TEMPERATURE SENSOR OPEN CIRCUIT

1) Outside air temperature sensor is located behind radiator grille. Remove radiator grille. Disconnect and remove outside air temperature sensor. Measure resistance between sensor terminals and compare values with SENSOR RESISTANCE TEST table. If resistance values are within specified range, go to next step. If resistance values are not within specified range, replace sensor.

2) Turn ignition on. Measure voltage at wiring harness side of outside air temperature sensor connector between terminal No. 1 (Blue/White wire) and body ground. If voltage is 4.8-5.2 volts, go to next step. If voltage is not 4.8-5.2 volts, backprobe A/C ECU connector terminal No. 10 (Blue/White wire). If voltage is 4.8-5.2 volts, check and repair open in Blue/White wire between A/C ECU and outside air temperature sensor. If Blue/White wire is okay, check A/C ECU circuit. See A/C ECU CIRCUIT TEST.

3) Turn ignition off. Ensure continuity is present in Yellow wire between A/C ECU connector terminal No. 7 and outside air temperature sensor connector terminal No. 2. Also check if continuity is present in Blue/White wire between A/C ECU connector terminal No. 10 and outside air temperature sensor connector terminal No. 1. Repair wiring as necessary. See WIRING DIAGRAMS.

DTC 14: OUTSIDE AIR TEMPERATURE SENSOR SHORT CIRCUIT

Check for short circuit in Yellow wire between A/C ECU connector terminal No. 7 and outside air temperature sensor connector terminal No. 2. Also check for short circuit in Blue/White wire between A/C ECU connector terminal No. 10 and outside air temperature sensor connector terminal No. 1. Repair wiring as necessary. See WIRING DIAGRAMS.

DTC 15: WATER TEMPERATURE SENSOR OPEN CIRCUIT

1) Remove instrument panel lower cover assembly. See Fig. 8. Remove glove box, glove box striker and glove box cover. Remove side console cover assembly. Disconnect and remove water temperature sensor from heater unit. See Fig. 4. Measure resistance between sensor terminals and compare values with SENSOR RESISTANCE TEST table. If resistance values are within specified range, go to next step. If resistance values are not within specified range, replace sensor.

2) Turn ignition on. Measure voltage at wiring harness side of water temperature sensor connector between terminal No. 1 (Blue/White wire) and body ground. If voltage is 4.8-5.2 volts, go to next step. If voltage is not 4.8-5.2 volts, backprobe A/C ECU connector terminal No. 10 (Blue/White wire). If voltage is 4.8-5.2 volts, check and repair open in Blue/White wire between A/C ECU and water temperature sensor. If Blue/White wire is okay, check A/C ECU circuit. See A/C ECU CIRCUIT TEST.

3) Reconnect water temperature sensor. Measure voltage between body ground and A/C ECU connector terminal No. 4 (Green wire). Voltage should read 2.3-2.9 volts. If voltage is not within specified range, check and repair Green wire between water temperature sensor and A/C ECU. If Green wire is okay, check A/C ECU circuit. See A/C ECU CIRCUIT TEST.

DTC 16: WATER TEMPERATURE SENSOR SHORT CIRCUIT

Turn ignition on. Measure voltage between body ground and A/C ECU connector terminal No. 4 (Green wire). Voltage should read 2.3-2.9 volts. If voltage is not within specified range, check and repair Green wire between water temperature sensor and A/C ECU. If Green wire

is okay, check A/C ECU circuit. See A/C ECU CIRCUIT TEST.

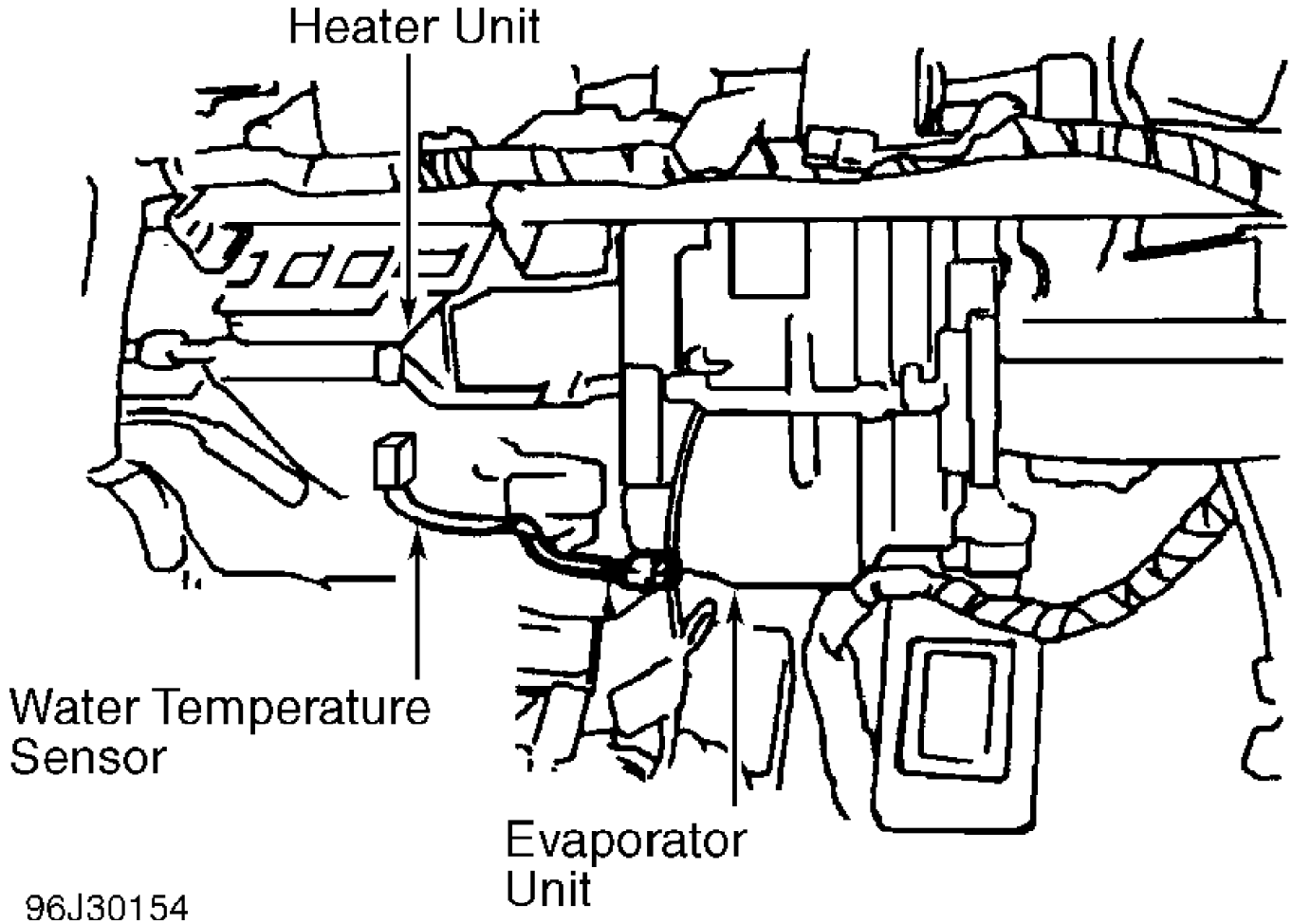


Fig. 4: Locating Water Temperature Sensor
Courtesy of Mitsubishi Motor Sales of America.

DTC 21: FIN THERMOSENSOR OPEN CIRCUIT

1) Remove instrument panel lower cover assembly. See Fig. 8. Remove glove box, glove box striker and glove box cover. Remove side console cover assembly. Remove corner panel and glove box frame. Locate and disconnect fin thermosensor connector. See Fig. 5. Measure resistance between sensor terminals and compare values with SENSOR RESISTANCE TEST table. If resistance values are within specified range, go to next step. If resistance values are not within specified range, replace sensor.

2) Turn ignition on. Measure voltage at wiring harness side of fin thermosensor connector between terminal No. 2 (Blue/White wire) and body ground. If voltage is 4.8-5.2 volts, go to next step. If voltage is not 4.8-5.2 volts, backprobe A/C ECU connector terminal No. 10 (Blue/White wire). If voltage is 4.8-5.2 volts, check and repair open in Blue/White wire between A/C ECU and fin thermosensor. If Blue/White wire is okay, check A/C ECU circuit. See A/C ECU CIRCUIT TEST.

3) Reconnect fin thermosensor. Measure voltage between body ground and A/C ECU connector terminal No. 8 (Yellow/Red wire). Voltage should read 2.3-2.9 volts. If voltage is not within specified range, check and repair Yellow/Red wire between fin thermosensor connector

terminal No. 1 and A/C ECU connector terminal No. 8. If Yellow/Red wire is okay, check A/C ECU circuit. See A/C ECU CIRCUIT TEST.

DTC 22: FIN THERMOSENSOR SHORT CIRCUIT

Measure voltage between body ground and A/C ECU connector terminal No. 8 (Yellow/Red wire). Voltage should read 2.3-2.9 volts. If voltage is not within specified range, check and repair Yellow/Red wire between fin thermosensor connector terminal No. 1 and A/C ECU connector terminal No. 8. If Yellow/Red wire is okay, check A/C ECU circuit. See A/C ECU CIRCUIT TEST.

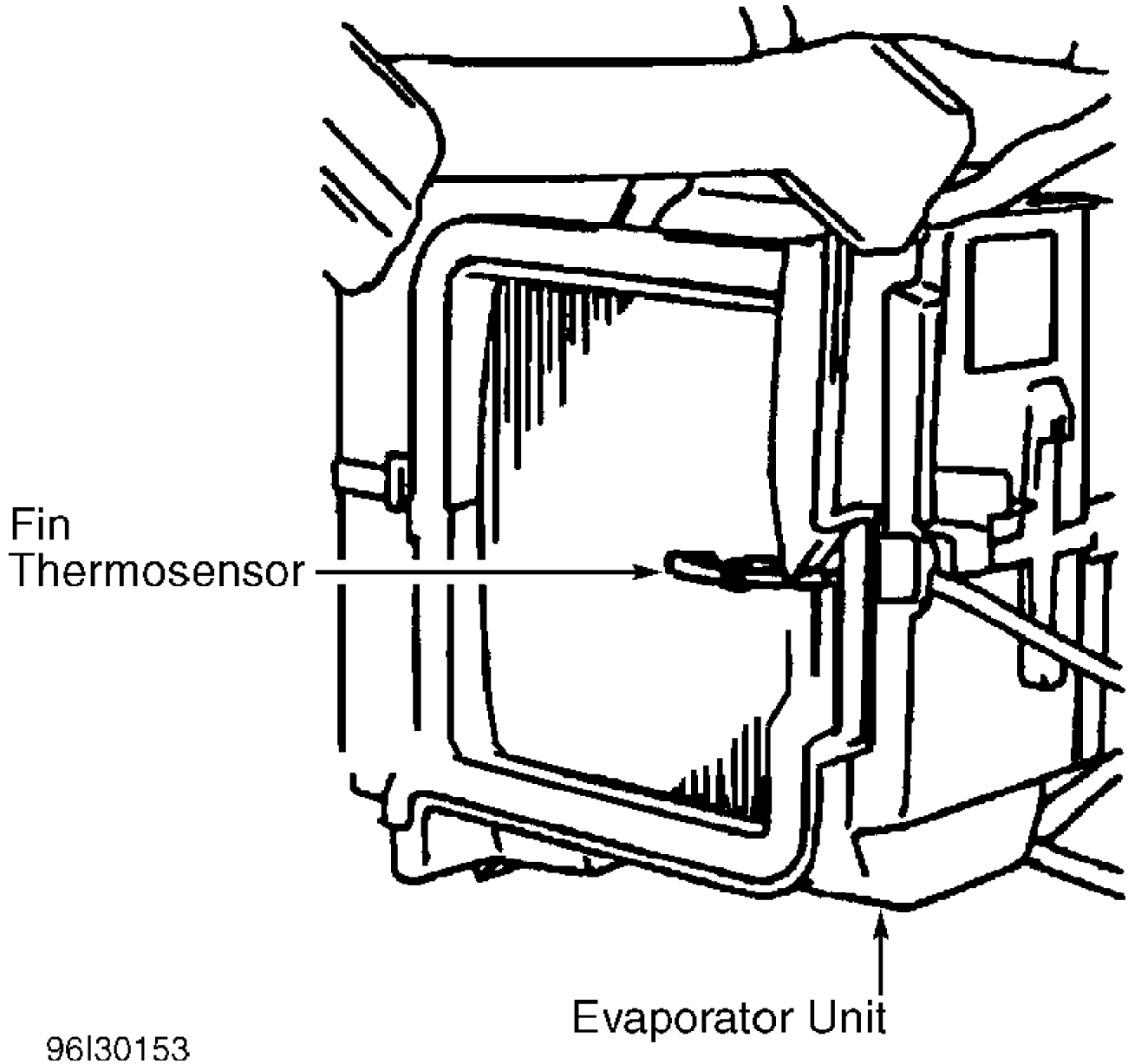


Fig. 5: Locating Fin Thermosensor
Courtesy of Mitsubishi Motor Sales of America.

SENSOR RESISTANCE TEST TABLE

Temperature °F (°C)	(1) Ohms
14 (-10)	19,000
32 (0)	12,000
50 (10)	8000
68 (20)	4500
86 (30)	3000
104 (40)	2500

(1) - Approximate values.

DTC 31: AIR MIX DAMPER MOTOR/ POTENTIOMETER OPEN OR SHORT CIRCUIT

1) Remove shift lever and center console panels. See Fig. 8. Remove radio and tape player. Remove glove box, glove box striker, glove box cover, and glove box frame. Remove side console cover assembly. Locate and disconnect air mix damper motor/potentiometer connector. See Fig. 6. Remove damper lever linkage and air mix damper motor/potentiometer.

2) Connect battery voltage to air mix damper motor/potentiometer terminals No. 1 and 3. If motor does not move or stops moving, replace air mix damper motor/potentiometer. Reverse polarity and ensure motor returns to full opposite position. If motor operates as specified, go to next step.

3) Ensure ignition is off. Measure resistance between air mix damper motor/potentiometer connector terminals No. 2 and 5. In maximum hot position, resistance should be 4800 ohms. In maximum cool position, resistance should be 200 ohms. If resistance is as specified, go to next step. If resistance is not as specified, replace air mix damper motor/potentiometer.

4) Turn ignition on. Measure voltage at wiring harness side of connector between terminal No. 6 (Blue/White wire) and body ground. If voltage is 4.8-5.2 volts, go to next step. If voltage is not 4.8-5.2 volts, backprobe A/C ECU connector terminal No. 10 (Blue/White wire). If voltage is 4.8-5.2 volts, check and repair Blue/White wire between A/C ECU and air mix damper motor/potentiometer. If voltage is not 4.8-5.2 volts, check A/C ECU circuit. See A/C ECU CIRCUIT.

5) Reconnect air mix damper motor/potentiometer connector. Adjust air mix selector to maximum hot position. Measure voltage between body ground and A/C ECU connector terminal No. 5 (Blue/Yellow wire). Voltage should read 4.7-5.0 volts. If voltage is not 4.7-5.0 volts, check and repair Blue/Yellow wire between air mix damper motor/potentiometer and A/C ECU. If Blue/Yellow wire is okay, check A/C ECU circuit. See A/C ECU CIRCUIT TEST.

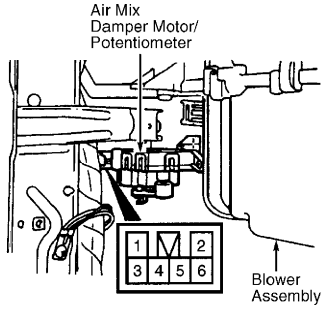


Fig. 6: Locating & Identifying Air Mix Damper Motor/Potentiometer
Courtesy of Mitsubishi Motor Sales of America.

DTC 32: AIR OUTLET CHANGEOVER DAMPER MOTOR/POTENTIOMETER

OPEN OR SHORT CIRCUIT

1) Remove hood lock release handle. See Fig. 8. Remove instrument panel lower cover assembly. Remove foot duct. Locate and disconnect mode selector connector. See Fig. 7. Remove damper lever linkage and air outlet changeover motor/potentiometer.

2) Connect battery voltage to air outlet changeover motor/potentiometer terminals No. 1 and 3. If motor does not move or stops moving, replace air outlet changeover motor/potentiometer. Reverse polarity and ensure motor returns to full opposite position. If motor operates as specified, go to next step.

3) Measure resistance between air mix damper motor/potentiometer connector terminals No. 2 and 5. In maximum hot position, resistance should be 4800 ohms. In maximum cool position, resistance should be 200 ohms. If resistance is as specified, go to next step. If resistance is not as specified, replace air mix damper motor/potentiometer.

4) Turn ignition on. Measure voltage at wiring harness side of connector between terminal No. 2 (Blue/White wire) and body ground. If voltage is 4.8-5.2 volts, go to next step. If voltage is not 4.8-5.2 volts, backprobe A/C ECU connector terminal No. 10 (Blue/White wire). If voltage is 4.8-5.2 volts, check and repair Blue/White wire between A/C ECU and air outlet changeover selector damper motor/potentiometer. If voltage is not 4.8-5.2 volts, check A/C ECU circuit. See A/C ECU CIRCUIT TEST.

5) Check connectors and wiring between air outlet changeover damper motor/potentiometer and A/C ECU. Repair connectors and wiring as necessary. See WIRING DIAGRAMS.

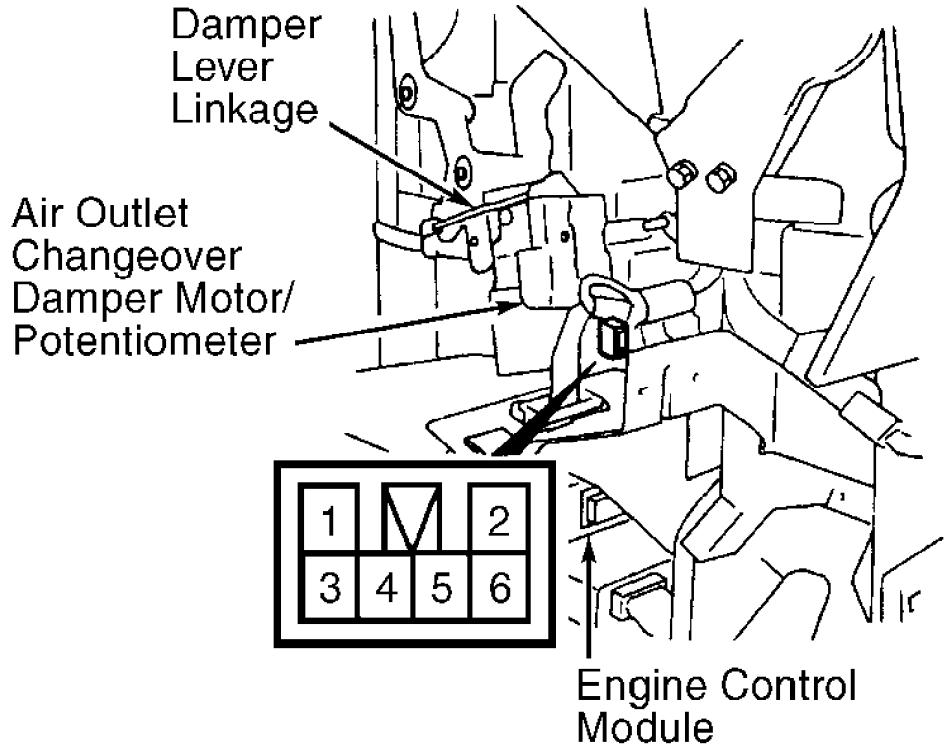


Fig. 7: Locating & Identifying Air Outlet Changeover Damper Motor/Potentiometer
Courtesy of Mitsubishi Motor Sales of America.

DTC 41: DEFECTIVE AIR MIX DAMPER MOTOR

1) Check air mix damper motor. See DTC 31: AIR MIX DAMPER MOTOR/POTENTIOMETER OPEN OR SHORT CIRCUIT. Replace motor as necessary. If motor is okay, go to next step.

2) Set temperature to MAX COOL 62°F (17°C). Measure voltage (backprobe) between A/C ECU connector terminal No. 22 (Red/Green wire) and ground. Voltmeter should indicate 10 volts for 40 seconds, then zero volts after 40 seconds. Measure voltage (backprobe) between A/C ECU connector terminal No. 25 (Black/Green wire) and ground. Voltmeter should indicate .5 volts for 40 seconds, then zero volts after 40 seconds. Go to next step.

3) Set temperature to MAX HOT 90°F (32°C). Measure voltage (backprobe) between A/C ECU connector terminal No. 22 (Red/Green wire) and ground. Voltmeter should indicate .5 volts for 40 seconds, then zero volts after 40 seconds. Measure voltage (backprobe) between A/C ECU connector terminal No. 25 (Black/Green wire) and ground. Voltmeter should indicate 10 volts for 40 seconds, then zero volts after 40 seconds. Go to next step.

4) If voltages are to specification, check air mix damper motor connector for poor terminal contact. Repair connector as necessary. If connector terminal contact is okay, check wiring between air mix damper motor assembly and A/C ECU. Repair wiring as necessary. See WIRING DIAGRAMS.

DTC 42: DEFECTIVE AIR OUTLET CHANGEOVER DAMPER MOTOR

1) Check air outlet changeover damper motor. See DTC 32: AIR OUTLET CHANGEOVER DAMPER MOTOR/POTENTIOMETER OPEN OR SHORT CIRCUIT. Replace motor as necessary. If motor is okay, go to next step.

2) Set damper to face position. Measure voltage (backprobe) between A/C ECU connector terminal No. 21 (Red/Yellow wire) and ground. Voltmeter should indicate 10 volts for 40 seconds, then zero volts after 40 seconds. Measure voltage (backprobe) between A/C ECU connector terminal No. 24 (Green/Blue wire) and ground. Voltmeter should indicate .5 volts for 40 seconds, then zero volts after 40 seconds. Go to next step.

3) Set damper to defrost position. Measure voltage (backprobe) between A/C ECU connector terminal No. 21 (Red/Yellow wire) and ground. Voltmeter should indicate .5 volts for 40 seconds, then zero volts after 40 seconds. Measure voltage (backprobe) between A/C ECU connector terminal No. 24 (Green/Blue wire) and ground. Voltmeter should indicate 10 volts for 40 seconds, then zero volts after 40 seconds. Go to next step.

4) If voltages are to specification, check air outlet changeover damper motor connector for poor terminal contact. Repair connector as necessary. If connector terminal contact is okay, check wiring between air outlet changeover damper motor assembly and A/C ECU. Repair wiring as necessary. See WIRING DIAGRAMS.

PHOTO SENSOR

Photo sensor is located on top center of dash. Disconnect photo sensor connector. Connect battery voltage to photo sensor connector terminals. Measure voltage between photo sensor terminals with sensor covered and uncovered. Compare voltage readings. Voltage should be greater when sensor is not covered.

REMOVAL & INSTALLATION

* PLEASE READ THIS FIRST *

WARNING: To avoid injury from accidental air bag deployment, read and

carefully follow all SERVICE PRECAUTIONS and DISABLING & ACTIVATING AIR BAG SYSTEM procedures in AIR BAG RESTRAINT SYSTEM article.

NOTE: For removal and installation procedures not covered in this article, see A/C-HEATER SYSTEM - MANUAL article.

AIR MIX DAMPER MOTOR/POTENTIOMETER ASSEMBLY

Removal & Installation

Remove shift lever and center console panels. See Fig. 8. Remove radio and tape player. Remove glove box, glove box striker, glove box cover, and glove box frame. Remove side console cover assembly. Locate and disconnect air mix damper motor/potentiometer connector. See Fig. 6. Remove damper lever linkage and air mix damper motor/potentiometer. To install, reverse removal procedure.

AIR OUTLET CHANGEOVER DAMPER MOTOR/POTENTIOMETER ASSEMBLY

Removal & Installation

Remove hood lock release handle. See Fig. 8. Remove instrument panel lower cover assembly. Remove foot duct. Locate and disconnect air outlet changeover connector. See Fig. 7. Remove damper lever linkage and air outlet changeover damper motor/potentiometer. To install, reverse removal procedure.

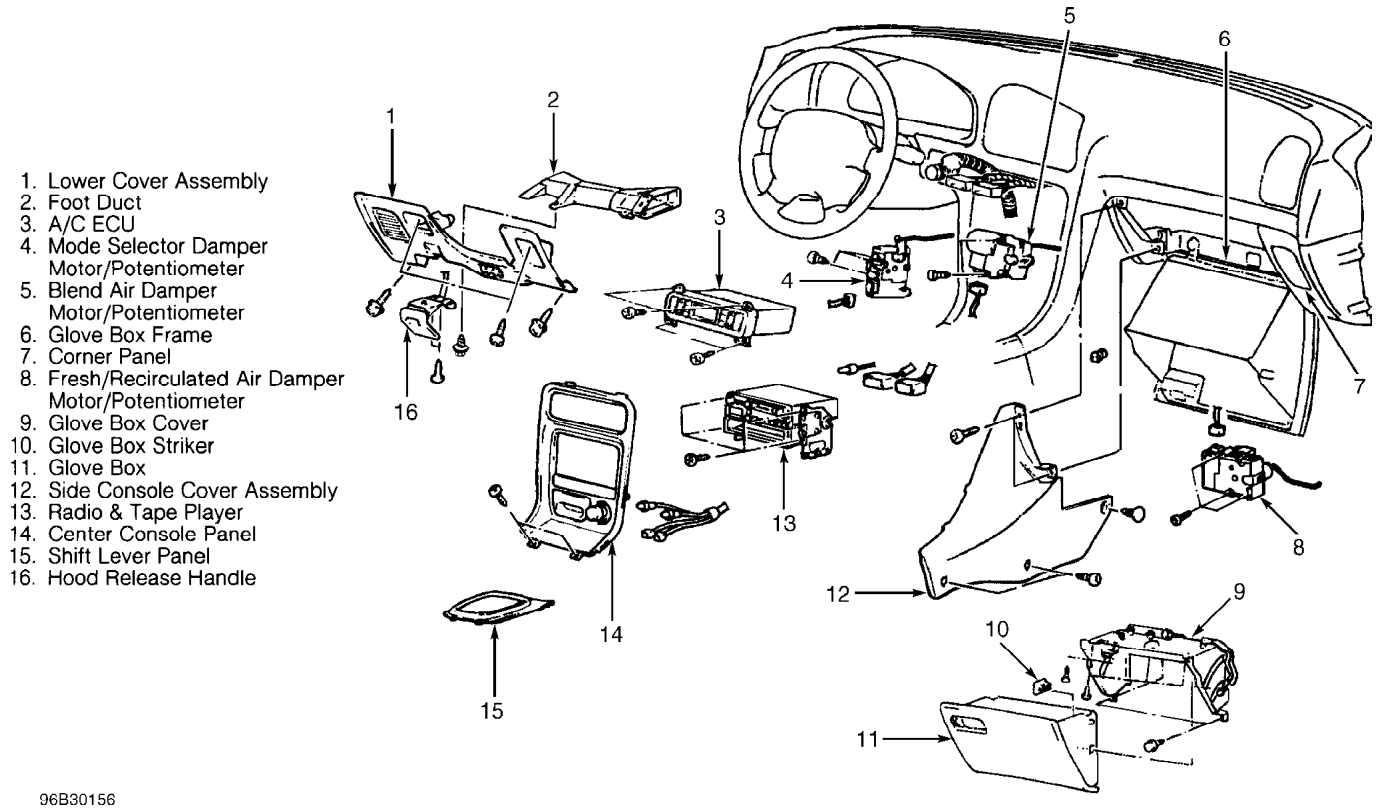


Fig. 8: Exploded View Of Lower Instrument Panel Components
Courtesy of Mitsubishi Motor Sales of America.

WIRING DIAGRAMS

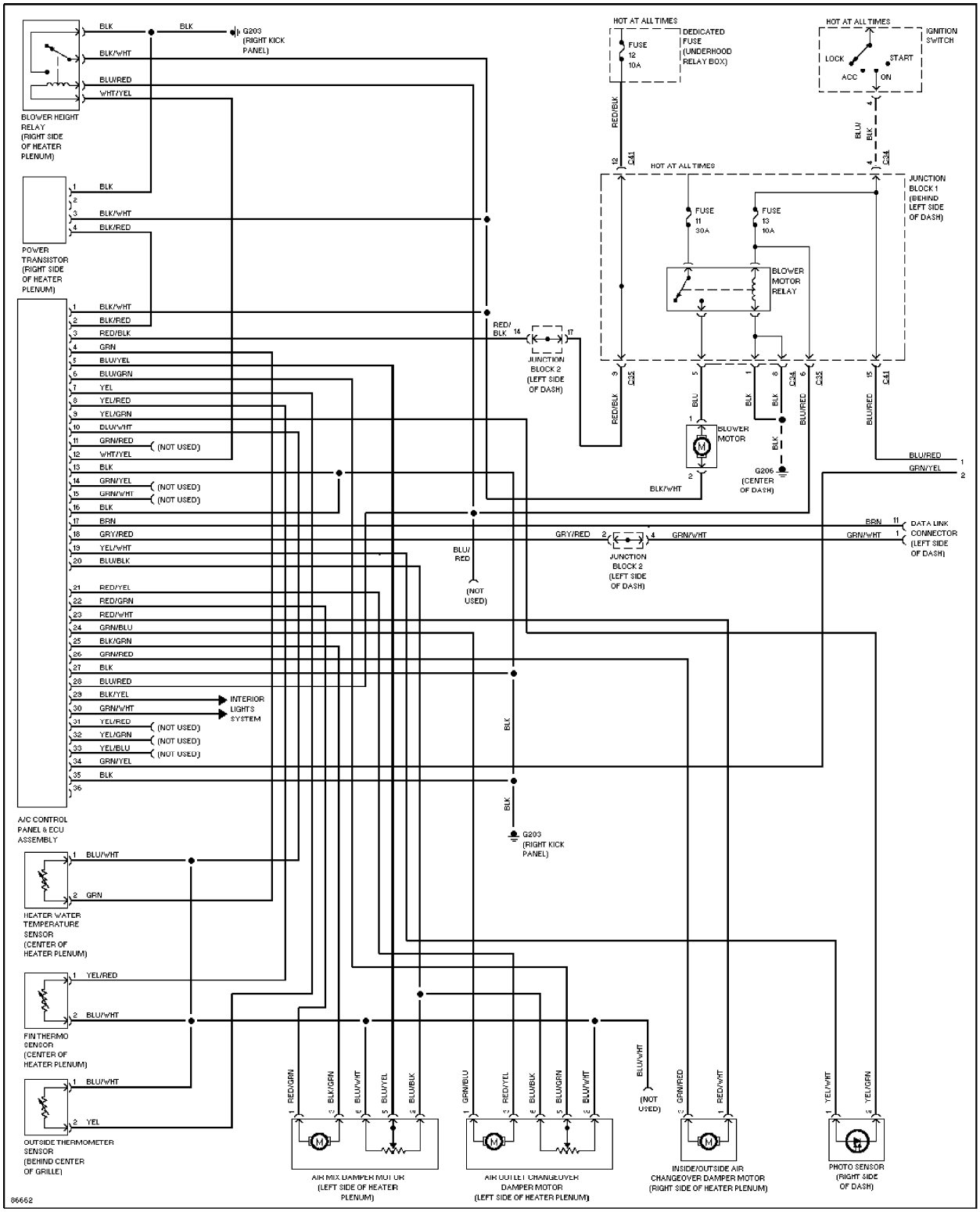


Fig. 9: Automatic A/C-Heater System Wiring Diagram (1 Of 2)

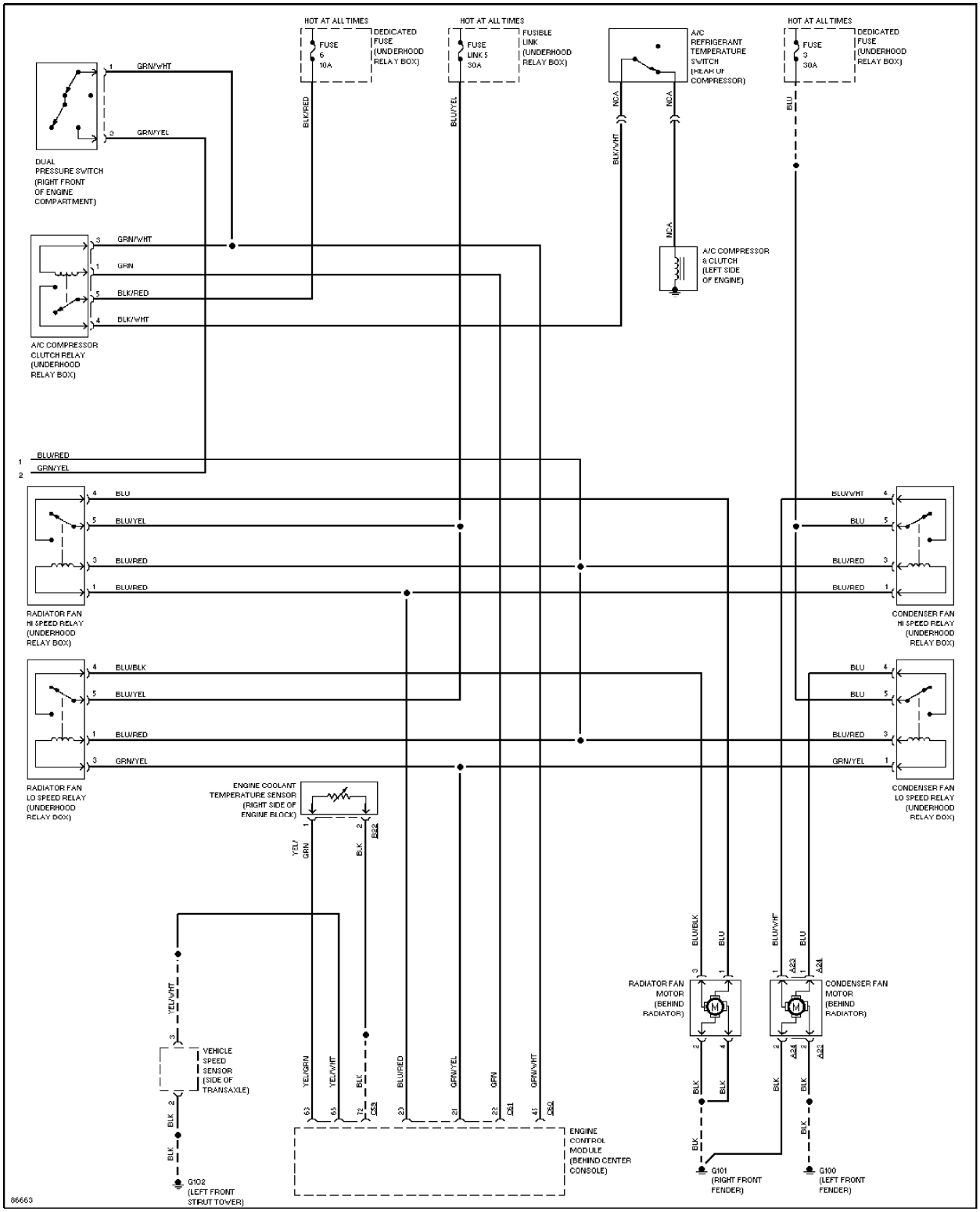


Fig. 10: Automatic A/C-Heater System Wiring Diagram (2 Of 2)

A/C-HEATER SYSTEM - MANUAL

1998 Mitsubishi Galant

1998 AIR CONDITIONING & HEAT
Mitsubishi - A/C-Heater System - Manual

Galant

* PLEASE READ THIS FIRST *

WARNING: To avoid injury from accidental air bag deployment, read and carefully follow all SERVICE PRECAUTIONS and DISABLING & ACTIVATING AIR BAG SYSTEM procedures in AIR BAG RESTRAINT SYSTEM article.

A/C SYSTEM SPECIFICATIONS

A/C SYSTEM SPECIFICATIONS TABLE

Application	Specification
Compressor Type	Sanden MSC90C12 Scroll
Compressor Belt Deflection	
New	7/32-15/64" (5.5-6.0 mm)
Used	1/4-19/64" (6.5-7.5 mm)
Compressor Oil Capacity	(1) 4.1 ozs.
Refrigerant (R-134a) Capacity	23-24.3 ozs.
System Operating Pressures (2)	
High Side	111-139 psi (7.8-9.8 kg/cm²)
Low Side	6-20 psi (.4-1.4 kg/cm²)

(1) - Use SUN PAG 56 refrigerant oil.
(2) - With ambient temperature at about 77°F (25°C).

DESCRIPTION

Vehicle uses a Sanden scroll compressor and R-134a refrigerant.A/C system is controlled by an A/C control unit.

Compressors will only operate within the normal operating temperatures and pressures set for each model. An electric condenser fan operates whenever A/C system is operating. System components include an A/C control unit, fan switch, evaporator, temperature sensor, dual-pressure switch, engine coolant temperature switch, compressor, condenser, receiver-drier and various pipes and hoses.

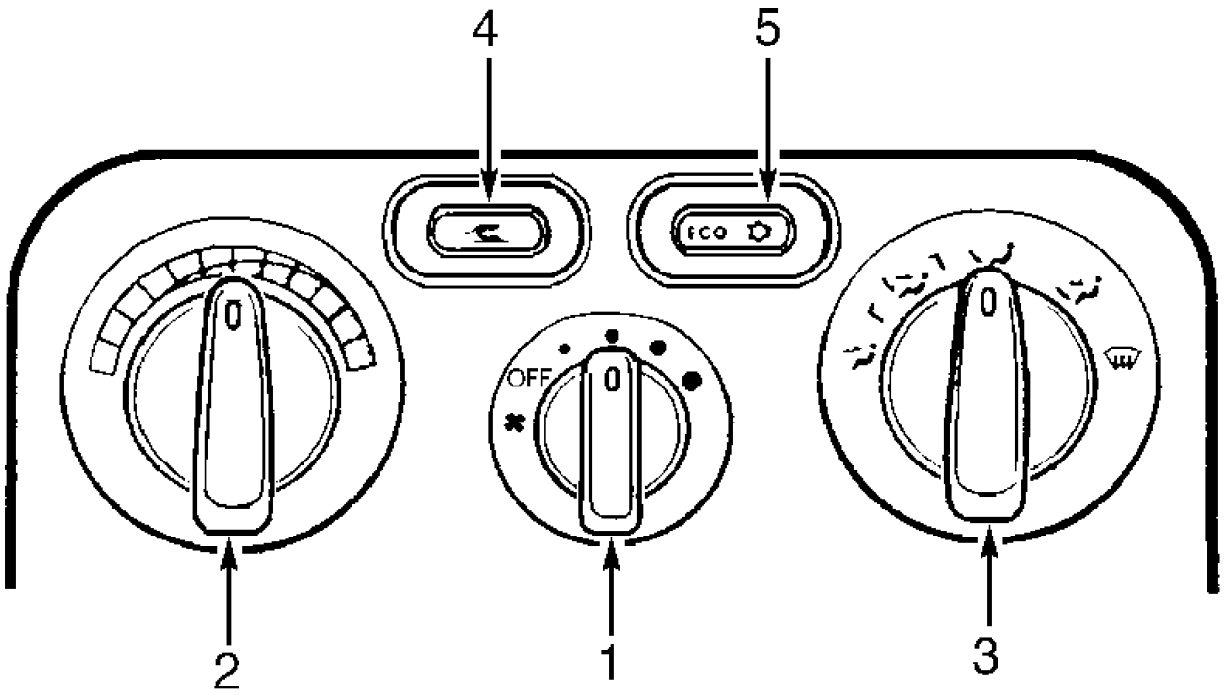
OPERATION

A/C CONTROL UNIT

The A/C control unit controls cycling of compressor clutch based on information received from fin thermo sensor, ECM, blower switch, dual pressure switch and engine coolant temperature sensor. The A/C control unit is located on bottom of evaporator housing.

A/C SWITCH

The A/C switch is located in the A/C control panel. See Fig. 1. A/C switch light will illuminate when A/C system is switched on.



1. Blower Motor Control Knob
2. Temperature Control Knob
3. Mode Selector Knob
4. Fresh/Recirculated Air Selector Switch
5. A/C Switch

95H10071

Fig. 1: Identifying A/C Switch & Control Panel
Courtesy of Mitsubishi Motor Sales of America.

FRESH/RECIRCULATED AIR SELECTOR CONTROL

Fresh/recirculated air selector control is used to select airflow source. With control at fresh air setting, outside air is allowed to enter and pass through heater and evaporator. With control at recirculated air setting, air is recirculated inside passenger compartment. Vehicle uses a fresh/recirculated air control switch and damper motor for fresh or recirculated air selection. Recirculation position is used to achieve maximum A/C cooling or heating.

BLOWER SWITCH

Blower switch controls 4 fan speeds to regulate amount of airflow. Fan speed increases as switch is turned clockwise.

MODE SELECTOR KNOB

Depending on position selected, air can be directed to both front and rear of passenger compartment. Airflow selection capabilities include individual areas or a combination of windshield (defrost), upper body, knee and/or foot area. Rear passenger air distribution is limited to foot area only.

TEMPERATURE CONTROL KNOB

Temperature level is selected by turning selector knob clockwise or counterclockwise. Highest heat setting is attained when selector knob is turned fully clockwise. When temperature selector knob is fully counterclockwise, ambient outside air temperature or A/C cooled air is available through vents.

DUAL-PRESSURE SWITCH

Dual-pressure switch is located on top of receiver-drier. Pressure switch is wired in series with compressor clutch. When system pressures are within control points, switch is ON and compressor can be energized. When system pressures decrease to less than (low charge) or increase to more than (overheating) control points of switch, power supplied to compressor will be cut. Compressor operation will cease until pressures are back within operating range.

ENGINE COOLANT TEMPERATURE SENSOR

Engine coolant temperature sensor signals Powertrain Control Module (PCM) when engine coolant temperature is 226°F (108°C) or less. PCM will then allow A/C operation until engine coolant reaches 239°F (115°C) or more.

FIN THERMO SENSOR

Fin thermo sensor is located in evaporator case. Fin thermo sensor provide a voltage signal to A/C control unit which it uses to control compressor clutch operation preventing evaporator freezing. Power to compressor clutch is cut, allowing evaporator to thaw, if temperature is 38°F (3.2°C) or less.

A/C REFRIGERANT TEMPERATURE SWITCH

A/C refrigerant temperature switch is located on compressor and is wired in series with compressor clutch relay. When A/C refrigerant temperature switch in ON compressor will operate. Switch is ON when refrigerant temperature is less than 320°F (160°C). Switch is OFF when refrigerant temperature is greater than 320°F (160°C) and until temperature drops to less than 266°F (130°C).

ADJUSTMENTS

NOTE: For cable adjustment procedures, see HEATER SYSTEM article.

TROUBLE SHOOTING

COMPRESSOR NOT OPERATING

1) Check fuses, A/C compressor clutch and clutch relay. Check A/C switch, dual-pressure switch and blower switch. Check fin thermo sensor or A/C control unit. Check refrigerant temperature switch.

2) Ensure system is properly charged and there are no leaks. Add refrigerant or repair leak and evacuate and recharge system as necessary. Ensure receiver-drier is not clogged. Check compressor belt for proper tension. Check for clogged expansion valve. Replace expansion valve as necessary. Check compressor operation. Repair or replace compressor as necessary.

INSUFFICIENT AIRFLOW

Check for air leakage at air duct joint. Check for frost on evaporator. Ensure blower motor is operating properly. Check for improper adjustment of mode selector dampers or incorrect installation of mode selector control cable. Check fresh/recirculated air selector. Check for faulty duct connections, or crushed, bent or clogged ducts. Check for obstructed air intake.

INSUFFICIENT COOLING

Ensure system is properly charged with correct amount of refrigerant and free of air and moisture. Add refrigerant or evacuate and recharge system as necessary. Check dual-pressure switch. Check fin thermo sensor or A/C control unit. Check refrigerant temperature switch. Ensure receiver-drier is not clogged. Ensure sufficient airflow through condenser and evaporator exists. Check compressor belt for proper tension. Check compressor operation. Repair or replace compressor as necessary. Check for clogged expansion valve. Replace expansion valve as necessary.

INTERMITTENT COOL AIR

Check for air or moisture in system. Evacuate and recharge system as necessary. Check for expansion valve malfunction. Replace expansion valve if necessary. Check compressor belt for proper tension.

TESTING

* PLEASE READ THIS FIRST *

WARNING: To avoid injury from accidental air bag deployment, read and carefully follow all SERVICE PRECAUTIONS and DISABLING & ACTIVATING AIR BAG SYSTEM procedures in AIR BAG RESTRAINT SYSTEM article.

A/C SYSTEM PERFORMANCE

1) Park vehicle out of direct sunlight. Install A/C gauge set. Start engine and allow it to idle at 1000 RPM. Set A/C controls to recirculate air, panel (vent) mode, full cold, and A/C button on.

2) Set blower/fan on high speed and close doors and windows. Insert thermometer in left center vent. Operate system for 20 minutes to allow system to stabilize. If clutch cycles, take temperature reading before clutch disengages.

3) Measure temperature at center vent, with ambient temperature at 77°F (25°C). Temperature must be about 33-40°F (2.5-4.5°C). Check that high side and low side pressures are within specification. See A/C SYSTEM SPECIFICATIONS table at beginning of article.

A/C CONTROL UNIT

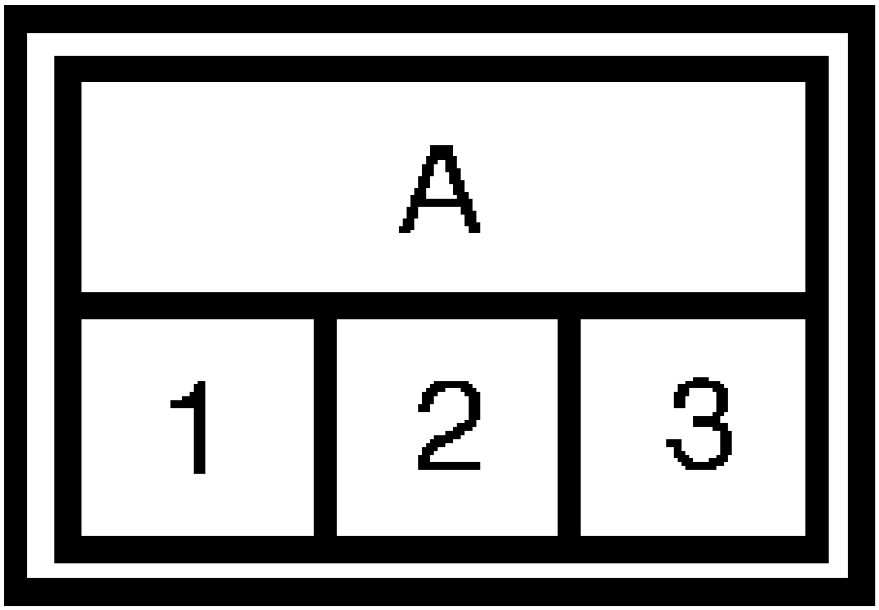
Start engine and allow it to reach normal operating temperature. Locate A/C Control Unit (ACCU) 3-pin connector. ACCU is located under blower motor. Inspect connector and wiring for damage. Repair as required. See Fig. 2. Turn ignition on, A/C switch to ON position, temperature control to maximum cooling and blower switch to high. Using a DVOM set to appropriate test function, backprobe ACCU harness connector. Test readings should be as specified. See A/C

CONTROL UNIT CIRCUIT TESTS table. If all test readings are as specified and all other components are within specifications, replace ACCU. If all test readings are not as specified, repair circuit(s) as required.

A/C CONTROL UNIT CIRCUIT TESTS TABLE

Terminal No. (Circuit) (1)	Value
1 (ACCU Power Supply Output)	Battery Voltage
2 (ACCU Power Supply Input)	Battery Voltage
3 (ACCU Ground)	Zero Volts

(1) - Resistance between terminals No. 7 and 9, should 185 ohms at 68°F (20°C)



HARNESS SIDE VIEW

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Fig. 2: Identifying A/C Control Unit Terminals
Courtesy of Mitsubishi Motor Sales of America.

A/C SWITCH

Disconnect A/C switch connector. With A/C switch in indicated position, ensure continuity exists between switch terminals. See A/C SWITCH CONTINUITY TEST table. See Fig. 3.

A/C SWITCH CONTINUITY TEST TABLE

Switch Position	Terminal No.	Continuity
Off	3 & 6	No
On	1 & 2, 2 & 5, 3 & 6	Yes

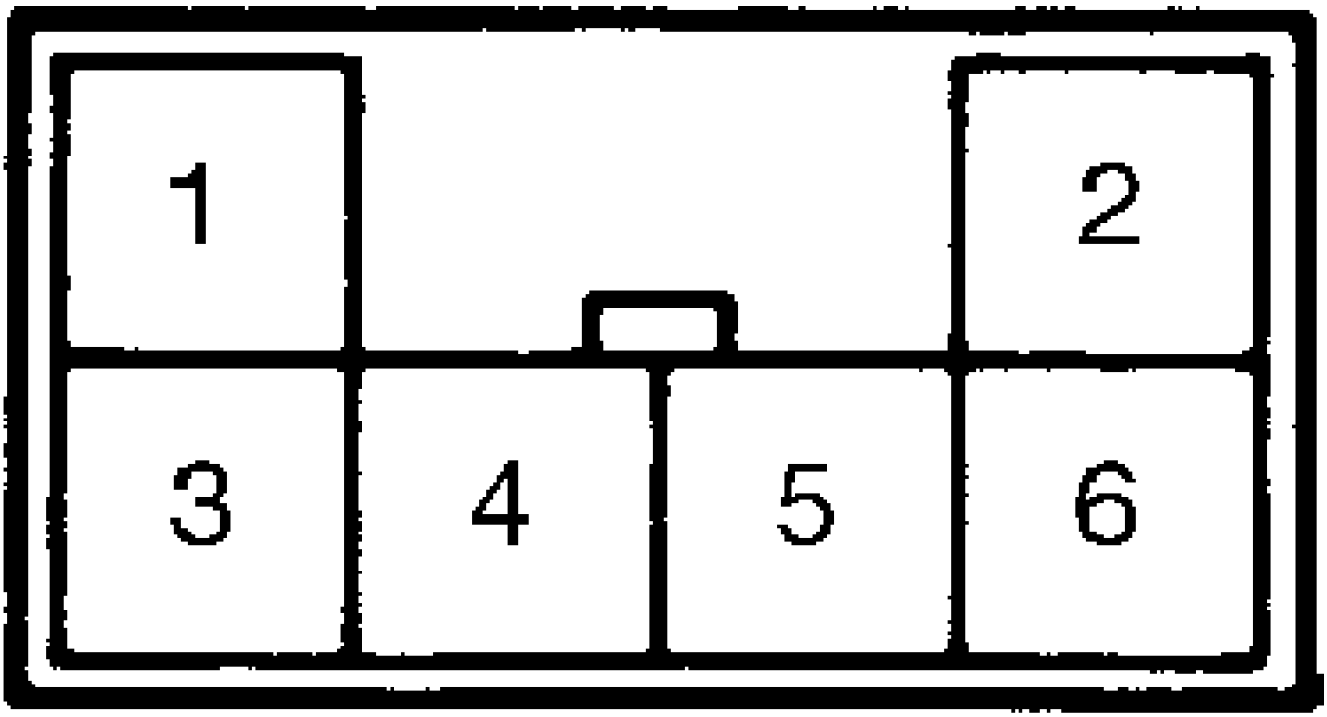

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Fig. 3: Identifying A/C Switch Terminals
Courtesy of Mitsubishi Motor Sales of America.

FIN THERMO SENSOR

1) Fin thermo sensor is part of the A/C control unit. Disconnect A/C control unit. Probe wires between fin thermo sensor and control unit, measure continuity. See FIN THERMO SENSOR SPECIFICATIONS table.

2) If resistance is not within specifications, fin thermo sensor is faulty. Replace A/C control unit.

FIN THERMO SENSOR SPECIFICATIONS TABLE

Sensor Temperature °F (°C)	Approximate Ohms
32 (0)	11,500
50 (10)	7500
68 (20)	4800
86 (30)	3300
104 (40)	2300

BLOWER RESISTOR

Disconnect blower resistor connector. Using an ohmmeter, measure resistance between terminals indicated in BLOWER RESISTOR RESISTANCE table. See Fig. 4.

BLOWER RESISTOR RESISTANCE TABLE

Terminal No. & Blower Speed	Approximate Ohms
3 & 2 (Low)	2.3
3 & 4 (Medium-Low)	1.1
3 & 1 (Medium-High)	0.4

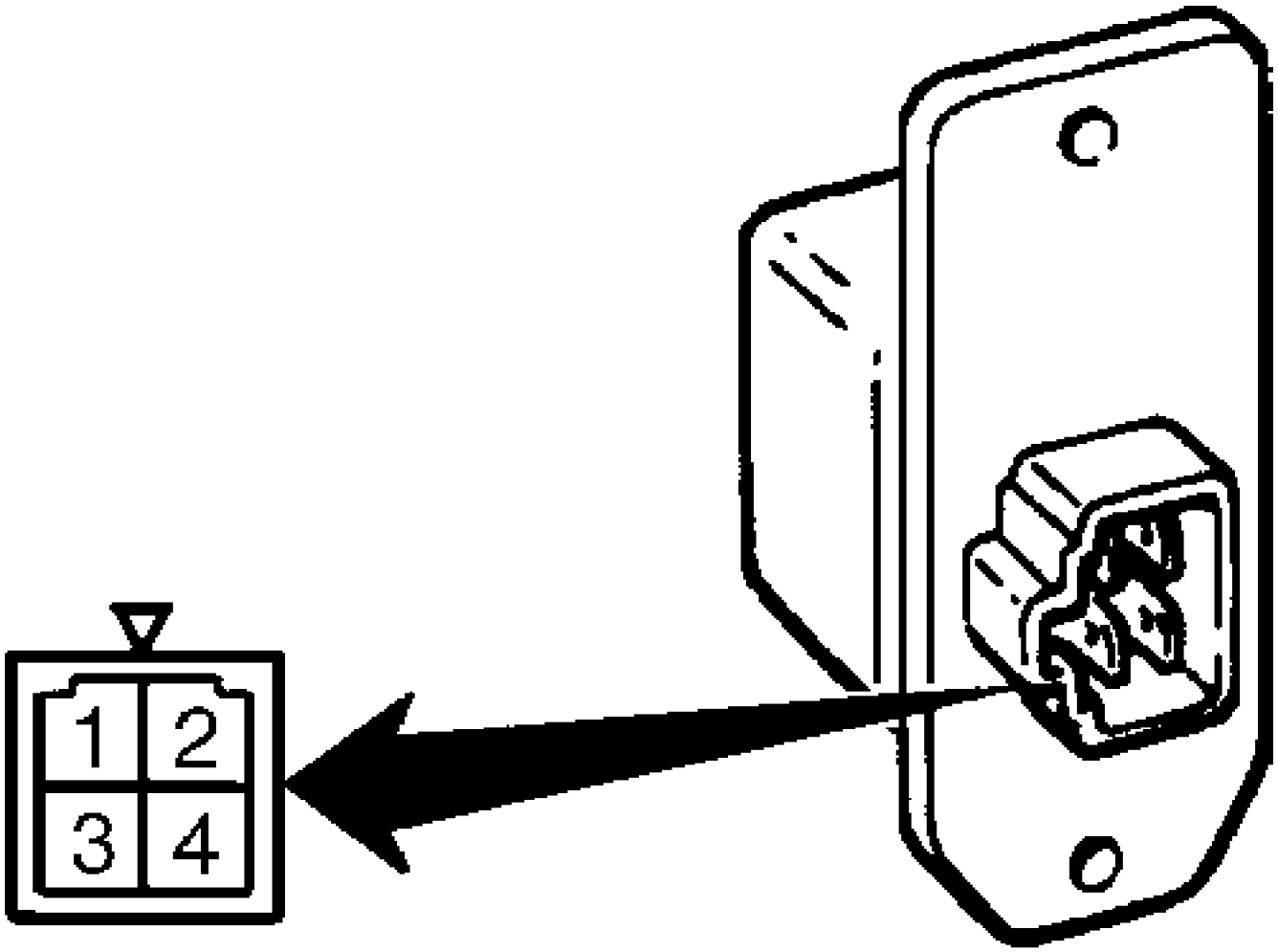

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Fig. 4: Testing Blower Resistor
Courtesy of Mitsubishi Motor Sales of America.

BLOWER SWITCH

With blower switch in position indicated in BLOWER SWITCH CONTINUITY TEST table, ensure continuity exists between listed terminals. See Fig. 5.

BLOWER SWITCH CONTINUITY TEST TABLE

Switch Position	Terminal No.	Continuity
OFF	(1)	No
Low	1 & 8; 3 & 5	Yes
Medium-Low	1 & 8; 5 & 6	Yes
Medium-High	1, 4 & 8; 2 & 5	Yes
High	1, 4 & 8; 5 & 7	Yes

(1) - Continuity should not exist between any terminals.

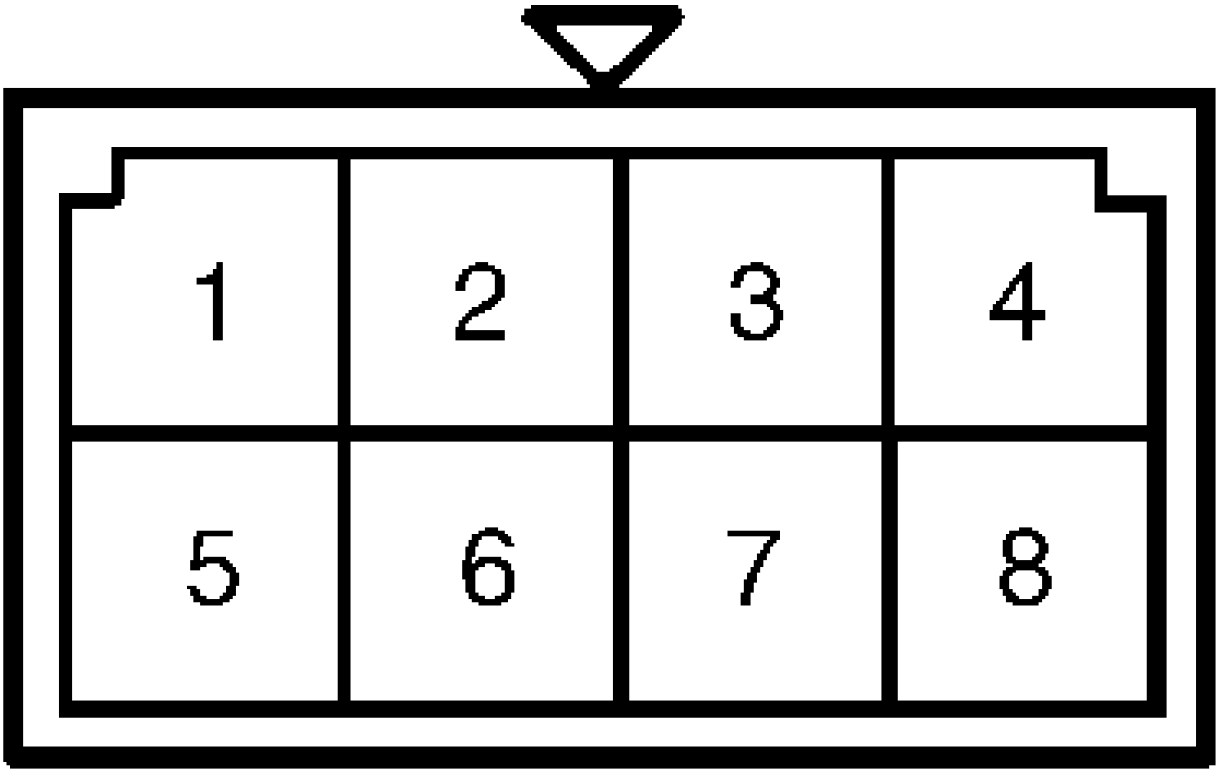


Fig. 5: Identifying Blower Switch Terminals
Courtesy of Mitsubishi Motor Sales of America.

DUAL-PRESSURE SWITCH

Disconnect dual-pressure connector and connect a jumper wire across connector terminals. Connect manifold gauge set to system and check operating pressures. Dual-pressure switch will allow compressor

operation when system pressure is within specification. Check continuity between switch terminals when pressures are as specified. See PRESSURE SWITCH SPECIFICATIONS table. If continuity is not present when switch is on, replace dual-pressure switch.

PRESSURE SWITCH SPECIFICATIONS TABLE

Pressure Side	Switch Position Off To On psi (kg/cm²)	Switch Position On To Off psi (kg/cm²)
Low	32 (2.2)	29 (2.0)
High	341 (24)	427 (30)

COMPRESSOR CLUTCH

Disconnect wiring to compressor clutch. Connect battery negative lead to compressor housing. Connect battery positive lead to A/C compressor clutch wiring harness connector. If click is heard, clutch engagement is okay. If click is not heard, pulley and armature are not making contact. Repair or replace compressor clutch as necessary.

REFRIGERANT TEMPERATURE SWITCH

Turn A/C off. Unplug temperature switch on compressor. Check for continuity between terminals. If continuity does not exist. Replace compressor.

RELAYS

NOTE: For blower motor relay and high blower relay testing see HEATER SYSTEM article.

Compressor Clutch & Condenser Fan Relays

Remove relay from under hood relay box. Using an ohmmeter, check that continuity exists between terminals No. 1 and 3. Check that continuity does not exist between terminals No. 4 and 5. Connect battery voltage to terminal No. 1, and ground terminal No. 3. Check that continuity exists between terminals No. 4 and 5. See Fig. 6. If continuity is not as specified, replace relay.

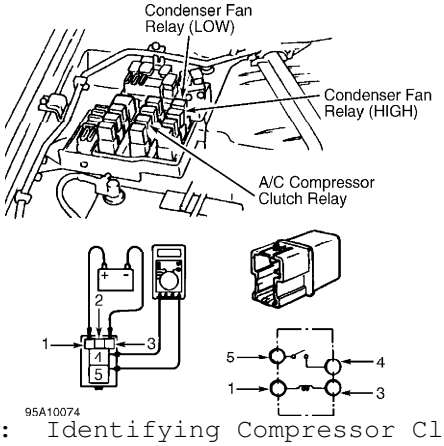


Fig. 6: Identifying Compressor Clutch & Condenser Fan Relays
Courtesy of Mitsubishi Motor Sales of America.

REMOVAL & INSTALLATION

* PLEASE READ THIS FIRST *

WARNING: To avoid injury from accidental air bag deployment, read and carefully follow all SERVICE PRECAUTIONS and DISABLING & ACTIVATING AIR BAG SYSTEM procedures in AIR BAG RESTRAINT SYSTEM article.

CAUTION: DO NOT allow any impact or shock to Supplemental Restraint System Electronic Control Unit (SRS-ECU), located under floor console.

NOTE: For removal and installation procedures not covered in this article, see HEATER SYSTEM article.

A/C SWITCH

Removal & Installation

Remove shift lever knob (M/T). Remove shift lever boots. Remove center console panel. Remove fresh/recirculated air switch. Remove A/C switch. Disconnect A/C switch electrical connector. To install A/C switch, reverse removal procedure.

COMPRESSOR

Removal & Installation

Discharge A/C system, using approved refrigerant recovery/recycling equipment. Remove compressor drive belt. Disconnect compressor electrical connector. Remove high and low pressure lines, and "O" rings from compressor. Remove compressor mounting bolts. Remove compressor. To install, reverse removal procedure.

CONDENSER

Removal & Installation

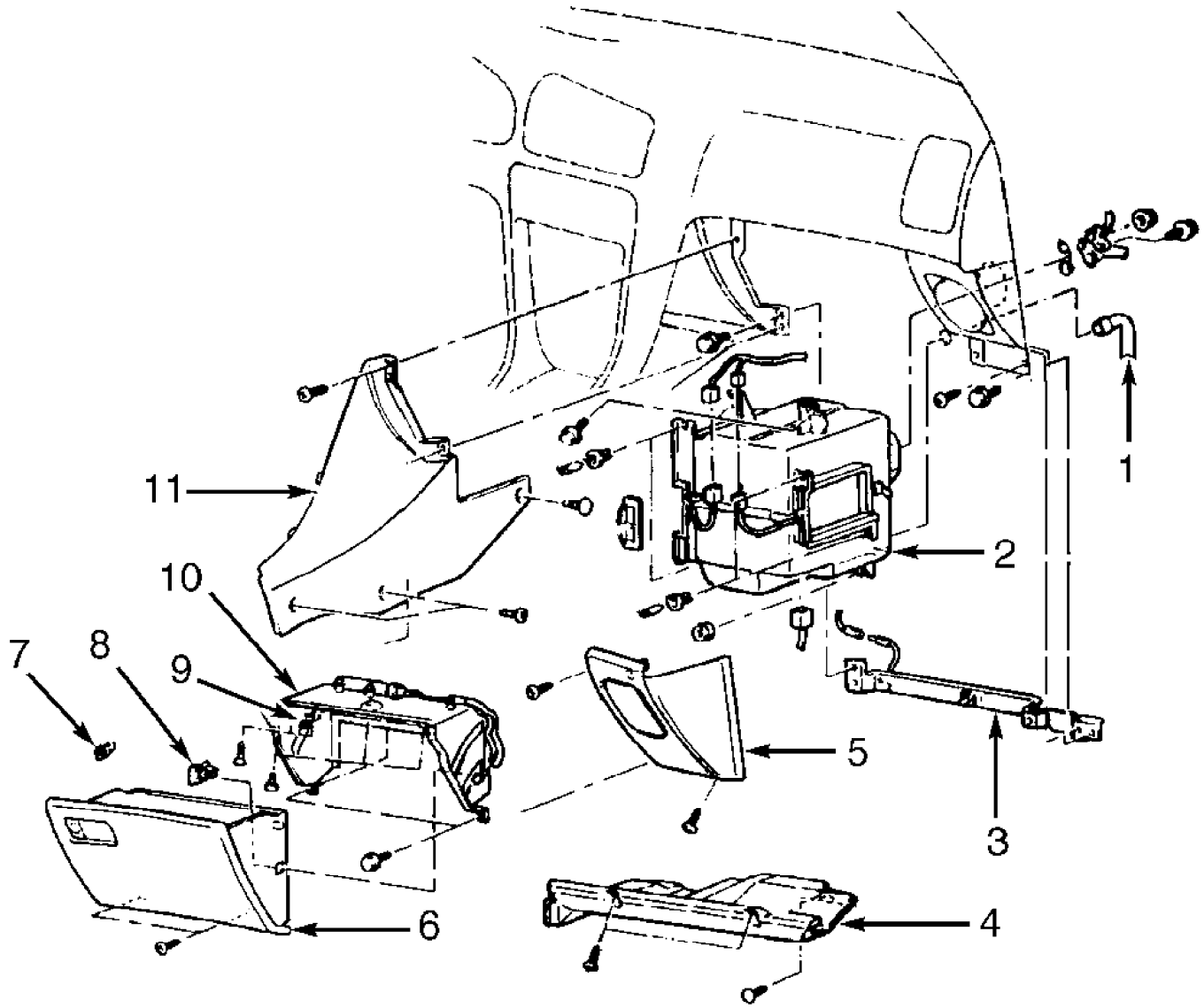
Discharge A/C system, using approved refrigerant recovery/recycling equipment. Remove coolant reservoir. Remove upper radiator mounting bolts. Slide condenser out of vehicle. To install, reverse removal procedure.

EVAPORATOR ASSEMBLY

Removal & Installation

1) Discharge A/C system, using approved refrigerant recovery/recycling equipment. Disconnect drain hose. Remove refrigerant lines and "O" rings from firewall side of evaporator. Remove instrument panel undercover. Remove glove box stopper and glove box. Remove glove box striker and cover.

2) Remove corner panel. Remove glove box frame. Remove 3 screws and instrument panel side cover. Disconnect evaporator electrical connectors. Unbolt and remove evaporator assembly. See Fig. 7. To install, reverse removal procedure. Evacuate and recharge system, and check for leaks.



1. Drain Hose
2. Evaporator Assembly
3. Glove Box Frame
4. Undercover
5. Corner Panel
6. Glove Box
7. Stopper
8. Glove Box Damper Catcher (If Equipped)
9. Glove Box Striker
10. Glove Box Cover
11. Side Cover

95B10075

Fig. 7: Removing Evaporator Assembly
Courtesy of Mitsubishi Motor Sales of America.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS TABLE

Application	Ft. Lbs. (N.m)
Belt Tensioner Adjusting Nut	17-19 (23-26)
Belt Tensioner Mounting Bolt	17-20 (23-27)
Clutch Mounting Bolt/Nut	11-13 (15-17)
Compressor Bracket Bolts	36 (49)
Compressor-To-Bracket Bolts	17-20 (23-27)
	INCH Lbs. (N.m)
Dual-Pressure Switch	80-97 (9-11)
Duct Screws	13-22 (1.5-2.5)

WIRING DIAGRAMS

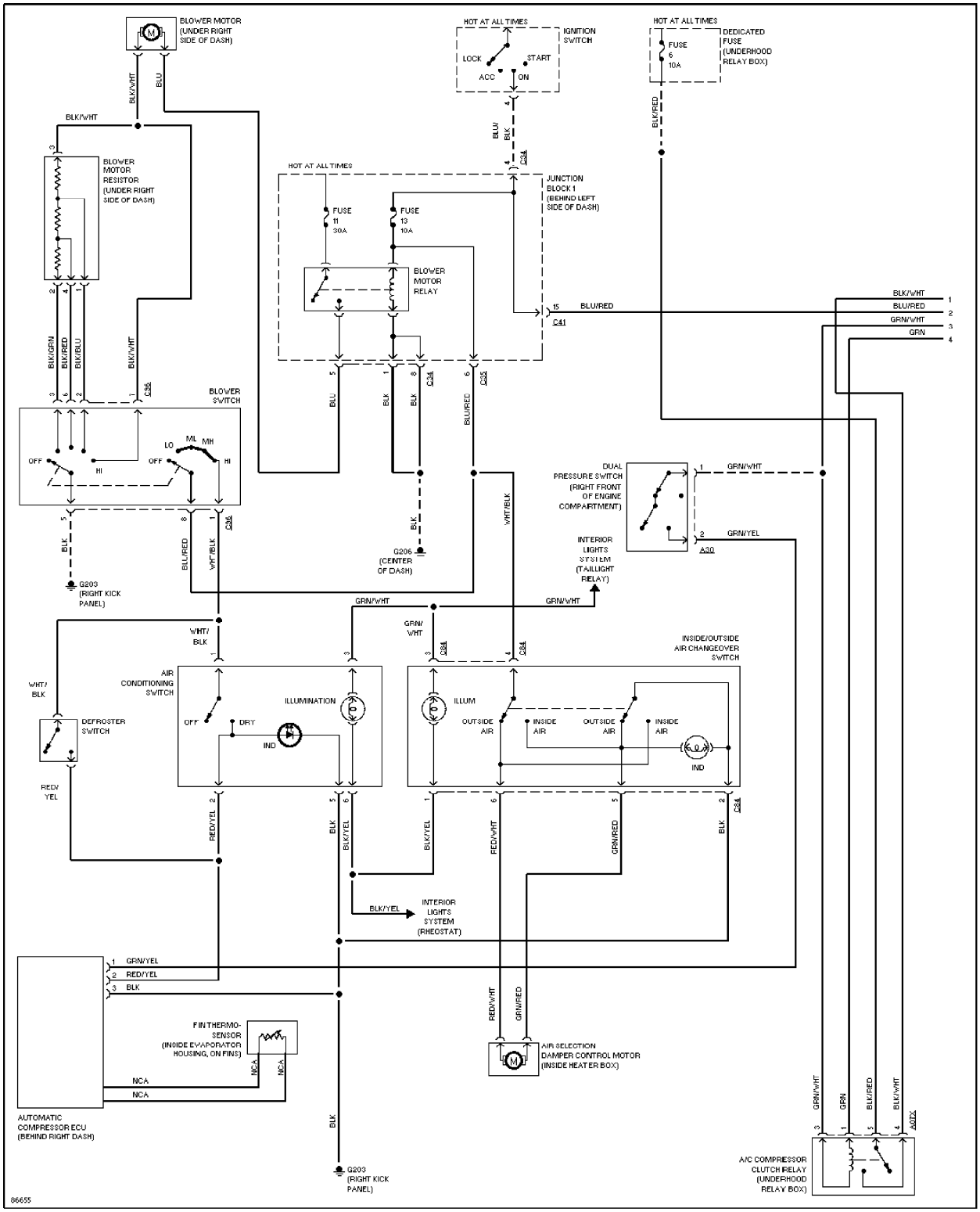


Fig. 8: Manual A/C-Heater System Wiring Diagram (1 Of 2)

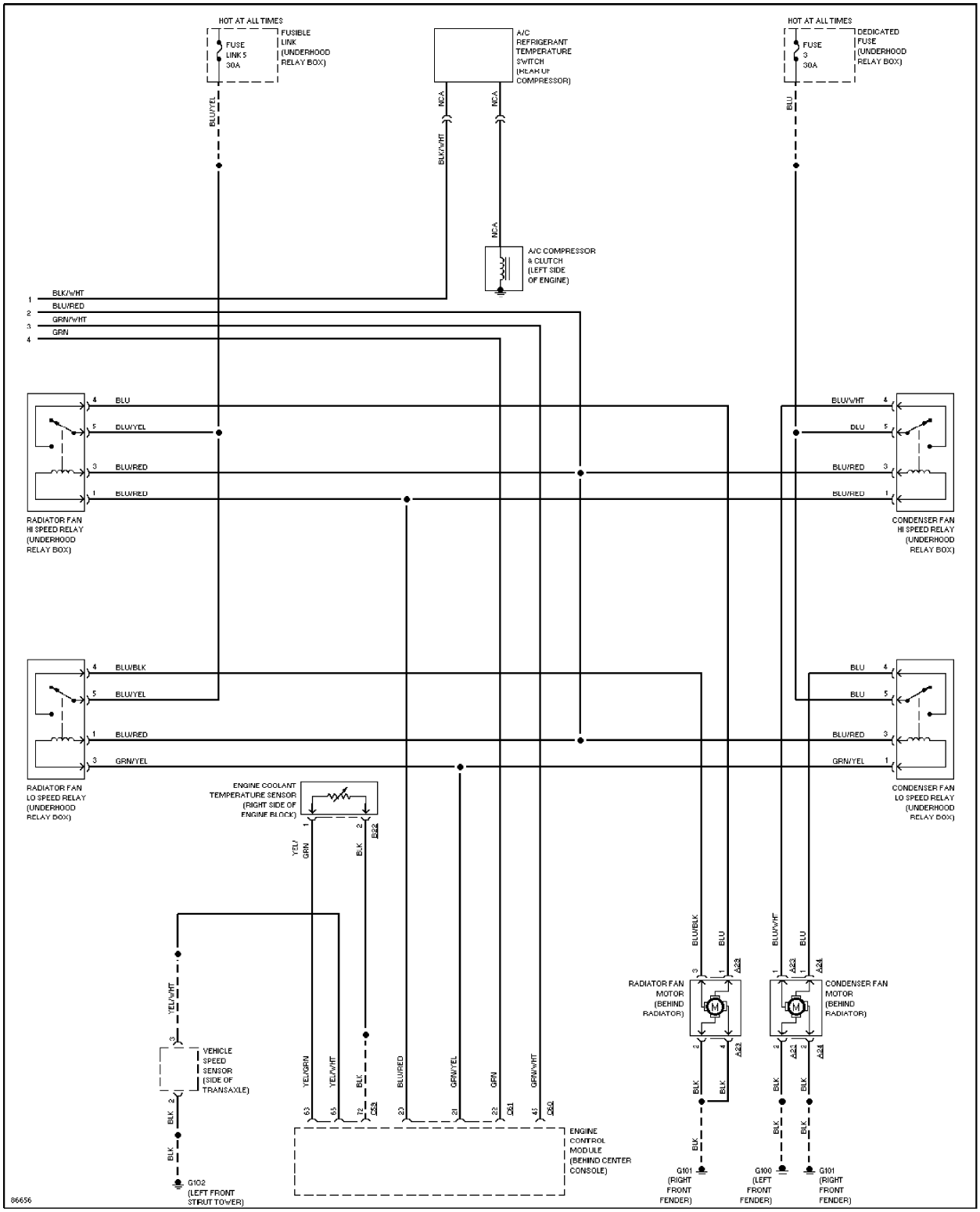


Fig. 9: Manual A/C-Heater System Wiring Diagram (2 Of 2)

* A/C-HEATER SYSTEM UNIFORM INSPECTION GUIDELINES *

1998 Mitsubishi Galant

GENERAL INFORMATION
A/C-Heater System Motorist Assurance Program
Standards For Automotive Repair

All Makes and Models

INTRODUCTION TO MOTORIST ASSURANCE PROGRAM (MAP)

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MOTORIST ASSURANCE PROGRAM (MAP)

OVERVIEW

The Motorist Assurance Program is the consumer outreach effort of the Automotive Maintenance and Repair Association, Inc. (AMRA). Participation in the Motorist Assurance Program is drawn from retailers, suppliers, independent repair facilities, vehicle manufacturers and industry associations.

Our organization's mission is to strengthen the relationship between the consumer and the auto repair industry. We produce materials that give motorists the information and encouragement to take greater responsibility for their vehicles-through proper, manufacturer-recommended, maintenance. We encourage participating service and repair shops (including franchisees and dealers) to adopt (1) a Pledge of Assurance to their Customers and (2) the Motorist Assurance Program Standards of Service. All participating service providers have agreed to subscribe to this Pledge and to adhere to the promulgated Standards of Service demonstrating to their customers that they are serious about customer satisfaction.

These Standards of Service require that an inspection of the vehicle's (problem) system be made and the results communicated to the customer according to industry standards. Given that the industry did not have such standards, the Motorist Assurance Program successfully promulgated industry inspection communication standards in 1994-95 for the following systems: Exhaust, Brakes, ABS, Steering and Suspension, Engine Maintenance and Performance, HVAC, and Electrical Systems. Further, revisions to all of these inspection communication standards

are continually republished. In addition to these, standards for Drive Train and Transmissions have recently been promulgated. Participating shops utilize these Uniform Inspection & Communication Standards as part of the inspection process and for communicating their findings to their customers.

The Motorist Assurance Program continues to work cooperatively and proactively with government agencies and consumer groups toward solutions that both benefit the customer and are mutually acceptable to both regulators and industry. We maintain the belief that industry must retain control over how we conduct our business, and we must be viewed as part of the solution and not part of the problem. Meetings with state and other government officials (and their representatives), concerned with auto repair and/or consumer protection, are conducted. Feedback from these sessions is brought back to the association, and the program adjusted as needed.

To assure auto repair customers recourse if they were not satisfied with a repair transaction, the Motorist Assurance Program offers mediation and arbitration through MAP/BBB-CARE and other non-profit organizations. MAP conducted pilot programs in twelve states before announcing the program nationally in October, 1998. During the pilots, participating repair shops demonstrated their adherence to the Pledge and Standards and agreed to follow the UICS in communicating the results of their inspection to their customers. To put some "teeth" in the program, an accreditation requirement for shops was initiated. The requirements are stringent, and a self-policing method has been incorporated which includes the "mystery shopping" of outlets.

We welcome you to join us as we continue our outreach... with your support, both the automotive repair industry and your customers will reap the benefits. Please visit MAP at our Internet site www.motorist.org or contact us at:

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Washington, DC 20005
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January 1999

MAP UNIFORM INSPECTION GENERAL GUIDELINES

OVERVIEW OF SERVICE REQUIREMENTS & SUGGESTIONS

It is MAP policy that all exhaust, brake, steering, suspension, wheel alignment, drive-line, engine performance and maintenance, and heating, ventilation and air conditioning, and electrical services be offered and performed under the standards and procedures specified in these sections.

Before any service is performed on a vehicle, an inspection of the appropriate system must be performed. The results of this inspection must be explained to the customer and documented on an inspection form. The condition of the vehicle and its components will indicate what services/part replacements may be "Required" or "Suggested". In addition, suggestions may be made to satisfy the requests expressed by the customer.

When a component is suggested or required to be repaired or replaced, the decision to repair or replace must be made in the customer's best interest, and at his or her choice given the options available.

This section lists the various parts and conditions that indicate a required or suggested service or part replacement. Although this list is extensive, it is not fully inclusive. In addition to this list, a technician may make a suggestion. However, any suggestions must be based on substantial and informed experience,

or the vehicle manufacturer's recommended service interval and must be documented.

Some conditions indicate that service or part replacement is required because the part in question is no longer providing the function for which it is intended, does not meet a vehicle manufacturer's design specification or is missing.

Example:
An exhaust pipe has corroded severely and has a hole in it through which exhaust gases are leaking. Replacement of the exhaust pipe in this case is required due to functional failure.

Example:
A brake rotor has been worn to the point where it measures less than the vehicle manufacturer's discard specifications. Replacement of the rotor is required because it does not meet design specifications.

Some conditions indicate that a service or part replacement is suggested because the part is close to the end of its useful life or addresses a customer's need, convenience or request. If a customer's vehicle has one of these conditions, the procedure may be only to suggest service.

Example:
An exhaust pipe is rusted, corroded or weak, but no leaks are present. In this case, the exhaust pipe has not failed. However, there is evidence that the pipe may need replacement in the near future. Replacement of the pipe may be suggested for the customer's convenience in avoiding a future problem.

Example:
The customer desires improved ride and/or handling, but the vehicle's shocks or struts have not failed. In this case, replacement may be suggested to satisfy the customer's wishes. In this case, replacement of the shocks or struts may not be sold as a requirement.

A customer, of course, has the choice of whether or not a shop will service his or her vehicle. He or she may decide not to follow some of your suggestions. When a repair is required, a MAP shop must refuse partial service on that system if, in the judgment of the service provider, proceeding with the work could create or continue an unsafe condition. When a procedure states that required or suggested repair or replacement is recommended, the customer must be informed of the generally acceptable repair/replacement options whether or not performed by the shop.

When presenting suggested repairs to the customer, you must present the facts, allowing the customer to draw their own conclusions and make an informed decision about how to proceed.

The following reasons may be used for required and suggested services. These codes are shown in the "Code" column of the MAP Uniform Inspection & Communications Standards that follow:

Reasons to Require Repair or Replacement

A – Part no longer performs intended purpose
B – Part does not meet a design specification (regardless of performance)
C – Part is missing

NOTE: When a repair is required, the shop must refuse partial

service to the system in question, if the repair creates or continues an unsafe condition.

Reasons to Suggest Repair or Replacement

1 - Part is close to the end of its useful life (just above discard specifications, or weak; failure likely to occur soon, etc.)
2 - To address a customer need, convenience, or request (to stiffen ride, enhance performance, eliminate noise, etc.)
3 - To comply with maintenance recommended by the vehicle's Original Equipment Manufacturer (OEM)
4 - Technician's recommendation based on substantial and informed experience

NOTE: Suggested services are always optional. When presenting suggested repairs to the customer, you must present the facts, allowing the customer to draw their own conclusions and make an informed decision about how to proceed.

HEATING, VENTILATION, AND AIR CONDITIONING

SERVICE PROCEDURES REQUIRED AND SUGGESTED FOR PROPER VEHICLE OPERATION

CAUTION: Before working on any air conditioning system, be sure to review current local, state, federal, and EPA regulations regarding charging, recycling, and disposal of refrigerant.

ACCUMULATORS

ACCUMULATOR INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Beyond vehicle manufacturer's service interval	3	Suggest replacement.
Dessicant at the end of its useful life (saturated with moisture)	1	Suggest repair or replacement.
Dessicant bag deteriorated	A	(1) Require replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Tubing connection leaking	A	Require repair or replacement.

(1) - Inspect system to determine effects of dessicant bag deterioration.

ACTUATORS (ELECTRICAL)

ACTUATOR (ELECTRICAL) INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted, affecting performance	A	(1) Require repair or replacement.
Connector melted, not affecting performance	2	(1) Suggest repair or replacement.
Connector missing	C	Require replacement.
Inoperative	A	(2) Require replacement.
Missing	C	Require replacement.
Noisy	2	Suggest repair or replacement.
Out of adjustment	B	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	1	(1) Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	1	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.

ACTUATORS (VACUUM)

ACTUATOR (VACUUM) INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of

			hardware.
Attaching hardware not functioning	A	...	Require repair or replacement of hardware.
Connector broken	A	..	Require repair or replacement.
Connector (Weatherpack type) leaking	A	..	Require repair or replacement.
Connector melted, affecting performance	A	.....	(1) Require repair or replacement.
Connector melted, not affecting performance	2	.....	(1) Suggest repair or replacement.
Connector missing	C	.....	Require replacement.
Inoperative	A	.....	(2) Require replacement.
Leaking (vacuum)	A	..	Require repair or replacement.
Linkage bent, affecting performance	A	...	Require repair or replacement of linkage.
Linkage bent, not affecting performance	2	...	Suggest repair or replacement of linkage.
Linkage binding, affecting performance	A	...	Require repair or replacement of linkage.
Linkage binding, not affecting performance	1	...	Suggest repair or replacement of linkage.
Linkage broken	A	...	Require repair or replacement of linkage.
Linkage loose, affecting performance	A	...	Require repair or replacement of linkage.
Linkage loose, not affecting performance	1	...	Suggest repair or replacement of linkage.
Linkage missing	C	.....	Require replacement.
Linkage noisy	2	..	Suggest repair or replacement.
Missing	C	.....	Require replacement.
Noisy	2	..	Suggest repair or replacement.
Out of adjustment	A	..	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Inoperative includes intermittent operation or out of OEM specification.

AIR CONDITIONING FITTINGS

See AIR CONDITIONING METAL LINES, HOSES AND FITTING ASSEMBLIES.

AIR CONDITIONING HOSES

See AIR CONDITIONING METAL LINES, HOSES AND FITTING ASSEMBLIES.

AIR CONDITIONING METAL LINES, HOSES AND FITTING ASSEMBLIES

AIR CONDITIONING METAL LINE, HOSE AND FITTING ASSEMBLY INSPECTION

Condition	Code	Procedure

Abrasion damage, affecting structural integrity	A	Require repair or replacement.
Abrasion damage, not affecting structural integrity		No service suggested or required.
Application incorrect	B	Require replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Clamp corroded, not reusable	1	Suggest replacement.
Connected incorrectly	A	Require repair.
Corroded, affecting structural integrity	A	Require replacement.
Corroded, not affecting structural integrity		No service suggested or required.
Cracked	A	Require repair or replacement.
Fitting type incorrect (such as compression fitting)	B	Require replacement.
Flange leaking	A	Require repair or replacement.
Insufficient clamping force, allowing hose to leak	A	Require repair or replacement.
Leaking	A	Require repair or replacement.
Melted	1	Suggest repair or replacement.
Missing	C	Require replacement.
Outer covering damaged to the extent that the inner fabric is visible	A	Require replacement.
Protective sleeves damaged	2	Suggest replacement of sleeves.
Protective sleeves missing	C	Require replacement of sleeves.
Restricted, affecting performance	A	Require repair or replacement.
Routed incorrectly	2	Require repair.
Swollen	1	Suggest replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Type incorrect	1	Suggest repair or replacement.

AIR CONTROL DOORS

See PLENUMS.

AIR DAMS (EXTERNAL)

AIR DAM (EXTERNAL) INSPECTION

Condition	Code	Procedure

Application incorrect, affecting air conditioning system performance	A	..	Require repair or replacement.
Attaching hardware broken	A	...	Require repair or replacement of hardware.
Attaching hardware missing	C	.....	Require replacement of hardware.
Attaching hardware not functioning	A	...	Require repair or replacement of hardware.
Bent, affecting air conditioning system performance	A	..	Require repair or replacement.
Blocked, affecting air conditioning system performance	A	..	Require repair or replacement.
Broken, affecting air conditioning system performance	A	..	Require repair or replacement.
Cracked, affecting air conditioning system performance	A	..	Require repair or replacement.
Loose, affecting air conditioning system performance	A	.....	Require repair.
Loose, not affecting air conditioning system performance	2	.....	Suggest repair.
Missing, affecting air conditioning system performance	C	.....	Require replacement.

AIR DISTRIBUTION SYSTEM

See PLENUMS.

BELTS

BELT INSPECTION

Condition	Code		Procedure
Alignment incorrect	B	.....	(1) Further inspection required.
Cracked	1	.....	Suggest replacement.
Frayed	1	.....	Suggest replacement.
Missing	C	.....	Require replacement.
Noisy	2	.....	(2) Further inspection required.
Plies separated	A	.....	Require replacement.
Serpentine belt routed incorrectly	B	.....	Require repair.
Tension out of specification	B	.....	Require adjustment or replacement.
Worn beyond adjustment range	B	.....	Require replacement.

Condition	Code	Procedure
Worn so it contacts bottom of pulley	A	Require replacement.

(1) - Determine cause of incorrect alignment and require repair.
(2) - Determine cause of noise and suggest repair.

BLEND DOORS

See PLENUMS.

BLOWER FANS (BLOWER WHEEL OR SQUIRREL CAGE)

BLOWER FAN (BLOWER WHEEL OR SQUIRREL CAGE) INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Application incorrect	B	Require repair or replacement.
Broken	A	Require replacement.
Cracked	A	Require replacement
Distorted	A	Require replacement.
Fins missing	C	Require replacement.
Hub separated	A	Require replacement.
Inoperative	A	(1) Require replacement.
Mounting loose	A	Require repair or replacement.
Noisy	2	Suggest replacement.
Out of balance	A	Require repair or replacement.

(1) - Inoperative includes intermittent operation or out of OEM specification.

BLOWER MOTORS

BLOWER MOTOR INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted, affecting performance	A	(1) Require repair or replacement.
Connector melted, not		

affecting performance	2	(1) Suggest repair or replacement.
Connector missing	C	Require replacement.
Current draw out of specification	B	Require repair or replacement.
Inoperative	A	(2) Require replacement.
Missing	C	Require replacement.
Motor speed insufficient	2	Suggest repair or replacement.
Noisy	2	Suggest replacement.
Rotation incorrect for application	B	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Vibration	1	Suggest replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Check fan motor/controls. Inoperative includes intermittent operation or out of OEM specification.

BLOWER RESISTORS

BLOWER RESISTOR INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Conductor exposed	A	Require replacement.
Connector broken	A	Require repair or replacement.
Connector melted, affecting performance	A	(1) Require repair or replacement.
Connector melted, not affecting performance	1	(1) Suggest repair or replacement.

Connector missing	C	Require replacement.
Inoperative	A	(2) Require replacement.
Insulation overheated	A	Require replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Inoperative includes intermittent operation or out of OEM specification.

BLOWER SWITCHES

See SWITCHES.

CABIN AIR FILTERS

CABIN AIR FILTER INSPECTION

Condition	Code	Procedure
Air flow obstruction	A	Require cleaning or replacement.
Maintenance intervals	3	Suggest replacement.
Missing	C	Require replacement.

CIRCUIT BREAKERS

See FUSES, FUSIBLE LINKS AND CIRCUIT BREAKERS.

COMPRESSOR CLUTCH ASSEMBLIES

COMPRESSOR CLUTCH ASSEMBLY INSPECTION

Condition	Code	Procedure
Air gap incorrect	B	Require repair or replacement.
Bearing seized	A	Require replacement of bearing or assembly.
Bearing worn, affecting performance	A	Require replacement of bearing or assembly.
Coil shows signs of overheating	1	Suggest replacement of coil.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted,		

affecting performance	A	(1) Require repair or replacement.
Connector melted, not affecting performance	2	(1) Suggest repair or replacement.
Connector missing	C	Require replacement.
Hub broken	A	Require replacement.
Hub cracked	B	Require replacement.
Hub loose on shaft	A	Require replacement.
Hub scored, affecting performance	A	Require replacement.
Hub warped, affecting performance	A	Require replacement.
Inoperative	A	(2) Require repair or replacement.
Noisy	2	Suggest repair or replacement.
Slips	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Will not disengage	A	Require repair or replacement.
Wire lead burned	A	Require repair or replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Inoperative includes intermittent operation or out of OEM specification.

COMPRESSORS

COMPRESSOR INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Bracket bent, affecting performance	A	Require repair or replacement.
Bracket bent, not affecting performance		No service suggested or required.

Bracket broken, affecting performance	A		Require replacement.
Bracket broken, not affecting performance			No service suggested or required.
Bracket corroded, affecting performance	A		Require repair or replacement.
Bracket corroded, not affecting performance	2		Suggest repair or replacement.
Bracket cracked, affecting performance	A		Require repair or replacement.
Bracket cracked, not affecting performance	1		Suggest repair or replacement.
Bracket holes elongated, affecting performance	A		Require repair or replacement.
Bracket holes elongated, not affecting performance			No service suggested or required.
Bracket loose, affecting performance	A		Require repair or replacement.
Bracket loose, not affecting performance	1		Suggest repair or replacement.
Bracket missing	C		Require replacement.
Housing broken, affecting performance	A		Require repair or replacement.
Housing broken, not affecting performance			No service suggested or required.
Housing cracked, affecting performance	A		Require repair or replacement.
Housing cracked, not affecting performance	1		Suggest repair or replacement.
Inoperative	A		(1) Require repair or replacement.
Leaking	A		Require repair or replacement.
Noisy	2		(2) Suggest repair or replacement.
Threads damaged	A		Require repair or replacement.
Threads stripped (threads missing)	A		Require replacement.
Tubing connection leaking	A		Require repair or replacement.

(1) - Inoperative includes intermittent operation or out of OEM specification.
(2) - Compressor noise can also be caused by low oil level, state of charge, air contamination, or type of refrigerant.

CONDENSER AIR SEALS

CONDENSER AIR SEAL INSPECTION

Condition	Code	Procedure
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.

CONDENSER FAN MOTORS

See COOLING FAN MOTORS.

CONDENSERS

CONDENSER INSPECTION

Condition	Code	Procedure
Abrasion damage, affecting structural integrity	A	Require repair or replacement.
Abrasion damage, not affecting structural integrity		No service suggested or required.
Air flow obstruction, affecting performance	A	Require repair or replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Bent, affecting performance	A	Require repair or replacement.
Bent, not affecting performance		No service suggested or required.
Bracket bent, affecting performance	A	Require repair or replacement.
Bracket bent, not affecting performance		No service suggested or required.
Bracket broken, affecting performance	A	Require replacement.
Bracket broken, not affecting performance		No service suggested or required.
Bracket corroded, affecting performance	A	Require repair or replacement.
Bracket corroded, not affecting performance	2	Suggest repair or replacement.
Bracket cracked, affecting performance	A	Require repair or replacement.
Bracket cracked, not affecting performance	1	Suggest repair or replacement.
Bracket holes elongated, affecting performance	A	Require repair or replacement.
Bracket holes elongated, not affecting performance		No service suggested or required.
Bracket loose, affecting performance	A	Require repair or replacement.
Bracket loose, not affecting performance	1	Suggest repair or replacement.
Bracket missing	C	Require replacement.
Corroded, affecting structural integrity	A	Require replacement.
Corroded, not affecting structural integrity		No service suggested or

			required.
Fitting type incorrect (such as compression fitting)	B	.....	Require replacement.
Flange leaking	A	..	Require repair or replacement.
Leaking	A	..	Require repair or replacement.
Restricted internally	A	..	Require repair or replacement.
Threads damaged	A	..	Require repair or replacement.
Threads stripped (threads missing)	A	.....	Require replacement.

CONNECTORS

See WIRING HARNESSES AND CONNECTORS.

CONTROL CABLES

CONTROL CABLE INSPECTION

Condition	Code		Procedure
Attaching hardware broken	A	...	Require repair or replacement of hardware.
Attaching hardware missing	C	.....	Require replacement of hardware.
Attaching hardware not functioning	A	...	Require repair or replacement of hardware.
Binding	A	..	Require repair or replacement.
Bracket bent, affecting performance	A	..	Require repair or replacement.
Bracket bent, not affecting performance	..	.....	No service suggested or required.
Bracket broken, affecting performance	A	.....	Require replacement.
Bracket broken, not affecting performance	..	.....	No service suggested or required.
Bracket corroded, affecting performance	A	..	Require repair or replacement.
Bracket corroded, not affecting performance	2	..	Suggest repair or replacement.
Bracket cracked, affecting performance	A	..	Require repair or replacement.
Bracket cracked, not affecting performance	1	..	Suggest repair or replacement.
Bracket holes elongated, affecting performance	A	..	Require repair or replacement.
Bracket holes elongated, not affecting performance	..	.....	No service suggested or required.
Bracket loose, affecting performance	A	..	Require repair or replacement.
Bracket loose, not affecting performance	1	..	Suggest repair or replacement.
Bracket missing	C	.....	Require replacement.
Broken	A	..	Require repair or replacement.
Cracked	2	..	Suggest repair or replacement.

Disconnected	A	..	Require repair or replacement.
Kinked	2	..	Suggest repair or replacement.
Melted	A	.....	(1) Require repair or replacement.
Missing	C	.....	Require replacement.
Out of adjustment	B	.....	(2) Require repair or replacement.
Routed incorrectly	2	.....	Suggest repair.
Seized	A	..	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Follow OEM recommended adjustment procedures. Require repair or replacement if out of specification.

CONTROL HEADS (FUNCTION SELECTORS)

CONTROL HEAD (FUNCTION SELECTOR) INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	... Require repair or replacement of hardware.
Attaching hardware missing	C	..... Require replacement of hardware.
Attaching hardware not functioning	A	... Require repair or replacement of hardware.
Connector broken	A	.. Require repair or replacement.
Connector (Weatherpack type) leaking	A	.. Require repair or replacement.
Connector melted, affecting performance	A	..... (1) Require repair or replacement.
Connector melted, not affecting performance	2	..... (1) Suggest repair or replacement.
Connector missing	C	..... Require replacement.
Contaminated	2	.... Suggest require replacement.
Leaking	A	.. Require repair or replacement.
Malfunctioning	A	..... (2) Require repair or replacement.
Melted, affecting performance	A	..... (1) Require repair or replacement.
Melted, not affecting performance	..	..... No service suggested or required.
Terminal broken	A	.. Require repair or replacement.
Terminal burned, affecting performance	A	..... (1) Require repair or replacement.
Terminal burned, not affecting performance	2	.. Suggest repair or replacement.
Terminal corroded, affecting performance	A	.. Require repair or replacement.
Terminal corroded, not affecting performance	2	.. Suggest repair or replacement.
Terminal loose, affecting performance	B	.. Require repair or replacement.

Terminal loose, not affecting performance	1	..	Suggest repair or replacement.
Wire lead burned	A	..	Require repair or replacement.
Wire lead conductors exposed	B	..	Require repair or replacement.
Wire lead open	A	..	Require repair or replacement.
Wire lead shorted	A	..	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Includes inoperative, intermittent operation, or failure to perform all functions.

CONTROL LINKAGES

CONTROL LINKAGE INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	.. Require repair or replacement of hardware.
Attaching hardware missing	C	..... Require replacement of hardware.
Attaching hardware not functioning	A	. Require repair or replacement of hardware.
Bent	A	. Require repair or replacement.
Binding	A	. Require repair or replacement.
Bracket bent, affecting performance	A	. Require repair or replacement.
Bracket bent, not affecting performance	..	..... No service suggested or required.
Bracket broken, affecting performance	A	..... Require replacement.
Bracket broken, not affecting performance	..	..... No service suggested or required.
Bracket corroded, affecting performance	A	. Require repair or replacement.
Bracket corroded, not affecting performance	2	. Suggest repair or replacement.
Bracket cracked, affecting performance	A	. Require repair or replacement.
Bracket cracked, not affecting performance	1	. Suggest repair or replacement.
Bracket holes elongated, affecting performance	A	. Require repair or replacement.
Bracket holes elongated, not affecting performance	..	..... No service suggested or required.
Bracket loose, affecting performance	A	. Require repair or replacement.
Bracket loose, not affecting performance	1	. Suggest repair or replacement.
Bracket missing	C	..... Require replacement.
Broken	A	..... Require replacement.
Cracked	A	. Require repair or replacement.
Disconnected	A	. Require repair or replacement.

Missing	C	Require replacement.
Noisy	2	Suggest repair or replacement.
Out of adjustment	B	(1) Require repair or replacement.
Seized	A	Require repair or replacement.

(1) - Follow OEM recommended adjustment procedures. Require repair or replacement if out of specification.

CONTROL MODULES

NOTE: Includes, but not limited to: IRCM, Coolant Fan Control Module (CFCM), AC Controller, Amplifier, Programmers, Control Heads, Power Modules, etc.

CONTROL MODULE INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Code set (if applicable)	A	(1) Further inspection required.
Connector broken	A	Require repair or replacement.
Connector melted, affecting performance	A	(2) Require repair or replacement.
Connector melted, not affecting performance	2	(2) Suggest repair or replacement.
Connector missing	A	Require repair.
Contaminated	A	(3) Require repair or replacement.
Inoperative	B	(4) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(2) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.

Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) – Refer to manufacturer's diagnostic trouble code procedure and require repair or replacement of affected component(s).
(2) – Determine cause and correct prior to repair or replacement of part.
(3) – Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement. Check for accepted cleaning procedure.
(4) – Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable.

COOLANT

COOLANT INSPECTION

Condition	Code	Procedure
Acidity (pH) incorrect	1	Suggest correction or replacement.
Contaminated	B	(1) Require replacement or recycling. Further inspection required.
Level incorrect	B	(2) Require filling to proper level.
Maintenance intervals	3	(3) Suggest replacement.
Mixture incorrect	B	Require correction or replacement.
Type incorrect	B	Require replacement.

(1) – Determine source of contamination and require correction prior to coolant replacement.
(2) – Determine source of incorrect level and suggest repair.
(3) – The system should be drained and/or flushed and refilled with correct coolant according to OEM recommended service interval and procedures.

COOLING FAN BLADES

COOLING FAN BLADE INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.

Bent	A	Require replacement.
Broken	A	Require replacement.
Cracked	A	Require replacement.
Loose	A	Require repair or replacement.
Missing	C	Require replacement.

COOLING FAN CLUTCHES

NOTE: Some lateral movement, measured at the fan blade tip, may be normal.

COOLING FAN CLUTCH INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Bearing noisy	A	Require replacement.
Bearing worn	A	Require replacement.
Fastener loose	A	Require repair or replacement of fastener.
Inoperative	A	(1) Require replacement.
Leaking	1	Suggest replacement.
Seized	A	Require replacement.
Slips (insufficient fan speed)	A	Require replacement.
Thermal control incorrect	B	Require repair or replacement.

(1) - Inoperative includes intermittent operation or out of OEM specification.

COOLING FAN MOTORS

COOLING FAN MOTOR INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted, affecting performance	A	(1) Require repair or replacement.

Connector melted, not affecting performance	2	(1) Suggest repair or replacement.
Connector missing	C	Require replacement.
Hydraulic fan motor leaking	A	Require repair or replacement.
Inoperative	A	(2) Require replacement.
Missing	C	Require replacement.
Noisy	2	Suggest replacement.
Rotation incorrect for application	B	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Vibration	1	Suggest replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Check fan motor/controls. Inoperative includes intermittent operation or out of OEM specification.

EVAPORATOR DRAIN TUBES

EVAPORATOR DRAIN TUBE INSPECTION

Condition	Code	Procedure
Disconnected	A	Require repair.
Leaking	A	Require replacement.
Missing	C	Require replacement.
Restricted	A	Require repair or replacement.
Routed incorrectly	B	Require repair.

EVAPORATOR PRESSURE REGULATORS (EPRS)

EVAPORATOR PRESSURE REGULATOR (EPR) INSPECTION

Condition	Code	Procedure
Inoperative	A	(1) Require repair or replacement.

(1) - Inoperative includes intermittent operation or out of OEM specification.

EVAPORATORS

EVAPORATOR INSPECTION

Condition	Code	Procedure
Abrasion damage, affecting structural integrity	A	Require repair or replacement.
Abrasion damage, not affecting structural integrity		No service suggested or required.
Air flow obstruction, affecting performance	A	Require repair or replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Bracket bent, affecting performance	A	Require repair or replacement.
Bracket bent, not affecting performance		No service suggested or required.
Bracket broken, affecting performance	A	Require replacement.
Bracket broken, not affecting performance		No service suggested or required.
Bracket corroded, affecting performance	A	Require repair or replacement.
Bracket corroded, not affecting performance	2	Suggest repair or replacement.
Bracket cracked, affecting performance	A	Require repair or replacement.
Bracket cracked, not affecting performance	1	Suggest repair or replacement.
Bracket holes elongated, affecting performance	A	Require repair or replacement.
Bracket holes elongated, not affecting performance		No service suggested or required.
Bracket loose, affecting performance	A	Require repair or replacement.
Bracket loose, not affecting performance	1	Suggest repair or replacement.
Bracket missing	C	Require replacement.
Corroded, affecting structural integrity	A	Require replacement.
Corroded, not affecting structural integrity		No service suggested or required.
Evaporator foam seal leaking	A	Require replacement.
Evaporator foam seal missing	C	Require replacement.
Fitting type incorrect		

Condition	Code	Procedure
(such as compression fitting)	B	Require replacement.
Flange leaking	A	Require repair or replacement.
Leaking	A	Require repair or replacement.
Restricted internally	A	Require repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

EXPANSION VALVES

EXPANSION VALVE INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Corroded internally	1	Suggest replacement.
Filter screen torn	A	Require replacement of screen.
Inoperative	A	(1) Require repair or replacement.
Leaking	A	Require replacement.
Restricted	A	Require repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

(1) - Expansion valve operation may be affected by capillary tube location, corrosion, and insulation tape. Inoperative includes intermittent operation.

FUNCTION SELECTORS

See CONTROL HEADS (FUNCTION SELECTORS).

FUSES, FUSIBLE LINKS AND CIRCUIT BREAKERS

FUSE, FUSIBLE LINK AND CIRCUIT BREAKER INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Blown	A	(1) Require replacement.
Corroded, affecting performance	A	Require repair or replacement.
Corroded, not affecting performance	2	Suggest repair or replacement.
Cracked, affecting performance	A	Require repair or replacement.
Cracked, not affecting performance	1	Suggest repair or replacement.
Inoperative	A	(2) Require replacement.
Insulation damaged,		

conductors exposed	A	..	Require repair or replacement.
Insulation damaged, conductors not exposed .	1	..	Suggest repair or replacement.
Missing	C	.....	Require replacement.
Routed incorrectly	B	.....	Require repair.
Secured incorrectly	B	.....	Require repair.
Terminal broken	A	..	Require repair or replacement.
Terminal burned, affecting performance	A	.....	(1) Require repair or replacement.
Terminal burned, not affecting performance ..	2	..	Suggest repair or replacement.
Terminal corroded, affecting performance ..	A	..	Require repair or replacement.
Terminal corroded, not affecting performance ..	2	..	Suggest repair or replacement.
Terminal loose, affecting performance	B	..	Require repair or replacement.
Terminal loose, not affecting performance ..	1	..	Suggest repair or replacement.

(1) - Determine cause and correct prior to replacement of part.
(2) - Inoperative includes intermittent operation.

FUSIBLE LINKS

See FUSES, FUSIBLE LINKS AND CIRCUIT BREAKERS.

GASKETS

GASKET INSPECTION

Condition	Code		Procedure
Leaking	A	.....	(1) Require repair or replacement.

(1) - Require inspection of mating and sealing surface and repair or replace as necessary.

HEATER CASES

See PLENUMS.

HEATER CONTROL VALVES

HEATER CONTROL VALVE INSPECTION

Condition	Code		Procedure
Application incorrect ...	B	.....	Require replacement.
Attaching hardware broken	A	...	Require repair or replacement of hardware.
Attaching hardware missing	C	.....	Require replacement of hardware.
Attaching hardware not functioning	A	...	Require repair or replacement

			of hardware.
Binding	2	..	Suggest repair or replacement.
Coolant leak	A	..	Require repair or replacement.
Disconnected	A	..	Require repair or replacement.
Malfunctioning	A	.....	(1) Require repair or replacement.
Missing	C	.....	Require replacement.
Restricted	A	..	Require repair or replacement.
Seized	A	..	Require repair or replacement.
Vacuum leak	A	..	Require repair or replacement.

(1) - Includes inoperative, intermittent operation, or failure to perform all functions.

HEATER CORES

HEATER CORE INSPECTION

Condition	Code		Procedure
Air flow obstruction	A	..	Require repair or replacement.
Attaching hardware broken	A	...	Require repair or replacement of hardware.
Attaching hardware missing	C	.....	Require replacement of hardware.
Attaching hardware not functioning	A	..	Require repair or replacement of hardware.
Connection leaking	A	..	Require repair or replacement.
Corroded	1	..	Suggest repair or replacement.
Disconnected	A	..	Require repair or replacement.
Fins damaged, affecting performance	A	..	Require repair or replacement.
Fins damaged, not affecting performance	..	.....	No service suggested or required.
Internal restrictions, affecting performance	A	..	Require repair or replacement.
Leaking	A	..	Require repair or replacement.
Missing	C	.....	Require replacement.

HEATER HOSES

HEATER HOSE INSPECTION

Condition	Code		Procedure
Application incorrect	B	.....	Require replacement.
Connected incorrectly	A	.....	Require repair.
Corroded, not reusable	1	.....	Suggest replacement.
Cracked	A	..	Require repair or replacement.
Hard (brittle)	1	..	Suggest repair or replacement.
Inner fabric (webbing) damaged	A	.....	Require replacement.
Insufficient clamping force, allowing hose to leak	A	..	Require repair or replacement.
Leaking	A	..	Require repair or replacement.
Maintenance intervals	3	.....	Suggest replacement.

Melted	1	..	Suggest repair or replacement.
Missing	C	.....	Require replacement.
Outer covering damaged	1	.....	Suggest replacement.
Outer covering damaged to the extent that the inner fabric is visible	A	.....	Require replacement.
Protective sleeves damaged	2	.	Suggest replacement of sleeves.
Protective sleeves missing	2	.	Suggest replacement of sleeves.
Restricted, affecting performance	A	..	Require repair or replacement.
Restricted, not affecting performance	2	..	Suggest repair or replacement.
Routed incorrectly	2	.....	Suggest repair.
Safety clip missing	C	.....	Require replacement.
Spongy	1	..	Suggest repair or replacement.
Stripped	A	.....	Require replacement.
Surface cracks (dry-rotted)	1	..	Suggest repair or replacement.
Swollen	B	.....	Require replacement.
Threads damaged	A	..	Require repair or replacement.
Threads stripped (threads missing)	A	.....	Require replacement.
Type incorrect	1	..	Suggest repair or replacement.

HIGH PRESSURE RELIEF VALVES (HPRV)

HIGH PRESSURE RELIEF VALVE (HPRV) INSPECTION

Condition	Code	Procedure
Inoperative	A	..... (1) Require repair or replacement.
Leaking	A	.. Require repair or replacement.
Missing	C	..... Require replacement.
Threads damaged	A	.. Require repair or replacement.
Threads stripped (threads missing)	A	..... Require replacement.

(1) - Inoperative includes intermittent operation or out of OEM specification.

IDLERS

See TENSIONERS.

IN-LINE FILTERS

IN-LINE FILTER INSPECTION

Condition	Code	Procedure
Connection leaking	B	.. Require repair or replacement.
Leaking	A	.. Require repair or replacement.
Restricted	A	..... Require replacement.
Threads damaged	A	.. Require repair or replacement.
Threads stripped (threads missing)	A	..... Require replacement.

METAL FITTINGS

See AIR CONDITIONING METAL LINES, HOSES AND FITTING ASSEMBLIES.

METAL LINES

See AIR CONDITIONING METAL LINES, HOSES AND FITTING ASSEMBLIES.

MIX AND AIR CONTROL DOORS (BLEND DOORS)

See PLENUMS.

O-RINGS

O-RING INSPECTION

Condition	Code	Procedure
Leaking	A	(1) Require repair or replacement.

(1) - Require inspection of mating and sealing surface and repair or replace as necessary.

ORIFICE TUBES

ORIFICE TUBE INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Bypassing internally	A	Require repair or replacement.
Filter screen torn	A	Require replacement.
Installation incorrect	B	Require repair.
Restricted	A	Require repair or replacement.

PILOT-OPERATED ABSOLUTES (POAS)

PILOT-OPERATED ABSOLUTE (POA) INSPECTION

Condition	Code	Procedure
Connection damaged	B	Require repair or replacement.
Fitting damaged	B	Require repair or replacement.
Inoperative	A	(1) Require repair or replacement.
Leaking	A	Require repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

(1) - Inoperative includes intermittent operation or out of OEM specification.

PLENUMS

PLENUM INSPECTION

Condition	Code	Procedure
Air control door binding	A	Require repair or replacement
Air control door broken	A	Require repair or replacement.
Air control door leaking	A	Require repair or replacement.
Air control door seized	A	Require repair or replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Cracked	2	Suggest repair or replacement.
Drain hole restricted	A	Require repair.
Drain plugged	A	Require repair.
Duct disconnected	A	Require repair or replacement.
Duct leaking	A	Require repair or replacement.
Duct missing	C	Require replacement.
Duct restricted	A	Require repair or replacement.
Leaking	A	Require repair or replacement.
Noisy	2	Suggest cleaning or repair.
Odor	2	Suggest cleaning or repair.
Restricted	A	Require cleaning, repair, or replacement.

PRESSURE CONTROL VALVES

See:

* EVAPORATOR PRESSURE REGULATORS (EPRS)
* HIGH PRESSURE RELIEF VALVES (HPRV)
* PILOT-OPERATED ABSOLUTES (POAS)
* SUCTION THROTTLING VALVES (STVS)
* VALVES IN RECEIVER (VIRS)

PRESSURE SENSORS

See THERMISTORS AND PRESSURE SENSORS.

PULLEYS

PULLEY INSPECTION

Condition	Code	Procedure
Alignment incorrect	B	Require repair or replacement.
Application incorrect	B	Require replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not		

functioning	A	Require repair or replacement of hardware.
Bearing noisy	2	Suggest replacement.
Bearing seized	A	Require repair or replacement.
Bearing worn	1	Suggest replacement.
Cracked	A	Require replacement.
Loose	A	Require repair or replacement.
Missing	C	Require replacement.
Pulley damaged, affecting belt life	A	Require replacement.

RADIATORS

RADIATOR INSPECTION

Condition	Code	Procedure
Air flow obstruction	A	Require repair.
Application incorrect	B	Require replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connection leaking	A	Require repair or replacement.
Corroded	1	Suggest repair or replacement.
Drain inoperative	A	Require repair or replacement.
Fins damaged, affecting performance	A	Require repair or replacement.
Fins damaged, not affecting performance		No service suggested or required.
Internal oil cooler leaking	A	Require repair or replacement.
Internal restrictions	B	Require repair or replacement.
Leaking	A	Require repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require repair or replacement.
Tubes damaged, affecting performance	A	Require repair or replacement.
Tubes damaged, not affecting performance		No service suggested or required.

RECEIVER-DRIERS

NOTE: For VIRs, see VALVES IN RECEIVER (VIRS).

RECEIVER-DRIER INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware		

missing	C	.....	Require replacement of hardware.
Attaching hardware not functioning	A	...	Require repair or replacement of hardware.
Contaminated, affecting performance	A	.....	Require replacement.
Dessicant bag deteriorated	A	.....	(1) Require replacement. Further inspection required.
Dessicant at the end of its useful life (saturated with moisture)	1	..	Suggest repair or replacement.
Fusible plug leaking	A	....	Require replacement of plug.
Leaking	A	.....	Require replacement.
Pressure relief device leaking	A	.	Require replacement of pressure relief device.
Restricted	A	..	Require repair or replacement.
Sight glass no longer transparent	2	...	Suggest replacement of drier.
Threads damaged	A	..	Require repair or replacement.
Threads stripped (threads missing)	A	.....	Require replacement.
Tubing connection leaking	A	..	Require repair or replacement.

(1) - Inspect system to determine effects of dessicant bag deterioration.

REFRIGERANT

NOTE: Refrigerants include any SNAP (Significant New Alternative Policy)-approved blends.

REFRIGERANT INSPECTION

Condition	Code	Procedure
Contaminated (other than refrigerant blends)	B	Require service to remove contamination.
Different types of refrigerants in the same system (other than refrigerant blends)	B	Require repair.
Overcharged	B	Require repair.
Refrigerant type does not match fittings and label	B	Require repair.
Undercharged	B	Require repair.

REFRIGERANT OIL

REFRIGERANT OIL INSPECTION

Condition	Code	Procedure
Contaminated	1	Require repair or replacement.
Overfilled	B	Require repair.

Condition	Code	Procedure
Underfilled	B	Require repair.

RELAYS

RELAY INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Housing broken	A	Require replacement.
Housing cracked	2	Suggest replacement.
Inoperative	A	(1) Require replacement.
Melted, affecting performance	A	(2) Require repair or replacement.
Melted, not affecting performance	2	(2) Suggest repair or replacement.
Missing	C	Require replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(2) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.

(1) - Inoperative includes intermittent operation or out of OEM specification.
(2) - Determine cause and correct prior to repair or replacement of part.

SEALS

SEAL INSPECTION

Condition	Code	Procedure
Leaking	A	(1) Require repair or replacement.

(1) - Require inspection of mating and sealing surface and repair or replace as necessary.

SERVICE PORTS

SERVICE PORT INSPECTION

Condition	Code	Procedure
Application does not match refrigerant type	B	Require replacement.
Leaking	A	Require repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Valve cap leaking	A	Require repair or replacement of cap.
Valve cap missing	C	Require replacement of valve cap.
Valve core sticking	B	Require repair or replacement.

SPRING LOCK COUPLINGS

SPRING LOCK COUPLING INSPECTION

Condition	Code	Procedure
Leaking	A	(1) Require repair or replacement.

(1) - Require inspection of mating and sealing surface and repair or replace as necessary.

SUCTION THROTTLING VALVES (STVS)

SUCTION THROTTLING VALVE (STV) INSPECTION

Condition	Code	Procedure
Connection damaged	B	Require repair or replacement.
Fitting damaged	B	Require repair or replacement.
Inoperative	A	(1) Require repair or replacement.
Leaking	A	Require repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

(1) - Inoperative includes intermittent operation or out of OEM specification.

SWITCHES (ELECTRICAL)

SWITCH (ELECTRICAL) INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.

Attaching hardware not functioning	A	Require repair or replacement of hardware.
Binding, affecting performance	A	Require repair or replacement.
Binding, not affecting performance	2	Suggest repair or replacement.
Broken	A	Require repair or replacement.
Burned, affecting performance	A	(1) Require repair or replacement.
Burned, not affecting performance	2	(1) Suggest repair or replacement.
Cracked, affecting performance	A	Require repair or replacement.
Cracked, not affecting performance	1	Suggest repair or replacement.
Malfunctioning	A	(2) Require repair or replacement.
Melted, affecting performance	A	(1) Require repair or replacement.
Melted, not affecting performance	2	(1) Suggest repair or replacement.
Missing	C	(3) Require replacement.
Out of adjustment	B	Require repair or replacement.
Pressure switch leaking	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Won’t return	A	Require repair or replacement.
Worn	1	Suggest replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Includes inoperative, intermittent operation, or failure to perform all functions.
(3) - Missing includes high pressure cut-off switches not installed during a retrofit from R12 to R134a.

TENSIONERS

TENSIONER INSPECTION

Condition	Code	Procedure

Condition	Code	Procedure
Alignment incorrect	B	Require repair or replacement.
Application incorrect	B	Require replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Bearing worn	1	Suggest replacement.
Belt tension incorrect	B	Require adjustment or repair.
Bracket cracked	A	Require repair or replacement.
Housing cracked	A	Require repair or replacement.
Missing	C	Require replacement.
Noisy	2	Suggest replacement.
Pulley damaged, affecting belt life	A	Require replacement.
Seized	A	Require repair or replacement.

THERMISTORS AND PRESSURE SENSORS

NOTE: Includes, but not limited to, In-Car Temperature, Ambient Air Temperature, Sun Load Sensor, etc.

THERMISTOR AND PRESSURE SENSOR INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Calibration incorrect	B	Require repair or replacement.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted, affecting performance	A	(1) Require repair or replacement.
Connector melted, not affecting performance	2	(1) Suggest repair or replacement.
Connector missing	C	Require replacement.
Inoperative	A	(2) Require repair or replacement.
Missing	C	Require replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.

Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Wire lead burned	A	Require repair or replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Inoperative includes intermittent operation or out of OEM specification.

THERMOSTATS AND HOUSINGS

THERMOSTAT AND HOUSING INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware corroded	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Cracked	A	Require replacement.
Housing corroded	1	Suggest replacement of housing.
Inoperative	A	(1) Require replacement.
Installation incorrect	B	Require repair or replacement.
Leaking	A	Require repair or replacement.
Thermostat missing	C	Require replacement of thermostat.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require repair or replacement.

(1) - Inoperative includes intermittent operation or out of OEM specification.

VACUUM HOSES AND TUBES

VACUUM HOSE AND TUBE INSPECTION

Condition	Code	Procedure
Disconnected	A	Require repair.
Leaking	A	Require repair or replacement.
Melted	A	Require repair replacement.
Missing	C	Require replacement.
Oil-soaked (spongy)	1	Suggest replacement.
Restricted	A	Require repair or replacement.

Routing incorrect	B	..... Require repair.
Surface cracks (dry-rotted)	1	..... Suggest replacement.

VACUUM RESERVOIRS

VACUUM RESERVOIR INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	... Require repair or replacement of hardware.
Attaching hardware missing	C	..... Require replacement of hardware.
Attaching hardware not functioning	A	... Require repair or replacement of hardware.
Check valve leaking internally	A	..... Require replacement.
Leaking	A	.. Require repair or replacement.
Missing	C	..... Require replacement.
Restricted	A	.. Require repair or replacement.

VACUUM TUBES

See VACUUM HOSES AND TUBES.

VALVES IN RECEIVER (VIRS)

VALVE IN RECEIVER (VIR) INSPECTION

Condition	Code	Procedure
Application incorrect ...	B	..... Require replacement.
Attaching hardware broken	A	... Require repair or replacement of hardware.
Attaching hardware missing	C	..... Require replacement of hardware.
Attaching hardware not functioning	A	... Require repair or replacement of hardware.
Bracket bent, affecting performance	A	.. Require repair or replacement.
Bracket bent, not affecting performance		..... No service suggested or required.
Bracket broken, affecting performance	A	..... Require replacement.
Bracket broken, not affecting performance		..... No service suggested or required.
Bracket corroded, affecting performance ..	A	.. Require repair or replacement.
Bracket corroded, not affecting performance ..	2	.. Suggest repair or replacement.
Bracket cracked, affecting performance	A	.. Require repair or replacement.

Bracket cracked, not affecting performance	1	..	Suggest repair or replacement.
Bracket holes elongated, affecting performance	A	..	Require repair or replacement.
Bracket holes elongated, not affecting performance			No service suggested or required.
Bracket loose, affecting performance	A	..	Require repair or replacement.
Bracket loose, not affecting performance	1	..	Suggest repair or replacement.
Bracket missing	C		Require replacement.
Connection damaged	B	..	Require repair or replacement.
Contaminated, affecting performance	A		Require replacement.
Corroded internally	1		Suggest replacement.
Dessicant bag deteriorated	A		(1) Require replacement. Further inspection required.
Dessicant at the end of its useful life (saturated with moisture)	1	..	Suggest repair or replacement.
Filter screen torn	A	..	Require replacement of screen.
Fitting damaged	B	..	Require repair or replacement.
Fusible plug leaking	A	....	Require replacement of plug.
Inoperative	A		(2) Require repair or replacement.
Leaking	A	..	Require repair or replacement.
Pressure relief device leaking	A	.	Require replacement of pressure relief device.
Restricted	A	..	Require repair or replacement.
Sight glass no longer transparent	2	...	Suggest replacement of drier.
Threads damaged	A	..	Require repair or replacement.
Threads stripped (threads missing)	A		Require replacement.
Tubing connection leaking	A	..	Require repair or replacement.

(1) - Inspect system to determine effects of dessicant bag deterioration.
(2) - Inoperative includes intermittent operation or out of OEM specification.

WATER PUMPS (ELECTRIC AUXILIARY)

WATER PUMP (ELECTRIC AUXILIARY) INSPECTION

Condition	Code		Procedure
Attaching hardware broken	A	...	Require repair or replacement of hardware.
Attaching hardware missing	C		Require replacement of hardware.
Attaching hardware not functioning	A	...	Require repair or replacement of hardware.

Condition	Code	Procedure
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted, affecting performance	A	(1) Require repair or replacement.
Connector melted, not affecting performance	2	(1) Suggest repair or replacement.
Connector missing	C	Require replacement.
Inoperative	A	(2) Require replacement.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Noisy	2	Suggest replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Vibration	1	Suggest replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Inoperative includes intermittent operation or out of OEM specification.

WIRING HARNESSES AND CONNECTORS

WIRING HARNESS AND CONNECTOR INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require repair or replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Circuit open	A	Require repair or replacement.
Circuit resistance (voltage drop) out of		

specification	A	Require repair or replacement.
Circuit shorted	A	Require repair or replacement.
Connector melted, affecting performance	A	(1) Require repair or replacement.
Connector melted, not affecting performance	2	(1) Suggest repair or replacement.
Connector missing	C	Require replacement.
Diode open	A	Require repair or replacement.
Diode shorted	A	Require repair or replacement.
Insulation damaged, conductors exposed	A	Require repair or replacement.
Insulation damaged, conductors not exposed	1	Suggest replacement.
Protective shield (conduit) melted	B	(1) Require replacement.
Protective shield (conduit) missing	C	Require replacement.
Routed incorrectly	B	Require repair.
Secured incorrectly	B	Require repair.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Voltage drop out of specification	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.

A/C SYSTEM GENERAL SERVICING

1998 Mitsubishi Galant

1998 AIR CONDITIONING & HEAT
Mitsubishi - A/C System General Servicing

Diamante, Eclipse, Galant, Mirage, Montero, Montero Sport & 3000GT

A/C COMPRESSOR APPLICATIONS

A/C COMPRESSOR APPLICATION TABLE

Application	Compressor
Diamante	Sanden MSC105CVS Scroll
Eclipse	
2.0L Non-Turbo	Nippondenso 10PA17C 10-Cyl.
2.0L Turbo & 2.4L	Sanden MSC105CVS Scroll
Galant	Sanden MSC90C12 Scroll
Mirage	Sanden MSC90 Scroll
Montero	Nippondenso 10PA15 10-Cyl.
Montero Sport	Sanden MSC105C Scroll
3000GT	Sanden MSC105 Scroll

USING R-12 & R-134a REFRIGERANT

HANDLING/SAFETY PRECAUTIONS

1) Always work in a well-ventilated, clean area. Avoid breathing refrigerant vapors. Exposure may irritate eyes, nose and throat. Refrigerant is colorless and is invisible as a gas. Refrigerant is heavier than oxygen and will displace oxygen in a confined area.

2) A/C system high pressure can cause severe injury to eyes and skin if a hose were to burst. Always wear eye protection, gloves and other protective clothing when working around A/C system and refrigerant.

3) Refrigerant evaporates quickly when exposed to atmosphere, freezing anything it contacts. If liquid refrigerant contacts eyes or skin (frostbite), DO NOT rub eyes or skin. Immediately flush affected area with cool water for 15 minutes and consult a doctor or hospital.

4) Never use R-134a in combination with compressed air for leak testing. Pressurized R-134a in the presence of oxygen (air concentrations greater than 60 percent by volume) may form a combustible mixture. DO NOT introduce compressed air into R-134a containers (full or empty), A/C system components or service equipment.

5) DO NOT expose A/C system components to high temperatures, steam cleaning for example, as excessive heat will cause refrigerant/system pressure to increase. Never expose refrigerant directly to open flame. If refrigerant needs to be warmed, place bottom of refrigerant tank in warm water. Water temperature MUST NOT exceed 125°F (52°C).

CAUTION: When R-134a is exposed to an open flame, drawn into engine, or detected with a Halide (propane) leak tester, a poisonous gas is formed. Keep work areas well ventilated.

6) Use care when handling refrigerant containers. DO NOT drop, strike, puncture or incinerate containers. Use Department Of

Transportation (DOT) approved, DOT 4BW or DOT 4BA refrigerant containers.

7) Never overfill refrigerant containers. The safe filling level of a refrigerant container MUST NOT exceed 60 percent of the container's gross weight rating. Store refrigerant containers at temperature less than 125°F (52°C).

8) R-134a refrigerant is sold and stored in 30- or 50-pound Light Blue containers, while Freon (R-12) is stored in White colored containers.

9) Refrigerant R-12 and R-134a must never be mixed, as they and their desiccants and lubricants are not compatible. If refrigerants are mixed, system cross-contamination or A/C system component failure may occur. Always use separate servicing and refrigerant recovery/recycling equipment.

10) Follow equipment manufacturer instructions of all service equipment to be used. The Material Safety Data Sheet (MSDS), provided by refrigerant manufacturer/suppliers, contains valuable information regarding the safe handling of refrigerants.

11) Before connecting refrigerant lines always lubricate "O" rings using appropriate refrigerant oil.

12) Always plug or cap A/C system refrigerant lines and component connections as soon as possible to protect components from moisture and/or dust. DO NOT remove plugs or caps until ready to install component.

13) Always use a back-up wrench when tightening or loosening fittings.

IDENTIFYING R-134a SYSTEMS & COMPONENTS

To prevent refrigerant cross-contamination, use following methods to identify R-134a based systems and components.

Fittings & "O" Rings

All R-134a based A/C systems use 1/2" - 16ACME threaded fittings (identifiable by square threads) and quick-connect service couplings. See Fig. 1. Besides the use of these fittings, most manufacturers will use Green colored "O" rings in R-134a systems.

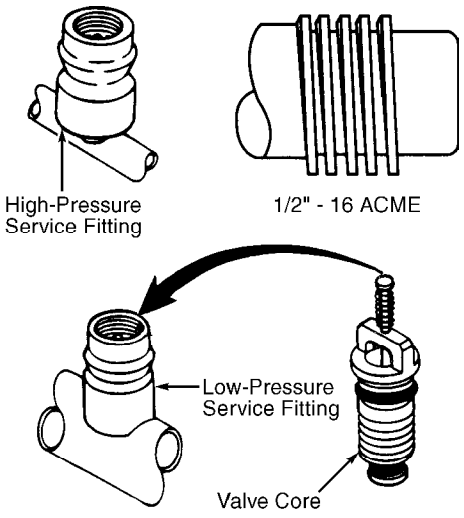

Fig. 1: Identifying R-134a Fittings & Quick-Connect Service Couplings
Courtesy of Audi of America, Inc.

Underhood A/C Specification Labels

Most R-134a based systems will be identified through the use

of underhood labels, or with R-134a refrigerant clearly printed on labels. See Figs. 2 and 3. Labels may be located on underside of hood, compressor, firewall and/or strut supports. Before servicing an A/C system, always determine which refrigerant is being used.

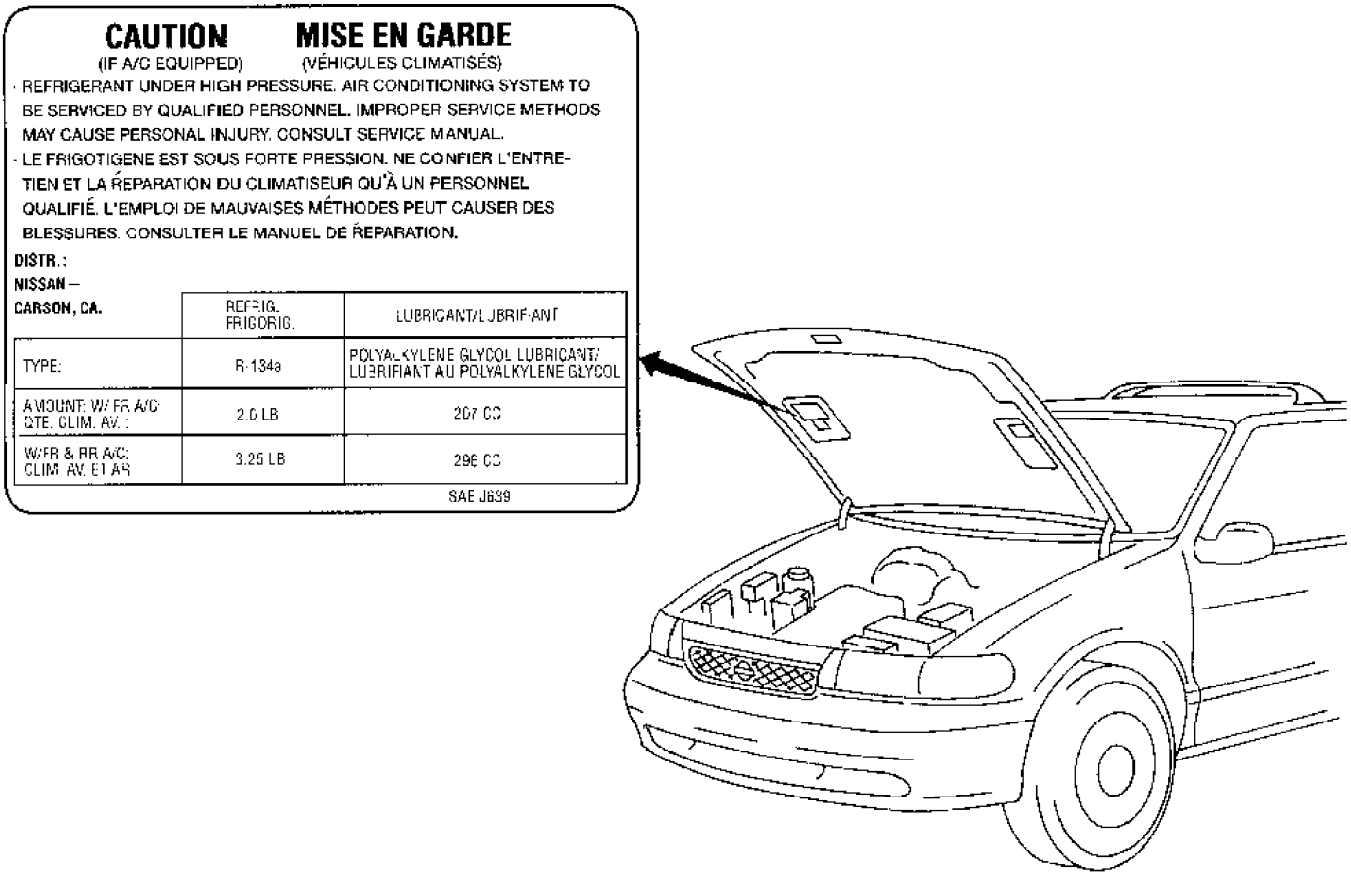

Fig. 2: Underhood A/C Specification Label (Typical)
Courtesy of Nissan Motor Co., U.S.A.

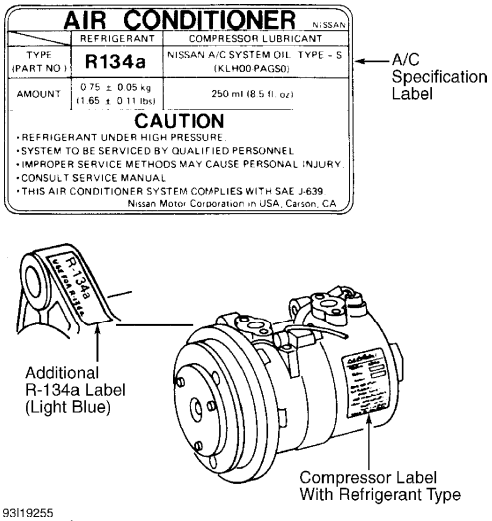

Fig. 3: A/C Specification Labels Located On Compressor (Typical)
Courtesy of Nissan Motor Co., U.S.A.

Other Means Of Identification

Refrigerant R-134a, when viewed through a sight glass, may have a "milky" appearance due to the mixture of refrigerant and lubricating oil. As the refrigerant and oil DO NOT exhibit a "clear" sight glass on a properly charged A/C system, most R-134a systems have no sight glass.

REFRIGERANT OILS

NOTE: Use ONLY the specified oil for the appropriate system or A/C compressor. Always check vehicle underhood A/C specification label or A/C compressor label before adding refrigerant oil to A/C compressor/system. See Figs. 2 and 3. Always use refrigerant oil specified on vehicle underhood A/C specification label if different from the following list.

Refrigerant R-12 based systems use mineral oil, while R-134a systems use Polyalkylene Glycol (PAG) oils. Using a mineral oil based lubricant with R-134a will result in A/C compressor failure due to lack of proper lubrication. The following R-134a refrigerant oils are currently specified:

Use DENSO/ND-Oil 8 refrigerant oil on Nippondenso compressors. Use SUN PAG 56 refrigerant oil on Sanden compressors.

NOTE: PAG oils absorb moisture very rapidly, 2.3-5.6 percent by weight, as compared to a mineral oil absorption rate of 0.005 percent by weight.

SERVICE EQUIPMENT

A/C systems using R-134a refrigerant and PAG lubricants cannot use R-12 refrigerant or mineral oil lubricants. R-134a refrigerant is NOT compatible or interchangeable with R-12 refrigerant. Separate sets of hoses, manifold gauge sets and recovery/recycling equipment are required to service the different systems. This is necessary to avoid cross-contaminating and damaging A/C system. A single set of A/C service equipment cannot be cleaned thoroughly enough to be used with both types of refrigerant.

All equipment used to service A/C systems using R-134a must be U.L. listed and certified to meet SAE standard J2210. The service hoses on the manifold gauge set must have manual (turn wheel) or automatic back-flow valves at the service port connector ends. This will prevent refrigerant from being released into the atmosphere.

For identification purposes, R-134a service hoses must have a Black stripe along its length and be clearly labeled SAE J2196/R-134a. The low pressure test hose is Blue with a Black stripe. The high pressure test hose is Red with a Black stripe, and the center test hose is Yellow with a Black stripe.

R-134a manifold gauge sets can be identified by one or all of the following: Labeled FOR USE WITH R-134a on set, labeled HFC-134a or R-134a on gauge face, or by a Light Blue color on gauge face. In addition, pressure/temperature scales on R-134a gauge sets are different from R-12 manifold gauge sets.

SYSTEM SERVICE VALVES

SCHRADER-TYPE VALVES

NOTE: Although similar in construction and operation to a tire valve, NEVER replace a Schrader-type valve with a tire valve.

Schrader valve is similar in construction and operation to a tire valve. When a test gauge hose with built-in valve core depressor is attached, Schrader stem is pushed inward to the open position and allows system pressure to reach gauge.

If test hose does not have a built-in core depressor, an adapter must be used. Never attach hose or adapter to Schrader valve unless it is first connected to manifold gauge set.

Refrigerant R-12 Schrader-type valve cores have TV5 thread size. Refrigerant R-134a Schrader-type valve cores use M6 (Metric) threads. See Fig. 1.

SERVICE VALVE LOCATIONS

SERVICE VALVE LOCATIONS TABLE

Vehicle	High	Low
Diamante	(1)	(2)
Eclipse	(1)	(2)
Galant	(1)	(2)
Mirage	(1)	(2)
Montero	(3)	(3)
Montero Sport	(1)	(2)
3000GT	(4)	(2)

(1) - On high pressure line, between accumulator/receiver-drier and evaporator.
(2) - On low pressure line, between evaporator and compressor.
(3) - On top of accumulator/receiver-drier.
(4) - On high pressure line, near receiver-drier.

REFRIGERANT RECOVERY/RECYCLING

Refrigerant recovery/recycling equipment is used to remove refrigerant from vehicle's A/C system without polluting atmosphere. To remove and recycle refrigerant, connect the recovery/recycling equipment and following the equipment manufacturer's instructions.

Removed refrigerant is filtered, dried and stored in a tank within the recovery/recycling equipment until it is ready to be pumped back into vehicle A/C system. With refrigerant stored in the recovery/recycling equipment, A/C system can be opened without polluting atmosphere.

NOTE: Separate sets of hoses, gauges and refrigerant recovery/recycling equipment MUST be used for R-12 and R-134a based systems. DO NOT mix R-12 and R-134a refrigerants, as their refrigerant oils and desiccants are not compatible. It is NOT possible to clean equipment thoroughly enough to prevent cross-contamination of A/C systems. On systems with R-134a refrigerant, use Polyalkylene Glycol (PAG) wax-free refrigerant oil.

A/C SYSTEM SPECIFICATIONS

1998 Mitsubishi Galant

1998 AIR CONDITIONING & HEAT
Mazda - A/C System Specifications

Galant

A/C SYSTEM SPECIFICATIONS

A/C SYSTEM SPECIFICATIONS TABLE

Application	Specification
Compressor Type	Sanden MSC90C12 Scroll
Compressor Belt Deflection	
New	7/32-15/64" (5.5-6.0 mm)
Used	1/4-19/64" (6.5-7.5 mm)
Compressor Oil Capacity	(1) 4.1 ozs.
Refrigerant (R-134a) Capacity	23-24.3 ozs.
System Operating Pressures (2)	
High Side	111-139 psi (7.8-9.8 kg/cm²)
Low Side	6-20 psi (.4-1.4 kg/cm²)

(1) - Use SUN PAG 56 refrigerant oil.
(2) - With ambient temperature at about 77°F (25°C).

D - ADJUSTMENTS

1998 Mitsubishi Galant

1998 ENGINE PERFORMANCE
Mitsubishi - On-Vehicle Adjustments

Diamante, Eclipse, Galant, Mirage, Montero, Montero Sport, 3000GT

ENGINE MECHANICAL

Before performing any on-vehicle adjustments to fuel or ignition system, ensure engine mechanical condition is okay (i.e., engine compression).

VALVE CLEARANCE

VALVE ADJUSTMENT

NOTE: All models use hydraulic valve lifters. Adjustment is not required.

CHECKING HYDRAULIC VALVE LIFTERS

1) Warm engine to normal operating temperature. Remove valve cover. Position cylinder No. 1 at TDC on compression stroke. On 4-cylinder engines, check intake rockers on cylinders No. 1 and 2. Check exhaust rockers on cylinders No. 1 and 3. On V6 engines, check intake rockers on cylinders No. 1, 5 and 6. Check exhaust rockers on cylinders No. 1, 2 and 3.

2) Push downward on end of rocker arm, above lash adjuster. Rotate crankshaft 360 degrees. On 4-cylinder engines, check intake rockers on cylinders No. 3 and 4. Check exhaust rockers on cylinders No. 2 and 4. On V6 engines, check intake rockers on cylinders No. 2, 3 and 4. Check exhaust rockers on cylinders No. 4, 5 and 6. If lash adjuster is normal, it will feel solid.

3) If lash adjuster moves downward easily when pushed, replace adjuster. If lash adjuster feels soft or spongy, air has probably entered lash adjuster. If this occurs, check engine oil level. If engine oil level is okay, check oil screen and oil screen gasket for damage.

4) After repairing cause of air ingestion, warm engine to operating temperature. Drive vehicle at low speed for approximately 5 minutes. Turn engine off for a few minutes.

5) Restart engine and drive at low speed for approximately 5 minutes. Repeat this step several times for about one hour. This helps remove air from engine oil.

IGNITION TIMING

NOTE: Perform all checks with engine at normal operating temperature, cooling fan and accessories off, transmission in Park or Neutral, and front wheels in straight-ahead position. Ignition timing check procedure for Eclipse 2.0L non-turbo not available from manufacturer at time of publication.

Diamante

1) Ignition timing is controlled by Powertrain Control Module (PCM) and is not adjustable. Manufacturer provides procedure for checking timing. DO NOT attempt to adjust ignition timing by rotating

distributor.

2) Start engine and warm engine until engine temperature coolant is 176-203°F (80-95°C). Turn engine off. Insert a paper clip in engine speed detection connector terminal No. 3. See Fig. 1. Connect a primary voltage detection-type tachometer to paper clip.

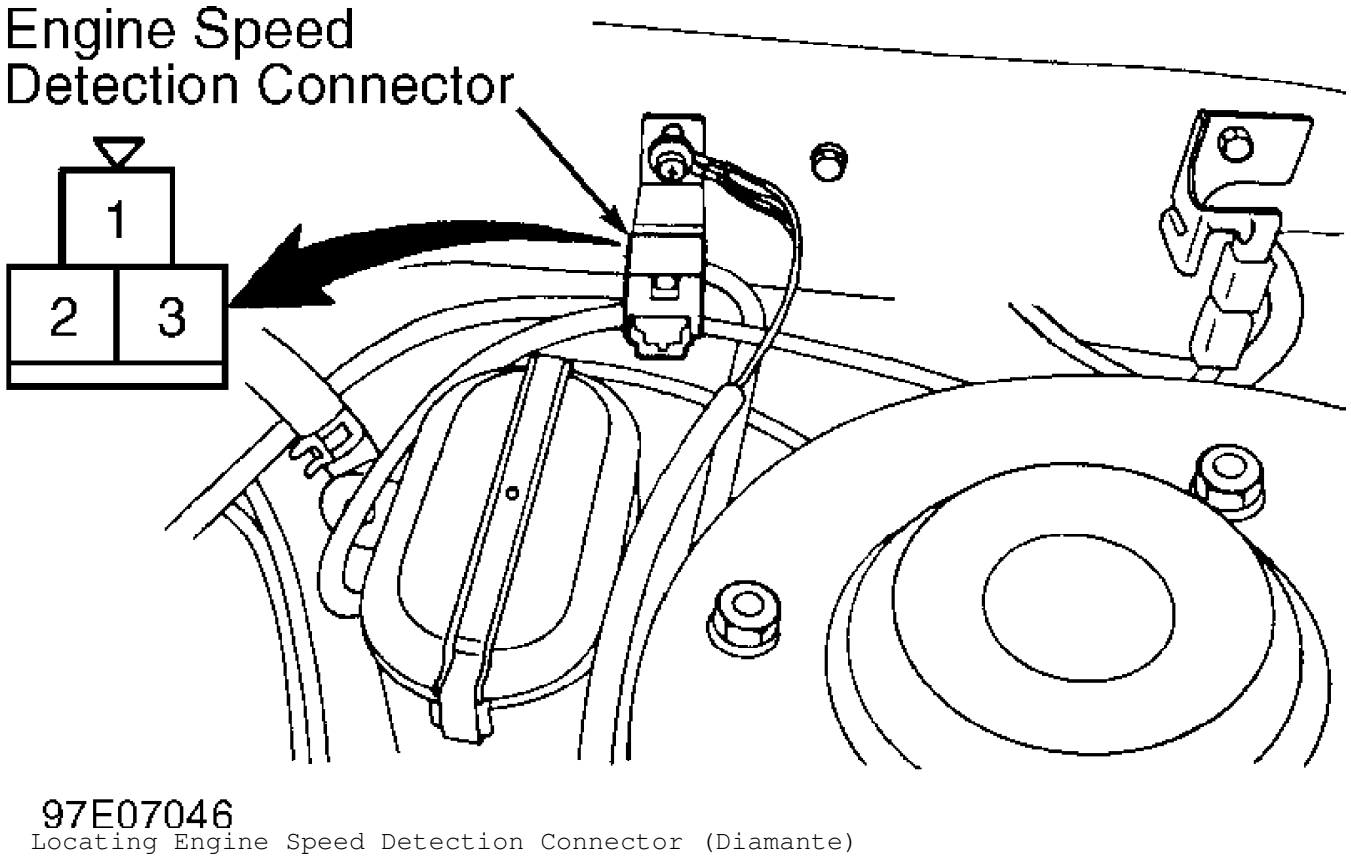

Fig. 1: Locating Engine Speed Detection Connector (Diamante)
Courtesy of Mitsubishi Motor Sales of America

3) Install a timing light. Start engine and allow it to idle. Ensure engine curb idle speed is about 700 RPM. Curb idle speed is automatically controlled by Idle Air Control (IAC) system. If curb idle speed is not as specified, see DTC P0505 in G - TESTS W/CODES article.

CAUTION: MFI system actuator test must be cancelled or test will continue to run for 27 minutes. Driving vehicle under this condition may damage engine.

4) Turn engine off. Connect scan tool to Data Link Connector (DLC). DLC is located below left side of dash, near steering column. See Fig. 2. Start engine and allow it to idle. Using scan tool, select MFI SYSTEM ACTUATOR TEST, then select item 17 (BASIC IGNITION TIMING). Press "Y" and read basic ignition timing value. See IGNITION TIMING SPECIFICATIONS table. If basic ignition timing is within specification, go to next step. If basic ignition timing is not within specification, cancel MFI system actuator test. See DTC P0335 in G - TESTS W/CODES article.

5) Read actual ignition timing value. If actual ignition timing is not within specification, cancel MFI system actuator test. See DTC P0335 in G - TESTS W/CODES article.

IGNITION TIMING

IGNITION TIMING SPECIFICATIONS (Degrees BTDC @ RPM) TABLE

Application	(1) Basic	(2) (3) (4) Actual
1.5L	2-8 @ 650-750	10 @ 600-800
1.8L	2-8 @ 600-800	5 @ 600-800
2.0L		
Non-Turbo	(5)	(5)
Turbo	2-8 @ 650-850	8 @ 650-850
2.4L	2-8 @ 650-850	10 @ 650-850
3.0L	2-8 @ 600-800	15 @ 600-800
3.5L	2-8 @ 600-800	15 @ 600-800

(1) - With ignition timing adjustment connector grounded or vacuum hose (farthest from distributor) disconnected.
(2) - With ignition timing adjustment connector ungrounded or vacuum hose (farthest from distributor) connected.
(3) - If vehicle altitude is more than 2300 feet above sea level, actualtiming may be advanced (5 degrees).
(4) - Actual ignition timing is approximate and may fluctuate plus or minus 7 degrees.
(5) - Ignition timing is NOT adjustable.

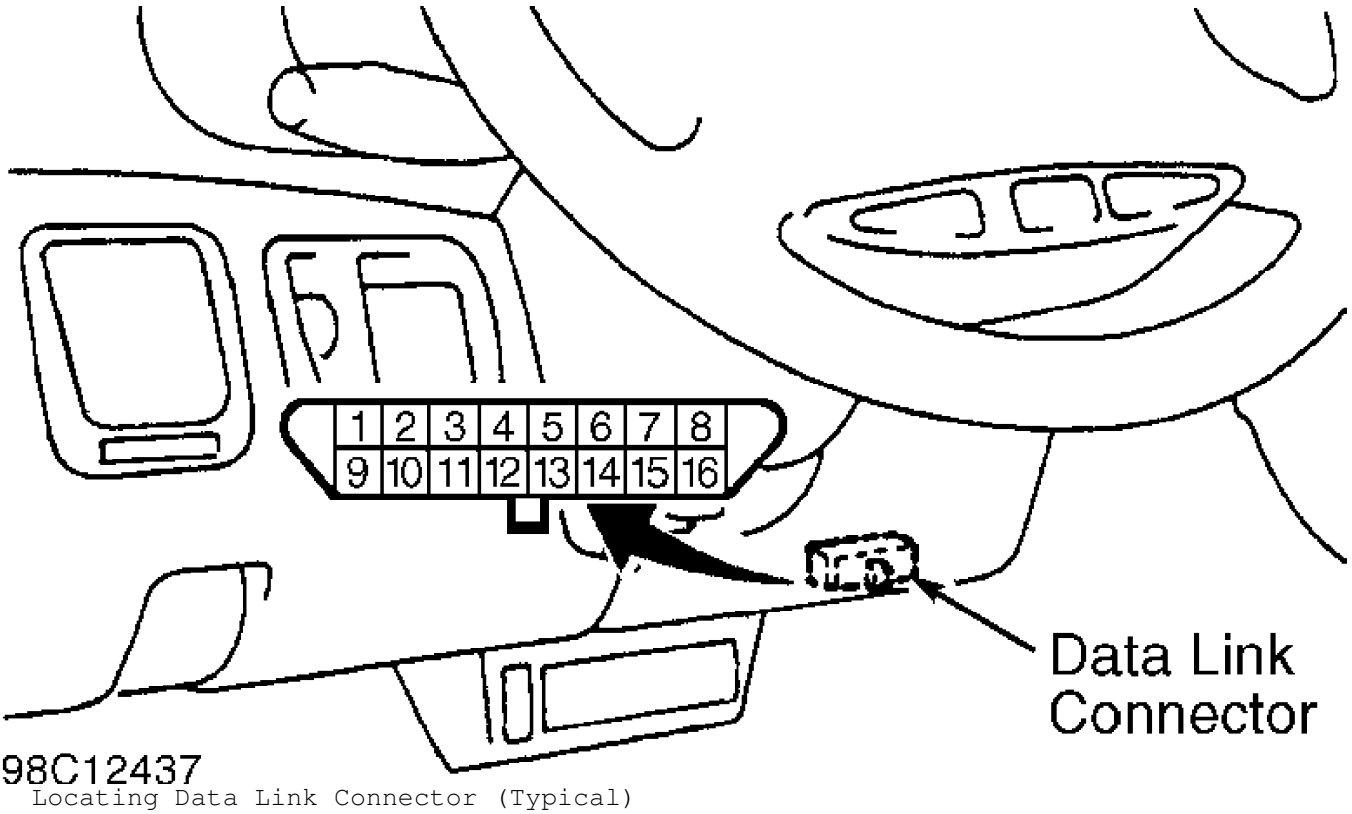

Fig. 2: Locating Data Link Connector (Typical)
Courtesy of Mitsubishi Motor Sales of America

3000GT (DOHC)

1) Ignition timing is controlled by Powertrain Control Module (PCM) and is not adjustable. Manufacturer provides procedure for checking timing.

2) Start engine and warm engine until engine temperature

coolant is 176-203°F (80-95°C). Turn engine off. Insert a paper clip in engine speed detection connector. See Fig. 3. Connect a tachometer to paper clip.

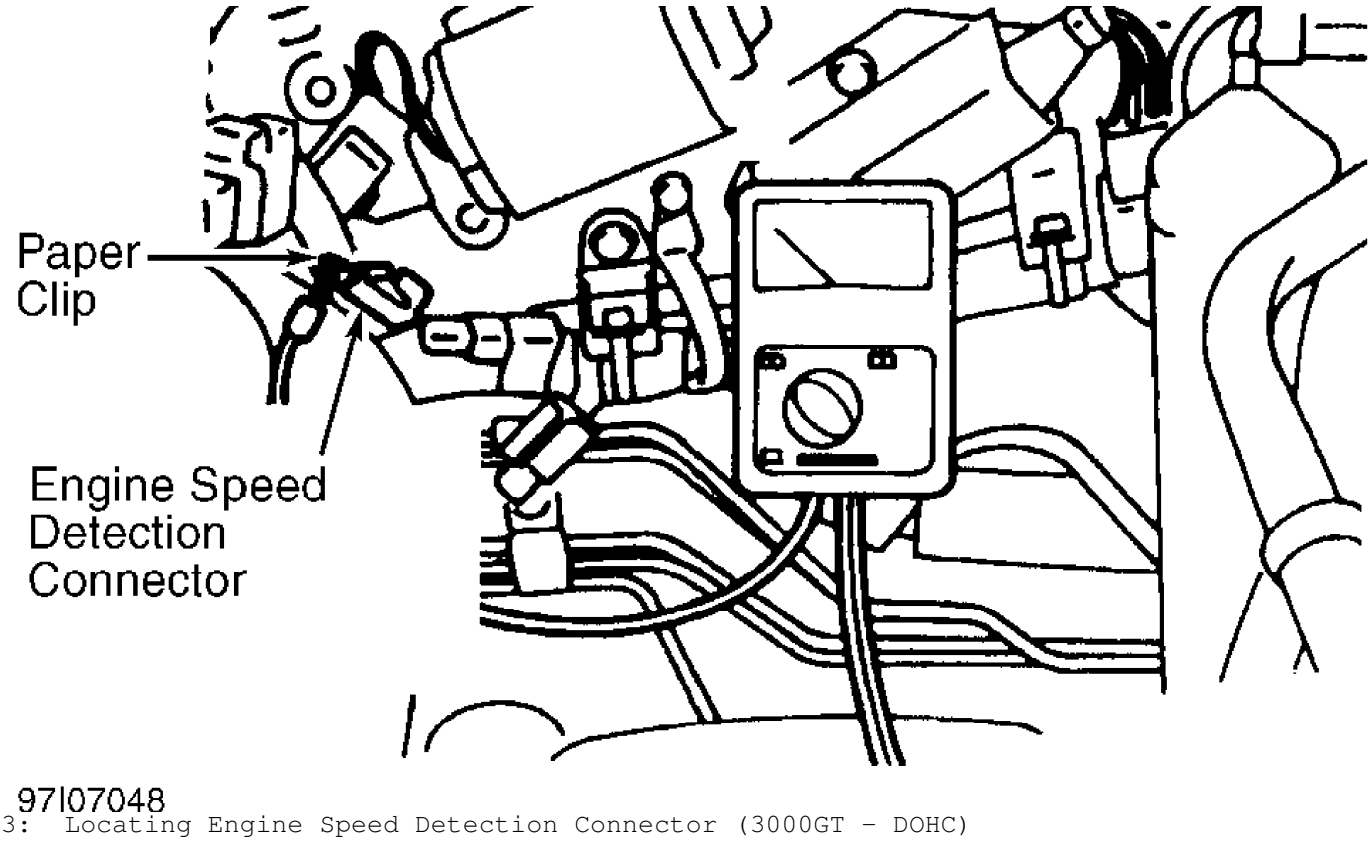

Fig. 3: Locating Engine Speed Detection Connector (3000GT - DOHC)
Courtesy of Mitsubishi Motor Sales of America

3) Install a timing light. Start engine and allow it to idle. Using tachometer, read curb idle (RPM). Multiply RPM reading by 3 to obtain actual curb idle speed. Ensure curb idle speed is 600-700 RPM. Turn engine off. Curb idle speed is automatically controlled by Idle Air Control (IAC) system. If curb idle speed is not as specified, see DTC P0505 in G - TESTS W/CODES article.

4) Disconnect waterproof female connector from Brown ignition timing check connector. See Fig. 4. Using a jumper wire, ground ignition timing check terminal to read basic ignition timing. Using timing light, read basic ignition timing value. See IGNITION TIMING SPECIFICATIONS table. If basic ignition timing is within specification, go to next step. If basic ignition timing is not within specification, see DTC P0335 in G - TESTS W/CODES article.

5) Remove jumper wire to read actual ignition timing. Using timing light, read actual ignition timing value. If actual ignition timing is not within specification, see DTC P0335 in G - TESTS W/CODES article.

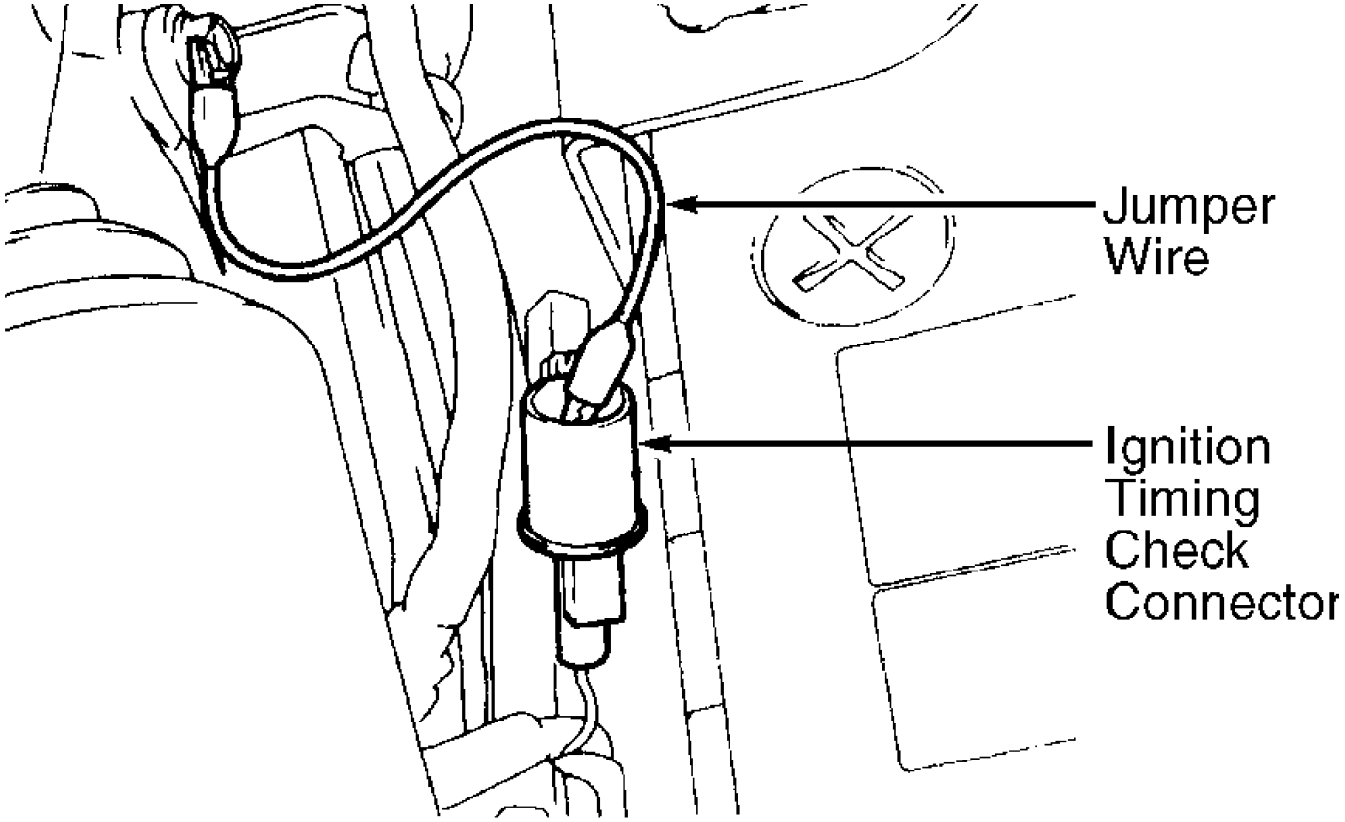

Fig. 4: Locating Ignition Timing Check Connector
Courtesy of Mitsubishi Motor Sales of America

3000GT (SOHC)

1) Ignition timing is controlled by Powertrain Control Module (PCM) and is not adjustable. Manufacturer provides procedure for checking timing.

2) Start engine and warm engine until engine temperature coolant is 176-203°F (80-95°C). Turn engine off. Insert a paper clip in noise filter connector. See Fig. 5. Connect a tachometer to paper clip.

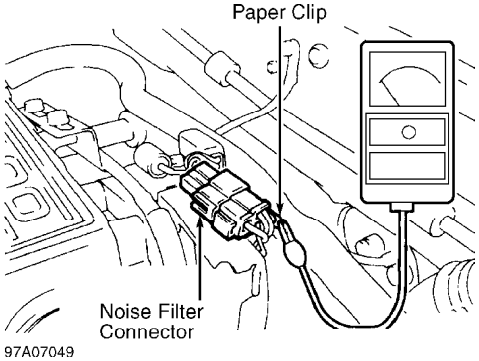

Fig. 5: Locating Noise Filter Connector
Courtesy of Mitsubishi Motor Sales of America

3) Install a timing light. Start engine and allow it to idle. Using tachometer, read curb idle speed (RPM). Ensure curb idle speed

is 600-700 RPM. Turn engine off. Curb idle speed is automatically controlled by Idle Air Control (IAC) system. If curb idle speed is not as specified, see DTC P0505 in G - TESTS W/CODES article.

4) Disconnect waterproof female connector from Brown ignition timing check connector. See Fig. 4. Using a jumper wire, ground ignition timing check terminal to read basic ignition timing. Using timing light, read basic ignition timing value. See IGNITION TIMING SPECIFICATIONS table. If basic ignition timing is within specification, go to next step. If basic ignition timing is not within specification, see DTC P0335 in G - TESTS W/CODES article.

5) Remove jumper wire to read actual ignition timing. Using timing light, read actual ignition timing value. If actual ignition timing is not within specification, see DTC P0335 in G - TESTS W/CODES article.

All Other Models

1) Ignition timing is controlled by Powertrain Control Module (PCM) and is not adjustable. Manufacturer provides procedure for checking timing. On models with distributor, DO NOT attempt to adjust ignition timing by rotating distributor.

2) Connect scan tool to Data Link Connector (DLC). DLC is located below dash, near steering column. See Fig. 2. Install a timing light. Start engine and allow it to idle.

3) Using scan tool, read curb idle speed (RPM). Ensure curb idle speed is about 750 RPM. Turn engine off. Curb idle speed is automatically controlled by Idle Air Control (IAC) system. If curb idle speed is not as specified, see DTC P0505 in G - TESTS W/CODES article.

CAUTION: MFI system actuator test must be cancelled or test will continue to run for 27 minutes. Driving vehicle under this condition may damage engine.

4) Using scan tool, select MFI SYSTEM ACTUATOR TEST, then select item 17 (BASIC IGNITION TIMING). Read basic ignition timing value. See IGNITION TIMING SPECIFICATIONS table. If basic ignition timing is within specification, go to next step. If basic ignition timing is not within specification, cancel MFI system actuator test. See DTCS P0100 (except Mirage 1.5L), P0105, P0115 and P0335 in G - TESTS W/CODES article.

5) Read actual ignition timing value. If actual ignition timing is not within specification, cancel MFI system actuator test. See DTCS P0100 (except Mirage 1.5L), P0105, P0115 and P0335 in G - TESTS W/CODES article.

IDLE SPEED & MIXTURE

* PLEASE READ THIS FIRST *

NOTE: Perform adjustments with engine at normal operating temperature, cooling fan and accessories off, transmission in Park or Neutral, and front wheels in straight-ahead position.

BASIC IDLE SPEED

NOTE: Basic idle speed adjustment information on Eclipse 2.0L non-turbo engine is not available from manufacturer at time of publication.

3000GT

1) Ensure vehicle is at normal operating temperature with all

lights, cooling fan and accessories off. Shift transmission into Neutral or Park position.

2) If not using scan tool, go to next step. Connect scan tool to Data Link Connector (DLC). DLC is located below dash, near steering column. See Fig. 2. Go to step 5).

3) On DOHC models, insert a paper clip in engine speed detection connector. See Fig. 3. On SOHC models, insert paper clip in noise filter connector. See Fig. 5. On all models, connect a tachometer to paper clip.

4) Connect a jumper wire between ground and Data Link Connector (DLC) terminal No. 1. See Fig. 2. Disconnect waterproof female connector from Brown ignition timing check connector. See Fig. 4. Using a jumper wire, ground ignition timing check terminal.

5) Start engine and allow it to idle. Check basic idle speed. See IDLE SPEED SPECIFICATIONS table. On DOHC models, multiply tachometer reading by 3 to obtain actual basic idle speed. If idle speed is not within specification, turn engine speed adjusting screw until correct engine speed is obtained. See Fig. 6. Access to speed adjusting screw is obtained by removing rubber plug on throttle body.

6) If idle speed cannot be lowered by turning engine speed adjusting screw, determine if Throttle Position (TP) sensor has been moved. Adjust TP sensor if necessary. See TP SENSOR ADJUSTMENT under THROTTLE POSITION (TP) SENSOR. If TP sensor is okay, replace throttle body.

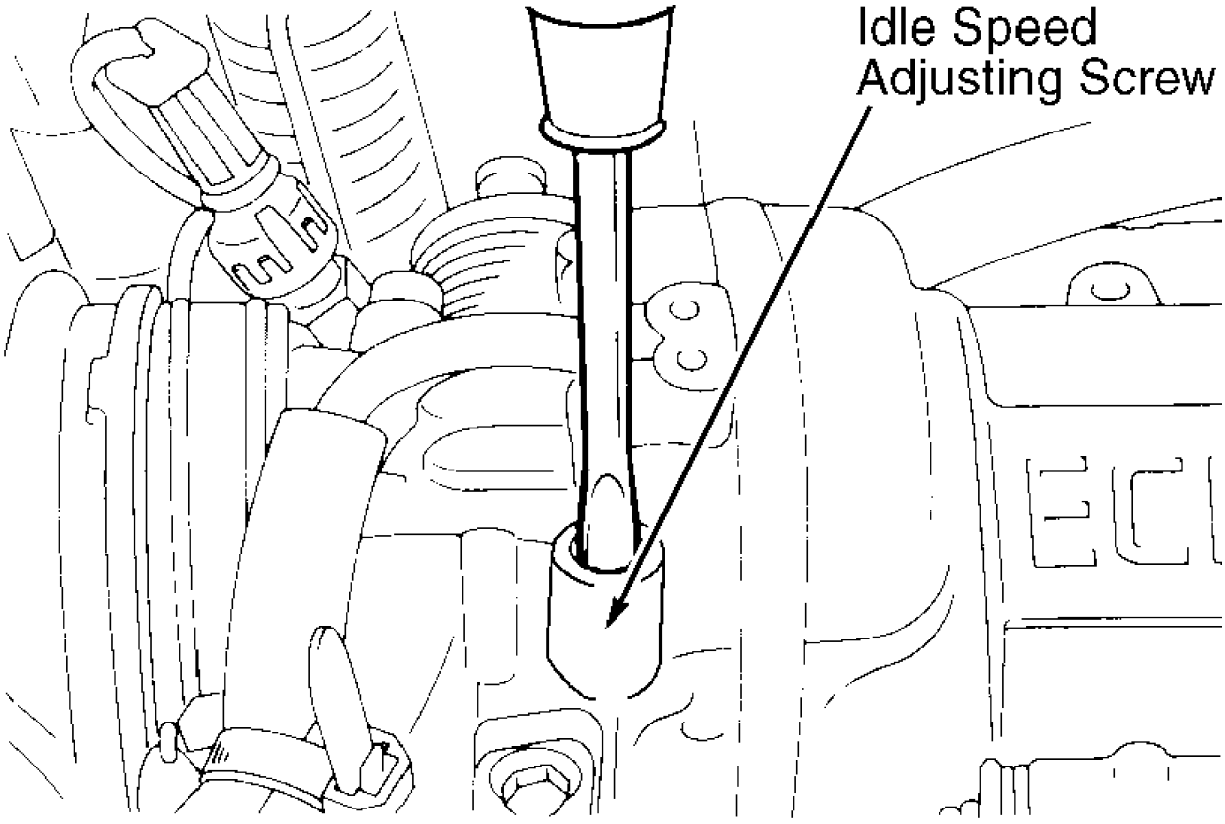

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Fig. 6: Adjusting Idle Speed (Typical)
Courtesy of Mitsubishi Motor Sales of America

IDLE SPEED SPECIFICATIONS TABLE

Application	Curb Idle	Basic Idle
1.5L & 1.8L	600-800	650-750
2.0L		
Non-Turbo	700-900	(1)
Turbo	650-850	700-800
2.4L	650-850	700-800
3.0L & 3.5L	600-800	650-750

(1) - Information is not available from manufacturer at time of publication.

NOTE: Basic idle speed should only be adjusted after verifying spark plugs, fuel injectors, idle air control motor and engine compression are okay.

All Other Models

1) Ensure vehicle is at normal operating temperature with all lights, cooling fan and accessories off. Shift transmission into Neutral or Park position.

2) Basic idle speed can only be adjusted using a scan tool to ground Data Link Connector (DLC). Connect scan tool to DLC. DLC is located below dash, near steering column. See Fig. 2.

3) Start engine and allow it to idle. Using scan tool, select MFI SYSTEM ACTUATOR TEST, then select item 30. Check basic idle speed. See IDLE SPEED SPECIFICATIONS table.

CAUTION: MFI system actuator test must be cancelled or test will continue to run for 27 minutes. Driving vehicle under this condition may damage engine.

4) Cancel MFI system actuator test. If idle speed is not within specification, turn engine speed adjusting screw until correct engine speed is obtained. See Fig. 6. Access to speed adjusting screw is obtained by removing rubber plug on throttle body.

5) If idle speed cannot be lowered by turning engine speed adjusting screw, determine if fixed Speed Adjusting Screw (SAS). Fixed SAS is stop screw contacting throttle lever. See FIXED SPEED ADJUSTING SCREW for procedure.

6) After all adjustments are verified to be correct, possible cause of incorrect idle speed is deterioration of Idle Air Control (IAC) circuit. See DTC P0505 in G - TESTS W/CODES article.

CURB (SLOW) IDLE SPEED

NOTE: Curb idle speed is controlled by Idle Air Control (IAC) motor. Adjustment is usually not necessary. For curb idle speed specifications, see IDLE SPEED SPECIFICATIONS table under BASIC IDLE SPEED.

1) Check ignition timing and adjust if necessary. See IGNITION TIMING. Run engine at 2000-3000 RPM for more than 5 seconds. Allow engine to idle for 2 minutes. Check curb idle speed.

2) If curb idle speed is not within specification, check IAC system. See DTC P0505 in G - TESTS W/CODES article. If IAC system is okay, adjust basic idle speed. See BASIC IDLE SPEED.

FIXED SPEED ADJUSTING SCREW

NOTE: Fixed Speed Adjusting Screw (SAS) is preset by manufacturer and usually does not require adjustment. Only adjust fixed SAS if other adjustment procedures require it, or if

manufacturer's original setting has been changed.

1) Loosen throttle cable. Loosen fixed SAS lock nut. See Fig. 7. Turn fixed SAS counterclockwise until throttle valve is fully closed. Turn fixed SAS clockwise until throttle valve begins to open. Turn fixed SAS clockwise 1 1/4 turns after throttle valve begins to open.

2) Tighten lock nut while holding fixed SAS in position. Adjust throttle cable. Adjust basic idle speed. See BASIC IDLE SPEED. Adjust Throttle Position (TP) sensor. See TP SENSOR ADJUSTMENT under THROTTLE POSITION (TP) SENSOR.

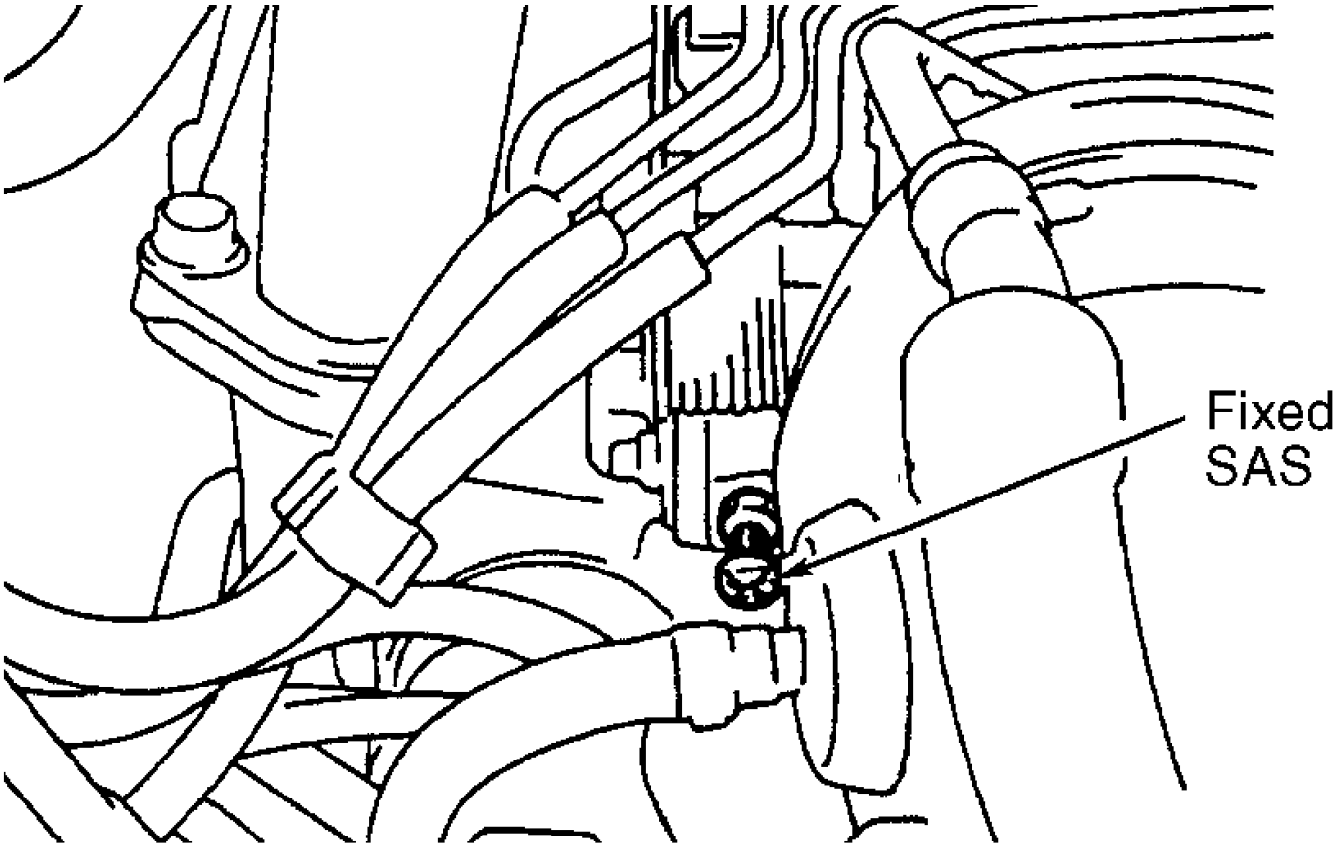

Fig. 7: Adjusting Fixed Speed Adjusting Screw (Typical)
Courtesy of Mitsubishi Motor Sales of America

IDLE MIXTURE

NOTE: Idle mixture is computer controlled on fuel injected engines and is nonadjustable. CO level should not exceed .5%. HC level should not exceed 100 ppm. If mixture levels exceed limits, see G - TESTS W/CODES article.

THROTTLE POSITION (TP) SENSOR

TP SENSOR ADJUSTMENT

NOTE: Ensure basic idle speed is set to specification before adjusting TP sensor. See BASIC IDLE SPEED under IDLE SPEED &

MIXTURE. Perform all adjustments with engine at normal operating temperature, front wheels in straight-ahead position, cooling fan and all accessories off, and transmission in Park or Neutral.

Eclipse 2.0L Non-Turbo

1) TP sensor is not adjustable. Disconnect TP sensor connector. Using external ohmmeter, measure resistance between TP sensor terminals No. 1 and 3. See Fig. 8. If resistance is not 3500-6500 ohms, replace TP sensor.

2) While slowly rotating throttle valve from idle to full open, measure resistance between TP sensor terminals No. 2 and 3. If resistance does not change smoothly in proportion to throttle opening, replace TP sensor.

Montero

1) Disconnect TP sensor connector. Using jumper wires, connect an external ohmmeter between TP sensor terminals No. 1 and 2. See Fig. 9. Insert .025" (.65 mm) feeler gauge between fixed speed adjusting screw and throttle lever.

2) Loosen TP sensor mounting screws and rotate TP sensor fully clockwise. Ensure there is continuity between terminals No. 1 and 2. Rotate TP sensor counterclockwise until there is no continuity, and tighten screws. Install Test Harness (MB991348) between TP sensor and harness connector.

3) Turn ignition on. Using external voltmeter, measure TP sensor output voltage between terminals No. 1 and 3. If voltage is not .4-1.0 volt, check harness and sensor. See DTC P0120 in G - TESTS W/CODES article.

All Other Models

1) Disconnect TP sensor connector. Using jumper wires, connect an external ohmmeter between TP sensor terminals No. 1 and 2 on Diamante or No. 3 and 4 on all other models. See Fig. 9. On Diamante and Mirage 1.8L with cruise control, insert .055" (1.40mm) feeler gauge between fixed speed adjusting screw and throttle lever. On Galant, insert .025" (.65 mm) feeler gauge between fixed speed adjusting screw and throttle lever. On all other models, insert .018" (.45 mm) feeler gauge between fixed speed adjusting screw and throttle lever.

2) Loosen TP sensor mounting screws and rotate TP sensor fully counterclockwise. Ensure there is continuity between terminals No. 1 and 2 on Diamante, or No. 3 and 4 on all other models. Rotate TP sensor clockwise until there is no continuity and tighten screws. Install Test Harness (MB991348) between TP sensor and harness connector.

3) Turn ignition on. Using external voltmeter, measure TP sensor output voltage between terminals No. 1 and 3 on Diamante, or No. 2 and 4 on all other models. If voltage is not .4-1.0 volt, check harness and sensor. See DTC P0120 in G - TESTS W/CODES article.

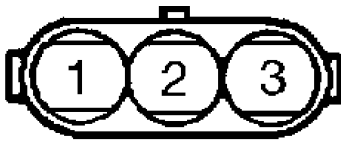

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Fig. 8: TP Sensor Connector Terminals (Eclipse 2.0L Non-Turbo)
Courtesy of Mitsubishi Motor Sales of America

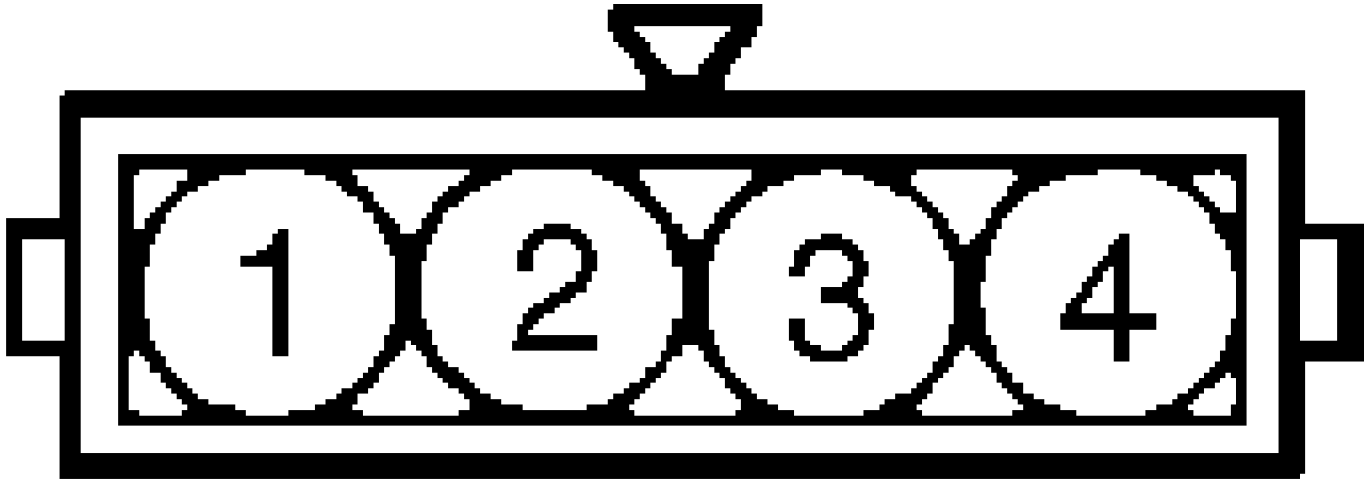

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Fig. 9: TP Sensor Connector Terminals (All Other Models)
Courtesy of Mitsubishi Motor Sales of America

AIR BAG RESTRAINT SYSTEM

1998 Mitsubishi Galant

1998 AIR BAG RESTRAINT SYSTEMS
Mitsubishi

Galant

DESCRIPTION & OPERATION

WARNING: To avoid injury from accidental air bag deployment, read and carefully follow all WARNINGS and SERVICE PRECAUTIONS.

Supplemental Restraint System (SRS) consists of an SRS warning light, driver-side and passenger-side air bag module, clockspring, and SRS Air Bag Control Unit (ECU). The SRS-ECU contains an analog and a safing impact sensor. See Fig. 1.

Air bags are designed to deploy in a frontal or near frontal impact of moderate to severe force. For air bags to deploy, ignition must be on and safing impact sensor and at least one front impact sensor must activate simultaneously.

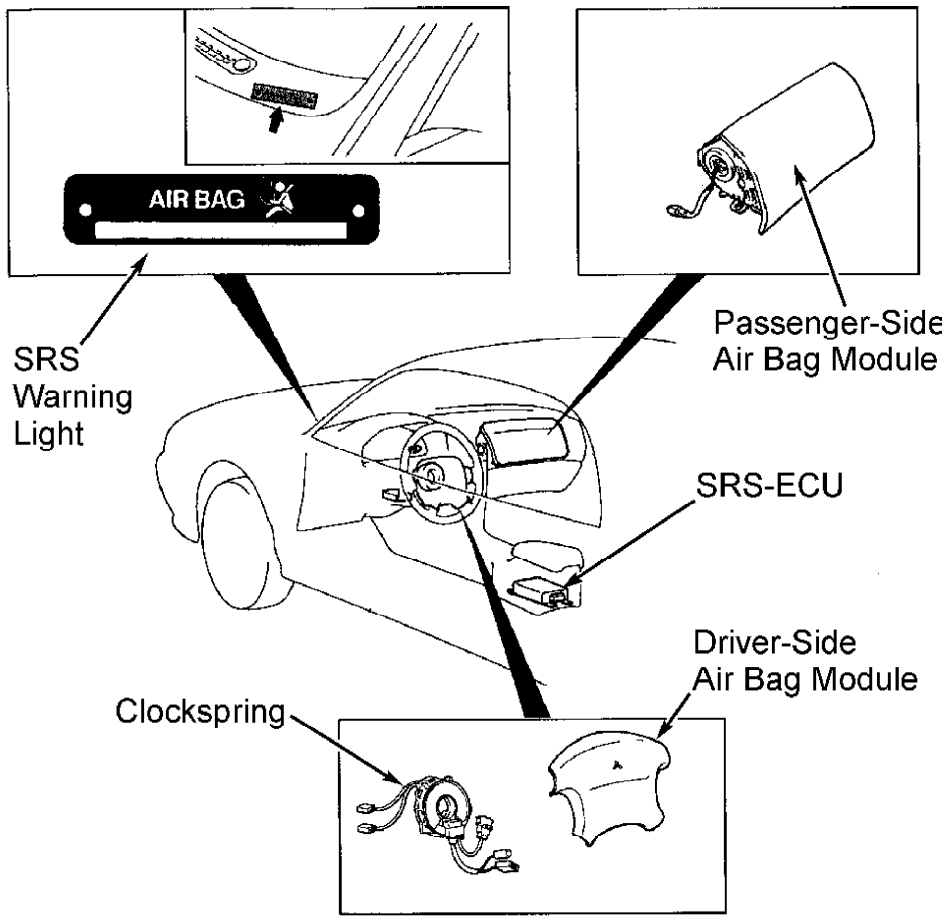

Fig. 1: Locating SRS Components
Courtesy of Mitsubishi Motor Sales of America.

SRS WARNING LIGHT

When ignition switch is turned to ON or START position, SRS warning light on instrument panel should come on for about 7 seconds and then go off. This indicates SRS-ECU has determined SRS is functioning properly. If SRS warning light flashes, stays on all the time, or does not come on, a fault exists in SRS. See DIAGNOSIS & TESTING.

AIR BAG MODULE(S)

An inflator assembly in the air bag module produces nitrogen gas to fill air bag. See Fig. 1. When a small amount of current from SRS-ECU is applied, ignitor starts a thermal reaction, which spreads to a pellet-filled canister that produces nitrogen gas. Gas pressure builds and discharges from inflator through a diffuser and screen assembly, forcing trim cover to burst along its seams until air bag is fully inflated. When air bag is fully inflated, gas escapes through vents on sides of air bag.

SRS AIR BAG CONTROL UNIT (ECU)

SRS-ECU (with integral safing and analog impact sensor) is located under center floor console assembly. See Fig. 1. If a system fault occurs, SRS-ECU memory stores a code.

DATA LINK CONNECTOR (DLC)

DLC is located under left side of dash. See Fig. 1. DLC is used to access SRS self-diagnostics through Mitsubishi Multi-Use Tester II (MUT-II) (MB991502).

CLOCKSPRING

Clockspring connects driver-side air bag module to steering column wiring, forming SRS circuit. See Fig. 1. Clockspring is a flat, ribbon-like cable that winds and unwinds when steering wheel is turned. Because of clockspring's constant movement, it is the most fragile part in the system.

SYSTEM OPERATION CHECK

WARNING: After servicing, always turn ignition on from passenger-side of vehicle in case of accidental air bag deployment.

Turn ignition switch to ON position. SRS warning light on instrument panel should come on for about 7 seconds and then turn off. This indicates SRS is functioning properly. If SRS warning light does not come on, stays on, or comes on while driving, SRS is malfunctioning and needs repair. See DIAGNOSIS & TESTING.

SERVICE PRECAUTIONS

Observe the following precautions when working with SRS:

* Disable SRS before servicing any SRS or steering column component. Failure to do this may result in accidental air bag deployment and possible personal injury. Refer to DISABLING & ACTIVATING AIR BAG SYSTEM.
* For about 60 seconds after air bag system is disabled, it retains enough voltage to deploy air bags. After disabling system, wait at least 60 seconds before servicing.
* After servicing, always turn ignition on from passenger-side

of vehicle in case of accidental air bag deployment.
* After servicing, check SRS warning light to verify system operation. See SYSTEM OPERATION CHECK.
* Always wear safety glasses when servicing or handling an air bag.
* The SRS-ECU must be stored in its original special container until used for service. It must be stored in a clean, dry place, away from sources of extreme heat, sparks and high electrical energy.
* DO NOT expose air bag module and clockspring to temperatures greater than 200°F (93°C).
* When placing a live air bag module on a bench or other surface, always face air bag module and trim cover up, away from surface. This will reduce motion of module if air bag accidentally deploys.
* After air bag deploys, air bag surface may contain deposits of sodium hydroxide, which irritates skin. Always wear safety glasses, rubber gloves and long-sleeved shirt during clean-up. Wash hands using mild soap and water. Follow correct clean-up and disposal procedures. Refer to DISPOSAL PROCEDURES.
* Because of critical system operating requirements, DO NOT service any SRS components. Repairs are only made by replacing defective part(s).
* DO NOT allow any electrical source near inflator on the back of air bag module.
* When carrying a live (undeployed) air bag module, trim cover must be pointed away from body to minimize injury in case of accidental air bag deployment.
* DO NOT probe wire harness connector terminals. Instead, use SRS Check Harness (MB991530).
* DO NOT probe a wire through insulator, as this will damage it and eventually cause failure due to corrosion.
* When performing electrical tests, prevent accidental shorting of terminals. Such shorts can damage fuses or components and may cause a second fault code to set, making diagnosis of original problem more difficult.
* Never use an analog volt/ohmmeter or test light in place of a Digital Volt/ohmmeter (DVOM). Use only a DVOM with a maximum test current of 2 mA (milliamps) at minimum range of resistance measurement. Also see SPECIAL TOOLS.
* If SRS is not fully functional for any reason, DO NOT drive vehicle until system is repaired and is fully functional. DO NOT remove bulbs, modules, sensors or other components, or in any way disable system from operating normally. If SRS is not functional, park vehicle until repairs are made.

SPECIAL TOOLS

To avoid air bag deployment when working on SRS, DO NOT use electrical test equipment such as test lights, battery or A/C-powered volt/ohmmeter, or any type of electrical equipment other than those specified by manufacturer. See SRS RECOMMENDED TOOLS table.

SRS RECOMMENDED TOOLS

Tool Name	Tool Number
For Component Replacement	
Steering Wheel Puller	MB990803
For Testing SRS	
Digital Volt/Ohmmeter (DVOM)	(1)
Multi-Use Tester II	MB991502

ROM Pack	(2)
SRS Check Harness	MB991613
For Deploying Air Bags	
SRS Air Bag Adapter Harness "A" (3)	MB686560
SRS Air Bag Adapter Harness "B" (4)	MB628919

(1) - Maximum current output of DVOM must not exceed 2 mA (milliamps) when set on minimum range of resistance measurement.
(2) - ROM pack is used with multi-use tester.
(3) - For on-vehicle deployment of driver-side air bag. For on-vehicle or off-vehicle deployment of passenger-side air bag.
(4) - For off-vehicle deployment of driver-side air bag.

DISABLING & ACTIVATING AIR BAG SYSTEM

WARNING: SRS system voltage is maintained for about 60 seconds after battery cable is disconnected. After disconnecting battery cable, wait at least 60 seconds before servicing SRS. Failure to wait may cause accidental air bag deployment and possible personal injury.

To disable system, turn ignition switch to LOCK position. Disconnect negative battery cable. Shield cable end. Wait at least 60 seconds before servicing. To activate system, reconnect negative battery cable.

DISPOSAL PROCEDURES

WARNING: Undeployed air bag must be deployed before disposal. Disposing of an undeployed air bag may violate federal, state and/or local laws. This also applies to vehicles that are to be scrapped. Never sell a used air bag module.

UNDEPLOYED AIR BAG

WARNING: Deploy air bag outdoors and away from people. Air bag deployment makes a loud noise. NEVER deploy air bag module with trim cover face down.

NOTE: If replacing a deployed air bag, both front impact sensors and SRS-ECU must also be replaced. If vehicle is to be scrapped, perform PROCEDURE 1 (ON-VEHICLE DEPLOYMENT) below. If vehicle will continue to be operated, perform PROCEDURE 2 (OFF-VEHICLE DEPLOYMENT) below.

Procedure 1 (On-Vehicle Deployment)

1) Before proceeding, follow air bag service precautions. See SERVICE PRECAUTIONS. Open all doors and windows. Move vehicle to an isolated area. Disconnect negative battery cable and wrap tape around cable terminal.

2) Disconnect positive battery cable. Remove battery. Wait at least 60 seconds before continuing. Remove steering column lower cover. Disconnect clockspring 2-pin Red connector.

3) Make a harness with two 20-foot (or longer) wires. Connect wires at one end of this harness to SRS Air Bag Adapter Harness "A" (MB686560). Wrap connections with insulating tape. See Fig. 2.

4) Temporarily connect other end of harness wires together to prevent unexpected air bag deployment. Connect SRS air bag adapter

harness "A" to clockspring 2-pin Red connector. Run 20-foot wires outside of vehicle as far away as possible from vehicle.

5) Ensure there are no loose parts in passenger compartment and no one is within 20 feet of vehicle.

6) Deploy air bag by connecting ends of 20-foot wires to terminals of a 12-volt battery. If air bags fail to deploy, go to PROCEDURE 2 below. After deployment, allow air bag modules to cool and dust to settle for at least 30 minutes before approaching vehicle.

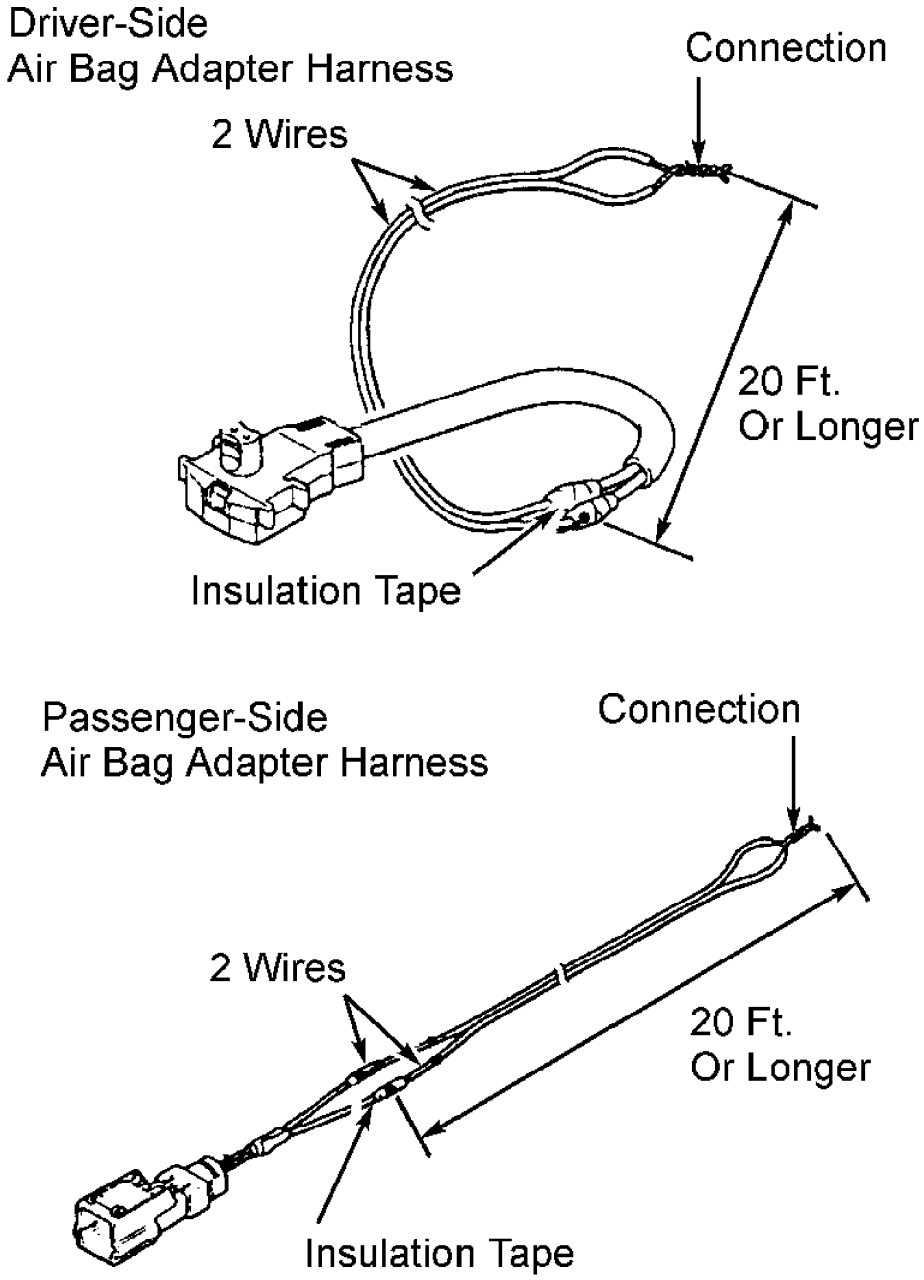

Fig. 2: Connecting Wires To Air Bag Adapter Harness
Courtesy of Mitsubishi Motor Sales of America.

Procedure 2 (Off-Vehicle Deployment)

1) Before proceeding, follow air bag service precautions. See

SERVICE PRECAUTIONS. Turn ignition switch to LOCK position. Disconnect negative battery cable. Shield cable end. Disconnect positive battery cable. Remove battery. Wait at least 60 seconds before continuing.

2) Remove air bag module. Place air bag module on ground at least 20 feet away from people or objects. Air bag module face (trim cover) must face upward to prevent movement of air bag module when it is deployed.

3) Make a harness with two 20-foot (or longer) wires. Connect wires at one end of this harness to stripped wires of SRS Air Bag Adapter Harness "B" (MB628919) for driver-side air bag, or SRS Air Bag Adapter Harness "A" (MB686560) for passenger-side air bag. See Fig. 2.

4) Wrap connections with insulating tape. Temporarily connect other end of harness wires together to prevent unexpected air bag deployment. Connect appropriate adapter harness to air bag module connector. Place a tire without a rim over the air bag module so rim hole surrounds air bag module. Stack 3 more tires on top of first tire. Connect ends of 20-foot wires to terminals of a 12-volt battery.

5) After air bag module deploys, let it cool off and allow dust to settle for at least 30 minutes before approaching. Tightly seal deployed air bag module in a strong vinyl bag and dispose of air bag as you would any other part.

DEPLOYED AIR BAG CLEAN-UP

WARNING: Vehicle interior will contain sodium hydroxide powder, a by-product of air bag deployment. Since this powder can irritate skin, eyes, nose and throat, wear safety glasses, rubber gloves and long-sleeved shirt during clean-up.

1) Avoid breathing powder from air bag deployment. Begin clean-up by putting tape over air bag exhaust vent to prevent additional powder from escaping into vehicle interior. Use a vacuum cleaner to remove any residual powder from A/C-heater outlets and vehicle interior.

2) Turn blower motor to low for a few minutes and exit vehicle. Turn blower motor off. Vacuum any other powder expelled from plenum. Vacuum interior a second time to recover all powder. Avoid kneeling or sitting on unclean areas. Wrap deployed air bag in heavy vinyl plastic and dispose of it as you would any other part.

POST-COLLISION INSPECTION

When a vehicle has been involved in a collision, certain components of the passive restraint system must be inspected or replaced. See PASSIVE RESTRAINT SYSTEM INSPECTION article in the GENERAL INFORMATION section for post-collision inspection information.

REMOVAL & INSTALLATION

WARNING: Follow air bag service precautions to prevent accidental air bag deployment and personal injury. See SERVICE PRECAUTIONS. Replace faulty SRS components; DO NOT repair or disassemble. Handle all SRS components carefully.

DRIVER-SIDE AIR BAG MODULE & CLOCKSPRING

NOTE: If replacing deployed air bag module, SRS-ECU must be replaced.

Removal

1) Before proceeding, see SERVICE PRECAUTIONS. Deactivate

SRS. See DISABLING & ACTIVATING AIR BAG SYSTEM.

2) Ensure front wheels are in straight-ahead position and steering wheel is locked. Remove lower covers from air bag module. Remove air bag module mounting nut using a socket wrench from back side. See Fig. 3. Remove air bag module mounting screws. Lift air bag module for access to clockspring connector at air bag module. To disconnect clockspring connector from air bag module, spread connector open and pry it outward with a screwdriver. Remove air bag module. See Fig. 4.

3) Place air bag module on flat surface with trim cover facing up. Remove steering wheel with Steering Wheel Puller (MB990803). Remove lower column cover. Disconnect clockspring lower connectors. Remove clockspring mounting screws. Remove clockspring.

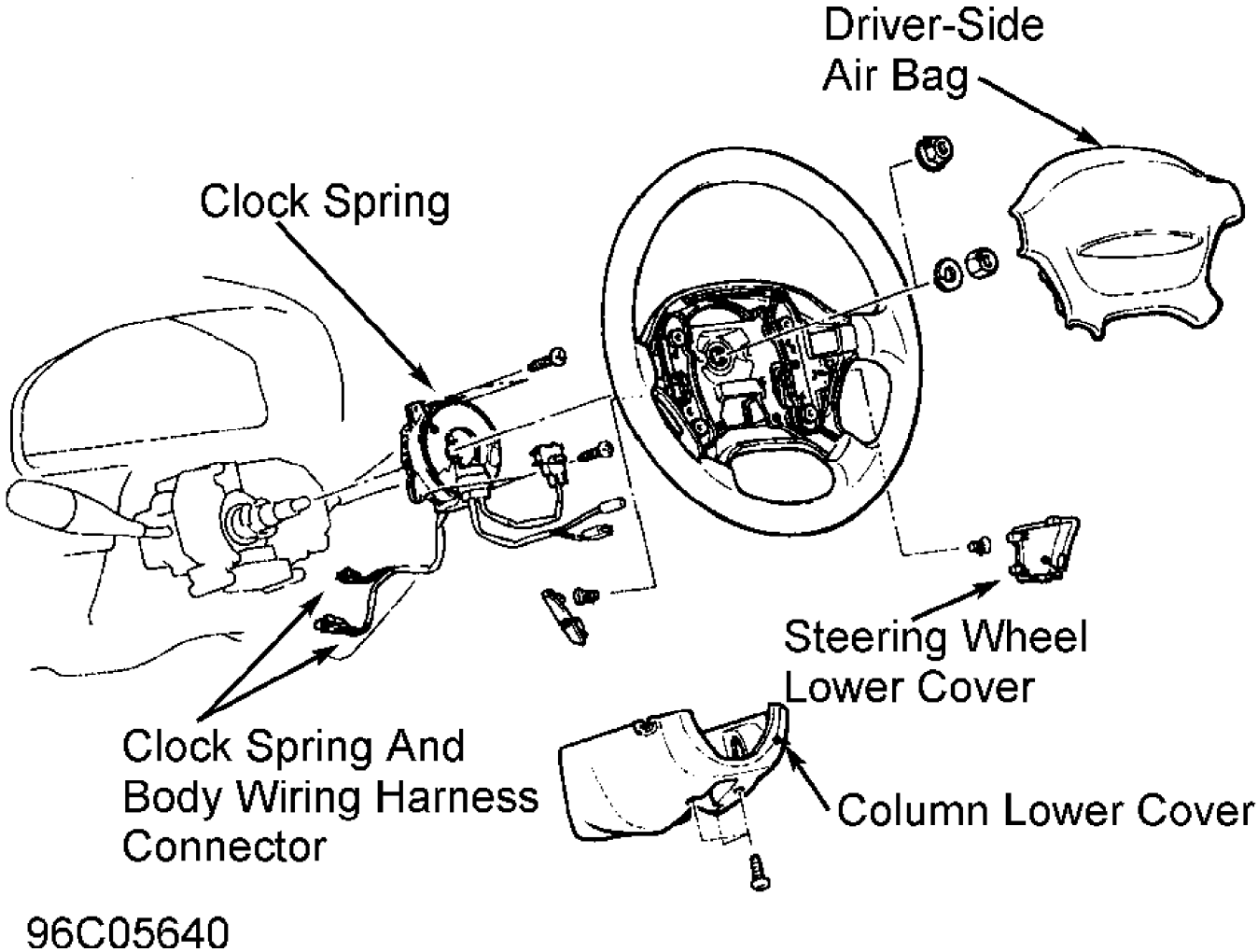

Fig. 3: Removing & Installing Driver-Side Air Bag & Clockspring
Courtesy of Mitsubishi Motor Sales of America.

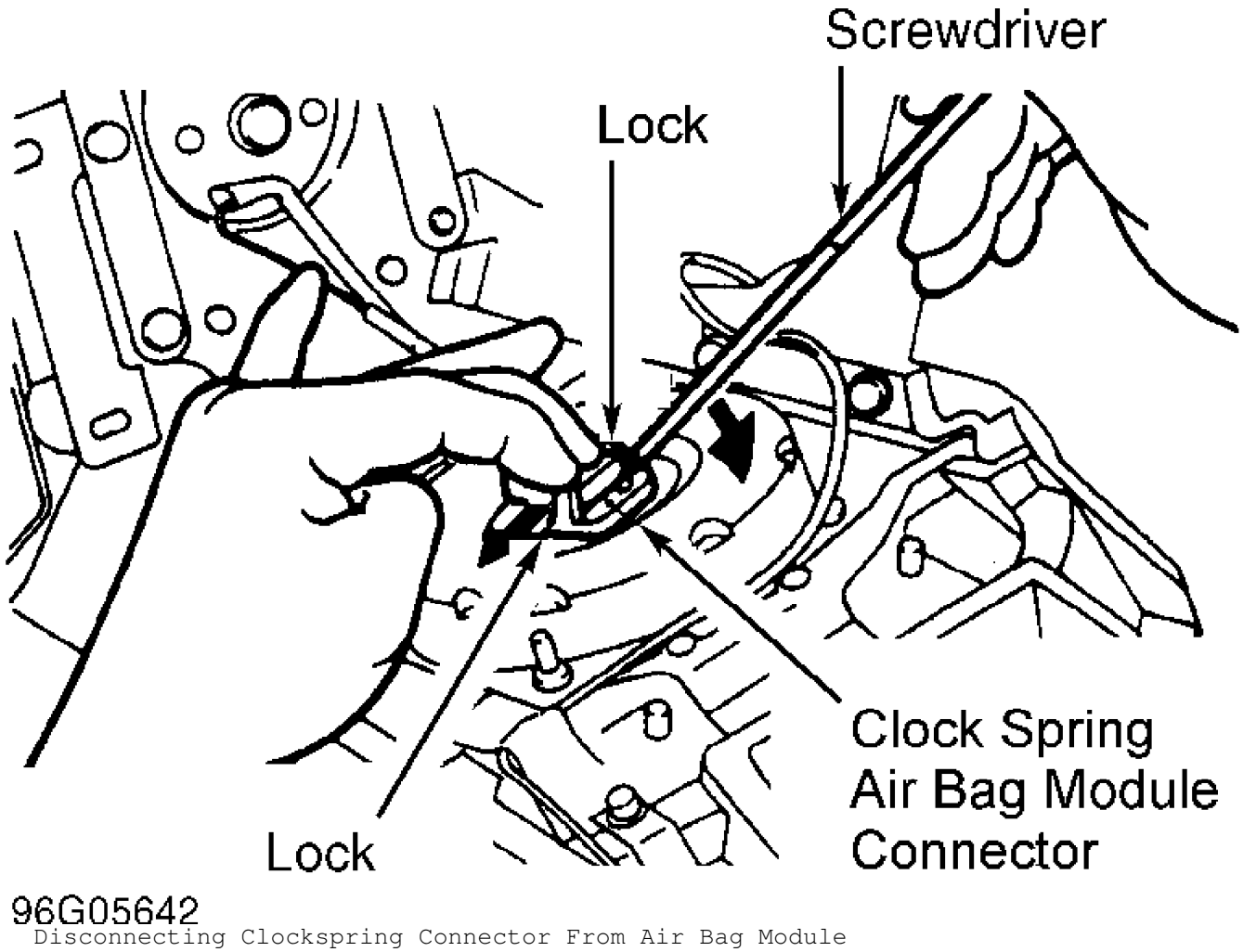

Fig. 4: Disconnecting Clockspring Connector From Air Bag Module
Courtesy of Mitsubishi Motor Sales of America.

WARNING: If front wheels are not in straight-ahead position or clockspring mating marks are not aligned before installing clockspring, the steering wheel may not turn completely, or flat cable inside clockspring may be severed, disabling SRS system and possibly causing serious injury to driver.

Installation

1) Ensure front wheels are in straight-ahead position. On clockspring, align mating marks. See Fig. 5. Install clockspring. To install remaining components, reverse removal procedure. Before installing air bag module, ensure horn switch wiring is positioned so that it will not be pinched.

2) Tighten fasteners to specification. See TORQUE SPECIFICATIONS. Activate SRS. See DISABLING & ACTIVATING AIR BAG SYSTEM. Check AIR BAG warning light for proper system function. See SYSTEM OPERATION CHECK.

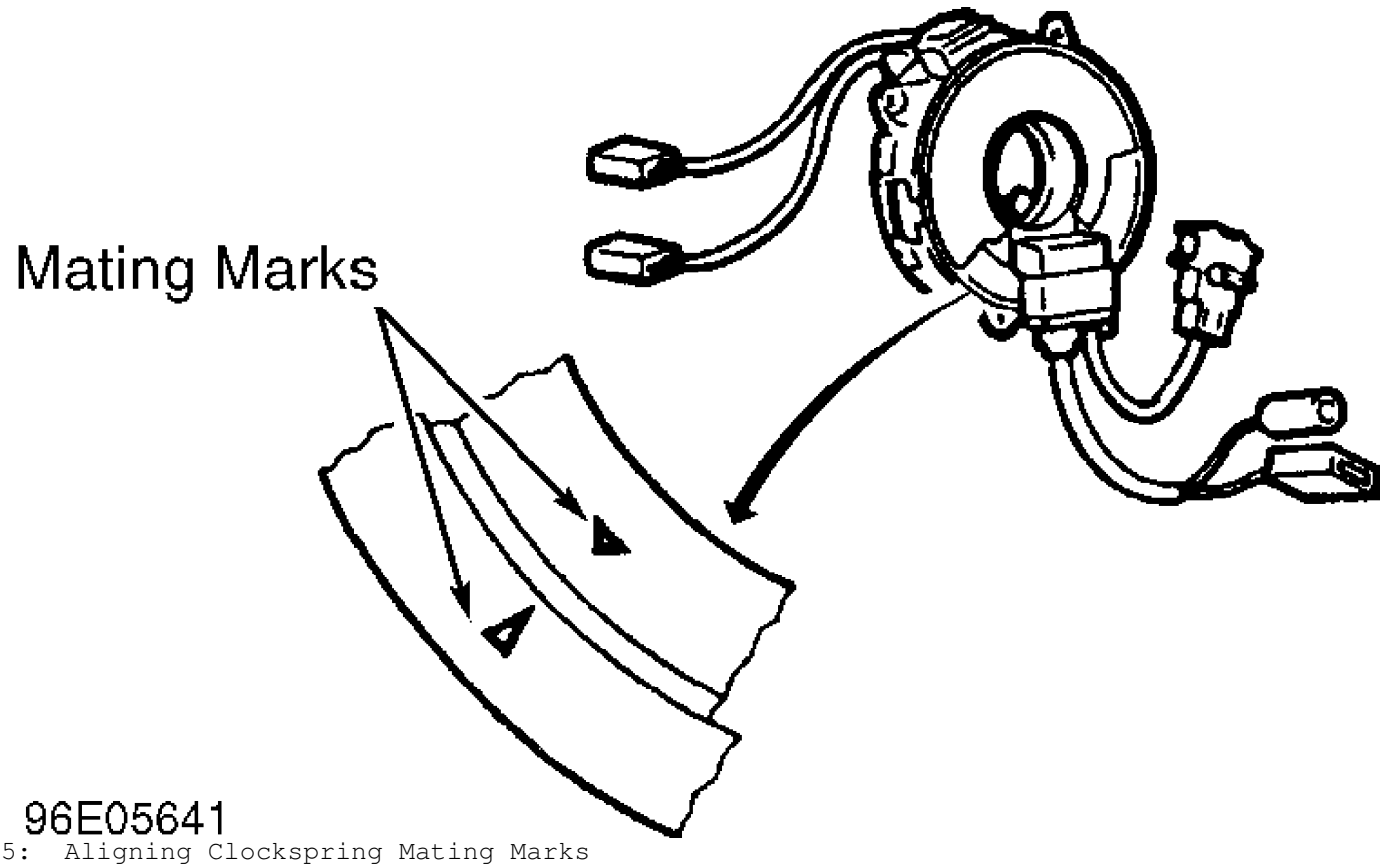

Fig. 5: Aligning Clockspring Mating Marks
Courtesy of Mitsubishi Motor Sales of America.

PASSENGER-SIDE AIR BAG MODULE

NOTE: If replacing deployed air bag module, SRS-ECU must be replaced.

Removal & Installation

1) Before proceeding, see SERVICE PRECAUTIONS. Deactivate SRS. See DISABLING & ACTIVATING AIR BAG SYSTEM.

2) Remove glove box and cover. Disconnect air bag module connector. Remove air bag module retaining bolts. Remove passenger-side air bag module. See Fig. 6.

3) To install, reverse removal procedure. Tighten bolts to specification. See TORQUE SPECIFICATIONS. Activate SRS. See procedures under DISABLING & ACTIVATING AIR BAG SYSTEM. Check AIR BAG warning light for proper system function. See SYSTEM OPERATION CHECK.

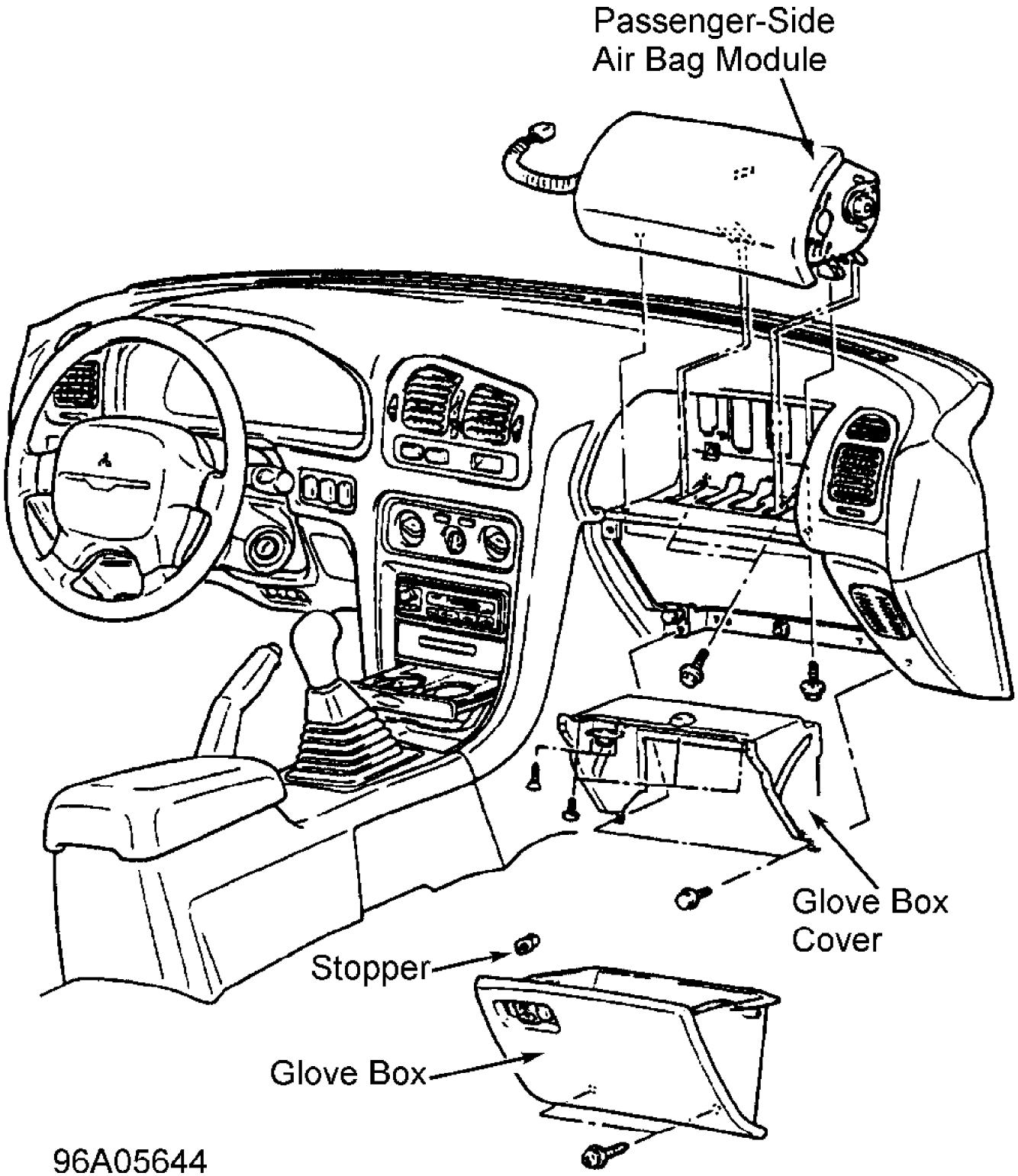

Fig. 6: Removing Passenger-Side Air Bag Module
Courtesy of Mitsubishi Motor Sales of America.

SRS AIR BAG CONTROL UNIT (ECU)

Removal & Installation

1) Before proceeding, see SERVICE PRECAUTIONS. Deactivate SRS. See DISABLING & ACTIVATING AIR BAG SYSTEM.

2) Remove center console floor assembly. See Fig. 7. Disconnect SRS-ECU connector. Remove SRS-ECU mounting bolts. Remove SRS-ECU.

3) To install, reverse removal procedure. Tighten bolts to specification. See TORQUE SPECIFICATIONS. Activate SRS. See procedures under DISABLING & ACTIVATING AIR BAG SYSTEM. Check AIR BAG warning light for proper system function. See SYSTEM OPERATION CHECK.

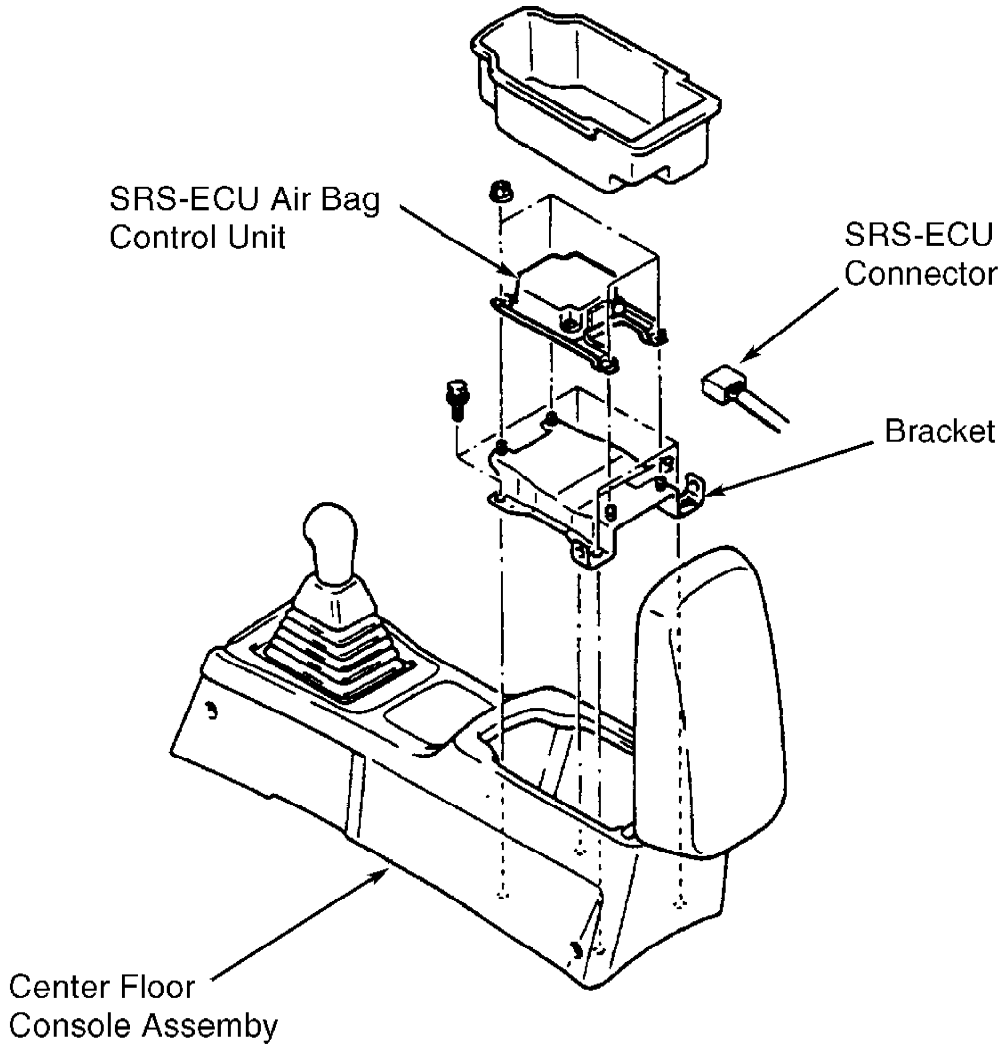

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Fig. 7: Removing SRS Air Bag Control Unit (ECU)
Courtesy of Mitsubishi Motor Sales of America.

ADJUSTMENTS

CLOCKSPRING CENTERING

WARNING: If front wheels are not in straight-ahead position or clockspring mating marks are not aligned before installing clockspring, the steering wheel may not turn completely, or flat cable inside clockspring may be severed, disabling SRS system and possibly causing serious injury to driver.

With clockspring removed, ensure front wheels are in straight-ahead position. Turn clockspring fully clockwise, and then turn it back approximately 3 1/3 turns counterclockwise to align mating marks. See Fig. 5.

WIRE REPAIR

DO NOT repair SRS wiring or harness connectors. If SRS wiring or harness connectors are faulty, replace faulty wiring harness.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Steering Wheel Nut	30 (41)
	INCH Lbs. (N.m)
Air Bag Module Bolt/Nut	
Driver-Side	84 (9.0)
Passenger-Side	(1)
Clockspring Screw	(1)
SRS-ECU (Air Bag Control Unit) Bolt	(1)

(1) - Information is not available from manufacturer.

DIAGNOSIS & TESTING

INITIAL SRS DIAGNOSTIC PROCEDURE

WARNING: Follow air bag service precautions to prevent accidental air bag deployment and personal injury. See SERVICE PRECAUTIONS.

NOTE: Ensure battery is fully charged. If battery voltage is too low, SRS warning light will come on. When battery voltage is restored to normal, light will go out. Codes remain stored for no more than about 7 days. Codes can be stored no more than 250 times. After servicing, reconnect negative battery cable. Erase codes using Multi-Use Tester II (MUT-II, MB991502) or DRB-III Scan Tool. Check SRS warning light to verify system operation. See SYSTEM OPERATION CHECK.

CAUTION: Ensure ignition is off before connecting or disconnecting scan tool at DLC.

1) Before proceeding, follow service precautions. See SERVICE PRECAUTIONS. Turn ignition on. If SRS warning light comes on for about 7 seconds and turns off, SRS is functioning properly at this

time.

2) If SRS warning light does not come on, or comes on and stays on, turn ignition switch to LOCK position. Connect scan tool to Data Link Connector (DLC). See Fig. 8. Turn ignition on. Use scan tool to retrieve code(s).

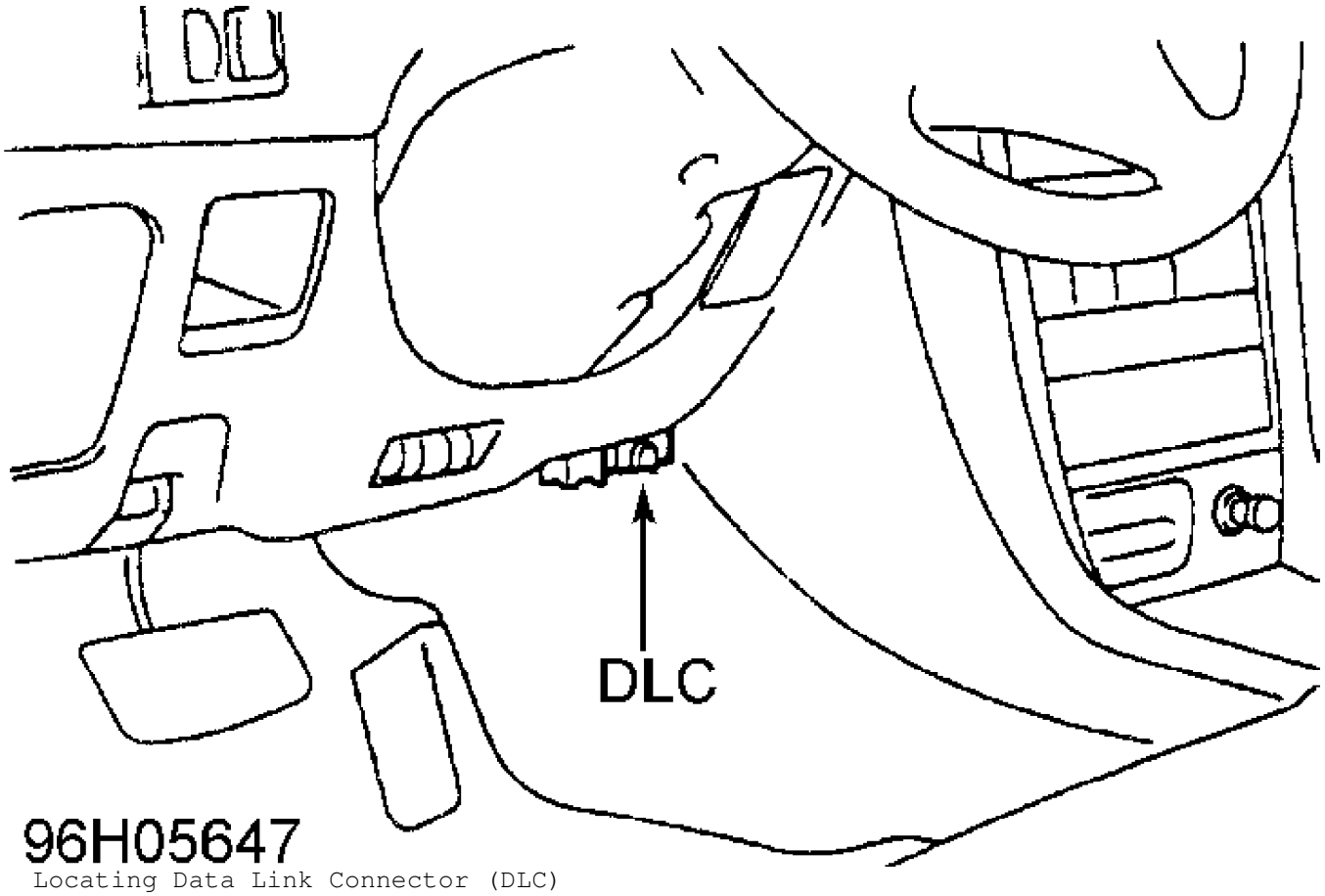


Fig. 8: Locating Data Link Connector (DLC)
Courtesy of Mitsubishi Motor Sales of America.

TROUBLE SYMPTOMS CHART

Symptom	Inspection Procedure
Communication With All Systems Not Possible	1
Communication With SRS Only Not Possible	2
Ignition Switch On (Engine Stopped)	
SRS Warning Light Does Not Come On	DTC 43
SRS Warning Light Stays On After 7 Seconds	DTC 43

INSPECTION PROCEDURE 1

The cause is probably in power supply system (including ground circuit of diagnostic line). Check connectors and harness, and repair if necessary.

INSPECTION PROCEDURE 2

NOTE: Refer to WIRING DIAGRAMS for connector identification.

1) Before proceeding, see SERVICE PRECAUTIONS. Deactivate SRS. See DISABLING & ACTIVATING AIR BAG SYSTEM.

2) Measure at SRS Check Harness (MB991613) connector No. 5. See Fig. 9. Remove center console floor assembly to access SRS-ECU. See Fig. 7. Disconnect SRS-ECU connector C-14. Connect SRS check harness connector No. 3 to C-14. Check continuity between terminal No. 20, 21 and ground. If there is no continuity, go to next step. If there is continuity, go to step 4).

3) Check connector C-14 and repair if necessary. If connector is okay, check for trouble symptoms. If fault still exists, check harness wire between SRS-ECU and ground, and repair if necessary.

4) Measure at SRS check harness connector No. 5. Disconnect SRS-ECU connector C-14 and connect SRS harness check connector No. 3 to C-14. Connect negative battery cable and turn ignition switch to ON position. Measure voltage between terminal No. 13 and 14, and body ground. If voltage at terminals is 9 volts or more, replace SRS-ECU. See SRS AIR BAG CONTROL UNIT (ECU) under REMOVAL & INSTALLATION. If voltage is not as specified, check connector D-14, C-37, C-35, C-53, and C-45, and repair if necessary. If connectors are okay, check for trouble symptoms. If fault still exists, check harness wire between SRS-ECU and ignition switch IG1, and repair if necessary.

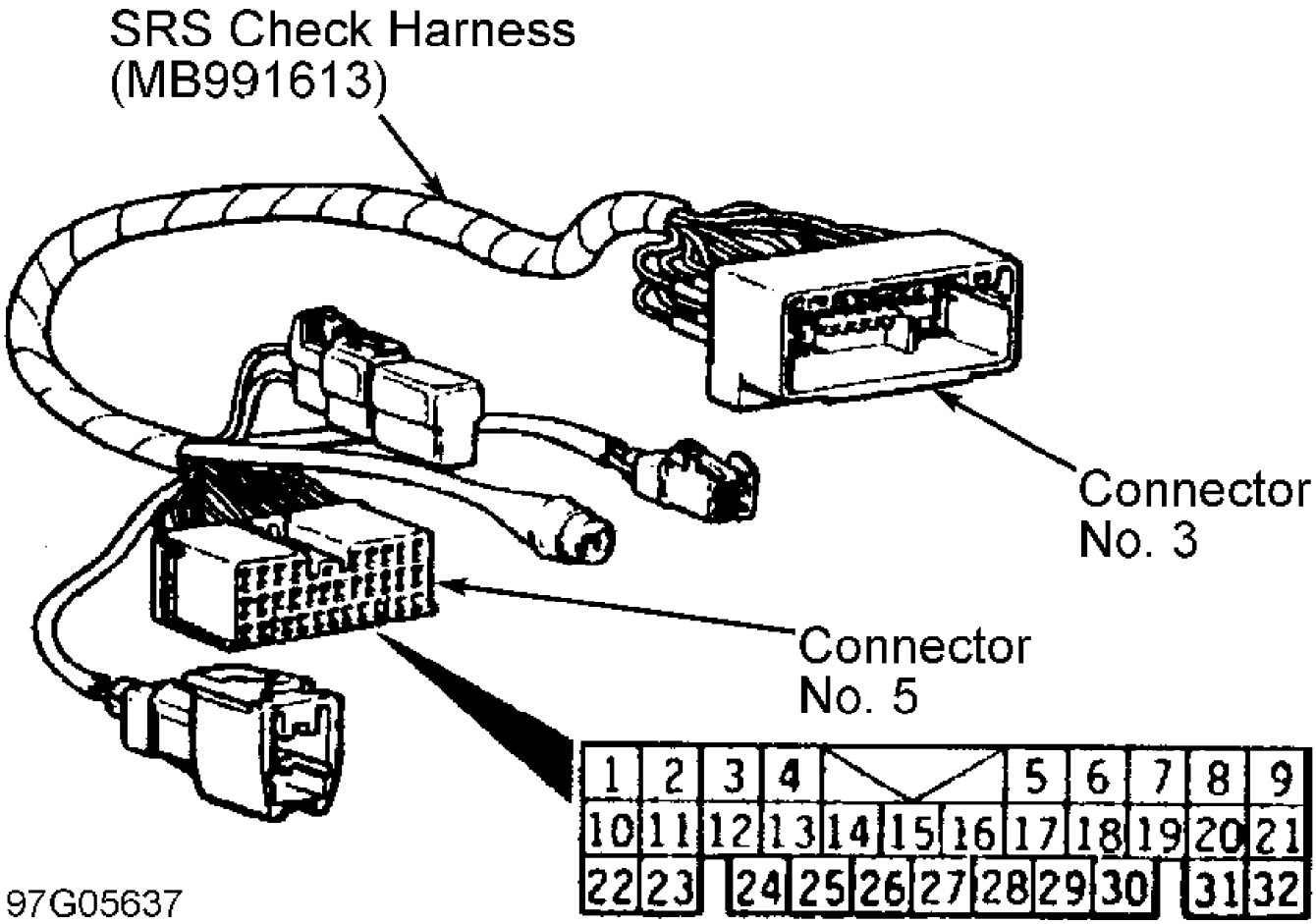


Fig. 9: Identifying SRS Check Harness (MB991613) Connectors
Courtesy of Mitsubishi Motor Sales of America.

DTC 14: ANALOG IMPACT SENSOR

Before proceeding, see SERVICE PRECAUTIONS. Replace SRS-ECU.

See SRS AIR BAG CONTROL UNIT (ECU) under REMOVAL & INSTALLATION.

DTC 15 & 16: SAFING IMPACT SENSOR

Before proceeding, see SERVICE PRECAUTIONS. Replace SRS-ECU. See SRS AIR BAG CONTROL UNIT (ECU) under REMOVAL & INSTALLATION.

DTC 21, 22, 61, 62: DRIVER-SIDE AIR BAG MODULE SYSTEM

WARNING: During the following procedure, never measure circuit resistance of air bag module (squib), even when using specified DVOM. If circuit resistance is measured, it may cause accidental air bag deployment and personal injury.

NOTE: Refer to WIRING DIAGRAMS for connector identification.

1) Before proceeding, see SERVICE PRECAUTIONS. Deactivate SRS. See DISABLING & ACTIVATING AIR BAG SYSTEM.
2) Disconnect clockspring connector C-05. Connect SRS Check Harness (MB991613) connector No. 1 to clockspring connector. See Fig. 9. Connect negative battery cable. Erase DTC memory and check if DTCs 21, 22, 61, or 62 are set. If any of these DTCs are output, go to next step. If DTCs are not output, go to step 4).
3) Check connectors C-05 and C-14, and repair if necessary. If connectors are okay, check trouble symptoms. If fault is still present, check harness wire between SRS-ECU and clockspring, and repair if necessary. If harness wire is okay, replace SRS-ECU. See SRS AIR BAG CONTROL UNIT (ECU) under REMOVAL & INSTALLATION.
4) Check clockspring and replace if necessary. See DRIVER-SIDE AIR BAG MODULE & CLOCKSPRING under REMOVAL & INSTALLATION. If clockspring is okay, replace driver-side air bag module.

DTC 24, 25, 64, 65: PASSENGER-SIDE AIR BAG MODULE SYSTEM

WARNING: During the following procedure, never measure circuit resistance of air bag module (squib), even when using specified DVOM. If circuit resistance is measured, it may cause accidental air bag deployment and personal injury.

NOTE: Refer to WIRING DIAGRAMS for connector identification.

1) Before proceeding, see SERVICE PRECAUTIONS. Deactivate SRS. See DISABLING & ACTIVATING AIR BAG SYSTEM.
2) Disconnect passenger-side air bag connector C-10. Connect SRS Check Harness (MB991613) connector No. 1 to passenger-side air bag connector. See Fig. 9. Connect negative battery cable. Erase DTC memory and check if DTCs 24, 25, 64, or 65 are set. If any of these DTCs are output, go to next step. If DTCs are not output, replace passenger-side air bag module. See PASSENGER-SIDE AIR BAG MODULE under REMOVAL & INSTALLATION.
3) Check connectors C-10 and C-14, and repair if necessary. If connectors are okay, check trouble symptoms. If fault is still present, check harness wire between passenger-side air bag module and SRS-ECU, and repair if necessary. If harness wire is okay, replace SRS-ECU. See SRS AIR BAG CONTROL UNIT (ECU) under REMOVAL & INSTALLATION.

DTC 31 & 32: SRS-ECU CAPACITOR SYSTEM

Before proceeding, see SERVICE PRECAUTIONS. Replace SRS-ECU. See SRS AIR BAG CONTROL UNIT (ECU) under REMOVAL & INSTALLATION.

DTC 34: CONNECTOR LOCK SYSTEM

NOTE: If vehicle condition returns to normal, DTC will be erased and SRS warning light will return to normal.

NOTE: Refer to WIRING DIAGRAMS for connector identification.

Before proceeding, see SERVICE PRECAUTIONS. Check connector C-14 and repair if necessary. If connector is okay, replace SRS-ECU. See SRS AIR BAG CONTROL UNIT (ECU) under REMOVAL & INSTALLATION.

DTC 35: SRS-ECU AIR BAG SYSTEM/AIR BAG DEPLOYMENT

Before proceeding, see SERVICE PRECAUTIONS. Replace SRS-ECU. See SRS AIR BAG CONTROL UNIT (ECU) under REMOVAL & INSTALLATION.

DTC 41: IG1 (A) POWER CIRCUIT SYSTEM

NOTE: If vehicle condition returns to normal, DTC will be erased and SRS warning light will return to normal.

NOTE: Refer to WIRING DIAGRAMS for connector identification.

1) Before proceeding, see SERVICE PRECAUTIONS. Deactivate SRS. See DISABLING & ACTIVATING AIR BAG SYSTEM.
2) Measure at SRS Check Harness (MB991613) connector No. 5. See Fig. 9. Disconnect SRS-ECU connector C-14 and connect SRS check harness connector No. 3 to C-14. Check terminal No. 20 and 21 for continuity to ground. If there is no continuity, go to next step. If there is continuity, go to step 4).
3) Check connector C-14 and repair if necessary. If connector is okay, check for trouble symptoms. If fault still exists, check harness wire between SRS-ECU and ground, and repair if necessary.
4) Measure at SRS check harness connector No. 5. Disconnect SRS-ECU connector C-14 and connect SRS harness check connector No. 3 to C-14. Connect negative battery cable and turn ignition switch to ON position. If voltage between terminal No. 14 and body ground is 9 volts or more, replace SRS-ECU. See SRS AIR BAG CONTROL UNIT (ECU) under REMOVAL & INSTALLATION. If voltage is not as specified, check connector C-14, C-35, and C-53, and repair if necessary. If connectors are okay, check for trouble symptoms. If fault still exists, check harness wire between SRS-ECU and ignition switch IG1, and repair if necessary.

DTC 42: IG1 (B) POWER CIRCUIT SYSTEM

NOTE: If vehicle condition returns to normal, DTC will be erased and SRS warning light will return to normal.

NOTE: Refer to WIRING DIAGRAMS for connector identification.

1) Before proceeding, see SERVICE PRECAUTIONS. Deactivate SRS. See DISABLING & ACTIVATING AIR BAG SYSTEM.
2) Measure at SRS Check Harness (MB991613) connector No. 5. See Fig. 9. Disconnect SRS-ECU connector C-14 and connect SRS check harness connector No. 3 to C-14. Check terminal No. 20 and 21 for continuity to ground. If there is no continuity, go to next step. If there is continuity, go to step 4).
3) Check connector C-14 and repair if necessary. If connector is okay, check for trouble symptoms. If fault still exists, check harness wire between SRS-ECU and ground, and repair if necessary.
4) Measure at SRS check harness connector No. 5. Disconnect

SRS-ECU connector C-14 and connect SRS harness check connector No. 3 to C-14. Connect negative battery cable and turn ignition switch to ON position. If voltage between terminal No. 13 and body ground is 9 volts or more, replace SRS-ECU. See SRS AIR BAG CONTROL UNIT (ECU) under REMOVAL & INSTALLATION. If voltage is not as specified, check connector D-14, C-37, and C-45, and repair if necessary. If connectors are okay, check for trouble symptoms. If fault still exists, check harness wire between SRS-ECU and ignition switch IG1, and repair if necessary.

DTC 43: SRS WARNING LIGHT DOES NOT COME ON

NOTE: Refer to WIRING DIAGRAMS for connector identification.

Light Does Not Come On

1) Before proceeding, see SERVICE PRECAUTIONS. Deactivate SRS. See DISABLING & ACTIVATING AIR BAG SYSTEM.

2) Measure at SRS Check Harness (MB991613) connector No. 5. See Fig. 9. Disconnect SRS-ECU connector C-14 and connect SRS check harness connector No. 3 to C-14. Check terminal No. 20 and 21 for continuity to ground. If there is no continuity, go to next step. If there is continuity, go to step 4).

3) Check connector C-14 and repair if necessary. If connector is okay, check for trouble symptoms. If fault still exists, check harness wire between SRS-ECU and ground, and repair if necessary.

4) Measure at SRS check harness connector No. 5. Disconnect SRS-ECU connector C-14 and connect SRS harness check connector No. 3 to C-14. Connect negative battery cable and turn ignition switch to ON position. Connect terminal No. 15 to body ground. If SRS warning light comes on, replace SRS-ECU. See SRS AIR BAG CONTROL UNIT (ECU) under REMOVAL & INSTALLATION. If SRS warning light does not come on, inspect for blown bulb and repair if necessary. If bulb is okay, check connector C-14, C-37, C-45, D-02, D-03, and D-14, and repair if necessary. If connectors are okay, check for trouble symptoms. If fault still exists, check harness wire between SRS-ECU and ignition switch IG1, and repair if necessary. If harness wire is okay, replace combination meter.

Light Does Not Turn Off

1) Before proceeding, see SERVICE PRECAUTIONS. Connect negative battery cable and turn ignition switch to ON position. If SRS warning light stays on when C-14 is disconnected, go to next step. If SRS warning light turns off when C-14 is disconnected, replace SRS-ECU. See SRS AIR BAG CONTROL UNIT (ECU) under REMOVAL & INSTALLATION.

2) Check connector C-14, D-03, and D-14, and repair if necessary. If connectors are okay, check trouble symptoms. If fault still exists, check wire harness between SRS-ECU and combination meter, and repair if necessary.

DTC 44: SRS WARNING LIGHT DRIVE CIRCUIT SYSTEM

NOTE: If vehicle condition returns to normal, DTC will be erased and SRS warning light will return to normal.

Before proceeding, see SERVICE PRECAUTIONS. Check SRS warning light drive circuit system. If warning light drive system is okay, replace SRS-ECU. See SRS AIR BAG CONTROL UNIT (ECU) under REMOVAL & INSTALLATION.

DTC 45: SRS-ECU EEPROM AND A/D CONVERTER SYSTEM

Before proceeding, see SERVICE PRECAUTIONS. Replace SRS-ECU. See SRS AIR BAG CONTROL UNIT (ECU) under REMOVAL & INSTALLATION.

DTC 51 & 52: SRS-ECU EEPROM AND A/D CONVERTER SYSTEM

Before proceeding, see SERVICE PRECAUTIONS. Replace SRS-ECU. See SRS AIR BAG CONTROL UNIT (ECU) under REMOVAL & INSTALLATION.

DTC 54 & 55: PASSENGER-SIDE AIR BAG MODULE IGNITION DRIVE CIRCUIT

Before proceeding, see SERVICE PRECAUTIONS. Replace SRS-ECU. See SRS AIR BAG CONTROL UNIT (ECU) under REMOVAL & INSTALLATION.

COMPONENT TESTING

CLOCKSPRING TEST

1) Before proceeding, see SERVICE PRECAUTIONS. Deactivate system. See DISABLING & ACTIVATING AIR BAG SYSTEM.

2) Remove driver-side air bag module and clockspring. See DRIVER-SIDE AIR BAG MODULE & CLOCKSPRING under REMOVAL & INSTALLATION. Check connectors, protective tubing, and case for damage, and terminals for deformities. Check for continuity between No. 1 connector of clockspring and connectors No. 3 and 4. See Figs. 10 and 11.

3) Align paint mark of SRS Check Harness (MB991613) connector No. 4 with notch in clockspring connector No. 2 and connect. See Fig. 12. Check continuity between terminals No. 22 and 23 of SRS check harness connector No. 5.

4) Replace clockspring if any damage was found or continuity does not exist between specified terminals. See DRIVER-SIDE AIR BAG MODULE & CLOCKSPRING under REMOVAL & INSTALLATION.

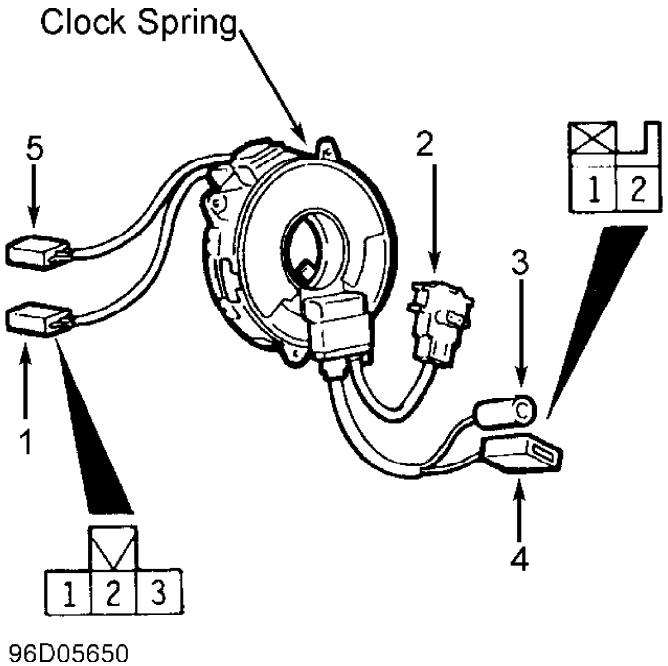


Fig. 10: Identifying Clockspring Connectors
Courtesy of Mitsubishi Motor Sales of America.

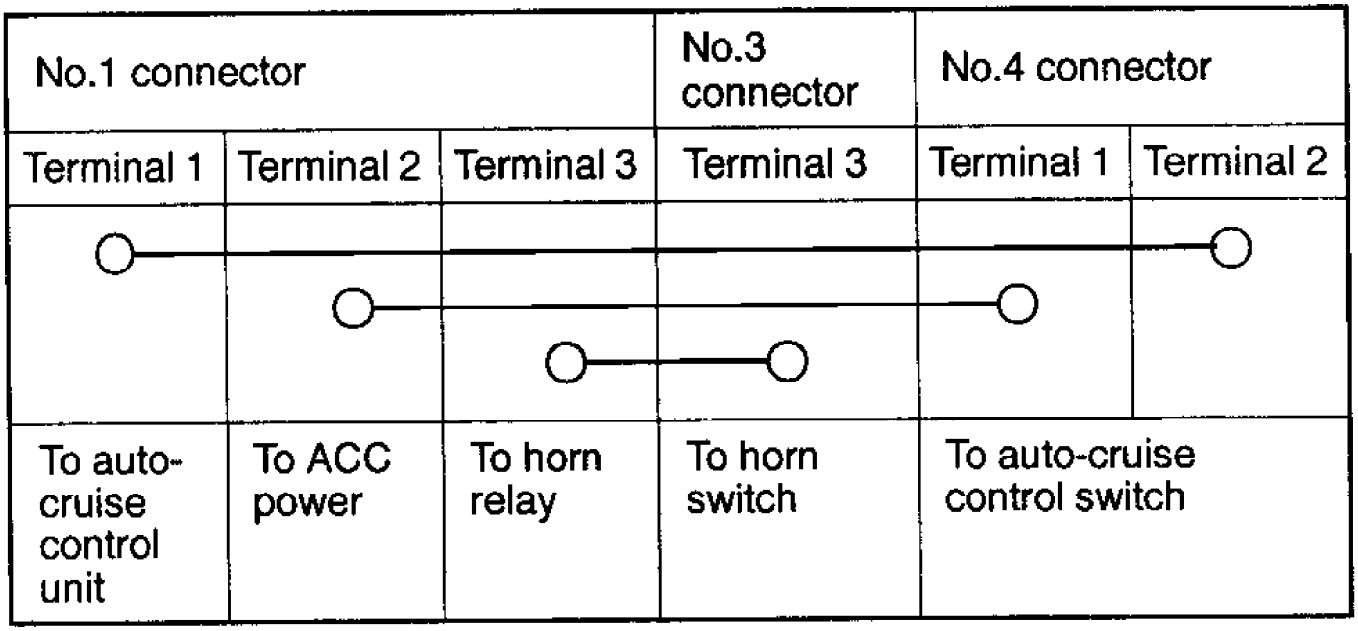


Fig. 11: Checking Continuity Between Clockspring Connectors
Courtesy of Mitsubishi Motor Sales of America.

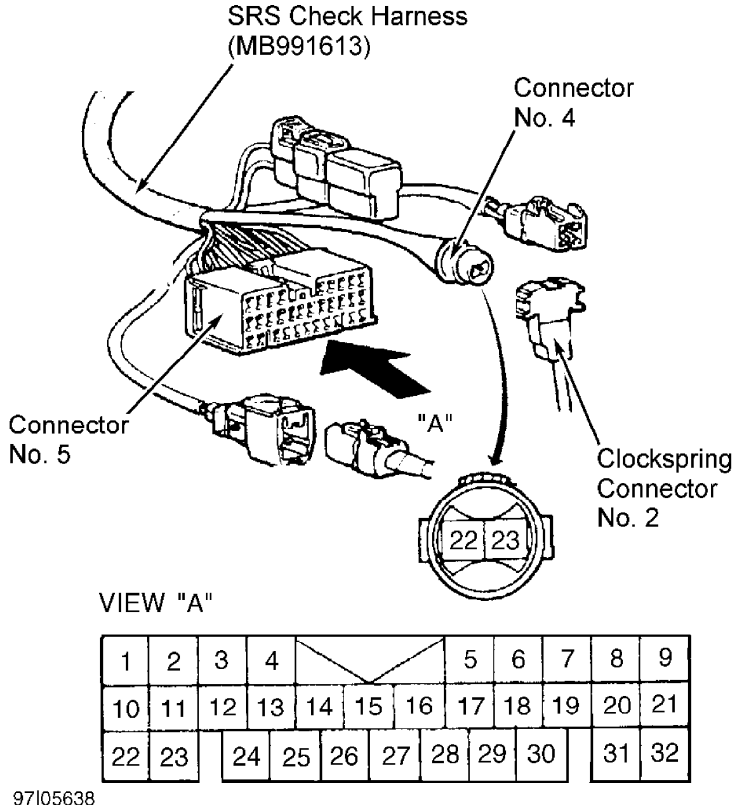


Fig. 12: Using SRS Check Harness To Test Clockspring & Connectors
Courtesy of Mitsubishi Motor Sales of America.

WIRING DIAGRAMS

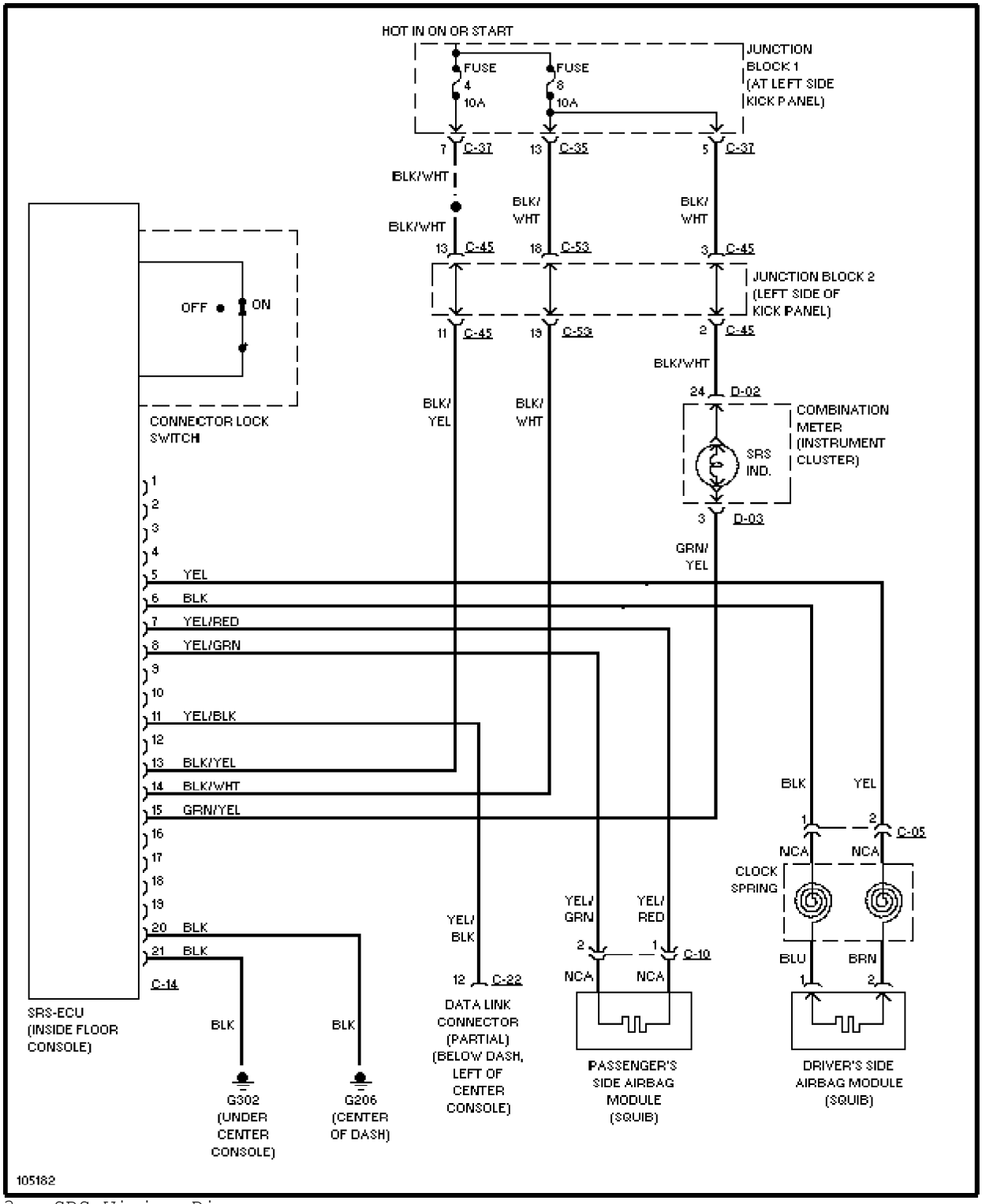


Fig. 13: SRS Wiring Diagram

ANTI-LOCK BRAKE SAFETY PRECAUTIONS

1998 Mitsubishi Galant

GENERAL INFORMATION
Anti-Lock Brake Safety Precautions

* PLEASE READ THIS FIRST *

This article is intended for general information purposes only. This information may not apply to all makes and models. If vehicle is equipped with Anti-Lock Brake System (ABS), refer to appropriate ANTI-LOCK BRAKE SYSTEM article in the BRAKES section for description, operation, depressurizing, testing, system bleeding, trouble shooting and servicing of specific system.

WARNING: Failure to depressurize ABS could lead to physical injury.

ANTI-LOCK BRAKE SAFETY PRECAUTIONS

WARNING: Failure to depressurize ABS could lead to physical injury.

* NEVER open a bleeder valve or loosen a hydraulic line while ABS is pressurized.
* NEVER disconnect or reconnect any electrical connectors while ignition is on. Damage to ABS control unit may result.
* DO NOT attempt to bleed hyudarulic system without first referring to the appropriate ANTI-LOCK BRAKE SYSTEM article in the BRAKES section.
* Only use specially designed brake hoses/lines on ABS equipped vehicles.
* DO NOT tap on speed sensor components (sensor, sensor rings). Sensor rings must be pressed into hubs, NOT hammered into hubs. Striking these components can cause demagnetization or a loss of polarization, affecting the accuracy of the speed signal returning to the ABS control unit.
* DO NOT mix tire sizes. Increasing the width, as long as tires remain close to the original diameter, is acceptable. Rolling diameter must be identical for all 4 tires. Some manufacturers recommend tires of the same brand, style and type. Failure to follow this precaution may cause inaccurate wheel speed readings.
* DO NOT contaminate speed sensor components with grease. Only use recommended coating, when system calls for an anti-corrosion coating.
* When speed sensor components have been removed, ALWAYS check sensor-to-ring air gaps when applicable. These specifications can be found in each appropriate article.
* ONLY use rocommended brake fluids. DO NOT use silicone brake fluids in an ABS equipped vehicle.
* When instlling transmittion devices (CB's, telephones, etc.) on ABS equipped vehicles, DO NOT locate the antenna near the ABS control unit (or any control unit).
* Disconnect all on-board computers, when using electric welding equipment.
* DO NOT expose the ABS control unit to prolonged periods of high heat (185 °F/85°C for 2 hours is generally considered a maximum limit).

ANTI-LOCK BRAKE SYSTEM

1998 Mitsubishi Galant

1997-98 BRAKES
Mitsubishi - Anti-Lock

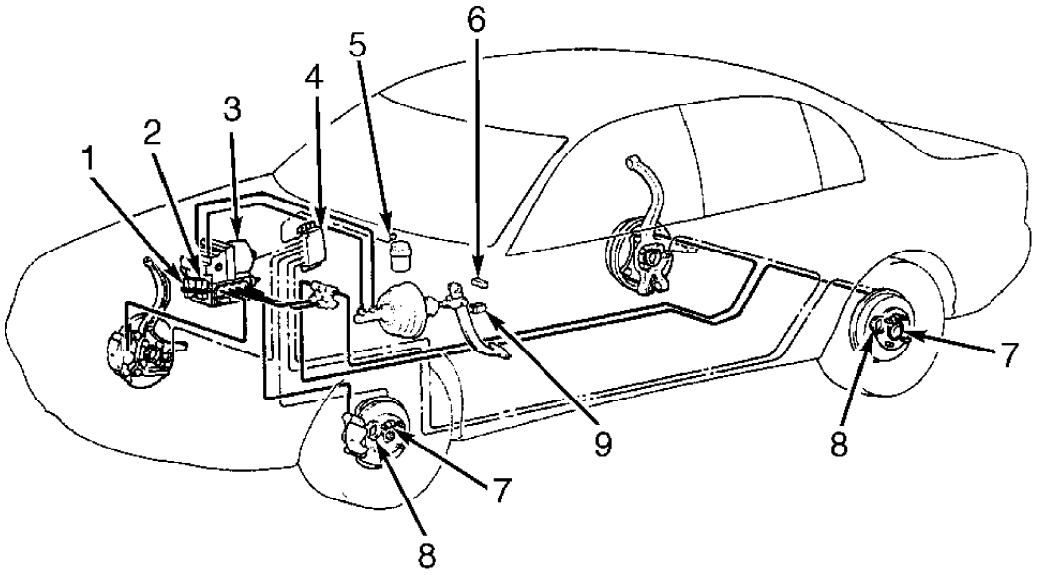
Galant

DESCRIPTION

CAUTION: See ANTI-LOCK BRAKE SAFETY PRECAUTIONS article in GENERAL INFORMATION.

NOTE: For more information on brake system, see BRAKE SYSTEM article.

The Anti-Lock Brake System (ABS) is designed to prevent wheel lock-up during heavy braking. This allows operator to maintain steering control while stopping vehicle in shortest distance possible. System consists of an ABS Electronic Control Unit (ECU), hydraulic unit, ABS valve relay, ABS motor relay, wheel speed sensors, ABS rotor, Data Link Connector (DLC), brakelight switch and ANTI-LOCK warning light. See Fig. 1. ABS has a self-diagnostic system to indicate a system malfunction by monitoring stored ABS ECU Diagnostic Trouble Codes (DTCs). See RETRIEVING DTCs under SELF-DIAGNOSTIC SYSTEM .



1. ABS Motor Relay
2. ABS Valve Relay
3. Hydraulic Unit
4. ABS ECU
5. ANTI-LOCK Warning Light
6. Data Link Connector
7. Wheel Speed Sensor
8. ABS Rotor
9. Brakelight Switch

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Fig. 1: Locating ABS Components
Courtesy of Mitsubishi Motor Sales of America.

OPERATION

Each wheel sensor sends an AC electrical signal to ABS ECU. The ABS ECU translates this information as wheel speed. When any decelerating wheel speed rate is determined to be excessive in comparison to other monitored wheels, the hydraulic unit cycles hydraulic brake pressure to each wheel to equalize speed of all wheels. ABS turns itself off when vehicle speed drops to 4 MPH. Minor lock-up may occur at this point.

With engine running and vehicle speed more than 4 MPH, pump motor will operate for a short period of time and may be heard inside vehicle. During pump motor operation, ABS system is completing a self-check. During ABS system operation, a pulsing brake pedal and vibration in steering wheel and vehicle body may be experienced. These conditions are normal.

BLEEDING BRAKE SYSTEM

CAUTION: When adding brake fluid, ensure filter/strainer is properly fitted on reservoir tank.

ABS system is bled using conventional method. With engine running, manually bleed system using an assistant. For bleeding order, see BRAKE LINE BLEEDING SEQUENCE table. Ensure all air is removed from brake system. Refill brake fluid reservoir after bleeding procedure is complete.

BRAKE LINE BLEEDING SEQUENCE

Application	Sequence
Galant	RR, LF, LR, RF

ADJUSTMENTS

* PLEASE READ FIRST *

NOTE: For adjustment information on brake pedal height, free play, parking brake and brakelight switch, see BRAKE SYSTEM article.

WHEEL SPEED SENSOR

NOTE: Galant wheel speed sensor is not adjustable. Clearance between sensor mounting surface and rotor outside surface should be 1.11-1.12" (28.2-28.5 mm).

TROUBLE SHOOTING

* PLEASE READ FIRST *

NOTE: If system is not functioning properly after all testing procedures have been completed, substitute known-good ABS ECU and retest.

ANTI-LOCK WARNING LIGHT

1) Turn ignition on. ANTI-LOCK warning light should illuminate. Turn ignition switch to START position. Warning light should remain on and then go out after one second.

2) If warning light functions as specified, go step 3). If warning light does not function as specified, see appropriate trouble shooting test:

* ANTI-LOCK WARNING LIGHT INOPERATIVE
* ENGINE RUNNING, ANTI-LOCK WARNING LIGHT REMAINS ON
* IGNITION SWITCH IN ON POSITION (ENGINE NOT RUNNING), ANTI-LOCK WARNING LIGHT STAYS ON FOR APPROXIMATELY ONE SECOND, THEN SWITCHES OFF
* IGNITION SWITCH IN ON POSITION, ANTI-LOCK WARNING LIGHT FLASHES
* IGNITION SWITCH TURNED TO START POSITION, WARNING LIGHT SWITCHES OFF IMMEDIATELY (DOES NOT REMAIN ON FOR ONE SECOND)

3) Test drive vehicle. If ABS light does not come on at low speed, go to next step. If ABS light comes on at low speed, motor relay, solenoid valve or wheel speed sensor malfunction is indicated. Go to step 6). If insufficient braking force or ABS malfunction exists, go to next step. If none of listed symptoms exist, go to step 6).

4) Check conventional brake system components for proper operation. Check for mechanical lock of hydraulic unit solenoid valve. Check for plugged hydraulic line in hydraulic unit. Repair or replace as necessary. If hydraulic unit is okay, go to next step.

5) Check for faulty wheel speed sensor. See WHEEL SPEED SENSOR under COMPONENT TESTS. Replace sensor as necessary. See WHEEL SPEED SENSOR under REMOVAL & INSTALLATION. Inspect ABS ECU wiring. If testing indicates no mechanical or electrical failures, replace ABS ECU.

6) Enter ABS self-diagnostics, and retrieve DTCs. See RETRIEVING DTCs under SELF-DIAGNOSTIC SYSTEM. If no DTCs are displayed, fault may be intermittent. Try to make malfunction reoccur. If no diagnostic output exists, check for faulty wiring harness between ABS ECU and self-diagnostic connector. Repair or replace as necessary.

ANTI-LOCK Warning Light Inoperative

1) If all other warning lights illuminate with ignition on, check for faulty warning light bulb. Replace bulb as necessary. If bulb is okay, go to step 3). If other warning lights do not illuminate, check fuse No. 8 in main fuse panel. If fuse is blown, correct cause of blown fuse, and replace fuse. If fuse is okay, go to next step.

2) Remove instrument cluster. Disconnect instrument cluster connector. Turn ignition on. Using a DVOM, measure voltage between ground and instrument cluster connector terminal No. 24 (Black/White wire). See Fig. 2. If battery voltage is present, go to next step. If battery voltage is not present, repair connectors or wiring between each junction block and instrument cluster. See WIRING DIAGRAMS.

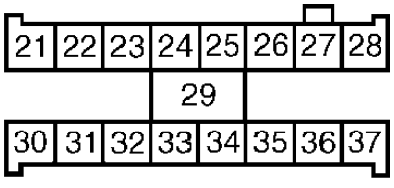

Fig. 2: Identifying Combination Meter Harness Connector Terminals
Courtesy of Mitsubishi Motor Sales of America.

3) Turn ignition off. Check for continuity between instrument cluster terminals No. 24 and 37. If no continuity is present, check

for faulty warning light bulb. Replace bulb as necessary. If bulb is okay, replace combination meter (instrument cluster). If continuity is present, go to next step.

4) Check and repair connectors and wiring harness between ABS valve relay and instrument cluster, and between instrument cluster and ABS ECU. See WIRING DIAGRAMS.

Engine Running, ANTI-LOCK Warning Light Remains On

1) Turn ignition off. Disconnect 22-pin ABS ECU connector. Restart engine. If light is no longer on, replace ABS ECU. If light remains on, go to next step.

2) Turn ignition off. Repair short inside instrument cluster or between instrument cluster and ABS ECU.

Ignition Switch In ON Position (Engine Not Running), ANTI-LOCK Warning Light Stays On For Approximately One Second, Then Switches Off

1) Turn ignition off. Disconnect ABS ECU 22-pin connector. Start and run engine. Using DVOM, check voltage between ABS ECU 22-pin connector terminal No. 38 and ground. See Figs. 3-4. If voltage is less than 7 volts, go to step 3). If voltage is more than 7 volts, go to next step.

2) Check and repair connectors and wiring harness between ignition switch and ABS ECU, and between generator and ABS ECU. See WIRING DIAGRAMS. If connectors and wiring harness are okay, go to next step.

3) Measure voltage between generator "L" terminal (White wire) and ground. If voltage is less than 7 volts, replace generator. If voltage is more than 7 volts, turn ignition off. Disconnect generator harness connector. Using DVOM, check continuity between generator "L" terminal (White wire) and ABS ECU 22-pin connector terminal No. 38.

4) If continuity does not exist, inspect and repair circuit as needed. If continuity exists, connect all components and retrieve DTCs. See RETRIEVING DTCs under SELF-DIAGNOSTIC SYSTEM.

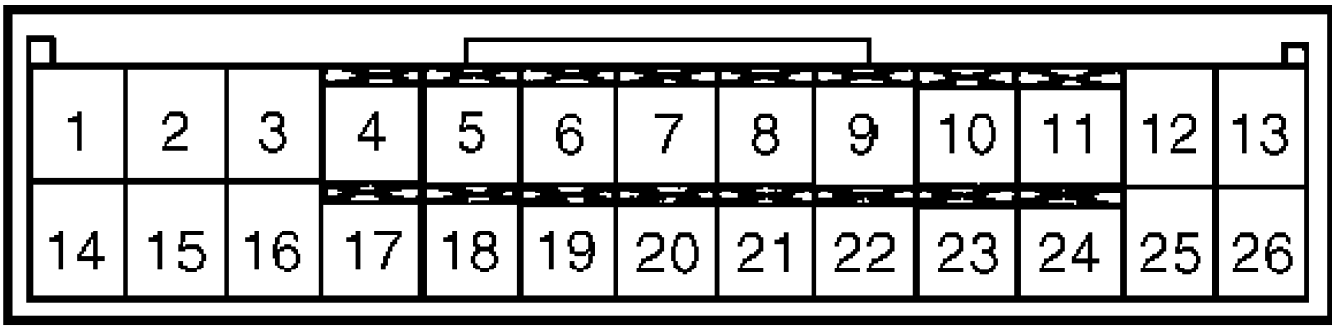

Fig. 3: Identifying ABS ECU Harness Connector Terminals 22-Pin Connector
Courtesy of Mitsubishi Motor Sales of America.

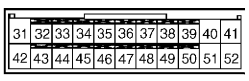

Fig. 4: Identifying ABS ECU Harness Connector Terminals 26-Pin Connector
Courtesy of Mitsubishi Motor Sales of America.

Ignition Switch In ON Position, ANTI-LOCK Warning Light Flashes

1) Turn ignition switch off and then on. Drive vehicle at more than 6 MPH. If light still flashes, go to next step.

2) Check and repair ABS ECU, ABS relay valve, ignition switch, and instrument cluster connectors and related wiring harness as needed. If connectors and wiring harness are okay, replace ABS ECU.

Ignition Switch Turned To START Position, ANTI-LOCK Warning Light Switches Off Immediately (Does Not Remain On For One Second)

1) Turn ignition off. Remove ABS valve relay. Inspect relay. See HYDRAULIC UNIT RELAYS under COMPONENT TESTS. Replace relay if needed. If relay is okay, DO NOT install relay and go to next step.

2) Disconnect ABS ECU 22-pin connector. Turn ignition on. Using DVOM, check voltage between relay connector terminal No. 3 (Green/Yellow wire) and ground. If battery voltage is present, inspect and repair ABS valve relay ground circuit (terminal No. 1, Black wire). See WIRING DIAGRAMS. If battery voltage is not present, go to next step.

3) Disconnect diode. See Fig. 5. Using DVOM, ensure continuity exists in one direction only. Replace diode if needed. If diode is okay, go to next step.

4) Check and repair ABS ECU, ABS relay valve, and diode connectors and related wiring harness as needed.

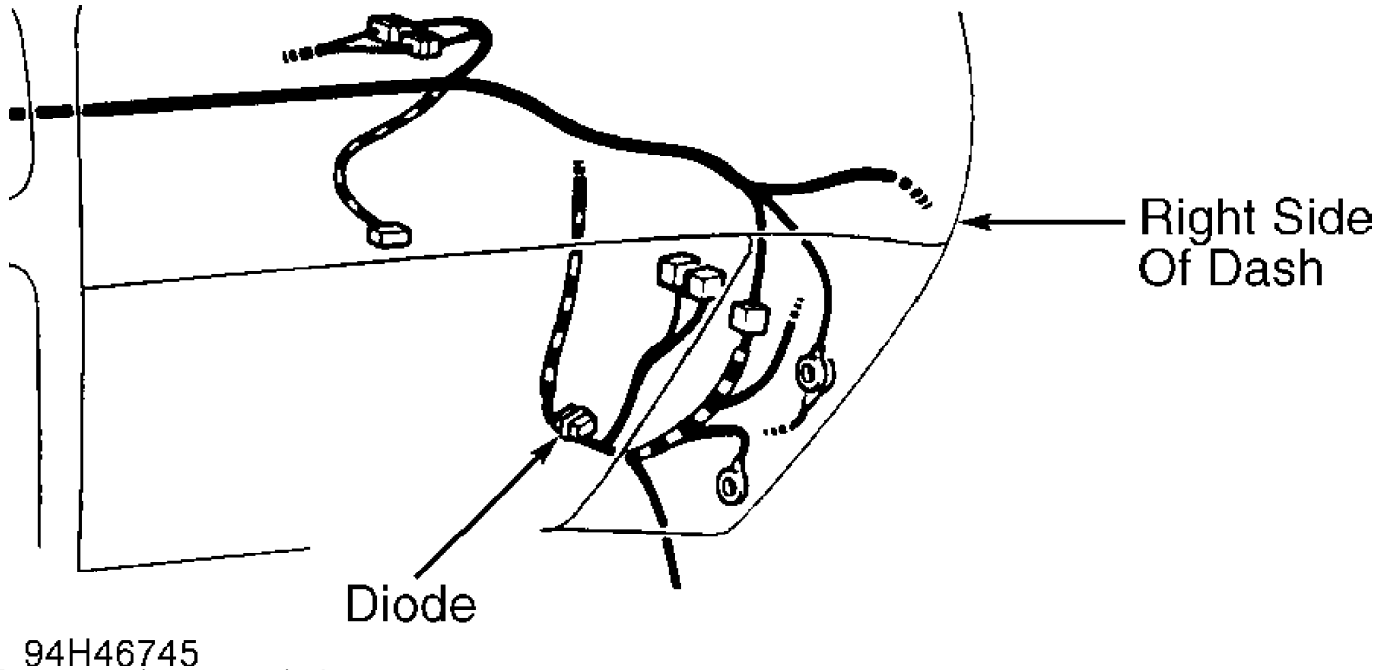

Fig. 5: Locating ABS Diode
Courtesy of Mitsubishi Motor Sales of America.

SELF-DIAGNOSTIC SYSTEM

RETRIEVING DTCs

Using Scan Tool

1) Refer to manufacturer's operation manual for instructions in use of scan tool. With ignition off, connect scan tool to 16-pin Data Link Connector (DLC), located under instrument panel, near

steering column. See Fig. 6.

2) Turn ignition on. ANTI-LOCK warning light should come on as ABS goes into self-diagnostic mode. Read and record all Diagnostic Trouble Codes (DTCs) from ABS ECU memory. Refer to scan tool manufacturer's instructions for specific DTC retrieval procedure.

3) After all DTCs have been retrieved and recorded, clear DTCs from ABS ECU memory. Refer to scan tool manufacturer's instructions for specific DTC clearing instructions. See DTC DEFINITION table and perform appropriate test(s) under DIAGNOSTIC TESTS.

4) If DTCs cannot be cleared, ABS ECU is currently detecting a malfunction. If DTCs can be cleared, problem is either intermittent or only appears while driving.

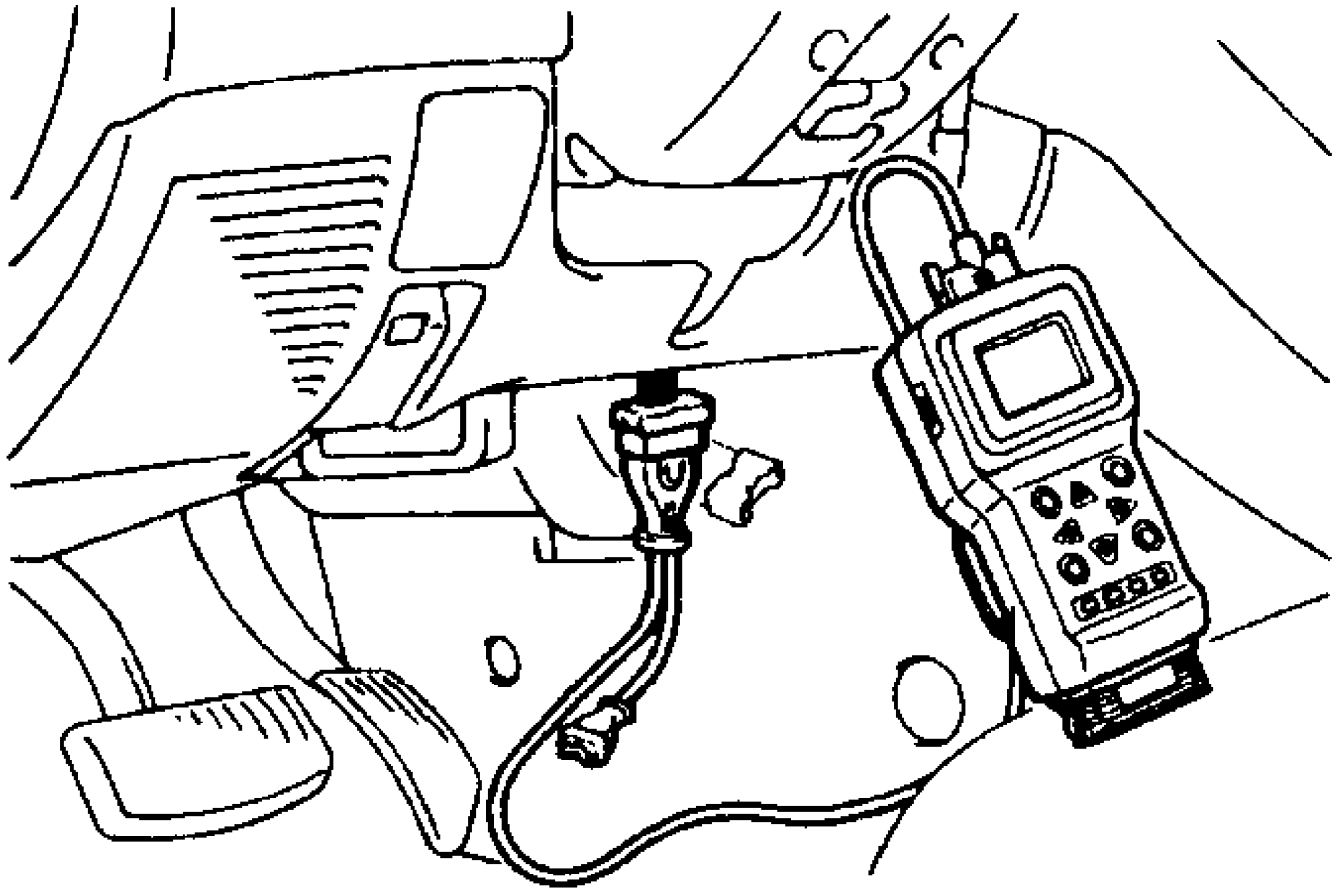

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Fig. 6: Locating Data Link Connector
Courtesy of Mitsubishi Motor Sales of America.

Using ANTI-LOCK Warning Light

1) Turn ignition on and depress brake pedal within 3 seconds and release. Continue to depress and release brake pedal once per second for 9 more cycles.

2) If DTCs are stored in ABS ECU memory, ANTI-LOCK light will begin to flash intermittently. Long flashes represent first digit of DTC; short flashes represent second digit. For example, 4 long flashes and 3 short flashes indicate DTC 43. If 2 or more DTCs are stored, lowest number will be displayed first.

3) After recording DTC(s), see DTC DEFINITION table and perform appropriate DTC test(s) under DIAGNOSTIC TESTS. If no DTCs are

stored, ANTI-LOCK warning light will flash constantly.

CLEARING DTCs

To erase DTC(s) with scan tool, follow scan tool manufacturer's instructions. To erase DTCs without scan tool, disconnect negative battery cable for at least 10 seconds.

DTC DEFINITION

DTC	(1) System Affected
11	Right Front Wheel Speed Sensor Circuit (Open)
12	Left Front Wheel Speed Sensor Circuit (Open)
13	Right Rear Wheel Speed Sensor Circuit (Open)
14	Left Rear Wheel Speed Sensor Circuit (Open)
16	Power Supply System
21	Right Front Wheel Speed Sensor Circuit (Short)
22	Left Front Wheel Speed Sensor Circuit (Short)
23	Right Rear Wheel Speed Sensor Circuit (Short)
24	Left Rear Wheel Speed Sensor Circuit (Short)
25	Right Front Wheel Speed Sensor (Excessive Gap)
26	Left Front Wheel Speed Sensor (Excessive Gap)
27	Right Rear Wheel Speed Sensor (Excessive Gap)
28	Left Rear Wheel Speed Sensor (Excessive Gap)
33	Brakelight Switch Circuit
35	Right Front Wheel Speed Sensor (High Speed Input)
36	Left Front Wheel Speed Sensor (High Speed Input)
37	Right Rear Wheel Speed Sensor (High Speed Input)
38	Left Rear Wheel Speed Sensor (High Speed Input)
41	Right Front Solenoid Valve Circuit (Input)
42	Left Front Solenoid Valve Circuit (Input)
43	Right Rear Solenoid Valve Circuit (Input)
44	Left Rear Solenoid Valve Circuit (Input)
45	Right Front Solenoid Valve Circuit (Output)
46	Left Front Solenoid Valve Circuit (Output)
47	Right Rear Solenoid Valve Circuit (Output)
48	Left Rear Solenoid Valve Circuit (Output)
51	Valve Relay Always Off
52	Valve Relay Always On
53	Motor Relay Always Off
54	Motor Relay Always On

(1) - See appropriate DTC under CIRCUIT TESTS.

DIAGNOSTIC TESTS

DTC 11, 12, 13 OR 14: WHEEL SPEED SENSOR CIRCUIT (OPEN)

NOTE: DTCs 11, 12, 13 and 14 are displayed when sensor with open circuit is identified. DTC 12 is also displayed if incorrect ABS ECU is installed.

1) Inspect condition of suspected speed sensor. Ensure tip of speed sensor is clean. If speed sensor is okay, go to next step.

2) Disconnect sensor connector. Using DVOM, check resistance between sensor terminals. If resistance is 1000-1200 ohms, go to next step. If resistance is not as specified, replace sensor.

3) Remove sensor. Check resistance between each sensor terminal and sensor body. If resistance is 100,000 ohms or more, go to next step. If resistance is not as specified, replace sensor.

4) Inspect condition of toothed rotor. Check for broken or deformed teeth. If toothed rotor is okay, go to next step.

5) Turn ignition off. Disconnect ABS ECU 22-pin and 26-pin connectors. Check resistance between specified ABS ECU connector terminals. See WHEEL SPEED SENSOR CIRCUIT IDENTIFICATION table. See Figs. 3-4. If resistance is 1000-1200 ohms, go to step 7). If resistance is not as specified, go to next step.

WHEEL SPEED SENSOR CIRCUIT IDENTIFICATION

Application	Terminals No.
Left Front	10 & 23
Right Front	34 & 45
Left Rear	35 & 46
Right Rear	9 & 22

6) Check connectors and wiring of each circuit between ABS ECU and sensor. See WIRING DIAGRAMS. Repair connectors and wiring as needed.

7) Check ABS ECU connectors. Repair connectors as needed. If connectors are okay, replace ABS ECU.

DTC 16: POWER SUPPLY SYSTEM

NOTE: DTC 16 is output when ABS ECU power supply voltage is not within standard value. If voltage returns to normal, DTC will be erased.

1) Ensure battery voltage is 10-17 volts. Turn ignition off. Disconnect ABS ECU 26-pin connector. Start engine. Using DVOM, check voltage between ABS ECU 26-pin connector terminal No. 12 and ground. See Figs. 3-4. If voltage is 10-17 volts, go to step 3). If voltage is not as specified, go to next step.

2) Check fuse No. 13. If fuse is okay, check continuity between fuse No. 13 connector (Black wire) and ignition switch, and fuse No. 13 connector (Blue wire) and ABS ECU 26-pin connector terminal No. 12. Repair wiring as needed. If circuit is okay, inspect charging system. Repair charging system as needed.

3) Check ABS ECU 26-pin connector. Repair connector as needed. If connector is okay, replace ABS ECU.

DTC 21, 22, 23 OR 24: WHEEL SPEED SENSOR CIRCUIT (SHORT)

NOTE: DTCs 21, 22, 23 and 24 are displayed when sensor with short circuit is identified.

1) Inspect condition of suspected speed sensor. Ensure tip of speed sensor is clean. If speed sensor is okay, go to next step.

2) Disconnect sensor connector. Using DVOM, check resistance between sensor terminals. If resistance is 1000-1200 ohms, go to next step. If resistance is not as specified, replace sensor.

3) Remove sensor. Check resistance between each sensor terminal and sensor body. If resistance is 100,000 ohms or more, go to next step. If resistance is not as specified, replace sensor.

4) Inspect condition of toothed rotor. Check for broken or deformed teeth. If toothed rotor is okay, go to next step.

5) Turn ignition off. Disconnect ABS ECU 22-pin and 26-pin connectors. Check for continuity between specified ABS ECU connector terminals and ground. See
WHEEL SPEED SENSOR POWER CIRCUIT IDENTIFICATION table. See Figs. 3-4. If continuity does exists, repair circuit between ABS ECU and wheel

speed sensor as necessary. See WIRING DIAGRAMS. If continuity does not exist, replace ABS ECU.

WHEEL SPEED SENSOR POWER CIRCUIT IDENTIFICATION

Application	Terminals No.
Left Front	23
Right Front	45
Left Rear	46
Right Rear	22

DTC 25, 26, 27 OR 28: EXCESSIVE WHEEL SPEED SENSOR GAP

NOTE: DTCs 25, 26, 27 and 28 are displayed when detection speed of wheel speed sensor is less than standard value.

1) Inspect speed sensor installation. See WHEEL SPEED SENSOR under REMOVAL & INSTALLATION. Correct speed sensor installation as needed. If sensor is properly installed, go to next step.

2) Raise and support vehicle. Disconnect ABS ECU connectors. Using DVOM, backprobe specified ABS ECU connector terminals. See WHEEL SPEED SENSOR OUTPUT CIRCUIT IDENTIFICATION table. See Figs. 3-4. Check voltage between each harness connector terminal while rotating wheel at 1/2 to one rotation per second. If pulse voltage is 70 mV or more, go to step 7). If voltage is not as specified, go to next step.

WHEEL SPEED SENSOR OUTPUT CIRCUIT IDENTIFICATION

Application	Terminals No.
Left Front	26 & 39
Right Front	8 & 19
Left Rear	7 & 18
Right Front	27 & 40

3) Disconnect sensor connector. Using DVOM, check resistance between sensor terminals. If resistance is 1000-1200 ohms, go to next step. If resistance is not as specified, replace sensor.

4) Remove sensor. Check resistance between each sensor terminal and sensor body. If resistance is 100,000 ohms or more, go to next step. If resistance is not as specified, replace sensor.

5) Inspect condition of toothed rotor. Check for broken or deformed teeth. If toothed rotor is okay, go to next step.

6) Turn ignition off. Disconnect ABS ECU connectors. Check and repair wiring harness between ABS ECU and wheel speed sensor as necessary. See WIRING DIAGRAMS.

7) Inspect sensor twisted-pair wires. Check for damage to cables and flex cables to check for open circuits. Repair twisted-pair wires as needed. If twisted-pair wires are okay, replace ABS ECU.

DTC 33: BRAKELIGHT SWITCH CIRCUIT

NOTE: DTC 33 is output if an open circuit is detected when brakelight switch is on for 15 minutes or more. DTC will also be output if a short circuit is detected.

1) Check if brakelights are functioning correctly. If brakelights function correctly, go to next step. If brakelights do not function correctly, check brakelight circuit and repair as needed.

2) Turn ignition off. Disconnect ABS ECU 26-pin connector.

Using DVOM, check voltage between ABS ECU 26-pin connector terminal No. 4 (Green wire) and ground while depressing brake pedal. If battery voltage is not present, repair or replace wiring harness between brakelight switch and ABS ECU. If battery voltage is present, go to next step.

3) Check ABS ECU 26-pin connector. Repair connector as needed. If connector is okay, replace ABS ECU.

DTC 35, 36, 37 & 38: WHEEL SPEED SENSOR (HIGH SPEED INPUT)

NOTE: DTCs 35, 36, 37 and 38 are output if a sensor pulse equal to a vehicle speed of 186 MPH or more is input to ABS ECU due to ignition noise or excessive axle vibration.

1) Inspect speed sensor installation. See WHEEL SPEED SENSOR under REMOVAL & INSTALLATION. Correct speed sensor installation as needed. If sensor is properly installed, go to next step.

2) Raise and support vehicle. Disconnect ABS ECU connectors. Using DVOM, backprobe specified ABS ECU connector terminals. See WHEEL SPEED SENSOR OUTPUT CIRCUIT IDENTIFICATION table. See Figs. 3-4. Check voltage between each harness connector terminal while rotating wheel at 1/2 to one rotation per second. If pulse voltage is 70 mV or more, go to step 7). If voltage is not as specified, go to next step.

3) Disconnect sensor connector. Using DVOM, check resistance between sensor terminals. If resistance is 1000-1200 ohms, go to next step. If resistance is not as specified, replace sensor.

4) Remove sensor. Check resistance between each sensor terminal and sensor body. If resistance is 100,000 ohms or more, go to next step. If resistance is not as specified, replace sensor.

5) Inspect condition of toothed rotor. Check for broken or deformed teeth. If toothed rotor is okay, go to next step.

6) Ensure all wheel bearings do not have any perceptible lateral movement. See BRAKE SYSTEM article for inspection procedures. If bearings are okay, inspect sensor harness for damage. Repair harness as needed.

7) Inspect sensor twisted-pair wires. Check for damage to cables and flex cables to check for open circuits. Repair twisted-pair wires as needed. If twisted-pair wires are okay, replace ABS ECU.

DTC 41- 48: SOLENOID VALVE CIRCUIT

NOTE: DTCs 41- 48 will be output if the ABS ECU detects a short or open in solenoid valve harness or solenoid coil.

1) Ensure battery voltage is 10-17 volts. Turn ignition off. Disconnect hydraulic unit 2-pin and 10-pin connectors. Using DVOM, check resistance between 2-pin connector terminal No. 31 or 32 (Green Yellow wires) and each 10-pin connector terminal (except terminals No. 5 and 10). See Fig. 7. Go to next step.

2) Resistance on input circuits should be 5.5-6.5 ohms, and 2.95-3.95 ohms on output circuits. See HYDRAULIC UNIT CONNECTOR CIRCUIT IDENTIFICATION table. If resistance is not as specified on each circuit, replace hydraulic unit. If resistance is as specified, go to next step.

HYDRAULIC UNIT CONNECTOR CIRCUIT IDENTIFICATION

Application	Terminals No.
Input Circuits	1, 2, 3, & 4
Output Circuits	6, 7, 8 & 9

3) Disconnect ABS ECU connectors. Check continuity of circuits between ABS ECU connectors and hydraulic unit 10-pin connector. See WIRING DIAGRAMS. If continuity does not exist in any circuit, inspect and repair suspected circuit(s) as needed. If continuity exists in all circuits, go to next step.

4) Check continuity between hydraulic unit 2-pin connector terminals No. 31 and 32, and ABS valve relay connector terminal No. 3. See WIRING DIAGRAMS. If continuity does not exist on either circuit, inspect and repair suspected circuit as needed. If continuity exists on both circuits, go to next step.

5) Check hydraulic unit 2-pin connector. Repair connector as needed. If connector is okay, replace ABS ECU.

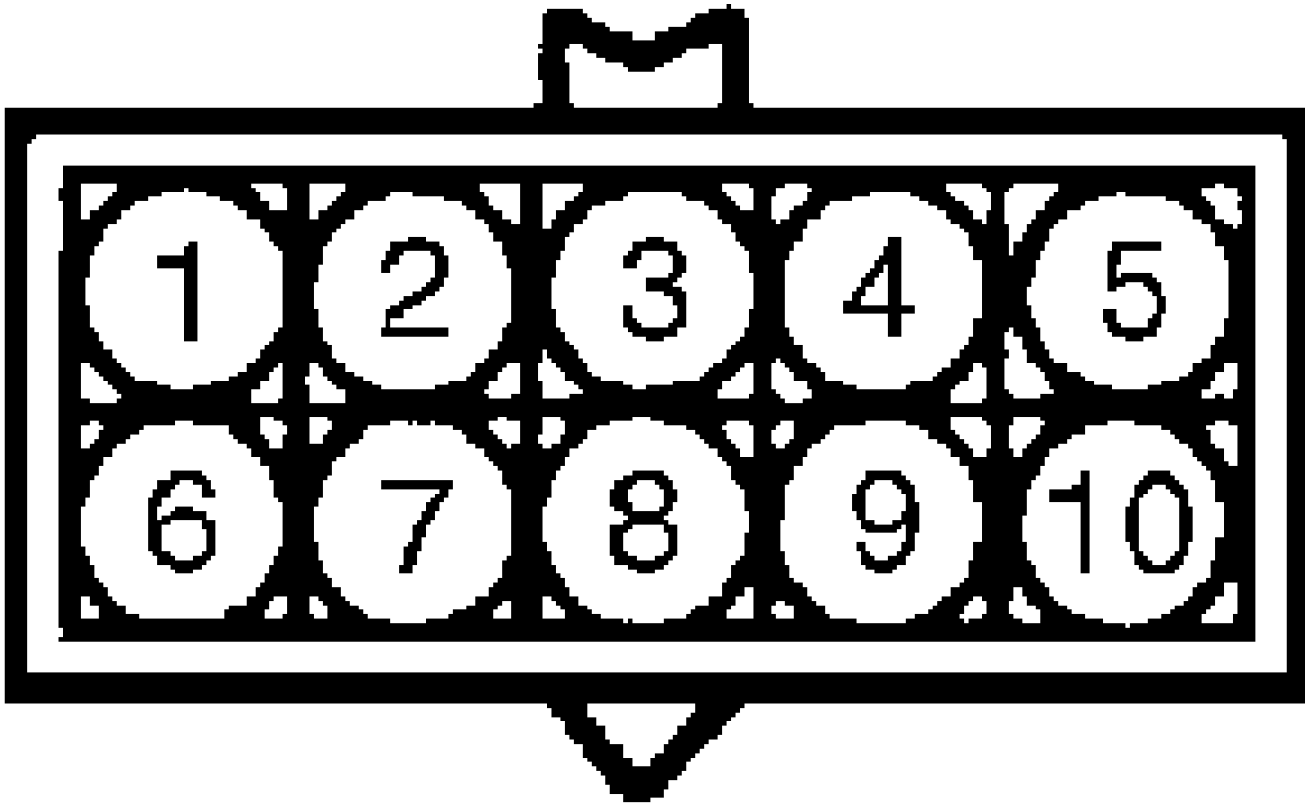


Fig. 7: Identifying Hydraulic Unit 10-Pin Harness Connector
Courtesy of Mitsubishi Motor Sales of America.

DTC 51: VALVE RELAY ALWAYS OFF

NOTE: DTC is output if ABS ECU detects relay is removed or if power is supplied to relay but relay does not energize.

1) Ensure battery voltage is 10-17 volts. Remove and test valve relay. See HYDRAULIC UNIT RELAYS under COMPONENT TESTS. Replace relay if needed. If relay is okay, go to next step.

2) Using DVOM, check voltage between valve relay connector terminal No. 6 (White/Yellow wire) and ground. See Fig. 8. If battery voltage is present, go to step 4). If battery voltage is not present, go to next step.

3) Check condition of fuse No. 1. Replace fuse if needed. If fuse is okay, inspect and repair circuit between fuse No. 1 and relay connector terminal No. 6.

4) Install valve relay. Turn ignition off. Disconnect ABS ECU 26-pin connector. Turn ignition on. Check voltage between ABS ECU 26-pin connector terminal No. 13 and ground. See Figs. 3-4. If battery voltage is present, go to step 6). If battery voltage is not present, go to next step.

5) Check and repair connectors and related wiring harness between ignition switch and ABS relay valve as needed. If connectors and wiring harness are okay, check and repair wiring harness between fusible link No. 13 and ABS ECU.

6) Check voltage between ABS valve relay connector terminal No. 3 (Green/Yellow wire) and ABS ECU 22-pin connector terminal No. 43 (Green/Yellow wire). If battery voltage is present, go to next step. If battery voltage is not present, inspect and repair circuit between ABS ECU terminal No. 43 and relay connector terminal No. 3.

7) Check ABS ECU 22-pin connector. Repair connector as needed. If connector is okay, replace ABS ECU.

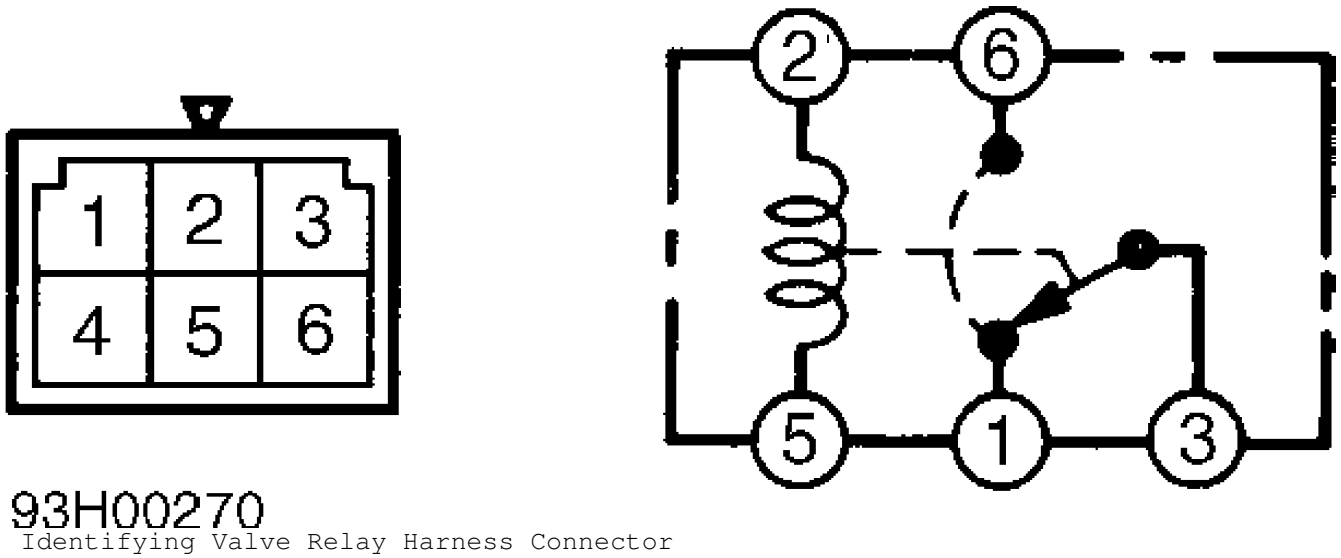


Fig. 8: Identifying Valve Relay Harness Connector
Courtesy of Mitsubishi Motor Sales of America.

DTC 52: VALVE RELAY ALWAYS ON

NOTE: DTC is output if ABS ECU detects relay is removed or if no power is supplied to relay and relay remains energized.

1) Remove and test valve relay. See HYDRAULIC UNIT RELAYS under COMPONENT TESTS. Replace relay if needed. If relay is okay, go to next step.

2) Turn ignition off. Disconnect ABS ECU 26-pin connector. Turn ignition on. Check voltage between ABS ECU 26-pin connector terminal No. 13 and ground. See Figs. 3-4. If battery voltage is present, replace ABS ECU. If battery voltage is not present, inspect and repair circuit between ABS ECU terminal No. 13 and relay connector.

DTC 53: MOTOR RELAY ALWAYS OFF

NOTE: DTC is output if ABS ECU detects relay is removed or if power is supplied to relay but relay does not energize.

1) Using scan tool, perform actuator tests No. 1-5. Refer to scan tool manufacturer's instructions for actuator test procedure. If hydraulic unit motor can be heard operating during each actuator test, go to step 6). If motor cannot be heard during specific actuator test(s), go to next step.

2) Remove and test motor relay. See HYDRAULIC UNIT RELAYS under COMPONENT TESTS. Replace relay if needed. If relay is okay, go to next step.

3) Check voltage between relay connector terminal No. 5 and ground. See Fig. 9. If battery voltage is present, go to next step. If battery voltage is not present, inspect and repair wiring harness between fusible link No. 4 and ABS motor relay.

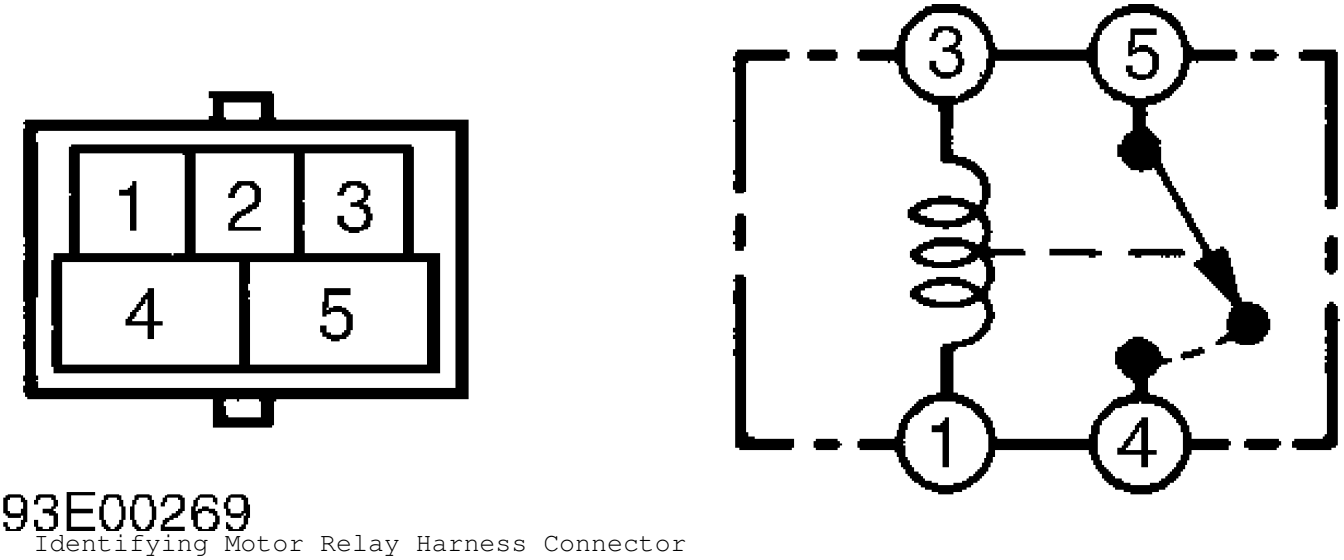


Fig. 9: Identifying Motor Relay Harness Connector
Courtesy of Mitsubishi Motor Sales of America.

4) Turn ignition off. Disconnect ABS ECU 22-pin connector. Check voltage between ABS ECU 22-pin connector terminal No. 31 and ground. See Figs. 3-4. If battery voltage is present, go to next step. If voltage is not present, inspect and repair circuit between ABS ECU terminal No. 31 and relay connector terminal No. 1.

5) Check ABS ECU 22-pin connector. Repair connector as needed. If connector is okay, replace ABS ECU.

6) Disconnect hydraulic unit 10-pin connector. Check resistance between 10-pin connector (component side) terminals No. 5 and 10. See Fig. 7. If resistance is 10-13 ohms, go to next step. If resistance is not within specification, replace hydraulic unit.

7) Turn ignition off. Disconnect ABS ECU 22-pin connector. Check resistance between ABS ECU 22-pin connector terminals No. 33 and 44. If resistance is 10-13 ohms, go to step 9). If resistance is not as specified, go to next step.

8) Inspect connectors and related wiring harness between ABS ECU and hydraulic unit. Repair connectors and wiring harness as needed. If connectors and wiring harness are okay, replace hydraulic unit.

9) Check ABS ECU 22-pin connector. Repair connector as needed. If connector is okay, replace ABS ECU.

DTC 54: MOTOR RELAY ALWAYS ON

NOTE: DTC 54 may output if hydraulic motor sensor is registering motor revolutions due to noise interference, even though motor relay is off .

1) Turn ignition switch to ON position. Monitor operation of hydraulic unit motor. Turn ignition off. If motor stops, replace ABS ECU. If motor continues to operate, go to next step.

2) Remove and inspect motor relay. See HYDRAULIC UNIT RELAYS under COMPONENT TESTS. Replace relay if needed. If relay is okay, go to next step.

3) Inspect and repair connectors and wiring harness between hydraulic unit and ABS ECU 22-pin connector terminal No. 44 (Black/Blue wire). See WIRING DIAGRAMS. If connectors and wiring harness are okay, go to next step.

4) Check and repair connectors and wiring harness between ABS motor relay and ABS ECU 22-pin connector terminal No. 31. See WIRING DIAGRAMS. If connectors and wiring harness are okay, replace ABS ECU.

COMPONENT TESTS

HYDRAULIC UNIT RELAYS

NOTE: Relays are mounted next to hydraulic unit.

Motor Relay

1) Remove relay. See Fig. 10. Using a DVOM, check resistance between relay terminals No. 1 and 3. See Fig. 9. Resistance should be 49-99 ohms. Check for continuity between terminals No. 4 and 5. Continuity should not exist.

2) Apply battery voltage and ground between relay terminals No. 1 and 3. Check for continuity between terminals No. 4 and 5. Continuity should be zero ohms. If relay does not test as specified, replace relay.

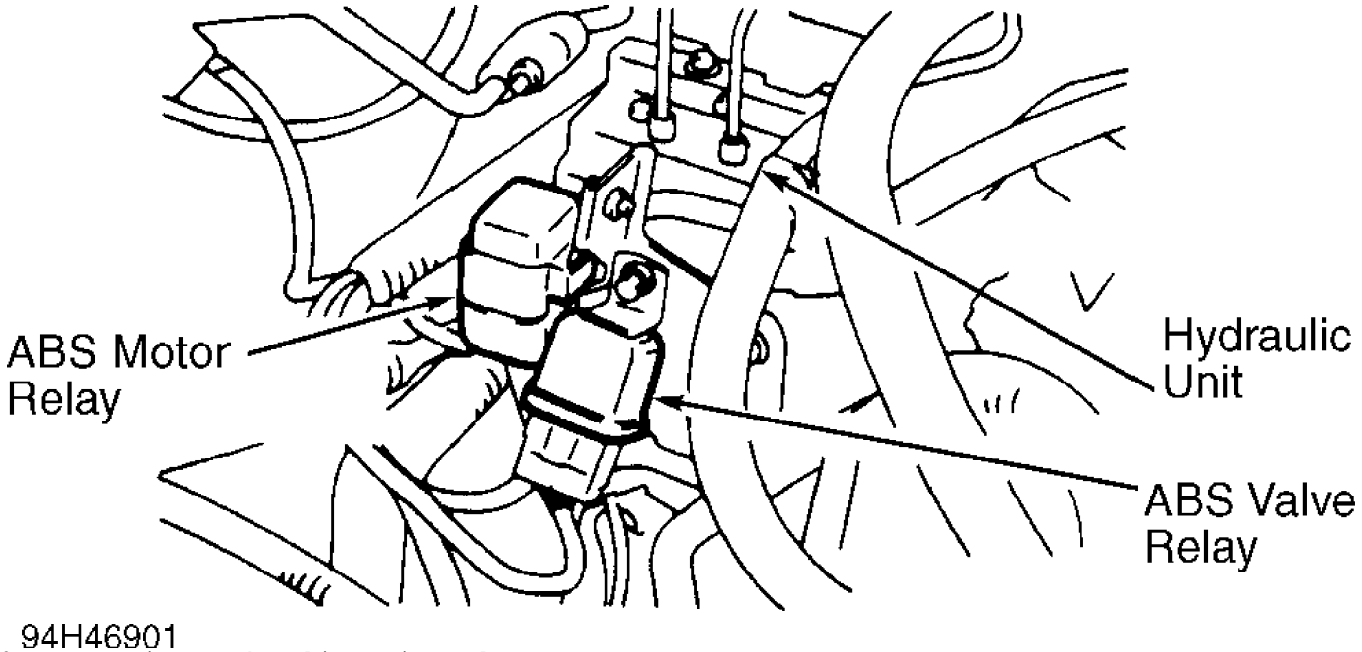


Fig. 10: Locating Hydraulic Unit Relays
Courtesy of Mitsubishi Motor Sales of America.

Valve Relay

1) Remove relay. Using a DVOM, check resistance between relay terminals No. 2 and 5. See Fig. 8. Resistance should be 55-105 ohms.

Check resistance between terminals No. 1 and 3. Resistance should be zero ohms.

2) Check for continuity between relay terminals No. 3 and 6. Continuity should not exist. Apply battery voltage and ground between terminals No. 2 and 5. Check for continuity between terminals No. 1 and 3. Continuity should not exist.

3) Check for resistance between terminals No. 3 and 6. Resistance should be zero ohms. If relay does not test as specified, replace relay.

WHEEL SPEED SENSOR

Sensor Resistance Test

1) Before testing sensor resistance, ensure pole piece-to-wheel speed sensor tip is clean. Check wheel sensor pole piece for damage. Replace pole piece if damaged.

2) Disconnect sensor connector. Inspect sensor wiring harness for broken and pinched wires. Repair or replace harness as necessary. Using a DVOM, check sensor resistance across wiring connector terminals. Resistance should be 1000-2000 ohms. If resistance is not as specified, replace sensor. If resistance is as specified, go to GROUND CIRCUIT TEST.

Ground Circuit Test

Disconnect wheel speed sensor connector. Check resistance between each wheel speed sensor terminal and sensor housing. Resistance should be more than 100,000 ohms. If resistance is less than specified, replace wheel speed sensor.

REMOVAL & INSTALLATION

ABS ECU

Remove dash panel under glove box. Remove passenger scuff plate. Remove right kick panel. Ensure ignition is off. Disconnect ABS ECU harness connectors. Remove ABS ECU. See Fig. 11. To install, reverse removal procedure.

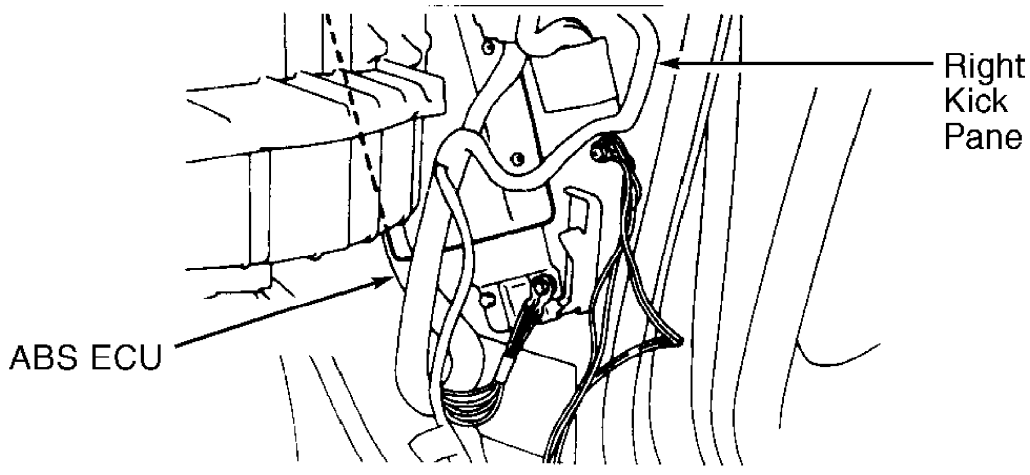


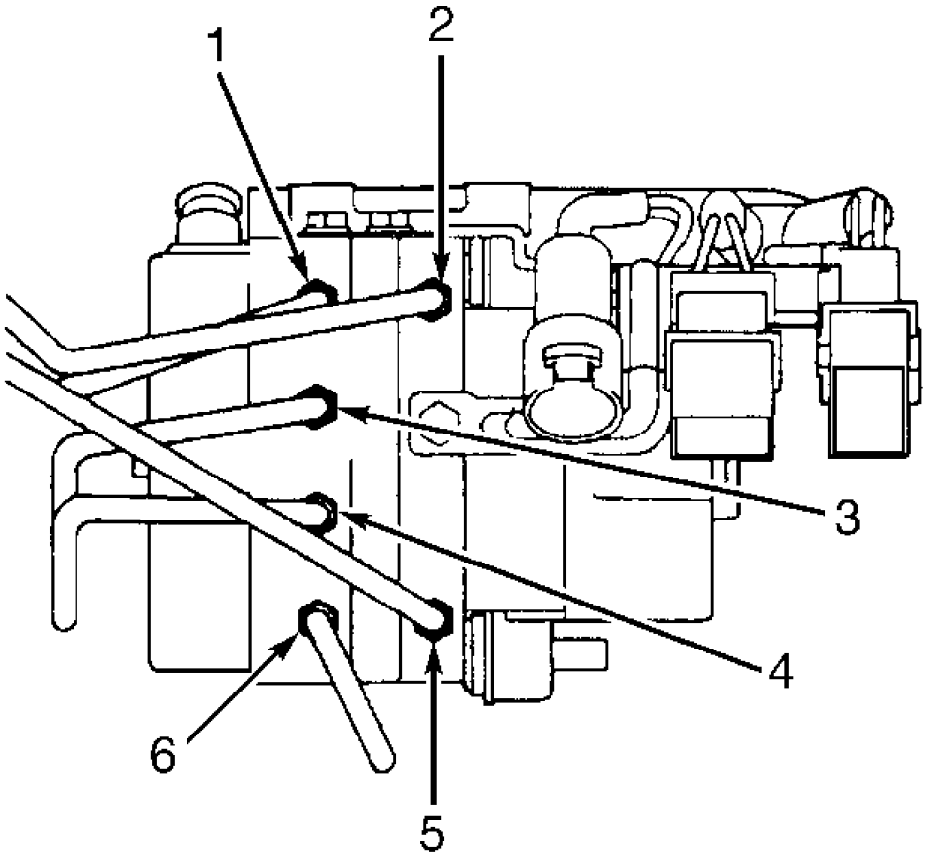
Fig. 11: Locating ABS ECU
Courtesy of Mitsubishi Motor Sales of America.

HYDRAULIC UNIT

CAUTION: DO NOT turn hydraulic unit upside down or lay unit on its side. DO NOT drop hydraulic unit. DO NOT disassemble unit. Replace hydraulic unit as an assembly. If unit is replaced, slowly release safety plug to release internal gas.

Removal & Installation

Remove air intake hose. Remove mounting bracket and relays. Disconnect brakelines and harness connectors. Remove hydraulic unit. To install, reverse removal procedure. Ensure brakelines are correctly installed. See Fig. 12.



1. Hydraulic Unit-To-Right Rear Brake
2. From Master Cylinder (For Right Front & Left Rear)
3. Hydraulic Unit-To-Right Front Brake
4. Hydraulic Unit-To-Left Rear Brake
5. From Master Cylinder (For Left Front & Right Rear)
6. Hydraulic Unit-To-Left Front Brake

98A12047

Fig. 12: Identifying Hydraulic Unit Brakeline Connections
Courtesy of Mitsubishi Motor Sales of America.

WHEEL SPEED SENSOR

NOTE: Before removing wheel speed sensor, note sensor wiring harness routing for installation reference.

Removal (Front)

Raise and support vehicle. Remove front wheel. Remove splash shield. Remove retaining clips from speed sensor wiring harness. Disconnect speed sensor connector. Remove sensor mounting bolt. Note sensor wiring harness routing, and remove sensor.

Installation

1) Install speed sensor bracket if removed. Sensor mounting brackets are not interchangeable from side-to-side. Each bracket is stamped with an "FR" indicating front bracket, and an "R" or "L" to indicate right or left.

2) Temporarily install speed sensor. Route speed sensor wiring harness in its original location, and ensure no twists exist in harness. To complete installation, reverse removal procedure.

Removal (Rear)

Raise and support vehicle. Remove rear wheel. Remove retaining clips and band from speed sensor wiring harness. Disconnect speed sensor connector. Remove sensor mounting bolt. Note sensor wiring harness routing, and remove sensor.

Installation

1) Install sensor bracket if removed. Sensor mounting brackets are not interchangeable from side-to-side. Each bracket is stamped with an "R" or "L" to indicate right or left.

2) Temporarily install speed sensor. Route speed sensor wiring harness in its original location, and ensure no twists exist in harness. Ensure sensor harness is not in contact with trailing arm. Reverse removal procedure to complete installation.

WHEEL SENSOR ROTOR

NOTE: For more information on front or rear brake assembly, see BRAKE SYSTEM article.

Removal & Installation (Front)

Raise and support vehicle. remove front wheel. Remove brake disc. Remove disc assembly. Remove wheel bearings. Remove axle hub. Remove bolts attaching sensor rotor to hub assembly. To install, reverse removal procedure.

Removal & Installation (Rear)

Raise and support vehicle. Remove rear wheel. Remove rear brake drum and shoes. Disconnect parking brake cable. Remove rear hub assembly. Remove sensor rotor. To install, reverse removal procedure.

OVERHAUL

HYDRAULIC UNIT

DO NOT attempt to overhaul or disassemble hydraulic unit. If hydraulic unit is defective, replace unit as an assembly. See HYDRAULIC UNIT under REMOVAL & INSTALLATION.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Hydraulic Unit Mounting Bolts	13-18 (18-24)
Wheel Lug Nuts	65-80 (88-108)
	INCH Lbs. (N.m)
Bleed Screw	60-84 (7-9)
Flared Brakeline Nuts	120-144 (14-16)
Front Sensor Rotor Mounting Bolts	84-120 (9-14)
Wheel Speed Sensor Bolt	84-120 (9-14)

WIRING DIAGRAMS

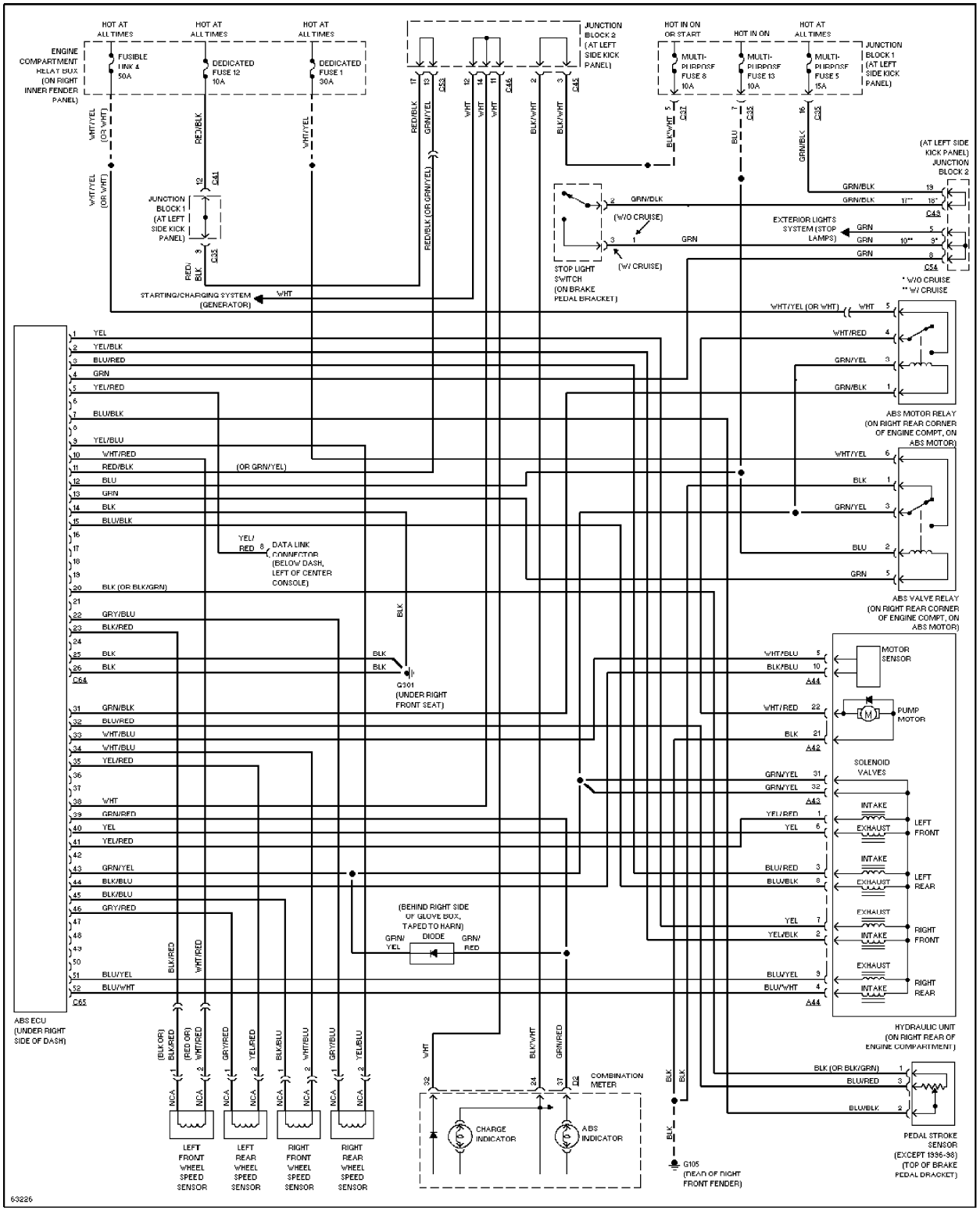


Fig. 13: Anti-Lock Brake System (ABS) Wiring Diagram (1997-98 Galant)

ANTI-THEFT SYSTEM

1998 Mitsubishi Galant

1998 ACCESSORIES & EQUIPMENT
Mitsubishi - Anti-Theft Systems

Galant

DESCRIPTION & OPERATION

WARNING: Deactivate air bag system before performing any service operation. See AIR BAG RESTRAINT SYSTEMS article. Do not apply electrical power to any component on steering column without first deactivating air bag system. Air bag may deploy.

Anti-theft system electrically disables starter, flashes lights and sounds an alarm if any door, luggage compartment or hood is forcibly opened, or if battery cables are disconnected then reconnected when anti-theft system is active.

Anti-theft system is controlled by Electronic Timer Alarm Control System (ETACS). ETACS-ECU is located under instrument panel to left of footwell. See Fig. 1.

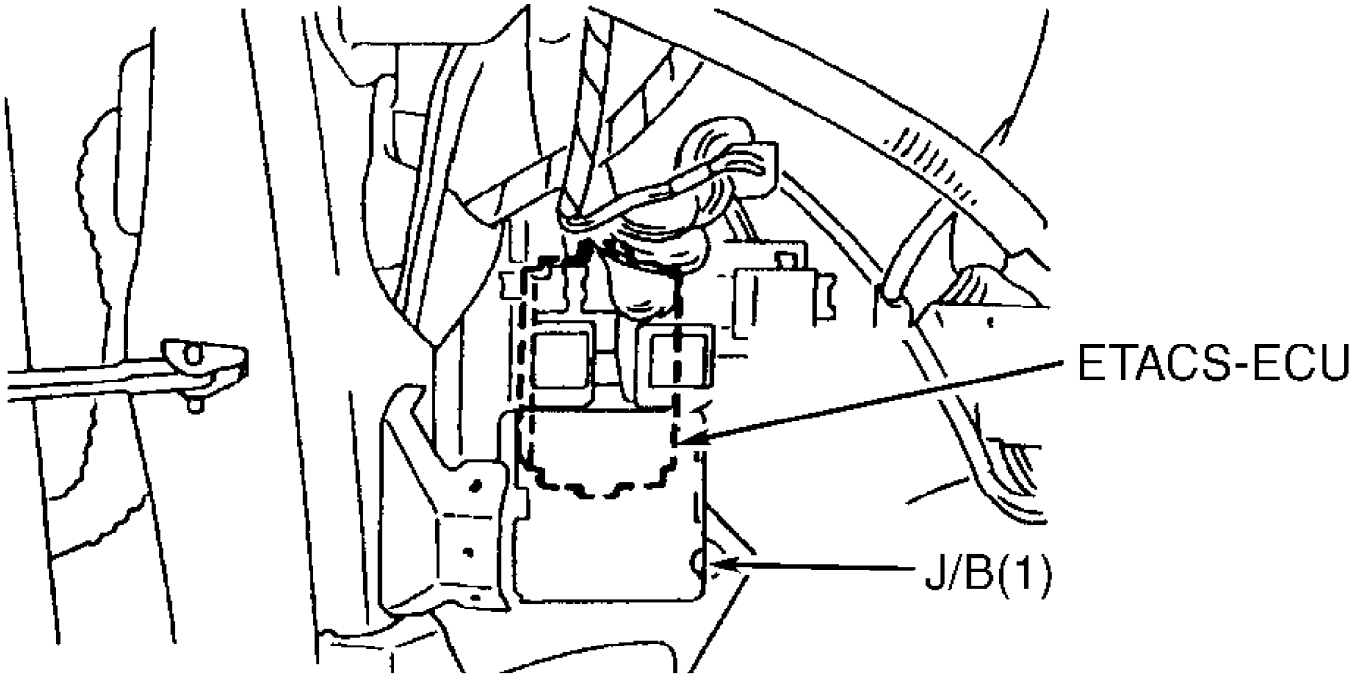


Fig. 1: Locating ETACS-ECU
Courtesy of Mitsubishi Motor Sales of America

NOTE: System will not arm if any door is ajar.

Arming Anti-Theft System

Close all doors, hood and luggage compartment. Remove ignition key from ignition switch. Lock vehicle using key, remote control switch or by using power door lock switch.

After locking vehicle using one of these methods, indicator light (SECURITY) on instrument panel will light continuously for about

20 seconds. After about 20 seconds, indicator light will go out, indicating system is armed.

Anti-theft system will also be armed if while indicator light is on, hood or luggage compartment is opened or closed. System will be armed even if hood or luggage compartment is open, but when system is set, ensure hood and luggage compartment are locked. Luggage compartment can only be unlocked by using key without triggering or disarming system even after system has been armed. When luggage compartment is locked, system will be rearmed.

Alarm Stage

Alarm will be activated if driver's or passenger's door is opened without using key or remote control switch, luggage compartment is opened without using key, or if hood is opened from outside vehicle. If alarm is activated, headlights will blink on and off for 3 minutes. After 3 minutes, headlights automatically shut off. Horn will sound intermittently for 3 minutes and starter circuit will be shut off, preventing vehicle from being started without using key.

NOTE: Alarm will continue to operate for 3 minutes. After 3 minutes, alarm will automatically shut off to save battery power. System will be rearmed until proper disarming step is taken. When key is used, starter circuit shut off is cancelled and engine can be started.

NOTE: Once system has been disarmed, it cannot be rearmed except by repeating arming procedure.

Disarming Anti-Theft System

Anti-theft system can be disarmed by unlocking driver's or passenger's door using key or remote control switch. System can also be disarmed by inserting key in ignition switch and turning to ACC or ON position. System will be disarmed if while indicator light is on, driver's or passenger's door is unlocked. System can be deactivated by turning key in driver's or passenger's door in either direction (lock or unlock) or by using key to unlock luggage compartment.

Testing Anti-Theft System

Open driver's window. Arm anti-theft system. Ensure theft alarm indicator light comes on and goes out in about 20 seconds. Wait a few seconds, then unlock driver's door by using inside door lock knob. Open door. Ensure horn sounds intermittently when door is opened and headlights blink on and off. Disarm system by unlocking driver's or passenger's door using key or remote control switch.

To check hood or luggage compartment alarm operation, open hood using hood release lever, or luggage compartment using remote release lever either before alarm is activated by opening of a door, or after first 3-minute alarm is completed.

COMPONENT LOCATIONS

For component locations, see Figs. 18-20.

TROUBLE SHOOTING

NOTE: Verify power door lock system is operating properly before trouble shooting anti-theft system. See KEYLESS ENTRY & POWER DOOR LOCKS article. Ensure all component terminals and ground connections are clean and tight. Repair or replace components and circuits as necessary.

Trouble shooting anti-theft system is accomplished with diagnosis by symptom. Locate appropriate primary symptom in SYMPTOM CHART under SYMPTOM TESTS. See Fig. 2. Refer to appropriate test in CIRCUIT TESTS under SYMPTOM TESTS for diagnosing appropriate circuit.

SYMPTOM TESTS

NOTE: If anti-theft system is not functioning properly after testing procedures are complete, substitute known-good ETACS-ECU and repeat test. ETACS-ECU is located under dash, to left of footwell.

NOTE: To diagnose symptom, see Fig. 2, then go to appropriate test under CIRCUIT TESTS.

Trouble Symptom		Circuit Test No.
Communication with scan tool is not possible.	Communication with all systems is not possible.	1
	Communication with one-shot pulse input signal only is not possible.	2
Arming/disarming relationship	The system is not armed (The SECURITY indicator doesn't illuminate, and the alarm doesn't function.)	3
	The arming procedures are followed, but the SECURITY indicator does not illuminate. (There is an alarm, however, when an alarm test is conducted after about 20 seconds have passed.)	4
	The alarm sounds in error when, while the system is armed, a door or the liftgate is unlocked by using the key.	–
Activation/deactivation relationship	There is no alarm when, as an alarm test, a door is opened without using the key. (The arming and disarming are normal, and the alarm is activated when the liftgate or hood is opened.)	–
	There is no alarm when, as an alarm test, the liftgate is opened without using the key. (The alarm is activated, however, by opening a door or the hood.)	–
	There is no alarm when, as an alarm test, the hood is opened from within the vehicle. (The alarm is activated, however, by opening a door or the liftgate.)	–
	Engine would not start	–
	When, as a test of the alarm, a door or the liftgate is opened without using the key, or the hood is opened from within the vehicle, the horn and the theft-alarm horn sound but the headlights don't flash. (The headlights can, however, be switched ON by using the passing switch.)	5
	The headlights flash during an alarm test but the horn or the theft alarm horn does not sound.	6
	The system is not deactivated when, during an alarm test in which the alarm is intentionally activated, the door or liftgate is unlocked by using the key. (The system cannot be disarmed, either.)	–

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Fig. 2: Symptom Chart
Courtesy of Mitsubishi Motor Sales of America

CIRCUIT TESTS

CAUTION: Ensure ignition switch is in OFF position when connecting or disconnecting component connectors.

CAUTION: When battery is disconnected, radio will go into anti-theft protection mode. Obtain radio anti-theft protection code from owner prior to servicing vehicle.

NOTE: Use illustrations for ETACS-ECU and other connector terminal identification. See Figs. 4-17. For wiring diagram, see WIRING DIAGRAMS.

Test No. 1

1) Using a voltmeter, check voltage between Data Link Connector (DLC) terminal No. 16 (Brown/Red wire) and ground. See Fig. 3. If battery voltage is present, go to next step. If battery voltage is not present, inspect harness connectors to junction block, DLC and ETACS-ECU. See WIRING DIAGRAMS. If connectors are okay and malfunction persists, check circuit between power supply and DLC. Repair as necessary.

2) Using an ohmmeter, check continuity between ground and DLC terminals No. 4 (Black wire) and No. 5 (Black wire). If continuity is present, scan tool is faulty. Retest using a known-good scan tool. If continuity is not present, check junction block connector. If malfunction remains, check circuit between DLC and ground. Repair as necessary.

Test No. 2

1) Using an ohmmeter, check continuity between DLC terminal No. 9 (Green/Orange wire) and ETACS-ECU harness connector terminal No. 7 (Green/Orange wire). See Figs. 4-17. If continuity does not exist, repair open in Green/Orange wire. If continuity exists, go to next step.

2) Check harness connectors to DLC, ETACS-ECU and joint connector between DLC and ETACS-ECU. Repair as necessary. If connectors are okay, replace ETACS-ECU.

Test No. 3

1) Using a voltmeter, check for battery voltage at fuse No. 12 (10-amp). If battery voltage is not present, replace fuse. If fuse is okay, inspect fusible link No. 2. If fusible link is okay, go to next step. If blown, replace fusible link.

2) Disconnect ETACS-ECU harness connector. See Figs. 4-17. Check voltage between ground and ETACS-ECU harness-side connector terminal No. 19 (Red/Black wire). If battery voltage is present, go to next step. If battery voltage is not present, check joint connector and ETACS-ECU harness connector. Repair as necessary. If connectors are okay and malfunction persists, check circuit between fusible link No. 2 and ETACS-ECU. Repair as necessary.

3) Using an ohmmeter, verify continuity between ground and ETACS-ECU harness-side connector terminal No. 20 (Black wire). If continuity is present, replace ETACS-ECU. If continuity is not present, inspect harness connectors to ETACS-ECU and junction block. Repair as necessary. If connectors are okay, check circuit between ETACS-ECU and ground. Repair as necessary.

Test No. 4

1) Remove combination meter (instrument cluster). See INSTRUMENT PANELS article. If security indicator bulb is burned out, replace faulty bulb. If security indicator bulb is okay, go to next step.

2) Disconnect combination meter harness connectors. Using an ohmmeter, check continuity between harness connector terminals No. 47 (Red/Black wire) and No. 7 (Brown/White wire). If continuity is not

present, replace combination meter. If continuity is present, go to next step.

3) Using a voltmeter, check for battery voltage between combination meter harness-side connector terminal No. 47 (Red/Black wire) and ground. If battery voltage is present, go to next step. If battery voltage is not present, check harness connectors to combination meter and in-line connector. See Figs. 4-17. See WIRING DIAGRAMS. Repair as necessary. If connectors are okay and malfunction persists, check harness connectors between combination meter and junction block. Repair as necessary. If connectors are okay, check circuit between combination meter and junction block. Repair as necessary.

4) Disconnect ETACS-ECU harness connector. Ground ETACS-ECU harness-side connector terminal No. 29 (Brown/White wire). If security indicator illuminates, replace ETACS-ECU. If security indicator does not illuminate, check harness connectors to ETACS-ECU, combination meter and joint connector between ETACS-ECU and combination meter. If connectors are okay and malfunction persists, check circuit between combination meter and ETACS-ECU. Repair as necessary. If circuit is okay, replace ETACS-ECU.

Test No. 5

1) Disconnect headlight relay harness connector. Check for battery voltage between ground and headlight relay harness-side connector terminal No. 5 (Red wire). See Figs. 4-17. If battery voltage is present, go to next step. If battery voltage is not present, check and repair headlight relay harness connector. If harness connector is okay and malfunction persists, check circuit between fusible link and headlight relay. Repair as necessary.

2) Using an ohmmeter, check continuity between theft alarm horn relay harness connector terminal No. 1 (Green wire) and ETACS-ECU harness connector terminal No. 23 (Green/Yellow wire). If continuity is present, go to next step. If continuity is not present, check joint connector and ETACS-ECU harness connector. Repair as necessary. If connectors are okay and malfunction persists, check circuit between headlight relay and ETACS-ECU. Repair as necessary.

3) Check theft alarm horn relay harness connector and repair as necessary. If connector is okay and malfunction persists, replace headlight relay.

Test No. 6

1) Check fuse No. 9 (10-amp) and replace if blown. If fuse is okay, check Red fusible link No. 3 (50-amp) and replace if blown. If fusible link is okay, check junction block connector C-48 (diode connector). Repair if necessary. If connector is okay, check diode. See WIRING DIAGRAMS. Replace if necessary. If diode is okay, go to next step.

2) Disconnect ETACS-ECU harness connector. Ground ETACS-ECU harness-side connector terminal No. 24 (Green/Black wire). See Figs. 4-17. If horn sounds, go to next step. If horn does not sound, check circuit between ETACS-ECU and theft-alarm horn relay, and between theft-alarm horn relay and ground. Repair as necessary.

3) Check continuity of theft-alarm horn relay. Replace relay as necessary. If relay is okay, go to next step.

4) Disconnect theft-alarm horn relay harness connector. Check voltage between ground and relay harness-side connector terminals No. 2 (Red wire) and No. 3 (Red wire). If battery voltage is present, go to next step. If battery voltage is not present, check theft-alarm relay harness connector and repair as necessary.

5) Check harness connectors to theft-alarm horn and theft-alarm horn relay. Repair as necessary. If connectors are okay and malfunction persists, check circuit between theft-alarm relay and ground. If circuit is okay, replace theft-alarm relay.

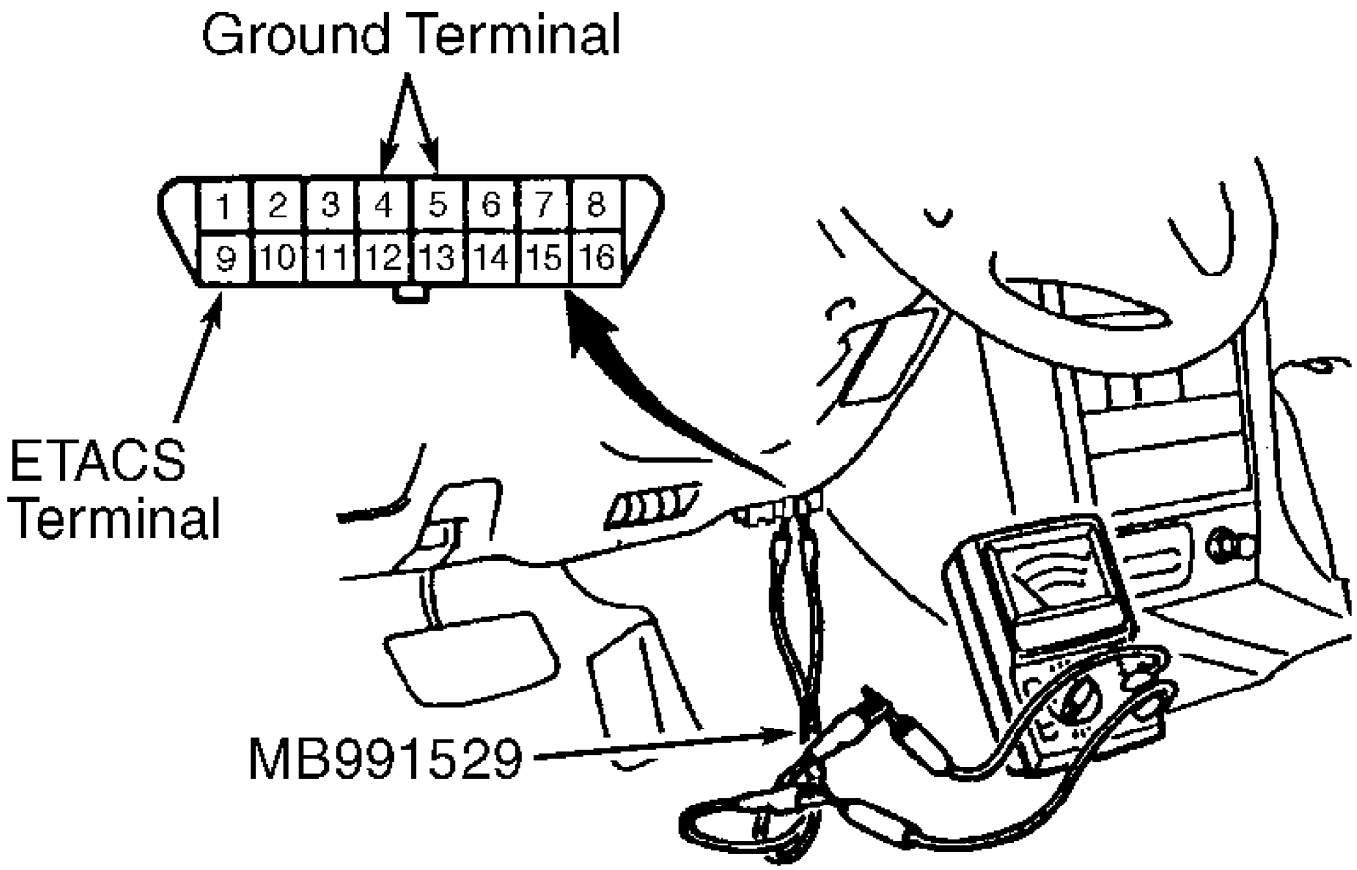

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Fig. 3: Identifying Data Link Connector Terminals
Courtesy of Mitsubishi Motor Sales of America

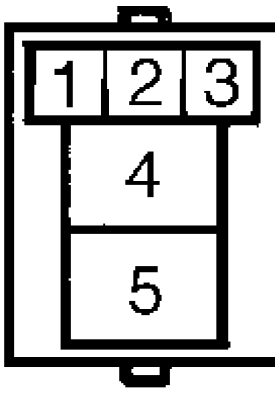

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Fig. 4: Identifying Connector Terminals: A-06X Horn Relay, A-12X Headlight Relay
Courtesy of Mitsubishi Motor Sales of America

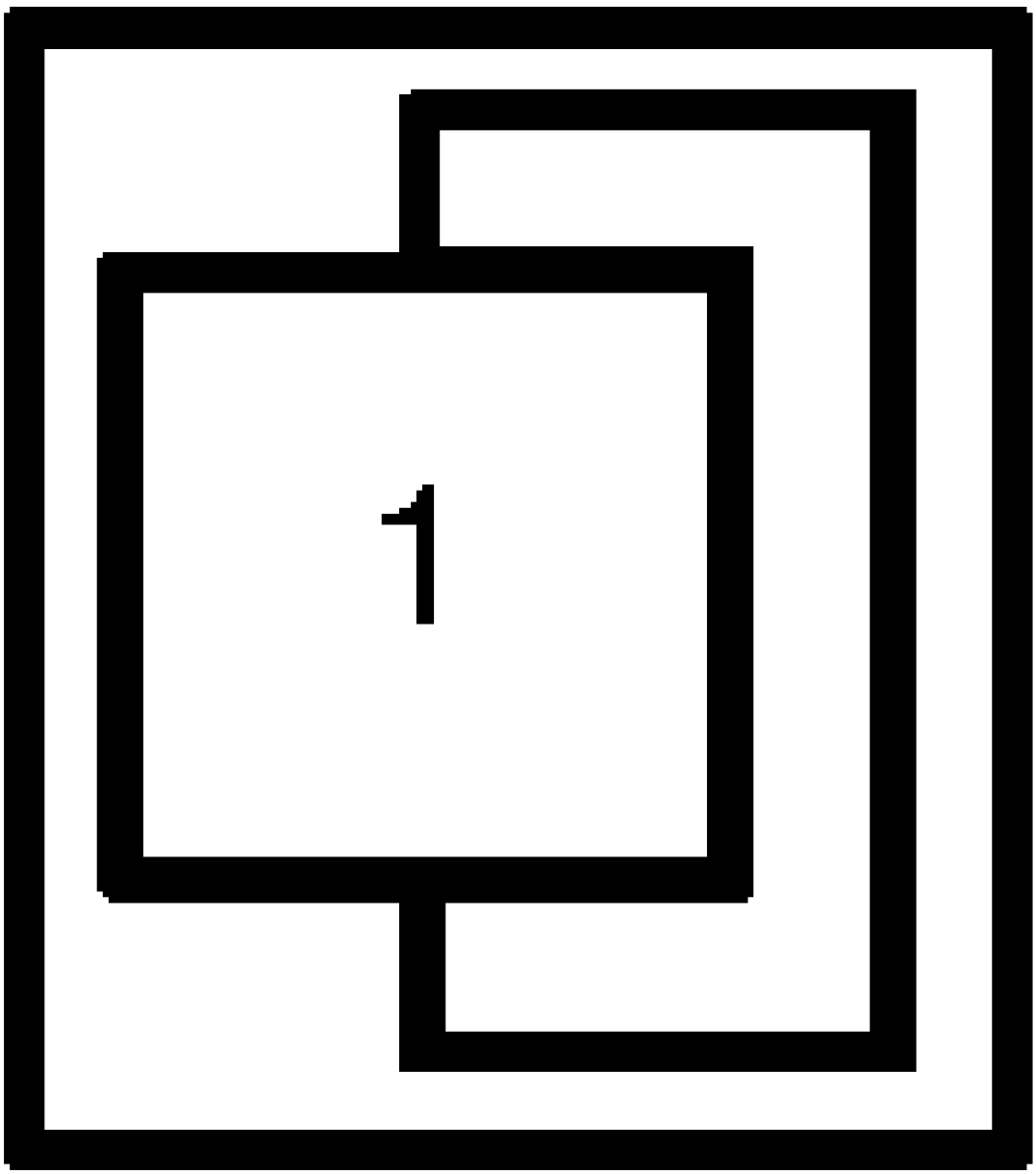

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Fig. 5: Identifying Connector Terminals: A-68 Theft Alarm Horn, A-83 Theft Alarm Horn
Courtesy of Mitsubishi Motor Sales of America

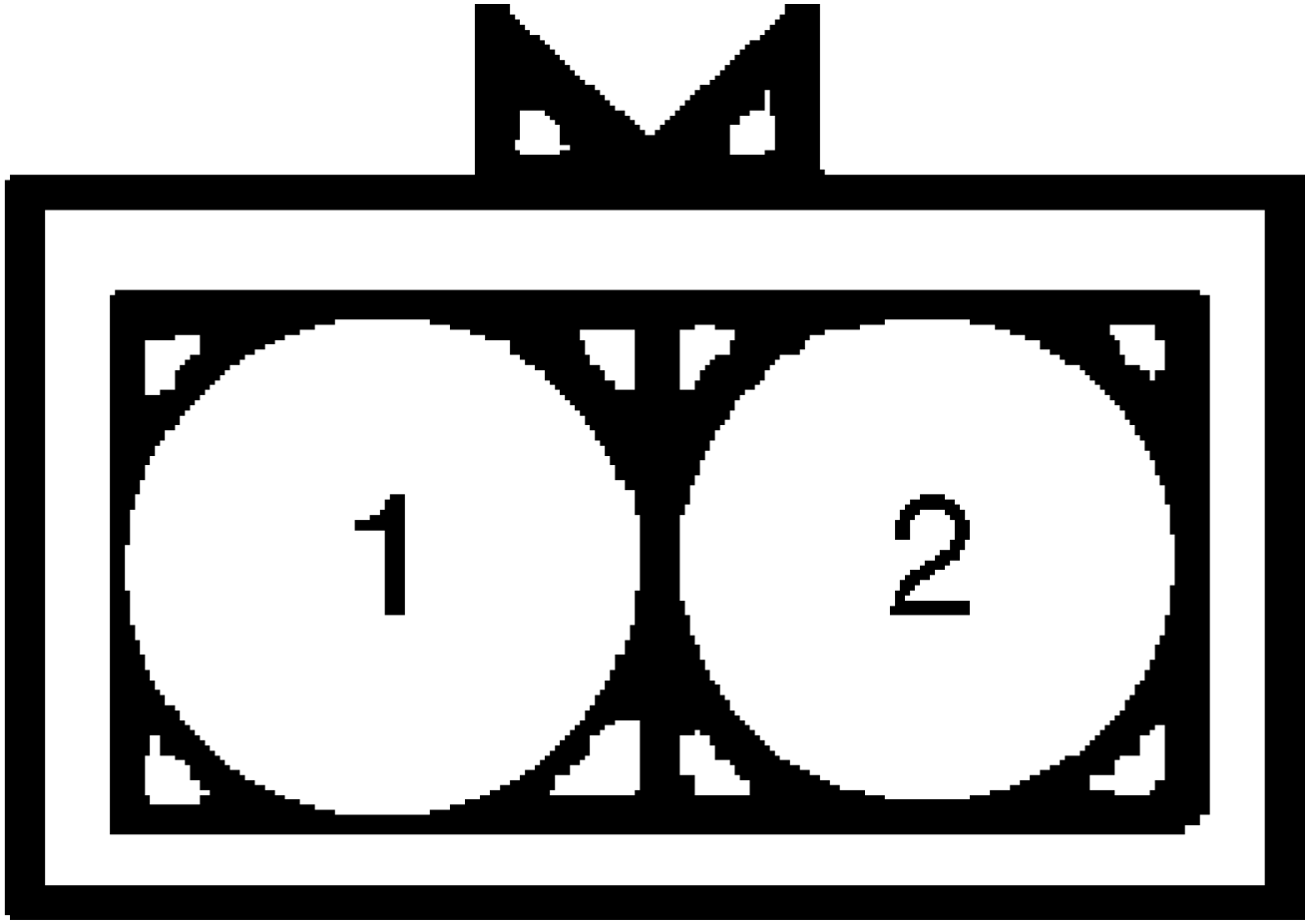

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Fig. 6: Identifying Connector Terminals: A-74 In-Line Connector Between Theft Alarm Horn Relay & Theft Alarm Horn
Courtesy of Mitsubishi Motor Sales of America

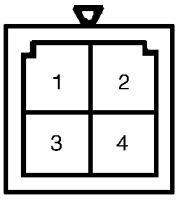

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Fig. 7: Identifying Connector Terminals: A-82 Theft Alarm Horn Relay
Courtesy of Mitsubishi Motor Sales of America

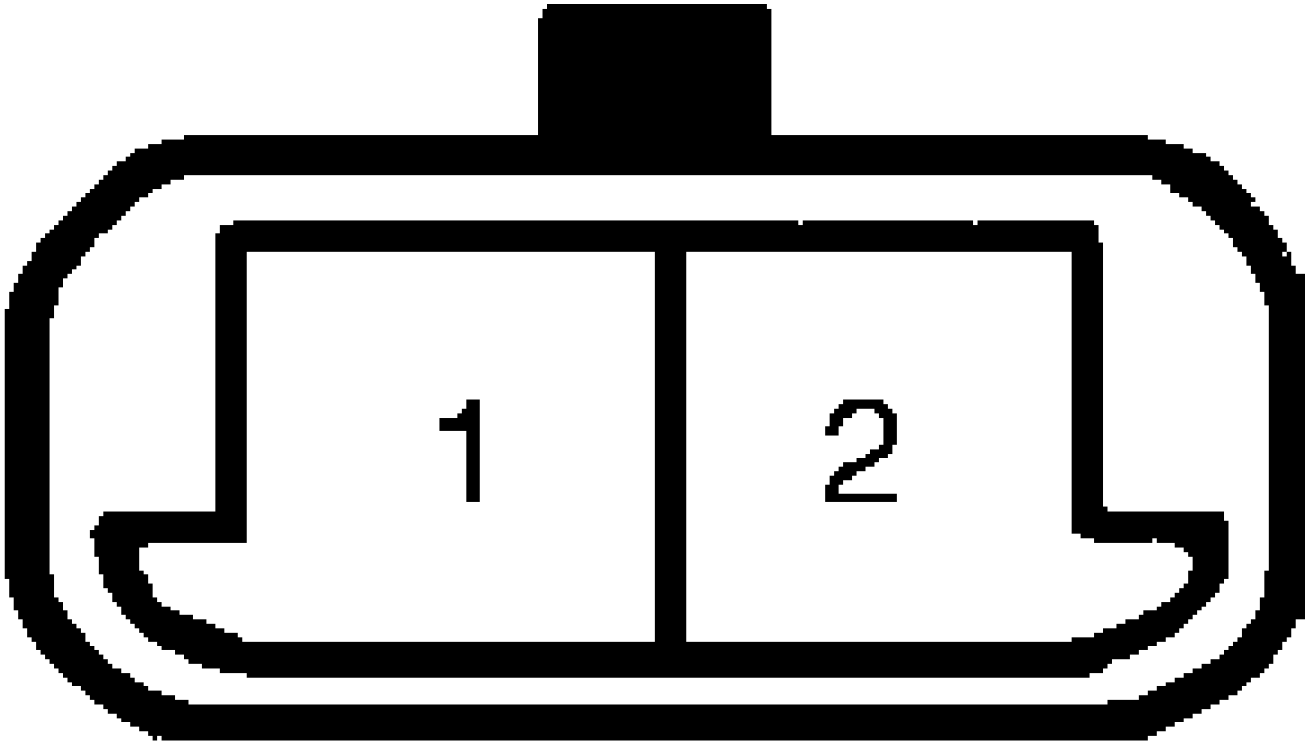

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Fig. 8: Identifying Connector Terminals: A-84 Lo Tone Horn
Courtesy of Mitsubishi Motor Sales of America

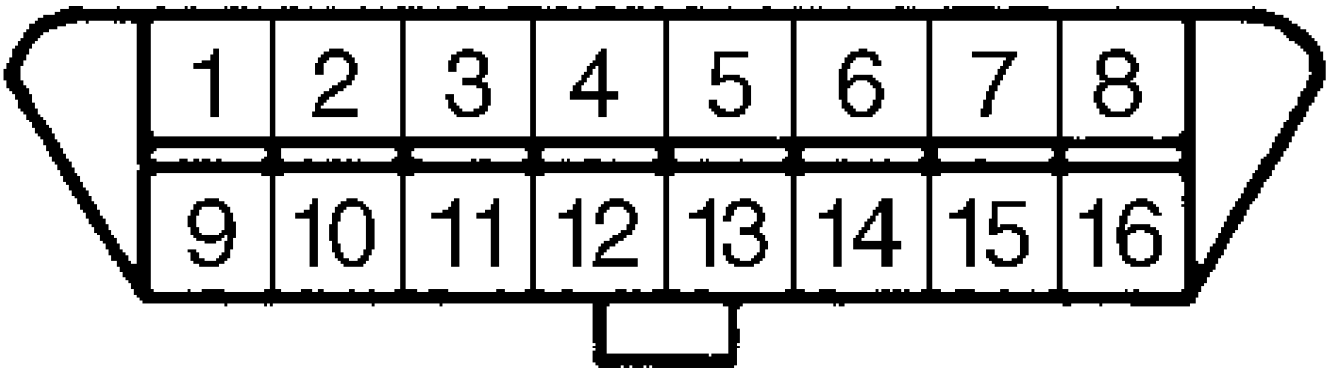

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Fig. 9: Identifying Connector Terminals: C-22 Data Link Connector
Courtesy of Mitsubishi Motor Sales of America

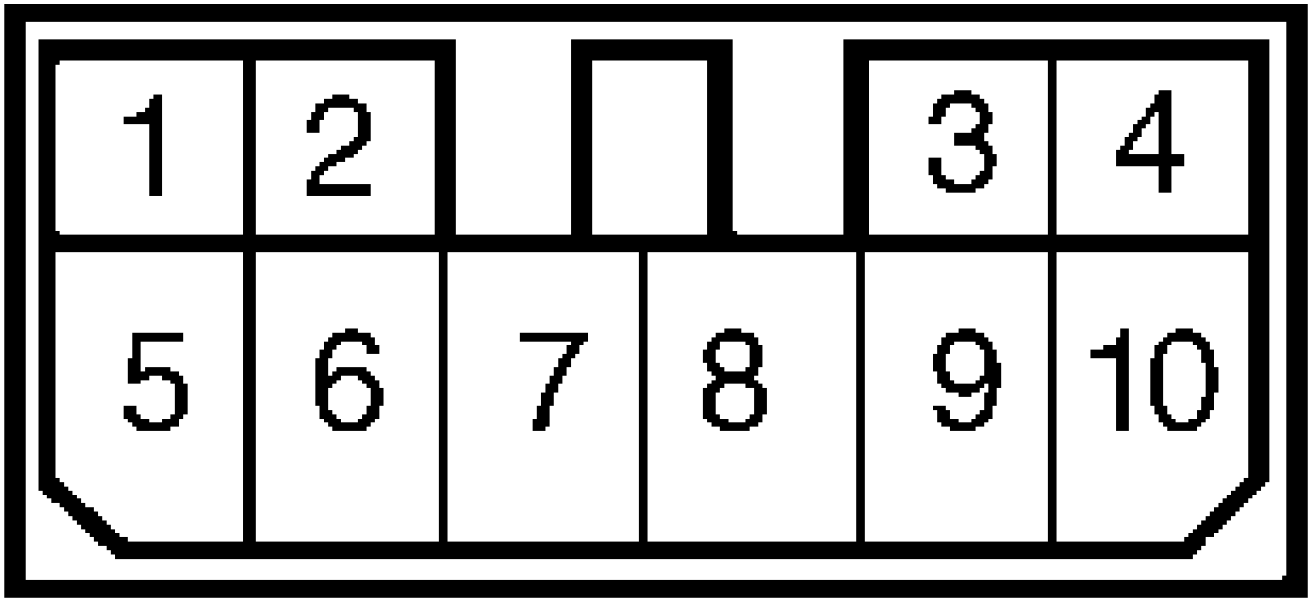

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Fig. 10: Identifying Connector Terminals: C-34 Junction Block To Column Switch
Courtesy of Mitsubishi Motor Sales of America

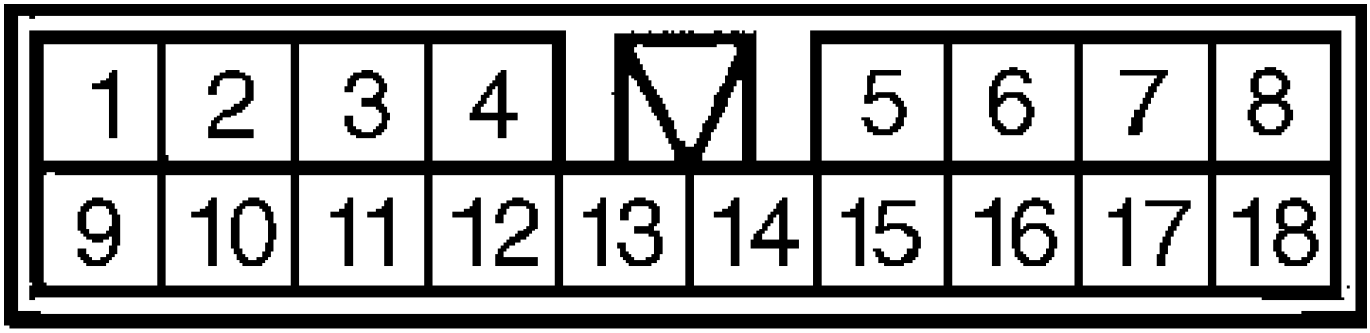

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Fig. 11: Identifying Connector Terminals:
C-35 In-Line Connector Between DLC & ETACS-ECU,
C-41 In-Line Connector Between ETACS-ECU & Horn Relay A-06X
Courtesy of Mitsubishi Motor Sales of America

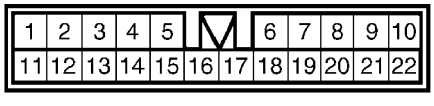

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Fig. 12: Identifying Connector Terminals:
C-37 Junction Block 1 Between ETACS-ECU & Combination Meter,
C-45 Junction Block 2 Between ETACS-ECU & Combination Meter,
C-48 Diode Connector,
C-50 Junction Block Between Diode Connector & Ground,

C-55 In-Line Connector Between Key Reminder Switch & Theft Alarm Starter Relay,
D-14 In-Line Connector Between Combination Meter & ETACS-ECU
Courtesy of Mitsubishi Motor Sales of America

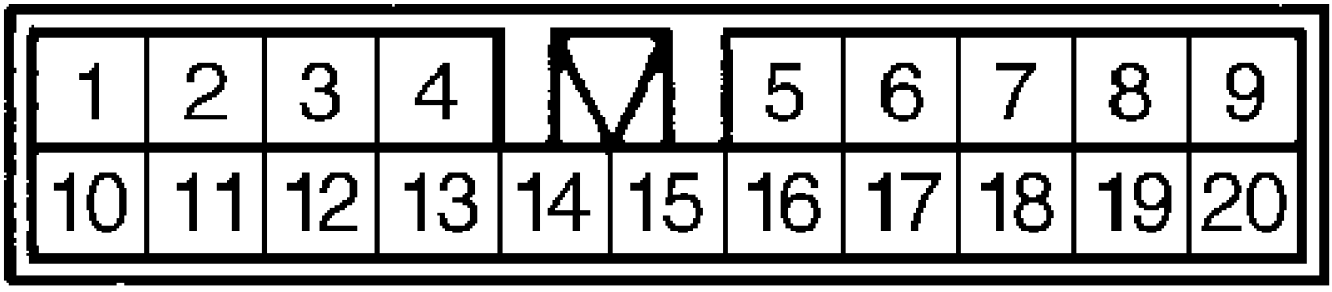

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Fig. 13: Identifying Connector Terminals: C-38 Junction Block Between DLC & ETACS-ECU
Courtesy of Mitsubishi Motor Sales of America

96B06366

Fig. 14: Identifying Connector Terminals: Connector C-43 ETACS-ECU
Courtesy of Mitsubishi Motor Sales of America

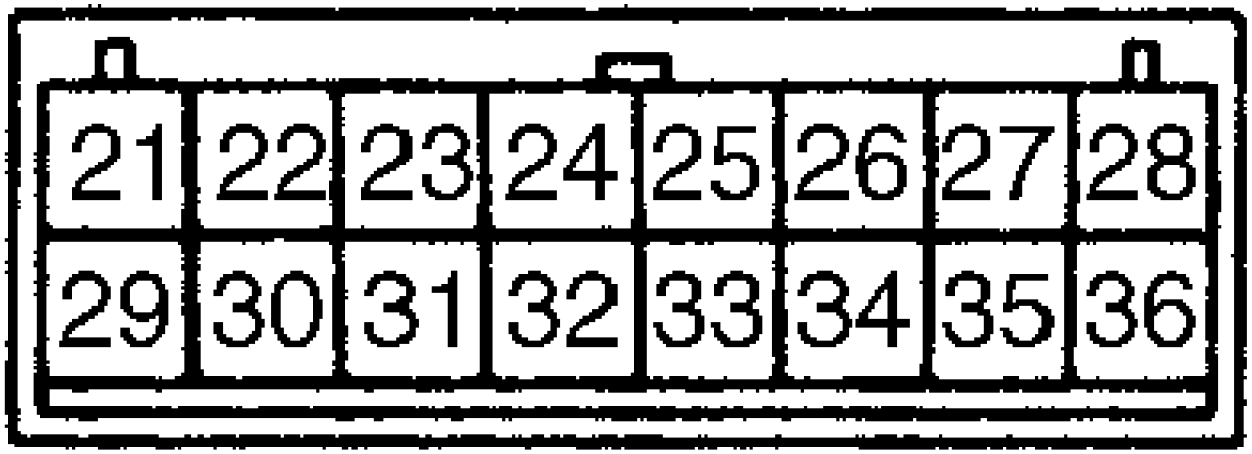

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Fig. 15: Identifying Connector Terminals: Connector C-109 ETACS-ECU
Courtesy of Mitsubishi Motor Sales of America

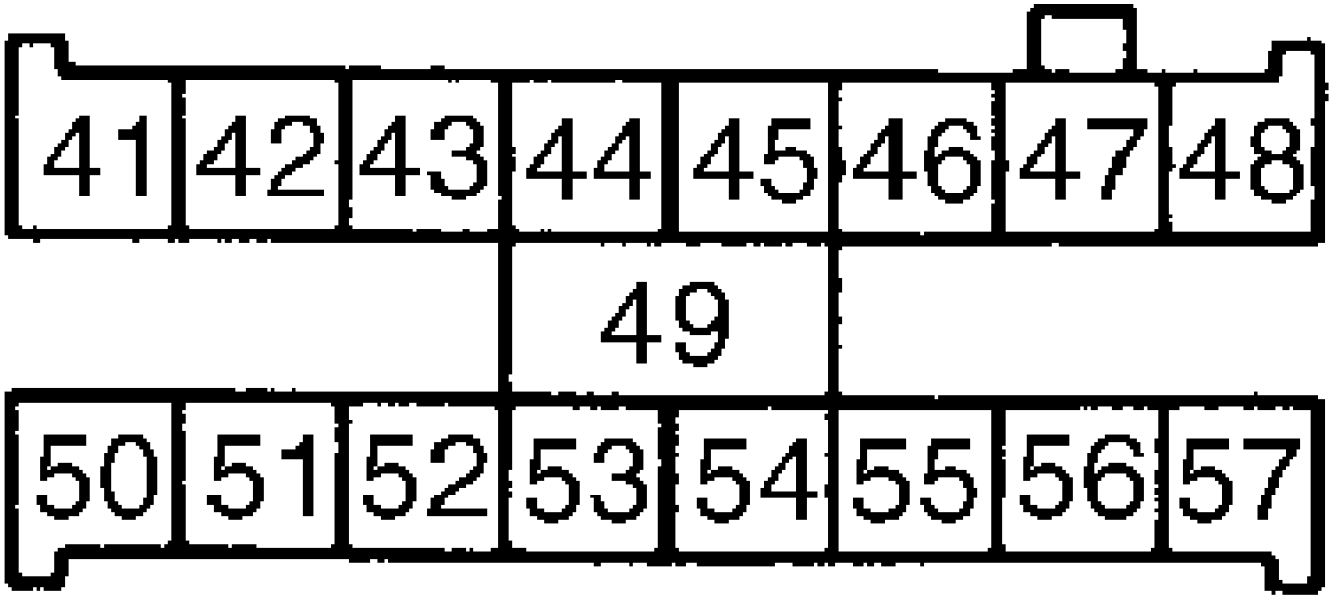

Fig. 16: Identifying Connector Terminals: D-01 Combination Meter
Courtesy of Mitsubishi Motor Sales of America

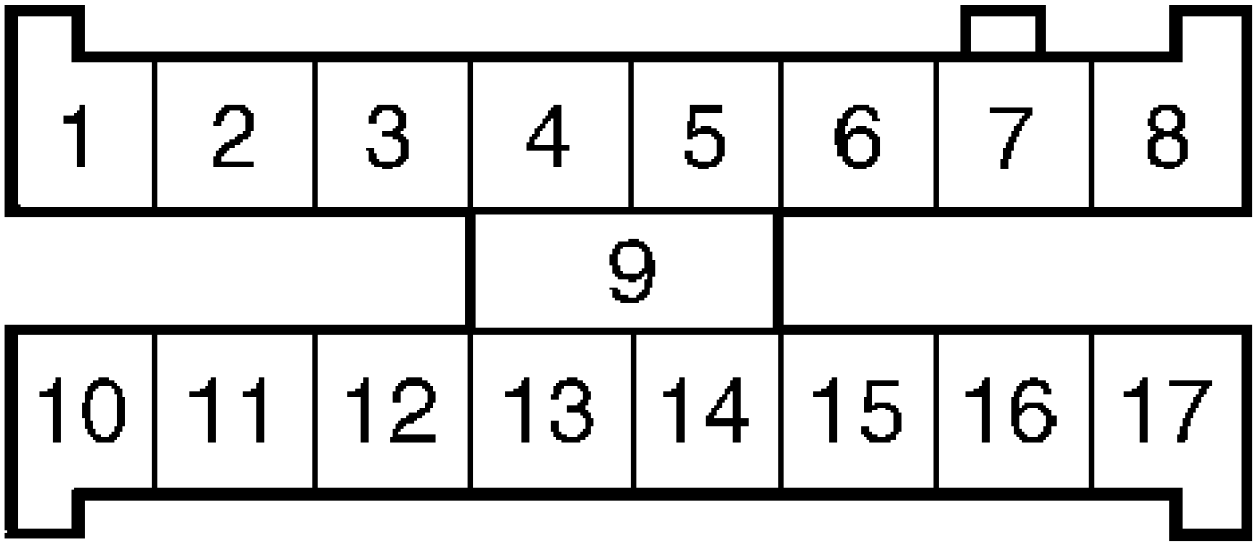

Fig. 17: Identifying Connector Terminals: D-03 Combination Meter
Courtesy of Mitsubishi Motor Sales of America

PIN VOLTAGE TESTS

ETACS-ECU PIN VOLTAGES TABLE (1) (2)

Application	Pin No.	Volts
Connector C-43		
Driver's Door Switch		
Door Open	9	0
Door Closed	9	5
ECU Power Supply		
At All Times	19	12
Connector C-109		
Passenger's Door Switch		
Door Open	21	0
Door Closed	21	5
Hood Switch		
Hood Open	22	0
Hood Closed	22	5
Front Door Actuator Switch (RH)		
Lock	25	5
Unlock	25	0
Rear Door Actuator Lock Knob		
Lock (OFF)	26	5
Unlock	26	0
Trunk Lock Cylinder Switch		
Open	27	0
Closed	27	5
Trunk Light Switch		
ON	28	0
OFF	28	5
Front Lock Actuator Switch (LH)		
Lock Knob Or Key (Lock)	30	5
Unlock	30	0
Door Lock Key Cylinder Switch (LH)		
Lock	31	0
Neutral	31	5
Transmitter Switch (Receiver Output Signal)		
ON	32	0
OFF	32	5
Key Cylinder Switch (LH)		
Unlock	33	0
Neutral	33	5
Key Cylinder Switch (RH)		
Lock	34	0
Neutral	34	5
Key Cylinder Switch (RH)		
Unlock	35	0
Neutral	35	5

(1) - Oscilloscope must be used for measurements other than ETACS-ECU power supply check.
(2) - See Figs. 4-17.

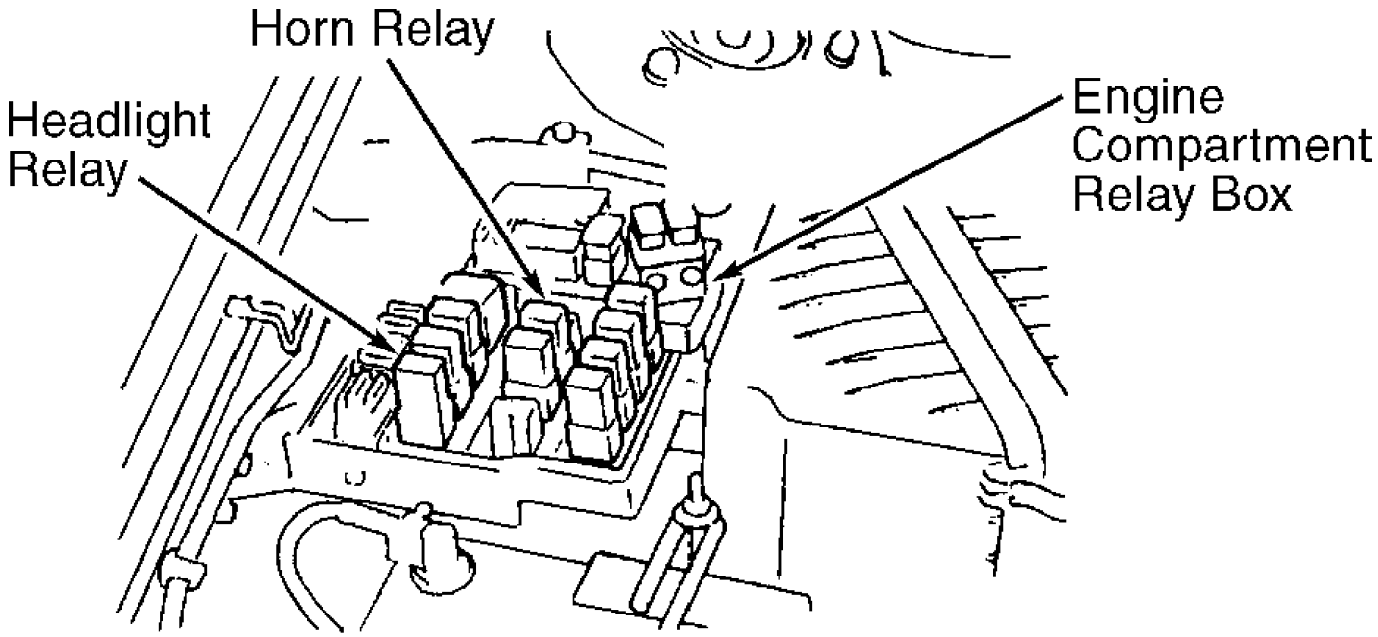

Fig. 18: Identifying Relay Locations
Courtesy of Mitsubishi Motor Sales of America

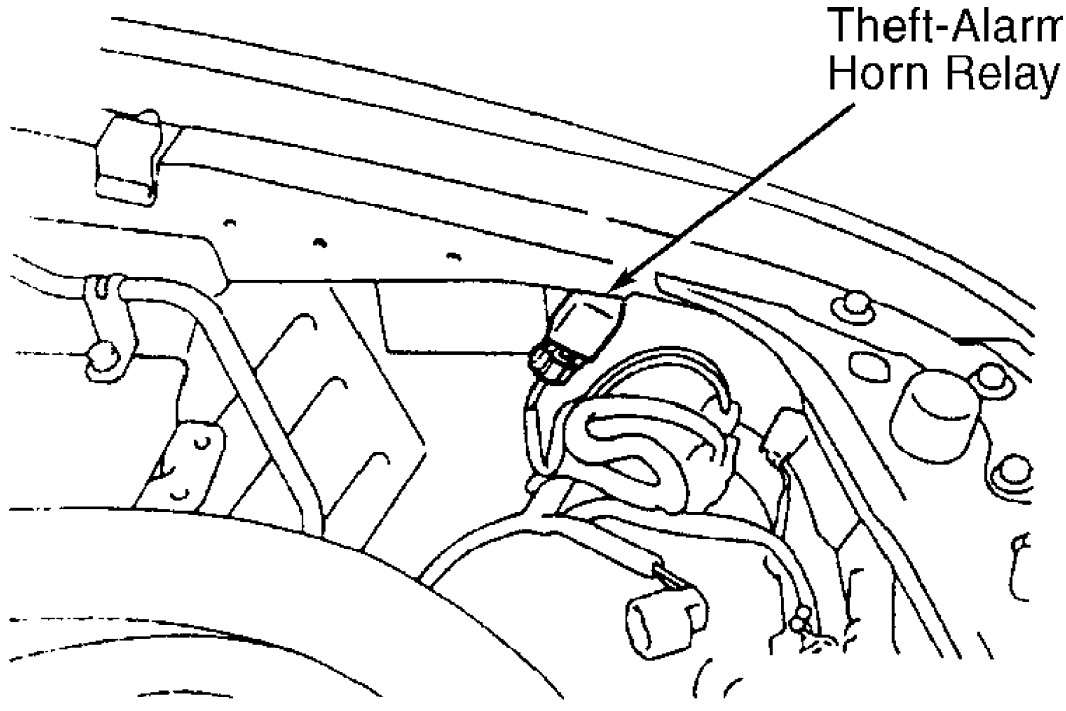

Fig. 19: Identifying Theft Alarm Horn Relay Location
Courtesy of Mitsubishi Motor Sales of America

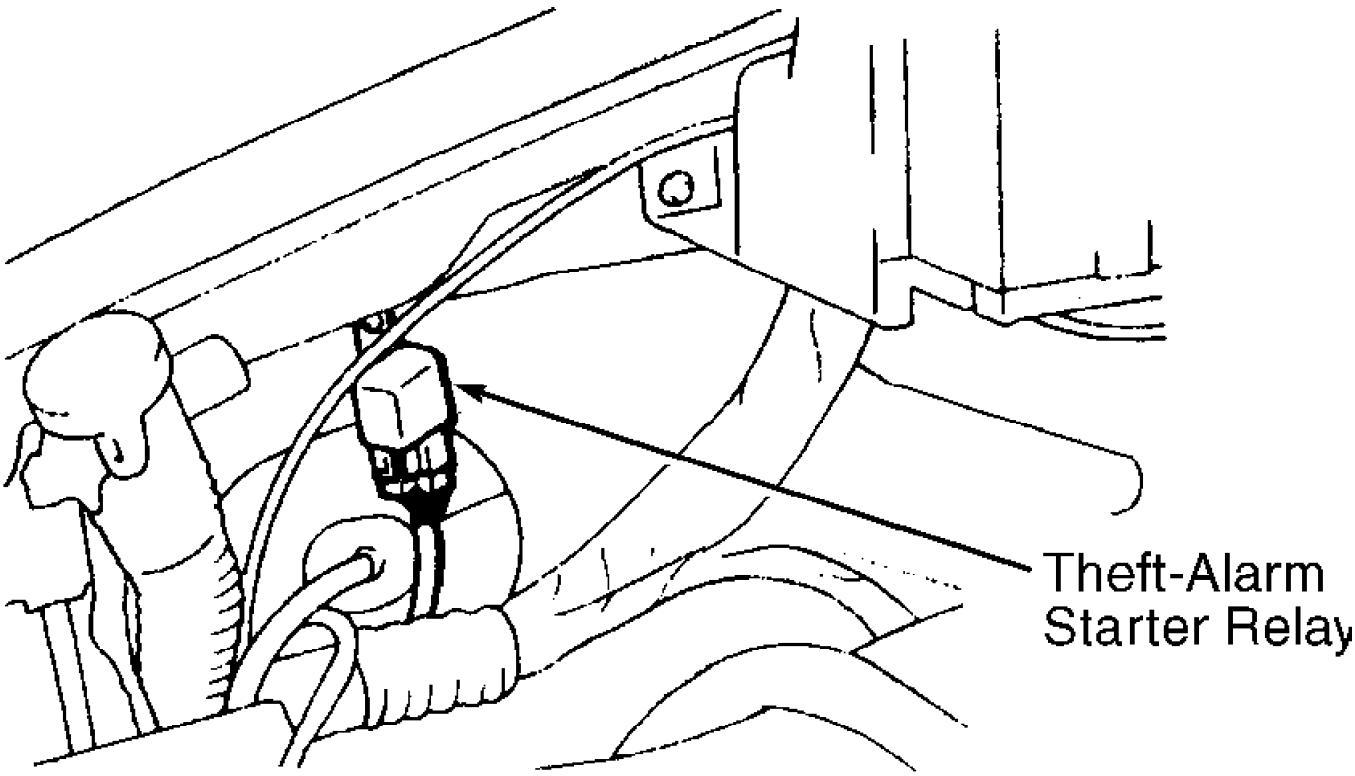

Fig. 20: Identifying Theft Alarm Starter Relay Location
Courtesy of Mitsubishi Motor Sales of America

WIRING DIAGRAMS

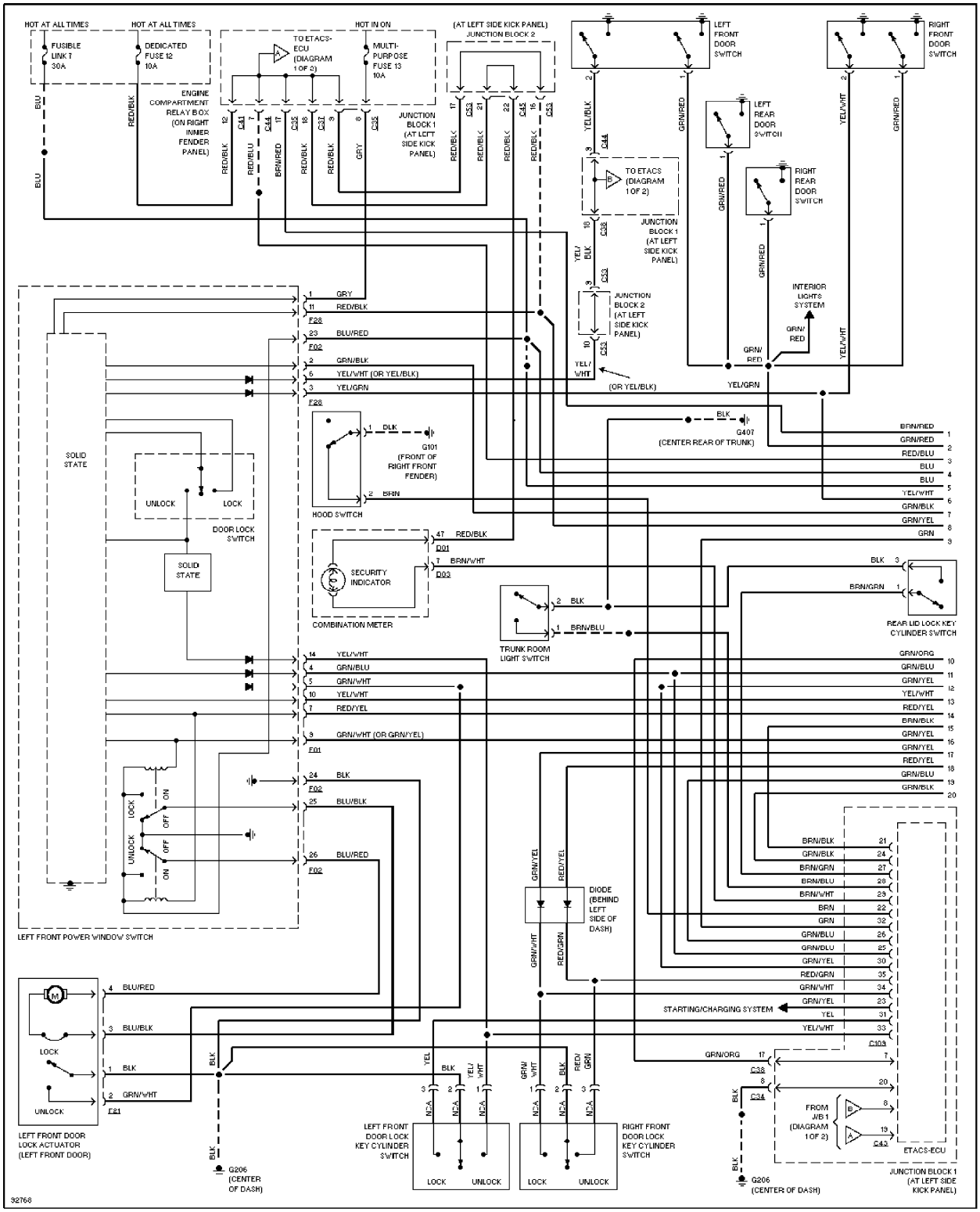

Fig. 21: Anti-Theft System Wiring Diagram (1 Of 2)

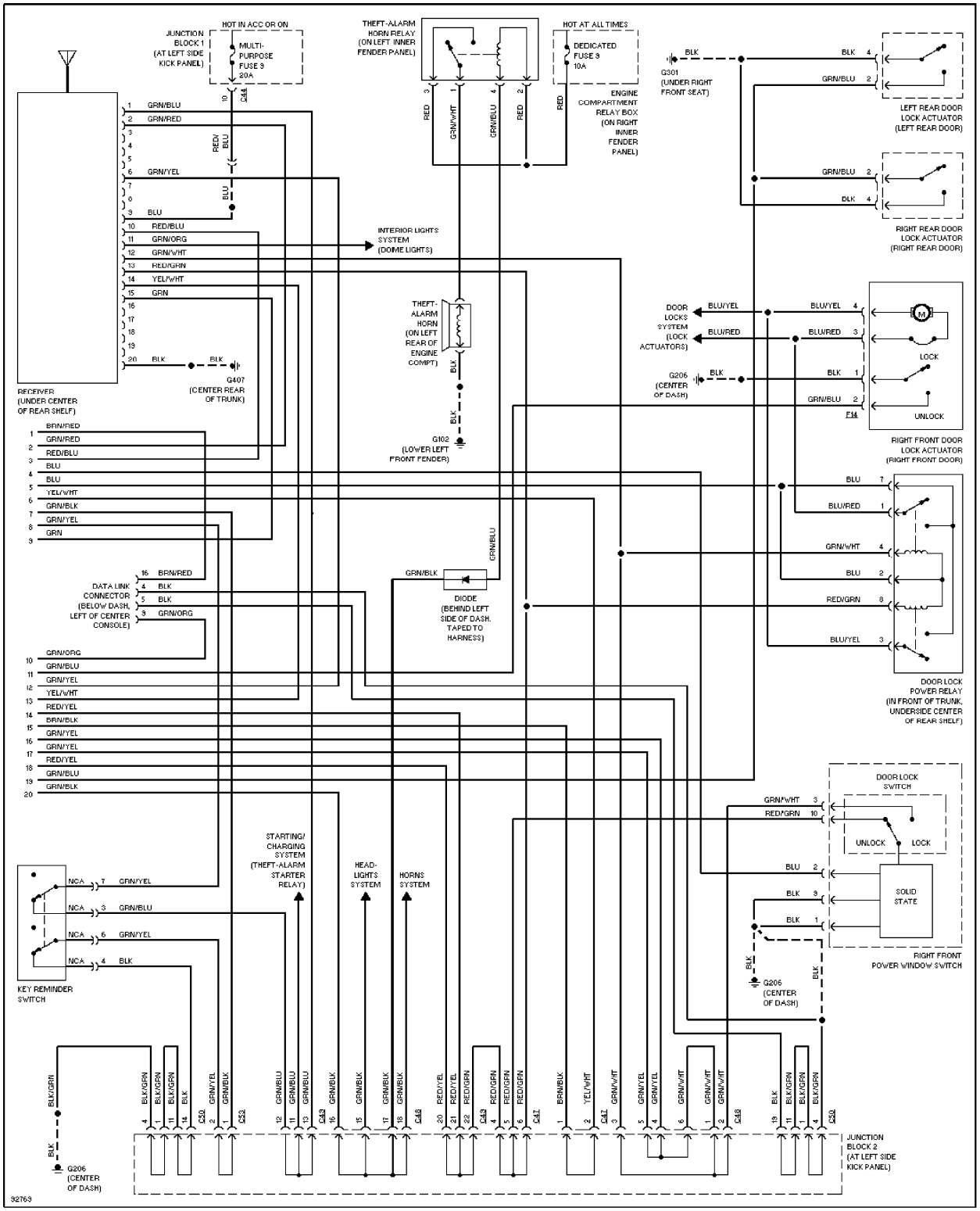

Fig. 22: Anti-Theft System Wiring Diagram (2 Of 2)

AUTO TRANS DIAGNOSIS

1998 Mitsubishi Galant

1997-98 AUTOMATIC TRANSMISSIONS
Mitsubishi Shift Lock Systems

Diamante, Eclipse, Galant, Mirage, Montero, Montero Sport, 3000GT

DESCRIPTION

Shift interlock system inhibits shift selector lever movement from "P" to drive ranges unless brake pedal is depressed. Key interlock system prevents ignition switch turning to LOCK position unless shift selector lever is in "P" position.

TESTING

KEY INTERLOCK SYSTEM

1) With ignition switch in LOCK position and brake pedal depressed, ensure selector lever cannot be moved from "P" to any other position. Ensure selector lever button cannot be pushed. With ignition switch in ACC position, brake pedal depressed and selector lever button pushed, ensure selector lever can be moved from "P" position to any other position. Ensure selector lever moves smoothly.

2) Ensure ignition key cannot be turned to LOCK position at all selector lever positions other than "P". Ensure ignition key turns smoothly to LOCK position when selector lever is set to "P" and selector lever button is released. If key interlock system is not as specified, adjust key interlock cable. See KEY INTERLOCK CABLE under ADJUSTMENTS.

SHIFT LOCK SYSTEM

1) With ignition switch in ACC position, brake pedal released and selector lever button pushed, ensure selector lever cannot be moved from "P" to any other position. With ignition switch in ACC position, brake pedal depressed and selector lever button pushed, ensure selector lever can be moved from "P" position to any other position.

2) With selector lever in "R" position, ignition switch in ACC position, brake pedal released and selector button pushed, ensure selector lever can be moved from "R" to "P" position. If shift lock system is not as specified, adjust shift lock cable. See SHIFT LOCK CABLE under ADJUSTMENTS.

ADJUSTMENTS

KEY INTERLOCK CABLE

3000GT

Remove front console assembly. Move selector lever to "P". Loosen nut securing key interlock cable. Gently press lock cam "A" down while pushing cable to take up slack. See Fig. 1. Tighten nut to specifications to secure cable. See TORQUE SPECIFICATIONS.

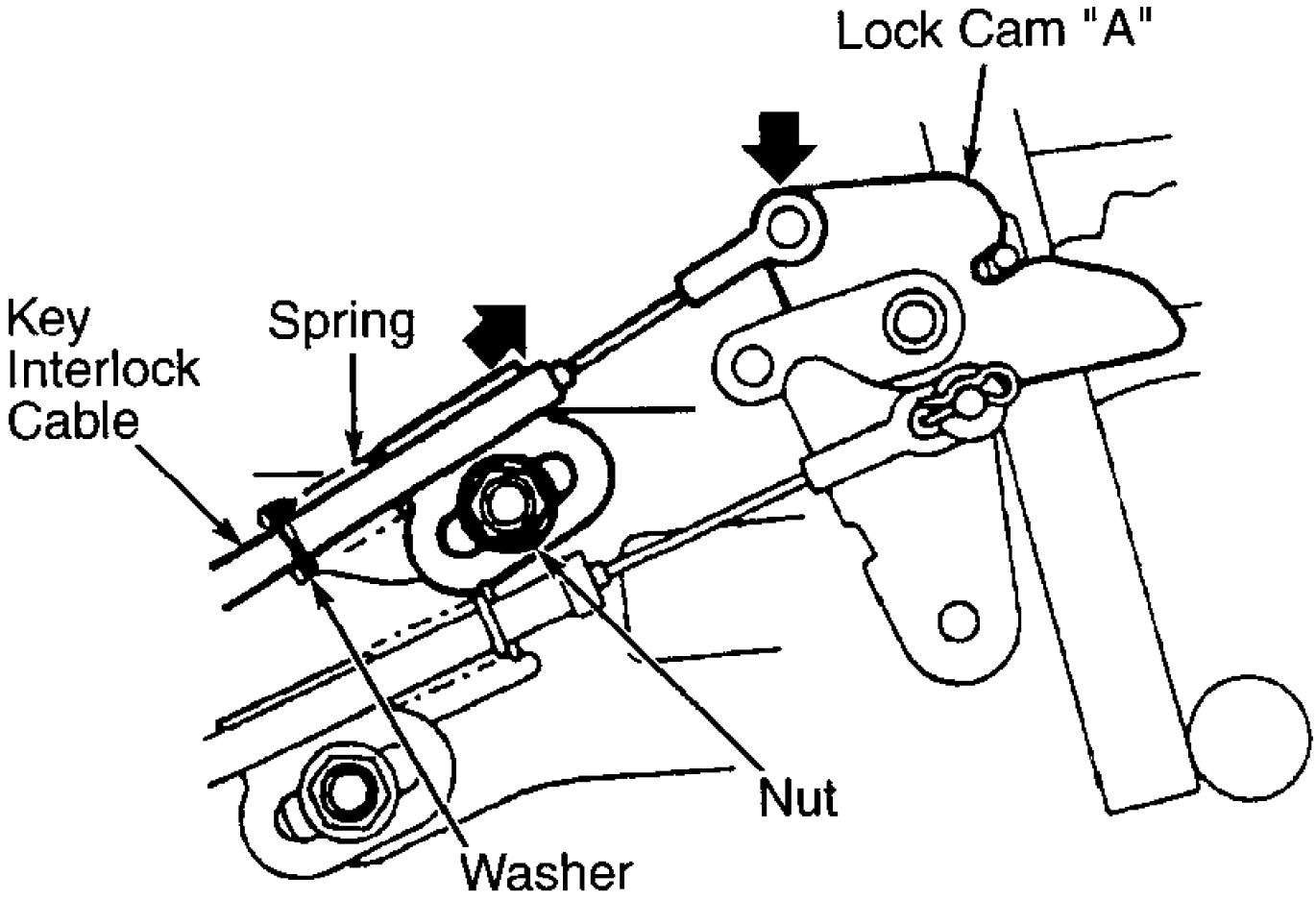

Fig. 1: Adjusting Key Interlock Cable (3000GT)
Courtesy of Mitsubishi Motor Sales of America.

Except 3000GT

Remove front console assembly. Move selector lever to "P". Turn ignition switch to LOCK position. Loosen nut securing key interlock cable. See Fig. 2. Gently push lock cam until pin stops in direction of arrow. Tighten nut to specifications to secure cable. See TORQUE SPECIFICATIONS. Install front console assembly.

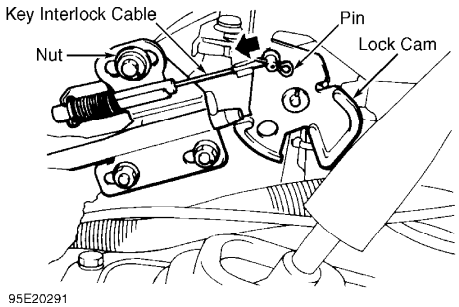

Fig. 2: Adjusting Key Interlock Cable (Except 3000GT)
Courtesy of Mitsubishi Motor Sales of America.

SHIFT LOCK CABLE

3000GT

Remove front console assembly. Move selector lever to "P". Loosen nuts securing shift lock cable and remove washer and cotter pin at cable end. Turn lock cam counterclockwise to move set lever upward. Fit cutout in set lever on pin of lock cam "B". Gently press set lever down while pushing cable to take up slack. See Fig. 3. Tighten nut to specifications to secure cable. See TORQUE SPECIFICATIONS. Ensure that cable end contacts pin on lock cam, then install washer and cotter pin.

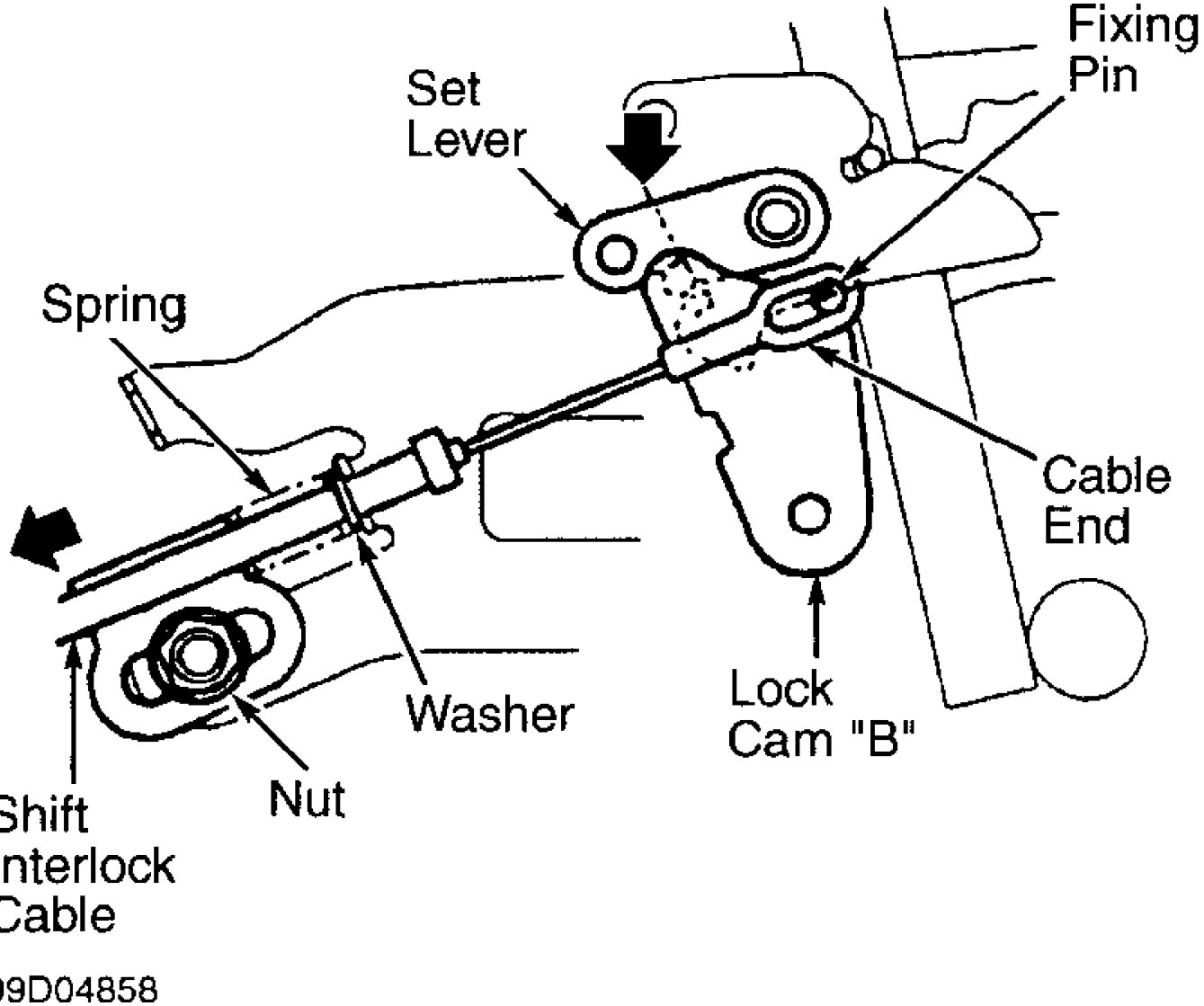

Fig. 3: Adjusting Shift Lock Cable (3000GT)
Courtesy of Mitsubishi Motor Sales of America.

Except 3000GT

Remove front console assembly. Move selector lever to "P". Loosen nuts securing shift lock cable. See Fig. 4. Adjust shift lock cable so end of cable (Red mark) sits between lobe of lock cam, then tighten nut to specifications to secure cable. See TORQUE SPECIFICATIONS. Install front console assembly.

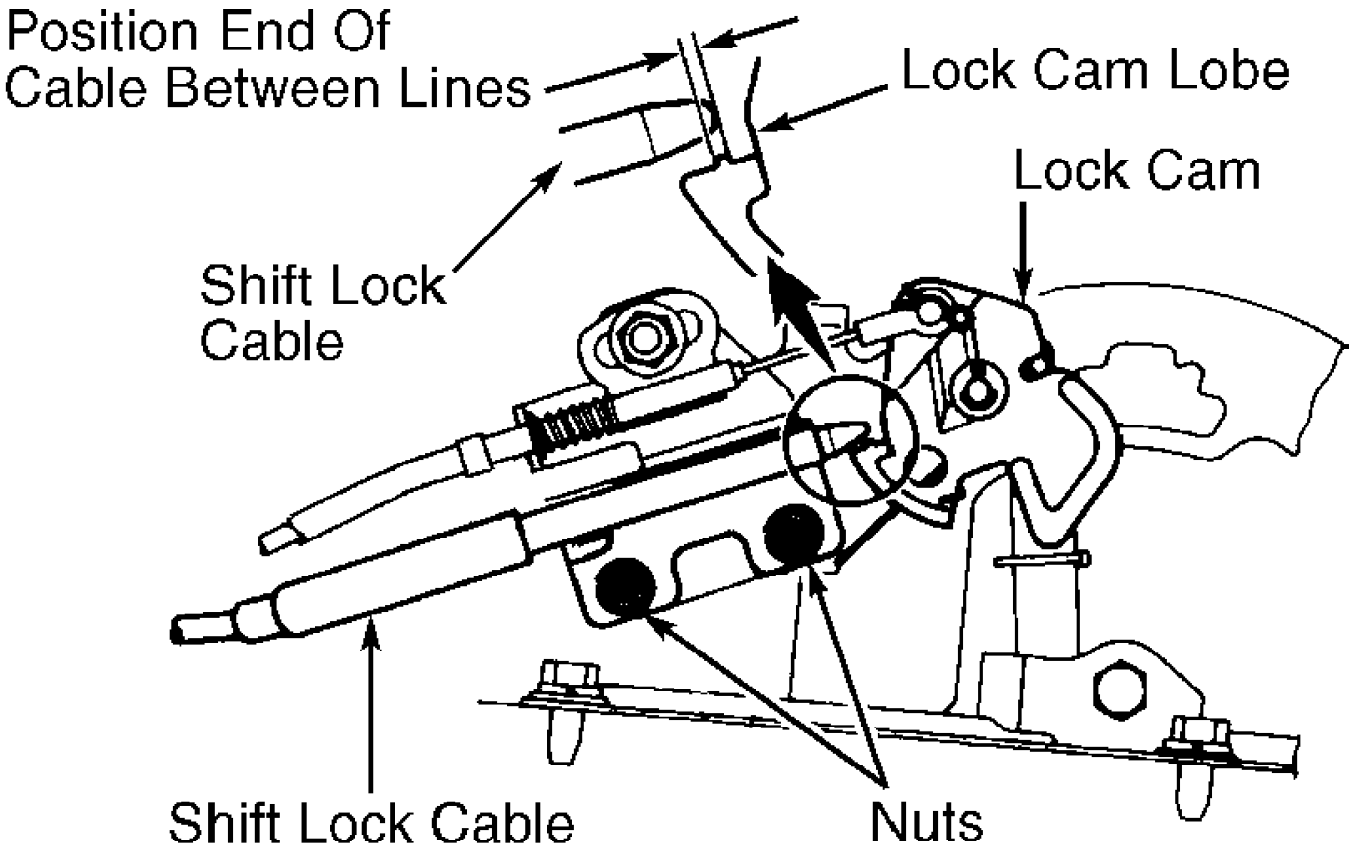

Fig. 4: Adjusting Shift Lock Cable (Except 3000GT)
Courtesy of Mitsubishi Motor Sales of America.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	INCH Lbs. (N.m)
Shift Lock Cable-To-Shift Console Assembly	
3000GT	89 (10)
Diamante, Eclipse & Galant	106 (12)
Montero & Montero Sport	44 (5)
Mirage	115 (13)
Key Interlock Cable-To-Shift Console Assembly	
3000GT	89 (10)
Diamante, Eclipse, Galant, Montero & Montero Sport	106 (12)
Mirage	115 (13)

AUTO TRANS DIAGNOSIS - F4A23, F4A33 & W4A33

1998 Mitsubishi Galant

1997-98 AUTOMATIC TRANSMISSIONS
Mitsubishi F4A23, F4A33 & W4A33 Electronic Controls

Hyundai; Sonata
Mitsubishi; Eclipse, Galant, 3000GT

APPLICATION

TRANSAXLE APPLICATIONS

Vehicle & Model	Transaxle Model
Hyundai	
Sonata	F4A33
Mitsubishi	
Eclipse 2.0L Turbo AWD	W4A33
Eclipse 2.0L Turbo FWD	F4A33
Eclipse 2.4L	F4A23
Galant	F4A23
3000GT	F4A33

INTRODUCTION

The first step in diagnosing any driveability problem is verifying the customer's complaint with a test drive under the conditions the problem reportedly occurred. Before entering self-diagnostics, perform a careful and complete visual inspection. Most transmission control problems result from mechanical breakdowns or poor electrical connections.

DESCRIPTION

The transaxle electronic control system controls transaxle shift points and torque converter clutch control for torque converter lock-up. Transaxle uses hydraulically operated clutches controlled by the Transaxle Control Module (TCM). Overdrive or 4th gear operation is controlled by a manually operated overdrive control switch. Transaxle will not shift into overdrive unless overdrive control switch is in the ON position.

OPERATION

TRANSAXLE CONTROL MODULE (TCM)

The TCM receives information from various input devices and controls various output devices for different gear operation. The TCM is located behind instrument panel, near center of console, and contains a 42-pin connector. See Figs. 1-3. On 3000GT models, a POWER/ECONOMY switch, located on center of console, is used to change shift patterns. The pre-set shift patterns are controlled by the TCM. The TCM controller contains a self-diagnostic system which stores a Diagnostic Trouble Code (FTC) if a transaxle fault exists. Trouble code can be retrieved to determine transaxle problem area. See SELF-DIAGNOSTIC SYSTEM. The TCM contains a fail-safe mode. If certain trouble codes are set, transaxle will enter fail-safe mode. When in fail-safe mode, transaxle will remain in 2nd or 3rd gear with no

upshifts or downshifts. Transaxle will also function in Park, Neutral and Reverse when in fail-safe mode. TCM works in conjunction with the Engine Control Module (ECM) for receiving information for transaxle control. See Figs. 1-3.

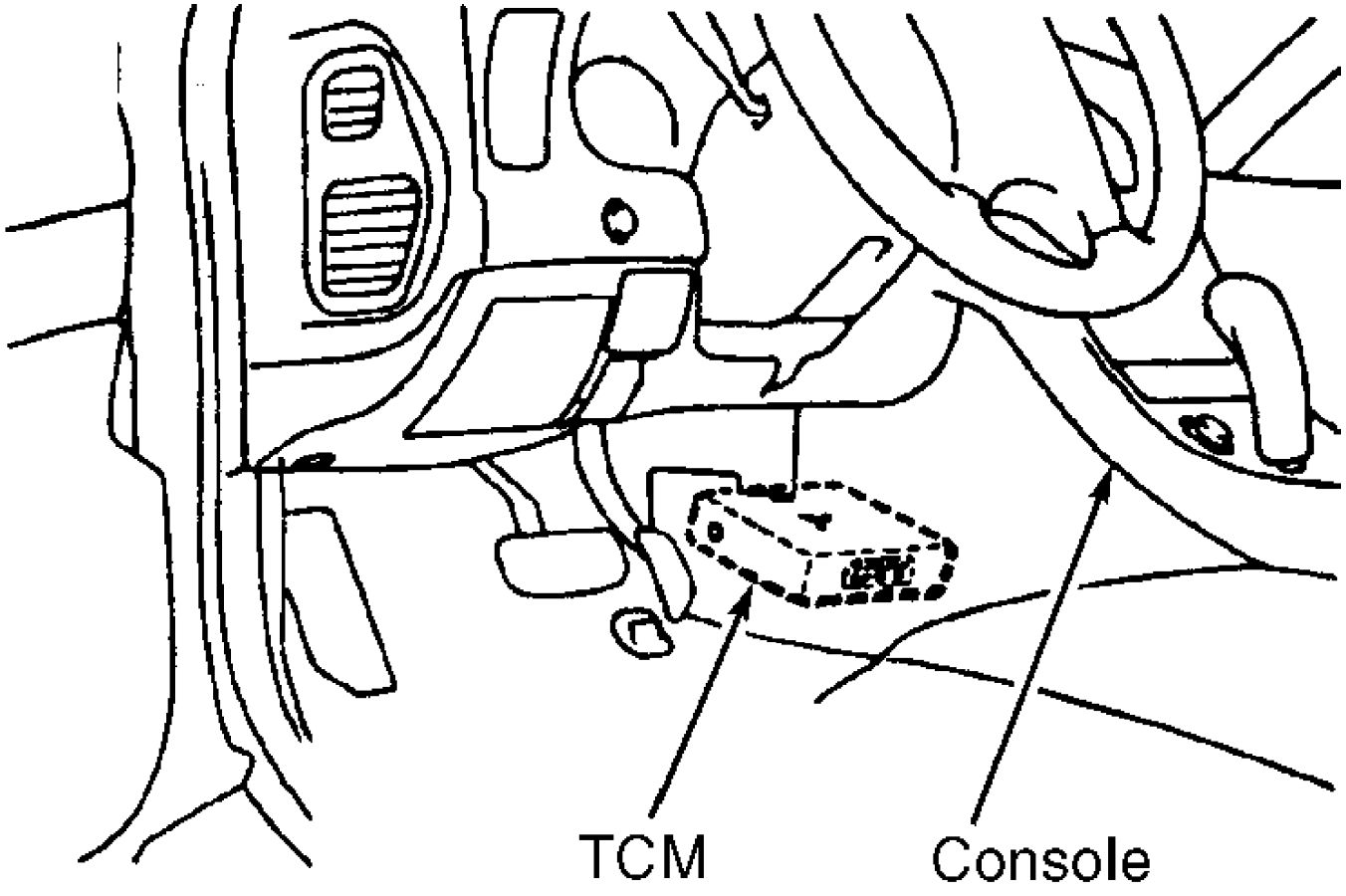

Fig. 1: Locating TCM (Eclipse)
Courtesy of Mitsubishi Motor Sales of America.

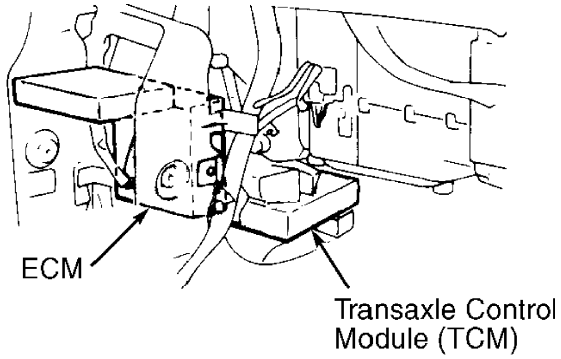

Fig. 2: Locating TCM (3000GT)
Courtesy of Mitsubishi Motor Sales of America.

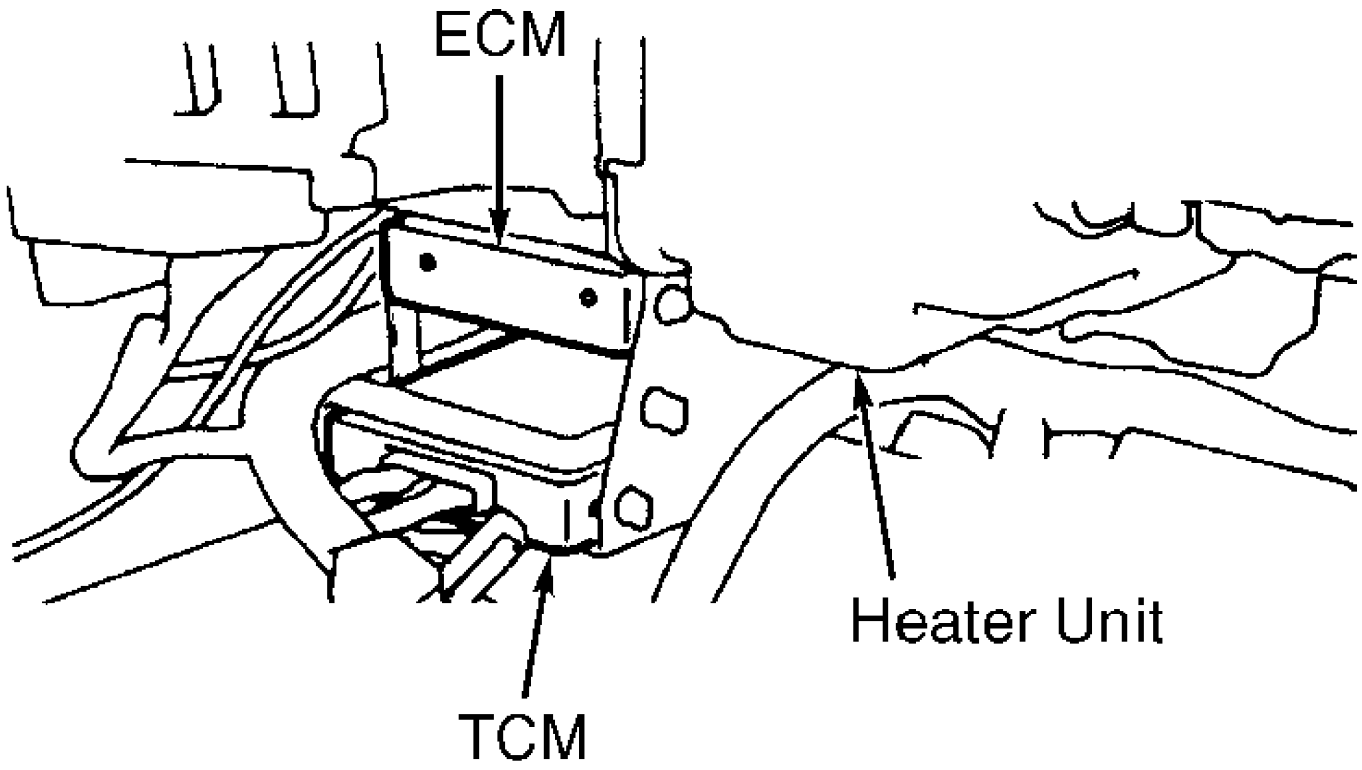

Fig. 3: Locating TCM (Galant & Sonata)
Courtesy of Mitsubishi Motor Sales of America.

INPUT DEVICES

Park Neutral Position (PNP) Switch

PNP switch is an input device mounted on the transaxle manual control shaft. See Fig. 4. PNP switch delivers an input signal to TCM, indicating transaxle manual valve gear position.

Kickdown Servo Switch

Kickdown servo switch is an input device mounted on the side of transaxle case. See Fig. 4. Kickdown servo switch delivers an input signal to the TCM to indicate kickdown servo operation.

NOTE: Oil temperature sensor may also be referred to as fluid temperature sensor. It may be necessary to identify wire color to oil temperature sensor for proper identification. See appropriate wiring diagram under WIRING DIAGRAMS.

Oil Temperature Sensor

Oil temperature sensor is an input device mounted inside the transaxle case. See Fig. 4. Oil temperature sensor delivers an input signal to the TCM to indicate the fluid temperature.

Overdrive Control Switch

Overdrive control switch, located on gear selector lever, delivers an input signal to the TCM. Transaxle will not shift into overdrive unless overdrive control switch is in the ON position.

Pulse Generators

Pulse generators are mounted on transaxle case. See Fig. 4 or

5. Pulse generators indicate transfer shaft speed and end clutch speed. Signals are input to the TCM for transaxle control.

Throttle Position (TP) Sensor

The TP sensor, mounted on the throttle body, determines throttle position and inputs a signal to the TCM. The TCM uses signal to control transaxle upshifts.

Vehicle Speed Sensor (VSS)

Vehicle speed sensor inputs signal to the TCM to indicate vehicle speed. Vehicle speed sensor is mounted on rear of instrument cluster.

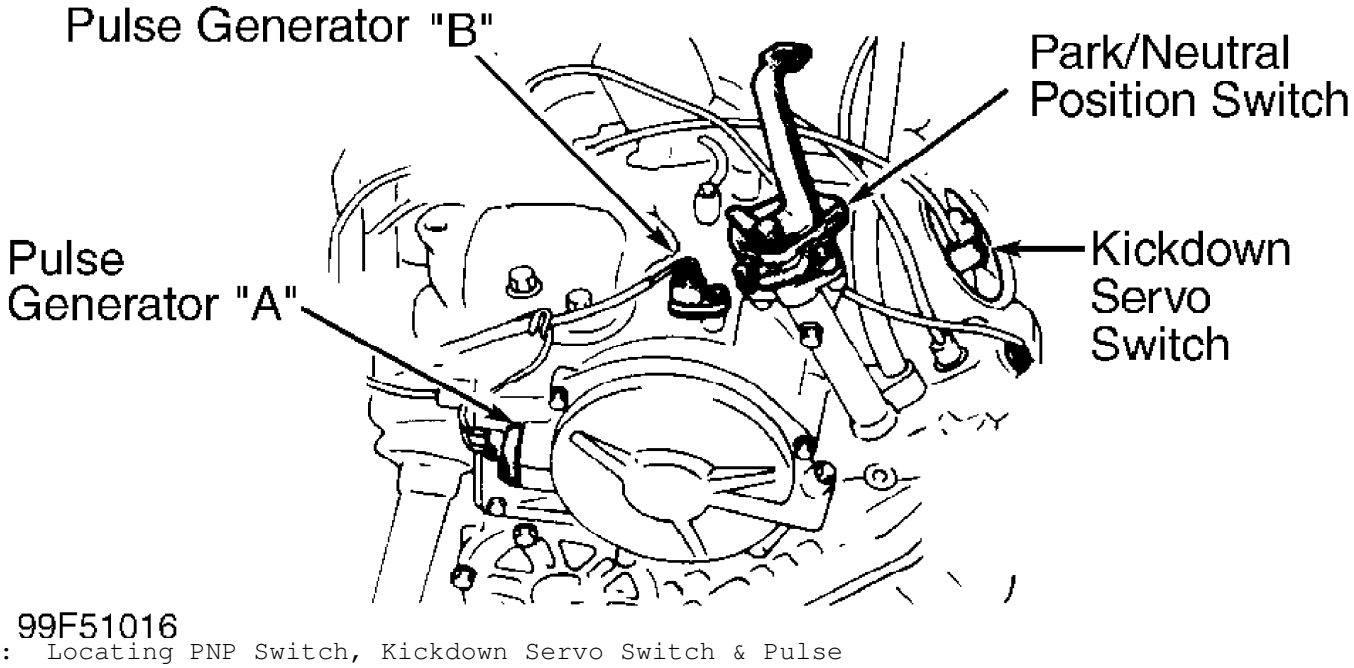

Fig. 4: Locating PNP Switch, Kickdown Servo Switch & Pulse Generators (AWD)
Courtesy of Mitsubishi Motor Sales of America.

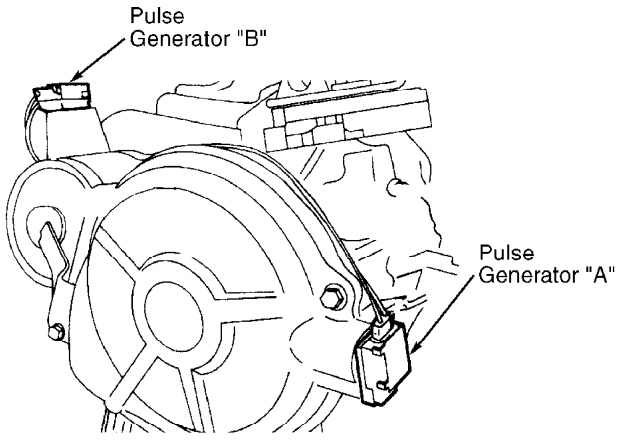

Fig. 5: Locating Pulse Generators (FWD)
Courtesy of Mitsubishi Motor Sales of America.

OUTPUT DEVICES

NOTE: For solenoid valve wire color identification, see WIRING DIAGRAMS.

Pressure Control Solenoid Valve (PCSV)
The PCSV is located on the valve body. See Fig. 6. The TCM operates the PCSV for controlling transaxle shifts.

Shift Control Solenoid Valve (SCSV)
The SCSV "A" or "B" are located on the valve body. See Fig. 6 . The TCM operates SCSV for controlling transaxle shifts.

Torque Converter Clutch Solenoid Valve (TCCSV)
The TCCSV is located on the valve body. See Fig. 6. The TCM operates the TCCSV for torque converter clutch control of torque converter lock-up.

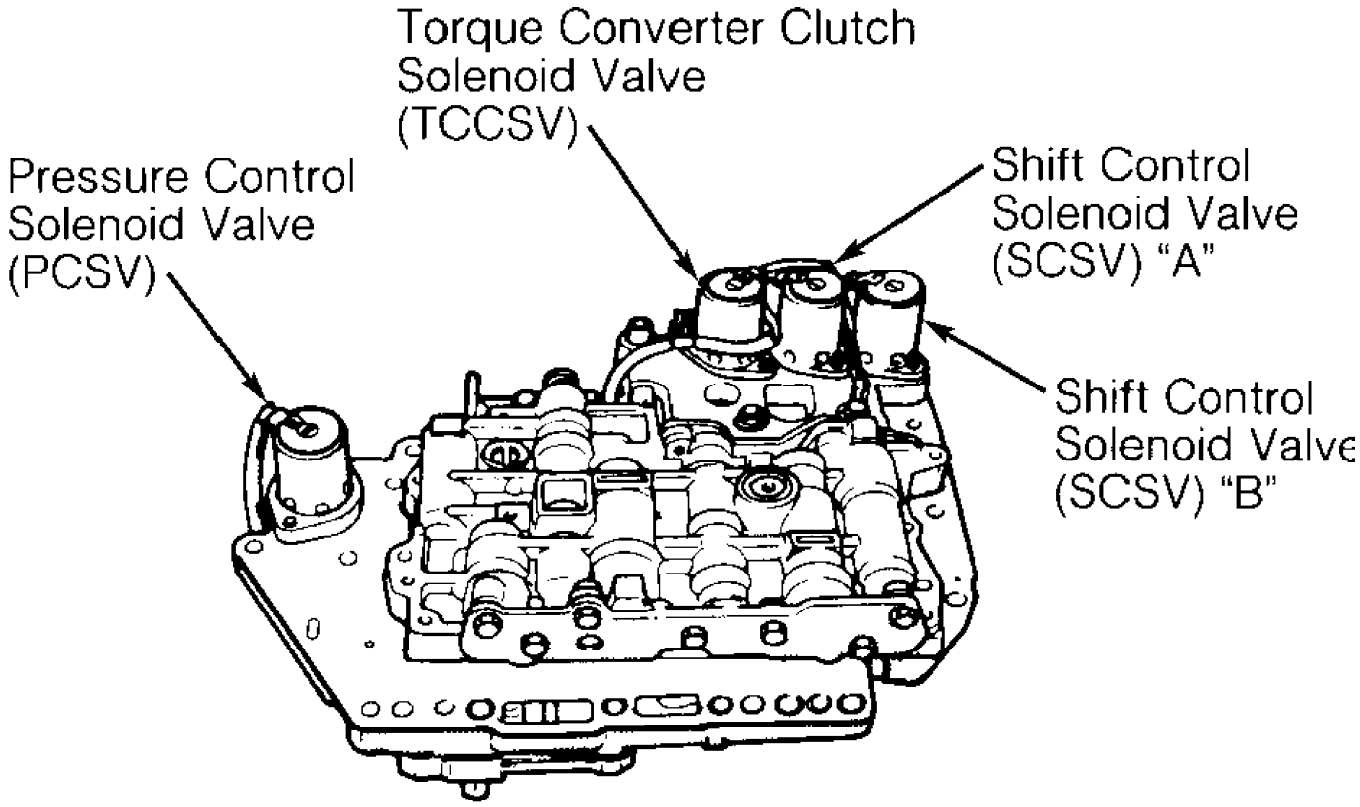

Fig. 6: Identifying Solenoid Valves
Courtesy of Mitsubishi Motor Sales of America.

ADJUSTMENTS

PARK NEUTRAL POSITION (PNP) SWITCH

1) Place gear selector lever and manual control lever on transaxle in Neutral position. Loosen PNP switch retaining screws. Rotate PNP switch body so hole in manual control lever aligns with hole on PNP switch body. See Fig. 7. Tighten PNP switch retaining screws to specification. See TORQUE SPECIFICATIONS.
2) Loosen shift control cable lock nut at shift control cable-to-manual control lever. Pull end of shift control cable toward

manual control lever. Tighten shift control cable lock nut to specification. See TORQUE SPECIFICATIONS.

3) Move gear selector lever through all gear ranges. Ensure manual control lever is in gear position corresponding to gear selector lever. Ensure vehicle starts only in Park and Neutral.

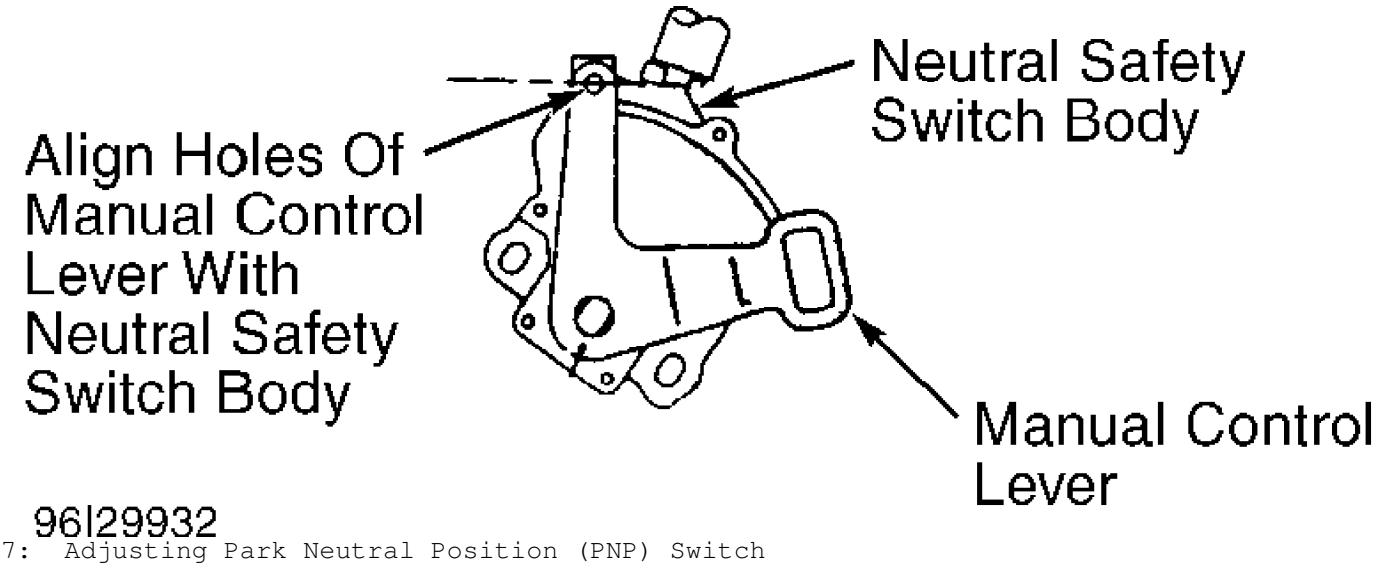

Fig. 7: Adjusting Park Neutral Position (PNP) Switch
Courtesy of Mitsubishi Motor Sales of America.

SELF-DIAGNOSTIC SYSTEM

DIAGNOSTIC PROCEDURE

When performing vehicle diagnosis, the following procedures must be followed:

* Ensure transaxle fluid level is correct and not contaminated or aerated.
* Ensure shift cable is properly adjusted by ensuring vehicle starts in only Park or Neutral. If adjustment is required, see PARK NEUTRAL POSITION (PNP) SWITCH under ADJUSTMENTS.
* Ensure all appropriate electrical connections at transaxle, TCM, throttle position sensor, PNP switch, etc. are clean and properly installed.
* Always clear trouble codes once repair is completed. See CLEARING TROUBLE CODES. Test drive vehicle to determine if complaint or code is repaired. Retrieve trouble codes to confirm code no longer exists. See RETRIEVING TROUBLE CODES.

RETRIEVING TROUBLE CODES

NOTE: Two methods can be used to retrieve trouble codes. Diagnostic Trouble Codes (FTC) can be retrieved with scan tool or voltmeter. Ensure proper method is being used for available tools. If scan tool is not available, see VOLTMETER METHOD to retrieve trouble codes. TCM will store 10 FTC if transaxle has not gone into fail-safe mode. Only 3 FTC will be stored if transaxle goes into fail-safe mode. See FTC IDENTIFICATION table for fail-safe mode trouble codes.

Scan Tool Method

Locate diagnostic connector below instrument panel. On Eclipse, Galant, Sonata and 3000GT models, diagnostic connector is located to the right side of steering wheel under the instrument panel. Connect scan tool and follow manufacturer's instructions. Check scan tool data list for system failure and test probable cause.

SCAN TOOL DATA LIST IDENTIFICATION

Data List No. & Circuit	Test
11 - TP Sensor	A
15 - Oil Temperature Sensor	B
21 - Kickdown Servo Switch	C
23 - Ignition Pulse Signal	D
25 - Closed TP Switch	E
26 - A/C Compressor Clutch Relay Signal	F
27 - Shift Control Solenoids "A" Or "B" Signal	G
28 - Stoplight Switch	H
31 - Pulse Generator "A"	I
32 - Pulse Generator "B"	J
35 - Overdrive Switch	K
37 - Park Neutral Position (PNP) Switch	L
38 - Vehicle Speed Sensor (VSS)	M
45 - PCSV Duty Solenoid	N
47 - Torque Converter Clutch Slippage	O
49 - Torque Converter Clutch Solenoid Duty	P

Test: A

With accelerator pedal released, voltage should be .4-1.0 volts. Voltage should increase smoothly as accelerator is depressed to Wide Open Throttle (WOT). Voltage should be 4.5-5.5 volts at WOT. Possible causes of malfunction may be:

* Incorrectly adjusted TP sensor. See appropriate SELF -DIAGNOSTICS article in ENGINE PERFORMANCE section.
* TP sensor or harness malfunction.
* Defective throttle cable.

Test: B

For cold engine, scan tool temperature should equal outside ambient temperature. Start and run vehicle engine. Temperature should gradually increase to 158-194°F (70-90°C) degrees. Possible cause of malfunction may be defective oil temperature sensor or harness.

Test: C

With engine idling and transaxle in "L" position, switch status should be ON. Test drive vehicle in "2" position, switch status should be OFF with vehicle stopped or above 25 MPH (40 KM/H) and ON when driving at 6 MPH (10 KM/H). Switch status should be ON in "D" position with overdrive switch OFF. Switch status should be OFF in overdrive. Possible causes of malfunction may be:

* Incorrectly adjusted kickdown servo.
* Defective kickdown servo switch or harness.
* Defective kickdown servo.

Test: D

With engine idling in neutral, engine speed should be 600-900 RPM. Drive vehicle at 31 MPH (50 KM/H) in "D" position with overdrive switch OFF. Scan tool should display 1800-2200 RPM. Possible causes of malfunction may be:

* Defective ignition system.
* Defective ignition signal pickup circuit harness.

Test: E

Turn ignition switch to On position, engine OFF and transaxle in "N" position. With accelerator pedal fully released, switch status should be ON. With accelerator pedal slightly depressed or at WOT, switch status should be OFF. Possible causes of malfunction may be:

* Incorrectly adjusted TP sensor. See appropriate SELF -DIAGNOSTICS article in ENGINE PERFORMANCE section.
* Defective TP sensor or harness.

Test: F

With engine idling in "D" position and air conditioning on, switch status should be ON. With air conditioning off, switch status should be OFF. Cause of malfunction may be defective air conditioning compressor clutch power relay ON signal detection circuit.

Test: G

Operate vehicle and note scan tool display. See DATA LIST NO. 27 DISPLAY table.

DATA LIST NO. 27 DISPLAY

Condition	Display
"D" Range	
Idling, Throttle Fully Closed, Vehicle Stopped	C
Throttle Slightly Open, Vehicle Stopped	1
"L" Range, Idling	1
"2" Range, 2nd Gear	
Idling, Vehicle Stopped	C
Driving At 6 MPH (10 KM/H)	1
Driving At Constant 25 MPH (40 KM/H)	2
"D" Range, O/D Off, 3rd Gear	3
"D" Range, O/D On, 4th Gear	4

Possible causes for malfunction may be:

* Defective TCM.
* Defective TP sensor.
* Defective PNP switch.

Test: H

With ignition switch in ON position, engine stopped and brake pedal depressed, switch status should be ON. With brake pedal released, switch status should be OFF. Possible cause for malfunction may be stoplight switch or stoplight signal circuit.

Test: I

Operate vehicle and note scan tool display for pulse generator "A". See DATA LIST NO. 31 DISPLAY table.

DATA LIST NO. 31 DISPLAY

Selector Lever Position & Condition	Display RPM
"D"/Overdrive OFF, 31 MPH (50 KM/H)	1800-2200
"D"/Overdrive ON, 31 MPH (50 KM/H)	1200-1500

Possible causes of malfunction may be:

* Defective pulse generator "A", shielded wire or ground wire.
* External noise interference.

Test: J
Operate vehicle and note scan tool display for pulse generator "B". See DATA LIST NO. 32 DISPLAY table.

DATA LIST NO. 32 DISPLAY

Selector Lever Position & Condition	Display RPM
"D"/Overdrive OFF, 31 MPH (50 KM/H)	1800-2200
"D"/Overdrive ON, 31 MPH (50 KM/H)	1800-2200

Possible causes of malfunction may be:

* Defective pulse generator "B", shielded wire or ground wire.
* External noise interference.

Test: K
Scan tool display should match overdrive switch position with ignition switch in ON position and engine OFF. Possible cause of malfunction may be defective OD switch or harness.

Test: L
Operate shift lever and note scan tool display. Display should match PNP switch position. Possible cause of malfunction is:

* Incorrectly adjusted PNP switch.
* Defective PNP switch or harness.
* Defective manual control cable.

Test: M
Test drive vehicle. Scan tool display should match speedometer reading. Possible cause of malfunction may be VSS or harness is defective.

Test: N
Operate vehicle and note scan tool display. See DATA LIST NO. 45 DISPLAY table.

DATA LIST NO. 45 DISPLAY

Selector Lever Position & Condition	Display
"D" Range, Throttle Closed, Vehicle Stopped	65-85%
"D" Range, Throttle Depressed Slightly, 3 MPH (5 KM/H)	90-100%

Possible causes of malfunction may be:

* Defective TCM.
* Defective TP sensor.

Test: O
Operate vehicle and note scan tool display. See DATA LIST NO. 47 DISPLAY table.

DATA LIST NO. 47 DISPLAY

Selector Lever Position & Condition	Display
"D"/Overdrive Off, 31 MPH (50 KM/H)	100-300 RPM
"D"/Overdrive Off, 43 MPH (70 KM/H)	0-10 RPM

Possible causes of malfunction may be:

* Defective torque converter clutch.
* Defective ignition signal line or pulse generator "B" circuit.
* Incorrect transmission fluid pressure.
* Defective TCC solenoid.

Test: P

Operate vehicle and note scan tool display. See DATA LIST NO. 49 DISPLAY table.

DATA LIST NO. 49 DISPLAY

Selector Lever Position & Condition	Display
"D"/Overdrive Off, 31 MPH (50 KM/H)	0%
"D"/Overdrive Off, 43 MPH (70 KM/H)	40-60%

Possible causes of malfunction may be:

* Defective TCM.
* Defective TP sensor circuit.
* Defective pulse generator "B" circuit.

Voltmeter Method

1) Locate diagnostic connector below instrument panel. On Eclipse, Galant, Sonata and 3000GT models, diagnostic connector is located to the right side of steering wheel under the instrument panel. Install voltmeter between ground terminal No. 4 or No. 5 and diagnostic output terminal No. 6. See Fig. 8.

2) Turn ignition on. Note fluctuations of voltmeter needle to indicate FTC. The first fluctuation indicates first digit of FTC. Following fluctuations indicate the second digit of FTC. See Fig. 9. Record FTC in order displayed. To identify FTC and items to be checked or adjusted, see FTC IDENTIFICATION table.

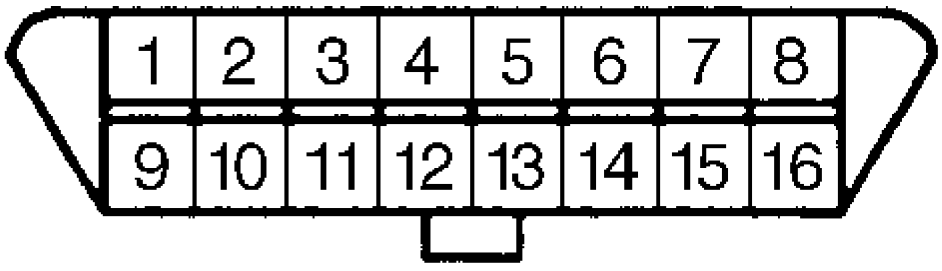

Fig. 8: Identifying Data Link Connector Terminals
Courtesy of Mitsubishi Motor Sales of America.

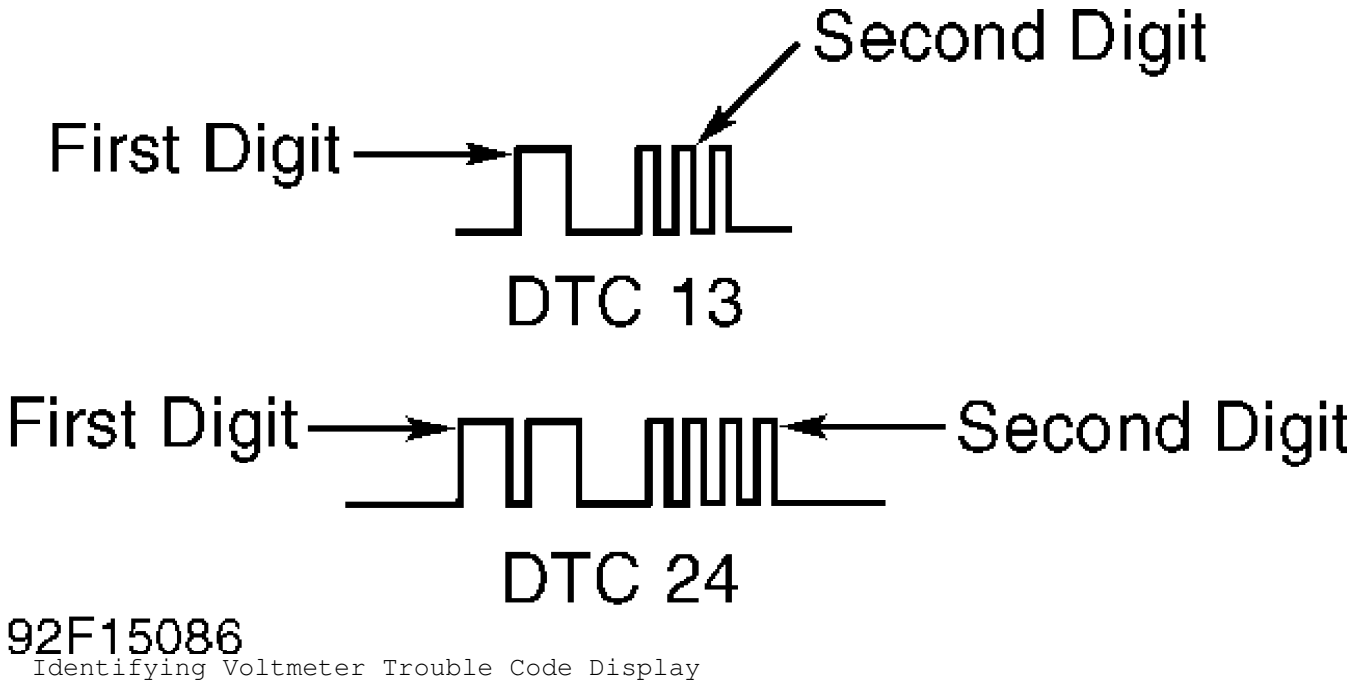

Fig. 9: Identifying Voltmeter Trouble Code Display
Courtesy of Mitsubishi Motor Sales of America.

FTC IDENTIFICATION

FTC IDENTIFICATION

11	High TP Sensor Output	Check TP Sensor Operation, Adjustment & Connector, Check Accelerator Switch
12	Low TP Sensor Output	Check TP Sensor Operation, Adjustment & Connector, Check Accelerator Switch
13	Defective Or Improperly Adjusted TP Sensor	Check TP Sensor Operation & Adjustment
14	Improperly Adjusted TP Sensor	Check TP Sensor Adjustment
15	Open Oil Temperature Sensor Circuit	Check Oil Temperature Sensor & Connector
16 (2)	Shorted Oil Temperature Sensor Circuit	Check Oil Temperature Sensor Wiring Harness
21	Open Kickdown Servo Switch Circuit	Check Kickdown Servo Switch & Connector
22	Shorted Kickdown Servo Switch Circuit	Check Kickdown Servo Switch & Connector
23	Open Ignition Pulse Signal Circuit	Check For Open Circuit To Pins No. 46 Or 63 At TCM
31	Open Pulse Generator "A" Circuit	Check Pulse Generator, Check Vehicle Speed Sensor

32	Open Pulse Generator "B" Circuit	Check Pulse Generator, Check Vehicle Speed Sensor
36 (2)	Short Circuit Neutral Safety Switch	Check Neutral Safety Switch
37 (2)	Open Circuit Neutral Safety Switch	Check Neutral Safety Switch
41	Open Shift Control Solenoid Valve "A" Circuit	Check Shift Control Solenoid Valve & Connector
42	Shorted Shift Control Solenoid Valve "A" Circuit	Check Shift Control Solenoid Valve & Connector
43	Open Shift Control Solenoid Valve "B" Circuit	Check Shift Control Solenoid Valve & Connector
44	Shorted Shift Control Solenoid Valve "B" Circuit	Check Shift Control Solenoid Valve & Connector
45	Open Pressure Control Solenoid Valve Circuit	Check Pressure Control Solenoid Valve & Connector
46	Shorted Pressure Control Solenoid Valve Circuit	Check Pressure Control Solenoid Valve & Connector
47	Open TCC Solenoid Valve Circuit	Check TCC Solenoid Valve & Connector
48	Shorted TCC Solenoid Valve Circuit	Check TCC Solenoid Valve & Connector
49	Defective TCC System	Check TCC Hydraulic Circuit, Check TCC Solenoid Valve, Defective TCM
51	Incorrect Or No Upshift From 1st Gear	Check Pulse Generators "A" & "B" Or Connectors, Rear Clutch Slipping
52	Incorrect Or No Upshift From 2nd Gear	Check Pulse Generators "A" & "B" Or Connectors, Rear Clutch Slipping, Kickdown Band Slipping
53	Incorrect Or No Upshift From 3rd Gear	Check Pulse Generators "A" & "B" Or Connectors, Front Or Rear Clutch Slipping
54	Incorrect Or No Upshift From 4th Gear	Check Pulse Generators "A" & "B" Or Connectors, End Clutch Slipping, Kickdown Band Slipping
59 (2)	Abnormal Vibration	Check Pulse Generator "A" Or Connector, Replace ATF
61 (3)	Shorted Torque Reduction Request Signal Line Or Open Torque Converter Reduction Execution Signal Line	Check Torque Reduction Request Or Execution Signal Line
62 (3)	Open Circuit On Torque Reduction Request Signal Line	Check Torque Reduction Request Signal Line

63 (3)	Shorted Circuit On Torque Reduction Execution Signal Line	Check Torque Reduction Execution Signal Line
81 (4)	Open Pulse Generator "A" Circuit	See DTC No. 31
82 (4)	Open Pulse Generator "B" Circuit	See DTC No. 32
83 (4)	Open Or Shorted Shift Control Solenoid Valve "A" Circuit	See DTC No. 41 & 42
84 (4)	Open Or Shorted Shift Control Solenoid Valve "B"	See DTC No. 43 & 44
85 (4)	Open Or Shorted Pressure Control Solenoid Valve	See DTC No. 45 & 46
86 (4)	Incorrect Or No Upshift	See DTC No. 51, 52, 53 & 54

(1) - To check items listed, see DIAGNOSTIC TESTING or COMPONENT TESTING.
(2) - Testing for Sonata not available.
(3) - Applies to Eclipse and 3000GT models only.
(4) - Trouble code is set in fail-safe mode only.

CLEARING TROUBLE CODES

WARNING: When battery is disconnected, vehicle computer and memory systems may lose memory data. Driveability problems may exist until computer systems have completed a relearn cycle. See COMPUTER RELEARN PROCEDURES article in APPLICATIONS & IDENTIFICATION before disconnecting battery.

Trouble codes can be cleared from TCM memory by disconnecting negative battery cable for more than 10 seconds. Ensure trouble codes are cleared after performing repairs.

DIAGNOSTIC TESTING

NOTE: For engine-related DTCs, see appropriate SELF-DIAGNOSTICS article in ENGINE PERFORMANCE section. These DTCs apply to engine performance and must be repaired first, as engine performance and related component signals will affect transmission operation and diagnosis. For TCM pin voltage tests, see TCM PIN VOLTAGES table under PIN VOLTAGE TESTING.

FTC 11, 12, 13 & 14: TP SENSOR MALFUNCTION

NOTE: If TP sensor output is excessive, FTC 11 is set. If TP sensor output is insufficient, FTC 12 is set. If TP sensor output and TCM value do not match, FTC 13 is set. If TP sensor adjustment is defective, FTC 14 is set.

1) Inspect TP sensor. See appropriate SELF-DIAGNOSTICS article in ENGINE PERFORMANCE section. Replace as needed and go to next step. If TP sensor is okay, inspect TP sensor connector and TCM

connector. Repair as needed and go to next step.

2) Clear FTC. See CLEARING TROUBLE CODES. Operate vehicle and check if FTC resets. If FTC is not present, vehicle is currently operating correctly. If FTC is reset, turn ignition off. Inspect continuity of circuits between TCM and TP sensor. See WIRING DIAGRAMS. Repair as needed. If circuit(s) are okay, replace TCM.

FTC 15 & 16: OIL TEMPERATURE SENSOR

NOTE: If FTC 15 is set, check for open circuit in oil temperature sensor. If FTC 16 is set, check for short circuit in oil temperature sensor.

1) Inspect oil temperature sensor. See COMPONENT TESTING. Replace as needed. With sensor connector disconnected, turn ignition on. Using voltmeter, measure voltage between sensor harness connector terminal No. 1 and ground. See Fig. 10. If voltage is not 4.8-5.2 volts, go to next step. If voltage is 4.8-5.2 volts, go to step 4).

2) Turn ignition off. Using ohmmeter, check continuity between ground and terminal No. 2 on sensor harness connector. If continuity does not exist, go to next step. If continuity exists, go to step 4).

3) Turn ignition off. Disconnect TCM connector. Inspect connector and repair as needed. Using ohmmeter, check continuity of circuits between TCM and oil temperature sensor harness connectors. See WIRING DIAGRAMS. Repair as needed. If circuit is okay, replace TCM.

4) Turn ignition off. Disconnect TCM connector(s). Inspect connector and repair as needed. Clear FTC. See CLEARING TROUBLE CODES. Operate vehicle and recheck FTC. If FTC is not present, vehicle is currently operating correctly. If FTC resets, repeat step 1).

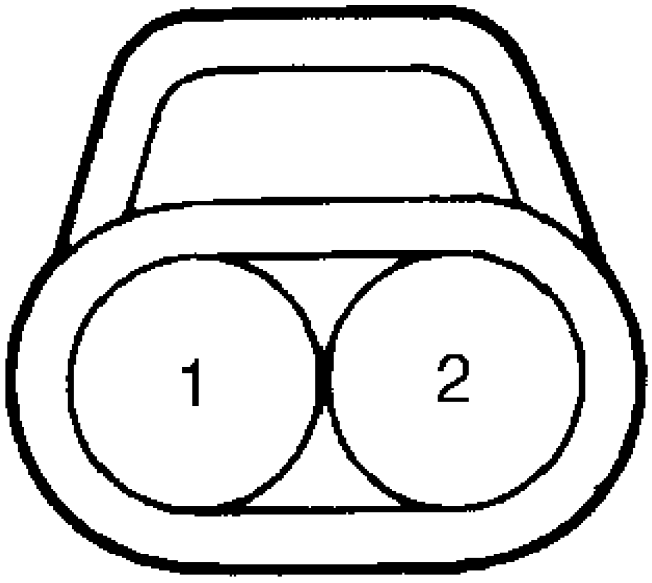

Fig. 10: Identifying Oil Temperature Sensor Terminals
Courtesy of Mitsubishi Motor Sales of America.

FTC 21 & 22: KICKDOWN SERVO SWITCH

NOTE: If FTC 21 is set, check for open circuit in kickdown servo switch. If FTC 22 is set, check for short circuit in kickdown servo switch.

1) Inspect kickdown servo switch. See COMPONENT TESTING. Replace as needed. With switch connector disconnected, turn ignition on. Using voltmeter, measure voltage at harness connector terminal. If battery voltage does not exist, go to next step. If battery voltage exists, go to step 3).
2) Turn ignition off. Disconnect TCM connector. Inspect connector and repair as needed. Using ohmmeter, check continuity between TCM and kickdown servo switch harness connectors. See WIRING DIAGRAMS. Repair as needed. If circuit is okay, replace TCM.
3) Turn ignition off. Disconnect TCM connector. Inspect connector and repair as needed. Clear FTC. See CLEARING TROUBLE CODES. Operate vehicle and recheck FTC. If FTC is not present, vehicle is currently operating correctly. If FTC resets, repeat step 1).

FTC 23: IGNITION SIGNAL

NOTE: FTC 23 may be set by possible open circuit in ignition signal.

1) If ignition pulses are not input to TCM while engine is idling, an open circuit in ignition signal line to TCM exists. Inspect appropriate connectors and wiring and repair as needed. See WIRING DIAGRAMS.
2) If vehicle's tachometer is not functioning correctly, inspect ignition circuit system. See appropriate SELF-DIAGNOSTICS article in ENGINE PERFORMANCE section. Possible causes of trouble code are ignition coil or power transistor malfunction. If tachometer is functioning correctly, replace TCM.

FTC 28: STOPLIGHT SWITCH MALFUNCTION

NOTE: FTC 28 may be set by possible short circuit in stoplight switch.

1) Inspect stoplight switch. See COMPONENT TESTING. Replace as needed. If stoplight switch is okay, inspect harness and connector. Repair as needed. Check continuity of circuit(s) between stoplight switch and TCM. See WIRING DIAGRAMS. Repair as needed.
2) Turn ignition off. Disconnect TCM connector. Using ohmmeter, check continuity of circuits between stoplight switch and TCM. Repair as needed. If all circuits are okay, replace TCM.

FTC 31 & 81: PULSE GENERATOR "A"

NOTE: If there is an open circuit in pulse generator "A", FTC 31 is set. If there is an open circuit in pulse generator "A" and vehicle is in limp-home mode, FTC 81 is set.

1) Inspect pulse generator "A". See COMPONENT TESTING. Replace as needed. If pulse generator is okay, inspect harness and connector. Repair as needed. Check continuity of circuit(s) between pulse generator "A" and TCM. See WIRING DIAGRAMS. Repair as needed.
2) Inspect end clutch retainer for damage. See appropriate overhaul article. Replace as needed. If end clutch retainer is okay, replace TCM.

FTC 32 & 82: PULSE GENERATOR "B"

NOTE: If there is an open circuit in pulse generator "B", FTC 32 is set. If there is an open circuit in pulse generator "B" and vehicle is in limp-home mode, FTC 82 is set.

1) Inspect pulse generator "B". See COMPONENT TESTING. Replace as needed. If pulse generator is okay, inspect harness and connector. Repair as needed. Check continuity between pulse generator "B" and TCM. See WIRING DIAGRAMS. Repair as needed.
2) Inspect end clutch retainer for damage. See appropriate overhaul article. Replace as needed. If end clutch retainer is okay, replace TCM.

FTC 36 & 37: PARK NEUTRAL POSITION (PNP) SWITCH

NOTE: If there is a short circuit in PNP, FTC 36 is set. If there is an open circuit in PNP, FTC 37 is set.

1) Inspect PNP switch. See COMPONENT TESTING. Replace as needed. If switch is okay, disconnect connector. Turn ignition on. Using voltmeter, measure voltage between PNP switch connector terminal No. 3 or No. 4 and ground. See Fig. 11. See WIRING DIAGRAMS. If battery voltage exists, go to next step. If battery voltage does not exist, repair circuit and recheck FTC.
2) Turn ignition off. Disconnect TCM connector. Using ohmmeter, check continuity of circuits between PNP switch and TCM. Repair as needed. If all circuits are okay, replace TCM.

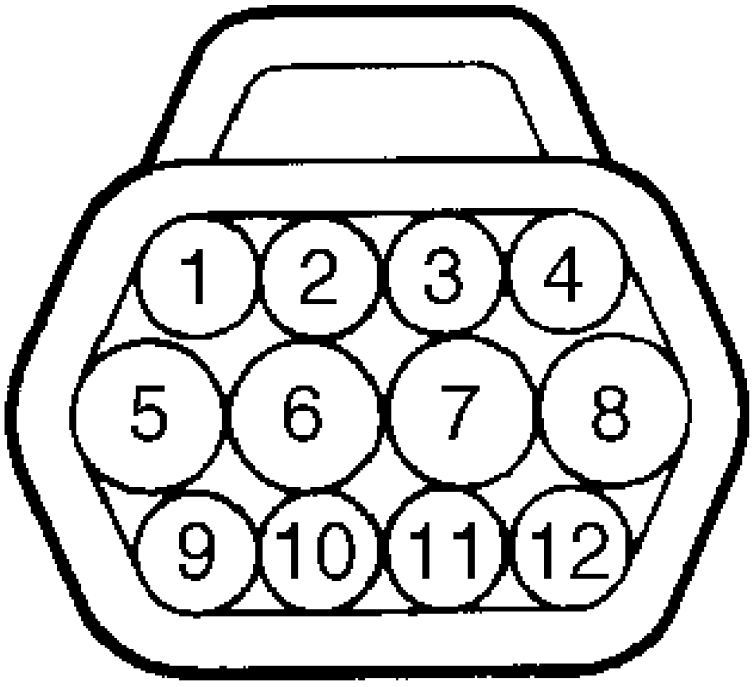

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Fig. 11: Identifying Park Neutral Position (PNP) Switch Connector Terminals
Courtesy of Mitsubishi Motor Sales of America.

FTC 41, 42 & 83: SHIFT CONTROL SOLENOID VALVE "A" (SCSV-A)

NOTE: If there is an open in SCSV-A, FTC 41 is set. If there is a short circuit in SCSV-A, FTC 42 is set. If either FTC 41 or 42 is set and vehicle is in limp-home mode, FTC 83 is set.

Inspect SCSV-A. See COMPONENT TESTING. Replace as needed. If shift solenoid is okay, disconnect TCM connector. Using ohmmeter, check continuity between SCSV-A and TCM. See WIRING DIAGRAMS. Repair as needed. If circuit is okay, replace TCM.

FTC 43, 44 & 84: SHIFT CONTROL SOLENOID VALVE "B" (SCSV-B)

NOTE: If there is an open in SCSV-B, FTC 43 is set. If there is a short circuit in SCSV-B, FTC 44 is set. If either FTC 43 or 44 is set and vehicle is in limp-home mode, FTC 84 is set.

Inspect SCSV-B. See COMPONENT TESTING. Replace as needed. If shift solenoid is okay, disconnect TCM connector. Using ohmmeter, check continuity between SCSV-B and TCM. See WIRING DIAGRAMS. Repair as needed. If circuit is okay, replace TCM.

FTC 45, 46 & 85: PRESSURE CONTROL SOLENOID VALVE (PCSV)

NOTE: If there is an open in PCSV, FTC 45 is set. If there is a short circuit in PCSV, FTC 46 is set. If either FTC 45 or 46 is set and vehicle is in limp-home mode, FTC 85 is set.

Inspect PCSV. See COMPONENT TESTING. Replace as needed. If shift solenoid is okay, disconnect TCM connector. Using ohmmeter, check continuity between PCSV and TCM. See WIRING DIAGRAMS. Repair as needed. If circuit is okay, replace TCM.

FTC 47, 48, 49 & 58: TORQUE CONVERTER CLUTCH (TCC) SOLENOID

NOTE: If there is an open in TCC, FTC 47 is set. If there is a short circuit in TCC, FTC 48 is set. If TCC drive duty stays at 100 percent for more than 4 seconds, an abnormality in TCC circuit has occurred and FTC 49 is set. If calculated slip amount is incorrect and TCC is locked all the time, FTC 58 is set.

Inspect TCC solenoid. See COMPONENT TESTING. Replace as needed. If shift solenoid is okay, disconnect TCM connector. Using ohmmeter, check continuity between TCC solenoid and TCM. See WIRING DIAGRAMS. Repair as needed. If circuit is okay, replace TCM.

FTC 51 & 86: 1ST GEAR RATIO INCORRECT

NOTE: If pulse generator "A" value and pulse generator "B" value do not match after 1st gear is engaged, FTC 51 may be set. If FTC 51, 52, 53 or 54 are set and vehicle is in limp-home mode, FTC 86 is set.

If code 31 is output, see FTC 31 & 81: PULSE GENERATOR "A". If code 32 is output, see FTC 32 & 82: PULSE GENERATOR "B". If neither code is output, inspect wiring harness to both pulse generators on transmission for damage. Noise interference may cause a trouble code to set. If wiring harness is okay, inspect transfer driven gear, end clutch retainer and rear clutch. See appropriate overhaul article.

FTC 52 & 86: 2ND GEAR RATIO INCORRECT

NOTE: If pulse generator "A" value and pulse generator "B" value do not match after 2nd gear is engaged, FTC 52 may be set. If FTC 51, 52, 53 or 54 are set and vehicle is in limp-home mode, FTC 86 is set.

If code 51 is output, see FTC 51 & 86: 1ST GEAR RATIO INCORRECT. If code 51 is not output, replace kickdown brake. See appropriate overhaul article.

FTC 53 & 86: 3RD GEAR RATIO INCORRECT

NOTE: If pulse generator "A" value and pulse generator "B" value do not match after 3rd gear is engaged, FTC 53 may be set. If FTC 51, 52, 53 or 54 are set and vehicle is in limp-home mode, FTC 86 is set.

If code 51 is output, see FTC 51 & 86: 1ST GEAR RATIO INCORRECT. If code 51 is not output, replace front clutch. See appropriate overhaul article.

FTC 54 & 86: 4TH GEAR RATIO INCORRECT

NOTE: If pulse generator "A" value and pulse generator "B" value do not match after 4th gear is engaged, FTC 54 may be set. If FTC 51, 52, 53 or 54 are set and vehicle is in limp-home mode, FTC 86 is set.

If code 52 is output, see FTC 52 & 86: 2ND GEAR RATIO INCORRECT. If code 52 is not output, replace end clutch. See appropriate overhaul article.

FTC 59: ABNORMAL VIBRATION

1) Most common cause of vibration is abnormal torque converter clutch pressure or defective torque converter. See appropriate overhaul article.
2) Disconnect transmission oil temperature sensor. If vibration still exists, engine vibration is most likely source. If vibration does not exist, inspect torque converter clutch hydraulic pressure. See appropriate overhaul article.
3) If pressure readings are not within specification, replace torque converter. If pressure readings are within specification, inspect valve body. Ensure valve body is not loose or has damaged "O" rings.

FTC 61, 62 & 63: TORQUE REDUCTION REQUEST & EXECUTION SIGNAL LINES

1) Code(s) are normally set due to poor connection, open circuit or, TCM or ECM malfunction. Ensure ignition is off. Disconnect ECM harness connector. Turn ignition on. Using voltmeter, measure voltage between ground and terminal No. 7 on ECM connector. See Fig. 12. If voltage is not 4.8-5.2 volts, go to next step. If voltage is 4.8-5.2 volts, substitute ECM with known good unit and retest.
2) Turn ignition off. Disconnect TCM connector. Using ohmmeter, check continuity of torque reduction request circuit between TCM and ECM. Repair as needed. If circuit is okay, replace TCM.

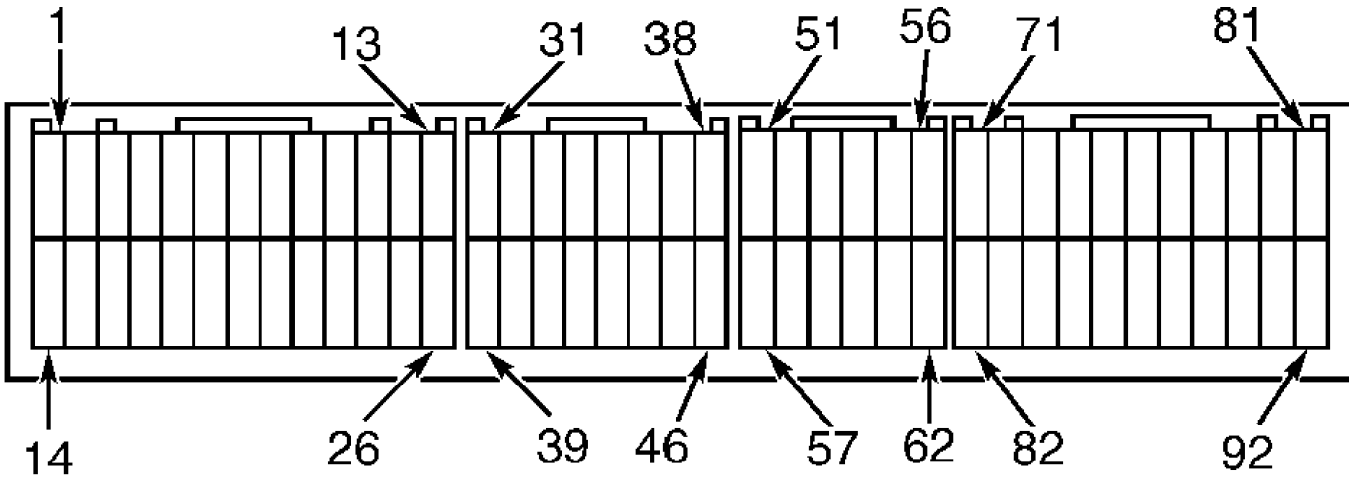

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Fig. 12: ECM Connector Terminals (Eclipse, Galant & 3000GT)
Courtesy of Mitsubishi Motor Sales of America.

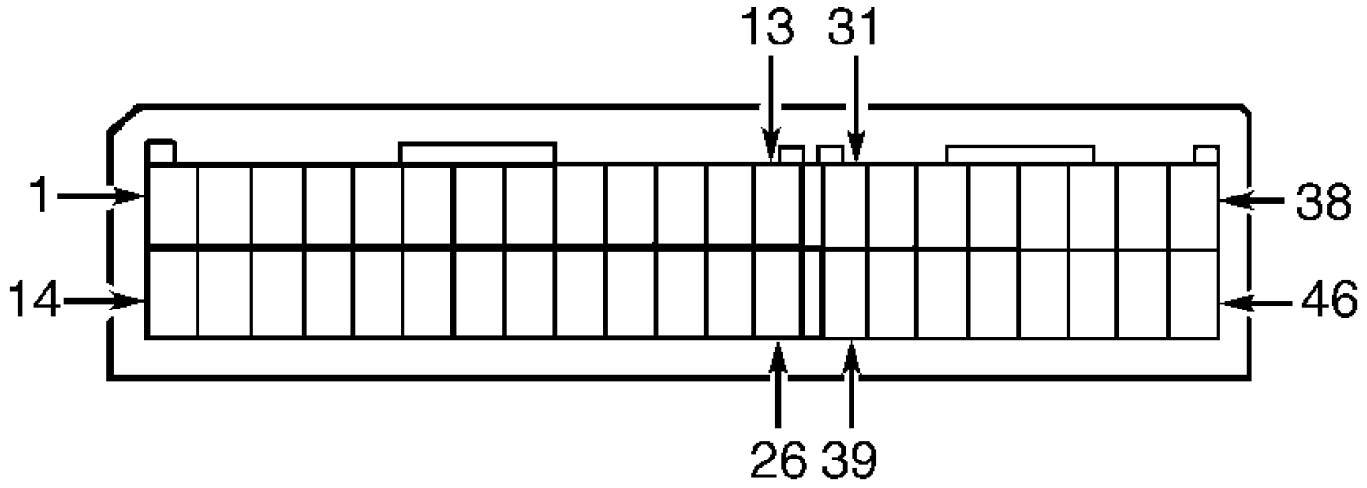

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Fig. 13: TCM Connector Terminal (Eclipse, Galant & 3000GT)
Courtesy of Mitsubishi Motor Sales of America.

PIN VOLTAGE TESTING

For the TCM pin voltage tests and correct TCM terminal locations, see Fig. 13 and TCM PIN VOLTAGES table.

TCM PIN VOLTAGES

Terminal Number	Description & Condition (1)	Value
No. 1 - Torque Converter Clutch (TCC) Solenoid	Selector Lever In "D" Position, Idling	0 Volts
	When Clutch Solenoid Is Operating	1-3 Volts

No. 2 - Shift Control Solenoid Valve "A" (SCSV-A)	Selector Lever In "L" Position, Idling	Battery Voltage
	Selector Lever In "2" Position, Idling	0 Volts
No. 3 - Oil Temperature Light (AWD Only) (2)	At All Times	0 Volts
	5 Minutes After Turning Ignition Switch On	Battery Voltage
No. 4 - ECM Communication, Idling With Selector Lever In "D" Position (2)		.5-4.5 Volts
No. 7 - Kickdown Servo Switch	Selector Lever In "L" Position, Idling	0 Volts
	Selector Lever In "D" Position, In 2nd Gear	Battery Voltage
No. 8 - A/C Compressor Clutch Relay Signal	A/C Switch On	Battery Voltage
	A/C Switch Off	0 Volts
No. 9 - Diagnostic Output Terminal		Fluctuates 0-5 volts
No. 11 - Diagnostic Test Mode Control Terminal (3)		
No. 12 - Power Supply, Idling		Battery Voltage
No. 13 - Ground, Idling		0 Volts
No. 14 - Pressure Control Solenoid Valve (PCSV), Idling In "D" Position		1.5-2.0 Volts
No. 15 - Shift Control Solenoid Valve "B" (SCSV-B)	In 1st & 2nd Gear	Battery voltage
	In 3rd & 4th Gear	0 Volts
No. 17 - ECM Communication, Idling With Engine Warm, Selector Lever In "D" Position		Approximately 2.5 Volts
No. 18 - ECM Communication, Idling With Selector Lever In "D" Position		5 Volts
No. 20 - Closed Throttle	Idling	0 Volts

Position Switch	Off Idle	5 Volts
No. 21 - Throttle Position Sensor	Throttle Fully Closed	.4-1.0 Volts
	Throttle Fully Open	4.5-5.5 Volts
No. 23 - Oil Temperature Sensor	Temperature At 68°F (20°C)	3.9 Volts
	Temperature At 212°F (100°C)	1.4 Volts
No. 24 - Sensor Ground, Idling		0 Volts
No. 25 - Power Supply, Idling		Battery voltage
No. 26 - Ground, Idling		0 Volts
No. 31 - Park Neutral Position (PNP) Switch	Selector Lever In "P" Position	Battery Voltage
	Selector Lever Out Of "P" Position	0 Volts
No. 32 - Park Neutral Position (PNP) Switch	Selector Lever In "R" Position	Battery Voltage
	Selector Lever Out Of "R" Position	0 Volts
No. 33 - Park Neutral Position (PNP) Switch	Selector Lever In "N" Position	Battery Voltage
	Selector Lever Out Of "N" Position	0 Volts
No. 34 - Park Neutral Position (PNP) Switch	Selector Lever In "D" Position	Battery Voltage
	Selector Lever Out Of "D" Position	0 Volts
No. 35 - Park Neutral Position (PNP) Switch	Selector Lever In "2" Position	Battery Voltage
	Selector Lever Out Of "2" Position	0 Volts
No. 36 - Park Neutral Position (PNP) Switch	Selector Lever In "L" Position	Battery Voltage
	Selector Lever Out Of "L" Position	0 Volts
No. 37 - Overdrive Switch	On Position	Battery Voltage
	Off Position	0 Volts
No. 38 - Stoplight	Brake Pedal Depressed	0 Volts

Switch		
	Brake Pedal Released	Battery Voltage
No. 39 - Backup Power Supply, Ignition Switch Off		Battery Voltage
No. 40 - Vehicle Speed Sensor (VSS), Slowly Moving		Fluctuates 0-5 Volts
No. 41 - Pulse Generator "B" (PG-B)	(4)	1.5 AC Volts Or More
No. 42 - Pulse Generator "B" (PG-B)	(4)	1.5 AC Volts Or More
No. 43 - Pulse Generator "A" (PG-A)	(5)	1.5 AC Volts Or More
No. 44 - Pulse Generator "A" (PG-A)	(5)	1.5 AC Volts Or More
No. 45 - Ground, Idling		0 Volts
No. 46 - Ignition Pulse	Engine Idling	1-4 Volts
	At 3000 RPM	.3-3.0 Volts

(1) - Terminals not listed are blank.
(2) - Terminals are not used on Sonata and Galant models.
(3) - Condition and value is not available.
(4) - Measure between terminals No. 41 and No. 42, with selector lever in "D" position, in 3rd gear and at 3000 RPM.
(5) - Measure between terminals No. 43 and No. 44, with selector lever in "D" position, in 3rd gear and at 3000 RPM.

COMPONENT TESTING

PARK NEUTRAL POSITION (PNP) SWITCH

Disconnect harness connector. Using ohmmeter, check continuity between specified terminals in each gear position. See Fig. 11. See PNP SWITCH CONTINUITY SPECIFICATIONS table. If continuity is not as specified, replace switch.

PNP SWITCH CONTINUITY SPECIFICATIONS

Vehicle/Switch Position	Continuity Between Terminals
Eclipse, Sonata & 3000GT	
"P"	3 & 4, 7 & 8
"R"	2 & 3, 5 & 6
"N"	3 & 12, 7 & 8
"D"	3 & 10
"2"	3 & 11
"1"	3 & 9
Galant	
"P"	1 & 4, 5 & 8
"R"	4 & 10, 6 & 7
"N"	2 & 4, 5 & 8

"D"	4 & 9
"2"	3 & 4
"1"	4 & 11

OIL TEMPERATURE SENSOR

Disconnect oil temperature sensor connector. Measure resistance between terminals on component side connector. Replace sensor if resistance is not within specification. See OIL TEMPERATURE SENSOR SPECIFICATION table.

OIL TEMPERATURE SENSOR SPECIFICATION

Oil Temperature °F (°C)	Resistance (Ohms)
32 (0)	16,700-20,500
212 (100)	570-690

OVERDRIVE CONTROL SWITCH

Disconnect electrical connector from overdrive control switch. Using ohmmeter, check continuity between specified wire terminals at switch connector. See Figs. 14-15. See OVERDRIVE CONTROL SWITCH CONTINUITY SPECIFICATIONS table. Replace overdrive control switch if defective.

OVERDRIVE CONTROL SWITCH CONTINUITY SPECIFICATIONS

Vehicle/Switch Position	Continuity Between Terminals
Eclipse & Galant	
ON	3 & 4
OFF	3 & 5
Sonata	
ON	2 & 5
OFF	1 & 2
3000GT	
ON	5 & 6
OFF	4 & 6

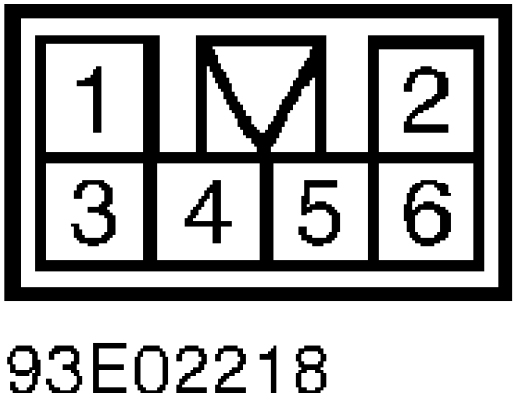


Fig. 14: Overdrive Switch Connector Terminals (All Except Sonata & 3000GT)
Courtesy of Mitsubishi Motor Sales of America.

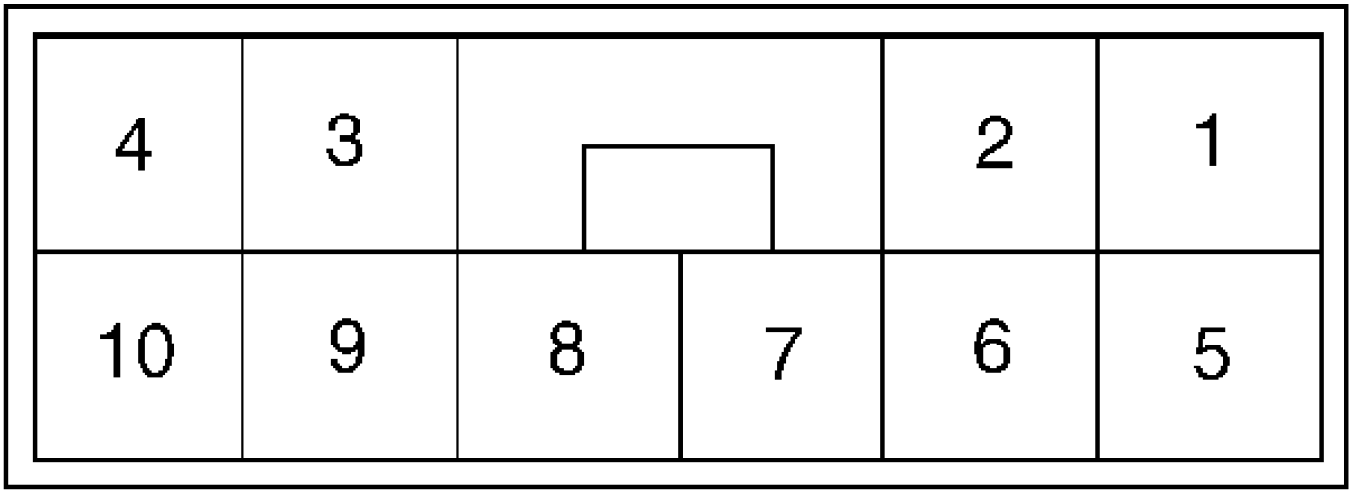


Fig. 15: Overdrive Switch Connector Terminals (Sonata)
Courtesy of Hyundai Motor Co.

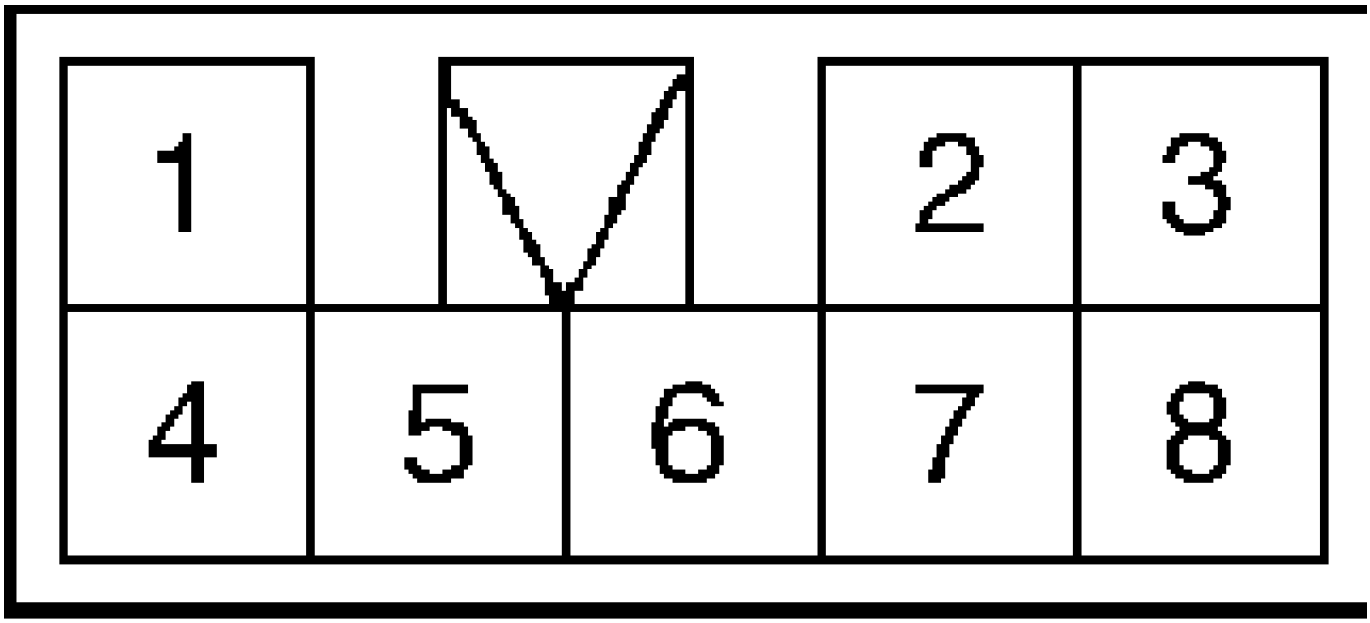


Fig. 16: Overdrive Switch & Power/Economy Switch Terminals (3000GT)
Courtesy of Mitsubishi Motor Sales of America.

POWER/ECONOMY SWITCH

On Sonata, disconnect power/normal switch connector. On 3000GT, disconnect power/economy and overdrive switch connector. Measure continuity between specified terminals. See POWER/ECONOMY SWITCH CONTINUITY SPECIFICATIONS table. See Fig. 16.

POWER/ECONOMY SWITCH CONTINUITY SPECIFICATIONS

Vehicle & Condition	Continuity Between Terminals
Sonata (1)	
Power Mode	3 & 5
Economy Mode	3 & 6
3000GT	
Power Mode	1 & 2
Economy Mode	(2)

(1) - To identify Power/Normal switch connector terminals for Sonata, see WIRING DIAGRAMS.
(2) - Continuity should not exist between any terminals in Economy mode. Continuity exists between terminals 2 and 3 in Hold mode.

PULSE GENERATORS

Disconnect pulse generator harness connector. Measure resistance between terminals No. 1 or No. 2 for generator "A" or terminals No. 3 and No. 4 for generator "B". See Fig. 17. Replace pulse generator if resistance is not 330-390 ohms at 68°F (20°C).

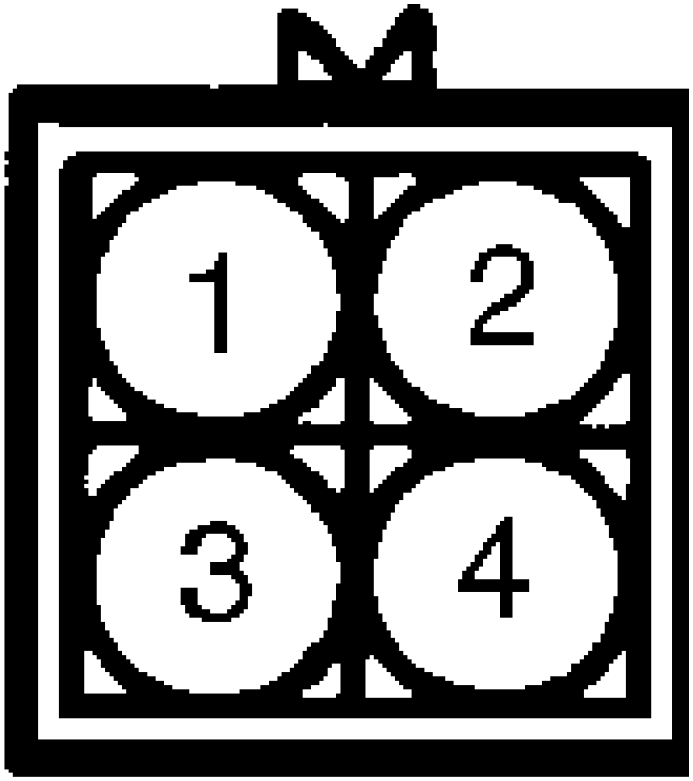


Fig. 17: Identifying Pulse Generator Or Solenoid Connector Terminals
Courtesy of Daimler Chrysler Corp.

SOLENOIDS

NOTE: All solenoids can be operated by applying 12 volts to specific connector terminal and solenoid case. See Fig. 17. See SOLENOID CONNECTOR TERMINAL IDENTIFICATION table.

Disconnect solenoid connector. Measure resistance between ground and appropriate terminal at component side of solenoid connector. See Fig. 17. See SOLENOID CONNECTOR TERMINAL IDENTIFICATION table. If solenoid does not test as specified, replace and retest system.

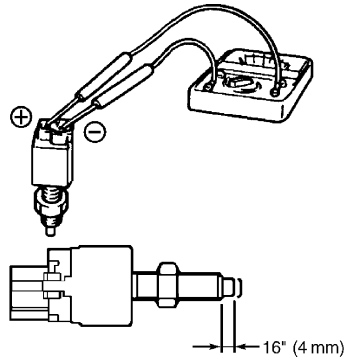
SOLENOID CONNECTOR TERMINAL IDENTIFICATION

Solenoid	Terminal No.	(1) Resistance (Ohms)
PCSV	1	2.6-3.2
SCSV "A"	3	20.8-23.8
SCSV "B"	4	20.8-23.8
TCC	2	13

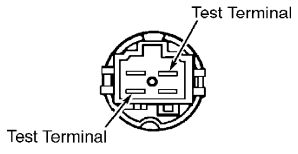
(1) - Test solenoid resistance with ambient temperature at 68°F (20°C).

STOPLIGHT SWITCH

Disconnect connector from stoplight switch and check continuity between terminals shown. See Fig. 18. Continuity should not exist when plunger of switch is pushed in to a depth of within .16" (4 mm) from outer case edge. See Fig. 18. Continuity should exist when released. For vehicles equipped with auto-cruise control system, see Fig. 18 for terminal locations.



VEHICLES WITHOUT CRUISE CONTROL



VEHICLES WITH CRUISE CONTROL

99D51014

Fig. 18: Testing Stoplight Switch (All Models)
Courtesy of Mitsubishi Motor Sales of America.

REMOVAL & INSTALLATION

PARK NEUTRAL POSITION (PNP) SWITCH

Removal & Installation

1) Disconnect shift control cable. Remove retaining bolt and manual control lever. Remove retaining screws and PNP switch.

2) To install, reverse removal procedure. DO NOT tighten PNP switch retaining screws at this time. Tighten manual control lever retaining bolt to specification. See TORQUE SPECIFICATIONS. Adjust PNP switch. See PARK NEUTRAL POSITION (PNP) SWITCH under ADJUSTMENTS.

KICKDOWN SERVO SWITCH

Removal & Installation

Disconnect electrical connector. Remove snap ring and kickdown servo switch. To install, reverse removal procedure.

OIL TEMPERATURE SENSOR

Removal & Installation

Oil temperature sensor is mounted inside transaxle case. See Fig. 19. Drain transaxle fluid. Remove oil pan bolts and oil pan. Remove bolts securing oil temperature sensor to valve body. To install, reverse removal procedure.

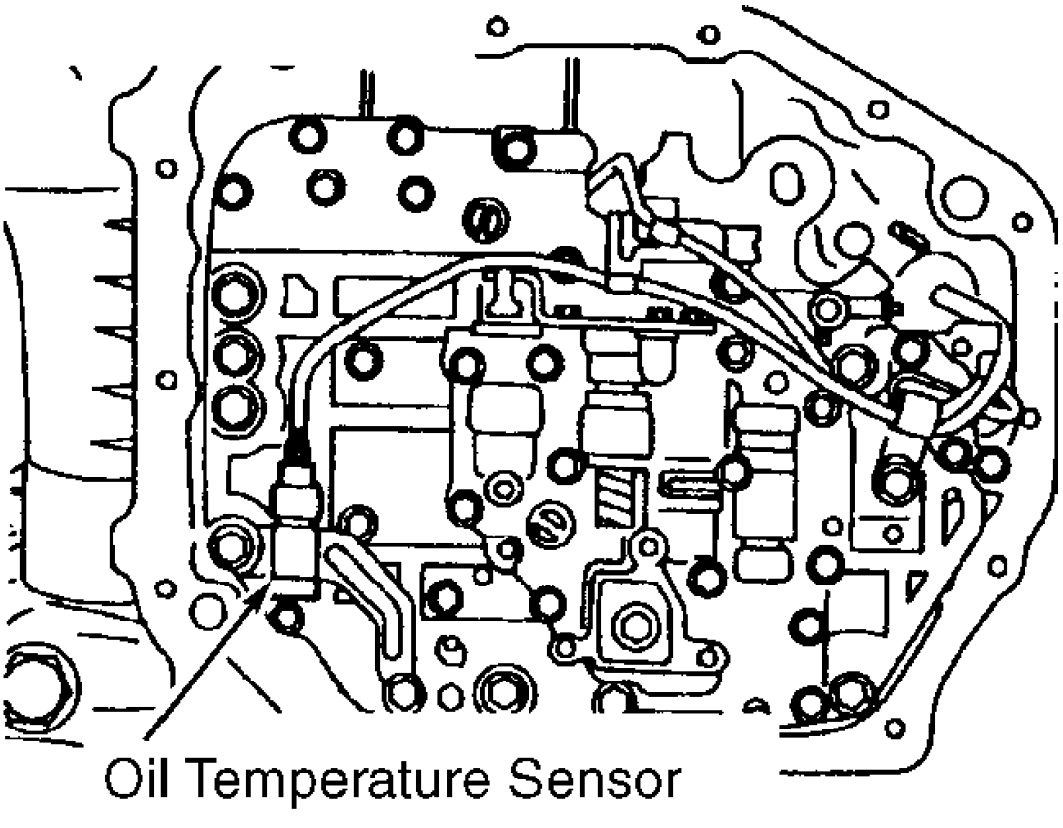


Fig. 19: Locating Oil Temperature Sensor
Courtesy of Mitsubishi Motor Sales of America.

OVERDRIVE CONTROL SWITCH

Removal & Installation

Remove cover plate on inside of gear selector lever. Remove screw securing overdrive switch to lever. Remove overdrive control switch from side of gear selector lever. To install, reverse removal procedure.

POWER/ECONOMY SWITCH

Removal & Installation (3000GT)

Slide flat tipped screw driver down each side of switch to unlatch tabs. Remove power/economy switch from center console. To install, reverse removal procedure.

PULSE GENERATORS

Removal & Installation

1) Note location of pulse generators "A" and "B" for reassembly reference. Pulse generator "A" wires are wrapped in a transparent tube and "B" wires are wrapped in a Black tube. See Fig. 4 .

2) Remove retaining bolt and pulse generator. To install, reverse removal procedure. Tighten retaining bolt to specification. See TORQUE SPECIFICATIONS.

TRANSAXLE CONTROL MODULE (TCM)

Removal & Installation

The TCM is located behind instrument panel, near center of console. See Figs. 1-3. Information is not available on TCM removal.

VALVE BODY SOLENOIDS

NOTE: Valve body solenoids consist of torque converter clutch control, pressure control and shift control solenoid valves.

Removal & Installation

1) Drain transaxle fluid. Remove retaining bolts, oil pan, magnet and gasket. Note location of solenoid valve. See Fig. 6. Disconnect necessary electrical connector. Remove retaining bolt and solenoid valve.

2) To install, reverse removal procedure. Ensure solenoid valve is installed in proper location. See Fig. 6. Solenoid valves can be identified by the wire color. For wire color identification, see WIRING DIAGRAMS. Fill transaxle with ATF.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Manual Control Lever Bolt	13-15 (18-20)
	INCH Lbs. (N.m)
Neutral Safety Switch Bolt	89-102 (10.1-11.5)
Oil Filter Bolt	48-60 (5.4-6.8)
Oil Pan Bolt	48-60 (5.4-6.8)
Pulse Generator Bolt	89-102 (10.1-11.5)
Shift Control Cable Lock Nut	108 (12.2)
TP Sensor Retaining Screw	17 (1.9)

WIRING DIAGRAMS

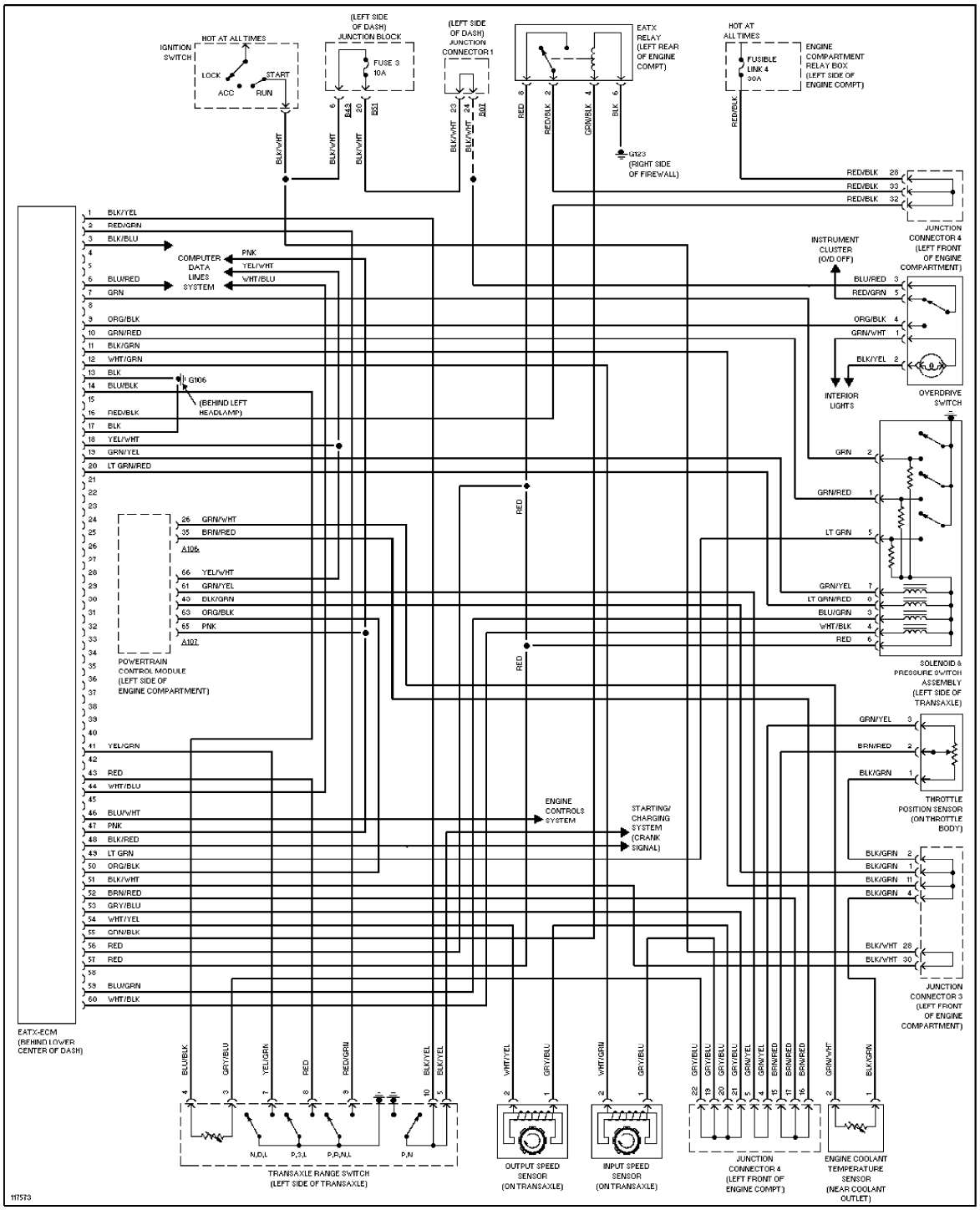


Fig. 20: 1997-98 Transaxle Wiring Diagram (Eclipse 2.0L Turbo & 2.4L)

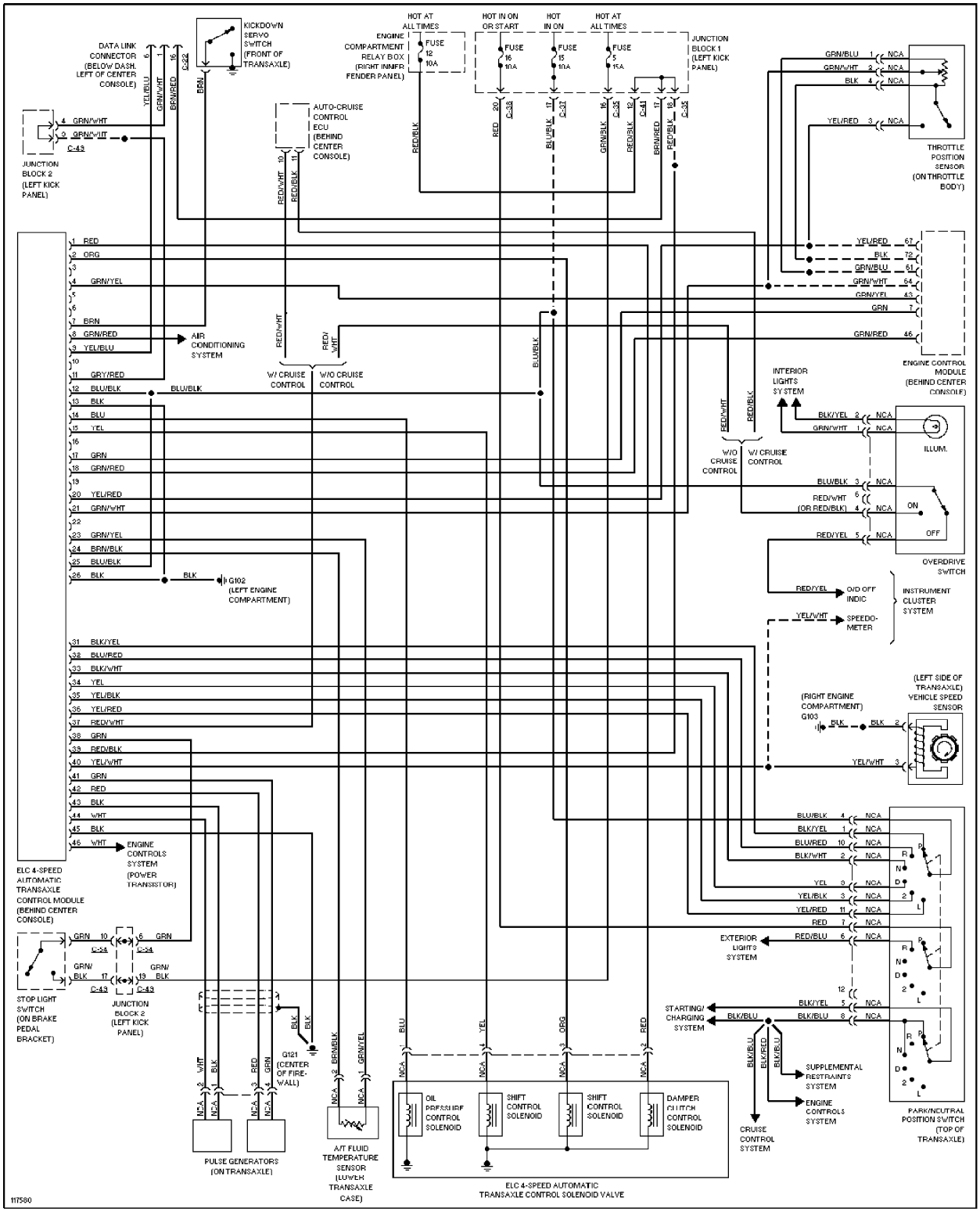


Fig. 21: 1997-98 Transaxle Wiring Diagram (Galant)

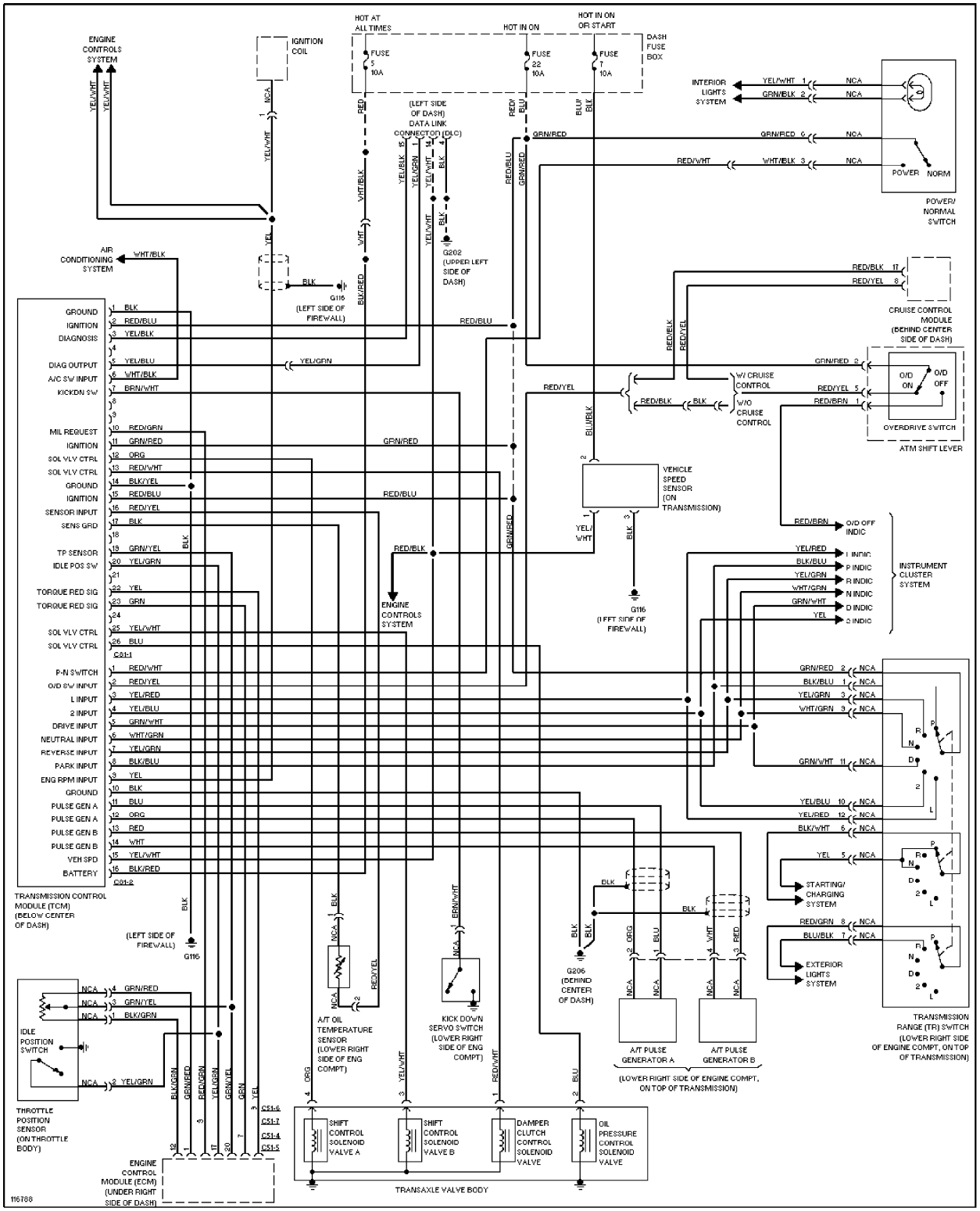


Fig. 22: 1997 Transaxle Wiring Diagram (Sonata 3.0L)

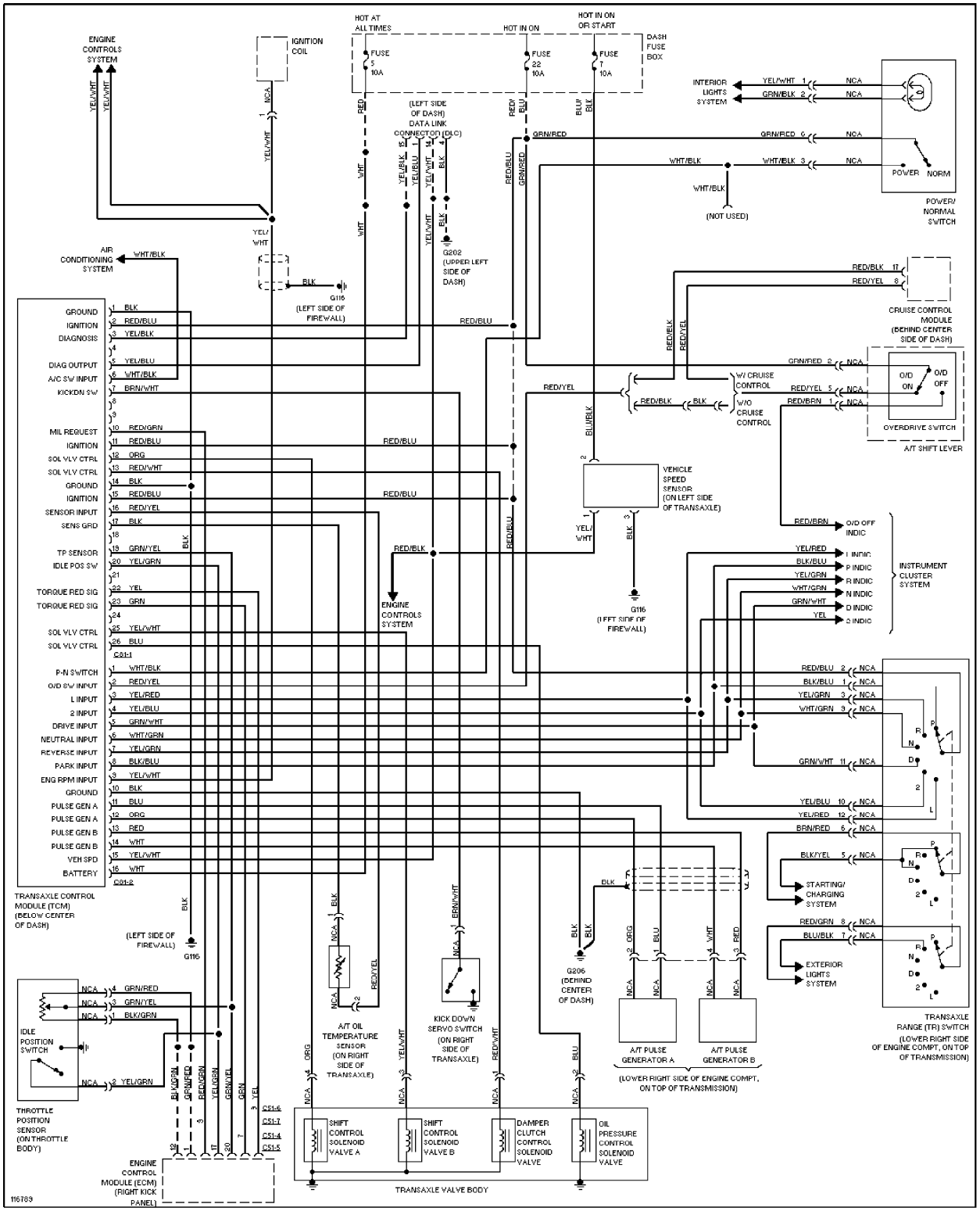


Fig. 23: 1998 Transaxle Wiring Diagram (Sonata 3.0L)

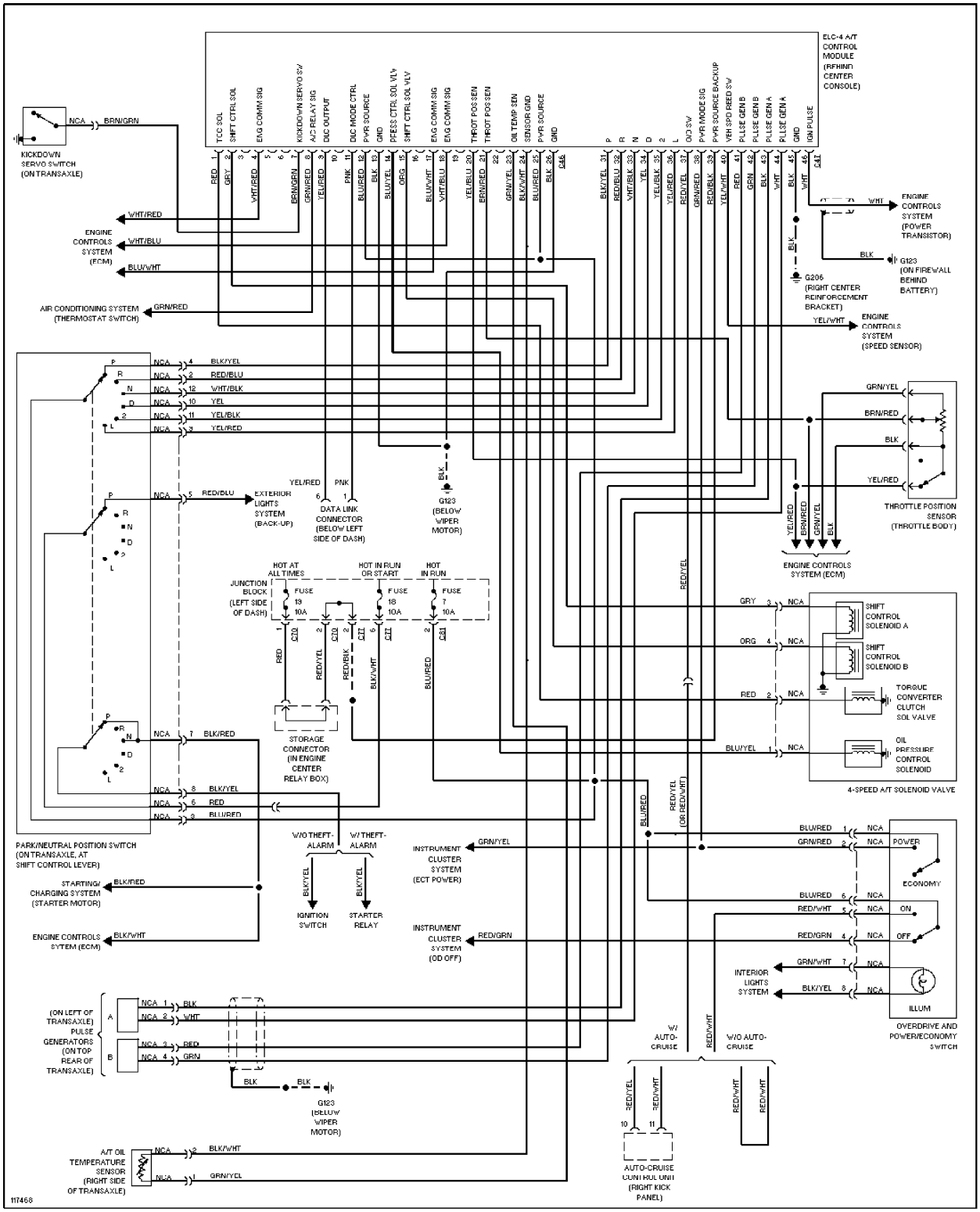


Fig. 24: 1997-98 Transaxle Wiring Diagram (3000GT)

AXLE SHAFTS - FRONT

1998 Mitsubishi Galant

1997-98 DRIVE AXLES
Mitsubishi FWD Axle Shafts

Diamante, Eclipse, Galant, Mirage, 3000GT

DESCRIPTION & OPERATION

NOTE: The following are possible types of Constant Velocity (CV) joints used on axle shaft: Birfield Joint (BJ), Double Offset Joint (DOJ), Rzeppa Joint (RJ) and Tripod Joint (TJ). Determine type of CV joint used prior to disassembly. See AXLE SHAFT SPECIFICATIONS table.

Power from transaxle is transferred to drive wheels by 2 axle shafts. Both axle shafts use Constant Velocity (CV) joints at inner and outer ends. CV joints are enclosed in CV boots, and connected by an intermediate shaft. Intermediate shaft is splined on both ends.

Retaining rings retain intermediate shaft in both inner and outer CV joints. A retaining ring retains inner CV joint stub in differential side gear. Outer CV joint stub is splined into wheel hub, and secured by a spindle nut. On some models, one or both axles have a dynamic damper to reduce vibration.

AXLE SHAFT SPECIFICATIONS

Application (1)	(2) Inner Joint	(2) Outer Joint	Shaft Length In. (mm)
Diamante	TJ	BJ	(3)
Eclipse	TJ	TJ	(3)
Galant	TJ	BJ	(3)
Mirage	TJ	RJ	(3)
3000GT	TJ	BJ	(3)

(1) - Right indicates passenger's side, and left indicates driver's side.
(2) - Type of CV joint used are identified by letters as follows: BJ - Birfield Joint, DOJ - Double Offset Joint, RJ - Rzeppa Joint, and TJ - Tripod Joint.
(3) - Information is not available from manufacturer.

TROUBLE SHOOTING

NOTE: See TROUBLE SHOOTING - BASIC PROCEDURES article in the GENERAL TROUBLE SHOOTING section.

BAND & BOOT IDENTIFICATION

NOTE: Determine type of CV joint used prior to disassembly. See AXLE SHAFT SPECIFICATIONS table. Note type of boot and location prior to removal. See BAND & BOOT APPLICATION table. Install a NEW retaining ring each time axle shaft is removed from transaxle.

Band identification numbers are stamped on inside edge of band. See Fig. 1. Boot identification numbers are stamped on largest ridge of boot. See BAND & BOOT APPLICATION table.

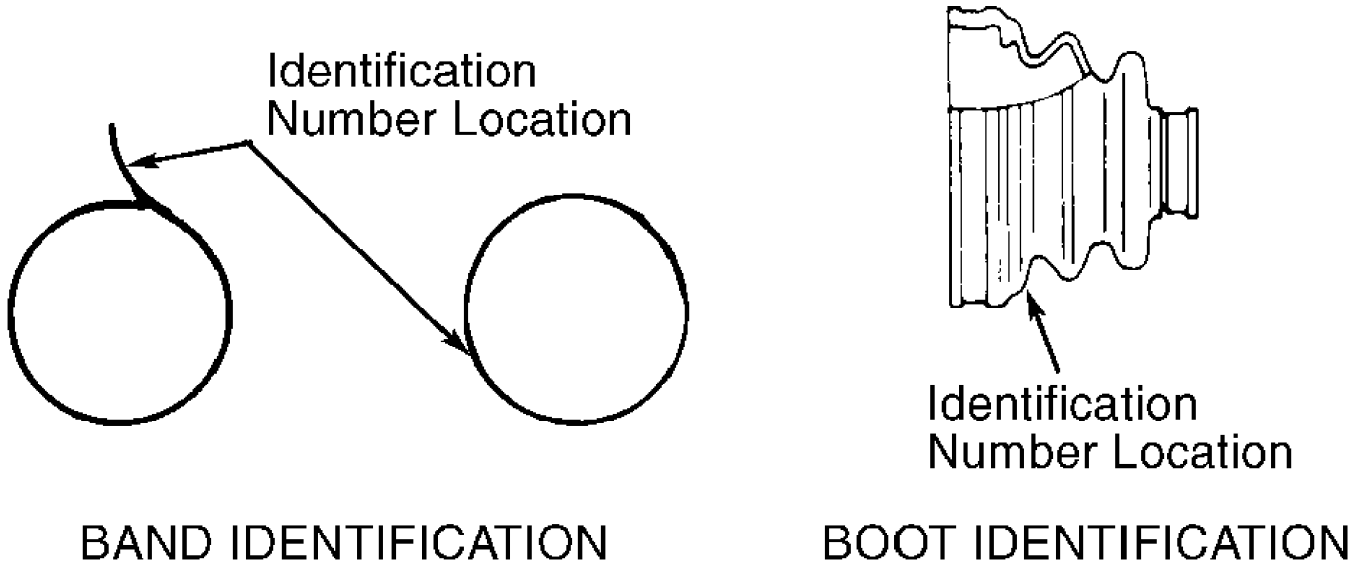


Fig. 1: Locating Band & Boot Identification Numbers
Courtesy of Mitsubishi Motor Sales of America.

BAND & BOOT APPLICATION

Application	Large Band	Small Band	Boot
Diamante	(1)	(1)	(1)
Eclipse	(1)	(1)	(1)
Galant	(1)	(1)	(1)
Mirage	33	31.3	(1)
3000GT			
BJ	(1)	(1)	(1)
TJ			
Except FWD (SOHC)	20-131	20-72	(1)
FWD (SOHC)	20-75	20-76	(1)

(1) - Boots and bands are packaged as a kit. Kits are broken down by type of joint. Identification numbers are not available from manufacturer.

REMOVAL, DISASSEMBLY, REASSEMBLY & INSTALLATION

AXLE SHAFT

CAUTION: DO NOT place vehicle weight on hub assembly with axle shaft removed.

Removal

1) Note type and location of CV joint prior to removal. See AXLE SHAFT SPECIFICATIONS table. Remove cotter pin, and loosen axle shaft nut with brakes applied. Raise and support vehicle. Remove front wheels. Remove axle shaft nut and washer. Remove brake caliper assembly, and wire aside. Support control arm.

2) Remove speed sensor and/or height sensor (if equipped). Remove ball joint stud nut, and separate ball joint from control arm.

Disconnect tie rod end from steering knuckle. Disconnect stabilizer bar and strut bar from control arm (if equipped).

CAUTION: DO NOT pull on axle shafts during removal, or damage to shaft assembly will result.

3) Attach puller to hub and press axle shaft off hub. Swing hub and steering knuckle assembly aside. On left axles without intermediate shaft, pry axle shafts from transaxle using pry bar. DO NOT damage oil seals.

4) On left axles with intermediate shaft, place screwdriver between center bearing and axle shaft. Pry axle shaft from center bearing. Remove center bearing bolts. Place pry bar between transaxle case and intermediate shaft. Pry intermediate shaft from transaxle.

5) On AWD models, remove center bearing bolts from left axle with intermediate shaft. Using soft-faced hammer, tap lightly on Tripod Joint (TJ) case, and remove axle shaft from transaxle. See Fig. 2.

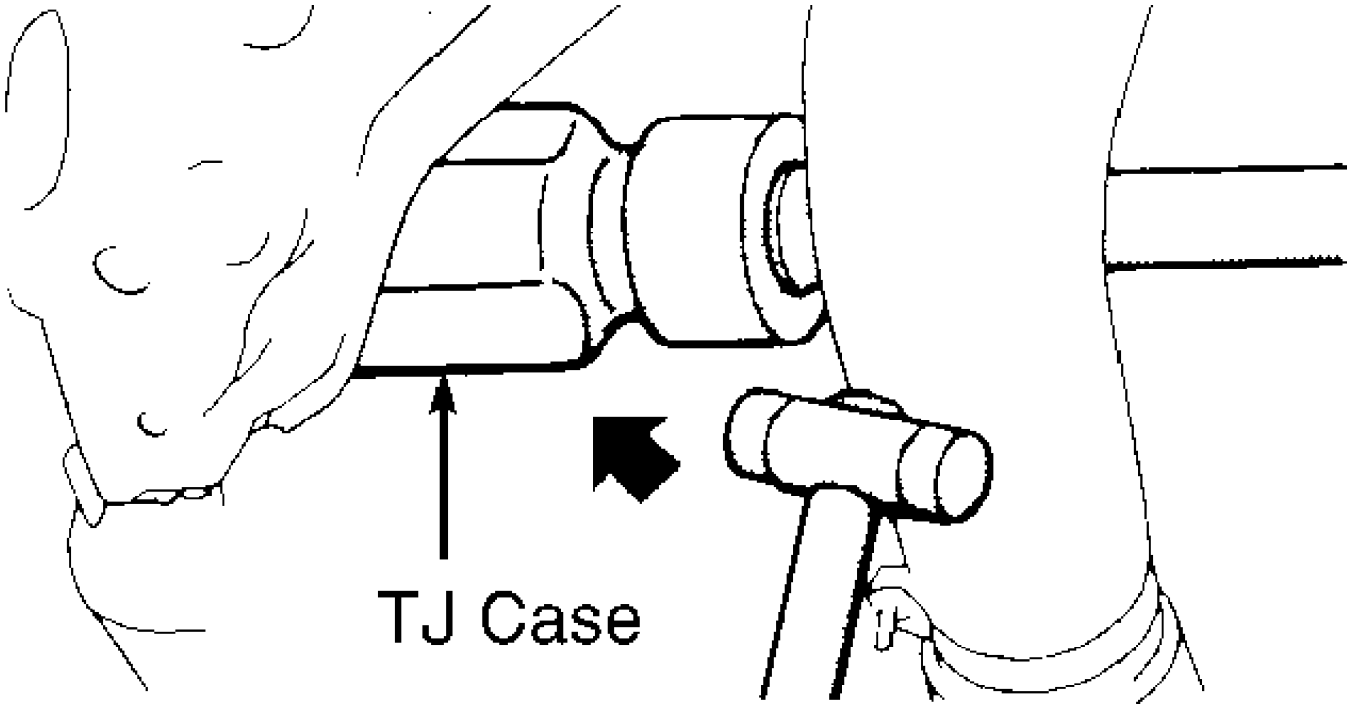


Fig. 2: Removing Left Axle Shaft (AWD Models)
Courtesy of Mitsubishi Motor Sales of America.

Installation

Position dynamic damper properly on axle shaft (if equipped). See DYNAMIC DAMPER. To complete installation, reverse removal procedure. See Fig. 3. On all models, when installing axle shaft nut, washer must be installed with chamfered edge (raised side) toward axle shaft nut. Tighten axle shaft nut to specification. See TORQUE SPECIFICATIONS.

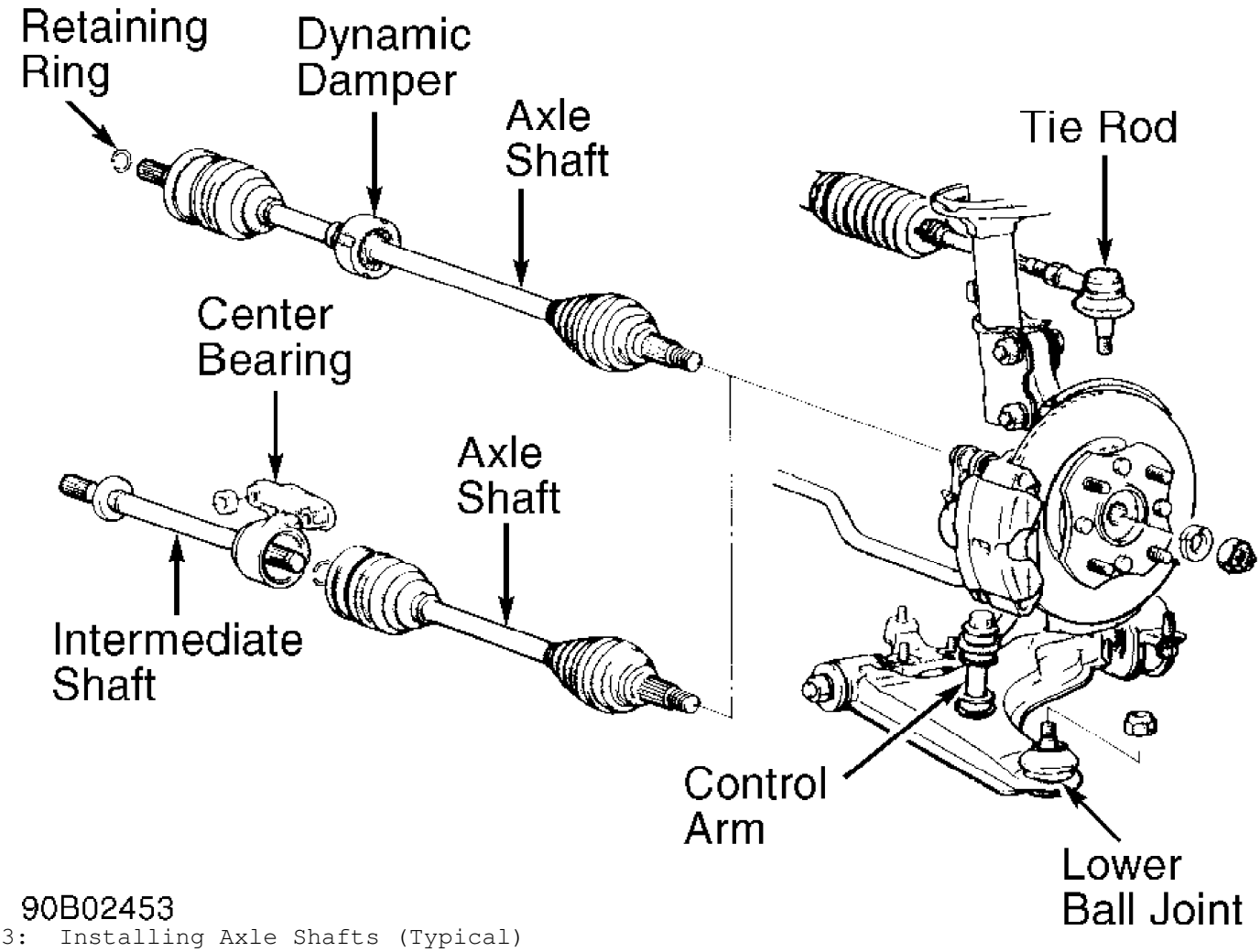


Fig. 3: Installing Axle Shafts (Typical)
Courtesy of Mitsubishi Motor Sales of America.

DYNAMIC DAMPER

Dynamic damper must be properly positioned on axle shaft. Position damper so proper distance exists between damper and end of boot with axle shaft in a straight/level position. See Fig. 4. Distance must be within specification. See DYNAMIC DAMPER INSTALLATION SPECIFICATIONS table.

DYNAMIC DAMPER INSTALLATION SPECIFICATIONS

Application	(1) Damper-To-Boot End Distance In. (mm)
Eclipse (FWD)	
2.0L Non-Turbo	
A/T	
Left	N/A
Right (2)	14.60-14.84 (371-377)
M/T	
Left (2)	7.52-7.76 (191-197)
Right (2)	14.60-14.84 (371-377)
2.0L Turbo	
Left (2)	14.60-14.72 (371-377)

Right	N/A
2.4L	
Left (2)	14.25-14.49 (362-368)
Right (2)	8.58-8.82 (218-224)
Galant	
Left (3)	14.25-14.49 (362-368)
Right (3)	8.58-8.82 (218-224)
Mirage	
1.5L (3)	17.24-17.48
1.8L (3)	14.88-15.12 (378-384)

(1) - Ensure axle shaft is in straight position.
(2) - Measure at width "A".
(3) - Measure at width "B".

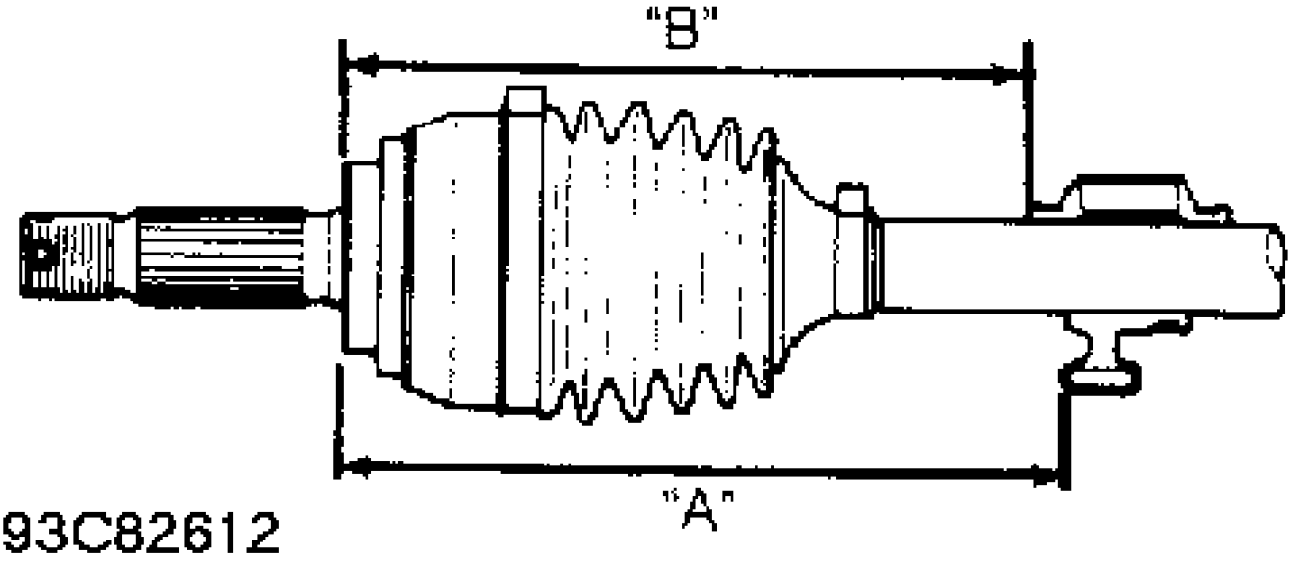


Fig. 4: Installing Dynamic Damper
Courtesy of Mitsubishi Motor Sales of America.

INTERMEDIATE SHAFT

Disassembly

Press intermediate shaft and bearing assembly (if equipped) from TJ case with Intermediate Shaft Remover (MB991248 or MD998801). Press out intermediate shaft from center bearing assembly with Bearing Puller (MB990810-01). Remove center bearing from bracket with appropriate bearing remover. See Fig. 5.

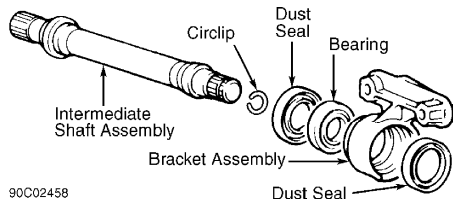


Fig. 5: Assembling Intermediate Shaft (Typical)
Courtesy of Mitsubishi Motor Sales of America.

Reassembly

Grease center bearing and inside center bearing bracket.

Press bearing into bearing bracket assembly with appropriate bearing installer. Press dust seals into bearing with handle and installer. Lubricate assembly with grease. Press intermediate shaft into center bearing assembly.

BIRFIELD JOINT (BJ) & RZEPPA JOINT (RJ) ASSEMBLY

CAUTION: DO NOT disassemble BJ or RJ type assemblies.

Disassembly

Note type of boot and location prior to removal. See BAND & BOOT IDENTIFICATION. DO NOT disassemble BJ or RJ type assemblies. Only CV boot may be replaced. To remove boot, wrap splined area of axle shaft with tape. Remove band and boot.

Reassembly

Ensure proper boot is installed. See BAND & BOOT APPLICATION table. Apply proper amount of grease to joint and inside of boot. See AXLE SHAFT LUBRICATION SPECIFICATIONS table. Tighten bands on boots with axle shaft in straight position.

AXLE SHAFT LUBRICATION SPECIFICATIONS

Application	Ozs. (g)
Diamante	
Inner Boot	5.1 (145)
Outer Boot	5.6 (160)
Eclipse	
Inner Boot	
2.0L Non-Turbo	3.7 (105)
2.0L Turbo & 2.4L	3.4 (95)
Outer Boot	
AWD	3.4 (95)
FWD	
2.0L Non-Turbo	3.9 (110)
2.0L Turbo & 2.4L	4.6 (130)
Galant	
Inner Boot	4.2 (120)
Outer Boot	
1997	4.6 (130)
1998	(1)
Mirage	
Inner Boot	
RJ Type Axle	4.4 (125)
BJ Type Axle	3.4 (95)
Outer Boot	3.5-4.2 (100-120)
3000GT	
Inner Boot	
AWD & FWD (DOHC)	5.6 (160)
FWD (SOHC)	5.3 (151)
Outer Boot	(1)

(1) - Bands, boots and grease are packaged as a kit. Specifications are not available from manufacturer. Apply 1/2 of the amount of grease supplied to joint, the other half to inside of boot.

DOUBLE OFFSET JOINT (DOJ) ASSEMBLY

Disassembly

1) Note type of boot and location prior to removal. Remove bands and boot from DOJ housing. See Fig. 6. Remove circlip and remove

DOJ housing.

2) Place reference marks on axle shaft, DOJ inner race and DOJ outer race for reassembly reference. Remove snap ring. Remove DOJ cage, balls and DOJ inner race. Wrap splined area of axle shaft with tape, and remove boot.

Reassembly

1) To reassemble, reverse disassembly procedure. Ensure reference marks are aligned on DOJ inner race and axle shaft. Apply one half of proper lubricant amount in balls and inner race, and other half in DOJ boot. See AXLE SHAFT LUBRICATION SPECIFICATIONS table.

2) Install boot and bands. Position boots so bands are positioned 3.42-3.66" (87.0-93.0 mm) from each other. Tighten bands with axle shaft in straight/level position.

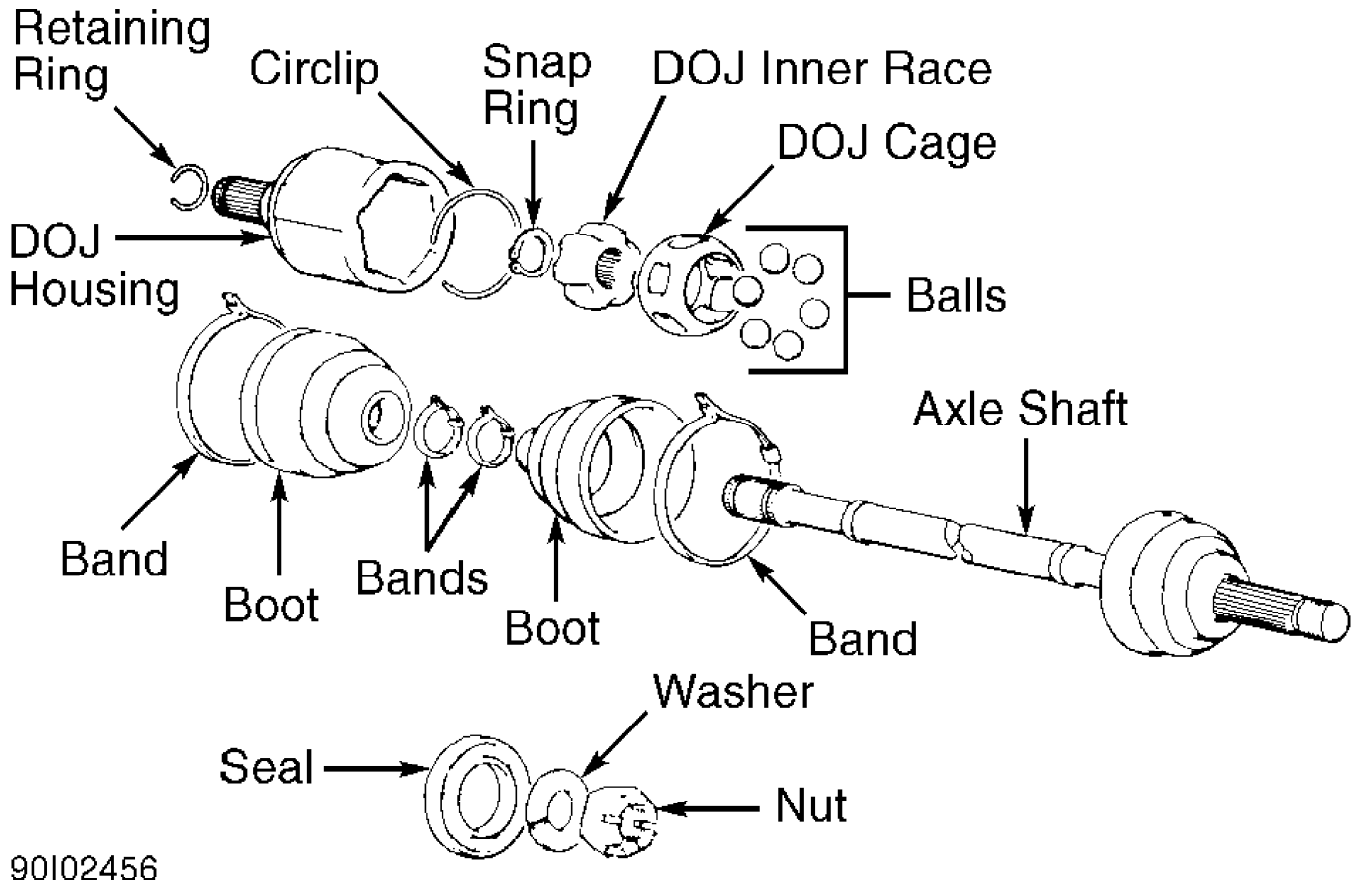


Fig. 6: Exploded View Of DOJ Assembly
Courtesy of Mitsubishi Motor Sales of America.

TRIPOD JOINT (TJ) ASSEMBLY

Disassembly

1) Note type of boot and location prior to removal. See BAND & BOOT APPLICATION table. Remove bands and boot from TJ case. See Fig. 7. Place reference mark on TJ case and spider assembly. Pull axle shaft and spider assembly from TJ case.

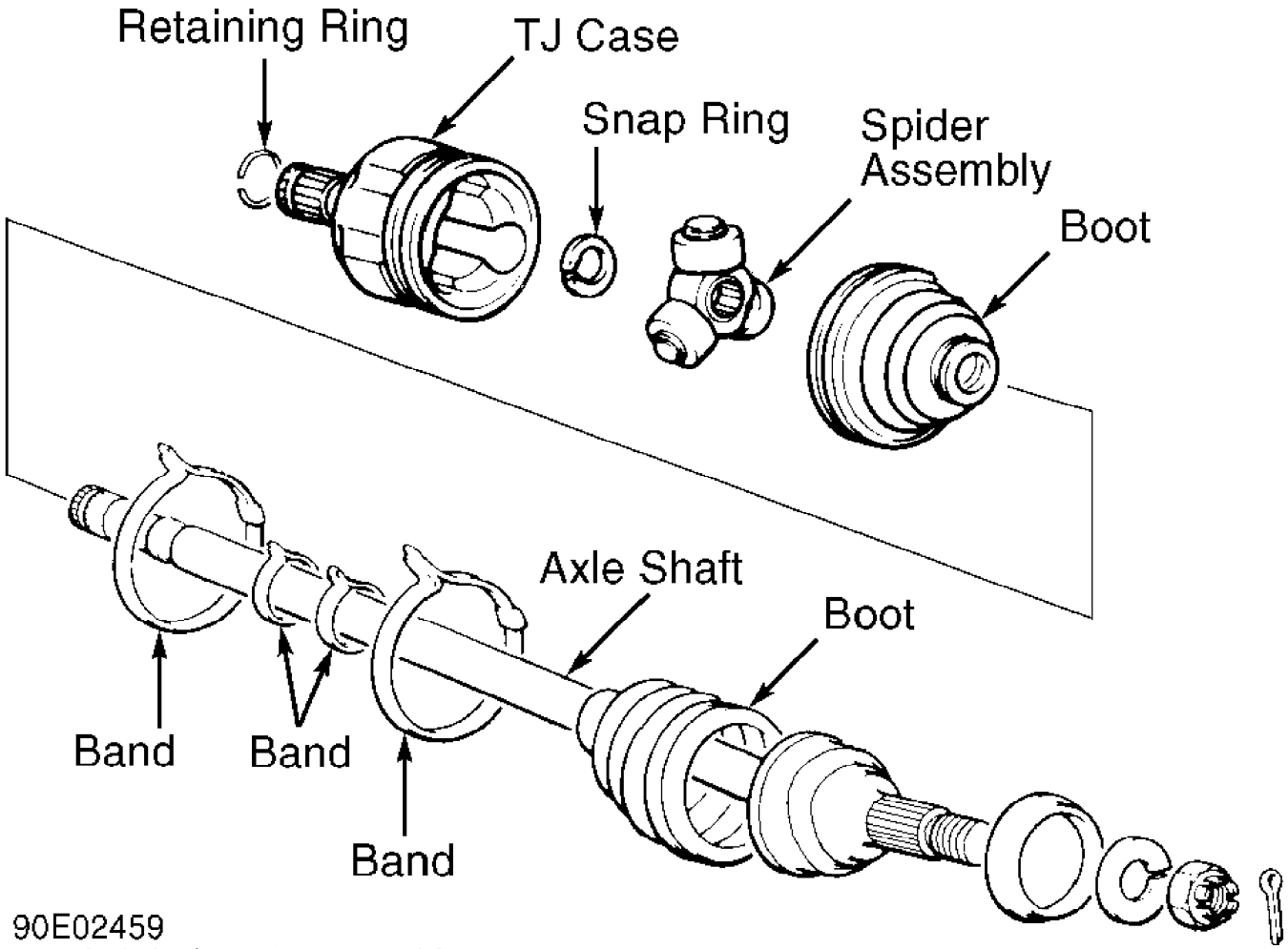


Fig. 7: Exploded View Of TJ Assembly
Courtesy of Mitsubishi Motor Sales of America.

2) Remove snap ring and pull spider assembly from axle shaft. Clean, but DO NOT disassemble spider assembly. Wrap splined area of axle shaft with tape, and remove boot. Dynamic damper (if equipped) and outer boots can be serviced at this time.

Reassembly

1) To reassemble, reverse disassembly procedure. Use NEW snap ring to retain spider assembly. Ensure reference marks are aligned on spider assembly and TJ case. Using proper lubricant, apply one half of grease in TJ case and other half TJ boot. See AXLE SHAFT LUBRICATION SPECIFICATIONS table.

2) Install boot and bands. Tighten bands on boots with axle shaft in straight position. Position boots so bands are positioned at specified distance and secure. See TJ BAND INSTALLATION SPECIFICATIONS table.

TJ BAND INSTALLATION SPECIFICATIONS

Application	Distance Between Bands In. (mm)
Diamante	2.83-3.07 (72.0-78.0)
Eclipse	3.03-3.27 (77.0-83.0)
Galant	3.03-3.27 (77.0-83.0)

Mirage	3.23-3.47 (82.0-88.0)
3000GT	3.23-3.47 (82.0-88.0)

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Axle Shaft Nut	
Mirage (1997)	130-203 (176-275)
3000GT	66-188 (225-255)
All Other Models	145-188 (197-255)
Ball Joint-To-Steering Knuckle Nut	
Galant (Upper)	21 (28)
All Other Models	43-53 (58-71)
Center Bearing Bracket Bolt	
Diamante & 3000GT	33 (45)
Eclipse (AWD)	30 (41)
Strut Fork-To-Lower Control Arm Nut	
Eclipse & Galant	65 (88)
Strut-To-Steering Knuckle Nut	
Diamante & 3000GT	65-76 (88-103)
Mirage	80-94 (108-127)
Tie Rod Nut	
Galant	17-25 (23-34)
Mirage	11-25 (15-34)
3000GT (AWD)	36 (49)
All Other Models	21 (28)
Wheel Lug Nut	
3000GT	87-101 (118-137)
All Others	65-80 (88-108)

F - BASIC TESTING

1998 Mitsubishi Galant

1998 ENGINE PERFORMANCE
Mitsubishi - Basic Diagnostic Procedures

Diamante, Eclipse, Galant, Mirage, Montero, Montero Sport, 3000GT

INTRODUCTION

The following diagnostic steps will help prevent overlooking a simple problem. This is also where to begin diagnosis for a no-start condition. The first step in diagnosing any driveability problem is verifying the customer's complaint with a test drive under the conditions the problem reportedly occurred.

Before entering self-diagnostics, perform a careful and complete visual inspection. Most engine control problems result from mechanical breakdowns, poor electrical connections or damaged/misrouted vacuum hoses. Before condemning the computerized system, perform each test listed in this article.

NOTE: Perform all voltage tests with a Digital Volt-Ohmmeter (DVOM) with a minimum 10-megohm input impedance, unless stated otherwise in test procedure.

PRELIMINARY INSPECTION & ADJUSTMENTS

VISUAL INSPECTION

Visually inspect all electrical wiring, looking for chafed, stretched, cut or pinched wiring. Ensure electrical connectors fit tightly and are not corroded. Ensure vacuum hoses are properly routed and are not pinched or cut. See M - VACUUM DIAGRAMS article to verify routing and connections (if necessary). Inspect air induction system for possible vacuum leaks.

MECHANICAL INSPECTION

Compression

Check engine mechanical condition with a compression gauge, vacuum gauge, or an engine analyzer. See engine analyzer manual for specific instructions.

WARNING: DO NOT use ignition switch during compression tests on fuel injected vehicles. Use a remote starter to crank engine. Fuel injectors on many models are triggered by ignition switch during cranking mode, which can create a fire hazard or contaminate the engine's oiling system.

Check engine compression with engine at normal operating temperature, all spark plugs removed and throttle wide open. See COMPRESSION SPECIFICATIONS table.

COMPRESSION SPECIFICATIONS TABLE

Application (1)	Specification
Compression Ratio	
1.5L (VIN A)	9.0:1
1.8L (VIN C)	9.5:1

2.0L	
(VIN F)	8.5:1
(VIN Y)	9.6:1
2.4L (VIN G)	9.5:1
3.0L	
(VIN H)	8.9:1
(VIN J)	10.0:1
(VIN K)	8.0:1
(VIN P)	9.0:1
3.5L (VIN M & P)	9.0:1
Compression Pressure	
1.5L (VIN A)	192 psi (13.4 kg/cm²)
1.8L (VIN C)	199 psi (13.9 kg/cm²)
2.0L (VIN F)	178 psi (12.5 kg/cm²)
2.0L (VIN Y)	170-225 psi (11.7-15.5 kg/cm²)
2.4L (VIN G)	192 psi (13.4 kg/cm²)
3.0L	
(VIN H & P)	171 psi (12.0 kg/cm²)
(VIN J)	185 psi (13.0 kg/cm²)
(VIN K)	156 psi (10.9 kg/cm²)
3.5L (VIN M & P)	171 psi (12.0 kg/cm²)
Maximum Variation	
Between Cylinders (2)	14 psi (1.0 kg/cm²)

(1) - See A - ENGINE/VIN ID article for VIN information.
(2) - On Eclipse 2.0L non-turbo engine, maximum variation between cylinders is 25%.

Exhaust System Backpressure

The exhaust system can be tested with a vacuum or pressure gauge. If using a pressure gauge, remove HO2S or air injection check valve (if equipped). Connect a 0-5 psi pressure gauge and run engine at 2500 RPM. If exhaust system backpressure is greater than 2 psi, exhaust system or catalytic converter is plugged.

If using a vacuum gauge, connect vacuum gauge hose to intake manifold vacuum port. Start engine. Observe vacuum gauge. Open throttle part way and hold steady. If vacuum gauge indication slowly drops after stabilizing, inspect exhaust system for restriction.

FUEL SYSTEM

* PLEASE READ THIS FIRST *

WARNING: ALWAYS relieve fuel pressure before disconnecting any fuel injection-related component. DO NOT allow fuel to contact engine or electrical components.

RELIEVING FUEL PRESSURE

1) On Diamante, disconnect fuel pump harness connector at fuel tank from underneath vehicle. On Montero and Montero Sport, remove cargo compartment carpet, remove access plate and disconnect fuel pump harness connector. On all other models, remove rear seat cushion, remove access plate (if required) and disconnect fuel pump harness connector.

2) On all models, start engine. Let engine run until it stops. Turn ignition off. Disconnect negative battery cable. Connect fuel pump harness connector. Install rear seat and/or carpet as necessary.

WARNING: Before disconnecting high pressure fuel hose at fuel

delivery pipe, cover fuel hose connection with a rag. Some residual fuel pressure may still be in system.

FUEL PRESSURE

1) Relieve fuel pressure. See RELIEVING FUEL PRESSURE. On models with fuel rail service valve, connect fuel pressure gauge to fuel rail. On models without fuel rail service valve, disconnect high pressure fuel inlet line at fuel rail. Remove throttle body bracket (if necessary). Connect fuel pressure gauge with adapter between fuel rail and high pressure fuel inlet line. See Fig. 1.

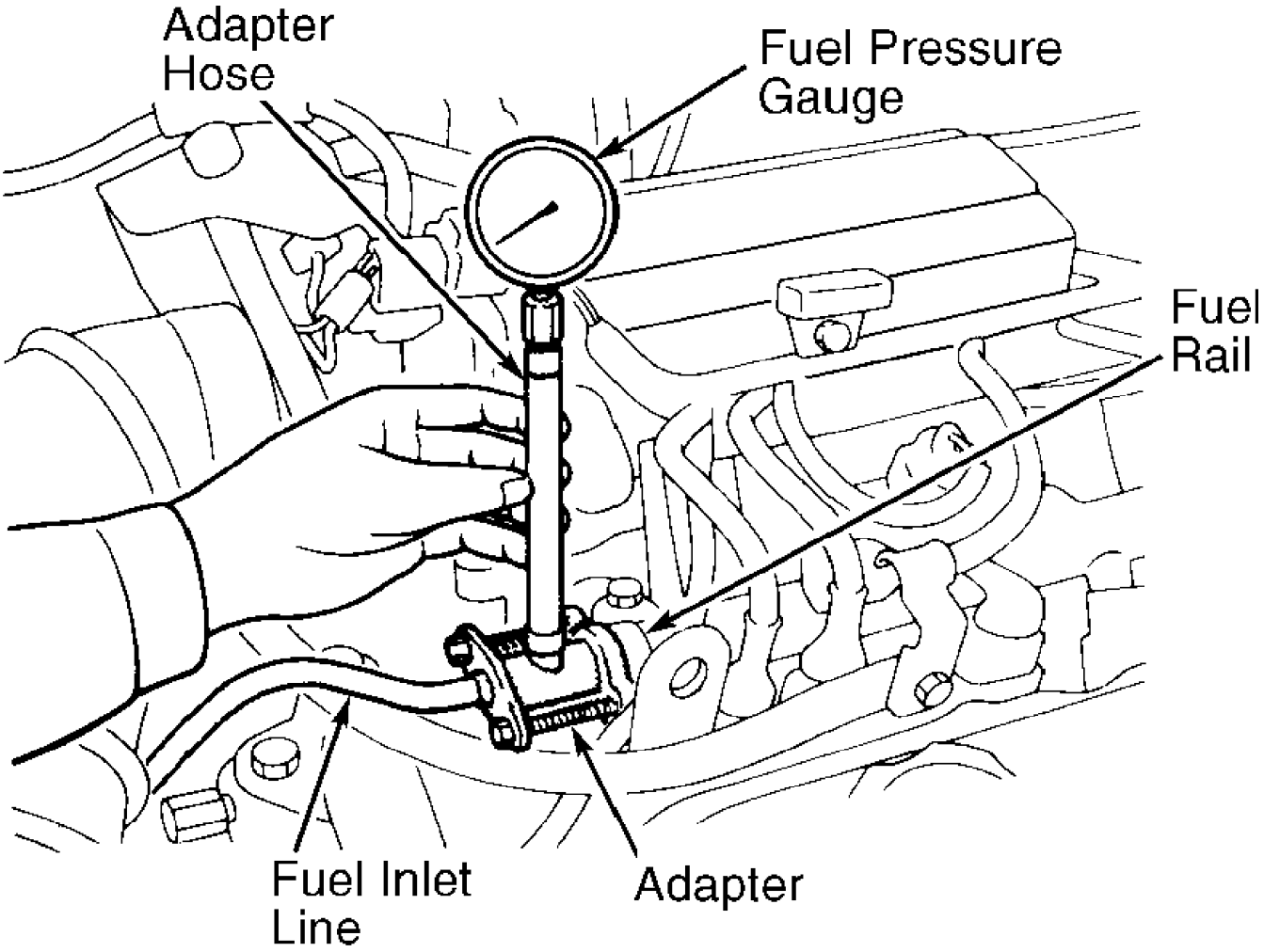


Fig. 1: Installing Fuel Pressure Tester (Typical)
Courtesy of Mitsubishi Motor Sales of America

2) On Eclipse 2.0L non-turbo and Montero Sport, use scan tool to operate fuel pump. On all other models, operate fuel pump by connecting battery voltage to fuel pump test terminal. See FUEL PUMP TEST TERMINAL LOCATION table. Ensure no fuel leaks are present. Disconnect battery voltage from fuel pump test terminal.

FUEL PUMP TEST TERMINAL LOCATION TABLE

Application	Wire Color	Location
Diamante	Black/Blue	(1)
Eclipse (Turbo & 2.4L)	Black/Blue	(2)
Galant	Black/Blue	(3)
Mirage	Black/Blue	(1)
Montero	White	(4)
3000GT	Black/Blue	(6)

(1) - On firewall, above brake master cylinder.
(2) - On firewall behind battery.
(3) - On main wiring harness, near center of firewall.
(4) - On main wiring harness, near right center of firewall.
(5) - Near left rear corner of engine compartment, below cruise control actuator (if equipped).
(6) - On main wiring harness, near wiper motor on firewall, behind battery.

3) Start engine and allow it to idle. Measure fuel pressure with vacuum hose connected to fuel pressure regulator. Record fuel pressure reading. See FUEL PUMP PERFORMANCE table. Disconnect and plug vacuum hose from fuel pressure regulator. Record fuel pressure reading.

4) Check for fuel pressure in fuel return hose by gently pinching hose while increasing engine speed. If fuel volume is low, fuel pressure in return hose will not be felt. Increase engine speed to 2500-3000 RPM, 2-3 times. Return engine to idle. Fuel pressure should not drop when engine is returned to idle.

5) Turn ignition off. Ensure fuel pressure reading does not decrease within 2 minutes. If a decrease is noted, monitor speed of decrease.

6) If fuel pressure is lower than specification, fuel pressure drops at idle after increasing engine speed to 2500-3000 RPM, or no fuel pressure in fuel return hose can be felt, check for clogged fuel filter, or faulty fuel pressure regulator or fuel pump.

7) If fuel pressure is greater than specification, check for a faulty fuel pressure regulator or plugged fuel return line. If fuel pressure does not change when vacuum hose to regulator is connected or disconnected, check for a leaking or clogged vacuum hose to fuel pressure regulator or faulty fuel pressure regulator.

8) If fuel pressure decreases suddenly after engine is stopped, check valve in fuel pump is not seated. Replace fuel pump. If fuel pressure drops slowly, fuel injector is leaking or fuel pressure regulator valve seat is leaking. Check for faulty fuel injector or fuel pressure regulator. Repair as necessary.

9) When fuel pressure test is complete, repeat fuel pressure release procedure before disconnecting fuel pressure gauge. Install NEW "O" ring at end of high pressure fuel inlet line. Check for fuel leaks.

FUEL PUMP PERFORMANCE TABLE

Application	At Idle w/Vacuum psi (kg/cm²)	At Idle w/o Vacuum psi (kg/cm²)
Eclipse 2.0L		
Non-Turbo	(1)	47-50 (3.3-3.5)
Turbo	33 (2.3)	42-45 (3.0-3.5)
3000GT Turbo	34 (2.4)	43-45 (3.0-3.1)
All Other Models	38 (2.7)	47-50 (3.3-3.5)

(1) - Information is not available from manufacturer at time

of publication.

MFI CONTROL RELAY

MFI control relay switches power to vehicle sensors and actuators including Volume Airflow (VAF) sensor, crankshaft position sensor, idle speed control, injectors and fuel pump. When ignition switch is turned to RUN position, PCM energizes coils controlling injectors, VAF sensor and idle air control. When ignition switch is turned to START position, PCM energizes coils (through park/neutral position switch on A/T models) to supply power to fuel pump. Relay failure will cause a no-start condition. For testing procedure, see I - SYSTEM/COMPONENT TESTS article.

IGNITION CHECKS

* PLEASE READ THIS FIRST *

NOTE: Perform all circuit tests with a Digital Volt-Ohmmeter (DVOM) with a minimum 10-megohm input impedance, unless stated otherwise in test procedure.

SPARK

Check for spark at coil wire (if applicable) and at each spark plug wire using a high output spark tester. Check spark plug wire resistance on suspect wires. Wire resistance should not exceed 22,000 ohms for all models except Eclipse 2.0L non-turbo and Montero. On Eclipse 2.0L non-turbo, resistance should not exceed 8000 ohms. On Montero, resistance should not exceed 26,000 ohms.

CAMSHAFT POSITION (CMP) SENSOR

For CMP sensor testing procedure, see G - TESTS W/CODES article.

CRANKSHAFT POSITION (CKP) SENSOR

For CKP sensor testing procedure, see G - TESTS W/CODES article.

DISTRIBUTORLESS IGNITION SYSTEM (DIS - 4-CYLINDER)

Ignition Coil Resistance (Eclipse)

1) On Mirage 1.8L, see POWER TRANSISTOR (MIRAGE). On Eclipse 2.0L non-turbo, go to step 3). On Eclipse 2.0L turbo and 2.4L, disconnect ignition coil connector. Go to next step.

2) On Eclipse 2.0L turbo, use DVOM to measure primary coil resistance between ignition coil connector terminals No. 2 and 3 (coil for cylinders No. 1 and 4) and terminals No. 1 and 3 (coil for cylinders No. 2 and 3). See Fig. 3. On Eclipse 2.4L, use DVOM to measure primary coil resistance Between ignition coil terminals. Go to step 4).

Fig. 2: Ignition Coil Connector Terminals (Eclipse 2.0L Non-Turbo)
Courtesy of Mitsubishi Motor Sales of America

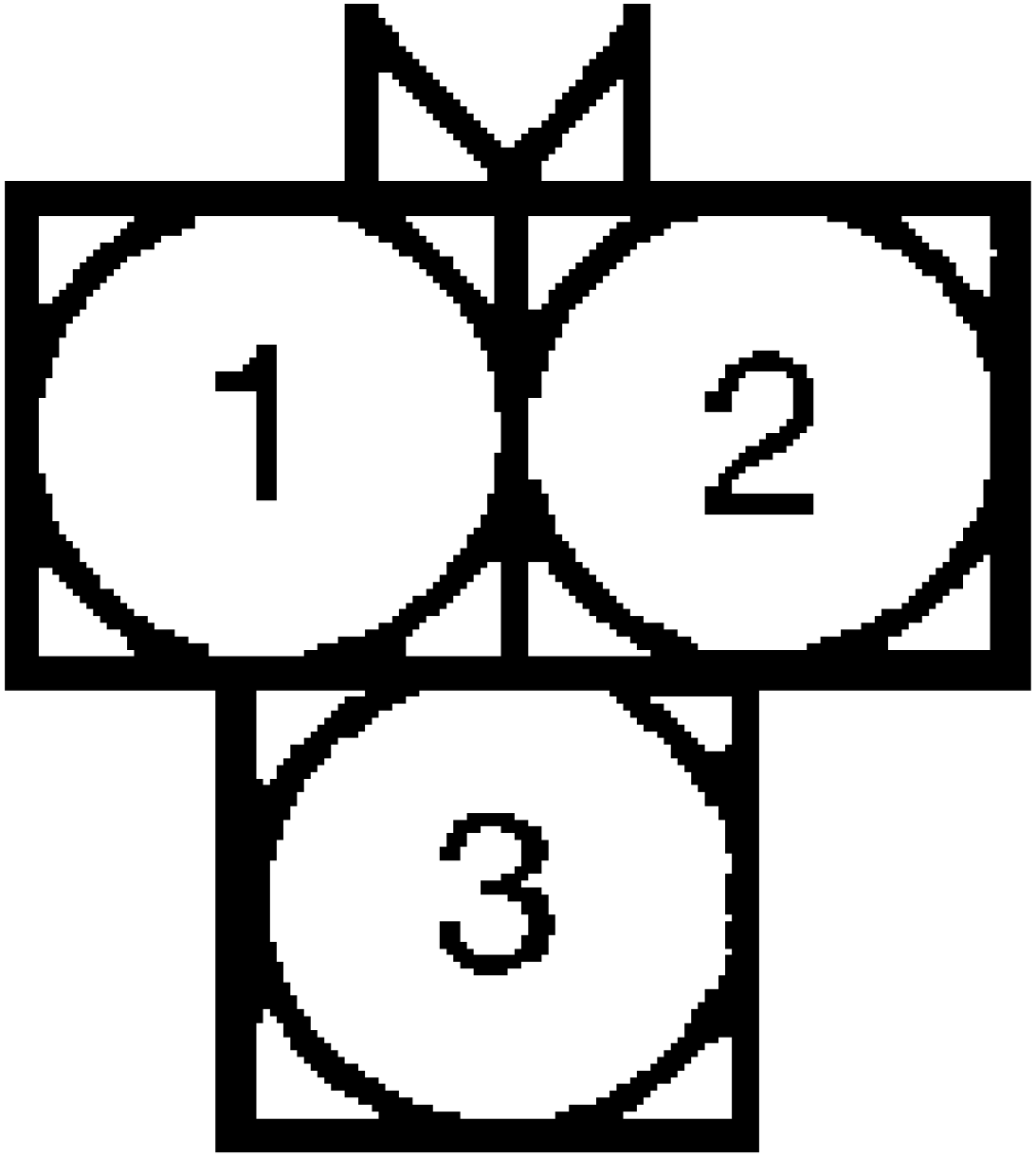


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Fig. 3: Ignition Coil Connector Terminals (Eclipse 2.0L Turbo)
Courtesy of Mitsubishi Motor Sales of America

3) Disconnect ignition coil connector. Using DVOM, measure primary coil resistance at coil (component side) 3-pin connector.

Measure between center and right terminals of connector for cylinders No. 1 and 4, and between center and left terminals of connector for cylinders No. 2 and 3.

4) On all models, remove ignition wires from coil. Measure secondary coil resistance between coil towers for cylinders No. 1 and 4 and between coil towers for cylinders No. 2 and 3. Primary and secondary coil resistance should be within specification. See IGNITION COIL RESISTANCE (ECLIPSE) table. Connect coil harness connector. Connect ignition wires to coil.

IGNITION COIL RESISTANCE (ECLIPSE) - Ohms @ 68°F (20°C) TABLE

Application	Primary	Secondary
2.0L		
Non-Turbo	.51-.61	11,500-13,500
Turbo	.70-.86	11,300-15,300
2.4L	.74-.90	20,100-27,300

Power Transistor (Eclipse 2.0L Turbo & 2.4L)

1) To test the section of the power transistor that controls cylinders No. 1 and 4, disconnect power transistor connector. Using a 1.5-volt dry cell battery, connect negative end of battery to terminal No. 3 of power transistor and positive end to terminal No. 7. See Fig. 4.

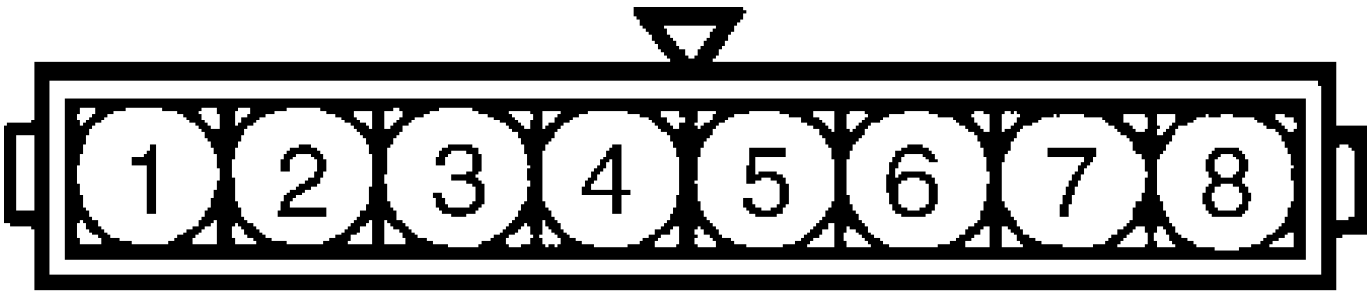

Fig. 4: Identifying Power Transistor Connector Terminals (Eclipse 2.0L Turbo & 2.4L)
Courtesy of Mitsubishi Motor Sales of America

2) Using an analog ohmmeter, check for continuity between terminals No. 3 and 8 of power transistor. Continuity should exist. With positive end of 1.5-volt battery disconnected, there should be no continuity. Replace power transistor if it fails test.

3) To test the section of the power transistor that controls cylinders No. 2 and 3, connect negative end of 1.5-volt dry cell battery to terminal No. 3 of power transistor and positive end to terminal No. 2.

4) Using an analog ohmmeter, check for continuity between terminals No. 1 and 3 of power transistor. Continuity should exist. With positive end of 1.5-volt battery disconnected, there should be no continuity. Replace power transistor if it fails test.

Power Transistor (Mirage)

1) Disconnect power transistor (distributor) connector. Using a 1.5-volt dry cell battery, connect negative end of battery to terminal No. 4 of power transistor and positive end to terminal No. 3. See Fig. 5.

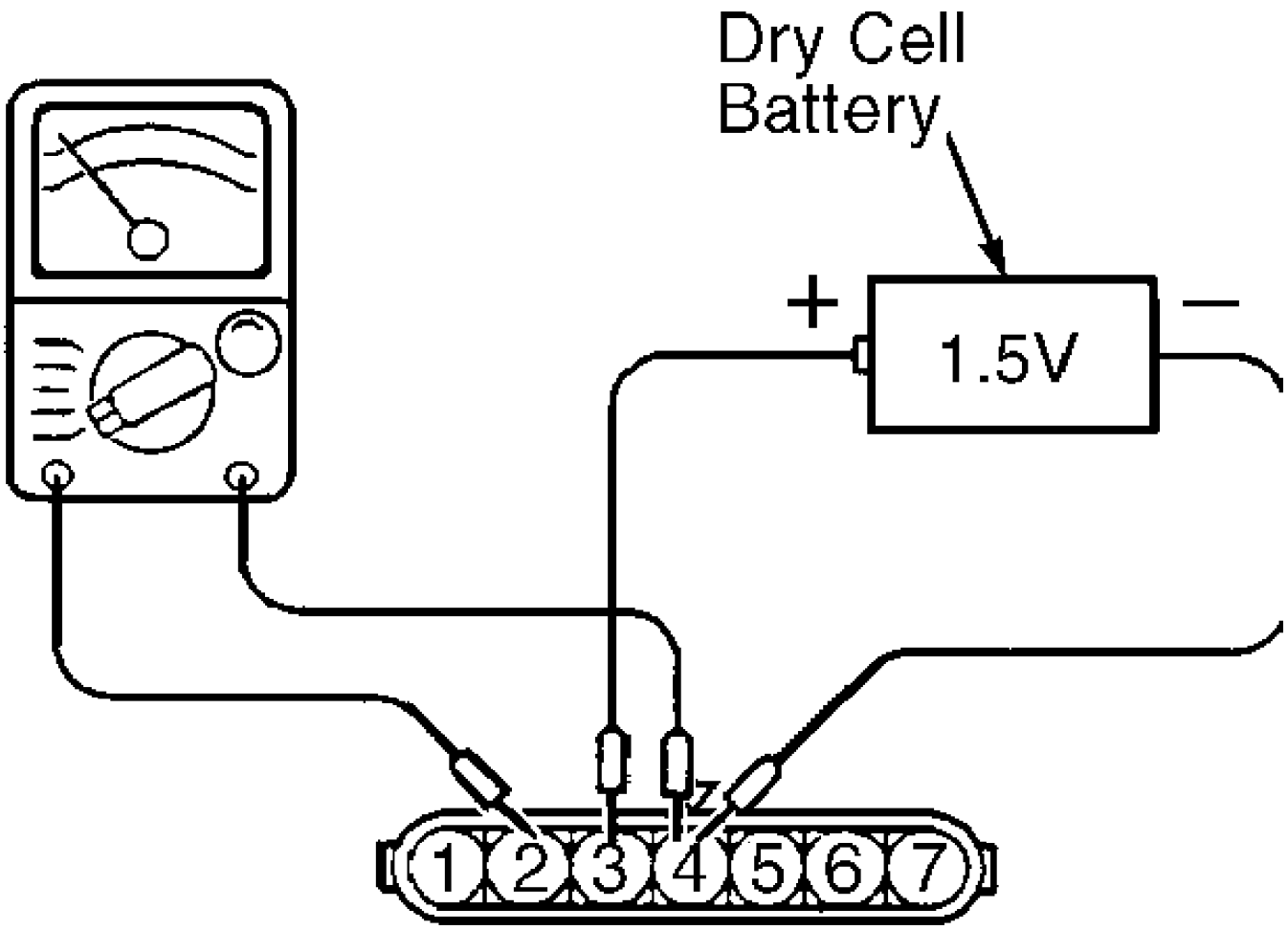

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Fig. 5: Power Transistor Connector Terminals (Mirage 1.8L)
Courtesy of Mitsubishi Motor Sales of America

2) Using an analog ohmmeter, check for continuity between terminals No. 2 and 3 of power transistor. Continuity should exist. With positive end of 1.5-volt battery disconnected, there should be no continuity. Replace power transistor if it fails test.

DISTRIBUTORLESS IGNITION SYSTEM (DIS - V6)

Ignition Coil Resistance

1) On 3000GT DOHC, go to next step. On Montero and Montero Sport, use DVOM to measure primary coil resistance between each individual coil. To check secondary coil resistance, measure resistance between towers of each individual coil. Replace coil if primary and secondary coil resistances are not within specification. See IGNITION COIL RESISTANCE (V6) table.

2) Using DVOM, measure primary coil resistance between terminal No. 3 (power terminal) and each individual coil terminal. See Fig. 6. Terminal No. 1 controls coil "B", terminal No. 2 controls coil "A", and terminal No. 4 controls coil "C". See Fig. 7. To check secondary coil resistance, measure resistance between towers of each individual coil. Replace coil if primary and secondary coil

resistances are not within specification. See IGNITION COIL RESISTANCE (V6) table.

IGNITION COIL RESISTANCE (V6) – Ohms @ 68°F (20°C) TABLE

Application	Primary	Secondary
3.0L		
VIN J & K	.67-.81	11,300-15,300
VIN P	.74-.90	20,100-27,300
3.5L (VIN M)	.74-.90	20,100-27,300

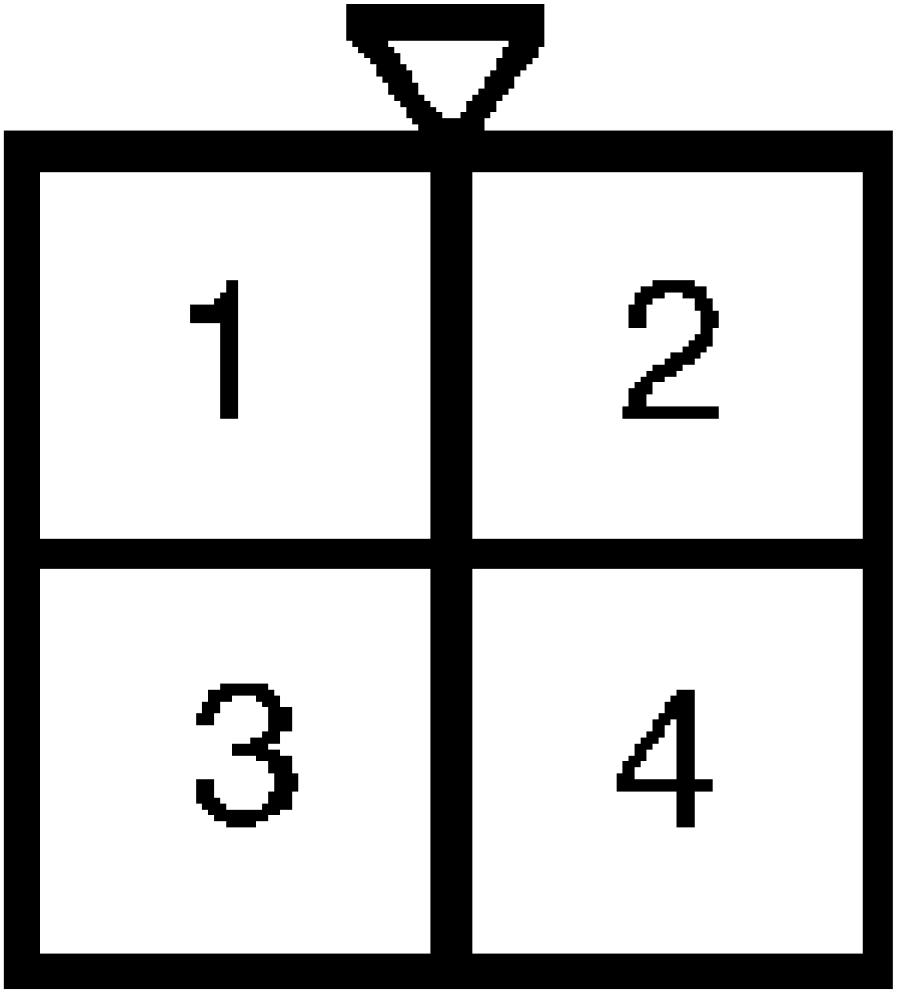

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Fig. 6: Identifying Ignition Coil Terminals (3000GT DOHC)
Courtesy of Mitsubishi Motor Sales of America

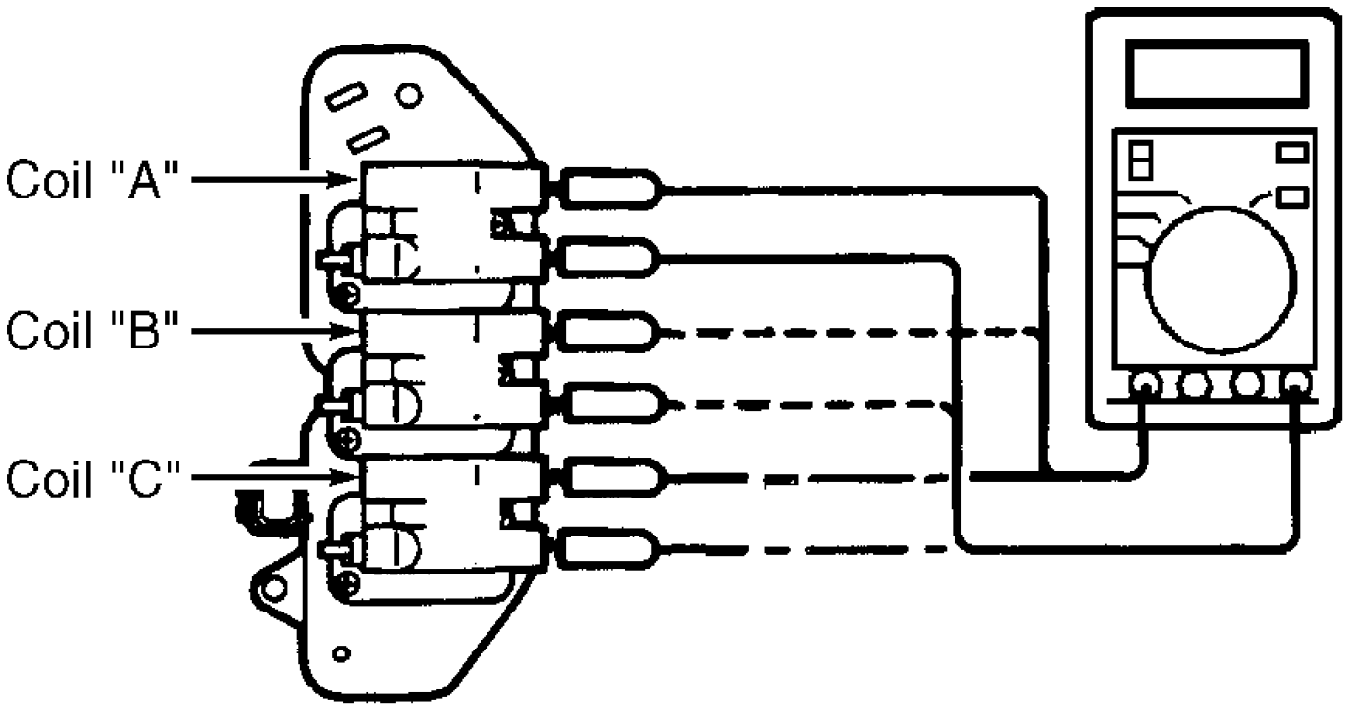

Fig. 7: Identifying Ignition Coils (3000GT DOHC)
Courtesy of Mitsubishi Motor Sales of America

Power Transistor

1) To test section of power transistor that controls cylinders No. 1 and 4 of ignition coil, disconnect power transistor connector. Using a 1.5-volt dry cell battery, connect negative end of 1.5-volt battery to terminal No. 4 of power transistor and positive end to terminal No. 3. See Fig. 8.

2) Using an analog ohmmeter, check for continuity between terminals No. 4 and 13 of power transistor. Continuity should exist. With positive end of 1.5-volt battery disconnected, there should be no continuity. Replace power transistor if it fails test.

3) To test section of power transistor that controls cylinders No. 2 and 5 of ignition coil, connect negative end of 1.5-volt battery to terminal No. 4 of power transistor and positive end to terminal No. 2.

4) Using an analog ohmmeter, check for continuity between terminals No. 4 and 12 of power transistor. Continuity should exist. With positive end of 1.5-volt battery disconnected, there should be no continuity. Replace power transistor if it fails test.

5) To test section of power transistor that controls cylinders No. 3 and 6 of ignition coil, connect negative end of 1.5-volt battery to terminal No. 4 of power transistor and positive end to terminal No. 1.

6) Using an analog ohmmeter, check for continuity between terminals No. 4 and 11 of power transistor. Continuity should exist. With positive end of 1.5-volt battery disconnected, there should be no continuity. Replace power transistor if it fails test.

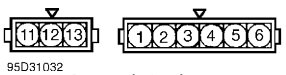

Fig. 8: Identifying Power Transistor Terminals
Courtesy of Mitsubishi Motor Sales of America

HALL EFFECT IGNITION

Ignition Coil Resistance

Using a DVOM, measure primary coil resistance between specified coil terminals. See Figs. 9-12. On Galant, measure between terminals No. 11 and 12. On Mirage measure between terminals No. 1 and 2. On all other vehicles, measure between positive and negative terminals. Measure secondary coil resistance between coil positive terminal and ignition coil tower. Primary and secondary coil resistance should be within specification. See IGNITION COIL RESISTANCE TABLE.

IGNITION COIL RESISTANCE TABLE - Ohms @ 68°F (20°C)

Application	Primary	Secondary
1.5L (VIN A)	.50-.70	15,000-22,000
2.4L (VIN G)		
Galant	.90-1.20	20,000-29,000
Montero Sport	.67-.81	11,300-15,300
3.0L (VIN H)	.72-.88	12,290-13,920
3.5L (VIN P)	.50-.70	9000-13,000

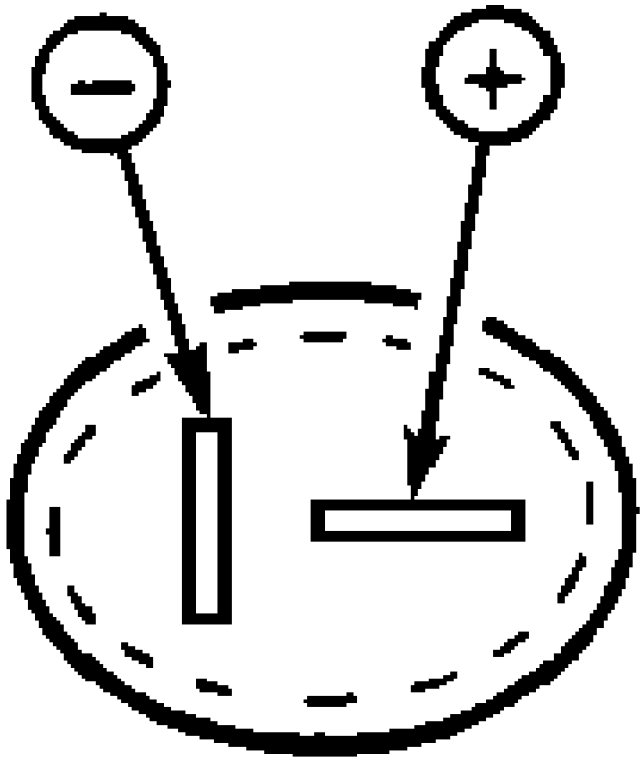

Fig. 9: Ignition Coil Connectors Terminals (Except DIS - Diamante)
Courtesy of Mitsubishi Motor Sales of America

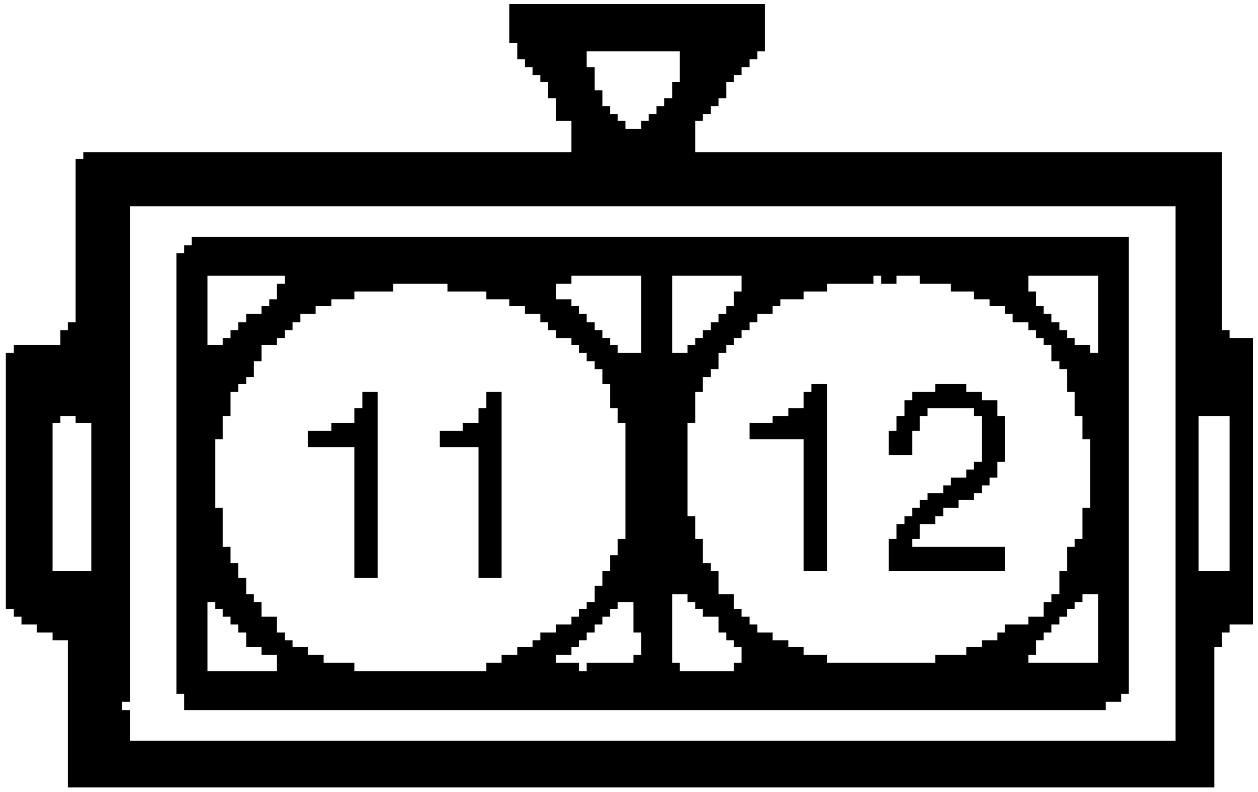

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Fig. 10: Ignition Coil Connectors Terminals (Except DIS - Galant)
Courtesy of Mitsubishi Motor Sales of America

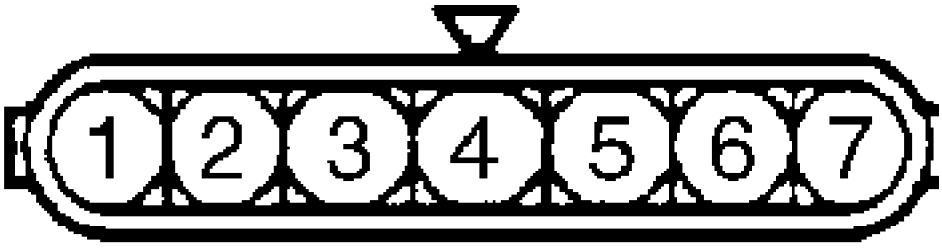

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Fig. 11: Ignition Coil Connectors Terminals (Except DIS - Mirage 1.5L)
Courtesy of Mitsubishi Motor Sales of America

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Fig. 12: Ignition Coil Connectors Terminals (Except DIS - Montero Sport 2.4L)
Courtesy of Mitsubishi Motor Sales of America

CAUTION: Power transistor test must be performed in less than 10 seconds to prevent coil from burning or power transistor from breaking.

Power Transistor (Diamante)

1) Disconnect power transistor connector. Using a 1.5-volt dry cell battery, connect negative end of 1.5-volt battery to terminal No. 4 of power transistor and positive end to terminal No. 3. See Fig. 13.

2) Using an analog ohmmeter, check for continuity between terminals No. 1 and 4 of power transistor. Continuity should exist. With positive end of 1.5-volt battery disconnected, there should be no continuity. Replace power transistor if it fails test.

Power Transistor (Galant)

1) Disconnect power transistor connector. Using a 1.5-volt dry cell battery, connect negative end of 1.5-volt battery to terminal No. 5 of power transistor and positive end to terminal No. 6. See Fig. 14.

2) Using an analog ohmmeter, check for continuity between terminals No. 5 and 12 of power transistor. Continuity should exist. With positive end of 1.5-volt battery disconnected, there should be no continuity. Replace power transistor if it fails test.

Power Transistor (Mirage)

1) Disconnect power transistor (distributor) connector. Using a 1.5-volt dry cell battery, connect negative end of 1.5-volt battery to terminal No. 4 of power transistor and positive end to terminal No. 3. See Fig. 15.

2) Using an analog ohmmeter, check for continuity between terminals No. 2 and 4 of power transistor. Continuity should exist. With positive end of 1.5-volt battery disconnected, there should be no

continuity. Replace power transistor if it fails test.

Power Transistor (3000GT SOHC)

1) Disconnect power transistor connector. Using a 1.5-volt dry cell battery, connect negative end of 1.5-volt battery to terminal No. 2 of power transistor and positive end to terminal No. 1. See Fig. 15.

2) Using an analog ohmmeter, check for continuity between terminals No. 2 and 3 of power transistor. Continuity should exist. With positive end of 1.5-volt battery disconnected, there should be no continuity. Replace power transistor if it fails test.

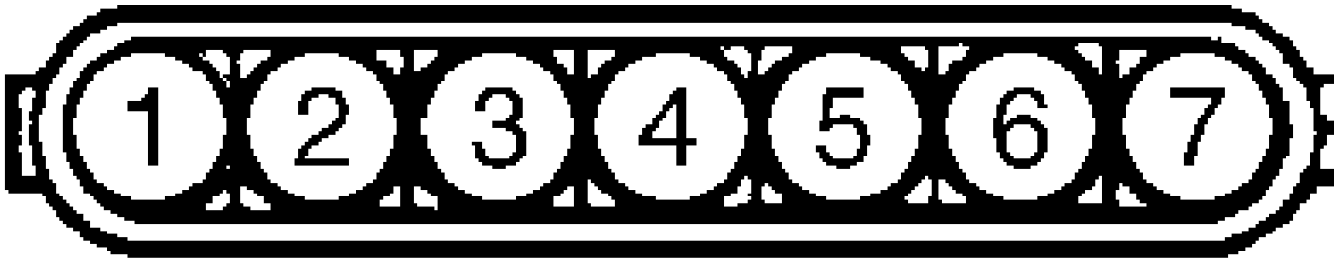

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Fig. 13: Power Transistor Connectors (Except DIS - Diamante)
Courtesy of Mitsubishi Motor Sales of America

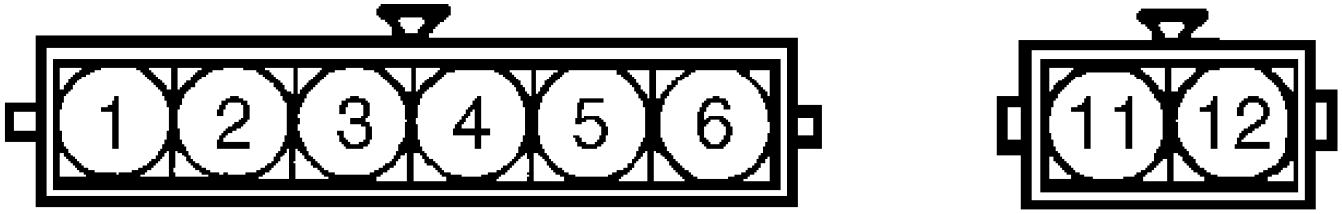

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Fig. 14: Power Transistor Connectors (Except DIS - Galant)
Courtesy of Mitsubishi Motor Sales of America

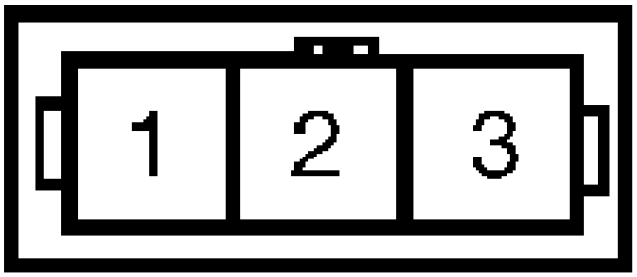

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Fig. 15: Power Transistor Connectors (Except DIS - Mirage & 3000GT SOHC)
Courtesy of Mitsubishi Motor Sales of America

IDLE SPEED & IGNITION TIMING

Ensure idle speed and ignition timing are set to specification. See IGNITION TIMING SPECIFICATIONS table. For adjustment procedures, see D - ADJUSTMENTS article.

IGNITION TIMING SPECIFICATIONS (Degrees BTDC @ RPM) TABLE

Application	(1) Base	(2)	(3) (4) Actual
1.5L	2-78@ 650-750		10 @ 600-800
1.8L	2-8 @ 600-800		5 @ 600-800
2.0L			
Non-Turbo	(5)		(5)
Turbo	2-8 @ 650-850		8 @ 650-850
2.4L	2-8 @ 650-850		10 @ 650-850
3.0L	2-8 @ 600-800		15 @ 600-800
3.5L	2-8 @ 600-800		15 @ 600-800

(1) - With ignition timing adjustment connector grounded or vacuum hose (farthest from distributor) disconnected.
(2) - With ignition timing adjustment connector ungrounded or vacuum hose (farthest from distributor) connected.
(3) - If vehicle altitude is more than 2300 feet above sea level, actual timing may be advanced (5 degrees).
(4) - Actual ignition timing is approximate and may fluctuate plus or minus 7 degrees.
(5) - Ignition timing is NOT adjustable.

SUMMARY

If no faults were found while performing BASIC DIAGNOSTIC PROCEDURES, proceed to G - TESTS W/CODES article. If no hard codes are found in self-diagnostics, proceed to H - TESTS W/O CODES article for diagnosis by symptom (i.e., ROUGH IDLE, NO START, etc.) or intermittent diagnostic procedures.

BRAKE SYSTEM

1998 Mitsubishi Galant

1997-98 BRAKES
Mitsubishi - Disc & Drum

Diamante, Eclipse, Galant, Mirage, Montero, Montero Sport, 3000GT

INTRODUCTION

This article contains information on repair and service of basic hydraulic brake system. If vehicle is equipped with anti-lock brakes, also see appropriate ANTI-LOCK article.

DESCRIPTION

Brake system consists of a master cylinder, vacuum power brake booster, proportioning valve and self-adjusting assembly. Montero has a Load-Sensing Proportioning Valve (LSPV). All models are equipped with front disc brakes and either rear disc or drum brakes. Parking brake assembly activates rear brakes.

BLEEDING BRAKE SYSTEM

BLEEDING PROCEDURES

Bleed brakes whenever hydraulic lines are opened or pedal feels spongy. Bleed system in appropriate sequence. See BRAKE LINE BLEEDING SEQUENCE table. Use only DOT 3 or DOT 4 approved fluid and DO NOT mix fluid types.

BRAKE LINE BLEEDING SEQUENCE

Application	Sequence
Diamante, Eclipse, Galant, Mirage & 3000GT	RR, LF, LR, RF
Montero	RR, LR, LSPV, RF, LF
Montero Sport	RR, LR, RF, LF

ADJUSTMENTS

BRAKE PEDAL HEIGHT, FREE PLAY & CLEARANCE

1) To measure brake pedal height, pull up carpet under brake pedal. Measure distance between floor board and middle of brake pedal pad surface with brake pedal released. See BRAKE PEDAL HEIGHT SPECIFICATIONS table.

2) To adjust pedal height, separate connector from stoplight switch, and loosen switch lock nut. Back-off switch so it does not contact brake pedal arm. Loosen master cylinder push rod lock nut. Adjust brake pedal height by rotating master cylinder push rod until brake pedal height is within specification.

BRAKE PEDAL HEIGHT SPECIFICATIONS

Application	Pedal Height: In. (mm)

Diamante, Eclipse, Montero Sport & Galant	6.9-7.1 (175-181)
Mirage	6.4-6.6 (164-167)
Montero	7.3-7.5 (186-191)
3000GT	7.0-7.2 (177-182)

3) Tighten lock nut, and ensure brake pedal height is within specification. Start engine to evacuate brake booster chamber. Stop engine, and apply brake several times to remove vacuum from brake booster.

4) Using hand pressure, depress brake pedal to measure free play before resistance is felt. Free play distance for all models is 0.10-0.31" (3-8 mm). If distance is not within specification, it is probably caused by excessive play between the brake pedal arm and the clevis pin. Check and replace as necessary.

5) Start engine and apply 110 lbs. (490 N) of pressure to brake pedal. With the carpet pulled back, measure the distance between the brake pedal and the floorboard. If the distance is not 3.1-3.5" (80-90 mm) check for air in brake hydraulic system, brake adjustment or defective parking brake component or adjustment. Adjust or repair as necessary.

LOAD-SENSING PROPORTIONING VALVE (LSPV)

Montero

1) Park vehicle on level surface. Remove excess weight from vehicle. Make sure the lever is all the way towards the valve side. Measure length of entire spring. See Fig. 1.

If spring length is not within specification, adjust spring support until correct length is obtained. See LSPV SPRING LENGTH table.

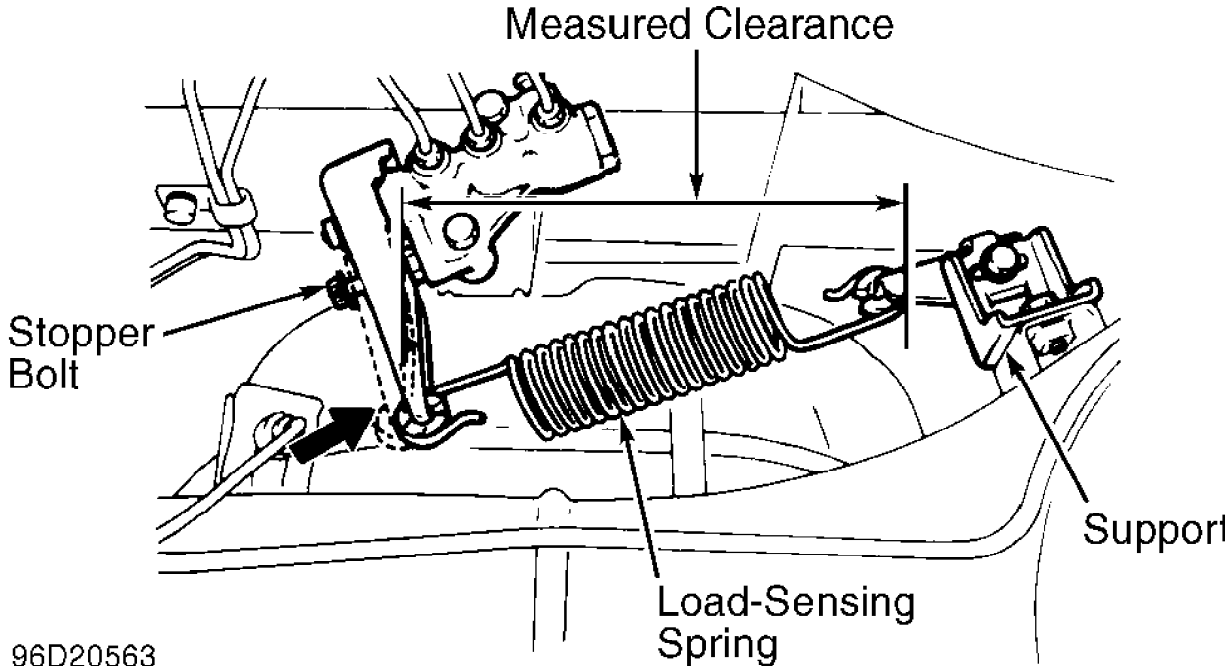


Fig. 1: Adjusting Load-Sensing Proportioning Valve Spring (Montero) Courtesy of Mitsubishi Motor Sales of America.

BRAKE BOOSTER PUSH ROD

Adjustment (Except Diamante)

1) Place the Push Rod Adjusting Gauge (MB991714) in the master cylinder, position gauge shaft so it contacts master cylinder piston and tighten wing bolt.

2) Apply a vacuum of 9.7 psi (-66.7 kPa) for Eclipse, Galant, Montero and 3000GT and 19.6 psi (-66.7 kPa) for Mirage and Montero Sport to the brake booster using a hand held vacuum pump.

3) Rotate the gauge tool so it is positioned offset from center of the brake booster. See Fig. 2.

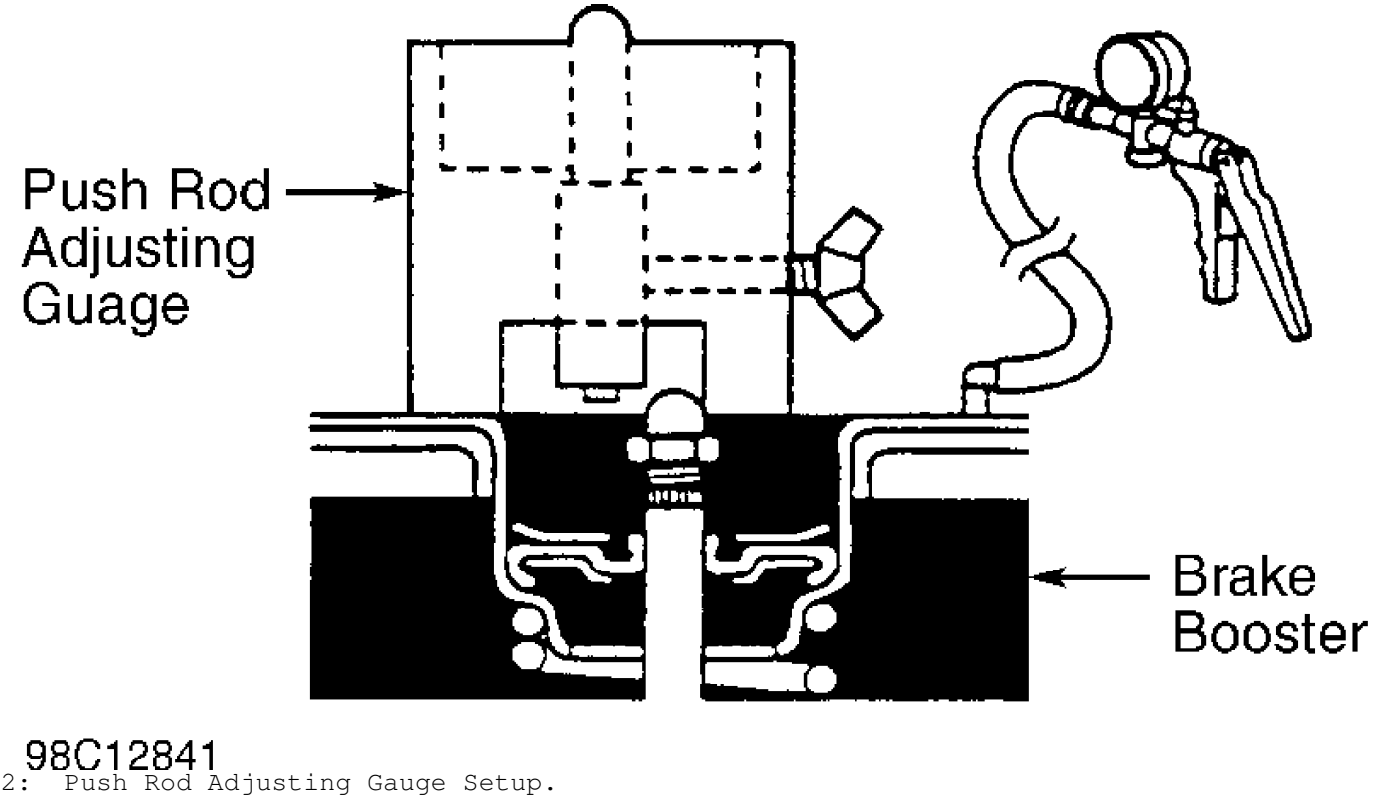


Fig. 2: Push Rod Adjusting Gauge Setup.
Courtesy of Mitshbishi Motor Sales of America.

4) Move the gauge tool towards the center so the shaft contacts the end of the brake booster push rod. If contact is not as shown in position "A", shorten the rod if position "B" is present, or lengthening it if position "C" is present. See Fig. 3.

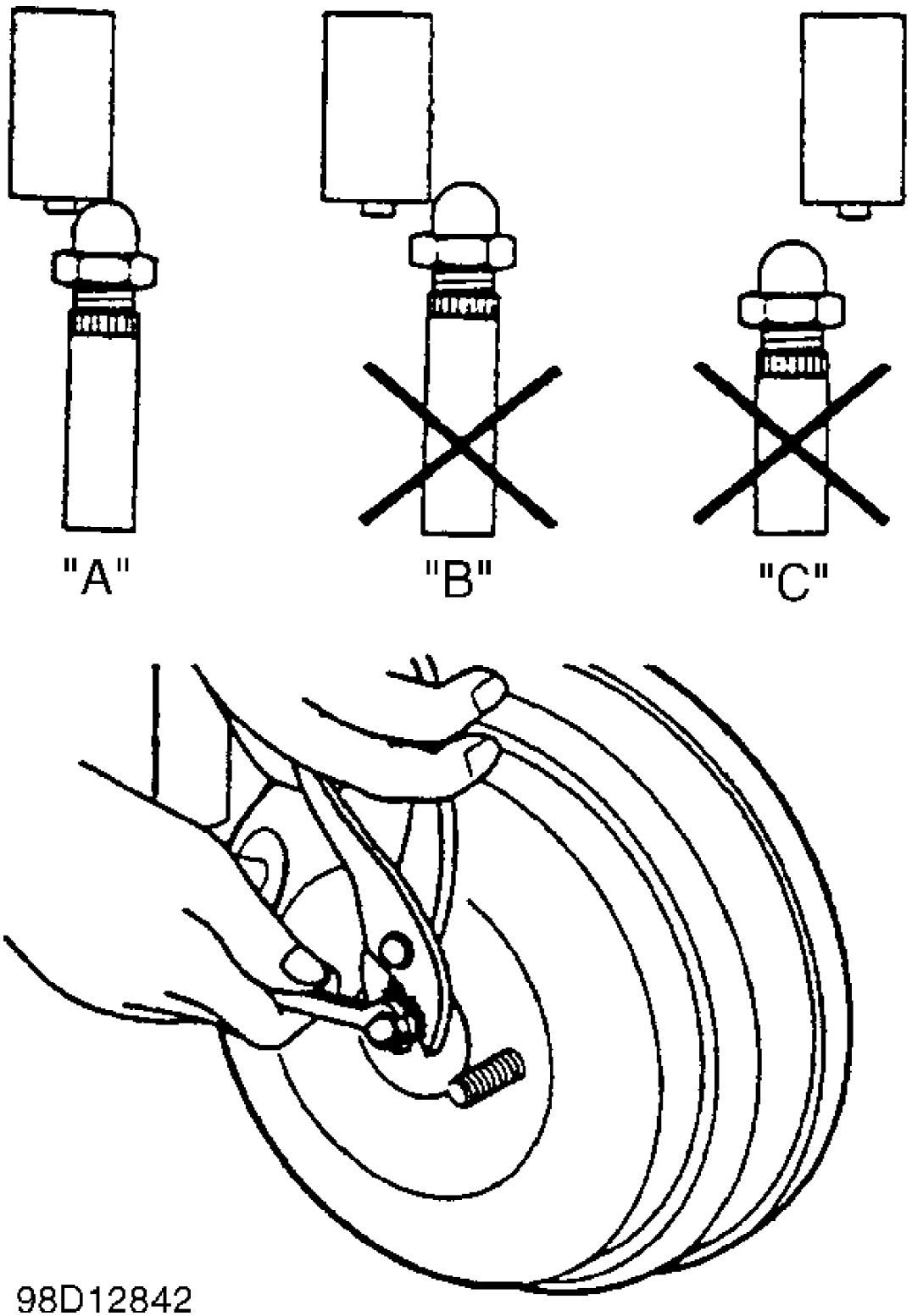


Fig. 3: Adjusting Brake Booster Push Rod Clearance
Courtesy of Mitshbishi Motor Sales of America.

Adjustment (Diamante)
1) Start engine and depress the brake pedal at least two

times then switch the engine off.

2) Remove the master cylinder from the brake booster making sure the push rod is not disturbed and the brake pedal is not depressed after master cylinder removal.

3) Using a Vernier Caliper and Block Gauge, measure the thickness of the block gauge and add .366" (9.3 mm) to the gauge thickness and set the caliper to this dimension. See Fig. 4.

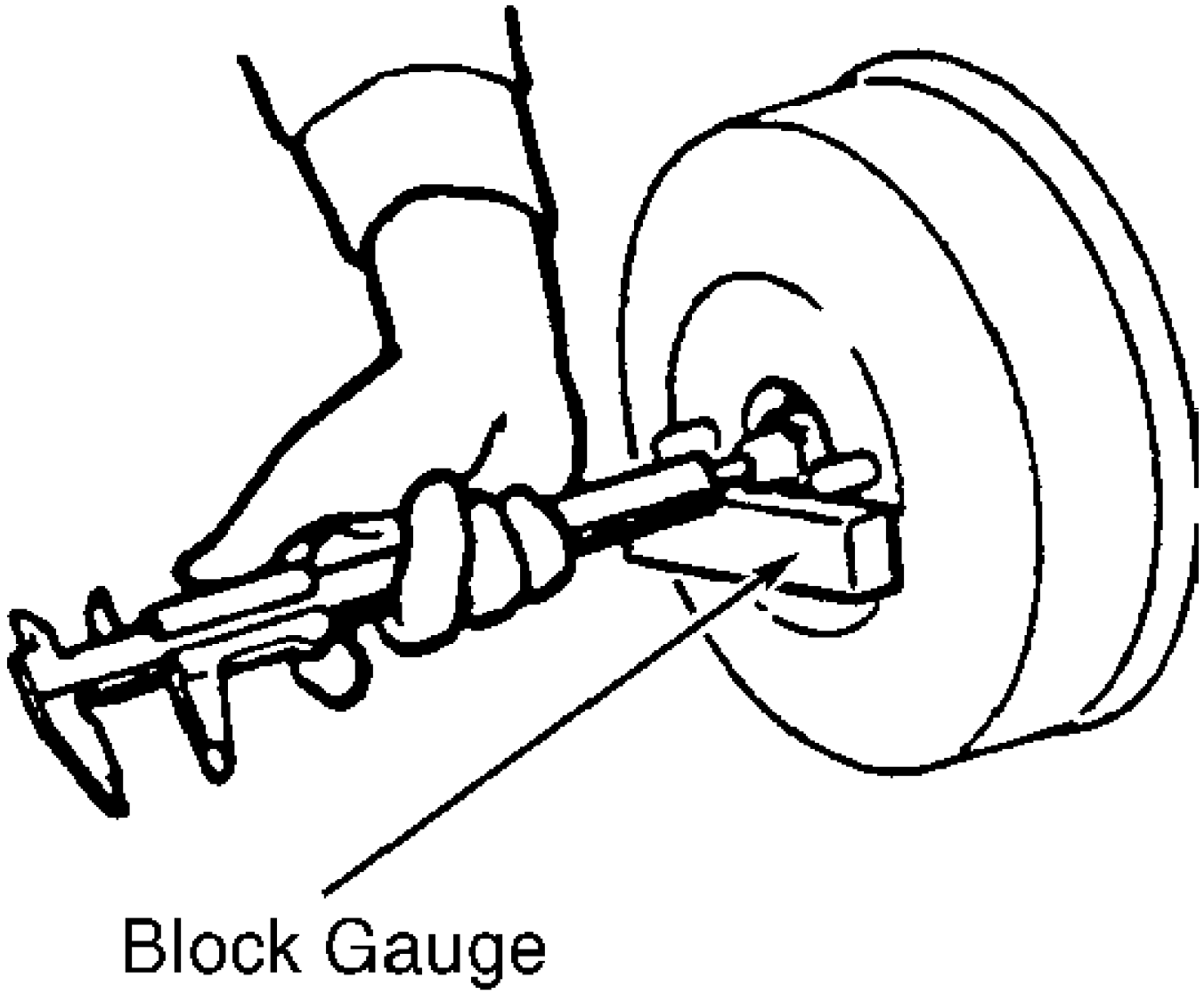


Fig. 4: Setting Caliper And Block Gauge (Diamante)
Courtesy of Mitshbishi Motor Sales of America.

4) Check the push rod position with vernier caliper set to the calculated dimension. Specification range .362"-.370" (9.2-9.4 mm). See Fig. 5.

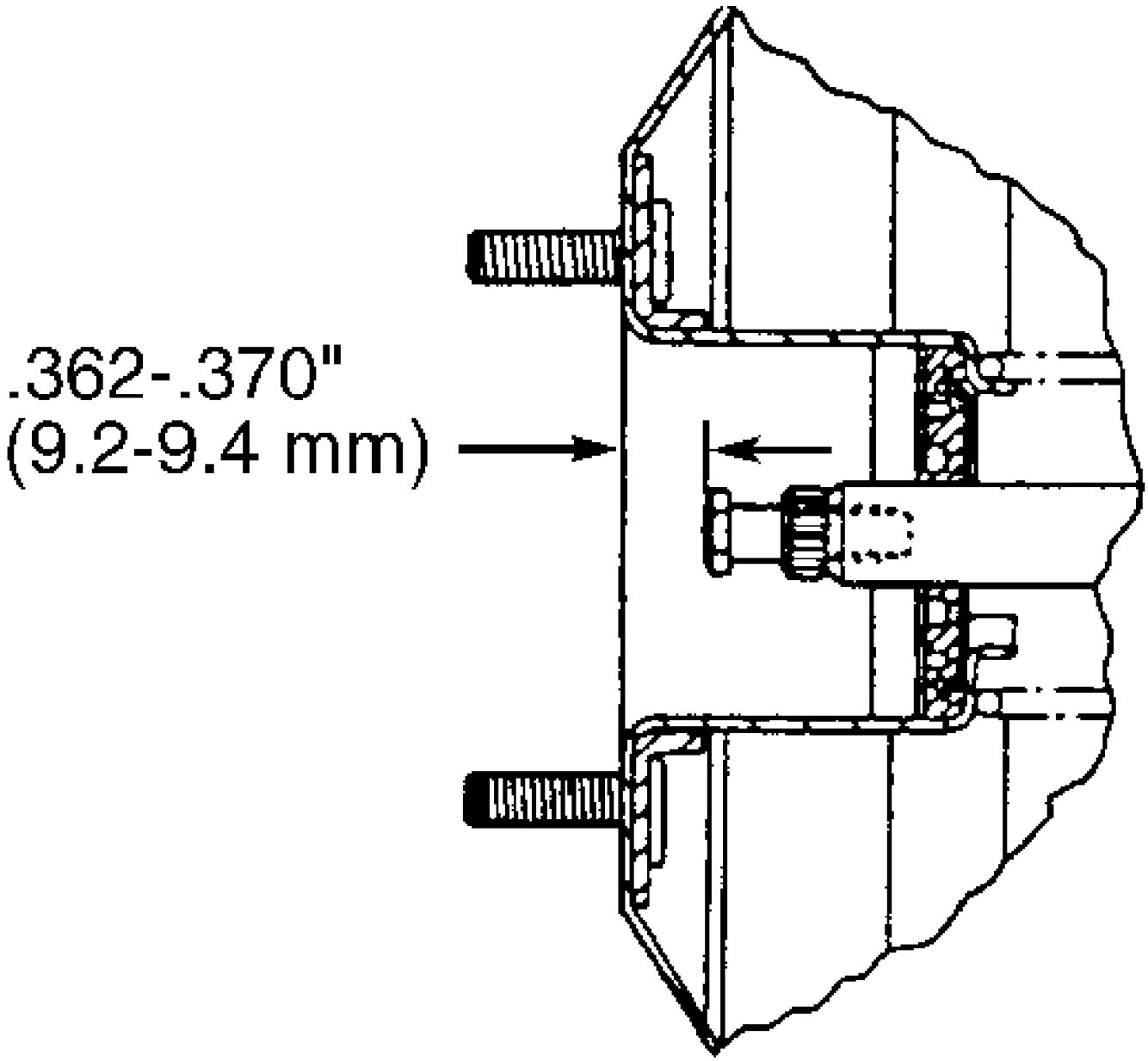


Fig. 5: Push Rod Setting (Diamante)
Courtesy of Mitshbishi Motor Sales of America.

5) If clearance is NOT within range, turn push rod screw to correct length.

NOTE: This measurement is taken on the radial face of the push rod, .085" (2.15 mm) from the center of the radial face. This adjusting procedure MUST be done with 18-22 in. Hg

(62-73 kPa) of vacuum applied to the brake booster.

PARKING/EMERGENCY BRAKE

NOTE: Adjust service brakes before adjusting parking brake.

Start engine, and apply brake pedal. Pull parking brake lever with a force of 44-45 lbs. (196-200 N). Parking brake lever should move up 3-5 notches on Diamante, Stealth and 3000GT, 4-6 notches on Montero, and 5-7 notches on all other models. If adjustment is necessary, turn adjusting nut located under console or at end of cable rod. See Fig. 6.

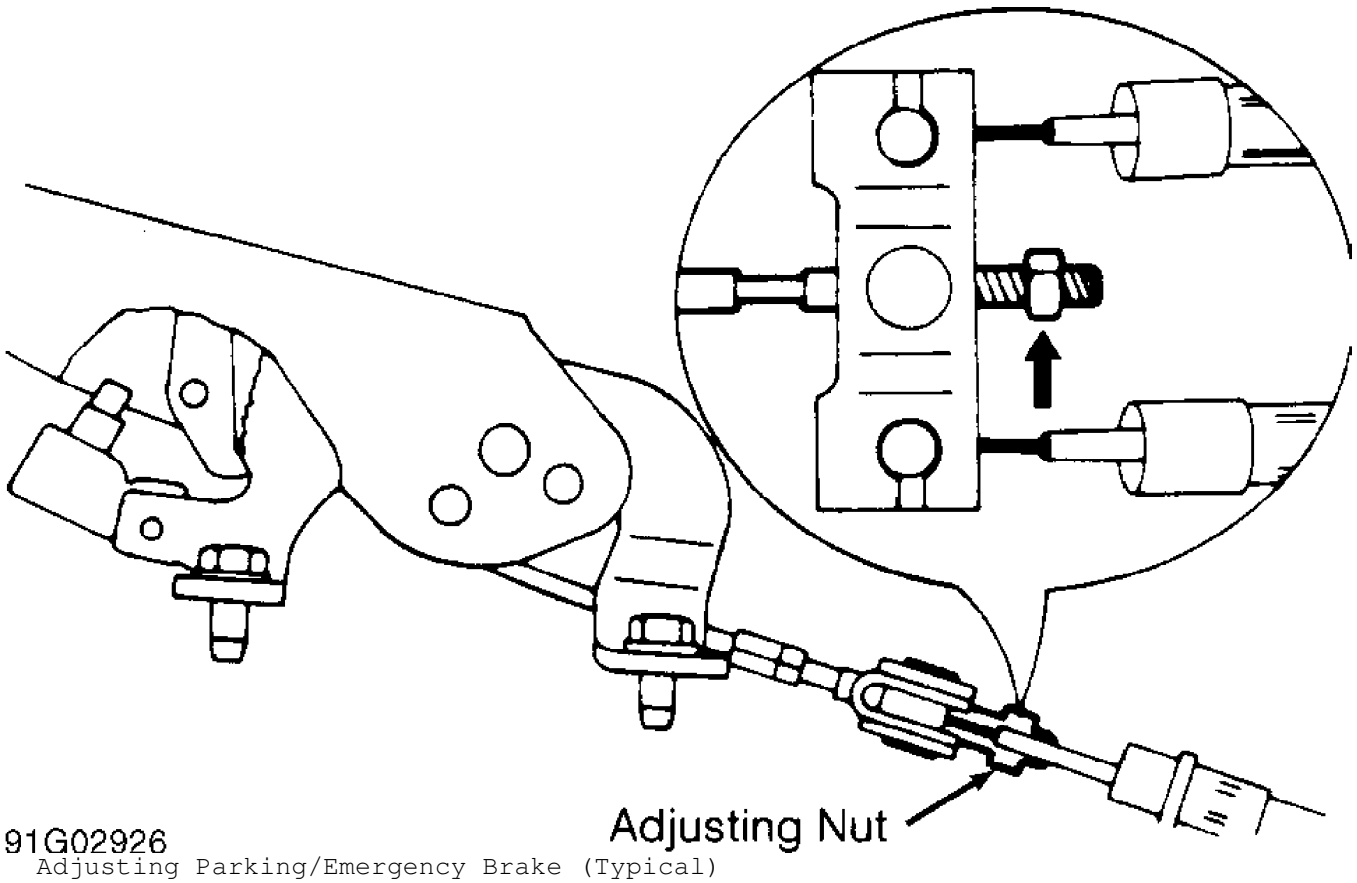


Fig. 6: Adjusting Parking/Emergency Brake (Typical)
Courtesy of Mitsubishi Motor Sales of America.

REAR BRAKE SHOES

Fully release parking brake and depress brake pedal several times to center shoes and adjust brake shoe clearance. Adjust shoes so brake shoes lightly contact brake drum. Adjust parking brake, and check pedal travel. Rotate brake drum to verify free movement.

STOPLIGHT SWITCH

Loosen lock nut, and adjust switch-to-pedal arm clearance to 0.02-0.04" (0.5-1.0 mm). Tighten lock nut. DO NOT depress master cylinder push rod during stoplight switch adjustment.

TESTING

POWER BRAKE BOOSTER

System Check

1) Run engine for 1-2 minutes. Shut engine off, and depress brake pedal several times with normal pressure. If pedal height gradually becomes higher with successive applications, power brake booster is okay. If pedal height remains steady, power brake booster is not operating properly, go to next step.

2) With engine stopped, depress brake pedal repeatedly until pedal height no longer falls. Hold brake pedal down, and start engine. If pedal moves downward slightly, power brake booster is okay. If pedal height does not change, power brake booster is not operating properly, go to next step.

3) With engine running, press and hold brake pedal. Shut off engine. Hold brake pedal for 30 seconds. Brake pedal height should not change. If pedal rises, power brake booster is not operating properly, go to next step.

4) If brake booster operation is not as specified in each step, disconnect vacuum hose at brake booster and check for sufficient vacuum with engine running. Also check brake booster check valve operation. Repair or replace as necessary.

Check Valve Inspection

Remove vacuum hose from power brake booster. Do not remove check valve from hose. Check valve should hold vacuum in one direction and allow air to pass in other direction.

LOAD-SENSING PROPORTIONING VALVE (LSPV)

Montero

1) Before diagnosing Load-Sensing Proportioning Valve (LSPV), ensure all other brake components are operating properly. When all other brake system components are determined to be okay, ensure LSPV spring length is within specification. See Fig. 1. See LOAD-SENSING PROPORTIONING VALVE (LSPV) under ADJUSTMENTS.

2) After spring length is determined to be within specification, connect pressure gauges to input and output ports of LSPV. See Fig. 7. Bleed brake system. See BLEEDING BRAKE SYSTEM.

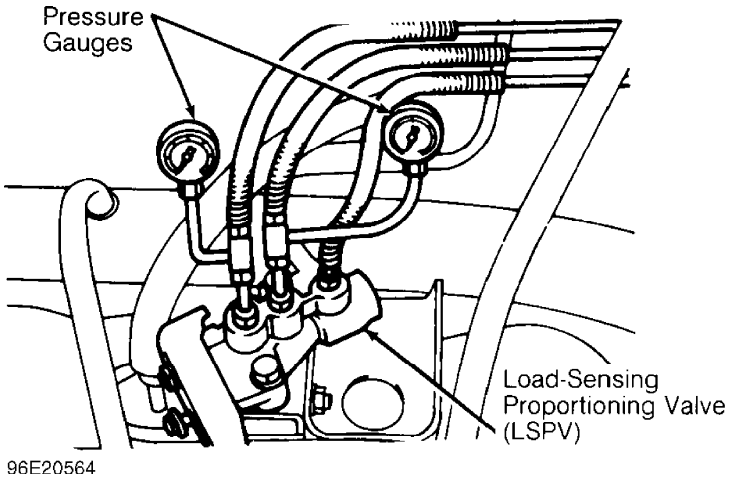


Fig. 7: Connecting Pressure Gauges To LSPV (Montero)
Courtesy of Mitsubishi Motor Sales of America.

3) With vehicle unloaded at correct ride height and LSPV spring correctly adjusted to 8.9" (227 mm), slowly depress brake pedal

and check fluid input and output pressures at LSPV. See LSPV PRESSURE SPECIFICATIONS table.

4) Disconnect spring at support and pull spring and lever toward support until spring length is 10.1" (257 mm). See Fig. 1. Slowly depress brake pedal and check input and output pressures at LSPV. See LSPV PRESSURE SPECIFICATIONS table. If fluid input pressure is okay and output pressure is not within specification, replace LSPV assembly. Remove gauges and bleed brake system.

LSPV PRESSURE SPECIFICATIONS

LSPV Spring Length	Inlet Pressure psi (kg/cm²)	Outlet Pressure psi (kg/cm²)
8.9" (227 mm)	1422 (100)	873-1002 (61-70)
8.9" (227 mm)	2560 (180)	1129-1314 (79-92)
10.1" (257 mm)	2560 (180)	1863-2148 (131-151)

NON-LOAD-SENSING PROPORTIONING VALVE

Pressure Test (Except Montero)

1) Connect pressure gauges to input and output ports of proportioning valve. See Fig. 8. Bleed brake system. See BLEEDING BRAKE SYSTEM.

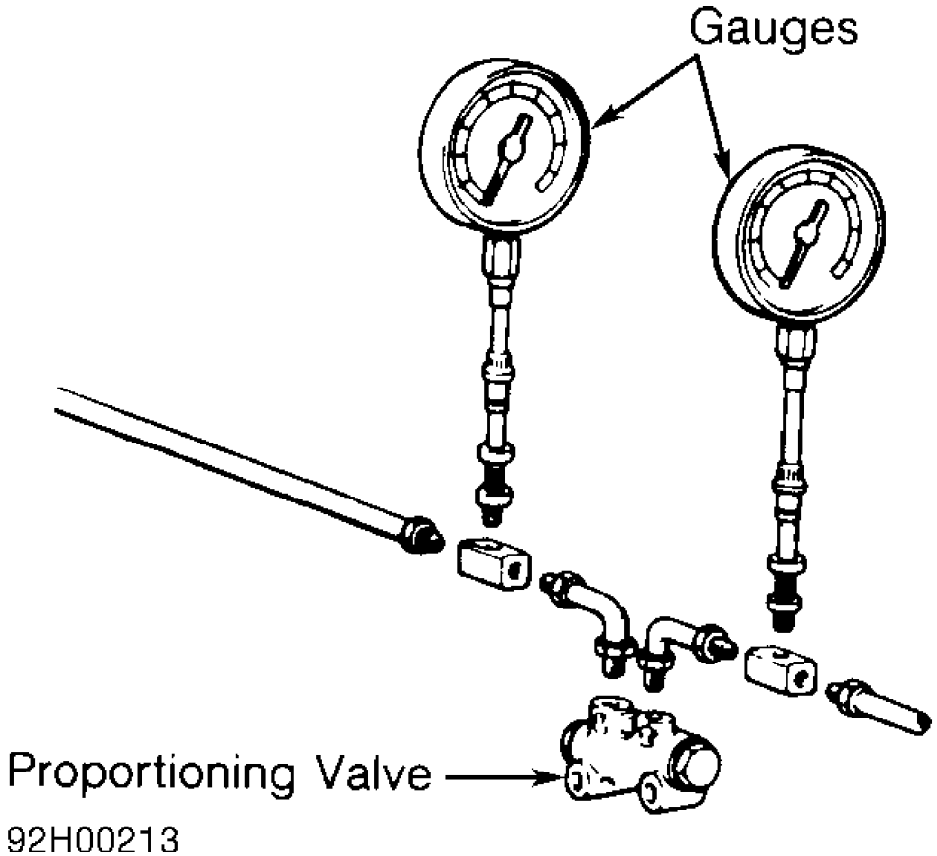


Fig. 8: Connecting Pressure Gauges To Proportioning Valve (Typical)
Courtesy of Mitsubishi Motor Sales of America.

2) Slowly depress brake pedal. Check readings on pressure gauges. Ensure output pressure begins to drop relative to input

pressure at specified pressure range (split point). See SPLIT POINT PRESSURE SPECIFICATIONS table.

SPLIT POINT PRESSURE SPECIFICATIONS

Application	psi (kg/cm²)
Diamante	312-383 (22-27)
Eclipse	
Without ABS	320-391 (22-27)
With ABS	320-391 (22-27)
Galant	462-533 (33-38)
Mirage	
2-Door	320-392 (22-26)
4-Door	391-463 (27-32)
Montero Sport	(1)

(1) - Information not available from manufacturer.

3) Continue depressing brake pedal, and check readings on pressure gauges. See PROPORTIONING VALVE PRESSURE SPECIFICATIONS table. If fluid pressures or split point are not within specification, replace proportioning valve.

PROPORTIONING VALVE PRESSURE SPECIFICATIONS

Application/ Model	Inlet Pressure psi (kg/cm²)	(1) Outlet Pressure psi (kg/cm²)
Diamante	1138 (80)	676-747 (48-53)
Eclipse		
With ABS	996 (69)	569-640 (39-44)
Without ABS	925 (61)	462-533 (32-37)
Galant	996 (69)	604 (43)
Mirage		
2-Door	1422 (98)	566-680 (39-47)
4-Door	1422 (98)	619-733 (43-51)
3000GT		
Hatchback	906 (64)	651-723 (46-51)
Convertible	1117 (79)	846-917 (60-65)
Montero Sport	(1)	(1)

(1) - Information is not available from manufacturer.

REMOVAL & INSTALLATION

FRONT DISC BRAKE PADS

CAUTION: DO NOT remove or contaminate special grease coating on lock pins.

Removal & Installation (Except 3000GT AWD)

1) Raise and support vehicle. Remove front wheels. Remove lower lock pin or sleeve bolt. See Figs. 13-15. Lift caliper body upward. Support caliper aside. Remove shims and pads from support mounting. Remove pad clips.

2) If installing new pads, compress piston to bottom of bore. Install retaining clips, pads and shims. Start engine and depress brake pedal several times to expand caliper piston. Check brake fluid level.

Removal & Installation (3000GT AWD)

1) Raise and support vehicle. Remove front wheels. Remove clip, brake pad retaining pins and spring. See Fig. 17. Remove shims and pads from caliper. Keep track of location of shims for reassembly.

2) Compress caliper pistons fully in bores. Install shims on brake pads. Install brake pads. Install spring clip, pad retaining pins and clip. Start engine and depress brake pedal several times to expand caliper piston. Check brake fluid level.

FRONT BRAKE CALIPER

Removal

Raise and support vehicle. Remove front wheels. Remove hose clip from brake hose mount (if equipped). Disconnect brake hose from caliper. Remove upper and lower caliper-to-steering knuckle bolts. Lift caliper body upward. Remove caliper.

Installation

To install, reverse removal procedure. Tighten bolts to specification. See TORQUE SPECIFICATIONS. Bleed brake system. See BLEEDING BRAKE SYSTEM.

FRONT BRAKE ROTOR

Removal & Installation (Except Montero & Montero Sport)

Raise vehicle, and remove wheel(s). Remove caliper. See FRONT BRAKE CALIPER. Slide rotor off hub. To install, reverse removal procedure.

Removal (Montero & Montero Sport)

Raise and support vehicle. Remove brake caliper. See FRONT BRAKE CALIPER. On 4WD, remove Remove bearing grease cap, snap ring, shim, 6 bolts and drive flange from axle shaft. On 2WD remove 6 bolts and hub cover. Remove screw(s) from lock washer. Remove lock washer. Remove lock nut using Lock Nut Wrench (MB990954). Remove hub assembly. Place match marks on rotor and hub. Remove rotor from front hub.

Installation

1) Install rotor on hub. Service wheel bearings and seals as necessary. Install front hub assembly. Install lock nut, and tighten it to 119 ft. lbs. (165 N.m). Loosen lock nut, and retighten it to 18 ft. lbs. (24 N.m). Loosen lock nut 30-40 degrees. Install lock washer and screw(s).

2) On 2WD, reverse removal procedure for remaining components. On 4WD, install drive flange, shim and snap ring. Using feeler gauge, check axle shaft-to-hub clearance. Clearance should be 0.016-0.028" (0.41-0.71 mm). Use appropriate shim to obtain correct clearance. Shim is located behind snap ring on end of axle shaft. Recheck clearance if necessary. Install remaining components.

PARKING BRAKE SHOES

Removal & Installation (Diamante)

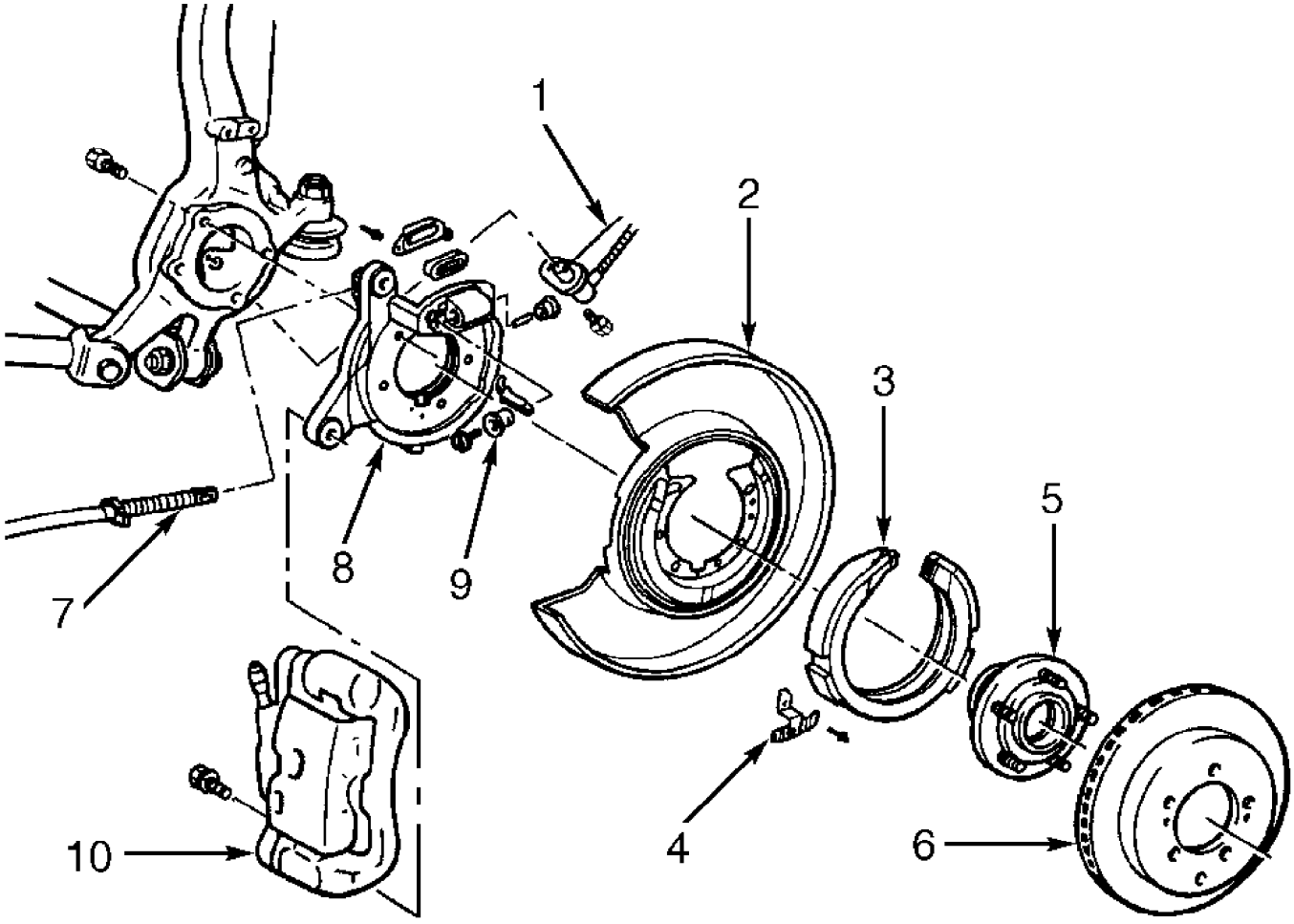
1) Raise and support vehicle. Remove rear wheels. Remove rear disc brake caliper and rotor. If rotor removal is difficult, rotate rotor until hole in rotor is upward. Back-off brake shoe adjustment with a flat blade screwdriver through hole in rotor.

2) Disconnect rear speed sensor. See Fig. 9. Remove 4 bolts and hub. Remove screw and shoe hold-down spring. Remove shoe. To install, reverse removal procedure. Adjust brake shoe by turning adjuster star wheel.

Removal (Eclipse, Montero & Montero Sport)

1) Raise and support vehicle. Remove rear wheels. Disconnect rear speed sensor (if equipped). Remove rear disc brake calipers and rotors. See REAR BRAKE CALIPER.

2) Remove adjuster spring. Remove shoe hold-down cup, spring and pin. See Fig. 10. Note how shoe-to-anchor spring is installed, and then remove adjuster and shoe-to-anchor spring. Remove strut and return spring. Remove clip and shoe and lining assembly.



1. Wheel Speed Sensor
2. Splash Shield
3. Brake Shoe
4. Shoe Hold-Down Spring
5. Hub
6. Rotor
7. Parking Brake Cable
8. Backing Plate
9. Star Wheel Adjuster
10. Caliper

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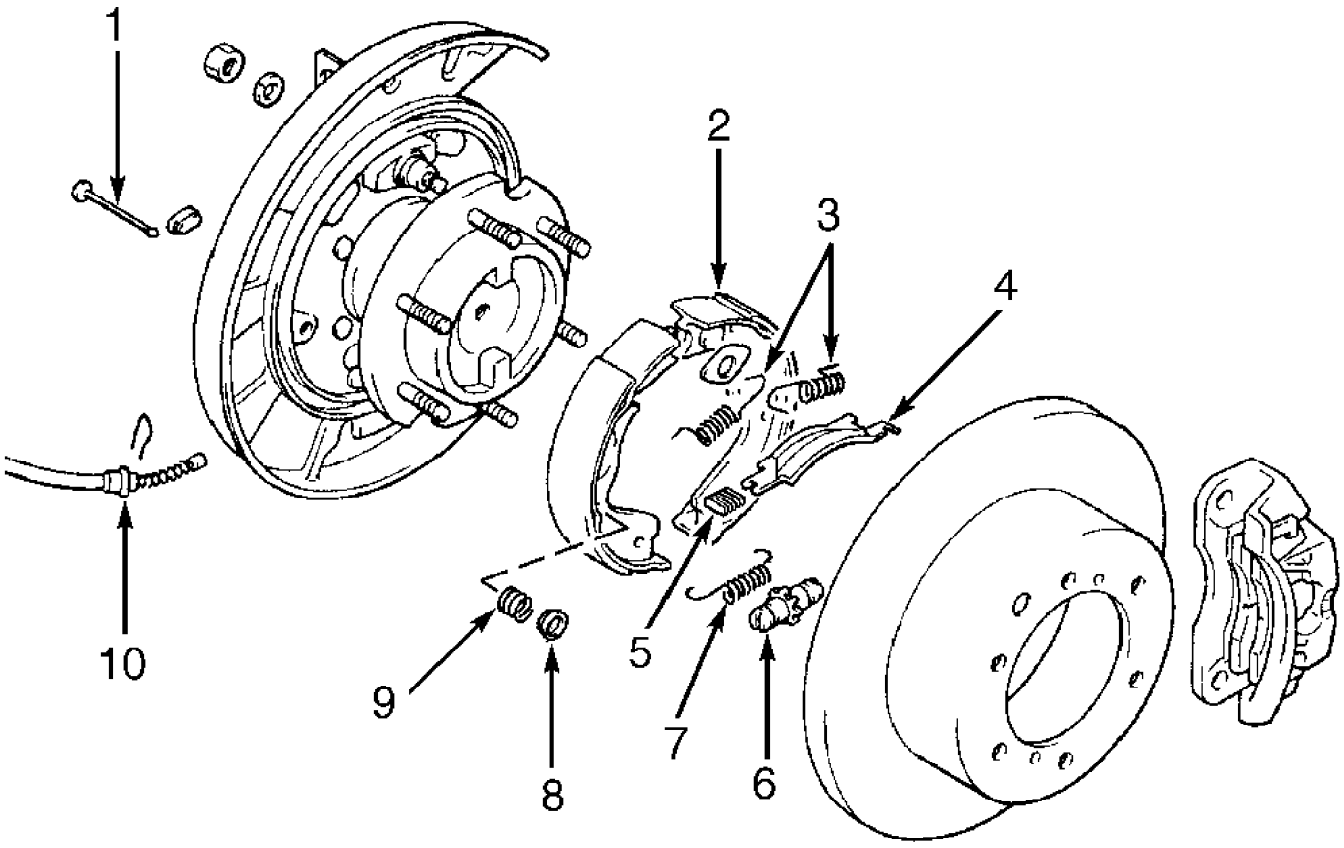
Fig. 9: Exploded View Of Parking Brake Assembly (Diamante)
Courtesy of Mitsubishi Motor Sales of America.



1. Hold-Down Pin
2. Brake Shoe
3. Shoe Return Spring
4. Strut
5. Strut Spring
6. Adjuster Assembly
7. Lower Shoe Spring
8. Spring Retainer
9. Hold-Down Spring
10. Parking Brake Cable

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Fig. 10: Exploded View Of Parking Brake Assembly (Typical With Rear Disc Brakes - Except Diamante)
Courtesy of Mitsubishi Motor Sales of America.

CAUTION: Shoe-to-anchor spring must be installed correctly for proper functioning of parking brakes.

Installation

1) To install, reverse removal procedure. When installing shoe-to-anchor spring, ensure spring is installed correctly. When installing adjuster, install left adjuster with adjusting bolt facing vehicle front and right adjuster with adjusting bolt facing vehicle rear.

2) On models with ABS, ensure gap between rotor teeth and speed sensor pole piece is 0.008-0.039" (0.20-1.00 mm).

Removal (3000GT)

1) Raise and support vehicle. Remove rear wheel(s). Disconnect rear speed sensor. Remove rear disc brake calipers and

rotors. See REAR BRAKE CALIPER.

2) On FWD models, remove grease cap, hub nut and hub. On AWD models, disconnect rear axle from companion flange at hub. Remove axle hub nut. Using slide hammer and Hub Adapter (MB991354), remove axle from knuckle.

3) On all models, remove adjusting wheel spring. Remove shoe hold-down cup, spring and pin. Note how shoe-to-anchor spring is installed, and then remove adjuster and shoe-to-anchor spring. Remove strut and return spring. Remove clip and shoe and lining assembly.

CAUTION: Shoe-to-anchor spring must be installed correctly for proper functioning of parking brakes.

Installation

To install, reverse removal procedure. When installing shoe-to-anchor spring, ensure spring is installed correctly. When installing adjuster, install left adjuster with adjusting bolt facing vehicle front and right adjuster with adjusting bolt facing vehicle rear. On AWD, tighten companion flange nut to 188-217 ft. lbs. (260-300 N.m).

REAR DISC BRAKE PADS

NOTE: Replace inner and outer pads at same time.

Removal

Raise and support vehicle. Remove rear wheels, and disconnect parking brake cable. Remove lower lock pin bolt. Lift caliper body upward. Using a wire, support caliper aside. Remove inner shims, anti-squeak shim and pad assembly from support mounting. Remove pad clips.

Installation

Rotate piston to align notches in piston projection on back of pads (if equipped). Install retaining clips, pad assembly, inner shims and anti-squeak shim onto support mounting. Lower caliper body, and install lock pin.

REAR BRAKE CALIPER

Removal

Raise and support vehicle. Remove rear wheels. Disconnect brake hose from caliper. Cap end of brake line to prevent spillage. Remove upper and lower caliper mounting bolts. Lift caliper body upward. Remove caliper.

Installation

To install, reverse removal procedure. Tighten bolts to specification. See TORQUE SPECIFICATIONS. Bleed brake system. See BLEEDING BRAKE SYSTEM.

REAR BRAKE ROTOR

Removal & Installation

Raise and support vehicle. Remove rear caliper. See REAR BRAKE CALIPER. Remove rotor. To install, reverse removal procedure.

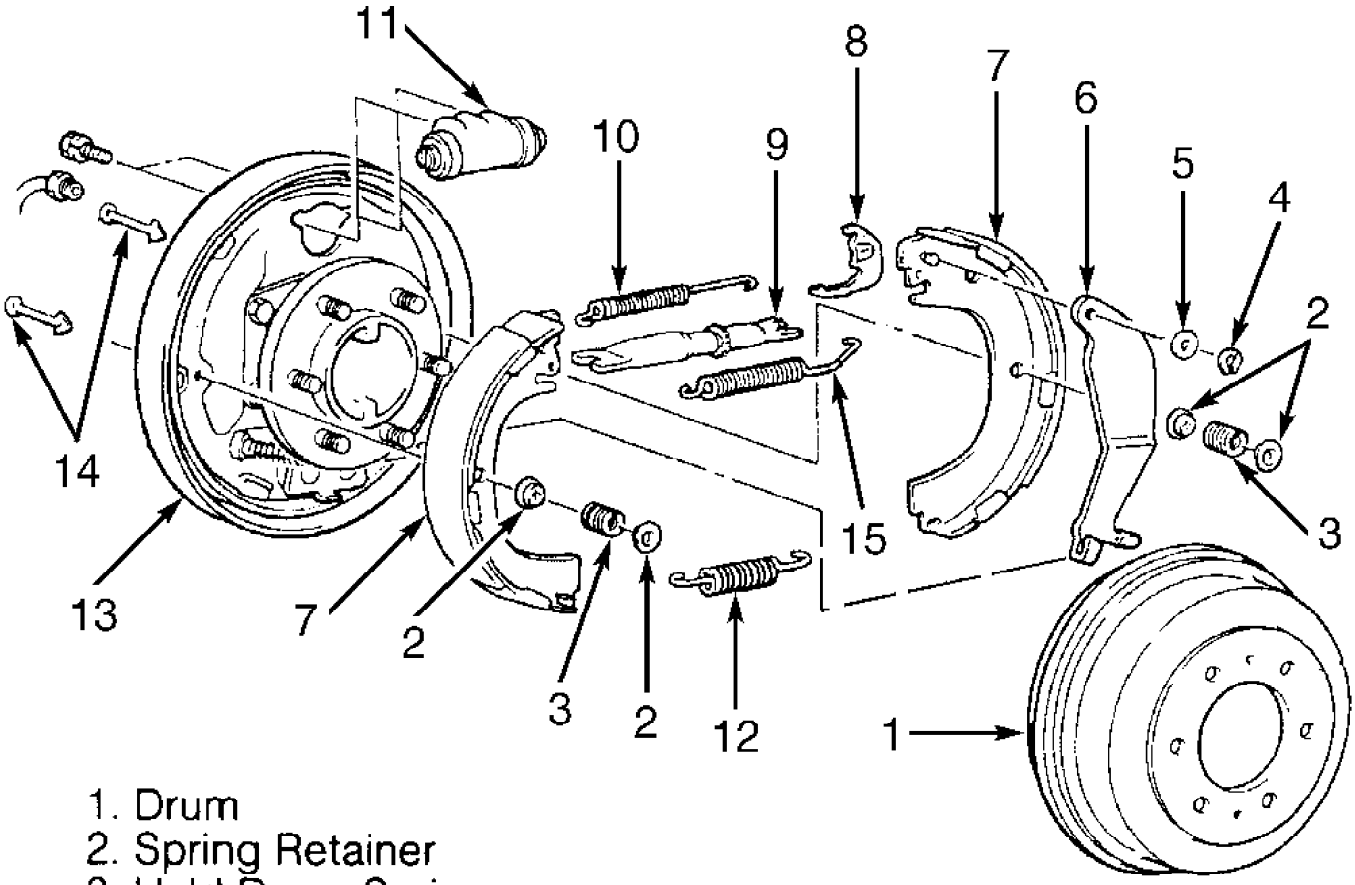
REAR BRAKE DRUM & SHOES

Removal

1) Raise and support vehicle. Remove wheels. Remove brake drum from hub. If drum is difficult to remove, back-off shoe adjuster

and remove drum. Remove shoe return springs and shoe hold-down springs. See Fig. 11.

2) Disconnect parking brake cable from lever. Remove brake shoes and adjuster assembly. Remove parking brake lever snap ring, and disengage lever from brake shoe.



1. Drum
2. Spring Retainer
3. Hold-Down Spring
4. Clip
5. Wave Washer
6. Parking Brake Lever
7. Brake Shoe
8. Adjuster Lever
9. Adjuster Assembly
10. Shoe-To-Lever Spring
11. Wheel Cylinder
12. Lower Shoe Spring
13. Backing Plate
14. Hold-Down Pins
15. Upper Shoe Return Spring

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Fig. 11: Exploded View Of Rear Drum Brake Assembly (Montero Sport Shown, Others Similar)
Courtesy of Mitsubishi Motor Sales of America.

Installation

1) To install, reverse removal procedure. Apply Lubriplate to shoe-to-backing plate bosses, adjuster assembly threads and parking brake lever pin.

2) Adjust shoes to lightly contact brake drum. See REAR BRAKE SHOES under ADJUSTMENTS. Depress brake pedal to center shoes, and check pedal travel. Rotate brake drum to ensure free movement.

WHEEL CYLINDERS

Removal & Installation

Raise and support vehicle. Remove rear brake drum and shoes. See REAR BRAKE DRUM & SHOES. Remove wheel cylinder and seal assembly. To install, reverse removal procedure. Bleed brakes. See BLEEDING BRAKE SYSTEM.

MASTER CYLINDER

Removal

Drain brake fluid from master cylinder. Remove sensor connector (if equipped). Disconnect brake lines from master cylinder, and install plugs to prevent brake fluid spillage. Remove master cylinder from booster and separate reservoirs from housing (if necessary).

Installation

To install, reverse removal procedure. Before installation, check and adjust clearance between back of master cylinder piston and power brake push rod. See MASTER CYLINDER PUSH ROD under ADJUSTMENTS. After installation, adjust pedal height. See BRAKE PEDAL HEIGHT & FREE PLAY under ADJUSTMENTS. Bleed brake system.

POWER BRAKE BOOSTER

Removal

Remove brake master cylinder. See MASTER CYLINDER. Disconnect vacuum hose from power brake booster. Disconnect clevis pin attaching brake pedal to power brake booster push rod. From inside vehicle, remove 4 nuts attaching power brake booster to firewall. Remove power brake booster.

Installation

To install, reverse removal procedure. Install master cylinder. Bleed brake system if necessary.

POWER BRAKE BOOSTER CHECK VALVE

NOTE: To test check valve before removal, see POWER BRAKE BOOSTER under TESTING.

Removal & Installation

Remove vacuum hose with check valve from power brake booster. Loosen hose clamp(s) and remove check valve from hose on Mirage and Summit. On all models, coat end(s) of check valve with sealant before installation. Install valve with arrow (identification mark) pointing toward intake manifold. Install and secure hose clamp(s).

REAR AXLE BEARINGS & OIL SEAL

Removal (Montero & Montero Sport)

1) With disc or drum removed, disconnect brake line from caliper or wheel cylinder. Disconnect parking brake cable end, and remove cable attaching bolts. Remove brake backing plate, bearing case and axle shaft as an assembly. If axle shaft binds, use slide hammer and puller to remove.

2) Remove shims, "O" ring and snap ring. Retain shims for installation. Secure axle shaft assembly in a vise, and remove one retainer bolt from backing plate. Push bearing case completely to side of dust cover. Place adhesive tape around edge of bearing case at

retainer bolt hole to prevent damage.

CAUTION: DO NOT damage bearing case or axle shaft when grinding or chiseling retainer ring.

3) Secure axle shaft, and grind retainer ring until retainer ring wall thickness is 0.04-0.06" (1.0-1.5 mm) on axle shaft side and 0.08" (2.0 mm) on bearing side (FIRST CUT). See Fig. 9.

4) Change angle of grind, and remove remaining 0.08" (2.0 mm) of retainer ring wall on bearing side (SECOND CUT). Using a chisel, cut retainer ring. Remove ring. DO NOT damage axle shaft.

5) Install Puller (MB990787-01) to remove bearing case from axle shaft. Rotate nuts with equal force to remove wheel bearing. Remove bearing outer race using a hammer and drift. Remove oil seal from axle housing using a slide hammer and hook.

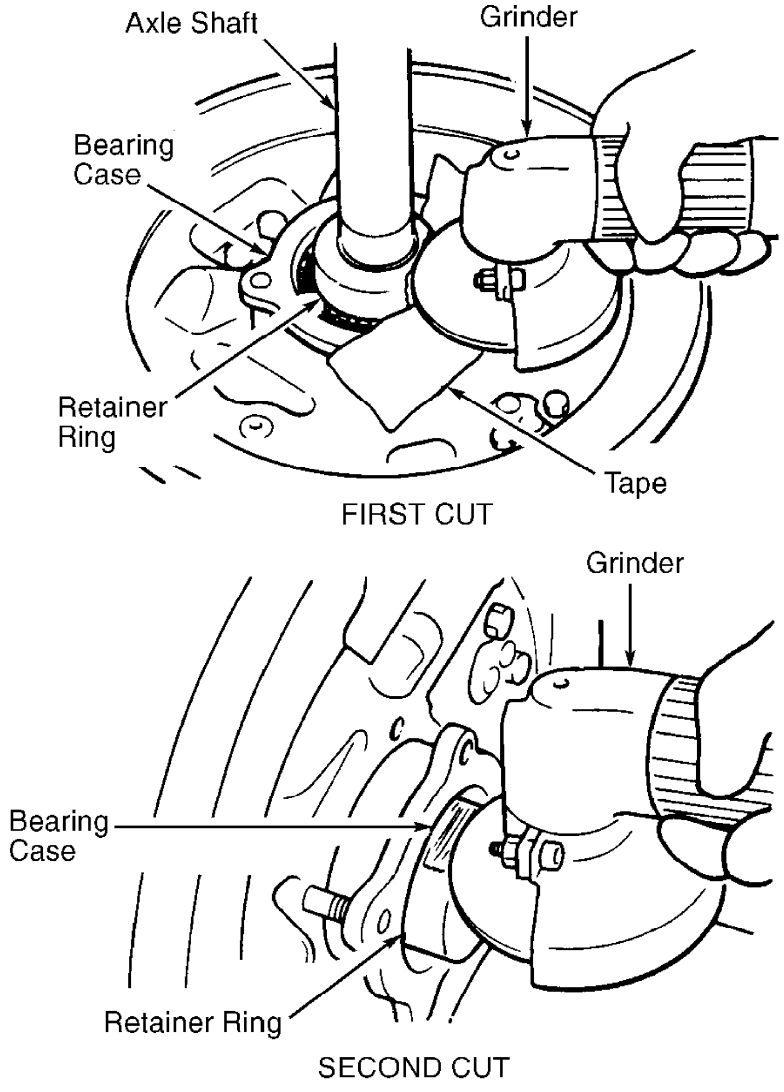


Fig. 12: Grinding Bearing Retainer Ring (Montero & Montero Sport) Courtesy of Mitsubishi Motor Sales of America.

Installation

1) Apply Multipurpose Grease (SAE J310) to oil seal, oil seal

cavity and contact surfaces. Install oil seal using seal driver. Press new oil seal into bearing case until it is flush with face of bearing case. Install backing plate and bearing case.

2) Apply grease to external surfaces of bearing outer race. Press bearing outer race into bearing case. Install rear brake assembly and bearing case. Pack bearing case and axle threads with grease. Install new retainer ring and snap ring.

3) Using a feeler gauge, measure clearance between snap ring and new retainer ring. Clearance should be less than 0.0065" (0.165 mm). If clearance exceeds specification, install a new selective snap ring to bring clearance to specification. See SNAP RING THICKNESS SPECIFICATION table.

SNAP RING THICKNESS SPECIFICATION

Thickness: In. (mm)	Color
0.060 (1.52)	Red
0.067 (1.70)	Purple
0.073 (1.85)	Blue
0.079 (2.01)	Yellow
0.085 (2.16)	Neutral

4) Check condition of oil seal and replace as necessary. Install axle shaft assembly into axle housing. Tighten bearing retainer bolts to 65 ft. lbs (15 N.m.). To complete installation, reverse removal procedure.

REAR AXLE HUB BEARINGS

NOTE: Rear hub bearings are not serviceable on FWD models.

Removal & Installation (FWD Models)

1) Raise and support vehicle. Remove wheels. Remove wheel speed sensor (if equipped). On models with drum brakes, remove brake drum and shoes. See REAR BRAKE DRUM & SHOES.

2) On models with disc brakes, remove caliper and rotor. On all models, remove hub bolts or spindle nut and hub assembly. To install, reverse removal procedure. Tighten hub bolts or spindle nut to specification. See HUB TIGHTENING TORQUE table. Rotate brake drum or disc to ensure free movement.

NOTE: Rear hub bearings are not serviceable on Eclipse AWD models.

Removal & Installation (Eclipse AWD)

1) Raise and support vehicle. Remove wheels. Remove wheel speed sensor (if equipped). On models with drum brakes, remove brake drum and shoes. See REAR BRAKE DRUM & SHOES.

2) On models with disc brakes, remove caliper and rotor. On all models, remove axle nut. Remove 4 hub bolts and hub assembly. To install, reverse removal procedure. Tighten hub bolts to specification. See HUB TIGHTENING TORQUE table. Rotate brake drum or disc to ensure free movement.

HUB TIGHTENING TORQUE

Application	Ft. Lbs. (N.m)
Hub Mounting Bolts	54-65 (74-85)
Spindle Nut	
Mirage	127 (172)
3000GT FWD	170 (230)

Removal & Installation (3000GT AWD Models)

1) Raise and support vehicle. Remove wheels. Remove wheel speed sensor (if equipped). Remove caliper and rotor.

2) Remove 4 bolts and separate rear drive axle from hub companion flange. Using Yoke Holder (MB990767), hold rear axle hub and remove axle nut at companion flange.

3) Using slide hammer and Hub Adapter (MB991354), remove axle shaft from knuckle. Place axle in hydraulic press. Using an appropriate bearing splitter, remove ABS rotor (if equipped) and outer axle bearing.

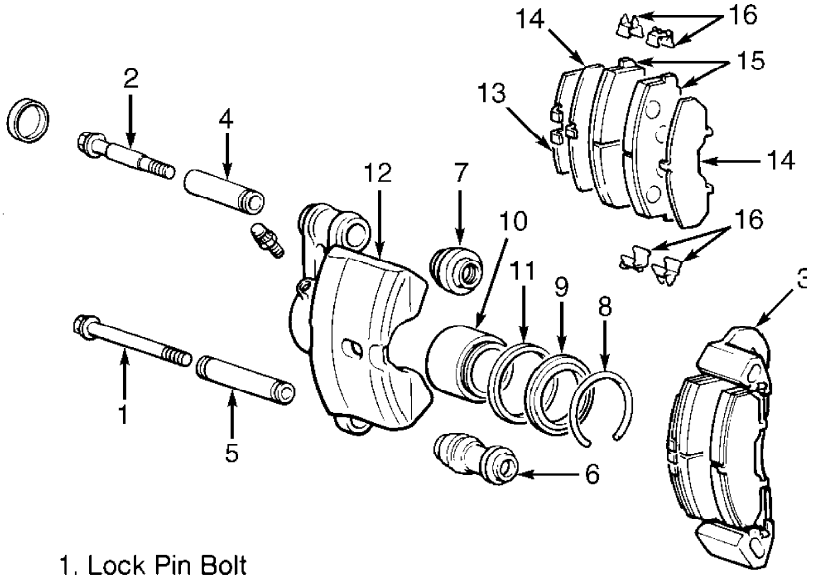
4) Remove inner bearing and seal from axle. Using Bearing Installer Handle (MB990938) and Adapter (MB990931), install bearing and axle seal.

5) Using Installer (MB990799), install dust shield onto axle shaft. Using hydraulic press, install outer axle bearing onto axle shaft so seal lip is facing towards axle shaft. Press on wheel speed sensor rotor (if equipped) with groove on speed sensor rotor is facing towards axle shaft flange.

6) Install axle shaft assembly into knuckle and tighten axle nut to 188-217 ft. lbs. (260-300 N.m.). To complete installation, reverse removal procedure. Tighten bolts to specification.

OVERHAUL

NOTE: For exploded views of calipers, see Figs. 13 through 17. For exploded view of master cylinder, see Fig. 18.



1. Lock Pin Bolt
2. Guide Pin Bolt
3. Support
4. Sleeve
5. Sleeve
6. Boot
7. Boot
8. Ring
9. Piston Boot
10. Piston
11. Seal
12. Caliper
13. Inner Shim
14. Outer Shim
15. Pad
16. Clip

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Fig. 13: Exploded View Of Single Piston Caliper Assembly (Except Montero Sport)
Courtesy of Mitsubishi Motor Sales of America.

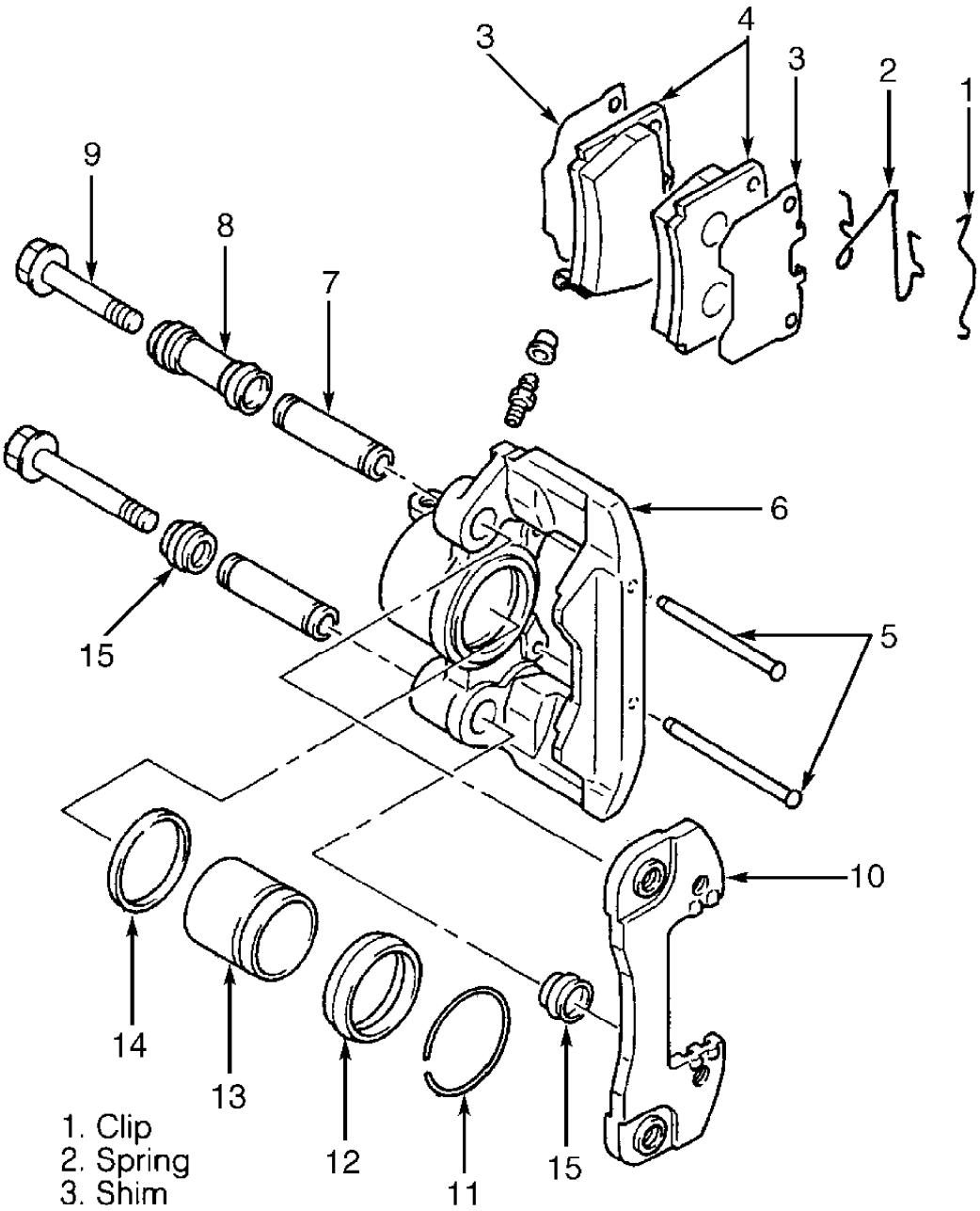

Fig. 14: Exploded View Of Single Piston Caliper Assembly (Montero Sport)
Courtesy of Mitsubishi Motor Sales of America.

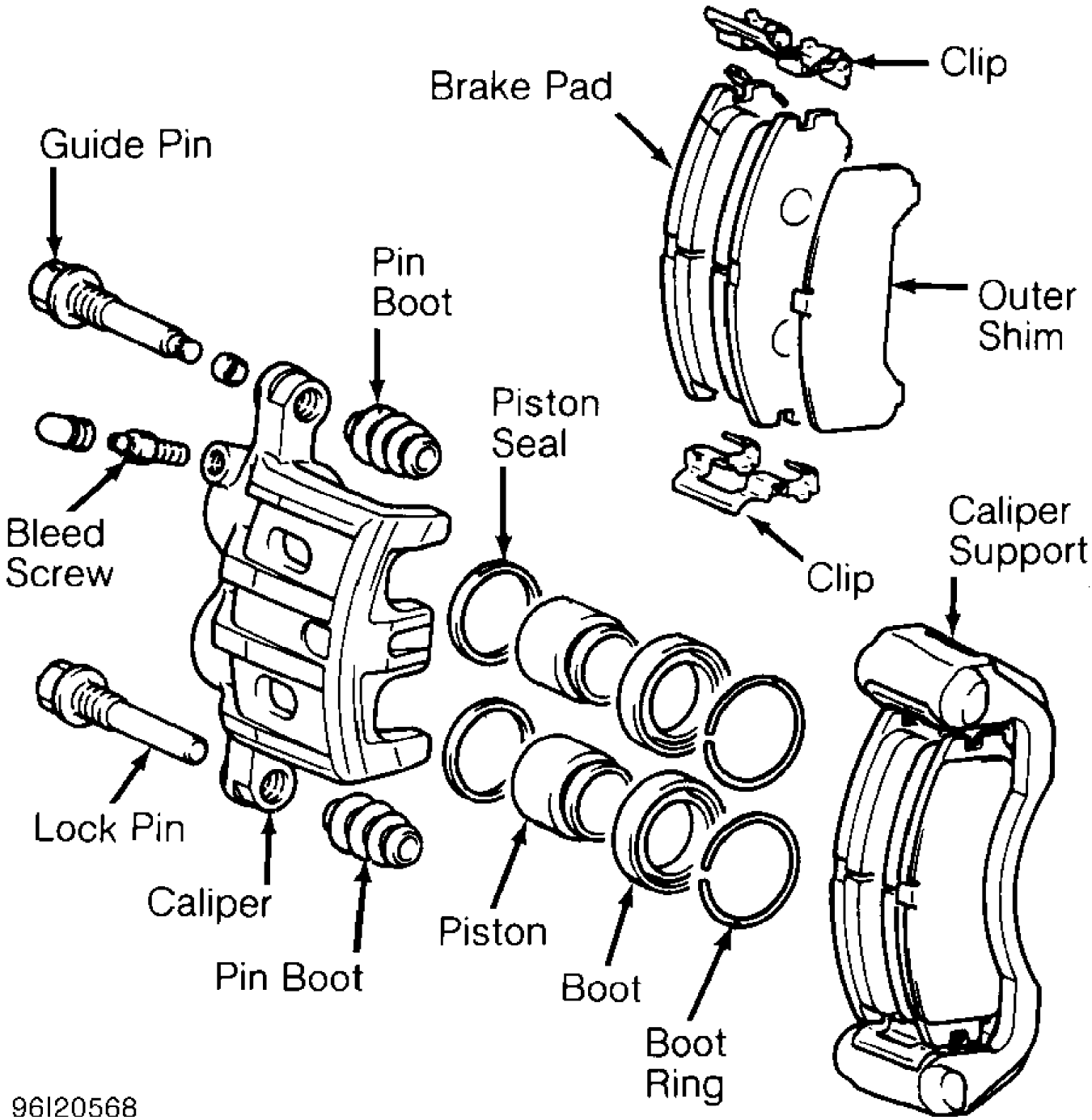

Fig. 15: Exploded View Of Dual Piston Caliper Assembly
Courtesy of Mitsubishi Motor Sales of America.

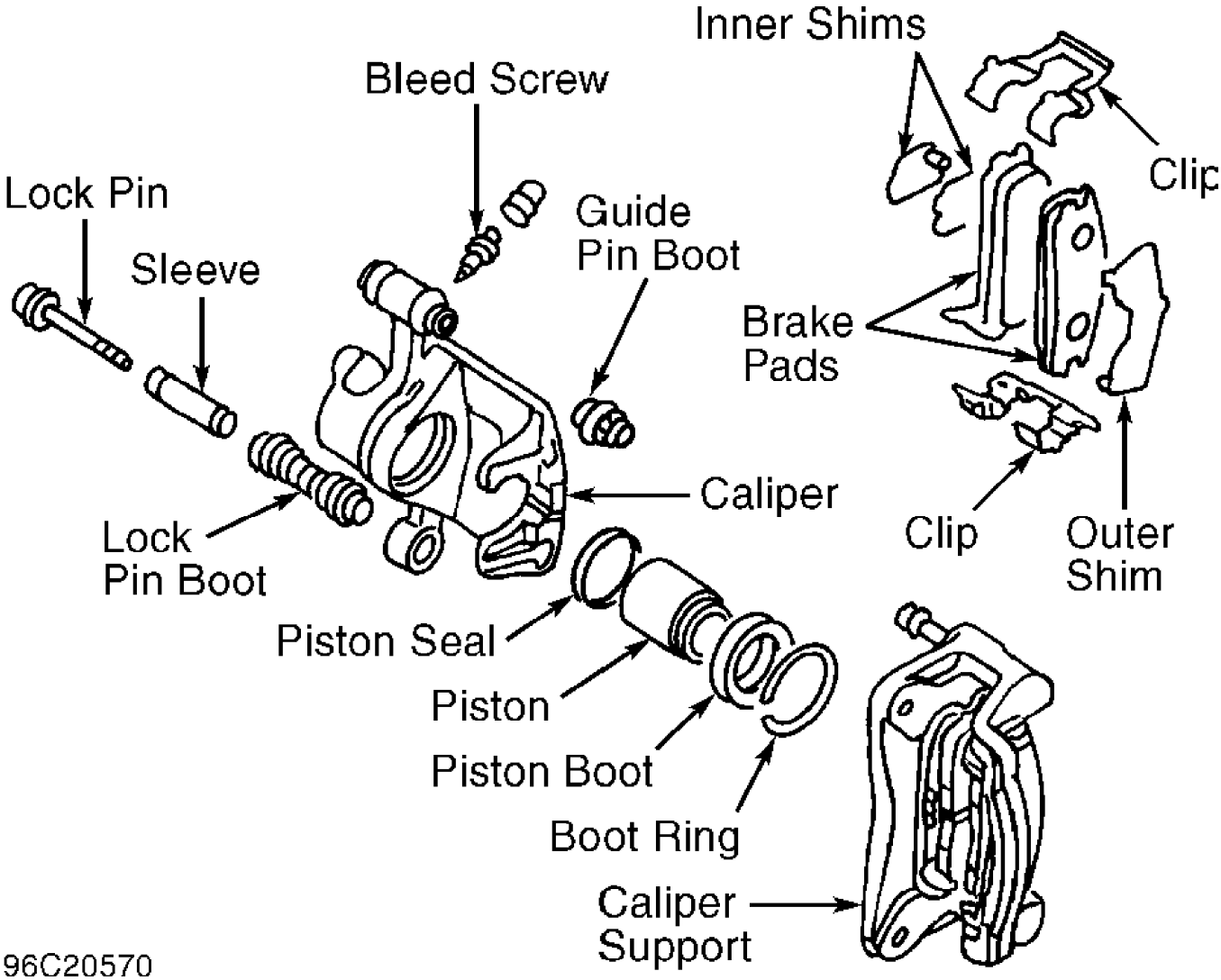

Fig. 16: Exploded View Of 4-Piston Caliper Assembly (Montero)
Courtesy of Mitsubishi Motor Sales of America.

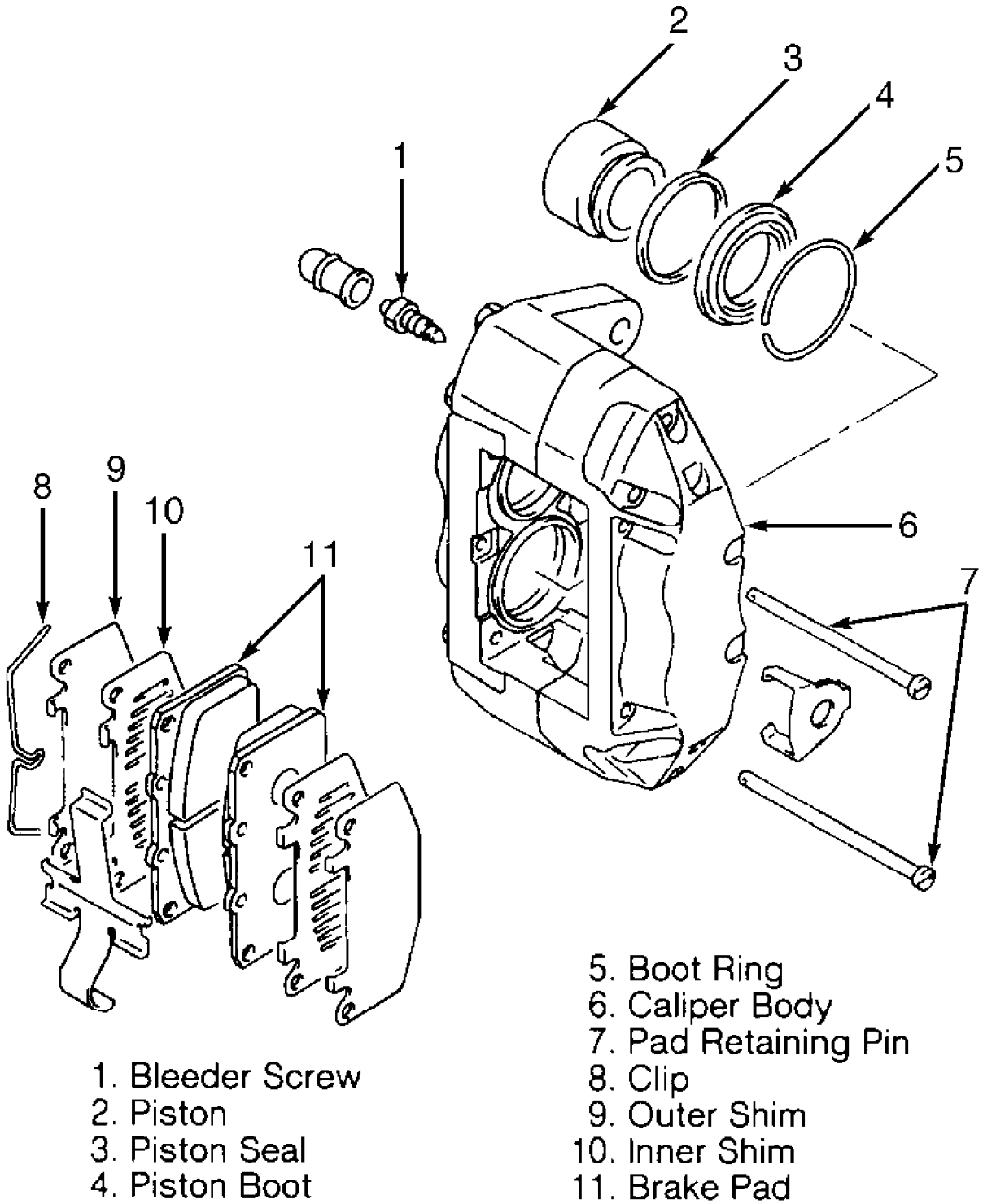

Fig. 17: Exploded View Of 4-Piston Caliper Assembly (3000GT AWD)
Courtesy of Mitsubishi Motor Sales of America.

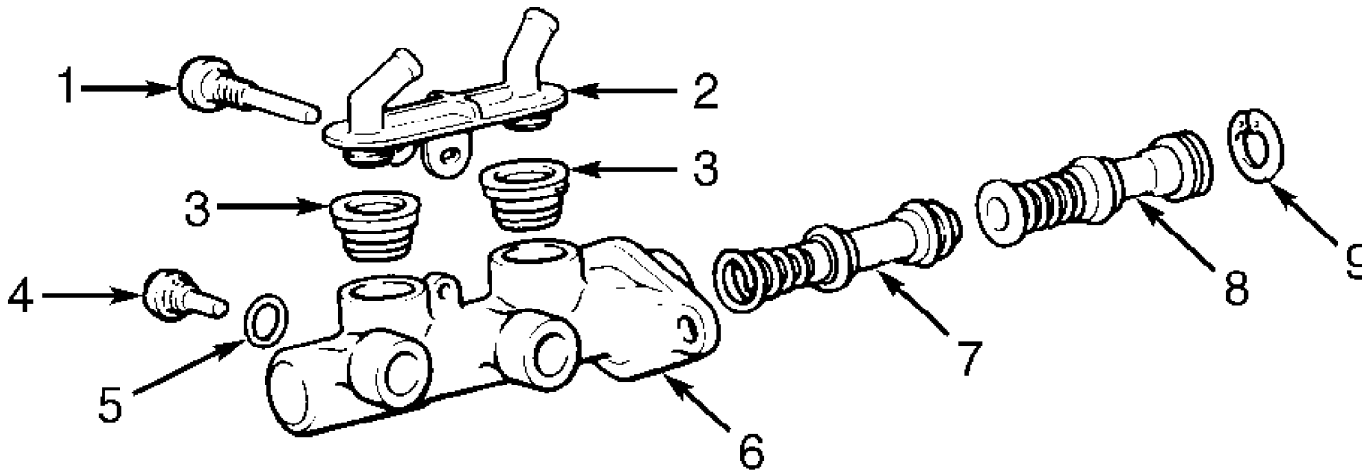

Fig. 18: Exploded View Of Master Cylinder (Typical)
Courtesy of Mitsubishi Motor Sales of America.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS (DIAMANTE)

Application	Ft. Lbs. (N.m)
Brake Line Flare Nuts	11 (15)
Caliper Guide & Lock Pin Bolt	
Front	54 (73)
Rear	24 (32)
Caliper Mounting Bolts	
Front	66 (90)
Rear	36-43 (49-59)
Rear Hub-To-Knuckle Bolts	55-65 (74-88)
Wheel Lug Nut	67-81 (90-110)

TORQUE SPECIFICATIONS (ECLIPSE)

Application	Ft. Lbs. (N.m)
Brake Line Flare Nuts	11 (15)
Caliper Guide & Lock Pin Bolt	54 (73)
Caliper Mounting Bolts	66 (90)
Rear Hub-To-Knuckle Nut	60 (81)
Wheel Lug Nut	89-103 (120-140)
	INCH Lbs. (N.m)
Master Cylinder Mounting Nut	115 (13)
Bleeder Screw	71 (8)

Wheel Cylinder Bolt	89 (10)

TORQUE SPECIFICATIONS (GALANT)

Application	Ft. Lbs. (N.m)
Brake Line Flare Nuts	11 (15)
Caliper Guide & Lock Pin Bolt	54 (73)
Caliper Mounting Bolts	66 (90)
Rear Hub-To-Knuckle Nut	60 (81)
Wheel Lug Nut	67-81 (90-110)
	INCH Lbs. (N.m)
Master Cylinder Mounting Booster Nut	115 (13)
Bleeder Screw	71 (8)
Wheel Cylinder Bolt	89 (10)

TORQUE SPECIFICATIONS (MIRAGE)

Application	Ft. Lbs. (N.m)
Brake Line Flare Nuts	11 (15)
Caliper Guide Pin Bolt	36 (49)
Caliper Lock Pin Bolt	61-69 (83-93)
Caliper Mounting Bolts	66-81 (90-110)
Rear Wheel Bearing Nut	127 (172)
Wheel Lug Nut	67-81 (90-110)
	INCH Lbs. (N.m)
Master Cylinder Mounting Booster Nut	115 (13)
Bleeder Screw	71 (8)
Wheel Cylinder Bolt	89 (10)

TORQUE SPECIFICATIONS (MONTERO)

Application	Ft. Lbs. (N.m)
Brake Line Flare Nuts	11 (15)
Caliper Guide & Lock Pin Bolt	
Front	54 (73)
Rear	32 (44)
Caliper Mounting Bolt	65 (88)
Wheel Lug Nut	72-87 (98-118)
Rear Axle Bearing Retainer Nut	145-173 (196-235)
	INCH Lbs. (N.m)
Master Cylinder Mounting Nut	115 (13)
Bleeder Screw	71 (8)

TORQUE SPECIFICATIONS (MONTERO SPORT)

Application	Ft. Lbs. (N.m)
Brake Line Flare Nuts	11 (15)
Caliper Guide & Lock Pin Bolt (Front)	54 (73)
Caliper Mounting Bolt	

Front	66 (90)
Rear	94 (127)
Wheel Lug Nut	
15x6" Wheel	87-101 (118-137)
15x7" Wheel	72-86 (98-117)
Rear Axle Bearing Retainer Nut	145-173 (196-235)
	INCH Lbs. (N.m)
Master Cylinder Mounting Nut	115 (13)
Bleeder Screw	71 (8)
Wheel Cylinder Nut	89 (10)

TORQUE SPECIFICATIONS (3000GT)

Application	Ft. Lbs. (N.m)
Brake Line Flare Nuts	11 (15)
Caliper Guide & Lock Pin Bolt (FWD)	
Front	54 (73)
Rear	20 (27)
Caliper Mounting Bolts	
Front	66 (90)
Rear	36-43 (49-59)
Front Axle Shaft Nut	166 (230)
Rear Wheel Bearing Nut	
AWD	192-221 (260-300)
FWD	170 (230)
	INCH Lbs. (N.m)
Master Cylinder Mounting Nut	84 (10)

BRAKE SYSTEM BRAKE SPECIFICATIONS

BRAKE SPECIFICATIONS (DIAMANTE)

Application	In. (mm)
Booster Pushrod Clearance	.016-.024 (.40-.60)
Disc Runout	.003 (.08)
Disc Thickness (Minimum)	
Front	.88 (22.4)
Rear	.33 (8.4)
Hub End Play	.002 (.05)
Master Cylinder Inside Diameter	1.0 (25.4)
Pad Lining Thickness (Minimum)	
Front	1.08 (2.0)
Rear	1.04 (1.0)

BRAKE SPECIFICATIONS (ECLIPSE)

Application	In. (mm)
Booster Pushrod Clearance	.023-.033 (.65-.85)
Disc Runout	.003 (.08)
Disc Diameter	
AWD	9.0 (228)
Except AWD	8.0 (204)

Disc Thickness (Minimum)	
Front	.88 (22.4)
Rear	.33 (8.4)
Drum Inside Diameter (Maximum)	9.1 (231)
Hub End Play	.002 (.05)
Master Cylinder Inside Diameter	
With ABS	1.0 (25.4)
Without ABS	.93 (23.8)
Pad Lining Thickness (Minimum)	.08 (2.0)
Shoe Lining Thickness (Minimum)	.039 (1.0)
Wheel Cylinder Inside Diameter	.750 (19.1)

BRAKE SPECIFICATIONS (GALANT)

Application	In. (mm)
Booster Pushrod Clearance	
Single Booster	.024-.031 (.60-.80)
Tandem Booster	.016-.024 (.40-.60)
Disc Runout	.003 (.08)
Disc Thickness (Minimum)	.88 (22.4)
Drum Inside Diameter (Maximum)	9.1 (231)
Hub End Play	.002 (.05)
Master Cylinder Inside Diameter	1.0 (25.4)
Pad Lining Thickness (Minimum)	.08 (2.0)
Shoe Lining Thickness (Minimum)	.039 (1.0)
Wheel Cylinder Inside Diameter	.750 (19.1)

BRAKE SPECIFICATIONS (MIRAGE)

Application	In. (mm)
Booster Pushrod Clearance	.026-.033 (.65-.85)
Disc Runout	.006 (.0024)
Disc Thickness (Minimum)	.65 (16.4)
Drum Inside Diameter (Maximum)	8.1 (206)
Hub End Play	.002 (.05)
Master Cylinder Inside Diameter	.87 (22.22)
Pad Lining Thickness (Minimum)	.08 (2.0)
Shoe Lining Thickness (Minimum)	.039 (1.0)
Wheel Cylinder Inside Diameter	.750 (19.1)

BRAKE SPECIFICATIONS (MONTERO)

Application	In. (mm)
Booster Pushrod Clearance	.026-.035 (.65-.90)
Disc Runout	
Front	.004 (.10)
Rear	.003 (.08)
Disc Thickness (Minimum)	
Front	1.0 (25.4)
Rear	.65 (16.4)
Hub End Play	.0098 (.25)
Master Cylinder Inside Diameter	.937 (23.8)
Pad Lining Thickness (Minimum)	
Front	1.08 (2.0)
Rear	(1)
Parking Brake Drum Diameter (Maximum)	7.795 (198)

(1) - Information not available from manufacturer.

BRAKE SPECIFICATIONS (MONTERO SPORT)

Application	In. (mm)
Disc Runout	
Front	.002 (.06)
Rear	.003 (.08)
Disc Thickness (Minimum)	
Front	.88 (22.4)
Rear	.65 (16.4)
Drum Diameter (Maximum)	10.71 (272.0)
Hub End Play (Maximum)	.002 (.05)
Master Cylinder Inside Diameter	.937 (23.8)
Pad Lining Thickness (Minimum)	1.08 (2.0)
Shoe Lining Thickness (Minimum)	.039 (1.0)
Wheel Cylinder Inside Diameter	.90 (22.8)

BRAKE SPECIFICATIONS (3000GT)

Application	In. (mm)
Booster Pushrod Clearance	.026-.030 (.65-.75)
Disc Runout	
Front	
AWD	.004 (.10)
FWD	.003 (.07)
Rear	.003 (.08)
Disc Thickness (Minimum)	
Front	
AWD	1.12 (28.4)
FWD	.88 (22.4)
Rear	
AWD	.72 (18.4)
FWD	.65 (16.4)
Hub End Play	.002 (.05)
Master Cylinder Inside Diameter	1.0 (25.4)
Pad Lining Thickness (Minimum)	1.08 (2.0)
Parking Brake Drum Diameter (Maximum)	6.65 (169)

* BRAKE SYSTEM UNIFORM INSPECTION GUIDELINES *

1998 Mitsubishi Galant

GENERAL INFORMATION
Brake Systems - Motorist Assurance Program
Standards For Automotive Repair

All Makes & Models

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INTRODUCTION TO MOTORIST ASSURANCE PROGRAM (MAP)

OVERVIEW OF MOTORIST ASSURANCE PROGRAM

The Motorist Assurance Program is the consumer outreach effort of the Automotive Maintenance and Repair Association, Inc. (AMRA). Participation in the Motorist Assurance Program is drawn from retailers, suppliers, independent repair facilities, vehicle manufacturers and industry associations.

Our organization's mission is to strengthen the relationship between the consumer and the auto repair industry. We produce materials that give motorists the information and encouragement to take greater responsibility for their vehicles-through proper, manufacturer-recommended, maintenance. We encourage participating service and repair shops (including franchisees and dealers) to adopt:

1) a Pledge of Assurance to their Customers and
2) the Motorist Assurance Program Standards of Service.

All participating service providers have agreed to subscribe to this Pledge and to adhere to the promulgated Standards of Service demonstrating to their customers that they are serious about customer satisfaction.

These Standards of Service require that an inspection of the vehicle's (problem) system be made and the results communicated to the customer according to industry standards. Given that the industry did not have such standards, the Motorist Assurance Program successfully promulgated industry inspection communication standards in 1994-95 for the following systems: Exhaust, Brakes, ABS, Steering and Suspension, Engine Maintenance and Performance, HVAC, and Electrical Systems. Further, revisions to all of these inspection communication standards are continually re-published. In addition to these, standards for Drive Train and Transmissions have recently been promulgated. Participating shops utilize these Uniform Inspection & Communication Standards as part of the inspection process and for communicating their findings to their customers.

The Motorist Assurance Program continues to work cooperatively and proactively with government agencies and consumer groups toward solutions that both benefit the customer and are mutually acceptable to both regulators and industry. We maintain the belief that industry must retain control over how we conduct our business, and we must be viewed as part of the solution and not part of the problem. Meetings with state and other government officials (and their representatives), concerned with auto repair and/or consumer protection, are conducted. Feedback from these sessions is brought back to the association, and the program adjusted as needed.

To assure auto repair customers recourse if they were not

satisfied with a repair transaction, the Motorist Assurance Program offers mediation and arbitration through MAP/BBB-CARE and other non-profit organizations. MAP conducted pilot programs in twelve states before announcing the program nationally in October, 1998. During the pilots, participating repair shops demonstrated their adherence to the Pledge and Standards and agreed to follow the UICS in communicating the results of their inspection to their customers. To put some "teeth" in the program, an accreditation requirement for shops was initiated. The requirements are stringent, and a self-policing method has been incorporated which includes the "mystery shopping" of outlets.

We welcome you to join us as we continue our outreach with your support, both the automotive repair industry and your customers will reap the benefits. Please visit MAP at our Internet site www.motorist.org or contact us at:

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Washington, DC 20005
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January 1999

MAP UNIFORM INSPECTION GENERAL GUIDELINES

OVERVIEW OF SERVICE REQUIREMENTS AND SUGGESTIONS

It is MAP policy that all exhaust, brake, steering, suspension, wheel alignment, drive-line, engine performance and maintenance, and heating, ventilation and air conditioning, and electrical services be offered and performed under the standards and procedures specified in these sections.

Before any service is performed on a vehicle, an inspection of the appropriate system must be performed. The results of this inspection must be explained to the customer and documented on an inspection form. The condition of the vehicle and its components will indicate what services/part replacements may be "Required" or "Suggested". In addition, suggestions may be made to satisfy the requests expressed by the customer.

When a component is suggested or required to be repaired or replaced, the decision to repair or replace must be made in the customer's best interest, and at his or her choice given the options available.

This section lists the various parts and conditions that indicate a required or suggested service or part replacement. Although this list is extensive, it is not fully inclusive. In addition to this list, a technician may make a suggestion. However, any suggestions must be based on substantial and informed experience, or the vehicle manufacturer's recommended service interval and must be documented.

Some conditions indicate that service or part replacement is required because the part in question is no longer providing the function for which it is intended, does not meet a vehicle manufacturer's design specification or is missing.

Example:
An exhaust pipe has corroded severely and has a hole in it through which exhaust gases are leaking. Replacement of the exhaust pipe in this case is required due to functional failure.

Example:
A brake rotor has been worn to the point where it measures less than the vehicle manufacturer's discard specifications.

Replacement of the rotor is required because it does not meet design specifications.

Some conditions indicate that a service or part replacement is suggested because the part is close to the end of its useful life or addresses a customer's need, convenience or request. If a customer's vehicle has one of these conditions, the procedure may be only to suggest service.

Example:
An exhaust pipe is rusted, corroded or weak, but no leaks are present. In this case, the exhaust pipe has not failed. However, there is evidence that the pipe may need replacement in the near future. Replacement of the pipe may be suggested for the customer's convenience in avoiding a future problem.

Example:
The customer desires improved ride and/or handling, but the vehicle's shocks or struts have not failed. In this case, replacement may be suggested to satisfy the customer's wishes. In this case, replacement of the shocks or struts may not be sold as a requirement.

A customer, of course, has the choice of whether or not a shop will service his or her vehicle. He or she may decide not to follow some of your suggestions. When a repair is required, a MAP shop must refuse partial service on that system if, in the judgment of the service provider, proceeding with the work could create or continue an unsafe condition. When a procedure states that required or suggested repair or replacement is recommended, the customer must be informed of the generally acceptable repair/replacement options whether or not performed by the shop.

When presenting suggested repairs to the customer, you must present the facts, allowing the customer to draw their own conclusions and make an informed decision about how to proceed.

The following reasons may be used for required and suggested services. These codes are shown in the "Code" column of the MAP Uniform Inspection & Communications Standards that follow:

Reasons to Require Repair or Replacement
A – Part no longer performs intended purpose
B – Part does not meet a design specification (regardless of performance)
C – Part is missing

NOTE: When a repair is required, the shop must refuse partial service to the system in question, if the repair creates or continues an unsafe condition.

Reasons to Suggest Repair or Replacement
1 – Part is close to the end of its useful life (just above discard specifications, or weak; failure likely to occur soon, etc.)
2 – To address a customer need, convenience, or request (to stiffen ride, enhance performance, eliminate noise, etc.)
3 – To comply with maintenance recommended by the vehicle's Original Equipment Manufacturer (OEM)
4 – Technician's recommendation based on substantial and informed experience

NOTE: Suggested services are always optional. When presenting suggested repairs to the customer, you must present the facts, allowing the customer to draw their own conclusions

and make an informed decision about how to proceed.

BRAKES

SERVICE PROCEDURES REQUIRED & SUGGESTED FOR PROPER VEHICLE OPERATION

Some states may have specifications that differ from OEM. Check your local/state regulations. Where state or local laws are stricter, they take precedence over these guidelines.

ACCELEROMETERS (G SENSOR OR LATERAL)

ACCELEROMETER INSPECTION

Condition	Code	Procedure
Broken	A	Require replacement.
Connector loose	A	Require repair or replacement.
Loose	B	Require repair or replacement.
Missing	C	Require replacement.
Out of position	B	Require re-positioning to vehicle manufacturer's specifications.
Output signal incorrect	B	Require replacement.

ACCUMULATORS

ACCUMULATOR INSPECTION

Condition	Code	Procedure
Leaking	B	Require replacement.
Missing	C	Require replacement.
Pre-charge incorrect	B	Require replacement.

ANCHOR PINS

See BACKING PLATES.

ANTI-LOCK BRAKE SYSTEMS

NOTE: Anti-lock brakes are an integral part of the brake system. It is essential that the anti-lock brakes function properly when brake service is performed.

Anti-lock brake systems are commonly referred to as "ABS" and will be referred to as "ABS" throughout these guidelines. Some ABS components also function as part of a traction control system (TCS).

WARNING: When diagnosing and servicing high pressure components, observe safety procedures and equipment requirements established by the vehicle manufacturer to reduce the possibility of serious personal injury.

NOTE: Intermittent electrical conditions are often caused by a loss of ground, poor connection, or water intrusion into the wiring harness.

NOTE: Electro-magnetic interference (EMI) may be caused by incorrect installation of accessories or components. EMI can result in improper system operation.

BACKING PLATES

BACKING PLATE INSPECTION

Condition	Code	Procedure
Anchor pin bent	B	Require repair or replacement.
Anchor pin broken	A	Require replacement.
Anchor pin worn, affecting structural integrity	B	Require replacement.
Backing plate bent	B	Require repair or replacement.
Backing plate broken	A	Require replacement.
Backing plate cracked	B	Require repair or replacement.
Corroded, affecting structural integrity	A	Require replacement.
Loose	B	Require repair or replacement.
Missing	C	Require replacement.
Shoe lands worn	A	Require repair or replacement.

BRAKE FLUID

CAUTION: Most manufacturers prohibit the use of DOT 5 brake fluid in a system equipped with ABS.

DOT 3, DOT 4, and DOT 5.1 brake fluids are clear or light amber in color. DOT 5 brake fluid is violet in color. Correct fluid required for the brake system is stamped on the master cylinder cover.

BRAKE FLUID INSPECTION

Condition	Code	Procedure
Beyond service interval	3	Suggest flushing and refilling with correct fluid.
Brake fluid type incorrect	B	Require flushing and refilling with correct fluid.
Contaminated, for example, fluid other than brake fluid present	A or B	(1) Require service.
Hydraulic component overhaul or replacement	3	Suggest flushing and refilling with correct fluid.
Rubber master cylinder cover gasket distorted and gummy	A	(2) Require replacement of gasket.

(1) - If a fluid other than brake fluid is present in the brake system which DOES affect the rubber parts, the required service is to:

* Remove all components having rubber parts from the system.
* Flush lines with denatured alcohol or brake cleaner
* Repair or replace all components having rubber parts
* Flush and fill with correct brake fluid. (Code A)

If a fluid other than brake fluid is present in the brake

system which DOES NOT affect the rubber parts, the required service is to flush and fill with the correct brake fluid. (Code B)

(2) - This condition may indicate contaminated brake fluid.

BRAKE FRICTION MATERIAL

See FRICTION MATERIAL.

BRAKE PADS

See FRICTION MATERIAL.

BRAKE PEDALS

BRAKE PEDAL INSPECTION

Condition	Code	Procedure
Bent, affecting performance	A	Require repair or replacement.
Broken	A	Require repair or replacement.
Pedal pad missing	C	Require replacement of pedal pad.
Pedal pad worn	1	Suggest replacement.
Pivot bushings worn, affecting performance	A	Require replacement of pivot bushings.

BRAKE SHOES

See FRICTION MATERIAL.

BRAKE SHOE HARDWARE

See also SELF-ADJUSTING SYSTEMS.

BRAKE SHOE HARDWARE INSPECTION

Condition	Code	Procedure
Broken	A	Require replacement.
Distorted	A	Require replacement.
Missing	C	Require replacement.
Surfaces rust-pitted	1	Suggest replacement.
Worn, affecting performance	A	Require replacement.

BRAKE STOPLIGHT SWITCHES

BRAKE STOPLIGHT INSPECTION

Condition	Code	Procedure
Bent	B	Require replacement.
Broken	A	Require replacement.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.

Connector melted	A	(1) Require replacement.
Connector missing	C	Require replacement.
Missing	C	Require replacement.
Out of adjustment	B	Require adjustment or replacement.
Output signal incorrect	B	Require replacement.
Terminal burned, affecting performance	A	(2) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

(1) - Determine cause and correct prior to replacement of part.
(2) - Determine cause and correct prior to repair or replacement of part.

BULB SOCKETS

BULB SOCKET INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Broken	A	Require repair or replacement.
Bulb seized in socket	A	Require repair or replacement.
Burned, affecting performance	A	(1) Require repair or replacement.
Burned, not affecting performance	2	(1) Suggest repair or replacement.
Connector broken	A	Require repair or replacement.
Connector missing	C	Require replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(2) Require repair or replacement.
Corroded, affecting performance	A	Require repair or replacement.
Corroded, not affecting performance	2	Suggest repair or replacement.
Leaking	A	Require repair or replacement.
Melted	A	(2) Require replacement.

Condition	Code	Procedure
Shorted	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(2) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of socket.
(2) - Determine cause and correct prior to repair or replacement of part.

BULBS AND LEDS

NOTE: Copied from Electrical UIGs and modified. Does not include soldered-in components.

BULB AND LED INSPECTION

Condition	Code	Procedure
Application incorrect	B	(1) Require replacement.
Base burned, affecting performance	A	(2) Require repair or replacement.
Base burned, not affecting performance	2	(2) Suggest repair or replacement.
Base corroded, affecting performance	A	Require repair or replacement.
Base corroded, not affecting performance	2	Suggest repair or replacement.
Base loose, affecting performance	B	Require repair or replacement.
Base loose, not affecting performance	1	Suggest repair or replacement.
Burned out	A	Require replacement.
Intermittent	A	Require replacement.
Missing	C	Require replacement.
Seized in socket	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(2) Require repair or replacement.
Terminal burned, not affecting performance	2	(2) Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.

Terminal loose, not affecting performance	1	Suggest repair or replacement.

(1) - Application incorrect includes wrong bulb coating or color.
(2) - Determine cause and correct prior to repair or replacement of part.

CALIPER HARDWARE

CALIPER HARDWARE INSPECTION

Condition	Code	Procedure
Bent	A	Require repair or replacement.
Broken	A	Require repair or replacement.
Corroded, affecting performance	A	Require repair or replacement.
Dust boots on slider pin (bolt) missing	C	Require replacement of boots.
Dust boots on slider pin (bolt) torn	A	Require replacement of boots.
Missing	C	Require replacement.
Shim bent	A	(1) Require removal or replacement.
Shim (OE standard) missing	C	(2) Require replacement.
Shim out of position	B	(1) Require removal or replacement.
Shim worn	A	(1) Require removal or replacement.
Slider pin (bolt) bent	B	Require replacement of slider pin or bolt and lubricants.
Slider pin (bolt) rust-pitted	A	Require replacement of slider pin or bolt and lubricants.
Slider pin (bolt) worn	A	Require replacement of slider pin or bolt and lubricants.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Worn, affecting performance	A	Require replacement.

(1) - Removal is acceptable if shim is not OE.
(2) - Aftermarket shims may be suggested to reduce noise.

CALIPERS

You are not required to replace or rebuild calipers in axle sets. However, when replacing or rebuilding a caliper due to the conditions that follow, you may suggest servicing, rebuilding, or replacement of the other caliper (on the same axle) for improved performance and preventive maintenance (for example, the part is close to the end of its useful life, replacing the caliper may extend pad life, or contribute to more balanced braking).

CAUTION: When installing loaded calipers, it is required that friction material be matched in axle sets for consistent braking characteristics.

CALIPER INSPECTION

Condition	Code	Procedure
Bleeder port damaged	A	Require repair or replacement of caliper.
Bleeder screw broken off in caliper	A	(1) Require repair or replacement of caliper.
Bleeder screw plugged	A	(1) Require repair or replacement of bleeder screw.
Bleeder screw seized	A	(2) Require replacement of caliper.
Casting corroded, affecting structural integrity	A	Require replacement.
Casting damaged, affecting structural integrity	A	Require replacement.
Dust boot around caliper torn	A	Require replacement of dust boot.
Leaking	A	Require repair or replacement.
Mounting pin threads damaged	A	Require repair or replacement of component with damaged threads.
Mounting pin threads stripped in caliper bracket (threads missing)	A	Require repair or replacement of caliper bracket.
Mounting pin threads stripped in steering knuckle (threads missing)	A	Require repair or replacement of steering knuckle.
Mounting pin threads stripped (threads missing)	A	Require repair or replacement of component with stripped threads.
Parking brake cable support, lever, or return spring bent	A	Require replacement of parts.
Parking brake cable support, lever, or return spring broken	A	Require replacement of parts.
Parking brake mechanism in caliper inoperative	A	Require repair or replacement.
Piston corroded (pitted or peeling chrome plating)	B	Require replacement of piston and rebuilding or replacement of caliper.
Piston damaged, affecting performance	B	Require replacement of piston and rebuilding or replacement of caliper.
Piston damaged, not affecting performance		No service suggested or required.
Piston finish worn off	B	Require replacement of piston and rebuilding or replacement

			of caliper.
Piston sticking	A	.....	Require rebuilding or replacement of caliper.
Slide mechanism sticking	A	...	Require repair or replacement of slide mechanism.

(1) - Only required if the hydraulic system must be opened.
(2) - Seized is defined as a bleeder screw that cannot be removed after a practical attempt at removing. Only required if the hydraulic system must be opened.

CONTROLLERS

See ELECTRONIC CONTROLLERS.

DIGITAL RATIO AXLE CONTROLLERS AND BUFFERS (DRAC AND DRAB)

DIGITAL RATIO AXLE CONTROLLER AND BUFFER INSPECTION

Condition	Code	Procedure
Connector broken	A	.. Require repair or replacement.
Connector (Weatherpack type) leaking	A	.. Require repair or replacement.
Connector melted	A	..... (1) Require replacement.
Connector missing	C	..... Require replacement.
Missing	C	..... Require replacement.
Output signal incorrect .	B	.. Require repair or replacement.
Terminal burned, affecting performance	A	..... (2) Require repair or replacement.
Terminal burned, not affecting performance ..	2	.. Suggest repair or replacement.
Terminal corroded, affecting performance ..	A	.. Require repair or replacement.
Terminal corroded, not affecting performance ..	2	.. Suggest repair or replacement.
Terminal loose, affecting performance	B	.. Require repair or replacement.
Terminal loose, not affecting performance ..	1	.. Suggest repair or replacement.

(1) - Determine cause and correct prior to replacement of part.
(2) - Determine cause and correct prior to repair or replacement of part.

DISABLE SWITCHES

See SWITCHES.

DRUMS

Determine the need to recondition based upon individual drum conditions that follow. Friction material replacement does not require drum reconditioning unless other justifications exist. DO NOT recondition new drums unless they are being pressed or bolted onto an existing hub. It is not necessary to replace drums in axle sets. However, when replacing or reconditioning a drum due to the conditions that follow, you may suggest reconditioning of the other drum on the

same axle to eliminate uneven braking behavior. Always wash drums after servicing or before installing.

DRUM INSPECTION

Condition	Code	Procedure
Balance weight missing		No service suggested or required.
Bell-mouthed, affecting performance	A	Require reconditioning or replacement.
Cooling fin broken		No service suggested or required.
Cracked	B	Require replacement.
Drum diameter is greater than OEM "machine to" specifications but less than "discard at" specifications, and the drum does not require reconditioning	1	(1) Suggest replacement.
Drum diameter will exceed OEM "machine to" specifications after required reconditioning	B	(2) Require replacement.
Hard-spotted	2	Suggest reconditioning or replacement.
Measured diameter is greater than OEM discard specifications	B	Require replacement.
Out-of-round (runout), affecting performance	A	Require reconditioning or replacement.
Out-of-round (runout), exceeding manufacturer's specifications	B	Require reconditioning or replacement.
Scored	B	Require reconditioning or replacement.
Surface threaded due to improper machining	B	Require reconditioning or replacement.
Tapered, affecting performance	A	Require reconditioning or replacement.

(1) - Only applies to vehicles for which OEM "machine to" specifications exist. If OEM does not supply "machine to" specifications, the drum may be worn to discard specifications.
(2) - If OEM does not supply "machine to" specifications, you may machine to discard specifications.

ELECTRICAL PUMPS AND MOTORS

Copied fuel pump conditions from engine UIGs & deleted pulsator from leaking conditions.

ELECTRICAL PUMP AND MOTOR INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require replacement.
Inoperative	A	(3) Require repair or replacement.
Leaking externally	A	Require repair or replacement.
Leaking internally	A	Require repair or replacement.
Noisy	2	Suggest repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specifications.

ELECTRONIC CONTROLLERS

ELECTRONIC CONTROLLER INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Attaching hardware missing	C	Require replacement of

			hardware.
Attaching hardware threads damaged	A	...	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	...	Require repair or replacement of hardware.
Code set (if applicable)	A	.....	(1) Further inspection required.
Connector broken	A	..	Require repair or replacement.
Connector melted	A	.....	(2) Require repair or replacement.
Connector missing	A	.....	Require repair.
Contaminated	A	..	Require repair or replacement.
Inoperative	B	..	Require repair or replacement. (3) Further inspection required.
Leaking	A	..	Require repair or replacement.
Missing	C	.....	Require replacement.
Terminal broken	A	..	Require repair or replacement.
Terminal burned, affecting performance	A	.....	(2) Require repair or replacement.
Terminal burned, not affecting performance	2	..	Suggest repair or replacement.
Terminal corroded, affecting performance	A	..	Require repair or replacement.
Terminal corroded, not affecting performance	2	..	Suggest repair or replacement.
Terminal loose, affecting performance	B	..	Require repair or replacement.
Terminal loose, not affecting performance	1	..	Suggest repair or replacement.
Threads damaged	A	..	Require repair or replacement.
Threads stripped (threads missing)	A	.....	Require replacement.
Wire lead conductors exposed	B	..	Require repair or replacement.
Wire lead corroded	A	..	Require repair or replacement.
Wire lead open	A	..	Require repair or replacement.
Wire lead shorted	A	..	Require repair or replacement.

(1) - Refer to manufacturer's diagnostic trouble code procedure and require repair or replacement of affected component(s).
(2) - Determine cause and correct prior to repair or replacement of part.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable. Check for accepted cleaning procedure.

FLUID

See BRAKE FLUID.

FLUID LEVEL SENSOR SWITCHES

See SWITCHES.

FOUR WHEEL DRIVE SWITCHES

See SWITCHES.

FRICTION MATERIAL

NOTE: Original Equipment Manufacturer (OEM) specifications designate replacement at different thicknesses.

CAUTION: It is required that friction material be matched in axle sets for consistent braking characteristics.

FRICTION MATERIAL INSPECTION

Condition	Code	Procedure
Contaminated, for example, fluid that leaked from caliper, wheel cylinder, or axle seal	A	(1) Require replacement.
Cracked through	B	Require replacement.
Flaking or chunking	B	Require replacement.
Glazed (shiny)	..	No service suggested or required.
Grooves or ridges	..	(2) No service suggested or required.
Permanently attached hardware bent	A	Require replacement.
Permanently attached hardware broken	A	Require replacement.
Permanently attached hardware loose	A	Require replacement.
Permanently attached hardware missing	C	Require replacement.
Permanently attached hardware seized	A	.. Require repair or replacement.
Rivets loose	B	Require replacement.
Separating from backing	B	Require replacement.
Shoe table or web bent	B	Require replacement.
Shoe table or web cracked	A	Require replacement.
Shoe table or web worn, affecting performance	A	Require replacement.
Surface cracking	..	No service suggested or required. Further inspection may be necessary to determine cause.
Tapered wear	B	(3) Suggest replacement.
Thickness of one pad is greater than opposite pad in the same caliper (uneven wear)	..	(4) Replacement of friction material not suggested or required. Further inspection required. See CALIPERS and CALIPER HARDWARE.
Wear indicator device (electronic) contacts rotor	B	(5) Require replacement of appropriate parts.
Wear indicator device (mechanical) bent	..	(6) Further inspection required.
Wear indicator device (mechanical) broken	..	(6) Further inspection required.

Wear indicator device (mechanical) contacts rotor	..	(6) Further inspection required.
Worn close to minimum specifications	1	(7) Suggest replacement.
Worn to, or below minimum specifications	B	Require replacement.

(1) - Identify and repair cause of contamination prior to replacing friction material.
(2) - When reconditioning or replacing drums or rotors, replacement of friction material may be suggested depending on the severity of the grooves or ridges.
(3) - Some vehicles use pads that are tapered by design. Refer to specific vehicle application. If not normal, require replacement of pads and correction of cause.
(4) - Uneven pad thickness is normal on some vehicles. Refer to specific vehicle applications.
(5) - The pad wear indicator light may come on due to other electrical problems.
(6) - Explain to the customer that the purpose of the wear indicator is to alert him or her to check for friction wear. Wear indicators may be bent or broken. Therefore, the friction material must be measured. The need for friction material replacement is determined based upon the conditions stated in this section. Periodic inspection is suggested.
(7) - When the part appears to be close to the end of its useful life, replacement may be suggested.

G SENSORS

See ACCELEROMETERS.

HOSES

HOSE INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Blistered	B	Require replacement.
Fitting threads damaged	A	Require repair or replacement.
Fitting threads stripped (threads missing)	A	Require replacement.
Incorrectly secured	B	Require repair.
Inner fabric (webbing) cut	B	Require replacement.
Leaking	A	Require replacement.
Missing	C	Require replacement.
Outer covering is cracked to the extent that inner fabric of hose		

is visible	B	Require replacement.
Restricted	A	Require replacement.
Routed incorrectly	B	Require repair.

HYDRAULIC MODULATORS

NOTE: Many modulators can only be replaced as complete assemblies. Whenever possible, replace the failed component part. If replacement of the failed part is not possible, then replace the modulator assembly.

HYDRAULIC MODULATOR INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require replacement.
Connector missing	C	Require replacement.
Disabled	A	Require repair or replacement.
Electrical failure	A	Require repair or replacement.
External leak	A	Require repair or replacement.
Housing cracked	B	Require repair or replacement.
Inoperative (2)	A	Require repair or replacement.
Internal leak	A	Require repair or replacement.
Missing	C	Require replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Valve stuck	A	Require repair or replacement.
Wire lead burned	A	Require repair or replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to replacement of part.
(2) - Inoperative includes intermittent operation or out of OEM specification.

HYDRO-BOOSTERS

NOTE: Hydro-boosters and hydro-electric boosters are combined.

HYDRO-BOOSTER INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require replacement.
Connector missing	C	Require replacement.
Does not apply assist, or inadequate assist	A	Require repair or replacement.
Leaking	B	Require repair or replacement.
Leaks fluid at fitting	B	Require tightening or replacement.
Leaks fluid at unit	B	Require repair or replacement.
Leaks fluid from pressure hose(s)	B	Require replacement of hose(s).
Leaks fluid into passenger compartment	B	Require repair or replacement.
Threads damaged	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

(1) - Determine cause and correct prior to replacement of part.

HYDRO-ELECTRIC BOOSTERS (POWERMASTER)

See HYDRO-BOOSTERS.

IGNITION DISABLE SWITCHES

See SWITCHES.

LATERAL ACCELERATION SWITCHES

See ACCELEROMETERS.

LEDS

See BULBS AND LEDS.

LENSES

LENSE INSPECTION

Condition	Code	Procedure
Application incorrect	A	Require replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Broken, affecting performance	A	Require replacement.
Broken, not affecting performance	..	No service suggested or required.
Cracked	A	Require replacement.
Discolored	A	Require replacement.
Leaking	A	Require repair or replacement.
Melted, affecting performance	A	Require replacement.
Melted, not affecting performance	2	Suggest replacement.
Missing	C	Require replacement.

MASTER CYLINDERS

MASTER CYLINDER INSPECTION

Condition	Code	Procedure
Brake fluid leaking from rear of master cylinder bore	B	Require repair or replacement.
Brake pedal drops intermittently	A	(1) Require repair or replacement.
Fluid level low	..	(2) Further inspection required.
Internal valve failure	A	Require repair or replacement.
Master cylinder leaking brake fluid internally	A	Require repair or replacement.
Piston does not return	A	Require repair or replacement.
Ports plugged	A	Require repair or replacement.
Rubber master cylinder cover gasket distorted and gummy	A	(3) Require replacement of the gasket.

(1) - This condition may be normal on some vehicles equipped with anti-lock brakes.
(2) - Refer to OEM procedures for adjusting low fluid level. Inspect for brake hydraulic system leaks and friction material wear.
(3) - This condition may indicate contaminated brake fluid. See BRAKE FLUID.

MODULATORS

See HYDRAULIC MODULATORS.

MOTORS

See ELECTRICAL PUMPS AND MOTORS.

PARKING BRAKE SWITCHES

See SWITCHES.

PARKING BRAKE SYSTEMS

NOTE: The parking brake is an integral part of the brake system. It is important that the parking brake function properly when brake service is performed.

PARKING BRAKE SYSTEM INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Cable improperly adjusted	B	Require cable adjustment.
Cable or individual wires in the cable are broken	A	Require replacement of cable assembly.
Cable sticking	A	Require cable lubrication.
Cable stuck inside conduit and cannot be lubricated so that parking brake functions properly	A	Require replacement of cable assembly.
Inoperative (1)	A	Require replacement of inoperative parts.
Parking brake parts bent	B	Require repair or replacement of bent parts.
Parking brake parts broken	A	Require replacement of broken parts.
Parking brake parts		

missing	C	..	Require replacement of missing parts.
Threads damaged	A	..	Require repair or replacement.
Threads stripped (threads missing)	A	.....	Require replacement.

(1) - Inoperative includes intermittent operation.

PADS

See FRICTION MATERIAL.

PEDAL TRAVEL SWITCHES

See SWITCHES.

PEDALS

See BRAKE PEDALS.

POWERMASTER

See HYDRO-BOOSTERS.

PUMPS

See ELECTRICAL PUMPS AND MOTORS.

PRESSURE DIFFERENTIAL SWITCHES

See SWITCHES.

PRESSURE SWITCHES

See SWITCHES.

RELAYS

NOTE: Copied from Electrical UIGs

RELAY INSPECTION

Condition	Code		Procedure
Attaching hardware broken	A	...	Require repair or replacement of hardware.
Attaching hardware missing	C	.....	Require replacement of hardware.
Attaching hardware not functioning	A	...	Require repair or replacement of hardware.
Housing broken	A	.....	Require replacement.
Housing cracked	2	.....	Suggest replacement.
Inoperative (1)	A	.....	Require replacement.
Missing	C	.....	Require replacement.
Terminal broken	A	..	Require repair or replacement.
Terminal burned, affecting performance	A	.....	(2) Require repair or replacement.

Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.

(1) - Inoperative includes intermittent operation or out of OEM specification.
(2) - Determine cause and correct prior to repair or replacement of part.

ROTORS

Determine the need to recondition based upon individual rotor conditions that follow. Friction material replacement does not require rotor reconditioning unless other justifications exist. DO NOT recondition new rotors unless they are being pressed or bolted onto an existing hub. It is not necessary to replace rotors in axle sets. However, when replacing or reconditioning a rotor due to the conditions that follow, you may suggest reconditioning of the other rotor on the same axle to eliminate uneven braking behavior.

Determine the need to replace based upon the individual rotor conditions that follow. Reconditioning is defined as machining and block sanding, or block sanding only. Block sanding is defined as using 120-150 grit sandpaper with moderate to heavy force for 60 seconds per side. Always wash rotors after servicing or before installing.

ROTOR INSPECTION

Condition	Code	Procedure
Corrosion affecting structural integrity	A	(1) Require replacement.
Cracked	B	Require replacement.
Hard spots	2	Suggest reconditioning or replacement of rotor according to OEM specifications.
Lateral runout (wobble) exceeds OEM specifications	B	Require re-indexing, reconditioning, or replacement according to specifications.
Measured thickness is less than OEM discard specifications	B	Require replacement.
Rotor thickness is less than OEM "machine to" specifications but thicker than "discard at" specifications, and the rotor does not require reconditioning	1	(2) Suggest replacement.
Rotor thickness will be less than OEM "machine to" specifications after required		

reconditioning	B	..... (3) Require replacement.
Surface is rust-pitted ..	B	..... Require reconditioning or replacement of rotor according to OEM specifications.
Surface is scored	B	... (4) Require reconditioning or replacement of rotor according to OEM specifications.
Thickness variation (parallelism) exceeds OEM specifications	B	..... Require reconditioning or replacement of rotor according to OEM specifications.

(1) - Examples of severe corrosion are: composite plate separated from friction surfaces and cooling fins cracked or missing.
(2) - Only applies to vehicles for which OEM "machine to" specifications exist. If OEM does not supply "machine to" specifications, the rotor may be worn to discard specifications.
(3) - If OEM does not supply "machine to" specifications, you may machine to discard specifications.
(4) - Scoring is defined as grooves or ridges in the friction contact surface. Some vehicle manufacturers require machining when scoring exceeds their allowable specifications.

SELF-ADJUSTING SYSTEMS

SELF-ADJUSTING SYSTEM INSPECTION

Condition	Code	Procedure
Bent	A	... Require repair or replacement of bent part.
Broken	A	... Require repair or replacement of broken part.
Inoperative	A	..... (1) Require repair or replacement of inoperative parts.
Missing	C	..... Require replacement of missing part.
Star wheel does not turn freely	A	.. Require repair or replacement.

(1) - Inoperative includes intermittent operation.

SHOE HARDWARE

See BRAKE SHOE HARDWARE.

SHOES

See FRICTION MATERIAL.

SOCKETS

See BULB SOCKETS.

SPEED SENSORS (ELECTRONIC WHEEL AND VEHICLE)

NOTE: Copied Vehicle Speed Sensors from Engine UIGs & added Air Gap incorrect, loose, and wire lead misrouted. For "contaminated" removed coolant & fuel examples from note.

SPEED SENSOR INSPECTION

Condition	Code	Procedure
Air gap incorrect	B	(1) Require adjustment or replacement.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(2) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(3) Require repair or replacement.
Inoperative	B	(4) Require repair or replacement. Further inspection required.
Lead routing incorrect	B	Require rerouting according to vehicle manufacturer's specifications.
Leaking	A	Require repair or replacement.
Loose	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Sensor housing cracked	2	Suggest replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(2) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead misrouted	B	Require re-routing according to vehicle manufacturer's

			specifications.
Wire lead open	A	..	Require repair or replacement.
Wire lead shorted	A	..	Require repair or replacement.

(1) - If a sensor is not adjustable, further inspection is required to identify and correct cause.
(2) - Determine cause and correct prior to repair or replacement of part.
(3) - Determine source of contamination, such as metal particles or water. Require repair or replacement.
(4) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

STEEL BRAKE LINES

STEEL BRAKE LINE INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Corroded, affecting structural integrity	A	Require replacement.
Fitting incorrect (for example, compression fitting)	B	Require replacement.
Flare type incorrect	B	Require repair or replacement.
Leaking	A	Require repair or replacement.
Line material incorrect (copper, etc.)	B	Require replacement.
Restricted	A	Require replacement.
Routed incorrectly	B	Require routing correction.
Rust-pitted	1	Suggest replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

STOPLIGHT SWITCHES

See BRAKE STOPLIGHT SWITCHES.

SWITCHES

NOTE: Copied from Electrical UIGs & added "float saturated" from old fluid level sensor switches.

STEEL BRAKE LINE INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.

Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Binding, affecting performance	A	Require repair or replacement.
Binding, not affecting performance	2	Suggest repair or replacement.
Broken	A	Require repair or replacement.
Burned, affecting performance	A	(1) Require repair or replacement.
Burned, not affecting performance	2	(1) Suggest repair or replacement.
Cracked, affecting performance	A	Require repair or replacement.
Cracked, not affecting performance	1	Suggest repair or replacement.
Float saturated	A	Require replacement.
Leaking	A	Require repair or replacement.
Malfunctioning	A	(2) Require repair or replacement.
Melted, affecting performance	A	(1) Require repair or replacement.
Melted, not affecting performance	2	(1) Suggest repair or replacement.
Missing	C	Require replacement.
Out of adjustment	B	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Won’t return	A	Require repair or replacement.
Worn	1	Suggest replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Includes inoperative, intermittent operation, or failure to perform all functions.

TIRES

Consult the vehicle owner’s manual or vehicle placard for correct size, speed ratings, and inflation pressure of the original tires.

TIRE INSPECTION

Condition	Code	Procedure
Tire diameter incorrect, affecting ABS or TCS	A	Require replacement.
Tire pressure incorrect, affecting ABS or TCS	A	Require repair or replacement.
Tire size incorrect, affecting ABS or TCS	A	Require replacement.

TOOTHED RINGS (TONE WHEEL)

NOTE: Copied from Drivetrain UIGs.

If the toothed ring requires replacement and cannot be replaced as a separate component, replace the assembly of which the ring is a part.

TOOTHED RING INSPECTION

Condition	Code	Procedure
Alignment incorrect	B	Require repair or replacement.
Bent	B	Require replacement.
Contaminated, affecting performance	A	Require repair. Identify and correct cause.
Cracked	B	Require replacement.
Loose	A	Require replacement of worn parts.
Missing	C	Require replacement.
Number of teeth incorrect	B	Require replacement.
Teeth broken	A	Require replacement.
Teeth damaged, affecting performance	A	Require replacement.

VACUUM BOOSTERS

VACUUM BOOSTER INSPECTION

Condition	Code	Procedure
Applies too much assist (oversensitive)	A	Require replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Auxiliary vacuum pump inoperative	A	(1) Require repair or replacement.
Check valve grommet deteriorated, affecting performance	A	Require replacement of grommet.

Condition	Code	Procedure
Check valve grommet deteriorated, not affecting performance	1	Suggest replacement of grommet.
Check valve inoperative	A	(2) Require repair or replacement.
Check valve leaking	A	Require replacement of check valve.
Check valve missing	C	Require replacement of check valve.
Check valve noisy	2	Suggest replacement.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(3) Require replacement.
Connector missing	C	Require replacement.
Leaking	A	Require replacement.
Terminal burned, affecting performance	A	(3) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Vacuum hose filter leaking	A	Require replacement of filter.
Vacuum hose filter restricted	A	Require replacement of filter.
Wire lead burned	A	Require repair or replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Inoperative includes intermittent operation or out of OEM specification.
(2) - Inoperative includes intermittent operation.
(3) - Determine cause and correct prior to replacement of part.

VACUUM HOSES

See HOSES.

VALVES

VALVE INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of

			hardware.
Attaching hardware not functioning	A	...	Require repair or replacement of hardware.
Leaking	B	..	Require repair or replacement.
Linkage bent (rear load valves)	A	...	Require repair or replacement of linkage.
Linkage broken (rear load valves)	A	...	Require repair or replacement of linkage.
Linkage disconnected (rear load valves)	C	...	Require repair or replacement of linkage.
Pressure out of specification	B	.....	Require adjustment. If not possible, require replacement.
Seized	A	.....	Require replacement.
Sticking	A	..	Require repair or replacement.
Terminal burned, affecting performance	A	.....	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	..	Suggest repair or replacement.
Terminal corroded, affecting performance	A	..	Require repair or replacement.
Terminal corroded, not affecting performance	2	..	Suggest repair or replacement.
Terminal loose, affecting performance	B	..	Require repair or replacement.
Terminal loose, not affecting performance	1	..	Suggest repair or replacement.
Threads damaged	A	..	Require repair or replacement.
Threads stripped (threads missing)	A	.....	Require replacement.
Wire lead burned	A	..	Require repair or replacement.
Wire lead conductors exposed	B	..	Require repair or replacement.
Wire lead open	A	..	Require repair or replacement.
Wire lead shorted	A	..	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.

WHEEL ATTACHING HARDWARE

For conditions noted below, also check condition of wheel stud holes.

CAUTION: Proper lug nut torque is essential. Follow manufacturer's torque specifications and tightening sequence. DO NOT lubricate threads unless specified by the vehicle manufacturer.

WHEEL ATTACHING HARDWARE INSPECTION

Condition	Code		Procedure
Bent	A	.....	Require replacement.
Broken	A	.....	(1) Require replacement.
Loose	B	...	Require repair or replacement of affected component.

Lug nut flats rounded	A	Require replacement of nut.
Lug nut installed backward	B	Require repair.
Lug nut mating surface dished	A	Require replacement of nut.
Lug nut mating type incorrect	B	Require replacement of nut.
Lug nut seized	A	Require replacement of nut and/or stud.
Stud incorrect	B	Require replacement of stud.
Threads damaged	A	Require repair or replacement of component with damaged threads.
Threads stripped (threads missing)	A	Require replacement of component with stripped threads.

(1) - Some manufacturers require replacement of all studs on any wheel if two or more studs or nuts on the same wheel are broken or missing.

WHEEL BEARINGS, RACES AND SEALS

NOTE: Grease seal replacement is required if seal is removed. You are not required to replace these components in axle sets. Determine the need to replace based upon the individual component conditions that follow.

WHEEL BEARINGS, RACES AND SEALS INSPECTION

Condition	Code	Procedure
Axle seal on drive axle leaking	A	Require replacement of seal and inspection of axle, bearing, housing, and vent tube.
Bearing end-play exceeds specifications	B	Require adjustment of bearing, if possible. If proper adjustment cannot be obtained, require replacement of bearing assembly.
Bearing rollers, balls or races are worn, pitted, or feel rough when rotated as an assembly	B	Require replacement of bearing assembly.
Seal leaking	A	(1) Require replacement of seal and inspection of bearings.
Spindle worn	B	Require replacement of spindle and bearings.

(1) - Require inspection of mating and sealing surface and repair or replace as necessary. Check vent. A plugged vent may force fluid past the seal.

WHEEL CYLINDERS

You are not required to replace or rebuild wheel cylinders in axle sets. However, when rebuilding or replacing a wheel cylinder due

to the conditions that follow, you may suggest rebuilding or replacement of the other wheel cylinder (on the same axle) for preventive maintenance, for example, the part is close to the end of its useful life.

Determine the need to rebuild or replace based upon the individual wheel cylinder conditions that follow.

WHEEL CYLINDER INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require replacement of bent parts.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware corroded, affecting structural integrity	A	Require replacement of corroded parts.
Attaching hardware loose	A	Require repair or replacement.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Bleeder port damaged (if non-repairable)	A	Require replacement.
Bleeder screw broken off in wheel cylinder (if non-repairable)	A	(1) Require replacement.
Bleeder screw plugged	A	(1) Require repair or replacement of bleeder screw.
Bleeder screw seized	A	(2) Require replacement.
Bore corroded (pitted)	B	Require replacement.
Bore grooved	A	Require replacement.
Bore oversized	B	Require replacement.
Dust boot missing	C	Require replacement of dust boot.
Dust boot torn	A	(3) Require replacement of dust boot.
Leaking	A	(4) Require rebuilding or replacement.
Piston corroded, affecting performance	B	Require replacement of piston and rebuilding or replacement of wheel cylinder.
Piston finish worn off	B	Require replacement of piston and rebuilding or replacement of wheel cylinder.
Piston stuck in bore	A	Require replacement of wheel cylinder.
Loose	B	Require repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

(1) - Only required if the hydraulic system must be opened.
(2) - Seized is defined as bleeder screw that cannot be removed after a practical attempt at removing. Only required if the hydraulic system must be opened.

(3) - Inspect for conditions related to wheel cylinder.
(4) - Leaking is defined as a drop or more. Dampness is normal.

WIRING HARNESSES

NOTE: Copied from Electrical UIGs.

WIRING HARNESS INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require repair or replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Insulation damaged, conductors exposed	A	Require repair or replacement.
Insulation damaged, conductors not exposed	1	Suggest replacement.
Open	A	Require repair or replacement.
Protective shield (conduit) melted	2	(1) Suggest repair or replacement.
Protective shield (conduit) missing	2	Suggest repair or replacement.
Resistance (voltage drop) out of specification	A	Require repair or replacement.
Routed incorrectly	B	Require repair.
Secured incorrectly	B	Require repair.
Shorted	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Voltage drop out of specification	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.

CLUTCH

1998 Mitsubishi Galant

1997-98 CLUTCHES
Mitsubishi FWD & AWD

Eclipse, Galant, Mirage, 3000GT

DESCRIPTION

All clutches are single-disc type. Pressure plate assembly uses a diaphragm spring to engage pressure plate to clutch disc and flywheel. A hydraulic clutch system is used.

ADJUSTMENTS

CLUTCH BOOSTER PUSH ROD (3000GT AWD)

1997
Check and adjust clearance between back of clutch master cylinder and clutch booster push rod. See Fig. 1. Dimension "A" should be .0083-.0181" (.210-.460 mm). Rotate push rod to adjust clearance. Apply 19.7 in. Hg (66.7 kPa) of vacuum to booster. Dimension "A" should be .0039-.0118" (.100-.300 mm). After adjusting push rod clearance, adjust pedal height and bleed hydraulic system.

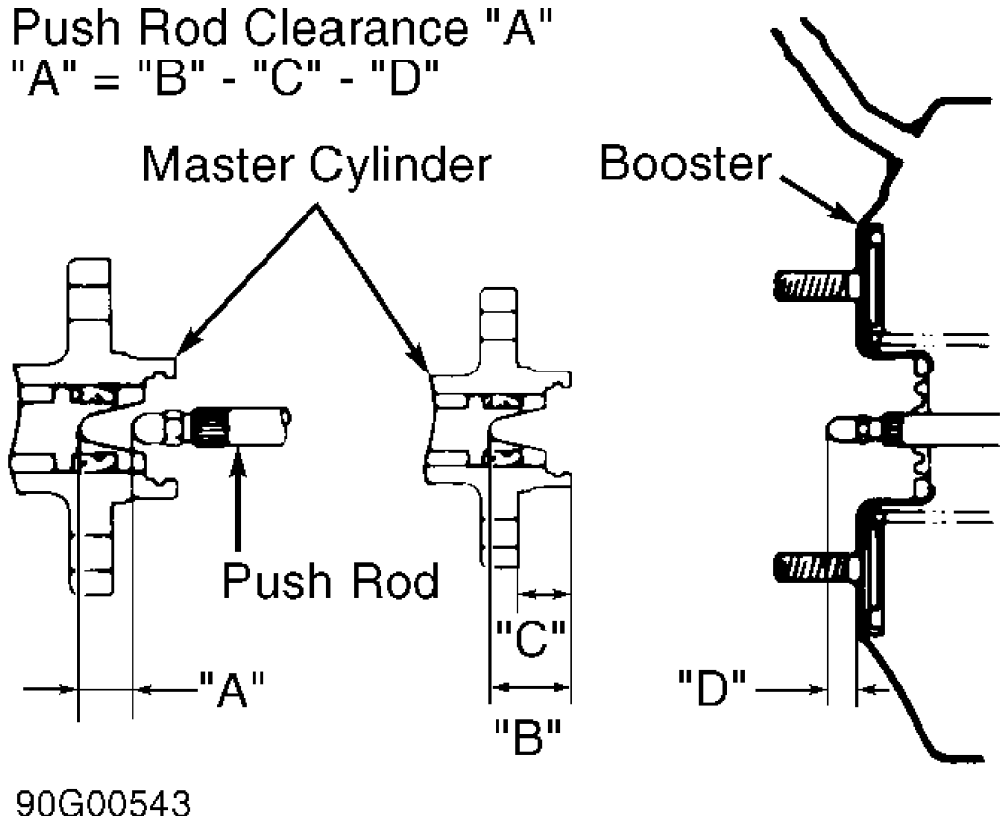


Fig. 1: Adjusting Clutch Booster Push Rod Clearance (3000GT AWD)
Courtesy of Mitsubishi Motor Sales of America.

1998
1) Install Push Rod Adjusting Gauge (MB991714) on clutch

master cylinder. Adjust shaft on adjusting gauge so it lightly contacts piston in master cylinder.

2) Lock shaft on adjusting gauge using wing nut. Using a hand-held vacuum gauge, apply about 19.7 in. Hg (66.7 kPa) to clutch booster. Turn adjusting gauge upside down and slowly slide gauge over booster push rod. Booster push rod should barely fit under the adjusting gauge and should slightly retract as it touches gauge, just before the protrusion on the gauge shaft.

3) Adjust clutch booster push rod if it is too short or too long. Ensure push rod extends after adjusting gauge is removed.

CLUTCH PEDAL DEPRESSED HEIGHT

Remove carpet. On 3000GT AWD, start engine. On all models, depress clutch pedal to floor. Measure depressed height between pedal face and bulkhead. See CLUTCH PEDAL SPECIFICATIONS table. If measurement is not as specified, bleed hydraulic system. If depressed height is still not correct, check master cylinder, release cylinder and clutch stop.

CLUTCH PEDAL FREE PLAY

On 3000GT AWD, ensure engine is off. Depress pedal 2-3 times to eliminate clutch booster vacuum. On all models, depress clutch pedal by hand until resistance is felt. Check clutch pedal free play. See CLUTCH PEDAL SPECIFICATIONS table. See Fig. 2. If clutch pedal free play and pedal height are okay and system fails to operate, defective system components exist.

CLUTCH PEDAL HEIGHT

1) Remove carpet. Measure clutch pedal height between pedal face and bulkhead. If equipped with a cruise control system, disconnect clutch pedal switch connector. Loosen adjusting bolt or clutch pedal switch lock nut located at upper end of clutch pedal. See Fig. 2.

2) Rotate adjusting bolt or switch until correct pedal height is obtained. See CLUTCH PEDAL SPECIFICATIONS table. After adjusting pedal height, adjust clutch pedal position switch so that switch is engaged with clutch pedal released.

CLUTCH PEDAL INTERLOCK SWITCH

Remove carpet. Depress clutch pedal, by hand, to its full-stoke position. Gradually release clutch pedal from its full-stroke position until interlock switch clicks. Measure distance of travel between pedal face and bulkhead. Travel distance should be .394-.591" (10-15 mm). If distance is not correct, disconnect interlock switch connector. Loosen lock nut. Rotate interlock switch until correct travel distance is obtained.

CLUTCH PEDAL STROKE

3000GT AWD

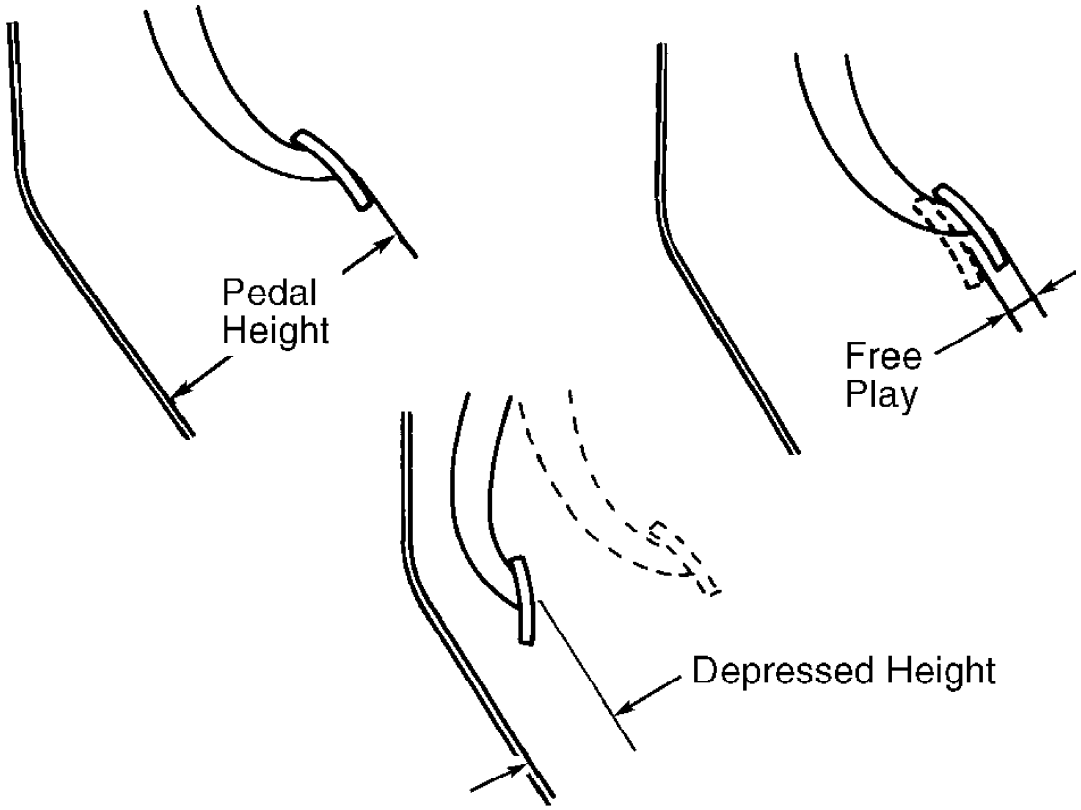
Remove carpet. Measure clutch pedal stroke between pedal face and bulkhead. Rotate clutch master cylinder or clutch booster (AWD) push rod until correct pedal stroke is obtained. See CLUTCH PEDAL SPECIFICATIONS table.

CLUTCH PEDAL SPECIFICATIONS

Application	In. (mm)

Eclipse & Galant	
Free Play	.24-.51 (6-13)
Pedal Height	
Pedal Depressed (1)	
Eclipse	2.76 (70)
Galant	1.97 (50)
Pedal Released	7.0-7.1 (177-180)
Mirage	
Free Play	.24-.51 (6-13)
Pedal Height	
Pedal Depressed (1)	2.8 (70)
Pedal Released	6.43-6.55 (164-167)
3000GT	
Disengagement Height (1)	2.2 (56)
Free Play	
FWD	.24-.51 (6-13)
AWD	.49-.79 (12-20)
Pedal Height	
FWD	6.97-7.17 (177-182)
AWD	7.20-7.40 (183-188)
Pedal Stroke	6.29 (160)

(1) - Specification given is minimum distance.



97G04242

Fig. 2: Adjusting Clutch Pedal (Typical)
Courtesy of Mitsubishi Motor Sales or America.

TESTING

CLUTCH BOOSTER

NOTE: Check valve is press fit into vacuum hose. DO NOT remove check valve from vacuum hose. If check valve is faulty, replace check valve and vacuum hose as an assembly.

3000GT AWD

1) Start engine and operate at idle for 1-2 minutes. Turn engine off. Depress clutch pedal several times. If depressed pedal height gradually rises with successive pedal strokes, go to next step. If clutch pedal depressed height remains the same on each stroke, inspect clutch booster check valve and vacuum hose, and go to step 4). If check valve and vacuum hose are okay, replace booster.

2) Depress clutch pedal repeatedly until depressed height no longer changes. Depress and hold clutch pedal. Start engine. If pedal moves down slightly, go to next step. If pedal does not move when engine is started, inspect booster check valve and vacuum hose, and go tostep 4). If check valve and vacuum hose are okay, replace booster.

3) With engine running, depress and hold clutch pedal. Turn engine off. Hold pedal depressed for 30 seconds. If pedal height does not change, booster is okay. If pedal height rises, inspect booster check valve and vacuum hose, and go to next step. If check valve and vacuum hose are okay, replace booster.

4) Remove booster vacuum hose from manifold and air line. Ensure air flows in manifold direction only. Ensure vacuum hose has no cracks or splits. Replace if necessary.

CLUTCH PEDAL INTERLOCK SWITCH

1) Place transmission in Neutral and apply parking brake. Turn ignition switch to START position. Engine should not crank. If engine cranks, adjust or replace interlock switch.

2) Disconnect interlock switch connector. Interlock switch connector is located at clutch pedal. Depress and release interlock switch. Using ohmmeter, check continuity between interlock switch terminals. If continuity does not exist with interlock switch depressed and exists with switch released, switch is okay. Replace if necessary.

CLUTCH PEDAL POSITION SWITCH

Disconnect clutch pedal position switch. Clutch pedal position switch connector is located at clutch pedal. Depress and release clutch pedal position switch. Using ohmmeter, check continuity between clutch pedal position switch terminals. If continuity exists with clutch pedal position switch depressed and does not exist with switch released, switch is okay. Replace if necessary.

REMOVAL & INSTALLATION

CLUTCH ASSEMBLY

CAUTION: DO NOT pull on axle shafts during removal, or damage to shaft assembly will result.

CAUTION: Ensure a pad is inserted between engine support and front deck. Ensure hood weatherstrip is not caught between front deck and pad.

Removal (Eclipse & Galant)

1) Drain transaxle. Remove battery and tray. On Eclipse,

remove battery tray bracket, evaporative canister and bracket. On all models, remove air cleaner and air intake hoses. Remove cruise control actuator and bracket (if equipped). Disconnect speedometer connector, control cables and electrical connections at transaxle.

2) Without disconnecting fluid line, remove clutch release cylinder with fluid line support bracket, and wire aside. Disconnect back-up light harness and starter motor wiring. Remove starter motor. Remove upper transaxle-to-engine bolts. Support engine with Engine Support (MZ203827-01). See Fig. 3.

3) Remove transaxle mount bracket. Raise and support vehicle. Remove front wheels and engine undercover. On models with anti-lock brakes, remove wheel speed sensor. Remove stabilizer bar. Remove strut forks and both lower control arm ball joints from knuckles. Disconnect tie rod ends, and disengage axle shafts and support aside. See AXLE SHAFTS - FRONT article in DRIVE AXLES.

4) Remove bellhousing cover. Support transaxle with jack. Remove remaining transaxle-to-engine bolts. Remove transaxle mount insulator bolt. Slide transaxle assembly to right, and lower unit from vehicle.

5) Insert a clutch alining tool to prevent pressure plate and clutch disc from dropping. Loosen pressure plate bolts gradually in a crisscross pattern to avoid warping pressure plate flange during removal. Remove pressure plate and clutch disc. See Fig. 4.

Inspection

1) Check release bearing and release fork for damage or wear. DO NOT clean release bearing assembly in solvent. Inspect hydraulic system components for fluid leakage. Inspect cylinder dust boot for cracks or deterioration.

2) Inspect pressure plate surface for wear, cracks, and/or discoloration. Measure diaphragm spring ends for wear and uneven height. Replace assembly if height difference between fingers exceeds .02" (.5 mm).

3) Check facing of clutch disc for loose rivets, uneven contact, deterioration, seizure or oil saturation. Measure distance from clutch disc surface to head of rivet. Replace clutch disc if distance is less than .012" (.30 mm). Replace worn or defective components as necessary.

CAUTION: Install clutch disc with manufacturer's stamp mark (located near hub of clutch disc) toward pressure plate.

Installation

1) Using a clutch alining tool, install pressure plate and clutch disc. Tighten bolts evenly in a crisscross pattern to specification. See TORQUE SPECIFICATIONS.

2) Clean release bearing sliding surface. Apply multipurpose grease to release bearing sliding surface. Apply a light amount of grease to input shaft splines. DO NOT allow grease or dirt on clutch disc or pressure plate surface.

3) To install remaining components, reverse removal procedure. Refill all fluids to proper levels. Adjust all control cables, clutch pedal height and free play. See CLUTCH PEDAL HEIGHT and CLUTCH PEDAL FREE PLAY under ADJUSTMENTS.

Removal (Mirage)

1) Remove battery, battery tray and air cleaner assembly. Drain transaxle oil. Disconnect tension rod located above transaxle mounting bracket.

2) Disconnect control cables, speedometer cable and electrical connections at transaxle. Remove clutch release cylinder with line connected and wire aside.

3) Remove starter motor, with harness connected, and wire

aside. Support engine with Engine Support (MZ203827). See Fig. 3. Remove upper transaxle-to-engine bolts and transaxle mounting bracket bolt. Raise and support vehicle. Loosen, but do not remove, nuts on ball joints and tie rod ends. Using Remover (MB991113), separate ball joints and tie rod ends from steering knuckles. Remove nuts and remove ball joints and tie rod ends. Remove stabilizer bar.

4) Disengage axle shafts and wire aside. See AXLE SHAFTS - FRONT article in DRIVE AXLES. DO NOT damage oil seal. Plug shaft openings in transaxle. Remove lower transaxle brackets.

5) Remove bellhousing cover. Support transaxle with jack. Remove remaining transaxle-to-engine bolts. Remove transaxle assembly. Insert a clutch alining tool to prevent pressure plate and clutch disc from dropping during removal.

6) Loosen pressure plate bolts gradually in a crisscross pattern to avoid warping pressure plate flange during removal. Remove pressure plate and clutch disc. See Fig. 4.

Inspection

1) Check release bearing and release fork for damage or wear. DO NOT clean release bearing assembly in solvent. Inspect hydraulic system components for fluid leakage, and cylinder dust boot for cracks or deterioration.

2) Inspect pressure plate surface for wear, cracks, and/or discoloration. Measure diaphragm spring ends for wear and uneven height. Replace assembly if height difference between fingers exceeds .02" (.5 mm).

3) Check facing of clutch disc for loose rivets, uneven contact, deterioration, seizure or oil saturation. Measure distance from clutch disc surface to head of rivet. Replace clutch disc if distance is less than .012" (.30 mm). Replace worn or defective components as necessary.

CAUTION: Install clutch disc with manufacturer's stamp mark (located near hub of clutch disc) toward pressure plate.

Installation

1) Using a clutch alining tool, install pressure plate and clutch disc. Tighten bolts evenly in a crisscross pattern to specification. See TORQUE SPECIFICATIONS.

2) Clean release bearing sliding surface. Apply multipurpose grease to release bearing sliding surface. Apply a light amount of grease to input shaft splines. DO NOT allow grease or dirt on clutch disc or pressure plate surface.

3) To install remaining components, reverse removal procedure. Refill all fluids to proper levels. Adjust all control cables, clutch pedal height and free play. See CLUTCH PEDAL HEIGHT and CLUTCH PEDAL FREE PLAY under ADJUSTMENTS.

Removal (3000GT AWD)

1) Remove air cleaner cover, air hoses and vacuum pipe. Remove air cleaner, intake hose, battery, battery tray and washer tank.

2) Disconnect transaxle control cables and speedometer cable. Raise and support vehicle.

3) Remove both inner fender splash shields. Remove clutch tube bracket and disconnect clutch release cylinder (including clutch damper assembly on FWD models) and wire aside. Support transaxle assembly with jack and disconnect upper transaxle mount. Remove mount, bracket, plug and stoppers.

4) Remove transaxle assembly upper coupling bolts. Disconnect tie rod ends and lower arm ball joints. Remove right support member, starter cover (if equipped) and starter.

5) Remove left side bearing bracket mounting bolts and pry

left axle shaft from transaxle. Wire left axle shaft and inner shaft assembly aside. Pry right axle shaft from transaxle and wire aside.

6) Remove front bank side and rear bank side transaxle stays. Support transaxle assembly with a transmission jack. Remove transaxle assembly lower coupling bolts and lower transaxle from vehicle.

7) Insert a clutch alining tool to prevent pressure plate and clutch disc from falling. Loosen pressure plate bolts gradually in a crisscross pattern to avoid warping pressure plate flange. Remove pressure plate and clutch disc. See Fig. 4.

Inspection

1) Check release bearing and release fork for damage or wear. DO NOT clean release bearing assembly in solvent. Inspect hydraulic system components for fluid leakage. Inspect cylinder dust boot for cracks or deterioration.

2) Inspect pressure plate surface for wear, cracks, and/or discoloration. Measure diaphragm spring ends for wear and uneven height. Replace assembly if height difference between fingers exceeds .02" (.5 mm).

3) Check facing of clutch disc for loose rivets, uneven contact, deterioration, seizure or oil saturation. Measure distance from clutch disc surface to head of rivet. Replace clutch disc if distance is less than .012" (.30 mm). Check clutch damper bracket for scratches or cracks. Replace worn or defective components as necessary.

CAUTION: Install clutch disc with manufacturer's stamp mark (located near hub of clutch disc) toward pressure plate.

Installation

1) Using a clutch alignment tool, install pressure plate and clutch disc. Tighten bolts evenly in a crisscross pattern to specification. See TORQUE SPECIFICATIONS.

2) Clean release bearing sliding surface. Apply multipurpose grease to release bearing sliding surface. Apply a light amount of grease to input shaft splines. DO NOT allow grease or dirt on clutch disc or pressure plate surface.

3) To install remaining components, reverse removal procedure. Install mounting stoppers as shown in illustration. See Fig. 5.

4) Reverse removal procedure for remaining components. Refill all fluids to proper levels. Adjust all control cables, clutch pedal height and free play. See CLUTCH PEDAL HEIGHT and CLUTCH PEDAL FREE PLAY under ADJUSTMENTS.

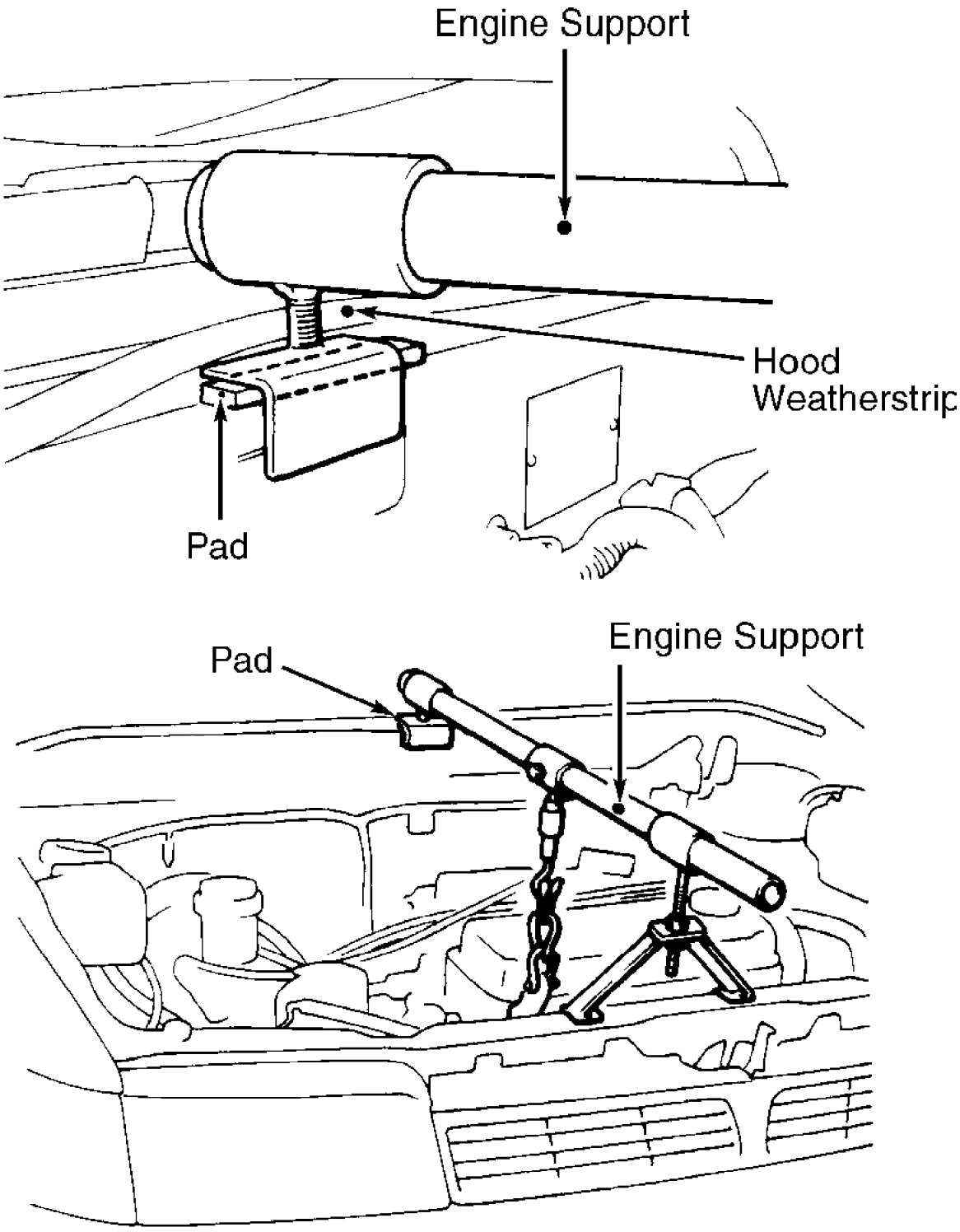


Fig. 3: Supporting Engine For Clutch Removal (Typical)
Courtesy of Mitsubishi Motor Sales of America.

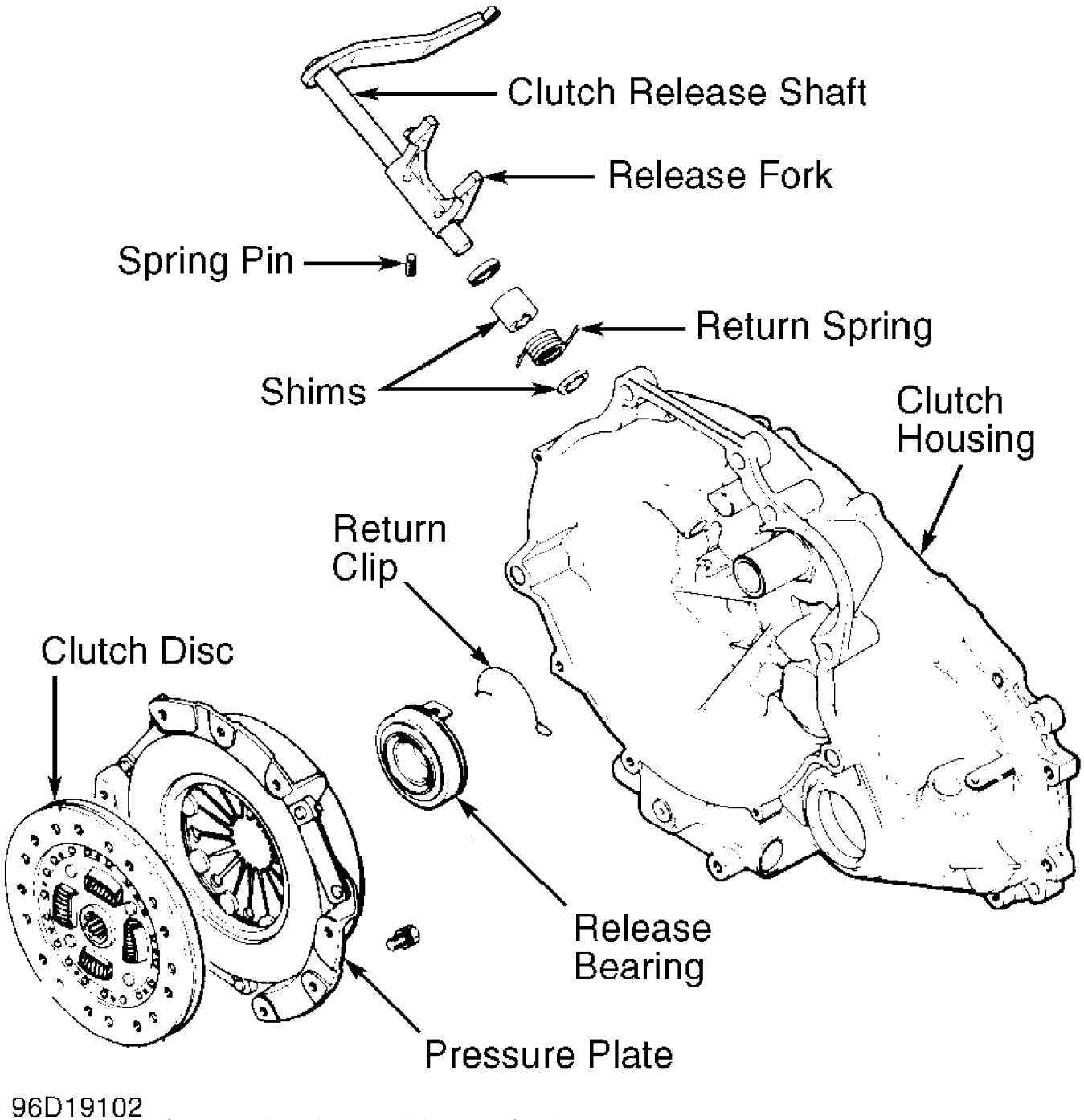


Fig. 4: Exploded View Of Clutch Assembly (Typical)
Courtesy of Mitsubishi Motor Sales of America.

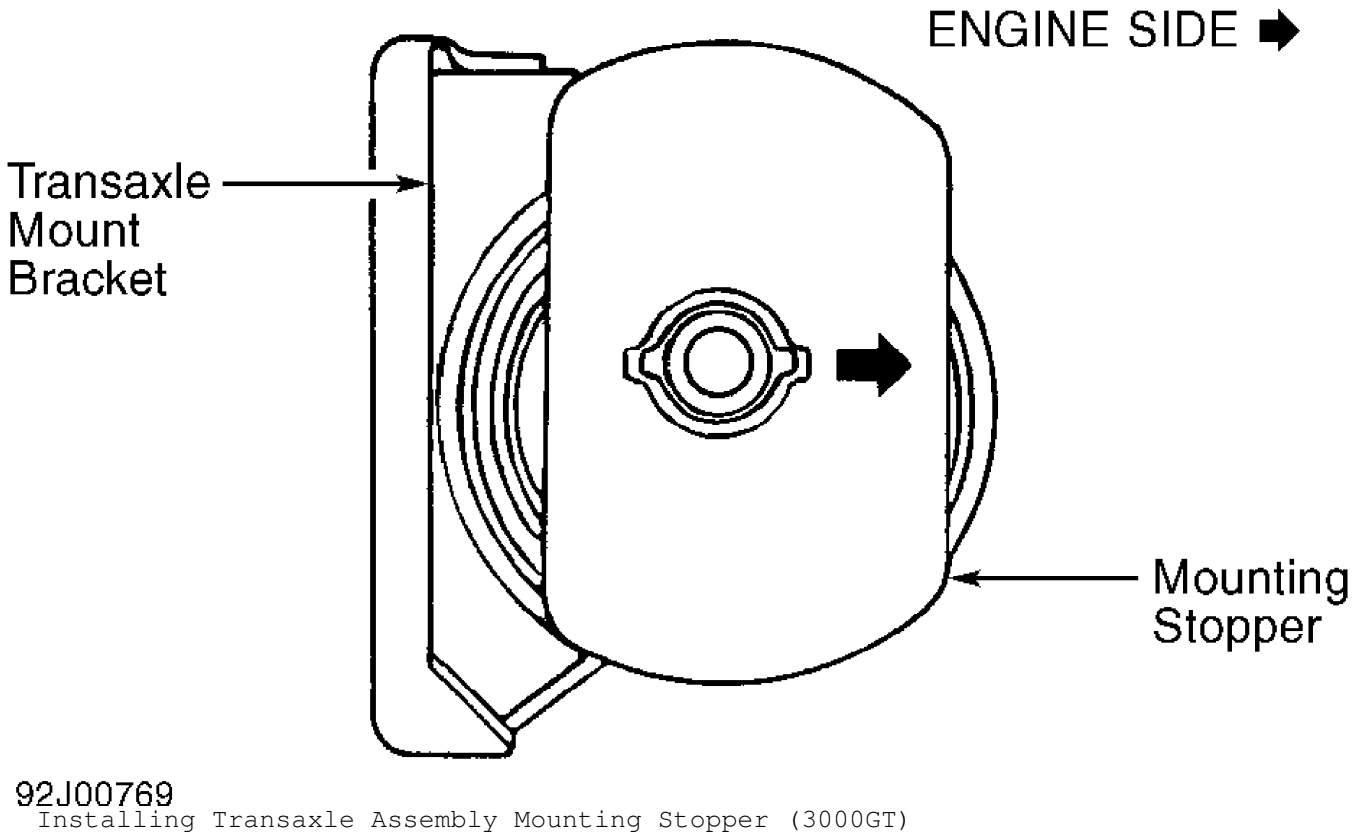


Fig. 5: Installing Transaxle Assembly Mounting Stopper (3000GT)
Courtesy of Mitsubishi Motor Sales of America.

CLUTCH BOOSTER

CAUTION: Wait at least 60 seconds after disconnecting negative battery cable before removing air bag module mounting nuts. Supplemental Restraint System (SRS) retains enough voltage for a short period after power disruption to deploy air bag.

Removal (3000GT AWD)

1) After setting steering wheel and front wheels to straight-ahead position, remove ignition key. Disconnect negative battery cable. Wait at least 60 seconds and then remove air bag module mounting nut from back of steering wheel. Pull air bag module forward.

CAUTION: When disconnecting air bag module-clock spring connector, take care not to apply excessive force.

2) When disconnecting clock spring connector from air bag module, press air bag's lock toward outer side to spread it open. Using a screwdriver, pry gently to remove connector. See Fig. 6. Remove air bag module. Store air bag module, with pad cover face up, in a clean, dry place.

3) Using puller, remove steering wheel. DO NOT hammer on steering wheel to remove it. Remove column covers and knee protector. Remove lap cooler duct and foot outlet duct.

4) Remove column switch assembly, key interlock cable and slide lever. Remove steering column assembly. Remove brake master cylinder and brake booster.

5) Disconnect clutch master cylinder from clutch pedal support bracket. See Fig. 7. Remove all clevis pins and yoke. Remove clutch pedal shaft and clutch pedal. Remove bushing, spacer and lever

assembly. Remove clutch booster support bracket and clutch booster.

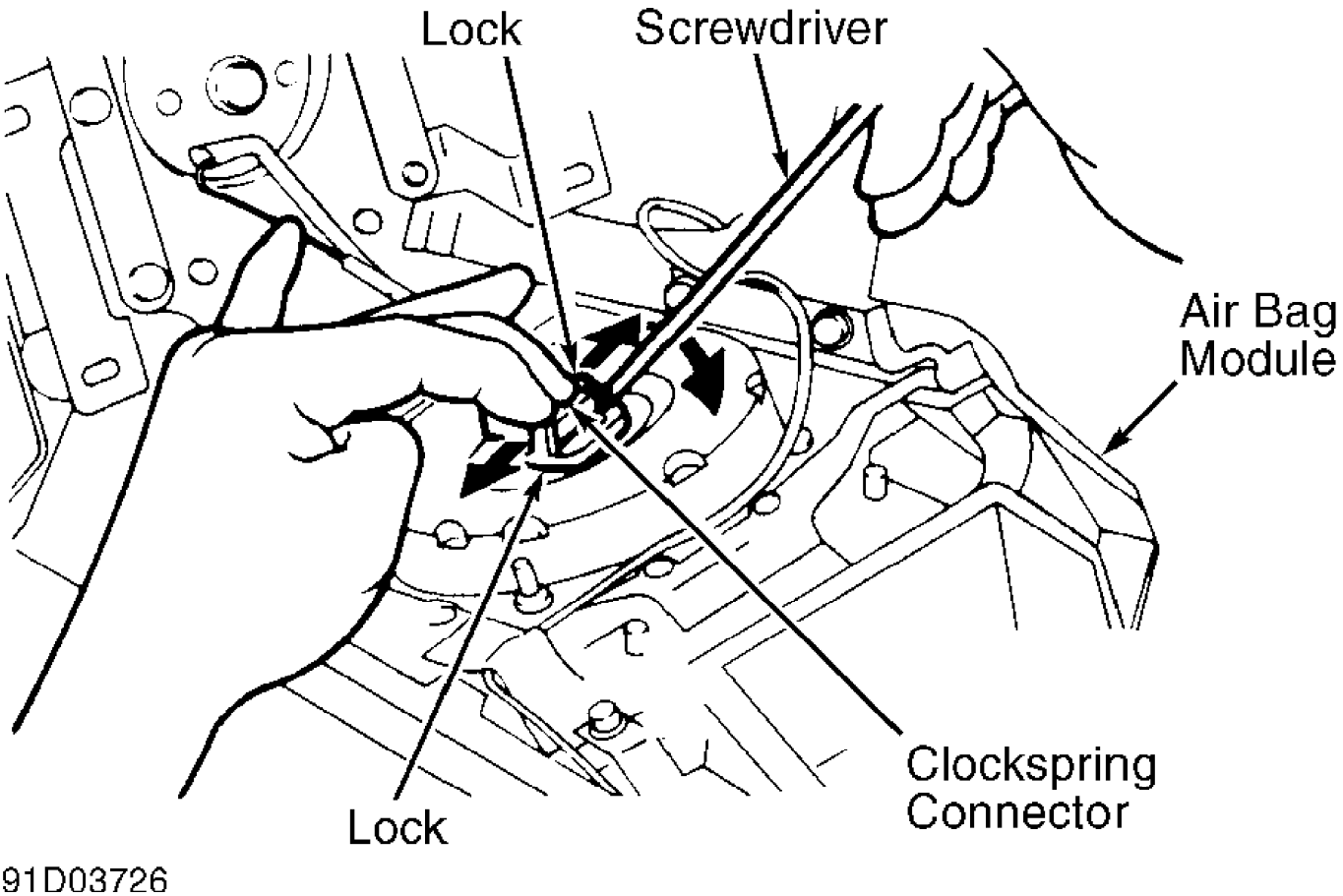


Fig. 6: Disconnecting Clockspring Connector (3000GT)
Courtesy of Mitsubishi Motor Sales of America.

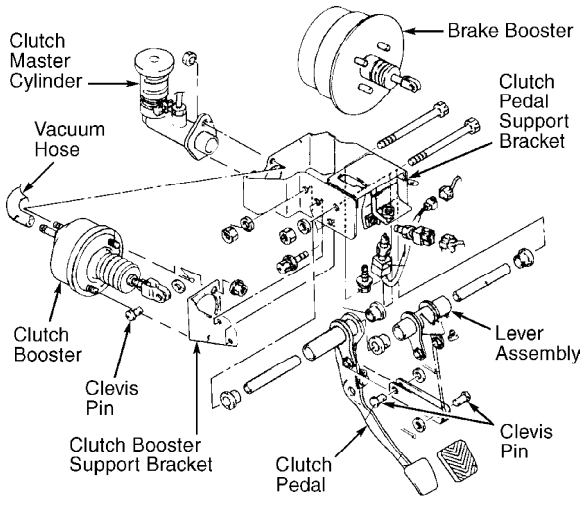


Fig. 7: Exploded View Of Clutch Pedal & Booster (3000GT AWD)
Courtesy of Mitsubishi Motor Sales of America.

Installation

1) To install, reverse removal procedure. Before installing

clutch booster, adjust clutch booster push rod. See CLUTCH BOOSTER PUSH ROD under ADJUSTMENTS.

2) Before installing brake booster, adjust brake booster push rod in similar fashion as clutch booster push rod. See Fig. 1. Dimension "A" for brake booster push rod is .026-.033" (.66-.84 mm). Bleed brake system.

3) Reverse removal procedure for remaining components. Before installing steering wheel, line up NEUTRAL mark on clockspring with mating mark on outer housing. Adjust clutch pedal height and free play. See CLUTCH PEDAL HEIGHT and CLUTCH PEDAL FREE PLAY under ADJUSTMENTS.

4) Turn ignition on from passenger's seat. SRS warning light in instrument cluster should illuminate for approximately 7 seconds and then go out. If SRS warning light fails to come on, remains on, or flashes, a problem exists in SRS. SRS should be serviced as soon as possible.

CLUTCH MASTER CYLINDER

Removal & Installation

1) Drain master cylinder. Disconnect external reservoir (if equipped). Remove lower instrument trim panel (if equipped). Remove cotter pin, washer and clevis pin. Disconnect clutch master cylinder push rod from clutch pedal. Remove hydraulic line at clutch master cylinder and plug openings.

2) Remove retaining nuts and clutch master cylinder. To install, reverse removal procedure. Apply grease to clevis pin before installation. Bleed clutch system. See BLEEDING CLUTCH HYDRAULIC SYSTEM.

CLUTCH RELEASE CYLINDER

Removal & Installation

1) Remove and plug hydraulic line at release cylinder. Remove clip and clevis pin attaching clutch release cylinder push rod to clutch release arm (if equipped). Remove cylinder-to-transaxle bolts and remove clutch release cylinder.

2) To install, reverse removal procedure. Apply grease to clevis pin or push rod-to-release shaft contact area. Bleed clutch system. See BLEEDING CLUTCH HYDRAULIC SYSTEM.

BLEEDING CLUTCH HYDRAULIC SYSTEM

Attach hose to bleeder fitting located on clutch release cylinder, next to hydraulic line. Submerge other end of hose in container half full of clean brake fluid. Fill reservoir with DOT 3 or DOT 4 brake fluid. Open bleeder fitting. Have assistant press clutch pedal to full release position. Close bleeder fitting. Release clutch pedal. Repeat until air bubbles no longer emerge from hose. Refill reservoir.

OVERHAUL

CLUTCH MASTER CYLINDER

Disassembly

Remove piston stop ring, damper and clutch master cylinder push rod assembly. Remove piston assembly. Note position of reservoir band for reassembly reference and remove reservoir. See Fig. 8.

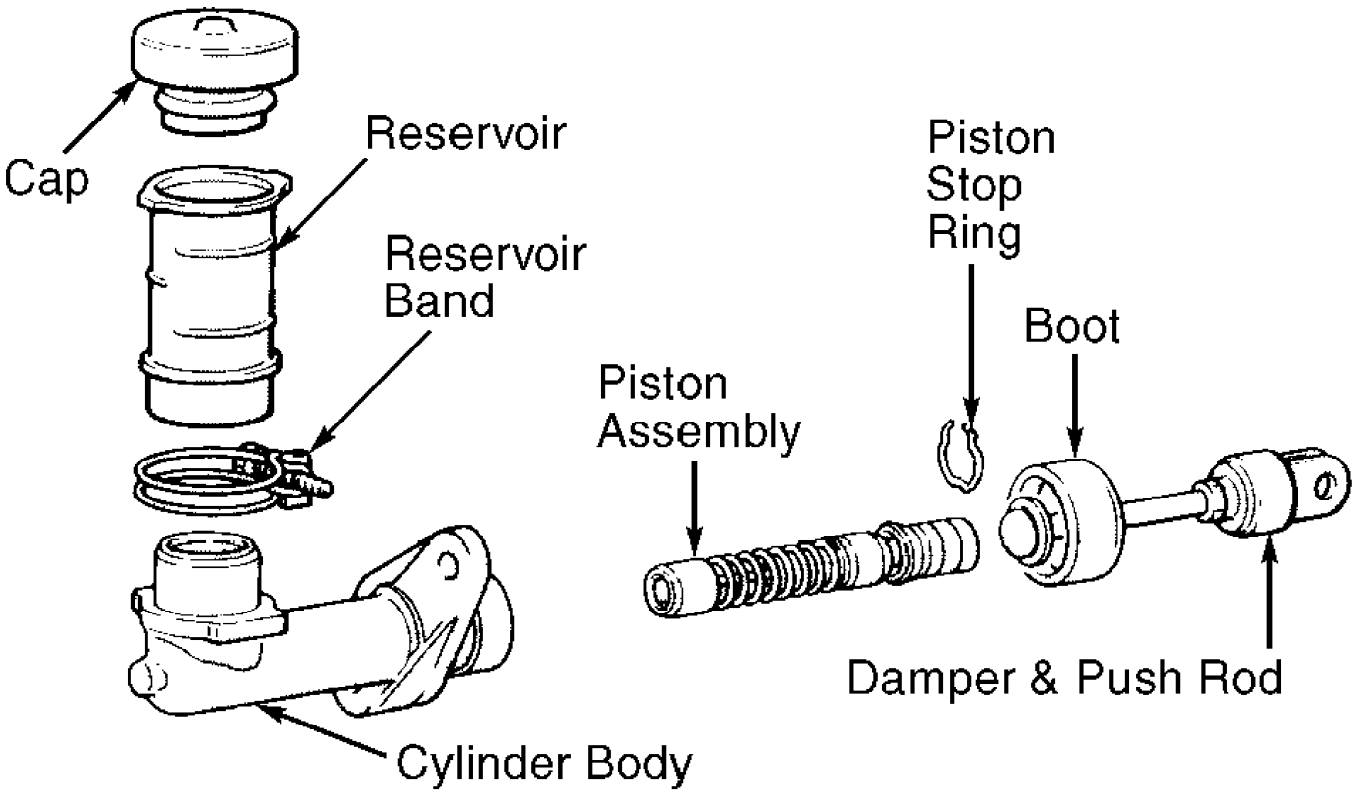


Fig. 8: Exploded View Of Clutch Master Cylinder (Typical)
Courtesy of Mitsubishi Motor Sales of America.

Inspection & Reassembly

Inspect components for rust, scoring or damage. Replace damaged component(s). Apply DOT 3 brake fluid to components during reassembly. Adjust push rod length to 4.80" (122 mm). To reassemble, reverse disassembly procedure. Ensure piston moves freely in bore.

CLUTCH RELEASE CYLINDER

Disassembly

Remove valve plate and spring. See Fig. 9. Remove clutch release cylinder push rod and boot. Cover piston assembly opening with a rag. Slowly apply air pressure to hydraulic line opening to force piston from body.

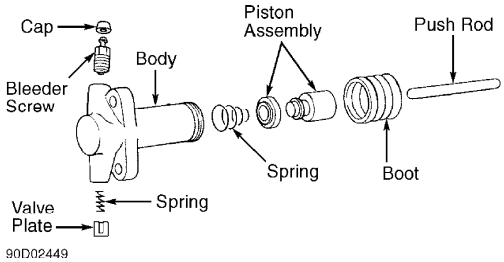


Fig. 9: Exploded View Of Clutch Release Cylinder (Typical)
Courtesy of Mitsubishi Motor Sales of America.

Inspection & Reassembly

Inspect components for rust, scoring or damage. Replace

damaged component(s). Apply brake fluid to components during reassembly. To reassemble, reverse disassembly procedure. Ensure piston moves freely in bore.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Clutch Damper Bolts	14 (19)
Engine Mount-To-Transaxle Bolts	
Eclipse, Galant & Mirage	
8-mm	(1)
10-mm	22-25 (30-34)
12-mm	32-39 (43-53)
3000GT	
Upper Mounting Bolt	54 (73)
Lower Mounting Bolt	65 (88)
Flywheel-To-Crankshaft Bolt	
Eclipse & 3000GT	55 (75)
All Others	94-101 (127-137)
Fulcrum Bolt	27 (36)
Pressure Plate-To-Flywheel Bolt	14 (19)
Release Cylinder Bolts	13 (18)
Transfer Case-To-Transaxle Bolt	
3000GT	64 (87)
All Others	40-43 (54-58)
Wheel Lug Nuts	
Eclipse & 3000GT	89-103 (120-140)
All Others	65-80 (88-109)
	INCH Lbs. (N.m)
Clutch Booster Mounting Nuts	
3000GT AWD	84-108 (9.5-12.2)
Master Cylinder Mounting Nuts	115 (13)

(1) - Tighten to 84-108 INCH lbs. (9.5-12.2 N.m).

COMPUTER RELEARN PROCEDURES

1998 Mitsubishi Galant

GENERAL INFORMATION
Computer Relearn Procedures

All Models

* PLEASE READ THIS FIRST *

The following general procedures are to be used if driveability problems are encountered after power loss or battery has been disconnected. These procedures may provide an aid in eliminating these problems.

To reduce the possibility of complaints, after any service which requires battery power to be disconnected, vehicle should be road tested.

COMPUTER RELEARN PROCEDURES

Vehicles equipped with engine or transmission computers may require a relearn procedure after vehicle battery is disconnected. Many vehicle computers memorize and store vehicle operation patterns for optimum driveability and performance. When vehicle battery is disconnected, this memory is lost. The computer will use default data until new data from each key start is stored. As computer memorizes vehicle operation for each new key start, driveability is restored. Vehicle computers may memorize vehicles operation patterns for 40 of more key starts.

Customers often complain of driveability problems during relearn stage because vehicle acts differently then before being serviced. Depending on type and make of vehicle and how it is equipped, the following complaints (driveability problems) may exist:

* Harsh Or Poor Shift Quality
* Rough Or Unstable Idle
* Hesitation Or Stumble
* Rich Or Lean Running
* Poor Fuel Mileage

These symptoms and complaints should disappear after a number of drive cycles have been memorized. To reduce the possibility of complaints, after any service which requires battery power to be disconnected, vehicle should be road tested. If a specific relearn procedure is not available, the following procedure may be used:

Automatic Transmission

* Set parking brake, start engine in "P" or "N" position. Warm-up vehicle to normal operating temperature or until cooling fan cycles.
* Allow vehicle to idle for one minute in "N" position. Select "D" and allow engine to idle for one minute.
* Accelerate at normal throttle position (20-50%) until vehicle shifts into top gear.
* Cruise at light to medium throttle.
* Decelerate to a stop, allowing vehicle to downshift, and use brakes normally.
* Process may be repeated as necessary.

Manual Transmission

* Place transmission in Neutral position.
* Ensure emergency brake has been set and all accessories are turned off.
* Start engine and bring to normal operating temperature.
* Allow vehicle to idle in Neutral for one minute.
* Initial relearn is complete: process will be completed during normal driving.

Some manufacturers identify a specific relearn procedure which will help establish suitable driveability during relearn stage. These procedures are especially important if vehicle is equipped with and electronically controlled automatic transmission or transaxle. Always complete procedure before returning vehicle to customer.

COOLING SYSTEM SPECIFICATIONS & ENGINE COOLING FANS

1998 Mitsubishi Galant

1997-98 ENGINE COOLING
Mitsubishi Specifications & Electric Cooling Fans

Diamante, Eclipse, Galant, Mirage, Montero, Montero Sport, 3000GT

SPECIFICATIONS

BELT ADJUSTMENT

NOTE: Use illustration for water pump drive belt routing. See Figs. 1-6. The terms alternator and generator are used interchangeably.

BELT ADJUSTMENT

Application	Deflection (1) In. (mm)
Diamante	(2)
Eclipse & Galant	
2.0L Non-Turbo	(2)
2.0L Turbo & 2.4L	
Generator & Water Pump	0.35-0.45 (9.0-11.4)
Water Pump & Power Steering	0.22-0.32 (5.6-8.1)
Mirage	
1.5L	0.34-0.45 (8.6-11.4)
1.8L	(2)
Montero	
A/C	0.26-0.30 (6.6-7.6)
Generator & Water Pump	(3) 0.22-0.26 (5.6-6.6)
Water Pump & Power Steering	0.54-0.70 (13.7-17.8)
Montero Sport	
2.4L	
A/C	0.24-0.26 (6.1-6.6)
Generator & Water Pump	(4) 0.28-0.35 (7.1-8.9)
Water Pump & Power Steering	0.22-0.30 (5.6-7.6)
3.0L	
A/C	0.22-0.26 (5.6-6.6)
Generator & Water Pump	(3) 0.20-0.27 (5.1-6.8)
Water Pump & Power Steering	0.52-0.68 (13.2-17.3)
3000GT	(3)

(1) - With 22 lbs. (10 kg) pressure applied midway on belt run. Values are for a used belt.
(2) - Water pump is driven by timing belt. Timing belt deflection is controlled by timing belt automatic tensioner.
(3) - Measured between water pump pulley and crankshaft pulley.
(4) - Measured between water pump pulley and generator pulley.

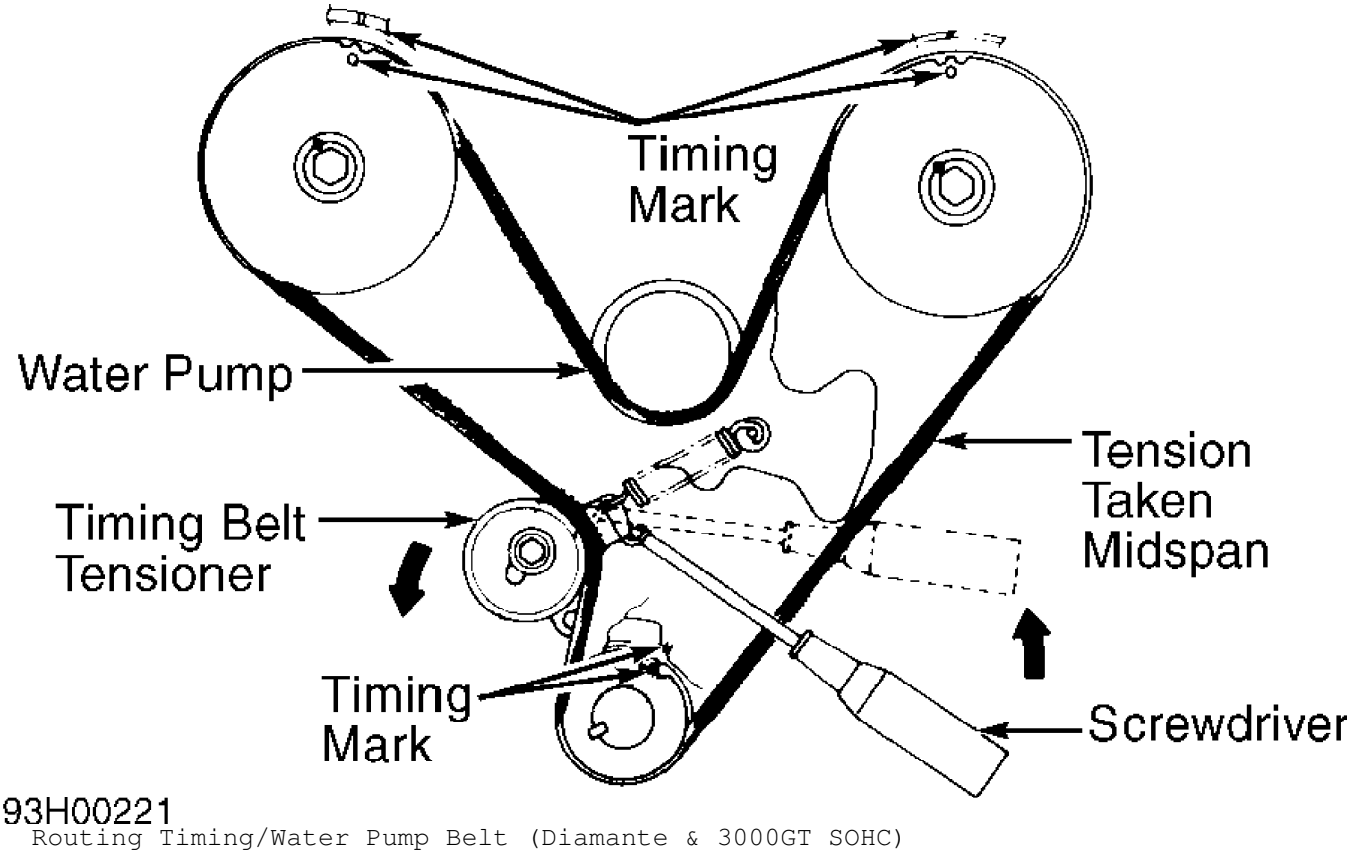


Fig. 1: Routing Timing/Water Pump Belt (Diamante & 3000GT SOHC)
Courtesy of Mitsubishi Motor Sales of America.

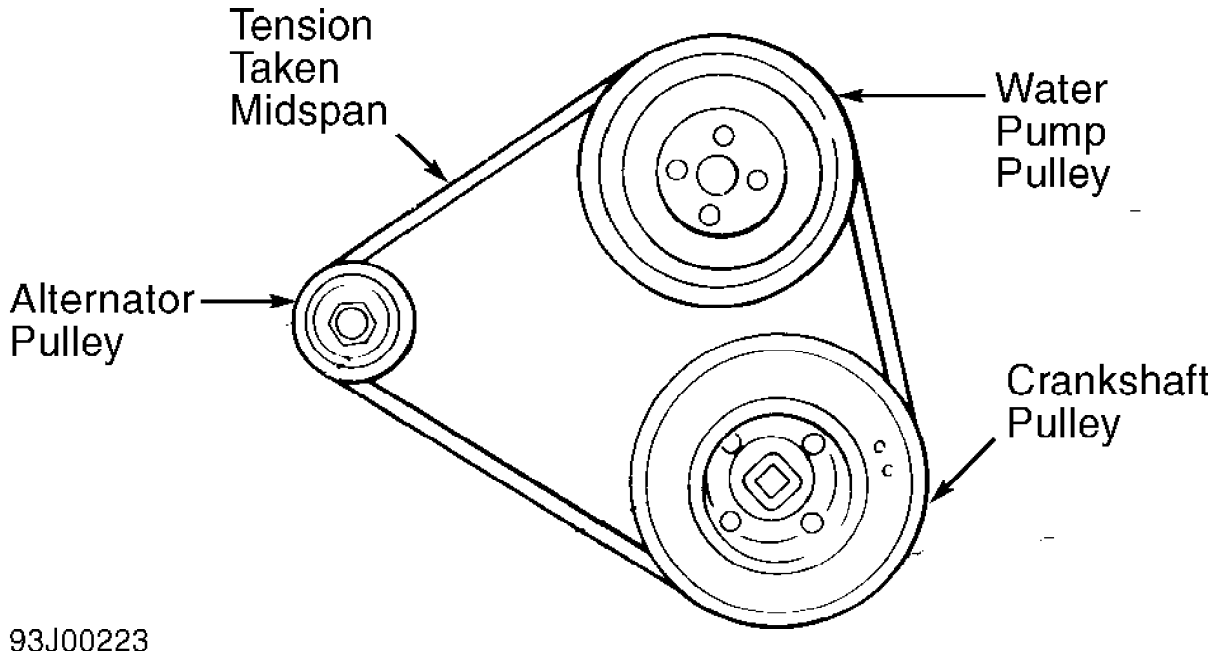


Fig. 2: Routing Alternator & Water Pump Belt (Eclipse - 2.0L Turbo & 2.4L, Galant & Mirage - 1.5L)
Courtesy of Mitsubishi Motor Sales of America.

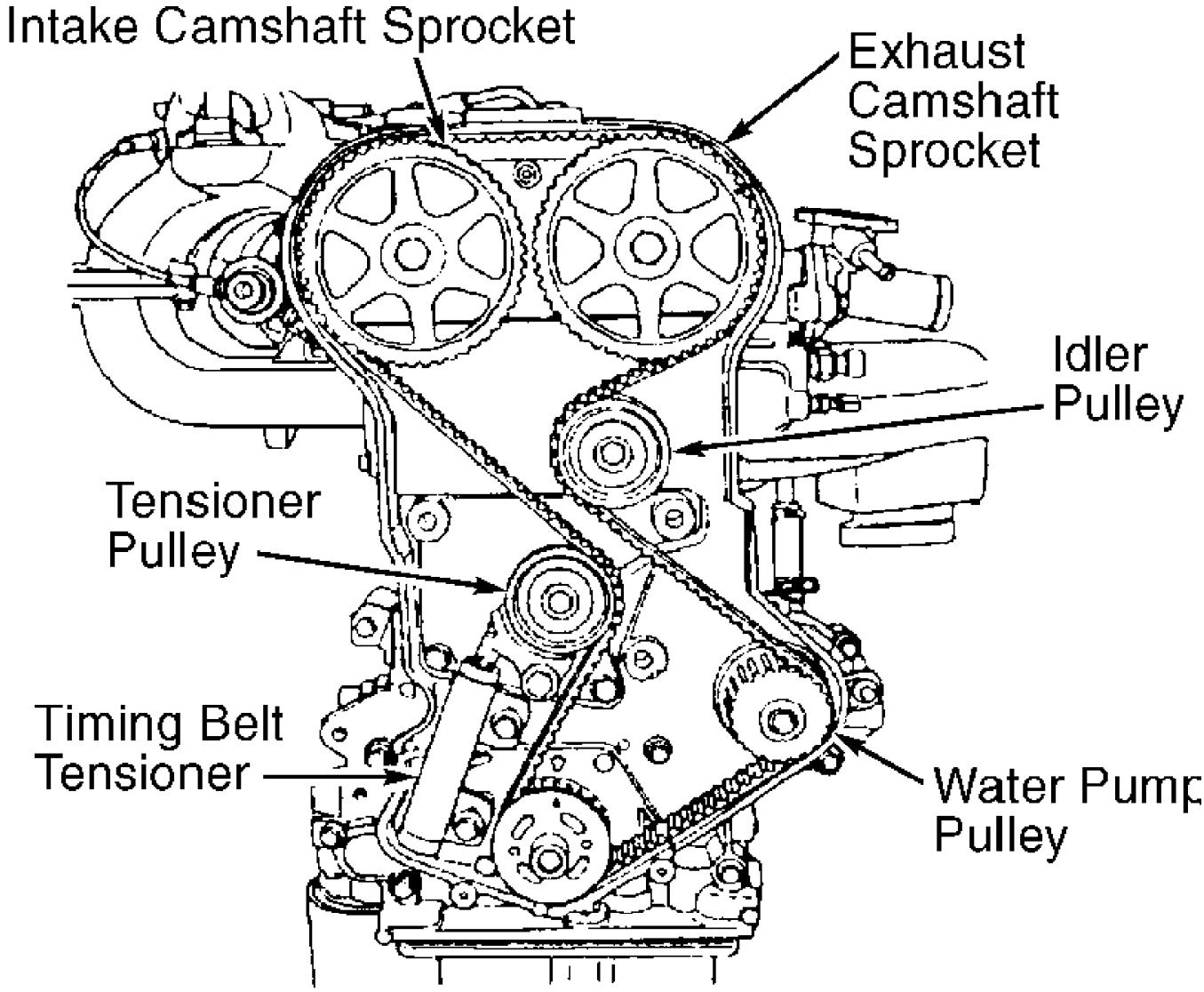


Fig. 3: Routing Timing/Water Pump Belt (Eclipse - 2.0L Non-Turbo)
Courtesy of Mitsubishi Motor Sales of America.

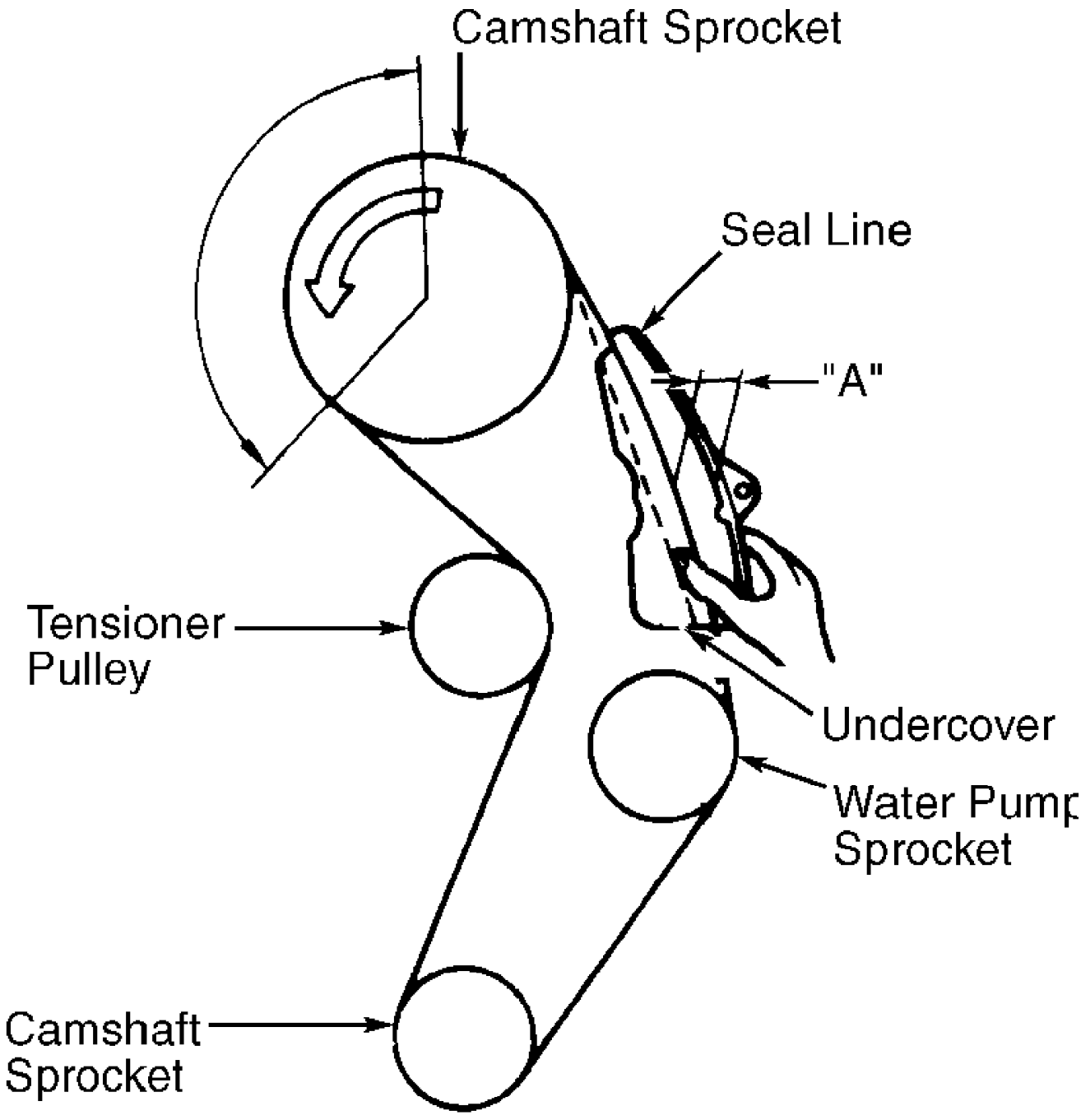


Fig. 4: Routing Timing/Water Pump Belt (Mirage - 1.8L)
Courtesy of Mitsubishi Motor Sales of America.

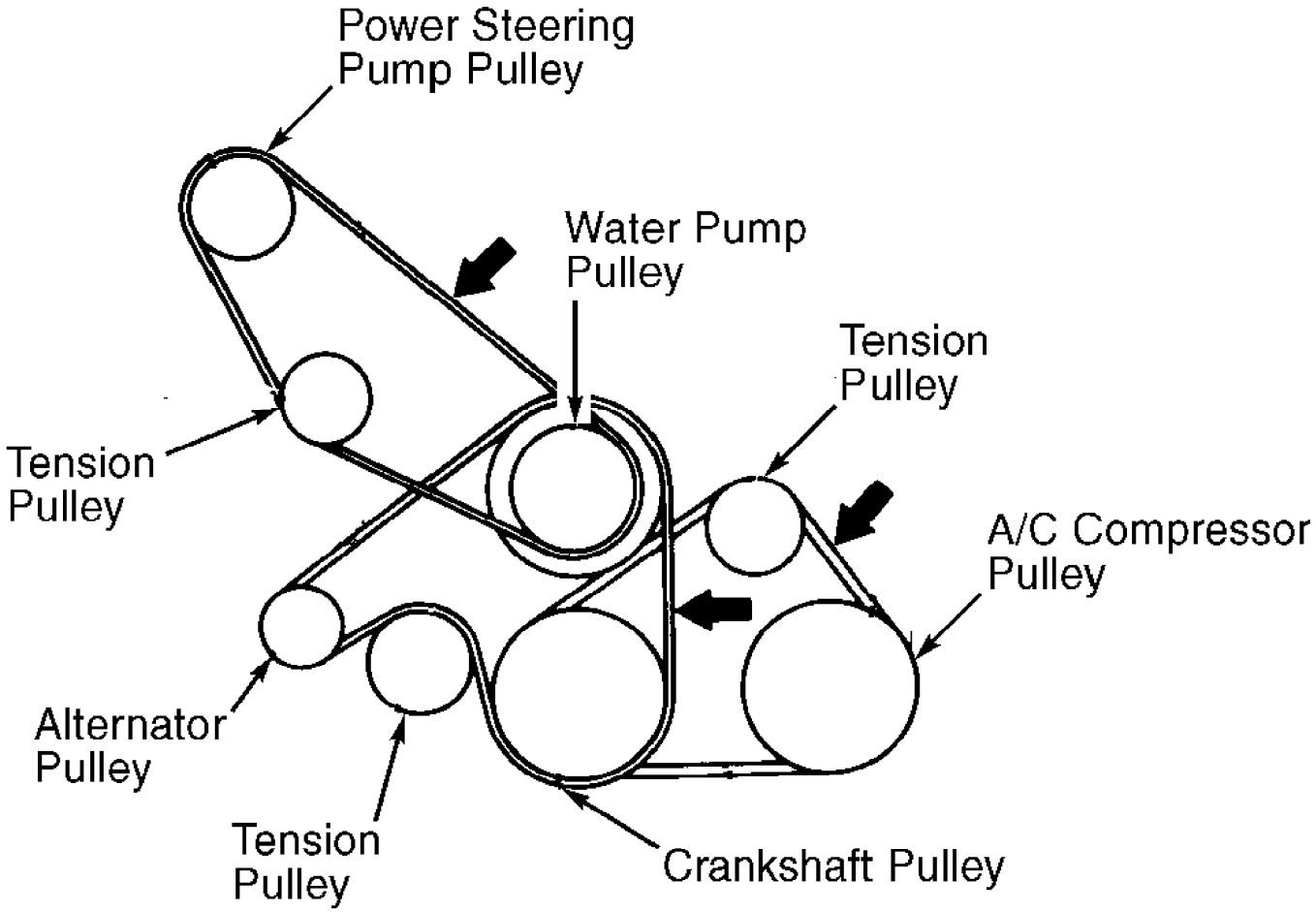
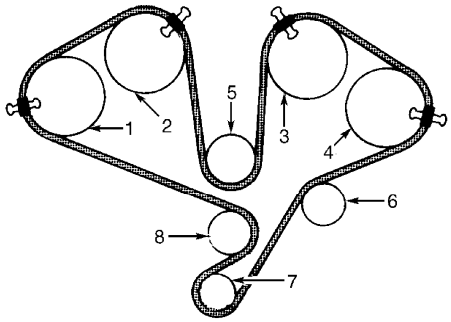


Fig. 5: Routing Accessory Drive Belts (Montero - 3.5L & Montero Sport - 3.0L; Montero Sport - 2.4L Similar)
Courtesy of Mitsubishi Motor Sales of America.



1. Exhaust Camshaft Sprocket (Front Bank)
2. Intake Camshaft Sprocket (Front Bank)
3. Intake Camshaft Sprocket (Rear Bank)
4. Exhaust Camshaft Sprocket (Rear Bank)
5. Water Pump Pulley
6. Idler Pulley
7. Crankshaft Sprocket
8. Tensioner Pulley

Fig. 6: Routing Timing/Water Pump Belt (3000GT - DOHC)
Courtesy of Mitsubishi Motor Sales of America.

COOLING SYSTEM SPECIFICATIONS

COOLING SYSTEM SPECIFICATIONS

Application	Specification
Coolant Replacement Interval	30,000 Miles Or 24 Months
Coolant Capacity (Includes Heater & Reserve Tank)	
Diamante	10.0 Qts. (9.5L)
Eclipse	7.4 Qts. (7.0L)
Galant	7.4 Qts. (7.0L)
Mirage	
1.5L	5.3 Qts. (5.0L)
1.8L	6.3 Qts. (6.0L)
Montero	10.0 Qts. (9.5L)
Montero Sport	
2.4L	
With Rear Heater	9.5 Qts. (9.0L)
Without Rear Heater	8.5 Qts. (8.0L)
3.0L	
With Rear Heater	10.6 Qts. (10.0L)
Without Rear Heater	9.5 Qts. (9.0L)
3000GT	8.5 Qts. (8.0L)
Pressure Cap	
Except Eclipse 2.0L Non-Turbo	11-15 psi
Eclipse 2.0L Non-Turbo	14-18 psi
Thermostat Opens	
Diamante	
1997	
Starts To Open	180°F (82°C)
Fully Open	203°F (95°C)
1998	
Starts To Open	192°F (89°C)
Fully Open	203°F (95°C)
Eclipse	
2.0L Turbo & 2.4L	
Starts To Open	180°F (82°C)
Fully Open	203°F (95°C)
2.0L Non-Turbo	
Starts To Open	195°F (90.5°C)
Fully Open	216°F (102°C)
Galant	
Starts To Open	180°F (82°C)
Fully Open	203°F (95°C)
Mirage	
Starts To Open	177-183°F (80.5-83.9°C)
Fully Open	203°F (95°C)
Montero	
1997	
Starts To Open	180°F (82°C)
Fully Open	203°F (95°C)
1998	
Starts To Open	190°F (88°C)
Fully Open	212°F (100°C)
Montero Sport	
Starts To Open	177-183°F (80.5-83.9°C)
Fully Open	203°F (95°C)
3000GT (SOHC)	
Starts To Open	180°F (82°C)
Fully Open	203°F (95°C)
3000GT (DOHC)	
Starts To Open	170°F (77°C)
Fully Open	194°F (90°C)

ELECTRIC COOLING FAN

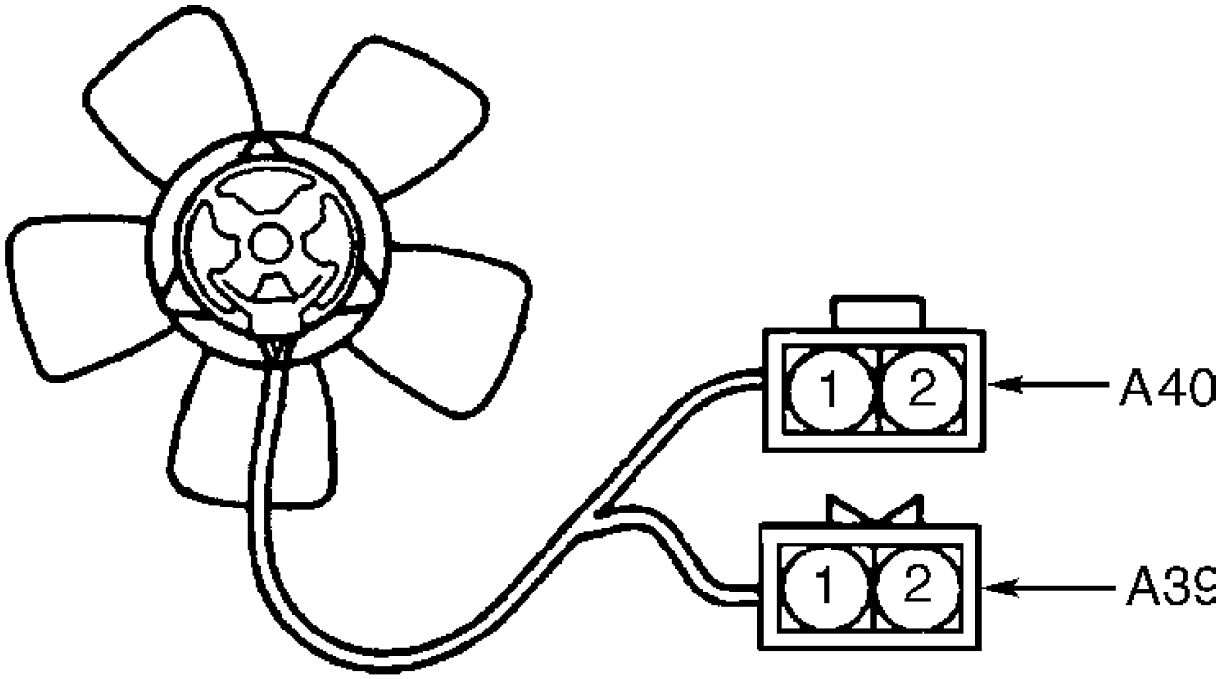
COMPONENT TESTING

Radiator Fan Motor (Diamante)

1) Disconnect radiator fan motor connectors A39 and A40. Ground fan motor connector A39 terminal No. 2 (Black wire). Using a fused jumper wire, connect battery voltage to fan motor connector A39 terminal No. 1 (Blue/Black wire). See Fig. 7. See WIRING DIAGRAMS. Fan motor should operate at low speed with no abnormal noises or interferences. Repair or replace components as necessary.

2) Ground fan motor connector A39 terminal No. 2 (Black wire) and connector A40 terminal No. 2 (Black wire). Using a fused jumper wire, connect battery voltage to fan motor connector A39 terminal No. 1 (Blue/Black wire). See Fig. 7. See WIRING DIAGRAMS. Fan motor should operate at medium speed with no abnormal noises or interferences. Repair or replace components as necessary.

3) Ground fan motor connector A39 terminal No. 2 (Black wire) and connector A40 terminal No. 2 (Black wire). Using 2 fused jumper wires, connect battery voltage to fan motor connector A39 terminal No. 1 (Blue/Black wire) and to connector A40 terminal No. 1 (Green wire). See Fig. 7. See WIRING DIAGRAMS. Fan motor should operate at high speed with no abnormal noises or interferences. Repair or replace components as necessary.



98C11058

Fig. 7: Testing Radiator Fan Motor (Diamante)
Courtesy of Mitsubishi Motor Sales of America.

Radiator Fan Motor (Eclipse)

1) Disconnect radiator fan motor 4-pin connector. Ground fan

motor connector terminal No. 2 (Black wire). Using a fused jumper wire, connect battery voltage to fan motor connector terminal No. 1 (White/Black wire). See WIRING DIAGRAMS. Fan motor should operate with no abnormal noises or interferences. Repair or replace components as necessary.

2) On all models except 1998 2.0L non-turbo, ground fan motor 4-pin connector terminal No. 4 (Black wire). Using a fused jumper wire, connect battery voltage to fan motor connector terminal No. 3 (White/Blue wire). See WIRING DIAGRAMS. Fan motor should operate with no abnormal noises or interferences. Repair or replace components as necessary.

Radiator Fan Motor (Galant)

1) Disconnect radiator fan motor 4-pin connector. Ground fan motor connector terminal No. 2 (Black wire). Using a fused jumper wire, connect battery voltage to fan motor connector terminal No. 1 (Blue wire). See WIRING DIAGRAMS. Fan motor should operate with no abnormal noises or interferences. Repair or replace components as necessary. If no problems exist, go to next step.

2) Ground fan motor 4-pin connector terminal No. 4 (Black wire). Using a fused jumper wire, connect battery voltage to fan motor connector terminal No. 3 (Blue/Black wire). See WIRING DIAGRAMS. Fan motor should operate with no abnormal noises or interferences. Repair or replace components as necessary.

Radiator Fan Motor (Mirage)

Disconnect radiator fan motor 2-pin connector. Ground fan motor 2-pin connector terminal No. 2 (Black wire). Using a fused jumper wire, connect battery voltage to 2-pin connector terminal No. 1 (Blue/Black wire). See WIRING DIAGRAMS. Fan motor should operate with no abnormal noises or interferences. Repair or replace components as necessary.

Radiator Fan Motor (3000GT)

1) Disconnect radiator fan motor 4-pin connector. Ground fan motor connector terminal No. 4 (Blue/Green wire). Using a fused jumper wire, connect battery voltage to fan motor connector terminal No. 2 (Red/Black wire). See WIRING DIAGRAMS. Fan motor should operate with no abnormal noises or interferences. Repair or replace components as necessary. If radiator fan motor operates as specified, go to next step.

2) Disconnect battery voltage and ground from radiator fan motor 4-pin connector. Using an ohmmeter, measure resistance between radiator fan motor 4-pin connector terminals No. 1 (Black wire) and No. 3 (Yellow/Blue wire). See WIRING DIAGRAMS. Resistance should be 0.29-0.35 ohms. Replace radiator fan motor if resistance is not as specified.

Condenser Fan Motor (Diamante)

1) Using a fused jumper wire, connect battery voltage to condenser fan motor 4-pin connector terminal No. 1 (Blue/White wire). Connect ground to connector terminal No. 2 (Black wire). Fan motor should operate with no abnormal noises or interferences. Repair or replace components as necessary. If no problems exist, go to next step.

2) Using a fused jumper wire, connect battery voltage to condenser fan motor 4-pin connector terminal No. 3 (Yellow wire). When terminal No. 4 (Black wire) is connected to ground, condenser fan should operate faster. Replace condenser fan if operation is not as specified. Ensure there are no abnormal noises or interferences during fan operation.

Condenser Fan Motor (Eclipse)

1) Using a fused jumper wire, connect battery voltage to condenser fan motor 4-pin connector terminal No. 1 (Blue wire). Connect ground to connector to terminal No. 4 (Black wire). Fan motor should operate with no abnormal noises or interferences. Repair or replace components as necessary. If no problems exist, go to next step.

2) Using a fused jumper wire, connect battery voltage to condenser fan motor 4-pin connector terminal No. 3 (Blue/White wire). When terminal No. 2 (Black wire) is connected to ground, condenser fan should operate faster. Replace condenser fan if operation is not as specified. Ensure there are no abnormal noises or interferences during fan operation.

Condenser Fan Motor (Galant)

1) Using a fused jumper wire, connect battery voltage to condenser fan motor 4-pin connector terminal No. 1 (Blue wire). Connect ground to connector to terminal No. 2 (Black wire). Fan motor should operate with no abnormal noises or interferences. Repair or replace components as necessary. If no problems exist, go to next step.

2) Using a fused jumper wire, connect battery voltage to condenser fan motor 4-pin connector terminal No. 3 (Blue/White wire). When terminal No. 4 (Black wire) is connected to ground, condenser fan should operate faster. Replace condenser fan if operation is not as specified. Ensure there are no abnormal noises or interferences during fan operation.

Condenser Fan Motor (Mirage)

Disconnect radiator fan motor 2-pin connector. Ground fan motor 2-pin connector terminal No. 2 (Black/Blue wire). Using a fused jumper wire, connect battery voltage to 2-pin connector terminal No. 1 (Black/Orange wire). See WIRING DIAGRAMS. Fan motor should operate with no abnormal noises or interferences. Repair or replace components as necessary.

Condenser Fan Motor (Montero & Montero Sport)

Disconnect radiator fan motor 2-pin connector. Ground fan motor 2-pin connector terminal No. 1 (Blue/Black wire). Using a fused jumper wire, connect battery voltage to 2-pin connector terminal No. 2 (Blue/White wire). See WIRING DIAGRAMS. Fan motor should operate with no abnormal noises or interferences. Repair or replace components as necessary.

Condenser Fan Motor (1997 3000GT)

1) Disconnect both condenser fan motor 2-pin connectors located on driver side of radiator. Ground fan motor 2-pin connector terminal No. 2 (Black wire). Using a fused jumper wire, connect battery voltage to 2-pin connector terminal No. 1 (Blue wire). See WIRING DIAGRAMS. Fan motor should operate with no abnormal noises or interferences. Repair or replace components as necessary. If no problems exist, go to next step.

2) Ground fan motor 2-pin connector terminal No. 2 (Blue/Black wire). Using a fused jumper wire, connect battery voltage to 2-pin connector terminal No. 1 (Blue/White wire). See WIRING DIAGRAMS. Fan motor should operate with no abnormal noises or interferences. Repair or replace components as necessary.

Condenser Fan Motor (1998 3000GT)

1) Disconnect condenser fan motor 3-pin connector located on driver-side of radiator. Ground fan motor 2-pin connector terminal No. 3 (Black wire). Using a fused jumper wire, connect battery voltage to 3-pin connector terminal No. 1 (Blue/White wire). See WIRING DIAGRAMS. Fan motor should operate with no abnormal noises or interferences.

Repair or replace components as necessary. If no problems exist, go to next step.

2) Ground fan motor 3-pin connector terminal No. 3 (Black wire). Using a fused jumper wire, connect battery voltage to 3-pin connector terminal No. 2 (Blue wire). See WIRING DIAGRAMS. Fan motor should operate with no abnormal noises or interferences. Repair or replace components as necessary.

Engine Coolant Temperature (ECT) Sensor

Remove ECT sensor from vehicle. Suspend sensor in water so that sensor does not touch container. Slowly heat water. Using an ohmmeter, check sensor continuity as temperature increases. Replace ECT sensor if resistance is not as specified. See ENGINE COOLANT TEMPERATURE SENSOR RESISTANCE table.

ENGINE COOLANT TEMPERATURE SENSOR RESISTANCE

Temperature °F (°C)	Ohms
Diamante, Eclipse 2.0L Turbo & 2.4L	
32 (0)	5100-6500
68 (20)	2100-2700
104 (40)	900-1300
176 (80)	260-360
Eclipse Non-Turbo	
77 (25)	900-1100
212 (100)	600-800
Galant & Mirage	
68 (20)	2100-2700
176 (80)	260-360
Montero	
68 (20)	2130-2610
176 (80)	258-322
Montero Sport	
68 (20)	2100-2700
176 (80)	260-360
3000GT	
32 (0)	5800
68 (20)	2400
104 (40)	1100
176 (80)	300

Electric Cooling Fan Relay (Diamante, Eclipse, Galant & Mirage)

1) Remove radiator fan motor relay from relay box located at right side of engine compartment. Check for continuity between relay terminals No. 1 and 3. If continuity exists, go to next step. If continuity does not exist, replace cooling fan relay. See Fig. 8.

2) Using a fused jumper wire, connect battery voltage to cooling fan relay terminal No. 1. Using another jumper wire, connect cooling fan relay terminal No. 3 to battery ground. With cooling fan relay energized, there should be continuity between cooling fan relay terminals No. 4 and 5. With cooling fan relay not energized, there should be no continuity between terminals No. 4 and 5. If continuity does not exist as specified, replace cooling fan relay. See Fig. 8.

Electric Cooling Fan Relay (Montero, Montero Sport & 3000GT)

1)Remove relay from relay box in engine compartment relay box. Check for continuity between relay terminals No. 2 and 4. If continuity exists, go to next step. If continuity does not exist, replace cooling fan relay. See Fig. 9.

2) Using a fused jumper wire, connect battery voltage to

cooling fan relay terminal No. 2. Using another jumper wire, connect cooling fan relay terminal No. 4 to battery ground. With cooling fan relay energized, there should be continuity between cooling fan relay terminals No. 1 and 3. With cooling fan relay not energized, there should be no continuity between terminals No. 1 and 3. If continuity does not exist as specified, replace cooling fan relay. See Fig. 9.

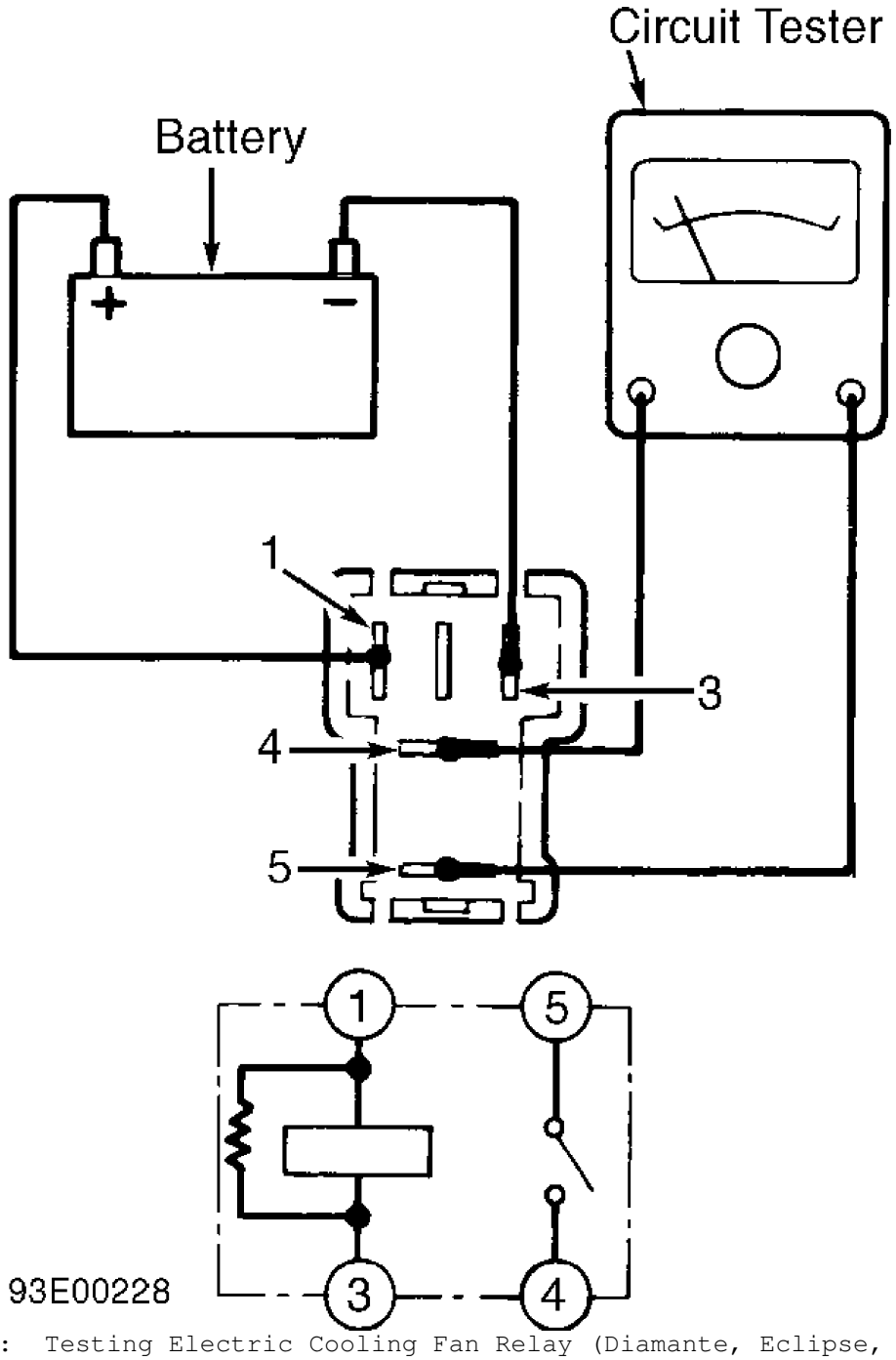


Fig. 8: Testing Electric Cooling Fan Relay (Diamante, Eclipse, Galant & Mirage)
Courtesy of Mitsubishi Motor Sales of America.

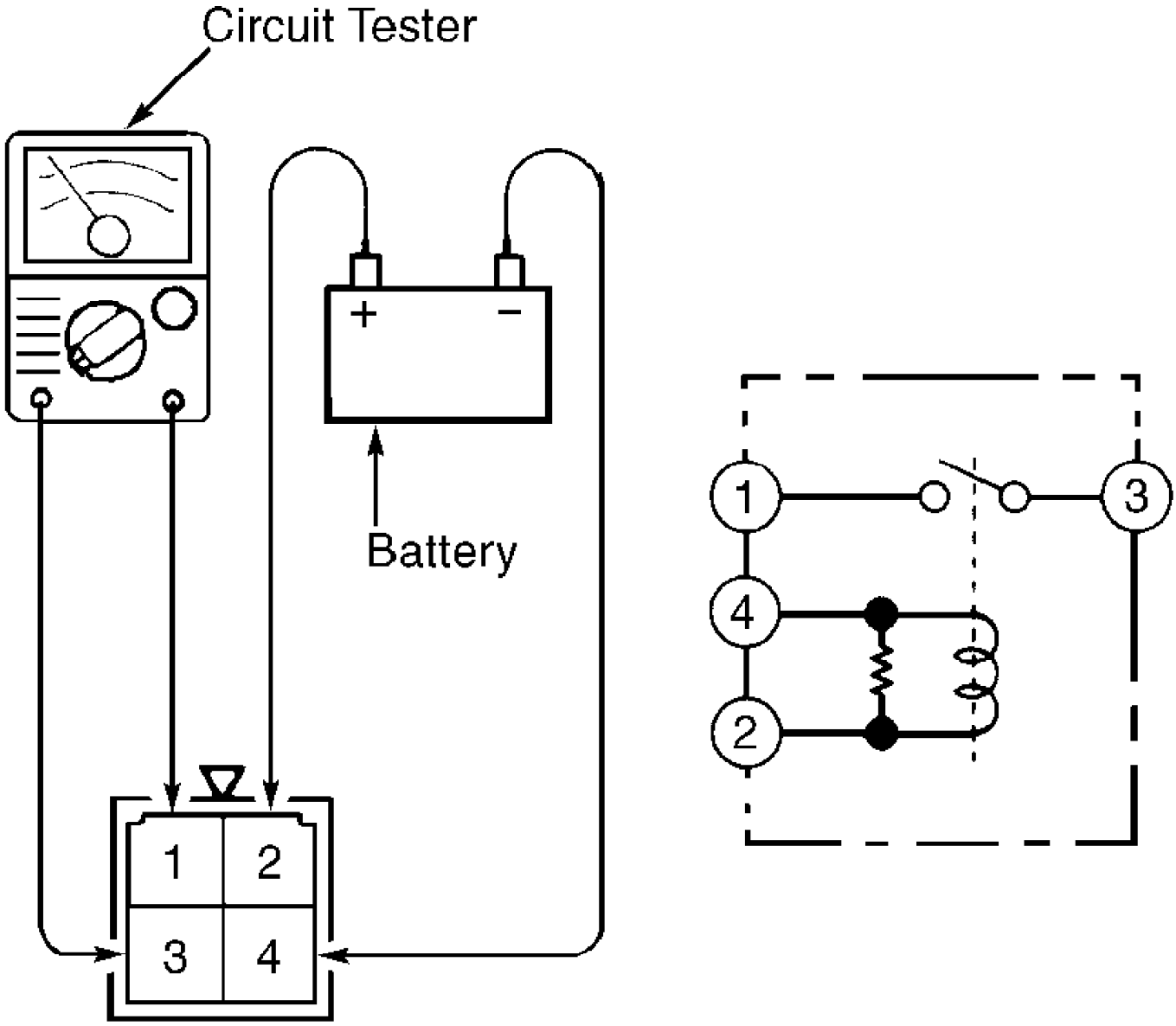


Fig. 9: Testing Electric Cooling Fan Relay (Montero, Montero Sport & 3000GT)
Courtesy of Mitsubishi Motor Sales of America.

SYSTEM TESTING

NOTE: For appropriate wiring diagram, see WIRING DIAGRAMS.

NOTE: Radiator fan on Montero and Montero Sport is mounted to a hydraulic fan clutch which is mounted to the water pump. Replace fan clutch if leaks are detected at case joints and seals, fan can be rotated with very light resistance or the bimetallic strip is damaged.

NOTE: Operation of radiator and condenser fans is controlled by vehicle Powertrain Control Module (PCM). Based on vehicle

speed, coolant temperature and A/C operation request, PCM will command low, medium or high speed fan operation.

Diamante

1) If only the radiator fan does not operate, check fusible link No. 6 located in engine compartment relay box. If only the condenser fan does not operate, check dedicated fuse No. 16 (20-amp) located in engine compartment relay box. See WIRING DIAGRAMS. Repair as necessary.

2) If radiator fan and condenser fan operate in all speeds except low, check appropriate low speed relay. See COMPONENT TESTS. See WIRING DIAGRAMS. If low speed relay is okay, check PCM. See appropriate G - TESTS W/CODES article in ENGINE PERFORMANCE.

* G - TESTS W/CODES - 1997
* G - TESTS W/CODES - 1998

3) If radiator fan and condenser fan operate in all speeds except high, check appropriate high speed relay. See COMPONENT TESTS. See WIRING DIAGRAMS. If high speed relay is okay, check PCM. See appropriate G - TESTS W/CODES article in ENGINE PERFORMANCE.

* G - TESTS W/CODES - 1997
* G - TESTS W/CODES - 1998

4) To confirm radiator fan or condenser fan operation, see FAN OPERATING MODE (DIAMANTE) table. If fan operation is not as specified, check wiring harness for opens or shorts. Repair as necessary.

FAN OPERATING MODE (DIAMANTE) (1)

Coolant Temp. °F (°C)	Power Circuit Operating Low/High	Radiator Fan Speed	Condenser Fan Speed
13 MPH (2)			
221 (105) (2)	On/Off	Low	Low
221 (105) (3)	Off/On	Mid	Mid
239 (115) (3)	On/On	High	High
13 MPH (3)			
221 (105) (2)	On/Off	Low	Low
221 (105) (2)	On/On	High	High
30 MPH (2)			
203 (95) (2)	Off/Off	Off	Off
203 (95) (3)	On/Off	Low	Off
221 (105) (3)	Off/On	Mid	Mid
30 MPH (3)			
194 (90) (2)	Off/Off	Off	Off
194 (90) (3)	On/Off	Low	Off
221 (105) (3)	On/On	High	Mid
50 MPH (3)			
221 (105) (2)	Off/Off	Off	Off
221 (105) (3)	On/On	High	Mid

(1) - A/C request switch is turned off.
(2) - Approximate vehicle speed/coolant temperature or less.
(3) - Approximate vehicle speed/coolant temperature or more.

NOTE: Operation of radiator and condenser fans is controlled by vehicle Powertrain Control Module (PCM). Based on vehicle speed, coolant temperature and A/C operation request, PCM

will command low, medium or high speed fan operation.

Eclipse

1) If only the radiator fan does not operate, check fusible link No. 7 (20-amp) located in engine compartment relay box. If only the condenser fan does not operate, check dedicated fuse No. 9 (20-amp) located in engine compartment relay box. See WIRING DIAGRAMS. Repair as necessary.

2) If radiator fan and condenser fan operate in all speeds except low, check appropriate low speed relay. See COMPONENT TESTS. See WIRING DIAGRAMS. If low speed relay is okay, check PCM. See appropriate G - TESTS W/CODES article in ENGINE PERFORMANCE.

* G - TESTS W/CODES - 2.0L NON-TURBO - 1997
* G - TESTS W/CODES - 2.0L TURBO - 1997
* G - TESTS W/CODES - 2.4L - 1997
* G - TESTS W/CODES - 2.0L NON-TURBO - 1998
* G - TESTS W/CODES - 2.0L TURBO & 2.4L - 1998

3) If radiator fan and condenser fan operate in all speeds except high, check appropriate high speed relay. See COMPONENT TESTS. See WIRING DIAGRAMS. If high speed relay is okay, check PCM. See appropriate G - TESTS W/CODES article in ENGINE PERFORMANCE.

* G - TESTS W/CODES - 2.0L NON-TURBO - 1997
* G - TESTS W/CODES - 2.0L TURBO - 1997
* G - TESTS W/CODES - 2.4L - 1997
* G - TESTS W/CODES - 2.0L NON-TURBO - 1998
* G - TESTS W/CODES - 2.0L TURBO & 2.4L - 1998

4) To confirm radiator fan or condenser fan operation, see FAN OPERATING MODE (ECLIPSE NON-TURBO) or FAN OPERATING MODE (ECLIPSE 2.0L TURBO & 2.4L) table. If fan operation is not as specified, check wiring harness for opens or shorts. Repair as necessary.

FAN OPERATING MODE (ECLIPSE NON-TURBO)

Coolant Temp. °F (°C)	With A/T Radiator Fan Speed	With M/T Radiator Fan Speed	Condenser Fan Speed
28 MPH (1) (2)			
203 (95) (2)	Off	Off	Off
203-210 (95-99)	Mid	High	Off
210 (99) (3)	High	High	Mid
28-50 MPH (1)			
194 (90) (2)	Off	Off	Off
194-210 (90-99)	Mid	High	Off
210 (99) (3)	High	High	Mid
50 MPH (1) (3)			
210 (99) (2)	Off	Off	Mid
210 (99) (3)	High	High	Off
12 MPH (2) (4)			
210 (99) (2)	Mid	High	Mid
210-242 (99-117)	High	High	High
242 (117) (3)	High	High	High
12-50 MPH (4)			
210 (99) (2)	Mid	High	Mid
210-242 (99-117)	High	High	High
242 (117) (3)	High	High	High
50 MPH (3) (4)			
210 (99) (2)	Mid	High	Mid
210-242 (99-117) (3)	High	High	High

242 (117) (3)	High	High	High

(1) - A/C request switch is turned off.
(2) - Approximate vehicle speed/coolant temperature or less.
(3) - Approximate vehicle speed/coolant temperature or more.
(4) - A/C request switch is turned on.

FAN OPERATING MODE (ECLIPSE 2.0L TURBO & 2.4L)

Coolant Temp. °F (°C)	With A/T Radiator Fan Speed	With M/T Radiator Fan Speed	Condenser Fan Speed
28 MPH (1) (2)			
203 (95) (2)	Off	Off	Off
203-210 (95-99)	Low	Mid	Off
210 (99) (3)	High	High	Mid
28-50 MPH (1)			
194 (90) (2)	Off	Off	Off
194-210 (90-99)	Low	Mid	Off
210 (99) (3)	High	High	Mid
50 MPH (1) (3)			
210 (99) (2)	Off	Off	Off
210 (99) (3)	High	High	Mid
12 MPH (2) (4)			
210 (99) (2)	Low	Mid	Mid
210-242 (99-117)	High	High	High
242 (117) (3)	High	High	High
12-50 MPH (4)			
210 (99) (2)	Low	Mid	Mid
210-242 (99-117)	High	High	High
242 (117) (3)	High	High	High
50 MPH (3) (4)			
210 (99) (2)	Low	Mid	Mid
210-242 (99-117) (3) ..	High	High	High
242 (117) (3)	High	High	High

(1) - A/C request switch is turned off.
(2) - Approximate vehicle speed/coolant temperature or less.
(3) - Approximate vehicle speed/coolant temperature or more.
(4) - A/C request switch is turned on.

NOTE: Operation of radiator and condenser fans is controlled by vehicle Powertrain Control Module (PCM). Based on vehicle speed, coolant temperature and A/C operation request, PCM will command low, medium or high speed fan operation.

Galant

1) If only the radiator fan does not operate, check fusible link No. 5 (30-amp) located in engine compartment relay box. If only the condenser fan does not operate, check dedicated fuse No. 3 (30-amp) located in engine compartment relay box. See WIRING DIAGRAMS. Repair as necessary.

2) If radiator fan and condenser fan operate in all speeds except low, check appropriate low speed relay. See COMPONENT TESTS. See WIRING DIAGRAMS. If low speed relay is okay, check PCM. See appropriate G - TESTS W/CODES article in ENGINE PERFORMANCE.

* G - TESTS W/CODES - 1997
* G - TESTS W/CODES - 1998

3) If radiator fan and condenser fan operate in all speeds except high, check appropriate high speed relay. See COMPONENT TESTS. See WIRING DIAGRAMS. If high speed relay is okay, check PCM. See appropriate G - TESTS W/CODES article in ENGINE PERFORMANCE.

* G - TESTS W/CODES - 1997
* G - TESTS W/CODES - 1998

4) To confirm radiator fan or condenser fan operation, see appropriate FAN OPERATING MODE (GALANT) table. If fan operation is not as specified, check wiring harness for opens or shorts. Repair as necessary.

FAN OPERATING MODE (GALANT) (1)

Coolant Temp. °F (°C)	Radiator Fan Speed	Condenser Fan Speed
28 MPH (2)		
203 (95) (2)	Off	Off
203-221 (95-105)	Low	Low
221 (105) (3)	High	High
28-50 MPH		
194 (90) (2)	Off	Off
194-221 (90-105)	Low	Low
221 (105) (3)	High	High
50 MPH (3)		
221 (105) (2)	Off	Off
221 (105) (3)	High	High
Any Speed (4)		
221 (105) (2)	Low	Low
221 (105) (3)	High	High

(1) - A/C request switch is turned off.
(2) - Approximate vehicle speed/coolant temperature or less.
(3) - Approximate vehicle speed/coolant temperature or more.
(4) - A/C request switch is turned on.

NOTE: Operation of radiator and condenser fans is controlled by vehicle Powertrain Control Module (PCM). Based on vehicle speed, coolant temperature and A/C operation request, PCM will command low, medium or high speed fan operation.

Mirage

1) If only the radiator fan does not operate, check fusible link No. 5 (30-amp) located in engine compartment relay box. If only the condenser fan does not operate, check fusible link No. 2 (100-amp) and dedicated fuse No. 1 (25-amp) located in engine compartment relay box. See WIRING DIAGRAMS. Repair as necessary.

2) If fusible links and dedicated fuse are okay, check appropriate fan relay and/or fan motor for proper operation. See COMPONENT TESTS. See WIRING DIAGRAMS. If fan relay and motor are okay, check PCM. See appropriate G - TESTS W/CODES article in ENGINE PERFORMANCE.

* G - TESTS W/CODES - 1.5L - 1997
* G - TESTS W/CODES - 1.8L - 1997
* G - TESTS W/CODES - 1998

3) To confirm radiator fan or condenser fan operation, see appropriate FAN OPERATING MODE (MIRAGE) table. If fan operation is not as specified, check wiring harness for opens or shorts. Repair as

necessary.

FAN OPERATING MODE (MIRAGE)

Coolant Temp. °F (°C)	Power Circuit Operating RAD/COND	Radiator Fan Speed	Condenser Fan Speed
203 (95) (1) (2)	Off/Off	Off	Off
203-221 (95-105) (1)	On/Off	On	Off
221 (105) (1) (3)	On/On	On	On
All Temp. (4)	On/On	On	On

(1) - A/C request switch is turned off.
(2) - Approximate coolant temperature or less.
(3) - Approximate coolant temperature or more.
(4) - A/C request switch is turned on.

NOTE: Operation of radiator and condenser fans is controlled by vehicle Powertrain Control Module (PCM). Based on vehicle speed, coolant temperature and A/C operation request, PCM will command low, medium or high speed fan operation.

3000GT

1) If neither the radiator fan nor the condenser fan operate, check fusible link No. 5 (40-amp). See WIRING DIAGRAMS. If only the condenser fan does not operate, check dedicated fuse No. 8 (20-amp).

2) If the condenser fan operates in all speeds except low and A/C compressor clutch does not enter the ON state, check for A/C compressor lock controller unit output signal. If the A/C compressor clutch does enter the ON state, check condenser fan low speed relay operation.

3) If the radiator fan and the condenser fan operate in all speeds except high, check PCM. See appropriate G - TESTS W/CODES article in ENGINE PERFORMANCE. If fan operation is not as specified, check wiring harness for opens or shorts. Repair as necessary.

* G - TESTS W/CODES - NON-TURBO - 1997
* G - TESTS W/CODES - TURBO - 1997
* G - TESTS W/CODES - 1998

4) To confirm radiator fan or condenser fan operation, see appropriate FAN OPERATING MODE (3000GT) table. If fan operation is not as specified, check wiring harness for opens or shorts. Repair as necessary.

FAN OPERATING MODE (3000GT)

Coolant Temp. °F (°C)	Power Circuit Operating Low/High	Radiator Fan Speed	Condenser Fan Speed
50 MPH (1) (2)			
203 (95) (2)	Off/Off	Off	Off
203-221 (95-105)	On/Off	Low	Off
221 (105) (3)	On/On	High	High
50 MPH (1) (3)			
221 (105) (2)	Off/Off	Off	Off
221 (105) (3)	On/On	High	High
All Speeds			
221 (105) (2)	On/Off	Low	Low
221 (105) (3)	On/On	High	High

(1) - A/C compressor lock controller output is low (zero volts).
(2) - Approximate vehicle speed/coolant temperature or less.
(3) - Approximate vehicle speed/coolant temperature or more.
(4) - A/C compressor lock controller output is high (12 volts).

WIRING DIAGRAMS

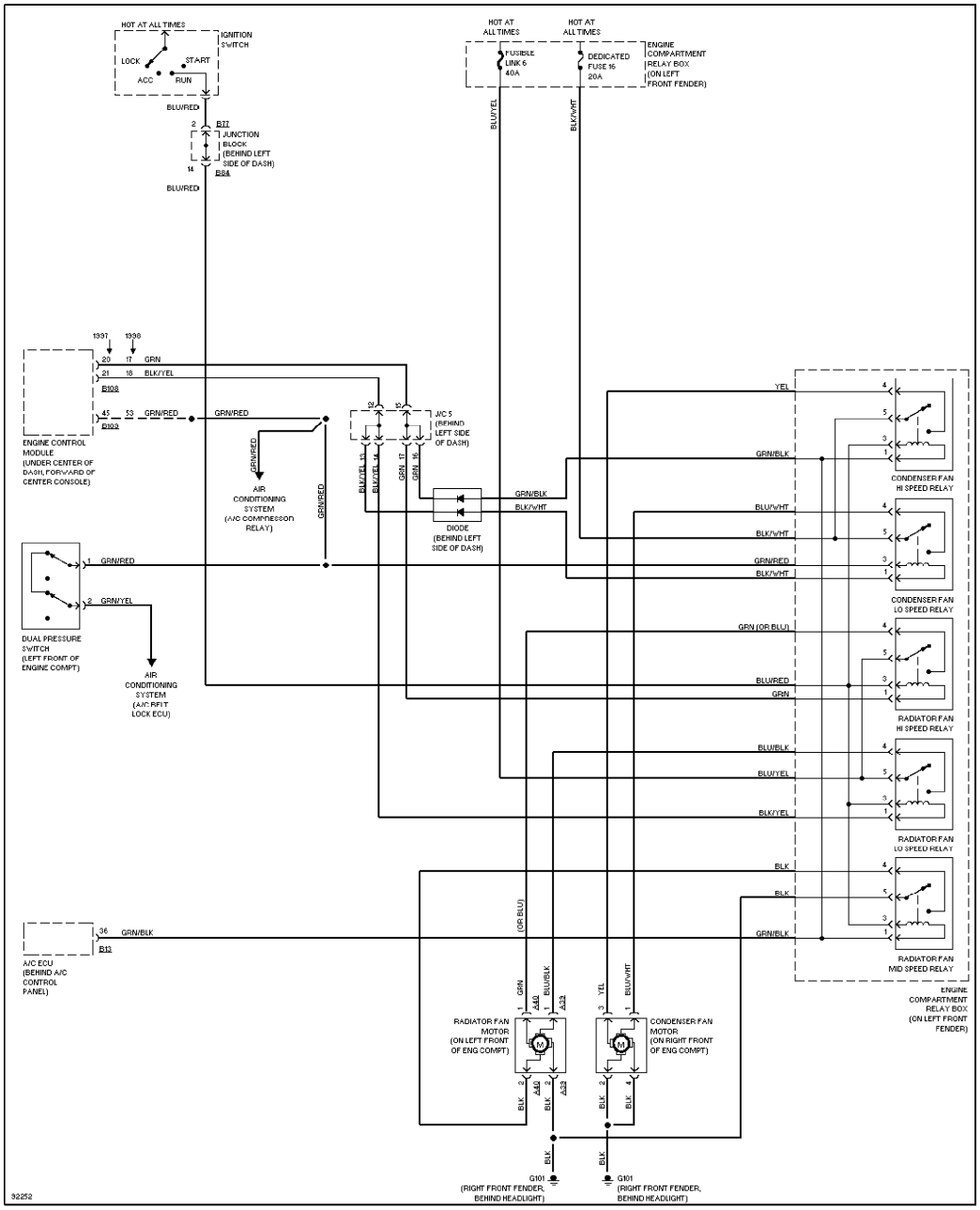


Fig. 10: Wiring Diagram (1997-98 Diamante)

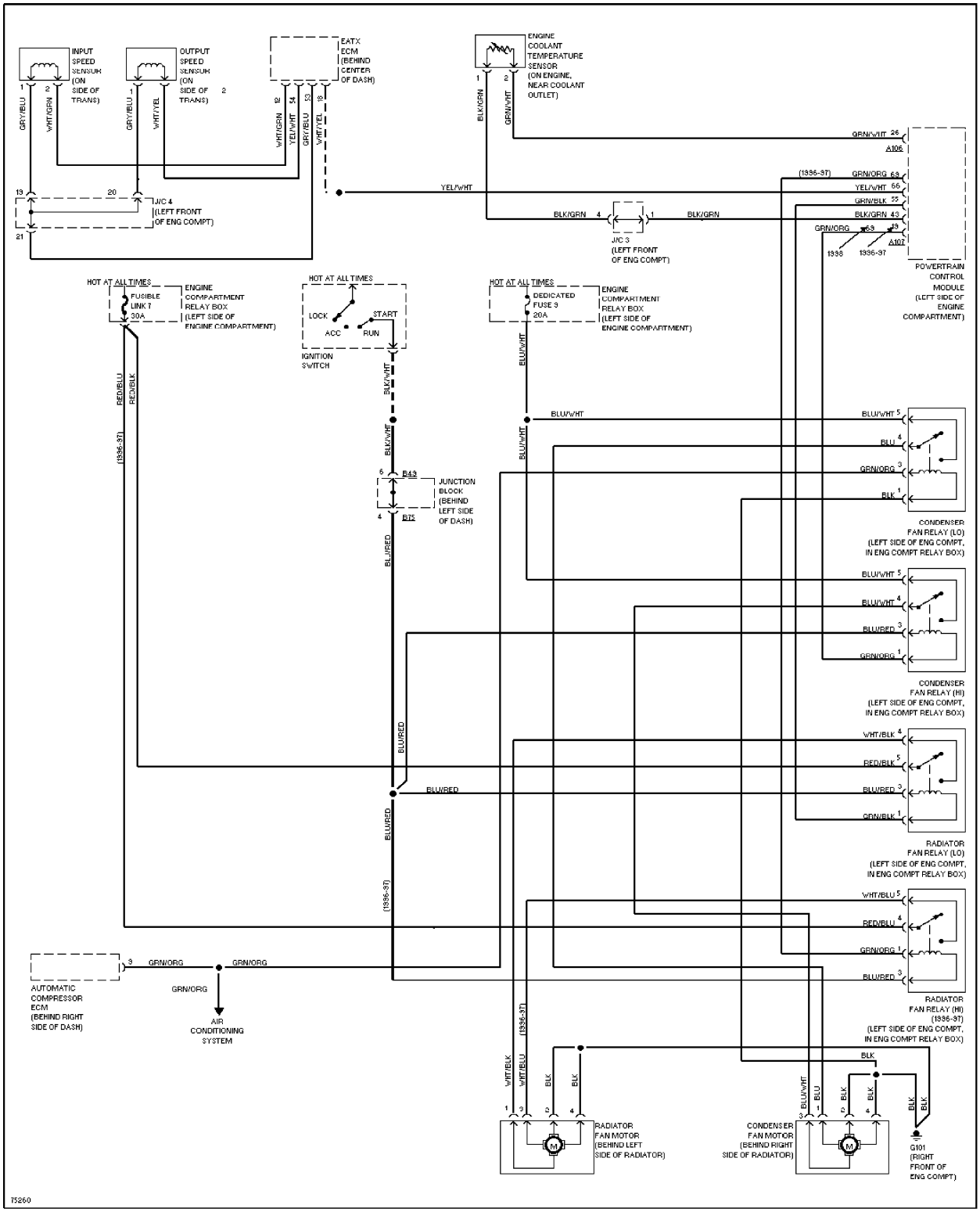


Fig. 11: Wiring Diagram (1997-98 Eclipse - 2.0L A/T)

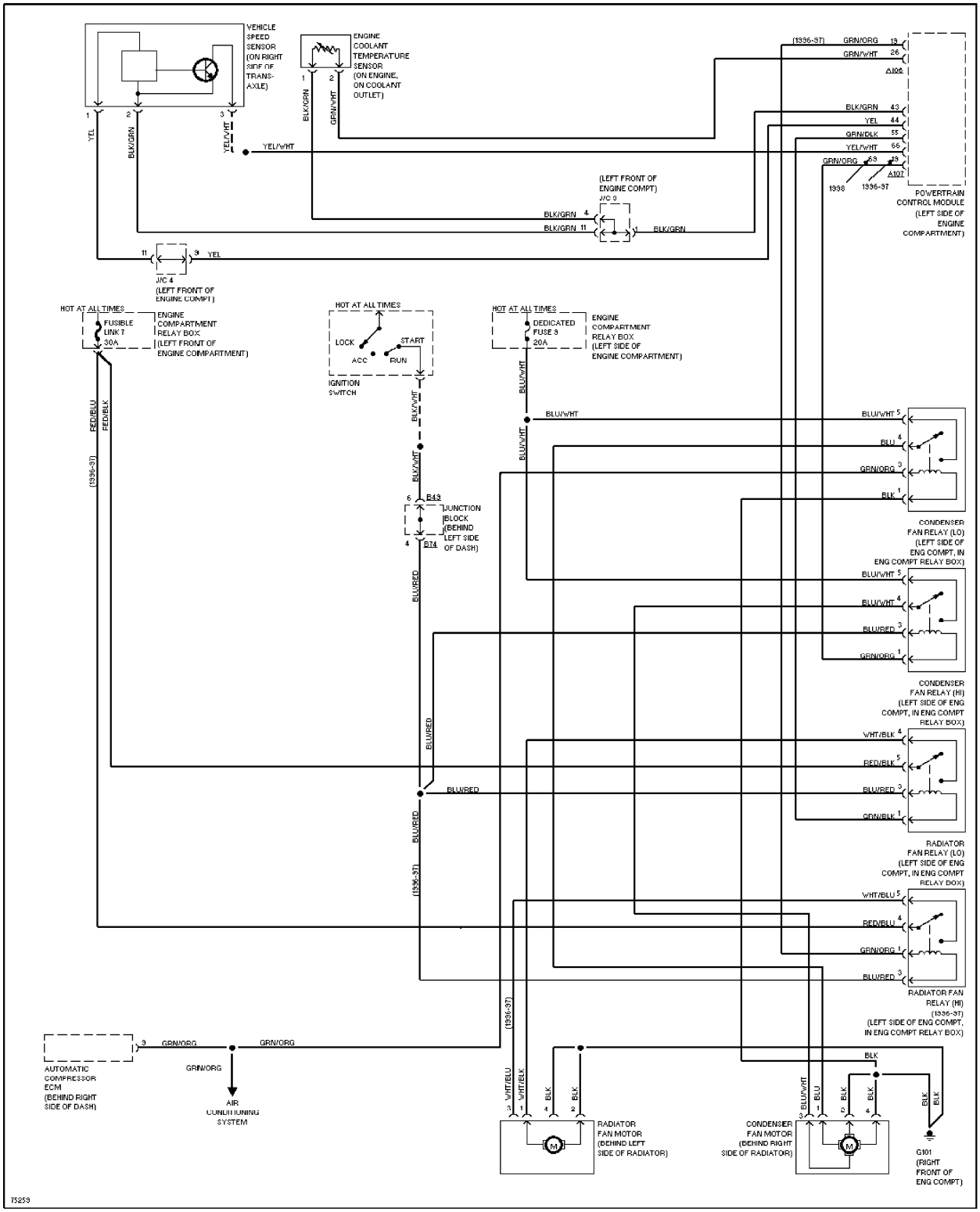


Fig. 12: Wiring Diagram (1997-98 Eclipse - 2.0L M/T)

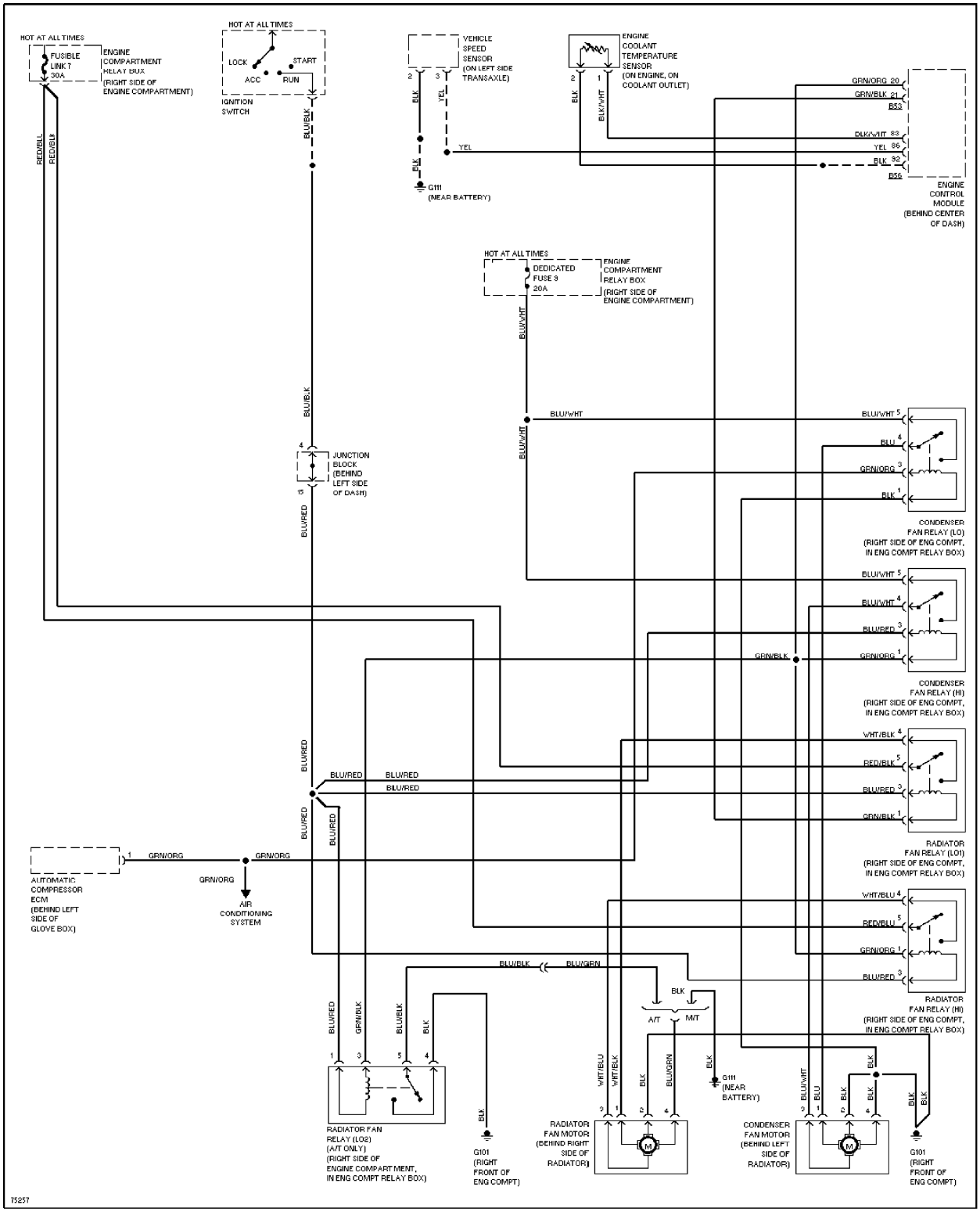


Fig. 13: Wiring Diagram (1997-98 Eclipse - 2.0L Turbo & 2.4L)

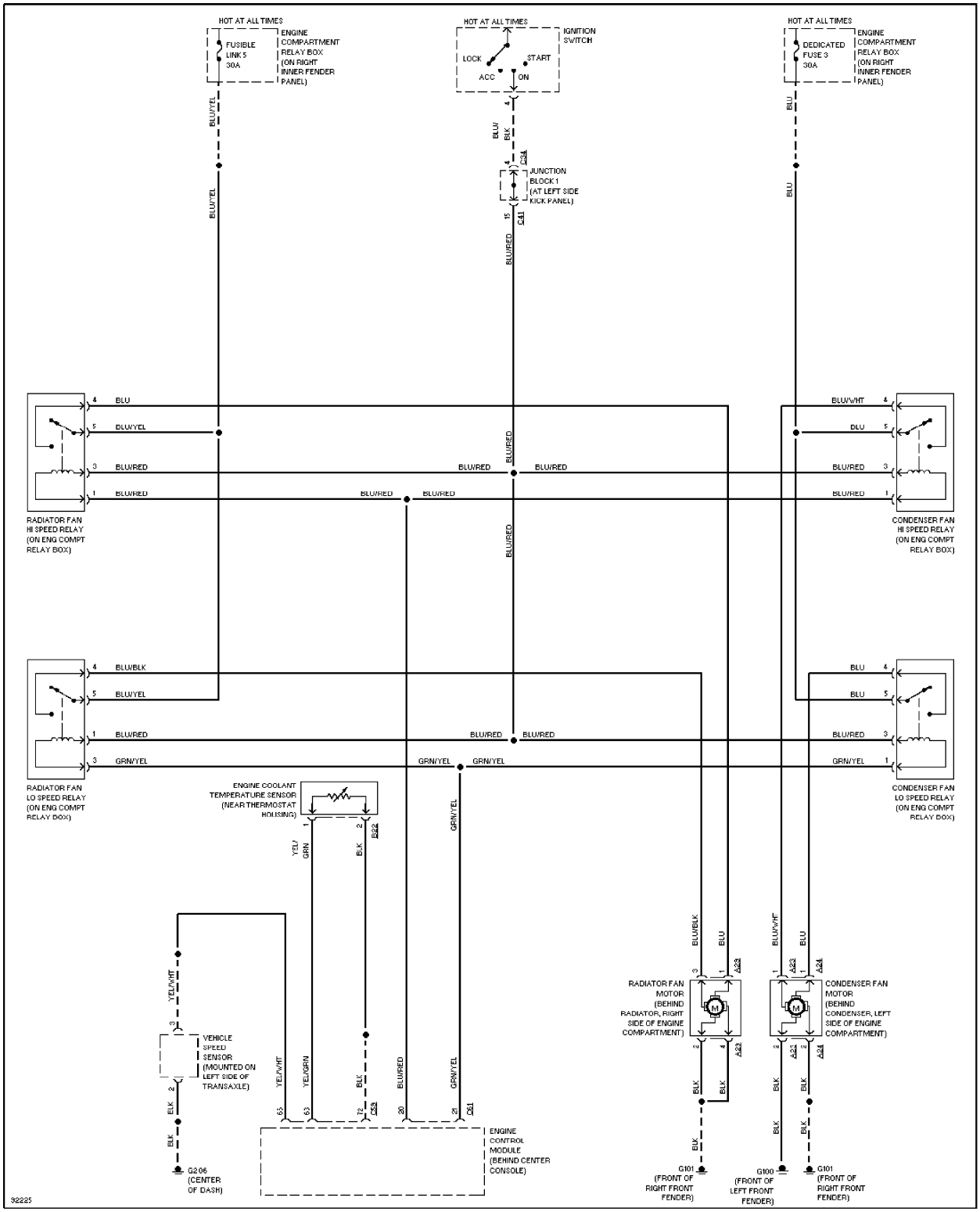


Fig. 14: Wiring Diagram (1997-98 Galant)

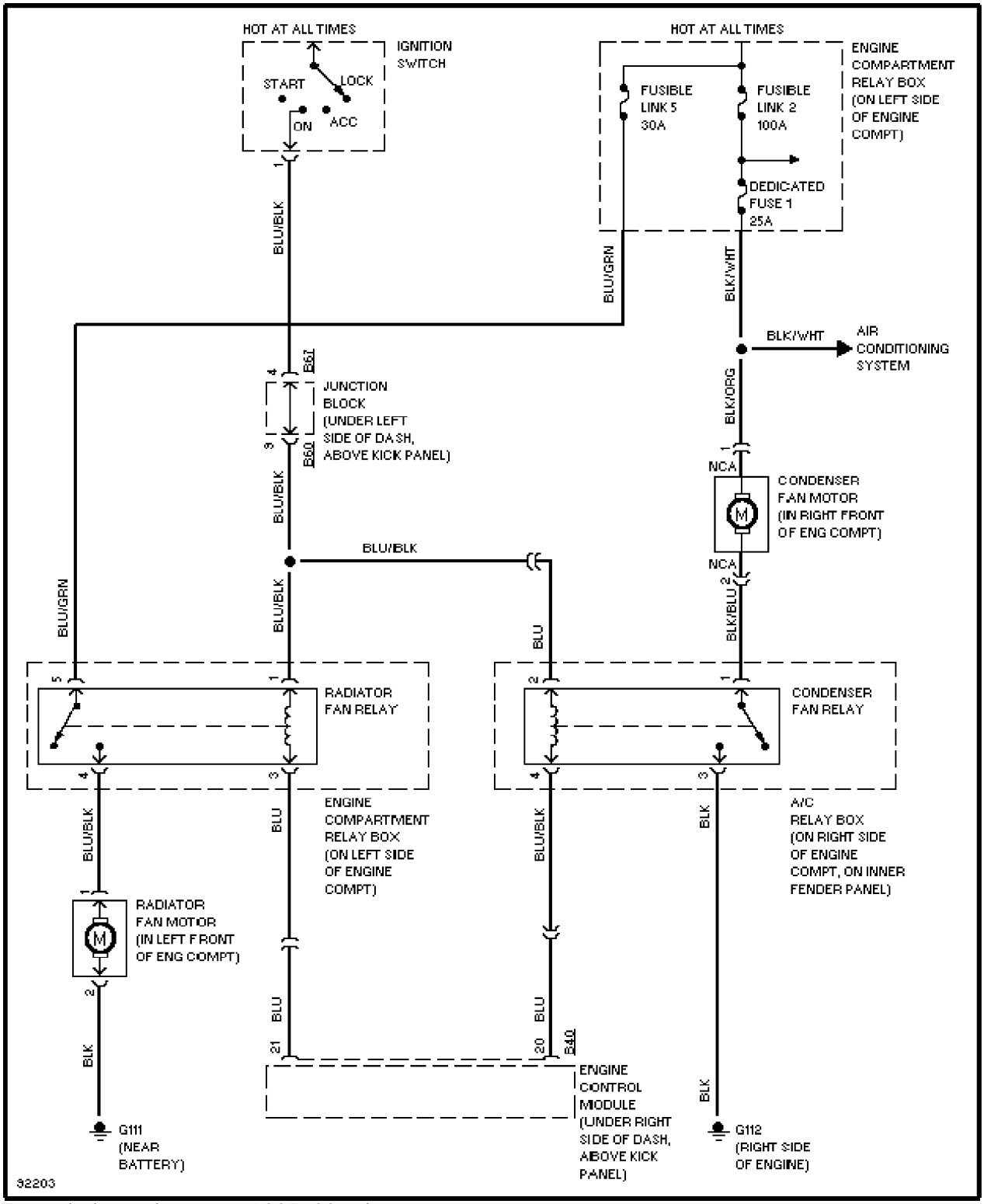


Fig. 15: Wiring Diagram (1997-98 Mirage)

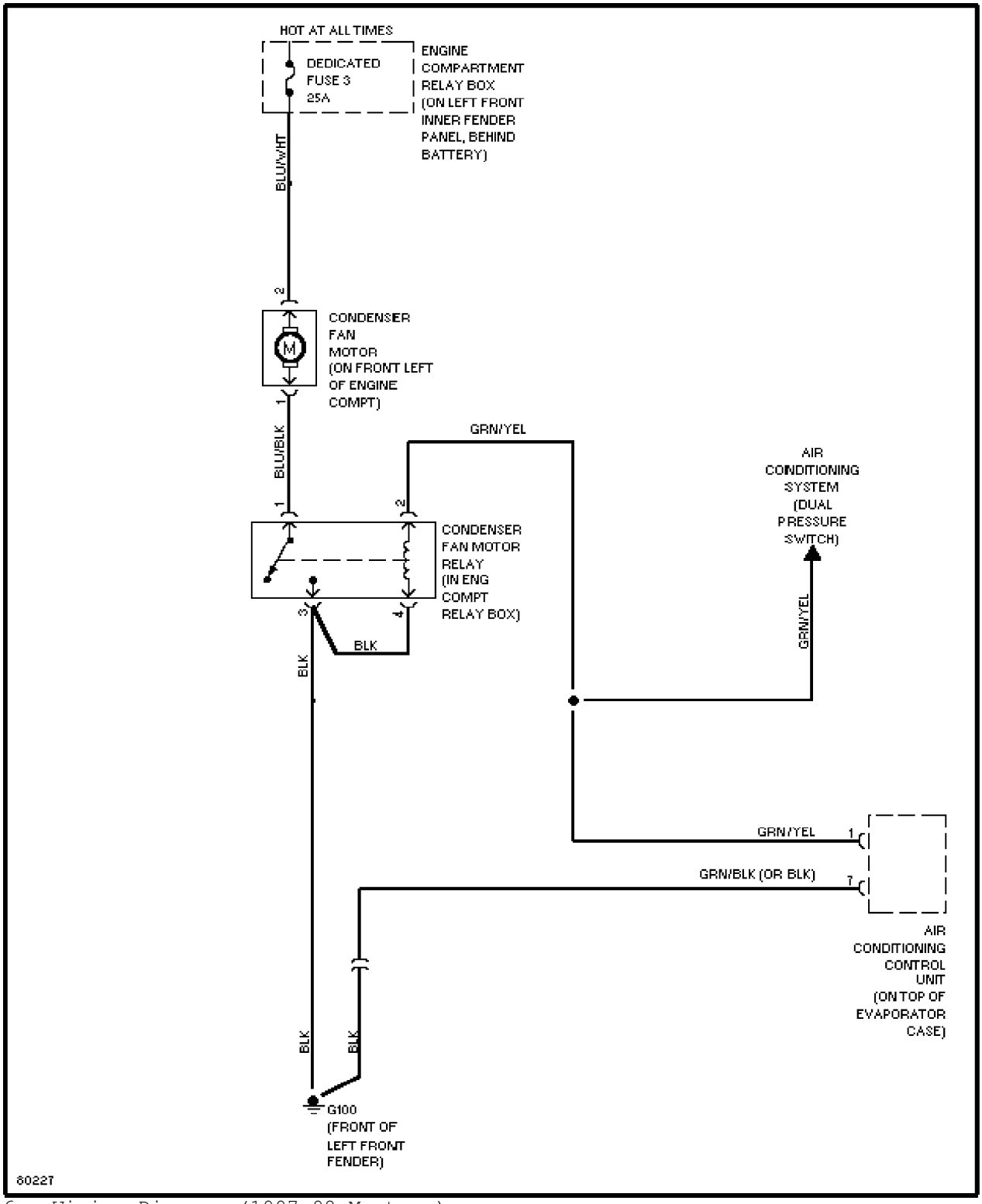


Fig. 16: Wiring Diagram (1997-98 Montero)

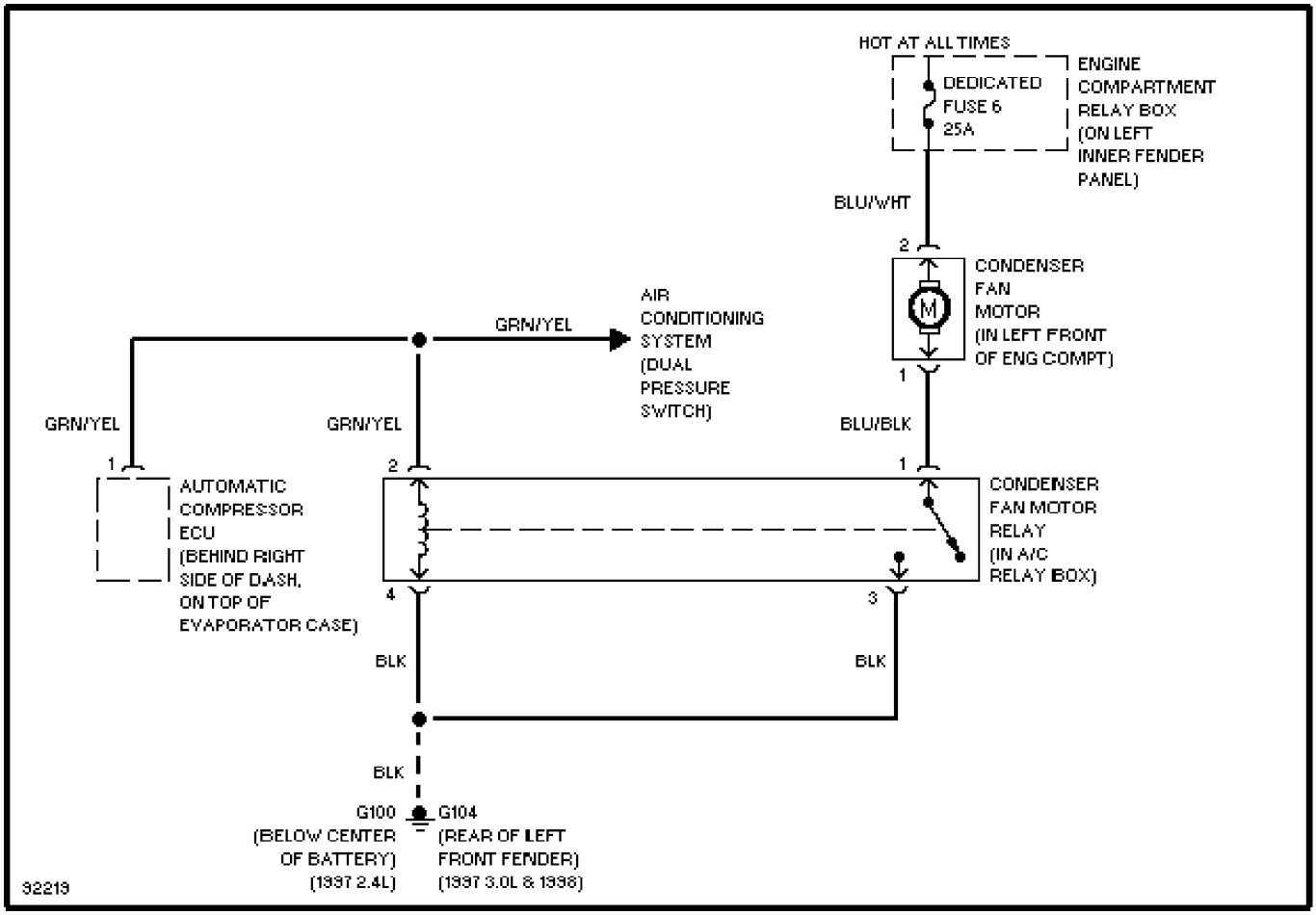


Fig. 17: Wiring Diagram (1997-98 Montero Sport)

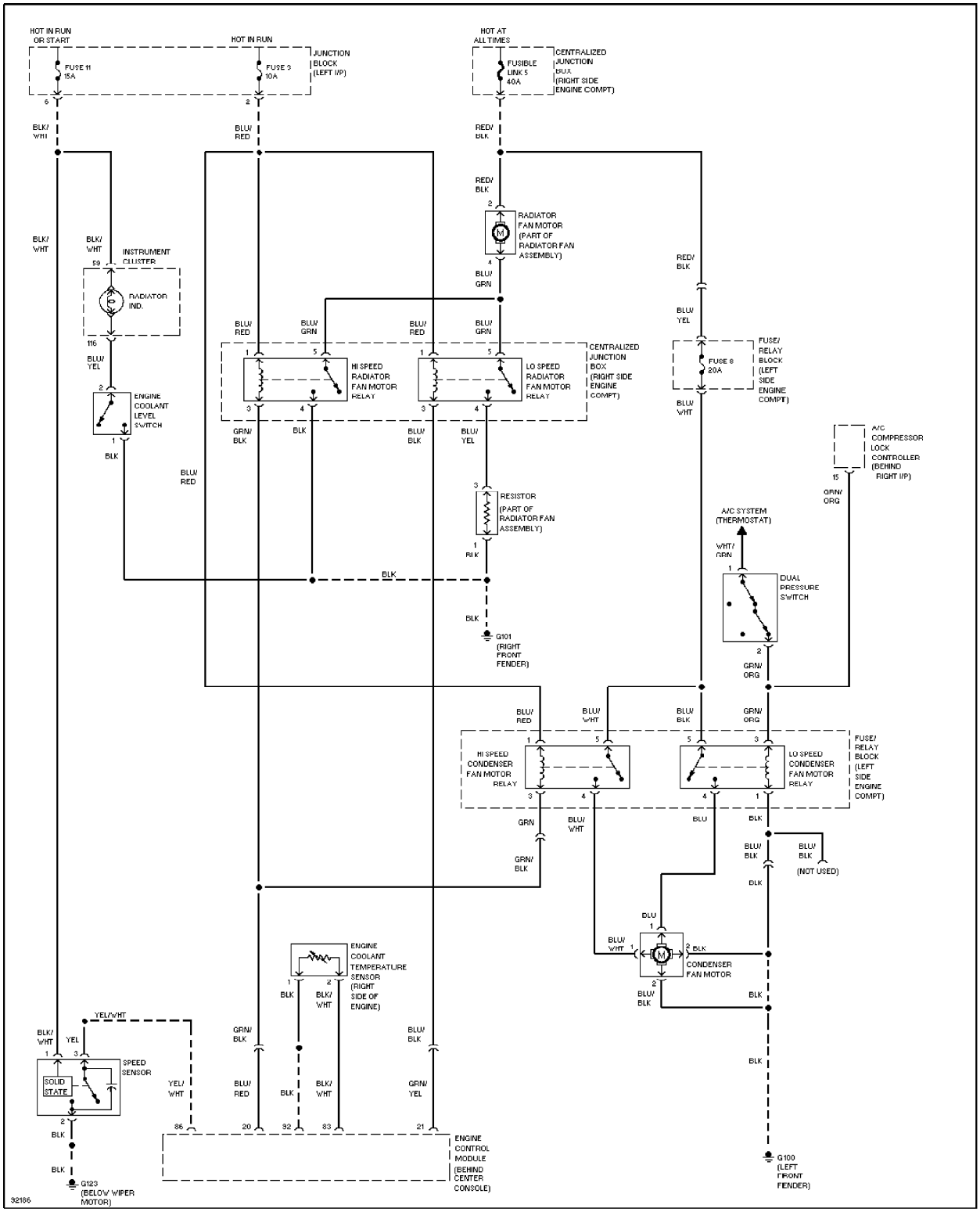


Fig. 18: Wiring Diagram (1997 3000GT)

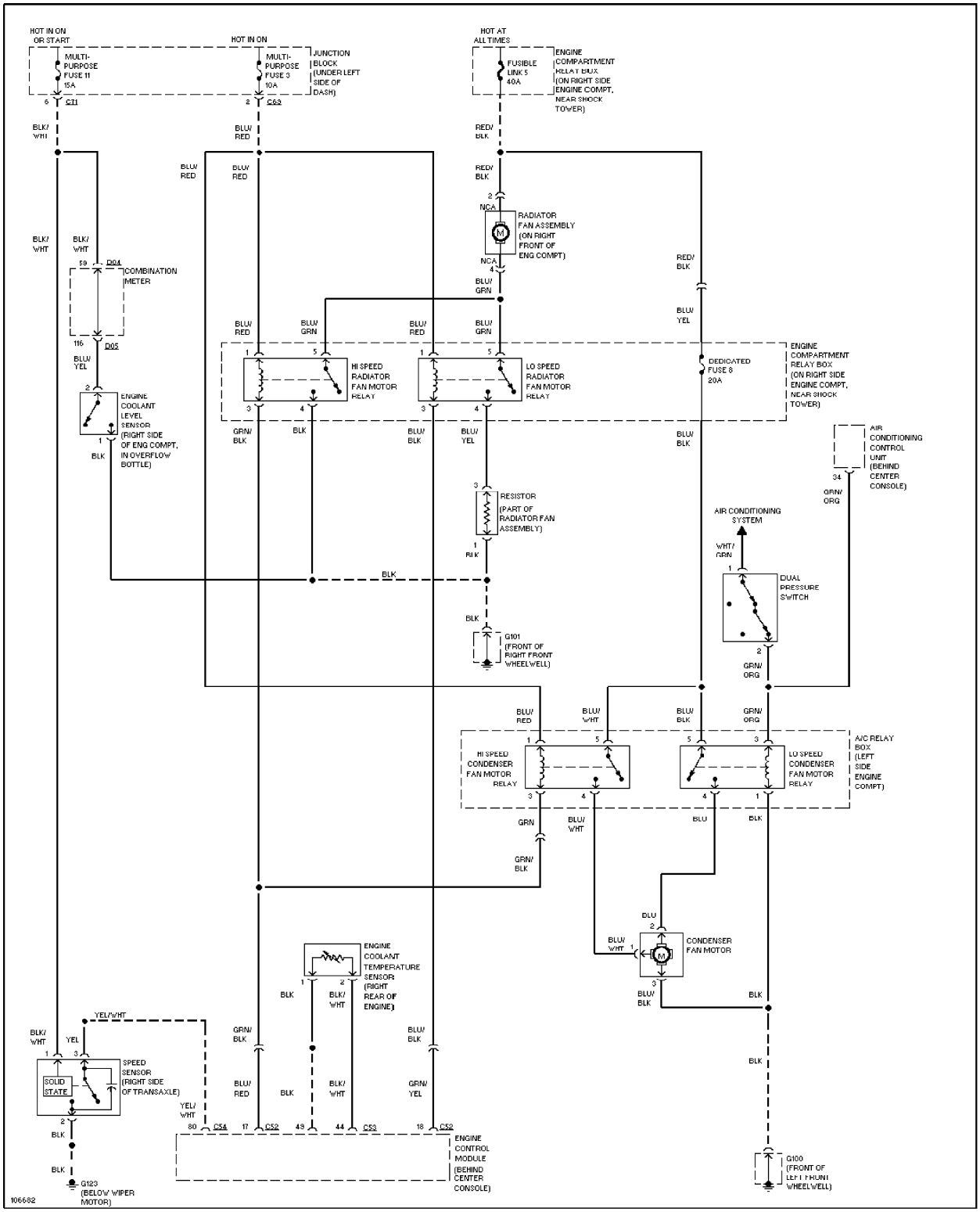


Fig. 19: Wiring Diagram (1998 3000GT)

CRUISE CONTROL SYSTEM

1998 Mitsubishi Galant

1998 ACCESSORIES & EQUIPMENT
Mitsubishi - Cruise Control Systems

Galant & 3000GT

DESCRIPTION & OPERATION

WARNING: Deactivate air bag system before performing any service operation. See AIR BAG RESTRAINT SYSTEMS article. Do not apply electrical power to any component on steering column without first deactivating air bag system. Air bag may deploy.

Cruise control system is electronically controlled and vacuum actuated. System components include an Electronic Control Unit (ECU), vacuum pump, actuator, cruise control switch, cruise control relay (3000GT), cruise indicator light, Park/Neutral (P/N) switch (A/T), clutch pedal position switch (M/T), stoplight switch, throttle position sensor and vehicle speed sensor.

System also has self-diagnostic capability. When self-diagnostic mode is activated, each switch and sensor is checked for faults. If cruise control system has been canceled without using a normal cancel method, a trouble code will be set and stored in the cruise control ECU. Trouble codes can be retrieved to help determine which circuit is malfunctioning.

COMPONENT LOCATIONS

COMPONENT LOCATIONS TABLE

Component	Location
Clutch Pedal Position Switch	On Clutch Pedal Bracket
Cruise Control Actuator	
Galant	On Right Rear Of Engine Compartment
3000GT	On Left Rear Of Engine Compartment
Cruise Control ECU	
Galant	Behind Center Of Dash, Under Radio
3000GT	Behind Right Kick Panel
Cruise Control Relay	
3000GT	Behind Center Of Dash, Forward Of Center Console
Data Link Connector (DLC)	Under Left Side Of Dash, Near Steering Column
Stoplight Switch	On Brake Pedal Bracket
Vacuum Pump	On Right Rear Of Engine Compartment
Vehicle Speed Sensor	On Top Of Transaxle

ADJUSTMENTS

CRUISE CONTROL CABLE

1) Warm engine to normal operating temperature. Ensure idle speed is as specified. See underhood label. Adjust as necessary. Turn engine off. Remove cable protector/cover. Ensure cable is free of harsh bends or kinks. Loosen lock nut at adjusting nut. See Fig. 1.

2) With end of linkage "A" lever held in contact with stopper on linkage "B", adjust cable play using adjusting nut "A" on cruise control cable (top cable) to .04-.08" (1-2 mm). Tighten lock nut.

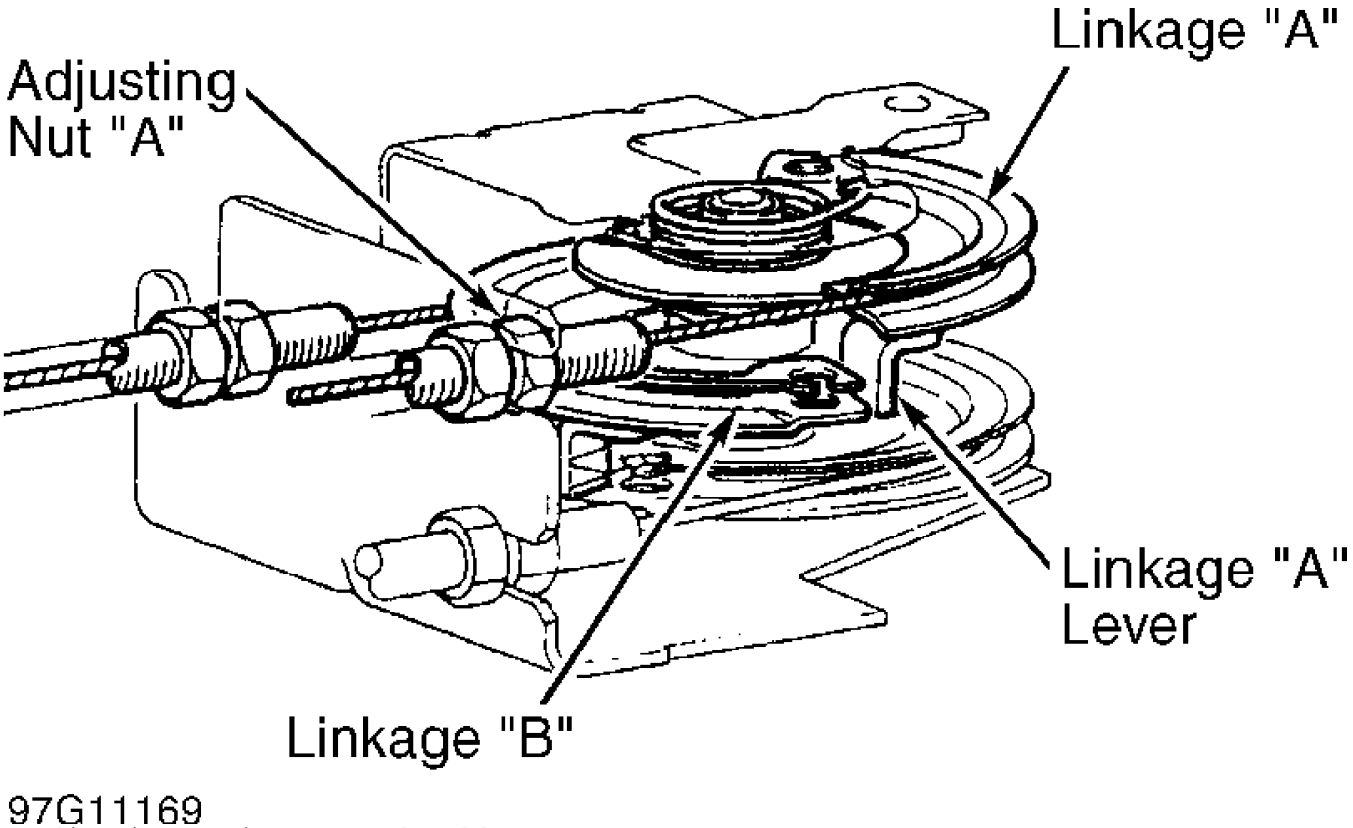


Fig. 1: Adjusting Cruise Control Cable
Courtesy of Mitsubishi Motor Sales of America

TROUBLE SHOOTING

* PLEASE READ THIS FIRST *

NOTE: For further trouble shooting information, see SYMPTOM TESTS.

PRELIMINARY CHECKS

Inspect vacuum pump, linkage assembly, actuator, cables and vacuum hoses. Ensure linkage and cables move smoothly. Ensure cables do not have excessive slack or tension.

CRUISE CONTROL SWITCH FUNCTION TEST

NOTE: Speed will not set beyond cruise control system speed limit of 124 MPH on both models.

NOTE: If vehicle speed decreases about 9 MPH less than the set speed, set speed will be canceled.

1) Cruise control switch is part of multifunction switch mounted on steering column. To operate cruise control system, turn cruise control switch to ON position. Ensure indicator light inside switch comes on.

2) Drive vehicle to about 25 MPH or greater. Press and release SET button. Vehicle speed should stay at set speed. Instrument cluster cruise indicator light should illuminate. To increase set speed, turn cruise control switch to RESUME position and hold until new set speed is reached.

3) To lower set speed, press SET button and hold until new set speed is reached. To return to set speed after cancellation, move RESUME switch to ON position. Vehicle speed should return to previous setting before cancellation. Set speed should cancel when any of the following occurs:

* Brake pedal is depressed.
* Clutch pedal is depressed.
* Cruise control cancel switch is activated.
* Cruise control main switch is turned to OFF position.
* Transmission is shifted to Neutral.

SYMPTOM TESTS

NOTE: To diagnose symptom, see Fig. 2, then go to appropriate test under CIRCUIT TESTS.

Trouble symptom		Circuit Test No.
Communication with scan tool is not possible.	Communication with all systems is not possible.	1
	Communication with auto-cruise control-ECU only is not possible.	2
Input switch inspection using the scan tool is not possible. (However, diagnostic inspection is possible.)		3
Auto-cruise control does not cancel.	When brake pedal is depressed	4
	When clutch pedal is depressed <M/T>	5
	When select lever is set to N range <A/T>	6
	When CANCEL switch is set to ON	7
The diagnosis result displayed on the scan tool is normal even though auto-cruise control cannot be set.		8
Auto-cruise control cannot be set.		9
Hunting (repeated acceleration and deceleration) occurs at the set vehicle speed.		10
When the auto-cruise control main switch is ON, the switch indicator on the instrument panel does not illuminate. (However, auto-cruise control is normal.)		11
Auto-cruise control main switch illumination light does not illuminate.		12
Auto-cruise control indicator light inside combination meter does not illuminate. (However, auto-cruise control is normal.)		13

97J11170

Fig. 2: Symptoms Chart
Courtesy of Mitsubishi Motor Sales of America

CIRCUIT TESTS

NOTE: To identify connector terminals, see WIRING DIAGRAMS.

Test No. 1 (Communication With Scan Tool Not Possible On All Systems)

1) Check voltage between ground and Data Link Connector (DLC) terminal No. 16 (Brown/Red wire on Galant or Red/Black wire on 3000GT). See WIRING DIAGRAMS. See Fig. 6. If battery voltage is present, go to step 3). If battery voltage is not present, go to next step.

2) Check joint connector and junction block between DLC terminal No. 16. See WIRING DIAGRAMS. If connectors are okay, check circuit between power supply and DLC. Repair as necessary.

3) Check continuity between ground and DLC terminals No. 4 (Black wire) and No. 5 (Black wire). See Fig. 6. If continuity is present, replace scan tool and retest. If continuity is not present, check circuit between ground and DLC. See WIRING DIAGRAMS. Repair as necessary.

Test No. 2 (Communication With Scan Tool Not Possible With Cruise Control ECU)

1) To check cruise control main switch circuit malfunction, go to next step. To check cruise control ECU ground circuit malfunction, go to step 4).

2) Check cruise control main switch. See CRUISE CONTROL MAIN SWITCH TEST under COMPONENT TESTS. Replace as necessary. If switch is okay, check voltage between ground and switch harness-side connector terminal No. 1 (Black/White wire) on Galant, or terminal No. 3 (Black/White wire) on 3000GT. See WIRING DIAGRAMS. If battery voltage is present, go to next step. If battery voltage is not present, go to step 6).

3) Check harness connectors to main switch and power supply. Repair as necessary. If connectors are okay, check circuit between cruise control main switch and ground or between cruise control main switch and cruise control ECU. See WIRING DIAGRAMS. Repair as necessary.

4) Disconnect cruise control ECU harness connector. Check continuity between ground and harness-side connector terminals No. 6, 8 and 14. See WIRING DIAGRAMS. If continuity is present, go to next step. If continuity is not present, go to step 6).

5) Check cruise control ECU harness connector. Repair as necessary. If connector is okay, replace cruise control ECU.

6) Check joint connector between ECU and ground. Repair as necessary. If connector is okay, check circuit between cruise control main switch and power supply. Repair as necessary.

WARNING: Deactivate air bag system before performing any service operation. See AIR BAG RESTRAINT SYSTEMS article. Do not apply electrical power to any component on steering column without first deactivating air bag system. Air bag may deploy.

Test No. 3 (Input Switch Inspection With Scan Tool Not Possible; Diagnostic Inspection Is Possible)

1) Check cruise control multifunction switch. See CRUISE CONTROL MULTIFUNCTION SWITCH TEST under COMPONENT TESTS. Replace switch as necessary. If switch is okay, go to next step.

2) Check clockspring. See CLOCKSPRING TEST under COMPONENT TESTS. Replace clockspring as necessary. If clockspring is okay, go to next step.

3) Disconnect clockspring harness connector. Check voltage between ground and harness-side of connector terminal No. 2 (Blue wire). If battery voltage is present, go to next step. If battery voltage is not present, go to step 5).

4) Check harness connector to clockspring and cruise control ECU. See WIRING DIAGRAMS. Repair as necessary. If connectors are okay, check circuit between clockspring and cruise control ECU. Repair as necessary.

5) Check harness connector to clockspring, junction block connectors to power supply, and harness connector between clockspring and power supply. Repair as necessary. If connectors are okay, check circuit between clockspring and power supply. See WIRING DIAGRAMS. Repair as necessary.

Test No. 4 (Cruise Control Does Not Cancel With Brake Pedal Depressed)

1) Check if stoplights operate/illuminate. If stoplights illuminate, replace cruise control ECU. If stoplights do not illuminate, go to next step.

2) Check stoplight switch. See STOPLIGHT SWITCH TEST under COMPONENT TESTS. Replace stoplight switch if faulty. If switch is okay, go to next step.

3) Disconnect stoplight switch harness connector. Check voltage between ground and stoplight switch harness-side connector terminal No. 2 (Green/Black wire on Galant or Red/Black wire on 3000GT). If battery voltage is present, go to next step. If battery voltage is not present, go to step 5).

4) Check joint connectors and cruise control ECU harness connector. See WIRING DIAGRAMS. Repair as necessary. If connectors are okay, check circuit between stoplight switch and cruise control ECU. Repair as necessary.

5) Check stoplight switch harness connector or joint connector between power supply and stoplight switch. See WIRING DIAGRAMS. Repair as necessary. If connectors are okay, check circuit between stoplight switch and power supply. Repair as necessary.

Test No. 5 (Cruise Control Does Not Cancel With Clutch Depressed)

1) Check clutch pedal position switch. See CLUTCH PEDAL POSITION SWITCH TEST under COMPONENT TESTS. Replace switch if faulty. If clutch pedal position switch is okay, go to next step.

2) Disconnect clutch pedal position switch. Check voltage between ground and clutch pedal position switch harness-side connector terminal No. 2 (Green/Black wire on Galant or Black/Yellow wire on 3000GT). If battery voltage is present, go to next step. If battery voltage is not present, go to step 4).

3) Check harness connectors to clutch pedal position switch and ground circuit. Repair as necessary. If connectors are okay, check circuit between clutch pedal position switch and ground. See WIRING DIAGRAMS. Repair as necessary. If circuit is okay, replace cruise control ECU.

4) Check cruise control harness connector. Repair as necessary. If connector is okay, check circuit between clutch pedal position switch and cruise control ECU. See WIRING DIAGRAMS. Repair as necessary.

Test No. 6 (Cruise Control Does Not Cancel With A/T Select Lever In "N")

1) Check park/neutral switch. See PARK/NEUTRAL SWITCH TEST under COMPONENT TESTS. Replace as necessary. If switch is okay, go to next step.

2) Check voltage between ground and park/neutral switch harness-side connector terminal No. 5 (Galant) or terminal No. 7 (3000GT). See WIRING DIAGRAMS. If battery voltage is present, go to next step. If battery voltage is not present, go to step 4).

3) Check park/neutral switch harness connector. Repair as necessary. If connector is okay, check circuit between park/neutral switch and ground. See WIRING DIAGRAMS. Repair as necessary. If circuit is okay, replace cruise control ECU.

4) Check starter relay. See STARTERS article in the STARTING & CHARGING SYSTEMS section. Replace as necessary. If relay is okay, check harness connectors to cruise control ECU, cruise control vacuum pump to cruise control ECU, and starter relay. See WIRING DIAGRAMS. Repair as necessary. If connectors are okay, check circuit between park/neutral switch and cruise control ECU. Repair as necessary.

Test No. 7 (Cruise Control Does Not Cancel Using CANCEL Switch)

Replace cruise control multifunction switch.

Test No. 8 (Scan Tool Diagnostic Result Is Normal But Cruise Control Cannot Be Set)

1) Disconnect cruise control ECU harness connector. Check voltage between ground and cruise control ECU harness connector terminal No. 16 (Red/Black wire). If battery voltage is present, go to next step. If battery voltage is not present, go to step 3).

2) Check cruise control ECU harness connector. Repair as necessary. If connector is okay, replace cruise control ECU.

3) Check harness connector to body harness junction block between power supply, cruise control ECU and main switch. See WIRING DIAGRAMS. Repair as necessary. If connectors are okay, check circuit between cruise control ECU and power supply. Repair as necessary.

Test No. 9 (Cruise Control Cannot Be Set)

1) Check if scan tool can communicate with cruise control system. If communication is not possible, go to TEST NO. 2. If communication is possible, go to next step for Galant or step 6) for 3000GT.

2) Check if system diagnosis displayed on scan tool is normal. If system diagnosis is not normal, go to TEST NO. 8. If system diagnosis is normal, go to next step.

3) Check if trouble code 11, 12, 15, 16 or 17 is present. If code(s) are present, go to appropriate trouble code diagnosis. See SELF-DIAGNOSTIC SYSTEM. If codes(s) are not present, go to next step.

4) Check if input switch inspection is possible using scan tool. If input switch inspection is not possible, go to TEST NO. 3. If input switch inspection is possible, go to next step.

5) Check if trouble code 23 or 26 is present. If code 23 is present, go to TEST NO. 14. If code 26 is present, go to TEST NO. 15. If trouble code(s) are not present, replace cruise control ECU.

6) Check if input switch inspection is possible using scan tool. If input switch inspection is possible, go to next step. If input switch inspection is not possible, go to TEST NO. 3.

7) Check if code 21, 22 or 27 is present. If any of these code(s) are present, replace cruise control ECU. If code 21, 22 or 27 is not present, go to next step.

8) Check if input switch code 23 or 26 is present. If code(s) are present, go to next step. If code(s) are not present, replace cruise control ECU.

9) If code 23 is present, go to TEST NO. 14. If code 26 is present, go to TEST NO. 15.

Test No. 10 (Hunting Occurs At Set Vehicle Speed)

1) Check vehicle speed sensor. See VEHICLE SPEED SENSOR TEST under COMPONENT TESTS. Replace as necessary. If sensor is okay, go to next step.

2) Check cruise control vacuum pump. See VACUUM PUMP TEST

under COMPONENT TESTS. Replace as necessary. If cruise control pump is okay, check actuator. See ACTUATOR TEST under COMPONENT TESTS. Replace as necessary. If actuator is okay, replace cruise control ECU.

Test No. 11 (Cruise Control Indicator On Instrument Panel Does Not Illuminate; Cruise Control Is Normal)
Replace cruise control main switch.

Test No. 12 (Cruise Control Main Switch Indicator Light Does Not Illuminate)
1) Check cruise control main switch. See CRUISE CONTROL MAIN SWITCH TEST under COMPONENT TESTS. Replace as necessary. If switch is okay, go to next step.
2) Check voltage between ground and harness-side of cruise control main switch connector terminal No. 2 (Green/White wire). If battery voltage is present, go to next step. If battery voltage is not present, go to step 4).
3) Check harness connector to cruise control main switch. Repair as necessary. If connector is okay, check circuit between cruise control main switch and rheostat.
4) Check harness connectors to power supply. See WIRING DIAGRAMS. Repair as necessary. If connectors are okay, check circuit between cruise control main switch and power supply.

Test No. 13 (Cruise Control Indicator In Combination Meter Does Not Illuminate; Cruise Control Is Normal)
1) Remove combination meter. See COMBINATION METER/INSTRUMENT CLUSTER under REMOVAL & INSTALLATION. On Galant, check continuity between combination meter terminals No. 24 and 33. On 3000GT, check continuity between combination meter terminals No. 57 and 59. See WIRING DIAGRAMS. On all models, if continuity is not present, replace cruise control indicator. If continuity is present, go to next step.
2) Ground cruise control ECU harness-side connector terminal No. 23 (Light Green/Red wire). If cruise control indicator illuminates, replace cruise control ECU. If cruise control indicator does not illuminate, go to next step.
3) Check harness connector to combination meter, instrument panel-to-body wiring and cruise control ECU. See WIRING DIAGRAMS. Repair as necessary. If connectors are okay, check circuit between combination meter and cruise control ECU. Repair as necessary.

Test No. 14 (Stoplight Switch Input Circuit Check)
1) Check stoplight switch. See STOPLIGHT SWITCH TEST under COMPONENT TESTS. Replace as necessary. If stoplight switch is okay, go to next step.
2) Check harness connector to cruise control ECU and power supply. Repair as necessary. If connectors are okay, check circuit between jumper connector and cruise control ECU. Repair as necessary.

Test No. 15 (Clutch Pedal Position Switch Or P/N Switch)
1) For A/T models, go to next step. For M/T models, check clutch pedal position switch. See CLUTCH PEDAL POSITION SWITCH TEST under COMPONENT TESTS. Replace as necessary. If switch is okay, check circuit between clutch pedal position switch and cruise control ECU. See WIRING DIAGRAMS. Repair as necessary.
2) Check Park/Neutral (P/N) switch. See PARK/NEUTRAL SWITCH TEST under COMPONENT TESTS. Replace as necessary. If switch is okay, check starter relay. See STARTERS article in the STARTING & CHARGING SYSTEMS section. Replace as necessary. If relay is okay, check harness connector to starter relay. Repair as necessary. If connector is okay, check circuit between cruise control ECU and power supply. Repair as necessary.

COMPONENT TESTS

ACTUATOR TEST

Remove actuator. Apply vacuum to actuator. Actuator linkage holder should move greater than 1.4" (35 mm). Actuator diaphragm should hold vacuum.

CLUTCH PEDAL POSITION SWITCH TEST

Disconnect clutch pedal position switch connector. Continuity should be present between clutch pedal position switch terminals when clutch pedal is depressed. If continuity is not present, replace clutch switch.

CRUISE CONTROL MAIN SWITCH TEST

Disconnect cruise control main switch harness connector. Remove main switch from instrument panel. Check continuity between specified switch terminals. See MAIN SWITCH TEST table. Replace as necessary.

MAIN SWITCH TEST TABLE

Application & Terminal No.	Condition
Galant	
OFF Position	
2 & 7	Continuity
NEUTRAL Position	
2 & 7	Continuity
4 & 5	Continuity
ON Position	
1 & 4	Continuity
1 & 5	Continuity
2 & 7	Continuity
3000GT	
OFF Position	
2 & 6	Continuity
NEUTRAL Position	
1 & 4	Continuity
2 & 6	Continuity
ON Position	
1 & 3	Continuity
1 & 4	Continuity
2 & 6	Continuity

CRUISE CONTROL MULTIFUNCTION SWITCH TEST

Disconnect cruise control multifunction switch harness connector. Check continuity or resistance between switch terminals No. 1 and 2. See MULTIFUNCTION SWITCH TEST table. Replace as necessary.

MULTIFUNCTION SWITCH TEST TABLE

Switch Position	Condition
OFF	No Continuity
CANCEL (Switch On)	Zero Ohms

RESUME (Switch On)	820 Ohms
SET (Switch On)	2700 Ohms

CRUISE CONTROL RELAY TEST

3000GT

1) Remove cruise control relay. Relay is located on firewall, mounted on cruise control linkage protector/cover. Using a jumper wire, connect battery voltage to relay terminal No. 2 and ground terminal No. 4. Continuity should be present between relay terminals No. 1 and 3. See WIRING DIAGRAMS.

2) Remove power supply to relay. Check continuity between relay terminals No. 2 and 4. Continuity should be present. Check continuity between relay terminals No. 1 and 3. Continuity should not be present. Replace relay as necessary.

PARK/NEUTRAL SWITCH TEST

Disconnect Park/Neutral (P/N) switch harness connector. On Galant, continuity should exist between connector terminals No. 5 (Black/Red wire on models with theft alarm, or Black/Yellow wire on models without theft alarm) and No. 8 (Black/Blue wire). On 3000GT, continuity should exist between connector terminals No. 7 (Black/Red wire) and No. 8 (Black/Yellow wire) when shift lever is in "N" position. If continuity is not as specified, replace switch.

STOPLIGHT SWITCH TEST

Disconnect switch harness connector. When brake pedal is depressed, continuity should exist between terminals No. 2 and 3. See WIRING DIAGRAMS. When brake pedal is released, continuity should exist between terminals No. 1 and 4. If continuity is not as specified, replace stoplight switch.

THROTTLE POSITION SENSOR TEST

1) Disconnect throttle position sensor harness connector. Check resistance between sensor terminals No. 1 and 4. See WIRING DIAGRAMS. Resistance should be 3.5-6.5 ohms.

2) Connect an analog ohmmeter between sensor terminals No. 2 and 4. Operate throttle valve slowly from idle to wide open throttle. Resistance should change smoothly as throttle is opened and closed. Replace throttle position sensor as necessary.

VACUUM PUMP TEST

Galant

1) Disconnect vacuum hose from vacuum pump. Connect a vacuum gauge to vacuum pump. Disconnect vacuum pump harness connector.

2) Using jumper wires, connect battery voltage to pump harness connector terminal No. 1 and connect terminals No. 3 and 4 to ground. Connect another jumper between ground and terminal No. 2. Vacuum pump should start and vacuum gauge should read about 15.7 in. Hg.

3) Disconnect jumper wire from vacuum pump terminals No. 2 and 3. Vacuum gauge should read 6 in. Hg or less. If vacuum pump does not operate or vacuum readings are not as specified, replace vacuum pump.

3000GT

1) Disconnect vacuum pump harness connector. Check resistance

between vacuum pump connector terminals No. 1 and 2 and terminals No. 1 and 3. Resistance should be 50-60 ohms.

2) Using a jumper wire, apply battery voltage to vacuum pump connectors No. 1 and 2 and terminals No. 1 and 3. If vacuum pump solenoids are activated, go to next step. If solenoids are not activated, replace vacuum pump.

3) Using jumper wires, apply battery voltage to pump terminals No. 1 and 4. Vacuum pump should operate. If pump does not operate, replace vacuum pump.

VEHICLE SPEED SENSOR TEST

1) Remove vehicle speed sensor from transaxle. Jumper a 3000-10,000 ohm resistor between sensor terminals No. 1 and 3. Connect battery positive to sensor terminal No. 1 and battery negative to sensor terminal No. 2. See Fig. 3.

2) Connect a voltmeter between sensor terminals No. 2 and 3. Manually turn speed sensor shaft. Voltage should pulse 4 times each revolution. Replace vehicle speed sensor if voltage is not as specified.

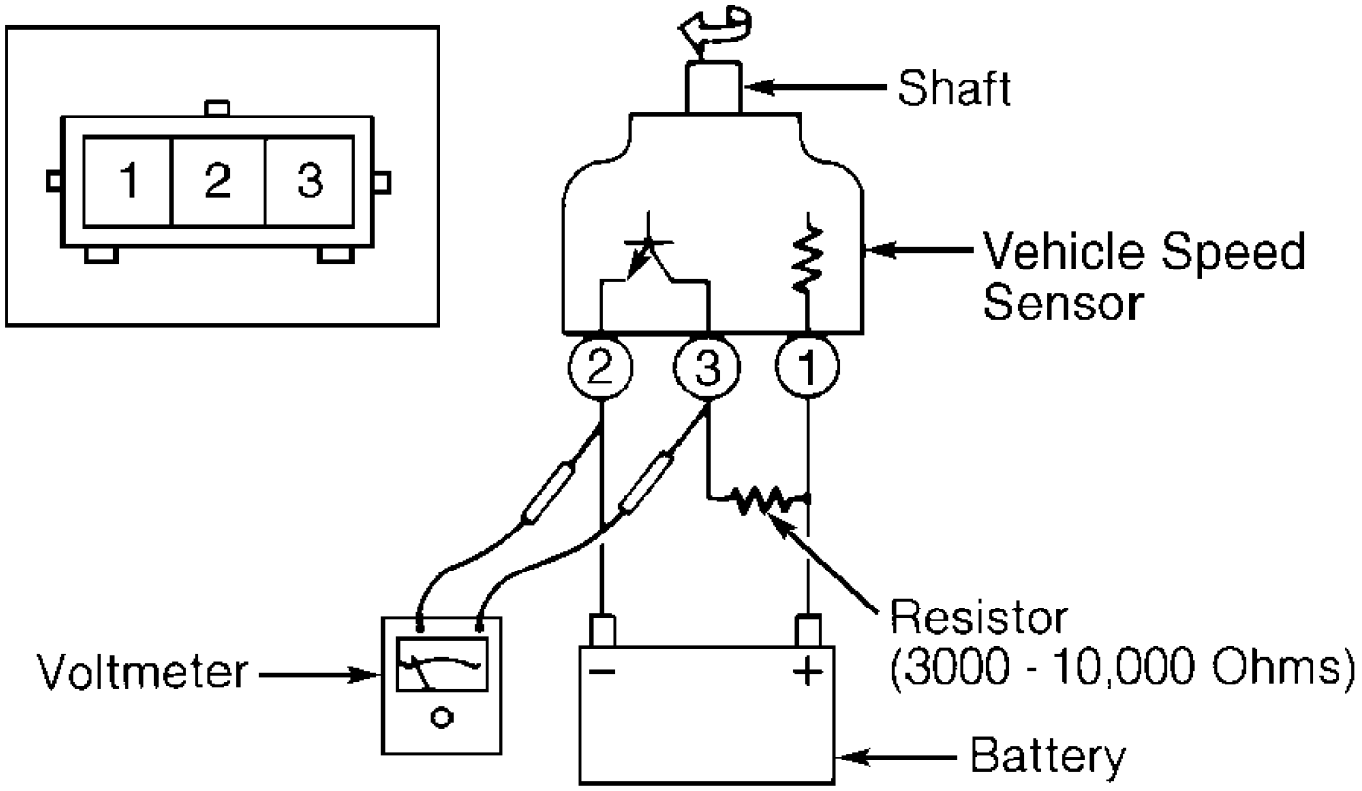


Fig. 3: Checking Vehicle Speed Sensor
Courtesy of Mitsubishi Motor Sales of America

CLOCKSPRING TEST

WARNING: Deactivate air bag system before performing any service operation. See AIR BAG RESTRAINT SYSTEMS article. Do not apply electrical power to any component on steering column without first deactivating air bag system. Air bag may deploy.

If clockspring fails any check, replace with a NEW clockspring.

1) Check connectors and protective tube for damage and deformities.
2) Visually check case for damage or deformities.
3) Continuity should be present between:

* Connector No. 1, terminal No. 1 and connector No. 4, terminal No. 2.
* Connector No. 1, terminal No. 2 and connector No. 4, terminal No. 1.
* Connector No. 1, terminal No. 3 and connector No. 3. See Fig. 4.

4) Align paint mark on SRS connector No. 4 with notch in clockspring connector No. 2 and join connectors. See Fig. 5. Using a DVOM, check for continuity between terminals No. 22 and 23 at SRS Test Harness (MB991613) connector No. 5.

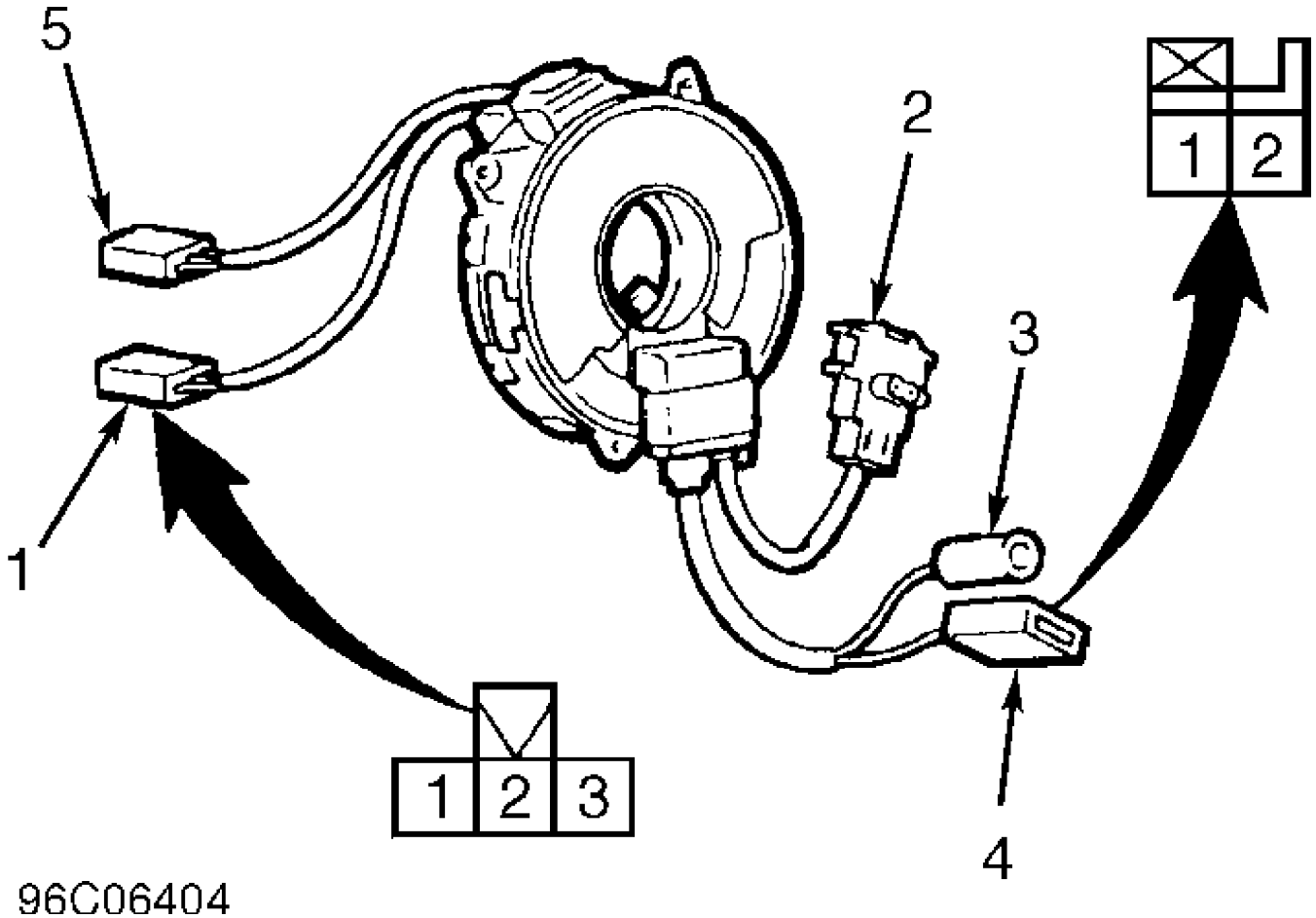


Fig. 4: Identifying Clockspring Connectors
Courtesy of Mitsubishi Motor Sales of America

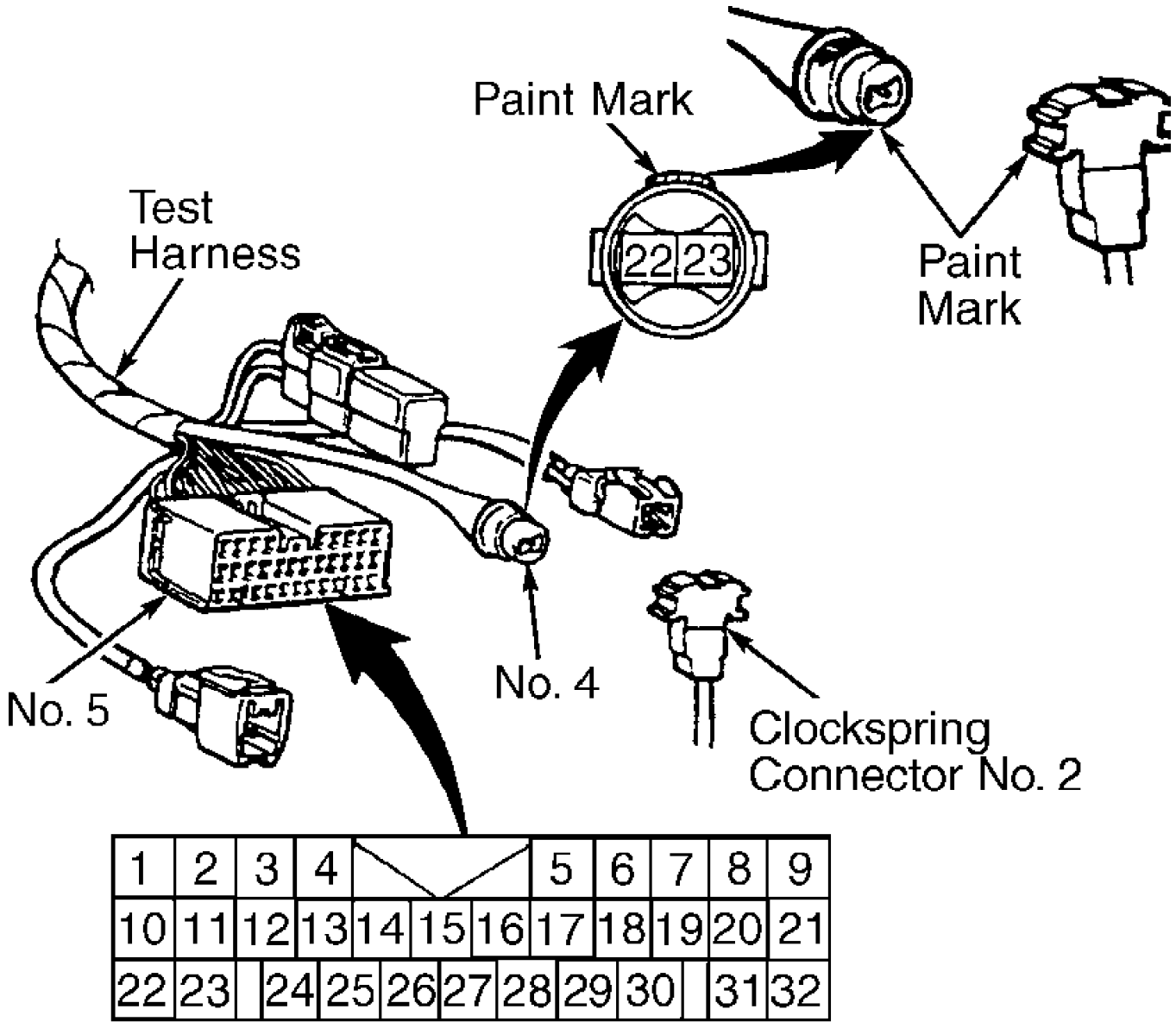


Fig. 5: Identifying SRS Harness Connectors
Courtesy of Mitsubishi Motor Sales of America

SELF-DIAGNOSTIC SYSTEM

SELF-DIAGNOSTICS

NOTE: Self-diagnostics should be performed when cruise control cancels without driver using normal cancel modes.

RETRIEVING TROUBLE CODES

1) Use scan tool or an analog voltmeter for code retrieval. Turn ignition off. Install scan tool. Turn ignition and cruise control main switch on. Read trouble codes. See

DIAGNOSTIC TROUBLE CODE (DTC) IDENTIFICATION table. In order to diagnose trouble code(s), go to DIAGNOSTIC TESTS.

2) If using an analog voltmeter, connect Diagnostic Trouble Code Check Harness (MB991529) leads between DLC terminals No. 4 or 5 (ground) and No. 13 (output). See Fig. 6. Connect voltmeter to check harness. Read voltmeter needle sweeps to determine trouble code. Once trouble codes have been displayed, see DIAGNOSTIC TROUBLE CODE (DTC) IDENTIFICATION table. In order to diagnose trouble code(s), go to DIAGNOSTIC TESTS.

DIAGNOSTIC TROUBLE CODE (DTC) IDENTIFICATION TABLE

Code	Probable Cause
11	Vacuum Pump Drive System
12	Vehicle Speed Signal System
15	Cruise Control Switch
16	Cruise Control ECU
17	Throttle Position Sensor

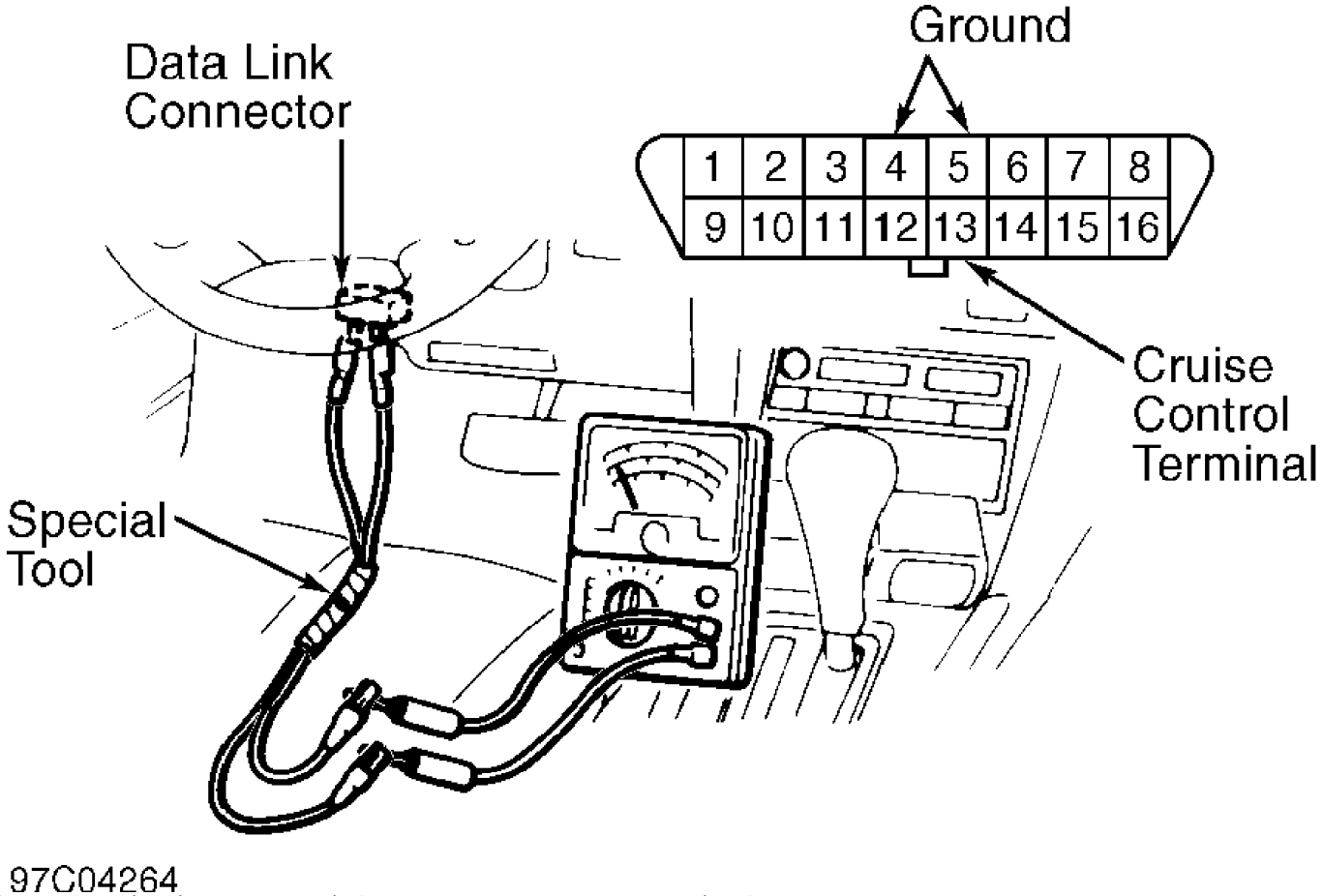


Fig. 6: Identifying Data Link Connector (DLC) Terminals
Courtesy of Mitsubishi Motor Sales of America

RETRIEVING INPUT SWITCH CODES

NOTE: System input switch test should be performed if no trouble codes are stored when performing self-diagnostics. System

input tests cycle each cruise control switch and sensor.

1) Use scan tool or an analog voltmeter for code retrieval. Turn ignition off. Install scan tool. Turn ignition and cruise control SET switch on. Turn on cruise control main switch, and within one second, turn on RESUME switch.

2) Operate each switch listed in CHECK RESULTS CODE IDENTIFICATION table, and read input switch codes on scan tool or voltmeter. Repair or replace components as necessary.

CHECK RESULTS CODE IDENTIFICATION TABLE

Code	Input Operation
21	SET Switch ON
22	RESUME Switch ON
23	Stoplight Switch ON (Brake Pedal Depressed)
24	(1) Vehicle Speed Signal
25	(2) Vehicle Speed Signal
26	(3) P/N Switch ON With Lever In "N" Range (A/T) Or (3) Clutch Pedal Position Switch (M/T)
27	CANCEL Switch ON
28	(4) Throttle Position (TP) Sensor Signal
29	(5) Closed Throttle Position Switch

(1) - ECU determines that vehicle speed is 25 MPH or greater.
(2) - ECU determines that vehicle speed is less than 25 MPH.
(3) - ECU determines that P/N or clutch pedal position switch is ON.
(4) - ECU determines that TP sensor voltage is 1.5 volts or greater.
(5) - ECU determines that closed throttle position switch is OFF.

CLEARING TROUBLE CODES

To clear trouble codes, disconnect negative battery cable for about 10 seconds. Codes can also be cleared by turning ignition on and then turning on cruise control SET switch. Turn cruise main switch on, and within one second, turn RESUME switch on. Depress brake pedal and hold cruise control SET switch in ON position for 5 seconds or more. Verify codes are cleared.

DIAGNOSTIC TESTS

CODE 11: CRUISE CONTROL VACUUM PUMP SYSTEM

1) Check cruise control vacuum pump. See VACUUM PUMP TEST under COMPONENT TESTS. Replace as necessary. If vacuum pump is okay, go to next step.

2) Disconnect vacuum pump harness connector. Check voltage between ground and vacuum pump harness-side connector terminal No. 1. See WIRING DIAGRAMS. If battery voltage is present, go to next step. If battery voltage is not present, go to step 4).

3) Disconnect cruise control ECU harness connector. Check voltage between ground and ECU harness-side connector terminals No. 12, 13 and 26. See WIRING DIAGRAMS. If battery voltage is present, go to step 5). If battery voltage is not present, go to step 6).

4) Check stoplight switch. See STOPLIGHT SWITCH TEST under

COMPONENT TESTS. Replace as necessary. If switch is okay, check harness connectors to stoplight switch, cruise control vacuum pump and power supply. Repair as necessary. If connectors are okay, check circuit between cruise control main switch and vacuum pump. See WIRING DIAGRAMS. Repair as necessary.

5) Check harness connector to cruise control ECU. Repair as necessary. If connector is okay, replace cruise control ECU.

6) Check harness connectors to cruise control ECU and vacuum pump. Repair as necessary. If connectors are okay, go to next step.

7) Check circuit between cruise control vacuum pump and cruise control ECU. See WIRING DIAGRAMS. Repair as necessary.

CODE 12: VEHICLE SPEED SIGNAL

Galant

1) Check vehicle speed sensor. See VEHICLE SPEED SENSOR TEST under COMPONENT TESTS. Replace sensor as necessary. If sensor is okay, go to next step.

2) Disconnect vehicle speed sensor harness connector. Turn ignition on. Check voltage between ground and sensor harness-side connector terminal No. 1 (Black/White wire). If battery voltage is present, go to next step. If battery voltage is not present, check circuit between sensor and ignition switch. See WIRING DIAGRAMS. Repair as necessary. If circuit is okay, check ignition switch. See STEERING COLUMN SWITCHES article. Replace as necessary.

3) Check voltage between ground and sensor harness-side connector terminal No. 3 (Yellow/White wire). Reading should be 4.8-5.2 volts. If voltage is as specified, go to next step. If voltage is not as specified, check harness connectors and circuit between cruise control ECU and vehicle speed sensor. See WIRING DIAGRAMS. Repair as necessary. If connectors and circuits are okay, replace cruise control ECU.

4) Check continuity between ground and vehicle speed sensor harness-side connector terminal No. 2 (Black wire). If continuity is present, go to next step. If continuity is not present, check harness between vehicle speed sensor and ground. See WIRING DIAGRAMS. Repair as necessary.

5) Check harness connectors to vehicle speed sensor, joint connector between combination meter and PCM, and joint connector between ignition switch and overdrive switch. See WIRING DIAGRAMS. Repair as necessary. If connectors are okay, go to next step.

6) Check circuit between cruise control ECU and vehicle speed sensor. See WIRING DIAGRAMS. Repair as necessary. If circuit is okay, replace cruise control ECU.

3000GT

1) Check vehicle speed sensor. See VEHICLE SPEED SENSOR TEST under COMPONENT TESTS. Replace sensor as necessary. If sensor is okay, go to next step.

2) Disconnect vehicle speed sensor harness connector. Turn ignition on. Check voltage between ground and sensor harness-side connector terminal No. 3 (Yellow wire). Reading should be 4.5 volts or greater. If voltage is as specified, go to next step. If voltage is not as specified, check harness connectors and circuit between cruise control ECU and vehicle speed sensor. See WIRING DIAGRAMS. Repair as necessary.

3) Check continuity between ground and vehicle speed sensor harness-side connector terminal No. 2 (Black wire). If continuity is present, go to next step. If continuity is not present, check harness between vehicle speed sensor and ground. See WIRING DIAGRAMS. Repair as necessary.

4) Check harness connectors to vehicle speed sensor. See WIRING DIAGRAMS. Repair as necessary. If connectors are okay, replace

cruise control ECU.

CODE 15: CRUISE CONTROL SWITCH

This code sets if cruise control RESUME, SET or CANCEL switch remains on. Replace cruise control multifunction switch.

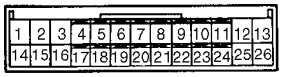
CODE 16: CRUISE CONTROL ECU

This code sets if there is an abnormality in CANCEL hold circuit or in microprocessor monitor circuit in cruise control ECU. Replace cruise control ECU.

CODE 17: THROTTLE POSITION SENSOR

1) Check if PCM DTC P0120 (engine performance code) is also present. If DTC P0120 is present, diagnose using G - TESTS W/CODES article in the ENGINE PERFORMANCE section. If DTC P0120 is not present, go to next step.
2) Check harness connector to cruise control ECU. Repair as necessary. If connector is okay, check circuit between throttle position sensor and cruise control ECU. See WIRING DIAGRAMS. Repair as necessary. If circuit is okay, replace cruise control ECU.

PIN VOLTAGE TESTS



Terminal No.	Check item	Check conditions		Normal condition
1	Clutch pedal position switch input <M/T>	When pedal is not depressed	When clutch pedal position switch is OFF	Battery positive voltage
		When pedal is depressed	When clutch pedal position switch is ON	0V
	Park/neutral position switch input <A/T>	When select lever is in a position other than N range	When park/neutral position switch is OFF	5V - Galant 12V - 3000GT
		When select lever is in N range	When park/neutral position switch is ON	0V
2	ECU power supply	When ignition switch is ON		Battery positive voltage
3	Power supply for OD signal control <A/T>	–		Battery positive voltage
4	Closed throttle position switch output	When accelerator pedal is depressed	When idle switch is OFF	4.5–5.5V
		When accelerator pedal is not depressed	When idle switch is ON	0V
5	Throttle position sensor input	When accelerator pedal is fully depressed		4.0–5.5V
		When accelerator pedal is released		0.5–0.7V
6	Ground	–		Continuity
8	Ground	–		Continuity
10	OD control output <A/T>	When OD switch is ON		Battery positive voltage
		When OD switch is OFF		0V
11	OD switch input <A/T>	When OD switch is ON		Battery positive voltage
		When OD switch is OFF		0V
12	Auto-cruise vacuum pump release valve and control valve input	When driving at constant speed using the SET switch	Release valve closed	0V
13			Control valve closed	0V
12		When accelerating with the RESUME switch while driving at constant speed	Release valve closed	0V
13			Release valve closed	0V
12		When decelerating with the SET switch while driving at constant speed	Release valve closed	0V
13			Control valve open	Battery positive voltage
12		When cancelling constant-speed driving with the CANCEL switch	Release valve open	Battery positive voltage
13			Control valve open	Battery positive voltage
14	Ground	–		Continuity

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Fig. 7: Pin Voltage Chart (1 Of 2)
Courtesy of Mitsubishi Motor Sales of America

Terminal No.	Check item	Check conditions		Normal condition
15	Stop light switch input	When brake pedal is depressed	When stop light switch is ON	Battery positive voltage
		When brake pedal is not depressed	When stop light switch is OFF	0V
16	ECU backup power supply	–		Battery positive voltage
18	Auto-cruise control switch input	When SET switch is pressed	When SET switch is ON	3V
		When SET switch is not pressed	When SET switch is OFF	0V
		When RESUME switch is pressed	When RESUME switch is ON	6V
		When RESUME switch is not pressed	When RESUME switch is OFF	0V
		When CANCEL switch is pressed	When CANCEL switch is ON	Battery positive voltage
		When CANCEL switch is not pressed	When CANCEL switch is OFF	0V
19	Vehicle speed sensor input	When vehicle is moved forwards and backwards, sensor turns ON and OFF repeatedly.	When sensor is ON	0V
			When sensor is OFF	4.5 V or more
20	ACC power supply	When ignition switch is in ACC position		Battery positive voltage
23	Indicator input (inside combination meter)	When driving at constant speed	When indicator is illuminated	0V
		When constant-speed driving is cancelled	When indicator is switched off	Battery positive voltage
24	Diagnosis control input	When ignition switch is ON		4V or more
26	Auto-cruise vacuum pump motor input	When driving at constant speed using the SET switch	Motor stopped	Battery positive voltage
		When accelerating with the RESUME switch while driving at constant speed	Motor running	0V
		When decelerating with the SET switch while driving at constant speed	Motor stopped	Battery positive voltage
		When cancelling constant-speed driving with the CANCEL switch	Motor stopped	Battery positive voltage

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Fig. 8: Pin Voltage Chart (2 Of 2)
Courtesy of Mitsubishi Motor Sales of America

REMOVAL & INSTALLATION

* PLEASE READ THIS FIRST *

WARNING: Deactivate air bag system before performing any service operation. See AIR BAG RESTRAINT SYSTEMS article. Do not apply electrical power to any component on steering column without first deactivating air bag system. Air bag may deploy.

CAUTION: When battery is disconnected, vehicle computer and memory systems may lose memory data. Driveability problems may exist until computer systems have completed a relearn cycle. See COMPUTER RELEARN PROCEDURES article in the GENERAL INFORMATION section before disconnecting battery.

AIR BAG MODULE

Removal & Installation

1) Remove air bag module mounting nuts from back of steering wheel. When disconnecting clockspring connector, press connector toward outer side to spread it open.

2) Disconnect clockspring connector from air bag module. DO NOT apply excessive force to connector. Lay air bag with pad cover face up. To install, reverse removal procedure. Recheck system operation. See AIR BAG RESTRAINT SYSTEMS article.

ACTUATOR

Removal & Installation

Remove linkage protector. Remove cruise control cable. Remove accelerator and throttle cables. Disconnect vacuum hoses and electrical connectors. Remove linkage assembly. Remove vacuum pump and bracket. Remove actuator and bracket. To install, reverse removal procedure.

CRUISE CONTROL ECU

Removal & Installation (Galant)

Remove center console panel. Remove radio assembly. Remove cruise control ECU. To install, reverse removal procedure.

Removal & Installation (3000GT)

Cruise control unit is located behind right kick panel. Remove kick panel. Remove cruise control ECU. To install, reverse removal procedure.

INDICATOR LIGHT

Removal & Installation

Indicator light is located in instrument cluster. Remove instrument cluster. See COMBINATION METER/INSTRUMENT CLUSTER. To install, reverse removal procedure.

COMBINATION METER/INSTRUMENT CLUSTER

Removal & Installation

1) Disconnect negative battery cable. Remove cluster cover. Remove cluster mounting screws. Disconnect all necessary electrical connectors. Remove combination meter/instrument cluster.

2) Disconnect speedometer cable at transaxle end. Pull speedometer cable slightly toward vehicle interior. Release adapter by turning left or right, and remove adapter. To install, reverse removal procedure.

MULTIFUNCTION SWITCH

WARNING: DO NOT hammer steering shaft. Collapsible steering column mechanism may be damaged.

Removal & Installation

Remove knee protector and lower panel. Remove column covers. Remove air bag module and bracket. See AIR BAG MODULE. Mark steering wheel location for installation reference. Using puller, remove steering wheel. Remove clip and column switch. To install, reverse removal procedure.

VEHICLE SPEED SENSOR

Removal & Installation

Vehicle speed sensor is located on top of transaxle. Remove hold-down bolt and remove sensor. To install, reverse removal procedure. Install NEW "O" ring.

WIRING DIAGRAMS

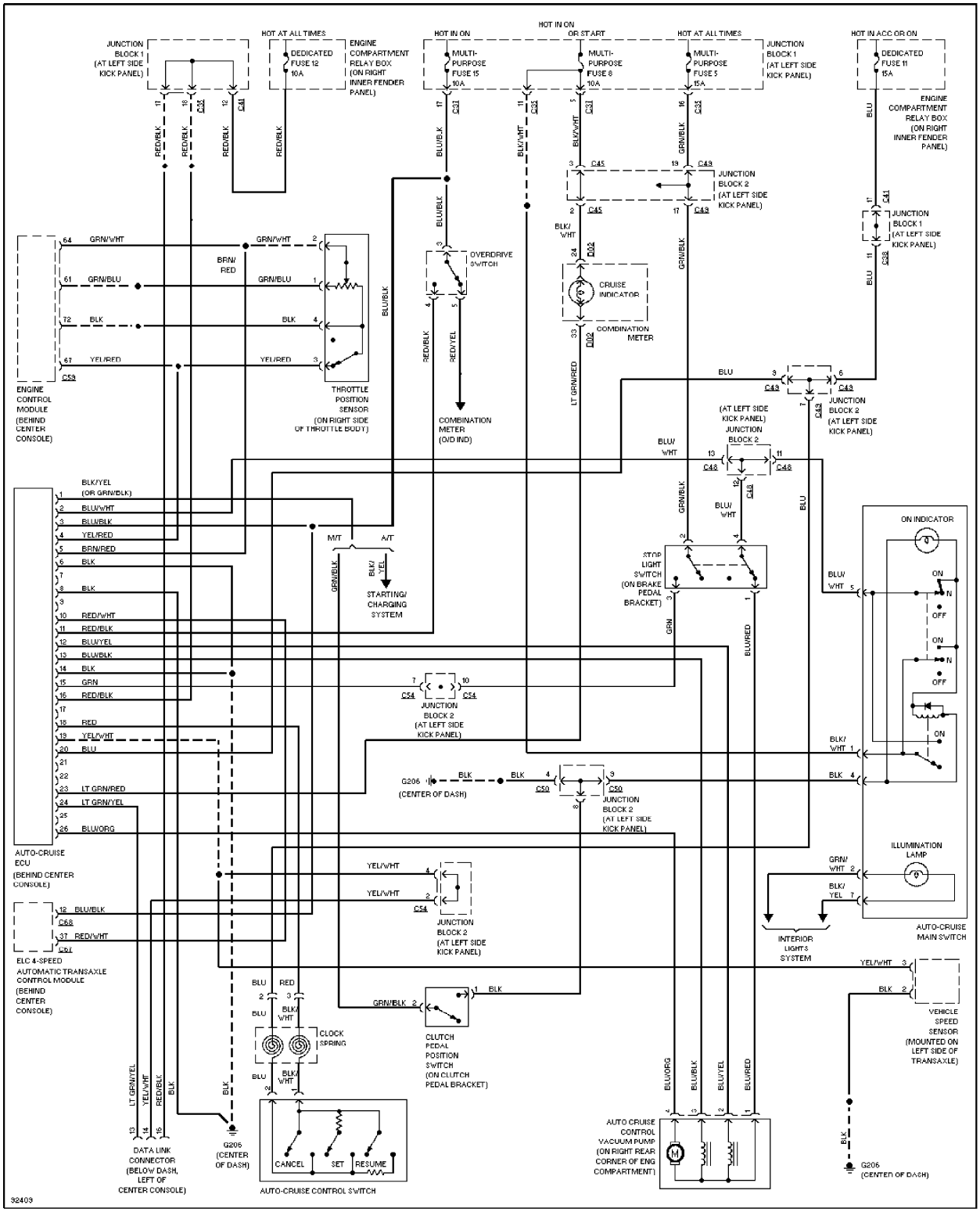

Fig. 9: Cruise Control System Wiring Diagram (Galant)

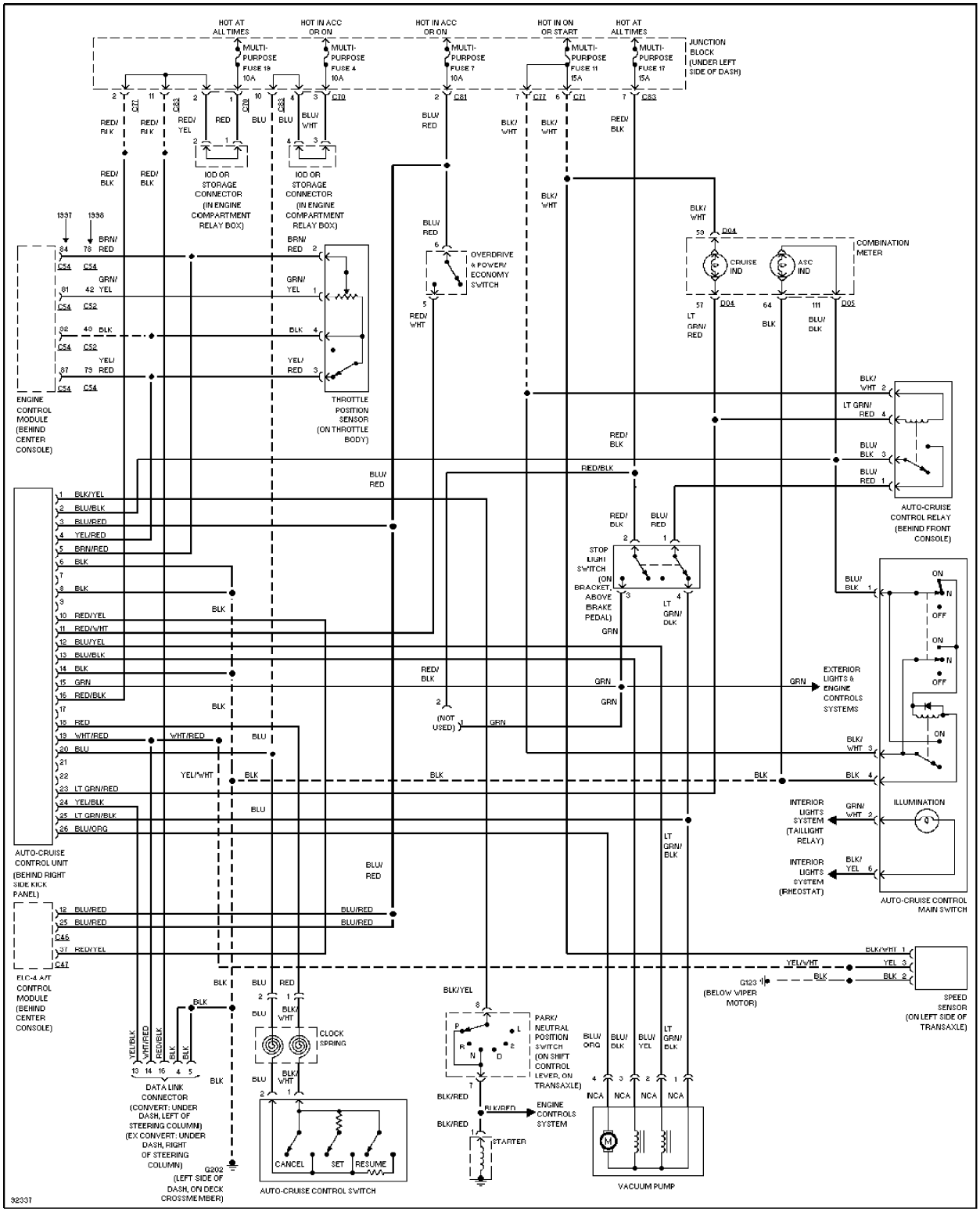

Fig. 10: Cruise Control System Wiring Diagram (3000GT - With A/T)

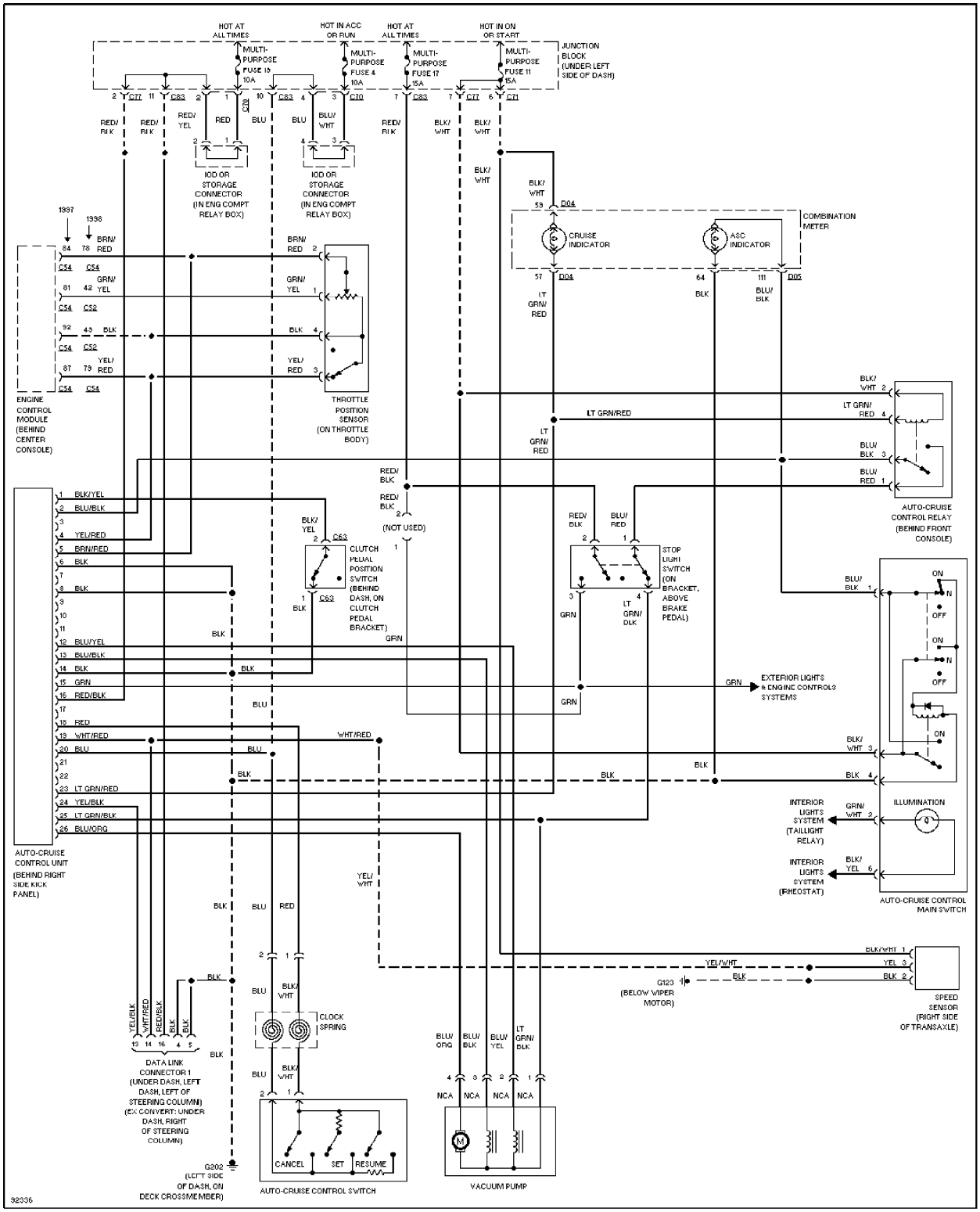

Fig. 11: Cruise Control System Wiring Diagram (3000GT - With M/T)

DEFOGGER - REAR WINDOW

1998 Mitsubishi Galant

1998 ACCESSORIES & EQUIPMENT
Mitsubishi - Rear Window Defoggers

Diamante, Eclipse, Galant, Mirage, Montero, Montero Sport, 3000GT

DESCRIPTION & OPERATION

Rear window defogger is a heating filament grid bonded to inside of window. Rear window defogger is controlled by defogger switch on instrument panel and a defogger relay.

On Montero, a timer relay controls defogger operation for 9-11 minutes, then turns defogger off. On Eclipse and Galant, defogger timer circuit is integral with Electronic Timer Alarm Control System (ETACS) ECU. Timer will operate defogger for 11 minutes then turn off, even with defogger switch in ON position and indicator light illuminated. On Diamante, timer will operate defogger for 20 minutes, then turn off.

COMPONENT LOCATIONS

COMPONENT LOCATIONS TABLE

Component	Location
A/C ECU	
Diamante	Behind Center Of Dash
Data Link Connector (DLC)	Under Left Side Of Dash, Near Steering Column
Defogger Relay	
Montero Sport	Under Left Side Of Glove Compartment
Except Montero Sport	On Relay Block, Behind Left Side Of Dash
Defogger Timer	
Diamante	Integral With A/C ECU
Eclipse & Galant	Integral With ETACS-ECU
Montero	Behind Left Side Of Dash, Behind Speaker
ETACS-ECU	Above Left Kick Panel, On Junction Block

TROUBLE SHOOTING

* PLEASE READ THIS FIRST *

NOTE: For additional trouble shooting information on Eclipse and Galant, see SYMPTOM TESTS.

DEFOGGER DOES NOT WORK

Check for blown fuse, poor contact, defective defogger switch, poor connection or open wire.

DEFOGGER TIMER INOPERATIVE

Check defogger switch or defogger timer. See COMPONENT TESTS.

INDICATOR LIGHT DOES NOT WORK

Check for burned out bulb, open circuit or poor connection.

INDICATOR LIGHT IS DIM

Check rheostat or indicator bulb.

SYMPTOM TESTS

INPUT SIGNAL INSPECTION

NOTE: The following information only applies to Eclipse and Galant.

NOTE: Perform input signal inspection before proceeding with SYSTEM TESTS.

Eclipse & Galant

1) Input signal inspection can be performed using scan tool or an analog voltmeter. To perform inspection using scan tool, go to next step. To perform inspection using an analog voltmeter, go to step 3).

2) Turn ignition off. Connect scan tool to Data Link Connector (DLC). Turn ignition on and then off. If buzzer on scan tool sounds when ignition was turned on, ECU input signal is normal. If buzzer did not sound, go to SYSTEM TESTS.

3) Turn ignition off. Connect DTC Check Harness (MB991529) to DLC terminals No. 4 or 5 (ground) and terminal No. 9. See Fig. 1. Connect voltmeter leads to check harness leads. Turn ignition switch on, then off. If voltmeter deflects once when ignition was turned on, ECU input signal is normal. If voltmeter did not deflect, go to SYSTEM TESTS.

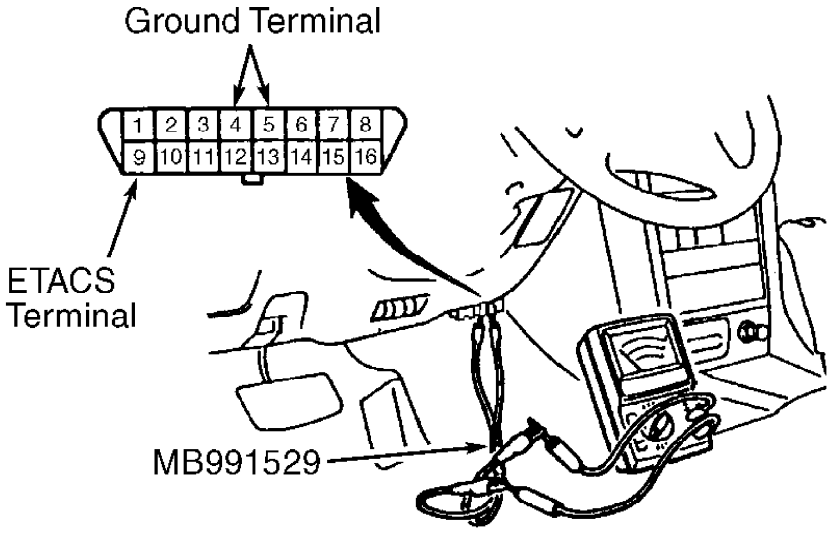

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Fig. 1: Identifying Data Link Connector (DLC) Terminals
Courtesy of Mitsubishi Motor Sales of America

SYSTEM TESTS

NOTE: The following information only applies to Eclipse and Galant.

NOTE: Perform INPUT SIGNAL INSPECTION before proceeding with SYSTEM TESTS. To identify circuit connector terminals, see WIRING DIAGRAMS.

Communication With All Systems Not Possible (Eclipse & Galant)

1) Check voltage between ground and Data Link Connector (DLC) terminal No. 16 (Red/Black wire on Eclipse or Brown/Red wire on Galant). See Fig. 1. If battery voltage is present, go to step 3). If battery voltage is not present, go to next step.

2) Check junction block connectors between DLC and power supply. See WIRING DIAGRAMS. If connectors are okay, check circuit between power supply and DLC. See WIRING DIAGRAMS. Repair as necessary.

3) Check continuity between ground and DLC terminals No. 4 and 5. If continuity is present, replace scan tool and retest. If continuity is not present, check circuit between ground and DLC. See WIRING DIAGRAMS. Repair as necessary.

Communication With One-Shot Pulse Input Signal Only Is Not Possible (Eclipse & Galant)

Check circuit between DLC and junction block No. 1. See WIRING DIAGRAMS. Repair as necessary. If circuit is okay, check harness connectors to ETACS-ECU, DLC and junction/joint connectors. Repair as necessary. If connectors are okay, replace ECU.

Defogger Does Not Operate With Defogger Switch ON (Eclipse & Galant)

1) Check defogger switch input signal. See INPUT SIGNAL INSPECTION. If switch input signal is okay, check defogger circuit and relay. See DEFOGGER RELAY TEST under COMPONENT TESTS. Repair or replace as necessary. If switch input signal is not okay, go to next step.

2) Check defogger switch. See DEFOGGER SWITCH TEST under COMPONENT TESTS. Replace as necessary. If defogger switch is okay, turn ignition on. Check voltage between ground and defogger switch harness-side connector terminal No. 4 (Eclipse) or terminal No. 2 (Galant). See WIRING DIAGRAMS. If voltage reading is 5 volts (Eclipse) or battery voltage (Galant), go to next step. If voltage reading is not as specified, go to step 4).

3) Check joint/junction connectors between switch, instrument panel cluster and ETACS-ECU. See WIRING DIAGRAMS. Repair as necessary. If connectors are okay, check circuit between defogger switch and ground. Repair as necessary. If circuit is okay, replace ECU.

4) Check harness connectors to ETACS-ECU and instrument panel cluster. Repair as necessary. If connectors are okay, check circuit between ECU and defogger switch. Repair as necessary.

Defogger Relay Circuit System Check (Eclipse & Galant)

1) Check defogger relay. See DEFOGGER RELAY TEST under COMPONENT TESTS. Replace as necessary. If relay is okay, go to next step.

2) Check voltage between ground and relay harness-side connector terminals No. 3 and 5. See WIRING DIAGRAMS. If battery voltage is present, go to next step. If battery voltage is not present, go to step 4).

3) Check harness connectors to relay, ETACS-ECU, junction block and rear wiring/liftgate. See WIRING DIAGRAMS. Repair as necessary. If connectors are okay, check circuit between defogger relay and rear defogger, defogger and ground, or defogger relay and ECU. See WIRING DIAGRAMS. Repair as necessary. If circuits are okay,

replace ECU.

4) Check harness connectors to junction block and ignition switch. Repair as necessary. If connectors are okay, check circuit between ignition switch and junction block, and between fusible link No. 2 and junction block. See WIRING DIAGRAMS. Repair as necessary.

COMPONENT TESTS

DEFOGGER RELAY TEST

Diamante & Eclipse

1) Remove defogger relay. See COMPONENT LOCATIONS. Ground relay terminal No. 1, and apply battery voltage to terminal No. 3. See Fig. 2. Check relay continuity using ohmmeter.

2) Continuity should exist between terminals No. 2 and 5. With voltage disconnected, continuity should not exist between terminals No. 2 and 5. Ensure continuity exists between terminals No. 1 and 3. If continuity is not as specified, replace relay.

Galant, Mirage & Montero Sport

1) Remove defogger relay. See COMPONENT LOCATIONS. Ground relay terminal No. 3, and apply battery voltage to terminal No. 1. See Fig. 2. Check relay continuity using ohmmeter.

2) Continuity should exist between terminals No. 2 and 5. With voltage disconnected, continuity should not exist between terminals No. 2and 5. Ensure continuity exists between terminals No. 1 and 3. If continuity is not as specified, replace relay.

Montero

1) Remove defogger relay. See COMPONENT LOCATIONS. Ground relay terminal No. 3 and apply battery voltage to terminal No. 1. See Fig. 3. Check relay continuity using ohmmeter.

2) Continuity should exist between terminals No. 4 and 5. With voltage disconnected, continuity should not exist between terminals No. 4and 5. Ensure continuity exists between terminals No. 1 and 3. If continuity is not as specified, replace relay.

3000GT

1) Remove defogger relay. See COMPONENT LOCATIONS. Ground relay terminal No. 3, and apply battery voltage to terminal No. 5. See Fig. 4. Check relay continuity using ohmmeter.

2) Continuity should exist between terminals No. 1 and 2. With voltage disconnected, continuity should not exist between terminals No. 1and 2. Ensure continuity exists between terminals No. 3 and 5. If continuity is not as specified, replace relay.

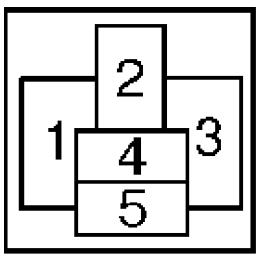

Fig. 2: Identifying Defogger Relay Terminals (Diamante, Eclipse, Galant, Mirage & Montero Sport)
Courtesy of Mitsubishi Motor Sales of America

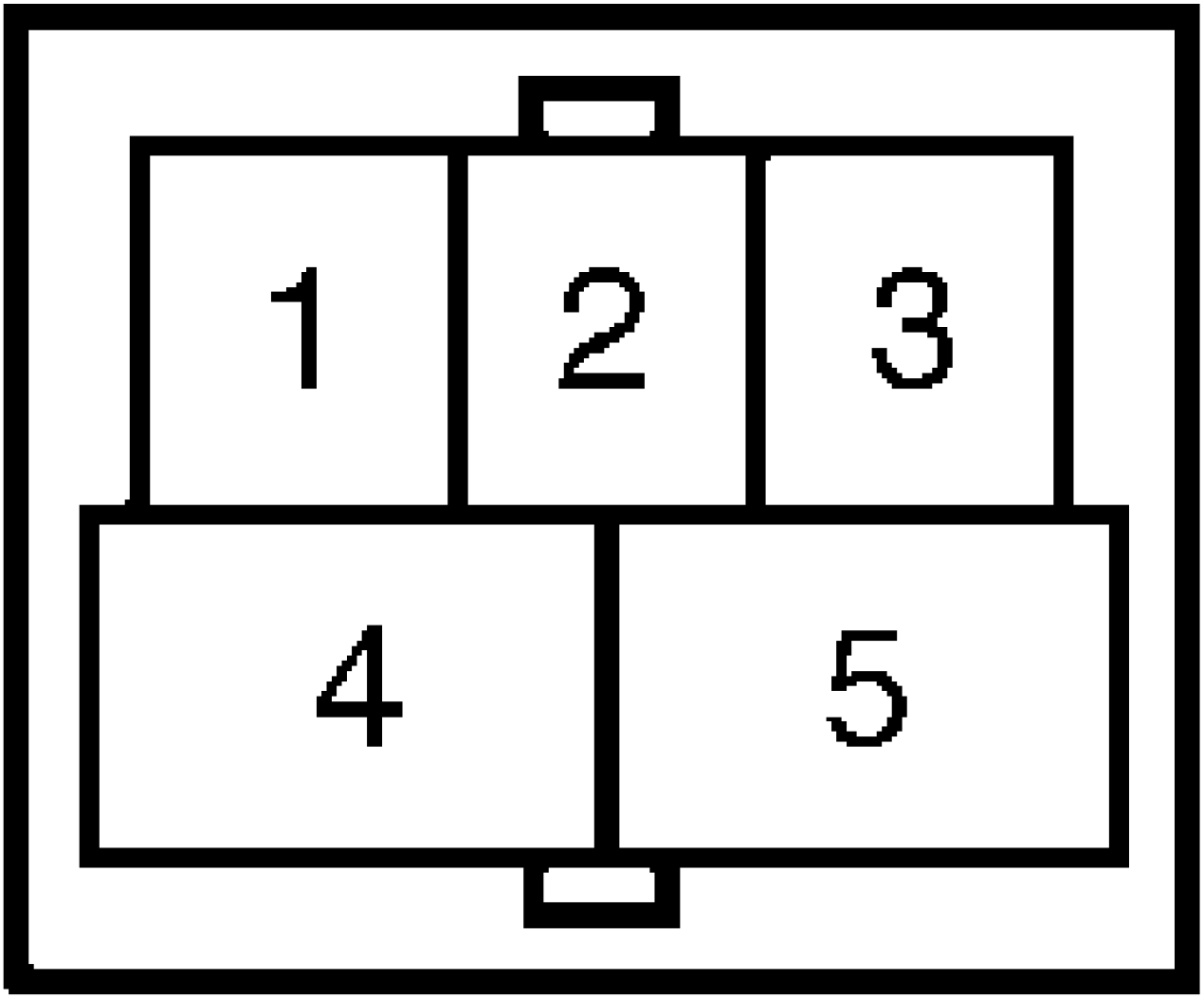

Fig. 3: Identifying Defogger Relay Terminals (Montero)
Courtesy of Mitsubishi Motor Sales of America

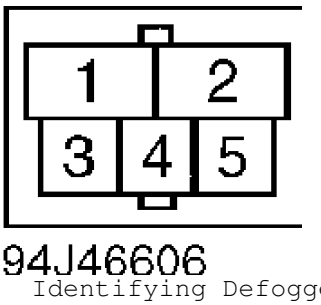

Fig. 4: Identifying Defogger Relay Terminals (3000GT)
Courtesy of Mitsubishi Motor Sales of America

DEFOGGER SWITCH TEST

NOTE: Remove window defogger switch and disconnect switch connector for the following test.

Diamante

Rear window defogger is integral with and controlled by A/C system ECU. To diagnose system, refer to AIR CONDITIONING & HEATING SERVICE & REPAIR article.

Eclipse

Turn defogger switch to OFF position. Using ohmmeter, check switch continuity. Continuity should be present between terminals No. 1 and 3, and terminals No. 2 and 6. Turn defogger switch to ON position. Continuity should be present between terminals No. 1, 3 and 4, and between terminals No. 2 and 6. See Fig. 5. If continuity is not as specified, replace switch.

Galant

Turn defogger switch to OFF position. Using ohmmeter, check switch continuity. Continuity should be present between terminals No. 1 and 3. Turn defogger switch to ON position. Continuity should exist between terminals No. 2, 4 and 6, and between terminals No. 1 and 3. See Fig. 5. If continuity is not as specified, replace switch.

Mirage

Turn defogger switch to OFF position. Using ohmmeter, check switch continuity. Continuity should be present between terminals No. 1 and 3, and terminals No. 2 and 6. Turn defogger switch to ON position. Continuity should exist between terminals No. 1 and 3, and terminals No. 2, 4, 5 and 6. See Fig. 5. If continuity is not as specified, replace switch.

Montero

Turn defogger switch to OFF position. Using ohmmeter, check switch continuity. Continuity should be present between terminals No. 1 and 3, and terminals No. 4 and 5. Turn defogger switch to ON position. Continuity should exist between terminals No. 1 and 3, terminals No. 4 and 5, and between terminals No. 2 and 6. See Fig. 5. If continuity is not as specified, replace switch.

Montero Sport

Turn defogger switch to OFF position. Using ohmmeter, check switch continuity. Continuity should be present between terminals No. 1 and 5, and terminals No. 2 and 6. Turn defogger switch to ON position. Continuity should be present between terminals No. 3 and 4, terminals No. 1 and 5, and between terminals No. 2 and 6. See Fig. 5. If continuity is not as specified, replace switch.

3000GT

1) Remove defogger switch assembly from instrument cluster bezel. With defogger switch in OFF position, check switch continuity using ohmmeter.

2) Continuity should exist between terminals No. 3 and 4. With defogger switch in ON position, continuity should exist between terminals No. 1 and 2, terminals No. 1 and 6, and between terminals No. 3 and 4. See Fig. 6. If continuity is not as specified, replace switch.

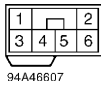

Fig. 5: Identifying Defogger Switch Terminals (Eclipse, Galant, Mirage, Montero & Montero Sport)
Courtesy of Mitsubishi Motor Sales of America

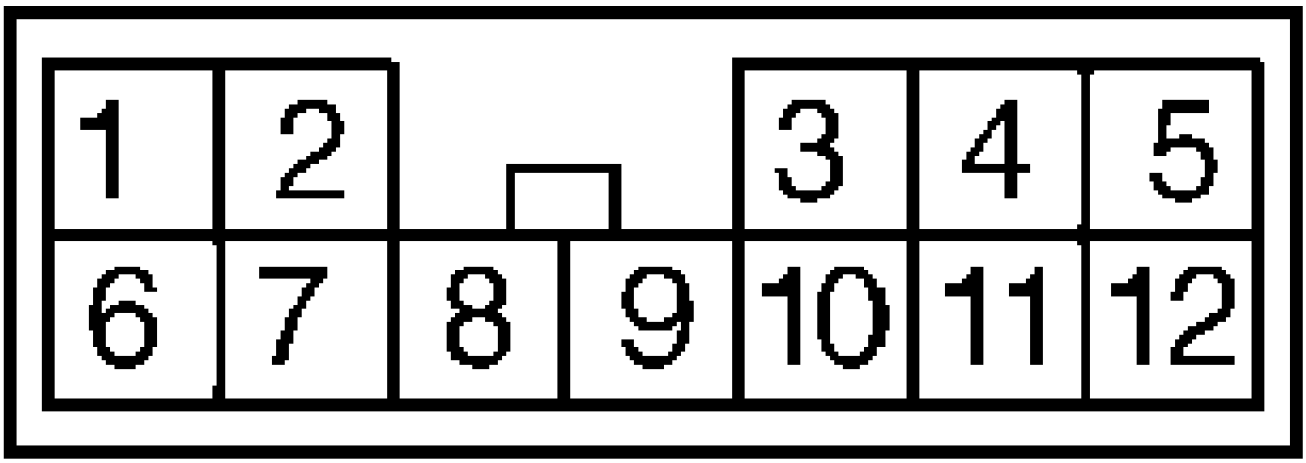

Fig. 6: Identifying Defogger Switch Terminals (3000GT)
Courtesy of Mitsubishi Motor Sales of America

DEFOGGER TIMER TEST

Montero

Remove defogger timer from interior relay block. Connect test battery and test light to timer. See Fig. 7. Ensure test light illuminates for about 11 seconds when battery voltage is applied to terminal No. 3. Reapply battery voltage to terminal No. 3 and observe test light. Test light should go off. If timer does not test as specified, replace timer.

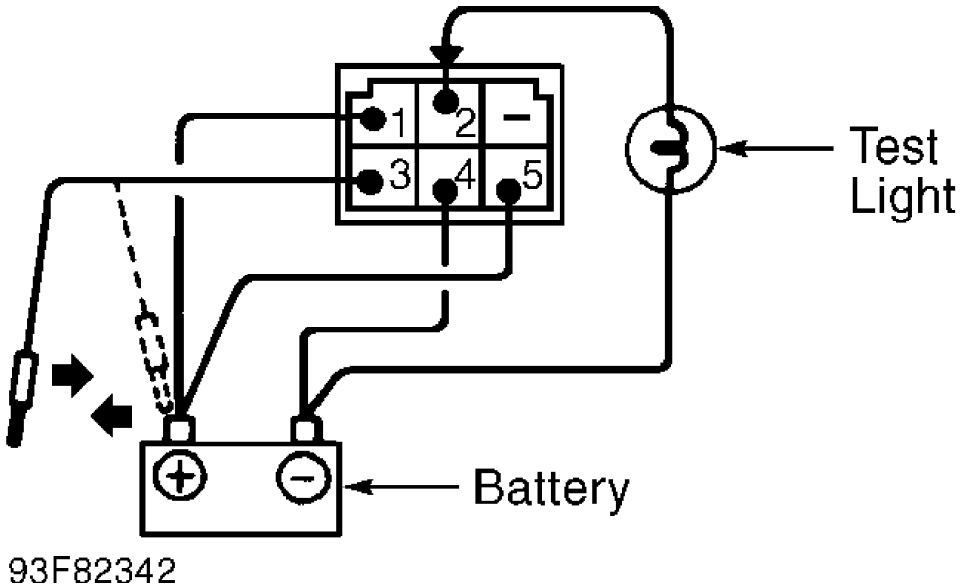

Fig. 7: Identifying Defogger Timer Terminals (Montero)
Courtesy of Mitsubishi Motor Sales of America

GRID TEST

1) Start and run engine at 2000 RPM. Ensure battery is fully charged. Turn defogger switch to ON position. Using a voltmeter, check voltage at center section of each defogger grid filament.

2) If voltage is about 6 volts, grid filament is okay. If voltage is about 12 volts, an open is present in negative circuit. Move probe slowly toward negative terminal to determine location of open circuit.

3) If voltage is zero volts, an open is present in positive circuit. Move probe slowly toward positive terminal to determine location of open circuit. Repair grid as necessary. See GRID FILAMENT REPAIR under ON-VEHICLE SERVICE.

ON-VEHICLE SERVICE

GRID FILAMENT REPAIR

Clean broken wire tips thoroughly. Place masking tape along both sides of broken wire. See Fig. 8. Apply Repair Paste (DuPont 4817) to broken section of grid. Remove masking tape after paste has dried. Wait 24 hours before using defogger.

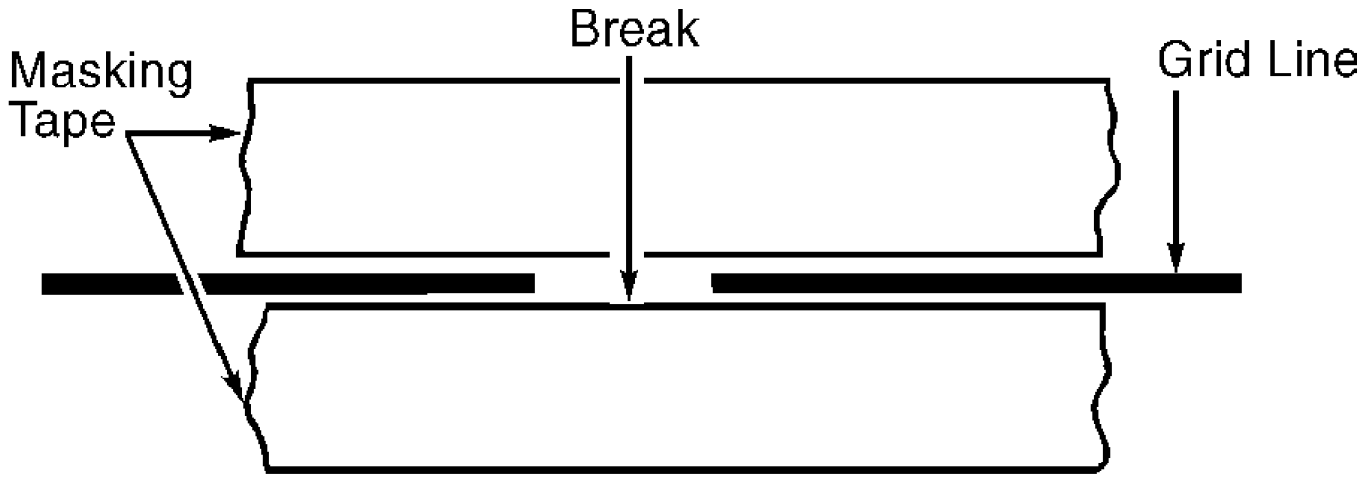

Fig. 8: Repairing Rear Defogger Grid Element

REMOVAL & INSTALLATION

DEFOGGER SWITCH

Removal & Installation (Diamante)

Defogger switch is integral with A/C system ECU. To remove A/C ECU, remove center console. Remove audio panel. Remove radio. Remove A/C ECU. To install, reverse removal procedure.

Removal & Installation (Eclipse)

Remove upper stoppers from glove compartment. Drop down glove compartment. From glove compartment opening, reach behind center air outlet assembly and disconnect harness connectors to switches. Release metal clips from center air outlet assembly. Remove center air outlet. Remove defogger switch from center air outlet. To install, reverse removal procedure.

Removal & Installation (Galant)

At heater unit, remove center air outlet cool air by-pass lever cable from damper lever. To remove center air outlet, push springs at bottom of center air outlet upward. Outlet is located above radio. Remove switch from center air outlet. To install, reverse removal procedure. Turn cool air by-pass lever on outlet fully upward. Pull air by-pass lever fully downward and install cool air by-pass lever cable to damper lever.

Removal & Installation (Mirage)

Remove driver-side lower dash panel. Remove center console assembly and foot distribution duct. Disconnect rear window defogger switch harness connector. Remove switch. To install, reverse removal procedure.

Removal & Installation (Montero)

Remove defogger switch by prying switch off instrument cluster bezel. Disconnect wiring harness from defogger switch. Remove switch. To install, reverse removal procedure.

Removal & Installation (Montero Sport)

Remove instrument cluster bezel. Bezel is held in by metal clips. Disconnect wiring harness from defogger switch. Remove switch from behind bezel. To install, reverse removal procedure.

Removal & Installation (3000GT)

Remove knee protector. Remove steering column upper and lower covers. Remove instrument cluster bezel. Disconnect wiring harness from defogger switch. Remove defogger switch. To install, reverse removal procedure.

WIRING DIAGRAMS

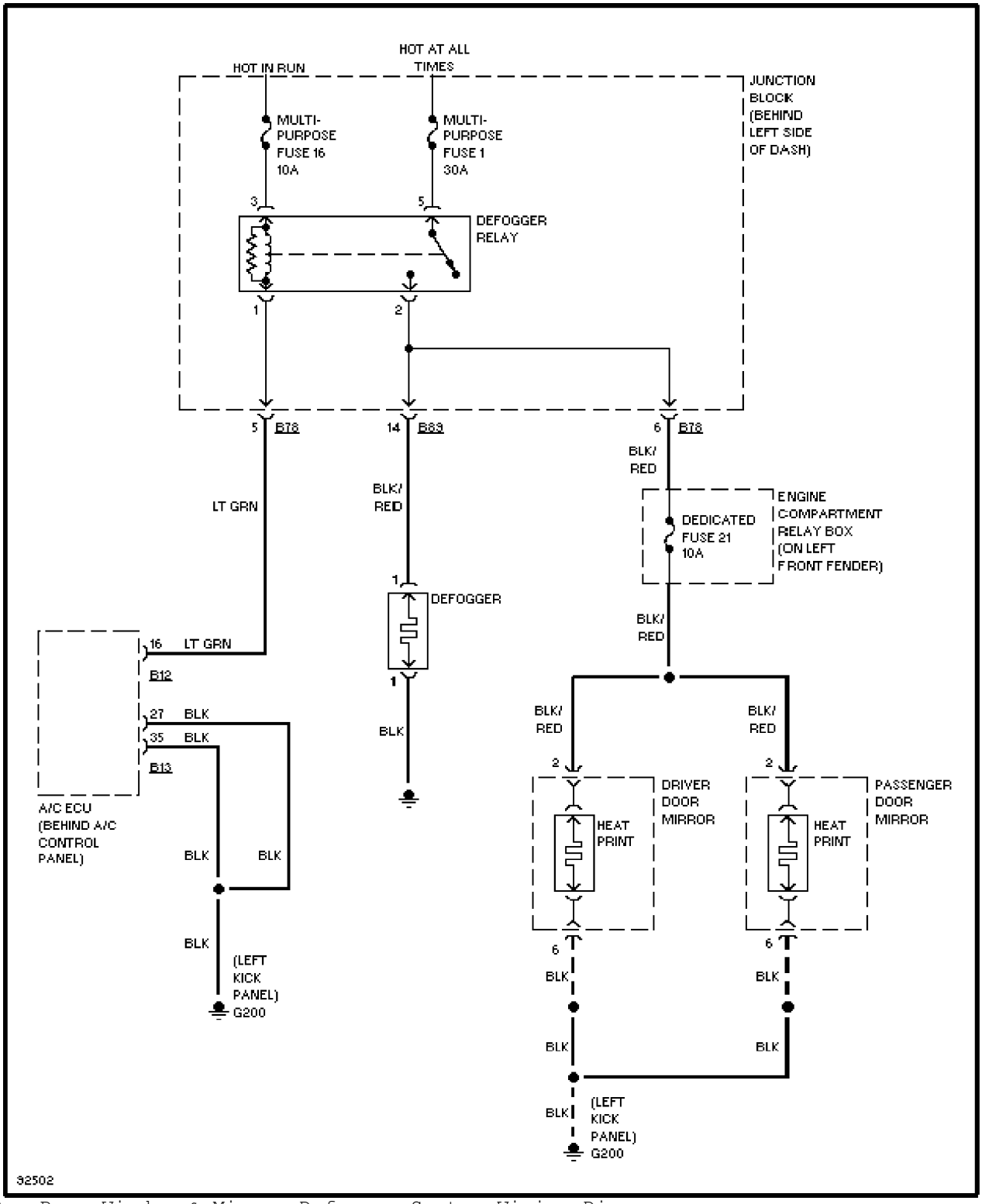

Fig. 9: Rear Window & Mirror Defogger System Wiring Diagram (Diamante)

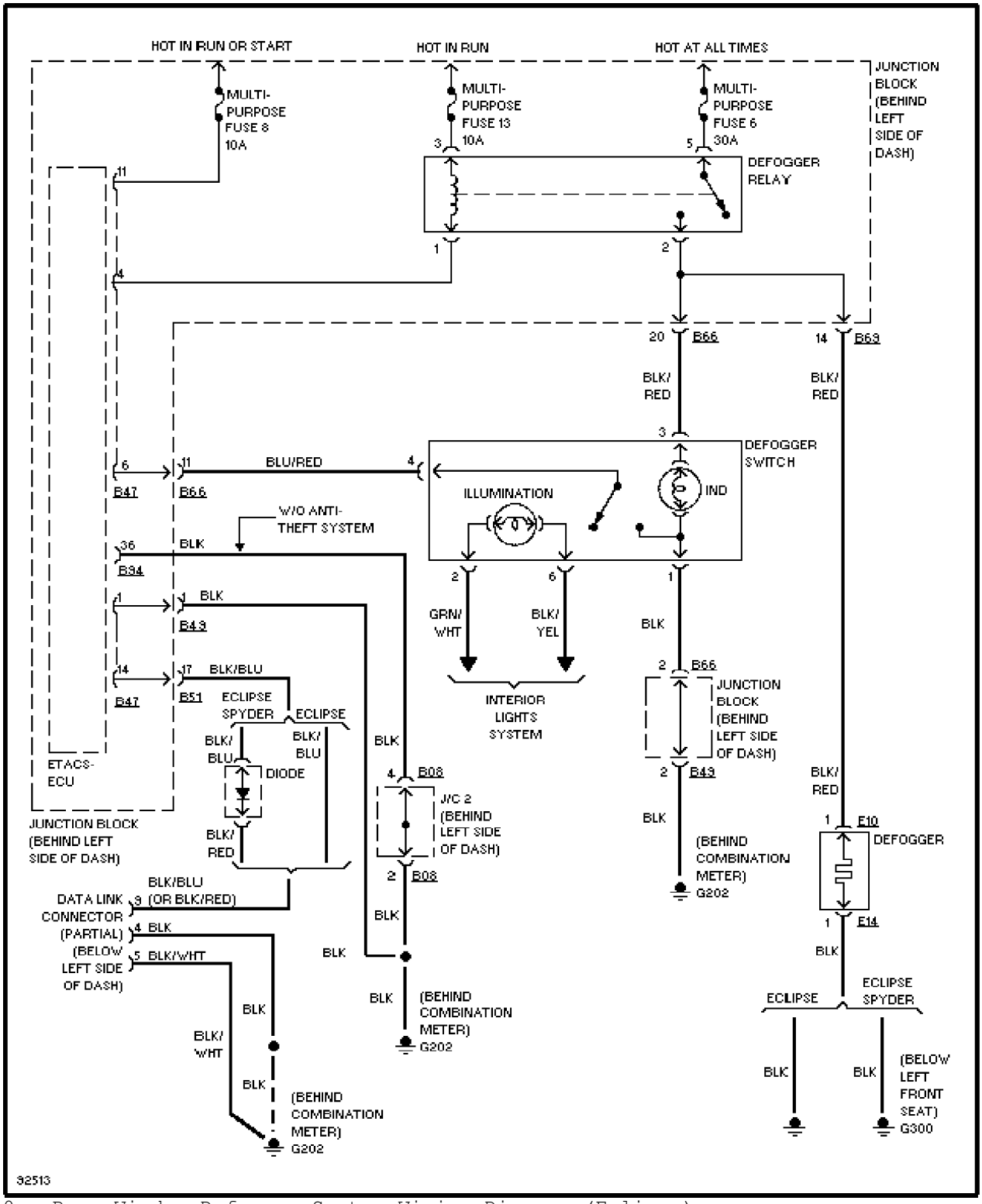

Fig. 10: Rear Window Defogger System Wiring Diagram (Eclipse)

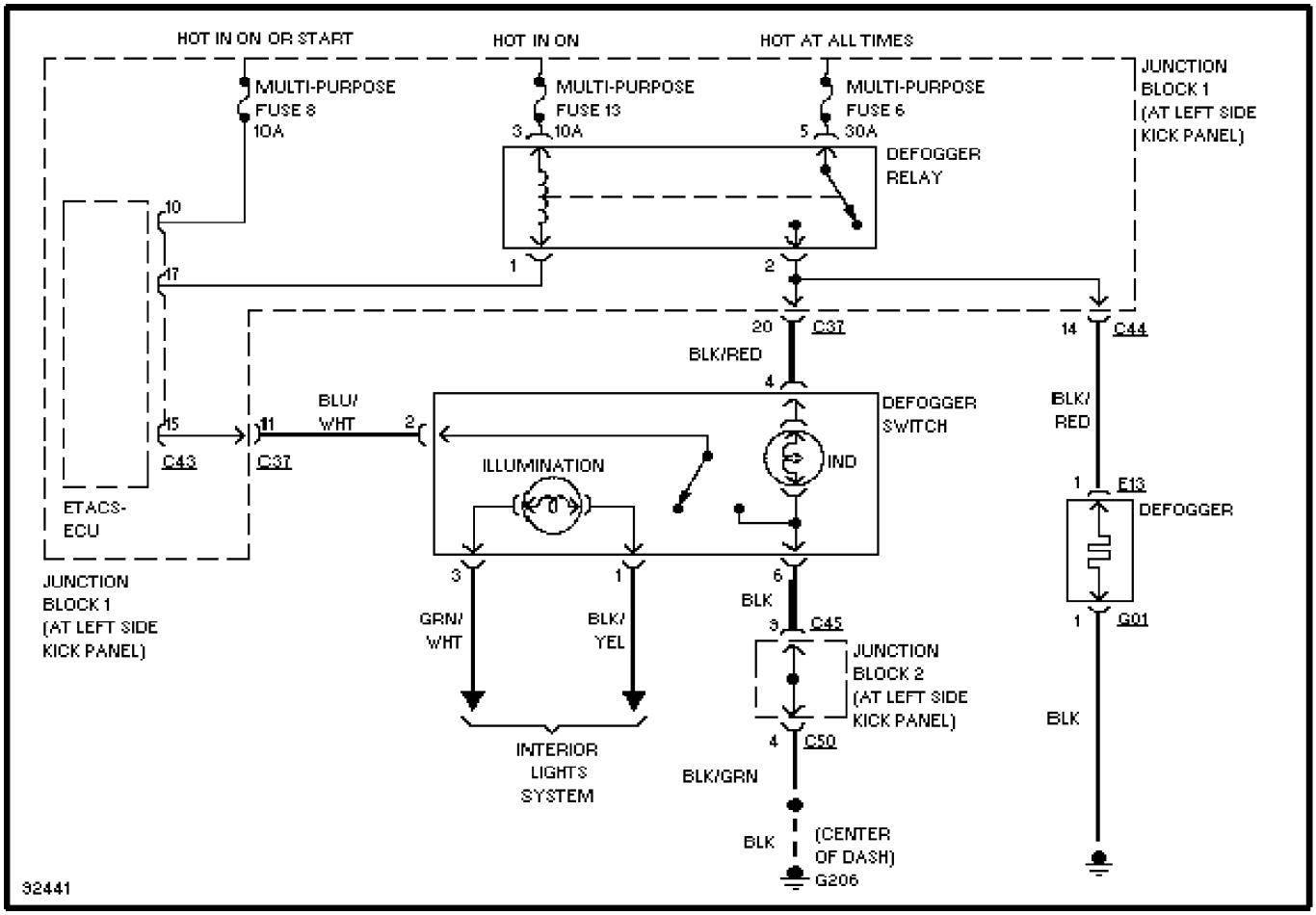

Fig. 11: Rear Window Defogger System Wiring Diagram (Galant With ETACS-ECU)

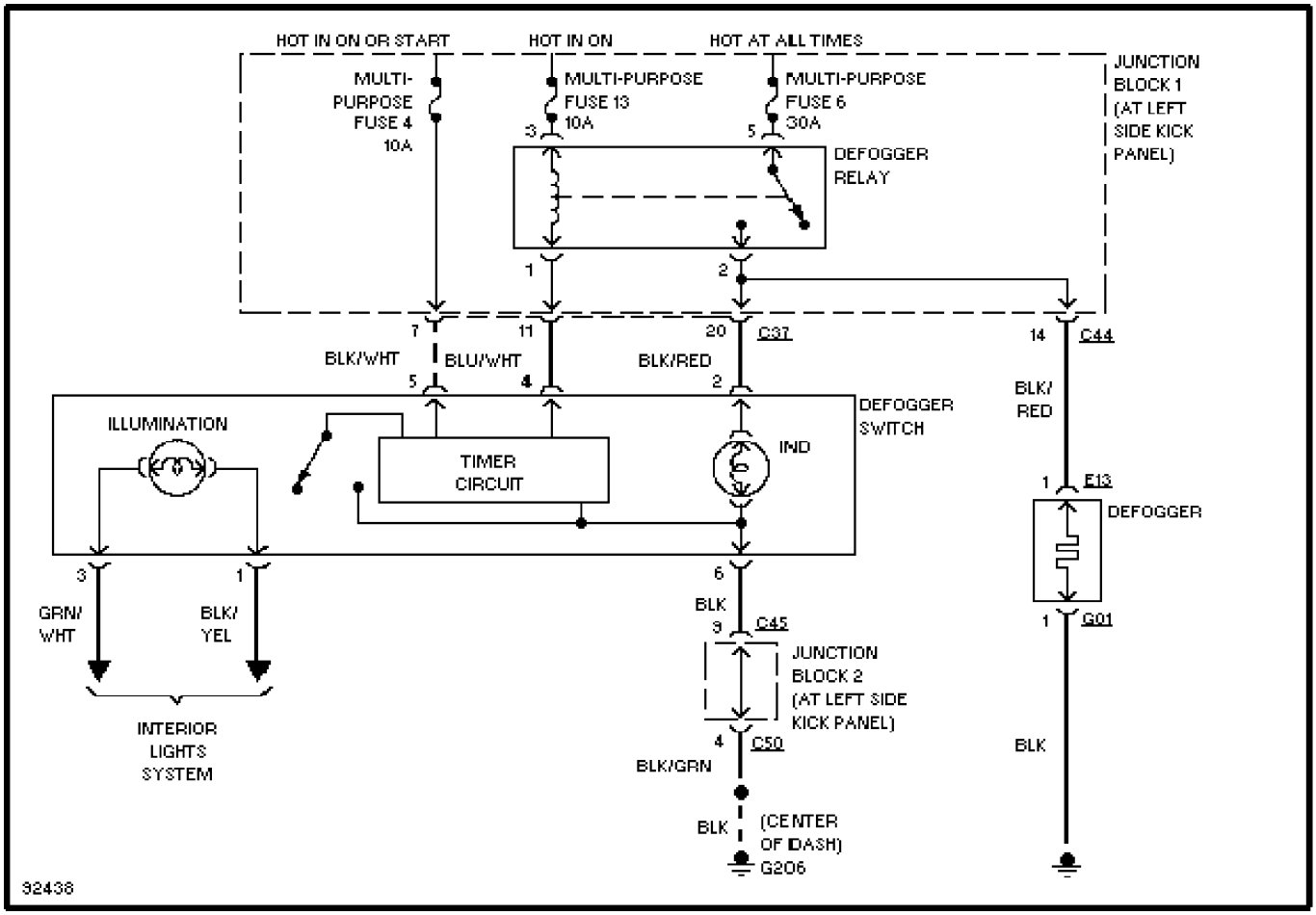

Fig. 12: Rear Window Defogger System Wiring Diagram (Galant Without ETACS-ECU)

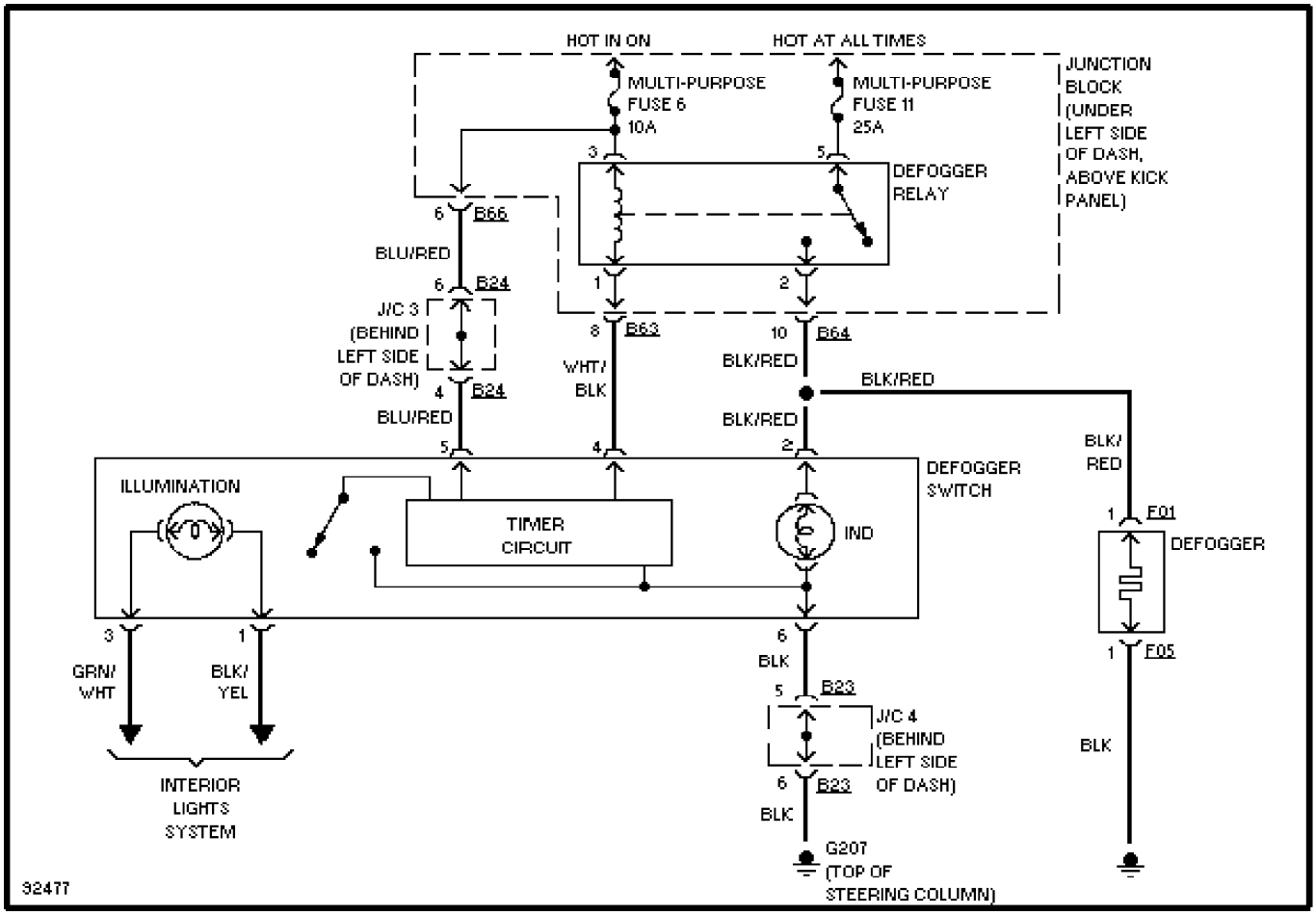

Fig. 13: Rear Window Defogger System Wiring Diagram (Mirage)

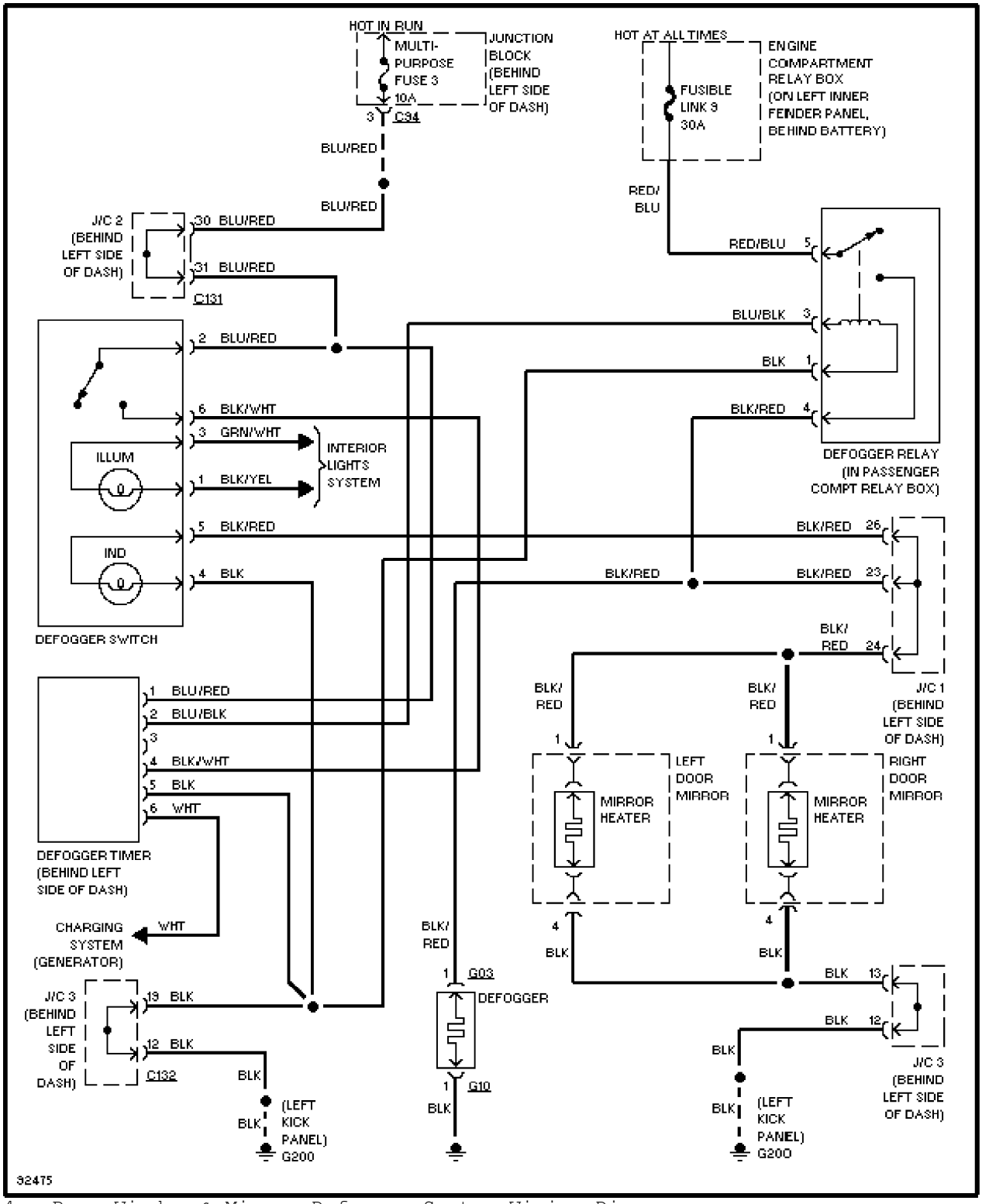

Fig. 14: Rear Window & Mirror Defogger System Wiring Diagram (Montero)

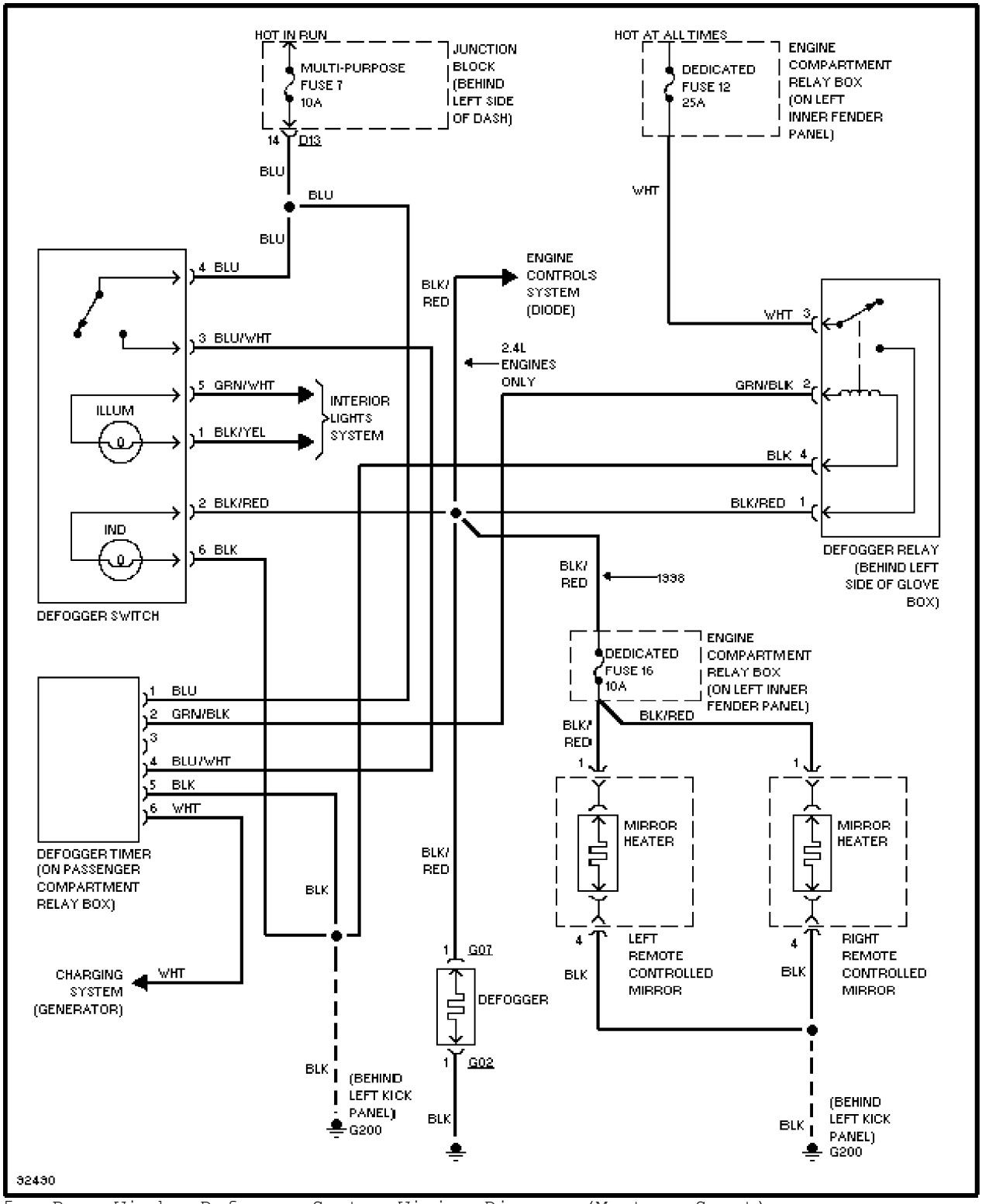

Fig. 15: Rear Window Defogger System Wiring Diagram (Montero Sport)

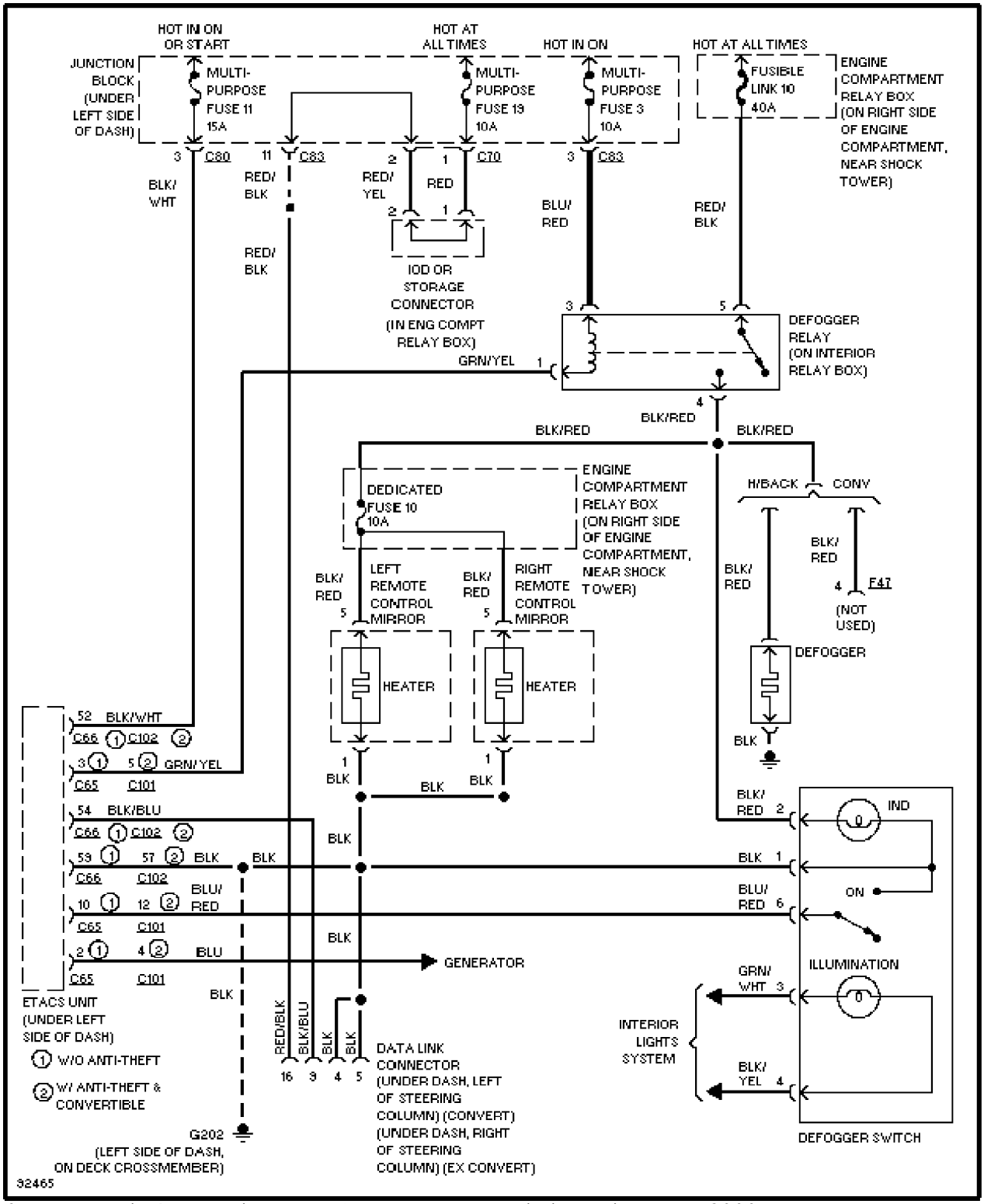

Fig. 16: Rear Window & Mirror Defogger System Wiring Diagram (3000GT)

DOOR LOCKS - POWER & KEYLESS ENTRY

1998 Mitsubishi Galant

1998 ACCESSORIES & EQUIPMENT
Mitsubishi - Keyless Entry & Power Door Locks

Galant

DESCRIPTION & OPERATION

Power door locks are controlled by driver or front passenger switches which send signals to the Electronic Time Alarm Control System (ETACS) ECU. The ETACS-ECU sends appropriate signals to individual door lock actuators.

The following features are incorporated in power door lock systems that are equipped with an ETACS-ECU:

* Once locked door is closed, system will unlock door if key remains in ignition switch.
* Continuous switching between lock and unlock of door will disable system for about one minute.

All door locks can be actuated with operation of driver-side door lock. An optional Remote Keyless Entry (RKE) system is available. Remote control operates door locks within a range of 13 ft. (4 m). Reading light flashes twice when doors are locked and illuminates for 3 seconds when doors are unlocked.

COMPONENT LOCATIONS

COMPONENT LOCATIONS TABLE

Component	Location
Data Link Connector (DLC)	Under Left Side Of Dash, Below Steering Column
Door Lock Actuator	Inside Each Door
Door Lock Relay	Under Rear Deck Shelf
ETACS-ECU	Behind Left Side Of Dash
Remote Keyless Entry (RKE) Receiver	Under Rear Deck Shelf

TRANSMITTER PROGRAMMING

NOTE: Transmitter programming should be performed only after verifying that door lock operates normally using key. Whenever a transmitter is replaced, register 2 secret codes in transmitter.

Each transmitter is programmed with an individual secret code. If transmitter or receiver is replaced or secret code is improperly registered, re-register code into receiver. Before registering, ensure doors lock and unlock using key. Two secret codes may be registered within receiver. One is stored in SET I position and another is stored in SET II position. When 2 codes have already been registered, a new code is replaced with old one.

1) Set code registration switch on receiver to SET I position (registration mode). Press any button on transmitter. Set code

registration switch on receiver to FIX position (operation mode). Ensure keyless entry system operates normally.

2) If system does not operate normally, repeat step 1). Set code registration switch on receiver to SET II position (registration mode). Press any button on transmitter. Set code registration switch on receiver to FIX position (operation mode). Ensure keyless entry system operates normally. After registration is complete, ensure registration switch on receiver is set to FIX position.

SYMPTOM TESTS

NOTE: To diagnose symptom, see Figs. 1 and 2, then go to appropriate test under CIRCUIT TESTS (KEYLESS ENTRY) or CIRCUIT TESTS (POWER DOOR LOCKS).

Trouble Symptom		Probable Cause	Circuit Test No.
No doors can be locked or unlocked.	The indicator light of the transmitter does not illuminate when the transmit switch is pressed.	• Dead transmitter battery. • Malfunction of transmitter.	1
	A transmission signal is being sent from the transmitter (indicator light illuminates) but the door lock does not operate.	• Malfunction of central door locking system. • Malfunction of receiver. • Malfunction of ETACS-ECU.	2
Not all of the doors can be locked or unlocked.		• Malfunction of door lock actuator.	3
All doors can be locked and unlocked with the transmitter, but the dome light and foot light do not flash or illuminate. (However, the dome light operation is normal when a door is opened and closed.)		• Malfunction of door.	4
When all doors are locked with the transmitter, the theft-alarm system is not set. (The SECURITY indicator doesn't illuminate, and the alarm doesn't function.) <Vehicles with theft-alarm system>		• Malfunction of receiver • Malfunction of ETACS-ECU	5
When the PANIC switch of the transmitter is pressed, the headlights do not flash and the horns do not sound. (However, the theft-alarm functions normally.) <Vehicles with theft-alarm system>		• Malfunction of receiver • Malfunction of ETACS-ECU	6

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Fig. 1: Symptom Chart (Keyless Entry)
Courtesy of Mitsubishi Motor Sales of America

Trouble Symptom	Probable Cause	Circuit Test No.
When the central door lock switch is operated, other doors do not lock or unlock.	• Malfunction of power window switch (front door) • Malfunction of door lock actuator • Incorrect connector connection or malfunction of harness	1
When the driver's side door lock is turned with the key or if the driver's side door inside door lock knob is operated, other doors do not lock or unlock.	• Malfunction of driver's side door actuator switch • Malfunction of power window switch (driver's side door) • Incorrect connector connection or malfunction of harness	2
When the driver's side door lock is turned with key, other doors do not unlock.	• Malfunction of driver's side door key cylinder switch • Malfunction of power window switch (driver's side door) • Incorrect connector connection or malfunction of harness	3
When the passenger's side door lock is turned with key, other doors do not lock or unlock.	• Malfunction of passenger's side door key cylinder switch • Malfunction of power window switch (driver's side door) • Incorrect connector connection or malfunction of harness	4

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Fig. 2: Symptom Chart (Power Door Locks)
Courtesy of Mitsubishi Motor Sales of America

CIRCUIT TESTS (KEYLESS ENTRY)

Test No. 1

Verify if transmitter LED illuminates when transmitter switch buttons are pressed. If LED illuminates, go to TEST NO. 2. If LED does not illuminate, replace transmitter battery and test again. If LED still does not illuminate, replace transmitter.

Test No. 2

1) Verify if doors can be locked or unlocked using key at left side door lock. If doors cannot be locked or unlocked, see SYMPTOM CHART (POWER DOOR LOCKS). See Fig. 2. If doors can be locked and unlocked, go to next step.

2) Verify if transmitter secret code has been programmed correctly. If secret code needs to be programmed, see TRANSMITTER PROGRAMMING. If secret code has been programmed correctly, go to next step.

3) Check receiver voltage. See PIN VOLTAGE TESTS. See Fig. 4. If voltages are as specified, go to next step. If voltages are not as specified, check circuit between receiver, ignition switch and fusible link. See WIRING DIAGRAMS. Repair as necessary. If circuit is okay, replace receiver.

4) Check connectors and circuit between receiver and ETACS-ECU. See WIRING DIAGRAMS. Repair as necessary. If connectors and circuit are okay, replace ETACS-ECU.

Test No. 3

1) Check door lock actuator on affected door. See DOOR LOCK ACTUATOR under COMPONENT TESTS. Replace door lock actuator as necessary. If door lock actuator is okay, go to next step.

2) Check connectors and circuit to affected door lock actuator. See WIRING DIAGRAMS. Repair as necessary. If connectors and circuit are okay, check circuit between ETACS-ECU and affected door lock actuator.

Test No. 4

1) Disconnect receiver harness connector. Set dome light in DOOR position. Check voltage between ground and receiver harness-side connector terminal No. 11 (Green/Orange wire). See WIRING DIAGRAMS. If battery voltage is present, go to next step. If battery voltage is not present, replace receiver.

2) Check connectors and circuit between dome light, foot light and receiver. See WIRING DIAGRAMS. Repair as necessary.

Test No. 5

1) Verify if anti-theft system is set when all doors are locked with key. If anti-theft system sets, go to next step. If anti-theft system does not set, diagnose anti-theft system. See ANTI-THEFT SYSTEMS article.

2) Check harness connectors to ETACS-ECU, central locking system and receiver. Repair as necessary. If harness connectors are okay, go to next step.

3) Disconnect receiver harness connector. Using an oscilloscope, check voltage between ground and receiver harness-side connector terminal No. 15 (Green wire). See WIRING DIAGRAMS. If 5-volt pulse output is present, replace receiver. If 5-volt pulse output is not present, check circuit between receiver and ETACS-ECU. Repair as necessary. If circuit is okay, replace ETACS-ECU.

Test No. 6

1) Check operation of anti-theft system. If anti-theft system operates normally, go to next step. If anti-theft system does not operate normally, diagnose anti-theft system. See ANTI-THEFT SYSTEMS article.

2) Check harness connector to ETACS-ECU, central door locking system and receiver. Repair as necessary. If harness connectors are okay, go to next step.

3) Disconnect receiver harness connector. Using an oscilloscope, check voltage between ground and receiver harness-side connector terminal No. 15 (Green wire). See WIRING DIAGRAMS. If 5-volt pulse output is present, replace receiver. If 5-volt pulse output is not present, check circuit between receiver and ETACS-ECU. Repair as necessary. If circuit is okay, replace ETACS-ECU.

CIRCUIT TESTS (POWER DOOR LOCKS)

Test No. 1

1) Check left front door lock switch. See DOOR LOCK SWITCH under COMPONENT TESTS. Repair or replace as necessary. If door lock switch is okay, check opening and closing of power windows. If power windows operate, go to next step. If power windows do not operate, go to POWER WINDOWS article.

2) Disconnect all door lock actuator harness connectors. Check for continuity between ground and front (left and right side) door lock actuator harness-side connector terminals No. 3 and 4, and between ground and rear (left and right side) door lock actuator harness-side connector terminals No. 1 and 3. See WIRING DIAGRAMS. If continuity is present, replace left side power window switch. If continuity is not present, go to next step.

3) Check harness connectors and circuit between ground and door lock actuator. See WIRING DIAGRAMS. Repair as necessary.

Test No. 2

1) Check left side actuator. See DOOR LOCK ACTUATOR under COMPONENT TESTS. Replace as necessary. If actuator is okay, go to next step.

2) Disconnect left side actuator harness connector. Check for continuity between ground and actuator switch harness-side connector terminal No. 1 (Black wire). See WIRING DIAGRAMS. If continuity is present, go to next step. If continuity is not present, check connectors and circuit between actuator switch and ground. Repair as necessary.

3) Check voltage between ground and left side actuator switch harness-side connector terminal No. 2 (Green/White wire). If voltage reading is about 5 volts, replace left side power window switch. If voltage reading is not about 5 volts, go to next step.

4) Check harness connectors and circuit between left side actuator switch and power window switch. See WIRING DIAGRAMS. Repair as necessary.

Test No. 3

1) Check left side key cylinder switch. See DOOR LOCK KEY CYLINDER SWITCH under COMPONENT TESTS. Replace as necessary. If key cylinder switch is okay, go to next step.

2) With key cylinder switch harness connector disconnected, check for continuity between ground and switch harness-side connector terminal No. 2 (Black wire). If continuity is present, go to step 4). If continuity is not present, go to next step.

3) Check connectors and circuit between key cylinder switch and ground. See WIRING DIAGRAMS. Repair as necessary.

4) Check voltage between ground and left side key cylinder switch harness-side connector terminal No. 1 (Yellow/White wire). If voltage reading is about 5 volts, replace left side power window switch. If voltage reading is not about 5 volts, go to next step.

5) Check connectors and circuit between left side key cylinder switch and left side power window switch. See WIRING DIAGRAMS . Repair as necessary.

Test No. 4

1) To check right side key cylinder switch, go to next step. To check left side door lock power supply, go to step 7). To check right side door lock power supply, go to step 12).

2) Check right side key cylinder switch. See DOOR LOCK KEY CYLINDER SWITCH under COMPONENT TESTS. Replace as necessary. If key cylinder switch is okay, go to next step.

3) With key cylinder switch harness connector disconnected, check for continuity between ground and switch harness-side connector terminal No. 2 (Black wire). If continuity is present, go to step 5). If continuity is not present, go to next step.

4) Check connectors and circuit between key cylinder switch and ground. See WIRING DIAGRAMS. Repair as necessary.

5) Check voltage between ground and right side key cylinder switch harness-side connector terminal No. 1 (Green/White wire), and between ground and terminal No. 3 (Red/Green wire). If battery voltage is present, replace right side power window switch. If battery voltage is not present, go to next step.

6) Check connectors and circuit between right side key cylinder switch and right side power window switch. See WIRING DIAGRAMS. Repair as necessary.

7) Disconnect left side power window switch harness connector. Check voltage between ground and power window switch harness-side connector terminals No. 9 (Green/Yellow wire) and No. 23 (Blue/Red wire). If battery voltage is present, go to next step. If battery voltage is not present, go to step 9).

8) Turn ignition on. Check voltage between ground and left side power window switch harness-side connector terminal No. 1 (Gray

wire). If battery voltage is present, go to step 10). If battery voltage is not present, go to next step.

9) Check connectors and circuit between left side power window switch and ground. See WIRING DIAGRAMS. Repair as necessary.

10) Check for continuity between ground and left side power window switch harness-side connector terminal No. 24 (Black wire). If continuity is present, replace left side power window switch. If continuity is not present, go to next step.

11) Check connectors and circuit between left side door power window switch and ground. See WIRING DIAGRAMS. Repair as necessary.

12) Disconnect right side power window switch harness connector. Check voltage between ground and power window switch harness-side connector terminal No. 2 (Blue wire). If battery voltage is present, go to step 14). If battery voltage is not present, go to next step.

13) Check connectors and circuit between right side power window switch and ground. See WIRING DIAGRAMS. Repair as necessary.

14) Check for continuity between ground and right side power window switch harness-side connector terminals No. 1 (Black wire) and No. 9 (Black wire). If continuity is present, replace right side power window switch. If continuity is not present, go to next step.

15) Check connectors and circuit between right side door power window switch and ground. See WIRING DIAGRAMS. Repair as necessary.

COMPONENT TESTS

* PLEASE READ THIS FIRST *

NOTE: If system is still not functioning properly after all testing procedures are completed, substitute a known-good ETACS-ECU and retest.

DOOR LOCK ACTUATOR

Left Front Door

1) Access left front door lock actuator. See DOOR LOCK ACTUATOR R & I under REMOVAL & INSTALLATION. Disconnect harness connector. Set actuator in LOCK position. Connect positive lead of 12-volt power source to actuator terminal No. 3 (Blue/Black wire). See WIRING DIAGRAMS. Actuator should move to UNLOCK position when terminal No. 4 (Blue/Red wire) is connected to ground.

2) With actuator set in UNLOCK position, connect positive lead of 12-volt power source to actuator terminal No. 4 (Blue/Red wire). Actuator should move to LOCK position when terminal No. 3 (Blue/Black wire) is connected to ground.

3) Check for continuity between actuator terminals No. 1 (Black wire) and No. 2 (Green/White wire). Continuity should be present with actuator set to UNLOCK position. Continuity should not be present with actuator set to LOCK position.

Right Front Door

1) Access right front door lock actuator. See DOOR LOCK ACTUATOR R & I under REMOVAL & INSTALLATION. Disconnect harness connector. Set actuator in LOCK position. Connect positive lead of 12-volt power source to actuator terminal No. 4 (Blue/Yellow wire). See WIRING DIAGRAMS. Actuator should move to UNLOCK position when terminal No. 3 (Blue/Red wire) is connected to ground.

2) With actuator set in UNLOCK position, connect positive lead of 12-volt power source to actuator terminal No. 3 (Blue/Red wire). Actuator should move to LOCK position when terminal No. 4 (Blue/Yellow wire) is connected to ground.

3) Check for continuity between actuator terminals No. 1 (Black wire) and No. 2 (Green/Blue wire). Continuity should be present with actuator set to UNLOCK position. Continuity should not be present with actuator set to LOCK position.

Left Rear Door

1) Access left rear door lock actuator. See DOOR LOCK ACTUATOR R & I under REMOVAL & INSTALLATION. Disconnect harness connector. Set actuator in LOCK position. Connect positive lead of 12-volt power source to actuator terminal No. 1 (Blue/Black wire). See WIRING DIAGRAMS. Actuator should move to UNLOCK position when terminal No. 3 (Blue/Red wire) is connected to ground.

2) With actuator set in UNLOCK position, connect positive lead of 12-volt power source to actuator terminal No. 3 (Blue/Red wire). See WIRING DIAGRAMS. Actuator should move to LOCK position when terminal No. 1 (Blue/Black wire) is connected to ground.

Right Rear Door

1) Access right rear door lock actuator. See DOOR LOCK ACTUATOR R & I under REMOVAL & INSTALLATION. Disconnect harness connector. Set actuator in LOCK position. Connect positive lead of 12-volt power source to actuator terminal No. 3 (Blue/Yellow wire). See WIRING DIAGRAMS. Actuator should move to UNLOCK position when terminal No. 1 (Blue/Red wire) is connected to ground.

2) With actuator set in UNLOCK position, connect positive lead of 12-volt power source to actuator terminal No. 1 (Blue/Red wire). See WIRING DIAGRAMS. Actuator should move to LOCK position when terminal No. 3 (Blue/Yellow wire) is connected to ground.

DOOR LOCK KEY CYLINDER SWITCH

Left Doors

1) Disconnect door lock key cylinder switch harness connector. With door lock key cylinder switch in LOCK position, continuity should be present between switch terminals No. 2 and 3. See WIRING DIAGRAMS.

2) Turn door lock switch to UNLOCK position. Continuity should be present between switch terminals No. 1 and 2. Turn door lock switch to OFF (Neutral) position. Continuity should not be present in any of the terminals. Replace door lock key cylinder if continuity is not as specified.

Right Doors

1) Disconnect door lock key cylinder switch harness connector. With door lock key cylinder switch in LOCK position, continuity should be present between switch terminals No. 1 and 2. See WIRING DIAGRAMS.

2) Turn door lock switch to UNLOCK position. Continuity should be present between switch terminals No. 2 and 3. Turn door lock switch to OFF (Neutral) position. Continuity should not be present in any of the terminals. Replace door lock key cylinder if continuity is not as specified.

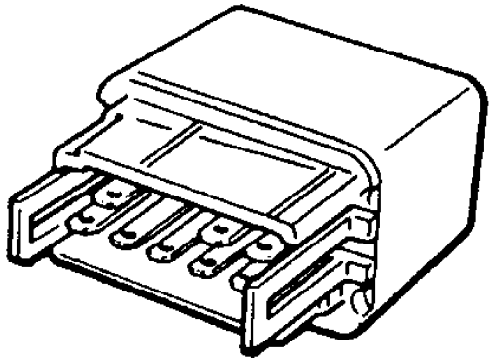
DOOR LOCK RELAY

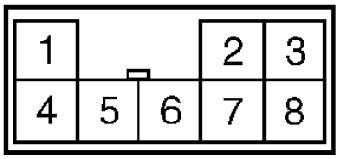
1) Disconnect relay harness connector. Check for continuity between relay terminals No. 1, 3 and 5, and between relay terminals No. 4, 7 and 8. See Fig. 3. Continuity should be present.

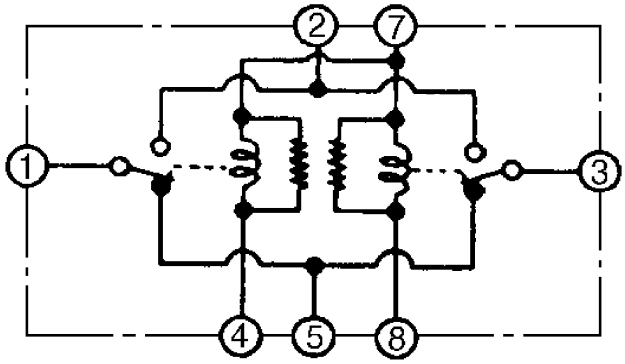
2) Apply positive battery voltage to relay terminal No. 7 and ground to terminal No. 4. Continuity should be present between relay terminals No. 1 and 2. See Fig. 3.

3) Apply positive battery voltage to relay terminal No. 7 and ground to terminal No. 8. Continuity should be present between relay

terminals No. 2 and 3. Replace relay as necessary.







Battery voltage	Terminal No.						
	1	2	3	4	5	7	8
Continuity no voltage	○		○		○		
				○		○	○
Continuity with voltage	○	○		⊖		⊕	
		○	○			⊕	⊖

97A11817

Fig. 3: Checking Door Lock Relay
Courtesy of Mitsubishi Motor Sales of America

DOOR LOCK SWITCH

Left Side

1) Remove left front power window switch from door panel. Apply positive battery voltage to switch terminals No. 9 (Green/Yellow wire) and No. 23 (Blue/Red wire). Apply ground to switch terminal No. 24 (Black wire). See WIRING DIAGRAMS.

2) Place door lock switch in LOCK position. Continuity should be present between power window switch terminals No. 7 (Red/Yellow wire), No. 8 (Red/Green wire), and No. 23 (Blue/Red wire); between power window switch terminals No. 23 (Blue/Red wire) and No. 25 (Blue/Black wire); and between power window switch terminals No. 24 (Black wire) and No. 26 (Blue/Red wire).

3) Place door switch in OFF (Neutral) position. Continuity should be present between power window switch terminals No. 7 (Red/Yellow wire), No. 8 (Red/Green wire), and No. 23 (Blue/Red wire).

4) Place door switch in UNLOCK position. Continuity should be present between power window switch terminals No. 7 (Red/Yellow wire), No. 8 (Red/Green wire), and No. 23 (Blue/Red wire); between switch terminals No. 23 (Blue/Red wire) and No. 26 (Blue/Red wire); and between switch terminals No. 24 (Black wire) and No. 25 (Blue/Black wire).

5) If continuity between switch terminals is not as specified, replace left front power window switch.

Right Side

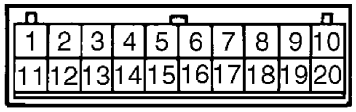
1) Remove right side door lock switch from door panel. Apply positive battery voltage to switch terminal No. 2 (Blue wire). Apply ground to switch terminals No. 1 (Black wire) and No. 9 (Black wire).

2) Place door switch in LOCK position. Continuity should be present between switch terminals No. 1 (Black wire), No. 3 (Green/White wire), and No. 9 (Black wire).

3) Place door switch in UNLOCK position. Continuity should be present between switch terminals No. 1 (Black wire), No. 9 (Black wire), and No. 10 (Red/Green wire).

4) If continuity between switch terminals is not as specified, replace right side door lock switch.

PIN VOLTAGE TESTS



Terminal No.	Signal	Conditions		Terminal Voltage
1	Key reminder switch (vehicles with theft alarm)	ON (Key removed)		Battery positive voltage
		OFF (Key inserted)		0V
2	Door switch	All doors close (Door switch: OFF)		Battery positive voltage
		One of doors open (Door switch: ON)		0V
6	Door lock actuator (L.H.)	LOCK		5V (Pulse output*)
		UNLOCK		0V
9	Receiver power source	Ignition switch (ACC or ON)		Battery positive voltage
		Ignition switch (OFF)		0V
10	Receiver power source	Always		Battery positive voltage
11	Room light	All doors close (door switch: OFF)	To operate	0V
			Not to operate	Battery positive voltage
12	Door lock output (All doors)	To operate		0V
		Not to operate		Battery positive voltage
13	Door unlock output (All doors)	To operate		0V
		Not to operate		Battery positive voltage
14	Door unlock output (Driver's side)	To operate		0V
		Not to operate		Battery positive voltage
15	ETACS-ECU <Vehicle with theft-alarm system>	Transmitter switch: ON		0V
		Transmitter switch: OFF		5V (Pulse output*)
20	Ground	Always		0V

NOTE
*: Use an oscilloscope. When using the tester, 0 – 0.03V are indicated repeatedly.

97G04275
Fig. 4: Pin Voltage Chart (Keyless Entry System)
Courtesy of Mitsubishi Motor Sales of America

REMOVAL & INSTALLATION

DOOR LOCK ACTUATOR R & I

Removal & Installation

Remove inner door panel. Remove switch panel and door trim. Remove mounting screws, and slide panel up to remove. Remove waterproof film. Remove actuator. To install, reverse removal procedure.

WIRING DIAGRAMS

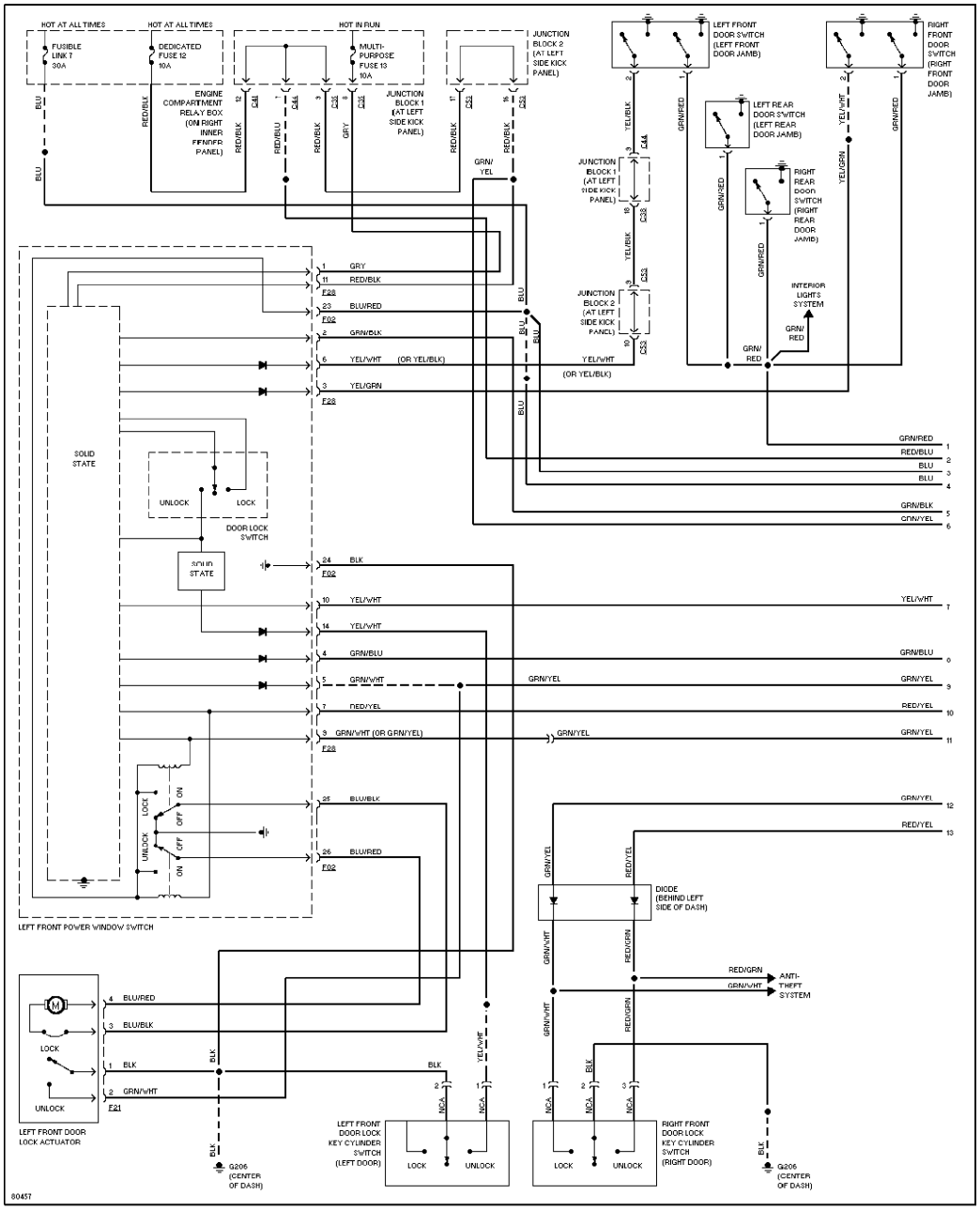


Fig. 5: Keyless Entry Wiring Diagram (1 Of 2)

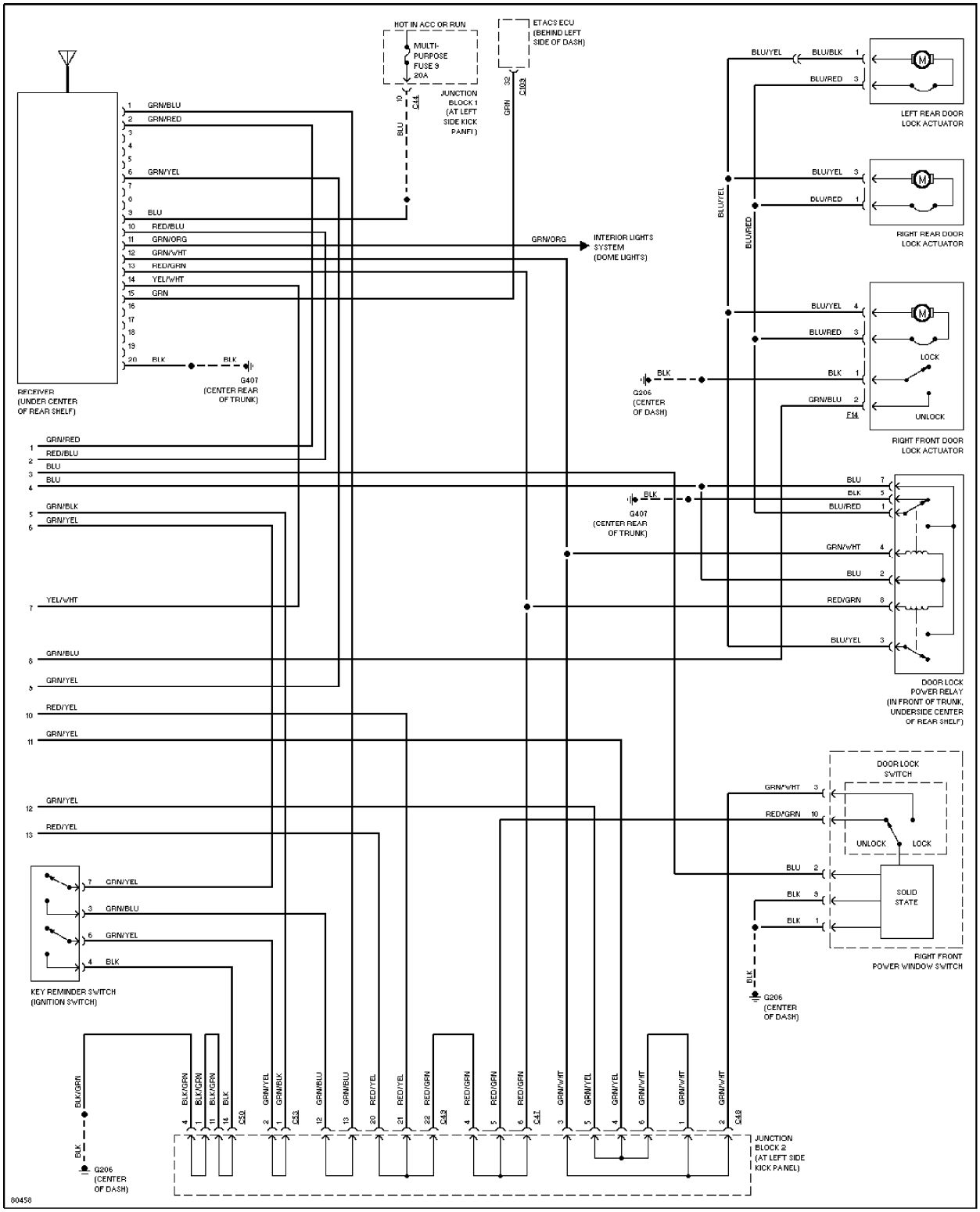


Fig. 6: Keyless Entry Wiring Diagram (2 Of 2)

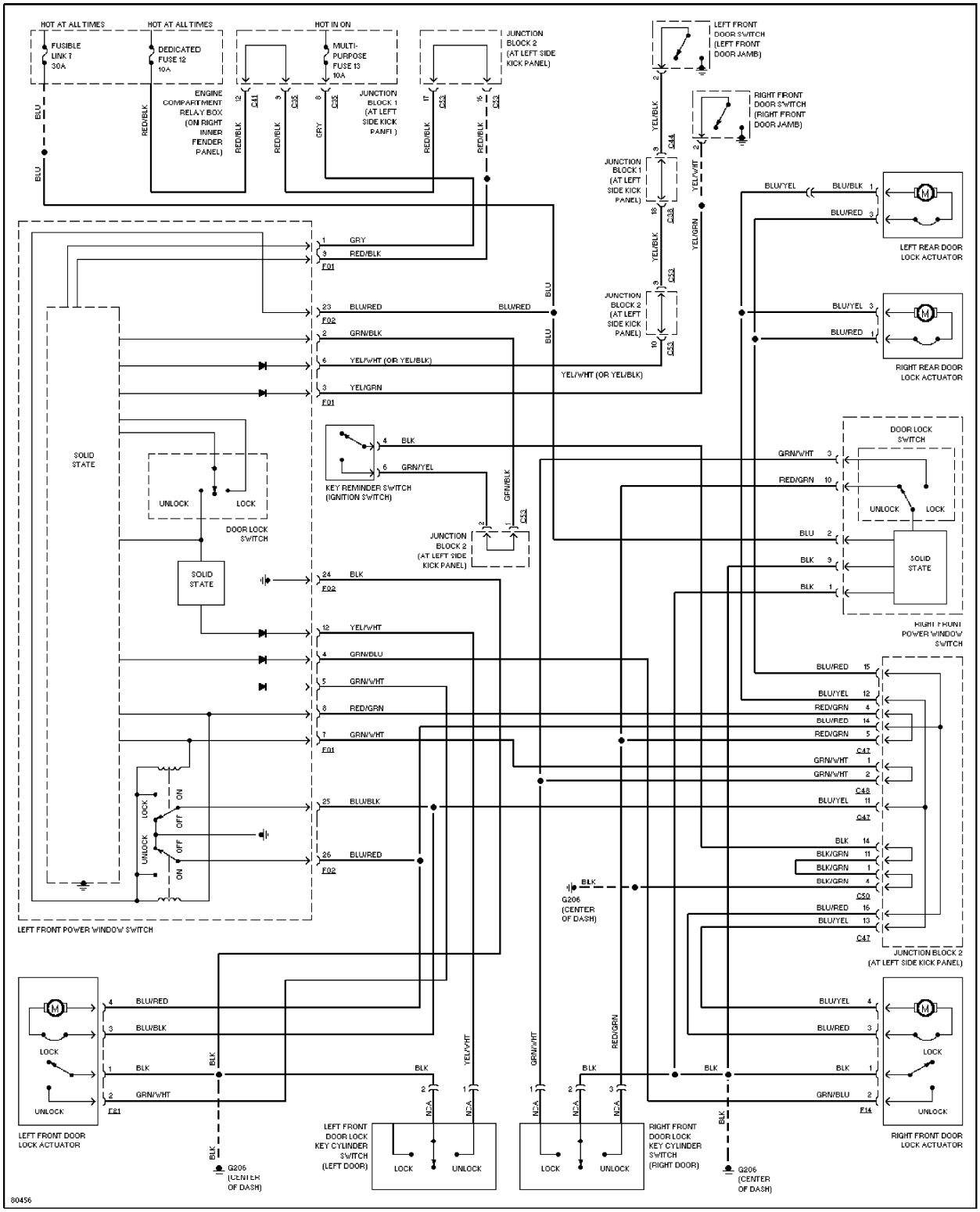


Fig. 7: Power Door Locks Wiring Diagram

* DRIVETRAIN SYSTEMS UNIFORM INSPECTION GUIDELINES *

1998 Mitsubishi Galant

GENERAL INFORMATION
Drivetrain/Transmission Motorist Assurance Program
Standards For Automotive Repair

All Makes and Models

INTRODUCTION TO MOTORIST ASSURANCE PROGRAM (MAP)

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Drive/Power Train Components

ACTUATORS (ELECTRICAL)
ACTUATORS (VACUUM)
AXLES
BEARINGS AND RACES
BELL CRANKS
BELL HOUSINGS
BUSHINGS (EXTERNAL)
CABLES (SPEEDOMETER)
CABLES (TV, DETENT AND SHIFT)
CARRIER BEARINGS
CLUTCH CABLES AND CABLE HOUSINGS
CLUTCH DISCS (MANUAL TRANSMISSION)
CLUTCH FORKS
CLUTCH LINKAGES (MECHANICAL)
CLUTCH MASTER CYLINDERS
CLUTCH PEDALS
CLUTCH PIVOTS
CLUTCH PRESSURE PLATES
CLUTCH RELEASE BEARINGS
CLUTCH SLAVE CYLINDERS (CONCENTRIC)
CLUTCH SLAVE CYLINDERS (CONVENTIONAL OR EXTERNAL)
COMPANION FLANGES
CONNECTORS
COOLER BYPASS VALVES
COOLER LINES
COOLERS
CV JOINTS
DIP STICK TUBES
DIP STICKS (FLUID LEVEL INDICATORS)
DOWEL PINS, GUIDES AND PILOT HOLES
DRIVE SHAFT FLANGES
DRIVE SHAFTS AND HALF SHAFTS
DUST BOOTS
ENGINE MOUNTS
EXCITER RINGS
FILLER TUBES
FILTERS AND SCREENS

FLANGES
FLEX PLATES
FLUID LEVEL INDICATORS
FLUIDS AND LUBRICANTS
FLYWHEELS
FORCE MOTORS
GUIDES
HALF SHAFTS
HOSES, LINES AND TUBES
HOUSINGS (BELL, CASE, TAIL (EXTENSION) AND AUXILIARY)
INTERMEDIATE SHAFT SUPPORT BEARINGS
KEY INTERLOCK SYSTEMS
LIMITED SLIPS
LINES
LINKAGES (EXTERNAL)
LOCKING HUB ASSEMBLIES
LOCKING HUB CONTROL KNOBS
LUBRICANTS
METAL-CLAD SEALS
METALASTIC JOINTS
MODULATOR PINS
MODULATORS
MOUNTS (ENGINE, TRANSAXLE AND TRANSMISSION)
ODOMETER DRIVES (MECHANICAL)
ODOMETER HEADS (MECHANICAL)
OIL PANS
PANS
PILOT HOLES
PRESSURE PLATES
PRESSURE SWITCHES
RACES
RUBBER JOINTS (METALASTIC)
SCREENS
SEALS
SEALS (METAL-CLAD)
SELECTOR INTERLOCK SYSTEMS
SERVOS
SHIFT INTERLOCK SYSTEMS (SELECTOR AND KEY INTERLOCK SYSTEMS)
SENSORS
SIDE COVERS
SLIP YOKES
SOLENOIDS
SPEED SENSORS (ELECTRONIC WHEEL AND VEHICLE)
SPEEDOMETER-DRIVEN GEAR HOUSINGS
SPEEDOMETER/ODOMETER DRIVES (MECHANICAL)
SPEEDOMETER/ODOMETER HEADS (MECHANICAL)
SPEEDOMETERS AND ODOMETERS (ELECTRONIC)
SWITCHES
TONE WHEELS
TOOTHED RINGS (TONE WHEELS)
TORQUE CONVERTERS
TRANSAXLE MOUNTS
TRANSDUCERS (TRANSMISSION)
TRANSMISSION COOLERS
TRANSMISSION MOUNTS
TRANSMISSION PANS
TRANSMISSION RANGE INDICATORS (PRNDL)
TUBES
UNIVERSAL JOINTS (CARDON OR CROSS TYPE)
VACUUM CONTROLS
VACUUM HOSES
VACUUM MOTORS
VACUUM-OPERATED SWITCHES

VEHICLE SPEED SENSORS
VENTS
VIBRATION DAMPERS
WHEEL ATTACHMENT HARDWARE
WHEEL SPEED SENSORS
WIRING HARNESSES AND CONNECTORS
YOKES AND SLIP YOKES

INTRODUCTION TO MOTORIST ASSURANCE PROGRAM (MAP)

OVERVIEW OF MOTORIST ASSURANCE PROGRAM

The Motorist Assurance Program is the consumer outreach effort of the Automotive Maintenance and Repair Association, Inc. (AMRA). Participation in the Motorist Assurance Program is drawn from retailers, suppliers, independent repair facilities, vehicle manufacturers and industry associations.

Our organization's mission is to strengthen the relationship between the consumer and the auto repair industry. We produce materials that give motorists the information and encouragement to take greater responsibility for their vehicles-through proper, manufacturer-recommended, maintenance. We encourage participating service and repair shops (including franchisees and dealers) to adopt (1) a Pledge of Assurance to their Customers and (2) the Motorist Assurance Program Standards of Service. All participating service providers have agreed to subscribe to this Pledge and to adhere to the promulgated Standards of Service demonstrating to their customers that they are serious about customer satisfaction.

These Standards of Service require that an inspection of the vehicle's (problem) system be made and the results communicated to the customer according to industry standards. Given that the industry did not have such standards, the Motorist Assurance Program successfully promulgated industry inspection communication standards in 1994-95 for the following systems: Exhaust, Brakes, ABS, Steering and Suspension, Engine Maintenance and Performance, HVAC, and Electrical Systems. Further, revisions to all of these inspection were recently published. Further, revisions to all of these inspection communication standards are continually republished. In addition to these, standards for Drive Train and Transmissions have recently been promulgated. Participating shops utilize these Uniform Inspection & Communication Standards as part of the inspection process and for communicating their findings to their customers.

The Motorist Assurance Program continues to work cooperatively and proactively with government agencies and consumer groups toward solutions that both benefit the customer and are mutually acceptable to both regulators and industry. We maintain the belief that industry must retain control over how we conduct our business, and we must be viewed as part of the solution and not part of the problem. Meetings with state and other government officials (and their representatives), concerned with auto repair and/or consumer protection, are conducted. Feedback from these sessions is brought back to the association, and the program adjusted as needed.

To assure auto repair customers recourse if they were not satisfied with a repair transaction, the Motorist Assurance Program offers mediation and arbitration through MAP/BBB-CARE and other non-profit organizations. MAP conducted pilot programs in twelve states before announcing the program nationally in October, 1998. During the pilots, participating repair shops demonstrated their adherence to the Pledge and Standards and agreed to follow the UICS in communicating the results of their inspection to their customers. To put some "teeth" in the program, an accreditation requirement for shops was initiated. The requirements are stringent, and a self-policing method

has been incorporated which includes the "mystery shopping" of outlets.

We welcome you to join us as we continue our outreach... with your support, both the automotive repair industry and your customers will reap the benefits. Please visit MAP at our Internet site www.motorist.org or contact us at:

1444 I Street, NW Suite 700
Washington, DC 20005
Phone (202) 712-9042 Fax (202) 216-9646

January 1999

MAP UNIFORM INSPECTION GENERAL GUIDELINES

OVERVIEW OF SERVICE REQUIREMENTS & SUGGESTIONS

It is MAP policy that all exhaust, brake, steering, suspension, wheel alignment, drive-line, engine performance and maintenance, and heating, ventilation and air conditioning, and electrical services be offered and performed under the standards and procedures specified in these sections.

Before any service is performed on a vehicle, an inspection of the appropriate system must be performed. The results of this inspection must be explained to the customer and documented on an inspection form. The condition of the vehicle and its components will indicate what services/part replacements may be "Required" or "Suggested". In addition, suggestions may be made to satisfy the requests expressed by the customer.

When a component is suggested or required to be repaired or replaced, the decision to repair or replace must be made in the customer's best interest, and at his or her choice given the options available.

This section lists the various parts and conditions that indicate a required or suggested service or part replacement. Although this list is extensive, it is not fully inclusive. In addition to this list, a technician may make a suggestion. However, any suggestions must be based on substantial and informed experience, or the vehicle manufacturer's recommended service interval and must be documented.

Some conditions indicate that service or part replacement is required because the part in question is no longer providing the function for which it is intended, does not meet a vehicle manufacturer's design specification or is missing.

Example:
An exhaust pipe has corroded severely and has a hole in it through which exhaust gases are leaking. Replacement of the exhaust pipe in this case is required due to functional failure.

Example:
A brake rotor has been worn to the point where it measures less than the vehicle manufacturer's discard specifications. Replacement of the rotor is required because it does not meet design specifications.

Some conditions indicate that a service or part replacement is suggested because the part is close to the end of its useful life or addresses a customer's need, convenience or request. If a customer's vehicle has one of these conditions, the procedure may be only to suggest service.

Example:
An exhaust pipe is rusted, corroded or weak, but no leaks are present. In this case, the exhaust pipe has not failed. However, there is evidence that the pipe may need replacement in the near future. Replacement of the pipe may be suggested for the customer's convenience in avoiding a future problem.

Example:
The customer desires improved ride and/or handling, but the vehicle's shocks or struts have not failed. In this case, replacement may be suggested to satisfy the customer's wishes. In this case, replacement of the shocks or struts may not be sold as a requirement.

A customer, of course, has the choice of whether or not a shop will service his or her vehicle. He or she may decide not to follow some of your suggestions. When a repair is required, a MAP shop must refuse partial service on that system if, in the judgment of the service provider, proceeding with the work could create or continue an unsafe condition. When a procedure states that required or suggested repair or replacement is recommended, the customer must be informed of the generally acceptable repair/replacement options whether or not performed by the shop.

When presenting suggested repairs to the customer, you must present the facts, allowing the customer to draw their own conclusions and make an informed decision about how to proceed.

The following reasons may be used for required and suggested services. These codes are shown in the "Code" column of the MAP Uniform Inspection & Communications Standards that follow:

Reasons to Require Repair or Replacement

A – Part no longer performs intended purpose
B – Part does not meet a design specification (regardless of performance)
C – Part is missing

NOTE: When a repair is required, the shop must refuse partial service to the system in question, if the repair creates or continues an unsafe condition.

Reasons to Suggest Repair or Replacement

1 – Part is close to the end of its useful life (just above discard specifications, or weak; failure likely to occur soon, etc.)
2 – To address a customer need, convenience, or request (to stiffen ride, enhance performance, eliminate noise, etc.)
3 – To comply with maintenance recommended by the vehicle's Original Equipment Manufacturer (OEM)
4 – Technician's recommendation based on substantial and informed experience

NOTE: Suggested services are always optional. When presenting suggested repairs to the customer, you must present the facts, allowing the customer to draw their own conclusions and make an informed decision about how to proceed.

DRIVE/POWER TRAIN ASSEMBLIES

SERVICE PROCEDURES REQUIRED AND SUGGESTED FOR PROPER VEHICLE OPERATION

NOTE: Whenever transmission or drivetrain service is performed that affects the suspension alignment, for example, removing the engine cradle, it is required that the alignment be checked and corrected if necessary.

AUTOMATIC TRANSMISSION/TRANSAXLE ASSEMBLIES

AUTOMATIC TRANSMISSION/TRANSAXLE ASSEMBLY INSPECTION

Condition	Code	Procedure
Any internal component failure that requires removal of the assembly from the vehicle for service. (1)	A	(2) Require repair or replacement of the automatic transmission/transaxle assembly.

(1) - It is Required that the torque converter and all other failure related components be inspected for cause and condition.
(2) - For components not requiring removal of the assembly, refer to the component listing in this document.

DIFFERENTIAL AND FINAL DRIVE ASSEMBLIES

NOTE: Does not include half shafts.

DIFFERENTIAL AND FINAL DRIVE ASSEMBLY INSPECTION

Condition	Code	Procedure
Any internal component failure that requires removal of the assembly from the vehicle for service. (1)	A	Require repair or replacement of the differential assembly.

(1) - For components not requiring removal of the assembly, refer to the component listing in this document.

MANUAL TRANSMISSION/TRANSAXLE ASSEMBLIES

MANUAL TRANSMISSION/TRANSAXLE ASSEMBLY INSPECTION

Condition	Code	Procedure
Any internal component failure that requires removal of the assembly from the vehicle for service. (1)	A	Require repair or replacement of the manual transmission/transaxle assembly.

(1) - For components not requiring removal of the assembly,

refer to the component listing in this document.

TRANSFER CASE ASSEMBLIES

TRANSFER CASE ASSEMBLY INSPECTION

Condition	Code	Procedure
Any internal component failure that requires removal of the assembly from the vehicle for service. (1)	A	Require repair or replacement of the transfer case differential assembly.

(1) - For components not requiring removal of the assembly, refer to the component listing in this document.

DRIVE TRAIN/COMPONENTS

The conditions listed for the components included in this section assume that the problem has been isolated to the specific component through proper testing.

ACTUATORS (ELECTRICAL)

ACTUATOR (ELECTRICAL) INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted, affecting performance	A	(1) Require repair or replacement.
Connector melted, not affecting performance	2	(1) Suggest repair or replacement.
Connector missing	C	Require replacement.
Inoperative	A	(2) Require replacement.
Missing	C	Require replacement.
Noisy	2	Suggest repair or replacement.
Out of adjustment	B	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	1	(1) Suggest repair or

			replacement.
Terminal corroded, affecting performance	A	..	Require repair or replacement.
Terminal corroded, not affecting performance	1	..	Suggest repair or replacement.
Terminal loose, affecting performance	B	..	Require repair or replacement.
Terminal loose, not affecting performance	1	..	Suggest repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Inoperative includes intermittent operation or out of OEM specification.

ACTUATORS (VACUUM)

ACTUATOR (VACUUM) INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted, affecting performance	A	(1) Require repair or replacement.
Connector melted, not affecting performance	2	(1) Suggest repair or replacement.
Connector missing	C	Require replacement.
Inoperative	A	(2) Require replacement.
Leaking (vacuum)	A	Require repair or replacement.
Linkage bent, affecting performance	A	Require repair or replacement of linkage.
Linkage bent, not affecting performance	2	Suggest repair or replacement of linkage.
Linkage binding, affecting performance	A	Require repair or replacement of linkage.
Linkage binding, not affecting performance	1	Suggest repair or replacement of linkage.
Linkage broken	A	Require repair or replacement of linkage.
Linkage loose, affecting performance	A	Require repair or replacement of linkage.
Linkage loose, not affecting performance	1	Suggest repair or replacement of linkage.

Linkage missing	C	....	Require replacement.
Linkage noisy	2	..	Suggest repair or replacement.
Missing	C	....	Require replacement.
Noisy	2	..	Suggest repair or replacement.
Out of adjustment	A	..	Require repair or replacement.
Terminal burned, affecting performance	A	....	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	..	Suggest repair or replacement.
Terminal corroded, affecting performance	A	..	Require repair or replacement.
Terminal corroded, not affecting performance	2	..	Suggest repair or replacement.
Terminal loose, affecting performance	B	..	Require repair or replacement.
Terminal loose, not affecting performance	1	..	Suggest repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Inoperative includes intermittent operation or out of OEM specification.

AXLES

AXLE INSPECTION

Condition	Code		Procedure
Bent	A	....	Require replacement.
Broken	A	....	Require replacement.
End play exceeds specifications	B	..	Require repair or replacement.
Flange bent	A	....	Require replacement.
Flange threads stripped	A	..	Require repair or replacement.
Twisted	A	....	Require replacement.
Worn, affecting performance	A	....	Require replacement.

BEARINGS AND RACES

NOTE: When replacing or repacking bearings, grease seal replacement is required. You are not required to replace these components in axle sets. Determine the need to replace based upon the individual component conditions that follow.

BEARING AND RACE INSPECTION

Condition	Code		Procedure
Bearing end-play exceeds specifications	B	..	Require adjustment of bearing, if possible. If proper adjustment cannot be obtained, require replacement of bearing assembly.
Bearing rollers, balls or races are worn, pitted, or			

feel rough when rotated as an assembly	B	Require replacement of bearing assembly.

BELL CRANKS

BELL CRANK INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Bent	A	Require repair or replacement.
Broken	A	Require repair or replacement.
Cracked	A	Require repair or replacement.
Missing	C	Require replacement.
Worn, affecting performance	A	Require repair or replacement.

BELL HOUSINGS

See HOUSINGS (BELL, CASE, TAIL (EXTENSION) AND AUXILIARY).

BUSHINGS (EXTERNAL)

BUSHING (EXTERNAL) INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require repair or replacement of bent part if available; otherwise, replace bushing.
Attaching hardware broken	A	Require replacement of broken part if available; otherwise, replace bushing.
Attaching hardware corroded, affecting structural integrity	A	Require replacement of corroded part if available; otherwise, replace bushing.
Attaching hardware incorrect	A	Require replacement of incorrect part if available; otherwise, replace bushing.
Attaching hardware loose	A	Require repair or replacement of loose part if available; otherwise, replace bushing.
Attaching hardware missing	C	Require replacement of missing part if available; otherwise, replace bushing.

Condition	Code	Procedure
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads if available; otherwise, replace bushing.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads if available; otherwise, replace bushing.
Binding	A	Require repair or replacement.
Contaminated	1	Suggest replacement.
Deteriorated, affecting performance	A	Require repair or replacement.
Distorted, affecting performance	A	Require repair or replacement.
Missing	A	Require replacement.
Noisy	2	(1) Further inspection required.
Rubber separating from internal metal sleeve on bonded bushing	A	Require replacement.
Seized	A	Require replacement.
Shifted (out of position)	B	Require repair or replacement.
Split	A	Require replacement.
Surface cracking (weather-checked)	..	No service suggested or required.
Worn, affecting performance	A	Require repair or replacement.
Worn close to the end of its useful life	1	Suggest replacement.

(1) - If noise isolated to bushing, suggest repair or replacement.

CAUTION: Use only approved lubricant on rubber bushings. Petroleum-based lubricants may damage rubber bushings.

CABLES (SPEEDOMETER)

CABLE (SPEEDOMETER) INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Bent	A	Require repair or replacement.
Binding	A	Require repair or replacement.
Bracket bent, affecting performance	A	Require repair or replacement.
Bracket bent, not affecting performance	..	No service suggested or

			required.
Bracket broken, affecting performance	A	.....	Require replacement.
Bracket broken, not affecting performance	..	.....	No service suggested or required.
Bracket corroded, affecting performance	A	..	Require repair or replacement.
Bracket corroded, not affecting performance	2	..	Suggest repair or replacement.
Bracket cracked, affecting performance	A	..	Require repair or replacement.
Bracket cracked, not affecting performance	1	..	Suggest repair or replacement.
Bracket loose, affecting performance	A	..	Require repair or replacement.
Bracket loose, not affecting performance	1	..	Suggest repair or replacement.
Bracket missing	C	.....	Require replacement.
Broken	A	.....	Require replacement.
Cracked	A	..	Require repair or replacement.
Disconnected	A	..	Require repair or replacement.
Kinked	A	..	Require repair or replacement.
Melted	A	.....	(1) Require repair or replacement.
Missing	C	.....	Require replacement.
Noisy	2	..	Suggest repair or replacement.
Routed incorrectly	2	.....	Suggest repair.
Seized	A	..	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.

CABLES (TV, DETENT AND SHIFT)

CABLE (TV, DETENT AND SHIFT) INSPECTION

Condition	Code		Procedure
Attaching hardware broken	A	...	Require repair or replacement of hardware.
Attaching hardware missing	C	.....	Require replacement of hardware.
Attaching hardware not functioning	A	...	Require repair or replacement of hardware.
Bent	A	..	Require repair or replacement.
Binding	A	..	Require repair or replacement.
Bracket bent, affecting performance	A	..	Require repair or replacement.
Bracket bent, not affecting performance	..	.....	No service suggested or required.
Bracket broken, affecting performance	A	.....	Require replacement.
Bracket broken, not affecting performance	..	.....	No service suggested or required.
Bracket corroded, affecting performance	A	..	Require repair or replacement.

Bracket corroded, not affecting performance	2	Suggest repair or replacement.
Bracket cracked, affecting performance	A	Require repair or replacement.
Bracket cracked, not affecting performance	1	Suggest repair or replacement.
Bracket loose, affecting performance	A	Require repair or replacement.
Bracket loose, not affecting performance	1	Suggest repair or replacement.
Bracket missing	C	Require replacement.
Broken	A	Require replacement.
Cracked	A	Require repair or replacement.
Disconnected	A	Require repair or replacement.
Frayed	A	Require replacement.
Kinked	A	Require repair or replacement.
Melted	A	(1) Require repair or replacement.
Missing	C	Require replacement.
Noisy	2	Suggest repair or replacement.
Out of adjustment	B	(2) Require repair or replacement.
Routed incorrectly	2	Suggest repair.
Seized	A	Require repair or replacement.
Self-adjuster inoperative	A	Require repair or replacement of self-adjuster.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Cable replacement is required if it cannot be adjusted within specifications.

CARRIER BEARINGS

See INTERMEDIATE SHAFT SUPPORT BEARINGS.

CLUTCH CABLES AND CABLE HOUSINGS

CLUTCH CABLE AND CABLE HOUSING INSPECTION

Condition	Code	Procedure
Broken	A	Require replacement.
Cable bent	A	Require replacement.
Cable binding	A	Require repair or replacement.
Cable mounting loose	B	Require repair or replacement.
Cable out of adjustment	B	Require repair or replacement.
Frayed	B	Require replacement.
Housing heat-damaged	1	Suggest replacement.
Missing	C	Require replacement.
Noisy	2	Suggest repair or replacement.
Seized	A	Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Worn, affecting performance	A	Require replacement.

CLUTCH DISCS (MANUAL TRANSMISSION)

CLUTCH DISC (MANUAL TRANSMISSION) INSPECTION

Condition	Code	Procedure
Backing plate cracked	A	Require replacement.
Broken	A	Require replacement.
Contaminated with oil	A	Require replacement.
Damper cushion broken	A	Require replacement.
Damper cushion collapsed	A	Require replacement.
Damper spring collapsed	A	Require replacement.
Damper spring missing	C	(1) Require replacement.
Friction material cracked through	B	Require replacement.
Friction material flaking or chunking	B	Require replacement.
Friction material surface cracking	B	No service suggested or required.
Grooved	B	No service suggested or required unless the pressure plate or flywheel is being resurfaced or replaced. In this case, replacement of clutch disc is required.
Ridged	B	No service suggested or required unless the pressure plate or flywheel is being resurfaced or replaced. In this case, replacement of clutch disc is required.
Splines worn, affecting performance	A	Require replacement.
Warped	A	Require replacement.
Wear exceeds specifications (where applicable)	B	Require replacement.
Worn close to the end of its useful life	1	Suggest replacement.
Worn, affecting performance	A	Require replacement.

(1) - Not all clutch discs have springs in all spring chambers on the disc.

CLUTCH FORKS

CLUTCH FORK INSPECTION

Condition	Code	Procedure
Bent	B	Require replacement.
Broken	A	Require repair or replacement.
Cracked	B	Require repair or replacement.
Worn close to the end of its useful life	1	Suggest replacement.
Worn, affecting performance	A	Require replacement.

CLUTCH LINKAGES (MECHANICAL)

See LINKAGES (EXTERNAL).

CLUTCH MASTER CYLINDERS

CLUTCH MASTER CYLINDER INSPECTION

Condition	Code	Procedure
Cover gasket distorted	A	Require replacement of cover gasket.
Cover gasket gummy	A	Require replacement of cover gasket.
Cylinder leaking fluid from rear of bore	A	Require repair or replacement.
Cylinder leaking fluid internally	A	Require replacement.
Dust boot missing	C	Require replacement of dust boot.
Dust boot punctured	A	Require replacement of dust boot.
Dust boot torn	A	Require replacement of dust boot.
Fluid level incorrect	B	Require fluid level adjustment.
Housing damaged, affecting performance	A	Require repair or replacement.
Master cylinder has residue in reservoir (make parallel w/brakes when they are done)	2	(1) Further inspection required.
Threads damaged	A	Require repair replacement
Threads stripped (threads missing)	A	Require replacement.

(1) - DO NOT replace master cylinder unless it exhibits conditions listed for replacement. You may suggest fluid change according to OEM service intervals.

CLUTCH PEDALS

CLUTCH PEDAL INSPECTION

Condition	Code	Procedure
Bent, affecting performance	A	Require repair or replacement.
Broken	A	Require repair or replacement.
Pedal pad missing	C	Require replacement of pedal pad.
Pivot bushings worn, affecting performance	A	Require replacement of pivot bushings.

CLUTCH PIVOTS

CLUTCH PIVOT INSPECTION

Condition	Code	Procedure
Bent	A	Require replacement.
Broken	A	Require repair or replacement.
Cracked	A	Require repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Worn close to the end of its useful life	1	Suggest replacement.
Worn, affecting performance	A	Require replacement.

CLUTCH PRESSURE PLATES

See PRESSURE PLATES.

CLUTCH RELEASE BEARINGS

CLUTCH RELEASE BEARING INSPECTION

Condition	Code	Procedure
Collar broken	A	Require replacement.
Cracked	A	Require replacement.
Rough when rotated as an assembly	B	Require replacement.
Seized	A	Require replacement.
Wear exceeds specifications	B	Require replacement.
Worn close to the end of its useful life	1	Suggest replacement.
Worn, affecting performance	A	Require replacement.

CLUTCH SLAVE CYLINDERS (CONCENTRIC)

CLUTCH SLAVE CYLINDER (CONCENTRIC) INSPECTION

Condition	Code	Procedure
Bearing rough when rotated as an assembly	B	Require replacement.
Bearing seized	A	Require replacement.
Bleeder pipe leaks	A	Require repair or replacement.
Carrier assembly worn, affecting performance	A	Require replacement.
Collar broken	A	Require replacement.
Cracked	A	Require replacement.
Housing leaks	A	Require replacement.
Inoperative	A	Require replacement.
Release binding	A	Require replacement.
Spring broken	A	Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Worn, affecting performance	A	Require replacement.

CLUTCH SLAVE CYLINDERS (CONVENTIONAL OR EXTERNAL)

CLUTCH SLAVE CYLINDER (CONVENTIONAL OR EXTERNAL) INSPECTION

Condition	Code	Procedure
Binding	A	Require repair or replacement.
Bleeder port damaged (not repairable)	A	(1) Require replacement.
Bleeder port damaged (repairable)	A	(1) Require repair.
Bleeder screw broken off in slave cylinder	A	(1) Require replacement.
Bleeder screw seized	A	(2) Require replacement.
Bore corroded (pitted)	B	Require replacement.
Bore grooved	A	Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

(1) - Only required if the hydraulic system must be opened.
(2) - Seized is defined as a bleeder screw that cannot be removed after a practical attempt at removing it has been made.

COMPANION FLANGES

See YOKES AND SLIP YOKES.

CONNECTORS

See WIRING HARNESSES AND CONNECTORS.

COOLER BYPASS VALVES

COOLER BYPASS VALVE INSPECTION

Condition	Code	Procedure
Inoperative	A	Require replacement.
Installed incorrectly	A	Require repair.
Leaking	A	Require repair or replacement.
Restricted	A	Require repair or replacement.

COOLER LINES

COOLER LINE INSPECTION

Condition	Code	Procedure
Abrasion damage, affecting structural integrity	A	Require repair or replacement.
Abrasion damage, not affecting structural integrity		No service suggested or required.
Application incorrect	B	Require replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Clamp corroded, not reusable	1	Suggest replacement.
Connected incorrectly	A	Require repair.
Corroded, affecting structural integrity	A	Require replacement.
Corroded, not affecting structural integrity	..	No service suggested or required.
Cracked	A	Require repair or replacement.
Fitting type incorrect (such as compression fitting)	B	Require replacement.
Flange leaking	A	Require repair or replacement.
Insufficient clamping force, allowing hose to leak	A	Require repair or replacement.
Leaking	A	Require repair or replacement.
Melted	1	Suggest repair or replacement.
Missing	C	Require replacement.
Outer covering damaged to the extent that the inner fabric is visible	A	Require replacement.
Protective sleeves damaged	2	Suggest replacement of sleeves.
Protective sleeves missing	C	Require replacement of sleeves.
Restricted, affecting performance	A	Require repair or replacement.
Routed incorrectly	2	Require repair.
Swollen	1	Suggest replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Type incorrect	1	Suggest repair or replacement.

COOLERS

See TRANSMISSION COOLERS.

CV JOINTS

CV JOINT INSPECTION

Condition	Code	Procedure
Bearing, bushing or seal surface worn, affecting performance	A	Require repair or replacement.
Boot clamp broken	A	Require repair or replacement of clamp.
Boot clamp loose	A	Require repair or replacement of clamp.
Boot clamp missing	C	Require repair or replacement of clamp.
Boot leaking	A	Require replacement of CV boot.
Boot surface cracked,		

not leaking	2	. Suggest replacement of CV boot.
Cage broken	A	... Require repair or replacement of CV joint.
Housing damaged to the extent that it no longer performs its intended function	A	..... (1) Require repair or replacement of CV joint.
Housing worn to the extent that it no longer performs its intended function ..	A	..... (1) Require repair or replacement of CV joint.
Holes elongated	A	..... Require replacement.
Internal parts binding ..	A	.. Require repair or replacement.
Internal parts worn	A	.. Require repair or replacement.
Lubricant missing	C	... Require cleaning, inspection, and repacking of CV joint.
Threads damaged	A	.. Require repair or replacement.
Threads stripped (threads missing)	A	..... Require replacement.

(1) - Housing assembly may appear blue in color from normal manufacturing process of heat-treating the housing.

DIP STICK TUBES

DIP STICK TUBE INSPECTION

Condition	Code	Procedure
Broken	A	.. Require repair or replacement.
Checkball missing	C	.. Suggest repair or replacement.
Cracked	A	.. Require repair or replacement.
Hold down bracket broken	A	.. Require repair or replacement.
Hold down bracket missing	C	..... Require replacement.
Leaking	A	.. Require repair or replacement.
Missing	C	..... Require replacement.
Threads damaged	A	.. Require repair or replacement.
Threads stripped (threads missing)	A	..... Require replacement.

DIP STICKS (FLUID LEVEL INDICATORS)

DIP STICK (FLUID LEVEL INDICATOR) INSPECTION

Condition	Code	Procedure
Application incorrect ...	B	..... Require replacement.
Broken	A	..... Require replacement.
Compressed	A	.. Require repair or replacement.
Missing	C	..... Require replacement.
Modified	A	..... Require replacement.
Stretched	A	.. Require repair or replacement.

DOWEL PINS, GUIDES AND PILOT HOLES

DOWEL PIN, GUIDE AND PILOT HOLE INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require repair or replacement.
Cracked	A	Require repair or replacement.
Distorted	A	Require repair or replacement.
Missing	C	Require replacement.
Positioned incorrectly	B	Require repair or replacement.
Stepped	A	Require repair or replacement.
Worn to the extent that it no longer performs its intended function	A	Require repair or replacement.

DRIVE SHAFT FLANGES

See COMPANION FLANGES.

DRIVE SHAFTS AND HALF SHAFTS

DRIVE SHAFT AND HALF SHAFT INSPECTION

Condition	Code	Procedure
Balance weight missing	C	Require repair or replacement.
Bearing cap bore distorted	A	Require repair or replacement.
Bent	A	Require replacement.
Bolt holes elongated	A	Require repair or replacement.
Bushing or seal surface worn, affecting performance	A	Require repair or replacement.
Leaking through soft yoke plug	A	Require repair or replacement of soft yoke plug.
Out of balance	A	Require repair or replacement.
Retainer strap bent	A	Require replacement of retainer strap.
Slip yoke broken	A	Require replacement.
Splines worn, affecting performance	A	Require replacement.
Splines worn close to the end of their useful life	1	Suggest replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
U-bolt damaged, affecting performance	A	Require replacement of U-bolts.
Yoke damaged, affecting performance	A	Require repair or replacement.

DUST BOOTS

NOTE: Does not include CV boots.

DUST BOOT INSPECTION

Condition	Code	Procedure
Cracked, not leaking	1	Suggest replacement.
Missing	C	Require replacement.
Leaking	A	Require repair or replacement.

Torn	A	Require replacement.

ENGINE MOUNTS

See MOUNTS (ENGINE, TRANSAXLE AND TRANSMISSION).

EXCITER RINGS

See TOOTHED RINGS (TONE WHEELS).

FILLER TUBES

See DIP STICK TUBES.

FILTERS AND SCREENS

FILTER AND SCREEN INSPECTION

Condition	Code	Procedure
At service interval	3	Suggest replacement.
Bent	A ..	Require repair or replacement.
Exceeding service interval	3	Suggest replacement.
Missing	C	Require replacement.
Near service interval ...	3	Suggest replacement.
Restricted	A	(1) Require repair or replacement.
Torn	A	Require replacement.
Worn, affecting performance (metal or nylon screen type)	A ..	Require repair or replacement.

(1) - Further inspection may be required to determine the source of restriction or contamination.

FLANGES

See COMPANION FLANGES.

FLEX PLATES

FLEX PLATE INSPECTION

Condition	Code	Procedure
Bent, affecting performance	A	Require replacement.
Bent, not affecting performance	.. ..	No service suggested or required.
Bolt or stud holes elongated	B	Require replacement.
Broken	A	Require replacement.
Cracked	A	Require replacement.
Ring gear worn close to the end of its useful life	1	Suggest replacement.
Ring gear worn to the extent that it no longer		

performs its intended function	A	Require replacement.
Weights missing	A	Require replacement.

FLUID LEVEL INDICATORS

See DIP STICKS (FLUID LEVEL INDICATORS).

FLUIDS AND LUBRICANTS

FLUID AND LUBRICANT INSPECTION

Condition	Code	Procedure
Application incorrect	B	(1) Require replacement.
At service interval	3	Suggest replacement.
Beyond service interval	3	Suggest replacement.
Burned	..	(2) Further inspection required.
Contaminated, for example, fluid other than hydraulic fluid present	A or B	(3)(4) Require service.
Exceeding service interval	3	Suggest replacement.
Hydraulic fluid incorrect	B	(5) Require service.
Level incorrect	B	Require correction of fluid level.
Near service interval	3	Suggest replacement.
Rubber master cylinder cover gasket distorted and gummy	A	(3) Require service.
Varnished	..	(6) Further inspection required.

(1) - Determine and correct cause.
(2) - Fluid that is burned indicates a serious problem. Determine and correct the cause.
(3) - If a fluid other than hydraulic fluid is present in the hydraulic system which DOES affect the rubber parts, the required service is to: 1) remove all components having rubber parts from the system, 2) flush lines with denatured alcohol or hydraulic cleaner, 3) repair or replace all components having rubber parts, and 4) bleed and flush with correct hydraulic fluid. (Code A)
(4) - If a fluid other than hydraulic fluid is present in the hydraulic system which DOES NOT affect the rubber parts, the required service is to flush and fill with the correct hydraulic fluid. (Code B)
(5) - If a fluid other than specification hydraulic fluid is present in the hydraulic system, the required service is to flush and fill with the correct hydraulic fluid.
(6) - Fluid that is varnished may indicate a serious problem. Determine and correct the cause.

FLYWHEELS

NOTE: Clutch disc replacement does not necessitate flywheel reconditioning, unless other conditions justify the reason to do so.

FLYWHEEL INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Cracked (other than mounting area)	A	(1) Require resurfacing or replacement.
Cracks in mounting area	B	Require replacement.
Hard spots	B	Require repair or replacement.
Ring gear broken	A	Require replacement of ring gear.
Ring gear teeth worn, affecting performance	A	Require replacement of ring gear.
Runout exceeds specifications	B	Require repair or replacement.
Scored	B	Require repair or replacement.
Surface cracks after resurfacing to manufacturer's minimum specifications	B	Require replacement.
Wear exceeds specifications	B	Require replacement.
Worn close to the end of its useful life	1	Suggest replacement.
Worn, affecting performance	A	Require repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

(1) - Some manufacturers allow slight surface cracking in the friction surface.

FORCE MOTORS

See ACTUATORS (ELECTRICAL).

GUIDES

See DOWEL PINS, GUIDES AND PILOT HOLES.

HALF SHAFTS

See DRIVE SHAFTS AND HALF SHAFTS.

HOSES, LINES AND TUBES

HOSE, LINE AND TUBE INSPECTION

Condition	Code	Procedure

Application incorrect	B	Require replacement.
Connected incorrectly	A	Require repair.
Corroded, not reusable	1	Suggest replacement.
Cracked	A	Require replacement.
Dry-rotted	1	Suggest repair or replacement.
Hard	1	Suggest repair or replacement.
Inner fabric (webbing) damaged	A	Require replacement.
Insufficient clamping force, allowing hose to leak	A	Require repair or replacement.
Leaking	A	Require repair or replacement.
Maintenance intervals	3	Suggest replacement.
Melted	1	Suggest repair or replacement.
Missing	C	Require replacement.
Outer covering damaged	1	Suggest replacement.
Outer covering damaged to the extent that the inner fabric is visible	A	Require replacement.
Protective sleeves damaged	2	Suggest replacement of sleeves.
Protective sleeves missing	2	Suggest replacement of sleeves.
Restricted, affecting performance	A	Require repair or replacement.
Restricted, not affecting performance	2	Suggest repair or replacement.
Routed incorrectly	2	Suggest replacement.
Safety clip missing	C	Require replacement.
Spongy	1	Suggest repair or replacement.
Stripped	A	Require replacement.
Swollen	B	Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Type incorrect	1	Suggest repair or replacement.

HOUSINGS (BELL, CASE, TAIL (EXTENSION) AND AUXILIARY)

HOUSING (BELL, CASE, TAIL (EXTENSION) AND AUXILIARY) INSPECTION

Condition	Code	Procedure
Bearing race loose in bore	A	Require repair or replacement.
Broken, affecting performance	A	Require repair or replacement.
Cracked	A	Require repair or replacement.
Dowel pin holes worn, affecting performance	A	(1) Require repair or replacement.
Machined surfaces damaged, affecting performance	A	Require repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Worn, affecting performance	A	Require repair or replacement.

(1) - See DOWEL PINS, GUIDES AND PILOT HOLES.

INTERMEDIATE SHAFT SUPPORT BEARINGS

INTERMEDIATE SHAFT SUPPORT BEARING INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Bearing rollers, balls or races are worn, pitted, noisy, or feel rough when rotated as an assembly	A	Require replacement of bearing assembly.
Bracket bent, affecting performance	A	Require repair or replacement.
Bracket bent, not affecting performance	..	No service suggested or required.
Bracket broken, affecting performance	A	Require replacement.
Bracket broken, not affecting performance	..	No service suggested or required.
Bracket corroded, affecting performance	A	Require repair or replacement.
Bracket corroded, not affecting performance	2	Suggest repair or replacement.
Bracket cracked, affecting performance	A	Require repair or replacement.
Bracket cracked, not affecting performance	1	Suggest repair or replacement.
Bracket holes elongated, affecting performance	A	Require repair or replacement.
Bracket holes elongated, not affecting performances)	..	No service suggested or required.
Bracket loose, affecting performance	A	Require repair or replacement.
Bracket loose, not affecting performance	1	Suggest repair or replacement.
Bracket missing	C	Require replacement.
Cracked	..	Require replacement.
Rough (brinelling, spalling)	A	Require replacement.
Rubber deteriorated, affecting performance	A	Require replacement.
Seized	A	Require replacement.

KEY INTERLOCK SYSTEMS

See SHIFT INTERLOCK SYSTEMS (SELECTOR AND KEY INTERLOCK SYSTEMS).

LIMITED SLIPS

See DIFFERENTIAL AND FINAL DRIVE ASSEMBLIES.

LINES

See HOSES, LINES AND TUBES.

LINKAGES (EXTERNAL)

LINKAGE (EXTERNAL) INSPECTION

Condition	Code	Procedure
Components missing	C	Require replacement of missing components.
Linkage bent, affecting performance	A	Require repair or replacement of linkage.
Linkage bent, not affecting performance	2	Suggest repair or replacement of linkage.
Linkage binding, affecting performance	A	Require repair or replacement of linkage.
Linkage binding, not affecting performance	1	Suggest repair or replacement of linkage.
Linkage broken	A	Require repair or replacement of linkage.
Linkage loose, affecting performance	A	Require repair or replacement of linkage.
Linkage loose, not affecting performance	1	Suggest repair or replacement of linkage.
Linkage missing	C	Require replacement.
Linkage noisy	2	Suggest repair or replacement.
Out of adjustment	B	Require repair or replacement.
Worn to the extent that it no longer performs its intended function	A	Require repair or replacement.

LOCKING HUB ASSEMBLIES

LOCKING HUB ASSEMBLY INSPECTION

Condition	Code	Procedure
Inoperative	A	(1) Require repair or replacement.
Loose	A	Require repair or replacement.
Seized in any position	A	Require repair or replacement.

(1) - Inoperative includes intermittent operation.

LOCKING HUB CONTROL KNOBS

LOCKING HUB CONTROL KNOB INSPECTION

Condition	Code	Procedure

Damaged, affecting performance	A	.....	Require replacement.
Missing	C	.....	Require replacement.
Worn, affecting performance	A	.....	Require replacement.

LUBRICANTS

See FLUIDS AND LUBRICANTS.

METAL-CLAD SEALS

See SEALS.

METALASTIC JOINTS

See RUBBER JOINTS (METALASTIC).

MODULATOR PINS

MODULATOR PIN INSPECTION

Condition	Code		Procedure
Application incorrect ...	B	.....	Require replacement.
Missing	C	.....	Require replacement.

MODULATORS

MODULATOR INSPECTION

Condition	Code		Procedure
Bent, affecting performance	A	.....	Require replacement.
Contaminated (water, fuel, etc.)	A	.....	(1) Require replacement.
Housing cracked	A	.....	Require replacement.
Inoperative	A	.....	(2) Require replacement.
Leaking fluid externally	A	..	Require repair or replacement.
Leaking fluid internally	A	.....	Require replacement.
Leaking vacuum	A	.....	Require replacement.
Nipple broken	A	.....	Require replacement.
Threads damaged	A	..	Require repair or replacement.
Threads stripped (threads missing)	A	.....	Require replacement.

(1) - Further inspection is required to determine the cause of the contamination.
(2) - Inoperative includes intermittent operation or out of OEM specification.

MOUNTS (ENGINE, TRANSAXLE AND TRANSMISSION)

MOUNT (ENGINE, TRANSAXLE AND TRANSMISSION) INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Broken	A	Require replacement.
Leaking (hydraulic mount)	A	Require replacement.
Mounting hole worn, affecting performance	A	Require replacement.
Mounting hole worn, not affecting performance		No service suggested or required.
Rubber deteriorated, affecting performance	A	Require replacement.
Rubber deteriorated, not affecting performance		No service suggested or required.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

ODOMETER DRIVES (MECHANICAL)

See SPEEDOMETER/ODOMETER DRIVES (MECHANICAL).

ODOMETER HEADS (MECHANICAL)

See SPEEDOMETER/ODOMETER HEADS (MECHANICAL).

OIL PANS

See TRANSMISSION PANS.

PANS

See TRANSMISSION PANS.

PILOT HOLES

See DOWEL PINS, GUIDES AND PILOT HOLES.

PRESSURE PLATES

PRESSURE PLATE INSPECTION

Condition	Code	Procedure
Balance weight missing	C	Require replacement.
Broken	A	Require replacement.
Contact surface distorted	B	Require replacement.
Cracks	B	Require replacement.
Fingers bent	A	Require replacement.
Hard spots	B	Require replacement.

Scored	B	Require replacement.
Spring rate less than specifications	B	Require replacement.
Worn, affecting performance	A	Require replacement.
Worn beyond specifications	B	Require replacement.
Worn close to the end of its useful life	1	Suggest replacement.

PRESSURE SWITCHES

See SWITCHES.

RACES

See BEARINGS AND RACES.

RUBBER JOINTS (METALASTIC)

These joints may be found on half and/or drive shafts. They are usually found on European vehicles featuring a three-lug drive flange. They may be equipped with a centering ball or pin.

RUBBER JOINT (METALASTIC) INSPECTION

Condition	Code	Procedure
Drive flange bent	A	Require repair or replacement.
Drive flange damaged, affecting performance	A	Require replacement.
Rubber drive joint cracked	2	Suggest replacement.
Rubber drive joint damaged, affecting performance	A	Require replacement.
Rubber drive joint split between mounting holes	A	Require replacement.
Rubber drive joint torn at mounting holes	A	Require replacement.
Rubber drive joint weather-cracked	..	No service suggested or required.

SCREENS

See FILTERS AND SCREENS.

SEALS

SEAL INSPECTION

Condition	Code	Procedure
Leaking	A	(1) Require repair or replacement.

(1) - Require inspection of mating and sealing surface and repair or replace as necessary. Check vent. A plugged

vent may force fluid past the seal.

SEALS (METAL-CLAD)

See SEALS.

SELECTOR INTERLOCK SYSTEMS

See SHIFT INTERLOCK SYSTEMS (SELECTOR AND KEY INTERLOCK SYSTEMS).

SERVOS

See ACTUATORS (VACUUM).

SHIFT INTERLOCK SYSTEMS (SELECTOR AND KEY INTERLOCK SYSTEMS)

See:
ACTUATORS (ELECTRICAL)
CABLES
LINKAGES (EXTERNAL)
SWITCHES

SENSORS

SENSOR INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Inoperative	A	(2) Require repair or replacement.
Leaking (vacuum/fluid/air)	A	Require replacement.
Out of adjustment	B	(3) Further inspection required.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting		

performance	B	..	Require repair or replacement.
Terminal loose, not affecting performance	1	..	Suggest repair or replacement.
Threads damaged	A	..	Require repair or replacement.
Threads stripped (threads missing)	A	.....	Require replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Inoperative includes intermittent operation or out of specification.
(3) - Follow OEM recommended adjustment procedures. Repair or replace if out of specification.

SIDE COVERS

See TRANSMISSION PANS.

SLIP YOKES

See YOKES AND SLIP YOKES.

SOLENOIDS

See:
ACTUATORS (ELECTRICAL)
ACTUATORS (VACUUM)

SPEED SENSORS (ELECTRONIC WHEEL AND VEHICLE)

SPEED SENSOR (ELECTRONIC WHEEL AND VEHICLE) INSPECTION

Condition	Code		Procedure
Air gap incorrect	B	.....	(1) Require adjustment or replacement.
Attaching hardware missing	C	.....	Require replacement of hardware.
Attaching hardware threads damaged	A	...	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	...	Require repair or replacement of hardware.
Connector broken	A	..	Require repair or replacement.
Connector (Weatherpack type) leaking	A	..	Require repair or replacement.
Connector melted	A	.....	(2) Require repair or replacement.
Connector missing	C	.....	Require replacement.
Contaminated	A	.....	(3) Require repair or replacement.
Inoperative	B	.....	(4) Require repair or replacement. Further inspection required.
Leaking	A	..	Require repair or replacement.
Loose	A	..	Require repair or replacement.
Missing	C	.....	Require replacement.
Resistance out of			

specification	B	Require repair or replacement.
Sensor housing cracked	2	Suggest replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(2) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead misrouted	B	Require re-routing according to vehicle manufacturer's specifications.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - If a sensor is not adjustable, further inspection is required to identify and correct cause.
(2) - Determine cause and correct prior to repair or replacement of part.
(3) - Determine source of contamination, such as metal particles or water. Require repair or replacement.
(4) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

SPEEDOMETER-DRIVEN GEAR HOUSINGS

See SPEEDOMETER/ODOMETER DRIVES (MECHANICAL).

SPEEDOMETER/ODOMETER DRIVES (MECHANICAL)

SPEEDOMETER/ODOMETER DRIVE (MECHANICAL) INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Inoperative	A	(1) Require replacement.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Teeth broken	A	Require repair or replacement.

Threads damaged	A	..	Require repair or replacement.
Threads stripped (threads missing)	A	.....	Require replacement.
Worn close to the end of its useful life	1	.....	Suggest replacement.
Worn, affecting performance	A	.....	Require replacement.

(1) - Inoperative includes intermittent operation.

SPEEDOMETER/ODOMETER HEADS (MECHANICAL)

SPEEDOMETER/ODOMETER HEAD (MECHANICAL) INSPECTION

Condition	Code		Procedure
Attaching hardware broken	A	...	Require repair or replacement of hardware.
Attaching hardware missing	C	.....	Require replacement of hardware.
Attaching hardware not functioning	A	...	Require repair or replacement of hardware.
Lens broken	A	.....	(1) Require repair or replacement.
Lens cloudy	2	.....	(1) Suggest repair or replacement.
Lens missing	C	.....	(1) Require repair or replacement.
Malfunctioning	A	.....	(2) Require repair or replacement.
Noisy	2	..	Suggest repair or replacement.
Threads damaged	A	..	Require repair or replacement.
Threads stripped (threads missing)	A	.....	Require replacement.

(1) - If lens is available as a separate part, require replacement of lens only.
(2) - Includes inoperative, intermittent operation, failure to perform all functions, out of OEM specification, or out of range.

SPEEDOMETERS AND ODOMETERS (ELECTRONIC)

SPEEDOMETER AND ODOMETER (ELECTRONIC) INSPECTION

Condition	Code		Procedure
Attaching hardware broken	A	...	Require repair or replacement of hardware.
Attaching hardware missing	C	.....	Require replacement of hardware.
Attaching hardware not functioning	A	...	Require repair or replacement of hardware.
Connector broken	A	..	Require repair or replacement.
Connector (Weatherpack			

type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Leaking	A	Require replacement.
Lens broken	A	(2) Require repair or replacement.
Lens cloudy	2	(2) Suggest repair or replacement.
Lens missing	C	(2) Require repair or replacement.
Malfunctioning	A	(3) Require repair or replacement.
Mechanical head noisy	2	Suggest repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - If lens is available as a separate part, require replacement of lens only.
(3) - Includes inoperative, intermittent operation, failure to perform all functions, out of OEM specification, or out of range.

SWITCHES

SWITCH INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Binding, affecting performance	A	Require repair or replacement.
Binding, not affecting performance	2	Suggest repair or replacement.
Broken	A	Require repair or replacement.
Burned, affecting performance	A	(1) Require repair or replacement.
Burned, not affecting performance	2	(1) Suggest repair or

			replacement.
Cracked, affecting performance	A	..	Require repair or replacement.
Cracked, not affecting performance	1	..	Suggest repair or replacement.
Leaking	A	..	Require repair or replacement.
Malfunctioning	A	.....	(2) Require repair or replacement.
Melted, affecting performance	A	.....	(1) Require repair or replacement.
Melted, not affecting performance	2	.....	(1) Suggest repair or replacement.
Missing	C	.....	Require replacement.
Out of adjustment	B	..	Require repair or replacement.
Terminal broken	A	..	Require repair or replacement.
Terminal burned, affecting performance	A	.....	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	..	Suggest repair or replacement.
Terminal corroded, affecting performance	A	..	Require repair or replacement.
Terminal corroded, not affecting performance	2	..	Suggest repair or replacement.
Terminal loose, affecting performance	B	..	Require repair or replacement.
Terminal loose, not affecting performance	1	..	Suggest repair or replacement.
Won't return	A	..	Require repair or replacement.
Worn	1	.....	Suggest replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Includes inoperative, intermittent operation, or failure to perform all functions.

TONE WHEELS

See TOOTHED RINGS (TONE WHEELS).

TOOTHED RINGS (TONE WHEELS)

If the toothed ring requires replacement and cannot be replaced as a separate component, replace the assembly of which the ring is a part.

TOOTHED RING (TONE WHEEL) INSPECTION

Condition	Code		Procedure
Alignment incorrect	B	..	Require repair or replacement.
Bent	B	.....	Require replacement.
Contaminated, affecting performance	A	....	Require repair. Identify and correct cause.
Cracked	B	.....	Require replacement.
Loose	A	.....	Require replacement of worn parts.
Missing	C	.....	Require replacement.
Number of teeth			

Condition	Code	Procedure
incorrect	B	Require replacement.
Teeth broken	A	Require replacement.
Teeth damaged, affecting performance	A	Require replacement.

TORQUE CONVERTERS

TORQUE CONVERTER INSPECTION

Condition	Code	Procedure
Converter clutch lock-up operation is faulty	A	Require replacement.
Cover shell damaged, affecting performance	A	Require replacement.
Does not meet stall speed specification	B	Require replacement.
End play exceeds specifications	B	Require replacement.
Hub broken	A	Require replacement.
Hub cracked	A	Require replacement.
Internal component failure	A	Require replacement.
Leaking	A	Require repair or replacement.
Pilot broken	A	Require replacement.
Pilot worn, affecting performance	A	Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Weights missing	C	Require replacement.

TRANSAXLE MOUNTS

See MOUNTS (ENGINE, TRANSAXLE AND TRANSMISSION).

TRANSDUCERS (TRANSMISSION)

See SENSORS.

TRANSMISSION COOLERS

TRANSMISSION COOLER INSPECTION

Condition	Code	Procedure
Air flow obstruction	A	Require repair.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connection leaking	A	Require repair or replacement.
Contaminated	A	Require repair or replacement.
Corroded	1	Suggest repair or replacement.
Fins damaged, affecting		

performance	A	..	Require repair or replacement.
Fins damaged, not affecting performance			No service suggested or required.
Internal restrictions ...	B	..	Require repair or replacement.
Leaking	A	..	Require repair or replacement.
Threads damaged	A	..	Require repair or replacement.
Threads stripped (threads missing)	A	..	Require repair or replacement.
Tubes damaged, affecting performance	A	..	Require repair or replacement.
Tubes damaged, not affecting performance			No service suggested or required.

TRANSMISSION MOUNTS

See MOUNTS (ENGINE, TRANSAXLE AND TRANSMISSION).

TRANSMISSION PANS

TRANSMISSION PAN INSPECTION

Condition	Code		Procedure
Bent, interfering with filter or other internal components	A	..	Require repair or replacement.
Leaking	A	..	Require repair or replacement.

TRANSMISSION RANGE INDICATORS (PRNDL)

TRANSMISSION RANGE INDICATOR (PRNDL) INSPECTION

Condition	Code		Procedure
Binding	A	..	Require repair or replacement.
Broken	A	..	Require repair or replacement.
Components missing	C	..	Require replacement of missing components.
Loose, affecting performance	A	..	Require repair or replacement.
Out of adjustment	A	.....	Require repair.
Worn, affecting performance	A	..	Require repair or replacement.

TUBES

See HOSES, LINES AND TUBES.

UNIVERSAL JOINTS (CARDON OR CROSS TYPE)

UNIVERSAL JOINT (CARDON OR CROSS TYPE) INSPECTION

Condition	Code		Procedure
Attaching hardware broken	A	...	Require repair or replacement of hardware.

Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Bearing cap distorted	B	Require replacement.
Binding	A	Require replacement.
Cross (trunion) worn, affecting performance	A	Require replacement.
Double cardon centering ball damaged	A	Require replacement.
Double cardon centering ball worn, affecting performance	A	Require replacement.
Double cardon centering spring broken	A	Require replacement.
Double cardon centering spring missing	C	Require replacement.
Double cardon centering spring weak	A	Require replacement.
End cap seal cracked	2	Suggest replacement.
End cap seal missing	C	Require replacement of seal.
Grease fitting broken	A	(1) Require replacement of grease fitting.
Grease fitting missing	C	(2) Require replacement of grease fitting.
Rust-colored powder around end cap seals	A	Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Worn, affecting performance	A	Require replacement.

(1) - A broken grease fitting does not require replacement of the U-Joint.
(2) - A missing grease fitting does not require replacement of the U-Joint.

VACUUM CONTROLS

See ACTUATORS (VACUUM).

VACUUM HOSES

See HOSES, LINES AND TUBES.

VACUUM MOTORS

See ACTUATORS (VACUUM).

VACUUM-OPERATED SWITCHES

See SWITCHES.

VEHICLE SPEED SENSORS

See SPEED SENSORS (ELECTRONIC WHEEL AND VEHICLE).

VENTS

VENT INSPECTION

Condition	Code	Procedure
Broken	A	Require replacement.
Missing	C	Require replacement.
Plugged	A	(1) Require repair or replacement.

(1) - A plugged vent may force fluid past the seal.

VIBRATION DAMPERS

VIBRATION DAMPER INSPECTION

Condition	Code	Procedure
Broken	A	Require replacement.
Missing	C	Require replacement.
Out of position	B	Require repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

WHEEL ATTACHMENT HARDWARE

NOTE: For conditions noted below, also check conditions of wheel stud holes.

CAUTION: Proper lug nut torque is essential. Follow recommended torque specifications and tightening sequence. DO NOT lubricate threads unless specified by the vehicle manufacturer.

WHEEL ATTACHMENT HARDWARE INSPECTION

Condition	Code	Procedure
Bent	A	Require replacement.
Broken	A	(1) Require replacement.
Loose	B	Require repair or replacement of affected component.
Lug nut installed backward	B	Require repair or replacement.
Lug nut mating surface dished	A	Require replacement of nut.
Lug nut mating type incorrect	B	Require replacement of nut.
Lug nut rounded	A	(2) Require replacement of nut.
Lug nut seized	A	(2) Require replacement of nut.
Stud incorrect	B	Require replacement of stud.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

(1) - Some manufacturers require replacement of all studs on that wheel if two or more studs or nuts on the same wheel are broken or missing.
(2) - Only required if removing wheel.

WHEEL SPEED SENSORS

See SPEED SENSORS (ELECTRONIC WHEEL AND VEHICLE).

WIRING HARNESSES AND CONNECTORS

WIRING HARNESS AND CONNECTOR INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require repair or replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Insulation damaged, conductors exposed	A	Require repair or replacement.
Insulation damaged, conductors not exposed	1	Suggest replacement.
Open	A	Require repair or replacement.
Protective shield (conduit) melted	2	(1) Suggest repair or replacement.
Protective shield (conduit) missing	2	Suggest repair or replacement.
Resistance (voltage drop) out of specification	A	Require repair or replacement.
Routed incorrectly	B	Require repair.
Secured incorrectly	B	Require repair.
Shorted	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Transmission connector leaking		See TRANSMISSION ASSEMBLY.
Voltage drop out of specification	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.

YOKES AND SLIP YOKES

YOKE AND SLIP YOKE INSPECTION

Condition	Code	Procedure
Bearing cap bore distorted	A	Require repair or replacement.
Bent	A	Require replacement.
Bolt holes elongated	A	Require repair or replacement.
Bushing or seal surface worn, affecting performance	A	Require repair or replacement.
Leaking through soft yoke plug	A	Require repair or replacement of soft yoke plug.
Retainer strap bent	A	Require replacement of retainer strap.
Slip yoke broken	A	Require replacement.
Splines worn, affecting performance	A	Require replacement.
Splines worn close to the end of their useful life	1	Suggest replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
U-bolt damaged, affecting performance	A	Require replacement of U-bolts.
Yoke damaged, affecting performance	A	Require repair or replacement.

ELECTRICAL COMPONENT LOCATOR

1998 Mitsubishi Galant

1998 ELECTRICAL COMPONENT LOCATION
Mitsubishi - Electrical Components

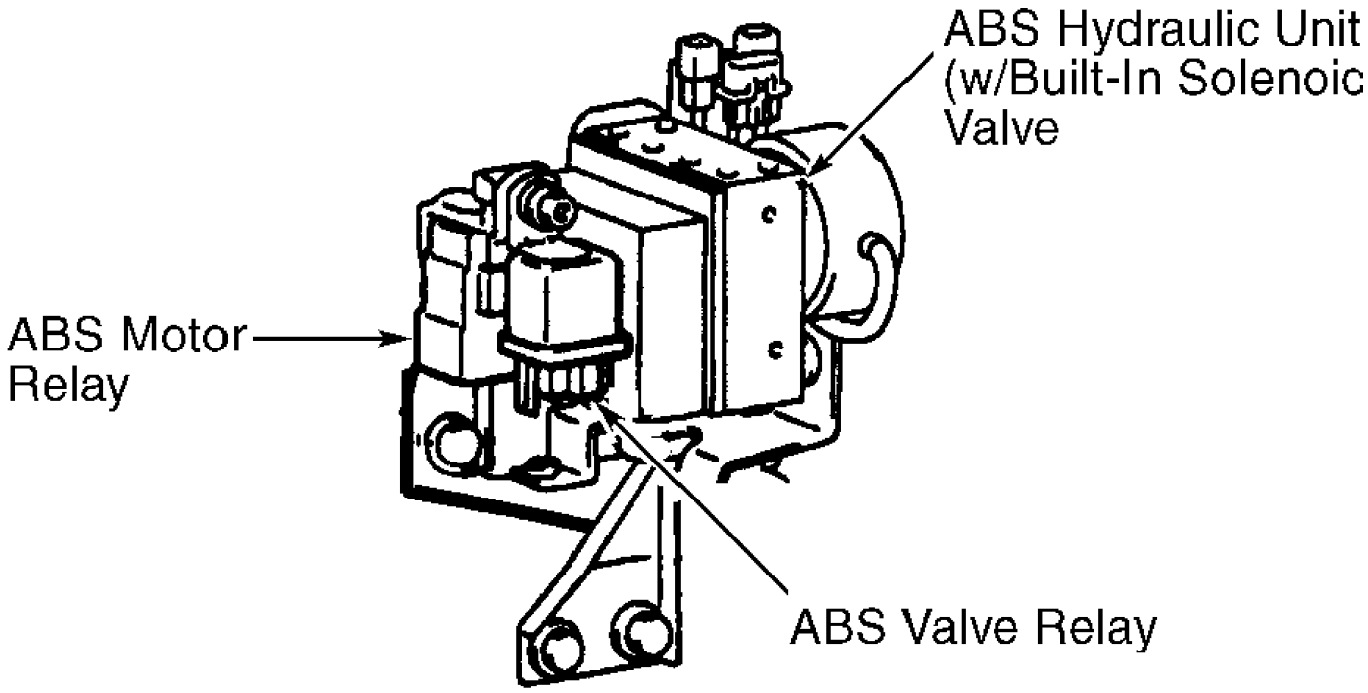
Galant

SAFETY PRECAUTION

WARNING: When working on vehicles equipped with Supplemental Restraint System (SRS), never apply electrical voltage to the system. This could cause the SRS (air bag) to be deployed.

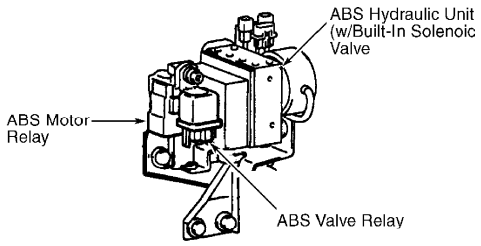
BUZZERS, RELAYS & TIMERS

Component	Component Location



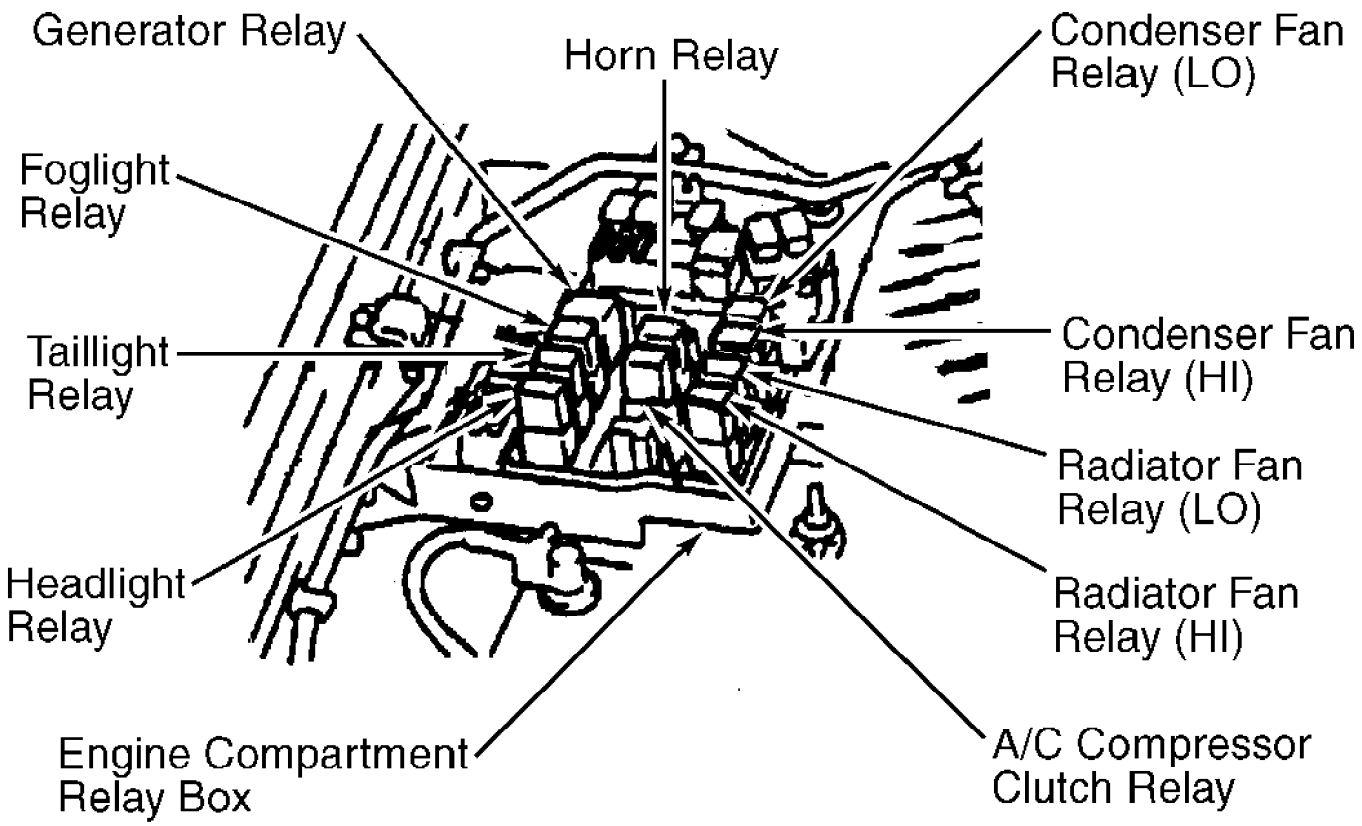
98B02325

ABS Motor Relay	On right rear corner of engine compartment, on ABS motor.



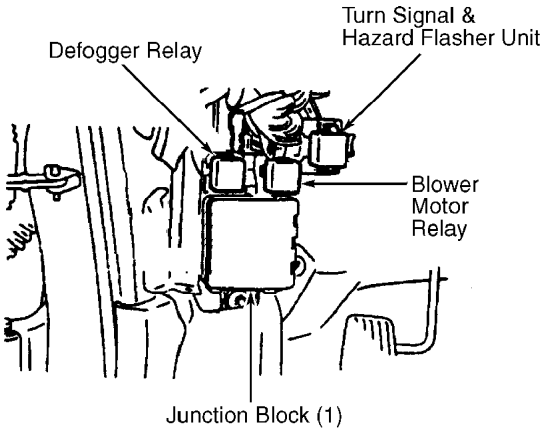
98B02325

ABS Valve Relay	On right rear corner of engine compartment, on ABS motor.



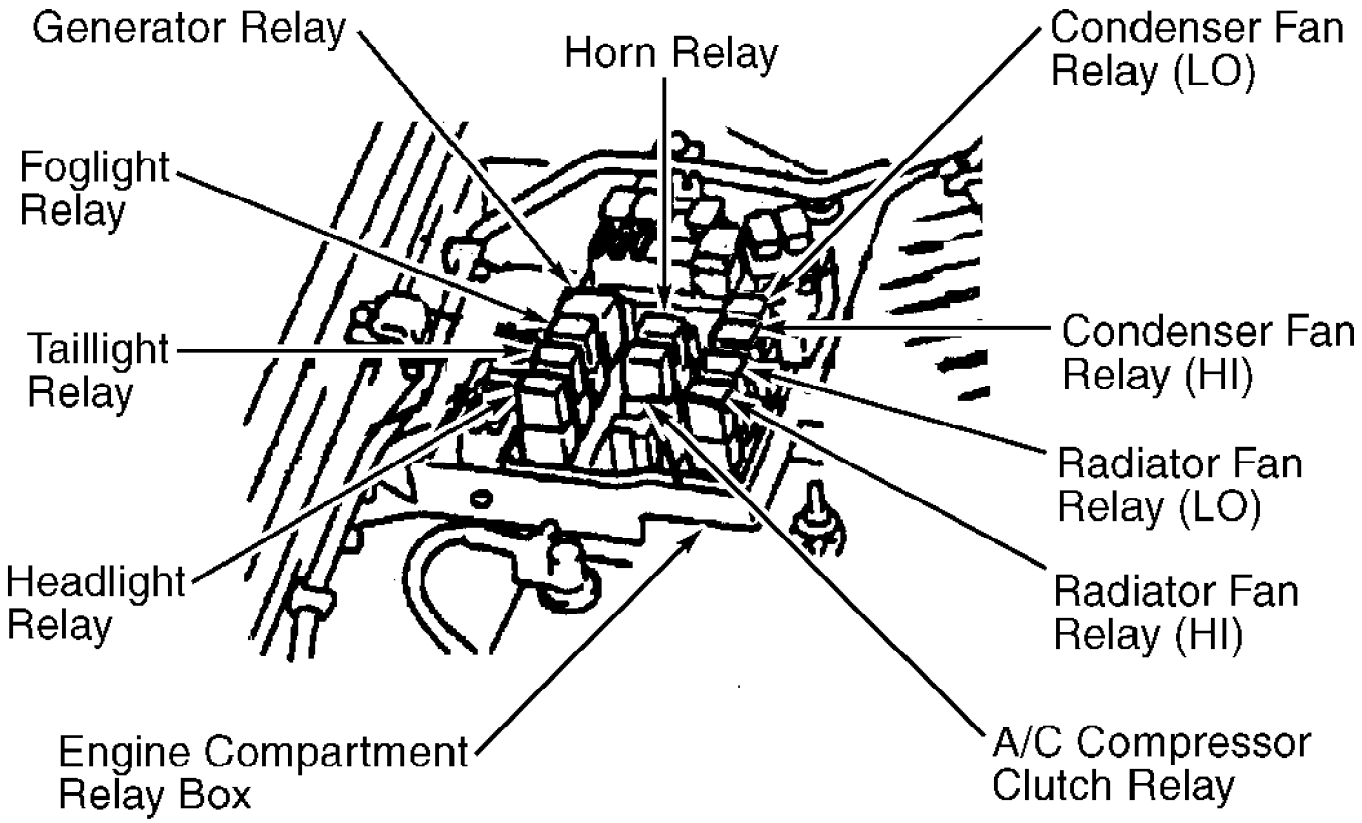
98G02323

A/C Compressor Clutch Relay	On engine compartment relay box, on right inner fender panel.
Blower Height Relay	Behind right side of dash, near blower motor.



98F02327

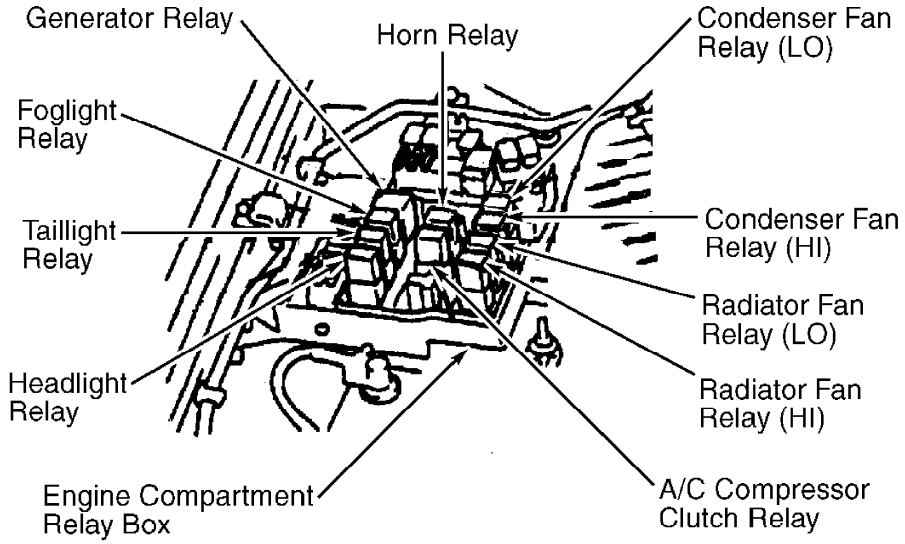
Blower Motor Relay	At left kick panel, on junction block (1).



98G02323

Condenser Fan Relay (HI)

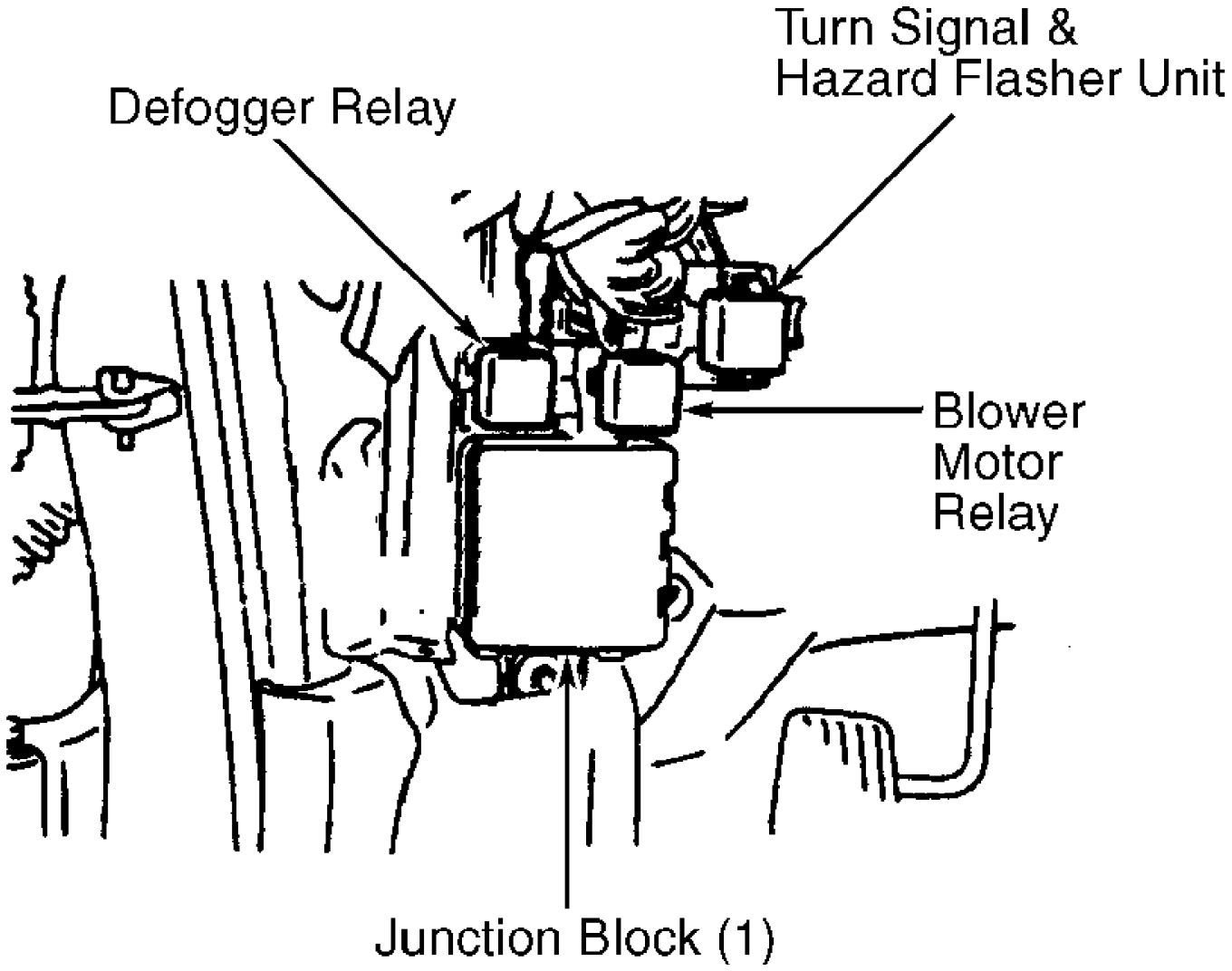
On engine compartment relay box, on right inner fender panel.



98G02323

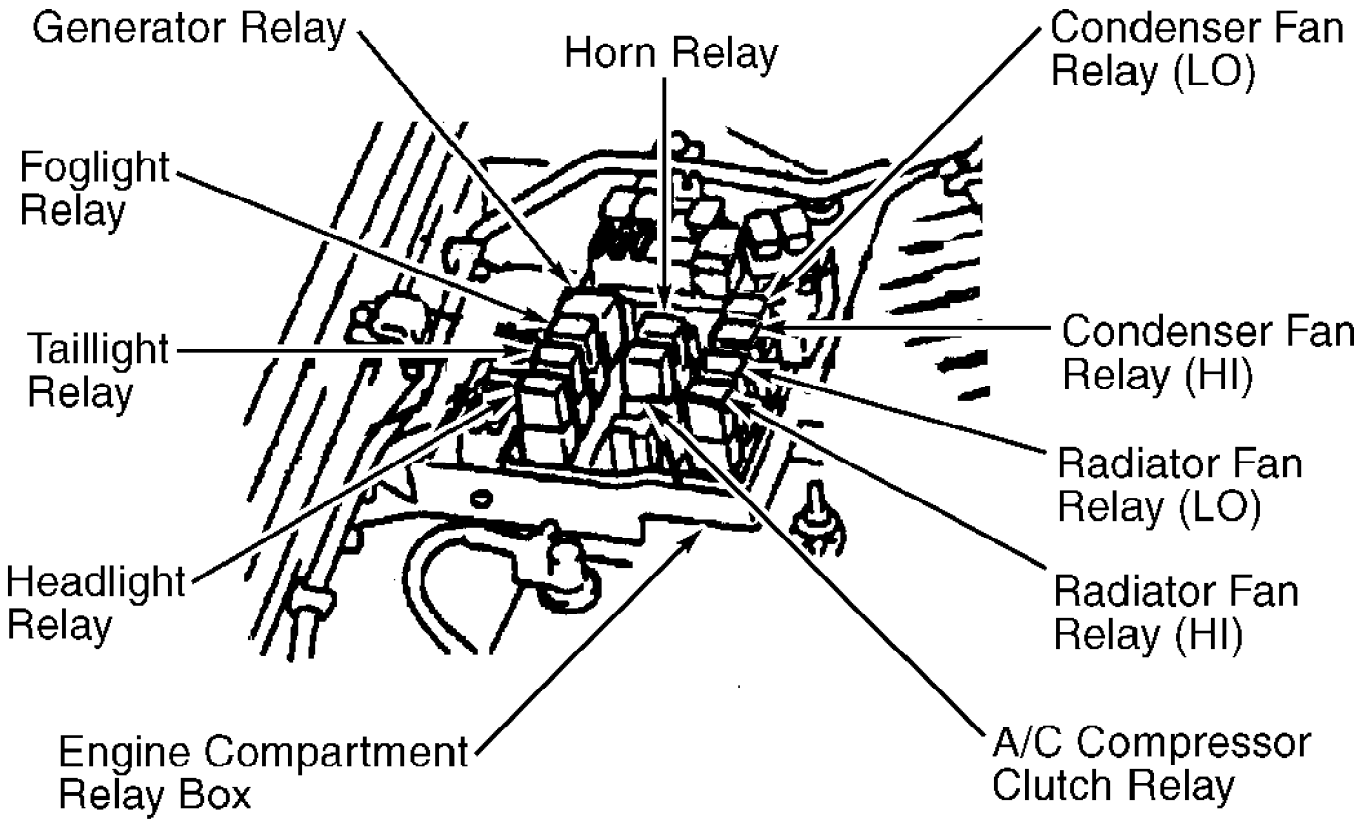
Condenser Fan Relay (LO)

On engine compartment relay box, on right inner fender panel.



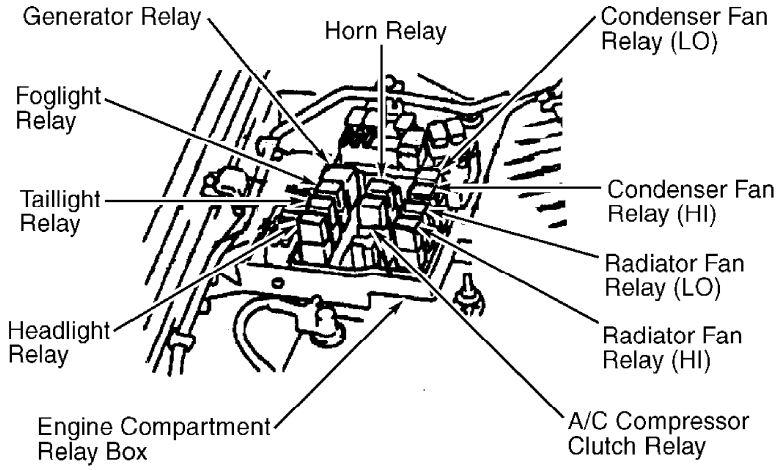
98F02327

Defogger Relay	At left kick panel, on junction block (1).
Door Lock Power Relay (Keyless Entry)	In front of trunk, underside center of rear shelf.



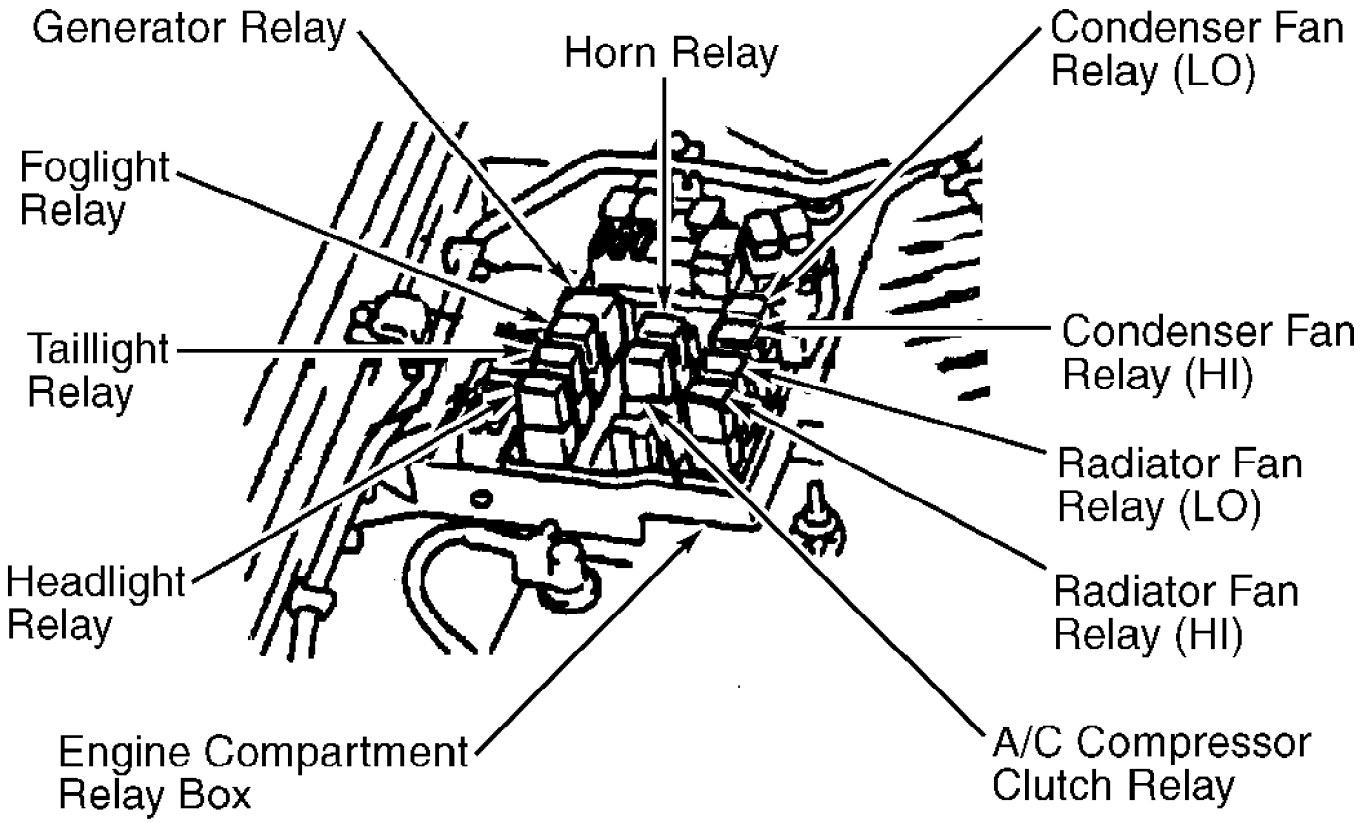
98G02323

Foglight Relay	On engine compartment relay box, on right inner fender panel.
Fuel Pump Relay	Behind dash, right of driver's footwell.



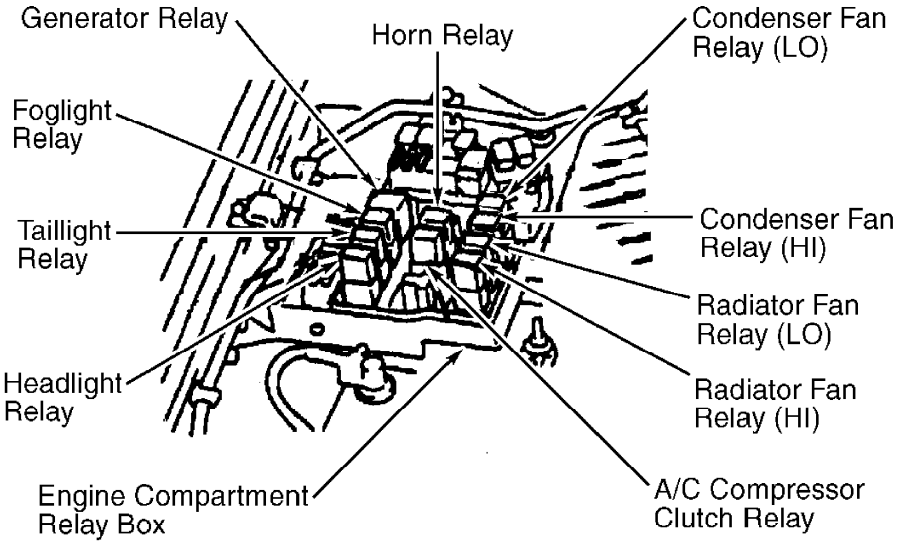
98G02323

Generator Relay	On engine compartment relay box, on right inner fender panel.



98G02323

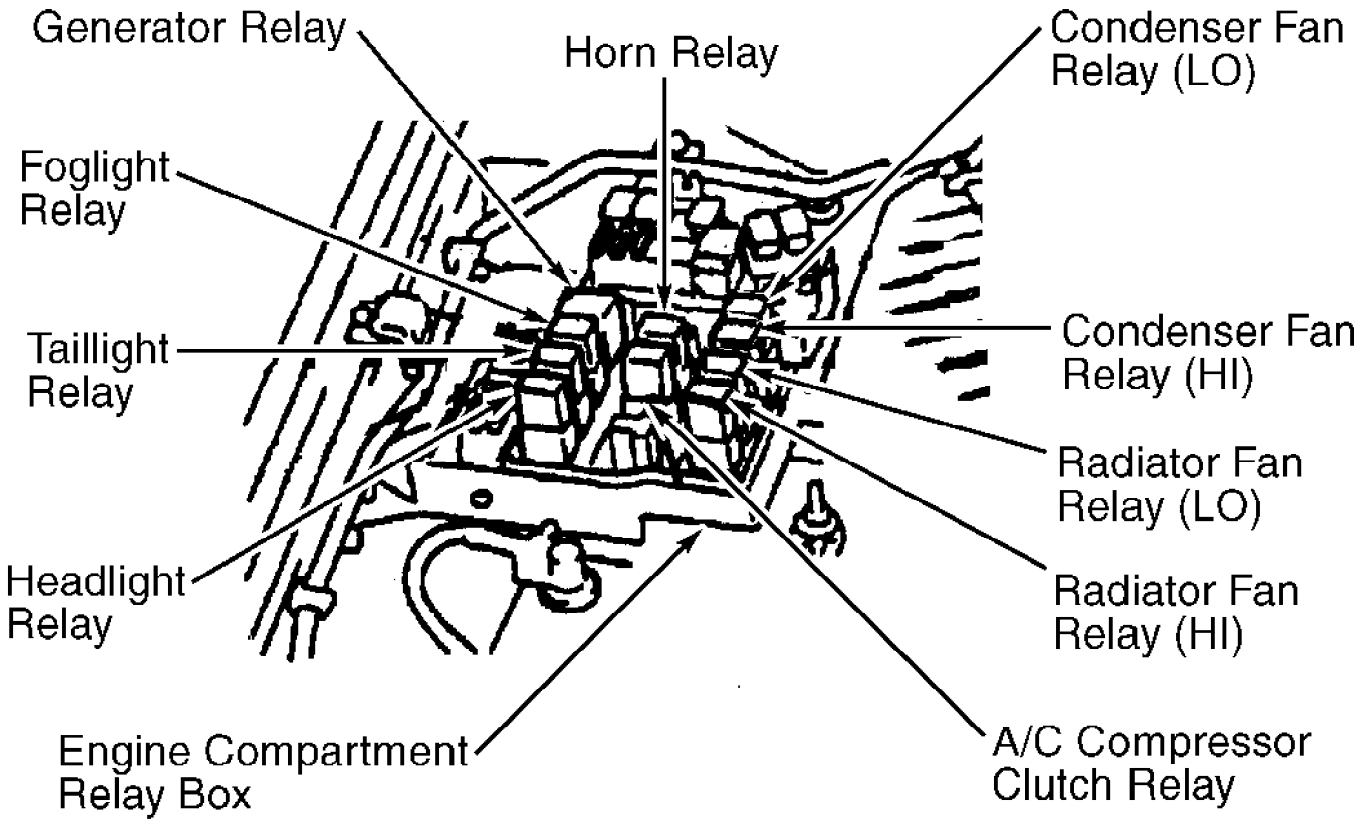
Headlight Relay	On engine compartment relay box, on right inner fender panel.



98G02323

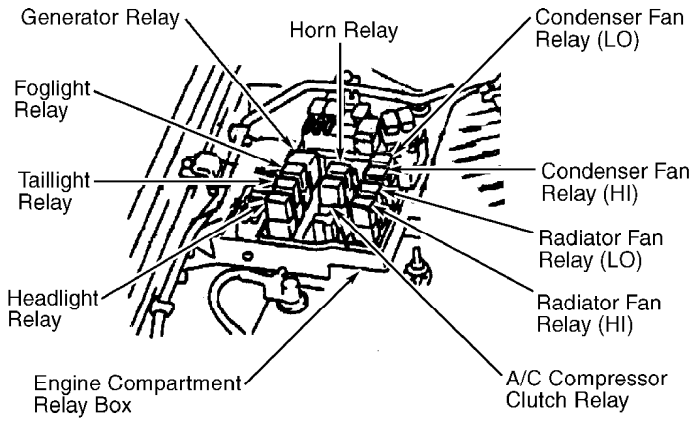
Horn Relay	On engine compartment relay box, on right inner fender panel.
Intermittent Wiper Relay	Behind steering wheel, in

	wiper column switch.
MFI Relay	Behind dash, right of driver's footwell.



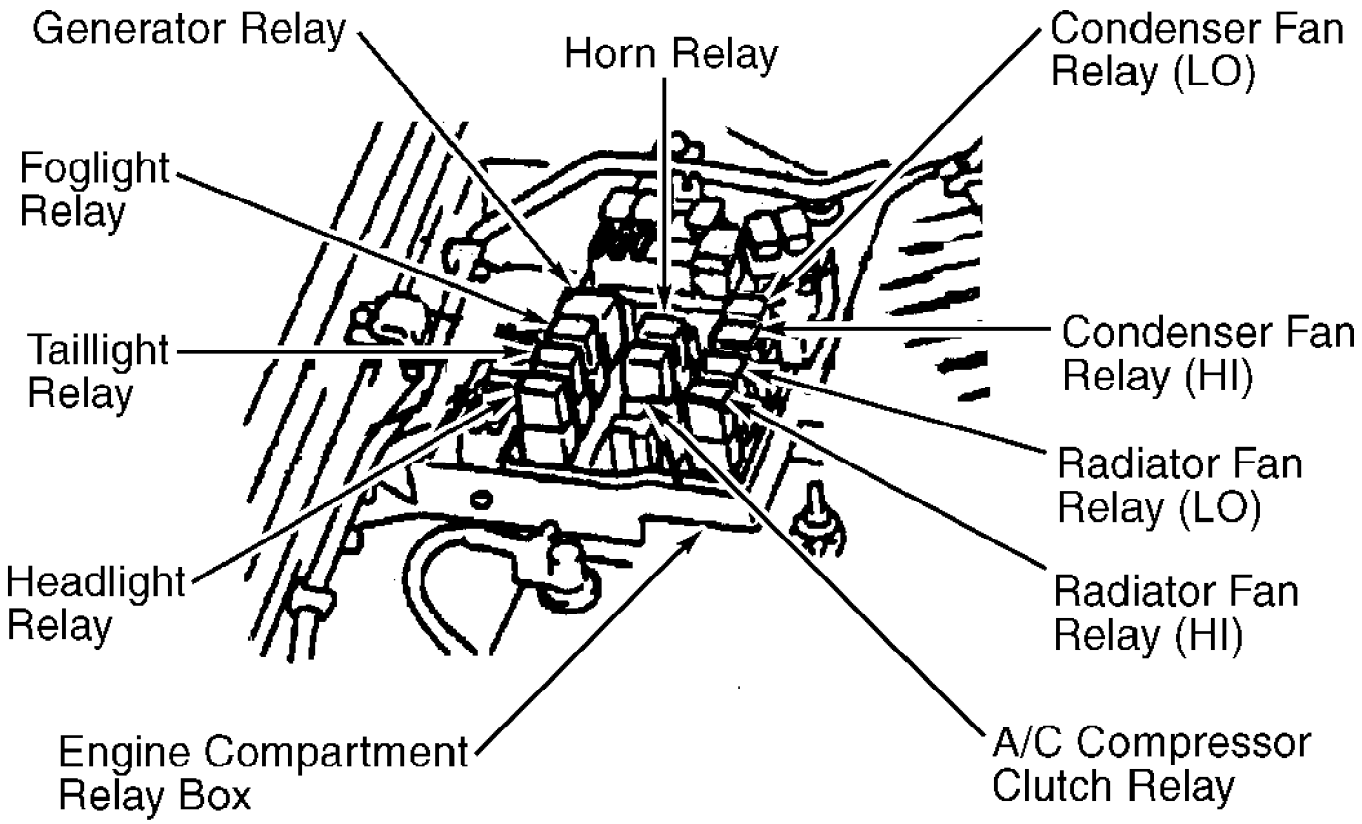
98G02323

Radiator Fan Relay (HI)	On engine compartment relay box, on right inner fender panel.



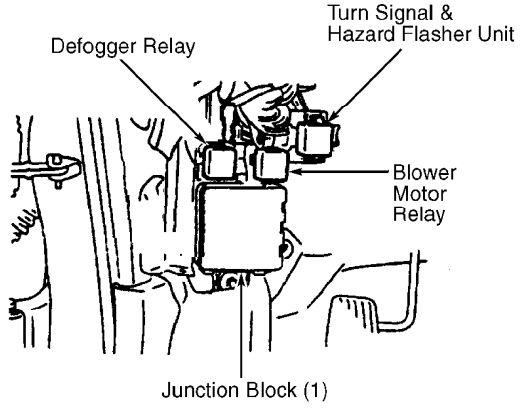
98G02323

Radiator Fan Relay (LO)	On engine compartment relay box, on right inner fender panel.
Starter Relay	On right inner fender panel.



98G02323

Taillight Relay	On engine compartment relay box, on right inner fender panel.
Theft-Alarm Horn Relay	On left inner fender panel.
Theft-Alarm Starter Relay	On right inner fender panel.

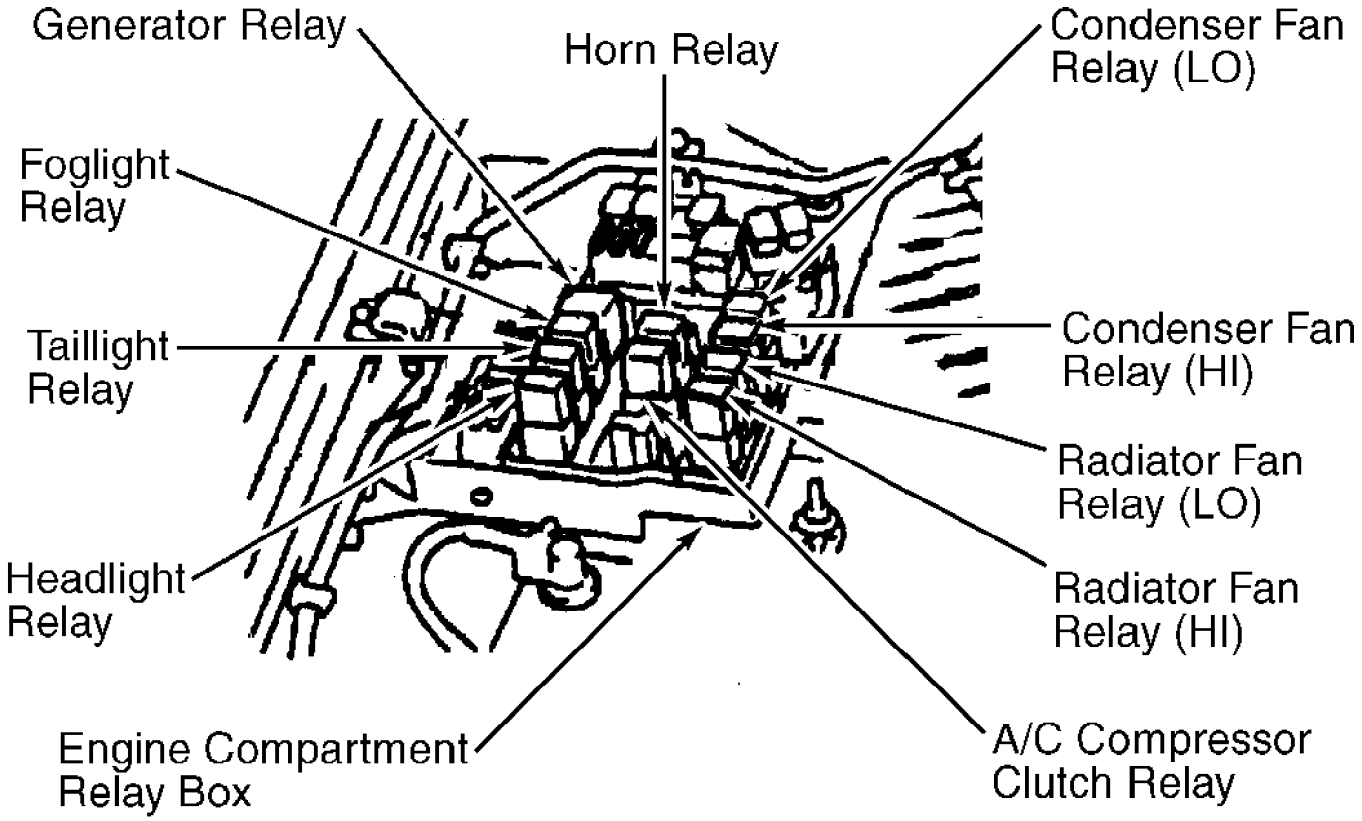


98F02327

Turn Signal & Hazard Flasher Unit	At left kick panel, on junction block (1).

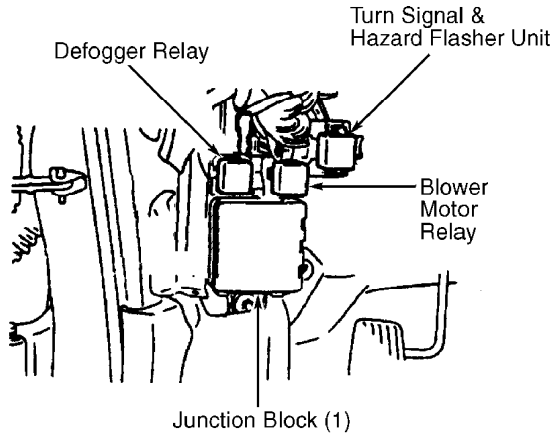
CIRCUIT PROTECTION DEVICES

Component	Component Location



98G02323

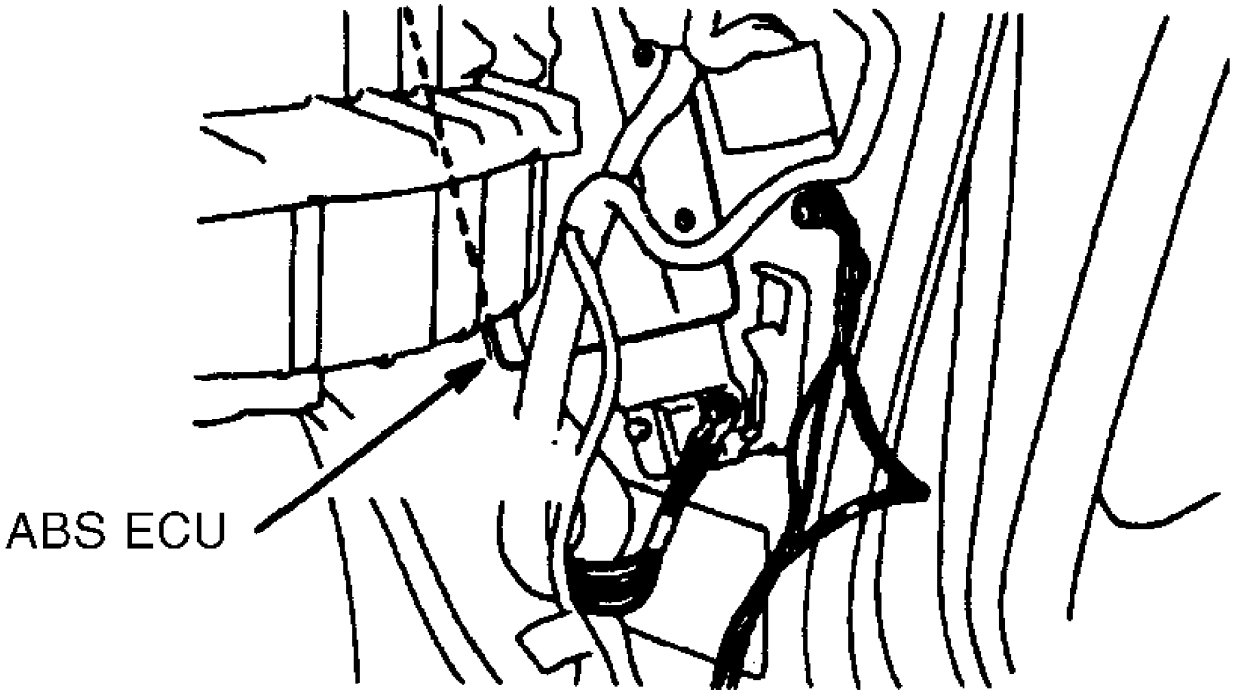
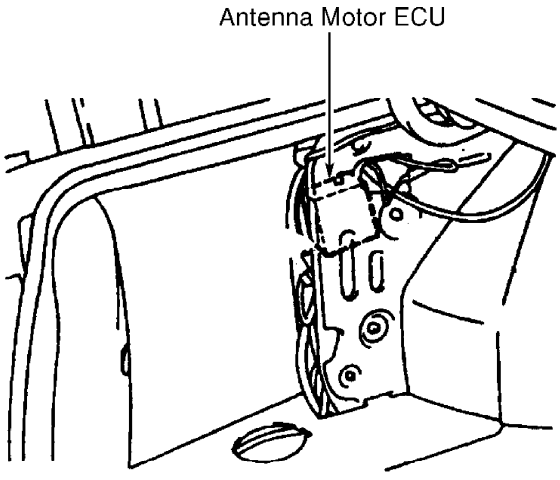
Engine Compartment Relay Box	On right inner fender panel.

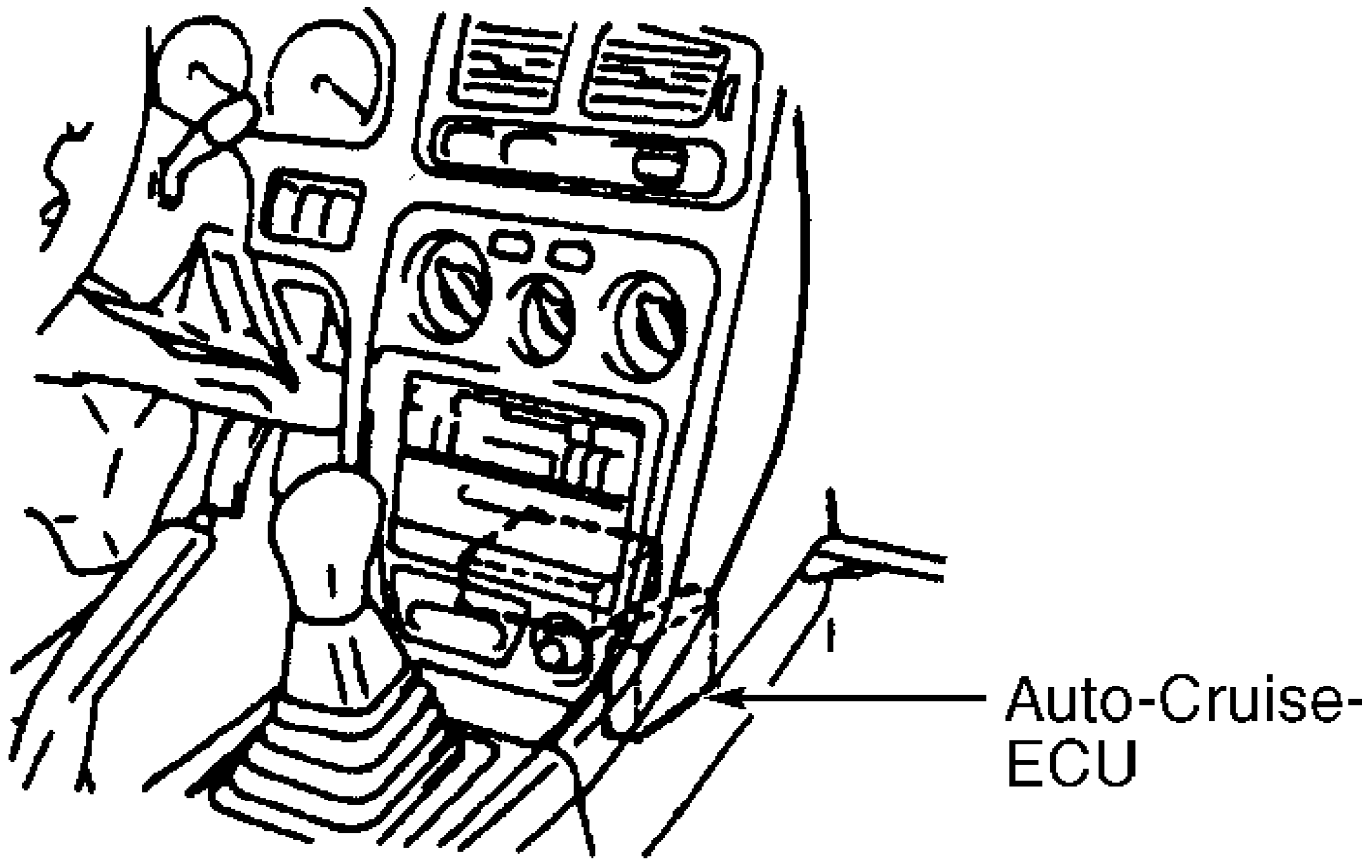


98F02327

Junction Block (1)	At left side kick panel.
Junction Block (2)	At left side kick panel.

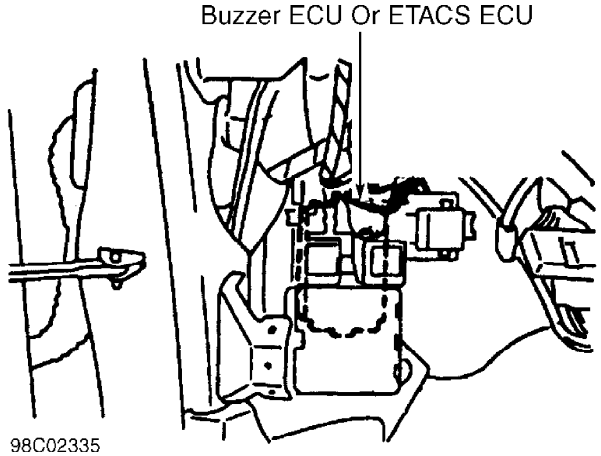
CONTROL UNITS

Component	Component Location
 96J03263	
ABS ECU	Under right side of dash.
A/C Control Panel & ECU Assembly (Auto A/C)	Behind center of dash.
 98H02333	
Antenna Motor ECU	On left side of luggage compartment.



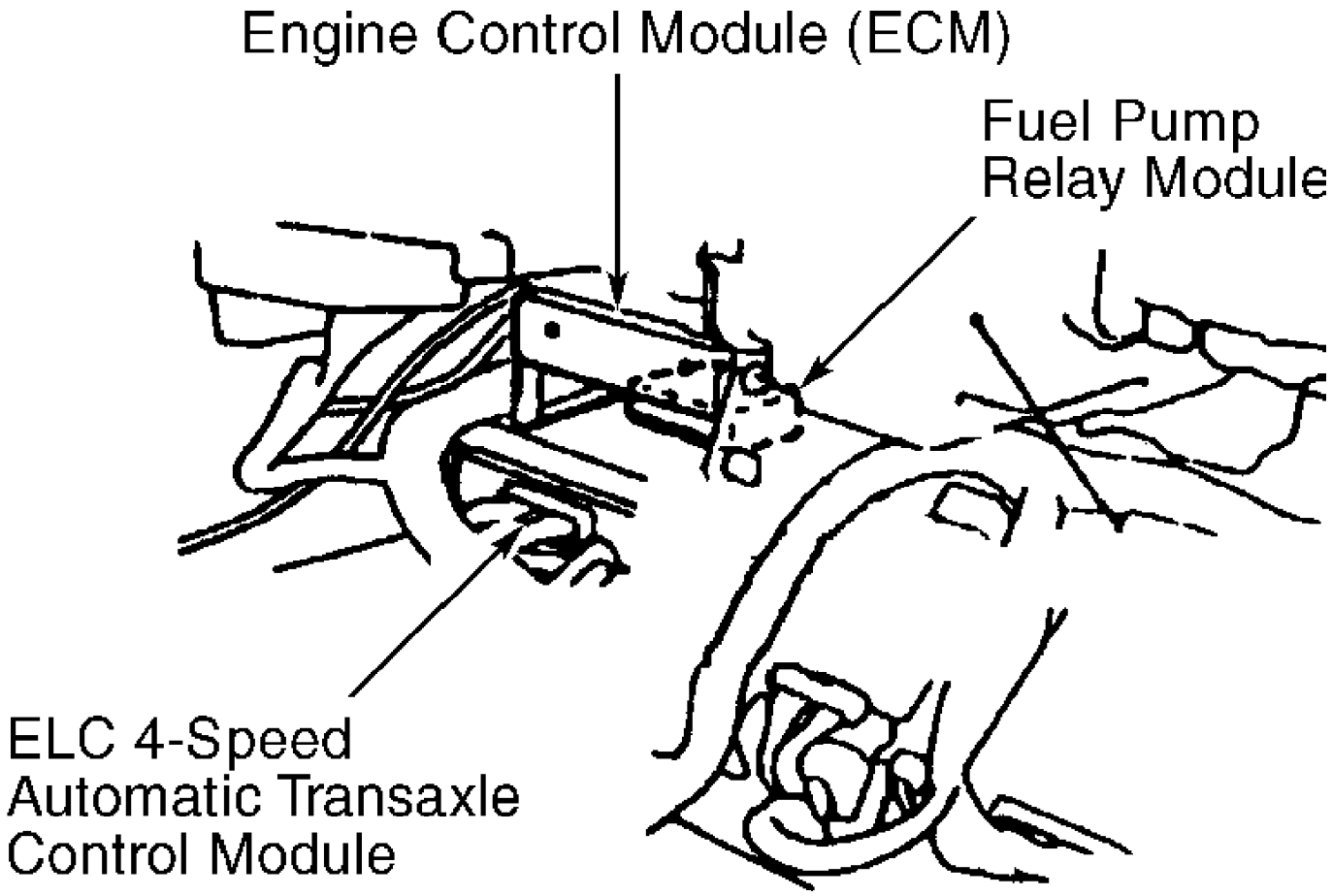
98J02329

Auto-Cruise ECU	Behind center console.
Automatic Compressor ECU (Manual A/C)	Under right side of dash, on front evaporator case.



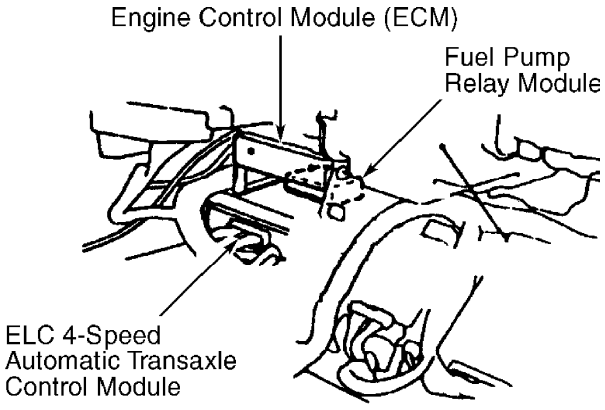
98C02335

Buzzer ECU	Behind left side of dash.
Door Lock ECU	In power window switch assembly, in driver’s door.



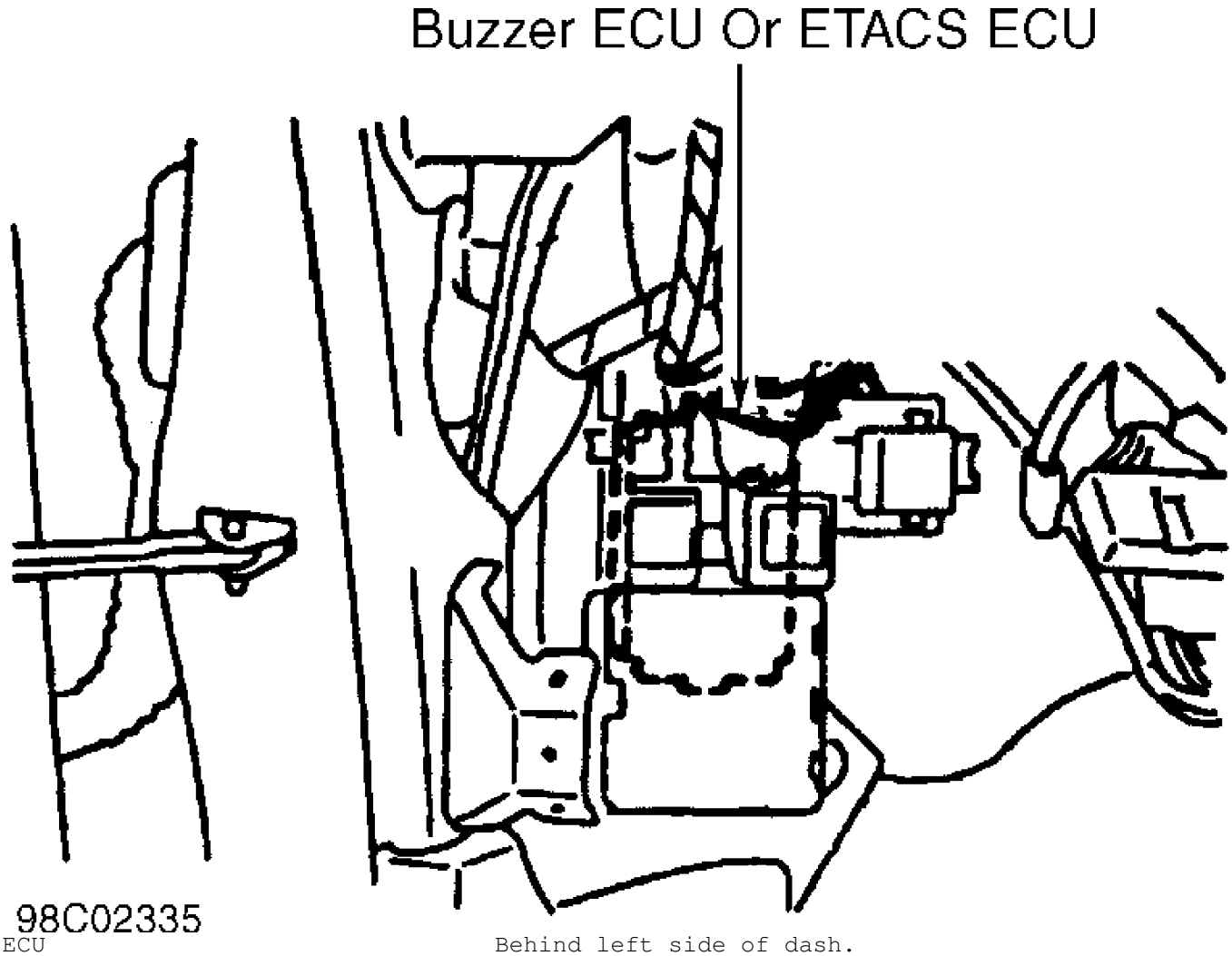
98D02331

ELC 4-Speed Automatic Transaxle Control Module	Behind center console.

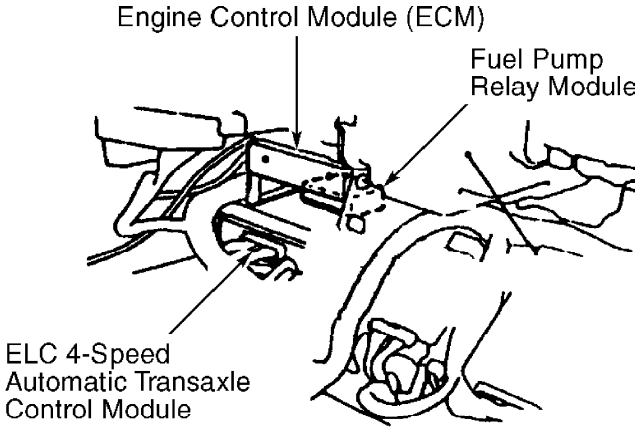


98D02331

Engine Control Module (ECM)	Behind center console.

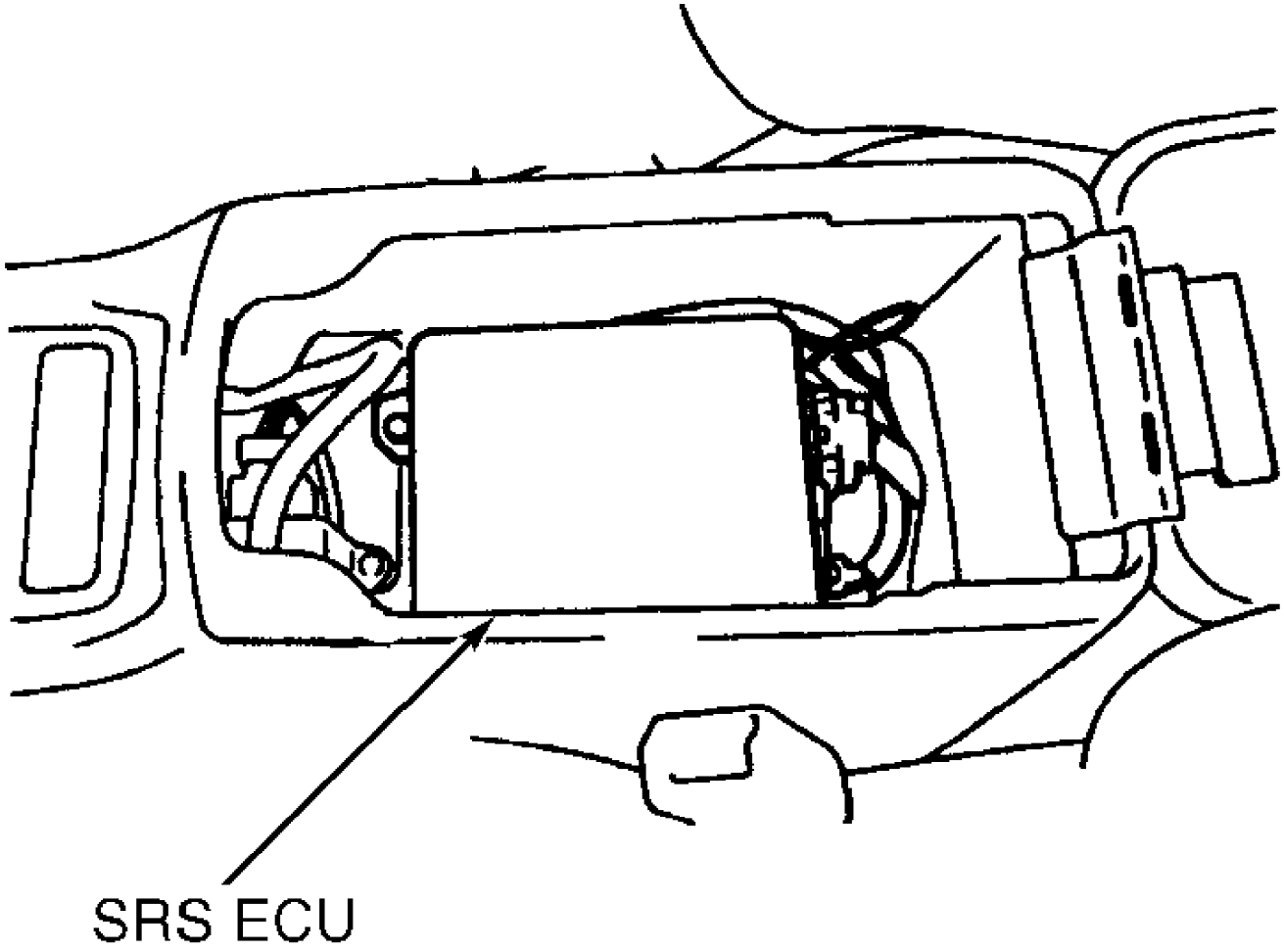


ETACS ECU	Behind left side of dash.



Fuel Pump Relay Module	Behind center console.
Power Window ECU	In power window switch assembly, in driver’s door.

Receiver	Under center of rear shelf.

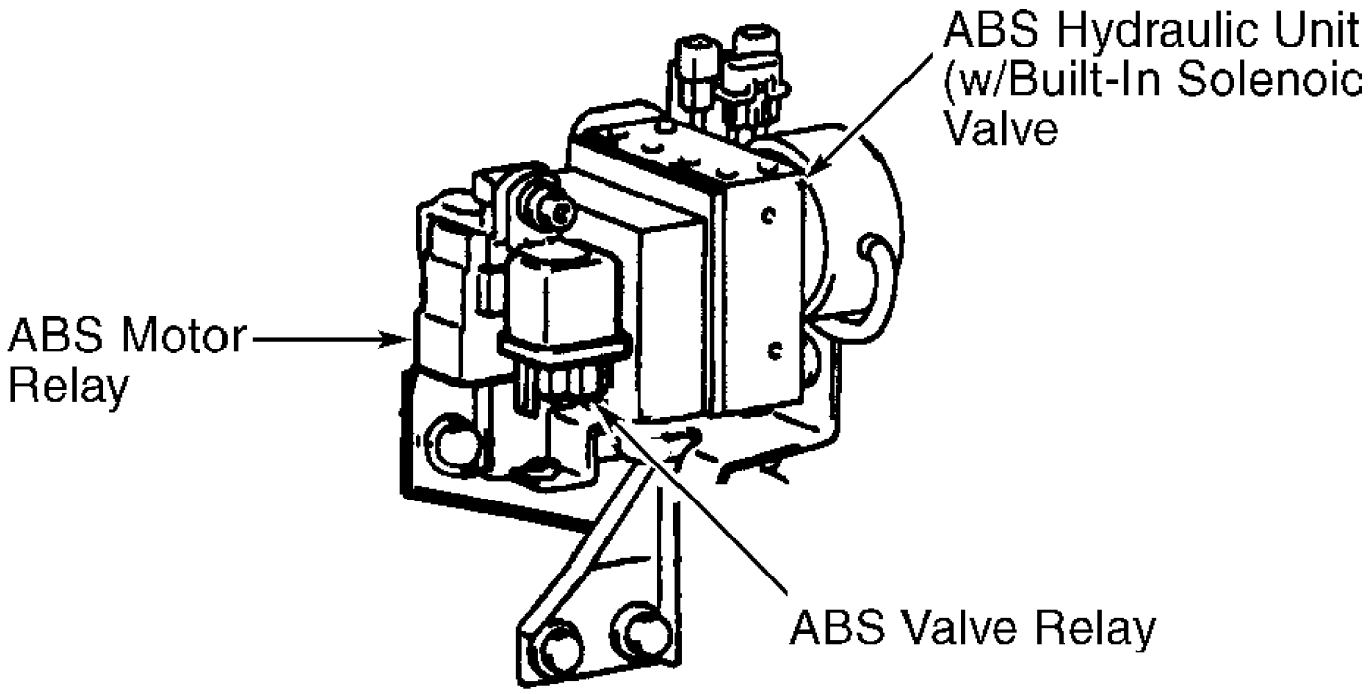


98G02337

SRS ECU	Inside floor console.
Sun Roof ECU	Center of windshield header.

MOTORS

Component	Component Location



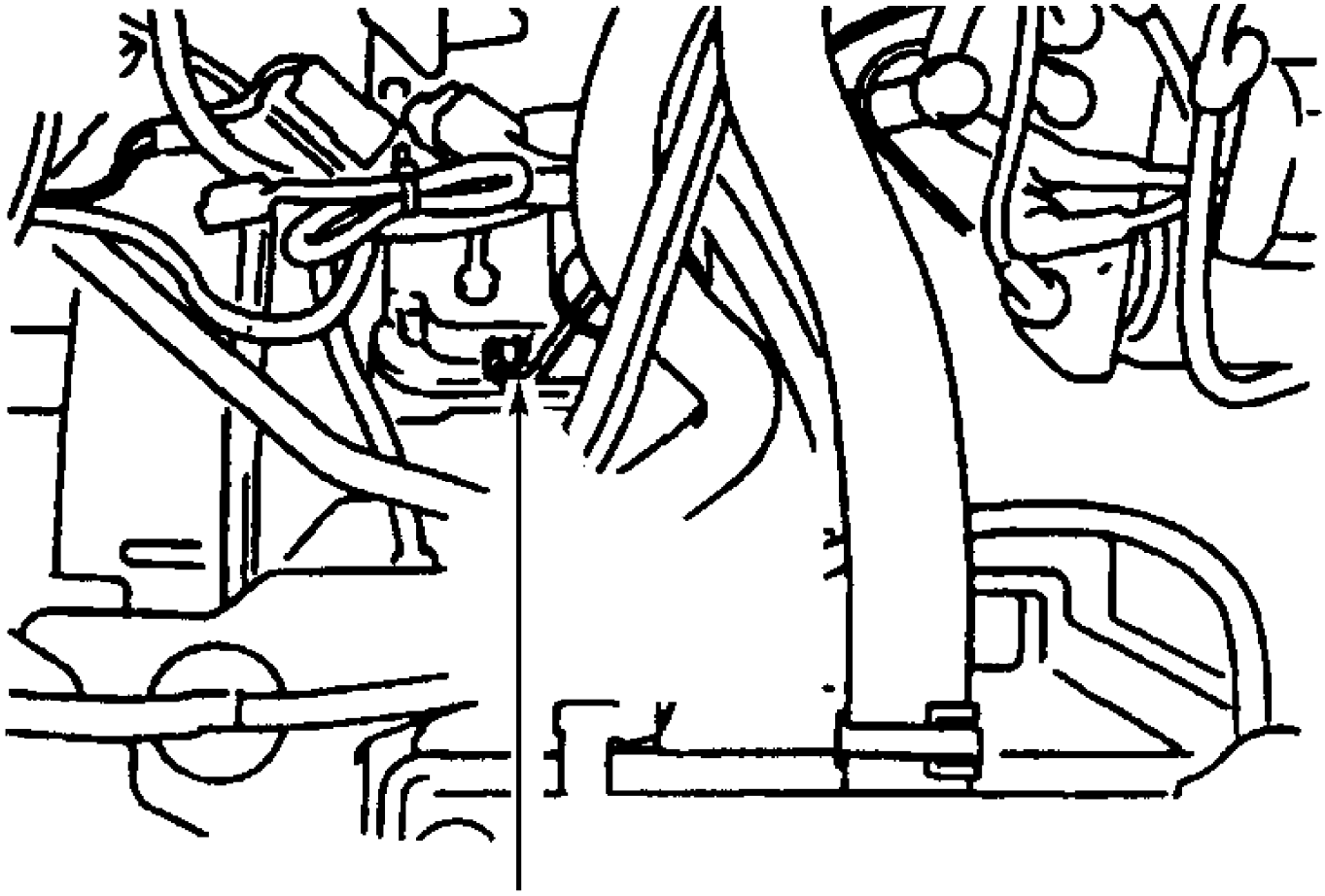
98B02325

ABS Hydraulic Unit	On right rear of engine compartment.
Air Mixing Damper Control Motor	Behind right side of dash, on A/C-heater housing.
Air Selection Damper Control Motor	Behind right side of dash, on A/C-heater housing.
Antenna Motor Assembly	On left side of luggage compartment.
Auto-Cruise Control Vacuum Pump	On right rear of engine compartment.
Blower Motor	Under right side of dash.
Condenser Fan Motor	Behind condenser, left side of engine compartment.
Fuel Pump	In fuel tank.
Idle Air Control Motor	On side of fuel injection throttle body.
Mode Selection Damper Control Motor	Behind right side of dash, on A/C-heater housing.
Radiator Fan Motor	Behind radiator, right side of engine compartment.
Sun Roof Motor	In front center of roof, behind dome lamp.
Windshield Washer Motor	Left side of engine

	compartment, in washer fluid reservoir.
Windshield Wiper Motor	Right rear of engine compartment.

SENDING UNITS & SENSORS

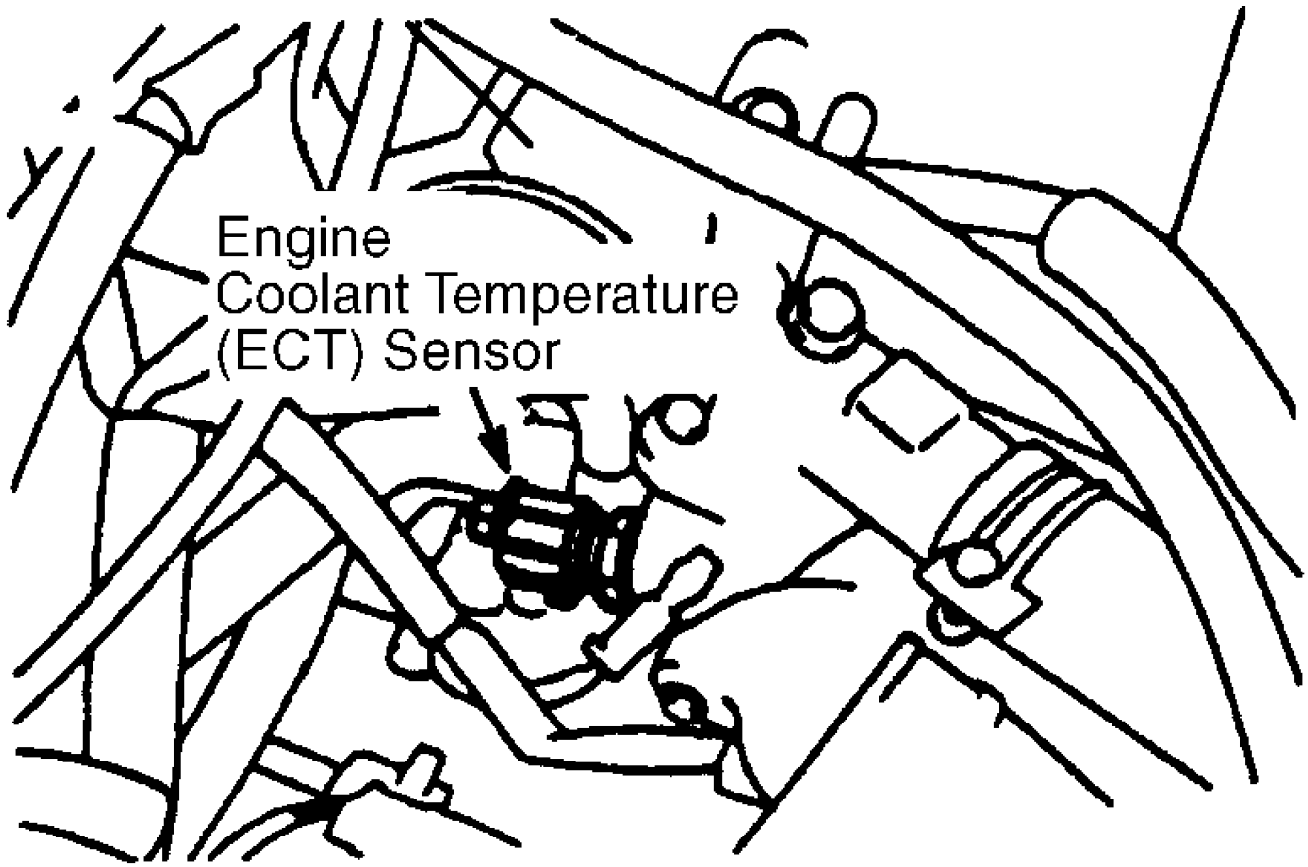
Component	Component Location
ABS Speed Sensors (Front) (2)	On steering knuckles.
ABS Speed Sensors (Rear) (2)	On brake caliper mounts.



95J24058

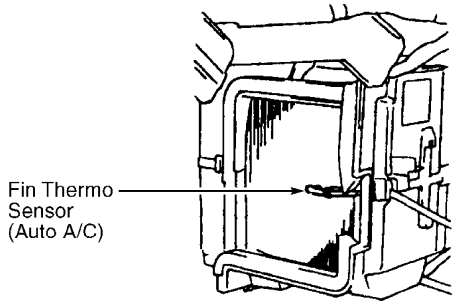
A/T Fluid Temperature Sensor	On lower transaxle case, near oil pan.
Camshaft Position (CMP) Sensor	Rear of cylinder head, in distributor.

Crankshaft Position (CKP) Sensor	On front of engine.
Engine Coolant Temperature (ECT) Gauge Unit	On rear of engine near thermostat housing.



97A00372

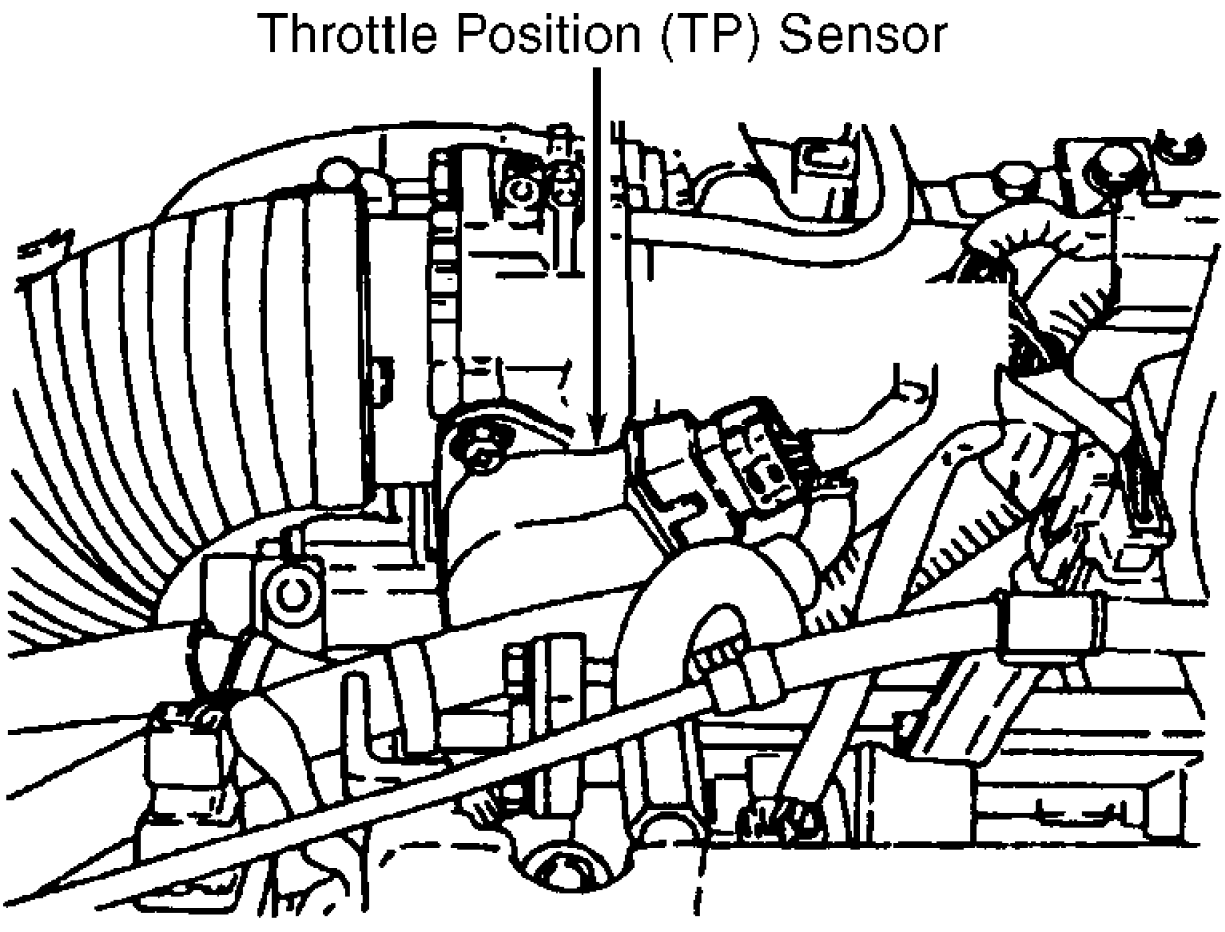
Engine Coolant Temperature (ECT) Sensor	Near thermostat housing.



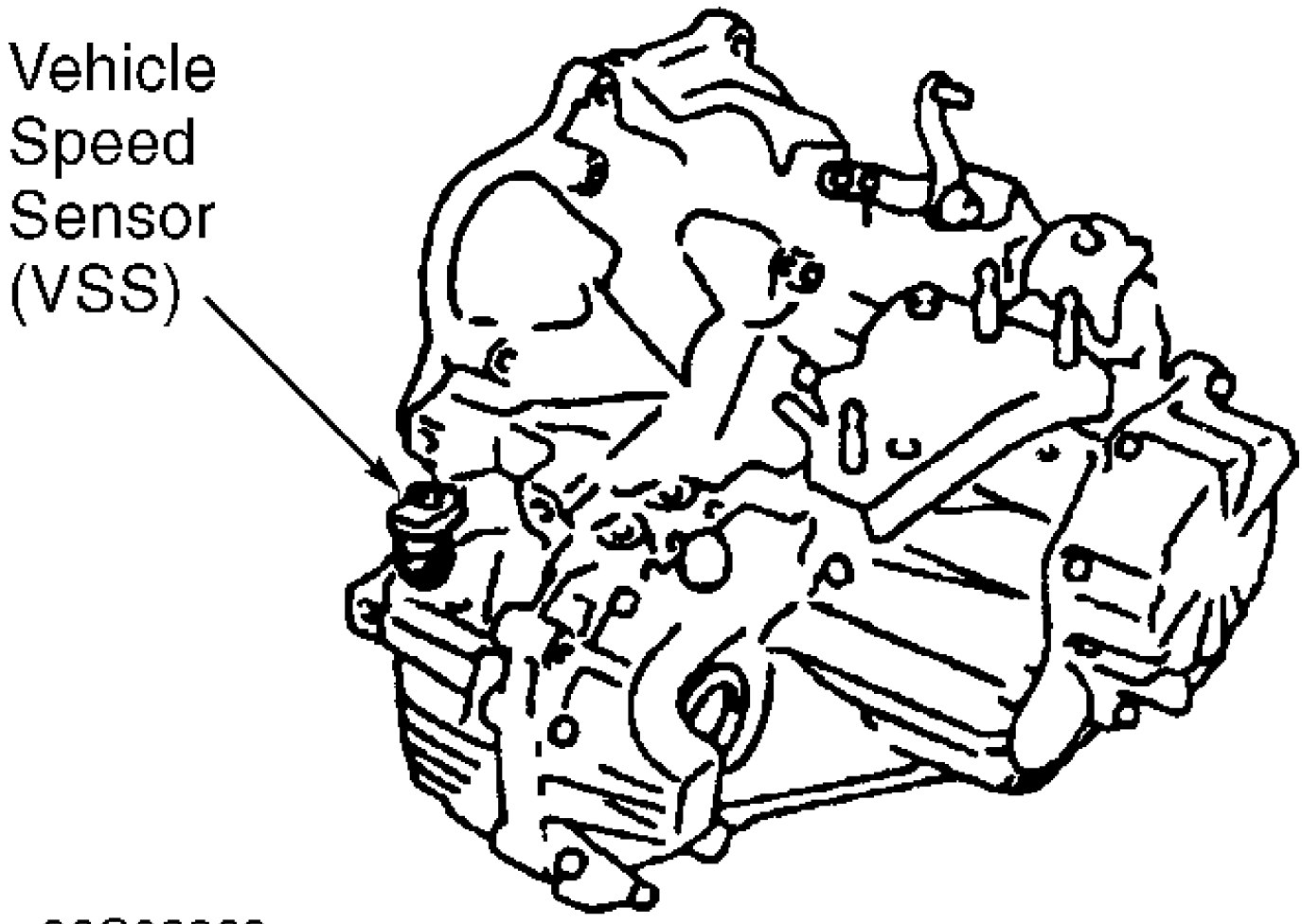
98E02341

Fin Thermo Sensor (Auto A/C)	In evaporator air outlet.
Fuel Gauge Unit	In fuel tank.
Fuel Tank Differential Pressure	

Sensor	Top of fuel tank.
Heated Oxygen Sensor (HO2S) (Front) (Calif.)	Front of engine compartment, on exhaust manifold.
Heated Oxygen Sensor (HO2S) (Front) (Federal)	Below left side of engine, on exhaust system.
Heated Oxygen Sensor (HO2S) (Rear)	Underside of vehicle, rear of catalytic converter.
Heater Water Temperature Sensor (Auto A/C)	Behind right side of dash.
Manifold Differential Pressure Sensor	Top left rear of engine.
Outside Thermometer Sensor (Auto A/C)	Behind right front grille.
Photo Sensor	On top right side of dash.

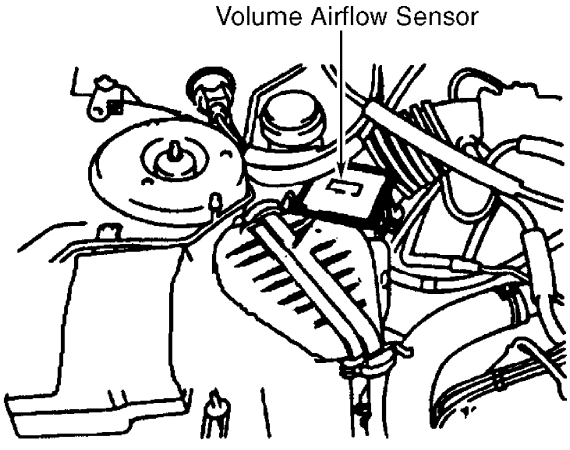


Throttle Position (TP) Sensor	On right side of throttle body (facing intake).



96C03269

Vehicle Speed Sensor (VSS)	Mounted on left side of transaxle.

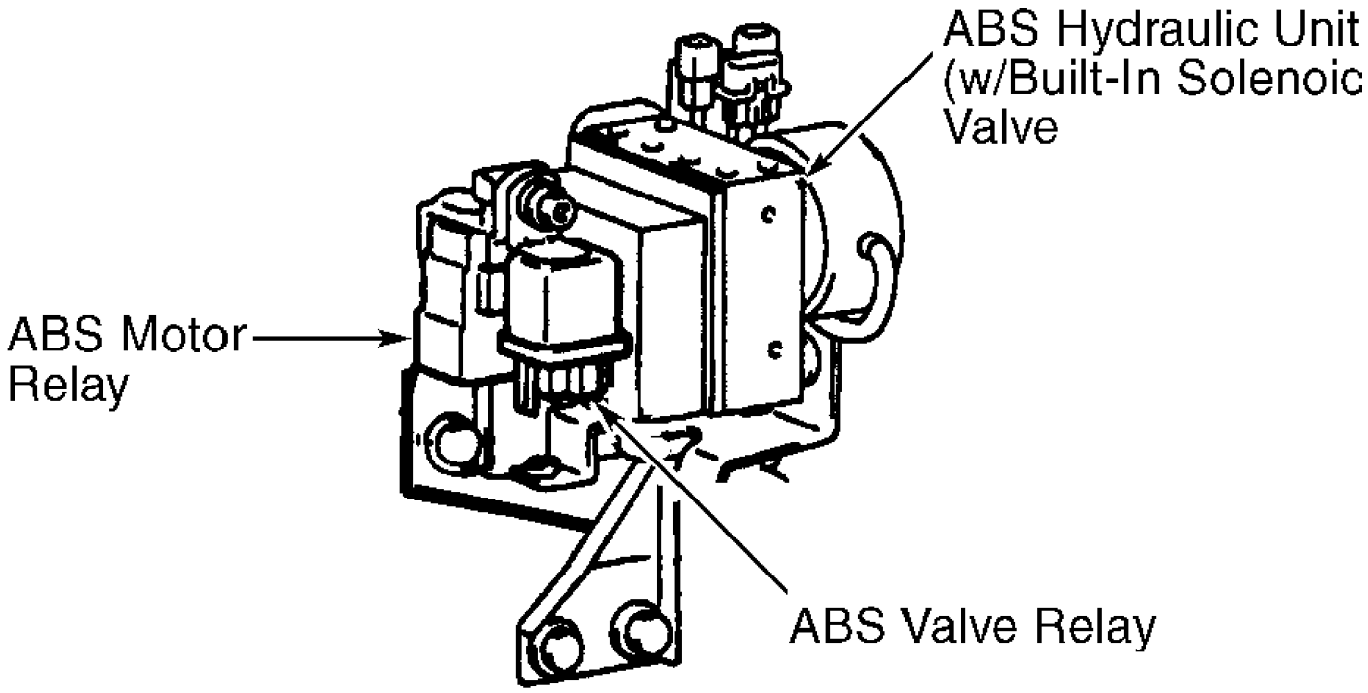


98A02339

Volume Airflow Sensor	In air cleaner housing (Includes intake air temperature & barometric pressure sensor).

SOLENOIDS & SOLENOID VALVES

Component	Component Location



98B02325

ABS Hydraulic Unit (w/Built-In Solenoid Valve)	On right rear of engine compartment.
Auto-Cruise Control Vacuum Pump (w/Built-In Control Valve & Release Valve)	On right rear corner of engine compartment.
ELC 4-Speed Automatic Transaxle Control Solenoid Valve	On valve body, in transaxle.
Evaporative Emission Purge Solenoid	Top front of engine.
Evaporative Emission Ventilation Solenoid	Lower right front of engine compartment.
Exhaust Gas Recirculation (EGR) Solenoid (Federal)	On center of firewall.

SWITCHES

Component	Component Location

A/C Refrigerant Temperature Switch	On A/C compressor.
Back-Up Light Switch	Top of transaxle.
Brake Fluid Level Switch	Left rear of engine compartment, in brake fluid reservoir.
Clutch Pedal Position Switch	On clutch pedal bracket.
Dual Pressure Switch	In receiver-drier, right front of engine compartment.
Hood Switch	On right front of engine compartment.
Inside/Outside Air Changeover Switch	Behind right side of dash, on A/C-heater housing.
Kickdown Servo Switch (A/T)	On kickdown servo piston cover.
Oil Pressure Switch	On right side front of engine.
Parking Brake Switch	Mounted below park brake lever.
Park/Neutral Position (PNP) Switch (A/T)	Top of transaxle.
Power Steering Pressure Switch	Lower left front of engine compartment, on P/S pump.
Seat Belt Switch (Left)	In driver seat belt buckle.
Stoplight Switch	On brake pedal bracket.

MISCELLANEOUS

Component	Component Location
Amplifier	Under center of rear shelf.
Blower Resistor	Behind right side of dash.
Data Link Connector (DLC)	Below dash, left of center console.
Diode (ABS Circuit)	Behind right side of glove box, taped to harness.
Diode (Theft-Alarm Circuit)	Behind left side of dash, taped to harness.
Diode (Theft-Alarm Circuit)	Left side of luggage compartment, taped to harness.
Fuel Pump Check Connector	On right side of firewall.
Noise Capacitor	On right rear of engine, near

	distributor.
Power Transistor	Behind right side of dash.
Pulse Generators ("A" & "B")	In right side of engine compartment, on transaxle.
Theft-Alarm Horn	On left rear of engine compartment.

ELECTROSTATIC DISCHARGE WARNING - BASIC INFORMATION

1998 Mitsubishi Galant

GENERAL INFORMATION
Electrostatic Discharge (ESD) Warning - Basic Information

All Makes amd Models

*** PLEASE READ THIS FIRST ***

NOTE: This article is intended for general information purposes only.

INTRODUCTION

All Electrostatic Discharge (ESD) sensitive components contain solid state circuits (transistors, diodes, semiconductors) that may become damaged when contacted with an electrostatic charge. The following information applies to all ESD sensitive devices. The ESD symbol shown in Fig. 1 may be used on schematics to indicate which components are ESD sensitive. See Fig. 1. Although different manufactures may display different symbols to represent ESD sensitive devices, the handling and measuring precautions and procedures are the same.

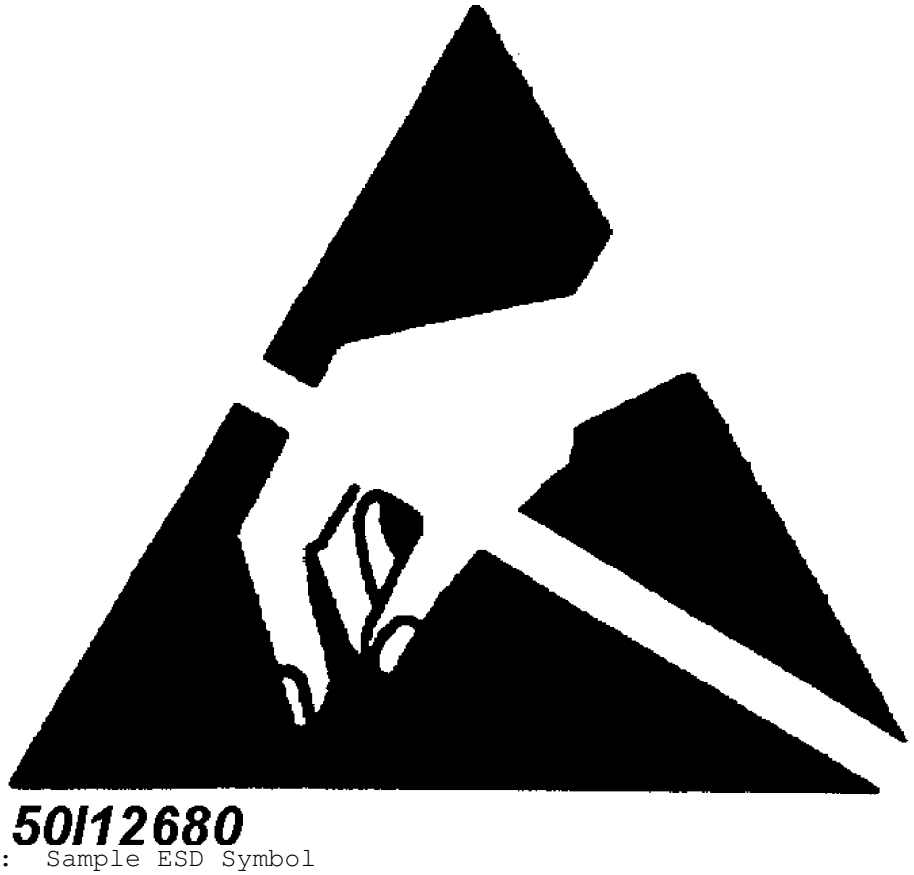


Fig. 1: Sample ESD Symbol

HANDLING STATIC-SENSITIVE CIRCUITS/DEVICES

When handling an electronic part that is ESD sensitive, the technician should follow these guidelines to reduce any possible electrostatic charge build-up on the technician's body and the electronic part.

1) Always touch a known good ground source before handling the part. This should be repeated while handling the part and more frequently after sitting down from a standing position, sliding across the seat or walking a distance.
2) Avoid touching electrical terminals of the part, unless instructed by a diagnostic procedure.
3) DO NOT open the package of a new part until it is time to install the part.
4) Before removing the part from its package, ground the package to a known good ground source.

CHECKING STATIC-SENSITIVE CIRCUITS/DEVICES

1) Solid State circuits in electronic devices are shown greatly simplified in schematics. See Fig. 2. Due to the simplification of the electronic devices on the schematic, resistance measurements could be misleading or could lead to an electrostatic discharge. Always follow the recommended diagnostic procedure.

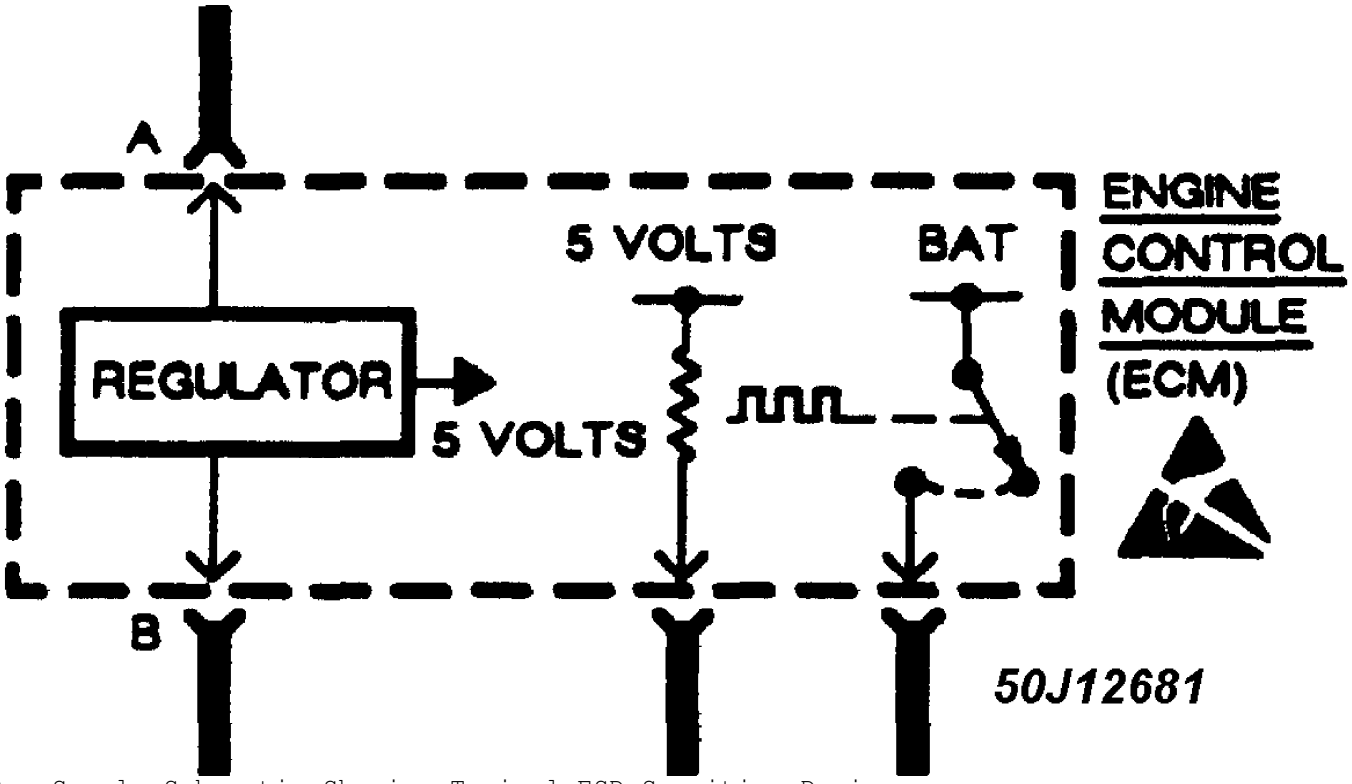


Fig. 2: Sample Schematic Showing Typical ESD Sensitive Device

2) Only measure resistance at the terminals of the devices when instructed by the recommended diagnostic procedure.
3) When using a voltmeter, be sure to connect the ground lead first.

EMISSION CONTROL VISUAL INSPECTION PROCEDURES

1998 Mitsubishi Galant

1983-98 GENERAL INFORMATION
Emission Control Visual Inspection Procedures

All Models

* PLEASE READ THIS FIRST *

This article is provided for general information only. Not all information applies to all makes and models. For more complete information, see appropriate article(s) in the ENGINE PERFORMANCE Section.

EMISSION CONTROL LABELS

The vehicle manufacturer's emission control label, also known as the underhood tune-up label or Vehicle's Underhood Emission Control System (VECI) label, is located in the engine compartment. Information regarding year model of vehicle, engine size, number of cylinders, emission equipment or type, engine tune-up specifications, whether vehicle was manufactured for sale in California or is a Federal vehicle, vacuum hose routing schematic, etc., can be found on this label. See Fig. 1.

In addition to the VECI label, some emission control inspection and maintenance programs may require an additional label to be affixed to the vehicle in special circumstances. For example, in California, a Bureau Of Automotive Repair (BAR) engine label may be affixed to the left door post. A BAR engine label is only used when the vehicle has an engine change, approved modification or is a Specially Constructed (SPCN) or an acceptable Gray market vehicle. Check your state's emission control inspection and maintenance laws to determine if a similar label is used.

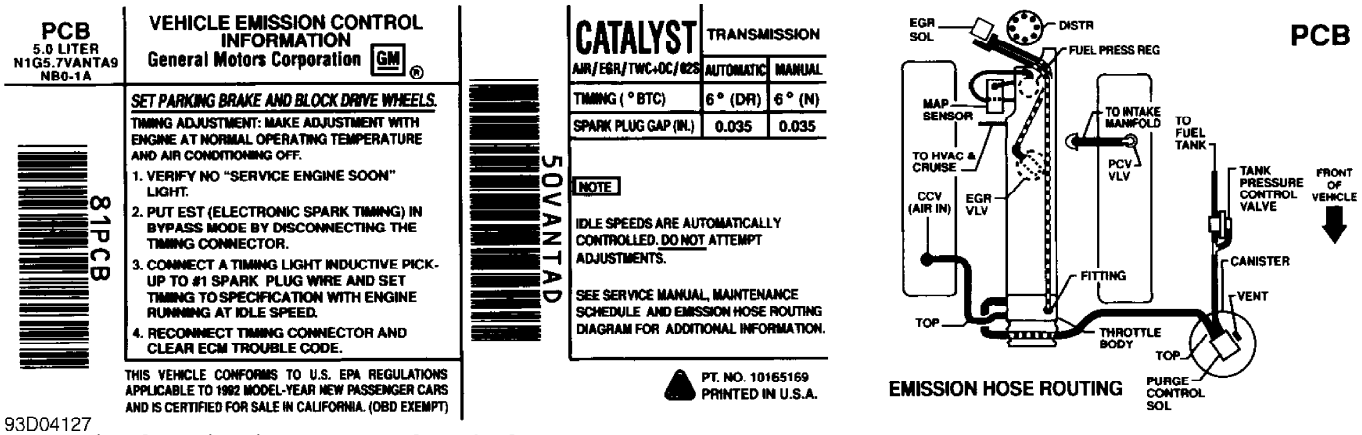


Fig. 1: Typical Emission Control Label
Courtesy of General Motors Corp.

EMISSION CONTROL VISUAL INSPECTION

* PLEASE READ THIS FIRST *

NOTE: The following emission control visual inspection procedures should be used as a guide only. When performing a visual inspection, always follow your state's recommended

inspection procedures.

A visual inspection is made to determine if any required emission control devices are missing, modified or disconnected. Missing, modified or disconnected systems must be made fully operational before a vehicle can be certified.

POSITIVE CRANKCASE VENTILATION (PCV)

PCV controls the flow of crankcase fumes into the intake manifold while preventing gases and flames from traveling in the opposite direction. PCV is either an open or closed system. See Fig. 2 .

Ensure PCV system is installed as required. Verify valve, required hoses, connections, flame arresters, etc., are present, routed properly and in serviceable condition.

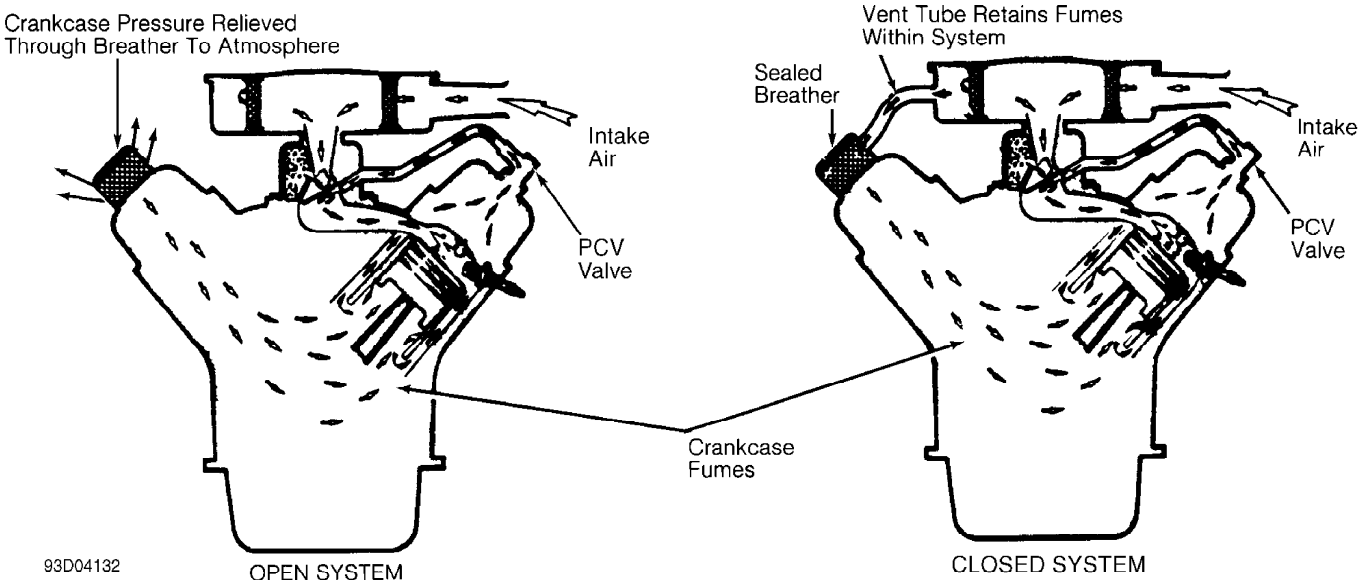


Fig. 2: Typical Open & Closed Type PCV System

THERMOSTATIC AIR CLEANER (TAC)

The TAC supplies warm air to air intake during cold engine operation. This system is active during cold engine warm-up only. Under all other operating conditions, air cleaner function is the same as any non-thermostatic unit.

Ensure required exhaust shroud, hot air duct, vacuum hoses and air cleaner components are present and installed properly. See Fig. 3. Ensure any required thermostatic vacuum switches are in place and vacuum hoses are installed and in serviceable condition. Also ensure air cleaner lid is installed right side up. Check for oversized air filter elements and for additional holes in the air cleaner housing.

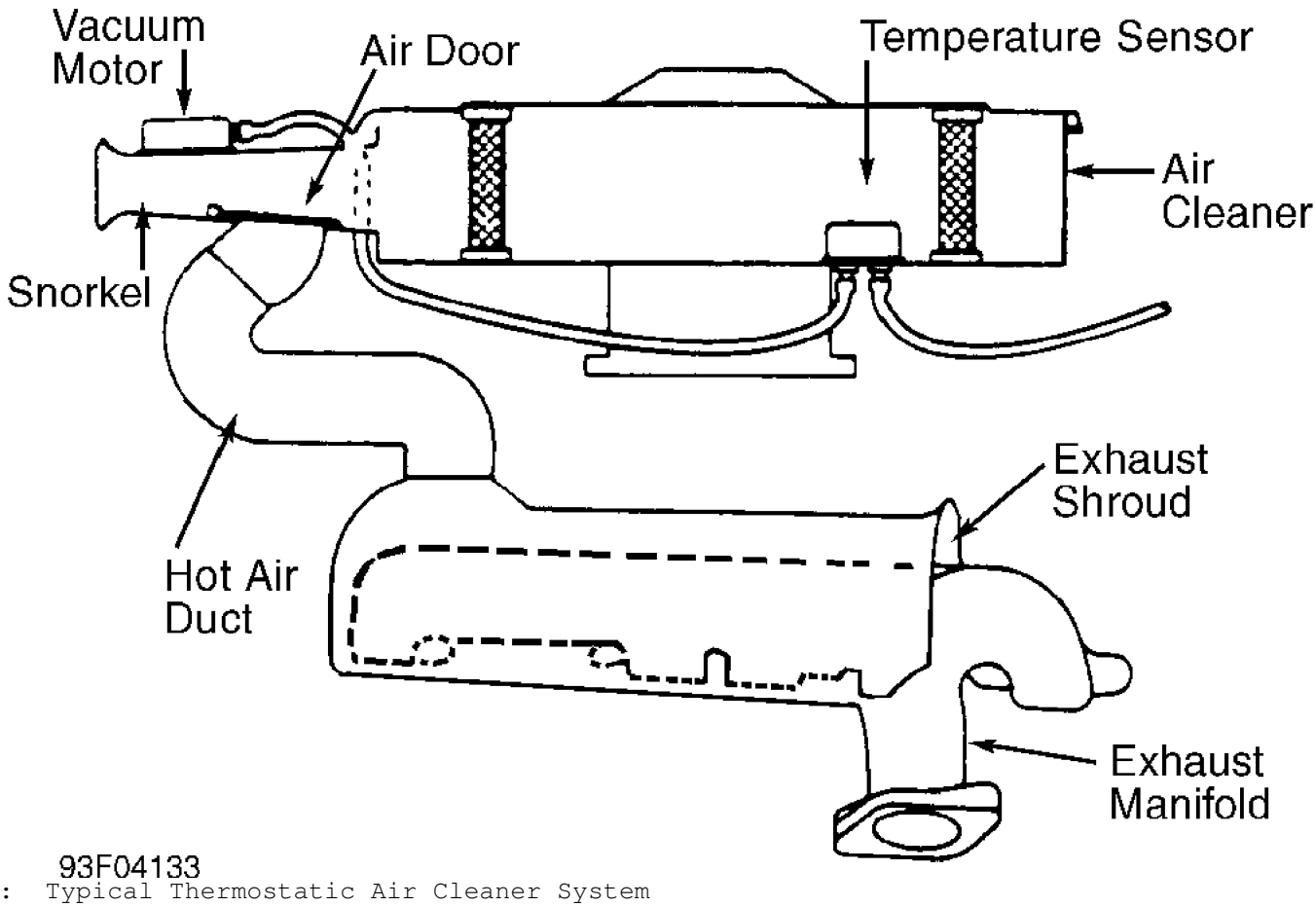


Fig. 3: Typical Thermostatic Air Cleaner System

FUEL EVAPORATIVE SYSTEM (EVAP)

The EVAP system allows for proper fuel system ventilation while preventing fuel vapors from reaching the atmosphere. This means that vapors must be caught and stored while the engine is off, which is when most fuel evaporation occurs. When the engine is started, these fuel vapors can be removed from storage and burned. In most systems, storage is provided by an activated charcoal (or carbon) canister. See Fig. 4. On a few early systems, charcoal canisters are not used. Instead, fuel vapors are vented into the PCV system and stored inside the crankcase.

The main components of a fuel evaporation system are a sealed fuel tank, a liquid-vapor separator and vent lines to a vapor-storing canister filled with activated charcoal. The filler cap is normally not vented to the atmosphere, but is fitted with a valve to allow both pressure and vacuum relief.

Although a few variations do exist between manufacturers, basic operation is the same for all systems. Check for presence of vapor storage canister or crankcase storage connections when required. Ensure required hoses, solenoids, etc., are present and connected properly. Check for proper type fuel tank cap. Check for any non-OEM or auxiliary fuel tanks for compliance and the required number of evaporation canisters.

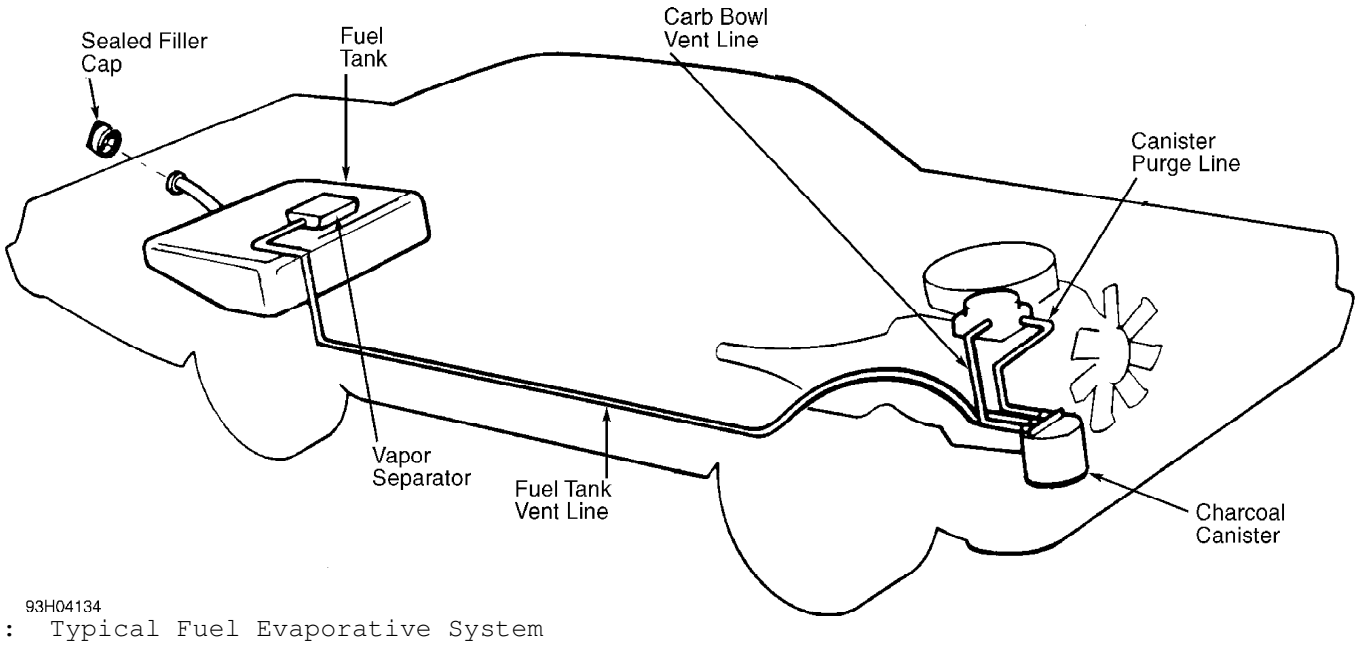


Fig. 4: Typical Fuel Evaporative System

CATALYTIC CONVERTERS

Oxidation Catalyst (OC)

This type of converter is the most common. It may use pellets or monolith medium, depending upon application. See Fig. 5. Platinum and palladium (or platinum alone) are used as catalyst in this type of converter.

Visually check for presence of catalytic converter(s). Check for external damage such as severe dents, removed or damaged heat shields, etc. Also check for pellets or pieces of converter in the tailpipe.

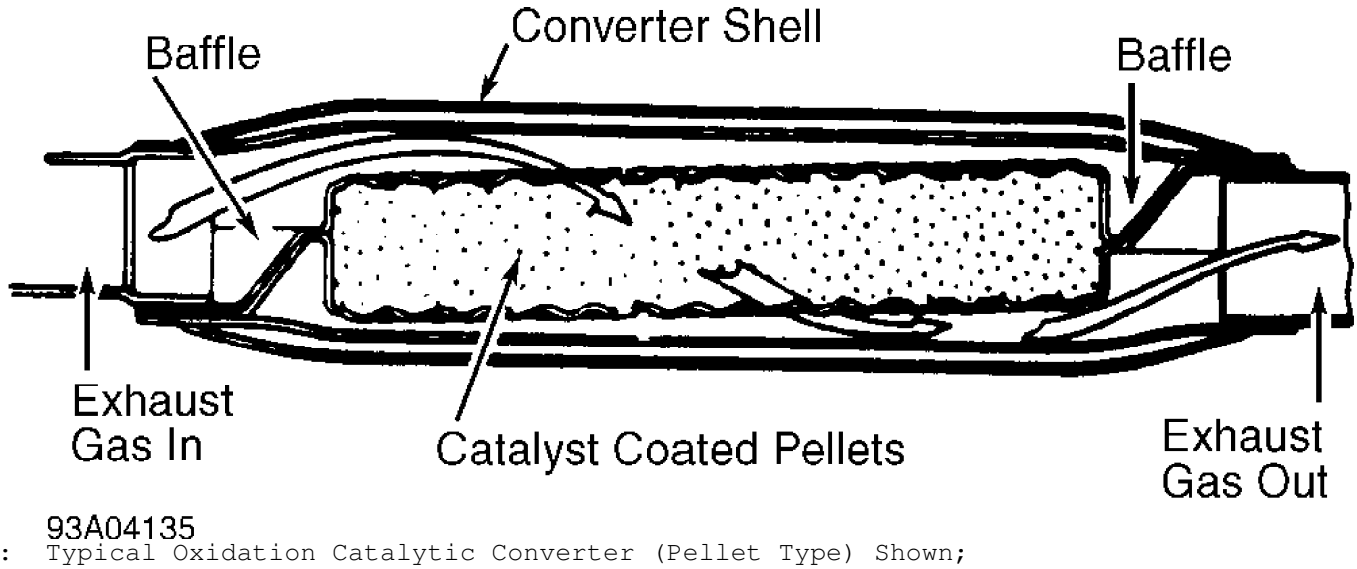


Fig. 5: Typical Oxidation Catalytic Converter (Pellet Type) Shown; Typical Three-Way Catalytic Converter Is Similar
Courtesy of General Motors Corp.

Three-Way Catalyst (TWC)

This type of converter is nearly identical to a conventional

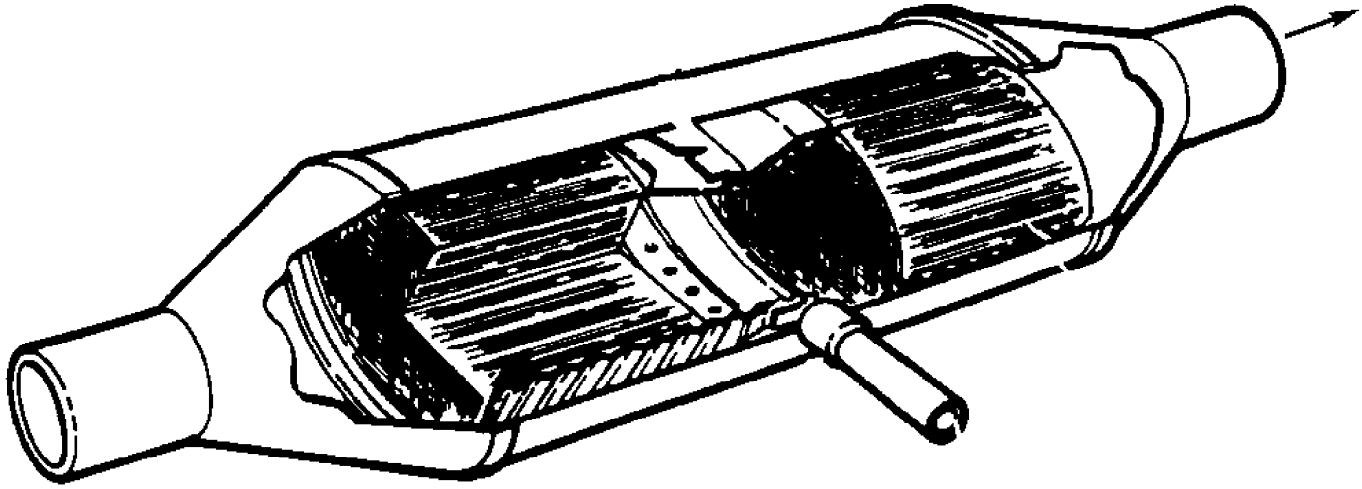
converter with the exception of the catalyst. See Fig. 5. The TWC converter uses rhodium, with or without platinum, as its catalyst. Rhodium helps reduce NOx emissions, as well as HC and CO.

Visually check for presence of catalytic converter(s). Also check for presence of any required air supply system for the oxidizing section of the converter. Check for external damage such as severe dents, removed or damaged heat shields, etc. Check for pellets or pieces of converter in the tailpipe.

Three-Way Catalyst + Oxidation Catalyst (TWC + OC)

This system contains a TWC converter and an OC converter in a common housing, separated by a small air space. See Fig. 6. The 2 catalysts are referred to as catalyst beds. Exhaust gases pass through the TWC first. The TWC bed performs the same function as it would as a separate device, reducing all 3 emissions. As exhaust gases leave the bed, they pass through the air space and into the second (OC) converter catalyst bed.

Visually check for presence of catalytic converter(s). Check for external damage such as severe dents, removed or damaged heat shields, etc. Check for pellets or pieces of converter in the tailpipe.



93C04136

Fig. 6: Typical Three-Way + Oxidation Catalytic Converter
Courtesy of General Motors Corp.

FILL PIPE RESTRICTOR (FR)

A fuel tank fill pipe restrictor is used to prohibit the introduction of leaded fuel into the fuel tank. Unleaded gasoline pump dispensers have a smaller diameter nozzle to fit fuel tank of vehicle requiring the use of unleaded fuel (vehicles equipped with catalytic converter).

Visually inspect fill pipe restrictor(s) for tampering, i.e., restrictor is oversize or the flapper is non-functional. If vehicle is equipped with an auxiliary fuel tank, ensure auxiliary fuel tank is also equipped with a fill pipe restrictor.

EXHAUST GAS RECIRCULATION (EGR) SYSTEM

Single Diaphragm EGR Valve

This type uses a single diaphragm connected to the valve by a shaft. Diaphragm is spring-loaded to keep valve closed in the absence of vacuum. As throttle valves open and engine speed increases, vacuum is applied to the EGR vacuum diaphragm, opening the EGR valve. This vacuum signal comes from a ported vacuum source. Variations in the vacuum signal control the amount of exhaust gas that is recirculated. See Fig. 7.

Verify EGR valve is present and not modified or purposely damaged. Ensure thermal vacuum switches, pressure transducers, speed switches, etc., (if applicable) are not by-passed or modified. Ensure vacuum hose(s) to EGR valve is not plugged.

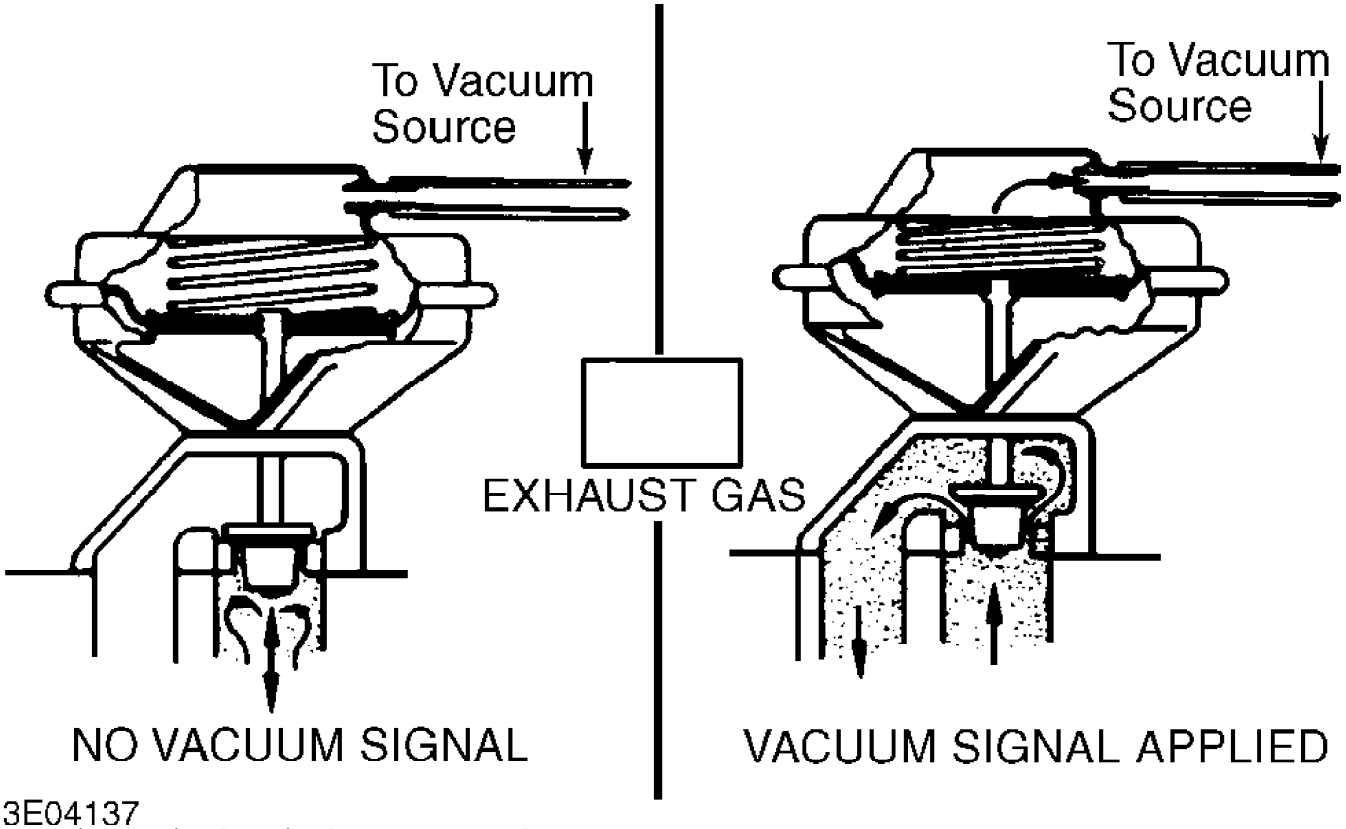


Fig. 7: Typical Single Diaphragm EGR Valve
Courtesy of General Motors Corp.

Dual Diaphragm EGR Valve

This type uses 2 diaphragms with different effective areas and 2 vacuum sources. Although similar to the single diaphragm type, the second diaphragm is added below the upper diaphragm and is rigidly attached to the valve seat. See Fig. 8. These diaphragms form a vacuum chamber which is connected to manifold vacuum.

During highway cruising when manifold vacuum is high in the center chamber, manifold vacuum tends to pull the valve closed. However, the vacuum signal applied to the top side of the upper diaphragm overcomes the downward spring force and the manifold vacuum pull, due to the diaphragm's larger piston. This regulates the amount of EGR.

When manifold vacuum is low during acceleration, the higher vacuum signal opens the valve, permitting more EGR. When manifold vacuum is high during highway cruising, the valve is only partially opened, reducing the amount of EGR.

Verify EGR valve is present and not modified or purposely damaged. Ensure thermal vacuum switches, pressure transducers, speed switches, etc., (if applicable) are not by-passed or modified. Ensure vacuum hose(s) to EGR valve is not plugged.

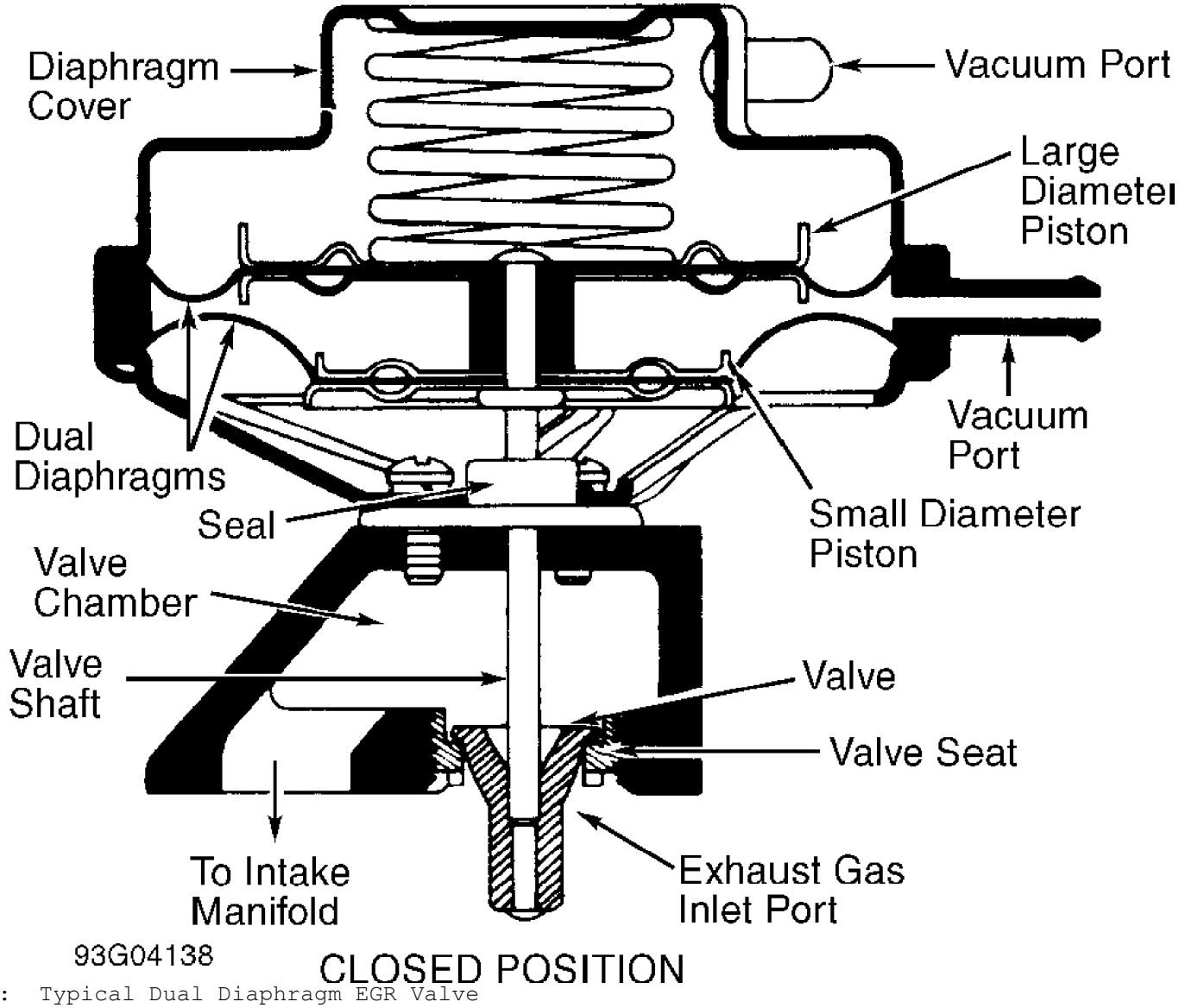


Fig. 8: Typical Dual Diaphragm EGR Valve
Courtesy of General Motors Corp.

Positive Backpressure EGR (BP/EGR) Valve

This type uses both engine vacuum and exhaust backpressure to control the amount of EGR. It provides more recirculation during heavy engine loads than the single diaphragm EGR valve.

A small diaphragm-controlled valve inside EGR valve acts as a pressure regulator. The control valve gets an exhaust backpressure signal through the hollow valve shaft. This exhaust backpressure exerts a force on bottom of control valve diaphragm. The diaphragm plate contains 6 bleed holes to bleed air into the vacuum chamber when backpressure valve is in open position. See Fig. 9.

Verify EGR valve is present and not modified or purposely damaged. Ensure thermal vacuum switches, pressure transducers, speed

switches, etc., (if applicable) are not by-passed or modified. Ensure vacuum hose(s) to EGR valve is not plugged.

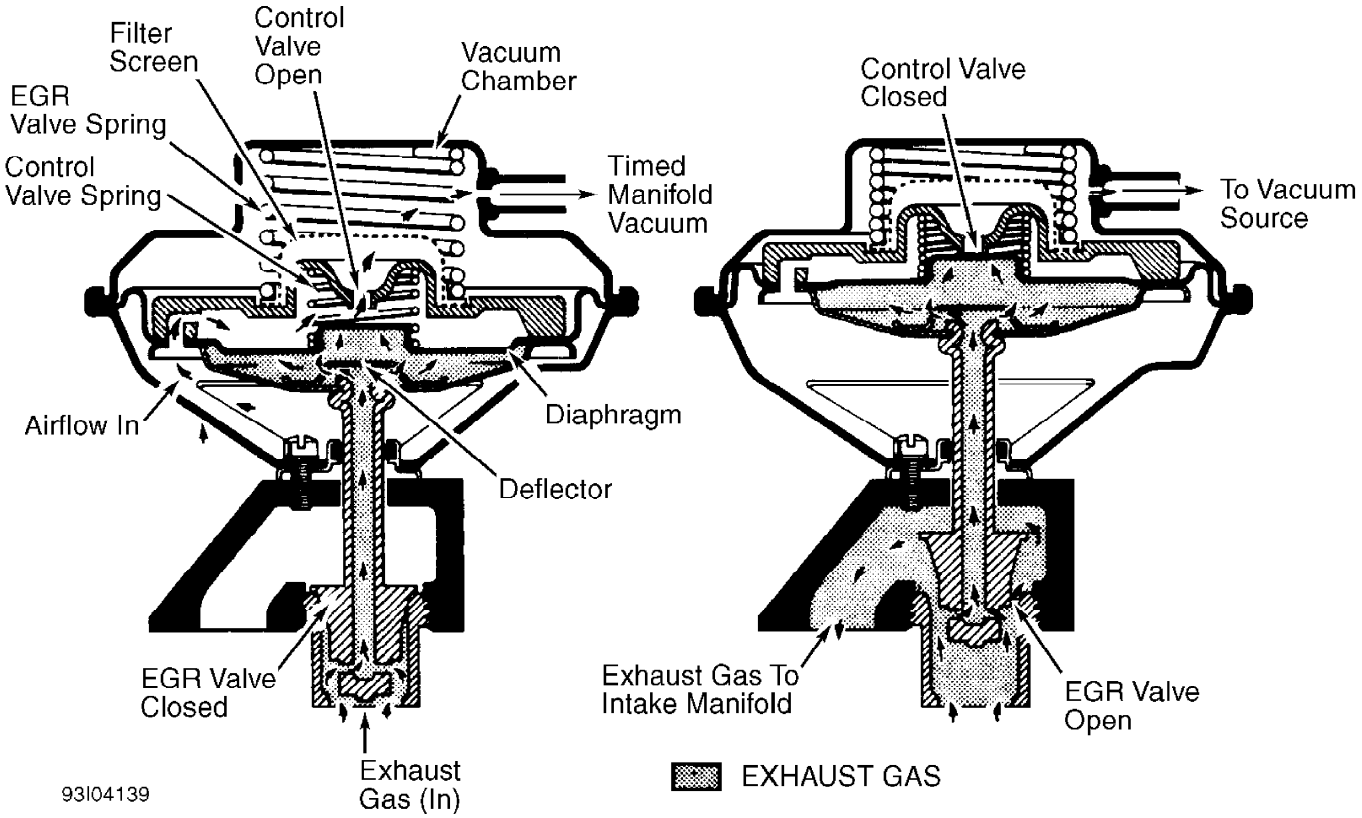


Fig. 9: Typical Positive Backpressure EGR Valve
Courtesy of General Motors Corp.

Negative Backpressure EGR (BP/EGR) Valve

This type has the same function as the positive BP/EGR valve except valve is designed to open with a negative exhaust backpressure. The control valve spring in the transducer is placed on the bottom side of the diaphragm. See Fig. 10.

When ported vacuum is applied to the main vacuum chamber, partially opening the valve, the vacuum signal from the manifold side (reduced by exhaust backpressure) is transmitted to the hollow stem of the valve. See Fig. 10. This enables the signal to act on the diaphragm, providing a specific flow. Thus, the EGR flow is a constant percentage of engine airflow.

Verify EGR valve is present and not modified or purposely damaged. Ensure thermal vacuum switches, pressure transducers, speed switches, etc., (if applicable) are not by-passed or modified. Ensure vacuum hose(s) to EGR valve is not plugged.

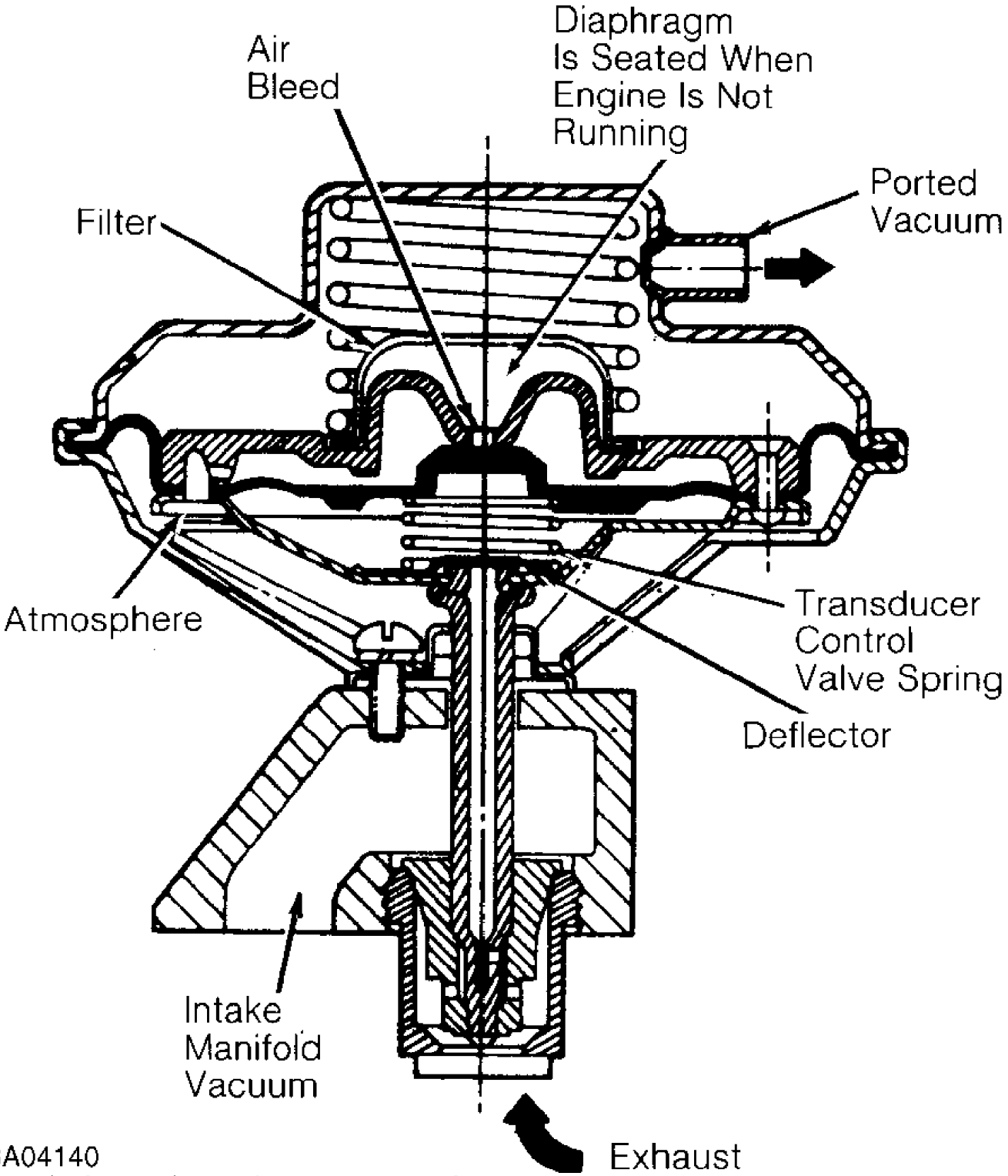


Fig. 10: Typical Negative Backpressure EGR Valve
Courtesy of General Motors Corp.

Digital EGR Valve

The digital EGR valve operates independently of engine manifold vacuum. This valve controls EGR flow through 3 orifices.

These 3 orifices are opened and closed by electric solenoids. The solenoids are, in turn, controlled by the Electronic Control Module (ECM). When a solenoid is energized, the armature with attached shaft and swivel pintle is lifted, opening the orifice. See Fig. 11.

The ECM uses inputs from the Coolant Temperature Sensor (CTS), Throttle Position Sensor (TPS) and Mass Airflow (MAF) sensors to control the EGR orifices to make 7 different combinations for precise EGR flow control. At idle, the EGR valve allows a very small amount of exhaust gas to enter the intake manifold. This EGR valve normally operates above idle speed during warm engine operation.

Verify EGR valve is present and not modified or purposely damaged. Ensure thermal vacuum switches, pressure transducers, speed switches, etc., (if applicable) are not by-passed or modified. Ensure vacuum hose(s) to EGR valve is not plugged. Ensure electrical connector to EGR valve is not disconnected.

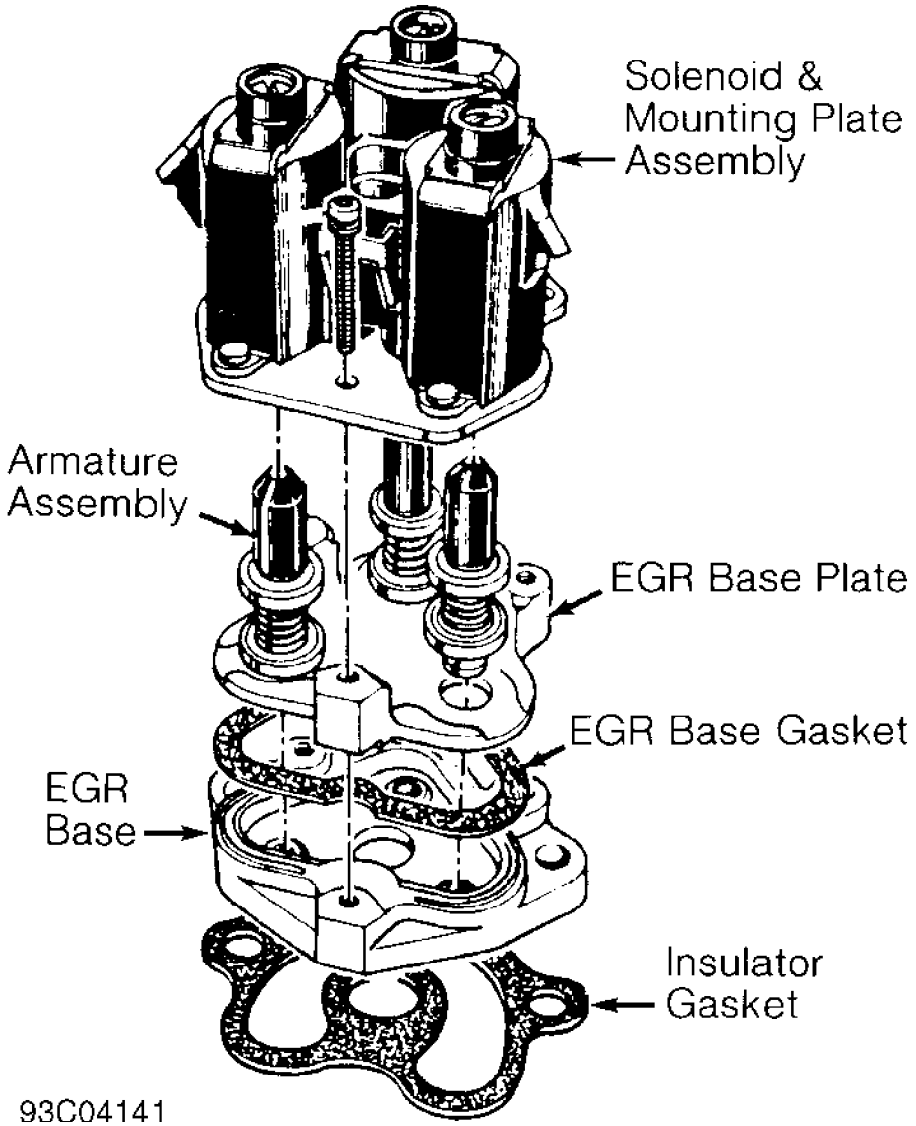


Fig. 11: Typical Digital EGR Valve
Courtesy of General Motors Corp.

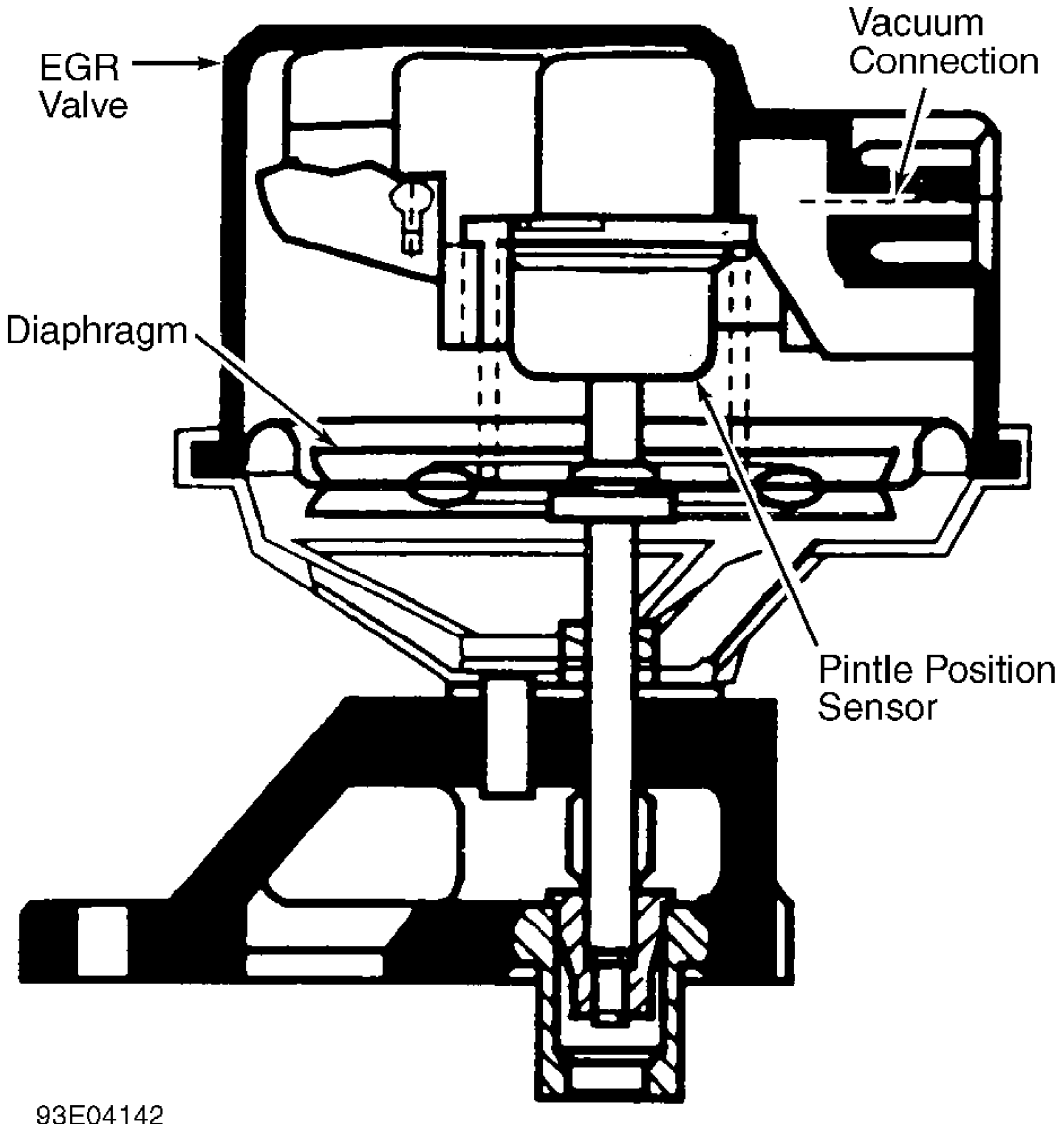
Integrated Electronic EGR Valve

This type functions similar to a ported EGR valve with a

remote vacuum regulator. The internal solenoid is normally open, which causes the vacuum signal to be vented off to the atmosphere when EGR is not controlled by the Electronic Control Module (ECM). The solenoid valve opens and closes the vacuum signal, controlling the amount of vacuum applied to the diaphragm. See Fig. 12.

The electronic EGR valve contains a voltage regulator, which converts ECM signal and regulates current to the solenoid. The ECM controls EGR flow with a pulse width modulated signal based on airflow, TPS and RPM. This system also contains a pintle position sensor, which works similarly to a TPS sensor. As EGR flow is increased, the sensor output increases.

Verify EGR valve is present and not modified or purposely damaged. Ensure thermal vacuum switches, pressure transducers, speed switches, etc., (if applicable) are not by-passed or modified. Ensure electrical connector to EGR valve is not disconnected.



93E04142

Fig. 12: Cutaway View Of Typical Integrated Electronic EGR Valve
Courtesy of General Motors Corp.

Spark control systems are designed to ensure the air/fuel mixture is ignited at the best possible moment to provide optimum efficiency and power and cleaner emissions.

Ensure vacuum hoses to the distributor, carburetor, spark delay valves, thermal vacuum switches, etc., are in place and routed properly. On Computerized Engine Controls (CEC), check for presence of required sensors (O2, MAP, CTS, TPS, etc.). Ensure they have not been tampered with or modified.

Check for visible modification or replacement of the feedback carburetor, fuel injection unit or injector(s) with a non-feedback carburetor or fuel injection system. Check for modified emission-related components unacceptable for use on pollution-controlled vehicles.

AIR INJECTION SYSTEM (AIS)

Air Pump Injection System (AP)

The air pump is a belt-driven vane type pump, mounted to engine in combination with other accessories. The air pump itself consists of the pump housing, an inner air cavity, a rotor and a vane assembly. As the vanes turn in the housing, filtered air is drawn in through the intake port and pushed out through the exhaust port. See Fig. 13.

Check for missing or disconnected belt, check valve(s), diverter valve(s), air distribution manifolds, etc. Check air injection system for proper hose routing.

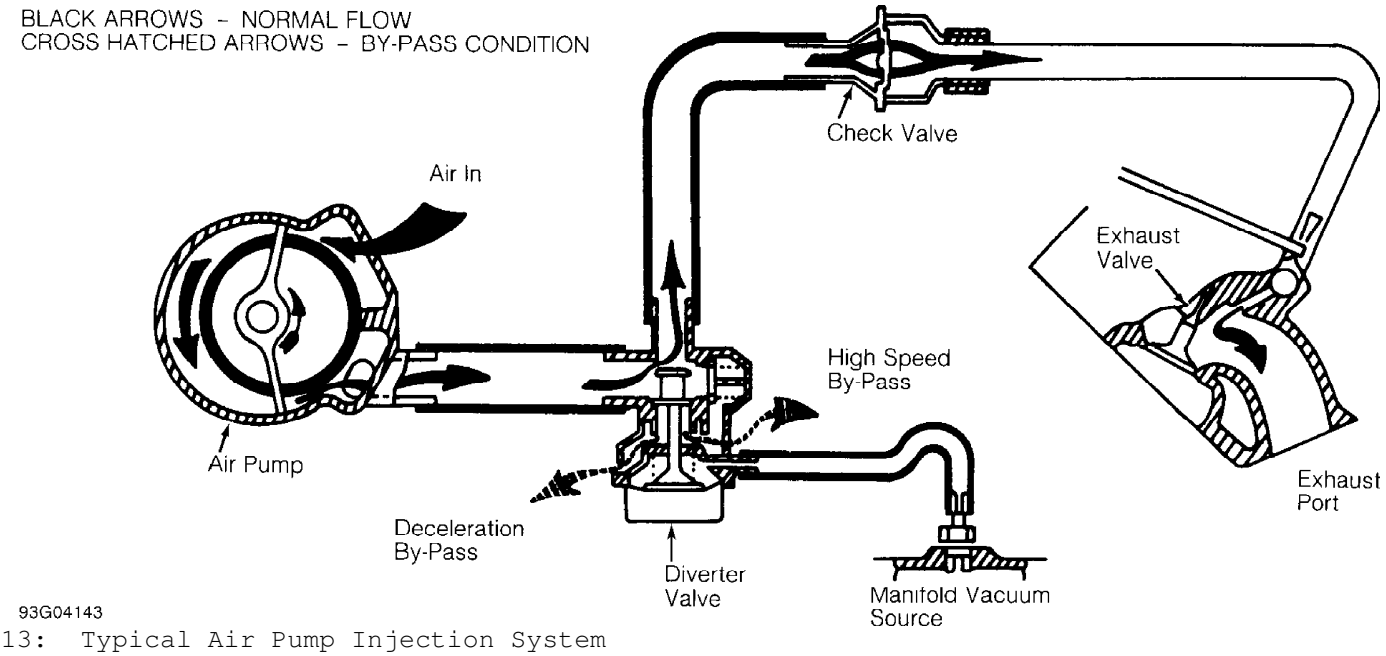


Fig. 13: Typical Air Pump Injection System
Courtesy of General Motors Corp.

Pulsed Secondary Air Injection (PAIR) System

PAIR eliminates the need for an air pump and most of the associated hardware. Most systems consists of air delivery pipe(s), pulse valve(s) and check valve(s). The check valve prevents exhaust gases from entering the air injection system. See Fig. 14.

Ensure required check valve(s), diverter valve(s), air distribution manifolds, etc., are present. Check air injection system for proper hose routing.

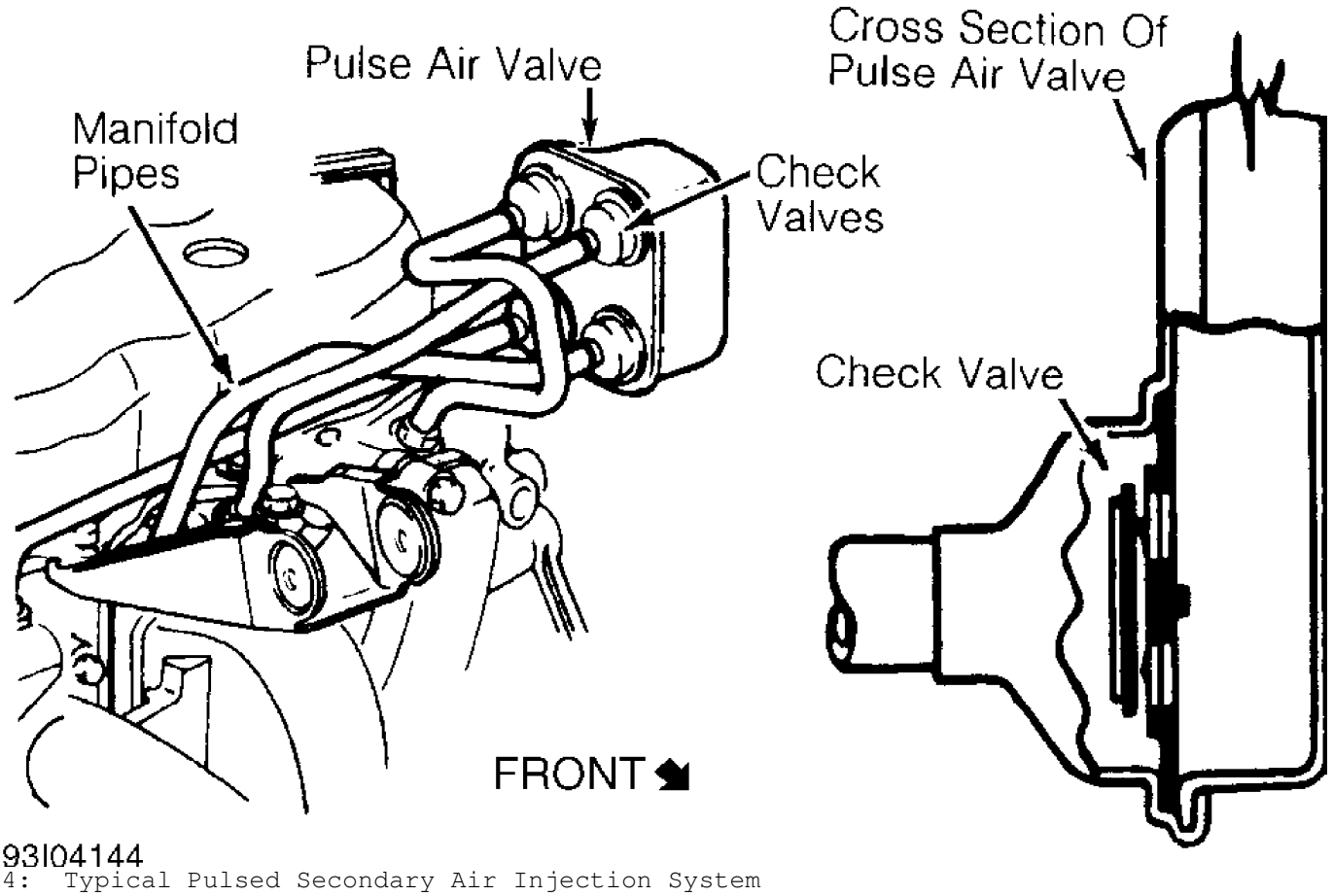


Fig. 14: Typical Pulsed Secondary Air Injection System
Courtesy of General Motors Corp.

OXYGEN SENSOR (O2)

The O2 sensor is mounted in the exhaust system where it monitors oxygen content of exhaust gases. Some vehicles may use 2 O2 sensors. The O2 sensor produces a voltage signal which is proportional to exhaust gas oxygen concentration (0-3%) compared to outside oxygen (20-21%). This voltage signal is low (about .1 volt) when a lean mixture is present and high (1.0 volt) when a rich mixture is present.

As ECM compensates for a lean or rich condition, this voltage signal constantly fluctuates between high and low, crossing a reference voltage supplied by the ECM on the O2 signal line. This is referred to as cross counts. A problem in the O2 sensor circuit should set a related trouble code.

COMPUTERIZED ENGINE CONTROLS (CEC)

The CEC system monitors and controls a variety of engine/vehicle functions. The CEC system is primarily an emission control system designed to maintain a 14.7:1 air/fuel ratio under most operating conditions. When the ideal air/fuel ratio is maintained, the catalytic converter can control oxides of nitrogen (NOx), hydrocarbon (HC) and carbon monoxide (CO) emissions.

The CEC system consists of the following sub-systems: Electronic Control Module (ECM), input devices (sensors and switches) and output signals.

EARLY FUEL EVAPORATION (EFE)

The EFE valve is actuated by either a vacuum actuator or a bimetal spring (heat-riser type). The EFE valve is closed when engine is cold. The closed valve restricts exhaust gas flow from the exhaust manifold. This forces part of the exhaust gas to flow up through a passage below the carburetor. As the exhaust gas quickly warms the intake mixture, distribution is improved. This results in better cold engine driveability, shorter choke periods and lower emissions.

Ensure EFE valve in exhaust manifold is not frozen or rusted in a fixed position. On vacuum-actuated EFE system, check EFE thermal vacuum valve and check valve(s). Also check for proper vacuum hose routing. See Fig. 15.

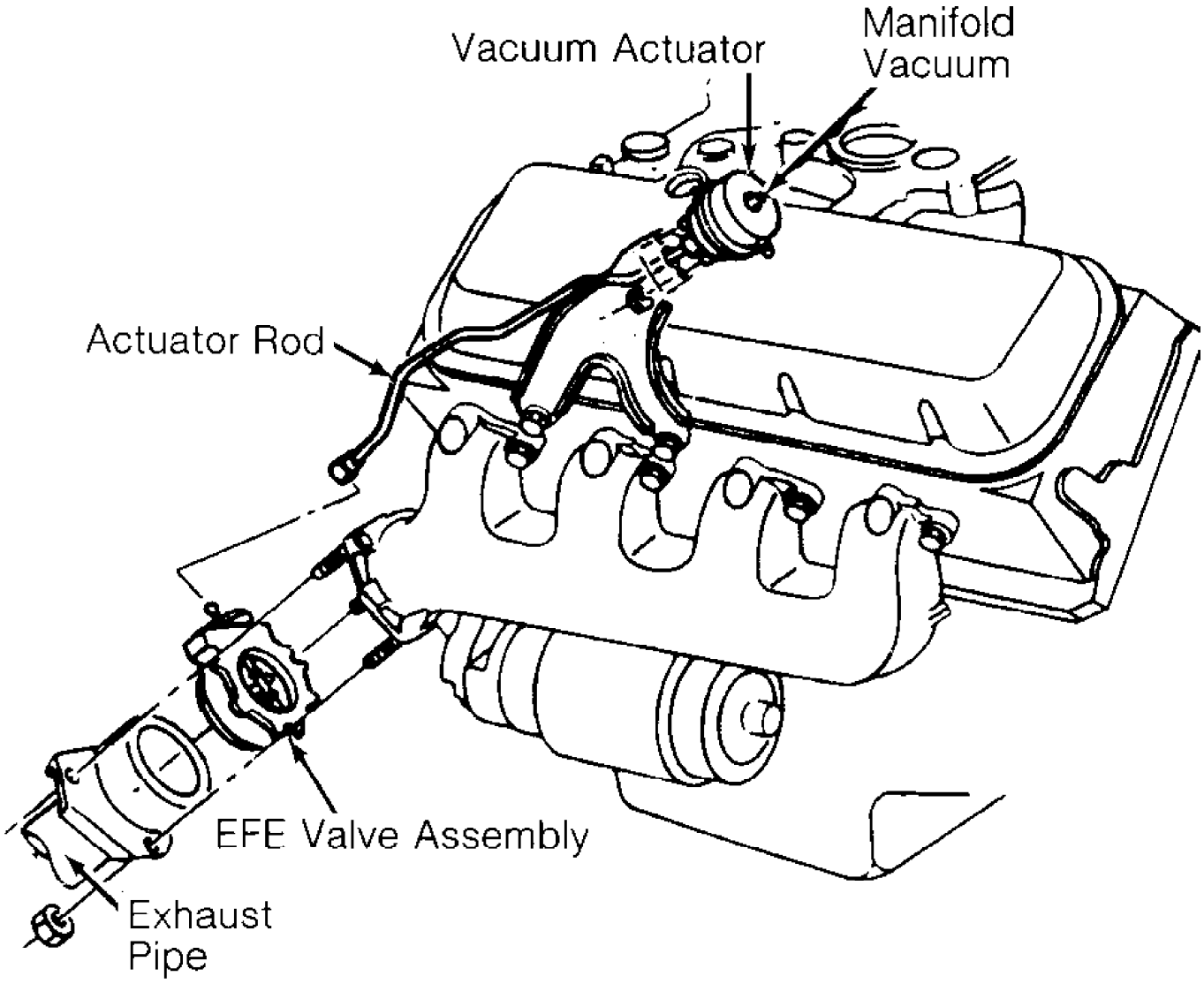


Fig. 15: Typical Vacuum-Actuated EFE System
Courtesy of General Motors Corp.

EMISSION MAINTENANCE REMINDER LIGHT (EMR) (IF EQUIPPED)

If equipped, the EMR light (some models may use a reminder flag) reminds vehicle operator that an emission system maintenance is required. This indicator is activated after a predetermined time/mileage.

When performing a smog check inspection, ensure EMR indicator is not activated. On models using an EMR light, light should glow when ignition switch is turned to ON position and should turn off when engine is running.

If an EMR flag is present or an EMR light stays on with engine running, fail vehicle and service or replace applicable emission-related components. To reset an EMR indicator, refer to appropriate MAINTENANCE REMINDER LIGHTS in the MAINTENANCE section.

MALFUNCTION INDICATOR LIGHT (MIL)

The Malfunction Indicator Light (MIL) is used to alert vehicle operator that the computerized engine control system has detected a malfunction (when it stays on all the time with engine running). On some models, the MIL may also be used to display trouble codes.

As a bulb and system check, malfunction indicator light will glow when ignition switch is turned to ON position and engine is not running. When engine is started, light should go out.

B - EMISSION APPLICATION

1998 Mitsubishi Galant

1998 ENGINE PERFORMANCE
Mitsubishi - Emission Applications

Diamante, Eclipse/Spyder, Galant, Mirage, Montero/Sport, 3000GT

EMISSION APPLICATIONS

EMISSION APPLICATIONS TABLE

Model, Engine & Fuel System	Emission Control Systems/Devices
Diamante	
3.5L V6 SFI	
Major Control Systems/Devices	PCV, EVAP, TWC, FR, EGR, SPK, (1) HO2S, CEC, MIL
Components/Other Related Devices	EVAP-CPCS, EVAP-VC, EVAP-VSOL, EGR-CS, EGR-VCV, SPK-CC
Eclipse	
2.0L 4-Cyl. SFI	
Non-Turbo	
Major Control Systems/Devices	PCV, EVAP, TWC, FR, EGR, SPK, (1) HO2S, CEC, MIL
Components/Other Related Devices	EVAP-CPCS, EVAP-VC, EVAP-VSOL, EGR-TS, SPK-CC
Turbo	
Major Control Systems/Devices	PCV, EVAP, TWC, FR, EGR, SPK, (1) HO2S, CEC, MIL
Components/Other Related Devices	(2) EVAP-CKV, EVAP-CPCS, EVAP-CPCV, EVAP-VC, EVAP-VSOL, EGR-SOL, SPK-CC
Eclipse Spyder	
2.0L 4-Cyl. Turbo SFI	
Major Control Systems/Devices	PCV, EVAP, TWC, FR, EGR, SPK, (1) HO2S, CEC, MIL
Components/Other Related Devices	(2) EVAP-CKV, EVAP-CPCS, EVAP-CPCV, EVAP-VC, EVAP-VSOL, EGR-SOL, SPK-CC
2.4L 4-Cyl. SFI	
Major Control Systems/Devices	PCV, EVAP, TWC, FR, EGR, SPK, (1) HO2S, CEC, MIL
Components/Other Related Devices	EVAP-CPCS, EVAP-VC, EVAP-VSOL, EGR-SOL, EGR-VCV, SPK-CC
Galant	
2.4L 4-Cyl. SFI	
Major Control Systems/Devices	PCV, EVAP, (3) TWC, FR, (4) EGR, SPK, (1) HO2S, CEC, MIL
Components/Other Related Devices	EVAP-CPCS, EVAP-VC, EVAP-VSOL, (4) EGR-CS, (4) EGR-VCV, SPK-CC
Mirage	
1.5L 4-Cyl. SFI	
Major Control Systems/Devices	PCV, EVAP, (3) TWC, FR, EGR, SPK, (1) HO2S, CEC, MIL
Components/Other Related Devices	EVAP-CPCS, EVAP-VC, EVAP-VSOL, EGR-SOL, EGR-VCV, SPK-CC
1.8L 4-Cyl. SFI	
Major Control Systems/Devices	PCV, EVAP, TWC, FR, EGR, SPK, (1) HO2S, CEC, MIL
Components/Other Related Devices	EVAP-CPCS, EVAP-VC, EVAP-VSOL, EGR-SOL, EGR-VCV, SPK-CC
Montero	
3.5L V6 SFI	

```
    Major Control Systems/Devices  .....  PCV, EVAP, (5) TWC, (4) EGR,
                                          FR, SPK, (6) (7) HO2S, CEC, MIL
    Components/Other Related Devices  ............  EVAP-CPCS, EVAP-VC,
                           EVAP-VSOL, (4) EGR-SOL, (4) EGR-VCV, SPK-CC
Montero Sport
  2.4L 4-Cyl. SFI
    Major Control Systems/Devices  .....  PCV, EVAP, TWC, FR, (4) EGR,
                                               SPK, (1) HO2S, CEC, MIL
    Components/Other Related Devices  ............  EVAP-CPCS, EVAP-VC,
                           EVAP-VSOL, (4) EGR-SOL, (4) EGR-VCV, SPK-CC
  3.0L V6 SFI
    Major Control Systems/Devices  .....  PCV, EVAP, TWC, (4) EGR, FR,
                                           SPK, (6) (7) HO2S, CEC, MIL
    Components/Other Related Devices  ............  EVAP-CPCS, EVAP-VC,
                             EVAP-VCS, EVAP-VSOL, (4) EGR-VCS, SPK-CC
3000GT
  3.0L V6 SFI
    Non-Turbo
      Major Control Systems/Devices  ........  PCV, EVAP, (8) TWC, FR,
                                          EGR, SPK, (9) HO2S, CEC, MIL
      Components/Other Related Devices  .........  EVAP-CPCS, EVAP-VC,
                                               EGR-SOL, EGR-VCV, SPK-CC
    Turbo
      Major Control Systems/Devices  ........  PCV, EVAP, (8) TWC, FR,
                                          EGR, SPK, (9) HO2S, CEC, MIL
      Components/Other Related Devices  ........  EVAP-CKV, EVAP-CPCS,
                                     EVAP-VC, EGR-SOL, EGR-VCV, SPK-CC

(1) - Equipped with 2 HO2Ss.
(2) - Equipped with 2 EVAP-CKVs.
(3) - California equipped with 2 TWCs.
(4) - Federal.
(5) - California equipped with 3 TWCs.
(6) - Federal equipped with 2 HO2Ss.
(7) - California equipped with 4 HO2Ss.
(8) - Equipped with 3 TWCs.
(9) - Equipped with 4 HO2Ss.
```

NOTE: California or Federal refers to installed emissions equipment. California emissions models may be available in all states.

APPLICATION ABBREIVEATIONS

APPLICATION ABBREIVEATIONS TABLE

Application	Abbreiveation
CEC	Computerized Engine Control
EGR	Exhaust Gas Recirculation
EGR-CS	EGR Control Solenoid
EGR-SOL	EGR Solenoid
EGR-TS	EGR Transducer Solenoid
EGR-VCV	EGR Vacuum Control Valve
EVAP	Fuel Evaporative System
EVAP-CKV	EVAP Check Valve
EVAP-CPCS	EVAP Canister Purge Control Solenoid
EVAP-CPCV	EVAP Canister Purge Control Valve
EVAP-VC	EVAP Vapor Canister
EVAP-VCS	EVAP Vacuum Control Solenoid
EVAP-VSOL	EVAP Ventilation Solenoid

FR ..... Fill Pipe Restrictor
HO2S ..... Heated Oxygen Sensor
MIL ..... Malfunction Indicator Light
PCV ..... Positive Crankcase Ventilation
SFI ..... Sequential Multiport Fuel Injection
SPK ..... Spark Controls
SPK-CC ..... SPK Computer Controlled
TWC ..... Three-Way Catalytic Converter

ENGINE OVERHAUL PROCEDURES - GENERAL INFORMATION

1998 Mitsubishi Galant

Engine Overhaul Procedures - General Information
ALL PISTON ENGINES

* PLEASE READ THIS FIRST *

Examples used in this article are general in nature and do not necessarily relate to a specific engine or system. Illustrations and procedures have been chosen to guide mechanic through engine overhaul process. Descriptions of processes of cleaning, inspection, assembly and machine shop practice are included.

Always refer to appropriate engine overhaul article in the ENGINES section for complete overhaul procedures and specifications for the vehicle being repaired.

ENGINE IDENTIFICATION

The engine may be identified from its Vehicle Identification Number (VIN) stamped on a metal tab. Metal tab may be located in different locations depending on manufacturer. Engine identification number or serial number is located on cylinder block. Location varies with manufacturer.

INSPECTION PROCEDURES

* PLEASE READ THIS FIRST *

NOTE: Always refer to appropriate engine overhaul article in the ENGINES section for complete overhaul procedures and specifications for the vehicle being repaired.

GENERAL

Engine components must be inspected to meet manufacturer's specifications and tolerances during overhaul. Proper dimensions and tolerances must be met to obtain proper performance and maximum engine life.

Micrometers, depth gauges and dial indicator are used for checking tolerances during engine overhaul. Magnaflux, Magnaglo, dye-check, ultrasonic and x-ray inspection procedures are used for parts inspection.

MAGNETIC PARTICLE INSPECTION

Magnaflux & Magnaglo

Magnaflux is an inspection technique used to locate material flaws and stress cracks. The part in question is subjected to a strong magnetic field. The entire part, or a localized area, can be magnetized. The part is coated with either a wet or dry material that contains fine magnetic particles.

Cracks which are outlined by the particles cause an interruption in the magnetic field. The dry powder method of Magnaflux can be used in normal light. A crack will appear as an obvious bright line.

Fluorescent liquid is used in conjunction with a blacklight in a second Magnaflux system called Magnaglo. This type of inspection demands a darkened room. The crack will appear as a glowing line in this process. Both systems require complete demagnetizing upon

completion of the inspection. Magnetic particle inspection applies to ferrous materials only.

PENETRANT INSPECTION

Zyglo

The Zyglo process coats the material with a fluorescent dye penetrant. The part is often warmed to expand cracks that will be penetrated by the dye. When the coated part is subjected to inspection with a blacklight, a crack will glow brightly. Developing solution is often used to enhance results. Parts made of any material, such as aluminum cylinder heads or plastics, may be tested using this process.

Dye Check

Penetrating dye is sprayed on the previously cleaned component. Dye is left on component for 5-45 minutes, depending upon material density. Component is then wiped clean and sprayed with a developing solution. Surface cracks will show up as a bright line.

ULTRASONIC INSPECTION

If an expensive part is suspected of internal cracking, Ultrasonic testing is used. Sound waves are used for component inspection.

X-RAY INSPECTION

This form of inspection is used on highly stressed components. X-ray inspection maybe used to detect internal and external flaws in any material.

PRESSURE TESTING

Cylinder heads can be tested for cracks using a pressure tester. Pressure testing is performed by plugging all but one of the holes in the head and injecting air or water into the open passage. Leaks are indicated by the appearance of wet or damp areas when using water. When air is used, it is necessary to spray the head surface with a soap solution. Bubbles will indicate a leak. Cylinder head may also be submerged in water heated to specified temperature to check for cracks created during heat expansion.

CLEANING PROCEDURES

* PLEASE READ THIS FIRST *

NOTE: Always refer to appropriate engine overhaul article in the ENGINES section for complete overhaul procedures and specifications for the vehicle being repaired.

GENERAL

All components of an engine do not have the same cleaning requirements. Physical methods include bead blasting and manual removal. Chemical methods include solvent blast, solvent tank, hot tank, cold tank and steam cleaning of components.

BEAD BLASTING

Manual removal of deposits may be required prior to bead blasting, followed by some other cleaning method. Carbon, paint and

rust may be removed using bead blasting method. Components must be free of oil and grease prior to bead blasting. Beads will stick to grease or oil soaked areas causing area not to be cleaned.

Use air pressure to remove all trapped residual beads from components after cleaning. After cleaning internal engine parts made of aluminum, wash thoroughly with hot soapy water. Component must be thoroughly cleaned as glass beads will enter engine oil resulting in bearing damage.

CHEMICAL CLEANING

Solvent tank is used for cleaning oily residue from components. Solvent blasting sprays solvent through a siphon gun using compressed air.

The hot tank, using heated caustic solvents, is used for cleaning ferrous materials only. DO NOT clean aluminum parts such as cylinder heads, bearings or other soft metals using the hot tank. After cleaning, flush parts with hot water.

A non-ferrous part will be ruined and caustic solution will be diluted if placed in the hot tank. Always use eye protection and gloves when using the hot tank.

Use of a cold tank is for cleaning of aluminum cylinder heads, carburetors and other soft metals. A less caustic and unheated solution is used. Parts may be lift in the tank for several hours without damage. After cleaning, flush parts with hot water.

Steam cleaning, with boiling hot water sprayed at high pressure, is recommended as the final cleaning process when using either hot or cold tank cleaning.

COMPONENT CLEANING

* PLEASE READ THIS FIRST *

NOTE: Always refer to appropriate engine overhaul article in the ENGINES section for complete overhaul procedures and specifications for the vehicle being repaired.

SHEET METAL PARTS

Examples of sheet metal parts are the rocker covers, front and side covers, oil pan and bellhousing dust cover. Glass bead blasting or hot tank may be used for cleaning.

Ensure all mating surfaces are flat. Deformed surfaces should be straightened. Check all sheet metal parts for cracks and dents.

INTAKE & EXHAUST MANIFOLDS

Using solvent cleaning or bead blasting, clean manifolds for inspection. If the intake manifold has an exhaust crossover, all carbon deposits must be removed. Inspect manifolds for cracks, burned or eroded areas, corrosion and damage to fasteners.

Exhaust heat and products of combustion cause threads of fasteners to corrode. Replace studs and bolts as necessary. On "V" type intake manifolds, the sheet metal oil shield must be removed for proper cleaning and inspection. Ensure that all manifold parting surfaces are flat and free of burrs.

CYLINDER HEAD REPLACEMENT

* PLEASE READ THIS FIRST *

NOTE: Always refer to appropriate engine overhaul article in the ENGINES section for complete overhaul procedures and specifications for the vehicle being repaired.

REMOVAL

Remove intake and exhaust manifolds and valve cover. Cylinder head and camshaft carrier bolts (if equipped), should be removed only when the engine is cold. On many aluminum cylinder heads, removal while hot will cause cylinder head warpage. Mark rocker arm or overhead cam components for location.

Remove rocker arm components or overhead cam components. Components must be installed in original location. Individual design rocker arms may utilize shafts, ball-type pedestal mounts or no rocker arms. For all design types, wire components together and identify according to the corresponding valve. Remove cylinder head bolts. Note length and location. Some applications require cylinder head bolts be removed in proper sequence to prevent cylinder head damage. See Fig. 1. Remove cylinder head.

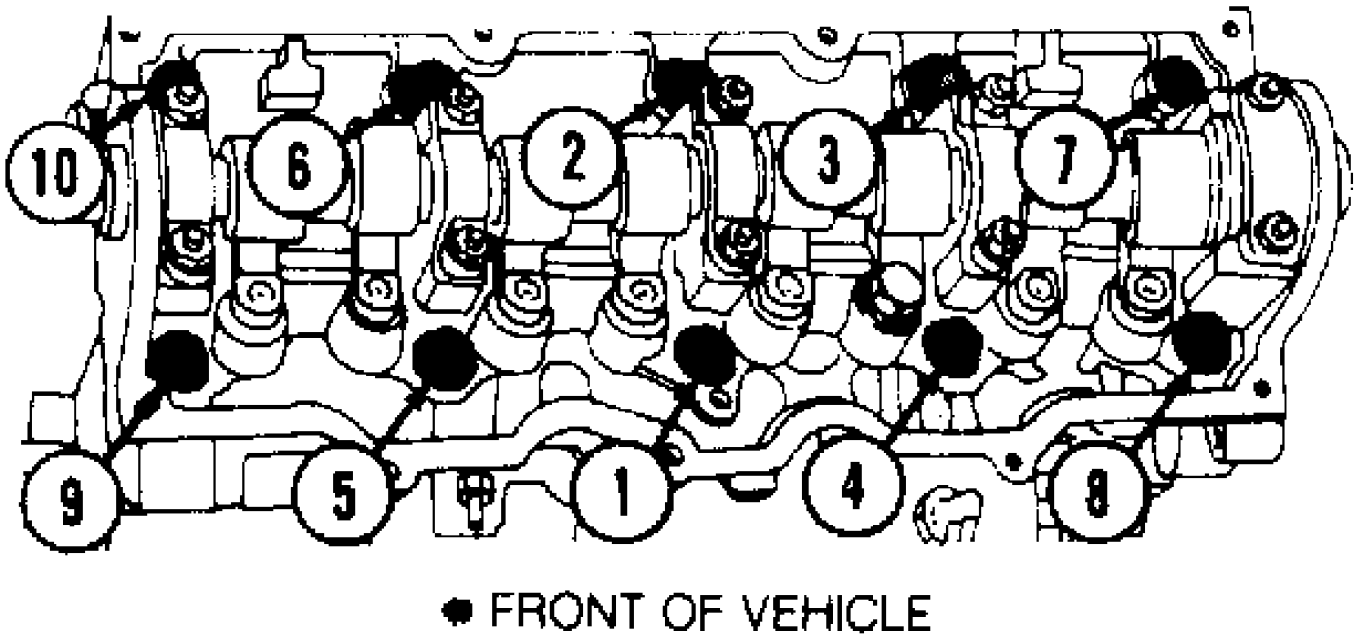


Fig. 1: Typical Cylinder Head Tightening or Loosening Sequence This Graphic For General Information Only

INSTALLATION

Ensure all surfaces and head bolts are clean. Check that head bolt holes of cylinder block are clean and dry to prevent block damage when bolts are tightened. Clean threads with tap to ensure accurate bolt torque.

Install head gasket on cylinder block. Some manufacturer's may recommend sealant be applied to head gasket prior to installation. Note that all holes are aligned. Some gasket applications may be marked so certain area faces upward. Install cylinder head using care not to damage head gasket. Ensure cylinder head is fully seated on cylinder block.

Some applications require head bolts be coated with sealant prior to installation. This is done if head bolts are exposed to water passages. Some applications require head bolts be coated with light coat of engine oil.

Install head bolts. Head bolts should be tightened in proper steps and sequence to specification. See Fig. 1. Install remaining components. Tighten all bolts to specification. Adjust valves if required. See VALVE ADJUSTMENT in this article.

NOTE: Some manufacturers require that head bolts be retightened after specified amount of operation. This must be done to prevent head gasket failure.

VALVE ADJUSTMENT

Engine specifications will indicate valve train clearance and temperature at which adjustment is to be made on most models. In most cases, adjustment will be made with a cold engine. In some cases, both a cold and a hot clearance will be given for maintenance convenience.

On some models, adjustment is not required. Rocker arms are tightened to specification and valve lash is automatically set. On some models with push rod actuated valve train, adjustment is made at push rod end of rocker arm while other models do not require adjustment.

Clearance will be checked between tip of rocker arm and tip of valve stem in proper sequence using a feeler gauge. Adjustment is made by rotating adjusting screw until proper clearance is obtained. Lock nut is then tightened. Engine will be rotated to obtain all valve adjustments to manufacturer's specifications.

Some models require hydraulic lifter to be bled down and clearance measured. Different length push rods can be used to obtain proper clearance. Clearance will be checked between tip of rocker arm and tip of valve stem in proper sequence using a feeler gauge.

On overhead cam engines designed without rocker arms actuate valves directly on a cam follower. A hardened, removable disc is installed between the cam lobe and lifter. Clearance will be checked between cam heel and adjusting disc in proper sequence using a feeler gauge. Engine will be rotated to obtain all valve adjustments.

On overhead cam engines designed with rocker arms, adjustment is made at push rod end of rocker arm. Ensure that the valve to be adjusted is riding on the heel of the cam on all engines. Clearance will be checked between tip of rocker arm and tip of valve stem in proper sequence using a feeler gauge. Adjustment is made by rotating adjusting screw until proper clearance is obtained. Lock nut is then tightened. Engine will be rotated to obtain all valve adjustments to manufacturer's specifications.

CYLINDER HEAD OVERHAUL

* PLEASE READ THIS FIRST *

NOTE: Always refer to appropriate engine overhaul article in the ENGINES section for complete overhaul procedures and specifications for the vehicle being repaired.

DISASSEMBLY

Mark valves for location. Using valve spring compressor, compress valve springs. Remove valve locks. Carefully release spring compressor. Remove retainer or rotator, valve spring, spring seat and valve. See Fig. 2.

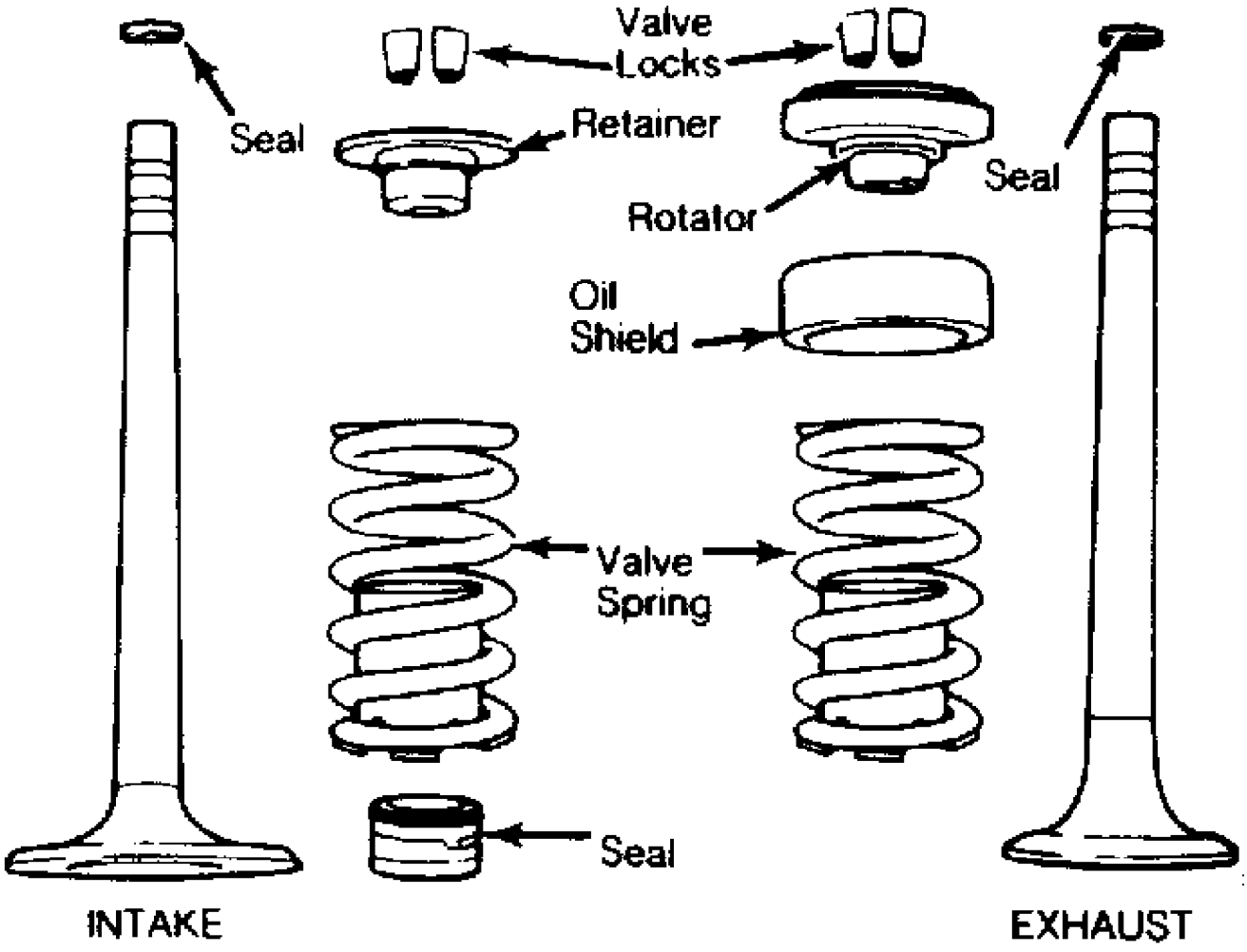


Fig. 2: Exploded View of Intake & Exhaust Valve Assemblies - Typical
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CLEANING & INSPECTION

Clean cylinder head and valve components using approved cleaning methods. Inspect cylinder head for cracks, damage or warped gasket surface. Place straightedge across gasket surface. Determine clearance at center of straightedge. Measure across both diagonals, longitudinal centerline and across the head at several points. See Fig. 3.

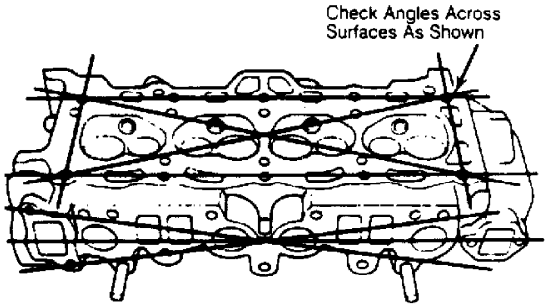

Fig. 3: Checking Cylinder Head for Warpage - Typical
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On cast cylinder heads, if warpage exceeds .003" (.08 mm) in a 6" span, or .006" (.15 mm) over total length, cylinder head must be resurfaced. On most aluminum cylinder heads, if warpage exceeds .002" (.05 mm) in any area, cylinder head must be resurfaced. Warpage specification may vary with manufacturer.

Cylinder head thickness should be measured to determine amount of material which can be removed before replacement is required. Cylinder head thickness must not be less than manufacturer's specifications.

If cylinder head required resurfacing, it may not align properly with intake manifold. On "V" type engines, misalignment is corrected by machining intake manifold surface that contacts cylinder head. Cylinder head may be machined on surface that contacts intake manifold.

Using oil stone, remove burrs or scratches from all sealing surfaces.

VALVE SPRINGS

Inspect valve springs for corroded or pitted valve spring surfaces which may lead to breakage. Polished spring ends caused by a rotating spring, indicates that spring surge has occurred. Replace springs showing evidence of these conditions.

Inspect valve springs for squareness using a 90 degree straightedge. See Fig. 4. Replace valve spring if out-of-square exceeds manufacturer's specification.

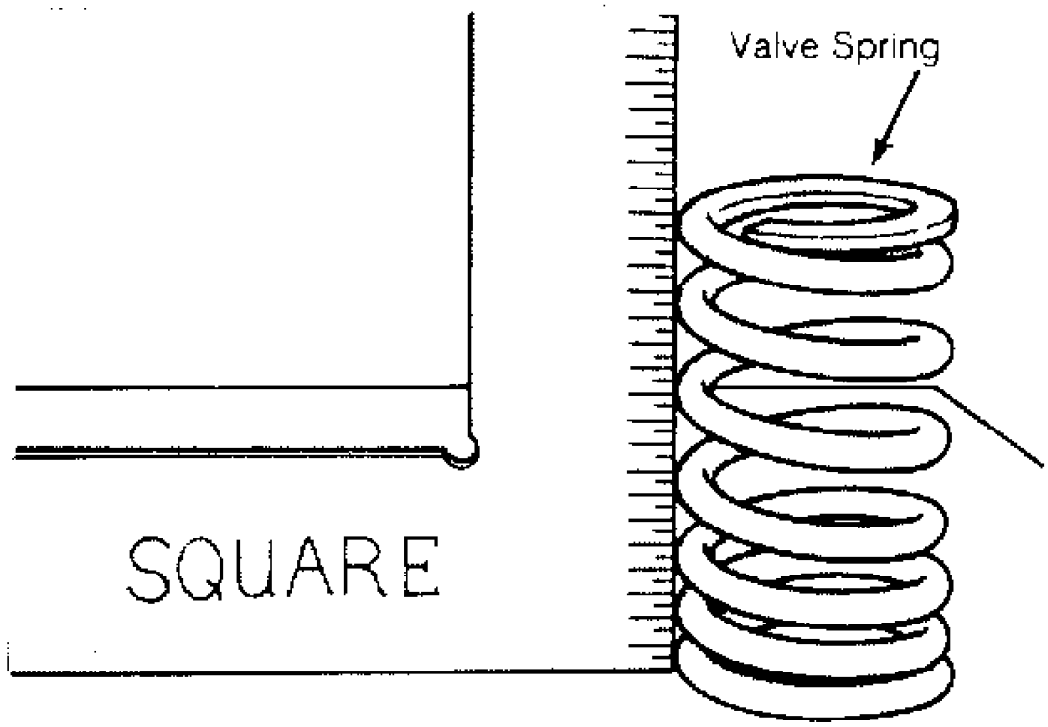

Fig. 4: Checking Valve Spring Squareness - Typical
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Using vernier caliper, measure free length of all valve springs. Replace springs if not within specification. Using valve

spring tester, test valve spring pressure at installed and compressed heights. See Fig. 5.

Usually compressed height is installed height minus valve lift. Replace valve spring if not within specification. It is recommended to replace all valve springs when overhauling cylinder head.

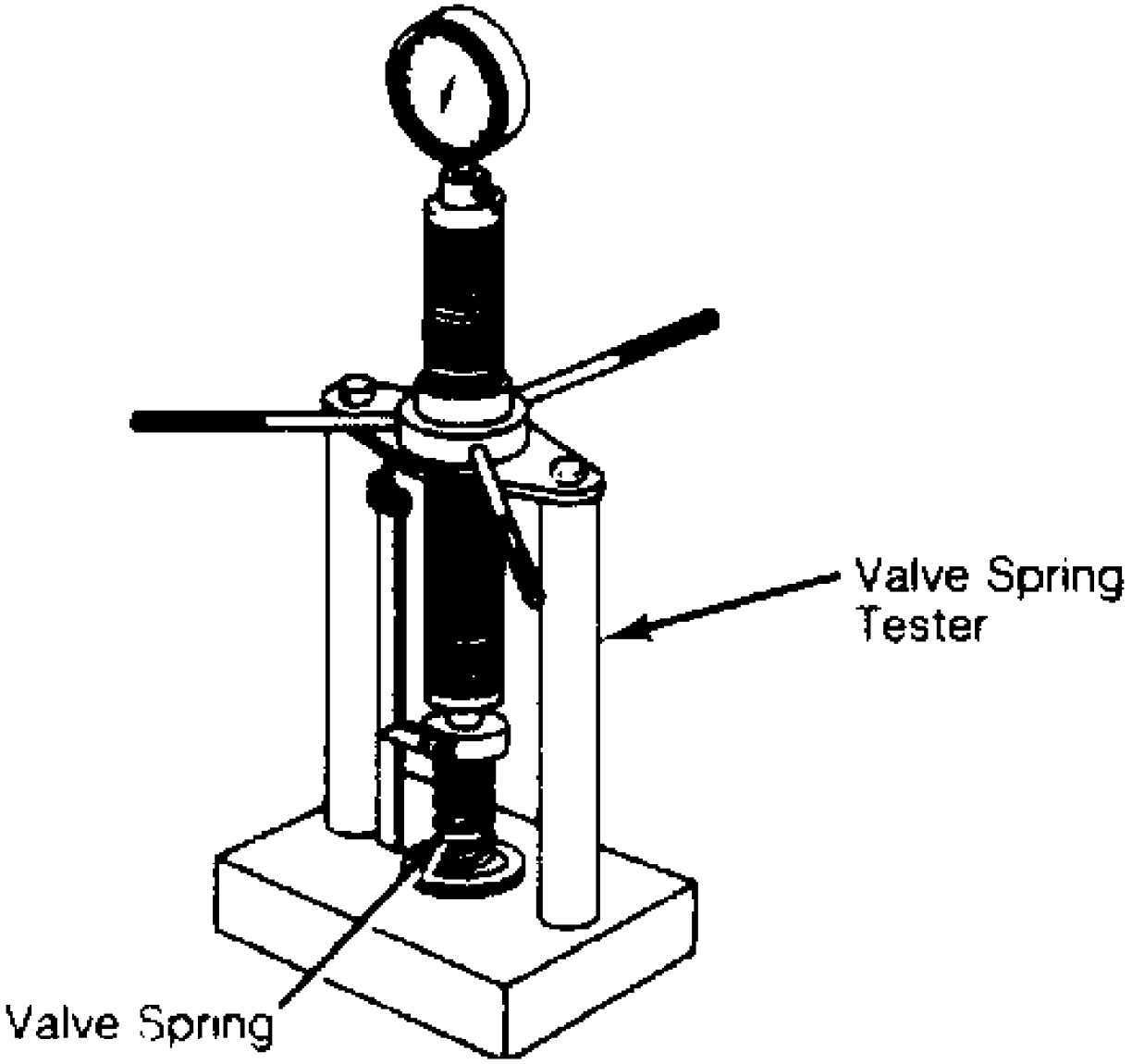

Fig. 5: Checking Valve Spring Pressure - Typical
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VALVE GUIDE

Measuring Valve Guide Clearance

Check valve stem-to-guide clearance. Ensure valve stem diameter is within specifications. Install valve in valve guide. Install dial indicator assembly on cylinder head with tip resting against valve stem just above valve guide. See Fig. 6.

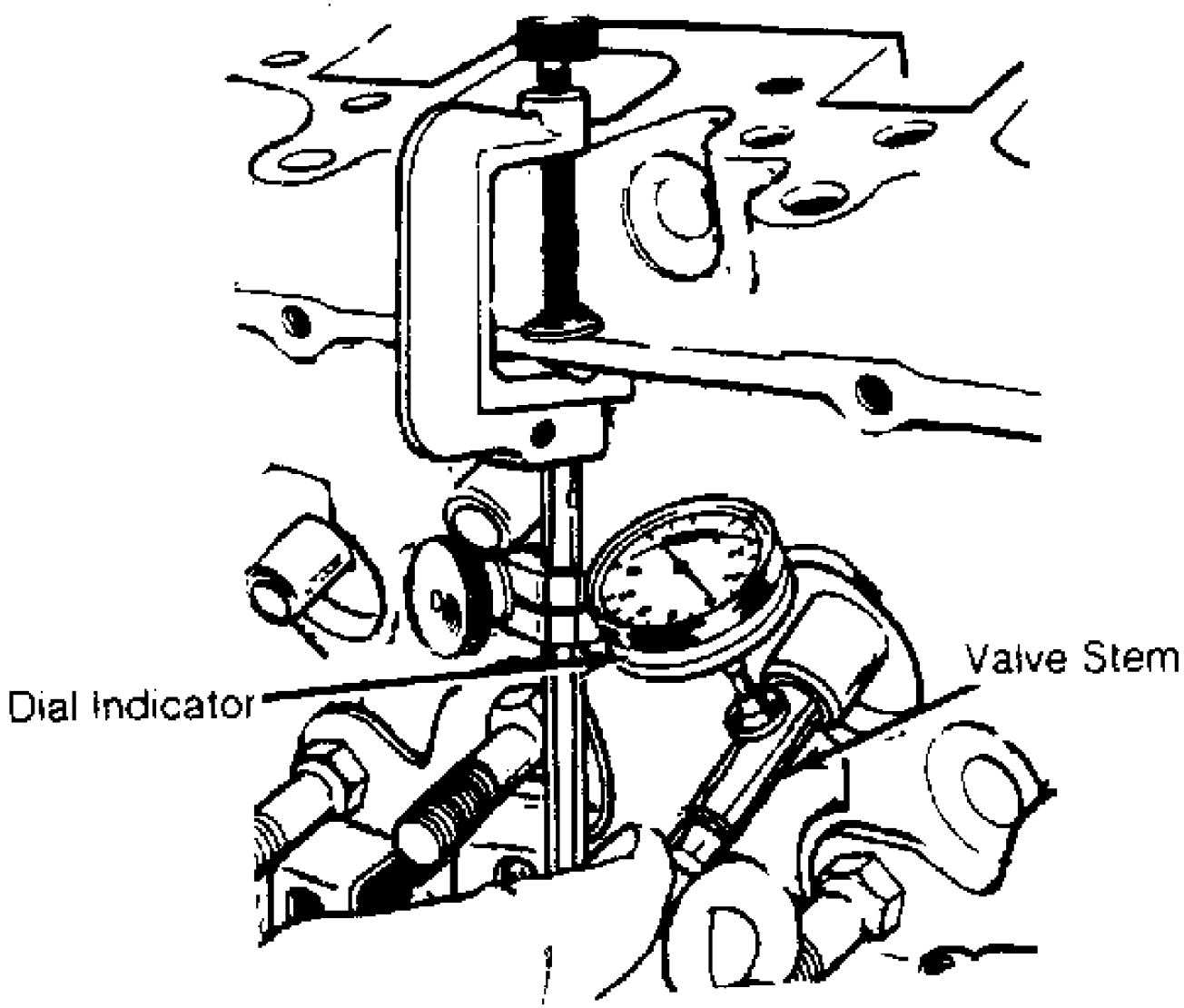

Fig. 6: Measuring Valve Stem-to-Guide Clearance - Typical
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Lower valve approximately 1/16" below valve seat. Push valve stem against valve guide as far as possible. Adjust dial indicator to zero. Push valve stem in opposite direction and note reading. Clearance must be within specification.

If valve guide clearance exceeds specification, valves with oversize stems may be used or valve guide must be replaced. On some applications, a false guide is installed, then reamed to proper specification. Valve guide reamer set is used to ream valve guide to obtain proper clearance for new valve.

Reaming Valve Guide

Select proper reamer for valve stem. Reamer must be of proper length to provide clean cut through entire length of valve guide. Install reamer in valve guide and rotate to cut valve guide. See Fig. 7.

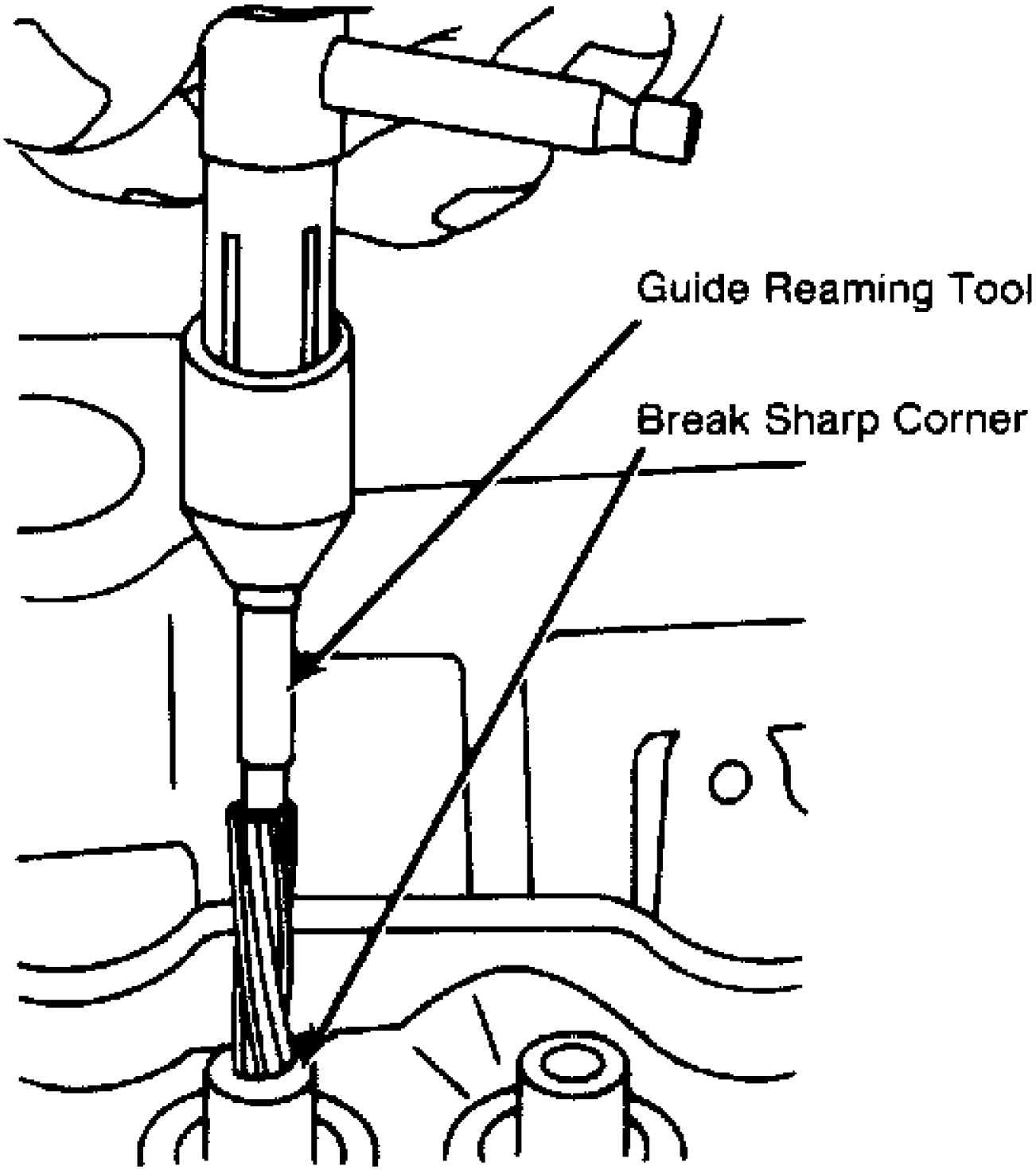

Fig. 7: Reaming Valve Guides - Typical
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Replacing Valve Guide

Replace valve guide if clearance exceeds specification. Valve guides are either pressed, hammered or shrunk in place, depending upon

cylinder head design and type of metal used.

Remove valve guide from cylinder head by pressing or tapping on a stepped drift. See Fig. 8. Once valve guide is installed, distance from cylinder head to top of valve guide must be checked. This distance must be within specification.

Aluminum heads are often heated before installing valve guide. Guide is sometimes chilled in dry ice before installation. Combination of a heated head and chilled guide insures a tight guide fit upon assembly. The new guide must be reamed to specification.

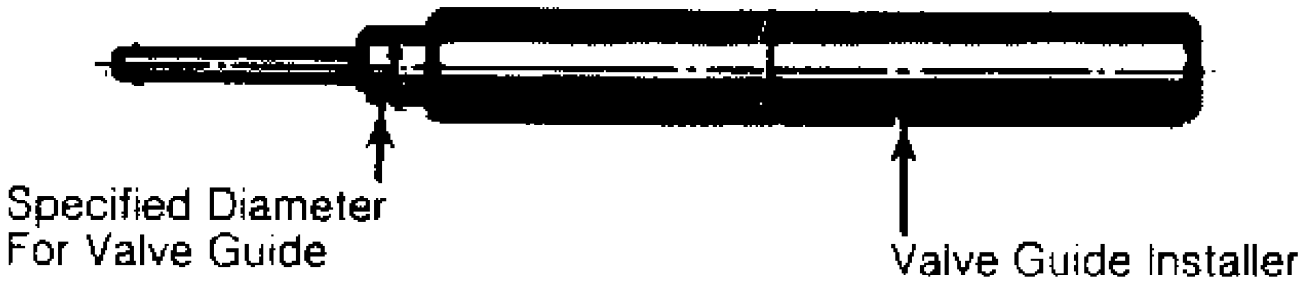

Fig. 8: Typical Valve Guide Remover & Installer
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VALVES & VALVE SEATS

Valve Grinding

Valve stem O.D. should be measured in several areas to indicate amount of wear. Replace valve if not within specification. Valve margin area should be measured to ensure that valve can be grounded. See Fig. 9.

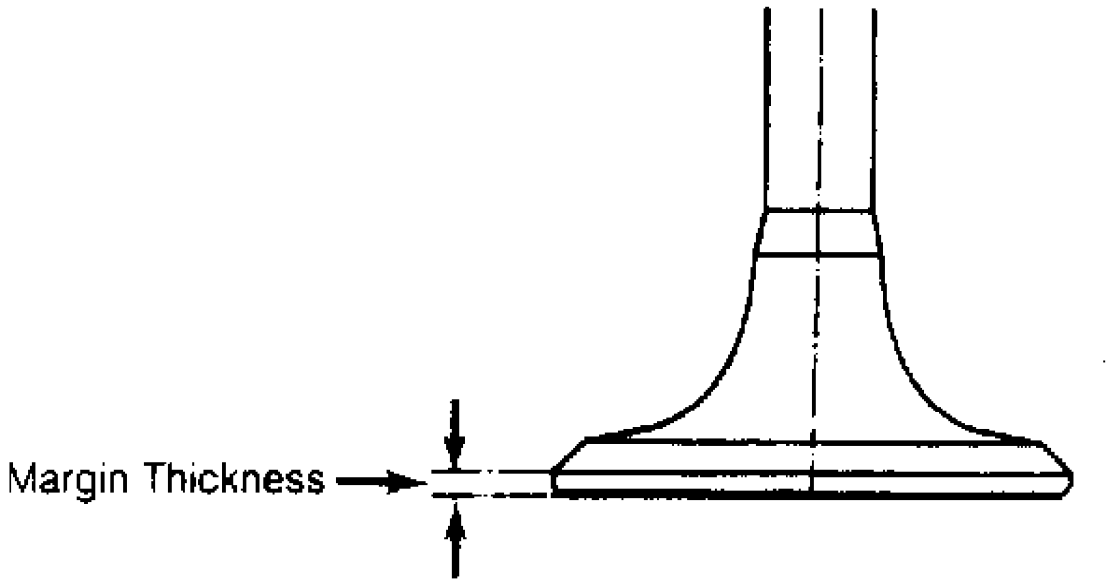

Fig. 9: Measuring Valve Head Margin - Typical
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If valve margin is less than specification, this will burn the valves. Valve must be replaced. Due to minimum margin dimensions

during manufacture, some new type valves cannot be reground.

Resurface valve on proper angle specification using valve grinding machine. Follow manufacturer's instructions for valve grinding machine. Specifications may indicate a different valve face angle than seat angle.

Measure valve margin after grinding. Replace valve if not within specification. Valve stem tip can be refinished using valve grinding machine.

Valve Lapping

During valve lapping of recent designed valves, be sure to follow manufacturers recommendations. Surface hardening and materials used with some valves do not permit lapping. Lapping process will remove excessive amounts of the hardened surface.

Valve lapping is done to ensure adequate sealing between valve face and seat. Use either a hand drill or lapping stick with suction cup attached.

Moisten and attach suction cup to valve. Lubricate valve stem and guide. Apply a thin coat of fine valve grinding compound between valve and seat. Rotate lapping tool between the palms or with hand drill.

Lift valve upward off the seat and change position often. This is done to prevent grooving of valve seat. Lap valve until a smooth polished seat is obtained. Thoroughly clean grinding compound from components. Valve to valve seat concentricity should be checked. See VALVE SEAT CONCENTRICITY.

CAUTION: Valve guides must be in good condition and free of carbon deposits prior to valve seat grinding. Some engines contain an induction hardened valve seat. Excessive material removal will damage valve seats.

Valve Seat Grinding

Select coarse stone of correct size and angle for seat to be ground. Ensure stone is true and has a smooth surface. Select correct size pilot for valve guide dimension. Install pilot in valve guide. Lightly lubricate pilot shaft. Install stone on pilot. Move stone off and on the seat approximately 2 times per second during grinding operation.

Select a fine stone to finish grinding operation. Grinding stones with 30 and 60 degree angles are used to center and narrow the valve seat as required. See Fig. 10.

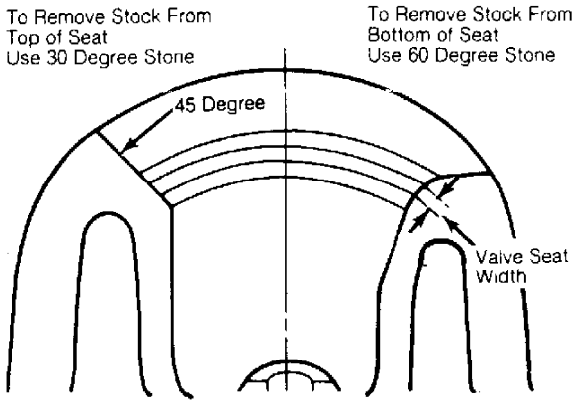

Fig. 10: Adjusting Valve Seat Width - Typical
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Valve Seat Replacement

Replacement of valve seat inserts is done by cutting out

the old insert and machining an oversize insert bore. Replacement oversize insert is usually chilled and the cylinder head is sometimes warmed. Valve seat is pressed into the head. This operation requires specialized machine shop equipment.

Valve Seat Concentricity

Using dial gauge, install gauge pilot in valve guide. Position gauge arm on the valve seat. Adjust dial indicator to zero. Rotate arm 360 degrees and note reading. Runout should not exceed specification.

To check valve-to-valve seat concentricity, coat valve face lightly with Prussian Blue dye. Install valve and rotate it on valve seat. If pattern is even and entire seat is coated at valve contact point, valve is concentric with the seat.

REASSEMBLY

Valve Stem Installed Height

Valve stem installed height must be checked when new valves are installed or when valves or valve seats have been ground. Install valve in valve guide. Measure distance from tip of valve stem to spring seat. See Fig. 11. Distance must be within specifications.

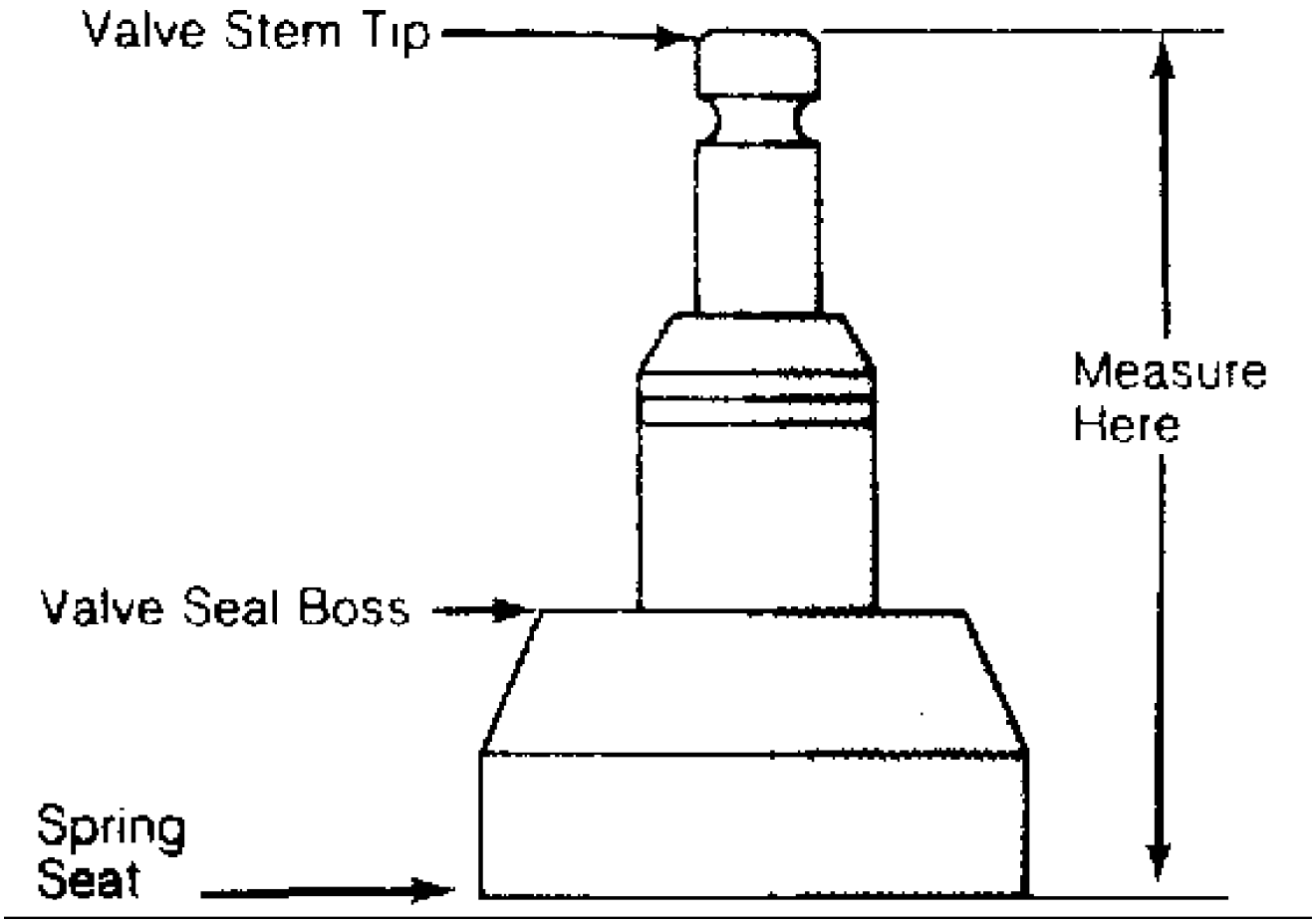

Fig. 11: Measuring Valve Stem Installed Height - Typical
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Remove valve and grind valve stem tip if height exceeds specification. Valve tips are surface hardened. DO NOT remove more

than .010" (.25 mm) from tip. Chamfer sharp edge of reground valve tip. Recheck valve stem installed height.

VALVE STEM OIL SEALS

Valve stem oil seals must be installed on valve stem. See Fig. 2. Seals are needed due to pressure differential at the ends of valve guides. Atmospheric pressure above intake guide, combined with manifold vacuum below guide, causes oil to be drawn into the cylinder.

Exhaust guides also have pressure differential created by exhaust gas flowing past the guide, creating a low pressure area. This low pressure area draws oil into the exhaust system.

Replacement (On Vehicle)

Mark rocker arm or overhead cam components for location. Remove rocker arm components or overhead cam components. Components must be installed in original location. Remove spark plugs. Valve stem oil seals may be replaced by holding valves against seats using air pressure.

Air pressure must be installed in cylinder using an adapter for spark plug hole. An adapter can be constructed by welding air hose connection to spark plug body with porcelain removed.

Install adapter in spark plug hole. Apply a minimum of 140 psi (9.8 kg/cm^2) to adapter. Air pressure should hold valve closed. If air pressure does not hold valve closed, check for damaged or bent valve. Cylinder head must be removed for service.

Using valve spring compressor, compress valve springs. Remove valve locks. Carefully release spring compressor. Remove retainer or rotator and valve spring. Remove valve stem oil seal.

If oversized valves have been installed, oversized oil seals must be used. Coat valve stem with engine oil. Install protective sleeve over end of valve stem. Install new oil seal over valve stem and seat on valve guide. Remove protective sleeve. Install spring seat, valve spring and retainer or rotator. Compress spring and install valve locks. Remove spring compressor. Ensure valve locks are fully seated.

Install rocker arms or overhead cam components. Tighten all bolts to specification. Adjust valves if required. Remove adapter. Install spark plugs, valve cover and gasket.

VALVE SPRING INSTALLED HEIGHT

Valve spring installed height should be checked during reassembly. Measure height from lower edge of valve spring to the upper edge. DO NOT include valve spring seat or retainer. Distance must be within specifications. If valves and/or seats have been ground, a valve spring shim may be required to correct spring height. See Fig. 12.

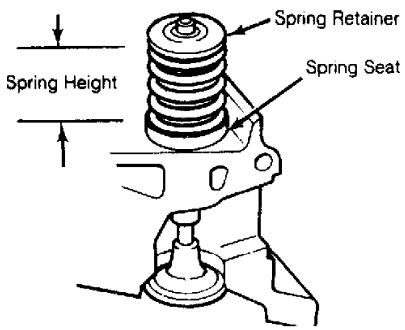

Fig. 12: Measuring Valve Spring Installed Height - Typical
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ROCKER ARMS & ASSEMBLIES

Rocker Studs

Rocker studs are either threaded or pressed in place. Threaded studs are removed by locking 2 nuts on the stud. Unscrew the stud by turning the jam nut. Coat the stud threads with Loctite and install. Tighten to specification.

Pressed in stud can be removed using a stud puller. Ream the stud bore to proper specification and press in a new oversize stud. Pressed in studs are often replaced by cutting threads in the stud bore to accept a threaded stud.

Rocker Arms & Shafts

Mark rocker arms for location. Remove rocker arm retaining bolts. Remove rocker arms. Inspect rocker arms, shafts, bushings and pivot balls (if equipped) for excessive wear. Inspect rocker arms for wear in valve stem contact area. Measure rocker arm bushing I.D. Replace bushings if excessively worn.

The rocker arm valve stem contact point can be reground, using special fixture for valve grinding machine. Remove minimum amount of material as possible. Ensure all oil passages are clear. Install rocker arms in original locations. Ensure rocker arm is properly seated in push rod. Tighten bolts to specification. Adjust valves if required. See VALVE ADJUSTMENT in this article.

Pushrods

Remove rocker arms. Mark push rods for location. Remove push rods. Push rods can be steel or aluminum, solid or hollow. Hollow pushrods must be internally cleaned to ensure oil passage to the rocker arms is cleaned. Check the pushrod for damage, such as loose ends on steel tipped aluminum types.

Check push rod for straightness. Roll push rod on a flat surface. Using feeler gauge, check clearance at center. Replace push rod if bent. The push rod can also be supported at each end and rotated. A dial indicator is used to detect bends in the push rod.

Lubricate ends of push rod and install push rod in original location. Ensure push rod is properly seated in lifter. Install rocker arm. Tighten bolts to specification. Adjust valves if required. See VALVE ADJUSTMENT in this article.

LIFTERS

Hydraulic Lifters

Before replacing a hydraulic lifter for noisy operation, ensure noise is not caused by worn rocker arms or valve tips. Hydraulic lifter assemblies must be installed in original locations. Remove the rocker arm assembly and push rod. Mark components for location. Some applications require intake manifold, or lifter cover removal. Remove lifter retainer plate (if used). To remove lifters, use a hydraulic lifter remover or magnet. Different type lifters are used. See Fig. 13.

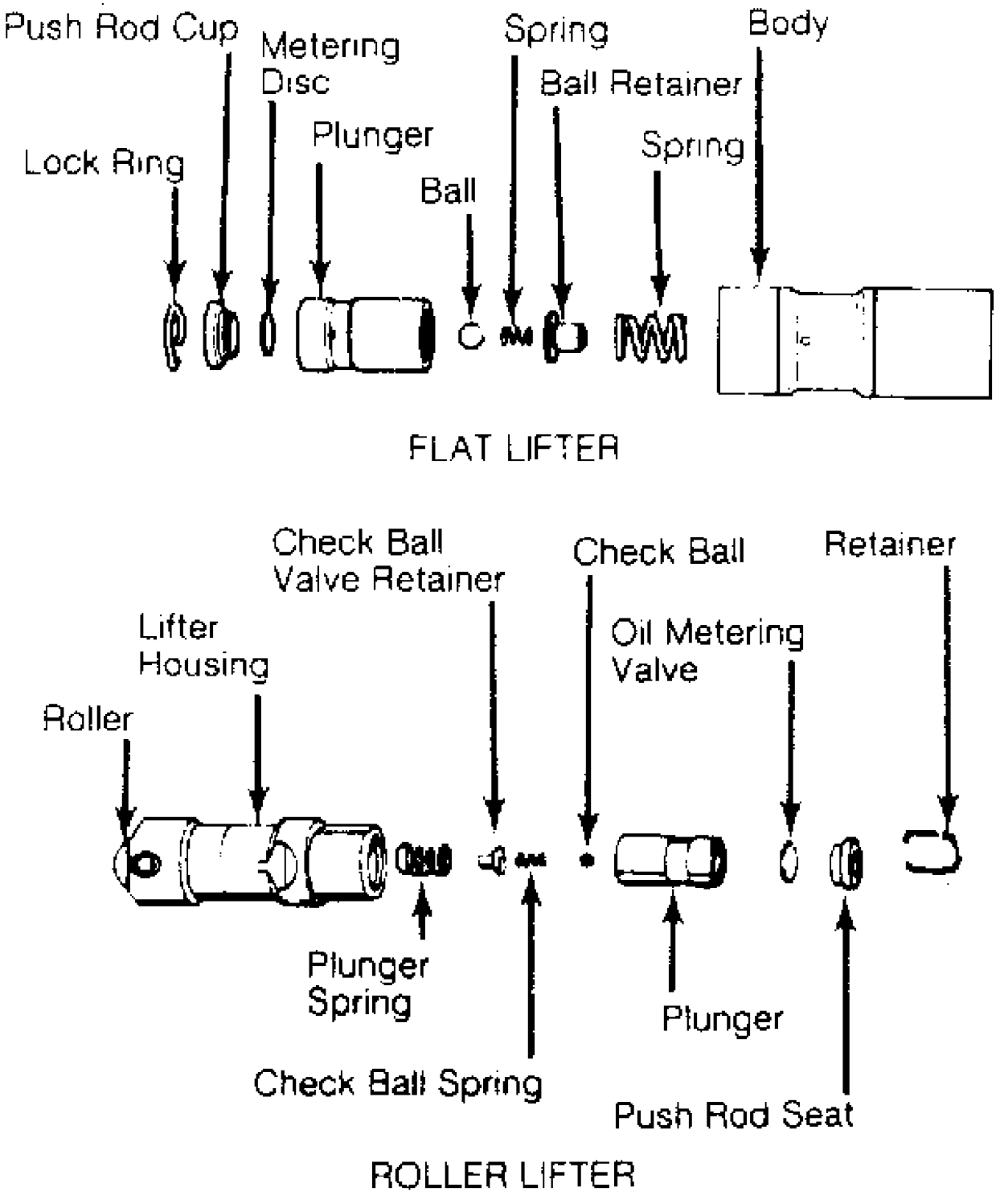

Fig. 13: Typical Hydraulic Valve Lifter Assemblies - Typical
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On sticking lifters, disassemble and clean lifter. DO NOT mix lifter components or positions. Parts are select-fitted and are not

interchangeable. Inspect all components for wear. Note amount of wear in lifter body-to-camshaft contact area. Surface must have smooth and convex contact face. If wear is apparent, carefully inspect cam lobe.

Inspect push rod contact area and lifter body for scoring or signs of wear. If body is scored, inspect lifter bore for damage and lack of lubrication. On roller type lifters, inspect roller for flaking, pitting, loss of needle bearings and roughness during rotation.

Measure lifter body O.D. in several areas. Measure lifter bore I.D. of cylinder block. Some models offer oversized lifters. Replace lifter if damaged.

If lifter check valve is not operating, obstructions may be preventing it from closing or valve spring may be broken. Clean or replace components as necessary.

Check plunger operation. Plunger should drop to bottom of the body by its own weight when assembled dry. If plunger is not free, soak lifter in solvent to dissolve deposits.

Lifter leak-down test can be performed on lifter. Lifter must be filled with special test oil. New lifters contain special test oil. Using lifter leak-down tester, perform leak-down test following manufacturer's instructions. If leak-down time is not within specifications, replace lifter assembly.

Lifters should be soaked in clean engine oil several hours prior to installation. Coat lifter base, roller (if equipped) and lifter body with ample amount of Molykote or camshaft lubricant. See Fig. 13. Install lifter in original location. Install remaining components. Valve lash adjustment is not required on most hydraulic lifters. Preload of hydraulic lifter is automatic. Some models may require adjustment.

Mechanical Lifters

Lifter assemblies must be installed in original locations. Remove rocker arm assembly and push rod. Mark components for location. Some applications require intake manifold or lifter cover removal. Remove lifter retainer plate (if used). To remove lifters, use lifter remover or magnet.

Inspect push rod contact area and lifter body for scoring or signs of wear. If body is scored, inspect lifter bore for damage and lack of lubrication. Note amount of wear in lifter body-to-camshaft contact area. Surface must have smooth and convex contact face. If wear is apparent, carefully inspect cam lobe.

Coat lifter base, roller (if equipped) and lifter body with ample amount of Molykote or camshaft lubricant. Install lifter in original location. Install remaining components. Tighten bolts to specification. Adjust valves. See VALVE ADJUSTMENT in this article.

PISTONS, CONNECTING RODS & BEARINGS

* PLEASE READ THIS FIRST *

NOTE: Always refer to appropriate engine overhaul article in the ENGINES section for complete overhaul procedures and specifications for the vehicle being repaired.

RIDGE REMOVAL

Ridge in cylinder wall must be removed prior to piston removal. Failure to remove ridge prior to removing pistons will cause piston damage in piston ring locations.

With the piston at bottom dead center, place a rag in the bore to trap metal chips. Install ridge reamer in cylinder bore. Adjust ridge reamer using manufacturer's instructions. Remove ridge

using ridge reamer. DO NOT remove an excessive amount of material. Ensure ridge is completely removed.

PISTON & CONNECTING ROD REMOVAL

Note top of piston. Some pistons may contain a notch, arrow or be marked "FRONT". Piston must be installed in proper direction to prevent damage with valve operation.

Check that connecting rod and cap are numbered for cylinder location and which side of cylinder block the number faces. Proper cap and connecting rod must be installed together. Connecting rod cap must be installed on connecting rod in proper direction to ensure bearing lock procedure. Mark connecting rod and cap if necessary. Pistons must be installed in original location.

Remove cap retaining nuts or bolts. Remove bearing cap. Install stud protectors on connecting rod bolts. This protects cylinder walls from scoring during removal. Ensure proper removal of ridge. Push piston and connecting rod from cylinder. Connecting rod boss can be tapped with a wooden dowel or hammer handle to aid in removal.

PISTON & CONNECTING ROD

Disassembly

Using ring expander, remove piston rings. Remove piston pin retaining rings (if equipped). On pressed type piston pins, special fixtures and procedures according to manufacturer must be used to remove piston pins. Follow manufacturer’s recommendations to avoid piston distortion or breakage.

Cleaning

Remove all carbon and varnish from piston. Pistons and connecting rods may be cleaned in cold type chemical tank. Using ring groove cleaner, clean all deposits from ring grooves. Ensure all deposits are cleaned from ring grooves to prevent ring breakage or sticking. DO NOT attempt to clean pistons using wire brush.

Inspection

Inspect pistons for nicks, scoring, cracks or damage in ring areas. Connecting rod should be checked for cracks using Magnaflux procedure. Piston diameter must be measured in manufacturers specified area.

Using telescopic gauge and micrometer, measure piston pin bore of piston in 2 areas, 90 degrees apart. This is done to check diameter and out-of-round.

Install proper bearing cap on connecting rod. Ensure bearing cap is installed in proper location. Tighten bolts or nuts to specification. Using inside micrometer, measure inside diameter in 2 areas, 90 degrees apart.

Connecting rod I.D. and out-of-round must be within specification. Measure piston pin bore I.D. and piston pin O.D. All components must be within specification. Subtract piston pin diameter from piston pin bore in piston and connecting rod to determine proper fit.

Connecting rod length must be measured from center of crankshaft journal inside diameter to center of piston pin bushing using proper caliper. Connecting rods must be the same length. Connecting rods should be checked on an alignment fixture for bent or twisted condition. Replace all components which are damaged or not within specification.

PISTON & CYLINDER BORE FIT

Ensure cylinder is checked for taper, out-of-round and properly honed prior to checking piston and cylinder bore fit. See CYLINDER BLOCK in this article. Using dial bore gauge, measure cylinder bore. Measure piston at right angle to piston pin in center of piston skirt area. Subtract piston diameter from cylinder bore diameter. The difference is piston-to-cylinder clearance. Clearance must be within specification. Mark piston for proper cylinder location.

ASSEMBLING PISTON & CONNECTING ROD

Install proper fitted piston on connecting rod for proper cylinder. Ensure piston marking on top of piston marked is in correspondence with connecting rod and cap number. See Fig. 14.

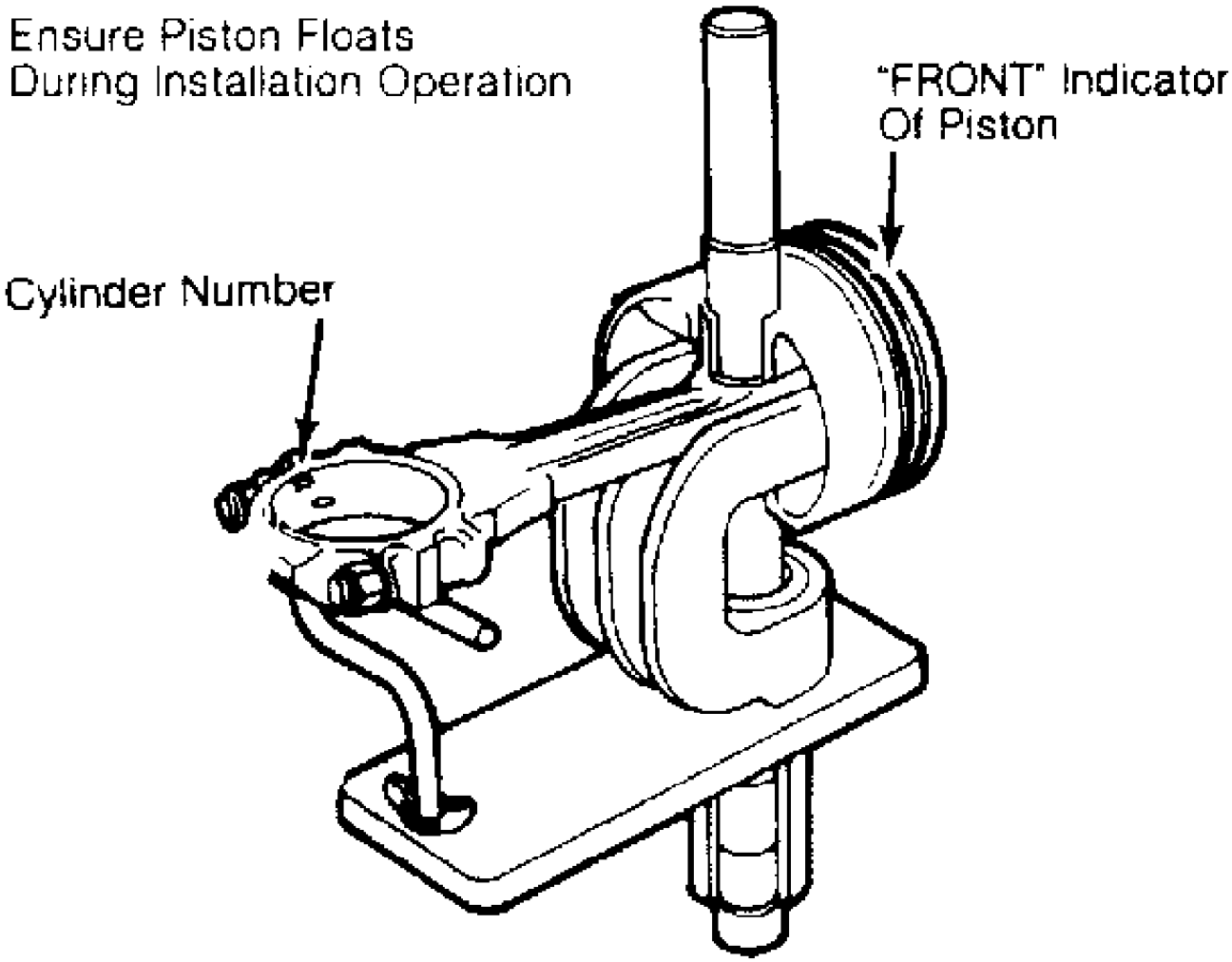

Fig. 14: Piston Pin Installation - Typical
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Lubricate piston pin and install in connecting rod. Ensure piston pin retainers are fully seated (if equipped). On pressed type piston pins, follow manufacturer's recommended procedure to avoid distortion or breakage.

CHECKING PISTON RING CLEARANCES

Piston rings must be checked for side clearance and end gap. To check end gap, install piston ring in cylinder which it is to be installed. Using an inverted piston, push ring to bottom of cylinder in smallest cylinder diameter.

Using feeler gauge, check ring end gap. See Fig. 15. Piston ring end gap must be within specification. Ring breakage will occur with insufficient ring end gap.

On some manufacturers, insufficient ring end gap may be corrected by using a fine file while other manufacturers recommend using another ring set. Mark rings for proper cylinder installation after checking end gap.

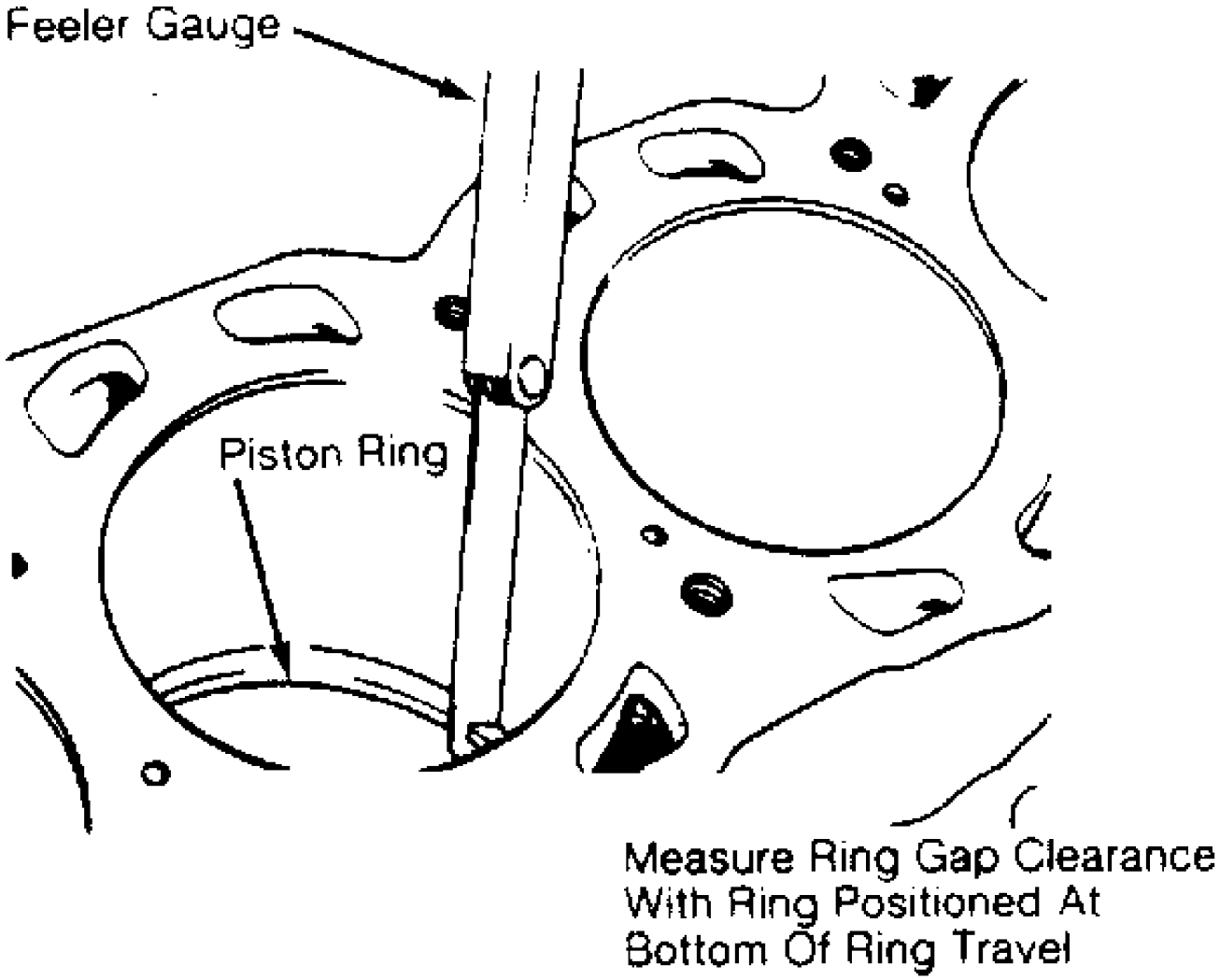

Fig. 15: Checking Piston Ring End Gap - Typical
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For checking side clearance, install rings on piston. Using feeler gauge, measure clearance between piston ring and piston ring land. Check side clearance in several areas around piston. Side clearance must be within specification.

If side clearance is excessive, piston ring grooves can be machined to accept oversized piston rings (if available). Normal practice is to replace piston.

PISTON & CONNECTING ROD INSTALLATION

Cylinders must be honed prior to piston installation. See CYLINDER HONING under CYLINDER BLOCK in this article.

Install upper connecting rod bearings. Lubricate upper bearings with engine oil. Install lower bearings in rod caps. Ensure bearing tabs are properly seated. Position piston ring gaps according to manufacturers recommendations. See Fig. 16. Lubricate pistons, rings and cylinder walls.

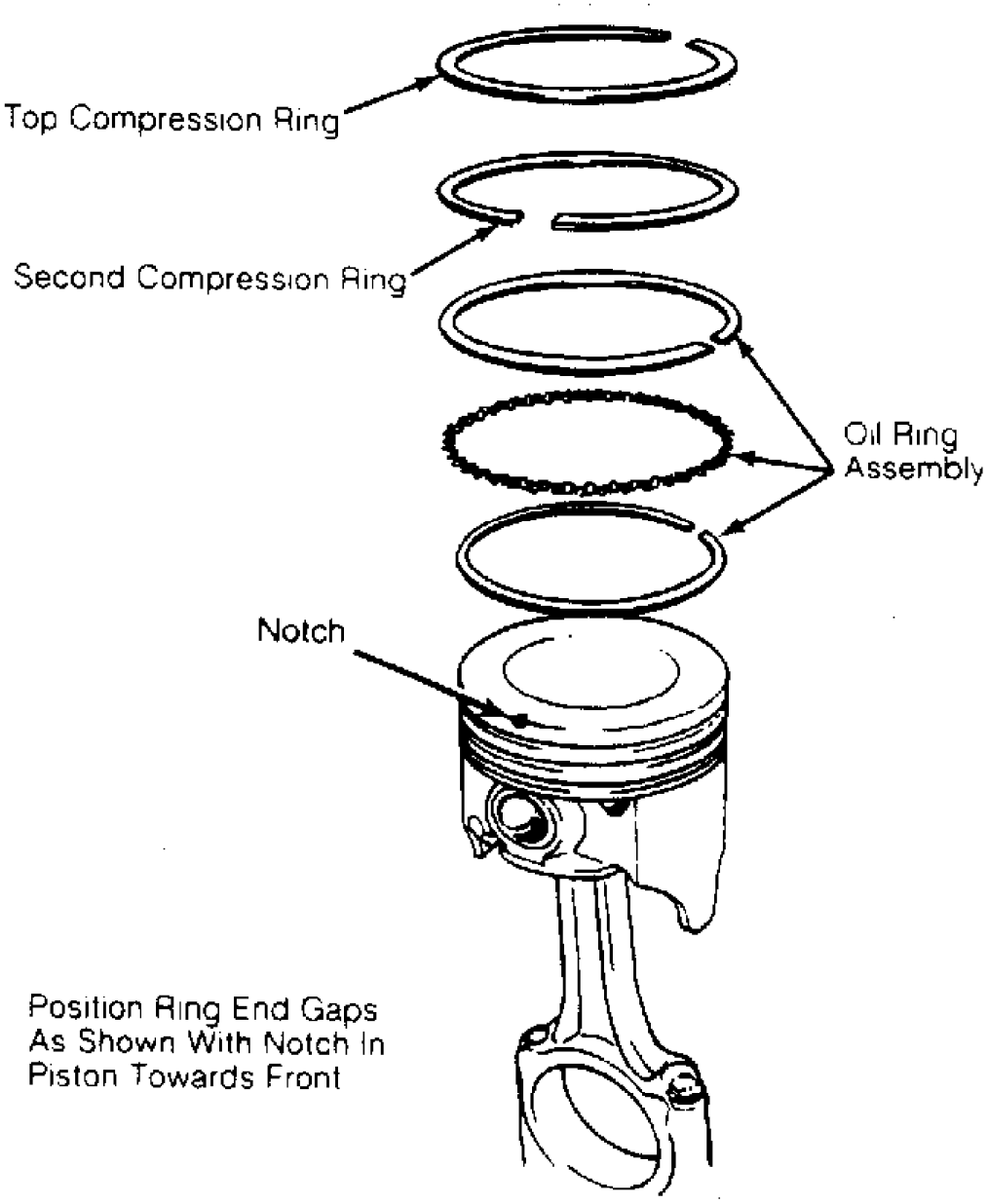

Fig. 16: Typical Piston Ring End Gap Positioning - Typical This Graphic For General Information Only

Install ring compressor. Use care not to rotate piston rings. Compress rings with ring compressor. Install plastic tubing protectors

over connecting rod bolts. Install piston and connecting rod assembly. Ensure piston notch, arrow or "FRONT" mark is toward front of engine. See Fig. 17.

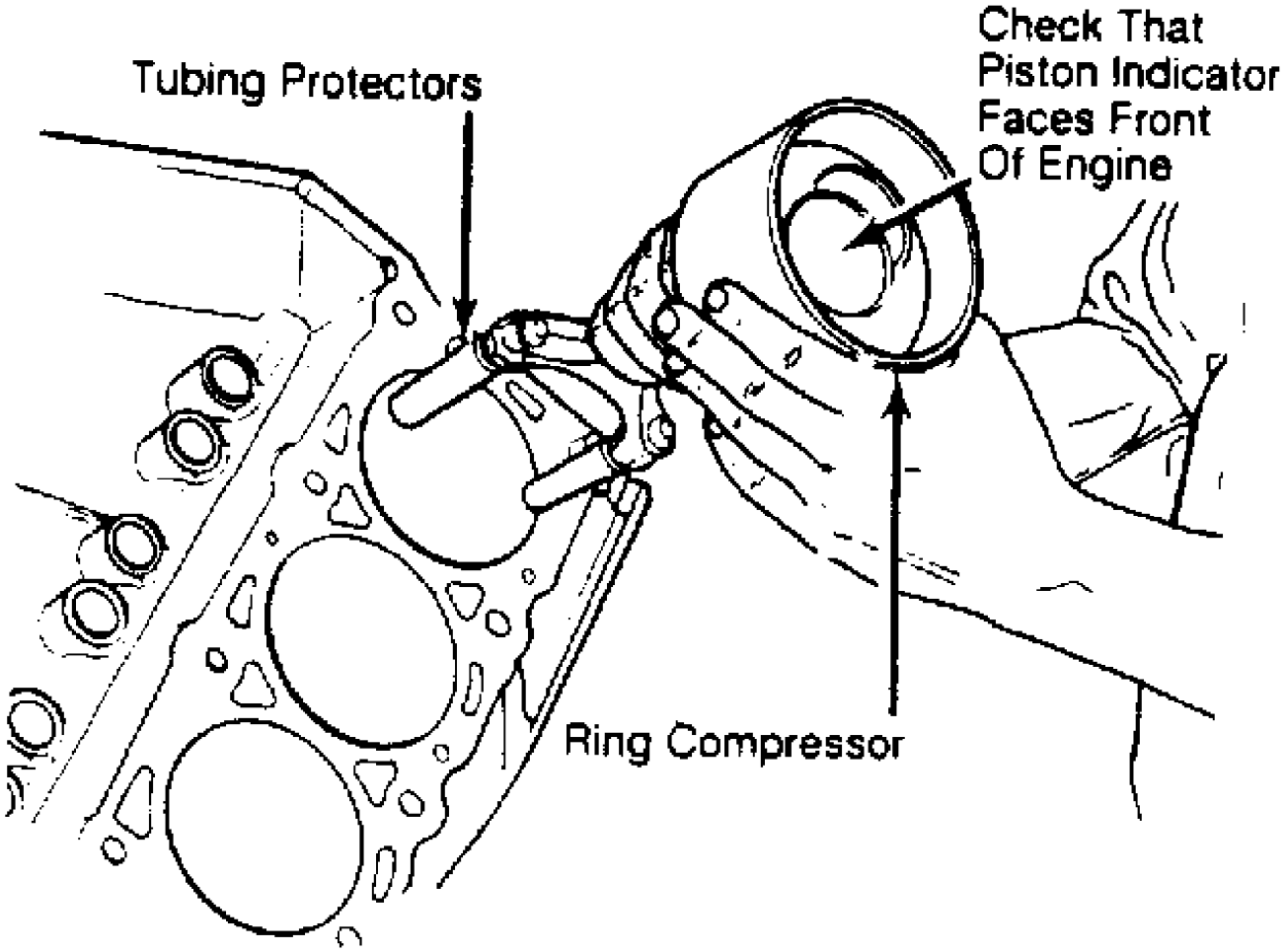

Fig. 17: Installing Piston & Connecting Rod Assembly - Typical
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Carefully tap piston into cylinder until rod bearing is seated on crankshaft journal. Remove protectors. Install rod cap and bearing. Lightly tighten connecting rod bolts. Repeat procedure for remaining cylinders. Check bearing clearance. See MAIN & CONNECTING ROD BEARING CLEARANCE in this article.

Once clearance is checked, lubricate journals and bearings. Install bearing caps. Ensure marks are aligned on connecting rod and cap. Tighten rod nuts or bolts to specification. Ensure rod moves freely on crankshaft. Check connecting rod side clearance. See CONNECTING ROD SIDE CLEARANCE in this article.

CONNECTING ROD SIDE CLEARANCE

Position connecting rod toward one side of crankshaft as far as possible. Using feeler gauge, measure clearance between side of connecting rod and crankshaft. See Fig. 18. Clearance must be within specifications.

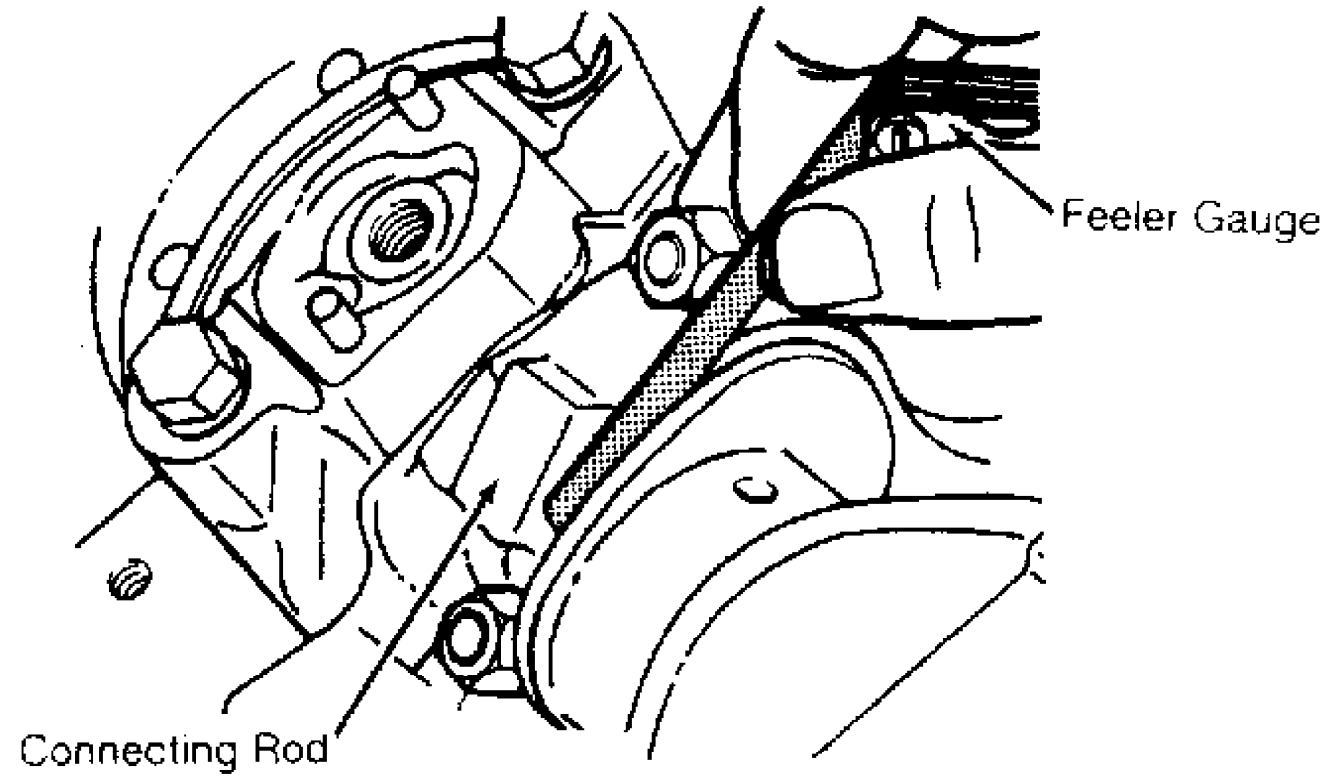

Fig. 18: Measuring Connecting Rod Side Clearance - Typical
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Check for improper bearing installation, wrong bearing cap or insufficient bearing clearance if side clearance is insufficient. Connecting rod may require machining to obtain proper clearance. Excessive clearance usually indicates excessive wear at crankshaft. Crankshaft must be repaired or replaced.

MAIN & CONNECTING ROD BEARING CLEARANCE

Plastigage Method

Plastigage method may be used to determine bearing clearance. Plastigage can be used with an engine in service or during reassembly. Plastigage material is oil soluble.

Ensure journals and bearings are free of oil or solvent. Oil or solvent will dissolve material and false reading will be obtained. Install small piece of Plastigage along full length of bearing journal. Install bearing cap in original location. Tighten bolts to specification.

CAUTION: DO NOT rotate crankshaft while Plastigage is installed. Bearing clearance will not be obtained if crankshaft is rotated.

Remove bearing cap. Compare Plastigage width with scale on Plastigage container to determine bearing clearance. See Fig. 19. Rotate crankshaft 90 degrees. Repeat procedure. this is done to check journal eccentricity. This procedure can be used to check oil clearance on both connecting rod and main bearings.

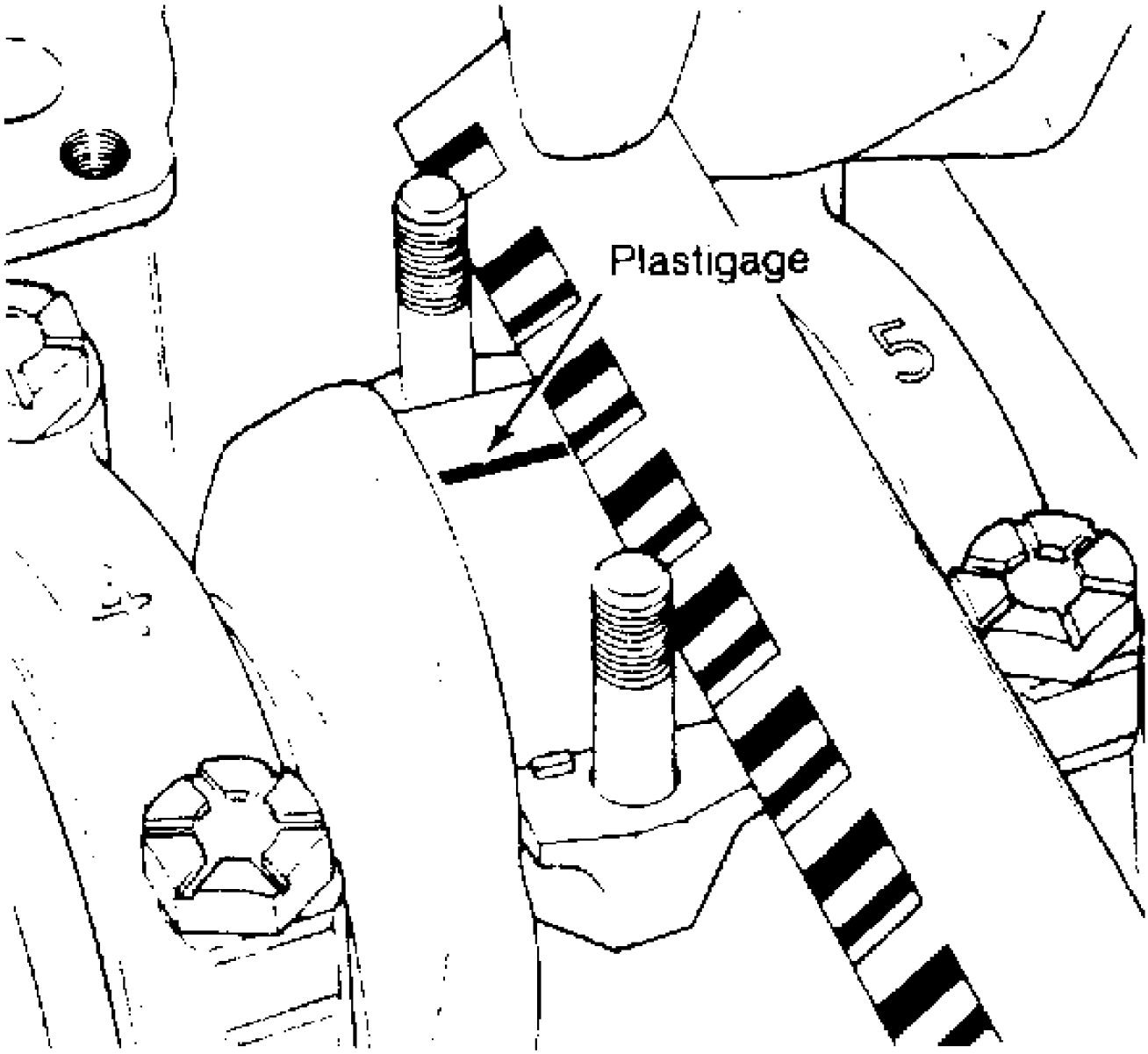

Fig. 19: Measuring Bearing Clearance - Typical
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Micrometer & Telescopic Gauge Method

A micrometer is used to determine journal diameter, taper and out-of-round dimensions of the crankshaft. See CLEANING & INSPECTION under CRANKSHAFT & MAIN BEARINGS in this article.

With crankshaft removed, install bearings and caps in original location on cylinder block. Tighten bolts to specification. On connecting rods, install bearings and caps on connecting rods. Install proper connecting rod cap on corresponding rod. Ensure bearing cap is installed in original location. Tighten bolts to specification.

Using a telescopic gauge and micrometer or inside micrometer measure inside diameter of connecting rod and main bearings bores. Subtract each crankshaft journal diameter from the corresponding inside bore diameter. This is the bearing clearance.

CRANKSHAFT & MAIN BEARINGS

* PLEASE READ THIS FIRST *

NOTE: Always refer to appropriate engine overhaul article in the ENGINES section for complete overhaul procedures and specifications for the vehicle being repaired.

REMOVAL

Ensure all main bearing caps are marked for location on cylinder block. Some main bearing caps have an arrow stamped on it which must face front of engine. Remove main bearing cap bolts. Remove main bearing caps. Carefully remove crankshaft. Use care not to bind crankshaft in cylinder block during removal.

CLEANING & INSPECTION

Thoroughly clean crankshaft using solvent. Dry with compressed air. Ensure all oil passages are clear and free of sludge, rust, dirt, and metal chips.

Inspect crankshaft for scoring and nicks. Inspect crankshaft for cracks using Magnaflux procedure. Inspect rear seal area for grooving or damage. Inspect bolt hole threads for damage. If pilot bearing or bushing is used, check pilot bearing or bushing fit in crankshaft. Inspect crankshaft gear for damaged or cracked teeth. Replace gear if damaged. Check that oil passage plugs are tight (if equipped).

Using micrometer, measure all journals in 4 areas to determine journal taper, out-of-round and undersize. See Fig. 20. Some crankshafts can be reground to the next largest undersize, depending on the amount of wear or damage. Crankshafts with rolled fillet cannot be reground and must be replaced.

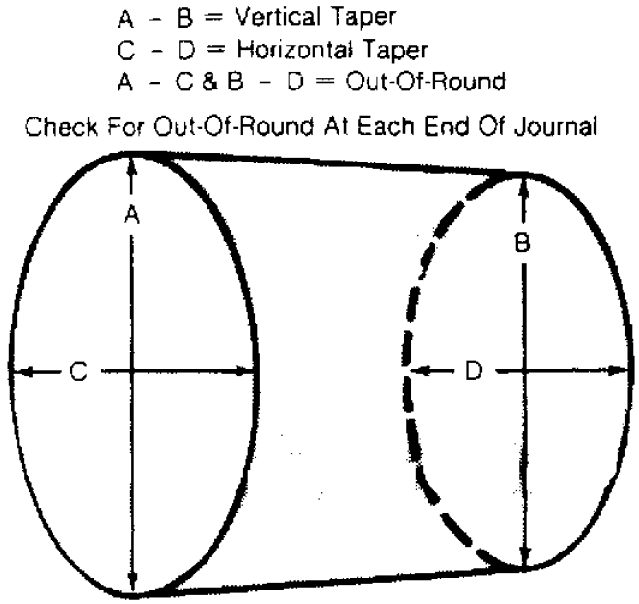

Fig. 20: Measuring Crankshaft Journal - Typical
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Crankshaft journal runout should be checked. Install crankshaft in "V" blocks or bench center. Position dial indicator

with tip resting on the main bearing journal area. See Fig. 21. Rotate crankshaft and note reading. Journal runout must not exceed specification. Repeat procedure on all main bearing journals. Crankshaft must be replaced if runout exceeds specification.

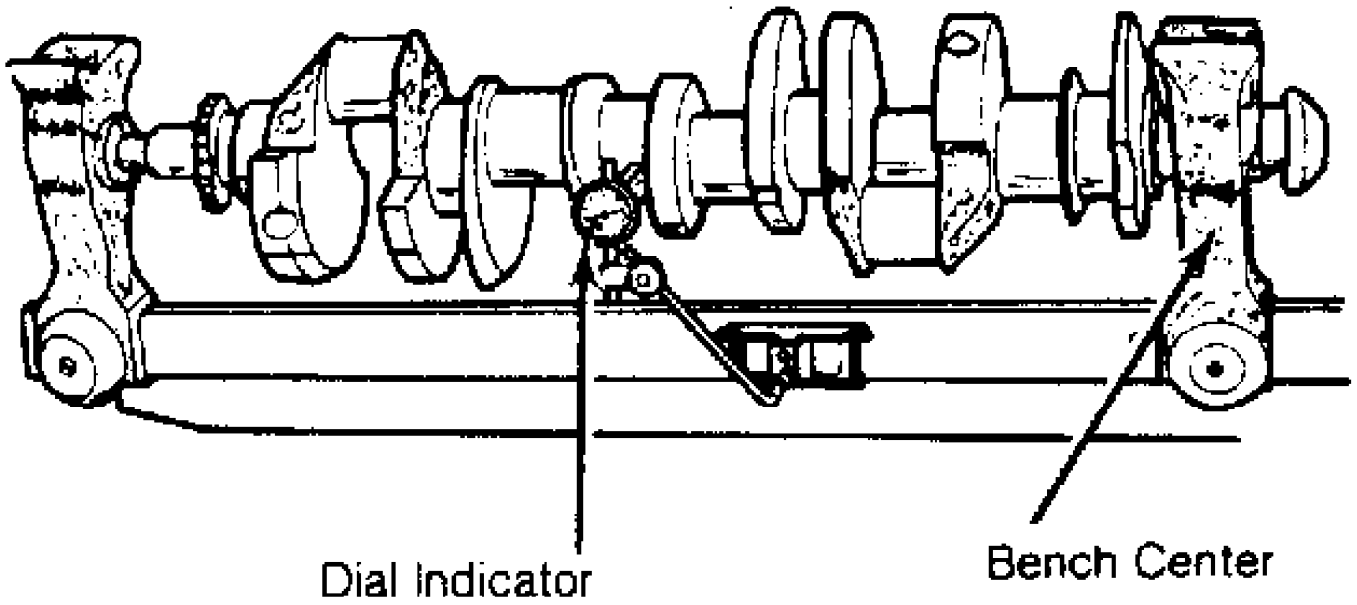

Fig. 21: Measuring Crankshaft Main Bearing Journal Runout - Typical This Graphic For General Information Only

INSTALLATION

Install upper main bearing in cylinder block. Ensure lock tab is properly located in cylinder block. Install bearings in main bearing caps. Ensure all oil passages are aligned. Install rear seal (if removed).

Ensure crankshaft journals are clean. Lubricate upper main bearings with clean engine oil. Carefully install crankshaft. Check each main bearing clearance using Plastigage method. See MAIN & CONNECTING ROD BEARING CLEARANCE in this article.

Once clearance is checked, lubricate lower main bearing and journals. Install main bearing caps in original location. Install rear seal in rear main bearing cap (if removed). Some rear main bearing caps require sealant to be applied in corners to prevent oil leakage.

Install and tighten all bolts except thrust bearing cap to specification. Tighten thrust bearing cap bolts finger tight only. Thrust bearing must be aligned. On most applications, crankshaft must be moved rearward then forward. Procedure may vary with manufacturer. Thrust bearing cap is then tighten to specification. Ensure crankshaft rotates freely. Crankshaft end play should be checked. See CRANKSHAFT END PLAY in this article.

CRANKSHAFT END PLAY

Dial Indicator Method

Crankshaft end play can be checked using dial indicator. Mount dial indicator on rear of cylinder block. Position dial indicator tip against rear of crankshaft. Ensure tip is resting against flat surface.

Pry crankshaft rearward. Adjust dial indicator to zero.

Pry crankshaft forward and note reading. Crankshaft end play must be within specification. If end play is not within specification, check for faulty thrust bearing installation or worn crankshaft. Some applications offer oversized thrust bearings.

Feeler Gauge Method

Crankshaft end play can be checked using feeler gauge. Pry crankshaft rearward. Pry crankshaft forward. Using feeler gauge, measure clearance between crankshaft and thrust bearing surface. See Fig. 22.

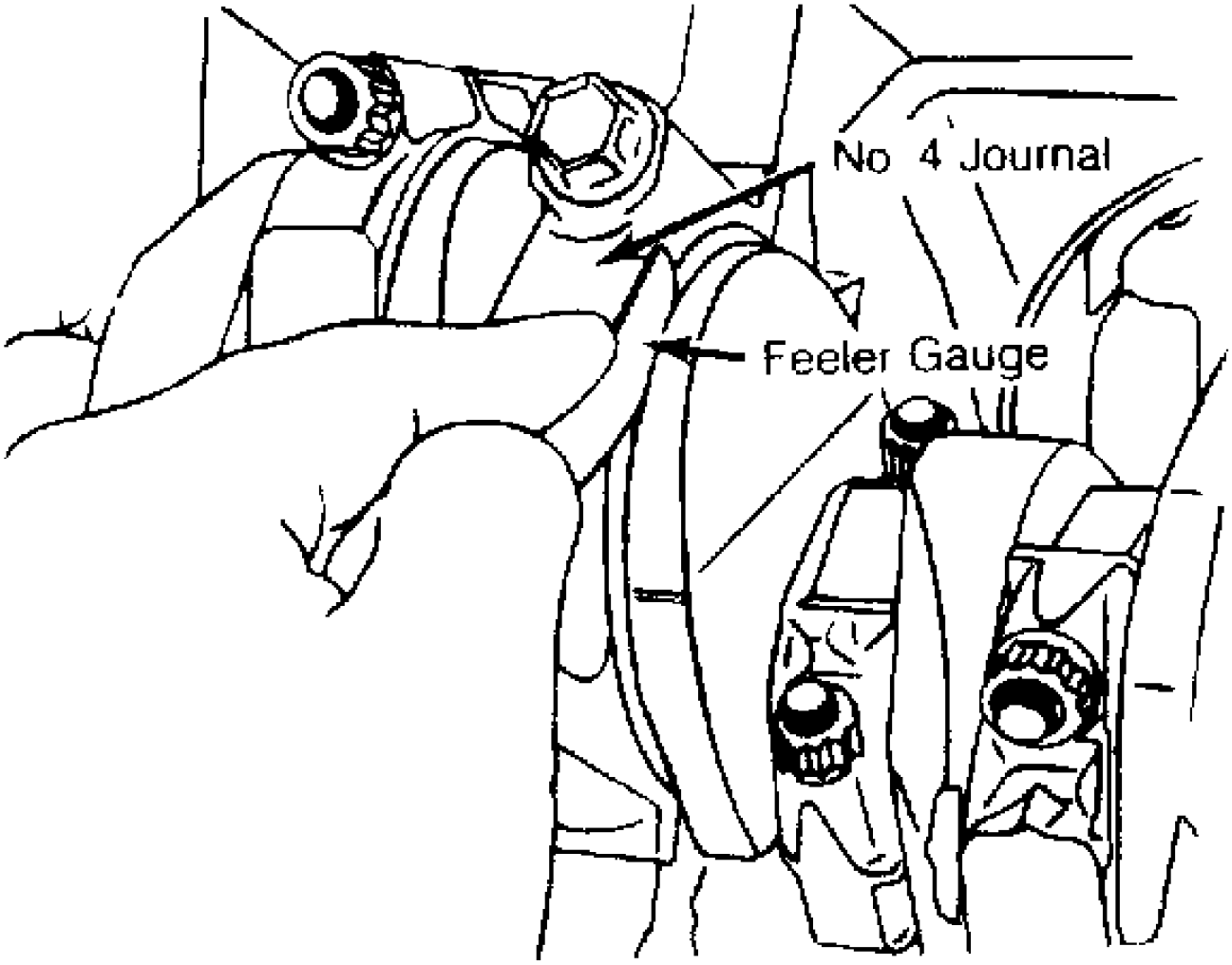

Fig. 22: Checking Crankshaft End Play - Typical
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Crankshaft end play must be within specification. If end play is not within specification, check for faulty thrust bearing installation or worn crankshaft. Some applications offer oversized thrust bearings.

CYLINDER BLOCK

* PLEASE READ THIS FIRST *

NOTE: Always refer to appropriate engine overhaul article in the ENGINES section for complete overhaul procedures and specifications for the vehicle being repaired.

BLOCK CLEANING

Only cast cylinder blocks should be hot tank cleaned. Aluminum cylinder blocks should be cleaned using cold tank method. Cylinder block is cleaned in order to remove carbon deposits, gasket residue and water jacket scale. Remove oil galley plugs, freeze plugs and cam bearings prior to block cleaning.

BLOCK INSPECTION

Visually inspect the block. Check suspected areas for cracks using the Dye Penetrant inspection method. Block may be checked for cracks using the Magnaflux method.

Cracks are most commonly found at the bottom of the cylinders, the main bearing saddles, near expansion plugs and between the cylinders and water jackets. Inspect lifter bores for damage. Inspect all head bolt holes for damaged threads. Threads should be cleaned using tap to ensure proper head bolt torque. Consult machine shop concerning possible welding and machining (if required).

CYLINDER BORE INSPECTION

Inspect the bore for scuffing or roughness. Cylinder bore is dimensionally checked for out-of-round and taper using dial bore gauge. For determining out-of-round, measure cylinder parallel and perpendicular to the block centerline. Difference in the 2 readings is the bore out-of-round. Cylinder bore must be checked at top, middle and bottom of piston travel area.

Bore taper is obtained by measuring bore at the top and bottom. If wear has exceeded allowable limits, block must be honed or bored to next available oversize piston dimension.

CYLINDER HONING

Cylinder must be properly honed to allow new piston rings to properly seat. Cross-hatching at correct angle and depth is critical to lubrication of cylinder walls and pistons.

A flexible drive hone and power drill are commonly used. Drive hone must be lubricated during operation. Mix equal parts of kerosene and SAE 20w engine oil for lubrication.

Apply lubrication to cylinder wall. Operate cylinder hone from top to bottom of cylinder using even strokes to produce 45 degree cross-hatch pattern on the cylinder wall. DO NOT allow cylinder hone to extend below cylinder during operation.

Recheck bore dimension after final honing. Wash cylinder wall with hot soapy water to remove abrasive particles. Blow dry with compressed air. Coat cleaned cylinder walls with lubricating oil.

DECK WARPAGE

Check deck for damage or warped head sealing surface. Place a straightedge across gasket surface of the deck. Using feeler gauge, measure clearance at center of straightedge. Measure across width and

length of cylinder block at several points.

If warpage exceeds specifications, deck must be resurfaced. If warpage exceeds manufacturer's maximum tolerance for material removal, replace block.

DECK HEIGHT

Distance from the crankshaft centerline to the block deck is termed the deck height. Measure and record front and rear main journals of crankshaft. To compute this distance, install crankshaft and retain with center main bearing and cap only. Measure distance from the crankshaft journal to the block deck, parallel to the cylinder centerline.

Add one half of the main bearing journal diameter to distance from crankshaft journal to block deck. This dimension should be checked at front and rear of cylinder block. Both readings should be the same.

If difference exceeds specifications, cylinder block must be repaired or replaced. Deck height and warpage should be corrected at the same time.

MAIN BEARING BORE & ALIGNMENT

For checking main bearing bore, remove all bearings from cylinder block and main bearing caps. Install main bearing caps in original location. Tighten bolts to specification. Using inside micrometer, measure main bearing bore in 2 areas 90 degrees apart. Determine bore size and out-of-round. If diameter is not within specification, block must be align-bored.

For checking alignment, place a straightedge along centerline of main bearing saddles. Check for clearance between straightedge and main bearing saddles. Block must be align-bored if clearance is present.

EXPANSION PLUG REMOVAL & INSTALLATION

Removal

Drill a hole in the center of expansion plug. Remove with screwdriver or punch. Use care not to damage sealing surface.

Installation

Ensure sealing surface is free of burrs. Coat expansion plug with sealer. Use a wooden dowel or pipe of slightly smaller diameter, install expansion plug. Ensure expansion plug is evenly located.

OIL GALLERY PLUG REMOVAL & INSTALLATION

Removal

Remove threaded oil gallery plugs using the appropriate wrench. Soft, press-in plugs are removed by drilling into plug and installing a sheet metal screw. Remove plug with slide hammer or pliers.

Installation

Ensure threads or sealing surface is clean. Coat threaded oil gallery plugs with sealer and install. Replacement soft press-in plugs are driven in place with a hammer and drift.

CAMSHAFT

* PLEASE READ THIS FIRST *

NOTE: Always refer to appropriate engine overhaul article in the ENGINES section for complete overhaul procedures and specifications for the vehicle being repaired.

CLEANING & INSPECTION

Clean camshaft with solvent. Ensure all oil passages are clear. Inspect cam lobes and bearing journals for pitting, flaking or scoring. Using micrometer, measure bearing journal O.D.

Support camshaft at each end with "V" blocks. Position dial indicator with tip resting on center bearing journal. Rotate camshaft and note reading. If reading exceeds specification, replace camshaft.

Check cam lobe lift by measuring base circle of camshaft using micrometer. Measure again at 90 degrees to tip of cam lobe. Cam lift can be determined by subtracting base circle diameter from tip of cam lobe measurement.

Different lift dimensions are given for intake and exhaust cam lobes. Reading must be within specifications. Replace camshaft if cam lobes or bearing journals are not within specifications.

Inspect camshaft gear for chipped, eroded or damaged teeth. Replace gear if damaged. On camshafts using thrust plate, measure distance between thrust plate and camshaft shoulder. Replace thrust plate if not within specification.

CAMSHAFT BEARINGS

Removal & Installation

Remove the camshaft rear plug. The camshaft bearing remover is assembled with its shoulder resting on the bearing to be removed according to manufacturer's instructions. Tighten puller nut until bearing is removed. Remove remaining bearings, leaving front and rear bearings until last. These bearings act as guide for camshaft bearing remover.

To install new bearings, puller is rearranged to pull bearings toward the center of block. Ensure all lubrication passages of bearing are aligned with cylinder block. Coat new camshaft rear plug with sealant. Install camshaft rear plug. Ensure plug is even in cylinder block.

CAMSHAFT INSTALLATION

Lubricate bearing surfaces and cam lobes with ample amount of Molykote or camshaft lubricant. Carefully install camshaft. Use care not to damage bearing journals during installation. Install thrust plate retaining bolts (if equipped). Tighten bolts to specification. On overhead camshafts, install bearing caps in original location. Tighten bolts to specification. Check end play.

CAMSHAFT END PLAY

Using dial indicator, check end play. Position dial indicator on front of engine block. Position indicator tip against camshaft. Push camshaft toward rear of engine and adjust indicator to zero.

Move camshaft forward and note reading. Camshaft end play must be within specification. End play may be adjusted by relocating gear, shimming thrust plate or replacing thrust plate depending on manufacturer.

TIMING CHAINS & BELTS

* PLEASE READ THIS FIRST *

NOTE: Always refer to appropriate engine overhaul article in the ENGINES section for complete overhaul procedures and specifications for the vehicle being repaired.

TIMING CHAINS

Timing chains will stretch during operation. Limits are placed upon amount of stretch before replacement is required. Timing chain stretch will alter ignition timing and valve timing.

To check timing chain stretch, rotate crankshaft to eliminate slack from one side of timing chain. Mark reference point on cylinder block. Rotate crankshaft in opposite direction to eliminate slack from remaining side of timing chain. Force other side of chain outward and measure distance between reference point and timing chain. See Fig. 23. Replace timing chain and gears if not within specification.

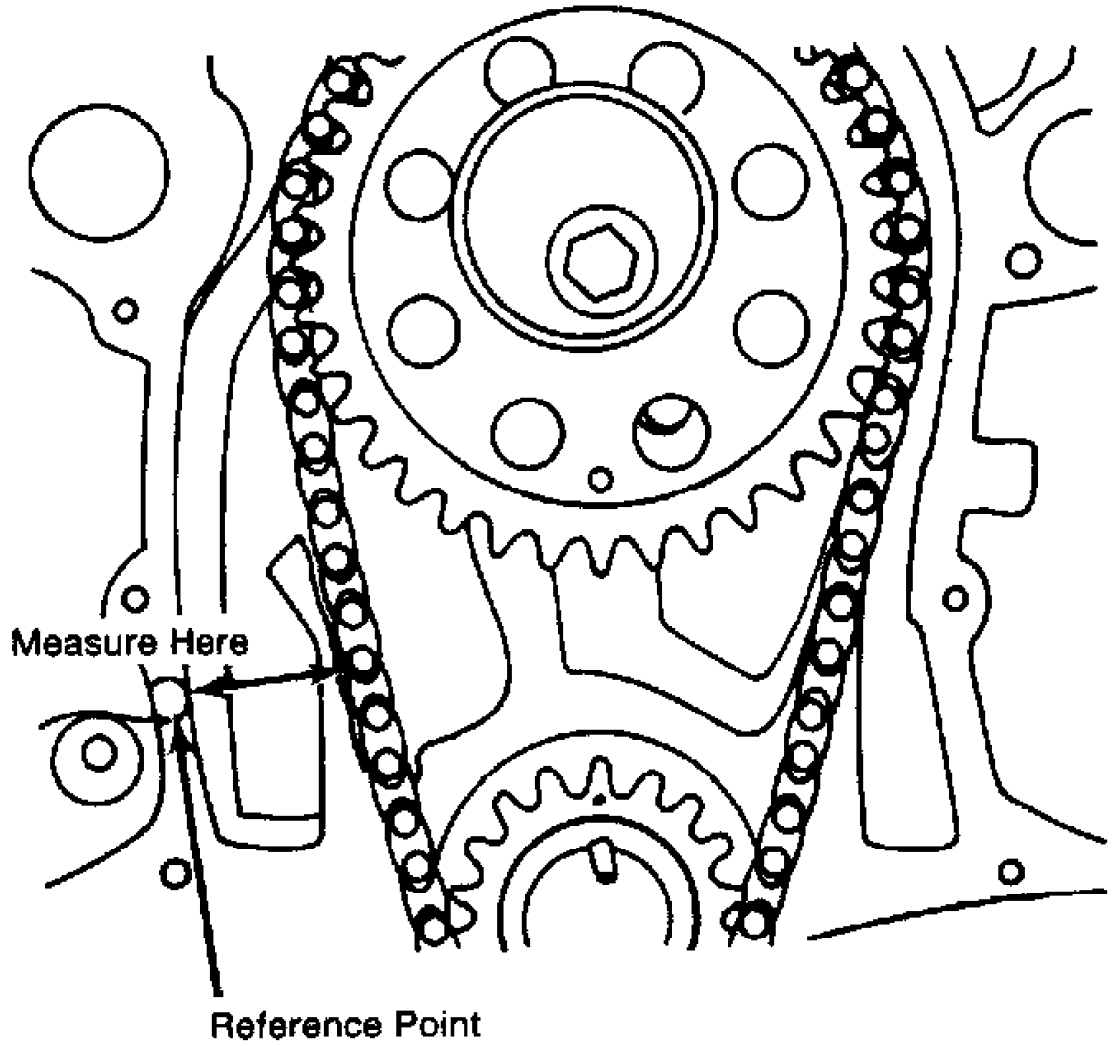

Fig. 23: Measuring Timing Chain Stretch - Typical
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Timing chains must be installed so that timing marks on camshaft gear and crankshaft gear are aligned according to

manufacturer. See Fig. 24.

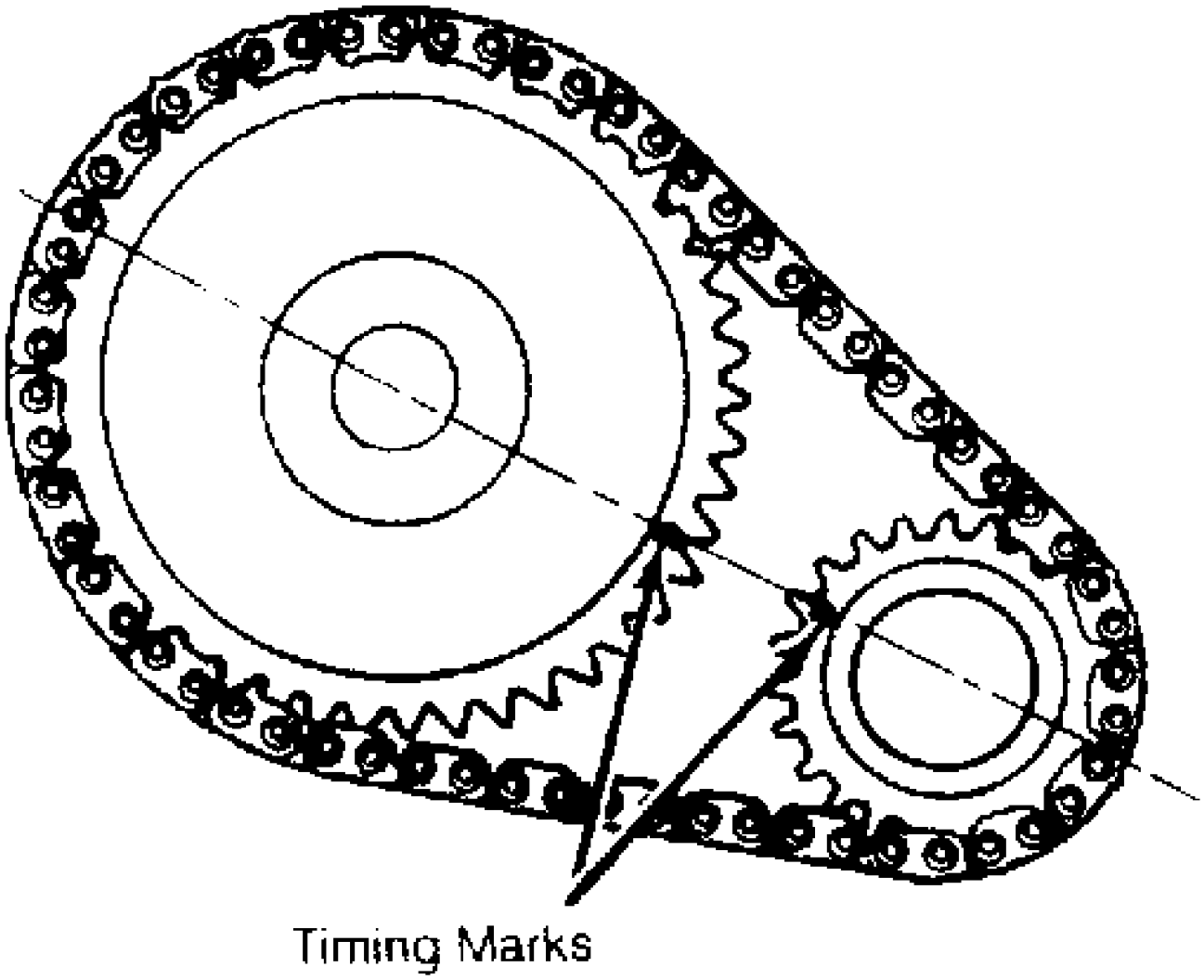

Fig. 24: Timing Gear Mark Alignment - Typical
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TIMING BELTS

Cogged tooth belts are commonly used on overhead cam engines. Inspect belt teeth for rounded corners or cracking. Replace belt if cracked, damaged, missing teeth or oil soaked.

Used timing belt must be installed in original direction of rotation. Inspect all sprocket teeth for wear. Replace all worn sprockets. Sprockets are marked for timing purposes. Engine is positioned so that crankshaft sprocket mark will be upward. Camshaft sprocket is aligned with reference mark on cylinder head and timing belt is installed. See Fig. 25.

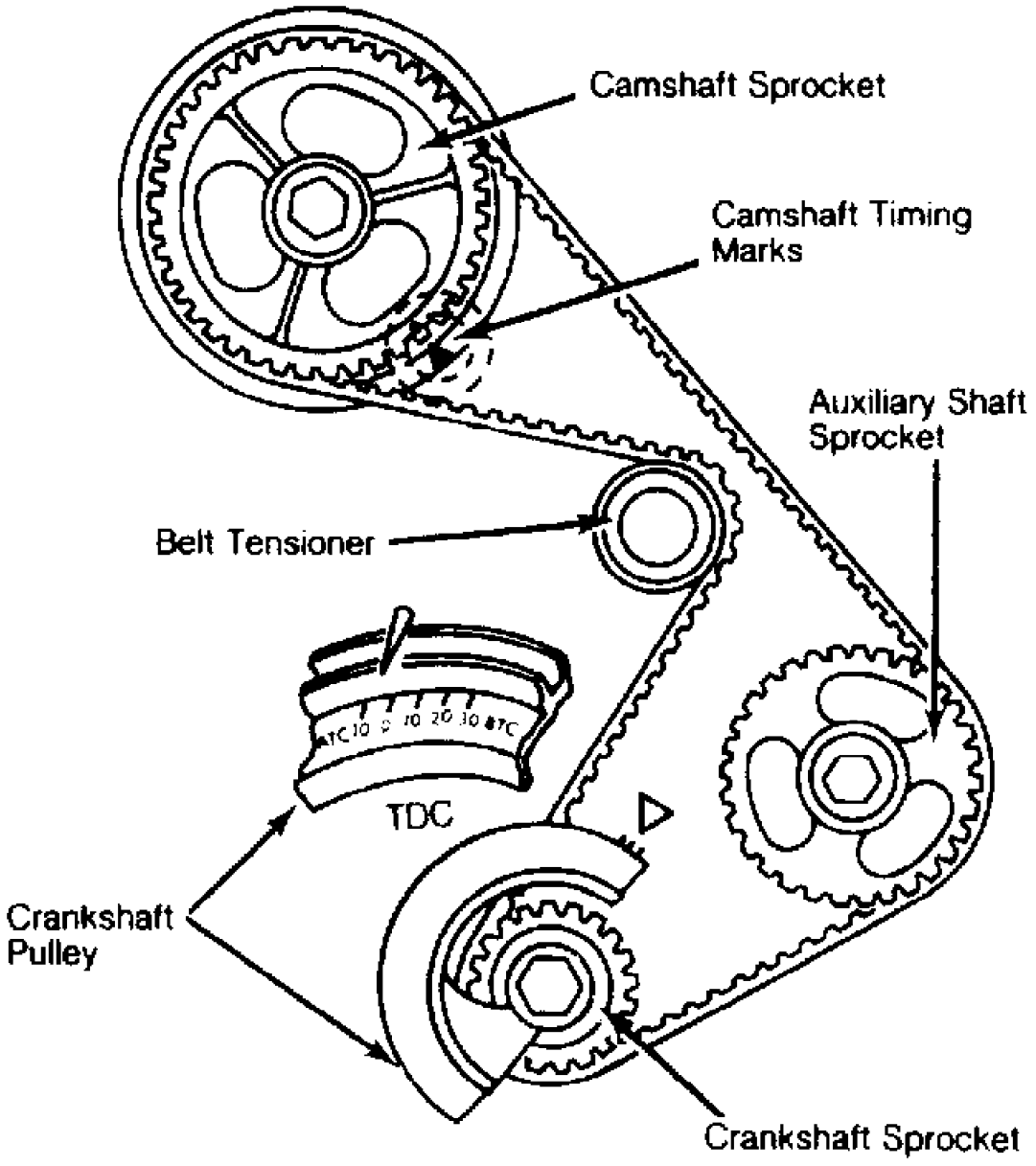

Fig. 25: Timing Belt Sprocket Alignment - Typical
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TENSION ADJUSTMENTS

If guide rails are used with spring loaded tensioners, ensure at least half of original rail thickness remains. Spring loaded tensioner should be inspected for damage.

Ensure all timing marks are aligned. Adjust belt tension using manufacturer's recommendations. Belt tension may require checking using tension gauge. See Fig. 26.

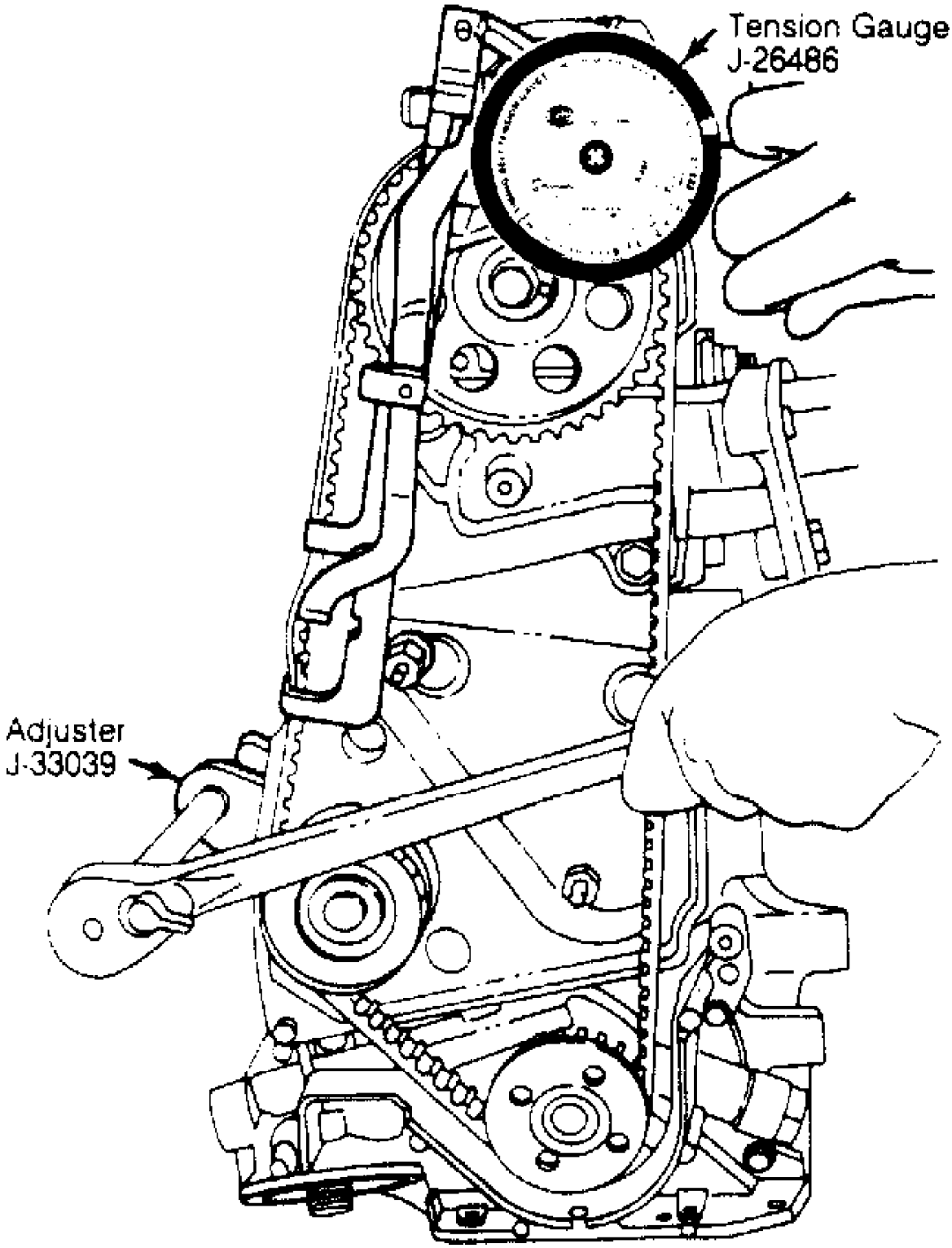

Fig. 26: Timing Belt Tension Adjustment - Typical
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TIMING GEARS

* PLEASE READ THIS FIRST *

NOTE: Always refer to appropriate engine overhaul article in the ENGINES section for complete overhaul procedures and specifications for the vehicle being repaired.

TIMING GEAR BACKLASH & RUNOUT

On engines where camshaft gear operates directly on crankshaft gear, gear backlash and runout must be checked. To check backlash, install dial indicator with tip resting on tooth of camshaft gear. Rotate camshaft gear as far as possible. Adjust indicator to zero. Rotate camshaft gear in opposite direction as far as possible and note reading.

To determine timing gear runout, mount dial indicator with tip resting on face edge of camshaft gear. Adjust indicator to zero. Rotate camshaft gear 360 degrees and note reading. If backlash or runout exceed specifications, replace camshaft and/or crankshaft gear.

REAR MAIN OIL SEAL

* PLEASE READ THIS FIRST *

NOTE: Always refer to appropriate engine overhaul article in the ENGINES section for complete overhaul procedures and specifications for the vehicle being repaired.

INSTALLATION

One-Piece Type Seal

For one-piece type oil seal installation, coat block contact surface of seal with sealer if seal is not factory coated. Ensure seal surface is free of burrs. Lubricate seal lip with engine oil and press seal into place using proper oil seal installer. See Fig. 27.

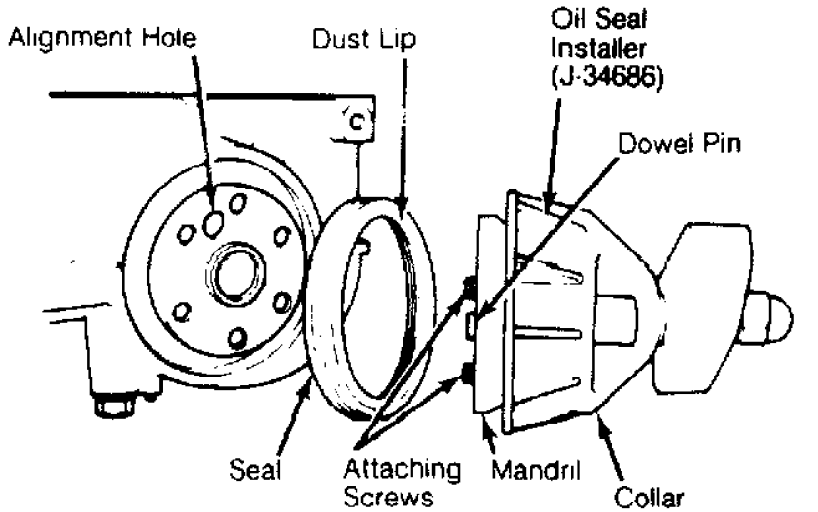

Fig. 27: Installing Typical One-Piece Oil Seal
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Rope Type Seal

For rope type rear main oil seal installation, press seal

lightly into its seat. Using seal installer, fully seat seal in bearing cap or cylinder block.

Trim seal ends even with block parting surface. Some applications require sealer to be applied on main bearing cap prior to installation. See Fig. 28.

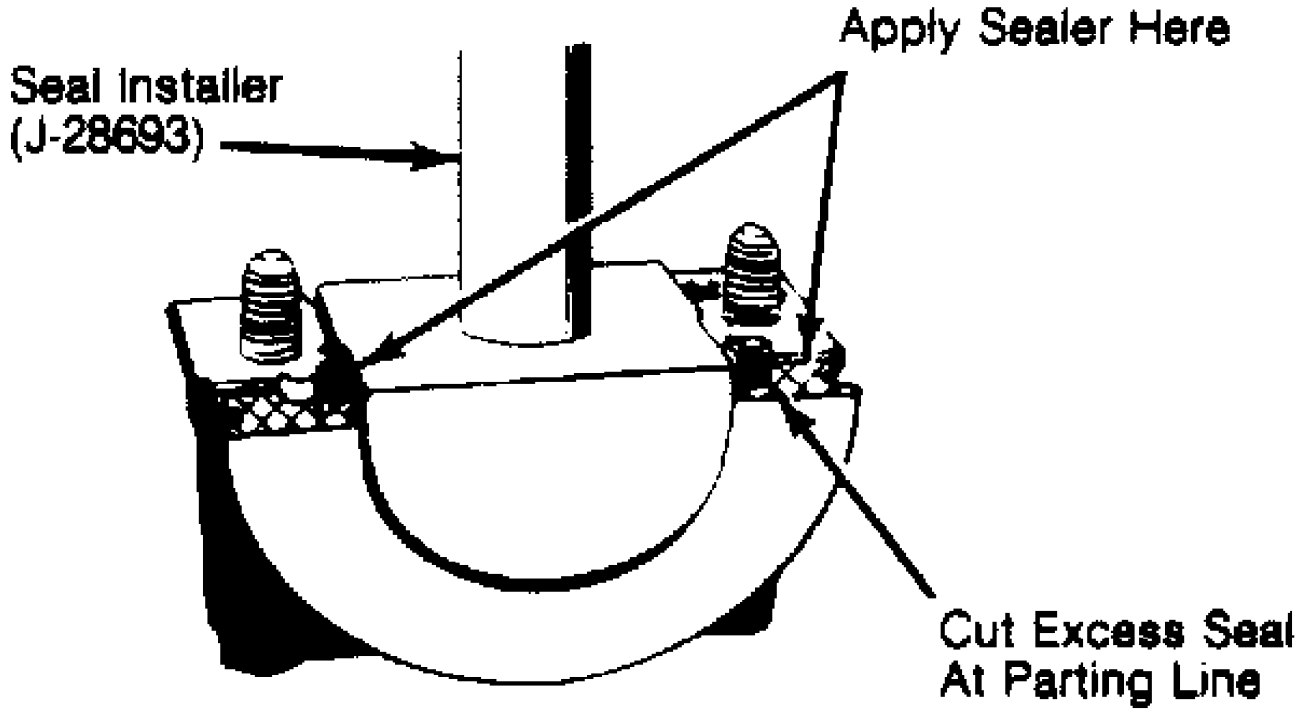

Fig. 28: Typical Rope Seal Installation
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Split-Rubber Type Seal

Follow manufacturers procedures when installing split-rubber type rear main oil seals. Installation procedures vary with engine type. See appropriate ENGINE article in this section. See Fig. 29.

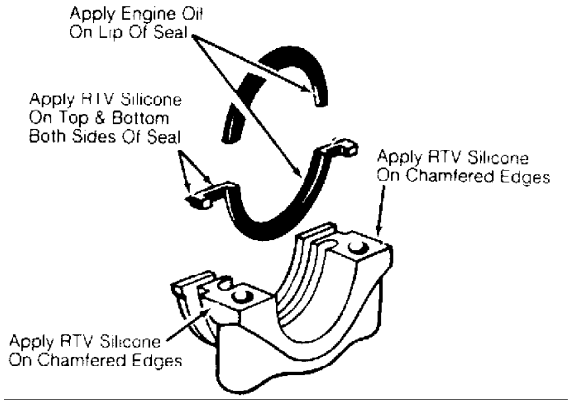

Fig. 29: Typical Split-Rubber Seal Installation
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OIL PUMP

* PLEASE READ THIS FIRST *

NOTE: Always refer to appropriate engine overhaul article in the ENGINES section for complete overhaul procedures and specifications for the vehicle being repaired.

ROTOR-TYPE

Oil pump rotors must be marked for location prior to removal. See Fig. 30. Remove outer rotor and measure thickness and diameter. Measure inner rotor thickness. Inspect shaft for scoring or wear. Inspect rotors for pitting or damage. Inspect cover for grooving or wear. Replace components if worn or damaged.

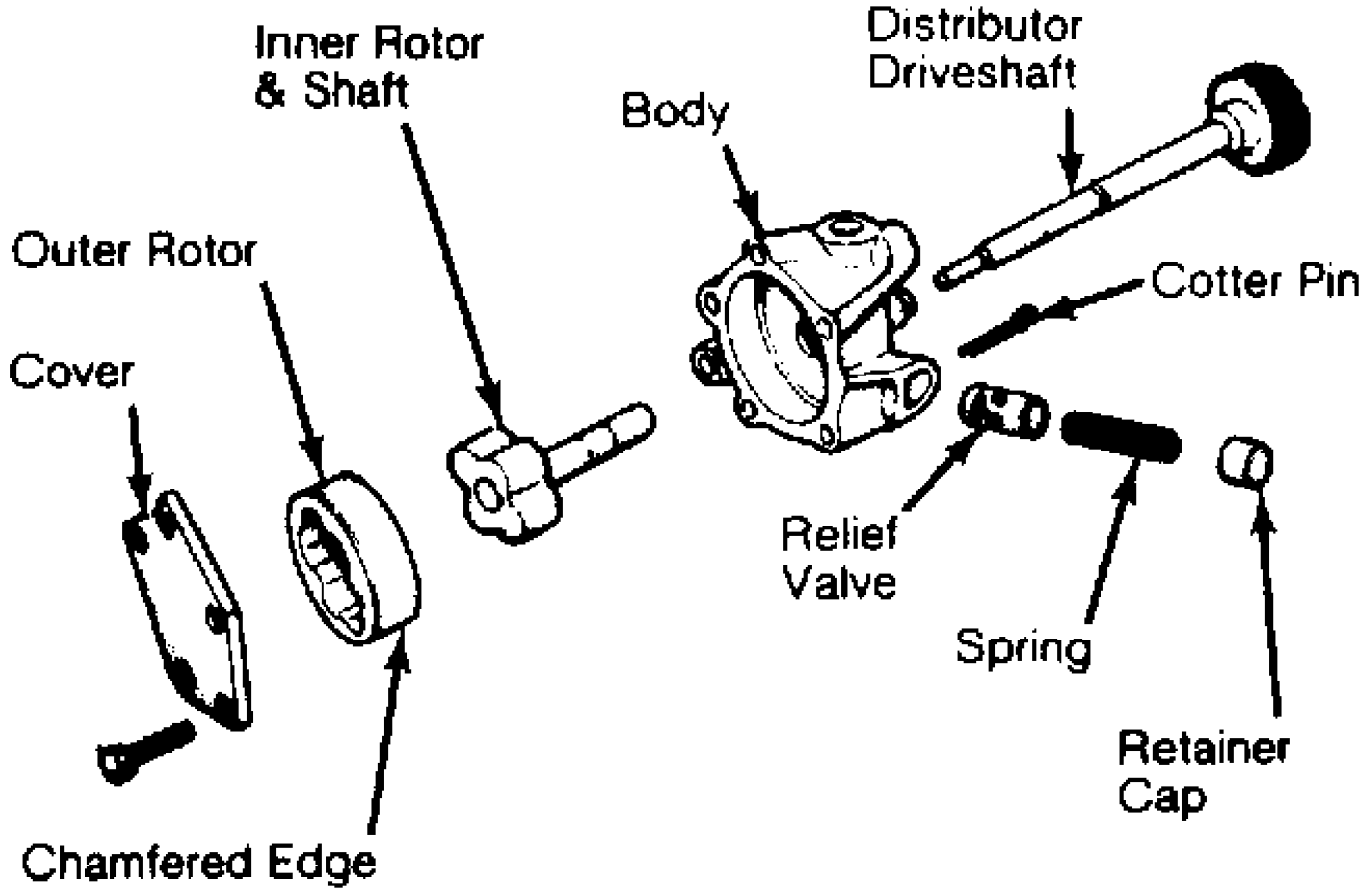

Fig. 30: Typical Rotor Type Oil Pump
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Measure outer rotor-to-body clearance. Replace pump assembly if clearance exceeds specification. Measure clearance between rotors. See Fig. 31. Replace shaft and both rotors if clearance exceeds specifications.

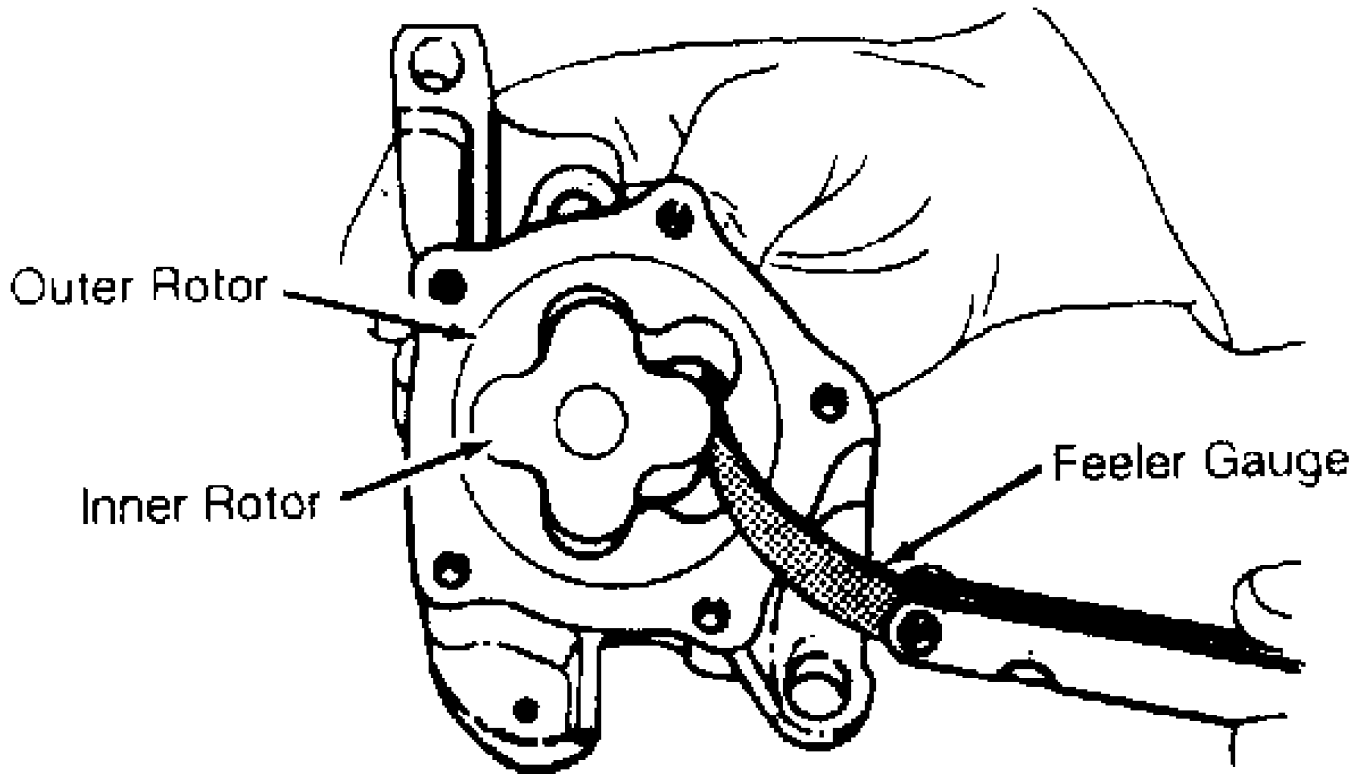

Fig. 31: Measuring Rotor Clearance - Typical
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Install rotors in pump body. Position straightedge across pump body. Using feeler gauge, measure clearance between rotors and straightedge. Pump cover wear is measured using a straightedge and feeler gauge. Replace pump if clearance exceeds specification.

GEAR TYPE

Oil pump gears must be marked for location prior to removal. See Fig. 32. Remove gears from pump body. Inspect gears for pitting or damage. Inspect cover for grooving or wear.

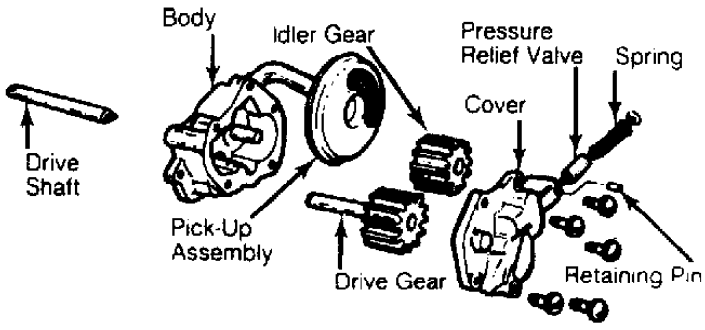

Fig. 32: Typical Gear Type Oil Pump
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Measure gear diameter and length. Measure gear housing cavity depth and diameter. See Fig. 33. Replace components if worn or

damaged.

Pump cover wear is measured using a straightedge and feeler gauge. Pump is to be replaced if warpage or wear exceeds specifications or mating surface of pump cover is scratched or grooved.

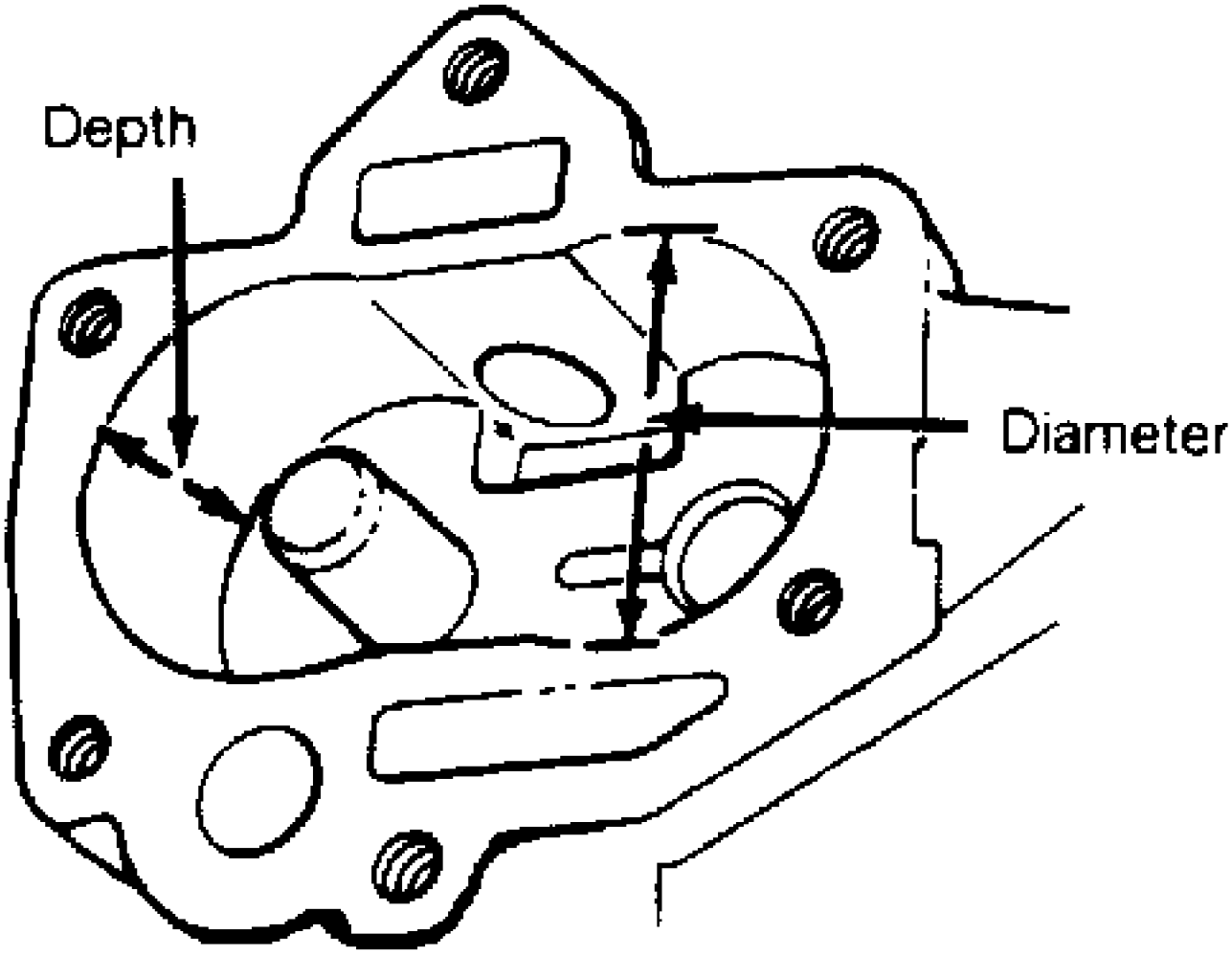

Fig. 33: Measuring Oil Pump Gear Cavity - Typical
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BREAK-IN-PROCEDURE

* PLEASE READ THIS FIRST *

NOTE: Always refer to appropriate engine overhaul article in the ENGINES section for complete overhaul procedures and specifications for the vehicle being repaired.

ENGINE PRE-OILING

Engine pre-oiling should be done prior to operation to prevent engine damage. A lightly oiled pump will cavitate unless oil pump cavities are filled with engine oil or petroleum jelly.

Engine pre-oiling can be done using pressure oiler (if available). Connect pressure oiler to cylinder block oil passage such as oil pressure sending unit. Operate pressure oiler long enough to ensure correct amount of oil has filled crankcase. Check oil level while pre-oiling.

If pressure oiler is not available, disconnect ignition system. Remove oil pressure sending unit and replace with oil pressure test gauge. Using starter motor, rotate engine starter until gauge shows normal oil pressure for several seconds. DO NOT crank engine for more than 30 seconds to avoid starter motor damage.

Ensure oil pressure has reached the most distant point from the oil pump. Reinstall oil pressure sending unit. Reconnect ignition system.

INITIAL START-UP

Start the engine and operate engine at low speed while checking for coolant, fuel and oil leaks. Stop engine. Recheck coolant and oil level. Adjust if necessary.

CAMSHAFT

Break-in procedure is required when a new or reground camshaft has been installed. Operate and maintain engine speed between 1500-2500 RPM for approximately 30 minutes. Procedure may vary due to manufacturers recommendations.

PISTON RINGS

Piston rings require a break-in procedure to ensure seating of rings to cylinder walls. Serious damage may occur to rings if correct procedures are not followed.

Extremely high piston ring temperatures are produced obtained during break-in process. If rings are exposed to excessively high RPM or high cylinder pressures, ring damage can occur. Follow piston ring manufacturer’s recommended break-in procedure.

FINAL ADJUSTMENTS

Check or adjust ignition timing and dwell (if applicable). Adjust valves (if necessary). Adjust carburetion or injection idle speed and mixture. Retighten cylinder heads (if required). If cylinder head or block is aluminum, retighten bolts when engine is cold. Follow the engine manufacturer’s recommended break-in procedure and maintenance schedule for new engines.

NOTE: Some manufacturer’s require that head bolts be retightened after specified amount of operation. This must be done to prevent head gasket failure.

* ENGINE SYSTEMS UNIFORM INSPECTION GUIDELINES *

1998 Mitsubishi Galant

GENERAL INFORMATION
Engine Performance and Maintenance Motorist Assurance Program
Standards For Automotive Repair

All Makes and Models

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INTRODUCTION TO MOTORIST ASSURANCE PROGRAM (MAP)

OVERVIEW OF MOTORIST ASSURANCE PROGRAM

The Motorist Assurance Program is the consumer outreach effort of the Automotive Maintenance and Repair Association, Inc. (AMRA). Participation in the Motorist Assurance Program is drawn from retailers, suppliers, independent repair facilities, vehicle manufacturers and industry associations.

Our organization's mission is to strengthen the relationship between the consumer and the auto repair industry. We produce materials that give motorists the information and encouragement to take greater responsibility for their vehicles-through proper, manufacturer-recommended, maintenance. We encourage participating service and repair shops (including franchisees and dealers) to adopt (1) a Pledge of Assurance to their Customers and (2) the Motorist Assurance Program Standards of Service. All participating service providers have agreed to subscribe to this Pledge and to adhere to the promulgated Standards of Service demonstrating to their customers that they are serious about customer satisfaction.

These Standards of Service require that an inspection of the vehicle's (problem) system be made and the results communicated to the customer according to industry standards. Given that the industry did not have such standards, the Motorist Assurance Program successfully promulgated industry inspection communication standards in 1994-95 for the following systems: Exhaust, Brakes, ABS, Steering and Suspension, Engine Maintenance and Performance, HVAC, and Electrical Systems. Further, revisions to all of these inspection communication standards are continually re-published. In addition to these, standards for Drive Train and Transmissions have recently been promulgated. Participating shops utilize these Uniform Inspection & Communication

Standards as part of the inspection process and for communicating their findings to their customers.

The Motorist Assurance Program continues to work cooperatively and proactively with government agencies and consumer groups toward solutions that both benefit the customer and are mutually acceptable to both regulators and industry. We maintain the belief that industry must retain control over how we conduct our business, and we must be viewed as part of the solution and not part of the problem. Meetings with state and other government officials (and their representatives), concerned with auto repair and/or consumer protection, are conducted. Feedback from these sessions is brought back to the association, and the program adjusted as needed.

To assure auto repair customers recourse if they were not satisfied with a repair transaction, the Motorist Assurance Program offers mediation and arbitration through MAP/BBB-CARE and other non-profit organizations. MAP conducted pilot programs in twelve states before announcing the program nationally in October, 1998. During the pilots, participating repair shops demonstrated their adherence to the Pledge and Standards and agreed to follow the UICS in communicating the results of their inspection to their customers. To put some "teeth" in the program, an accreditation requirement for shops was initiated. The requirements are stringent, and a self-policing method has been incorporated which includes the "mystery shopping" of outlets.

We welcome you to join us as we continue our outreach... with your support, both the automotive repair industry and your customers will reap the benefits. Please visit MAP at our Internet site www.motorist.org or contact us at:

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January 1999

MAP UNIFORM INSPECTION GENERAL GUIDELINES

OVERVIEW OF SERVICE REQUIREMENTS AND SUGGESTIONS

It is MAP policy that all exhaust, brake, steering, suspension, wheel alignment, drive-line, engine performance and maintenance, and heating, ventilation and air conditioning, and electrical services be offered and performed under the standards and procedures specified in these sections.

Before any service is performed on a vehicle, an inspection of the appropriate system must be performed. The results of this inspection must be explained to the customer and documented on an inspection form. The condition of the vehicle and its components will indicate what services/part replacements may be "Required" or "Suggested". In addition, suggestions may be made to satisfy the requests expressed by the customer.

When a component is suggested or required to be repaired or replaced, the decision to repair or replace must be made in the customer’s best interest, and at his or her choice given the options available.

This section lists the various parts and conditions that indicate a required or suggested service or part replacement. Although this list is extensive, it is not fully inclusive. In addition to this list, a technician may make a suggestion. However, any suggestions must be based on substantial and informed experience, or the vehicle manufacturer’s recommended service interval and must be documented.

Some conditions indicate that service or part replacement is

required because the part in question is no longer providing the function for which it is intended, does not meet a vehicle manufacturer's design specification or is missing.

Example:
An exhaust pipe has corroded severely and has a hole in it through which exhaust gases are leaking. Replacement of the exhaust pipe in this case is required due to functional failure.

Example:
A brake rotor has been worn to the point where it measures less than the vehicle manufacturer's discard specifications. Replacement of the rotor is required because it does not meet design specifications.

Some conditions indicate that a service or part replacement is suggested because the part is close to the end of its useful life or addresses a customer's need, convenience or request. If a customer's vehicle has one of these conditions, the procedure may be only to suggest service.

Example:
An exhaust pipe is rusted, corroded or weak, but no leaks are present. In this case, the exhaust pipe has not failed. However, there is evidence that the pipe may need replacement in the near future. Replacement of the pipe may be suggested for the customer's convenience in avoiding a future problem.

Example:
The customer desires improved ride and/or handling, but the vehicle's shocks or struts have not failed. In this case, replacement may be suggested to satisfy the customer's wishes. In this case, replacement of the shocks or struts may not be sold as a requirement.

A customer, of course, has the choice of whether or not a shop will service his or her vehicle. He or she may decide not to follow some of your suggestions. When a repair is required, a MAP shop must refuse partial service on that system if, in the judgment of the service provider, proceeding with the work could create or continue an unsafe condition. When a procedure states that required or suggested repair or replacement is recommended, the customer must be informed of the generally acceptable repair/replacement options whether or not performed by the shop.

When presenting suggested repairs to the customer, you must present the facts, allowing the customer to draw their own conclusions and make an informed decision about how to proceed.

The following reasons may be used for required and suggested services. These codes are shown in the "Code" column of the MAP Uniform Inspection & Communications Standards that follow:

Reasons to Require Repair or Replacement

A – Part no longer performs intended purpose
B – Part does not meet a design specification (regardless of performance)
C – Part is missing

NOTE: When a repair is required, the shop must refuse partial service to the system in question, if the repair creates or continues an unsafe condition.

Reasons to Suggest Repair or Replacement

1 - Part is close to the end of its useful life (just above discard specifications, or weak; failure likely to occur soon, etc.)
2 - To address a customer need, convenience, or request (to stiffen ride, enhance performance, eliminate noise, etc.)
3 - To comply with maintenance recommended by the vehicle's Original Equipment Manufacturer (OEM)
4 - Technician's recommendation based on substantial and informed experience

NOTE: Suggested services are always optional. When presenting suggested repairs to the customer, you must present the facts, allowing the customer to draw their own conclusions and make an informed decision about how to proceed.

ENGINE ASSEMBLIES

SERVICE PROCEDURES REQUIRED AND SUGGESTED FOR PROPER VEHICLE OPERATION

CYLINDER HEAD ASSEMBLIES

NOTE: A Cylinder Head Assembly is a cylinder head fitted with valves, associated springs, retainers, and on overhead camshaft cylinder heads (OHC), camshaft, camshaft bearings, lash adjusters, tappets and rockers.

CYLINDER HEAD ASSEMBLY INSPECTION

Condition	Code	Procedure
Adjustable valve lash is out of specification ...	B	Require repair.
Internal component failure (any component)	A	(1) Require repair or replacement of cylinder head assembly.

(1) - It is Required that all other failure related components be inspected for cause and condition. Additional components or assemblies may be Suggested for repair or replacement, such as a water pump on a short block (reason code 4, technician's recommendation based on substantial and informed experience).

Example:
If there is a failed head gasket with an external coolant leak, in addition to Requiring replacement of the head gasket, inspection of the following for cause and condition is Required: Block, Cooling System, Cylinder Head. It may be Suggested that additional inspections be performed, such as the other head gasket on a V-type engine.

LONG BLOCK ASSEMBLIES

NOTE: A Long Block Assembly is a short block assembly together with a cylinder head assembly and all those components fitted within the rocker or cam cover, and timing cover

(the whole presented as an assembly). A rebuilt or new oil pump, or kit shall be supplied or fitted as appropriate.

LONG BLOCK ASSEMBLY INSPECTION

Condition	Code	Procedure
Internal component failure (any component)	A	(1) Require repair or replacement of the long block assembly.

(1) - It is Required that all other failure related components be inspected for cause and condition. Additional components or assemblies may be Suggested for repair or replacement such as a water pump on a short block (reason code 4, technician's recommendation based on substantial and informed experience).

Example:
If there is a failed head gasket with an external coolant leak, in addition to Requiring replacement of the head gasket, inspection of the following for cause and condition is Required: Block, Cooling System, Cylinder Head. It may be Suggested that additional inspections be performed, such as the other head gasket on a V-type engine.

SHORT BLOCK ASSEMBLIES

NOTE: A Short Block Assembly is a cylinder block and all those components contained within the limits of the block deck or decks, the pan rail, the block rear face and the timing cover (where fitted), including the crankshaft.

SHORT BLOCK ASSEMBLY INSPECTION

Condition	Code	Procedure
Any internal component failure	A	(1) Require repair or replacement of the short block assembly.

(1) - It is Required that all other failure related components be inspected for cause and condition. Additional components or assemblies may be Suggested for repair or replacement, such as a water pump on a short block (reason code 4, technician's recommendation based on substantial and informed experience).

Example:
If there is a failed head gasket with an external coolant leak, in addition to Requiring replacement of the head gasket, inspection of the following for cause and condition is Required: Block, Cooling System, Cylinder Head. It may be Suggested that additional inspections be performed, such as the other head gasket on a V-type engine.

ENGINE COMPONENTS

ACCELERATOR PEDAL POSITION SENSORS

ACCELERATOR PEDAL POSITION SENSOR INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Inoperative	B	(2) Require repair or replacement. Further inspection required.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

ACCESSORY BELTS

ACCESSORY BELT INSPECTION

Condition	Code	Procedure
Alignment incorrect	B	(1) Further inspection required.
Cracked	1	Suggest replacement.
Frayed	1	Suggest replacement.
Missing	C	Require replacement.
Noisy	2	(2) Further inspection required.
Plies separated	A	Require replacement.
Tension out of specification	B	Require adjustment or replacement.
Worn beyond adjustment range	B	Require replacement.
Worn so it contacts bottom of pulley	A	Require replacement.

(1) - Determine cause of incorrect alignment and require repair.
(2) - Determine cause of noise and suggest repair.

ACCESSORY PULLEYS

ACCESSORY PULLEY INSPECTION

Condition	Code	Procedure
Alignment incorrect	B	Require repair or replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Bent	A	Require replacement.
Cracked	A	Require replacement.
Loose	A	Require repair or replacement.
Missing	C	Require replacement.
Pulley damaged, affecting belt life	A	Require replacement.

ACTUATORS

See SENSORS AND ACTUATORS.

AIR CONDITIONING CYCLING SWITCHES

AIR CONDITIONING CYCLING SWITCH INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.

Condition	Code	Procedure
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Inoperative	B	(3) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Restricted, affecting performance	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

AIR CONDITIONING PRESSURE SENSORS

AIR CONDITIONING PRESSURE SENSOR INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.

Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Inoperative	B	(3) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Restricted, affecting performance	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

AIR DUCTS AND TUBES

AIR DUCT AND TUBE INSPECTION

Condition	Code	Procedure

Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Restricted, affecting performance	A	Require repair or replacement.

AIR FILTER ELEMENTS

AIR FILTER ELEMENT INSPECTION

Condition	Code	Procedure
Leaking	A	Require replacement.
Paper filter element oil-soaked	A	(1) Require replacement.
Maintenance intervals	3	Suggest replacement to comply with vehicle's OEM recommended service intervals.
Melted	A	Required replacement.
Missing	C	Require replacement.
Restricted, affecting performance	A	Require replacement.
Water-contaminated	A	(1) Require replacement.

(1) - Further inspection required to determine cause.

AIR FILTER GASKETS

See AIR FILTER HOUSINGS AND GASKETS.

AIR FILTER HOUSINGS AND GASKETS

AIR FILTER HOUSING AND GASKET INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.

AIR FUEL RATIO SENSORS

AIR FUEL RATIO SENSOR INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Inoperative	B	(3) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Restricted, affecting performance	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

AIR INJECTION CONTROL SOLENOIDS

AIR INJECTION CONTROL SOLENOID INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Inoperative	B	(2) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Restricted, affecting performance	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

AIR PLENUMS

AIR PLENUM INSPECTION

Condition	Code	Procedure
Integrated air or fuel control components inoperative	A	(1) Require repair or replacement.
Internal air or fuel components damaged, affecting performance	A	Require repair or replacement of component.
Internal air or fuel components damaged, not affecting performance		No service suggested or required.
Internal air or fuel components missing	C	Require replacement of component.
Leaking	A	Require repair or replacement.
Restricted	A	Require repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require repair or replacement.

(1) - Inoperative includes intermittent operation or out of OEM specification.

AIR PUMP BELTS

AIR PUMP BELT INSPECTION

Condition	Code	Procedure
Alignment incorrect	B	(1) Further inspection required.
Cracked	1	Suggest replacement.
Frayed	1	Suggest replacement.
Maintenance intervals	3	Suggest replacement to comply with vehicle OEM recommended service intervals.
Missing	C	Require replacement.
Noisy	2	(2) Further inspection required.
Plies separated	A	Require replacement.
Tension out of specification	B	Require adjustment or replacement.
Worn beyond adjustment range	B	Require replacement.
Worn so it contacts bottom of pulley	A	Require replacement.

(1) - Determine cause of incorrect alignment and require repair.
(2) - Determine cause of noise and suggest repair.

AIR PUMPS (ELECTRIC-DRIVEN)

AIR PUMP (ELECTRIC-DRIVEN) INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Inoperative	A	(2) Require replacement.
Leaking	A	Require replacement.
Missing	C	Require replacement.
Noisy	2	Suggest replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Inoperative includes intermittent operation or out of OEM specification.

AIR TUBES

See AIR DUCTS AND TUBES.

ASPIRATOR, CHECK AND DECEL VALVES

ASPIRATOR, CHECK AND DECEL VALVE INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement

			of hardware.
Inoperative	A	(1)	Require repair or replacement.
Leaking	A		Require replacement.
Melted, affecting performance	A		Require replacement.
Melted, not affecting performance	..		No service suggested or required.
Missing	C		Require replacement.
Threads damaged	A	..	Require repair or replacement.
Threads stripped (threads missing)	A	..	Require repair or replacement.

(1) - Inoperative includes intermittent operation or out of OEM specification.

BAFFLES

See SHROUDS, BAFFLES AND DEFLECTORS.

BALLAST PRIMARY SUPPLY RESISTOR WIRES

See BALLAST RESISTORS AND PRIMARY SUPPLY RESISTOR WIRES.

BALLAST RESISTORS AND PRIMARY SUPPLY RESISTOR WIRES

BALLAST RESISTOR AND PRIMARY SUPPLY RESISTOR WIRE INSPECTION

Condition	Code		Procedure
Attaching hardware broken	A	...	Require repair or replacement of hardware.
Attaching hardware missing	C		Require replacement of hardware.
Attaching hardware not functioning	A	...	Require repair or replacement of hardware.
Conductor exposed	A		Require replacement.
Connector broken	A	..	Require repair or replacement.
Connector melted	A	(1)	Require repair or replacement.
Connector missing	C		Require replacement.
Inoperative	A	(2)	Require replacement.
Insulation overheated	A		Require replacement.
Terminal broken	A	..	Require repair or replacement.
Terminal burned, affecting performance	A		Require repair or replacement.
Terminal burned, not affecting performance	2	..	Suggest repair or replacement.
Terminal corroded, affecting performance	A	..	Require repair or replacement.
Terminal corroded, not affecting performance	2	..	Suggest repair or replacement.
Terminal loose, affecting performance	B	..	Require repair or replacement.
Terminal loose, not affecting performance	1	..	Suggest repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Inoperative includes intermittent operation or out of OEM specification.

BAROMETRIC PRESSURE SENSORS

BAROMETRIC PRESSURE SENSOR INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Inoperative	B	(3) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Restricted, affecting performance	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or

replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

BATTERIES

Proper operation of any electrical system or component can be affected by battery condition. The battery(ies) must meet or exceed minimum specification for vehicle as equipped and test to that specific battery's CCA.

Definition of Terms

* Battery Performance Testing
  Testing that determines whether or not a battery meets both vehicle OEM and battery manufacturer's specifications.

* Cold Cranking Amp (CCA) Rating
  The number of amperes a new, fully charged battery at 0° F (-17.8° C) can deliver for 30 seconds and maintain at least a voltage of 1.2 volts per cell (7.2 volts for a 12-volt battery).

* Cranking Amps (CA)
  The number of amperes a new, fully charged battery, typically at 32° F (0° C) can deliver for 30 seconds and maintain at least a voltage of 1.2 volts per cell (7.2 volts for a 12-volt battery).

* OEM Cranking Amps
  The minimum CCA required by the original vehicle manufacturer for a specific vehicle.

BATTERY INSPECTION

Condition	Code	Procedure
Battery frozen	..	(1) Further inspection required.
Case leaking	A	Require replacement.
Casing swollen	A	(2) Further inspection required.
Circuit open internally	A	Require replacement.
Electrolyte contamination	A	(2) Further inspection required.
Electrolyte discoloration	A	(2) Further inspection required.
Fails to accept and hold charge	A	(3) Require replacement.
Fluid level low	B	(4) Further inspection required.
Out of performance specification for battery	B	(5) Require replacement.
Out of specification for application	B	(5) Require replacement.

Post (top or side) burned, affecting performance ..	A	.....	(6) Require repair or replacement.
Post (top or side) burned, not affecting performance	2	.....	(6) Suggest repair or replacement.
Post (top or side) corroded, affecting performance	A	.....	Require repair.
Post (top or side) corroded, not affecting performance	2	.....	Suggest repair.
Post (top or side) loose	A	.....	Require replacement.
Post (top or side) melted, affecting performance	A	.....	(6) Require repair or replacement.
Post (top or side) melted, not affecting performance	2	.....	(6) Suggest repair or replacement.
Specific gravity low	B	.....	(7) Further inspection required.
State of charge low	A	.....	(7) Further inspection required.
Top dirty	2	.....	Suggest cleaning battery.
Top wet	A	...	(8) Require cleaning battery. Further inspection required.
Vent cap loose	A	...	Require repair or replacement of vent cap.
Vent cap missing	C	.....	Require replacement of vent cap.

(1) – DO NOT attempt to charge a frozen battery. Allow battery to warm thoroughly and then performance-test. If battery fails performance test, require replacement.
(2) – No service suggested or required unless the battery fails performance test, in which case, require replacement.
(3) – This phrase refers to a battery that fails to either accept and/or retain a charge using appropriate times listed in the Battery Charging Guide of the BCI Service Manual, battery charger operating manual, or battery manufacturer's specifications.
(4) – Determine cause of low fluid level. Refill to proper level(s) with water (distilled water preferred). Recharge battery and performance-test.
(5) – The battery may meet battery manufacturer's specifications but test below the minimum specification defined by the vehicle's OEM for that vehicle.
(6) – Determine cause and correct prior to repair or replacement of part.
(7) – Recharge and test to manufacturer's specifications. If battery fails performance test, require replacement.
(8) – Check fluid level and adjust to manufacturer's specification. Suggest checking charging system for proper operation.

BATTERY CABLE, WIRE AND CONNECTOR INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require repair or replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Insulation damaged, conductors exposed	A	(2) Require repair or replacement.
Insulation damaged, conductors not exposed	1	Suggest replacement.
Open	A	Require repair or replacement.
Protective shield (conduit) melted	2	(1) Suggest repair or replacement.
Protective shield (conduit) missing	2	Suggest repair or replacement.
Resistance (voltage drop) out of specification	A	Require repair or replacement.
Routed incorrectly	B	Require repair.
Secured incorrectly	B	Require repair.
Shorted	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Voltage drop out of specification	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Exposed conductor at replacement (aftermarket) terminal end does not require repair or replacement.

BATTERY CONNECTORS

See BATTERY CABLES, WIRES AND CONNECTORS.

BATTERY TRAYS AND HOLD DOWN HARDWARE

BATTERY TRAY AND HOLD DOWN HARDWARE INSPECTION

Condition	Code	Procedure
Battery improperly secured	2	Suggest repair.
Bent, affecting performance	A	Require repair or replacement.
Bent, not affecting performance	..	No service suggested or required.
Broken, affecting performance	A	Require repair or replacement.
Broken, not affecting performance	..	No service suggested or required.
Corroded, affecting performance	A	Require repair or replacement.
Corroded, not affecting performance	2	Suggest repair or replacement.
Cracked, affecting performance	A	Require repair or replacement.
Cracked, not affecting performance	1	Suggest repair or replacement.
Missing	C	Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Water drain clogged	A	Require repair.

BATTERY WIRES

See BATTERY CABLES, WIRES AND CONNECTORS.

BELT-DRIVEN AIR PUMPS

BELT-DRIVEN AIR PUMP INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Inoperative	A	(1) Require replacement.
Leaking	A	Require replacement.
Missing	C	Require replacement.
Noisy	2	Suggest replacement.
Pulley alignment incorrect	B	Require repair or replacement.
Pulley bent	A	Require replacement.
Pulley cracked	A	Require replacement.
Pulley loose	A	Require repair or replacement.
Pulley missing	C	Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads		

missing)	A	..	Require repair or replacement.

(1) - Inoperative includes intermittent operation or out of OEM specification.

BELT IDLER ASSEMBLIES (ACCESSORY AND CAM BELTS)

BELT IDLER ASSEMBLY (ACCESSORY AND CAM BELT) INSPECTION

Condition	Code	Procedure
Alignment incorrect	B	.. Require repair or replacement.
Attaching hardware broken	A	... Require repair or replacement of hardware.
Attaching hardware missing	C	..... Require replacement of hardware.
Attaching hardware not functioning	A	... Require repair or replacement of hardware.
Bearings worn	1	..... Suggest replacement.
Cracked	2	..... Suggest replacement.
Missing	C	..... Require replacement.
Noisy	2	..... Suggest replacement.
Seized	A	.. Require repair or replacement.

BELT TENSIONERS (ACCESSORY AND CAM BELTS)

BELT TENSIONER (ACCESSORY AND CAM BELT) INSPECTION

Condition	Code	Procedure
Alignment incorrect	B	.. Require repair or replacement.
Attaching hardware broken	A	.. Require repair or replacement of hardware.
Attaching hardware missing	C	..... Require replacement of hardware.
Attaching hardware not functioning	A	... Require repair or replacement of hardware.
Bearings worn	1	..... Suggest replacement.
Belt tension incorrect ..	B	... Require adjustment or repair.
Cracked	2	..... Suggest replacement.
Missing	C	..... Require replacement.
Noisy	2	..... Suggest replacement.
Pulley damaged, affecting belt life	A	..... Require replacement.
Seized	A	.. Require repair or replacement.

BOOST CONTROL MECHANISMS

See WASTE GATES AND BOOST CONTROL MECHANISMS.

CAMSHAFT POSITION SENSORS

CAMSHAFT POSITION SENSOR INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Inoperative	B	(3) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

CARBURETORS AND CHOKES

NOTE: Proper operation of a carburetor includes the ability to control air/fuel mixtures during all phases or driving operation to comply with all federal and local emissions standards. Adjustments are to be considered repairs.

CARBURETOR AND CHOKE INSPECTION

Condition	Code	Procedure
Air/fuel control incorrect	B	Require repair or replacement.
Application incorrect	B	Require repair or replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Components binding	A	Require repair or replacement.
Components damaged, affecting operation or performance	A	Require repair or replacement.
Components missing	C	Require replacement of components.
Contaminated	A	(1) Require repair or replacement. Further inspection required.
Controlling linkages binding	A	Require repair or replacement of linkage.
Leaking	A	Require repair or replacement.
Mechanical operation incorrect	B	Require repair or replacement.
Operating incorrectly	B	Require repair or replacement.

(1) - Some components may be serviceable; check for accepted cleaning procedure. Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.

CASTING CORE PLUGS AND EXPANSION PLUGS

CASTING CORE PLUG AND EXPANSION PLUG INSPECTION

Condition	Code	Procedure
Leaking	A	Require replacement.
Material type incorrect	2	Suggest replacement.

CHARGE AIR COOLERS "INTERCOOLERS" (CAC)

CHARGE AIR COOLER "INTERCOOLER" (CAC) INSPECTION

Condition	Code	Procedure
Air-to-air intercooler leaking, affecting boost performance	A	Require repair or replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware		

Condition	Code	Procedure
missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Leaking coolant	A	Require repair or replacement.
Missing	C	Require replacement.
Restricted, affecting performance	A	Require repair or replacement.

CHECK VALVES

See ASPIRATOR, CHECK AND DECEL VALVES.

CHOKES

See CARBURETORS AND CHOKES.

CLUTCH PEDAL POSITION SWITCHES

CLUTCH PEDAL POSITION SWITCH INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Inoperative	B	(2) Require repair or replacement. Further inspection required.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors		

exposed	B	..	Require repair or replacement.
Wire lead corroded	A	..	Require repair or replacement.
Wire lead open	A	..	Require repair or replacement.
Wire lead shorted	A	..	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

COLD START INJECTORS

See FUEL AND COLD START INJECTORS.

CONNECTORS

See WIRING HARNESSES AND CONNECTORS.

COOLANT

COOLANT INSPECTION

Condition	Code	Procedure
Acidity (pH) incorrect	1	Suggest correction or replacement.
Contaminated	B	(1) Require replacement or recycling. Further inspection required.
Level low	B	(2) Require filling to proper level.
Maintenance intervals	3	(3) Suggest replacement.
Mixture incorrect	B	Require correction or replacement.
Type incorrect	B	Require replacement.

(1) - Determine source of contamination and require correction prior to coolant replacement.
(2) - Determine source of incorrect level and suggest repair.
(3) - The system should be drained and/or flushed and refilled with correct coolant according to OEM recommended service interval and procedures.

COOLANT RECOVERY TANKS

COOLANT RECOVERY TANK INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Leaking	A	Require repair or replacement.

Missing (if original equipment)	C	Require replacement.

COOLING FAN MOTOR MODULES

See COOLING FAN MOTOR RELAYS AND MODULES.

COOLING FAN MOTOR RELAYS AND MODULES

COOLING FAN MOTOR RELAY AND MODULE INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A ...	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A ...	Require repair or replacement of hardware.
Connector broken	A ..	Require repair or replacement.
Connector (Weatherpack type) leaking	A ..	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Housing cracked	2 ..	Suggest repair or replacement.
Malfunctioning	A	(2) Require repair or replacement.
Missing	C	Require replacement.
Terminal broken	A ..	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance ..	2 ..	Suggest repair or replacement.
Terminal corroded, affecting performance ..	A ..	Require repair or replacement.
Terminal corroded, not affecting performance ..	2 ..	Suggest repair or replacement.
Terminal loose, affecting performance	B ..	Require repair or replacement.
Terminal loose, not affecting performance ..	1 ..	Suggest repair or replacement.
Wire lead conductors exposed	B ..	Require repair or replacement.
Wire lead corroded	A ..	Require repair or replacement.
Wire lead open	A ..	Require repair or replacement.
Wire lead shorted	A ..	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Includes inoperative, intermittent operation, failure to perform all functions, or out of OEM specification.

COOLING FAN MOTOR RESISTORS

COOLING FAN MOTOR RESISTOR INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Missing	C	Require replacement.
Open	A	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Shorted	A	Require replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.

COOLING FAN MOTOR SENSORS AND SWITCHES

COOLING FAN MOTOR SENSOR AND SWITCH INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or

			replacement.
Inoperative	B		(3) Require repair or replacement. Further inspection required.
Leaking	A		Require repair or replacement.
Missing	C		Require replacement.
Resistance out of specification	B		Require repair or replacement.
Terminal broken	A		Require repair or replacement.
Terminal burned, affecting performance	A		(1) Require repair or replacement.
Terminal burned, not affecting performance	2		Suggest repair or replacement.
Terminal corroded, affecting performance	A		Require repair or replacement.
Terminal corroded, not affecting performance	2		Suggest repair or replacement.
Terminal loose, affecting performance	B		Require repair or replacement.
Terminal loose, not affecting performance	1		Suggest repair or replacement.
Threads damaged	A		Require repair or replacement.
Threads stripped (threads missing)	A		Require replacement.
Wire lead conductors exposed	B		Require repair or replacement.
Wire lead corroded	A		Require repair or replacement.
Wire lead open	A		Require repair or replacement.
Wire lead shorted	A		Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

COOLING FAN MOTOR SWITCHES

See COOLING FAN MOTOR SENSORS AND SWITCHES.

COOLING FAN MOTORS

COOLING FAN MOTOR INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.

Condition	Code	Procedure
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Hydraulic fan motor leaking	A	Require repair or replacement.
Inoperative	A	(2) Require replacement.
Missing	C	Require replacement.
Noisy	2	Suggest replacement.
Rotation incorrect for application	B	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Vibration	1	Suggest replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Check fan motor/controls. Inoperative includes intermittent operation or out of OEM specification.

CRANKSHAFT POSITION SENSORS

CRANKSHAFT POSITION SENSOR INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	Require repair or replacement.
Inoperative	B	Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.

Missing	C		Require replacement.
Resistance out of specification	B	..	Require repair or replacement.
Terminal broken	A	..	Require repair or replacement.
Terminal burned, affecting performance	A		(1) Require repair or replacement.
Terminal burned, not affecting performance	2	..	Suggest repair or replacement.
Terminal corroded, affecting performance	A	..	Require repair or replacement.
Terminal corroded, not affecting performance	2	..	Suggest repair or replacement.
Terminal loose, affecting performance	B	..	Require repair or replacement.
Terminal loose, not affecting performance	1	..	Suggest repair or replacement.
Threads damaged	A	..	Require repair or replacement.
Threads stripped (threads missing)	A		Require replacement.
Wire lead conductors exposed	B	..	Require repair or replacement.
Wire lead corroded	A	..	Require repair or replacement.
Wire lead open	A	..	Require repair or replacement.
Wire lead shorted	A	..	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

DECEL VALVES

See ASPIRATOR, CHECK AND DECEL VALVES.

DEFLECTORS

See SHROUDS, BAFFLES AND DEFLECTORS.

DIP STICKS AND TUBES

DIP STICK AND TUBE INSPECTION

Condition	Code		Procedure
Application incorrect	B		Require replacement.
Bent	2	..	Suggest repair or replacement.
Broken, affecting performance (for example, fuel mixture)	A	..	Require repair or replacement.
Broken, not affecting performance	2	..	Suggest repair or replacement.
Leaking, affecting performance (for example, fuel mixture)	A	..	Require repair or replacement.
Leaking, not affecting performance	2	..	Suggest repair or replacement.
Missing	C		Require replacement.

DIP STICK TUBES

See DIP STICKS AND TUBES.

DISTRIBUTOR ADVANCES AND RETARDERS (MECHANICAL AND VACUUM)

DISTRIBUTOR ADVANCE AND RETARDER (MECHANICAL AND VACUUM) INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Binding	A	Require repair or replacement.
Inoperative	A	(1) Require repair or replacement.
Leaking	A	Require replacement.
Out of specification	B	Require repair or replacement.

(1) - Inoperative includes intermittent operation.

DISTRIBUTOR BOOTS AND SHIELDS

DISTRIBUTOR BOOT AND SHIELD INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Deteriorated	A	Require replacement.
Leaking	A	Require replacement.
Missing	A	Require replacement.
Torn	A	Require replacement.

DISTRIBUTOR CAPS

DISTRIBUTOR CAP INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Arcing	A	Require replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Burned	A	Require replacement.
Carbon button missing	A	Require replacement.
Carbon button worn, affecting performance	A	Require replacement.
Carbon button worn, not affecting performance	1	Suggest replacement.
Carbon-tracked	A	Require replacement.
Cracked	A	Require replacement.
Loose	2	Suggest repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal eroded, affecting performance	A	Require repair or replacement.
Terminal eroded, not affecting performance		No service suggested or required.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.

DISTRIBUTOR RETARDERS (MECHANICAL AND VACUUM)

See DISTRIBUTOR ADVANCES AND RETARDERS (MECHANICAL AND VACUUM).

DISTRIBUTOR ROTORS

DISTRIBUTOR ROTOR INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Carbon-tracked	A	Require replacement.
Contact burned	A	Require replacement.
Corroded	1	Suggest replacement.

Eroded	1	Suggest replacement.
Loose	A	Require repair or replacement.
Out of specification	B	Require replacement.

DISTRIBUTOR SHIELDS

See DISTRIBUTOR BOOTS AND SHIELDS.

DISTRIBUTORS

DISTRIBUTOR INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Bushings worn, affecting performance	A	Require repair or replacement.
Bushings worn, not affecting performance	1	Suggest repair or replacement.
Cam lobes worn, affecting performance	A	Require repair or replacement.
Cam lobes worn, not affecting performance	1	Suggest repair or replacement.
Gear broken	A	Require repair or replacement.
Gear worn, affecting performance	A	Require replacement.
Gear worn, not affecting performance		No service suggested or required.
Integrated pickup triggering device loose	A	Require repair or replacement.
Integrated pickup triggering device magnetism incorrect	A	Require repair or replacement.
Leaking oil internally	A	Require repair or replacement.
Noisy	2	Suggest repair or replacement.
Pickup triggering device (reluctor) broken	A	Require repair or replacement.
Pickup triggering device (reluctor) loose	A	Require repair or replacement.
Pickup triggering device (reluctor) weak	A	Require repair or replacement.
Reluctor (pickup triggering device) broken	A	Require repair or replacement.
Reluctor (pickup triggering device) loose	A	Require repair or replacement.
Reluctor (pickup triggering device) weak	A	Require repair or replacement.
Shaft bent	A	Require replacement.
Thrust washer broken	A	Require repair or replacement.

Thrust washer missing	C	Require repair or replacement.
Thrust washer worn, affecting performance	A	Require repair or replacement.
Thrust washer worn, not affecting performance	1	Suggest repair or replacement.

EARLY FUEL EVAPORATION VALVES (HEAT RISER ASSEMBLIES)

EARLY FUEL EVAPORATION VALVE (HEAT RISER ASSEMBLY) INSPECTION

Condition	Code	Procedure
Broken	A	Require replacement of affected parts.
Diaphragm inoperative	A	(1) Further inspection required.
Leaking	A	Require repair or replacement.
Noisy	2	Suggest repair or replacement.
Seized	A	Require replacement of affected parts.
Spring broken	B	Require replacement of spring(s).
Spring inoperative	A	(2) Require replacement of spring(s).

(1) - Inoperative includes intermittent operation or out of OEM specification. If the inoperative diaphragm is separate from the heat riser, then require replacement of the inoperative diaphragm. If the inoperative diaphragm is part of the heat riser, then replace the heat riser.
(2) - Inoperative includes intermittent operation or out of OEM specification.

EGR COOLERS

See EGR PLATES AND COOLERS.

EGR EXHAUST MANIFOLD PASSAGES

See EGR INTAKE AND EXHAUST MANIFOLD PASSAGES.

EGR INTAKE AND EXHAUST MANIFOLD PASSAGES

EGR INTAKE AND EXHAUST MANIFOLD PASSAGE INSPECTION

Condition	Code	Procedure
Leaking	A	Require repair or replacement.
Restricted, affecting performance	A	Require repair or replacement.

EGR PLATES AND COOLERS

EGR PLATE AND COOLER INSPECTION

Condition	Code	Procedure
Leaking	A	Require repair or replacement.

Missing	C	Require replacement.
Restricted, affecting performance	A	Require repair or replacement.

ELECTRONIC SPARK CONTROL MODULES

ELECTRONIC SPARK CONTROL MODULE INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	A	Require repair.
Contaminated	A	(2) Require repair or replacement.
Leaking	A	Require repair or replacement.
Malfunctioning	A	(3) Require repair or replacement.
Missing	C	Require replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement of source.
(3) - Includes inoperative, intermittent operation, failure to

perform all functions, or out of OEM specification.

ELECTRONIC TRANSMISSION CONTROL DEVICES

ELECTRONIC TRANSMISSION CONTROL DEVICE INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Leaking	A	Require repair or replacement.
Malfunctioning	A	(3) Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Restricted, affecting performance	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.

(3) - Includes inoperative, intermittent operation, failure to perform all functions, or out of OEM specification.

ELECTRONIC TRANSMISSION FEEDBACK DEVICES

ELECTRONIC TRANSMISSION FEEDBACK DEVICE INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Inoperative	B	(3) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Restricted, affecting performance	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant,

fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

ENGINE COOLANT TEMPERATURE SENSORS

ENGINE COOLANT TEMPERATURE SENSOR INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Inoperative	B	(3) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Restricted, affecting performance	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

ENGINE COOLING SYSTEMS

NOTE: Overheating, poor engine performance, and insufficient cabin heat can be affected by, but are not limited to, all of the components in the engine cooling system.

ENGINE COVERS (OIL PAN, VALVE COVER, TIMING COVER)

ENGINE COVER (OIL PAN, VALVE COVER, TIMING COVER) INSPECTION

Condition	Code	Procedure
Attaching hardware incorrect	B	Require replacement.
Attaching hardware loose	A	Require repair or replacement.
Attaching hardware missing	C	Require replacement.
Baffle loose	2	Suggest repair or replacement.
Baffle missing	C	Require replacement.
Bent, affecting performance	A	Require repair or replacement.
Bent, not affecting performance		No service suggested or required.
Cracked (not leaking)	2	Suggest repair or replacement.
Leaking externally	A	Require repair or replacement.
Leaking internally, causing fluid contamination	A	Require repair or replacement.
Missing	C	Require replacement.
Restricted passage	A	Require repair or replacement.
Threads damaged	A	Require repair or replacement.

ENGINE OIL

ENGINE OIL INSPECTION

Condition	Code	Procedure
Contaminated	A	(1) Require replacement of oil and filter.
Level high	B	Determine source of incorrect level and require repair.
Level low	B	Determine source of incorrect level and require repair.
Maintenance intervals	3	Suggest replacement to comply with vehicle's OEM recommended service intervals.

(1) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water when changing oil. Require

repair or replacement.

ENGINE OIL CANISTERS

See ENGINE OIL FILTERS AND CANISTERS.

ENGINE OIL COOLERS (EXTERNAL)

ENGINE OIL COOLER (EXTERNAL) INSPECTION

Condition	Code	Procedure
Air flow restriction	A	Require repair or replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Bypassed	A	Require repair or replacement.
Connection leaking	A	Require repair or replacement.
Corroded	1	Suggest repair or replacement.
Fins damaged, affecting performance	A	Require repair or replacement.
Fins damaged, not affecting performance	2	Suggest repair or replacement.
Fluid flow restrictions	A	Require repair or replacement.
Internal restrictions, affecting performance	A	Require repair or replacement.
Leaking	A	Require repair or replacement.
Missing	A	Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

ENGINE OIL DRAIN PLUGS AND GASKETS

ENGINE OIL DRAIN PLUG AND GASKET INSPECTION

Condition	Code	Procedure
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Threads damaged	A	(1) Require repair or replacement.

(1) - Some OEMs require replacement of drain plug gasket when removing drain plug. Inspect threads in oil pan for damage.

ENGINE OIL FILTERS AND CANISTERS

ENGINE OIL FILTER AND CANISTER INSPECTION

Condition	Code	Procedure
Bulged	A	(1) Require replacement.

			Further inspection required.
Canister attaching hardware broken	A	...	Require repair or replacement of hardware.
Canister attaching hardware loose	A	...	Require repair.
Canister attaching hardware missing	C	...	Require replacement.
Canister attaching hardware not functioning	A	...	Require repair or replacement of hardware.
Center tube collapsed	A	...	(2) Require replacement.
			Further inspection required.
Contaminated	A	...	(3) Require replacement of oil and filter.
Dented	2	...	(4) Suggest replacement.
			Further inspection required.
Leaking	A	..	Require repair or replacement.
Maintenance intervals	3	...	Suggest replacement to comply with vehicle's OEM recommended service intervals.

(1) - Inspect pressure relief valve.
(2) - Inspect bypass.
(3) - Determine cause of contamination, such as engine coolant, fuel, metal particles, or water when changing oil. Require repair or replacement.
(4) - Determine cause, such as broken motor mount.

ENGINE OIL GASKETS

See ENGINE OIL DRAIN PLUGS AND GASKETS.

ENGINE OIL PRESSURE GAUGES (MECHANICAL)

ENGINE OIL PRESSURE GAUGE (MECHANICAL) INSPECTION

Condition	Code	Procedure
Indicates out of range	B	(1) Further inspection required.
Inoperative	A	(2) Further inspection required.
Leaking	A	.. Require repair or replacement.
Reads inaccurately	2	.. Suggest repair or replacement.

(1) - Gauge may indicate problem with contaminated oil, level, pressure, or temperature, or problem with gauge.
(2) - Gauge may indicate problem with contaminated oil, level, pressure, or temperature, or problem with gauge. Inoperative includes intermittent operation, out of OEM specification, or out of range. Further inspection required to determine cause.

EVAPORATIVE EMISSION (EVAP) CANISTER FILTERS

EVAPORATIVE EMISSION (EVAP) CANISTER FILTER INSPECTION

Condition	Code	Procedure

Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Maintenance interval	3	Suggest replacement to comply with OEM recommended service interval.
Missing	C	Require replacement.
Restricted, affecting performance	A	Require replacement.
Restricted, not affecting performance	1	Suggest replacement.
Water-contaminated	A	Require replacement.

EVAPORATIVE EMISSION (EVAP) CANISTER PURGE DEVICES

EVAPORATIVE EMISSION (EVAP) CANISTER PURGE DEVICE INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Inoperative	B	(3) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Restricted, affecting performance	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.

Terminal loose, affecting performance	B	..	Require repair or replacement.
Terminal loose, not affecting performance	1	..	Suggest repair or replacement.
Threads damaged	A	..	Require repair or replacement.
Threads stripped (threads missing)	A	.....	Require replacement.
Wire lead conductors exposed	B	..	Require repair or replacement.
Wire lead corroded	A	..	Require repair or replacement.
Wire lead open	A	..	Require repair or replacement.
Wire lead shorted	A	..	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

EVAPORATIVE EMISSION (EVAP) CANISTERS

EVAPORATIVE EMISSION (EVAP) CANISTER INSPECTION

Condition	Code	Procedure
Inoperative	A	(1) Require repair or replacement.
Leaking	A	Require replacement.
Missing	C	Require replacement.
Saturated	A	Require replacement.

(1) - Inoperative includes intermittent operation or out of OEM specification.

EVAPORATIVE EMISSION (EVAP) FEEDBACK DEVICES

EVAPORATIVE EMISSION (EVAP) FEEDBACK DEVICE INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.

Inoperative	B	(3) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Restricted, affecting performance	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

EXHAUST GAS RECIRCULATION DEVICES

EXHAUST GAS RECIRCULATION DEVICE INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.

Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Inoperative	B	(3) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Restricted, affecting performance	A	Require repair or replacement.
Restricted, not affecting performance	1	Suggest repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

EXHAUST GAS RECIRCULATION FEEDBACK DEVICES

EXHAUST GAS RECIRCULATION FEEDBACK DEVICE INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.

Connector broken	A	..	Require repair or replacement.
Connector (Weatherpack type) leaking	A	..	Require repair or replacement.
Connector melted	A	.....	(1) Require repair or replacement.
Connector missing	C	.....	Require replacement.
Contaminated	A	.....	(2) Require repair or replacement.
Inoperative	B	.....	(3) Require repair or replacement. Further inspection required.
Leaking	A	..	Require repair or replacement.
Missing	C	.....	Require replacement.
Resistance out of specification	B	..	Require repair or replacement.
Restricted, affecting performance	A	..	Require repair or replacement.
Restricted, not affecting performance	1	..	Suggest repair or replacement.
Terminal broken	A	..	Require repair or replacement.
Terminal burned, affecting performance	A	.....	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	..	Suggest repair or replacement.
Terminal corroded, affecting performance	A	..	Require repair or replacement.
Terminal corroded, not affecting performance	2	..	Suggest repair or replacement.
Terminal loose, affecting performance	B	..	Require repair or replacement.
Terminal loose, not affecting performance	1	..	Suggest repair or replacement.
Threads damaged	A	..	Require repair or replacement.
Threads stripped (threads missing)	A	.....	Require replacement.
Wire lead conductors exposed	B	..	Require repair or replacement.
Wire lead corroded	A	..	Require repair or replacement.
Wire lead open	A	..	Require repair or replacement.
Wire lead shorted	A	..	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

EXPANSION PLUGS

See CASTING CORE PLUGS AND EXPANSION PLUGS.

FAN CONTROL SENSORS

FAN CONTROL SENSOR INSPECTION

Condition	Code	Procedure
Attaching hardware		

missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Inoperative	B	(3) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Restricted, affecting performance	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

FUEL

FUEL INSPECTION

Condition	Code	Procedure
Contaminated	B	(1) Require repair or replacement.
Fuel incorrect	B	(2) Require flushing of system.

(1) - Determine of source of contamination. Require repair or replacement.
(2) - If a fuel other than specification fuel is present in the system, the required service is to flush and fill with the correct fuel.

FUEL ACCUMULATORS AND DAMPERS

FUEL ACCUMULATOR AND DAMPER INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connections leaking	A	Require repair or replacement.
Inoperative	A	(1) Require replacement.
Leaking	A	Require replacement.

(1) - Inoperative includes intermittent operation or out of OEM specification.

FUEL AND COLD START INJECTORS

NOTE: You are not required to replace injectors in sets. However, you may suggest replacement of all injectors for preventive maintenance.

FUEL AND COLD START INJECTOR INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.

Condition	Code	Procedure
Flow restricted	B	Require repair or replacement.
Inoperative	B	(2) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Resistance out of specification	B	Require replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Inoperative includes intermittent operation, out of OEM specification. Some components may be serviceable.

FUEL DAMPERS

See FUEL ACCUMULATORS AND DAMPERS.

FUEL DELIVERY CHECK VALVES

FUEL DELIVERY CHECK VALVE INSPECTION

Condition	Code	Procedure
Inoperative	A	(1) Require replacement.
Leaking externally	A	Require repair or replacement.
Missing	C	Require replacement.
Pressure leaking (bleeds down)	A	Require repair or replacement.

(1) - Inoperative includes intermittent operation or out of OEM specification.

FUEL DISTRIBUTORS (BOSCH CIS)

FUEL DISTRIBUTOR (BOSCH CIS) INSPECTION

Condition	Code	Procedure
Inoperative	A	(1) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Out of specification	B	Require repair or replacement.
Restricted, affecting		

performance	A	(2) Require repair or replacement. Further inspection required.

(1) - Inoperative includes intermittent operation.
(2) - Some components may be serviceable; check for accepted cleaning procedure.

FUEL FILLER NECKS AND RESTRICTORS

FUEL FILLER NECK AND RESTRICTOR INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A ...	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A ...	Require repair or replacement of hardware.
Leaking	A ..	Require repair or replacement.
Missing	C	Require replacement.
Restricted	2 ..	Suggest repair or replacement.

FUEL FILTERS

FUEL FILTER INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A ...	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A ...	Require repair or replacement of hardware.
Leaking	A ..	Require repair or replacement.
Maintenance interval	3 ...	Suggest replacement to comply with OEM recommended service interval.
Missing	C	Require replacement.
Restricted, affecting performance	A	Require replacement.
Restricted, not affecting performance	1	Suggest replacement.
Water-contaminated	2	Suggest replacement.

FUEL INJECTORS

FUEL INJECTOR INSPECTION

Condition	Code	Procedure
Attaching hardware		

missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A ..	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A ..	Require repair or replacement of hardware.
Connector broken	A .	Require repair or replacement.
Connector (Weatherpack type) leaking	A .	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Inoperative	B	(3) Require repair or replacement. Further inspection required.
Leaking	A .	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B .	Require repair or replacement.
Restricted, affecting performance	A .	Require repair or replacement.
Restricted, not affecting performance	2 .	Suggest repair or replacement.
Terminal broken	A .	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance ..	2 .	Suggest repair or replacement.
Terminal corroded, affecting performance ..	A .	Require repair or replacement.
Terminal corroded, not affecting performance ..	2 .	Suggest repair or replacement.
Terminal loose, affecting performance	B .	Require repair or replacement.
Terminal loose, not affecting performance ..	1 .	Suggest repair or replacement.
Threads damaged	A .	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B .	Require repair or replacement.
Wire lead corroded	A .	Require repair or replacement.
Wire lead open	A .	Require repair or replacement.
Wire lead shorted	A .	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

FUEL LEVEL SENDER INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Inoperative	A	(1) Require repair or replacement.
Leaking	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(2) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Inoperative includes intermittent operation or out of OEM specification.
(2) - Determine cause and correct prior to repair or replacement of part.

FUEL PRESSURE REGULATORS

FUEL PRESSURE REGULATOR INSPECTION

Condition	Code	Procedure
Contaminated	2	(1) Suggest repair or replacement. Further inspection required.
Inoperative	B	(2) Require repair or replacement.
Leaking (internally or externally)	A	Require repair or replacement.
Pressure out of specification	B	Require repair or replacement.
Vapor bypass restricted	A	Require repair or replacement.

(1) - Some components may be serviceable; check for accepted cleaning procedure. Determine source of contamination. Require repair or replacement.

(2) - Inoperative includes intermittent operation or out of OEM specification.

FUEL PUMPS (IN-TANK AND EXTERNAL, ELECTRICAL OR MECHANICAL)

FUEL PUMP (IN-TANK AND EXTERNAL, ELECTRICAL OR MECHANICAL) INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require replacement.
Inoperative	A	(3) Require repair or replacement.
Leaking externally (includes pulsator)	A	Require repair or replacement.
Leaking internally (includes pulsator)	A	Require repair or replacement.
Noisy	2	Suggest repair or replacement.
Out of specification	B	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination. Require repair or replacement.
(3) - Inoperative includes intermittent operation.

FUEL RAILS

FUEL RAIL INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Contaminated	A	(1) Require replacement.
Leaking	A	Require repair or replacement.
Restricted	A	Require repair or replacement.
Rust-pitted	1	Suggest replacement.

(1) - Determine source of contamination. Require repair or replacement.

FUEL RESTRICTORS

See FUEL FILLER NECKS AND RESTRICTORS.

FUEL TANKS

FUEL TANK INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Baffles loose	A	Require repair or replacement.
Contaminated	A	(1) Require repair.
Corroded internally	A	Require repair or replacement.
Distorted, affecting performance	B	Require replacement.
Distorted, not affecting performance	..	No service suggested or required.
Leaking	A	Require repair or replacement.

(1) - Determine source of contamination. Require repair or replacement.

GAS CAPS

GAS CAP INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Fails to maintain proper pressure	A	Require replacement.
Gaskets missing	C	Require replacement.
Leaking	A	Require replacement.
Missing	C	Require replacement.
Plugged (vacuum and pressure relief)	A	Require replacement.
Seals missing	C	Require replacement.

GASKETS

GASKET INSPECTION

Condition	Code	Procedure
Leaking	A	(1) Require repair or replacement.

(1) - Require inspection of mating and sealing surface and repair or replace as necessary.

GROMMETS (VALVE COVER)

GROMMET (VALVE COVER) INSPECTION

Condition	Code	Procedure
Leaking	2	(1) Suggest repair or replacement.

(1) - Require inspection of mating and sealing surface and repair or replace as necessary.

HARMONIC DAMPERS

HARMONIC DAMPER INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Cracked	A	Require replacement.
Dented (fluid type only)	A	Require replacement.
Keyway distorted	A	Require repair or replacement.
Leaking (Fluid damper only)	A	Require replacement.
Loose	A	Require replacement.
Noisy	A	Require replacement.

Outer ring slipped out of position	A	Require replacement.
Positioned incorrectly	A	Require repair or replacement.
Rubber damping material deteriorated	1	Suggest replacement.
Seal surface worn, causing a leak	A	Require repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

HEATER CONTROL VALVES

HEATER CONTROL VALVE INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Bypassed	A	Require replacement.
Coolant leak	A	Require repair or replacement.
Malfunctioning	A	(1) Require repair or replacement.
Missing	C	Require replacement.
Restricted	A	Require repair or replacement.
Vacuum leak	A	Require repair or replacement.

(1) - Includes inoperative, intermittent operation, or failure to perform all functions.

HEATER CORES

HEATER CORE INSPECTION

Condition	Code	Procedure
Air flow restriction	A	Require repair or replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Bypassed	A	Require repair or replacement.
Connection leaking	A	Require repair or replacement.
Corroded	1	Suggest repair or replacement.
Fins damaged, affecting performance	A	Require repair or replacement.
Fins damaged, not affecting performance	2	Suggest repair or replacement.
Internal restrictions,		

Condition	Code	Procedure
affecting performance	A	Require repair or replacement.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.

HOSE AND TUBE COUPLERS, CONNECTORS AND CLAMPS

NOTE: When replacing fuel lines and hoses, replace with product that meets or exceeds OEM design specifications.

HOSE AND TUBE COUPLER, CONNECTOR AND CLAMP INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Connected incorrectly	A	Require repair.
Corroded, not reusable	1	Suggest replacement.
Cracked	A	Require replacement.
Insufficient clamping force, allowing hose to leak	A	Require repair or replacement.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Safety clip missing (not leaking)	C	Require replacement of safety clip.
Stripped	A	Require replacement.

HOSE CLAMPS

See HOSE AND TUBE COUPLERS, CONNECTORS AND CLAMPS.

HOSE CONNECTORS

See HOSE AND TUBE COUPLERS, CONNECTORS AND CLAMPS.

HOSE COUPLERS

See HOSE AND TUBE COUPLERS, CONNECTORS AND CLAMPS.

HOSES AND TUBES (FUEL LINES, RADIATOR, VACUUM, BY PASS, HEATER, RECOVERY TANK AND OIL COOLERS)

HOSE AND TUBE (FUEL LINE, RADIATOR, VACUUM, BY PASS, HEATER, RECOVERY TANK AND OIL COOLER) INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Connected incorrectly	A	Require repair.
Corroded, not reusable	1	Suggest replacement.
Cracked	A	Require replacement.
Dry-rotted	1	Suggest repair or replacement.
Hard	1	Suggest repair or replacement.
Inner fabric (webbing) damaged	A	Require replacement.
Insufficient clamping force, allowing hose to leak	A	Require repair or replacement.
Leaking	A	Require repair or replacement.
Maintenance intervals	3	Suggest replacement.

Melted	1	Suggest repair or replacement.
Missing	C	Require replacement.
Outer covering damaged	1	Suggest replacement.
Outer covering damaged to the extent that the inner fabric is visible	A	Require replacement.
Protective sleeves damaged	2	Suggest replacement of sleeves.
Protective sleeves missing	2	Suggest replacement of sleeves.
Restricted, affecting performance	A	Require repair or replacement.
Restricted, not affecting performance	2	Suggest repair or replacement.
Routed incorrectly	2	Suggest repair or replacement.
Safety clip missing	C	Require replacement.
Spongy	1	Suggest repair or replacement.
Stripped	A	Require replacement.
Swollen	B	Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Type incorrect	1	Suggest repair or replacement.

HOUSINGS

See THERMOSTATS AND HOUSINGS.

IDLE AIR CONTROLS

IDLE AIR CONTROL INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Inoperative	B	(3) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Restricted, affecting performance	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.

Condition	Code	Procedure
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

IDLE SPEED CONTROL ACTUATORS

IDLE SPEED CONTROL ACTUATOR INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Inoperative	B	(3) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.

Condition	Code	Procedure
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

IGNITION BOOTS

See IGNITION WIRES, BOOTS, COIL TOWERS AND TERMINALS (SECONDARY).

IGNITION COIL TOWERS

See IGNITION WIRES, BOOTS, COIL TOWERS AND TERMINALS (SECONDARY).

IGNITION COILS

IGNITION COIL INSPECTION

Condition	Code	Procedure
Arcing	A	Require replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or

			replacement.
Connector missing	C		Require replacement.
Corroded, affecting performance	A		Require replacement.
Corroded, not affecting performance	2		Suggest replacement.
Distorted	..		(2) No service suggested or required.
Inoperative	A		(3) Require replacement.
Oil leaking	A		Require replacement.
Out of specification	B		Require replacement.
Terminal broken	A	..	Require repair or replacement.
Terminal burned, affecting performance	A		(1) Require repair or replacement.
Terminal burned, not affecting performance	2	..	Suggest repair or replacement.
Terminal corroded, affecting performance	A	..	Require repair or replacement.
Terminal corroded, not affecting performance	2	..	Suggest repair or replacement.
Terminal loose, affecting performance	B	..	Require repair or replacement.
Terminal loose, not affecting performance	1	..	Suggest repair or replacement.
Wire lead conductors exposed	B	..	Require repair or replacement.
Wire lead corroded	A	..	Require repair or replacement.
Wire lead open	A	..	Require repair or replacement.
Wire lead shorted	A	..	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Distortion may be the result of overheating; coil should be tested.
(3) - Inoperative includes intermittent operation.

IGNITION CONTROL MODULES (ICM)

IGNITION CONTROL MODULE (ICM) INSPECTION

Condition	Code		Procedure
Application incorrect	B		Require replacement.
Attaching hardware missing	C		Require replacement of hardware.
Attaching hardware threads damaged	A	...	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	...	Require repair or replacement of hardware.
Code set (if applicable)	A		(1) Further inspection required.
Connector broken	A	..	Require repair or replacement.
Connector (Weatherpack type) leaking	A	..	Require repair or replacement.
Connector melted	A		(2) Require repair or replacement.

Condition	Code	Procedure
Connector missing	A	Require repair.
Contaminated	A	(3) Require repair or replacement.
Leaking	A	Require repair or replacement.
Malfunctioning	A	(4) Require repair or replacement.
Missing	C	Require replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(2) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Refer to manufacturer's diagnostic trouble code procedure and require repair or replacement of affected component(s).
(2) - Determine cause and correct prior to repair or replacement of part.
(3) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(4) - Includes inoperative, intermittent operation, or failure to perform all functions.

IGNITION SWITCHES

See SWITCHES.

IGNITION TERMINALS

See IGNITION WIRES, BOOTS, COIL TOWERS AND TERMINALS (SECONDARY).

IGNITION WIRES, BOOTS, COIL TOWERS AND TERMINALS (SECONDARY)

NOTE: You are not required to replace ignition wires in sets. However, you may suggest replacement of the entire secondary wire set for preventive maintenance.

IGNITION WIRE, BOOT, COIL TOWER AND TERMINAL (SECONDARY) INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.

Attaching hardware missing	C	.....	Require replacement of hardware.
Attaching hardware not functioning	A	...	Require repair or replacement of hardware.
Carbon-tracked	A	.....	Require replacement.
Corroded	1	..	Suggest repair or replacement.
Insulation leaking (shorted)	A	..	Require repair or replacement.
Metal heat shield bent	2	..	Suggest repair or replacement.
Missing	C	.....	Require replacement.
Oil-soaked (spongy)	1	.....	Suggest replacement.
Resistance incorrect	B	.....	Require replacement.
Routed incorrectly	2	.....	(1) Suggest repair.
Terminal broken	A	..	Require repair or replacement.
Terminal burned, affecting performance	A	.....	(2) Require repair or replacement.
Terminal burned, not affecting performance	2	..	Suggest repair or replacement.
Terminal corroded, affecting performance	A	..	Require repair or replacement.
Terminal corroded, not affecting performance	2	..	Suggest repair or replacement.
Terminal loose, affecting performance	B	..	Require repair or replacement.
Terminal loose, not affecting performance	1	..	Suggest repair or replacement.

(1) - If improper routing affects the performance of other systems, require repair. Proper routing, hardware, heatshields, etc., are intended to prevent premature failure of secondary ignition components.
(2) - Determine cause and correct prior to repair or replacement of part.

IN-TANK FUEL STRAINERS

IN-TANK FUEL STRAINER INSPECTION

Condition	Code		Procedure
Missing	C	.....	Require replacement.
Restricted	A	..	Require repair or replacement.
Torn	A	.....	Require replacement.

INERTIA FUEL SHUT-OFF SWITCHES

INERTIA FUEL SHUT-OFF SWITCH INSPECTION

Condition	Code		Procedure
Attaching hardware broken	A	...	Require repair or replacement of hardware.
Attaching hardware missing	C	.....	Require replacement of hardware.
Attaching hardware not functioning	A	...	Require repair or replacement

			of hardware.
Connector broken	A	..	Require repair or replacement.
Connector melted	A	.....	(1) Require repair or replacement.
Connector missing	C	.....	Require replacement.
Contaminated	A	.....	(2) Require replacement.
Inoperative	A	.....	(3) Require repair or replacement.
Missing	C	.....	Require replacement.
Terminal broken	A	..	Require repair or replacement.
Terminal burned, affecting performance	A	.....	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	..	Suggest repair or replacement.
Terminal corroded, affecting performance	A	..	Require repair or replacement.
Terminal corroded, not affecting performance	2	..	Suggest repair or replacement.
Terminal loose, affecting performance	B	..	Require repair or replacement.
Terminal loose, not affecting performance	1	..	Suggest repair or replacement.
Wire lead conductors exposed	B	..	Require repair or replacement.
Wire lead corroded	A	..	Require repair or replacement.
Wire lead open	A	..	Require repair or replacement.
Wire lead shorted	A	..	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification.

INTAKE AIR TEMPERATURE SENSORS

INTAKE AIR TEMPERATURE SENSOR INSPECTION

Condition	Code		Procedure
Attaching hardware missing	C	.....	Require replacement of hardware.
Attaching hardware threads damaged	A	...	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	...	Require repair or replacement of hardware.
Connector broken	A	..	Require repair or replacement.
Connector (Weatherpack type) leaking	A	..	Require repair or replacement.
Connector melted	A	.....	(1) Require repair or replacement.
Connector missing	C	.....	Require replacement.
Contaminated	A	.....	(2) Require repair or replacement.
Inoperative	B	.....	(3) Require repair or

			replacement. Further inspection required.
Leaking	A	..	Require repair or replacement.
Missing	C	.....	Require replacement.
Resistance out of specification	B	..	Require repair or replacement.
Restricted, affecting performance	A	..	Require repair or replacement.
Terminal broken	A	..	Require repair or replacement.
Terminal burned, affecting performance	A	.....	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	..	Suggest repair or replacement.
Terminal corroded, affecting performance	A	..	Require repair or replacement.
Terminal corroded, not affecting performance	2	..	Suggest repair or replacement.
Terminal loose, affecting performance	B	..	Require repair or replacement.
Terminal loose, not affecting performance	1	..	Suggest repair or replacement.
Threads damaged	A	..	Require repair or replacement.
Threads stripped (threads missing)	A	.....	Require replacement.
Wire lead conductors exposed	B	..	Require repair or replacement.
Wire lead corroded	A	..	Require repair or replacement.
Wire lead open	A	..	Require repair or replacement.
Wire lead shorted	A	..	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

INTAKE MANIFOLDS

INTAKE MANIFOLD INSPECTION

Condition	Code		Procedure
Corroded, affecting sealability	A	..	Require repair or replacement.
Integrated air or fuel control components inoperative	A	.....	(1) Require repair or replacement.
Internal air or fuel components damaged, affecting performance	A	...	Require repair or replacement of component.
Internal air or fuel components damaged, not affecting performance	..	.....	No service suggested or required.
Internal air or fuel components missing	C	.....	Require replacement of

		component.
Leaking	A	Require repair or replacement.
Out of specification	B	Require replacement.
Restricted	A	Require repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require repair or replacement.
Warped	B	Require repair or replacement.

(1) - Inoperative includes intermittent operation or out of OEM specification.

INTERCOOLERS

See CHARGE AIR COOLERS "INTERCOOLERS" (CAC).

KNOCK SENSORS

KNOCK SENSOR INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Inoperative	B	(2) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

Wire lead conductors exposed	B	..	Require repair or replacement.
Wire lead corroded	A	..	Require repair or replacement.
Wire lead open	A	..	Require repair or replacement.
Wire lead shorted	A	..	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

LIQUID VAPOR SEPARATORS

LIQUID VAPOR SEPARATOR INSPECTION

Condition	Code	Procedure
Inoperative	A	(1) Require repair or replacement.
Leaking	A	Require replacement.
Missing	C	Require replacement.
Restricted	A	Require repair or replacement.

(1) - Inoperative includes intermittent operation or out of OEM specification.

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSORS

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Inoperative	B	(3) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Restricted, affecting performance	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.

Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

MASS AIR FLOW (MAF) SENSORS

MASS AIR FLOW (MAF) SENSOR INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Inoperative	B	(3) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.

Restricted, affecting performance	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

METAL AIR MANIFOLDS AND PIPES

METAL AIR MANIFOLD AND PIPE INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Broken	A	Require repair of injection tube or replacement of manifold.
Corroded, affecting structural integrity	1	Suggest replacement of injection tube or manifold.
Leaking	A	Require repair of injection tube or replacement of manifold.
Loose	A	Require repair.
Missing	C	Require replacement.
Restricted	A	Require replacement of injection tube or manifold.

Threads damaged	A	Require repair.
Threads stripped (threads missing)	A	Require replacement.

METAL AIR PIPES

See METAL AIR MANIFOLDS AND PIPES.

MIX CONTROL SOLENOIDS

MIX CONTROL SOLENOID INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Inoperative	B	(3) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Restricted, affecting performance	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.

Wire lead shorted	A ..	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

MOTOR MOUNTS

MOTOR MOUNT INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A ...	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A ...	Require repair or replacement of hardware.
Broken	A	Require replacement.
Leaking (hydraulic mount)	A	Require replacement.
Mounting hole worn, affecting performance ..	A	Require replacement.
Mounting hole worn, not affecting performance	.....	No service suggested or required.
Rubber deteriorated, affecting performance ..	A	Require replacement.
Rubber deteriorated, not affecting performance	.....	No service suggested or required.
Threads damaged	A ..	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

O-RINGS, GASKETS, SEALS AND SPRING LOCKS

O-RING, GASKET, SEAL AND SPRING LOCK INSPECTION

Condition	Code	Procedure
Leaking	A	(1) Require repair or replacement.

(1) - Require inspection of mating and sealing surface and repair or replace as necessary.

O2 SENSORS

O2 SENSOR INSPECTION

Condition	Code	Procedure

Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Inoperative	B	(3) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Restricted, affecting performance	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

OIL PRESSURE SENDING UNIT INSPECTION

Condition	Code	Procedure
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Inoperative	A	(2) Require repair or replacement.
Leaking	A	Require replacement.
Output signal incorrect	B	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Inoperative includes intermittent operation or out of OEM specification.

OIL PUMP PICK-UP SCREENS

OIL PUMP PICK-UP SCREEN INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Bypass stuck	A	Require repair or replacement.
Cracked	A	Require repair or replacement.
Loose	A	Require repair or replacement.
Missing	C	Require replacement.
Positioned incorrectly	A	Require repair or replacement.
Restricted	A	Require repair or replacement.
Screen torn	A	Require replacement.

OIL PUMPS

OIL PUMP INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Broken	A	Require repair or replacement.
Housing cracked	A	Require repair or replacement.
Leaking	A	Require repair or replacement.
Pressure relief valve stuck	A	Require repair or replacement.
Seized	A	Require repair or replacement.
Worn beyond specifications	B	Require repair or replacement.

PARK NEUTRAL POSITION SWITCHES

PARK NEUTRAL POSITION SWITCH INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Inoperative	B	(3) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.

Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) – Determine cause and correct prior to repair or replacement of part.
(2) – Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) – Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

PCV BREATHER ELEMENTS

PCV BREATHER ELEMENT INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Leaking	A	Require replacement.
Maintenance intervals	3	Suggest replacement to comply with vehicle's OEM recommended service intervals.
Melted	A	Required replacement.
Missing	C	Require replacement.
Restricted, affecting performance	A	Require replacement.
Restricted, not affecting performance	1	Suggest replacement.
Water-contaminated	A	Require replacement.

PCV ORIFICES

PCV ORIFICE INSPECTION

Condition	Code	Procedure
Leaking	A	Require replacement.
Maintenance interval	3	Suggest repair or replacement to comply with OEM recommended service intervals.

Missing	C	Require replacement.
Restricted	A	Require repair or replacement.

PCV VALVES

PCV VALVE INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Grommet broken	A	Require repair or replacement of grommet.
Grommet missing	C	Require replacement of grommet.
Grommet not functioning	A	Require repair or replacement of grommet.
Inoperative	A	(1) Require replacement.
Leaking	A	Require replacement.
Maintenance interval	3	Suggest replacement to comply with vehicle's OEM recommended service intervals.
Missing	C	Require replacement.
Restricted	A	Require replacement.

(1) - Inoperative includes intermittent operation or out of OEM specification.

PICK-UP ASSEMBLIES (INCLUDES MAGNETIC, HALL EFFECT AND OPTICAL)

PICK-UP ASSEMBLY (MAGNETIC, HALL EFFECT AND OPTICAL) INSPECTION

Condition	Code	Procedure
Adjustment incorrect	B	Require repair.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Inoperative	B	(2) Require replacement.
Oil-soaked	A	Require replacement.

Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Inoperative includes intermittent operation or out of OEM specification. Refer to OEM recommended service' procedures.

POWER STEERING PRESSURE SENSORS

POWER STEERING PRESSURE SENSOR INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Inoperative	B	(3) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Restricted, affecting performance	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or

			replacement.
Terminal burned, not affecting performance	2	..	Suggest repair or replacement.
Terminal corroded, affecting performance	A	..	Require repair or replacement.
Terminal corroded, not affecting performance	2	..	Suggest repair or replacement.
Terminal loose, affecting performance	B	..	Require repair or replacement.
Terminal loose, not affecting performance	1	..	Suggest repair or replacement.
Threads damaged	A	..	Require repair or replacement.
Threads stripped (threads missing)	A	..	Require replacement.
Wire lead conductors exposed	B	..	Require repair or replacement.
Wire lead corroded	A	..	Require repair or replacement.
Wire lead open	A	..	Require repair or replacement.
Wire lead shorted	A	..	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

POWERTRAIN CONTROL MODULES (PCM) AND PROM

POWERTRAIN CONTROL MODULE (PCM) AND PROM INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Code set (if applicable)	A	(1) Further inspection required.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(2) Require repair or replacement.
Connector missing	A	Require repair.
Contaminated	A	(3) Require repair or replacement.
Leaking	A	Require repair or replacement.
Malfunctioning	A	(4) Require repair or replacement.
Missing	C	Require replacement.
Terminal broken	A	Require repair or replacement.

Terminal burned, affecting performance	A	.....	(2) Require repair or replacement.
Terminal burned, not affecting performance	2	..	Suggest repair or replacement.
Terminal corroded, affecting performance	A	..	Require repair or replacement.
Terminal corroded, not affecting performance	2	..	Suggest repair or replacement.
Terminal loose, affecting performance	B	..	Require repair or replacement.
Terminal loose, not affecting performance	1	..	Suggest repair or replacement.
Threads damaged	A	..	Require repair or replacement.
Threads stripped (threads missing)	A	.....	Require replacement.
Wire lead conductors exposed	B	..	Require repair or replacement.
Wire lead corroded	A	..	Require repair or replacement.
Wire lead open	A	..	Require repair or replacement.
Wire lead shorted	A	..	Require repair or replacement.

(1) - Refer to manufacturer's diagnostic trouble code procedure and require repair or replacement of affected component(s).
(2) - Determine cause and correct prior to repair or replacement of part.
(3) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(4) - Includes inoperative, intermittent operation, failure to perform all functions, or out of OEM specification.

POWERTRAIN CONTROL PROM

See POWERTRAIN CONTROL MODULES (PCM) AND PROM.

PRESSURIZED EXPANSION TANK CAPS

See RADIATOR CAPS AND PRESSURIZED EXPANSION TANK CAPS.

RADIATOR CAPS AND PRESSURIZED EXPANSION TANK CAPS

RADIATOR CAP AND PRESSURIZED EXPANSION TANK CAP INSPECTION

Condition	Code		Procedure
Application incorrect	B	.....	Require replacement.
Coolant recovery check valve inoperative	A	.....	(1) Require replacement.
Fails to maintain proper pressure	B	.....	Require replacement.
Gasket missing	C	.	Require replacement of gasket.
Missing	C	.....	Require replacement.
Seal missing	C	...	Require replacement of seal.

(1) - Inoperative includes intermittent operation or out of OEM specification.

RADIATOR FAN BLADES

RADIATOR FAN BLADE INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Bent	A	Require replacement.
Broken	A	Require replacement.
Cracked	A	Require replacement.
Loose	A	Require repair or replacement.
Missing	C	Require replacement.

RADIATOR FAN CLUTCHES

NOTE: Some lateral movement, measured at the fan blade tip, may be normal.

RADIATOR FAN CLUTCH INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Bearing noisy	A	Require replacement.
Bearing worn	A	Require replacement.
Fastener loose	A	Require repair or replacement of fastener.
Inoperative	A	(1) Require replacement.
Leaking	1	Suggest replacement.
Seized	A	Require replacement.
Slips (insufficient fan speed)	A	Require replacement.
Thermal control incorrect	B	Require repair or replacement.

(1) - Inoperative includes intermittent operation or out of OEM specification.

RADIATORS

RADIATOR INSPECTION

Condition	Code	Procedure
Air flow restriction	A	Require repair.

Application incorrect	B	Require replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connection leaking	A	Require repair or replacement.
Corroded	1	Suggest repair or replacement.
Fins damaged, affecting performance	A	Require repair or replacement.
Fins damaged, not affecting performance	2	Suggest repair or replacement.
Internal oil cooler leaking	A	Require repair or replacement.
Internal restrictions, affecting performance	B	Require repair or replacement.
Internal restrictions, not affecting performance	2	Suggest repair or replacement.
Leaking	A	Require repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require repair or replacement.
Tubes damaged, affecting performance	A	Require repair or replacement.
Tubes damaged, not affecting performance		No service suggested or required.

ROLL OVER VALVES

ROLL OVER VALVE INSPECTION

Condition	Code	Procedure
Inoperative	A	(1) Require replacement.
Leaking	A	Require replacement.
Missing	C	Require replacement.

(1) - Inoperative includes intermittent operation or out of OEM specification.

SEALING COMPOUNDS

SEALING COMPOUND INSPECTION

Condition	Code	Procedure
Leaking	A	(1) Require repair or replacement.

(1) - Require inspection of mating and sealing surface and repair or replace as necessary.

SEALS

SEAL INSPECTION

Condition	Code	Procedure
Leaking	A	(1) Require repair or replacement.

(1) - Require inspection of mating and sealing surface and repair or replace as necessary.

SECONDARY AIR INJECTION SYSTEM MANAGEMENT DEVICES

SECONDARY AIR INJECTION SYSTEM MANAGEMENT DEVICE INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Inoperative	B	(3) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Restricted, affecting performance	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.

Wire lead open	A	..	Require repair or replacement.
Wire lead shorted	A	..	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

SENSORS AND ACTUATORS

NOTE: Conditions pertaining to the sensors and actuators listed in this section may be found under the name of the sensor or actuator.

SENSOR ABBREVIATION TABLE

Sensor	Abbreviation
Accelerator Pedal Position Sensor	APP
Air Conditioning Cycling Switch	AC
Air Conditioning Pressure Sensor	..
Air Fuel Ratio Sensor	..
Barometric Pressure Sensor	BARO
Camshaft Position Sensor	CMP
Clutch Pedal Position Switch	CPP
Cooling Fan Motor Sensors and Switches	..
Crankshaft Position Sensor	CKP
Electronic Transmission Feedback Devices	..
Engine Coolant Temperature Sensor	ECT
Evaporative Emission feedback devices	..
Exhaust Gas Recirculation feedback devices	..
Fan Control Sensor	FC
Intake Air Temperature Sensor	IAT
Knock Sensor	KS
Manifold Absolute Pressure Sensor	MAP
Mass Air Flow Sensor	MAF
O2 Sensor	O2S
Park Neutral Position Switch	PNP
Power Steering Pressure Sensor	PSP
Thermal Vacuum Valve	TVV
Throttle Position Sensor	TP Sensor
Throttle Position Switch	..
Transmission Range Switch	TR Switch
Vehicle Speed Sensor	VSS
Volume Air Flow Sensor	VAF

ACTUATOR ABBREVIATION TABLE

Actuator	Abbreviation
Air Injection Control Solenoid	..
Electronic Transmission control devices	..
Evaporative Emission Canister	EVAP
Purge Device	..
Exhaust Gas Recirculation Device	EGR
Fuel Injector	..
Idle Air Control	IAC

Idle Speed Control Actuator	ISC
Mix Control Solenoid	MC Solenoid
Secondary Air Injection System Management Device	AIR, PAIR
Vacuum Regulator Solenoid	..
Waste Gate Control Solenoid	..

SHROUDS, BAFFLES AND DEFLECTORS

SHROUD, BAFFLE AND DEFLECTOR INSPECTION

Condition	Code	Procedure
Application incorrect, affecting cooling system performance	A	Require repair or replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Bent, affecting cooling system performance	A	Require repair or replacement.
Blocked, affecting cooling system performance	A	Require repair or replacement.
Broken, affecting cooling system performance	A	Require repair or replacement.
Cracked, affecting cooling system performance	A	Require repair or replacement.
Loose, affecting cooling system performance	A	Require repair.
Loose, not affecting cooling system performance	2	Suggest repair.
Missing, affecting cooling system performance	C	Require replacement.

SPARK PLUGS

NOTE: You are not required to replace spark plugs in sets. However, you may suggest replacement of the other plugs for preventive maintenance.

SPARK PLUG INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Electrode eroded	1	Suggest replacement.
Fouled	A	(1) Require repair or replacement.
Gap incorrect	B	Require repair or replacement.
Insulation broken	A	Require replacement
Insulator cracked	A	Require replacement.
Leaking compression	A	Require repair or replacement.
Maintenance interval	3	Suggest replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads		

missing)	A	Require replacement.

(1) - Determine cause of fouling and suggest repair.

SPRING LOCKS

SPRING LOCK INSPECTION

Condition	Code	Procedure
Leaking	A	(1) Require repair or replacement.

(1) - Require inspection of mating and sealing surface and repair or replace as necessary.

SUPER CHARGERS

SUPER CHARGER INSPECTION

Condition	Code	Procedure
Attaching hardware damaged, affecting operation or performance	A ...	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Bearing noisy	A	Require replacement.
Bearing worn	A	Require replacement.
Boost pressure incorrect	A	(1) Require repair or replacement.
Clearance out of specification	B ..	Require repair or replacement.
Leaking	A ..	Require repair or replacement.
Noisy	2 ..	Suggest repair or replacement.
Threads damaged	A ..	Require repair or replacement.
Threads stripped (threads missing)	A ..	Require repair or replacement.

(1) - Boost pressure problems may be caused by other systems or components.

SWITCHES

SWITCH INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A ...	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A ...	Require repair or replacement

			of hardware.
Binding, affecting performance	A	..	Require repair or replacement.
Binding, not affecting performance	2	..	Suggest repair or replacement.
Broken	A	..	Require repair or replacement.
Burned, affecting performance	A	....	(1) Require repair or replacement.
Burned, not affecting performance	2	....	(1) Suggest repair or replacement.
Cracked, affecting performance	A	..	Require repair or replacement.
Cracked, not affecting performance	1	..	Suggest repair or replacement.
Leaking	A	..	Require repair or replacement.
Malfunctioning	A	....	(2) Require repair or replacement.
Melted, affecting performance	A	....	(1) Require repair or replacement.
Melted, not affecting performance	2	....	(1) Suggest repair or replacement.
Missing	C	....	Require replacement.
Out of adjustment	B	..	Require repair or replacement.
Terminal broken	A	..	Require repair or replacement.
Terminal burned, affecting performance	A	....	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	..	Suggest repair or replacement.
Terminal corroded, affecting performance	A	..	Require repair or replacement.
Terminal corroded, not affecting performance	2	..	Suggest repair or replacement.
Terminal loose, affecting performance	B	..	Require repair or replacement.
Terminal loose, not affecting performance	1	..	Suggest repair or replacement.
Won’t return	A	..	Require repair or replacement.
Worn	1	....	Suggest replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Includes inoperative, intermittent operation, or failure to perform all functions.

THERMAL VACUUM VALVES

THERMAL VACUUM VALVE INSPECTION

Condition	Code		Procedure
Connector broken	A	..	Require repair or replacement.
Connector (Weatherpack type) leaking	A	..	Require repair or replacement.
Connector melted	A	....	(1) Require repair or replacement.
Connector missing	C	....	Require replacement.
Contaminated	A	....	(2) Require repair or

			replacement.
Inoperative	B		(3) Require repair or replacement. Further inspection required.
Leaking	A		Require repair or replacement.
Missing	C		Require replacement.
Resistance out of specification	B		Require repair or replacement.
Restricted, affecting performance	A		Require repair or replacement.
Terminal broken	A		Require repair or replacement.
Terminal burned, affecting performance	A		(1) Require repair or replacement.
Terminal burned, not affecting performance	2		Suggest repair or replacement.
Terminal corroded, affecting performance	A		Require repair or replacement.
Terminal corroded, not affecting performance	2		Suggest repair or replacement.
Terminal loose, affecting performance	B		Require repair or replacement.
Terminal loose, not affecting performance	1		Suggest repair or replacement.
Threads damaged	A		Require repair or replacement.
Threads stripped (threads missing)	A		Require replacement.
Wire lead conductors exposed	B		Require repair or replacement.
Wire lead corroded	A		Require repair or replacement.
Wire lead open	A		Require repair or replacement.
Wire lead shorted	A		Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

THERMOSTATIC AIR DOOR ASSEMBLIES

THERMOSTATIC AIR DOOR ASSEMBLY INSPECTION

Condition	Code	Procedure
Attaching hardware damaged, affecting operation or performance	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Binding	A	Require repair or replacement.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Seized	A	Require repair or replacement.

THERMOSTATS AND HOUSINGS

THERMOSTAT AND HOUSING INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware corroded	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Housing corroded	1	Suggest replacement of housing.
Inoperative	A	(1) Require replacement.
Installation incorrect	B	Require repair or replacement.
Leaking	A	Require repair or replacement.
Thermostat missing	C	Require replacement of thermostat.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require repair or replacement.

(1) - Inoperative includes intermittent operation or out of OEM specification.

THROTTLE BODIES

THROTTLE BODY INSPECTION

Condition	Code	Procedure
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Leaking	A	Require repair or replacement.
Restricted	A	(3) Require repair.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.

Threads damaged	A	..	Require repair or replacement.
Threads stripped (threads missing)	A	..	Require repair or replacement.
Throttle shaft binding, affecting performance	A	..	Require repair or replacement.
Throttle shaft worn, affecting performance	A	..	Require repair or replacement.
Throttle shaft worn, not affecting performance	1	..	Suggest repair or replacement.
Wire lead conductors exposed	B	..	Require repair or replacement.
Wire lead corroded	A	..	Require repair or replacement.
Wire lead open	A	..	Require repair or replacement.
Wire lead shorted	A	..	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Some components may be serviceable; check for accepted cleaning procedure.

THROTTLE CABLES

See THROTTLE LINKAGES AND CABLES.

THROTTLE LINKAGES AND CABLES

THROTTLE LINKAGE AND CABLE INSPECTION

Condition	Code		Procedure
Attaching hardware broken	A	...	Require repair or replacement of hardware.
Attaching hardware missing	C	.....	Require replacement of hardware.
Attaching hardware not functioning	A	..	Require repair or replacement of hardware.
Bent	A	..	Require repair or replacement.
Binding	A	..	Require repair or replacement.
Bracket bent, affecting performance	A	..	Require repair or replacement.
Bracket bent, not affecting performance	..	.....	No service suggested or required.
Bracket broken, affecting performance	A		Require replacement.
Bracket broken, not affecting performance	..	.....	No service suggested or required.
Bracket corroded, affecting performance	A	..	Require repair or replacement.
Bracket corroded, not affecting performance	2	..	Suggest repair or replacement.
Bracket cracked, affecting performance	A	..	Require repair or replacement.
Bracket cracked, not affecting performance	1	..	Suggest repair or replacement.

Bracket loose, affecting performance	A	..	Require repair or replacement.
Bracket loose, not affecting performance	1	..	Suggest repair or replacement.
Bracket missing	C	.....	Require replacement.
Broken	A	.....	Require replacement.
Cracked	A	..	Require repair or replacement.
Disconnected	A	..	Require repair or replacement.
Kinked	A	..	Require repair or replacement.
Melted	A	..	Require repair or replacement.
Missing	C	.....	Require replacement.
Noisy	2	..	Suggest repair or replacement.
Out of adjustment	B	.....	(1) Require repair or replacement.
Routed incorrectly	2	.....	Suggest repair.
Seized	A	..	Require repair or replacement.

(1) - Follow OEM recommended adjustment procedures. Require repair or replacement if out of specification.

THROTTLE POSITION SENSORS

THROTTLE POSITION SENSOR INSPECTION

Condition	Code		Procedure
Attaching hardware missing	C	.....	Require replacement of hardware.
Attaching hardware threads damaged	A	...	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	...	Require repair or replacement of hardware.
Connector broken	A	..	Require repair or replacement.
Connector (Weatherpack type) leaking	A	..	Require repair or replacement.
Connector melted	A	.....	(1) Require repair or replacement.
Connector missing	C	.....	Require replacement.
Contaminated	A	.....	(2) Require repair or replacement.
Inoperative	B	.....	(3) Require repair or replacement. Further inspection required.
Missing	C	.....	Require replacement.
Resistance out of specification	B	..	Require repair or replacement.
Terminal broken	A	..	Require repair or replacement.
Terminal burned, affecting performance	A	..	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	..	Suggest repair or replacement.
Terminal corroded, affecting performance	A	..	Require repair or replacement.
Terminal corroded, not affecting performance	2	..	Suggest repair or replacement.
Terminal loose, affecting performance	B	..	Require repair or replacement.
Terminal loose, not			

affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

THROTTLE POSITION SWITCHES

THROTTLE POSITION SWITCH INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Inoperative	B	(2) Require repair or replacement. Further inspection required.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.

Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

TIMING BELT SPROCKETS

TIMING BELT SPROCKET INSPECTION

Condition	Code	Procedure
Alignment incorrect	B	Require repair.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Bent	A	Require replacement.
Cracked	A	Require replacement.
Key damaged	A	Require replacement.
Loose	A	Require repair or replacement.
Missing	C	Require replacement.
Pulley damaged, affecting belt life	A	Require replacement.
Sprocket damaged, affecting belt life	A	Require repair or replacement.
Sprocket loose	B	Require repair or replacement.
Sprocket-to-shaft alignment incorrect	B	Require repair or replacement.

TIMING BELTS

TIMING BELT INSPECTION

Condition	Code	Procedure
Adjustment incorrect	2	(1) Suggest adjustment.
Alignment incorrect	B	(2) Further inspection required.
Broken	A	Require replacement.
Cam timing out of specification	B	Require repair.
Cracked	1	Suggest replacement.
Fluid-soaked	1	Suggest replacement. Further inspection required.
Frayed	1	Suggest replacement.
Maintenance intervals	3	Suggest replacement to comply with vehicle OEM recommended

			service intervals.
Missing	C	.....	(3) Require replacement.
Noisy	2	.....	(4) Further inspection required. See note below.
Plies separated	A	.....	Require replacement.
Tension out of specification	B	.....	Require adjustment or replacement.
Teeth missing	A	.....	Require replacement.

(1) - Inspect belt tensioners, pulleys, and cover.
(2) - Determine cause of incorrect alignment and require repair.
(3) - CAUTION: Internal engine damage may result from timing belt damage/failure.
(4) - Determine cause of noise and suggest repair.

TORQUE STRUTS

TORQUE STRUT INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	... Require repair or replacement of hardware.
Attaching hardware missing	C	..... Require replacement of hardware.
Attaching hardware not functioning	A	... Require repair or replacement of hardware.
Binding	A	..... Require replacement.
Body dented	A	..... (1) Further inspection required.
Body punctured	A	..... Require replacement.
Bushing deteriorated, affecting performance ..	A	..... Require replacement.
Bushing deteriorated, not affecting performance ..	..	..... No service suggested or required.
Bushings missing	C	..... Require replacement.
Bushings separated from mounting eye	1	..... Suggest replacement.
Damping (none)	A	..... Require replacement.
Leaking oil, enough for fluid to be running down the body	A	..... Require replacement.
Missing	C	..... Require replacement.
Noisy	2	..... (2) Further inspection required.
Piston rod bent	A	..... Require replacement.
Piston rod broken	A	..... Require replacement.
Seized	A	..... Require replacement.
Threads damaged	A	.. Require repair or replacement.
Threads stripped (threads missing)	A	..... Require replacement.

(1) - Require replacement of units where dents restrict strut piston rod movement. If dents don't restrict movement, no service is suggested or required.
(2) - If noise is isolated to shock or strut, suggest replacement.

TRANSMISSION RANGE SWITCHES

TRANSMISSION RANGE SWITCH INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Inoperative	B	(3) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable;

check for accepted cleaning procedure.

TUBE CLAMPS

See HOSE AND TUBE COUPLERS, CONNECTORS AND CLAMPS.

TUBE CONNECTORS

See HOSE AND TUBE COUPLERS, CONNECTORS AND CLAMPS.

TUBE COUPLERS

See HOSE AND TUBE COUPLERS, CONNECTORS AND CLAMPS.

TUBES

See HOSES AND TUBES (FUEL LINES, RADIATOR, BY PASS, HEATER, RECOVERY TANK AND OIL COOLERS).

TURBO CHARGERS

TURBO CHARGER INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Boost pressure incorrect	A	(1) Require repair or replacement.
Leaking	A	Require repair or replacement.
Noisy	2	Suggest repair or replacement.
Oil seal (internal) leaking	A	Require repair or replacement.
Vibrates	A	Require repair or replacement.

(1) - Boost pressure problems may be caused by other systems or components.

VACUUM CONNECTIONS

See VACUUM HOSES, TUBES AND CONNECTIONS (NON-METALLIC).

VACUUM HOSES, TUBES AND CONNECTIONS (NON-METALLIC)

VACUUM HOSE, TUBE AND CONNECTION (NON-METALLIC) INSPECTION

Condition	Code	Procedure
Leaking	A	Require repair or replacement.
Melted	A	Require replacement.
Missing	C	Require replacement.
Oil-soaked (spongy)	1	Suggest replacement.

Restricted	A	..	Require repair or replacement.
Surface cracks (dry-rotted)	1	.....	Suggest replacement.

VACUUM REGULATOR SOLENOIDS

VACUUM REGULATOR SOLENOID INSPECTION

Condition	Code		Procedure
Attaching hardware missing	C	.....	Require replacement of hardware.
Attaching hardware threads damaged	A	...	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	...	Require repair or replacement of hardware.
Connector broken	A	..	Require repair or replacement.
Connector (Weatherpack type) leaking	A	..	Require repair or replacement.
Connector melted	A	.....	(1) Require repair or replacement.
Connector missing	C	.....	Require replacement.
Contaminated	A	.....	(2) Require repair or replacement.
Inoperative	B	.....	(3) Require repair or replacement. Further inspection required.
Leaking	A	..	Require repair or replacement.
Missing	C	.....	Require replacement.
Resistance out of specification	B	..	Require repair or replacement.
Restricted, affecting performance	A	..	Require repair or replacement.
Terminal broken	A	..	Require repair or replacement.
Terminal burned, affecting performance	A	.....	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	..	Suggest repair or replacement.
Terminal corroded, affecting performance	A	..	Require repair or replacement.
Terminal corroded, not affecting performance	2	..	Suggest repair or replacement.
Terminal loose, affecting performance	B	..	Require repair or replacement.
Terminal loose, not affecting performance	1	..	Suggest repair or replacement.
Threads damaged	A	..	Require repair or replacement.
Threads stripped (threads missing)	A	.....	Require replacement.
Wire lead conductors exposed	B	..	Require repair or replacement.
Wire lead corroded	A	..	Require repair or replacement.
Wire lead open	A	..	Require repair or replacement.
Wire lead shorted	A	..	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.

(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

VACUUM TUBES

See VACUUM HOSES, TUBES AND CONNECTIONS (NON-METALLIC).

VEHICLE SPEED SENSORS

VEHICLE SPEED SENSOR INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Inoperative	B	(3) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.

Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

VOLUME AIR FLOW SENSORS

VOLUME AIR FLOW SENSOR INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Inoperative	B	(3) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Restricted, affecting performance	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

Wire lead conductors exposed	B	..	Require repair or replacement.
Wire lead corroded	A	..	Require repair or replacement.
Wire lead open	A	..	Require repair or replacement.
Wire lead shorted	A	..	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

WASTE GATE CONTROL SOLENOIDS

WASTE GATE CONTROL SOLENOID INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Inoperative	B	(3) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Restricted, affecting performance	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.

Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

WASTE GATES AND BOOST CONTROL MECHANISMS

WASTE GATE AND BOOST CONTROL MECHANISM INSPECTION

Condition	Code	Procedure
Boost pressure incorrect	A	(1) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.

(1) - Incorrect boost pressure includes intermittent operation or out of OEM specification.

WATER PUMPS (ELECTRIC)

WATER PUMP (ELECTRIC) INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Inoperative	A	(2) Require replacement.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Noisy	2	Suggest replacement.
Rotation incorrect for application	B	Require repair or replacement.
Terminal broken	A	Require repair or replacement.

Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Vibration	1	Suggest replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Check fan motor/controls. Inoperative includes intermittent operation or out of OEM specification.

WATER PUMPS (NON-ELECTRIC)

WATER PUMP (NON-ELECTRIC) INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware corroded	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Corrosion (internal) is excessive, affecting performance	A	Require replacement.
Corrosion (internal) is excessive, not affecting performance	2	Suggest cooling system service.
Inoperative	A	(1) Require replacement.
Leaking	A	Require replacement.
Noisy	A	Require replacement.
Rotation incorrect for application	B	Require repair or replacement.
Shaft bent	A	Require replacement.

(1) - Inoperative includes intermittent operation or out of OEM specification.

WIRING HARNESSES AND CONNECTORS

WIRING HARNESS AND CONNECTOR INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require repair or replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Insulation damaged, conductors exposed	A	Require repair or replacement.
Insulation damaged, conductors not exposed	1	Suggest replacement.
Open	A	Require repair or replacement.
Protective shield (conduit) melted	2	(1) Suggest repair or replacement.
Protective shield (conduit) missing	2	Suggest repair or replacement.
Resistance (voltage drop) out of specification	A	Require repair or replacement.
Routed incorrectly	B	Require repair.
Secured incorrectly	B	Require repair.
Shorted	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Voltage drop out of specification	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.

* EXHAUST SYSTEM UNIFORM INSPECTION GUIDELINES *

1998 Mitsubishi Galant

GENERAL INFORMATION
Exhaust Systems Motorist Assurance Program
Standards For Automotive Repair

All Makes and Models

INTRODUCTION TO MOTORIST ASSURANCE PROGRAM (MAP)

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INTRODUCTION TO MOTORIST ASSURANCE PROGRAM (MAP)

OVERVIEW OF MOTORIST ASSURANCE PROGRAM

The Motorist Assurance Program is the consumer outreach effort of the Automotive Maintenance and Repair Association, Inc. (AMRA). Participation in the Motorist Assurance Program is drawn from retailers, suppliers, independent repair facilities, vehicle manufacturers and industry associations.

Our organization's mission is to strengthen the relationship between the consumer and the auto repair industry. We produce materials that give motorists the information and encouragement to take greater responsibility for their vehicles-through proper, manufacturer-recommended, maintenance. We encourage participating service and repair shops (including franchisees and dealers) to adopt (1) a Pledge of Assurance to their Customers and (2) the Motorist Assurance Program Standards of Service. All participating service providers have agreed to subscribe to this Pledge and to adhere to the promulgated Standards of Service demonstrating to their customers that they are serious about customer satisfaction.

These Standards of Service require that an inspection of the vehicle's (problem) system be made and the results communicated to the customer according to industry standards. Given that the industry did not have such standards, the Motorist Assurance Program successfully promulgated industry inspection communication standards in 1994-95 for the following systems: Exhaust, Brakes, ABS, Steering and Suspension, Engine Maintenance and Performance, HVAC, and Electrical Systems. Further, revisions to all of these inspection communication standards are continually re-published. In addition to these, standards for Drive Train and Transmissions have recently been promulgated. Participating shops utilize these Uniform Inspection & Communication

Standards as part of the inspection process and for communicating their findings to their customers.

The Motorist Assurance Program continues to work cooperatively and proactively with government agencies and consumer groups toward solutions that both benefit the customer and are mutually acceptable to both regulators and industry. We maintain the belief that industry must retain control over how we conduct our business, and we must be viewed as part of the solution and not part of the problem. Meetings with state and other government officials (and their representatives), concerned with auto repair and/or consumer protection, are conducted. Feedback from these sessions is brought back to the association, and the program adjusted as needed.

To assure auto repair customers recourse if they were not satisfied with a repair transaction, the Motorist Assurance Program offers mediation and arbitration through MAP/BBB-CARE and other non-profit organizations. MAP conducted pilot programs in twelve states before announcing the program nationally in October, 1998. During the pilots, participating repair shops demonstrated their adherence to the Pledge and Standards and agreed to follow the UICS in communicating the results of their inspection to their customers. To put some "teeth" in the program, an accreditation requirement for shops was initiated. The requirements are stringent, and a self-policing method has been incorporated which includes the "mystery shopping" of outlets.

We welcome you to join us as we continue our outreach... with your support, both the automotive repair industry and your customers will reap the benefits. Please visit MAP at our Internet site www.motorist.org or contact us at:

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Washington, DC 20005
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January 1999

MAP UNIFORM INSPECTION GENERAL GUIDELINES

OVERVIEW OF SERVICE REQUIREMENTS AND SUGGESTIONS

It is MAP policy that all exhaust, brake, steering, suspension, wheel alignment, drive-line, engine performance and maintenance, and heating, ventilation and air conditioning, and electrical services be offered and performed under the standards and procedures specified in these sections.

Before any service is performed on a vehicle, an inspection of the appropriate system must be performed. The results of this inspection must be explained to the customer and documented on an inspection form. The condition of the vehicle and its components will indicate what services/part replacements may be "Required" or "Suggested". In addition, suggestions may be made to satisfy the requests expressed by the customer.

When a component is suggested or required to be repaired or replaced, the decision to repair or replace must be made in the customer’s best interest, and at his or her choice given the options available.

This section lists the various parts and conditions that indicate a required or suggested service or part replacement. Although this list is extensive, it is not fully inclusive. In addition to this list, a technician may make a suggestion. However, any suggestions must be based on substantial and informed experience, or the vehicle manufacturer’s recommended service interval and must be documented.

Some conditions indicate that service or part replacement is

required because the part in question is no longer providing the function for which it is intended, does not meet a vehicle manufacturer's design specification or is missing.

Example:
An exhaust pipe has corroded severely and has a hole in it through which exhaust gases are leaking. Replacement of the exhaust pipe in this case is required due to functional failure.

Example:
A brake rotor has been worn to the point where it measures less than the vehicle manufacturer's discard specifications. Replacement of the rotor is required because it does not meet design specifications.

Some conditions indicate that a service or part replacement is suggested because the part is close to the end of its useful life or addresses a customer's need, convenience or request. If a customer's vehicle has one of these conditions, the procedure may be only to suggest service.

Example:
An exhaust pipe is rusted, corroded or weak, but no leaks are present. In this case, the exhaust pipe has not failed. However, there is evidence that the pipe may need replacement in the near future. Replacement of the pipe may be suggested for the customer's convenience in avoiding a future problem.

Example:
The customer desires improved ride and/or handling, but the vehicle's shocks or struts have not failed. In this case, replacement may be suggested to satisfy the customer's wishes. In this case, replacement of the shocks or struts may not be sold as a requirement.

A customer, of course, has the choice of whether or not a shop will service his or her vehicle. He or she may decide not to follow some of your suggestions. When a repair is required, a MAP shop must refuse partial service on that system if, in the judgment of the service provider, proceeding with the work could create or continue an unsafe condition. When a procedure states that required or suggested repair or replacement is recommended, the customer must be informed of the generally acceptable repair/replacement options whether or not performed by the shop.

When presenting suggested repairs to the customer, you must present the facts, allowing the customer to draw their own conclusions and make an informed decision about how to proceed.

The following reasons may be used for required and suggested services. These codes are shown in the "Code" column of the MAP Uniform Inspection & Communications Standards that follow:

Reasons to Require Repair or Replacement
A – Part no longer performs intended purpose
B – Part does not meet a design specification (regardless of performance)
C – Part is missing

NOTE: When a repair is required, the shop must refuse partial service to the system in question, if the repair creates or continues an unsafe condition.

Reasons to Suggest Repair or Replacement

1 - Part is close to the end of its useful life (just above discard specifications, or weak; failure likely to occur soon, etc.)
2 - To address a customer need, convenience, or request (to stiffen ride, enhance performance, eliminate noise, etc.)
3 - To comply with maintenance recommended by the vehicle's Original Equipment Manufacturer (OEM)
4 - Technician's recommendation based on substantial and informed experience

NOTE: Suggested services are always optional. When presenting suggested repairs to the customer, you must present the facts, allowing the customer to draw their own conclusions and make an informed decision about how to proceed.

EXHAUST

SERVICE PROCEDURES REQUIRED AND SUGGESTED FOR PROPER VEHICLE OPERATION

WARNING: Federal EPA rules prohibit altering an exhaust system in any way that defeats the emission reduction components of a vehicle. Be sure to review and adhere to EPA policy on removing and replacing catalytic converters. Where state or local laws are stricter, they take precedence over these guidelines.

NOTE: Some exhaust systems are of a welded design. It is not required that the entire system be replaced. Determine the need to replace individual components based on conditions of component.

CATALYTIC CONVERTERS

CAUTION: Before working on an exhaust system, review EPA regulations on removing and replacing catalytic converters.

NOTE: Any time a converter has failed, further diagnosis is required to determine the reason(s) for converter failure.

CATALYTIC CONVERTER INSPECTION

Condition	Code	Procedure
Air injection tube broken	A ...	Require repair or replacement of injection tube or replacement of catalytic converter.
Air injection tube burnt	A ...	Require repair or replacement of injection tube or replacement of catalytic converter.
Air injection tube leaking	A ...	Require repair or replacement of injection tube or replacement of catalytic converter.
Air injection tube		

loose	A	...	Require repair or replacement of injection tube or replacement of catalytic converter.
Air injection tube restricted	A	...	Require repair or replacement of injection tube or replacement of catalytic converter.
Air injection tube threads damaged	A	...	Require repair or replacement of injection tube or replacement of catalytic converter.
Air injection tube threads stripped (threads missing)	A	...	Require repair or replacement of injection tube or replacement of catalytic converter.
Body cracked	B	..	Require repair or replacement.
Converter empty	A	..	Require repair or replacement.
Converter fill plug missing	C	..	Require repair or replacement.
Converter missing	C	.....	Require replacement.
Exhaust gases leaking	A	..	Require repair or replacement.
Flanges leaking	A	...	Require repair or replacement of flanges.
Inlet pipes cracked	B	..	Require repair or replacement.
Internal rattle (except pellet-type)	2	.....	(1) Further inspection required.
Mounting brackets that are part of converter broken	A	..	Require repair or replacement.
Obvious overheating	..	.....	(2) Require testing of converter.
Outlet pipes cracked	B	..	Require repair or replacement.
Pieces of catalyst material found downstream	1	.....	Suggest replacement.
Plugged	A	.....	(3) Require replacement.
Testing has determined that existing converter has been lead-poisoned, contaminated, or failed testing	A	..	Require repair or replacement.

(1) - If the converter is breaking up, suggest converter replacement. If an object has fallen into the converter, remove the object.
(2) - Overheating is caused by something other than the converter. Further diagnosis is required to determine the cause of the overheating.
(3) - Determine cause and correct to ensure that new converter will not become plugged.

EXHAUST AND TAIL PIPES

NOTE: For pipes with resonators, also see MUFFLERS AND RESONATORS.

EXHAUST AND TAIL PIPE INSPECTION

Condition	Code	Procedure
Bracket broken	A	Require repair or replacement.
Pipe bent out of position	B	Require repair or replacement.
Pipe broken	A	Require repair or replacement.
Pipe cracked	B	Require repair or replacement.
Pipe leaking	A	Require replacement.
Pipe missing	C	Require replacement.
Pipe plugged	A	Require replacement.
Pipe weak due to corrosion, but no leaks present	1	Suggest replacement.
Weld broken	A	Require repair or replacement.

EXHAUST CONNECTIONS

EXHAUST CONNECTION INSPECTION

Condition	Code	Procedure
Attaching hardware incorrect	B	Require replacement of hardware.
Clamp broken	A	Require replacement.
Clamp loose	A	Require repair or replacement.
Clamp missing	C	Require replacement.
Corroded, affecting structural integrity	1	Suggest replacement.
Incorrect type (i.e. flange, ball & socket etc.)	B	Require replacement.
Leaking	A	Require repair.
Loose	A	Require repair.

HANGERS

HANGER INSPECTION

Condition	Code	Procedure
Broken	A	Require replacement.
Corroded, affecting structural integrity	1	Suggest replacement.
Incorrect type	B	Require replacement.
Loose	A	Require repair or replacement.
Missing	C	Require replacement.
Out of position	B	Require repair or replacement.
Rubber deteriorated	1	Suggest replacement.

HEAT RISERS (MECHANICAL EFE DEVICES)

HEAT RISER (MECHANICAL EFE DEVICE) INSPECTION

Condition	Code	Procedure
Broken	A	Require replacement of affected parts.
Diaphragm inoperative	A	(1) Require replacement.

Leaking	A	Require repair or replacement.
Noisy	2	Suggest repair or replacement of affected parts.
Seized	A	Require repair or replacement of affected parts.
Spring broken	B	Require replacement of spring(s).
Spring inoperative	A	Require replacement of spring(s).

(1) - If the inoperative diaphragm is separate from the heat riser, then require replacement of the inoperative diaphragm. If the inoperative diaphragm is part of the heat riser, then replace the heat riser.

HEAT SHIELDS

HEAT SHIELD INSPECTION

Condition	Code	Procedure
Bent	B	Require repair or replacement.
Broken	A	Require replacement.
Corroded, affecting structural integrity	1	Suggest replacement.
Loose	A	Require repair or replacement.
Missing	C	Require replacement.

MANIFOLDS (CAST AND TUBE TYPE)

MANIFOLD (CAST AND TUBE TYPE) INSPECTION

Condition	Code	Procedure
Air injection tube in manifold broken	A	Require repair or replacement of injection tube or replacement of manifold.
Air injection tube in manifold corroded, affecting structural integrity	1	Suggest replacement of injection tube or manifold.
Air injection tube in manifold leaking	A	Require repair or replacement of injection tube or replacement of manifold.
Air injection tube in manifold loose	A	Require repair.
Air injection tube in manifold restricted	A	Require replacement of injection tube or manifold.
Air injection tube in manifold threads damaged	A	Require repair of injection tube or manifold.
Air injection tube in manifold threads stripped (threads missing)	A	Require replacement of injection tube or manifold.
Bolt broken	A	Require replacement of bolts.

Bolt loose	A	Require tightening or replacement of bolts.
Bolt missing	C	Require replacement of bolts.
Corroded, affecting sealability	A	Require repair or replacement.
Cylinder head threads stripped	A	Require repair or replacement of cylinder head.
Gasket leaking	A	Require tightening or replacement of gasket.
Heat stove bent	B	(1) Require repair or replacement of stove.
Heat stove broken	A	(1) Require replacement of stove.
Heat stove corroded, affecting structural integrity	1	(1) Suggest replacement of stove.
Heat stove missing	C	(1) Require replacement of stove.
Manifold broken	A	Require repair or replacement.
Manifold cracked	B	Require repair or replacement.
Manifold warped	A	Require repair or replacement.
Out of specification	B	Require repair or replacement.
Stud broken	A	Require replacement of stud.
Stud missing	C	Require replacement of stud.
Stud threads damaged	A	Require repair or replacement of stud.
Stud threads stripped (threads missing)	A	Require replacement of stud.

(1) - Stove may not be available separately; this may require replacement of manifold.

MECHANICAL EFE DEVICES

See HEAT RISERS (MECHANICAL EFE DEVICES).

MUFFLERS AND RESONATORS

MUFFLER AND RESONATOR INSPECTION

Condition	Code	Procedure
Body shell distorted, affecting performance or structural integrity	A	Require replacement.
Corrosion hole	A	Require replacement.
Missing	C	Require replacement.
Mounting bracket broken	A	Require repair or replacement.
Mounting bracket cracked	B	Require repair or replacement.
Nipple cracked	A	Require repair or replacement.
Nipple loose	B	Require replacement.
Outer wrap peeling (exhaust not leaking)	1	Suggest replacement.
Plugged	A	Require replacement.
Puncture (other than a drain hole)	A	Require replacement.
Rattling or knocking noise from inside muffler	B	Require replacement.
Seam open (exhaust		

leaking)	A	.....	Require replacement.
Sound quality unsatisfactory	2	..	Suggest replacement to address customer need and/or request.
Split (exhaust leaking) .	A	.....	Require replacement.
Weak due to corrosion, but no leaks present	1	.....	Suggest replacement.

GEAR TOOTH CONTACT PATTERNS

1998 Mitsubishi Galant

GENERAL INFORMATION
Gear Tooth Contact Patterns

*** PLEASE READ THIS FIRST ***

The following article is for GENERAL INFORMATION purposes only. Information does not SPECIFICALLY apply to all years, makes and models, but is to be used as a general reference guide.

INSPECTION

PRELIMINARY INSPECTION

Wipe lubricant from internal parts. Rotate gears and inspect for wear or damage. Mount dial indicator to housing, and check backlash at several points around ring gear. Backlash must be within specifications at all points. If no defects are found, check gear tooth contact pattern.

GEAR TOOTH CONTACT PATTERN

NOTE: Drive pattern should be well centered on ring gear teeth. Coast pattern should be centered, but may be slightly toward toe of ring gear teeth.

1) Paint ring gear teeth with marking compound. Wrap cloth or rope around drive pinion flange to act as brake. Rotate ring gear until clear tooth contact pattern is obtained.

2) Contact pattern will indicate whether correct pinion bearing mounting shim has been installed and if drive gear backlash has been set properly. Backlash between drive gear and pinion must be maintained within specified limits, until correct tooth pattern is obtained.

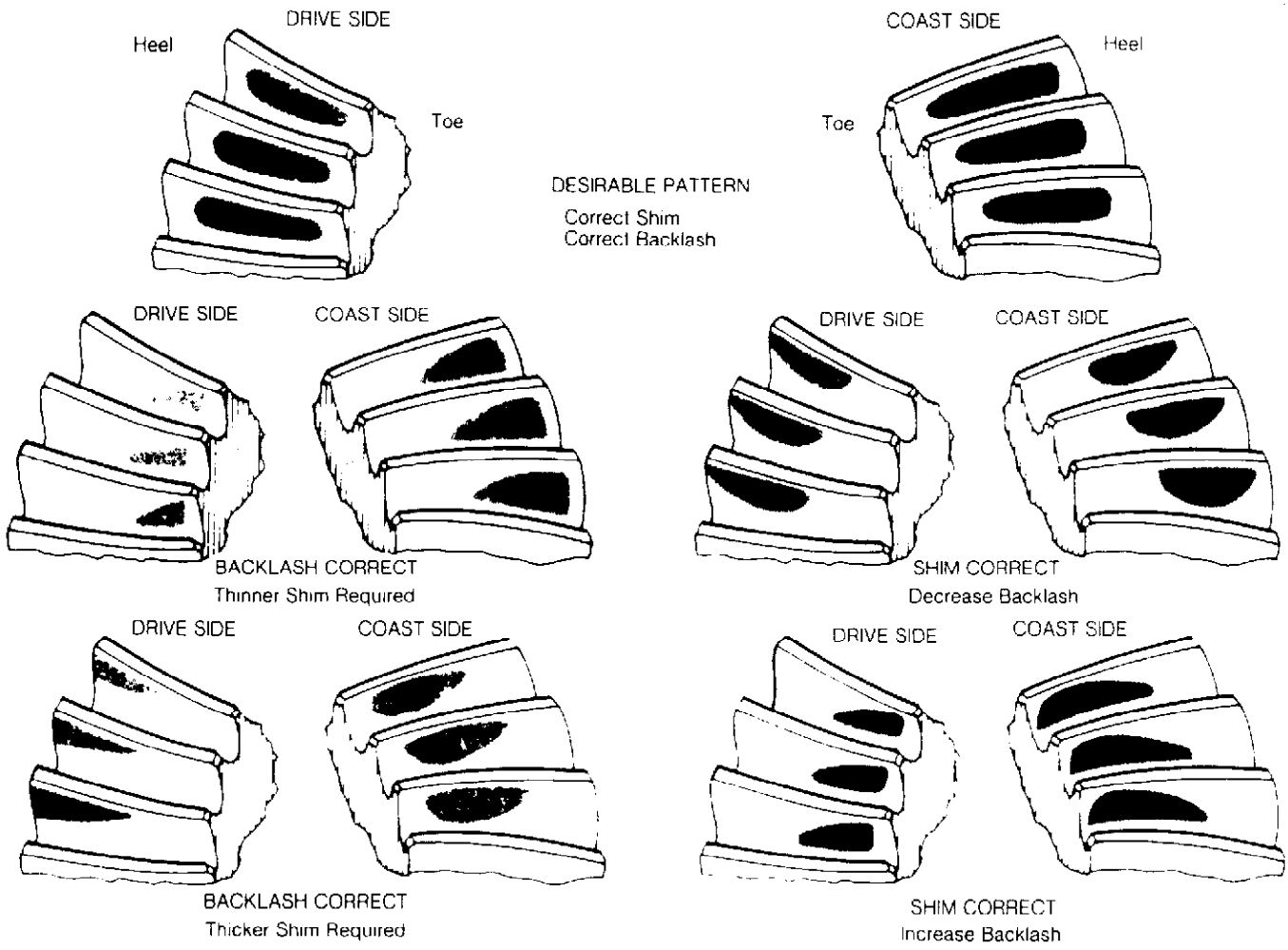

Fig. 1: Drive Axle Gear Tooth Patterns

ADJUSTMENTS

GEAR BACKLASH & PINION SHIM CHANGES

NOTE: Backlash is adjusted by either moving shims from one side of differential case to the other or by turning adjusting nuts on which side bearing races ride. Changing of pinion shims alters the distance from face of pinion of centerline of ring gear.

1) With no change in backlash, moving pinion further from ring gear moves drive pattern toward heel and top of tooth, and moves coast pattern toward toe and top of tooth.

2) With no change in backlash, moving pinion closer to ring gear moves drive pattern toward toe and bottom of tooth, and moves coast pattern toward heel and bottom of tooth.

3) With no change in pinion shim thickness, an increase in backlash moves ring gear further from pinion. Drive pattern moves toward heel and top of tooth, and coast pattern moves toward heel and top of tooth.

4) With no change in pinion shim thickness, decrease in

backlash moves ring gear closer to pinion gear. Drive pattern moves toward toe and bottom of tooth, and coast pattern moves toward toe and bottom of tooth.

GENERAL COOLING SYSTEM SERVICING

1998 Mitsubishi Galant

GENERAL INFORMATION
General Cooling System Servicing

* PLEASE READ THIS FIRST *

The following article is for general information only. Information may not apply to all years, makes and models. See specific article in the ENGINE COOLING section.

DESCRIPTION

The basic liquid cooling system consists of a radiator, water pump, thermostat, electric or belt-driven cooling fan, pressure cap, heater, and various connecting hoses and cooling passages in the block and cylinder head.

MAINTENANCE

DRAINING

Remove radiator cap and open heater control valve to maximum heat position. Open drain cocks or remove plugs in bottom of radiator and engine block. In-line engines usually have one plug or drain cock, while "V" type engines will have 2, one in each bank of cylinders.

CLEANING

A good cleaning compound removes most rust and scale. Follow manufacturer's instructions in the use of cleaner. If considerable rust and scale has to be removed, cooling system should be flushed. Clean radiator air passages with compressed air.

FLUSHING

CAUTION: Some manufacturers use an aluminum and plastic radiator. Flushing solution must be compatible with aluminum.

Back Flushing
Back flushing is an effective means of removing cooling system rust and scale. The radiator, engine and heater core should be flushed separately.

Radiator
To flush radiator, connect flushing gun to water outlet of radiator and disconnect water inlet hose. To prevent flooding engine, use a hose connected to radiator inlet. Use air in short bursts to prevent damage to radiator. Continue flushing until water runs clear.

Engine
To flush engine, remove thermostat and replace housing. Connect flushing gun to water outlet of engine. Flush using short air bursts until water runs clean.

Heater Core
Flush heater core as described for radiator. Ensure heater control valve is set to maximum heat position before flushing heater.

REFILLING

To prevent air from being trapped in engine block, engine should be running when refilling cooling system. After system is full, continue running engine until thermostat is open, then recheck fill level. Do not overfill system.

TESTING

THERMOSTAT

1) Visually inspect thermostat for corrosion and proper sealing of valve and seat. If okay, suspend thermostat and thermometer in a 50/50 mixture of coolant and water. See Fig. 1. Do not allow thermostat or thermometer to touch bottom of container. Heat water until thermostat just begins to open.

2) Read temperature on thermometer. This is the initial opening temperature and should be within specification. Continue heating water until thermostat is fully open and note temperature. This is the fully opened temperature. If either reading is not to specification, replace thermostat.

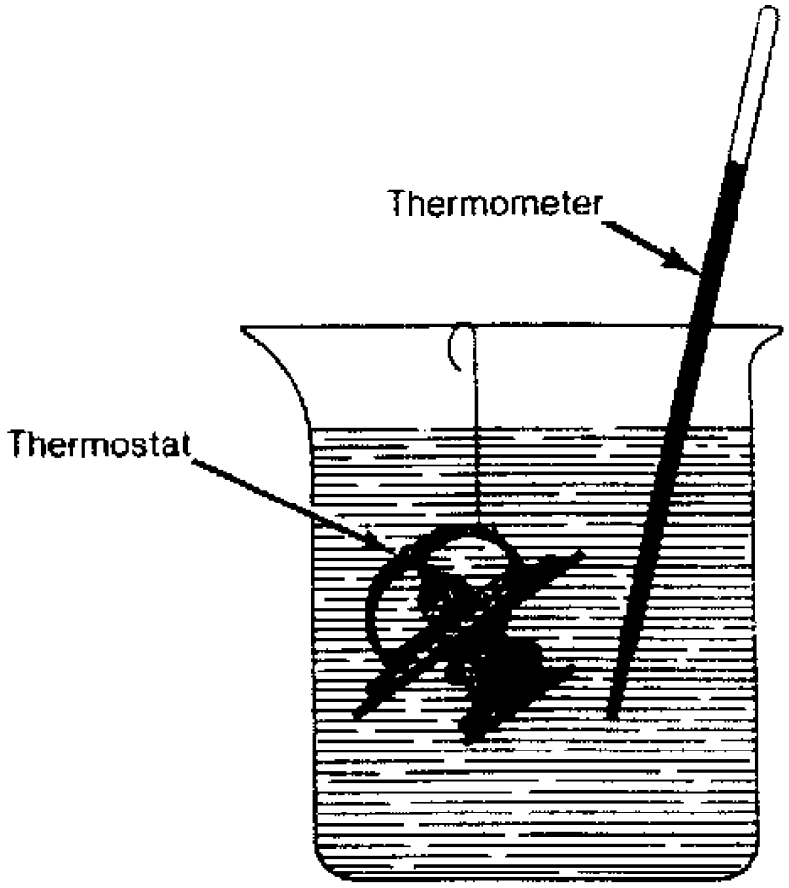

Fig. 1: Testing Thermostat in Anti-Freeze/Water Solution

PRESSURE TESTING

A pressure tester is used to check both radiator cap and

complete cooling system. Test components as follows, following tool manufacturer's instructions.

Radiator Cap

Visually inspect radiator cap, then dip cap into water and connect to tester. Pump tester to bring pressure to upper limit of cap specification. If cap fails to hold pressure, replace cap.

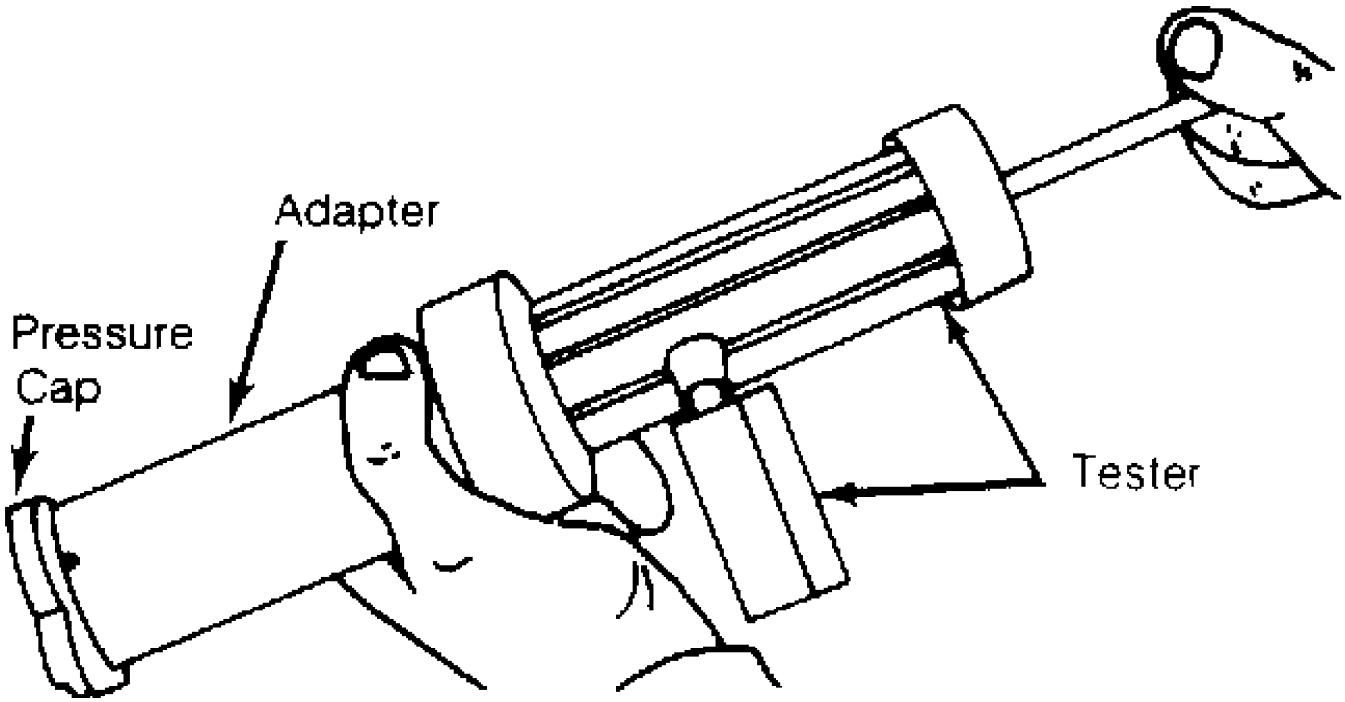

Fig. 2: Testing Radiator Pressure Cap

Cooling System

1) With engine off, wipe radiator filler neck seat clean. Fill radiator to correct level. Attach tester to radiator and pump until pressure is at upper level of radiator rating.

2) If pressure drops, inspect for external leaks. If no leaks are apparent, detach tester and run engine until normal operating temperature is reached. Reattach tester and observe. If pressure builds up immediately, a possible leak exists from a faulty head gasket or crack in head or block.

NOTE: Pressure may build up quickly. Release any excess pressure or cooling system damage may result.

3) If there is no immediate pressure build up, pump tester to within system pressure range (on radiator cap). Vibration of gauge pointer indicates compression or combustion leak into cooling system. Isolate leak by shorting each spark plug wire to cylinder block. Gauge pointer should stop or decrease vibration when leaking cylinder is shorted.

GENERATOR & REGULATOR

1998 Mitsubishi Galant

1998 STARTING & CHARGING SYSTEMS
Mitsubishi - Generators & Regulators

Diamante, Eclipse, Galant, Mirage, Montero, Montero Sport, 3000GT

DESCRIPTION & OPERATION

NOTE: The terms generator and alternator are interchangeable.

Mitsubishi generators are conventional 3-phase, self-rectifying type units containing 6 diodes (3 positive and 3 negative) which are used to rectify current. All models use a case-mounted Integrated Circuit (IC) voltage regulator.

Generator relay or resistor with diode is used to ensure charging of battery even if charging indicator light is defective.

ADJUSTMENTS

BELT TENSION

For belt tension, see DRIVE BELT ADJUSTMENT table.

DRIVE BELT ADJUSTMENT TABLE

Application	(1) Deflection New Belt In. (mm)	(1) Deflection Used Belt In. (mm)
Diamante (2)	.24-.28 (6.0-7.2)	.32-.37 (8.2-9.3)
Eclipse		
2.0L Non-Turbo (3)	.30-.41 (7.5-10.5)	.35-.47 (9.0-12.0)
2.0L Turbo (4)	.30-.35 (7.5-9.0)	.39 (10.0)
2.4L (4)	.30-.35 (7.5-9.0)	.39 (10.0)
Galant (4)	.30-.35 (7.5-9.0)	.39 (10.0)
Mirage (3)		
1.5L	.36-.42 (9.2-10.6)	.26-.33 (6.6-8.3)
1.8L	.33-.39 (8.5-10.0)	.28-.31 (7.0-8.0)
Montero (4)	.22-.29 (5.5-7.5)	.31-.35 (8.0-9.0)
Montero Sport		
2.4L (4)	.22-.29 (5.5-7.5)	.30-.33 (7.5-8.3)
3.0L (4)	.22-.29 (5.5-7.5)	.31-.35 (8.0-9.0)
3000GT		
DOHC (5)	.14-.16 (3.5-4.0)	.16-.20 (4.0-5.0)
SOHC (6)	.16-.20 (4.0-5.0)	.24-.32 (6.0-8.0)

(1) - With 22 lbs. (10 kg) pressure applied midway on belt run.
(2) - Measure between A/C compressor pulley and crankshaft pulley.
(3) - Measure between crankshaft pulley and generator pulley.
(4) - Measure between water pump pulley and generator pulley.
(5) - Measure between crankshaft pulley and idler pulley.
(6) - Measure between power steering pulley and idler pulley.

TROUBLE SHOOTING

NOTE: See TROUBLE SHOOTING article in the GENERAL INFORMATION section.

ON-VEHICLE TESTING

GENERATOR TO BATTERY CONTINUITY TEST

NOTE: Check generator wiring harness connections and drive belt tension and ensure battery is fully charged before performing test.

1) Turn ignition off. Disconnect negative battery cable. Remove output lead from generator terminal "B". See Fig. 1. Install a 100-amp or 130-amp ammeter in series with terminal "B" and disconnected output lead. Install positive lead of ammeter to terminal "B" and negative lead to disconnected output wire.

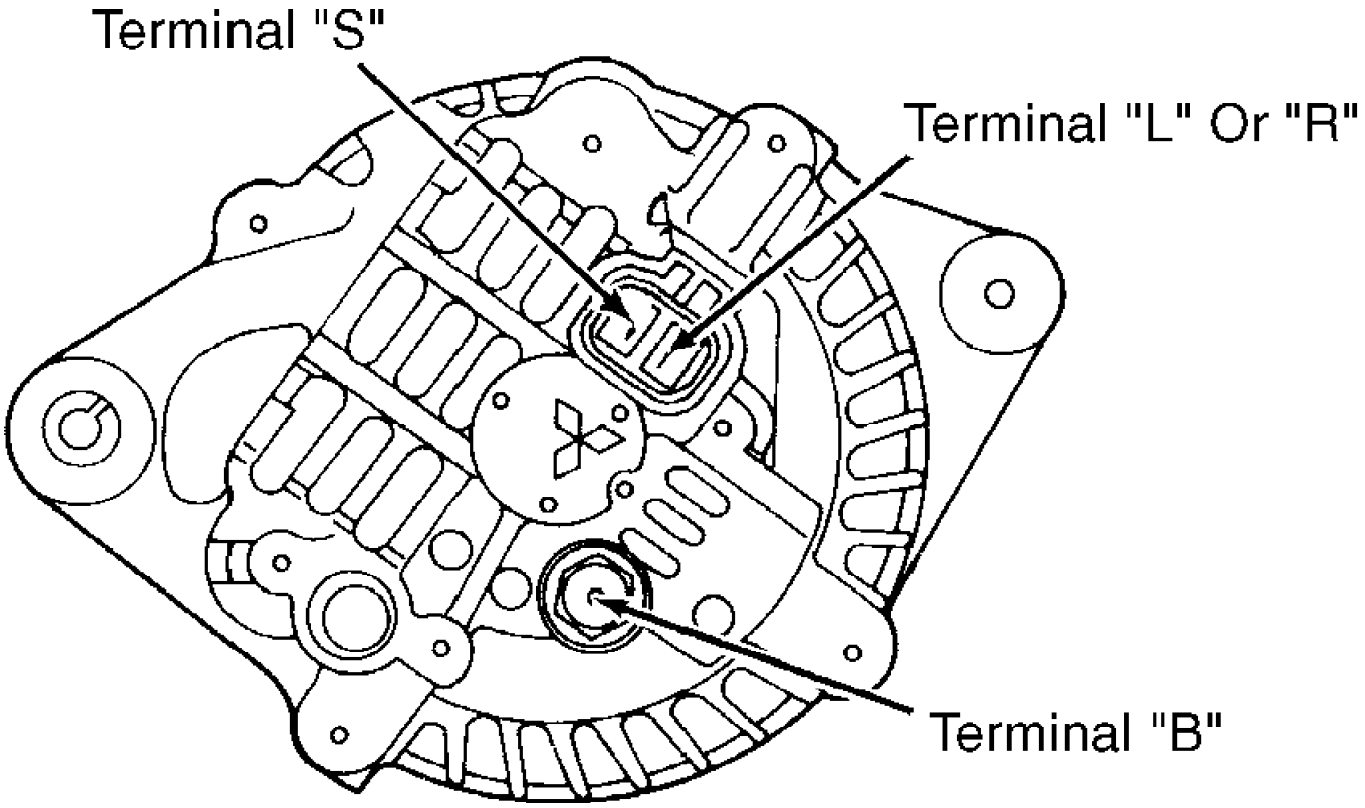

Fig. 1: Identifying Generator Terminals (Typical)
Courtesy of Mitsubishi Motor Sales of America

2) Install positive lead of digital voltmeter to terminal "B" and negative lead to positive battery terminal. Install a tachometer and reconnect negative battery cable.

3) Start and operate engine at 2500 RPM. Turn accessories on and adjust engine speed until ammeter indicates slightly greater than 30 amps, and note voltmeter reading. If voltmeter indicates .3 volt or less, system is okay.

4) If voltage is greater than .3 volt, check wiring between generator terminal "B", fusible link and positive battery terminal. If terminal is not sufficiently tight or if harness is discolored due to overheating, repair as necessary and retest.

GENERATOR OUTPUT TEST

NOTE: A slightly discharged battery should be used, as a fully charged battery may not allow full generator output.

1) Turn ignition off. Disconnect negative battery cable. Disconnect generator output wire from terminal "B". Connect positive lead of 100-amp ammeter to terminal "B" and negative lead to disconnected output lead.

CAUTION: Tighten each connection securely, as heavy current flow will exist. DO NOT use clips on ammeter. An inductive-type ammeter is recommended.

2) Connect positive voltmeter lead (0-20 volts) to generator terminal "B" and negative lead to ground. Install a tachometer and reconnect negative battery cable.

3) Ensure voltmeter indicates battery voltage. If voltage is not present, check for open circuit in wire between generator terminal "B" and positive battery terminal. Check grounds and fusible link.

4) Start engine and turn headlights on. Set headlights at high beam and heater blower switch on HIGH. Increase engine speed to 2500 RPM and note generator output current on ammeter. Minimum output should be within specification. See GENERATOR MINIMUM OUTPUT SPECIFICATIONS table.

NOTE: Output voltage changes with electrical load and temperature. Ensure proper electrical load is applied while checking output. Nominal output may not be obtained if generator or ambient temperature is excessive. Allow generator or temperature to cool, and recheck output. Generator output is stamped on metal plate attached to generator case.

5) If minimum output is not obtained and generator wiring is okay, repair generator. Operate engine at idle speed after the test.

GENERATOR MINIMUM OUTPUT SPECIFICATIONS TABLE

Application	Amps
Diamante	110
Eclipse	
2.0L Non-Turbo	90
2.0L Turbo	75
2.4L	90
Galant	90
Mirage	80
Montero	100
Montero Sport	
2.4L	60
3.0L	85
3000GT	
DOHC	110
SOHC	90

REGULATED VOLTAGE TEST

NOTE: Ensure battery is fully charged and proper drive belt tension exists.

1) Turn ignition switch off. Disconnect negative battery cable. Connect positive voltmeter lead to terminal "S" of generator.

See Fig. 1. Connect negative voltmeter lead to ground.

2) Disconnect generator output wire from terminal "B". Install a 100-amp ammeter in series with terminal "B" and disconnected output lead. Connect positive lead of ammeter to terminal "B" and negative lead to disconnected output wire. Install a tachometer, and reconnect negative battery cable.

3) Turn ignition switch on and ensure voltmeter indicates battery voltage. If voltage is not present, check for open in wire between generator terminal "S" and positive battery terminal. Check for blown fusible link.

4) Start engine. Ensure all lights and accessories are off. Operate engine at 2500 RPM and read voltmeter when generator output current drops to 10 amps or less. Voltage regulator is okay if voltage output is within specification. See REGULATOR VOLTAGE SPECIFICATIONS table.

REGULATOR VOLTAGE SPECIFICATIONS TABLE

Ambient Temperature	Voltage
-4°F (-20°C)	14.2-15.4
68°F (20°C)	13.9-14.9
140°F (60°C)	13.4-14.6
176°F (80°C)	13.1-14.5

GENERATOR RELAY TEST

NOTE: Information for all other models is not available from manufacturer at time of publication.

Diamante & Mirage

Remove generator relay. On Diamante, relay is located in relay box in engine compartment near battery. On Mirage, relay is located in relay box in engine compartment between battery and strut tower. On both models, connect positive lead of ohmmeter to relay terminal No. 4. See WIRING DIAGRAMS. Connect negative lead of ohmmeter to relay terminal No. 2. Continuity should be present. Switch ohmmeter lead locations. Continuity should not be present. Replace generator relay if continuity is not as specified.

BENCH TESTING

RECTIFIER ASSEMBLY

1) Using ohmmeter, check for continuity between diodes and stator coil lead connection. See Fig. 2. Reverse leads. If continuity is present in both directions, diode is shorted. Replace rectifier assembly.

2) To check entire diode assembly, use an ohmmeter to check for continuity between both ends of each diode. See Fig. 2. Switch ohmmeter leads. Continuity should be present in one direction only. If continuity is not as specified, diode is defective. Replace rectifier assembly.

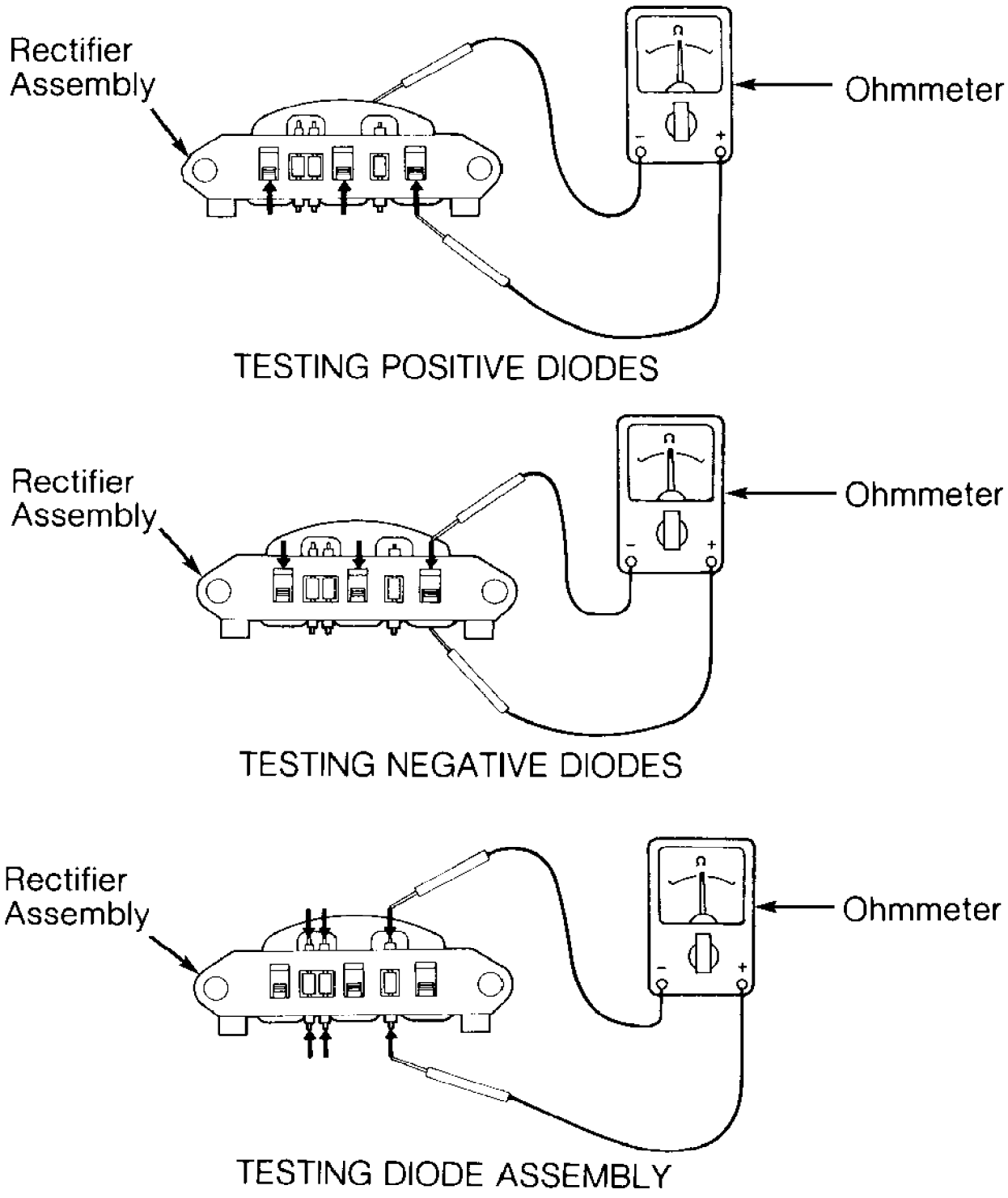

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Fig. 2: Testing Rectifier Assembly
Courtesy of Mitsubishi Motor Sales of America

ROTOR

1) Check continuity across rotor slip rings. Resistance should be 3-5 ohms. Replace rotor if continuity is not present or resistance is not within specification.

2) Check continuity between individual slip rings and rotor shaft. If continuity is present, rotor coil or slip ring is grounded. Replace rotor.

STATOR

Ensure continuity is not present between stator coil leads and stator core. Check continuity between leads of stator coil. If continuity is not present between coil leads, replace stator.

OVERHAUL

Replace brushes if worn to limit line. Limit line is line closest to rotor contact end of brush. Brushes can be retained in brush holder while installing rotor by inserting wire into back of rear housing. See Fig. 3.

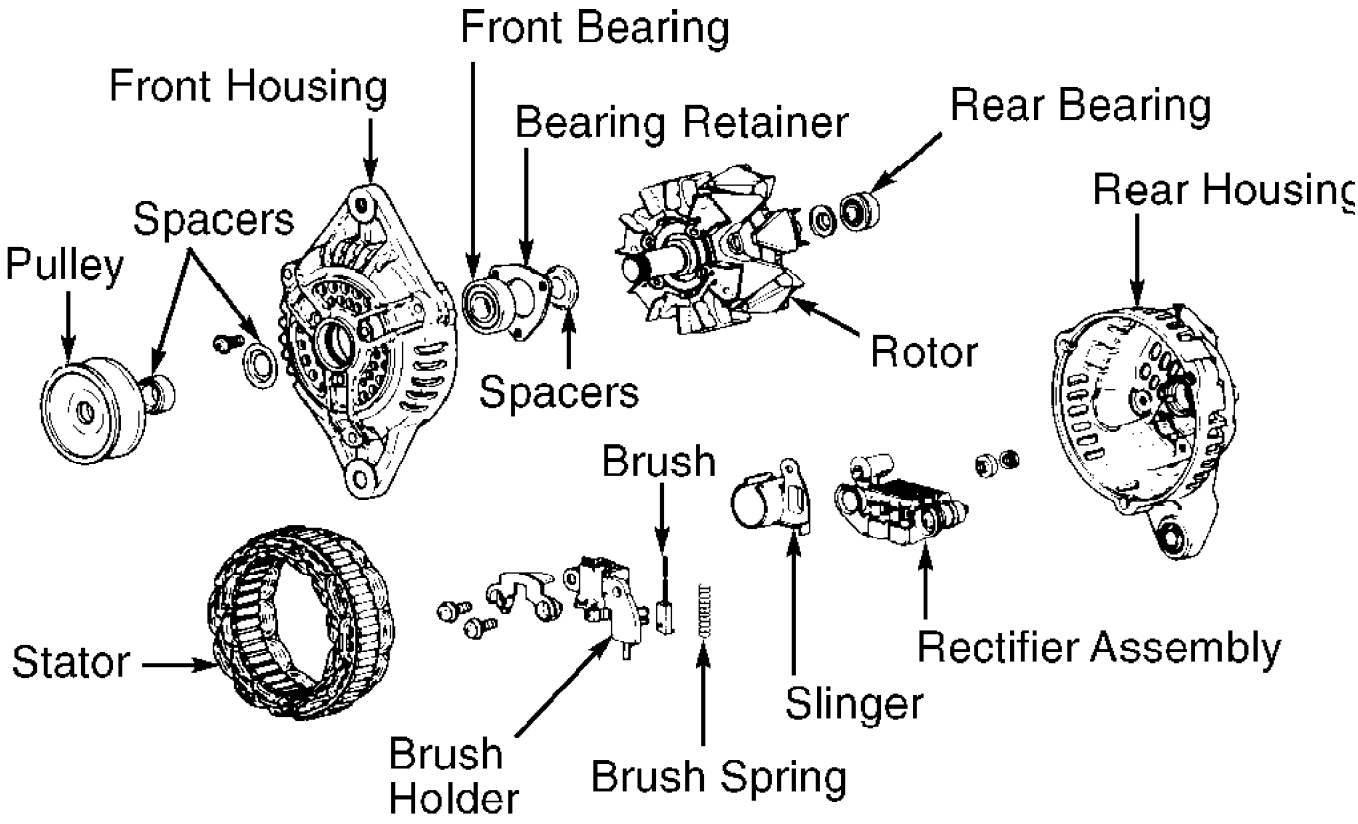


Fig. 3: Exploded View Of Mitsubishi Generator (Typical)
Courtesy of Mitsubishi Motor Sales of America

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS TABLE

Application	Ft. Lbs. (N.m)

Generator Adjusting Bolt	
Diamante, Mirage, Montero & Montero Sport (3.0L)	16 (22)
Eclipse, Galant & Montero Sport (2.4L)	9-11 (12-15)
3000GT	
DOHC	33 (44)
SOHC	9-11 (12-15)
Generator Pivot Bolt Nut	
Diamante, Mirage & 3000GT (DOHC)	33 (44)
Eclipse, Galant & Montero Sport (2.4L)	15-18 (20-25)
Montero & Montero Sport (3.0L)	38 (52)
3000GT (SOHC)	15-18 (20-25)

WIRING DIAGRAMS

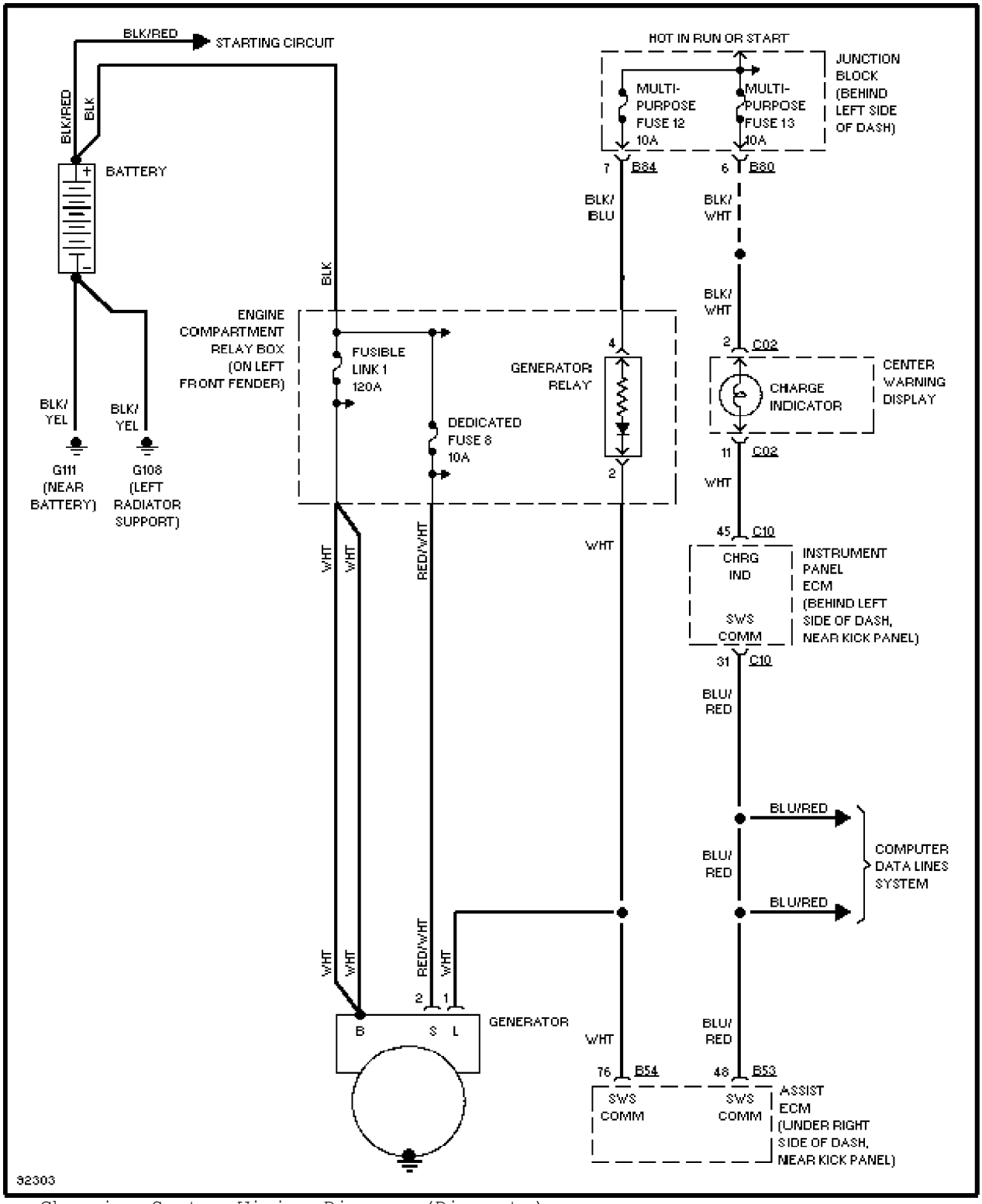


Fig. 4: Charging System Wiring Diagram (Diamante)

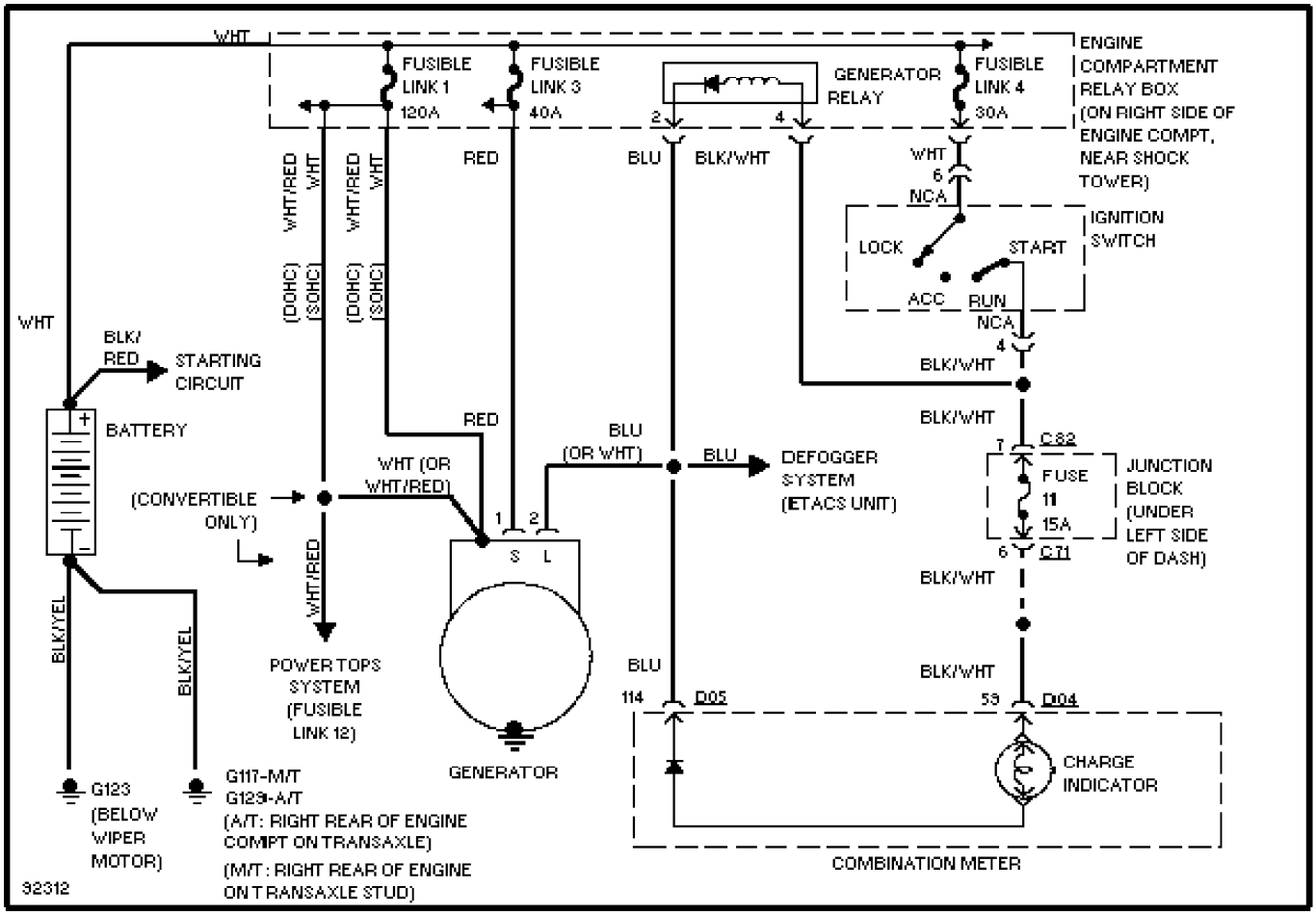


Fig. 5: Charging System Wiring Diagram (3000GT)

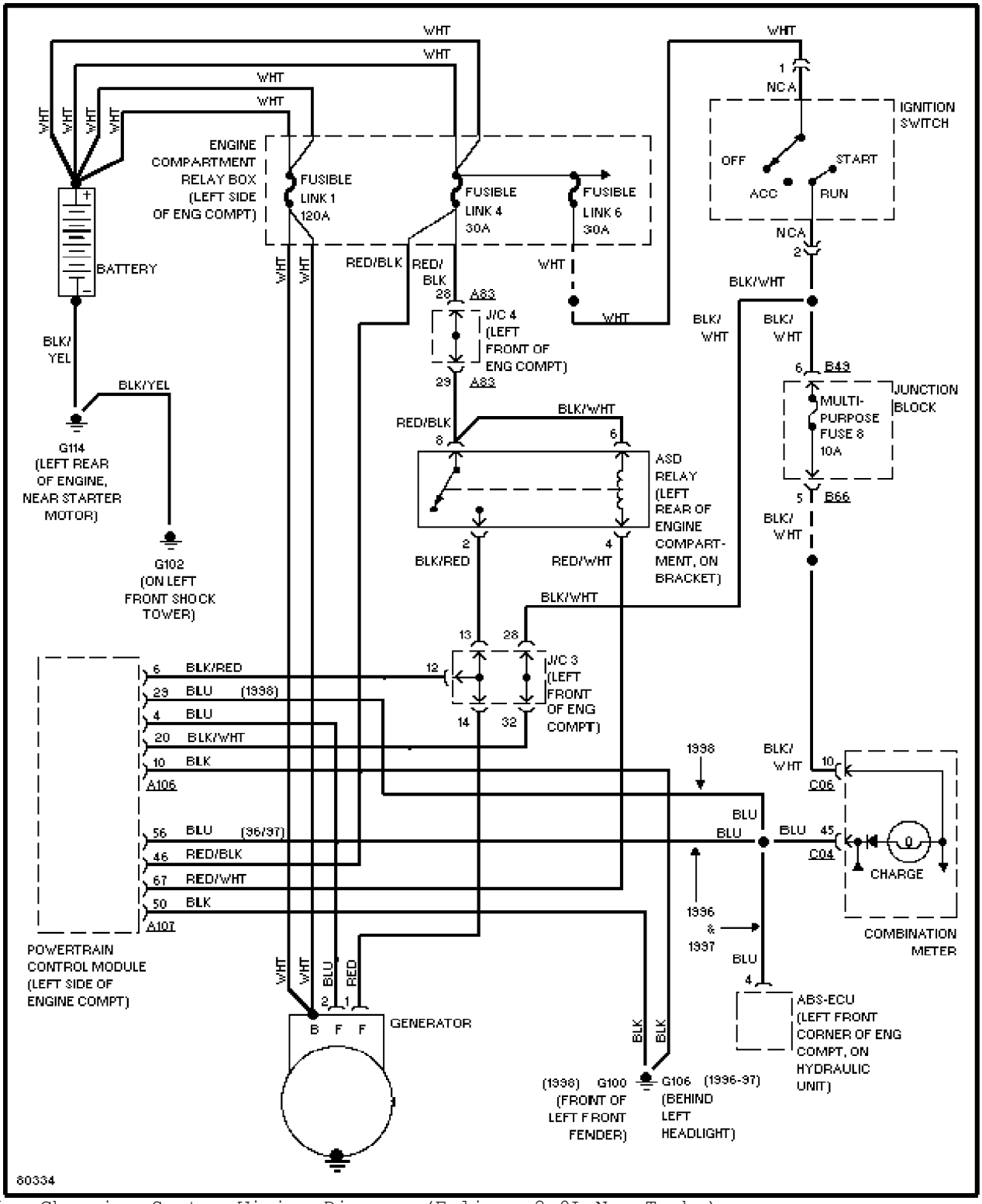


Fig. 6: Charging System Wiring Diagram (Eclipse 2.0L Non-Turbo)

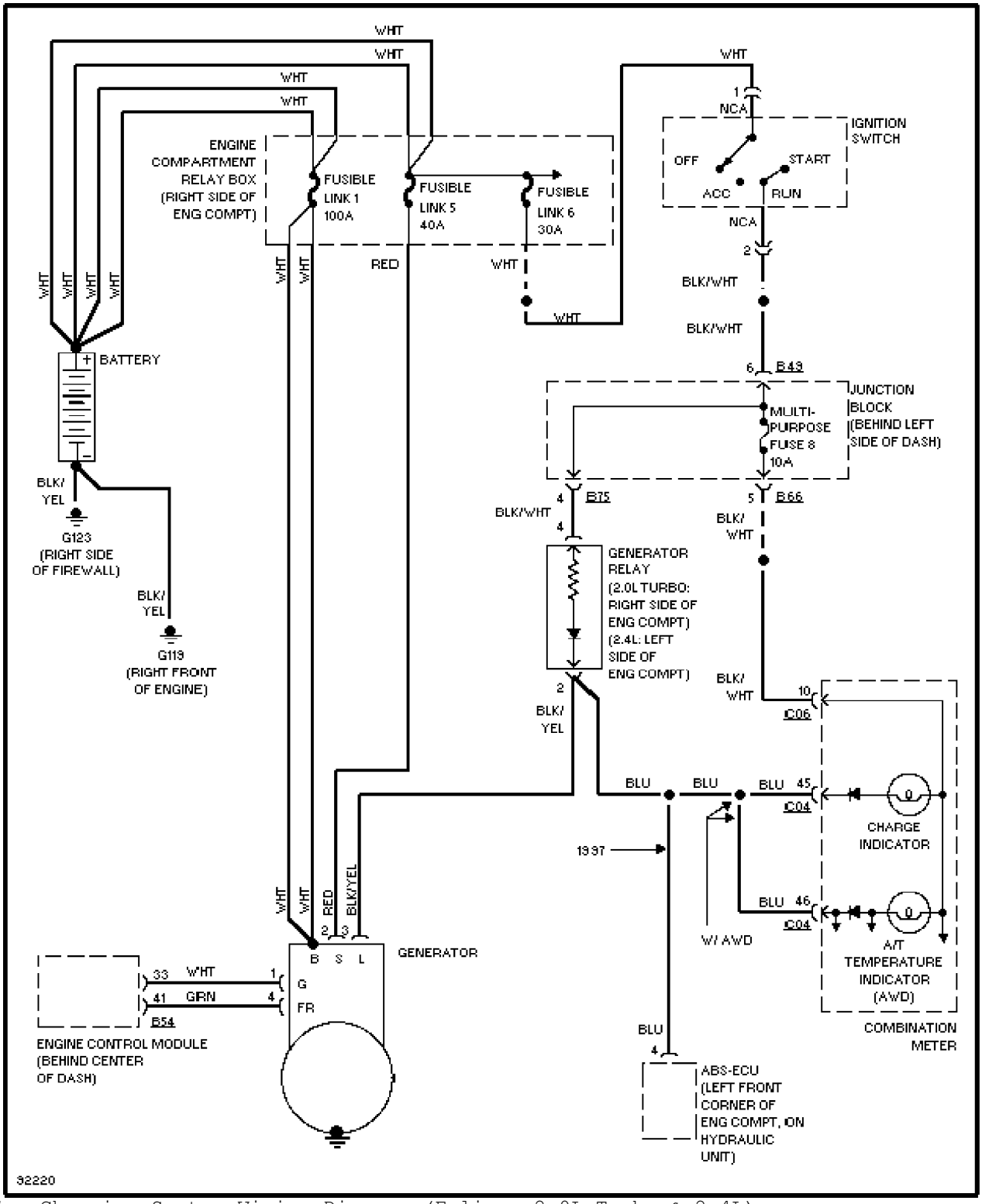


Fig. 7: Charging System Wiring Diagram (Eclipse 2.0L Turbo & 2.4L)

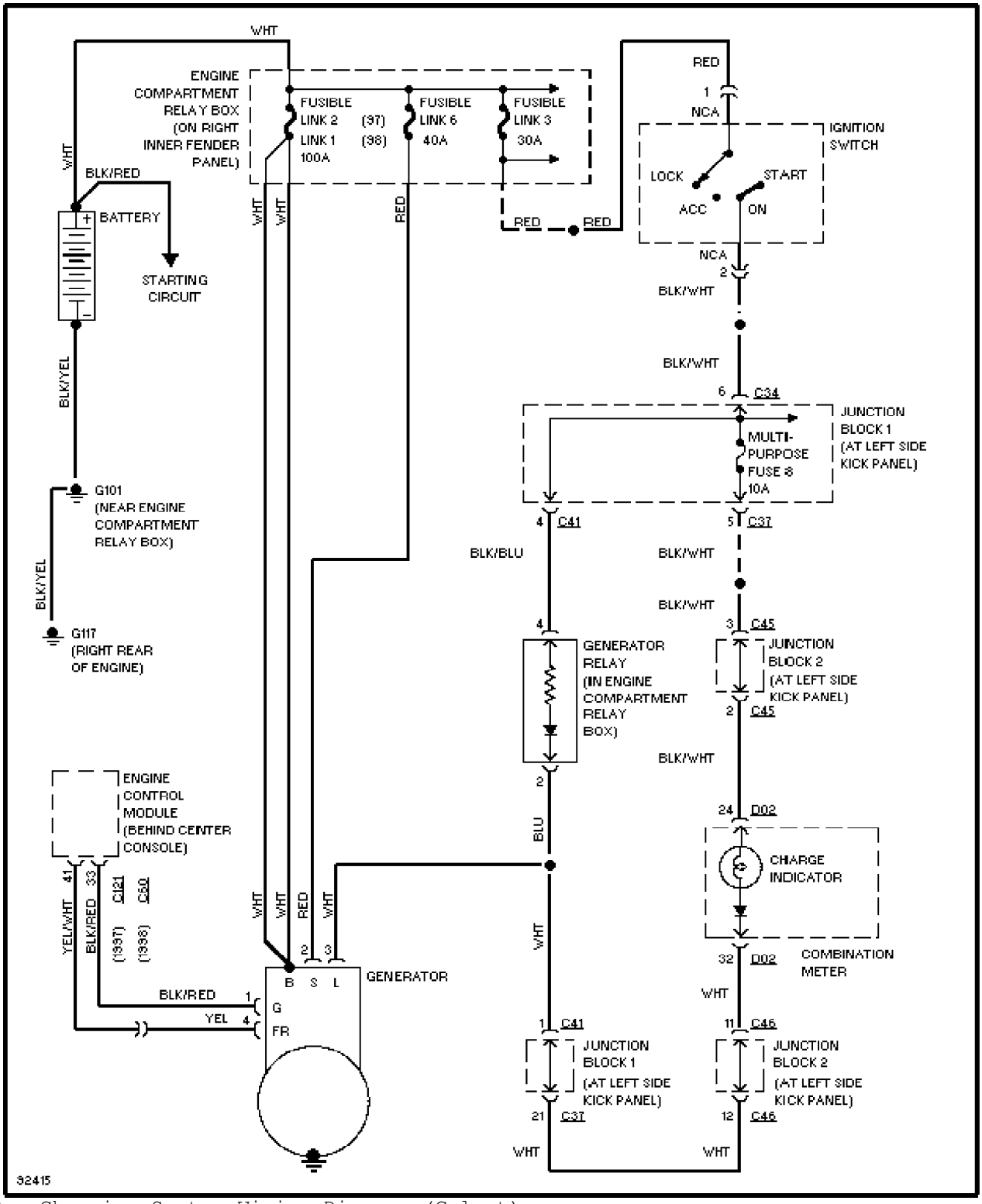


Fig. 8: Charging System Wiring Diagram (Galant)

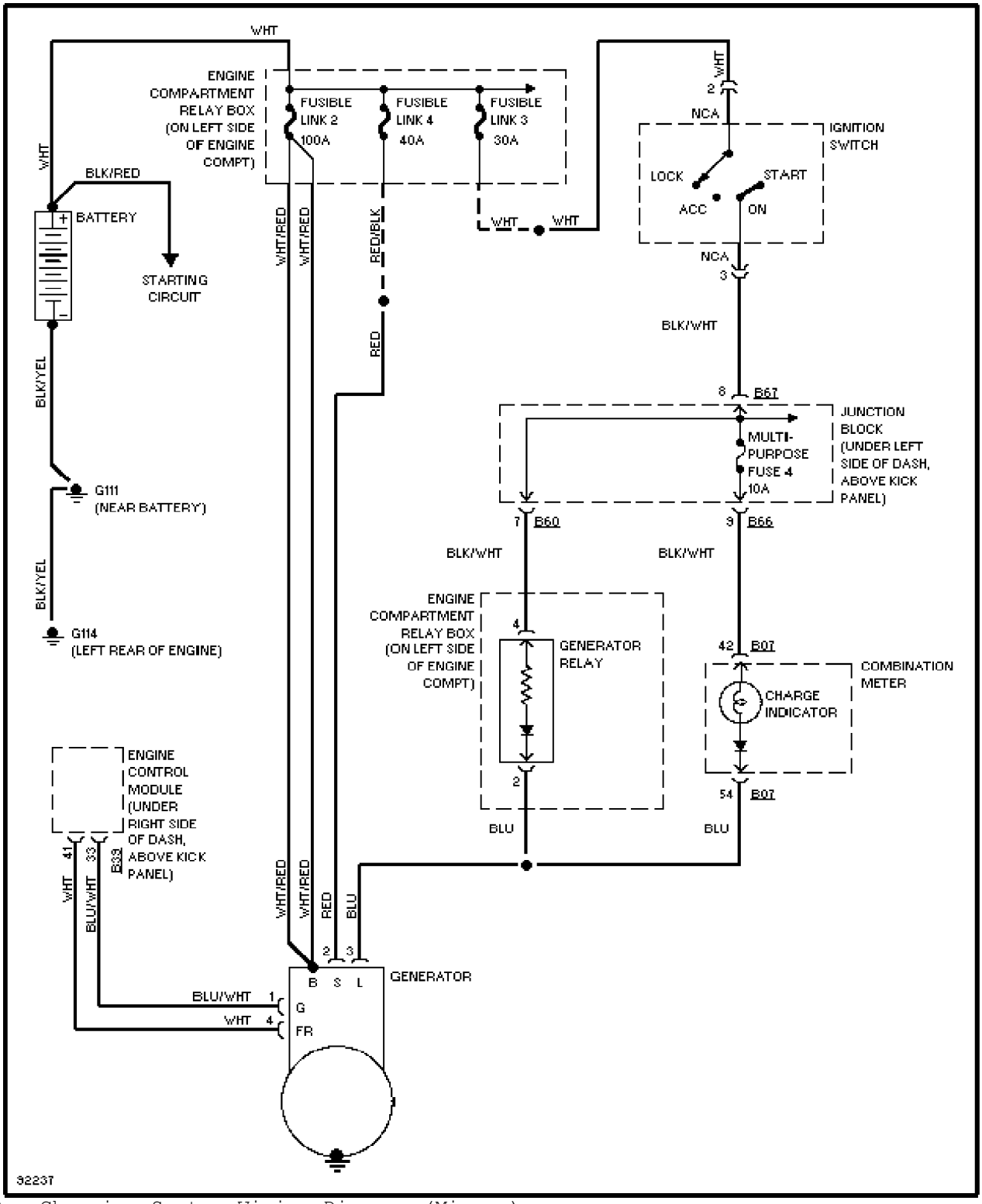


Fig. 9: Charging System Wiring Diagram (Mirage)

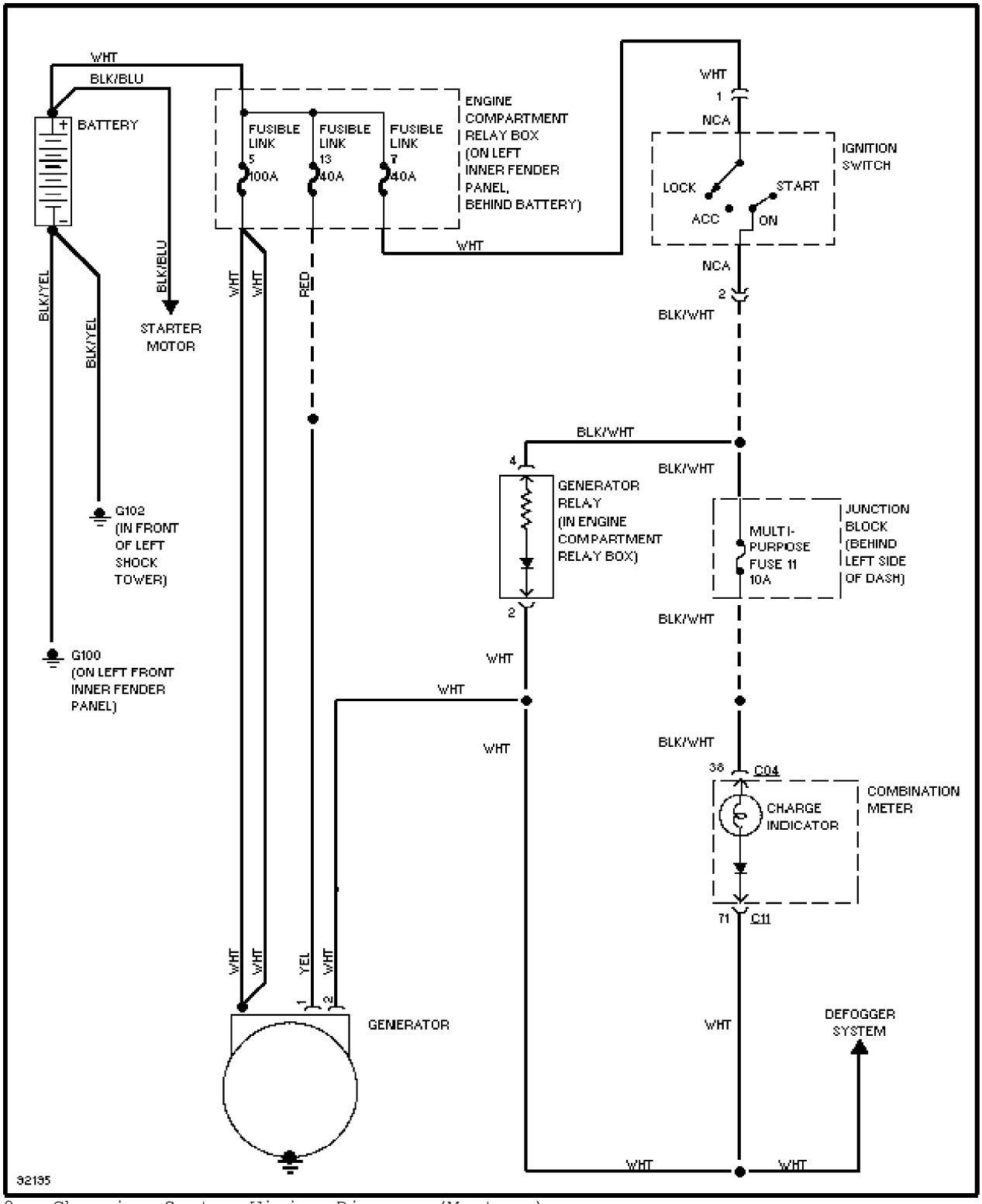


Fig. 10: Charging System Wiring Diagram (Montero)

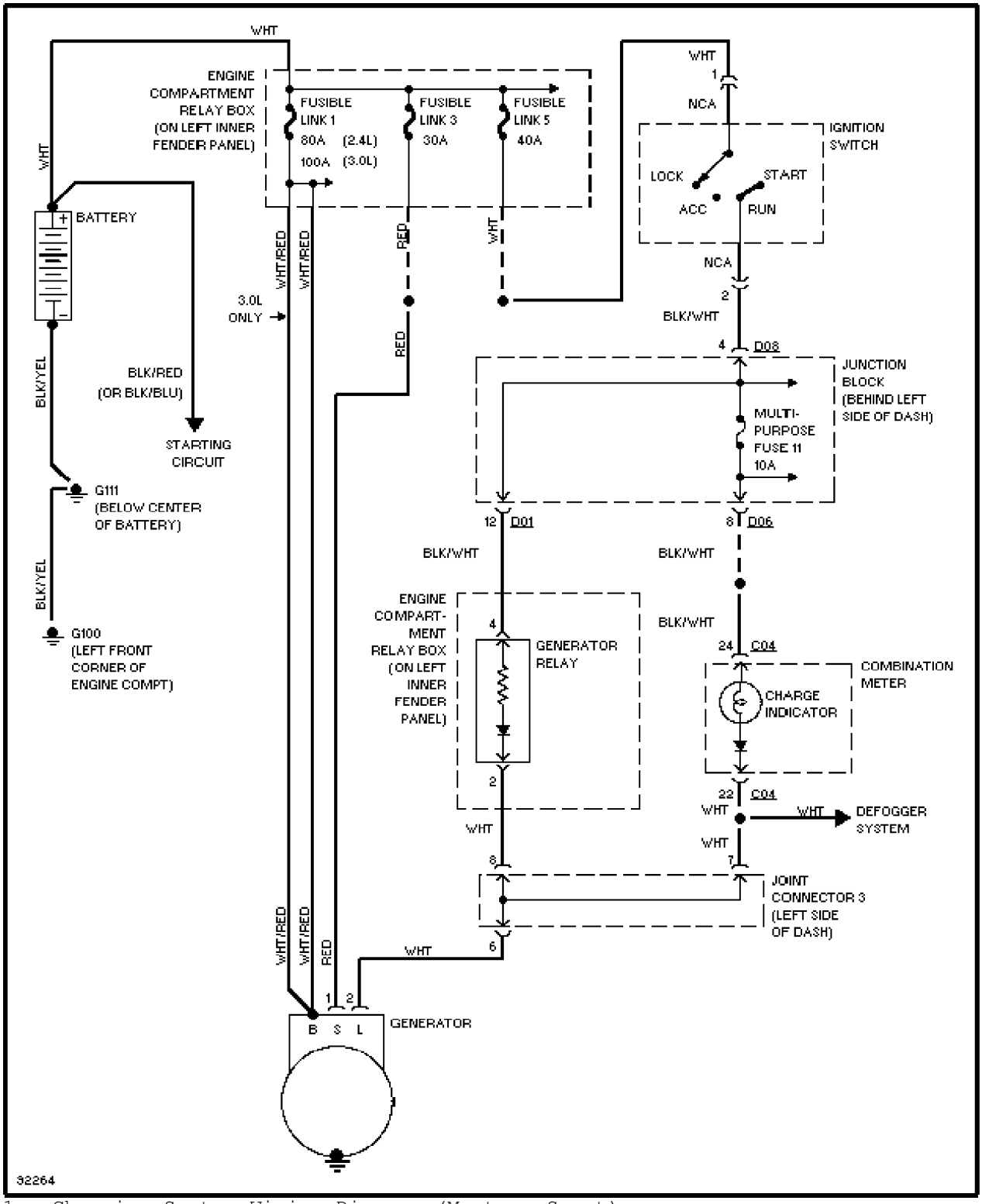


Fig. 11: Charging System Wiring Diagram (Montero Sport)

HEATER SYSTEM

1998 Mitsubishi Galant

1998 AIR CONDITIONING & HEAT
Mitsubishi - Heater System

Galant

* PLEASE READ THIS FIRST *

WARNING: To avoid injury from accidental air bag deployment, read and carefully follow all SERVICE PRECAUTIONS and DISABLING & ACTIVATING AIR BAG SYSTEM procedures in AIR BAG RESTRAINT SYSTEM article.

DESCRIPTION

Heater assembly is located in passenger compartment. A blend air damper is used to regulate airflow and heat output. Heater assembly contains heater core, air ducts, blower motor and intake ducts. See Fig. 1. Heater systems are blend-air type.

OPERATION

Air selector control regulates airflow source (fresh or recirculated). Temperature control opens and closes blend air damper, which determines heat output. Mode selector lever directs airflow to appropriate outlet based on selection.

FRESH/RECIRCULATED AIR SELECTOR CONTROL

A fresh/recirculated air control switch and damper motor are used for fresh or recirculated air selection. See Fig. 2. With control switch at fresh air setting, outside air is allowed to enter and pass through heater core.

With control switch at recirculated air setting, air is recirculated inside passenger compartment. Vehicle uses a fresh/recirculated air control switch and damper motor for fresh or recirculated air selection. Recirculation position is used to achieve maximum heating.

BLOWER SWITCH

Blower switch controls 4 fan speeds to regulate amount of airflow. Fan speed increases as switch is turned clockwise. When blower switch is turned off, all functions stop.

MODE SELECTOR KNOB

Depending on position selected, air can be directed to both front and rear of passenger compartment. Airflow selection capabilities include individual areas or a combination of windshield (defrost), upper body, knee and/or foot area. Rear passenger air distribution is limited to foot area only.

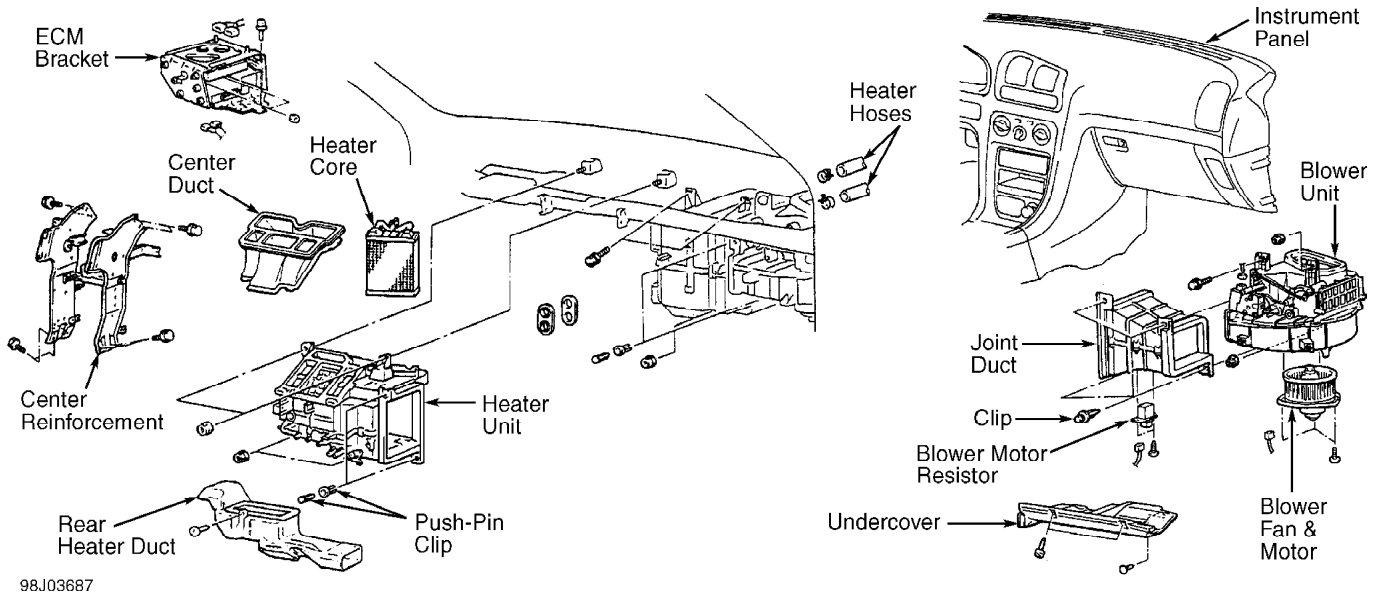
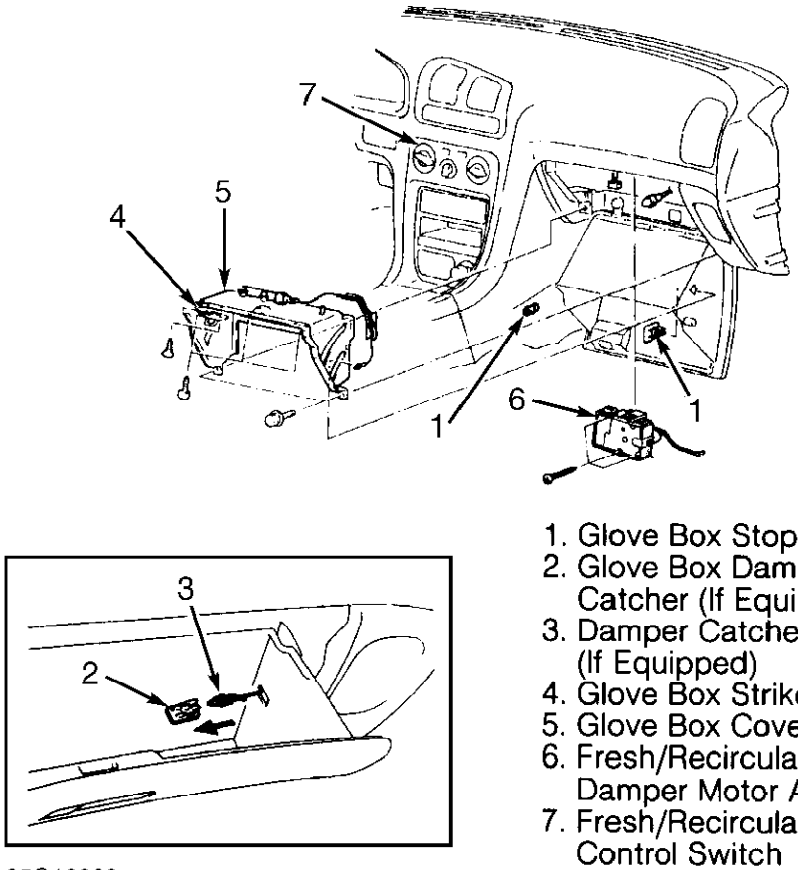


Fig. 1: Exploded View Of Heater System Components
Courtesy of Mitsubishi Motor Sales of America.



1. Glove Box Stopper
2. Glove Box Damper Catcher (If Equipped)
3. Damper Catcher Clip (If Equipped)
4. Glove Box Striker
5. Glove Box Cover
6. Fresh/Recirculated Air Damper Motor Assembly
7. Fresh/Recirculated Air Control Switch

Fig. 2: Fresh/Recirculated Air Control Switch & Damper Motor Assembly
Courtesy of Mitsubishi Motor Sales of America.

TEMPERATURE CONTROL KNOB

Temperature level is selected by turning control knob clockwise or counterclockwise. Highest heat setting is attained when control knob is turned fully clockwise. When temperature control knob is fully counterclockwise, ambient outside air temperature is available through vents.

ADJUSTMENTS

TEMPERATURE CONTROL CABLE

Turn temperature control knob counterclockwise to maximum cold setting. Place temperature control lever on bottom of heater unit to maximum cold setting. Install inner cable to lever pin. See Fig. 3. Push outer cable away from lever so there is no slack. Secure outer wire with clip.

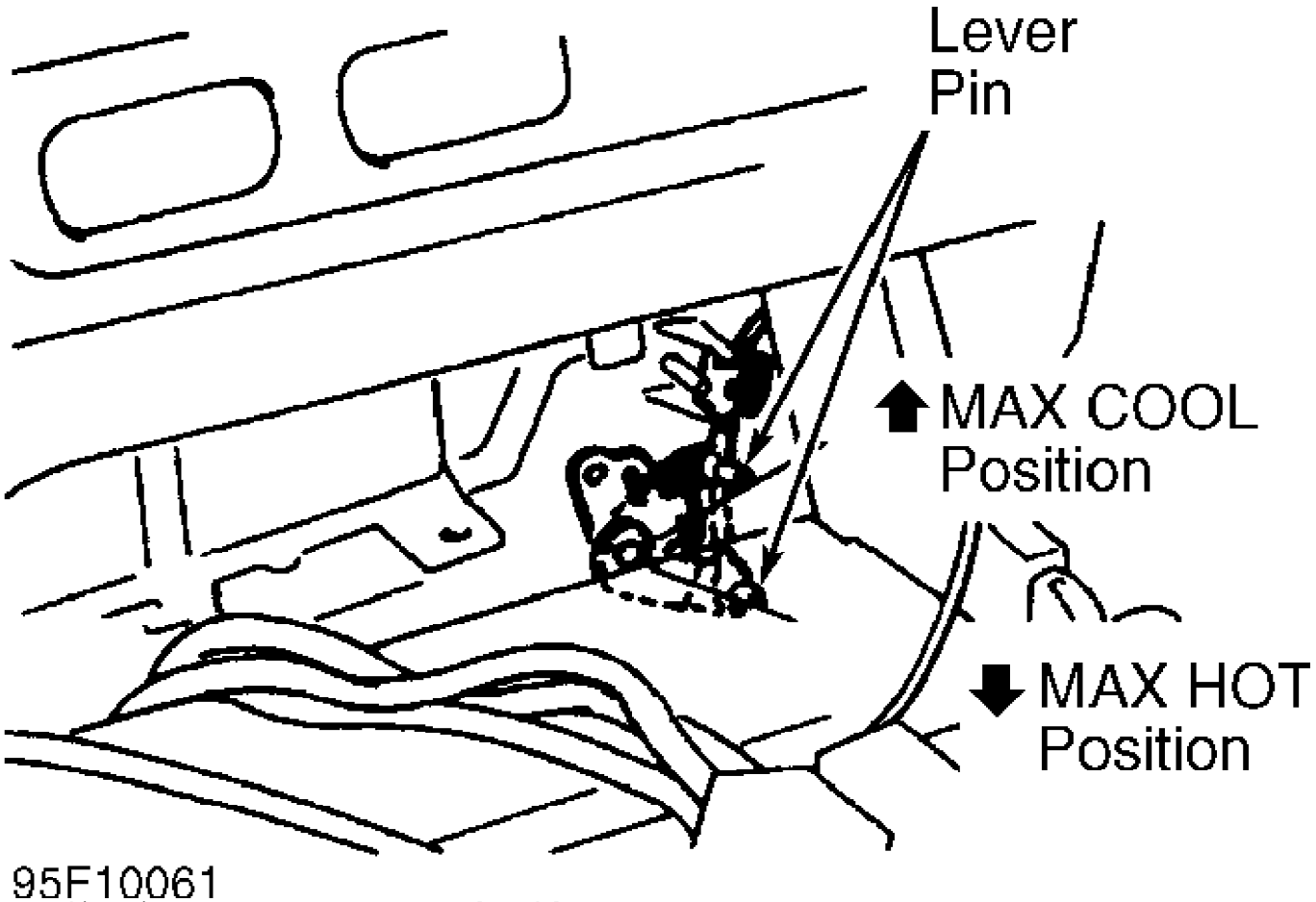


Fig. 3: Adjusting Temperature Control Cable
Courtesy of Mitsubishi Motor Sales of America.

MODE SELECTOR CABLE

Place mode selector knob at defrost setting. Place damper lever to defrost position. See Fig. 4. Connect inner cable to damper lever pin. Push outer cable away from lever so there is no slack. Secure outer wire with clip.

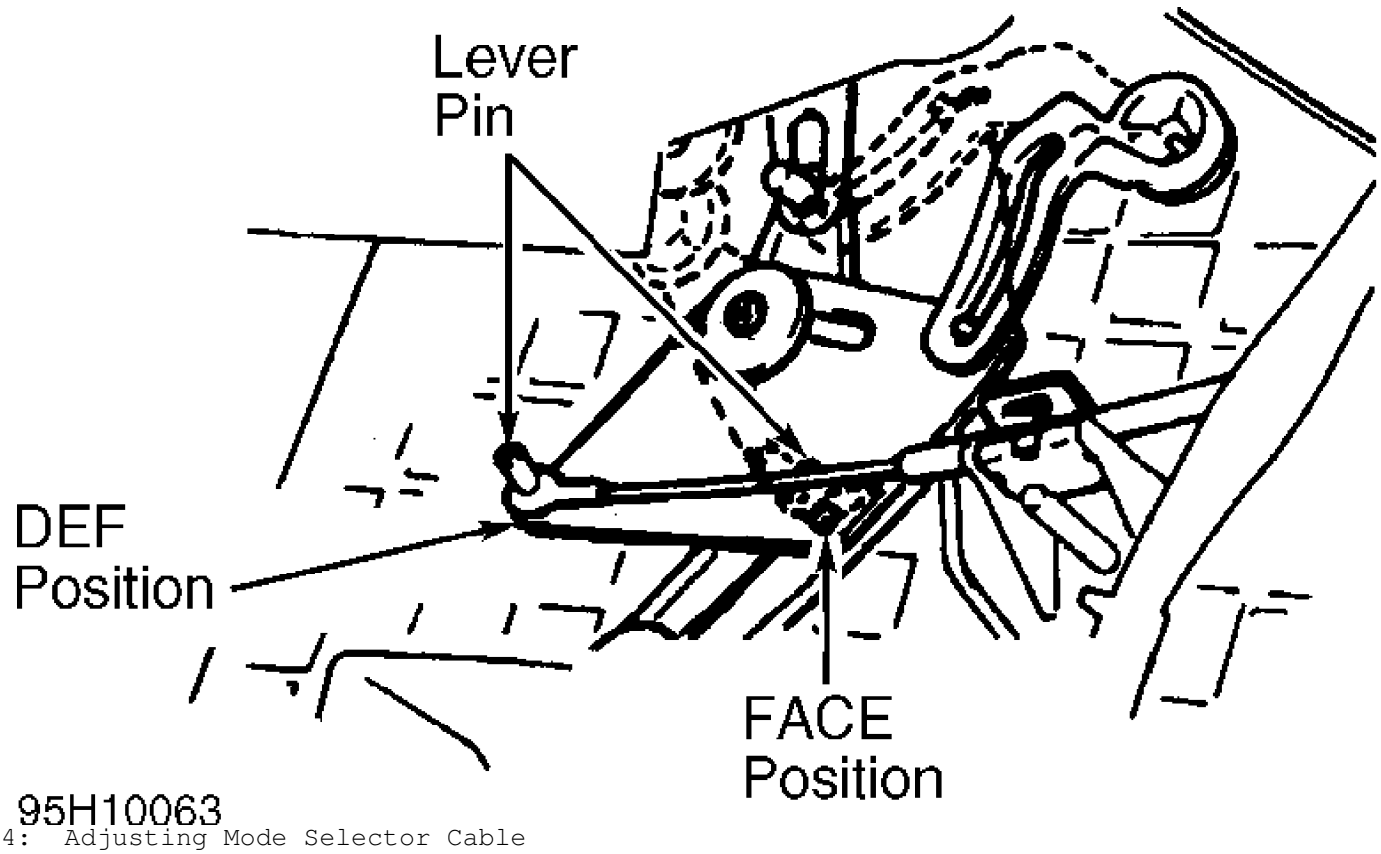


Fig. 4: Adjusting Mode Selector Cable
Courtesy of Mitsubishi Motor Sales of America.

TROUBLE SHOOTING

BLOWER INOPERATIVE

Check for blown fuse, blower motor improperly grounded, defective blower motor switch, defective blower motor, faulty blower motor resistor, or faulty blower motor relay.

INSUFFICIENT HEAT

Check for obstructed heater outlets, bound or improperly adjusted blend-air dampers, faulty thermostat, obstructed heater hoses, improperly adjusted temperature control cable, or plugged heater core.

NO VENTILATION

Check for improper adjustment of mode selector dampers, incorrect installation of mode selector control cable, faulty duct connections, or crushed, bent or clogged ducts.

TESTING

* PLEASE READ THIS FIRST *

WARNING: To avoid injury from accidental air bag deployment, read and carefully follow all SERVICE PRECAUTIONS and DISABLING &

ACTIVATING AIR BAG SYSTEM procedures in AIR BAG RESTRAINT SYSTEM article.

BLOWER MOTOR SWITCH

Disconnect blower motor switch connector. Operate switch, check continuity between indicated terminals using ohmmeter. See BLOWER MOTOR SWITCH CONTINUITY table. See Fig. 5.

BLOWER MOTOR SWITCH CONTINUITY TABLE

Switch Setting	Continuity Between Terminal No.
Low	3 & 5; 1 & 8
Medium-Low	5 & 6; 1 & 8
Medium-High	1, 4 & 8; 2 & 5
High	1, 4 & 8; 5 & 7

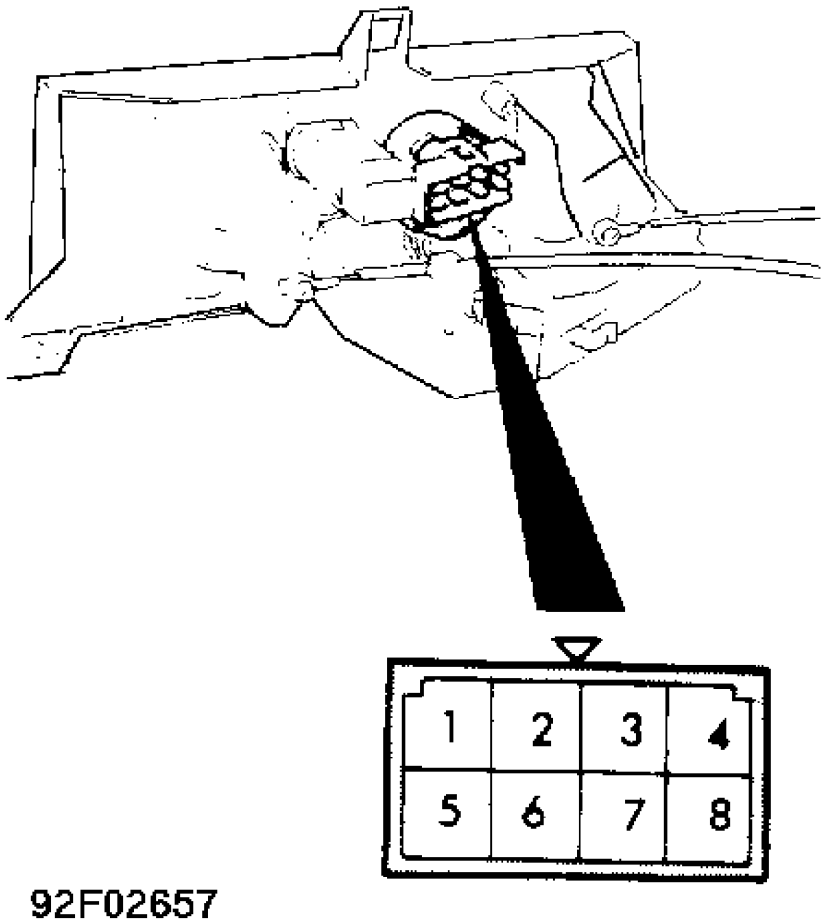


Fig. 5: Identifying Blower Motor Switch Connector Terminals
Courtesy of Mitsubishi Motor Sales of America.

BLOWER MOTOR

Disconnect blower motor connector. Connect battery directly to blower motor terminals. Ensure blower motor operates smoothly and quietly. Replace blower motor if it does not function as specified.

BLOWER MOTOR RELAY

1) Remove blower motor relay from fuse/relay block. Using ohmmeter, check continuity between relay terminals No. 2 and 5. See Fig. 6. Continuity should not be present.

2) Check continuity between relay terminals No. 1 and 3. Continuity should be present. Connect battery voltage to relay terminals No. 1 and 3. See Fig. 6. Check continuity between relay terminals No. 2 and 5. Continuity should be present. If continuity is not as specified, replace blower motor relay.

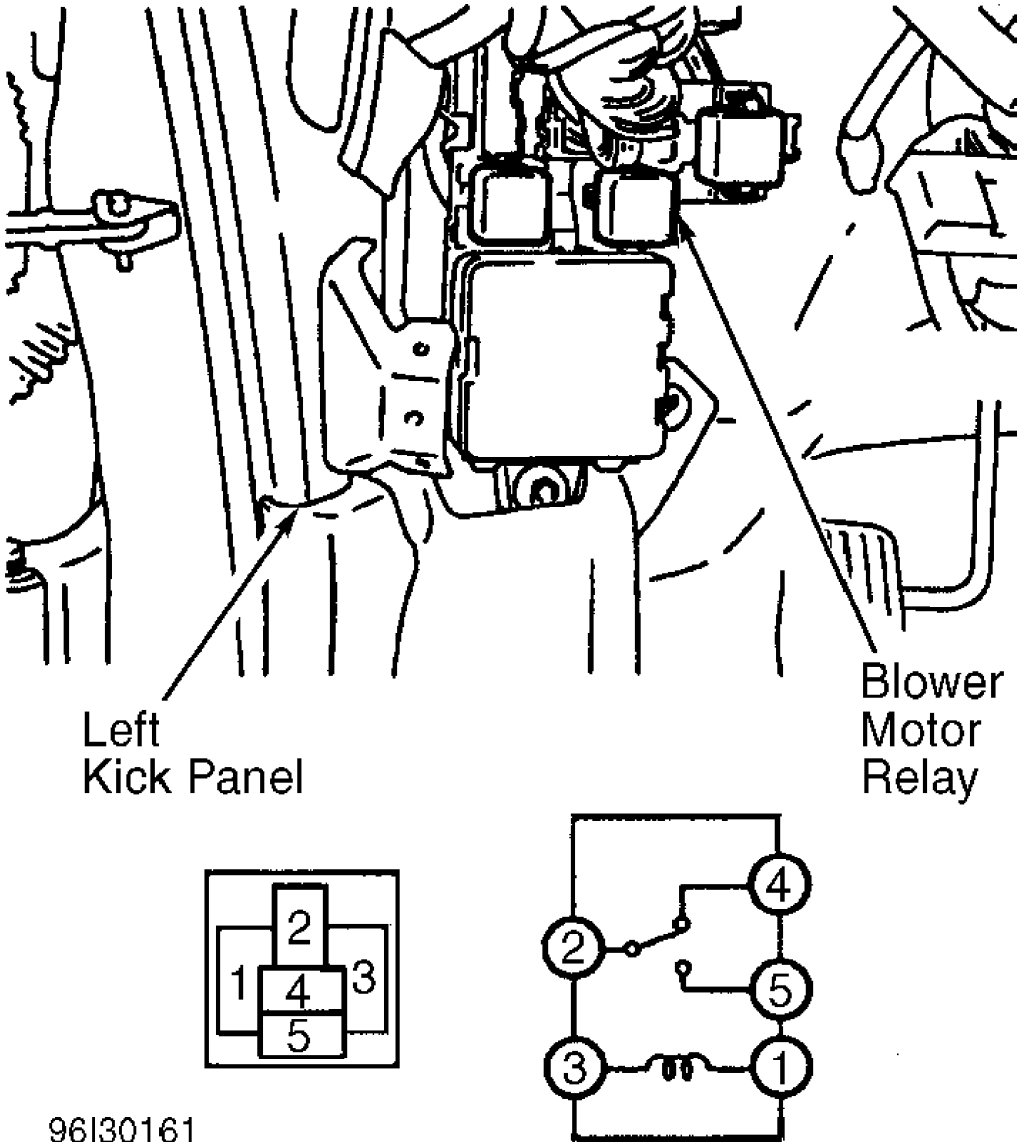


Fig. 6: Identifying Blower Relay Terminals
Courtesy of Mitsubishi Motor Sales of America.

BLOWER MOTOR RESISTOR

Disconnect resistor harness connector. See Fig. 7. Using ohmmeter, check resistance between indicated terminals. See BLOWER MOTOR RESISTOR RESISTANCE table. If resistance is not as specified, replace resistor.

BLOWER MOTOR RESISTOR RESISTANCE TABLE

Terminal No.	Ohms
2 & 3	2.30
3 & 4	1.10
1 & 3	0.40

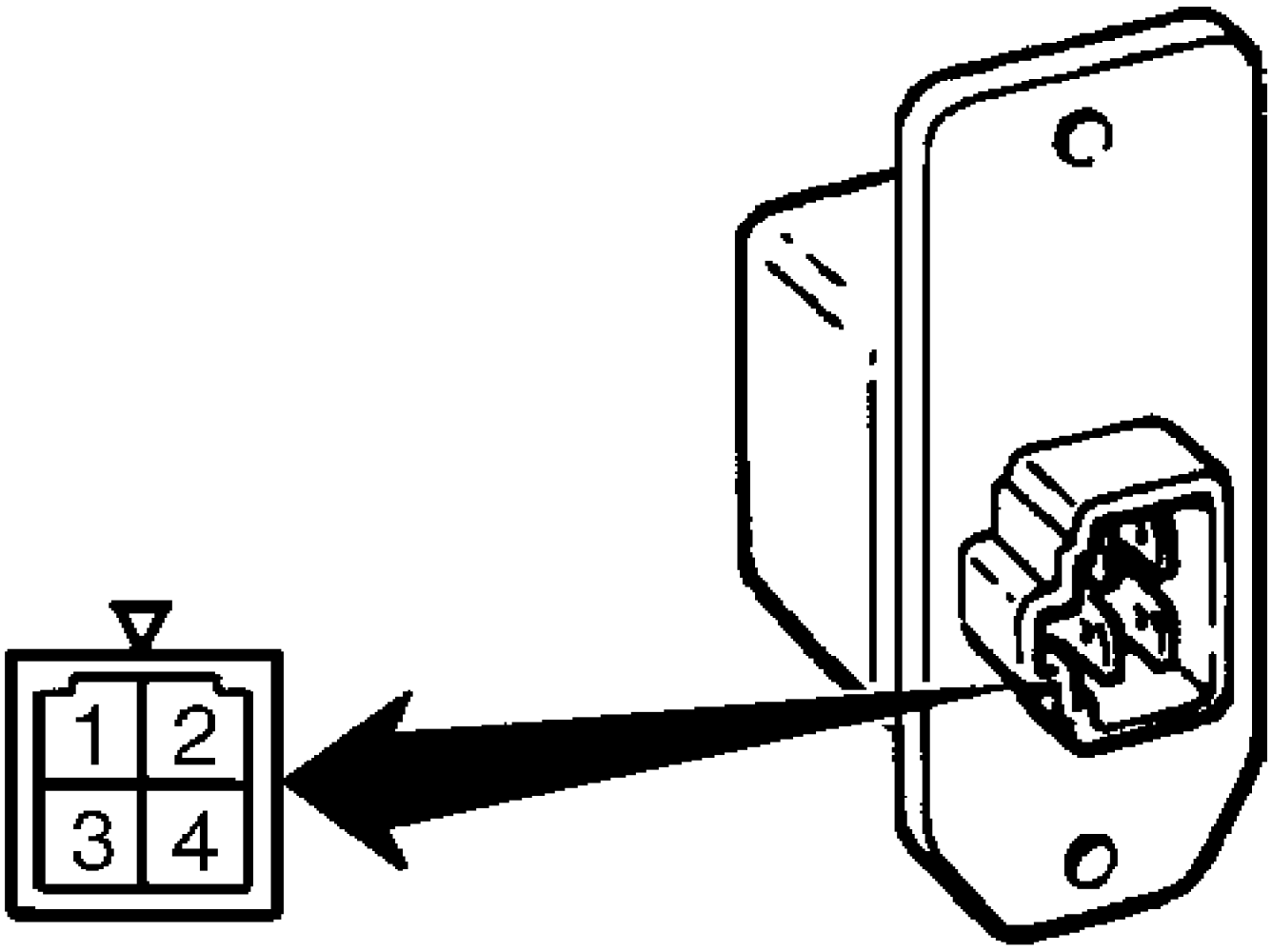


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Fig. 7: Locating Blower Resistor & Identifying Terminals
Courtesy of Mitsubishi Motor Sales of America.

FRESH/RECIRCULATED AIR DAMPER MOTOR

Remove fresh/recirculated air damper motor located behind glove box. See Fig. 1. Check that fresh/recirculated air damper motor

moves in both directions when battery voltage is applied between terminals No. 1 and 3. See Fig. 8. When damper motor reaches fresh air or recirculated air position, remove battery voltage and reverse polarity. If damper motor does not move in both directions, replace fresh/recirculated air damper motor.

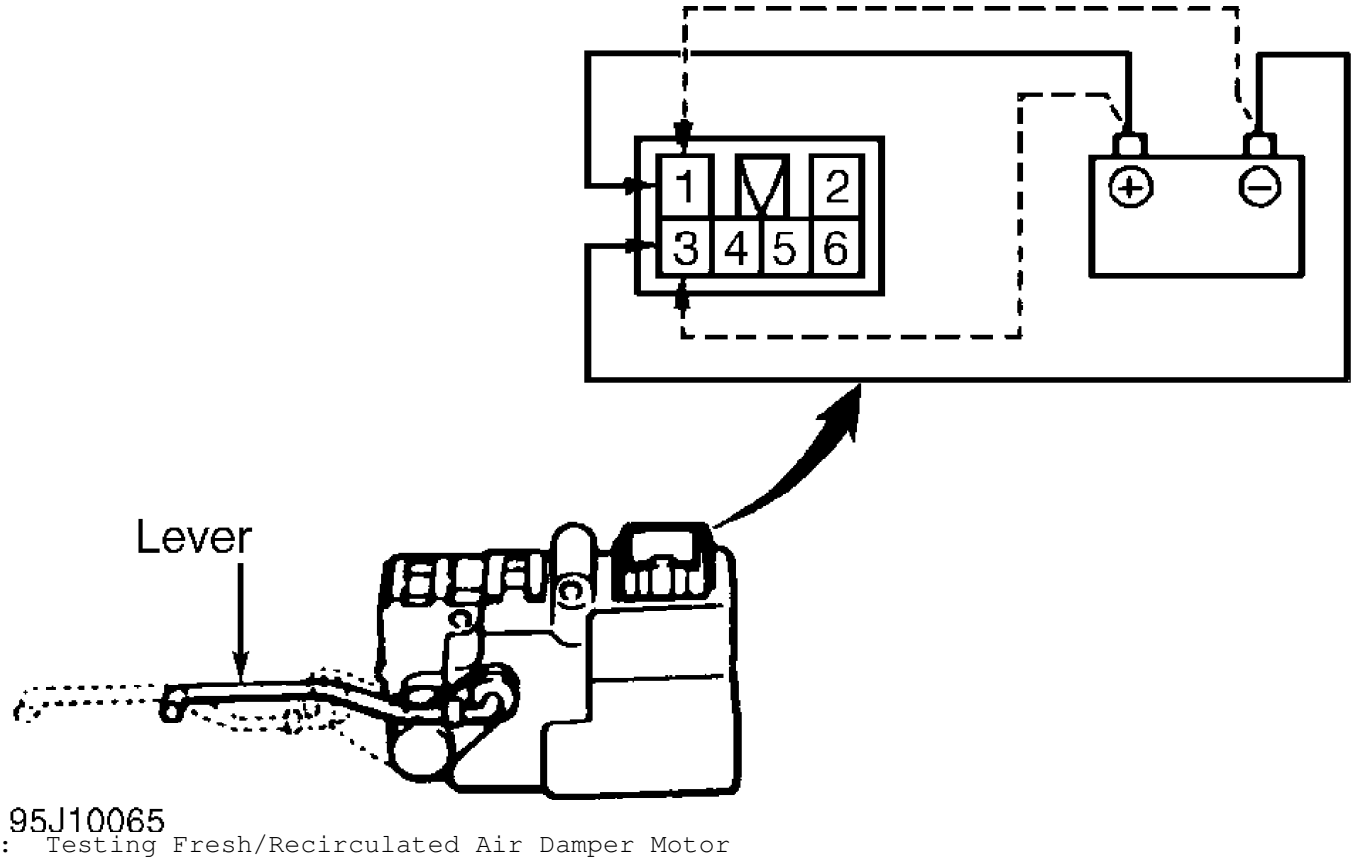

Fig. 8: Testing Fresh/Recirculated Air Damper Motor
Courtesy of Mitsubishi Motor Sales of America.

FRESH/RECIRCULATED AIR CONTROL SWITCH

Locate fresh/recirculated air control switch above blower motor switch. Remove switch and check continuity between specified terminals. See FRESH/RECIRCULATED AIR CONTROL SWITCH CONTINUITY table. See Fig. 9. If continuity is not as specified, replace switch.

FRESH/RECIRCULATED AIR CONTROL SWITCH CONTINUITY TABLE

Switch Position	Terminal No.
Recirculated Air	2 & 6; 4 & 5
Fresh Air	2 & 5; 4 & 6

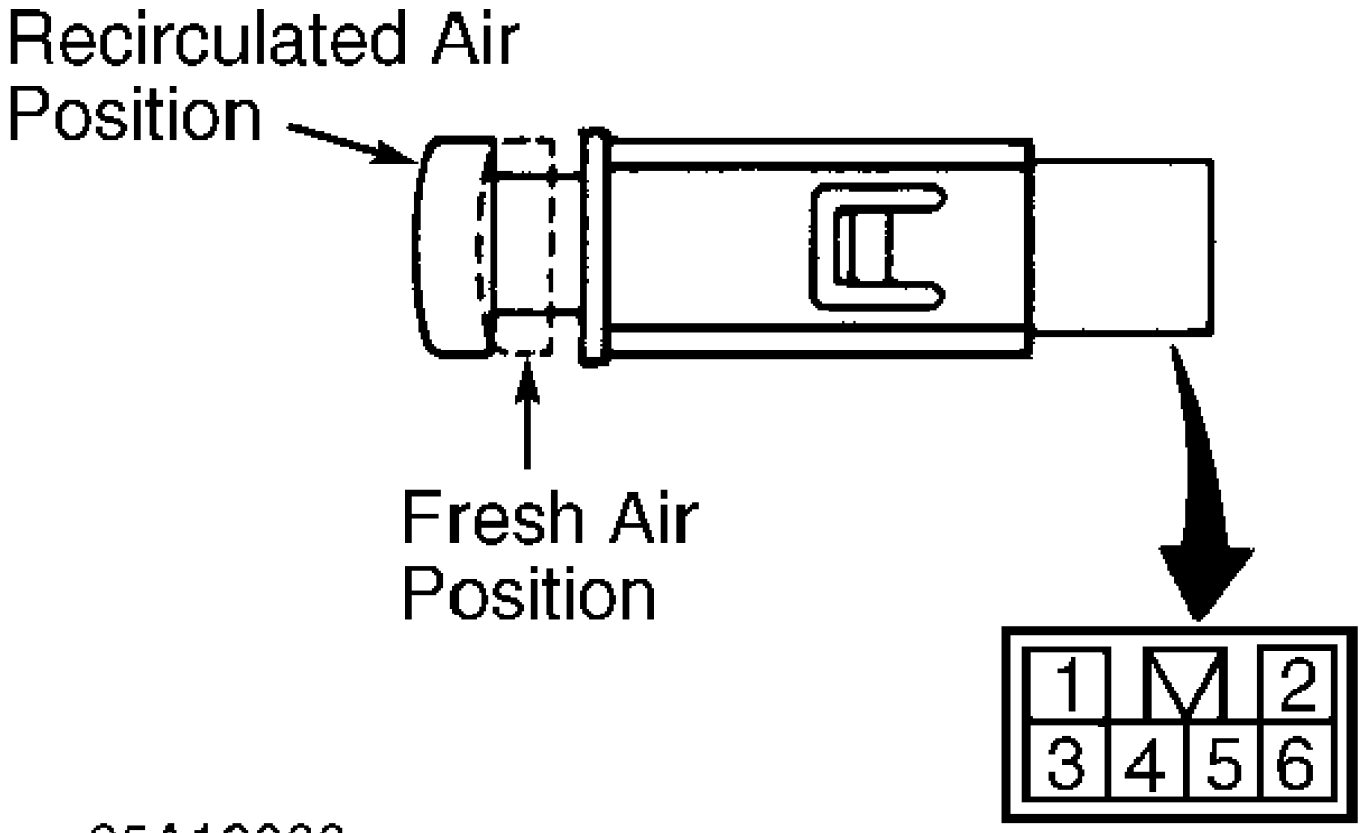

Fig. 9: Fresh/Recirculated Air Control Switch Testing
Courtesy of Mitsubishi Motor Sales of America.

REMOVAL & INSTALLATION

* PLEASE READ THIS FIRST *

WARNING: To avoid injury from accidental air bag deployment, read and carefully follow all SERVICE PRECAUTIONS and DISABLING & ACTIVATING AIR BAG SYSTEM procedures in AIR BAG RESTRAINT SYSTEM article.

HEATER UNIT & HEATER CORE

Removal

1) Disable air bag system. See AIR BAG RESTRAINT SYSTEM article. Drain coolant, and remove heater hoses. Remove shift knob (M/T). Remove shift lever panel and console box. Remove center console bezel. Remove console.

2) Remove steering column cover and instrument cluster bezel. Remove instrument cluster. Remove instrument panel switch and hood lock release handle. Remove foot duct and instrument cluster undercover. Remove lap cooler duct, left side cover, and right side undercover.

3) Remove glove box stopper. Remove glove box catcher and glove box damper (if equipped). See Fig. 1. Remove glove box, glove box striker, glove box cover, and corner panel. Remove upper and lower right side covers. Remove radio/tape player, box and cup holder.

4) Remove heater control cables from heater unit. Remove heater control panel mounting screws and boss at top of heater control

panel. Pull heater control panel forward and remove it. Remove right side air outlet. Disconnect cool air by-pass lever damper cable connection at heater unit.

5) Remove passenger-side air bag module. Remove steering column mounting bracket bolts and lower steering column. Disconnect instrument cluster harness connector. Remove instrument panel bolts. Disconnect electrical connections. Remove instrument panel.

6) Remove center ventilation duct. Remove center reinforcement. Remove foot distribution air duct. Remove Engine Control Module (ECM) bracket. Remove heater unit mounting nuts and push-pin clip. Remove heater unit. Remove heater core cover plate. Remove heater core from heater unit.

Installation

Carefully insert heater core into heater unit to prevent damaging core fin or pad. Install heater core cover plate. Install heater unit. To complete installation, reverse removal procedure. Fill and bleed cooling system.

HEATER CONTROL PANEL

Removal

Remove shift knob (M/T). Remove shift lever boot and center console panel. Remove hood release and instrument panel undercover. Remove foot duct and lap cooler ducts. See Fig. 1. Remove heater control panel.

Installation

To install, reverse removal procedure. Adjust cables as necessary. See ADJUSTMENTS.

BLOWER MOTOR

Removal & Installation

Remove glove box undercover. See Fig. 1. Remove blower motor and fan assembly. To install, reverse removal procedure.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS TABLE

Application	Ft. Lbs. (N.m)
Steering Wheel Nut	30 (41)
	INCH Lbs. (N.m)
Driver-Side Air Bag Module	80 (9)
Passenger-Side Air Bag Module	48 (5.4)

WIRING DIAGRAMS

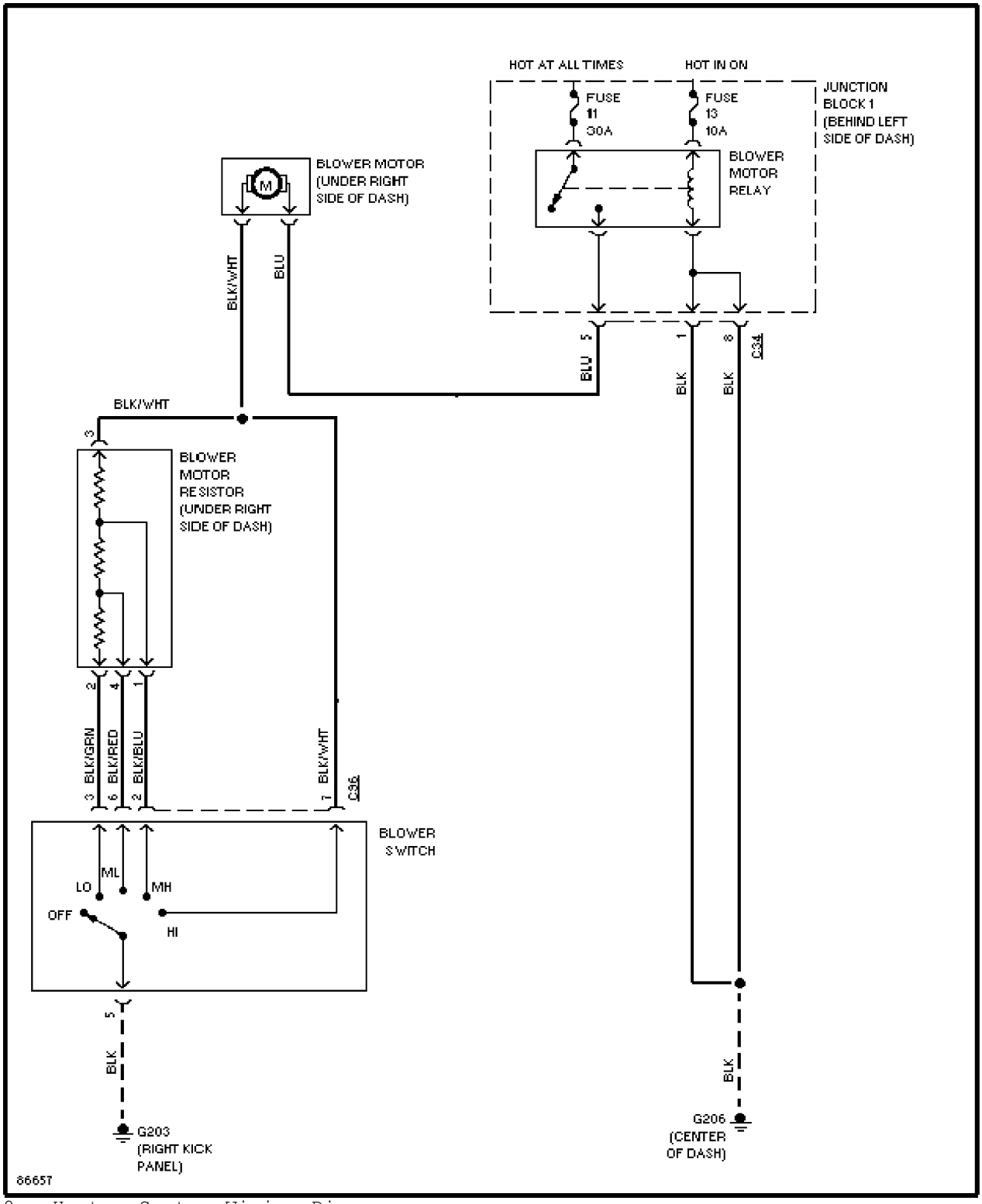

Fig. 10: Heater System Wiring Diagram

INSTRUMENT PANEL

1998 Mitsubishi Galant

1998 ACCESSORIES & EQUIPMENT
Mitsubishi - Instrument Panels

Eclipse, Galant, Mirage, Montero, Montero Sport, 3000GT

DESCRIPTION & OPERATION

WARNING: Deactivate air bag system before performing any service operation. See AIR BAG RESTRAINT SYSTEMS article. Do not apply electrical power to any component on steering column without first deactivating air bag system. Air bag may deploy.

Instrument cluster includes speedometer, fuel gauge and temperature gauge. Fuel gauge has a built-in voltage limiter to keep voltage supply to gauges at 7 volts. Some models may also have an ammeter, oil pressure gauge, tachometer, voltmeter and/or turbo boost pressure gauge. Oil pressure gauge uses full battery voltage. Tachometer operates by pulse feed.

COMPONENT LOCATIONS

COMPONENT LOCATIONS TABLE

Component	Location
Engine Coolant Temperature (ECT) Sensor	
Eclipse, Galant, Montero & Montero Sport	On Thermostat Housing
Mirage	On Rear Of Cylinder Head
3000GT	On Cylinder Head, Below Ignition Coil
Input Speed Sensor	
Eclipse	On Side Of Transaxle
Output Speed Sensor	
Eclipse	On Side Of Transaxle
Vehicle Speed Sensor	
Eclipse, Galant, Mirage & 3000GT	On Top Of Transaxle
Montero & Montero Sport	On Transmission Tailshaft

TROUBLE SHOOTING

FUEL/TEMPERATURE GAUGE NOT WORKING

Check for blown fuse, faulty voltage limiter and faulty relay. Ensure sending unit connections are clean and tight. Test sending unit for correct operation. Tighten connections in instrument cluster.

SPEEDOMETER NOT WORKING

On mechanical-type speedometers, ensure speedometer cable is properly connected and correctly routed. If speedometer pointer and/or odometer still do not work, replace speedometer cable or speedometer assembly.

On electric-type speedometers, check for faulty vehicle speed sensor, input/output sensors or faulty circuit. For testing, see

SPEEDOMETER TEST under COMPONENT TESTS. Repair or replace as necessary.

TACHOMETER NOT WORKING

Tachometer is serviced as an assembly. If wiring harness is okay, replace tachometer assembly.

WARNING LIGHTS NOT WORKING

Test for defective sending unit, burned-out bulb and broken printed circuit. Ensure all connections are clean and tight.

COMPONENT TESTS

BOOST PRESSURE GAUGE (TURBO)

Resistance Test (Eclipse & 3000GT)

1) Remove instrument cluster from instrument panel. See INSTRUMENT CLUSTER under REMOVAL & INSTALLATION. On 3000GT, remove air distribution duct and combination gauges.

2) On all models, check resistance between boost pressure gauge terminals on back of instrument cluster or combination gauges. See Fig. 1 or 2. Resistance should be 68.2-83.4 ohms on Eclipse, or 72 ohms on 3000GT. If resistance is not as specified, replace gauge.

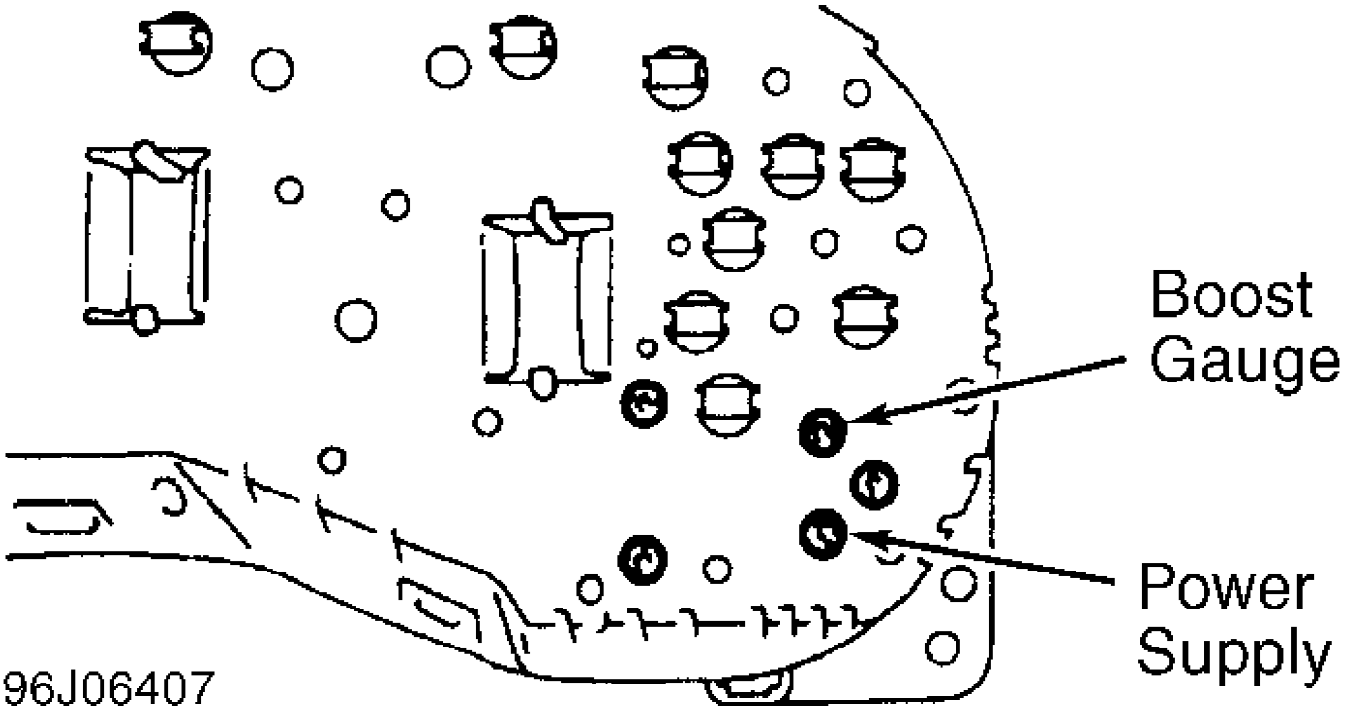

Fig. 1: Boost Pressure Gauge Test Terminals (Eclipse Turbo)
Courtesy of Mitsubishi Motor Sales of America

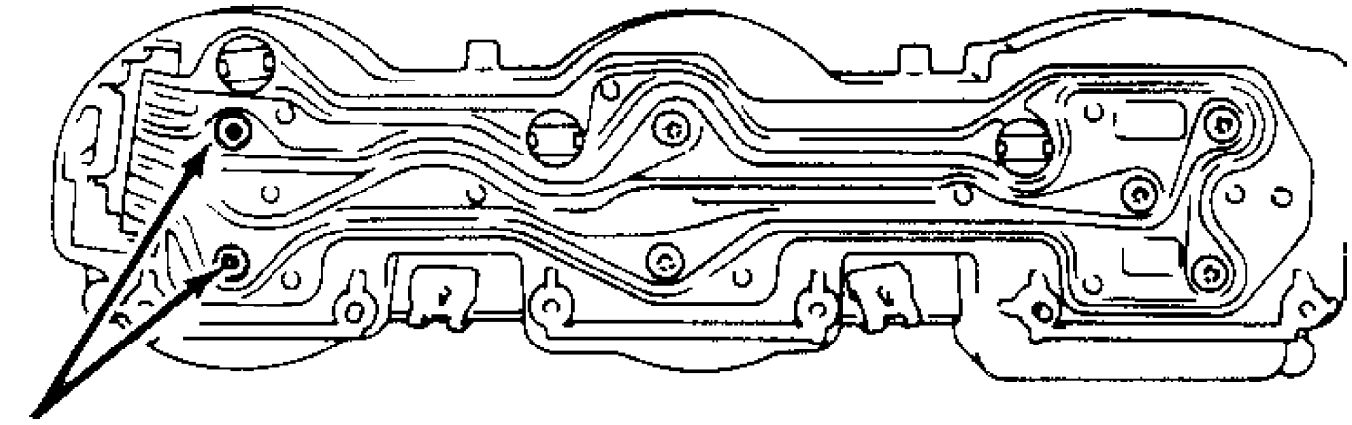

Fig. 2: Boost Pressure Gauge Test Terminals (3000GT Turbo)
Courtesy of Mitsubishi Motor Sales of America

FUEL TANK SENDING UNIT

Resistance Test

Remove fuel tank sending unit from fuel tank. Check resistance between appropriate terminals with fuel float in FULL and EMPTY positions. See Fig. 3, 4, 5, 6, 7, 8 or 9. Compare resistance reading to FUEL TANK SENDING UNIT RESISTANCE SPECIFICATIONS table. If resistance is not as specified, replace fuel tank sending unit.

FUEL TANK SENDING UNIT RESISTANCE SPECIFICATIONS TABLE

Application	Empty	Full
Eclipse		
AWD (1)		
Main	56	1-3
Sub	49-51	1-3
FWD	105-119	2-6
Galant	105-119	2-6
Mirage	102-118	0.9-5.1
Montero, Montero Sport & 3000GT	103-117	1-5

(1) - Equipped with a main fuel sender and a sub fuel sender.

FUEL GAUGE

CAUTION: Gauge coils can be damaged if wire is grounded for too long. Perform test as quickly as possible.

Simple Test

1) Disconnect fuel gauge sending unit connector wire in luggage compartment, in cargo space or at tank unit. Connect a 12-volt, 3.4-watt bulb to harness side of connector between appropriate terminals. See Fig. 3, 4, 5, 6, 7, 8 or 9.

2) Turn ignition switch to ON position. Ensure test bulb flashes, or stays on, and fuel gauge needle moves. If bulb or gauge needle does not function as described, repair fuel gauge circuit.

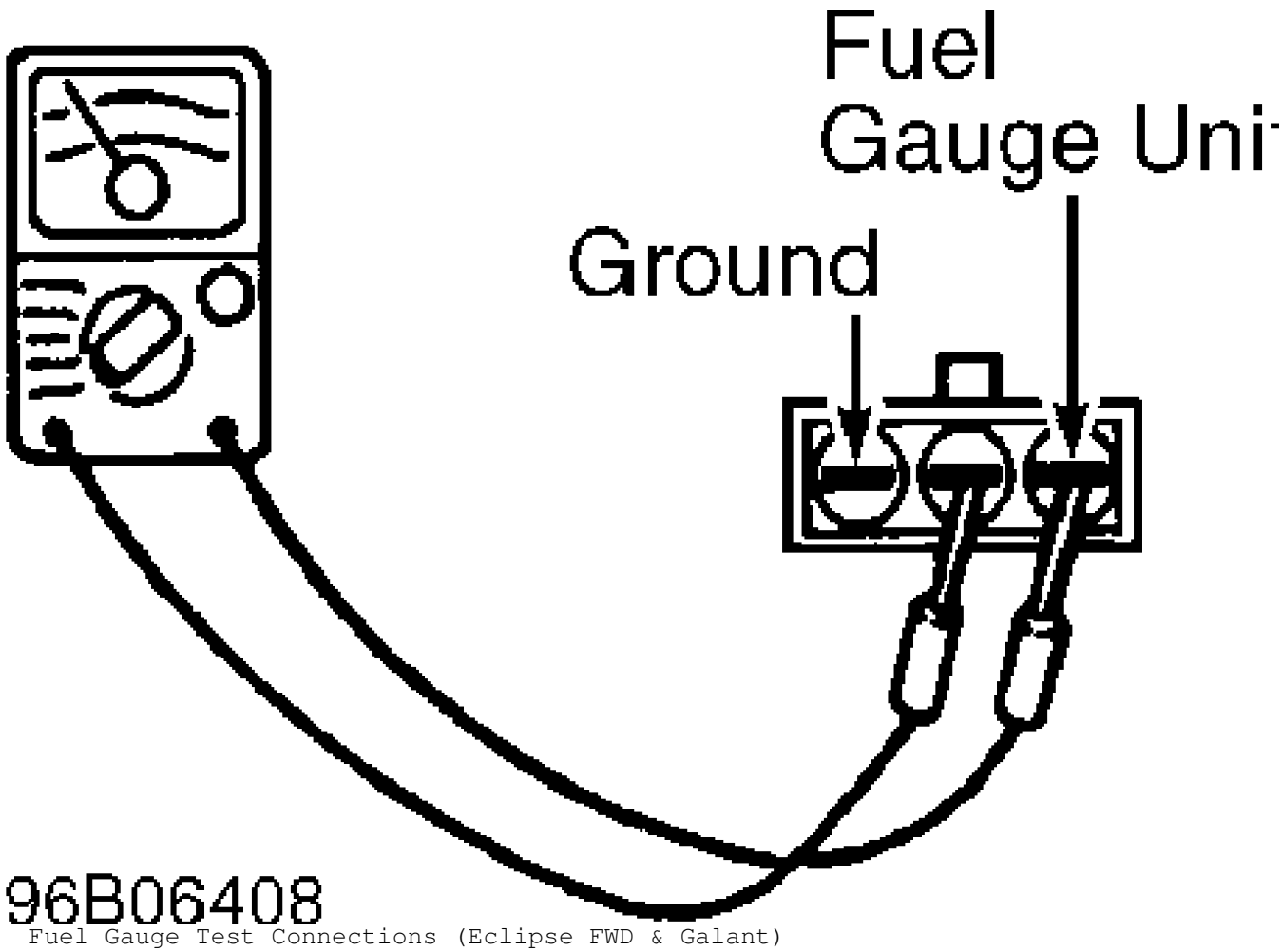

Fig. 3: Fuel Gauge Test Connections (Eclipse FWD & Galant)
Courtesy of Mitsubishi Motor Sales of America

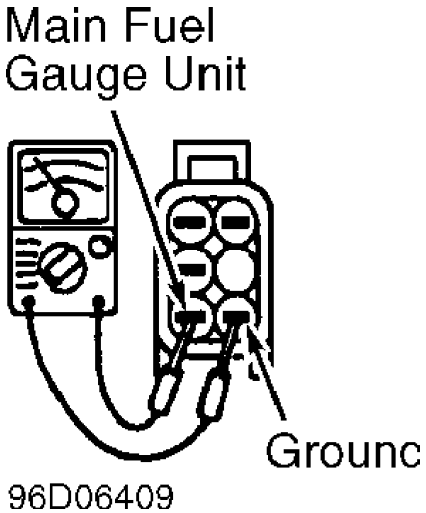

Fig. 4: Identifying Fuel Gauge Test Connections (Eclipse AWD - Main)
Courtesy of Mitsubishi Motor Sales of America

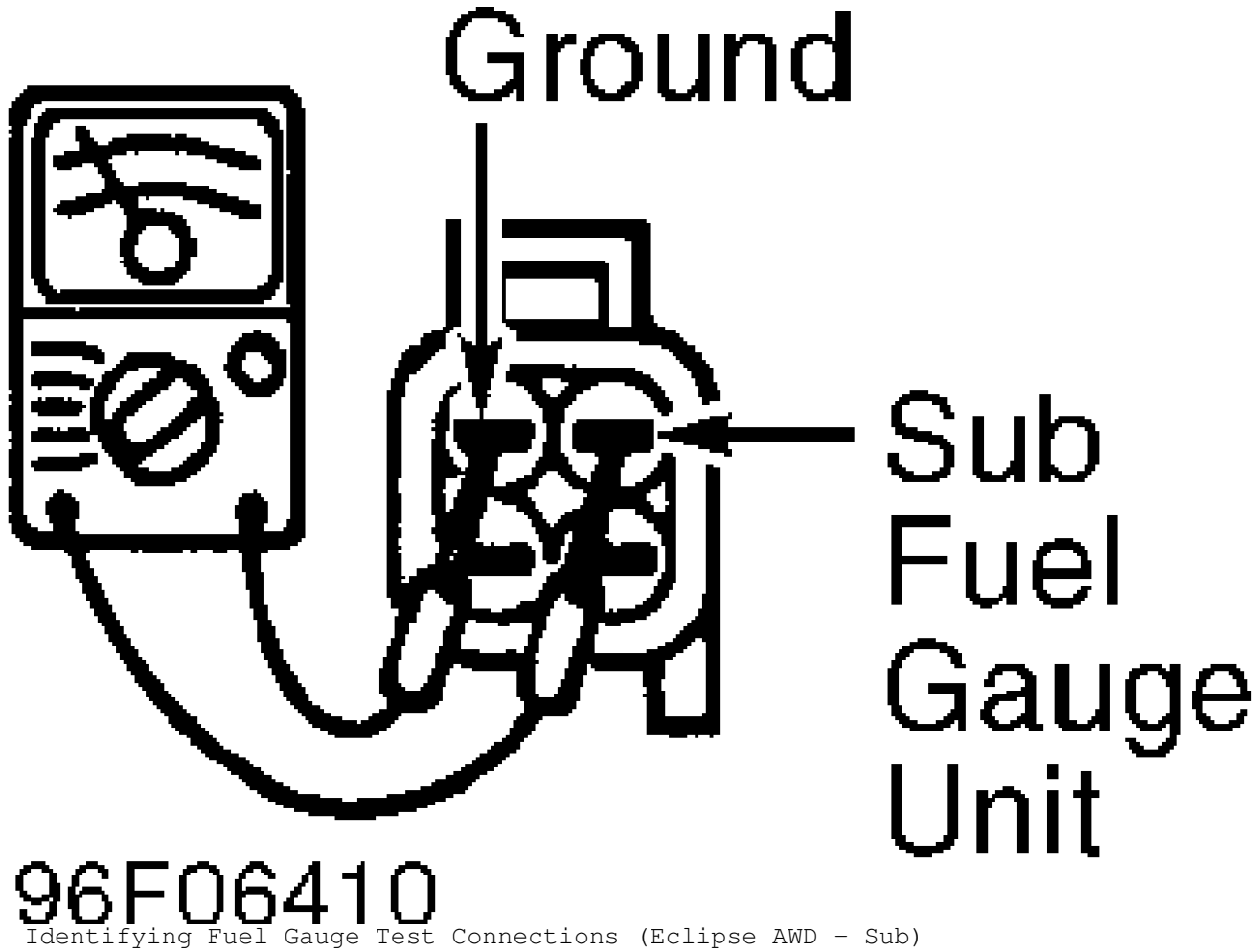

Fig. 5: Identifying Fuel Gauge Test Connections (Eclipse AWD - Sub)
Courtesy of Mitsubishi Motor Sales of America

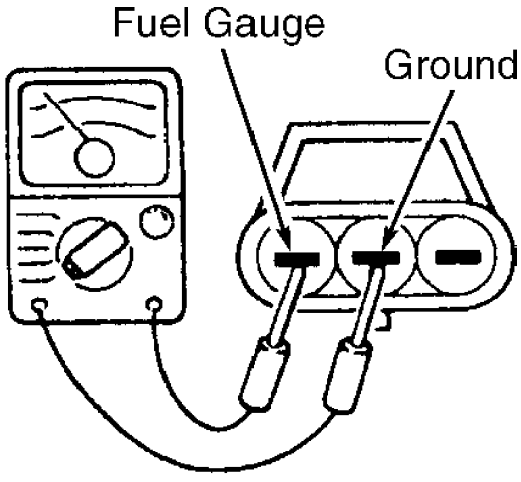

Fig. 6: Identifying Fuel Gauge Test Connections (Mirage)
Courtesy of Mitsubishi Motor Sales of America

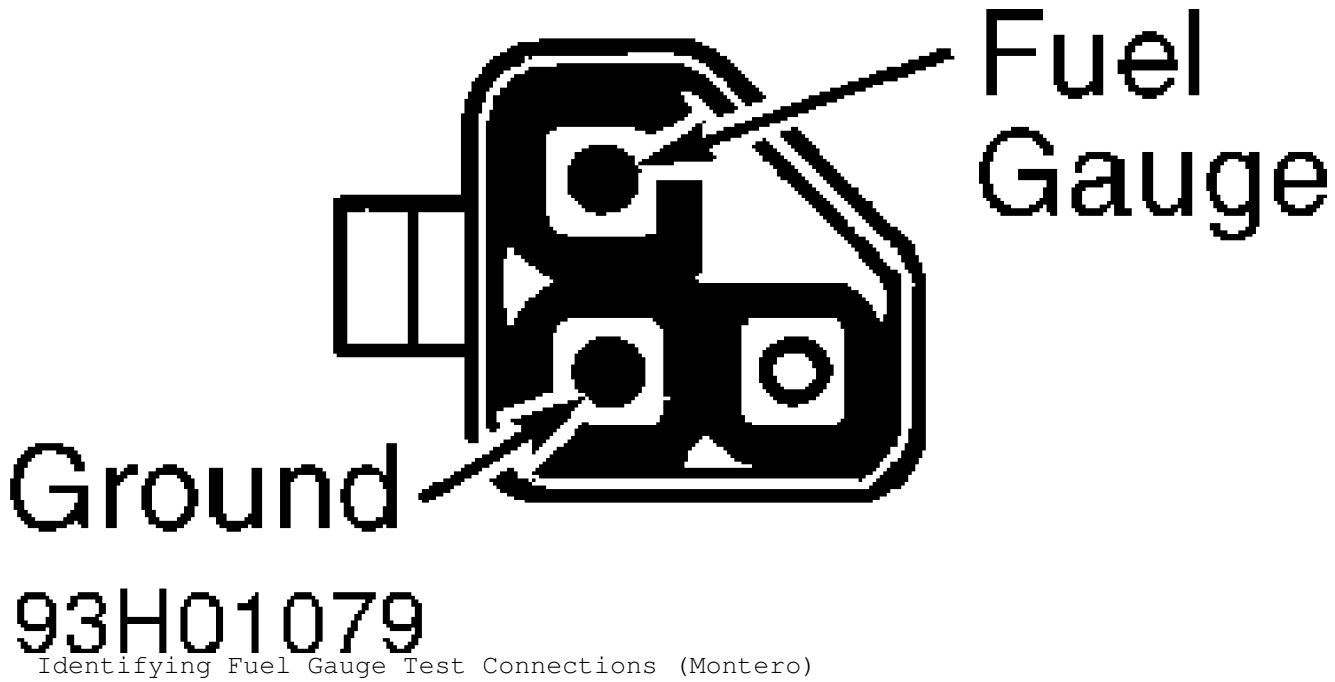

Fig. 7: Identifying Fuel Gauge Test Connections (Montero)
Courtesy of Mitsubishi Motor Sales of America

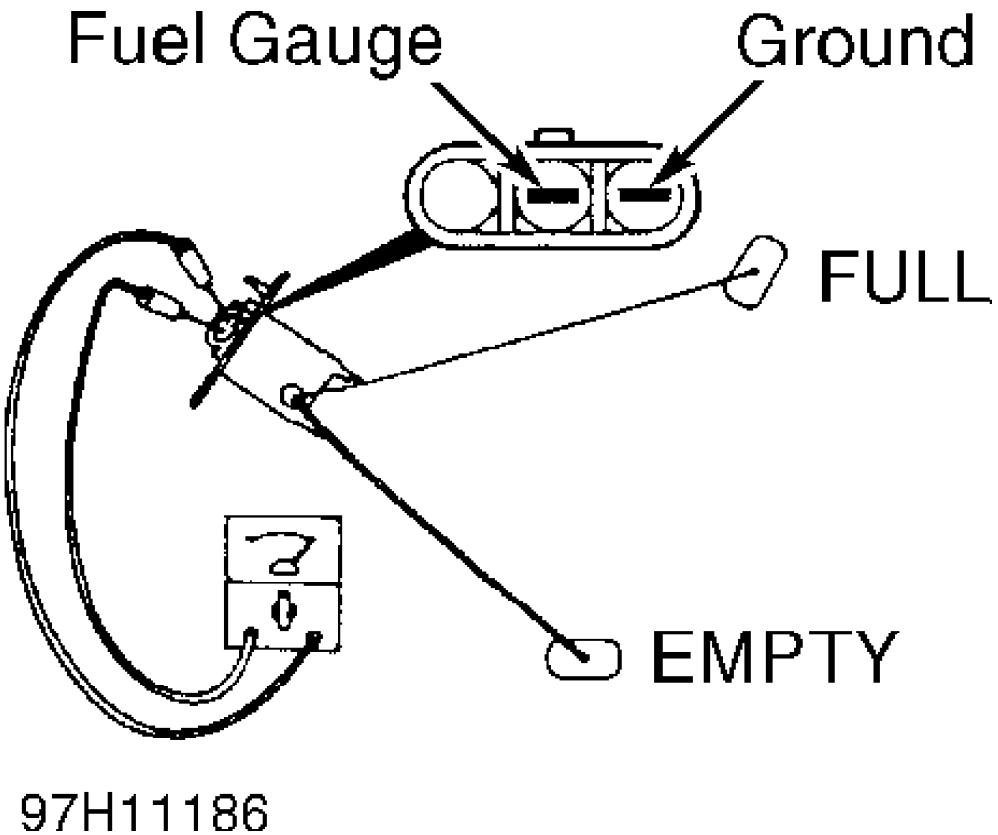

Fig. 8: Identifying Fuel Gauge Test Connections (Montero Sport)
Courtesy of Mitsubishi Motor Sales of America

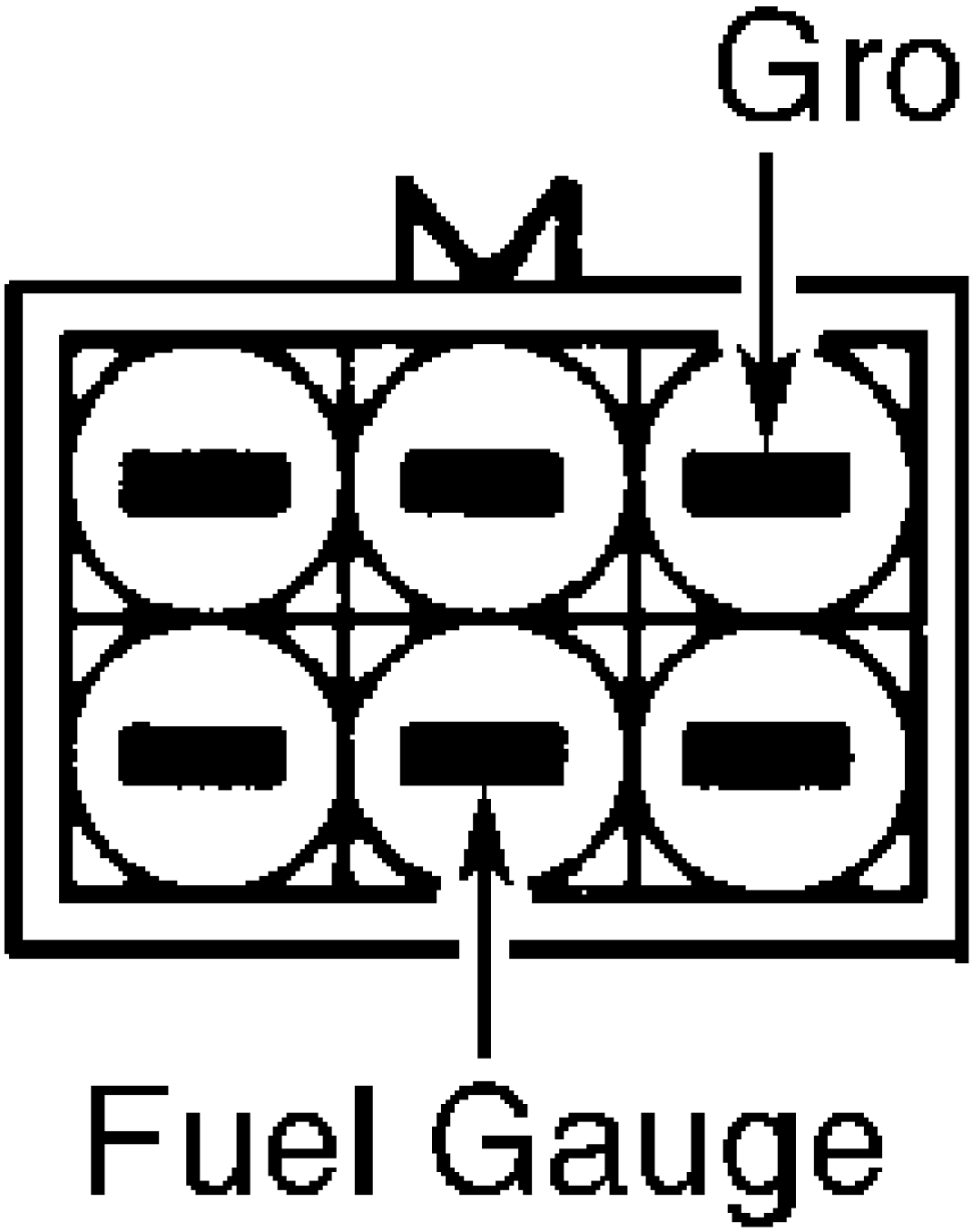

Fig. 9: Identifying Fuel Gauge Test Connections (3000GT)
Courtesy of Mitsubishi Motor Sales of America

NOTE: Fuel gauge resistance test must be completed with instrument panel cluster removed. Use ohmmeter for all measurements. If resistance is extremely low, a short may exist in coil. If resistance is extremely high, a broken wire or similar

problem may exist in gauge.

Resistance Test

1) Remove instrument cluster. See INSTRUMENT CLUSTER under REMOVAL & INSTALLATION. On 3000GT, remove air distribution duct and combination gauges.

2) On all models, check resistance between appropriate terminals of instrument cluster or combination gauges. See Fig. 10, 11, 12, 13, 14, 15 or 16. See FUEL GAUGE RESISTANCE SPECIFICATIONS table. If resistance readings are not as specified, replace fuel gauge.

FUEL GAUGE RESISTANCE SPECIFICATIONS TABLE

Application	(1) Terminals	Ohms
Eclipse	"A" & "B"	219-279
Eclipse	"A" & "C"	102-152
Eclipse	"B" & "C"	112-132
Galant	"A" & "B"	99
Galant	"A" & "C"	262
Galant	"B" & "C"	163
Mirage	"A" & "B"	80-98
Mirage	"A" & "C"	173-211
Mirage	"B" & "C"	93-113
Montero	No. 4 & 8	104-127
Montero	No. 4 & 6	132-162
Montero	No. 6 & 8	71-87
Montero Sport	"A" & "B"	85
Montero Sport	"A" & "C"	107
Montero Sport	"B" & "C"	192
3000GT	"A" & "B"	254
3000GT	"A" & "C"	101
3000GT	"B" & "C"	153

(1) - For terminal locations, see Fig. 10, 11, 12, 13, 14, 15 or 16.

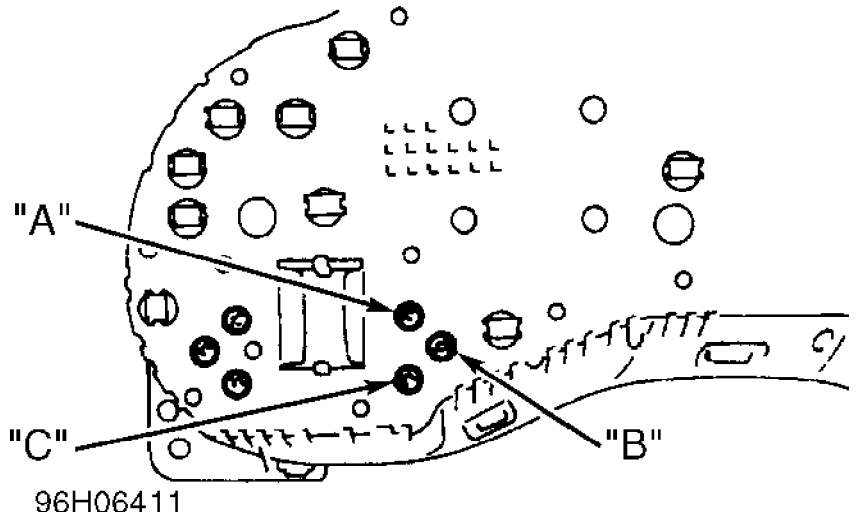

Fig. 10: Identifying Instrument Panel Fuel Gauge Resistance Check Terminals (Eclipse)
Courtesy of Mitsubishi Motor Sales of America

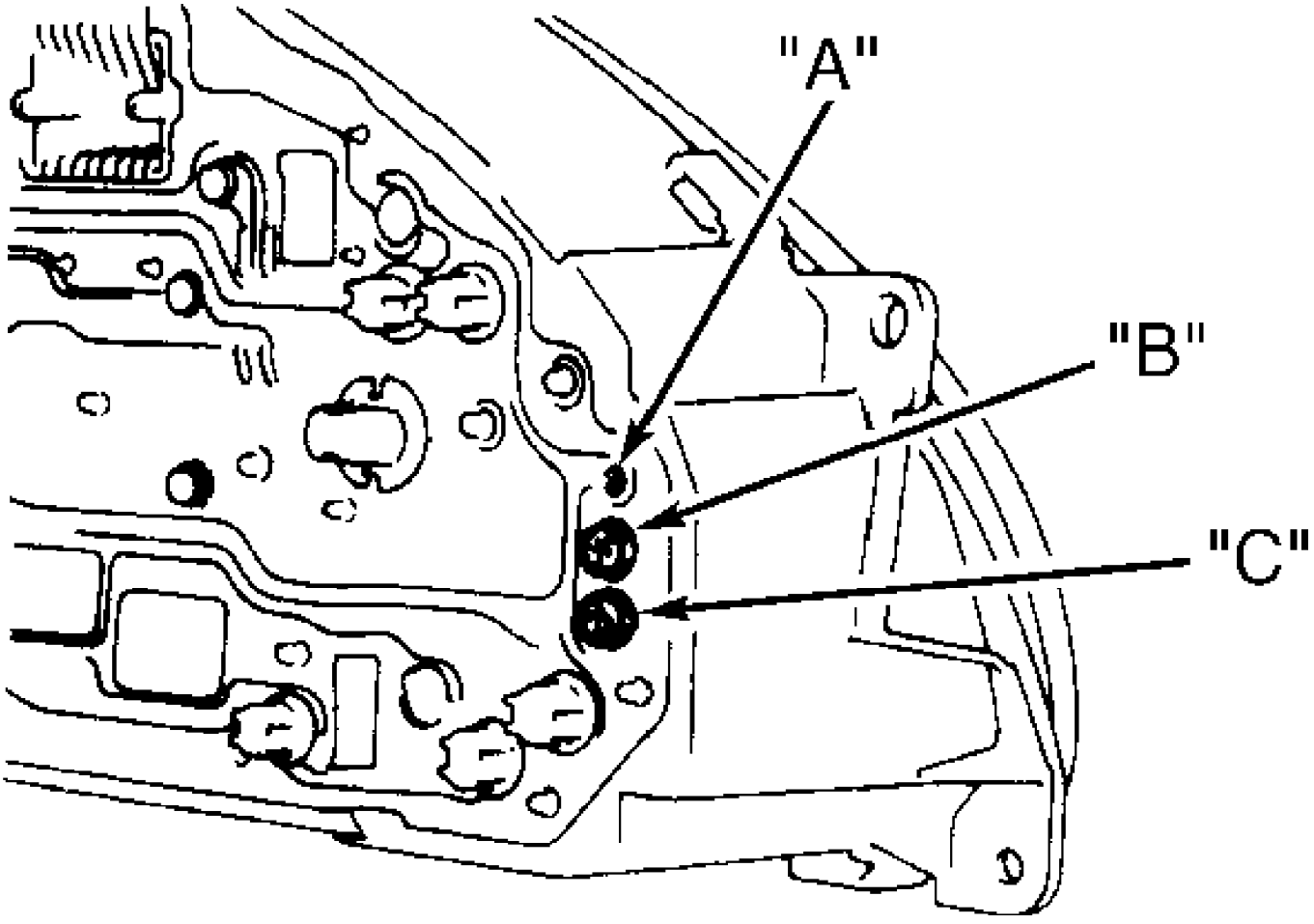

Fig. 11: Identifying Instrument Panel Fuel Gauge Resistance Check Terminals (Galant)
Courtesy of Mitsubishi Motor Sales of America

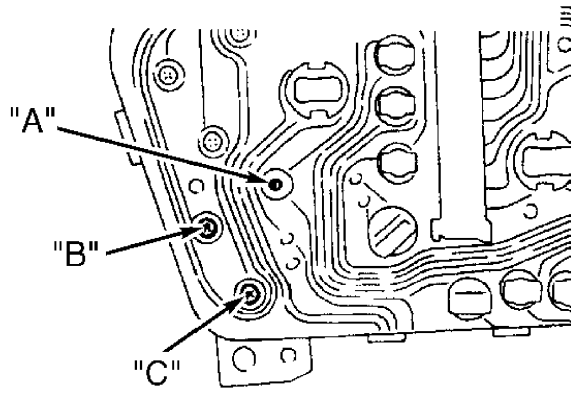

Fig. 12: Identifying Instrument Panel Fuel Gauge Resistance Check Terminals (Mirage - With Tachometer)
Courtesy of Mitsubishi Motor Sales of America

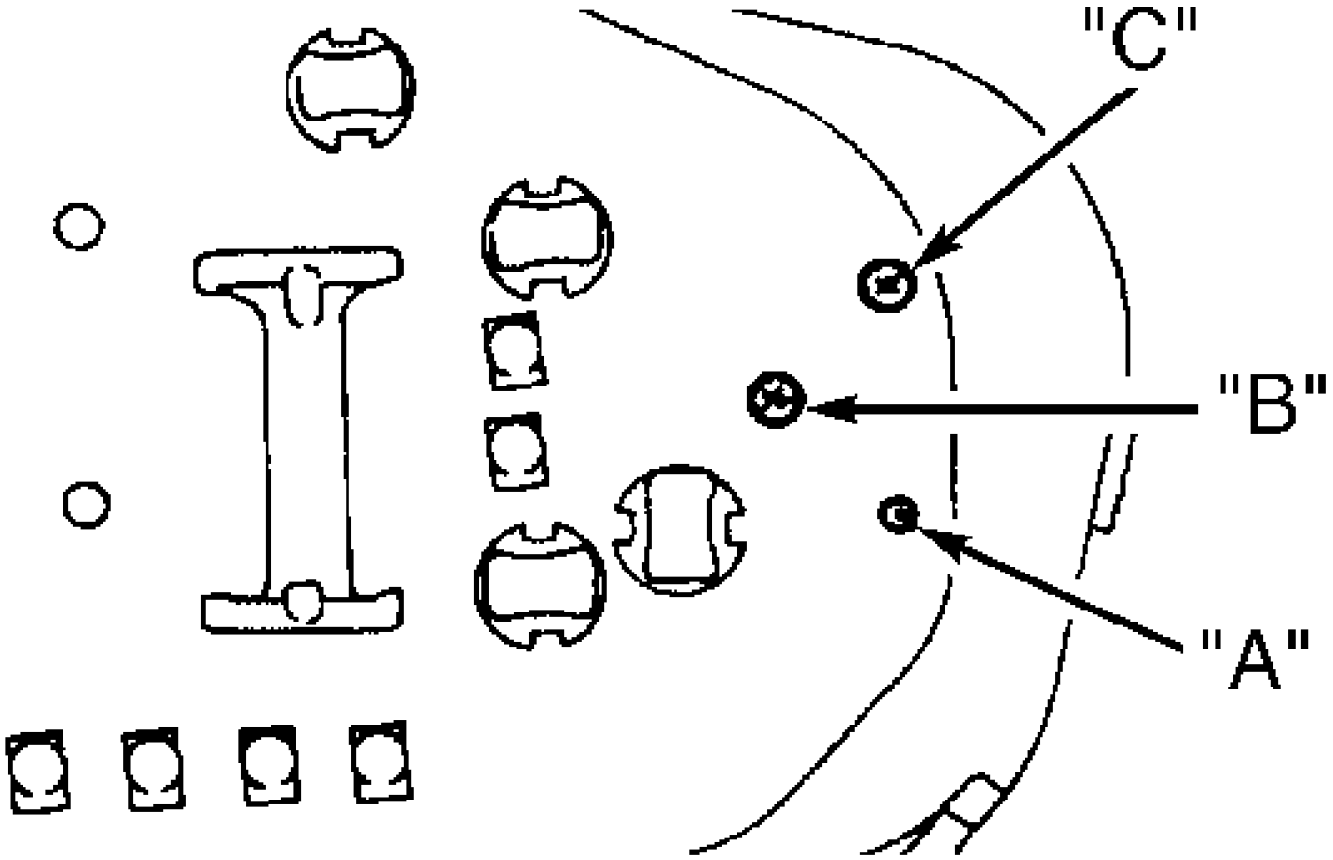

Fig. 13: Identifying Instrument Panel Fuel Gauge Resistance Check Terminals (Mirage - Without Tachometer)
Courtesy of Mitsubishi Motor Sales of America

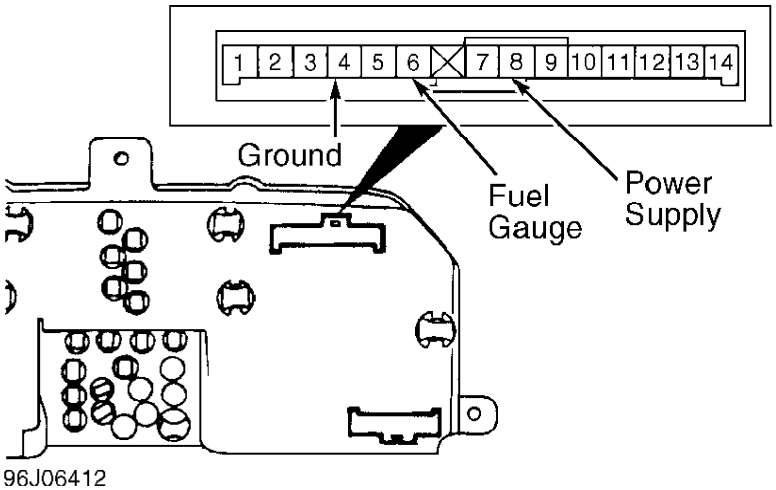

Fig. 14: Identifying Instrument Panel Fuel Gauge Resistance Check Terminals (Montero)
Courtesy of Mitsubishi Motor Sales of America

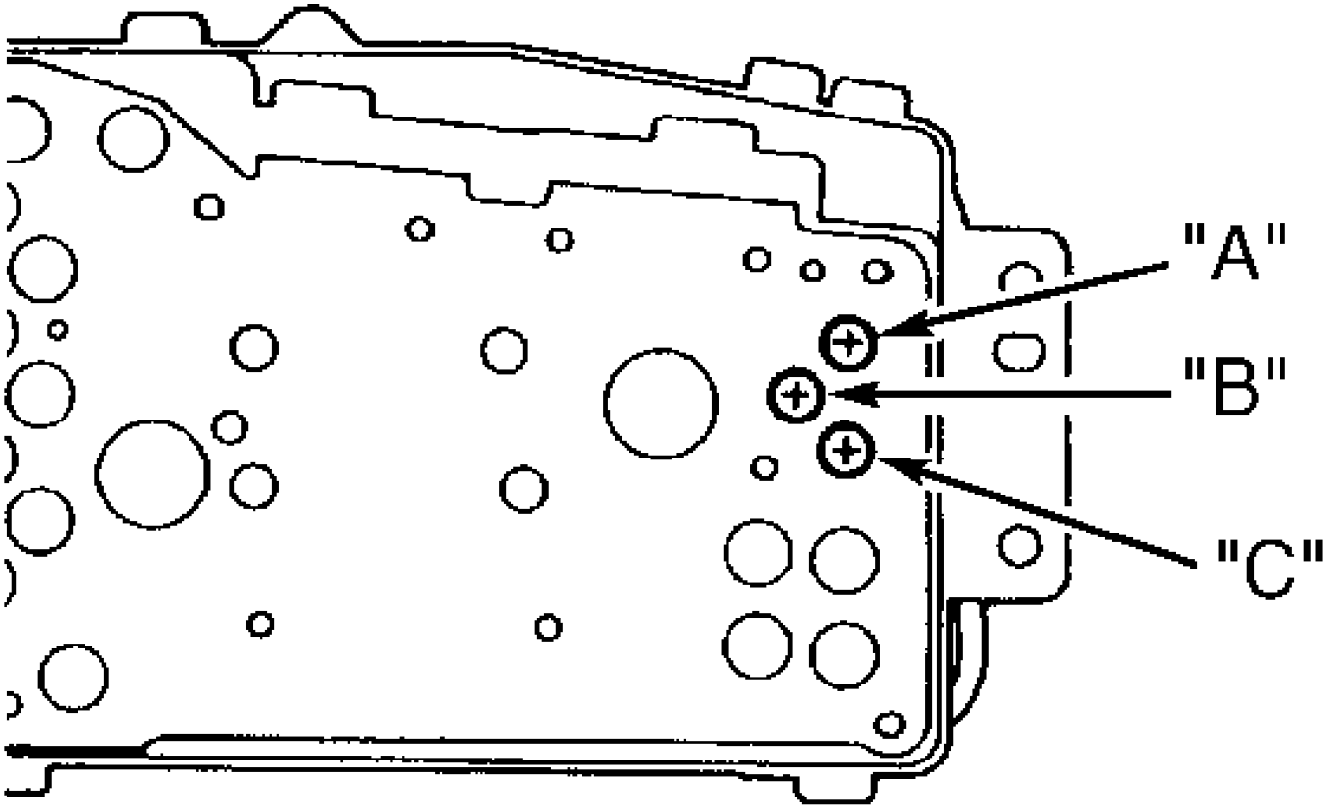

Fig. 15: Identifying Instrument Panel Fuel Gauge Resistance Check Terminals (Montero Sport)
Courtesy of Mitsubishi Motor Sales of America

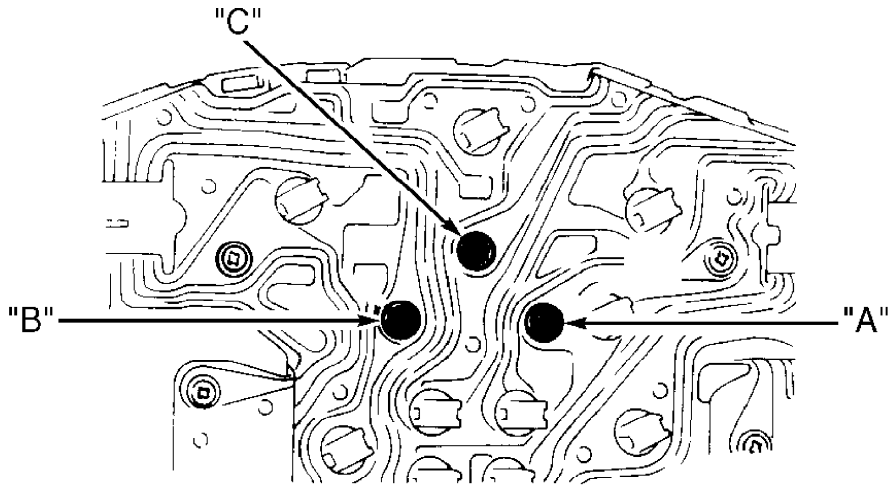

Fig. 16: Identifying Instrument Panel Fuel Gauge Resistance Check Terminals (3000GT)
Courtesy of Mitsubishi Motor Sales of America

INPUT/OUTPUT SENSOR

Eclipse 2.0L Non-Turbo With A/T

Disconnect sensor harness connector. Check resistance between sensor terminals. Resistance should be 300-1200 ohms. Replace sensor as necessary.

OIL PRESSURE GAUGE

Circuit Test (Eclipse, Montero & 3000GT)

1) Disconnect oil pressure gauge wiring connector from sending unit inside engine compartment. Connect a 12-volt test light between harness connector terminal and ground. Turn ignition on, but DO NOT start engine.

2) If test light comes on and gauge needle moves, go to GAUGE RESISTANCE TEST. If test light does not come on and gauge needle does not move, repair wiring to sending unit.

Gauge Resistance Test (Eclipse, Montero & 3000GT)

1) Remove instrument cluster from instrument panel. See INSTRUMENT CLUSTER under REMOVAL & INSTALLATION. On 3000GT, remove air distribution duct and combination gauges.

2) On all models, check continuity between oil pressure gauge terminals. See Fig. 17, 18 or 19. See OIL PRESSURE GAUGE RESISTANCE SPECIFICATIONS table. If resistance is not within specification, replace oil pressure gauge.

OIL PRESSURE GAUGE RESISTANCE SPECIFICATIONS TABLE

Application	Ohms
Eclipse & 3000GT	40-44
Montero	50

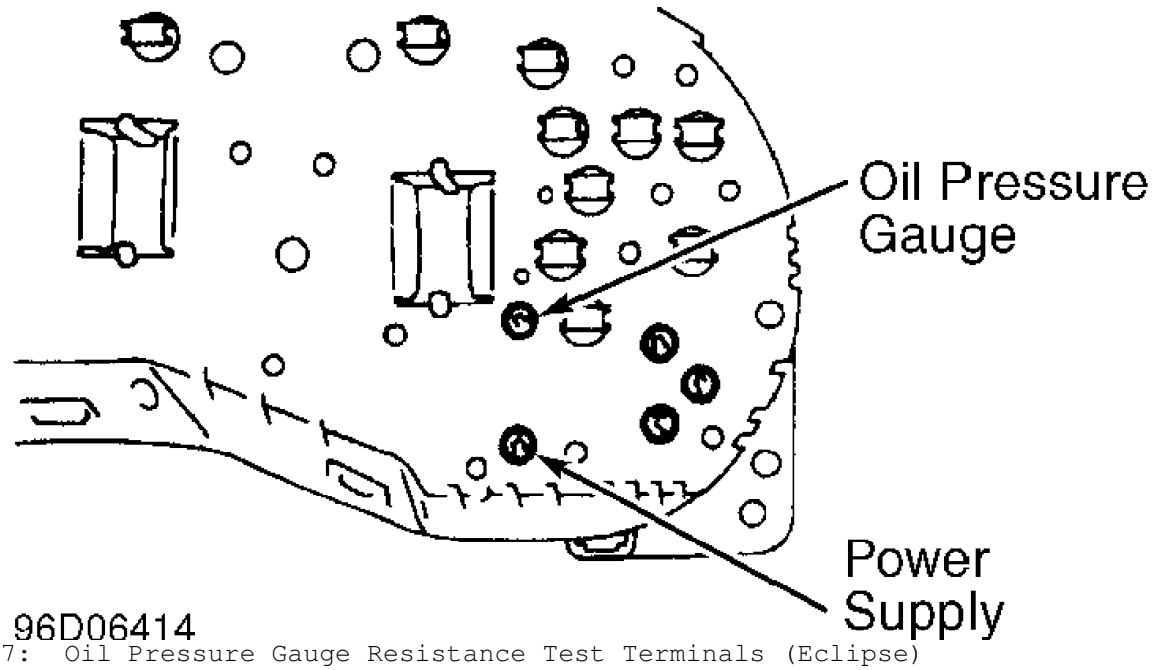

Fig. 17: Oil Pressure Gauge Resistance Test Terminals (Eclipse)
Courtesy of Mitsubishi Motor Sales of America

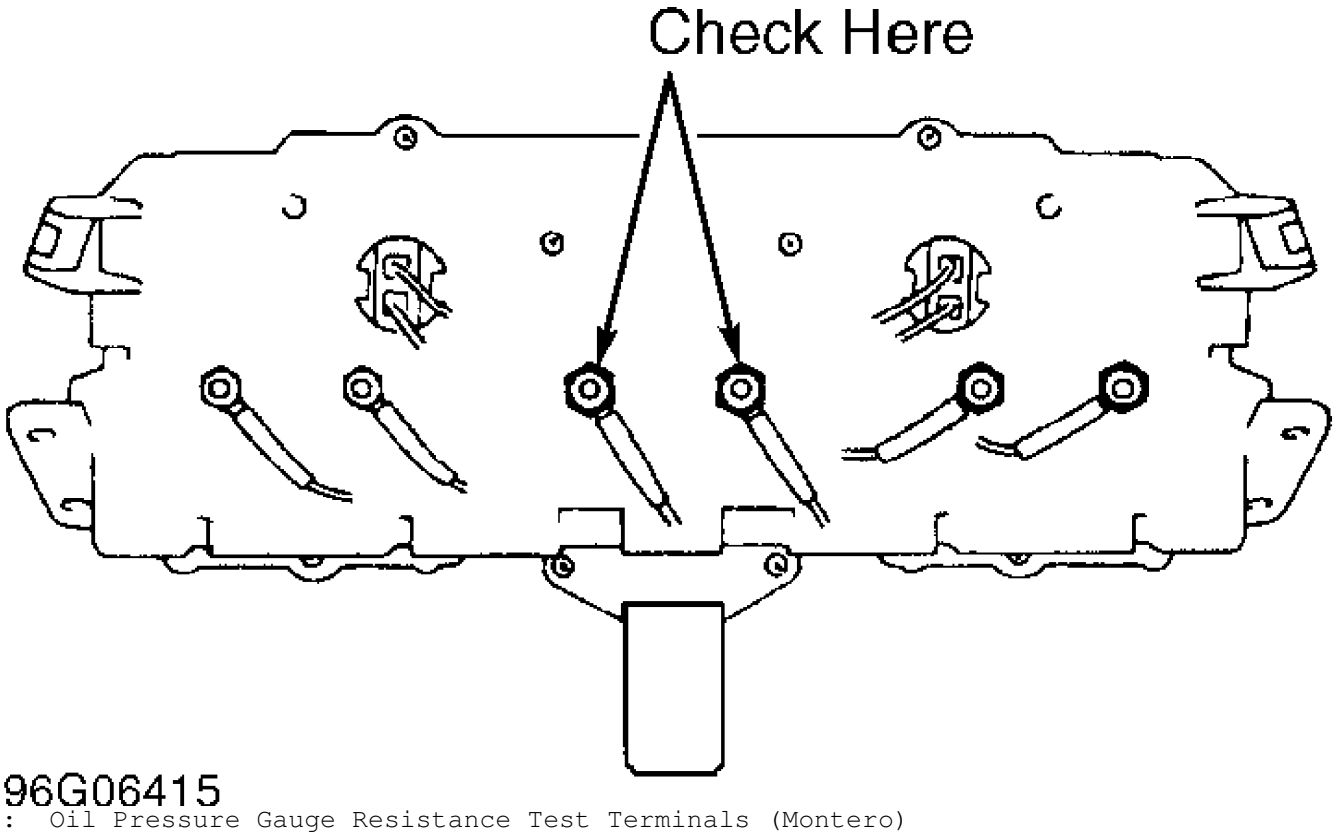

Fig. 18: Oil Pressure Gauge Resistance Test Terminals (Montero)
Courtesy of Mitsubishi Motor Sales of America

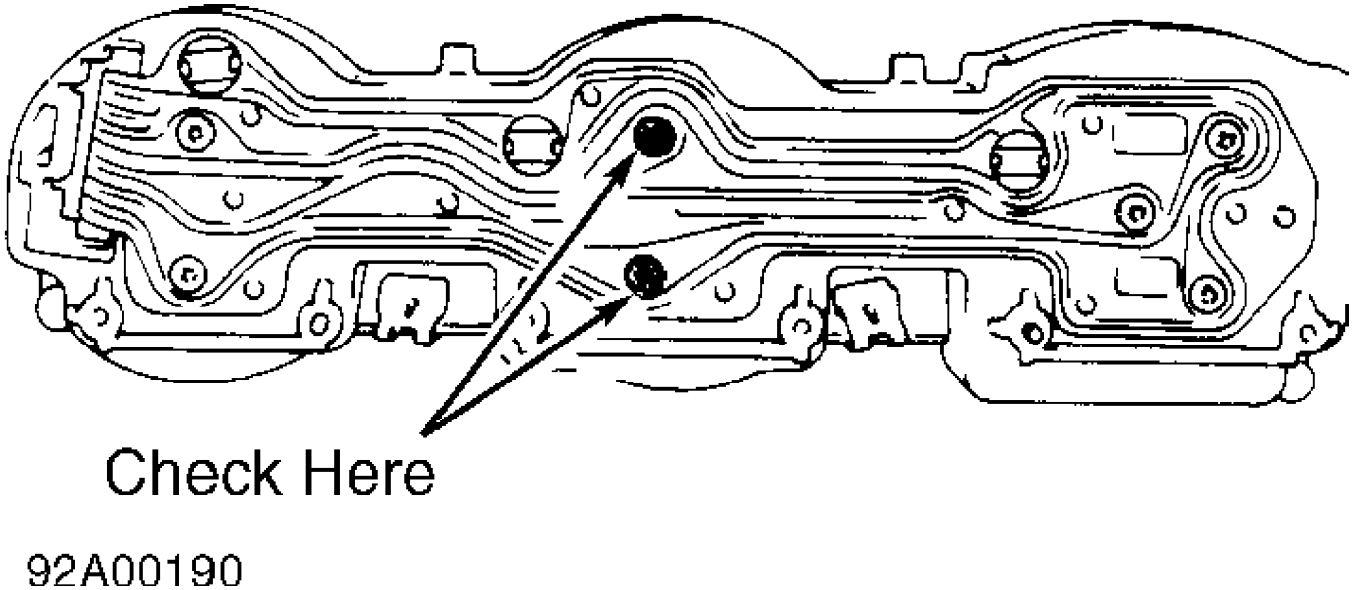

Fig. 19: Oil Pressure Gauge Resistance Test Terminals (3000GT)
Courtesy of Mitsubishi Motor Sales of America

NOTE: On Montero Sport, oil pressure gauge is mounted on multi-meter assembly on center of dashboard.

Circuit Test (Montero Sport)
1) Disconnect harness connector from oil pressure sending

unit. Turn ignition on. Check voltage between ground and sending unit harness-side connector. If battery voltage is present, problem is intermittent. If battery voltage is not present, go to next step.

2) Check sending unit harness connector. Repair as necessary. If connector is okay, check circuit (Yellow wire) between oil pressure gauge and oil pressure sending unit. See WIRING DIAGRAMS. Repair as necessary. If circuit is okay, go to next step.

3) Remove multi-meter assembly. Check voltage between ground and harness-side connector terminal No. 10 (Red/Black wire). See WIRING DIAGRAMS. If battery voltage is present, problem is intermittent. If battery voltage is not present, go to next step.

4) Check harness connector to multi-meter assembly. Repair as necessary. If connector is okay, check circuit between multi-meter harness connector and fusible link No. 6. See WIRING DIAGRAMS. Repair as necessary. If circuit is okay, go to next step.

5) Turn ignition on. Check voltage between ground and multi-meter harness-side connector terminal No. 11 (Black/White wire). See WIRING DIAGRAMS. If battery voltage is present, problem is intermittent. If battery voltage is not present, go to next step.

6) Check harness connector to multi-meter assembly. Repair as necessary. If connector is okay, check circuit between multi-meter assembly harness connector and ignition switch. See WIRING DIAGRAMS. Repair as necessary. If circuit is okay, go to next step.

7) Turn ignition off. Check continuity between ground and multi-meter assembly harness-side connector terminal No. 3 (Black wire). If continuity is present, problem is intermittent. If continuity is not present, go to next step.

8) Check harness connector to multi-meter assembly. Repair as necessary. If connector is okay, check circuit (Black wire) between multi-meter assembly harness connector and ground. See WIRING DIAGRAMS . Repair as necessary. If circuit is okay, problem is intermittent.

Gauge Sending Unit Resistance Test (Montero Sport)

Disconnect harness connector to oil pressure sending unit. Start and idle engine. Check resistance between oil pressure gauge sending unit terminal and engine block. Resistance should be about 2 ohms. Replace sending unit if resistance is not as specified.

REED SWITCH

Continuity Check (Montero)

1) Remove instrument cluster. See INSTRUMENT CLUSTER under REMOVAL & INSTALLATION. Check continuity between reed switch terminals No. 1 and 2. See Fig. 20.

2) Ensure continuity pulses on and off 4 times per revolution of speedometer shaft connection. If continuity is not as specified, replace reed switch.

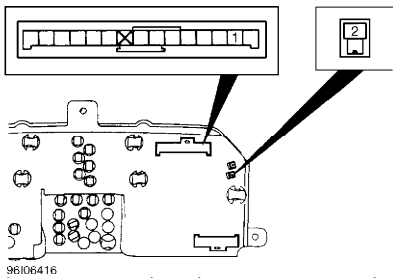

Fig. 20: Identifying Reed Switch Test Terminals (Montero)
Courtesy of Mitsubishi Motor Sales of America

SPEEDOMETER TEST

Calibration Test

Adjust tire pressure to standard value. Using a calibrated, reliable speedometer tester, compare reading of vehicle speedometer to speedometer tester. See SPEEDOMETER ALLOWABLE VARIATION table. Replace speedometer if necessary.

SPEEDOMETER ALLOWABLE VARIATION TABLE

MPH (KM/H)	Allowable Variation MPH (KM/H)
20 (32)	19-22 (31-35)
40 (64)	38-44 (61-71)
60 (97)	57-66 (92-106)
80 (129)	76-88 (122-142)
100 (161)	94-110 (151-177)

NOTE: Speedometer circuit test for Montero and 3000GT is not available from manufacturer at time of publication.

Circuit Test (Eclipse, Galant & Mirage)

1) Remove instrument cluster. See INSTRUMENT CLUSTER under REMOVAL & INSTALLATION. Disconnect instrument cluster harness connector. Turn ignition on. Connect voltmeter between ground and instrument cluster harness-side connector terminal No. 36 (Yellow/White wire) on Eclipse, terminal No. 49 (Yellow/White wire) on Galant, or terminal No. 51 (Yellow wire) on Mirage. Move vehicle forward and backward. If voltmeter reads 4.5 volts or greater, go to step 4). If voltage reading is not as specified, replace speedometer assembly.

2) Connect voltmeter between ground and instrument cluster harness-side connector terminal No. 10 (Black/White wire) on Eclipse, terminal No. 24 (Black/White wire) on Galant, or terminal No. 42 (Black/White wire) on Mirage. Turn ignition on. Move vehicle forward and backward. If battery voltage is present, replace speedometer assembly. If battery voltage is not present, go to step 4).

3) On Mirage, check continuity between ground and instrument cluster harness-side connector terminal No. 11 (Black wire). If continuity is present, go to next step. If continuity is not present, check circuit between ground and instrument cluster. See WIRING DIAGRAMS. Repair as necessary.

4) Check vehicle speed sensor. See VEHICLE SPEED SENSOR under COMPONENT TESTS. Replace as necessary. If sensor is okay, check harness connectors to instrument cluster. Repair as necessary. If connectors are okay, check circuit between power supply and instrument cluster. See WIRING DIAGRAMS. Repair as necessary.

Circuit Test (Montero Sport)

1) Disconnect vehicle speed sensor harness connector. Check vehicle speed sensor. See VEHICLE SPEED SENSOR under COMPONENT TESTS. Replace sensor as necessary. If sensor is okay, go to next step.

2) Turn ignition on. Check voltage between ground and vehicle speed sensor harness-side connector terminal No. 3 (Yellow/White wire). See WIRING DIAGRAMS. If voltage reading is 4.5 volts, problem is intermittent. If voltage reading is not 4.5 volts, go to next step.

3) Check vehicle speed sensor harness connector. Repair as necessary. If connector is okay, check circuit between vehicle speed sensor and instrument cluster. See WIRING DIAGRAMS. Repair as necessary. If circuit is okay, go to next step.

4) Check voltage between ground and vehicle speed sensor harness-side connector terminal No. 1 (Black/White wire). See WIRING DIAGRAMS. Battery voltage should be present. If battery voltage is present, problem is intermittent. If battery voltage is not

present, go to next step.

5) Check harness connectors to vehicle speed sensor and ignition switch. See WIRING DIAGRAMS. Repair as necessary. If connectors are okay, check circuit between vehicle speed sensor and ignition switch. Repair as necessary. If circuit is okay, go to next step.

6) Turn ignition off. Check resistance between ground and vehicle speed sensor harness-side connector terminal No. 2 (Black wire). See WIRING DIAGRAMS. Continuity should be present. If continuity is present, problem is intermittent. If continuity is not present, check circuit between sensor harness-side connector terminal No. 2 and ground. Repair as necessary. If circuit is okay, go to next step.

7) Remove instrument cluster. See INSTRUMENT CLUSTER under REMOVAL & INSTALLATION. Check voltage between ground and instrument cluster harness-side connector terminal No. 53 (Red/Black wire). See WIRING DIAGRAMS. Battery voltage should be present. If battery voltage is present, go to step 9). If battery voltage is not present, go to next step.

8) Check harness connector to instrument cluster. Repair as necessary. If connector is okay, check circuit between instrument cluster harness connector and fusible link No. 6. See WIRING DIAGRAMS. Repair as necessary. If circuit is okay, go to next step.

9) Check voltage between ground and instrument cluster harness-side connector terminal No. 24 (Black/White wire). See WIRING DIAGRAMS. Battery voltage should be present. If battery voltage is present, problem is intermittent. If battery voltage is not present, check harness connector. Repair as necessary.

TACHOMETER

NOTE: DO NOT reverse polarity when installing tachometer, or diode and transistor may be damaged.

Calibration Test

Connect a calibrated, reliable tachometer to vehicle ignition system. Operate engine at various speeds (RPM). See TACHOMETER ALLOWABLE VARIATION table. If comparison between tach-dwell meter and vehicle tachometer readings are not within permissible variation, replace vehicle tachometer.

TACHOMETER ALLOWABLE VARIATION TABLE

Application & Engine Speed (RPM)	Allowable Variation (RPM)
Eclipse, Galant & 3000GT	
1000	900-1100
3000	2850-3150
5000	4750-5250
6000	5700-6300
Mirage, Montero & Montero Sport	
700	600-800
3000	2850-3150
5000	4750-5250
6000	5700-6300

NOTE: Circuit test for Eclipse, Galant, Montero and 3000GT is not available from manufacturer at time of publication.

Circuit Test (Mirage)

1) Disconnect instrument cluster harness connector. Check

voltage between ground and harness-side connector terminal No. 33 (White wire). See WIRING DIAGRAMS. Voltmeter should read 5 volts. If voltage is as specified, replace tachometer. If voltage is not as specified, go to step 4).

2) Check continuity between ground and instrument cluster harness-side connector terminal No. 34 (Black wire). See WIRING DIAGRAMS. If continuity is present, replace tachometer. If continuity is not present, go to step 5).

3) Check voltage between ground and instrument cluster harness-side connector terminal No. 42 (Black/White wire). See WIRING DIAGRAMS. Battery voltage should be present. If battery voltage is present, replace tachometer. If battery voltage is not present, go to step 6).

4) Check harness connectors to ECM, instrument cluster or distributor assembly (1.5L). Repair as necessary. If connectors are okay, check circuit between ECM, instrument cluster and distributor (1.5L). See WIRING DIAGRAMS. Repair as necessary.

5) Check joint connector to instrument cluster. Repair as necessary. If connector is okay, check circuit between instrument cluster and ground. See WIRING DIAGRAMS. Repair as necessary.

6) Check harness and joint connectors to power supply junction block. Repair as necessary. If connectors are okay, check circuit between instrument cluster and power supply. See WIRING DIAGRAMS. Repair as necessary.

Circuit Test (Montero Sport)

1) Remove instrument cluster. See INSTRUMENT CLUSTER under REMOVAL & INSTALLATION. Disconnect instrument cluster harness connector. Connect voltmeter between ground and instrument cluster harness-side connector terminal No. 14 (White wire). Start and idle engine. Voltmeter should read about 5 volts. If voltage is as specified, problem is intermittent. If voltage is not as specified, go to next step.

2) Check instrument cluster harness connector. Repair as necessary. If connector is okay, go to next step on 2.4L engines or step 7) on 3.0L engines.

3) Check noise filter harness connector (located behind instrument cluster). Repair as necessary. If connector is okay, go to next step.

4) Check circuit between instrument cluster harness connector and noise filter connector. See WIRING DIAGRAMS. Repair as necessary. If circuit is okay, go to next step.

5) Remove noise filter (located near throttle position sensor harness). Check resistance between noise filter terminals. Resistance should be 1760-2640 ohms. If resistance is not as specified, replace noise filter. If resistance is as specified, go to next step.

6) Check joint connector behind right side of dash. Repair as necessary. If connector is okay, check circuit between joint connector and instrument cluster harness connector. See WIRING DIAGRAMS. Repair as necessary. If circuit is okay, go to next step.

7) Check voltage between ground and instrument cluster harness-side connector terminal No. 24 (Black/White wire). If battery voltage is present, problem is intermittent. If battery voltage is not present, go to next step.

8) Check harness connector to instrument cluster. Repair as necessary. If connector is okay, check circuit between instrument cluster and ignition switch. See WIRING DIAGRAMS. Repair as necessary. If circuit is okay, go to next step.

9) Check circuit between ground and instrument cluster harness-side connector terminal No. 13 (Black wire). If continuity is present, problem is intermittent. If continuity is not present, check harness connector to instrument cluster and to chassis ground. See WIRING DIAGRAMS. Repair as necessary. If connectors are okay, replace

speedometer.

TEMPERATURE GAUGE

CAUTION: DO NOT connect sender wire directly to ground during test.

Circuit Test

1) Disconnect temperature sender wire from sending unit. Connect a 12-volt, 3.4-watt test light between connector terminal and ground. Turn ignition switch to ON position.

2) If test light flashes and temperature gauge needle moves, go to SENSOR RESISTANCE TEST. If test light does not flash or gauge needle does not move, repair wiring to sending unit.

Sensor Resistance Test

1) Remove Engine Coolant Temperature (ECT) sensor from engine. See COMPONENT LOCATIONS. Place sending unit in 158°F (70°C) water. Check sensor resistance using ohmmeter.

2) ECT sensor resistance should be 90-117 ohms. If ECT sensor resistance is okay, go to GAUGE RESISTANCE TEST. Replace ECT sensor if resistance is not as specified.

Gauge Resistance Test

1) Remove instrument cluster. See INSTRUMENT CLUSTER under REMOVAL & INSTALLATION. On 3000GT, remove air distribution duct and combination gauges.

2) On all models, check resistance between temperature gauge terminals at rear of cluster or combination gauges. See TEMPERATURE GAUGE RESISTANCE SPECIFICATIONS table. See Fig. 21, 22, 23, 24, 25, 26, 27 or 28.

TEMPERATURE GAUGE RESISTANCE SPECIFICATIONS TABLE

Application	(1) Terminals	Ohms
Eclipse	"A" & "B"	161-197
Eclipse	"A" & "C"	51-57
Eclipse	"B" & "C"	210-256
Galant	"B" & "C"	(2)
Mirage	"A" & "B"	86-95
Mirage	"A" & "C"	168-206
Mirage	"B" & "C"	222-272
Montero	No. 4 & 8	103-128
Montero	No. 4 & 9	221-271
Montero	No. 8 & 9	130-160
Montero Sport	"A" & "B"	88
Montero Sport	"A" & "C"	103
Montero Sport	"B" & "C"	191
3000GT	"A" & "B"	51
3000GT	"A" & "C"	139
3000GT	"B" & "C"	190

(1) - See Fig. 21, 22, 23, 24, 25, 26, 27 or 28.
(2) - With positive battery voltage applied to terminal "A", battery ground applied to terminal "C" and a 50-ohm resistor connected between battery ground and terminal "B", needle should be about 1/4 position on gauge.

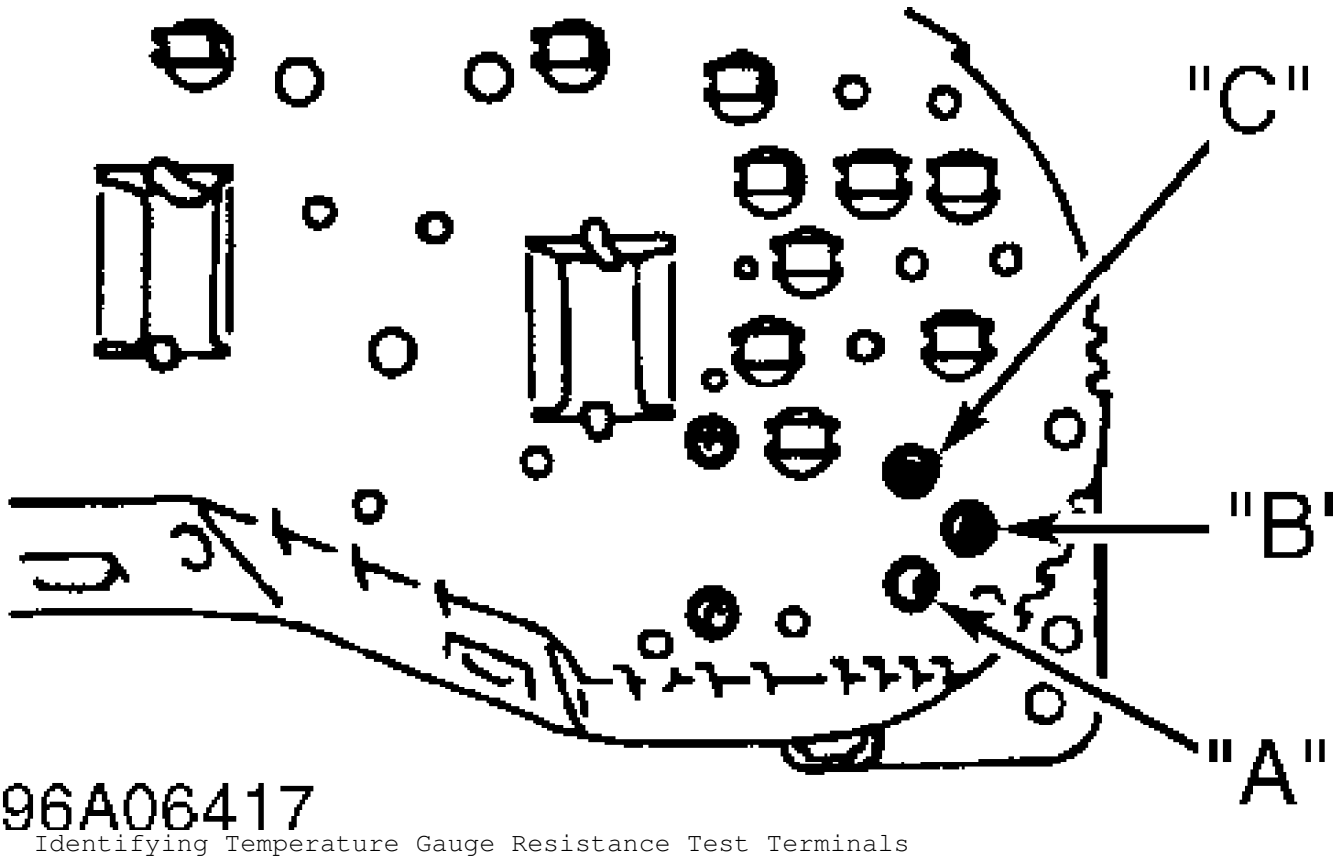

Fig. 21: Identifying Temperature Gauge Resistance Test Terminals (Eclipse 2.0L Non-Turbo & 2.4L)
Courtesy of Mitsubishi Motor Sales of America

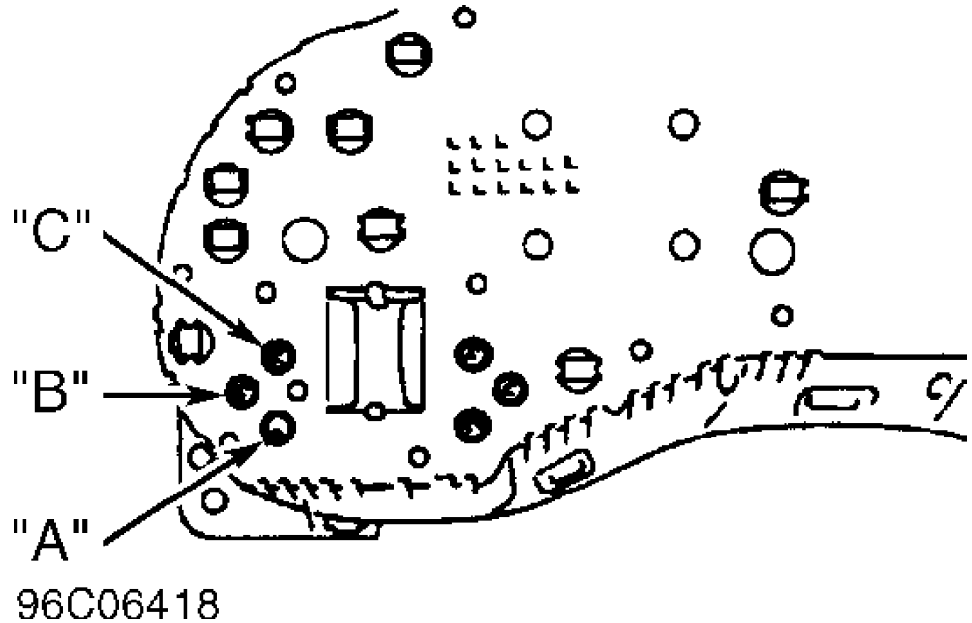

Fig. 22: Identifying Temperature Gauge Resistance Test Terminals (Eclipse 2.0L Turbo)
Courtesy of Mitsubishi Motor Sales of America

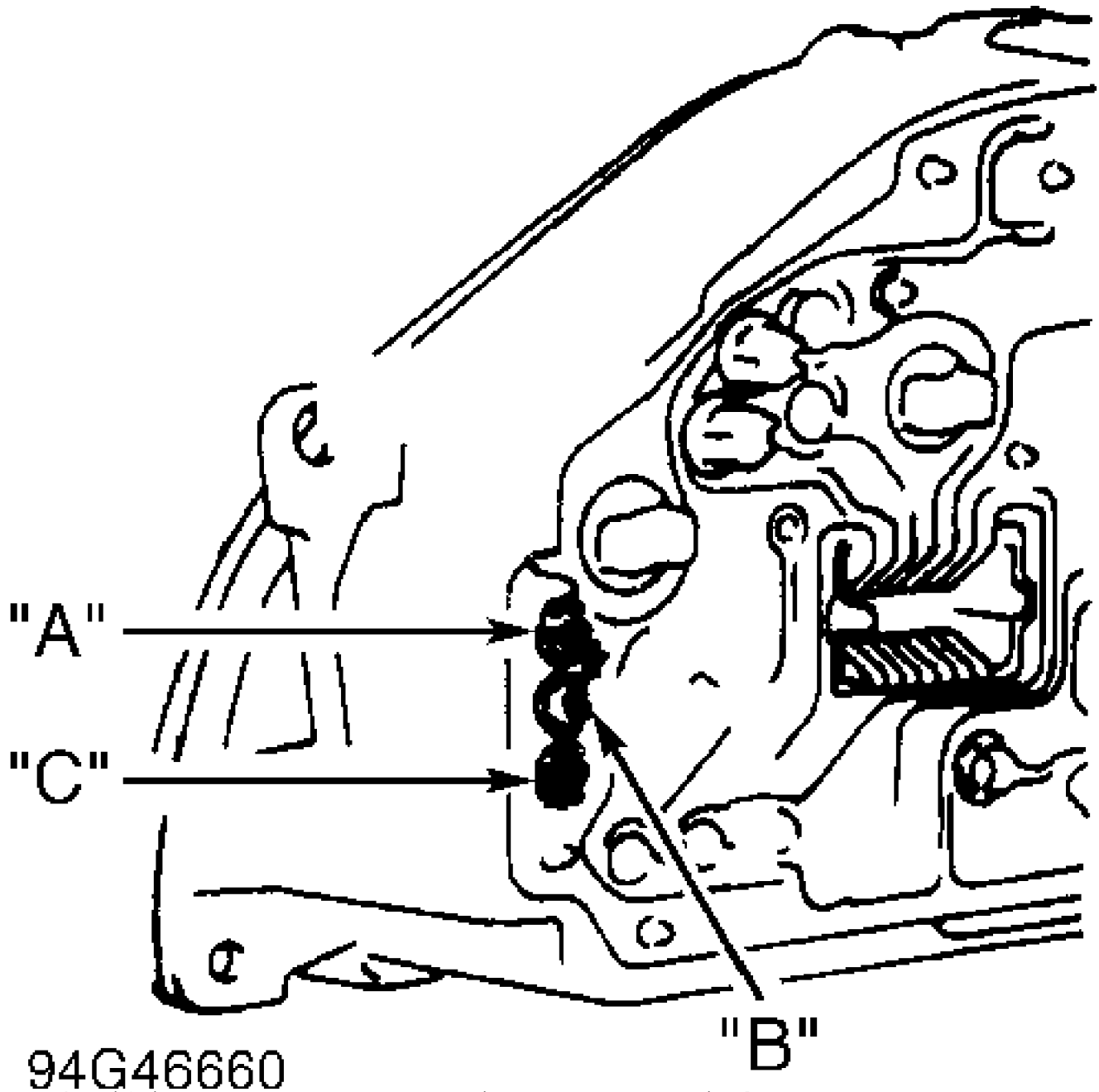

Fig. 23: Identifying Temperature Gauge Resistance Test Terminals (Galant)
Courtesy of Mitsubishi Motor Sales of America

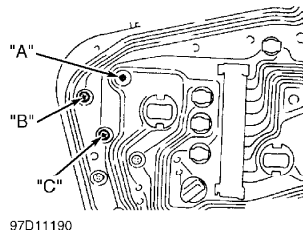

Fig. 24: Identifying Temperature Gauge Resistance Test Terminals (Mirage - With Tachometer)

Courtesy of Mitsubishi Motor Sales of America

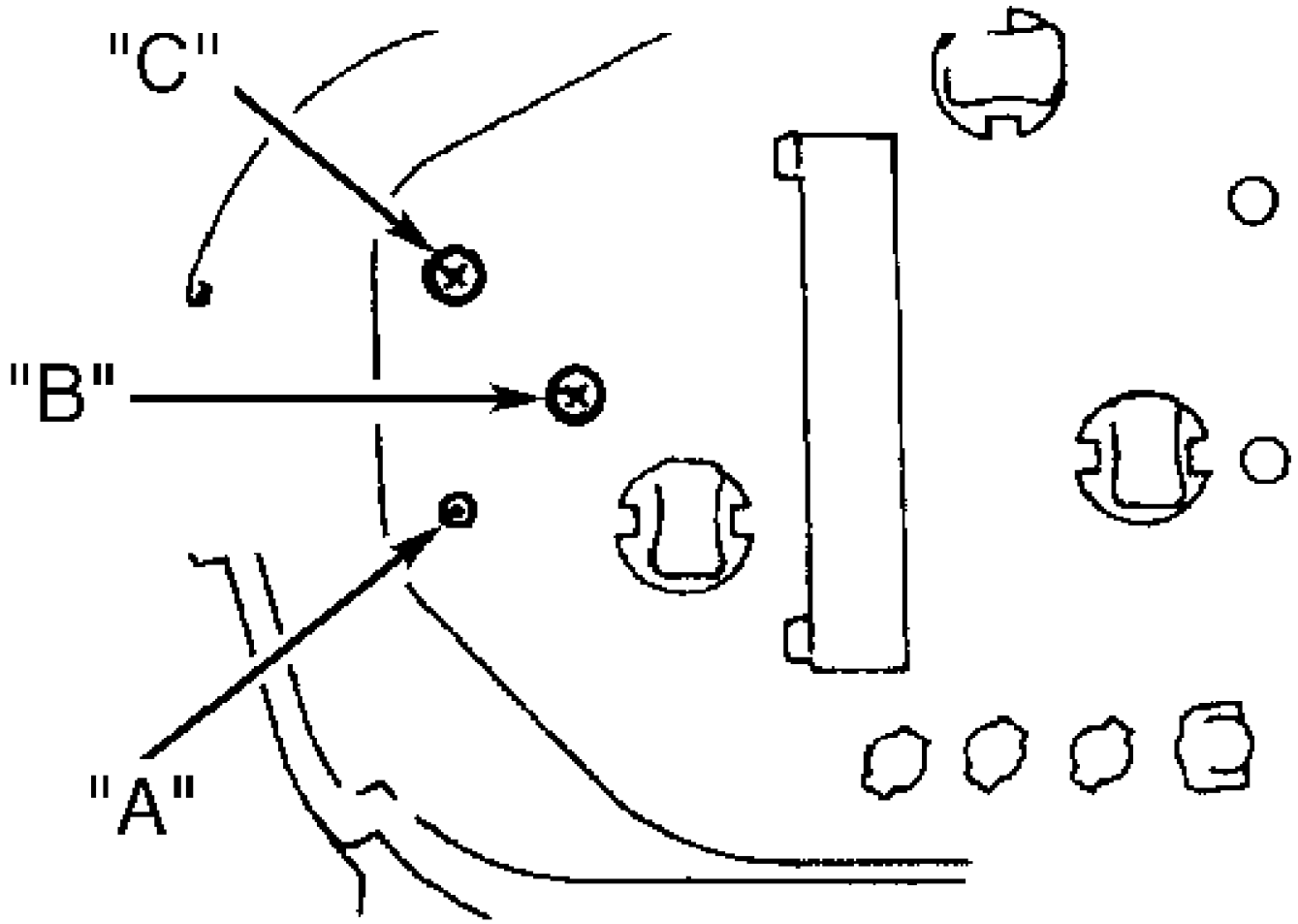

Fig. 25: Identifying Temperature Gauge Resistance Test Terminals (Mirage - Without Tachometer)
Courtesy of Mitsubishi Motor Sales of America

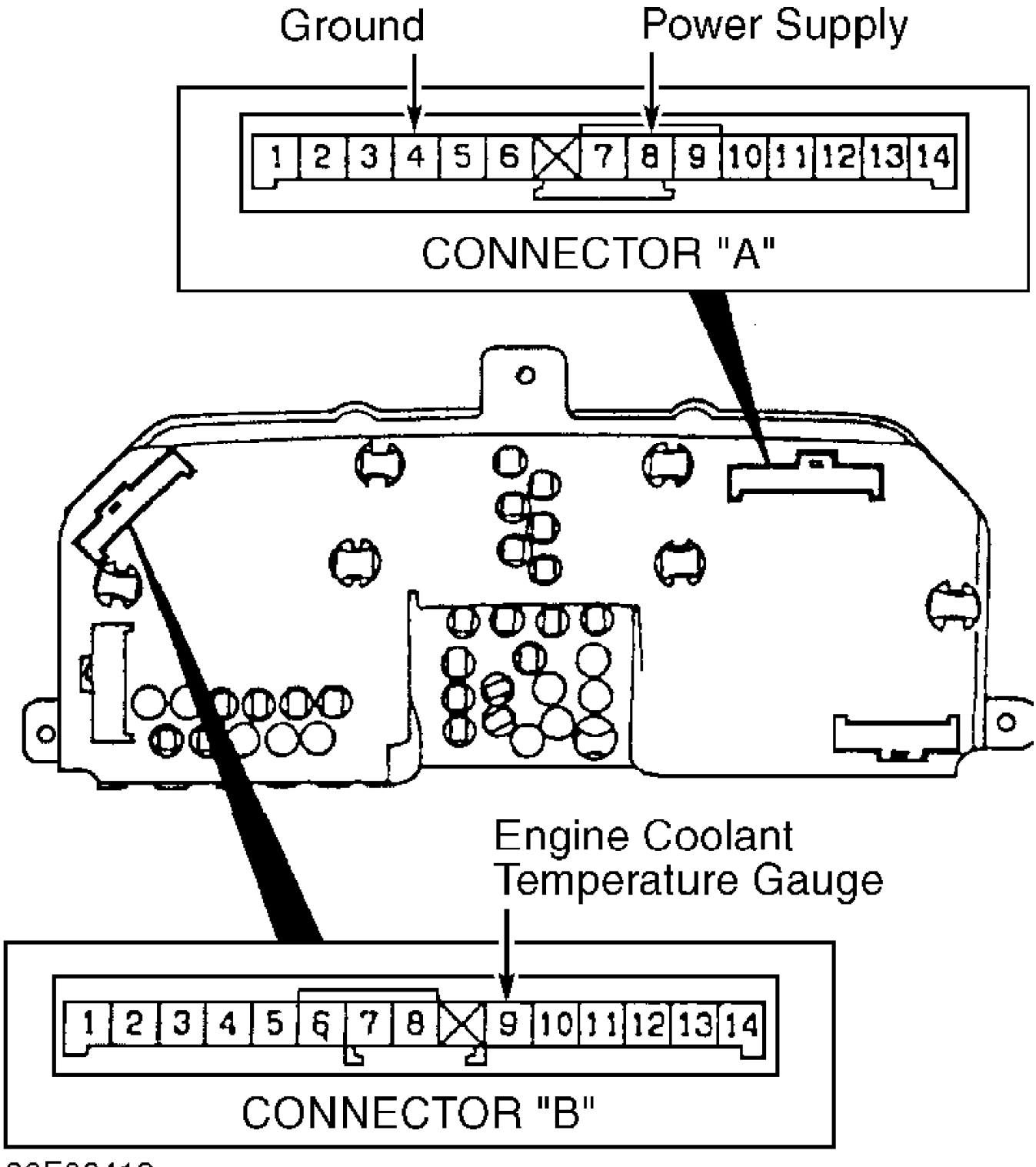

Fig. 26: Identifying Temperature Gauge Resistance Test Terminals (Montero)
Courtesy of Mitsubishi Motor Sales of America

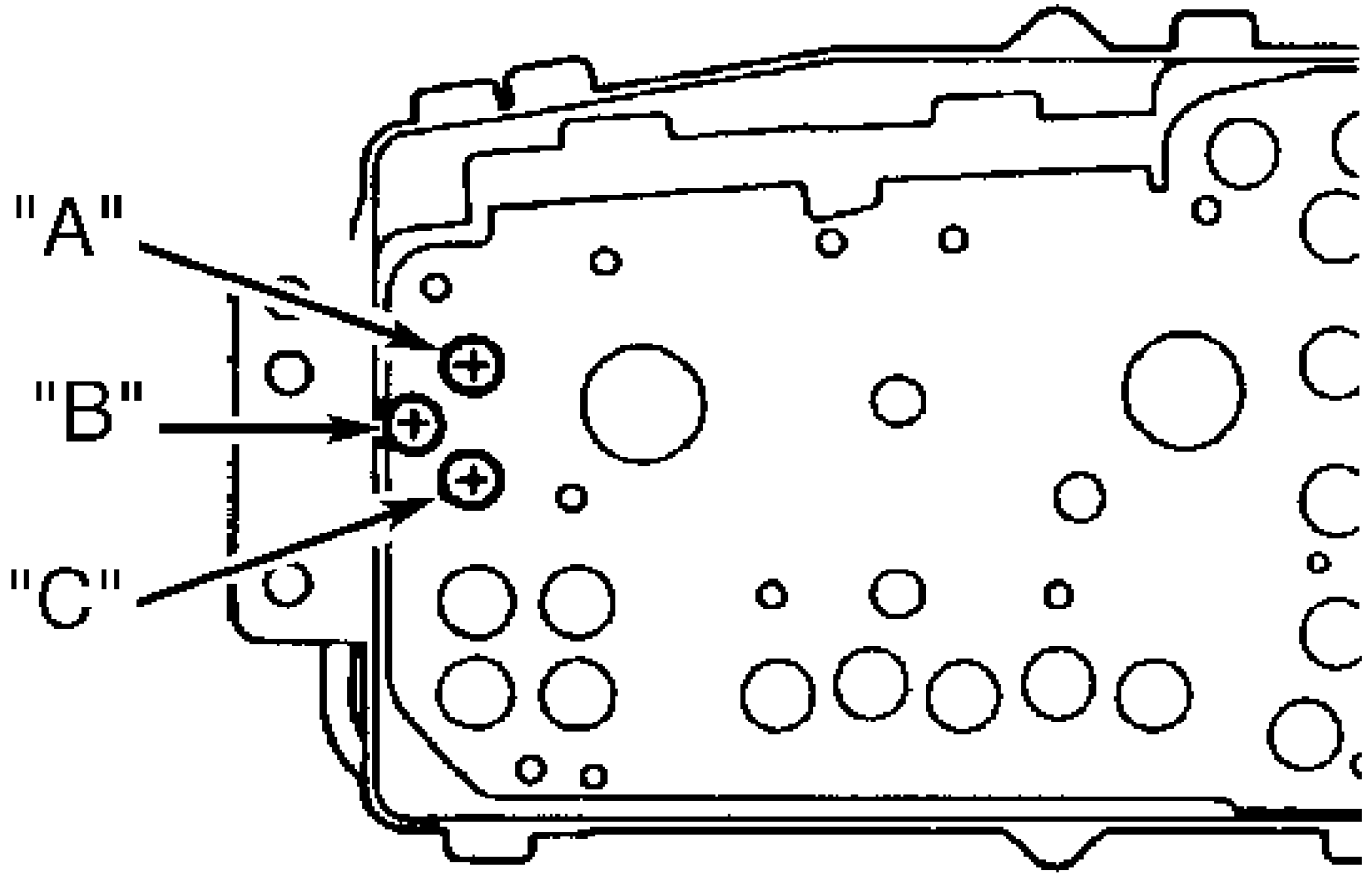

Fig. 27: Identifying Temperature Gauge Resistance Test Terminals (Montero Sport)
Courtesy of Mitsubishi Motor Sales of America

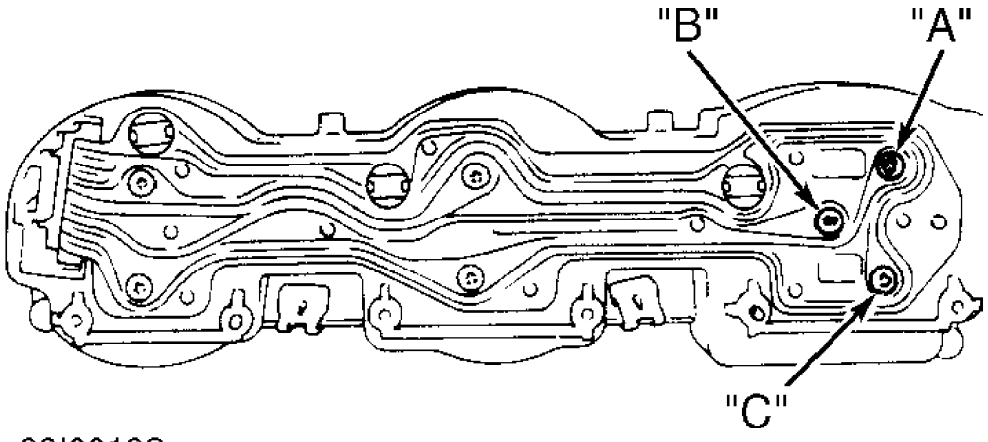

Fig. 28: Identifying Temperature Gauge Resistance Test Terminals (3000GT)
Courtesy of Mitsubishi Motor Sales of America

VEHICLE SPEED SENSOR

NOTE: Vehicle speed sensor circuit test for Montero and 3000GT is not available from manufacturer at time of publication.

Circuit Test (Eclipse, Galant & Mirage)

1) Disconnect vehicle speed sensor harness connector. Turn ignition on. Check voltage between ground and vehicle speed sensor harness-side connector terminal No. 3 (Yellow/White wire on Eclipse 2.0L Non-Turbo models and Galant, or Yellow wire on Eclipse 2.0L Turbo and 2.4L models and Mirage). Voltmeter should read 4.5 volts or greater. If voltage is as specified, go to step 4). If voltage is not as specified, go to step 5).

2) Check voltage between ground and vehicle speed sensor harness-side connector terminal No. 1 (Yellow wire on Eclipse 2.0L Non-Turbo models, Black/White wire on Eclipse 2.0L Turbo and 2.4L models and Mirage, or Yellow/White wire on Galant). Voltmeter should read battery voltage. If voltage is as specified, go to step 4). If voltage is not as specified, go to step 5).

3) Check continuity between ground and vehicle speed sensor harness-side connector terminal No. 2 (Black/Green wire on Eclipse 2.0L Non-Turbo models, or Black wire on Eclipse 2.0L Turbo and 2.4L models, Galant and Mirage). If continuity is present, go to next step. If continuity is not present, go to step 5).

4) Check harness connector to instrument cluster. Repair as necessary. If connector is okay, check circuit between vehicle speed sensor and power supply. See WIRING DIAGRAMS. Repair as necessary.

5) Check harness connectors to instrument cluster and vehicle speed sensor. Repair as necessary. If connectors are okay, check circuit between vehicle speed sensor and instrument cluster. See WIRING DIAGRAMS. Repair as necessary.

Circuit Test (Montero Sport)

1) Disconnect vehicle speed sensor harness connector. Check circuit between instrument cluster harness connector and ignition switch. See WIRING DIAGRAMS. Repair as necessary. If circuit is okay, go to next step.

2) Remove instrument cluster. See INSTRUMENT CLUSTER under REMOVAL & INSTALLATION. Check continuity between ground and instrument cluster harness-side connector terminal No. 31 (Black wire). See WIRING DIAGRAMS. If continuity is present, problem is intermittent. If continuity is not present, go to next step.

3) Check circuit between instrument cluster and ignition switch. See WIRING DIAGRAMS. Repair as necessary. If circuit is okay, replace speedometer assembly.

Sensor Test (All Models)

1) Remove vehicle speed sensor from transaxle. Jumper a 3000-10,000 ohm resistor between sensor terminals No. 1 and 3. Connect battery positive to sensor terminal No. 1 and battery negative to sensor terminal No. 2. See Fig. 29.

2) Connect a voltmeter between sensor terminals No. 2 and 3. Manually turn speed sensor shaft. Voltage should pulse 4 times each revolution. Replace vehicle speed sensor if operation is not correct.

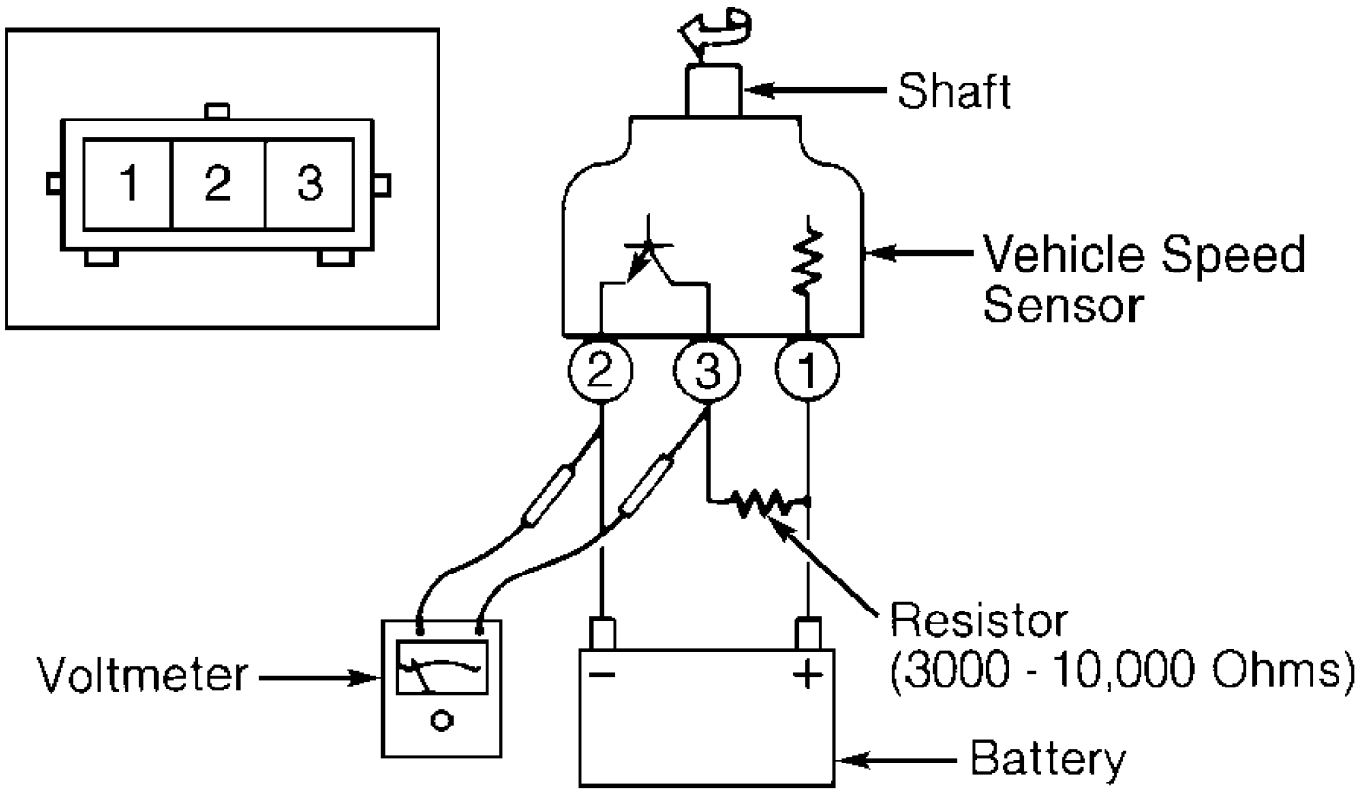

Fig. 29: Testing Vehicle Speed Sensor
Courtesy of Mitsubishi Motor Sales of America

VOLTMETER

Circuit Test (Montero Sport Only)

1) Remove multi-meter assembly from top of dashboard. Check voltage between ground and multi-meter harness-side connector terminal No. 10 (Red/Black wire). If voltage reading is about 12 volts, go to step 4). If voltage reading is not about 12 volts, go to next step.

2) Check harness connector to multi-meter assembly. Repair as necessary. If connector is okay, check circuit between multi-meter harness connector and fusible link No. 6. See WIRING DIAGRAMS. Repair as necessary. If circuit is okay, go to next step.

3) Turn ignition on. Check voltage between ground and multi-meter harness-side connector terminal No. 11 (Black/White wire). See WIRING DIAGRAMS. If voltage reading is about 12 volts, problem is intermittent. If voltage reading is not about 12 volts, go to next step.

4) Check harness connector to multi-meter assembly. Repair as necessary. If connector is okay, check circuit between multi-meter assembly harness connector and ignition switch. See WIRING DIAGRAMS. Repair as necessary. If circuit is okay, go to next step.

5) Turn ignition off. Check continuity between ground and multi-meter assembly harness-side connector terminal No. 3 (Black wire). If continuity is present, problem is intermittent. If continuity is not present, go to next step.

6) Check harness connector to multi-meter assembly. Repair as necessary. If connector is okay, check multi-meter assembly harness connector ground circuit. See WIRING DIAGRAMS. Repair as necessary. If circuit is okay, replace multi-meter assembly.

Resistance Test (Montero Only)

Using an ohmmeter, check resistance between voltmeter terminals. See Fig. 30. Resistance should be 380-460 ohms.

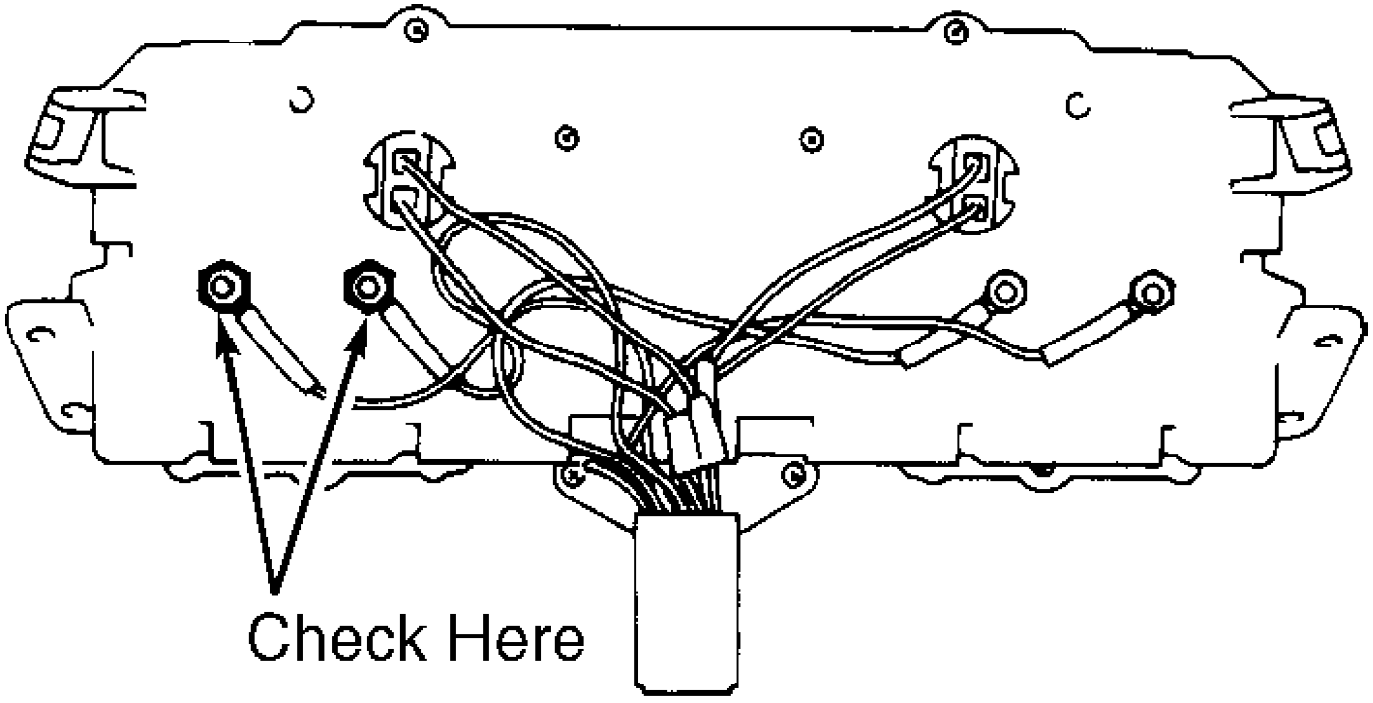

Fig. 30: Identifying Voltmeter Resistance Test Terminals (Montero)
Courtesy of Mitsubishi Motor Sales of America

Voltage Test (3000GT Only)

Start engine, and let it idle. Connect voltmeter to battery. Compare voltage reading of test voltmeter to voltage reading of vehicle voltmeter. Voltage variation should not exceed 0.5 volt (plus or minus). Replace instrument cluster voltmeter if voltage reading is not as specified.

FOGLIGHT SWITCH TEST

NOTE: Montero Sport is not equipped with foglights.

Eclipse

Remove foglight switch from instrument panel. Disconnect switch connector. Using an ohmmeter, check switch continuity. With switch in OFF position, continuity should exist between terminals No. 1 and 3. With switch in ON position, continuity should exist between terminals No. 1 and 3, and between terminals No. 4 and 5. See Fig. 31. If continuity is not as specified, replace switch.

Galant & Mirage

Remove foglight switch from instrument panel. Disconnect switch connector. Using an ohmmeter, check switch continuity. With switch in OFF position, continuity should exist between terminals No. 1 and 2. With switch in ON position, continuity should exist between terminals No. 1 and 2, terminals No. 3 and 4, and terminals No. 5 and 6. See Fig. 31. If continuity is not as specified, replace switch.

Montero

Remove foglight switch from instrument panel. Disconnect switch connector. Using an ohmmeter, check switch continuity. With switch in OFF position, continuity should exist between terminals No. 2 and 5. With switch in ON position, continuity should exist between terminals No. 1 and 4, terminals No. 2 and 5, and terminals No. 3 and 6. See Fig. 32. If continuity is not as specified, replace switch.

3000GT

Remove foglight switch from instrument panel. Disconnect switch connector. Using an ohmmeter, check switch continuity. With switch in OFF position, continuity should exist between terminals No. 3 and 4. With switch in ON position, continuity should exist between terminals No. 1 and 5. See Fig. 34. If continuity is not as specified, replace switch.

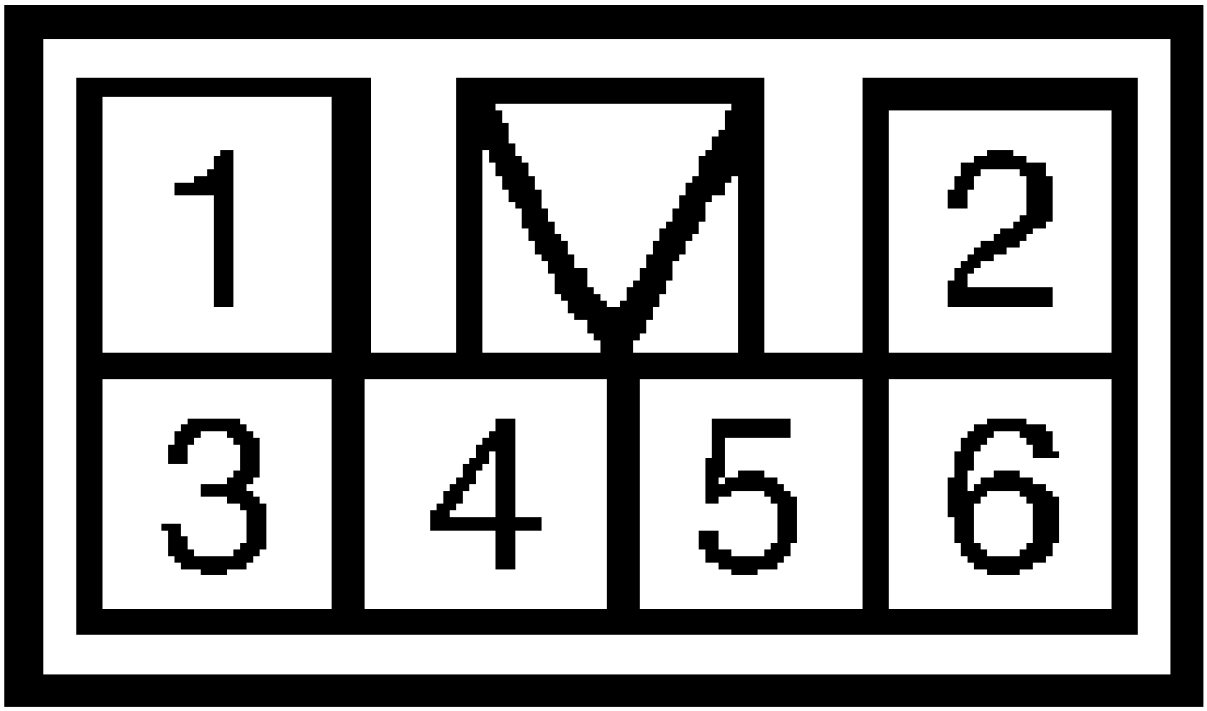

Fig. 31: Identifying Foglight Switch Connector Terminals (Eclipse, Galant & Mirage)
Courtesy of Mitsubishi Motor Sales of America

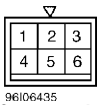

Fig. 32: Identifying Foglight Switch Connector Terminals (Montero)
Courtesy of Mitsubishi Motor Sales of America

FOGLIGHT RELAY TEST

Remove relay from engine compartment fuse/relay box. Using an ohmmeter, check relay continuity. With battery voltage not supplied to relay, continuity should exist between terminals No. 1 and 3. With positive battery terminal connected to relay terminal No. 1 and negative battery terminal connected to relay terminal No. 3, continuity should exist between terminals No. 4 and 5. See Fig. 33. If continuity is not as specified, replace relay.

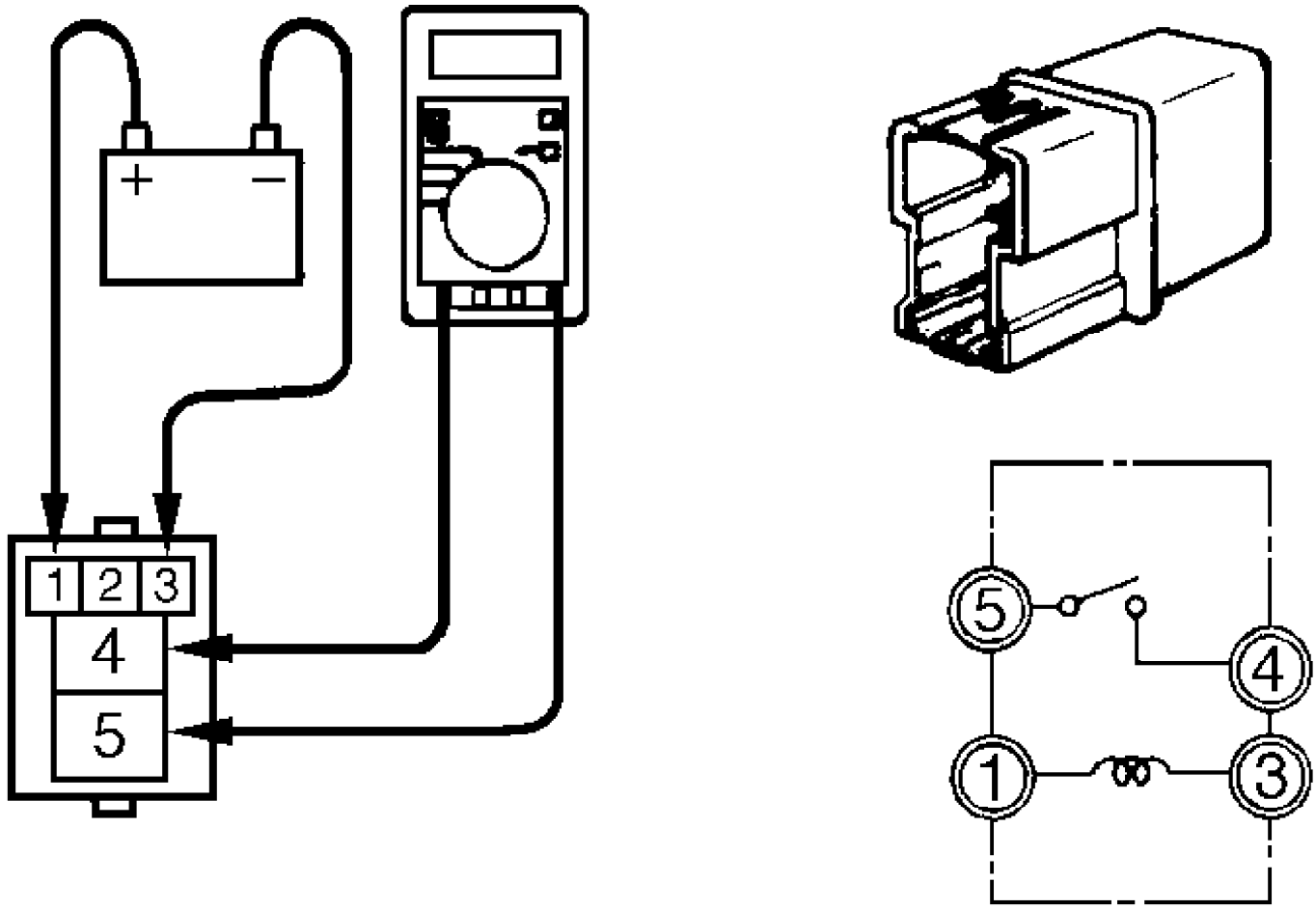

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Fig. 33: Identifying Foglight Relay Connector Terminals
Courtesy of Mitsubishi Motor Sales of America

HAZARD LIGHT SWITCH TEST

Eclipse, Mirage & Montero Sport

Remove hazard light switch from instrument panel. Disconnect switch connector. Using an ohmmeter, check switch continuity. With switch in OFF position, continuity should exist between terminals No. 5 and 7, and between terminals No. 9 and 10. With switch in ON position, continuity should exist between terminals No. 1, 2 and 4, between terminals No. 5 and 6, and between terminals No. 9 and 10. See Fig. 34. If continuity is not as specified, replace switch.

Galant

Remove hazard light switch from instrument panel. Disconnect switch connector. Using an ohmmeter, check switch continuity. With switch in OFF position, continuity should exist between terminals No. 5 and 7, and between terminals No. 8, 9 and 10. With switch in ON position, continuity should exist between terminals No. 1-4, between terminals No. 5 and 6, and between terminals No. 9 and 10. See Fig. 34 . If continuity is not as specified, replace switch.

Montero

Remove hazard light switch from instrument panel. Disconnect switch connector. Using an ohmmeter, check switch continuity. With switch in OFF position, continuity should exist between terminals No. 5 and 7, and between terminals No. 8, 9 and 10. With switch in ON position, continuity should exist between terminals No. 1-6, and between terminals No. 9 and 10. See Fig. 34. If continuity is not as specified, replace switch.

3000GT

Remove hazard light switch from instrument panel. Disconnect switch connector. Using an ohmmeter, check switch continuity. With switch in OFF position, continuity should exist between terminals No. 2 and 3, and between terminals No. 5 and 8. With switch in ON position, continuity should exist between terminals No. 2 and 3, between terminals No. 6, 9 and 10, and between terminals No. 7 and 8. See Fig. 34. If continuity is not as specified, replace switch.

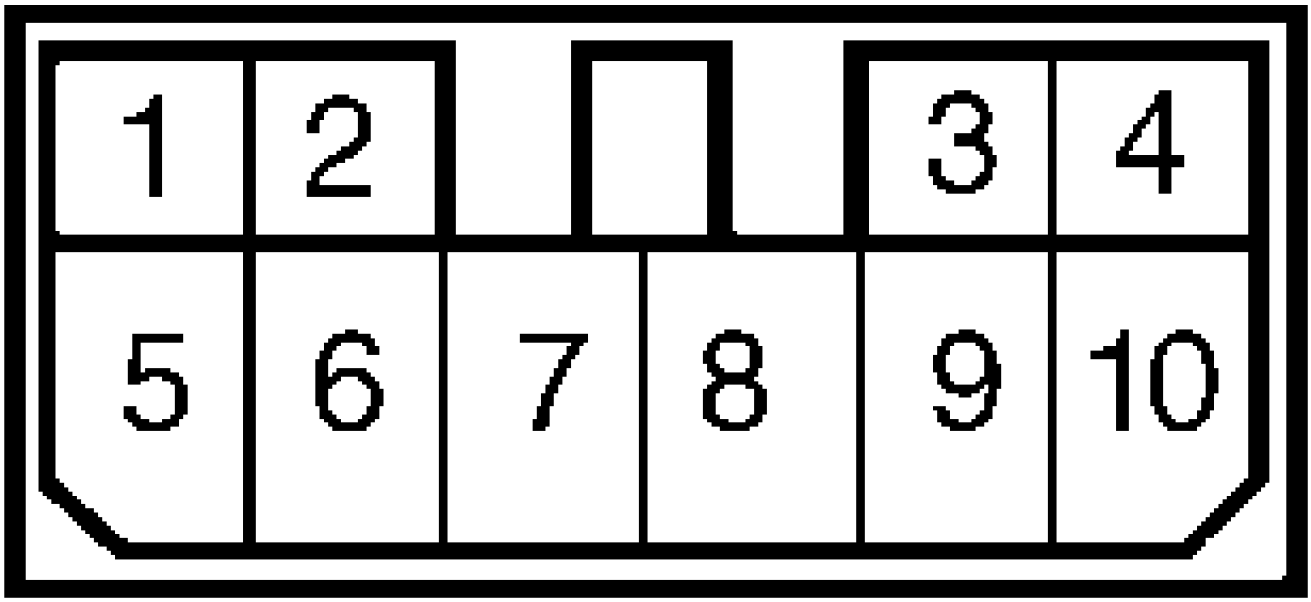

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Fig. 34: Identifying Hazard Light Switch Connector Terminals & Foglight Switch Connector Terminals (3000GT)
Courtesy of Mitsubishi Motor Sales of America

INSTRUMENT PANEL RHEOSTAT TEST

Remove driver-side knee protector. Remove rheostat from instrument panel. Connect battery and 40-watt test light to rheostat. See Figs. 35-38. Operate rheostat. If brightness changes smoothly without switching off, rheostat function is normal. If brightness does

not change smoothly or switches off, replace rheostat.

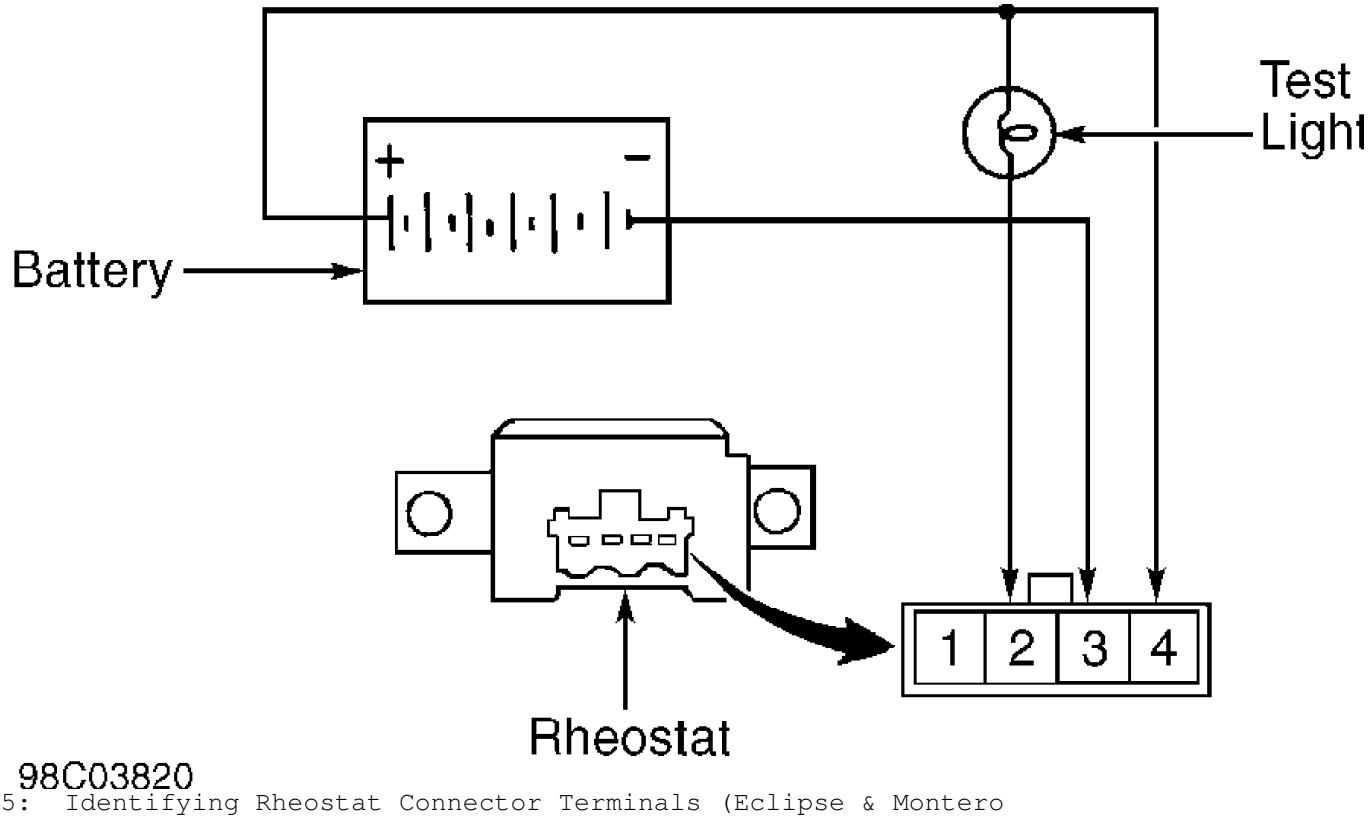


Fig. 35: Identifying Rheostat Connector Terminals (Eclipse & Montero Sport)
Courtesy of Mitsubishi Motor Sales of America

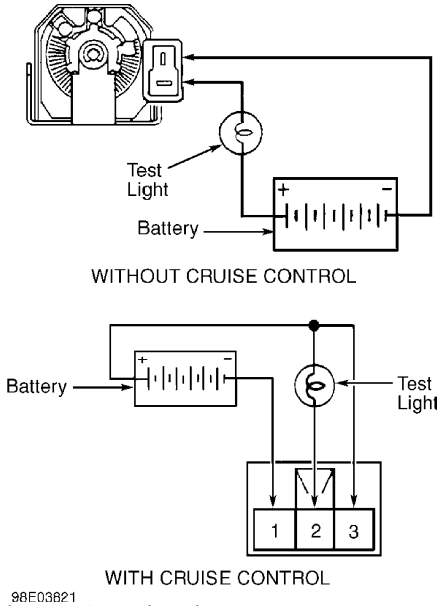


Fig. 36: Identifying Rheostat Connector Terminals (Galant & Mirage)
Courtesy of Mitsubishi Motor Sales of America

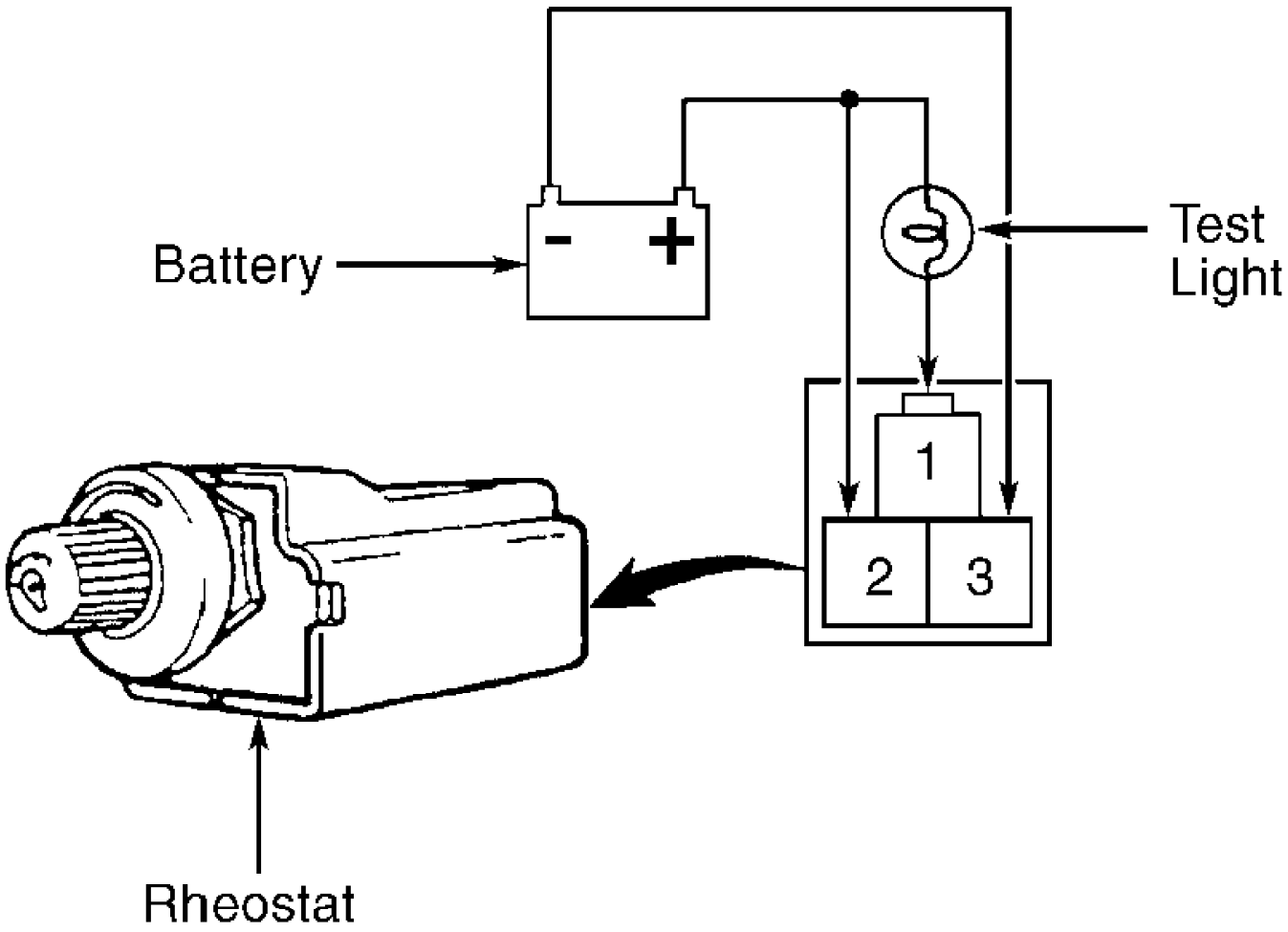


Fig. 37: Identifying Rheostat Connector Terminals (Montero)
Courtesy of Mitsubishi Motor Sales of America

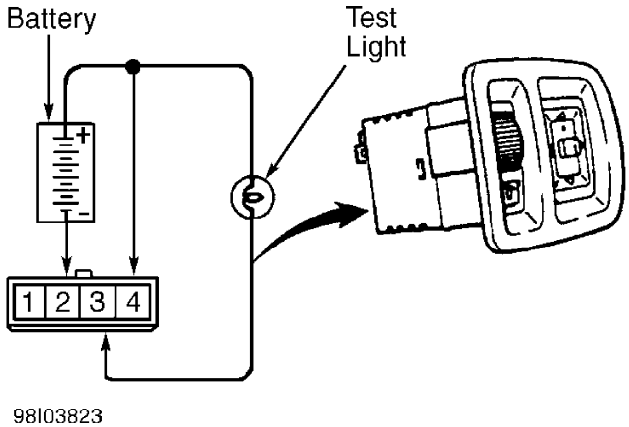


Fig. 38: Identifying Rheostat Connector Terminals (3000GT)
Courtesy of Mitsubishi Motor Sales of America

REMOVAL & INSTALLATION

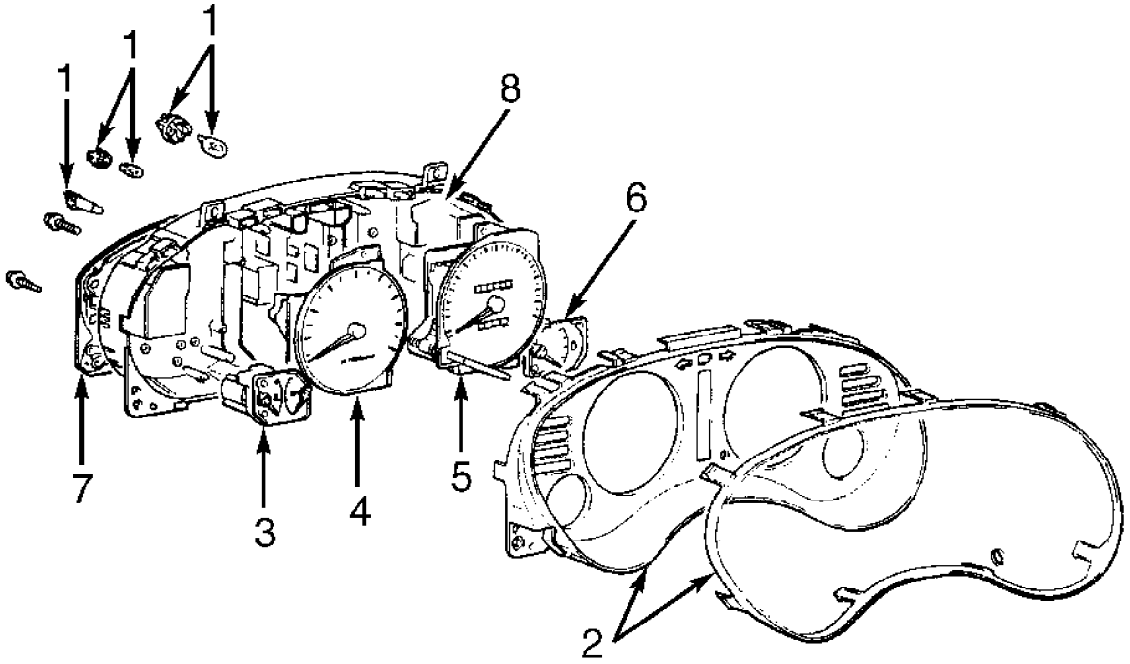
* PLEASE READ THIS FIRST *

WARNING: Deactivate air bag system before performing any service operation. See AIR BAG RESTRAINT SYSTEMS article. Do not apply electrical power to any component on steering column without first deactivating air bag system. Air bag may deploy.

INSTRUMENT CLUSTER

Removal & Installation (Eclipse, Galant & Mirage)

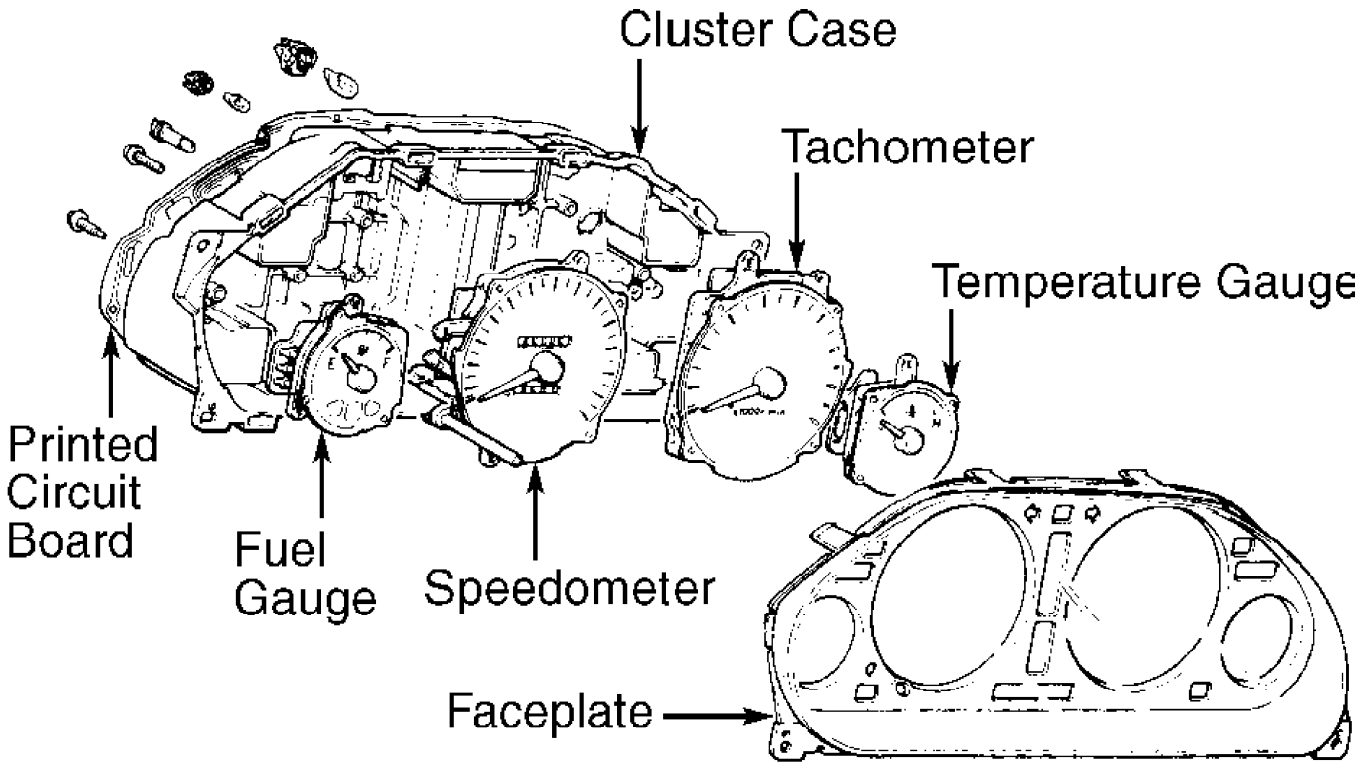
Disconnect negative battery cable. Remove cluster cover. Remove cluster mounting screws. Remove cluster by turning upper part toward front. Disconnect all necessary electrical connectors. Remove instrument cluster. To install, reverse removal procedure. See Fig. 39 , 40 or 42.



1. Bulb & Socket
2. Meter Glass & Window Plate
3. Boost Gauge/Oil Pressure Gauge
   2.0L Turbo
   Temperature Gauge
   2.0L Non-Turbo & 2.4L
4. Tachometer
5. Speedometer
6. Fuel Gauge/Temperature Gauge
   2.0L Turbo
   Fuel Gauge
   2.0L Non-Turbo & 2.4L
7. Printed Circuit Board
8. Meter Case

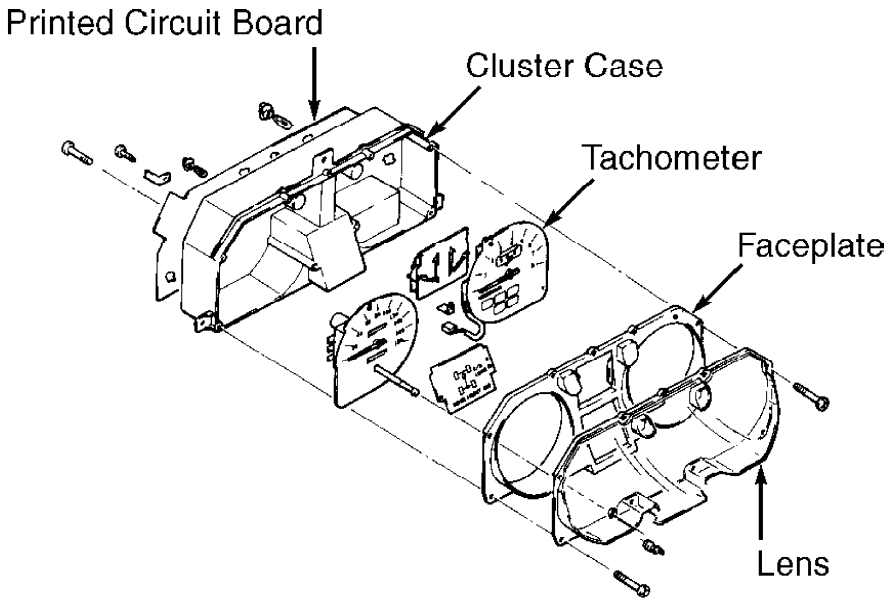
96I06421

Fig. 39: Identifying Instrument Cluster Components (Eclipse)
Courtesy of Mitsubishi Motor Sales of America



94D46642

Fig. 40: Identifying Instrument Cluster Components (Galant)
Courtesy of Mitsubishi Motor Sales of America



93J01099

Fig. 41: Identifying Instrument Cluster Components (Montero)
Courtesy of Mitsubishi Motor Sales of America

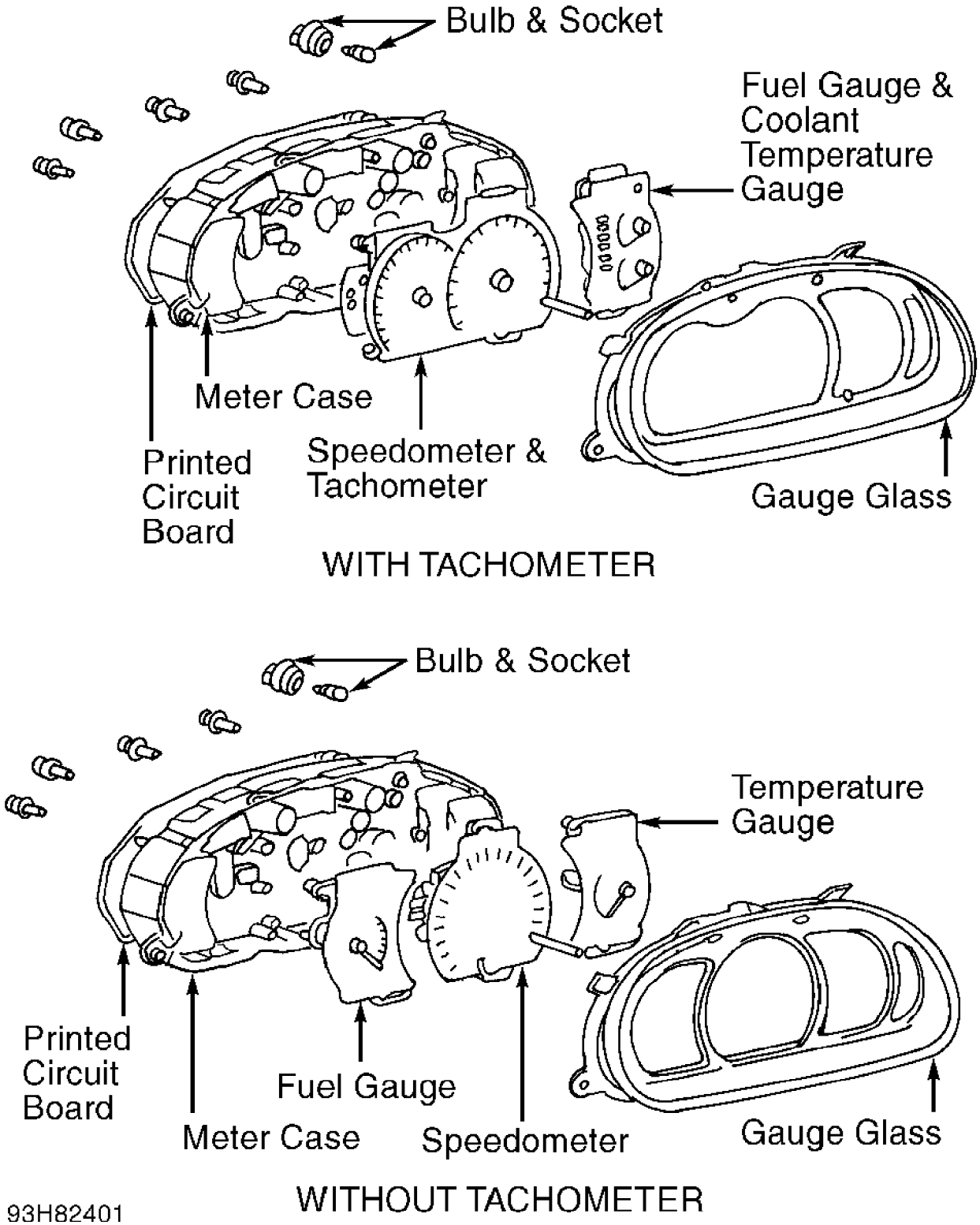


Fig. 42: Identifying Instrument Cluster Components (Mirage)
Courtesy of Mitsubishi Motor Sales of America

Removal & Installation (Montero)
Disconnect negative battery cable. Remove instrument cluster

cover plug. Remove cluster cover. Remove screws from instrument cluster. Disconnect all connectors from back of instrument cluster. Remove cluster. To install, reverse removal procedure. See Fig. 41.

Removal & Installation (Montero Sport)

Disconnect negative battery cable. Remove instrument cluster cover. Remove screws from instrument cluster. Disconnect all connectors attaching cluster. Remove cluster. To install, reverse removal procedure. See Fig. 43.

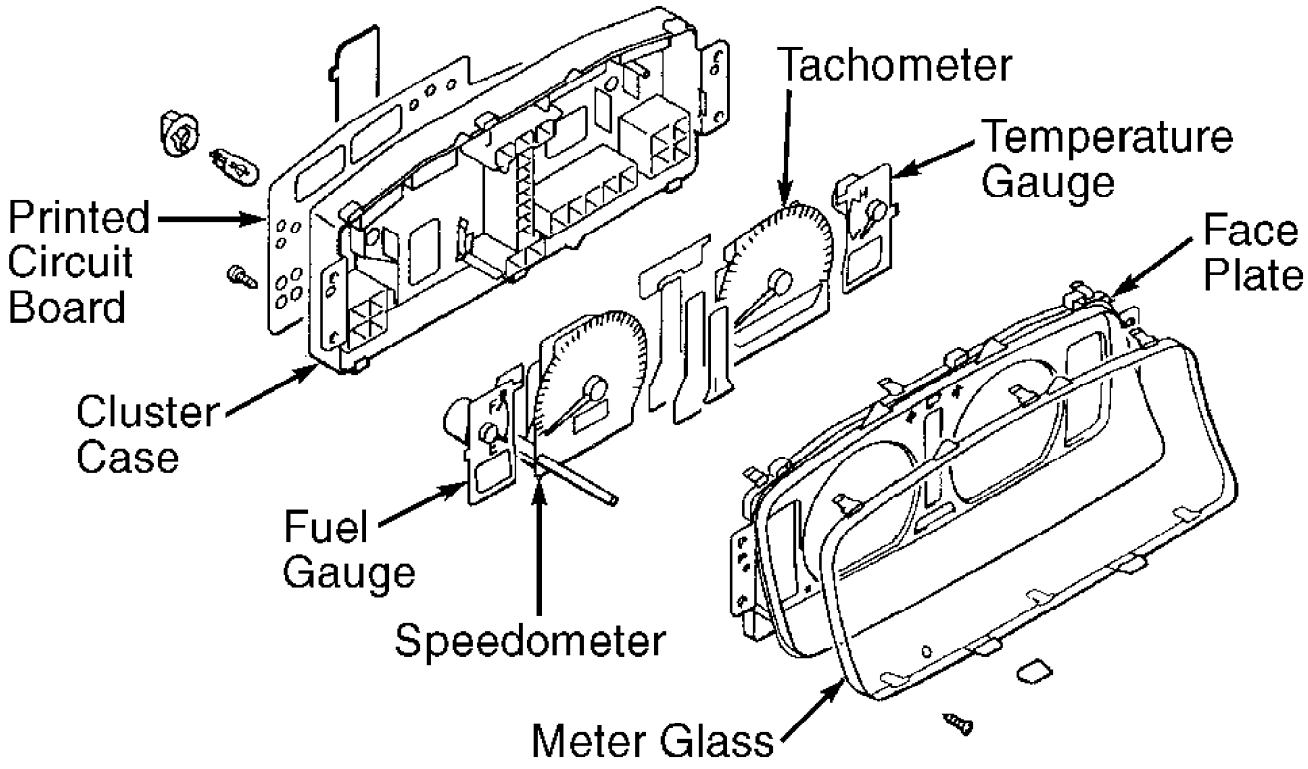


Fig. 43: Identifying Instrument Cluster Components (Montero Sport)
Courtesy of Mitsubishi Motor Sales of America

Removal & Installation (3000GT)

Disconnect negative battery cable. Remove driver-side knee protector. Remove lower and upper column covers. Remove meter bezel and instrument cluster. Disconnect connectors from back of instrument cluster. Remove cluster. To install, reverse removal procedure. See Fig. 44.

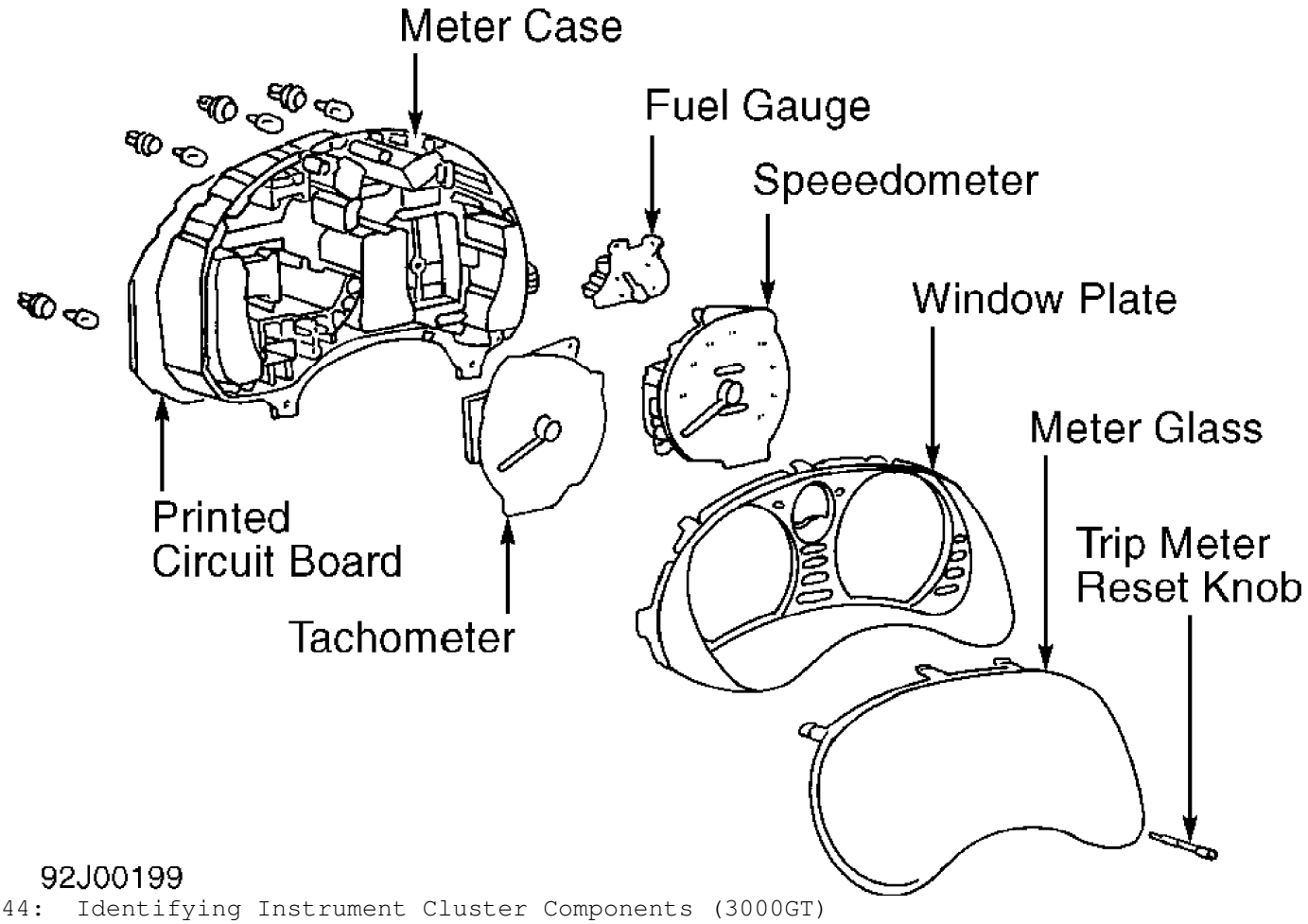


Fig. 44: Identifying Instrument Cluster Components (3000GT)
Courtesy of Mitsubishi Motor Sales of America

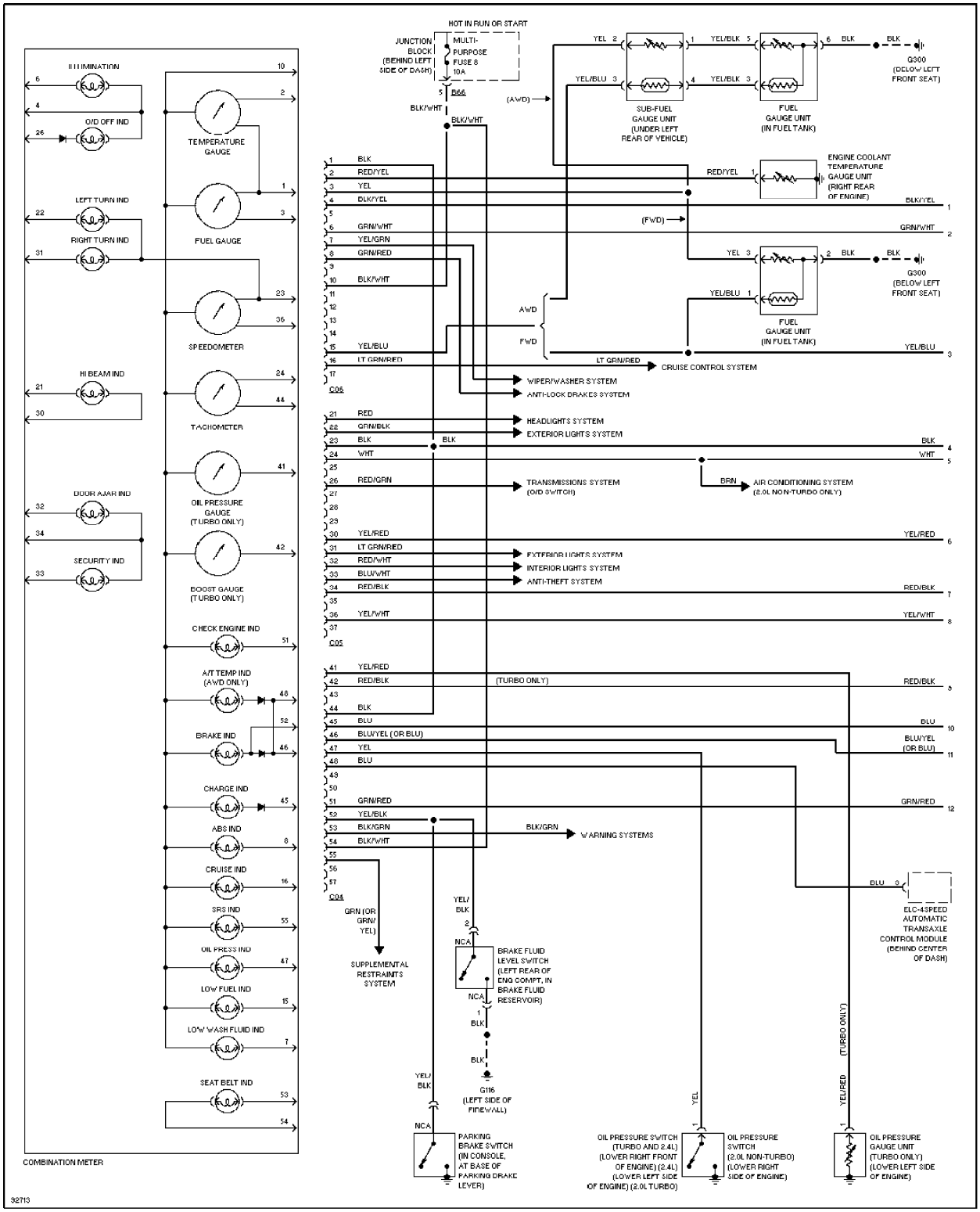


Fig. 45: Instrument Cluster Wiring Diagram (Eclipse - 1 Of 2)

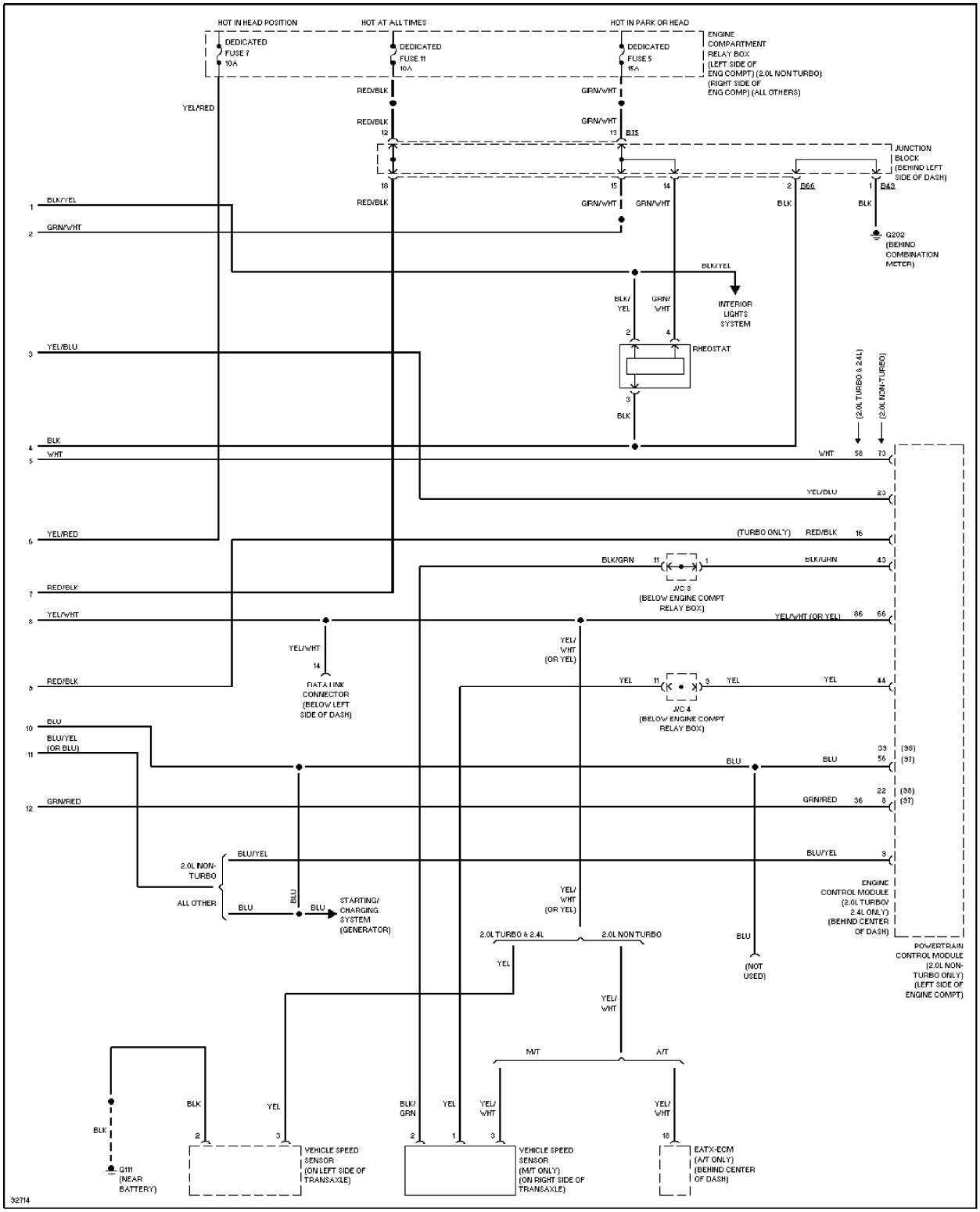


Fig. 46: Instrument Cluster Wiring Diagram (Eclipse - 2 Of 2)

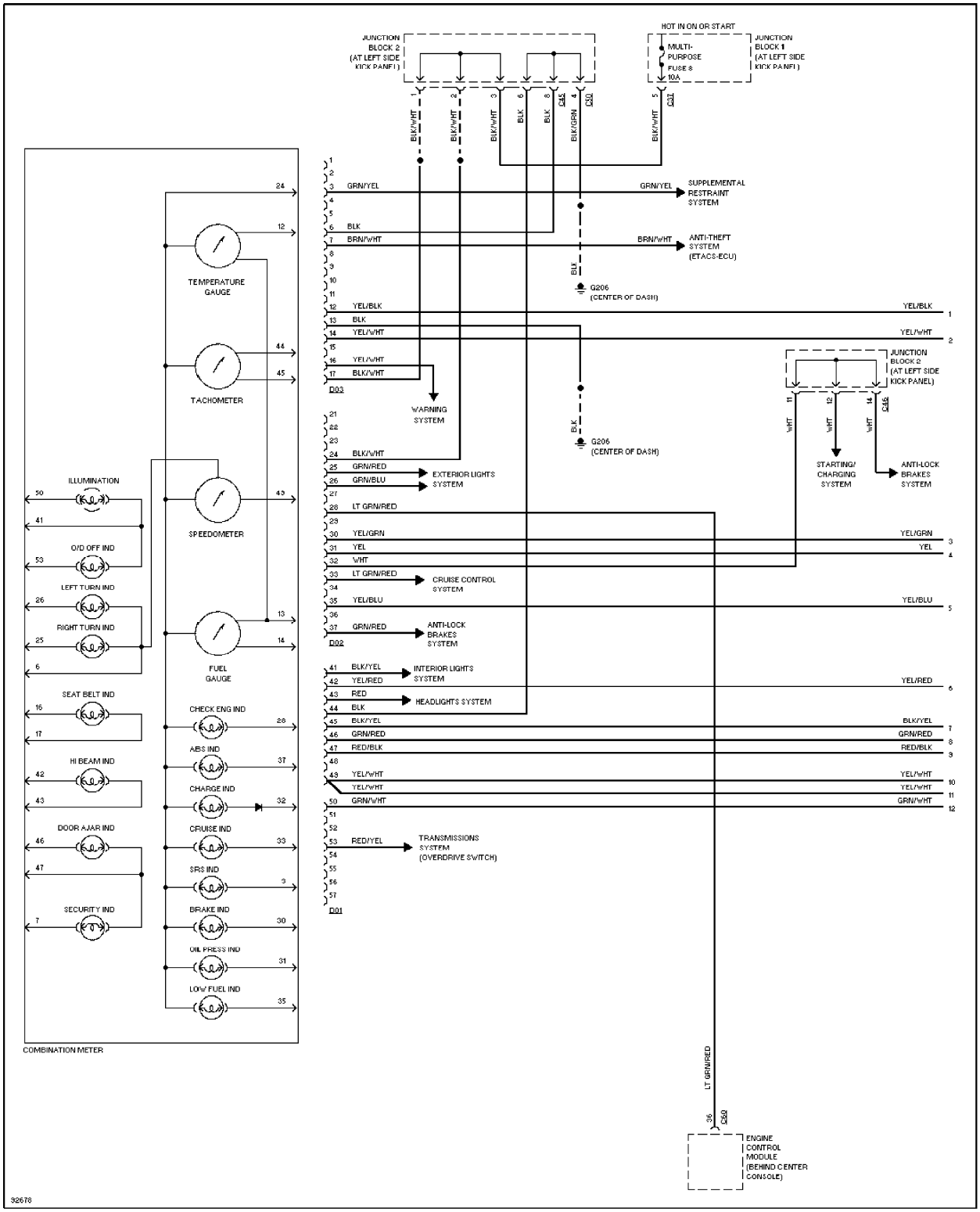


Fig. 47: Instrument Cluster Wiring Diagram (Galant - 1 Of 2)

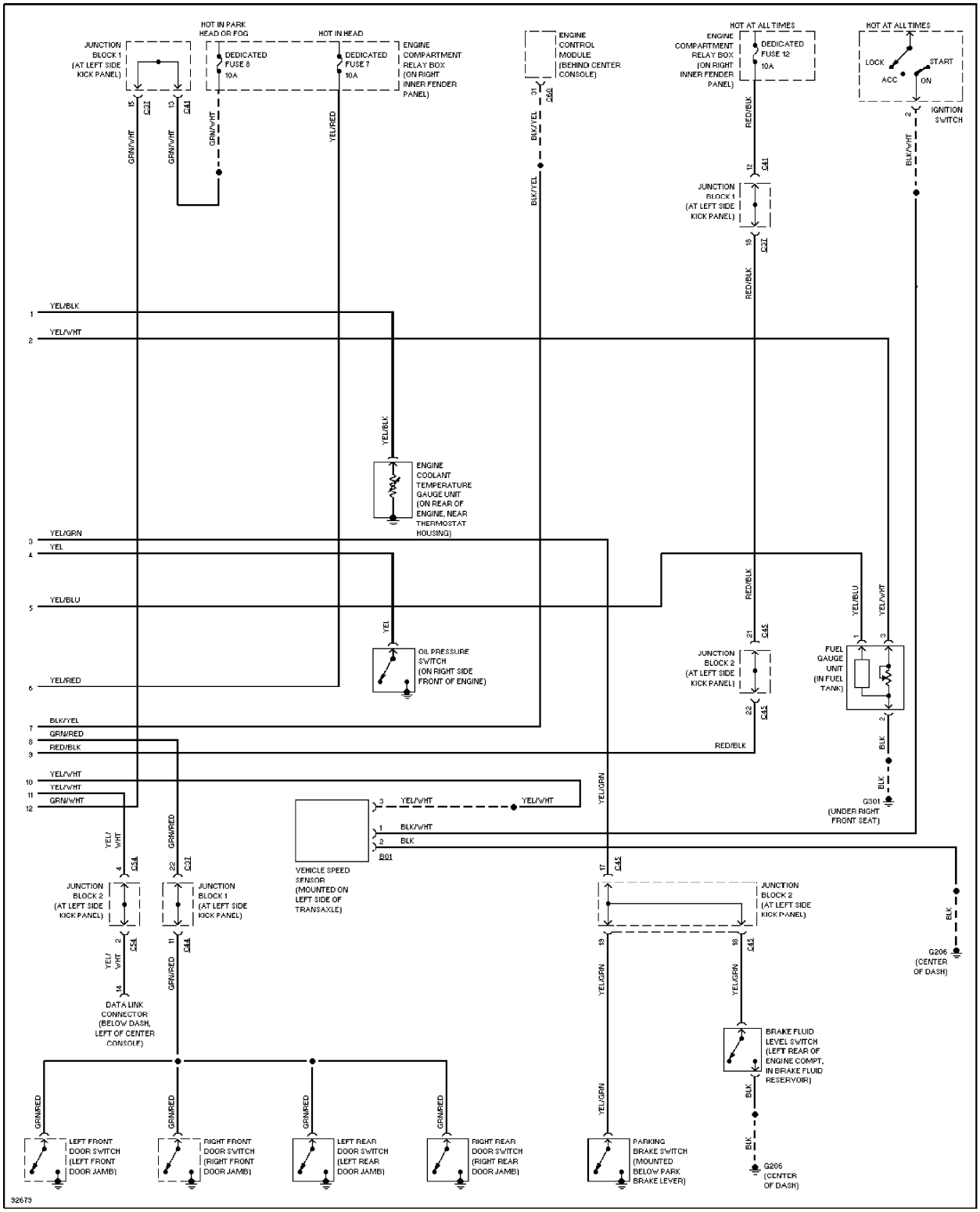


Fig. 48: Instrument Cluster Wiring Diagram (Galant - 2 Of 2)

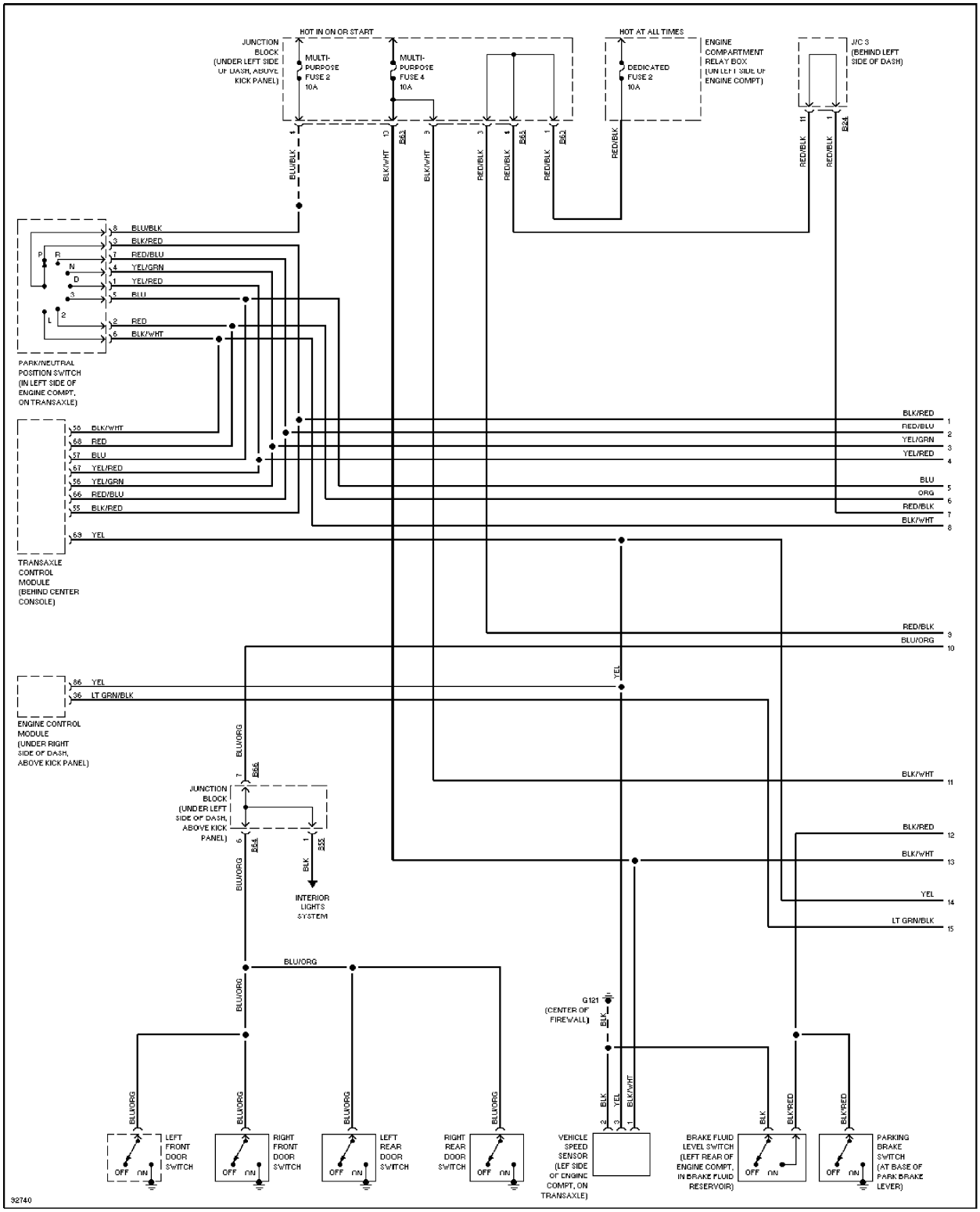


Fig. 49: Instrument Cluster Wiring Diagram (Mirage - 1 Of 3)

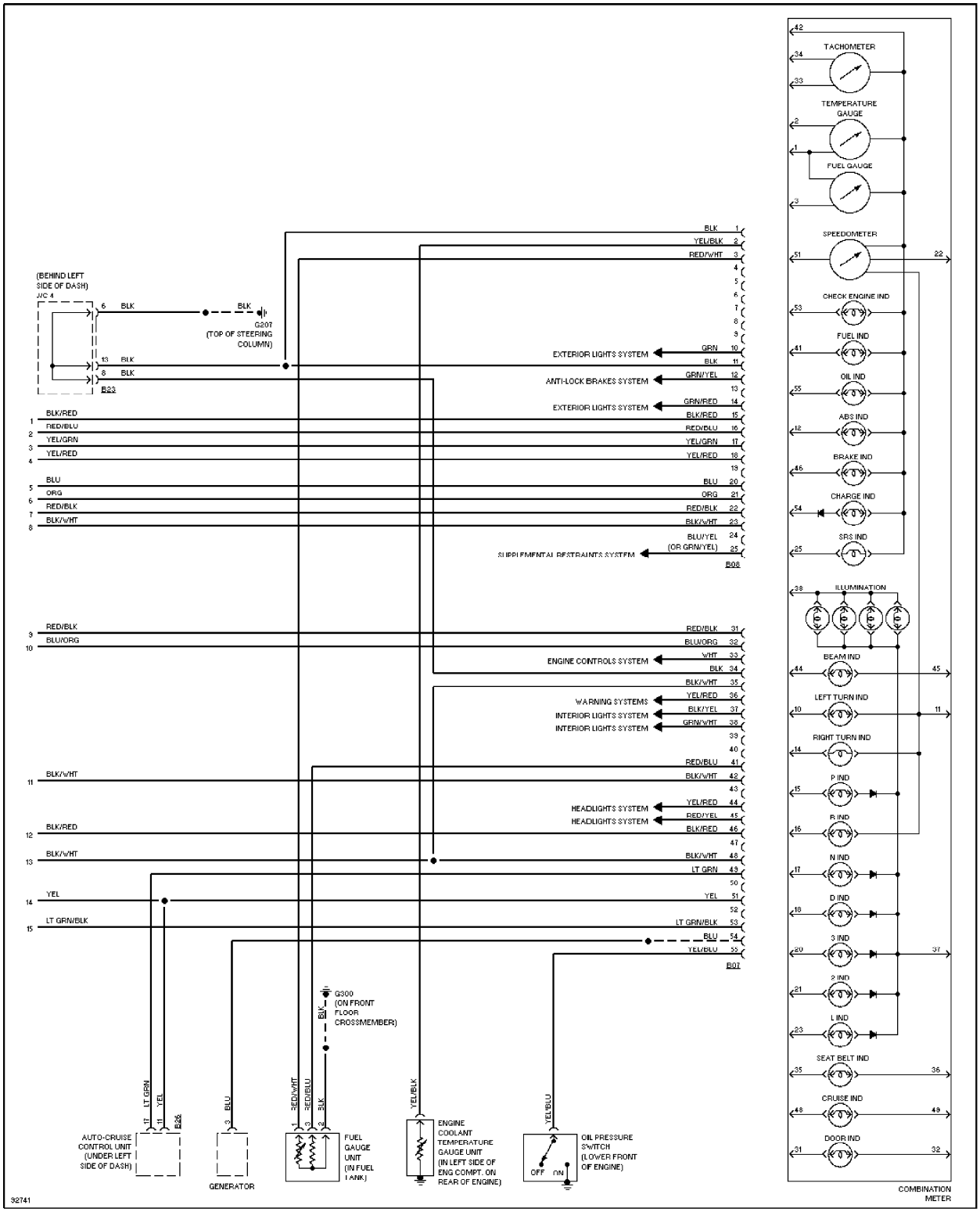


Fig. 50: Instrument Cluster Wiring Diagram (Mirage - 2 Of 3)

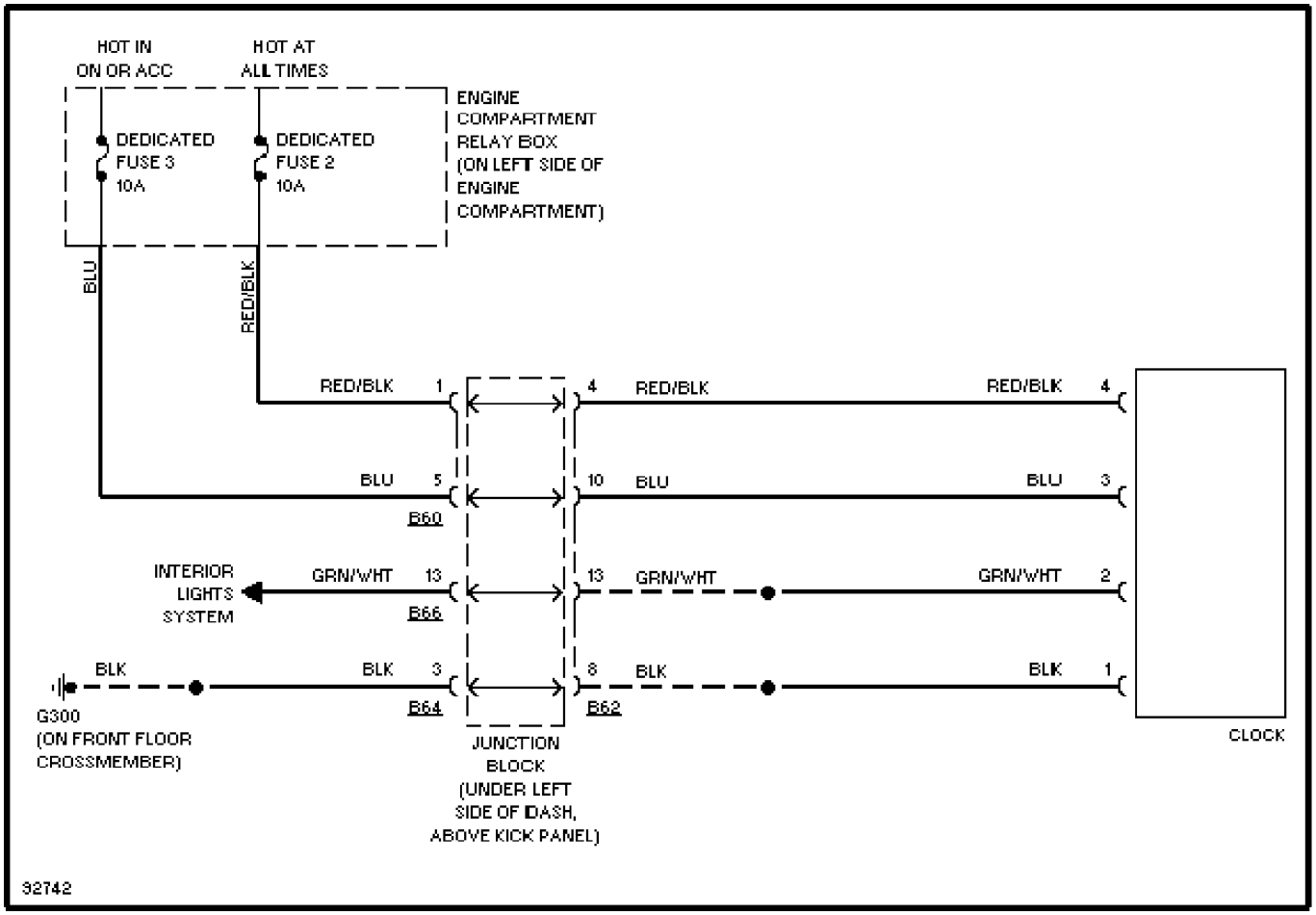


Fig. 51: Instrument Cluster Wiring Diagram (Mirage - 3 Of 3)

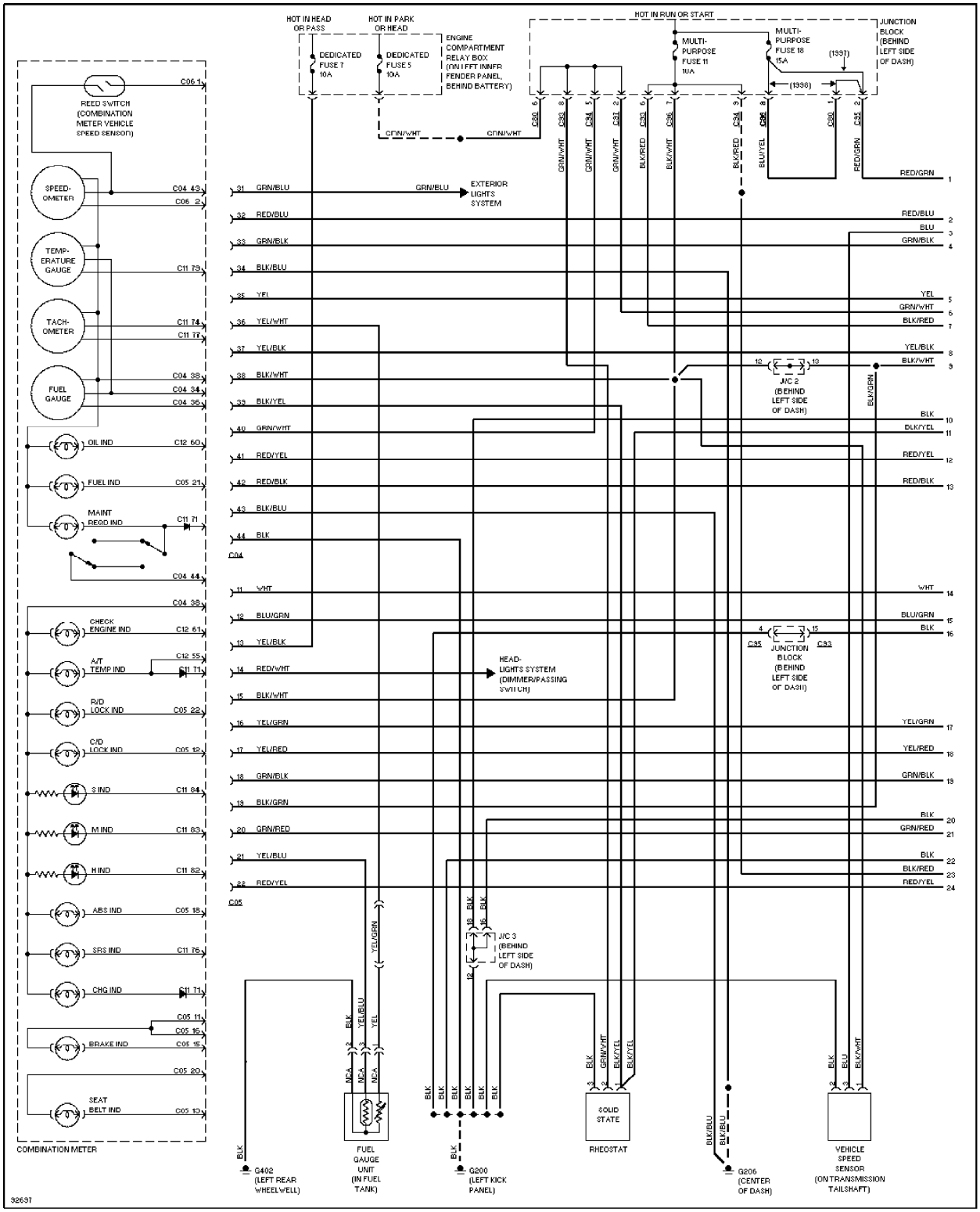


Fig. 52: Instrument Cluster Wiring Diagram (Montero - 1 Of 3)

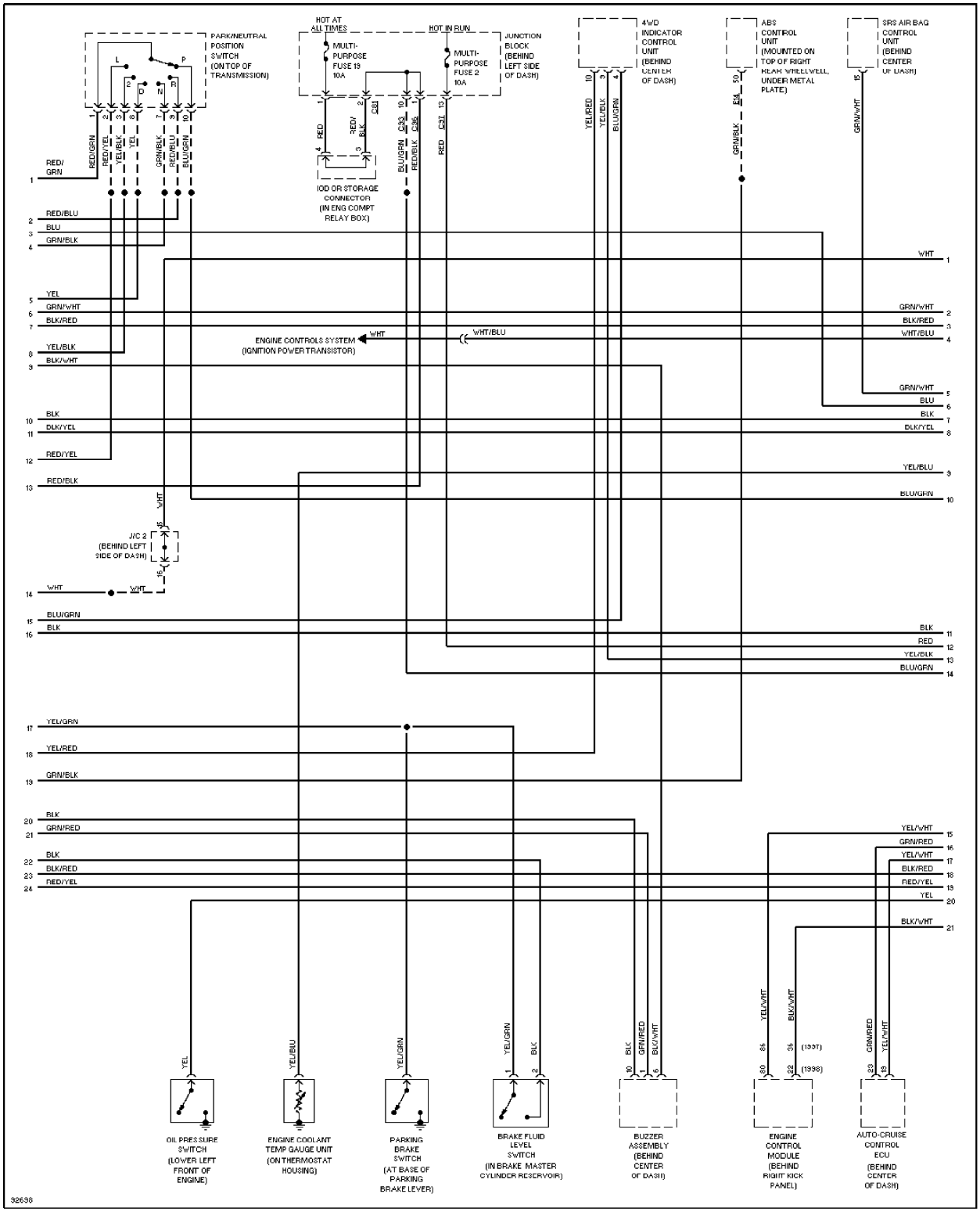


Fig. 53: Instrument Cluster Wiring Diagram (Montero - 2 Of 3)

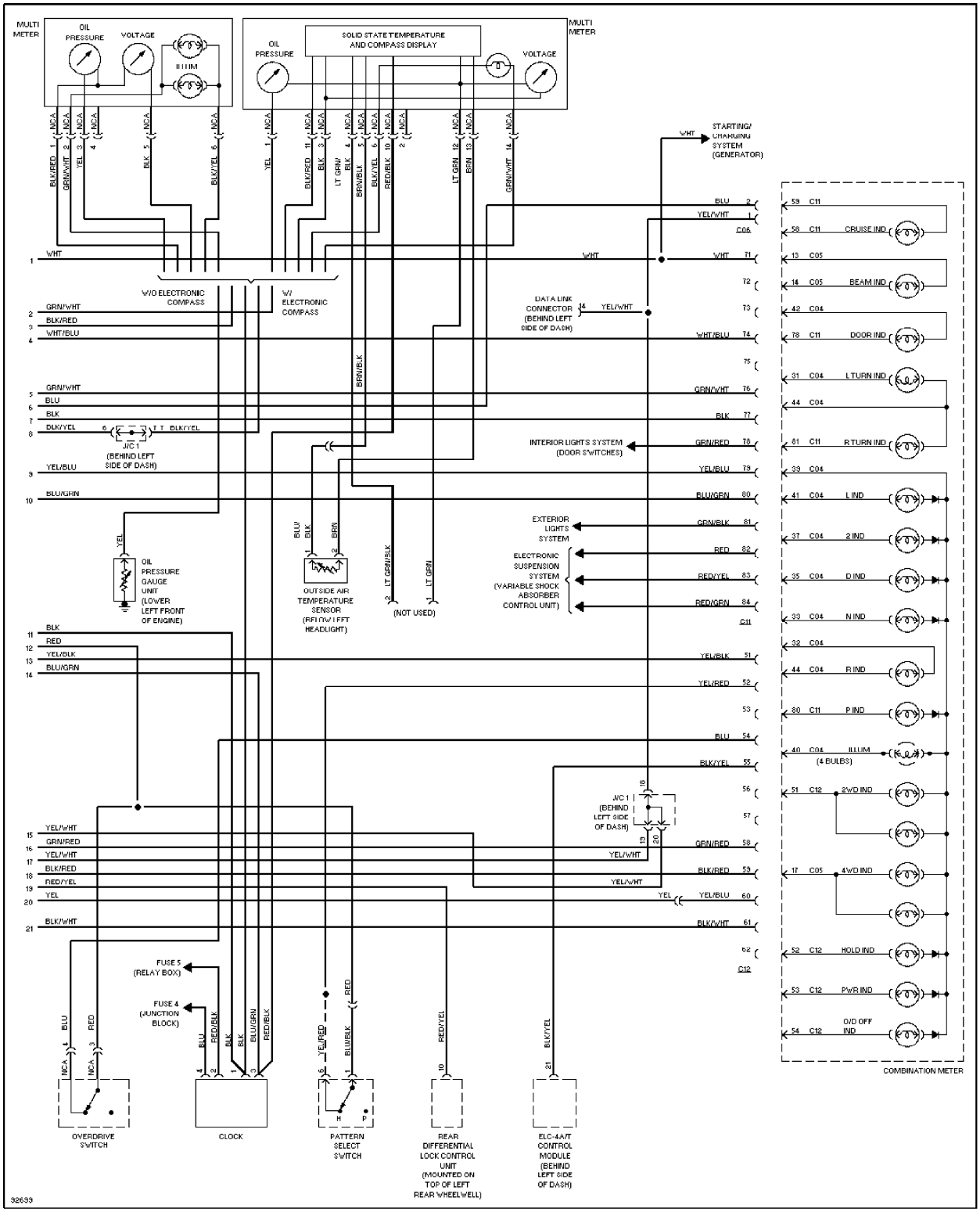


Fig. 54: Instrument Cluster Wiring Diagram (Montero - 3 Of 3)

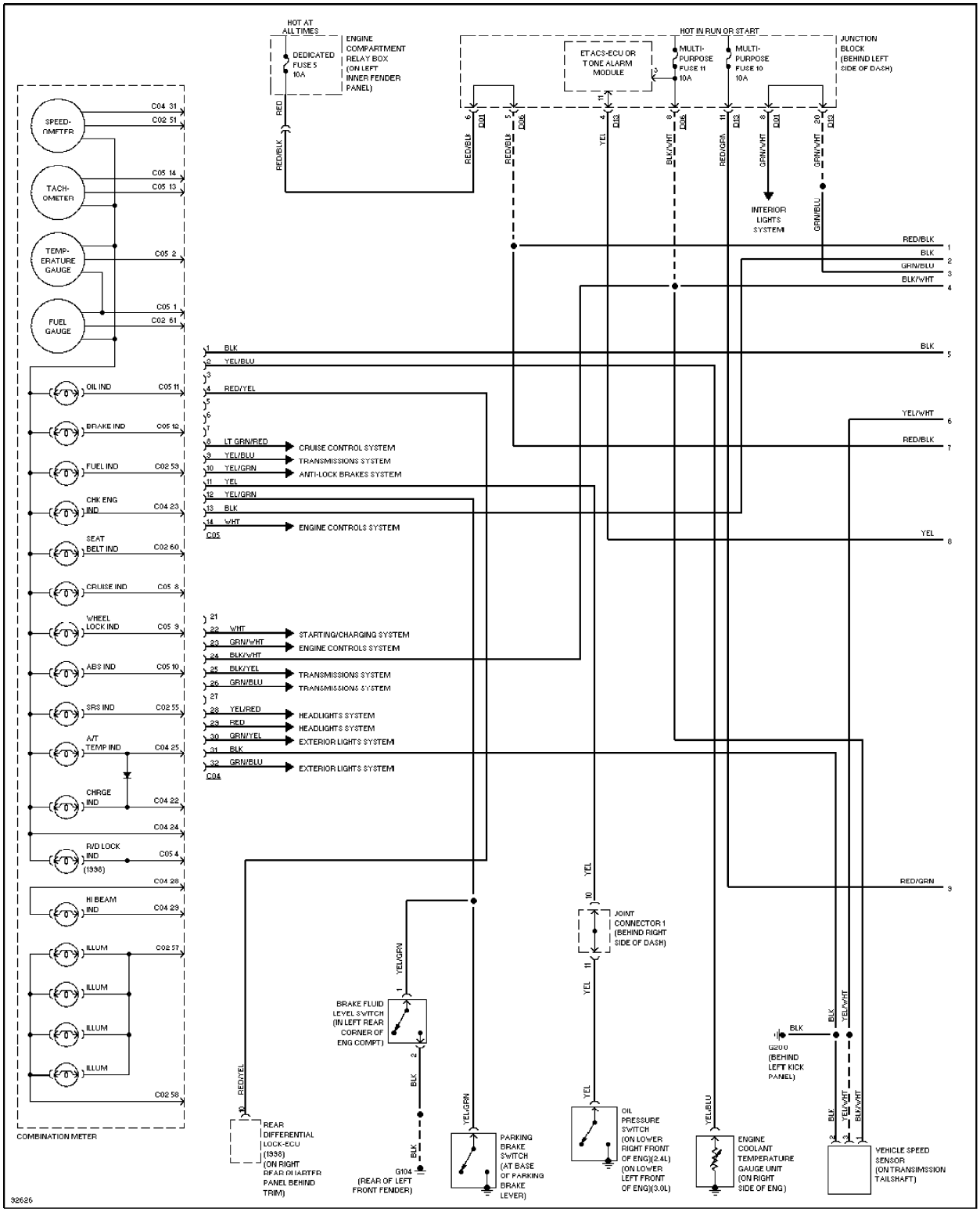


Fig. 55: Instrument Cluster Wiring Diagram (Montero Sport - 1 Of 2)

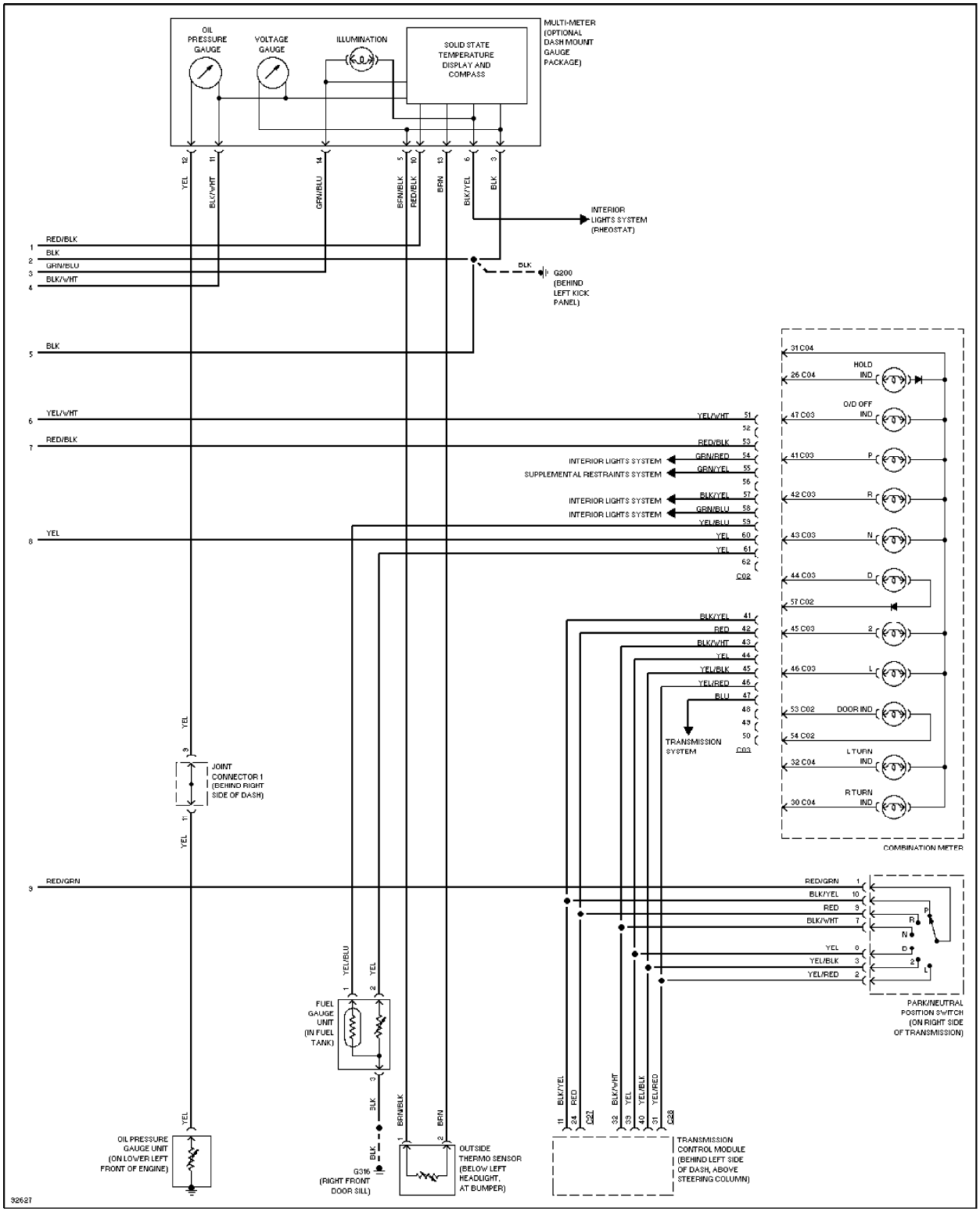


Fig. 56: Instrument Cluster Wiring Diagram (Montero Sport - 2 Of 2)

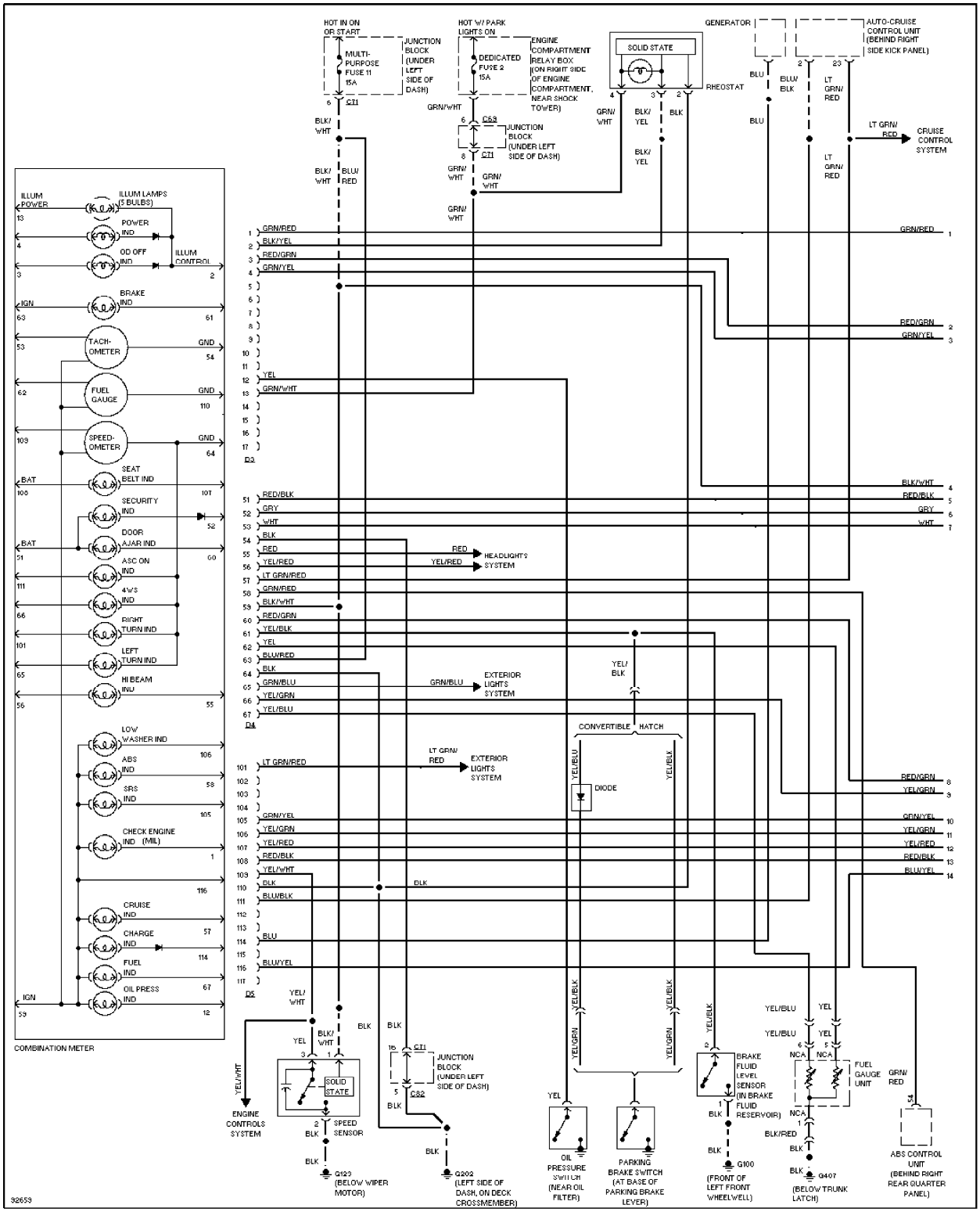


Fig. 57: Instrument Cluster Wiring Diagram (3000GT - 1 Of 3)

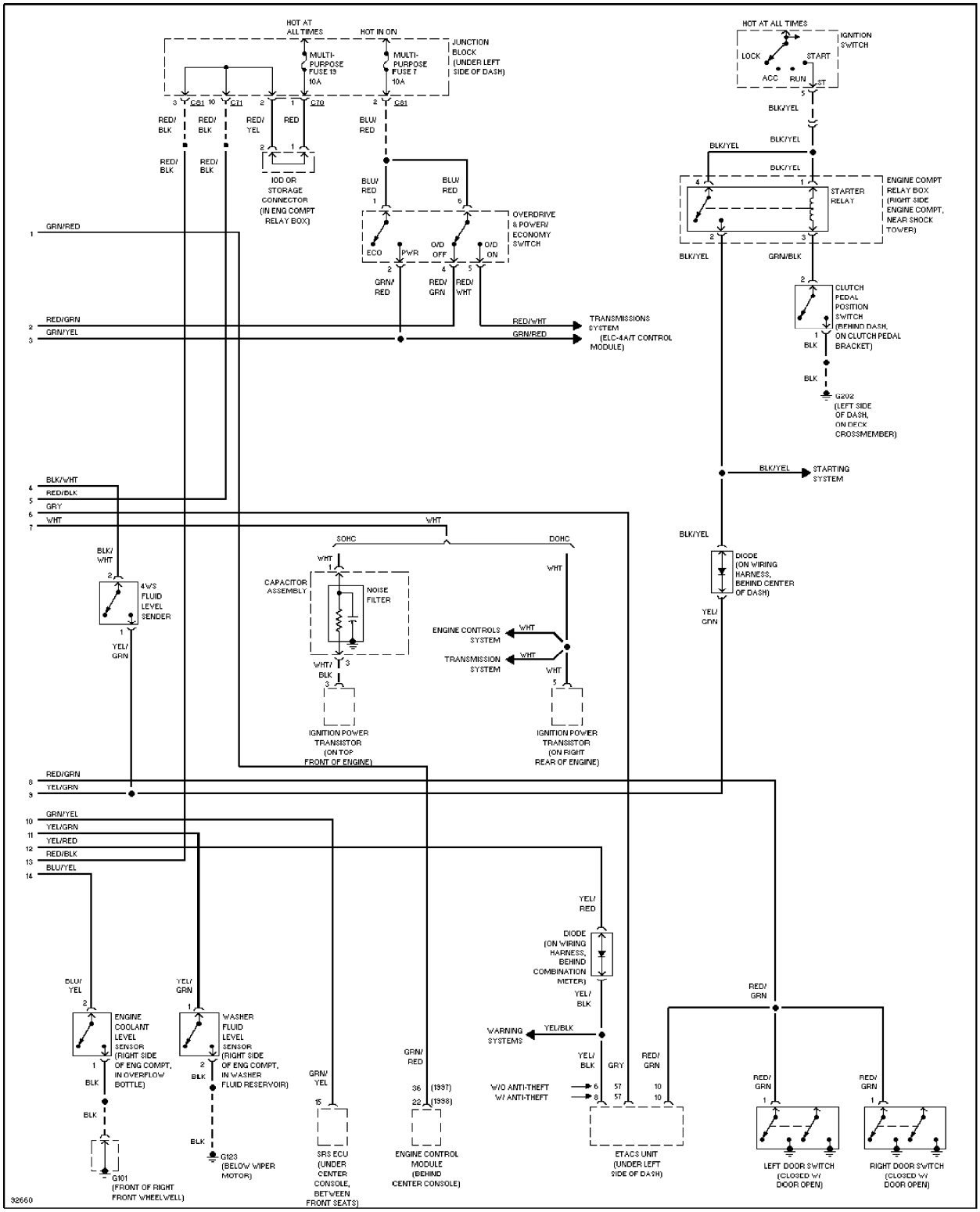


Fig. 58: Instrument Cluster Wiring Diagram (3000GT - 2 Of 3)

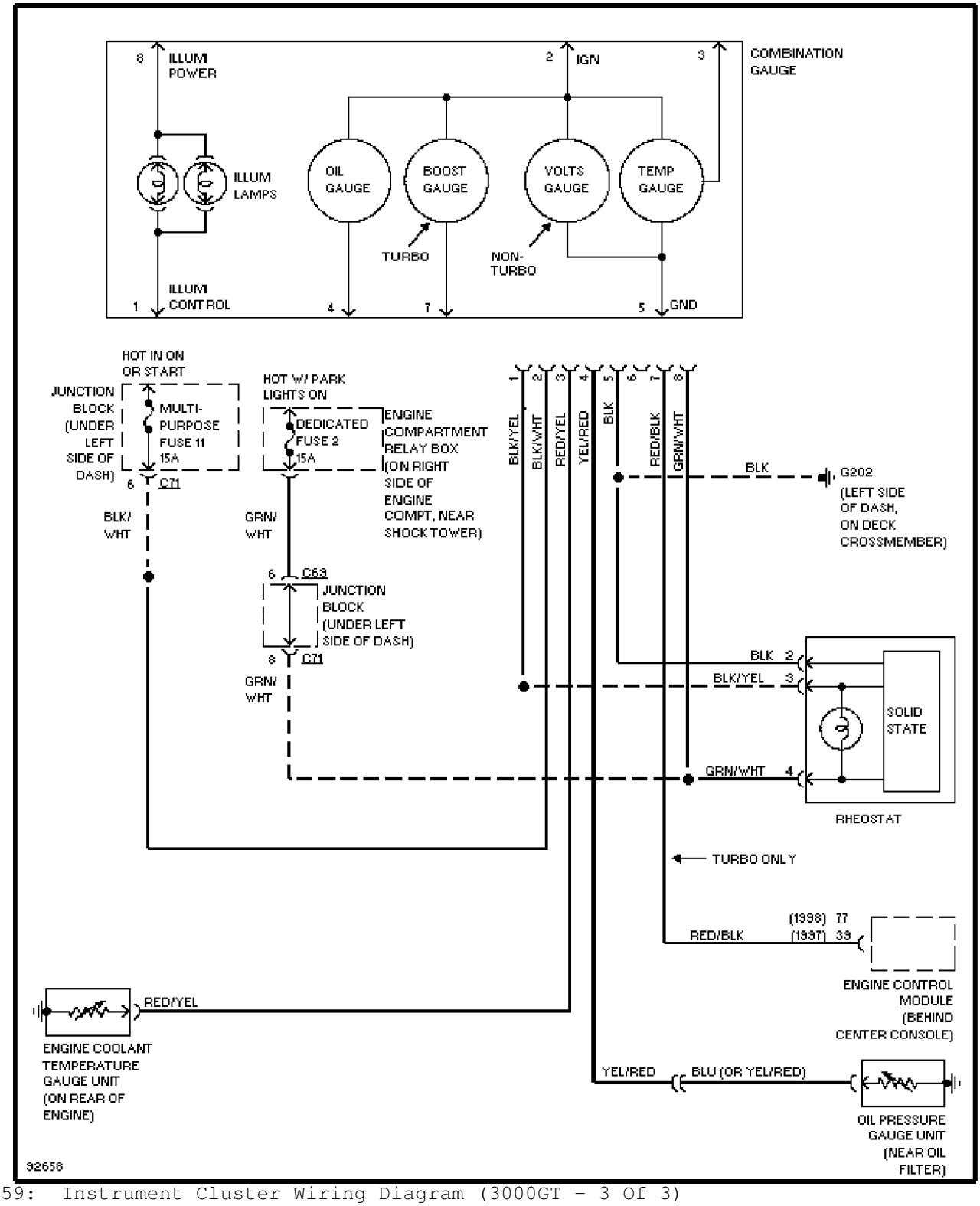


Fig. 59: Instrument Cluster Wiring Diagram (3000GT - 3 Of 3)

L - WIRING DIAGRAMS

1998 Mitsubishi Galant

1998 ENGINE PERFORMANCE
Mitsubishi - Wiring Diagrams

Diamante, Eclipse, Galant, Mirage, Montero, Montero Sport & 3000GT

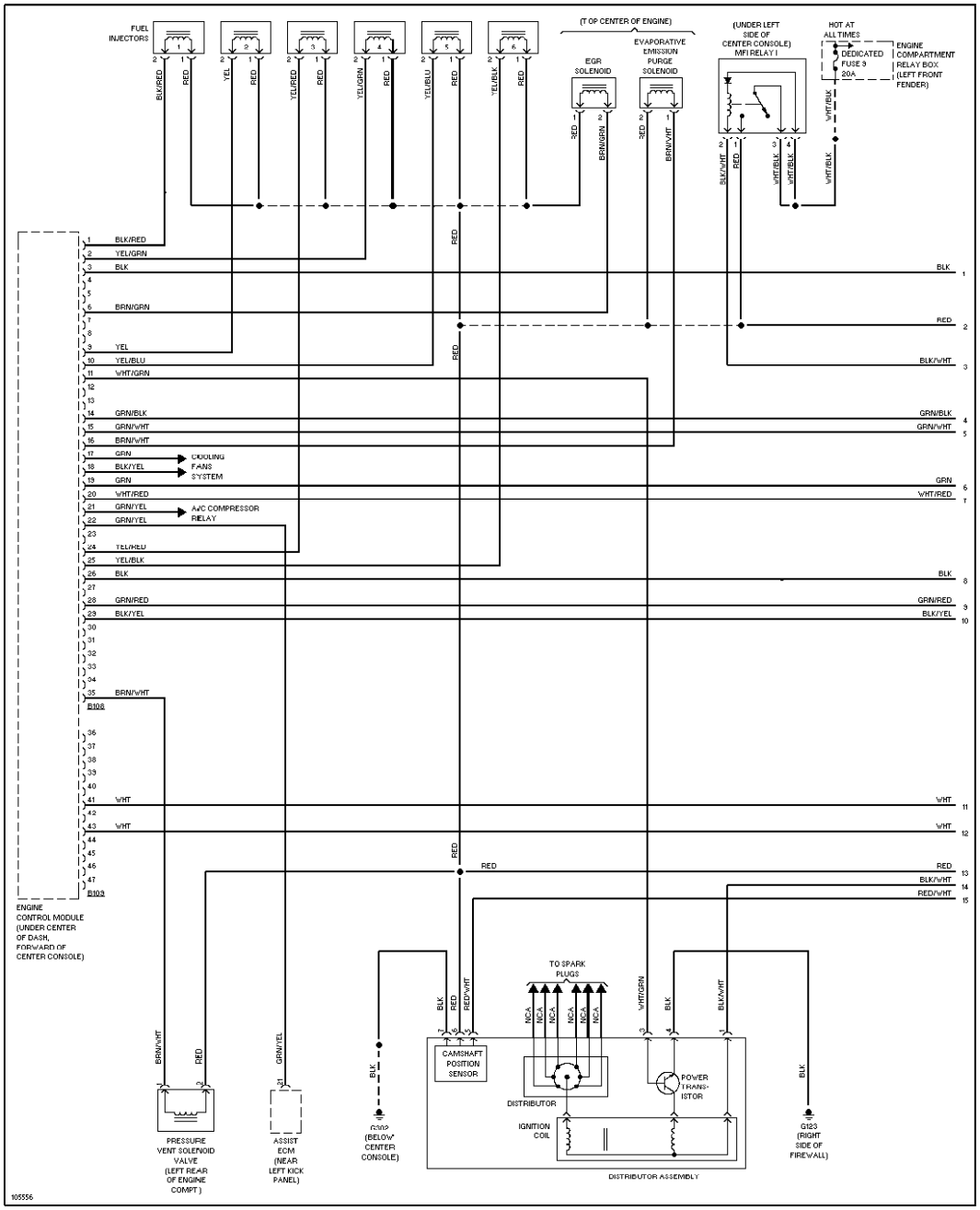


Fig. 1: Wiring Diagram (Diamante 3.5L - 1 Of 3)

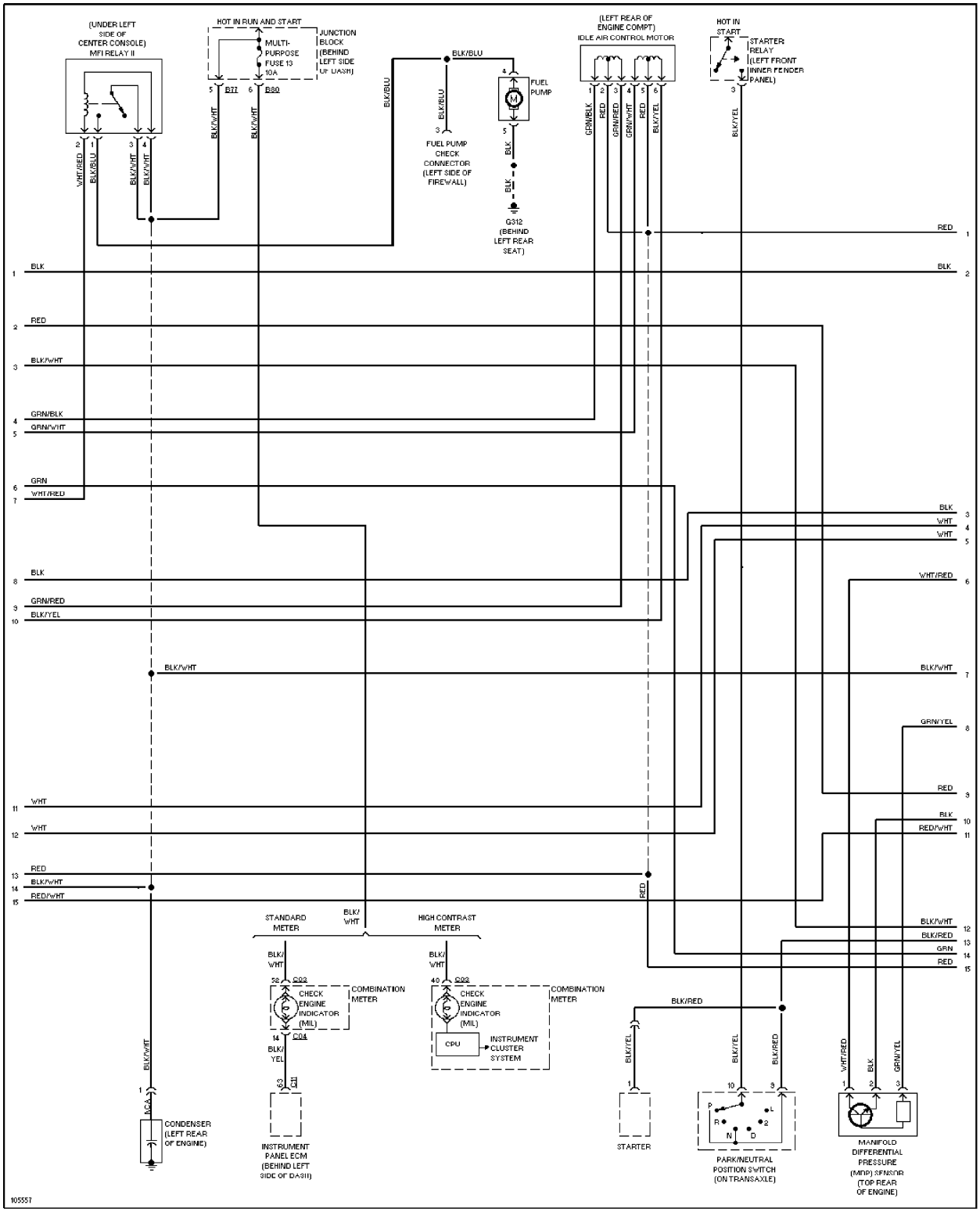


Fig. 2: Wiring Diagram (Diamante 3.5L - 2 Of 3)

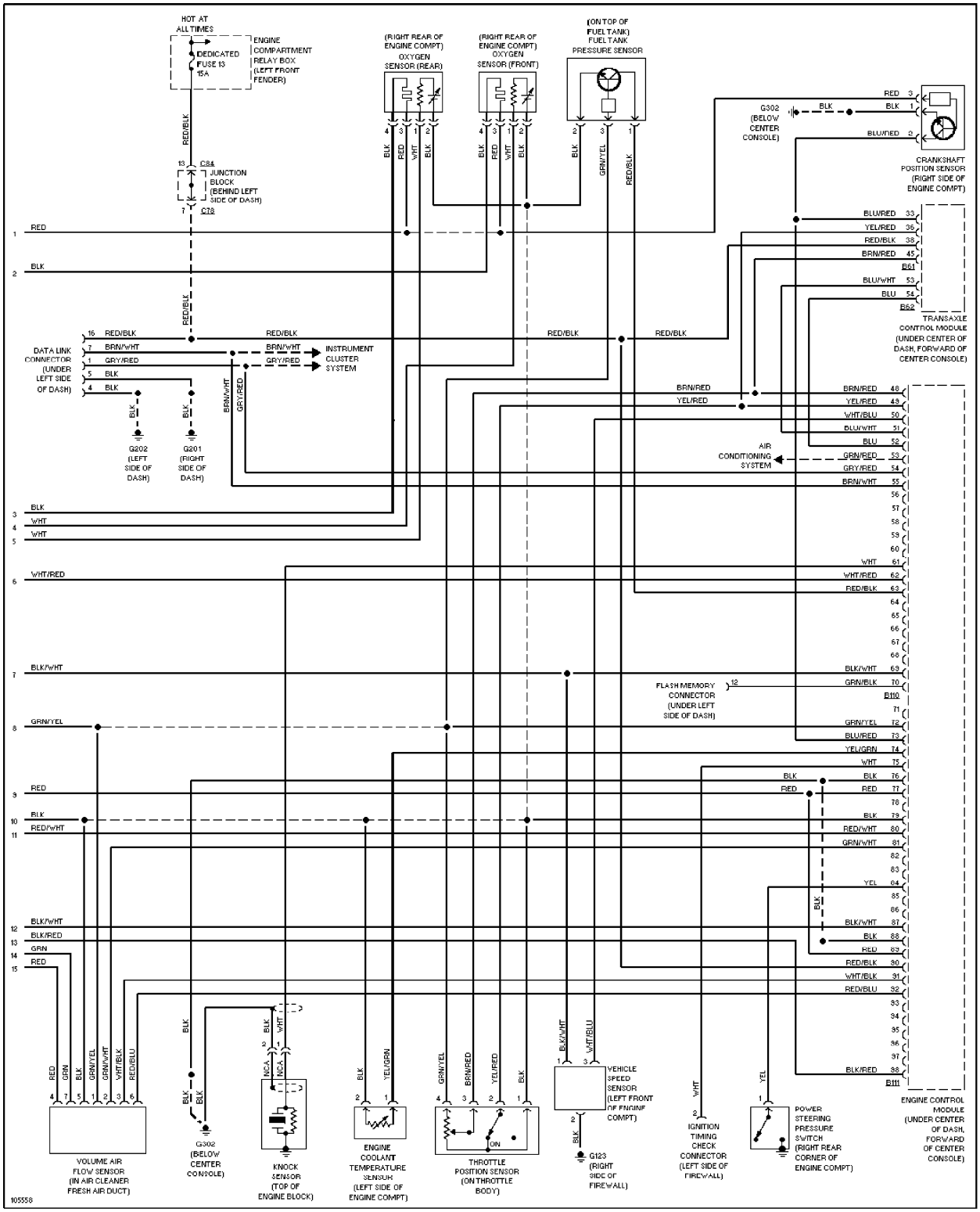


Fig. 3: Wiring Diagram (Diamante 3.5L - 3 Of 3)

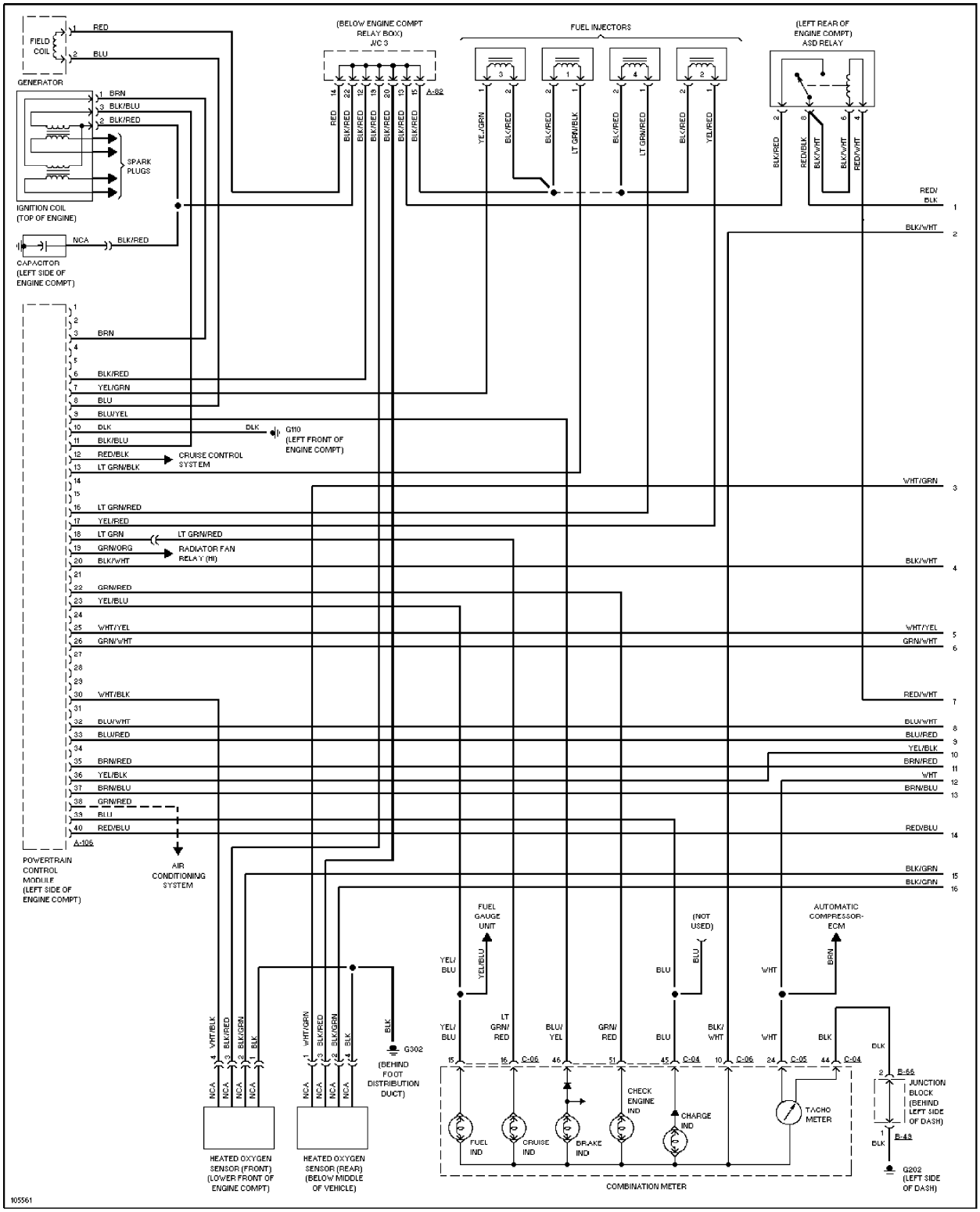


Fig. 4: Wiring Diagram (Eclipse 2.0L Non-Turbo - 1 Of 3)

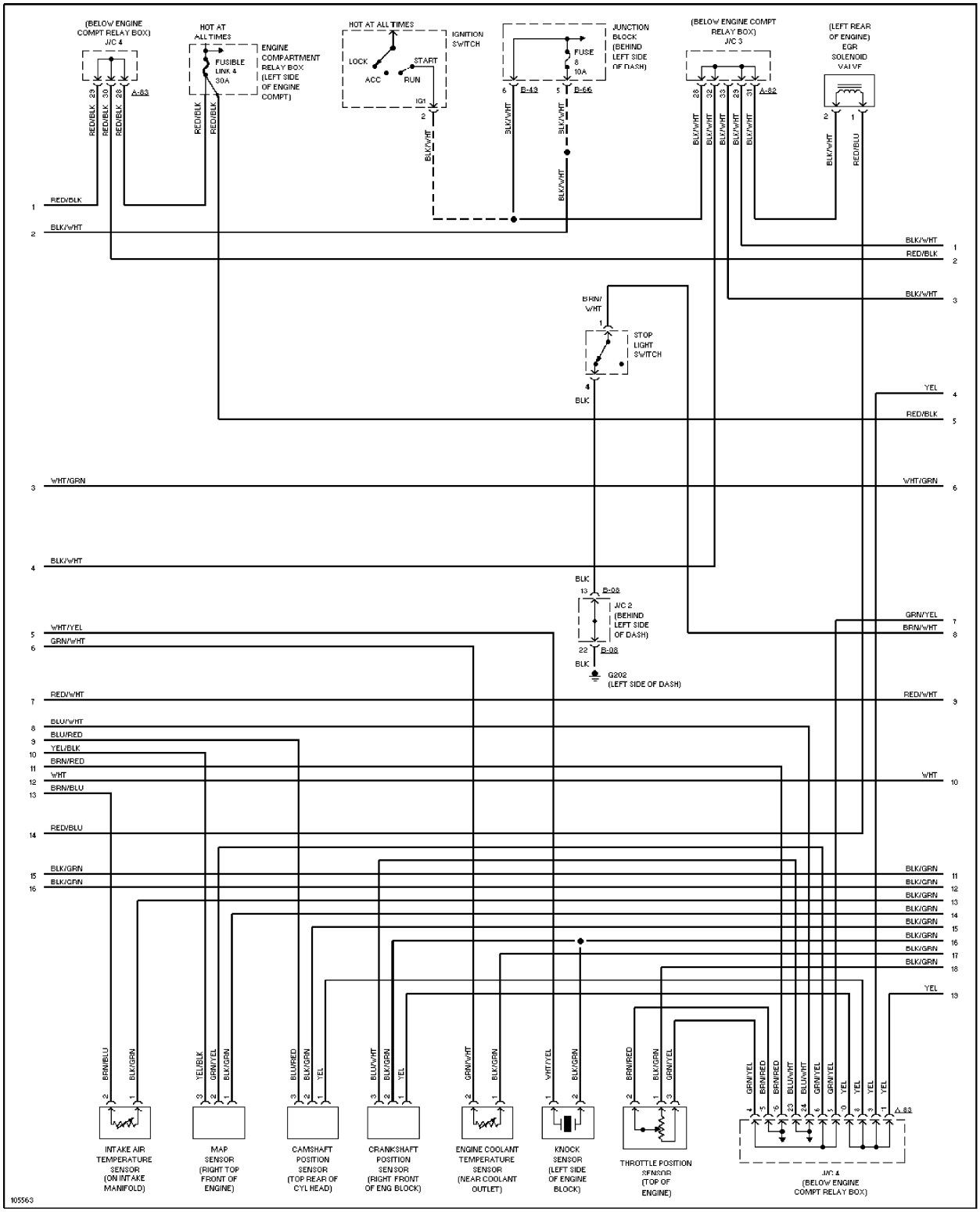


Fig. 5: Wiring Diagram (Eclipse 2.0L Non-Turbo - 2 Of 3)

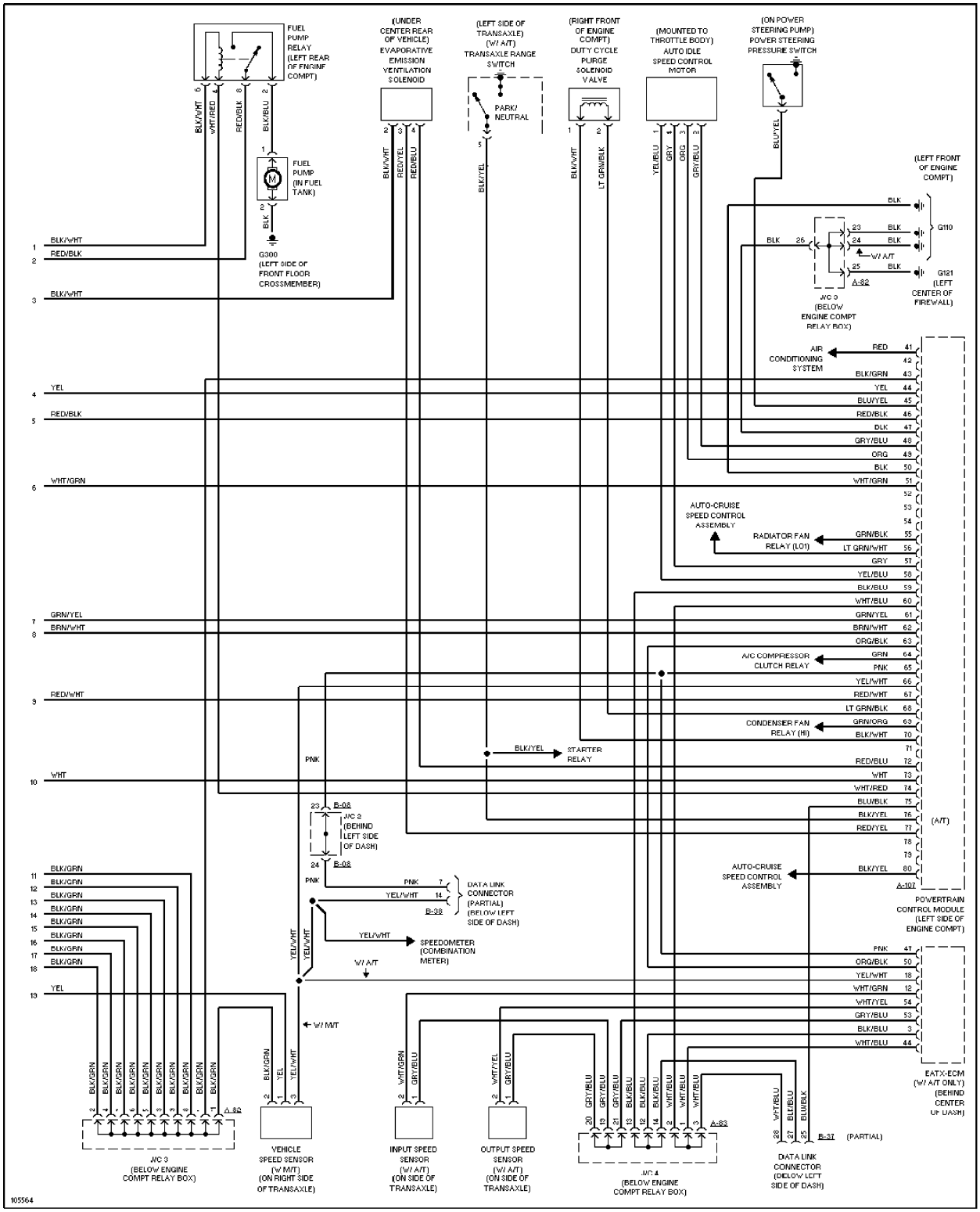


Fig. 6: Wiring Diagram (Eclipse 2.0L Non-Turbo - 3 Of 3)

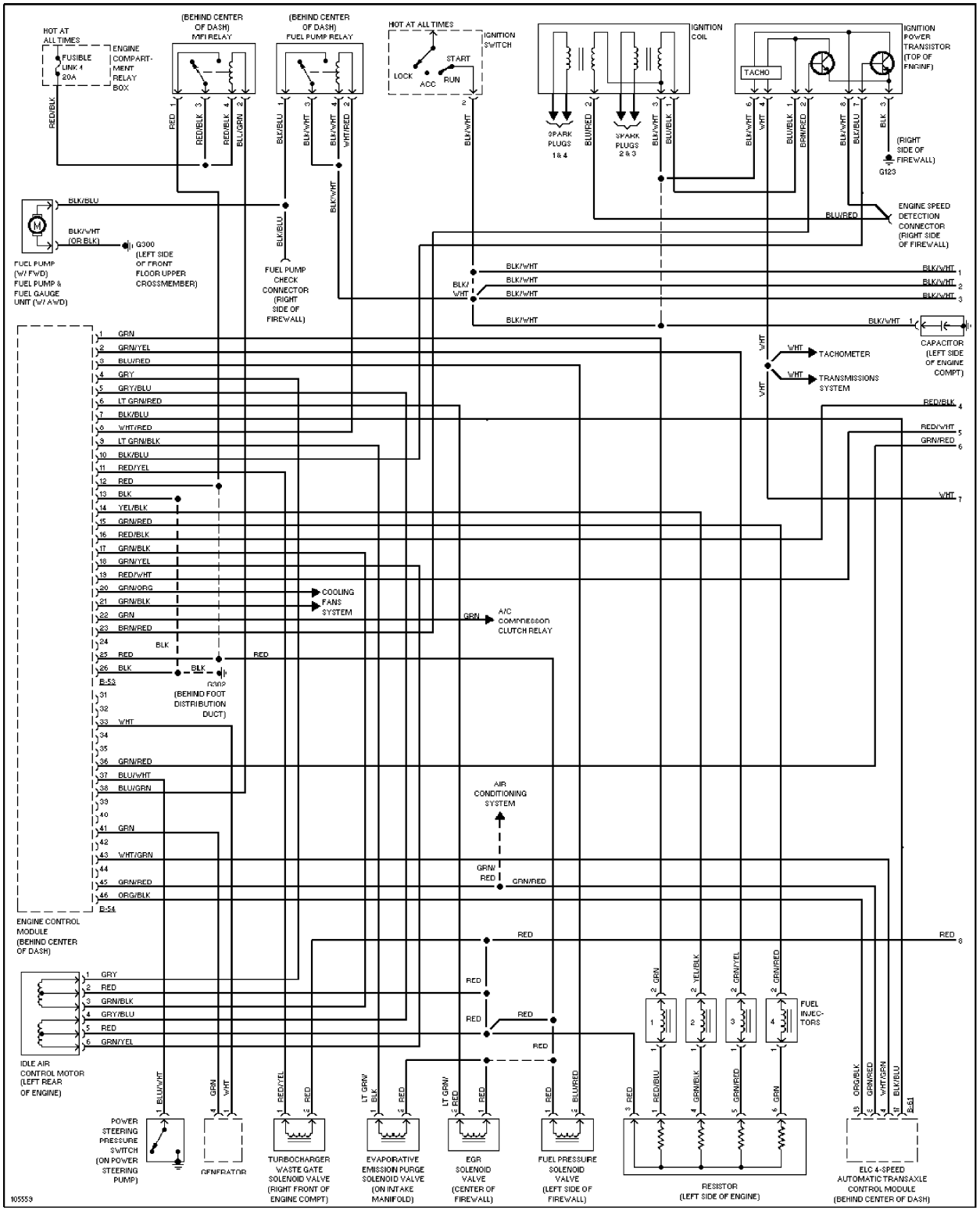


Fig. 7: Wiring Diagram (Eclipse 2.0L Turbo - 1 Of 2)

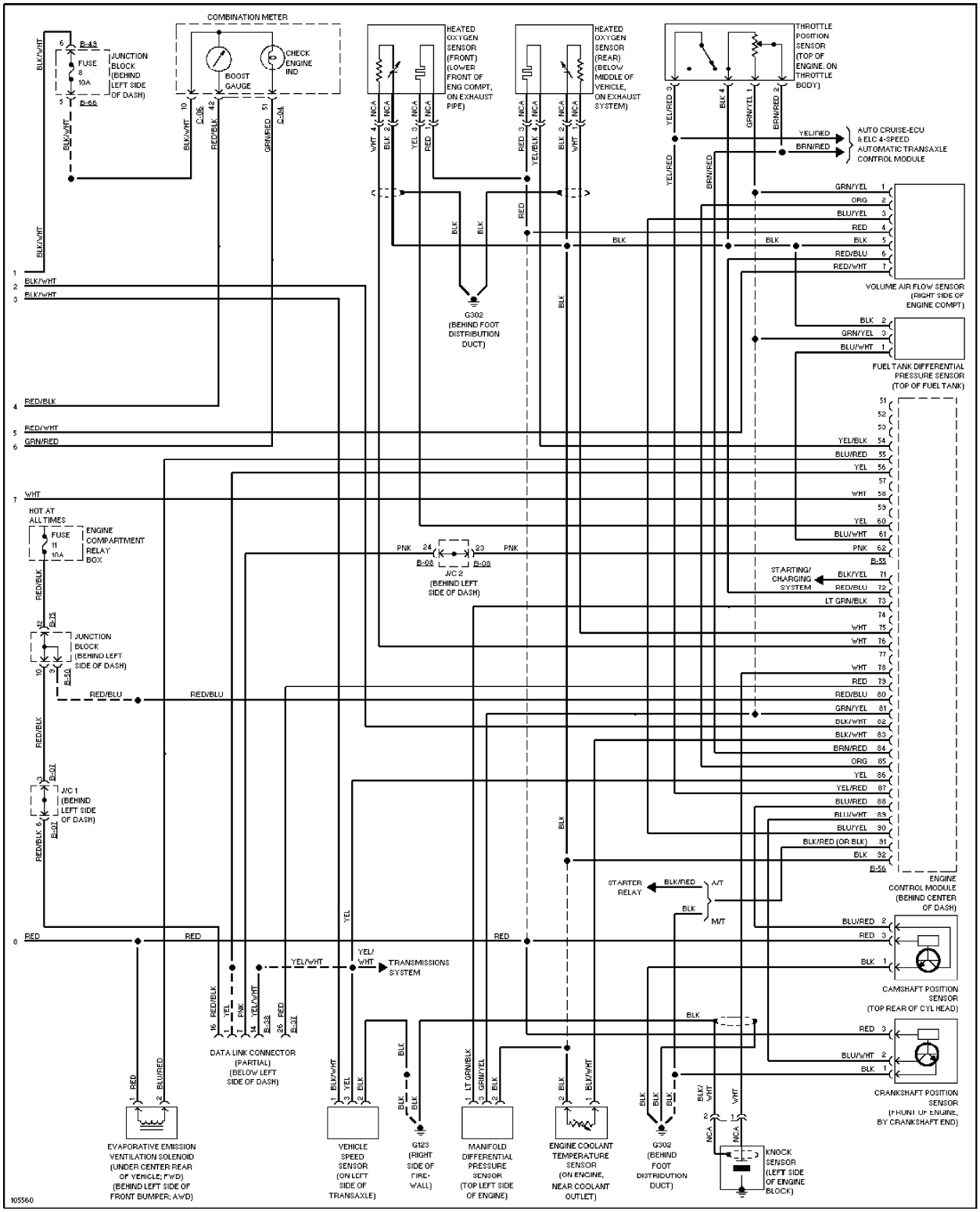


Fig. 8: Wiring Diagram (Eclipse 2.0L Turbo - 2 Of 2)

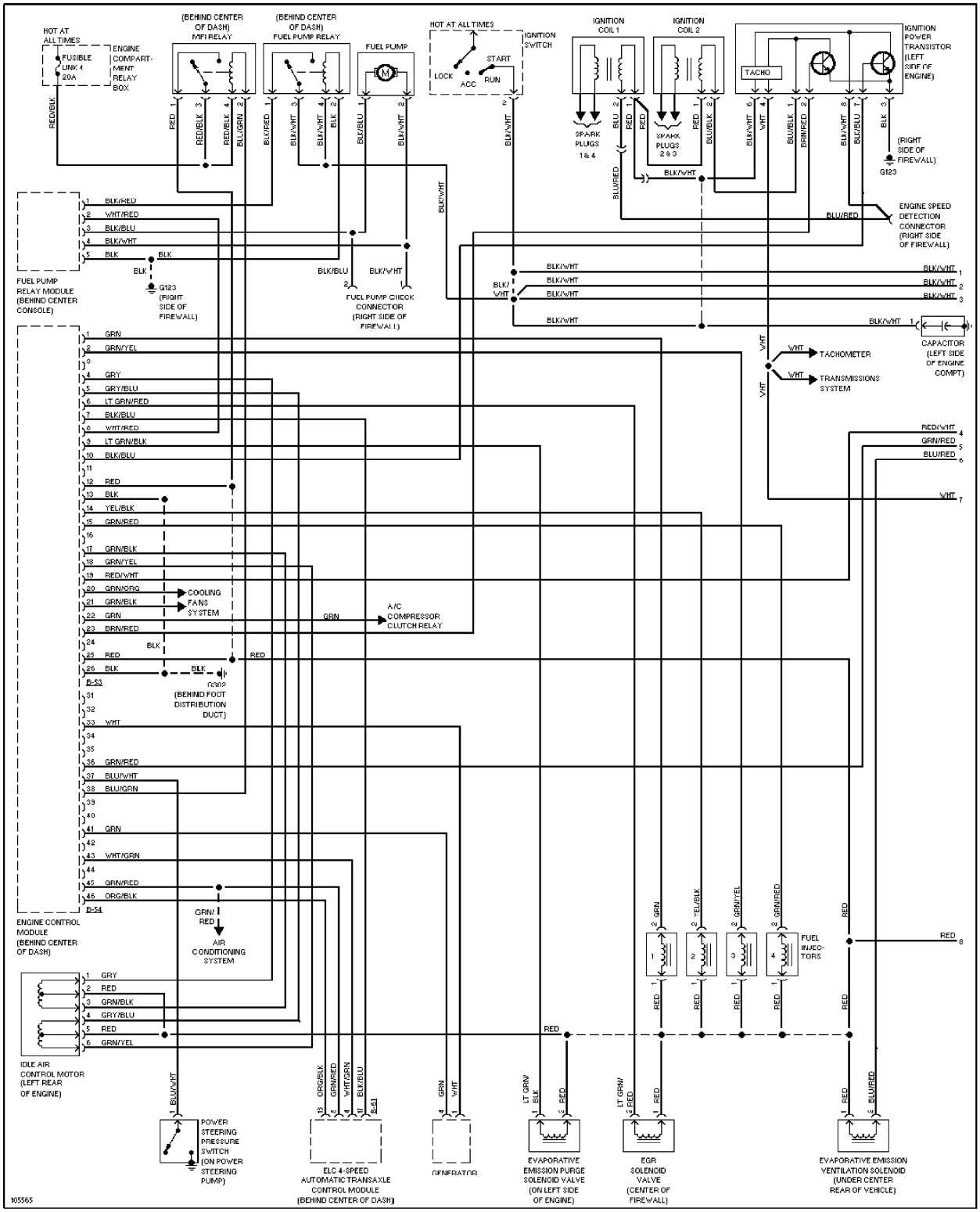


Fig. 9: Wiring Diagram (Eclipse 2.4L - 1 Of 2)

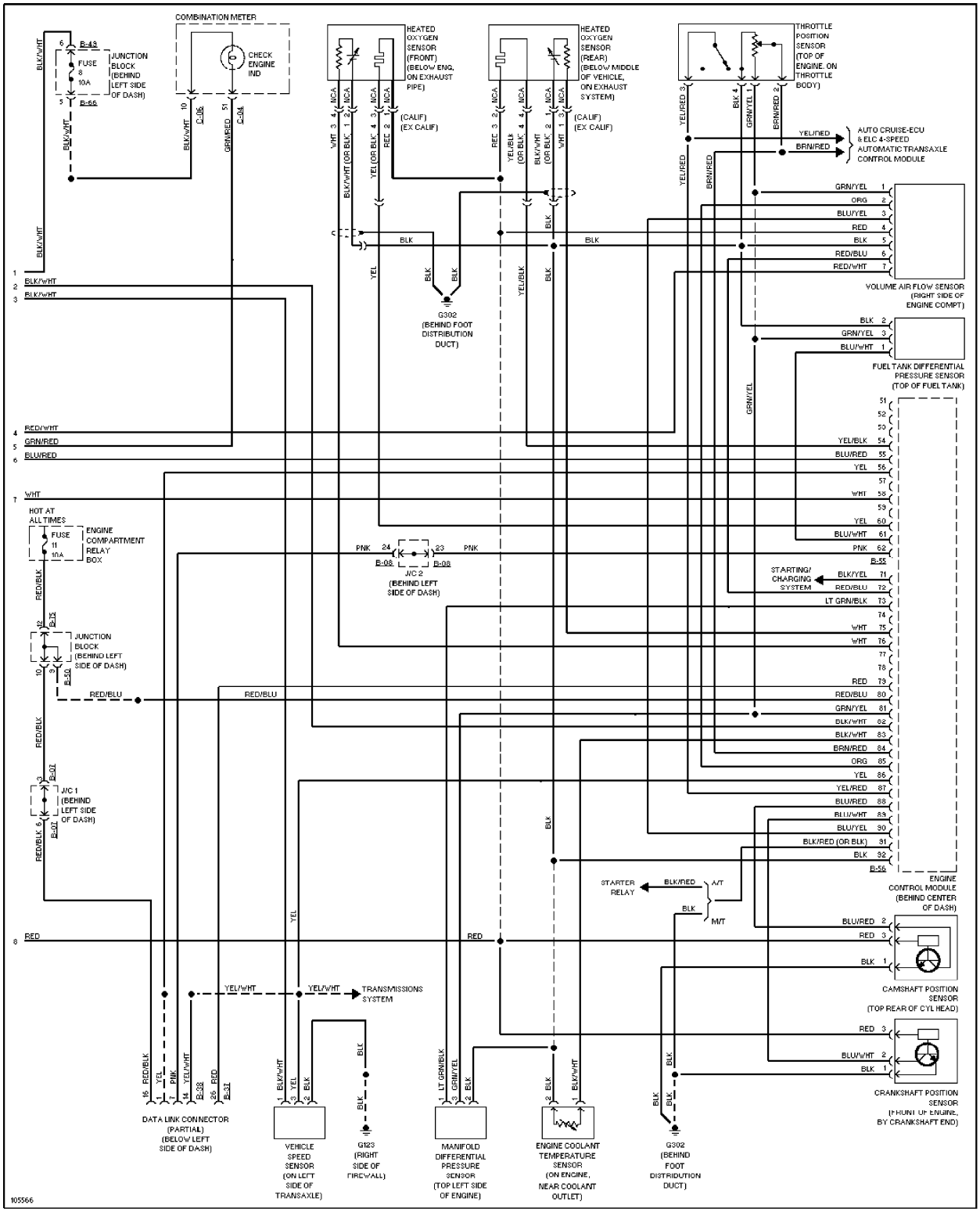


Fig. 10: Wiring Diagram (Eclipse 2.4L - 2 Of 2)

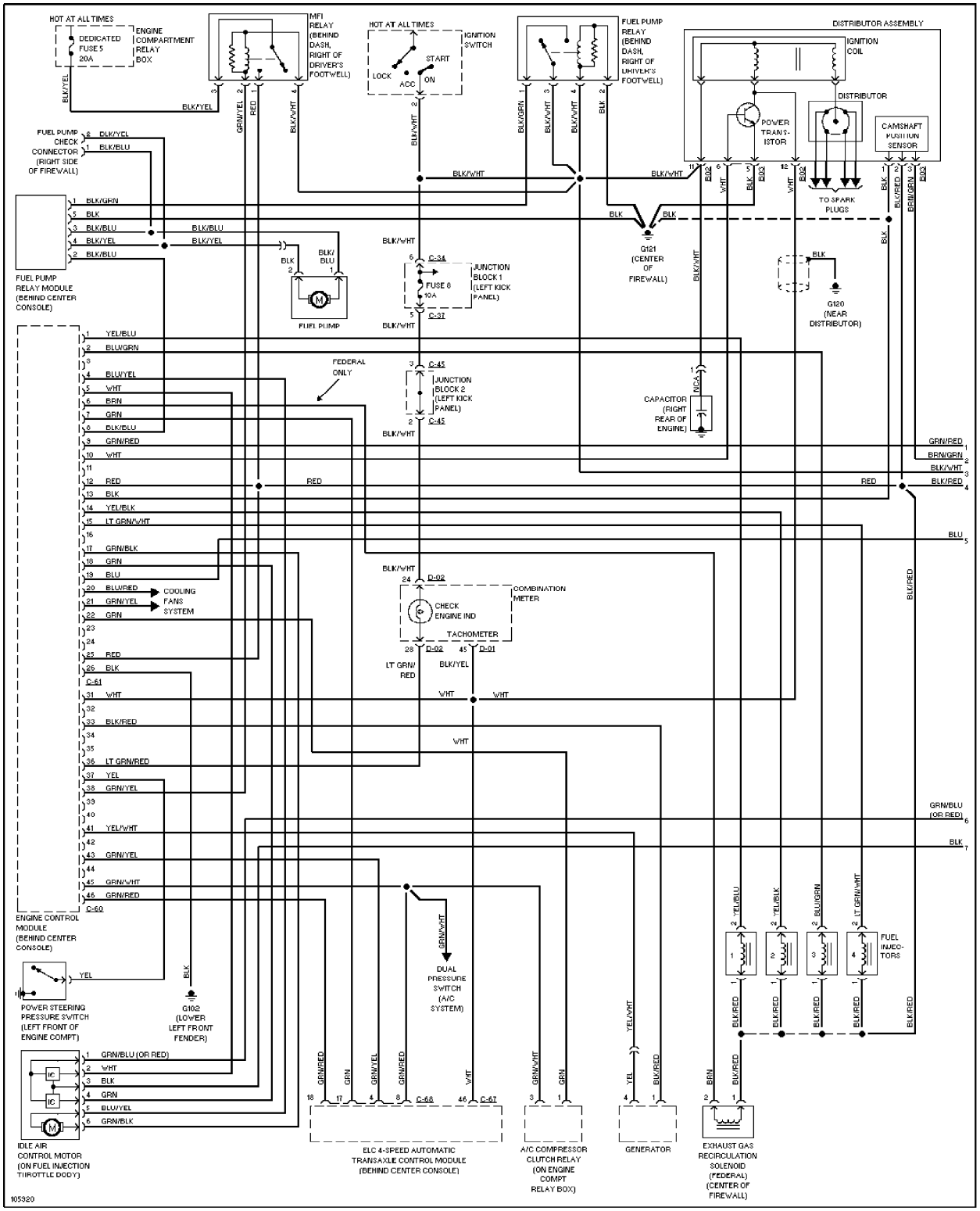


Fig. 11: Wiring Diagram (Galant 2.4L - 1 Of 2)

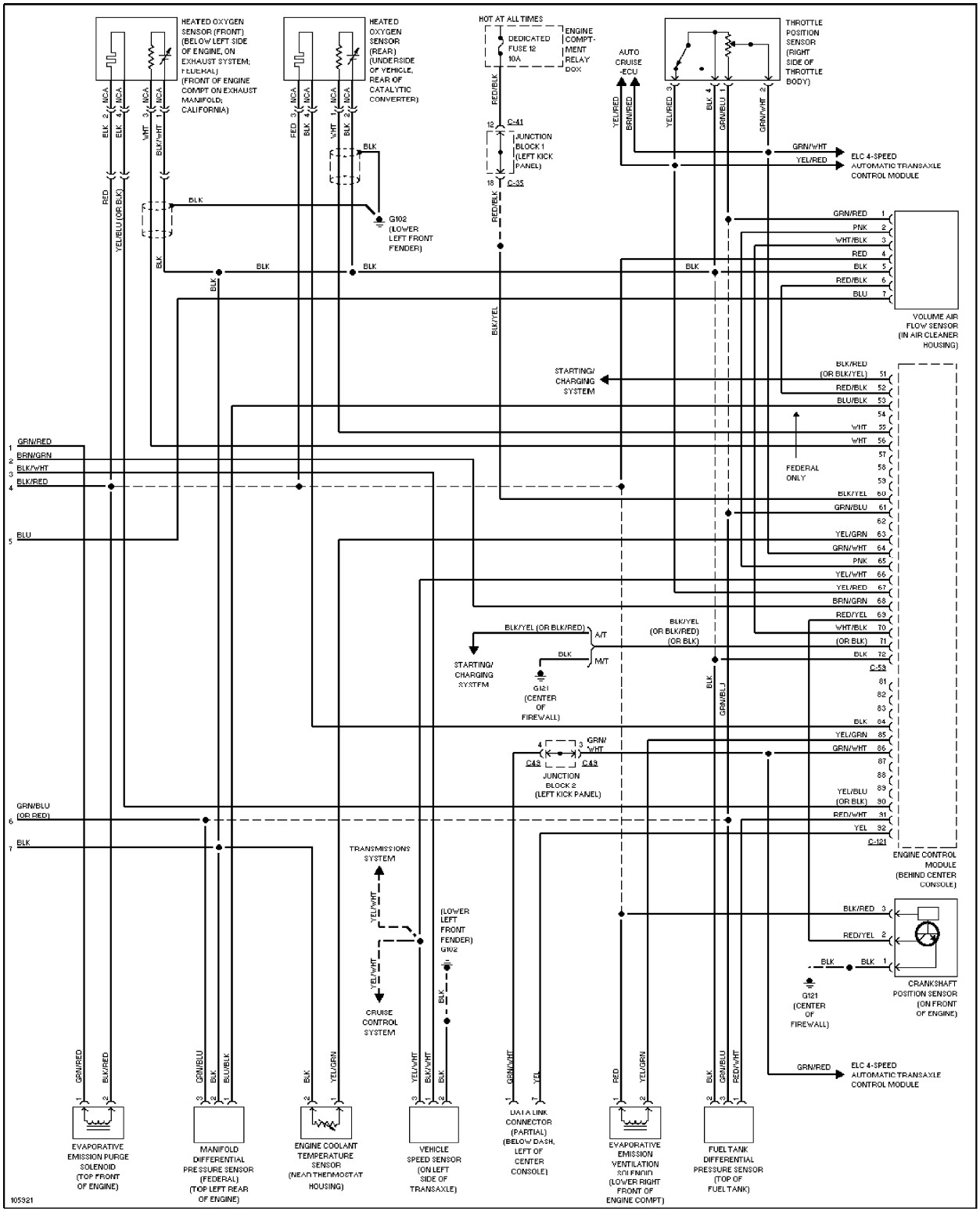


Fig. 12: Wiring Diagram (Galant 2.4L - 2 Of 2)

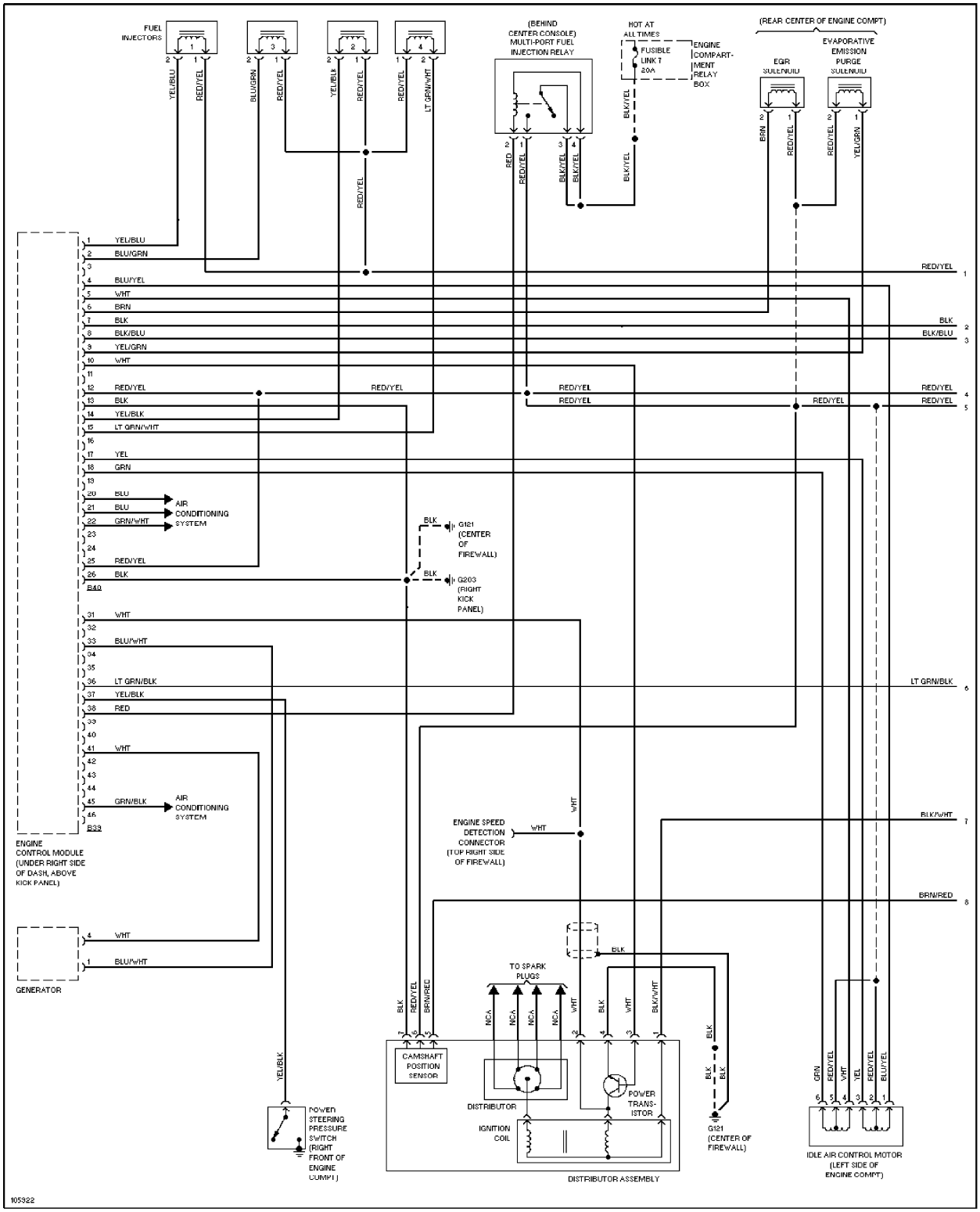


Fig. 13: Wiring Diagram (Mirage 1.5L - 1 Of 3)

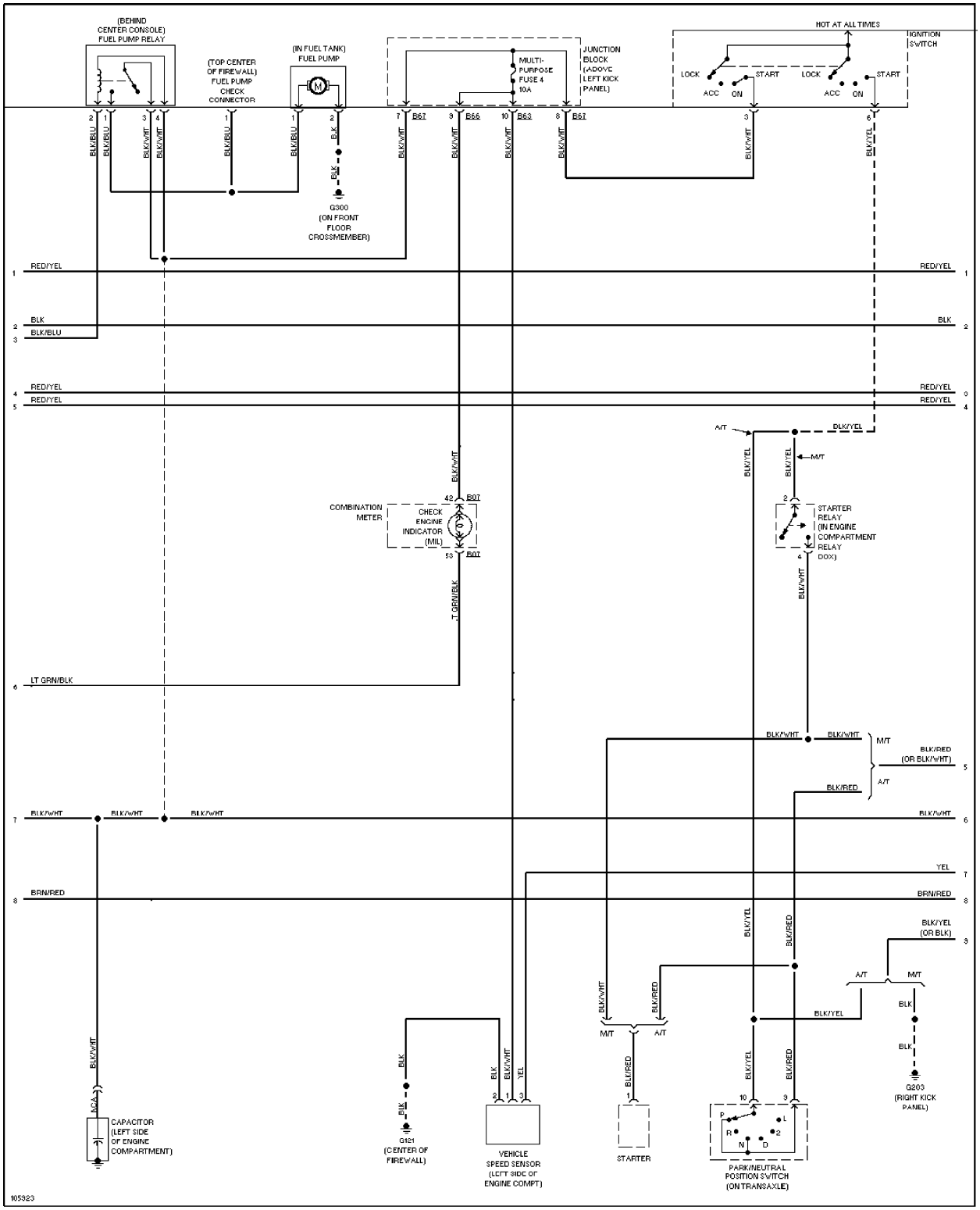


Fig. 14: Wiring Diagram (Mirage 1.5L - 2 Of 3)

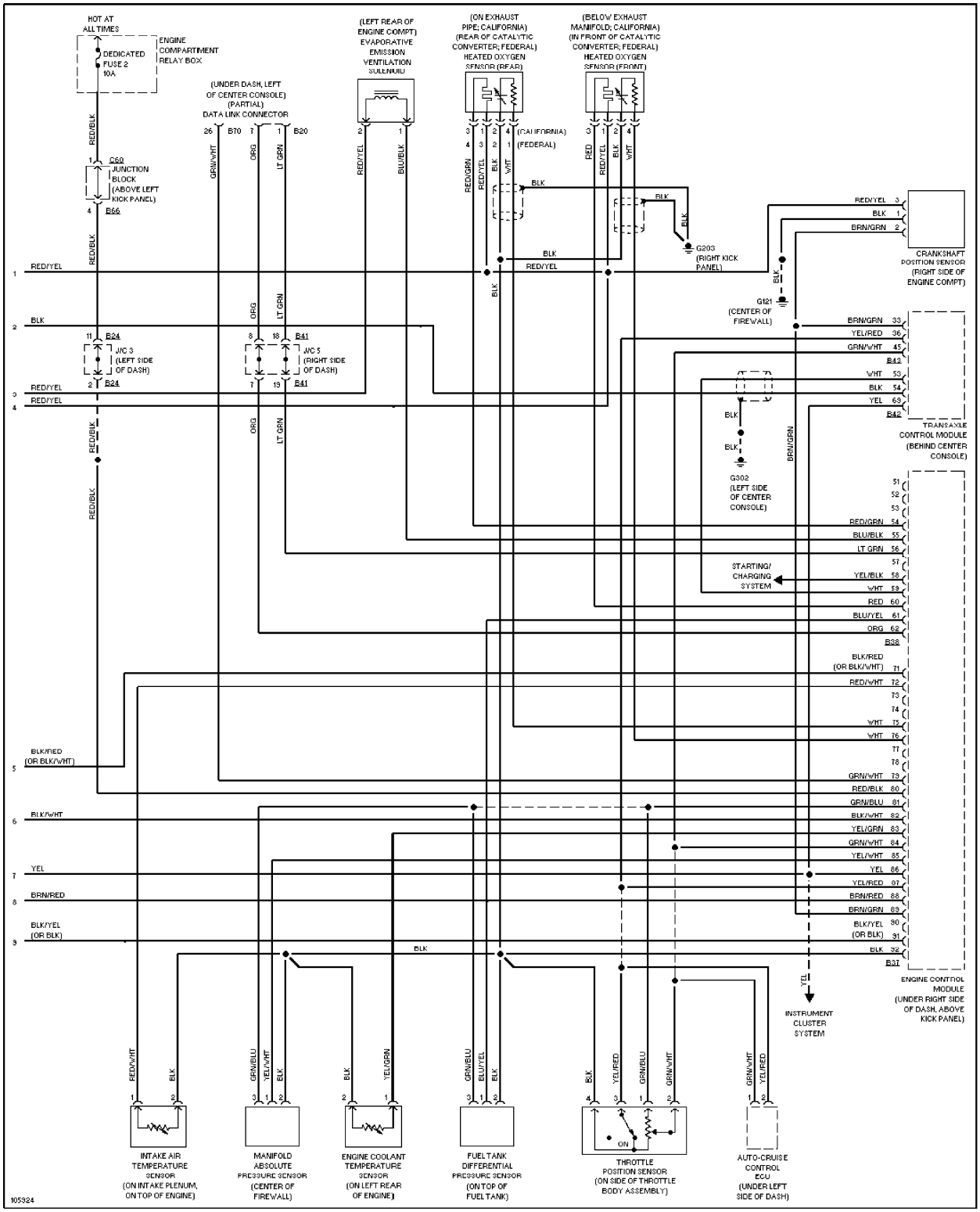


Fig. 15: Wiring Diagram (Mirage 1.5L - 3 Of 3)

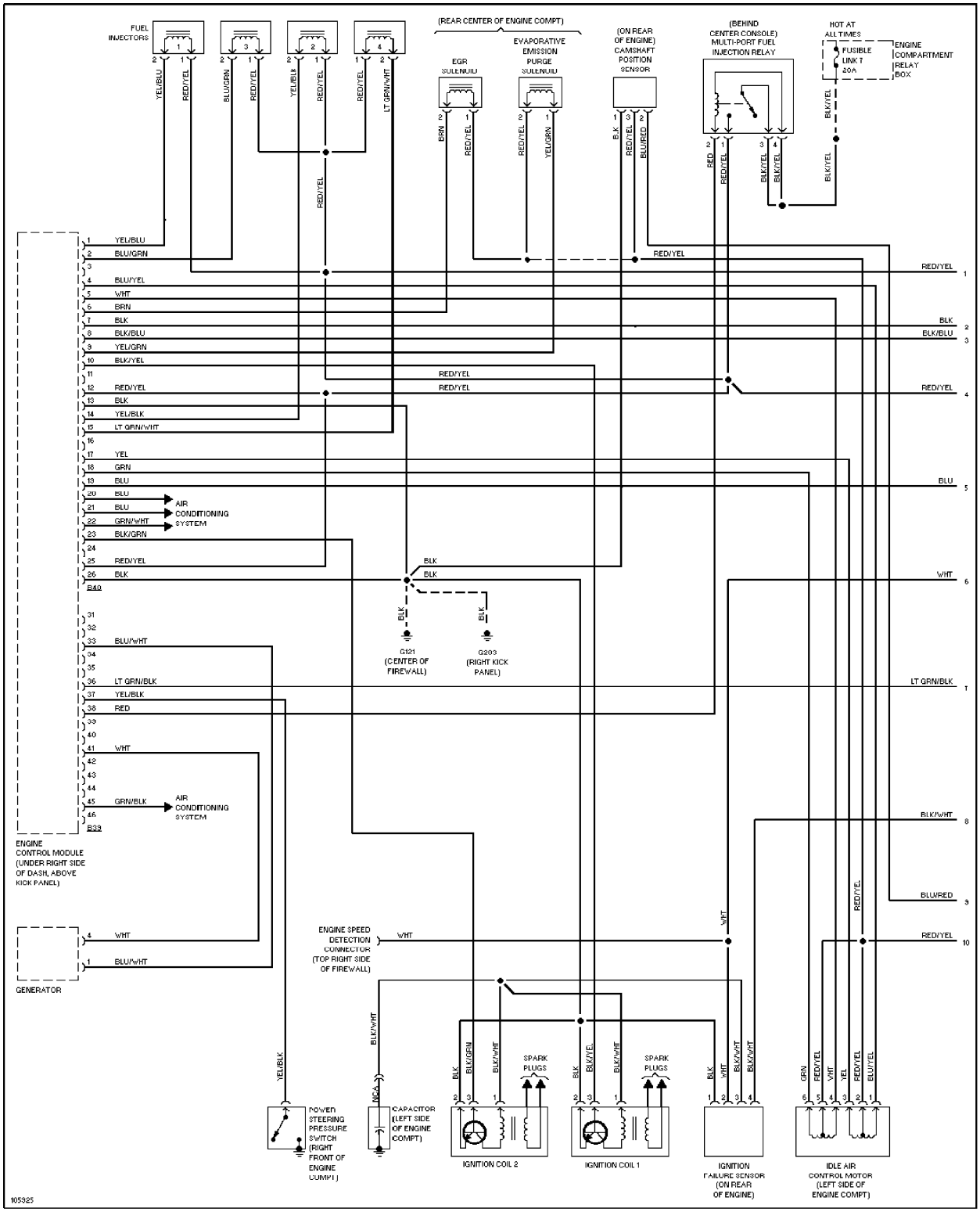


Fig. 16: Wiring Diagram (Mirage 1.8L - 1 Of 3)

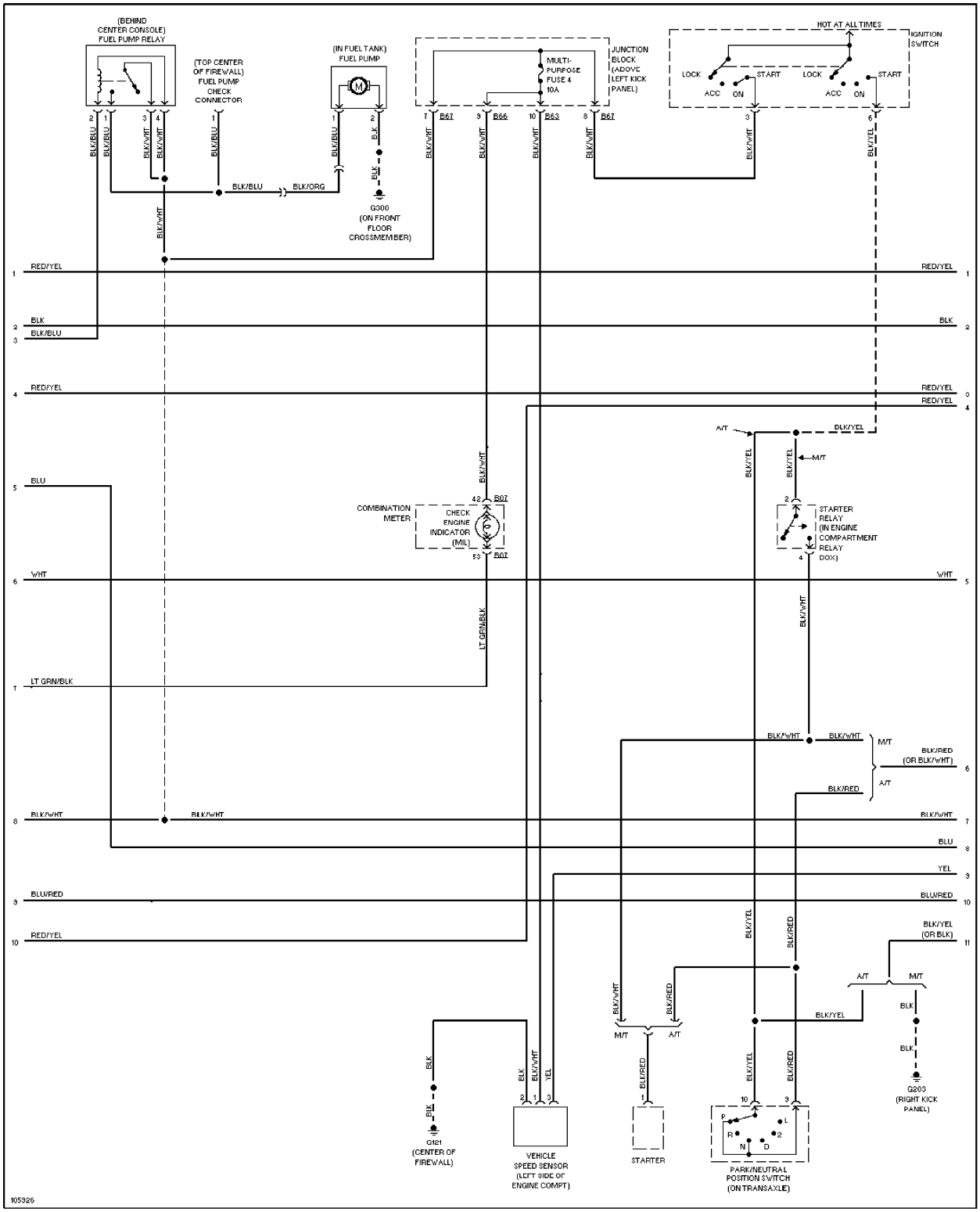


Fig. 17: Wiring Diagram (Mirage 1.8L - 2 Of 3)

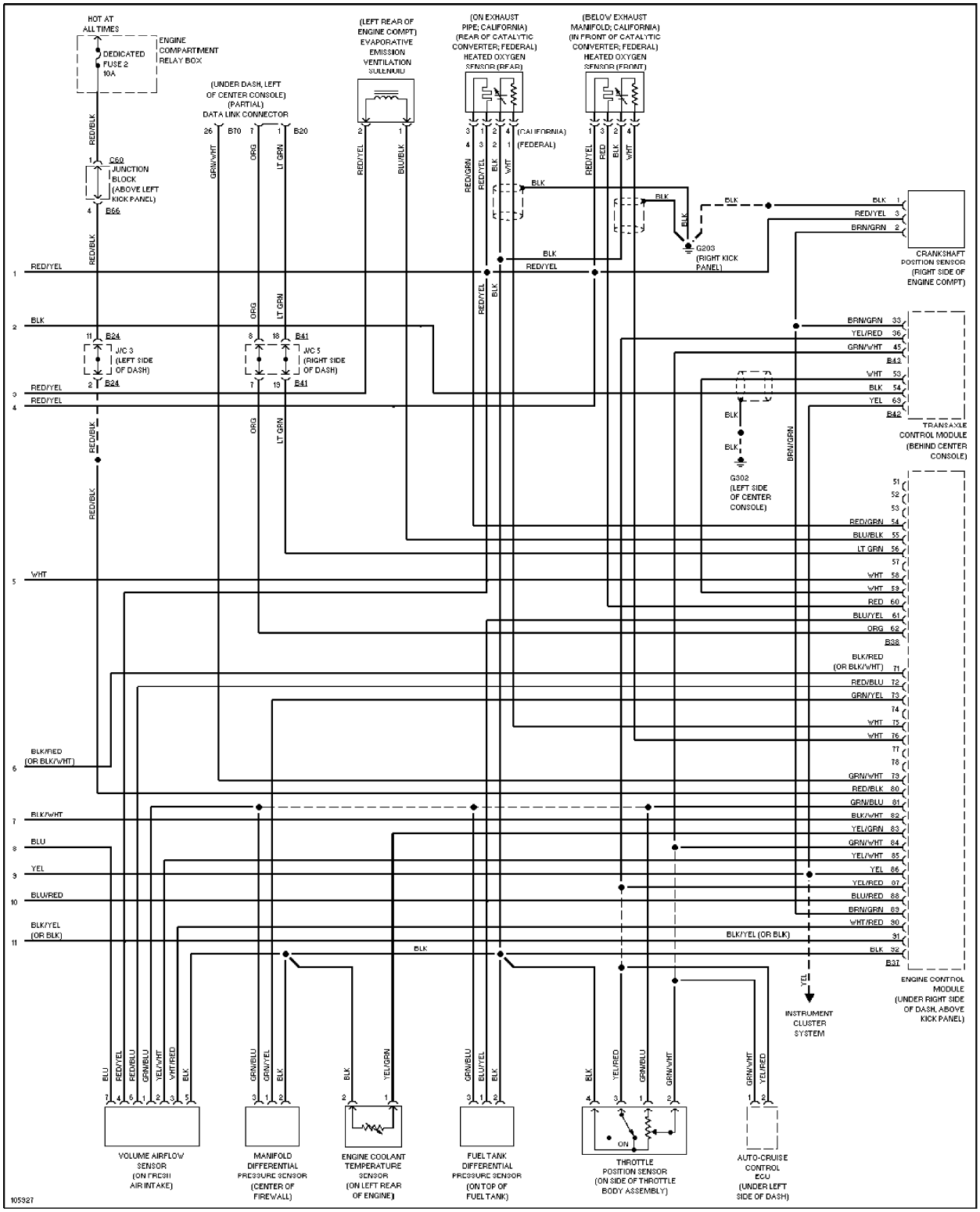


Fig. 18: Wiring Diagram (Mirage 1.8L - 3 Of 3)

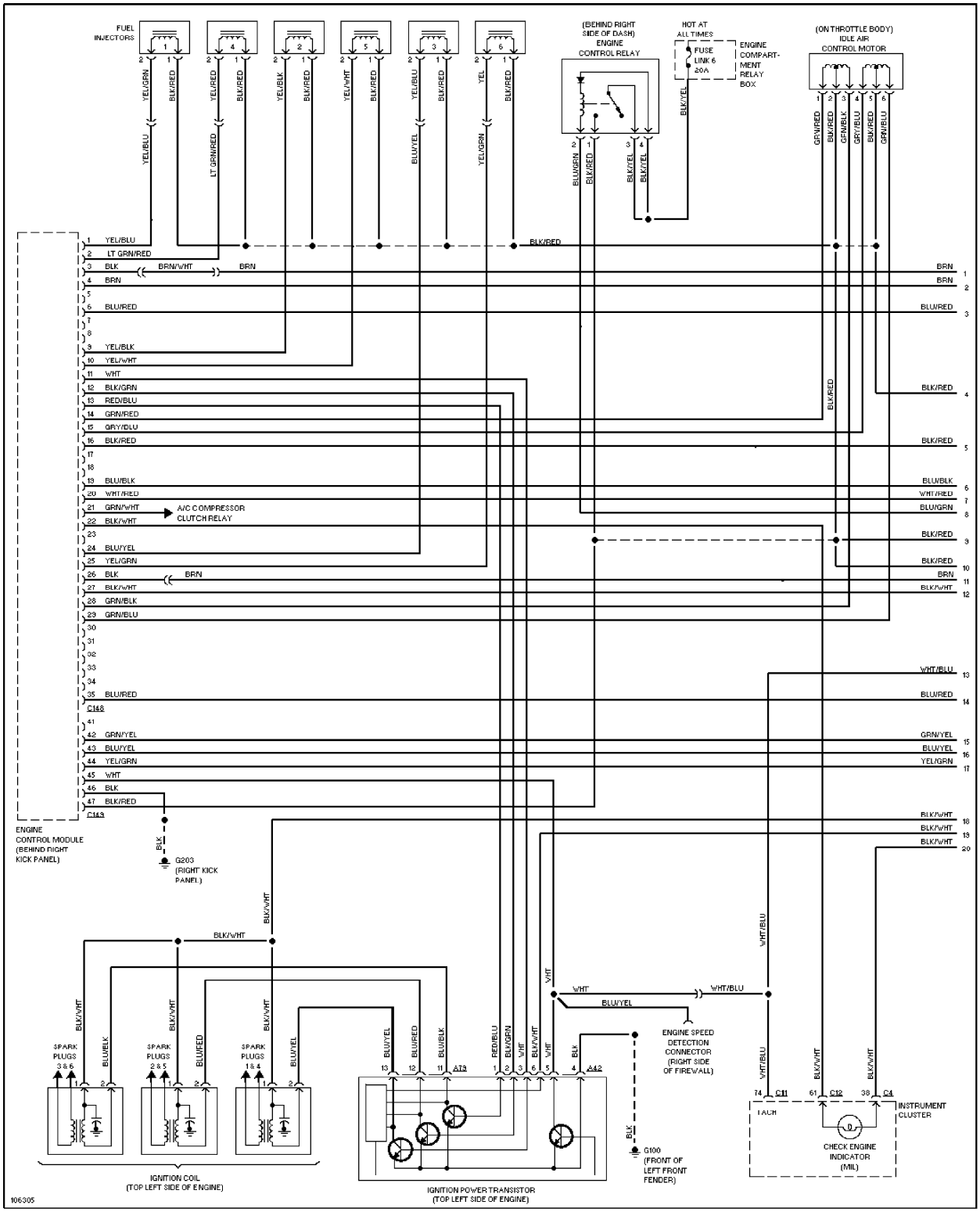


Fig. 19: Wiring Diagram (Montero 3.5L - California Emissions - 1 Of 3)

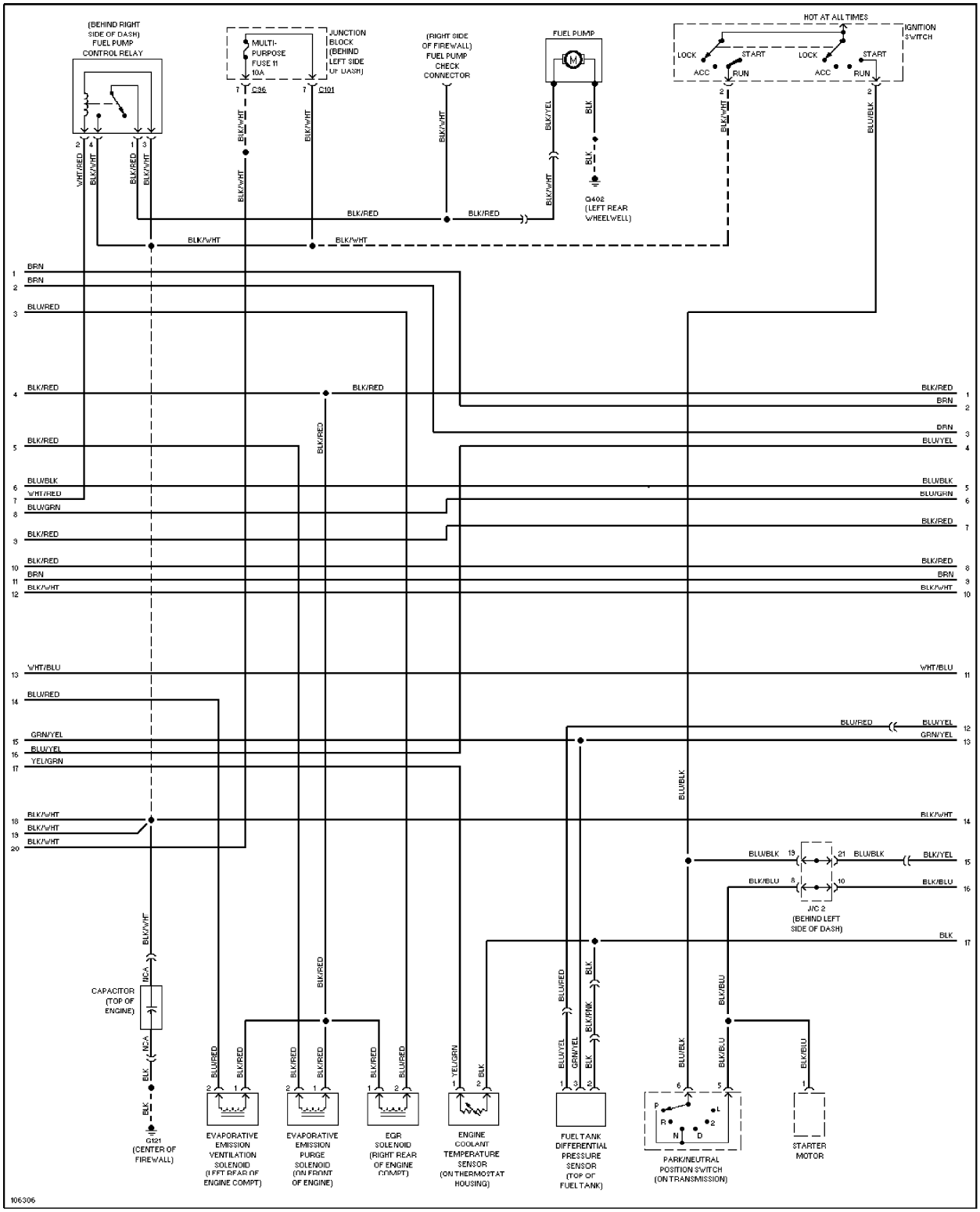


Fig. 20: Wiring Diagram (Montero 3.5L - California Emissions - 2 Of 3)

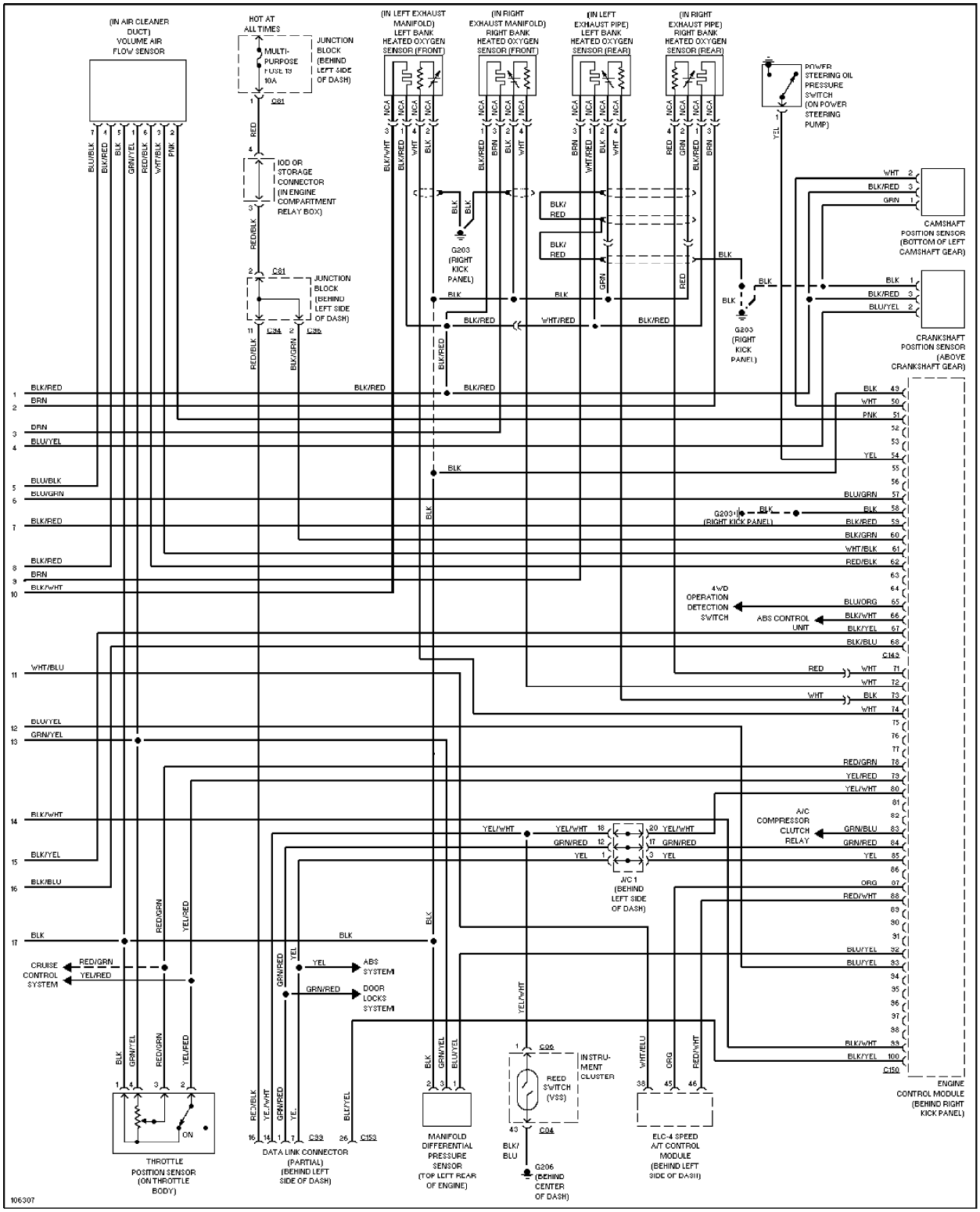


Fig. 21: Wiring Diagram (Montero 3.5L - California Emissions - 3 Of 3)

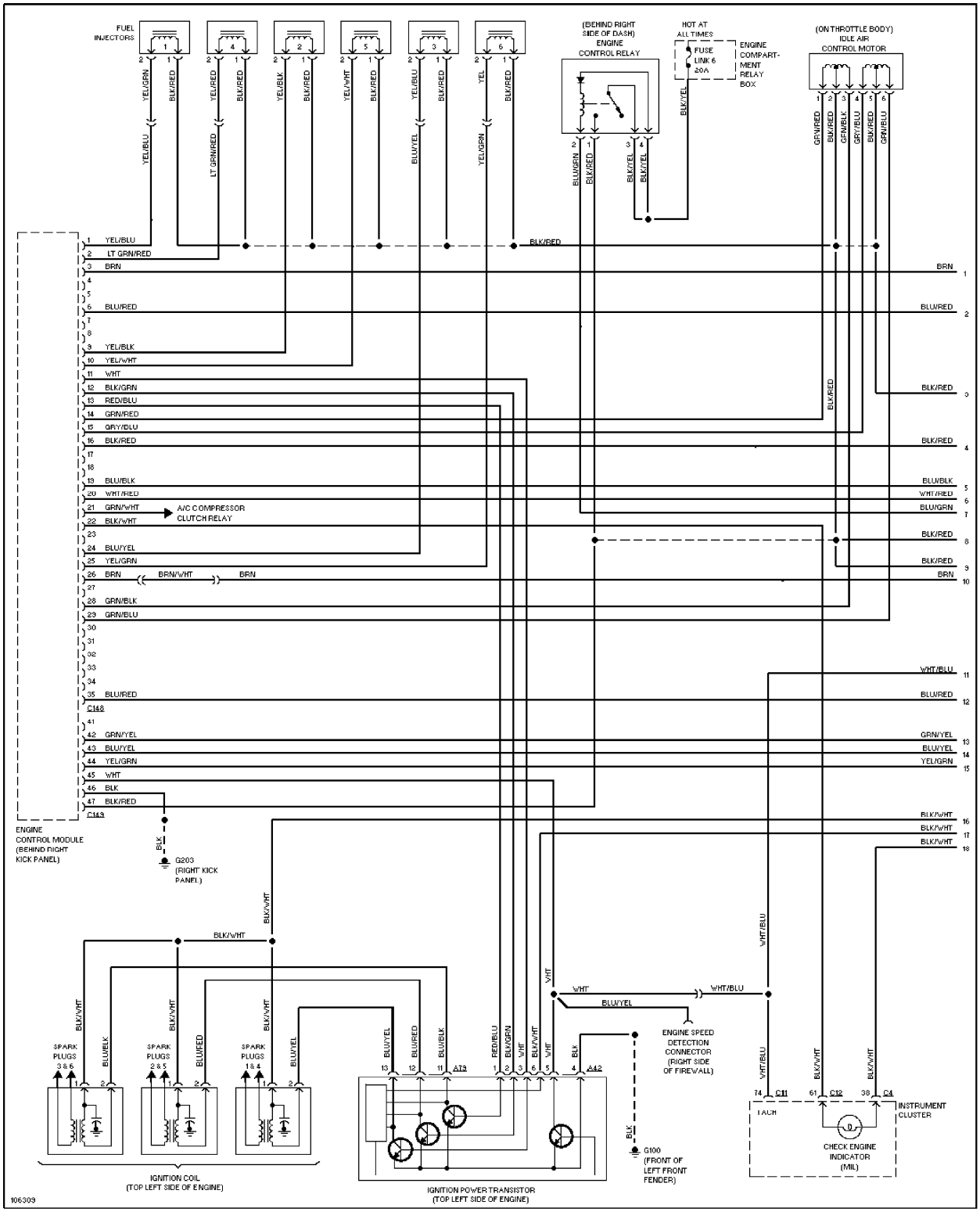


Fig. 22: Wiring Diagram (Montero 3.5L - Federal Emissions - 1 Of 3)

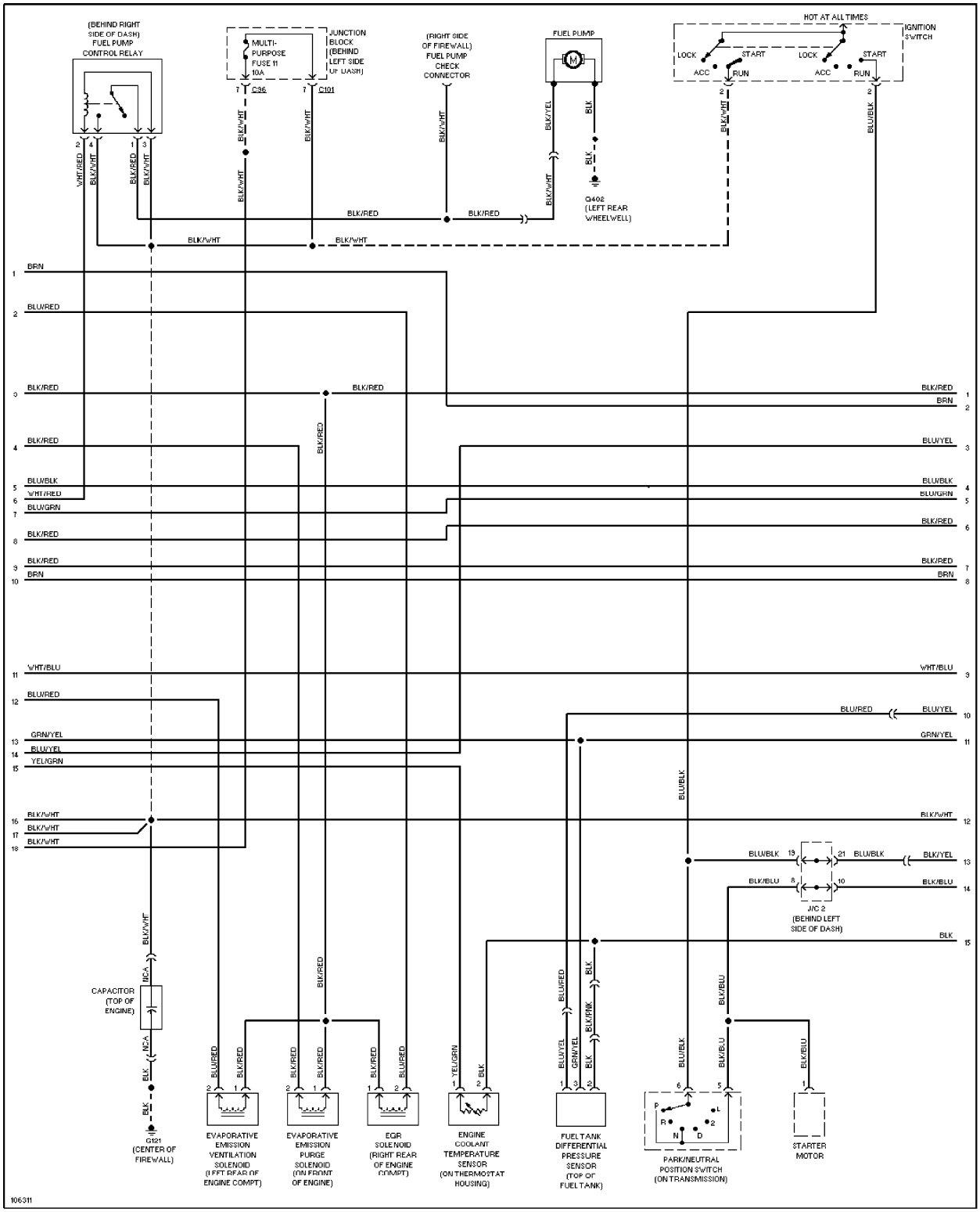


Fig. 23: Wiring Diagram (Montero 3.5L - Federal Emissions - 2 Of 3)

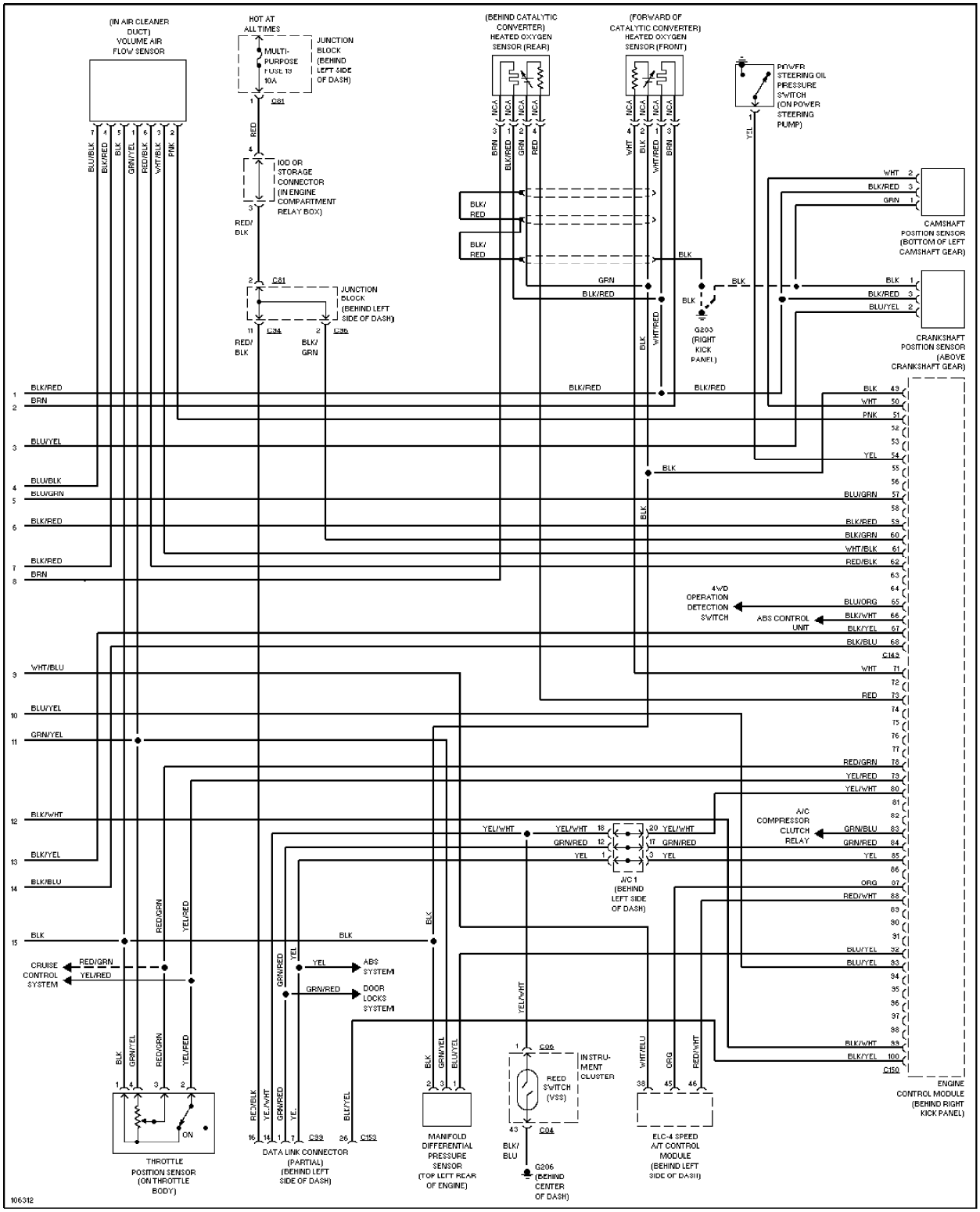


Fig. 24: Wiring Diagram (Montero 3.5L - Federal Emissions - 3 Of 3)

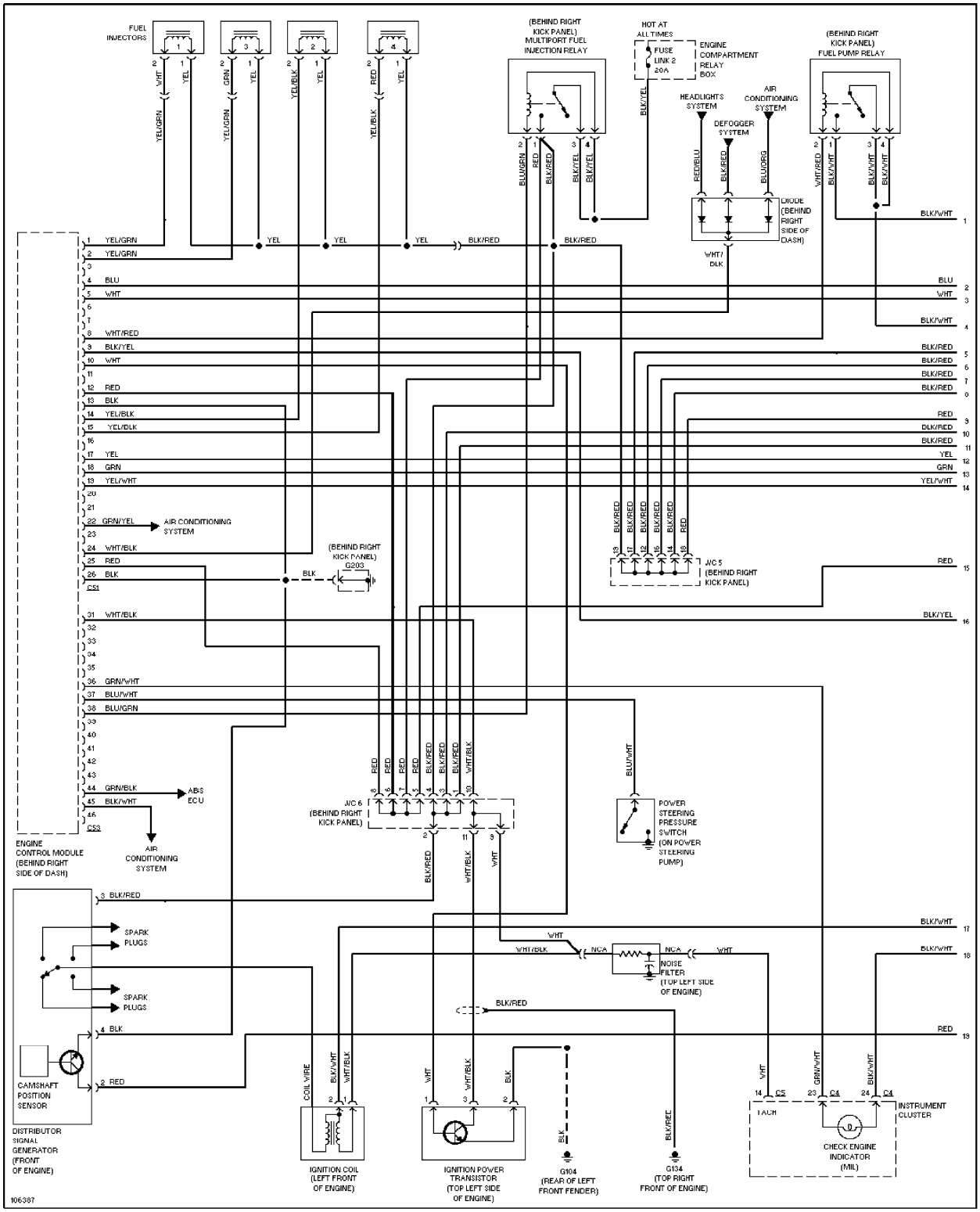


Fig. 25: Wiring Diagram (Montero Sport 2.4L - California Emissions - 1 Of 3)

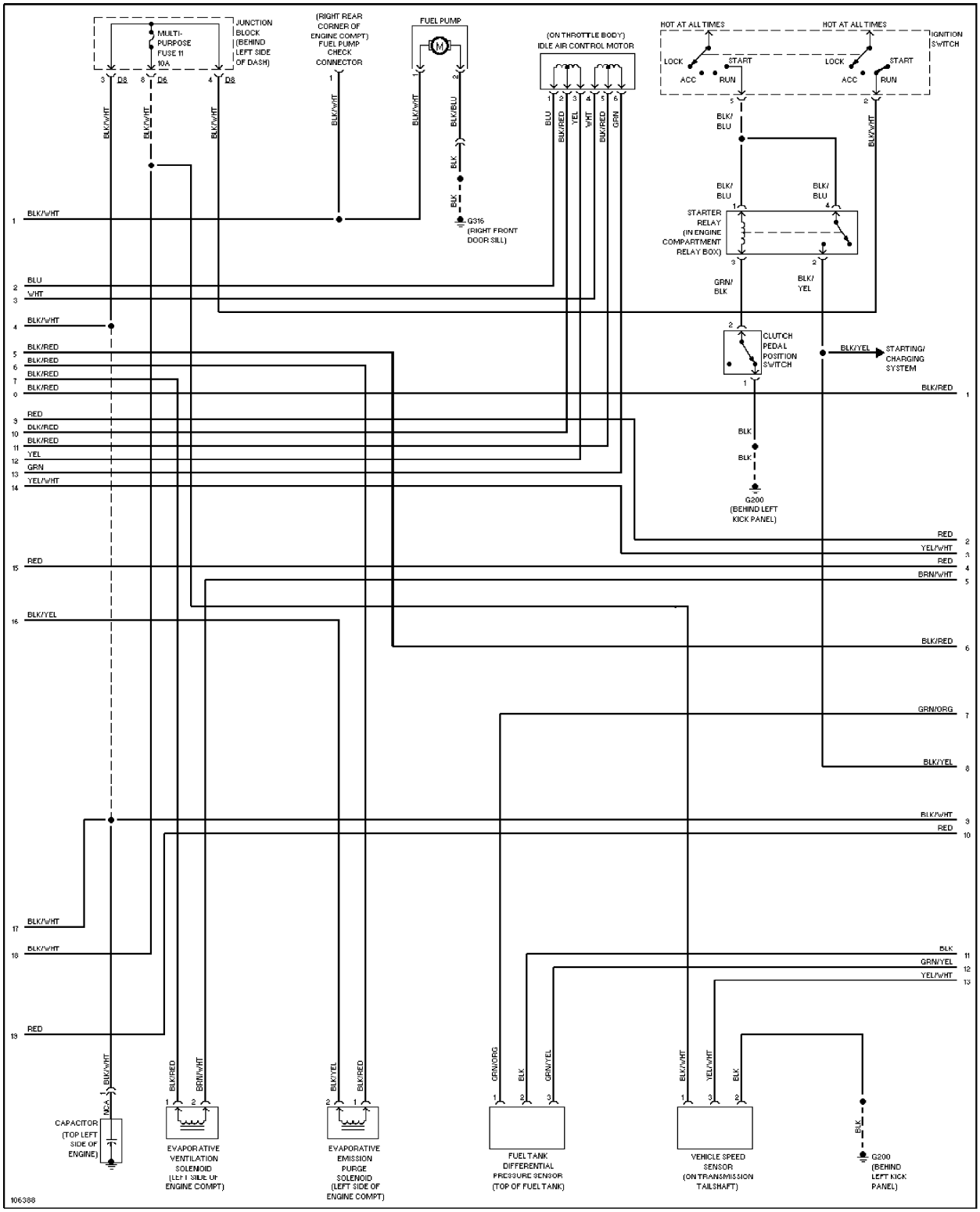


Fig. 26: Wiring Diagram (Montero Sport 2.4L - California Emissions - 2 Of 3)

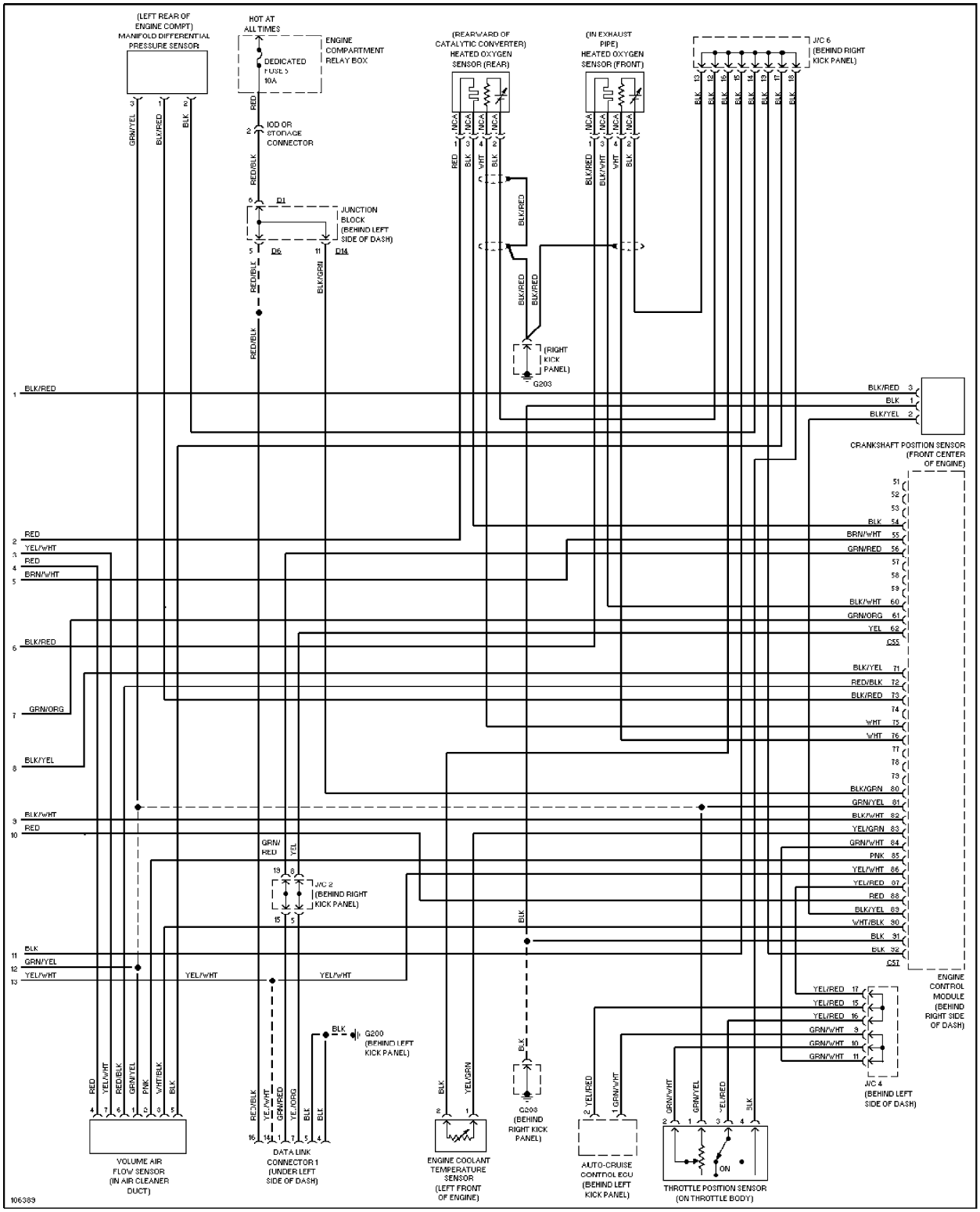


Fig. 27: Wiring Diagram (Montero Sport 2.4L - California Emissions - 3 Of 3)

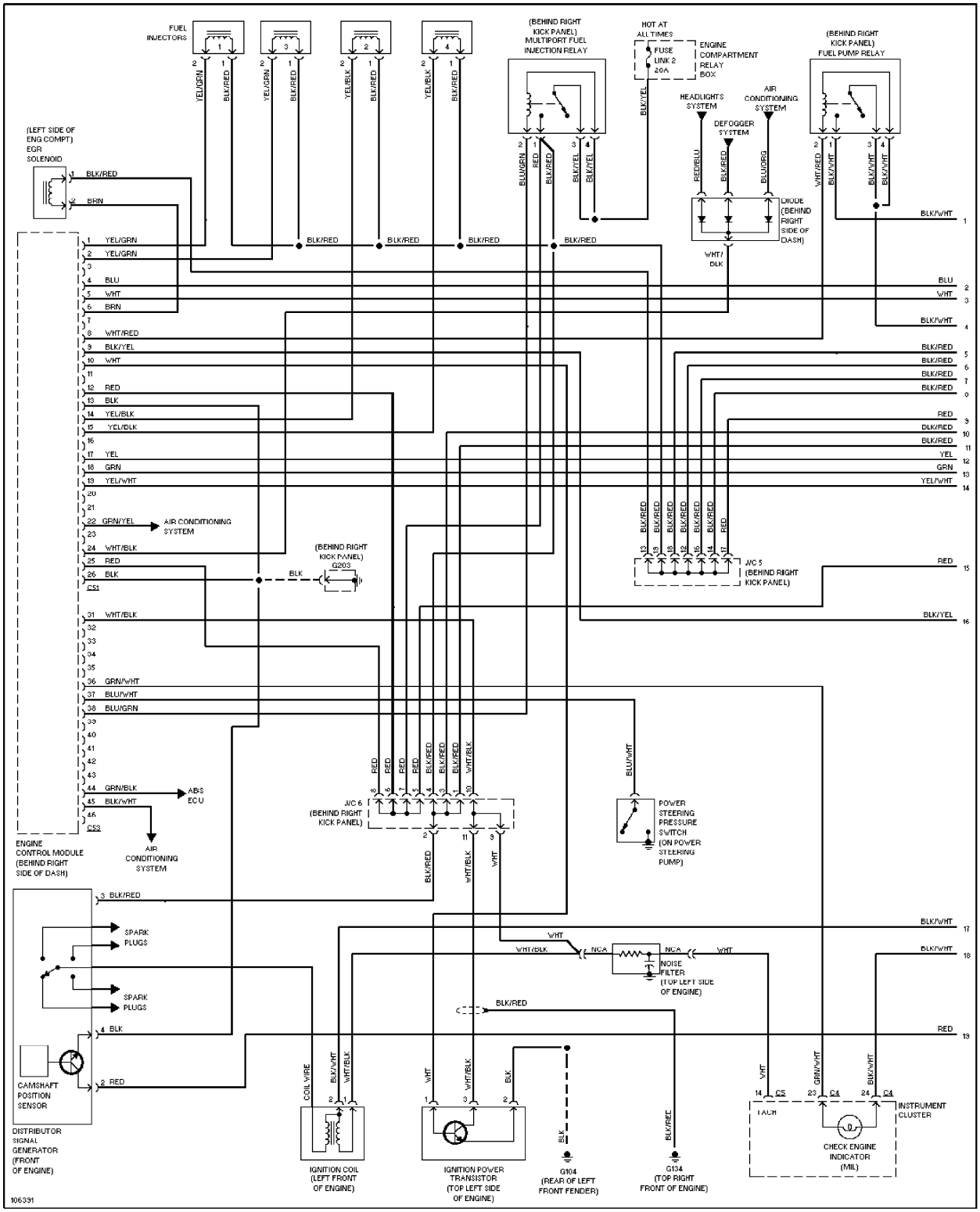


Fig. 28: Wiring Diagram (Montero Sport 2.4L - Federal Emissions - 1 Of 3)

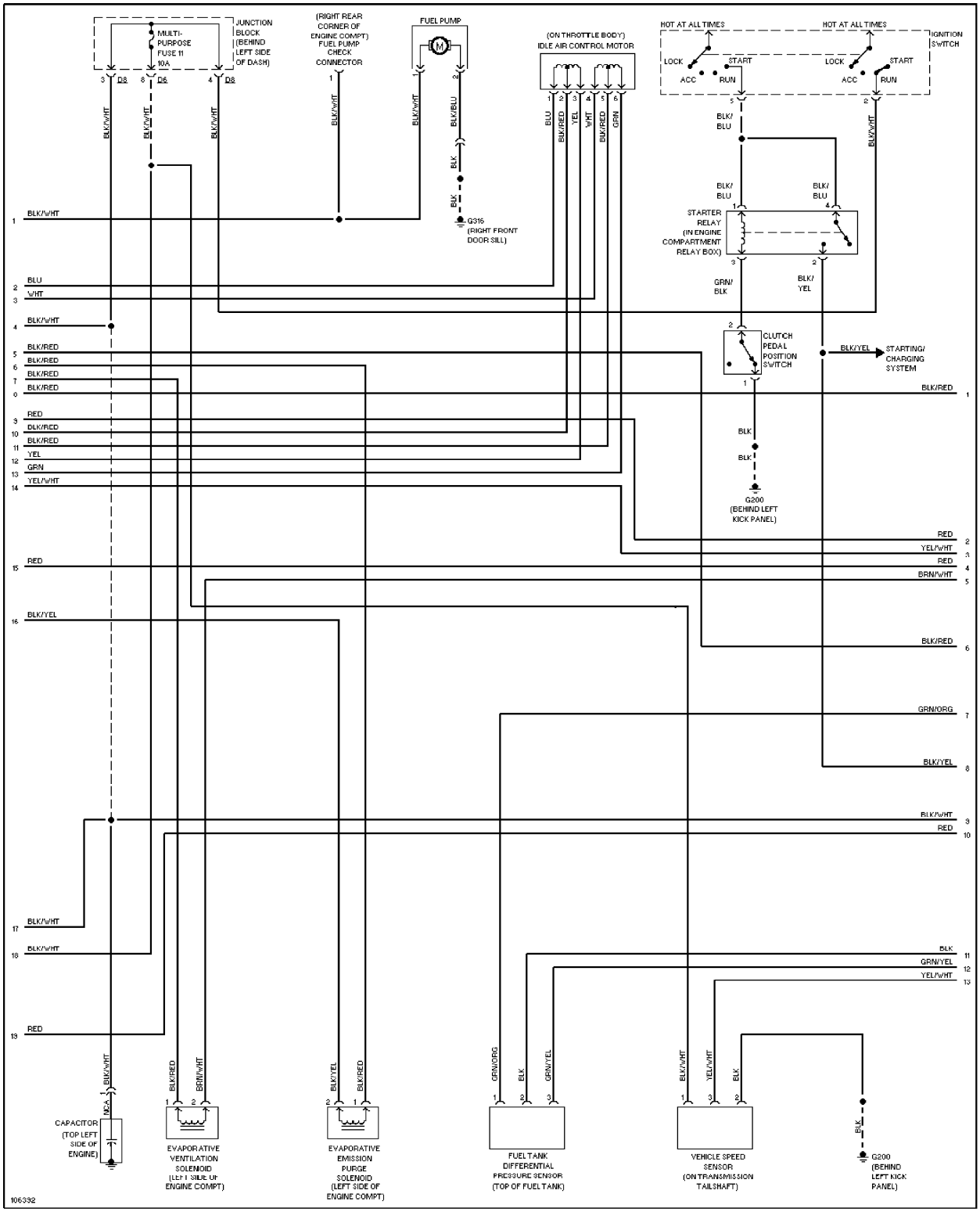


Fig. 29: Wiring Diagram (Montero Sport 2.4L - Federal Emissions - 2 Of 3)

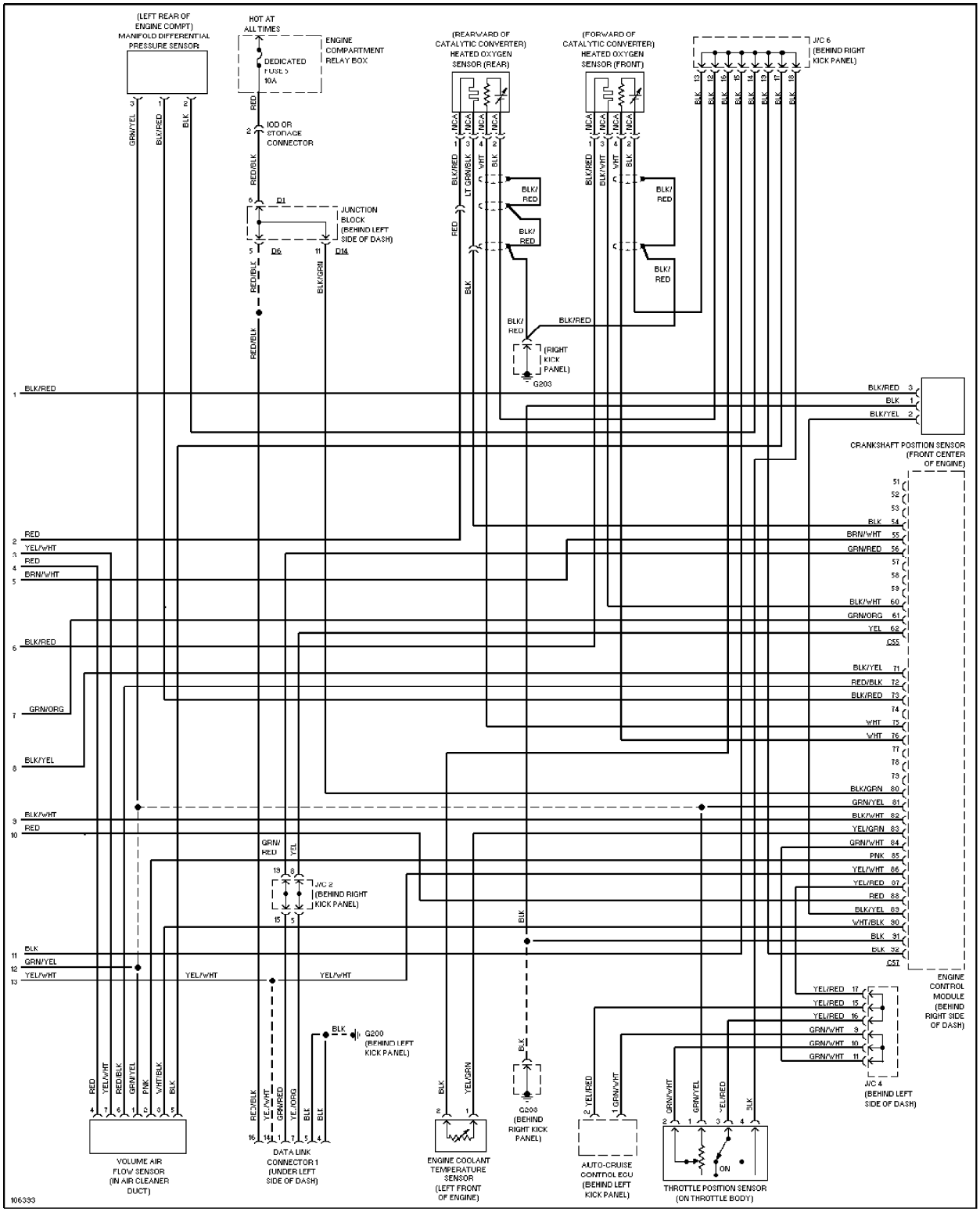


Fig. 30: Wiring Diagram (Montero Sport 2.4L - Federal Emissions - 3 Of 3)

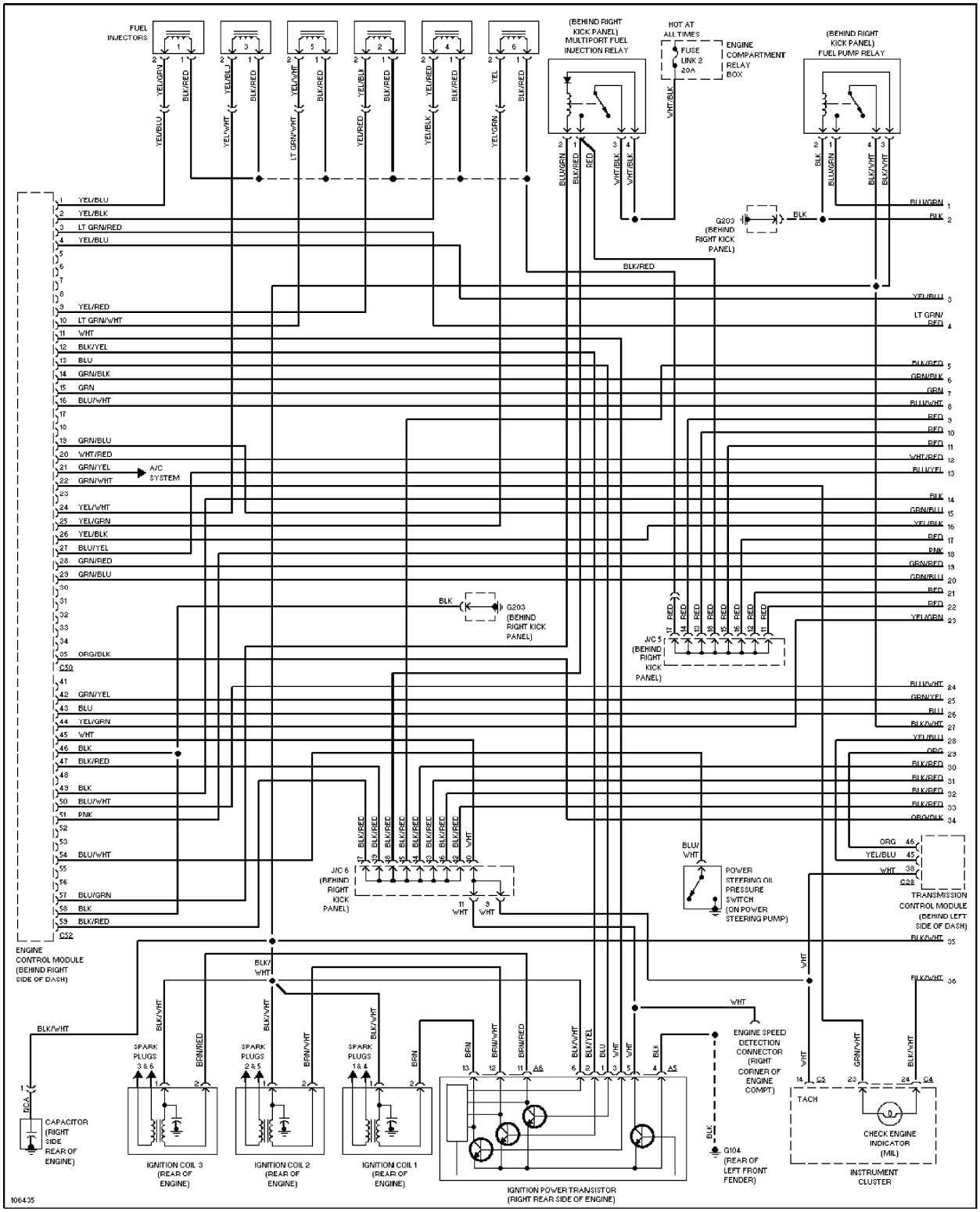


Fig. 31: Wiring Diagram (Montero Sport 3.0L - California Emissions - 1 Of 3)

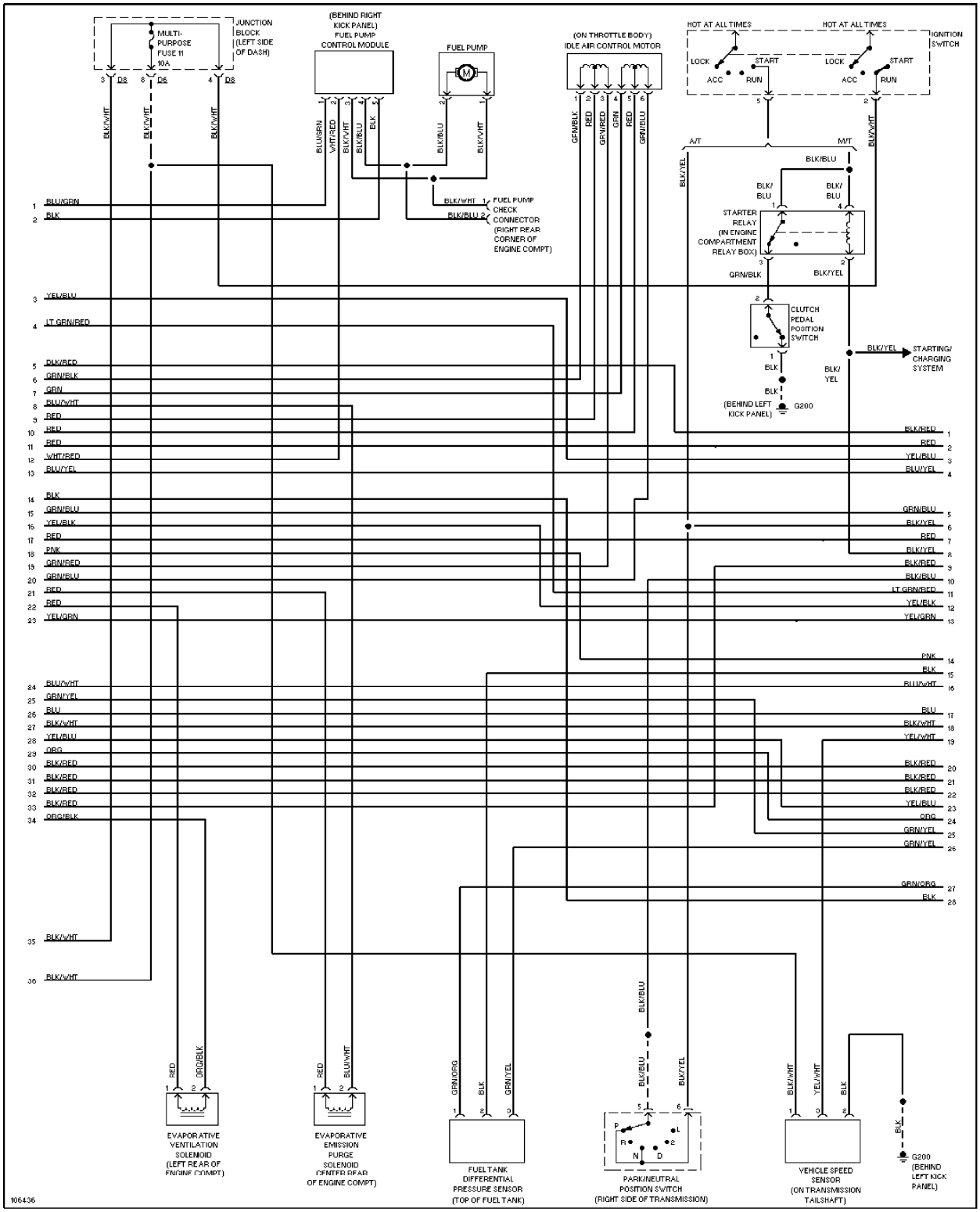


Fig. 32: Wiring Diagram (Montero Sport 3.0L - California Emissions - 2 Of 3)

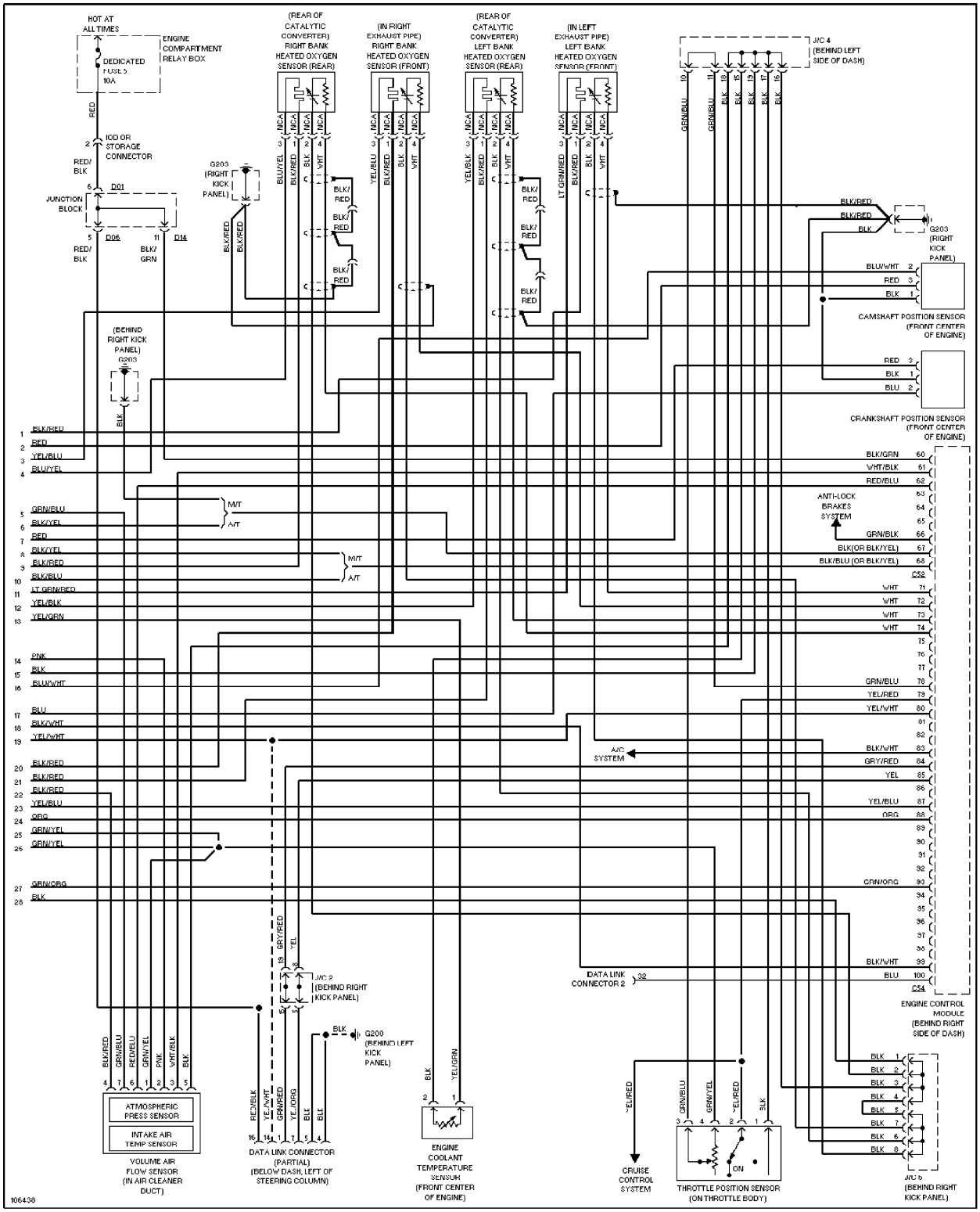


Fig. 33: Wiring Diagram (Montero Sport 3.0L - California Emissions - 3 Of 3)

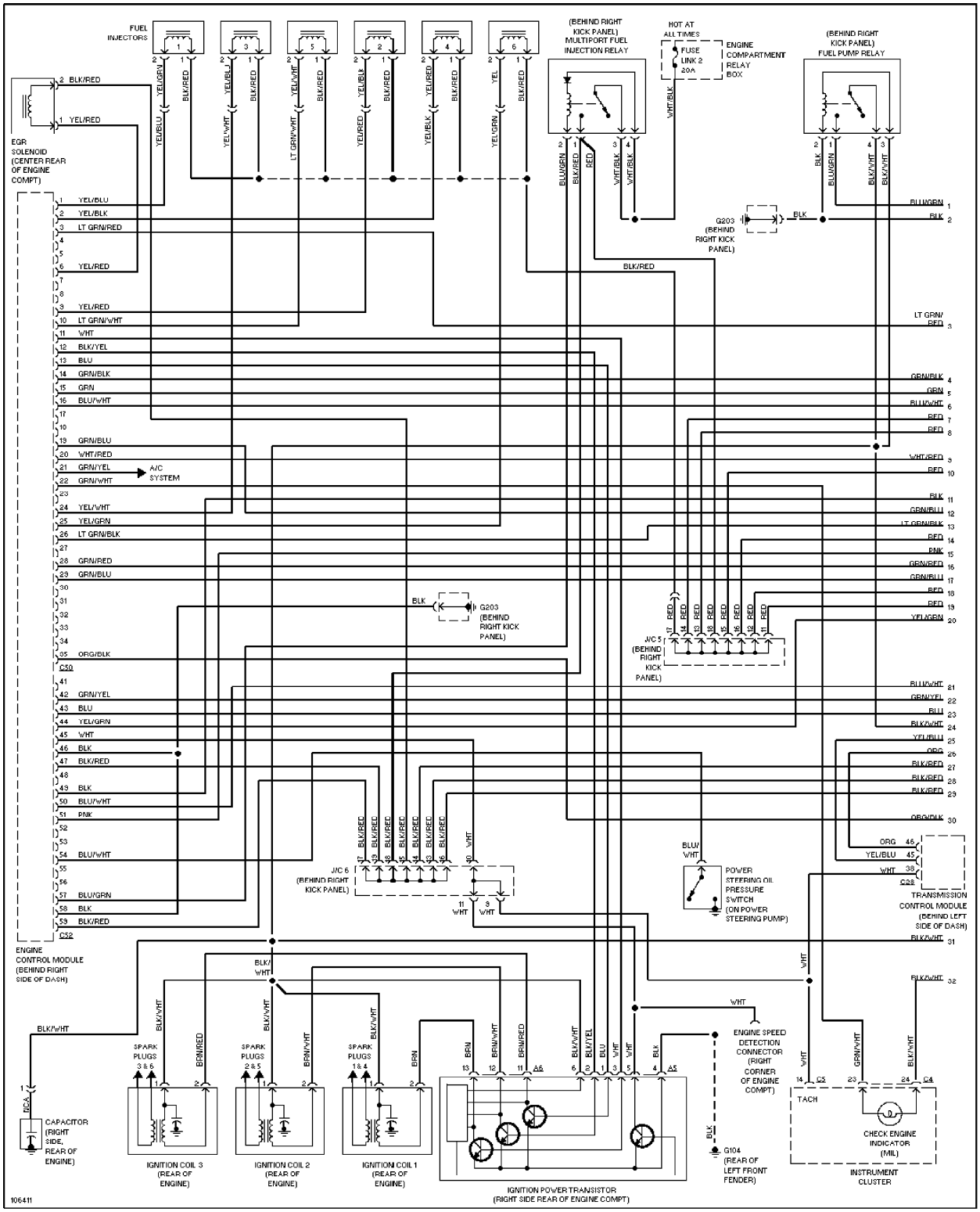


Fig. 34: Wiring Diagram (Montero Sport 3.0L - Federal Emissions - 1 Of 3)

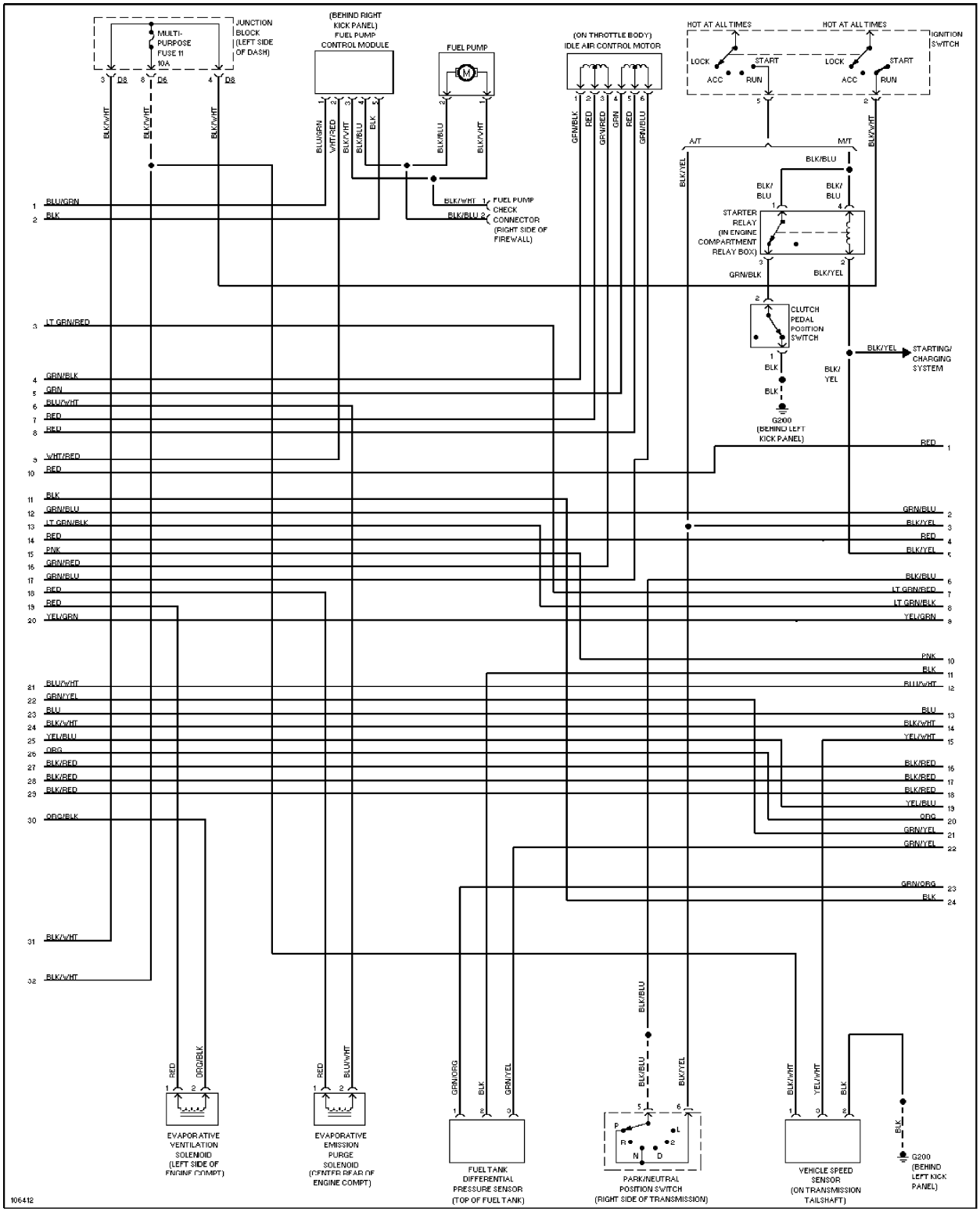


Fig. 35: Wiring Diagram (Montero Sport 3.0L - Federal Emissions - 2 Of 3)

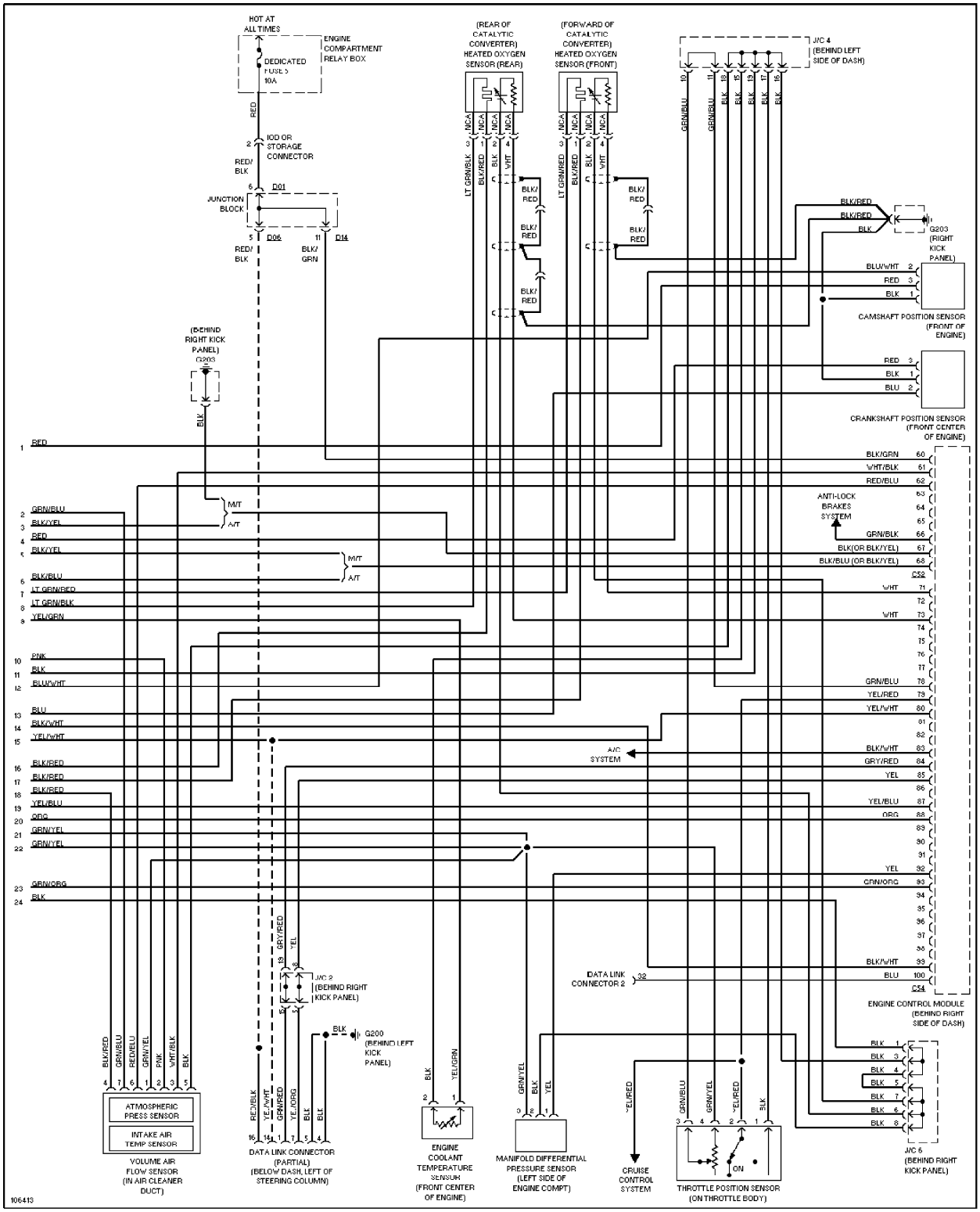


Fig. 36: Wiring Diagram (Montero Sport 3.0L - Federal Emissions - 3 Of 3)

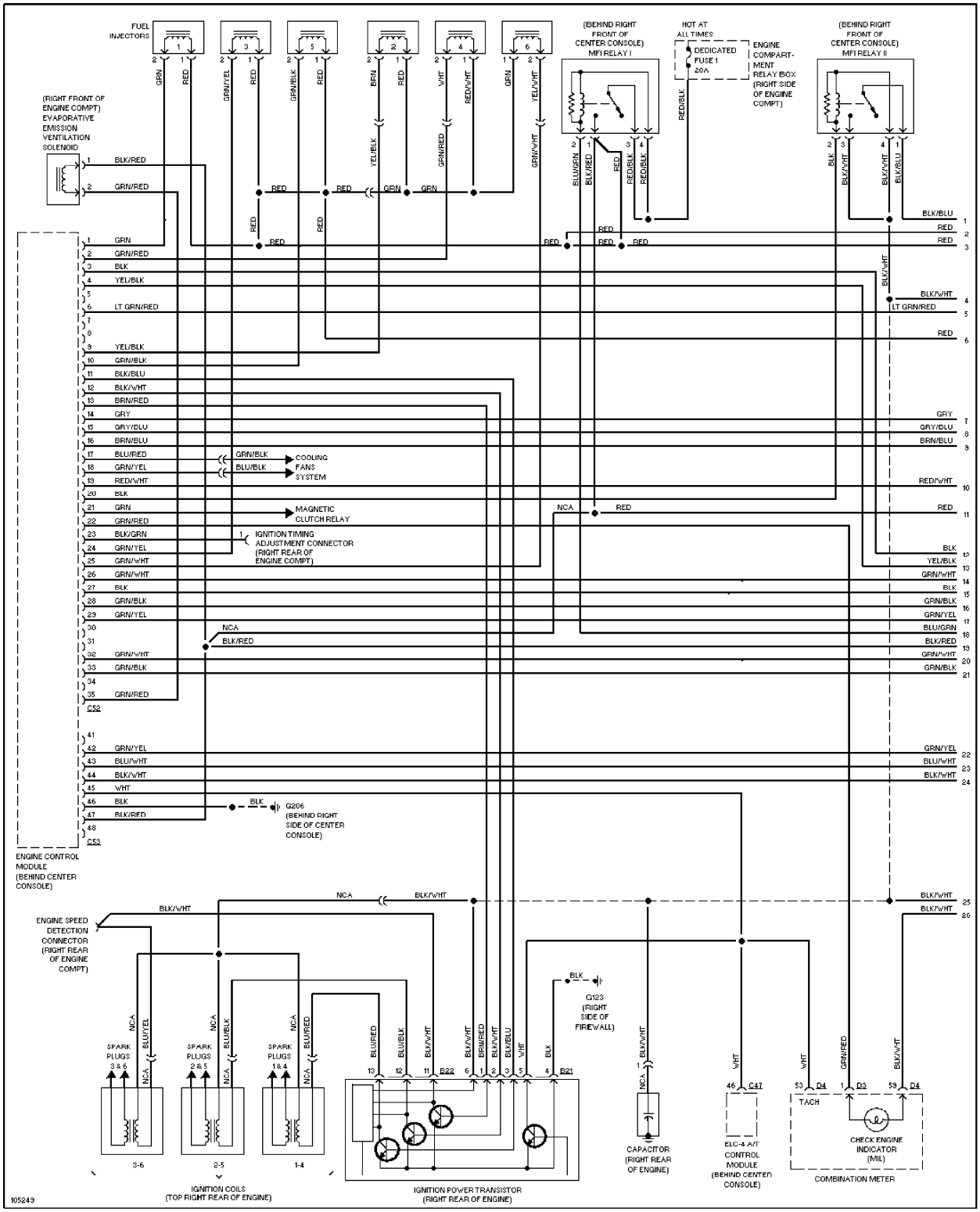


Fig. 37: Wiring Diagram (3000GT 3.0L DOHC - 1 Of 3)

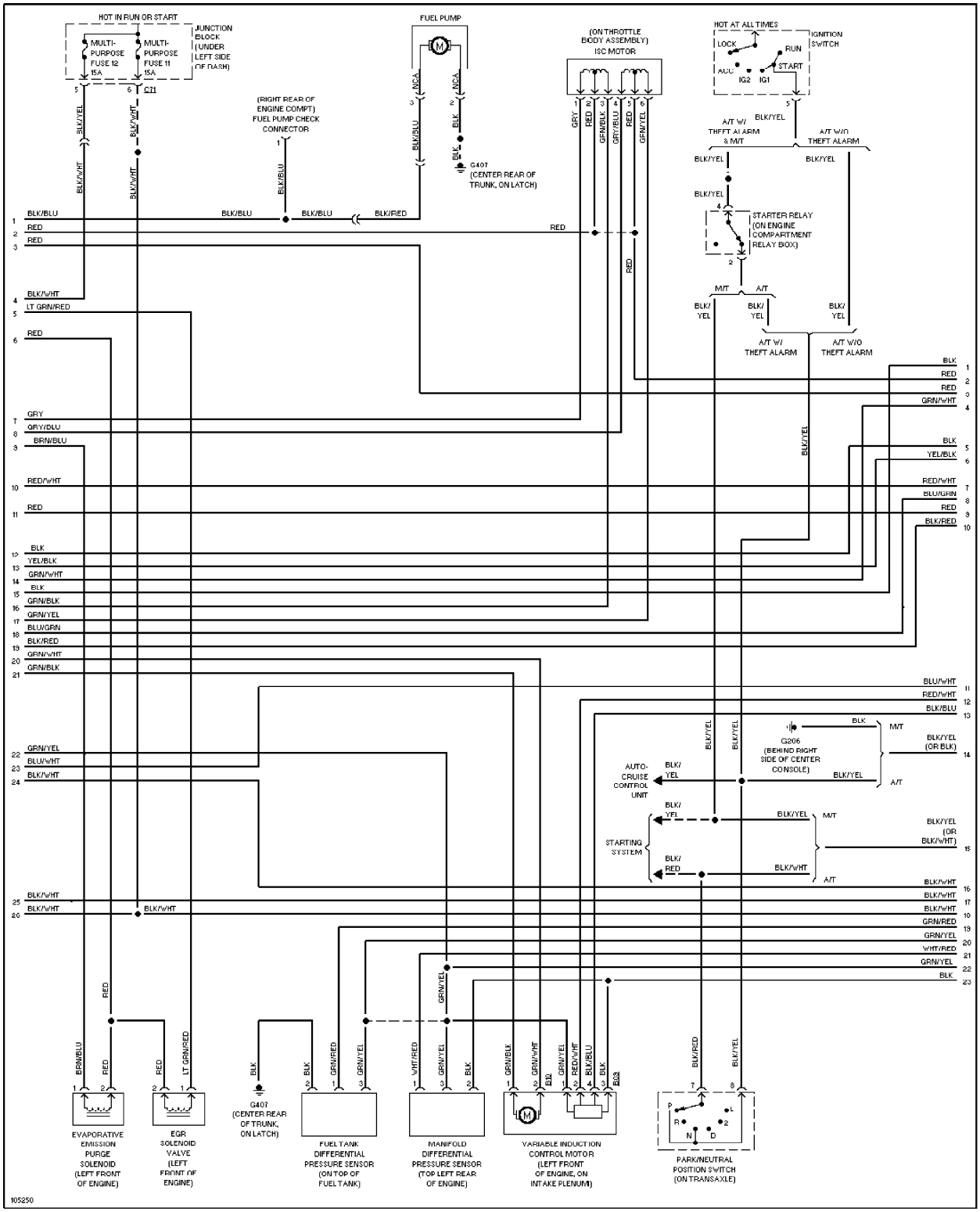


Fig. 38: Wiring Diagram (3000GT 3.0L DOHC - 2 Of 3)

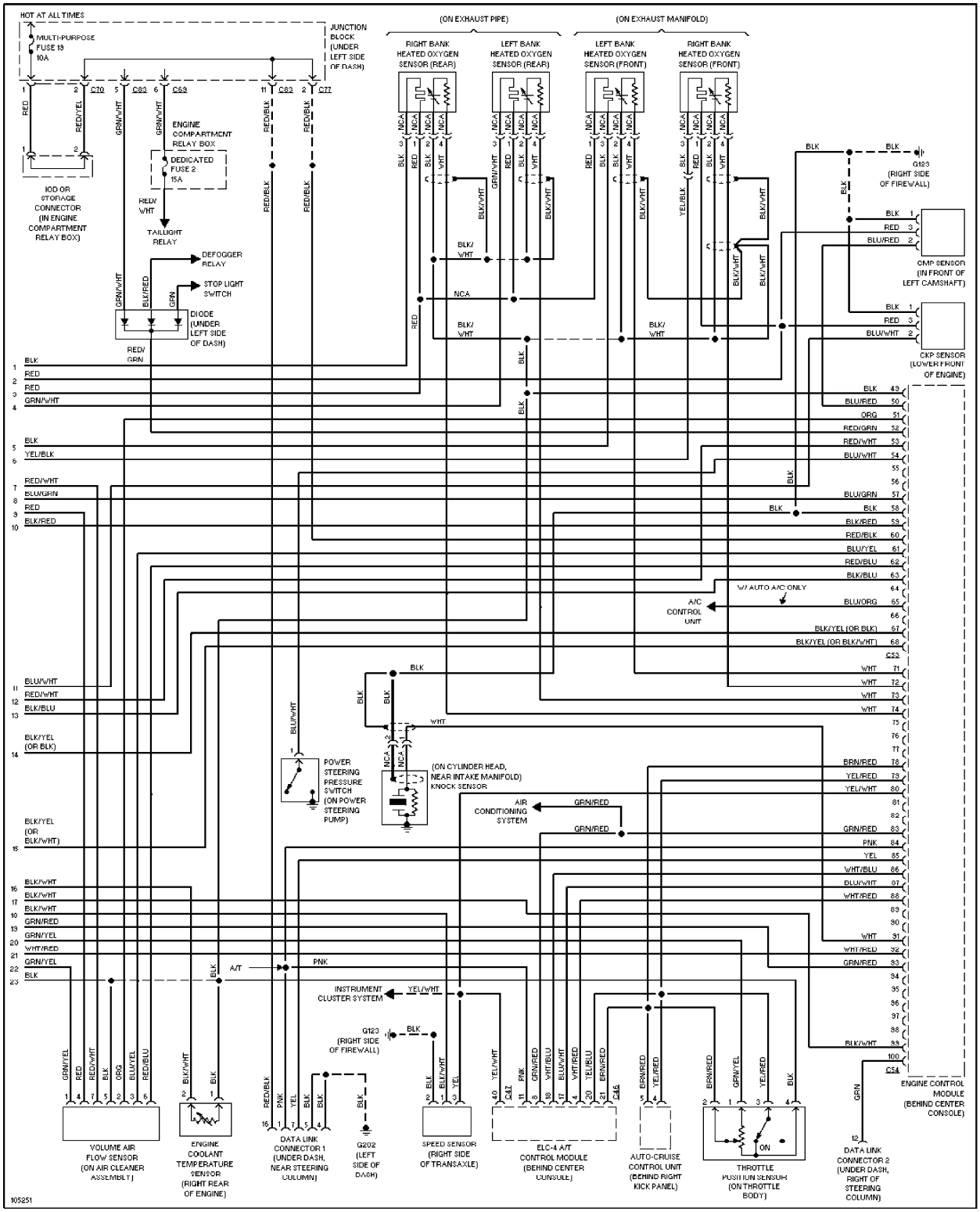


Fig. 39: Wiring Diagram (3000GT 3.0L DOHC - 3 Of 3)

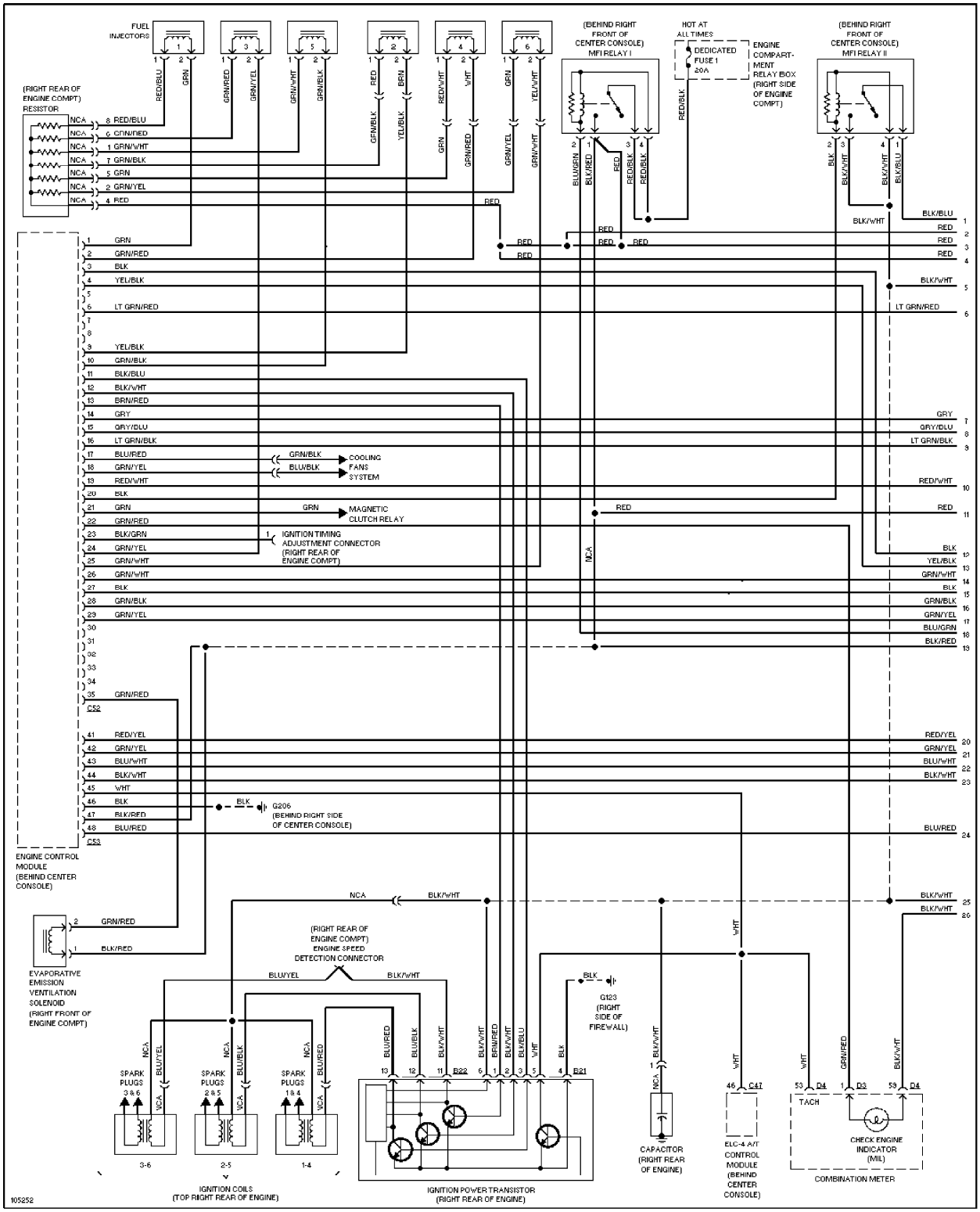


Fig. 40: Wiring Diagram (3000GT 3.0L DOHC Turbo - 1 Of 3)

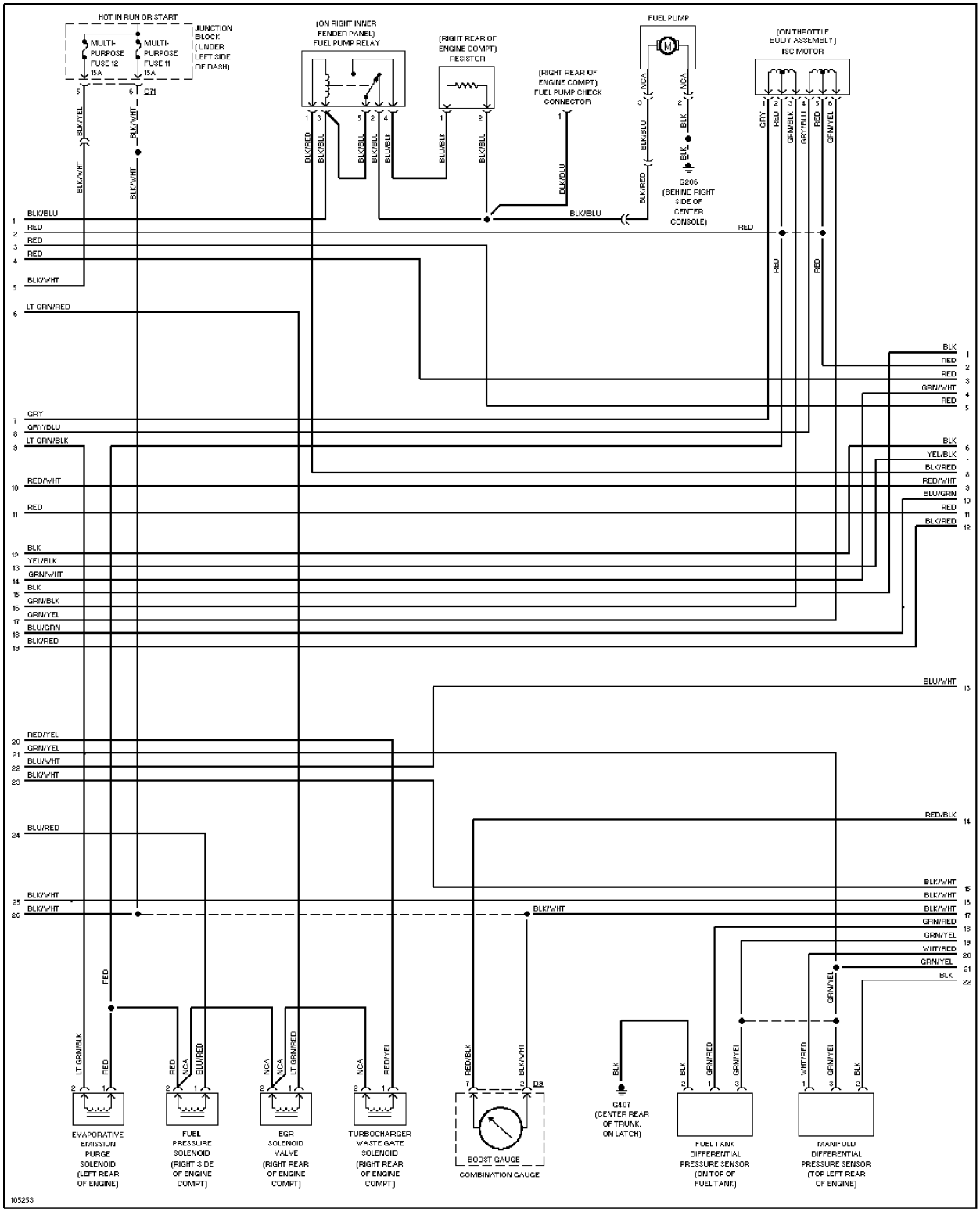


Fig. 41: Wiring Diagram (3000GT 3.0L DOHC Turbo - 2 Of 3)

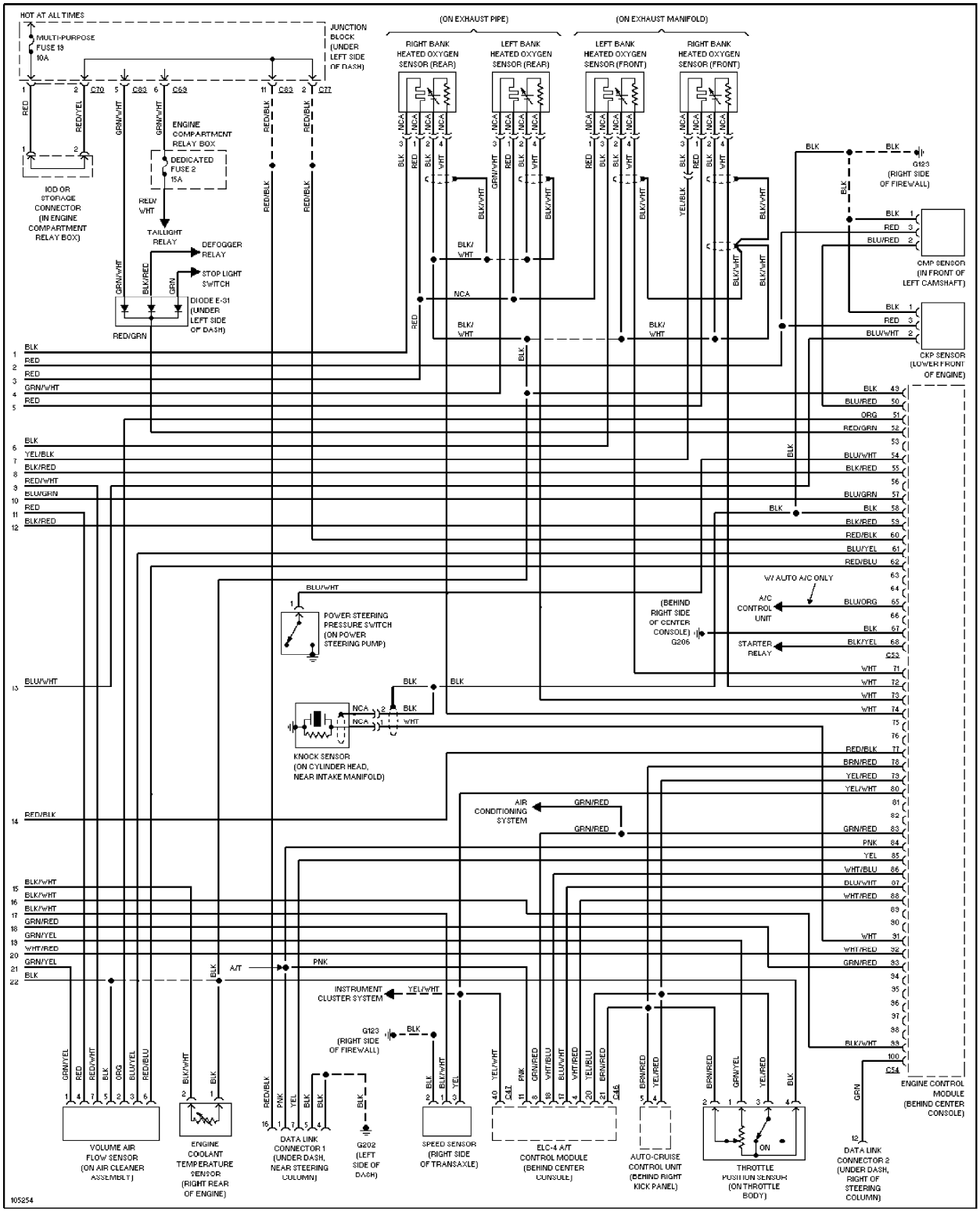


Fig. 42: Wiring Diagram (3000GT 3.0L DOHC Turbo - 3 Of 3)

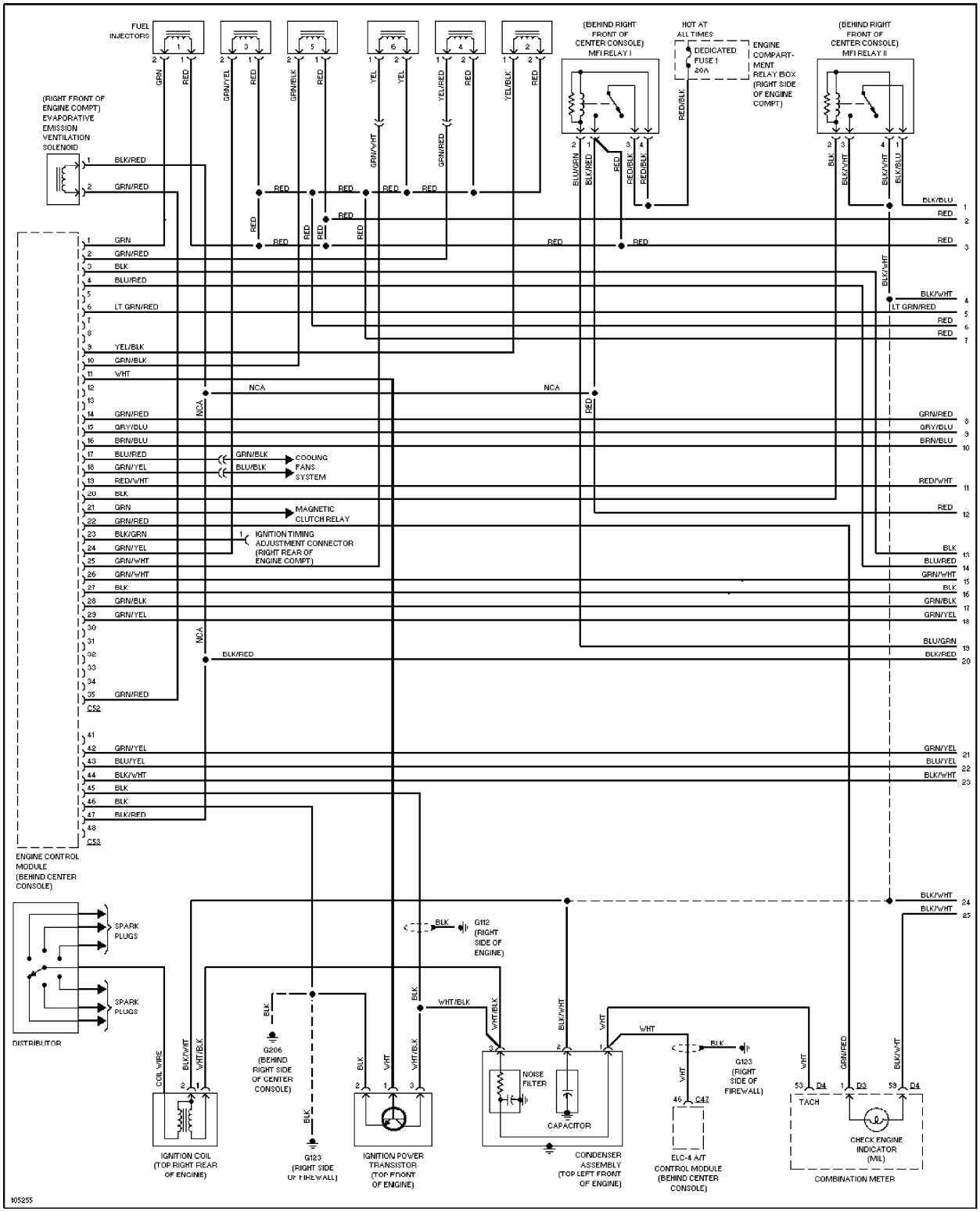


Fig. 43: Wiring Diagram (3000GT 3.0L SOHC - 1 Of 3)

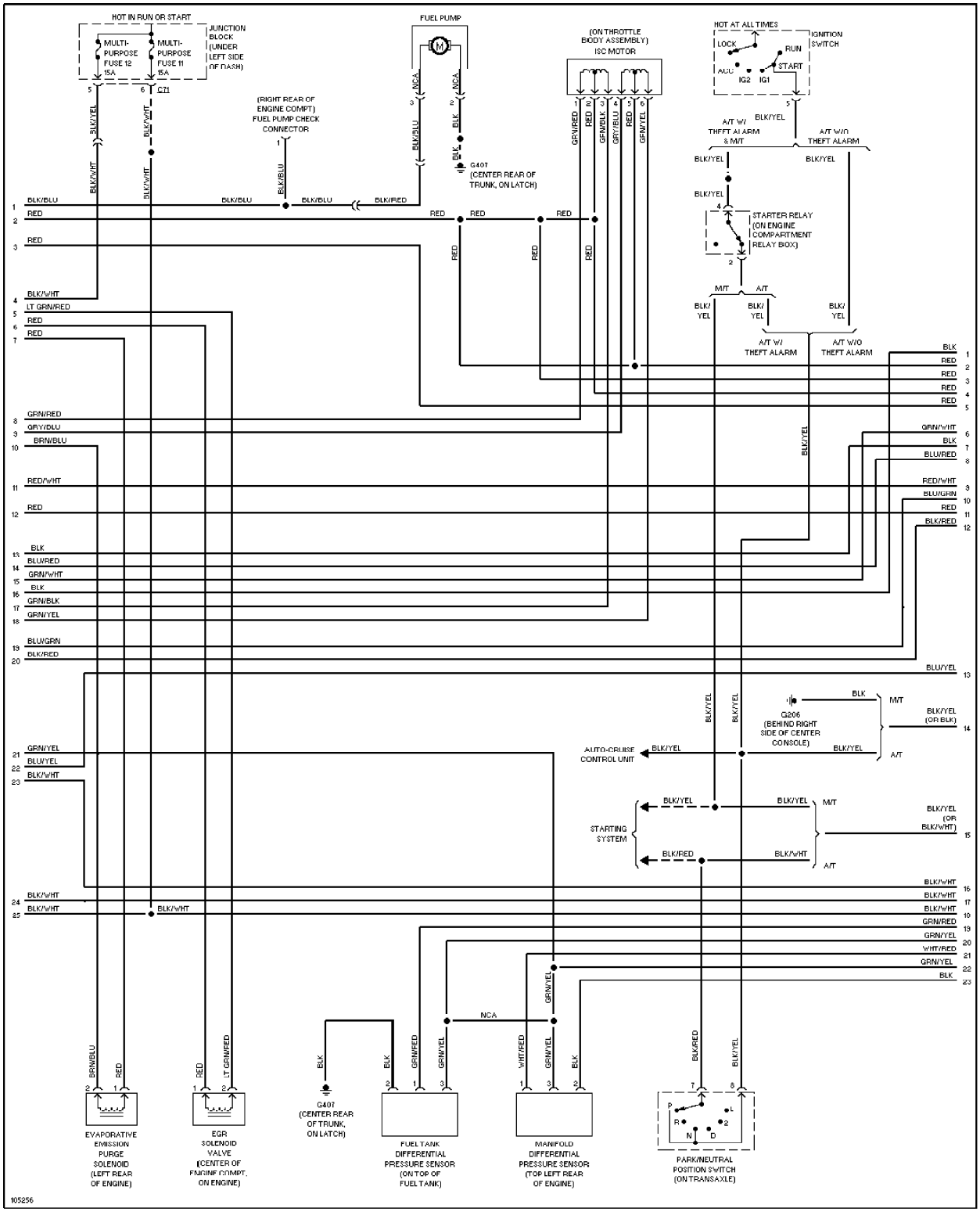


Fig. 44: Wiring Diagram (3000GT 3.0L SOHC - 2 Of 3)

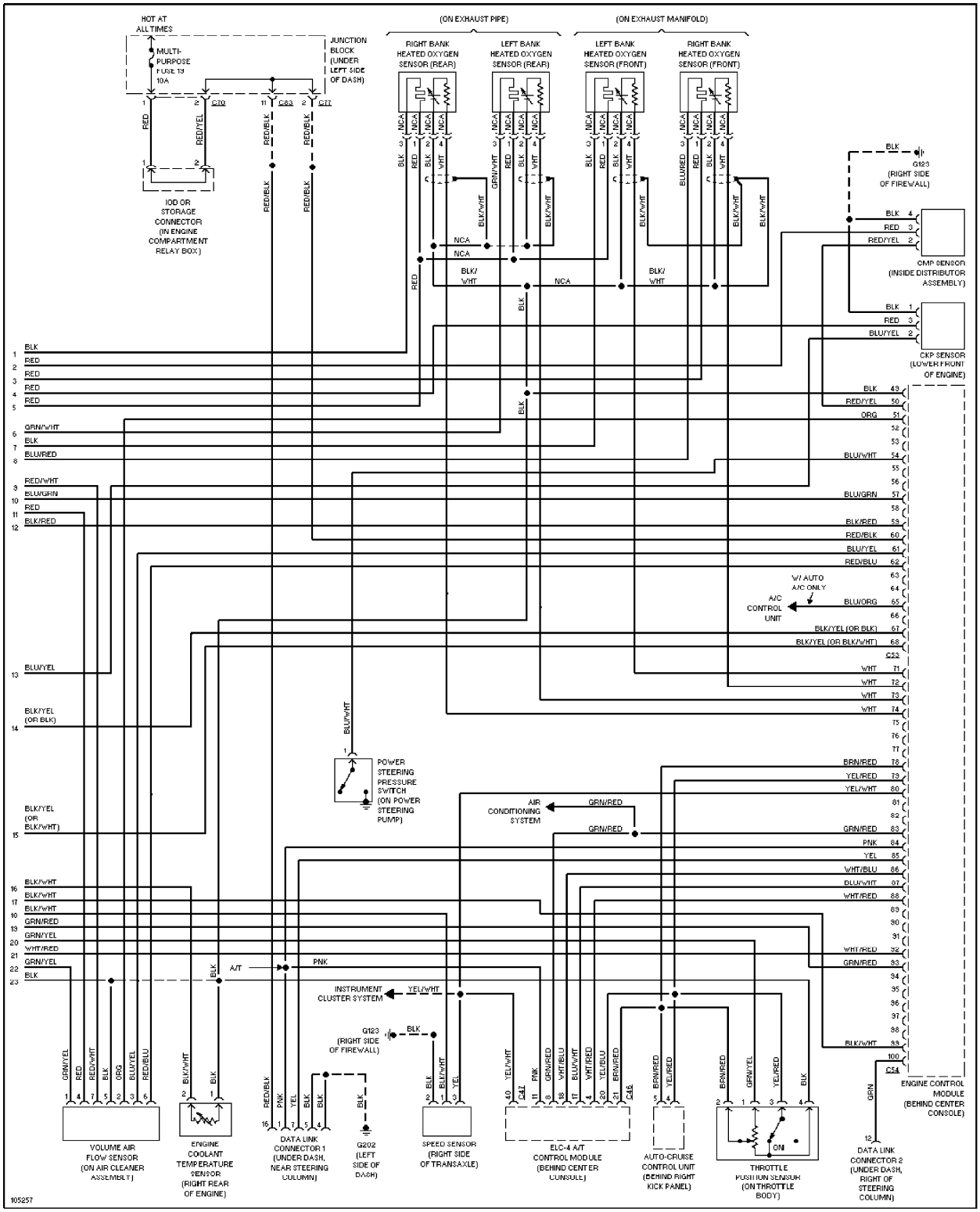


Fig. 45: Wiring Diagram (3000GT 3.0L SOHC - 3 Of 3)

MAINTENANCE INFORMATION

1998 Mitsubishi Galant

1997-98 MAINTENANCE
Mitsubishi Maintenance Information

Galant

* PLEASE READ THIS FIRST *

NOTE: For scheduled maintenance intervals and the related fluid capacities, fluid specifications and labor times for major service intervals, see SCHEDULED SERVICES article below:

* SCHEDULED SERVICES - 1997

Warranty information and specifications for fluid capacities, lubrication specifications, wheel and tire size, and battery type are covered in this article.

MODEL IDENTIFICATION

VIN LOCATION

The Vehicle Identification Number (VIN) is located on the left side of the dash panel at the base of the windshield. The VIN chart explains the code characters.

VIN CODE ID EXPLANATION

Numbers preceding the explanations in the legend below refer to the sequence of characters as listed on VIN identification label. See VIN example below.

(VIN)	J	A	3	B	B	4	6	L	1	H	Y	7	0	0	0	0	1
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17

1 - Manufacturing Country
- J * Japan
- 4 * USA

2 - Manufacturer
- A * Mitsubishi Motor Corp

3 - Vehicle Type
- 3 * Passenger Car

4 - Restraint System
- A * Driver and Passenger Air Bags

5 - Vehicle Line
- J * Galant

6 - Vehicle Series
- 4 * High
- 5 * Premium

7 - Body Type
- 6 * 4-Door Sedan

8 - Engine Type
  G * 2.4L 4-Cylinder SOHC MFI

9 - VIN Check Digit
     * 1 Through 9 Or X

10 - Vehicle Model Year
  V * 1997

11 - Assembly Plant
  E * DSM Plant, Normal Illinois USA

12-17 - Serial Number (1986-96)
     * Sequential Production Number

MAINTENANCE SERVICE INFORMATION

SEVERE & NORMAL SERVICE DEFINITIONS

NOTE: Use the Severe Service schedule if the vehicle to be serviced is operated under ANY (one or more) of these conditions:

Service is recommended at mileage intervals based on vehicle operation. Service schedules are based on the following primary operating conditions:

Normal Service

* Driven More Than 10 Miles Daily
* No Operating Conditions From Severe Service Schedule

Severe Service (Unique Driving Conditions)

* Driving In Dusty Conditions
* Towing A Trailer, Police, Taxi, Or Commercial Type Operation
* Extensive Idling, Driving In Stop And Go Traffic
* Short-Trip Operation At Freezing Temperatures (Engine Not Thoroughly Warmed Up)
* Driving In Sandy Areas
* Driving In Salty Areas
* More Than 50% Operation In Heavy City Traffic Or At Sustained High Speeds During Hot Weather Above 90°F (32°C)
* Driving On Off-Road

CAMSHAFT TIMING BELT

Replace the camshaft timing belt every 60,000 miles. It is recommended that the timing belt be inspected every 30,000 miles after replacement.

CAUTION: Failure to replace a faulty camshaft timing belt may result in serious engine damage.

The condition of camshaft drive belts should always be checked on vehicles which have more than 50,000 miles. Although some manufacturers do not recommend belt replacement at a specified mileage, others require it at 60,000-100,000 miles. A camshaft drive belt failure may cause extensive damage to internal engine components on most engines, although some designs do not allow piston-to-valve contact. These designs are often called "Free Wheeling".
Many manufacturers changed their maintenance and warranty

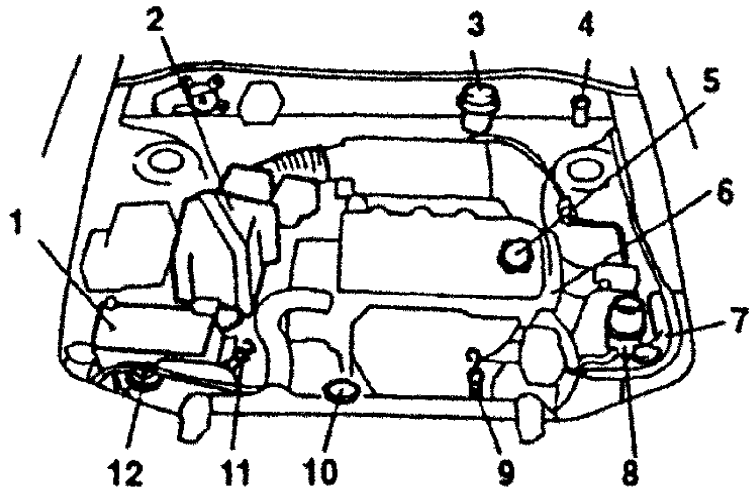
schedules in the mid-1980's to reflect timing belt inspection and/or replacement at 50,000-60,000 miles. Most service interval schedules in this manual reflect these changes.

Belts or components should be inspected and replaced if any of the following conditions exist:

* Cracks Or Tears In Belt Surface
* Missing, Damaged, Cracked Or Rounded Teeth
* Oil Contamination
* Damaged Or Faulty Tensioners
* Incorrect Tension Adjustment

SERVICE POINT LOCATIONS

2.4 liter



1- Battery
2- Air cleaner element
3- Brake fluid reservoir
4- Clutch fluid reservoir
5- Engine oil filler cap
6- Drive belt
7- Windshield washer reservoir
8- Power steering fluid reservoir
9- Engine oil level dipstick
10- Radiator cap
11- Automatic transaxle fluid level dipstick
12- Engine coolant reservoir

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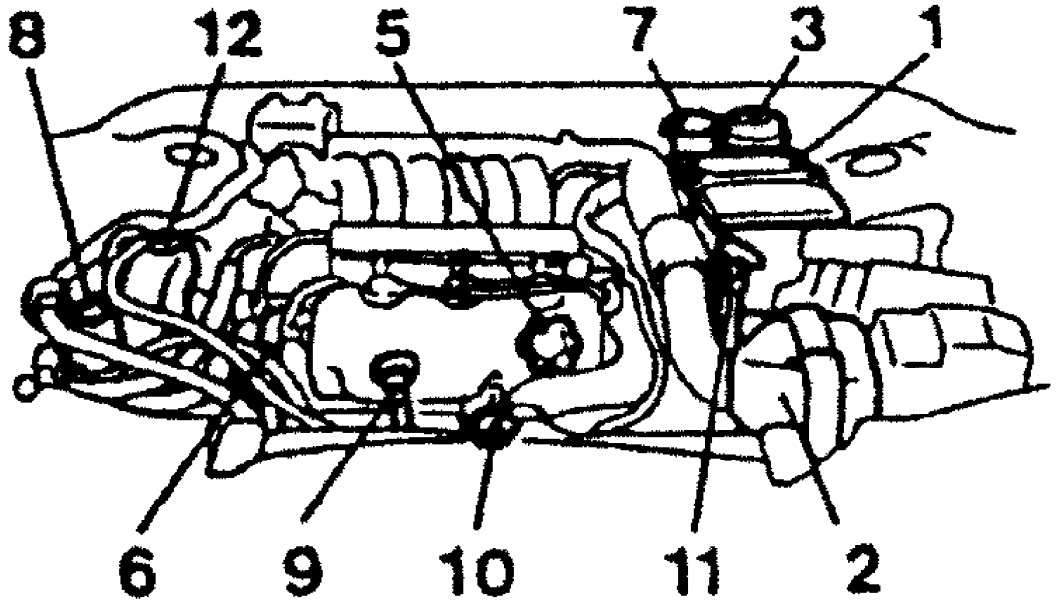
Fig. 1: Service Point Locations (2.4L)
Courtesy of Mitsubishi Motor Sales of America.

2.5 liter



1- Battery
2- Air cleaner element
3- Brake fluid reservoir
4- Clutch fluid reservoir
5- Engine oil filler cap
6- Drive belt
7- Windshield washer reservoir
8- Power steering fluid reservoir
9- Engine oil level dipstick
10- Radiator cap
11- Automatic transaxle fluid level dipstick
12- Engine coolant reservoir

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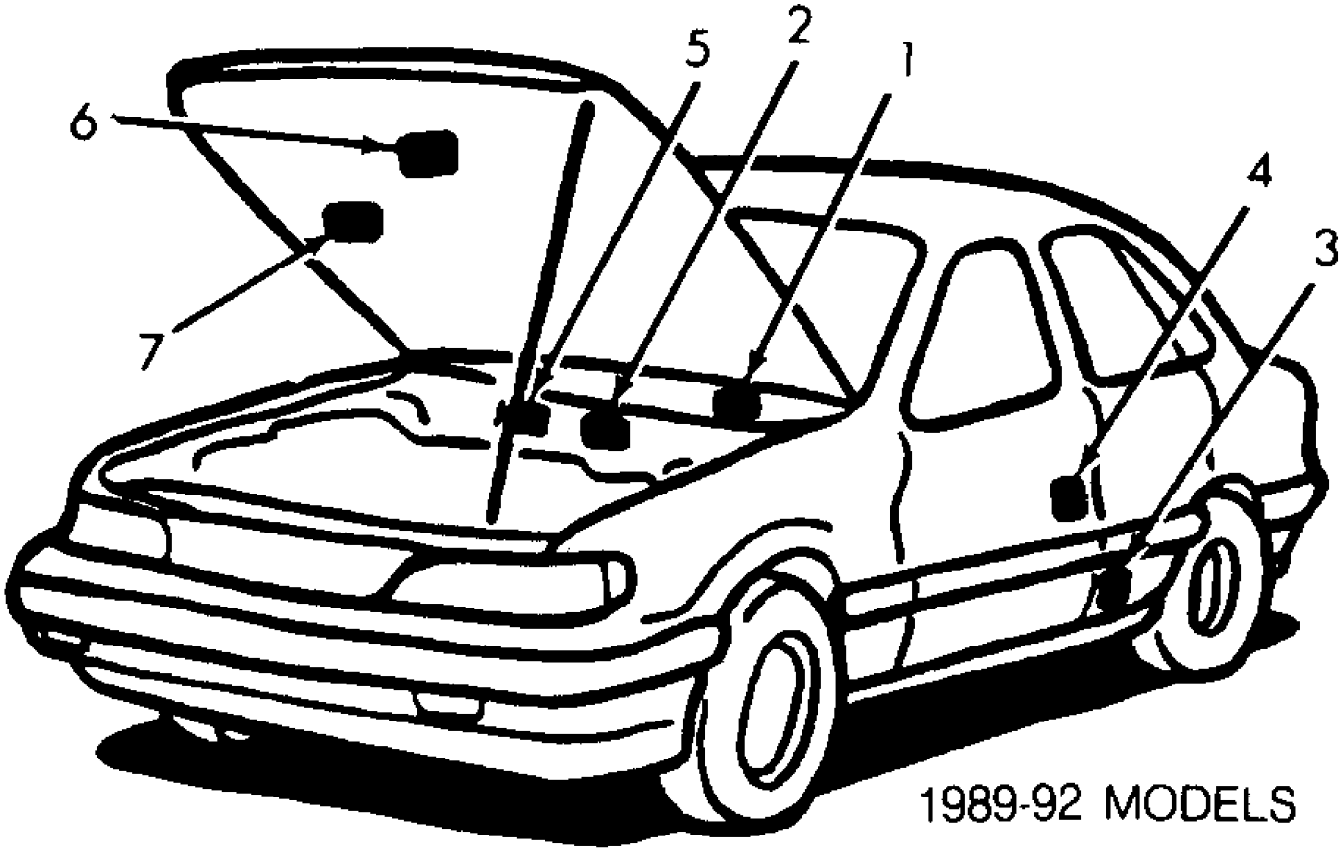
Fig. 2: Service Point Locations (2.5L)
Courtesy of Mitsubishi Motor Sales of America.

INFORMATION LABEL LOCATIONS



1. Vehicle Identification Number (VIN) Plate
2. Chassis Number
3. Certification Label
4. Tire Inflation Pressure Label
5. Vehicle Information Code Plate
6. Vehicle Emission Control Information Label
7. Service Points Label

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Fig. 3: Information Label Locations (1989-92 Models)
Courtesy of Mitsubishi Motor Sales of America.

LUBRICATION SPECIFICATIONS

LUBRICATION SPECIFICATIONS TABLE

Material	Condition	Specification
Engine Oil (1)	Ambient Temperature Less Than 0°F (-18°C) To 100°F (38°C)	SAE 5W-30
	Ambient Temperature Above 0°F (-18°C) To Over 100°F (38°C)	SAE 10W-30
Power	All	Automatic Transmission

Steering Fluid		Fluid DEXRON II
Engine Coolant	All	50/50 Mixture Of Distilled Water & Ethylene Glycol
Manual Transaxle	All	API Classification GL-4 SAE 75W-85W Or 75W-90
Automatic Transaxle	All	DIAMOND ATF SP II Or Equivalent
Brake Fluid	All	Conforming To DOT 3 Or DOT 4
Clutch Fluid	All	Conforming To DOT 3 Or DOT 4
Transaxle Linkage, Parking Brake Cable Mechan-ism, Hood Lock & Hook, Door Latches Seat Adjusters	All	Multipurpose Grease NLGI Grade 2
Door Hinges, Deck Lid Hinges	All	Engine Oil
A/C Refrigerant	All	HFC-134a
(1) - SAE 5W-30 engine oil is preferred. SAE 10W-30 may be used if the Ambient Temperature is above 0° F (-18° C).		

FLUID CAPACITIES

FLUID CAPACITIES TABLE (1)

Item	Condition	Specification
Engine Oil	Oil Pan	4.2 Qts. (4.0L)
	Oil Filter	0.32 Qts. (0.3L)
Engine Coolant	Drained; With Reserve Tank	8.1 Qts. (6.7L)
Manual Transaxle	Drained	2.1 Qts. (2.0L)
Automatic Transaxle	2.4L: Drained	6.3 Qts. (6.0L)
	2.5L: Drained	9.1 Qts. (8.6L)
Power	Drained	1.0 Qts. (0.9L)

Steering		
A/C Refrigerant	Drained	680 g
Fuel Tank	Capacity	16.9 gal (64L)

(1) - Capacities are recommended or calculated levels. Always use dipstick to measure level.

WHEEL & TIRE SPECIFICATIONS

SERVICE INFORMATION

Tire specifications are imprinted on the tire side wall. The recommended cold tire inflation pressures are listed on a label attached to the rear face of the driver's door.

CAUTION: DO NOT mix tires of different design such as radial ply with bias or bias-belted tires. Mixing tire types will adversely affect road handling and may lead to loss of vehicle control. DO NOT use tire chains on rear wheels.

TIRE & WHEEL SPECIFICATIONS TABLE

Wheel Size	Tire Size
Standard	
14 x 5.5JJ (Steel)	P185/70 R14 87H
15 x 6JJ (Aluminum)	P195/60 R15 88H
15 x 6JJ (Aluminum)	P205/60 R15 90H
Spare	
15 x 4T (Steel)	T125/70 D15

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS TABLE

Wheel Type	Ft. Lbs. (N.m.)
Steel & Aluminum	65-80 (90-110)

BATTERY SPECIFICATIONS

CAUTION: When battery is disconnected, vehicles equipped with computers may lose memory data. When battery power is restored, driveability problems may exist on some vehicles. These vehicles may require a relearn procedure. See COMPUTER RELEARN PROCEDURES article in the GENERAL INFORMATION Section.

CAUTIONS & WARNINGS

SUPPLEMENTAL RESTRAINT SYSTEM (AIR BAG)

NOTE: See the AIR BAGS article in the ACCESSORIES/SAFETY EQUIPMENT Section.

Modifications or improper maintenance, including incorrect removal and installation of the Supplemental Restraint System (SRS), can adversely affect system performance. DO NOT cover, obstruct or change the steering wheel horn pad in any way, as such action could cause improper function of the system. Use only plain water when cleaning the horn pad. Solvents or cleaners could adversely affect the air bag cover and cause improper deployment of the system.

WARNING: Service on or around Air Bag System Components or Wiring must be preformed only by an authorized Suzuki dealer. Please observe all WARNINGS and SERVICE PRECAUTIONS.

WARNING: Technical service work must be started at least 90 seconds after the ignition switch is turned to the LOCK position and the cable is disconnected from the battery.

WARNING: Never attempt to disassemble or repair the passenger air bag (inflator) module. If any abnormality is found, be sure to replace it with new one as an assembly.

WARNING: To avoid injury from accidental air bag deployment, read and carefully follow all warnings and service precautions. See appropriate AIR BAG RESTRAINT SYSTEM article in the ACCESSORIES/SAFETY EQUIPMENT section.

CAUTION: Disconnect negative battery cable before servicing any air bag system, steering column or passenger side dash component. After any repair, turn ignition key to the ON position from passenger's side of vehicle in case of accidental air bag inflation

AIR CONDITIONING SERVICING

WARNING: Avoid breathing R-134a refrigerant and PAG lubricant vapors, exposure may irritate eyes, nose and throat. To remove R-134a from system use R-134a recycling equipment that meets SAE J2210 specifications. If accidental system discharge occurs, ventilate work area before resuming service.

WARNING: R-134a service equipment or vehicle A/C systems SHOULD NOT be pressure tested or leak tested with compressed air. Some mixtures of air/R134a have shown to be combustible at elevated pressures. These mixtures are dangerous and may cause fire and/or explosions. See AIR CONDITIONING SERVICE article in GENERAL INFORMATION section.

AIR CLEANER FILTER

WARNING: Operating the engine with the air cleaner off can cause you or others to be burned. The air cleaner not only cleans the air, it stops flame if the engine backfires. Do not drive with it off, and be careful working on the engine with the air cleaner off.

ANTI-LOCK BRAKE SYSTEM

The anti-lock brake system contains electronic equipment that can be susceptible to interference caused by improperly installed or high output radio transmitting equipment. Since this interference could cause the possible loss of the anti-lock braking capability,

such equipment should be installed by qualified professionals.

On models equipped with anti-lock brake systems, ALWAYS observe the following cautions:

* DO NOT attempt to bleed hydraulic system without first referring to the appropriate ANTI-LOCK BRAKE SYSTEM article in the BRAKES Section.
* DO NOT mix tire sizes. As long as tires remain close to the original diameter, increasing the width is acceptable. Rolling diameter must be identical for all 4 tires. Some manufacturers recommend tires of the same brand, style and type. Failure to follow this precaution may cause inaccurate wheel speed readings.
* Use ONLY recommended brake fluids. DO NOT use silicone brake fluids in an ABS-equipped vehicle.

ALL-WHEEL DRIVE (AWD) OPERATION

AWD vehicles are not designed for off-road use and are unsuitable for driving on bumpy ground that may cause excessive strain. AWD vehicles should be driven only under the same conditions suitable for FWD vehicles.

AUTOMATIC TRANSAXLE SERVICE

WARNING: Make certain that no fluid is spilled when the transaxle fluid is inspected, or when fluid is added soon after driving (since the engine is hot). If the fluid spills onto the exhaust manifold, there is danger of fire.

BATTERY SERVICE

WARNING: When battery is disconnected, vehicles equipped with computers may lose memory data. When battery power is restored, driveability problems may exist on some vehicles. These vehicles may require a relearn procedure. See COMPUTER RELEARN PROCEDURES article in GENERAL INFORMATION section.

WARNING: Batteries produce flammable hydrogen gas. Keep flames and sparks away from the battery or and explosion may occur. Never smoke when working in the vicinity of the battery.

WARNING: When checking or servicing the battery, disconnect the negative cable. Be careful not to cause a short circuit by allowing metal objects to contact the battery posts and the vehicle at the same time.

CAUTION: Never disconnect the battery while the engine is running; doing so could damage the car’s electrical components.

REPLACING BLOWN FUSES

Before replacing a blown fuse, remove ignition key, turn off all lights and accessories to avoid damaging the electrical system. Be sure to use fuse with the correct indicated amperage rating. The use of an incorrect amperage rating fuse may result in a dangerous electrical system overload.

BRAKE PAD WEAR INDICATOR

Indicator will cause a squealing or scraping noise, warning

that brake pads need replacement.

BRAKE FLUID

WARNING: DO NOT use reclaimed fluid or fluid that has been stored in old or open containers. It is essential that foreign particles and other liquids are kept out of the brake fluid reservoir.

CATALYTIC CONVERTER

Continued operation of vehicle with a severe malfunction could cause converter to overheat, resulting in possible damage to converter and vehicle.

ENGINE COOLANT SERVICE

WARNING: To avoid the danger of being scalded never change the coolant when the engine is hot.

WARNING: Never remove the radiator cap when the engine is hot Serious burns could be caused by high pressure fluid escaping from the radiator.

CAUTION: When adding or replacing engine coolant, use a high quality ethylene glycol antifreeze diluted with 50% distilled water. When putting the cap on the reserve tank, line up the arrow on the cap and the arrow on the tank, or coolant can leak out

ENGINE DRIVE BELT SERVICE

WARNING: Be sure the ignition key is OFF. The engine could rotate unexpectedly.

ENGINE OIL

WARNING: The engine oil may be high enough to burn your fingers when the drain plug is loosened. Wait until the drain plug is cool enough to touch with you bare hands.

WARNING: Continuous contact with used engine oil has been found to cause skin cancer in laboratory animals. Brief contact with used engine oil may irritate skin. To minimize your exposure to used oil, wear a long sleeve shirt and moisture-proof gloves when changing oil. If oil contacts your skin, wash thoroughly with soap and water.

CAUTION: Never use non-detergent or straight mineral oil.

FUEL SYSTEM SERVICE

WARNING: Relieve fuel system pressure prior to servicing any fuel system component (fuel injection models).

HALOGEN BULBS

WARNING: Halogen bulbs contain pressurized gas which may explode if overheated. DO NOT touch glass portion of bulb with bare hands. Eye protection should be worn when handling or working around halogen bulbs.

RADIATOR CAP

CAUTION: Always disconnect the fan motor when working near the radiator fan. The fan is temperature controlled and could start at any time even when the ignition key is in the OFF position. DO NOT loosen or remove radiator cap when cooling system is hot.

RADIATOR FAN

WARNING: Keep hands away from radiator fan. Fan is controlled by a thermostatic switch which may come on or run for up to 15 minutes even after engine is turned off.

WARRANTY INFORMATION

CAUTION: Due to the different warranties offered in various regions and the variety of after-market extended warranties available, please refer to the warranty package that came with the vehicle to verify all warranty options.

FUSES & CIRCUIT BREAKERS

FUSE PANEL LOCATION

The fuse block is located under the instrument panel on the driver's side. If a fuse is blown, locate the cause before replacing the fuse. Spare fuses are contained in the fuse block.

FUSE PANEL IDENTIFICATION

Fuse & Circuit Breaker Identification

PASSENGER COMPARTMENT

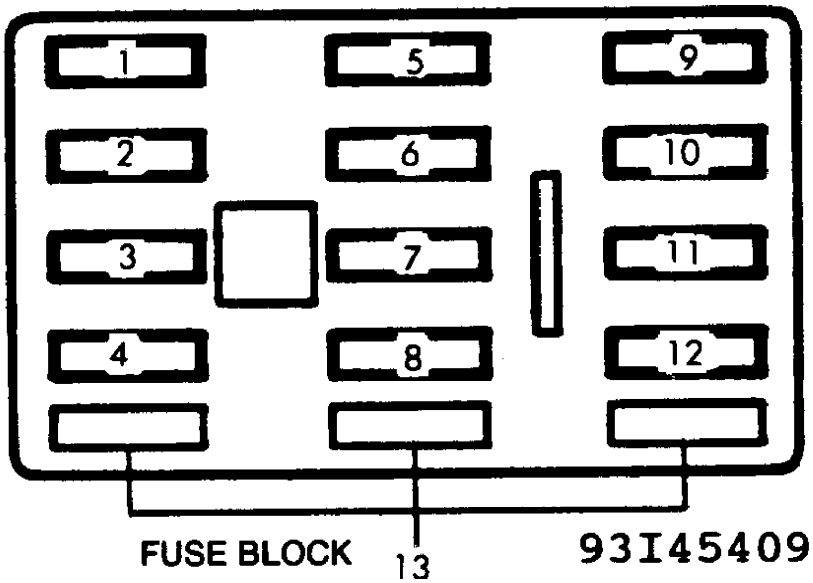

Fig. 4: Passenger Compartment Fuse Box
Courtesy of Mitsubishi Motor Sales of America.

1 - 15 Amp
Stoplights

2 - 10 Amp
Turn Signals
3 - 10 Amp
Backup Lights
4 - 30 Amp
Heater
5 - 15 Amp
Wiper
6 - 10 Amp
Meters
7 - 30 Amp
Rear Window Defogger
8 - 20 Amp
Sunroof
9 - 10 Amp
4 A/T
10 - 15 Amp
Cigarette Lighter
11 - 10 Amp
Heater Relay
12 - 10 Amp
Horn
13 - Spare Fuses

Engine COMPARTMENT 2.4L

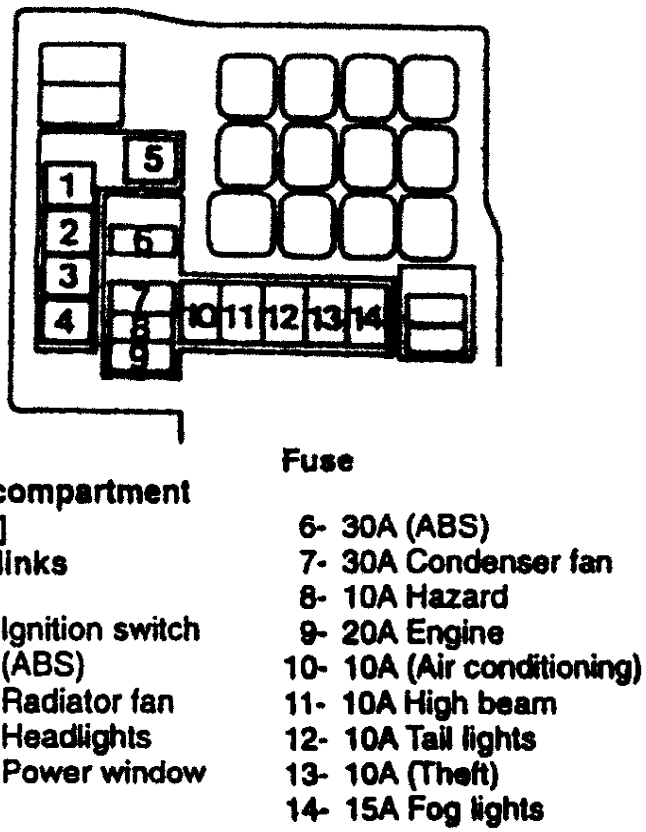

Fig. 5: Engine Compartment Fuse & Fusible Links (2.4L)
Courtesy of Mitsubishi Motor Sales of America.

1 - 30 Amp
Ignition Switch

2 - 50 Amp
ABS
3 - 30 Amp
Radiator Fan
4 - 40 Amp
Headlights
5 - 30 Amp
Power Window
6 - 30 Amp
ABS
7 - 30 Amp
Condenser Fan
8 - 10 Amp
Hazard
9 - 20 Amp
Engine
10 - 10 Amp
Air Conditioning
11 - 10 Amp
High Beam
12 - 10 Amp
Tail Lights
13 - 10 Amp
Theft
14 - 15 Amp
Fog Lights

ENGINE COMPARTMENT 2.5L

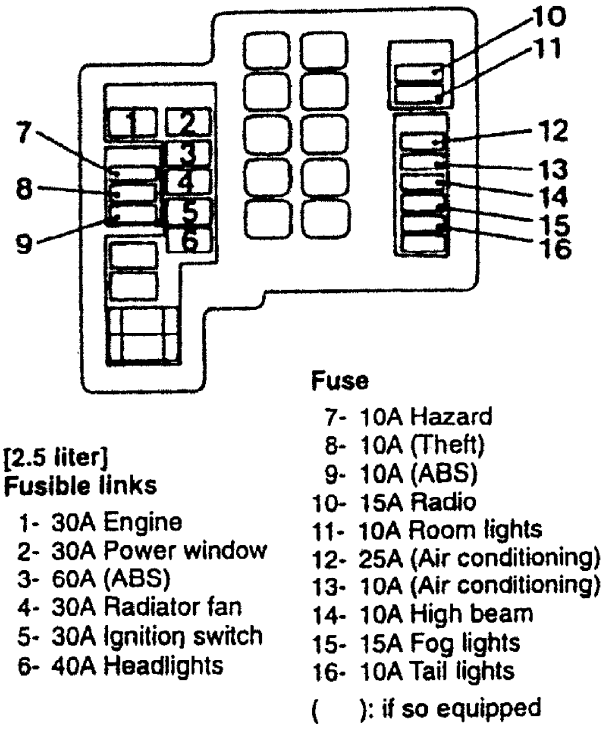

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Fig. 6: Engine Compartment Fusible Links
Courtesy of Mitsubishi Motor Sales of America.

1 - 30 Amp
Engine

2 - 30 Amp
Power Window
3 - 60 Amp
ABS
4 - 30 Amp
Radiator Fan
5 - 30 Amp
Ignition Switch
6 - 40 Amp
Headlights
7 - 10 Amp
Hazard
8 - 10 Amp
Theft
9 - 10 Amp
ABS
10 - 15 Amp
Radio
11 - 10 Amp
Room Lights
12 - 25 Amp
Air Conditioning
13 - 10 Amp
Air Conditioning
14 - 10 Amp
High Beam
15 - 15 Amp
Fog Lights
16 - 10 Amp
Tail Lights

METRIC CONVERSIONS

1998 Mitsubishi Galant

GENERAL INFORMATION

METRIC CONVERSIONS

METRIC CONVERSIONS

Metric conversions are making life more difficult for the mechanic. In addition to doubling the number of tools required, metric-dimensioned nuts and bolts are used alongside English components in many new vehicles. The mechanic has to decide which tool to use, slowing down the job. The tool problem can be solved by trial and error, but some metric conversions aren't so simple. Converting temperature, lengths or volumes requires a calculator and conversion charts, or else a very nimble mind. Conversion charts are only part of the answer though, because they don't help you "think" metric, or "visualize" what you are converting. The following examples are intended to help you "see" metric sizes:

LENGTH

Meters are the standard unit of length in the metric system. The smaller units are 10ths (decimeter), 100ths (centimeter), and 1000ths (millimeter) of a meter. These common examples might help you to visualize the metric units:

* A meter is slightly longer than a yard (about 40 inches).
* An aspirin tablet is about one centimeter across (.4 inches).
* A millimeter is about the thickness of a dime.

VOLUME

Cubic meters and centimeters are used to measure volume, just as we normally think of cubic feet and inches. Liquid volume measurements include the liter and milliliter, like the English quarts or ounces.

* One teaspoon is about 4 cubic centimeters.
* A liter is about one quart.
* A liter is about 61 cubic inches.

WEIGHT

The metric weight system is based on the gram, with the most common unit being the kilogram (1000 grams). Our comparable units are ounces and pounds:

* A kilogram is about 2.2 pounds.
* An ounce is about 28 grams.

TORQUE

Torque is somewhat complicated. The term describes the amount of effort exerted to turn something. A chosen unit of weight or force is applied to a lever of standard length. The resulting leverage is called torque. In our standard system, we use the weight of one pound applied to a lever a foot long, resulting in the unit called a foot-pound. A smaller unit is the inch-pound (the lever is one inch long).

Metric units include the meter kilogram (lever one meter long with a kilogram of weight applied) and the Newton-meter (lever one

meter long with force of one Newton applied). Some conversions are:

* A meter kilogram is about 7.2 foot pounds.
* A foot pound is about 1.4 Newton-meters.
* A centimeter kilogram (cmkg) is equal to .9 inch pounds.

PRESSURE

Pressure is another complicated measurement. Pressure is described as a force or weight applied to a given area. Our common unit is pounds per square inch. Metric units can be expressed in several ways. One is the kilogram per square centimeter (kg/cm^2). Another unit of pressure is the Pascal (force of one Newton on an area of one square meter), which equals about 4 ounces on a square yard. Since this is a very small amount of pressure, we usually see the kiloPascal, or kPa (1000 Pascals). Another common automotive term for pressure is the bar (used by German manufacturers), which equals 10 Pascals. Thoroughly confused? Try the examples below:

* Atmospheric pressure at sea level is about 14.7 psi.
* Atmospheric pressure at sea level is about 1 bar.
* Atmospheric pressure at sea level is about 1 kg/cm^2.
* One pound per square inch is about 7 kPa.

CONVERSION FACTORS

CONVERSION FACTORS

TO CONVERT	TO	MULTIPLY BY
LENGTH		
Millimeters (mm)	Inches	.03937
Inches	Millimeters	25.4
Meters (M)	Feet	3.28084
Feet	Meters	.3048
Kilometers(Km)	Miles	.62137
AREA		
Square Centimeters (cm^2)	Square Inches	.155
Square Inches	Square Centimeters	6.45159
VOLUME		
Cubic Centimeters	Cubic Inches	.06103
Cubic Inches	Cubic Centimeters	16.38703
Liters	Cubic Inches	61.025
Cubic Inches	Liters	.01639
Liters	Quarts	1.05672
Quarts	Liters	.94633
Liters	Pints	2.11344
Pints	Liters	.47317
Liters	Ounces	33.81497
Ounces	Liters	.02957
WEIGHT		
Grams	Ounces	.03527
Ounces	Grams	28.34953
Kilograms	Pounds	2.20462
Pounds	Kilograms	.45359
WORK		
Centimeter Kilograms	Inch Pounds	.8676
Pounds/Sq. Inch	Kilograms/Sq.Centimeter	.07031
Bar	Pounds/Sq. Inch	14.504

Pounds/Sq. Inch	Bar	.06895
Atmosphere	Pounds/Sq. Inch	14.696
Pounds/Sq. Inch	Atmosphere	.06805
TEMPERATURE		
Centigrade Degrees	Fahrenheit Degrees	(°Cx(9)/5)+32
Fahrenheit Degrees	Centigrade Degrees	(°F-32)x(5)/9

CONVERSION FACTORS (Cont.)

INCHES	DECIMALS	mm
1/64	.016	.397
1/32	.031	.794
3/64	.047	1.191
1/16	.063	1.588
5/64	.078	1.984
3/32	.094	2.381
7/64	.109	2.778
1/8	.125	3.175
9/64	.141	3.572
5/32	.156	3.969
11/64	.172	4.366
3/16	.188	4.763
13/64	.203	5.159
7/32	.219	5.556
15/64	.234	5.953
1/4	.250	6.350
17/64	.266	6.747
9/32	.281	7.144
19/64	.297	7.541
5/16	.313	7.938
21/64	.328	8.334
11/32	.344	8.731
23/64	.359	9.128
3/8	.375	9.525
25/64	.391	9.992
13/32	.406	10.319
27/64	.422	10.716
7/16	.438	11.113
29/64	.453	11.509
15/32	.469	11.906
31/64	.484	12.303
1/2	.500	12.700
33/64	.516	13.097
17/32	.531	13.494
35/64	.547	13.891
9/16	.563	14.288
37/64	.578	14.684
19/32	.594	15.081
39/64	.609	15.478
5/8	.625	15.875
41/64	.641	16.272
21/32	.656	16.669
43/64	.672	17.066
11/16	.687	17.463
45/64	.703	17.859
23/32	.719	18.256
47/64	.734	18.653
3/4	.750	19.050
49/64	.766	19.447

25/32	.....	.781	.....	19.844
51/64	.....	.797	.....	20.241
13/16	.....	.813	.....	20.638
53/64	.....	.828	.....	21.034
27/32	.....	.844	.....	21.431
55/64	.....	.859	.....	21.828
7/8	.....	.875	.....	22.225
57/64	.....	.891	.....	22.622
29/32	.....	.906	.....	23.019
59/64	.....	.922	.....	23.416
15/16	.....	.938	.....	23.813
61/64	.....	.953	.....	24.209
31/32	.....	.969	.....	24.606
63/64	.....	.984	.....	25.003
1	.....	1.000	.....	25.400

MIRRORS - POWER

1998 Mitsubishi Galant

1998 ACCESSORIES & EQUIPMENT
Mitsubishi - Power Mirrors

Eclipse, Galant, Mirage, Montero, Montero Sport, 3000GT

DESCRIPTION & OPERATION

Electric remote control mirrors are controlled by a dual-control switch mounted on driver's door, dash or center console depending on model. Left/right switch directs current to desired mirror. Horizontal/vertical switch directs current to electric motor in mirror assembly, controlling up/down and left/right adjustment. Heated mirrors are controlled by defogger relay.

TROUBLE SHOOTING

POWER MIRRORS INOPERATIVE

Check for faulty fuse, faulty power mirror switch or faulty power mirror motor. See POWER MIRROR FUSE IDENTIFICATION table.

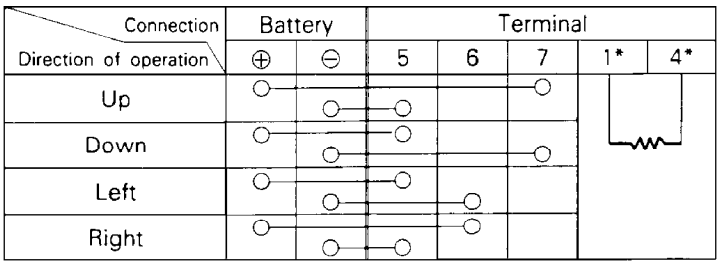
POWER MIRROR FUSE IDENTIFICATION TABLE

Application	Fuse No.
Eclipse	13
Galant	9
Mirage	7
Montero & 3000GT	5
Montero Sport	8

COMPONENT TESTS

POWER MIRROR MOTOR TEST

Connect 12-volt power source to mirror connector terminals. See Figs. 1-6. Replace mirror as necessary.



NOTE
○—○ indicates each terminal is connected to the battery.
*: Vehicles with heated mirror
94H46729

Fig. 1: Identifying Power Mirror Operational Test Charts (Eclipse, Galant, Montero - W/Heater & Montero Sport - W/Heater)
Courtesy of Chrysler Corp.

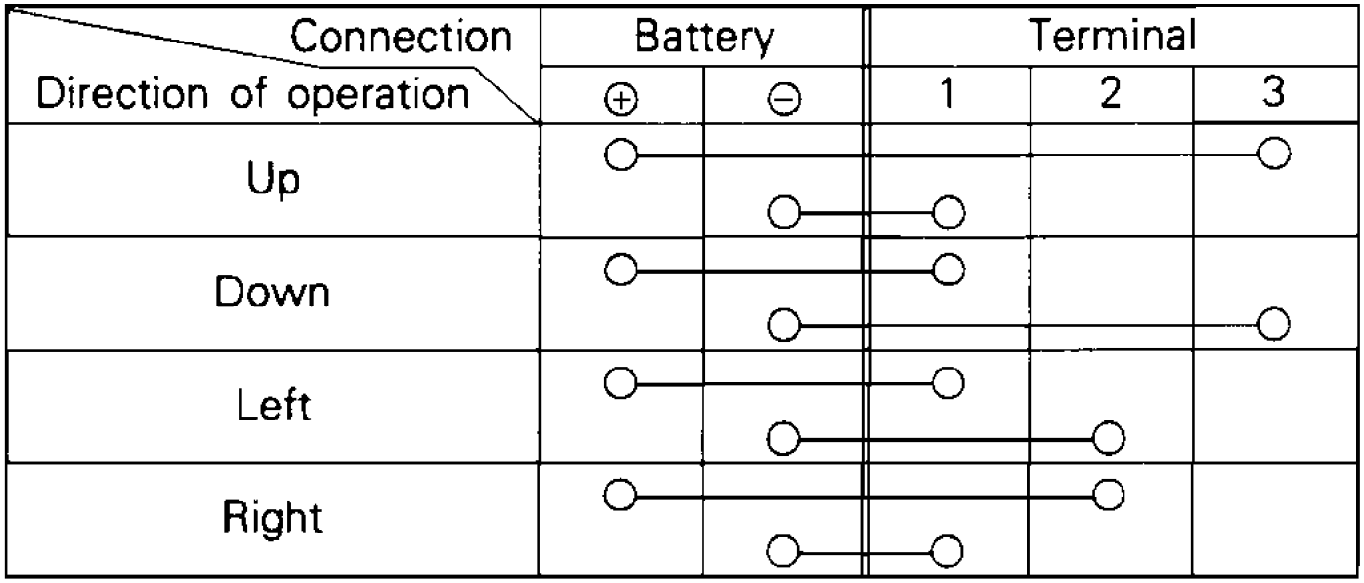


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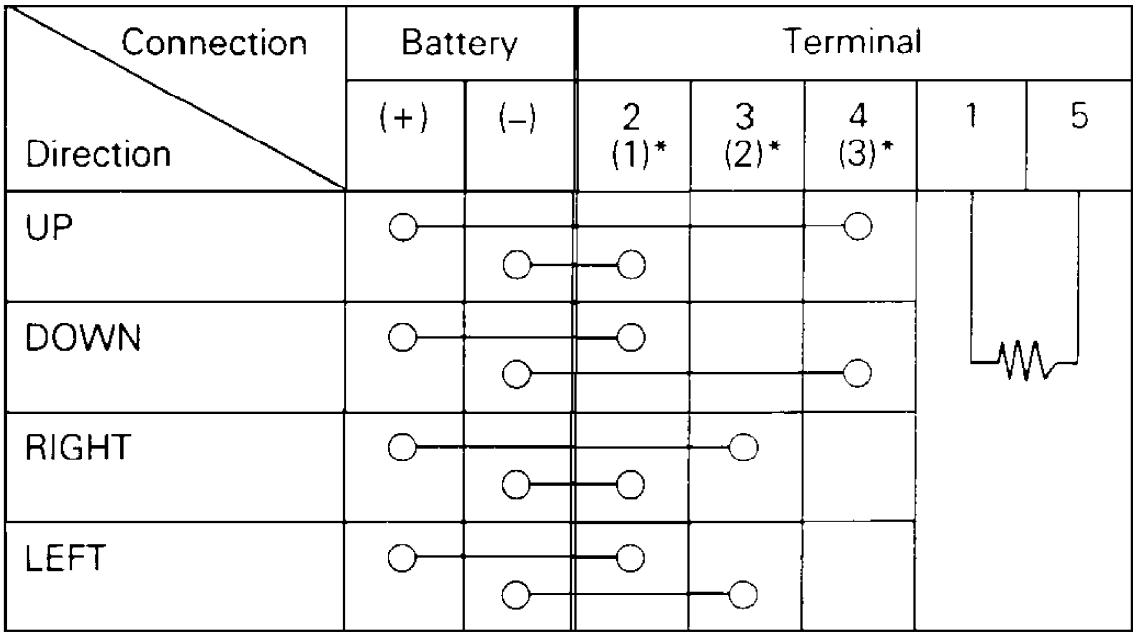
Fig. 2: Identifying Power Mirror Operational Test Charts (Mirage, Montero - W/out Heater & Montero Sport - W/out Heater)
Courtesy of Chrysler Corp.



NOTE
(1) ○—○ indicates that each terminal is connected to the battery.
(2) * indicates door mirror terminal on vehicles without heater.

93B83296

Fig. 3: Identifying Power Mirror Operational Test Charts (3000GT)
Courtesy of Chrysler Corp.

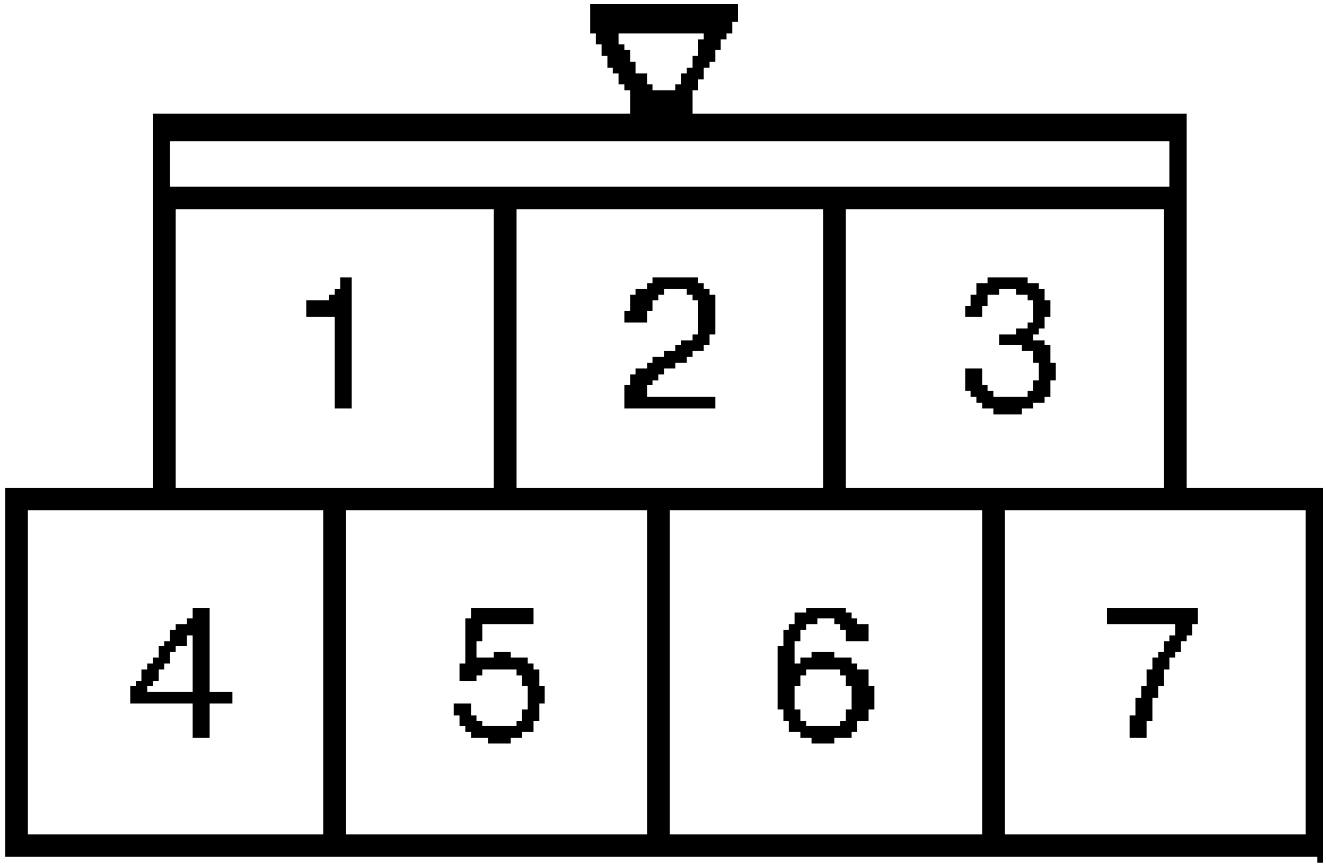


Fig. 4: Identifying Power Mirror Connector (Eclipse, Galant, Montero - W/Heater & Montero Sport - W/Heater)
Courtesy of Chrysler Corp.

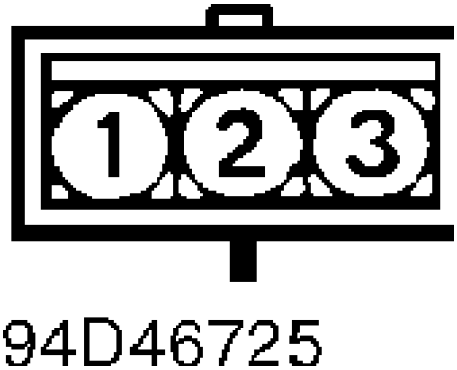


Fig. 5: Identifying Power Mirror Connector (Mirage, Montero - W/out Heater, Montero Sport - W/out Heater & 3000GT - W/out Heater)
Courtesy of Chrysler Corp.

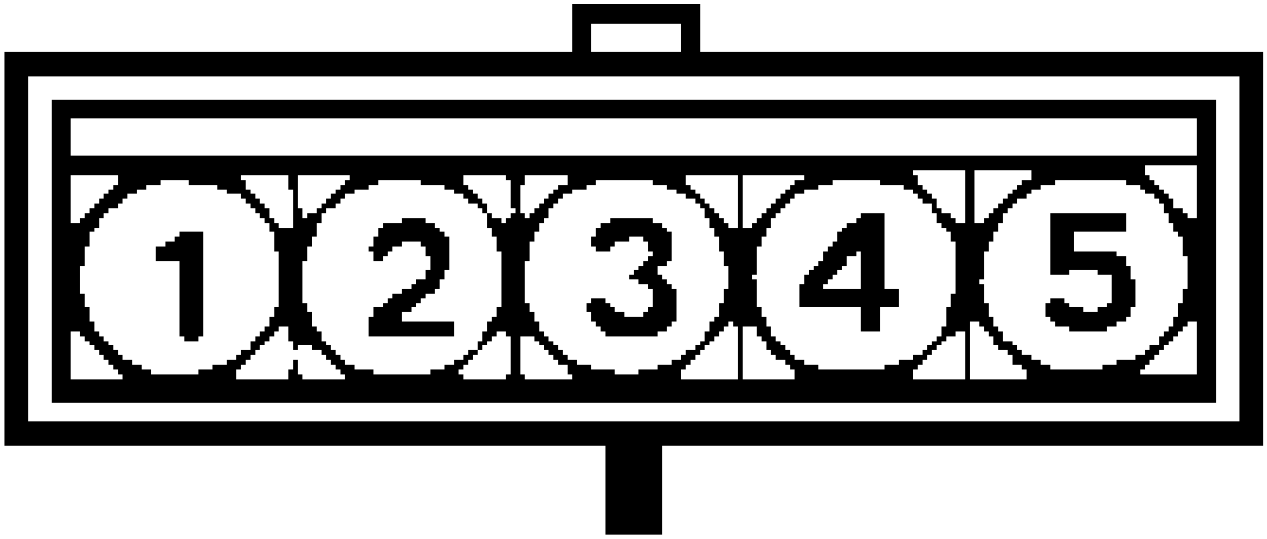


Fig. 6: Identifying Power Mirror Connector (3000GT - W/Heater)
Courtesy of Chrysler Corp.

POWER MIRROR SWITCH TEST

Remove mirror switch. Using ohmmeter, check continuity of switch. See appropriate POWER MIRROR SWITCH CONTINUITY CHART. See Fig. 7 or 8. Replace switch if switch continuity is not as specified.

POWER MIRROR SWITCH CONTINUITY CHART (ECLIPSE)

Switch Position	(1) Check Continuity Between Pins No.
Left Side	
UP	3 & 4; 5 & 10
DOWN	3 & 5; 4 & 10
LEFT	3 & 11; 4 & 10
RIGHT	3 & 4; 10 & 11
Right Side	
UP	3 & 4; 9 & 10
DOWN	3 & 9; 4 & 10
LEFT	3 & 8; 4 & 10
RIGHT	3 & 4; 8 & 10

(1) - See Fig. 7.

POWER MIRROR SWITCH CONTINUITY CHART (ALL OTHERS)

Switch Position	(1) Check Continuity Between Pins No.
Left Side	
UP	4 & 8; 6 & 7
DOWN	4 & 7; 6 & 8
LEFT	3 & 6; 4 & 7
RIGHT	3 & 4; 6 & 7

Right Side
  UP ..... 2 & 4; 6 & 7
  DOWN ..... 2 & 6; 4 & 7
  LEFT ..... 4 & 7; 6 & 9
  RIGHT ..... 4 & 9; 6 & 7

(1) - See Fig. 8.

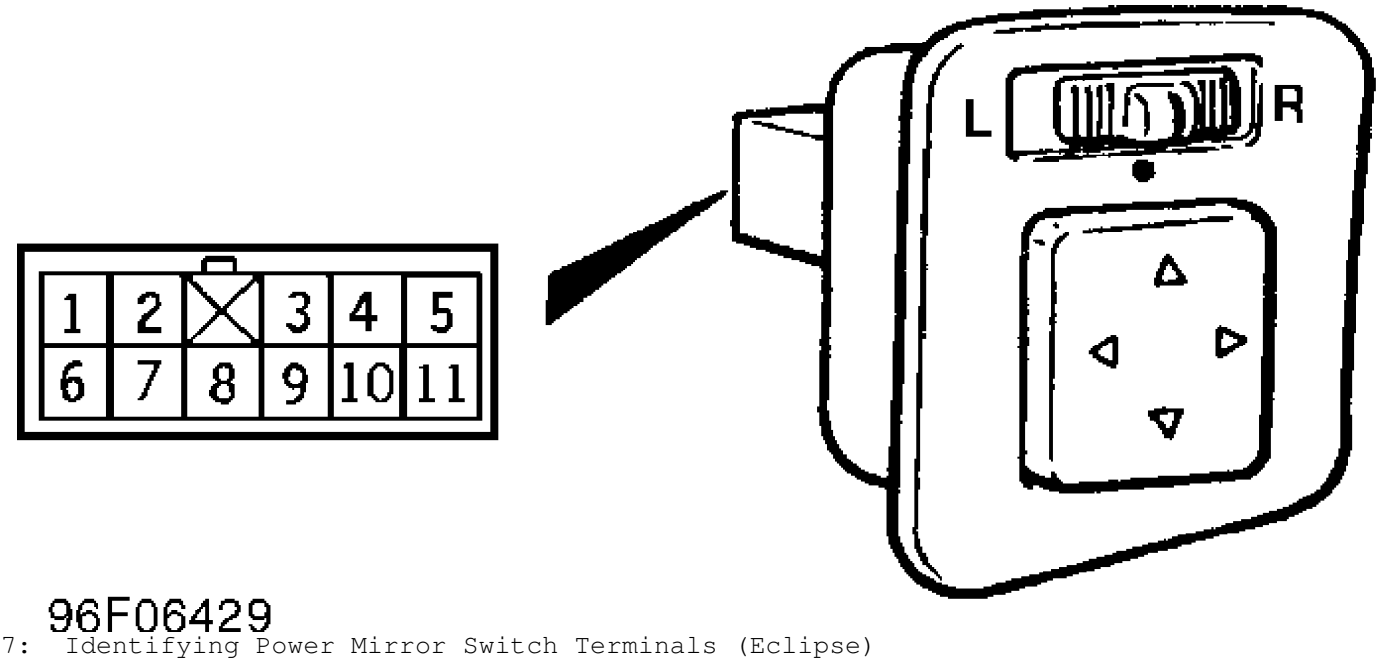


Fig. 7: Identifying Power Mirror Switch Terminals (Eclipse)
Courtesy of Mitsubishi Motor Sales of America

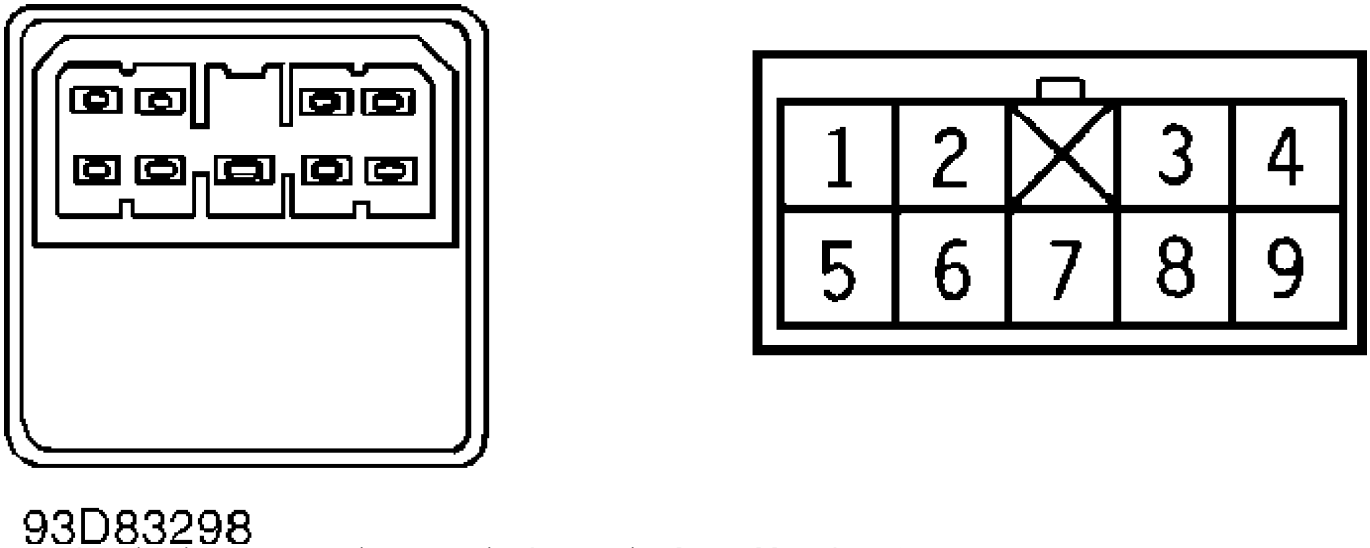


Fig. 8: Identifying Power Mirror Switch Terminals (All Others)
Courtesy of Mitsubishi Motor Sales of America

REMOVAL & INSTALLATION

POWER MIRROR ASSEMBLY

Removal & Installation

Remove delta cover (trim cover), screws and electrical connector. Remove mirror assembly. To install, reverse removal procedure.

WIRING DIAGRAMS

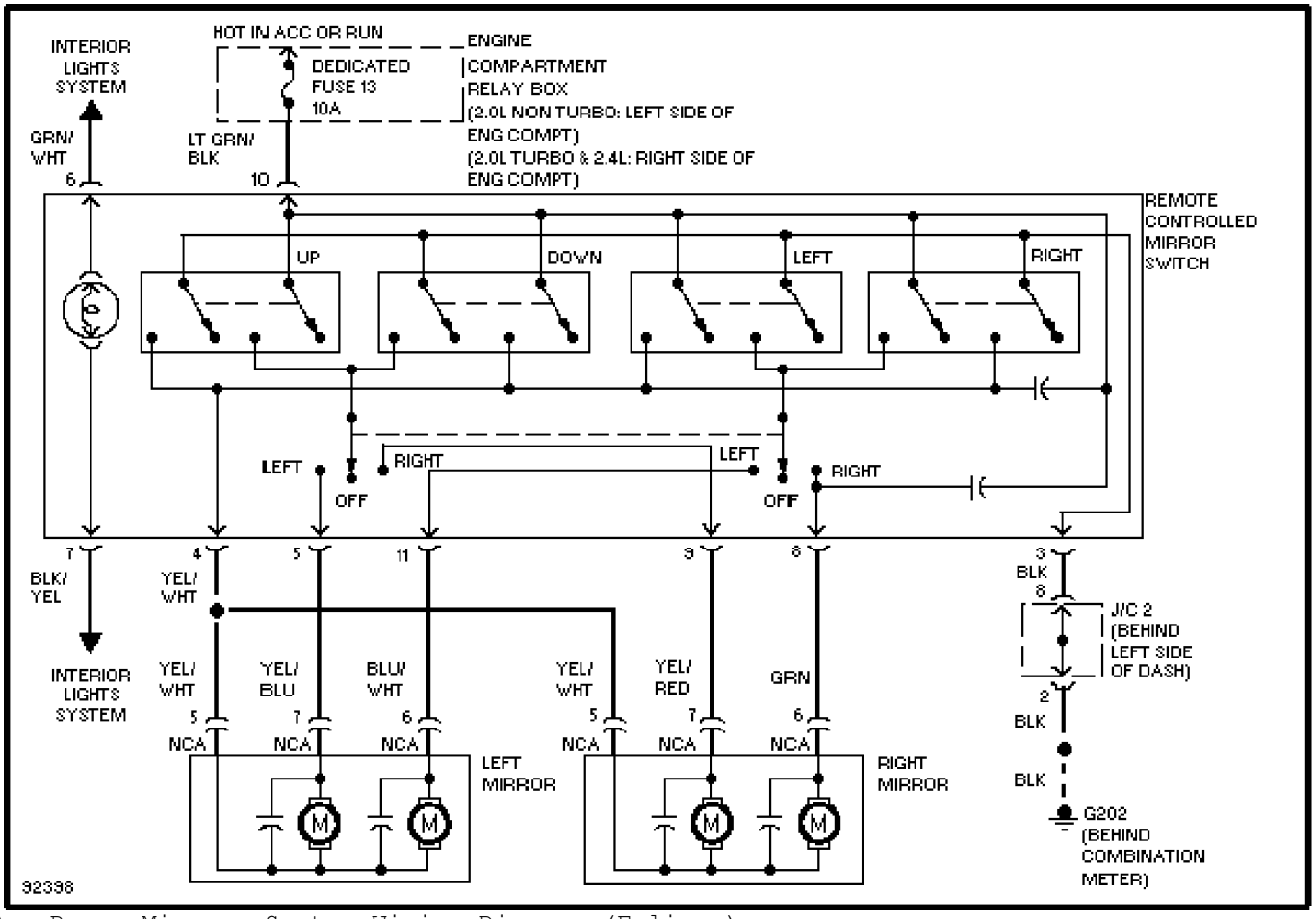


Fig. 9: Power Mirrors System Wiring Diagram (Eclipse)

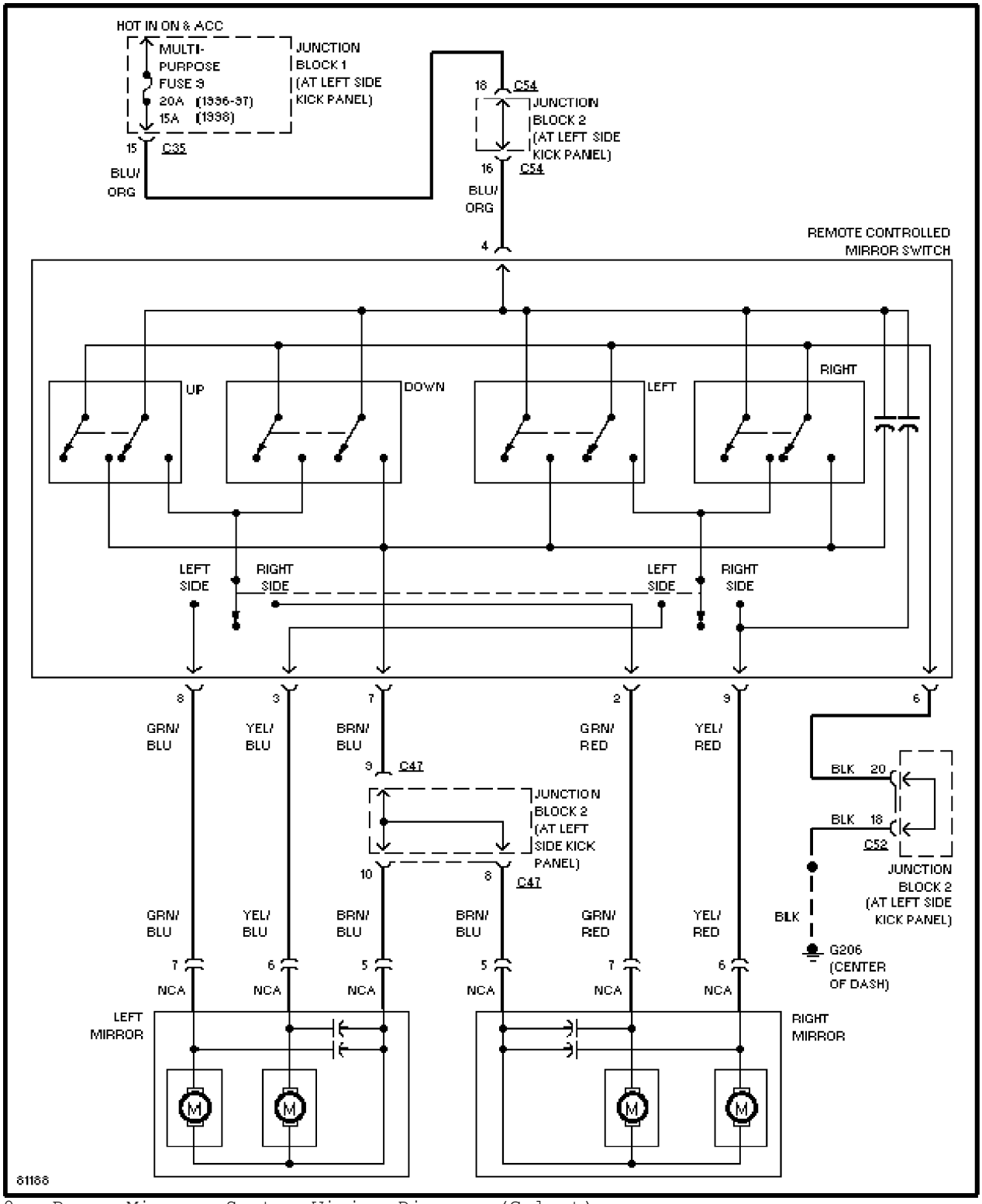


Fig. 10: Power Mirrors System Wiring Diagram (Galant)

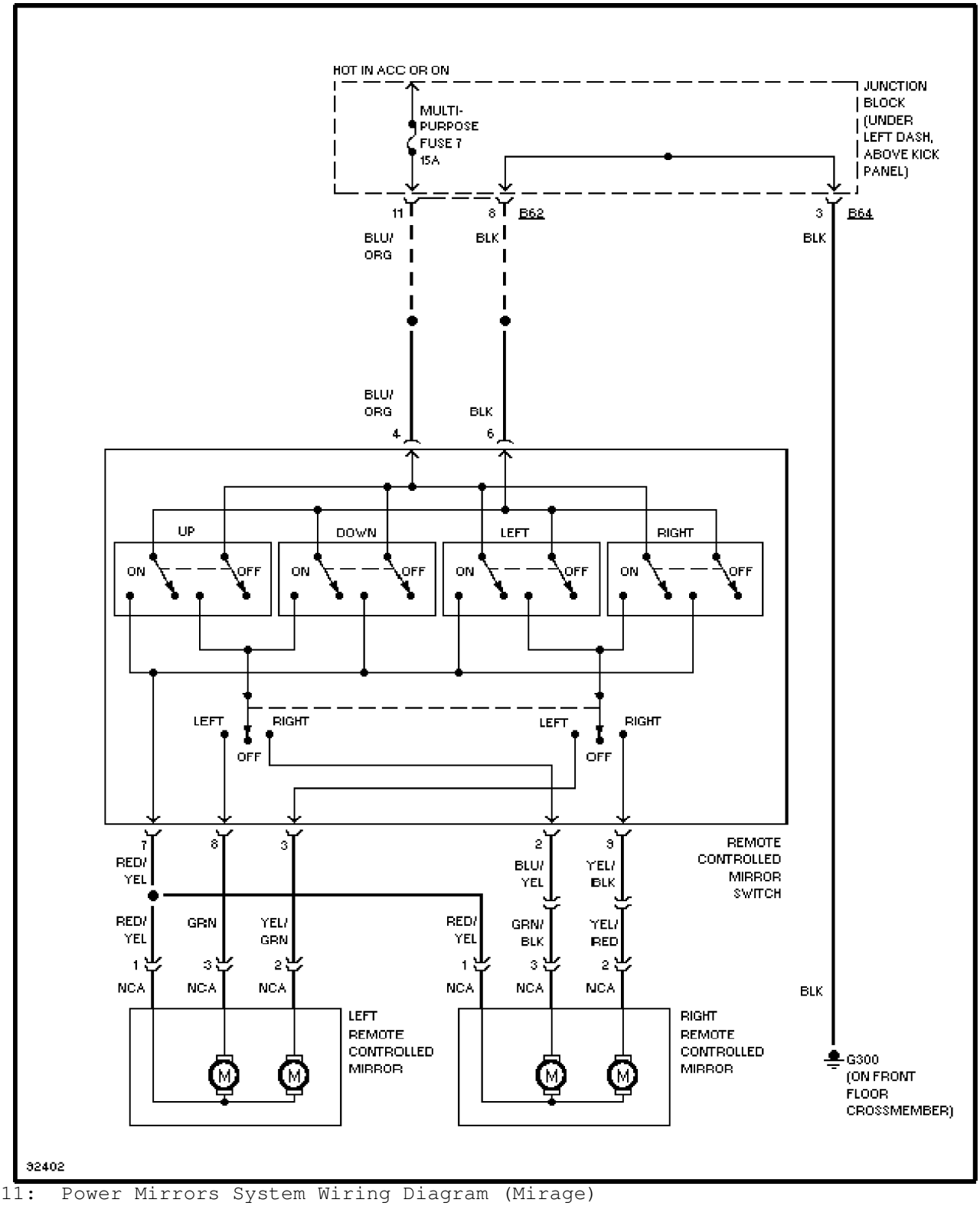


Fig. 11: Power Mirrors System Wiring Diagram (Mirage)

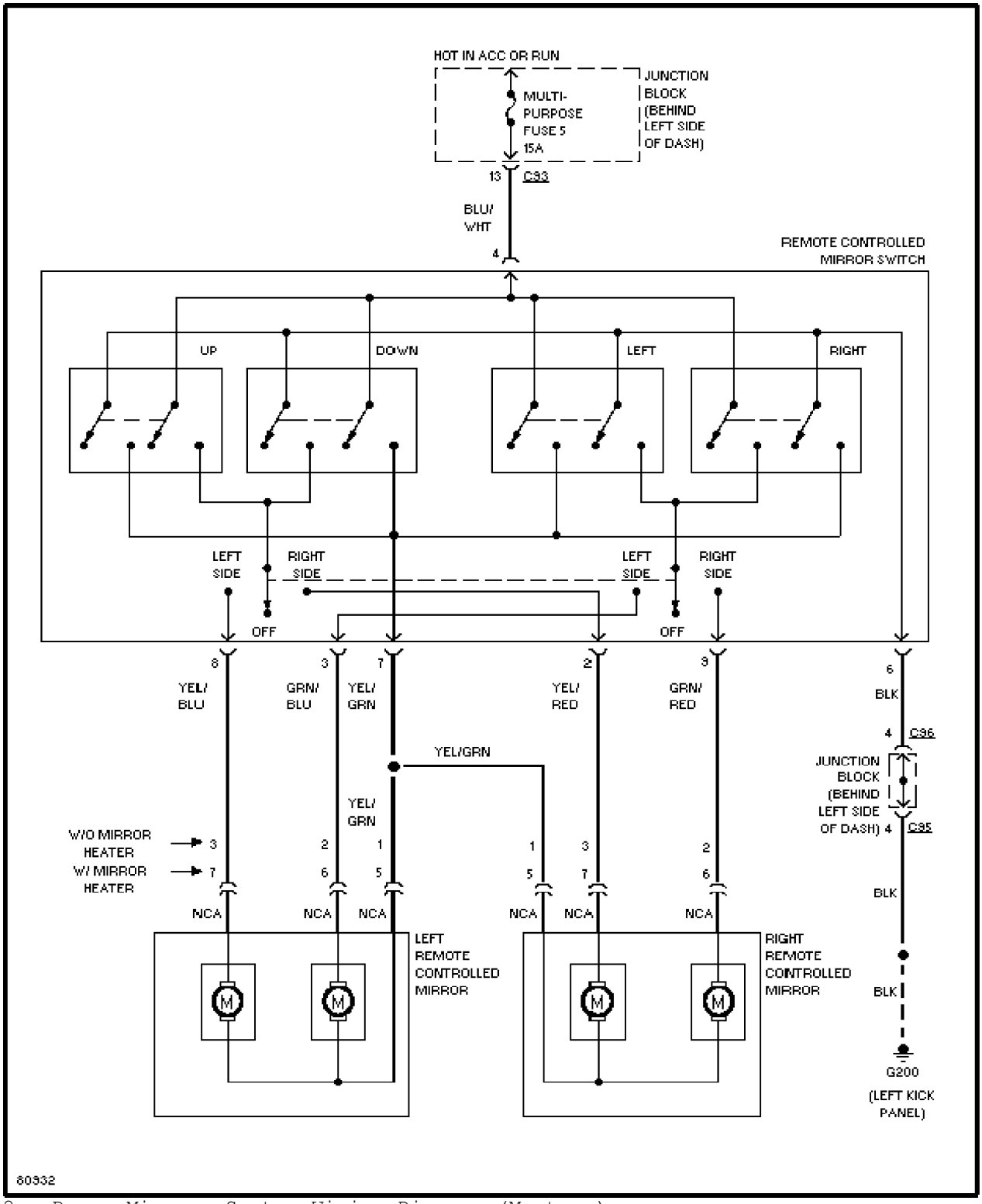


Fig. 12: Power Mirrors System Wiring Diagram (Montero)

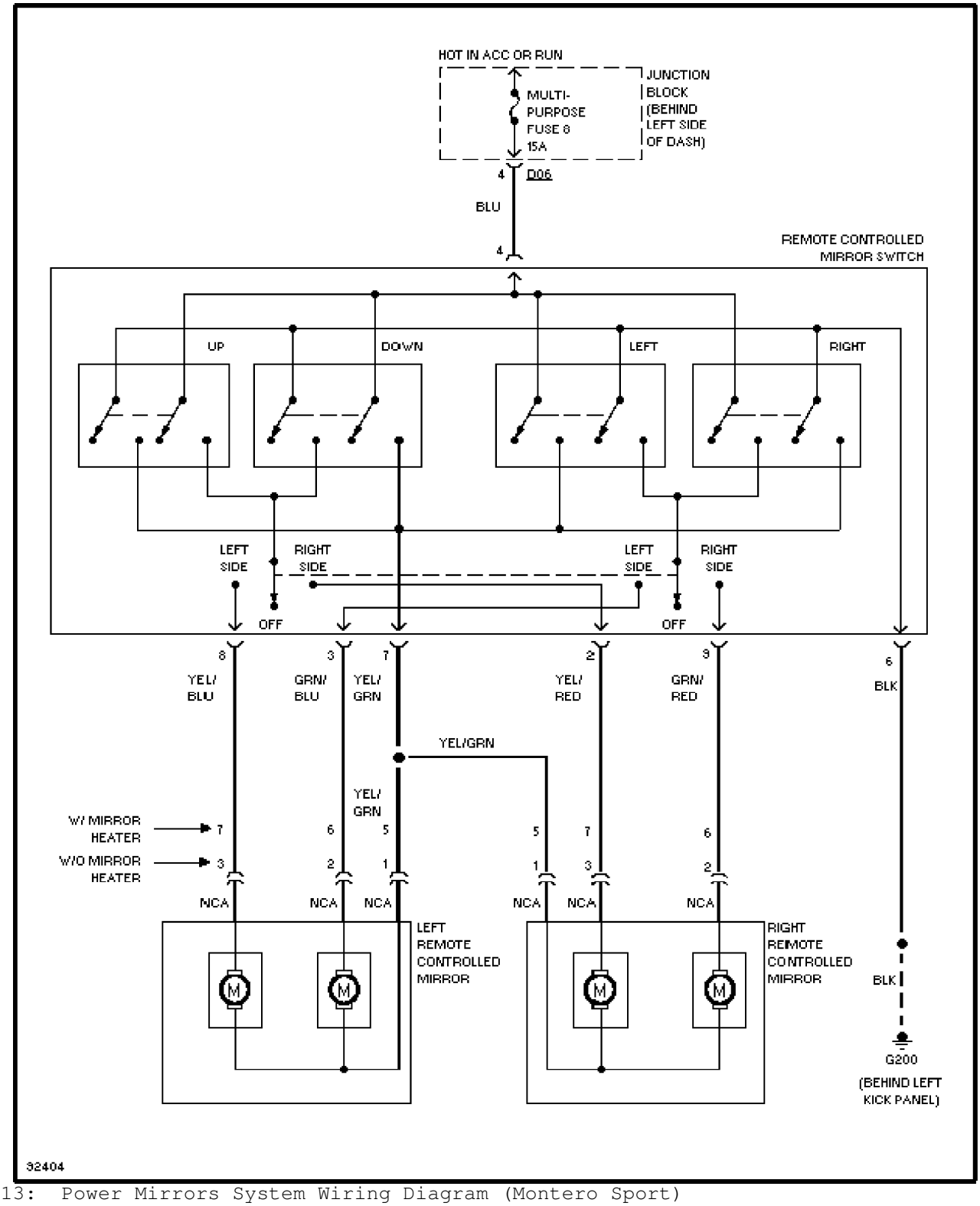


Fig. 13: Power Mirrors System Wiring Diagram (Montero Sport)

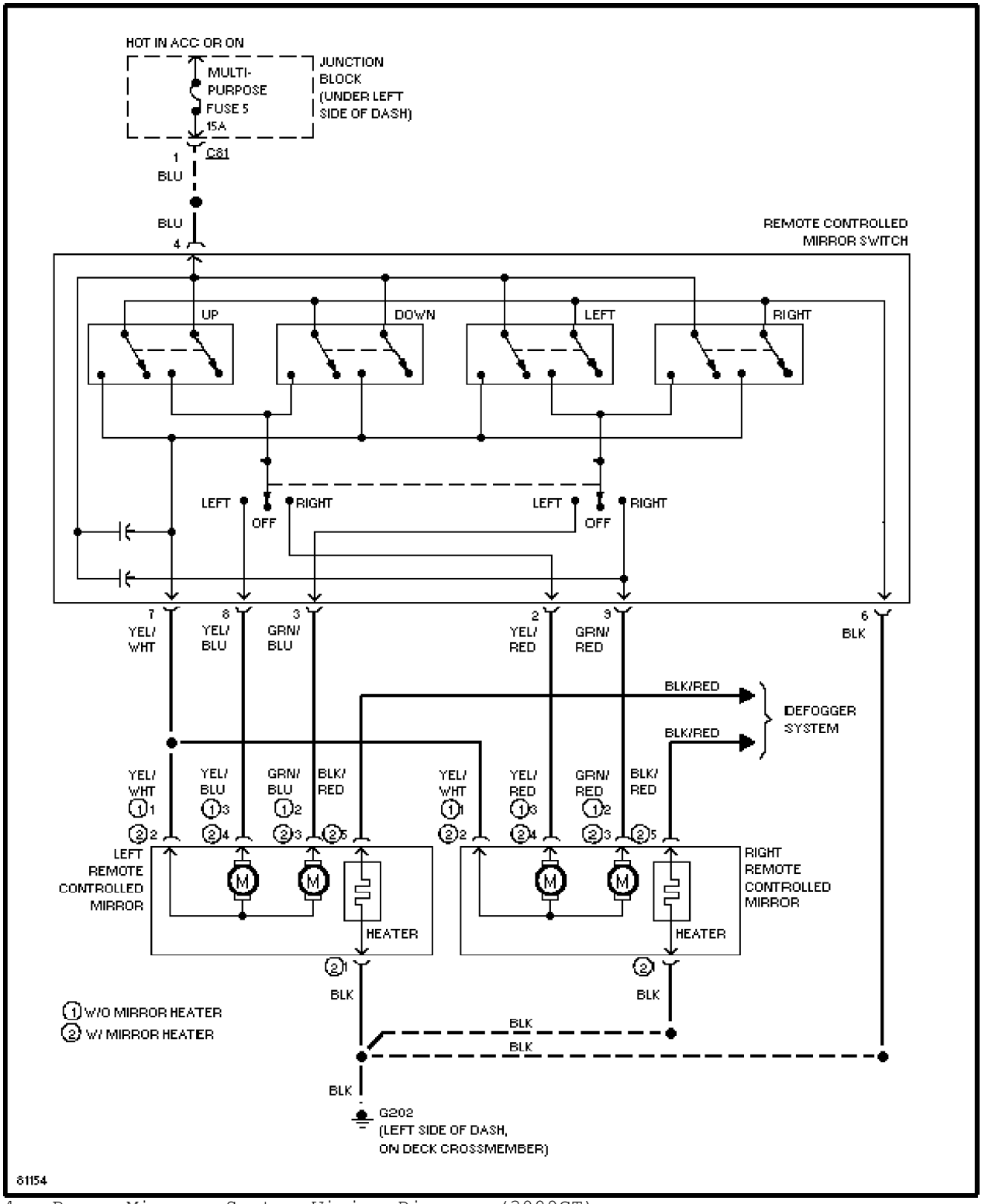


Fig. 14: Power Mirrors System Wiring Diagram (3000GT)

PARASITIC LOAD EXPLANATION & TEST PROCEDURES

1998 Mitsubishi Galant

GENERAL INFORMATION
Parasitic Load Explanation & Test Procedures

* PLEASE READ THIS FIRST *

This article is provided for general information only. Not all procedures apply to all makes and models.

GENERAL INFORMATION

The term Parasitic Load refers to electrical devices that continue to use or draw current after the ignition switch is turned to OFF position. This small amount of continuous battery draw is expressed in milliamps (mA). On Ford Motor Co. and General Motors vehicles produced after 1980, a typical Parasitic Load should be no more than 50 milliamps (0.050 amps).

Vehicles produced since 1980 have memory devices that draw current with ignition off for as long as 20 minutes before shutting down the Parasitic Drain. When Parasitic Load exceeds normal specifications, the vehicle may exhibit dead battery and no-start condition.

Follow test procedure for checking Parasitic Loads to completion. A brief overview of a suggested test procedure is included along with some typical Parasitic Load specifications. Refer to the GENERAL MOTORS PARASITIC LOAD TABLE chart.

TESTING FOR PARASITIC LOAD

INTRODUCTION

CAUTION: Always turn ignition off when connecting or disconnecting battery cables, battery chargers or jumper cables. DO NOT turn test switch to OFF position (which causes current to run through ammeter or vehicle electrical system).

NOTE: Memory functions of various accessories must be reset after the battery is reconnected.

The battery circuit must be opened to connect test switch (shunt) and ammeter into the circuit. When a battery cable is removed, timer circuits within the vehicle computer are interrupted and immediately begin to discharge. If in doubt about the condition of the ammeter fuse, test it with an ohmmeter prior to beginning test. An open fuse will show the same reading (00.00) as no parasitic drain. Begin test sequence with the meter installed and on the 10-amp scale. Select lower scale to read parasitic draw.

TEST PROCEDURE USING TEST SWITCH

1) Turn ignition off. Remove negative battery terminal cable. Install Disconnect Tool (J-38758) test switch male end to negative battery cable. Turn test switch knob to OFF position (current through meter). Install negative battery cable to the female end of test switch.

2) Turn test switch knob to ON position (current through switch). Road test vehicle with vehicle accessories on (radio, air conditioner, etc.). After road test, turn ignition switch to LOCKED position and remove key. Connect ammeter terminals to test switch

terminals. See Fig. 1. Select 10-amp scale.

3) Turn off all electrical accessories. Turn off interior lights, underhood lamp, trunk light, illuminated entry, etc. To avoid damaging ammeter or obtaining a false meter reading, all accessories must be off before turning test switch knob to OFF position.

4) Turn test switch knob to OFF position to allow current to flow through ammeter. If meter reads wrong polarity, turn test switch to ON position and reverse leads. Turn test switch to OFF position. Observe current reading. If reading is less than 2 amps, turn test switch to ON position to keep electrical circuits powered-up.

5) Select low amp scale. Switch lead to the correct meter position. Turn test switch to OFF position and compare results to normal current draw. See the GENERAL MOTORS PARASITIC LOAD TABLE. If current draw is unusually high for the vehicle's overall electrical system, remove system fuses one at a time until current draw returns to normal.

6) Turn test switch to ON position each time door is opened or fuse is removed. Turn switch to OFF position to read current draw value through meter. When the cause of excessive current drain has been located and repaired, remove test switch and reconnect negative battery cable to the negative battery terminal.

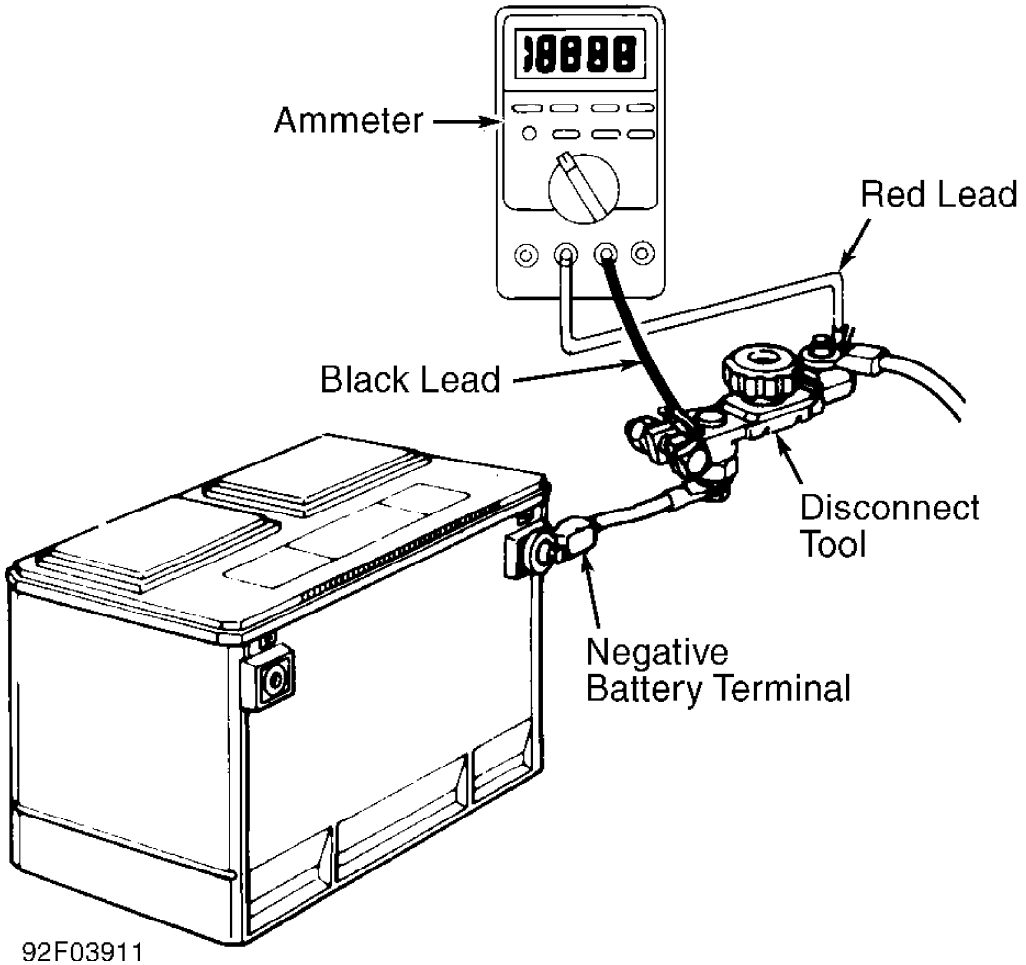


Fig. 1: Connecting Kent-Moore Disconnect Tool (J-38758)
Courtesy of General Motors Corp.

GENERAL MOTORS PARASITIC LOAD TABLE (MILLIAMPS)

Component	Normal Draw	Maximum Draw	Time-Out (Minutes)
Anti-Theft System	0.4	1.0	...
Auto Door Lock	1.0	1.0	...
Body Control Module	3.6	12.4	20
Central Processing System	1.6	2.7	20
Electronic Control Module	5.6	10.0	...
Electronic Level Control	2.0	3.3	20
Heated Windshield Module	0.3	0.4	...
HVAC Power Module	1.0	1.0	...
Illuminated Entry	1.0	1.0	1
Light Control Module	0.5	1.0	...
Oil Level Module	0.1	0.1	...
Multi-Function Chime	1.0	1.0	...
Pass Key Decoder Module	0.75	1.0	...
Power Control Module	5.0	7.0	...
Retained Accessory Power	3.8	3.8	...
Radio	7.0	8.0	15
Twilight Sentinel Module	1.0	1.0	...
Voltage Regulator	1.4	2.0	...

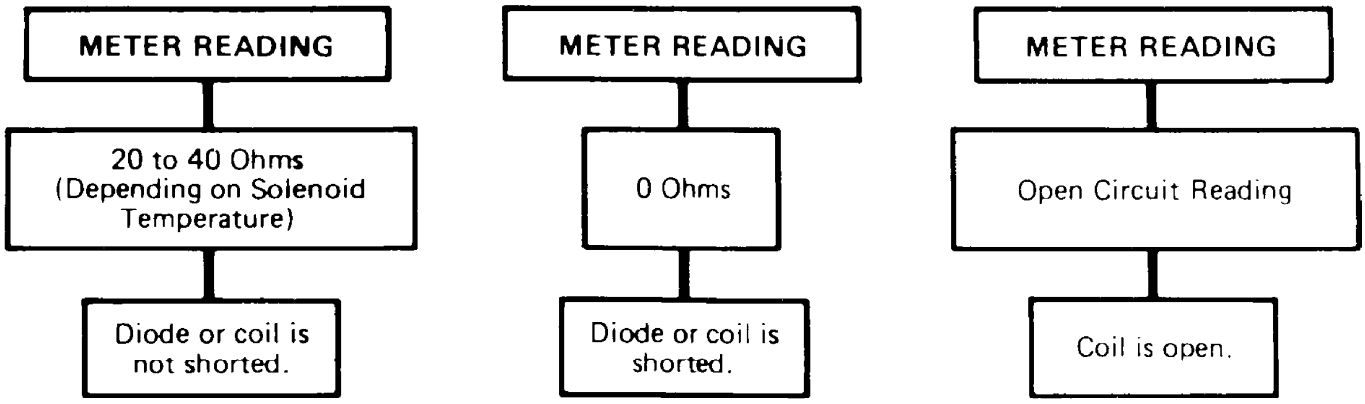
INTERMITTENT PARASITIC LOAD PROBLEMS

Intermittent parasitic lad can occur because of a memory device that does not power down with ignition off. With an intermittent parasitic load, battery draw can be greater than 1.0 amp. To find and intermittent problem requires that an ammeter and Disconnect Tool (J-38758) test switch be connected and left in the circuit. See Fig. 1. Road test vehicle. After road test, turn ignition off and remove key.

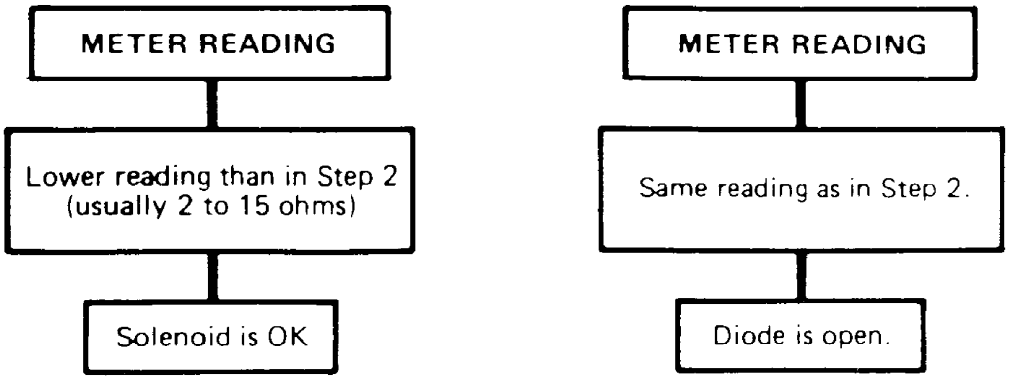
Monitor the milliamps scale for 15-20 minutes after ignition is turned off. This allows monitoring memory devices to determine if they time out and stop drawing memory current. The test switch is needed to protect ammeter when the vehicles is started.

DIODE CHECK & SOLENOID TEST (GENERAL MOTORS)

Step 1) Select the X1 SCALE and zero the needle.
Step 2) Attach the POSITIVE SOLENOID LEAD (Red lead) to the POSITIVE METER LEAD and the NEGATIVE SOLENOID LEAD (Black lead) to the NEGATIVE METER LEAD.



Step 3) Reverse the solenoid lead attachments.



92H03912
Fig. 2: Diode Check & Solenoid Test (General Motors)
Courtesy of General Motors Corp.

QUAD DRIVER TEST (GENERAL MOTORS)

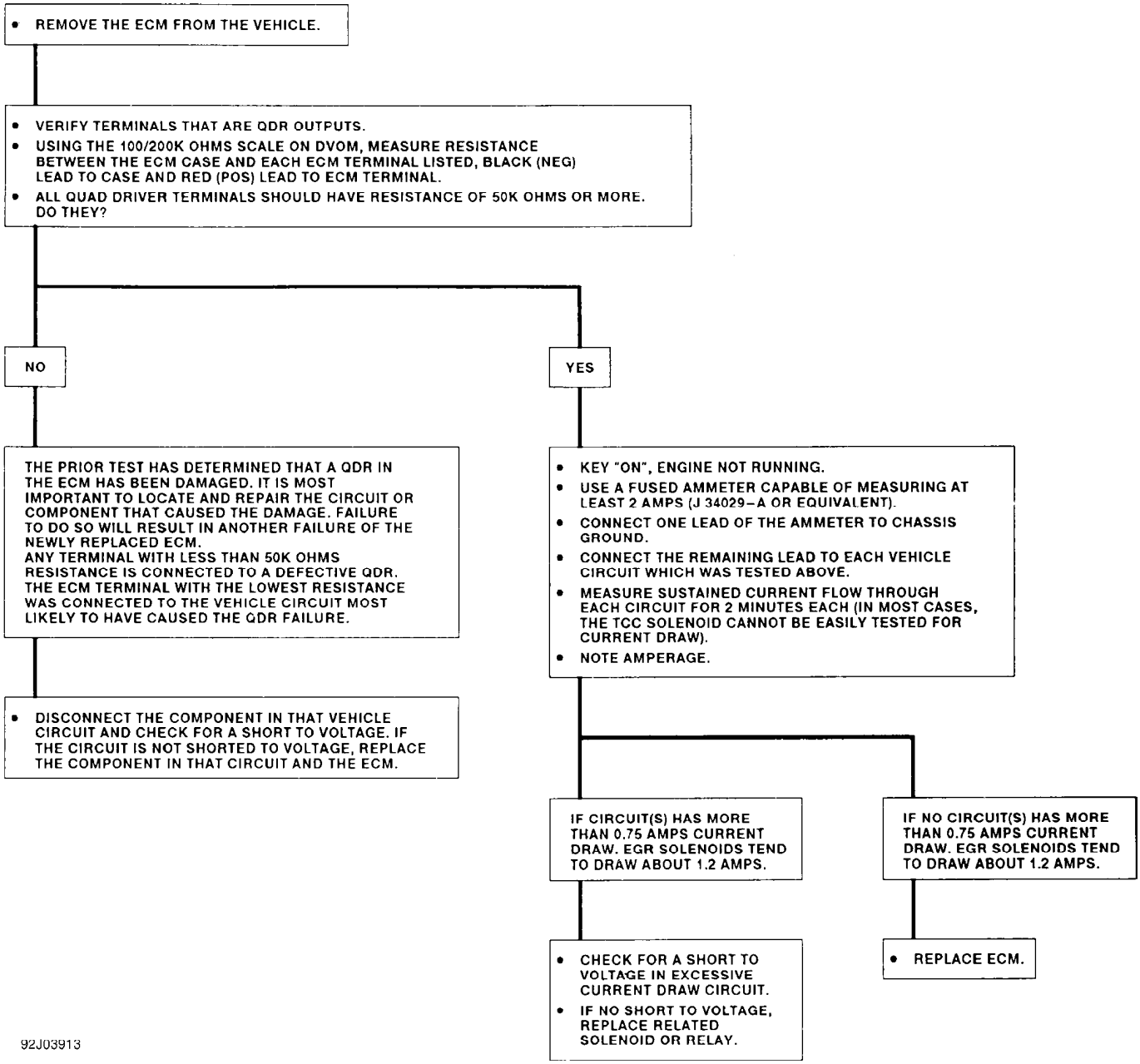


Fig. 3: Quad Driver Test (General Motors)
Courtesy of General Motors Corp.

PASSIVE RESTRAINT SYSTEM INSPECTION

1998 Mitsubishi Galant

GENERAL INFORMATION
Passive Restraint System Inspection - Asian

*** PLEASE READ THIS FIRST ***

Follow all manufacturers servicing precautions when working with air bag systems. See SERVICE PRECAUTIONS in the appropriate AIR BAG RESTRAINT SYSTEM article in the ACCESSORIES/SAFETY EQUIPMENT section.

INTRODUCTION

When a vehicle equipped with passive restraint system has been involved in a collision, certain systems and components must be inspected and or replaced regardless of whether or not the air bag has deployed. Follow the manufacturer's guidelines provided in this article.

ACURA (1988-98)

AIR BAG APPLICATION

AIR BAG APPLICATION TABLE - ACURA (1988-98)

Model	Year	(1) Location
Integra	1994-98	D/P
Legend	1991-95	D/P
	1988-90	DS
NSX	1993-98	D/P
	1991-92	DS
Vigor	1993-94	D/P
	1992	DS
2.2CL	1997	D/P
2.3CL	1998	D/P
2.5TL	1995-98	D/P
3.0CL	1997-98	D/P
3.2TL	1996-98	D/P
3.5RL	1996-98	D/P
SLX	1996-98	D/P

(1) - Location Definitions: D/P = Driver's & Passenger's Side, DS = Driver's Side Only, SI = Side Impact.

INSPECTION PROCEDURES

INSPECTION PROCEDURES TABLE - ACURA (1988-98 EXCEPT SLX)

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Seat Belt Tensioners (If Equipped) * SRS Control Unit
Inspect & If Damaged, Replace Component	* Cable Reel * Dash or Impact Sensors (If Equipped) * Seat Belts

(Even If Air Bag Did Not Deploy)	* SRS Control Unit * Wiring Harness
Comments	* If any components are damaged or bent, they must be replaced. * DO NOT attempt SRS wiring repairs. If SRS wiring or harness connectors are faulty, replace faulty wiring harness. * After vehicle is repaired, ensure AIR BAG warning light is functioning properly.

INSPECTION PROCEDURES TABLE - ACURA (1996-98 SLX)

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Sensing & Diagnostic Module (SDM)
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Instrument Panel Braces * Instrument Panel Steering Column Reinforcement Plate * Seat Belts & Mounting Points * Knee Bolsters & Mounting Points * Steering Column * SRS Coil Assembly * Wiring Harnesses
Comments	* If any components are damaged or bent, they must be replaced. * DO NOT attempt wiring harness repairs. Replace harness.

HONDA (1991-98)

AIR BAG APPLICATION

AIR BAG APPLICATION TABLE - HONDA (1991-98)

Model	Year	(1) Location
Accord	1993-98	D/P
	1991-92	DS
Civic	1994-98	D/P
	1992-93	DS
Civic del Sol	1994-97	D/P
	1993	DS
CR-V	1997-98	D/P
Odyssey	1995-98	D/P
Prelude	1994-98	D/P
SI 4WS	1992-93	D/P
Except SI 4WS	1992-93	DS
Passport	1995 1/2-98	D/P

(1) - Location Definitions: D/P = Driver's & Passenger's Side, DS = Driver's Side Only, SI = Side Impact.

INSPECTION PROCEDURES

INSPECTION PROCEDURES TABLE - HONDA (1991-98 EXCEPT PASSPORT)

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Seat Belt Tensioners (If Equipped) * SRS Control Unit
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Cable Reel * Dash Sensors (1991-94) * Seat Belts * SRS Control Unit * Wiring Harness
Comments	* If any components are damaged or bent, they must be replaced. * DO NOT attempt SRS wiring repairs. If SRS wiring or harness connectors are faulty, replace faulty wiring harness. * After vehicle is repaired, ensure AIR BAG warning light is functioning properly.

INSPECTION PROCEDURES TABLE - HONDA (1995 1/2-98 PASSPORT)

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Sensing & Diagnostic Module (SDM)
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Instrument Panel Braces * Instrument Panel Steering Column Reinforcement Plate * Seat Belts & Mounting Points * Knee Bolsters & Mounting Points * Steering Column * SRS Coil Assembly * Wiring Harnesses
Comments	* If any components are damaged or bent, they must be replaced. * DO NOT attempt wiring harness repairs. Replace harness.

HYUNDAI (1994-98)

AIR BAG APPLICATION

AIR BAG APPLICATION TABLE - HYUNDAI (1994-98)

Model	Year	(1) Location
Accent	1995-98	D/P
Elantra	1996-98	D/P
	1994-95	DS
Sonata	1995-98	D/P
Tiburon	1997-98	D/P

(1) - Location Definitions: D/P = Driver's & Passenger's Side, DS = Driver's Side Only, SI = Side Impact.

INSPECTION PROCEDURES

INSPECTION PROCEDURES TABLE - HYUNDAI (1994-98)

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Control Module * Steering Column Clockspring
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Any Seat Belt In Use At Time Of Collision * Steering Column * Steering Wheel * Wiring Harness
Comments	* If any components are damaged or bent, they must be replaced. * DO NOT attempt SRS wiring repairs. If SRS wiring or harness connectors are faulty, replace faulty wiring harness.

INFINITI (1990-98)

AIR BAG APPLICATION

AIR BAG APPLICATION TABLE - INFINITI (1990-98)

Model	Year	(1) Location	Inspection Table
G20	1993-96	D/P	INFINITI-2
I30	1998	D/P, SI	INFINITI-1
	1997	D/P	INFINITI-1
	1996	D/P	INFINITI-2
J30	1997	D/P	INFINITI-1
	1994-96	D/P	INFINITI-2
	1993	D/P	INFINITI-3
M30	1990-92	DS	INFINITI-3
Q45	1998	D/P, SI	INFINITI-1
	1997	D/P	INFINITI-1
	1994-96	D/P	INFINITI-2
	1990-93	DS	INFINITI-3
QX4	1997-98	D/P	INFINITI-1

(1) - Location Definitions: D/P = Driver's & Passenger's Side, DS = Driver's Side Only, SI = Side Impact.

INSPECTION PROCEDURES

INSPECTION PROCEDURES TABLE - INFINITI-1

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Control Unit, Diagnosis * Satellite Sensor (1) * Seat Belt Pretensioners (2)

	* Side Air Bag Module (1)
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Center Pillar Inner (1) * Instrument Panel * Seat (1) * Seat Belt Pretensioners (2) * Spiral Cable * Steering Wheel * Wiring Harnesses
Comments	* Inspect all SRS components for dents, deformities or rust. * After repairs are completed, check AIR BAG warning light to ensure system is functioning properly.
(1) - On side of impact. (2) - Except I30 and QX4.	

INSPECTION PROCEDURES TABLE - INFINITI-2

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Control Unit, Diagnosis * Instrument Panel * Seat Belt Pretensioners (1)
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* All Sensors (2) * Spiral Cable * Steering Wheel * Wiring Harnesses
Comments	* Inspect all SRS components for dents, deformities or rust. * After repairs are completed, check AIR BAG warning light to ensure system is functioning properly.
(1) - Except I30. (2) - Except 1996 I30, 1995-96 J30 and 1995-96 Q45.	

INSPECTION PROCEDURES TABLE - INFINITI-3

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Control Unit, Diagnosis * Sensors In Affected Collision Area
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* All Sensors * Spiral Cable * Steering Wheel * Wiring Harnesses
Comments	* Inspect all SRS components for dents, deformities or rust.

	* After repairs are completed, check AIR BAG warning light to ensure system is functioning properly.

ISUZU (1990-98)

AIR BAG APPLICATION

AIR BAG APPLICATION TABLE - ISUZU (1990-98)

Model	Year	(1) Location	Inspection Table
Hombre	1996-97	DS	ISUZU-1
Impulse	1990-92	DS	ISUZU-5
Oasis	1996-98	D/P	ISUZU-2
Rodeo	1996-98	D/P	ISUZU-3
	1995 1/2	D/P	ISUZU-3
Stylus	1991-93	DS	ISUZU-5
Trooper	1996-98	D/P	ISUZU-3
	1995	D/P	ISUZU-4

(1) - Location Definitions: D/P = Driver's & Passenger's Side, DS = Driver's Side Only, SI = Side Impact.

INSPECTION PROCEDURES

INSPECTION PROCEDURES TABLE - ISUZU-1

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Sensors In Area Of Accident Damage
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Instrument Panel Braces * Instrument Panel Steering Column Reinforcement Plate * Seat Belts & Mounting Points * Knee Bolster * Sensors In Area Of Accident Damage * SRS Coil Assembly
Comments	* Any sensor which the Diagnostic Energy Reserve Module (DERM) indicates as bad must be replaced. * If any components are damaged or bent, they must be replaced. * SRS wiring can be repaired following manufacturer's instructions.

INSPECTION PROCEDURES TABLE - ISUZU-2

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Seat Belt Tensioners (If Equipped) * SRS Control Unit
Inspect & If Damaged, Replace	* Cable Reel * Dash Sensors (1991-94)

Component (Even If Air Bag Did Not Deploy)	* Seat Belts * SRS Control Unit * Wiring Harness
Comments	* If any components are damaged or bent, they must be replaced. * DO NOT attempt SRS wiring repairs. If SRS wiring or harness connectors are faulty, replace faulty wiring harness. * After vehicle is repaired, ensure AIR BAG warning light is functioning properly.

INSPECTION PROCEDURES TABLE - ISUZU-3

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Sensing & Diagnostic Module (SDM)
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Instrument Panel Braces * Instrument Panel Steering Column Reinforcement Plate * Seat Belts & Mounting Points * Knee Bolsters & Mounting Points * Steering Column * SRS Coil Assembly * Wiring Harnesses
Comments	* If any components are damaged or bent, they must be replaced. * DO NOT attempt wiring harness repairs. Replace harness.

INSPECTION PROCEDURES TABLE - ISUZU-4

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * All Sensors
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* SRS Coil Assembly * Instrument Panel Steering Column Reinforcement Panel * Instrument Panel Braces * Knee Bolsters * Seat Belts Mounting Points * Sensors In Area of Accident Damage * Steering Column
Comments	* If any components are damaged or bent, they must be replaced. * DO NOT attempt wiring harness repairs. Replace harness.

INSPECTION PROCEDURES TABLE - ISUZU-5

Action	Component or System
Replace After	* Air Bag Module

Deployment	
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Arming Sensor * Coil Assembly * Diagnostic Energy Reserve Module (DERM) * Forward Sensor * Instrument Panel-To-Steering Column Reinforcement * Knee Pad * Passenger Compartment Sensor * Steering Column * Wiring Harness & Brackets
Comments	* If any components are damaged or bent, they must be replaced.

KIA (1995-98)

AIR BAG APPLICATION

AIR BAG APPLICATION TABLE - KIA (1995-98)

Model	Year	(1) Location
Sephia	1996-98	D/P
	1995 1/2	D/P
Sportage	1996-98	D/P

(1) - Location Definitions: D/P = Driver's & Passenger's Side, DS = Driver's Side Only, SI = Side Impact.

INSPECTION PROCEDURES

INSPECTION PROCEDURES TABLE - KIA (1995-98)

Action	Component or System
Replace After Deployment	* Air Bag Module(s)
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Air Bag Diagnosis Control Unit * Clockspring * Impact Sensors Sensor Mountings (1) * Steering Column * Steering Wheel * Wiring Harness
Comments	* After repairs a completed, ensure Warning Light is functioning properly.
(1) - 1995 1/2 Sephia only.	

LEXUS (1990-98)

AIR BAG APPLICATION

AIR BAG APPLICATION TABLE - LEXUS (1990-98)

Model	Year	(1) Location	Inspection Table
ES250	1990-91	DS	LEXUS-6
ES300	1998	D/P, SI	LEXUS-3
	1997	D/P	LEXUS-1
	1994-96	D/P	LEXUS-4
	1992-93	DS	LEXUS-5
GS300	1998	D/P, SI	LEXUS-3
	1993-97	D/P	LEXUS-4
GS400	1998	D/P, SI	LEXUS-3
LS400	1997-98	D/P, SI	LEXUS-3
	1995-96	D/P	LEXUS-1
	1993-94	D/P	LEXUS-4
	1990-92	DS	LEXUS-6
LX450	1996-97	D/P	LEXUS-1
LX470	1998	D/P	LEXUS-2
SC300	1996-98	D/P	LEXUS-1
	1993-95	D/P	LEXUS-4
	1992	DS	LEXUS-5
SC400	1996-98	D/P	LEXUS-1
	1993-95	D/P	LEXUS-4
	1992	DS	LEXUS-5

(1) - Location Definitions: D/P = Driver's & Passenger's Side, DS = Driver's Side Only, SI = Side Impact.

INSPECTION PROCEDURES

INSPECTION PROCEDURES TABLE - LEXUS-1

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Air Bag Sensor Assembly * Front Seat Belt Pretensioners (1)
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Glove Compartment Door (2) * Instrument Panel * Instrument Panel Reinforcement * Spiral Cable * Steering Wheel * Wiring Harness & Connectors
Comments	* If any components are damaged or bent, they must be replaced.

(1) - 1995 LS400 only.
(2) - 1997 ES300, 1996 LS400 and 1996-97 LX450 only.

INSPECTION PROCEDURES TABLE - LEXUS-2

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Air Bag Sensor Assembly * Front Air Bag Sensors * Seat Belt Pretensioner
Inspect & If Damaged, Replace Component	* Instrument Panel * Instrument Panel Reinforcement * Seat Belt Pretensioner

(Even If Air Bag Did Not Deploy)	* Spiral Cable Steering Wheel * Wiring Harness & Connectors
Comments	* If any components are damaged or bent, they must be replaced. * DO NOT attempt wiring harness repairs. Replace entire wiring harness.

INSPECTION PROCEDURES TABLE - LEXUS-3

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Air Bag Sensor Assembly * Seat Belt Pretensioner (1) * Side Air Bag Modules * Side Air Bag Sensor Assembly
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Glove Compartment Door (2) * Instrument Panel Instrument Panel Reinforcement * Seat Belt Pretensioner (1) * Spiral Cable * Steering Wheel * Wiring Harness & Connectors
Comments	* If any components are damaged or bent, they must be replaced. * DO NOT attempt wiring harness repairs. Replace entire wiring harness.
(1) - Except 1997 LS400. (2) - 1997 LS400 only.	

INSPECTION PROCEDURES TABLE - LEXUS-4

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Center Air Bag Sensor Assembly * Front Air Bag Sensors * Front Seat Belt Tensioners (1)
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Glove Compartment Door (2) * Instrument Panel * Instrument Panel Reinforcement * Spiral Cable * Steering Wheel * Wiring Harness & Connectors
Comments	* If any components are damaged or bent, they must be replaced. * Wiring for Front Air Bag Sensors can be repaired following manufacturer's instructions.
(1) - 1993-95 GS300 and 1993-94 LS400. (2) - Except 1994-95 SC300 and SC400.	

INSPECTION PROCEDURES TABLE - LEXUS-5

Action	Component or System
Replace After Deployment	* Air Bag Module * Center Air Bag Sensor Assembly * Front Air Bag Sensors
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Spiral Cable * Steering Wheel * Wiring Harness & Connectors
Comments	* If any components are damaged or bent, they must be replaced. * Wiring for Front Air Bag Sensors can be repaired following manufacturer's instructions.

INSPECTION PROCEDURES TABLE - LEXUS-6

Action	Component or System
Replace After Deployment	* Air Bag Module * Front Air Bag Sensors
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Center Air Bag Sensor Assembly * Spiral Cable * Steering Wheel * Wiring Harness & Connectors
Comments	* If any components are damaged or bent, they must be replaced. * Wiring for Front Air Bag Sensors can be repaired following manufacturer's instructions.

MAZDA (1990-98)

AIR BAG APPLICATION

AIR BAG APPLICATION TABLE - MAZDA (1990-98)

Model	Year	(1) Location	Inspection Table
Miata	1995-97	D/P	MAZDA-1
	1994	D/P	MAZDA-2
	1990-93	DS	MAZDA-2
Millenia	1995-98	D/P	MAZDA-1
MPV	1996-98	D/P	MAZDA-1
	1995	DS	MAZDA-1
	1994	DS	MAZDA-2
MX-3	1994-95	D/P	MAZDA-2
MX-6	1995-98	D/P	MAZDA-1
	1994	D/P	MAZDA-2
	1993	DS	MAZDA-2

Pickup	1996-98	D/P	MAZDA-2
	1995-96	DS	MAZDA-2
Protege	1995-98	D/P	MAZDA-1
RX7	1994-95	D/P	MAZDA-2
	1990-93	DS	MAZDA-2
626	1995-98	D/P	MAZDA-1
	1994	D/P	MAZDA-2
	1993	DS	MAZDA-2
929	1992-95	D/P	MAZDA-2

(1) - Location Definitions: D/P = Driver's & Passenger's Side, DS = Driver's Side Only, SI = Side Impact.

INSPECTION PROCEDURES

INSPECTION PROCEDURES TABLE - MAZDA-1

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Air Bag Sensor Unit
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Clockspring * Impact Sensors & Sensors Mountings * Steering Column * Steering Wheel * Wiring Harness
Comments	* DO NOT attempt wiring harness repairs. Replace entire wiring harness. * Impact sensors must always be installed with arrow on sensor facing front of vehicle.

INSPECTION PROCEDURES TABLE - MAZDA-2

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Air Bag Diagnosis Control Unit
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Clockspring * Impact Sensors & Sensors Mountings * Steering Column Steering Wheel Wiring Harness
Comments	* DO NOT attempt wiring harness repairs. Replace entire wiring harness. * Impact sensors must always be installed with arrow on sensor facing front of vehicle.

MITSUBISHI (1990-98)

AIR BAG APPLICATION

AIR BAG APPLICATION TABLE - MITSUBISHI (1990-98)

Model	Year	(1) Location	Inspection Table
Diamante	1997-98	D/P	MITSUBISHI-1
	1994-96	D/P	MITSUBISHI-2
	1992-93	DS	MITSUBISHI-2
Eclipse	1996-98	D/P	MITSUBISHI-1
	1995	D/P	MITSUBISHI-3
Expo	1994-95	DS	MITSUBISHI-1
Galant	1997-98	D/P	MITSUBISHI-1
	1994-96	D/P	MITSUBISHI-2
Mirage	1997-98	D/P	MITSUBISHI-1
	1995-96	D/P	MITSUBISHI-4
	1994	DS	MITSUBISHI-4
Montero	1996-98	D/P	MITSUBISHI-2
	1994-95	DS	MITSUBISHI-2
Montero Sport	1997-98	D/P	MITSUBISHI-2
Sigma	1990	DS	MITSUBISHI-3
3000GT	1997-98	D/P	MITSUBISHI-1
	1994-96	D/P	MITSUBISHI-2
	1991-93	DS	MITSUBISHI-2

(1) - Location Definitions: D/P = Driver's & Passenger's Side, DS = Driver's Side Only, SI = Side Impact.

INSPECTION PROCEDURES

INSPECTION PROCEDURES TABLE - MITSUBISHI-1

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * SRS Control Unit
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Clockspring * Steering Column & Intermediate Joint * Steering Wheel * Wiring Harness
Comments	* If any components are damaged or bent, they must be replaced.

INSPECTION PROCEDURES TABLE - MITSUBISHI-2

Action	Component or System
Replace After Deployment	* Air BagModule(s) * Front Impact Sensors * SRS Control Unit
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Clockspring * Steering Column & Intermediate Joint * Steering Wheel * Wiring Harness
Comments	* If any components are damaged or bent, they must be replaced.

INSPECTION PROCEDURES TABLE - MITSUBISHI-3

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Clockspring * Front Impact Sensors * SRS Control Unit * Steering Column & Intermediate Joint * Steering Wheel
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Wiring Harness
Comments	* If any components are damaged or bent, they must be replaced.

INSPECTION PROCEDURES TABLE - MITSUBISHI-4

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Air Bag Control Unit
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Clockspring * Steering Column * Steering Wheel * Wiring Harness
Comments	* If any components are damaged or bent, they must be replaced.

NISSAN (1989-98)

AIR BAG APPLICATION

AIR BAG APPLICATION TABLE - NISSAN (1989-98)

Model	Year	(1) Location	Inspection Table
Altima	1998	D/P	NISSAN-3
	1995-97	D/P	NISSAN-4
	1994	D/P	NISSAN-6
	1993	DS	NISSAN-6
Frontier	1998	D/P	NISSAN-1
Maxima	1998	D/P, SI	NISSAN-2
	1997	D/P	NISSAN-3
	1995-96	D/P	NISSAN-4
	1994	D/P	NISSAN-5
	1992-93	DS	NISSAN-6
NX Coupe	1991-93	DS	NISSAN-6
Pathfinder	1996-98	D/P	NISSAN-5

Pickup	1996-97	DS		NISSAN-5
Pulsar NX	1989-90	DS		NISSAN-6
Quest	1997-98	D/P		NISSAN-3
	1996	D/P		NISSAN-4
	1994-95	DS		NISSAN-5
Sentra	1997-98	D/P		NISSAN-3
	1995-96	D/P		NISSAN-4
	1994	DS		NISSAN-5
	1993	DS		NISSAN-6
200SX	1997-98	D/P		NISSAN-3
	1995-96	D/P		NISSAN-4
240SX	1997-98	D/P		NISSAN-3
	1995-96	D/P		NISSAN-4
300ZX	1994-96	D/P		NISSAN-4
	1991-93	DS		NISSAN-6

(1) - Location Definitions: D/P = Driver's & Passenger's Side, DS = Driver's Side Only, SI = Side Impact.

INSPECTION PROCEDURES

INSPECTION PROCEDURES TABLE - NISSAN-1

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Control Unit, Diagnosis
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Crash Zone Sensor (1) * Instrument Panel * Passenger Deactivation Switch * Spiral Cable * Steering Wheel * Wiring Harnesses
Comments	* If any components are damaged or bent, they must be replaced. * DO NOT attempt SRS wiring harness repairs.
(1) - 4WD only.	

INSPECTION PROCEDURES TABLE - NISSAN-2

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Control Unit, Diagnosis * Side Air Bag Module (1) * Satellite Sensor (1)
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Center Pillar Inner (1) * Instrument Panel * Seat (1) * Spiral Cable * Steering Wheel * Wiring Harnesses
Comments	* If any components are damaged or bent, they must be replaced.

	* DO NOT attempt SRS wiring harness repairs.
(1) - On side of impact.	

INSPECTION PROCEDURES TABLE - NISSAN-3

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Control Unit, Diagnosis
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Instrument Panel * Spiral Cable * Steering Wheel * Wiring Harnesses
Comments	* If any components are damaged or bent, they must be replaced. * DO NOT attempt SRS wiring harness repairs.

INSPECTION PROCEDURES TABLE - NISSAN-4

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Control Unit, Diagnosis
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* All Sensors (1) * Instrument Panel * Spiral Cable * Steering Wheel * Wiring Harnesses
Comments	* If any components are damaged or bent, they must be replaced. * DO NOT attempt SRS wiring harness repairs.
(1) - 300ZX Only.	

INSPECTION PROCEDURES TABLE - NISSAN-5

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Control Unit, Diagnosis
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* All Sensors (1) * Crash Zone Sensor (2) * Instrument Panel (3) * Spiral Cable * Steering Wheel * Wiring Harnesses
Comments	* If any components are damaged or bent, they must be replaced. DO NOT attempt SRS wiring harness repairs.

(1) - Except Pathfinder and Pickup.
(2) - 4WD Pickup only.
(3) - Pathfinder only.

INSPECTION PROCEDURES TABLE - NISSAN-6

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Control Unit, Diagnosis * Sensors In Affected Collision Area
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* All Sensors Spiral Cable * Steering Wheel * Wiring Harnesses
Comments	* If any components are damaged or bent, they must be replaced. * DO NOT attempt SRS wiring harness repairs.

SUBARU (1992-98)

AIR BAG APPLICATION

AIR BAG APPLICATION TABLE - SUBARU (1992-98)

Model	Year	(1) Location
Forester	1998	D/P
Impreza	1994-98	D/P
	1993	DS
Legacy	1995-98	D/P
	1992-94	DS
SVX	1994-97	D/P
	1992-93	DS

(1) - Location Definitions: D/P = Driver's & Passenger's Side, DS = Driver's Side Only, SI = Side Impact.

INSPECTION PROCEDURES

INSPECTION PROCEDURES TABLE - SUBARU (1992-98)

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Air Bag Control Module * Front Impact Sensors (1) * Side Air Bag Sensors (2)
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Air Bag Control Module * Combination Switch & Clockspring * Front Impact Sensors

Comments	* DO NOT attempt SRS wiring repairs. * If any components are damaged or bent, they must be replaced.

(1) - If Equipped.
(2) - 1998 Legacy, on side of deployment.

SUZUKI (1995-98)

AIR BAG APPLICATION

AIR BAG APPLICATION TABLE - SUZUKI (1995-98)

Model	Year	(1) Location
Esteem	1995-98	D/P
Sidekick	1996-98	D/P
Swift	1995-98	D/P
X90	1996-98	D/P

(1) - Location Definitions: D/P = Driver's & Passenger's Side, DS = Driver's Side Only, SI = Side Impact.

INSPECTION PROCEDURES

INSPECTION PROCEDURES TABLE - SUZUKI (1995-98)

Action	Component or System
Replace After Deployment	* Air BagModule(s) * Sensing & Diagnostic Module (SDM)
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Air Bag Warning Light * Combination Switch Assembly * Contact Coil * Forward Discriminating Sensor (1) * Instrument Panel Reinforcement * Knee Bolsters * Seat Belts & Mounting Points * SDM Bracket * Steering Column Bracket * Steering Column & Shaft Joints * Steering Wheel * Wiring Harness
Comments	* If any components are damaged or bent, they must be replaced.

(1) - Swift Only

TOYOTA (1990-98)

AIR BAG APPLICATION

AIR BAG APPLICATION TABLE - TOYOTA (1990-98)

Model	Year	(1) Location	Inspection Table
Avalon	1998	D/P, SI	TOYOTA-1
	1996-97	D/P	TOYOTA-3
	1995	D/P	TOYOTA-4
Camry	1998	D/P, SI	TOYOTA-1
	1997	D/P	TOYOTA-3
	1996	D/P	TOYOTA-5
	1994-95	D/P	TOYOTA-6
	1992-93	DS	TOYOTA-9
Celica	1998	D/P	TOYOTA-2
	1996-97	D/P	TOYOTA-5
	1994-95	D/P	TOYOTA-7
	1990-93	DS	TOYOTA-10
Corolla	1998	D/P, SI	TOYOTA-1
	1996-97	D/P	TOYOTA-3
	1994-95	D/P	TOYOTA-6
	1993	DS	TOYOTA-9
Land Cruiser	1998	D/P	TOYOTA-2
	1995-97	D/P	TOYOTA-4
MR2	1994-95	D/P	TOYOTA-5
	1991-93	DS	TOYOTA-10
Paseo	1996-97	D/P	TOYOTA-3
	1993-95	DS	TOYOTA-9
Previa	1996-97	D/P	TOYOTA-3
	1994-95	D/P	TOYOTA-6
	1992-93	DS	TOYOTA-9
RAV4	1996-98	D/P	TOYOTA-3
Sienna	1998	D/P	TOYOTA-1
Supra	1997-98	D/P	TOYOTA-3
	1993-96	D/P	TOYOTA-5
	1990-92	DS	TOYOTA-10
Tercel	1998	D/P	TOYOTA-2
	1996-97	D/P	TOYOTA-3
	1995	D/P	TOYOTA-8
	1993-94	DS	TOYOTA-9
Tacoma	1998	D/P	TOYOTA-3
	1996-97	DS	TOYOTA-3
T100	1994-98	DS	TOYOTA-9
4Runner	1996-98	D/P	TOYOTA-4

(1) - Location Definitions: D/P = Driver's & Passenger's Side, DS = Driver's Side Only, SI = Side Impact.

INSPECTION PROCEDURES

INSPECTION PROCEDURES TABLE - TOYOTA-1

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Air Bag Sensor Assembly * Front Air Bag Sensors (1) * Seat Belt Pretensioner (2) * Seatback Assembly (2) (3) * Side Air Bag Modules (If Equipped) (2) * Side Air Bag Sensor Assembly (If equipped) (1)

Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Instrument Panel * Instrument Panel Reinforcement * Seatback Assembly (2) * Seat Belt Pretensioner (2) * Spiral Cable * Steering Wheel * Wiring Harness & Connectors
Comments	* If any components are damaged or bent, they must be replaced. * DO NOT attempt wiring harness repairs. Replace entire wiring harness.
(1) - Corolla and Sienna only. Replace both sensors. (2) - On side of impact. (3) - Avalon only.	

INSPECTION PROCEDURES TABLE - TOYOTA-2

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Air Bag Sensor Assembly * Front Air Bag Sensors * Seat Belt Pretensioner (1)
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Instrument Panel * Instrument Panel Reinforcement * Seat Belt Pretensioner (1) * Spiral Cable * Steering Wheel * Wiring Harness & Connectors
Comments	* If any components are damaged or bent, they must be replaced. * DO NOT attempt wiring harness repairs. Replace entire wiring harness.
(1) - Land Cruiser and Tercel only.	

INSPECTION PROCEDURES TABLE - TOYOTA-3

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Air Bag Sensor Assembly * Front Air Bag Sensor (1) * Instrument Panel (2) * Instrument Panel Reinforcement (2) * Spiral Cable (3) * Steering Wheel (3)
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Spiral Cable (4) * Steering Wheel (4) * Wiring Harness & Connectors
Comments	* If any components are damaged or bent, they

	must be replaced.

(1) - 1998 RAV4 only.
(2) - Except 1996-97 Tacoma and 1998 Supra.
(3) - Except 1998 Tacoma.
(4) - 1998 Tacoma.

INSPECTION PROCEDURES TABLE - TOYOTA-4

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Air Bag Sensor Assembly * Glove Compartment Door * Instrument Panel * Instrument Panel Reinforcement * Spiral Cable * Steering Wheel
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Wiring Harness & Connectors
Comments	* If any components are damaged or bent, they must be replaced.

INSPECTION PROCEDURES TABLE - TOYOTA-5

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Center Air Bag Sensor Assembly * Front Air Bag Sensors * Instrument Panel * Instrument Panel Reinforcement * Spiral Cable * Steering Wheel
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Wiring Harness & Connectors
Comments	* If any components are damaged or bent, they must be replaced. * Wiring for Front Air Bag Sensors can be repaired following manufacturer's instructions.

INSPECTION PROCEDURES TABLE - TOYOTA-6

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Center Air Bag Sensor Assembly

	* Front Air Bag Sensors * Glove Compartment * Glove Compartment Door * Instrument Panel * Instrument Panel Reinforcement * Spiral Cable * Steering Wheel
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Wiring Harness & Connectors
Comments	* If any components are damaged or bent, they must be replaced. * Wiring for Front Air Bag Sensors can be repaired following manufacturer's instructions.

INSPECTION PROCEDURES TABLE - TOYOTA-7

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Center Air Bag Sensor Assembly * Center Console Bracket Support * Front Air Bag Sensors * Instrument Panel * Spiral Cable * Steering Wheel
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Wiring Harness & Connectors
Comments	* If any components are damaged or bent, they must be replaced. * Wiring for Front Air Bag Sensors can be repaired following manufacturer's instructions.

INSPECTION PROCEDURES TABLE - TOYOTA-8

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Air Bag Sensor Assembly * Center Console Bracket Support * Instrument Panel Spiral Cable * Steering Wheel
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not	* Wiring Harness & Connectors

Deploy)	
Comments	* If any components are damaged or bent, they must be replaced.

INSPECTION PROCEDURES TABLE - TOYOTA-9

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Center Air Bag Sensor Assembly * Front Air Bag Sensors * Spiral Cable * Steering Wheel
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Wiring Harness & Connectors
Comments	* If any components are damaged or bent, they must be replaced. * Wiring for Front Air Bag Sensors can be repaired following manufacturer’s instructions.

INSPECTION PROCEDURES TABLE - TOYOTA-10

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Front Air Bag Sensors * Spiral Cable * Steering Wheel
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Center Air Bag Sensor Assembly * Wiring Harness & Connectors
Comments	* If any components are damaged or bent, they must be replaced. * Wiring for Front Air Bag Sensors can be repaired following manufacturer’s instructions.

J - PIN VOLTAGE CHARTS

1998 Mitsubishi Galant

1998 ENGINE PERFORMANCE
Mitsubishi - Pin Voltage Charts

Diamante, Eclipse, Galant, Mirage, Montero, Montero Sport, 3000GT

INTRODUCTION

NOTE: Unless stated otherwise in testing procedures, perform all voltage tests using a Digital Volt-Ohmmeter (DVOM) with a minimum 10-megohm input impedance. Voltage readings may vary slightly due to battery condition or charging rate.

Pin voltage charts are supplied to reduce diagnostic time. Checking pin voltages at the PCM connector determines whether it is receiving and transmitting proper voltage signals. Diagnostic charts may also help determine if PCM harness is shorted or open.

TEST PROCEDURE

CAUTION: Shorting positive DVOM lead between connector terminal and ground could damage vehicle wiring, sensor and PCM.

1) If necessary, remove Powertrain Control Module (PCM) to access harness connector. For PCM location, see PCM LOCATION table. Leave PCM connectors connected.

2) Using DVOM, backprobe terminals. Connect positive DVOM lead to appropriate PCM terminal. Connect negative DVOM lead to PCM ground terminal. For PCM terminal identification, see appropriate chart. See Figs. 1-24.

3) All measurements are applicable to vehicle at normal operating temperature at sea level. Unless otherwise noted, engine is idling when specification requires engine running. Ensure transmission shift selector is in Neutral or Park (as applicable). If DVOM displays measurement that is not within specification, see G - TESTS W/CODES article.

PCM LOCATION TABLE

Application	Location
Eclipse 2.0L Non-Turbo	In Front of Left Front Strut Tower
Mirage & Montero Sport	Behind Right Side Of Instrument Panel (Glove Box)
Montero	Right Front Kick Panel
All Others	Behind Center Console

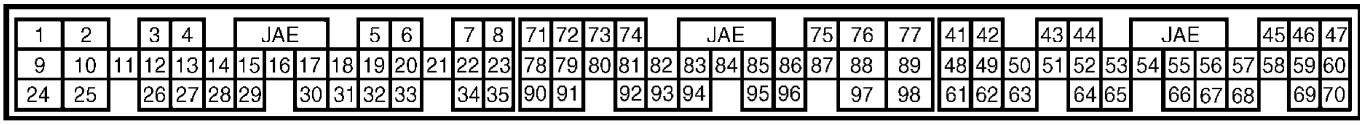


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Fig. 1: Identifying PCM Terminals (Diamante)
Courtesy of Mitsubishi Motor Sales of America

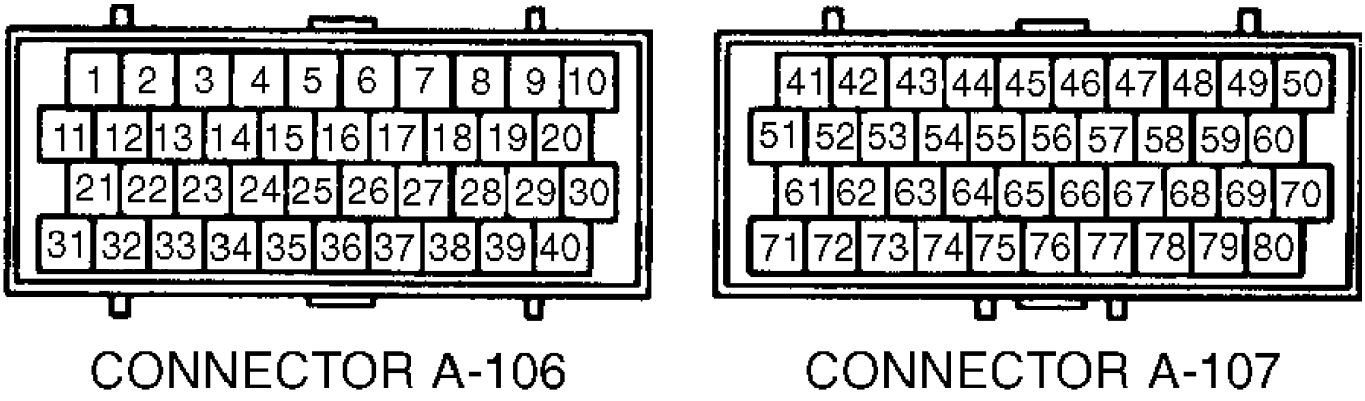

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Fig. 2: Identifying PCM Terminals (Eclipse 2.0L Non-Turbo)
Courtesy of Mitsubishi Motor Sales of America

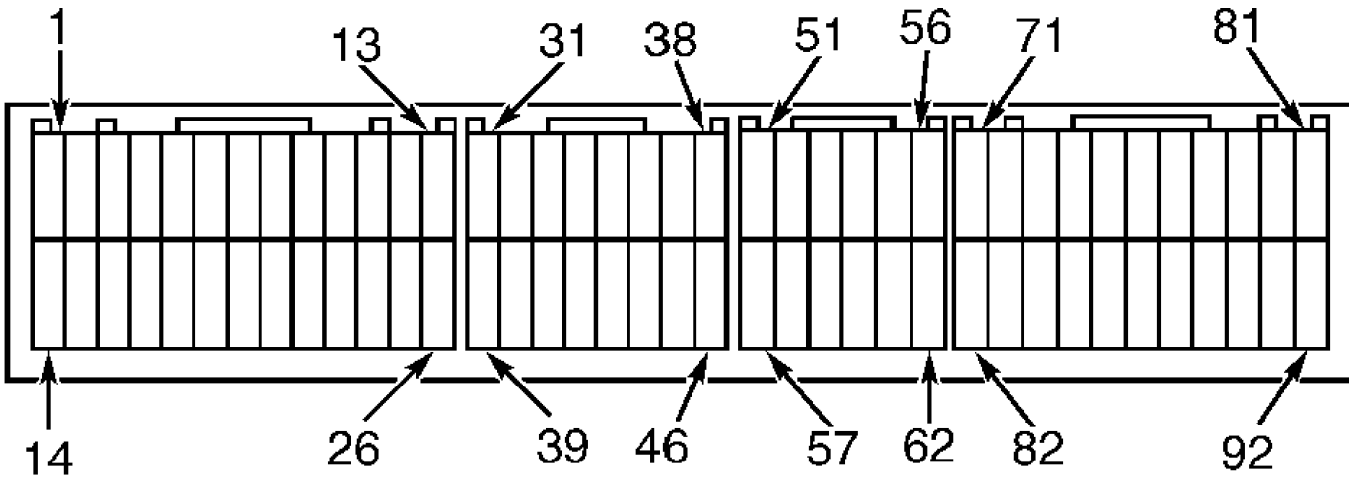

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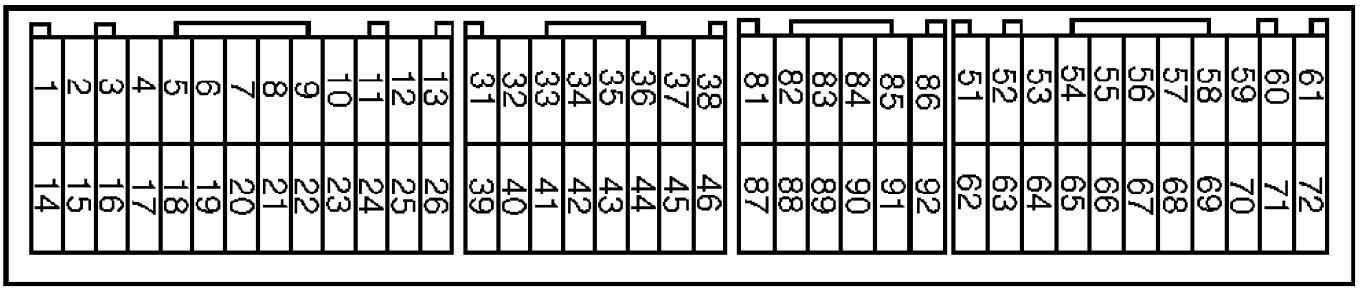
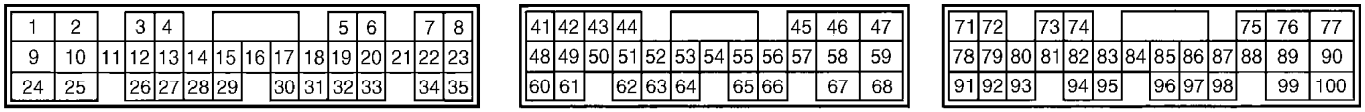
Fig. 3: Identifying PCM Terminals (Eclipse 2.0L Turbo & 2.4L & Mirage
Courtesy of Mitsubishi Motor Sales of America



98F12430

Fig. 4: Identifying PCM Terminals (Galant)
Courtesy of Mitsubishi Motor Sales of America



98G12431

Fig. 5: Identifying PCM Terminals (Montero, Montero Sport & 3000GT)
Courtesy of Mitsubishi Motor Sales of America

	Terminal ID.	Function/Description	Voltage Value (DC Volts Unless Otherwise Specified)
Black/Red	1	Injector No. 1	B+ With KOER [1] B+ & Momentary Drop @ WOT With KOER [1]
Yellow/Green	2	Injector No. 4	B+ With KOER [1] B+ & Momentary Drop @ WOT With KOER [1]
Black	3	Front Heated Oxygen Sensor Heater	0-3 Volts With KOER [1], B+ @ 5000 RPM
Brown/Green	6	EGR Solenoid	B+ With KOEO [2] B+ & Momentary Drop @ WOT With KOER [1]
Yellow	9	Injector No. 2	B+ With KOER [1] B+ & Momentary Drop @ WOT With KOER [1]
Yellow/Blue	10	Injector No. 5	B+ With KOER [1] B+ & Momentary Drop @ WOT With KOER [1]
White/Green	11	Ignition Power Transistor	0.3-3.0 Volts @ 3000 RPM
Green/Black	14	Idle Air Control Motor A1	B+/0-3 Volts [3] (Load Controlled)
Green/White	15	Idle Air Control Motor B1	B+/0-3 Volts [3] (Load Controlled)
Brown/White	16	EVAP Emission Purge Solenoid	[4]
Green	17	Radiator Fan Motor Relay (Low)	B+ With KOEO [2] (Fan Off) 0-3 Volts KOEO [2] (Fan On)
Black/Yellow	18	Radiator Fan Motor Relay (High)	B+ With KOEO [2] (Fan Off) 0-3 Volts KOEO [2] (Fan On)
Green	19	Volume Airflow Sensor	2.2-3.2 Volts With KOER [1]
White/Red	20	MFI Relay Supply Voltage	B+ With Ignition Off, 0-3 Volts With KOEO [2]
Green/Yellow	21	A/C Compressor Clutch Relay	6 Volts Or More KOER [1] 0-3 Volts With Clutch Cycling
Green/Yellow	22	Malfunction Indicator Light	0-3 Volts With KOEO [2] (Initially) 9-13 Volts After Several Seconds
Yellow/Red	24	Injector No. 3	B+ With KOER [1] B+ & Momentary Drop @ WOT With KOER [1]
Yellow/Black	25	Injector No. 6	B+ With KOER [1] B+ & Momentary Drop @ WOT With KOER [1]
Black	26	Rear Heated Oxygen Sensor Heater	0-3 Volts With KOER [1]
Green/Red	28	Idle Air Control Motor A2	B+/0-3 Volts [3] (Load Controlled)
Black/Yellow	29	Idle Air Control Motor B2	B+/0-3 Volts [3] (Load Controlled)
Brown/White	35	EVAP Emission Vent Solenoid	B+ KOEO [2] 0-3 Volts (Initially) During Driving
White	41	Front Heated Oxygen Sensor	0-0.8 Volt (Pulse) With KOER [1]
White	43	Front Heated Oxygen Sensor	0-0.8 Volt (Pulse) With KOER [1]
Yellow/Red	49	Closed Throttle Position Switch	0-1 Volt With KOEO [2] (Throttle Closed) 4 Volts Or More With KOEO [2] (Throttle Open)
White/Blue	50	Vehicle Speed Sensor	0-5 Volts (Pulse) With KOER [1] (Vehicle Moving)
Blue/White	51	Transaxle	[4]
Blue	52	Transaxle	[4]
Green/Red	53	Air Conditioning Switch	0-3 Volts With KOER [1] (A/C Off) B+ With KOER [1] (A/C On)

[1] - KOER - Key On, Engine Running.
[2] - KOEO - Key On, Engine Off.
[3] - Check immediately after hot start.
[4] - Information is not available from manufacturer.

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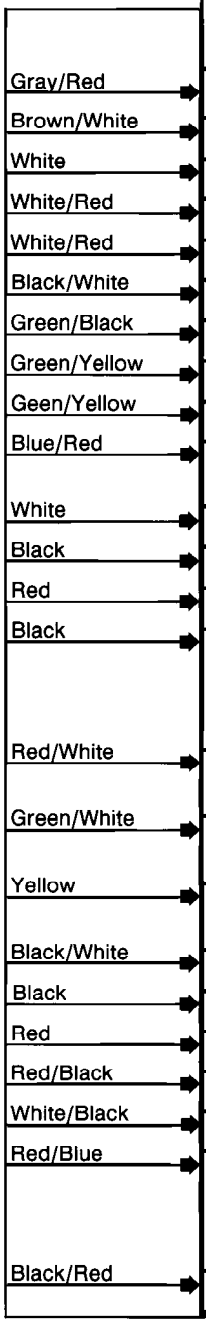
Fig. 6: Pin Voltage Chart (Diamante - 1 Of 2)



Terminal ID.	Function/Description	Voltage Value (DC Volts Unless Otherwise Specified)
54	Data Link Connector	Not Applicable
55	Data Link Connector	Not Applicable
61	Knock Sensor	[1]
62	Manifold Differential Pressure Sensor	0.8-2.4 Volts With KOER [2]
63	Fuel Tank Pressure Differential Sensor	1.2-3.8 Volts With KOER [2]
69	Ignition Switch (IG)	B+ With KOEO [3]
70	Flash Memory Connector	[1]
72	Sensor Impressed Voltage	4.5-5.5 Volts With KOEO [3]
72	Throttle Position Sensor	0.3-1.0 Volt With KOEO [3], 4.5-5.5 Volts @ WOT
73	Crankshaft Position Sensor	0.4-4.0 Volts With Engine Cranking 1.0.5-2.5 Volts With KOER [2]
75	Check Ignition Connector	[1]
76	Ground Circuit	[1]
77	Power Supply	B+ With KOEO [3]
79	Engine Coolant Temperature Sensor	3.2-3.8 Volts With KOEO [3] (Sensor @ 32°F) 2.3-2.9 Volts With KOEO [3] (Sensor @ 68°F) 1.3-1.9 Volts With KOEO [3] (Sensor @ 104°F) 0.3-0.9 Volt With KOEO [3] (Sensor @ 176°F)
80	Camshaft Position Sensor	0.4-3.0 Volts With Engine Cranking 0.5-2.0 Volts With KOER [2]
81	Barometric Pressure Sensor	3.7-4.3 Volts With KOEO [3] (Sea Level) 3.2-3.8 Volts With KOEO [3] (@ 3937 Ft.)
84	Power Steering Pressure Switch	B+ With KOER [2] Steering Wheel Stationary 0-3 Volts When Steering Wheel Is Turned
87	MFI Relay Supply Voltage	B+ With Ignition Off, 0-3 Volts With KOEO [3]
88	Ground Circuit	[1]
89	Power Supply	B+ With KOEO [3]
90	Back-Up Power Supply	B+ With Ignition Off
91	Volume Airflow Sensor Reset Signal	0-1 Volt @ idle, 6-9 volts @ 3000 RPM
92	Intake Air Temperature Sensor	3.2-3.8 Volts With KOEO [3] (Sensor @ 32°F) 2.3-2.9 Volts With KOEO [3] (Sensor @ 68°F) 1.5-2.1 Volts With KOEO [3] (Sensor @ 104°F) 0.4-1.0 Volt With KOEO [3] (Sensor @ 176°F)
98	Ignition Switch (ST)	8 Volts Or More (Engine Cranking)

[1] - Information is not available from manufacturer.
[2] - KOER - Key On, Engine Running.
[3] - KOEO - Key On, Engine Off.

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Fig. 7: Pin Voltage Chart (Diamante - 2 Of 2)

NOTE: Manufacturer does not provide pin voltage information for 2.0L non-turbo models. For wire color identification at PCM terminals, see WIRING DIAGRAMS article.

Terminal ID.	Function/Description	Voltage Value (DC Volts Unless Otherwise Specified)
1 (Green)	Injector No. 1	B+ With KOER [1] B+ & Momentary Drop @ WOT With KOER [1]
2 (Green/Yellow)	Injector No. 3	B+ With KOER [1] B+ & Momentary Drop @ WOT With KOER [1]
3 (Blue/Red)	Fuel Pressure Solenoid Valve (Turbo)	B+ With KOEO [2] 0-3 Volts/B+ With KOER [1]
4 (Gray)	Idle Air Control Motor A1	B+/0-6 Volts With KOER [3] (Load Controlled)
5 (Gray/Blue)	Idle Air Control Motor B1	B+/0-6 Volts With KOER [3] (Load Controlled)
6 (Light Green/Red)	EGR Solenoid	B+ With KOEO [2] B+ & Momentary Drop At WOT With KOER [1]
7 (Black/Blue)	Torque Reduce Request Signal No. 1	4.5-5.5 Volts With KOER [1] 0-1 Volt During Driving & Speed Changes
8 (White/Red)	Fuel Pump Relay (Turbo)	B+ With KOEO [2], 0-3 Volts With KOER [1]
8 (White/Red)	Fuel Pump Relay Module (2.4L)	0-0.5 Volt With KOEO [2] 0.7-2.8 Volts With KOER [1] Or Cranking
9 (Lt. Green/Black)	EVAP Emission Purge Solenoid	B+ With KOEO [2], 0-3 Volts @ 3000 RPM
10 (Black/Blue)	Power Transistor "A"	0.3-3.0 Volts @ 3000 RPM
11 (Red/Yellow)	Waste Gate Solenoid (Turbo)	B+ With KOEO [2], 0-3 Volts With KOER [1]
12 (Red)	Power Supply	B+ With KOEO [2]
13 (Black)	Camshaft Position Sensor Ground	Not Applicable
14 (Yellow/Black)	Injector No. 2	B+ With KOER [1] B+ & Momentary Drop @ WOT With KOER [1]
15 (Green/Red)	Injector No. 4	B+ With KOER [1] B+ & Momentary Drop @ WOT With KOER [1]
16 (Red/Black)	Boost Meter (Turbo)	4-13 Volts With KOEO [2] B+ & Momentary Drop At WOT With KOER [1]
17 (Green/Black)	Idle Air Control Motor A2	B+/0-6 Volts With KOER [3] (Load Controlled)
18 (Green/Yellow)	Idle Air Control Motor B2	B+/0-6 Volts With KOER [3] (Load Controlled)
19 (Red/White)	Volume Airflow Sensor Reset Signal	0-1 Volt With KOER [1], 6-9 Volts @ 3000 RPM
20 (Green/Orange)	Fan Motor Relay (High)	B+ At Less Than 194°F (Fan Motor Off) 0-3 Volts @ 221°F Or More (Fan Motor On)
21 (Green/Black)	Fan Motor Relay (Low)	B+ At Less Than 194° F (Fan Motor Off) 0-3 Volts @ More Than 221°F (Fan Motor On
22 (Green)	A/C Compressor Clutch Relay	6 Volts Or More With KOER [1] 0-3 Volts With Clutch Cycling
23 (Brown/Red)	Power Transistor "B"	0.3-3.0 Volts @ 3000 RPM

[1] - KOER - Key On, Engine Running.
[2] - KOEO - Key On, Engine Off.
[3] - Check immediately after hot start.

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Fig. 8: Pin Voltage Chart (Eclipse - 1 Of 3)

NOTE: Manufacturer does not provide pin voltage information for 2.0L non-turbo models. For wire color identification at PCM terminals, see WIRING DIAGRAMS article.

Terminal ID.	Function/Description	Voltage Value (DC Volts Unless Otherwise Specified)
25 (Red)	Power Supply	B+ With KOEO [1]
26 (Black)	Ground	Not Applicable
33 (White)	Generator Terminal "G"	0.2-3.5 Volts KOER [2] (Fan & Accessories Off) Voltage Rises As Fan & Accessories Come On
36 (Green/Red)	Malfunction Indicator Light	0-3 Volts KOEO [1] (Initially) 9-13 Volts After Several Seconds
37 (Blue/White)	Power Steering Pressure Switch	B+ With KOER [2] Steering Wheel Stationary 0-3 Volts When Steering Wheel Is Turned
38 (Blue/Green)	MFI Relay Power Supply	B+ (Ignition Off) 0-3 Volts With KOEO [1]
41 (Green)	Generator Terminal "FR"	0.2-3.5 Volts KOER [2] (Fan & Accessories Off) Voltage Drops As Fan & Accessories Come On
42 [3]	A/C Refrigerant Intermediate Switch (High Side)	B+ With Pressure 199 PSI Or Less 0-3 Volts With Pressure 270 PSI Or More
43 (White/Green)	Torque Reduce Request Signal No. 2	0-1 Volt With KOER [2] 1-5.5 Volts During Driving & Speed Changes
45 (Green/Red)	A/C Switch	0-3 Volts With KOER [2] (A/C Off) B+ With KOER [2] (A/C On)
46 (Orange/Black)	Torque Execute Signal	0-1 Volt With KOER [2] (Eng. Temp. 122°F Or Less) 1-4 Volts With KOER [2] (Engine Temp. Normal)
54 (Yellow/Black)	Rear Heated Oxygen Sensor Heater	0-3 Volts With KOER [2], B+ @ 5000 RPM
55 (Blue/Red)	EVAP Vent Solenoid	B+ KOEO [1] 0-3 Volts (Initially) During Driving
56 (Yellow)	Data Link Connector	Not Applicable
58 (White)	Engine Ignition Signal	0.3-3.0 Volts @ 3000 RPM
60 (Yellow)	Front Heated Oxygen Sensor Heater	0-3 Volts With KOER [2], B+ @ 5000 RPM
61 (Blue/White)	Fuel Tank Differential Pressure Sensor	1.2-3.8 Volts KOER [2]
62 (Pink)	Data Link Connector	Not Applicable
71 (Black/Yellow)	Ignition Switch (ST)	8 Volts Or More Engine Cranking
72 (Red/Blue)	Intake Air Temperature Sensor	3.2-3.8 Volts With KOEO [1] (Sensor @ 32°F) 2.3-2.9 Volts With KOEO [1] (Sensor @ 68°F) 1.5-2.1 Volts With KOEO [1] (Sensor @ 104°F) 0.4-1.0 Volt With KOEO [1] (Sensor @ 176°F)
73 (Lt. Green/Black)	Manifold Differential Pressure Sensor	0.8-2.4 Volts With KOER [2]
75 (White)	Rear Heated Oxygen Sensor	0.6-1.0 Volt @ 3500 RPM Or More
76 (White)	Front Heated Oxygen Sensor	0-0.8 Volt @ 2000 RPM
78 (White)	Knock Sensor Ground (Turbo)	Not Applicable
80 (Red/Blue)	Back-Up Power Supply	B+ (Ignition OFF)
81 (Green/Yellow)	Sensor Impressed Voltage	4.5-5.5 Volts With KOEO [1]
82 (Black/White)	Ignition Switch (IG)	B+ With KOEO [1]

[1] - KOEO - Key On, Engine Off.
[2] - KOER - Key On, Engine Running.
[3] - Wire color information is not available from manufacturer.

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Fig. 9: Pin Voltage Chart (Eclipse - 2 Of 3)

NOTE: Manufacturer does not provide pin voltage information for 2.0L non-turbo models. For wire color identification at PCM terminals, see WIRING DIAGRAMS article.

Terminal ID.	Function/Description	Voltage Value (DC Volts Unless Otherwise Specified)
83 (Black/White)	Engine Coolant Temperature Sensor	3.2-3.8 Volts With KOEO [1] (Sensor @ 32°F) 2.3-2.9 Volts With KOEO [1] (Sensor @ 68°F) 1.3-1.9 Volts With KOEO [1] (Sensor @ 104°F) 0.3-0.9 Volt With KOEO [1] (Sensor @ 176°F)
84 (Brown/Red)	Throttle Position Sensor	0.3-1.0 Volt With KOER [2], 4.5-5.5 Volts @ WOT
85 (Orange)	Barometric Pressure Sensor	3.7-4.3 Volts With KOEO [1] (Sea Level) 3.2-3.8 Volts With KOEO [2] (@ 3937 Ft.)
86 (Yellow)	Vehicle Speed Sensor	0-5 Volts (Pulse) KOER [2] (Vehicle Moving)
87 (Yellow/Red)	Closed Throttle Position Switch	0-1 Volt With KOEO [1] (Throttle Closed) 4 Volts Or More With KOEO [1] (Throttle Open)
88 (Blue/Red)	Camshaft Position Sensor	0.4-3.0 Volts (Engine Cranking) 0.5-2.0 Volts With KOER [2]
89 (Blue/White)	Crankshaft Position Sensor	0.4-4.0 Volts (Engine Cranking) 1.5-2.5 Volts With KOER [2]
90 (Blue/Yellow)	Volume Airflow Sensor	2.2-3.2 Volts @ Idle Or 2500 RPM
91 (Black/Red)	Park/Neutral Position Switch (A/T)	0-3 Volts With KOEO [1] (In "P" Or "N") 8-14 Volts KOEO [1] (In "D", "2", "L" Or "R")
91 (Black)	Ground Circuit (M/T)	Not Applicable
92 (Black)	Engine Coolant Temperature Sensor Ground	Not Applicable

[1] - KOEO - Key On, Engine Off.
[2] - KOER - Key On, Engine Running.

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Fig. 10: Pin Voltage Chart (Eclipse - 3 Of 3)

	Terminal ID.	Function/Description	Voltage Value (DC Volts Unless Otherwise Specified)
Yellow/Blue	1	Injector No. 1	B+ With KOER [1] B+ & Momentary Drop @ WOT With KOER [1]
Blue/Green	2	Injector No. 3	B+ With KOER [1] B+ & Momentary Drop @ WOT With KOER [1]
Blue/Yellow	4	Idle Air Control Motor (Closed)	More Than 2 Volts (Initially) KOEO [2] Then 0-1 Volt With KOEO [2]
White	5	IAC Motor Valve Position Sensor No. 1	1.5-4 Volts (Initially) KOEO [2] Then 0-1 or 4.5-5.5 Volts With KOEO [2]
Brown	6	EGR Solenoid (Fed.)	B+ With KOEO [2] B+ & Momentary Drop @ WOT With KOER [1]
Green	7	Torque Reduce Execute Signal	0-1 Volt With KOER [1] (Eng. Temp. 122°F Or Less) 1-4 Volts With KOER [1] (Eng. Temp. Normal)
Black/Blue	8	Fuel Pump Relay Module	0-0.5 Volt With KOEO [2] 0.7-2.8 Volts With KOER [1] Or Cranking
Green/Red [3]	9	EVAP Emission Purge Solenoid	B+ With KOEO [2], 0-3 Volts @ 3000 RPM
Red	10	Ignition Power Transistor	0.3-3.0 Volts @ 3000 RPM
Black	12	Power Supply	B+ With KOEO [2]
Yellow/Black	13	System Ground	Not Applicable
Lt. Green/White	14	Injector No. 2	B+ With KOER [1] B+ & Momentary Drop @ WOT With KOER [1]
Green/Black	15	Injector No. 4	B+ With KOER [1] B+ & Momentary Drop @ WOT With KOER [1]
Green	17	Idle Air Control Motor (Open)	More Than 4 Volts (Initially) KOEO [2] Then 0-1 Volt With KOEO [2]
Blue	18	IAC Motor Valve Position Sensor No. 2	1.5-4 Volts (Initially) KOEO [2] Then 0-1 or 4.5-5.5 Volts With KOEO [2]
Blue/Red	19	Volume Airflow Sensor Reset Signal	0-1 Volt With KOER [1], 6-9 Volts @ 3000 RPM
Green/Yellow	20	Radiator Fan Motor Relay (High)	B+ At Less Than 194°F (Fan Motor Off) 0-3 Volts @ 221°F Or More (Fan Motor On)
Green	21	Radiator Fan Motor Relay (Low)	B+ At Less Than 194° F (Fan Motor Off) 0-3 Volts @ More Than 221°F (Fan Motor On
Red	22	A/C Compressor Clutch Relay	6 Volts Or More With KOER [1] 0-3 Volts With Clutch Cycling
Black	25	Power Supply	B+ With KOEO [2]
[3]	26	System Ground	Not Applicable
Brown/Red	31	Engine Ignition Signal	0.3-3 Volts @ 3000 RPM
Lt. Green/Red	33	Generator Terminal "G"	0.2-3.5 Volts KOER [1] (Fan & Accessories Off) Voltage Drops As Fan & Accessories Come On
	36	Malfunction Indicator Light	0-3 Volts KOEO [2] (Initially) 9-13 Volts After Several Seconds

[1] - KOER - Key On, Engine Running.
[2] - KOEO - Key On, Engine Off.
[3] - Wire color identification is not available from manufacturer.

98J12582

Fig. 11: Pin Voltage Chart (Galant - 1 Of 3)

	Terminal ID.	Function/Description	Voltage Value (DC Volts Unless Otherwise Specified)
Yellow	37	Power Steering Pressure Switch	B+ With KOER [1] Steering Wheel Stationary 0-3 Volts When Steering Wheel Is Turned
Green/Yellow	38	MFI Relay Power Supply	B+ With Ignition Off, 0-3V With KOEO [2]
Yellow/White	41	Generator Terminal "FR"	0.2-3.5 Volts KOER [1] (Fan & Accessories Off) Voltage Drops As Fan & Accessories Come On
[3]	42	A/C Refrigerant Intermediate Switch (High Side)	B+ With Pressure 199 PSI Or Less 0-3 Volts With Pressure 270 PSI Or More
Green/Yellow	43	Torque Reduce Request Signal No. 2	0-1 Volt With KOER [1] 1-5.5 Volts During Driving & Speed Changes
Green/White	45	Air Conditioning Switch	0-3 Volts With KOER [1] (A/C Off) B+ With KOER [1] (A/C On)
Green/Red	46	Torque Reduce Request Signal No. 1	4.5-5.5 Volts With KOER [1] 0-1 Volt During Driving & Speed Changes
Black/Yellow [4]	51	Ignition Switch (ST)	8 Volts Or More (Engine Cranking)
Red/Black	52	Intake Air Temperature Sensor	3.2-3.8 Volts With KOEO [2] (Sensor @ 32°F) 2.3-2.9 Volts With KOEO [2] (Sensor @ 68°F) 1.5-2.1 Volts With KOEO [2] (Sensor @ 104°F) 0.4-1.0 Volt With KOEO [2] (Sensor @ 176°F)
Blue/Black	53	Manifold Differential Pressure Sensor (Fed.)	0.8-2.4 Volts KOER [1]
White	55	Rear Heated Oxygen Sensor	0.6-1 Volt In 2nd Gear Or "L" @ WOT
White	56	Front Heated Oxygen Sensor	0-0.8 Volt (Pulse) @ 2500 RPM
Black/Yellow	60	Back-Up Power Supply	B+ With Ignition Off
Green/Blue	61	Sensor Impressed Voltage	4.5-5.5 Volts With KOEO [2]
Yellow/Green	63	Engine Coolant Temperature Sensor	3.2-3.8 Volts With KOEO [2] (Sensor @ 32°F) 2.3-2.9 Volts With KOEO [2] (Sensor @ 68°F) 1.3-1.9 Volts With KOEO [2] (Sensor @ 104°F) 0.3-0.9 Volt With KOEO [2] (Sensor @ 176°F)
Green/White	64	Throttle Position Sensor	0.3-1.0 Volt With KOER [1], 4.5-5.5 Volts @ WOT
Pink	65	Barometric Pressure Sensor	3.7-4.3 Volts With KOEO [2] (Sea Level) 3.2-3.8 Volts With KOEO [2] (@ 3937 Ft.)
Yellow/White	66	Vehicle Speed Sensor	0-5 Volts (Pulse) KOER [1] (Vehicle Moving)
Yellow/Red	67	Closed Throttle Position Switch	0-1 Volt With KOEO [2] (Throttle Closed) 4 Volts Or More With KOEO [2] (Throttle Open)
Brown/Green	68	Camshaft Position Sensor	0.4-3.0 Volts (Engine Cranking) 0.5-2.0 Volts With KOER [1]
Red/Yellow	69	Crankshaft Position Sensor	0.4-4.0 Volts (Engine Cranking) 1.5-2.5 Volts With KOER [1]
White/Black	70	Volume Airflow Sensor	2.2-3.2 Volts @ Idle Or 2500 RPM

[1] - KOER - Key On, Engine Running.
[2] - KOEO - Key On, Engine Off.
[3] - Wire color identification is not available from manufacturer.
[4] - Wire color is Black/Red on A/T.

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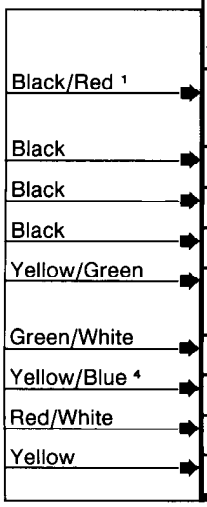
Fig. 12: Pin Voltage Chart (Galant - 2 Of 3)



Terminal ID.	Function/Description	Voltage Value (DC Volts Unless Otherwise Specified)
71	Park/Neutral Position Switch (A/T)	0-3 Volts With KOEO 2 (In "P" Or "N") 8-14 Volts KOEO 2 (In "D", "2", "L" Or "R")
71	Ground Circuit (M/T)	Not Applicable
72	Engine Coolant Temperature Sensor Ground	Not Applicable
84	Rear Heated Oxygen Sensor Heater	0-3 Volts With KOER 3, B+ @ 5000 RPM
85	EVAP Emission Vent Solenoid (Calif.)	B+ KOEO 2 0-3 Volts (Initially) During Driving
86	Data Link Connector	Not Applicable
90	Front Heated Oxygen Sensor Heater	0-3 Volts With KOER 3, B+ @ 5000 RPM
91	Fuel Tank Differential Pressure Sensor	1.2-3.8 Volts With KOER 3
92	Data Link Connector	Not Applicable

1 - Wire color is Black/Yellow on vehicles without alarm system.
2 - KOEO - Key On, Engine Off.
3 - KOER - Key On, Engine Running.
4 - Wire color is Black on Federal emission vehicles.

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Fig. 13: Pin Voltage Chart (Galant - 3 Of 3)

	Terminal ID.	Function/Description	Voltage Value (DC Volts Unless Otherwise Specified)
Yellow/Blue	1	Injector No. 1	B+ With KOER [1] B+ & Momentary Drop @ WOT With KOER [1]
Blue/Green	2	Injector No. 3	B+ With KOER [1] B+ & Momentary Drop @ WOT With KOER [1]
Blue/Yellow	4	Idle Air Control Motor A1	B+/0 Volt (Pulse) Soon After Start
White	5	Idle Air Control Motor B1	B+/0 Volt (Pulse) Soon After Start
Brown	6	EGR Solenoid	B+ With KOEO [2] B+ & Momentary Drop @ WOT With KOER [1]
Black	7	Transaxle	[3]
Black/Blue	8	Fuel Pump Relay	B+ With KOEO [2], 0-3 Volts With KOER [1]
Yellow/Green	9	EVAP Emission Purge Solenoid	B+ With KOEO [2], 0-3 Volts With KOER [1]
White [4]	10	Ignition Power Transistor [5]	0.3-3.0 Volts With Engine @ 3000 RPM
Red/Yellow	12	Power Supply	B+ With KOEO [2]
Black	13	System Ground	Not Applicable
Yellow/Black	14	Injector No. 2	B+ With KOER [1] B+ & Momentary Drop @ WOT With KOER [1]
Lt. Green/White	15	Injector No. 4	B+ With KOER [1] B+ & Momentary Drop @ WOT With KOER [1]
Yellow	17	Idle Air Control Motor A2	B+/0 Volt (Pulse) Soon After Start
Green	18	Idle Air Control Motor B2	B+/0 Volt (Pulse) Soon After Start
Blue	19	Volume Airflow Sensor Reset Signal (1.8L)	0-1 Volt With KOER [1], 6-9 Volts @ 3000 RPM
Blue	20	Condenser Fan Motor Relay	B+ At Less Than 194°F (Fan Motor Off) 0-3 Volts @ 221°F Or More (Fan Motor On)
Blue	21	Radiator Fan Motor Relay	B+ At Less Than 194°F (Fan Motor Off) 0-3 Volts @ 221°F Or More (Fan Motor On)
Green/White	22	Air Conditioning Relay	6 Volts Or More With KOER [1] 0-3 Volts With Clutch Cycling
Black/Green	23	Ignition Power Transistor [6] (1.8L)	0.3-3.0 Volts @ 3000 RPM
Red/Yellow	25	Power Supply	B+ With KOEO [2]
Black	26	System Ground	Not Applicable
White	31	Engine Ignition Signal (1.5)	0.3-3.0 Volts With Engine @ 3000 RPM
Blue/White	33	Generator Terminal "G"	0.2-3.5 Volts KOER [1] (Fan & Accessories Off) Voltage Drops As Fan & Accessories Come On 0.8-1.2 Volts With KOER [1] (Headlights On)
Lt. Green/Black	36	Malfunction Indicator Light	0-3 Volts KOEO [2] (Initially) 9-13 Volts After Several Seconds
Yellow/Black	37	Power Steering Pressure Switch	B+ With KOER [1] Steering Wheel Stationary 0-3 Volts When Steering Wheel Is Turned
Red	38	MFI Relay Power Supply	B+ With Ignition Off, 0-3V With KOEO [2]
White	41	Generator Terminal "FR"	0.2-3.5 Volts KOER [1] (Fan & Accessories Off) Voltage Drops As Fan & Accessories Come On
Green/Black	45	Air Conditioning Switch	0-3 Volts With KOER [1] (A/C Off) B+ With KOER [1] (A/C On)

[1] - KOER - Key On, Engine Running.
[2] - KOEO - Key On, Engine Off.
[3] - Information is not available from manufacturer.
[4] - Wire color is Black/Yellow on 1.8L.
[5] - This transistor powers ignition coils No. 1 and 4 on 1.8L.
[6] - This transistor powers coils No. 2 and 3.

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Fig. 14: Pin Voltage Chart (Mirage - 1 Of 2)

	Terminal ID.	Function/Description	Voltage Value (DC Volts Unless Otherwise Specified)
Red/Green	54	Rear Heated Oxygen Sensor Heater	0-3 Volts With KOER [1], B+ @ 5000 RPM
Blue/Black	55	EVAP Vent Solenoid	B+ KOEO [1] 0-3 Volts (Initially) During Driving
Lt. Green	56	Data Link Connector	Not Applicable
White	58	Engine Ignition Signal (1.8L)	0.3-3.0 Volts @ 3000 RPM
White	59	Transaxle	[2]
Red	60	Front Heated Oxygen Sensor Heater	0-3 Volts With KOER [1], B+ @ 5000 RPM
Blue/Yellow	61	Fuel Tank Differential Pressure Sensor	1.2-3.8 Volts KOER [1]
Orange	62	Data Link Connector	Not Applicable
Brown/Red	71	Ignition Switch (ST - A/T)	8 Volts Or More Engine Cranking
Black/White	71	Ground Circuit (M/T)	Not Applicable
Red/White [3]	72	Intake Air Temperature Sensor	3.2-3.8 Volts With KOEO [4] (Sensor @ 32°F) 2.3-2.9 Volts With KOEO [4] (Sensor @ 68°F) 1.5-2.1 Volts With KOEO [4] (Sensor @ 104°F) 0.4-1.0 Volt With KOEO [4] (Sensor @ 176°F)
Gray/Yellow	73	Manifold Differential Pressure Sensor (1.8L)	0.8-2.4 Volts With KOER [1]
White	75	Rear Heated Oxygen Sensor	0.6-1 Volt In 2nd Gear Or "L" @ WOT
White	76	Front Heated Oxygen Sensor	0-0.8 Volt (Pulse) @ 2500 RPM
Green/White	79	Data Link Connector	Not Applicable
Red/Black	80	Back-Up Power Supply	B+ (Ignition OFF)
Green/Blue	81	Sensor Impressed Voltage	4.5-5.5 Volts With KOEO [4]
Black/White	82	Ignition Switch (IG)	B+ With KOEO [4]
Yellow/Green	83	Engine Coolant Temperature Sensor	3.2-3.8 Volts With KOEO [1] (Sensor @ 32°F) 2.3-2.9 Volts With KOEO [1] (Sensor @ 68°F) 1.3-1.9 Volts With KOEO [1] (Sensor @ 104°F) 0.3-0.9 Volt With KOEO [1] (Sensor @ 176°F)
Green/White	84	Throttle Position Sensor	0.3-1.0 Volt With KOER [1], 4.5-5.5 Volts @ WOT
Yellow/White	85	Manifold Absolute Pressure Sensor (1.5L)	3.7-4.3 Volts With KOEO [4] (Sea Level) 3.2-3.8 Volts With KOEO [4] (@ 3937 Ft.) .9-1.5 Volt With KOER [1] (@ 3937 Ft.) Momentary Increase @ WOT
Yellow/White	85	Barometric Pressure Sensor (1.8L)	3.7-4.3 Volts With KOEO [4] (Sea Level) 3.2-3.8 Volts With KOEO [4] (@ 3937 Ft.)
Yellow	86	Vehicle Speed Sensor	0-5 Volts (Pulse) KOER [1] (Vehicle Moving)
Yellow/Red	87	Closed Throttle Position Switch	0-1 Volt With KOEO [4] (Throttle Closed) 4 Volts Or More With KOEO [4] (Throttle Open)
Brown/Red [5]	88	Camshaft Position Sensor	0.4-3.0 Volts (Engine Cranking) 0.5-2.0 Volts With KOER [1]
Brown/Green	89	Crankshaft Position Sensor	0.4-4.0 Volts (Engine Cranking) 1.5-2.5 Volts With KOER [1]
White/Red	90	Volume Airflow Sensor (1.8L)	2.2-3.2 Volts @ Idle Or 2500 RPM
Brown/Yellow	91	Park/Neutral Position Switch (A/T)	0-3 Volts With KOEO [4] (In "P" Or "N") 8-14 Volts KOEO [4] (In "D", "2", "L" Or "R")
Black	91	Ground Circuit (M/T)	Not Applicable

[1] - KOER - Key On, Engine Running.
[2] - Information is not available from manufacturer.
[3] - Wire color is Red/Blue on 1.8L.
[4] - KOEO - Key On, Engine Off.
[5] - Wire color is Blue/Red on 1.8L.

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Fig. 15: Pin Voltage Chart (Mirage - 2 Of 2)

	Terminal ID.	Function/Description	Voltage Value (DC Volts Unless Otherwise Specified)
Yellow/Blue	1	Injector No. 1	B+ With KOER [1] B+ & Momentary Drop @ WOT With KOER [1]
Lt. Green/Red	2	Injector No. 4	B+ With KOER [1] B+ & Momentary Drop @ WOT With KOER [1]
Brown	3	Front Heated Oxygen Sensor Heater (Fed.)	0-3 Volts With KOER [1], B+ @ 5000 RPM
Brown	3	LF Heated Oxygen Sensor Heater (Calif.)	0-3 Volts With KOER [1], B+ @ 5000 RPM
Brown	4	RF Heated Oxygen Sensor Heater (Calif.)	0-3 Volts With KOER [1], B+ @ 5000 RPM
Blue/Red	6	EGR Solenoid	B+ With KOEO [2] B+ & Momentary Drop @ WOT With KOER [1]
Yellow/Black	9	Injector No. 2	B+ With KOER [1] B+ & Momentary Drop @ WOT With KOER [1]
Yellow/White	10	Injector No. 5	B+ With KOER [1] B+ & Momentary Drop @ WOT With KOER [1]
White	11	Ignition Power Transistor "A"	0.3-3.0 Volts @ 3000 RPM
Black/Green	12	Ignition Power Transistor "B"	0.3-3.0 Volts @ 3000 RPM
Red/Blue	13	Ignition Power Transistor "C"	0.3-3.0 Volts @ 3000 RPM
Green/Red	14	Idle Air Control Motor A1	B+/0-3 Volts (Pulse) After Hot Start
Gray/Blue	15	Idle Air Control Motor B1	B+/0-3 Volts (Pulse) After Hot Start
Black/Red	16	EVAP Emission Purge Solenoid	B+ With KOEO [2], 0-3 Volts With KOER [1]
Blue/Black	19	Volume Airflow Sensor Reset Signal	0-1 Volt With KOER [1], 6-9 Volts @ 3000 RPM
White/Red	20	MFI Pump Relay	B+ With KOEO [2], 0-3 Volts With KOER [1]
Green/White	21	A/C Compressor Clutch Relay	6 Volts Or More With KOER [1] 0-3 Volts With Clutch Cycling
Black/White	22	Malfunction Indicator Light	0-3 Volts KOEO [2] (Initially) 9-13 Volts After Several Seconds
Blue/Yellow	24	Injector No. 3	B+ With KOER [1] B+ & Momentary Drop @ WOT With KOER [1]
Yellow/Green	25	Injector No. 6	B+ With KOER [1] B+ & Momentary Drop @ WOT With KOER [1]
Brown	26	LR Heated Oxygen Sensor Heater (Calif.)	0-3 Volts With KOER [1], B+ @ 5000 RPM
Brown	26	Rear Heated Oxygen Sensor Heater (Fed.)	0-3 Volts With KOER [1], B+ @ 5000 RPM
Black/White	27	RR Heated Oxygen Sensor Heater (Calif.)	0-3 Volts With KOER [1], B+ @ 5000 RPM
Green/Black	28	Idle Air Control Motor A2	B+/0-3 Volts (Pulse) After Hot Start
Green/Blue	29	Idle Air Control Motor B2	B+/0-3 Volts (Pulse) After Hot Start
Blue/Red	35	EVAP Emission Vent Solenoid	B+ KOEO [2] 0-3 Volts (Initially) During Driving
Green/Yellow	42	Sensor Impressed Voltage	4.5-5.5 Volts With KOEO [2]
Blue/Yellow	43	Crankshaft Position Sensor	0.2-3.0 Volts With KOER [1] Or Cranking
Yellow/Green	44	Engine Coolant Temperature Sensor	0.6-1.0 Volt In 1st Gear Or "L" @ WOT
White	45	Engine Ignition Signal	0.3-3.0 Volts @ 3000 RPM
Black	46	Ground	Not Applicable
Black/Red	47	Power Supply	B+ With KOEO [2]

[1] - KOER - Key On, Engine Running.

[2] - KOEO - Key On, Engine Off.

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Fig. 16: Pin Voltage Chart (Montero - 1 Of 2)

	Terminal ID.	Function/Description	Voltage Value (DC Volts Unless Otherwise Specified)
White	50	Camshaft Position Sensor	0.2-3.0 Volts With KOER [1] Or Cranking
Pink	51	Barometric Pressure Sensor	3.7-4.3 Volts With KOEO [2] (Sea Level) 3.2-3.8 Volts With KOEO [2] (@ 3937 Ft.)
Yellow	54	Power Steering Pressure Switch	B+ With KOER [1] Steering Wheel Stationary 0-3 Volts When Steering Wheel Is Turned
Blue/Green	57	MFI Relay Supply Voltage	B+ With Ignition Off, 0-3V With KOEO [2]
Black	58	Ground	Not Applicable
Black/Red	59	Power Supply	B+ With KOEO [2]
Black/Green	60	Back-Up Power Supply	B+ With Ignition Off
White/Black	61	Volume Airflow Sensor	2.2-3.2 Volts @ 2500 RPM
Red/Black	62	Intake Air Temperature Sensor	3.2-3.8 Volts With KOEO [2] (Sensor @ 32°F) 2.3-2.9 Volts With KOEO [2] (Sensor @ 68°F) 1.5-2.1 Volts With KOEO [2] (Sensor @ 104°F) 0.4-1.0 Volt With KOEO [2] (Sensor @ 176°F)
Blue/Orange	65	4WD Detection Switch	[3]
Black/Yellow	66	ABS Control Unit	[3]
Black/Blue	67	Ignition Switch (ST)	8 Volts Or More (Engine Cranking)
Black/Yellow	68	Park/Neutral Position Switch (A/T)	0-3 Volts With KOEO [2] (In Park)
White	71	Front Heated Oxygen Sensor (Fed.)	0-0.8 Volt (Pulse) @ 2500 RPM
White	71	LF Heated Oxygen Sensor (Calif.)	0-0.8 Volt (Pulse) With KOER [1] (2000 RPM)
White	72	RF Heated Oxygen Sensor (Calif.)	0-0.8 Volt (Pulse) @ 2500 RPM
White	73	LR Heated Oxygen Sensor (Calif.)	0.6-1.0 Volt In 1st Gear Or "L" @ WOT
Red	73	Rear Heated Oxygen Sensor (Fed.)	0.6-1.0 Volt In 1st Gear Or "L" @ WOT
White	74	RR Heated Oxygen Sensor (Calif.)	0.6-1.0 Volt In 1st Gear Or "L" @ WOT
Red/Green	78	Throttle Position Sensor	0.3-1.0 Volt With KOEO [2], 4.5-5.5 Volts @ WOT
Yellow/Red	79	Closed Throttle Position Switch	0-1 Volt With KOEO [2] (Throttle Closed) 4 Volts Or More With KOEO [2] (Throttle Open)
Yellow/White	80	Vehicle Speed Sensor	0-5 Volts (Pulse) With KOER [1] (Vehicle Moving)
Green/Blue	83	Air Conditioning Switch	0-3 Volts With KOER [1] (A/C Off) B+ With KOER [1] (A/C On)
Green/Red	84	Data Link Connector	Not Applicable
Yellow	85	Data Link Connector	Not Applicable
Orange	87	Transaxle	[3]
Red/White	88	Transaxle	[3]
Blue/Yellow	92	Manifold Differential Pressure Sensor	0.8-2.4 Volts With KOER [1]
Blue/Yellow	93	Fuel Tank Differential Pressure Sensor	1.2-3.8 Volts With KOER [1]
Black/White	99	Ignition Switch (IG)	B+ With KOEO [2]
Black/Yellow	100	Data Link Connector	Not Applicable

[1] - KOER - Key On, Engine Running.
[2] - KOEO - Key On, Engine Off.
[3] - Information is not available from manufacturer.

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Fig. 17: Pin Voltage Chart (Montero - 2 Of 2)

	Terminal ID.	Function/Description	Voltage Value (DC Volts Unless Otherwise Specified)
Yellow/Green	1	Injector No. 1	B+ With KOER [1] B+ & Momentary Drop @ WOT With KOER [1]
Yellow/Green	2	Injector No. 3 (2.4L)	B+ With KOER [1] B+ & Momentary Drop @ WOT With KOER [1]
Yellow/Red	2	Injector No. 4 (3.0L)	B+ With KOER [1] B+ & Momentary Drop @ WOT With KOER [1]
Lt. Green/Red	3	Front Heated Oxygen Sensor Heater (3.0L – Fed.)	0-3 Volts With KOER [1], B+ @ 5000 RPM
Lt. Green/Red	3	LF Heated Oxygen Sensor Heater (3.0L – Calif.)	0-3 Volts With KOER [1], B+ @ 5000 RPM
Blue	4	Idle Air Control Motor A1 (2.4L)	B+/0-3 Volts (Pulse) After Hot Start
Yellow/Blue	4	RF Heated Oxygen Sensor Heater (3.0L – Calif.)	0-3 Volts With KOER [1], B+ @ 5000 RPM
White	5	Idle Air Control Motor B1 (2.4L)	B+/0-3 Volts (Pulse) After Hot Start
Brown [2]	6	EGR Solenoid (Fed.)	B+ With KOEO [3] B+ & Momentary Drop @ WOT With KOER [1]
White/Red	8	Fuel Pump Relay (2.4L)	B+ With KOEO [3], 0-3 Volts With KOER [1]
Black/Yellow	9	EVAP Emission Purge Solenoid (2.4L)	B+ With KOEO [3], 0-3 Volts With KOER [1]
Yellow/Black	9	Injector No. 2 (3.0L)	B+ With KOER [1] B+ & Momentary Drop @ WOT With KOER [1]
White	10	Ignition Power Transistor (2.4L)	0.3-3.0 Volts @ 3000 RPM
Yellow/White	10	Injector No. 5 (3.0L)	B+ With KOER [1] B+ & Momentary Drop @ WOT With KOER [1]
White	11	Ignition Power Transistor "A" (3.0L)	0.3-3.0 Volts @ 3000 RPM
Red	12	Power Supply (2.4L)	B+ With KOEO [3]
Black/Yellow	12	Ignition Power Transistor "B" (3.0L)	0.3-3.0 Volts @ 3000 RPM
Black	13	Ground Circuit (2.4L)	Not Applicable
Blue	13	Ignition Power Transistor "C" (3.0L)	0.3-3.0 Volts @ 3000 RPM
Yellow/Black	14	Injector No. 2 (2.4L)	B+ With KOER [1] B+ & Momentary Drop @ WOT With KOER [1]
Green/Black	14	Idle Air Control Motor A1 (3.0L)	B+/0-3 Volts (Pulse) After Hot Start
Yellow/Black	15	Injector No. 4 (2.4L)	B+ With KOER [1] B+ & Momentary Drop @ WOT With KOER [1]
Green	15	Idle Air Control Motor B1 (3.0L)	B+/0-3 Volts (Pulse) After Hot Start
Blue/White	16	EVAP Emission Purge Solenoid (3.0L)	B+ With KOEO [3], 0-3 Volts With KOER [1]
Yellow	17	Idle Air Control Motor A2 (2.4L)	B+/0-3 Volts (Pulse) After Hot Start
Green	18	Idle Air Control Motor B2 (2.4L)	B+/0-3 Volts (Pulse) After Hot Start
Yellow/White [4]	19	Volume Airflow Sensor Reset Signal	0-1 Volt With KOER [1], 6-9 Volts @ 3000 RPM
White/Red	20	Fuel Pump Relay Module (3.0L)	0-0.5 Volt With KOEO [3] 0.7-2.8 Volts With KOER [1] Or Cranking
Green/Yellow	21	A/C Compressor Clutch Relay (3.0L)	6 Volts Or More With KOER [1] 0-3 Volts With Clutch Cycling
Green/Yellow	22	A/C Compressor Clutch Relay (2.4L)	6 Volts Or More With KOER [1] 0-3 Volts With Clutch Cycling
Green/White	22	Malfunction Indicator Light (3.0L)	0-3 Volts KOEO [3] (Initially) 9-13 Volts After Several Seconds

[1] - KOER - Key On, Engine Running.
[2] - Wire color is Yellow/Red on 3.0L.
[3] - KOEO - Key On, Engine Off.
[4] - Wire color is Green/Blue on 3.0L.

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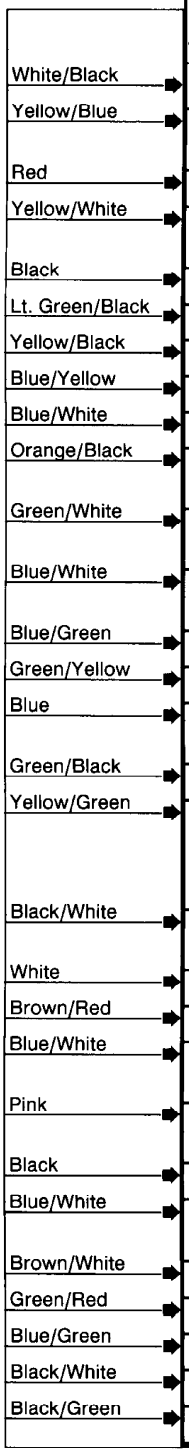
Fig. 18: Pin Voltage Chart (Montero Sport - 1 Of 4)



Terminal ID.	Function/Description	Voltage Value (DC Volts Unless Otherwise Specified)
White/Black	Defogger System (2.4L)	[1]
Yellow/Blue	Injector No. 3 (3.0L)	B+ With KOER [2] B+ & Momentary Drop @ WOT With KOER [2]
Red	Power Supply (2.4L)	B+ With KOEO [3]
Yellow/White	Injector No. 6 (3.0L)	B+ With KOER [2] B+ & Momentary Drop @ WOT With KOER [2]
Black	Ground Circuit (2.4L)	Not Applicable
Lt. Green/Black	Rear Heated Oxygen Sensor Heater (3.0L - Fed.)	0-3 Volts With KOER [2], B+ @ 5000 RPM
Yellow/Black	LR Heated Oxygen Sensor Heater (3.0L - Calif.)	0-3 Volts With KOER [2], B+ @ 5000 RPM
Blue/Yellow	RR Heated Oxygen Sensor Heater (3.0L - Calif.)	0-3 Volts With KOER [2], B+ @ 5000 RPM
Blue/White	Spark Check Signal (2.4L)	2-6 Volts @ 3000 RPM
Orange/Black	EVAP Emission Vent Solenoid (3.0L)	B+ With KOEO [3] 0-3 Volts (Initially) During Driving
Green/White	Malfunction Indicator Light (2.4L)	0-3 Volts KOEO [3] (Initially) 9-13 Volts After Several Seconds
Blue/White	Power Steering Pressure Switch (2.4L)	B+ With KOER [2] Steering Wheel Stationary 0-3 Volts When Steering Wheel Is Turned
Blue/Green	MFI Relay Supply Voltage (2.4L)	B+ With Ignition Off, 0-3 Volts With KOEO [3]
Green/Yellow	Sensor Impressed Voltage (3.0L)	4.5-5.5 Volts With KOEO [3]
Blue	Crankshaft Position Sensor	0.4-3.0 Volts (Engine Cranking) 1.5-2.5 With KOEO [3]
Green/Black	ABS Signal (2.4L)	B+ With KOER [2]
Yellow/Green	Engine Coolant Temperature Sensor (3.0L)	3.2-3.8 Volts With KOEO [3] (Sensor @ 32°F) 2.3-2.9 Volts With KOEO [3] (Sensor @ 68°F) 1.3-1.9 Volts With KOEO [3] (Sensor @ 104°F) 0.3-0.9 Volt With KOEO [3] (Sensor @ 176°F)
Black/White	Air Conditioning Switch (2.4L)	0-3 Volts With KOER [2] (A/C Off) B+ With KOER [2] (A/C On)
White	Spark Check Signal (3.0L)	0.3-3.0 Volts @ 3000 RPM
Brown/Red	Power Supply (3.0L)	B+ With KOEO [3]
Blue/White	Camshaft Position Sensor (3.0L)	0.4-3.0 Volts (Engine Cranking) 0.5-2.0 Volts With KOER [2]
Pink	Barometric Pressure Sensor (2.4L)	3.7-4.3 Volts With KOEO [3] (Sea Level) 3.2-3.8 Volts With KOEO [3] (@ 3937 Ft.)
Black	Rear Heated Oxygen Sensor Heater (2.4L)	0-3 Volts With KOER [2], B+ @ 5000 RPM
Blue/White	Power Steering Pressure Switch (3.0L)	B+ With KOER [2] Steering Wheel Stationary 0-3 Volts When Steering Wheel Is Turned
Brown/White	EVAP Emission Vent Solenoid (2.4L)	B+ With KOEO [3], 0-3 Volts With KOER [2]
Green/Red	Data Link Connector (2.4L)	Not Applicable
Blue/Green	MFI Relay Power Supply (3.0L)	B+ With Ignition Off, 0-3 Volts With KOEO [3]
Black/White	Front Heated Oxygen Sensor Heater (2.4L)	0-3 Volts With KOER [2], B+ @ 5000 RPM
Black/Green	Back-Up Power Supply (3.0L)	B+ With Ignition Off

[1] - Information is not available from manufacturer.
[2] - KOER - Key On, Engine Running.
[3] - KOEO - Key On, Engine Off.

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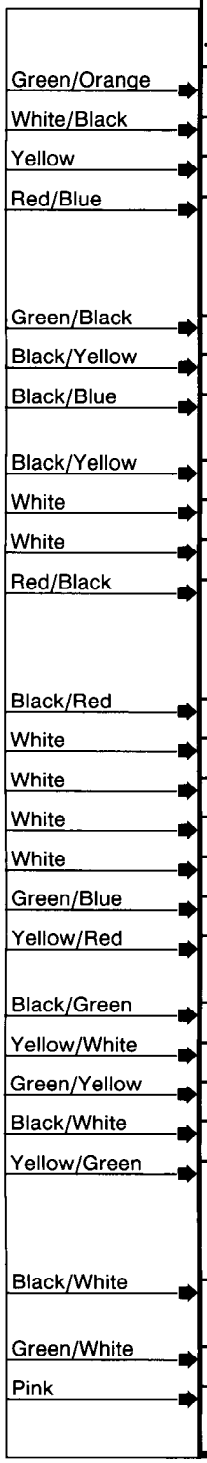
Fig. 19: Pin Voltage Chart (Montero Sport - 2 Of 4)



Terminal ID.	Function/Description	Voltage Value (DC Volts Unless Otherwise Specified)
61	Fuel Tank Differential Pressure Sensor (2.4L)	1.2-3.8 Volts With KOER [1]
61	Volume Airflow Sensor (3.0L)	2.2-3.2 Volts KOER [1] Or @ 2500 RPM
62	Data Link Connector (2.4L)	Not Applicable
62	Intake Air Temperature Sensor (3.0L)	3.2-3.8 Volts With KOEO [2] (Sensor @ 32°F) 2.3-2.9 Volts With KOEO [2] (Sensor @ 68°F) 1.5-2.1 Volts With KOEO [2] (Sensor @ 104°F) 0.4-1.0 Volt With KOEO [2] (Sensor @ 176°F)
66	ABS Signal (M/T - 3.0L)	B+ With KOER [1]
67	Ignition Switch (ST - 3.0L)	8 Volts Or More (Engine Cranking)
68	Park/Neutral Position Switch (A/T - 3.0L)	0-3 Volts With KOEO [2] (In "P" Or "N") 8-14 Volts KOEO [2] (In "D", "2", "L" Or "R")
71	Ignition Switch (ST - 2.4L)	8 Volts Or More (Engine Cranking)
71	Front Heated Oxygen Sensor (3.0L - Fed.)	0-0.8 Volt (Pulse) With KOER [1] (2000 RPM)
71	LF Heated Oxygen Sensor (3.0L - Calif.)	0-0.8 Volt (Pulse) With KOER [1] (2000 RPM)
72	Intake Air Temperature Sensor (2.4L)	3.2-3.8 Volts With KOEO [2] (Sensor @ 32°F) 2.3-2.9 Volts With KOEO [2] (Sensor @ 68°F) 1.5-2.1 Volts With KOEO [2] (Sensor @ 104°F) 0.4-1.0 Volt With KOEO [2] (Sensor @ 176°F)
73	Manifold Differential Pressure Sensor (2.4L - Fed.)	0.8-2.4 Volts With KOER [1]
73	LR Heated Oxygen Sensor (3.0L - Calif.)	0.6-1.0 Volt In 2nd Gear Or "L" @ WOT
73	Rear Heated Oxygen Sensor (3.0L - Fed.)	0.6-1.0 Volt In 2nd Gear Or "L" @ WOT
74	RR Heated Oxygen Sensor (3.0L - Calif.)	0.6-1.0 Volt In 2nd Gear Or "L" @ WOT
76	Front Heated Oxygen Sensor (2.4L)	0-0.8 Volt (Pulse) With KOER [1] (2000 RPM)
78	Throttle Position Sensor (3.0L)	0.3-1.0 Volt With KOEO [2], 4.5-5.5 Volts @ WOT
79	Closed Throttle Position Switch (3.0L)	0-1 Volt With KOEO [2] (Throttle Closed) 4 Volts Or More With KOEO [2] (Throttle Open)
80	Back-Up Power Supply (2.4L)	B+ With Ignition Off
80	Vehicle Speed Sensor (3.0L)	0-5 Volts (Pulse) With KOER [2] (Vehicle Moving)
81	Sensor Impressed Voltage (2.4L)	4.5-5.5 Volts With KOEO [2]
82	Ignition Switch (IG - 2.4L)	B+ With KOEO [2]
83	Engine Coolant Temperature Sensor (2.4L)	3.2-3.8 Volts With KOEO [2] (Sensor @ 32°F) 2.3-2.9 Volts With KOEO [2] (Sensor @ 68°F) 1.3-1.9 Volts With KOEO [2] (Sensor @ 104°F) 0.3-0.9 Volt With KOEO [2] (Sensor @ 176°F)
83	Air Conditioning Switch (3.0L)	0-3 Volts With KOER [1] (A/C Off) B+ With KOER [1] (A/C On)
84	Throttle Position Sensor (2.4L)	0.3-1.0 Volt With KOEO [2], 4.5-5.5 Volts @ WOT
85	Barometric Pressure Sensor (2.4L)	3.7-4.3 Volts With KOEO [2] (Sea Level) 3.2-3.8 Volts With KOEO [2] (@ 3937 Ft.)

[1] - KOER - Key On, Engine Running.
[2] - KOEO - Key On, Engine Off.

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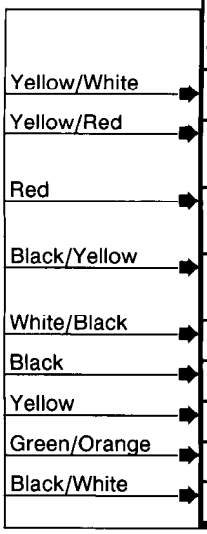
Fig. 20: Pin Voltage Chart (Montero Sport - 3 Of 4)



Terminal ID.	Function/Description	Voltage Value (DC Volts Unless Otherwise Specified)
86	Vehicle Speed Sensor (2.4L)	0-5 Volts (Pulse) With KOER [1] (Vehicle Moving)
87	Closed Throttle Position Switch (2.4L)	0-1 Volt With KOEO [2] (Throttle Closed) 4 Volts Or More With KOEO [2] (Throttle Open)
88	Camshaft Position Sensor (2.4L)	0.4-3.0 Volts (Engine Cranking) 0.5-2.0 Volts With KOER [1]
89	Crankshaft Position Sensor (2.4L)	0.4-4.0 Volts (Engine Cranking) 1.5-2.5 Volts With KOER [1]
90	Volume Airflow Sensor (2.4L)	2.2-3.2 Volts KOER [1] Or @ 2500 RPM
91	Ground Circuit (M/T - 2.4L)	Not applicable
92	Manifold Differential Pressure Sensor (3.0L - Fed.)	0.8-2.4 Volts With KOER [1]
93	Fuel Tank Differential Pressure Sensor (3.0L)	1.2-3.8 Volts With KOER [1]
99	Ignition Switch (IG - 3.0L)	B+ With KOEO [2]

[1] - KOER - Key On, Engine Running.
[2] - KOEO - Key On, Engine Off.

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Fig. 21: Pin Voltage Chart (Montero Sport - 4 Of 4)

	Terminal ID.	Function/Description	Voltage Value (DC Volts Unless Otherwise Specified)
Green	1	Injector No. 1	B+ With KOER [1] B+ & Momentary Drop @ WOT With KOER [1]
Green/Red	2	Injector No. 4	B+ With KOER [1] B+ & Momentary Drop @ WOT With KOER [1]
Black	3	LF Heated Oxygen Sensor Heater	0-3 Volts With KOER [1], B+ @ 5000 RPM
Blue/Red [2]	4	RF Heated Oxygen Sensor Heater	0-3 Volts With KOER [1], B+ @ 5000 RPM
Light Green/Red	6	EGR Solenoid	B+ With KOEO [3] B+ & Momentary Drop @ WOT With KOER [1]
Yellow/Black	9	Injector No. 2	B+ With KOER [1] B+ & Momentary Drop @ WOT With KOER [1]
Green/Black	10	Injector No. 5	B+ With KOER [1] B+ & Momentary Drop @ WOT With KOER [1]
Black/Blue	11	Ignition Power Transistor "A" (DOHC)	0.3-3.0 Volts @ 3000 RPM
White	11	Ignition Power Transistor (SOHC)	0.3-3.0 Volts @ 3000 RPM
Black/White	12	Ignition Power Transistor "B" (DOHC)	0.3-3.0 Volts @ 3000 RPM
Brown/Red	13	Ignition Power Transistor "C" (DOHC)	0.3-3.0 Volts @ 3000 RPM
Green/Red [4]	14	Idle Air Control Motor A1	B+/0-3 Volts [5] (Load Controlled)
Gray/Blue	15	Idle Air Control Motor B1	B+/0-3 Volts [5] (Load Controlled)
Brown/Blue [6]	16	EVAP Emission Purge Solenoid	[7]
Blue/Red	17	Radiator Fan Motor Relay (High)	B+ With KOEO [3] (Fan Off) 0-3 Volts KOEO [3] (Fan On)
Green/Yellow	18	Radiator Fan Motor Relay (Low)	B+ With KOEO [3] (Fan Off) 0-3 Volts KOEO [3] (Fan On)
Red/White	19	Volume Airflow Sensor Reset Signal	2.2-3.2 Volts With KOER [1]
Black	20	Fuel Pump Relay	B+ With Ignition Off, 0-3 Volts With KOEO [3]
Green	21	A/C Compressor Clutch Relay	6 Volts Or More KOER [1] 0-3 Volts With Clutch Cycling
Green/Red	22	Malfunction Indicator Light	0-3 Volts With KOEO [3] (Initially) 9-13 Volts After Several Seconds
Black/Green	23	Ignition Timing Adjustment Terminal	0-1 Volt KOEO [3] (GND Connected) 4.0-5.5 Volts With KOEO [3] (GND Disconnected)
Green/Yellow	24	Injector No. 3	B+ With KOER [1] B+ & Momentary Drop @ WOT With KOER [1]
Green/White	25	Injector No. 6	B+ With KOER [1] B+ & Momentary Drop @ WOT With KOER [1]
Black/White [8]	26	LR Heated Oxygen Sensor Heater	0-3 Volts With KOER [1]
Black	27	RR Heated Oxygen Sensor Heater	0-3 Volts With KOER [1]
Green/Black	28	Idle Air Control Motor A2	B+/0-3 Volts [5] (Load Controlled)
Green/Yellow	29	Idle Air Control Motor B2	B+/0-3 Volts [5] (Load Controlled)
Green/White	32	VIC Valve - Open (DOHC - Non-Turbo)	0-1 Volt With KOER , 4 Volts Or More [9]
Green/Black	33	VIC Valve - Closed (DOHC - Non-Turbo)	0-1 Volt With KOER [1], 4 Volts Or More [10]

[1] - KOER - Key On, Engine Running.
[2] - Wire color is Yellow/Black on DOHC.
[3] - KOEO - Key On, Engine Off.
[4] - Wire color is Gray on DOHC.
[5] - Check immediately after hot start.
[6] - Wire color is Light Green/Black on turbo.
[7] - Information is not available from manufacturer.
[8] - Wire color is Green/White on turbo.
[9] - Slowly decelerated from 5000 RPM to idle.
[10] - Slowly accelerated from idle to 5000 RPM.

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Fig. 22: Pin Voltage Chart (3000GT - 1 Of 3)

	Terminal ID.	Function/Description	Voltage Value (DC Volts Unless Otherwise Specified)
Green/Red	35	EVAP Emission Vent Solenoid	[1]
Red/Yellow	41	Wastegate Solenoid (Turbo)	B+ With KOEO [2], 0-3 Volts With KOER [3]
Green/Yellow	42	Sensor Impressed Voltage	4.5-5.5 Volts With KOEO [2]
Blue/Yellow [4]	43	Crankshaft Position Sensor	0.2-3.0 Volts With KOER [3] Or Cranking
Black/White	44	Engine Coolant Temperature Sensor	3.2-3.8 Volts With KOEO [2] (Sensor @ 32°F) 2.3-2.9 Volts With KOEO [2] (Sensor @ 68°F) 1.3-1.9 Volts With KOEO [2] (Sensor @ 104°F) 0.3-0.9 Volt With KOEO [2] (Sensor @ 176°F)
White/Black [5]	45	Engine Ignition Signal	0-3 Volts @ 3000 RPM
Black	46	Ground	Not Applicable
Black/Red	47	Power Supply	B+ With KOEO [2]
Blue/Red	48	Fuel Pressure Solenoid (Turbo)	B+ With KOEO [2] 0-3 Volts/B+ With KOER [3]
Red/Yellow [6]	50	Camshaft Position Sensor	0.2-3.0 Volts With KOER [3] Or Cranking
Orange	51	Barometric Pressure Sensor	3.7-4.3 Volts With KOEO [2] (Sea Level) 3.2-3.8 Volts With KOEO [2] (@ 3937 Ft.)
Red/Green	52	Electric Load Switch (DOHC)	0-3 Volts With KOER [3] (Accessories Off) B+ With KOER [3] (Accessories On)
Red/White	53	VIC Position Sensor No. 1 (DOHC - Non-Turbo)	0-1 Or 4.0-5.5 Volts With KOEO [2] 1.5-4 Volts (Momentarily) [7]
Blue/White	54	Power Steering Pressure Switch	B+ With KOER [3] Steering Wheel Stationary 0-3 Volts When Steering Wheel Is Turned
Black/Red	55	Fuel Pump Relay No. 2 (Turbo)	0-3 Volts @ 3000 RPM
Blue/Green	57	MFI Relay	B+ With Ignition Off, 0-3V With KOEO [2]
Black	58	Ground	Not Applicable
Black/Red	59	Power Supply	B+ With KOEO [2]
Red/Black	60	Back-Up Power Supply	B+ With Ignition Off
Blue/Yellow	61	Volume Airflow Sensor	2.2-3.2 Volts @ 2000 RPM
Red/Blue	62	Intake Air Temperature Sensor	3.2-3.8 Volts With KOEO [2] (Sensor @ 32°F) 2.3-2.9 Volts With KOEO [2] (Sensor @ 68°F) 1.5-2.1 Volts With KOEO [2] (Sensor @ 104°F) 0.4-1.0 Volt With KOEO [2] (Sensor @ 176°F)
Black/Blue	63	VIC Position Sensor No. 2 (DOHC - Non-Turbo)	0-1 Or 4.0-5.5 Volts With KOEO [2] 1.5-4 Volts (Momentarily) [7]
Blue/Orange	65	A/C Switch No. 2	0-3 Volts With KOER [3] (A/C Off) B+ KOER [3] (A/C On)
Black/Yellow	67	Park/Neutral Position Switch (A/T)	0-3 Volts With KOEO [2] (In "P" Or "N") 8-14 Volts KOEO [2] (In "D", "2", "L" Or "R")
Black	67	Ground (M/T)	Not Applicable
Black/Yellow	68	Ignition Switch (ST - M/T)	8 Volts Or More (Engine Cranking)
White	71	LF Heated Oxygen Sensor	0-0.8 Volt (Pulse) With KOER [3] (2000 RPM)
White	72	RF Heated Oxygen Sensor	0-0.8 Volt (Pulse) With KOER [3] (2000 RPM)

[1] - Information is not available from manufacturer.
[2] - KOEO - Key On, Engine Off.
[3] - KOER - Key On, Engine Running.
[4] - Wire color is Blue/White on turbo.
[5] - Wire color is White on DOHC.
[6] - Wire color is Blue/Red on turbo.
[7] - Slowly accelerated from idle to 5000RPM.

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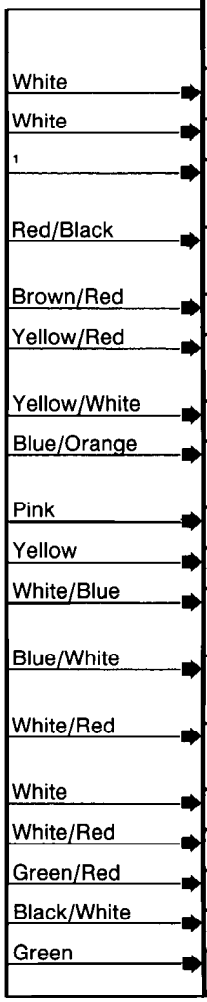
Fig. 23: Pin Voltage Chart (3000GT - 2 Of 3)



Terminal ID.	Function/Description	Voltage Value (DC Volts Unless Otherwise Specified)
73	LR Heated Oxygen Sensor	0.6-1.0 Volt In 2nd Gear Or "L" @ WOT
74	RR Heated Oxygen Sensor (Except SOHC - Fed.)	0.6-1.0 Volt In 2nd Gear Or "L" @ WOT
75	Muffler Mode Switch (Turbo)	0-3 Volt (Switch Set To TOUR) With KOEO [2] B+ Volts (Switch Set To SPORT) With KOEO [2]
77	Turbo Meter (Turbo)	4-13 Volts With KOEO [2] B+ & Momentary Drop At WOT With KOER [3]
78	Throttle Position Sensor	0.3-1.0 Volt With KOEO [2], 4.5-5.5 Volts @ WOT
79	Closed Throttle Position Switch	0-1 Volt With KOEO [2] (Throttle Closed) 4 Volts Or More With KOEO [2] (Throttle Open)
80	Vehicle Speed Sensor	0-5 Volts (Pulse) With KOER [3] (Vehicle Moving)
83	A/C Switch No. 2 (Turbo)	0-3 Volts With KOER [3] (A/C Off) B+ KOER [3] (A/C On)
84	Data Link Connector	Not Applicable
87	Data Link Connector	Not Applicable
86	Torque Reduce Request Signal No. 1 (A/T)	4.5-5.5 Volts With KOER [3] 0-1 Volts During Driving & Speed Changes
87	Torque Reduce Execute Signal (A/T)	0-1 Volt With KOER [3] (Eng. Temp. 122°F Or Less) 1-4 Volts With KOER [3] (Eng. Temp. Normal)
88	Torque Reduce Request Signal No. 2 (A/T)	0-1 Volt With KOER [3] 1-5.5 Volts During Driving & Speed Changes
91	Knock Sensor (DOHC)	[4]
92	Manifold Differential Pressure Sensor (A/T)	0.8-2.4 Volts With KOER [3] (A/T)
93	Fuel Tank Differential Pressure Sensor	1.2-3.8 Volts With KOER [3]
99	Ignition Switch (IG)	B+ With KOEO [2]
100	Data Link Connector	Not Applicable

[1] - Wire color is not available from manufacturer.
[2] - KOEO - Key On, Engine Off.
[3] - KOER - Key On, Engine Running.
[4] - Information is not available from manufacturer.

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Fig. 24: Pin Voltage Chart (3000GT - 3 Of 3)

POWER WINDOWS

1998 Mitsubishi Galant

1998 ACCESSORIES & EQUIPMENT
Mitsubishi - Power Windows

Galant

DESCRIPTION & OPERATION

With ignition switch in RUN position, battery voltage is applied to master power window switch located on driver's door. Master power window switch provides power and ground for all power window switches and motors. Master power window switch offers one-touch operation of driver's window. A solid state control unit, incorporated in master switch, fully lowers driver's window when switch is completely depressed. Master switch also includes lock-out feature to prevent passengers from operating any of the other power window door switches. Power windows can be operated for up to 30 seconds after ignition is turned off.

COMPONENT LOCATIONS

COMPONENT LOCATIONS TABLE

Component	Location
Data Link Connector (DLC)	Under Left Of Dash, Below Steering Column
ETACS-ECU	Behind Left Side Of Dash

TROUBLE SHOOTING

* PLEASE READ THIS FIRST *

NOTE: For trouble shooting information, see SYMPTOM TESTS.

POWER WINDOWS INOPERATIVE

Check for faulty fusible link, faulty fuse or faulty power window switches. See WIRING DIAGRAMS.

ONE WINDOW FAILS TO OPERATE

If one window does not operate, even if both master and passenger side power window switches are pressed, check for faulty master power window switch or power window motor that is inoperative. If one window does not operate only when either main/master or passenger side power window sub-switch is pressed, but does operate when both switches are pressed, check power window switch that is inoperative.

ONE-TOUCH SWITCH FUNCTION INOPERATIVE

Replace main/master power window switch.

SYMPTOM TESTS

NOTE: To diagnose symptom, see Fig. 1, then go to appropriate test under CIRCUIT TESTS.

Trouble symptom	Probable cause	Circuit test no.
When ignition switch is turned to ON, power window does not operate.	• Broken wire in power window switch circuit or in each harness. • Power window switch is faulty. • Power window motor is faulty.	1
Opening and closing of the power windows is possible with each seat switch, but operation from the power window main switch (driver's side door) is not possible.	• Short circuit in data line • Open circuit in data line • Malfunction of power window main switch	2
Opening and closing of the power windows is possible with the power window main switch, but operation from each sub switch is not possible.	• Malfunction of sub switch	Replace the respective sub switch.
After turning the ignition switch to OFF, the power windows operate even if the front door is opened within 30 seconds.	• Broken wire in input circuit in front door switch. • Front door switch is faulty. • Power window switch (driver's side door) is faulty	3
After turning the ignition switch to OFF, the timer does not operate.	• Power window switch (driver's side door) is faulty.	Replace power window switch (driver's side door).

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Fig. 1: Symptom Chart
Courtesy of Mitsubishi Motor Sales of America

CIRCUIT TESTS

Test No. 1

1) Check power window motor. See POWER WINDOW MOTOR under COMPONENT TESTS. Replace as necessary. Check power window switch. See POWER WINDOW SWITCH under COMPONENT TESTS. Replace as necessary. If motor and switch are okay, go to next step.

2) Check dedicated fuses No. 12 and 13. See WIRING DIAGRAMS. Replace fuses as necessary. If fuses are okay, disconnect left front power window switch harness connector. Turn ignition on. Check voltage between ground and power window switch harness-side connector terminal No. 1 (Green wire). If battery voltage is present, go to next step. If battery voltage is not present, go to step 4).

3) Check voltage between ground and power window switch harness-side connector terminal No. 9 (vehicles without keyless entry) or terminal No. 11 (vehicles with keyless entry). See WIRING DIAGRAMS. If battery voltage is present, go to step 5). If battery voltage is not present, go to next step.

4) Check connectors and circuit between dedicated fuses, ignition switch and power window main switch. See WIRING DIAGRAMS. Repair as necessary.

5) Check for continuity between ground and left front power window switch harness-side connector terminal No. 24 (Black wire). If continuity is present, go to next step. If continuity is not present, go to step 9).

6) Disconnect right front power window switch harness connector. Check for continuity between ground and right front power window switch harness-side connector terminals No. 1 (Black wire) and No. 9 (Black wire). If continuity is present, go to next step. If

continuity is not present, go to step 9).

7) Disconnect right rear power window switch harness connector. Check for continuity between ground and right rear power window switch harness-side connector terminals No. 1 (Black wire) and No. 3 (Black wire). If continuity is present, go to next step. If continuity is not present, go to step 9).

8) Disconnect left rear power window switch harness connector. Check for continuity between ground and left rear power window switch harness-side connector terminals No. 1 (Black wire) and No. 10 (Black wire). If continuity is present, replace left front (driver's side) power window switch. If continuity is not present, go to next step.

9) Check connectors and circuit between each power window switch and ground. See WIRING DIAGRAMS. Repair as necessary.

Test No. 2

1) To check for open in data line circuit, go to next step. To check for short in data line circuit, go to step 3).

2) Disconnect left front (driver's side) power window switch harness connector. Check voltage between ground and left front power window switch harness-side connector terminal No. 11 (vehicles without keyless entry) or terminal No. 13 (vehicles with keyless entry). See WIRING DIAGRAMS. If battery voltage is present, replace left front power window switch. If battery voltage is not present, repair open in data line circuit.

3) Disconnect harness connector from all power window switches. Check for continuity between ground and left front door harness-side connector terminals No. 11 (vehicle without keyless entry) or terminal No. 13 (vehicles with keyless entry). See WIRING DIAGRAMS. If continuity is not present, go to next step. If continuity is present, repair short in data line circuit.

4) Connect harness connector to all power window sub-switches. Check voltage between ground and left front power window switch harness-side connector terminal No. 11 (vehicle without keyless entry) or terminal No. 13 (vehicles with keyless entry). See WIRING DIAGRAMS. If battery voltage is present, replace left front power window switch. If battery voltage is not present, replace affected power window sub-switch.

Test No. 3

1) Check front door switch. See DOOR SWITCH under COMPONENT TESTS. Replace as necessary. If door switch is okay, go to next step.

2) Disconnect harness connector from left front power window switch. Turn ignition on. Turn off front door switch by closing front doors. Remove door light bulbs. Check voltage between ground and left front door power window switch harness-side connector terminal No. 11 (vehicles without keyless entry) or terminal No. 13 (vehicles with keyless entry). See WIRING DIAGRAMS. If 5 volts are present, go to next step. If 5 volts are not present, replace left front power window switch.

3) Check circuit between left front power window switch and left front door switch. See WIRING DIAGRAMS. Repair as necessary.

COMPONENT TESTS

CIRCUIT BREAKER

Press UP switch to fully close window. Continue to press switch for 40 seconds. Release UP switch and immediately press DOWN switch. If window begins to open within 60 seconds, circuit breaker is okay. Circuit breaker is part of window motor assembly.

DOOR SWITCH

Remove appropriate door switch from door jam. Disconnect harness connector from door switch. With switch in ON (open) position, continuity should be present on all terminals. With switch in OFF (depressed) position, continuity should not be present on any terminals. Replace as necessary.

POWER WINDOW MOTOR

1) Remove appropriate door trim panel. Connect positive lead of a 12-volt test battery to either motor terminal. Connect negative lead of test battery to other motor terminal. Motor should operate, unless it is already at maximum travel.

2) Reverse test battery leads. Motor should operate in opposite direction. If motor does not operate as specified, inspect wiring. If wiring is okay, replace motor. Reverse test battery leads again to complete full function test of motor.

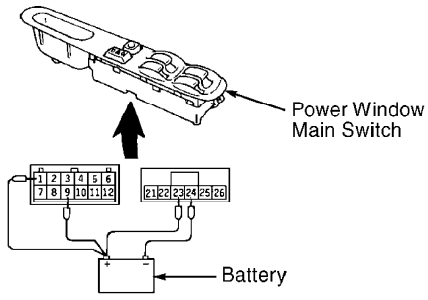
POWER WINDOW SWITCH

Main Switch

Remove power window main switch from trim panel. Apply battery positive voltage to switch terminals No. 1, 9 and 23. Apply battery ground to switch terminal No. 24. See Fig. 2. Continuity should be present at specified terminals. See Fig. 2. If continuity is not as specified, replace power window main switch.

Sub-Switch

Remove power window sub-switch from trim panel. Apply battery positive voltage to switch terminal No. 2. Apply battery ground to switch terminals No. 1, 3, 4, 9 and 10. See Fig. 3. Continuity should be present at specified terminals. See Fig. 3. If continuity is not as specified, replace power window sub-switch.



Terminal No.			Switch position		
			UP	OFF	DOWN
Front (L.H.)		21	○	○	○
Front (L.H.)		22	○	○	○
		23	○		○
		24	○	○	○
Front (R.H.), Rear (R.H., L.H.)	Normal	10	○	○	○
		11	○		○
		24	○ ○	○	○ ○
	Lock	11	○		○
	Lock	24	○		○

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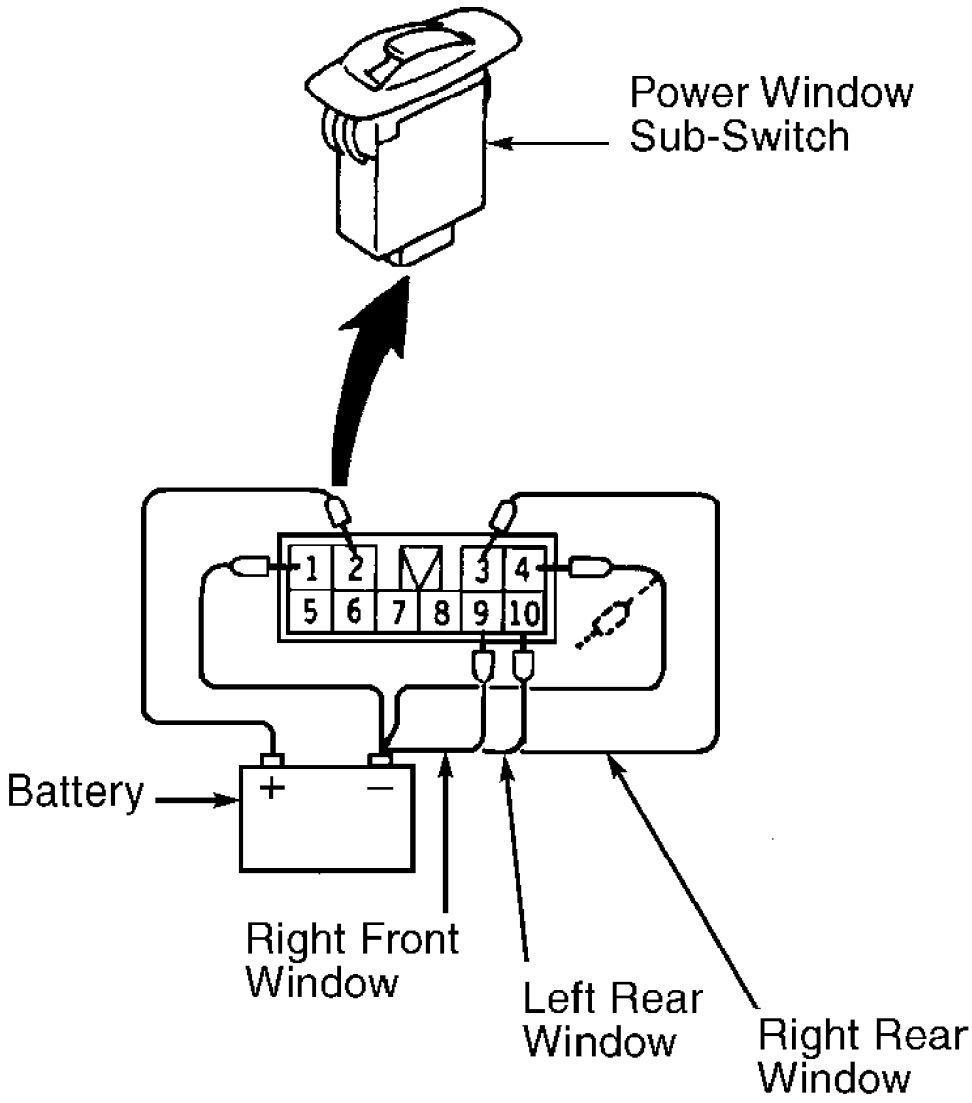
Fig. 2: Testing Power Window Main Switch
Courtesy of Mitsubishi Motor Sales of America



Terminal No.		Switch position		
		UP	OFF	DOWN
Sub switch	1			
	2			
	7			
	8			

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Fig. 3: Testing Power Window Sub-Switch
Courtesy of Mitsubishi Motor Sales of America

REMOVAL & INSTALLATION

POWER WINDOW MOTOR

Removal & Installation

Remove door trim panel and waterproof shield. Remove glass retaining screws and glass. See Fig. 4. Remove motor and slider assembly retaining bolts. Remove motor and slider assembly from door. To install, reverse removal procedure.

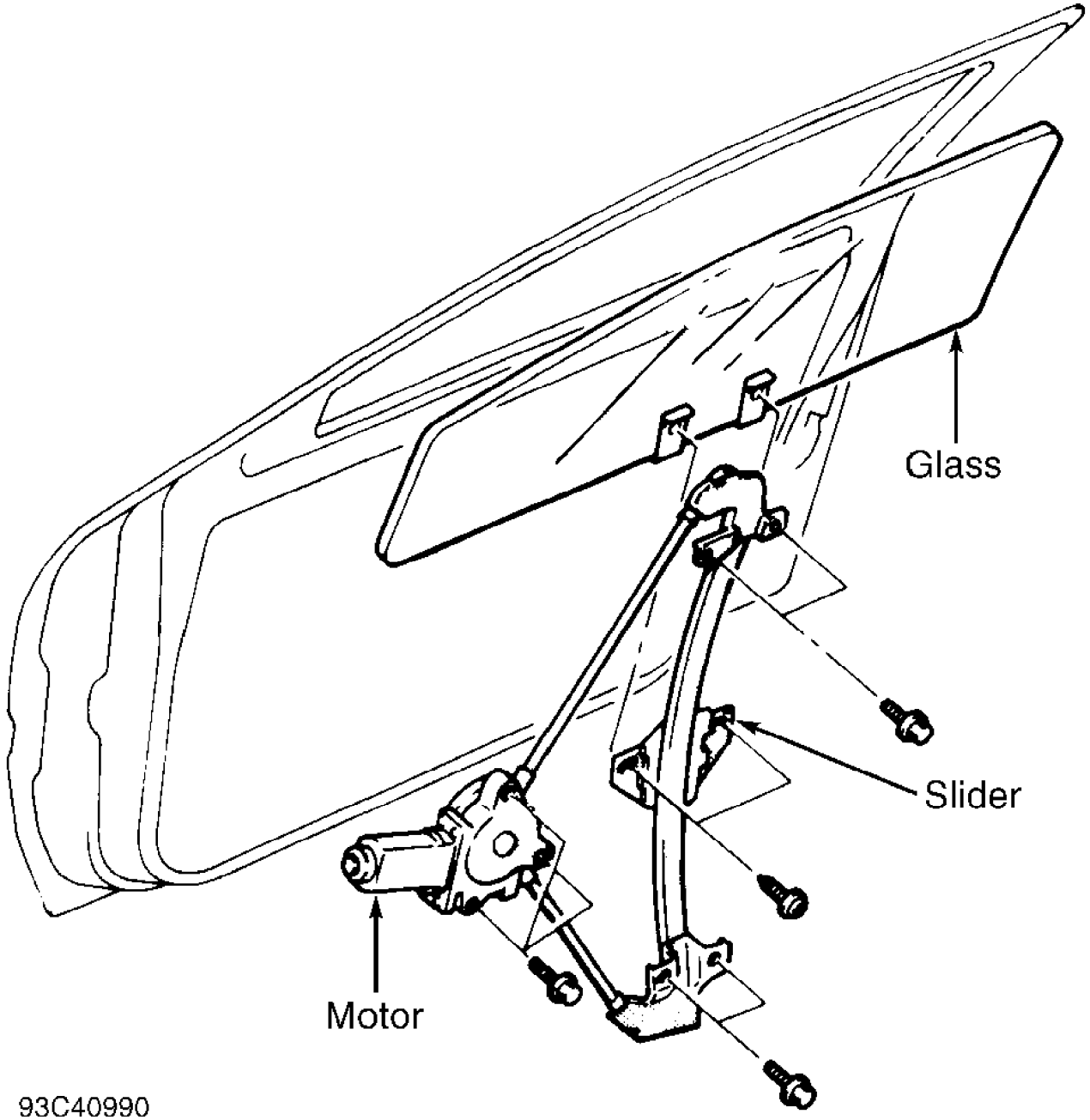


Fig. 4: Removing Power Window Motor & Slider Assembly
Courtesy of Mitsubishi Motor Sales of America

WIRING DIAGRAMS

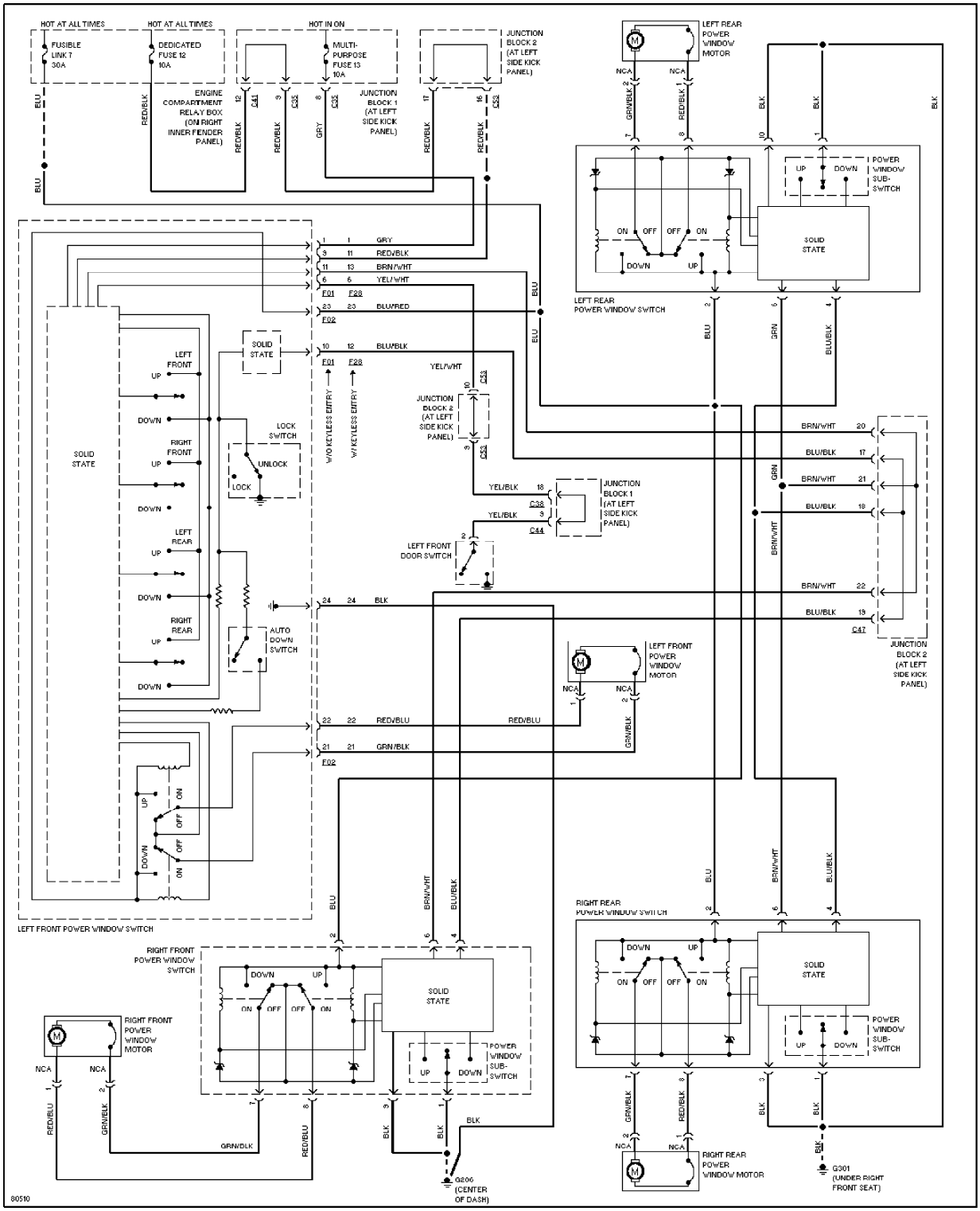


Fig. 5: Power Windows System Wiring Diagram

N - REMOVE/INSTALL/OVERHAUL

1998 Mitsubishi Galant

1998 ENGINE PERFORMANCE
Mitsubishi - Removal, Overhaul & Installation

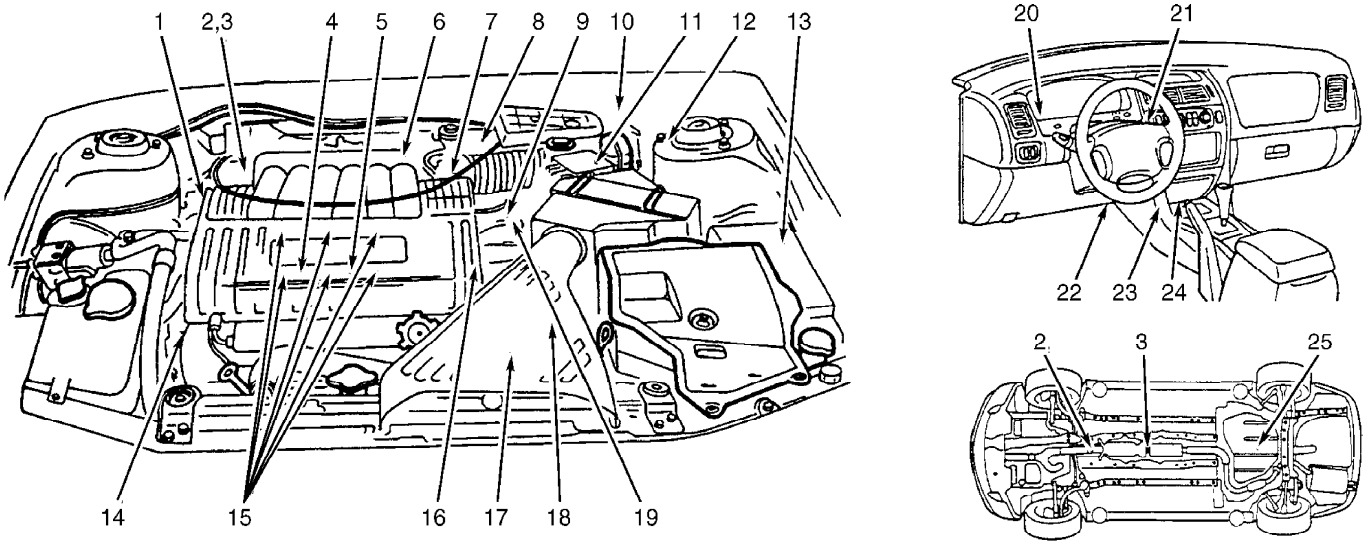
Diamante, Eclipse, Galant, Mirage, Montero, Montero Sport, 3000GT

INTRODUCTION

Removal, overhaul and installation procedures are covered in this article. If component removal and installation is primarily an unbolt and bolt-on procedure, only a torque specification may be furnished.

COMPONENT LOCATION

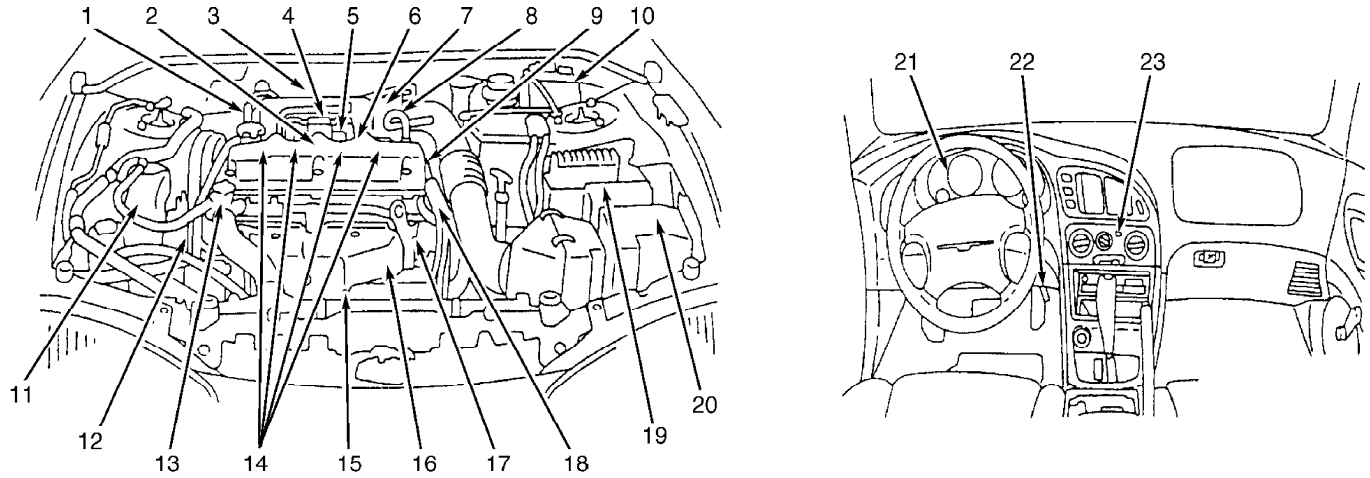
The following illustrations are provided to assist in locating components for which removal and installation procedures may not be provided. See Figs. 1-12.



1. Power Steering Pressure (PSP) Switch
2. Front Heated Oxygen Sensor (HO2S)
3. Rear Heated Oxygen Sensor (HO2S)
4. Evaporative Emission (EVAP) Purge Solenoid
5. Exhaust Gas Recirculation (EGR) Solenoid
6. Manifold Differential Pressure (MDP) Sensor
7. Throttle Position (TP) Sensor With Built-In Closed Throttle Position Sensor (CTP)
8. Idle Air Control (IAC) Motor
9. Camshaft Position (CMP) Sensor
10. Fuel Pump Check Terminal
11. Volume Airflow Sensor (VAF) With Built-In Intake Air Temperature (IAT) & Barometric (BARO) Pressure Sensors
12. Evaporative Emission (EVAP) Vent Solenoid
13. A/C Clutch Relay
14. Crankshaft Position (CKP) Sensor
15. Fuel Injector
16. Engine Coolant Temperature (ECT) Sensor
17. Vehicle Speed Sensor (VSS)
18. Park/Neutral Position (PNP) Switch (A/T)
19. Ignition Coil/Power Transistor
20. Malfunction Indicator Light (MIL)
21. A/C Switch
22. Data Link Connector (DLC)
23. MFI & Fuel Pump Relays
24. Powertrain Control Module (PCM)
25. Fuel Tank Pressure Differential Sensor

98E12595

Fig. 1: Engine Performance-Related Components (Diamante)
Courtesy of Mitsubishi Motor Sales of America



1. Manifold Absolute Pressure (MAP) Sensor
2. Crankshaft Position (CKP) Sensor
3. Intake Air Temperature (IAT) Sensor
4. Ignition Coil
5. Rear Heated Oxygen Sensor (HO2S)
6. Knock Sensor (KS)
7. Idle Air Control (IAC) Motor
8. Throttle Position (TP) Sensor
9. Camshaft Position (CMP) Sensor
10. MFI/ASD Relay
11. Evaporative Emission (EVAP) Purge Solenoid
12. Power Steering Pressure (PSP) Switch
13. Engine Coolant Temperature (ECT) Sensor
14. Fuel Injector
15. Front Heated Oxygen Sensor (HO2S)
16. Vehicle Speed Sensor
17. Park/Neutral Position (PNP) Switch (A/T)
18. Electric Exhaust Gas Recirculation (EGR) Transducer Solenoid
19. Powertrain Control Module (PCM)
20. A/C Clutch Relay
21. Malfunction Indicator Light (MIL)
22. Data Link Connector (DLC)
23. A/C Switch

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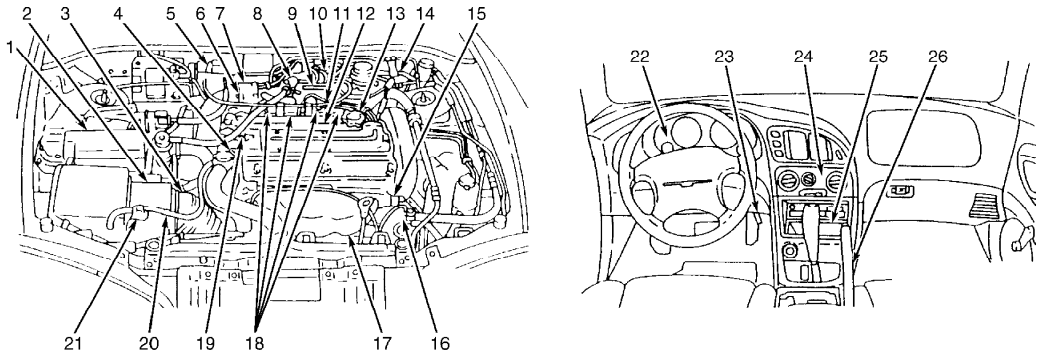
Fig. 2: Engine Performance-Related Components (Eclipse 2.0L Non-Turbo)
Courtesy of Mitsubishi Motor Sales of America



1. A/C Clutch Relay
2. Volume Airflow Sensor (VAF) With Built-In Intake Air Temperature (IAT) & Barometric (BARO) Pressure Sensors
3. Vehicle Speed Sensor (VSS)
4. Engine Coolant Temperature (ECT) Sensor
5. Fuel Pump Check Terminal
6. Idle Air Control (IAC) Motor
7. Throttle Position (TP) Sensor With Built-In Closed Throttle Position (CTP) Sensor
8. Manifold Differential Pressure (MDP) Sensor
9. Resistor
10. Exhaust Gas Recirculation (EGR) Solenoid
11. Ignition Coil/Power Transistor
12. Knock Sensor (KS)
13. Evaporative Emission (EVAP) Purge Solenoid
14. Fuel Pressure Solenoid
15. Crankshaft Position (CKP) Sensor
16. Power Steering Pressure (PSP) Switch
17. Front Heated Oxygen Sensor (HO2S)
18. Fuel Injector
19. Camshaft Position (CMP) Sensor
20. Turbocharger Wastegate Solenoid (Turbo)
21. MFI Relay
22. Malfunction Indicator Light (MIL)
23. Data Link Connector (DLC)
24. A/C Switch
25. Powertrain Control Module (PCM)
26. Fuel Pump Relay

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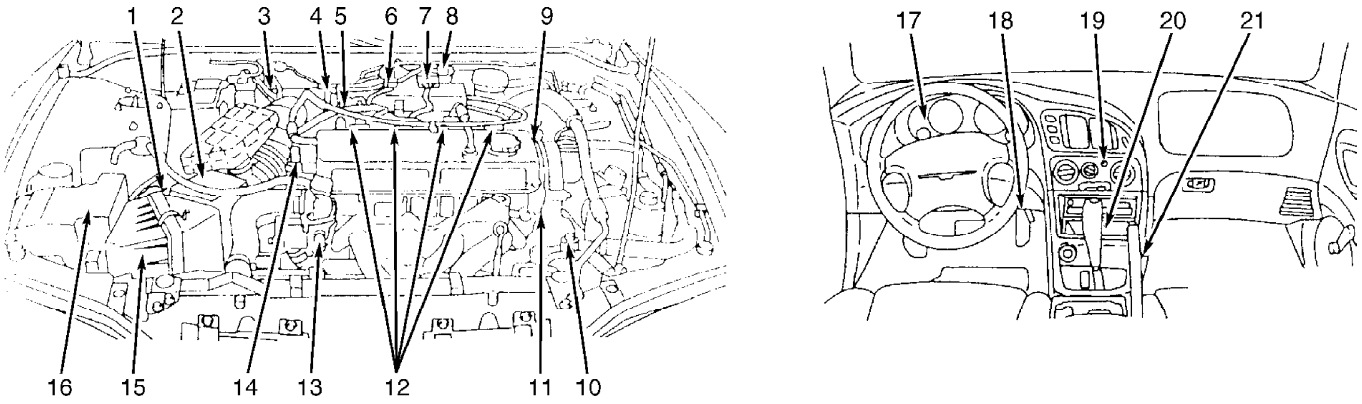
Fig. 3: Engine Performance-Related Components (Eclipse 2.0L Turbo)
Courtesy of Mitsubishi Motor Sales of America



1. Vehicle Speed Sensor
2. Volume Airflow Sensor (VAF) With Built-In Intake Air Temperature (IAT) & Barometric (BARO) Pressure Sensors
3. Fuel Pump Check Terminal
4. Idle Air Control Motor
5. Throttle Position (TP) Sensor With Built-In Closed Throttle Position (CTP) Sensor
6. Manifold Differential Pressure (MDP) Sensor
7. Ignition Power Transistor
8. Evaporative Emission (EVAP) Purge Solenoid
9. Ignition Coil/Power Transistor
10. Power Steering Pressure (PSP) Sensor
11. Crankshaft Position (CKP) Sensor
12. Fuel Injector
13. Engine Coolant Temperature (ECT) Sensor
14. Camshaft Position (CMP) Sensor
15. Park/Neutral Position (PNP) Switch (A/T)
16. A/C Clutch Relay
17. Malfunction Indicator Light (MIL)
18. Data Link Connector (DLC)
19. A/C Switch
20. Powertrain Control Module (PCM)
21. Fuel Pump Relay

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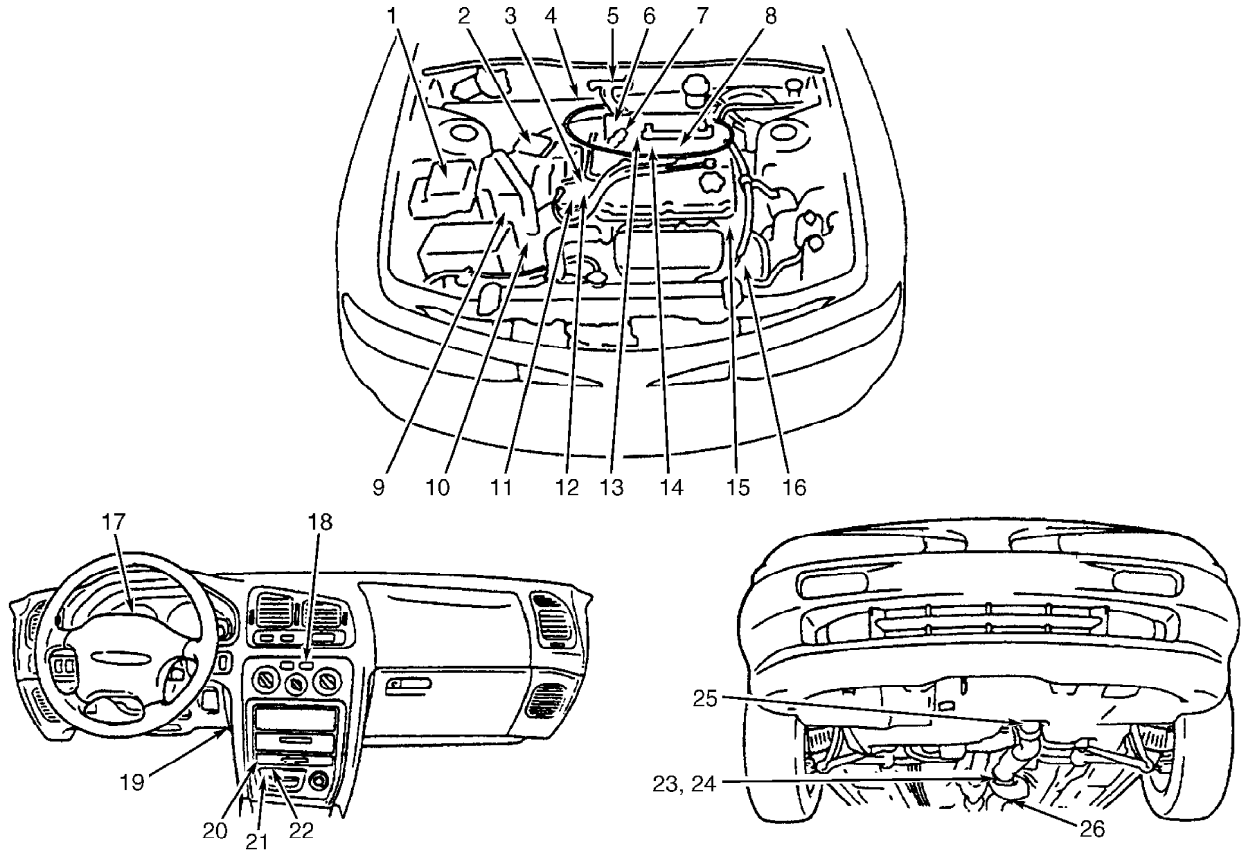
Fig. 4: Engine Performance-Related Components (Eclipse 2.4L)
Courtesy of Mitsubishi Motor Sales of America



1. A/C Clutch Relay
2. Volume Airflow Sensor (VAF) With Built-In Intake Air Temperature (IAT) & Barometric (BARO) Pressure Sensors
3. Engine Coolant Temperature (ECT) Sensor
4. Fuel Pump Check Terminal
5. Exhaust Gas Recirculation (EGR) Solenoid (Fed.)
6. Idle Air Control (IAC) Motor
7. Throttle Position (TP) Sensor With Built-In Closed Throttle Position Sensor (CTP)
8. Fuel Injector
9. Vehicle Speed Sensor (VSS)
10. Park/Neutral Position (PNP) Switch (A/T)
11. Ignition Coil/Power Transistor
12. Camshaft Position (CMP) Sensor
13. Manifold Differential Pressure (MDP) Sensor (Fed.)
14. Evaporative Emission (EVAP) Purge Solenoid
15. Crankshaft Position (CKP) Sensor
16. Power Steering Pressure (PSP) Switch
17. Malfunction Indicator Light (MIL)
18. A/C Switch
19. Data Link Connector (DLC)
20. MFI & Fuel Pump Relays
21. Powertrain Control Module (PCM)
22. Fuel Pump Relay Module (Ca.)
23. Front Heated Oxygen Sensor (HO2S - Fed.)
24. Rear Heated Oxygen Sensor (HO2S - Ca.)
25. Front Heated Oxygen Sensor (HO2S - Ca.)
26. Rear Heated Oxygen Sensor (HO2S - Fed.)

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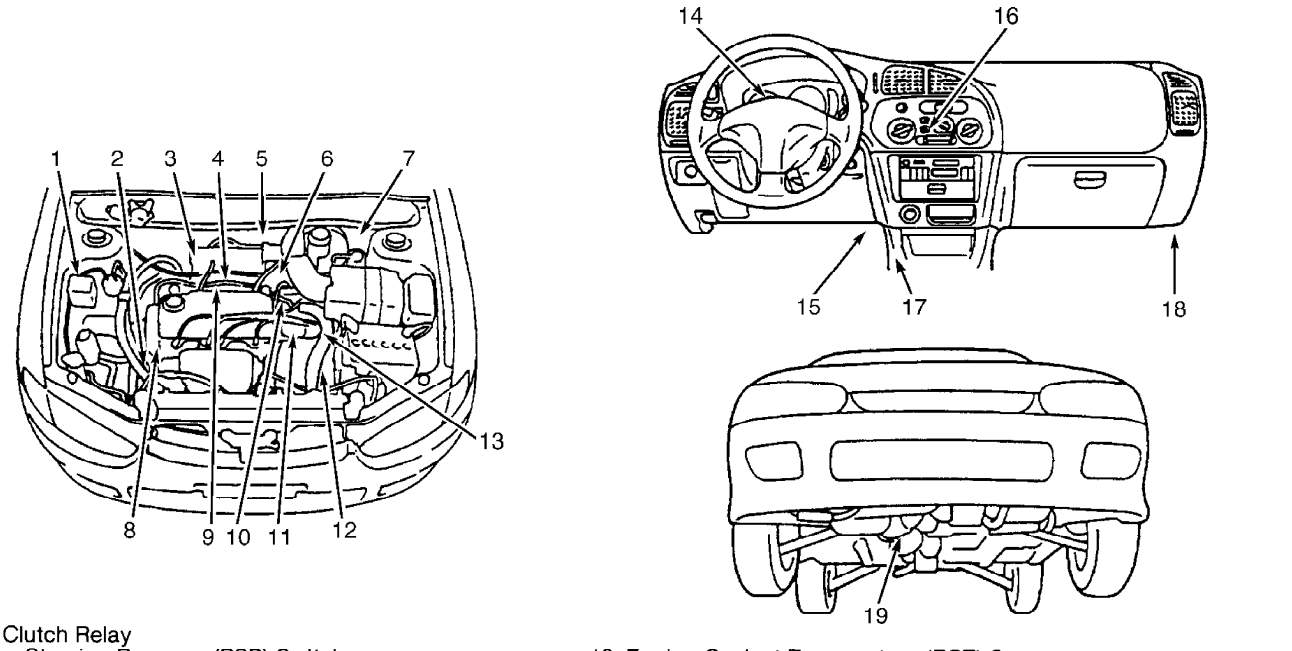
Fig. 5: Engine Performance-Related Components (Galant)
Courtesy of Mitsubishi Motor Sales of America



1. A/C Clutch Relay
2. Power Steering Pressure (PSP) Switch
3. Intake Air Temperature (IAT) Sensor
4. Exhaust Gas Recirculation (EGR) & Evaporative Emission (EVAP) Purge Solenoids
5. Manifold Absolute Pressure (MAP) Sensor
6. Idle Air Control (IAC) Motor & Throttle Position (TP) Sensor With Built-In Closed Throttle Position Sensor (CTP)
7. Fuel Pump Check Terminal
8. Crankshaft Position (CKP) Sensor
9. Fuel Injector
10. Engine Coolant Temperature (ECT) Sensor
11. Camshaft Position (CMP) Sensor & Ignition Coil/Power Transistor
12. Park/Neutral Position (PNP) Switch (A/T)
13. Vehicle Speed Sensor (VSS)
14. Malfunction Indicator Light (MIL)
15. Data Link Connector (DLC)
16. A/C Switch
17. MFI & Fuel Pump Relays
18. Powertrain Control Module (PCM)
19. Heated Oxygen Sensor (HO2S)

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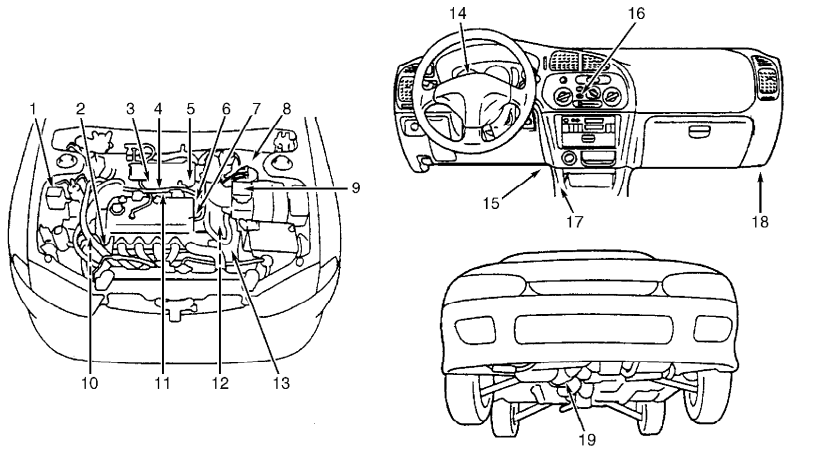
Fig. 6: Engine Performance-Related Components (Mirage 1.5L)
Courtesy of Mitsubishi Motor Sales of America



1. A/C Clutch Relay
2. Power Steering Pressure (PSP) Switch
3. Exhaust Gas Recirculation (EGR) & Evaporative Emission (EVAP) Purge Solenoids
4. Manifold Differential Pressure (MDP) Sensor
5. Idle Air Control (IAC) Motor & Throttle Position (TP) Sensor With Built-In Closed Throttle Position Sensor (CTP)
6. Camshaft Position (CMP) Sensor
7. Engine Coolant Temperature (ECT) Sensor
8. Fuel Pump Check Terminal
9. Volume Airflow Sensor (VAF) With Built-In Intake Air Temperature (IAT) & Barometric (BARO) Pressure Sensors
10. Ignition Failure Sensor
11. Injector & Ignition Coil/Power Transistor
12. Vehicle Speed Sensor
13. Park/Neutral Position (PNP) Switch (A/T)
14. Malfunction Indicator Light (MIL)
15. Data Link Connector (DLC)
16. A/C Switch
17. MFI & Fuel Pump Relays
18. Powertrain Control Module (PCM)
19. Heated Oxygen Sensor (HO2S)

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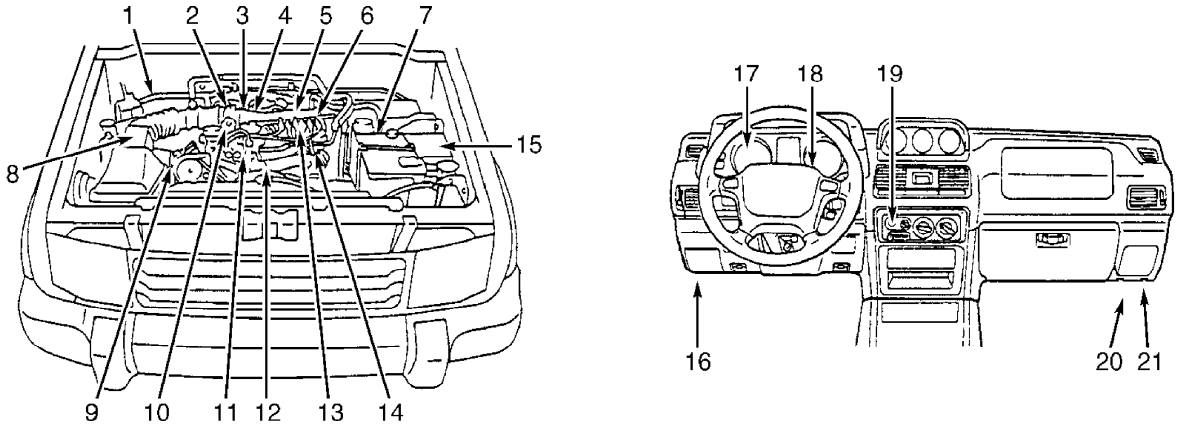
Fig. 7: Engine Performance-Related Components (Mirage 1.8L)
Courtesy of Mitsubishi Motor Sales of America



1. Fuel Pump Check Terminal
2. Throttle Position (TP) Sensor With Built-In Closed Throttle Position Sensor (CTP)
3. Exhaust Gas Recirculation (EGR) Solenoid
4. Evaporative Emission (EVAP) Purge Solenoid
5. Fuel Injector
6. Manifold Differential Pressure (MDP) Sensor
7. Evaporative Emission (EVAP) Vent Solenoid
8. Volume Airflow Sensor (VAF) With Built-In Intake Air Temperature (IAT) & Barometric (BARO) Pressure Sensors
9. Power Steering Pressure (PSP) Switch
10. Idle Air Control (IAC) Motor
11. Engine Coolant Temperature (ECT) Sensor
12. Crankshaft Position (CKP) Sensor
13. Ignition Coil/Power Transistor
14. Camshaft Position (CMP) Sensor
15. A/C Clutch Relay
16. Data Link Connector (DLC)
17. Vehicle Speed Sensor (VSS)
18. Malfunction Indicator Light (MIL)
19. A/C Switch
20. Powertrain Control Module (PCM)
21. MFI & Fuel Pump Relays

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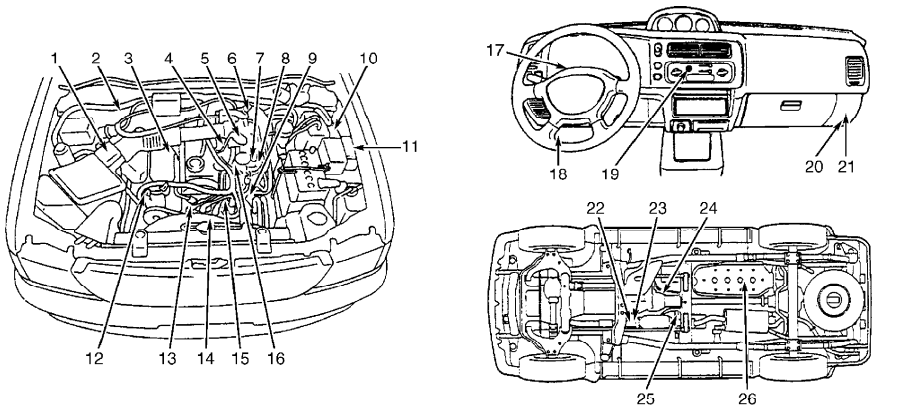
Fig. 8: Engine Performance-Related Components (Montero)
Courtesy of Mitsubishi Motor Sales of America



1. Volume Airflow Sensor (VAF) With Built-In Intake Air Temperature (IAT) & Barometric (BARO) Pressure Sensors
2. Fuel Pump Check Terminal
3. Front Heated Oxygen Sensor (HO2S - Ca.)
4. Idle Air Control (IAC) Motor
5. Throttle Position (TP) Sensor With Built-In Closed Throttle Position Sensor (CTP)
6. Manifold Differential Pressure (MDP) Sensor (Fed.)
7. Evaporative Emission (EVAP) Purge & Exhaust Gas Recirculation (EGR) Solenoids (Fed.)
8. Evaporative Emission (EVAP) Purge Solenoid (Ca.)
9. Engine Coolant Temperature (ECT) Sensor
10. Evaporative (EVAP) Vent Solenoid (Ca.)
11. A/C Clutch Relay
12. Power Steering Pressure (PSP) Switch
13. Camshaft Position (CMP) Sensor
14. Crankshaft Position (CKP) Sensor
15. Ignition Coil/Power Transistor
16. Fuel Injector
17. Malfunction Indicator Light (MIL)
18. Data Link Connector (DLC)
19. A/C Switch
20. MFI & Fuel Pump Relays
21. Powertrain Control Module (PCM)
22. Rear Heated Oxygen Sensor (HO2S - Ca.)
23. Front Heated Oxygen Sensor (HO2S - Fed.)
24. Vehicle Speed Sensor (VSS)
25. Rear Heated Oxygen Sensor (HO2S - Fed.)
26. Fuel Tank Differential Pressure Sensor

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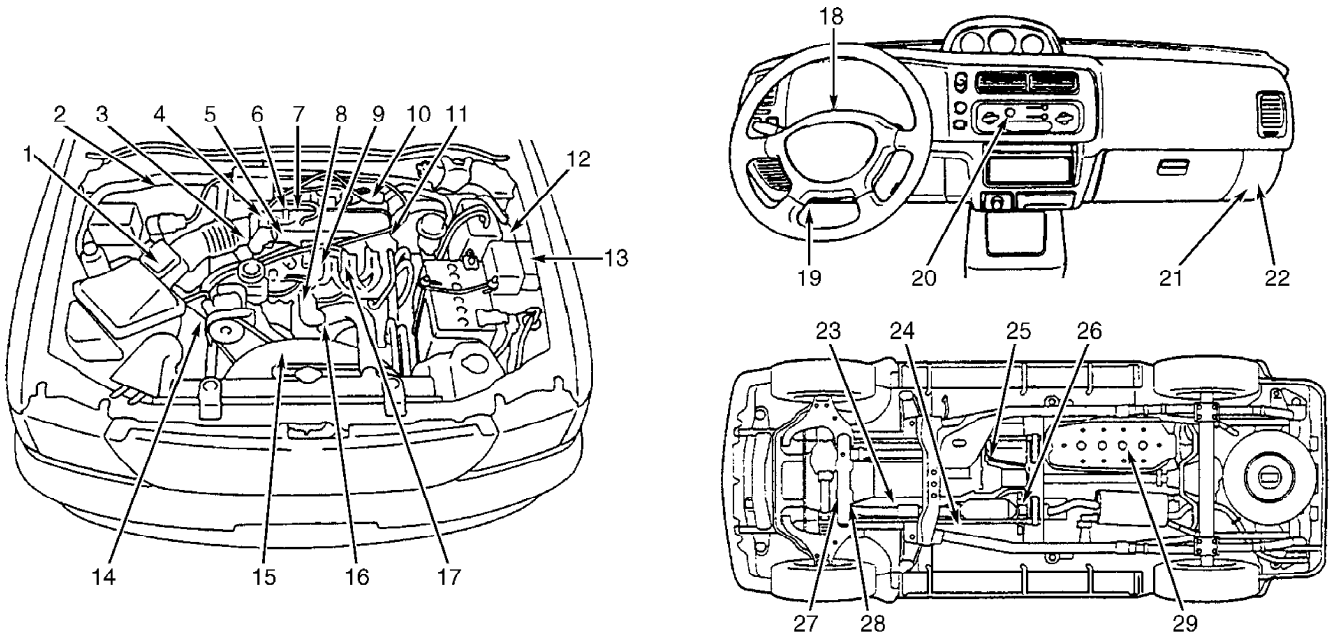
Fig. 9: Engine Performance-Related Components (Montero Sport 2.4L)
Courtesy of Mitsubishi Motor Sales of America



1. Volume Airflow Sensor (VAF) With Built-In Intake Air Temperature (IAT) & Barometric (BARO) Pressure Sensors
2. Fuel Pump Check Terminal
3. Idle Air Control (IAC) Motor
4. Throttle Position (TP) Sensor With Built-In Closed Throttle Position Sensor (CTP)
5. RF Heated Oxygen Sensor (HO2S - Ca.)
6. Exhaust Gas Recirculation (EGR) & Evaporative Emission (EVAP) Purge Solenoids (Fed.)
7. Evaporative Emission (EVAP) Purge Solenoid (Ca.)
8. Engine Coolant Temperature (ECT) Sensor
9. Fuel Injector
10. Manifold Differential Pressure (MDP) Sensor
11. LF Heated Oxygen Sensor (HO2S - Ca.)
12. Evaporative Emission (EVAP) Vent Solenoid
13. A/C Clutch Relay
14. Power Steering Pressure (PSP) Switch
15. Crankshaft Position (CKP) Sensor
16. Camshaft Position (CMP)
17. Ignition Coil/Power Transistor
18. Malfunction Indicator Light (MIL)
19. Data Link Connector (DLC)
20. A/C Switch
21. MFI & Fuel Pump Relays
22. Powertrain Control Module (PCM)
23. Park/Neutral Position (PNP) Switch (A/T)
24. Front Heated Oxygen Sensor (HO2S - Fed.)
25. Vehicle Speed Sensor (VSS)
26. Rear Heated Oxygen Sensor (HO2S - Fed.)
27. RR Heated Oxygen Sensor (HO2S - Ca.)
28. LR Heated Oxygen Sensor (HO2S - Ca.)
29. Fuel Tank Differential Pressure Sensor

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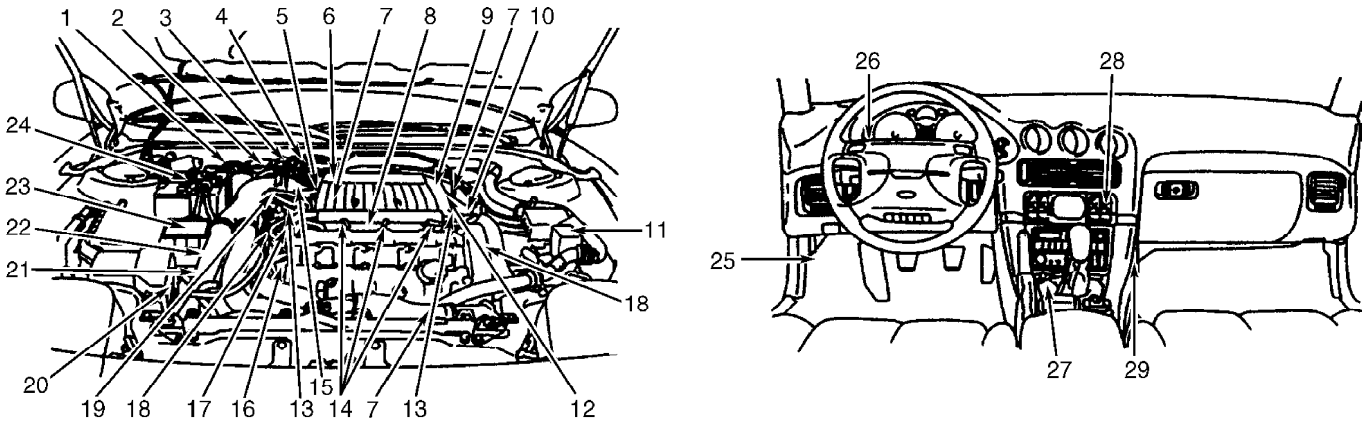
Fig. 10: Engine Performance-Related Components (Montero Sport 3.0L)
Courtesy of Mitsubishi Motor Sales of America



1. Resistor (Turbo)
2. Fuel Pressure Solenoid (Turbo)
3. Exhaust Gas Recirculation (EGR) Solenoid (Turbo)
4. Wastegate Solenoid (Turbo)
5. Evaporative Emission (EVAP) Purge Solenoid
6. Manifold Differential Pressure Sensor
7. Heated Oxygen Sensor (HO2S)
8. Knock Sensor (KS)
9. Variable Induction Control (VIC) Motor With Built-In VIC Control Valve Sensor (Non-Turbo)
10. Power Steering Pressure (PSP) Switch
11. A/C Clutch Relay
12. Exhaust Gas Recirculation (EGR) Sensor
13. Camshaft Position (CMP) Sensor
14. Fuel Injector
15. Throttle Position (TP) Sensor With Built-In Closed Throttle Position Sensor (CTP)
16. Ignition Coil/Power Transistor
17. Engine Coolant Temperature (ECT) Sensor
18. Crankshaft Position (CKP) Sensor
19. Idle Air Control (IAC) Motor
20. Evaporative Emission (EVAP) Vent Solenoid
21. Park/Neutral Position (PNP) Switch (A/T)
22. Vehicle Speed Sensor (VSS)
23. Volume Airflow Sensor (VAF) With Built-In Intake Air Temperature (IAT) & Barometric (BARO) Pressure Sensors
24. Ignition Timing Terminal
25. Data Link Connector (DLC)
26. Malfunction Indicator Light (MIL)
27. Powertrain Control Module (PCM)
28. A/C Switch
29. MFI Relay

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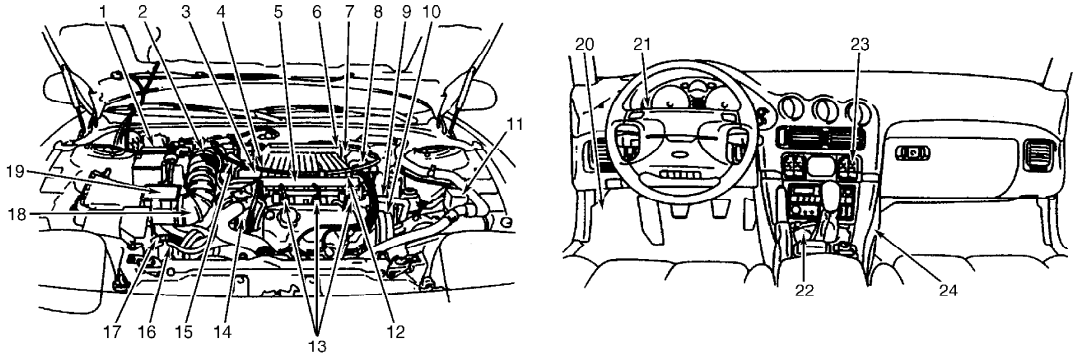
Fig. 11: Engine Performance-Related Components (3000GT DOHC)
Courtesy of Mitsubishi Motor Sales of America



1. Ignition Timing Terminal
2. Idle Air Control (IAC) Motor
3. Evaporative Emission (EVAP) Purge Solenoid
4. Exhaust Gas Recirculation (EGR) Solenoid
5. Heated Oxygen Sensor (HO2S)
6. Manifold Differential Pressure (MDP) Solenoid
7. Variable Induction Control (VIC) Motor With Built-In Idle Air Control (IAC) Valve
8. Camshaft Position (CMP) Sensor
9. Power Steering Pressure (PSP) Switch
10. Crankshaft Position (CKP) Sensor
11. A/C Clutch Relay
12. Ignition Coil/Power Transistor
13. Fuel Injector
14. Engine Coolant Temperature (ECT) Sensor
15. Throttle Position (TP) Sensor With Built-In Closed Throttle Position Sensor (CTP)
16. Evaporative Emission (EVAP) Vent Solenoid
17. Park/Neutral Position (PNP) Switch (A/T)
18. Vehicle Speed Sensor
19. Volume Airflow Sensor (VAF) With Built-In Intake Air Temperature (IAT) & Barometric (BARO) Pressure Sensors
20. Data Link Connector (DLC)
21. Malfunction Indicator Light (MIL)
22. Powertrain Control Module (PCM)
23. A/C Switch
24. MFI Relay

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Fig. 12: Engine Performance-Related Components (3000GT SOHC)
Courtesy of Mitsubishi Motor Sales of America

IGNITION SYSTEM

DISTRIBUTOR

NOTE: Eclipse, Mirage 1.8L, Montero, Montero Sport 3.0L and 3000GT DOHC use Distributorless Ignition System (DIS). All other models use distributor type ignition systems with non-serviceable distributors on which only the rotor and distributor cap can be changed.

FUEL SYSTEM

* PLEASE READ THIS FIRST *

WARNING: Always relieve fuel pressure before disconnecting any fuel injection-related component. DO NOT allow fuel to contact engine or electrical components.

FUEL SYSTEM PRESSURE RELEASE

Relieving Fuel Pressure

1) On Diamante, disconnect fuel pump harness connector at fuel tank from underneath vehicle. On Montero and Montero Sport, remove cargo compartment carpet, remove access plate and disconnect fuel pump harness connector. On all other models, remove rear seat cushion and remove access plate (if required) to disconnect fuel pump harness connector.

2) On all models, start engine. Let engine run until it stops. Turn ignition off. Disconnect negative battery cable. Connect fuel pump harness connector. Reinstall rear seat (if necessary.)

FUEL PUMP

Removal & Installation (Diamante, Eclipse, Galant & Montero)

1) Fuel pump assembly is located inside fuel tank. Release fuel pressure. See FUEL SYSTEM PRESSURE RELEASE. Remove access panel under seat, in trunk or in rear cargo area. Disconnect electrical connectors and fuel hoses at fuel tank.

2) Remove fuel filler hose from fuel tank. Remove fuel pump assembly. To install, reverse removal procedure. Tighten nuts to specification. See TORQUE SPECIFICATIONS.

Removal & Installation (Mirage, Montero Sport & 3000GT)

1) Fuel pump assembly is located inside fuel tank. Release fuel pressure. See FUEL SYSTEM PRESSURE RELEASE. Raise vehicle on hoist. Drain fuel into suitable container. Disconnect electrical connectors and breather/fuel hoses at fuel tank.

2) Remove fuel filler hose from fuel tank. Support fuel tank with transmission jack. Remove nuts securing fuel tank. Remove fuel tank from vehicle. Remove fuel pump assembly. To install, reverse removal procedure. Tighten nuts to specification. See TORQUE SPECIFICATIONS.

FUEL RAILS & INJECTORS

WARNING: Use a rag to cover fuel hose connection before disconnecting high pressure fuel hose at fuel rail. Some residual fuel pressure may still be in system.

CAUTION: DO NOT drop injectors while removing or installing fuel rail.

Removal (Diamante, Montero Sport 2.4L & 3000GT)

1) Relieve fuel pressure. See FUEL SYSTEM PRESSURE RELEASE. Disconnect negative battery cable. Drain coolant. Remove air intake hose. Remove throttle body and gasket with control cables and vacuum hoses attached.

2) Remove EGR pipe (if equipped). Disconnect power brake hose. Label and disconnect vacuum hoses and wiring harness connectors as necessary. Remove intake plenum brackets and mounting bolts. Remove intake plenum and gasket.

3) Disconnect high pressure fuel hose at fuel rail. Disconnect fuel return hose. Disconnect vacuum hoses. Disconnect injector electrical connectors. Remove fuel rail bolts, and lift fuel rail and injectors from engine. Injectors may be removed after fuel rail is removed from intake manifold.

Installation

To install, reverse removal procedure. Use NEW insulators and "O" rings when installing injectors. Install injectors into fuel rail with a twisting motion. Ensure injectors rotate smoothly when installing. Refill cooling system.

Removal (Eclipse, Galant, Mirage & Montero Sport 3.0L)

1) Relieve fuel pressure. See FUEL SYSTEM PRESSURE RELEASE. Disconnect negative battery cable. Disconnect PCV hose and breather hoses. Disconnect high pressure fuel hose at fuel rail. Disconnect fuel return hose and vacuum hoses.

2) Disconnect injector electrical connectors. Remove fuel rail bolts, and lift fuel rail and injectors from engine. Injectors may be removed after fuel rail is removed from intake manifold.

Installation

To install, reverse removal procedure. Use NEW insulators and "O" rings when installing injectors. Use lubricant on "O" rings. Install injectors into fuel rail with a twisting motion. Ensure injectors rotate smoothly when installing.

Removal (Montero)

1) Relieve fuel pressure. See FUEL SYSTEM PRESSURE RELEASE. Disconnect negative battery cable. Remove air intake hose. Remove accelerator cable adjusting bolts. On A/T models, remove throttle control cable. On all models, remove accelerator cable. Label and disconnect all vacuum hoses from throttle body and upper intake manifold (air intake plenum).

2) Remove EGR pipe and gasket. Remove ignition coil (if necessary). Remove engine oil filler neck bracket. Disconnect PCV hose. Remove throttle body, leaving coolant hoses connected. Remove throttle body gasket. Remove front and rear intake plenum brackets. Remove intake plenum mounting bolts. Remove intake plenum and gasket.

3) Disconnect high pressure fuel hose at fuel rail. Disconnect fuel return hose. Disconnect vacuum hoses. Disconnect injector electrical connectors. Remove fuel rail bolts, and lift fuel rail and injectors from engine. Injectors may be removed after fuel rail is removed from intake manifold.

Installation

To install, reverse removal procedure. Use NEW insulators and "O" rings when installing injectors. Use lubricant on "O" rings. Install injectors into fuel rail using a twisting motion. Ensure injectors rotate smoothly when installing. Adjust throttle control and accelerator cables (if necessary). Refill cooling system.

HEATED OXYGEN SENSOR (HO2S)

Removal & Installation

1) Front HO2S is mounted in exhaust pipe below exhaust header. Rear HO2S is mounted behind catalytic converter. HO2S is equipped with a permanent pigtail which must be protected from damage when HO2S is removed. Ensure HO2S is free of contaminants. Avoid using cleaning solvents of any type.

2) HO2S may be difficult to remove when engine temperature is less than 120°F (48°C). If using original sensor, always use anti-seize compound on threads before installation. New sensor threads are precoated with anti-seize. Tighten HO2S to specification. See TORQUE SPECIFICATIONS.

THROTTLE BODY

Removal

1) Relieve fuel pressure. See FUEL SYSTEM PRESSURE RELEASE. Drain enough coolant to ensure coolant level is below throttle body. Disconnect air intake hose.

2) Remove accelerator, cruise control and A/T throttle valve cables (if equipped). Disconnect fuel vapor hose, electrical harness connector, vacuum hose and coolant hoses. Remove throttle body retaining bolts.

Disassembly

Remove throttle position sensor. Remove idle air control motor. Remove throttle bracket and connector bracket (if equipped). Remove idle position switch and adjusting nut (if equipped).

CAUTION: DO NOT remove throttle valve. DO NOT use cleaning solvents on throttle position sensor, idle air control motor or idle position switch.

Cleaning

1) Clean all parts except throttle position sensor, idle air control motor and idle position switch in solvent.

WARNING: Safety glasses MUST be worn whenever compressed air is used for parts cleaning.

2) Check vacuum port and passage for clogging. Clean vacuum, vapor and fuel passages using compressed air.

Reassembly

To reassemble, reverse disassembly procedure.

Installation

To install, reverse removal procedure.

THROTTLE POSITION (TP) SENSOR

Removal & Installation

Throttle Position (TP) sensor is located on throttle body. Disconnect TP sensor electrical connector. Remove TP sensor screws and TP sensor. To install, reverse removal procedure. Tighten TP sensor screws to specification. See TORQUE SPECIFICATIONS. For TP sensor adjustment procedure, see D - ADJUSTMENTS article.

TURBOCHARGERS

Removal (Eclipse)

1) Disconnect negative battery cable. Drain engine coolant and oil. On models equipped with A/C, remove condenser fan motor assembly. Remove front heated oxygen sensor. Remove oil dipstick guide and "O" ring.

2) Disconnect air intake hose and vacuum hoses. Remove air hose and air outlet housing. Remove heat protectors. Disconnect exhaust pipe. Remove power steering oil pump and bracket. Remove engine hanger bracket. Disconnect oil inlet pipe.

3) Disconnect engine coolant hoses and tubes from turbocharger. Remove exhaust manifold nuts and bolts. Remove exhaust manifold and gaskets. Disconnect oil pressure and return pipes. Remove turbocharger and exhaust manifold assembly. Separate turbocharger from exhaust manifold.

Removal (3000GT - Front)

1) Disconnect negative battery cable. Drain engine oil and coolant. Remove radiator. Disconnect exhaust pipe. Remove air intake hose, air hoses and air pipe. Remove generator and belt. Remove oil dipstick guide.

2) Remove heat protector. Disconnect front heated oxygen sensor connector. Remove oil return pipe. Remove turbocharger support bracket, and remove turbocharger from exhaust manifold.

Removal (3000GT - Rear)

1) Disconnect battery cables, and remove battery. Drain engine oil and cooling system. Remove accelerator cable. Remove air hose, air pipe and heat protectors. Disconnect clutch booster vacuum hose. Remove air intake hoses and EGR pipe. Disconnect heated oxygen sensor connectors.

2) Remove oil pipe and EGR valve. Disconnect exhaust fitting, and remove rear heat protector. Remove oil return pipe. Remove turbocharger assembly.

Inspection (All Models)

Check turbine and compressor wheels for cracking and other damage. Ensure turbine and compressor wheels turn smoothly. Check for oil leakage from turbocharger assembly. Check for proper wastegate valve operation. See I - SYSTEM/COMPONENT TESTS article.

CAUTION: Apply light coat of oil to inner surface of flared area on water pipe (flare nut fitting) before connecting to engine.

Installation (All Models)

1) To install, reverse removal procedure. Before oil pipe flare nut (above turbocharger) is installed, pour clean engine oil into turbocharger oil pipe installation hole. Ensure oil and air hoses are properly installed and securely clamped.

2) Use NEW gaskets. Adjust accelerator cable (if necessary). Refill engine oil and coolant. Check for oil and coolant leaks. Tighten all bolts to specification. See TORQUE SPECIFICATIONS.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS TABLE

Applications	Ft. Lbs. (N.m)
Coolant Pipe-To-Turbocharger Banjo Bolt	31 (42)
EGR Valve	16 (22)
Engine Coolant Temperature Sensor	22 (30)
Exhaust Manifold-To-Engine Nuts	18-21 (24-29)
Exhaust Manifold-To-Turbocharger Bolts	40-47 (54-64)
Exhaust Pipe Bolts	21-36 (29-49)
Fuel Filter Line	27 (36)
Fuel Tank Drain Plug	11-18 (15-24)
Fuel Tank Nuts	15-21 (20-29)

Heated Oxygen Sensor	
Front	29-33 (39-44)
Rear	15-29 (20-39)
Heat Protector Bolts	8.8-11 (12.0-15.0)
Intake Manifold Plenum Bolt/Nut	13 (18)
Knock Sensor	15-18 (20-24)
Oil Return Pipe-To-Engine	10-14 (14-19)
Oil Supply Pipe-To-Engine Nut	14 (19)
Oil Supply Pipe-To-Turbocharger Nut	14 (19)
Plenum-To-Intake Manifold Bolts	11-15 (15-20)
Throttle Body	14 (19)
Turbocharger-To-Exhaust Manifold Bolt/Nut	
Step 1	21 (29)
Step 2	Additional 60-70 Degrees
Water Pipe-To-Turbocharger	
Eclipse	25-36 (34-49)
3000GT	22 (30)

	INCH Lbs. (N.m)
Camshaft Position Sensor	80 (9)
Crankshaft Position Sensor	80 (9)
Distributor Hold-Down Bolt	106 (12)
Engine Cover	22-40 (2.5-4.5)
Fuel Pressure Regulator	80 (9)
Fuel Pump Nuts	22 (2.5)
Fuel Rail Bolts	80-106 (9.0-12.0)
TP Sensor Screws	13-22 (1.5-2.5)
Wastegate Actuator Bolts	80-106 (9.0-12.0)

SCHEDULED SERVICES

1998 Mitsubishi Galant

1997-98 MAINTENANCE
Mitsubishi Maintenance & Service Intervals
Normal Service

Mitsubishi: Galant 2.4L
Mitsubishi: Galant 2.5L

* READ THIS FIRST *

Before preforming maintenance on vehicle, ensure that all cautions and warnings have been observed to prevent vehicle damage or personal injury. See CAUTIONS & WARNINGS in MAINTENANCE INFORMATION article in this section.

Introduction
The frequency of scheduled inspection and maintenance services in this article are based on "normal" vehicle usage. They DO NOT take into account the following "severe" conditions:

* Driving In Dusty Conditions
* Trailer Towing, Police, Taxi, commercial Type Operation
* Extensive Idling, Driving In Stop-And-Go Traffic
* Short Trip Operation At Freezing Temperatures (Engine Not Thoroughly Warmed Up)
* Driving In Sandy Areas
* Driving In Salty Areas
* More Than 50% Operation In Heavy City Traffic Or At Sustained High Speeds During Hot Weather Above 90°F (32°C)
* Driving On Off-Road

If any of these severe conditions exist, the "normal" service schedule frequency for some service items is inadequate and must be supplemented. See the following section for specific details, SEVERE SERVICE CONDITIONS/ACTIONS.

SEVERE SERVICE CONDITIONS/ACTIONS

The following table identifies eight "severe" conditions that cause faster-than-normal wear. Each condition lists affected service item(s) and their revised (more frequent) service interval.
If any severe condition(s) is applicable, its revised service interval(s) supersede those found in the "normal" schedules. Depending on the specific mileage/time, the revised interval(s) may overlap a normal schedule (in which case they can be done together). If not, it must be performed outside of the normal schedule.

SEVERE SERVICE CONDITIONS/ACTIONS TABLE

Condition	Action	Item	Perform Every (1)
Driving In Dusty Conditions	Replace	Engine Oil	3,000 Mile (4800 KM) Or 3 Months
	Replace	Oil Filter	6,000 Mile (9600 KM) Or 6 Months
	Replace	Air Cleaner Filter	15,000 Mile (24,000 KM)

	Inspect	Disk Brake Pads	6,000 Mile (9,600 KM) Or 6 Months
	Inspect	Rear Drum Brake Linings & Rear Wheel Cylinders (2.4L)	15,000 Mile (24,000 KM) Or 12 Months
Trailer Towing Or Police, Taxi Or Commercial Type Operation	Replace	Engine Oil	3,000 Mile (4800 KM) Or 3 Months
	Replace	Oil Filter	6,000 Mile (9600 KM) Or 6 Months
	Replace	Spark Plugs	15,000 Mile (24,000 KM)
	Replace	Manual Transaxle Oil (2.4L)	30,000 Mile (48,000 KM)
	Replace	Automatic Transaxle Fluid (2.4L)	30,000 Mile (48,000 KM)
	Replace	Automatic Transaxle External Oil Filter	30,000 Mile (48,000 KM)
Extensive Idling Driving in Stop & Stop & Go Traffic	Replace	Engine Oil	3,000 Mile (4800 KM) Or 3 Months
	Replace	Oil Filter	6,000 Mile (9600 KM) Or 6 Months
Short-trip Operation at Freezing Temperatures (Engine not thoroughly warmed)	Replace	Engine Oil	3,000 Mile (4800 KM) Or 3 Months
	Replace	Oil Filter	6,000 Mile (9600 KM) Or 6 Months
	Replace	Spark Plugs	15,000 Mile (24,000 KM)
Driving In Sandy Areas	Replace	Air Cleaner Filter	15,000 Mile (24,000 KM)
Driving In Salty Areas	Inspect	Disc Brake Pads	6,000 Mile (9,600 KM) Or 6 Months
	Inspect	Rear Drum Brake Linings & Rear Wheel Cylinders (2.4L)	15,000 Mile (24,000 KM) Or 12 Months
More than 50 % Operation in Heavy City Traffic Or At Sustained High Speeds During Hot Weather Above	Replace	Engine Oil	3,000 Mile (4800 KM) Or 3 Months
	Replace	Oil Filter	6,000 Mile (9600 KM) Or 6 Months

90° F (32° C)	Replace	Manual Transaxle Oil (2.4L)	30,000 Mile (48,000 KM)
	Replace	Automatic Transaxle Fluid (2.4L)	30,000 Mile (48,000 KM)
	Replace	Automatic Transaxle Fluid (2.5L)	15,000 Mile (24,000 KM)
	Replace	Automatic Transaxle External Oil Filter	30,000 Mile (48,000 KM)
Driving On Off-Road	Replace	Manual Transaxle Oil (2.4L)	30,000 Mile (48,000 KM)
	Replace	Automatic Transaxle Fluid (2.4L)	30,000 Mile (48,000 KM)
	Replace	Automatic Transaxle Fluid (2.5L)	15,000 Mile (24,000 KM)
	Replace	Automatic Transaxle External Oil Filter	30,000 Mile (48,000 KM)

(1) - Perform these services at the mileage or number of months (since the last time), WHICHEVER COMES FIRST.

7,500 MILE (12,000 KM) NORMAL SERVICE

7,500 MILE (12,000 KM) NORMAL SERVICE

REPLACE
Engine Oil (1)
Engine Oil Filter (2)

(1) - Change once a year or every 7,500 miles (12,000 KM).
(2) - If mileage is less than 7,500 miles (12,000 KM) each year, replace the oil filter at every oil change.

LUBRICATION SPECIFICATIONS

Material	Condition	Specification
Engine Oil (1)	Ambient Temperature Less Than 0°F (-18°C) To 100°F (38°C)	SAE 5W-30
	Ambient Temperature Above 0°F (-18°C) To Over 100°F (38°C)	SAE 10W-30

(1) - SAE 5W-30 engine oil is preferred. SAE 10W-30 may be used if the Ambient Temperature is above 0° F (-18° C).		
FLUID CAPACITIES		
Item	Condition	Specification (1)
Engine Oil (1)	Oil Pan	4.2 Qts. (4.0L)
	Oil Filter	0.32 Qts. (0.3L)
(1) - Capacities are recommended or calculated levels. Always use dipstick to measure level.		

15,000 MILE (24,000 KM) NORMAL SERVICE

15,000 MILE (24,000 KM) NORMAL SERVICE

INSPECT	
	Disc Brake Pads (3)
	Brake Hoses (3)
	Automatic Transaxle Fluid (3)
	Drive Shaft Boots (3)
REPLACE	
	Engine Oil (1)
	Engine Oil Filter (2)
(1) - Change once a year or every 7,500 miles (12,000 KM). (2) - If mileage is less than 7,500 miles (12,000 KM) each year, replace the oil filter at every oil change. (3) - Or inspect every year.	

LUBRICATION SPECIFICATIONS		
Material	Condition	Specification
Engine Oil (1)	Ambient Temperature Less Than 0°F (-18°C) To 100°F (38°C)	SAE 5W-30
	Ambient Temperature Above 0°F (-18°C) To Over 100°F (38°C)	SAE 10W-30
Automatic Transaxle	All	DIAMOND ATF SP II Or Equivalent
Brake Fluid	All	Conforming To DOT 3 Or DOT 4
(1) - SAE 5W-30 engine oil is preferred. SAE 10W-30 may be used if the Ambient Temperature is above 0° F (-18° C).		
FLUID CAPACITIES		

Item	Condition	Specification (1)
Engine Oil (1)	Oil Pan	4.2 Qts. (4.0L)
	Oil Filter	0.32 Qts. (0.3L)
Automatic Transaxle	2.4L: Drained	6.3 Qts. (6.0L)
	2.5L: Drained	9.1 Qts. (8.6L)

(1) - Capacities are recommended or calculated levels. Always use dipstick to measure level.

22,500 MILE (36,000 KM) NORMAL SERVICE

22,500 MILE (36,000 KM) NORMAL SERVICE

VERIFY	
	Last Major Service Was Performed
REPLACE	
	Engine Oil (1)
	Engine Oil Filter (2)

(1) - Change once a year or every 7,500 miles (12,000 KM).
(2) - If mileage is less than 7,500 miles (12,000 KM) each year, replace the oil filter at every oil change.

LUBRICATION SPECIFICATIONS

Material	Condition	Specification
Engine Oil (1)	Ambient Temperature Less Than 0°F (-18°C) To 100°F (38°C)	SAE 5W-30
	Ambient Temperature Above 0°F (-18°C) To Over 100°F (38°C)	SAE 10W-30

(1) - SAE 5W-30 engine oil is preferred. SAE 10W-30 may be used if the Ambient Temperature is above 0° F (-18° C).

FLUID CAPACITIES

Item	Condition	Specification (1)
Engine Oil (1)	Oil Pan	4.2 Qts. (4.0L)
	Oil Filter	0.32 Qts. (0.3L)

(1) - Capacities are recommended or calculated levels. Always use dipstick to measure level.

30,000 MILE (48,000 KM) NORMAL SERVICE

30,000 MILE (48,000 KM) NORMAL SERVICE

VERIFY

	Last Major Service Was Performed
	INSPECT
	Fuel Hoses (4)
	Drive Belt (For Generator, Water Pump, Power Steering Pump)
	Manual Transaxle Oil
	Automatic Transaxle Fluid (3)
	Disc Brake Pads (3)
	Rear Drum Brake Linings & Rear Wheel Cylinders (2.4L Engine Only) (4)
	Brake Hoses (3)
	Ball Joint & Steering Linkage Seals (4)
	Drive Shaft Boots (3)
	Exhaust System (Connection Portion of Muffler, Pipings & Converter Heat Sheilds) (4)
	REPLACE
	Engine Oil (1)
	Engine Oil Filter (2)
	Engine Coolant (5)
	Air Cleaner Filter
	Spark Plugs (2.4L Engine Only)

(1) - Change once a year or every 7,500 miles (12,000 KM).
(2) - If mileage is less than 7,500 miles (12,000 KM) each year, replace the oil filter at every oil change.
(3) - Or inspect every year.
(4) - Or inspect every 2 years.
(5) - Or change every 2 years.

LUBRICATION SPECIFICATIONS

Material	Condition	Specification
Engine Oil (1)	Ambient Temperature Less Than 0°F (-18°C) To 100°F (38°C)	SAE 5W-30
	Ambient Temperature Above 0°F (-18°C) To Over 100°F (38°C)	SAE 10W-30
Engine Coolant	All	50/50 Mixture Of Distilled Water & Ethylene Glycol
Manual Transaxle	All	API Classification GL-4 SAE 75W-85W Or 75W-90

Automatic Transaxle	All	DIAMOND ATF SP II Or Equivalent
Brake Fluid	All	Conforming To DOT 3 Or DOT 4

(1) - SAE 5W-30 engine oil is preferred. SAE 10W-30 may be used if the Ambient Temperature is above 0° F (-18° C).

FLUID CAPACITIES

Item	Condition	Specification (1)
Engine Oil (1)	Oil Pan	4.2 Qts. (4.0L)
	Oil Filter	0.32 Qts. (0.3L)
Engine Coolant	Drained; With Reserve Tank	8.1 Qts. (6.7L)
Manual Transaxle	Drained	2.1 Qts. (2.0L)
Automatic Transaxle	2.4L: Drained	6.3 Qts. (6.0L)
	2.5L: Drained	9.1 Qts. (8.6L)

(1) - Capacities are recommended or calculated levels. Always use dipstick to measure level.

37,500 MILE (60,000 KM) NORMAL SERVICE

37,500 MILE (60,000 KM) NORMAL SERVICE

VERIFY	
	Last Major Service Was Performed
REPLACE	
	Engine Oil (1)
	Engine Oil Filter (2)

(1) - Change once a year or every 7,500 miles (12,000 KM).
(2) - If mileage is less than 7,500 miles (12,000 KM) each year, replace the oil filter at every oil change.

LUBRICATION SPECIFICATIONS

Material	Condition	Specification
Engine Oil (1)	Ambient Temperature Less Than 0°F (-18°C) To 100°F (38°C)	SAE 5W-30
	Ambient Temperature Above 0°F (-18°C) To Over 100°F (38°C)	SAE 10W-30

(1) - SAE 5W-30 engine oil is preferred. SAE 10W-30 may be used if the Ambient Temperature is above 0° F (-18° C).

FLUID CAPACITIES		
Item	Condition	Specification (1)
Engine Oil (1)	Oil Pan	4.2 Qts. (4.0L)
	Oil Filter	0.32 Qts. (0.3L)
(1) - Capacities are recommended or calculated levels. Always use dipstick to measure level.		

45,000 MILE (72,000 KM) NORMAL SERVICE

45,000 MILE (72,000 KM) NORMAL SERVICE

VERIFY	
	Last Major Service Was Performed
INSPECT	
	Disc Brake Pads (3)
	Brake Hoses (3)
	Automatic Transaxle Fluid (3)
	Drive Shaft Boots (3)
REPLACE	
	Engine Oil (1)
	Engine Oil Filter (2)
(1) - Change once a year or every 7,500 miles (12,000 KM). (2) - If mileage is less than 7,500 miles (12,000 KM) each year, replace the oil filter at every oil change. (3) - Or inspect every year.	

LUBRICATION SPECIFICATIONS		
Material	Condition	Specification
Engine Oil (1)	Ambient Temperature Less Than 0°F (-18°C) To 100°F (38°C)	SAE 5W-30
	Ambient Temperature Above 0°F (-18°C) To Over 100°F (38°C)	SAE 10W-30
Automatic Transaxle	All	DIAMOND ATF SP II Or Equivalent
Brake Fluid	All	Conforming To DOT 3 Or DOT 4
(1) - SAE 5W-30 engine oil is preferred. SAE 10W-30 may be used if the Ambient Temperature is above 0° F (-18° C).		

FLUID CAPACITIES		

Item	Condition	Specification (1)
Engine Oil (1)	Oil Pan	4.2 Qts. (4.0L)
	Oil Filter	0.32 Qts. (0.3L)
Automatic Transaxle	2.4L: Drained	6.3 Qts. (6.0L)
	2.5L: Drained	9.1 Qts. (8.6L)
(1) - Capacities are recommended or calculated levels. Always use dipstick to measure level.		

52,500 MILE (84,000 KM) NORMAL SERVICE

52,500 MILE (84,000 KM) NORMAL SERVICE

VERIFY	
	Last Major Service Was Performed
REPLACE	
	Engine Oil (1)
	Engine Oil Filter (2)
(1) - Change once a year or every 7,500 miles (12,000 KM). (2) - If mileage is less than 7,500 miles (12,000 KM) each year, replace the oil filter at every oil change.	

LUBRICATION SPECIFICATIONS

Material	Condition	Specification
Engine Oil (1)	Ambient Temperature Less Than 0°F (-18°C) To 100°F (38°C)	SAE 5W-30
	Ambient Temperature Above 0°F (-18°C) To Over 100°F (38°C)	SAE 10W-30
(1) - SAE 5W-30 engine oil is preferred. SAE 10W-30 may be used if the Ambient Temperature is above 0° F (-18° C).		

FLUID CAPACITIES

Item	Condition	Specification (1)
Engine Oil (1)	Oil Pan	4.2 Qts. (4.0L)
	Oil Filter	0.32 Qts. (0.3L)
(1) - Capacities are recommended or calculated levels. Always use dipstick to measure level.		

60,000 MILE (96,000 KM) NORMAL SERVICE

60,000 MILE (96,000 KM) NORMAL SERVICE

VERIFY

	Last Major Service Was Performed
	INSPECT
	Fuel System (Tank, Pipe Line & Connection, & Fuel Tank Filler Tube Cap. (6)
	Evaporative Emission Control System (Except Evaporative Emission Canister) (6)
	Distributor Cap & Rotor (6)
	Fuel Hoses (4)
	Drive Belt (For Generator, Water Pump, Power Steering Pump)
	Manual Transaxle Oil
	Automatic Transaxle Fluid (3)
	Disc Brake Pads (3)
	Rear Drum Brake Linings & Rear Wheel Cylinders (2.4L Engine Only) (4)
	Brake Hoses (3)
	Ball Joint & Steering Linkage Seals (4)
	Drive Shaft Boots (3)
	Exhaust System (Connection Portion of Muffler, Pipings & Converter Heat Sheilds) (4)
	REPLACE
	Engine Oil (1)
	Engine Oil Filter (2)
	Engine Coolant (5)
	Ignition Cables (7)
	Timing Belt (8)
	Air Cleaner Filter
	Spark Plugs (2.4L & 2.5L Engines)

(1) - Change once a year or every 7,500 miles (12,000 KM).
(2) - If mileage is less than 7,500 miles (12,000 KM) each year, replace the oil filter at every oil change.
(3) - Or inspect every year.
(4) - Or inspect every 2 years.
(5) - Or change every 2 years.
(6) - Or inspect every 5 years.
(7) - Or replace every 5 years.
(8) - For California & Massachusetts, this maintenance is recommended but not required.

LUBRICATION SPECIFICATIONS

Material	Condition	Specification
Engine Oil (1)	Ambient Temperature Less Than 0°F (-18°C) To 100°F (38°C)	SAE 5W-30
	Ambient Temperature Above 0°F (-18°C) To Over 100°F (38°C)	SAE 10W-30
Engine Coolant	All	50/50 Mixture Of Distilled Water & Ethylene Glycol
Manual Transaxle	All	API Classification GL-4 SAE 75W-85W Or 75W-90
Automatic Transaxle	All	DIAMOND ATF SP II Or Equivalent
Brake Fluid	All	Conforming To DOT 3 Or DOT 4

(1) - SAE 5W-30 engine oil is preferred. SAE 10W-30 may be used if the Ambient Temperature is above 0° F (-18° C).

FLUID CAPACITIES

Item	Condition	Specification (1)
Engine Oil (1)	Oil Pan	4.2 Qts. (4.0L)
	Oil Filter	0.32 Qts. (0.3L)
Engine Coolant	Drained; With Reserve Tank	8.1 Qts. (6.7L)
Manual Transaxle	Drained	2.1 Qts. (2.0L)
Automatic Transaxle	2.4L: Drained	6.3 Qts. (6.0L)
	2.5L: Drained	9.1 Qts. (8.6L)

(1) - Capacities are recommended or calculated levels. Always use dipstick to measure level.

67,500 MILE (108,000 KM) NORMAL SERVICE

67,500 MILE (108,000 KM) NORMAL SERVICE

VERIFY	
	Last Major Service Was Performed
REPLACE	
	Engine Oil (1)
	Engine Oil Filter (2)

(1) - Change once a year or every 7,500 miles (12,000 KM).

(2) - If mileage is less than 7,500 miles (12,000 KM) each year, replace the oil filter at every oil change.

LUBRICATION SPECIFICATIONS		
Material	Condition	Specification
Engine Oil (1)	Ambient Temperature Less Than 0°F (-18°C) To 100°F (38°C)	SAE 5W-30
	Ambient Temperature Above 0°F (-18°C) To Over 100°F (38°C)	SAE 10W-30
(1) - SAE 5W-30 engine oil is preferred. SAE 10W-30 may be used if the Ambient Temperature is above 0° F (-18° C).		

FLUID CAPACITIES		
Item	Condition	Specification (1)
Engine Oil (1)	Oil Pan	4.2 Qts. (4.0L)
	Oil Filter	0.32 Qts. (0.3L)
(1) - Capacities are recommended or calculated levels. Always use dipstick to measure level.		

75,000 MILE (120,000 KM) NORMAL SERVICE

75,000 MILE (120,000 KM) NORMAL SERVICE

VERIFY	
	Last Major Service Was Performed
INSPECT	
	Disc Brake Pads (3)
	Brake Hoses (3)
	Automatic Transaxle Fluid (3)
	Drive Shaft Boots (3)
REPLACE	
	Engine Oil (1)
	Engine Oil Filter (2)
(1) - Change once a year or every 7,500 miles (12,000 KM). (2) - If mileage is less than 7,500 miles (12,000 KM) each year, replace the oil filter at every oil change. (3) - Or inspect every year.	

LUBRICATION SPECIFICATIONS		
Material	Condition	Specification
Engine Oil	Ambient Temperature Less Than	SAE 5W-30

(1)	0°F (-18°C) To 100°F (38°C)	
	Ambient Temperature Above 0°F (-18°C) To Over 100°F (38°C)	SAE 10W-30
Automatic Transaxle	All	DIAMOND ATF SP II Or Equivalent
Brake Fluid	All	Conforming To DOT 3 Or DOT 4
(1) - SAE 5W-30 engine oil is preferred. SAE 10W-30 may be used if the Ambient Temperature is above 0° F (-18° C).		

FLUID CAPACITIES		
Item	Condition	Specification (1)
Engine Oil (1)	Oil Pan	4.2 Qts. (4.0L)
	Oil Filter	0.32 Qts. (0.3L)
Automatic Transaxle	2.4L: Drained	6.3 Qts. (6.0L)
	2.5L: Drained	9.1 Qts. (8.6L)
(1) - Capacities are recommended or calculated levels. Always use dipstick to measure level.		

82,500 MILE (132,000 KM) NORMAL SERVICE

82,500 MILE (132,000 KM) NORMAL SERVICE

VERIFY	
	Last Major Service Was Performed
REPLACE	
	Engine Oil (1)
	Engine Oil Filter (2)
(1) - Change once a year or every 7,500 miles (12,000 KM). (2) - If mileage is less than 7,500 miles (12,000 KM) each year, replace the oil filter at every oil change.	

LUBRICATION SPECIFICATIONS		
Material	Condition	Specification
Engine Oil (1)	Ambient Temperature Less Than 0°F (-18°C) To 100°F (38°C)	SAE 5W-30
	Ambient Temperature Above 0°F (-18°C) To Over 100°F (38°C)	SAE 10W-30
(1) - SAE 5W-30 engine oil is preferred. SAE 10W-30 may be used if the Ambient Temperature is above 0° F (-18° C).		

FLUID CAPACITIES

Item	Condition	Specification (1)
Engine Oil (1)	Oil Pan	4.2 Qts. (4.0L)
	Oil Filter	0.32 Qts. (0.3L)

(1) - Capacities are recommended or calculated levels. Always use dipstick to measure level.

90,000 MILE (144,000 KM) NORMAL SERVICE

90,000 MILE (144,000 KM) NORMAL SERVICE

	VERIFY
	Last Major Service Was Performed
	INSPECT
	Fuel Hoses (4)
	Drive Belt (For Generator, Water Pump, Power Steering Pump)
	Manual Transaxle Oil
	Automatic Transaxle Fluid (3)
	Disc Brake Pads (3)
	Rear Drum Brake Linings & Rear Wheel Cylinders (2.4L Engine Only) (4)
	Brake Hoses (3)
	Ball Joint & Steering Linkage Seals (4)
	Drive Shaft Boots (3)
	Exhaust System (Connection Portion of Muffler, Pipings & Converter Heat Sheilds) (4)
	REPLACE
	Engine Oil (1)
	Engine Oil Filter (2)
	Engine Coolant (5)
	Air Cleaner Filter
	Spark Plugs (2.4L Engine Only)

(1) - Change once a year or every 7,500 miles (12,000 KM).
(2) - If mileage is less than 7,500 miles (12,000 KM) each year, replace the oil filter at every oil change.
(3) - Or inspect every year.
(4) - Or inspect every 2 years.
(5) - Or change every 2 years.

LUBRICATION SPECIFICATIONS		
Material	Condition	Specification
Engine Oil (1)	Ambient Temperature Less Than 0°F (-18°C) To 100°F (38°C)	SAE 5W-30
	Ambient Temperature Above 0°F (-18°C) To Over 100°F (38°C)	SAE 10W-30
Engine Coolant	All	50/50 Mixture Of Distilled Water & Ethylene Glycol
Manual Transaxle	All	API Classification GL-4 SAE 75W-85W Or 75W-90
Automatic Transaxle	All	DIAMOND ATF SP II Or Equivalent
Brake Fluid	All	Conforming To DOT 3 Or DOT 4
(1) - SAE 5W-30 engine oil is preferred. SAE 10W-30 may be used if the Ambient Temperature is above 0° F (-18° C).		

FLUID CAPACITIES		
Item	Condition	Specification (1)
Engine Oil (1)	Oil Pan	4.2 Qts. (4.0L)
	Oil Filter	0.32 Qts. (0.3L)
Engine Coolant	Drained; With Reserve Tank	8.1 Qts. (6.7L)
Manual Transaxle	Drained	2.1 Qts. (2.0L)
Automatic Transaxle	2.4L: Drained	6.3 Qts. (6.0L)
	2.5L: Drained	9.1 Qts. (8.6L)
(1) - Capacities are recommended or calculated levels. Always use dipstick to measure level.		

97,500 MILE (156,000 KM) NORMAL SERVICE

97,500 MILE (156,000 KM) NORMAL SERVICE

	VERIFY
	Last Major Service Was Performed
	REPLACE
	Engine Oil (1)
	Engine Oil Filter (2)

(1) - Change once a year or every 7,500 miles (12,000 KM). (2) - If mileage is less than 7,500 miles (12,000 KM) each year, replace the oil filter at every oil change.

LUBRICATION SPECIFICATIONS		
Material	Condition	Specification
Engine Oil (1)	Ambient Temperature Less Than 0°F (-18°C) To 100°F (38°C)	SAE 5W-30
	Ambient Temperature Above 0°F (-18°C) To Over 100°F (38°C)	SAE 10W-30
(1) - SAE 5W-30 engine oil is preferred. SAE 10W-30 may be used if the Ambient Temperature is above 0° F (-18° C).		

FLUID CAPACITIES		
Item	Condition	Specification (1)
Engine Oil (1)	Oil Pan	4.2 Qts. (4.0L)
	Oil Filter	0.32 Qts. (0.3L)
(1) - Capacities are recommended or calculated levels. Always use dipstick to measure level.		

105,000 MILE (168,000 KM) NORMAL SERVICE

105,000 MILE (168,000 KM) NORMAL SERVICE

VERIFY	
	Last Major Service Was Performed
INSPECT	
	Disc Brake Pads (3)
	Brake Hoses (3)
	Automatic Transaxle Fluid (3)
	Drive Shaft Boots (3)
REPLACE	
	Engine Oil (1)
	Engine Oil Filter (2)
(1) - Change once a year or every 7,500 miles (12,000 KM). (2) - If mileage is less than 7,500 miles (12,000 KM) each year, replace the oil filter at every oil change. (3) - Or inspect every year.	

LUBRICATION SPECIFICATIONS		
Material	Condition	Specification

Engine Oil (1)	Ambient Temperature Less Than 0°F (-18°C) To 100°F (38°C)	SAE 5W-30
	Ambient Temperature Above 0°F (-18°C) To Over 100°F (38°C)	SAE 10W-30
Automatic Transaxle	All	DIAMOND ATF SP II Or Equivalent
Brake Fluid	All	Conforming To DOT 3 Or DOT 4
(1) - SAE 5W-30 engine oil is preferred. SAE 10W-30 may be used if the Ambient Temperature is above 0° F (-18° C).		

FLUID CAPACITIES

Item	Condition	Specification (1)
Engine Oil (1)	Oil Pan	4.2 Qts. (4.0L)
	Oil Filter	0.32 Qts. (0.3L)
Automatic Transaxle	2.4L: Drained	6.3 Qts. (6.0L)
	2.5L: Drained	9.1 Qts. (8.6L)
(1) - Capacities are recommended or calculated levels. Always use dipstick to measure level.		

112,500 MILE (187,500 KM) NORMAL SERVICE

112,500 MILE (187,500 KM) NORMAL SERVICE

VERIFY	
	Last Major Service Was Performed
REPLACE	
	Engine Oil (1)
	Engine Oil Filter (2)
(1) - Change once a year or every 7,500 miles (12,000 KM). (2) - If mileage is less than 7,500 miles (12,000 KM) each year, replace the oil filter at every oil change.	

LUBRICATION SPECIFICATIONS

Material	Condition	Specification
Engine Oil (1)	Ambient Temperature Less Than 0°F (-18°C) To 100°F (38°C)	SAE 5W-30
	Ambient Temperature Above 0°F (-18°C) To Over 100°F (38°C)	SAE 10W-30
(1) - SAE 5W-30 engine oil is preferred. SAE 10W-30 may be used if the Ambient Temperature is above 0° F (-18° C).		

FLUID CAPACITIES		
Item	Condition	Specification (1)
Engine Oil (1)	Oil Pan	4.2 Qts. (4.0L)
	Oil Filter	0.32 Qts. (0.3L)
(1) - Capacities are recommended or calculated levels. Always use dipstick to measure level.		

120,000 MILE (200,000 KM) NORMAL SERVICE

120,000 MILE (200,000 KM) NORMAL SERVICE

	VERIFY
	Last Major Service Was Performed
	INSPECT
	Fuel System (Tank, Pipe Line & Connection, & Fuel Tank Filler Tube Cap. (6)
	Evaporative Emission Control System (Except Evaporative Emission Canister) (6)
	Distributor Cap & Rotor (6)
	Fuel Hoses (4)
	Drive Belt (For Generator, Water Pump, Power Steering Pump)
	Manual Transaxle Oil
	Automatic Transaxle Fluid (3)
	Disc Brake Pads (3)
	Rear Drum Brake Linings & Rear Wheel Cylinders (2.4L Engine Only) (4)
	Brake Hoses (3)
	Ball Joint & Steering Linkage Seals (4)
	Drive Shaft Boots (3)
	Exhaust System (Connection Portion of Muffler, Pipings & Converter Heat Sheilds) (4)
	REPLACE
	Engine Oil (1)
	Engine Oil Filter (2)
	Engine Coolant (5)
	Ignition Cables (7)

	Air Cleaner Filter
	Spark Plugs (2.4L & 2.5L Engines)

(1) - Change once a year or every 7,500 miles (12,000 KM).
(2) - If mileage is less than 7,500 miles (12,000 KM) each year, replace the oil filter at every oil change.
(3) - Or inspect every year.
(4) - Or inspect every 2 years.
(5) - Or change every 2 years.
(6) - Or inspect every 5 years.
(7) - Or replace every 5 years.

LUBRICATION SPECIFICATIONS

Material	Condition	Specification
Engine Oil (1)	Ambient Temperature Less Than 0°F (-18°C) To 100°F (38°C)	SAE 5W-30
	Ambient Temperature Above 0°F (-18°C) To Over 100°F (38°C)	SAE 10W-30
Engine Coolant	All	50/50 Mixture Of Distilled Water & Ethylene Glycol
Manual Transaxle	All	API Classification GL-4 SAE 75W-85W Or 75W-90
Automatic Transaxle	All	DIAMOND ATF SP II Or Equivalent
Brake Fluid	All	Conforming To DOT 3 Or DOT 4

(1) - SAE 5W-30 engine oil is preferred. SAE 10W-30 may be used if the Ambient Temperature is above 0° F (-18° C).

FLUID CAPACITIES

Item	Condition	Specification (1)
Engine Oil (1)	Oil Pan	4.2 Qts. (4.0L)
	Oil Filter	0.32 Qts. (0.3L)
Engine Coolant	Drained; With Reserve Tank	8.1 Qts. (6.7L)
Manual Transaxle	Drained	2.1 Qts. (2.0L)
Automatic Transaxle	2.4L: Drained	6.3 Qts. (6.0L)
	2.5L: Drained	9.1 Qts. (8.6L)

(1) - Capacities are recommended or calculated levels. Always use dipstick to measure level.

LUBRICATION SPECIFICATIONS

LUBRICATION SPECIFICATIONS TABLE

Material	Condition	Specification
Engine Oil (1)	Ambient Temperature Less Than 0°F (-18°C) To 100°F (38°C)	SAE 5W-30
	Ambient Temperature Above 0°F (-18°C) To Over 100°F (38°C)	SAE 10W-30
Power Steering Fluid	All	Automatic Transmission Fluid DEXRON II
Engine Coolant	All	50/50 Mixture Of Distilled Water & Ethylene Glycol
Manual Transaxle	All	API Classification GL-4 SAE 75W-85W Or 75W-90
Automatic Transaxle	All	DIAMOND ATF SP II Or Equivalent
Brake Fluid	All	Conforming To DOT 3 Or DOT 4
Clutch Fluid	All	Conforming To DOT 3 Or DOT 4
Transaxle Linkage, Parking Brake Cable Mechanism, Hood Lock & Hook, Door Latches Seat Adjusters	All	Multipurpose Grease NLGI Grade 2
Door Hinges, Deck Lid Hinges	All	Engine Oil
A/C Refrigerant	All	HFC-134a

(1) - SAE 5W-30 engine oil is preferred. SAE 10W-30 may be used if the Ambient Temperature is above 0° F (-18° C).

FLUID CAPACITIES

FLUID CAPACITIES TABLE (1)

Item	Condition	Specification
Engine Oil	Oil Pan	4.2 Qts. (4.0L)
	Oil Filter	0.32 Qts. (0.3L)

Engine Coolant	Drained; With Reserve Tank	8.1 Qts. (6.7L)
Manual Transaxle	Drained	2.1 Qts. (2.0L)
Automatic Transaxle	2.4L: Drained	6.3 Qts. (6.0L)
	2.5L: Drained	9.1 Qts. (8.6L)
Power Steering	Drained	1.0 Qts. (0.9L)
A/C Refrigerant	Drained	680 g
Fuel Tank	Capacity	16.9 gal (64L)

(1) - Capacities are recommended or calculated levels. Always use dipstick to measure level.

MISCELLANEOUS NOTES

* The Supplemental Restraint System must be inspected by an authorized dealer 10 years after the Manufacture date.

SEATS - POWER

1998 Mitsubishi Galant

1998 ACCESSORIES & EQUIPMENT
Mitsubishi - Power Seats

Eclipse, Galant, Montero, 3000GT

DESCRIPTION & OPERATION

Power seat system consists of reversible motors, a control switch assembly and a wiring harness. Circuit is protected by a fusible link, located in main relay box in engine compartment.

Power assist adjustments offered are: forward and backward movement, height adjustment and separately adjusted front or rear seat tilt. Controls are located on side of seat cushion or on center console.

COMPONENT LOCATIONS

COMPONENT LOCATIONS TABLE

Component	Location
Data Link Connector (DLC)	Under Left Of Dash, Below Steering Column
ETACS-ECU	
3000GT	Left Of Steering Column
Seat Adjusting Motors	Under Each Front Seat

COMPONENT TESTS

LIMIT SWITCH/SENSOR

Galant (Driver's Seat)

Disconnect each limit switch harness connector. Operate each switch to check continuity between specified pins using ohmmeter. See LIMIT SWITCH CONTINUITY TABLE (GALANT). See Fig. 1. Replace power seat adjuster assembly if any switch fails testing.

LIMIT SWITCH CONTINUITY TABLE (GALANT)

Switch Position	Check Continuity Between Pins No.
Slide Limit Switch	
Forward	1 & 2
Backward	1 & 3
Middle (ON)	1, 2 & 3
Front & Rear Height Limit Switch	
Front Up	1 & 3
Front Down	1 & 2
Front Middle (ON)	1, 2 & 3
Rear Up	1 & 3
Rear Down	1 & 2
Rear Middle (ON)	1, 2 & 3

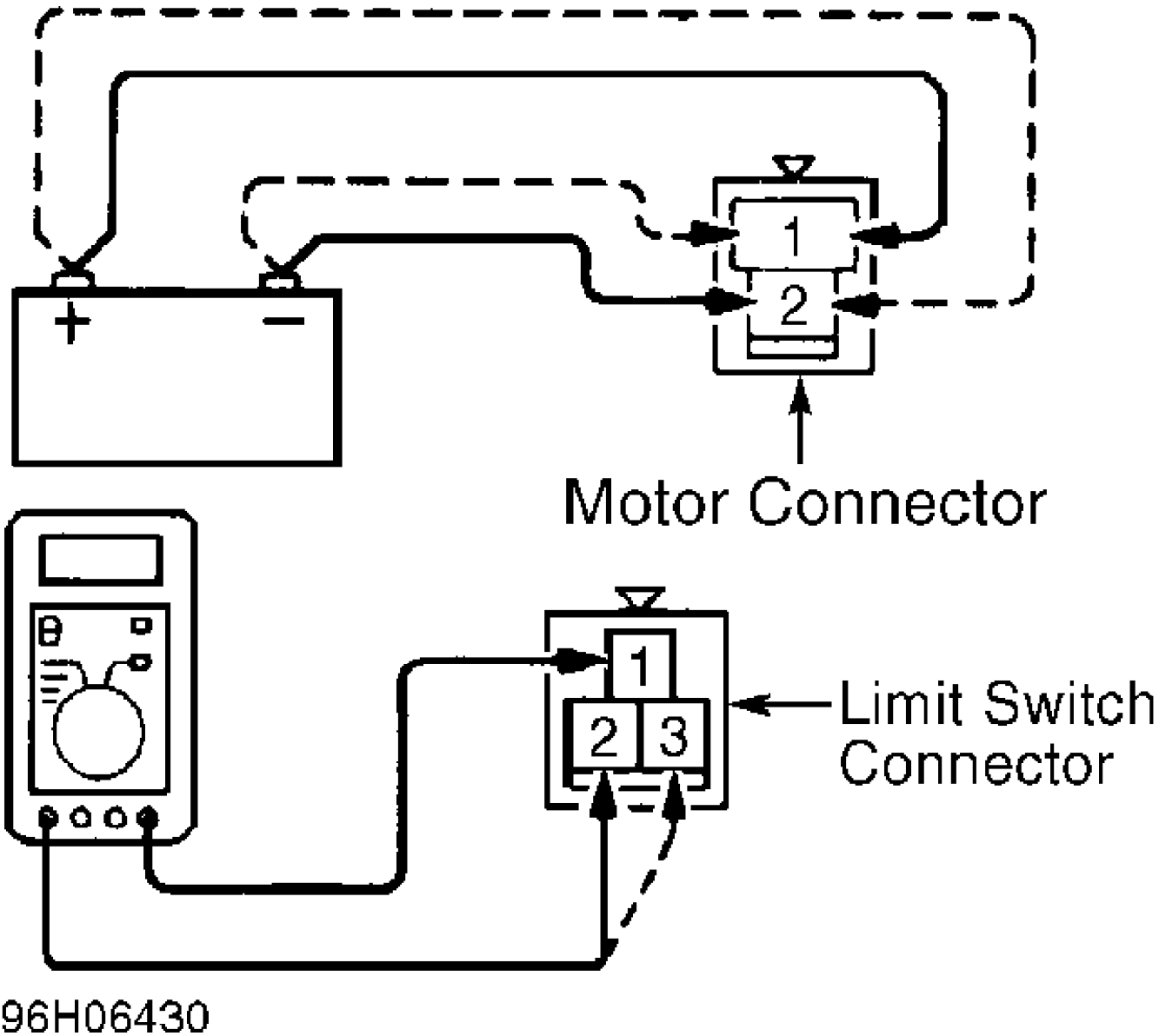

Fig. 1: Identifying Limit Switch Connectors (Galant)
Courtesy of Mitsubishi Motor Sales of America

3000GT (Driver's Seat)

Disconnect each limit switch harness connector. Operate each switch to check continuity between specified pins using ohmmeter. See LIMIT SWITCH CONTINUITY TABLE (3000GT). See Fig. 2. Replace power seat adjuster assembly if any switch fails testing.

LIMIT SWITCH CONTINUITY TABLE (3000GT)

Switch Position	Check Continuity Between Pins No.
Slide Limit Switch	
Forward	1 & 3
Backward	1 & 2
Middle (ON)	1, 2 & 3
Front & Rear Height Limit Switch	

Front Up	1 & 3
Front Down	1 & 2
Front Middle (ON)	1, 2 & 3
Rear Up	4 & 6
Rear Down	4 & 5
Rear Middle (ON)	4, 5 & 6

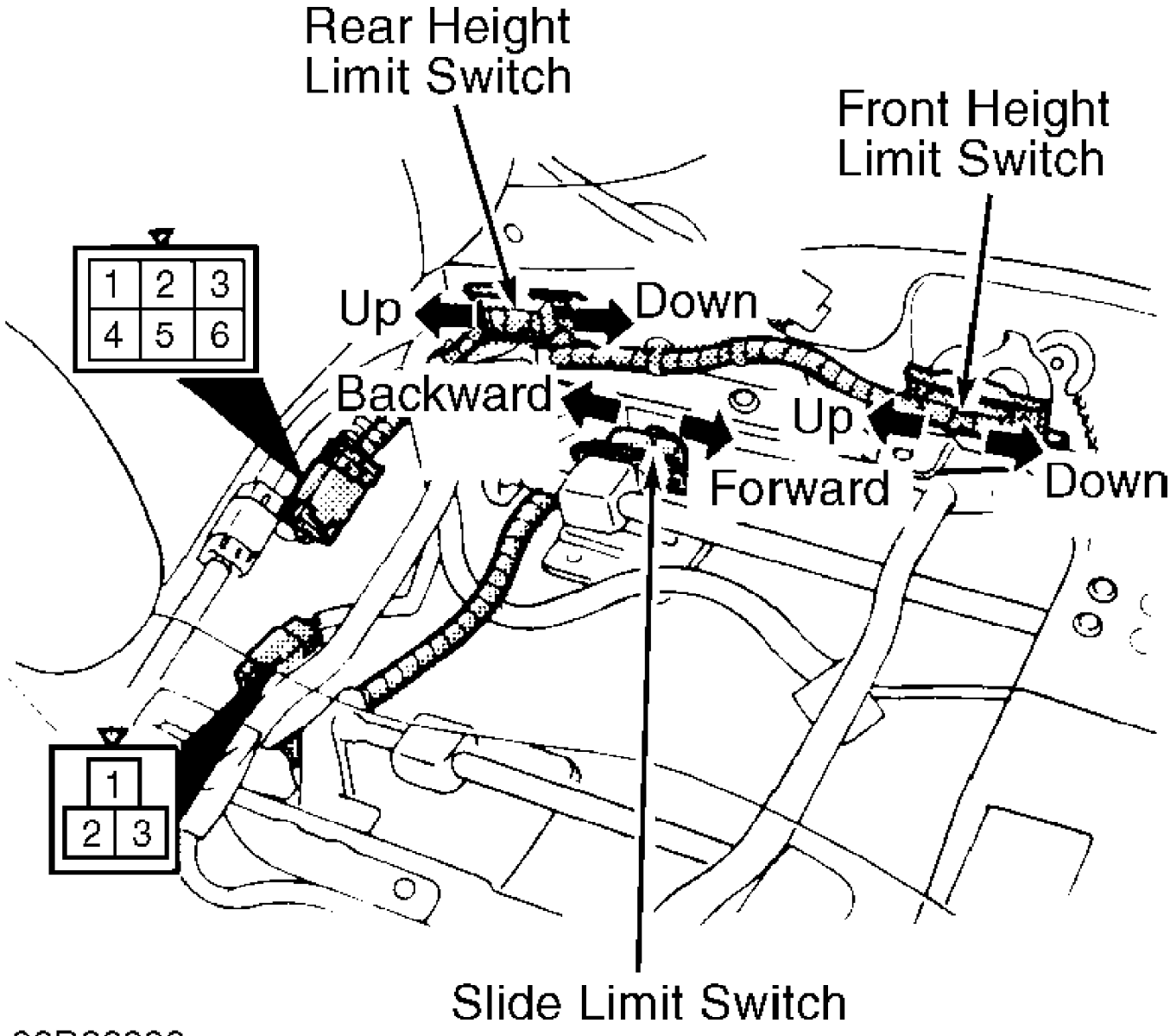

Fig. 2: Identifying Limit Switch Connectors (3000GT)
Courtesy of Mitsubishi Motor Sales of America

LUMBAR/SIDE ADJUSTMENT SWITCH

3000GT

Remove switch from center console. Using ohmmeter, check continuity of switch. See LUMBAR/SIDE ADJUSTMENT SWITCH CONTINUITY TABLE (3000GT). See Fig. 3.

Replace switch if continuity is not as specified.

LUMBAR/SIDE ADJUSTMENT SWITCH CONTINUITY TABLE (3000GT)

Switch Position	Check Continuity Between Pins No.
Lumbar Support	
Push	2 & 3; 5 & 7
Off	2, 3 & 5
Release	2 & 5; 3 & 7
Side Support	
Spread	1 & 2; 7 & 8
Off	1, 2 & 8
Close	1 & 7; 2 & 8

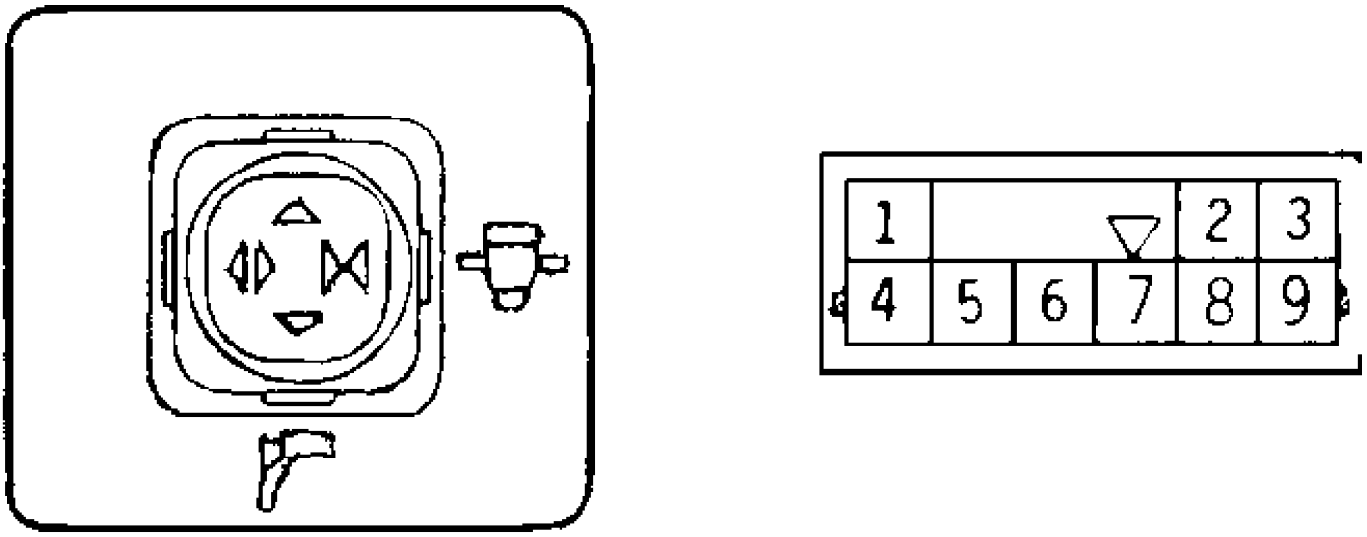

Fig. 3: Identifying Lumbar/Side Adjustment Switch Terminals (3000GT)
Courtesy of Mitsubishi Motor Sales of America

POWER SEAT MOTORS

Eclipse, Galant & Montero

Disconnect each motor harness connector. Connect 12-volt power supply to motor connector terminals. Reverse power supply leads to reverse direction of motor operation. Motor should operate freely and smoothly. If any motor does not operate correctly, replace power seat adjuster assembly. Motors cannot be replaced individually.

3000GT

Disconnect each motor harness connector. To access lumbar and side support motor harness connectors, remove seatback panel. Connect 12-volt power supply to motor connector terminals. Reverse power supply leads to reverse direction of motor operation. Motor should operate freely and smoothly. If any motor does not operate correctly, replace power seat adjuster assembly or seatback assembly. Motors cannot be replaced individually.

POWER SEAT SWITCH

Eclipse & 3000GT

Disconnect power seat switch harness connector. Using ohmmeter, check continuity of switch. See POWER SEAT SWITCH CONTINUITY TABLE (ECLIPSE & 3000GT). See Fig. 4. Replace switch if continuity is not as specified.

POWER SEAT SWITCH CONTINUITY TABLE (ECLIPSE & 3000GT)

Switch Position	Check Continuity Between Pins No.
Slide Switch	
Forward	2 & 3; 4 & 14
Backward	1 & 4; 3 & 14
Front Height Switch	
Up	9 & 10; 11 & 14
Down	8 & 11; 10 & 14
Rear Height Switch	
Up	6 & 12; 7 & 14
Down	5 & 7; 12 & 14
All Switches Off	No Continuity, All Terminals

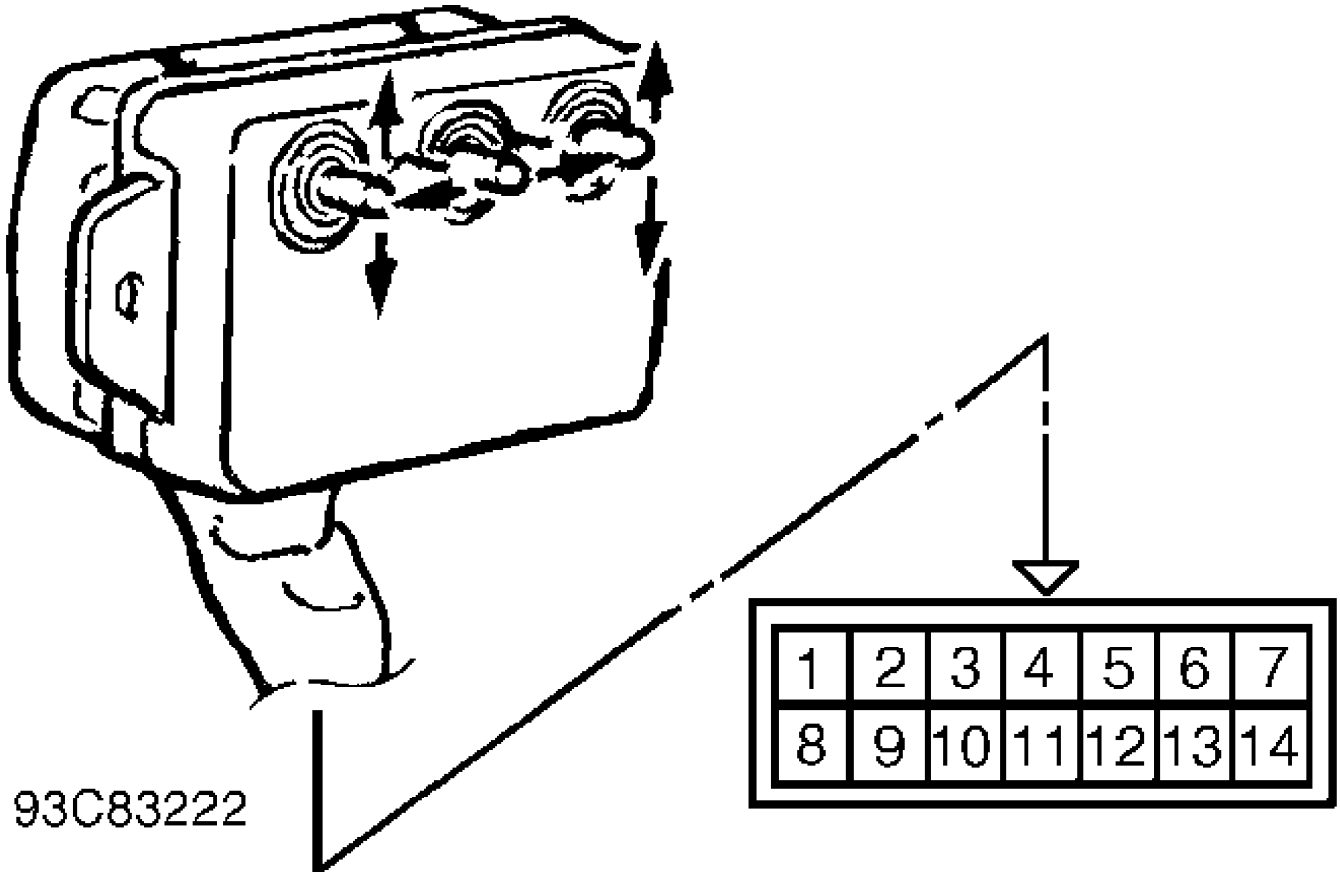

Fig. 4: Identifying Power Seat Switch Terminals (Eclipse & 3000GT)
Courtesy of Mitsubishi Motor Sales of America

Galant

Disconnect power seat switch harness connector. Using ohmmeter, check continuity of switch. See POWER SEAT SWITCH CONTINUITY TABLE (GALANT). See Fig. 5. Replace switch if continuity is not as specified.

POWER SEAT SWITCH CONTINUITY TABLE (GALANT)

Switch Position	Check Continuity Between Pins No.
Driver's & Passenger's Seat	
Front Height Switch	
Up	11 & 14; 13 & 22
Down	12 & 13; 14 & 22
Rear Height Switch	
Up	17 & 18; 15 & 22
Down	15 & 19; 17 & 22
Slide Switch	
Forward	1 & 4; 3 & 22
Backward	2 & 3; 4 & 22
Reclining Switch	
Forward	16 & 21; 20 & 22
Backward	16 & 20; 21 & 22
All Switches	
Off	1 & 4; 2 & 3; 11 & 14; 12 & 13; 15 & 19; 16, 20 & 21; 17 & 18

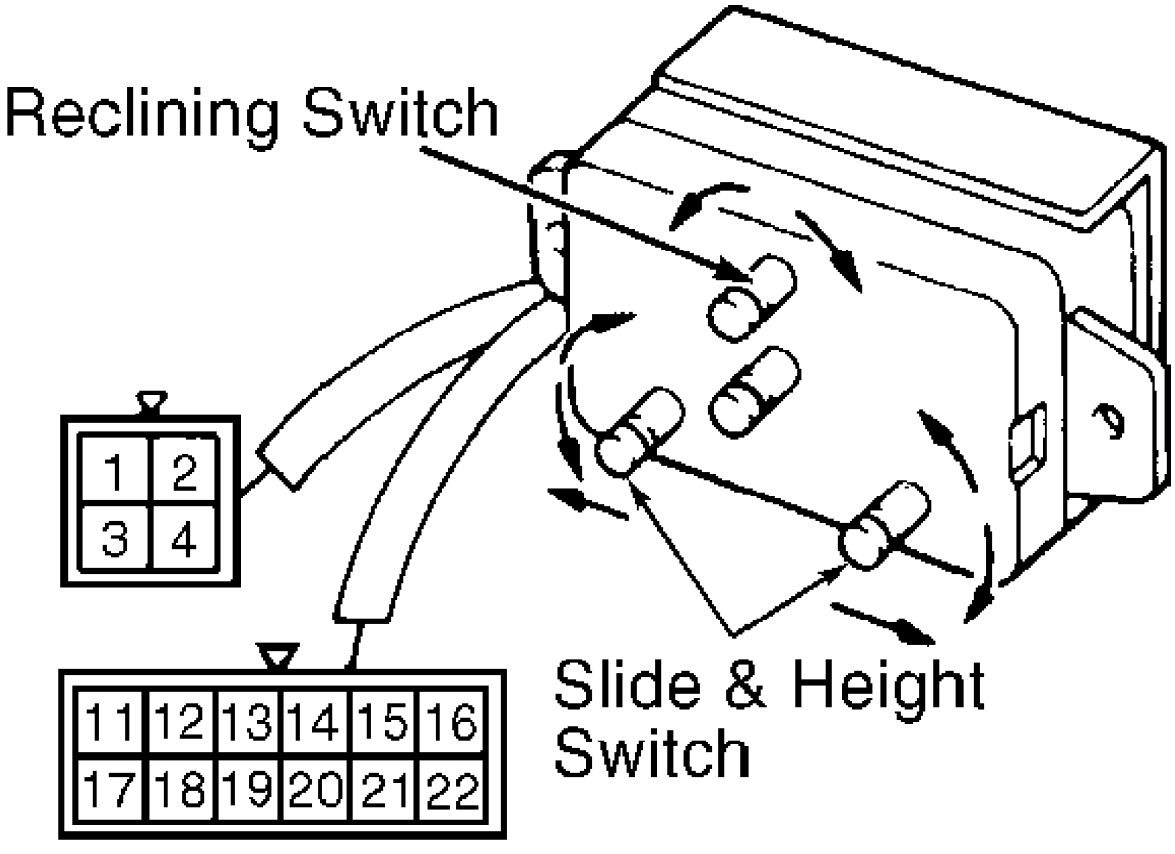

Fig. 5: Identifying Power Seat Switch Terminals (Galant)
Courtesy of Mitsubishi Motor Sales of America

Montero
Disconnect power seat switch harness connector. Using

ohmmeter, check continuity of switch. See POWER SEAT SWITCH CONTINUITY TABLE (MONTERO). See Fig. 6. Replace switch if continuity is not as specified.

POWER SEAT SWITCH CONTINUITY TABLE (MONTERO)

Switch Position	(1) Check Continuity Between Pins No.
Driver's Seat	
Front Height Switch	
Up	A-1 & B-2; B-1 & C-3
Down	A-1 & B-1; B-2 & C-2
Rear Height Switch	
Up	A-1 & D-2; D-1 & E-2
Down	A-1 & E-3; D-2 & E-3
Slide Switch	
Forward	A-1 & A-2
Backward	A-1 & A-5
Reclining Switch	
Forward	A-1 & A-3
Backward	A-1 & A-6
All Switches	
Off	A-2, A-3, A-4, A-5, A-6, C-1 & E-1

(1) - Letter prefix identifies connector.

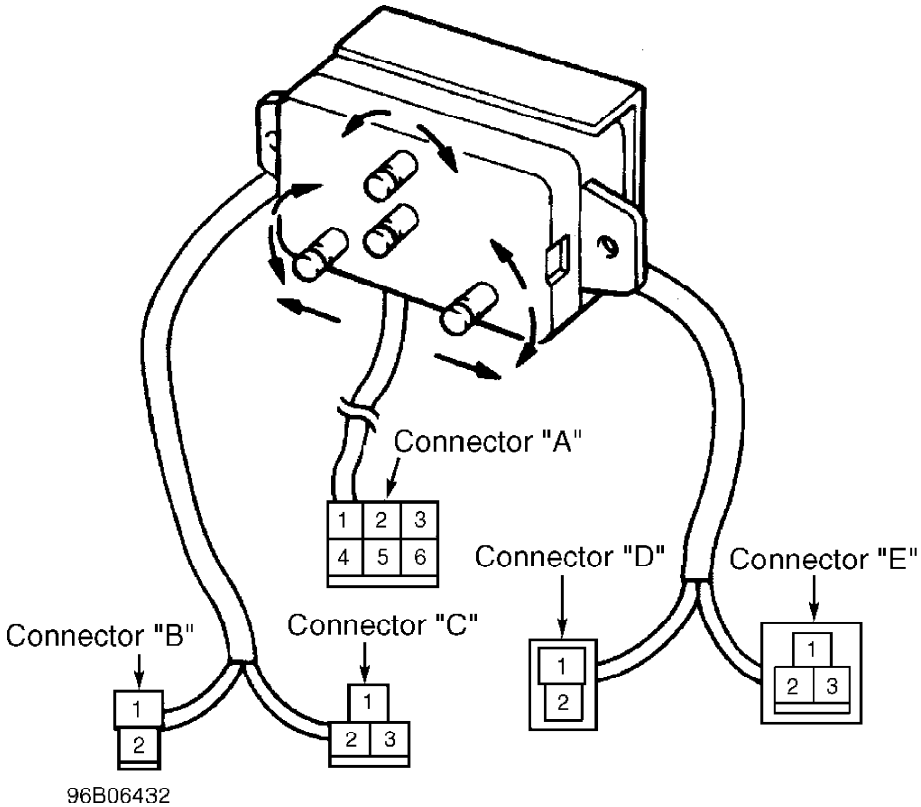

Fig. 6: Identifying Power Seat Switch Terminals (Montero)
Courtesy of Mitsubishi Motor Sales of America

REMOVAL & INSTALLATION

SEAT ASSEMBLY

Removal & Installation (Functioning Power Seat)

With ignition on, move seat fully rearward. Remove front seat anchor covers and remove nuts. Move seat fully forward. Remove rear seat anchor covers and remove bolts. Turn ignition off. Disconnect electrical harness connectors. Remove seat assembly. To install, reverse removal procedure.

Removal & Installation (Malfunctioning Power Seat)

1) Removal of seat assembly front or rear mounting bolt is not possible due to malfunction of slide motor, slide switch or frozen slide rails. If seat is stuck in forward position, go to next step. If seat is stuck in rearward position, go to step 3).

2) Remove rear seat anchor covers and mounting bolts. Remove adjuster screw nut housing mounting bolt. See Fig. 7. Both adjuster screw nut housings mount to center of slider frame rail. Insert screwdriver blade between housing nut and rail. Lift and rotate housing nut. Slide seat back and remove front anchor nuts. Once seat is repaired, install housing nut bolts.

3) Lift up front seat cushion cover to expose slide motor. Remove slide motor mounting bolts. If seat assembly cannot be moved forward, remove slide motor bracket mounting bolts. Move seat forward and remove rear anchor bolts. Once seat is repaired, install slide motor bracket mounting bolts.

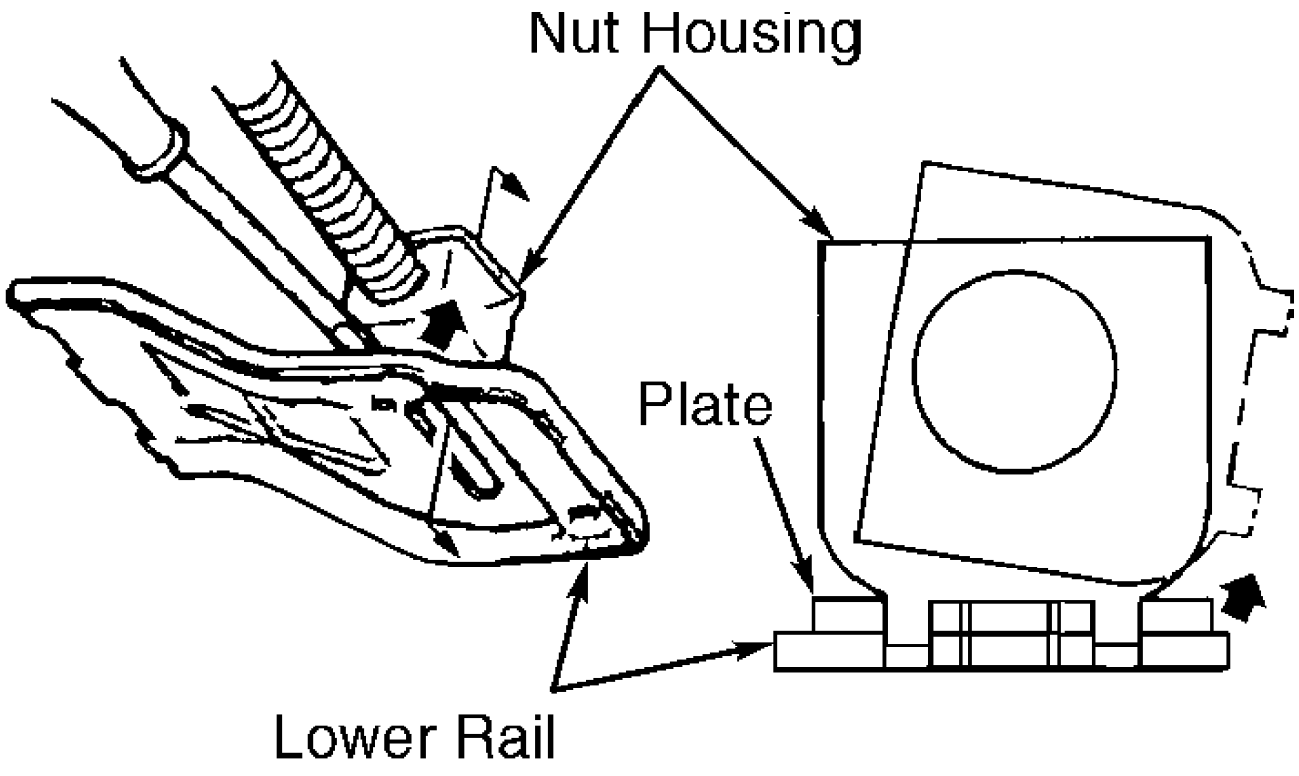

Fig. 7: Disconnecting Nut Housing (Typical)
Courtesy of Mitsubishi Motor Sales of America

WIRING DIAGRAMS

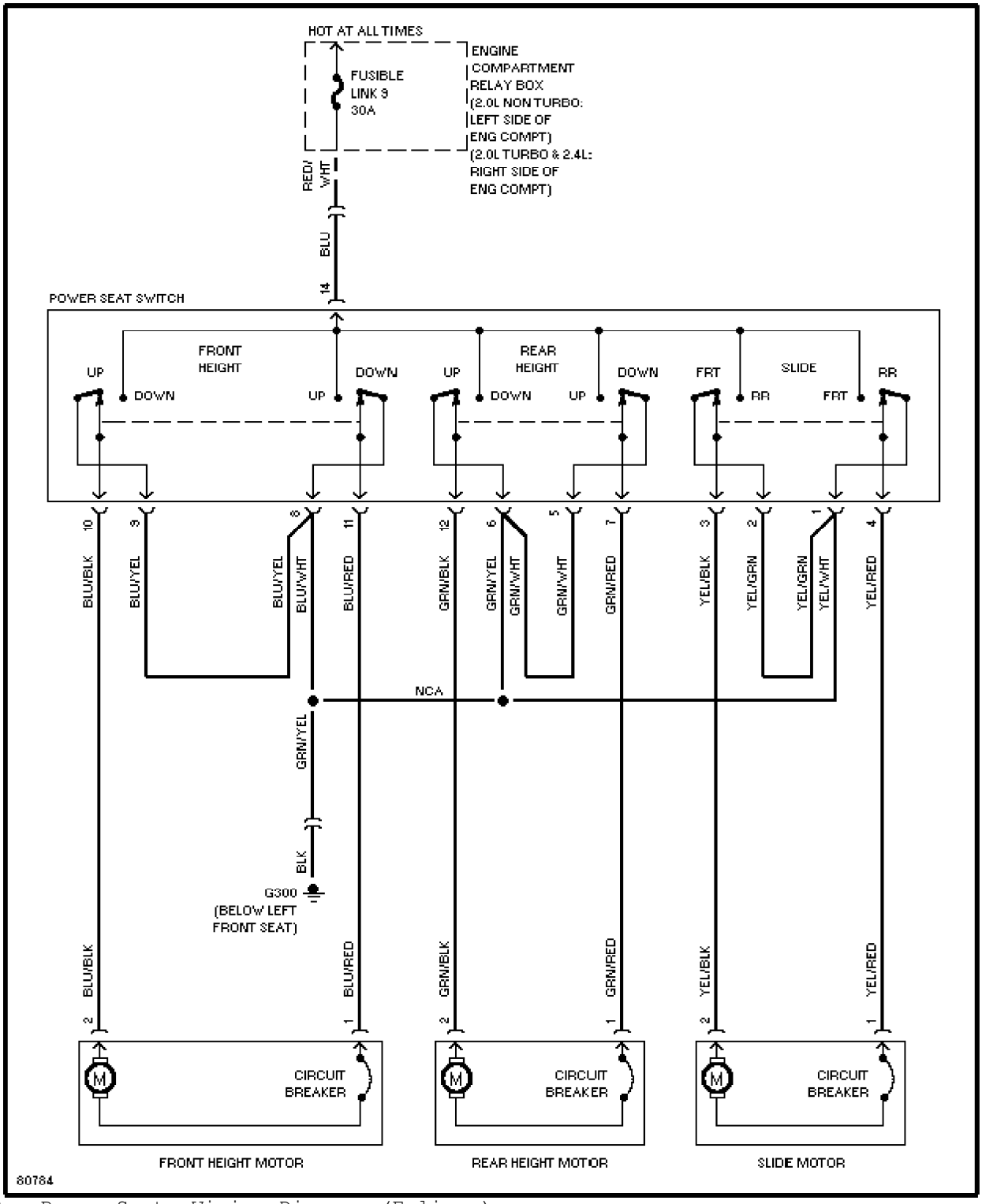

Fig. 8: Power Seats Wiring Diagram (Eclipse)

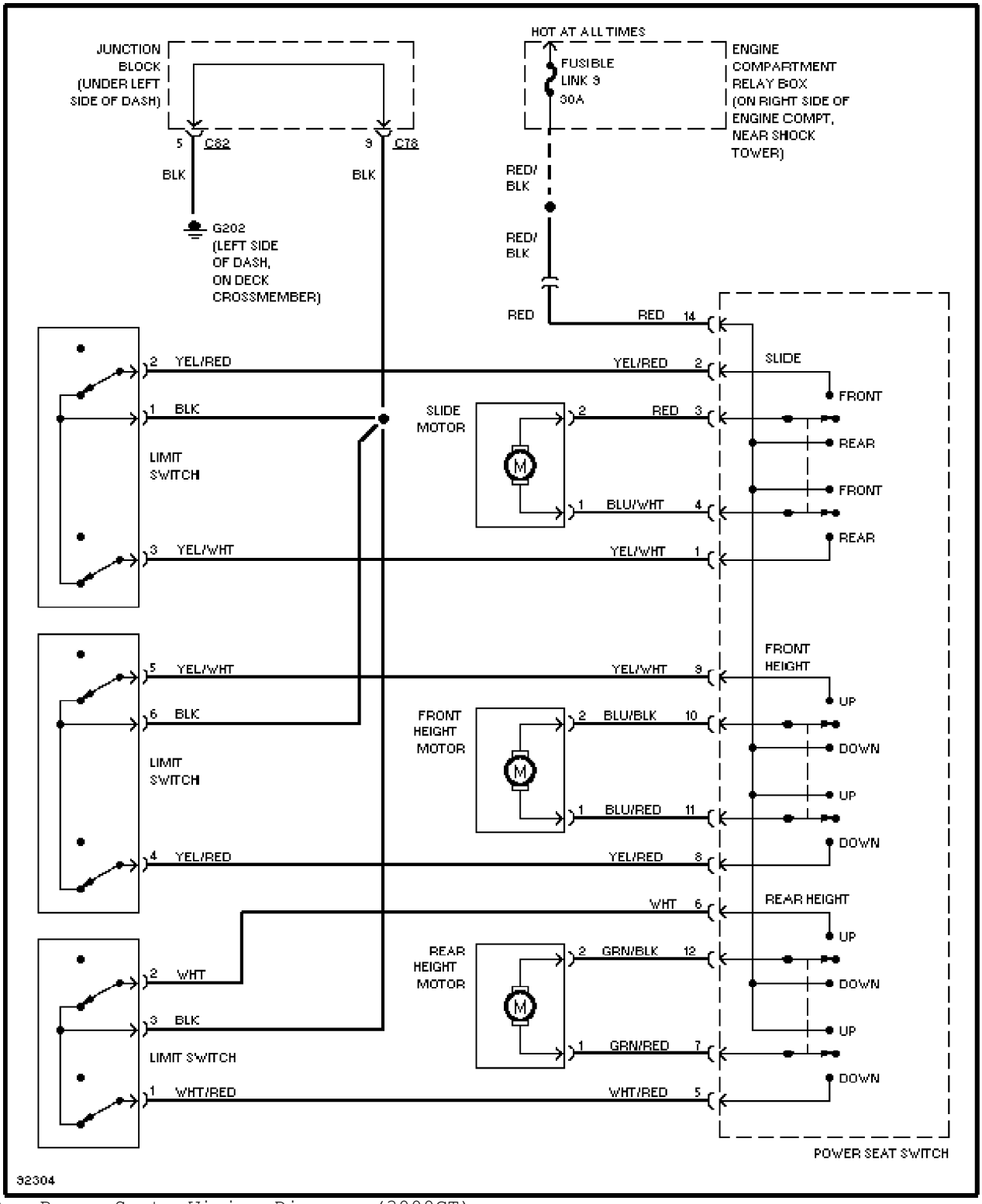

Fig. 9: Power Seats Wiring Diagram (3000GT)

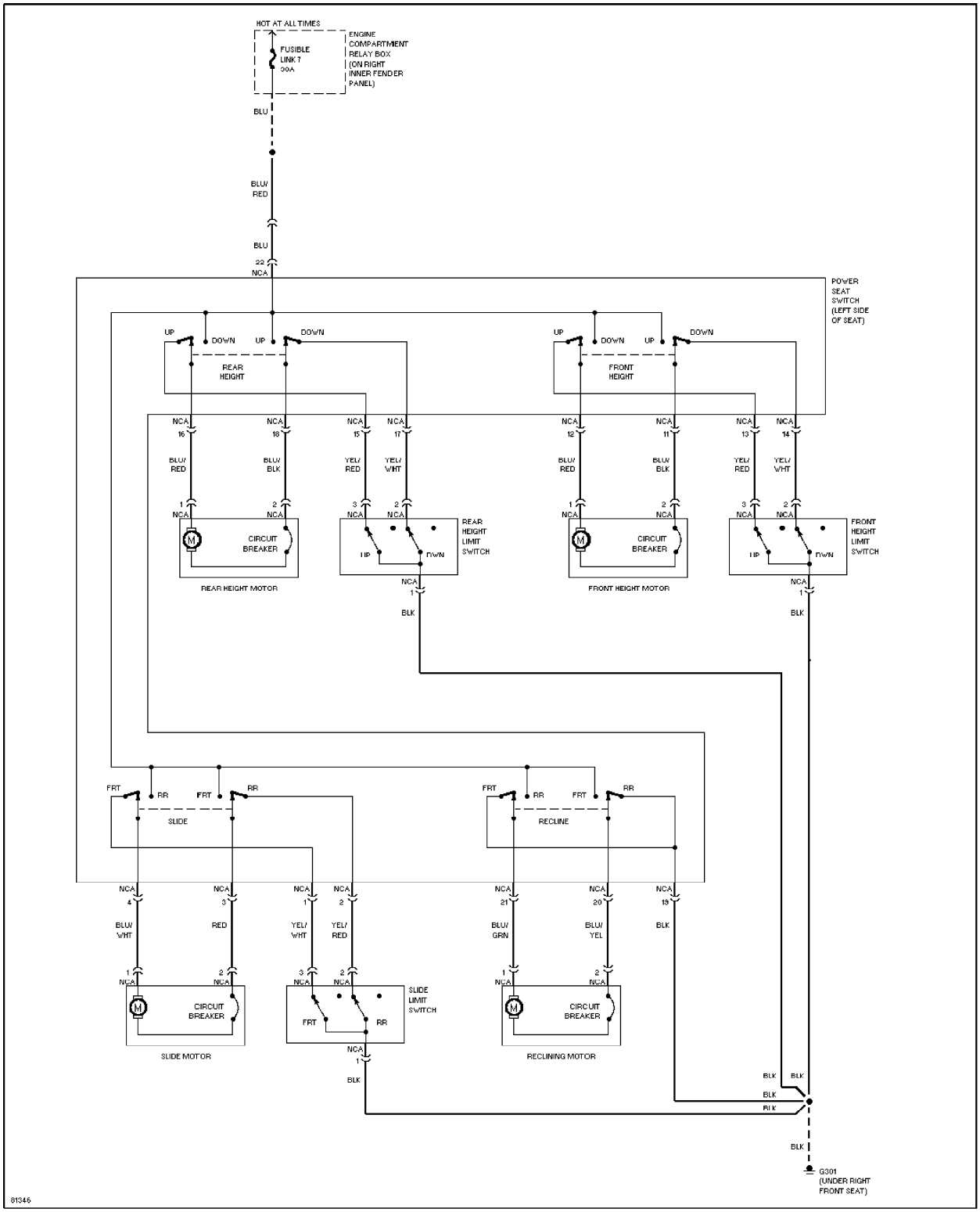

Fig. 10: Power Seats Wiring Diagram (Galant)

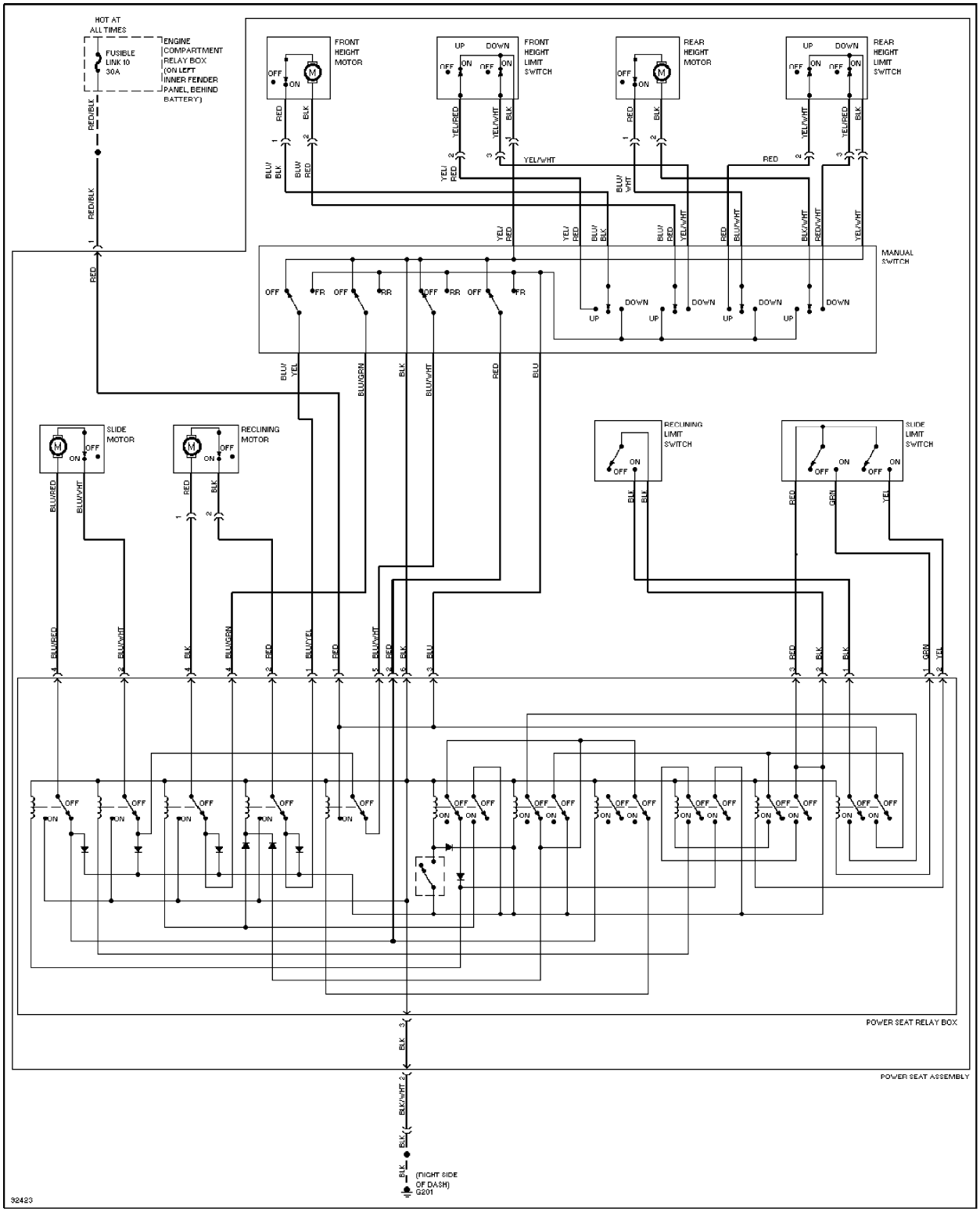

Fig. 11: Power Seats Wiring Diagram (Montero)

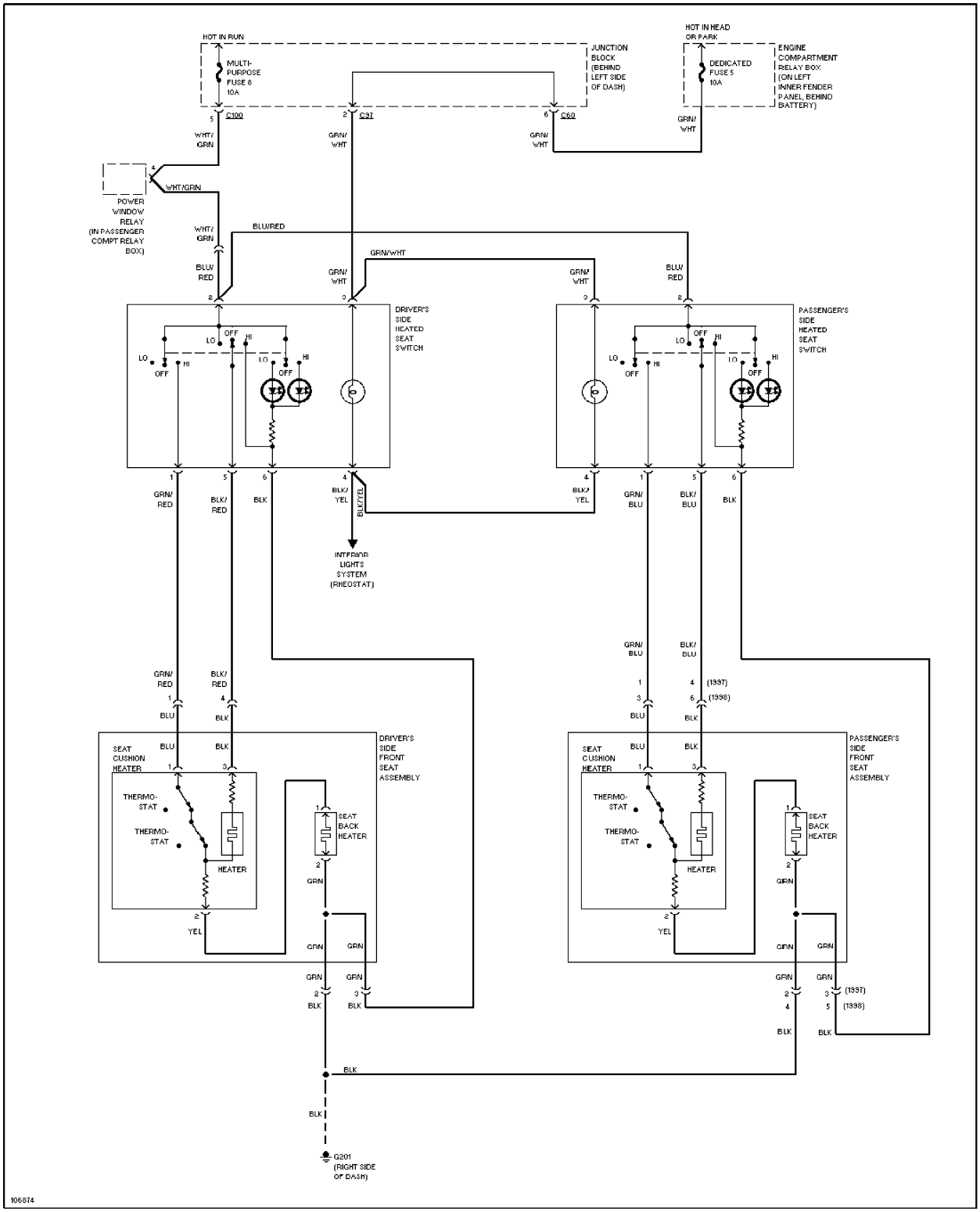

Fig. 12: Heated Seats Wiring Diagram (Montero)

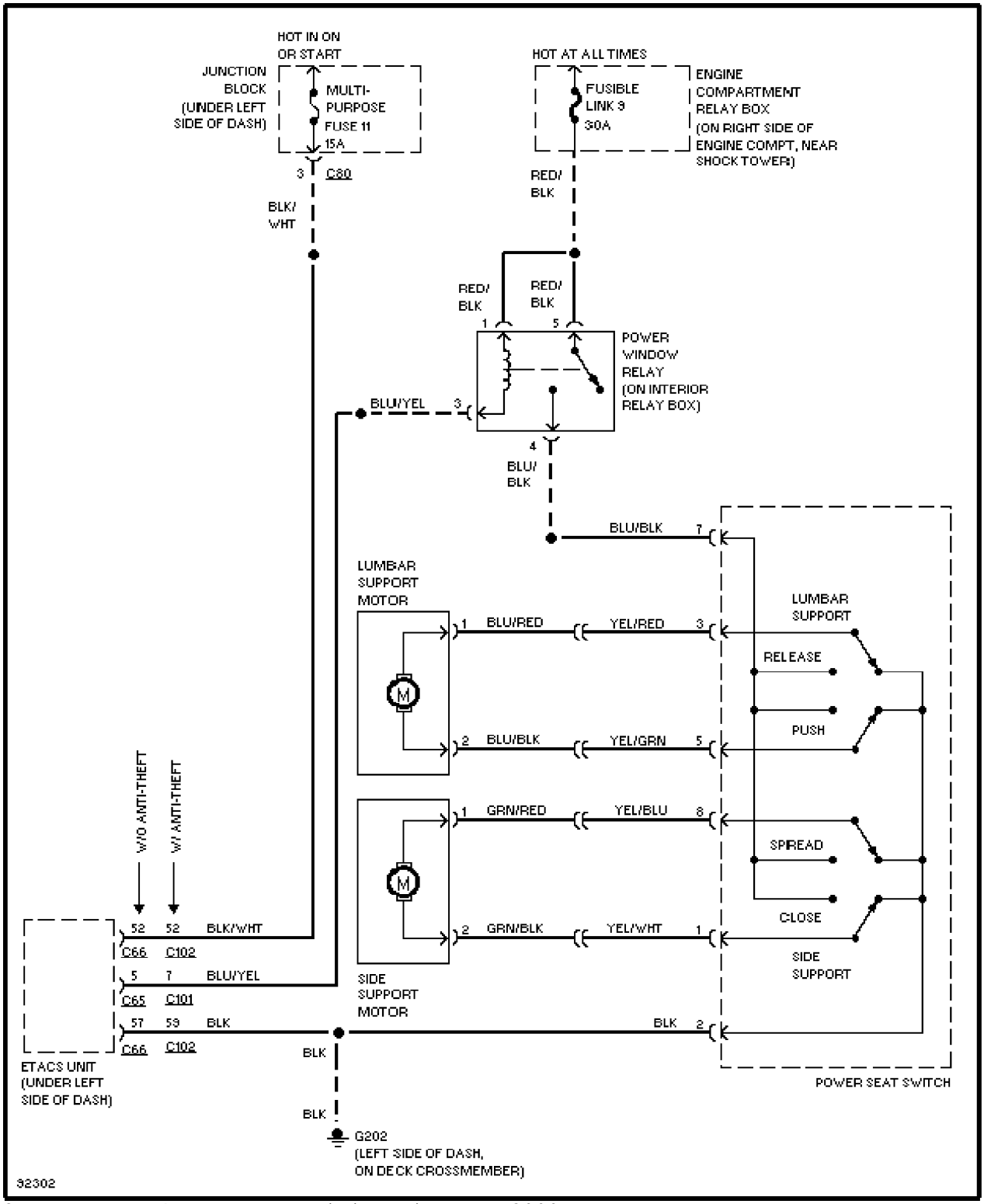

Fig. 13: Power Lumbar Support Wiring Diagram (3000GT)

K - SENSOR RANGE CHARTS

1998 Mitsubishi Galant

1998 ENGINE PERFORMANCE
Mitsubishi - Sensor Operating Range Charts

Diamante, Eclipse, Galant, Mirage, Montero, Montero Sport, 3000GT

INTRODUCTION

Sensor operating range information can help determine if a sensor is out of calibration. An out-of-calibration sensor may not set a diagnostic trouble code, but it may cause driveability problems. For sensors not listed in this article, see G - TESTS W/CODES article.

NOTE: Unless stated otherwise in test procedure, perform all voltage tests using a Digital Volt-Ohmmeter (DVOM) with a minimum 10-megohm input impedance. For connector terminal identification, see TERMINAL IDENTIFICATION in G - TESTS W/CODES article.

ENGINE COOLANT TEMPERATURE (ECT) SENSOR RESISTANCE TABLE (1)

Application & Temperature °F (°C)	Ohms
Diamante, & Eclipse Turbo & 2.4L	
32 (0)	5100-6500
68 (20)	2100-2700
104 (40)	900-1300
176 (80)	260-360
Eclipse 2.0L Non-Turbo	
77 (25)	9000-11,000
212 (100)	600-800
Galant, Mirage & Montero Sport	
68 (20)	2100-2700
176 (80)	260-360
Montero & 3000GT	
32 (0)	5800
68 (20)	2400
104 (40)	1100
176 (80)	300

(1) - Check resistance across ECT sensor terminals.

INTAKE AIR TEMPERATURE (IAT) SENSOR RESISTANCE TABLE

Application & Temperature °F (°C)	Ohms
Diamante, & Eclipse Turbo & 2.4L (1)	
32 (0)	5300-6700
68 (20)	2300-3000
104 (40)	1000-1500
176 (80)	300-420
Eclipse 2.0L Non-Turbo (2)	
77 (25)	9000-11,000
212 (100)	600-800
Galant, Mirage 1.8L & Montero Sport (1)	
68 (20)	2300-3000
176 (80)	300-420
Mirage 1.5L (2)	
68 (20)	2300-3000

176 (80)	300-420
Montero & 3000GT (1)	
32 (0)	6000
68 (20)	2700
176 (80)	400

(1) - IAT sensor is incorporated in airflow sensor assembly. Check resistance between IAT sensor terminals No. 5 and 6. See Figs. 1-4.
(2) - Check resistance across IAT sensor terminals No. 1 and 2. See Figs. 1-4.

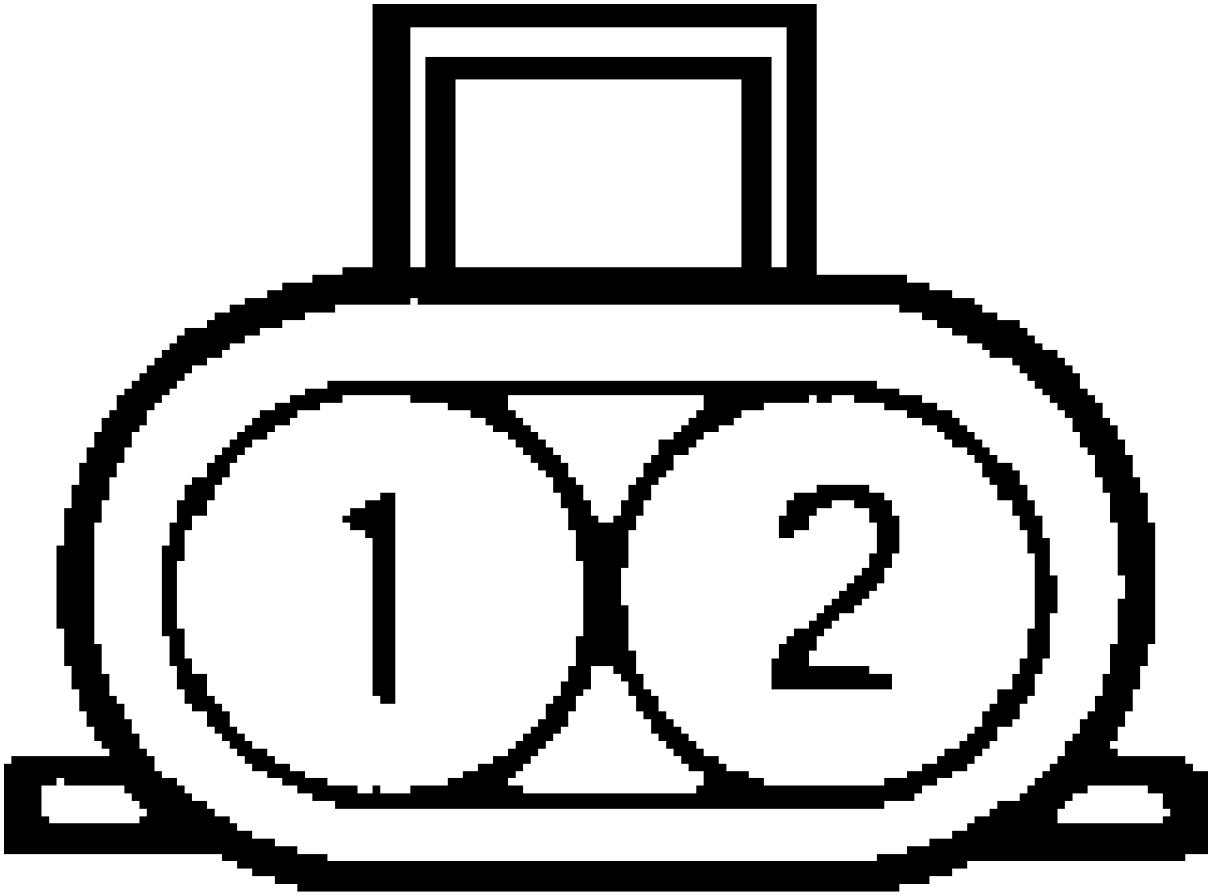

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Fig. 1: IAT Sensor Terminals (Eclipse 2.0L Non-Turbo)
Courtesy of Mitsubishi Motor Sales of America

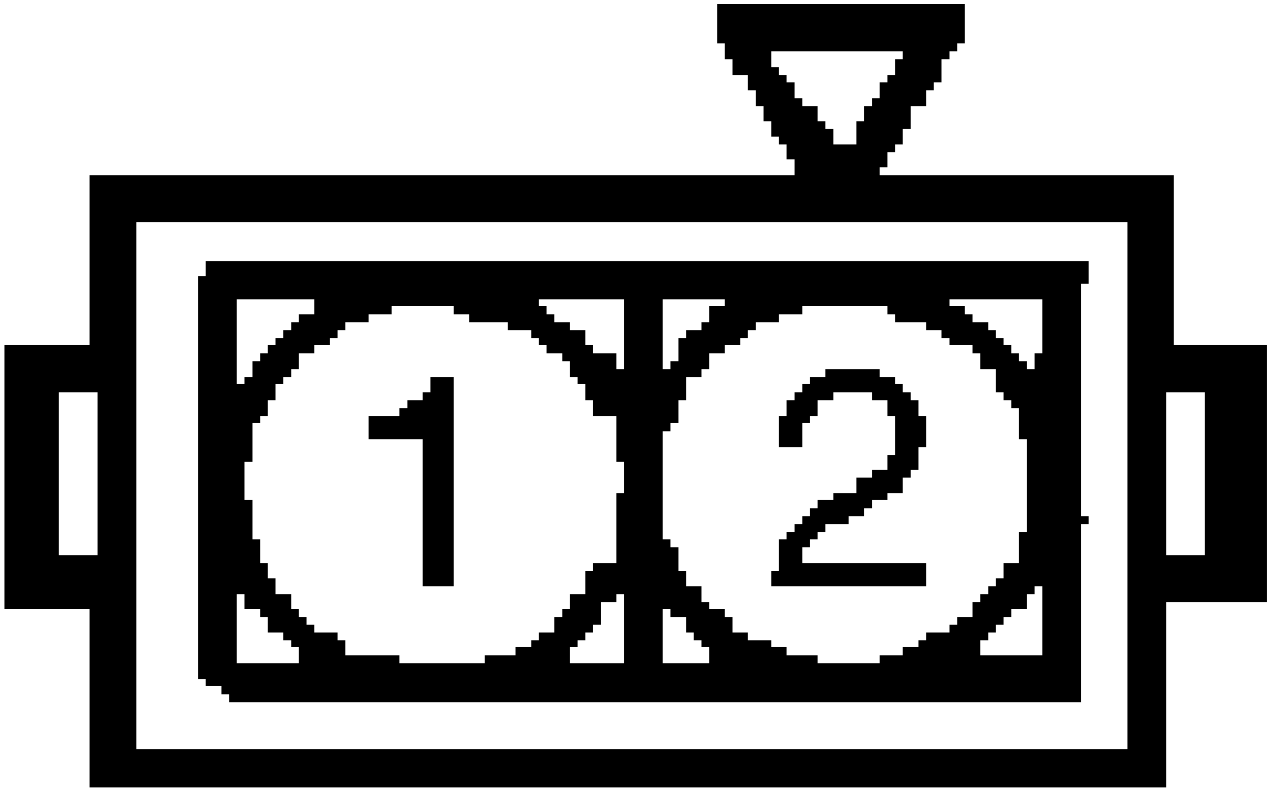

Fig. 2: IAT Sensor Terminals (Mirage 1.5L)
Courtesy of Mitsubishi Motor Sales of America

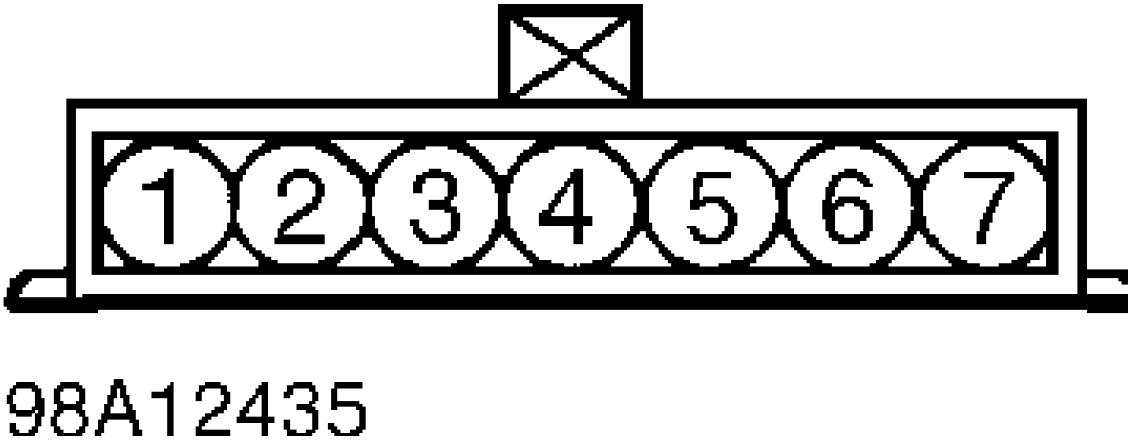

Fig. 3: IAT Sensor Terminals (Mirage 1.8L & Montero Sport 2.4L)
Courtesy of Mitsubishi Motor Sales of America

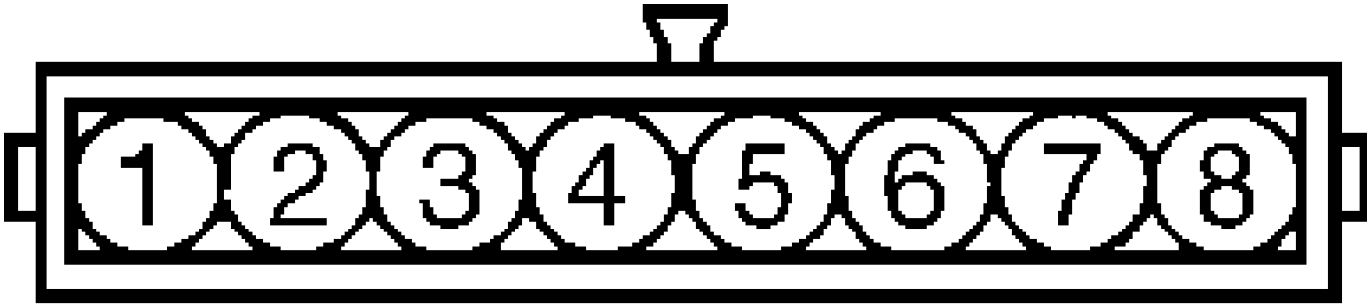

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Fig. 4: IAT Sensor Terminals (All Other Models)
Courtesy of Mitsubishi Motor Sales of America

Throttle Position (TP) Sensor

Measure total and variable resistance between specified TP sensor terminals. See Fig. 5 or 6. See TP SENSOR TEST TERMINAL IDENTIFICATION table. Total resistance should be 3500-6500 ohms. Variable resistance should change smoothly between 3500 and 6500 ohms as throttle valve is moved from closed to wide open throttle.

TP SENSOR TEST TERMINAL IDENTIFICATION TABLE

Application	Terminals No.
Total Resistance	
Eclipse 2.0L Non-Turbo	1 & 3
All Other Models	1 & 4
Variable Resistance	
Eclipse 2.0L Non-Turbo	2 & 3
Diamante, Montero & Montero Sport 3.0L	1 & 3
All Other Models	2 & 4

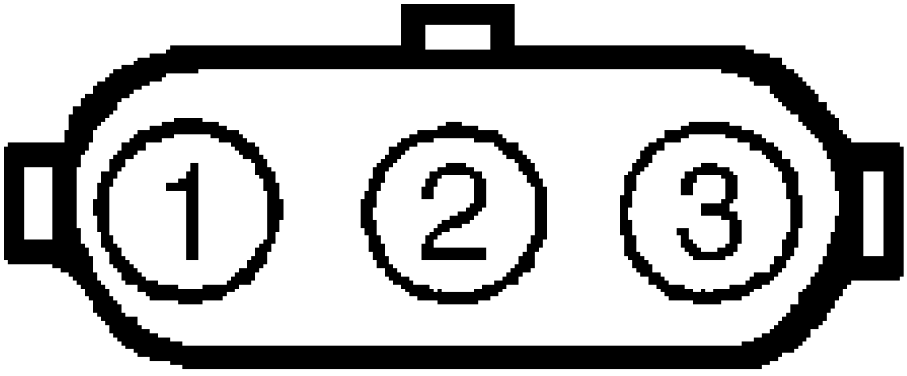

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Fig. 5: Identifying TP Sensor Terminals (Eclipse 2.0L Non-Turbo)
Courtesy of Mitsubishi Motor Sales of America

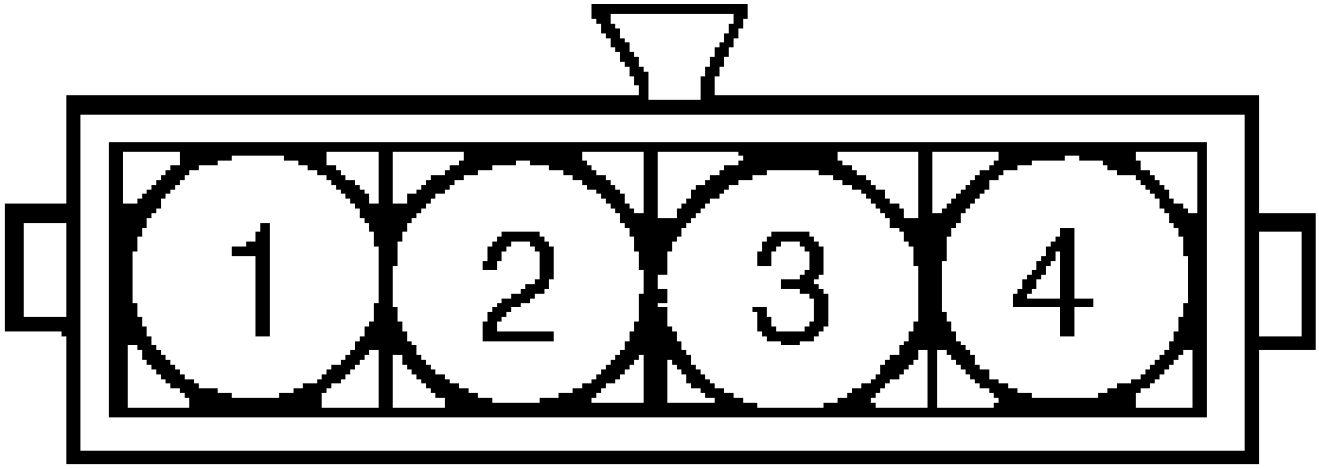


Fig. 6: Identifying TP Sensor Terminals (All Other Models)
Courtesy of Mitsubishi Motor Sales of America

VOLUME AIRFLOW (VAF) HERTZ TEST TABLE (1)

Application	Hz @ 700 RPM	Hz @ 2500 RPM
Eclipse 2.0L Non-Turbo & Mirage 1.5L	(2)	(2)
Montero	25-51	80-120
3000GT		
DOHC		
Non-Turbo	24-50	71-111
Turbo	26-52	93-133
SOHC	21-47	57-97
All Other Models	(3)	(3)

(1) - Measure Hertz frequency using a scan tool.
(2) - Vehicle is not equipped with VAF sensor.
(3) - See G - TESTS W/CODES article.

C - SPECIFICATIONS

1998 Mitsubishi Galant

1998 ENGINE PERFORMANCE
Mitsubishi - Service & Adjustment Specifications

Diamante, Eclipse, Galant, Mirage, Montero, Montero Sport, 3000GT

INTRODUCTION

Use this article to quickly find specifications related to servicing and on-vehicle adjustments. This is a quick reference article to use when you are familiar with an adjustment procedure and only need a specification.

CAPACITIES

BATTERY SPECIFICATIONS TABLE

Application	Group Size	CCA Rating
Diamante	57NAS	520
Eclipse	86	430 Or (1) 525
Galant	D26	490
Mirage	55B24L	433
Montero	75D26R-MF	490
Montero Sport	75D23R	520
3000GT	75D23R-MF	520

(1) - Used on 2.0L non-turbo with A/T.

NOTE: Refill capacities are approximate. Correct fluid level should be determined by mark on dipstick, if applicable.

FLUID CAPACITIES TABLE

Application	Quantity
Automatic Transaxle	
(Mitsubishi Plus/Mopar Plus/Dexron-II)	
Diamante	9.0 Qts. (8.5L)
Eclipse	
2.0L	
Non-Turbo	9.1 Qts. (8.6L)
Turbo	7.1 Qts. (6.7L)
2.4L	6.4 Qts. (6.1L)
Galant	6.3 Qts. (6.0L)
Mirage	8.2 Qts. (7.8L)
3000GT	7.9 Qts. (7.5L)
Automatic Transmission	
(Mitsubishi Plus/Mopar Plus/Dexron II)	
Montero	10.0 Qts. (9.8L)
Montero Sport	10.4 Qts. (9.8L)
Cooling System	
(Includes Heater & Reserve Tank)	
Diamante	10 Qts. (9.5L)
Eclipse & Galant	7.4 Qts. (7.0L)
Mirage	
1.5L	5.3 Qts. (5.0L)
1.8L	6.3 Qts. (6.0L)

Montero	10.0 Qts. (9.5L)
Montero Sport	
2.4L	
With Rear Heater	9.5 Qts. (9.0L)
Without Rear Heater	8.5 Qts. (8.0L)
3.0L	
With Rear Heater	10.6 Qts. (10.0L)
Without Rear Heater	9.5 Qts. (9.0L)
3000GT	8.5 Qts. (8.0L)
Crankcase (Includes Filter)	
Diamante	4.5 Qts. (4.3L)
Eclipse	
Non-Turbo	4.5 Qts. (4.3L)
2.0L Turbo	4.6 Qts. (4.4L)
Galant	4.5 Qts. (4.3L)
Mirage	
1.5L	3.5 Qts. (3.3L)
1.8L	4.0 Qts. (3.8L)
Montero	(1) 5.0 Qts. (4.8L)
Montero Sport	
2.4L	4.5 Qts. (4.3L)
3.0L	5.2 Qts. (4.9L)
3000GT	
Non-Turbo	4.5 Qts. (4.3L)
Turbo	5.0 Qts. (4.6L)
Differential (SAE 80W-90/API GL-5)	
Eclipse	.9 Qt. (.8L)
Montero	
Front	1.3 Qts. (1.2L)
Rear	3.3 Qts. (3.2L)
Montero Sport	
Front	1.2 Qts. (1.1L)
Rear	
2.4L	1.6 Qts. (1.5L)
3.0L	2.7 Qts. (2.6L)
3000GT	1.2 Qts. (1.1L)
Manual Transaxle (SAE 75W-85/API GL-4)	
Eclipse	
Non-Turbo (2)	2.1 Qts. (2.0L)
Turbo	
AWD	2.4 Qts. (2.3L)
FWD	2.1 Qts. (2.0L)
Galant	2.3 Qts. (2.2L)
Mirage	
1.5L	2.2 Qts. (2.1L)
1.8L	2.3 Qts. (2.2L)
3000GT	
AWD	2.5 Qts. (2.4L)
FWD	2.4 Qts. (2.3L)
Manual Transmission (SAE 75W-85/API GL-4)	
Montero	3.3 Qts. (3.2L)
Montero Sport	2.4 Qts. (2.3L)
Power Steering (Dexron-II)	
3000GT W/4-Wheel Steering	3.2 Pts. (1.5L)
Montero	2.2 Pts. (1.1L)
All Others	1.9 Pts. (.9L)
Transfer Case (SAE 75W-85/API GL-4)	
Eclipse (AWD)	1.1 Pts. (.5L)
Montero	5.0 Pts. (2.5L)
Montero Sport	4.6 Pts. (2.3L)
3000GT	.7 Pt. (.3L)

(1) - Add .5 qt. (.3L) if oil cooler is drained.

(2) - Use Texaco MTX FM fluid.

QUICK-SERVICE

SERVICE INTERVALS & SPECIFICATIONS

REPLACEMENT INTERVALS TABLE (DIAMANTE)

Component	Miles
Air Filter	30,000
Automatic Transaxle Fluid	(1)
Coolant	30,000
Oil	7500
Oil Filter	(2) 15,000
Spark Plugs	60,000
Spark Plug Wires	60,000
Timing Belt	60,000

(1) - Inspect fluid every 15,000 miles. Replace fluid if evidence of contamination appears, after repairing reason for contamination.
(2) - Replace oil filter at oil change if annual mileage is less than 7500 miles.

REPLACEMENT INTERVALS TABLE (ECLIPSE)

Component	Miles
Air Filter	30,000
Automatic Transaxle Fluid	(1)
Coolant	30,000
Oil	
Non-Turbo	7500
Turbo	5000
Oil Filter	
Non-Turbo	(2) 15,000
Turbo	(2) 10,000
Spark Plugs	30,000
Spark Plug Wires	60,000
Transfer Case Fluid	(3)
Timing Belt	60,000

(1) - Inspect fluid every 15,000 miles. Replace fluid if evidence of contamination appears, after repairing reason for contamination.
(2) - Replace oil filter at oil change if annual mileage is less than 7500 miles.
(3) - Inspect fluid every 30,000 miles. Replace fluid if evidence of contamination appears, after repairing reason for contamination.

REPLACEMENT INTERVALS TABLE (GALANT)

Component	Miles
Air Filter	30,000
Automatic Transaxle Fluid	(1)
Coolant	(2)

Oil	7500
Oil Filter	(3) 15,000
Spark Plugs	30,000
Spark Plug Wires	60,000
Timing & Balance Shaft Belts	60,000

(1) - Inspect fluid every 15,000 miles. Replace fluid if evidence of contamination appears, after repairing reason for contamination.
(2) - Inspect fluid every 30,000 miles. Replace fluid if evidence of contamination appears, after repairing reason for contamination.
(3) - Replace oil filter at oil change if annual mileage is less than 7500 miles.

REPLACEMENT INTERVALS TABLE (MIRAGE)

Component	Miles
Air Filter	30,000
Automatic Transaxle Fluid	(1)
Coolant	(2)
Oil	7500
Oil Filter	(3) 15,000
Spark Plugs	30,000
Spark Plug Wires	60,000
Timing Belt	60,000

(1) - Inspect fluid every 15,000 miles. Replace fluid if evidence of contamination appears, after repairing reason for contamination.
(2) - Inspect fluid every 30,000 miles. Replace fluid if evidence of contamination appears, after repairing reason for contamination.
(3) - Replace oil filter at oil change if annual mileage is less than 7500 miles.

REPLACEMENT INTERVALS TABLE (MONTERO)

Component	Miles
Air Filter	30,000
Automatic Transmission Fluid	(1)
Coolant	30,000
Front & Rear Axle Fluid (2)	30,000
Oil	7500
Oil Filter	(3) 15,000
Manual Transmission	(4)
Spark Plugs (5)	60,000
Spark Plug Wires	60,000
Timing Belt	60,000

(1) - Inspect fluid every 15,000 miles. Replace fluid if evidence of contamination appears, after repairing reason for contamination.
(2) - Limited-slip differential.
(3) - Replace oil filter at oil change if annual mileage is less than 7500 miles.
(4) - Inspect fluid every 30,000 miles. Replace fluid if evidence of contamination appears, after repairing reason for contamination.

(5) - Use Platinum spark plugs only.

REPLACEMENT INTERVALS TABLE (MONTERO SPORT)

Component	Miles
Air Filter	30,000
Automatic Transmission	
Except 4WD	(1)
4WD	30,000
Axle Fluid (2)	30,000
Coolant	30,000
Oil	7500
Oil Filter	(3) 15,000
Spark Plugs (4)	60,000
Spark Plug Wires	60,000
Timing Belt	60,000

(1) - Inspect fluid every 15,000 miles. Replace fluid if evidence of contamination appears, after repairing reason for contamination.
(2) - Limited-slip differential.
(3) - Replace oil filter at oil change if annual mileage is less than 7500 miles.
(4) - Use Platinum spark plugs only.

REPLACEMENT INTERVALS TABLE (3000GT)

Component	Miles
Air Filter	30,000
Automatic Transaxle Fluid	(1)
Coolant	30,000
Oil	
Non-Turbo	7500
Turbo	5000
Oil Filter	
Non-Turbo	15,000
Turbo	10,000
Spark Plugs	
Except Platinum	30,000
Platinum	60,000
Spark Plug Wires (2)	60,000
Timing Belt	60,000

(1) - Inspect fluid every 15,000 miles. Replace fluid if evidence of contamination appears, after repairing reason for contamination.
(2) - Except vehicles equipped with Federal Emissions.

BELT ADJUSTMENT TABLE

Application	(1) Deflection New Belt - In. (mm)	(1) Deflection Used Belt - In. (mm)
Diamante		
Generator & A/C	.24-.28 (6.0-7.2)	.32-.37 (8.2-9.3)
P/S	.33-.37 (8.4-9.3)	.46-.52 (11.7-13.4)
Eclipse		
2.0L Non-Turbo		

Generator	.30-.41 (7.5-10.5)	.35-.47 (9.0-12.0)	
P/S (W/O A/C)	.26-.37 (6.5-9.5)	.43-.55 (11.0-14.0)	
P/S & A/C	.32-.35 (8.0-9.0)	.39-.43 (10.0-11.0)	
2.0L Turbo & 2.4L			
A/C	.22-.24 (5.5-6.0)	.26-.30 (6.5-7.5)	
Generator	.30-.35 (7.5-9.0)	.39 (10.0)	
P/S	.18-.22 (4.5-5.5)	.24-.28 (6.0-7.0)	
Galant			
A/C	.22-.24 (5.5-6.0)	.26-.30 (6.5-7.6)	
Generator	.30-.35 (7.5-8.8)	.39 (10.0)	
P/S	.18-.22 (4.5-5.6)	.24-.28 (6.0-7.0)	
Mirage			
1.5L			
A/C	.13-.17 (3.4-4.3)	.20-.22 (5.0-5.7)	
Generator	.26-.33 (6.6-8.3)	.36-.42 (9.2-10.6)	
P/S	.28-.36 (7.2-9.0)	.40-.46 (10.2-11.6)	
1.8L			
Generator	.28-.31 (7.0-8.0)	.33-.39 (8.5-10.0)	
P/S & A/C	.28-.36 (7.0-9.0)	.39-.43 (10.0-11.0)	
Montero			
A/C	.20-.24 (5.0-6.0)	.26-.30 (6.5-7.5)	
Generator	.16-.20 (4.0-5.0)	.22-.26 (5.5-6.5)	
P/S	.42-.54 (10.7-13.7)	.58-.66 (14.8-16.8)	
Montero Sport			
2.4L			
A/C	.20-.22 (5.0-6.0)	.24-.26 (6.0-6.5)	
Generator	.22-.29 (5.5-7.5)	.30-.33 (7.5-8.5)	
P/S	.16-.24 (4.0-6.0)	.24-.28 (6.0-7.0)	
3.0L			
A/C	.17-.20 (4.3-5.1)	.22-.26 (5.6-6.5)	
Generator	.22-.29 (5.5-7.5)	.31-.35 (8.0-9.0)	
P/S	.44-.52 (11.0-13.0)	.56-.64 (14.0-16.0)	
3000GT			
SOHC			
A/C	.26-.28 (6.5-7.0)	.30-.34 (7.5-8.5)	
Generator & P/S	.16-.20 (4.0-5.0)	.24-.32 (6.0-8.0)	
DOHC			
Generator	.14-.16 (3.5-4.0)	.16-.20 (4.0-5.0)	
P/S	.30-.35 (7.5-9.0)	.41-.49 (10.4-12.4)	

(1) - With 22 lbs. (10 kg) pressure applied midway between pulleys.

MECHANICAL CHECKS

ENGINE COMPRESSION

Check engine compression with engine at normal operating temperature, all spark plugs removed and throttle wide open.

COMPRESSION SPECIFICATIONS TABLE

Application (1)	Specification
Compression Ratio	
1.5L (VIN A)	9.0:1
1.8L (VIN C)	9.5:1
2.0L	
(VIN F)	8.5:1
(VIN Y)	9.6:1
2.4L (VIN G)	9.5:1
3.0L	

(VIN H)	8.9:1
(VIN J)	10.0:1
(VIN K)	8.0:1
(VIN P)	9.0:1
3.5L (VIN M & P)	9.0:1
Compression Pressure	
1.5L (VIN A)	192 psi (13.4 kg/cm²)
1.8L (VIN C)	199 psi (13.9 kg/cm²)
2.0L (VIN F)	178 psi (12.5 kg/cm²)
2.0L (VIN Y)	170-225 psi (11.7-15.5 kg/cm²)
2.4L (VIN G)	192 psi (13.4 kg/cm²)
3.0L	
(VIN H & P)	171 psi (12.0 kg/cm²)
(VIN J)	185 psi (13.0 kg/cm²)
(VIN K)	156 psi (10.9 kg/cm²)
3.5L (VIN M & P)	171 psi (12.0 kg/cm²)
Maximum Variation	
Between Cylinders (2)	14 psi (1.0 kg/cm²)

(1) - See A - ENGINE/VIN ID article for VIN information.
(2) - On Eclipse 2.0L non-turbo engine, maximum variation between cylinders is 25 percent.

VALVE CLEARANCE

NOTE: All engines are equipped with hydraulic lifters. No adjustment is required.

IGNITION SYSTEM

IGNITION COIL

IGNITION COIL RESISTANCE - Ohms @ 68°F (20°C) TABLE

Application (1)	Primary	Secondary
1.5L (VIN A)	.5-.7	15,000-22,000
1.8L (VIN C)	(2)	14,000-21,000
2.0L		
(VIN F)	.70-.86	11,300-15,300
(VIN Y)	.51-.61	11,500-13,500
2.4L (VIN G)		
Eclipse	.74-.90	20,100-27,300
Galant	.9-1.2	20,000-29,000
Montero Sport	.67-.81	11,300-15,300
3.0L		
(VIN H)	.72-.88	10,300-13,900
(VIN J & K)	.67-.81	11,300-15,300
(VIN P)	.74-.90	20,100-27,300
3.5L		
(VIN M)	.74-90	20,100-27,300
(VIN P)	.50-.70	9000-13,000

(1) - See A - ENGINE/VIN ID article for VIN information.
(2) - Information is not available from manufacturer at time of publication.

HIGH TENSION WIRE RESISTANCE

Wire resistance should not exceed 22,000 ohms for all models

except Eclipse 2.0L non-turbo and Montero. On Eclipse 2.0L non-turbo, resistance should not exceed 8000 ohms. On Montero, resistance should not exceed 26,000 ohms.

SPARK PLUGS

SPARK PLUG TYPE TABLE

Application (1)	Nippondenso No.
1.5L (VIN A)	W16EPR-11
1.8L (VIN C)	K16PR-U11
2.0L (VIN F)	W20ETR-L8 Or W20EPR
2.0L (VIN Y)	(2) RC9YC5
2.4L (VIN G)	K16PR-U11
3.0L	
(VIN H)	W16EPR11
(VIN J, K & P)	PK20PR-P11
3.5L	
(VIN P)	PK20PR-11
(VIN M)	PK16PR-P11

(1) - See A - ENGINE/VIN ID article for VIN information.
(2) - Champion Spark Plug.

SPARK PLUG SPECIFICATIONS TABLE

Application	(1) Gap In. (mm)	Torque Ft. Lbs. (N.m)
Diamante	.039-.043 (1.0-1.1)	15-21 (20-30)
Eclipse 2.0L		
Non-Turbo	.048-.053 (1.2-1.4)	20 (28)
Turbo	.028-.031 (.7-.8)	18 (25)
All Others	.039-.043 (1.0-1.1)	18 (25)

(1) - DO NOT adjust gap on Platinum spark plugs.

FIRING ORDER

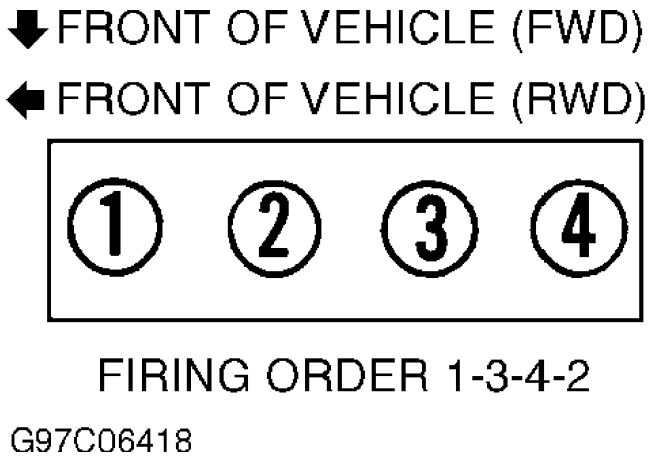


Fig. 1: Firing Order Firing Order (4-Cylinder)

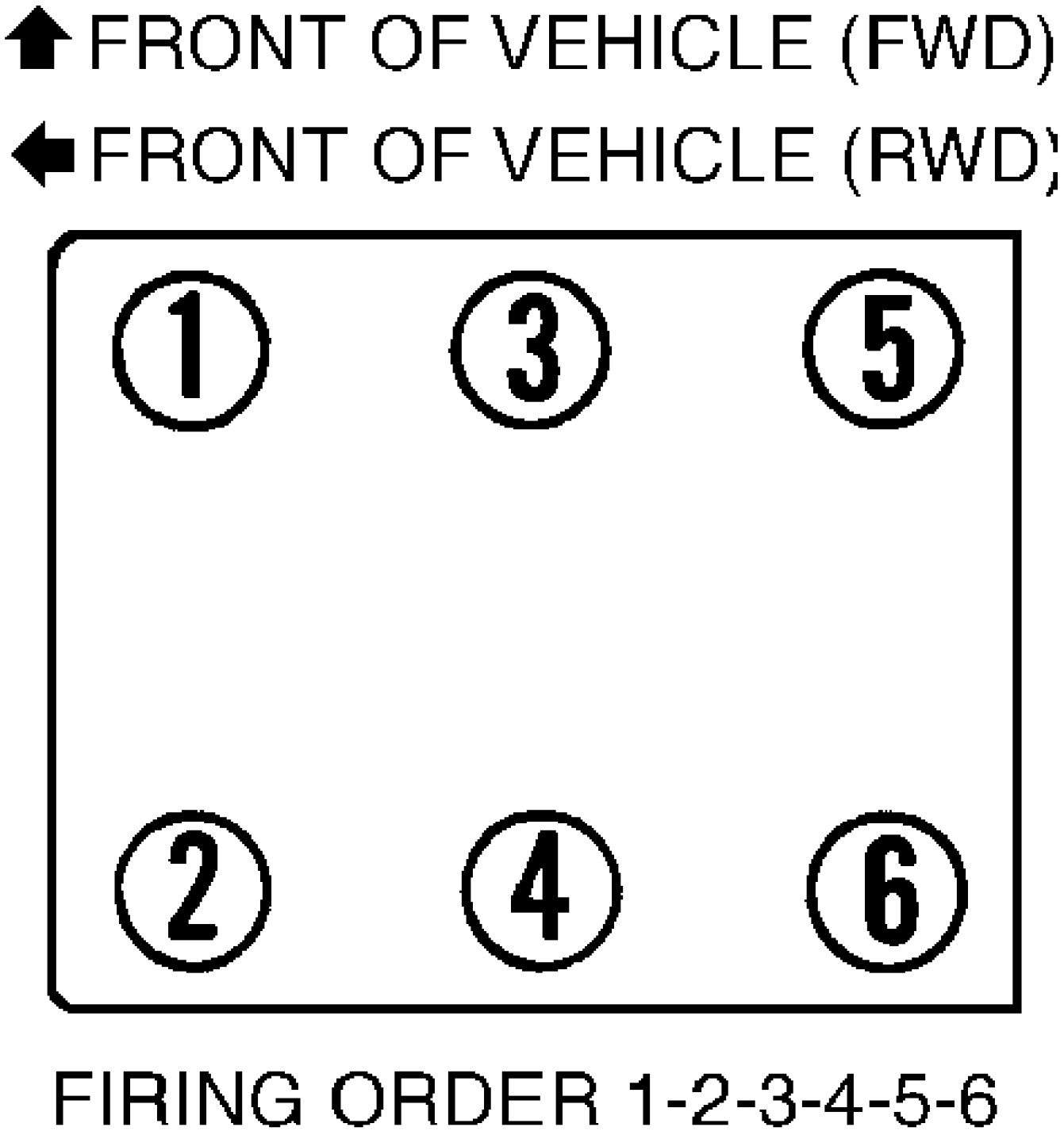


Fig. 2: Firing Order Firing Order (V6)

IGNITION TIMING

IGNITION TIMING (Degrees BTDC @ RPM) TABLE

Application	(1) Basic	(2) (3) (4) Actual
1.5L	2-78@ 650-750	10 @ 600-800
1.8L	2-8 @ 600-800	5 @ 600-800
2.0L		
Non-Turbo	(5)	(5)
Turbo	2-8 @ 650-850	8 @ 650-850
2.4L	2-8 @ 650-850	10 @ 650-850
3.0L	2-8 @ 600-800	15 @ 600-800
3.5L	2-8 @ 600-800	15 @ 600-800

(1) - With ignition timing adjustment connector grounded or vacuum hose (farthest from distributor) disconnected.
(2) - With ignition timing adjustment connector ungrounded or vacuum hose (farthest from distributor) connected.
(3) - If vehicle altitude is more than 2300 feet above sea level, actualtiming may be advanced (5 degrees).
(4) - Actual ignition timing is approximate and may fluctuate plus or minus 7 degrees.
(5) - Ignition timing is NOT adjustable.

FUEL SYSTEM

FUEL PUMP

REGULATED FUEL PRESSURE TABLE

Application	At Idle w/Vacuum psi (kg/cm²)	At Idle w/o Vacuum psi (kg/cm²)
Eclipse 2.0L		
Non-Turbo	(1)	47-50 (3.3-3.5)
Turbo	33 (2.3)	42-45 (3.0-3.5)
3000GT Turbo	34 (2.4)	43-45 (3.0-3.1)
All Other Models	38 (2.7)	47-50 (3.3-3.5)

(1) - Information is not available from manufacturer at time of publication.

IDLE SPEED

IDLE SPEED SPECIFICATIONS TABLE

Application	Curb Idle	Basic Idle
1.5L & 1.8L	600-800	650-750
2.0L		
Non-Turbo	700-900	(1)
Turbo	650-850	700-800
2.4L	650-850	700-800
3.0L & 3.5L	600-800	650-750

(1) - Information is not available from manufacturer at time of publication.

INJECTOR RESISTANCE

INJECTOR RESISTANCE TABLE

Application	Ohms
Non-Turbo	
Eclipse 2.0L	11-15
Except Eclipse 2.0L	13-16
Turbo	2-3

THROTTLE POSITION (TP) SENSOR

TP SENSOR SPECIFICATIONS TABLE

Application	(1) Volts
Eclipse 2.0L Non-Turbo	(2)
All Others	.4-1.0

(1) - At idle.
(2) - Information is not available from manufacturer at time of publication.

STARTER

1998 Mitsubishi Galant

1998 STARTING & CHARGING SYSTEMS
Mitsubishi - Starters

Diamante, Eclipse, Galant, Mirage, Montero, Montero Sport, 3000GT

DESCRIPTION & OPERATION

Starter is a conventional 12-volt, 4-pole brush-type motor, with direct or gear reduction drive. Starter-mounted solenoid shifts overrunning clutch and pinion into flywheel when starter is energized.

TROUBLE SHOOTING

NOTE: See TROUBLE SHOOTING article in the GENERAL INFORMATION section.

ON-VEHICLE TESTING

TROUBLE SHOOTING

1) If starter motor does not operate at all:

* Check starter coil.
* Check electrical connections.
* Check clutch pedal position switch (M/T).
* Check starter relay (M/T).
* Check park/neutral position switch (A/T).

2) If starter motor does not stop, check starter magnetic switch solenoid.

STARTER RELAY

Diamante, Galant & Montero

1) Remove starter relay. See STARTER RELAY LOCATIONS table. With no power supplied to any relay, continuity should exist between relay terminals No. 1 and 2. See WIRING DIAGRAMS.

2) Connect a jumper wire from positive battery terminal to relay terminal No. 1 and another jumper wire from negative battery terminal to relay terminal No. 2. Continuity should exist between relay terminals No. 3 and 4. Replace relay as necessary.

Eclipse (A/T With Theft Alarm)

1) Remove starter relay. See STARTER RELAY LOCATIONS table. With no power supplied to any relay, continuity should exist between relay terminals No. 1 and 2. See WIRING DIAGRAMS.

2) Connect a jumper wire from positive battery terminal to relay terminal No. 1 and another jumper wire from negative battery terminal to relay terminal No. 2. Continuity should exist between relay terminals No. 3 and 4. Replace relay as necessary.

Eclipse (A/T Without Theft Alarm)

1) Remove starter relay. See STARTER RELAY LOCATIONS table. With no power supplied to any relay, continuity should exist between relay terminals No. 1 and 3. See WIRING DIAGRAMS.

2) Connect a jumper wire from positive battery terminal to relay terminal No. 1 and another jumper wire from negative battery

terminal to relay terminal No. 3. Continuity should exist between relay terminals No. 4 and 5. Replace relay as necessary.

Eclipse (M/T With Theft Alarm)

1) Remove starter relay. See STARTER RELAY LOCATIONS table. With no power supplied to any relay, continuity should exist between relay terminals No. 1 and 3. See WIRING DIAGRAMS.

2) Connect a jumper wire from positive battery terminal to relay terminal No. 3 and another jumper wire from negative battery terminal to relay terminal No. 1. Continuity should exist between relay terminals No. 2 and 5. Replace relay as necessary.

Eclipse (M/T Without Theft Alarm)

1) Remove starter relay. See STARTER RELAY LOCATIONS table. With no power supplied to any relay, continuity should exist between relay terminals No. 1 and 2. See WIRING DIAGRAMS.

2) Connect a jumper wire from positive battery terminal to relay terminal No. 1 and another jumper wire from negative battery terminal to relay terminal No. 2. Continuity should exist between relay terminals No. 3 and 4. Replace relay as necessary.

Mirage

1) Remove starter relay. See STARTER RELAY LOCATIONS table. With no power supplied to any relay, continuity should exist between relay terminals No. 1 and 3. See WIRING DIAGRAMS.

2) Connect a jumper wire from positive battery terminal to relay terminal No. 3 and another jumper wire from negative battery terminal to relay terminal No. 1. Continuity should exist between relay terminals No. 2 and 4. Replace relay as necessary.

Montero Sport With A/T

1) Remove starter relay. See STARTER RELAY LOCATIONS table. With no power supplied to any relay, continuity should exist between relay terminals No. 1 and 3. See WIRING DIAGRAMS.

2) Connect a jumper wire from positive battery terminal to relay terminal No. 3 and another jumper wire from negative battery terminal to relay terminal No. 1. Continuity should exist between relay terminals No. 2 and 5. Replace relay as necessary.

Montero Sport With M/T

1) Remove starter relay. See STARTER RELAY LOCATIONS table. With no power supplied to any relay, continuity should exist between relay terminals No. 1 and 3. See WIRING DIAGRAMS.

2) Connect a jumper wire from positive battery terminal to relay terminal No. 1 and another jumper wire from negative battery terminal to relay terminal No. 3. Continuity should exist between relay terminals No. 2 and 4. Replace relay as necessary.

3000GT

1) Remove starter relay. See STARTER RELAY LOCATIONS table. With no power supplied to any relay, continuity should exist between relay terminals No. 1 and 2 and between relay terminals No. 3 and 4. See Fig. 1.

2) Connect a jumper wire from positive battery terminal to relay terminal No. 1 and another jumper wire from negative battery terminal to relay terminal No. 2. Continuity should exist between relay terminals No. 3 and 5. See Fig. 1. Replace relay as necessary.

STARTER RELAY LOCATIONS TABLE

Application	Location
Diamante	At Left Front Fender, Inside Fuse/Relay Block

Eclipse
  Without Theft Alarm ..... Behind Center Of Dash
  With Theft Alarm .... Under Left Of Instrument Panel, On Relay Box
Galant ..... Inside Right Front Fender
Mirage ..... In Left Underhood Fuse/Relay Block
Montero ..... Behind Center Of Dash
Montero Sport ..... In Left Underhood Fuse/Relay Block
3000GT ..... In Right Underhood Fuse/Relay Block

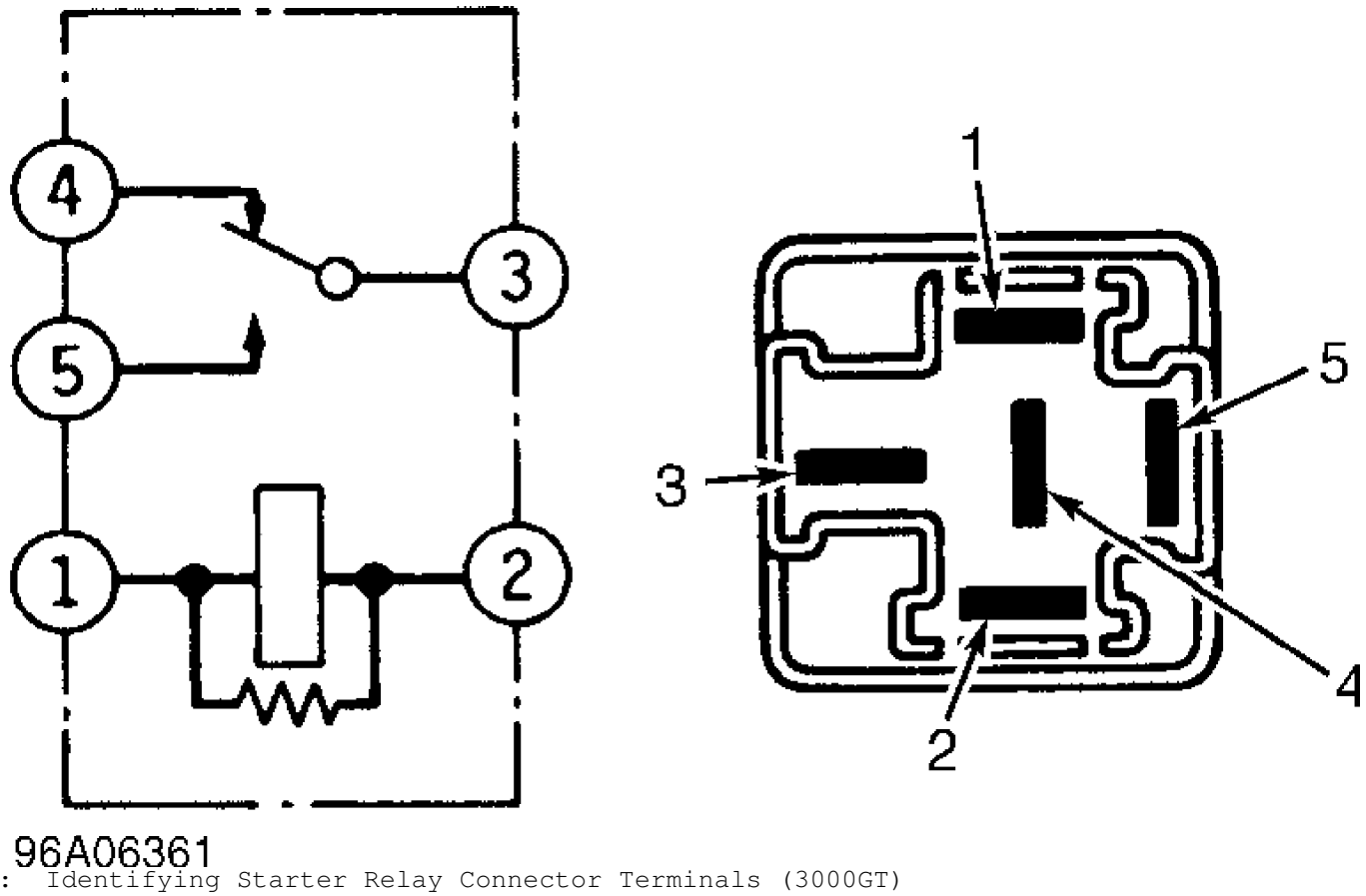


Fig. 1: Identifying Starter Relay Connector Terminals (3000GT)
Courtesy of Chrysler Corp.

BENCH TESTING

* PLEASE READ THIS FIRST *

CAUTION: Perform tests in less than 10 seconds to prevent damage to coil.

NO-LOAD TEST

1) Install starter in soft-jawed vise. Connect starter in series with a fully-charged 12-volt battery. Connect a 100-amp ammeter and carbon pile rheostat in series with positive battery post and starter motor terminal. See Fig. 2.

2) Install voltmeter across starter motor. Adjust carbon pile rheostat to full resistance. Connect cable from starter motor body to negative battery terminal. Adjust carbon pile rheostat to proper test voltage. Ensure maximum amperage is as specified and starter rotates

smoothly. See STARTER NO-LOAD TEST SPECIFICATIONS table.

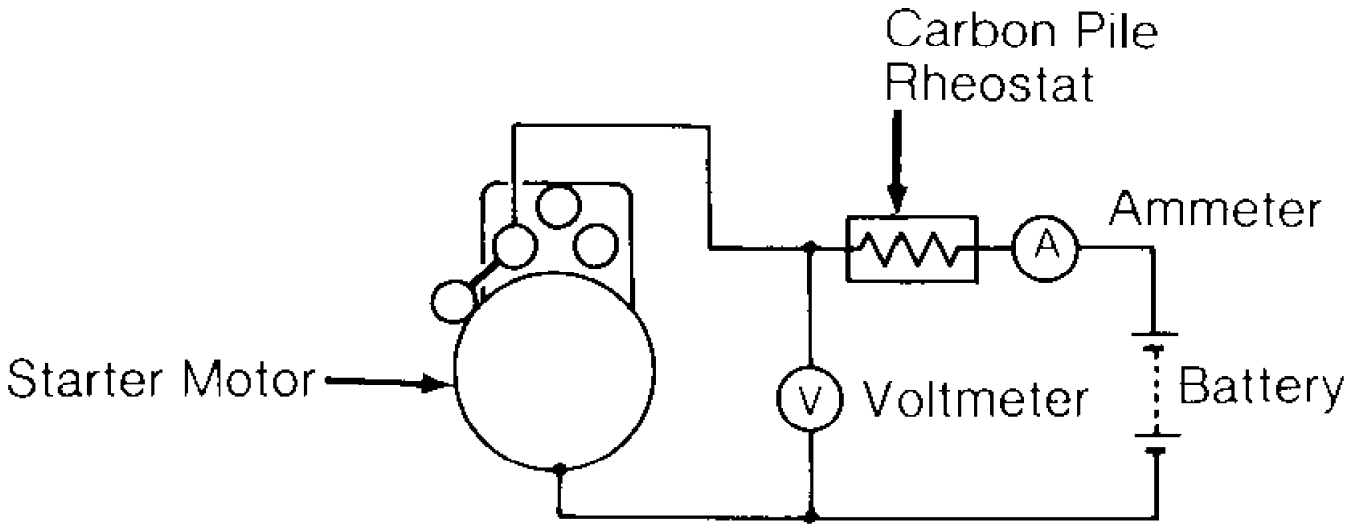


Fig. 2: Performing Starter No-Load Test
Courtesy of Mitsubishi Motor Sales of America

STARTER NO-LOAD TEST SPECIFICATIONS TABLE

Application	(1) Starter Type	Test Voltage	Maximum Amps @ Minimum RPM
Diamante	GR	12.0	110 @ 5000
Eclipse			
2.0L Non-Turbo	DD	11.5	(2)
2.0L Turbo & 2.4L	GR	11.0	90 @ 3000
Galant, Montero & 3000GT	GR	11.0	90 @ 3000
Mirage			
1.5L & 1.8L M/T	DD	11.5	60 @ 6000
1.8L A/T & M/T	GR	11.0	90 @ 2800
Montero Sport	GR	12	(2)

(1) - DD indicates direct drive. GR indicates gear reduction.
(2) - Information is not available from manufacturer at time of publication.

PULL-IN COIL TEST

1) Disconnect field coil wire from terminal "M" at starter solenoid. See Fig. 3. Connect jumper wire between positive battery terminal of 12-volt battery and terminal "S" of solenoid.

2) Connect a second jumper wire from negative battery terminal and touch terminal "M" of starter solenoid. If solenoid plunger moves inward, solenoid is good. If solenoid plunger does not move inward, replace solenoid.

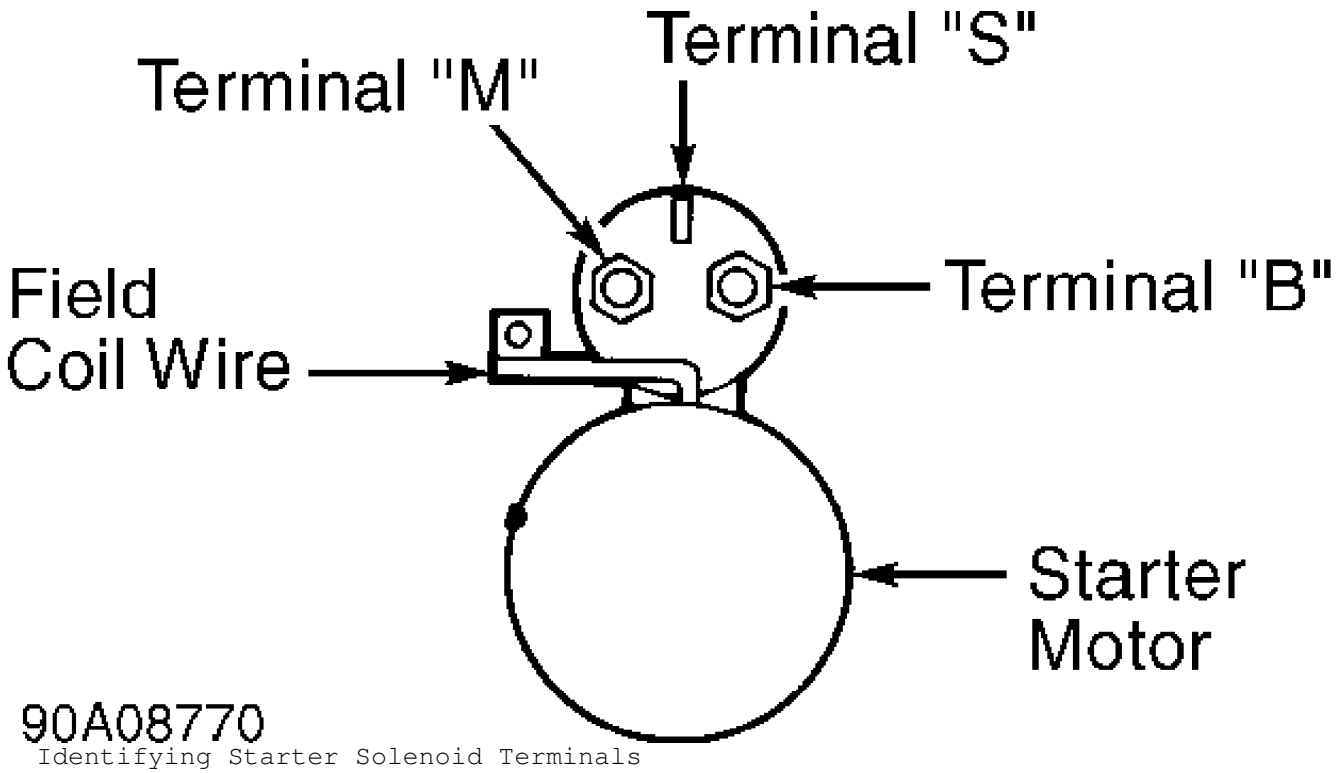


Fig. 3: Identifying Starter Solenoid Terminals
Courtesy of Mitsubishi Motor Sales of America

HOLD-IN COIL TEST

1) Disconnect field coil wire from terminal "M" at starter solenoid. See Fig. 3. Connect jumper wire between positive battery terminal of 12-volt battery and terminal "S" of starter solenoid.
2) Connect a second jumper wire from negative battery terminal and touch starter case. If solenoid plunger is pulled in, hold-in coil is good. If solenoid plunger is not pulled in, replace solenoid.

PINION RETURN TEST

1) Disconnect field coil wire from terminal "M" at starter solenoid. See Fig. 3. Connect jumper wire between positive battery terminal of 12-volt battery and terminal "M" of starter solenoid.
2) Connect a second jumper wire from negative battery terminal and touch starter case. Pull pinion outward and release it. Replace solenoid if pinion remains out.

PINION GAP MEASUREMENT

1) Disconnect field coil wire from terminal "M" at starter solenoid. See Fig. 3. Connect jumper wire between positive battery terminal of 12-volt battery and terminal "S" of starter solenoid.
2) Connect a second jumper wire from negative battery terminal and touch terminal "M" of starter solenoid. Using a feeler gauge, measure clearance between pinion and stopper. See Fig. 4.
3) Clearance should be within specification. See STARTER SPECIFICATIONS table. Adjust clearance by adding or removing gaskets between solenoid and front housing.

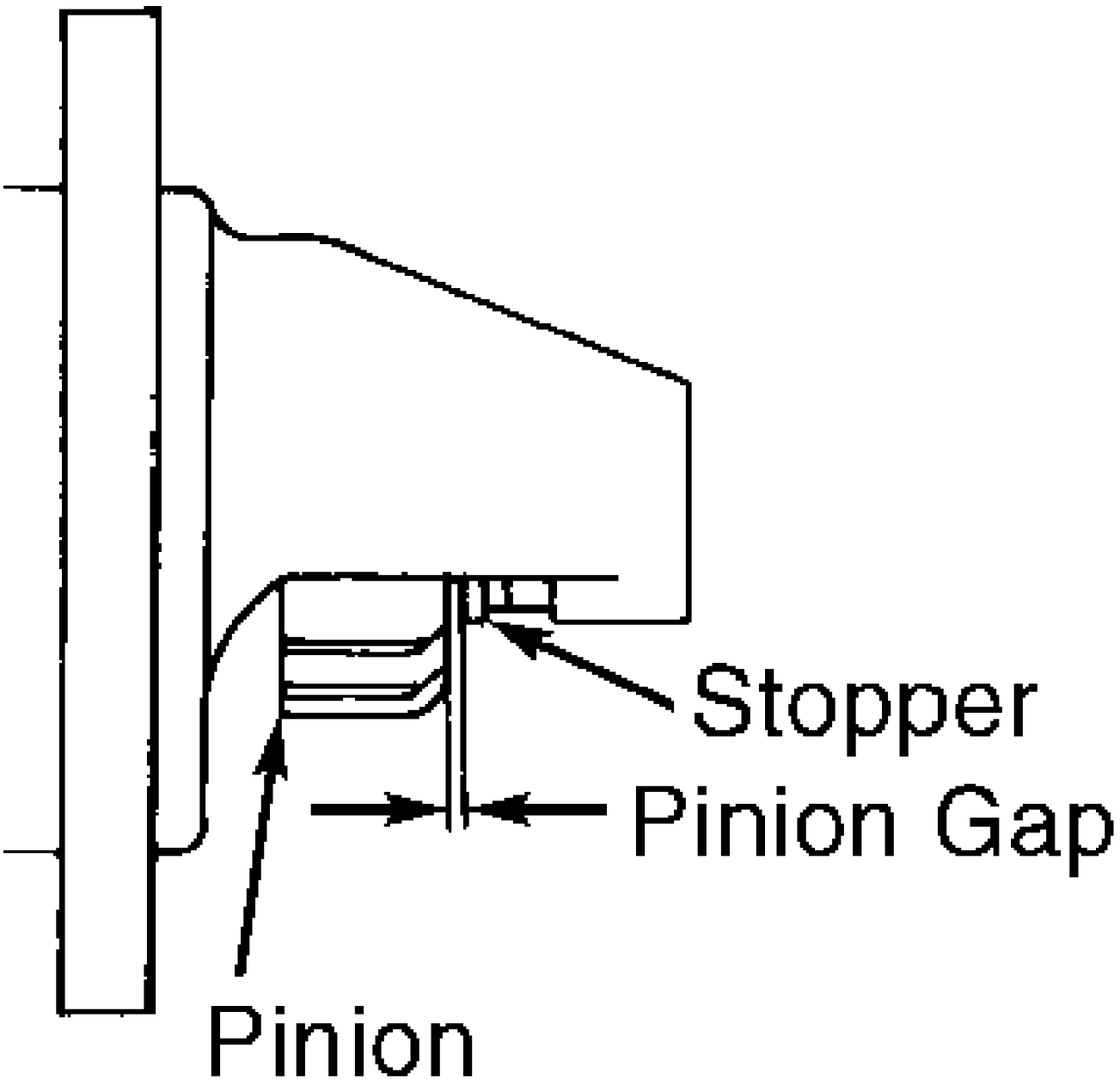


Fig. 4: Measuring Pinion Gap
Courtesy of Mitsubishi Motor Sales of America

PINION TEST

While holding pinion housing, rotate pinion. Pinion should rotate smoothly in clockwise direction only. Inspect pinion and ring gear for wear or burrs. If pinion does not rotate as specified or damage is found, replace pinion.

ARMATURE TEST

Ensure armature is not grounded. Place armature in growler. Hold a thin steel blade parallel and just above armature while slowly rotating armature in growler. A shorted armature will cause blade to vibrate and be attracted to core. Using an ohmmeter, check continuity between armature coil cores and commutator segments (small diameter end of armature). Continuity should not exist. Check for continuity between segments. Continuity should exist. Replace armature as necessary.

BRUSH HOLDER TEST

Using an ohmmeter, check continuity between brush holder plate and brush holder. Continuity should not exist. Replace brush holder as necessary.

REMOVAL & INSTALLATION

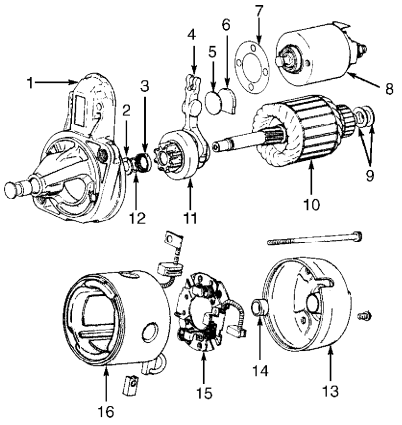
NOTE: On Montero with A/T, it may be necessary to disconnect transmission oil cooler line for starter removal.

Removal & Installation

Disconnect negative battery cable. If necessary, raise vehicle on hoist. Remove starter mounting bolts and starter. To install, reverse removal procedure.

OVERHAUL

Check commutator for out-of-round and proper amount of undercut. Replace or repair armature if not within specification. See STARTER SPECIFICATIONS table. Ensure brushes are not worn beyond wear line (outer line closest to commutator contact surface). Check pinion gap. See PINION GAP MEASUREMENT under BENCH TESTING. See Figs. 5 and 6.



1. Front Housing
2. Washer
3. Stopper
4. Lever
5. Plate
6. Packing
7. Gasket
8. Starter Solenoid
9. Washers
10. Armature
11. Pinion
12. Snap Ring
13. Rear Housing
14. Rear Bearing
15. Brush Holder Assembly
16. Yoke Assembly

Fig. 5: Exploded View Of Direct Drive Starter (Typical)
Courtesy of Mitsubishi Motor Sales of America

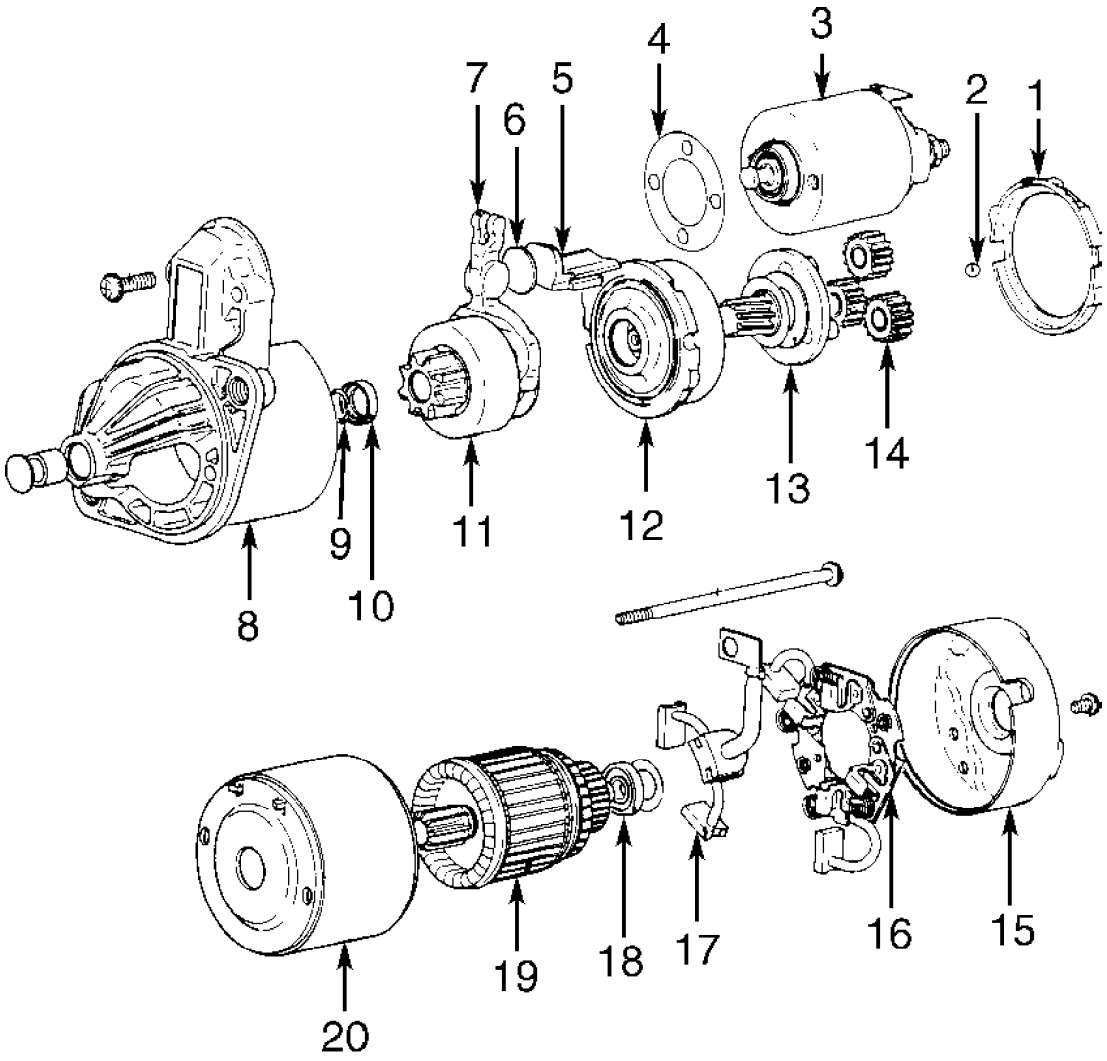


Fig. 6: Exploded View Of Gear Reduction Starter (Typical)
Courtesy of Mitsubishi Motor Sales of America

STARTER SPECIFICATIONS

STARTER SPECIFICATIONS TABLE

Application	In. (mm)
Commutator Maximum Runout	.004 (.10)
Commutator Minimum Diameter	
Diamante	1.23 (31.2)
Eclipse	
Direct Drive Type	(1)
Gear Reduction Type	1.12 (28.4)
Galant	1.12 (28.4)
Mirage	
Direct Drive Type	1.22 (31.4)
Gear Reduction Type	1.12 (28.4)
Montero & Montero Sport	1.13 (28.8)
3000GT	1.12 (28.4)
Commutator Undercut Depth	.020 (.51)
Pinion Gap	.020-.079 (.51-2.01)

(1) - Information is not available from manufacturer at time of publication.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS TABLE

Application	Ft. Lbs. (N.m)
Starter-To-Block Bolts	
Diamante	23 (31)
Eclipse	
2.0L Non-Turbo	40 (54)
2.0L Turbo & 2.4L	22 (30)
Galant	22 (30)
Mirage	36 (49)
Montero & Montero Sport	19-24 (26-33)
3000GT	23 (31)

WIRING DIAGRAMS

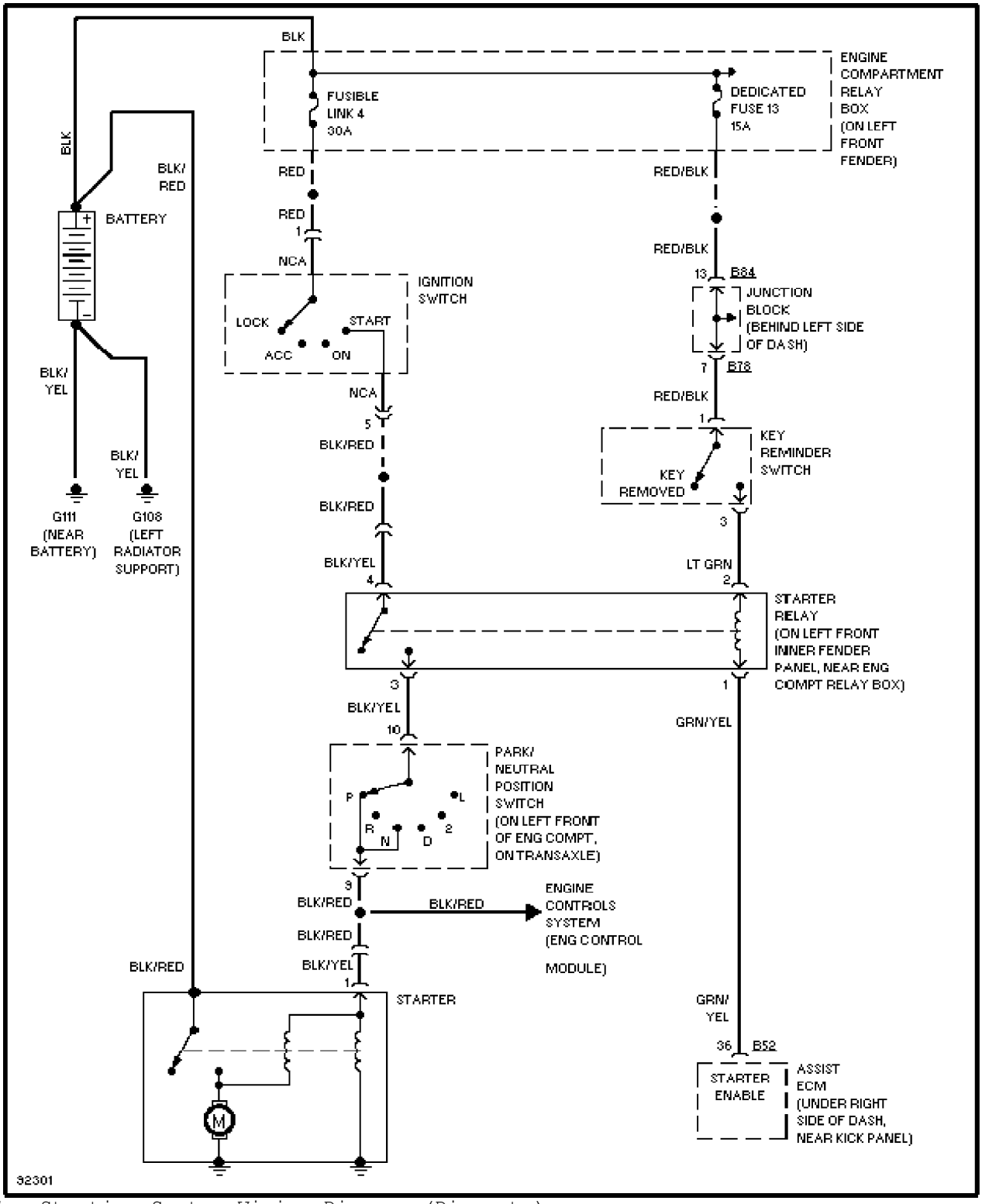


Fig. 7: Starting System Wiring Diagram (Diamante)

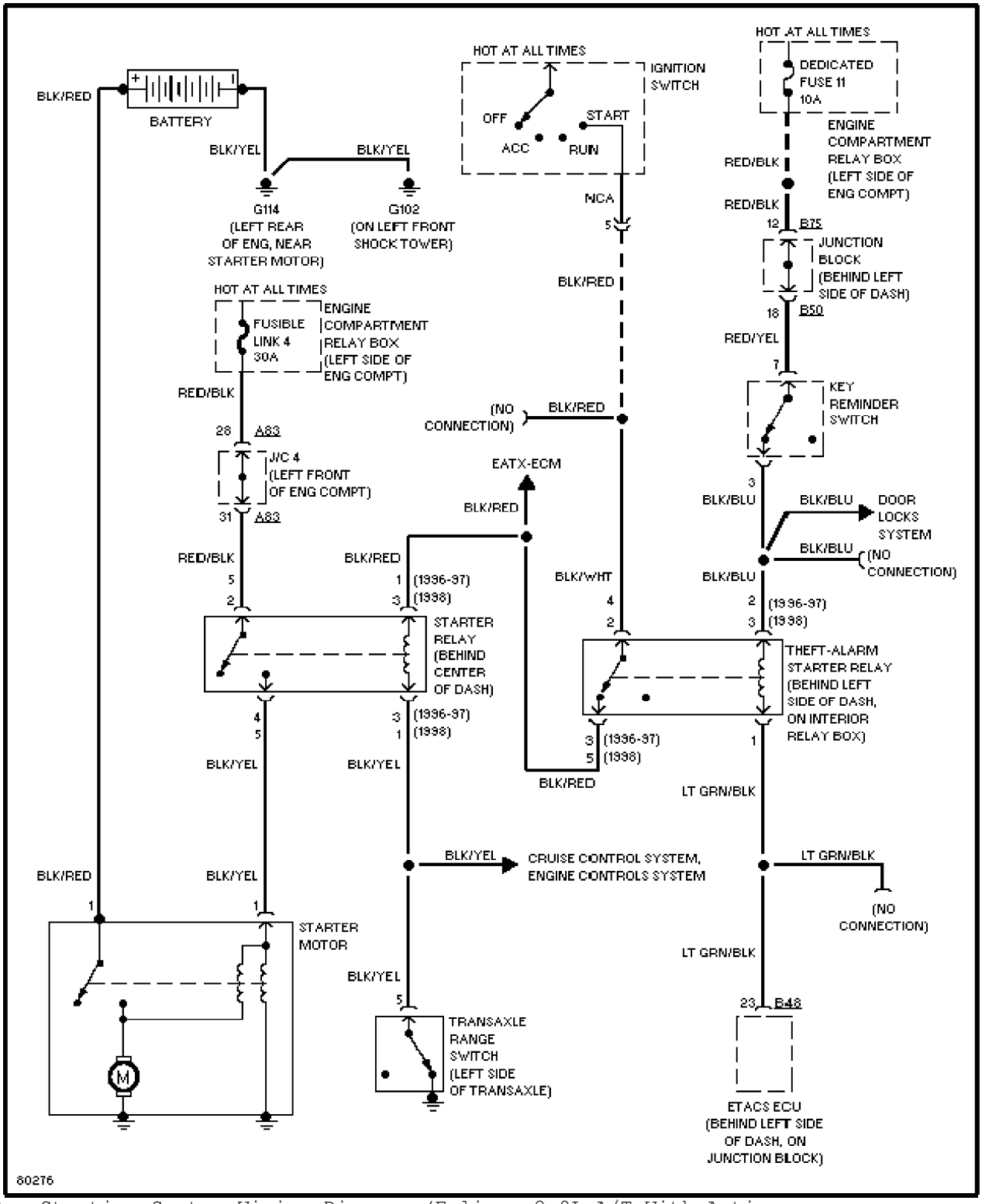


Fig. 8: Starting System Wiring Diagram (Eclipse 2.0L A/T With Anti-Theft)

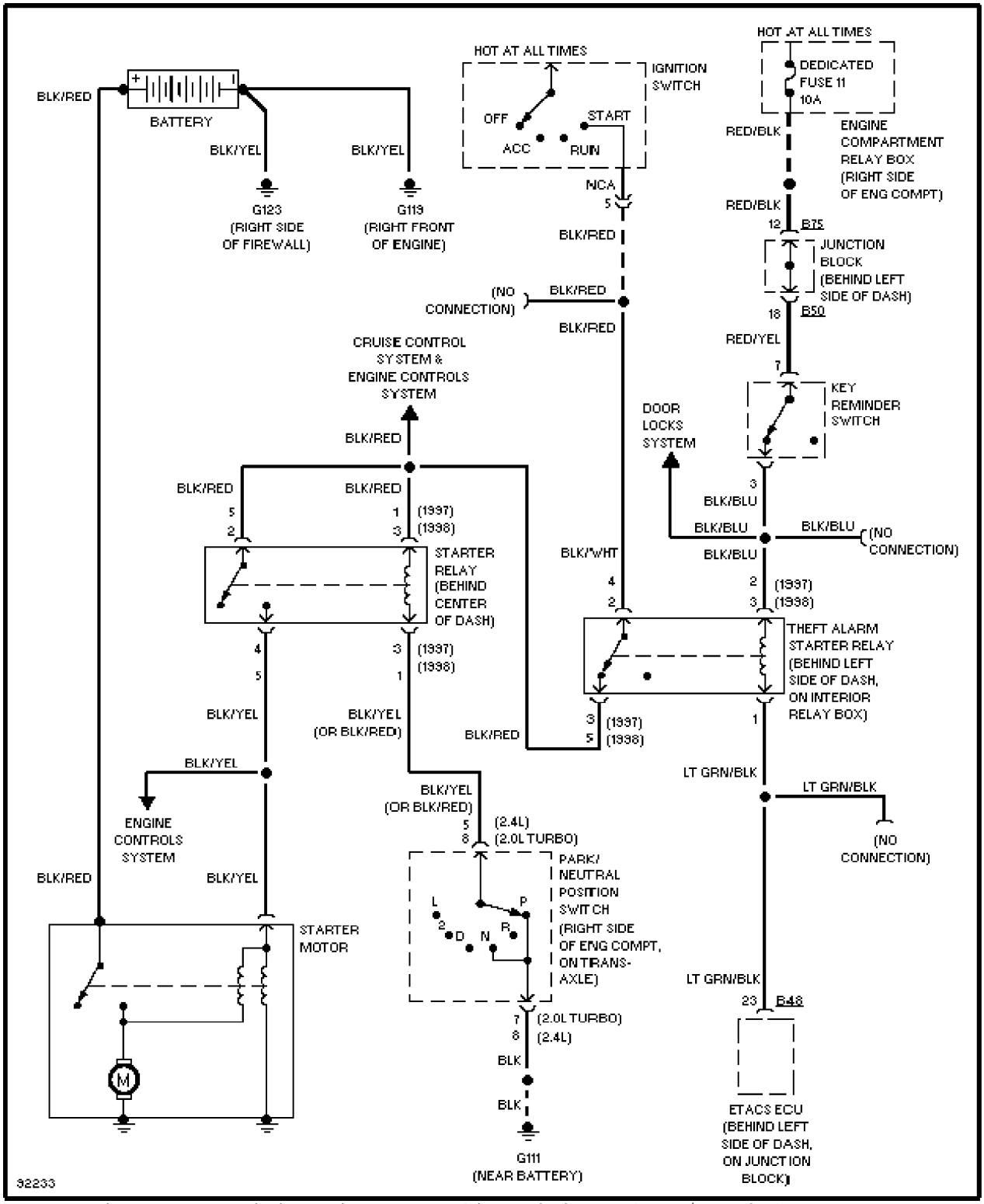


Fig. 9: Starting System Wiring Diagram (Eclipse 2.0L Turbo A/T & 2.4L A/T With Anti-Theft)

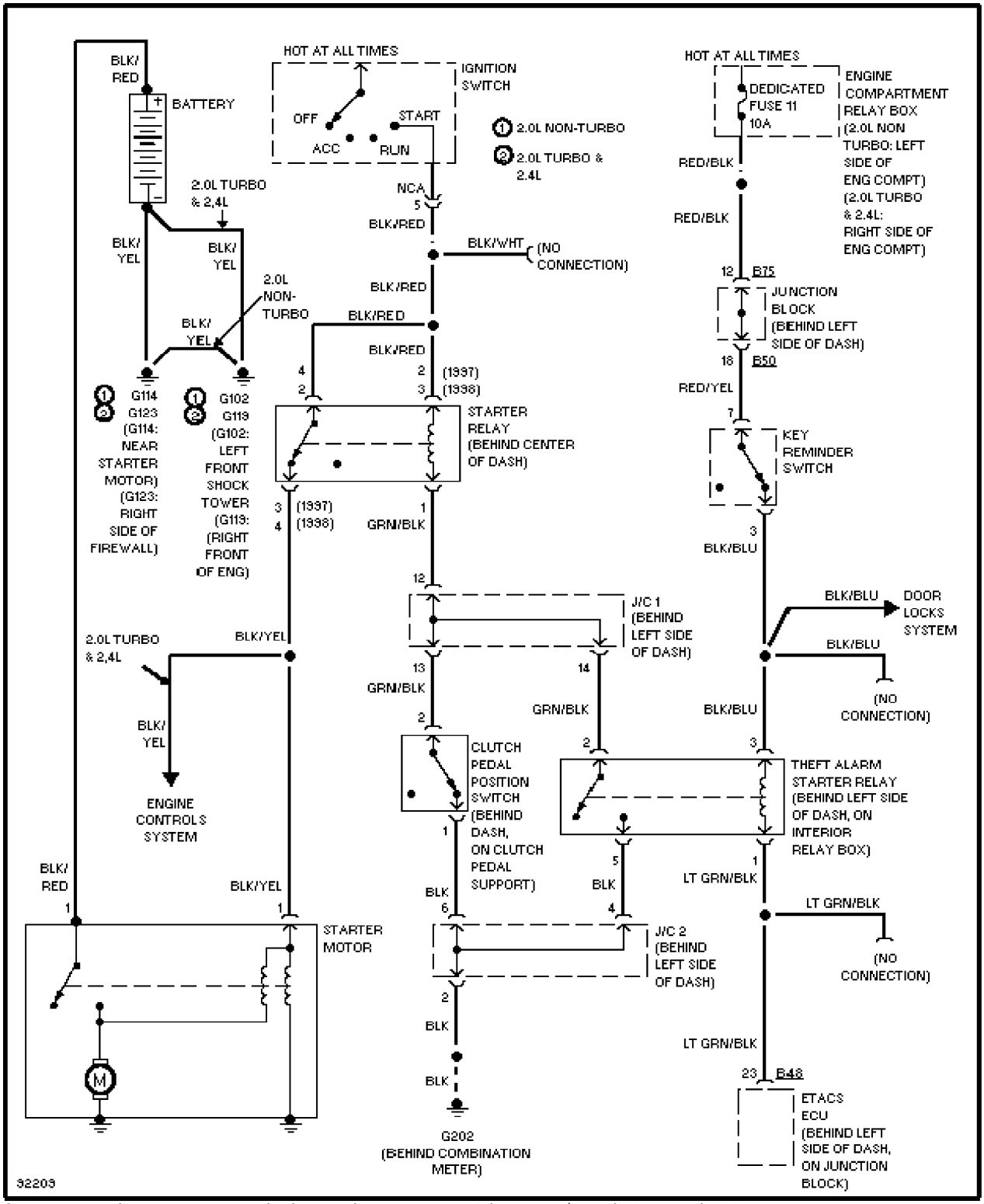


Fig. 10: Starting System Wiring Diagram (Eclipse M/T With Anti-Theft)

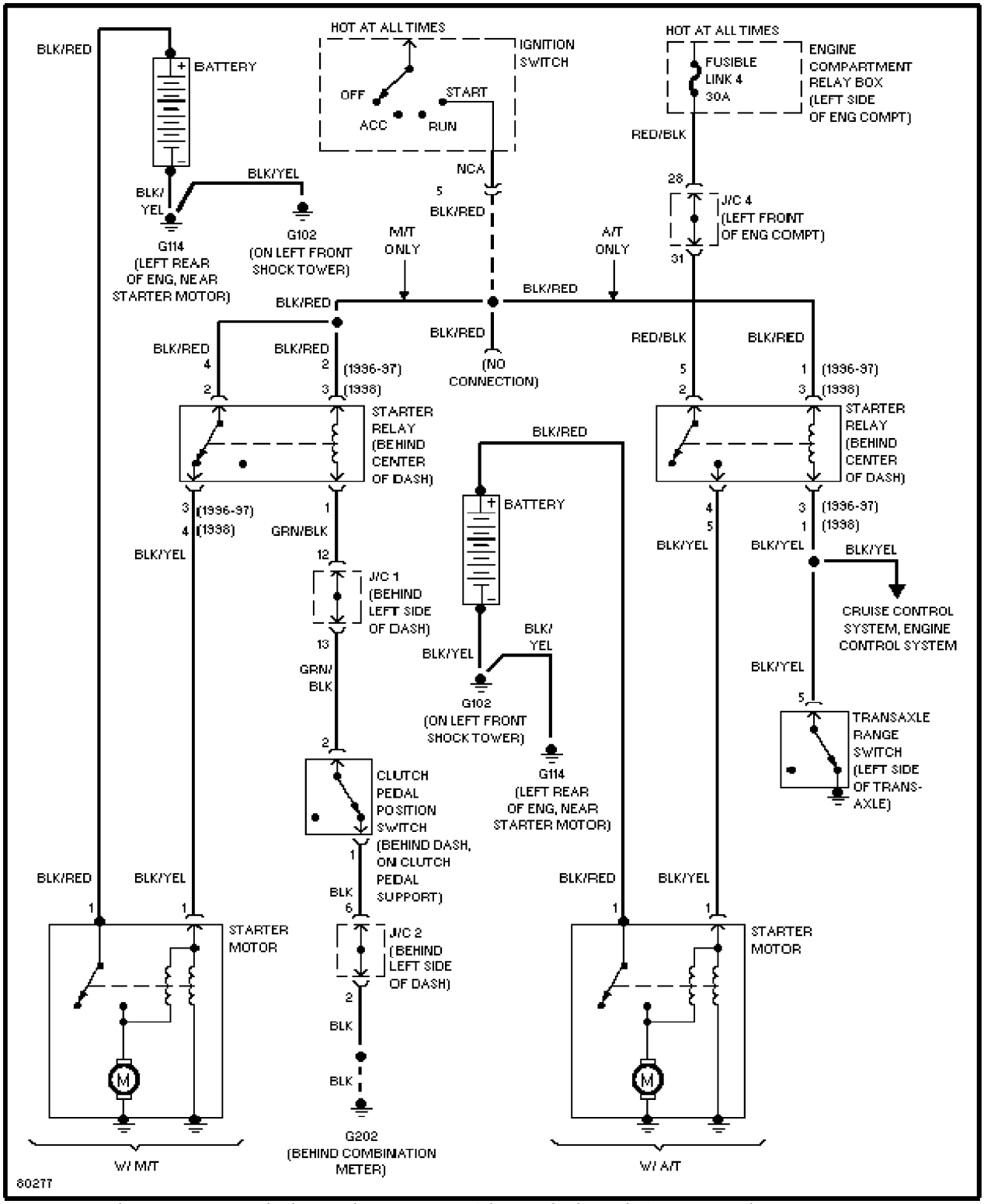


Fig. 11: Starting System Wiring Diagram (Eclipse 2.0L Without Anti-Theft)

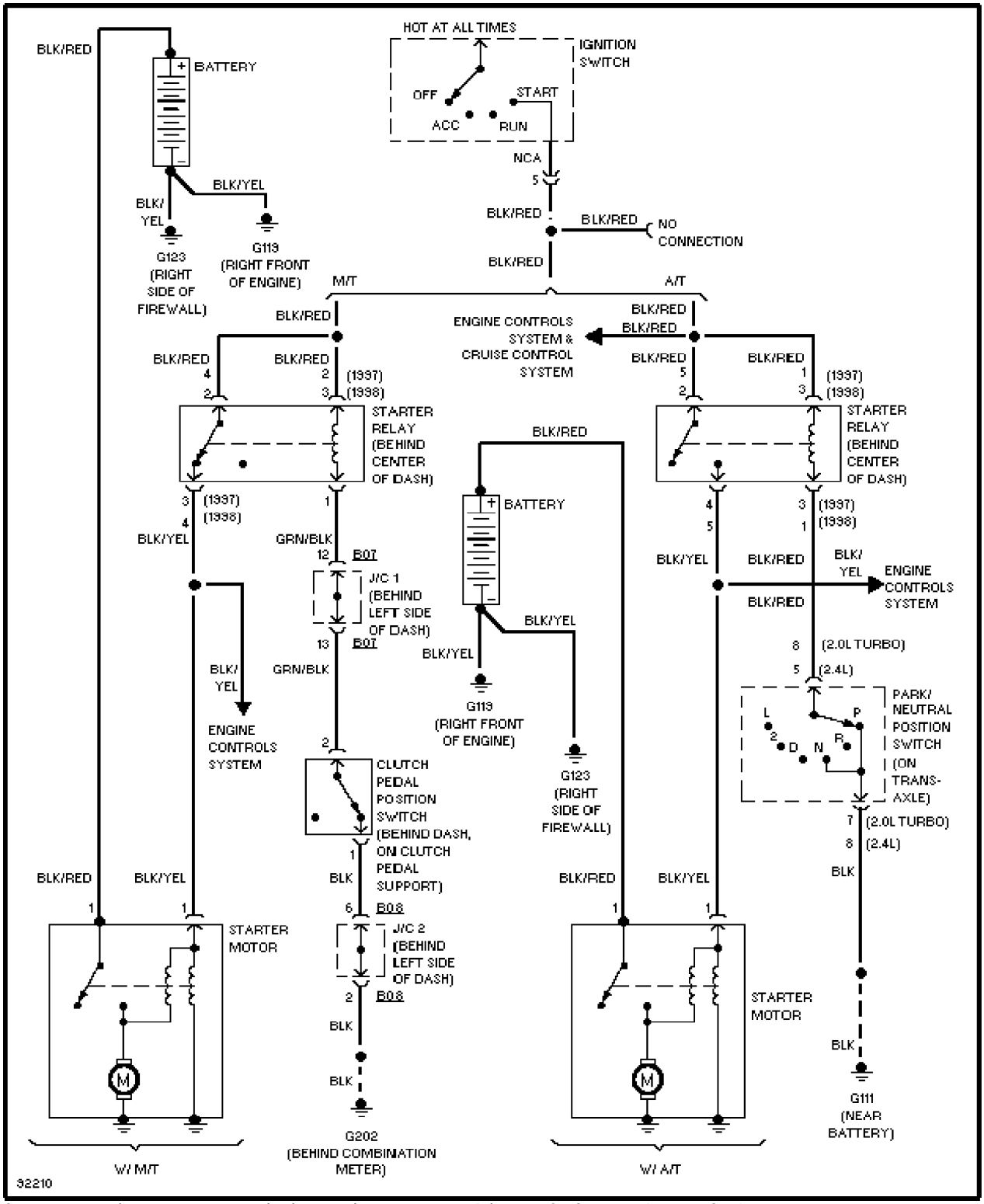


Fig. 12: Starting System Wiring Diagram (Eclipse 2.0L Turbo & 2.4L Without Anti-Theft)

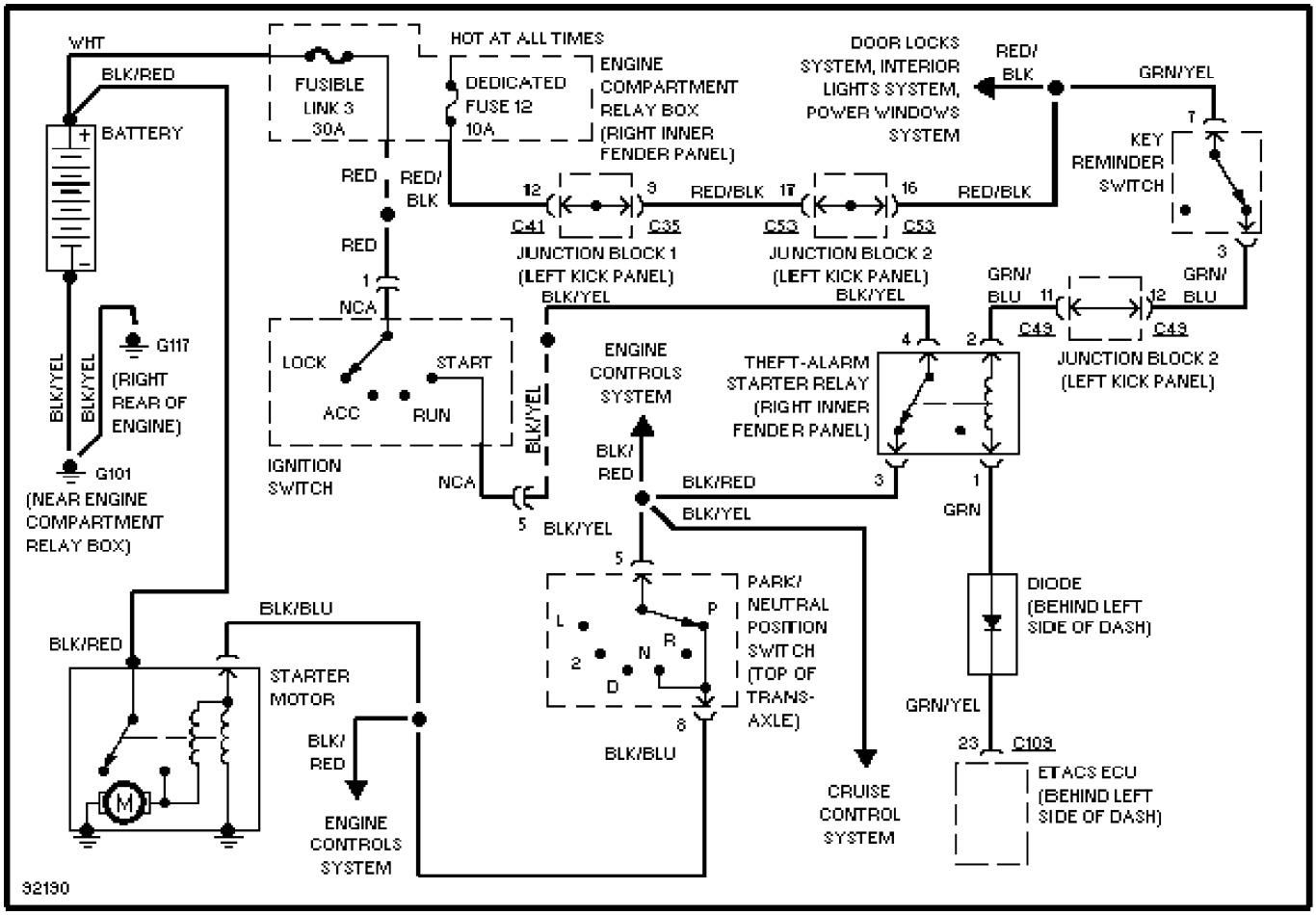


Fig. 13: Starting System Wiring Diagram (Galant With Anti-Theft)

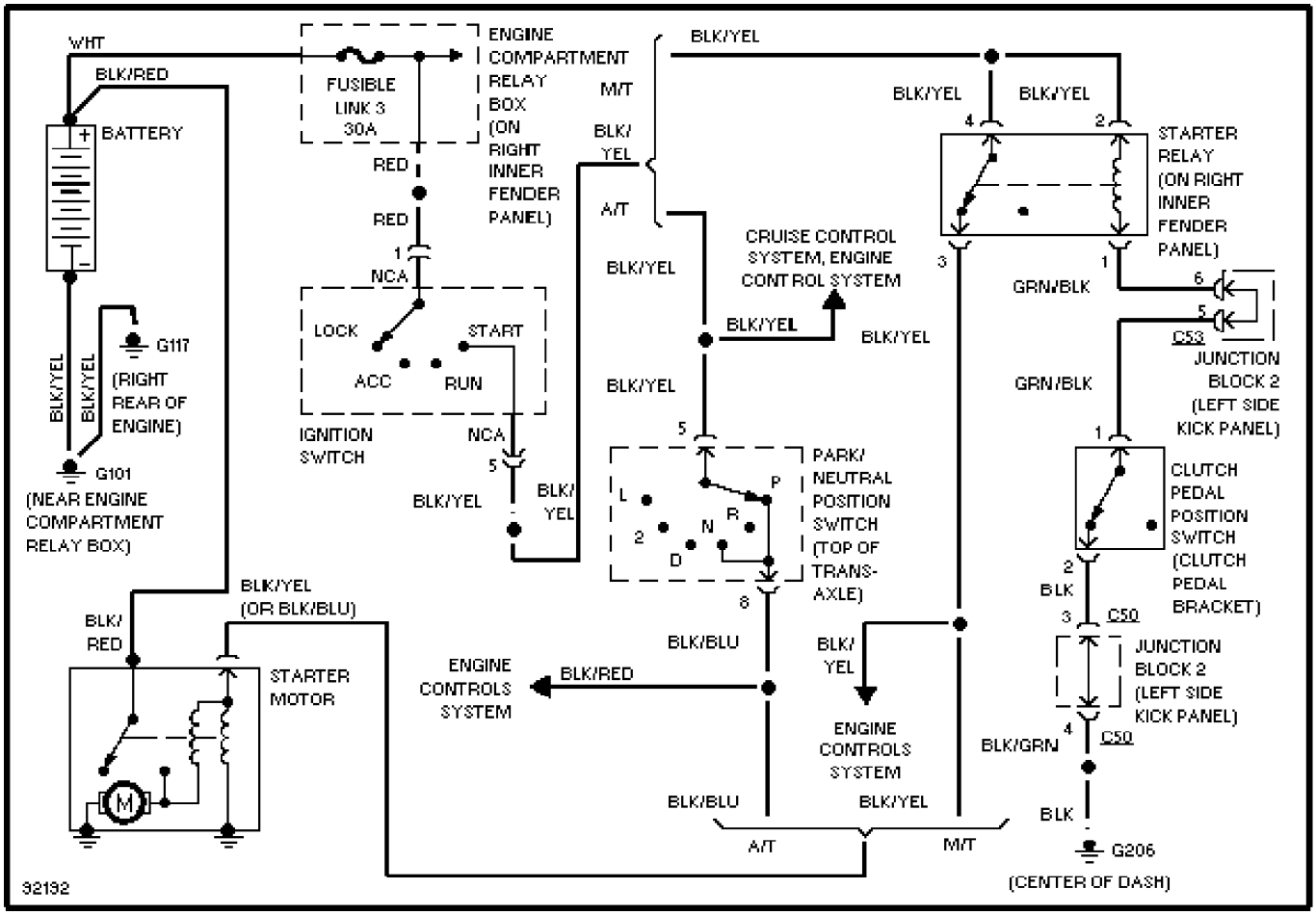


Fig. 14: Starting System Wiring Diagram (Galant Without Anti-Theft)

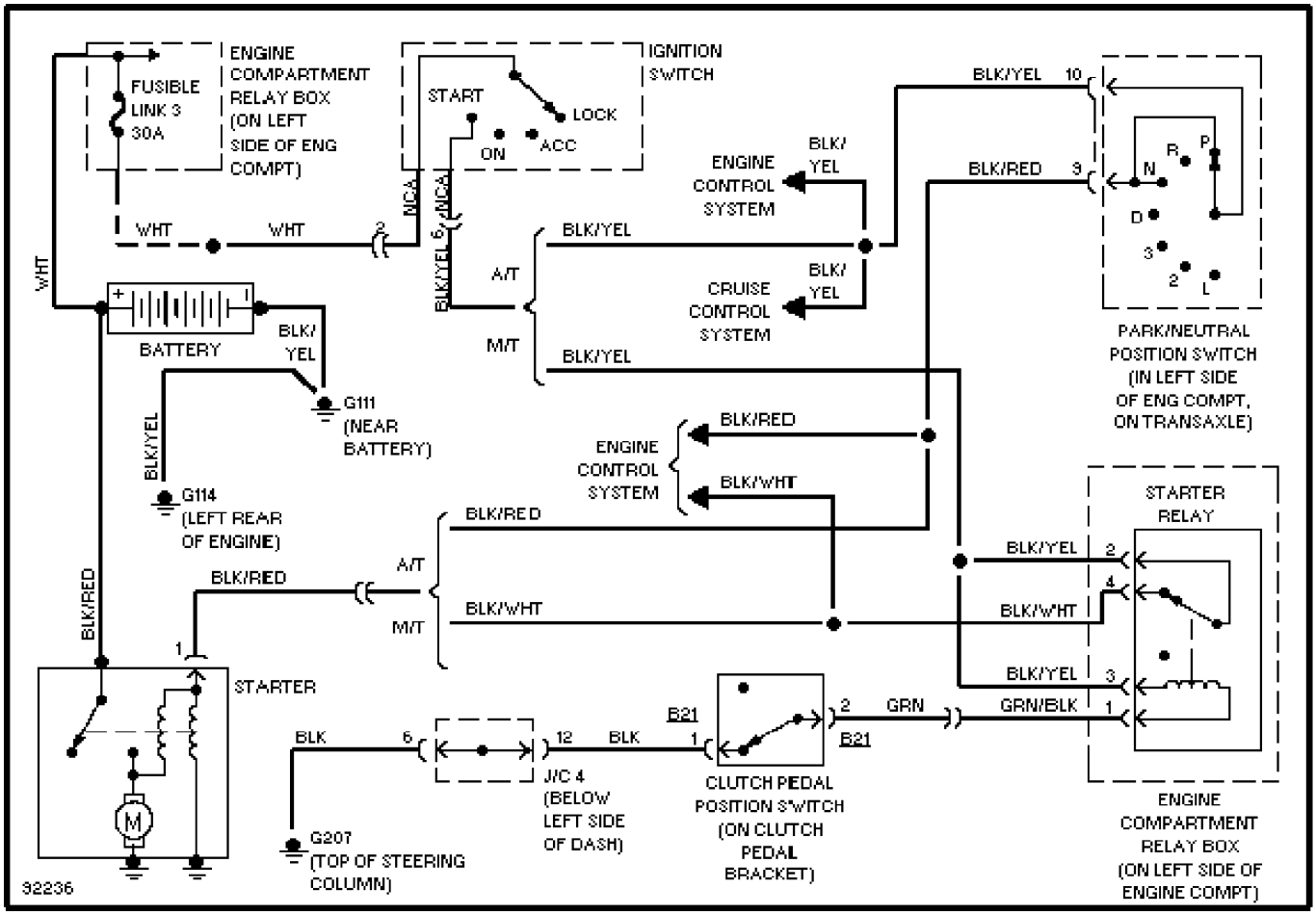


Fig. 15: Starting System Wiring Diagram (Mirage)

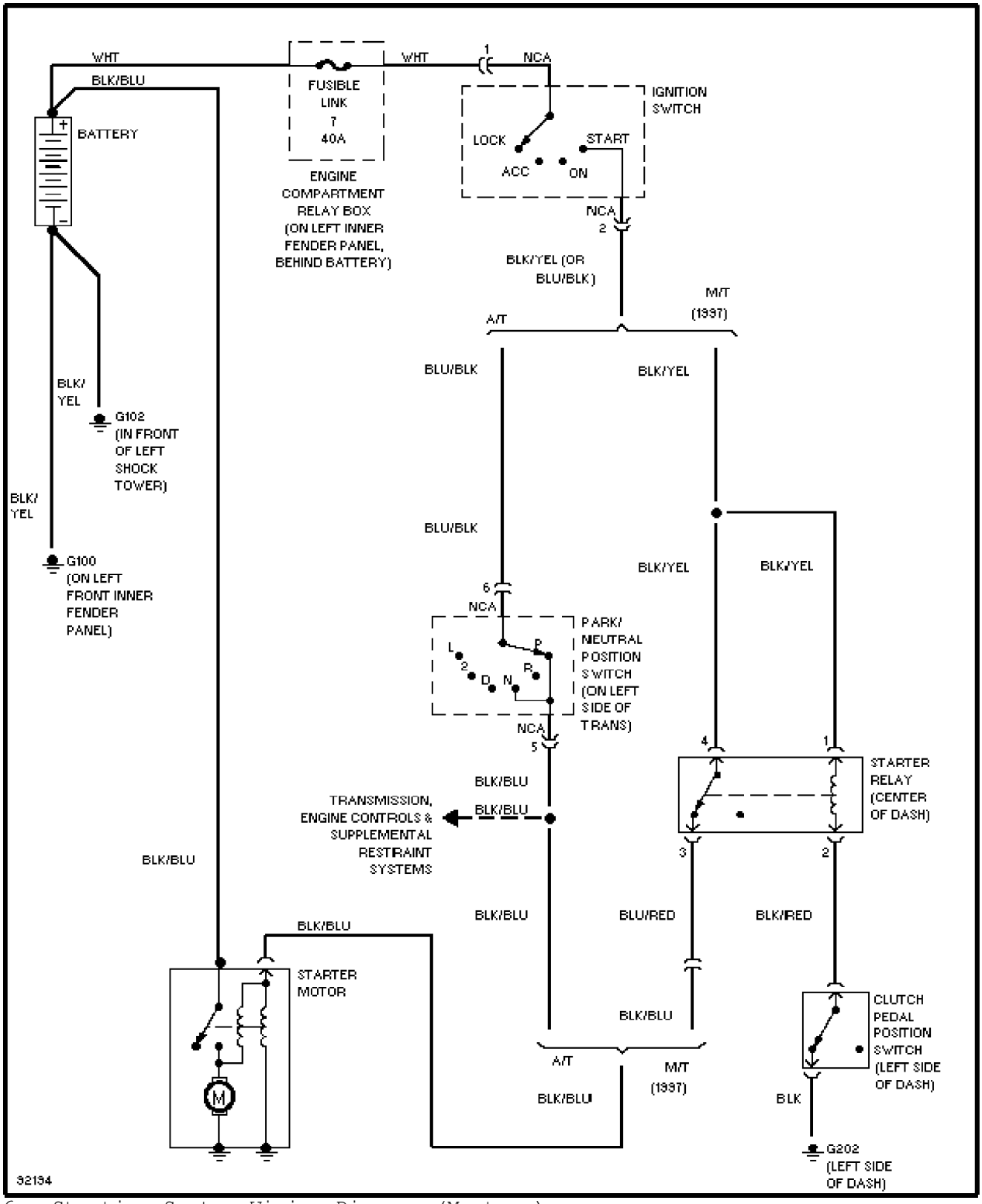


Fig. 16: Starting System Wiring Diagram (Montero)

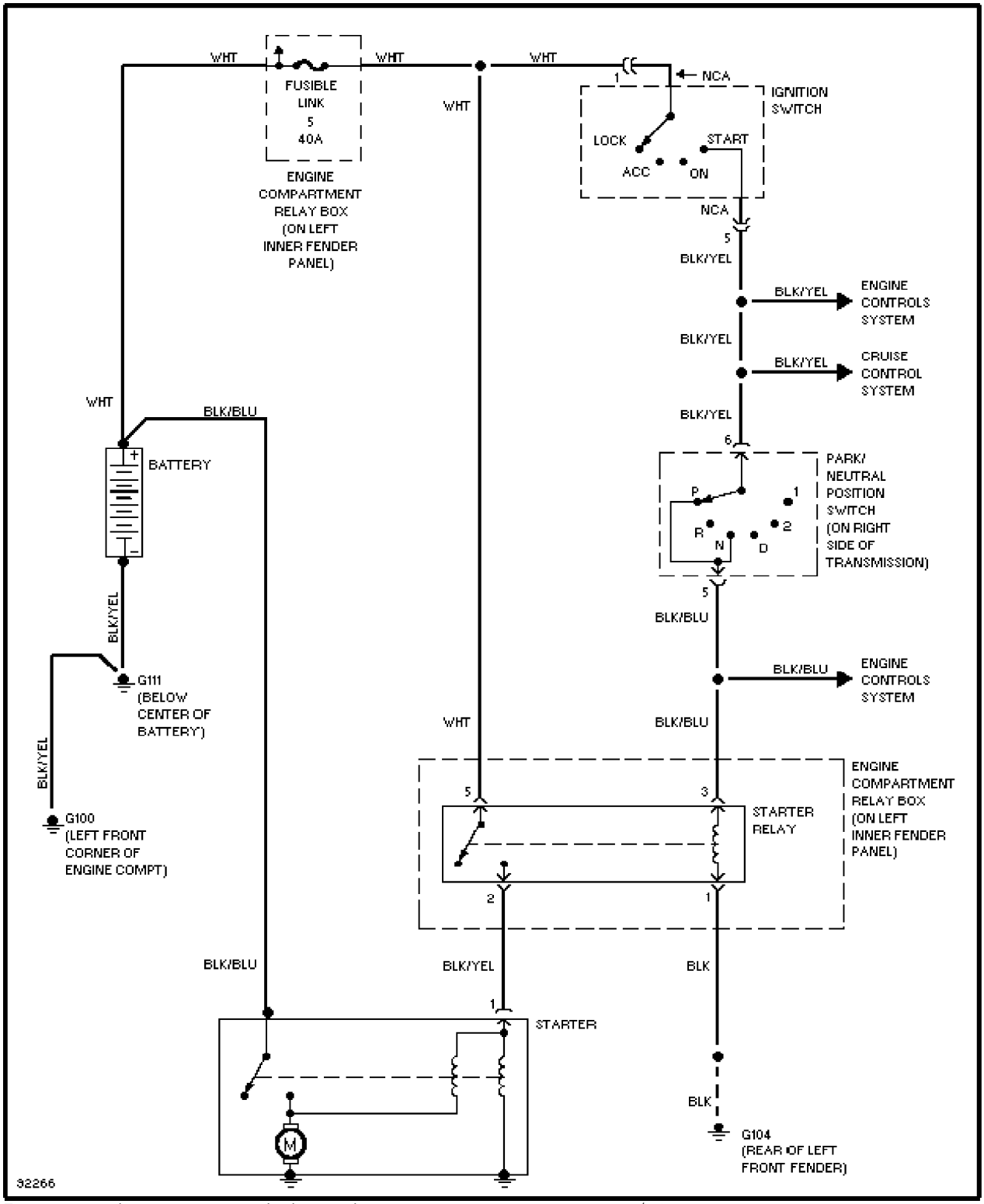


Fig. 17: Starting System Wiring Diagram (Montero Sport A/T)

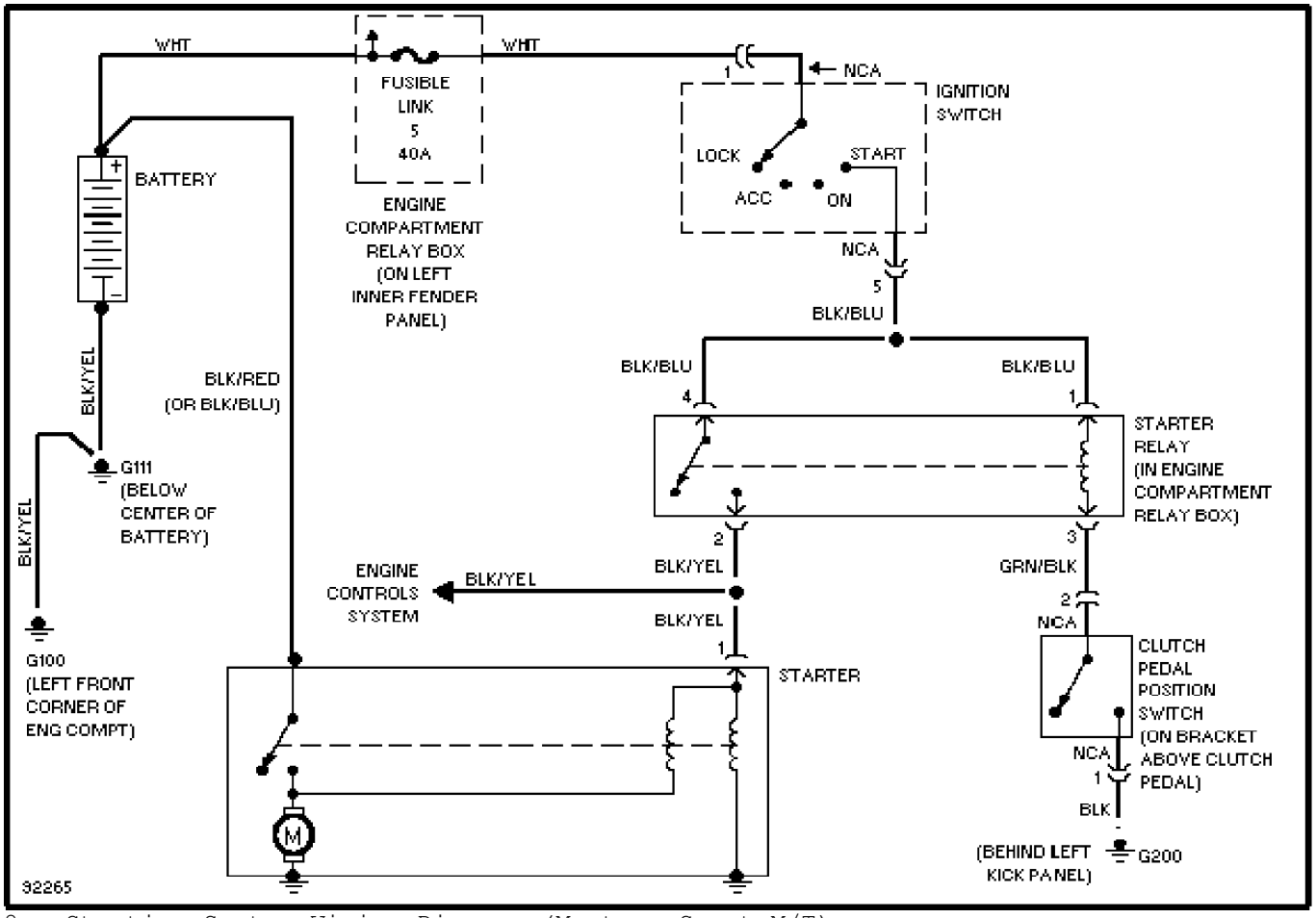


Fig. 18: Starting System Wiring Diagram (Montero Sport M/T)

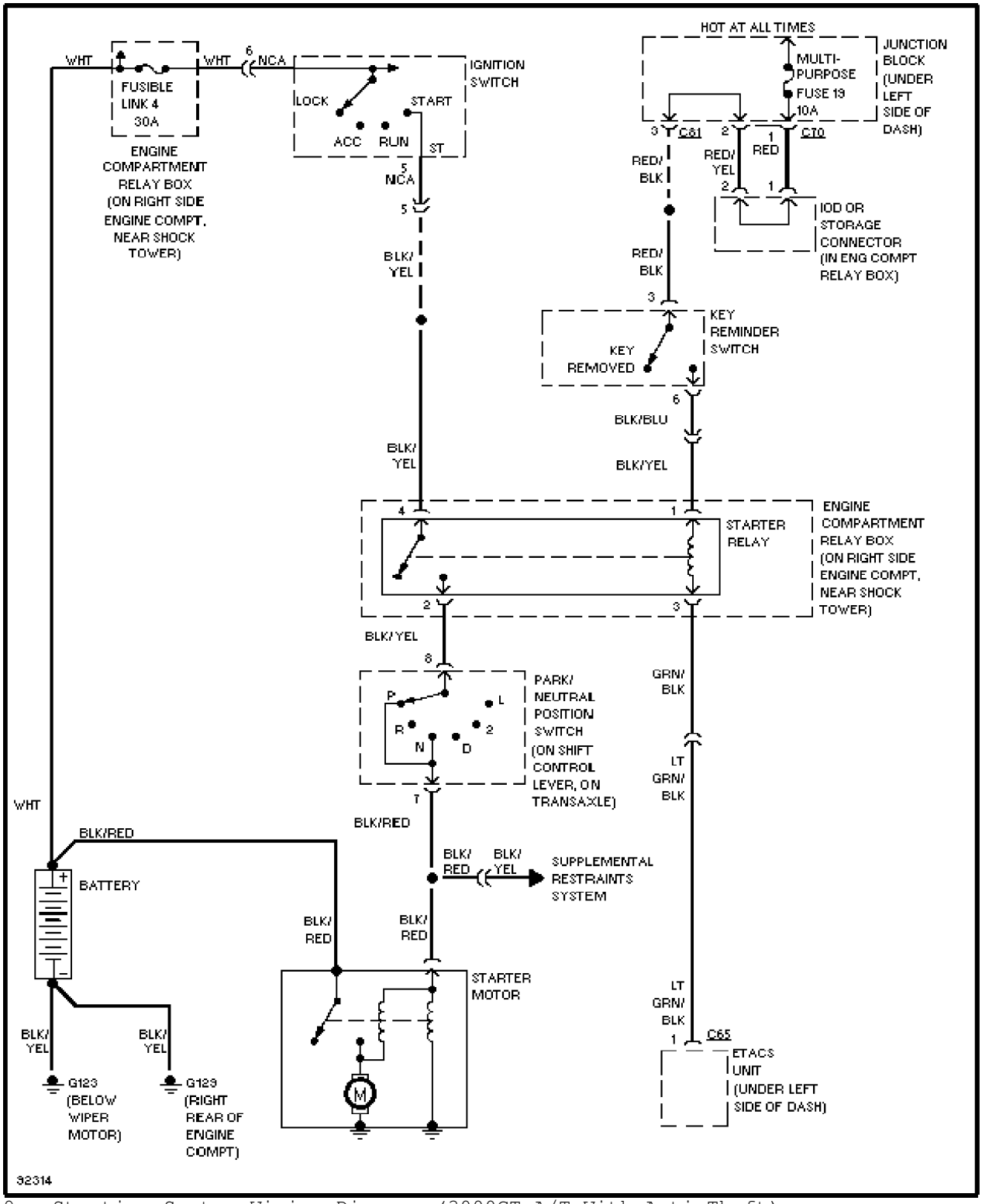


Fig. 19: Starting System Wiring Diagram (3000GT A/T With Anti-Theft)

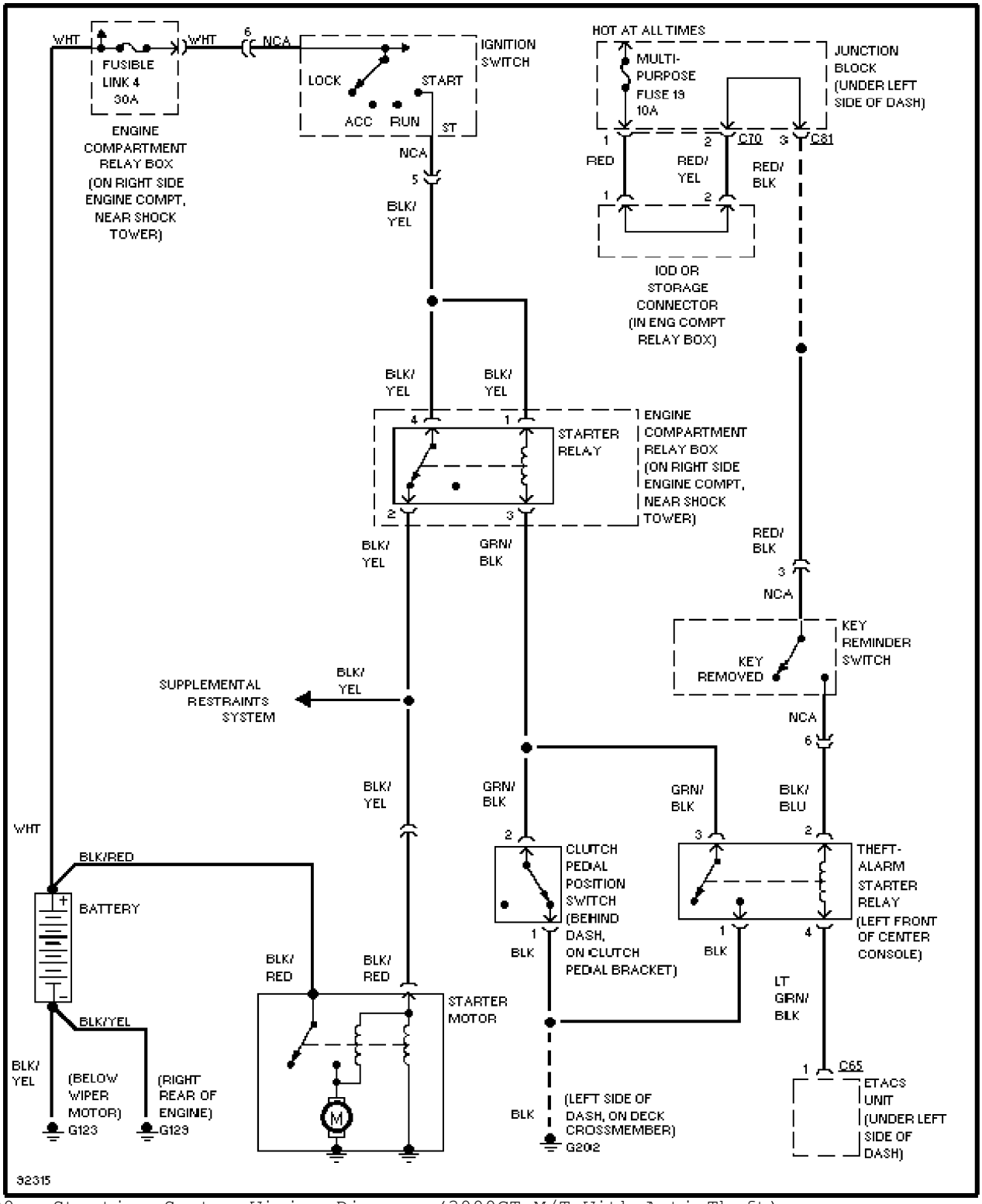


Fig. 20: Starting System Wiring Diagram (3000GT M/T With Anti-Theft)

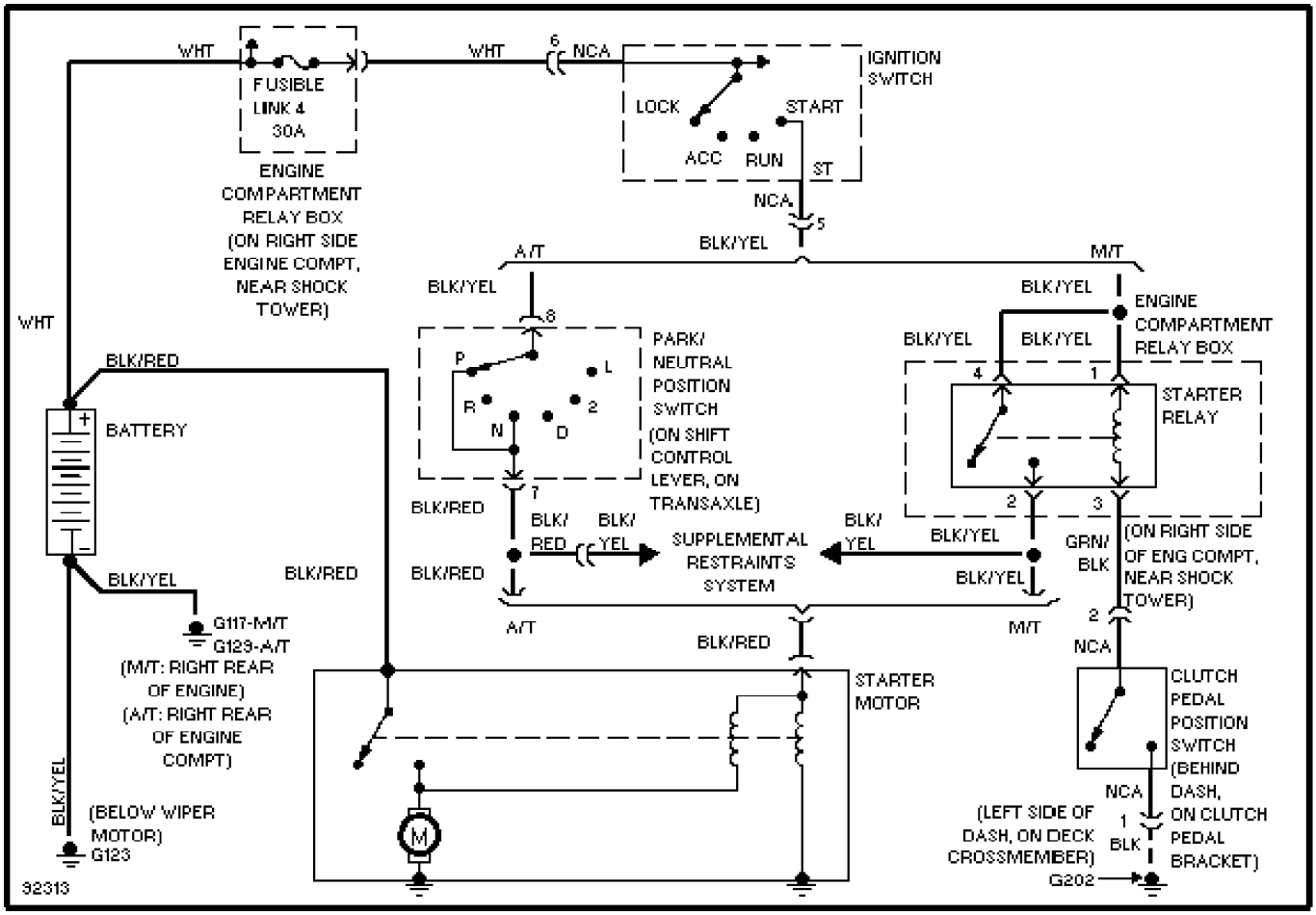


Fig. 21: Starting System Wiring Diagram (3000GT Without Anti-Theft)

STEERING COLUMN

1998 Mitsubishi Galant

1997-98 STEERING
Steering Columns - AWD & FWD

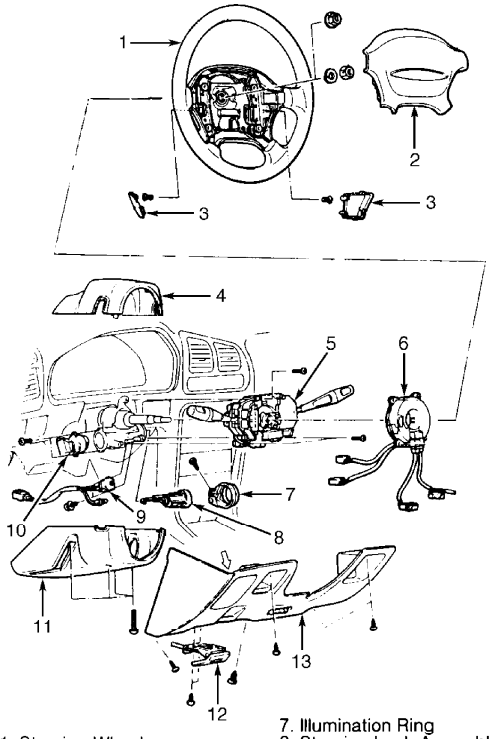
Diamante, Eclipse, Galant, Mirage, 3000GT

DESCRIPTION & OPERATION

WARNING: All models are equipped with a Supplemental Restraint System (SRS). Use caution when working around steering column. Ensure battery is disconnected before attempting any repair. DO NOT apply electrical power to any component on steering column without disabling air bag system (air bag could deploy).

NOTE: For information on air bag DIAGNOSIS & TESTING or DISPOSAL PROCEDURES, see AIR BAG RESTRAINT SYSTEM.

The steering system consists of solid steering shaft with a lower joint assembly. All models are equipped with a Supplemental Restraint System (SRS) that includes an air bag located in steering wheel and a clockspring located in the steering column. See Fig. 1.



1. Steering Wheel
2. Air Bag Module
3. Cover
4. Upper Column Cover
5. Combination Switch
6. SRS Clockspring
7. Illumination Ring
8. Steering Lock Assembly
9. Key Reminder Switch
10. Ignition Switch
11. Lower Column Cover
12. Hood Release Handle
13. Instrument Undercover

94J46523

Fig. 1: Exploded View Of SRS Steering Column Components (Typical) Courtesy of Mitsubishi Motor Sales of America.

DISABLING & ACTIVATING AIR BAG SYSTEM

WARNING: Wait at least 60 seconds after disconnecting negative battery cable before servicing SRS. System reserve capacitor maintains SRS voltage for about 60 seconds after battery is disconnected. Servicing SRS before 60-second period may cause accidental air bag deployment and possible personal injury.

To disable system, turn ignition switch to OFF position. Disconnect and isolate negative battery cable end. Wait at least 60 seconds. To activate system, reconnect negative battery cable.

AIR BAG SERVICE PRECAUTIONS

The following precautions should be observed when working with SRS:

* Disable SRS before servicing any SRS or steering column component. Failure to do this may result in accidental air bag deployment and possible personal injury. See DISABLING & ACTIVATING AIR BAG SYSTEM.
* Wait at least 60 SECONDS after disabling air bag system. SRS system retains enough voltage, for a short time after system is disabled, to deploy air bag.
* After repairs, always turn ignition on to ensure SRS warning light is working properly and no system faults are indicated.
* Always wear safety glasses when servicing or handling an air bag.
* DO NOT expose air bag module and clockspring to temperatures more than 200°F (93°C).
* When placing a live air bag on a bench or other surface, always face air bag and trim cover up, away from surface. This will reduce motion of module if air bag accidentally deploys.
* After air bag deploys, air bag surface may contain deposits of sodium hydroxide, which irritate skin. Always wear safety glasses, rubber gloves and long-sleeved shirt during clean up. Wash hands using mild soap and water. Follow correct clean-up and disposal procedures.
* Because of critical system operating requirements, DO NOT service any SRS components. Repairs are only made by replacing defective part(s).
* DO NOT allow any electrical source near inflator on the back of air bag module.
* When carrying live air bag module, trim cover should be pointed away from body to minimize injury in case of accidental air bag deployment.
* If SRS is not fully functional for any reason, DO NOT drive

  vehicle until system is repaired and is fully functional. DO NOT remove bulbs, modules, sensors or other components, or in any way disable system from operating normally. If SRS is not functional, park vehicle until repairs are made.

REMOVAL & INSTALLATION

STEERING WHEEL & AIR BAG

Removal

1) Before proceeding, follow air bag service precautions. See AIR BAG SERVICE PRECAUTIONS. Disable SRS. See

DISABLING & ACTIVATING AIR BAG SYSTEM.

2) Driver's air bag module is mounted on face of steering wheel. See Fig. 1. Ensure wheels are straight ahead and steering wheel is locked. Remove air bag module-to-steering wheel nuts from back side of steering wheel.

3) Lift air bag module. Disconnect electrical connector from air bag module by pressing air bag connector lock toward outside to spread it open. See Fig. 2. Pry upward gently to remove connector. DO NOT apply excessive force. Remove air bag module.

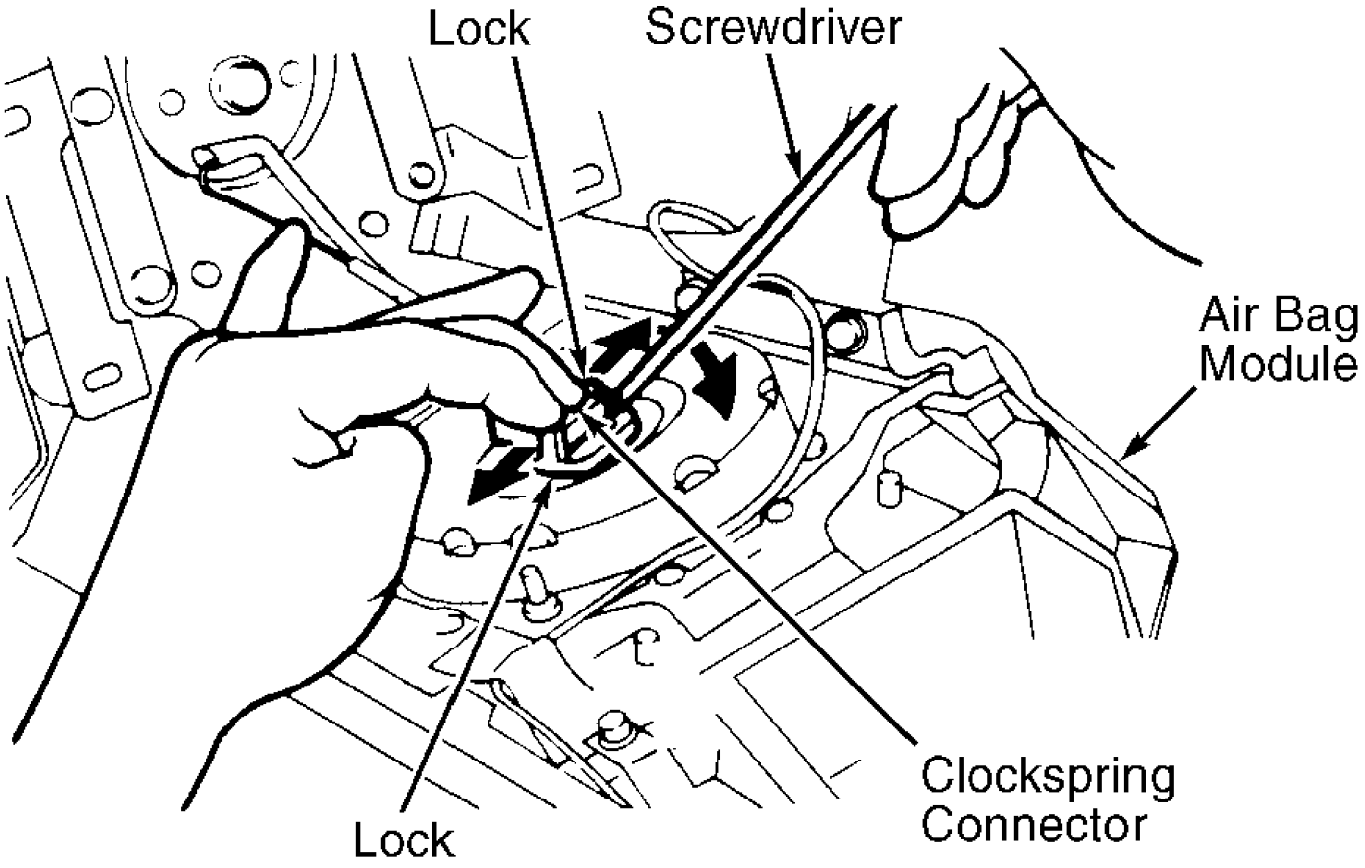


Fig. 2: Disconnecting Clockspring Connector
Courtesy of Mitsubishi Motor Sales of America.

CAUTION: DO NOT hammer on steering wheel during removal or installation, as it may damage steering column.

4) Place reference mark on steering wheel and steering column shaft for installation reference. Remove steering wheel nut and washer. Using steering wheel puller, remove steering wheel.

Installation

To install, reverse removal procedure. Ensure reference marks are aligned. Tighten steering wheel nut to specification. See TORQUE SPECIFICATIONS.

COMBINATION SWITCH

CAUTION: When installing steering wheel, if rotating part of clockspring is not properly centered with steering column

and front wheels, clockspring failure will result.

Removal & Installation

1) Remove steering wheel and air bag. See STEERING WHEEL & AIR BAG. Remove instrument panel undercover (if equipped). See Fig. 1. Remove steering column covers.

CAUTION: A double-lock connector locking mechanism is used on SRS Diagnosis Unit (SDU). DO NOT use excessive force when disconnecting connector, or damage to connector may occur.

2) Disconnect clockspring electrical connector. Remove screws attaching clockspring. Remove clockspring. Disconnect combination switch electrical connectors. Remove screws and combination switch. See Fig. 1. To install, reverse removal procedure.

IGNITION SWITCH & STEERING LOCK CYLINDER

Removal

Remove steering wheel and combination switch. See STEERING WHEEL & AIR BAG and COMBINATION SWITCH. Disconnect ignition switch electrical connector. Using a hacksaw, cut bolts at steering lock bracket. Remove ignition switch, steering lock and bracket.

Installation

To install, reverse removal procedure. Use NEW steering lock bracket and bolts. Temporarily install ignition switch and steering lock cylinder onto steering column. Ensure ignition switch functions normally, then tighten steering lock cylinder bolts. Tighten lock bolts until heads twist off. To complete installation, reverse removal procedure.

STEERING COLUMN

NOTE: Before removing, ensure wheels are in straight-ahead position and note steering wheel location for reassembly reference.

Removal

1) Remove steering wheel, horn pad and combination switch. See STEERING WHEEL & AIR BAG and COMBINATION SWITCH. Remove lower instrument panel covers and air ducts. Disconnect all electrical connectors to steering column.

2) Remove key interlock cable and slide lever (if equipped). Remove coupling bolt at steering gear. Remove cover bolts or retaining band. Remove steering column bracket bolts. Remove steering column assembly.

Installation

To install, reverse removal procedure. Ensure coupling is installed on steering gear so steering wheel will be centered.

OVERHAUL

STEERING COLUMN

Disassembly

Remove steering column. See STEERING COLUMN under REMOVAL & INSTALLATION. Remove joint assembly. See Fig. 3. Remove boot, cover and bearing. Remove snap ring, stopper and spacer. If removing steering lock, cut retaining screws with hacksaw. Remove steering lock and bracket.

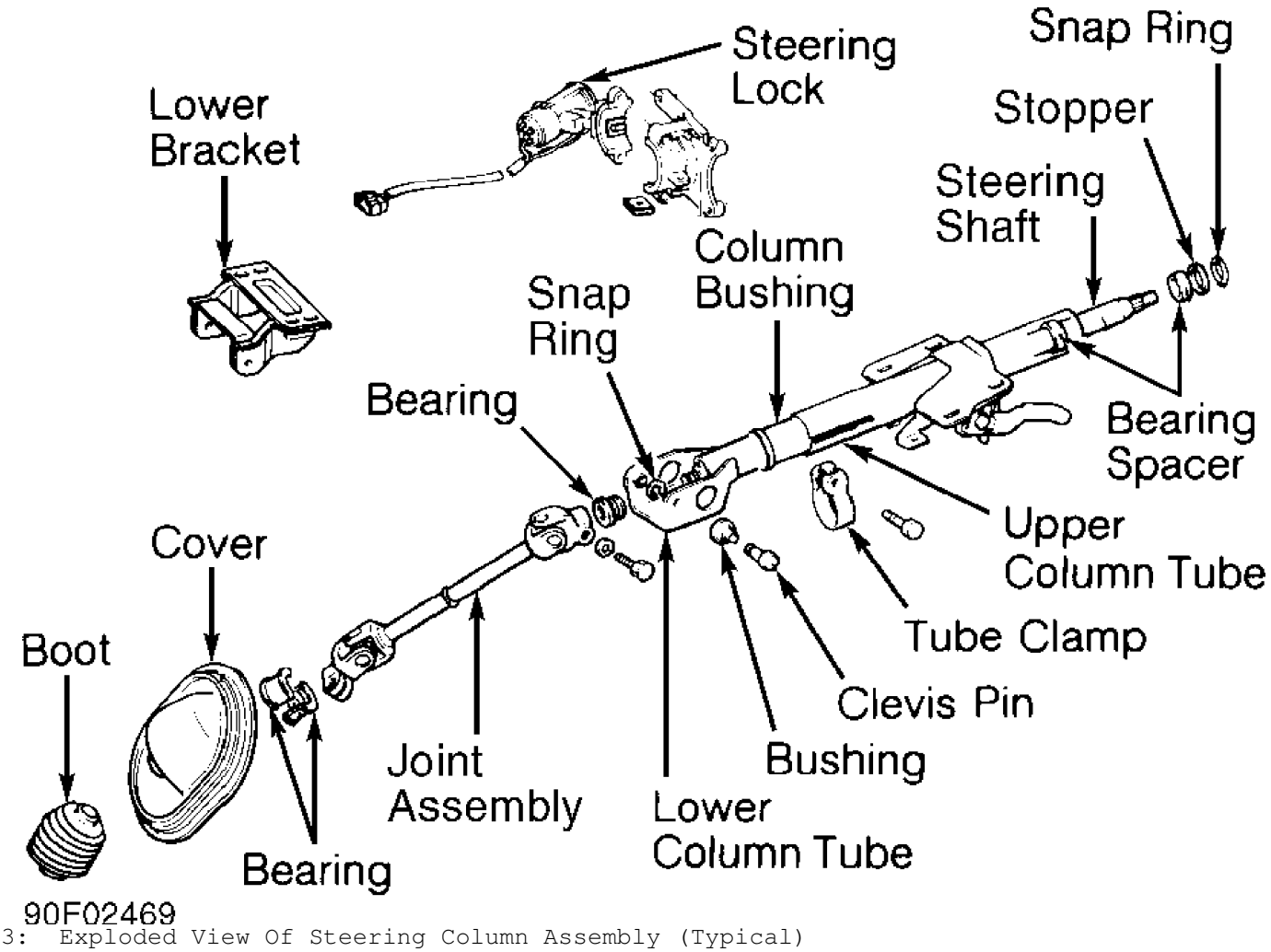


Fig. 3: Exploded View Of Steering Column Assembly (Typical)
Courtesy of Mitsubishi Motor Sales of America.

CAUTION: If steering lock is removed, use NEW steering lock bracket and bolts when assembling steering lock.

Reassembly

1) To reassemble, reverse disassembly procedure. Align steering lock with column boss. Ensure steering lock is operational. Tighten steering lock bracket bolt until bolt head breaks off.

2) Apply multipurpose grease to bearing spacer and lower column tube-to-shaft contact areas. Install cover on joint assembly. Fill inside of bearing with multi-purpose grease. Install bearing on joint assembly. Wrap tape around circumference of bearing approximately 1 1/2 times. Press bearings into cover.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Joint Clamp Bolt	13 (18)
Steering Wheel Nut	30 (41)

	INCH Lbs. (N.m)
Air Bag Module Nuts	48 (5)
Column Bracket Bolt	81 (12)
Dust Cover Bolt	43 (5)

STEERING COLUMN SWITCHES

1998 Mitsubishi Galant

1998 ACCESSORIES & EQUIPMENT
Mitsubishi - Steering Column Switches

Diamante, Eclipse, Galant, Mirage, Montero, Montero Sport, 3000GT

* PLEASE READ THIS FIRST *

WARNING: Deactivate air bag system before performing any service operation. See AIR BAG RESTRAINT SYSTEMS article. DO NOT apply electrical power to any component on steering column without first deactivating air bag system. Air bag may deploy.

DESCRIPTION

Headlight and turn signal switch and wiper/washer switch are part of combination switch. For information on cruise control switch (right side of column), see appropriate CRUISE CONTROL SYSTEMS article.

COMPONENT LOCATIONS

COMPONENT LOCATIONS TABLE

Component	Location
Headlight Relay	In Engine Compartment Fuse/Relay Block
Foglight Relay	
Except Montero & Montero Sport	In Engine Compartment Fuse/Relay Block
Taillight Relay	
Except Montero Sport	In Engine Compartment Fuse/Relay Block
Turn Signal/Hazard Flasher Unit	
Diamante	At Left Kick Panel
Eclipse	Behind Center Of Dash
Except Diamante & Eclipse	Behind Left Side Of Dash
Wiper Relay	
Front	
Except Diamante & 3000GT	On Steering Column
Rear	
Eclipse	Behind Center Of Dash
Montero & Montero Sport	On Relay Block, Behind Left Side Of Dash
3000GT	Behind Left Rear Quarter Panel

COMPONENT TESTS

DIAMANTE

Turn Signal, Lighting & Dimmer/Passing Switch Tests

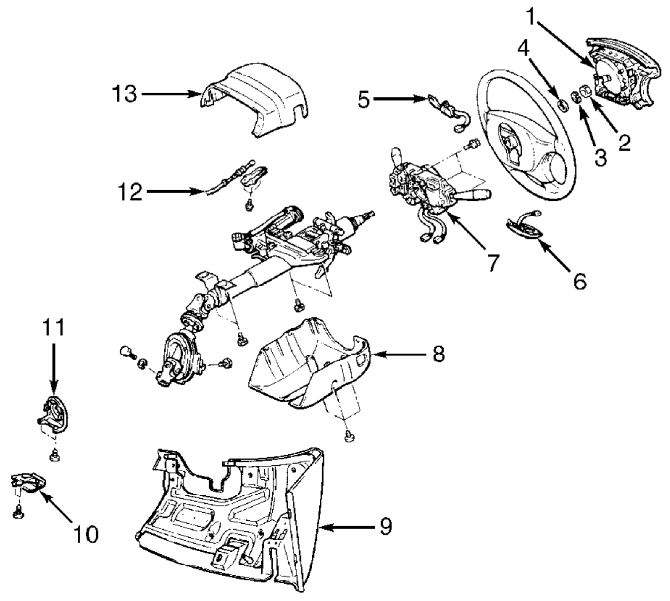
Disconnect steering column combination switch connector. See Fig. 1. Check continuity between specified terminals. See STEERING COLUMN COMBINATION SWITCH CONTINUITY CHECK TABLE (DIAMANTE).

If continuity is not as specified, replace steering column combination switch.

STEERING COLUMN COMBINATION SWITCH CONTINUITY CHECK TABLE (DIAMANTE)

Switch & Position	Check Continuity Between Terminals No.
Lights Switch (1)	
Foglight ON	3 & 7
Headlight ON	2, 5 & 8
Taillight ON	5 & 8
Dimmer Switch (2)	
Low Beam	3 & 4
High Beam	4 & 6
Passing	
Low Beam	1, 2 & 6; 3 & 4
High Beam	1, 2 & 6; 4 & 6
Turn Signal Switch (3)	
Left Turn	5 & 8
Right Turn	7 & 8

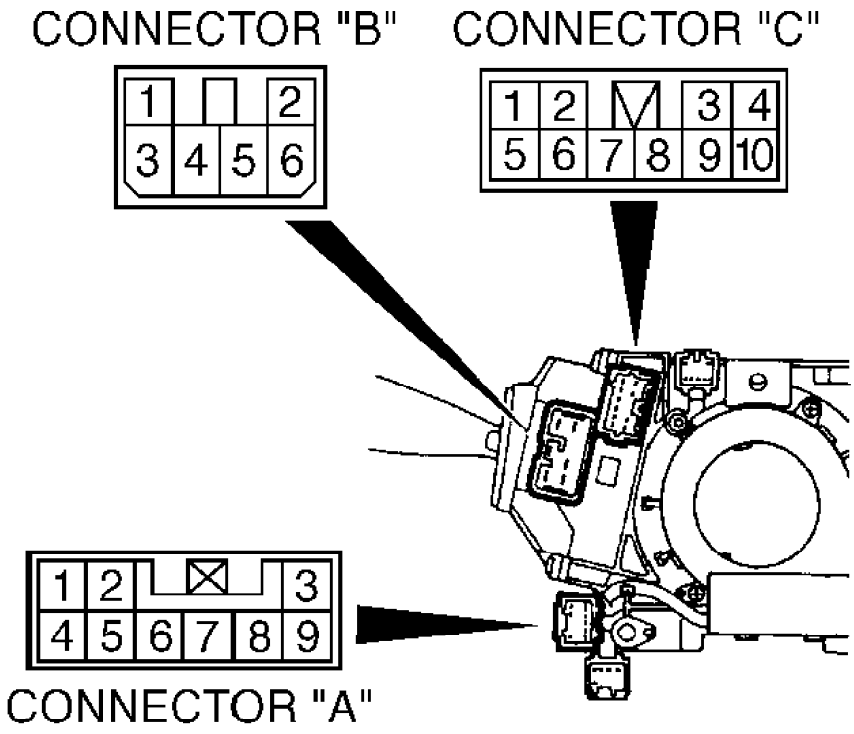
(1) - Check at connector "A". See Fig. 2.
(2) - Check at connector "B". See Fig. 2.
(3) - Check at connector "C". See Fig. 2.



1. Air Bag Module
2. Steering Wheel Nut
3. Spring Washer
4. Flat Washer
5. Cruise Control Switch
6. Remote Control Switch
7. Steering Column Combination Switch & Clockspring Assembly
8. Lower Steering Column Cover
9. Lower Instrument Panel Cover
10. Lock Release Handle
11. Key Cylinder Panel
12. Key/Shift InterLock Cable
13. Upper Steering Column Cover

97C11850

Fig. 1: Exploded View Of Steering Column (Diamante)
Courtesy of Mitsubishi Motor Sales of America



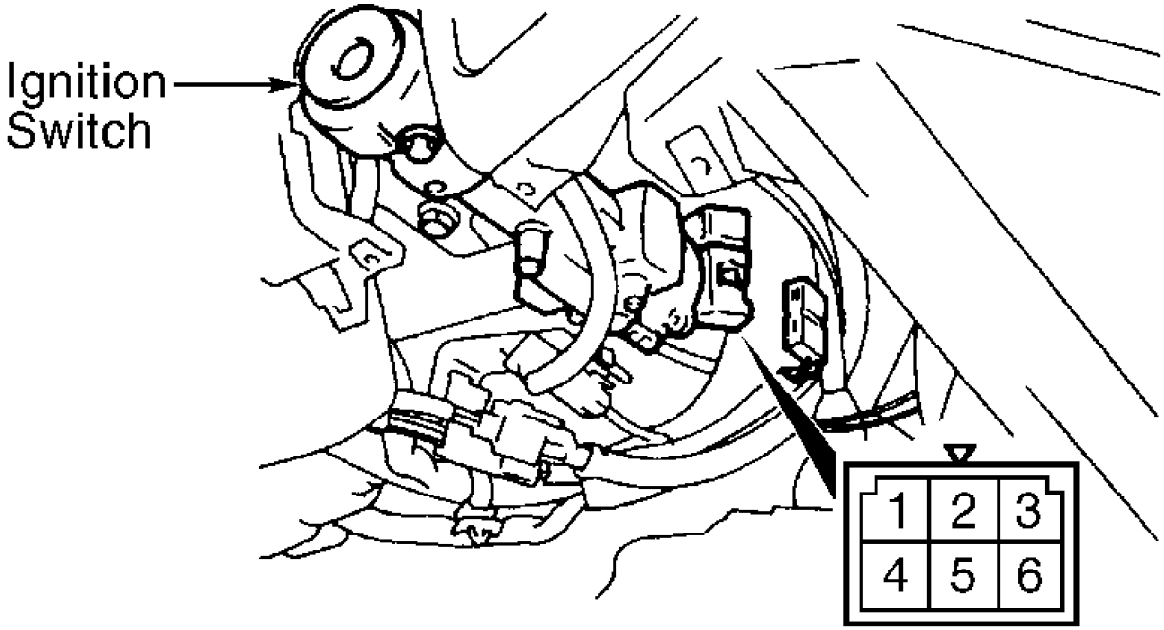
Switch position			Connector (A) terminal No.				Connector (B) terminal No.				
			2	5	8	9	1	2	3	4	6
OFF											
Lighting Switch	Position taillight			○	○						
	Headlight		○	○	○						
Dimmer Switch	Low-beam								○	○	
	High-beam									○	○
	PASSING	At low beam					○	○	○	○	○
		At high beam					○	○		○	○

97D11851

Fig. 2: Steering Column Switch Terminal Identification (Diamante)
Courtesy of Mitsubishi Motor Sales of America

Ignition Switch Test
Disconnect ignition switch connector. Check continuity

between specified terminals. See Figs. 1 and 3. If continuity is not as specified, replace ignition switch.



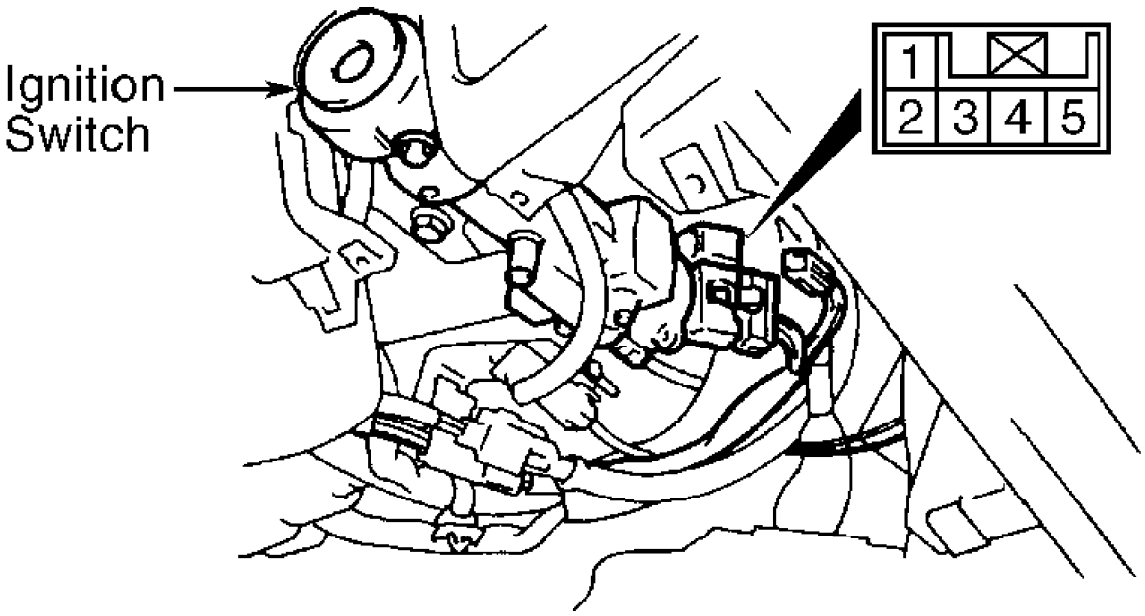
Ignition key position	Terminal No.					
	1	2	3	4	5	6
LOCK						
ACC	○					○
ON	○	○		○		○
START	○	○	○		○	

97E11852

Fig. 3: Testing Ignition Switch (Diamante)
Courtesy of Mitsubishi Motor Sales of America

Key Reminder Switch Test

Remove instrument panel lower cover. Disconnect key reminder switch harness connector. Check continuity between specified terminals with ignition key inserted and removed from ignition switch. See Fig. 4. If continuity is not as specified, replace key reminder switch.



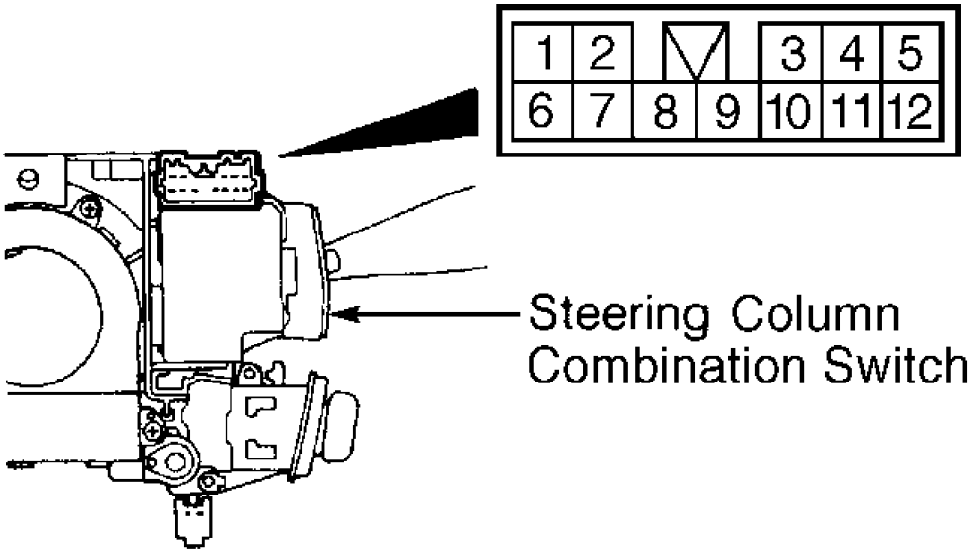
Ignition key	Terminal No.	
	Key reminder switch	
	2	5
Removed	○	○
Inserted		

97F11853

Fig. 4: Testing Key Reminder Switch (Diamante)
Courtesy of Mitsubishi Motor Sales of America

Wiper/Washer Switch Tests

Disconnect steering column combination switch connector. Check continuity between specified terminals. See Fig. 5. If continuity is not as specified, replace wiper/washer switch.



Switch position		Terminal Numbers						
		3	7	8	9	10	11	6
Wiper switch	OFF							
	INT		○				○	
	LO			○		○		
	HI				○	○		
Intermittent variable speed switch		○					○	
Washer switch ON						○		○

97G11854

Fig. 5: Testing Wiper/Washer Switch (Diamante)
Courtesy of Mitsubishi Motor Sales of America

ECLIPSE

Lighting & Turn Signal Switch Tests

Disconnect steering column combination switch connector. Check continuity between specified terminals. See Figs. 6 and 7. If continuity is not as specified, replace steering column combination switch.

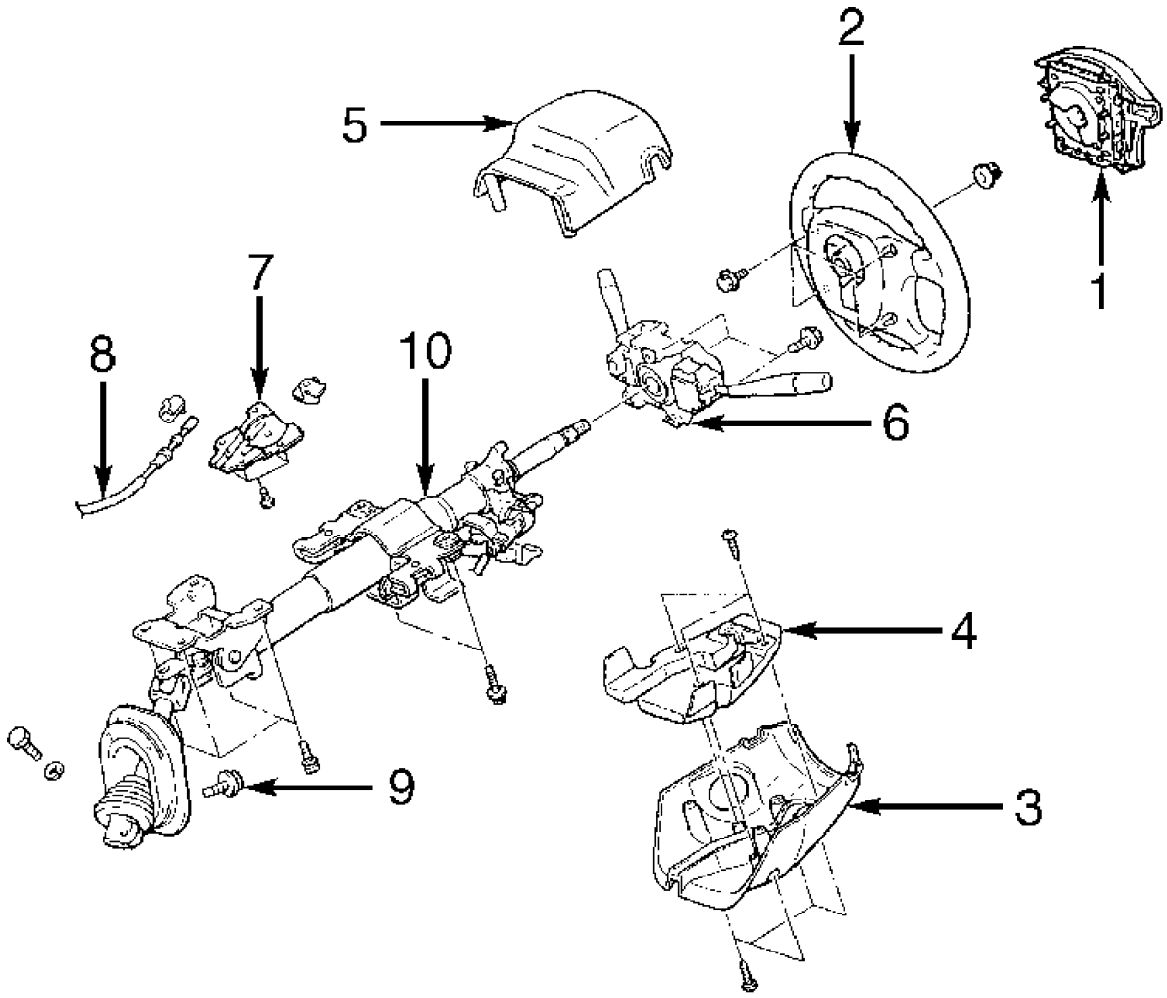
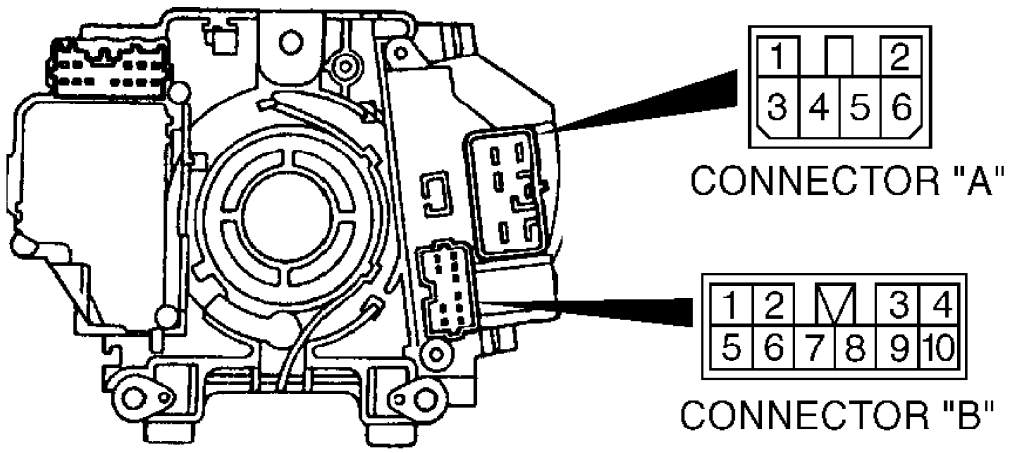


Fig. 6: Exploded View Of Steering Column (Eclipse)
Courtesy of Mitsubishi Motor Sales of America



Switch position		Connector A– terminal No.					Connector B– terminal No.					
		1	2	3	4	6	3	5	6	7	8	9
LIGHTING SWITCH	OFF											
	TAIL							○		○		
	HEAD	○						○	○	○		
DIMMER/ PASSING SWITCH	LOWER			○	○							
	UPPER				○	○						
	PASSING	○	○	○	*1 ○	*2 ○ ○						
TURN-SIGNAL LAMP SWITCH	RH										○	○
	OFF											
	LH						○				○	

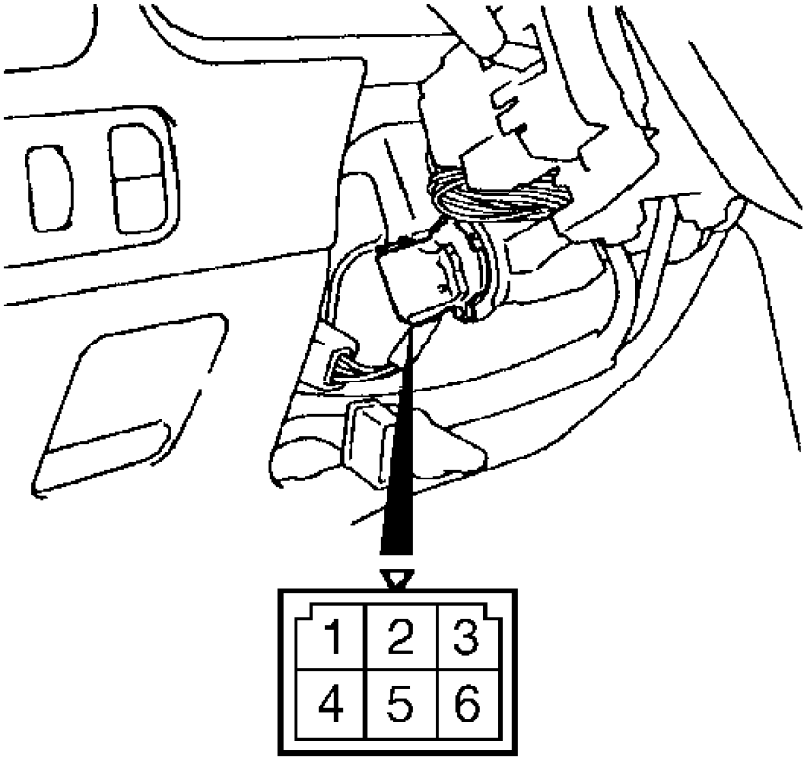
NOTE
1. *1 indicates continuity when the dimmer switch in the lower beam position.
2. *2 indicates continuity when the dimmer switch in the upper beam position.

97H11855

Fig. 7: Testing Lighting & Turn Signal Switches (Eclipse)
Courtesy of Mitsubishi Motor Sales of America

Ignition Switch Test
Disconnect ignition switch connector. Check continuity

between specified terminals. See Figs. 6 and 8. If continuity is not as specified, replace ignition switch.



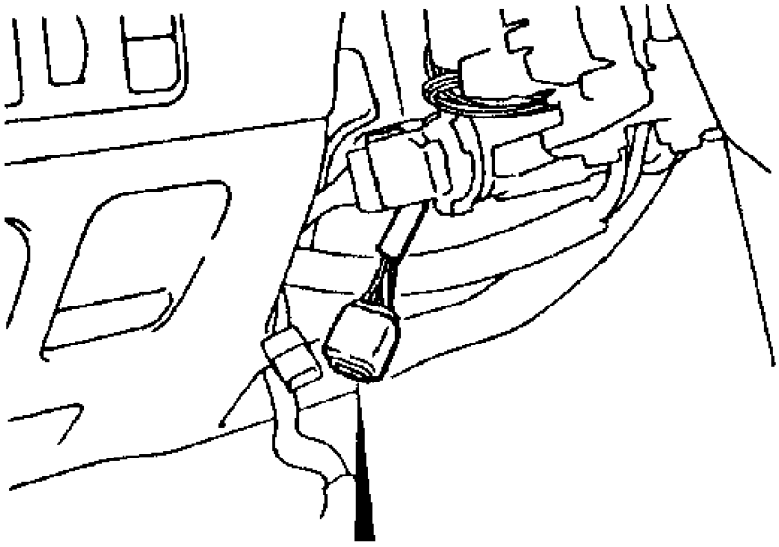
Ignition key position	Terminal No					
	1	2	3	4	5	6
LOCK						
ACC	○					○
ON	○	○		○		○
START	○	○	○		○	

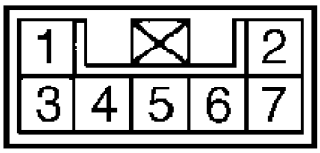
96G06953

Fig. 8: Testing Ignition Switch (Eclipse)
Courtesy of Mitsubishi Motor Sales of America

Key Reminder Switch Test

Disconnect key reminder switch connector. Check continuity between specified terminals. See Figs. 6 and 9. If continuity is not as specified, replace key reminder switch.





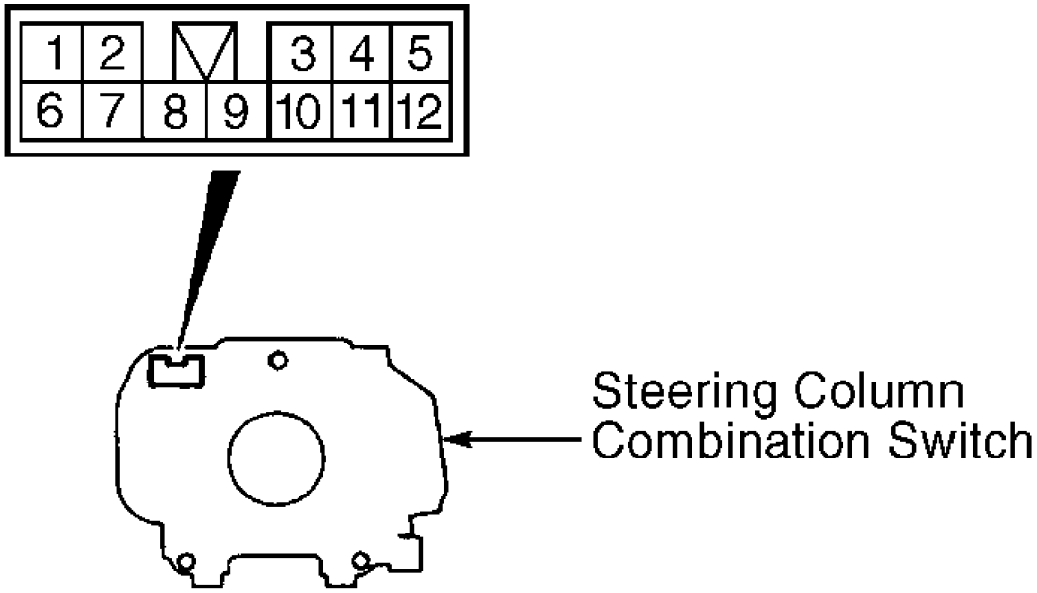
Ignition key position	Terminal No.			
	Key reminder switch		Key hole illumination light	
	4	6	1	2
Removed	○	○	○	○
Inserted				

96I06954

Fig. 9: Testing Key Reminder Switch (Eclipse)
Courtesy of Mitsubishi Motor Sales of America

Wiper/Washer Switch Tests

Disconnect steering column combination switch connector. Check continuity between specified terminals. See Figs. 6 and 10. If continuity is not as specified, replace wiper/washer switch.



Switch position		Terminal No.				
		6	7	8	9	10
Wiper switch	OFF		○	○		
	INT		○	○		
	1 (LO)			○		○
	2 (HI)				○	○
Washer switch	ON	○				○

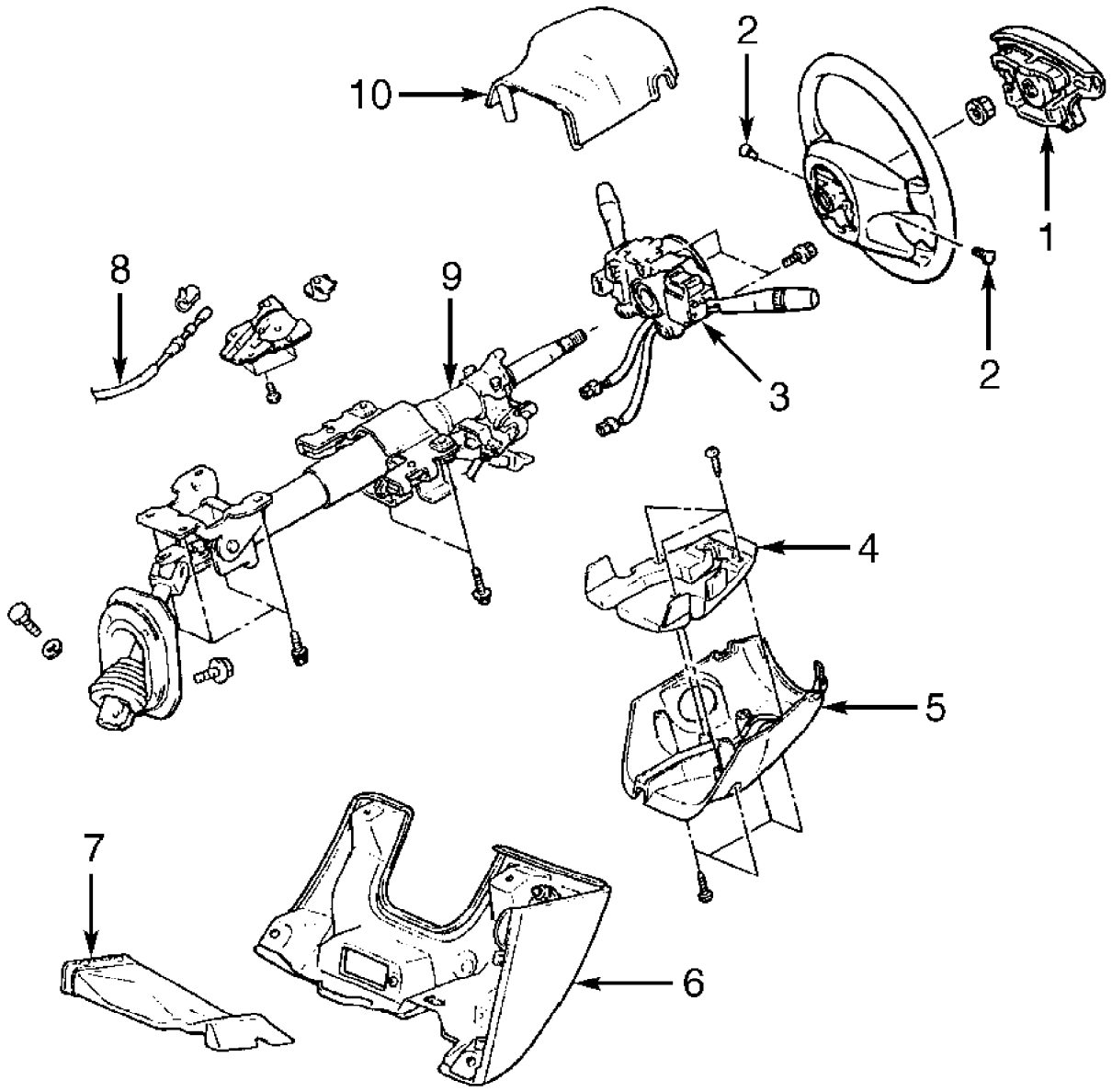
97I11856

Fig. 10: Testing Wiper/Washer Switch (Eclipse)
Courtesy of Mitsubishi Motor Sales of America

GALANT

Ignition Switch Tests

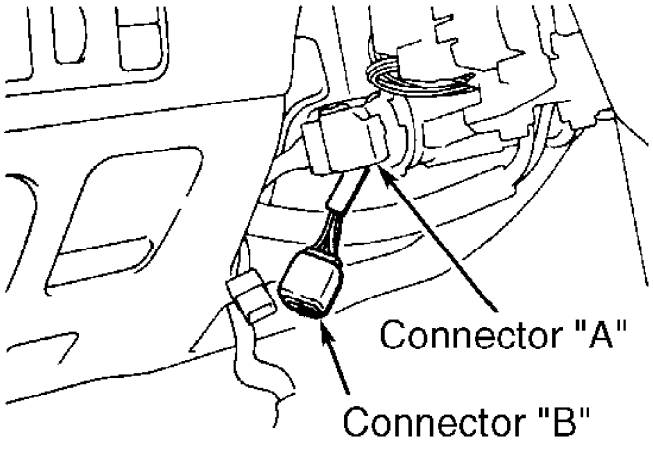
Disconnect ignition switch harness connector. Check continuity between specified terminals. See Figs. 11 and 12. If continuity is not as specified, replace ignition or key reminder switch.

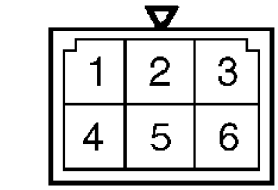


1. Air Bag Module
2. Air Bag Mounting Bolt
3. Steering Column Combination Switch & Air Bag Clockspring
4. Column Pad
5. Lower Steering Column Cover
6. Lower Instrument Panel Cover
7. Foot Duct
8. Key Interlock Cable (A/T)
9. Steering Column Assembly
10. Upper Steering Column Cover

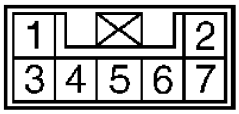
97J11857

Fig. 11: Exploded View Of Steering Column (Galant)
Courtesy of Mitsubishi Motor Sales of America





CONNECTOR "A"



CONNECTOR "B"

IGNITION SWITCH (CONNECTOR "A")

Terminal No. / Ignition key position	1	2	3	4	5	6
LOCK						
ACC	○					○
ON	○	○		○		○
START	○	○	○		○	

NOTE
○—○ indicates that there is continuity between the terminals.

KEY REMINDER SWITCH (CONNECTOR "B")

Terminal No. / Ignition key	Key reminder switch		Key hole illumination light	
	4	6	1	2
Removed	○	○	○—○—○	
Inserted				

NOTE
○—○ indicates that there is continuity between the terminals.

96I06671

Fig. 12: Testing Ignition Switch & Key Reminder Switch (Galant)
Courtesy of Mitsubishi Motor Sales of America

Key Reminder Switch Tests
Disconnect key reminder switch connector. Check continuity

between specified terminals. See Fig. 12. If continuity is not as specified, replace key reminder switch.

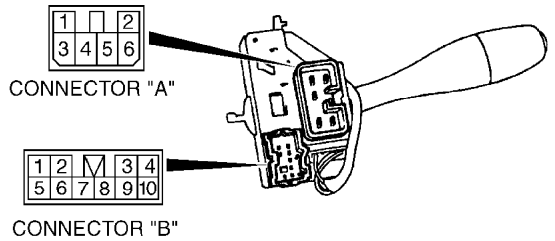
Lighting & Turn Signal Switch Tests

Disconnect steering column combination switch connector. Check continuity between specified terminals. See STEERING COLUMN COMBINATION SWITCH CONTINUITY CHECK TABLE (GALANT). See Figs. 11 and 13. If continuity is not as specified, replace steering column combination switch.

STEERING COLUMN COMBINATION SWITCH CONTINUITY CHECK TABLE (GALANT)

Switch & Position	Check Continuity Between Terminals No.
Lights Switch	
Headlight ON	(1) 1 & (2) 6; (2) 5 & (2) 7
Taillight ON (2)	5 & 7
Dimmer Switch (1)	
Low Beam	4 & 6
High Beam	3 & 4
Passing	
Low Beam	1, 2 & 6; 3 & 4
High Beam	1, 2 & 6; 4 & 6
Turn Signal Switch (2)	
Left Turn	3 & 8
Right Turn	8 & 9

(1) - Check at connector "A". See Fig. 13.
(2) - Check at connector "B". See Fig. 13.



Switch position		Connector A-terminal No.					Connector B-terminal No.					
		1	2	3	4	6	3	5	6	7	8	9
LIGHTING SWITCH	OFF											
	TAIL							○		○		
	HEAD	○						○	○	○		
DIMMER/ PASSING SWITCH	HI			○	○							
	LOW				○	○						
	PASSING	○	○	○ *1	○ *2	○						

NOTE
1. *1 indicates that the dimmer switch has continuity at the low-beam position.
2. *2 indicates that the dimmer switch has continuity at the high-beam position.

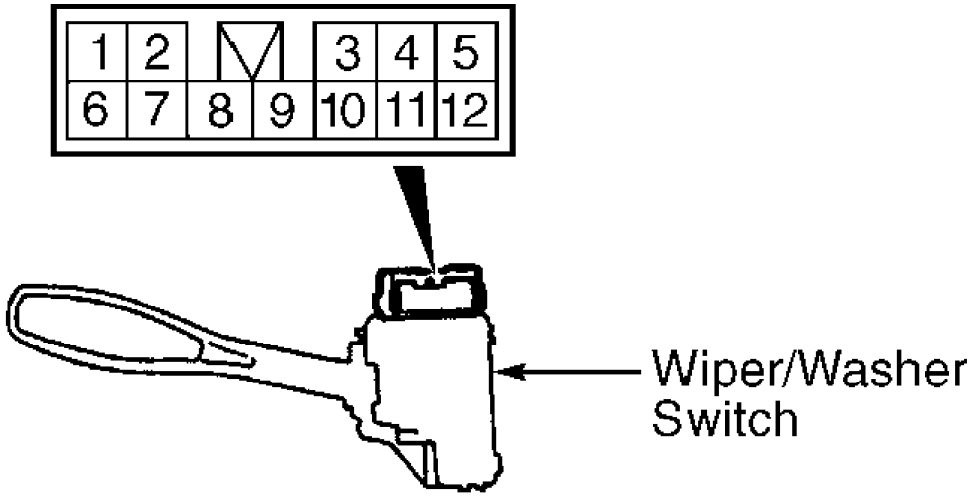
97B11859

Fig. 13: Identifying Lighting & Turn Signal Switches (Galant)
Courtesy of Mitsubishi Motor Sales of America

Wiper/Washer Switch Tests

Disconnect steering column combination switch connector.

Check continuity between specified terminals. See Figs. 11 and 14. If continuity is not as specified, replace wiper/washer switch.



Switch position		Terminal No.				
		6	7	8	9	10
Wiper switch	OFF		○	○		
	INT		○	○		
	1 (LO)			○		○
	2 (HI)				○	○
Washer switch	ON	○				○

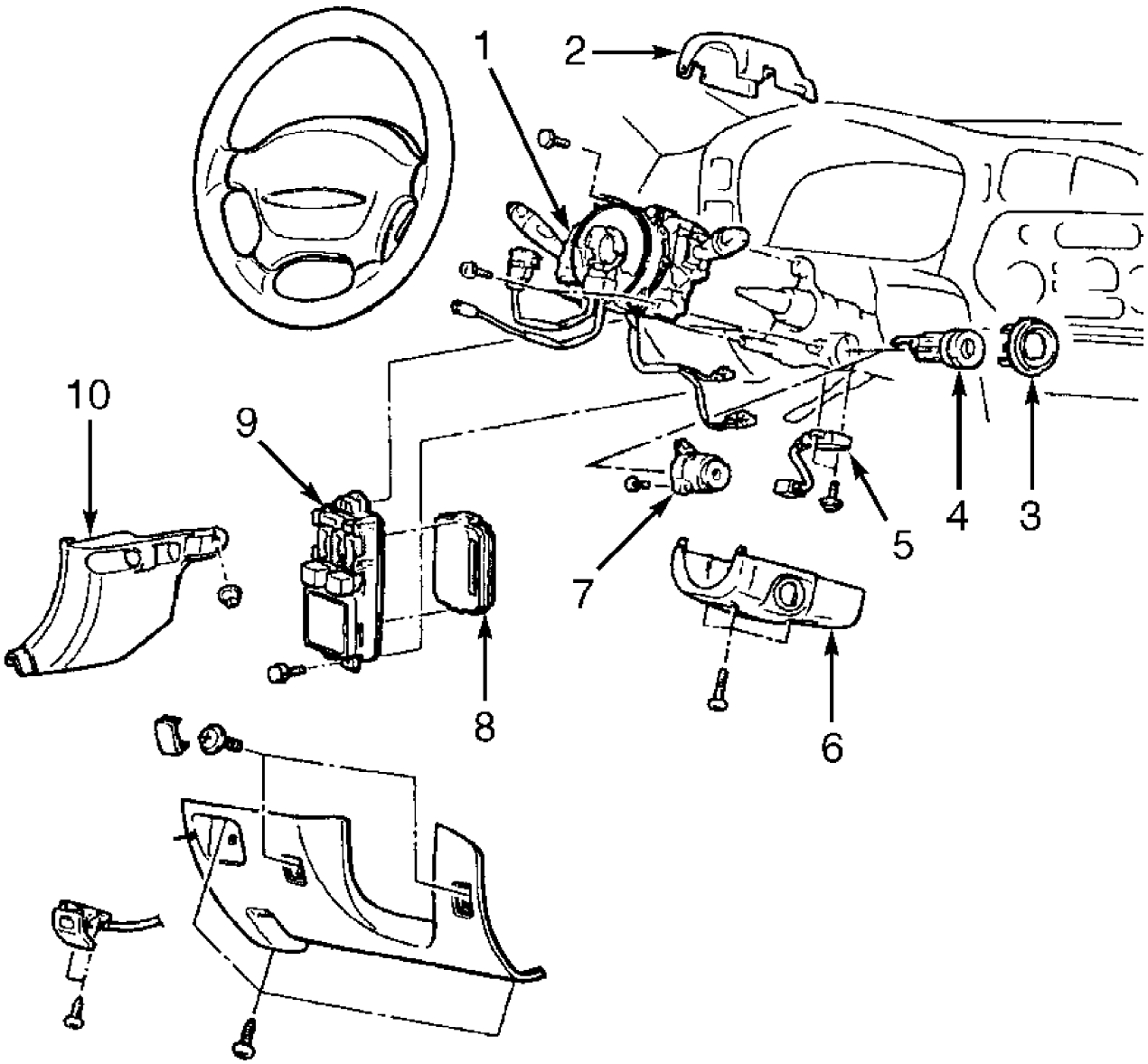
97E11860

Fig. 14: Testing Wiper/Washer Switch (Galant & Mirage)
Courtesy of Mitsubishi Motor Sales of America

MIRAGE

Ignition Switch Test

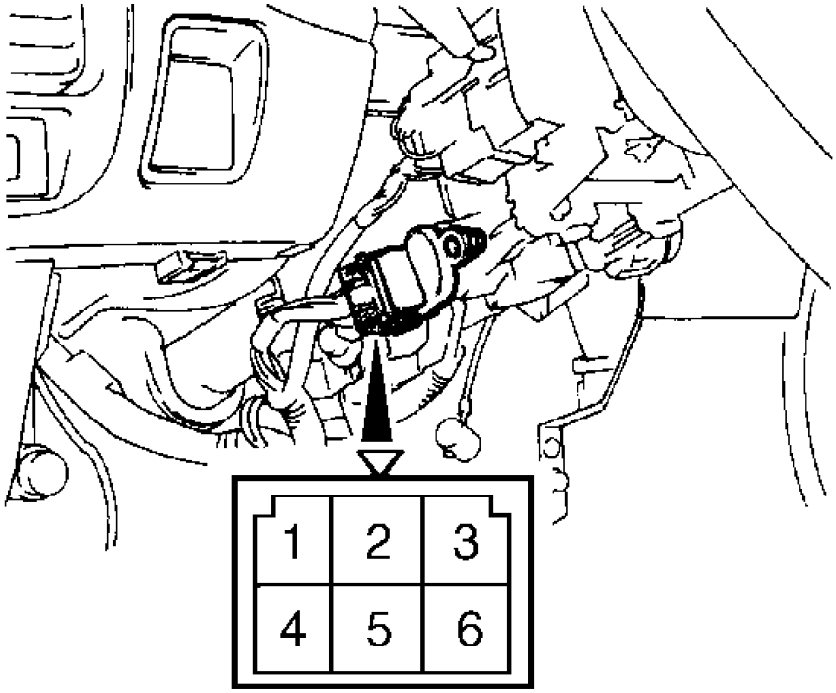
Disconnect ignition switch connector. Check continuity between specified terminals. See Figs. 15 and 16. If continuity is not as specified, replace ignition switch.



1. Steering Column Combination Switch & Air Bag Clockspring
2. Upper Steering Column Cover
3. Ignition Switch Ring Cover
4. Steering Lock Cylinder
5. Key Reminder Switch
6. Lower Steering Column Cover
7. Ignition Switch
8. ETACS-ECU
9. Fuse/Relay Block
10. Left Trim Panel

97H11871

Fig. 15: Exploded View Of Steering Column (Mirage)
Courtesy of Mitsubishi Motor Sales of America



IGNITION SWITCH

Terminal / Ignition key position	1	2	3	4	5	6
LOCK						
ACC		○			○	
ON	○	○	○		○	
START		○	○	○		○

NOTE
○–○ indicates that there is continuity between the terminals.

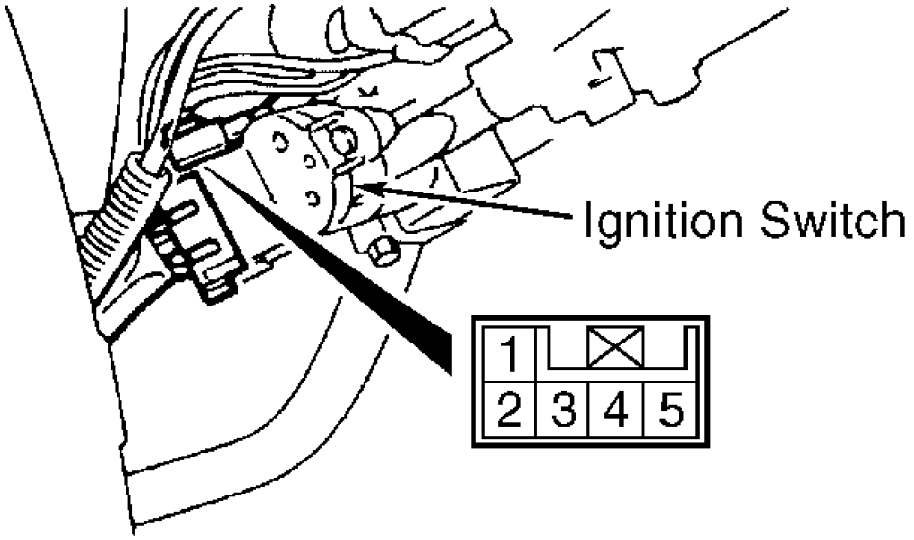
96F06679

Fig. 16: Testing Ignition Switch (Mirage)
Courtesy of Mitsubishi Motor Sales of America

Key Reminder Switch Test

Disconnect key reminder switch connector. Check continuity between specified terminals. See Fig. 17. If continuity is not as

specified, replace key reminder switch.



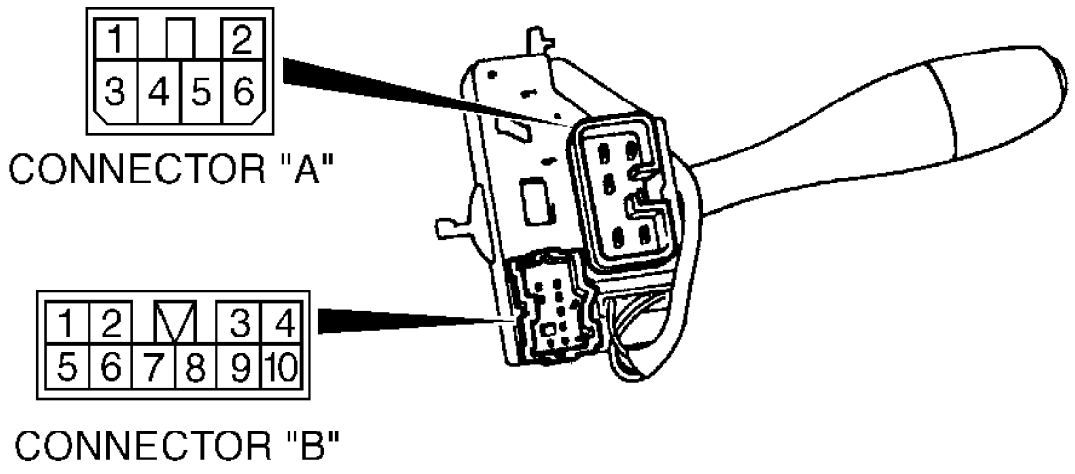
Ignition key	Terminal No.	
	2	5
Removed	○	○
Inserted		

97F11861

Fig. 17: Testing Key Reminder Switch (Mirage)
Courtesy of Mitsubishi Motor Sales of America

Lighting & Turn Signal Switch Tests

Disconnect steering column combination switch connector. Check continuity between specified terminals. See Figs. 15 and 18. If continuity is not as specified, replace steering column combination switch.



Switch position		Connector A– terminal No.					Connector B– terminal No.					
		1	2	3	4	6	3	5	6	7	8	9
LIGHTING SWITCH	OFF											
	TAIL							○		○		
	HEAD	○						○	○	○		
DIMMER/ PASSING SWITCH	HI			○	○							
	LOW				○	○						
	PASSING	○	○	○	○ *1 ○	○ *2						
TURN-SIGNAL LIGHT SWITCH	RH										○	○
	OFF											
	LH						○				○	

NOTE

1. *1 indicates continuity when the dimmer switch is at the low beam position.
2. *2 indicates continuity when the dimmer switch is at the high beam position.

97G11862

Fig. 18: Testing Lighting & Turn Signal Switches (Mirage)
Courtesy of Mitsubishi Motor Sales of America

Wiper/Washer Switch Tests

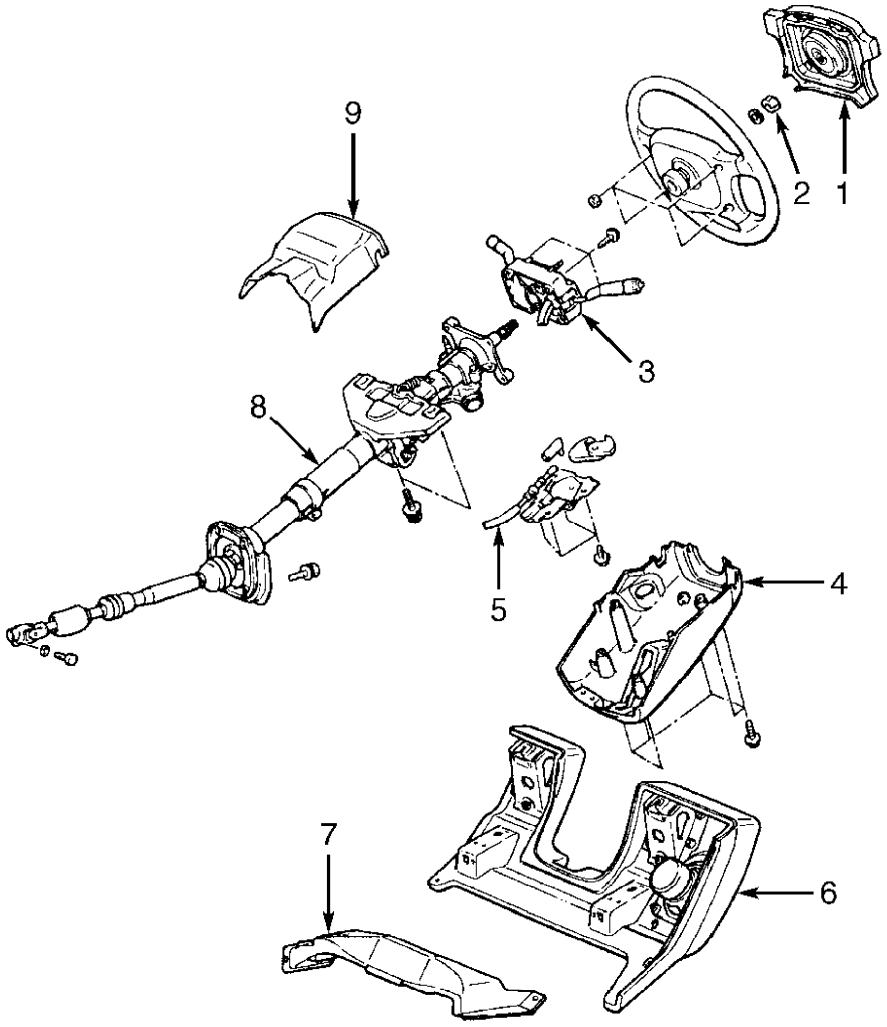
Disconnect steering column combination switch connector.

Check continuity between specified terminals. See Fig. 14. If continuity is not as specified, replace wiper/washer switch.

MONTERO

Ignition Switch & Key Reminder Switch Tests

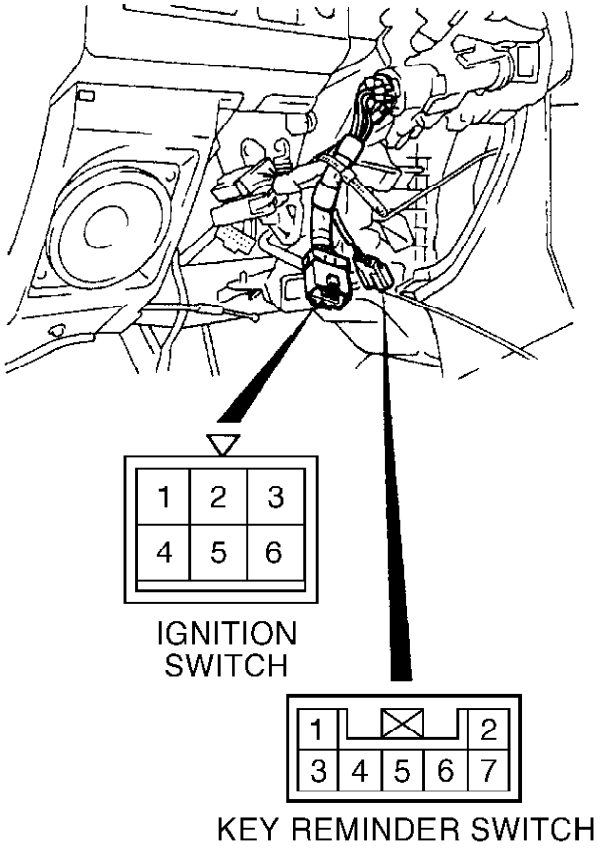
Disconnect ignition switch and key reminder switch connectors. Check continuity between specified terminals. See Figs. 19 and 20. If continuity is not as specified, replace ignition switch or key reminder switch.



1. Air Bag Module
2. Steering Wheel Nut
3. Steering Column Combination Switch & Clockspring Assembly
4. Lower Steering Column Cover
5. Key Interlock Cable
6. Lower Instrument Panel Cover
7. Foot Duct
8. Steering Column Assembly
9. Upper Steering Column Cover

97I11864

Fig. 19: Exploded View Of Steering Column (Montero)
Courtesy of Mitsubishi Motor Sales of America



IGNITION SWITCH

Position	Terminal					
	1	2	3	4	5	6
LOCK						
ACC	○					○
ON	○	○		○		○
START	○	○	○		○	

KEY REMINDER SWITCH

Key	Key reminder switch terminal		Key hole illumination light terminal	
	4	6	1	2
Removed	○	○	○	○
Inserted				

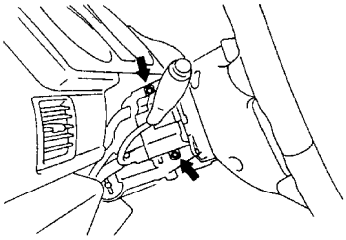
96A06950

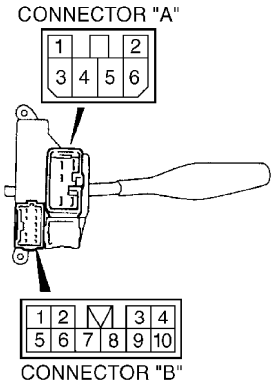
Fig. 20: Testing Ignition Switch & Key Reminder Switch (Montero)
Courtesy of Mitsubishi Motor Sales of America

Lighting & Turn Signal Switch Tests

Disconnect steering column combination switch connector.

Check continuity between specified terminals. See Figs. 19 and 21. If continuity is not as specified, replace steering column combination switch.





LIGHTING SWITCH

Switch position	Connector A terminal	Connector B terminal		
	1	5	6	7
OFF				
TAIL		○		○
HEAD	○	○	○	○

DIMMER SWITCH

Switch position	Connector A terminal		
	3	4	6
LOW BEAM	○	○	
HIGH BEAM		○	○

PASSING SWITCH

Switch position	Connector A terminal				
	1	2	3	4	6
P1	○	○	○	○	○
P2	○	○		○	○

TURN SIGNAL LIGHT SWITCH

Switch position	Connector B terminal					
	1	3	4	8	9	10
R.H.				○	○	
OFF						
L.H.		○		○		

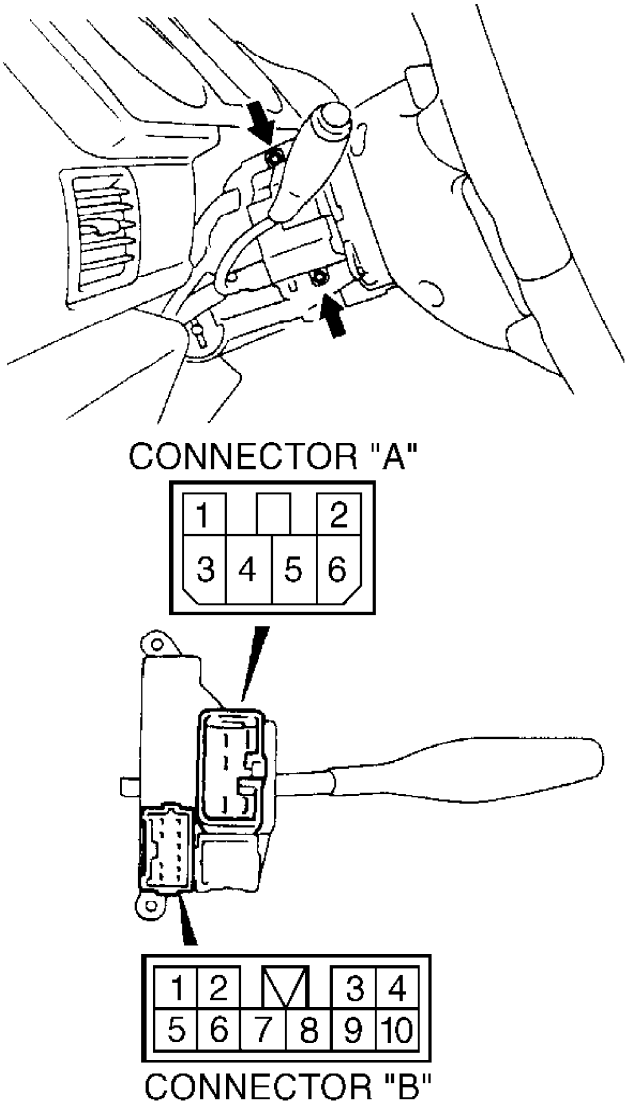
96I06949

Fig. 21: Testing Lighting & Turn Signal Switches (Montero)
Courtesy of Mitsubishi Motor Sales of America

Headlight Washer Switch Test

Disconnect steering column combination switch connector.

Check continuity between specified terminals. See Figs. 19 and 22. If continuity is not as specified, replace steering column combination switch.



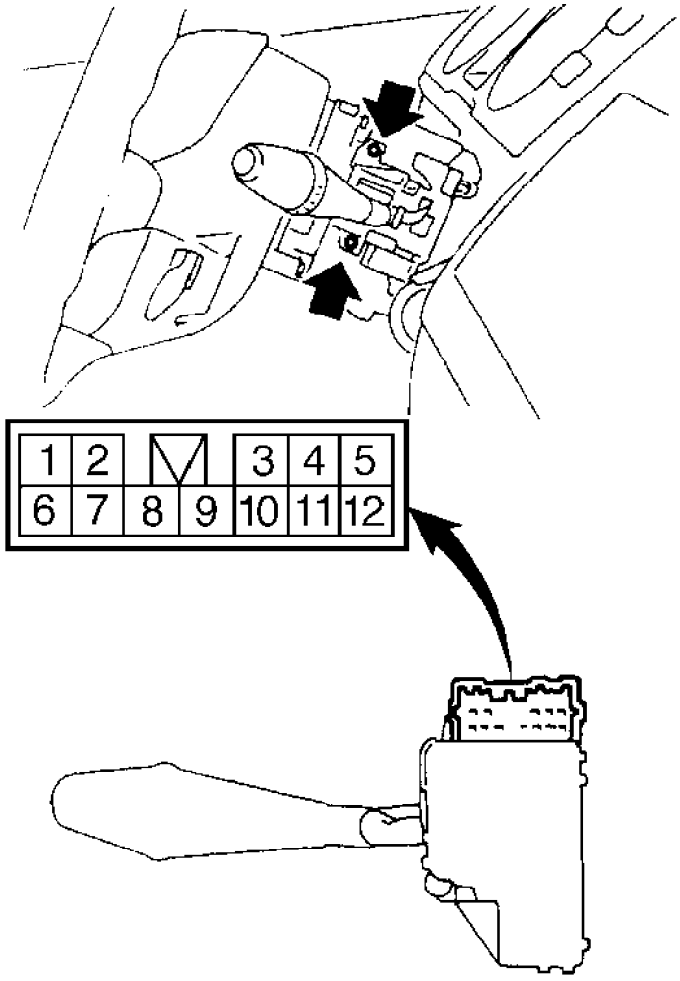
Switch position	Connector A terminal	Connector B terminal
	1	2
OFF		
ON	○	○

96H06958

Fig. 22: Testing Headlight Washer Switch (Montero)
Courtesy of Mitsubishi Motor Sales of America

Rear Wiper Switch Test
Disconnect steering column combination switch connector.

Check continuity between specified terminals. See Figs. 19 and 23. If continuity is not as specified, replace steering column combination switch.



Switch position		Terminal			
		2	3	4	10
Wiper switch	OFF				
	INT		○		○
	ON			○	○
Washer switch	ON	○			○

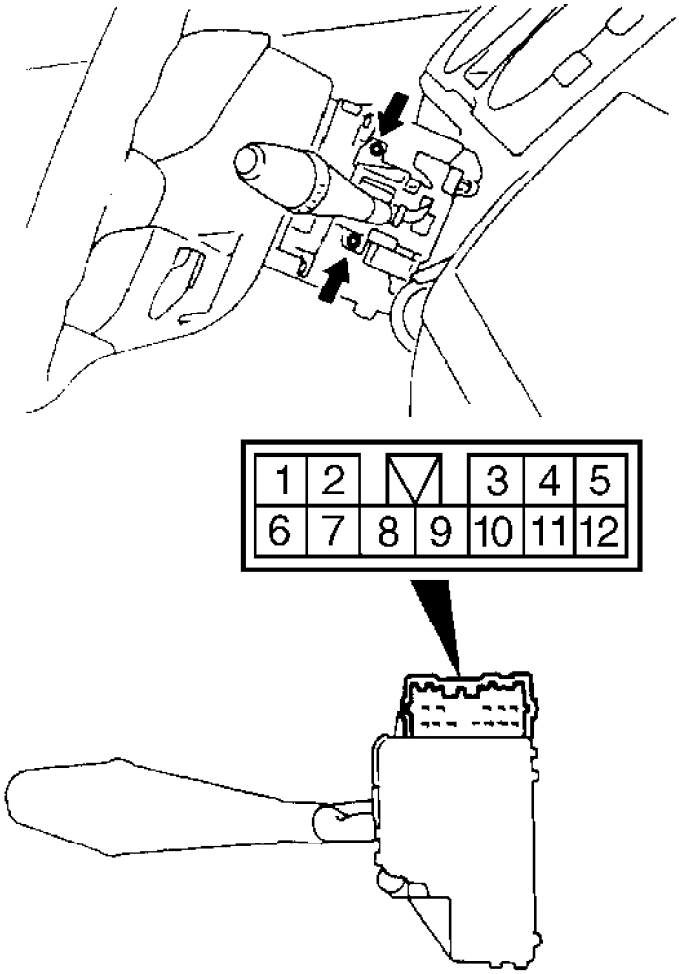
96G06948

Fig. 23: Testing Rear Wiper Switch (Montero)
Courtesy of Mitsubishi Motor Sales of America

Wiper/Washer Switch Test

Disconnect steering column combination switch connector.

Check continuity between specified terminals. See Figs. 19 and 24. If continuity is not as specified, replace steering column combination switch.



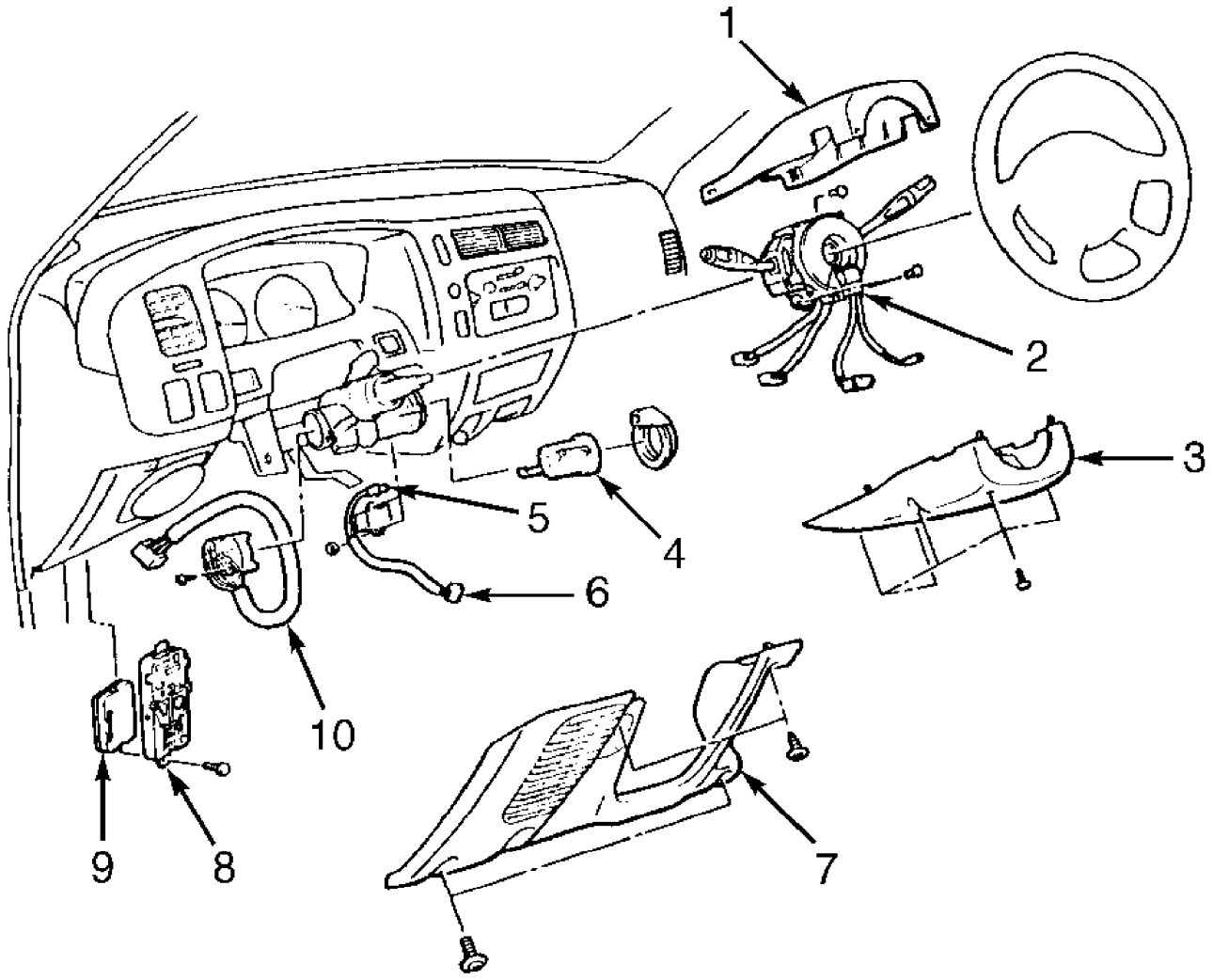
Switch position		Terminal				
		6	7	8	9	10
Wiper switch	OFF		○	○		
	1 (LO)			○		○
	2 (HI)				○	○
Washer switch	ON	○				○

96A06945

Fig. 24: Testing Wiper/Washer Switch (Montero)
Courtesy of Mitsubishi Motor Sales of America

Ignition Switch Test

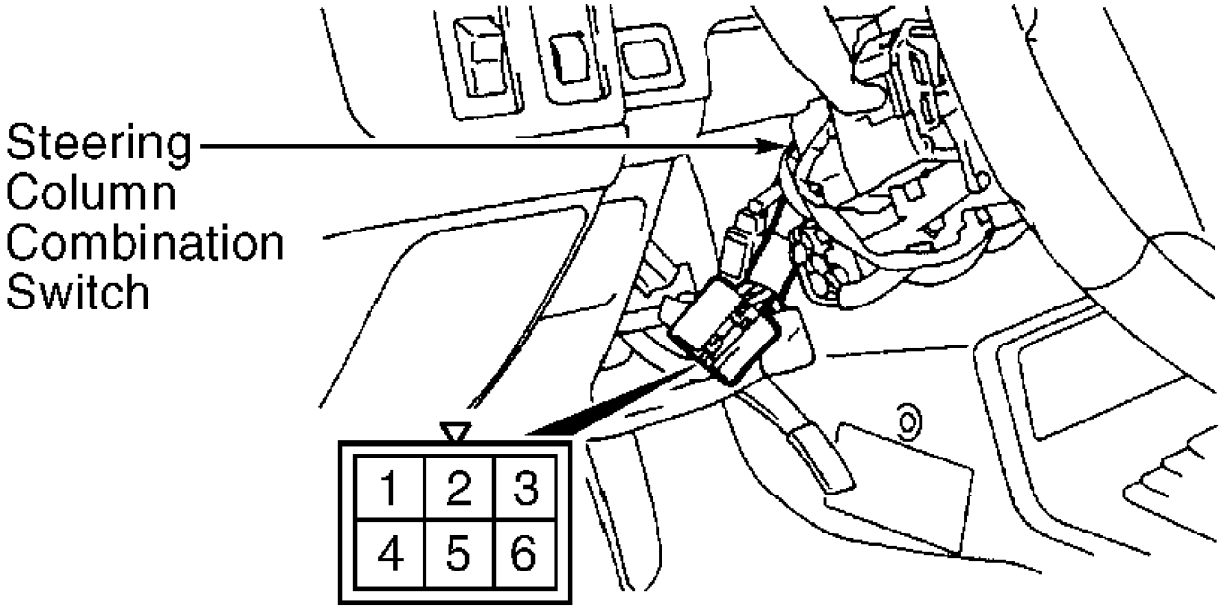
Disconnect ignition switch connectors. Check continuity between specified terminals. See Figs. 25 and 26. If continuity is not as specified, replace ignition switch.



1. Upper Steering Column Cover
2. Steering Column Combination Switch & Clockspring Assembly
3. Lower Steering Column Cover
4. Steering Lock Cylinder
5. Key Hole Illumination Light
6. Key Reminder Switch
7. Lower Instrument Panel Cover
8. Fuse/Relay Block
9. ETACS-ECU
10. Ignition Switch

97J11865

Fig. 25: Exploded View Of Steering Column (Montero Sport)
Courtesy of Mitsubishi Motor Sales of America



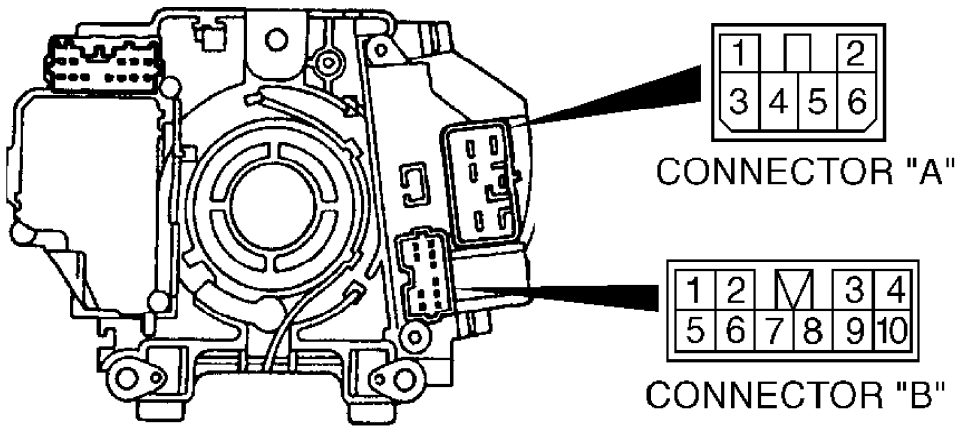
IGNITION KEY POSITION	TERMINAL NO.				
	1	2	4	5	6
LOCK					
ACC	○	—	—	—	○
ON	○	○	○	—	○
START	○	○	—	○	—

97A11866

Fig. 26: Testing Ignition Switch (Montero Sport)
Courtesy of Mitsubishi Motor Sales of America

Lighting & Turn Signal Switch Tests

Disconnect steering column combination switch connector. Check continuity between specified terminals. See Figs. 25 and 27. If continuity is not as specified, replace steering column combination switch.



SWITCH POSITION		CONNECTOR A-TERMINAL NO.					CONNECTOR B-TERMINAL NO.					
		1	2	3	4	6	3	5	6	7	8	9
LIGHTING SWITCH	OFF											
	TAIL							○		○		
	HEAD	○						○	○	○		
DIMMER/ PASSING SWITCH	LOWER			○	○							
	UPPER				○	○						
	PASSING	○	○	○	○	○*						
					○	○						

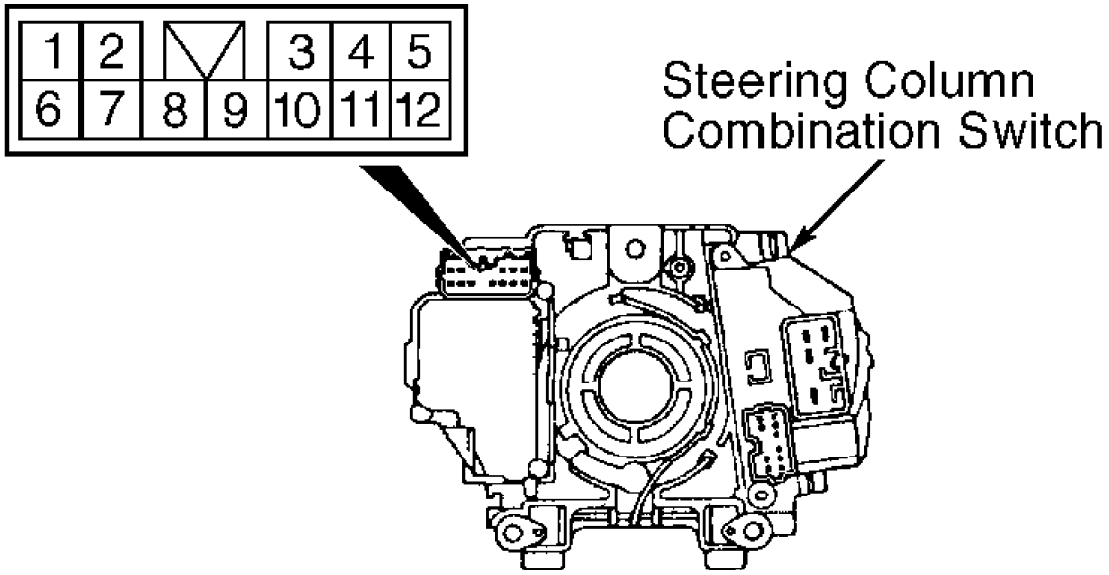
NOTE
* indicates continuity with the dimmer switch in the lower beam position.

SWITCH POSITION		TERMINAL NO.				
		3	5	7	8	9
TURN-SIGNAL LIGHT SWITCH	RH				○	○
	OFF					
	LH	○			○	

97B11867
Fig. 27: Testing Lighting & Turn Signal Switches (Montero Sport)
Courtesy of Mitsubishi Motor Sales of America

Front Wiper/Washer Switch Test
Disconnect steering column combination switch connector.

Check continuity between specified terminals. See Figs. 25 and 28. If continuity is not as specified, replace steering column combination switch.



SWITCH POSITION		TERMINAL NO.				
		6	7	8	9	10
WIPER SWITCH	OFF		○	○		
	INTER-MITTENT		○	○		
	1 (LOW)			○		○
	2 (HIGH)				○	○
WASHER SWITCH	ON	○				○

97C11868

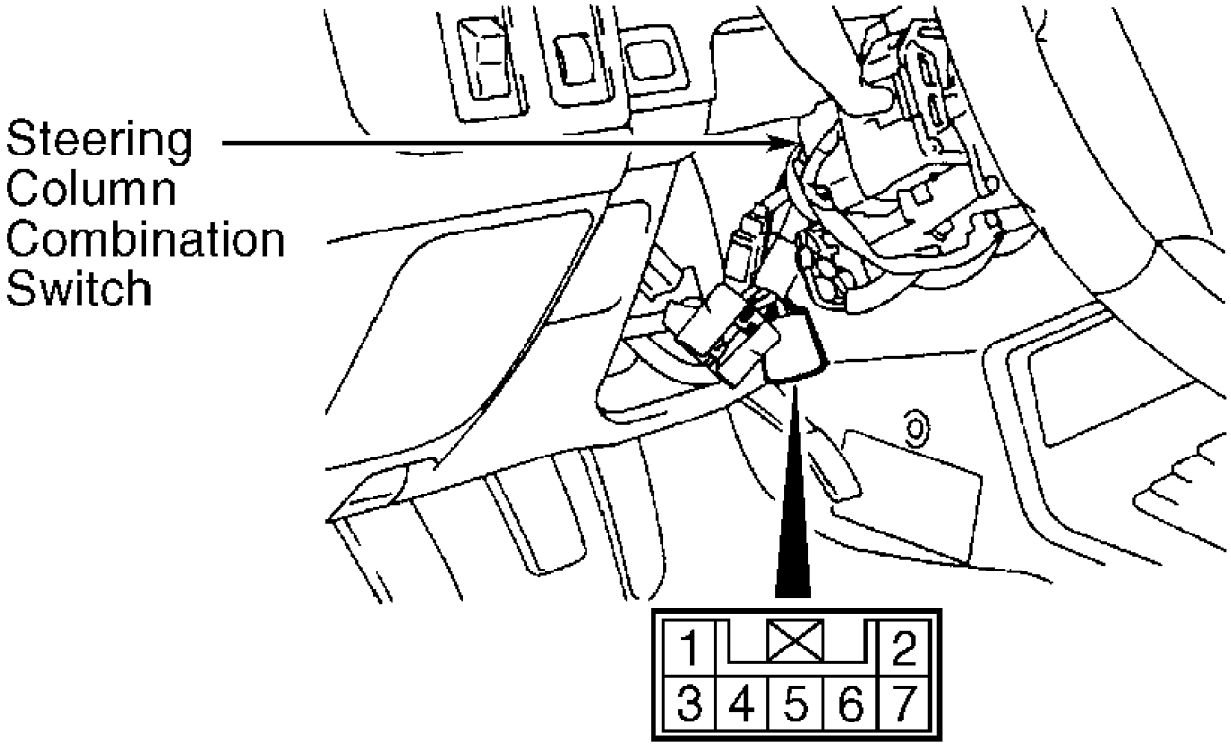
Fig. 28: Front Wiper/Washer Switch (Montero Sport)
Courtesy of Mitsubishi Motor Sales of America

Key Reminder Switch Test

Disconnect key reminder switch connectors. Check continuity between specified terminals. See Figs. 25 and 29. If continuity is not as specified, replace key reminder switch.

Rear Wiper/Washer Switch Test

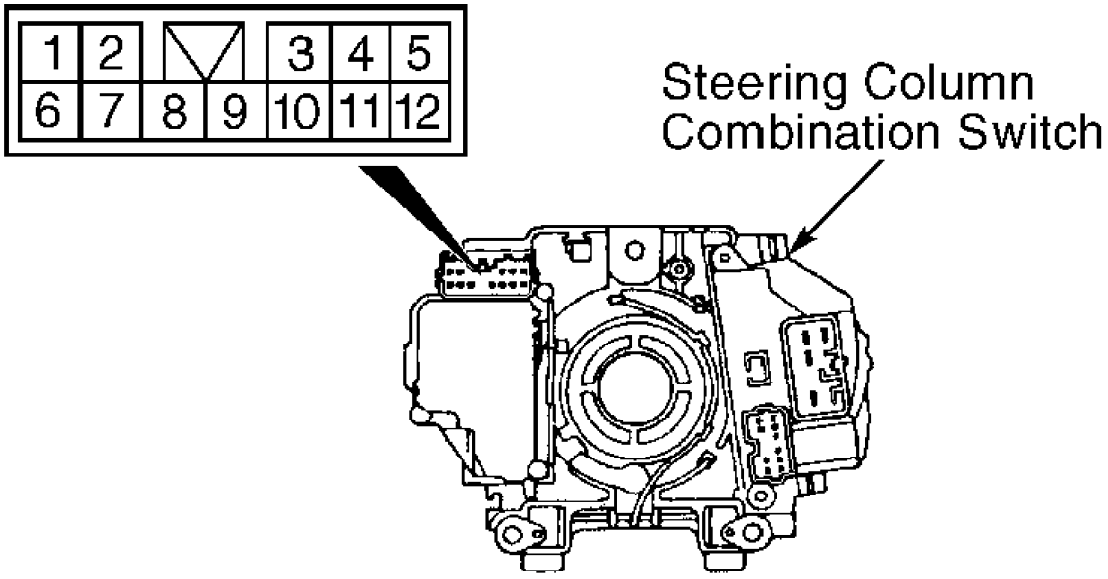
Disconnect steering column combination switch connector. Check continuity between specified terminals. See Fig. 30. If continuity is not as specified, replace steering column combination switch.



IGNITION KEY POSITION	TERMINAL NO.				
	1		2	4	6
PULLED OUT		ILL			
INSERTED		ILL			

97D11869

Fig. 29: Testing Key Reminder Switch (Montero Sport)
Courtesy of Mitsubishi Motor Sales of America



SWITCH POSITION		TERMINAL NO.			
		2	3	4	10
WIPER SWITCH	INTERMITTENT		○		○
	ON			○	○
WASHER SWITCH	ON	○		○	○

97G11870

Fig. 30: Testing Rear Wiper/Washer Switch (Montero Sport)
Courtesy of Mitsubishi Motor Sales of America

3000GT

Lighting, Turn Signal & Dimmer/Passing Switch Tests

Disconnect steering column combination switch connector. Check continuity between specified terminals. See Figs. 31 and 32. If continuity is not as specified, replace steering column combination switch.

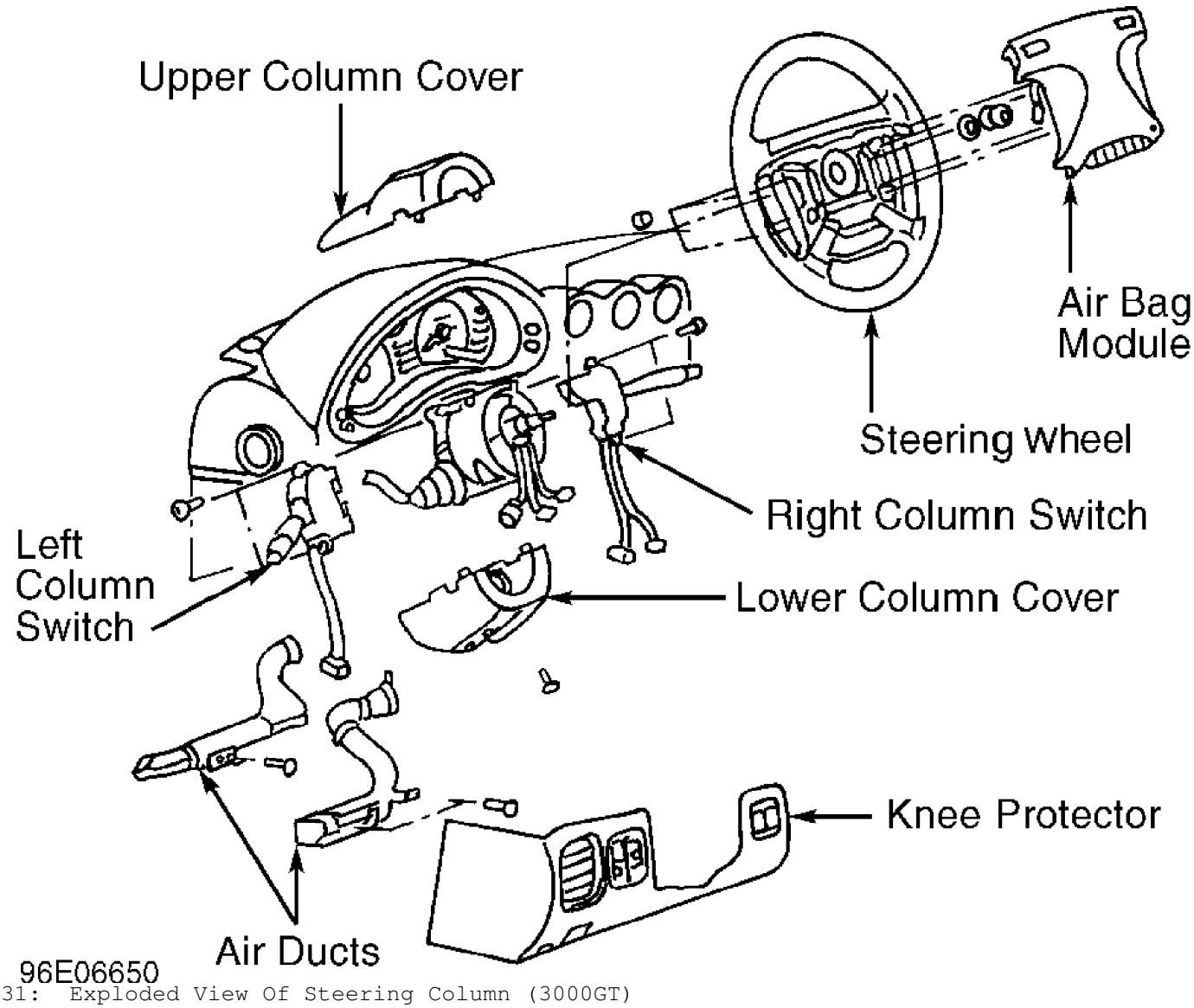
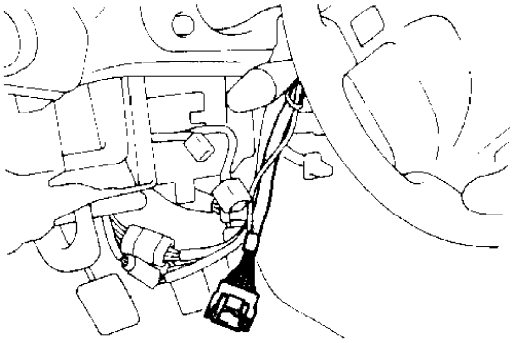


Fig. 31: Exploded View Of Steering Column (3000GT)
Courtesy of Mitsubishi Motor Sales of America

COLUMN SWITCH CONNECTOR



1	2	3	4	5	6	7	8
9	10	11	12	13	14	15	16

LIGHTING SWITCH

Switch position \ Terminal	3	5	6	7	10	14
OFF						
		●	●		●	●
	●	●		●	●	●

TURN SIGNAL SWITCH

Switch position \ Terminal	1	12	13
Left	●		●
Neutral			
Right	●	●	

DIMMER/PASSING SWITCH

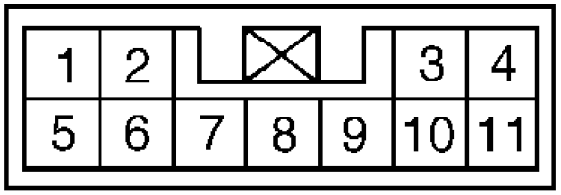
Switch position \ Terminal		2	8	9	16
Dimmer switch	LOW			●	●
	HIGH		●	●	
Passing switch		●	●	●	

96I06652

Fig. 32: Testing Lighting, Turn Signal & Dimmer/Passing Switches (3000GT)
Courtesy of Mitsubishi Motor Sales of America

Ignition Switch & Key Reminder Switch Tests

Disconnect ignition switch and key reminder switch connectors. Check continuity between specified terminals. See Figs. 31 and 34. If continuity is not as specified, replace ignition switch or key reminder switch.

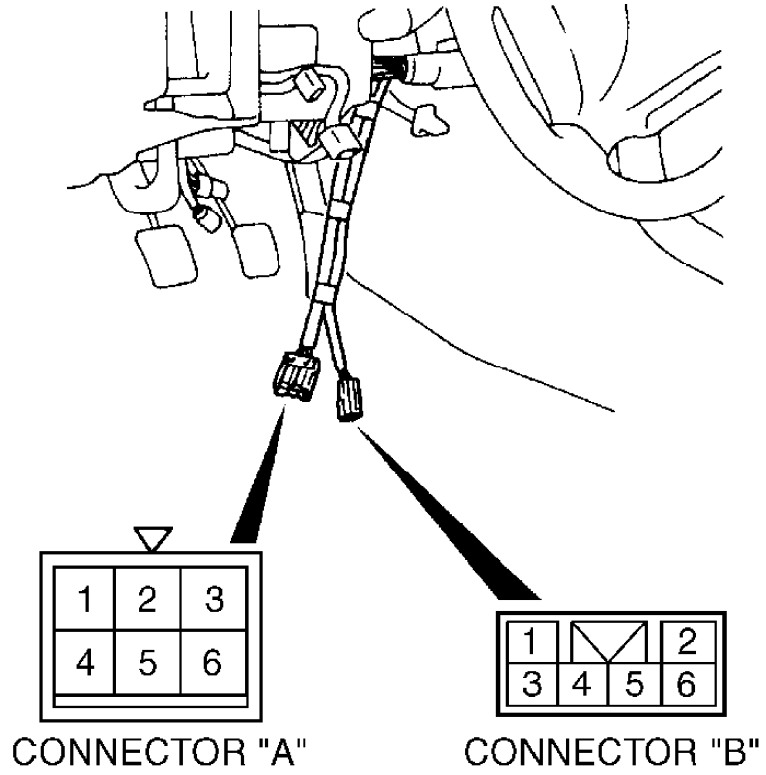


Switch position \ Terminal No.		3	4	5	6	7	8	9	10
Wiper switch	OFF				○				○
	INT	○			○			○	○
	LO			○	○				
	HI			○		○			
Variable intermittent wiper control switch			○					○	
Washer switch				○			○		

NOTE
○—○ denotes that there is continuity between the terminals.

96H06656

Fig. 33: Testing Front Wiper/Washer Switch (3000GT)
Courtesy of Mitsubishi Motor Sales of America



Position	Key	Connector A						Connector B				Connector B	
		Ignition switch terminal No.						Key reminder switch terminal No.				Ignition key illumination light terminal No.	
		1	2	3	4	5	6	1	2	3	6	4	5
LOCK	Removed									○—○			
	Installed												
ACC				○			○						
ON			○	○	○		○	○	○				
START		○			○	○	○						

97A11858

Fig. 34: Testing Ignition Switch & Key Reminder Switch (3000GT)
Courtesy of Mitsubishi Motor Sales of America

Wiper/Washer Switch Test (Front)
Disconnect steering column combination switch connector.

Check continuity between specified terminals. See Figs. 31 and 33. If continuity is not as specified, replace steering column combination switch.

REMOVAL & INSTALLATION

* PLEASE READ THIS FIRST *

WARNING: Deactivate air bag system before performing any service operation. See AIR BAG RESTRAINT SYSTEMS article. DO NOT apply electrical power to any component on steering column without first deactivating air bag system. Air bag may deploy.

IGNITION SWITCH

Removal & Installation (Diamante)

Remove instrument panel lower cover. Remove upper and lower steering column covers. See Fig. 1. Remove ignition switch. To install, reverse removal procedure.

Removal & Installation (Eclipse)

1) Remove knee protector mount screw plugs. Remove knee protector. Remove hood lock release handle. Remove upper and lower steering column covers. See Fig. 6. Remove ignition key illumination light.

2) Remove steering lock cylinder. Remove A/C-heater system lap cooler and shower ducts. On A/T models, remove key interlock cable and slide lever. On all models, remove ignition switch. To install, reverse removal procedure.

Removal & Installation (Galant)

Remove knee protector. Remove upper and lower column covers. See Fig. 11. Remove ignition switch. To install, reverse removal procedure.

Removal & Installation (Mirage)

Remove knee protector. Remove steering column cover. See Fig. 15. Remove clip and cover. On A/T models, remove key interlock cable, spring and slide lever. On all models, remove ignition switch. To install, reverse removal procedure.

Removal & Installation (Montero & Montero Sport)

Remove lower instrument panel cover. Remove upper and lower column covers. See Fig. 19 or 25. Remove ignition switch. To install, reverse removal procedure.

Removal & Installation (3000GT)

Remove knee protector. Remove upper and lower steering column covers. See Fig. 31. Remove A/C-heater system lap cooler duct and foot duct. Remove key reminder switch. Remove ignition switch. To install, reverse removal procedure.

STEERING COLUMN SWITCH

CAUTION: DO NOT hammer on steering shaft. Collapsible steering column mechanism may be damaged.

Removal & Installation (Diamante)

Remove air bag module. See AIR BAG RESTRAINT SYSTEMS article. Remove steering wheel. Remove instrument panel lower cover. Remove upper and lower steering column covers. See Fig. 1. Remove steering

column switch. To install, reverse removal procedure.

Removal & Installation (Eclipse)

Remove air bag module. See AIR BAG RESTRAINT SYSTEMS article. Remove horn pad and steering wheel. Remove hood lock release handle. Remove column pad and upper and lower column covers. See Fig. 6. Remove A/C-heater system lap cooler duct and foot shower duct. Remove steering column switch. To install, reverse removal procedure.

Removal & Installation (Galant)

Remove air bag module. See AIR BAG RESTRAINT SYSTEMS article. Remove steering wheel. Remove column pad. Remove foot duct. Remove upper and lower steering column covers. See Fig. 11. Remove steering column switch. To install, reverse removal procedure.

Removal & Installation (Mirage)

Remove air bag module. See AIR BAG RESTRAINT SYSTEMS article. Remove steering wheel. Remove hood release handle. Remove knee protector. Remove upper and lower steering column covers. See Fig. 15. Remove steering column switch. To install, reverse removal procedure.

Removal & Installation (Montero)

Remove air bag module. See AIR BAG RESTRAINT SYSTEMS article. Remove steering wheel. Remove foot duct. Remove lower instrument panel cover. Remove upper and lower steering column covers. See Fig. 19. Remove steering column switch. To install, reverse removal procedure.

Removal & Installation (Montero Sport)

Remove air bag module. See AIR BAG RESTRAINT SYSTEMS article. Remove steering wheel. Remove instrument panel lower cover. Remove upper and lower steering column covers. See Fig. 25. Remove steering column switch. To install, reverse removal procedure.

Removal & Installation (3000GT)

Remove air bag module. See AIR BAG RESTRAINT SYSTEMS article. Remove steering wheel. Remove knee protector. Remove upper and lower steering column covers. Remove A/C-heater system lap cooler duct and foot duct. Remove left or right steering column switch. See Fig. 31. To install, reverse removal procedure.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS TABLE

Application	Ft. Lbs. (N.m)
Steering Wheel Nut	
Diamante, Montero, Montero Sport & 3000GT	29 (39)
Eclipse, Galant & Mirage	30 (41)
	INCH Lbs. (N.m)
Air Bag Module Bolts/Nuts	
Diamante, Eclipse & Mirage	53 (6.0)
Galant & Montero	80 (9.0)
Montero Sport	78 (8.8)
3000GT	39 (4.4)

WIRING DIAGRAMS

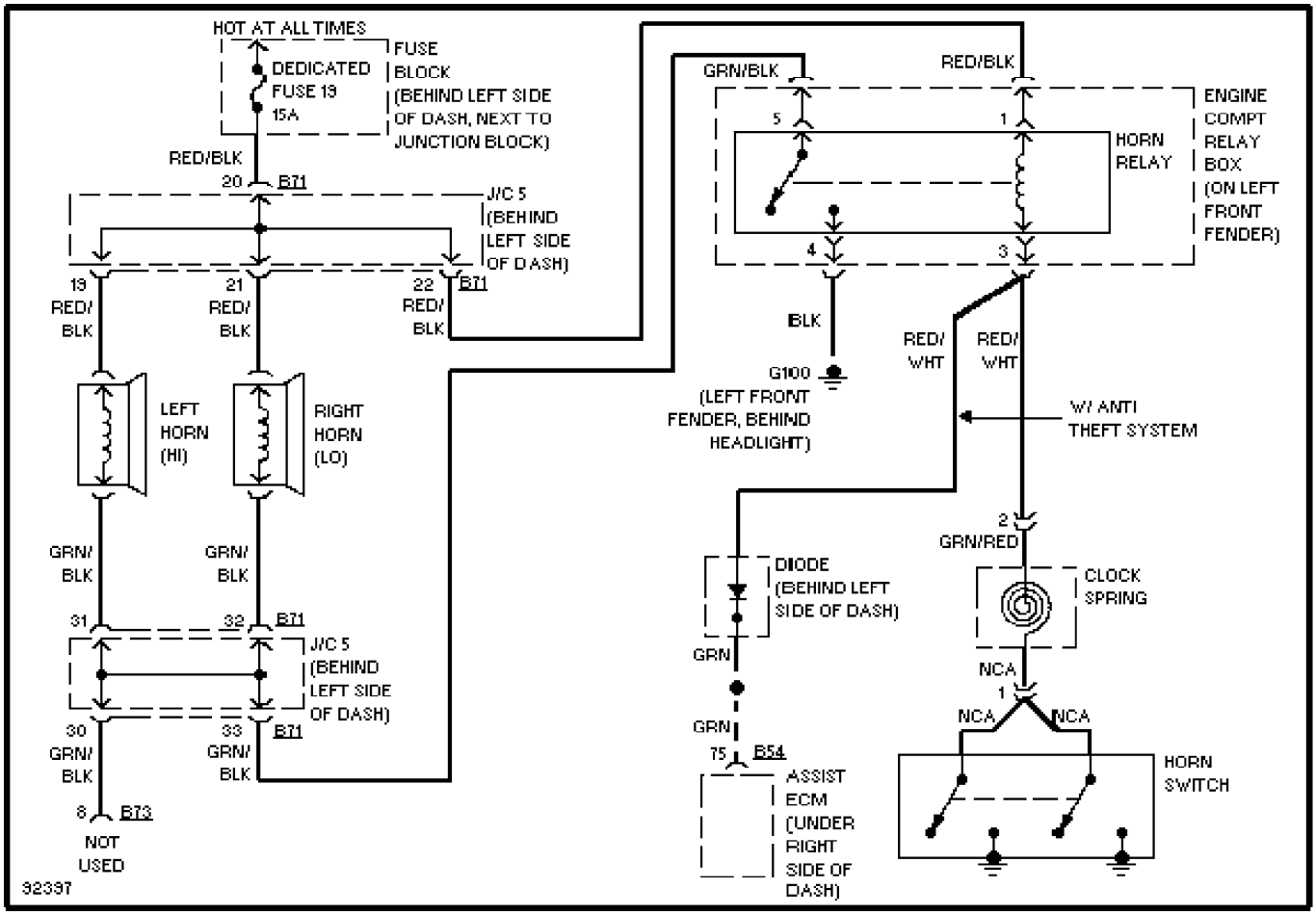


Fig. 35: Horn Circuit Wiring Diagram (Diamante)

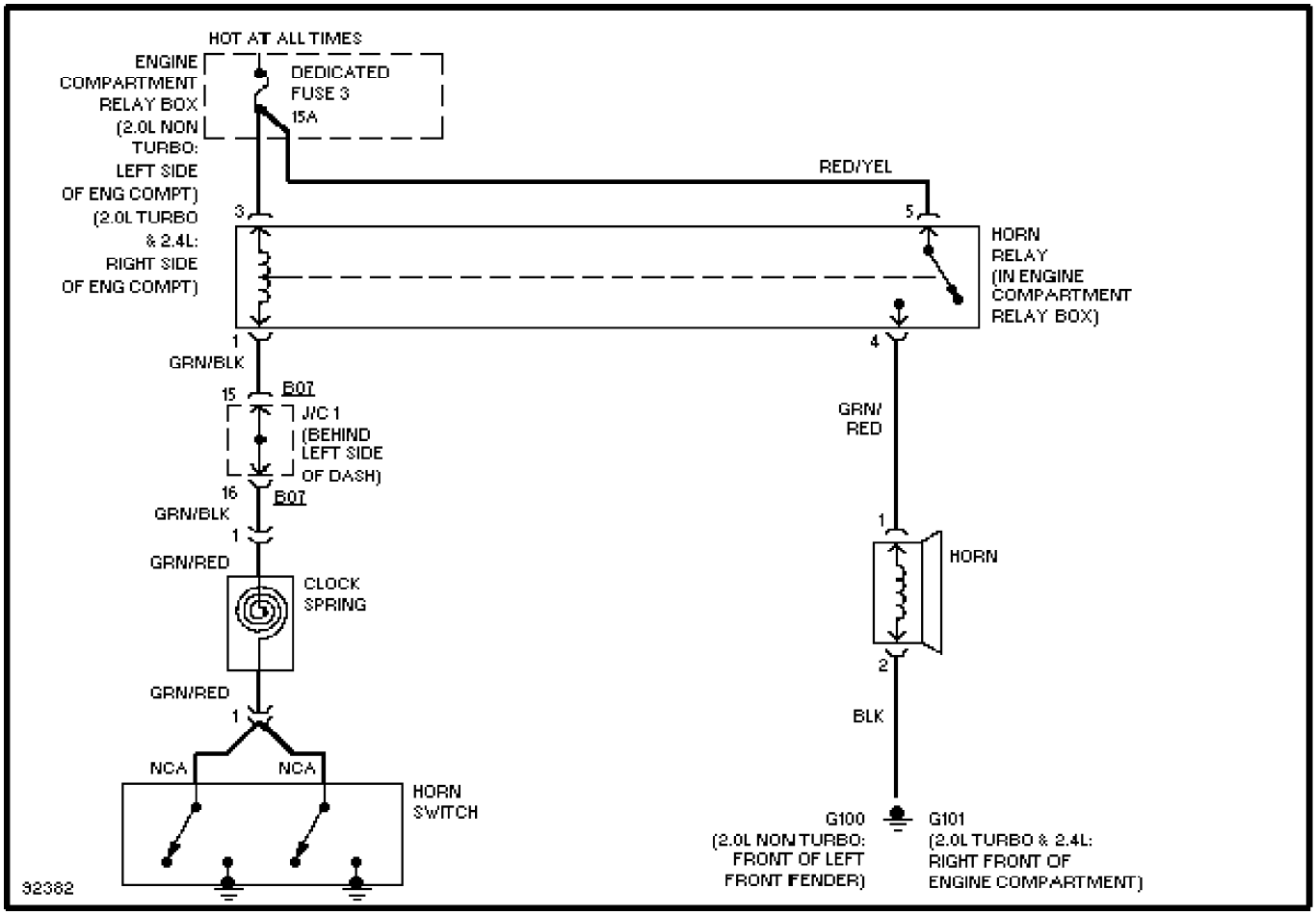


Fig. 36: Horn Circuit Wiring Diagram (Eclipse)

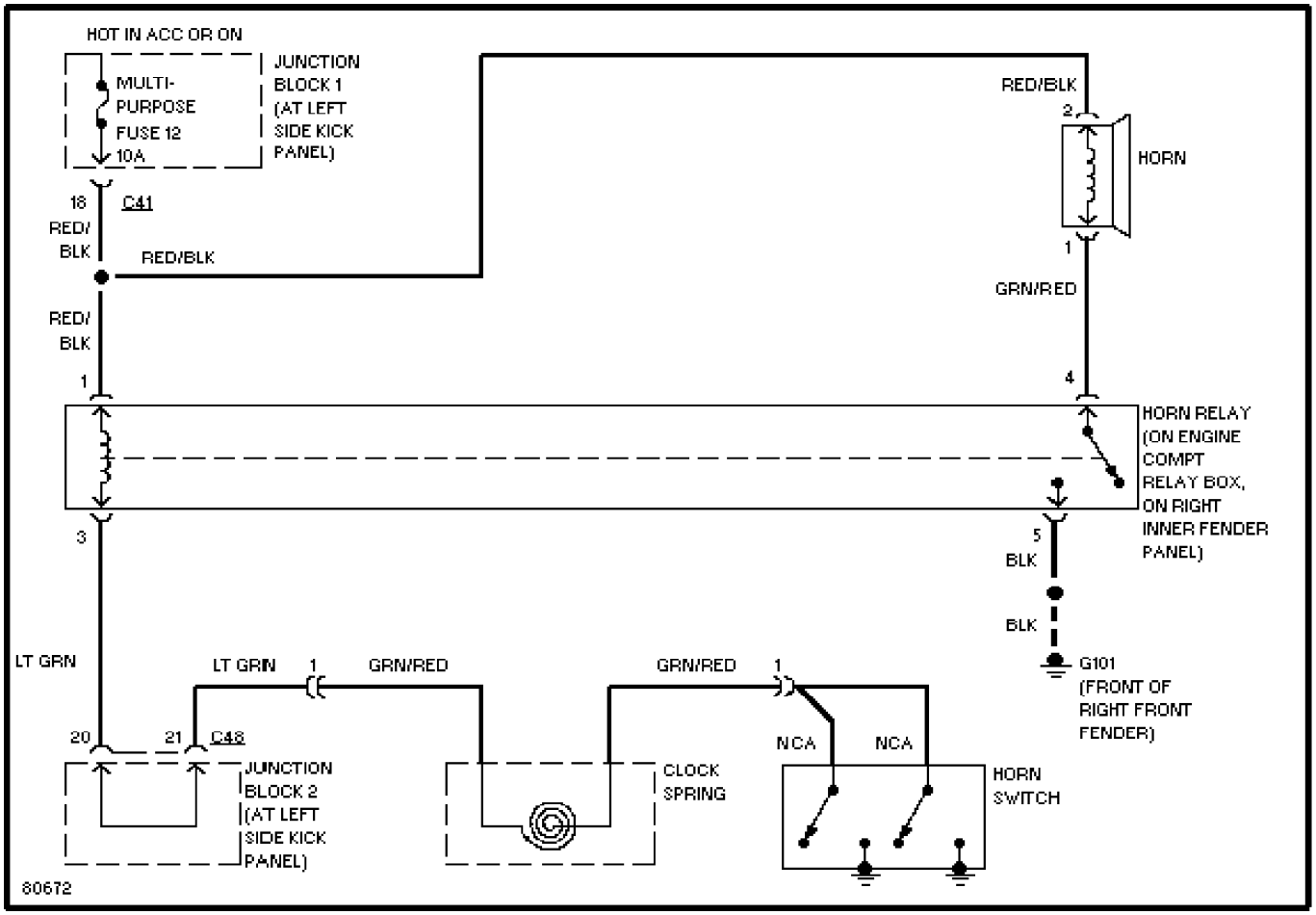


Fig. 37: Horn Circuit Wiring Diagram (Galant)

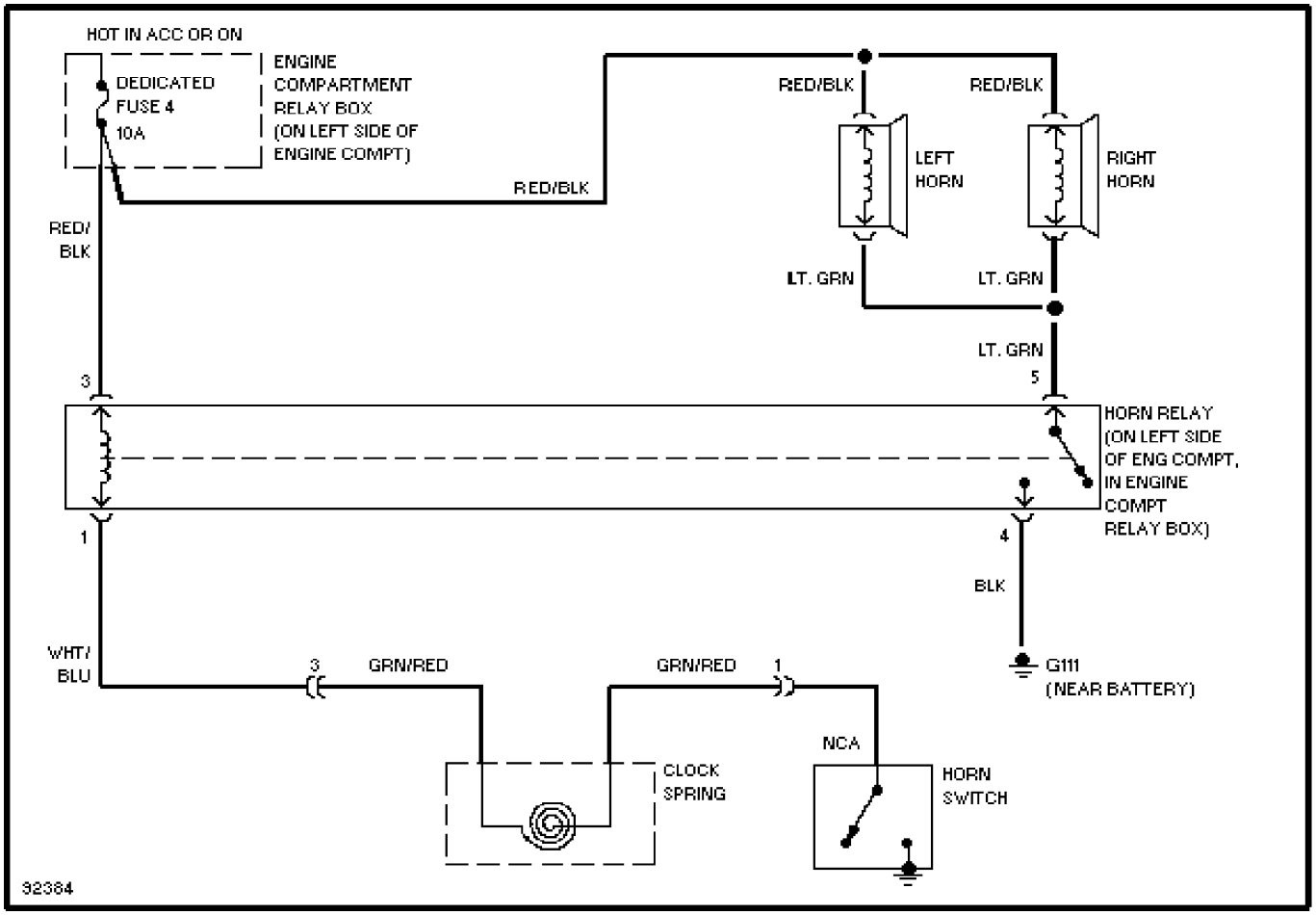


Fig. 38: Horn Circuit Wiring Diagram (Mirage)

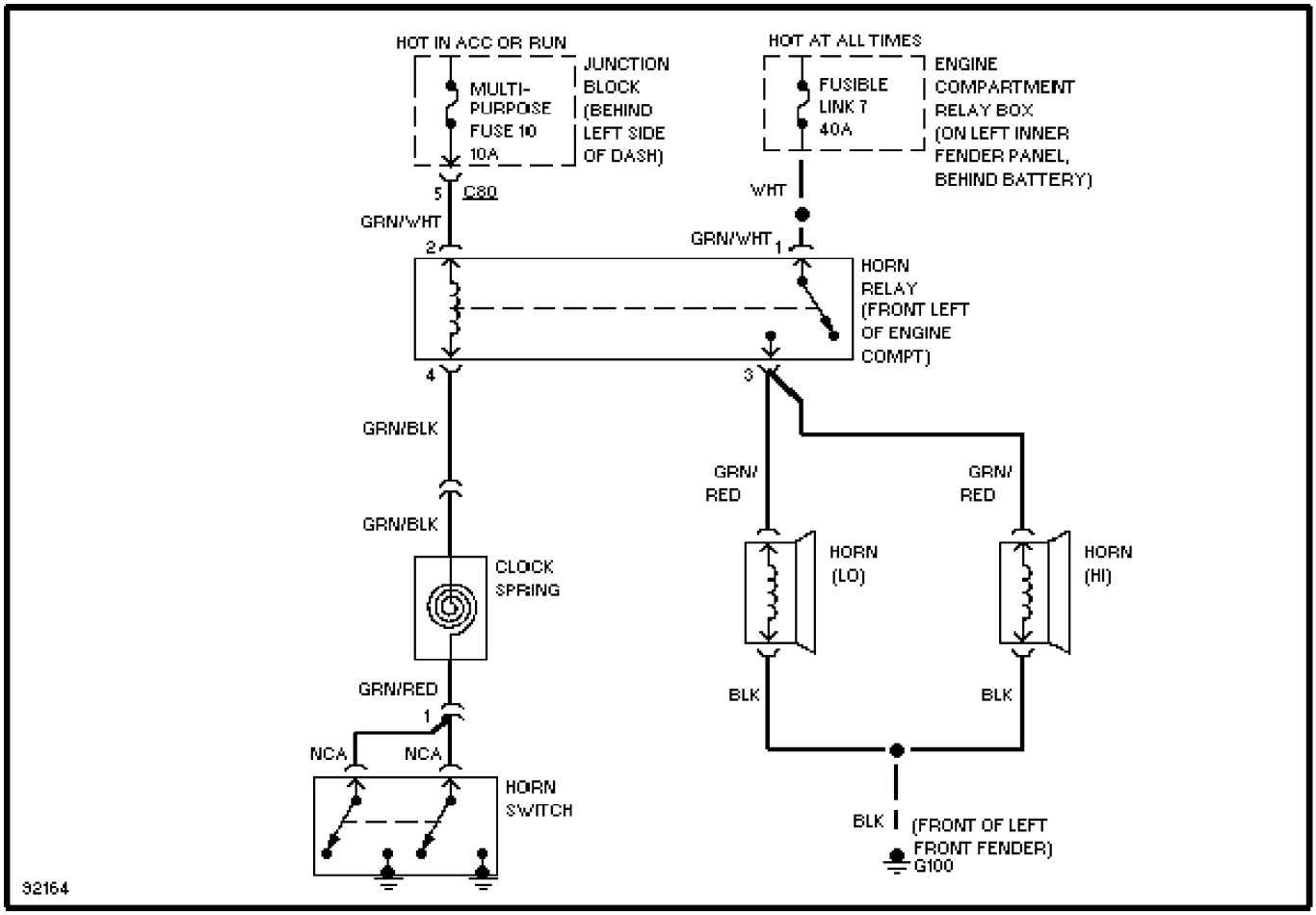


Fig. 39: Horn Circuit Wiring Diagram (Montero)

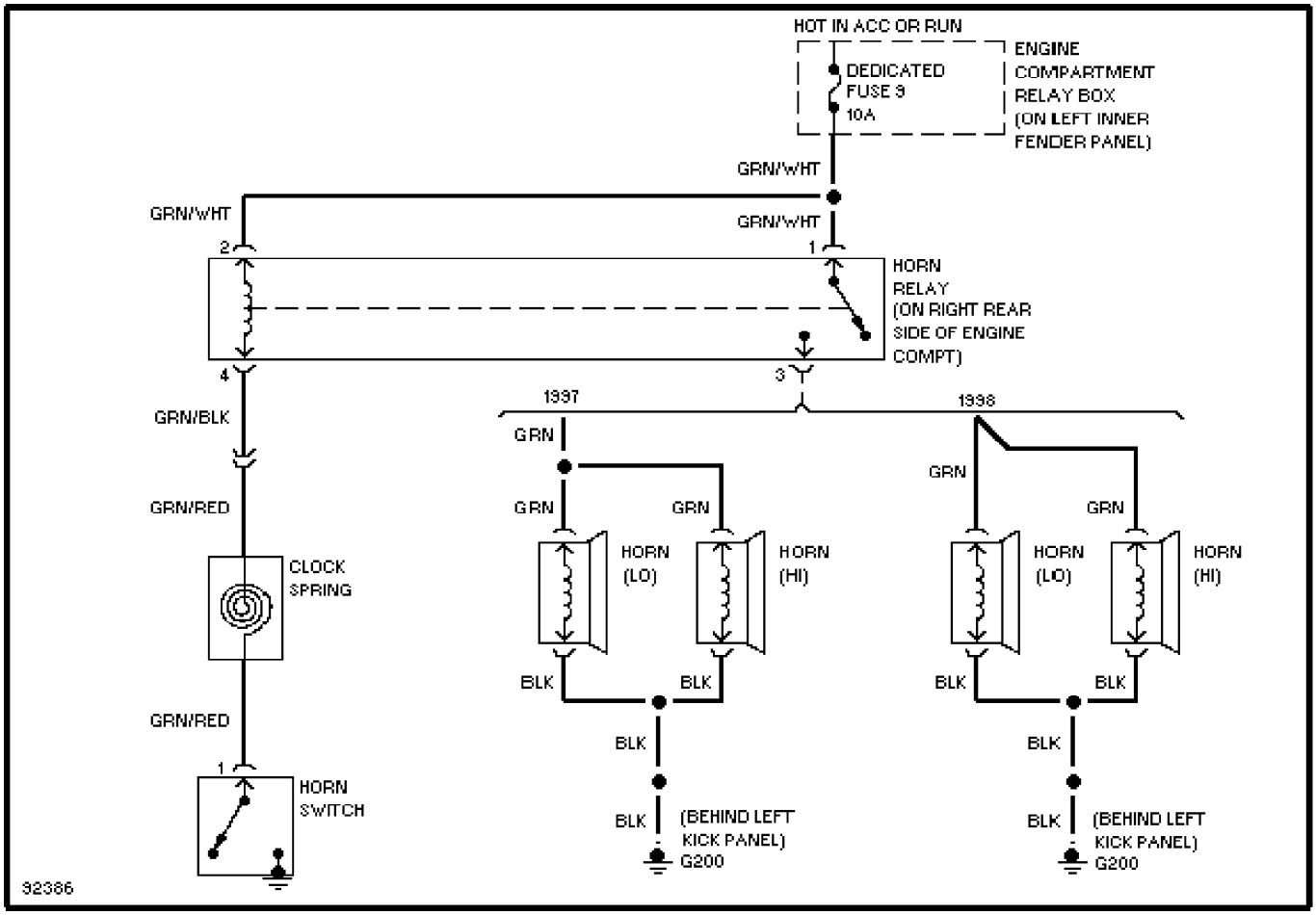


Fig. 40: Horn Circuit Wiring Diagram (Montero Sport)

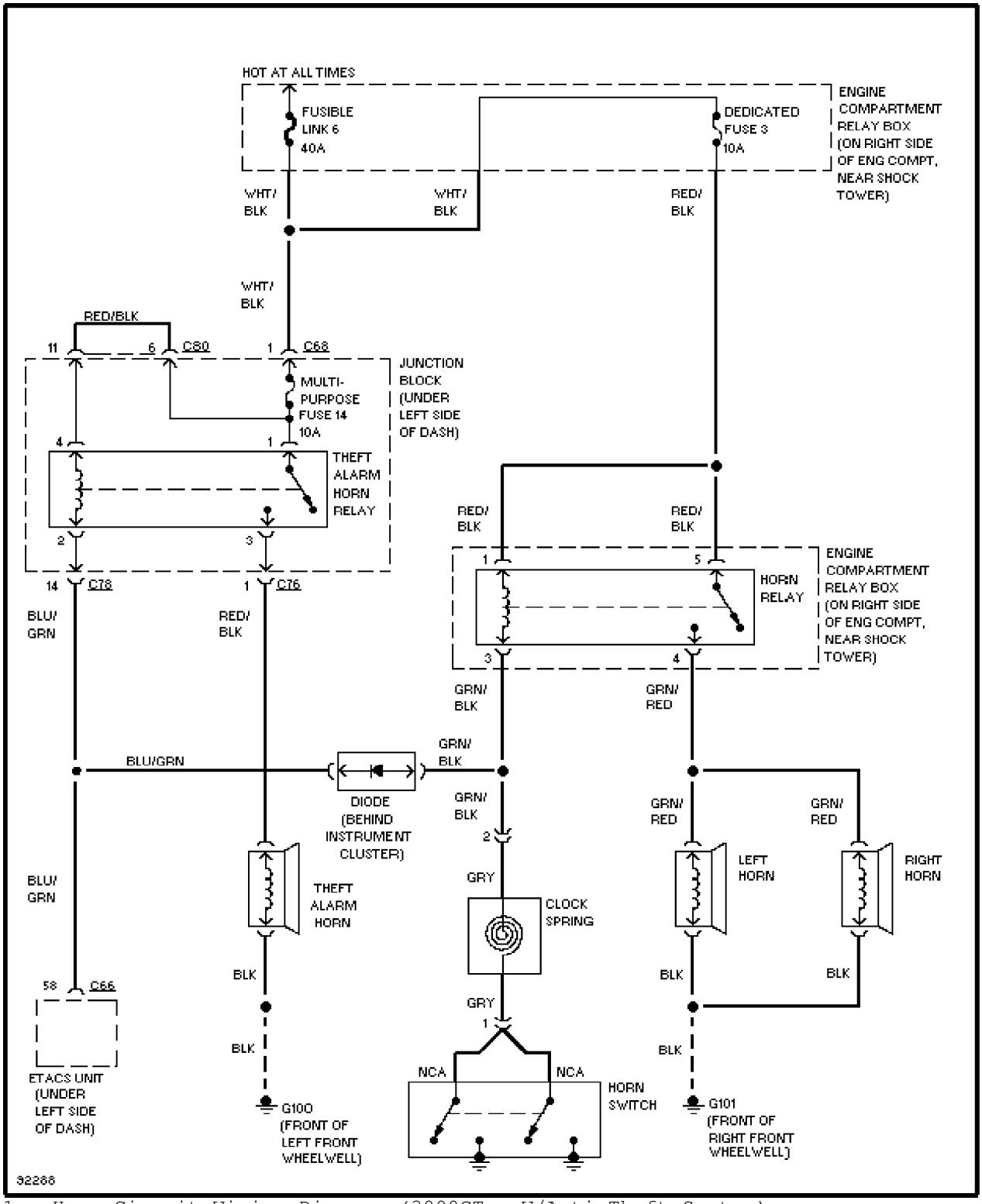


Fig. 41: Horn Circuit Wiring Diagram (3000GT - W/Anti-Theft System)

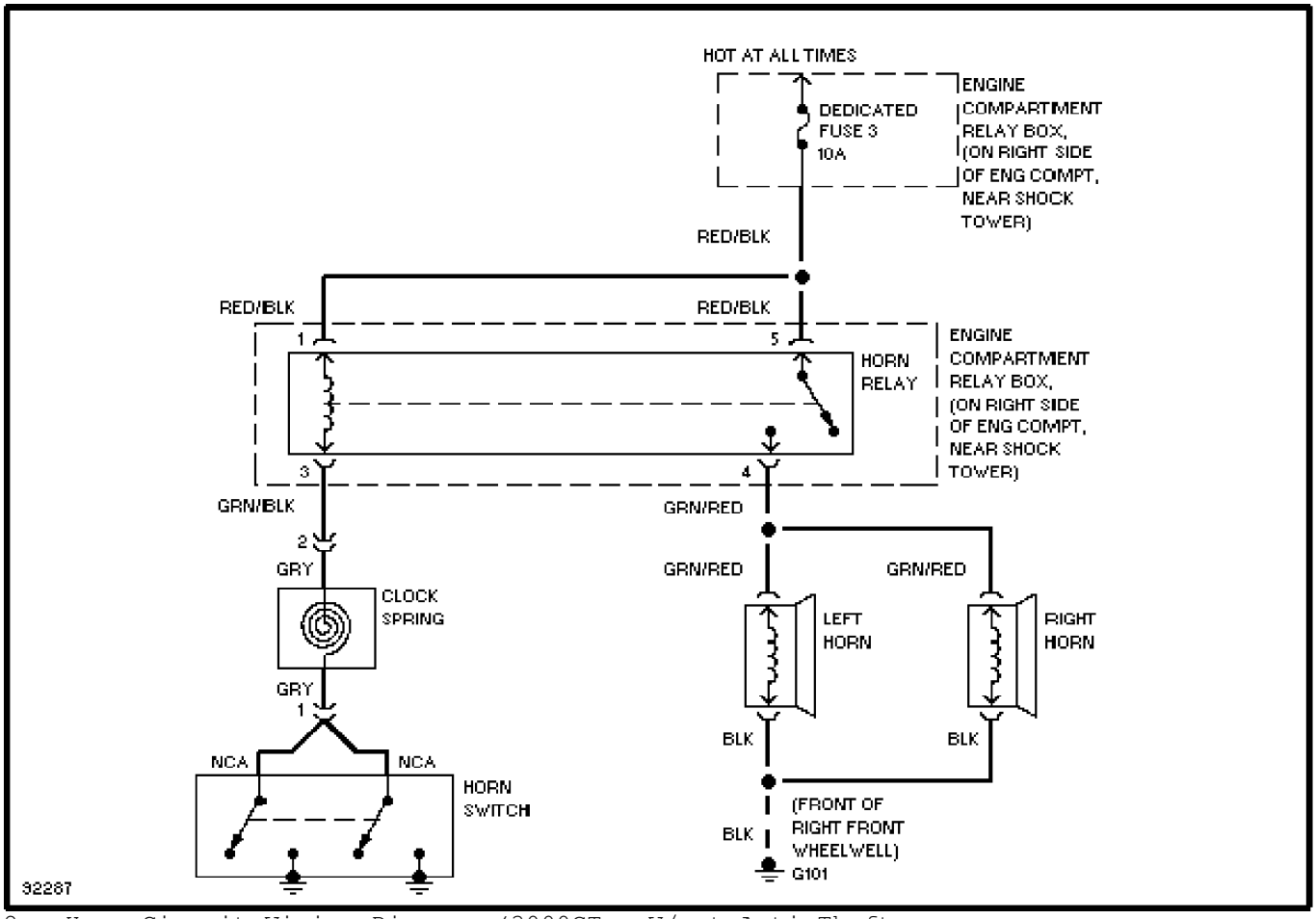


Fig. 42: Horn Circuit Wiring Diagram (3000GT - W/out Anti-Theft System)

STEERING SYSTEM - POWER RACK & PINION

1998 Mitsubishi Galant

1997-98 STEERING
Mitsubishi - Power Rack & Pinion

Diamante, Eclipse, Galant, Mirage, 3000GT

DESCRIPTION & OPERATION

Power-assisted rack and pinion steering system consists of a vane pump, flow control valve and an oil reservoir. Belt-driven vane pump supplies fluid through hoses to flow control valve. Flow control valve regulates fluid pressure to assist rack and pinion steering gear.

On 3000GT models with 4-Wheel Steering (4WS), a rear oil pump, flow control valve and power cylinder are included in power-assisted steering system. See Fig. 1.

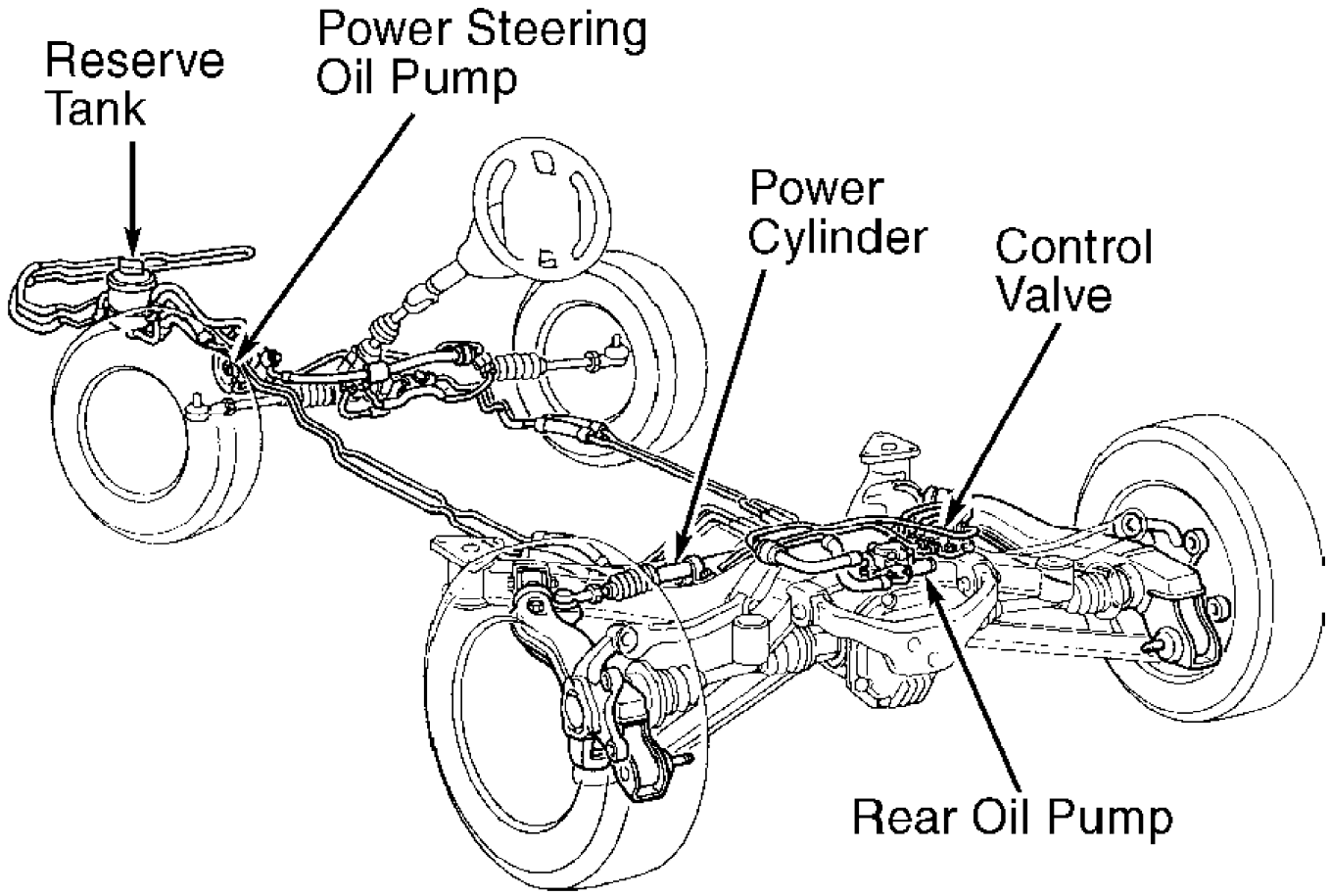


Fig. 1: Identifying 4-Wheel Steering Components
Courtesy of Mitsubishi Motor Sales of America.

LUBRICATION

CAPACITY

On 4WS models, fluid capacity is approximately 1.6 qts. (1.5L). On all other models, fluid capacity is approximately .95 qt. (.9L).

FLUID TYPE

Use Dexron-II ATF type fluid.

FLUID LEVEL CHECK

Park the vehicle on a level surface. Start engine, and let it idle. Turn steering wheel several times to bring steering fluid to normal operating temperature. Turn steering wheel left and right several times while checking fluid for foaming and clouding. Fluid level should be between MIN and MAX marks on filler cap dipstick. Fill to MAX mark with Dexron-II ATF.

HYDRAULIC SYSTEM BLEEDING

CAUTION: DO NOT hold steering wheel to left or right lock for longer than 10 seconds, or oil pump damage may occur. If air bleeding is performed with engine running, the air will be absorbed into the fluid. Bleed air from system with engine cranking only.

WARNING: Use caution when bleeding system on 4WS models. All 4 wheels will be rotating during testing.

All Models (Front Steering)

1) Lift and support vehicle. Manually turn the oil pump pulley a few times. Turn the steering wheel to left and right stops 5 or 6 times. Disconnect coil high tension wire. Crank engine 10-15 seconds while turning steering wheel left and right. Replenish fluid supply if necessary so fluid level does not fall below the lower position of the filler. Connect coil high tension wire. Start engine, and let it idle. Turn steering wheel left and right until no air bubbles appear in oil reservoir.

2) Check fluid level, and ensure fluid is not milky. Turn steering wheel left and right, and ensure fluid level does not change. If fluid level changes more than 0.25" (6.3 mm) or if pump is noisy, fill with fluid to MAX mark on dipstick again. Repeat procedure until air bubbles are no longer present in fluid and fluid level stabilizes. Check fluid level with engine running and stopped. If level changes more than 0.2" (5 mm) bleed air from power steering system again until fluid level is within specifications.

4WS (Rear Steering)

1) Bleed air from power steering system. See ALL MODELS. Have an assistant enter vehicle. Raise and support vehicle. Start engine, and let it idle. Loosen bleed screw on left side of rear control valve, and install a bleed hose to bleed screw.

2) Have assistant turn steering wheel to full left position, and then immediately return wheel halfway. Ensure air and fluid is discharged from hose. Repeat step several times. Ensure all air has been bled from system. Repeat step for right side bleed screw, turning steering wheel to full right position, and then immediately returning wheel halfway.

3) Turn engine off. Loosen bleed screws on power cylinder. Install a bleed hose to power cylinder bleed screws. Have assistant start engine and run vehicle to 43-50 MPH to circulate fluid. Ensure all 4 wheels rotate and fluid does not circulate through bleed hose. Reduce vehicle speed to 19-25 MPH, and maintain speed while turning steering wheel to full left and right positions.

4) When steering wheel is turned to full left or right positions, pressure will rise and air will circulate through bleed hose. Ensure air is discharged into oil reservoir. Repeat step several times until all air has been bled from system.

ADJUSTMENTS

POWER STEERING PUMP BELT

BELT ADJUSTMENT

Application/ Model	(1) Deflection New Belt - In. (mm)	(1) Deflection Used Belt - In. (mm)
Diamante	.33-.37 (8.4-9.3)	.46-.52 (11.7-13.4)
Eclipse		
2.0L Non-Turbo	.26-.37 (6.5-9.5)	.43-.55 (11.0-14.0)
2.0L Turbo & 2.4L	.18-.22 (4.5-5.5)	.24-.28 (6.0-7.0)
Galant	.18-.22 (4.5-5.5)	.24-.28 (6.0-7.0)
Mirage		
1.5L	.28-.36 (7.2-9.0)	.40-.46 (10.2-11.6)
1.8L	.28-.35 (7.0-9.0)	.39-.43 (10.0-11.0)
3000GT		
DOHC	.30-.35 (7.5-9.0)	.41-.49 (10.5-12.5)
SOHC	.16-.20 (4.0-5.0)	.24-.32 (6.0-8.0)

(1) - With 22 lbs. (98 n) pressure applied midway on longest belt run.

PINION ROTATING FORCE

NOTE: Pinion rotating force procedure is performed with rack and pinion assembly off vehicle and supported in soft-jawed vise.

Using Adapter (MB991006) and torque wrench, measure rotating force while turning pinion gear through one complete rotation within 4-6 seconds. See PINION ROTATING FORCE SPECIFICATIONS table. If rotating force is not within specification, adjust end plug (rack support cover), and recheck rotating force.See Fig. 5. Tighten locking nut to 36-51 ft. lbs. (49-69 N.m).

PINION ROTATING FORCE SPECIFICATIONS

Application	INCH Lbs. (N.m)
Except Diamante, Mirage & 3000GT	6-12 (.7-1.4)
Diamante	7-14 (.8-1.6)
Mirage	5-12 (.6-1.4)
3000GT	5-11 (.6-1.3)

TESTING

HYDRAULIC SYSTEM PRESSURE TEST

CAUTION: DO NOT leave valve on pressure gauge closed longer than 10 seconds, or damage to oil pump will result.

1) Disconnect pressure hose from oil pump. Install Pressure Gauge (MB990662-01). See Fig. 2. Bleed air from system. See HYDRAULIC SYSTEM BLEEDING under LUBRICATION. Start engine, and let it idle. Turn

steering wheel several times until temperature reaches 122°F (50°C). Set engine idle speed to 1000 RPM.

2) Close valve to measure oil pump relief pressure. Open valve to measure oil pump no-load pressure. Replace pump if pressure is not within specification. See OIL PUMP PRESSURE SPECIFICATIONS table. Install pressure hose. Bleed system.

OIL PUMP PRESSURE SPECIFICATIONS

Application	psi (kg/cm²)
Valve Closed	
Except Galant, Mirage & 3000GT	1203-1309 (83-90)
Galant	1422 (98)
Mirage	1351-1451 (95-102)
3000GT	1067-1166 (75-82)
Valve Open	
Except Mirage	114-142 (8-10)
Mirage	28-71 (2-5)

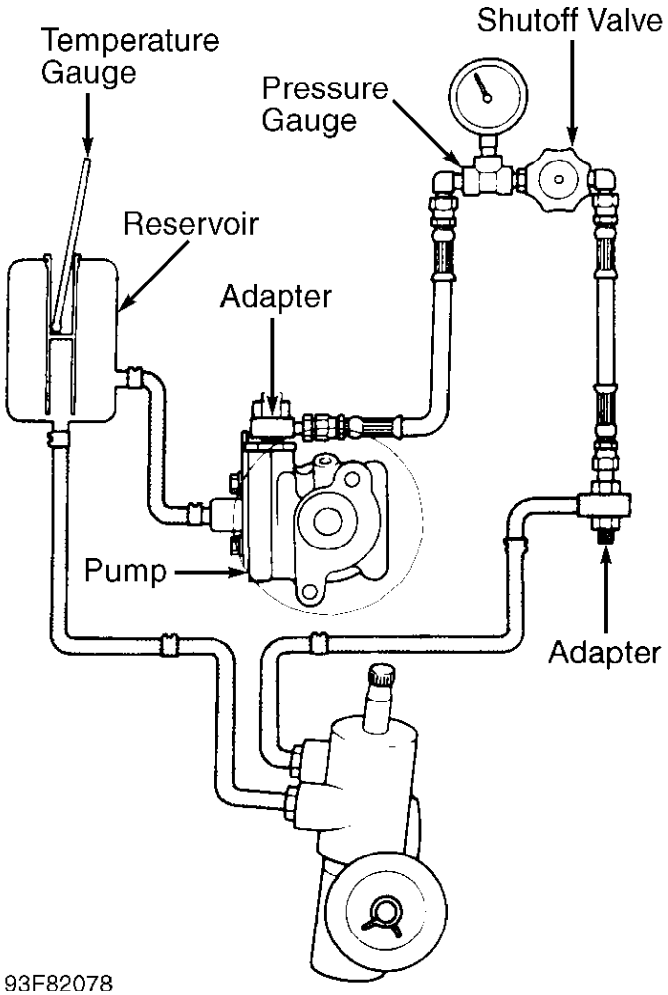


Fig. 2: Connecting Pressure Gauge & Shutoff Valve
Courtesy of Mitsubishi Motor Sales of America.

STEERING WHEEL TURNING FORCE

Place vehicle on level surface with steering wheel in straight-ahead position. Attach a spring scale to steering wheel. With engine running at 1000 RPM, measure turning force by turning steering wheel left and right within a range of 1 1/2 turns. See STEERING WHEEL TURNING FORCE table.

STEERING WHEEL TURNING FORCE

Application	Lbs. (kg)
Except Diamante	7.6-8.0 (3.4-3.5)
Diamante	6.1 (2.7)

REMOVAL & INSTALLATION

* PLEASE READ FIRST *

CAUTION: On vehicles equipped with Supplemental Restraint System (SRS), ensure steering wheel is straight ahead and locked (key removed from ignition switch) before removing steering rack and pinion, to prevent damage to clockspring.

POWER STEERING PUMP

Removal & Installation

Disconnect pressure and suction hoses from pump. Drain fluid into container. Remove oil pump mounting bolts, belt and oil pump. Remove reservoir hoses and retaining bolts. Remove reservoir. To install, reverse removal procedure. Fill and bleed system. See HYDRAULIC SYSTEM BLEEDING under LUBRICATION.

POWER RACK & PINION

Removal & Installation (Diamante & 3000GT)

1) Raise and support vehicle. Remove coupling bolt from pinion shaft joint. Remove hydraulic lines from steering gear. Drain fluid. Remove tie rod end cotter pins and loosen nuts. Using Steering Linkage Puller (MB991113), separate tie rods from steering knuckles and then remove tie rod nuts. Remove left and right crossmember.

2) Remove front exhaust pipe mounting nuts and lower pipe. On AWD vehicles, remove bolts from transfer assembly, and remove transfer assembly from transaxle. Remove and support drive shaft from transfer assembly. Remove stabilizer bar (if necessary).

3) Remove power rack and pinion assembly by moving assembly completely to right and off crossmember. Tilt power rack and pinion assembly downward, and remove from left side.

4) To install, reverse removal procedure. Fill and bleed system. Check wheel alignment. See WHEEL ALIGNMENT SPECIFICATIONS & PROCEDURES article in WHEEL ALIGNMENT section.

Removal & Installation (Eclipse)

1) Raise and support vehicle. Remove windshield washer tank. On 2.0L turbo and 2.4L engines it is necessary to remove the brake fluid reservoir assembly and the A/C compressor. Remove coupling bolt from pinion shaft joint. Remove hydraulic lines from steering gear. Drain fluid.

2) Remove tie rod end cotter pins and loosen nuts. Using Steering Linkage Puller (MB991113), separate tie rods from steering knuckles and remove tie rod nuts. Remove rear mounting bolts from center crossmember. Remove left and right stays. Remove long bolt from engine mount attached to center crossmember.

3) Remove exhaust pipe mounting nuts and lower pipe. On AWD models, remove bolts, and remove transfer assembly from transaxle. Remove and support drive shaft from transfer assembly. Remove stabilizer bar (if necessary).

4) Remove rack housing mounting clamp assemblies. Remove rack and pinion assembly by moving assembly completely to right and off crossmember. Tilt power rack and pinion assembly downward, and remove from left side.

5) To install, reverse removal procedure. Fill and bleed system. Check wheel alignment. See WHEEL ALIGNMENT SPECIFICATIONS & PROCEDURES article in WHEEL ALIGNMENT section.

Removal & Installation (Galant)

1) Raise and support vehicle. Remove front wheels. Disconnect stabilizer bar from link. Unbolt frame mount bracket from crossmember. Remove stabilizer bar. Remove coupling bolt from pinion shaft joint. Remove hydraulic lines from steering gear. Drain fluid. On Galant with electronic power steering, disconnect solenoid valve connector.

2) Remove tie rod end cotter pins and loosen nuts. Using Steering Linkage Puller (MB991113), separate tie rods from steering knuckles and remove tie rod nuts. Remove both crossmember stays (crossmember reinforcement brackets). Remove rear mounting bolts from center crossmember. Remove long bolt from engine mount attached to center crossmember.

3) Remove rack housing mounting clamp assemblies. Unbolt compression lower control arm and support with wire. Do not allow arm to be supported by ball joint. Remove rack and pinion assembly by moving assembly completely to left and off crossmember. To install, reverse removal procedure. Ensure steering is straight ahead. Fill and bleed system. Check wheel alignment. See WHEEL ALIGNMENT SPECIFICATIONS & PROCEDURES article in WHEEL ALIGNMENT section.

Removal & Installation (Mirage)

1) Raise and support vehicle. Remove center member and front exhaust pipe (if necessary). Pull back dust shield (if equipped), and remove coupling bolt from pinion shaft joint. Disconnect hydraulic lines from steering gear, and remove "O" rings. Drain fluid.

2) Remove tie rod end cotter pins and loosen nuts. Using Steering Linkage Puller (MB991113), separate tie rod ends from steering knuckles and remove tie rod nuts. Remove rack housing mounting clamp assemblies. Remove power rack and pinion assembly. To install, reverse removal procedure. Fill and bleed system. Check wheel alignment. See WHEEL ALIGNMENT SPECIFICATIONS & PROCEDURES article in WHEEL ALIGNMENT section.

REAR OIL PUMP

Removal & Installation (4WS)

1) Raise and support vehicle. Remove muffler. Support differential case using transmission jack. Remove rear strut assembly lower mounting bolts. Remove crossmember brackets at front of suspension.

2) Remove crossmember mounting nuts on differential (rear) side of suspension. Disconnect pressure and suction hoses from rear oil pump. Drain fluid. Slightly lower rear suspension. Remove rear oil pump. To install, reverse removal procedure. Fill and bleed system. See HYDRAULIC SYSTEM BLEEDING.

POWER CYLINDER

Removal & Installation (4WS)

1) Raise and support vehicle. Remove muffler. Support differential case using transmission jack. Remove rear strut assembly

lower mounting bolts. Remove crossmember brackets at front of suspension.

2) Remove crossmember mounting nuts on differential (rear) side of suspension. Disconnect pressure hoses and "O" rings from power cylinder. Drain fluid. Slightly lower rear suspension. Remove tie rod nuts and power cylinder mounting bracket bolts. Remove power cylinder. To install, reverse removal procedure. Fill and bleed system. See HYDRAULIC SYSTEM BLEEDING. Check wheel alignment. See WHEEL ALIGNMENT SPECIFICATIONS & PROCEDURES article in WHEEL ALIGNMENT section.

OVERHAUL

POWER STEERING PUMP

NOTE: Manufacturer does not supply information on rear oil pump overhaul.

Disassembly

1) Remove pump rear cover, cam ring, "O" rings and vanes from rotor. See Fig. 3. Remove snap ring from pulley assembly. Remove rotor.

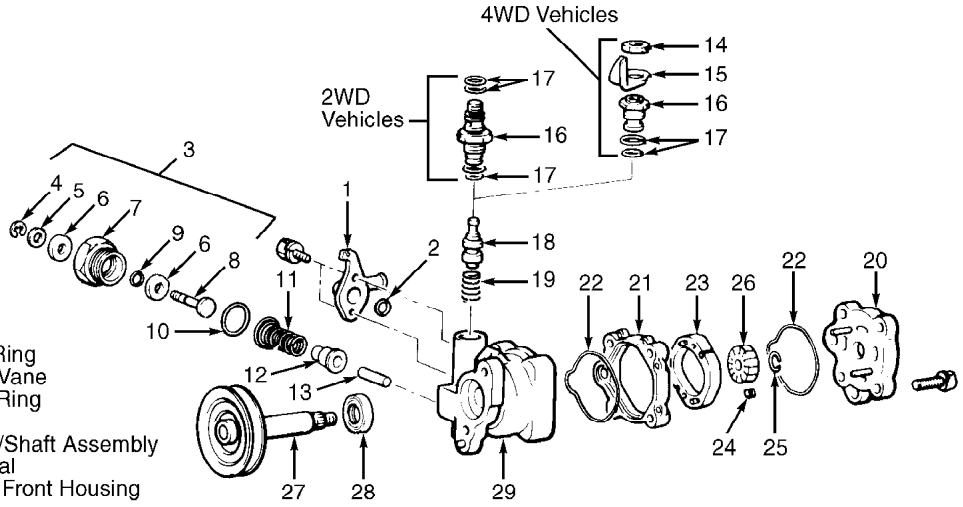


Fig. 3: Exploded View Of Power Steering Pump (Typical)
Courtesy of Mitsubishi Motor Sales of America.

2) Tap pulley assembly using plastic hammer to remove it from pump body. Remove suction connector and oil seal from pump body. Remove connector, flow control valve and spring from pump body.

Inspection

Check pulley assembly, cam ring, rotor and vanes for wear. Check pump cover and pump body for abrasion. Check flow control valve for clogging.

Reassembly

Apply Dexron-II ATF fluid to "O" rings and vanes. To reassemble, reverse disassembly procedure. Install oil seal into pump body using Installers (MB990925-01 and MB990938-01). Install vanes into rotor in correct direction. See Fig. 4.

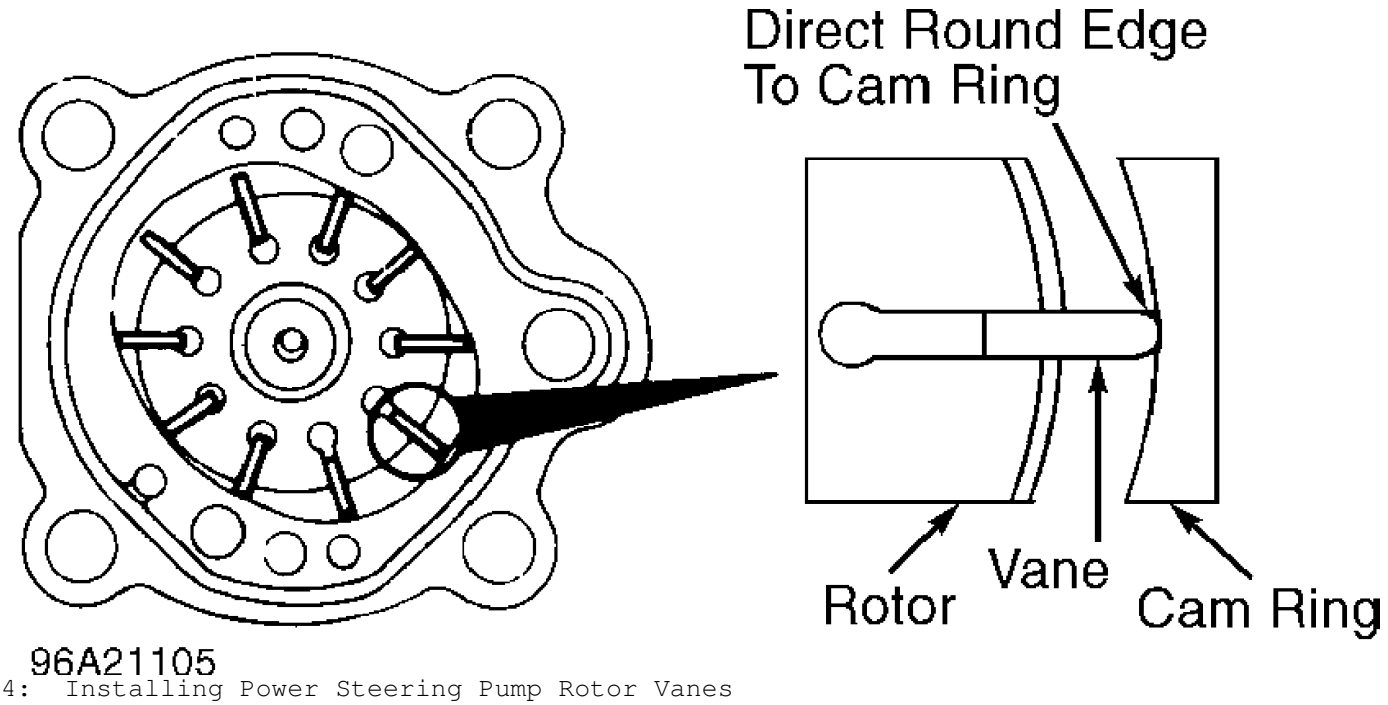


Fig. 4: Installing Power Steering Pump Rotor Vanes
Courtesy of Mitsubishi Motor Sales of America.

POWER RACK & PINION

NOTE: Some Diamante and Galant models are equipped with Electronic Power Steering. For exploded view of electronic power rack and pinion assembly, see ELECTRONIC POWER STEERING article.

Disassembly

1) With power rack and pinion assembly mounted in soft-jawed vise, remove tie rod ends, boot clamps and boots. See Fig. 5. Using a chisel, remove tie rod tab washer. Remove tie rod assemblies. Remove steel hydraulic lines. Remove end plug and self-locking nut from pinion/valve assembly.

2) Remove locking nut. Using Socket (MB990607-A), remove rack support cover. Remove rack support spring and rack support. Remove valve housing. Remove oil seals and pinion/valve assembly. Turn end housing in cylinder assembly clockwise to align circlip with slot in cylinder housing for removal.

3) When circlip comes out of housing, turn end housing counterclockwise to remove circlip. Remove end housing, rack bushing and rack from rack housing. Remove "O" ring and oil seal from cylinder housing.

4) Use brass drift to remove ball bearing, needle bearing and oil seal from pinion side of rack housing. Use a pipe to remove oil seal from rear of rack housing.

Inspection

Check bearings, rack bushing and rack teeth for damage and wear. Check pinion/valve assembly for damage to teeth and wear to bearings. Inspect valve housing for damage or wear from sealing rings. Replace all oil seals, "O" rings and sealing rings.

Reassembly

1) Apply Dexron-II ATF fluid to all "O" rings. lubricate rack teeth, bearings and teeth on pinion valve assembly with lubricant supplied by manufacturer. Reassemble rack in reverse order of

disassembly.

2) Using Drivers (MB991197 and MB991202), install and oil seal in rack housing. Using Drivers (MB990938 and MB991202), install bearings in rack housing. Using Socket (MB990607-A), install locking nut.

3) Install rack support spring, rack support cover and rack support. Install self-locking nut. Using Drivers (MB990938 and MB991203), install pinion oil seal in rack housing. Using Drivers (C-4637-1 and MB990927), install "O" ring into rack bushing. Adjust pinion rotating force. See PINION ROTATING FORCE under ADJUSTMENTS.

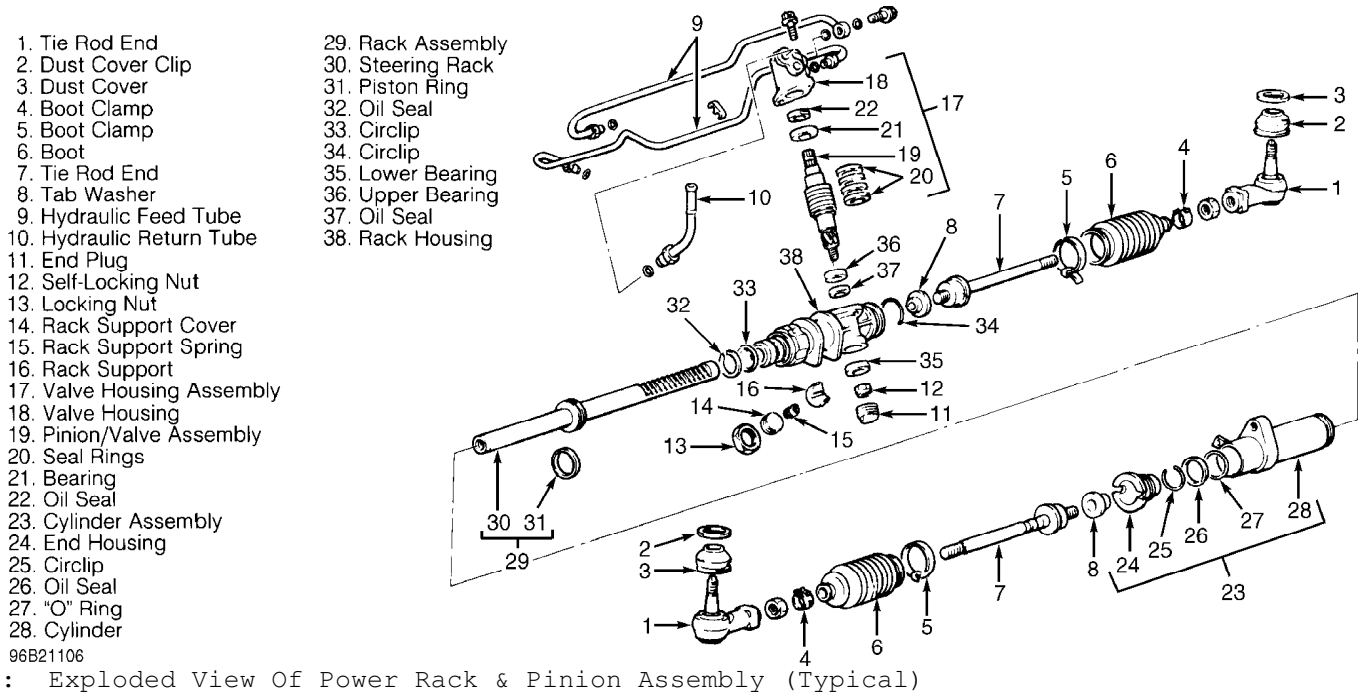


Fig. 5: Exploded View Of Power Rack & Pinion Assembly (Typical)
Courtesy of Mitsubishi Motor Sales of America.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS (DIAMANTE)

Application	Ft. Lbs. (N.m)
Centermember Mounting Bolt (Front)	58-65 (78-88)
Centermember Mounting Bolt (Rear)	51-58 (69-78)
Crossmember Bracket Bolt	33 (44)
Coupling-To-Pinion Shaft Joint Bolt	13 (18)
Exhaust Pipe Nuts	36 (49)
Power Steering Pump Cover Bolts	15 (20)
Power Steering Pump Mounting Bolt And Nut	29 (39)
Power Steering Pump Pulley Bolt	29 (39)
Pressure Hose-To-Pump Nut	18 (24)
Rack Mounting Bolt	51 (69)
Tie Rod End-To-Steering Knuckle	20 (27)
Tie Rod Lock Nut	36-40 (49-54)
Tie Rod-To-Rack Bolt/Nut	65 (88)

TORQUE SPECIFICATIONS (ECLIPSE)

Application	Ft. Lbs. (N.m)

Centermember Mounting Bolt	58-65 (78-88)
Crossmember Bracket Bolt	51-58 (69-78)
Coupling-To-Pinion Shaft Joint Bolt	13 (18)
Power Steering Pump Cover Bolt (Long)	32 (43)
Power Steering Pump Pulley Nut	32 (43)
Power Steering Pump Cover Bolts (Short)	12 (17)
Power Steering Pump Mounting Bolts	29 (39)
Pressure Hose-To-Pump Bolt	42 (57)
Rack Mounting Bolt	51 (69)
Tie Rod End-To-Steering Knuckle	18-24 (24-33)
Tie Rod Lock Nut	36-40 (49-54)
Tie Rod-To-Rack Bolt/Nut	65 (88)

TORQUE SPECIFICATIONS (GALANT)

Application	Ft. Lbs. (N.m)
Centermember Mounting Bolt	58-65 (78-88)
Crossmember Bracket Bolt	51-58 (69-78)
Coupling-To-Pinion Shaft Joint Bolt	13 (18)
Exhaust Pipe Nuts	13 (18)
Power Steering Pump Cover Bolts	13 (18)
Power Steering Pump Mounting Bolts	21 (28)
Pressure Hose-To-Pump Nut	13 (18)
Rack Mounting Bolts	51 (69)
Tie Rod End-To-Steering Knuckle	18-24 (24-33)
Tie Rod Lock Nut	36-40 (49-54)
Tie Rod-To-Rack Bolt/Nut	65 (88)

TORQUE SPECIFICATIONS (MIRAGE)

Application	Ft. Lbs. (N.m)
Centermember Mounting Bolt	51 (69)
Crossmember Bracket Bolt	25 (34)
Coupling-To-Pinion Shaft Joint Bolt	13 (18)
Exhaust Pipe Nuts	13 (18)
Power Steering Pump Cover Bolts	14 (20)
Power Steering Pump Mounting Bolts	29 (39)
Pressure Hose-To-Pump Nut	13 (18)
Rack Mounting Bolt	51 (69)
Tie Rod End-To-Steering Knuckle	11-25 (15-33)
Tie Rod Lock Nut	30 (41)
Tie Rod-To-Rack Bolt/Nut	65 (88)

TORQUE SPECIFICATIONS (3000GT)

Application	Ft. Lbs. (N.m)
Front Steering	
Centermember Mounting Bolt	43-51 (60-70)
Coupling-To-Pinion Shaft Joint Bolt	13 (18)
Exhaust Pipe Nuts	36 (50)
Power Steering Pump Bracket Mounting Bolts	16 (22)
Power Steering Pump Mounting Bolt (Long)	16 (22)
Power Steering Pump Mounting Bolt (Short)	129 (40)
Pressure Hose-To-Pump Nut	17 (24)
Rack Mounting Bolt	51 (70)
Strut Assembly Lower Mounting Bolt	72 (100)

Tie Rod End-To-Steering Knuckle	
AWD	36 (50)
FWD	21 (29)
Tie Rod Lock Nut	36-40 (50-55)
Tie Rod-To-Rack Bolt/Nut	65 (90)
Rear Steering (AWD)	
Bleeder Screws	5 (7)
Front Line Fittings-To-Control Valve Lines	25 (35)
Power Cylinder Mounting Bracket Bolts	30 (42)
Rear Crossmember Mounting Nuts	80-94 (110-130)
Rear Pump Mounting Bolts	17 (24)
Rear Pump-To-Control Valve Line Fittings	25 (35)
Strut Assembly Lower Mounting Bolt	72 (100)
Tie Rod End-To-Control Arm	42 (52)
Tie Rod Lock Nut	30 (42)

* STEERING UNIFORM INSPECTION GUIDELINES *

1998 Mitsubishi Galant

GENERAL INFORMATION
Steering, Suspension, Wheel Alignment, Wheels and Tires
Motorist Assurance Program
Standards For Automotive Repair

All Makes and Models

INTRODUCTION TO MOTORIST ASSURANCE PROGRAM (MAP)

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Wheel Alignment

WHEEL ALIGNMENT

Wheels and Tires

TIRES
VALVE STEMS
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MOTORIST ASSURANCE PROGRAM (MAP)

OVERVIEW

The Motorist Assurance Program is the consumer outreach effort of the Automotive Maintenance and Repair Association, Inc. (AMRA). Participation in the Motorist Assurance Program is drawn from retailers, suppliers, independent repair facilities, vehicle manufacturers and industry associations.

Our organization's mission is to strengthen the relationship between the consumer and the auto repair industry. We produce materials that give motorists the information and encouragement to take greater responsibility for their vehicles-through proper, manufacturer-recommended, maintenance. We encourage participating service and repair shops (including franchisees and dealers) to adopt 1) a Pledge of Assurance to their Customers and 2) the Motorist Assurance Program Standards of Service. All participating service providers have agreed to subscribe to this Pledge and to adhere to the promulgated Standards of Service demonstrating to their customers that they are serious about customer satisfaction.

These Standards of Service require that an inspection of the vehicle's (problem) system be made and the results communicated to the customer according to industry standards. Given that the industry did not have such standards, the Motorist Assurance Program successfully promulgated industry inspection communication standards in 1994-95 for the following systems: Exhaust, Brakes, ABS, Steering and Suspension, Engine Maintenance and Performance, HVAC, and Electrical Systems. Further, revisions to all of these inspection communication standards are continually re-published. In addition to these, standards for Drive Train and Transmissions have recently been promulgated. Participating shops utilize these Uniform Inspection & Communication Standards as part of the inspection process and for communicating their findings to their customers.

The Motorist Assurance Program continues to work cooperatively and proactively with government agencies and consumer groups toward solutions that both benefit the customer and are mutually acceptable to both regulators and industry. We maintain the belief that industry must retain control over how we conduct our business, and we must be viewed as part of the solution and not part of the problem. Meetings with state and other government officials (and their representatives), concerned with auto repair and/or consumer protection, are conducted. Feedback from these sessions is brought back to the association, and the program adjusted as needed.

To assure auto repair customers recourse if they were not satisfied with a repair transaction, the Motorist Assurance Program offers mediation and arbitration through MAP/BBB-CARE and other non-

profit organizations. MAP conducted pilot programs in twelve states before announcing the program nationally in October, 1998. During the pilots, participating repair shops demonstrated their adherence to the Pledge and Standards and agreed to follow the UICS in communicating the results of their inspection to their customers. To put some "teeth" in the program, an accreditation requirement for shops was initiated. The requirements are stringent, and a self-policing method has been incorporated which includes the "mystery shopping" of outlets.

We welcome you to join us as we continue our outreach... with your support, both the automotive repair industry and your customers will reap the benefits. Please visit MAP at our Internet site www.motorist.org or contact us at:

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January 1999

MAP UNIFORM INSPECTION GENERAL GUIDELINES

OVERVIEW OF SERVICE REQUIREMENTS & SUGGESTIONS

It is MAP policy that all exhaust, brake, steering, suspension, wheel alignment, drive-line, engine performance and maintenance, and heating, ventilation and air conditioning, and electrical services be offered and performed under the standards and procedures specified in these sections.

Before any service is performed on a vehicle, an inspection of the appropriate system must be performed. The results of this inspection must be explained to the customer and documented on an inspection form. The condition of the vehicle and its components will indicate what services/part replacements may be "Required" or "Suggested". In addition, suggestions may be made to satisfy the requests expressed by the customer.

When a component is suggested or required to be repaired or replaced, the decision to repair or replace must be made in the customer's best interest, and at his or her choice given the options available.

This section lists the various parts and conditions that indicate a required or suggested service or part replacement. Although this list is extensive, it is not fully inclusive. In addition to this list, a technician may make a suggestion. However, any suggestions must be based on substantial and informed experience, or the vehicle manufacturer's recommended service interval and must be documented.

Some conditions indicate that service or part replacement is required because the part in question is no longer providing the function for which it is intended, does not meet a vehicle manufacturer's design specification or is missing.

Example:
An exhaust pipe has corroded severely and has a hole in it through which exhaust gases are leaking. Replacement of the exhaust pipe in this case is required due to functional failure.

Example:
A brake rotor has been worn to the point where it measures less than the vehicle manufacturer's discard specifications. Replacement of the rotor is required because it does not meet design specifications.

Some conditions indicate that a service or part replacement is suggested because the part is close to the end of its useful life or addresses a customer's need, convenience or request. If a customer's vehicle has one of these conditions, the procedure may be only to suggest service.

Example:
An exhaust pipe is rusted, corroded or weak, but no leaks are present. In this case, the exhaust pipe has not failed. However, there is evidence that the pipe may need replacement in the near future. Replacement of the pipe may be suggested for the customer's convenience in avoiding a future problem.

Example:
The customer desires improved ride and/or handling, but the vehicle's shocks or struts have not failed. In this case, replacement may be suggested to satisfy the customer's wishes. In this case, replacement of the shocks or struts may not be sold as a requirement.

A customer, of course, has the choice of whether or not a shop will service his or her vehicle. He or she may decide not to follow some of your suggestions. When a repair is required, a MAP shop must refuse partial service on that system if, in the judgment of the service provider, proceeding with the work could create or continue an unsafe condition. When a procedure states that required or suggested repair or replacement is recommended, the customer must be informed of the generally acceptable repair/replacement options whether or not performed by the shop.

When presenting suggested repairs to the customer, you must present the facts, allowing the customer to draw their own conclusions and make an informed decision about how to proceed.

The following reasons may be used for required and suggested services. These codes are shown in the "Code" column of the MAP Uniform Inspection & Communications Standards that follow:

Reasons to Require Repair or Replacement

A – Part no longer performs intended purpose
B – Part does not meet a design specification (regardless of performance)
C – Part is missing

NOTE: When a repair is required, the shop must refuse partial service to the system in question, if the repair creates or continues an unsafe condition.

Reasons to Suggest Repair or Replacement

1 – Part is close to the end of its useful life (just above discard specifications, or weak; failure likely to occur soon, etc.)
2 – To address a customer need, convenience, or request (to stiffen ride, enhance performance, eliminate noise, etc.)
3 – To comply with maintenance recommended by the vehicle's Original Equipment Manufacturer (OEM)
4 – Technician's recommendation based on substantial and informed experience

NOTE: Suggested services are always optional. When presenting suggested repairs to the customer, you must present

the facts, allowing the customer to draw their own conclusions and make an informed decision about how to proceed.

STEERING AND SUSPENSION

SERVICE PROCEDURES REQUIRED AND SUGGESTED FOR PROPER VEHICLE OPERATION

Steering and suspension are complex systems made up of a variety of interdependent components. For proper vehicle handling, ride, and tire wear, a thorough inspection is required whenever suspension work is being performed.

Conditions listed assume that the problem has been isolated to the specific component by proper testing procedures.

NOTE: When replacing steering and/or suspension components which may affect an alignment angle, you are required to check and adjust alignment as needed. Refer to the OEM specifications.

CAUTION: DO NOT use ride height altering or load compensating components, such as variable rate springs and coil over shocks, on vehicles with height or load sensing proportioning valve-equipped braking systems, unless these components are original equipment.

AIR RIDE SUSPENSION

NOTE: Depending on the air suspension design, there are some aftermarket products available to eliminate the air ride suspension on certain vehicles. If the system has been eliminated with one of these products, then no service is suggested or required.

AIR RIDE SUSPENSION - AIR SHOCKS AND AIR STRUTS

NOTE: This section covers the air spring portion of the air shock or strut. For damping portion of shock or strut conditions and procedures, refer to the SHOCK ABSORBERS, STRUT CARTRIDGES AND STRUT ASSEMBLIES section.

AIR RIDE SUSPENSION - AIR SHOCK AND AIR STRUT INSPECTION

Condition	Code	Procedure
Inner fabric of air bag damaged	A	Require replacement.
Leaking	A	Require repair or replacement.
Outer covering of air bag is cracked to the extent that inner fabric of air bag is visible	1	Suggest replacement.

AIR RIDE SUSPENSION - AIR SPRING VALVES

AIR RIDE SUSPENSION - AIR SPRING VALVE INSPECTION

Condition	Code	Procedure

Condition	Code	Procedure
Attaching hardware incorrect	A	Require replacement of incorrect part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Blocked	A	Require repair or replacement.
Connector bent	A	Require repair or replacement.
Connector broken	A	Require replacement.
Connector loose	A	Require repair or replacement.
Inoperative	A	Require repair or replacement.
Leaking	A	Require repair or replacement.
Restricted	A	Require repair or replacement.

AIR RIDE SUSPENSION - AIR SPRINGS

AIR RIDE SUSPENSION - AIR SPRING INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require replacement of broken part.
Attaching hardware incorrect	A	Require replacement of incorrect part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Collar cracked	A	Require replacement.
End cap cracked	A	Require replacement.
Inner fabric of bag damaged	A	Require replacement.
Leaking	A	Require repair or replacement.
Outer covering of air bag is cracked to the extent that inner fabric of air bag is visible	1	Suggest replacement.
Piston cracked	A	Require replacement.

AIR RIDE SUSPENSION - COMPRESSORS

AIR RIDE SUSPENSION - COMPRESSOR INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require repair or replacement of bent part.
Attaching hardware broken	A	Require replacement of broken part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Connector bent	A	Require repair or replacement.
Connector broken	A	Require replacement.
Connector loose	A	Require repair or replacement.
Does not build pressure	A	(1) Further inspection required.
Excessive run time	B	(2) Further inspection required.
Inoperative	A	Require replacement.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.

(1) - If failure to build pressure is traced to the compressor, require replacement.
(2) - If excessive run time is traced to the compressor, require replacement.

AIR RIDE SUSPENSION - HEIGHT SENSORS

AIR RIDE SUSPENSION - HEIGHT SENSOR INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require repair or replacement of bent part.
Attaching hardware broken	A	Require replacement of broken part.
Attaching hardware corroded, affecting structural integrity	A	Require replacement of corroded part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware		

threads damaged	A	... Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	..... Require replacement of part with stripped threads.
Dust boot missing	2	..... (1) Suggest replacement.
Dust boot split	2	..... (1) Suggest replacement.
Dust boot torn	2	..... (1) Suggest replacement.
Housing cracked	A	..... Require replacement.
Lead routing incorrect ..	B	.. Require rerouting according to vehicle manufacturer's specifications.
Loose	B	... Require adjustment to vehicle manufacturer's specifications.
Missing	C	..... Require replacement.
Output signal incorrect .	A	.. Require repair or replacement.
Wire lead damaged	A	.. Require repair or replacement.

(1) - This condition can lead to damage of the sliding magnet, which, in turn, causes premature sensor failure.

AIR RIDE SUSPENSION - MODULES

AIR RIDE SUSPENSION - MODULE INSPECTION

Condition	Code	Procedure
Attaching hardware loose	A	... Require repair or replacement of loose part.
Attaching hardware missing	C	.. Require replacement of missing part.
Attaching hardware threads damaged	A	... Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	..... Require replacement of part with stripped threads.
Housing cracked	2	.. Suggest repair or replacement.
Inoperative	A	..... Require replacement.
Missing	C	..... Require replacement.

AIR RIDE SUSPENSION - RELAYS (COMPRESSOR)

AIR RIDE SUSPENSION - RELAY (COMPRESSOR) INSPECTION

Condition	Code	Procedure
Housing cracked	2	..... (1) Suggest replacement.
Intermittent	A	..... Require replacement.
Missing	C	..... Require replacement.
Output signal incorrect .	A	..... Require replacement.

(1) - If moisture enters the relay, it can reduce life expectancy or impair function.

AIR RIDE SUSPENSION - SWITCHES (ON/OFF)

AIR RIDE SUSPENSION - SWITCH (ON/OFF) INSPECTION

Condition	Code	Procedure
Broken	A	Require replacement.
Missing	C	Require replacement.
Output signal incorrect	A	Require replacement.

AIR RIDE SUSPENSION - TORSION SPRINGS (COUNTER BALANCING)

AIR RIDE SUSPENSION - TORSION SPRING (COUNTER BALANCING) INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require repair or replacement of bent part.
Attaching hardware broken	A	Require replacement of broken part.
Attaching hardware incorrect	A	Require replacement of incorrect part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Broken	A	Require replacement.
Missing	C	Require replacement.

AIR RIDE SUSPENSION - TUBING

AIR RIDE SUSPENSION - TUBING INSPECTION

Condition	Code	Procedure
Attaching hardware incorrect	A	Require replacement of incorrect part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Blocked	A	Require repair or replacement.
Fitting incorrect	B	Require replacement.
Leaking	A	Require repair or replacement.
Line type incorrect	B	Require replacement.
Missing	C	Require replacement.
Restricted	A	Require repair or replacement.
Routed incorrectly	B	Require routing correction.

AIR RIDE SUSPENSION - WARNING LAMPS

AIR RIDE SUSPENSION – WARNING LAMP INSPECTION

Condition	Code	Procedure
Bulb burned out	A	Require replacement.
Warning light does not come on during bulb check	.	Further inspection required to determine cause.
Warning light flashes	.	Further inspection required to determine cause.
Warning light is intermittent	.	Further inspection required to determine cause.
Warning light stays on after initial bulb check	.	Further inspection required to determine cause.

AIR RIDE SUSPENSION - WIRING HARNESSES

AIR RIDE SUSPENSION – WIRING HARNESS INSPECTION

Condition	Code	Procedure
Connector bent	A	Require repair or replacement.
Connector broken	A	Require repair or replacement.
Connector loose	A	Require repair or replacement.
Damaged (cut, burned, or chafed)	A	Require repair or replacement.
Excessive resistance	B	Require repair or replacement.
Fuse blown	A	Require replacement.
Fusible link blown	A	Require replacement.
Open	A	Require repair or replacement.
Poor ground	A	Require repair or replacement.
Routed incorrectly	B	Require rerouting according to vehicle manufacturer’s specifications.
Shorted	A	Require repair or replacement.
Terminal bent	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal corroded	A	Require repair or replacement.
Terminal loose	A	Require repair or replacement.

BALL JOINTS

Before requiring or suggesting ball joint replacement, the approved OEM procedure must be used to measure ball joint wear. The measurement(s) obtained, along with the vehicle manufacturer’s specifications, must be noted on the inspection report. Some states require that these measurements also appear on the invoice.

NOTE: The term "perceptible movement," defined as any visible movement in any direction, has been the industry standard for determining the need for replacement of follower ball joints. Some vehicle manufacturers are now publishing specifications for follower ball joints that were

previously diagnosed by the "perceptible movement" standard. Before requiring or suggesting any parts be replaced based on "perceptible movement," consult your repair manual to determine if OEM specifications exist.

You are not required to replace ball joints in axle sets. However, when replacing a ball joint due to wear exceeding manufacturer's specification, you may suggest replacement of the other ball joint if its measurement shows it is close to the end of its useful life, for preventive maintenance.

BALL JOINT INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require repair or replacement of bent part if available; otherwise, replace ball joint.
Attaching hardware broken	A	Require replacement of broken part if available; otherwise, replace ball joint.
Attaching hardware corroded, affecting structural integrity	A	Require replacement of corroded part if available; otherwise, replace ball joint.
Attaching hardware incorrect	A	Require replacement of incorrect part if available; otherwise, replace ball joint.
Attaching hardware loose	A	Require repair or replacement of loose part if available; otherwise, replace ball joint.
Attaching hardware missing	C	Require replacement of missing part if available; otherwise, replace ball joint.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads if available; otherwise, replace ball joint.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads if available; otherwise, replace ball joint.
Binding	A	(1) Further inspection required.
Grease boot cracked	2	(2) Suggest replacement.
Grease boot missing	2	(3) Suggest replacement.
Grease boot torn	2	(4) Suggest replacement.
Grease fitting broken	A	Require replacement of grease fitting.
Grease fitting missing	C	Require replacement of grease fitting.
Grease fitting won't seal	A	Require replacement of grease fitting.
Greaseable ball joint will		

not take grease	2	.....	(5) Suggest replacement of grease fitting.
Nut on ball joint loose	A	.....	(6) Require repair or replacement.
Pre-load adjustment incorrect	B	..	Require repair or replacement.
Seized	A	.....	Require replacement.
Stud bent	B	.....	(7) Require replacement.
Stud broken	A	.....	(7) Require replacement.
Threads damaged	A	..	Require repair or replacement.
Threads stripped (threads missing)	A	.....	(7) Require replacement.
Wear exceeds manufacturer's specifications	B	.....	Require replacement.

(1) - If greaseable, grease ball joint. If problem persists or joint is non-greaseable, require replacement.
(2) - Cracked grease boot will allow contaminants to enter the ball joint and will accelerate wear.
(3) - Lack of grease boot will allow contaminants to enter the ball joint and will accelerate wear.
(4) - Torn grease boot will allow contaminants to enter the ball joint and will accelerate wear.
(5) - If the greaseable ball joint still will not take grease after replacing the grease fitting, suggest replacement of ball joint.
(6) - Check for bent stud or damaged taper hole.
(7) - Check for damaged taper hole.

BUSHINGS

BUSHING INSPECTION

Condition	Code		Procedure
Attaching hardware bent	B	...	Require repair or replacement of bent part if available; otherwise, replace bushing.
Attaching hardware broken	A	...	Require replacement of broken part if available; otherwise, replace bushing.
Attaching hardware corroded, affecting structural integrity	A	.	Require replacement of corroded part if available; otherwise, replace bushing.
Attaching hardware incorrect	A	.....	Require replacement of incorrect part if available; otherwise, replace bushing.
Attaching hardware loose	A	...	Require repair or replacement of loose part if available; otherwise, replace bushing.
Attaching hardware missing	C	..	Require replacement of missing part if available; otherwise, replace bushing.
Attaching hardware threads damaged	A	...	Require repair or replacement

			of part with damaged threads if available; otherwise, replace bushing.
Attaching hardware threads stripped (threads missing)	A	.....	Require replacement of part with stripped threads if available; otherwise, replace bushing.
Binding	A	..	Require repair or replacement.
Deteriorated, affecting performance	A	..	Require repair or replacement.
Distorted, affecting performance	A	..	Require repair or replacement.
Leaking (fluid-filled type)	A	.....	Require replacement.
Missing	C	.....	Require replacement.
Noisy	2	.....	(1) Further inspection required.
Rubber separating from internal metal sleeve on bonded bushing	A	.....	Require replacement.
Seized	A	.....	Require replacement.
Shifted (out of position)	B	..	Require repair or replacement.
Split	A	.....	Require replacement.
Surface cracking (weather-checked)	..	.....	No service suggested or required.

(1) - If noise isolated to bushing, suggest repair or replacement.

CAUTION: Use only approved lubricant on rubber bushings. Petroleum-based lubricants may damage rubber bushings.

CENTER LINKS

CENTER LINK INSPECTION

Condition	Code		Procedure
Attaching hardware incorrect	A	.....	Require replacement of incorrect part, if available; otherwise, replace center link.
Attaching hardware loose	A	...	Require repair or replacement of loose part, if available; otherwise, replace center link.
Attaching hardware missing	C	..	Require replacement of missing part, if available; otherwise, replace center link.
Attaching hardware threads damaged	A	...	Require repair or replacement of part with damaged threads, if available; otherwise, replace center link.
Attaching hardware threads stripped (threads missing)	A	.....	Require replacement of part with stripped threads, if

		available; otherwise, replace center link.
Bent	B	Require replacement.
Binding	A	(1) Further inspection required.
Grease boot cracked	2	(2) Suggest replacement.
Grease boot missing	2	(3) Suggest replacement.
Grease boot torn	2	(4) Suggest replacement.
Grease fitting broken	A	Require replacement of grease fitting.
Grease fitting missing	C	Require replacement of grease fitting.
Grease fitting won't seal	A	Require replacement of grease fitting.
Grease seal missing	2	(3) Suggest replacement.
Grease seal torn	2	(4) Suggest replacement.
Looseness (perceptible horizontal movement)	1	(5) Suggest replacement.
Looseness that is excessive	B	(5)(6) Require replacement.
Seized	A	Require replacement.
Stud bent	B	(7) Require replacement.
Stud broken	A	(7) Require replacement.
Stud loose in taper hole	A	(7) Require repair or replacement.
Taper hole elongated	A	(8) Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	(7) Require replacement.
Wear exceeds manufacturer's specifications	B	Require replacement.

(1) - If greaseable, grease joint. If problem persists or joint is non-greaseable, require replacement.
(2) - Cracked grease boot will allow contaminants to enter the joint and will accelerate wear.
(3) - Lack of grease boot will allow contaminants to enter the joint and will accelerate wear.
(4) - Torn grease boot will allow contaminants to enter the joint and will accelerate wear.
(5) - If manufacturer's procedures for inspection exist, use those procedures; otherwise, use an approved inspection method such as the dry park check.
CAUTION: DO NOT use pliers or pry bar to check ball and socket movement. Use only moderate hand pressure.
(6) - Excessive looseness is defined as being significant enough to affect vehicle handling or structural integrity.
(7) - Check for damaged taper hole.
(8) - Check for damaged stud.

CONTROL ARM SHAFTS

CONTROL ARM SHAFT INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require replacement of broken

		part, if available; otherwise, replace shaft.
Attaching hardware loose	A	Require repair or replacement of loose part, if available; otherwise, replace shaft.
Attaching hardware missing	C	Require replacement of missing part, if available; otherwise, replace shaft.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads, if available; otherwise, replace shaft.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads, if available; otherwise, replace shaft.
Bent	B	Require replacement.
Shaft bushing surface undersized (worn)	B	Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

CONTROL ARMS

CONTROL ARM INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require repair or replacement of bent part, if available; otherwise, replace control arm.
Attaching hardware broken	A	Require replacement of broken part, if available; otherwise, replace control arm.
Attaching hardware corroded, affecting structural integrity	A	Require replacement of corroded part, if available; otherwise, replace control arm.
Attaching hardware incorrect	A	Require replacement of incorrect part, if available; otherwise, replace control arm.
Attaching hardware loose	A	Require repair or replacement of loose part, if available; otherwise, replace control arm.
Attaching hardware missing	C	Require replacement of missing part, if available; otherwise, replace control arm.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads,

		if available; otherwise, replace control arm.
Attaching hardware threads stripped (threads missing)	A	..... Require replacement of part with stripped threads, if available; otherwise, replace control arm.
Bent	B	..... Require replacement.
Bushing hole oversized ..	B	..... Require replacement.
Ball joint hole oversized (loose interference or press fit)	B	..... (1) Further inspection required.
Corroded, affecting structural integrity ...	A	..... Require replacement.
Holes distorted	A	..... Require replacement.
Threads damaged	A	.. Require repair or replacement.
Threads stripped (threads missing)	A	..... Require replacement.

(1) - If oversized ball joint is available, require replacement of ball joint. If oversized ball joint is not available, require replacement of control arm.

DRAG LINKS

DRAG LINK INSPECTION

Condition	Code	Procedure
Attaching hardware incorrect	A	..... Require replacement of incorrect part, if available; otherwise, replace drag link.
Attaching hardware loose	A	... Require repair or replacement of loose part, if available; otherwise, replace drag link.
Attaching hardware missing	C	.. Require replacement of missing part, if available; otherwise, replace drag link.
Attaching hardware threads damaged	A	... Require repair or replacement of part with damaged threads, if available; otherwise, replace drag link.
Attaching hardware threads stripped (threads missing)	A	..... Require replacement of part with stripped threads, if available; otherwise, replace drag link.
Bent	B	..... Require replacement.
Binding	A	..... (1) Further inspection required.
Grease boot cracked	2	..... (2) Suggest replacement.
Grease boot missing	2	..... (3) Suggest replacement.
Grease boot torn	2	..... (4) Suggest replacement.
Grease fitting broken ...	A	... Require replacement of grease fitting.

Grease fitting missing	C	...	Require replacement of grease fitting.
Grease fitting won't seal	A	...	Require replacement of grease fitting.
Grease seal missing	2	.....	(5) Suggest replacement.
Grease seal torn	2	.....	(4) Suggest replacement.
Looseness (perceptible horizontal movement)	1	.....	(6) Suggest replacement.
Looseness that is excessive	B	.....	(6)(7) Require replacement.
Seized	A	.....	Require replacement.
Stud bent	B	.....	(8) Require replacement.
Stud broken	A	.....	(8) Require replacement.
Stud loose in taper hole	A	.....	(8) Require repair or replacement.
Taper hole elongated	A	.....	(9) Require replacement.
Threads damaged	A	..	Require repair or replacement.
Threads stripped (threads missing)	A	.....	(8) Require replacement.
Wear exceeds manufacturer's specifications	B	.....	Require replacement.

(1) - If greaseable, grease joint. If problem persists or joint is non-greaseable, require replacement.
(2) - Cracked grease boot will allow contaminants to enter the joint and will accelerate wear.
(3) - Lack of grease boot will allow contaminants to enter the joint and will accelerate wear.
(4) - Torn grease boot will allow contaminants to enter the joint and will accelerate wear.
(5) - Missing grease seal will allow contaminants to enter the joint and will accelerate wear.
(6) - If manufacturer's procedures for inspection exist, use those procedures; otherwise, use an approved inspection method such as the dry park check.

CAUTION: DO NOT use pliers or pry bar to check ball and socket movement. Use only moderate hand pressure.

(7) - Excessive looseness is defined as being significant enough to affect vehicle handling or structural integrity.
(8) - Check for damaged taper hole.
(9) - Check for damaged stud.

ELECTRONIC RIDE CONTROL SHOCKS AND STRUTS

NOTE: This section covers the electronic damping control portion of the electronic shock or strut. For dampening portion of shock or strut conditions and procedures, refer to the SHOCK ABSORBERS, STRUT CARTRIDGES AND STRUT ASSEMBLIES section.

ELECTRONIC RIDE CONTROL SHOCK AND STRUT INSPECTION

Condition	Code		Procedure
Connector bent	A	..	Require repair or replacement.
Connector broken	A	..	Require repair or replacement.
Connector loose	A	..	Require repair or replacement.
Electronic valve control			

inoperative	2	(1) Suggest replacement.
Terminal bent	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal corroded	A	Require repair or replacement.
Terminal loose	A	Require repair or replacement.

(1) - It is acceptable to replace with a non-electronically controlled unit, where available.

IDLER ARMS

IDLER ARM INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require replacement of broken part, if available; otherwise, replace idler arm.
Attaching hardware incorrect	A	Require replacement of incorrect part, if available; otherwise, replace idler arm.
Attaching hardware loose	A	Require repair or replacement of loose part, if available; otherwise, replace idler arm.
Attaching hardware missing	C	Require replacement of missing part, if available; otherwise, replace idler arm.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads, if available; otherwise, replace idler arm.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads, if available; otherwise, replace idler arm.
Binding	A	(1) Further inspection required.
Grease boot cracked	2	(2) Suggest replacement.
Grease boot missing	2	(3) Suggest replacement.
Grease boot torn	2	(4) Suggest replacement.
Grease fitting broken	A	Require replacement of grease fitting.
Grease fitting missing	C	Require replacement of grease fitting.
Grease fitting won't seal	A	Require replacement of grease fitting.
Grease seal missing	2	(5) Suggest replacement.
Grease seal torn	2	(4) Suggest replacement.
Greaseable joint will not take grease	2	(1) Suggest replacement of grease fitting.
Looseness at frame bracket end	B	(6)(7) Require repair or replacement.

Looseness at link end (perceptible horizontal movement)	1	(8)	Suggest replacement.
Looseness at link end that is excessive	B	(8)(9)	Require replacement.
Mounted out of position (center link not parallel)	B		Require repositioning.
Nut on stud loose	A	(10)	Require repair or replacement.
Seized	A		Require replacement.
Stud bent	B	(11)	Require replacement.
Stud broken	A	(11)	Require replacement.
Taper hole elongated	A	(12)	Require replacement.
Threads damaged	A		Require repair or replacement.
Threads stripped (threads missing)	A	(11)	Require replacement.
Wear exceeds manufacturer's specifications	B		Require replacement.

(1) - If greaseable, grease joint. If problem persists or joint is non-greaseable, require replacement.
(2) - Cracked grease boot will allow contaminants to enter joint and will accelerate wear.
(3) - Lack of grease boot will allow contaminants to enter joint and will accelerate wear.
(4) - Torn grease boot will allow contaminants to enter joint and will accelerate wear.
(5) - Missing grease seal will allow contaminants to enter joint and will accelerate wear.
(6) - If manufacturer's procedures and specifications exist, use those procedures and specifications; otherwise, use an approved inspection method such as the dry park check.
(7) - Looseness is defined as movement that creates excessive toe change.
(8) - If manufacturer's procedures for inspection exist, use those procedures; otherwise, use an approved inspection method such as the dry park check.
CAUTION: DO NOT use pliers or pry bar to check ball and socket movement. Use only moderate hand pressure.
(9) - Excessive looseness is defined as significant enough to affect vehicle handling or structural integrity.
(10) - Check for bent stud or damaged taper hole.
(11) - Check for damaged taper hole.
(12) - Check for damaged stud.

KING PINS

You are not required to replace king pins in axle sets. However, when replacing a king pin due to wear exceeding manufacturer's specifications, you may suggest replacement of the other king pin on the axle if its measurement shows it is close to the end of its useful life.

KING PIN INSPECTION

Condition	Code	Procedure
Bearing balls pitted	A	Require replacement.
Bearing balls worn	A	Require replacement.
Bearing races pitted	A	Require replacement.

Bearing races worn	A	..... Require replacement.
Bearing rollers pitted ..	A	..... Require replacement.
Bearing rollers worn	A	..... Require replacement.
Bearing seal bent	2	. Suggest replacement of seal or bearing.
Bearing seal missing	2	. Suggest replacement of seal or bearing.
Bearing seal torn	2	. Suggest replacement of seal or bearing.
Binding	A	.. Require repair or replacement of affected parts.
End caps missing	C	. Require replacement of missing part, if available; otherwise, replace king pin.
End play exceeds specifications	B	..... Require repair.
Grease fitting broken ...	A	.. Require replacement of grease fitting.
Grease fitting missing ..	C	.. Require replacement of grease fitting.
Grease fitting won't seal	A	.. Require replacement of grease fitting.
Locating pins missing ...	C	. Require replacement of missing part, if available; otherwise, replace king pin.
Looseness exceeds manufacturer's specifications	B	.... Require replacement of worn parts.
Seized	A	..... Require replacement.
Threads damaged	A	. Require repair or replacement.
Threads stripped (threads missing)	A	..... Require replacement.
Will not take grease	2	..... (1) Suggest replacement of grease fitting.

(1) - If king pin will not take grease after replacement of grease fitting, suggest replacement of king pin.

PITMAN ARMS

PITMAN ARM INSPECTION

Condition	Code	Procedure
Attaching hardware incorrect	A	..... Require replacement of incorrect part, if available; otherwise, replace pitman arm.
Attaching hardware loose	A	... Require repair or replacement of loose part, if available; otherwise, replace pitman arm.
Attaching hardware missing	C	.. Require replacement of missing part, if available; otherwise, replace pitman arm.
Attaching hardware threads damaged	A	... Require repair or replacement of part with damaged threads, if available; otherwise,

			replace pitman arm.
Attaching hardware threads stripped (threads missing)	A	.....	Require replacement of part with stripped threads, if available; otherwise, replace pitman arm.
Bent	B	.....	Require replacement.
Binding	A	.....	(1) Further inspection required.
Grease boot cracked	2	.....	(2) Suggest replacement.
Grease boot missing	2	.....	(3) Suggest replacement.
Grease boot torn	2	.....	(4) Suggest replacement.
Grease fitting broken	A	.....	Require replacement grease fitting.
Grease fitting missing	C	...	Require replacement of grease fitting.
Grease fitting won't seal	A	...	Require replacement of grease fitting.
Grease seal missing	2	.....	(3) Suggest replacement of seal.
Grease seal torn	2	.....	(4) Suggest replacement of seal.
Looseness (perceptible horizontal movement)	1	.....	(5) Suggest replacement.
Looseness that is excessive	B	.....	(5)(6) Require replacement.
Nut on stud loose	A	.....	(7) Require repair or replacement.
Seized	A	.....	Require replacement.
Splines damaged	A	..	Require repair or replacement.
Splines stripped (splines missing)	A	.....	Require replacement.
Stud bent	B	.....	(8) Require replacement.
Stud broken	A	.....	(8) Require replacement.
Stud loose in taper hole	A	.....	(8) Require repair or replacement.
Taper hole elongated	A	.....	(9) Require replacement.
Threads damaged	A	..	Require repair or replacement.
Threads stripped (threads missing)	A	.....	(8) Require replacement.

(1) - If greaseable, grease joint. If problem persists or joint is non-greaseable, require replacement.
(2) - Cracked grease boot will allow contaminants to enter joint and will accelerate wear.
(3) - Lack of grease boot will allow contaminants to enter joint and will accelerate wear.
(4) - Torn grease boot will allow contaminants to enter joint and will accelerate wear.
(5) - If manufacturer's procedures for inspection exist, use those procedures; otherwise, use an approved inspection method such as the dry park check.
CAUTION: DO NOT use pliers or pry bar to check ball and socket movement. Use only moderate hand pressure.
(6) - Excessive looseness is defined as being significant enough to affect vehicle handling or structural integrity.
(7) - Check for bent stud of damaged taper hole.
(8) - Check for damaged taper hole.
(9) - Check for damaged stud.

POWER STEERING HOSES

POWER STEERING HOSE INSPECTION

Condition	Code	Procedure
Blistered	B	Require replacement.
Blocked	A	Require repair or replacement.
Fitting threads damaged	A	Require repair or replacement.
Fitting threads stripped (threads missing)	A	Require replacement.
Inner fabric (webbing) cut	A	Require replacement.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Outer covering is cracked to the extent that the inner fabric of hose is visible	B	Require replacement.
Restricted	A	Require repair or replacement.

POWER STEERING (HYDRAULIC) PUMPS

If diagnosis has determined that complete disassembly is necessary to determine the extent of the system failure, the suggestion may be made to rebuild or replace the power steering pump. Repair or replacement of the following components may be required if performed as part of a power steering pump overhaul or rebuild service to meet a minimum rebuild standard.

POWER STEERING (HYDRAULIC) PUMP INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require repair or replacement of bent part.
Attaching hardware broken	A	Require replacement of broken part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Belt alignment incorrect	B	(1) Further inspection required.
Belt cracked	1	Suggest replacement.
Belt frayed	1	Suggest replacement.
Belt missing	C	Require replacement.
Belt noisy	2	(2) Further inspection required.
Belt plies separated	A	Require replacement.

Belt tension out of specification	B	Require adjustment or replacement.
Belt worn beyond adjustment range	B	Require replacement.
Belt worn so it contacts bottom of pulley	A	Require replacement.
Binding	A	Require repair or replacement.
Fluid at or beyond service interval	3	Suggest fluid change.
Fluid contaminated	B	(3) Require flushing and refilling of the system.
Fluid level incorrect	B	Require adjustment of fluid level.
Inadequate assist	A	(4) Further inspection required.
Leaking	A	Require repair or replacement.
Noise	2	(5) Further inspection required.
Pulley bent	A	Require repair or replacement of pulley.
Pulley missing	C	Require replacement of pulley.
Remote reservoir leaking	A	Require replacement of reservoir,
Reservoir cap broken	A	Require replacement of cap.
Reservoir cap missing	C	Require replacement of cap.
Seized	A	Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

(1) - Determine cause of incorrect alignment and require repair.
(2) - Determine cause of noise and suggest repair.
(3) - Determine and correct source of contamination. OEM specifications must be followed for fluid type.
(4) - If pump is source of inadequate assist, require repair or replacement.
(5) - If noise is isolated to pump, suggest repair or replacement.

RADIUS ARMS

RADIUS ARM INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require replacement of broken part.
Attaching hardware incorrect	A	Require replacement of incorrect part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.

Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Bent	B	Require replacement.
Corroded, affecting structural integrity	A	Require replacement.
Holes distorted	A	Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

RELAY RODS

RELAY ROD INSPECTION

Condition	Code	Procedure
Attaching hardware incorrect	A	Require replacement of incorrect part, if available; otherwise, replace relay rod.
Attaching hardware loose	A	Require repair or replacement of loose part, if available; otherwise, replace relay rod.
Attaching hardware missing	C	Require replacement of missing part, if available; otherwise, replace relay rod.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads, if available; otherwise, replace relay rod.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads, if available; otherwise, replace relay rod.
Bent	B	Require replacement.
Binding	A	(1) Further inspection required.
Grease boot cracked	2	(2) Suggest replacement.
Grease boot missing	2	(3) Suggest replacement.
Grease boot torn	2	(4) Suggest replacement.
Grease fitting broken	A	Require replacement grease fitting.
Grease fitting missing	C	Require replacement of grease fitting.
Grease fitting won't seal	A	Require replacement of grease fitting.
Grease seal missing	2	(3) Suggest replacement.
Grease seal torn	2	(4) Suggest replacement.
Looseness (perceptible horizontal movement)	1	(5) Suggest replacement.
Looseness that is excessive	B	(5)(6) Require replacement.
Seized	A	Require replacement.
Stud bent	B	(7) Require replacement.

Stud loose in taper hole	A		(7) Require repair or replacement.
Taper hole elongated	A		(8) Require replacement.
Threads damaged	A		Require repair or replacement.
Threads stripped (threads missing)	A		(7) Require replacement.
Wear exceeds manufacturer's specifications	B		Require replacement.

(1) - If greaseable, grease joint. If problem persists or joint is non-greaseable, require replacement.
(2) - Cracked grease boot will allow contaminants to enter the joint and will accelerate wear.
(3) - Lack of grease boot will allow contaminants to enter the joint and will accelerate wear.
(4) - Torn grease boot will allow contaminants to enter the joint and will accelerate wear.
(5) - If manufacturer's procedures for inspection exist, use those procedures; otherwise, use an approved inspection method such as the dry park check.
CAUTION: DO NOT use pliers or pry bar to check ball and socket movement. Use only moderate hand pressure.
(6) - Excessive looseness is defined as being significant enough to affect vehicle handling or structural integrity.
(7) - Check for damaged taper hole.
(8) - Check for damaged stud.

SHOCK ABSORBERS, STRUT CARTRIDGES AND STRUT ASSEMBLIES

You are not required to replace shocks or struts in axle sets. However, when replacing a shock or strut due to the conditions that follow, you may suggest replacement of the other shock or strut on the same axle for improved performance and preventive maintenance.

* Part is close to the end of its useful life
* To extend tire life
* To balance ride and handling
* To improve stopping distance

When replacing steering and/or suspension components which may affect an alignment angle, you are required to check and adjust alignment as needed. Refer to the OEM specifications.

Under no circumstances should a technician bend struts or strut housings.

A vehicle's load-carrying and handling abilities are limited by its suspension, tires, brakes, and driveline. Installing coil over shocks or any other load assist device does not increase the vehicle's load capacity. See the vehicle owner's manual for more details.

NOTE: If vehicle is equipped with original equipment coil over shocks, apply the conditions for coil springs from the SPRINGS - COIL, LEAF AND TORSION BAR section of the STEERING AND SUSPENSION guidelines. If the vehicle is equipped with add-on coil over shocks, you may suggest replacing the shocks with standard shocks for any spring-related condition.

SHOCK ABSORBER, STRUT CARTRIDGE AND STRUT ASSEMBLY INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require repair or replacement of bent part, if available; otherwise, replace shock or strut.
Attaching hardware broken	A	Require replacement of broken part, if available; otherwise, replace shock or strut.
Attaching hardware corroded, affecting structural integrity	A	Require replacement of corroded part, if available; otherwise, replace shock or strut.
Attaching hardware incorrect	A	Require replacement of incorrect part, if available; otherwise, replace shock or strut.
Attaching hardware loose	A	Require repair or replacement of loose part, if available; otherwise, replace shock or strut.
Attaching hardware missing	C	Require replacement of missing part, if available; otherwise, replace shock or strut.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads, if available; otherwise, replace shock or strut.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads, if available; otherwise, replace shock or strut.
Binding	A	Require replacement.
Body dented	A	(1) Further inspection required.
Body punctured	A	Require replacement.
Brake hose bracket bent	B	Require repair or replacement.
Brake hose bracket missing	C	Require replacement.
Brake hose bracket threads damaged	A	Require repair or replacement.
Brake hose bracket threads stripped (threads missing)	C	Require replacement.
Compression bumper missing	C	Require replacement of compression bumper.
Compression bumper split	1	Suggest replacement of compression bumper.
Damping (none)	A	Require replacement.
Dust boot (bellows) split	2	(2) Suggest replacement of boot.

Dust boot (bellows) missing	2	.....	(2) Suggest replacement of boot.
Dust boot (bellows) torn	2	.....	(2) Suggest replacement of boot.
Dust shield broken	2	.....	(2) Suggest replacement.
Dust shield missing	2	.....	(2) Suggest replacement.
Gland nut (strut housing cap) is not removable using appropriate tool	A	..	(3) Require replacement of nut and/or housing.
Gland nut (strut housing cap) threads damaged	A	...	Require repair or replacement of nut.
Gland nut (strut housing cap) threads stripped (threads missing)	A	.....	Require replacement of nut.
Housing dented	A	.....	(1) Further inspection required.
Housing punctured	A	.....	Require replacement.
Jounce bumper missing	C	...	Require replacement of jounce bumper.
Jounce bumper split	1	...	Suggest replacement of jounce bumper.
Leaking oil, enough for fluid to be running down the body	A	.....	(4) Require replacement.
Noise	2	.....	(5) Further inspection required.
Piston rod bent	A	.....	Require replacement.
Piston rod broken	A	.....	Require replacement.
Piston rod has surface defect	2	.....	Suggest replacement.
Piston rod threads damaged	A	..	Require repair or replacement.
Piston rod threads stripped (threads missing)	A	.....	Require replacement.
Seized	A	.....	Require replacement.
Shock missing	C	.....	Require replacement.
Strut housing bent	A	.....	Require replacement.
Strut housing cap (gland nut) is not removable using appropriate tool	A	.....	(3) Require replacement of nut and/or housing.
Strut housing cap (gland nut) threads damaged	A	...	Require repair or replacement of nut.
Strut housing cap (gland nut) threads stripped (threads missing)	A	.....	Require replacement of nut.
Strut housing severely corroded, affecting structural integrity	A	.....	Require replacement.
Strut housing threads damaged	A	..	Require repair or replacement.
Strut housing threads stripped (threads missing)	A	.....	Require replacement.
Tire cupping	A	.....	(6) Further inspection required.

(1) - Require replacement of units where dents restrict shock or strut piston rod movement. If dents don't restrict movement, no service is suggested or required. Especially critical on mono-tube shocks.
(2) - This condition can lead to damage of the piston rod, which, in turn, causes premature piston rod seal wear.
(3) - Only required if replacing cartridge.
(4) - CAUTION: If the strut cartridge has been replaced previously, the oil on the strut housing may be filler oil. The technician must identify the source of the oil.
(5) - If noise is isolated to shock or strut, suggest replacement.
(6) - Although shocks or struts may have contributed to tire cupping, an inspection is needed of the entire suspension system. If the shock or strut is found to be contributing to the tire cupping, require replacement.

SPINDLES

SPINDLE INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require replacement of broken part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Bent	B	Require replacement.
Broken	A	Require replacement.
Race seat area undersized	B	Require replacement.
Scored	A	Require repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

SPRINGS - COIL, LEAF AND TORSION BAR

When springs are replaced, it is suggested, but not required, that both springs on an axle be replaced to maintain equal height from side to side and to provide a balanced ride and proper handling.

When variable rate springs are installed in place of conventional coil springs, they must be installed in axle sets to ensure proper handling, uniform ride, and proper chassis height.

Erroneous height measurements may result from: improper tire inflation, non-standard tire or wheel size, and heavy load in vehicle or trunk.

SPRING (COIL, LEAF AND TORSION BAR) INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require repair or replacement of bent part.
Attaching hardware broken	A	Require replacement of broken part.
Attaching hardware corroded, affecting structural integrity	A	Require replacement of corroded part.
Attaching hardware incorrect	A	Require replacement of incorrect part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Broken (all springs except secondary leave(s) on multi-leaf springs)	A	Require replacement.
Coil clash	..	(1) Require ride height check.
Coil spring insulator deteriorated	2	Suggest replacement of insulator.
Coil spring insulator missing	2	Suggest replacement of insulator.
Coil spring insulator split	2	Suggest replacement of insulator.
Coil spring plastic coating deteriorated - rust present	A	(2) Refer to manufacturer's service requirements.
Composite spring damaged	..	(3) Further inspection required.
Cracked (all springs except composite leaf and secondary leave(s) on multi-leaf springs)	A	Require replacement.
Installed incorrectly	B	Require repair.
Leaf spring insulators missing	2	Suggest replacement of insulators.
Secondary leaf on multi-leaf spring broken	1	Suggest repair or replacement
Secondary leaf on multi-leaf spring cracked	1	Suggest repair or replacement
Torsion bar		

adjuster bent	A	.....	(4) Require repair or replacement of adjuster.
Torsion bar adjuster seized	A	....	(4) Require repair or replacement of adjuster.
Torsion bar adjuster threads damaged	A	....	(4) Require repair or replacement of part with damaged threads.
Torsion bar adjuster threads stripped (threads missing)	A	.....	Require replacement of part with stripped threads.
Vehicle suspension height not within OEM specifications	B	.....	Require adjustment or replacement.

(1) – If vehicle is within manufacturer's height specifications, no service is suggested or required.
(2) – Some manufacturers require replacement under these conditions.
(3) – Check vehicle ride height. If ride height is OK, no service is suggested or required.
(4) – Only required if ride height needs to be adjusted.

STEEL POWER STEERING LINES

CAUTION: When replacing steel power steering lines, be sure to use a replacement product that meets or exceeds OEM design specifications.

STEEL POWER STEERING LINE INSPECTION

Condition	Code		Procedure
Attaching hardware bent	B	...	Require repair or replacement of bent part.
Attaching hardware broken	A	...	Require replacement of broken part.
Attaching hardware loose	A	...	Require repair or replacement of loose part.
Attaching hardware missing	C	..	Require replacement of missing part.
Attaching hardware threads damaged	A	...	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	.....	Require replacement of part with stripped threads.
Blocked	A	..	Require repair or replacement.
Fitting incorrect (such as compression fitting)	B	.....	Require replacement.
Flare type incorrect	B	.....	Required replacement.
Leaking	A	.....	Require tightening or replacement.
Line type incorrect	B	.....	Require replacement.

Restricted	A	..... Require replacement.
Routed incorrectly	B	..... Require routing correction.
Rust-pitted	1	..... Suggest replacement.
Rust pitted, affecting structural integrity ..	A	..... Require replacement.

STEERING ARMS

STEERING ARM INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	... Require repair or replacement of bent part.
Attaching hardware broken	A	... Require replacement of broken part.
Attaching hardware incorrect	A	..... Require replacement of incorrect part.
Attaching hardware loose	A	... Require repair or replacement of loose part.
Attaching hardware missing	C	.. Require replacement of missing part.
Attaching hardware threads damaged	A	... Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	..... Require replacement of part with stripped threads.
Bent	B	..... Require replacement.
Broken	A	..... Require replacement.
Taper hole elongated	A	..... (1) Require replacement.
Threads damaged	A	.. Require repair or replacement.
Threads stripped (threads missing)	A	..... Require replacement.

(1) - Check for damaged stud.

STEERING DAMPERS

The following procedures are only required if the vehicle was originally equipped from the factory with a steering damper. If the steering damper is an add-on unit, then the unit may be removed instead of repairing or replacing.

STEERING DAMPER INSPECTION

Condition	Code	Procedure
Attaching hardware bent .	B	... Require repair or replacement of bent part, if available; otherwise, replace steering damper.
Attaching hardware broken	A	... Require replacement of broken part, if available; otherwise,

		replace steering damper.
Attaching hardware corroded, affecting structural integrity ...	A	. Require replacement of corroded part, if available; otherwise, replace steering damper.
Attaching hardware incorrect	A	..... Require replacement of incorrect part, if available; otherwise, replace steering damper.
Attaching hardware loose	A	... Require repair or replacement of loose part, if available; otherwise, replace steering damper.
Attaching hardware missing	C	.. Require replacement of missing part, if available; otherwise, replace steering damper.
Attaching hardware threads damaged	A	... Require repair or replacement of part with damaged threads, if available; otherwise, replace steering damper.
Attaching hardware threads stripped (threads missing)	A	..... Require replacement of part with stripped threads, if available; otherwise, replace steering damper.
Binding	A	..... Require replacement.
Damper body dented	A	..... (1) Further inspection required.
Damper body punctured ...	A	..... Require replacement.
Damping (none)	A	..... Require replacement.
Dust boot (bellows) missing	2	..... (2) Suggest replacement of boot.
Dust boot (bellows) split	2	..... (2) Suggest replacement of boot.
Dust shield broken	2	..... (2) Suggest replacement.
Dust shield missing	2	..... (2) Suggest replacement.
Leaking oil, enough for fluid to be running down the body	A	..... Require replacement.
Loose	A	.. Require repair or replacement.
Missing	C	..... Require replacement.
Noise	2	..... (3) Further inspection required.
Piston rod bent	A	..... Require replacement.
Piston rod broken	A	..... Require replacement.
Piston rod has surface defect	2	..... Suggest replacement.
Piston rod threads stripped (threads missing)	A	..... Require replacement.
Piston rod threads damaged	A	.. Require repair or replacement.
Seized	A	..... Require replacement.

(1) - Require replacement of units where dents restrict damper

piston rod movement. If dents don't restrict movement, no service is suggested or required. Especially critical on mono-tube dampers.

(2) - This condition can lead to damage of the piston rod, which, in turn, causes premature piston rod seal wear.

(3) - If noise is isolated to damper, suggest replacement.

STEERING GEARS (EXCEPT RACK AND PINION)

If diagnosis has determined that complete disassembly is necessary to determine the extent of the system failure, the suggestion may be made to rebuild or replace the power steering pump. Repair or replacement of the following components may be required, if performed as part of a power steering pump overhaul or rebuild service to meet a minimum rebuild standard.

STEERING GEAR (EXCEPT RACK AND PINION) INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require replacement of broken part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Binding	A	Require repair or replacement
Flex coupler binding	A	Require repair or replacement of coupler.
Flex coupler loose	A	Require repair or replacement of coupler.
Flex coupler missing parts	A	Require repair or replacement of coupler.
Flex coupler soft/spongy	A	Require replacement of coupler.
Flex coupler torn	A	Require replacement of coupler.
Fluid contaminated	B	(1) Require flushing and refilling of the system.
Gasket leaking	A	Require repair or replacement of gasket.
Housing leaking	A	Require replacement.
Hydraulic fittings leaking	A	Require repair or replacement of fittings.
Inadequate power assist	A	(2) Further inspection required. See note below.
Lash exceeds manufacturer's specifications	B	Require repair or replacement.
Seal leaking	A	Require repair or replacement

		of seal and/or mating part.
Splines damaged	A	... Require repair or replacement of splines.
Splines stripped	A	. Require replacement of splines.
Steering coupler shield cracked	2	..... Suggest replacement.
Steering coupler shield missing	C	..... Require replacement.
Threads damaged	A	... Require repair or replacement of part with damaged threads.
Threads stripped (threads missing)	A	..... Require replacement of part with stripped threads.
U-joint binding	A	... Require repair or replacement of joint.
U-joint loose	A	... Require repair or replacement of joint.
Unequal power assist	A	.. Require repair or replacement.

(1) - Determine and correct source of contamination. OEM specifications must be followed for fluid type.
(2) - If steering gear is source of inadequate assist, require repair or replacement.

STEERING GEARS - RACK AND PINION

If diagnosis has determined that complete disassembly is necessary to determine the extent of the system failure, the suggestion may be made to rebuild or replace the power steering pump. Repair or replacement of the following components may be required, if performed as part of a power steering pump overhaul or rebuild service to meet a minimum rebuild standard.

STEERING GEARS - RACK AND PINION INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	..... Require replacement of broken part.
Attaching hardware loose	A	.. Require repair or replacement of loose part.
Attaching hardware missing	C	..... Require replacement of missing part.
Attaching hardware threads damaged	A	.. Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	.... Require replacement of part with stripped threads.
Balance tube blocked	A	.. Require repair or replacement of balance tube.
Balance tube missing	C	.. Require replacement of balance tube.
Balance tube restricted .	A	... Require repair or replacement of balance tube.
Bellows boot clamp missing	C	... Require replacement of clamp.
Bellows boot cracked		

(not through)	2	..	Suggest replacement of bellows boot.
Bellows boot missing	C	..	Require replacement of bellows boot.
Bellows boot not sealing	A	...	Require repair or replacement of bellows boot.
Bellows boot torn	A	..	Require replacement of bellows boot.
Bellows boot twisted (from toe adjustment) ..	B	.....	Require repair.
Fitting leaking	A	..	Require repair or replacement.
Fitting missing	A	.	Require replacement of fitting.
Fitting threads damaged	A	...	Require repair or replacement of part with damaged threads.
Fitting threads stripped (threads missing)	A	.....	Require replacement of part with stripped threads.
Flex coupler binding	A	...	Require repair or replacement of coupler.
Flex coupler loose	A	...	Require repair or replacement of coupler.
Flex coupler missing parts	A	...	Require repair or replacement of coupler.
Flex coupler soft/spongy	A	.	Require replacement of coupler.
Flex coupler torn	A	.	Require replacement of coupler.
Fluid contaminated	B	.....	(1) Require flushing and refilling of the system.
Gasket leaking	A	..	Require repair or replacement.
Hard steering on cold start-up	1	.....	(2) Suggest repair or replacement.
Housing cracked, affecting structural integrity	B	.....	Require replacement.
Housing leaking	A	.....	Require replacement.
Inadequate power assist .	A	.....	(3) Further inspection required.
Lash exceeds manufacturer's specifications	B	..	Require repair or replacement.
Seal leaking	A	..	Require repair or replacement.
Splines damaged	A	..	Require repair or replacement.
Splines stripped (splines missing)	A	.....	Require replacement.
Steel line blocked	A	...	Require repair or replacement of line.
Steel line leaking	A	...	Require repair or replacement of line.
Steel line missing	C	....	Require replacement of line.
Steel line restricted ...	A	...	Require repair or replacement of line.
Steering coupler shield cracked	2	.....	Suggest replacement.
Steering coupler shield missing	C	.....	Require replacement.
Steering coupler shield torn	2	.....	Suggest replacement.
Threads damaged	A	...	Require repair or replacement of part with damaged threads.

Condition	Code	Procedure
Threads stripped (threads missing)	A	Require replacement of part with stripped threads.
U-joint binding	A	Require repair or replacement of joint.
U-joint loose	A	Require repair or replacement of joint.
Unequal power assist	A	Require repair or replacement.

(1) - Determine and correct source of contamination. Follow OE specifications for fluid type.
(2) - Indicates internal wear.
(3) - If steering gear is source of inadequate assist, require repair or replacement.

STEERING KNUCKLES

STEERING KNUCKLE INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require repair or replacement of bent part.
Attaching hardware broken	A	Require replacement of broken part.
Attaching hardware incorrect	A	Require replacement of incorrect part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Bent	B	Require replacement.
Broken	A	Require replacement.
Pinch bolt incorrect	B	Require replacement with bolt that meets OE design.
Pinch bolt loose	B	Require repair.
Pinch bolt missing	B	Require replacement.
Pinch bolt tabs deformed (pinched together), .032" or more before clamping	B	(1) Require replacement.
Taper hole elongated	A	(2) Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require repair or replacement.

(1) - Steering knuckle deformation can cause pinch bolt breakage.
(2) - Check for damaged stud.

STRIKE OUT BUMPERS

STRIKE OUT BUMPER INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require replacement of broken part.
Attaching hardware corroded, affecting structural integrity	A	Require replacement of corroded part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Missing	C	Require replacement.
Split	1	Suggest replacement.

STRUT RODS

STRUT ROD INSPECTION

Condition	Code	Procedure
Adjusting nut seized	A	(1) Require repair or replacement.
Attaching hardware bent	B	Require repair or replacement of bent part, if available; otherwise, replace strut rod.
Attaching hardware broken	A	Require replacement of broken part, if available; otherwise, replace strut rod.
Attaching hardware incorrect	A	Require replacement of incorrect part, if available; otherwise, replace strut rod.
Attaching hardware loose	A	Require repair or replacement of loose part, if available; otherwise, replace strut rod.
Attaching hardware missing	C	Require replacement of missing part, if available; otherwise, replace strut rod.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads,

			if available; otherwise, replace strut rod.
Attaching hardware threads stripped (threads missing)	A	.....	Require replacement of part with stripped threads, if available; otherwise, replace strut rod.
Attaching (mating) hole oversized	A	...	Require repair or replacement of frame.
Attaching point on frame corroded, affecting structural integrity	A	.....	Require repair of frame.
Bent	A	.....	Require replacement.
Mating (attaching) hole oversized	A	...	Require repair or replacement of frame.
Threads damaged	A	..	Require repair or replacement.
Threads stripped (threads missing)	A	.....	Require replacement.

(1) - Only required if an alignment is being performed.

STRUT UPPER BEARING PLATE ASSEMBLIES

NOTE: When the following guidelines indicate replacement of bearing, only the bearing should be replaced if it is available separately; otherwise, replace the bearing plate assembly.

STRUT UPPER BEARING PLATE ASSEMBLY INSPECTION

Condition	Code		Procedure
Attaching hardware broken	A	...	Require replacement of broken part, if available; otherwise, replace bearing plate assembly.
Attaching hardware loose	A	...	Require repair or replacement of loose part, if available; otherwise, replace bearing plate assembly.
Attaching hardware missing	C	..	Require replacement of missing part, if available; otherwise, replace bearing plate assembly.
Attaching hardware threads damaged	A	...	Require repair or replacement of part with damaged threads, if available; otherwise, replace bearing plate assembly.
Attaching hardware threads stripped (threads missing)	A	.....	Require replacement of part with stripped threads, if available; otherwise, replace bearing plate assembly.
Bearing axial or radial movement exceeds vehicle manufacturer's			

specifications	B	.....	Require replacement of bearing.
Bearing binding	A	.....	Require replacement of bearing.
Bearing missing	C	.....	Require replacement of bearing.
Bearing seized	A	.....	Require replacement of bearing.
Bent	B	.....	Require replacement.
Holes distorted	A	.....	Require replacement.
Missing	C	.....	Require replacement.
Severely corroded, affecting structural integrity	A	.....	Require replacement.

SWAY BAR LINKS

SWAY BAR LINK INSPECTION

Condition	Code		Procedure
Attaching hardware incorrect	A	.....	Require replacement of incorrect part, if available; otherwise, replace link.
Attaching hardware loose	A	...	Require repair or replacement of loose part, if available; otherwise, replace link.
Attaching hardware missing	C	..	Require replacement of missing part, if available; otherwise, replace link.
Attaching hardware threads damaged	A	...	Require repair or replacement of part with damaged threads, if available; otherwise, replace link.
Attaching hardware threads stripped (threads missing)	A	.....	Require replacement of part with stripped threads, if available; otherwise, replace link.
Ball and socket has looseness (perceptible vertical movement)	1	.....	(1) Suggest replacement.
Ball and socket has looseness that is excessive	B	.....	(1)(2) Require replacement.
Bent	B	.....	Require replacement.
Broken	A	.....	Require replacement.
Corroded, affecting structural integrity ...	A	.....	Require replacement.
Grease boot cracked	2	.....	(3) Suggest replacement.
Grease boot missing	2	.....	(4) Suggest replacement.
Grease boot torn	2	.....	(5) Suggest replacement.
Missing	C	.....	Require replacement.
Nut on stud loose	A	.....	(6) Require repair.
Stud bent	B	.....	(7) Require replacement.
Stud broken	A	.....	(7) Require replacement.
Threads damaged	A	..	Require repair or replacement.

Threads stripped (threads missing)	A	(7) Require replacement.

(1) - If manufacturer's procedures for inspection exist, use those procedures; otherwise, use an approved inspection method such as the dry park check.
CAUTION: DO NOT use pliers or pry bar to check ball and socket movement. Use only moderate hand pressure.
(2) - Excessive looseness is defined as being significant enough to affect vehicle handling or structural integrity.
(3) - Cracked grease boot will allow contaminants to enter the joint and will accelerate wear.
(4) - Lack of grease boot will allow contaminants to enter the joint and will accelerate wear.
(5) - Torn grease boot will allow contaminants to enter the joint and will accelerate wear.
(6) - Check for bent stud or damaged taper hole.
(7) - Check for damaged taper hole.

SWAY BARS

SWAY BAR INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A ...	Require replacement of broken part, if available; otherwise, replace sway bar.
Attaching hardware corroded, affecting structural integrity ...	A	Require replacement of corroded part, if available; otherwise, replace sway bar.
Attaching hardware loose	A ...	Require repair or replacement of loose part, if available; otherwise, replace sway bar.
Attaching hardware missing	C ..	Require replacement of missing part, if available; otherwise, replace sway bar.
Attaching hardware threads damaged	A ...	Require repair or replacement of part with damaged threads, if available; otherwise, replace sway bar.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads, if available; otherwise, replace sway bar.
Bent	B	Require replacement.
Broken	A	Require replacement.
Threads damaged	A ..	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

TIE ROD ENDS (INNER AND OUTER)

TIE ROD END (INNER AND OUTER) INSPECTION

Condition	Code	Procedure
Attaching hardware incorrect	A	Require replacement of incorrect part, if available; otherwise, replace tie rod end.
Attaching hardware loose	A	Require repair or replacement of loose part, if available; otherwise, replace tie rod end.
Attaching hardware missing	C	Require replacement of missing part, if available; otherwise, replace tie rod end.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads, if available; otherwise, replace tie rod end.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads, if available; otherwise, replace tie rod end.
Adjusting sleeve bent	B	Require replacement of sleeve or tie rod end.
Adjusting sleeve clamps out of position	B	Require repair.
Adjusting sleeve corroded, affecting structural integrity	A	Require replacement of sleeve or tie rod end.
Adjusting sleeve missing	C	Require replacement of sleeve or tie rod end.
Adjusting sleeve seized	A	(1) Require repair or replacement.
Adjusting sleeve threads damaged	A	Require repair or replacement of sleeve or tie rod end.
Adjusting sleeve threads stripped (threads missing)	A	Require replacement of sleeve or tie rod end.
Binding	A	(2) Further inspection required.
Grease boot cracked	2	(3) Suggest replacement.
Grease boot missing	2	(4) Suggest replacement.
Grease boot torn	2	(5) Suggest replacement.
Grease fitting broken	A	Require replacement of grease fitting.
Grease fitting missing	C	Require replacement of grease fitting.
Grease fitting won't seal	A	Require replacement of grease fitting.
Grease seal missing	2	(4) Suggest replacement of seal.

Grease seal torn	2	(5) Suggest replacement of seal.
Greaseable tie rod end won't take grease	2	(6) Suggest replacement of grease fitting.
Looseness (perceptible horizontal movement)	1	(7) Suggest replacement.
Looseness exceeds manufacturer's specifications	B	Require replacement.
Looseness that is excessive	B	(7)(8) Require replacement.
Nut on stud loose	A	(9) Require repair or replacement of nut.
Seized	A	Require replacement
Stud bent	B	(10) Require replacement.
Stud broken	A	(10) Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	(10) Require replacement.

(1) - Only required if toe needs to be adjusted.
(2) - If greaseable, grease joint. If problem persists or joint is non-greaseable, require replacement.
(3) - Cracked grease boot will allow contaminants to enter joint and will accelerate wear.
(4) - Lack of grease boot will allow contaminants to enter joint and will accelerate wear.
(5) - Torn grease boot will allow contaminants to enter joint and will accelerate wear.
(6) - If greaseable tie rod end will not take grease after replacing the grease fitting, suggest replacement of tie rod end.
(7) - If manufacturer's procedures for inspection exist, use those procedures; otherwise, use an approved inspection method such as the dry park check.
CAUTION: DO NOT use pliers or pry bar to check ball and socket movement. Use only moderate hand pressure.
(8) - Excessive looseness is defined as being significant enough to affect vehicle handling or structural integrity.
(9) - Check for bent stud or damaged taper hole.
(10) - Check for damaged taper hole.

TRACK BARS

TRACK BAR INSPECTION

Condition	Code	Procedure
Attaching hardware incorrect	A	Require replacement of incorrect part, if available; otherwise, replace track bar.
Attaching hardware loose	A	Require repair or replacement of loose part, if available; otherwise, replace track bar.
Attaching hardware missing	C	Require replacement of missing part, if available; otherwise, replace track bar.
Attaching hardware		

threads damaged	A	...	Require repair or replacement of part with damaged threads, if available; otherwise, replace track bar.
Attaching hardware threads stripped (threads missing)	A	.....	Require replacement of part with stripped threads, if available; otherwise, replace track bar.
Bent	B	.....	Require replacement.
Corroded, affecting structural integrity	A	.....	Require replacement.
Grease boot cracked	2	.....	(1) Suggest replacement.
Grease boot missing	2	.....	(2) Suggest replacement.
Grease boot torn	2	.....	(3) Suggest replacement.
Holes distorted	A	.....	Require replacement.
Looseness (perceptible horizontal movement)	1	.....	(4) Suggest replacement.
Looseness that is excessive	B	.....	(4)(5) Require replacement.
Nut on stud loose	A	.....	(6) Require repair or replacement of nut.
Seized	A	.....	Require replacement.
Stud bent	B	.....	(7) Require replacement.
Stud broken	A	.....	(7) Require replacement.
Threads damaged	A	..	Require repair or replacement.
Threads stripped (threads missing)	A	.....	(7) Require replacement.
Wear exceeds manufacturer's specifications	B	.....	Require replacement.

(1) - Cracked grease boot will allow contaminants to enter joint and will accelerate wear.
(2) - Lack of grease boot will allow contaminants to enter joint and will accelerate wear.
(3) - Torn grease boot will allow contaminants to enter joint and will accelerate wear.
(4) - If manufacturer's procedures for inspection exist, use those procedures; otherwise, use an approved inspection method such as the dry park check.
CAUTION: DO NOT use pliers or pry bar to check ball and socket movement. Use only moderate hand pressure.
(5) - Excessive looseness is defined as being significant enough to affect vehicle handling or structural integrity.
(6) - Check for bent stud or damaged taper hole.
(7) - Check for damaged taper hole.

TRAILING ARMS

TRAILING ARM INSPECTION

Condition	Code		Procedure
Attaching hardware broken	A	...	Require replacement of broken part, if available; otherwise, replace trailing arm.
Attaching hardware loose	A	...	Require repair or replacement of loose part, if available;

		otherwise, replace trailing arm.
Attaching hardware missing	C	Require replacement of missing part, if available; otherwise, replace trailing arm.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads, if available; otherwise, replace trailing arm.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads, if available; otherwise, replace trailing arm.
Bent	B	Require replacement.
Bushing hole oversized	B	Require replacement.
Corroded, affecting structural integrity	A	Require replacement.
Holes distorted	A	Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

WHEEL BEARINGS, RACES AND SEALS

NOTE: When replacing or repacking wheel bearings, grease seal replacement is required. You are not required to replace these components in axle sets. Determine the need to replace based upon the individual component conditions that follow.

WHEEL BEARING, RACE AND SEAL INSPECTION

Condition	Code	Procedure
Rear axle seal on rear-wheel drive leaking	A	Require replacement of seal and inspection of axle, bearing, housing, and vent tube.
Seal bent	1	Suggest replacement.
Seal leaking	A	Require replacement of seal and inspection of bearings.
Seal missing	C	Require replacement.
Seal torn	A	Require replacement.
Wheel bearing assembly feels rough when rotated	A	Require replacement of bearing assembly.
Wheel bearing balls are pitted	A	Require replacement of bearing assembly.
Wheel bearing balls are worn	A	Require replacement of bearing assembly.
Wheel bearing end-play exceeds vehicle manufacturer's specifications	B	Require adjustment of bearing,

			if possible. If proper adjustment cannot be obtained, require repair or replacement of worn component.
Wheel bearing race is loose in the hub bore	.....	A	..... Require replacement of hub assembly and wheel bearings.
Wheel bearing races are pitted	.....	A	.. Require replacement of bearing assembly.
Wheel bearing races are worn	.....	A	.. Require replacement of bearing assembly.
Wheel bearing rollers are pitted	.....	A	.. Require replacement of bearing assembly.
Wheel bearing rollers are worn	.....	A	.. Require replacement of bearing assembly.

WHEEL ALIGNMENT

WHEEL ALIGNMENT

Wheel alignment is defined as the measurement, analysis, and adjustment of steering and suspension angles to conform to OEM specifications. These angles usually include, but are not limited to: caster, camber, toe, and thrust angle. Where these angles are not adjustable and not in specification, component replacement or correction kits may be required. Errors in set-back and steering axis inclination (SAI) are often attributable to failed or damaged components and must be corrected prior to performing an alignment.

Failure to replace or correct suggested parts or service may prevent a proper alignment.

Before performing an alignment check, inspect and verify the following:

* Tire pressure and size
* Vehicle loading
* Ride height
* Steering and suspension parts

If the inspection reveals that all the above are within published specifications, a wheel alignment check and an alignment, if needed, may be performed.

CAUTION: Under no circumstances should a technician bend or heat any steering or suspension component, unless specified by the vehicle manufacturer, for example, Ford forged twin "I" beam axles. All measurements and specifications must be noted on the inspection report.

WHEEL ALIGNMENT INSPECTION

Condition	Code	Procedure
Dog tracking, shown to be caused by faulty alignment	 2	..... Suggest repair.
Lead, shown to		

be caused by faulty alignment	A	.....	Require alignment.
Part has been changed, affecting alignment	A	.....	Require alignment check.
Pull, shown to be caused by faulty alignment	A	.....	Require alignment.
Steering wheel off-center	2	.....	Suggest alignment.
Tire wear, shown to be caused by faulty alignment	A	.....	Require alignment.
Wander, shown to be caused by faulty alignment	A	.....	Require alignment.

WHEELS AND TIRES

TIRES

These guidelines do not apply to split rims. Some vehicle manufacturers restrict replacement of tires to specific brands, types, or sizes.

WARNING: High pressure temporary compact spare tires should not be used with any other rims or wheels, nor should standard tires, snow tires, wheel covers, or trim rings be used with high pressure compact spare rims or wheels. Attempting to mount a tire of one diameter on a wheel of a different diameter or flange type may result in serious injury or death.

WARNING: Only specially trained persons should dismount or mount tires. Explosions of tire and wheel assembly can result from improper mounting, possibly causing serious injury or death.

WARNING: Consult the vehicle owner’s manual or vehicle placard for correct size, speed rating, designation, and cold inflation pressure of the original tires. DO NOT exceed the maximum load or inflation capacity of the tire specified by the Tire and Rim Association

WARNING: When replacing tires, it is suggested that the replacement tires match or exceed the OEM speed rating designation. If tires of different speed rating designations are mixed on the same vehicle, the tires may vary in handling characteristics. DO NOT mix different speed rating designations on the same axle.

WARNING: DO NOT mix radials with non-radial tires on the same axle, as this may affect vehicle handling and stability. If radial tires and bias or bias-belted ply tires are mixed on the same vehicle, the radials must be on the rear. High-pressure temporary compact spare tires are exempt from this rule.

WARNING: DO NOT mix size or type (all season, performance, mud and snow) of tires on the same axle.

TIRE INSPECTION

Condition	Code	Procedure
Air pressure incorrect	B	Require repair
Bead broken	A	Require replacement.
Bead leaking, caused by tire	A	Require repair or replacement.
Bead wire/cord exposed	A	Require replacement.
Cord or belt material exposed	A	Require replacement.
Cord ply separations	A	Require replacement.
Directional/asymmetrical tires mounted incorrectly	B	Require remounting and/or repositioning.
Irregular tread wear, affecting performance	2	(1) Suggest replacement.
Load ratings less than OEM specifications	B	Require replacement.
Mixed tread types (all season, performance, mud and snow) on same axle	A	Require replacement.
Number of punctures exceeds manufacturer's limit	B	Require replacement.
Out of balance	B	Require rebalance of tire/wheel assembly.
Ply separation	A	Require replacement.
Pull or lead, caused by tire	A	Require repair or replacement.
Radial and bias or bias-belted ply tires on same axle	B	Require repair or replacement.
Radials are on the front and not on the rear	B	(2) Require repair or replacement.
Run flat damage	A	Require replacement.
Shoulder cut	A	Require replacement.
Shoulder puncture	A	Require replacement.
Shoulder with plug	A	Require replacement.
Sidewall bulge	A	Require replacement.
Sidewall cut	A	Require replacement.
Sidewall indentation	..	No service required or suggested.
Sidewall puncture	A	Require replacement.
Sidewall with plug	A	Require replacement.
Speed rating designations different on same axle	2	Suggest repair or replacement.
Tire and wheel assembly has excessive run-out	B	(3) Require repair or replacement of appropriate part.
Tires with more than 1/4" diameter difference on a four-wheel drive vehicle	B	Require replacement.
Tread area puncture larger in diameter than manufacturer's specifications	B	Require replacement.
Tread missing pieces		

(chunking), exposing cord	A	.....	Require replacement.
Tread missing pieces (chunking), not exposing cord	1	.....	Suggest replacement.
Tread separations	A	.....	Require replacement.
Tube in tubeless tire	3	.... (4)	Suggest removal of tube.
Weather-checking	..	.....	No service required or suggested.
Worn to tread wear indicators	B	.....	Require replacement.

(1) - Determine and correct cause of irregular tire wear.
(2) - If radials and bias or bias-belted ply tires are on the same vehicle, the radials must be on the rear axle, except for high-pressure temporary spares.
(3) - Excessive is defined as enough to contribute to performance problems. Match mounting may correct run-out. If not, require replacement of appropriate part. Refer to manufacturer's specifications.
(4) - Most manufacturers do not recommend tubes in tubeless tires. Inspect tire and wheel assembly to determine the reason for a tube in tubeless tire. Recommendation for repair or replacement should be based upon condition of tires and/or wheel listed in these guidelines.

VALVE STEMS

VALVE STEM INSPECTION

Condition	Code	Procedure
Bent	1	..... Suggest replacement.
Broken	A	..... Require replacement.
Cut, but not leaking	1	..... Suggest replacement.
Deteriorated (cracking, dry rot)	1	..... Suggest replacement.
Leaking	A	. Require repair or replacement.
Missing	C	..... Require replacement.
Threads damaged	A	. Require repair or replacement.
Threads stripped	A	..... Require replacement.
Valve cap missing	C	.... Require replacement of cap.
Weather-checking	1	..... Suggest replacement.
Won't take air	A	. Require repair or replacement.

WHEEL ATTACHMENT HARDWARE

For conditions noted below, also check conditions of wheel stud holes.

CAUTION: Proper lug nut torque is essential. Follow recommended torque specifications and tightening sequence. DO NOT lubricate threads unless specified by the vehicle manufacturer.

WHEEL ATTACHMENT HARDWARE INSPECTION

Condition	Code	Procedure
Bent	A	..... Require replacement.
Broken	A	..... (1) Require replacement.

Loose	B	Require repair or replacement of affected component.
Lug nut installed backward	B	Require repair or replacement.
Lug nut mating type incorrect	B	Require replacement of nut.
Lug nut mating surface dished	A	Require replacement of nut.
Lug nut rounded	A	(2) Require replacement of nut.
Lug nut seized	A	(2) Require replacement of nut.
Stud incorrect	B	Require replacement of stud.
Threads damaged	A	Require repair or replacement of component with damaged threads.
Threads stripped	A	Require replacement of component with stripped threads.

(1) - Some manufacturers require replacement of all studs on that wheel if two or more studs or nuts on the same wheel are broken or missing.
(2) - Only required if removing wheel.

WHEELS (RIMS)

WARNING: Mounting a regular tire on a high-pressure compact spare wheel is not permitted. Attempting to mount a tire of one diameter on a wheel of a different diameter or flange type may result in serious injury or death. If the wheel identification stamp is not legible, or cannot be found, do not use the wheel until the size and type have been properly identified. Wheels of different diameter, offset, or width cannot be mixed on the same axle. Bead seat tapers cannot be interchanged.

WHEEL (RIM) INSPECTION

Condition	Code	Procedure
Bead leaking, caused by wheel	A	(1) Require repair or replacement.
Bent hub mounting surface	A	Require replacement.
Bent rim, causing vibration	2	(1) Suggest replacement.
Broken	A	Require replacement.
Cast wheel porous, causing a leak	A	Require repair or replacement.
Clip-on balance weight is incorrect type for rim flange	2	Suggest replacement.
Corrosion, affecting structural integrity	A	Require replacement.
Corrosion build-up on wheel mounting surface	A	Require repair.
Cracked	A	Require replacement.
Directional/asymmetrical wheels mounted incorrectly	B	Require remounting and/or repositioning.

Load capacity less than OEM specifications	B	.....	Require replacement.
Offset mismatched on same axle	B	.....	Require replacement.
Rivets leaking	A	.....	Require replacement.
Run-out beyond OEM specs	B	.....	Require replacement.
Stud holes elongated	A	..... (2)	Require replacement.
Welded or brazed repair	2	.....	Suggest replacement.
Welds leaking	A	.....	Require replacement.
Wheel centering (pilot) hole incorrect	B	.....	Require replacement.

(1) - CAUTION: DO NOT attempt to correct a bent rim.
(2) - Inspect wheel attaching hardware for damage.

98V020000: SUNROOF DOES NOT MEET FMVSS NO. 118

1998 Mitsubishi Galant

NHTSA RECALL BULLETIN

Model(s):	1994-98 Mitsubishi 3000GT 1994-98 Mitsubishi Galant 1997-98 Mitsubishi Mirage
Campaign No:	98V020000
Number of Affected Vehicles:	57294

VEHICLE DESCRIPTION:

Passsenger vehicles.

DESCRIPTION OF DEFECT:

After the ignition key is turned off, the sunroof immediately stops when opening the driver's door. This meets the requirements of FMVSS No. 118, "Power-Operated Window Systems." However, the sunroof does not stop when the passenger's door is opened.

CORRECTIVE ACTION:

Mitsubishi has not submitted a corrective action for this noncompliance. The manufacturer is petitioning NHTSA for a determination that this matter is inconsequential with respect to motor vehicle safety. The manufacturer is not obligated to conduct an owner notification and remedy campaign until NHTSA has resolved that the matter is consequential.

ADDITIONAL INFORMATION:

The National Highway Traffic Safety Administration operates Monday through Friday from 8:00 AM to 4:00 PM, Eastern Time. For more information call (800) 424-9393 or (202) 366-0123. For the hearing impaired, call (800) 424-9153.

SUN ROOF - POWER

1998 Mitsubishi Galant

1998 ACCESSORIES & EQUIPMENT
Mitsubishi - Power Sun Roofs

Eclipse, Galant, Montero, Montero Sport, 3000GT

DESCRIPTION & OPERATION

Sun roof is actuated by an overhead console-mounted switch. Sun roof motor, located near switch, moves sun roof panel by means of drive cables. If necessary, sun roof can be closed manually using manual closure wrench stored in vehicle's tool pouch.

On vehicles equipped with Electronic Timer Alarm Control System (ETACS) ECU, sun roof can be operated up to 30 seconds after ignition switch is turned to OFF position.

Sun roof motor incorporates a safety feature that initially limits opening or closing of roof glass panel. Sun roof will not fully close from fully open position without first releasing and then depressing slide switch during operation. Sun roof initially stops about 8" short of fully closed position.

COMPONENT LOCATIONS

COMPONENT LOCATIONS TABLE

Component	Location
Data Link Connector (DLC)	Under Left Side Of Dash, Below Steering Column
Sun Roof ECU	
Galant	Inside Headliner, On Left Rear Of Sun Roof
Montero Sport	Inside Headliner, On Right Front Of Sun Roof
Eclipse, Montero & 3000GT	Inside Headliner, On Front Center Of Sun Roof
Sun Roof Motor	Inside Headliner, Near ECU

SERVICING

LUBRICATION

NOTE: Only Lubrication procedures during reassembly of sliding roof assembly components are available from manufacturer at time of publication.

ADJUSTMENTS

SUN ROOF FIT

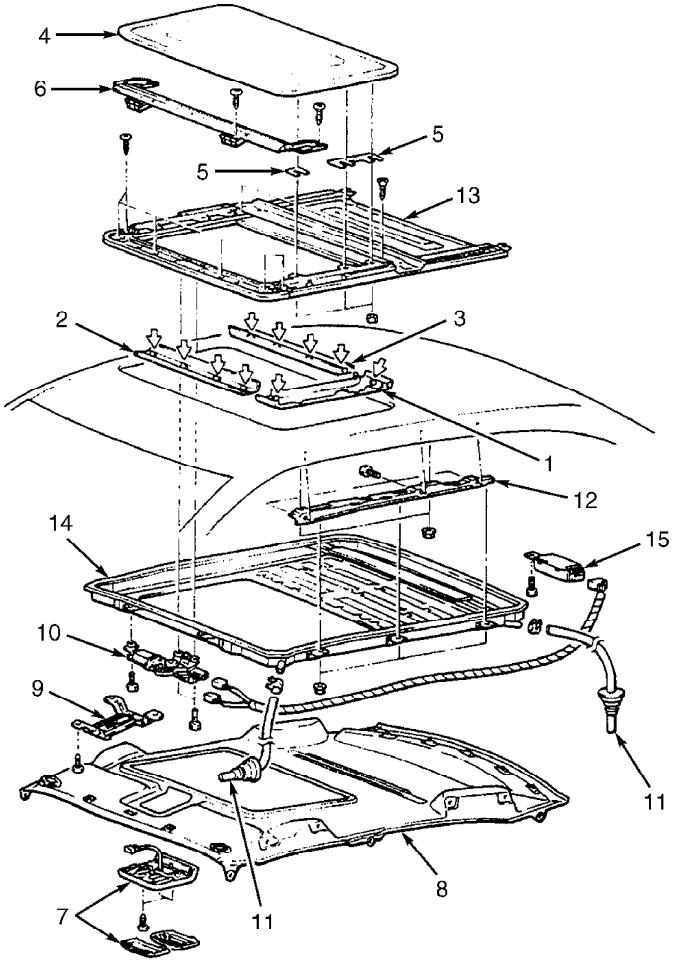
1) Fully close sun roof. Fully open sun shade. Remove side covers from underneath sun roof. Loosen 6 sun roof glass mounting nuts and adjust glass forward, backward or sideways, if necessary.

2) If adjustment cannot be made by loosening mounting nuts, check if sun roof glass or motor is in fully closed position. Readjust as necessary.

SUN ROOF GLASS FIT

1) Fully close sun roof. Ensure roof glass panel is parallel with roof opening. Sun roof glass panel parallelism should be within .04" (1 mm), above and below roof surface. If parallelism is not as specified, adjust glass panel by loosening sun roof glass panel attaching screws and repositioning glass panel. Tighten screws. See Fig. 1.

2) If adjustment cannot be made by loosening mounting screws, check if sun roof glass or motor is in fully closed position. Readjust as necessary.



1. Side Trim Cover
2. Front Trim Cover
3. Rear Trim Cover
4. Roof Glass Panel
5. Adjust Plate
6. Deflector
7. Sun Roof Switch & Light Assembly
8. Headliner
9. Light Bracket
10. Sun Roof Motor
11. Drain Hose Connection
12. Set Bracket
13. Sliding Roof Assembly
14. Housing Assembly
15. Sun Roof ECU

98J03809

Fig. 1: Exploded View Of Sun Roof Assembly (Typical)
Courtesy of Mitsubishi Motor Sales of America

SUN ROOF MOTOR CLUTCH CHECK

Except Eclipse & Montero Sport

1) Remove sun roof motor. See DRIVE MOTOR R & I under REMOVAL & INSTALLATION. Using crank handle stored in tool pouch, place crank handle into drive motor shaft.

2) Place spring scale on crank handle about 3.92" (100 mm) from drive motor shaft. Ensure spring scale is at right angle to crank handle. On Galant, connect battery source to sun roof motor connector terminals No. 1 and 4 to rotate motor. See Fig. 4. On Montero, connect battery source to sun roof motor connector terminals No. 1 and 3 to rotate motor. See Fig. 5. On 3000GT, connect battery source to sun roof motor connector terminals No. 1 and 2 to rotate motor. See Fig. 6 .

3) On Galant, spring scale should read 30-38 INCH lbs. (3.4-4.3 N.m). On Montero and 3000GT, spring scale should read 35-43 INCH lbs. (3.9-4.9 N.m). If clutch sliding force is not as specified, on Galant and Montero, adjust motor adjusting nut to left or right. On 3000GT, replace sun roof motor.

TROUBLE SHOOTING

Check following items listed below symptom to aid in diagnosis and repair of sun roof assembly.

SUN ROOF INOPERATIVE

* Fusible link or multipurpose fuse.
* Sun roof switch.
* Drive motor.

ROOF GLASS PANEL DOES NOT OPERATE CORRECTLY

* Foreign matter lodged in guide rail.
* Drive motor drive gear not correctly indexed with drive cables.
* Decrease in clutch slipping force of drive motor.
* Misaligned roof glass panel causing binding.

NOISY MOTOR OPERATION

* Drive motor drive gear not correctly indexed with drive cables.
* Worn or damaged drive motor pinion bearing.
* Worn or deformed drive cable.

NOISY ROOF PANEL OPERATION

* Foreign matter lodged in guide rail.
* Loose guide rail and lid.

WATER LEAKS

* Dust accumulation in housing assembly.
* Clogged drain hose.
* Broken or disconnected drain hose.
* Worn roof lid weatherstrip.
* Excessive roof panel-to-roof opening clearance and/or incorrectly fitted weatherstrip.

WIND NOISE

* Loose or deformed deflector.

COMPONENT TESTS

DRIVE MOTOR

Eclipse & Montero Sport

Remove drive motor. See DRIVE MOTOR R & I under REMOVAL & INSTALLATION. Using 12-volt power supply, apply voltage to 2-terminal connector. Reverse power supply leads to reverse motor direction. Replace motor as necessary.

Galant

Remove drive motor. See DRIVE MOTOR R & I under REMOVAL & INSTALLATION. Using 12-volt power supply, apply voltage to terminals No. 1 (Blue wire) and No. 4 (Blue/White wire) of 6-terminal drive motor connector. Reverse power supply leads to reverse motor direction. Replace motor as necessary.

Montero

Remove drive motor. See DRIVE MOTOR R & I under REMOVAL & INSTALLATION. Using 12-volt power supply, apply voltage to terminals No. 1 (Green wire) and No. 3 (Green/Red wire and Black wire) of 4-terminal drive motor connector. Reverse power supply leads to reverse motor direction. Replace motor as necessary.

3000GT

Remove drive motor. See DRIVE MOTOR R & I under REMOVAL & INSTALLATION. Using 12-volt power supply, apply voltage to terminals No. 1 (Red/Blue wire) and No. 2 (Red/Yellow wire) of 8-terminal drive motor connector. Reverse power supply leads to reverse motor direction. Replace motor as necessary.

DRIVE MOTOR LIMIT SWITCH

Eclipse & Montero Sport

1) Remove sun roof ECU. Look into viewing windows while turning rotating wheel. See Fig. 2. Turn rotating wheel until White marks appear. When White marks appear in viewing windows at same time, stop turning rotating wheel.

2) Close sun roof fully. Install timed sun roof control unit. Ensure wiring connector is properly inserted into control unit. Insert a flat-blade screwdriver, place on tab and press to right, being careful not to pinch wiring. See Fig. 3.

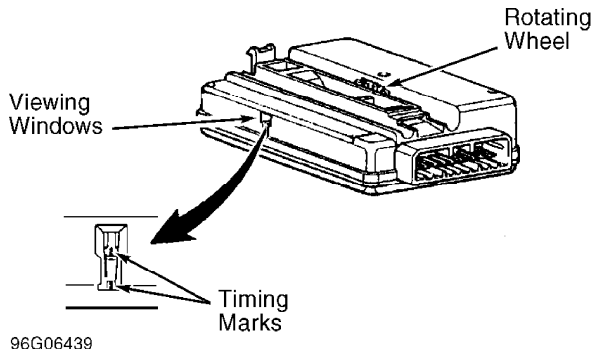


Fig. 2: Timing Sun Roof ECU (Eclipse & Montero Sport)
Courtesy of Mitsubishi Motor Sales of America

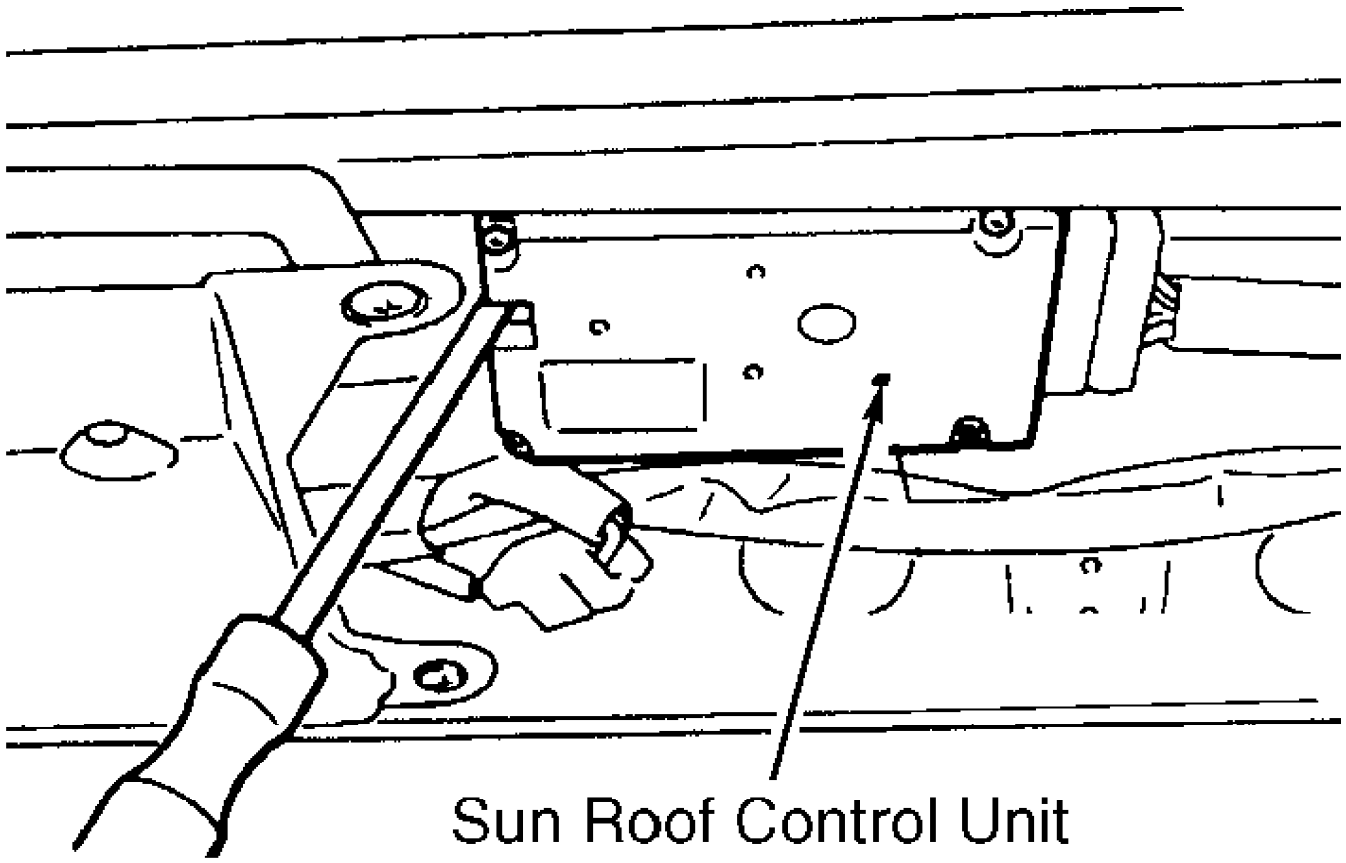


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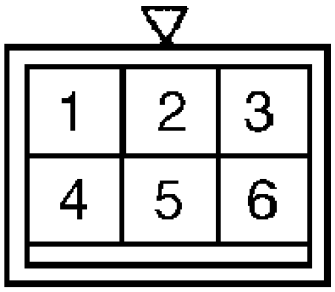
Fig. 3: Installing Sun Roof ECU (Eclipse & Montero Sport)
Courtesy of Mitsubishi Motor Sales of America

Galant

Remove limit switches from drive motor. Using ohmmeter, check continuity of each switch. Continuity should exist between terminals No. 3 (Blue/Red wire) and No. 5 (Black wire) for switch No. 1, and terminals No. 5 (Black wire) and No. 6 (Blue/Black wire) for switch No. 2. Replace switches as necessary. See Fig. 4.



96I06435

Fig. 4: Identifying Sun Roof Motor Connector (Galant)
Courtesy of Mitsubishi Motor Sales of America

Montero

Using ohmmeter, check continuity of limit switch. When

intermittent gear cam of drive motor depresses switch lever, continuity should exist between right side terminals (No. 2 and 4) of drive motor 4-terminal connector (connector latch upward). Replace drive motor if switch fails test. See Fig. 5.

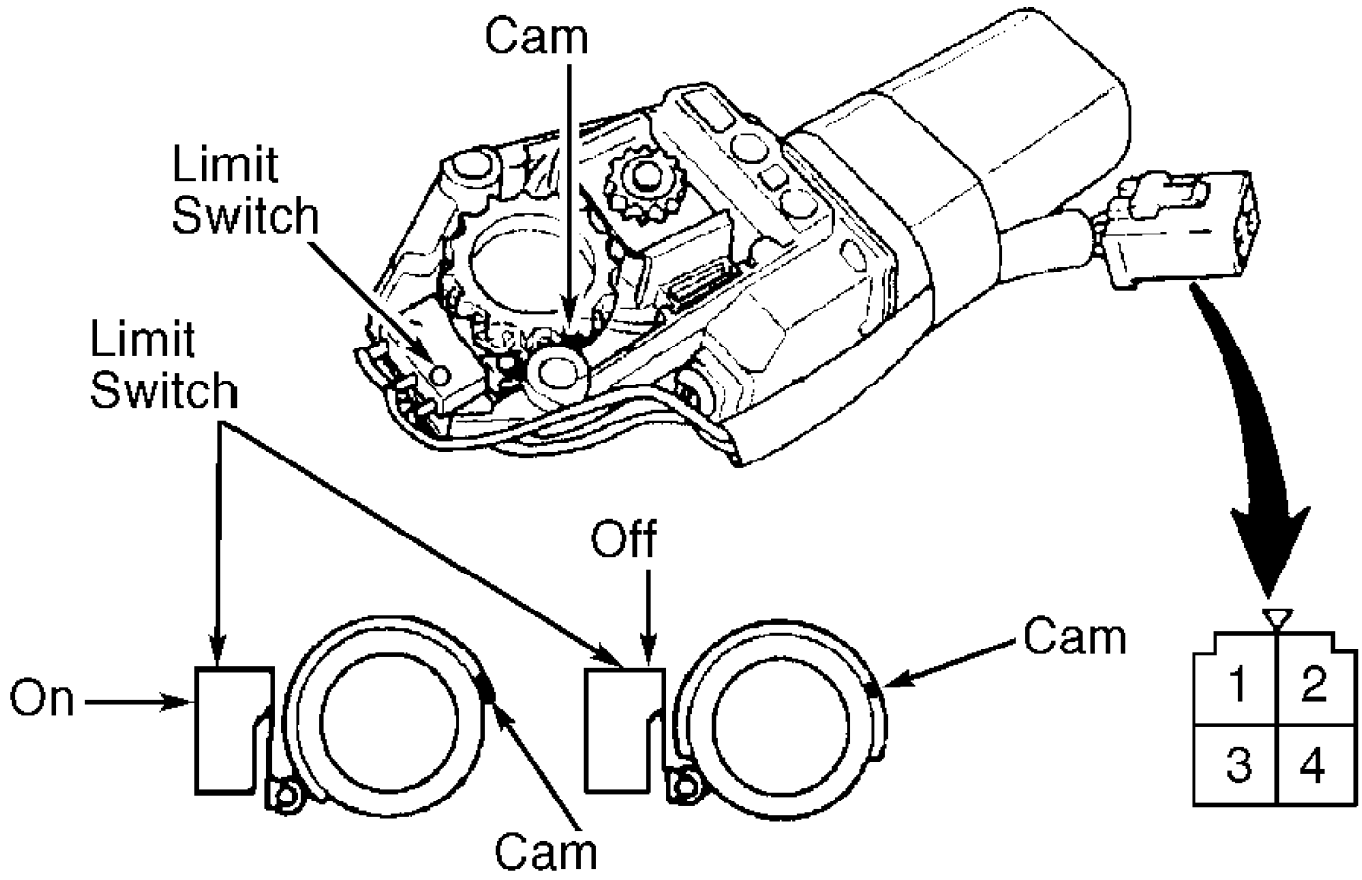


Fig. 5: Inspecting Sun Roof Limit Switches (Montero)
Courtesy of Mitsubishi Motor Sales of America

3000GT

Remove limit switches from drive motor. Using ohmmeter, check continuity of each switch. Continuity should exist between terminals No. 5 and 6 for switch "A", and terminals No. 5 and 8 for switch "B". Replace switches as necessary. See Fig. 6.

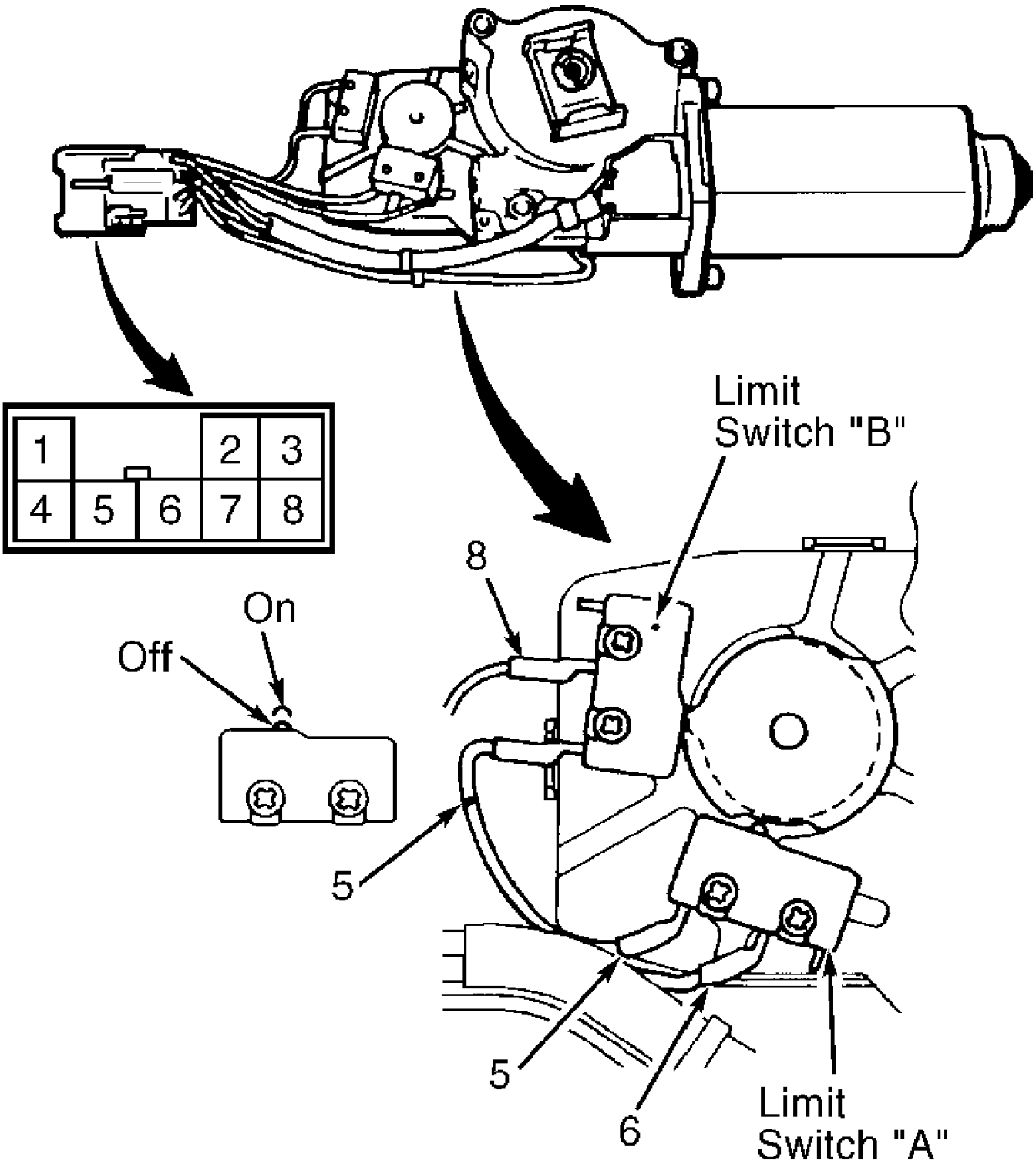
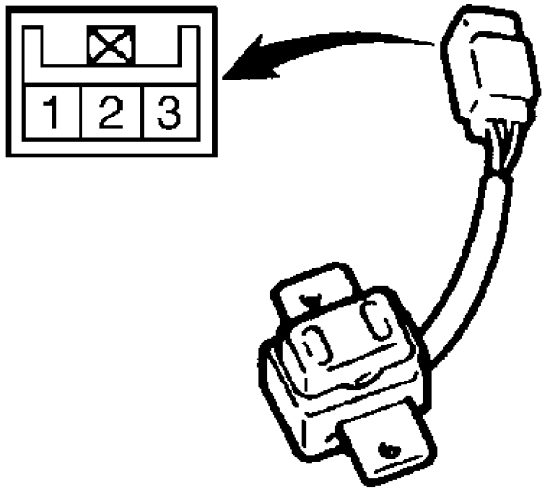


Fig. 6: Inspecting Sun Roof Limit Switches (3000GT)
Courtesy of Mitsubishi Motor Sales of America

SUN ROOF SWITCH

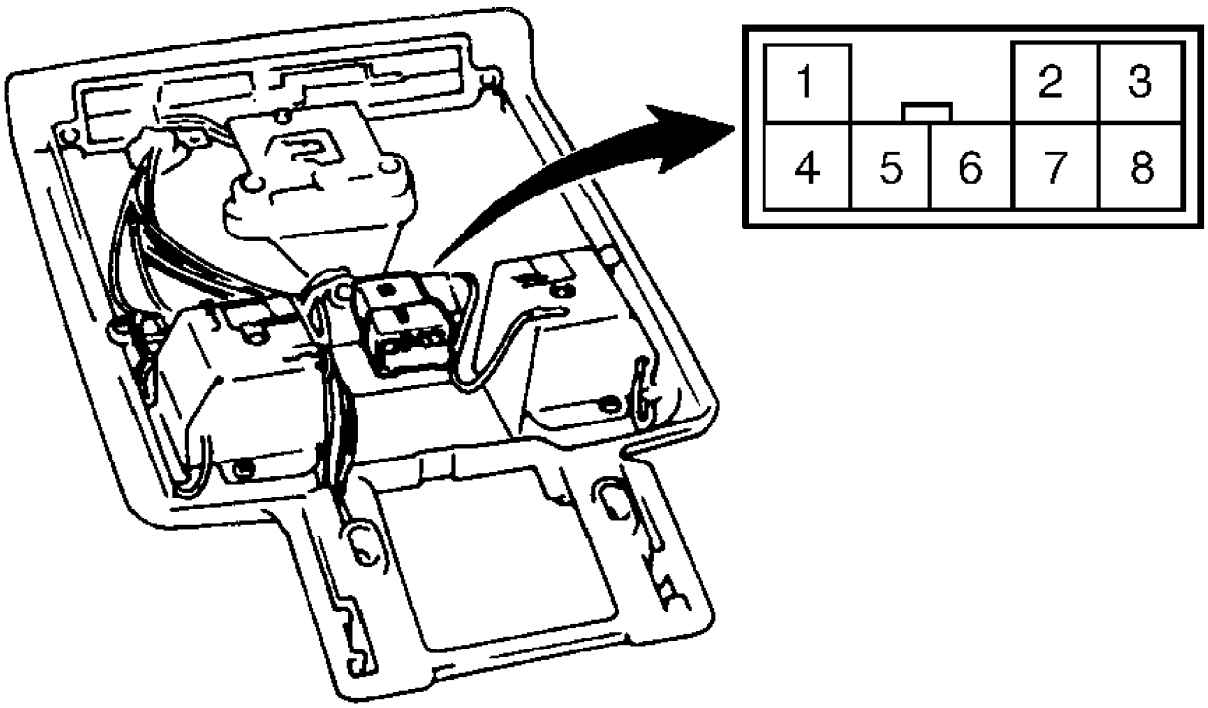
Using ohmmeter, check continuity between selected switch terminals. See Fig. 7, 8, 9 or 10. Replace switch as necessary.



Switch position	Terminal No.		
	1	2	3
Open	O	O	
OFF			
Close		O	O

96E06438

Fig. 7: Inspecting Sun Roof Switch Continuity (Eclipse & 3000GT)
Courtesy of Mitsubishi Motor Sales of America

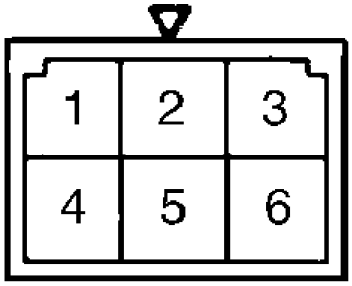


Switch	Terminal	2	3	5	7	8
Slide switch	Open	○		○		
	Closed			○	○	
Tilt switch	Up		○	○		
	Down			○		○

NOTE
○—○ indicates that there is continuity between the terminals.

93F83381

Fig. 8: Inspecting Sun Roof Switch Continuity (Galant)
Courtesy of Mitsubishi Motor Sales of America



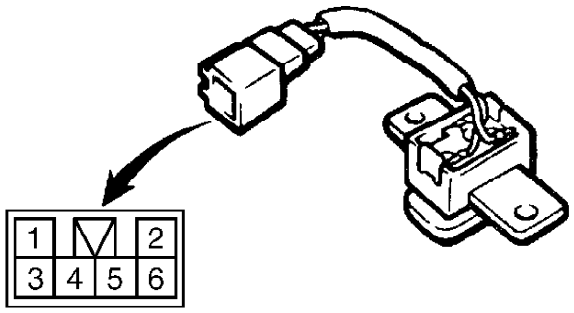
Terminal / Switch	1	2	3	5	6
OPEN	○	○		○	○
OFF		○	○	○	○
CLOSED	○	○	○	○	

NOTE

○-○ Indicates that there is continuity between the terminals.

93I83418

Fig. 9: Inspecting Sun Roof Switch Continuity (Montero)
Courtesy of Mitsubishi Motor Sales of America



SWITCH POSITION	TERMINAL NO.		
	1	3	4
OPEN		○	○
OFF			
CLOSE	○		○

97B04292

Fig. 10: Inspecting Sun Roof Switch Continuity (Montero Sport)
Courtesy of Mitsubishi Motor Sales of America

MOTOR ROTATION SENSOR CHECK (3000GT)

1) Connect ohmmeter negative lead to terminal No. 3 and positive lead to terminal No. 8. See Fig. 11. Continuity should exist. Reverse ohmmeter leads. Continuity should not exist.

2) Remove motor cover. Connect ohmmeter negative lead to terminal No. 7 and positive lead to terminal No. 8. See Fig. 11. Continuity should not exist. Continuity should exist when light is shone onto sensor receiver. Replace rotation sensor if continuity is not as specified.

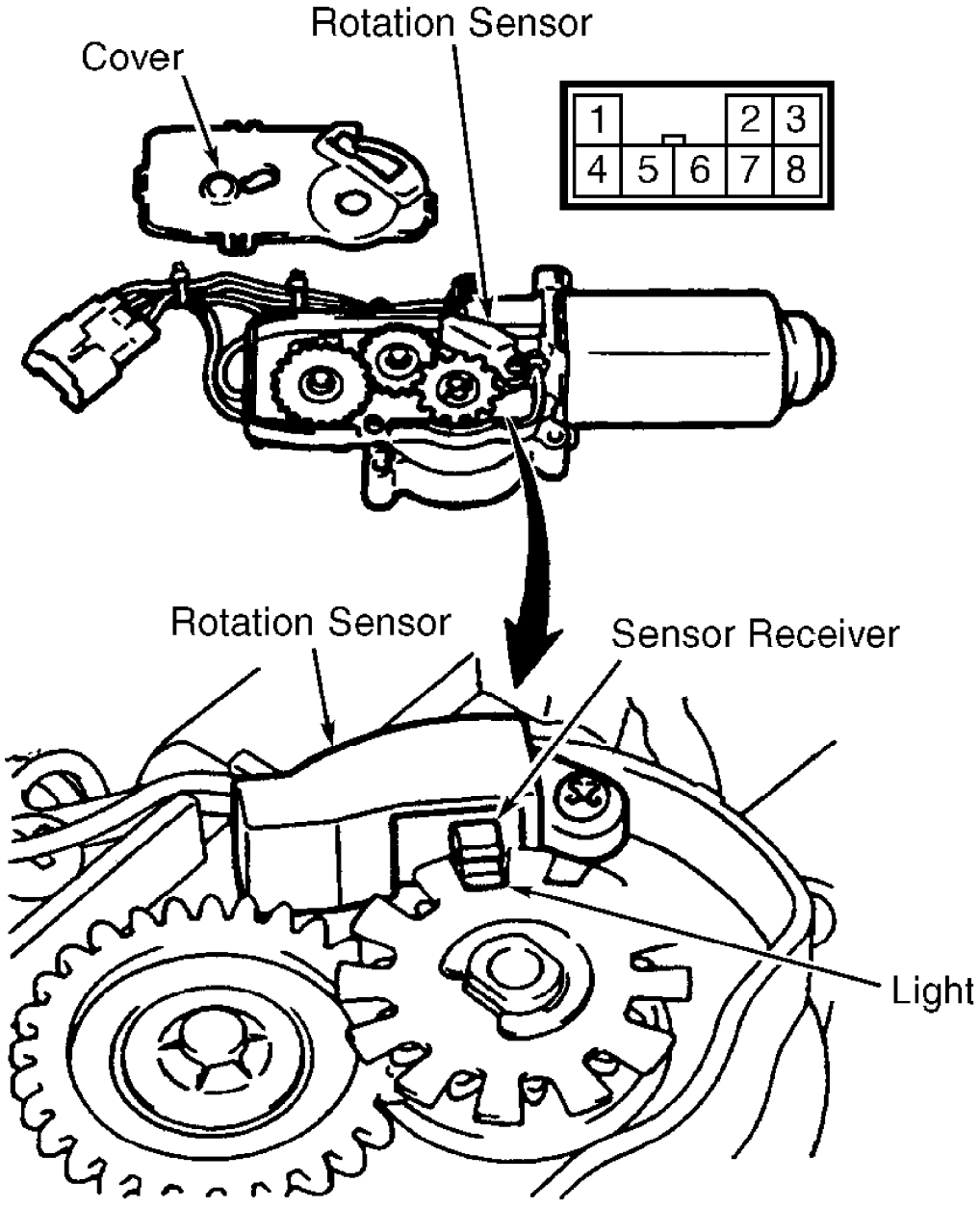


Fig. 11: Checking Motor Rotation Sensor (3000GT)
Courtesy of Mitsubishi Motor Sales of America

REMOVAL & INSTALLATION

DRIVE CABLES

NOTE: Drive cable removal and installation information for 3000GT not available from manufacturer at time of publication.

Removal & Installation (Eclipse & Galant)

1) Remove sliding roof assembly. See SUN ROOF R & I under REMOVAL & INSTALLATION. Remove sun shade and stopper at rear end of drive rail. Remove sliding roof drive cable assembly from rear part of guide rail. Depress assembly into guide rail to slide past notches if necessary.

2) Once sliding assembly is removed, DO NOT lose plastic sliding shoes attached to assembly. Ensure guide rail, sliding assembly and drive cables are clean before reassembly.

3) To install components, reverse removal procedure. Apply multipurpose grease to all moving components. To install sliding roof assembly, reverse removal procedure.

Removal & Installation (Montero)

1) Remove sliding roof assembly. See SUN ROOF R & I under REMOVAL & INSTALLATION. Remove plastic mounting cover and roof glass panel. Remove front guide bracket and deflector assembly. Remove front guide rail end cover. Remove set plate and guide rail assembly. Remove sun shade and drive cable tube. Remove lifter assembly and slider assembly from housing assembly.

2) Ensure guide rail, sliding assembly and drive cables are clean before installation. To install components, reverse removal procedure. Apply multipurpose grease to all moving components. To install sliding roof assembly, reverse removal procedure.

Removal & Installation (Montero Sport)

Tilt sun roof guide assembly. Remove sun roof guide rail rod holder. Close sun roof guide assembly and disconnect drive cable end from sun roof guide assembly. To install components, reverse removal procedure. Always replace cables in pairs. Apply multipurpose grease to all moving components.

DRIVE MOTOR R & I

Removal (Eclipse & Galant)

1) To remove sun roof drive motor, lower headliner enough to gain access to motor. Remove overhead switch assembly. Remove front and rear door scuff plate.

2) Remove center pillar lower and upper trim. Remove roof rail and sun roof trim strips. Remove front pillar trim. Remove assist handle (if necessary). Lower headliner to gain access to motor assembly. Disconnect motor harness connector. Remove motor mounting bolts and remove motor.

Inspection

Check each drive gear tooth for abrasion or wear. Check both drive cables for wear. Replace as necessary.

Installation

Ensure sun roof glass panel is fully closed. Sun roof drive cables must be properly indexed to drive motor drive gear. Remove drive motor cam gear cover. Using crank handle (included in tool pouch), rotate motor to correct position. For Galant, see Fig. 12. Install motor. To complete installation, reverse removal procedure.

Removal & Installation (Montero)

Remove sun roof switch assembly. Remove drive motor. To

install, open roof glass panel about 7.9" (200 mm). Using crank handle, rotate drive motor until alignment hole of intermittent gear is aligned with center of drive gear. See Fig. 13. To complete installation, reverse removal procedure.

Removal & Installation (Montero Sport & 3000GT)

Remove sun roof switch and dome light assembly. Remove bracket. Remove headliner. Remove drive motor. To install, reverse removal procedure.

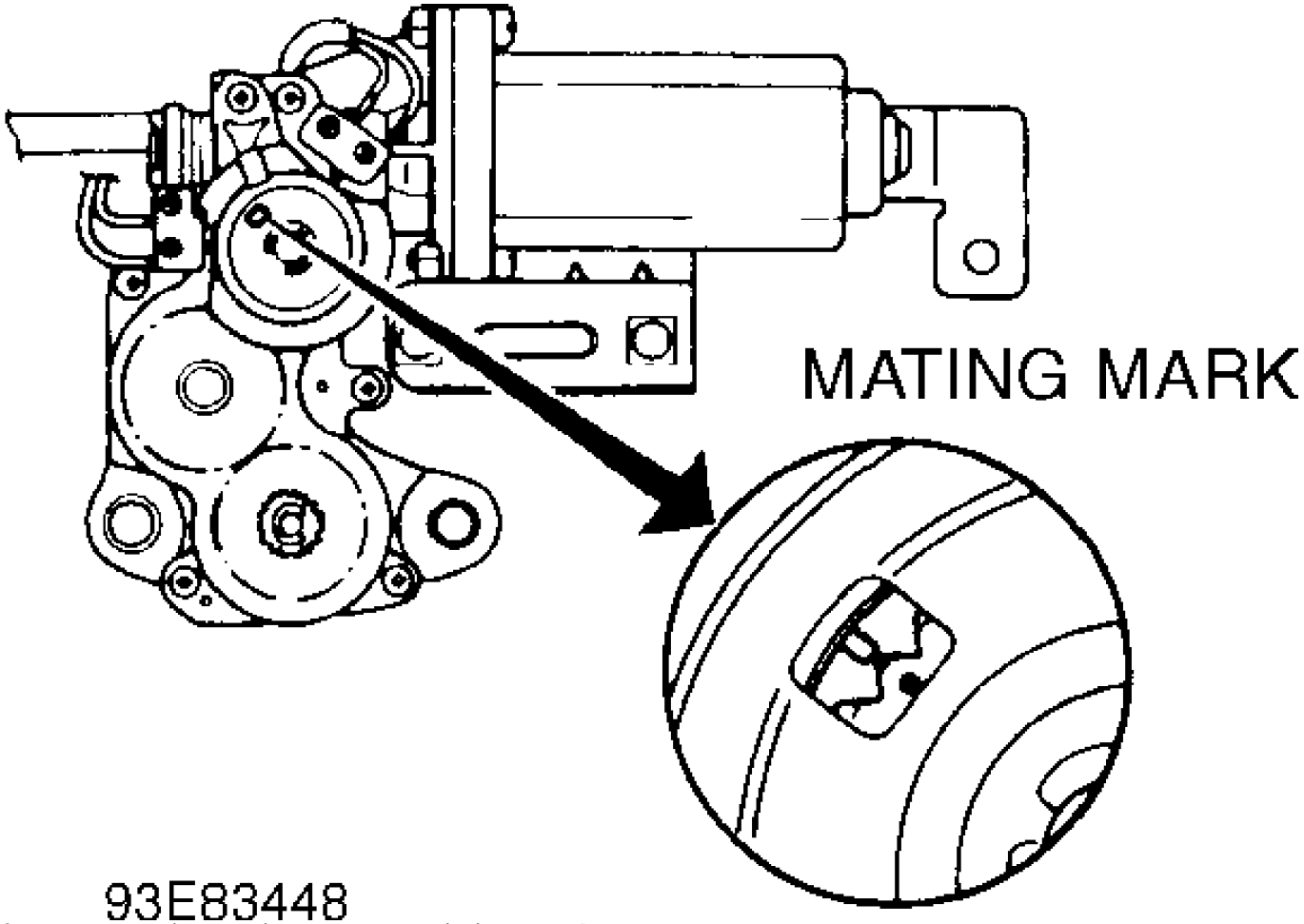


Fig. 12: Inspecting Drive Gear Position (Galant)
Courtesy of Mitsubishi Motor Sales of America

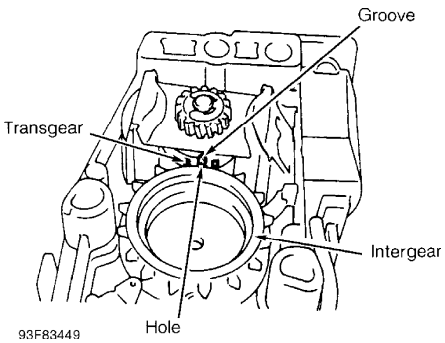


Fig. 13: Inspecting Drive Gear Position (Montero)
Courtesy of Mitsubishi Motor Sales of America

SUN ROOF R & I

Removal & Installation (Eclipse & Galant)

1) Remove side trim covers by lightly pulling panels straight down. Unbolt and remove roof glass panel with adjust plates. See Fig. 1. Operate sun roof drive cable assembly to fully open position. Remove deflector. Remove guide rail cover. Operate sun roof drive cable assembly to fully closed position and remove rear drip channel.

2) Remove overhead switch assembly. Remove rear seat. Push down on rear seat cushion and pull seat release lever. Unbolt and remove seat back. Remove front and rear door scuff plate.

3) Remove center pillar lower and upper trim. Remove roof rail and sun roof trim strips. Remove front and rear pillar trim. Remove assist handle. Remove headliner. Disconnect motor harness connector. Remove motor mounting bolts and remove motor.

4) Attach protective tape around roof opening. Pull sliding roof assembly forward through roof opening. Disconnect drain hoses. If drain hoses need replacement, attach cord to exterior end of drain hose. Pull drain hose from interior end. Remove housing assembly and set brackets.

5) To install components, reverse removal procedure. Sun roof drive cables must be properly indexed to drive motor drive gear. Remove drive motor cam gear cover. Using manual closure wrench (included in tool pouch), rotate motor to correct position. See Fig. 12. Install motor. Install remaining components. To adjust roof glass panel, see SUN ROOF GLASS FIT under ADJUSTMENTS.

Removal & Installation (Montero)

1) Remove trim covers. Unbolt roof glass panel from sliding assembly and remove. Remove sun roof switch assembly and drive motor. Remove front and rear door scuff plate.

2) Remove center pillar lower and upper trim. Remove roof rail and sun roof trim strips. Remove front and rear pillar trim. Remove assist handle. Remove headliner. Remove rear set bracket. Remove sun roof assembly. Disconnect drain hoses.

3) If drain hoses need replacement, attach cord to exterior end of drain hose. Pull drain hose from interior end. To install components, reverse removal procedure. See DRIVE MOTOR R & I for installation procedures.

Removal & Installation (Montero Sport & 3000GT)

Remove sun roof switch and dome light assembly. Remove bracket behind dome light. Remove headliner. Remove drain hose retaining clips and remove drain hose. Remove sun roof assembly. To install, reverse removal procedure.

WIRING DIAGRAMS

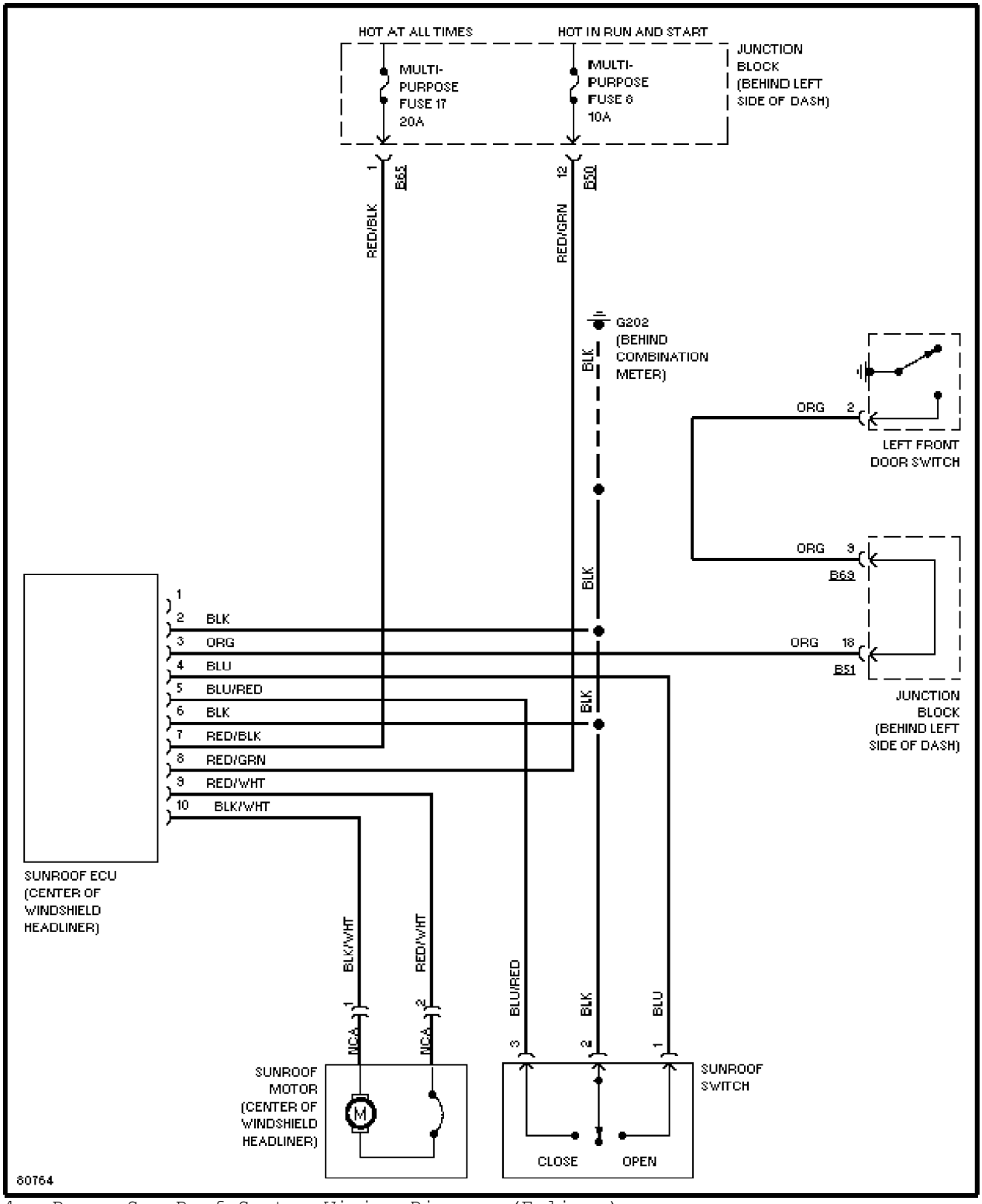


Fig. 14: Power Sun Roof System Wiring Diagram (Eclipse)

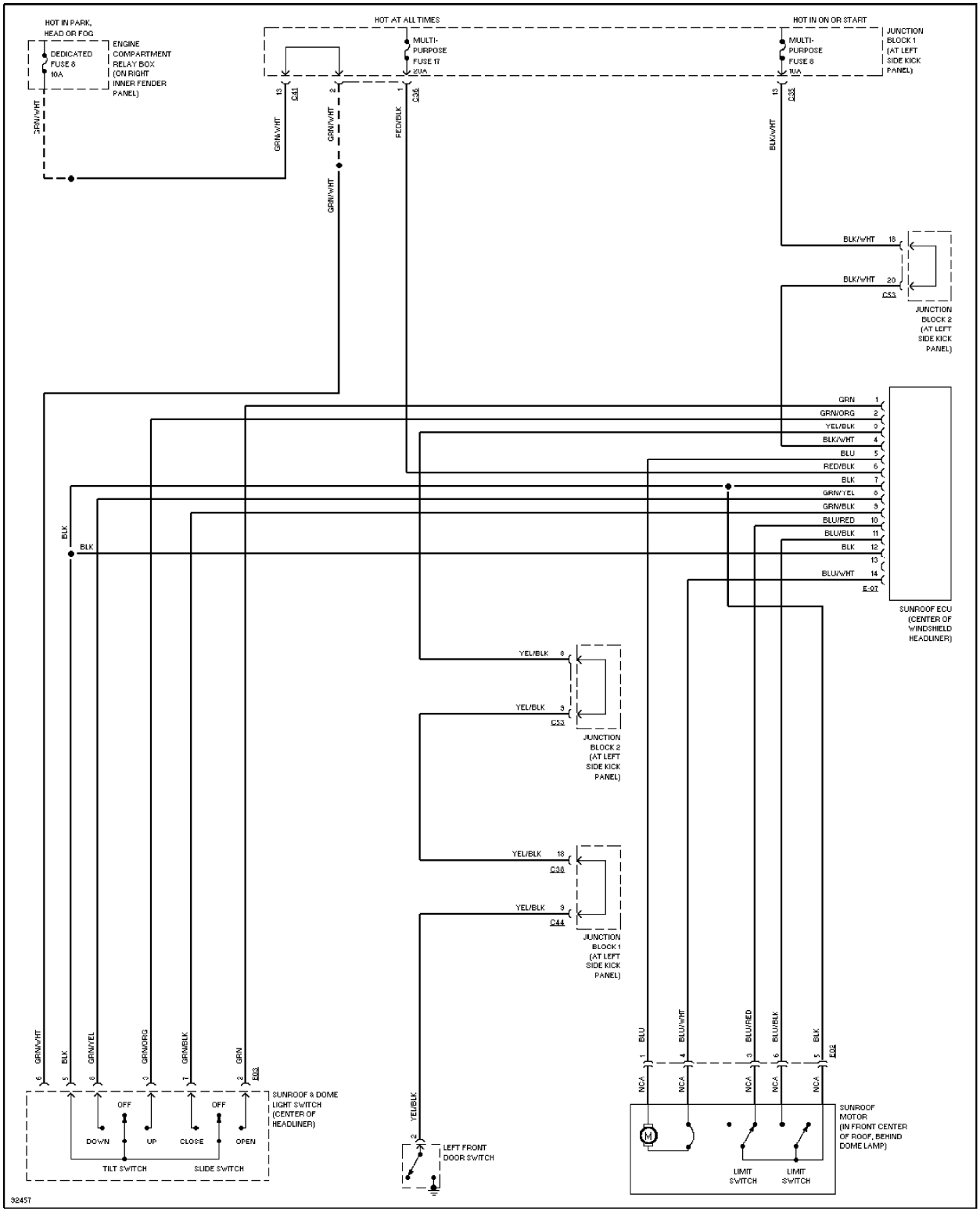


Fig. 15: Power Sun Roof System Wiring Diagram (Galant)

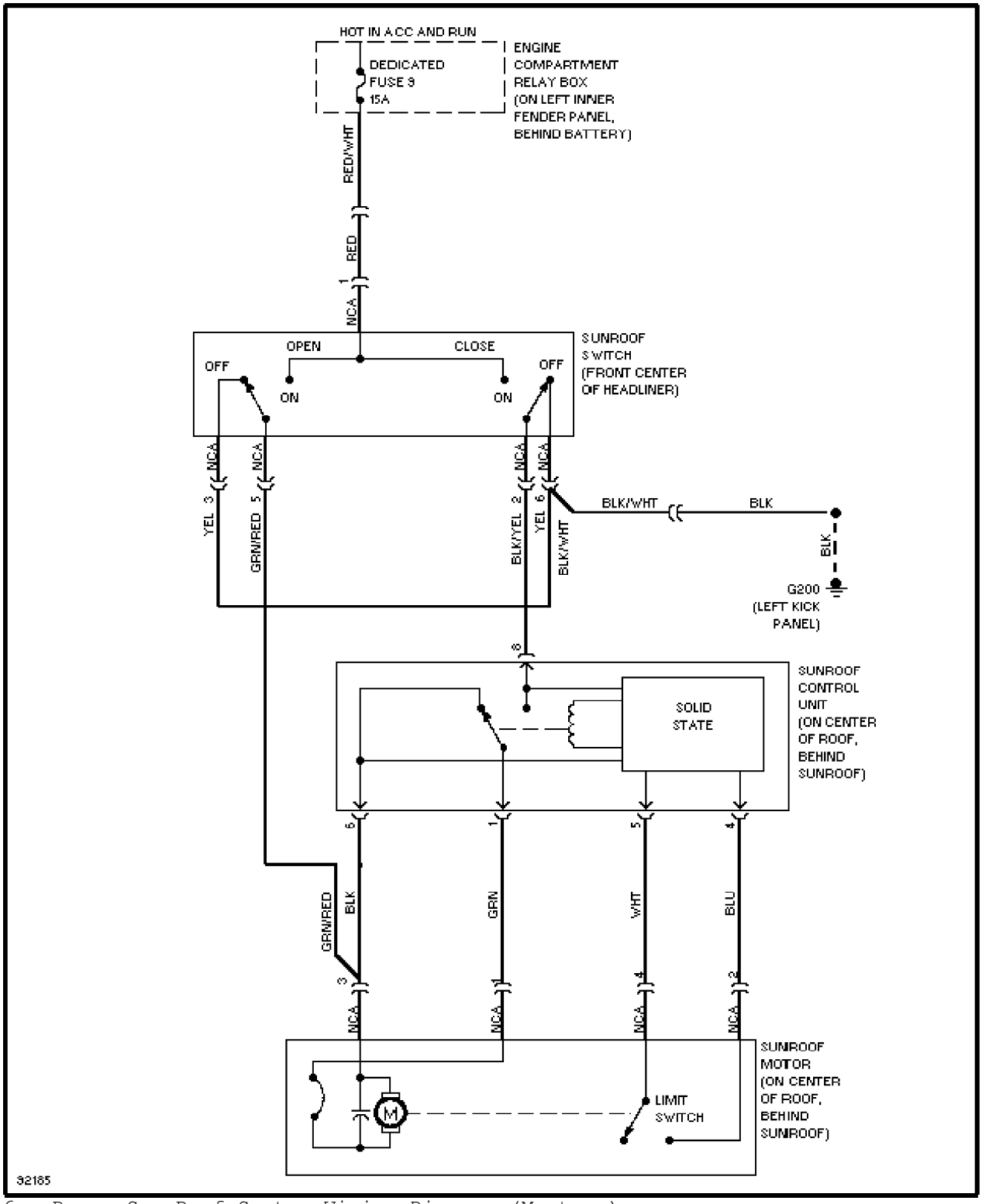


Fig. 16: Power Sun Roof System Wiring Diagram (Montero)

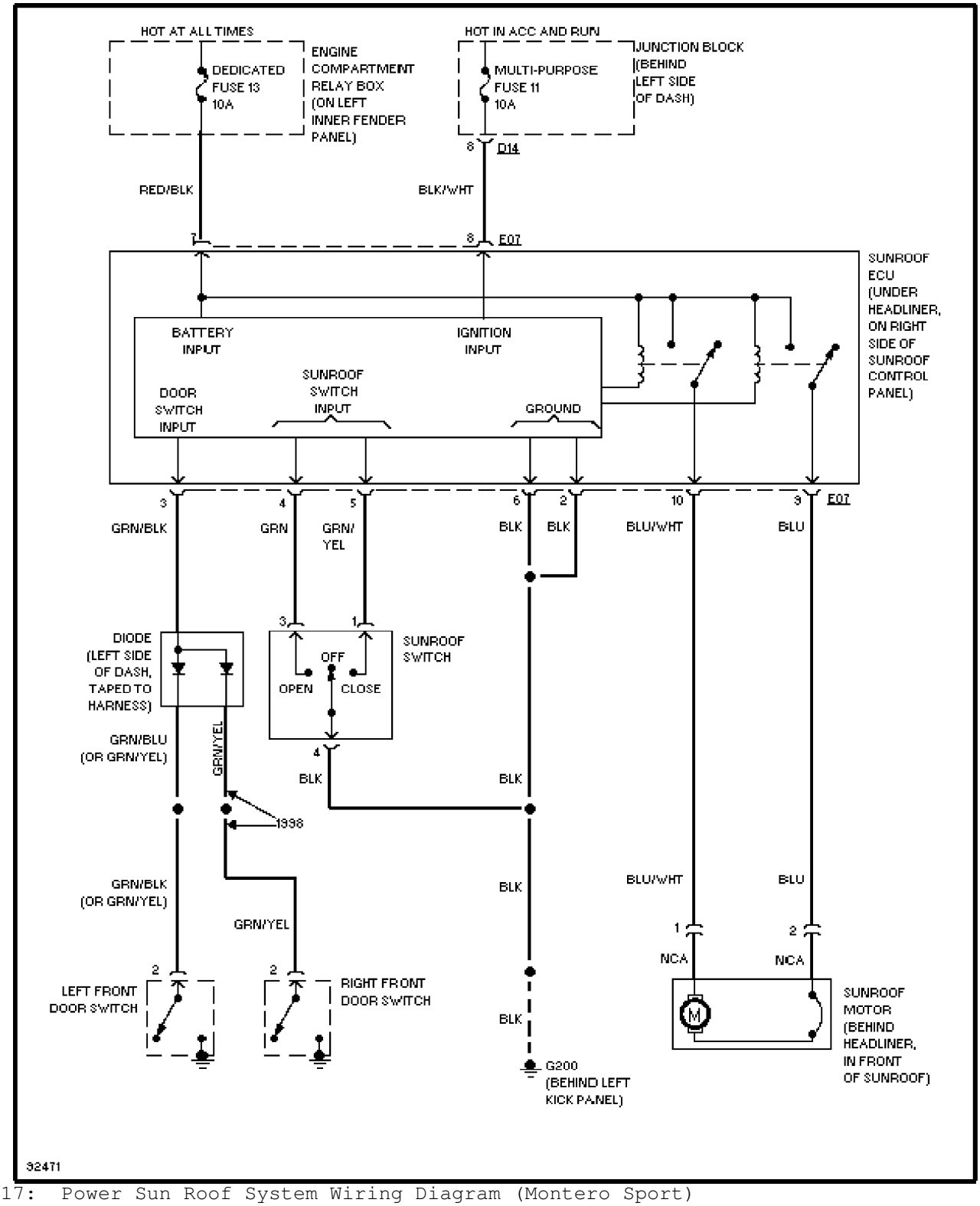


Fig. 17: Power Sun Roof System Wiring Diagram (Montero Sport)

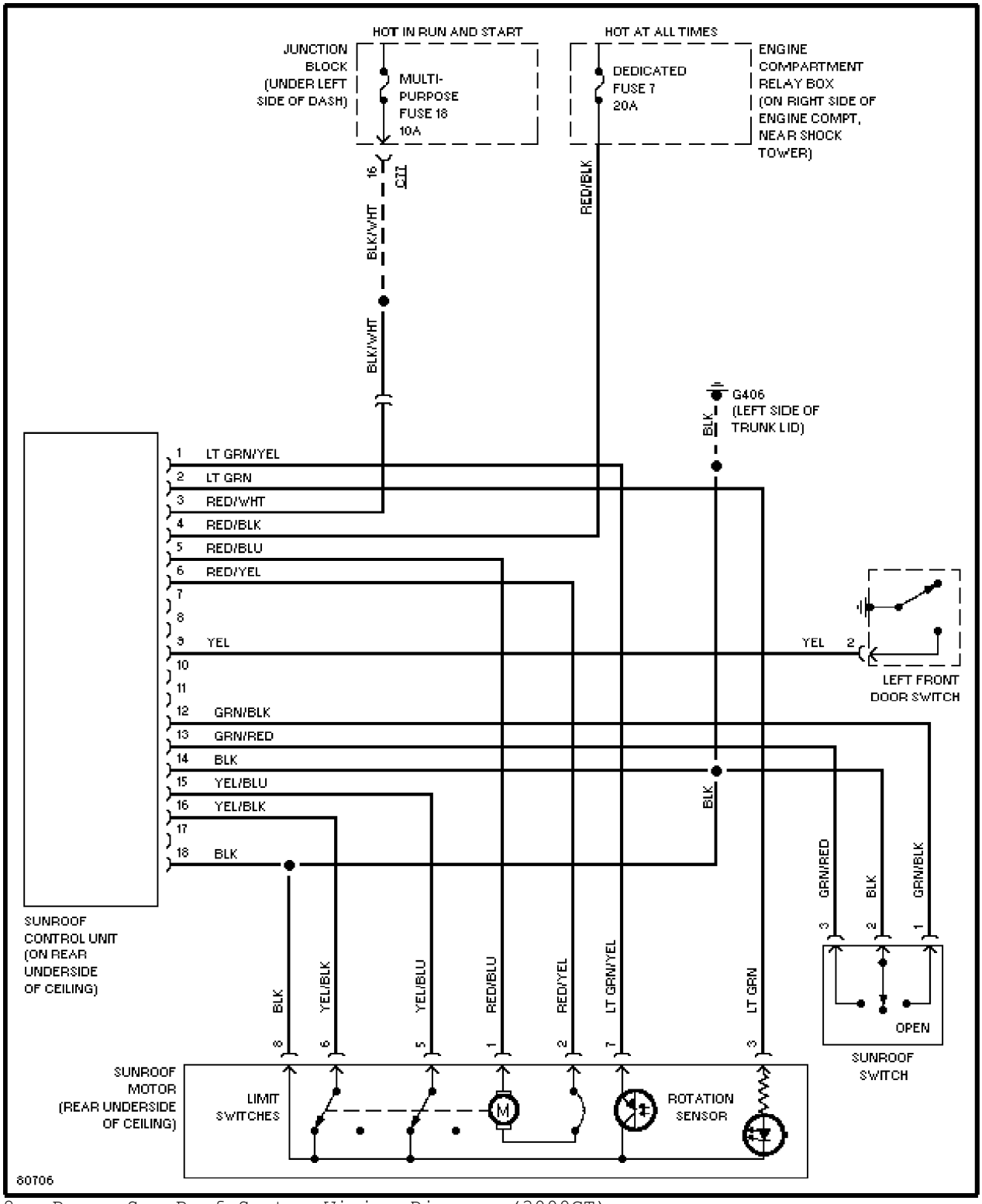


Fig. 18: Power Sun Roof System Wiring Diagram (3000GT)

SUSPENSION - FRONT

1998 Mitsubishi Galant

1997-98 SUSPENSION
Mitsubishi - Front - AWD & FWD

Diamante, Eclipse, Galant, Mirage, 3000GT

DESCRIPTION

Front suspension consists of a MacPherson strut assembly, steering knuckle, control arm, ball joint and stabilizer bar. See Fig. 1 or 2.

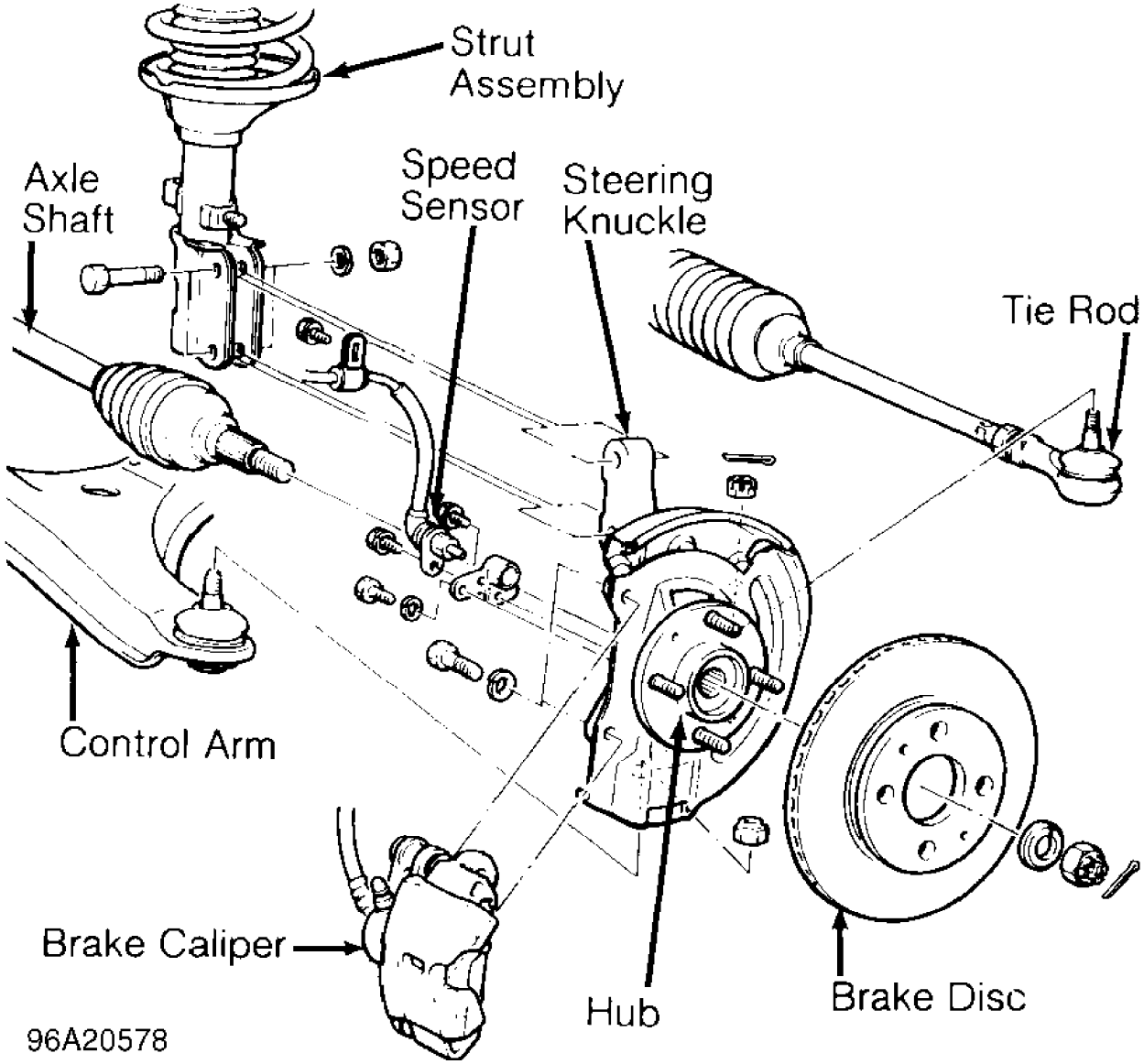


Fig. 1: Exploded View Of Front Suspension (Except Eclipse & Galant - Typical)
Courtesy of Mitsubishi Motor Sales of America.

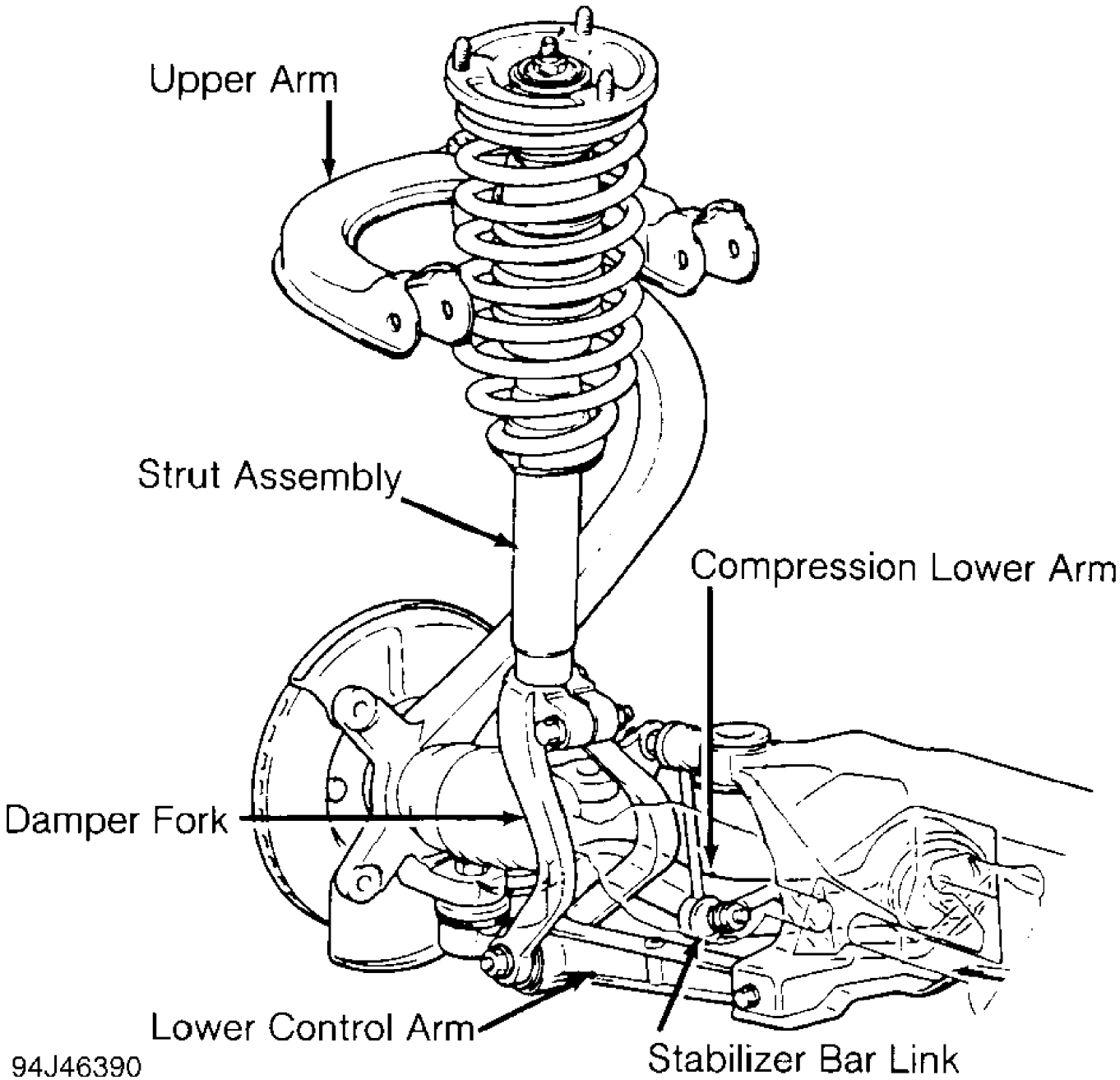


Fig. 2: View Of Front Suspension (Eclipse & Galant)
Courtesy of Mitsubishi Motor Sales of America.

ADJUSTMENTS & INSPECTION

WHEEL ALIGNMENT SPECIFICATIONS & PROCEDURES

NOTE: See WHEEL ALIGNMENT SPECIFICATIONS & PROCEDURES article in WHEEL ALIGNMENT section.

WHEEL BEARING

Axial Play Inspection

1) Wheel bearings are not adjustable. To inspect bearings, raise and support vehicle. Remove wheel assembly. Remove brake caliper. Remove brake disc from hub (if necessary).

2) Attach dial indicator at right angle to hub. Move hub in and out, and measure axial play. Maximum play should be .002" (.05 mm). Replace bearings or hub assembly as needed if movement exceeds specification.

BALL JOINT CHECKING

Upper Control Arm Ball Joint

1) Raise and support vehicle. Remove wheel. Loosen ball joint nut. Using Steering Linkage Puller (MB991113-01), separate ball joint from steering knuckle. Install nut on ball joint stud. Move stud from side-to-side. Replace ball joint if side play is present.

2) Using INCH-lb. torque wrench, rotate ball joint and note starting torque. Replace ball joint if roughness is felt when rotating ball joint or if starting torque exceeds specification. See BALL JOINT STARTING TORQUE SPECIFICATIONS table.

Lower Control Arm Ball Joint, Lateral Arm Ball Joint & Stabilizer Link Ball Joint

1) Raise and support vehicle. Remove wheel. Disconnect stabilizer bar from control arm (if needed). Loosen ball joint nut. Using Steering Linkage Puller (MB991113-01), separate ball joint from steering knuckle. Install nut on ball joint stud. Move stud from side-to-side. Replace ball joint if side play is present.

2) Using INCH-lb. torque wrench, rotate ball joint and note starting torque. Replace ball joint if roughness is felt when rotating ball joint or if starting torque exceeds specification. See BALL JOINT STARTING TORQUE SPECIFICATIONS table.

BALL JOINT STARTING TORQUE SPECIFICATIONS

Application	INCH Lbs. (N.m)
Control Arm Ball Joint	
3000GT	86-191 (10-22)
Diamante	87-190 (10-22)
Eclipse & Galant	
Lower Control Arm Ball Joint	4-22 (.5-2.5)
Lateral Lower Arm Ball Joint	13 (1.5)
Upper Control Arm Ball Joint	3-13 (.3-1.5)
Mirage	9-56 (1.0-6.4)
Stabilizer Link Ball Joint	
Eclipse & Galant	4-13 (.5-1.5)
All Others	15-28 (1.7-3.2)

REMOVAL & INSTALLATION

LOWER CONTROL ARM & BALL JOINT

Removal (All Except Eclipse & Galant)

1) Raise and support vehicle. Remove wheel(s). Disconnect stabilizer bar from control arm (if necessary). Loosen ball joint nut.

2) Using Steering Linkage Puller (MB991113), separate ball joint from steering knuckle. Remove control arm bushing or clamp (if equipped). Loosen control arm mounting nuts. Remove control arm.

Removal (Eclipse & Galant)

1) Raise and support vehicle. Remove wheel(s). Loosen ball

joint nut. Using Steering Linkage Puller (MB991113), separate ball joint from steering knuckle.

2) Remove control arm mounting nuts. Remove lower control arm. Remove stay mounting bolts and remove stay. Unbolt damper fork from lower strut mount. Disconnect lateral lower arm ball joint connection. Remove lateral lower arm mounting bolt and lateral lower arm.

Inspection

1) Check ball joint dust cover for damage. Check control arm for bending and cracks. Check all bolts for damage and wear. Check clamp (if equipped) for damage or deterioration. Check ball joints. See BALL JOINT CHECKING under ADJUSTMENTS & INSPECTION. Replace ball joint if defective.

2) Inspect control arm bushings for cracks and deterioration. Replace bushings if damaged. See LOWER CONTROL ARM BUSHINGS under REMOVAL & INSTALLATION.

3) If ball joint dust cover replacement is necessary, remove dust cover from ball joint. Apply grease to lip and inside of dust cover. Install dust cover using dust cover installer. See DUST COVER INSTALLER APPLICATION table. Ensure dust cover is fully seated.

DUST COVER INSTALLER APPLICATION

Application	Dust Cover Installer
Diamante & 3000GT	MB990799
Eclipse, Galant & Mirage	MB990800

Installation

1) Install control arm to crossmember. Ensure control arm is not twisted. Install control arm mounting bolt, bushings and clamp (if equipped). Connect stabilizer bar to control arm (as necessary).

2) To complete installation, reverse removal procedure. Install new self-locking nuts (if used). Lower vehicle and tighten all bolts to specification. See TORQUE SPECIFICATIONS.

LOWER CONTROL ARM BUSHINGS

Removal & Installation (Except Mirage)

Information is not available from manufacturer.

Removal (Mirage)

Remove control arm. Apply soapy water solution between control arm bushing and shaft. Pry upward on bushing to remove.

Installation

Apply soapy water to control arm shaft and replacement bushing. Install bushing on control arm shaft, with locator pin located within 72-78 degrees of control arm center. See Fig. 3. Using press and wood block, press bushing on control arm until clearance between bushing and control arm is .04-.12" (1-3 mm).

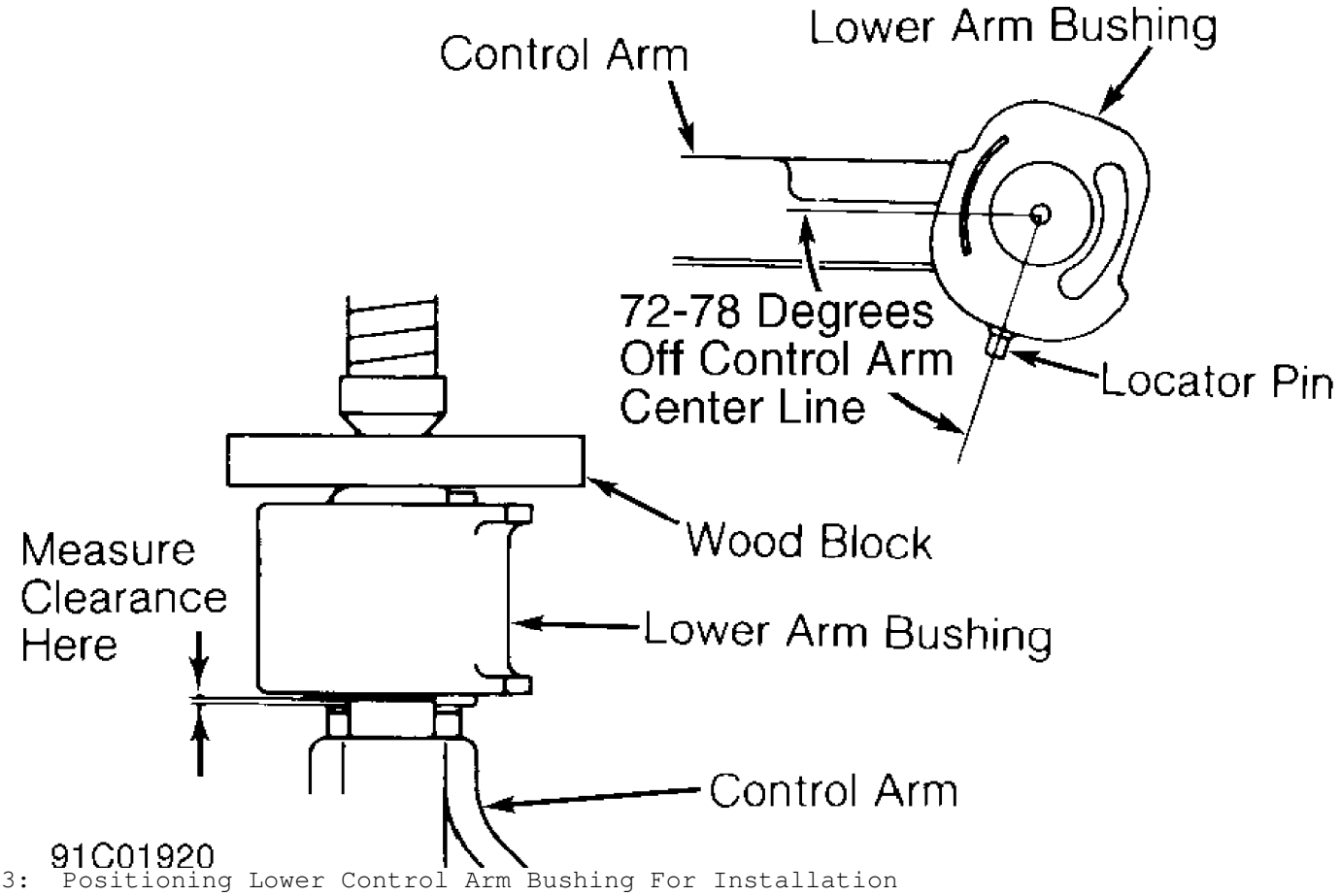


Fig. 3: Positioning Lower Control Arm Bushing For Installation (Mirage)
Courtesy of Mitsubishi Motor Sales of America.

STABILIZER BAR

Removal (Diamante)

1) Raise and support vehicle. Remove front exhaust pipe. Remove lower control arm. See LOWER CONTROL ARM & BALL JOINT under REMOVAL & INSTALLATION.

2) Remove stabilizer link mounting nuts. Remove stabilizer link. Remove stabilizer bar mounting brackets. Remove stabilizer bar and bushings. Remove bushings from stabilizer bar.

Inspection

1) Check for bent stabilizer bar. Inspect all bushings for wear and deterioration. Check stabilizer link ball joint dust cover (if equipped) for cracks. Check bolts for damage and wear. Replace damaged parts as necessary.

2) Check stabilizer link ball joint(s) starting torque. See BALL JOINT CHECKING under ADJUSTMENTS & INSPECTION. Replace the stabilizer bar link if ball joint starting torque exceeds specification.

Installation

1) If stabilizer link ball joint dust cover needs replacing, remove clip ring and dust cover. Pack ball joint with grease. Apply grease to lip and inside of new dust cover. Tape threads of ball joint to protect them and install new dust cover. See DUST COVER INSTALLER APPLICATION table under LOWER CONTROL ARM & BALL

JOINT. Install clip ring. Ensure clip ring ends are perpendicular to link axis line.

2) To install stabilizer bar, reverse removal procedure. Install bushings securely in brackets. Position stabilizer brackets so that approximately .39" (10 mm) of the marking on the stabilizer bar is visible inside the brackets. Tighten all stabilizer bar fasteners with vehicle at normal riding height. See TORQUE SPECIFICATIONS.

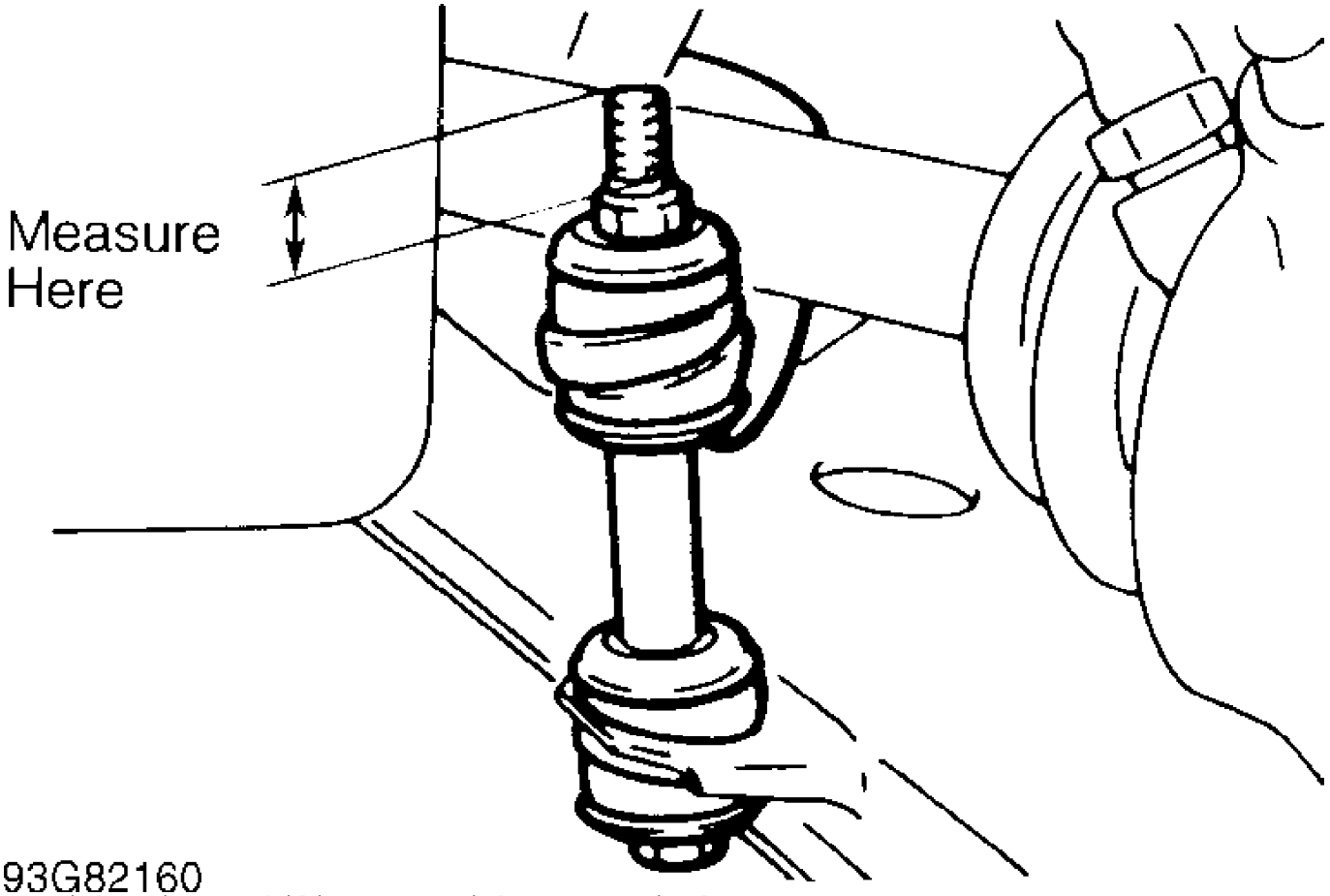


Fig. 4: Tightening Stabilizer Bar Link Nut (Typical)
Courtesy of Mitsubishi Motor Sales of America.

Removal (Eclipse & Galant)

Raise and support vehicle. Remove front wheels. Disconnect stabilizer bar from link. Remove stabilizer bar bracket from chassis. Remove stabilizer bar and bushings.

Inspection

1) Check for bent or damaged stabilizer bar. Inspect all bushings for wear and deterioration. Check stabilizer link ball joint dust cover for cracks. Replace damaged parts as necessary.

2) Check stabilizer link ball joint(s) starting torque. See BALL JOINT CHECKING under ADJUSTMENTS & INSPECTION. Replace stabilizer link if ball joint starting torque exceeds specification.

Installation

To install stabilizer bar, reverse removal procedure. On all models, tighten all fasteners to specification. See TORQUE SPECIFICATIONS.

Removal (Mirage)

1) Raise and support vehicle. Remove front exhaust pipe. Disconnect rear crossmember bolts. Remove front and rear roll stopper brackets. Remove upper and lower centermember attaching bushings. Remove collar and centermember. Remove control arm attaching bolt locknut. Remove lateral arm lower mounting bolts.

2) Remove oil return pipe clamp. Remove steering gear and linkage clamp. Remove crossmember assembly. Note location of brackets and bushings. Remove stabilizer bar mounting bolts and brackets. Remove stabilizer bar and bushings. Remove bushings from stabilizer bar.

Inspection

1) Check for bent or damaged stabilizer bar. Inspect all bushings for wear and deterioration. Check stabilizer link ball joint dust cover for cracks. Replace damaged parts as necessary.

2) Check stabilizer link ball joint(s) starting torque. See BALL JOINT CHECKING under ADJUSTMENTS & INSPECTION. Replace stabilizer link if ball joint starting torque exceeds specification.

NOTE: Replace self-locking nuts (if used). Tighten stabilizer bar bolts to specification with vehicle at normal riding height. See TORQUE SPECIFICATIONS.

Installation

1) If stabilizer link ball joint dust cover needs replacing, remove clip ring and dust cover. Pack ball joint with grease. Apply grease to lip and inside of new dust cover. Install dust cover. See DUST COVER INSTALLER APPLICATION table under LOWER CONTROL ARM & BALL JOINT. Install clip ring. Ensure clip ring ends are perpendicular to link axis line.

2) To complete installation, reverse removal procedure. Stabilizer bar brackets are marked "R" for right and "L" for left. Position stabilizer bushing so marking on bushing is the left, and the marked area of stabilizer bar protrudes 0.4" (10 mm) from the edge of the inside of the bushing. See Fig. 5.

3) Tighten stabilizer link nuts until distance from end of bolt to nut is .87" (22 mm). See Fig. 4. Lower vehicle. To complete installation, reverse removal procedure. Tighten remaining stabilizer bar fasteners to specification. See TORQUE SPECIFICATIONS.

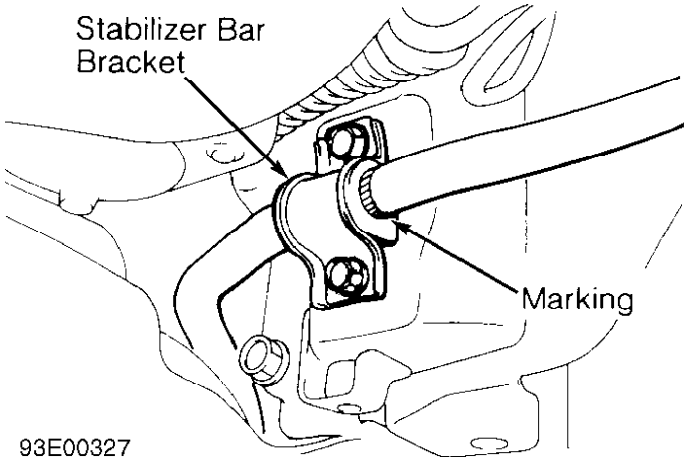


Fig. 5: Adjusting Stabilizer Bar (Typical)
Courtesy of Mitsubishi Motor Sales of America.

Removal (3000GT)

1) Raise and support vehicle. Remove front exhaust pipe.

Remove engine undercover. Remove right and left chassis members and crossmember (if necessary). On AWD vehicles with automatic transmission, remove transmission stay. On AWD models, remove transfer case and bracket.

2) On all models, remove stabilizer links.Note location of brackets and bushings. Remove stabilizer bar mounting brackets and hardware. Remove stabilizer bar and bushings.

Inspection

1) Check for bent or damaged stabilizer bar. Inspect all bushings for wear and deterioration. Check stabilizer link ball joint dust cover for cracks. Replace damaged parts as necessary.

2) Check stabilizer link ball joint(s) starting torque. See BALL JOINT CHECKING under ADJUSTMENTS & INSPECTION. Replace stabilizer link if ball joint starting torque exceeds specification.

Installation

1) If stabilizer link ball joint dust cover needs replacing, remove clip ring and dust cover. Pack ball joint with grease. Apply grease to lip and inside of new dust cover. Tape threads of ball joint to protect them and install new dust cover. See DUST COVER INSTALLER APPLICATION table under LOWER CONTROL ARM & BALL JOINT. Install clip ring. Ensure clip ring ends are perpendicular to link axis line.

2) To install stabilizer bar, reverse removal procedure. Position stabilizer brackets so they are inside marked area of stabilizer bar. See Fig. 5. Tighten all fasteners to specification. See TORQUE SPECIFICATIONS.

STEERING KNUCKLE

Removal

1) Remove cotter pin, and loosen axle shaft nut. Raise and support vehicle. Remove wheel assembly. Remove axle shaft nut. Remove brake caliper, and wire aside. Do not allow caliper to hang from brake hose.

2) Remove brake disc from hub (if possible). Remove front speed sensor (if equipped). Disconnect stabilizer bar from control arm (as necessary). Support control arm. Disconnect damper fork (if equipped). Disconnect lateral lower arm ball joint connection. Remove lateral lower arm mounting bolt and lateral lower arm (if equipped). Disconnect lower ball joint and tie rod end from steering knuckle. Install puller on hub.

3) Tighten puller, and separate axle shaft from hub. On Eclipse and Galant, unbolt and separate upper ball joint from knuckle. On all other models, separate steering knuckle from strut. On all models, remove knuckle/hub assembly from vehicle. Separate hub from steering knuckle (if required). See WHEEL BEARINGS under REMOVAL & INSTALLATION.

Installation

To install, reverse removal procedure. Install washer on axle shaft, with raised area toward axle shaft nut. Tighten bolts to specification. See TORQUE SPECIFICATIONS. Tighten axle shaft nut to specification with vehicle on ground.

STRUT ASSEMBLY

Removal (Eclipse & Galant)

1) Raise and support vehicle. Remove front wheels. Support lower control arms. Remove stabilizer link mounting nut. Remove strut assembly-to-damper fork pinch bolt.

2) Place punch mark on a upper strut mounting stud and on

inner fender adjacent to stud for reassembly reference. Remove upper strut mounting nuts and lower mounting bolt. Remove the damper fork. Remove strut assembly. Using Spring Compressor Body and Arm Set (MB991237 and MB991238) compress the coil spring. Remove self-locking nut, washer, bushings, bracket, spring pad, collar, cup assembly and dust cover noting the order of component removal.

NOTE: Air tools should NOT be used on tools (MB991237 and MB991238) or the self-locking nut.

Installation

To install, reverse removal procedure. Ensure strut assembly and damper fork mating surfaces are clean. Tighten fasteners to specification. See TORQUE SPECIFICATIONS.

Removal (Except Eclipse & Galant)

1) Raise and support vehicle. Remove front wheels. Separate brake hose bracket and speed sensor bracket (if equipped) from strut. Support lower control arms. Remove strut assembly-to-steering knuckle bolts.

2) Place punch mark on a upper strut mounting stud and on inner fender adjacent to stud for reassembly reference. Remove upper strut mounting nuts. Remove strut assembly carefully to avoid damaging actuator on struts (if equipped). Using Spring Compressor Body and Arm Set (MB991237 and MB991238) compress the coil spring. Remove the dust cover, self-locking nut, insulator, upper spring seat, bump rubber, coil spring and lower spring pad noting the order of component removal.

NOTE: Air tools should NOT be used on tools (MB991237 and MB991238) or the self-locking nut.

Installation

To install, reverse removal procedure. Ensure strut assembly and steering knuckle mating surfaces are clean. Tighten fasteners to specification. See TORQUE SPECIFICATIONS.

WHEEL BEARINGS

NOTE: Eclipse & Galant use sealed bearings that are not serviceable. Hub and bearing unit must be replaced as a unit.

CAUTION: DO NOT use hammer to remove hub. Bearings may be damaged during removal.

Removal (3000GT)

1) Remove steering knuckle. See STEERING KNUCKLE under REMOVAL & INSTALLATION. Use an End Yoke Holder (MB990767) and Puller (MB991354) to pull the drive shaft from front hub. Unbolt and remove hub/bearing assembly.

2) Install Front Hub Remover/Installer (MB990998) and Knuckle Arm Bridge (MB991355) to hub/bearing assembly. Tighten nut and remove hub and rotor from knuckle. Crush the oil seal in 2 places so that the tabs of the Puller (MB990810) will catch on the wheel bearing inner race. Using the puller, remove wheel bearing inner race. Remove snap ring from knuckle. Use Knuckle Arm Bridge (MB991355) and Press Tools (MB99032 and MB990938) to remove wheel bearing.

Installation

1) Pack bearing with grease. Coat steering knuckle and bearing contact areas with grease. Using Press Tools (MB990883 and MB990890) and press, install bearing with inner race removed. Install the inner race into the bearing. Drive the hub side oil seal into the

knuckle until it is flush with the knuckle end surface using Bearing and Oil Seal Installer (MB990947 and MB990955). Grease the oil seal lip and the surfaces which contact hub. Place hub on steering knuckle.

2) Using Hub Remover/Installer (MB990998), install hub on steering knuckle. Tighten nut to 145-188 ft. lbs. (1200-260 N.m.). Rotate hub to seat bearing. Using an INCH-lb. torque wrench, measure bearing starting torque. See Fig. 6.

3) Starting torque should be 16 INCH lbs. (1.8 N.m) or less. Rotation roughness must not be felt. Install steering knuckle in vise. Install dial indicator, with stem resting against hub surface. Check hub axial play.

4) Hub axial play should not exceed specification. See WHEEL BEARING AXIAL PLAY SPECIFICATIONS table under ADJUSTMENTS & INSPECTION . If starting torque or hub axial play are not to specifications, check component installation. Remove hub remover/installer.

5) Apply grease to bearing and inside of steering knuckle. Using Seal Installer (MB990890) and Handle (MB990883), install inner oil seal until seal contacts snap ring. Apply grease to lip of oil seal. To complete installation, reverse removal procedure. Tighten axle shaft nut to 188 ft. lbs. (260 N.m) with brakes applied. Install new cotter pin.

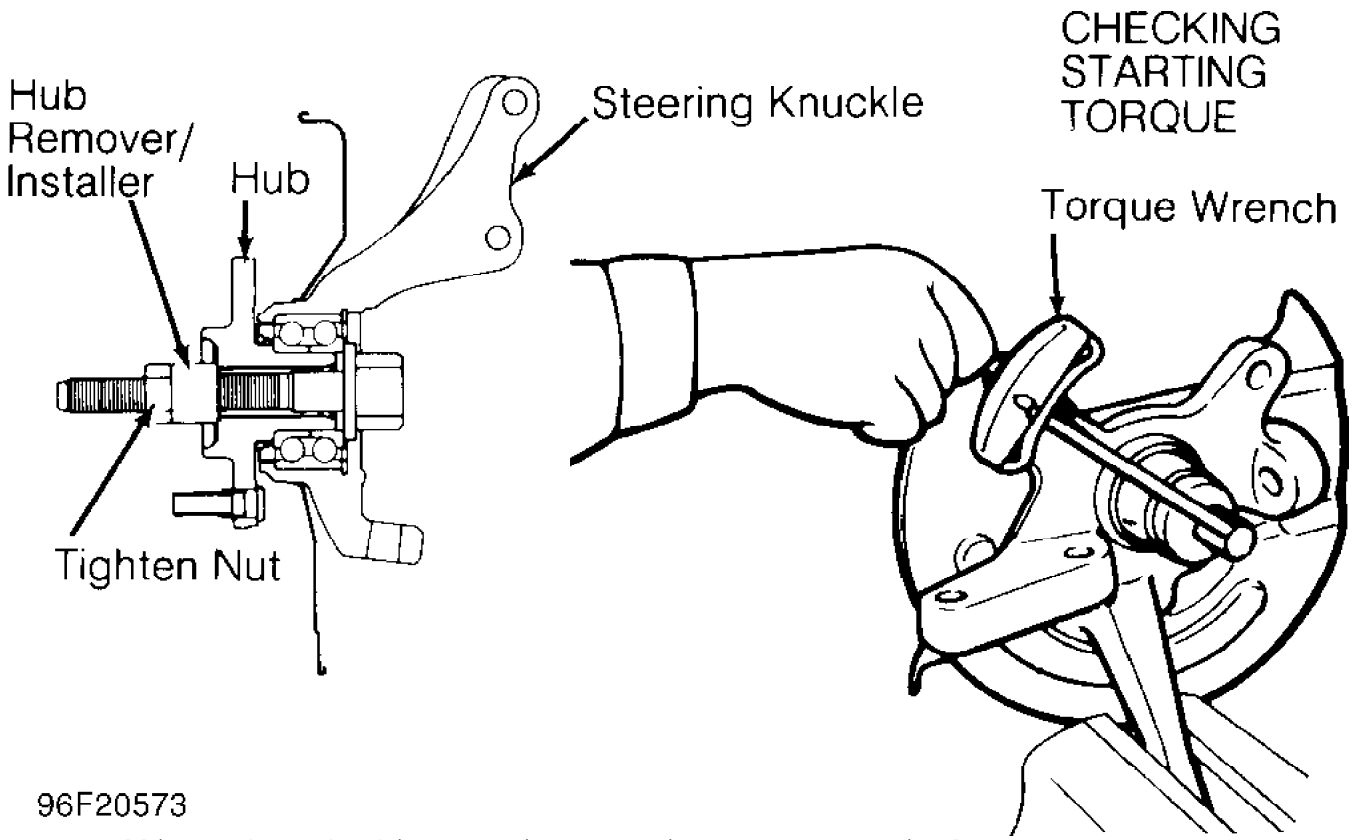


Fig. 6: Installing Hub & Checking Bearing Starting Torque (Typical) Courtesy of Mitsubishi Motor Sales of America.

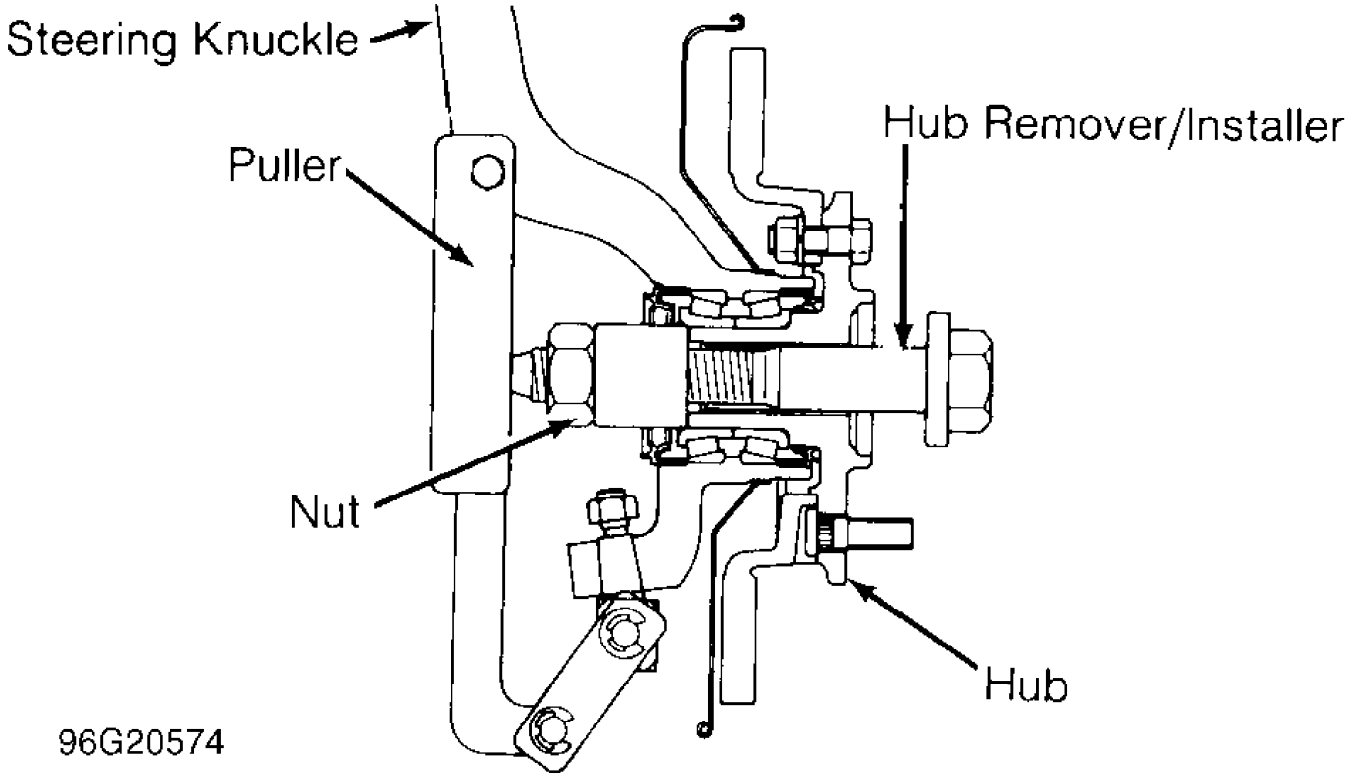


Fig. 7: Removing Hub From Steering Knuckle (Typical)
Courtesy of Mitsubishi Motor Sales of America.

Removal (Diamante & Mirage)

Remove steering knuckle. See STEERING KNUCKLE under REMOVAL & INSTALLATION. Use an Endyoke Holder (MB990767) and Puller (MB990241) to pull the driveshaft from the front hub. Unbolt and remove hub/bearing assembly. Install Front Hub Remover/Installer (MB990998) and Knuckle Arm Bridge (MB991055) to hub/bearing assembly. Tighten nut and remove hub from knuckle. Crush the oil seal in 2 places so that the tabs of the Puller (MB990810) will catch on the wheel bearing inner race. Using the Puller, remove wheel bearing inner race. Remove the wheel bearing inner race (outside) from the front hub using Puller (MB990810 on Mirage, MB990197 on Diamante). See Fig. 9. Install the removed race to the wheel bearing and use Knuckle Arm Bridge (MB991355) and Press Tools (MB99032 and MB990938) to remove the wheel bearing.

Installation

1) Pack bearing with grease. Coat steering knuckle and bearing contact areas with grease. Using Press Tools (MB990883 and MB990890 on Diamante, MB991050 on Mirage) and press, install bearing. Drive the hub side oil seal into the knuckle until it is flush with the knuckle end surface using Bearing and Oil Seal Installer (MB990947 and MB990955 on Diamante, MB991387 on Mirage). Grease the oil seal lip and the surfaces which contact hub. Place hub on steering knuckle.

2) Using Hub Remover/Installer (MB990998), install hub on steering knuckle. On Diamante, tighten nut to 145-188 ft. lbs. (1196-255 N.m.). On Mirage, tighten 130-203 ft. lbs. (177-275 N.m). Rotate hub to seat bearing. Using an INCH-lb. torque wrench, measure bearing starting torque. See Fig. 6.

3) Starting torque should be 15.62 INCH lbs. (1.8 N.m) or less. Rotation roughness must not be felt. Install steering knuckle in vise. Install dial indicator, with stem resting against hub surface.

Check hub axial play.

4) Hub axial play should not exceed specification. See WHEEL BEARING AXIAL PLAY SPECIFICATIONS table under ADJUSTMENTS & INSPECTION . If starting torque or hub axial play are not to specifications, check component installation. Remove hub remover/installer.

5) Apply grease to bearing and inside of steering knuckle. Using Seal Installer (MB991389), install inner oil seal until seal contacts snap ring. To complete installation, reverse removal procedure.

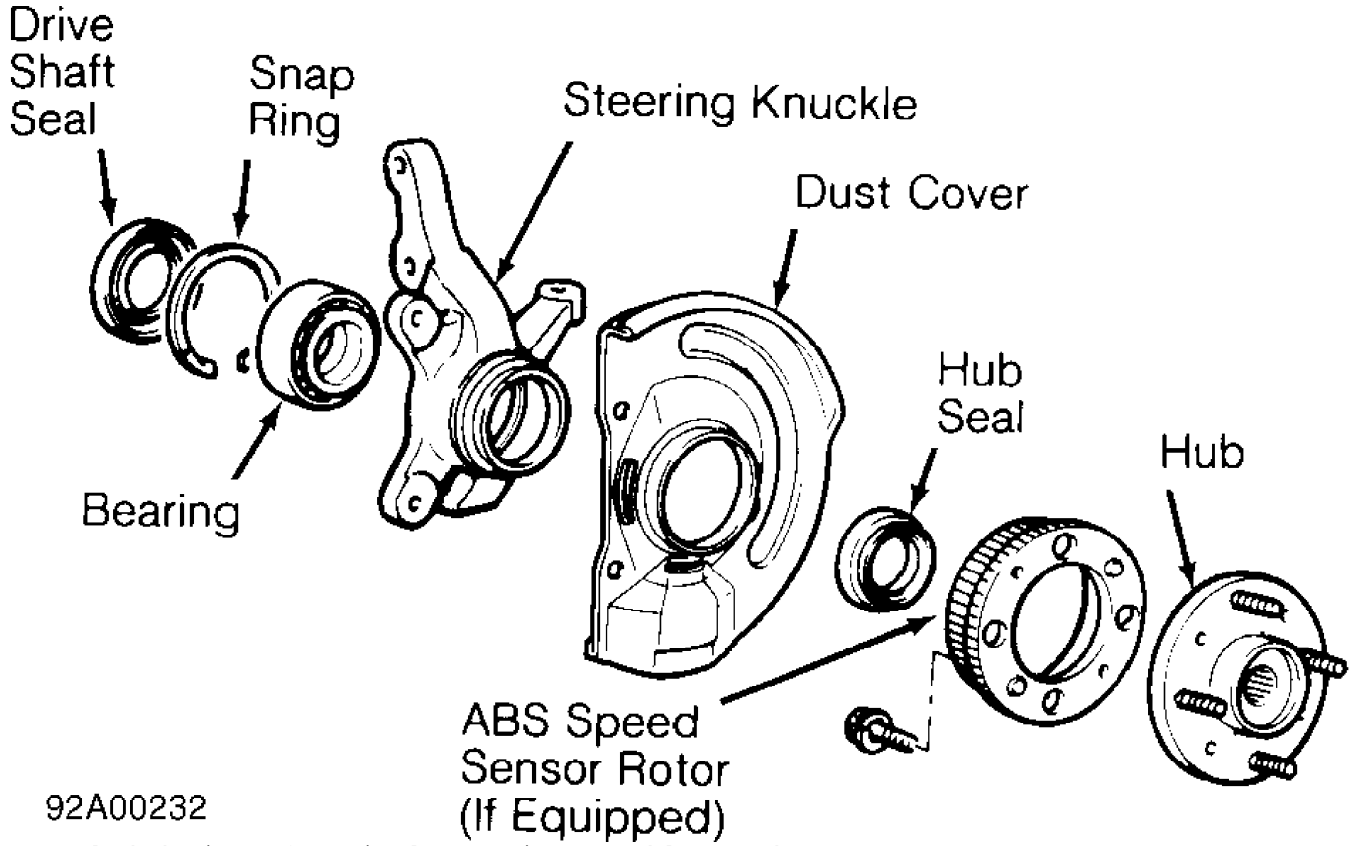


Fig. 8: Exploded View Of Typical Steering Knuckle & Hub
Courtesy of Mitsubishi Motor Sales of America.

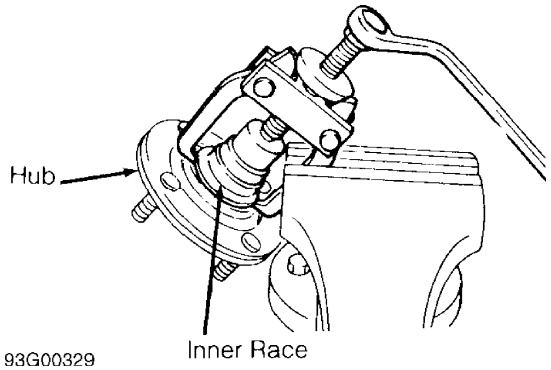


Fig. 9: Removing Inner Race From Hub
Courtesy of Mitsubishi Motor Sales of America.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Axle Shaft Nut	
3000GT	188 (260 N.m)
Mirage	130-203 (177-275 N.m)
All Others	145-188 (196-255)
Caliper Assembly-To-Knuckle Bolts	
3000GT	65 (90)
Mirage	67-81 (90-110)
All Others	65 (88)
Centermember Rear Mounting Bolt Or Nut	
Mirage	65 (88)
Damper Fork Pinch Bolt	
Eclipse & Galant	75 (103)
Damper Fork-To-Lower Control Arm Bolt	
Eclipse & Galant	64 (88)
Hub/Bearing-To-Knuckle	
Mirage	43-52 (59-71)
All Others	65 (88)
Lower Ball Joint-To-Knuckle Nut	43-52 (59-71)
Lower Lateral Arm-To-Crossmember Bolt (1)	
Eclipse & Galant	71-85 (98-118)
Lower Control Arm Bushing Bracket-To-Body Bolt	
Mirage	58-72 (78-98)
Lower Control Arm Bushing Bracket-To-Body Self-Locking Nut	
3000GT	29 (40)
Lower Control Arm-To-Crossmember Bolt (1)	
3000GT	72-87 (100-120)
Lower Control Arm Pivot Bolt	
3000GT & Mirage	78 (106-108)
Diamante	72-87 (100-120)
Lower Control Arm Rear Pivot Nut	
3000GT & Diamante	72 (100)
Lug Nut	
Eclipse & 3000GT	87-101 (120-140)
All Others	65-80 (88-108)
Roll Stopper (Mirage)	
Center Bolts	38 (52)
Mounting Bolts	25 (34)
Stabilizer Bar Bracket-To-Crossmember Bolt	
3000GT	29 (40)
Diamante	25-33 (34-44)
Eclipse & Galant	28 (39)
Mirage	16 (22)
Stabilizer Link Mounting Nuts	
3000GT	29 (40)
Diamante	26-33 (35-44)
Eclipse & Galant	28 (39)
Strut-To-Body Mounting Nut	
Diamante	29-36 (40-50)
Mirage	32 (44)
All Others	32-33 (44-45)
Strut-To-Insulator Lock Nut	
3000GT	56 (78)
Eclipse	14-18 (20-25)
Galant	18 (25)
Mirage	43 (59)
Strut-To-Steering Knuckle Bolt	
3000GT	65-76 (90-105)
Diamante	65-76 (90-105)

Mirage	80-94 (108-127)
Tie Rod-To-Knuckle Nut	
3000GT FWD	21 (29)
3000GT AWD	36 (50)
Diamante	20 (27)
Eclipse & Galant	18-24 (24-33)
Mirage	11-25 (15-33)
Upper Ball Joint Nut	20 (28)
Upper Control Arm Shaft-To-Body Mounting Nut	62 (86)
Upper Control Arm Pivot Bolt	41 (57)

(1) - Fastener should be temporarily tightened, and then fully tightened when installation is completed with vehicle at normal operating height.

SUSPENSION - REAR

1998 Mitsubishi Galant

1997-98 SUSPENSION
Rear - AWD & FWD

Diamante, Eclipse, Galant, Mirage, 3000GT

DESCRIPTION

NOTE: 3000GT may be equipped with Electronically Controlled Suspension (ECS). The suspension remains the same, but it is electronically controlled. For testing and diagnosis information on electronically controlled suspension, see ELECTRONIC - 3000GT article.

3000GT FWD
Rear suspension system is multi-link type with hydraulic shock absorbers, coil springs and stabilizer bar. See Fig. 1.

Eclipse AWD & 3000GT AWD
Rear suspension system is an independent, double-wishbone type. System consists of upper and lower suspension arms, shock absorbers, coil springs and stabilizer bar. See Figs. 2 and 4.

Mirage
Rear suspension system is a trailing arm multi-link type. It uses trailing arm, control link and lower control arm. See Fig. 3.

Diamante, Eclipse FWD & Galant
Rear multi-link suspension incorporates an upper A-arm, lower trailing link and 2 lower split level lateral links. Rear strut assembly is connected to knuckle. Rear stabilizer bar is available as an option. See Fig. 5.

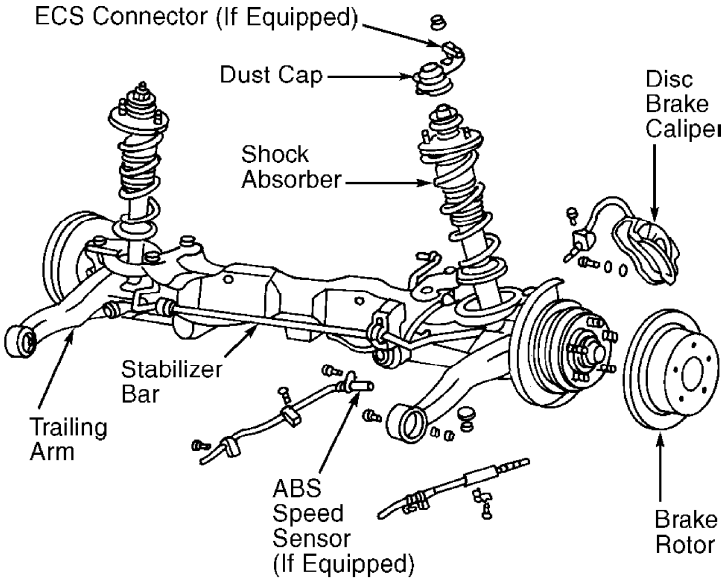


Fig. 1: Exploded View Of Rear Suspension (3000GT FWD)
Courtesy of Mitsubishi Motor Sales of America.

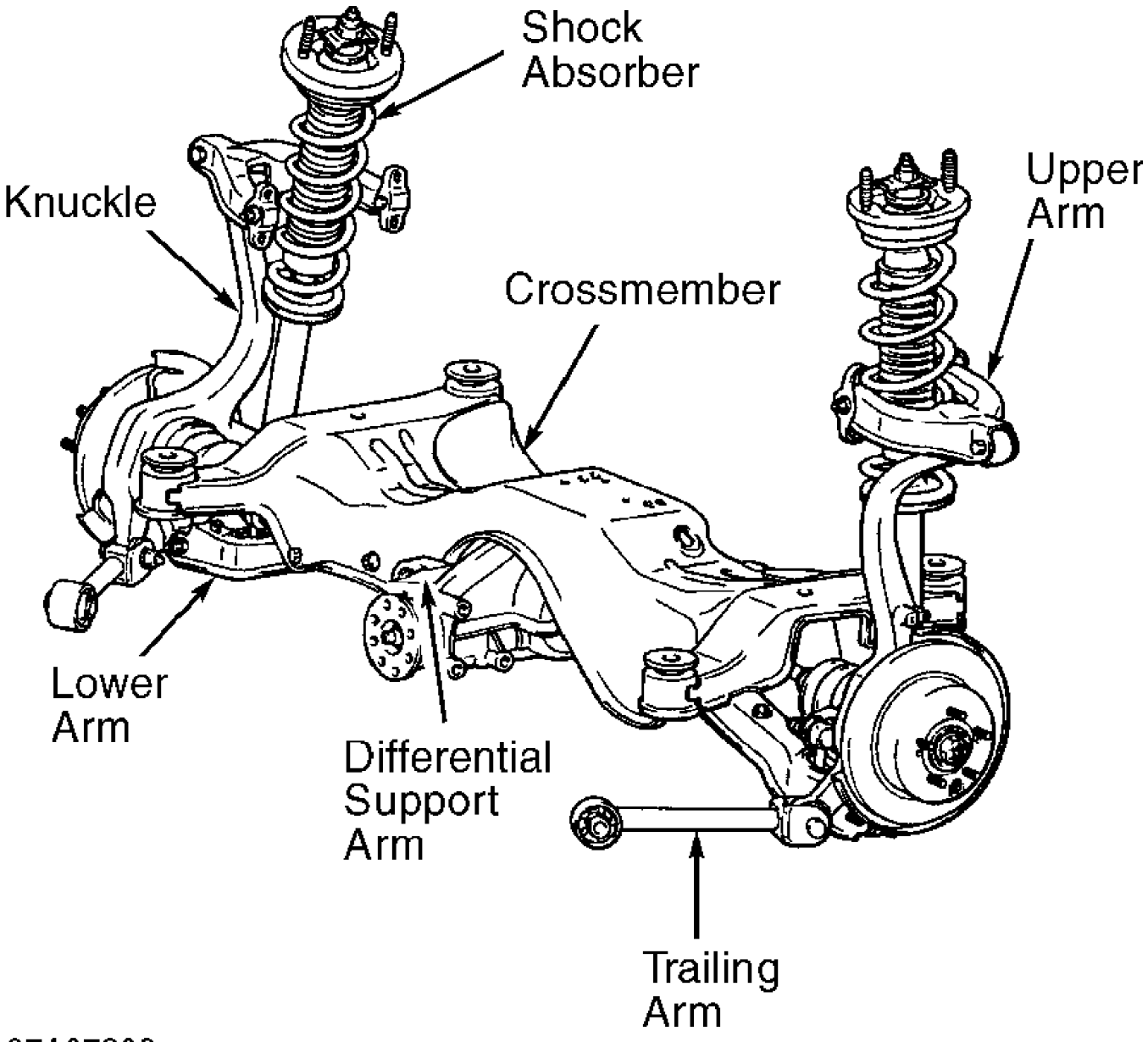


Fig. 2: Exploded View Of Rear Suspension (Eclipse AWD)
Courtesy of Mitsubishi Motor Sales of America.

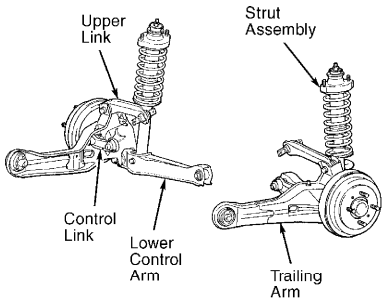


Fig. 3: Exploded View Of Rear Suspension (Mirage)
Courtesy of Mitsubishi Motor Sales of America.

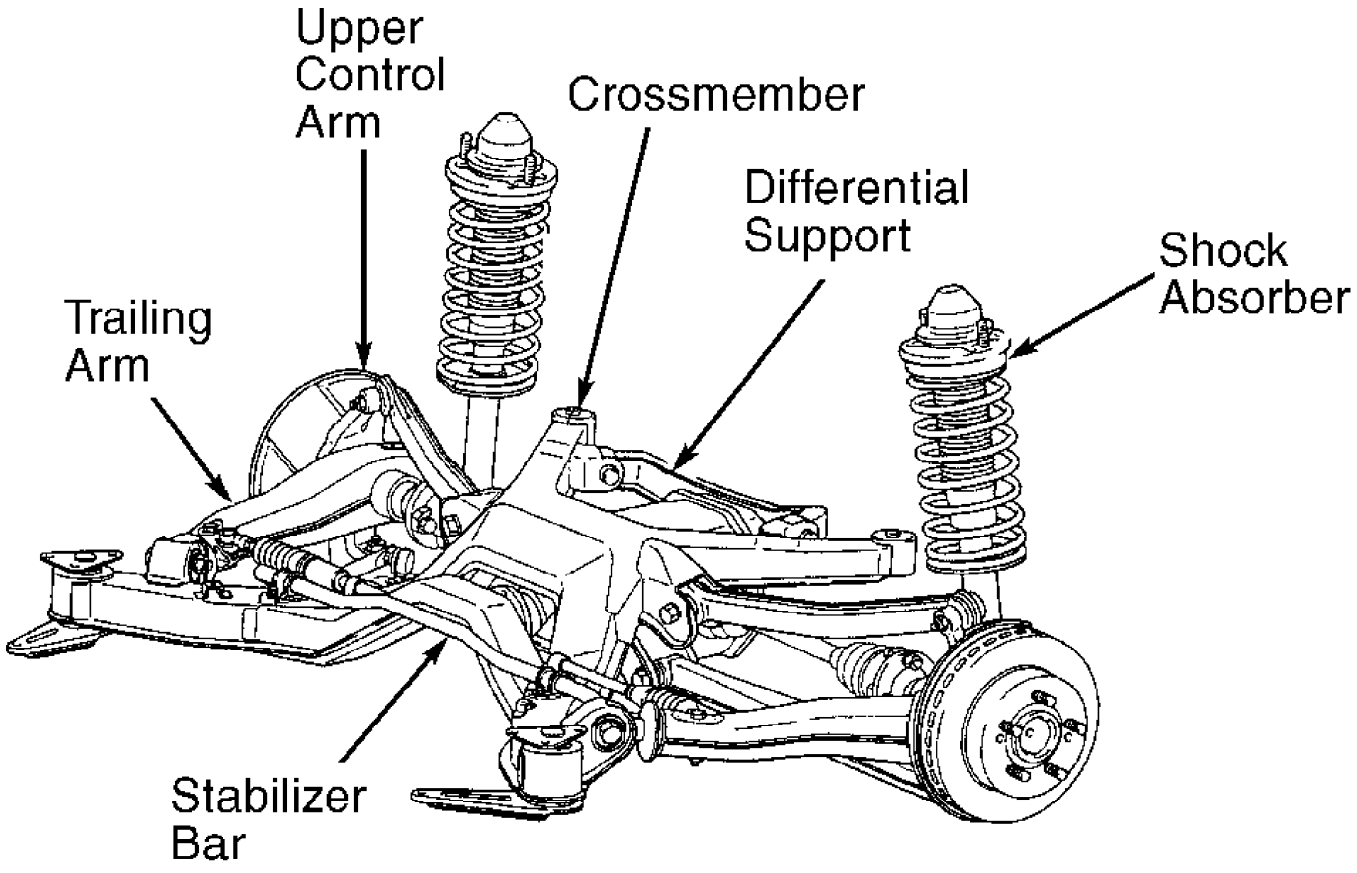


Fig. 4: Exploded View Of Rear Suspension (3000GT AWD)
Courtesy of Mitsubishi Motor Sales of America.

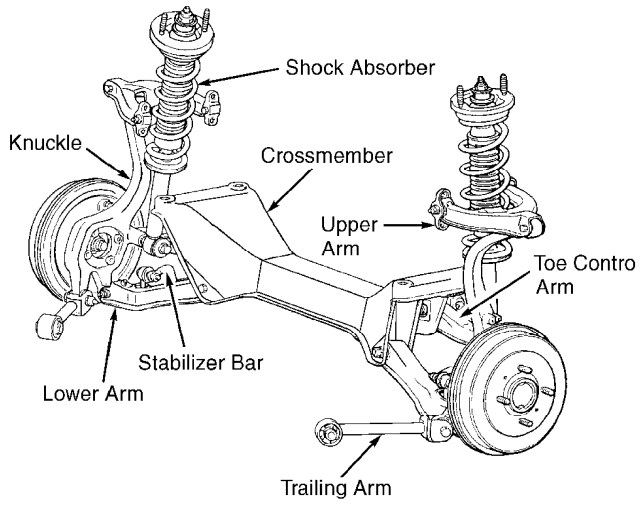


Fig. 5: Exploded View Of Rear Suspension (Eclipse FWD & Galant Shown; Diamante Similar)
Courtesy of Mitsubishi Motor Sales of America.

ADJUSTMENTS & INSPECTION

WHEEL ALIGNMENT SPECIFICATIONS & PROCEDURES

NOTE: See WHEEL ALIGNMENT SPECIFICATIONS & PROCEDURES article in WHEEL ALIGNMENT section.

WHEEL BEARING

NOTE: Specifications and procedures for Diamante, Eclipse, Galant, Mirage and 3000GT AWD are not available from the manufacturer.

3000GT FWD

1) Raise and support vehicle. Remove rear wheel assembly. Remove brake disc or drum if necessary. Measure axle shaft end play using dial indicator. See AXIAL END PLAY & ROTARY SLIDING RESISTANCE SPECIFICATIONS table.

2) If end play exceeds limit, retighten wheel bearing nut or companion flange nut (if equipped) to specification. See TORQUE SPECIFICATIONS. DO NOT back off wheel bearing nut more than 15 degrees to align cotter pin holes (if equipped). Recheck end play. If end play exceeds limit, replace wheel bearings.

3) Check rotary sliding resistance. Attach a spring scale to hub bolt. Measure rotary sliding resistance by pulling spring scale at a 90-degree angle to hub bolt. Note measurement when hub begins to rotate. See AXIAL END PLAY & ROTARY SLIDING RESISTANCE SPECIFICATIONS table. If resistance exceeds limit, remove and inspect wheel bearings. Replace wheel bearings as needed.

AXIAL END PLAY & ROTARY SLIDING RESISTANCE SPECIFICATIONS

Application/ Model	End Play In. (mm)	Rotary Resistance Lbs. (kg)
3000GT FWD	.002 (.05)	7.0 (3.1)

BALL JOINT CHECKING

NOTE: Specifications and procedures for Mirage are not available from the manufacturer.

Control Arm Ball Joint & Stabilizer Link Ball Joint

1) Raise and support vehicle. Remove wheel. Disconnect stabilizer bar from control arm (if needed). Loosen selected ball joint nut. Using Steering Linkage Puller (MB991113-01), separate ball joint from mating component. Install nut on ball joint stud. Move stud from side-to-side. Replace ball joint if side play is present.

2) Using INCH-lb. torque wrench, rotate ball joint and note starting torque. Replace ball joint if roughness is felt when rotating ball joint or if starting torque exceeds specification. See BALL JOINT STARTING TORQUE SPECIFICATIONS table.

BALL JOINT STARTING TORQUE SPECIFICATIONS

Application	INCH Lbs. (N.m)
Control Arm Ball Joint	
3000GT	17-78 (2-9)
Diamante, Eclipse & Galant	1-23 (.1-2.7)
Stabilizer Link Ball Joint	

Diamante, Eclipse & Galant	4-13 (.5-1.5)
3000GT	15-28 (1.7-3.2)

REMOVAL & INSTALLATION

REAR SUSPENSION ASSEMBLY

NOTE: Procedures for Mirage are for control link, upper link and lower arm only.

Removal (3000GT FWD)

1) Remove strut cap trim piece. Remove main muffler. Remove upper strut mounting nuts. Raise and support vehicle. Remove wheel assembly. Remove brake tube clamp bolt. Remove mounting bolts and remove caliper and disc assembly. See Fig. 1 or 4. Disconnect parking brake cable from brake assembly.

2) Disconnect and remove rear speed sensor. Support the crossmember with a floor or transmission jack. Remove trailing arm mounting bolt and nut. Remove crossmember mounting nut and lower rear suspension assembly from vehicle.

Inspection

Check trailing arm for deformation and damage. Check rubber bushings for deterioration, cracks and unusual wear.

Installation

1) If crossmember bushing needs replacing, remove bushing using Bushing Press (MB991045). Apply soapy water and press in new bushing with marks aligned with centerline of crossmember. The inner sleeve should protrude 0.33-0.37" (8.5-9.5 mm) from the crossmember.

2) To complete installation, reverse removal procedure. Bleed brakes, and check wheel bearings. See WHEEL BEARING under ADJUSTMENTS & INSPECTION. Tighten all fasteners to specification. See TORQUE SPECIFICATIONS. Check wheel alignment. See WHEEL ALIGNMENT SPECIFICATIONS & PROCEDURES article in WHEEL ALIGNMENT section.

Removal (3000GT AWD)

1) Remove trunk room trim. Remove center exhaust pipe and main muffler. Remove shock absorber upper mounting nuts and center cap. Disconnect brake tube to brake hose connection.

2) Disconnect parking brake cable. Remove brake caliper and brake disc. On models with 4-wheel steering, disconnect pressure tubes, feed, suction and return lines. Remove steering power cylinder tie rod coupling nut. On all models, mark drive shaft flange and differential flange for installation reference. Disconnect drive shaft, and secure it using wire. Support differential using transmission jack, and remove self-locking nuts.

3) Remove center bearing mounting nut. Remove ABS speed sensor harness connector (if equipped). Disconnect parking brake cable and remove ABS speed sensor. Remove cable band. Remove crossmember bracket and mounting nuts. Lower jack and remove rear suspension assembly.

CAUTION: Ensure drive shaft does not bend excessively. Due to weight being handled, 3 people are required to lower suspension assembly.

4) Move suspension assembly toward rear of vehicle, and slowly lower suspension assembly. DO NOT contact stabilizer bar and drive shaft. Support lower arm using a wooden block to protect dust shield.

Inspection

Check crossmember for cracks and other damage. Inspect all components for damage and unusual wear. Replace components as necessary.

Installation

To install, reverse removal procedure. Ensure reference marks align when installing drive shaft. Tighten all suspension fasteners to specification with vehicle on ground and suspension unloaded. See TORQUE SPECIFICATIONS. Check wheel alignment. See WHEEL ALIGNMENT SPECIFICATIONS & PROCEDURES article in WHEEL ALIGNMENT section.

Removal (Eclipse)

1) Remove trunk lid. On Spyder, remove luggage compartment side trim. On FWD models, remove rear crossmember undercover panel. Remove center exhaust pipe. On AWD models, mark drive shaft flange and differential flange for installation reference. Disconnect drive shaft, and secure it using wire. On all models, remove brake caliper or drum.

2) Disconnect parking brake cable. On drum brake models, disconnect and plug hydraulic brake hose. Remove upper arm bracket mounting bolts. Remove cap from top of shock. Remove shock absorber upper mounting nuts. On models with anti-lock brakes, disconnect electrical harness connectors.

3) Remove frame grommet to access trailing arm front mounting bolt. Disconnect trailing arm. Support crossmember on FWD vehicles or differential on AWD vehicles with a floor or transmission jack. Remove nuts connecting rear suspension crossmember to body. Lower rear suspension assembly.

Inspection

Check crossmember for cracks and other damage. Inspect all components for damage and unusual wear. Replace components as necessary.

Installation

To install, reverse removal procedure. Ensure reference marks align when installing drive shaft. Tighten all suspension fasteners to specification with vehicle on ground and suspension unloaded. See TORQUE SPECIFICATIONS. Check wheel alignment. See WHEEL ALIGNMENT SPECIFICATIONS & PROCEDURES article in WHEEL ALIGNMENT section.

Removal (Diamante & Galant)

1) Remove rear seat to access upper strut mounting nuts. Remove center exhaust pipe. Mark upper strut mounting stud and body for reassembly reference. Remove nuts. Raise and support vehicle.

2) Remove caliper and disc or brake drum. Disconnect parking brake cable. Disconnect and plug hydraulic brake hose. Remove rear ABS sensor connector (if equipped). Unbolt upper arm brackets from frame. Remove frame grommet to access trailing arm front mounting bolt. Disconnect trailing arm.See Fig. 5.

3) Support crossmember with transmission jack. Remove nuts connecting rear suspension crossmember to body. Lower rear suspension assembly.

Inspection

Check all components from damage or cracking. Replace as needed.

Installation

Install rear suspension assembly in reverse order of disassembly. Tighten bolts to specification. See TORQUE SPECIFICATIONS . Bleed brake system. Ensure parking brake is correctly adjusted.

Inspect rear wheel alignment. See WHEEL ALIGNMENT SPECIFICATIONS & PROCEDURES article in WHEEL ALIGNMENT section.

Removal (Mirage)

1) Raise and support vehicle. Remove rear wheels. Remove bolt connecting control link to trailing arm. Remove control link. See Fig. 3. Remove bolt connecting upper link to trailing arm. Remove upper link.

2) Support lower arm with a jack. Remove bolts attaching lower control arm to trailing arm. Remove strut attaching bolts. Remove lower arm.

Inspection

Check all components from damage or cracking. Replace as needed.

Installation

Install rear suspension assembly in reverse order of disassembly. Tighten bolts to specification. See TORQUE SPECIFICATIONS . Bleed brake system. Ensure parking brake is correctly adjusted. Inspect rear wheel alignment. See WHEEL ALIGNMENT SPECIFICATIONS & PROCEDURES article in WHEEL ALIGNMENT section.

SHOCK & STRUT ASSEMBLIES

Removal

1) On Eclipse and 3000GT, remove trunk side trim or shock/strut access cover. On Galant, remove rear seat. On 3000GT, remove brake tube clamp bolt. On all models, raise and support vehicle. Remove wheel assembly.

CAUTION: On models with spring assisted shock absorbers, DO NOT remove center strut rod nut until spring is compressed.

2) On Mirage, disconnect lower arm and trailing arm connection, supporting arm with a jack. Remove bolt attaching lower arm and strut assembly and remove strut.

3) On all models except Mirage, support lower arm assembly using jack stands. Remove dust cap from top of shock assembly. Raise lower arm assembly using a jack. Remove mounting nuts, and disconnect upper strut mount from body. Disconnect shock from lower arm or knuckle assembly. Lower jack, and remove shock assembly from vehicle.

Inspection

Check shock for oil leakage, abnormal noise and poor function. Check coil spring for bending and weakness. Check rubber parts for deterioration and cracks. Check suspension arm and spindle for cracks and deformation.

Installation

To install, reverse removal procedure. Tighten all fasteners to specification. See TORQUE SPECIFICATIONS. Check wheel alignment. See WHEEL ALIGNMENT SPECIFICATIONS & PROCEDURES article in WHEEL ALIGNMENT section.

STABILIZER BAR

Removal (Diamante, Eclipse & Galant)

Raise and support vehicle. Support rear suspension assembly using a transmission jack. Remove lower arm cover on Eclipse with Aero package. On all models, remove stabilizer link nuts and disconnect links. Remove stabilizer bar bracket and bushings. Remove stabilizer bar.

Removal (3000GT FWD)

Raise and support vehicle. Support rear suspension assembly using a transmission jack. Remove stabilizer bar bracket and bushings. Remove upper stabilizer link nut. Remove stabilizer link-to-stabilizer bar nut. Remove lower joint cups and stabilizer rubber from bottom of stabilizer link. Remove stabilizer link. Lower transmission jack slightly, and remove stabilizer bar.

Removal (3000GT AWD)

1) Raise and support vehicle. Support rear suspension assembly using a transmission jack. Remove stabilizer link nut. Remove lower joint cups and stabilizer rubber. Remove stabilizer link-to-stabilizer bar nut, and remove stabilizer link.

2) Remove 4-wheel steering power cylinder tie rod coupling nut. Remove bolt attaching parking brake cable to mounting bracket. Remove 4-wheel steering pipe mounting bolts. Remove lower shock absorber bolt. Remove power cylinder mounting bolt.

3) Remove crossmember bracket and crossmember mounting nuts. Remove stabilizer bar bracket and bushings. Lower transmission jack slightly, and remove stabilizer bar.

Inspection (All Models)

1) Check bushings for wear and deterioration. Check stabilizer bar, stabilizer link and all bolts for damage and wear. Check ball joint dust cover for cracks. Replace components as necessary.

2) If replacing ball joint dust cover, remove clip ring and dust cover. Pack new dust cover with grease. Wrap stud threads using vinyl tape, and install dust cover. Secure cover using clip ring.

3) Check stabilizer link ball joint starting torque. Deflect ball joint stud from side to side several times. Install 2 nuts on ball joint. Measure ball joint starting torque using INCH-lb. torque wrench.

4) Starting torque should be 15-28 INCH lbs. (1.7-3.2 N.m) on 3000GT, and 4-13 INCH lbs. (0.5-1.5 N.m) on all others. If starting torque exceeds specification, replace link. If ball joint starting torque is less than specification, ball joint may be reused unless it has drag and excessive play.

Installation (All Models)

To install, reverse removal procedure. On 3000GT, when installing stabilizer link, hold link using wrench and tighten nut until distance from end of bolt to edge of nut is .20-.28" (5.1-7.1 mm). Align end of stabilizer bar bushing with the outside of marking on stabilizer bar. On all other models, when installing stabilizer bar to bracket position stabilizer bushing so that the marked area of stabilizer bar protrudes 0.4" (10 mm) from the edge of the inside of the bushing. On all models, tighten all remaining fasteners to specification. See TORQUE SPECIFICATIONS.

TRAILING ARM

Removal & Installation (Diamante, Eclipse & Galant)

Remove bolt attaching knuckle and trailing arm assembly at lower end of arm. Remove grommet covering upper end of trailing arm. Remove mounting bolt from upper end of trailing arm. Remove stopper assembly from backside of trailing arm and remove trailing arm. Check trailing arm and bushing for cracks, deterioration and wear. Replace components as necessary.

Installation

To install trailing arm, reverse removal procedure. Tighten

all fasteners to specification. See TORQUE SPECIFICATIONS. Check wheel alignment. See WHEEL ALIGNMENT SPECIFICATIONS & PROCEDURES article in WHEEL ALIGNMENT section.

Removal (3000GT FWD)

1) Remove rear brake caliper mounting bolts. Remove caliper and suspend using wire. Remove brake tube clamp bolt. Remove brake disc. Remove hub cap and wheel bearing nut. Remove rear hub assembly. Disconnect parking brake cable end and clamp bolt. On vehicles with ABS, remove speed sensor. Remove brake backing plate.

2) Disconnect stabilizer link lower mounting nut. Remove attaching nut at the lower end of the suspension lower arm. Remove shock absorber mounting bolt. Remove upper arm ball joint self-locking nut and separate ball joint using Puller (MB99113). Remove trailing arm mounting nut and bolt and remove trailing arm assembly. Check trailing arm and bushing for cracks, deterioration and wear. Replace components as necessary. Bushings may be replaced using Arbor (MB990847) and Base (MB990880).

NOTE: If inner bearing race was left on spindle when removing hub, hub assembly must be replaced.

Installation

To install trailing arm, reverse removal procedure. Tighten all fasteners to specification. See TORQUE SPECIFICATIONS. Check wheel alignment. See WHEEL ALIGNMENT SPECIFICATIONS & PROCEDURES article in WHEEL ALIGNMENT section.

Removal (3000GT AWD)

1) Remove rear brake caliper mounting bolts. Remove caliper and suspend using wire. Remove brake disc. Hold hub using Yoke Holder (MB990767-01), and remove companion flange-to-axle shaft nut. Remove companion flange and rear axle shaft, using Slide Hammer (MB991354) and Axle Shaft Puller (MB990241).

2) Disconnect parking brake cable end and clamp bolt. On vehicles with ABS, remove speed sensor, speed sensor cable and parking brake cable bands. On all models, remove dust shield. Remove self-locking nuts attaching upper and lower control arms to trailing arm knuckle, using Steering Linkage Puller (MB99113).

3) Remove tie rod end mounting nut and trailing arm mounting bolt and nut. Remove stopper from front end of trailing arm (if equipped). Remove rear shock absorber mounting bolt and remove trailing arm. Check trailing arm and bushing for cracks, deterioration and wear. Replace components as necessary.

Disassembly

1) Using Bushing Arbor (MB990800) and Base (MB990847) remove bushing. Remove connecting rod bolt and nut. Install Rod Remover/Installer (MB991254) on trailing arm.

2) Apply lubricant to sliding areas marked "A". See Fig. 6. Install bolt "B" to trailing arm at point shown. Turn threaded shaft "C" on remover/installer to remove connecting rod.

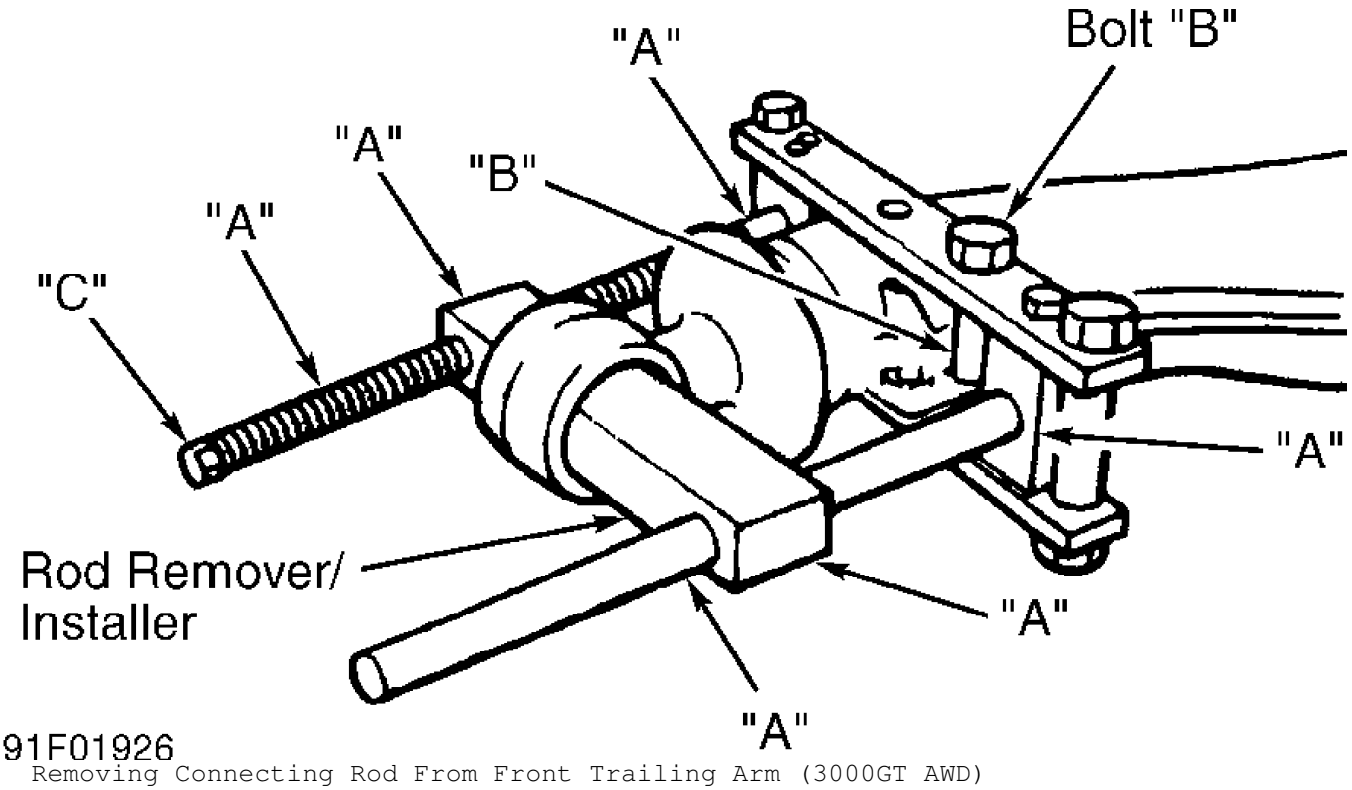


Fig. 6: Removing Connecting Rod From Front Trailing Arm (3000GT AWD) Courtesy of Mitsubishi Motor Sales of America.

Reassembly

If trailing arm bushing needs replacement, use bushing arbor and base to install new bushing. Press fit bushing until bushing outer pipe edge is flush with lower arm pipe edge. To complete reassembly, reverse disassembly procedure. Apply soapy water to rubber portion of connecting rod.

Installation

To install trailing arm, reverse removal procedure. Tighten all fasteners to specification. See TORQUE SPECIFICATIONS. Check wheel alignment. See WHEEL ALIGNMENT SPECIFICATIONS & PROCEDURES article in WHEEL ALIGNMENT section.

UPPER ARM

NOTE: Coil springs have color marks for spring identification and load classification. When replacing springs, ensure markings are correct for appropriate vehicle.

Removal (Diamante, Eclipse & Galant)

Remove bolt connecting upper arm to knuckle. Remove upper arm mounting bolts. Remove upper arm assembly.

Installation

Tighten the upper arm bracket so that the vertical center of the upper arm-to-knuckle pivot bolt is 1.38-1.54" (35.2-39.2 mm) above the center of the upper arm bracket bolts. If installed correctly, a triangle can be measured with the distance from the center of the top surface of the control arm above the upper arm-to-knuckle pivot bolt is 8.4" (213.5 mm), and the center of the top surface of the control arm above the upper arm-to-knuckle pivot bolt is 10.6" (296.2 mm).

Removal & Installation (3000GT FWD)

Remove brake tube clamp bolt. Remove upper arm ball joint nut. Remove upper arm mounting nut and bolt. Remove upper arm. To install, reverse removal procedure.

LOWER ARM

Removal & Installation (3000GT)

Remove upper arm. See UPPER ARM under REMOVAL & INSTALLATION. Remove lower arm pivot bolt and nut. Remove stabilizer link-to-lower arm attaching nut. separate ball joint from knuckle using Steering Linkage Puller (MB991113). Separate ball joint from lower arm and knuckle using puller. Remove lower arm.

Inspection

1) Check bushing for wear and deterioration. Check upper and lower arms for bends and breakage. Check ball joint dust covers for cracks. Check all bolts for wear and damage. Replace components as necessary.

2) Check ball joint starting torque. Deflect ball joint stud side to side several times. Install 2 nuts on ball joint. Using INCH-lb. torque wrench, measure ball joint starting torque. Starting torque should be 17-78 INCH lbs. (2-9 N.m). If starting torque exceeds specification, replace arm. If ball joint starting torque is less than specification, ball joint may be reused unless it has drag and excessive play.

Installation

1) If ball joint dust cover needs replacement, remove dust cover and apply grease to lip and inside of new dust cover. Install dust cover using Installer (MB990800). Ensure dust cover is fully seated.

2) If lower arm bushing needs replacement, use Bushing Arbor (MB991072) and Base (MB991073) to remove and install bushing. Press fit bushing until bushing outer edge is flush with lower arm edge.

3) To complete installation, reverse removal procedure. When installing stabilizer link, hold link using a wrench and tighten nut until distance from end of bolt to edge of nut is as specified. See STABILIZER LINK SPECIFICATIONS table under STABILIZER BAR. Tighten upper and lower arm nuts to specification. See TORQUE SPECIFICATIONS. Check wheel alignment. See WHEEL ALIGNMENT SPECIFICATIONS & PROCEDURES article in WHEEL ALIGNMENT section.

Removal & Installation (Mirage)

See REAR SUSPENSION under REMOVAL & INSTALLATION.

LOWER ARM & TOE CONTROL ARM

Removal (Diamante, Eclipse & Galant)

1) To remove lower arm, remove lower arm cover (if equipped). Disconnect stabilizer link and lower arm connection. On vehicles with ABS, disconnect ABS speed sensor clamp bolts. Remove bolt attaching knuckle to lower arm. Remove lower arm pivot bolt and remove lower arm.

2) To remove toe control arm, separate ball joint connecting toe control arm and knuckle using Steering Linkage Puller (MB991113). Remove toe control arm pivot bolt. Remove toe control arm.

WHEEL BEARING

NOTE: Most models use integral hub/bearing assemblies. Wheel bearing procedures are not available from manufacturer.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS (3000GT FWD)

Application	Ft. Lbs. (N.m)
Assist Link Ball Joint Nut	54-64 (75-89)
Assist Link Pivot Bolt	101-116 (140-160)
Brake Caliper Bolt	36-43 (49-58)
Lower Arm-To-Crossmember Pivot Bolt (1)	101-116 (140-160)
Lower Arm-To-Knuckle Ball Joint Nut	54-64 (75-89)
Shock Absorber-To-Body Bolt/Nut (1)	33 (45)
Shock Absorber Lower Bolt	65 (90)
Shock Absorber-To-Insulator Nut	14-18 (19-25)
Stabilizer Bar Frame Bracket Bolt	29 (40)
Stabilizer Link Ball Joint Nut	29 (40)
Trailing Arm-To-Frame Bolt (1)	101-116 (137-157)
Upper Arm Ball Joint Nut Upper Arm-To-Frame Pivot Bolt (1)	101-116 (140-160)
Wheel Bearing Nut	181 (250)

(1) - Tighten with vehicle at normal operating height and no load.

TORQUE SPECIFICATIONS (3000GT AWD)

Application	Ft. Lbs. (N.m)
Brake Assembly Bolt	36-43 (49-58)
Crossmember Bracket-To-Body Bolt	51-61 (69-83)
Crossmember Bracket-To-Crossmember Bolt	80-94 (109-127)
Differential Carrier-To-Driveshaft Bolts	22-25 (30-35)
Lower Arm Ball Joint Nut	54-64 (73-87)
Lower Arm-To-Crossmember Nut (1)	101-116 (137-157)
Rear Steering Tie Rod End Nut	42 (58)
Shock Absorber-To-Body Nut	33 (45)
Shock Absorber Lower Bolt	72 (100)
Stabilizer Bar Bracket Bolt	30 (42)
Stabilizer Link-To-Stabilizer Bar Nut	29 (40)
Trailing Arm-To-Crossmember Nut (1)	145-174 (197-236)
Upper Arm Ball Joint Nut	54-64 (73-87)
Upper Arm-To-Crossmember Nut (1)	101-116 (137-157)

(1) - Tighten with vehicle at normal operating height and no load.

TORQUE SPECIFICATIONS (DIAMANTE, ECLIPSE & GALANT)

Application	Ft. Lbs. (N.m)
Ball Joint Nut	21 (28)
Caliper Bolt	64 (88)
Lower Arm-To-Crossmember Nut (1)	72 (98)
Lower Arm-To-Knuckle Nut	72 (98)
Shock Absorber Lower Attaching Bolt (1)	72 (98)
Shock Absorber-To-Body Nuts	32 (44)
Shock Absorber-To-Insulator Nut	14-18 (19-25)
Stabilizer Bar Frame Bracket Bolt	10 (14)
Stabilizer Link Ball Joint Nut	28 (39)
Toe Control Arm-To-Crossmember Nut (1)	
Diamante & Galant	50-56 (69-78)
Eclipse	72 (98)

Trailing Arm-To-Frame Bolt (1)	101-116 (137-157)
Trailing Arm-To-Knuckle Nut (1)	87-101 (118-137)
Upper Arm Frame Bracket-to-Body Bolts	28 (39)
Upper Arm-to-Frame Bracket Pivot Bolts	41 (57)
Upper Arm-To-Knuckle Nut (1)	72 (98)

(1) - Tighten with vehicle at normal operating height and no load.

TORQUE SPECIFICATIONS (MIRAGE)

Application	Ft. Lbs. (N.m)
Shock Absorber-To-Body Nut	32 (44)
Shock Absorber-To-Insulator Nut	18 (25)
Shock Absorber Lower Mounting Bolt (1)	66 (88)
Brake Hose-to-Frame Bolts	48 (65)
Lower Control Arm-to-Trailing Arm (1)	66 (88)
Lower Control Link-to-Trailing Arm	18 (25)
Lower Control Link-to-Frame(1)	69 (93)
Upper Link-To-Frame Bolts (1)	69 (93)
Upper Link-To-Trailing Arm Bolt (1)	66 (88)

(1) - Tighten with vehicle at normal operating height and no load.

* SUSPENSION UNIFORM INSPECTION GUIDELINES *

1998 Mitsubishi Galant

GENERAL INFORMATION
Steering, Suspension, Wheel Alignment, Wheels and Tires
Motorist Assurance Program
Standards For Automotive Repair

All Makes and Models

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Wheel Alignment

WHEEL ALIGNMENT

Wheels and Tires

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MOTORIST ASSURANCE PROGRAM (MAP)

OVERVIEW

The Motorist Assurance Program is the consumer outreach effort of the Automotive Maintenance and Repair Association, Inc. (AMRA). Participation in the Motorist Assurance Program is drawn from retailers, suppliers, independent repair facilities, vehicle manufacturers and industry associations.

Our organization's mission is to strengthen the relationship between the consumer and the auto repair industry. We produce materials that give motorists the information and encouragement to take greater responsibility for their vehicles-through proper, manufacturer-recommended, maintenance. We encourage participating service and repair shops (including franchisees and dealers) to adopt 1) a Pledge of Assurance to their Customers and 2) the Motorist Assurance Program Standards of Service. All participating service providers have agreed to subscribe to this Pledge and to adhere to the promulgated Standards of Service demonstrating to their customers that they are serious about customer satisfaction.

These Standards of Service require that an inspection of the vehicle's (problem) system be made and the results communicated to the customer according to industry standards. Given that the industry did not have such standards, the Motorist Assurance Program successfully promulgated industry inspection communication standards in 1994-95 for the following systems: Exhaust, Brakes, ABS, Steering and Suspension, Engine Maintenance and Performance, HVAC, and Electrical Systems. Further, revisions to all of these inspection communication standards are continually re-published. In addition to these, standards for Drive Train and Transmissions have recently been promulgated. Participating shops utilize these Uniform Inspection & Communication Standards as part of the inspection process and for communicating their findings to their customers.

The Motorist Assurance Program continues to work cooperatively and proactively with government agencies and consumer groups toward solutions that both benefit the customer and are mutually acceptable to both regulators and industry. We maintain the belief that industry must retain control over how we conduct our business, and we must be viewed as part of the solution and not part of the problem. Meetings with state and other government officials (and their representatives), concerned with auto repair and/or consumer protection, are conducted. Feedback from these sessions is brought back to the association, and the program adjusted as needed.

To assure auto repair customers recourse if they were not satisfied with a repair transaction, the Motorist Assurance Program offers mediation and arbitration through MAP/BBB-CARE and other non-

profit organizations. MAP conducted pilot programs in twelve states before announcing the program nationally in October, 1998. During the pilots, participating repair shops demonstrated their adherence to the Pledge and Standards and agreed to follow the UICS in communicating the results of their inspection to their customers. To put some "teeth" in the program, an accreditation requirement for shops was initiated. The requirements are stringent, and a self-policing method has been incorporated which includes the "mystery shopping" of outlets.

We welcome you to join us as we continue our outreach... with your support, both the automotive repair industry and your customers will reap the benefits. Please visit MAP at our Internet site www.motorist.org or contact us at:

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January 1999

MAP UNIFORM INSPECTION GENERAL GUIDELINES

OVERVIEW OF SERVICE REQUIREMENTS & SUGGESTIONS

It is MAP policy that all exhaust, brake, steering, suspension, wheel alignment, drive-line, engine performance and maintenance, and heating, ventilation and air conditioning, and electrical services be offered and performed under the standards and procedures specified in these sections.

Before any service is performed on a vehicle, an inspection of the appropriate system must be performed. The results of this inspection must be explained to the customer and documented on an inspection form. The condition of the vehicle and its components will indicate what services/part replacements may be "Required" or "Suggested". In addition, suggestions may be made to satisfy the requests expressed by the customer.

When a component is suggested or required to be repaired or replaced, the decision to repair or replace must be made in the customer's best interest, and at his or her choice given the options available.

This section lists the various parts and conditions that indicate a required or suggested service or part replacement. Although this list is extensive, it is not fully inclusive. In addition to this list, a technician may make a suggestion. However, any suggestions must be based on substantial and informed experience, or the vehicle manufacturer's recommended service interval and must be documented.

Some conditions indicate that service or part replacement is required because the part in question is no longer providing the function for which it is intended, does not meet a vehicle manufacturer's design specification or is missing.

Example:
An exhaust pipe has corroded severely and has a hole in it through which exhaust gases are leaking. Replacement of the exhaust pipe in this case is required due to functional failure.

Example:
A brake rotor has been worn to the point where it measures less than the vehicle manufacturer's discard specifications. Replacement of the rotor is required because it does not meet design specifications.

Some conditions indicate that a service or part replacement is suggested because the part is close to the end of its useful life or addresses a customer's need, convenience or request. If a customer's vehicle has one of these conditions, the procedure may be only to suggest service.

Example:
An exhaust pipe is rusted, corroded or weak, but no leaks are present. In this case, the exhaust pipe has not failed. However, there is evidence that the pipe may need replacement in the near future. Replacement of the pipe may be suggested for the customer's convenience in avoiding a future problem.

Example:
The customer desires improved ride and/or handling, but the vehicle's shocks or struts have not failed. In this case, replacement may be suggested to satisfy the customer's wishes. In this case, replacement of the shocks or struts may not be sold as a requirement.

A customer, of course, has the choice of whether or not a shop will service his or her vehicle. He or she may decide not to follow some of your suggestions. When a repair is required, a MAP shop must refuse partial service on that system if, in the judgment of the service provider, proceeding with the work could create or continue an unsafe condition. When a procedure states that required or suggested repair or replacement is recommended, the customer must be informed of the generally acceptable repair/replacement options whether or not performed by the shop.

When presenting suggested repairs to the customer, you must present the facts, allowing the customer to draw their own conclusions and make an informed decision about how to proceed.

The following reasons may be used for required and suggested services. These codes are shown in the "Code" column of the MAP Uniform Inspection & Communications Standards that follow:

Reasons to Require Repair or Replacement

A – Part no longer performs intended purpose
B – Part does not meet a design specification (regardless of performance)
C – Part is missing

NOTE: When a repair is required, the shop must refuse partial service to the system in question, if the repair creates or continues an unsafe condition.

Reasons to Suggest Repair or Replacement

1 – Part is close to the end of its useful life (just above discard specifications, or weak; failure likely to occur soon, etc.)
2 – To address a customer need, convenience, or request (to stiffen ride, enhance performance, eliminate noise, etc.)
3 – To comply with maintenance recommended by the vehicle's Original Equipment Manufacturer (OEM)
4 – Technician's recommendation based on substantial and informed experience

NOTE: Suggested services are always optional. When presenting suggested repairs to the customer, you must present

the facts, allowing the customer to draw their own conclusions and make an informed decision about how to proceed.

STEERING AND SUSPENSION

SERVICE PROCEDURES REQUIRED AND SUGGESTED FOR PROPER VEHICLE OPERATION

Steering and suspension are complex systems made up of a variety of interdependent components. For proper vehicle handling, ride, and tire wear, a thorough inspection is required whenever suspension work is being performed.

Conditions listed assume that the problem has been isolated to the specific component by proper testing procedures.

NOTE: When replacing steering and/or suspension components which may affect an alignment angle, you are required to check and adjust alignment as needed. Refer to the OEM specifications.

CAUTION: DO NOT use ride height altering or load compensating components, such as variable rate springs and coil over shocks, on vehicles with height or load sensing proportioning valve-equipped braking systems, unless these components are original equipment.

AIR RIDE SUSPENSION

NOTE: Depending on the air suspension design, there are some aftermarket products available to eliminate the air ride suspension on certain vehicles. If the system has been eliminated with one of these products, then no service is suggested or required.

AIR RIDE SUSPENSION - AIR SHOCKS AND AIR STRUTS

NOTE: This section covers the air spring portion of the air shock or strut. For damping portion of shock or strut conditions and procedures, refer to the SHOCK ABSORBERS, STRUT CARTRIDGES AND STRUT ASSEMBLIES section.

AIR RIDE SUSPENSION - AIR SHOCK AND AIR STRUT INSPECTION

Condition	Code	Procedure
Inner fabric of air bag damaged	A	Require replacement.
Leaking	A	Require repair or replacement.
Outer covering of air bag is cracked to the extent that inner fabric of air bag is visible	1	Suggest replacement.

AIR RIDE SUSPENSION - AIR SPRING VALVES

AIR RIDE SUSPENSION - AIR SPRING VALVE INSPECTION

Condition	Code	Procedure

Condition	Code	Procedure
Attaching hardware incorrect	A	Require replacement of incorrect part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Blocked	A	Require repair or replacement.
Connector bent	A	Require repair or replacement.
Connector broken	A	Require replacement.
Connector loose	A	Require repair or replacement.
Inoperative	A	Require repair or replacement.
Leaking	A	Require repair or replacement.
Restricted	A	Require repair or replacement.

AIR RIDE SUSPENSION - AIR SPRINGS

AIR RIDE SUSPENSION - AIR SPRING INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require replacement of broken part.
Attaching hardware incorrect	A	Require replacement of incorrect part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Collar cracked	A	Require replacement.
End cap cracked	A	Require replacement.
Inner fabric of bag damaged	A	Require replacement.
Leaking	A	Require repair or replacement.
Outer covering of air bag is cracked to the extent that inner fabric of air bag is visible	1	Suggest replacement.
Piston cracked	A	Require replacement.

AIR RIDE SUSPENSION - COMPRESSORS

AIR RIDE SUSPENSION - COMPRESSOR INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require repair or replacement of bent part.
Attaching hardware broken	A	Require replacement of broken part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Connector bent	A	Require repair or replacement.
Connector broken	A	Require replacement.
Connector loose	A	Require repair or replacement.
Does not build pressure	A	(1) Further inspection required.
Excessive run time	B	(2) Further inspection required.
Inoperative	A	Require replacement.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.

(1) - If failure to build pressure is traced to the compressor, require replacement.
(2) - If excessive run time is traced to the compressor, require replacement.

AIR RIDE SUSPENSION - HEIGHT SENSORS

AIR RIDE SUSPENSION - HEIGHT SENSOR INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require repair or replacement of bent part.
Attaching hardware broken	A	Require replacement of broken part.
Attaching hardware corroded, affecting structural integrity	A	Require replacement of corroded part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware		

threads damaged	A	... Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	..... Require replacement of part with stripped threads.
Dust boot missing	2	..... (1) Suggest replacement.
Dust boot split	2	..... (1) Suggest replacement.
Dust boot torn	2	..... (1) Suggest replacement.
Housing cracked	A	..... Require replacement.
Lead routing incorrect ..	B	.. Require rerouting according to vehicle manufacturer's specifications.
Loose	B	... Require adjustment to vehicle manufacturer's specifications.
Missing	C	..... Require replacement.
Output signal incorrect .	A	.. Require repair or replacement.
Wire lead damaged	A	.. Require repair or replacement.

(1) - This condition can lead to damage of the sliding magnet, which, in turn, causes premature sensor failure.

AIR RIDE SUSPENSION - MODULES

AIR RIDE SUSPENSION - MODULE INSPECTION

Condition	Code	Procedure
Attaching hardware loose	A	... Require repair or replacement of loose part.
Attaching hardware missing	C	.. Require replacement of missing part.
Attaching hardware threads damaged	A	... Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	..... Require replacement of part with stripped threads.
Housing cracked	2	.. Suggest repair or replacement.
Inoperative	A	..... Require replacement.
Missing	C	..... Require replacement.

AIR RIDE SUSPENSION - RELAYS (COMPRESSOR)

AIR RIDE SUSPENSION - RELAY (COMPRESSOR) INSPECTION

Condition	Code	Procedure
Housing cracked	2	..... (1) Suggest replacement.
Intermittent	A	..... Require replacement.
Missing	C	..... Require replacement.
Output signal incorrect .	A	..... Require replacement.

(1) - If moisture enters the relay, it can reduce life expectancy or impair function.

AIR RIDE SUSPENSION - SWITCHES (ON/OFF)

AIR RIDE SUSPENSION - SWITCH (ON/OFF) INSPECTION

Condition	Code	Procedure
Broken	A	Require replacement.
Missing	C	Require replacement.
Output signal incorrect	A	Require replacement.

AIR RIDE SUSPENSION - TORSION SPRINGS (COUNTER BALANCING)

AIR RIDE SUSPENSION - TORSION SPRING (COUNTER BALANCING) INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require repair or replacement of bent part.
Attaching hardware broken	A	Require replacement of broken part.
Attaching hardware incorrect	A	Require replacement of incorrect part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Broken	A	Require replacement.
Missing	C	Require replacement.

AIR RIDE SUSPENSION - TUBING

AIR RIDE SUSPENSION - TUBING INSPECTION

Condition	Code	Procedure
Attaching hardware incorrect	A	Require replacement of incorrect part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Blocked	A	Require repair or replacement.
Fitting incorrect	B	Require replacement.
Leaking	A	Require repair or replacement.
Line type incorrect	B	Require replacement.
Missing	C	Require replacement.
Restricted	A	Require repair or replacement.
Routed incorrectly	B	Require routing correction.

AIR RIDE SUSPENSION - WARNING LAMPS

AIR RIDE SUSPENSION – WARNING LAMP INSPECTION

Condition	Code	Procedure
Bulb burned out	A	Require replacement.
Warning light does not come on during bulb check	.	Further inspection required to determine cause.
Warning light flashes	.	Further inspection required to determine cause.
Warning light is intermittent	.	Further inspection required to determine cause.
Warning light stays on after initial bulb check	.	Further inspection required to determine cause.

AIR RIDE SUSPENSION - WIRING HARNESSES

AIR RIDE SUSPENSION – WIRING HARNESS INSPECTION

Condition	Code	Procedure
Connector bent	A	Require repair or replacement.
Connector broken	A	Require repair or replacement.
Connector loose	A	Require repair or replacement.
Damaged (cut, burned, or chafed)	A	Require repair or replacement.
Excessive resistance	B	Require repair or replacement.
Fuse blown	A	Require replacement.
Fusible link blown	A	Require replacement.
Open	A	Require repair or replacement.
Poor ground	A	Require repair or replacement.
Routed incorrectly	B	Require rerouting according to vehicle manufacturer’s specifications.
Shorted	A	Require repair or replacement.
Terminal bent	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal corroded	A	Require repair or replacement.
Terminal loose	A	Require repair or replacement.

BALL JOINTS

Before requiring or suggesting ball joint replacement, the approved OEM procedure must be used to measure ball joint wear. The measurement(s) obtained, along with the vehicle manufacturer’s specifications, must be noted on the inspection report. Some states require that these measurements also appear on the invoice.

NOTE: The term "perceptible movement," defined as any visible movement in any direction, has been the industry standard for determining the need for replacement of follower ball joints. Some vehicle manufacturers are now publishing specifications for follower ball joints that were

previously diagnosed by the "perceptible movement" standard. Before requiring or suggesting any parts be replaced based on "perceptible movement," consult your repair manual to determine if OEM specifications exist.

You are not required to replace ball joints in axle sets. However, when replacing a ball joint due to wear exceeding manufacturer's specification, you may suggest replacement of the other ball joint if its measurement shows it is close to the end of its useful life, for preventive maintenance.

BALL JOINT INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require repair or replacement of bent part if available; otherwise, replace ball joint.
Attaching hardware broken	A	Require replacement of broken part if available; otherwise, replace ball joint.
Attaching hardware corroded, affecting structural integrity	A	Require replacement of corroded part if available; otherwise, replace ball joint.
Attaching hardware incorrect	A	Require replacement of incorrect part if available; otherwise, replace ball joint.
Attaching hardware loose	A	Require repair or replacement of loose part if available; otherwise, replace ball joint.
Attaching hardware missing	C	Require replacement of missing part if available; otherwise, replace ball joint.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads if available; otherwise, replace ball joint.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads if available; otherwise, replace ball joint.
Binding	A	(1) Further inspection required.
Grease boot cracked	2	(2) Suggest replacement.
Grease boot missing	2	(3) Suggest replacement.
Grease boot torn	2	(4) Suggest replacement.
Grease fitting broken	A	Require replacement of grease fitting.
Grease fitting missing	C	Require replacement of grease fitting.
Grease fitting won't seal	A	Require replacement of grease fitting.
Greaseable ball joint will		

not take grease	2	.....	(5) Suggest replacement of grease fitting.
Nut on ball joint loose	A	.....	(6) Require repair or replacement.
Pre-load adjustment incorrect	B	..	Require repair or replacement.
Seized	A	.....	Require replacement.
Stud bent	B	.....	(7) Require replacement.
Stud broken	A	.....	(7) Require replacement.
Threads damaged	A	..	Require repair or replacement.
Threads stripped (threads missing)	A	.....	(7) Require replacement.
Wear exceeds manufacturer's specifications	B	.....	Require replacement.

(1) - If greaseable, grease ball joint. If problem persists or joint is non-greaseable, require replacement.
(2) - Cracked grease boot will allow contaminants to enter the ball joint and will accelerate wear.
(3) - Lack of grease boot will allow contaminants to enter the ball joint and will accelerate wear.
(4) - Torn grease boot will allow contaminants to enter the ball joint and will accelerate wear.
(5) - If the greaseable ball joint still will not take grease after replacing the grease fitting, suggest replacement of ball joint.
(6) - Check for bent stud or damaged taper hole.
(7) - Check for damaged taper hole.

BUSHINGS

BUSHING INSPECTION

Condition	Code		Procedure
Attaching hardware bent	B	...	Require repair or replacement of bent part if available; otherwise, replace bushing.
Attaching hardware broken	A	...	Require replacement of broken part if available; otherwise, replace bushing.
Attaching hardware corroded, affecting structural integrity	A	.	Require replacement of corroded part if available; otherwise, replace bushing.
Attaching hardware incorrect	A	.....	Require replacement of incorrect part if available; otherwise, replace bushing.
Attaching hardware loose	A	...	Require repair or replacement of loose part if available; otherwise, replace bushing.
Attaching hardware missing	C	..	Require replacement of missing part if available; otherwise, replace bushing.
Attaching hardware threads damaged	A	...	Require repair or replacement

			of part with damaged threads if available; otherwise, replace bushing.
Attaching hardware threads stripped (threads missing)	A	.....	Require replacement of part with stripped threads if available; otherwise, replace bushing.
Binding	A	..	Require repair or replacement.
Deteriorated, affecting performance	A	..	Require repair or replacement.
Distorted, affecting performance	A	..	Require repair or replacement.
Leaking (fluid-filled type)	A	.....	Require replacement.
Missing	C	.....	Require replacement.
Noisy	2	.....	(1) Further inspection required.
Rubber separating from internal metal sleeve on bonded bushing	A	.....	Require replacement.
Seized	A	.....	Require replacement.
Shifted (out of position)	B	..	Require repair or replacement.
Split	A	.....	Require replacement.
Surface cracking (weather-checked)	..	.....	No service suggested or required.

(1) - If noise isolated to bushing, suggest repair or replacement.

CAUTION: Use only approved lubricant on rubber bushings. Petroleum-based lubricants may damage rubber bushings.

CENTER LINKS

CENTER LINK INSPECTION

Condition	Code		Procedure
Attaching hardware incorrect	A	.....	Require replacement of incorrect part, if available; otherwise, replace center link.
Attaching hardware loose	A	...	Require repair or replacement of loose part, if available; otherwise, replace center link.
Attaching hardware missing	C	..	Require replacement of missing part, if available; otherwise, replace center link.
Attaching hardware threads damaged	A	...	Require repair or replacement of part with damaged threads, if available; otherwise, replace center link.
Attaching hardware threads stripped (threads missing)	A	.....	Require replacement of part with stripped threads, if

		available; otherwise, replace center link.
Bent	B	Require replacement.
Binding	A	(1) Further inspection required.
Grease boot cracked	2	(2) Suggest replacement.
Grease boot missing	2	(3) Suggest replacement.
Grease boot torn	2	(4) Suggest replacement.
Grease fitting broken	A	Require replacement of grease fitting.
Grease fitting missing	C	Require replacement of grease fitting.
Grease fitting won't seal	A	Require replacement of grease fitting.
Grease seal missing	2	(3) Suggest replacement.
Grease seal torn	2	(4) Suggest replacement.
Looseness (perceptible horizontal movement)	1	(5) Suggest replacement.
Looseness that is excessive	B	(5)(6) Require replacement.
Seized	A	Require replacement.
Stud bent	B	(7) Require replacement.
Stud broken	A	(7) Require replacement.
Stud loose in taper hole	A	(7) Require repair or replacement.
Taper hole elongated	A	(8) Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	(7) Require replacement.
Wear exceeds manufacturer's specifications	B	Require replacement.

(1) - If greaseable, grease joint. If problem persists or joint is non-greaseable, require replacement.
(2) - Cracked grease boot will allow contaminants to enter the joint and will accelerate wear.
(3) - Lack of grease boot will allow contaminants to enter the joint and will accelerate wear.
(4) - Torn grease boot will allow contaminants to enter the joint and will accelerate wear.
(5) - If manufacturer's procedures for inspection exist, use those procedures; otherwise, use an approved inspection method such as the dry park check.
CAUTION: DO NOT use pliers or pry bar to check ball and socket movement. Use only moderate hand pressure.
(6) - Excessive looseness is defined as being significant enough to affect vehicle handling or structural integrity.
(7) - Check for damaged taper hole.
(8) - Check for damaged stud.

CONTROL ARM SHAFTS

CONTROL ARM SHAFT INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require replacement of broken

		part, if available; otherwise, replace shaft.
Attaching hardware loose	A	Require repair or replacement of loose part, if available; otherwise, replace shaft.
Attaching hardware missing	C	Require replacement of missing part, if available; otherwise, replace shaft.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads, if available; otherwise, replace shaft.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads, if available; otherwise, replace shaft.
Bent	B	Require replacement.
Shaft bushing surface undersized (worn)	B	Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

CONTROL ARMS

CONTROL ARM INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require repair or replacement of bent part, if available; otherwise, replace control arm.
Attaching hardware broken	A	Require replacement of broken part, if available; otherwise, replace control arm.
Attaching hardware corroded, affecting structural integrity	A	Require replacement of corroded part, if available; otherwise, replace control arm.
Attaching hardware incorrect	A	Require replacement of incorrect part, if available; otherwise, replace control arm.
Attaching hardware loose	A	Require repair or replacement of loose part, if available; otherwise, replace control arm.
Attaching hardware missing	C	Require replacement of missing part, if available; otherwise, replace control arm.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads,

		if available; otherwise, replace control arm.
Attaching hardware threads stripped (threads missing)	A	..... Require replacement of part with stripped threads, if available; otherwise, replace control arm.
Bent	B	..... Require replacement.
Bushing hole oversized ..	B	..... Require replacement.
Ball joint hole oversized (loose interference or press fit)	B	..... (1) Further inspection required.
Corroded, affecting structural integrity ...	A	..... Require replacement.
Holes distorted	A	..... Require replacement.
Threads damaged	A	.. Require repair or replacement.
Threads stripped (threads missing)	A	..... Require replacement.

(1) - If oversized ball joint is available, require replacement of ball joint. If oversized ball joint is not available, require replacement of control arm.

DRAG LINKS

DRAG LINK INSPECTION

Condition	Code	Procedure
Attaching hardware incorrect	A	..... Require replacement of incorrect part, if available; otherwise, replace drag link.
Attaching hardware loose	A	... Require repair or replacement of loose part, if available; otherwise, replace drag link.
Attaching hardware missing	C	.. Require replacement of missing part, if available; otherwise, replace drag link.
Attaching hardware threads damaged	A	... Require repair or replacement of part with damaged threads, if available; otherwise, replace drag link.
Attaching hardware threads stripped (threads missing)	A	..... Require replacement of part with stripped threads, if available; otherwise, replace drag link.
Bent	B	..... Require replacement.
Binding	A	..... (1) Further inspection required.
Grease boot cracked	2	..... (2) Suggest replacement.
Grease boot missing	2	..... (3) Suggest replacement.
Grease boot torn	2	..... (4) Suggest replacement.
Grease fitting broken ...	A	... Require replacement of grease fitting.

Grease fitting missing	C	...	Require replacement of grease fitting.
Grease fitting won't seal	A	...	Require replacement of grease fitting.
Grease seal missing	2	.....	(5) Suggest replacement.
Grease seal torn	2	.....	(4) Suggest replacement.
Looseness (perceptible horizontal movement)	1	.....	(6) Suggest replacement.
Looseness that is excessive	B	.....	(6)(7) Require replacement.
Seized	A	.....	Require replacement.
Stud bent	B	.....	(8) Require replacement.
Stud broken	A	.....	(8) Require replacement.
Stud loose in taper hole	A	.....	(8) Require repair or replacement.
Taper hole elongated	A	.....	(9) Require replacement.
Threads damaged	A	..	Require repair or replacement.
Threads stripped (threads missing)	A	.....	(8) Require replacement.
Wear exceeds manufacturer's specifications	B	.....	Require replacement.

(1) - If greaseable, grease joint. If problem persists or joint is non-greaseable, require replacement.
(2) - Cracked grease boot will allow contaminants to enter the joint and will accelerate wear.
(3) - Lack of grease boot will allow contaminants to enter the joint and will accelerate wear.
(4) - Torn grease boot will allow contaminants to enter the joint and will accelerate wear.
(5) - Missing grease seal will allow contaminants to enter the joint and will accelerate wear.
(6) - If manufacturer's procedures for inspection exist, use those procedures; otherwise, use an approved inspection method such as the dry park check.

CAUTION: DO NOT use pliers or pry bar to check ball and socket movement. Use only moderate hand pressure.

(7) - Excessive looseness is defined as being significant enough to affect vehicle handling or structural integrity.
(8) - Check for damaged taper hole.
(9) - Check for damaged stud.

ELECTRONIC RIDE CONTROL SHOCKS AND STRUTS

NOTE: This section covers the electronic damping control portion of the electronic shock or strut. For dampening portion of shock or strut conditions and procedures, refer to the SHOCK ABSORBERS, STRUT CARTRIDGES AND STRUT ASSEMBLIES section.

ELECTRONIC RIDE CONTROL SHOCK AND STRUT INSPECTION

Condition	Code		Procedure
Connector bent	A	..	Require repair or replacement.
Connector broken	A	..	Require repair or replacement.
Connector loose	A	..	Require repair or replacement.
Electronic valve control			

inoperative	2	(1) Suggest replacement.
Terminal bent	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal corroded	A	Require repair or replacement.
Terminal loose	A	Require repair or replacement.

(1) - It is acceptable to replace with a non-electronically controlled unit, where available.

IDLER ARMS

IDLER ARM INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require replacement of broken part, if available; otherwise, replace idler arm.
Attaching hardware incorrect	A	Require replacement of incorrect part, if available; otherwise, replace idler arm.
Attaching hardware loose	A	Require repair or replacement of loose part, if available; otherwise, replace idler arm.
Attaching hardware missing	C	Require replacement of missing part, if available; otherwise, replace idler arm.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads, if available; otherwise, replace idler arm.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads, if available; otherwise, replace idler arm.
Binding	A	(1) Further inspection required.
Grease boot cracked	2	(2) Suggest replacement.
Grease boot missing	2	(3) Suggest replacement.
Grease boot torn	2	(4) Suggest replacement.
Grease fitting broken	A	Require replacement of grease fitting.
Grease fitting missing	C	Require replacement of grease fitting.
Grease fitting won't seal	A	Require replacement of grease fitting.
Grease seal missing	2	(5) Suggest replacement.
Grease seal torn	2	(4) Suggest replacement.
Greaseable joint will not take grease	2	(1) Suggest replacement of grease fitting.
Looseness at frame bracket end	B	(6)(7) Require repair or replacement.

Looseness at link end (perceptible horizontal movement)	1	(8)	Suggest replacement.
Looseness at link end that is excessive	B	(8)(9)	Require replacement.
Mounted out of position (center link not parallel)	B		Require repositioning.
Nut on stud loose	A	(10)	Require repair or replacement.
Seized	A		Require replacement.
Stud bent	B	(11)	Require replacement.
Stud broken	A	(11)	Require replacement.
Taper hole elongated	A	(12)	Require replacement.
Threads damaged	A		Require repair or replacement.
Threads stripped (threads missing)	A	(11)	Require replacement.
Wear exceeds manufacturer's specifications	B		Require replacement.

(1) - If greaseable, grease joint. If problem persists or joint is non-greaseable, require replacement.
(2) - Cracked grease boot will allow contaminants to enter joint and will accelerate wear.
(3) - Lack of grease boot will allow contaminants to enter joint and will accelerate wear.
(4) - Torn grease boot will allow contaminants to enter joint and will accelerate wear.
(5) - Missing grease seal will allow contaminants to enter joint and will accelerate wear.
(6) - If manufacturer's procedures and specifications exist, use those procedures and specifications; otherwise, use an approved inspection method such as the dry park check.
(7) - Looseness is defined as movement that creates excessive toe change.
(8) - If manufacturer's procedures for inspection exist, use those procedures; otherwise, use an approved inspection method such as the dry park check.
CAUTION: DO NOT use pliers or pry bar to check ball and socket movement. Use only moderate hand pressure.
(9) - Excessive looseness is defined as significant enough to affect vehicle handling or structural integrity.
(10) - Check for bent stud or damaged taper hole.
(11) - Check for damaged taper hole.
(12) - Check for damaged stud.

KING PINS

You are not required to replace king pins in axle sets. However, when replacing a king pin due to wear exceeding manufacturer's specifications, you may suggest replacement of the other king pin on the axle if its measurement shows it is close to the end of its useful life.

KING PIN INSPECTION

Condition	Code	Procedure
Bearing balls pitted	A	Require replacement.
Bearing balls worn	A	Require replacement.
Bearing races pitted	A	Require replacement.

Bearing races worn	A	..... Require replacement.
Bearing rollers pitted ..	A	..... Require replacement.
Bearing rollers worn	A	..... Require replacement.
Bearing seal bent	2	. Suggest replacement of seal or bearing.
Bearing seal missing	2	. Suggest replacement of seal or bearing.
Bearing seal torn	2	. Suggest replacement of seal or bearing.
Binding	A	.. Require repair or replacement of affected parts.
End caps missing	C	. Require replacement of missing part, if available; otherwise, replace king pin.
End play exceeds specifications	B	..... Require repair.
Grease fitting broken ...	A	.. Require replacement of grease fitting.
Grease fitting missing ..	C	.. Require replacement of grease fitting.
Grease fitting won't seal	A	.. Require replacement of grease fitting.
Locating pins missing ...	C	. Require replacement of missing part, if available; otherwise, replace king pin.
Looseness exceeds manufacturer's specifications	B	.... Require replacement of worn parts.
Seized	A	..... Require replacement.
Threads damaged	A	. Require repair or replacement.
Threads stripped (threads missing)	A	..... Require replacement.
Will not take grease	2	..... (1) Suggest replacement of grease fitting.

(1) - If king pin will not take grease after replacement of grease fitting, suggest replacement of king pin.

PITMAN ARMS

PITMAN ARM INSPECTION

Condition	Code	Procedure
Attaching hardware incorrect	A	..... Require replacement of incorrect part, if available; otherwise, replace pitman arm.
Attaching hardware loose	A	... Require repair or replacement of loose part, if available; otherwise, replace pitman arm.
Attaching hardware missing	C	.. Require replacement of missing part, if available; otherwise, replace pitman arm.
Attaching hardware threads damaged	A	... Require repair or replacement of part with damaged threads, if available; otherwise,

			replace pitman arm.
Attaching hardware threads stripped (threads missing)	A	.....	Require replacement of part with stripped threads, if available; otherwise, replace pitman arm.
Bent	B	.....	Require replacement.
Binding	A	.....	(1) Further inspection required.
Grease boot cracked	2	.....	(2) Suggest replacement.
Grease boot missing	2	.....	(3) Suggest replacement.
Grease boot torn	2	.....	(4) Suggest replacement.
Grease fitting broken	A	.....	Require replacement grease fitting.
Grease fitting missing	C	...	Require replacement of grease fitting.
Grease fitting won't seal	A	...	Require replacement of grease fitting.
Grease seal missing	2	.....	(3) Suggest replacement of seal.
Grease seal torn	2	.....	(4) Suggest replacement of seal.
Looseness (perceptible horizontal movement)	1	.....	(5) Suggest replacement.
Looseness that is excessive	B	.....	(5)(6) Require replacement.
Nut on stud loose	A	.....	(7) Require repair or replacement.
Seized	A	.....	Require replacement.
Splines damaged	A	..	Require repair or replacement.
Splines stripped (splines missing)	A	.....	Require replacement.
Stud bent	B	.....	(8) Require replacement.
Stud broken	A	.....	(8) Require replacement.
Stud loose in taper hole	A	.....	(8) Require repair or replacement.
Taper hole elongated	A	.....	(9) Require replacement.
Threads damaged	A	..	Require repair or replacement.
Threads stripped (threads missing)	A	.....	(8) Require replacement.

(1) - If greaseable, grease joint. If problem persists or joint is non-greaseable, require replacement.
(2) - Cracked grease boot will allow contaminants to enter joint and will accelerate wear.
(3) - Lack of grease boot will allow contaminants to enter joint and will accelerate wear.
(4) - Torn grease boot will allow contaminants to enter joint and will accelerate wear.
(5) - If manufacturer's procedures for inspection exist, use those procedures; otherwise, use an approved inspection method such as the dry park check.
CAUTION: DO NOT use pliers or pry bar to check ball and socket movement. Use only moderate hand pressure.
(6) - Excessive looseness is defined as being significant enough to affect vehicle handling or structural integrity.
(7) - Check for bent stud of damaged taper hole.
(8) - Check for damaged taper hole.
(9) - Check for damaged stud.

POWER STEERING HOSES

POWER STEERING HOSE INSPECTION

Condition	Code	Procedure
Blistered	B	Require replacement.
Blocked	A	Require repair or replacement.
Fitting threads damaged	A	Require repair or replacement.
Fitting threads stripped (threads missing)	A	Require replacement.
Inner fabric (webbing) cut	A	Require replacement.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Outer covering is cracked to the extent that the inner fabric of hose is visible	B	Require replacement.
Restricted	A	Require repair or replacement.

POWER STEERING (HYDRAULIC) PUMPS

If diagnosis has determined that complete disassembly is necessary to determine the extent of the system failure, the suggestion may be made to rebuild or replace the power steering pump. Repair or replacement of the following components may be required if performed as part of a power steering pump overhaul or rebuild service to meet a minimum rebuild standard.

POWER STEERING (HYDRAULIC) PUMP INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require repair or replacement of bent part.
Attaching hardware broken	A	Require replacement of broken part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Belt alignment incorrect	B	(1) Further inspection required.
Belt cracked	1	Suggest replacement.
Belt frayed	1	Suggest replacement.
Belt missing	C	Require replacement.
Belt noisy	2	(2) Further inspection required.
Belt plies separated	A	Require replacement.

Belt tension out of specification	B	Require adjustment or replacement.
Belt worn beyond adjustment range	B	Require replacement.
Belt worn so it contacts bottom of pulley	A	Require replacement.
Binding	A	Require repair or replacement.
Fluid at or beyond service interval	3	Suggest fluid change.
Fluid contaminated	B	(3) Require flushing and refilling of the system.
Fluid level incorrect	B	Require adjustment of fluid level.
Inadequate assist	A	(4) Further inspection required.
Leaking	A	Require repair or replacement.
Noise	2	(5) Further inspection required.
Pulley bent	A	Require repair or replacement of pulley.
Pulley missing	C	Require replacement of pulley.
Remote reservoir leaking	A	Require replacement of reservoir,
Reservoir cap broken	A	Require replacement of cap.
Reservoir cap missing	C	Require replacement of cap.
Seized	A	Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

(1) - Determine cause of incorrect alignment and require repair.
(2) - Determine cause of noise and suggest repair.
(3) - Determine and correct source of contamination. OEM specifications must be followed for fluid type.
(4) - If pump is source of inadequate assist, require repair or replacement.
(5) - If noise is isolated to pump, suggest repair or replacement.

RADIUS ARMS

RADIUS ARM INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require replacement of broken part.
Attaching hardware incorrect	A	Require replacement of incorrect part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.

Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Bent	B	Require replacement.
Corroded, affecting structural integrity	A	Require replacement.
Holes distorted	A	Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

RELAY RODS

RELAY ROD INSPECTION

Condition	Code	Procedure
Attaching hardware incorrect	A	Require replacement of incorrect part, if available; otherwise, replace relay rod.
Attaching hardware loose	A	Require repair or replacement of loose part, if available; otherwise, replace relay rod.
Attaching hardware missing	C	Require replacement of missing part, if available; otherwise, replace relay rod.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads, if available; otherwise, replace relay rod.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads, if available; otherwise, replace relay rod.
Bent	B	Require replacement.
Binding	A	(1) Further inspection required.
Grease boot cracked	2	(2) Suggest replacement.
Grease boot missing	2	(3) Suggest replacement.
Grease boot torn	2	(4) Suggest replacement.
Grease fitting broken	A	Require replacement grease fitting.
Grease fitting missing	C	Require replacement of grease fitting.
Grease fitting won't seal	A	Require replacement of grease fitting.
Grease seal missing	2	(3) Suggest replacement.
Grease seal torn	2	(4) Suggest replacement.
Looseness (perceptible horizontal movement)	1	(5) Suggest replacement.
Looseness that is excessive	B	(5)(6) Require replacement.
Seized	A	Require replacement.
Stud bent	B	(7) Require replacement.

Stud loose in taper hole	A		(7) Require repair or replacement.
Taper hole elongated	A		(8) Require replacement.
Threads damaged	A		Require repair or replacement.
Threads stripped (threads missing)	A		(7) Require replacement.
Wear exceeds manufacturer's specifications	B		Require replacement.

(1) - If greaseable, grease joint. If problem persists or joint is non-greaseable, require replacement.
(2) - Cracked grease boot will allow contaminants to enter the joint and will accelerate wear.
(3) - Lack of grease boot will allow contaminants to enter the joint and will accelerate wear.
(4) - Torn grease boot will allow contaminants to enter the joint and will accelerate wear.
(5) - If manufacturer's procedures for inspection exist, use those procedures; otherwise, use an approved inspection method such as the dry park check.
CAUTION: DO NOT use pliers or pry bar to check ball and socket movement. Use only moderate hand pressure.
(6) - Excessive looseness is defined as being significant enough to affect vehicle handling or structural integrity.
(7) - Check for damaged taper hole.
(8) - Check for damaged stud.

SHOCK ABSORBERS, STRUT CARTRIDGES AND STRUT ASSEMBLIES

You are not required to replace shocks or struts in axle sets. However, when replacing a shock or strut due to the conditions that follow, you may suggest replacement of the other shock or strut on the same axle for improved performance and preventive maintenance.

* Part is close to the end of its useful life
* To extend tire life
* To balance ride and handling
* To improve stopping distance

When replacing steering and/or suspension components which may affect an alignment angle, you are required to check and adjust alignment as needed. Refer to the OEM specifications.

Under no circumstances should a technician bend struts or strut housings.

A vehicle's load-carrying and handling abilities are limited by its suspension, tires, brakes, and driveline. Installing coil over shocks or any other load assist device does not increase the vehicle's load capacity. See the vehicle owner's manual for more details.

NOTE: If vehicle is equipped with original equipment coil over shocks, apply the conditions for coil springs from the SPRINGS - COIL, LEAF AND TORSION BAR section of the STEERING AND SUSPENSION guidelines. If the vehicle is equipped with add-on coil over shocks, you may suggest replacing the shocks with standard shocks for any spring-related condition.

SHOCK ABSORBER, STRUT CARTRIDGE AND STRUT ASSEMBLY INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require repair or replacement of bent part, if available; otherwise, replace shock or strut.
Attaching hardware broken	A	Require replacement of broken part, if available; otherwise, replace shock or strut.
Attaching hardware corroded, affecting structural integrity	A	Require replacement of corroded part, if available; otherwise, replace shock or strut.
Attaching hardware incorrect	A	Require replacement of incorrect part, if available; otherwise, replace shock or strut.
Attaching hardware loose	A	Require repair or replacement of loose part, if available; otherwise, replace shock or strut.
Attaching hardware missing	C	Require replacement of missing part, if available; otherwise, replace shock or strut.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads, if available; otherwise, replace shock or strut.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads, if available; otherwise, replace shock or strut.
Binding	A	Require replacement.
Body dented	A	(1) Further inspection required.
Body punctured	A	Require replacement.
Brake hose bracket bent	B	Require repair or replacement.
Brake hose bracket missing	C	Require replacement.
Brake hose bracket threads damaged	A	Require repair or replacement.
Brake hose bracket threads stripped (threads missing)	C	Require replacement.
Compression bumper missing	C	Require replacement of compression bumper.
Compression bumper split	1	Suggest replacement of compression bumper.
Damping (none)	A	Require replacement.
Dust boot (bellows) split	2	(2) Suggest replacement of boot.

Dust boot (bellows) missing	2	.....	(2) Suggest replacement of boot.
Dust boot (bellows) torn	2	.....	(2) Suggest replacement of boot.
Dust shield broken	2	.....	(2) Suggest replacement.
Dust shield missing	2	.....	(2) Suggest replacement.
Gland nut (strut housing cap) is not removable using appropriate tool	A	..	(3) Require replacement of nut and/or housing.
Gland nut (strut housing cap) threads damaged	A	...	Require repair or replacement of nut.
Gland nut (strut housing cap) threads stripped (threads missing)	A	.....	Require replacement of nut.
Housing dented	A	.....	(1) Further inspection required.
Housing punctured	A	.....	Require replacement.
Jounce bumper missing	C	...	Require replacement of jounce bumper.
Jounce bumper split	1	...	Suggest replacement of jounce bumper.
Leaking oil, enough for fluid to be running down the body	A	.....	(4) Require replacement.
Noise	2	.....	(5) Further inspection required.
Piston rod bent	A	.....	Require replacement.
Piston rod broken	A	.....	Require replacement.
Piston rod has surface defect	2	.....	Suggest replacement.
Piston rod threads damaged	A	..	Require repair or replacement.
Piston rod threads stripped (threads missing)	A	.....	Require replacement.
Seized	A	.....	Require replacement.
Shock missing	C	.....	Require replacement.
Strut housing bent	A	.....	Require replacement.
Strut housing cap (gland nut) is not removable using appropriate tool	A	.....	(3) Require replacement of nut and/or housing.
Strut housing cap (gland nut) threads damaged	A	...	Require repair or replacement of nut.
Strut housing cap (gland nut) threads stripped (threads missing)	A	.....	Require replacement of nut.
Strut housing severely corroded, affecting structural integrity	A	.....	Require replacement.
Strut housing threads damaged	A	..	Require repair or replacement.
Strut housing threads stripped (threads missing)	A	.....	Require replacement.
Tire cupping	A	.....	(6) Further inspection required.

(1) - Require replacement of units where dents restrict shock or strut piston rod movement. If dents don't restrict movement, no service is suggested or required. Especially critical on mono-tube shocks.
(2) - This condition can lead to damage of the piston rod, which, in turn, causes premature piston rod seal wear.
(3) - Only required if replacing cartridge.
(4) - CAUTION: If the strut cartridge has been replaced previously, the oil on the strut housing may be filler oil. The technician must identify the source of the oil.
(5) - If noise is isolated to shock or strut, suggest replacement.
(6) - Although shocks or struts may have contributed to tire cupping, an inspection is needed of the entire suspension system. If the shock or strut is found to be contributing to the tire cupping, require replacement.

SPINDLES

SPINDLE INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require replacement of broken part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Bent	B	Require replacement.
Broken	A	Require replacement.
Race seat area undersized	B	Require replacement.
Scored	A	Require repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

SPRINGS - COIL, LEAF AND TORSION BAR

When springs are replaced, it is suggested, but not required, that both springs on an axle be replaced to maintain equal height from side to side and to provide a balanced ride and proper handling.

When variable rate springs are installed in place of conventional coil springs, they must be installed in axle sets to ensure proper handling, uniform ride, and proper chassis height.

Erroneous height measurements may result from: improper tire inflation, non-standard tire or wheel size, and heavy load in vehicle or trunk.

SPRING (COIL, LEAF AND TORSION BAR) INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require repair or replacement of bent part.
Attaching hardware broken	A	Require replacement of broken part.
Attaching hardware corroded, affecting structural integrity	A	Require replacement of corroded part.
Attaching hardware incorrect	A	Require replacement of incorrect part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Broken (all springs except secondary leave(s) on multi-leaf springs)	A	Require replacement.
Coil clash	..	(1) Require ride height check.
Coil spring insulator deteriorated	2	Suggest replacement of insulator.
Coil spring insulator missing	2	Suggest replacement of insulator.
Coil spring insulator split	2	Suggest replacement of insulator.
Coil spring plastic coating deteriorated - rust present	A	(2) Refer to manufacturer's service requirements.
Composite spring damaged	..	(3) Further inspection required.
Cracked (all springs except composite leaf and secondary leave(s) on multi-leaf springs)	A	Require replacement.
Installed incorrectly	B	Require repair.
Leaf spring insulators missing	2	Suggest replacement of insulators.
Secondary leaf on multi-leaf spring broken	1	Suggest repair or replacement
Secondary leaf on multi-leaf spring cracked	1	Suggest repair or replacement
Torsion bar		

adjuster bent	A	.....	(4) Require repair or replacement of adjuster.
Torsion bar adjuster seized	A	....	(4) Require repair or replacement of adjuster.
Torsion bar adjuster threads damaged	A	....	(4) Require repair or replacement of part with damaged threads.
Torsion bar adjuster threads stripped (threads missing)	A	.....	Require replacement of part with stripped threads.
Vehicle suspension height not within OEM specifications	B	.....	Require adjustment or replacement.

(1) – If vehicle is within manufacturer's height specifications, no service is suggested or required.
(2) – Some manufacturers require replacement under these conditions.
(3) – Check vehicle ride height. If ride height is OK, no service is suggested or required.
(4) – Only required if ride height needs to be adjusted.

STEEL POWER STEERING LINES

CAUTION: When replacing steel power steering lines, be sure to use a replacement product that meets or exceeds OEM design specifications.

STEEL POWER STEERING LINE INSPECTION

Condition	Code		Procedure
Attaching hardware bent	B	...	Require repair or replacement of bent part.
Attaching hardware broken	A	...	Require replacement of broken part.
Attaching hardware loose	A	...	Require repair or replacement of loose part.
Attaching hardware missing	C	..	Require replacement of missing part.
Attaching hardware threads damaged	A	...	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	.....	Require replacement of part with stripped threads.
Blocked	A	..	Require repair or replacement.
Fitting incorrect (such as compression fitting)	B	.....	Require replacement.
Flare type incorrect	B	.....	Required replacement.
Leaking	A	.....	Require tightening or replacement.
Line type incorrect	B	.....	Require replacement.

Restricted	A	..... Require replacement.
Routed incorrectly	B	..... Require routing correction.
Rust-pitted	1	..... Suggest replacement.
Rust pitted, affecting structural integrity ..	A	..... Require replacement.

STEERING ARMS

STEERING ARM INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	... Require repair or replacement of bent part.
Attaching hardware broken	A	... Require replacement of broken part.
Attaching hardware incorrect	A	..... Require replacement of incorrect part.
Attaching hardware loose	A	... Require repair or replacement of loose part.
Attaching hardware missing	C	.. Require replacement of missing part.
Attaching hardware threads damaged	A	... Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	..... Require replacement of part with stripped threads.
Bent	B	..... Require replacement.
Broken	A	..... Require replacement.
Taper hole elongated	A	..... (1) Require replacement.
Threads damaged	A	.. Require repair or replacement.
Threads stripped (threads missing)	A	..... Require replacement.

(1) - Check for damaged stud.

STEERING DAMPERS

The following procedures are only required if the vehicle was originally equipped from the factory with a steering damper. If the steering damper is an add-on unit, then the unit may be removed instead of repairing or replacing.

STEERING DAMPER INSPECTION

Condition	Code	Procedure
Attaching hardware bent .	B	... Require repair or replacement of bent part, if available; otherwise, replace steering damper.
Attaching hardware broken	A	... Require replacement of broken part, if available; otherwise,

		replace steering damper.
Attaching hardware corroded, affecting structural integrity ...	A	. Require replacement of corroded part, if available; otherwise, replace steering damper.
Attaching hardware incorrect	A	..... Require replacement of incorrect part, if available; otherwise, replace steering damper.
Attaching hardware loose	A	... Require repair or replacement of loose part, if available; otherwise, replace steering damper.
Attaching hardware missing	C	.. Require replacement of missing part, if available; otherwise, replace steering damper.
Attaching hardware threads damaged	A	... Require repair or replacement of part with damaged threads, if available; otherwise, replace steering damper.
Attaching hardware threads stripped (threads missing)	A	..... Require replacement of part with stripped threads, if available; otherwise, replace steering damper.
Binding	A	..... Require replacement.
Damper body dented	A	..... (1) Further inspection required.
Damper body punctured ...	A	..... Require replacement.
Damping (none)	A	..... Require replacement.
Dust boot (bellows) missing	2	..... (2) Suggest replacement of boot.
Dust boot (bellows) split	2	..... (2) Suggest replacement of boot.
Dust shield broken	2	..... (2) Suggest replacement.
Dust shield missing	2	..... (2) Suggest replacement.
Leaking oil, enough for fluid to be running down the body	A	..... Require replacement.
Loose	A	.. Require repair or replacement.
Missing	C	..... Require replacement.
Noise	2	..... (3) Further inspection required.
Piston rod bent	A	..... Require replacement.
Piston rod broken	A	..... Require replacement.
Piston rod has surface defect	2	..... Suggest replacement.
Piston rod threads stripped (threads missing)	A	..... Require replacement.
Piston rod threads damaged	A	.. Require repair or replacement.
Seized	A	..... Require replacement.

(1) - Require replacement of units where dents restrict damper

piston rod movement. If dents don't restrict movement, no service is suggested or required. Especially critical on mono-tube dampers.

(2) - This condition can lead to damage of the piston rod, which, in turn, causes premature piston rod seal wear.

(3) - If noise is isolated to damper, suggest replacement.

STEERING GEARS (EXCEPT RACK AND PINION)

If diagnosis has determined that complete disassembly is necessary to determine the extent of the system failure, the suggestion may be made to rebuild or replace the power steering pump. Repair or replacement of the following components may be required, if performed as part of a power steering pump overhaul or rebuild service to meet a minimum rebuild standard.

STEERING GEAR (EXCEPT RACK AND PINION) INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require replacement of broken part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Binding	A	Require repair or replacement
Flex coupler binding	A	Require repair or replacement of coupler.
Flex coupler loose	A	Require repair or replacement of coupler.
Flex coupler missing parts	A	Require repair or replacement of coupler.
Flex coupler soft/spongy	A	Require replacement of coupler.
Flex coupler torn	A	Require replacement of coupler.
Fluid contaminated	B	(1) Require flushing and refilling of the system.
Gasket leaking	A	Require repair or replacement of gasket.
Housing leaking	A	Require replacement.
Hydraulic fittings leaking	A	Require repair or replacement of fittings.
Inadequate power assist	A	(2) Further inspection required. See note below.
Lash exceeds manufacturer's specifications	B	Require repair or replacement.
Seal leaking	A	Require repair or replacement

		of seal and/or mating part.
Splines damaged	A	... Require repair or replacement of splines.
Splines stripped	A	. Require replacement of splines.
Steering coupler shield cracked	2	..... Suggest replacement.
Steering coupler shield missing	C	..... Require replacement.
Threads damaged	A	... Require repair or replacement of part with damaged threads.
Threads stripped (threads missing)	A	..... Require replacement of part with stripped threads.
U-joint binding	A	... Require repair or replacement of joint.
U-joint loose	A	... Require repair or replacement of joint.
Unequal power assist	A	.. Require repair or replacement.

(1) - Determine and correct source of contamination. OEM specifications must be followed for fluid type.
(2) - If steering gear is source of inadequate assist, require repair or replacement.

STEERING GEARS - RACK AND PINION

If diagnosis has determined that complete disassembly is necessary to determine the extent of the system failure, the suggestion may be made to rebuild or replace the power steering pump. Repair or replacement of the following components may be required, if performed as part of a power steering pump overhaul or rebuild service to meet a minimum rebuild standard.

STEERING GEARS - RACK AND PINION INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	..... Require replacement of broken part.
Attaching hardware loose	A	.. Require repair or replacement of loose part.
Attaching hardware missing	C	..... Require replacement of missing part.
Attaching hardware threads damaged	A	.. Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	.... Require replacement of part with stripped threads.
Balance tube blocked	A	.. Require repair or replacement of balance tube.
Balance tube missing	C	.. Require replacement of balance tube.
Balance tube restricted .	A	... Require repair or replacement of balance tube.
Bellows boot clamp missing	C	... Require replacement of clamp.
Bellows boot cracked		

(not through)	2	..	Suggest replacement of bellows boot.
Bellows boot missing	C	..	Require replacement of bellows boot.
Bellows boot not sealing	A	...	Require repair or replacement of bellows boot.
Bellows boot torn	A	..	Require replacement of bellows boot.
Bellows boot twisted (from toe adjustment) ..	B	.....	Require repair.
Fitting leaking	A	..	Require repair or replacement.
Fitting missing	A	.	Require replacement of fitting.
Fitting threads damaged	A	...	Require repair or replacement of part with damaged threads.
Fitting threads stripped (threads missing)	A	.....	Require replacement of part with stripped threads.
Flex coupler binding	A	...	Require repair or replacement of coupler.
Flex coupler loose	A	...	Require repair or replacement of coupler.
Flex coupler missing parts	A	...	Require repair or replacement of coupler.
Flex coupler soft/spongy	A	.	Require replacement of coupler.
Flex coupler torn	A	.	Require replacement of coupler.
Fluid contaminated	B	.....	(1) Require flushing and refilling of the system.
Gasket leaking	A	..	Require repair or replacement.
Hard steering on cold start-up	1	.....	(2) Suggest repair or replacement.
Housing cracked, affecting structural integrity	B	.....	Require replacement.
Housing leaking	A	.....	Require replacement.
Inadequate power assist .	A	.....	(3) Further inspection required.
Lash exceeds manufacturer's specifications	B	..	Require repair or replacement.
Seal leaking	A	..	Require repair or replacement.
Splines damaged	A	..	Require repair or replacement.
Splines stripped (splines missing)	A	.....	Require replacement.
Steel line blocked	A	...	Require repair or replacement of line.
Steel line leaking	A	...	Require repair or replacement of line.
Steel line missing	C	....	Require replacement of line.
Steel line restricted ...	A	...	Require repair or replacement of line.
Steering coupler shield cracked	2	.....	Suggest replacement.
Steering coupler shield missing	C	.....	Require replacement.
Steering coupler shield torn	2	.....	Suggest replacement.
Threads damaged	A	...	Require repair or replacement of part with damaged threads.

Condition	Code	Procedure
Threads stripped (threads missing)	A	Require replacement of part with stripped threads.
U-joint binding	A	Require repair or replacement of joint.
U-joint loose	A	Require repair or replacement of joint.
Unequal power assist	A	Require repair or replacement.

(1) - Determine and correct source of contamination. Follow OE specifications for fluid type.
(2) - Indicates internal wear.
(3) - If steering gear is source of inadequate assist, require repair or replacement.

STEERING KNUCKLES

STEERING KNUCKLE INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require repair or replacement of bent part.
Attaching hardware broken	A	Require replacement of broken part.
Attaching hardware incorrect	A	Require replacement of incorrect part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Bent	B	Require replacement.
Broken	A	Require replacement.
Pinch bolt incorrect	B	Require replacement with bolt that meets OE design.
Pinch bolt loose	B	Require repair.
Pinch bolt missing	B	Require replacement.
Pinch bolt tabs deformed (pinched together), .032" or more before clamping	B	(1) Require replacement.
Taper hole elongated	A	(2) Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require repair or replacement.

(1) - Steering knuckle deformation can cause pinch bolt breakage.
(2) - Check for damaged stud.

STRIKE OUT BUMPERS

STRIKE OUT BUMPER INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require replacement of broken part.
Attaching hardware corroded, affecting structural integrity	A	Require replacement of corroded part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Missing	C	Require replacement.
Split	1	Suggest replacement.

STRUT RODS

STRUT ROD INSPECTION

Condition	Code	Procedure
Adjusting nut seized	A	(1) Require repair or replacement.
Attaching hardware bent	B	Require repair or replacement of bent part, if available; otherwise, replace strut rod.
Attaching hardware broken	A	Require replacement of broken part, if available; otherwise, replace strut rod.
Attaching hardware incorrect	A	Require replacement of incorrect part, if available; otherwise, replace strut rod.
Attaching hardware loose	A	Require repair or replacement of loose part, if available; otherwise, replace strut rod.
Attaching hardware missing	C	Require replacement of missing part, if available; otherwise, replace strut rod.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads,

			if available; otherwise, replace strut rod.
Attaching hardware threads stripped (threads missing)	A	.....	Require replacement of part with stripped threads, if available; otherwise, replace strut rod.
Attaching (mating) hole oversized	A	...	Require repair or replacement of frame.
Attaching point on frame corroded, affecting structural integrity	A	.....	Require repair of frame.
Bent	A	.....	Require replacement.
Mating (attaching) hole oversized	A	...	Require repair or replacement of frame.
Threads damaged	A	..	Require repair or replacement.
Threads stripped (threads missing)	A	.....	Require replacement.

(1) - Only required if an alignment is being performed.

STRUT UPPER BEARING PLATE ASSEMBLIES

NOTE: When the following guidelines indicate replacement of bearing, only the bearing should be replaced if it is available separately; otherwise, replace the bearing plate assembly.

STRUT UPPER BEARING PLATE ASSEMBLY INSPECTION

Condition	Code		Procedure
Attaching hardware broken	A	...	Require replacement of broken part, if available; otherwise, replace bearing plate assembly.
Attaching hardware loose	A	...	Require repair or replacement of loose part, if available; otherwise, replace bearing plate assembly.
Attaching hardware missing	C	..	Require replacement of missing part, if available; otherwise, replace bearing plate assembly.
Attaching hardware threads damaged	A	...	Require repair or replacement of part with damaged threads, if available; otherwise, replace bearing plate assembly.
Attaching hardware threads stripped (threads missing)	A	.....	Require replacement of part with stripped threads, if available; otherwise, replace bearing plate assembly.
Bearing axial or radial movement exceeds vehicle manufacturer's			

specifications	B	.....	Require replacement of bearing.
Bearing binding	A	.....	Require replacement of bearing.
Bearing missing	C	.....	Require replacement of bearing.
Bearing seized	A	.....	Require replacement of bearing.
Bent	B	.....	Require replacement.
Holes distorted	A	.....	Require replacement.
Missing	C	.....	Require replacement.
Severely corroded, affecting structural integrity	A	.....	Require replacement.

SWAY BAR LINKS

SWAY BAR LINK INSPECTION

Condition	Code		Procedure
Attaching hardware incorrect	A	.....	Require replacement of incorrect part, if available; otherwise, replace link.
Attaching hardware loose	A	...	Require repair or replacement of loose part, if available; otherwise, replace link.
Attaching hardware missing	C	..	Require replacement of missing part, if available; otherwise, replace link.
Attaching hardware threads damaged	A	...	Require repair or replacement of part with damaged threads, if available; otherwise, replace link.
Attaching hardware threads stripped (threads missing)	A	.....	Require replacement of part with stripped threads, if available; otherwise, replace link.
Ball and socket has looseness (perceptible vertical movement)	1	.....	(1) Suggest replacement.
Ball and socket has looseness that is excessive	B	.....	(1)(2) Require replacement.
Bent	B	.....	Require replacement.
Broken	A	.....	Require replacement.
Corroded, affecting structural integrity ...	A	.....	Require replacement.
Grease boot cracked	2	.....	(3) Suggest replacement.
Grease boot missing	2	.....	(4) Suggest replacement.
Grease boot torn	2	.....	(5) Suggest replacement.
Missing	C	.....	Require replacement.
Nut on stud loose	A	.....	(6) Require repair.
Stud bent	B	.....	(7) Require replacement.
Stud broken	A	.....	(7) Require replacement.
Threads damaged	A	..	Require repair or replacement.

Threads stripped (threads missing)	A	(7) Require replacement.

(1) - If manufacturer's procedures for inspection exist, use those procedures; otherwise, use an approved inspection method such as the dry park check.
CAUTION: DO NOT use pliers or pry bar to check ball and socket movement. Use only moderate hand pressure.
(2) - Excessive looseness is defined as being significant enough to affect vehicle handling or structural integrity.
(3) - Cracked grease boot will allow contaminants to enter the joint and will accelerate wear.
(4) - Lack of grease boot will allow contaminants to enter the joint and will accelerate wear.
(5) - Torn grease boot will allow contaminants to enter the joint and will accelerate wear.
(6) - Check for bent stud or damaged taper hole.
(7) - Check for damaged taper hole.

SWAY BARS

SWAY BAR INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A ...	Require replacement of broken part, if available; otherwise, replace sway bar.
Attaching hardware corroded, affecting structural integrity ...	A	Require replacement of corroded part, if available; otherwise, replace sway bar.
Attaching hardware loose	A ...	Require repair or replacement of loose part, if available; otherwise, replace sway bar.
Attaching hardware missing	C ..	Require replacement of missing part, if available; otherwise, replace sway bar.
Attaching hardware threads damaged	A ...	Require repair or replacement of part with damaged threads, if available; otherwise, replace sway bar.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads, if available; otherwise, replace sway bar.
Bent	B	Require replacement.
Broken	A	Require replacement.
Threads damaged	A ..	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

TIE ROD ENDS (INNER AND OUTER)

TIE ROD END (INNER AND OUTER) INSPECTION

Condition	Code	Procedure
Attaching hardware incorrect	A	Require replacement of incorrect part, if available; otherwise, replace tie rod end.
Attaching hardware loose	A	Require repair or replacement of loose part, if available; otherwise, replace tie rod end.
Attaching hardware missing	C	Require replacement of missing part, if available; otherwise, replace tie rod end.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads, if available; otherwise, replace tie rod end.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads, if available; otherwise, replace tie rod end.
Adjusting sleeve bent	B	Require replacement of sleeve or tie rod end.
Adjusting sleeve clamps out of position	B	Require repair.
Adjusting sleeve corroded, affecting structural integrity	A	Require replacement of sleeve or tie rod end.
Adjusting sleeve missing	C	Require replacement of sleeve or tie rod end.
Adjusting sleeve seized	A	(1) Require repair or replacement.
Adjusting sleeve threads damaged	A	Require repair or replacement of sleeve or tie rod end.
Adjusting sleeve threads stripped (threads missing)	A	Require replacement of sleeve or tie rod end.
Binding	A	(2) Further inspection required.
Grease boot cracked	2	(3) Suggest replacement.
Grease boot missing	2	(4) Suggest replacement.
Grease boot torn	2	(5) Suggest replacement.
Grease fitting broken	A	Require replacement of grease fitting.
Grease fitting missing	C	Require replacement of grease fitting.
Grease fitting won't seal	A	Require replacement of grease fitting.
Grease seal missing	2	(4) Suggest replacement of seal.

Grease seal torn	2	(5) Suggest replacement of seal.
Greaseable tie rod end won't take grease	2	(6) Suggest replacement of grease fitting.
Looseness (perceptible horizontal movement)	1	(7) Suggest replacement.
Looseness exceeds manufacturer's specifications	B	Require replacement.
Looseness that is excessive	B	(7)(8) Require replacement.
Nut on stud loose	A	(9) Require repair or replacement of nut.
Seized	A	Require replacement
Stud bent	B	(10) Require replacement.
Stud broken	A	(10) Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	(10) Require replacement.

(1) - Only required if toe needs to be adjusted.
(2) - If greaseable, grease joint. If problem persists or joint is non-greaseable, require replacement.
(3) - Cracked grease boot will allow contaminants to enter joint and will accelerate wear.
(4) - Lack of grease boot will allow contaminants to enter joint and will accelerate wear.
(5) - Torn grease boot will allow contaminants to enter joint and will accelerate wear.
(6) - If greaseable tie rod end will not take grease after replacing the grease fitting, suggest replacement of tie rod end.
(7) - If manufacturer's procedures for inspection exist, use those procedures; otherwise, use an approved inspection method such as the dry park check.
CAUTION: DO NOT use pliers or pry bar to check ball and socket movement. Use only moderate hand pressure.
(8) - Excessive looseness is defined as being significant enough to affect vehicle handling or structural integrity.
(9) - Check for bent stud or damaged taper hole.
(10) - Check for damaged taper hole.

TRACK BARS

TRACK BAR INSPECTION

Condition	Code	Procedure
Attaching hardware incorrect	A	Require replacement of incorrect part, if available; otherwise, replace track bar.
Attaching hardware loose	A	Require repair or replacement of loose part, if available; otherwise, replace track bar.
Attaching hardware missing	C	Require replacement of missing part, if available; otherwise, replace track bar.
Attaching hardware		

threads damaged	A	...	Require repair or replacement of part with damaged threads, if available; otherwise, replace track bar.
Attaching hardware threads stripped (threads missing)	A	.....	Require replacement of part with stripped threads, if available; otherwise, replace track bar.
Bent	B	.....	Require replacement.
Corroded, affecting structural integrity	A	.....	Require replacement.
Grease boot cracked	2	.....	(1) Suggest replacement.
Grease boot missing	2	.....	(2) Suggest replacement.
Grease boot torn	2	.....	(3) Suggest replacement.
Holes distorted	A	.....	Require replacement.
Looseness (perceptible horizontal movement)	1	.....	(4) Suggest replacement.
Looseness that is excessive	B	.....	(4)(5) Require replacement.
Nut on stud loose	A	.....	(6) Require repair or replacement of nut.
Seized	A	.....	Require replacement.
Stud bent	B	.....	(7) Require replacement.
Stud broken	A	.....	(7) Require replacement.
Threads damaged	A	..	Require repair or replacement.
Threads stripped (threads missing)	A	.....	(7) Require replacement.
Wear exceeds manufacturer's specifications	B	.....	Require replacement.

(1) - Cracked grease boot will allow contaminants to enter joint and will accelerate wear.
(2) - Lack of grease boot will allow contaminants to enter joint and will accelerate wear.
(3) - Torn grease boot will allow contaminants to enter joint and will accelerate wear.
(4) - If manufacturer's procedures for inspection exist, use those procedures; otherwise, use an approved inspection method such as the dry park check.
CAUTION: DO NOT use pliers or pry bar to check ball and socket movement. Use only moderate hand pressure.
(5) - Excessive looseness is defined as being significant enough to affect vehicle handling or structural integrity.
(6) - Check for bent stud or damaged taper hole.
(7) - Check for damaged taper hole.

TRAILING ARMS

TRAILING ARM INSPECTION

Condition	Code		Procedure
Attaching hardware broken	A	...	Require replacement of broken part, if available; otherwise, replace trailing arm.
Attaching hardware loose	A	...	Require repair or replacement of loose part, if available;

		otherwise, replace trailing arm.
Attaching hardware missing	C	Require replacement of missing part, if available; otherwise, replace trailing arm.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads, if available; otherwise, replace trailing arm.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads, if available; otherwise, replace trailing arm.
Bent	B	Require replacement.
Bushing hole oversized	B	Require replacement.
Corroded, affecting structural integrity	A	Require replacement.
Holes distorted	A	Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

WHEEL BEARINGS, RACES AND SEALS

NOTE: When replacing or repacking wheel bearings, grease seal replacement is required. You are not required to replace these components in axle sets. Determine the need to replace based upon the individual component conditions that follow.

WHEEL BEARING, RACE AND SEAL INSPECTION

Condition	Code	Procedure
Rear axle seal on rear-wheel drive leaking	A	Require replacement of seal and inspection of axle, bearing, housing, and vent tube.
Seal bent	1	Suggest replacement.
Seal leaking	A	Require replacement of seal and inspection of bearings.
Seal missing	C	Require replacement.
Seal torn	A	Require replacement.
Wheel bearing assembly feels rough when rotated	A	Require replacement of bearing assembly.
Wheel bearing balls are pitted	A	Require replacement of bearing assembly.
Wheel bearing balls are worn	A	Require replacement of bearing assembly.
Wheel bearing end-play exceeds vehicle manufacturer's specifications	B	Require adjustment of bearing,

			if possible. If proper adjustment cannot be obtained, require repair or replacement of worn component.
Wheel bearing race is loose in the hub bore	.....	A	..... Require replacement of hub assembly and wheel bearings.
Wheel bearing races are pitted	.....	A	.. Require replacement of bearing assembly.
Wheel bearing races are worn	.....	A	.. Require replacement of bearing assembly.
Wheel bearing rollers are pitted	.....	A	.. Require replacement of bearing assembly.
Wheel bearing rollers are worn	.....	A	.. Require replacement of bearing assembly.

WHEEL ALIGNMENT

WHEEL ALIGNMENT

Wheel alignment is defined as the measurement, analysis, and adjustment of steering and suspension angles to conform to OEM specifications. These angles usually include, but are not limited to: caster, camber, toe, and thrust angle. Where these angles are not adjustable and not in specification, component replacement or correction kits may be required. Errors in set-back and steering axis inclination (SAI) are often attributable to failed or damaged components and must be corrected prior to performing an alignment.

Failure to replace or correct suggested parts or service may prevent a proper alignment.

Before performing an alignment check, inspect and verify the following:

* Tire pressure and size
* Vehicle loading
* Ride height
* Steering and suspension parts

If the inspection reveals that all the above are within published specifications, a wheel alignment check and an alignment, if needed, may be performed.

CAUTION: Under no circumstances should a technician bend or heat any steering or suspension component, unless specified by the vehicle manufacturer, for example, Ford forged twin "I" beam axles. All measurements and specifications must be noted on the inspection report.

WHEEL ALIGNMENT INSPECTION

Condition	Code	Procedure
Dog tracking, shown to be caused by faulty alignment	 2	..... Suggest repair.
Lead, shown to		

be caused by faulty alignment	A	.....	Require alignment.
Part has been changed, affecting alignment	A	.....	Require alignment check.
Pull, shown to be caused by faulty alignment	A	.....	Require alignment.
Steering wheel off-center	2	.....	Suggest alignment.
Tire wear, shown to be caused by faulty alignment	A	.....	Require alignment.
Wander, shown to be caused by faulty alignment	A	.....	Require alignment.

WHEELS AND TIRES

TIRES

These guidelines do not apply to split rims. Some vehicle manufacturers restrict replacement of tires to specific brands, types, or sizes.

WARNING: High pressure temporary compact spare tires should not be used with any other rims or wheels, nor should standard tires, snow tires, wheel covers, or trim rings be used with high pressure compact spare rims or wheels. Attempting to mount a tire of one diameter on a wheel of a different diameter or flange type may result in serious injury or death.

WARNING: Only specially trained persons should dismount or mount tires. Explosions of tire and wheel assembly can result from improper mounting, possibly causing serious injury or death.

WARNING: Consult the vehicle owner’s manual or vehicle placard for correct size, speed rating, designation, and cold inflation pressure of the original tires. DO NOT exceed the maximum load or inflation capacity of the tire specified by the Tire and Rim Association

WARNING: When replacing tires, it is suggested that the replacement tires match or exceed the OEM speed rating designation. If tires of different speed rating designations are mixed on the same vehicle, the tires may vary in handling characteristics. DO NOT mix different speed rating designations on the same axle.

WARNING: DO NOT mix radials with non-radial tires on the same axle, as this may affect vehicle handling and stability. If radial tires and bias or bias-belted ply tires are mixed on the same vehicle, the radials must be on the rear. High-pressure temporary compact spare tires are exempt from this rule.

WARNING: DO NOT mix size or type (all season, performance, mud and snow) of tires on the same axle.

TIRE INSPECTION

Condition	Code	Procedure
Air pressure incorrect	B	Require repair
Bead broken	A	Require replacement.
Bead leaking, caused by tire	A	Require repair or replacement.
Bead wire/cord exposed	A	Require replacement.
Cord or belt material exposed	A	Require replacement.
Cord ply separations	A	Require replacement.
Directional/asymmetrical tires mounted incorrectly	B	Require remounting and/or repositioning.
Irregular tread wear, affecting performance	2	(1) Suggest replacement.
Load ratings less than OEM specifications	B	Require replacement.
Mixed tread types (all season, performance, mud and snow) on same axle	A	Require replacement.
Number of punctures exceeds manufacturer's limit	B	Require replacement.
Out of balance	B	Require rebalance of tire/wheel assembly.
Ply separation	A	Require replacement.
Pull or lead, caused by tire	A	Require repair or replacement.
Radial and bias or bias-belted ply tires on same axle	B	Require repair or replacement.
Radials are on the front and not on the rear	B	(2) Require repair or replacement.
Run flat damage	A	Require replacement.
Shoulder cut	A	Require replacement.
Shoulder puncture	A	Require replacement.
Shoulder with plug	A	Require replacement.
Sidewall bulge	A	Require replacement.
Sidewall cut	A	Require replacement.
Sidewall indentation	..	No service required or suggested.
Sidewall puncture	A	Require replacement.
Sidewall with plug	A	Require replacement.
Speed rating designations different on same axle	2	Suggest repair or replacement.
Tire and wheel assembly has excessive run-out	B	(3) Require repair or replacement of appropriate part.
Tires with more than 1/4" diameter difference on a four-wheel drive vehicle	B	Require replacement.
Tread area puncture larger in diameter than manufacturer's specifications	B	Require replacement.
Tread missing pieces		

(chunking), exposing cord	A	.....	Require replacement.
Tread missing pieces (chunking), not exposing cord	1	.....	Suggest replacement.
Tread separations	A	.....	Require replacement.
Tube in tubeless tire	3	.... (4)	Suggest removal of tube.
Weather-checking	..	.....	No service required or suggested.
Worn to tread wear indicators	B	.....	Require replacement.

(1) - Determine and correct cause of irregular tire wear.
(2) - If radials and bias or bias-belted ply tires are on the same vehicle, the radials must be on the rear axle, except for high-pressure temporary spares.
(3) - Excessive is defined as enough to contribute to performance problems. Match mounting may correct run-out. If not, require replacement of appropriate part. Refer to manufacturer's specifications.
(4) - Most manufacturers do not recommend tubes in tubeless tires. Inspect tire and wheel assembly to determine the reason for a tube in tubeless tire. Recommendation for repair or replacement should be based upon condition of tires and/or wheel listed in these guidelines.

VALVE STEMS

VALVE STEM INSPECTION

Condition	Code	Procedure
Bent	1	..... Suggest replacement.
Broken	A	..... Require replacement.
Cut, but not leaking	1	..... Suggest replacement.
Deteriorated (cracking, dry rot)	1	..... Suggest replacement.
Leaking	A	. Require repair or replacement.
Missing	C	..... Require replacement.
Threads damaged	A	. Require repair or replacement.
Threads stripped	A	..... Require replacement.
Valve cap missing	C	.... Require replacement of cap.
Weather-checking	1	..... Suggest replacement.
Won't take air	A	. Require repair or replacement.

WHEEL ATTACHMENT HARDWARE

For conditions noted below, also check conditions of wheel stud holes.

CAUTION: Proper lug nut torque is essential. Follow recommended torque specifications and tightening sequence. DO NOT lubricate threads unless specified by the vehicle manufacturer.

WHEEL ATTACHMENT HARDWARE INSPECTION

Condition	Code	Procedure
Bent	A	..... Require replacement.
Broken	A	..... (1) Require replacement.

Loose	B	Require repair or replacement of affected component.
Lug nut installed backward	B	Require repair or replacement.
Lug nut mating type incorrect	B	Require replacement of nut.
Lug nut mating surface dished	A	Require replacement of nut.
Lug nut rounded	A	(2) Require replacement of nut.
Lug nut seized	A	(2) Require replacement of nut.
Stud incorrect	B	Require replacement of stud.
Threads damaged	A	Require repair or replacement of component with damaged threads.
Threads stripped	A	Require replacement of component with stripped threads.

(1) - Some manufacturers require replacement of all studs on that wheel if two or more studs or nuts on the same wheel are broken or missing.
(2) - Only required if removing wheel.

WHEELS (RIMS)

WARNING: Mounting a regular tire on a high-pressure compact spare wheel is not permitted. Attempting to mount a tire of one diameter on a wheel of a different diameter or flange type may result in serious injury or death. If the wheel identification stamp is not legible, or cannot be found, do not use the wheel until the size and type have been properly identified. Wheels of different diameter, offset, or width cannot be mixed on the same axle. Bead seat tapers cannot be interchanged.

WHEEL (RIM) INSPECTION

Condition	Code	Procedure
Bead leaking, caused by wheel	A	(1) Require repair or replacement.
Bent hub mounting surface	A	Require replacement.
Bent rim, causing vibration	2	(1) Suggest replacement.
Broken	A	Require replacement.
Cast wheel porous, causing a leak	A	Require repair or replacement.
Clip-on balance weight is incorrect type for rim flange	2	Suggest replacement.
Corrosion, affecting structural integrity	A	Require replacement.
Corrosion build-up on wheel mounting surface	A	Require repair.
Cracked	A	Require replacement.
Directional/asymmetrical wheels mounted incorrectly	B	Require remounting and/or repositioning.

Load capacity less than OEM specifications	B	.....	Require replacement.
Offset mismatched on same axle	B	.....	Require replacement.
Rivets leaking	A	.....	Require replacement.
Run-out beyond OEM specs	B	.....	Require replacement.
Stud holes elongated	A	..... (2)	Require replacement.
Welded or brazed repair	2	.....	Suggest replacement.
Welds leaking	A	.....	Require replacement.
Wheel centering (pilot) hole incorrect	B	.....	Require replacement.

(1) - CAUTION: DO NOT attempt to correct a bent rim.
(2) - Inspect wheel attaching hardware for damage.

* SYMPTOM CHECK LIST *

1998 Mitsubishi Galant

SYMPTOM CHECK LIST WORKSHEETS

* PLEASE READ THIS FIRST *

NOTE: This article is intended for general information purposes only. It does not apply specifically to one make or model.

PURPOSE

Why Use the Symptom Check List Worksheets?

One of the most difficult and critical lines of communication is between the service customer and the technician. The clearer the technician understands the customer's concerns, the more likely the problem will be "fixed right the first time".

The Symptom Check List Worksheets in this article are designed to improve this communication. When used consistently, they can be helpful in reducing shop comebacks, increasing technician productivity, and producing satisfied customers. They also provide other benefits:

* Reduce "No Trouble Found" problems
* Increase customer involvement
* Customer perceive that "they really care and listen"
* Save time during peak write-up periods
* Reduce recontacting customers for additional information
* Improve night drop information
* Insure all the right questions are asked at write-up

Making the Worksheets a Part of Your Normal Routine

The following information contains ideas that may be helpful in forming habits that promote daily use of the Symptom Check Lists:

* HAVE THE SERVICE ADVISER FILL OUT THE FORM(S) WITH THE CUSTOMER WHENEVER POSSIBLE.
* Place them in your night drop for the customer to fill out, along with an instruction sheet to help them understand what to do.
* Hand out the worksheets to customers while they wait in line during the peak morning rush and ask them to fill it out. It will save time for all concerned and improve the quality of information received from the customer.
* Make sure it is attached to the hard copy when it goes to the technician.
* Place a copy with the final repair papers and review it with the customer at delivery.
* Put a new worksheet in the glovebox of all departing customers.
* Require that you personally see a copy of all worksheets filled out for shop comebacks.
* Hold a shop meeting to get employee buy-in and their ideas on how to make it effective in your shop.

There are many other ways to utilize the concept, but as with every other idea, successful implementation depends on employee involvement and buy-in.

SYMPTOM CHECK LIST WORKSHEETS

CONDENSED VERSION - ALL ON ONE PAGE

NOTE: Have the service adviser fill out this form with the customer whenever possible.

DRIVEABILITY WORKSHEET

(To Be Filled Out By Vehicle Owner)

Name: _____ **Date:** _____ **Make:** _____

Model: _____ **Year:** _____ **Engine:** _____ **Mileage:** _____

FAULT CHARACTERISTICS – SYMPTOMS – DESCRIPTION OF PROBLEM (Please Check All That Apply In All Categories)

Starting Problems	☐ Will Not Crank ☐ Cranks, But Won't Start ☐ Starts, But Takes A Long Time
Engine Quits/ Running Problems	**Quits:** ☐ Right After Starting ☐ When Put Into Gear ☐ Right After Vehicle Comes To A Stop ☐ During Steady Speed Driving ☐ While Idling ☐ During Acceleration ☐ When Parking
Poor Idling Conditions	**Idle Speed:** ☐ Is Too Slow At All Times ☐ Is Too Slow With A/C On ☐ Is Too Fast ☐ Is Rough Or Uneven ☐ Fluctuates Up and Down
Poor Running Conditions	☐ Runs Rough ☐ Lacks Power ☐ Hesitates Or Stumbles On Acceleration ☐ Bucks and Jerks ☐ Engine Knocks, Pings, Rattles ☐ Backfires ☐ Poor Fuel Economy ☐ Misfires or Cuts Out ☐ Surges and/or Chuggles ☐ Dieseling or Run-On ☐ Engine Light Always On ☐ Engine Light On Sometimes ☐ Fuel, Gas, or Sulfur Smell
Auto. Transmission Problems	☐ Improper Shifting (early/late) ☐ Changes Gear Randomly On Its Own ☐ Vehicle Does Not Move When In Gear
Poor Handling	☐ Pulls To One Side ☐ Hard Steering ☐ Vehicle Shakes and/or Vibrates While Moving
Noise Problems	**Explain:**
Odor Problems	**Explain:**
Problem Frequency	☐ Always ☐ Often ☐ Occasionally
Usually Occurs	☐ Morning ☐ Afternoon ☐ Anytime
Engine Temp.	☐ Cold ☐ Warm ☐ Hot
Vehicle Speed	☐ Low ☐ Cruising ☐ High
Driving Conditions During Occurrence	☐ Short – Less Than 2 Miles ☐ 2-10 Miles ☐ Long – More Than 10 Miles ☐ Stop & Go ☐ While Turning ☐ While Braking ☐ At Gear Engagement ☐ With A/C Operating ☐ With Headlights On ☐ During Acceleration ☐ During Deceleration ☐ Mostly Downhill ☐ Mostly Uphill ☐ Mostly Level ☐ Mostly Curvy ☐ Rough Road
Driving Habits	☐ Drive Hard Before Engine Is Warmed ☐ Allow Engine To Warm ☐ Mostly City Driving ☐ Highway ☐ Park Vehicle Inside ☐ Outside **Drive Per Day:** ☐ Less Than 10 Miles ☐ 10-50 ☐ More Than 50 **Fuel Octane:** ☐ 87 ☐ 89 ☐ 91 ☐ More Than 91 **Brand:** _____ ☐ Gasohol ☐ Propane Conversion
Outside Weather	☐ Cold ☐ Warm ☐ Hot ☐ Wet/Rainy ☐ Fog ☐ Snow/Hail ☐ Dust/Dirt ☐ Dry ☐ Humid

Fig. 1: Entire Vehicle – Symptom Check List For Customer

FULL VERSION - ALL ON FOUR PAGES

NOTE: Have the service adviser fill out these forms with the

customer whenever possible.

Dear Valued Customer:
Our goal is to fix your problem correctly and get you back on the road as soon as possible in the unlikely event you experience a problem with your vehicle. Help us identify the exact nature of the concern by taking a few moments to complete the appropriate section of this diagnostic worksheet. Thank you.

CUSTOMER NAME: **PHONE NO.:** **REPAIR ORDER NO.:**

DIAGNOSTIC WORKSHEET

DRIVEABILITY - ENGINE - AUTOMATIC TRANSMISSION

SYMPTOM (CHECK ALL THAT APPLY)
ENGINE

- ☐ "Service Engine Soon"/"Malfunction Indicator Light" on
- ☐ Hard start/no start (cranks OK)
- ☐ Won't crank
- ☐ Engine stalls
- ☐ Engine miss
- ☐ Miss while driving
- ☐ Hesitates, stumbles or sags
- ☐ Rough idle
- ☐ Idle is too high ☐ Idle is too low
- ☐ Poor power/performance
- ☐ Surge or chuggle, buck - jerk - skip
- ☐ Poor gas mileage ☐ Highway ☐ City
- ☐ Pings, detonates
- ☐ Suphur, rotten egg odor
- ☐ Backfires (popping noise) - underhood/tailpipe
- ☐ Exhaust smoke ☐ Increased oil consumption
- ☐ Runs on after key is turned off
- ☐ Speed fluctuates without moving accelerator
- ☐ Engine noise (explain): _____

(whine, rattle, groan, clunk, etc.)

- ☐ Other: _____

TRANSMISSION

- ☐ Does not shift properly ☐ Hard shift
- ☐ Will not shift ☐ Up ☐ Down
- ☐ Will not shift into overdrive
- ☐ Engine starts in other than "P" or "N"
- ☐ Noise (describe): _____

(whine, rattle, groan, clunk, buzz, etc.)

- ☐ Shifts into gear too early
- ☐ Overdrive doesn't work with speed control, but is otherwise OK
- ☐ Highway speed - shudder, surge, etc.
- ☐ Other: _____

EXPLAIN: _____

OPERATING CONDITIONS (CHECK ALL THAT APPLY)
HOW OFTEN DOES IT OCCUR? (Engine and/or Transmission)

- ☐ Always ☐ Few seconds ☐ Few minutes
- ☐ Few hours ☐ Few days ☐ Few weeks
- ☐ Few months ☐ Variable ☐ Only during event
- ☐ Every _____ to ___ miles ☐ Unknown
- ☐ Other (explain): _____
- ☐ Just started ☐ Getting better ☐ Getting worse
- ☐ Since new

WHEN DOES IT OCCUR? (Engine and/or Transmission)
When Engine Temperature is:

- ☐ Cold ☐ Warm ☐ Hot
- ☐ All the time ☐ Only during warmup

Weather Conditions:

- ☐ Very cold - below 0 degrees F ☐ Cold - 0 to 32 degrees F
- ☐ Cool - 32 to 60 degrees F ☐ Warm - 60 to 80 degrees F
- ☐ Hot - Above 80 degrees F ☐ Any environment
- ☐ Raining ☐ Dry ☐ Humid
- ☐ Snow/Ice ☐ Wet roads ☐ Other (explain below)

Driving Conditions:

- ☐ Light throttle ☐ Medium throttle ☐ Hard throttle
- ☐ Starting ☐ At idle ☐ Decelerating
- ☐ Over bumps ☐ When shifting ☐ While turning
- ☐ Cruising steady at _____ MPH ☐ While braking
- ☐ Anytime ☐ Uphill ☐ Downhill
- ☐ Highway ☐ City/town ☐ Stop and go
- ☐ Between _____ MPH and _____ MPH
- ☐ Only with A/C or Defrost on

What Type of Fuel? **What Brand?** _____

- ☐ Regular UL ☐ Mid range UL ☐ Premium Unleaded
- ☐ Gasohol ☐ Ethanol ☐ Methanol
- ☐ Diesel #1 ☐ Diesel #2 ☐ Various brands

When Gear Selector is in:

- ☐ Park/Neutral ☐ Reverse ☐ Overdrive
- ☐ Drive/3 ☐ Drive/2 ☐ Drive/1

Between Gears:

- ☐ Park to R or D ☐ Rev/Drive ☐ First/Second
- ☐ Second/Third ☐ Third/Overdrive

50G15061

Fig. 2: Symptom Check List - Page 1

BRAKES - STEERING - SUSPENSION

SYMPTOM

- ☐ Vehicle pulls right - When _____
- ☐ Vehicle pulls left - When _____
- ☐ Steering wheel vibrates at ____ MPH
- ☐ Excessive play in steering
- ☐ Erratic steering when braking
- ☐ Poor steering wheel return after cornering
- ☐ Suspension bottoms out
- ☐ Leans or sways in corners
- ☐ Brake light on
- ☐ Traction control light on
- ☐ Uneven tire wear
- ☐ Sits uneven
- ☐ "Dog" tracks
- ☐ ABS light on
- ☐ Soft ride

Hard to steer

- ☐ Effort
- ☐ Wanders
- ☐ Steering wheel off center

Shimmy/vibration (check box below for location)

- ☐ Front
- ☐ Rear
- ☐ Don't know
- ☐ Seat
- ☐ Floor
- ☐ Other _____

Brake pedal

- ☐ Noise
- ☐ Pulses
- ☐ Squeaks
- ☐ Hard
- ☐ Mushy
- ☐ Excessive travel

WHEN DOES IT OCCUR?

- ☐ Cold days
- ☐ Hot days
- ☐ Wet/rain
- ☐ All the time
- ☐ Intermittent
- ☐ Parking manuevers
- ☐ At road speed
- ☐ Accelerating
- ☐ Decelerating

EXPLAIN: _____

SQUEAK - RATTLE - NOISE CONDITIONS

AREA OF NOISE

☐ Engine Compartment	☐ Left	☐ Right	☐ Center	☐ Don't know
☐ Front Suspension	☐ Left	☐ Right	☐ Center	☐ Don't know
☐ Rear Suspension	☐ Left	☐ Right	☐ Center	☐ Don't know
☐ Passenger Compartment	☐ Left	☐ Right	☐ Center	☐ Don't know
☐ Instrument Panel	☐ Left	☐ Right	☐ Center	☐ Don't know
☐ Doors	☐ Left	☐ Right	☐ Center	☐ Don't know
☐ Rear seat area	☐ Console	☐ Other _____		

NOISE SOUNDS LIKE

- ☐ Knocks
- ☐ Hard metal
- ☐ Light metal
- ☐ Roars
- ☐ Ticking
- ☐ Whine
- ☐ Squeaks
- ☐ Rattles
- ☐ Scraping
- ☐ Other _____

HOW OFTEN DOES IT OCCUR?

- ☐ Continuous
- ☐ Often
- ☐ Intermittent
- ☐ Just started
- ☐ Since new

WHEN DOES IT OCCUR?

- ☐ All the time
- ☐ Speed
- ☐ RPM
- ☐ Only moving
- ☐ On turns
- ☐ Braking
- ☐ Hard throttle
- ☐ Light throttle
- ☐ Decelerate
- ☐ Steady speed
- ☐ Idle in gear
- ☐ Idle out of gear
- ☐ Hot days
- ☐ Cold days
- ☐ Humid or rainy
- ☐ Temperature _____
- ☐ Heavy bumps
- ☐ Light bumps
- ☐ Smooth pavement

EXPLAIN: _____

CUSTOMER NAME: **PHONE NO.:** **REPAIR ORDER NO:**

SHOP USE ONLY:

VIN#: **MILES:** **TECHNICIAN:** **ADVISOR#:**

50H15062

Fig. 3: Symptom Check List - Page 2

AIR CONDITIONING - HEATER - VENTILATION

SYSTEM OR AREA AFFECTED

☐ Air conditioner ☐ Heater ☐ Defroster ☐ Vent ☐ Bi-Level ☐ Fan/blower
☐ Max A/C ☐ Automatic Temperature Control ☐ Mix/blend ☐ Economy ☐ All

SYMPTOM

☐ Does not work ☐ Blows wrong temperature air ☐ No air comes out of vents ☐ Rapid cycling
☐ Noisy (explain) ☐ Broken ☐ Odor ☐ Air comes from wrong outlets ☐ Blows fuse
☐ Leaks ☐ Insufficient heat or cool ☐ Other (explain below)

WHEN DOES IT OCCUR?

☐ All the time ☐ Hot ☐ Cold ☐ Intermittent ☐ Right after startup
☐ When change controls only ☐ Other (explain below) ☐ Fan blower speed High / Med / Low

EXPLAIN: _____

_____

ELECTRICAL - RADIO - TAPE/CD PLAYER

SYMPTOM - MUSIC SYSTEM

☐ Does not work ☐ Noisy ☐ Static ☐ Won't load ☐ Won't eject ☐ Poor reception
☐ Controls do not work ☐ Blows fuse ☐ Other (explain below)

SYSTEM AFFECTED

☐ Radio only ☐ AM ☐ FM ☐ FM stereo ☐ Graphic equalizer
☐ Tape player ☐ CD player ☐ Whole system ☐ Steering wheel buttons ☐ Phone
☐ Speakers ☐ Front ☐ Rear ☐ Left ☐ Right
☐ Antenna ☐ Clock ☐ Radio or player controls ☐ Rear seat controls

ALL OTHER ELECTRICAL ITEMS OR ACCESSORIES
Please list the complaint accessory or item and check any applicable symptom(s) from the list that follows:

_____ ☐ Inoperable ☐ Noisy ☐ No control ☐ Erratic
☐ Check light on or flashing ☐ Works improperly (explain below)
☐ Blows fuse ☐ Intermittent ☐ Related system affected (explain below)

_____ ☐ Inoperable ☐ Noisy ☐ No control ☐ Erratic
☐ Check light on or flashing ☐ Works improperly (explain below)
☐ Blows fuse ☐ Intermittent ☐ Related system affected (explain below)

_____ ☐ Inoperable ☐ Noisy ☐ No control ☐ Erratic
☐ Check light on or flashing ☐ Works improperly (explain below)
WHEN DOES IT OCCUR? ☐ Blows fuse ☐ Intermittent ☐ Related system affected (explain below)

☐ All the time ☐ Hot ☐ Cold ☐ Just after starting - malfunctions for a while
☐ Intermittent ☐ After runs for _____ minutes ☐ Rough roads or bumps only
☐ Other (explain below)

EXPLAIN: _____

_____

CUSTOMER NAME: **PHONE NO.:** **REPAIR ORDER NO:**

SHOP USE ONLY:
VIN#: **MILES:** **TECHNICIAN:** **ADVISOR#:**

50I15063

Fig. 4: Symptom Check List - Page 3

WATER LEAK - WINDNOISE

WATER LEAK
Leak Occurs When?

☐ Setting level ☐ Any time it rains ☐ While driving in the rain ☐ Car wash only
☐ Back lower than front (facing uphill) ☐ Front lower than back (facing downhill)

Location of Leak (where water appears):

☐ LF Door ☐ RF Door ☐ LR Door ☐ RR Door ☐ Windshield ☐ Rear window
☐ LF window ☐ RF window ☐ LR window ☐ RR window ☐ Side door ☐ Sunroof/T-Top
☐ Under instrument panel ☐ Rear door/rear hatch

WINDNOISE:
Location:

☐ LF Door ☐ RF Door ☐ LR Door ☐ RR Door ☐ Windshield ☐ Rear window
☐ LF window ☐ RF window ☐ LR window ☐ RR window ☐ Side door ☐ Sunroof/T-Top
☐ Under instrument panel ☐ Rear door/rear hatch

EXPLAIN: _____

MANUAL TRANSMISSION - CLUTCH

SYMPTOM - MANUAL GEAR SHIFT

☐ Hard to shift ☐ Doesn't shift
☐ Grinds going into____ gear
☐ Noisy when in _____ gear or neutral _____
☐ Slips/pops out of gear
☐ Noise (describe): _____
☐ Upshift light stays on
☐ Upshift light doesn't light

WHEN DOES IT OCCUR?

☐ All the time ☐ Light load
☐ Heavy load

SYMPTOM - CLUTCH

☐ Hard to push ☐ Fail to release
☐ Noise when pressing pedal down (describe): _____
☐ Slips ☐ Chattering (grabbing)
☐ Odor present ☐ Pedal stays on the floor
☐ Squealing sound

WHEN DOES IT OCCUR?
When Engine Temperature is:

☐ Cold ☐ Hot
☐ Accelerating ☐ Decelerating

EXPLAIN: _____

COMMENTS:

CUSTOMER NAME: **PHONE NO.:** **REPAIR ORDER NO:**

SHOP USE ONLY:
VIN#: **MILES:** **TECHNICIAN:** **ADVISOR#:**

50J15064
Fig. 5: Symptom Check List - Page 4

INDIVIDUAL SYSTEM-BASED CHECK LISTS

NOTE: Have the service adviser fill out these forms with the customer whenever possible.

DRIVEABILITY - ENGINE - AUTOMATIC TRANSMISSION

SYMPTOM (CHECK ALL THAT APPLY)
ENGINE

- ☐ "Service Engine Soon"/Malfunction Indicator Light" on
- ☐ Hard start/no start (cranks OK)
- ☐ Won't crank
- ☐ Engine stalls
- ☐ Engine miss
- ☐ Miss while driving
- ☐ Hesitates, stumbles or sags
- ☐ Rough idle
- ☐ Idle is too high ☐ Idle is too low
- ☐ Poor power/performance
- ☐ Surge or chuggle, buck - jerk - skip
- ☐ Poor gas mileage ☐ Highway ☐ City
- ☐ Ping, detonates
- ☐ Sulphur/rotten egg odor
- ☐ Backfires (popping noise) - underhood/tailpipe
- ☐ Exhaust smoke ☐ Increased oil consumption
- ☐ Runs on after key is turned off
- ☐ Speed fluctuates without moving accelerator
- ☐ Engine noise (explain): _____

(whine, rattle, groan, clunk, etc.)

- ☐ Other: _____

TRANSMISSION

- ☐ Does not shift properly ☐ Hard shift
- ☐ Will not shift ☐ Up ☐ Down
- ☐ Will not shift into overdrive
- ☐ Engine starts in other than "P" or "N"
- ☐ Noise (describe): _____

(whine, rattle, groan, clunk, buzz, etc.)

- ☐ Shifts into next gear too early
- ☐ Overdrive doesn't work with speed control, but is otherwise OK
- ☐ Highway speed - shudder, surge, etc.
- ☐ Other: _____

EXPLAIN: _____

OPERATING CONDITIONS (CHECK ALL THAT APPLY)
HOW OFTEN DOES IT OCCUR? (Engine &/or Transmission)

- ☐ Always ☐ Few Seconds ☐ Few minutes
- ☐ Few hours ☐ Few days ☐ Few weeks
- ☐ Few months ☐ Variable ☐ Only during event
- ☐ Every _____ to ____ miles ☐ Unknown
- ☐ Other (explain): _____
- ☐ Just started ☐ Getting better ☐ Getting worse
- ☐ Since new

WHEN DOES IT OCCUR? (Engine and/or Transmission)
When Engine Temperature is:

- ☐ Cold ☐ Warm ☐ Hot
- ☐ All the time ☐ Only during warmup

Weather Conditions:

- ☐ Very cold - below 0°F ☐ Cold - 0 to 32°F
- ☐ Cool - 32 to 60°F ☐ Warm - 60 to 80°F
- ☐ Hot - above 80°F ☐ Any environment
- ☐ Raining ☐ Dry ☐ Humid
- ☐ Snow/Ice ☐ Wet roads
- ☐ Other (explain): _____

Driving Conditions:

- ☐ Light throttle ☐ Medium throttle ☐ Hard throttle
- ☐ Starting ☐ At idle ☐ Decelerating
- ☐ Over bumps ☐ When shifting ☐ While turning
- ☐ Cruising - steady at MPH ☐ While braking
- ☐ Anytime ☐ Uphill ☐ Downhill
- ☐ Highway ☐ City/town ☐ Stop and go
- ☐ Between ____ MPH and _____ MPH
- ☐ Only with A/C or Defrost on

What Type of Fuel? **What Brand?**

- ☐ Regular UL ☐ Midrange UL ☐ Premium UL
- ☐ Gasohol ☐ Ethanol ☐ Methanol
- ☐ Diesel #1 ☐ Diesel #2 ☐ Various brands

When Gear Selector is in:

- ☐ Park/Neutral ☐ Reverse ☐ Overdrive
- ☐ Drive/3 ☐ Drive/2 ☐ Drive/1

Between Gears:

- ☐ Park to R or D ☐ Reverse/Drive ☐ First/Second
- ☐ Second/Third ☐ Third/Overdrive

CUSTOMER NAME: **PHONE NO.:** **REPAIR ORDER NO:**

SHOP USE ONLY:
VIN#: **MILES:** **TECHNICIAN:** **ADVISOR#:**

50H15054

Fig. 6: Engine Driveability & Automatic Transmission

BRAKES - STEERING - SUSPENSION

SYMPTOM

- ☐ Vehicle pulls right - When _____
- ☐ Vehicle pulls left - When _____
- ☐ Steering wheel vibrates at ____ MPH
- ☐ Excessive play in steering
- ☐ Erratic steering when braking
- ☐ Poor steering wheel return after cornering
- ☐ Suspension bottoms out
- ☐ Leans or sways in corners
- ☐ Brake light on
- ☐ Traction control light on
- ☐ Uneven tire wear
- ☐ Sits uneven
- ☐ "Dog" tracks
- ☐ ABS light on
- ☐ Soft ride

Hard to steer

- ☐ Effort
- ☐ Wanders
- ☐ Steering wheel off center

Shimmy/vibration (check box below for location)

- ☐ Front
- ☐ Rear
- ☐ Don't know
- ☐ Seat
- ☐ Floor
- ☐ Other _____

Brake pedal

- ☐ Noise
- ☐ Pulses
- ☐ Squeaks
- ☐ Hard
- ☐ Mushy
- ☐ Excessive travel

WHEN DOES IT OCCUR?

- ☐ Cold days
- ☐ Hot days
- ☐ Wet/rain
- ☐ All the time
- ☐ Intermittent
- ☐ Parking manuevers
- ☐ At road speed
- ☐ Accelerating
- ☐ Decelerating

EXPLAIN: _____

CUSTOMER NAME: **PHONE NO.:** **REPAIR ORDER NO:**

SHOP USE ONLY:
VIN#: **MILES:** **TECHNICIAN:** **ADVISOR#:**

50C15059

Fig. 7: Brakes, Steering, & Suspension

AIR CONDITIONING - HEATER - VENTILATION

SYSTEM OR AREA AFFECTED

- ☐ Air conditioner
- ☐ Heater
- ☐ Defroster
- ☐ Vent
- ☐ Bi-Level
- ☐ Fan/blower
- ☐ Max A/C
- ☐ Automatic Temperature Control
- ☐ Mix/blend
- ☐ Economy
- ☐ All

SYMPTOM

- ☐ Does not work
- ☐ Blows wrong temperature air
- ☐ No air comes out of vents
- ☐ Rapid cycling
- ☐ Noisy (explain)
- ☐ Broken
- ☐ Odor
- ☐ Air comes from wrong outlets
- ☐ Blows fuse
- ☐ Leaks
- ☐ Insufficient heat or cool
- ☐ Other (explain below)

WHEN DOES IT OCCUR?

- ☐ All the time
- ☐ Hot
- ☐ Cold
- ☐ Intermittent
- ☐ Right after startup
- ☐ When change controls only
- ☐ Other (explain below)
- ☐ Fan blower speed High / Med / Low

EXPLAIN: _____

CUSTOMER NAME: **PHONE NO.:** **REPAIR ORDER NO:**

SHOP USE ONLY:
VIN#: **MILES:** **TECHNICIAN:** **ADVISOR#:**

50A15057

Fig. 8: Air Conditioning, Heater & Ventilation

ELECTRICAL - RADIO - TAPE/CD PLAYER

SYMPTOM - MUSIC SYSTEM

☐ Does not work ☐ Noisy ☐ Static ☐ Won't load ☐ Won't eject ☐ Poor reception
☐ Controls do not work ☐ Blows fuse ☐ Other (explain below)

SYSTEM AFFECTED

☐ Radio only ☐ AM ☐ FM ☐ FM stereo ☐ Graphic equalizer
☐ Tape player ☐ CD player ☐ Whole system ☐ Steering wheel buttons ☐ Phone
☐ Speakers ☐ Front ☐ Rear ☐ Left ☐ Right
☐ Antenna ☐ Clock ☐ Radio or player controls ☐ Rear seat controls

ALL OTHER ELECTRICAL ITEMS OR ACCESSORIES
Please list the complaint accessory or item and check any applicable symptom(s) from the list that follows:

_____ ☐ Inoperable ☐ Noisy ☐ No control ☐ Erratic
☐ Check light on or flashing ☐ Works improperly (explain below)
☐ Blows fuse ☐ Intermittent ☐ Related system affected (explain below)

_____ ☐ Inoperable ☐ Noisy ☐ No control ☐ Erratic
☐ Check light on or flashing ☐ Works improperly (explain below)
☐ Blows fuse ☐ Intermittent ☐ Related system affected (explain below)

_____ ☐ Inoperable ☐ Noisy ☐ No control ☐ Erratic
☐ Check light on or flashing ☐ Works improperly (explain below)
☐ Blows fuse ☐ Intermittent ☐ Related system affected (explain below)

WHEN DOES IT OCCUR?

☐ All the time ☐ Hot ☐ Cold ☐ Just after starting - malfunctions for a while
☐ Intermittent ☐ After runs for _____ minutes ☐ Rough roads or bumps only
☐ Other (explain below)

EXPLAIN: _____

CUSTOMER NAME: **PHONE NO.:** **REPAIR ORDER NO:**

SHOP USE ONLY:
VIN#: **MILES:** **TECHNICIAN:** **ADVISOR#:**

50B15058
Fig. 9: Electrical, Radio & Tape/CD Player

MANUAL TRANSMISSION - CLUTCH

SYMPTOM - MANUAL GEAR SHIFT

☐ Hard to shift ☐ Doesn't shift
☐ Grinds going into_____ gear
☐ Noisy when in _____ gear or neutral _____
☐ Slips/pops out of gear
☐ Noise (describe): _____
_____
_____
☐ Upshift light stays on
☐ Upshift light doesn't light

WHEN DOES IT OCCUR?

☐ All the time ☐ Light load
☐ Heavy load

SYMPTOM - CLUTCH

☐ Hard to push ☐ Fail to release
☐ Noise when pressing pedal down (describe): _____
_____
_____
☐ Slips ☐ Chattering (grabbing)
☐ Odor present ☐ Pedal stays on the floor
☐ Squealing sound

WHEN DOES IT OCCUR?
When Engine Temperature is:

☐ Cold ☐ Hot
☐ Accelerating ☐ Decelerating

EXPLAIN: _____
_____
_____
_____
_____
_____

CUSTOMER NAME: **PHONE NO.:** **REPAIR ORDER NO:**

SHOP USE ONLY:
VIN#: **MILES:** **TECHNICIAN:** **ADVISOR#:**

50J15056

Fig. 10: Manual Transmission & Clutch

SQUEAK - RATTLE - NOISE CONDITIONS

AREA OF NOISE

☐ Engine Compartment	☐ Left	☐ Right	☐ Center	☐ Don't know
☐ Front Suspension	☐ Left	☐ Right	☐ Center	☐ Don't know
☐ Rear Suspension	☐ Left	☐ Right	☐ Center	☐ Don't know
☐ Passenger Compartment	☐ Left	☐ Right	☐ Center	☐ Don't know
☐ Instrument Panel	☐ Left	☐ Right	☐ Center	☐ Don't know
☐ Doors	☐ Left	☐ Right	☐ Center	☐ Don't know
☐ Rear seat area	☐ Console	☐ Other _____		

NOISE SOUNDS LIKE

☐ Knocks	☐ Hard metal	☐ Light metal	☐ Roars	☐ Ticking	☐ Whine
☐ Squeaks	☐ Rattles	☐ Scraping	☐ Other _____		

HOW OFTEN DOES IT OCCUR?

☐ Continuous ☐ Often ☐ Intermittent ☐ Just started ☐ Since new

WHEN DOES IT OCCUR?

☐ All the time	☐ Speed	☐ RPM	☐ Only moving	☐ On turns	☐ Braking
☐ Hard throttle	☐ Light throttle	☐ Decelerate	☐ Steady speed	☐ Idle in gear	☐ Idle out of gear
☐ Hot days	☐ Cold days	☐ Humid or rainy	☐ Temperature _____		
☐ Heavy bumps	☐ Light bumps	☐ Smooth pavement			

EXPLAIN: _____

CUSTOMER NAME: **PHONE NO.:** **REPAIR ORDER NO:**

SHOP USE ONLY:
VIN#: **MILES:** **TECHNICIAN:** **ADVISOR#:**

50F15060

Fig. 11: Squeak, Rattle, & Noise Conditions

WATER LEAK - WINDNOISE

WATER LEAK
Leak Occurs When?

☐ Setting level	☐ Any time it rains	☐ While driving in the rain	☐ Car wash only
☐ Back lower than front (facing uphill)		☐ Front lower than back (facing downhill)	

Location of Leak (where water appears):

☐ LF Door	☐ RF Door	☐ LR Door	☐ RR Door	☐ Windshield	☐ Rear window
☐ LF window	☐ RF window	☐ LR window	☐ RR window	☐ Side door	☐ Sunroof/T-Top
☐ Under instrument panel			☐ Rear door/rear hatch		

WINDNOISE:
Location:

☐ LF Door	☐ RF Door	☐ LR Door	☐ RR Door	☐ Windshield	☐ Rear window
☐ LF window	☐ RF window	☐ LR window	☐ RR window	☐ Side door	☐ Sunroof/T-Top
☐ Under instrument panel			☐ Rear door/rear hatch		

EXPLAIN: _____

CUSTOMER NAME: **PHONE NO.:** **REPAIR ORDER NO:**

SHOP USE ONLY:
VIN#: **MILES:** **TECHNICIAN:** **ADVISOR#:**

50I15055

Fig. 12: Water Leak & Wind Noise

I - SYSTEM/COMPONENT TESTS

1998 Mitsubishi Galant

1998 ENGINE PERFORMANCE
Mitsubishi - System & Component Testing

Diamante, Eclipse, Galant, Mirage, Montero, Montero Sport, 3000GT

INTRODUCTION

NOTE: Testing individual components does not isolate shorts or opens. Perform all voltage tests using a Digital Volt-Ohmmeter (DVOM) with minimum 10-megohm input impedance, unless stated otherwise in test procedure. Use ohmmeter to isolate wiring harness shorts or opens. Testing procedures not covered in this article require a scan tool. See G - TESTS W/CODES article.

Before testing separate components or systems, perform basic diagnostic procedures in F - BASIC TESTING article. Since many computer-controlled and monitored components set a diagnostic trouble code if they malfunction, also perform self-diagnostics in G - TESTS W/CODES article.

AIR INDUCTION SYSTEMS

TURBOCHARGER

Turbocharger Pressure Check

1) Disconnect Black turbocharger pressure control hose at wastegate solenoid valve, and plug valve nipple. Attach pressure gauge to hose. Drive vehicle and accelerate engine, in 2nd gear, to 3500 RPM or more. Check turbocharger pressure when pressure gauge stabilizes. See TURBOCHARGER PRESSURE SPECIFICATIONS table.

2) If pressure gauge reading is more than specified, check wastegate actuator. See DTCs P1103 and P1104 in G - TESTS W/CODES article. Replace wastegate actuator as required. If pressure gauge reading is less than specified, check for malfunctioning wastegate valve, turbocharger pressure leaks and faulty turbocharger.

TURBOCHARGER PRESSURE SPECIFICATIONS TABLE

Application	Pressure psi (kg/cm²)
Eclipse	6.4-14.7 (.4-1.0)
3000GT	2.9-8.7 (.2-.6)

Air By-Pass Valve

Remove air by-pass valve. Valve is mounted to intake air duct between air-to-air intercooler and intake plenum. Apply vacuum to diaphragm of vacuum valve. Valve should begin opening at approximately 16 in. Hg. Observe operation of valve through by-pass opening.

Wastegate Actuator Test

Actuator is mounted on turbocharger. For testing procedures, see DTCs P1103 and P1104 in G - TESTS W/CODES article.

Wastegate Control Solenoid Valve Test

On Eclipse, valve is mounted to top back section of air cleaner. On 3000GT, valve is mounted to firewall, beside EGR solenoid.

For testing procedures, see DTCs P1103 and P1104 in G - TESTS W/CODES article.

COMPUTERIZED ENGINE CONTROLS

CONTROL UNIT

NOTE: For Powertrain Control Module (PCM) location, see POWERTRAIN CONTROL MODULE (PCM) LOCATION table. To identify PCM power and ground terminals, see appropriate pin voltage chart in J - PIN VOLTAGE CHARTS article. To identify PCM power and ground circuits, see appropriate wiring diagram in L - WIRING DIAGRAMS article.

Ground Circuits

1) Turn ignition off. Using an ohmmeter, check continuity between chassis ground and PCM ground terminal(s). See Figs. 1-5. Ohmmeter should indicate zero ohms. If reading is not as specified, check and repair open circuit between PCM connector and chassis ground. If reading is as specified, go to next step.

2) Connect voltmeter negative lead to chassis ground. Connect positive lead to PCM ground terminal(s). With engine running, voltmeter should indicate less than one volt. If reading is more than one volt, check for open, corrosion or loose connection in ground circuit.

Power Circuits

Turn ignition on. Check for battery voltage on both PCM power terminals. See Figs. 1-5. If battery voltage is not present, check operation of MFI relay. See RELAYS under MOTORS, RELAYS & SOLENOIDS.

POWERTRAIN CONTROL MODULE (PCM) LOCATION TABLE

Application	Location
Eclipse 2.0L Non-Turbo	In Front Of Left Front Strut Tower
Mirage & Montero Sport	Behind Right Side Of Instrument Panel (Glove Box)
Montero	Right Front Kick Panel
All Other Models	Behind Center Console

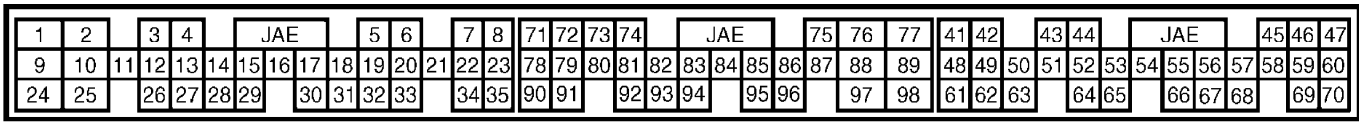

Fig. 1: Identifying PCM Terminals (Diamante)
Courtesy of Mitsubishi Motor Sales of America

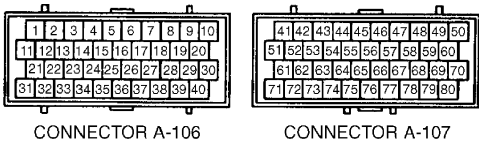

Fig. 2: Identifying PCM Terminals (Eclipse 2.0L Non-Turbo)
Courtesy of Mitsubishi Motor Sales of America

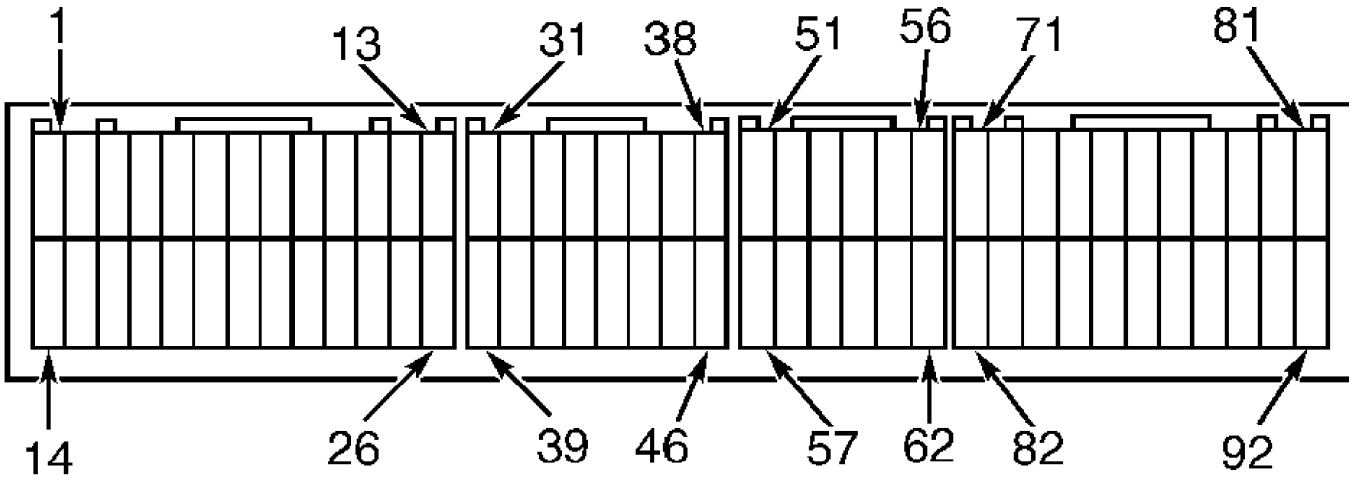

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Fig. 3: Identifying PCM Terminals (Eclipse 2.0L Turbo, 2.4L & Mirage)
Courtesy of Mitsubishi Motor Sales of America

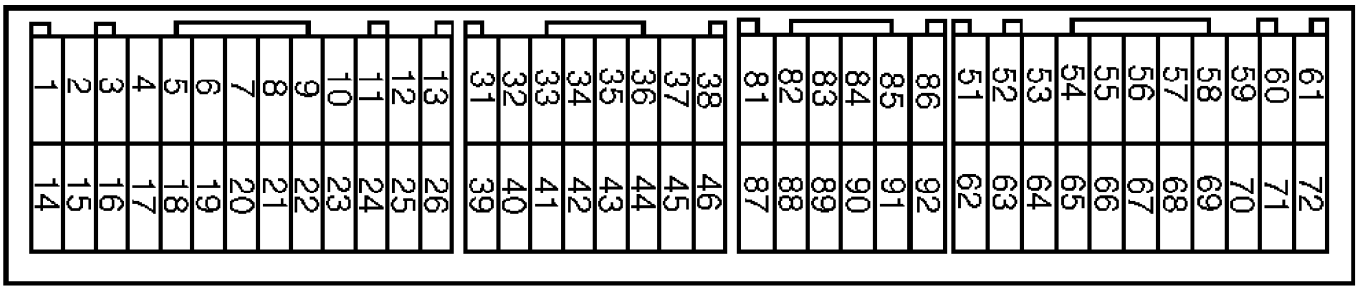

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Fig. 4: Identifying PCM Terminals (Galant)
Courtesy of Mitsubishi Motor Sales of America

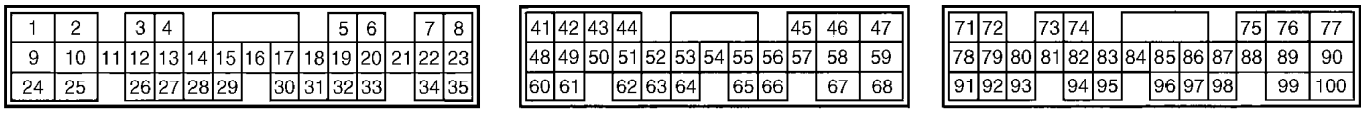

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Fig. 5: Identifying PCM Terminals (All Other Models)
Courtesy of Mitsubishi Motor Sales of America

ENGINE SENSORS & SWITCHES

NOTE: For circuit identification, see appropriate wiring diagram in L - WIRING DIAGRAMS article.

Automatic Transaxle/Transmission Range Switch Or Park Neutral Position Switch
See G - TESTS W/CODES article.

Barometric Pressure Sensor
Sensor is a part of volume airflow sensor assembly. See G - TESTS W/CODES article.

Closed Throttle Position Switch
Switch is part of throttle position sensor. See CLOSED

THROTTLE POSITION (TP) SWITCH or THROTTLE POSITION (TP) SENSOR in G - TESTS W/CODES article.

Engine Coolant Temperature Sensor
See G - TESTS W/CODES article.

Heated Oxygen Sensor
See G - TESTS W/CODES article.

Intake Air Temperature (IAT) Sensor
On all models except Eclipse 2.0L non-turbo and Mirage 1.5L, IAT sensor is a part of volume airflow sensor assembly. On all models, see G - TESTS W/CODES article.

Manifold Absolute Pressure Sensor
See G - TESTS W/CODES article.

Manifold Differential Pressure Sensor
See G - TESTS W/CODES article.

Power Steering Oil Pressure (PSP) Switch
On Eclipse 2.0L non-turbo, see DTC 115 in G - TESTS W/CODES - NON-TURBO article. On all other models except Eclipse 2.0L non-turbo, see G - TESTS W/CODES article.

Throttle Position Sensor
See G - TESTS W/CODES article.

Vehicle Speed Sensor
See G - TESTS W/CODES article.

Volume Airflow Sensor
See G - TESTS W/CODES article.

MOTORS, RELAYS & SOLENOIDS

MOTORS

Idle Air Control Motor
See G - TESTS W/CODES article.

RELAYS

ASD, Fuel Pump & MFI Relay
See G - TESTS W/CODES article.

Radiator Cooling Fan Control Relay (High & Low)
See G - TESTS W/CODES article.

SOLENOIDS

EGR Control Solenoid Valve
See EXHAUST GAS RECIRCULATION (EGR) under EMISSION SYSTEMS & SUB-SYSTEMS.

EVAP Purge Control Solenoid Valve
See FUEL EVAPORATION under EMISSION SYSTEMS & SUB-SYSTEMS.

Fuel Pressure Regulator Control Solenoid Valve (Turbo Models)
See FUEL DELIVERY under FUEL SYSTEM.

Wastegate Control Solenoid Valve

See TURBOCHARGER under AIR INDUCTION SYSTEMS.

FUEL SYSTEM

FUEL DELIVERY

NOTE: For fuel system pressure testing, see F - BASIC TESTING article.

Fuel Pressure Regulator Control Solenoid Valve (Turbo Models)
See G - TESTS W/CODES article.

FUEL CONTROL

Fuel Injectors
See G - TESTS W/CODES article.

IDLE CONTROL SYSTEM

ELECTRICAL LOAD SWITCH

3000GT (DOHC)

1) Turn ignition off. Disconnect PCM connector. See POWERTRAIN CONTROL MODULE (PCM) LOCATION table under COMPUTERIZED ENGINE CONTROLS. Go to next step.

2) Turn headlights on. Using DVOM, check voltage between PCM connector terminal No. 58 and chassis ground. If battery voltage is present, turn headlights off and go to next step. If battery voltage is not present, check and repair circuit between headlight relay connector and PCM connector.

3) Turn defogger switch on. Using DVOM, check voltage between PCM connector terminal No. 58 and chassis ground. If battery voltage is present, turn defogger switch off and go to next step. If battery voltage is not present, check and repair circuit between defogger relay connector and PCM connector.

4) Turn blower switch on. Using DVOM, check voltage between PCM connector terminal No. 58 and chassis ground. If battery voltage is present, turn blower switch off and go to next step. If battery voltage is not present, check and repair circuit between blower switch connector and PCM connector.

5) If battery voltage is present and preceding tests do not show any system or component malfunction and PCM is suspected, substitute PCM with known-good unit and retest system.

IDLE AIR CONTROL (IAC) MOTOR

For testing procedures, see G - TESTS W/CODES article.

IGNITION SYSTEM

NOTE: For basic ignition checks, see F - BASIC TESTING article.

TIMING CONTROL SYSTEMS

Camshaft Position Sensor
See G - TESTS W/CODES article.

Crankshaft Position Sensor
See G - TESTS W/CODES article.

Knock Sensor
See G - TESTS W/CODES article.

EMISSION SYSTEMS & SUB-SYSTEMS

EXHAUST GAS RECIRCULATION (EGR)

EGR Control Solenoid Valve
See G - TESTS W/CODES article.

FUEL EVAPORATION

EVAP Purge Control Valve
See G - TESTS W/CODES article.

EVAP Purge Control Solenoid Valve
See G - TESTS W/CODES article.

POSITIVE CRANKCASE VENTILATION (PCV)

PCV Valve
Remove PCV valve. Shake valve. Valve should rattle if moving freely. Apply air pressure to valve. Air should flow freely in one direction only. Connect PCV valve to vacuum hose and start engine. Ensure vacuum is flowing through valve.

MISCELLANEOUS CONTROLS

NOTE: Although the controlled devices listed here are not technically engine performance components, they can affect driveability if they malfunction.

NOTE: To identify PCM A/C power supply voltage terminals, see appropriate pin voltage chart in J - PIN VOLTAGE CHARTS article. To identify PCM A/C power supply circuit, see appropriate wiring diagram in L - WIRING DIAGRAMS article.

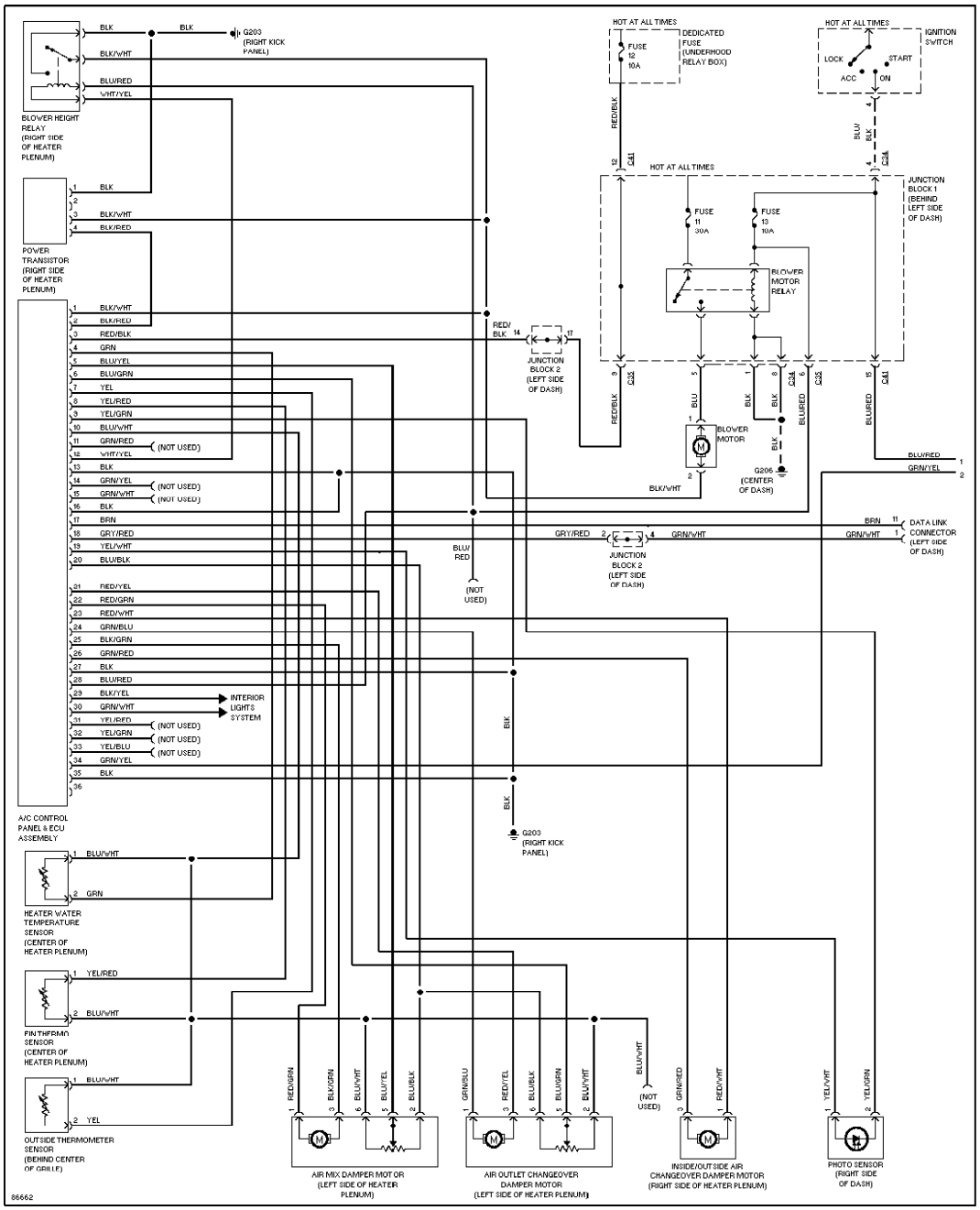
A/C Switch & Compressor Clutch Relay
Using DVOM, check A/C power supply voltage from PCM. Turn ignition switch to OFF position. Disconnect PCM connector. Turn A/C switch and ignition switch to ON position. Check voltage between PCM A/C power supply terminal and chassis ground. If battery voltage is not as present, check and repair circuit(s).

SYSTEM WIRING DIAGRAMS

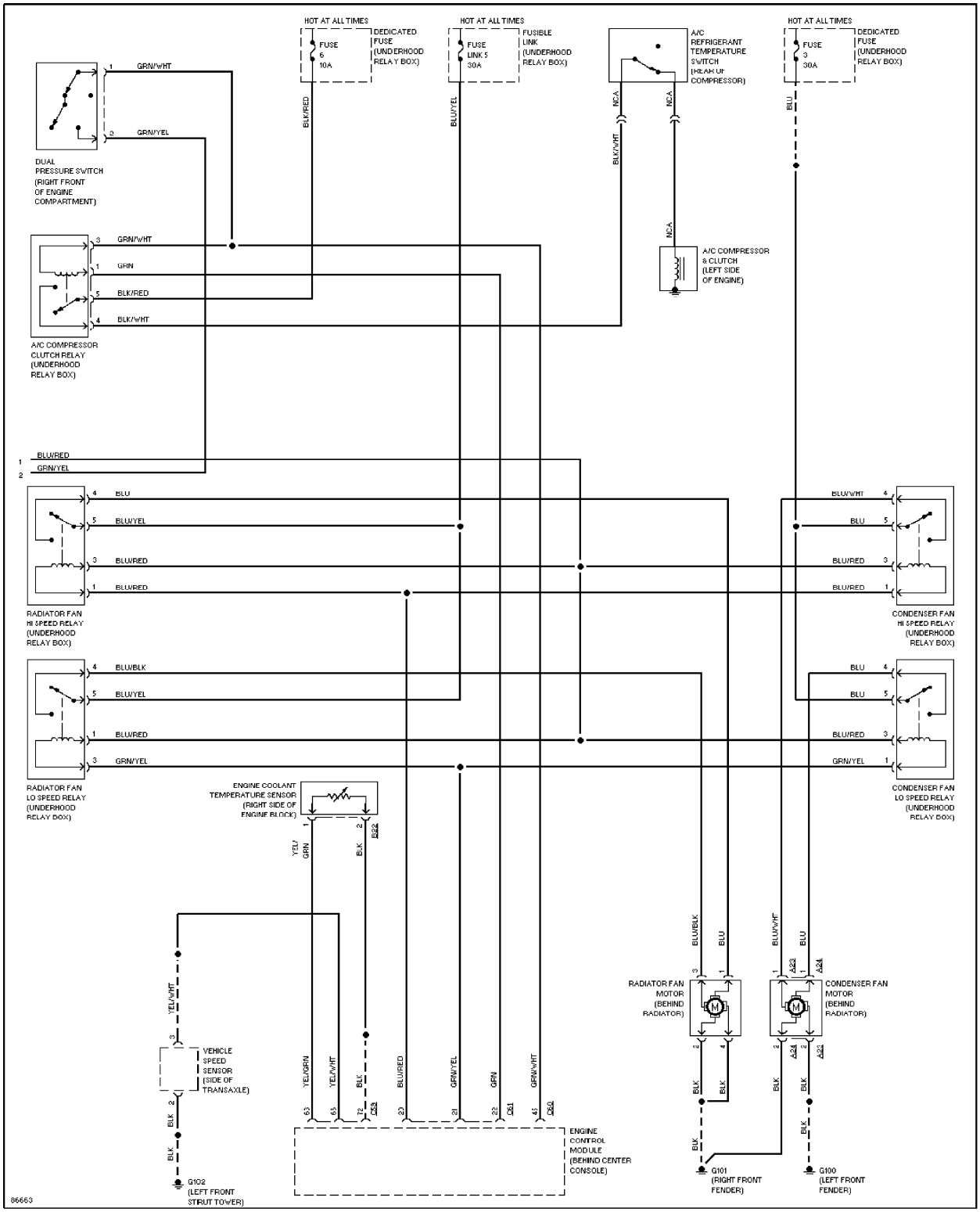
1998 Mitsubishi Galant

1998 System Wiring Diagrams
Mitsubishi - Galant

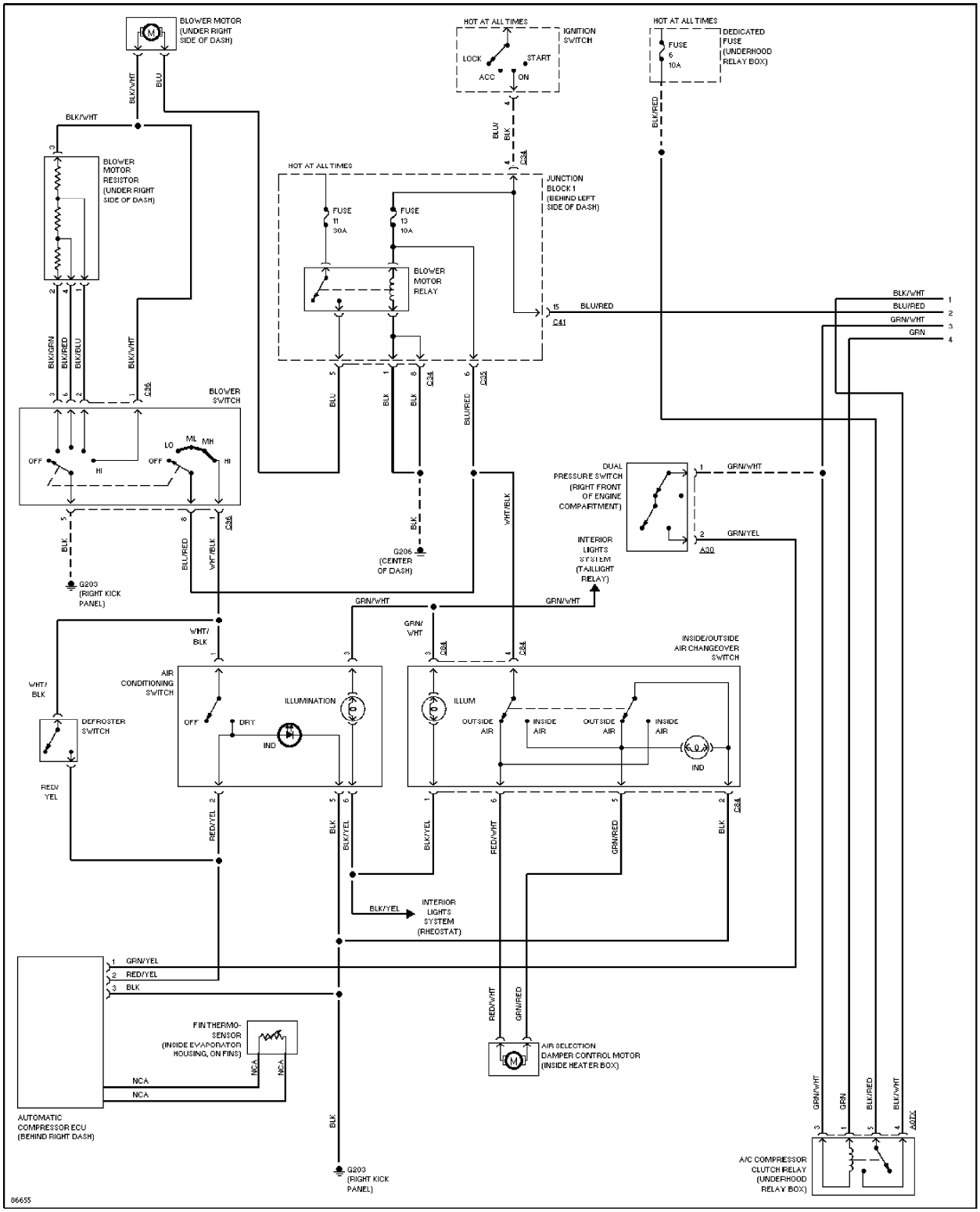
AIR CONDITIONING



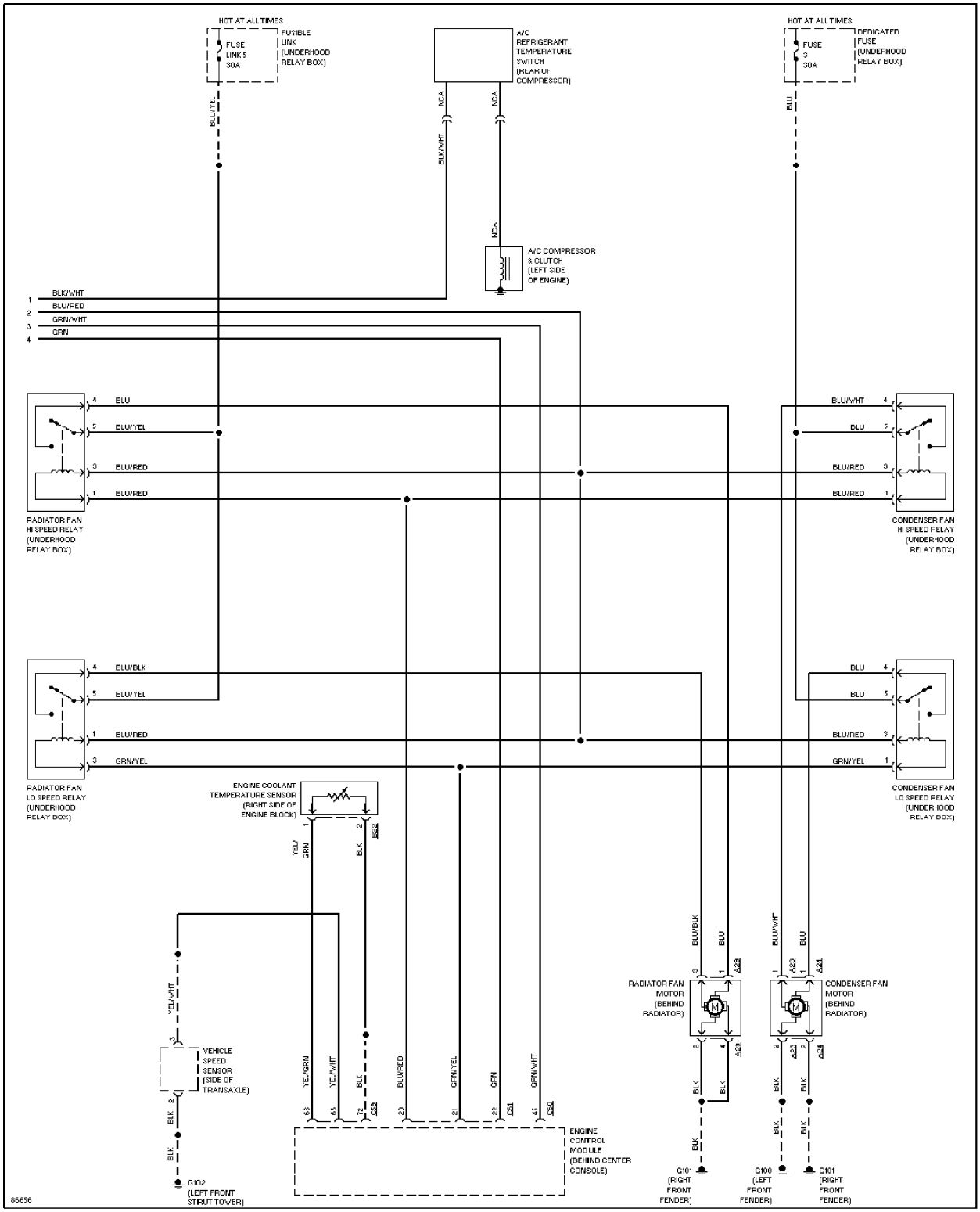
A/C Circuit, Auto A/C (1 of 2)



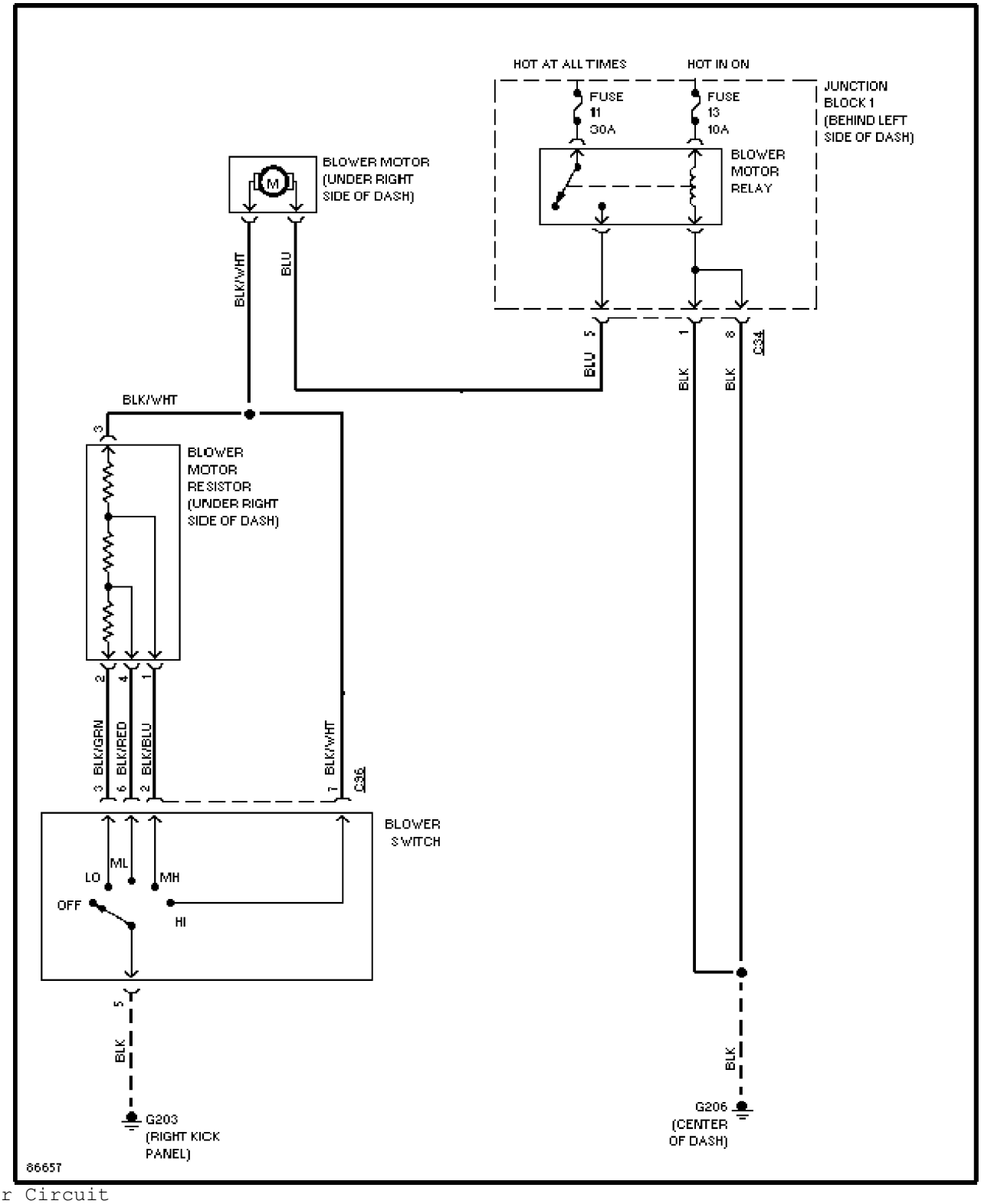
A/C Circuit, Auto A/C (2 of 2)



A/C Circuit, Manual A/C (1 of 2)

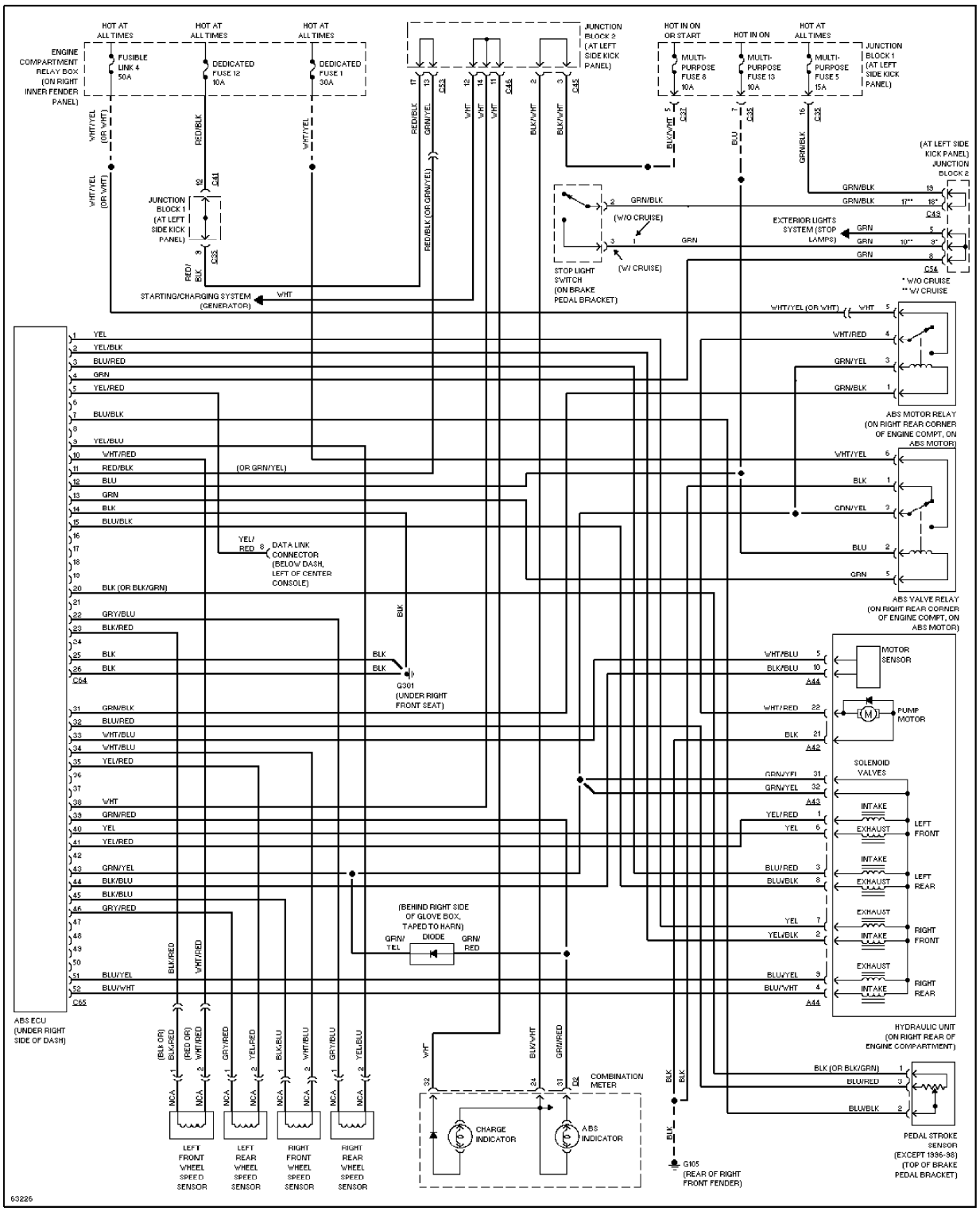


A/C Circuit, Manual A/C (2 of 2)



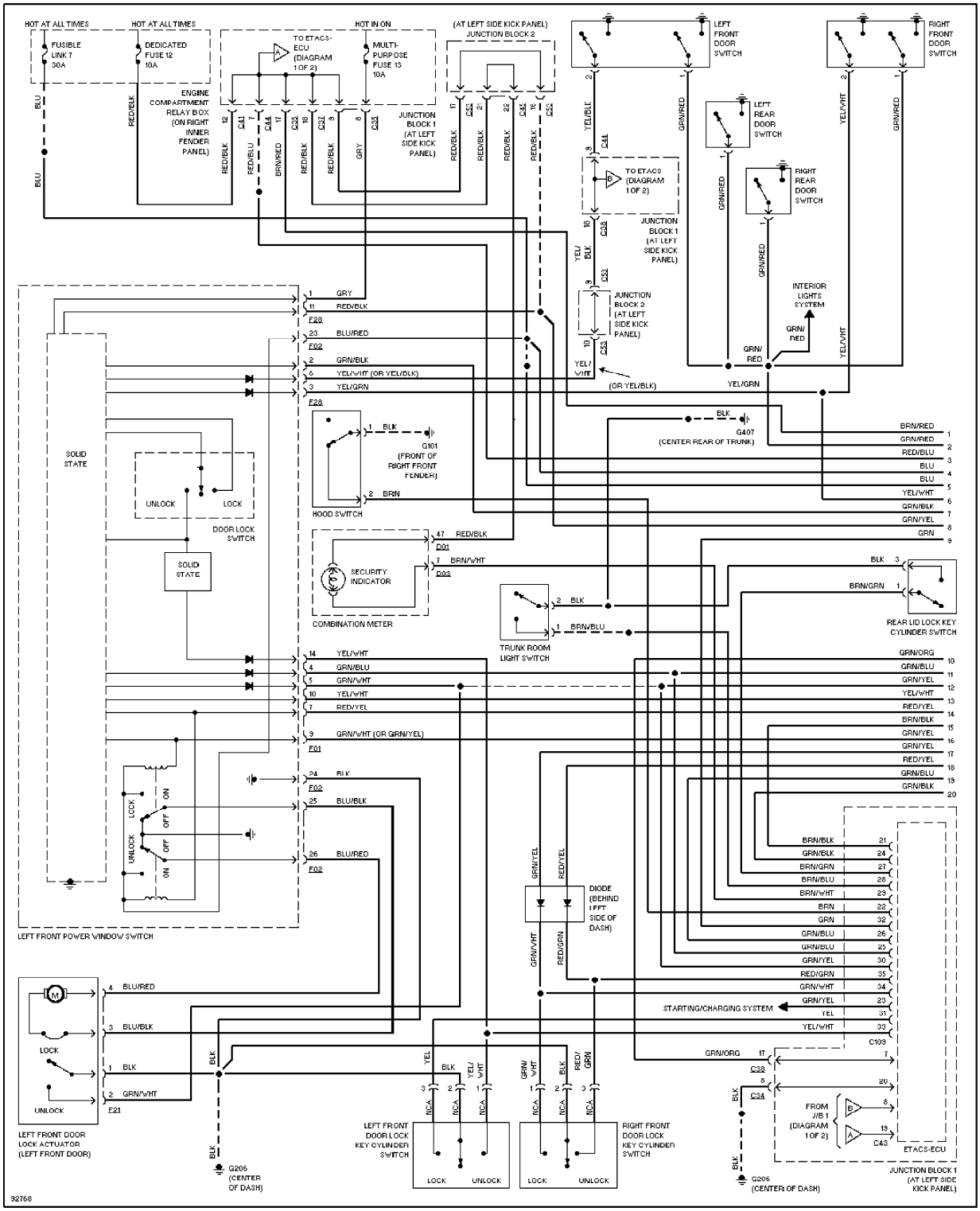
Heater Circuit

ANTI-LOCK BRAKES

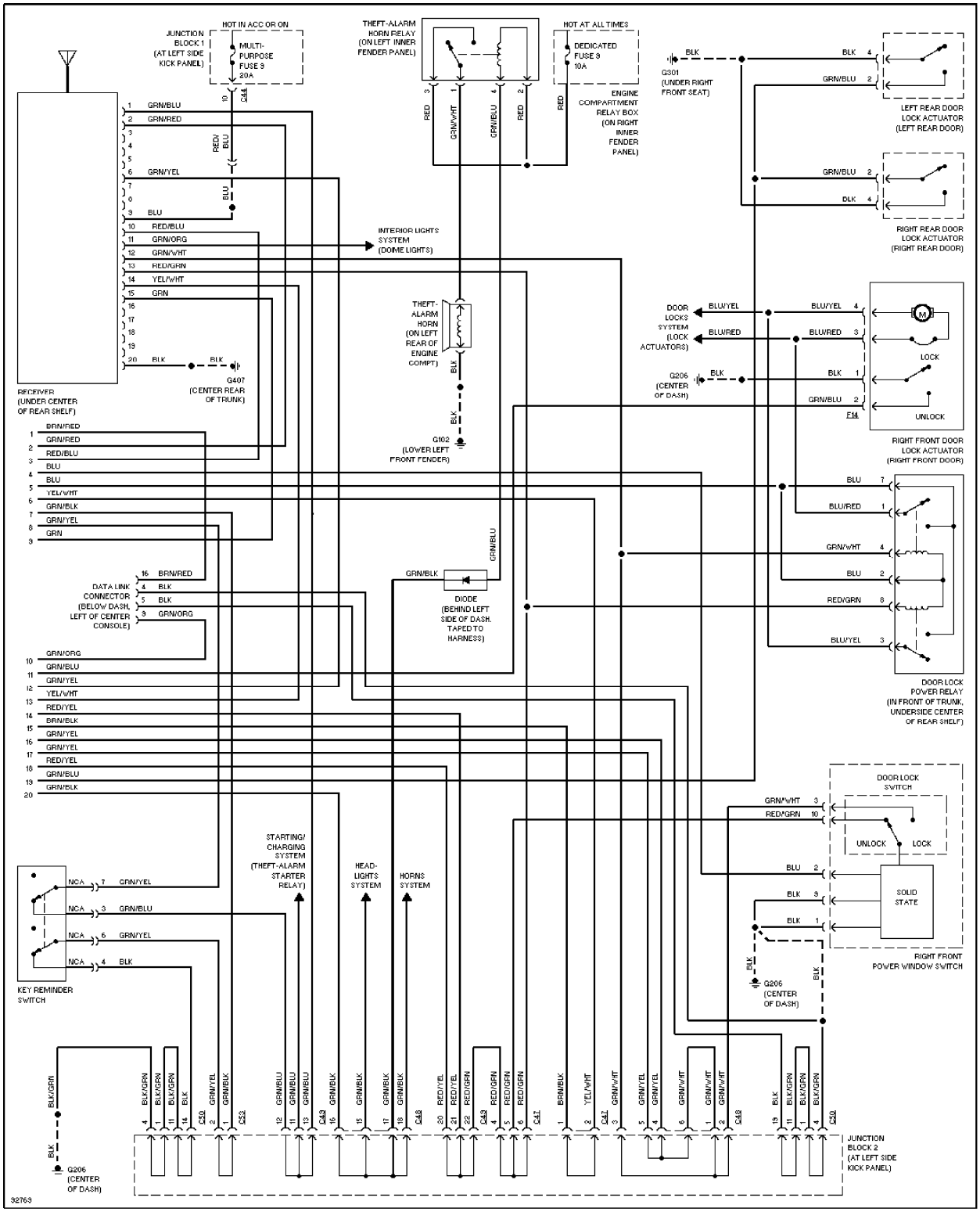


Anti-lock Brake Circuits

ANTI-THEFT

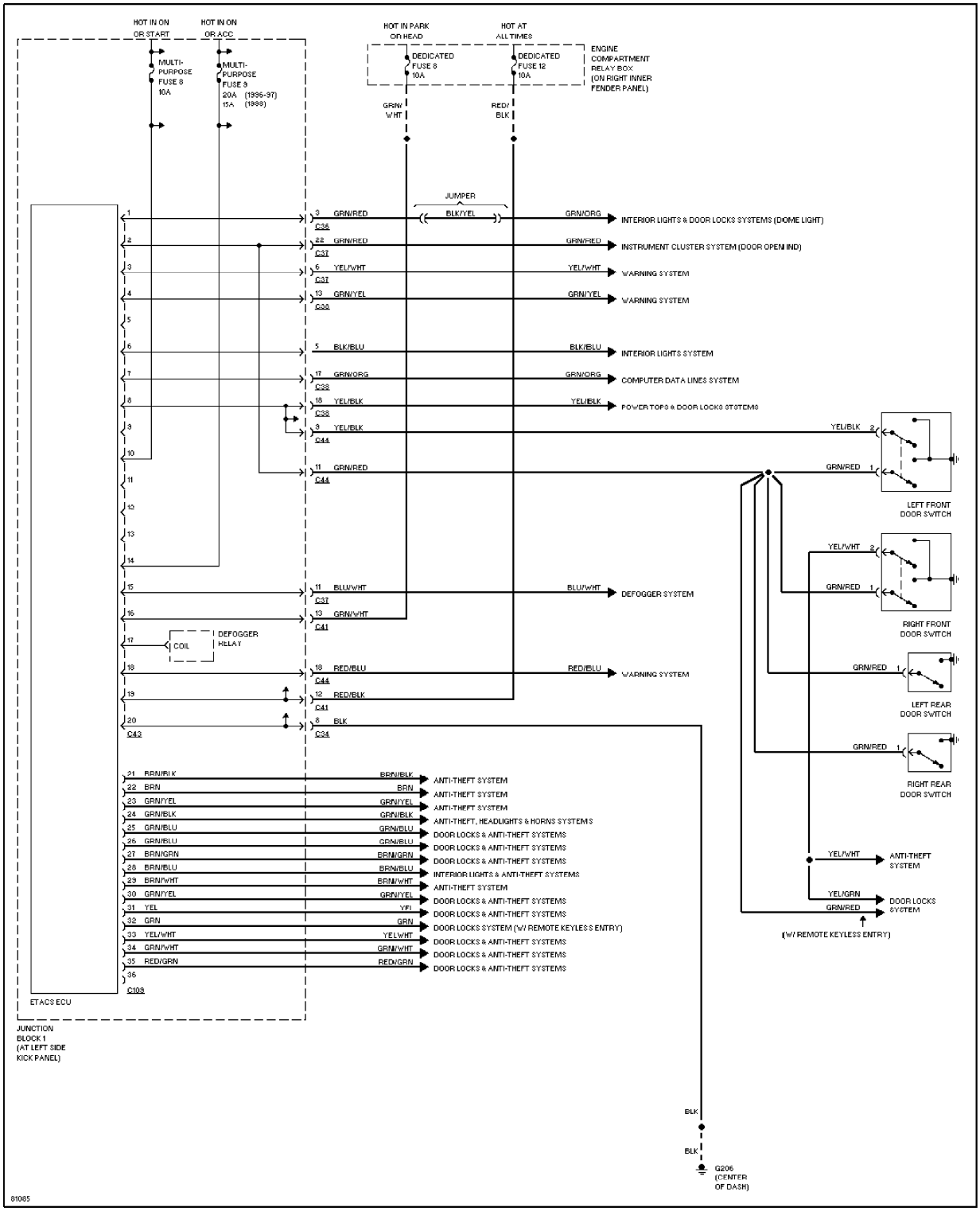


Anti-theft Circuit (1 of 2)



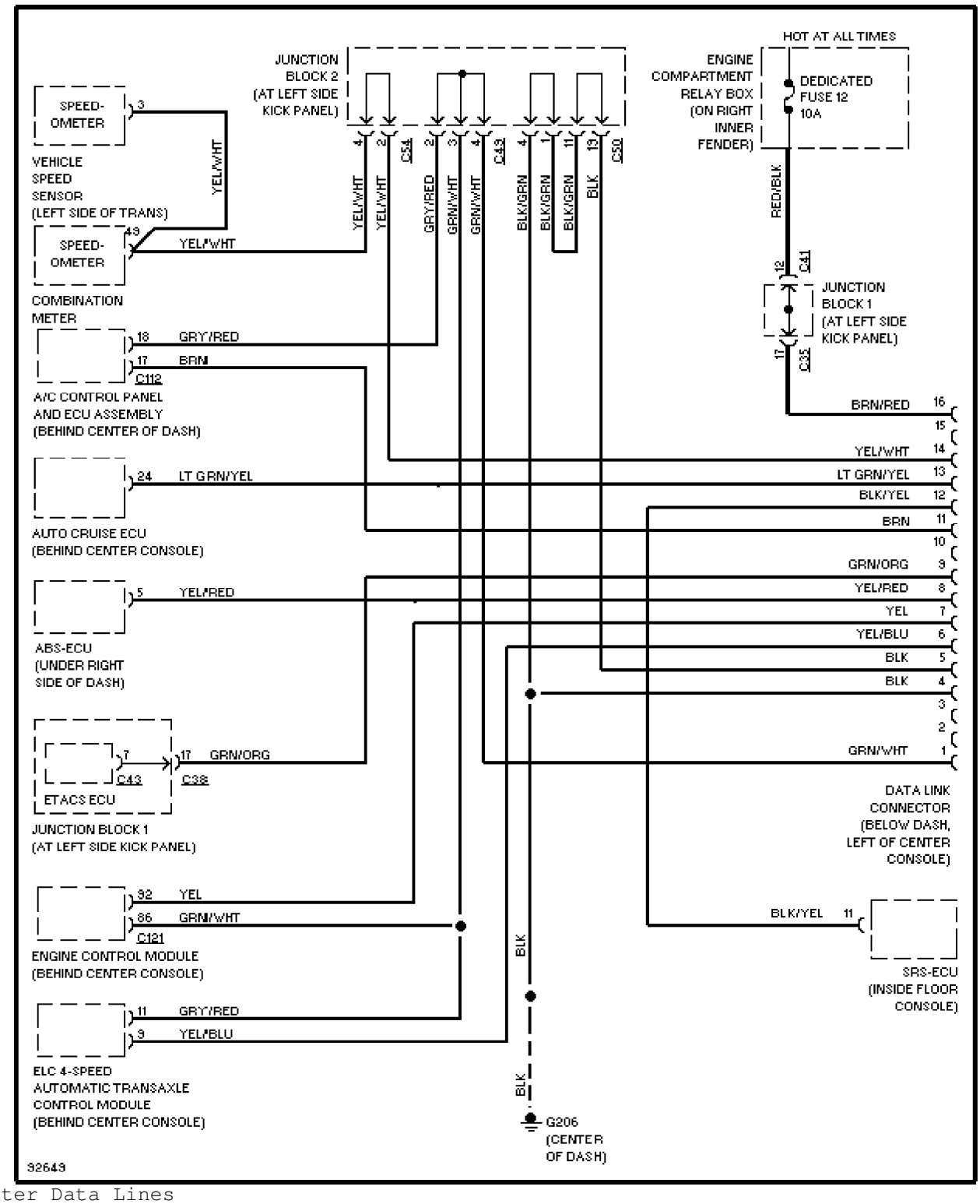
Anti-theft Circuit (2 of 2)

BODY COMPUTER



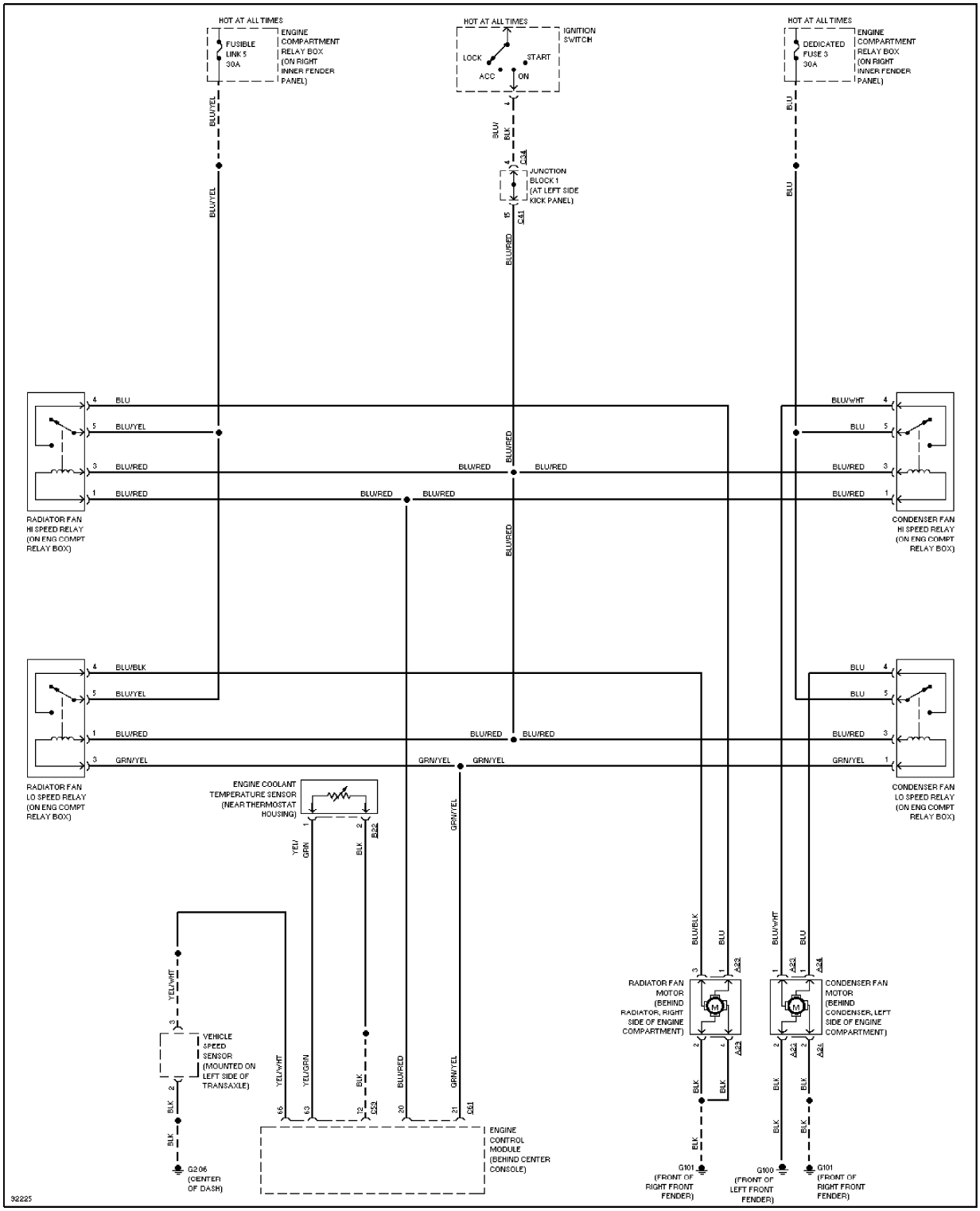
Body Computer Circuits

COMPUTER DATA LINES



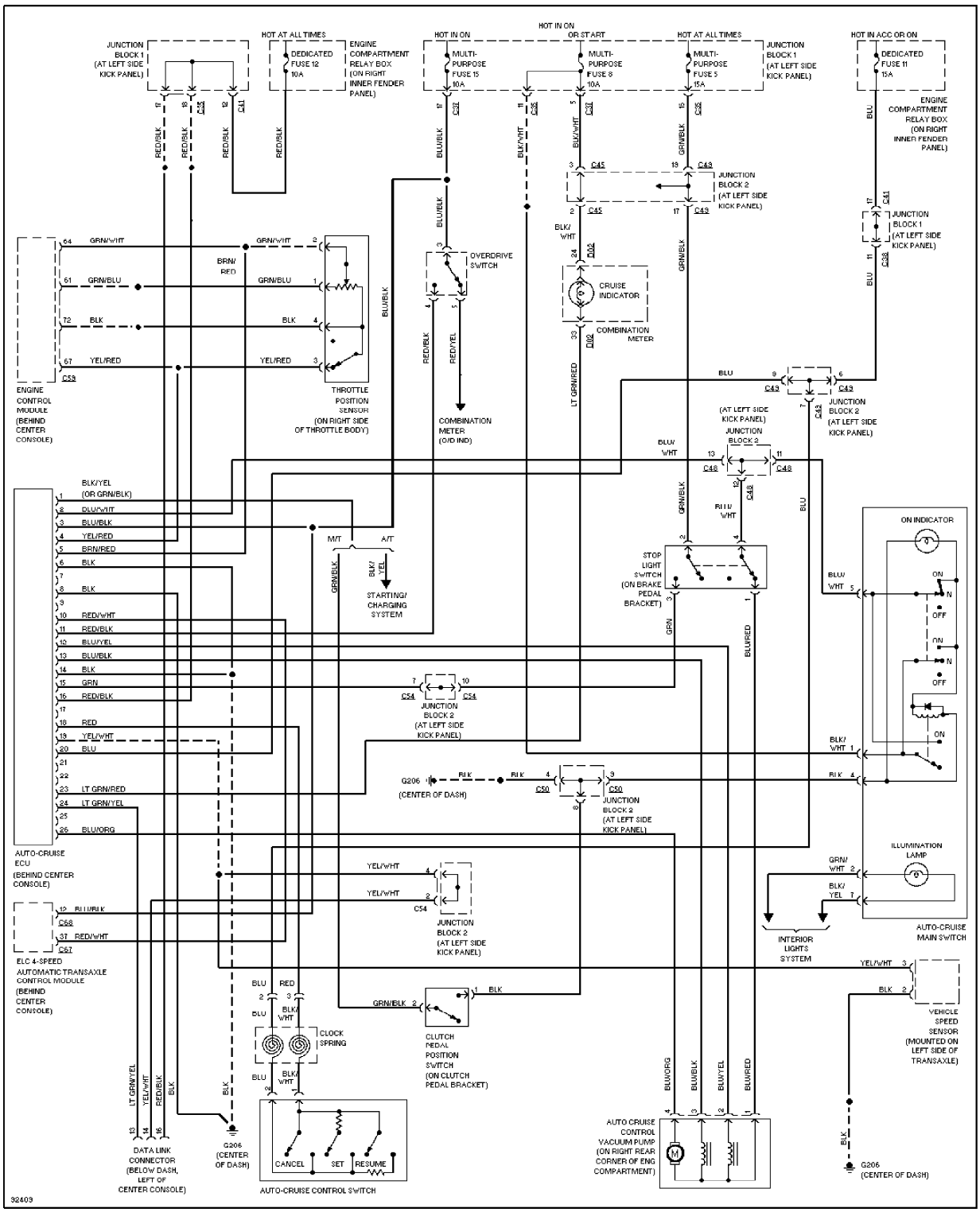
Computer Data Lines

COOLING FAN



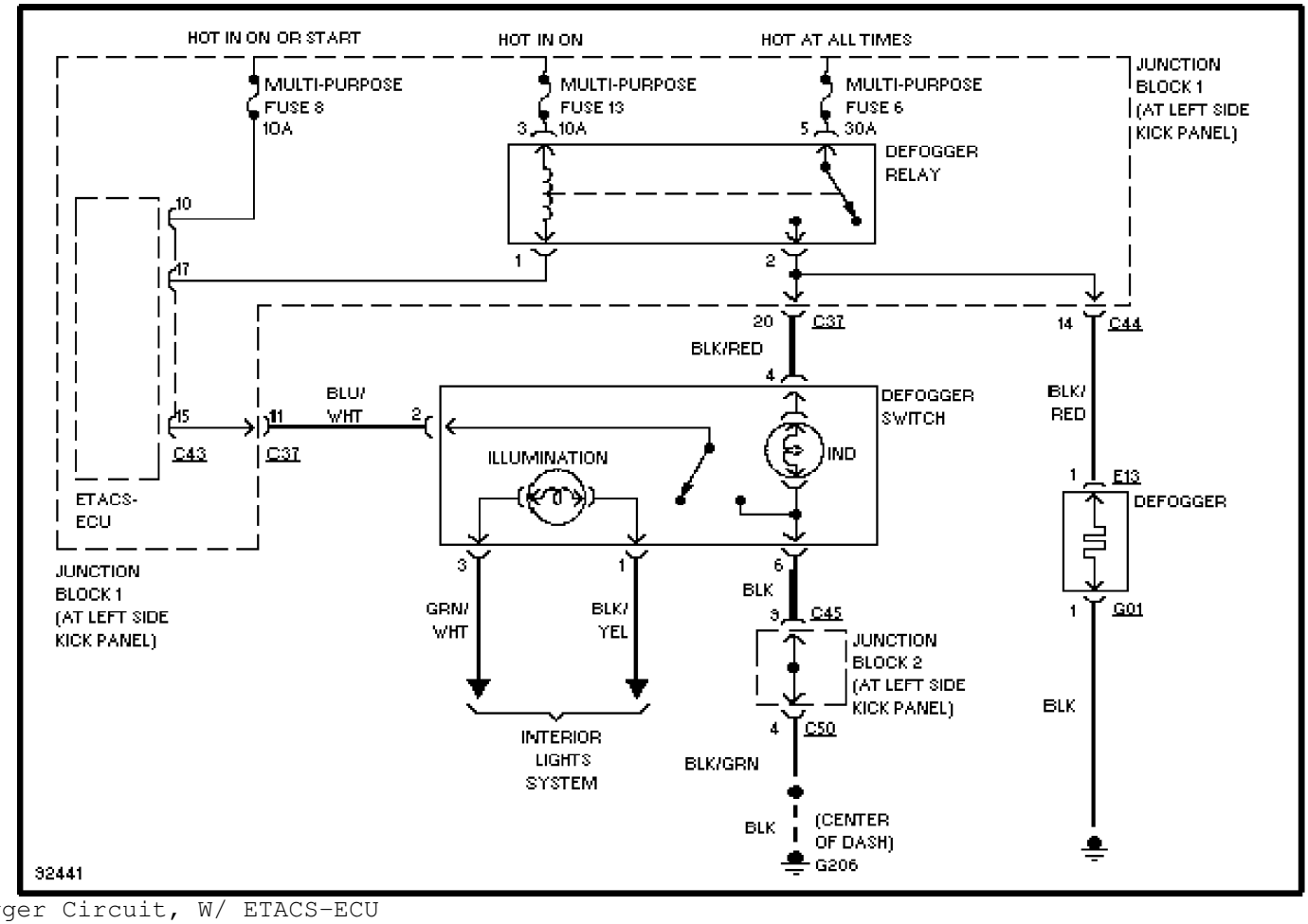
Cooling Fan Circuit

CRUISE CONTROL

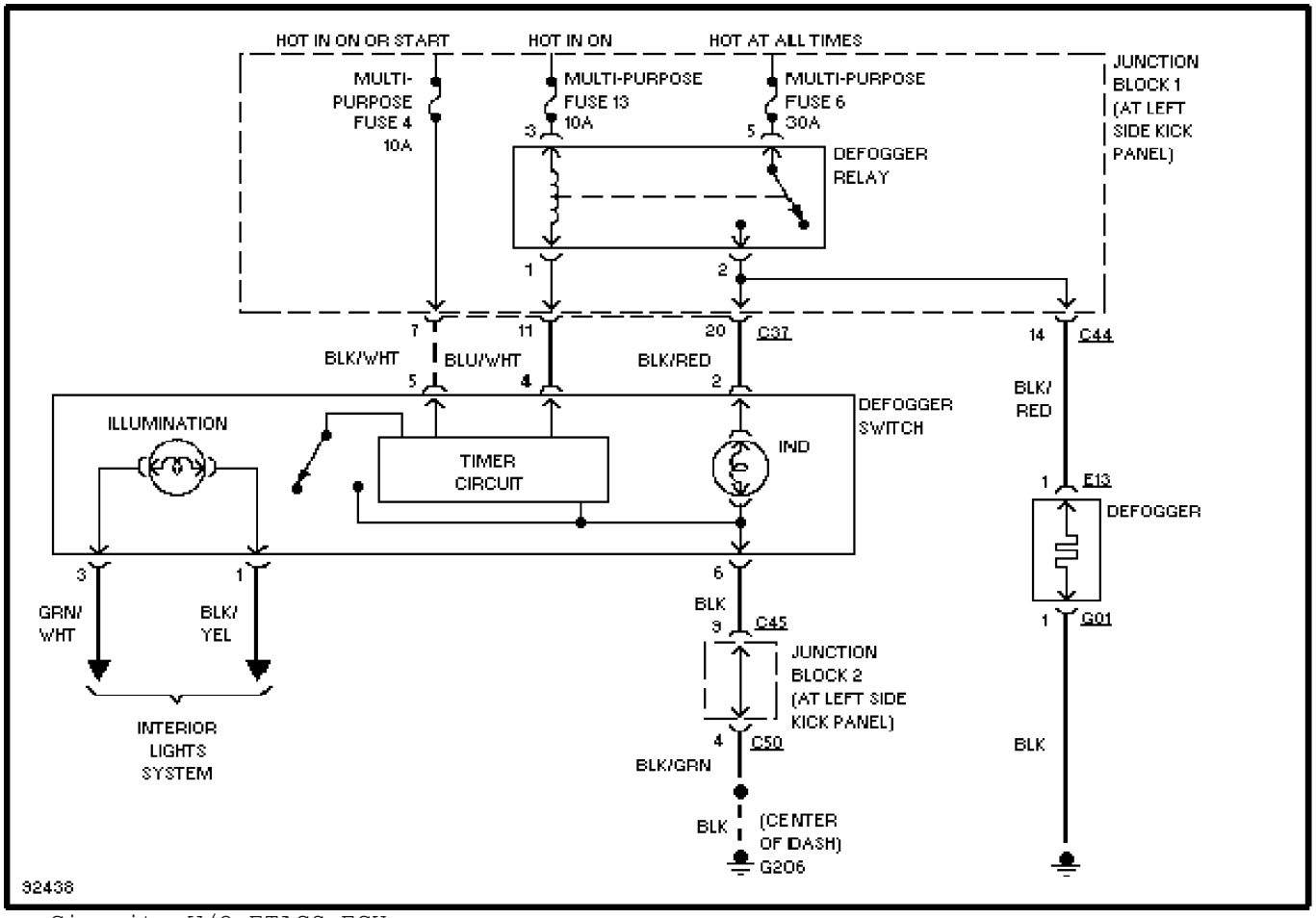


Cruise Control Circuit

DEFOGGERS



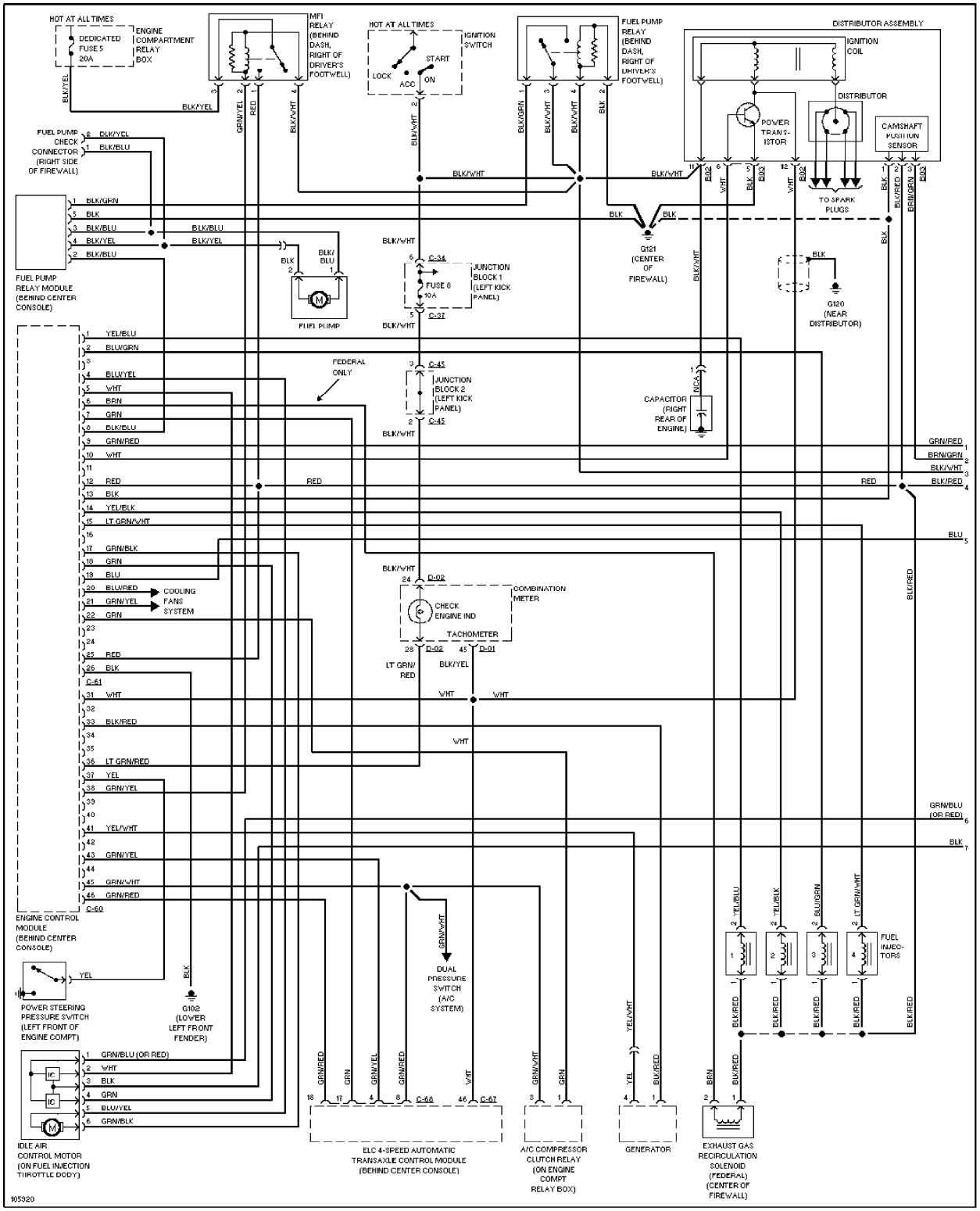
Defogger Circuit, W/ ETACS-ECU



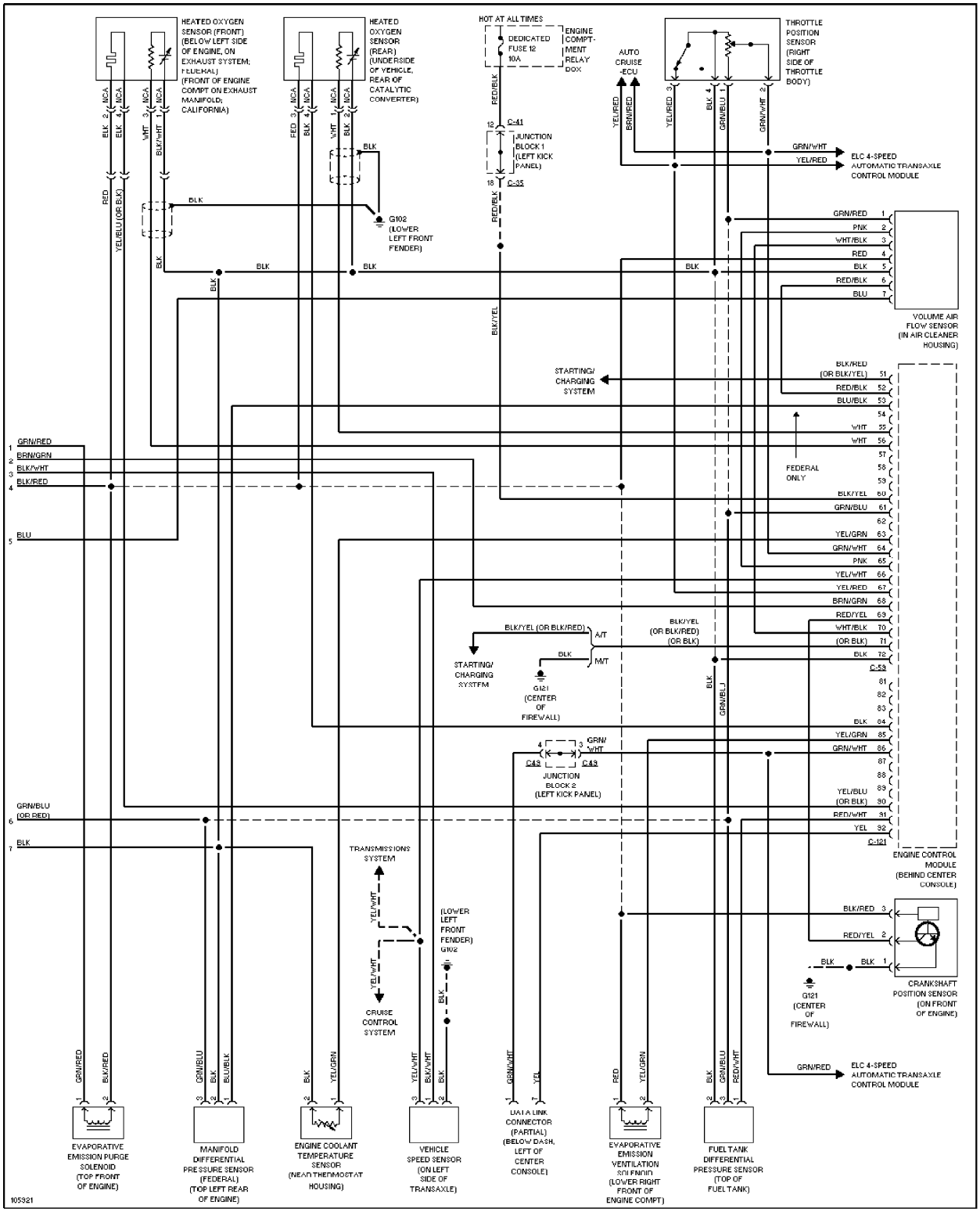
Defogger Circuit, W/O ETACS-ECU

ENGINE PERFORMANCE

2.4L

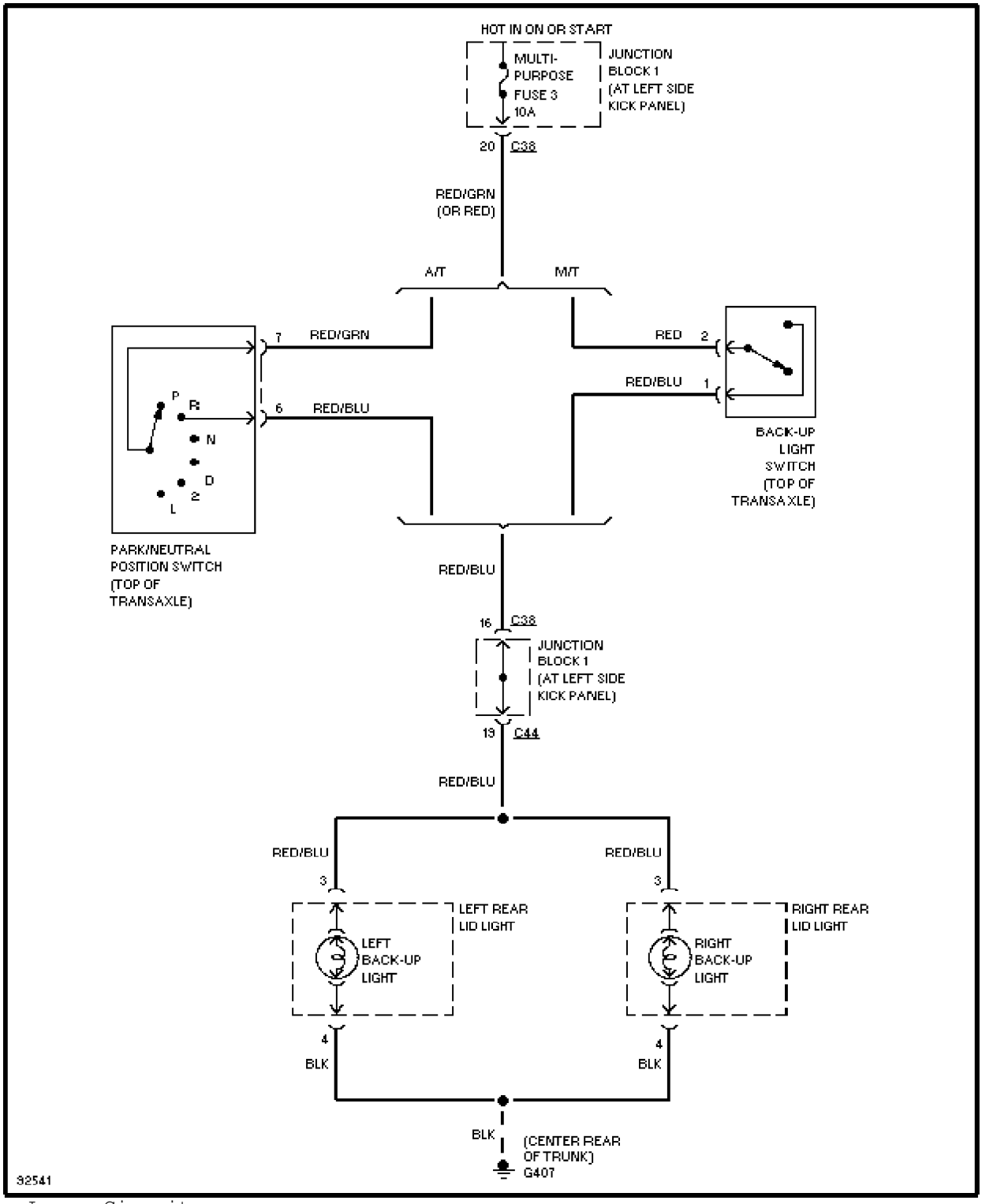


2.4L, Engine Performance Circuits (1 of 2)

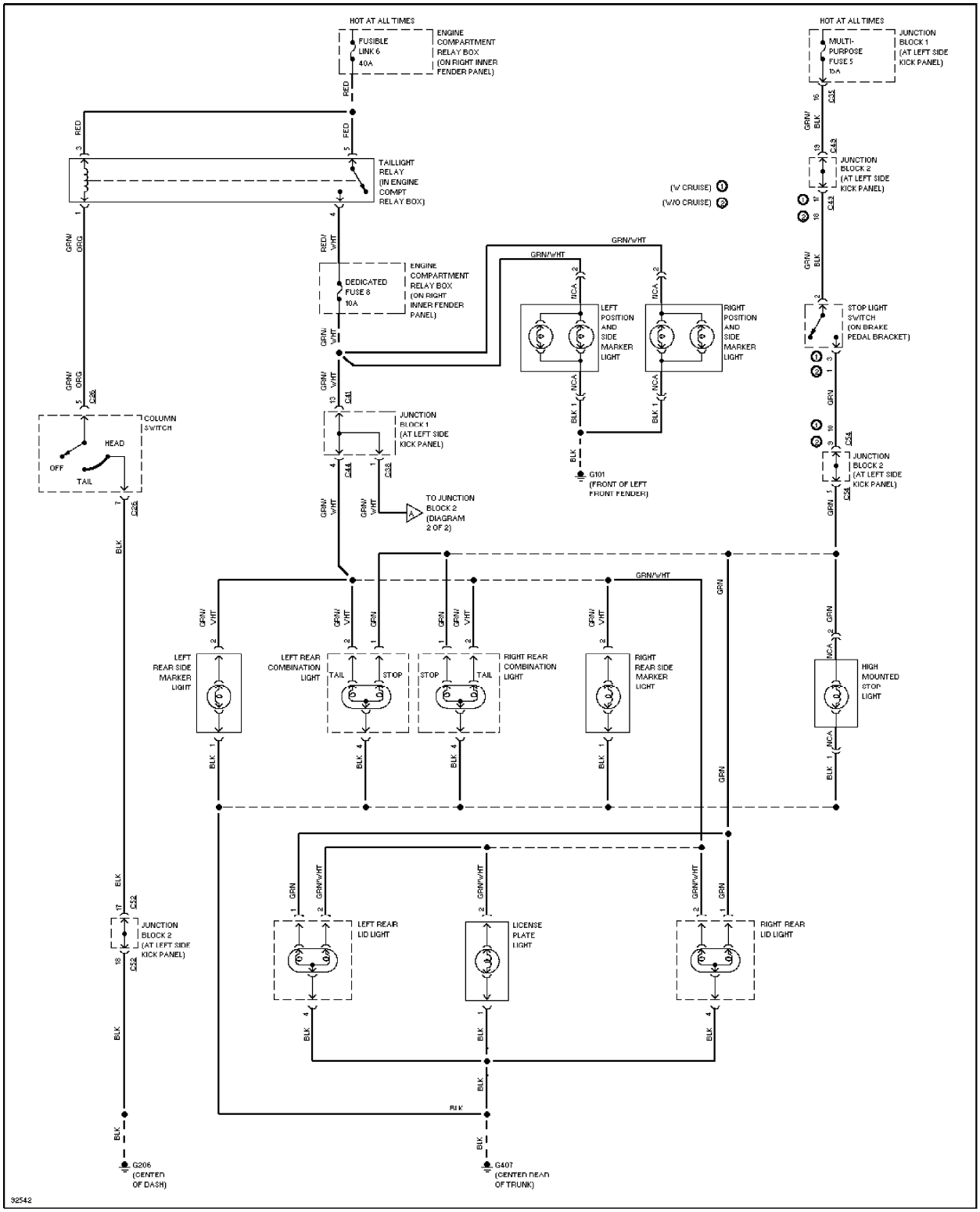


2.4L, Engine Performance Circuits (2 of 2)

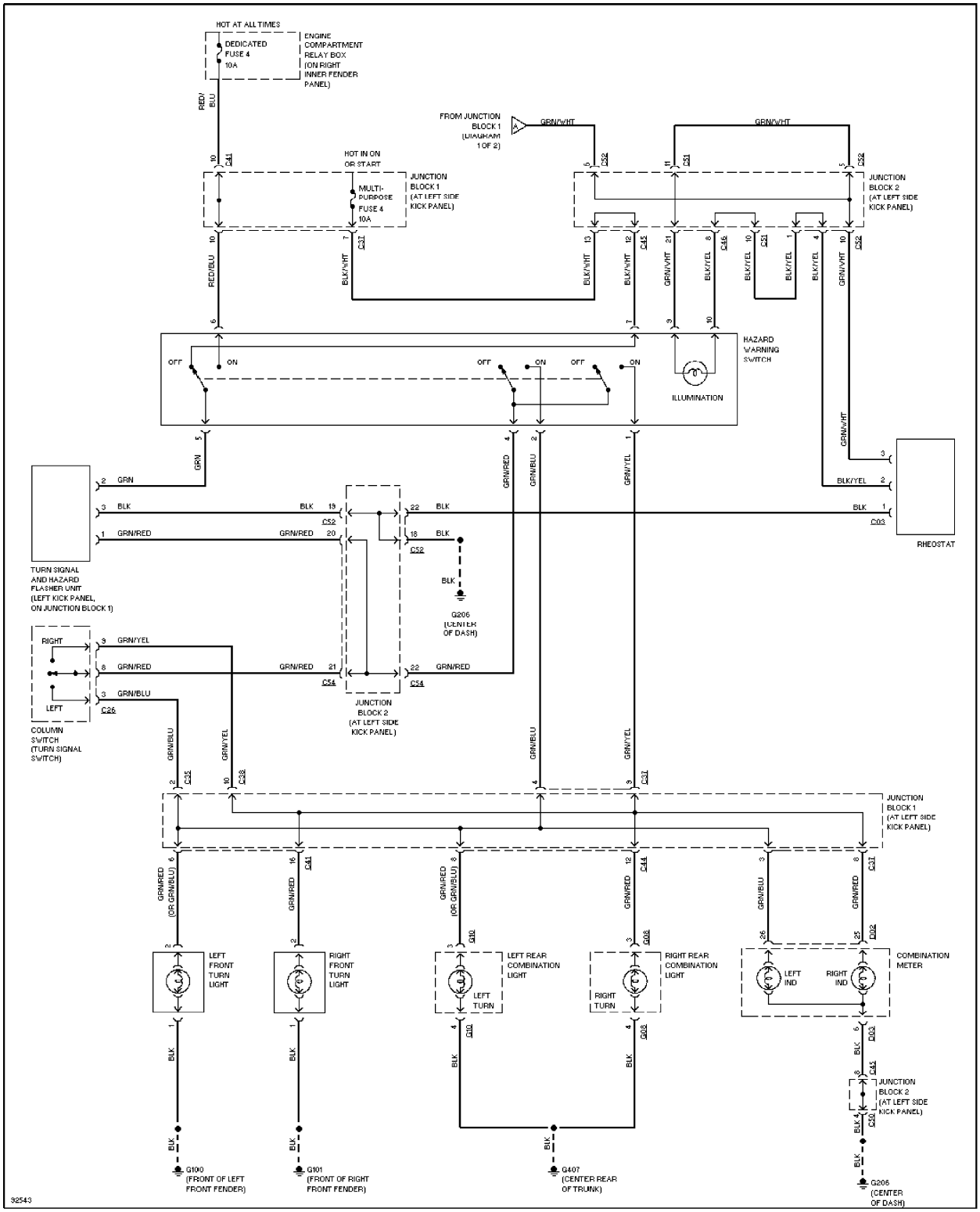
EXTERIOR LIGHTS



Back-up Lamps Circuit

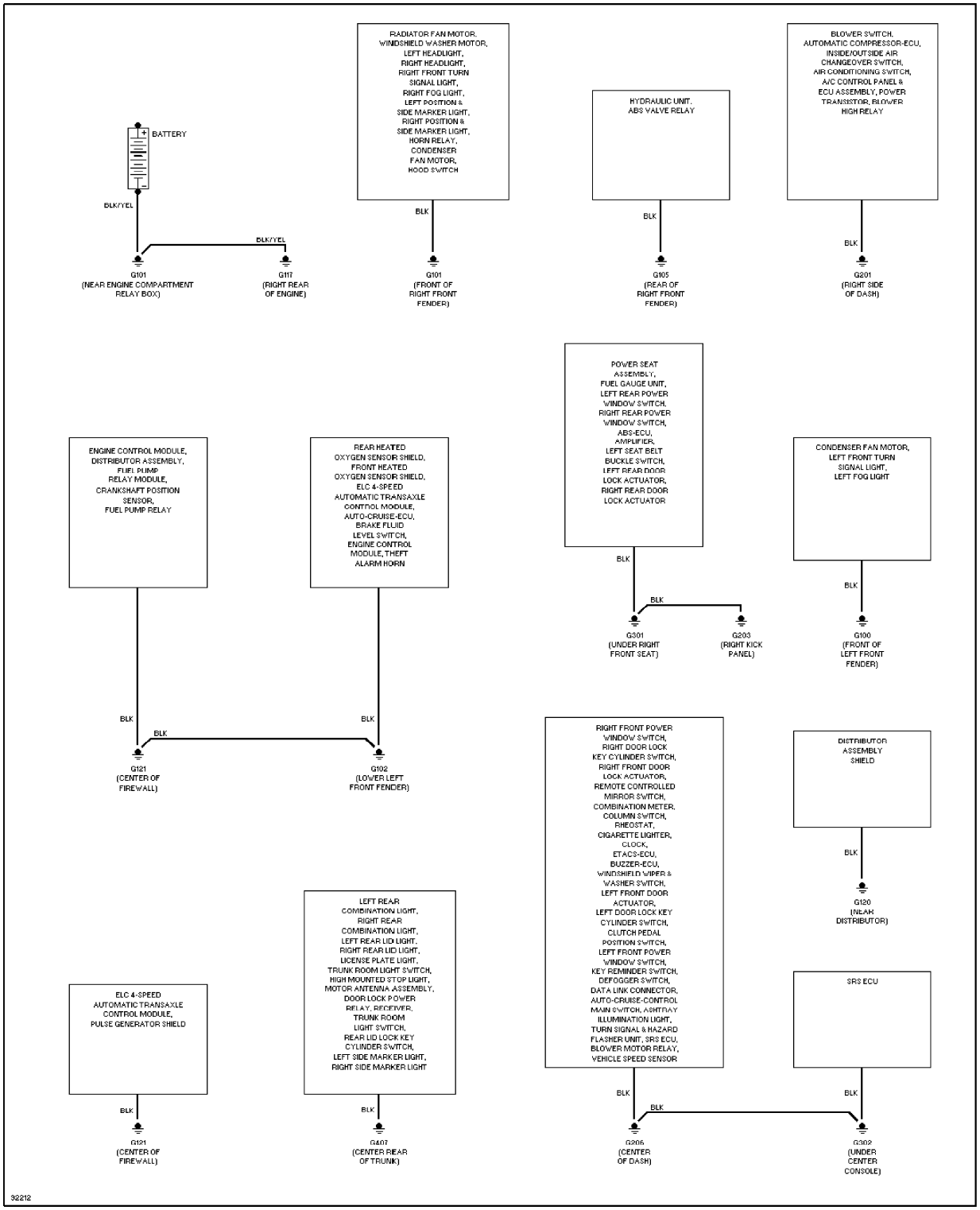


Exterior Lamps Circuit (1 of 2)



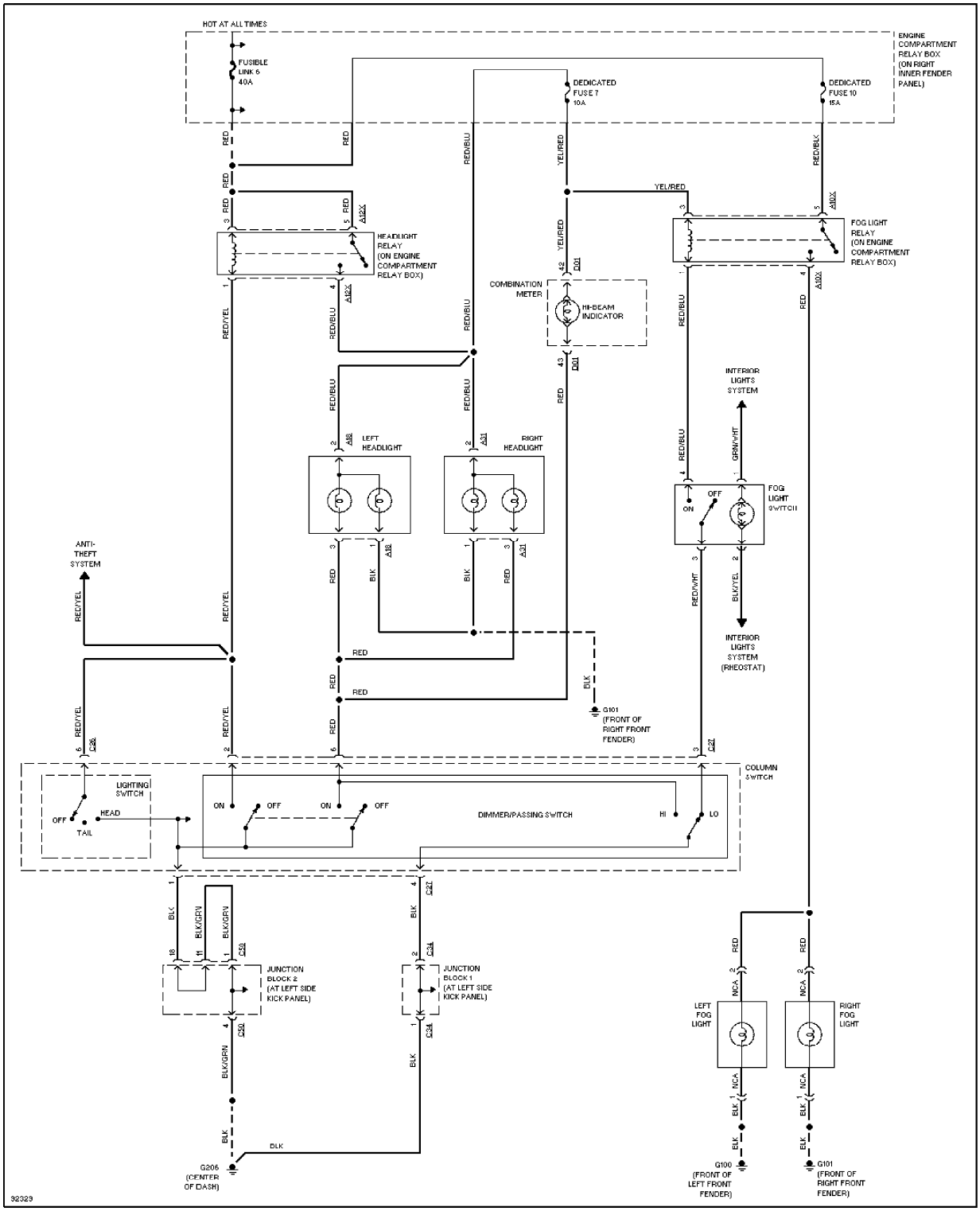
Exterior Lamps Circuit (2 of 2)

GROUND DISTRIBUTION



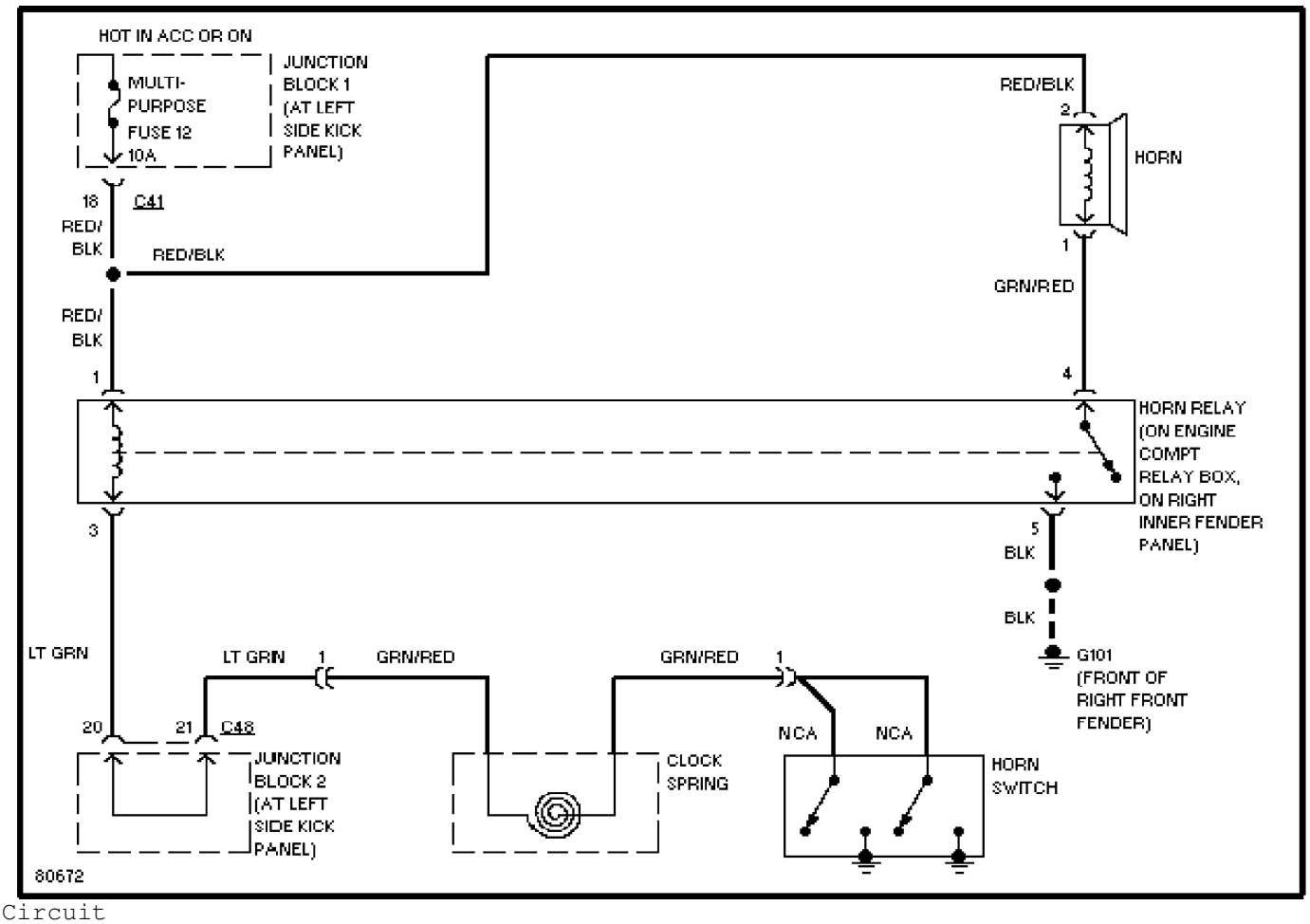
Ground Distribution Circuit

HEADLIGHTS



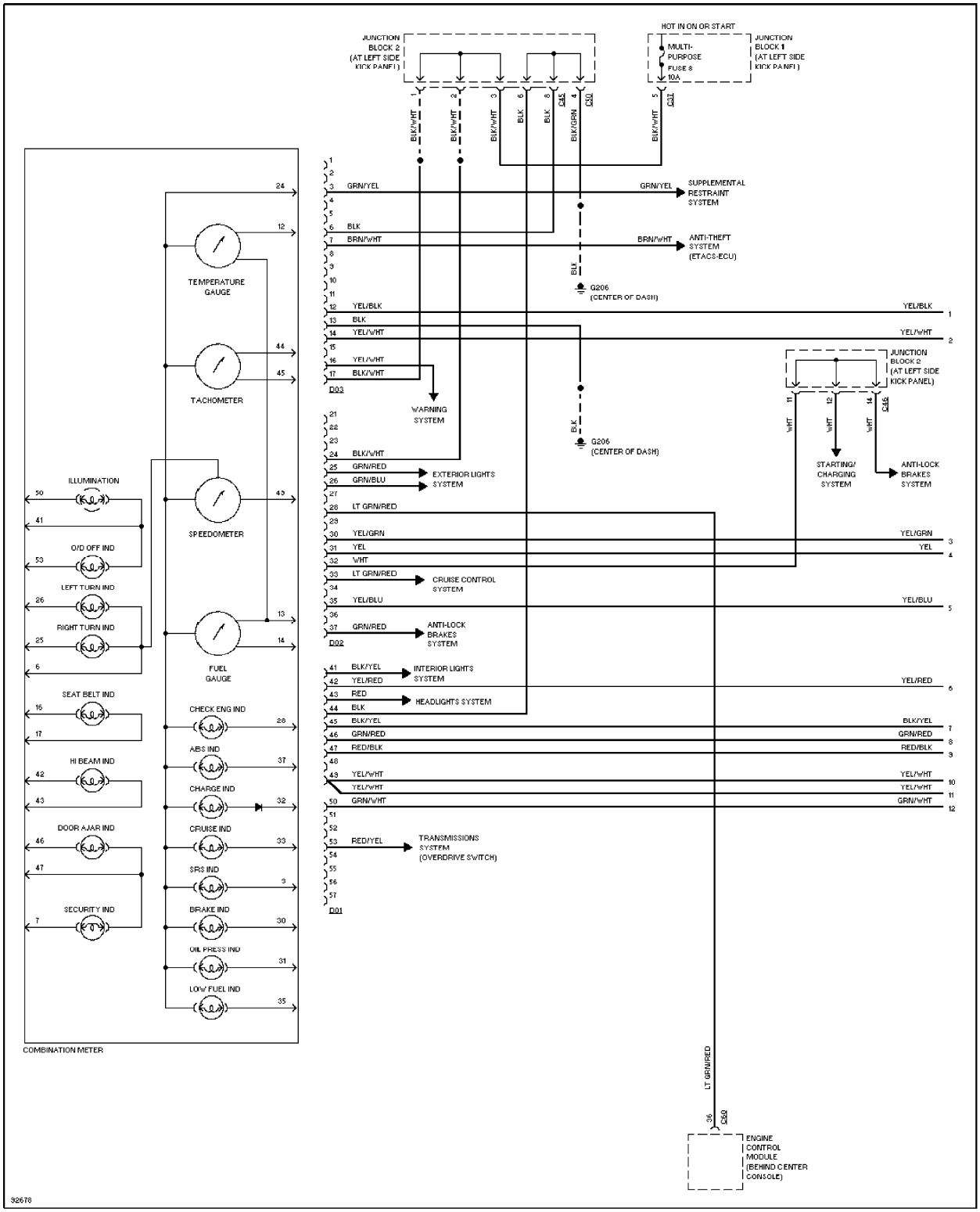
Headlight Circuit

HORN

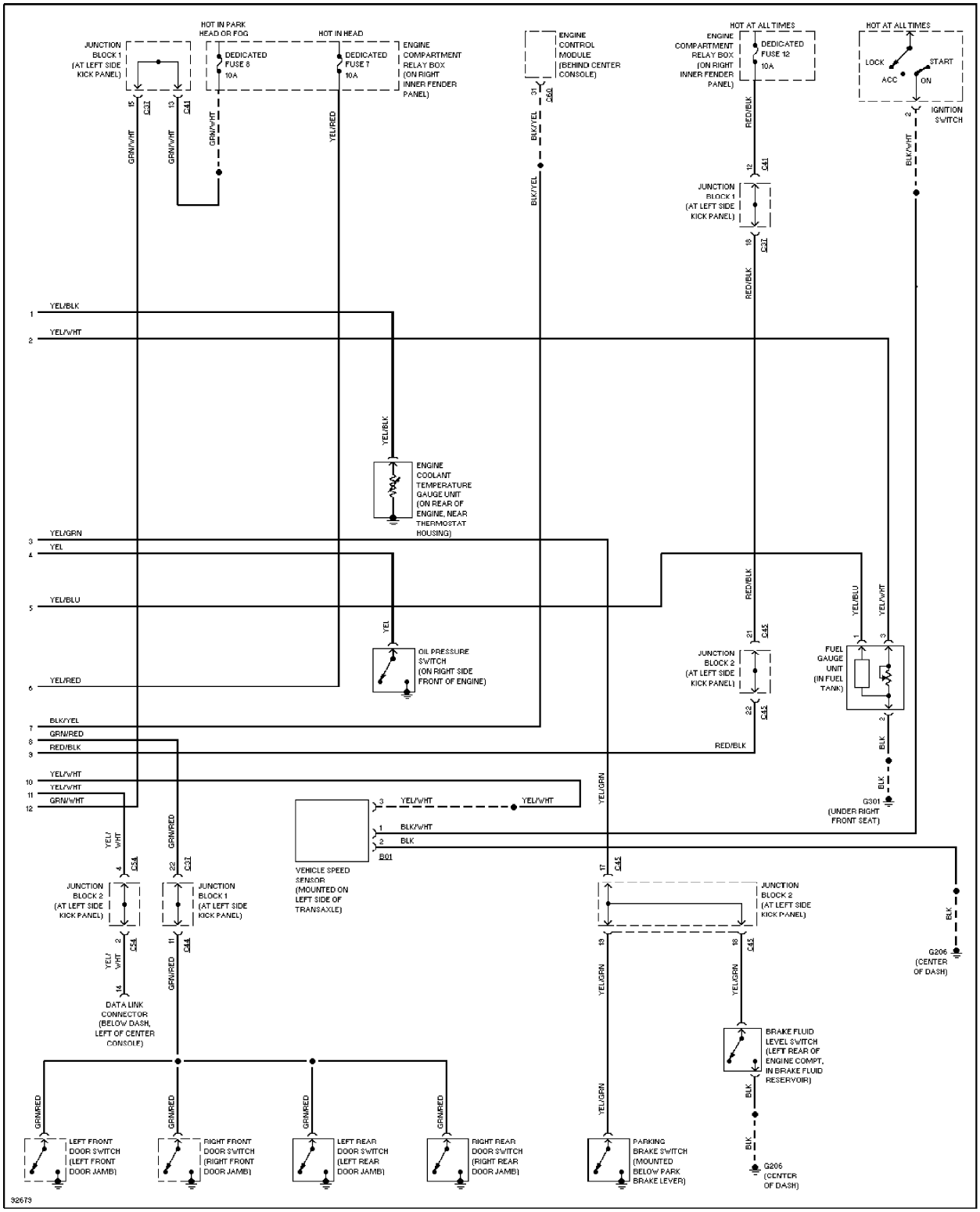


Horn Circuit

INSTRUMENT CLUSTER

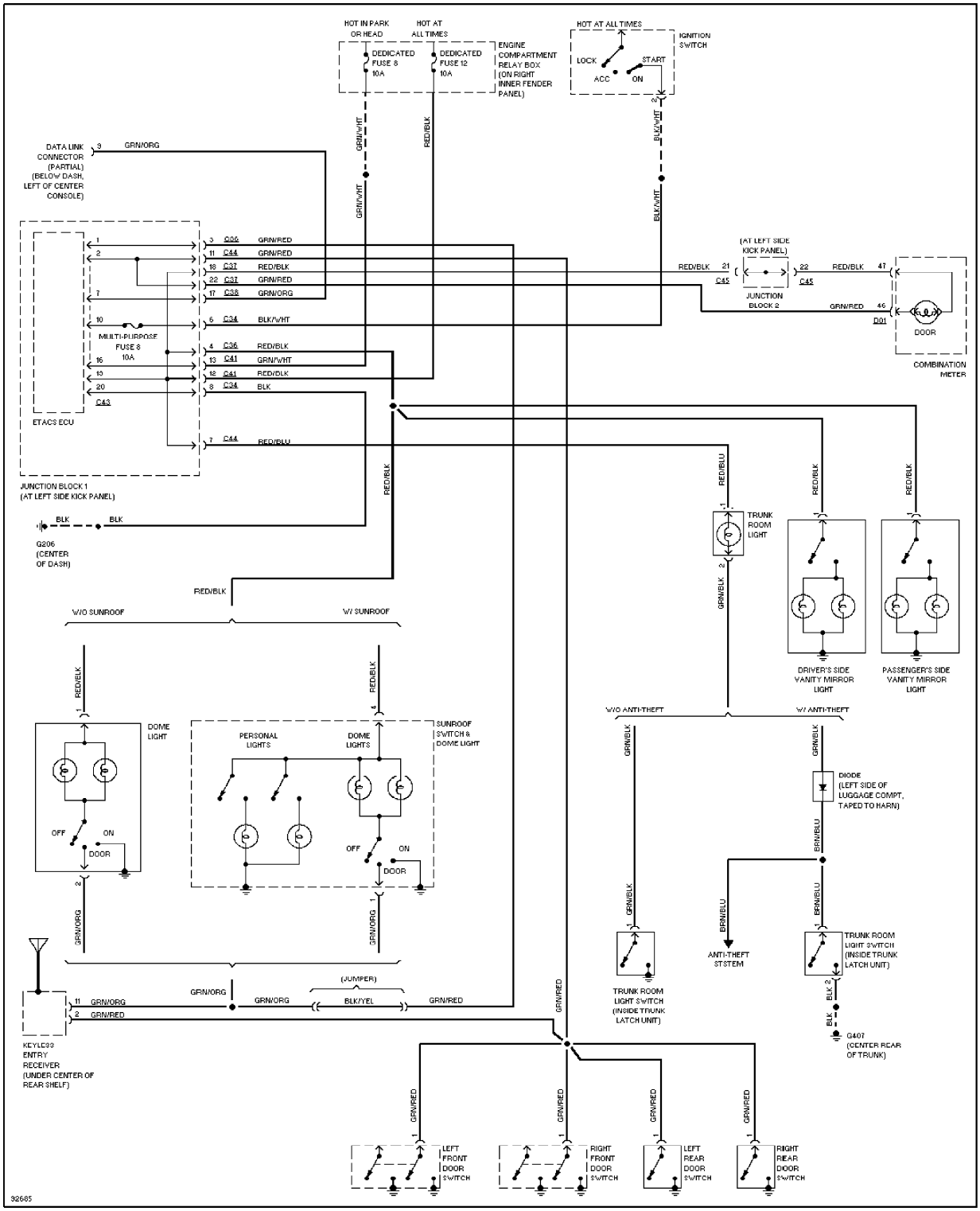


Instrument Cluster Circuit (1 of 2)

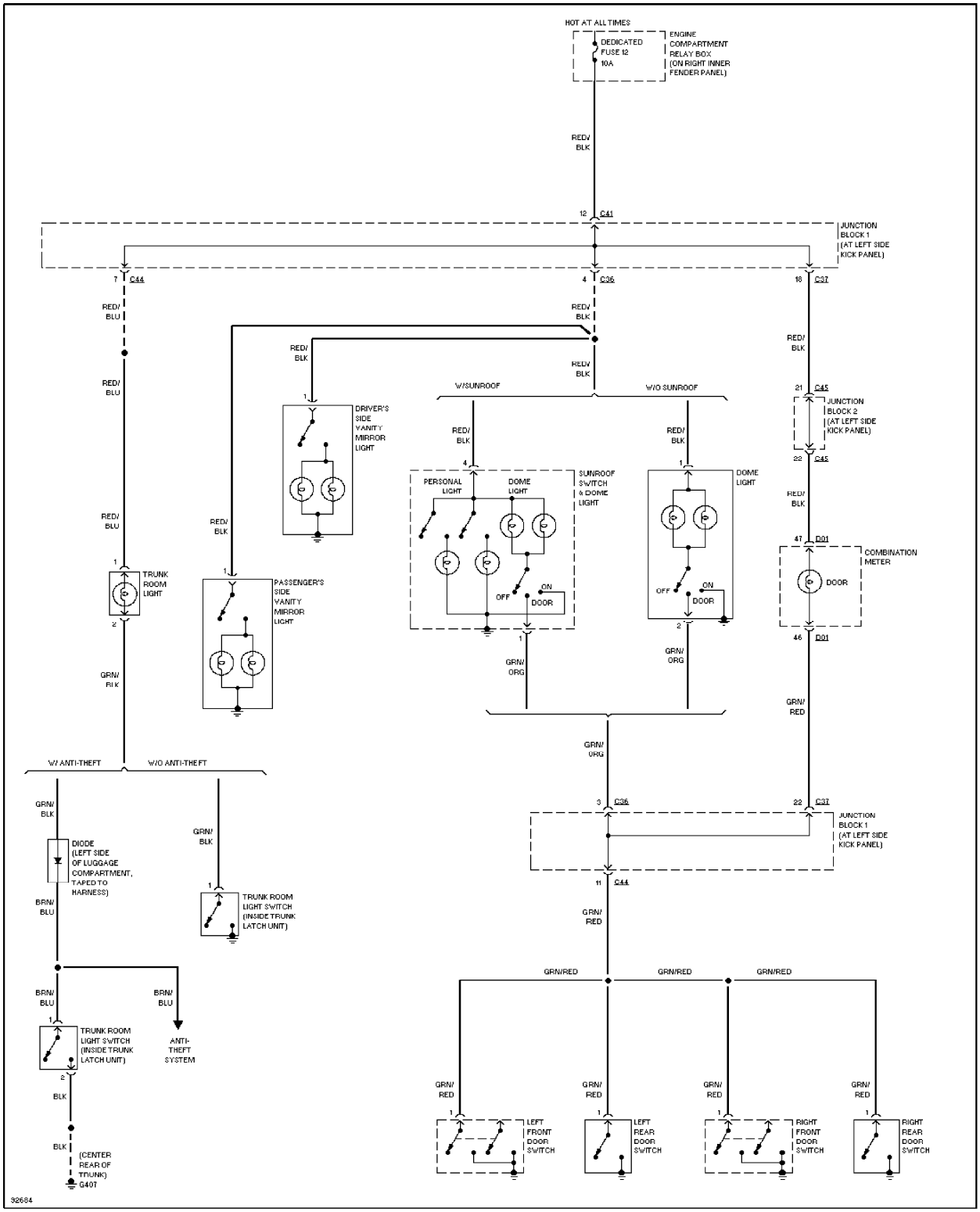


Instrument Cluster Circuit (2 of 2)

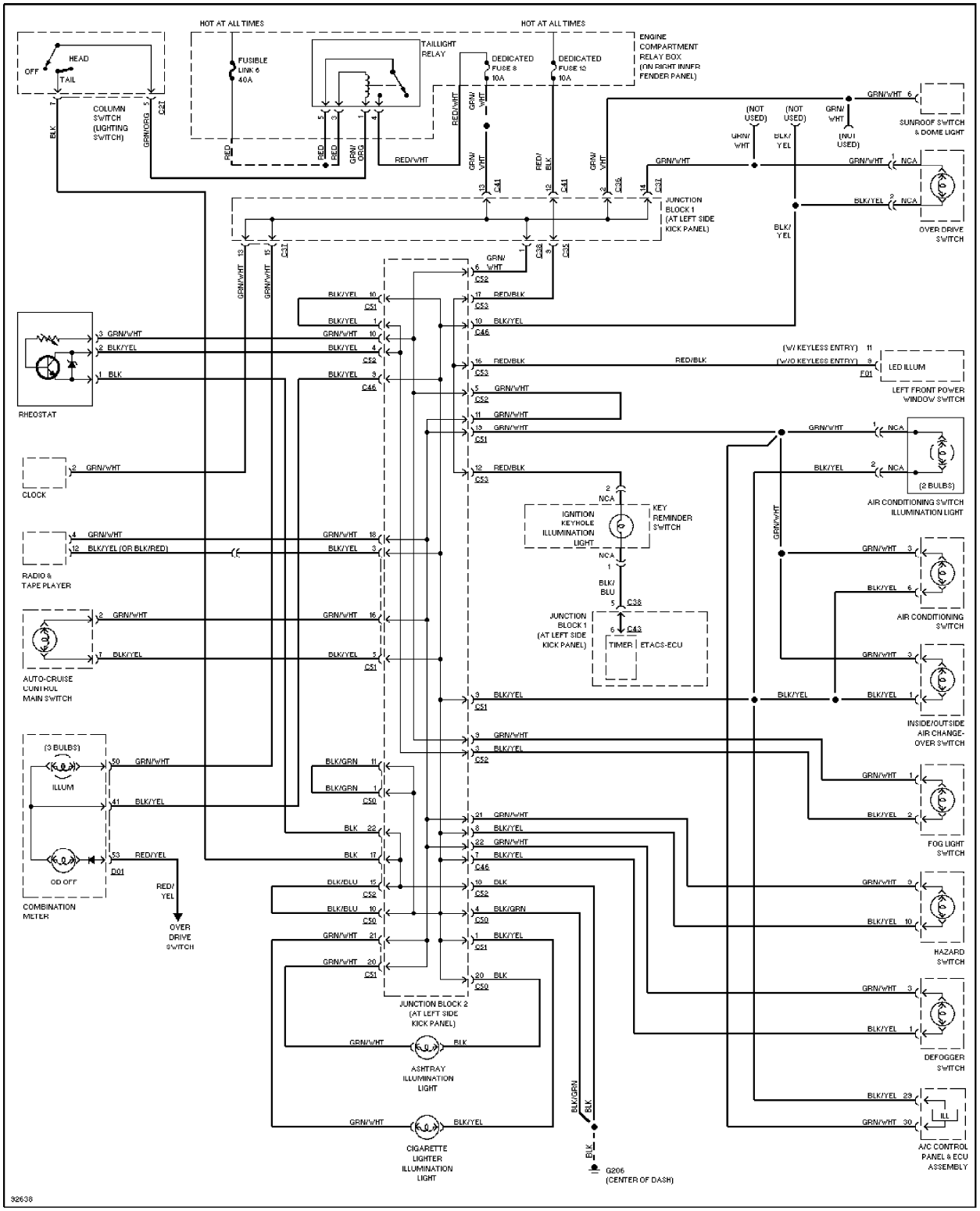
INTERIOR LIGHTS



Courtesy Lamps Circuit, W/ ETACS-ECU

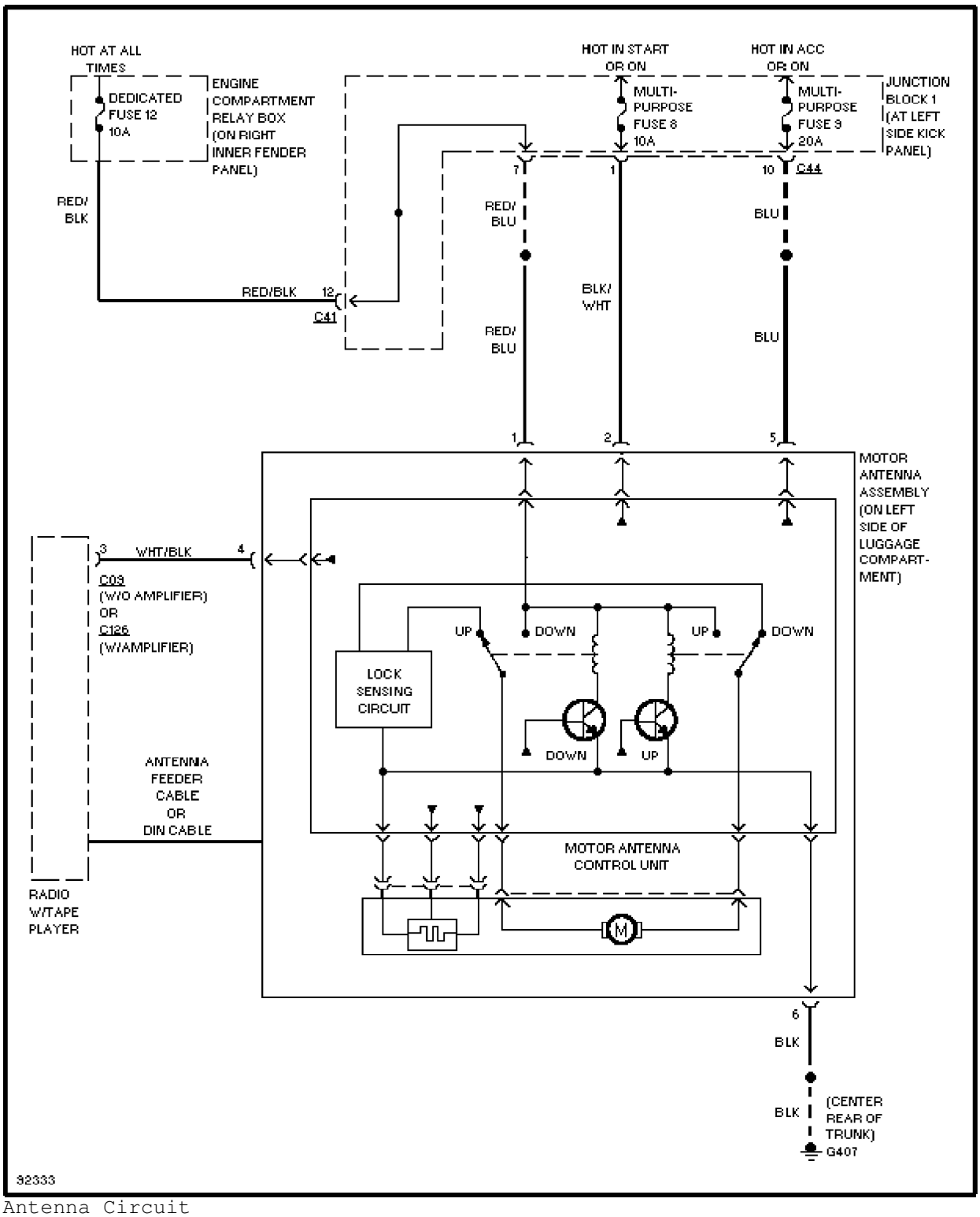


Courtesy Lamps Circuit, W/O ETACS-ECU



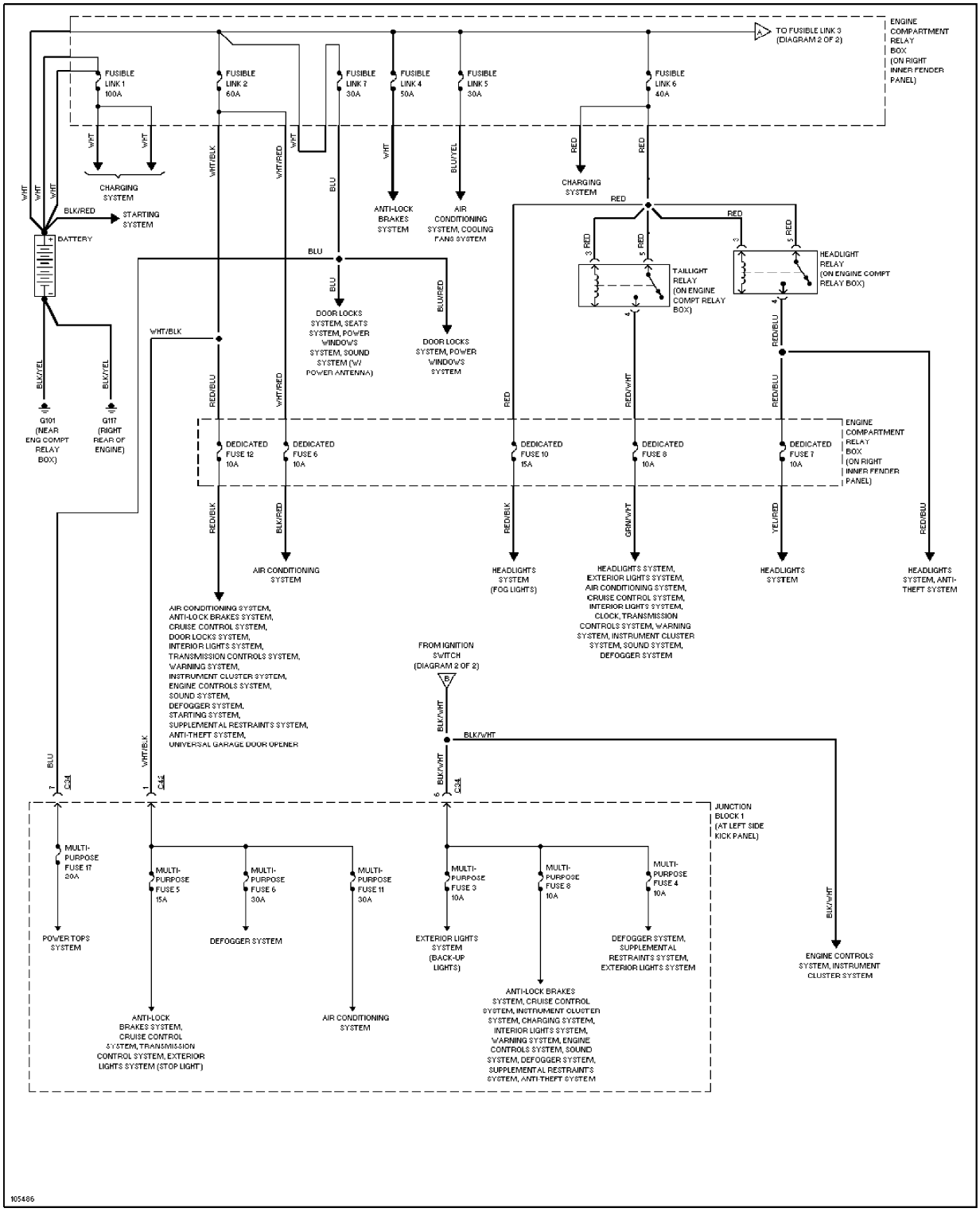
Instrument Illumination Circuit

POWER ANTENNA

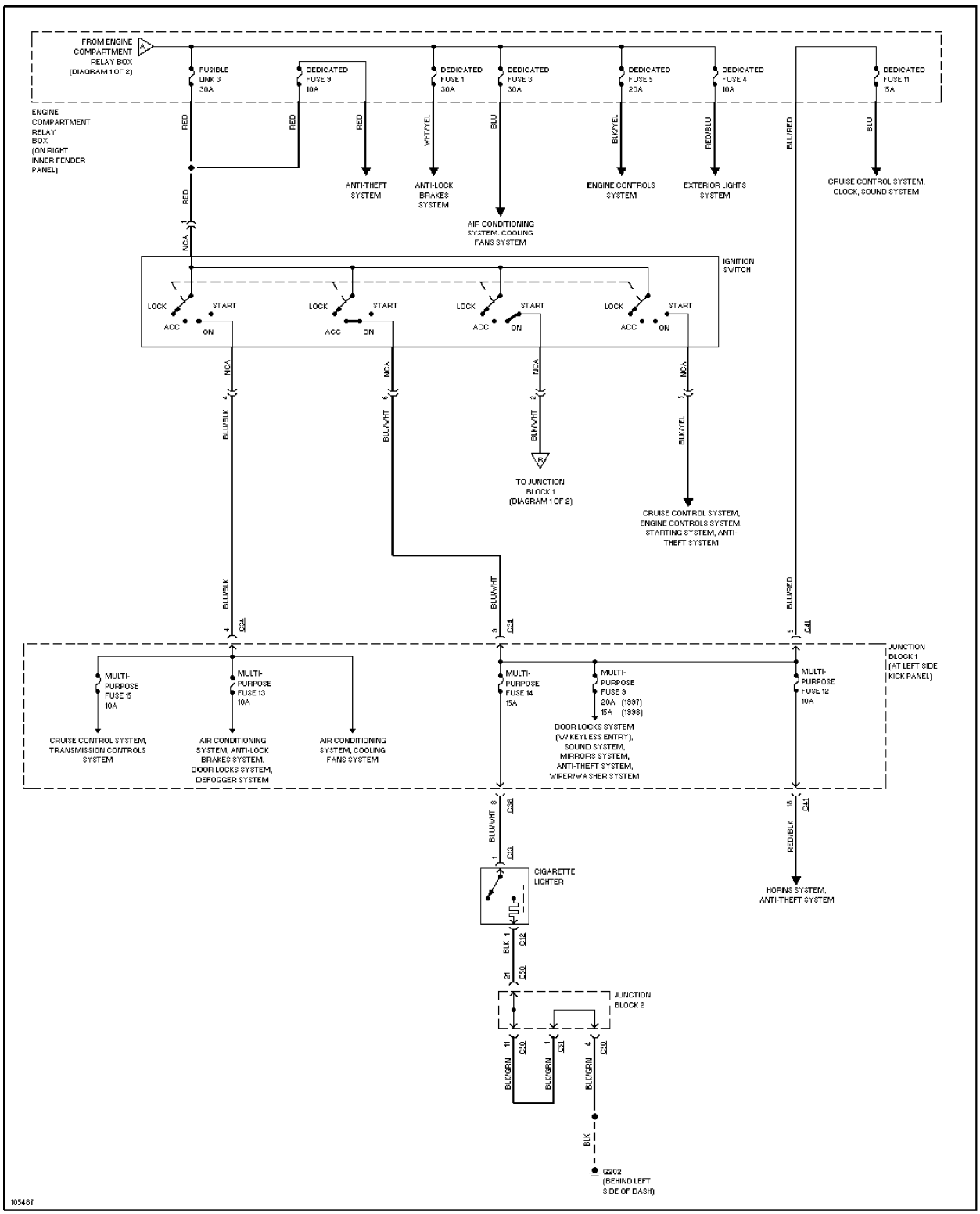


Power Antenna Circuit

POWER DISTRIBUTION

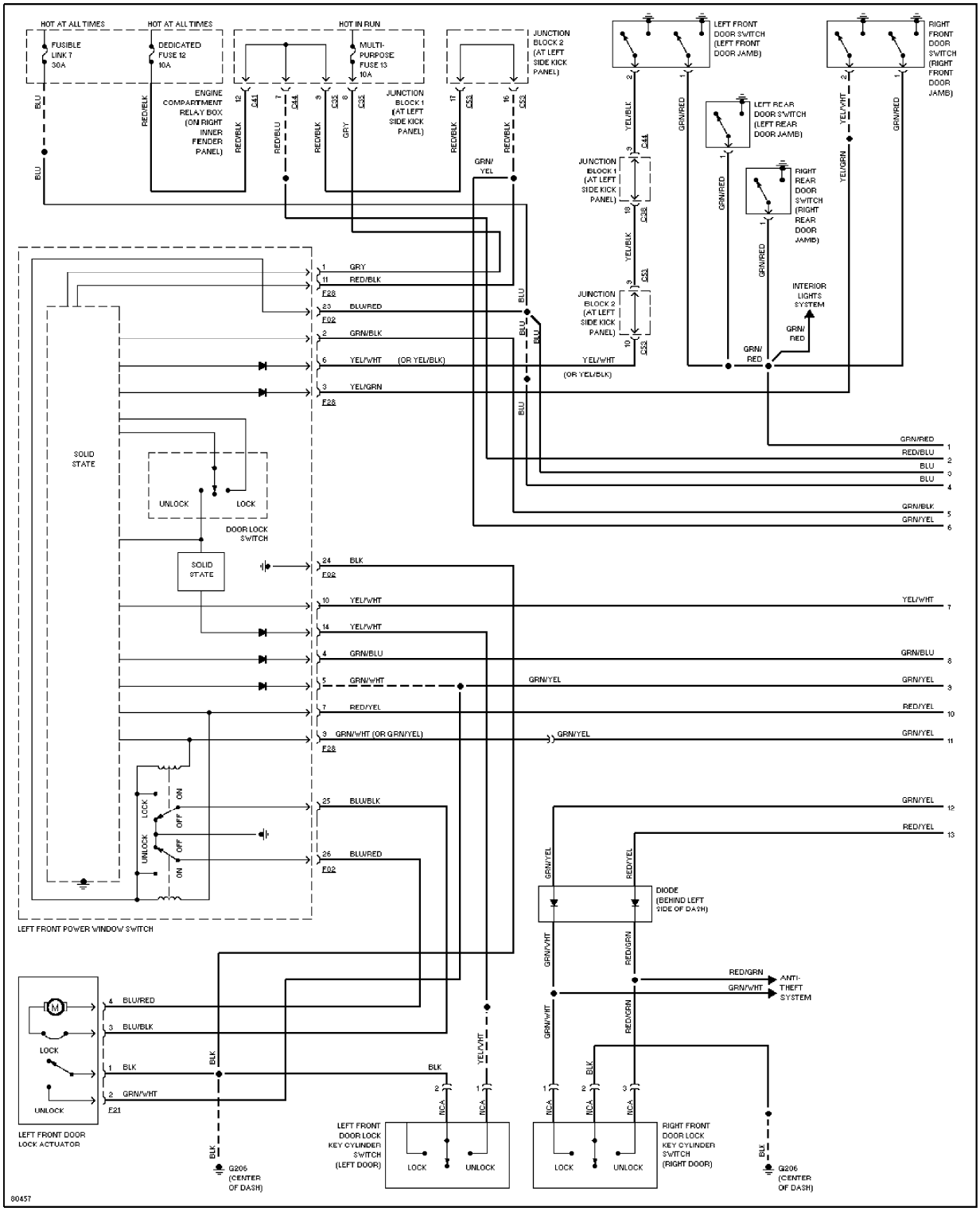


Power Distribution Circuit (1 of 2)

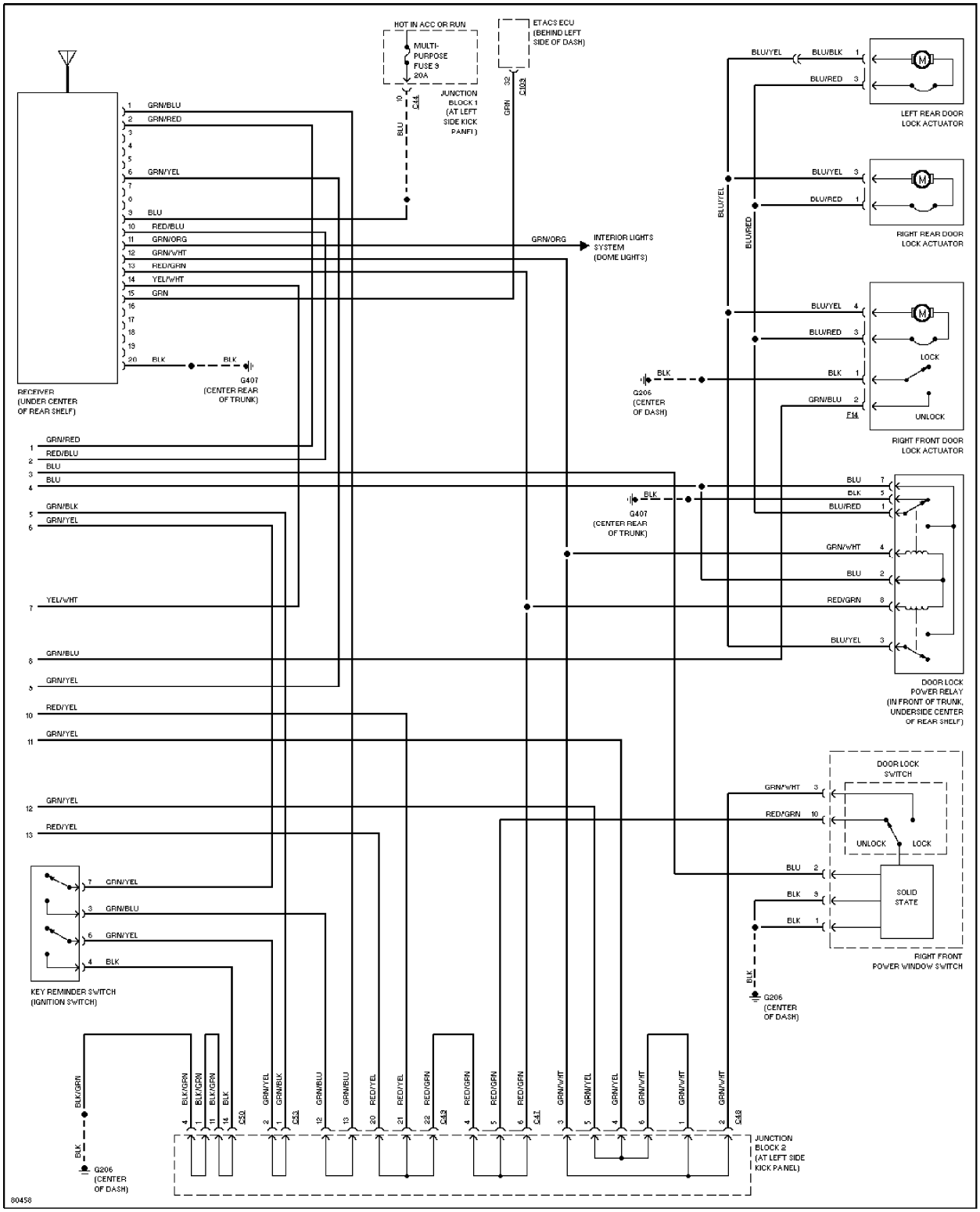


Power Distribution Circuit (2 of 2)

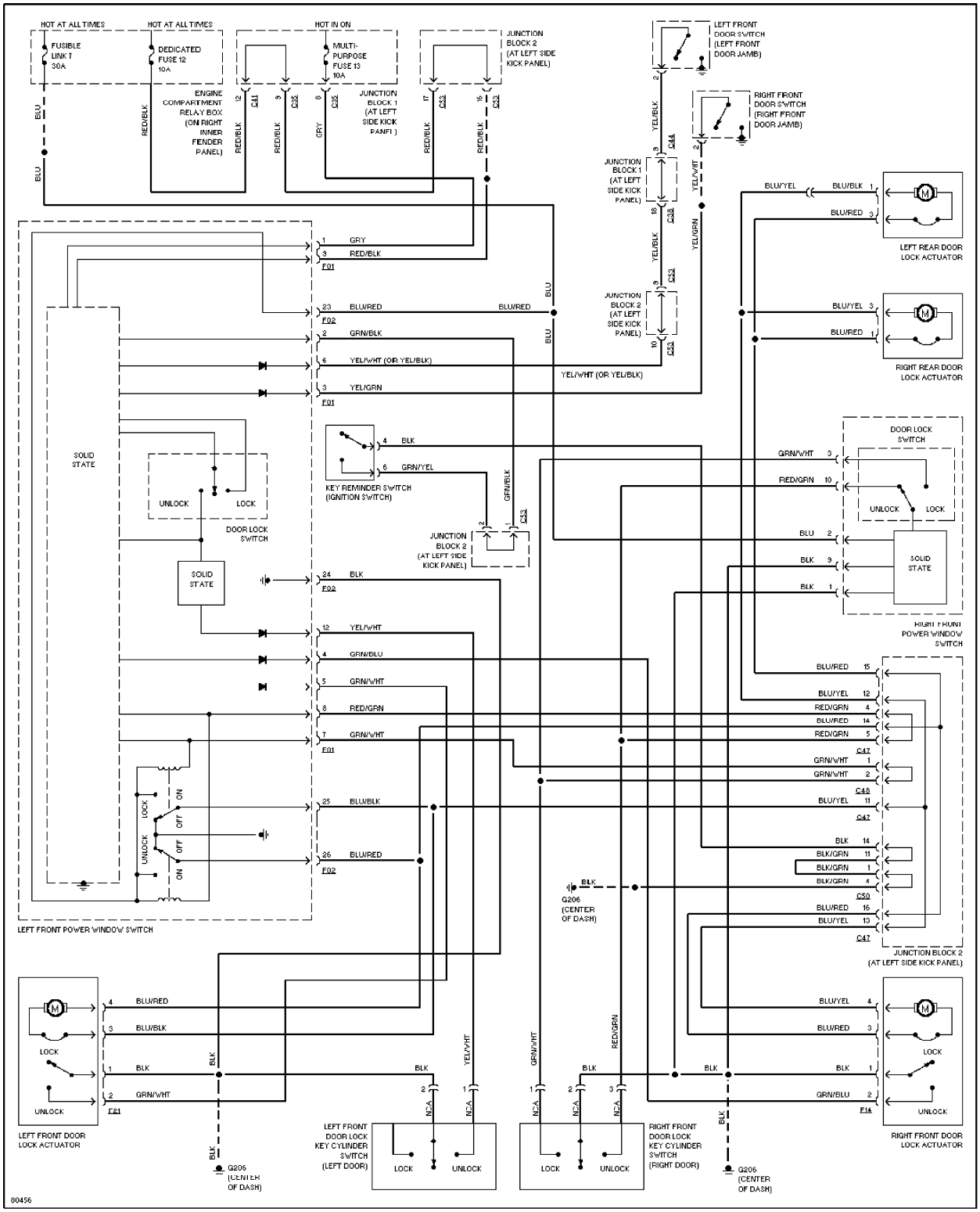
POWER DOOR LOCKS



Power Door Lock Circuit, W/ Keyless Entry (1 of 2)

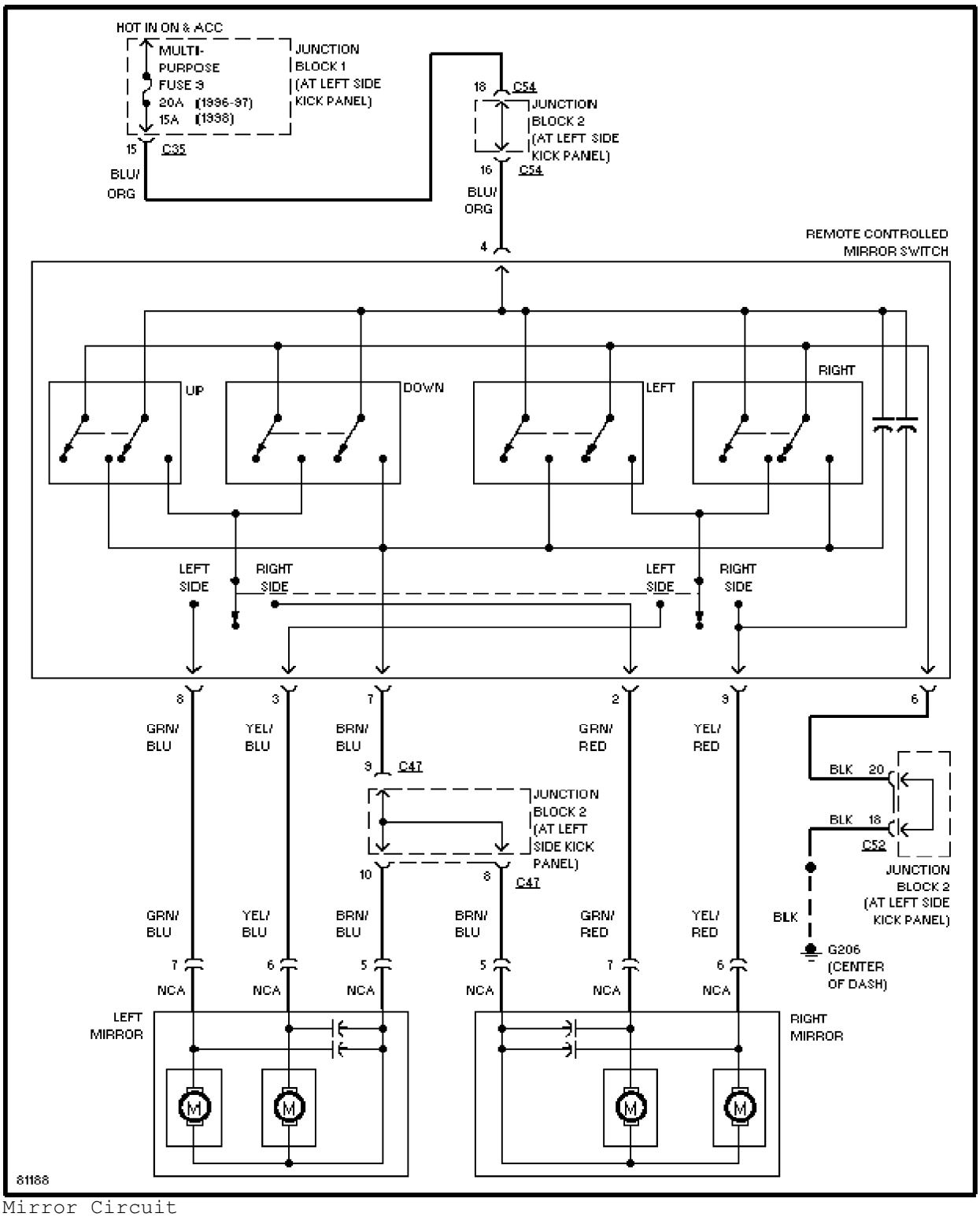


Power Door Lock Circuit, W/ Keyless Entry (2 of 2)



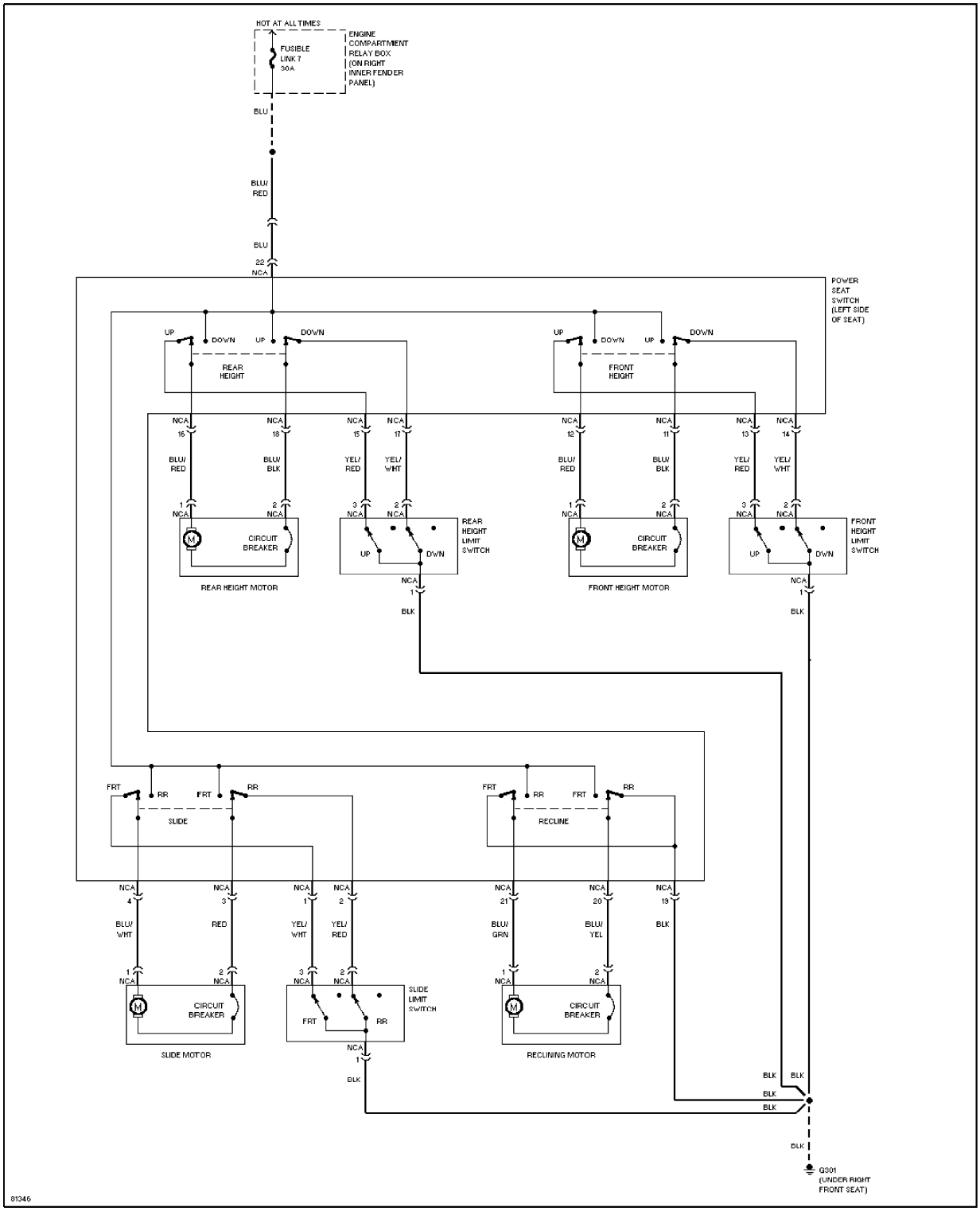
Power Door Lock Circuit, W/O Keyless Entry

POWER MIRRORS



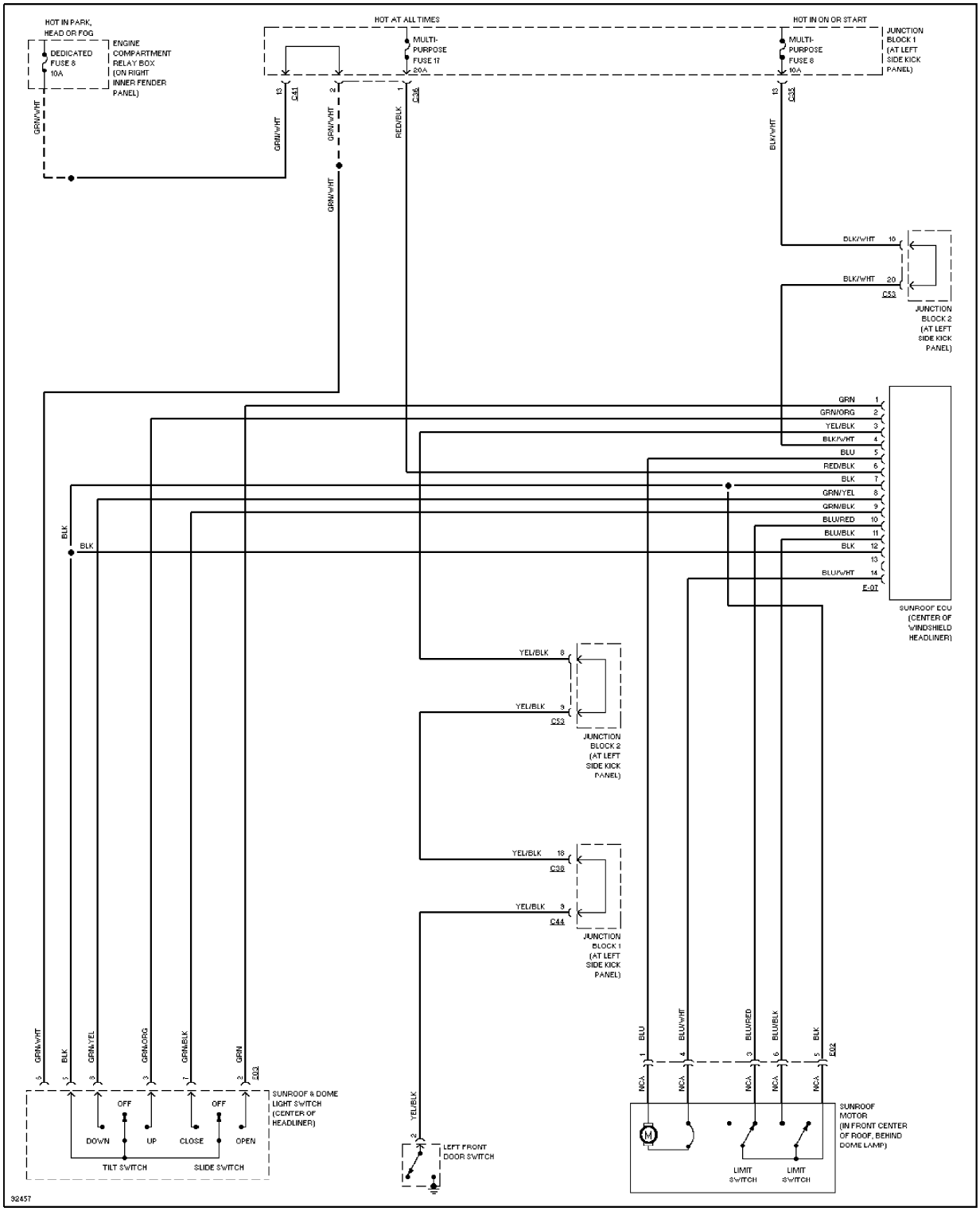
Power Mirror Circuit

POWER SEATS



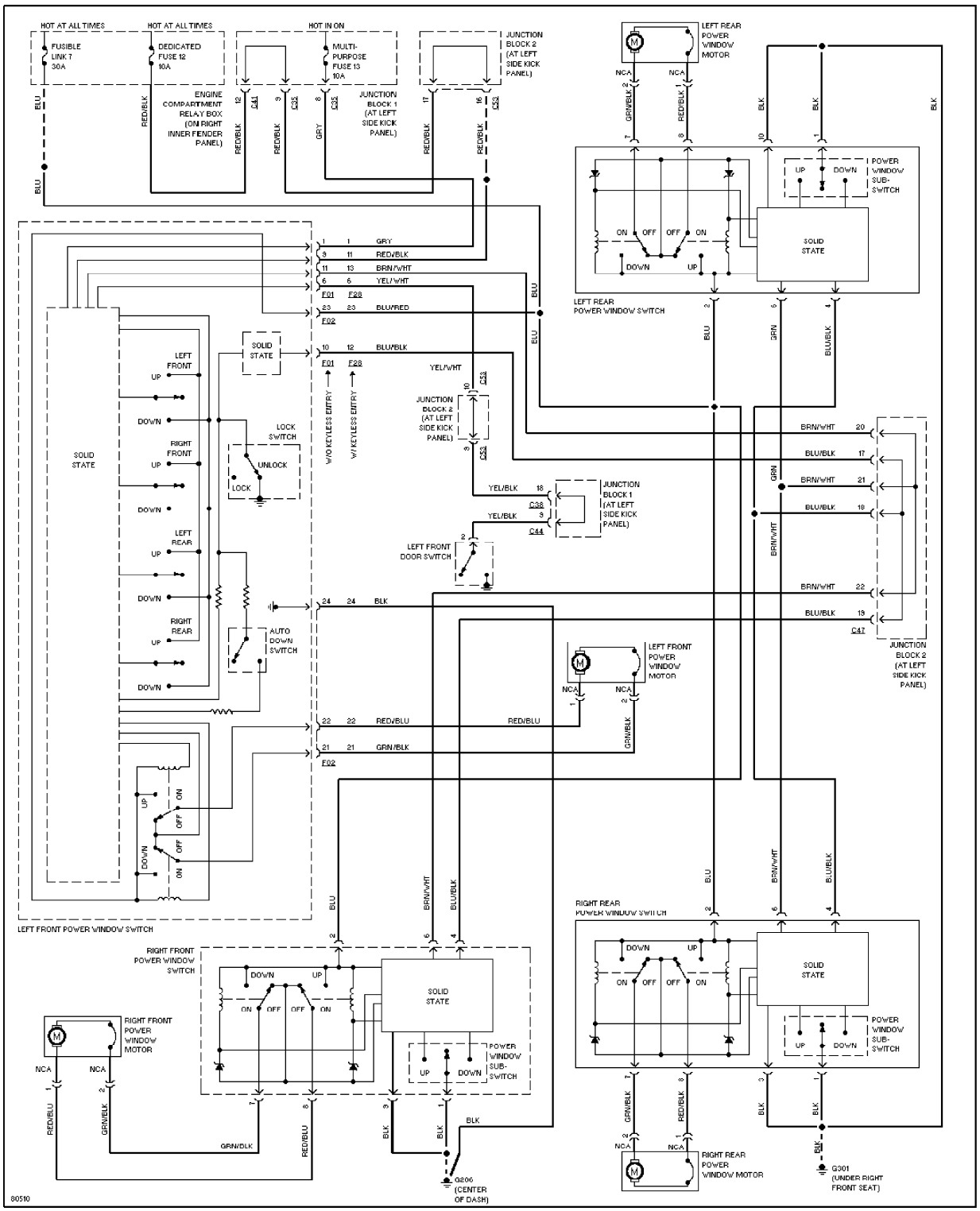
Power Seat Circuits

POWER TOP/SUNROOF



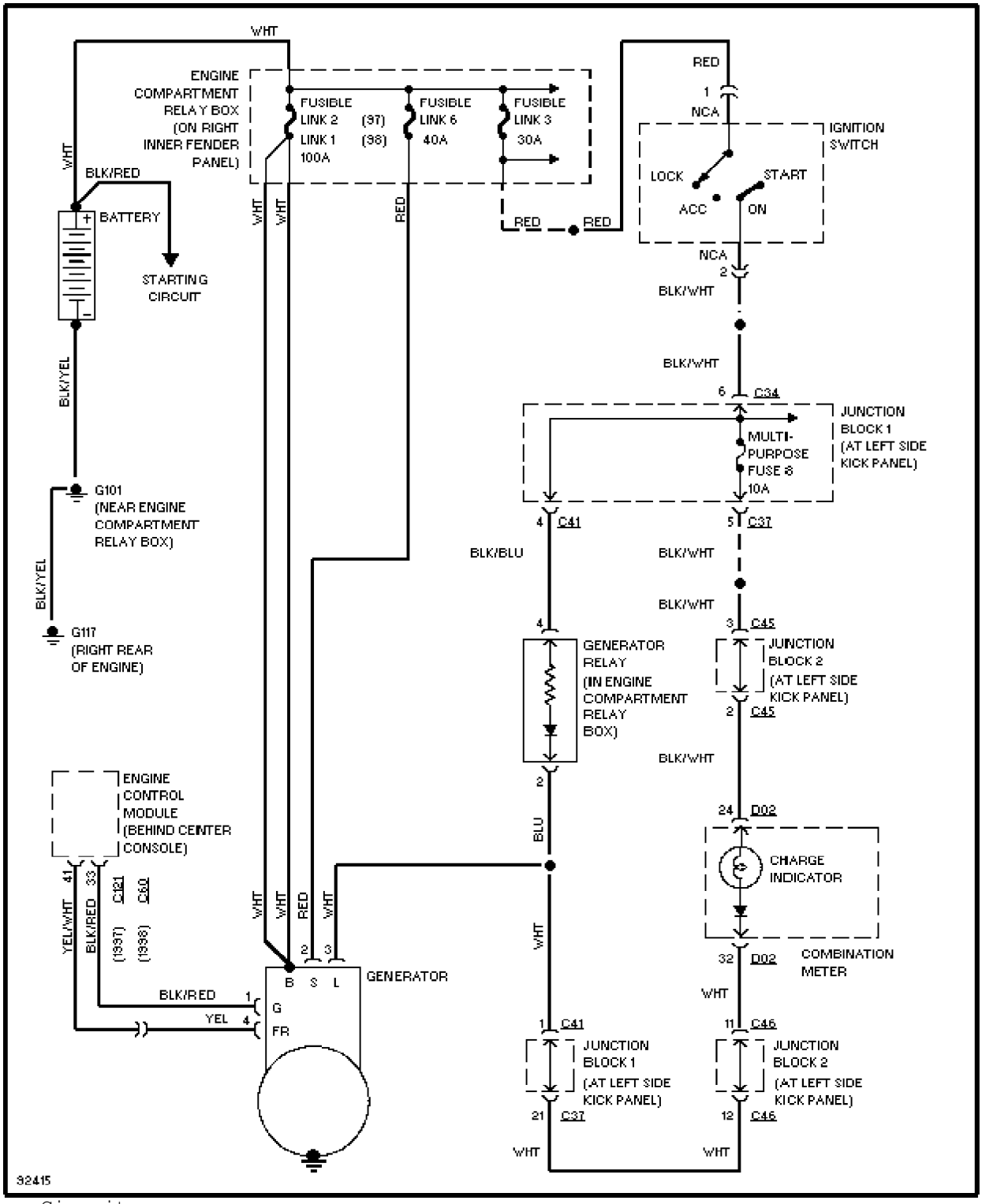
Power Top/Sunroof Circuits

POWER WINDOWS

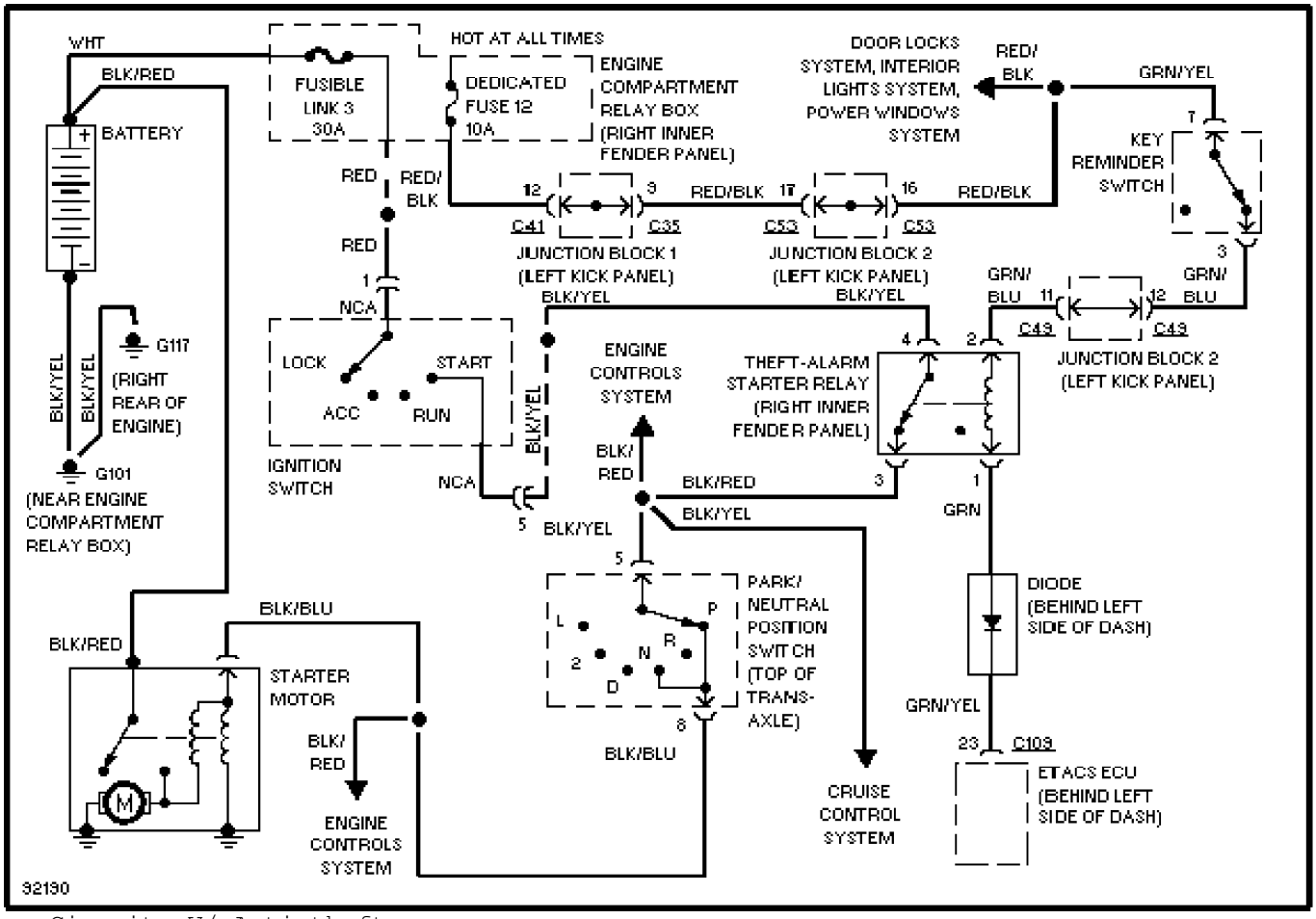


Power Window Circuit

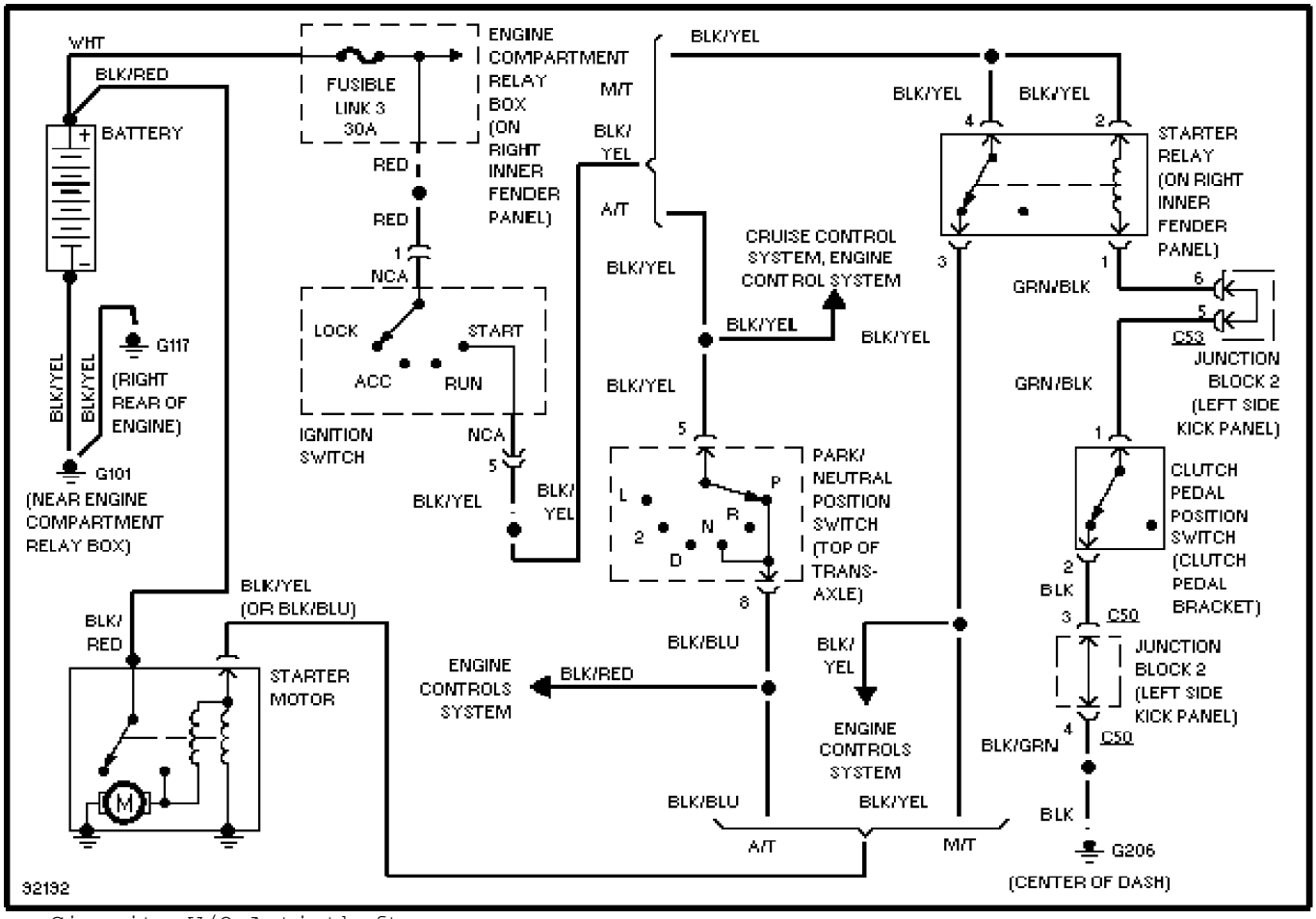
STARTING/CHARGING



Charging Circuit

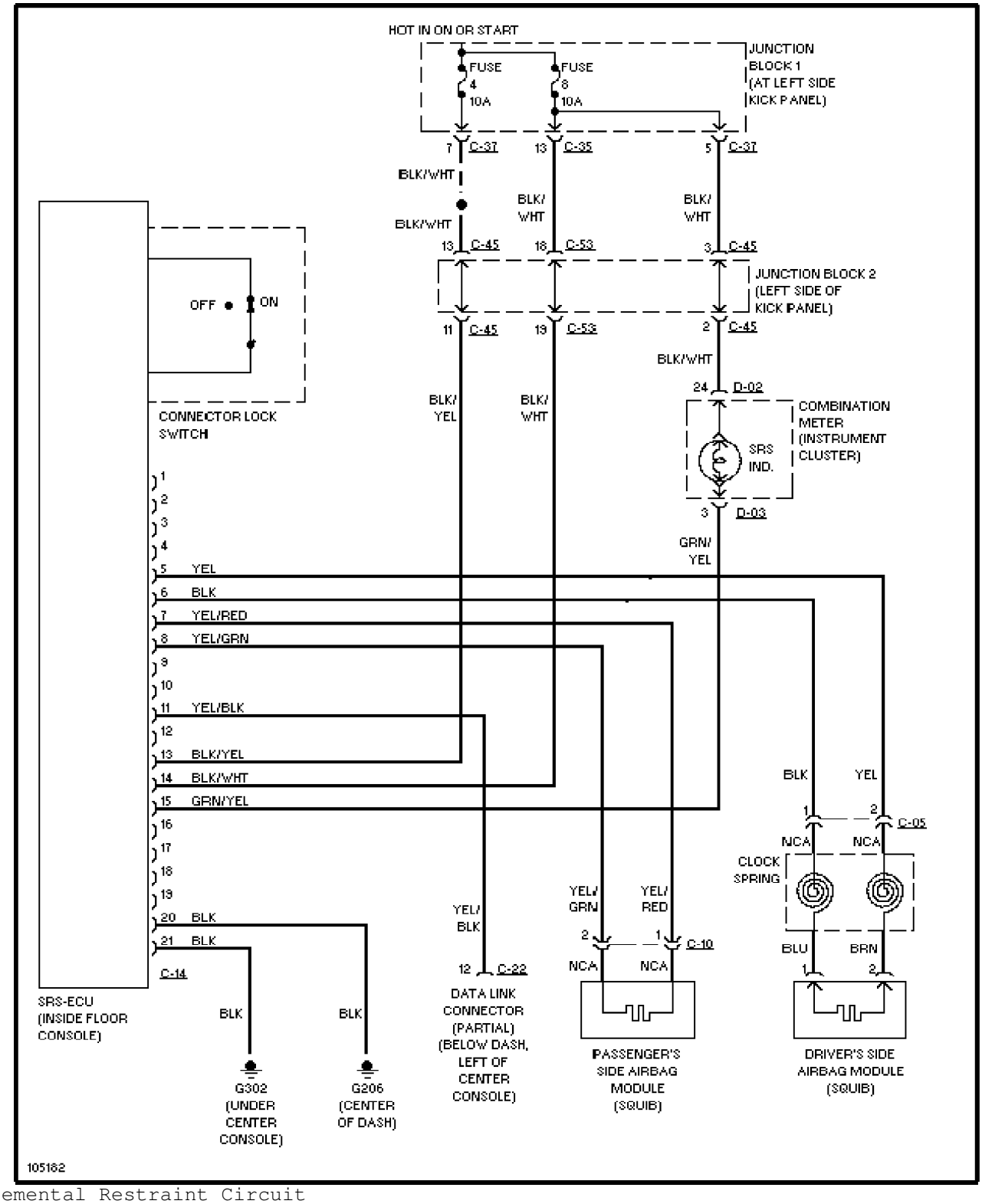


Starting Circuit, W/ Anti-theft



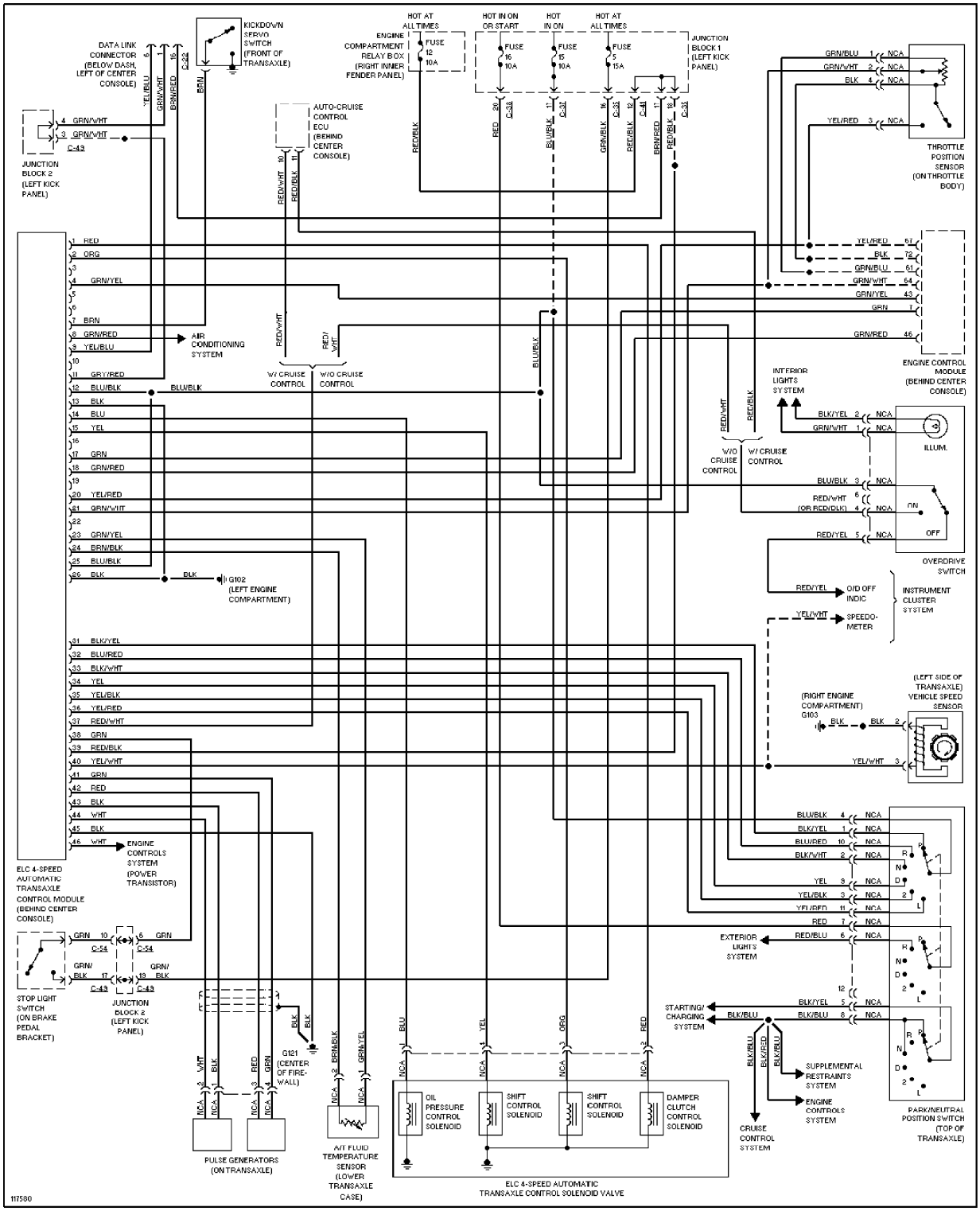
Starting Circuit, W/O Anti-theft

SUPPLEMENTAL RESTRAINTS



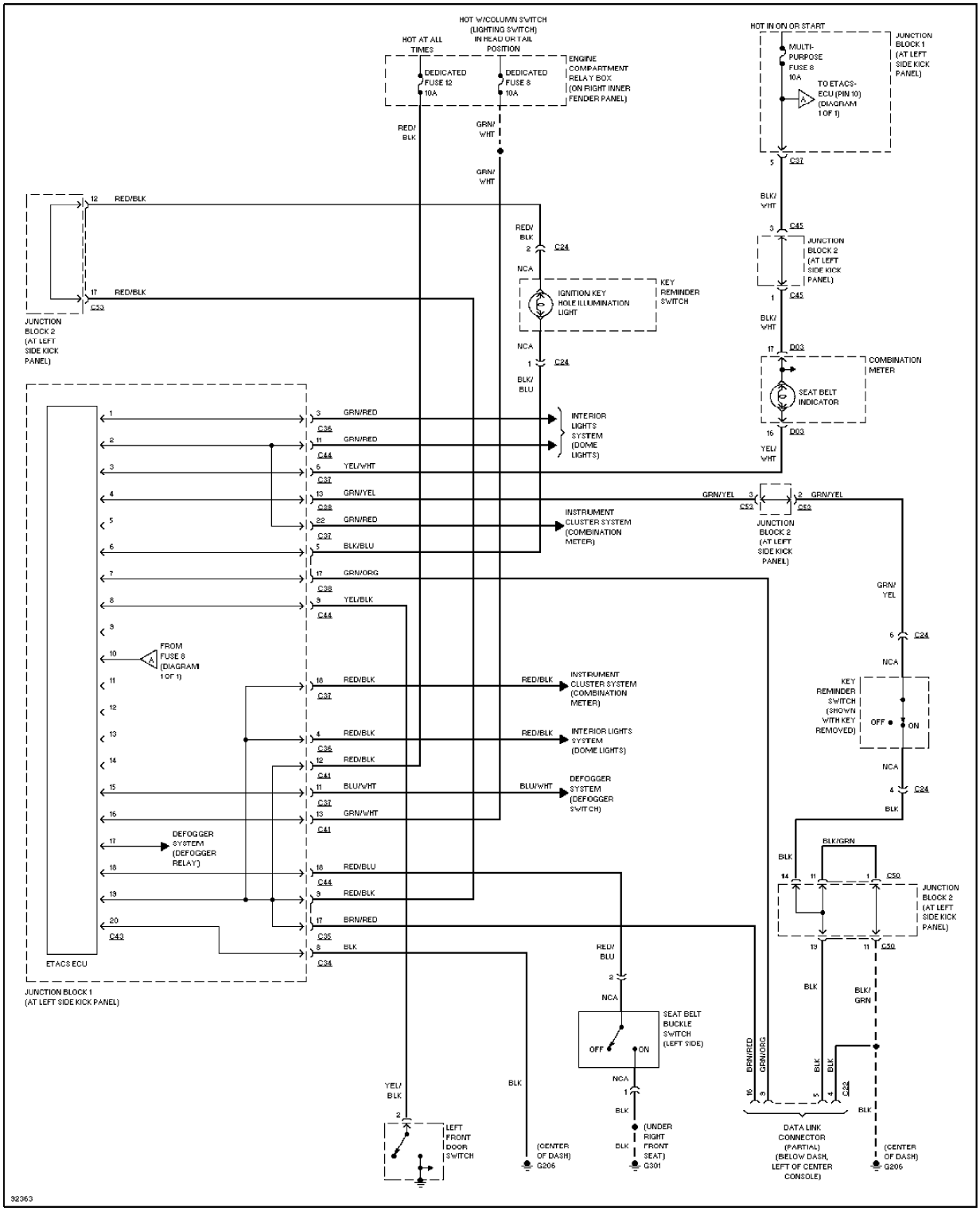
Supplemental Restraint Circuit

TRANSMISSION

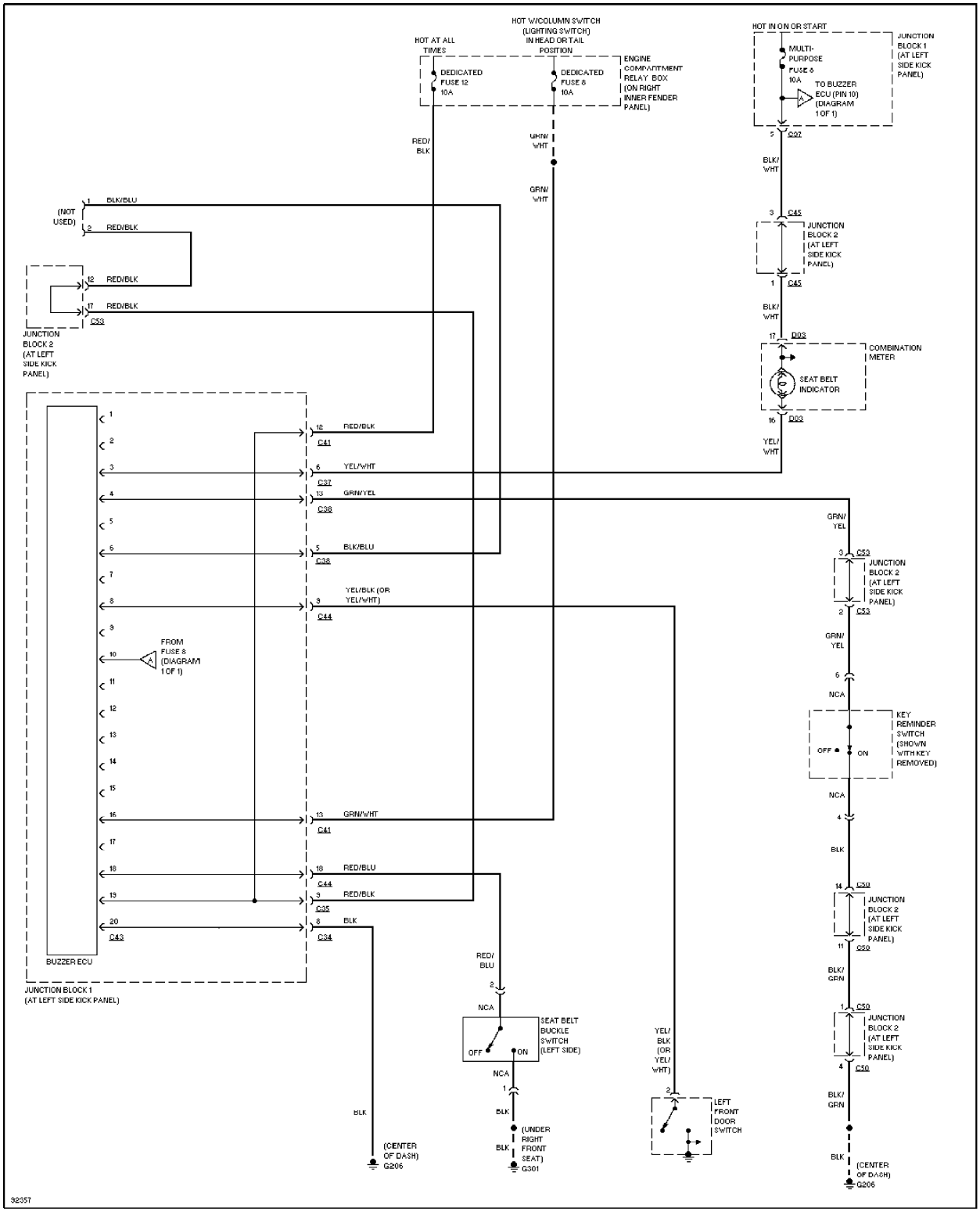


A/T Circuit

WARNING SYSTEMS

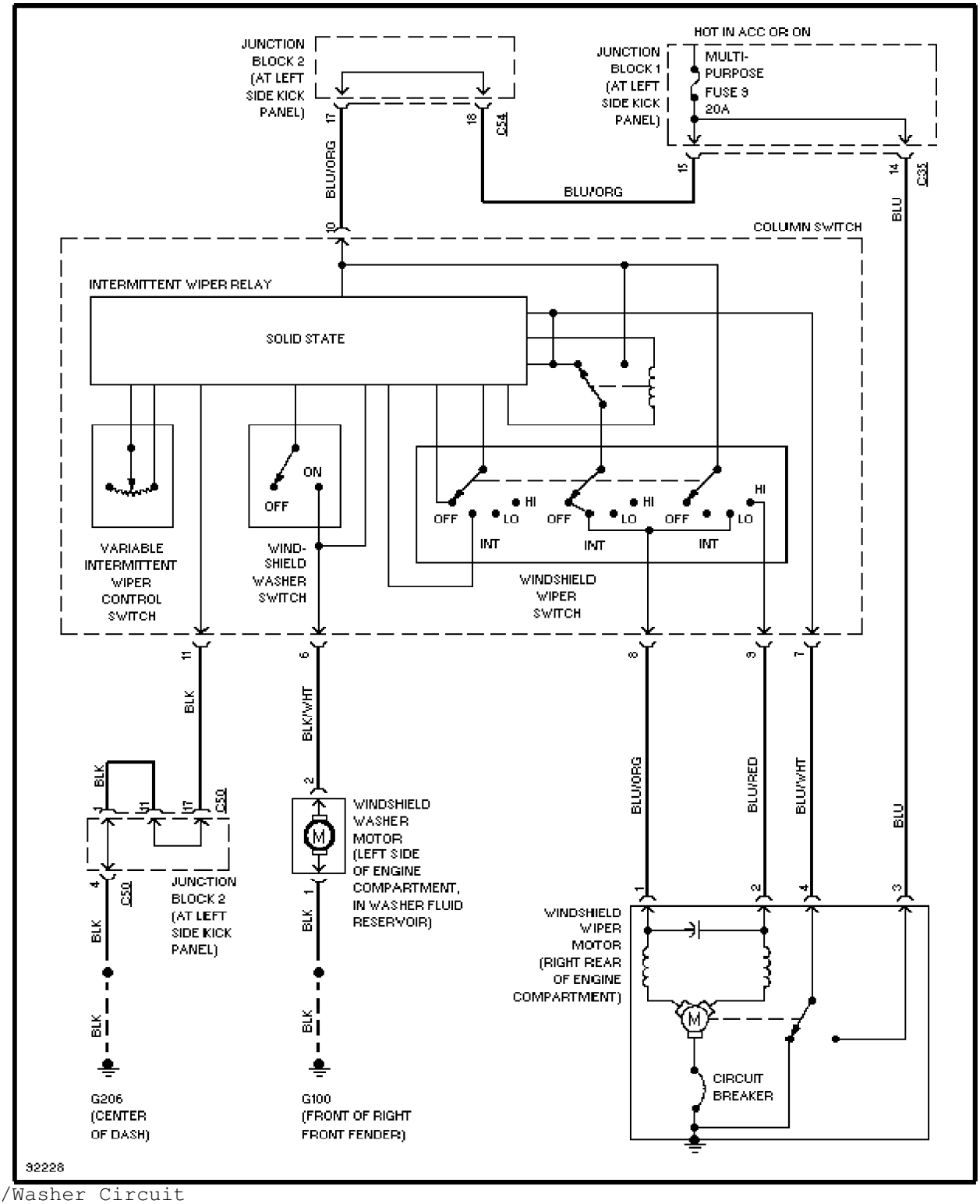


Warning System Circuits, W/ ETACS-ECU



Warning System Circuits, W/O ETACS-ECU

WIPER/WASHER



Wiper/Washer Circuit

HOW TO USE SYSTEM WIRING DIAGRAMS

1998 Mitsubishi Galant

GENERAL INFORMATION
Using Wiring Diagrams

All Models

INTRODUCTION

This CD obtains wiring diagrams and technical service bulletins, containing wiring diagram changes from the domestic and import manufacturers. These are checked for accuracy and are all redrawn into a consistent format for easy use.

In the past, when cars were simpler, diagrams were simpler. All components were connected by wires and diagrams seldom exceeded 4 pages in length. Today, some wiring diagrams require more than 16 pages. It would be impractical to expect a service technician to trace a wire from page 1 across every page to page 16.

Removing some of the wiring maze reduces eyestrain and time wasted searching across several pages. Today the majority of these diagrams follow a much improved format, which permits space for internal switch details.

Wiring diagrams are drawn in a "top-down" format. The diagrams are drawn with the power source at the top of the diagram and the ground point at the bottom of the diagram. Components locations are identified on the wiring diagrams. Any wires that don't connect directly to a component are identified on the diagram to indicate where they go.

COLOR ABBREVIATIONS

COLOR ABBREVIATIONS TABLE

Color	Normal	Optional
Black	BLK	BK
Blue	BLU	BU
Brown	BRN	BN
Clear	CLR	CR
Dark Blue	DK BLU	DK BU
Dark Green	DK GRN	DK GN
Green	GRN	GN
Gray	GRY	GY
Light Blue	LT BLU	LT BU
Light Green	LT GRN	LT GN
Orange	ORG	OG
Pink	PNK	PK
Purple	PPL	PL
Red	RED	RD
Tan	TAN	TN
Violet	VIO	VI
White	WHT	WT
Yellow	YEL	YL

IDENTIFYING WIRING DIAGRAM ABBREVIATIONS

NOTE: Abbreviations used on these diagrams are normally self-explanatory. If necessary see ABBREVIATIONS

article in GENERAL INFORMATION.

IDENTIFYING WIRING DIAGRAM SYMBOLS

NOTE: Standard wiring symbol are used in these diagrams. The illustration below will help clarify any symbols that are not easily understood at a glance. Most components are labeled "Motor", "Switch" or "Relay" in addition to being drawn with the standard symbol.

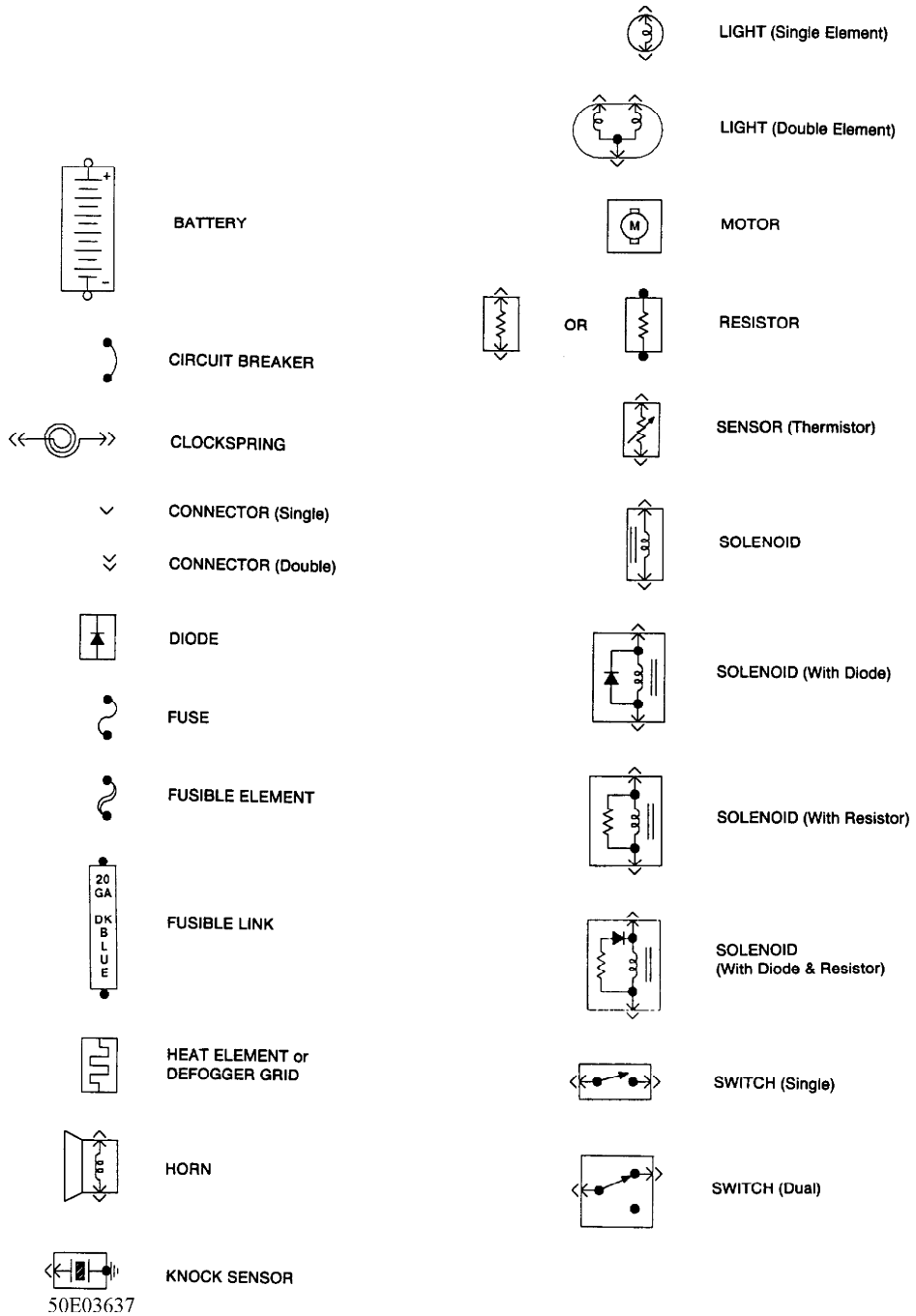


Fig. 1: Identifying Wiring Diagram Symbols

WIRING DIAGRAM COMPONENT LOCATIONS

When trying to locate a component in a wiring diagram and you don't know the specific system where it is located, use this handy component locator to find the system wiring diagram in which the component is located. Then, go to that system and locate the component within the wiring diagram.

For example, if you don't know the specific system in which the ignition switch is located, look up ignition switch in the wiring diagram component location tables and go to the appropriate wiring diagram(s) which contain either full or partial views of the ignition switch. The full view of the ignition switch is located in Power Distribution.

The first listing for the component will be the full or most complete view of the component. Additional listings will be partial views of the component. Not all components are used on all models.

All components will have a partial view in Ground Distribution and Power Distribution. Data Link Connectors show connecting circuits between modules. Alternate names for components may be listed in wiring diagram component locations tables.

WIRING DIAGRAM COMPONENT LOCATIONS TABLE

Component	Wiring Diagram
ABS Electronic Control Unit	Anti-Lock Brakes
	Data Link Connectors
ABS Hydraulic Unit	Anti-Lock Brakes
Acceleration Sensor	Anti-Lock Brakes
Accessory Delay Relay	Power Windows
A/C Compressor Clutch Relay	Engine Performance
A/C Sensor	Engine Performance
A/C Pressure Switch	Engine Performance
Adaptive Lamp Control Module	Exterior Lights
Air Bag(s)	Air Bag Restraint System
Air Bag Module	Air Bag Restraint System
Air Bag Sensor(s)	Air Bag Restraint System
Air Injection Pump Relay	Engine Performance
Air Temperature Sensor	Overhead Console
Alternator (Generator)	Generators & Regulators
Anti-Theft Control Module	Anti-Theft System
	Starters
Autolamp Control Relay	Headlight Systems
	Daytime Running Lights
Automatic Shutdown (ASD) Relay	Engine Performance
	Generators & Regulators
Autostick Switch	Engine Performance
Auxiliary Battery Relay	Generators & Regulators
Back-Up Lights	Back-Up Lights
	Exterior Lights
Barometric (BARO) Pressure Sensor	Engine Performance
Battery	Power Distribution
Battery Temperature Sensor	Engine Performance
Body Control Module	Body Control Computer
	Anti-Theft System
	Daytime Running Lights
	Engine Performance
	Headlight Systems
	Warning Systems
Boost Control Solenoid	Engine Performance
Boost Sensor	Engine Performance
Brake Fluid Level Switch	Analog Instrument Panels

Brake On/Off (BOO) Switch ..... Cruise Control Systems
Engine Performance
Shift Interlock Systems
Buzzer Module ..... Warning Systems
Camshaft Position (CMP) Sensor ..... Engine Performance
Central Control Module ..... Anti-Theft System
Clockspring ..... Air Bag Restraint System
Cruise Control Systems
Steering Column Switches
Clutch Pedal Position Switch ..... Starters
Clutch Start Switch ..... Starters
Combination Meter ..... Analog Instrument Panels
Constant Control Relay Module (CCRM) ..... Engine Performance
Electric Cooling Fans
Convenience Center ..... Power Distribution
Illumination/Interior Lights
Convertible Top Motor ..... Power Convertible Top
Convertible Top Switch ..... Power Convertible Top
Crankshaft Position (CKP) Sensor ..... Engine Performance
Cruise Control Module ..... Cruise Control Systems
Cruise Control Switch ..... Cruise Control Systems
Condenser Fan Relay(s) ..... Electric Cooling Fans
Data Link Connector (DLC) ..... Engine Performance
Daytime Running Lights Module ..... Daytime Running Lights
Exterior Lights
Defogger Relay ..... Rear Window Defogger
Diagnostic Energy Reserve Module (DERM) ... Air Bag Restraint System
Discriminating Sensor (Air Bag) ..... Air Bag Restraint System
Distributor ..... Engine Performance
Door Lock Actuators ..... Power Door Locks
Remote Keyless Entry
Door Lock Relay(s) ..... Power Door Locks
Electrochromic Mirror ..... Power Mirrors
Electronic Level Control (ELC)
Height Sensor ..... Electronic Suspension
Electronic Level Control (ELC) Module ..... Electronic Suspension
Engine Coolant Temperature (ECT)
Sending Unit ..... Analog Instrument Panels
Engine Coolant Temperature (ECT) Sensor ..... Engine Performance
Engine Control Module ..... Engine Performance
Generators & Regulators
Starters
ETACS ECU ..... Warning Systems
Power Windows
Remote Keyless Entry
Evaporative (EVAP) Emissions Canister ..... Engine Performance
EVAP Canister Purge Solenoid ..... Engine Performance
EVAP Canister Vent Solenoid ..... Engine Performance
Exhaust Gas Recirculation (EGR) Valve ..... Engine Performance
Fuel Tank Vacuum Sensor ..... Engine Performance
Fog Lights ..... Headlight Systems
Daytime Running Lights
Fog Light Relay ..... Headlight Systems
Daytime Running Lights
Fuel Door Release Solenoid ..... Power Fuel Door Release
Fuel Gauge Sending Unit ..... Analog Instrument Panels
Fuel Injectors ..... Engine Performance
Fuel Pump ..... Engine Performance
Fuel Pump Relay ..... Engine Performance
Power Distribution
Fuse/Relay Block ..... Power Distribution
Fusible Links ..... Power Distribution
Generators & Regulators

Starters
Generator ..... Generators & Regulators
Engine Performance
Power Distribution
Generic Electronic Module (GEM) ..... Body Control Modules
Electronic Suspension
Glow Plug Relay ..... Engine Performance
Glow Plugs ..... Engine Performance
Grounds ..... Ground Distribution
Headlight Door Module ..... Headlight Doors
Headlight Relay ..... Headlight Systems
Daytime Running Lights
Headlights ..... Headlight Systems
Daytime Running Lights
Heated Oxygen Sensor(s) (HO2S) ..... Engine Performance
Heated Windshield Control Module ..... Heated Windshields
Height Sensor ..... Electronic Suspension
Horns ..... Steering Column Switches
Horn Relay ..... Steering Column Switches
Idle Air Control (IAC) Motor/Valve ..... Engine Performance
Ignition Coil(s) ..... Engine Performance
Ignition Key Lock Cylinder ..... Anti-Theft System
Ignition Module ..... Engine Performance
Ignition Switch ..... Power Distribution
Engine Performance
Generators & Regulators
Starters
Illuminated Entry Module ..... Illumination/Interior Lights
Illumination Lights ..... Illumination/Interior Lights
Impact Sensor ..... Air Bag Restraint System
Inertia Fuel Shutoff Switch ..... Engine Performance
Inhibit Relay ..... Starters
Instrument Cluster ..... Analog Instrument Panels
Intake Air Temperature (IAT) Sensor ..... Engine Performance
Interior Lights ..... Illumination/Interior Lights
Interlock Switch ..... Starters
Junction Block ..... Power Distribution
Keyless Entry Receiver ..... Remote Keyless Entry
Key Reminder Switch ..... Starters
Knock Sensor ..... Engine Performance
Lamp Control Module ..... Exterior Lights
License Plate Lamp ..... Exterior Lights
Lighting Control Module ..... Lighting Control Modules
Anti-Theft System
Daytime Running Lights
Headlight Systems
Lower Relay ..... Power Convertible Top
Malfunction Indicator Light (MIL) ..... Engine Performance
Instrument Panels
Manifold Absolute Pressure (MAP) Sensor ..... Engine Performance
Mass Airflow (MAF) Sensor ..... Engine Performance
Mega Fuse ..... Generators & Regulators
Memory Seat/Mirror Module ..... Memory Systems
Mirror Defogger ..... Rear Window Defogger
Moon Roof Motor ..... Power Moon Roof
Moon Roof Relay ..... Power Moon Roof
Multi-Function Control Module ..... Warning Systems
Neutral Safety Switch ..... Starters
Oil Level Switch ..... Engine Performance
Oil Pressure Switch/Sending Unit ..... Analog Instrument Panels
Engine Performance
Overhead Console ..... Overhead Console
Oxygen Sensor(s) (O2S) ..... Engine Performance

Parking Brake Switch ..... Analog Instrument Panels
Park Lights ..... Exterior Lights
Park/Neutral Position Switch ..... Starters
Engine Performance
Anti-Theft System
Body Control Module
Perimeter Lighting Control Relay ..... Exterior Lights
Power Amplifier ..... Power Antennas
Power Antenna Module ..... Power Antennas
Power Antenna Motor ..... Power Antennas
Power Distribution Center ..... Power Distribution
Generators & Regulators
Starters
Power Door Lock Motors ..... Power Door Locks
Power Mirror Motors ..... Power Mirrors
Memory Systems
Power Sliding Door Controller ..... Power Sliding Side Door
Power Seat Motors ..... Power Seats
Memory Systems
Power Steering Pressure Switch ..... Engine Performance
Power Top Motor ..... Power Convertible Top
Power Top Relay(s) ..... Power Convertible Top
Powertrain Control Module ..... Engine Performance
Analog Instrument Panels
Cruise Control Systems
Data Link Connectors
Generators & Regulators
Starters
Power Window Motors ..... Power Windows
Power Window Relay(s) ..... Power Windows
Radiator Fan Motor(s) ..... Electric Cooling Fans
Radiator Fan Relay(s) ..... Engine Performance
Electric Cooling Fans
Rainsense Module ..... Wiper/Washer Systems
Raise Relay ..... Power Convertible Top
Remote Anti-Theft Personality (RAP) Module ..... Anti-Theft System
Starters
Warning Systems
Seat Belt Pretensioners ..... Air Bag Restraint System
Seat Belt Retractor Solenoid ..... Passive Restraints
Seat Belt Switch ..... Air Bag Restraint System
Passive Restraints
Shift Interlock Solenoid ..... Shift Interlock Systems
Shift Lock Actuator ..... Shift Interlock Systems
Side Marker Lights ..... Exterior Lights
SIR Coil Assembly (Clockspring) ..... Air Bag Restraint System
Slip Ring (Clockspring) ..... Air Bag Restraint System
Steering Column Switches
SRS Control Module ..... Air Bag Restraint System
Starter Motor ..... Starters
Starter Interrupt Relay ..... Starters
Starter Solenoid ..... Starters
Starter Relay ..... Starters
Steering Wheel Position Sensor ..... Anti-Lock Brakes
Stoplights ..... Exterior Lights
Stoplight Switch ..... Engine Performance
Cruise Control Systems
Anti-Lock Brakes
Sun Roof ECU ..... Power Sun Roof
Sun Roof Motor ..... Power Sun Roof
Sun Roof Position Sensor ..... Power Sun Roof
Taillights ..... Exterior Lights
Throttle Position (TP) Sensor ..... Engine Performance

Torque Converter Clutch Solenoid/Switch ..... Engine Performance
Traction Control Switch ..... Anti-Lock Brakes
Trailer Tow Connector ..... Exterior Lights
Trailer Tow Relay ..... Exterior Lights
Transmission/Transaxle ..... Engine Performance
Transmission Control Module (TCM) ..... Engine Performance
Starters
Transmission Range Sensor ..... Starters
Back-Up Lights
Engine Performance
Transmission Range Switch ..... Back-Up Lights
Engine Performance
Anti-Theft System
Turn Signal Flasher ..... Exterior Lights
Turn Signal Lights ..... Exterior Lights
Twilight Sentinel Switch ..... Headlight Systems
Daytime Running Lights
Vapor Canister Leak Detection Pump ..... Engine Performance
Vehicle Control Module (VCM) ..... Engine Performance
Vehicle Dynamic Module ..... Electronic Suspension
Vehicle Speed Control Servo ..... Cruise Control Systems
Vehicle Speed Sensor ..... Data Link Connectors
Analog Instrument Panels
Cruise Control Systems
Electronic Suspension
Voltage Regulator ..... Generators & Regulators
Water-In-Fuel Sensor ..... Engine Performance
Analog Instrument Panels
Wheel Speed Sensors ..... Anti-Lock Brakes
Window Timer Module ..... Power Convertible Top
Windshield Intermittent Wiper Relay ..... Wiper/Washer Systems
Windshield Washer Motor ..... Wiper/Washer Systems
Wiper Motor ..... Wiper/Washer Systems

G - TESTS W/CODES - 2.0L TURBO & 2.4L

1998 Mitsubishi Galant

1998 ENGINE PERFORMANCE
Mitsubishi - Self-Diagnostics

Eclipse 2.0L Turbo & 2.4L, Galant

INTRODUCTION

* PLEASE READ THIS FIRST *

NOTE: If no faults were found while performing BASIC DIAGNOSTIC PROCEDURES, proceed with self-diagnostics in this article. If no Diagnostic Trouble Codes (DTCs) or only pass codes are present after entering self-diagnostics, proceed to H - TESTS W/O CODES article for diagnosis by symptom (i.e., ROUGH IDLE, NO START, etc.).

SYSTEM DIAGNOSIS

NOTE: PCM diagnostic memory is retained by direct power supply from battery. Memory is not erased by turning off ignition, but it will be erased if battery or PCM is disconnected.

System diagnosis can be accomplished using a scan tool. See ENTERING ON-BOARD DIAGNOSTICS. Powertrain Control Module (PCM) monitors several different engine control system circuits. If an abnormal input signal occurs, a Diagnostic Trouble Code (DTC) is stored in PCM memory and assigned a DTC number. Each circuit has its own DTC number and message. A specific DTC indicates a particular system failure, but does not indicate that cause of failure is necessarily within system.

A DTC does not condemn any specific component; it simply points out a probable malfunctioning area. If a DTC is set, PCM will turn on MIL. System failures encountered are identified as either hard failures or intermittent failures as determined by PCM.

Hard Failures

Hard failures cause MIL to come on and remain on until failure is repaired. If MIL comes on and remains on (MIL may flash) during vehicle operation, cause of failure may be determined by using appropriate DTC diagnostic procedure. See TROUBLE CODE DEFINITION. If a sensor fails, PCM will use a substitute value in its calculations to continue engine operation. In this condition (limp-in mode), vehicle is functional, but loss of good driveability may result.

Intermittent Failures

Intermittent failures may cause MIL to flicker, or come on and go out after intermittent DTC goes away. However, corresponding DTC will be retained in PCM memory. If related DTC does not reoccur within a certain time frame, related DTC will be erased from PCM memory. Intermittent failures may be caused by a sensor, connector or wiring problems. See INTERMITTENTS in H - TESTS W/O CODES article.

The PCM also records and stores engine operating conditions when malfunction occurred. This information is referred to as freeze frame data. If malfunction is an engine misfire, or fuel system rich or fuel system lean condition, freeze frame data will be updated with the most current information regarding these failures. Freeze frame data recorded is:

* Fuel System Status

* Load Value (Displayed As Percent)
* Engine Coolant Temperature
* Short Term Fuel Trim (Displayed As Percent)
* Long Term Fuel Trim (Displayed As Percent)
* MAP Vacuum
* Engine RPM
* Vehicle Speed Sensor
* DTC During Data Recording

SELF-DIAGNOSTIC SYSTEM

SERVICE PRECAUTIONS

Before proceeding with diagnosis, following precautions must be observed:

* Ensure vehicle has a fully charged battery and functional charging system.
* Visually inspect connectors and circuit wiring being worked on.
* DO NOT disconnect battery or PCM. This will erase any DTCs stored in PCM.
* DO NOT cause short circuits when performing electrical tests. This will set additional DTCs, making diagnosis of original problem more difficult.
* DO NOT use a test light in place of a voltmeter.
* When checking for spark, ensure coil wire is NOT more than 1/4" from chassis ground. If coil wire is more than 1/4" from chassis ground, damage to vehicle electronics and/or PCM may result.
* DO NOT prolong testing of fuel injectors. Engine may hydrostatically (liquid) lock.
* When a vehicle has multiple DTCs, always repair lowest number DTC first.

VISUAL INSPECTION

Most driveability problems in the engine control system result from faulty wiring, poor electrical connections or leaking air and vacuum hose connections. To avoid unnecessary component testing, perform a visual inspection before beginning self-diagnostic tests.

ENTERING ON-BOARD DIAGNOSTICS

NOTE: DO NOT skip any steps in self-diagnostic tests or incorrect diagnosis may result. Ensure self-diagnostic test applies to vehicle being tested.

DTCs may be retrieved by using a scan tool only. Proceed to DTC retrieval method.

NOTE: Although other scan tools are available, Mitsubishi recommends using Multi-Use Tester II (MUT II) scan tool.

Using Scan Tool

1) Refer to manufacturer’s operation manual for instructions in use of scan tool. Before entering on-board diagnostics, see SERVICE PRECAUTIONS. Locate Data Link Connector (DLC) under instrument panel, near steering column.

2) Turn ignition switch to OFF position. Connect scan tool to DLC. Turn ignition switch to ON position. Read and record scan tool self-diagnostic output. Proceed to TROUBLE CODE DEFINITION.

TROUBLE CODE DEFINITION

When DTC is obtained, refer to appropriate DTC test procedure.

DIAGNOSTIC TROUBLE CODES (DTCS)

NOTE: DTCs can only be retrieved by using a scan tool. Listed DTCs are retrieved using a generic scan tool. MUT II scan tool can be used, but it may not read all DTCs. DTCS listed are not used on all vehicles.

DTC P0100
Volume Airflow (VAF) circuit failure. Possible causes are: connector or harness, or faulty VAF sensor.

DTC P0105
Barometric (BARO) pressure circuit failure. Possible causes are: connector or harness, or faulty BARO pressure sensor.

DTC P0105
Manifold Absolute Pressure (MAP) circuit failure. Possible causes are: connector or harness, or faulty MAP sensor.

DTC P0110
Intake Air Temperature (IAT) circuit failure. Possible causes are: connector or harness, or faulty VAF sensor.

DTC P0115
Engine Coolant Temperature (ECT) circuit failure. Possible causes are: connector or harness, or faulty ECT sensor.

DTC P0120
Throttle Position (TP) circuit failure. Possible causes are: connector or harness, or faulty TP sensor.

DTC P0125
Excessive time to enter closed loop fuel control. Possible causes are: faulty front HO2S, HO2S connector or harness, or faulty fuel injector.

DTC P0130
Front Heated Oxygen Sensor (HO2S) circuit failure. Possible causes are: connector or harness, or faulty HO2S.

DTC P0135
Front Heated Oxygen Sensor (HO2S) heater circuit failure. Possible causes are: connector or harness, or faulty HO2S.

DTC P0136
Rear Heated Oxygen Sensor (HO2S) circuit failure. Possible causes are: connector or harness, or faulty HO2S.

DTC P0141
Rear Heated Oxygen Sensor (HO2S) heater circuit failure. Possible causes are: connector or harness, or faulty HO2S.

DTC P0150
Heated Oxygen Sensor (HO2S) circuit failure (bank 2, sensor 1). Possible causes are: connector or harness, or HO2S.

DTC P0155
Heated Oxygen Sensor (HO2S) heater circuit failure (bank 2, sensor 1). Possible causes are: connector or harness, or HO2S.

DTC P0156
Heated Oxygen Sensor (HO2S) circuit failure (bank 2, sensor 2). Possible causes are: connector or harness, or HO2S.

DTC P0161
Heated Oxygen Sensor (HO2S) heater circuit failure (bank 2, sensor 2). Possible causes are: connector or harness, or HO2S.

DTC P0170
Fuel trim failure (bank 1). Possible causes are: intake air leaks, cracked exhaust manifold, faulty VAF sensor frequency, HO2S, injector, fuel pressure, ECT, IAT or BARO pressure sensor.

DTC P0173
Fuel trim failure (bank 2). Possible causes are: intake air leaks, cracked exhaust manifold, faulty VAF sensor frequency, HO2S, injector, fuel pressure, ECT, IAT or BARO pressure sensor.

DTC P0201
Cylinder No. 1 injector circuit failure. Possible causes are: connector or harness, or faulty injector.

DTC P0202
Cylinder No. 2 injector circuit failure. Possible causes are: connector or harness, or faulty injector.

DTC P0203
Cylinder No. 3 injector circuit failure. Possible causes are: connector or harness, or faulty injector.

DTC P0204
Cylinder No. 4 injector circuit failure. Possible causes are: connector or harness, or faulty injector.

DTC P0205
Cylinder No. 5 injector circuit failure. Possible causes are: connector or harness, or faulty injector.

DTC P0206
Cylinder No. 6 injector circuit failure. Possible causes are: connector or harness, or faulty injector.

DTC P0300
Random misfire detected. Possible causes are: connector or harness, faulty ignition coil, ignition power transistor, spark plug, ignition circuit, injector, HO2S, compression pressure, timing belt, air intake system, fuel pressure, or CKP sensor.

DTC P0301
Cylinder No. 1 misfire detected. Possible causes are: connector or harness, faulty ignition coil, ignition power transistor, spark plug, ignition circuit, injector, HO2S, compression pressure, timing belt, air intake system, fuel pressure, or CKP sensor.

DTC P0302
Cylinder No. 2 misfire detected. Possible causes are: connector or harness, faulty ignition coil, ignition power transistor, spark plug, ignition circuit, injector, HO2S, compression pressure, timing belt, air intake system, fuel pressure, or CKP sensor.

DTC P0303
Cylinder No. 3 misfire detected. Possible causes are: connector or harness, faulty ignition coil, ignition power transistor, spark plug, ignition circuit, injector, HO2S, compression pressure, timing belt, air intake system, fuel pressure, or CKP sensor.

DTC P0304
Cylinder No. 4 misfire detected. Possible causes are: connector or harness, faulty ignition coil, ignition power transistor, spark plug, ignition circuit, injector, HO2S, compression pressure, timing belt, air intake system, fuel pressure, or CKP sensor.

DTC P0305
Cylinder No. 5 misfire detected. Possible causes are: connector or harness, faulty ignition coil, ignition power transistor, spark plug, ignition circuit, injector, HO2S, compression pressure, timing belt, air intake system, fuel pressure, or CKP sensor.

DTC P0306
Cylinder No. 6 misfire detected. Possible causes are: connector or harness, faulty ignition coil, ignition power transistor, spark plug, ignition circuit, injector, HO2S, compression pressure, timing belt, air intake system, fuel pressure, or CKP sensor.

DTC P0325
Knock Sensor (KS) circuit failure. Possible causes are: connector or harness, or faulty KS.

DTC P0335
Crankshaft Position (CKP) sensor circuit failure. Possible causes are: connector or harness, or faulty CKP sensor.

DTC P0340
Camshaft Position (CMP) sensor circuit failure. Possible causes are: connector or harness, or faulty CMP sensor.

DTC P0400
Exhaust Gas Recirculation (EGR) flow failure. Possible causes are: connector or harness, faulty EGR valve, EGR solenoid, EGR valve control vacuum, or manifold differential pressure sensor.

DTC P0403
Exhaust Gas Recirculation (EGR) solenoid failure. Possible causes are: connector or harness, or faulty EGR solenoid.

DTC P0420
Catalyst efficiency below threshold. Possible causes are: cracked exhaust manifold, or faulty catalytic converter.

DTC P0421
Warm-up catalyst efficiency below threshold (bank 1). Possible causes are: faulty exhaust manifold. If exhaust manifold is okay, replace catalytic converter.

DTC P0431
Warm-up catalyst efficiency below threshold (bank 2). Possible causes are: faulty exhaust manifold. If exhaust manifold is okay, replace catalytic converter.

DTC P0442
Evaporative (EVAP) emission control system leak detected. Possible causes are: connector or harness, faulty EVAP purge solenoid,

purge control valve, or vacuum hose routing.

DTC P0443
Evaporative (EVAP) purge control valve circuit failure. Possible causes are: connector or harness, or faulty EVAP solenoid.

DTC P0446
Evaporative (EVAP) emission control system vent control failure. Possible causes are: connector or harness, faulty EVAP vent solenoid.

DTC P0450
Evaporative (EVAP) emission control system pressure sensor failure. Possible causes are: connector or harness, or faulty fuel tank differential pressure sensor.

DTC P0455
Evaporative (EVAP) emission control system large leak detected. Possible causes are: connector or harness, faulty EVAP purge solenoid, purge control valve, or vacuum hose routing.

DTC P0500
Vehicle Speed Sensor (VSS) failure. Possible causes are: connector or harness, or faulty VSS.

DTC P0505
Idle Air Control (IAC) system failure. Possible causes are: connector or harness, or faulty IAC motor.

DTC P0510
Closed Throttle Position (TP) switch failure. Possible causes are: connector or harness, or faulty closed TP switch.

DTC P0551
Power Steering Pressure (PSP) sensor failure. Possible causes are: connector or harness, or faulty PSP sensor.

DTC P0705
Automatic transaxle/transmission range sensor circuit failure. Possible causes are: connector or harness, or faulty PNP switch.

DTC P0710
Automatic transaxle/transmission fluid sensor failure. Possible causes are: connector or harness, or faulty transaxle/transmission sensor.

DTC P0715
Automatic transaxle input/turbine speed sensor circuit failure. Possible causes are: connector or harness, or pulse generator.

DTC P0720
Automatic transaxle input/turbine speed sensor circuit failure. Possible causes are: connector or harness, or pulse generator.

DTC P0725
Engine speed input circuit failure. Possible causes are: connector or harness.

DTC P0740
Torque converter clutch system failure. Possible causes are:

connector or harness, or torque converter clutch solenoid.

DTC P0750
Shift solenoid "A" failure. Possible causes are: connector or harness, or low-reverse solenoid.

DTC P0755
Shift solenoid "B" failure. Possible causes are: connector or harness, or underdrive solenoid.

DTC P0760
Shift solenoid "C" failure. Possible causes are: connector or harness, or second solenoid.

DTC P0765
Shift solenoid "D" failure. Possible causes are: connector or harness, or overdrive solenoid.

DTC P1103
Turbocharger wastegate actuator failure. Possible causes are: connector or harness, faulty wastegate solenoid or actuator, or vacuum hose routing.

DTC P1104
Turbocharger wastegate solenoid failure. Possible causes are: connector or harness, or faulty wastegate solenoid.

DTC P1105
Fuel pressure solenoid failure. Possible causes are: connector or harness, or faulty fuel pressure solenoid.

DTC P1400
Manifold Differential Pressure (MDP) sensor circuit failure. Possible causes are: connector or harness, or faulty MDP sensor.

DTC P1500
Generator FR terminal circuit failure. Possible causes are: connector or harness.

DTC P1600
Serial communication link failure. Possible causes are: connector or harness.

DTC P1715
Pulse Generator (PG) failure. Possible causes are: connector or harness, or faulty PG.

DTC P1750
Solenoid failure. Possible causes are: connector or harness, faulty converter clutch solenoid, shift control solenoid, or pressure control solenoid.

DTC P0751
Automatic transaxle control relay failure. Possible causes are: connector or harness, or automatic transaxle relay.

DTC P1791
Engine coolant temperature level input circuit (to TCM) failure. Possible causes are: connector or harness.

DTC P1795
Throttle position input circuit failure. Possible causes are: connector or harness.

CLEARING DTCS

CAUTION: When battery is disconnected, vehicle computer and memory systems may lose memory data. Driveability problems may exist until computer systems have completed a relearn cycle.

To clear DTCs using a scan tool, refer to owners manual supplied with scan tool. If scan tool is not available, DTCs may also be cleared by disconnecting negative battery cable or PCM for at least 15 seconds, allowing PCM to clear DTCs. Reconnect negative battery cable and check for DTCs to confirm repair.

PCM LOCATION

PCM LOCATION TABLE

Application	Location
Eclipse & Galant	Behind Center Console

SUMMARY

If no hard DTCs (or only pass DTCs) are present, driveability symptoms exist, or intermittent DTCs exist, proceed to H - TESTS W/O CODES article for diagnosis by symptom (i.e., ROUGH IDLE, NO START, etc.) or intermittent diagnostic procedures.

TERMINAL IDENTIFICATION

NOTE: The following terminals are shown as viewed from component side of connector. Vehicles are equipped with different combinations of components. Not all components are used on all models. To determine component usage, see appropriate wiring diagram in L - WIRING DIAGRAMS article.

TERMINAL IDENTIFICATION DIRECTORY TABLE

Connector	See
ASD/Fuel Pump/MFI Relay	Fig. 1
CKP/CMP Sensor	Fig. 2, 3 or 4
DLC	Fig. 5
ECT Sensor	Fig. 6
EVAP Purge Solenoid	Fig. 7 or 8
EVAP Vent Solenoid	Fig. 9
Fuel Injector	Fig. 10
Fuel Pump	Fig. 11 or 12
Fuel Pump Control/Relay Module	Fig. 13
FTDP Sensor	Fig. 14
Generator Field	Fig. 15
HO2S	Fig. 16
IAC Motor	Fig. 17 or 18
Ignition Coil	Fig. 19
Ignition Failure Sensor	Fig. 20
Ignition Power Transistor	Fig. 21
KS	Fig. 22
MDP Sensor	Fig. 23
PCM	Fig. 24 or 25
PNP Switch	Fig. 26

Starter Relay	Fig. 27 or 28
TCM	Fig. 29
TP Sensor	Fig. 30
VAF Sensor	Fig. 31
VIC Valve Position Sensor	Fig. 32
VSS	Fig. 33

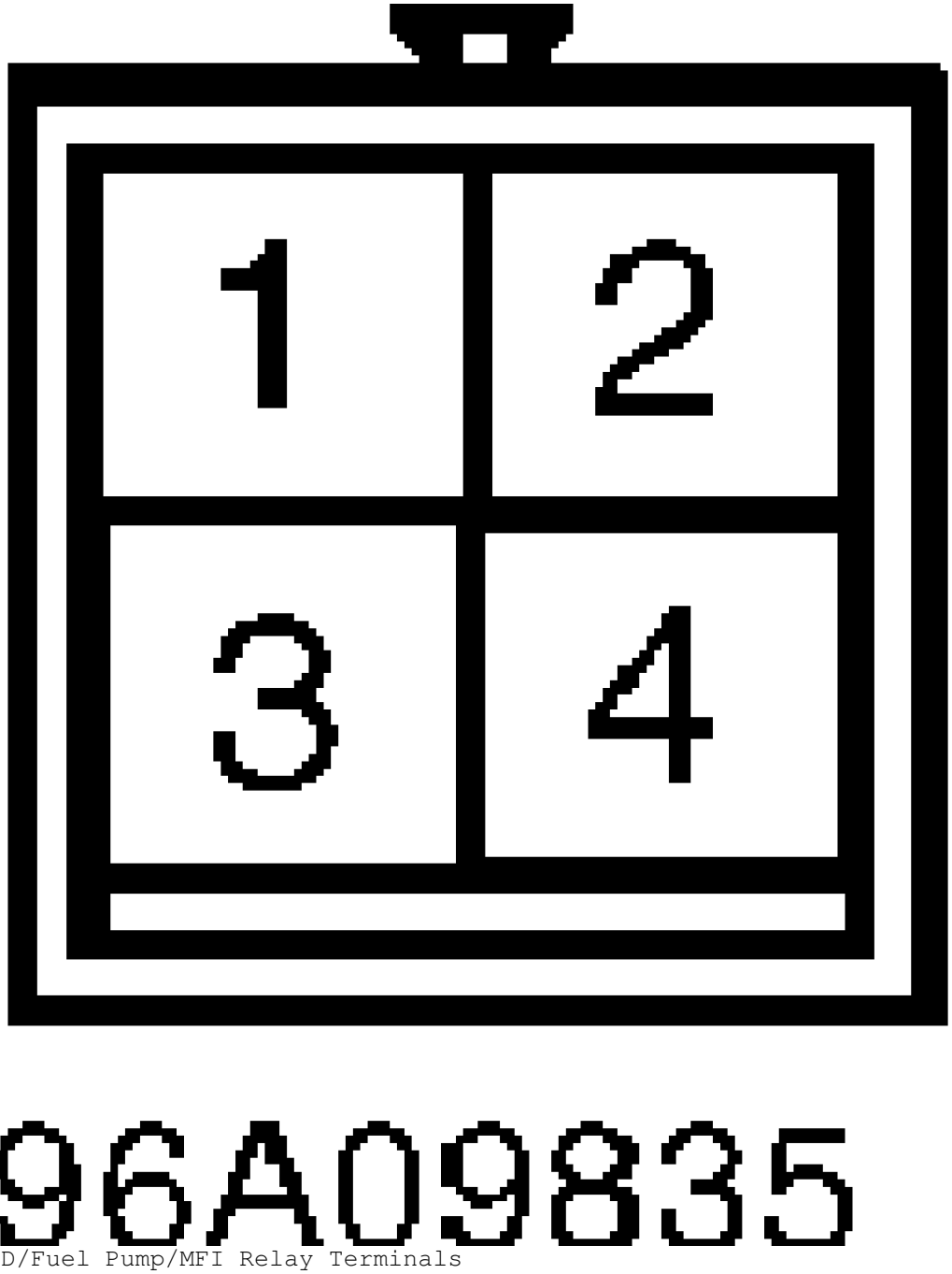


Fig. 1: ASD/Fuel Pump/MFI Relay Terminals
Courtesy of Mitsubishi Motor Sales of America

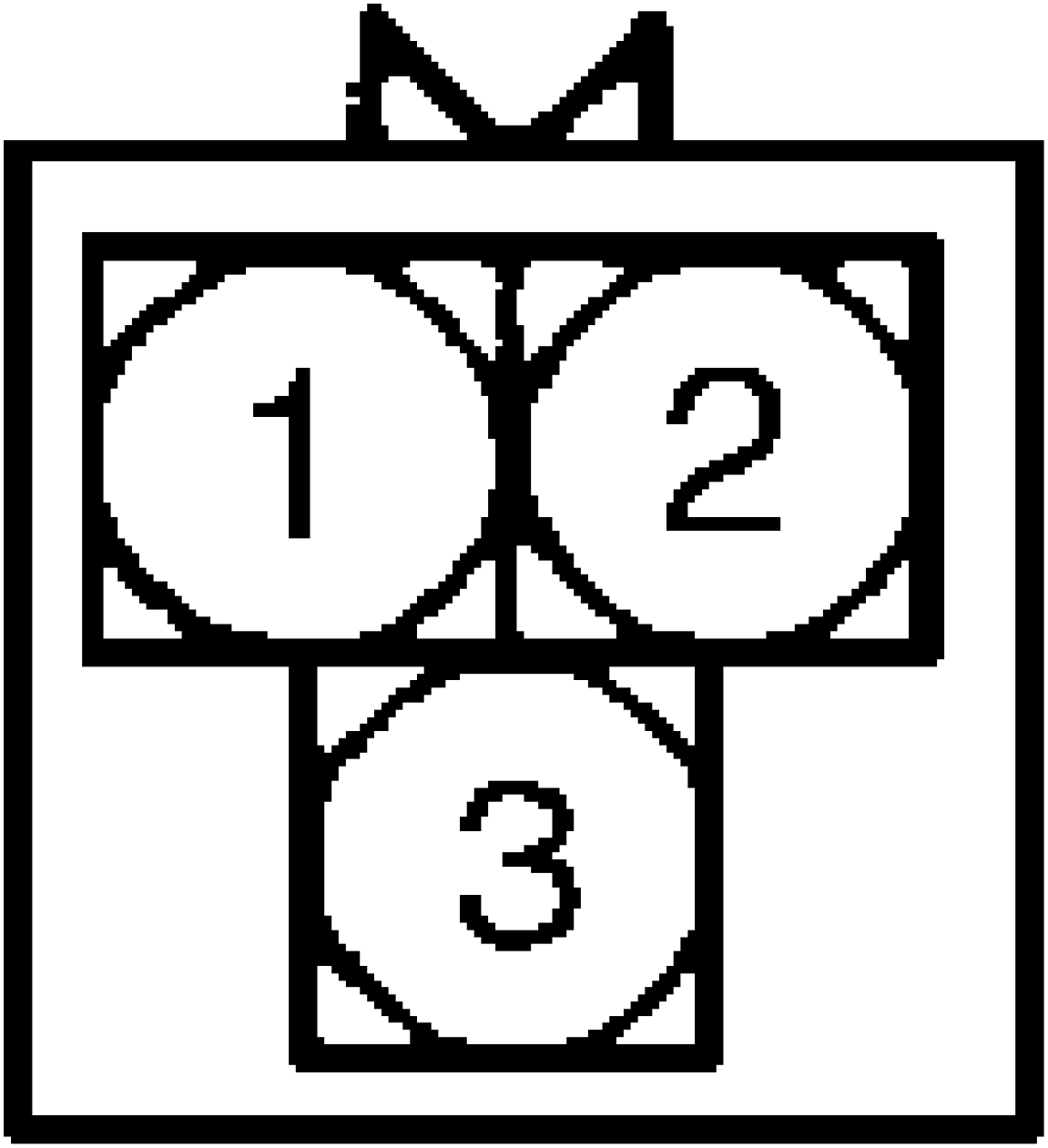


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Fig. 2: CKP Terminals
Courtesy of Mitsubishi Motor Sales of America

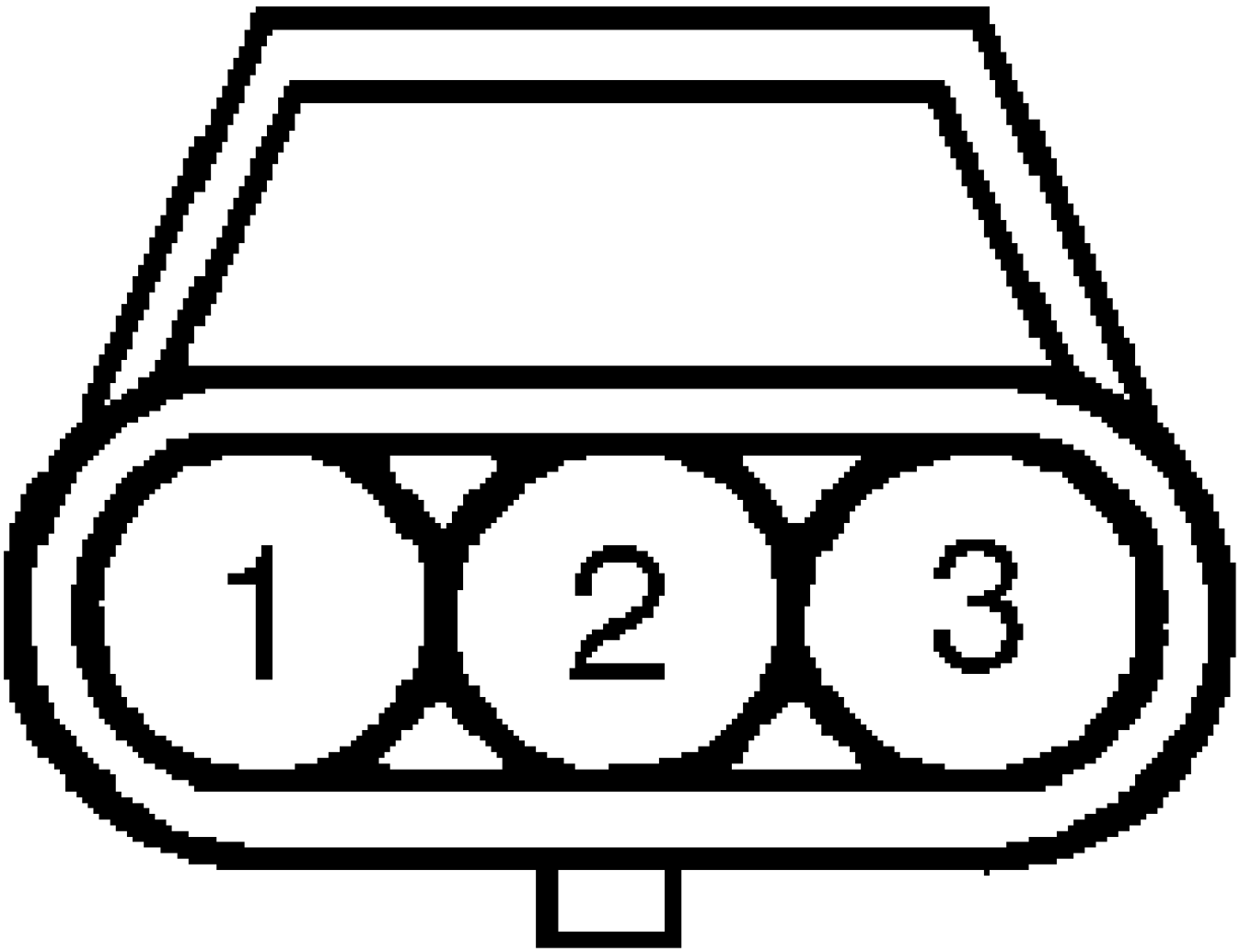

Fig. 3: CMP Terminals (Eclipse 2.0L Turbo & 2.4L)
Courtesy of Mitsubishi Motor Sales of America

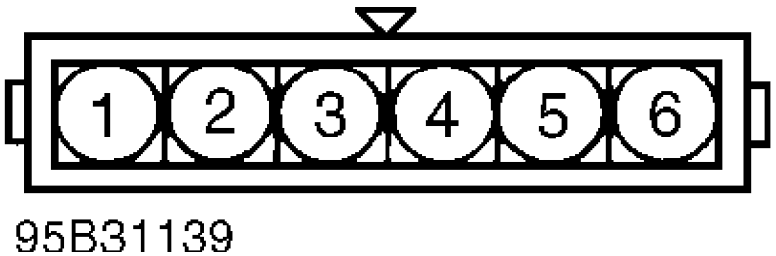

Fig. 4: CMP Terminals (Galant)
Courtesy of Mitsubishi Motor Sales of America

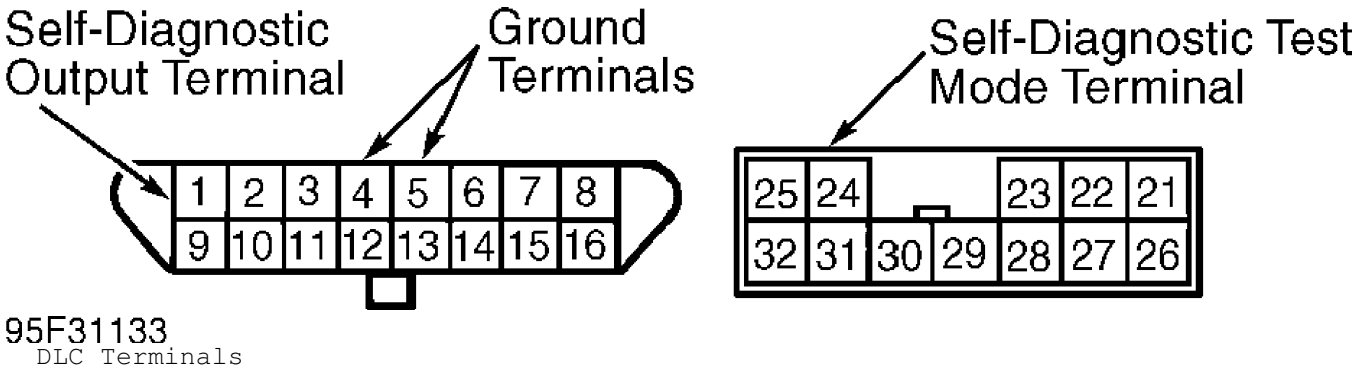

Fig. 5: DLC Terminals
Courtesy of Mitsubishi Motor Sales of America

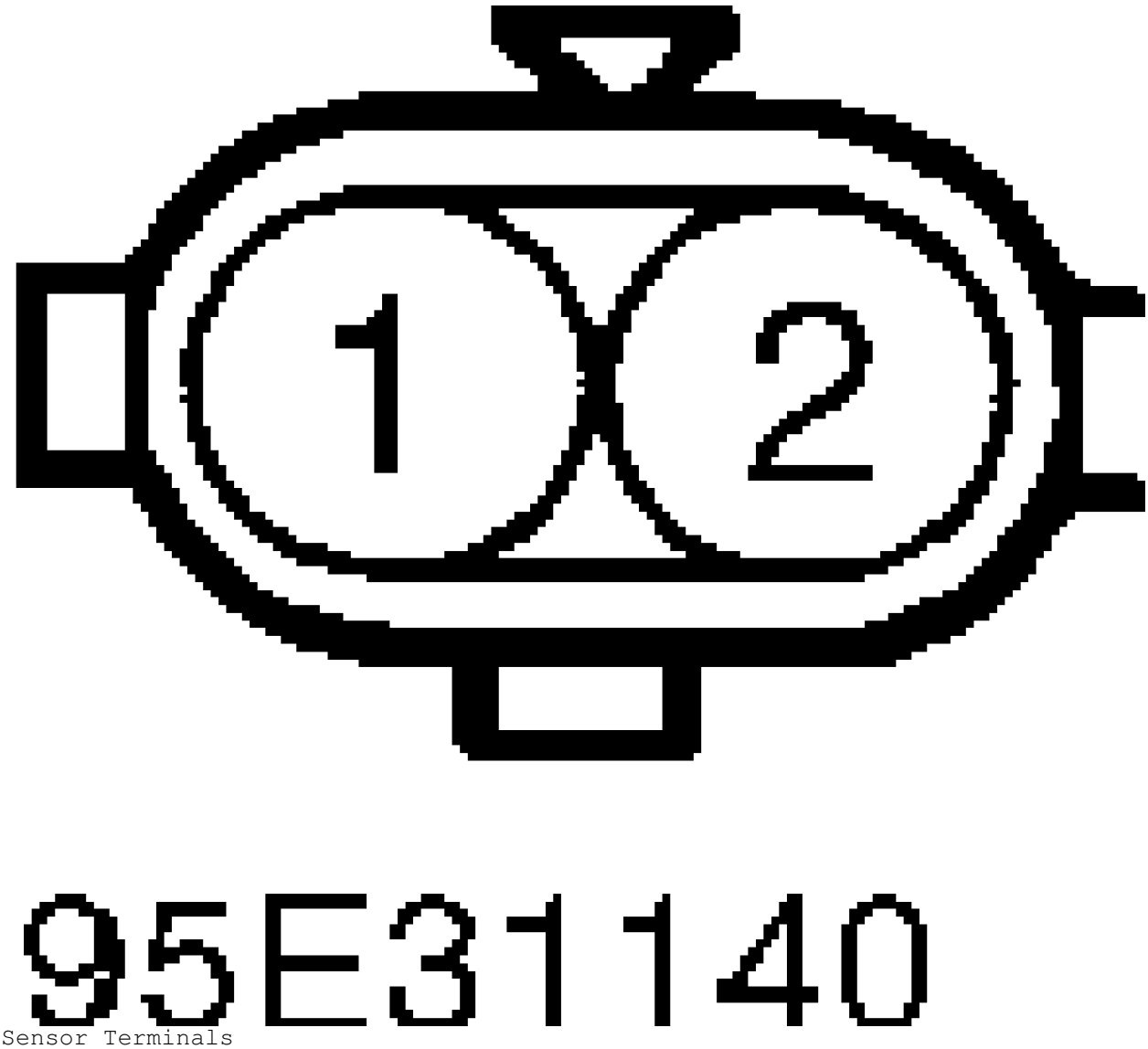

Fig. 6: ECT Sensor Terminals
Courtesy of Mitsubishi Motor Sales of America

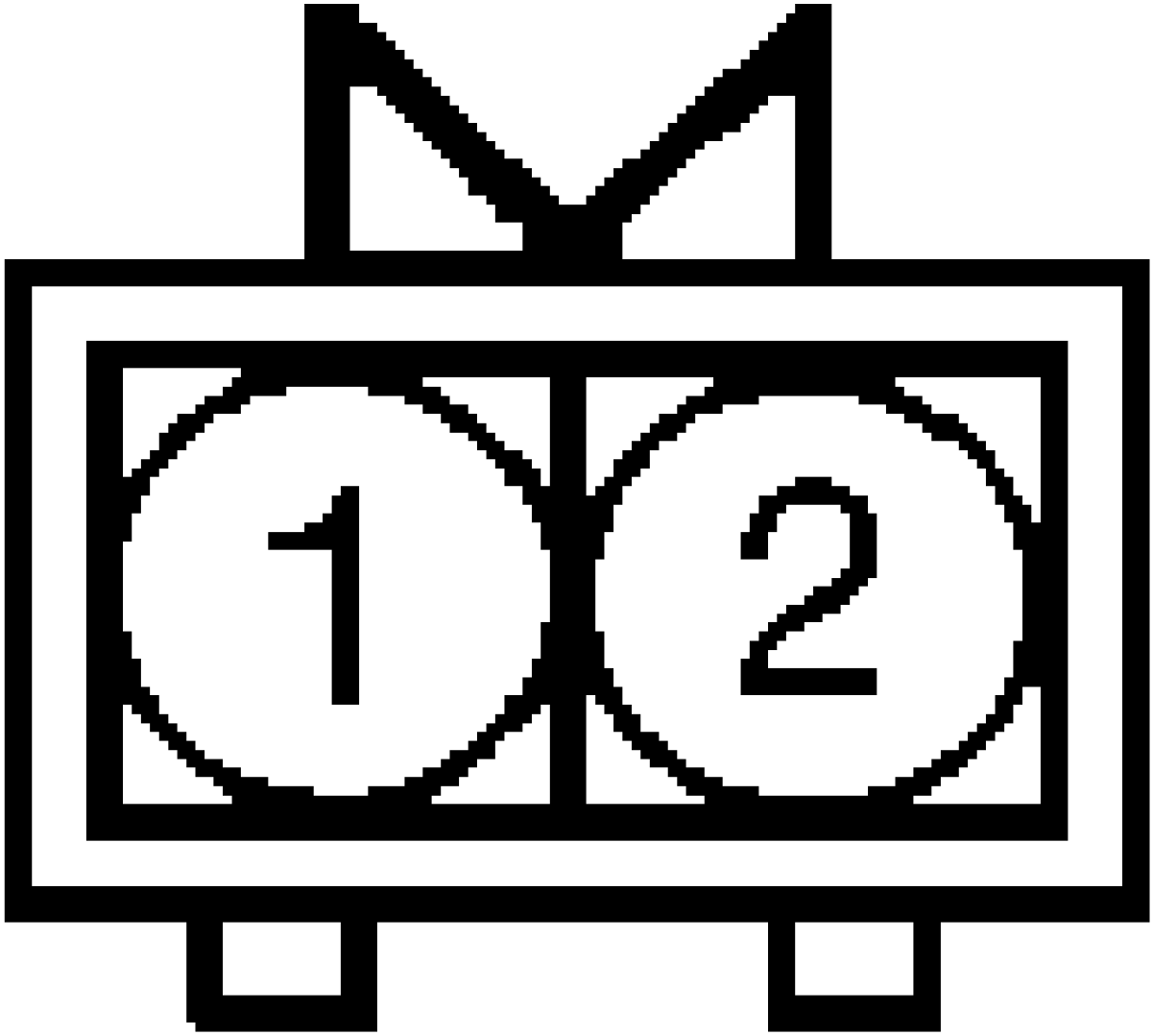

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Fig. 7: EVAP Purge Solenoid Terminals (Galant)
Courtesy of Mitsubishi Motor Sales of America

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Fig. 8: EVAP Purge Solenoid Terminals (Eclipse 2.0L Turbo & 2.4L)
Courtesy of Mitsubishi Motor Sales of America

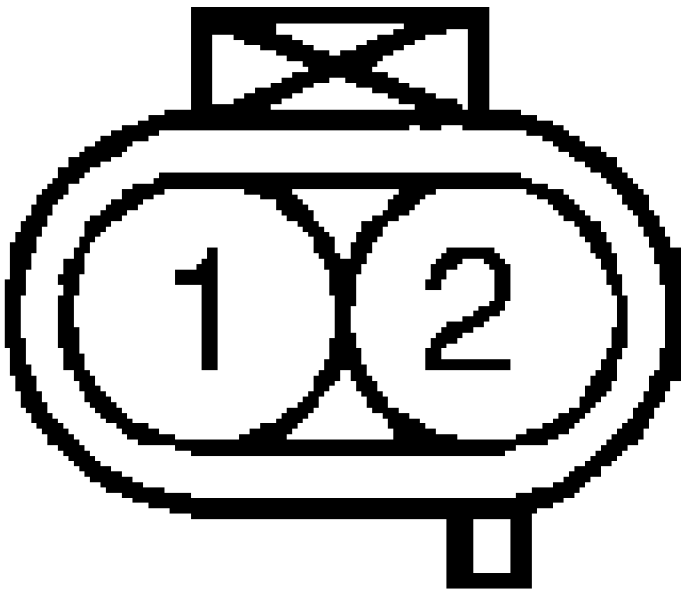

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Fig. 9: EVAP Vent Solenoid Terminals
Courtesy of Mitsubishi Motor Sales of America

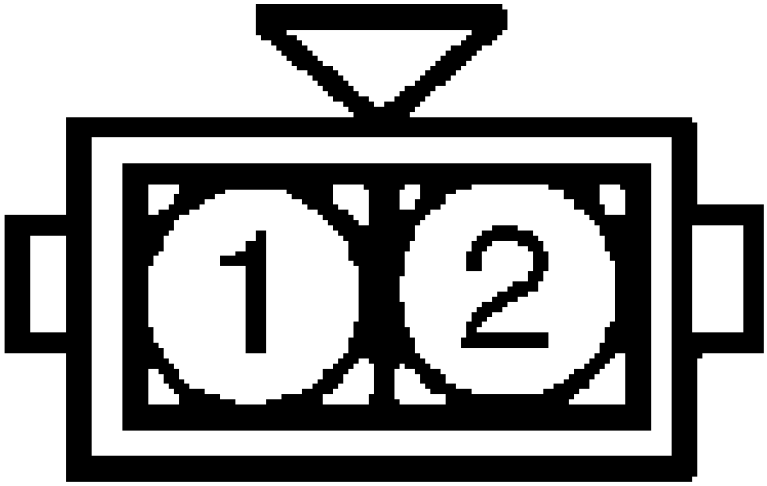

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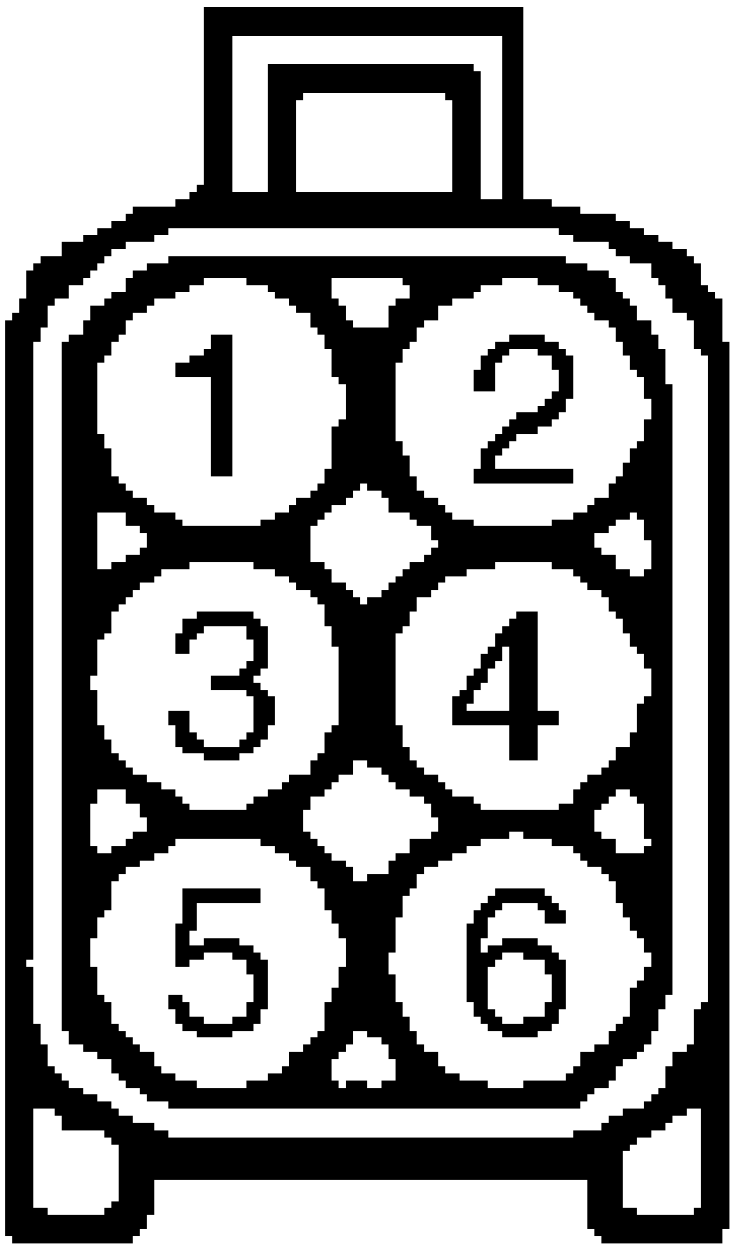
Fig. 10: Fuel Injector Terminals
Courtesy of Mitsubishi Motor Sales of America



95A31146

Fig. 11: Fuel Pump Terminals (Eclipse 2.0L Turbo-AWD)
Courtesy of Mitsubishi Motor Sales of America

95B31147

Fig. 12: Fuel Pump Terminals (All Other Models)
Courtesy of Mitsubishi Motor Sales of America

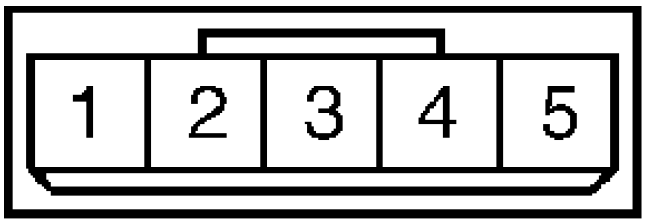


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Fig. 13: Fuel Pump Control/Relay Module Terminals
Courtesy of Mitsubishi Motor Sales of America

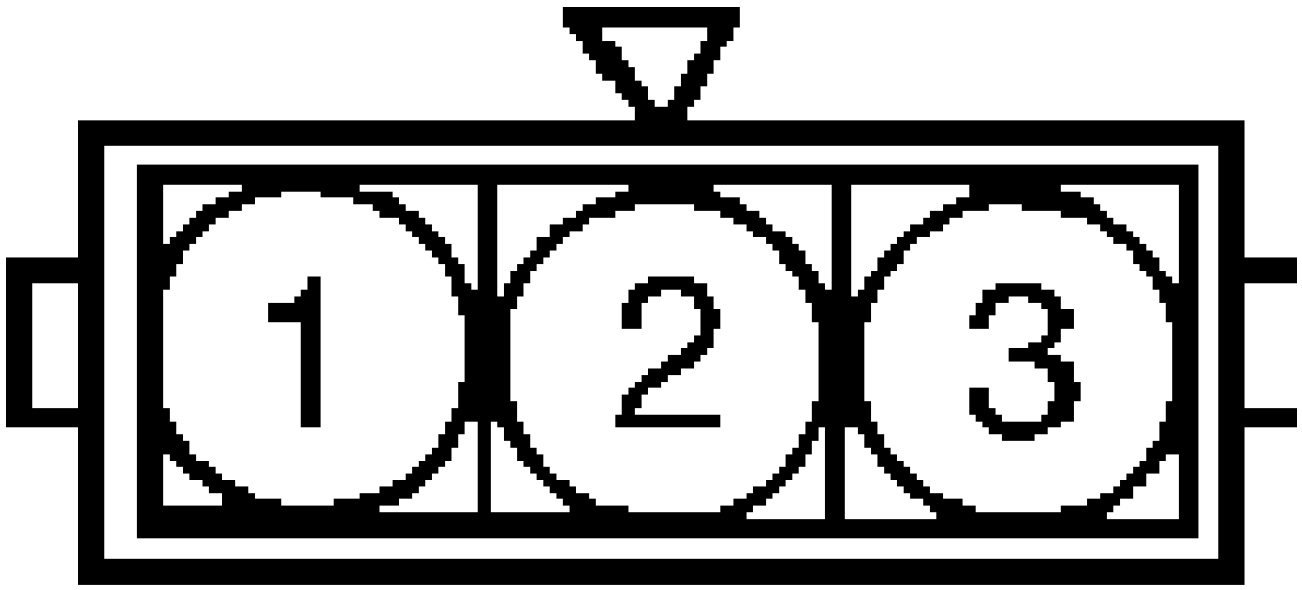

Fig. 14: FTDP Sensor Terminals
Courtesy of Mitsubishi Motor Sales of America

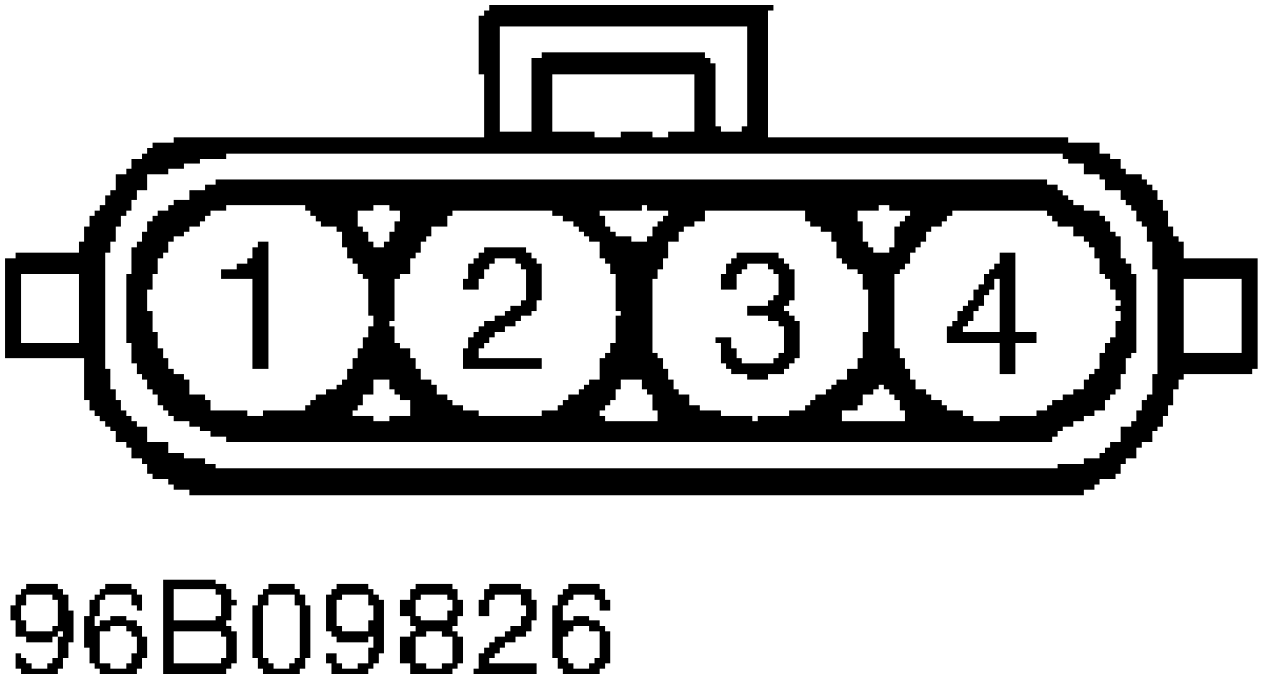

Fig. 15: Generator Field Terminals
Courtesy of Mitsubishi Motor Sales of America

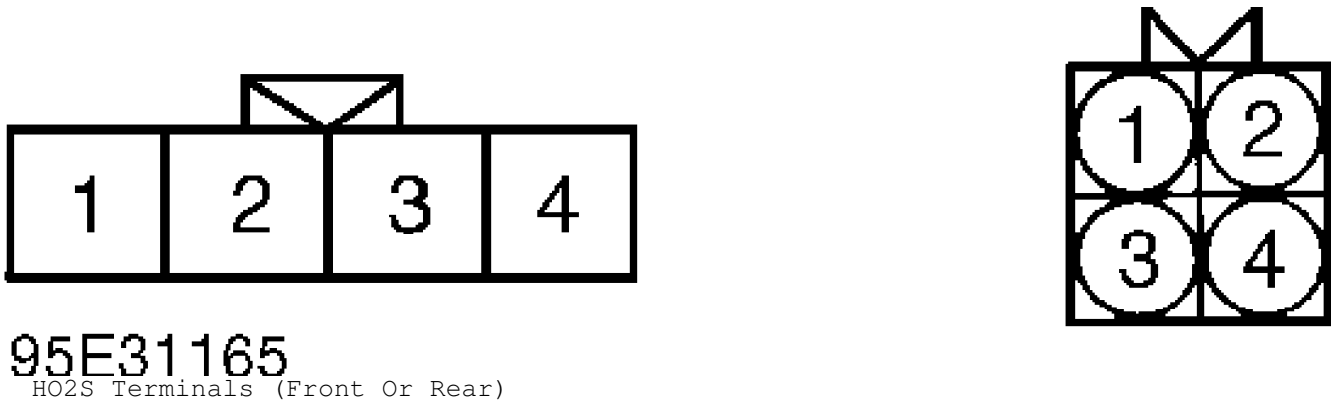

Fig. 16: HO2S Terminals (Front Or Rear)
Courtesy of Mitsubishi Motor Sales of America

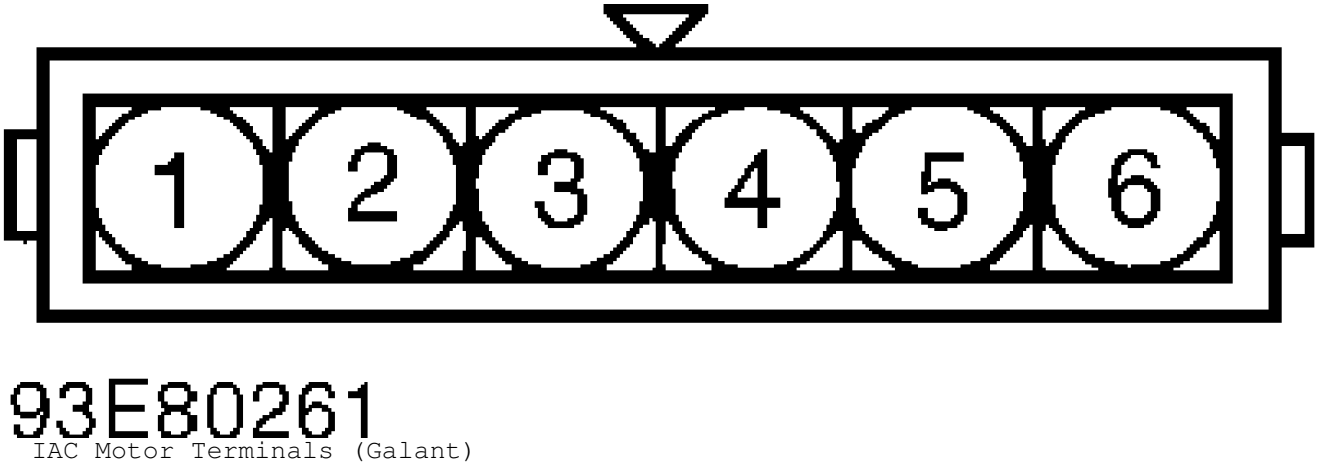

Fig. 17: IAC Motor Terminals (Galant)
Courtesy of Mitsubishi Motor Sales of America

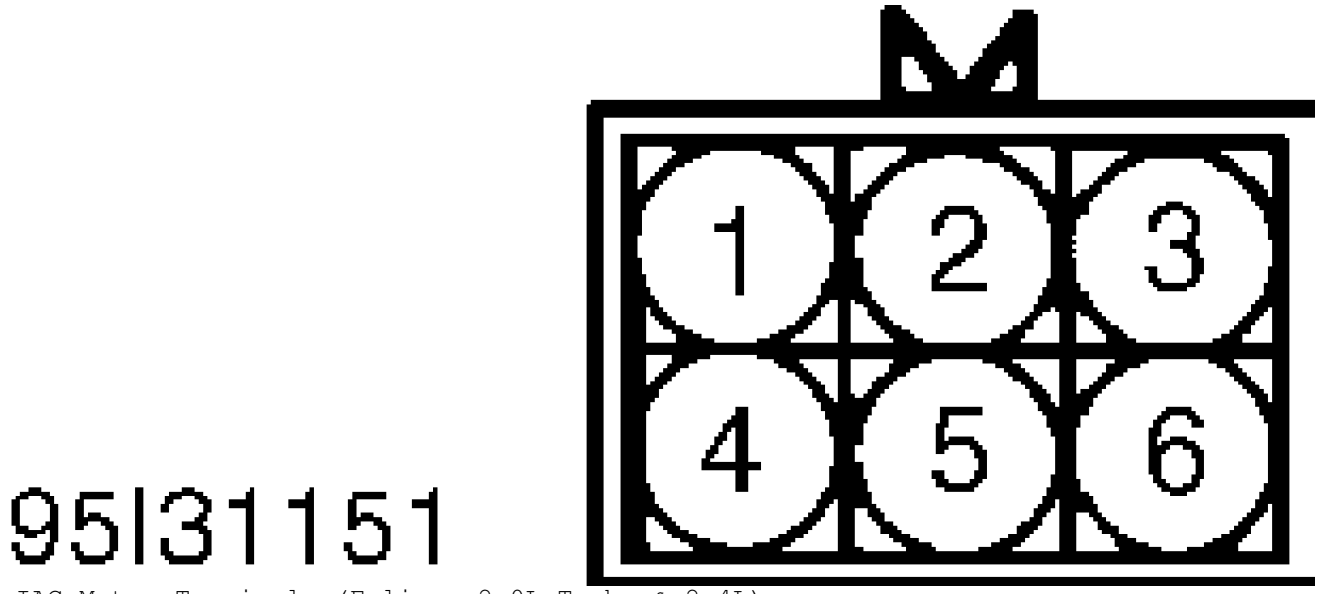

Fig. 18: IAC Motor Terminals (Eclipse 2.0L Turbo & 2.4L)
Courtesy of Mitsubishi Motor Sales of America

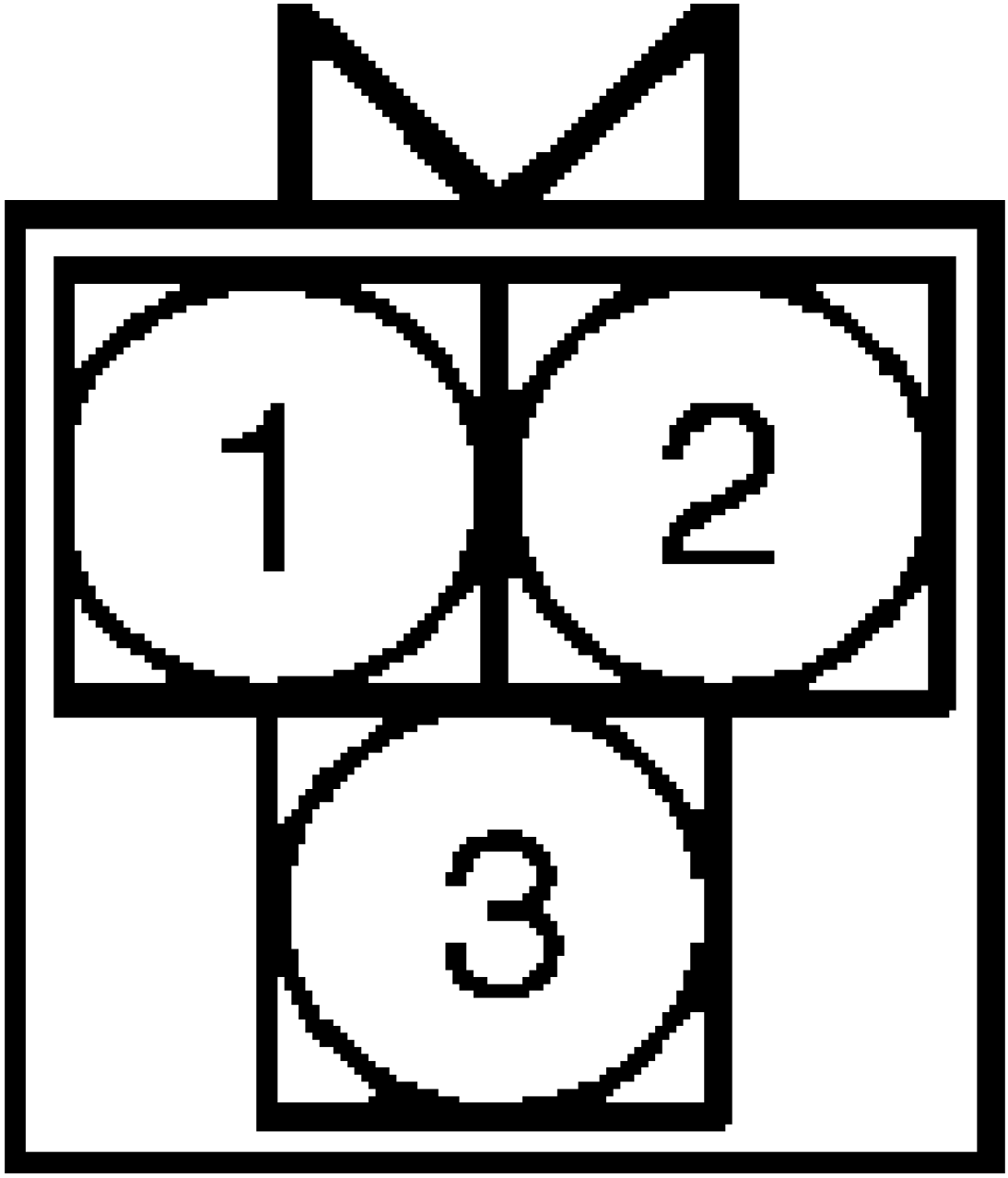

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Fig. 19: Ignition Coil Terminals
Courtesy of Mitsubishi Motor Sales of America

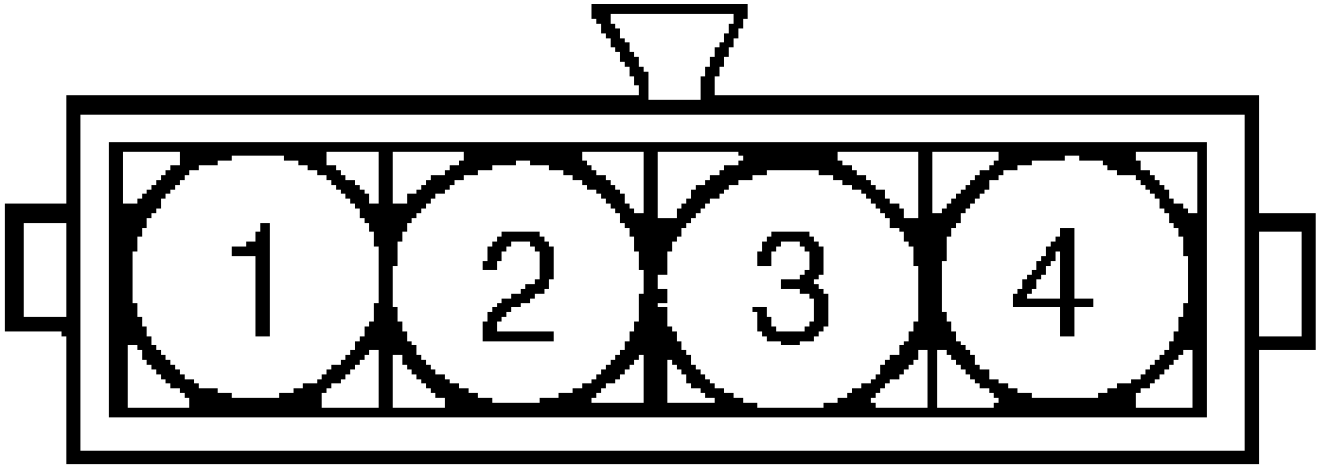


Fig. 20: Ignition Failure Sensor Terminals
Courtesy of Mitsubishi Motor Sales of America

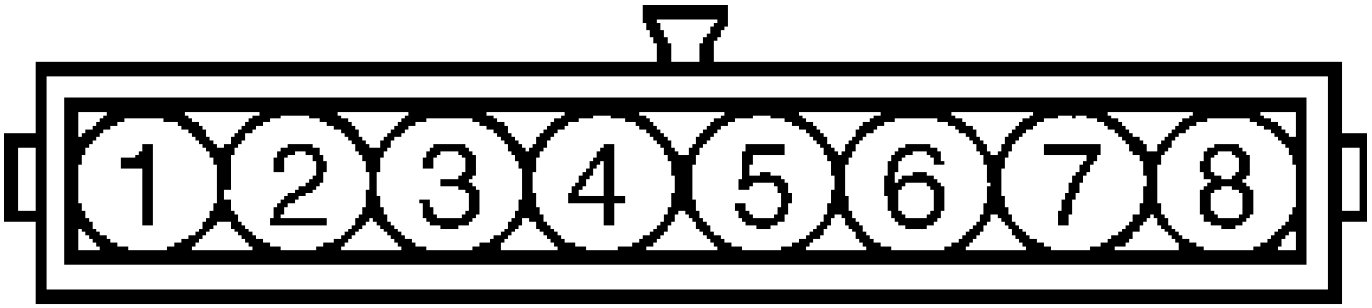


Fig. 21: Ignition Coil Terminals (Eclipse 2.0L Turbo & 2.4L)
Courtesy of Mitsubishi Motor Sales of America

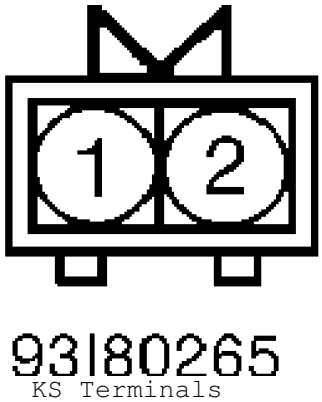


Fig. 22: KS Terminals
Courtesy of Mitsubishi Motor Sales of America

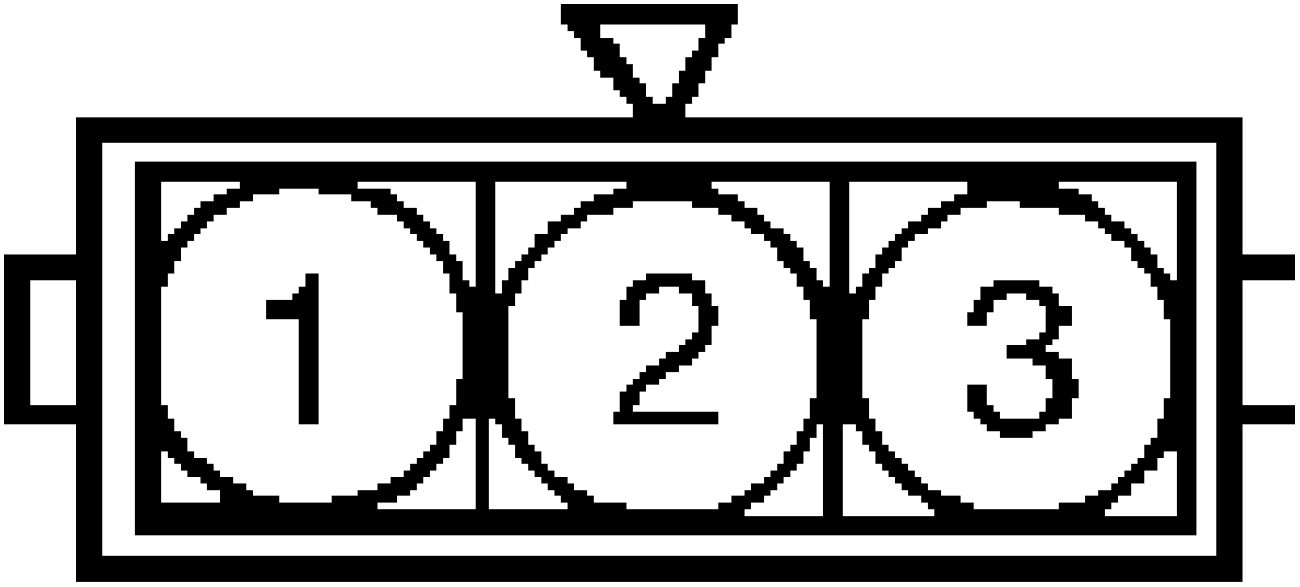


Fig. 23: MDP Sensor Terminals
Courtesy of Mitsubishi Motor Sales of America

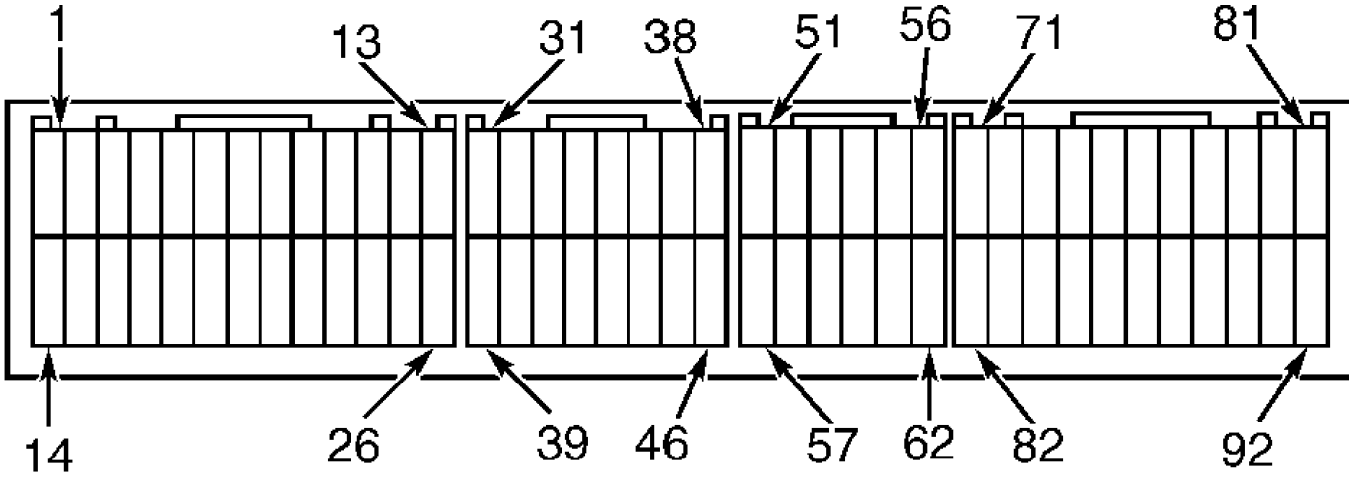


Fig. 24: PCM Terminals (Eclipse 2.0L Turbo & 2.4L)
Courtesy of Mitsubishi Motor Sales of America

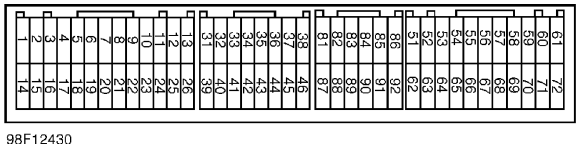
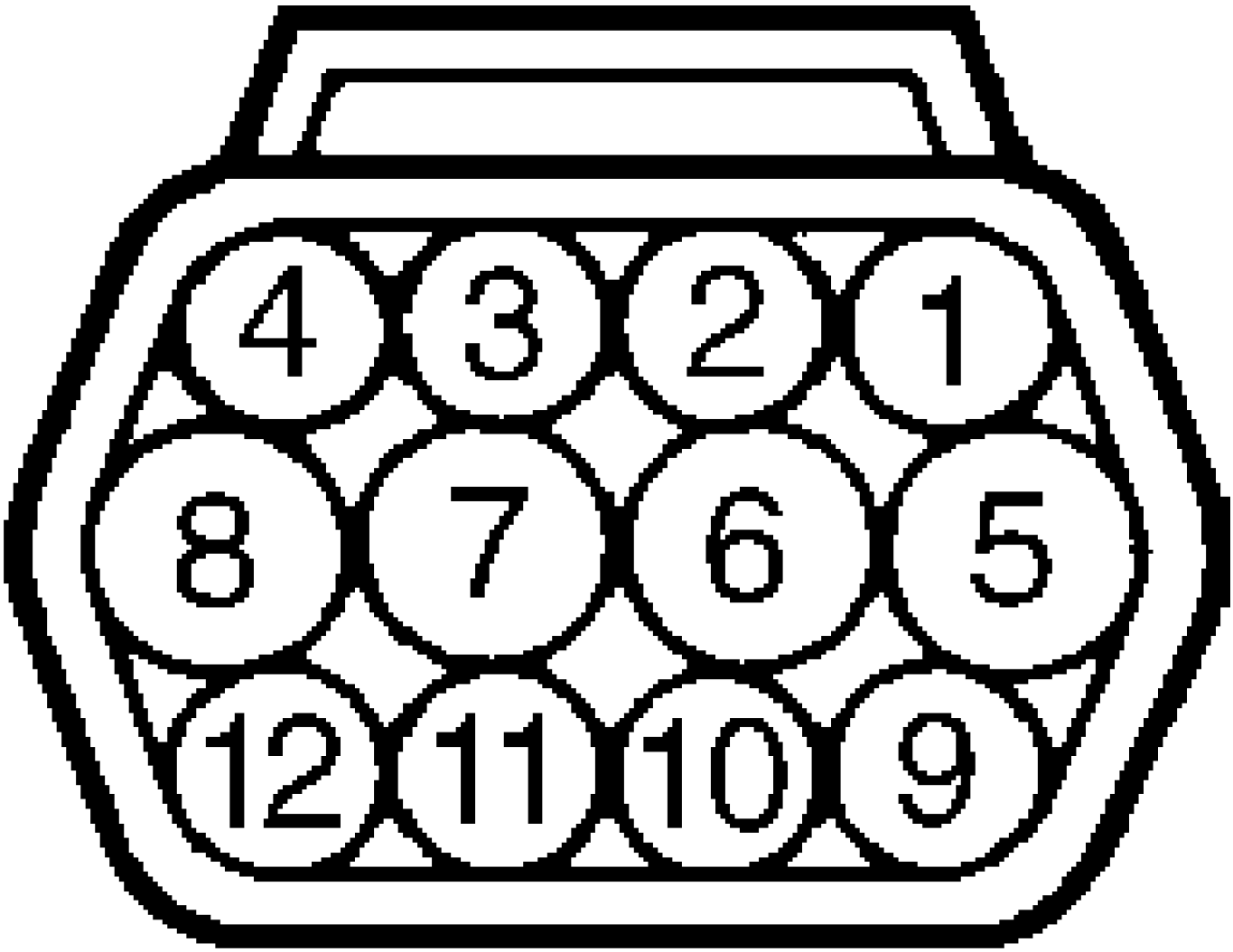
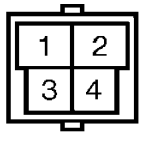


Fig. 25: PCM Terminals (Galant)
Courtesy of Mitsubishi Motor Sales of America



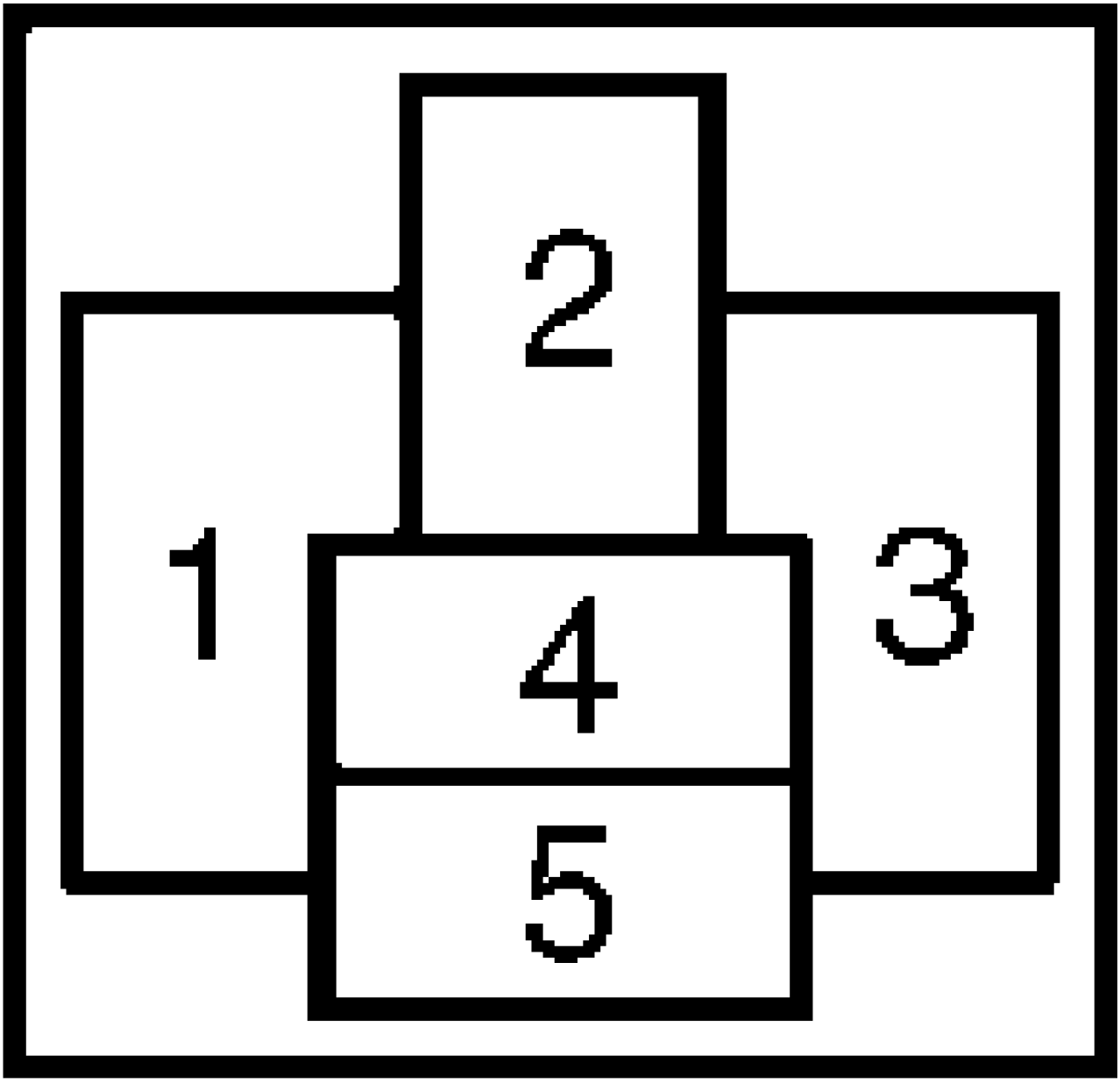
95F31166

Fig. 26: PNP Switch Terminals
Courtesy of Mitsubishi Motor Sales of America



98I12433

Fig. 27: Starter Relay Terminals (Galant)
Courtesy of Mitsubishi Motor Sales of America



98J12434

Fig. 28: Starter Relay Terminals (Eclipse 2.0L Turbo & 2.4L)
Courtesy of Mitsubishi Motor Sales of America

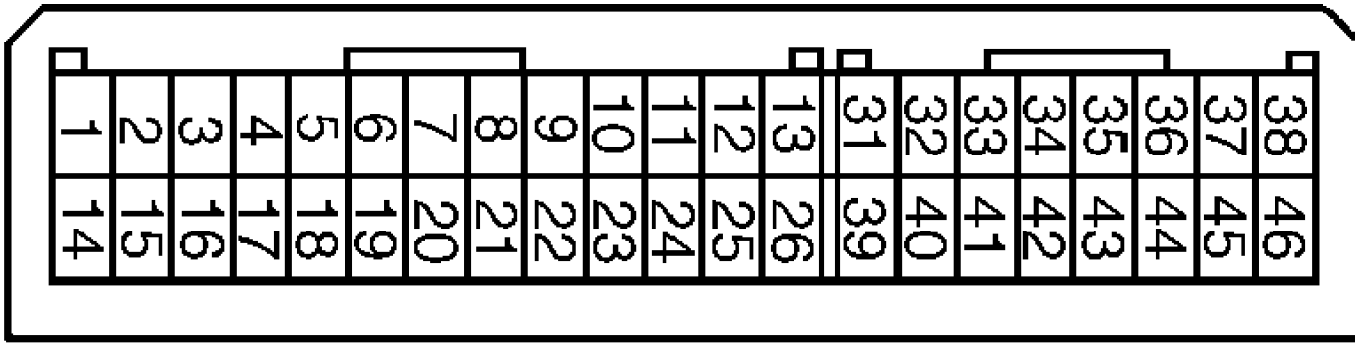


Fig. 29: TCM Terminals
Courtesy of Mitsubishi Motor Sales of America

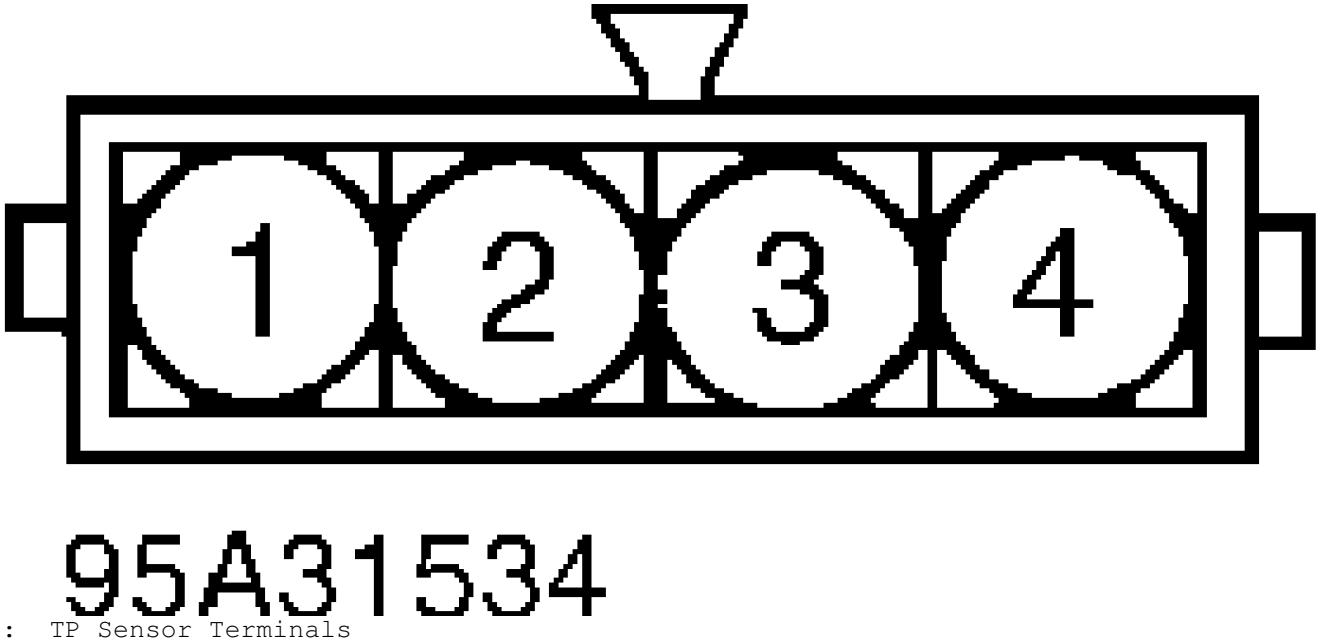


Fig. 30: TP Sensor Terminals
Courtesy of Mitsubishi Motor Sales of America

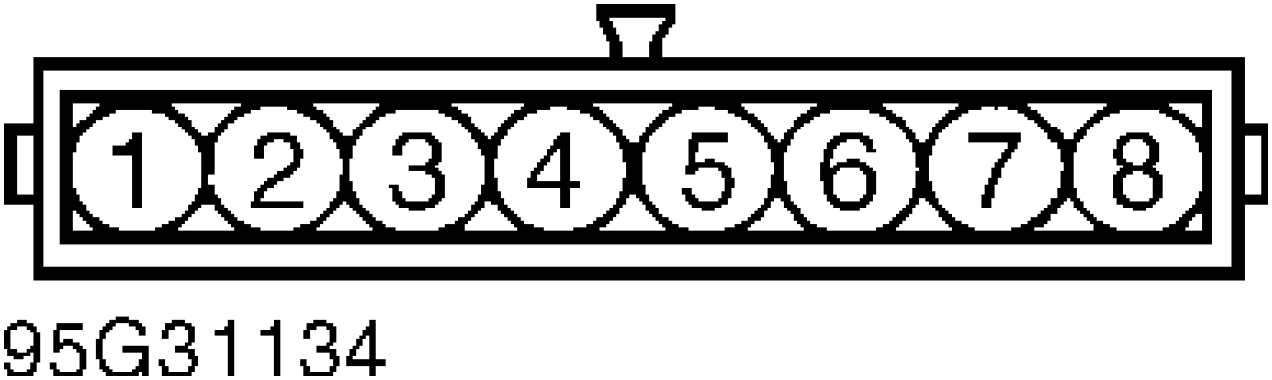


Fig. 31: VAF Sensor Terminals
Courtesy of Mitsubishi Motor Sales of America

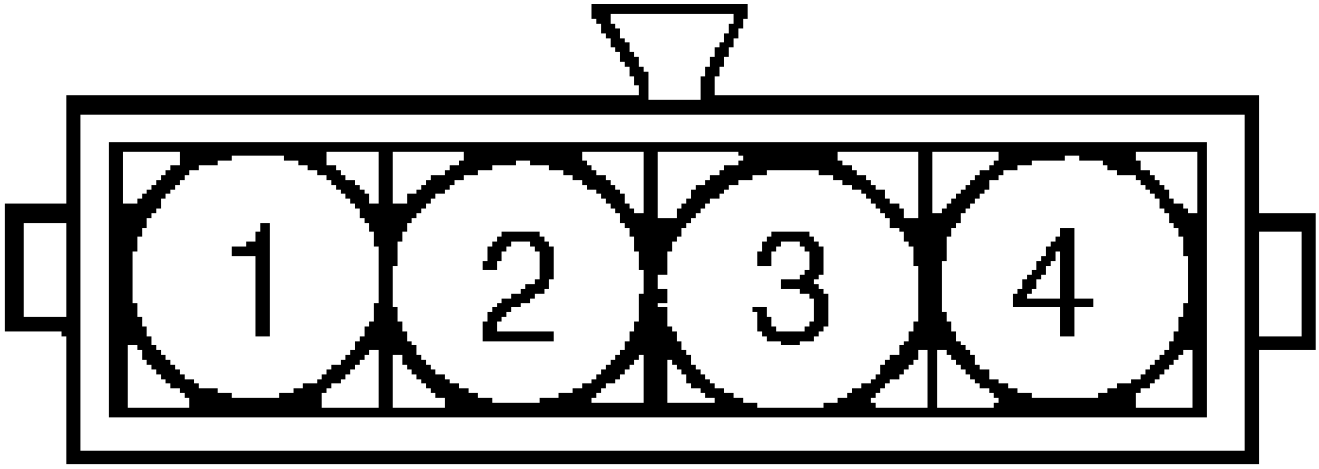


Fig. 32: VIC Valve Position Sensor Terminals
Courtesy of Mitsubishi Motor Sales of America

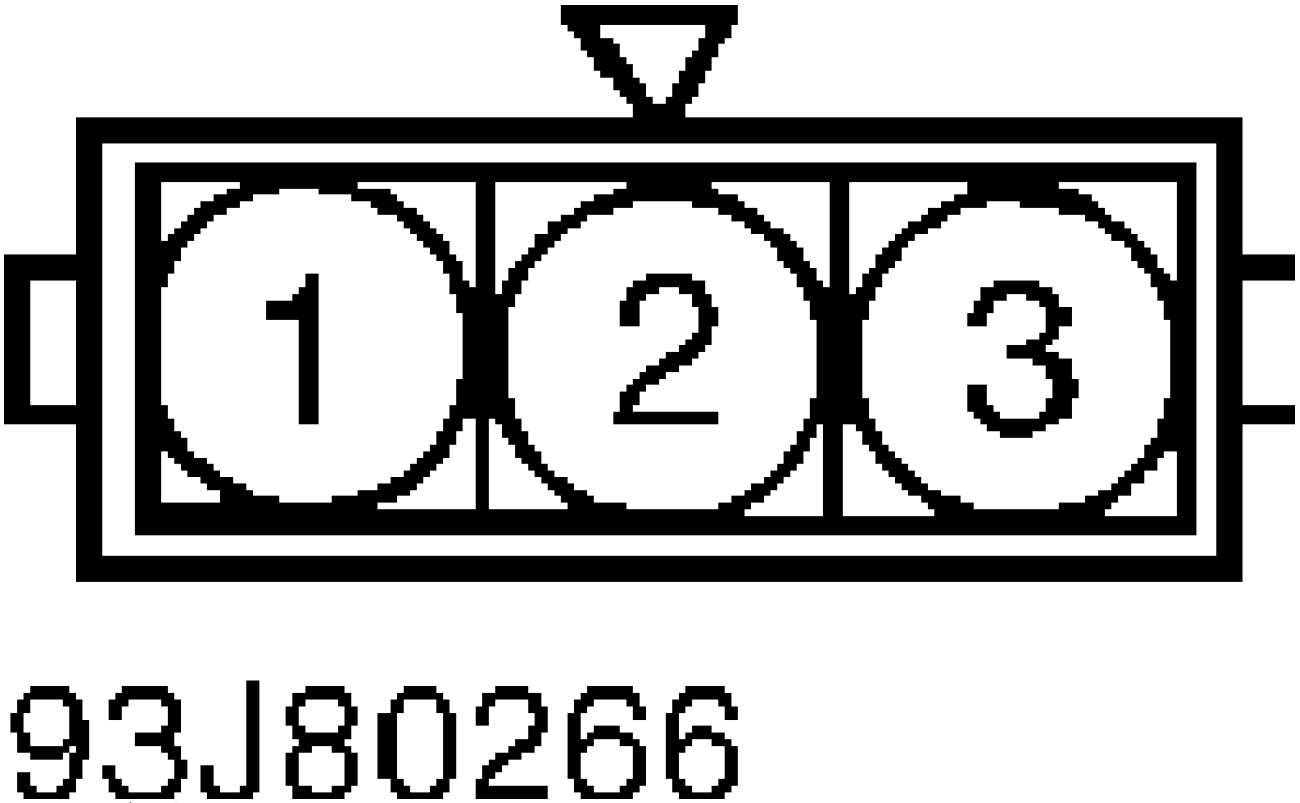


Fig. 33: VSS Terminals
Courtesy of Mitsubishi Motor Sales of America

CIRCUIT TESTS

CAUTION: Ensure ignition switch is in OFF position when performing

resistance tests. Perform all resistance and voltage tests using a Digital Volt-Ohmmeter (DVOM) with a minimum 10-megohm impedance, unless stated otherwise in test procedures.

NOTE: PCM diagnostic memory is retained by direct power supply from battery. Memory is not erased by turning off ignition, but it will be erased if battery or PCM is disconnected.

NOTE: For component locations, see N - REMOVE/INSTALL/OVERHAUL article.

Multi-Use Tester II (MUT II) scan tool has 2 modes of operation; generic scan tool mode and MUT II mode. Perform all Diagnostic Trouble Code (DTC) tests using generic scan tool mode, unless stated otherwise in test procedures. All DTC tests are listed using generic scan tool DTCs.

Using scan tool, display and record DTCs. See ENTERING ON-BOARD DIAGNOSTICS under SELF-DIAGNOSTIC SYSTEM. If no DTCs are displayed, see H - TESTS W/O CODES article.

Clear DTCs. See CLEARING DTCS under SELF-DIAGNOSTIC SYSTEM. Road test vehicle (if necessary) and attempt to duplicate conditions that caused original complaint. Recheck for DTCs. If no DTCs are displayed, go to INTERMITTENT DTCS. If one or more DTCs are displayed, repair DTCs in order starting with lowest numbered DTC. Clear DTCs after each repair. Recheck for DTCs to confirm repair.

INTERMITTENT DTCS

This procedure applies if you have been sent here from diagnostic tests and have just attempted to simulate the condition that initially set the DTC. The following additional checks may assist in identifying a possible intermittent problem:

* Visually inspect related wiring harness connectors for broken, bent, pushed out or corroded terminals.
* Visually inspect related wiring harness for chafed, pierced or partially broken wires.
* Check all pertinent technical service bulletins.

SCAN TOOL WILL NOT COMMUNICATE

NOTE: For terminal identification, see TERMINAL IDENTIFICATION. For circuit and wire color identification, see L - WIRING DIAGRAMS article.

No Communication With All Systems

1) Check voltage between ground and DLC terminal No. 16. If battery voltage does not exist, check connectors and wiring harness between DLC and power supply. If battery voltage exists, go to next step.

2) Check continuity between ground and DLC terminal No. 4, and between ground and terminal No. 5. If continuity exists, replace scan tool. If continuity does not exist, check wiring harness between ground and DLC.

No Communication With PCM

1) Check connectors and wiring harness between PCM and DLC, and between PCM and power supply. If wiring and connectors are okay, check MFI relay. See RELAYS in I - SYSTEM/COMPONENT TESTS article. If MFI relay is okay, go to next step.

2) Remove MFI relay. Check voltage between ground and MFI relay connector terminal No. 3. If battery voltage exists, go to next

step. If battery voltage does not exist, check wiring harness between MFI relay and battery.

3) On Galant, go to next step. On Eclipse, check voltage between ground and MFI relay connector terminal No. 4. If battery voltage exists, go to step 5). If battery voltage does not exist, check wiring harness between MFI relay and battery.

4) Turn ignition on. Check voltage between ground and MFI relay connector terminal No. 4. If battery voltage exists, go to next step. If battery voltage does not exist, check connectors and wiring harness between ignition switch and MFI relay. If connectors and wiring are okay, check ignition switch.

5) On all models, disconnect PCM connector. On 2.4L engine, go to next step. Turn ignition on. Check voltage between ground and PCM connector terminal No. 82. If battery voltage exists, go to next step. If battery voltage does not exist, check junction connector between MFI relay connector and PCM and wiring harness between ignition switch connector and PCM. If wiring and connectors are okay, check ignition switch.

6) On Galant, go to next step. On Eclipse, check voltage between ground and PCM connector terminal No. 38. If battery voltage exists, go to next step. If battery voltage does not exist, check connectors and wiring harness between PCM and MFI relay.

7) On all models, turn ignition on. Ground PCM terminal No. 38. Check voltage between ground and PCM connector terminals No. 12 and 25. If battery voltage exists, go to next step. If battery voltage does not exist, check MFI relay connector and PCM and wiring harness between MFI relay connector and PCM.

8) Check continuity between ground and PCM connector terminals No. 13 and 26. If continuity exists, go to next step. If continuity does not exist, check wiring harness between ground and PCM.

9) Check voltage between ground and PCM connector terminal No. 80 on Eclipse, or No. 60 on Galant. If battery voltage exists, check PCM connector. If PCM connector is okay, replace PCM. If battery voltage does not exist, check wiring harness between PCM and battery.

MALFUNCTION INDICATOR LIGHT (MIL)

MIL Does Not Come On

1) Using scan tool in MUT II mode, read SERVICE DATA No. 16 (PCM power supply voltage). If battery voltage exists, go to step 8). If battery voltage does not exist, go to next step.

2) On Galant, go to next step. On Eclipse, Check MFI relay. See RELAYS in I - SYSTEM/COMPONENT TESTS article. If MFI relay is okay, remove MFI relay. Check voltage between ground and MFI relay connector terminals No.3 and 4. If battery voltage exists, go to next step. If battery voltage does not exist, check wiring harness between MFI relay and battery.

3) On all models, disconnect PCM connector. On 2.4L engine, go to next step. Turn ignition on. Check voltage between ground and PCM connector terminal No. 82. If battery voltage exists, go to next step. If battery voltage does not exist, check junction connector between MFI relay connector and PCM and wiring harness between ignition switch connector and PCM. If wiring and connectors are okay, check ignition switch.

4) On Galant, go to next step. On Eclipse, check voltage between ground and PCM connector terminal No. 38. If battery voltage exists, go to next step. If battery voltage does not exist, check connectors and wiring harness between PCM and MFI relay.

5) On all models, turn ignition on. Connect a jumper wire between ground and PCM connector terminal No. 38. Check voltage between ground and PCM connector terminals No. 12 and 25. If battery voltage exists, go to next step. If battery voltage does not exist,

check MFI relay connector and PCM and wiring harness between MFI relay connector and PCM.

6) Check continuity between ground and PCM connector terminals No. 13 and 26. If continuity exists, go to next step. If continuity does not exist, check wiring harness between ground and PCM.

7) Check voltage between ground and PCM connector terminal No. 80 on Eclipse, or No. 60 on Galant. If battery voltage exists, check PCM connector. If PCM connector is okay, replace PCM. If battery voltage does not exist, check wiring harness between PCM and battery.

8) Turn ignition off. Disconnect PCM connector. Connect jumper wire between ground and PCM connector terminal No. 36. Turn ignition on. If MIL comes on, check PCM connector. If PCM connector is okay, replace PCM. If MIL does not come on, go to next step.

9) Check for open bulb. If bulb is okay, disconnect combination meter connector C06 on Eclipse, or D02 on Galant. Turn ignition on. Check voltage between ground and combination meter connector C06 terminal No. 10, or D02 terminal No. 24. If battery voltage exists, check junction connectors and wiring harness between combination meter connector and PCM. If battery voltage does not exist, check power supply circuit to MIL.

Malfunction Indicator Light (MIL) Stays On

1) Using scan tool, check for stored DTCs. See ENTERING ON-BOARD DIAGNOSTICS under SELF-DIAGNOSTIC SYSTEM. If no DTCs are displayed, go to next step. If DTCs are displayed, record all DTCs and go to appropriate test(s) under CIRCUIT TESTS.

2) Disconnect PCM connector. Disconnect combination meter connector C04 on Eclipse or D02 on Galant. Check continuity between ground and combination meter connector C04 terminal No. 51, or D02 terminal No. 28. If continuity exists, check wiring harness between combination meter connector and PCM. If continuity does not exist, replace PCM.

DIAGNOSTIC TESTS

DTC P0100: VOLUME AIRFLOW (VAF) CIRCUIT MALFUNCTION

1) Install Test Harness MB991348 between VAF sensor harness connector and sensor. Start engine and allow it to idle. Check voltage between ground and VAF sensor connector terminal No. 3. If voltage is 2.2-3.2 volts, go to next step. If voltage is not as specified, go to step 3).

2) Check voltage between ground and VAF sensor connector terminal No. 7. Voltage should be 0-1 volt at idle and 6-9 volts at 2000 RPM. If voltage is as specified, replace PCM. If voltage is not as specified, go to step 6).

3) Disconnect VAF sensor connector. Turn ignition on. Check voltage between ground and VAF sensor connector terminal No. 4. If battery voltage exists, go to next step. If battery voltage does not exist, check wiring harness between VAF sensor, fuel pump relay connector and MFI relay connector.

4) Check voltage between ground and VAF sensor connector terminal No. 3. Voltage should be 4.8-5.2 volts. Check continuity between ground and VAF sensor connector terminal No. 5. If voltage is as specified and continuity exists, check VAF sensor connector. If connector is okay, replace VAF sensor. If voltage is not as specified or continuity does not exist, go to next step.

5) Check VAF sensor connector and wiring harness between PCM and VAF sensor connector. If connector and wiring are okay, replace PCM.

6) Turn ignition on. With PCM connector connected, check

voltage between ground and PCM terminal No. 19. If voltage is 6-9 volts, check PCM connector. If PCM connector is okay, replace PCM. If voltage is not as specified, check VAF sensor connector. If VAF sensor connector is okay, replace, VAF sensor.

DTC P0105: BAROMETRIC PRESSURE CIRCUIT MALFUNCTION

1) Barometric pressure sensor is located in Volume Airflow (VAF) sensor. Install Test Harness MB991348 between VAF sensor harness connector and VAF. Check voltage between ground and VAF sensor connector terminal No. 2. Voltage should be 3.7-4.3 volts at 0 ft. (0 m) to 3.2-3.8 volts at 3937 ft. (1200 m). If voltage is as specified, go to next step. If voltage is not as specified, go to step 3).

2) Turn ignition on. With PCM connector connected, check voltage between ground and PCM terminal No. 85 on Eclipse or No. 65 on Galant. Voltage should be 3.7-4.3 volts at 0 ft. (0 m) to 3.2-3.8 volts at 3937 ft. (1200 m). If voltage is as specified, check PCM connector. If PCM connector is okay, replace PCM. If voltage is not as specified, check wiring harness between PCM and VAF sensor.

3) Disconnect VAF sensor connector. Turn ignition on. Check voltage between ground and VAF sensor connector terminal No. 1. Voltage should be 4.8-5.2 volts. Turn ignition off. Check continuity between ground and VAF sensor connector terminal No. 1. If voltage is as specified and continuity exists, go to next step. If voltage is not as specified or continuity does not exist, go to step 5).

4) Check VAF sensor connector and wiring harness between PCM and VAF sensor. If connector and wiring are okay, replace VAF sensor.

5) Check PCM connector and wiring harness between PCM and VAF sensor connector. If connector and wiring are okay, replace PCM.

DTC P0110: INTAKE AIR TEMPERATURE (IAT) CIRCUIT MALFUNCTION

1) Intake Air Temperature (IAT) sensor is located in Volume Airflow (VAF) sensor. Disconnect VAF sensor connector. Check resistance between VAF sensor terminals No. 5 and 6. Resistance should be 5.3-6.7 k/ohms at 32°F (0°C), 2.3-3.0 k/ohms at 68°F (20°C) and 0.30-0.42 k/ohms at 176°F (80°C). Check resistance while heating sensor with hair dryer. If resistance remains unchanged or increases as temperature is increased, replace VAF sensor. If resistance decreases, go to next step.

2) Disconnect VAF sensor connector. Turn ignition on. Check voltage between ground and VAF sensor connector terminal No. 6. Voltage should be 4.5-4.9 volts. Check continuity between ground and VAF sensor connector terminal No. 5. If voltage is not as specified or continuity does not exist, go to next step. If voltage is as specified and continuity exists, check VAF sensor connector. If connector is okay, replace PCM.

3) Check PCM connector and wiring harness between PCM and VAF sensor connector. If connector and wiring are okay, replace PCM.

DTC P0115: ENGINE COOLANT TEMPERATURE (ECT) CIRCUIT MALFUNCTION

1) Remove ECT sensor. Immerse ECT sensor probe in hot water and check resistance between ECT sensor terminals, while heating ECT sensor. Resistance should be 5.1-6.5 k/ohms at 32°F (0°C), 2.1-2.7 k/ohms at 68°F (20°C), 0.9-1.3 k/ohms at 104°F (40°C) and 0.26-0.36 k/ohms at 176°F (80°C). If resistance is as specified, go to next step. If resistance is not as specified, replace ECT sensor.

2) Turn ignition on. Check voltage between ground and ECT sensor connector terminal No. 1. Voltage should be 4.5-4.9 volts. Check for continuity between ground and ECT sensor connector terminal No. 2. If voltage is not as specified or continuity to ground does not

exist at terminal No. 2, go to next step. If voltage is as specified and continuity exists, check ECT sensor connector. If ECT sensor connector is okay, replace PCM.

3) Check PCM connector and wiring harness between PCM and ECT sensor connector. If connector and wiring are okay, replace PCM.

DTC P0120: THROTTLE POSITION (TP) CIRCUIT MALFUNCTION

1) Using scan tool in MUT II mode, read SERVICE DATA No. 26 (closed throttle position switch). Scan tool display should switch between ON (throttle at idle) and OFF (throttle open slightly). If display is as specified, go to step 3). If display is not as specified, go to next step.

2) Disconnect TP sensor connector. Check continuity between TP sensor terminals No. 3 and 4. Continuity should exist with throttle at idle. Continuity should not exist when throttle is opened. If continuity is as specified, go to next step. If continuity is not as specified, replace TP sensor.

3) Disconnect TP sensor connector. Check resistance between ground and TP sensor terminals No. 1 and 4. Resistance should be 3.5-6.5 k/ohms. Check resistance between ground and TP sensor terminals No. 2 and 4. Slowly open and close throttle. If resistance is not as specified or does not change smoothly in proportion to throttle opening, replace TP sensor. If resistance is as specified, go to next step.

4) Turn ignition on. Check voltage between ground and TP sensor harness connector terminal No. 1. Voltage should be 4.8-5.2 volts. Check for continuity between ground and TP sensor connector terminal No. 4. If voltage is as specified and continuity exists, go to next step. If voltage is not as specified or continuity does not exist, go to step 7).

5) Turn ignition off. Connect TP sensor connector. Turn ignition on. With PCM connector connected, check voltage (backprobe) between ground and PCM connector terminal No. 84 on Eclipse, or No. 64 on Galant. Voltage should be 0.3-1.0 volt with throttle at idle, and 4.5-5.5 volts with throttle full open. Go to next step.

6) If voltage is not as specified, check TP sensor connector and wiring harness between PCM and TP sensor connector. If voltage is as specified, check PCM connector. If PCM connector is okay, replace PCM.

7) Check PCM connector and wiring harness between PCM and TP sensor connector. If connector and wiring are okay, replace PCM.

DTC P0125: EXCESSIVE TIME TO ENTER CLOSED LOOP FUEL CONTROL

1) Disconnect front Heated Oxygen Sensor (HO2S) connector. Connect Test Harness (MD998464) to front HO2S. Check continuity between ground and test harness terminals No. 1 (Red clip) and No. 3 (Blue clip) on Eclipse and Galant (California), or terminals No. 2 (Red clip) and No. 4 (Blue clip) on Galant (Federal). If continuity exists, go to next step. If continuity does not exist, replace front HO2S.

2) Start and warm engine until engine coolant temperature is 176°F (80°C) or more. Connect jumper wires between battery positive terminal and test harness terminal No. 1 (Red clip) and between battery ground and terminal No. 3 (Blue clip). Connect DVOM between test harness terminals No. 2 (Black clip) and No. 4 (White clip) on Eclipse and Galant (California), or terminals No. 1 (Black clip) and No. 3 (White clip) on Galant (Federal). Check front HO2S output voltage while repeatedly racing engine. If voltage is 0.6-1.0 volt, go to next step. If voltage is not as specified, replace front HO2S.

3) Check connectors and wiring harness between front HO2S and PCM. If wiring and connectors are okay, Go to next step.

4) Disconnect fuel injector connector. Check resistance across fuel injector terminals. Resistance at 68°F (20°C) should be 2-3 ohms on turbo engine, or 13-16 ohms on 2.4L engine. If resistance is as specified, go to next step. If resistance is not as specified, replace the fuel injector.

5) Using stethoscope, check injector operating sound during cranking and at idle. Check that frequency of operating sound increases as engine RPM increases. If injectors are okay, go to next step. If no operating sound is heard from an injector, check injector drive circuit. If drive circuit is okay, injector or PCM is suspect.

6) Check fuel injector connectors, PCM connector and wiring harness between PCM and injector connectors. If wiring and connectors are okay, perform fuel pressure test. See FUEL SYSTEM in F - BASIC TESTING article. If fuel pressure is okay, go to next step.

7) Check for air being drawn into air intake or exhaust system. Check for exhaust leaks at HO2S fittings, exhaust manifold or front pipes. Check for fuel filter and/or fuel line blockage. Check fuel pump for poor fuel delivery. If no problems are found, replace PCM.

DTC P0130: FRONT HEATED OXYGEN SENSOR (HO2S) CIRCUIT

MALFUNCTION

1) Disconnect front Heated Oxygen Sensor (HO2S) connector. Connect Test Harness (MD998464) to front HO2S. Check continuity between ground and test harness terminals No. 1 (Red clip) and No. 3 (Blue clip) on Eclipse and Galant (California), or terminals No. 2 (Red clip) and No. 4 (Blue clip) on Galant (Federal). If continuity exists, go to next step. If continuity does not exist, replace front HO2S.

2) Start and warm engine until engine coolant temperature is 176°F (80°C) or more. Connect jumper wires between battery voltage and test harness terminal No. 1 (Red clip) and between ground and terminal No. 3 (Blue clip). Connect DVOM between test harness terminals No. 2 (Black clip) and No. 4 (White clip) on Eclipse and Galant (California), or terminals No. 1 (Black clip) and No. 3 (White clip) on Galant (Federal). Check front HO2S output voltage while repeatedly racing engine. If voltage is 0.6-1.0 volt, go to next step. If voltage is not as specified, replace front HO2S.

3) Check front HO2S connector, PCM connector and wiring harness between front HO2S connector and PCM. If wiring and connectors are okay, replace front HO2S. Clear DTCs. Road test vehicle to verify repairs. If DTC P0130 resets, replace PCM.

DTC P0135: FRONT HEATED OXYGEN SENSOR (HO2S) HEATER CIRCUIT

MALFUNCTION

1) Disconnect front Heated Oxygen Sensor (HO2S) connector. Connect Test Harness (MD998464) to front HO2S. Check continuity between ground and test harness terminals No. 1 (Red clip) and No. 3 (Blue clip) on Eclipse and Galant (California), or terminals No. 2 (Red clip) and No. 4 (Blue clip) on Galant (Federal). If continuity exists, go to next step. If continuity does not exist, replace front HO2S.

2) Start and warm engine until engine coolant temperature is 176°F (80°C) or more. Connect jumper wires between battery voltage and test harness terminal No. 1 (Red clip) and between ground and terminal No. 3 (Blue clip). Connect DVOM between test harness terminals No. 2 (Black clip) and No. 4 (White clip) on Eclipse and Galant (California), or terminals No. 1 (Black clip) and No. 3 (White clip) on Galant (Federal). Check front HO2S output voltage while repeatedly racing engine. If voltage is 0.6-1.0 volt, go to next step. If voltage is not as specified, replace front HO2S.

3) Disconnect test harness. Turn ignition on. Check voltage between rear HO2S connector terminal No. 1 on Eclipse 2.0L and Galant (California), or No. 2 on Eclipse 2.4L and Galant (Federal). If battery voltage exists, go to next step. If battery voltage does not exist, check PCM connector and wiring harness between front HO2S connector and PCM.

4) Disconnect PCM connector. Turn ignition on. Check voltage between ground and PCM connector terminal No. 60 on Eclipse, or No. 90 on Galant. If battery voltage does not exist, check connectors and wiring harness between front HO2S connector and PCM. If battery voltage exists, check PCM connector. If PCM connector is okay, replace PCM.

DTC P0136: REAR HEATED OXYGEN SENSOR (HO2S) CIRCUIT MALFUNCTION

1) Disconnect rear HO2S connector. Check resistance between rear HO2S terminals No. 3 and 4. Resistance at 68°F (20°C) should be about 12 ohms on Eclipse, or 7-40 ohms on Galant. If resistance is as specified, go to next step. If resistance is not as specified, replace rear HO2S.

2) Check rear HO2S connector, PCM connector and wiring harness between rear HO2S connector and PCM. If wiring and connectors are okay, replace rear HO2S. Clear DTCs. Road test vehicle to verify repairs. If DTC P0136 resets, replace PCM.

DTC P0141: REAR HEATED OXYGEN SENSOR (HO2S) HEATER CIRCUIT MALFUNCTION

1) Disconnect rear HO2S connector. Check resistance between rear HO2S terminals No. 3 and 4. Resistance at 68°F (20°C) should be about 12 ohms on Eclipse, or 7-40 ohms on Galant. If resistance is as specified, go to next step. If resistance is not as specified, replace rear HO2S.

2) Turn ignition on. Check voltage between ground and rear HO2S connector terminal No. 3. If battery voltage exists, go to next step. If battery voltage does not exist, check wiring harness between rear HO2S connector and MFI relay connector.

3) Turn ignition off. Disconnect PCM connector. Turn ignition on. Check voltage between ground and PCM connector terminal No. 54 on Eclipse, or No. 84 on Galant. If battery voltage exists, check PCM connector. If PCM connector is okay, replace PCM. If battery voltage does not exist, check rear HO2S connector and wiring harness between PCM and rear HO2S connector.

DTC P0170: FUEL TRIM MALFUNCTION

1) Using scan tool in MUT II mode, read SERVICE DATA No. 13 (intake air temperature). If temperature displayed on scan tool is equal to actual air temperature as measured with a thermometer, go to next step. If temperature displayed on scan tool is not equal to actual air temperature, check air temperature circuit. See DTC P0110: INTAKE AIR TEMPERATURE (IAT) CIRCUIT MALFUNCTION.

2) Using scan tool in MUT II mode, read SERVICE DATA No. 21 (engine coolant temperature). If temperature displayed on scan tool is equal to actual engine coolant temperature as measured with a thermometer, go to next step. If temperature displayed on scan tool is not equal to actual coolant temperature, check engine coolant temperature circuit. See DTC P0115: ENGINE COOLANT TEMPERATURE (ECT) CIRCUIT MALFUNCTION.

3) Using scan tool in MUT II mode, read SERVICE DATA No. 25 (barometric pressure). Reading should be 101 kPa at 0 ft. (0 m), 95 kPa at 1969 ft. (600 m), 88 kPa at 3937 ft. (1200 m) or 81 kPa at 5906

ft. (1800 m). If scan tool reading is as specified, go to next step. If scan tool reading is not as specified, check barometric pressure circuit. See DTC P0105: BAROMETRIC PRESSURE CIRCUIT MALFUNCTION.

4) Disconnect fuel injector connector. Check resistance across fuel injector terminals. Resistance at 68°F (20°C) should be 2-3 ohms on turbo engine, or 13-16 ohms on 2.4L engine. If resistance is as specified, go to next step. If resistance is not as specified, replace the fuel injector.

5) Using stethoscope, check injector operating sound during cranking and at idle. Check that frequency of operating sound increases as engine RPM increases. If injectors are okay, go to next step. If no operating sound is heard from an injector, check injector drive circuit. If drive circuit is okay, injector or PCM is suspect.

6) Check fuel injector connectors, PCM connector and wiring harness between PCM and injector connectors. If wiring and connectors are okay, perform fuel pressure test. See FUEL SYSTEM in F - BASIC TESTING article. If fuel pressure is okay, go to next step.

7) Using scan tool in MUT II mode, read SERVICE DATA No. 81 (long-term fuel compensation). If fuel trim is less than zero (during closed loop), go to next step. If fuel trim is more than zero (during closed loop), go to step 9).

8) Using scan tool in MUT II mode, read SERVICE DATA No. 12 (volume airflow). Reading should be from 18-44 Hz at idle to 63-103 Hz at 2500 RPM on 2.4L, or 22-48 Hz at idle to 60-100 Hz at 2500 RPM on turbo engine. Check that frequency (VAF volume) increases as RPM is increased. If scan tool reading is more than specification or does not increase with RPM increase, replace VAF sensor. If scan tool reading is less than or equal to specification, replace PCM.

9) Check air intake system for leaks or obstructions. If air intake system is okay, use scan tool in MUT II mode to read SERVICE DATA No. 12 (volume airflow). Reading should be from 18-44 Hz at idle to 63-103 Hz at 2500 RPM on 2.4L, or 22-48 Hz at idle to 60-100 Hz at 2500 RPM on turbo engine. Check that frequency (VAF volume) increases as RPM is increased. If scan tool reading is less than specification or does not increase with RPM increase, replace VAF sensor. If scan tool reading is more than or equal to specification, go to next step.

10) Check for air being drawn into air intake or exhaust system. check for exhaust leaks at HO2S fittings, exhaust manifold, or front pipes. Check for fuel filter and/or fuel line blockage. Check fuel pump for poor fuel supply. If no problems are found, replace PCM.

DTC P0201-P0204: INJECTORS NO. 1-4 CIRCUIT MALFUNCTION

1) Disconnect fuel injector connector. Check resistance between fuel injector terminals. If resistance at 68°F (20°C) is 13-16 ohms on 2.4L, or 2-3 ohms on turbo engine, go to next step. If resistance is not as specified), replace fuel injector.

2) Using stethoscope, check injector operating sound during cranking or at idle. Check that frequency of operating sound increases as engine RPM increases. If injectors are okay, go to next step. If no operating sound is heard from an injector, check injector drive circuit. If drive circuit is okay, injector or PCM is suspect.

3) Check fuel injector connectors, PCM connector and wiring harness between PCM and injector connectors. If wiring and connectors are okay on 2.4L, go to step 5). On turbo engine, disconnect injector resistor connector. Check resistance across resistor terminals No. 1 and 3, 4 and 3, 5 and 3, and 6 and 3. If resistance is 5.5-6.5 ohms at 68°F (20°C), go to next step. If resistance is not 5.5-6.5 ohms at 68°F (20°C), replace resistor.

4) Turn ignition on. Check voltage between ground and injector resistor connector terminal No. 3. If battery voltage exists, go to next step. If battery voltage does not exist, check wiring harness between MFI relay and resistor connector.

5) On all engines, disconnect fuel injector connectors. Turn ignition on. Check voltage between ground and each injector connector terminal No. 1. If battery voltage exists at all 4 connectors, go to next step. If battery voltage does not exist at any one or all 4 connectors, check connectors and wiring harness between PCM and fuel injector connectors.

6) Connect fuel injector connectors. Disconnect PCM connector. Turn ignition on. Check voltage between ground and PCM connector terminals No. 1, 2, 14 and 15. If battery voltage exists at all 4 terminals, check PCM connector. If PCM connector is okay, replace PCM. If battery voltage does not exist at any one or all 4 terminals, check fuel injector connectors and wiring harness between PCM and injector connector.

DTC P0300: RANDOM MISFIRE DETECTED

1) Connect external tachometer. Using scan tool in MUT II mode, read SERVICE DATA No. 22 (crankshaft position sensor). Check engine RPM during cranking and at idle. If RPM displayed on scan tool and tachometer are equal, go to next step. If RPM displayed on scan tool and tachometer are not equal, go to step 4).

2) Using oscilloscope, perform crankshaft position sensor wave form check. Connect Test Harness (MD998478) between Crankshaft Position (CKP) sensor and harness connector. Connect analyzer special patterns pickup to CKP sensor terminal No. 2. If test harness is not available, connect analyzer special patterns pickup to PCM terminal No. 89 Eclipse or No. 69 on Galant. Go to next step.

3) With engine idle speed stable, compare CKP sensor wave pattern to that of a known-good wave pattern. See Fig. 34. If wave pattern is okay, go to step 5). If wave pattern is not okay, go to next step.

4) Check CKP sensor connector, PCM connector and wiring harness between PCM and CKP sensor connector. Check CKP sensor and sensing plate for proper installation. If wiring, connectors and sensor installation are okay, replace CKP sensor.

5) Start and warm engine. Turn all accessories off. Increase engine speed to 2500 RPM. Using scan tool in MUT II mode, read SERVICE DATA No. 81 (long-term fuel compensation). If fuel trim is-12.5-12.5 percent (during closed loop), go to next step. If fuel trim is not as specified, check fuel trim fault. See DTC P0170: FUEL TRIM MALFUNCTION.

6) Using scan tool in MUT II mode, read SERVICE DATA No. 21 (engine coolant temperature). If temperature displayed on scan tool is equal to actual engine coolant temperature as measured with a thermometer, go to next step. If temperature displayed on scan tool is not equal to actual coolant temperature, check ECT circuit. See DTC P0115: ENGINE COOLANT TEMPERATURE (ECT) CIRCUIT MALFUNCTION.

7) Check ignition coil, spark plugs and spark plug wires. Check for broken timing belt teeth. Check engine compression, and EGR system. See F - BASIC TESTING article.

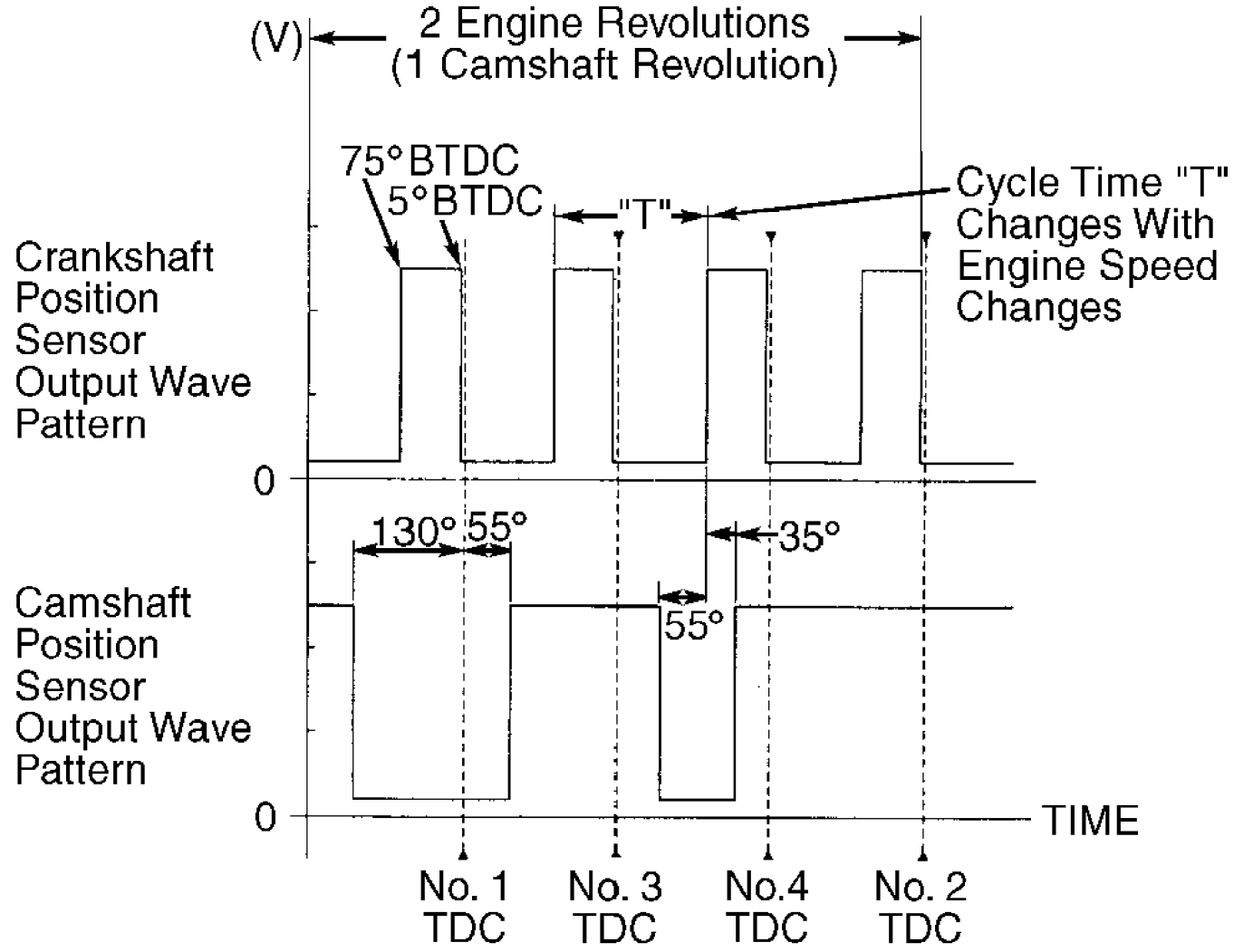


Fig. 34: Identifying Known-Good CMP/CKP Sensor Wave Pattern
Courtesy of Mitsubishi Motor Sales of America

DTC P0301-P0304: CYLINDERS NO. 1-4 MISFIRE DETECTED

1) Disconnect fuel injector connector. Check resistance across fuel injector terminals. If resistance at 68°F (20°C) is 13-16 ohms on 2.4L, or 2-3 ohms on turbo engine, go to next step. If resistance is not as specified, replace fuel injector.

2) Using stethoscope, check injector operating sound during cranking and at idle. Check that frequency of operating sound increases as engine RPM increases. If operating sound is okay, go to next step. If no operating sound is heard from an injector, check injector drive circuit. If drive circuit is okay, injector or PCM is suspect.

3) Check wiring harness between PCM and injector. If wiring harness is okay, go to next step.

4) Check spark plugs and spark plug wires. Check compression pressure. See F - BASIC TESTING article.

DTC P0325: KNOCK SENSOR (KS) NO. 1 CIRCUIT

NOTE: This test applies to Eclipse with 2.0L turbo engine only.

1) Disconnect KS connector. Check continuity between ground and KS connector terminal No. 2. If continuity exists, go to next step. If continuity does not exist, check wiring harness between ground and KS connector.

2) Check KS connector, PCM connector and wiring harness between PCM and KS connector. If wiring and connectors are okay, replace KS. Clear DTCs. Road test vehicle to verify repairs. If DTC P0325 resets, replace PCM.

DTC P0335: CRANKSHAFT POSITION (CKP) SENSOR CIRCUIT MALFUNCTION

1) Connect Test Harness (MD998478) between CKP sensor and harness connector. Check voltage between ground and test harness terminal No. 2 (Black clip). Voltage should be 0.4-4.0 volts while cranking engine, and 1.5-2.5 volts with engine idling. If voltage is not as specified, go to next step. If voltage is as specified, replace PCM.

2) Disconnect CKP sensor connector. Turn ignition on. Check voltage between ground and CKP sensor connector terminal No. 3. If battery voltage exists, go to next step. If battery voltage does not exist, check wiring harness between MFI relay connector and CKP sensor.

3) Check voltage between ground and CKP sensor connector terminal No. 2. If battery voltage exists, go to next step. If battery voltage does not exist, check PCM connector and wiring harness between CKP sensor connector and PCM. If connector and wiring are okay, replace PCM.

4) Check continuity between ground and CKP sensor connector terminal No. 1. If continuity exists, check CKP sensor connector. If connector is okay, replace CKP sensor. If continuity does not exist, check wiring harness between ground and CKP sensor.

DTC P0340: CAMSHAFT POSITION (CMP) SENSOR CIRCUIT MALFUNCTION

1) With CMP sensor connector connected. Check voltage between ground and CMP sensor connector terminal No. 2 on Eclipse, or No. 3 on Galant. Voltage should be 0.4-3.0 volts while cranking engine, and 0.5-2.0 volts with engine idling. If voltage is not as specified, go to next step. If voltage is as specified, replace PCM.

2) Disconnect CMP sensor connector. Turn ignition on. Check voltage between ground and CMP sensor connector terminal No. 3 on Eclipse, or No. 2 on Galant. If battery voltage exists, go to next step. If battery voltage does not exist, check wiring harness between MFI relay connector and CMP sensor.

3) Check voltage between ground and CMP sensor connector terminal No. 2 on Eclipse, or No. 3 on Galant. If voltage is 4.8-5.2 volts, go to next step. If battery voltage is not 4.8-5.2 volts, check PCM connector and wiring harness between CMP sensor connector and PCM. If connector and wiring are okay, replace PCM.

4) Check continuity between ground and CMP sensor connector terminal No. 1. If continuity exists, check CMP sensor connector. If connector is okay, replace CMP sensor. If continuity does not exist, check wiring harness between ground and CMP sensor.

DTC P0400: EXHAUST GAS RECIRCULATION (EGR) FLOW MALFUNCTION

1) Install a "T" fitting between vacuum hose (Green-striped on turbo engine, White-striped on 2.4L) and EGR solenoid nipple. Connect hand vacuum pump to "T" fitting. Start engine. Monitor vacuum while racing engine. If engine coolant temperature is 68°F (20°C) or

less, vacuum should not exist. If engine coolant temperature is 176°F (80°C) or more, vacuum should momentarily rise more than 3.9 in. Hg.

2) If vacuum is as specified, go to step 5). If vacuum is not as specified, disconnect EGR vacuum hose (Green-striped on turbo engine, White-striped on 2.4L) from throttle body nipple. Connect hand-held vacuum pump to nipple. Start engine and gradually increase RPM. Vacuum reading should remain constant as RPM increases. If vacuum is as specified, go to next step. If no vacuum exists, check throttle body purge port for obstructions.

3) Turn engine off. Label and disconnect vacuum hoses from solenoid valve. Disconnect electrical connector. Connect hand vacuum pump to solenoid valve nipple where hose was connected. Apply vacuum to solenoid valve. Vacuum should hold.

4) Apply battery voltage across terminals of solenoid valve. Vacuum should bleed down when voltage is applied to terminals. Using an ohmmeter, check resistance across solenoid valve terminals. If resistance at 68°F (20°C) is 36 to 44 ohms on Eclipse, or 62-74 ohms on Galant, go to next step. If resistance is not as specified, replace solenoid valve.

5) Disconnect "T" fitting and connect hand vacuum pump to EGR solenoid nipple. Apply 7.9 in. Hg of vacuum to EGR solenoid. If idle speed does not change, go to step 8). If idle becomes rough or engine stalls, go to next step.

6) Using scan tool in MUT II mode, read SERVICE DATA No. 95 (manifold differential pressure). Scan tool reading should be 32.8-46.2 kPa on 2.0L engine, 55.3-68.7 kPa on Eclipse 2.4L, or 49.0-75.0 kPa on Galant 2.4L.

7) If scan tool reading is as specified, go to next step. If scan tool reading is not as specified, check Manifold Differential Pressure (MDP) circuit. See DTC P1400: MANIFOLD DIFFERENTIAL PRESSURE (MDP) SENSOR CIRCUIT MALFUNCTION.

8) Remove EGR valve and check for sticking or obstructions. Apply 20 in. Hg of vacuum to EGR valve. Vacuum should hold. Check that EGR valve remains closed with 1.6 in. Hg or less of vacuum applied. Check that EGR valve is full open with 7.9 in. Hg or more of vacuum applied. Replace EGR valve if not okay.

DTC P0403: EXHAUST GAS RECIRCULATION (EGR) FLOW MALFUNCTION

1) Install a "T" fitting between vacuum hose (Green-striped on turbo engine, White-striped on 2.4L) and EGR solenoid nipple. Connect hand-held vacuum pump to "T" fitting. Start engine. Monitor vacuum while racing engine. If engine coolant temperature is 68°F (20°C) or less, vacuum should not exist. If engine coolant temperature is 176°F (80°C) or more, vacuum should momentarily rise over 3.9 in. Hg.

2) If vacuum is as specified, go to step 5). If vacuum is not as specified, disconnect EGR vacuum hose (Green-striped on turbo engine, White-striped on 2.4L) from throttle body nipple. Connect hand vacuum pump to nipple. Start engine and gradually increase RPM. Vacuum reading should remain constant as RPM increases. If vacuum is as specified, go to next step. If no vacuum exists, check throttle body purge port for obstructions.

3) Turn engine off. Label and disconnect vacuum hoses from solenoid valve. Disconnect electrical connector. Connect hand vacuum pump to solenoid valve nipple where White-striped hose was connected. Apply vacuum to solenoid valve. Vacuum should hold.

4) Apply battery voltage across terminals of solenoid valve. Vacuum should bleed down when voltage is applied to terminals. Using an ohmmeter, check resistance across solenoid valve terminals. If resistance at 68°F (20°C) is 36 to 44 ohms on Eclipse, or 62-74 ohms on Galant, go to next step. If resistance is not as specified, replace solenoid valve.

5) Disconnect EGR solenoid connector. Turn ignition on. Check voltage between ground and EGR solenoid connector terminal No. 1. If battery voltage exists, go to next step. If battery voltage does not exist, check wiring harness between MFI relay and EGR solenoid.

6) Turn ignition off. Disconnect PCM connector. Turn ignition on. Check voltage between ground and PCM connector terminal No. 6. If battery voltage exists, check PCM connector. If PCM connector is okay, replace PCM. If battery voltage does not exist, check EGR solenoid connector. If connector is okay, check wiring harness between PCM and EGR solenoid.

DTC P0420: CATALYTIC CONVERTER EFFICIENCY BELOW THRESHOLD

NOTE: This test does not apply to 2.4L engine with California emissions.

1) Check exhaust manifold for cracks. If exhaust manifold is okay, go to next step.

2) Using scan tool in MUT II mode, read SERVICE DATA No. 59 (rear heated oxygen sensor). Drive vehicle with transaxle in 2nd gear (M/T) or Low Range (A/T), and with wide open throttle. If voltage is .6-1.0 volt, go to next step. If voltage is not as specified, check rear Heated Oxygen Sensor (HO2S) circuit. See DTC P0136: REAR HEATED OXYGEN SENSOR (HO2S) CIRCUIT MALFUNCTION.

3) Using scan tool in MUT II mode, read SERVICE DATA No. 11 (front heated oxygen sensor). Monitor rear HO2S output voltage while repeatedly racing engine. If voltage is .6-1.0 volt, go to next step. If voltage is not as specified, check front HO2S circuit. See DTC P0130: FRONT HEATED OXYGEN SENSOR (HO2S) CIRCUIT MALFUNCTION.

4) Using scan tool, perform SENSOR READ TEST No. 11 (front heated oxygen sensor volts). Monitor front HO2S output voltage with engine at idle. Scan tool reading should alternate between 0-.4 volt and .6-1.0 volt. If voltage is as specified, go to next step. If voltage is not as specified, replace front HO2S.

5) Replace rear HO2S. Clear DTCs. Road test vehicle to verify repairs. If DTC P0420 resets, replace catalytic convertor. Clear DTCs. Road test vehicle to verify repairs. If DTC P0420 resets, replace PCM.

DTC P0421: WARM-UP CATALYTIC CONVERTER EFFICIENCY BELOW THRESHOLD

NOTE: This test applies to 2.4L engine with California emissions only.

1) Check exhaust manifold for cracks. If exhaust manifold is okay, go to next step.

2) Using scan tool in MUT II mode, read SERVICE DATA No. 59 (rear heated oxygen sensor). Drive vehicle with transaxle in 2nd gear (M/T) or Low Range (A/T), and with wide open throttle. If voltage is .6-1.0 volt, go to next step. If voltage is not as specified, check rear Heated Oxygen Sensor (HO2S) circuit. See DTC P0136: REAR HEATED OXYGEN SENSOR (HO2S) CIRCUIT MALFUNCTION.

3) Using scan tool in MUT II mode, read SERVICE DATA No. 11 (front heated oxygen sensor). Monitor rear HO2S output voltage while repeatedly racing engine. If voltage is .6-1.0 volt, go to next step. If voltage is not as specified, check front HO2S circuit. See DTC P0130: FRONT HEATED OXYGEN SENSOR (HO2S) CIRCUIT MALFUNCTION.

4) Using scan tool, perform SENSOR READ TEST No. 11 (front heated oxygen sensor volts). Monitor front HO2S output voltage with engine at idle. Scan tool reading should alternate between 0-.4 volt and .6-1.0 volt. If voltage is as specified, go to next step. If voltage is not as specified, replace front HO2S.

5) Replace rear HO2S. Clear DTCs. Road test vehicle to verify

repairs. If DTC 0421 resets, replace catalytic convertor. Clear DTCs. Road test vehicle to verify repairs. If DTC 0421 resets, replace PCM.

DTC P0442: EVAPORATIVE (EVAP) CONTROL SYSTEM LEAK DETECTED

1) Ensure fuel tank cap is tight. Check fuel vent valve. Repair or replace as necessary. If fuel vent valve is okay, go to next step.

2) Using scan tool in MUT-II mode, read SERVICE DATA No. 08 (evaporative emission purge solenoid). Turn ignition on. If solenoid turns on, go to next step. If solenoid does not turn on, check for EVAP control system purge control valve malfunction. See DTC P0443: EVAPORATIVE (EVAP) CONTROL SYSTEM PURGE CONTROL VALVE CIRCUIT MALFUNCTION.

3) Using scan tool in MUT-II mode, read SERVICE DATA No. 29 (evaporative ventilation solenoid). Turn ignition on. If solenoid turns on, go to next step. If solenoid does not turn on, check for EVAP control system vent control valve malfunction. See DTC P0446: EVAPORATIVE (EVAP) CONTROL SYSTEM VENT CONTROL MALFUNCTION.

4) On Galant (Federal), go to next step. On all other models, using scan tool in MUT-II mode, read SERVICE DATA No. 73 (fuel tank differential pressure sensor). Remove gas cap. Turn ignition on. If scan tool displays -3.3-3.3 kPa, go to next step. If scan tool does not display -3.3-3.3 kPa, check for EVAP control system pressure sensor malfunction. See DTC P0450: EVAPORATIVE (EVAP) CONTROL SYSTEM PRESSURE SENSOR MALFUNCTION.

5) Using scan tool in MUT-II mode, read SERVICE DATA No. 21 (engine coolant temperature sensor). If temperature displayed on scan tool is equal to actual engine coolant temperature as measured with a thermometer, go to next step. If temperature displayed on scan tool is not equal to actual coolant temperature, check engine coolant temperature circuit. See DTC P0115: ENGINE COOLANT TEMPERATURE (ECT) CIRCUIT MALFUNCTION.

6) Using scan tool in MUT II mode, read SERVICE DATA No. 13 (intake air temperature). If temperature displayed on scan tool is equal to actual air temperature as measured with a thermometer, go to next step. If temperature displayed on scan tool is not equal to actual air temperature, check air temperature circuit. See DTC P0110: INTAKE AIR TEMPERATURE (IAT) CIRCUIT MALFUNCTION.

7) Using scan tool in MUT II mode, read SERVICE DATA No. 27 (power steering pressure switch). Start engine and allow it to idle. If scan tool displays OFF with steering wheel in straight-ahead position and ON with steering wheel turning, go to next step. If scan tool does not display as described, check power steering pressure sensor circuit. see DTC P0551: POWER STEERING PRESSURE SENSOR CIRCUIT RANGE/PERFORMANCE.

8) Check for contaminated fuel. Check if any fuel tank, purge line or vapor line seals have failed.

DTC P0443: EVAPORATIVE (EVAP) CONTROL SYSTEM PURGE CONTROL VALVE CIRCUIT MALFUNCTION

1) Turn engine off. Label and disconnect vacuum hose (Brown hose on Eclipse, Black/Red hose on Galant) from purge solenoid. Disconnect electrical connector. Connect hand vacuum pump to solenoid valve nipple where hose was connected. Apply vacuum to solenoid valve. Vacuum should hold.

2) Apply battery voltage across terminals of solenoid. Vacuum should bleed down when voltage is applied to terminals. Using an ohmmeter, check resistance across solenoid terminals. If resistance at 68°F (20°C) is 36 to 44 ohms on Eclipse and Galant (California), or 62-74 ohms on Galant (Federal), go to next step. If solenoid does not test as specified, replace solenoid.

3) Disconnect purge solenoid vacuum hose (Red paint mark on hose on Eclipse 2.4L engine, Red hose on all other models) from throttle body on turbo engine and Galant (Federal), or from intake manifold or plenum on all other engines. Connect hand-held vacuum pump to nipple. Apply 16 in. Hg of vacuum. Start engine and gradually increase RPM. Vacuum reading should remain constant as RPM increases. If vacuum is as specified, go to next step. If no vacuum exists, check throttle body purge port for obstruction.

4) Disconnect purge solenoid electrical connector. Check voltage between ground and purge solenoid connector terminal No. 2. Turn ignition on. If battery voltage exists, go to next step. If battery voltage does not exist, check wiring harness between MFI relay and purge solenoid connector.

5) Turn ignition off. Disconnect PCM connector. Turn ignition on. Check voltage between ground and PCM connector terminal No. 9. If battery voltage exists, check PCM connector. If PCM connector is okay, replace PCM. If battery voltage does not exist, check purge solenoid connector and wiring harness between PCM and purge solenoid connector.

DTC P0446: EVAPORATIVE (EVAP) CONTROL SYSTEM VENT CONTROL MALFUNCTION

1) Label and disconnect both vacuum hoses from EVAP vent solenoid. Disconnect EVAP vent solenoid electrical connector. Connect hand vacuum pump to EVAP vent solenoid valve nipple where Red-striped hose was connected. Apply vacuum to EVAP vent solenoid. Vacuum should hold.

2) Apply battery voltage to EVAP vent solenoid terminals. Vacuum should bleed down when voltage is applied to terminals. Using an ohmmeter, check resistance across EVAP vent solenoid terminals. If resistance is 17-21 ohms at 68°F (20°C), go to next step. If resistance is not as specified, replace EVAP vent solenoid.

3) Turn ignition on. Check voltage between ground and EVAP vent solenoid connector terminal No. 1. If battery voltage exists, go to next step. If battery voltage does not exist, check wiring harness between MFI relay and EVAP vent solenoid connector.

4) Turn ignition off. Disconnect PCM connector. Turn ignition on. Check voltage between ground and PCM connector terminal No. 55 on Eclipse, or No. 85 on Galant. Go to next step.

5) If battery voltage exists, check PCM connector. If PCM connector is okay, replace PCM. If battery voltage exists, clear DTCs. Road test vehicle to verify repairs. If DTC P0446 resets, replace PCM. If battery voltage does not exist, check EVAP vent solenoid connector. If connector is okay, check wiring harness between PCM and EVAP vent solenoid connector.

DTC P0450: EVAPORATIVE (EVAP) EMISSION CONTROL SYSTEM PRESSURE SENSOR MALFUNCTION

1) Disconnect fuel tank differential pressure sensor connector. Check voltage between ground and sensor connector terminal No. 3. If voltage is 4.8-5.2 volts, go to next step. If voltage is not as specified, check connectors and wiring harness between PCM and fuel tank differential pressure sensor.

2) Check continuity between ground and sensor connector terminal No. 2. If continuity exists, go to next step. If continuity does not exist, check connectors and wiring harness between PCM and fuel tank differential pressure sensor.

3) Check PCM connector. Repair connector as necessary. If PCM connector is okay, check wiring harness between PCM and fuel tank differential pressure sensor. Repair as necessary. If wiring harness is okay, replace sensor. Clear DTCs. Road test vehicle to verify repairs. If DTC P0450 resets, replace PCM.

DTC P0455: EVAPORATIVE (EVAP) CONTROL SYSTEM LARGE LEAK DETECTED

1) Ensure fuel tank cap is tight. Check fuel vent valve. Repair or replace as necessary. If fuel vent valve is okay, go to next step.

2) Using scan tool in MUT-II mode, read SERVICE DATA No. 08 (evaporative emission purge solenoid). Turn ignition on. If solenoid turns on, go to next step. If solenoid does not turn on, check for EVAP control system purge control valve malfunction. See DTC P0443: EVAPORATIVE (EVAP) CONTROL SYSTEM PURGE CONTROL VALVE CIRCUIT MALFUNCTION.

3) Using scan tool in MUT-II mode, read SERVICE DATA No. 29 (evaporative ventilation solenoid). Turn ignition on. If solenoid turns on, go to next step. If solenoid does not turn on, check for EVAP control system vent control valve malfunction. See DTC P0446: EVAPORATIVE (EVAP) CONTROL SYSTEM VENT CONTROL MALFUNCTION.

4) On Galant (Federal), go to next step. Using scan tool in MUT-II mode, read SERVICE DATA No. 73 (fuel tank differential pressure sensor). Remove gas cap. Turn ignition on. If scan tool displays -3.3-3.3 kPa, go to next step. If scan tool does not display -3.3-3.3 kPa, check for EVAP control system pressure sensor malfunction. See DTC P0450: EVAPORATIVE (EVAP) CONTROL SYSTEM PRESSURE SENSOR MALFUNCTION.

5) Using scan tool in MUT-II mode, read SERVICE DATA No. 21 (engine coolant temperature sensor). If temperature displayed on scan tool is equal to actual engine coolant temperature as measured using a thermometer, go to next step. If temperature displayed on scan tool is not equal to actual coolant temperature, check engine coolant temperature circuit. See DTC P0115: ENGINE COOLANT TEMPERATURE (ECT) CIRCUIT MALFUNCTION.

6) Using scan tool in MUT II mode, read SERVICE DATA No. 13 (intake air temperature). If temperature displayed on scan tool is equal to actual air temperature as measured using a thermometer, go to next step. If temperature displayed on scan tool is not equal to actual air temperature, check air temperature circuit. See DTC P0110: INTAKE AIR TEMPERATURE (IAT) CIRCUIT MALFUNCTION.

7) Using scan tool in MUT II mode, read SERVICE DATA No. 27 (power steering pressure switch). Turn engine on and allow it to idle. If scan tool displays OFF with steering wheel straight ahead and ON with steering wheel turning, go to next step. If scan tool does not display as described, check power steering pressure sensor circuit. see DTC P0551: POWER STEERING PRESSURE (PSP) SENSOR CIRCUIT RANGE/PERFORMANCE.

8) Check for contaminated fuel. Check if any fuel tank, purge line or vapor line seals have failed.

DTC P0500: VEHICLE SPEED SENSOR (VSS) MALFUNCTION

1) Disconnect Instrument Panel (I/P) connectors. Turn ignition on. While turning drive wheels, check voltage between ground and I/P connector C05 terminal No. 36 on Eclipse, or I/P connector D01 terminal No. 49 on Galant. If voltage is 4.7 volts or more, go to next step. If voltage is not as specified, go to step 3).

2) Check voltage between ground and connector C06 terminal No. 10 on Eclipse, or I/P connector D02 terminal No. 24. If battery voltage exists, replace instrument panel cluster. If battery voltage does not exist, check junction connectors and wiring harness between power supply and instrument panel cluster.

3) Remove VSS. Connect 12-volt power source between VSS terminals No. 1 and 2. Connect negative****positive lead of power source to terminal No. 1. Connect a 3-10 k/ohm resistor between

negative***positive lead of power source and terminal No. 3. Using an analog voltmeter, check voltage between terminals No. 2 and 3 while turning VSS shaft. Meter should pulse 4 times per revolution. If VSS is okay, go to next step on turbo engine or step 7) on 2.4L.

4) Turn ignition on. Check voltage between ground and VSS connector terminal No. 3. If voltage is 4.5 volts or more, go to next step. If voltage is not 4.5 volts or more, check wiring harness between VSS and instrument panel cluster.

5) Check continuity between ground and VSS connector terminal No. 2. If continuity exists, go to next step. If continuity does not exist, check wiring harness between ground and VSS.

6) Check voltage between ground and VSS connector terminal No. 1. If battery voltage does not exist, check junction connector and wiring harness between VSS and power supply.

7) Turn ignition on. Check voltage between ground and VSS connector terminal No. 3. If voltage is 4.5 volts or more, go to next step. If voltage is not 4.5 volts or more, check junction connector and wiring harness between VSS and instrument panel cluster.

8) Check voltage between ground and VSS connector terminal No. 1. If approximately 8 volts exist, go to next step. If voltage is not as specified, check junction connector and wiring harness between VSS and power supply.

9) Disconnect VSS connector. Turn ignition on. Check voltage between ground and VSS connector terminal No. 3. If voltage is 4.8-5.2 volts, go to next step. If voltage is not as specified, check connectors and wiring harness between VSS and PCM. If connectors and wiring harness are okay, replace PCM.

10) Check continuity between ground and VSS connector terminal No. 2. If continuity exists, go to next step. If continuity does not exist, check connectors and wiring harness between PCM and VSS.

11) Check PCM connector. Repair connector as necessary. If PCM connector is okay, check wiring harness between PCM and VSS. Repair as necessary. If wiring harness is okay, replace sensor. Clear DTCs. Road test vehicle to verify repairs. If DTC P0500 resets, replace PCM.

DTC P0505: IDLE CONTROL SYSTEM MALFUNCTION

1) Ensure engine coolant temperature is less than 68°F (20°C). Using a stethoscope, listen for operating sound of Idle Air Control (IAC) motor when ignition switch is placed in ON position. If operating sound can be heard, go to next step. If no operating sound can be heard on 2.4L, go to step 5). On turbo, go to step 4).

2) Disconnect IAC motor connector. Turn ignition on. Check voltage between ground and IAC motor connector terminal No. 2, and between ground and terminal No. 5. If battery voltage exists, go to next step. If battery voltage does not exist, check wiring harness between MFI relay and IAC motor connector.

3) Disconnect PCM connector. Turn ignition on. Check voltage between ground and PCM terminals No. 4, 5, 17 and 18. If battery voltage exists, check PCM connector. If PCM connector is okay, replace PCM. If battery voltage does not exist, go to next step.

4) Check IAC motor connector and wiring harness between PCM and IAC motor connector. If connector and wiring harness are okay, replace IAC motor.

5) Turn ignition off. Connect Test Harness (MB991348) between IAC motor and connector. Check voltage between ground and test harness terminals No. 2 and 4. Voltage should momentarily go from 1.5-4.0 volts to less than one volt or more than 4.5 volts right after ignition switch is turned on. If voltage is as specified on both circuits, replace PCM. If voltage is not as specified, go to next step.

6) Disconnect IAC motor connector. Check voltage between ground and IAC motor connector terminals No. 1, 2 and 4. Voltage should be 4.8-5.2 volts. Check continuity between ground and IAC motor connector terminal No. 3. Go to next step.

7) If voltage is as specified and continuity exists, check IAC motor connector. If IAC motor connector is okay, replace IAC motor on Eclipse or valve position sensor on Galant. If voltage is not as specified or continuity does not exist, check IAC motor connector and wiring harness between PCM and IAC motor connector. If connector and wiring are okay, replace PCM.

DTC P0510: CLOSED THROTTLE POSITION (TP) SWITCH MALFUNCTION

1) Disconnect TP sensor connector. Check continuity between TP sensor terminals No. 3 and 4. Continuity should exist with throttle at idle. Continuity should not exist when throttle is opened. If continuity is as specified, go to next step. If continuity is not as specified, replace TP sensor.

2) Turn ignition on. Check voltage between ground and TP sensor connector terminal No. 3. Voltage should be more than 4 volts. Check continuity between ground and TP sensor connector terminal No. 4. If voltage is as specified and continuity exists, check TP sensor connector. If connector is okay, replace PCM. If voltage is not as specified or continuity does not exist, check PCM connector and wiring harness between PCM and TP sensor connector. If connector and wiring are okay, replace PCM.

DTC P0551: POWER STEERING PRESSURE (PSP) SENSOR CIRCUIT RANGE/PERFORMANCE

Disconnect PSP switch connector. Turn ignition on. Check voltage between ground and PSP switch connector terminal No. 1. If battery voltage exists, check PSP switch connector. If PSP switch connector is okay, replace PCM. If battery voltage does not exist, check PCM connector, PSP switch connector and wiring harness between PCM and PSP switch. If connectors and wiring are okay, replace PCM.

DTC P0705: TRANSMISSION RANGE SENSOR CIRCUIT MALFUNCTION (A/T)

DTC P0705 is related to Electronic Automatic Transaxle (EATX) diagnostics. For diagnostic procedure, see TRANSMISSION SERVICE & REPAIR article.

DTC P1103: TURBOCHARGER WASTEGATE SOLENOID MALFUNCTION

NOTE: This test applies to Eclipse with 2.0L turbo engine only.

1) Disconnect Black vacuum hose from turbocharger wastegate solenoid. Connect a pressure gauge to disconnected hose. Plug solenoid nipple where Black hose was connected. Go to next step.

2) Drive vehicle at wide open throttle and accelerate to more than 3500 RPM in 2nd. Pressure gauge should stabilize at 6.4-14.7 psi (.4-1.0 kg/cm^2). Go to next step.

3) If pressure is more than specified, check for disconnected or cracked wastegate actuator hose, or malfunctioning wastegate actuator or wastegate valve. If pressure is less than specified, check for malfunctioning wastegate actuator, pressure leaks or faulty turbocharger.

DTC P1104: TURBOCHARGER WASTEGATE SOLENOID MALFUNCTION

NOTE: This test applies to Eclipse with 2.0L turbo engine only.

1) Disconnect White vacuum hose from wastegate solenoid nipple. Disconnect electrical connector. Connect hand vacuum pump to solenoid nipple where White hose was connected. Apply vacuum to solenoid. Vacuum should hold. Go to next step.
2) Disconnect Black vacuum hose from solenoid nipple. Apply battery voltage across terminals of solenoid. Using finger, plug and open solenoid nipple where Black hose was connected. Vacuum should exist with solenoid nipple open and should not exist with nipple plugged. If vacuum is not as specified, replace solenoid. If vacuum is as specified, go to next step.
3) Check voltage between ground and solenoid connector terminal No. 2. If battery voltage exists, go to next step. If battery voltage does not exist, check wiring harness between MFI relay and solenoid.
4) Turn ignition off. Disconnect PCM connector. Turn ignition on. Check voltage between ground and PCM connector terminal No. 11. If battery voltage exists, check PCM connector. If PCM connector is okay, replace PCM. If battery voltage does not exist, check solenoid connector. If connector is okay, check wiring harness between PCM and solenoid.

DTC P1105: FUEL PRESSURE SOLENOID MALFUNCTION

NOTE: This test applies to Eclipse with 2.0L turbo engine only.

1) Disconnect Black vacuum hose from fuel pressure solenoid nipple. Disconnect electrical connector. Connect hand vacuum pump to solenoid nipple where Black hose was connected. Apply vacuum to solenoid. Vacuum should hold. Go to next step.
2) Disconnect White vacuum hose from solenoid nipple. Apply battery voltage across solenoid terminals. Using finger, plug and open solenoid nipple where White hose was connected. Vacuum should exist with solenoid nipple open and should not exist with nipple plugged. If vacuum is not as specified, replace solenoid. If vacuum is as specified, go to next step.
3) Turn ignition off. Check resistance between solenoid terminals. If resistance is 36-44 k/ohms at 68°F (20°C), go to next step. If resistance is not as specified, replace solenoid.
4) Turn ignition on. Check voltage between ground and solenoid connector terminal No. 1. If battery voltage exists, go to next step. If battery voltage does not exist, check wiring harness between MFI relay and solenoid.
5) Turn ignition off. Disconnect PCM connector. Turn ignition on. Check voltage between ground and PCM connector terminal No. 3. If battery voltage exists, check PCM connector. If PCM connector is okay, replace PCM. If battery voltage does not exist, check solenoid connector. If connector is okay, check wiring harness between PCM and solenoid.

DTC P1400: MANIFOLD DIFFERENTIAL PRESSURE (MDP) SENSOR CIRCUIT MALFUNCTION

1) Disconnect MDP sensor connector. Install Test Harness (MD991348) between MDP sensor and harness connector. With engine at idle, check voltage between ground and test harness terminal No. 1. Reading should be 0.8-2.4 volts. When throttle is opened suddenly, voltage should momentarily rise to more than 0.8-2.4 volts. If voltage is as specified, go to next step. If voltage is not as specified, go to step 3).
2) With PCM connector connected, check voltage between ground and PCM connector terminal No. 73 on Eclipse, or No. 53 on Galant.

Start engine and allow it idle. If voltage is 0.8-2.4 volts, check PCM connector. If PCM connector is okay, replace PCM. If voltage is not as specified, check wiring harness between PCM and MDP sensor connector.

3) Disconnect MDP sensor connector. Turn ignition on. Check voltage between ground and MDP sensor connector terminal No. 3. Voltage should be 4.8-5.2 volts. Check continuity between ground and MDP sensor connector terminal No. 2.

4) If voltage is not as specified or continuity does not exist, check PCM connector and wiring harness between MDP sensor connector and PCM. If connector and wiring are okay, replace PCM. If voltage is as specified and continuity exists, check MDP sensor connector and wiring harness between PCM and MDP sensor connector. If connector and wiring are okay, replace MDP sensor.

DTC P1500: GENERATOR FR TERMINAL CIRCUIT MALFUNCTION

1) With generator field connector connected. Check voltage between ground and field connector terminal No. 4. Ensure radiator fan is off. In sequence, turn headlights, stoplights and rear defogger switch on and then off. Voltage should drop .2-3.5 volts with accessories on. If voltage is not as specified, go to next step. If voltage is as specified, replace PCM.

2) Disconnect generator field connector. Turn ignition on. Check voltage between ground and field connector terminal No. 4. If voltage is 4.8-5.2 volts, check field connector, and wiring harness between PCM and field connector. If connector and wiring are okay, replace generator. If voltage is not as specified, check PCM connector, junction connector and wiring harness between PCM and field connector. If wiring and connectors are okay, replace PCM.

DTC P1600: SERIAL COMMUNICATION LINK MALFUNCTION

DTC P1600 is related to Electronic Automatic Transaxle (EATX) diagnostics. For diagnostic procedure, see TRANSMISSION SERVICE & REPAIR article.

DTC P1715: PG ASSEMBLY MALFUNCTION

DTC P1715 is related to Electronic Automatic Transaxle (EATX) diagnostics. For diagnostic procedure, see TRANSMISSION SERVICE & REPAIR article.

DTC P1750: SOLENOID ASSEMBLY MALFUNCTION

DTC P1750 is related to Electronic Automatic Transaxle (EATX) diagnostics. For diagnostic procedure, see TRANSMISSION SERVICE & REPAIR article.

DTC P1791: ENGINE COOLANT TEMPERATURE LEVEL INPUT CIRCUIT TO TCM MALFUNCTION

DTC P1791 is related to Electronic Automatic Transaxle (EATX) diagnostics. For diagnostic procedure, see TRANSMISSION SERVICE & REPAIR article.

SUMMARY

If no hard DTCs (or only pass DTCs) are present, driveability symptoms exist, or intermittent DTCs exist, proceed to H - TESTS W/O CODES article for diagnosis by symptom (i.e., ROUGH IDLE, NO START, etc.) or intermittent diagnostic procedures.

H - TESTS W/O CODES

1998 Mitsubishi Galant

1998 ENGINE PERFORMANCE
Mitsubishi - Trouble Shooting - No Codes

Diamante, Eclipse, Galant, Mirage, Montero, Montero Sport, 3000GT

INTRODUCTION

Before using this article to diagnose symptoms or intermittent faults, perform testing in F - BASIC TESTING article and G - TESTS W/CODES article. Use this article to diagnose driveability problems existing when a hard Diagnostic Trouble Code (DTC) is not present.

NOTE: Some driveability problems may have been corrected by manufacturer with a revised Powertrain Control Module (PCM). Check with manufacturer for latest PCM.

Symptom checks can direct technician to malfunctioning component(s) for further diagnosis. A symptom should lead to a specific component, system test or adjustment.

Use intermittent test procedures to locate driveability problems that DO NOT occur when vehicle is being tested. These test procedures should also be used if an intermittent DTC was present, but no problem was found during self-diagnostic testing.

NOTE: For specific testing procedures, see G - TESTS W/CODES article. For specifications, see D - ADJUSTMENTS or C - SPECIFICATIONS article.

SYMPTOMS

SYMPTOM DIAGNOSIS

Symptom checks cannot be used unless problem occurs while vehicle is being tested. Before using this article to diagnose any symptom, perform basic diagnostic procedures in F - BASIC TESTING article and self-diagnostics in G - TESTS W/CODES article in order to reduce diagnostic time. The following symptoms are available for diagnosis:

* Difficult To Start/No Start (Cranks Okay)
* Rough Or Unstable Idle
* Engine Hesitates Or Poor Acceleration
* Engine Surges
* Detonation Or Knocking
* Poor Fuel Mileage

DIFFICULT TO START/NO START (CRANKS OKAY)

* Check idle air control (DC) motor (if applicable).
* Check idle air control (stepper) motor (if applicable).
* Check ignition switch.
* Check camshaft position sensor.
* Check crankshaft position sensor.
* Check park/neutral position switch (A/T).
* Check volume airflow sensor.
* Check engine coolant temperature sensor.

* Check power supply to PCM.
* Check fuel pressure.
* Check ignition timing.
* Check for disconnected or damaged vacuum hoses.
* Check for control relay malfunction.
* Check for SFI system malfunction.
* Check for fuel pump drive control system malfunction.
* Check for ignition coil malfunction.
* Check for power transistor malfunction (if applicable).
* Check for fuel injector malfunction.
* Check for PCM malfunction.
* Ensure electrical harness, connectors and wires are not broken, bent or loose.

ROUGH OR UNSTABLE IDLE

* Check intake air temperature sensor.
* Check EVAP purge control solenoid valve (if applicable).
* Check vehicle speed sensor.
* Check engine coolant temperature sensor.
* Check barometric pressure sensor (if applicable).
* Check manifold absolute pressure sensor (if applicable).
* Check ignition switch.
* Check throttle position sensor.
* Check camshaft position sensor.
* Check crankshaft position sensor.
* Check power steering oil pressure switch (if applicable).
* Check A/C switch and power relay (if applicable).
* Check park/neutral position switch (A/T).
* Check heated oxygen sensor.
* Check volume airflow sensor.
* Check fuel pressure.
* Check for disconnected or damaged vacuum hoses.
* Check for SFI system malfunction.
* Check idle air control (DC) motor (if applicable).
* Check idle air control (stepper) motor (if applicable).
* Check for fuel injector malfunction.
* Check for power transistor malfunction (if applicable).
* Check for vehicle speed sensor malfunction.
* Check for PCM malfunction.
* Ensure electrical harness, connectors and wires are not broken, bent or loose.

ENGINE HESITATES OR POOR ACCELERATION

* Check intake air temperature sensor.
* Check engine coolant temperature sensor.
* Check barometric pressure sensor (if applicable).
* Check manifold absolute pressure sensor (if applicable).
* Check ignition switch.
* Check ignition coil.
* Check EGR control solenoid valve (if applicable).
* Check throttle position sensor.
* Check camshaft position sensor.
* Check crankshaft position sensor.
* Check power steering oil pressure switch (if applicable).
* Check A/C switch and power relay (if applicable).
* Check park/neutral position switch (A/T).
* Check heated oxygen sensor.
* Check volume airflow sensor.
* Check fuel pressure.
* Check for disconnected or damaged vacuum hoses.
* Check for SFI system malfunction.

* Check idle air control (DC) motor (if applicable).
* Check idle air control (stepper) motor (if applicable).
* Check for fuel injector malfunction.
* Check for power transistor malfunction (if applicable).
* Check A/C switch and power relay (if applicable).
* Check for PCM malfunction.
* Ensure electrical harness, connectors and wires are not broken, bent or loose.

ENGINE SURGES

* Check engine coolant temperature sensor.
* Check EGR control solenoid valve (if applicable).
* Check fuel pressure.
* Check for fuel injector malfunction.

DETONATION OR KNOCKING

* Check for knock sensor malfunction (if applicable).
* Check volume airflow sensor.
* Check for engine cooling system problems.
* Check fuel quality.
* Check intake air temperature sensor.
* Check barometric pressure sensor (if applicable).
* Check manifold absolute pressure sensor (if applicable).
* Check ignition coil.
* Check power transistor (if applicable).
* Check for EGR system malfunction.

POOR FUEL MILEAGE

* Check intake air temperature sensor.
* Check engine coolant temperature sensor.
* Check barometric pressure sensor (if applicable).
* Check manifold absolute pressure sensor (if applicable).
* Check ignition switch.
* Check throttle position sensor.
* Check camshaft position sensor.
* Check crankshaft position sensor.
* Check power steering oil pressure switch (if applicable).
* Check A/C switch and power relay (if applicable).
* Check park/neutral position switch (A/T).
* Check heated oxygen sensor.
* Check volume airflow sensor.
* Check fuel pressure.
* Check for SFI system malfunction.
* Check idle air control (DC) motor (if applicable).
* Check idle air control (stepper) motor (if applicable).
* Check for fuel injector malfunction.
* Check for power transistor malfunction (if applicable).

INTERMITTENTS

INTERMITTENT PROBLEM DIAGNOSIS

Intermittent fault testing requires duplicating circuit or component failure to identify problem. These procedures may lead to computer setting a Diagnostic Trouble Code (DTC) which may help in diagnosis.

If problem vehicle does not produce DTCs, monitor voltage or resistance values using a DVOM while attempting to reproduce conditions causing intermittent fault. A status change on DVOM

indicates a fault has been located.

Use a DVOM to pinpoint faults. See J - PIN VOLTAGE CHARTS article. When monitoring voltage, ensure ignition switch is in ON position or engine is running. Ensure ignition switch is in OFF position when monitoring circuit resistance. Status changes on DVOM during test procedures indicate area of fault.

TEST PROCEDURES

Intermittent Simulation

To reproduce conditions creating an intermittent fault, use following methods:

* Lightly vibrate component.
* Heat component.
* Wiggle or bend wiring harness.
* Spray component with water mist.
* Remove/apply vacuum source.

Monitor circuit/component voltage or resistance while simulating intermittent fault. If engine is running, monitor for diagnostic trouble codes. Use test results to identify a faulty component or circuit.

E - THEORY/OPERATION

1998 Mitsubishi Galant

1998 ENGINE PERFORMANCE
Mitsubishi - Theory & Operation

Diamante, Eclipse, Galant, Mirage, Montero, Montero Sport, 3000GT

INTRODUCTION

This article covers basic description and operation of engine performance-related systems and components. Read this article before diagnosing vehicles or systems with which you are not completely familiar.

AIR INDUCTION SYSTEM

NON-TURBOCHARGED ENGINES

Mirage equipped with 1.5L engine uses a Manifold Absolute Pressure (MAP) sensor instead of a Volume Airflow (VAF) sensor. Filtered air is ducted to a plenum-mounted throttle body.

All other models use same basic air induction system using a remote air filter (with VAF sensor) connected to a plenum-mounted throttle body.

TURBOCHARGED ENGINES

In addition to basic air induction system, turbocharging system components include turbocharger(s), charge air cooler(s), air by-pass valve(s), wastegate actuator(s), wastegate control solenoid valve(s) and intake duct(s).

Wastegate Control Solenoid Valve(s)

Powertrain Control Module (PCM) energizes solenoid valve(s), controlling bleed-off rate of turbocharger pressure by wastegate actuator(s).

COMPUTERIZED ENGINE CONTROLS

Sequential Fuel Injection (SFI) is a computerized engine control system, which controls fuel injection, ignition timing, idle speed and emission control systems.

POWERTRAIN CONTROL MODULE (PCM)

PCM, also known as Engine Control Module (ECM), receives and processes signals from input devices. Operating conditions such as cold starting, altitude, acceleration and deceleration affect input device signals. Based on signals received, PCM sends signals to various components, which control fuel injection, ignition timing, idle speed and emission control systems. For PCM location, see PCM LOCATION table.

PCM LOCATION TABLE

Application	Location
Eclipse 2.0L Non-Turbo	In Front of Left Front Strut Tower

Mirage & Montero Sport	Behind Right Side Of Instrument Panel (Glove Box)
Montero	Right Front Kick Panel
All Others	Behind Center Console

NOTE: Components are grouped into 2 categories. The first category covers INPUT DEVICES, which control or produce voltage signals monitored by Powertrain Control Module (PCM). The second category covers OUTPUT SIGNALS, which are components controlled by PCM.

INPUT DEVICES

Vehicles are equipped with different combinations of input devices. Not all input devices are used on all models. To determine input device usage on specific models, see appropriate wiring diagram in L - WIRING DIAGRAMS article. The following are available input devices.

Air Conditioning Switch

When A/C is turned on, signal is sent to PCM. With engine at idle, PCM increases idle speed through Idle Air Control (IAC) motor.

Airflow Sensor Assembly

Assembly is mounted inside air cleaner, and incorporates barometric pressure sensor, intake air temperature sensor and volume airflow sensor.

Barometric (BARO) Pressure Sensor

Sensor is incorporated into airflow sensor assembly. Sensor converts barometric pressure to electrical signal, which is sent to PCM. PCM adjusts air/fuel ratio and ignition timing according to altitude.

Camshaft Position (CMP) Sensor

On SOHC engines equipped with a distributor, CMP sensor is located in distributor. On Eclipse (Turbo) and DOHC V6 engines, sensor is located beside camshaft, in front of engine. On all other engines, CMP sensor is a separate unit mounted in place of distributor. PCM determines TDC based on pulse signals received from sensor, and then controls MFI timing.

Closed Throttle Position (CTP) Switch

CTP switch is located in the Throttle Position (TP) sensor. PCM senses whether accelerator pedal is depressed or not. High voltage (open) or low voltage (closed) signal is input to PCM, which then controls Idle Air Control (IAC) motor based on input signal.

Crankshaft Position (CKP) Sensor

CKP sensor is located in distributor on SOHC engines, except 1.5L 4-cylinder with California emissions. On DOHC 4-cylinder, DOHC V6 and 1.5L 4-cylinder engines with California emissions, CKP sensor is located beside crankshaft, in front of engine. PCM determines crankshaft position on pulse signals received from sensor, and then controls MFI timing and ignition timing.

Engine Coolant Temperature (ECT) Sensor

ECT sensor converts coolant temperature to electrical signal for use by PCM. PCM uses coolant temperature information to control fuel enrichment when engine is cold.

Heated Oxygen Sensor (HO2S)

HO2S detects oxygen content in exhaust gas and sends this information to PCM. PCM uses input signals from HO2S to vary duration of fuel injection. HO2S heater stabilizes sensor temperature regardless of exhaust gas temperature to allow for more accurate exhaust oxygen content readings.

Idle Air Control (IAC) Valve Position Sensor

Sensor is incorporated in IAC motor. Sensor senses IAC motor plunger position and sends electrical signal to PCM.

Ignition Timing Adjustment Terminal

Used for adjusting base ignition timing. When terminal is grounded, PCM timing control function is by-passed, allowing base timing to be adjusted.

Intake Air Temperature (IAT) Sensor

IAT sensor is incorporated into airflow sensor assembly. This resistor-based sensor measures temperature of incoming air and supplies air density information to PCM.

Knock Sensor (KS)

KS is located in cylinder block and senses engine vibration during detonation (knock). KS converts vibration into electrical signal. PCM retards ignition timing based on this signal.

Manifold Differential Pressure (MDP) Sensor

MDP sensor converts negative air pressure in intake manifold plenum into voltage signals sent to PCM. PCM monitors Exhaust Gas Recirculation (EGR) system using these signals.

Park/Neutral Position (PNP) Switch (Automatic Transmission)

PNP switch senses position of transmission select lever, indicating engine load due to automatic transmission engagement. Based on this signal, PCM commands IAC motor to increase throttle angle, maintaining optimum idle speed.

Power Steering Oil Pressure Switch

Switch detects increase in power steering oil pressure. When power steering oil pressure increases, switch contacts close, signaling PCM. PCM commands IAC motor, raising idle speed to compensate for drop in engine RPM due to power steering load.

Throttle Position (TP) Sensor

TP sensor is a variable resistor mounted on throttle body. PCM uses voltage signal from TP sensor to determine throttle plate angle.

Vehicle Speed Sensor (VSS)

Mounted on transaxle/transmission, VSS sends a pulsing signal to PCM for vehicle speed calculation. PCM uses this calculation for cruise control and fuel cut-off.

Volume Airflow (VAF) Sensor

Incorporated into airflow sensor assembly, VAF sensor measures intake airflow rate. Intake air flows through tunnel in airflow sensor assembly. VAF sensor sends frequency signal to PCM. PCM uses signal to adjust fuel injection rate.

OUTPUT SIGNALS

NOTE: Vehicles are equipped with various combinations of computer-controlled components. Not all components listed below are used on every vehicle. To determine component

usage on specific models, see appropriate wiring diagram in L - WIRING DIAGRAMS article. For theory and operation on each output component, refer to system indicated after component.

Data Link Connector (DLC)
See SELF-DIAGNOSTIC SYSTEM.

EGR Control Solenoid Valve
See EXHAUST GAS RECIRCULATION (EGR) CONTROL under EMISSION SYSTEMS.

Fuel Injectors
See FUEL CONTROL under FUEL SYSTEM.

Fuel Pressure Control Solenoid Valve (Turbo)
See FUEL DELIVERY under FUEL SYSTEM.

Fuel Pressure Regulator
See FUEL DELIVERY under FUEL SYSTEM.

Idle Air Control (IAC) Motor
See IDLE SPEED under FUEL SYSTEM.

Malfunction Indicator Light
See SELF-DIAGNOSTIC SYSTEM.

Power Transistor(s) & Ignition Coils
See IGNITION SYSTEMS.

Purge Control Solenoid Valve
See EVAPORATIVE CONTROL under EMISSION SYSTEMS.

Wastegate Control Solenoid Valve
See TURBOCHARGED ENGINES under AIR INDUCTION SYSTEM.

FUEL SYSTEM

FUEL DELIVERY

Electric fuel pump, located in gas tank, feeds fuel through in-tank fuel filter, external fuel filter (located in engine compartment) and fuel injector rail.

Fuel Pump
Fuel pump consists of a motor-driven impeller. Pump has an internal check valve to maintain system pressure, and a relief valve to protect fuel pressure circuit. Pump receives voltage supply from MFI control relay.

Fuel Pressure Control Solenoid Valve (Turbo)
Valve prevents rough idle due to fuel percolation. On engine restart, if engine coolant or intake air temperature reaches a preset value, PCM applies voltage to fuel pressure control solenoid valve for 2 minutes after enginerestart. Valve will open, allowing atmospheric pressure to be applied to fuel pressure regulator diaphragm. This allows maximum available fuel pressure at injectors, enriching fuel mixture and maintaining stable idle at high engine temperatures.

Fuel Pressure Regulator
Located on fuel injector rail, this diaphragm-operated relief valve adjusts fuel pressure according to engine manifold vacuum.
As engine manifold vacuum increases (closed throttle), fuel

pressure regulator diaphragm opens relief valve, allowing pressure to bleed off through fuel return line, reducing fuel pressure.

As engine manifold vacuum decreases (open throttle), fuel pressure regulator diaphragm closes valve, preventing pressure from bleeding off through fuel return line, increasing fuel pressure.

FUEL CONTROL

Fuel Injectors

Fuel is supplied to engine through electronically pulsed (timed) injector valves located on fuel rail(s). PCM controls amount of fuel metered through injectors based on information received from sensors.

IDLE SPEED

Air Conditioning (A/C) Relay

When A/C is turned on with engine at idle, PCM signals IAC motor to increase idle speed. To prevent A/C compressor from switching on before idle speed has increased, PCM momentarily opens A/C relay circuit.

Idle Air Control (IAC) Motor

Motor controls pintle-type air valve to regulate volume of intake air at idle.

During start mode, PCM controls idle intake air volume according to Engine Coolant Temperature (ECT) sensor input. After starting, with idle position switch activated (throttle closed), fast idle speed is controlled by IAC motor and fast idle air control valve (if equipped).

When idle switch is deactivated (throttle open), IAC motor moves to a preset position in accordance with ECT sensor input.

PCM signals IAC motor to increase engine RPM in the following situations: A/T (if applicable) is shifted from Neutral to Drive, A/C is turned on, or power steering pressure reaches a preset value.

IGNITION SYSTEMS

DIRECT IGNITION SYSTEM (DIS)

Depending on number of cylinders, ignition system is a 2 or 3-coil, distributorless ignition system. On Eclipse (Turbo) and DOHC V6 engines, Camshaft Position (CMP) sensor is located beside camshaft, in front of engine. On all other engines equipped with DIS, CMP sensor is a separate unit mounted in place of distributor. On DOHC 4-cylinder, DOHC V6 and 1.8L 4-cylinder engines with California emissions, Crankshaft Position (CKP) sensor is located beside crankshaft, in front of engine. PCM determines TDC based on pulse signals received from sensors and then controls MFI and ignition timing.

Power Transistors & Ignition Coils

Based on crankshaft position and CMP sensor inputs, PCM controls timing and directly activates each power transistor to fire coils. On 4-cylinder engines, power transistor "A" controls primary current of ignition coil "A" to fire spark plugs on cylinders No. 1 and No. 4 at the same time. Power transistor "B" controls primary current of ignition coil "B" to fire spark plugs on cylinders No. 2 and No. 3 at the same time. On V6 engines, companion cylinders No. 1 and 4, 2 and 5, and 3 and 6 are fired together.

On all models, although each coil fires 2 plugs at the same time, ignition takes place in only one cylinder, since the other

cylinder is on its exhaust stroke when plug fires.

HALL EFFECT IGNITION SYSTEM

This system is equipped with a Hall Effect distributor. Shutter(s) attached to distributor shaft rotate through distributor Hall Effect switch, also referred to as a Camshaft Position (CMP) sensor, which contains a distributor pick-up (a Hall Effect device and magnet). As shutter blade(s) pass through pick-up, magnetic field is interrupted and voltage is toggled between high and low. PCM uses this data along with Crankshaft Position (CKP) sensor data to control ignition timing and injector pulse width to maintain optimum driveability.

Power Transistor & Ignition Coil

Power transistor is mounted inside distributor with disc and optical sensing unit. When ignition is on, ignition coil primary circuit is energized. As distributor shaft rotates, disc rotates, triggering optical sensing unit. PCM receives signals from optical sensing unit. Signals are converted and sent to power transistor, interrupting primary current flow and inducing secondary voltage.

IGNITION TIMING CONTROL SYSTEM

Ignition timing is controlled by PCM. PCM adjusts timing based on various conditions such as engine temperature, altitude and detonation.

EMISSION SYSTEMS

EXHAUST GAS RECIRCULATION (EGR) CONTROL

Federal Emissions (Non-Turbo)

To lower oxides of nitrogen (NOx) exhaust emissions, a non-computer controlled exhaust gas recirculation system is used. EGR operation is controlled by throttle body ported vacuum. Vacuum is routed through vacuum control valve to prevent EGR operation at low engine temperatures.

Spring pressure holds EGR valve closed during low vacuum conditions (engine idling or wide open throttle). When vacuum pressure increases and overcomes EGR spring pressure, EGR valve is lifted to allow exhaust gases to flow into intake manifold for combustion.

California Emissions & Turbo

PCM controls EGR operation by activating EGR control solenoid valve according to engine load. When engine is cold, PCM signals EGR control solenoid valve to deactivate EGR.

EGR Control Solenoid Valve

Valve denies or allows vacuum supply to EGR valve based on PCM commands.

EVAPORATIVE CONTROL

Fuel evaporation system prevents fuel vapor from entering atmosphere. System consists of special fuel tank with vapor separator tanks (if equipped), vacuum relief filler cap, overfill limiter (2-way valve), fuel check valve, thermovalve (if equipped), charcoal canister, purge control valve, purge control solenoid valve, and connecting lines and hoses.

Purge Control Solenoid Valve

When engine is off, fuel vapors are vented into charcoal canister. When engine is warmed to normal operating temperature and running at speeds greater than idle, PCM energizes purge control solenoid valve, allowing vacuum to purge valve.

Canister vapors are then drawn through solenoid valve into intake manifold for burning. Purge control solenoid valve remains closed during idle and engine warm-up to reduce HC (hydrocarbons) and CO (carbon monoxide) emissions.

POSITIVE CRANKCASE VENTILATION (PCV) VALVE

PCV valve operates in closed crankcase ventilation system. Closed crankcase ventilation system consists of PCV valve, oil separator, breather and ventilation hoses.

PCV valve is a one-way check valve located in valve cover. When engine is running, manifold vacuum pulls PCV valve open, allowing crankcase fumes to enter intake manifold. If engine backfires through intake manifold, PCV valve closes to prevent crankcase combustion.

SELF-DIAGNOSTIC SYSTEM

NOTE: PCM diagnostic memory is retained by direct power supply from battery. Memory is not erased by turning off ignition, but it will be erased if battery or PCM is disconnected.

Self-diagnostic system monitors input and output signals through the Data Link Connector (DLC). Diagnostic Trouble Codes (DTCs) can only be read using a scan tester. For additional information, see G - TESTS W/CODES article.

Malfunction Indicator Light (MIL)

MIL (CHECK ENGINE light) comes on when ignition is turned on. MIL remains on for several seconds after engine has started. If an abnormal input signal occurs, MIL comes on and code is stored in memory. If an abnormal input signal returns to normal, PCM turns MIL off, but code remains stored in memory until it is cleared. If ignition is turned on again, MIL will not come on until PCM detects malfunction during system operation.

TRANSMISSION REMOVAL & INSTALLATION - A/T

1998 Mitsubishi Galant

1997-98 TRANSMISSION SERVICING
Mitsubishi Transmission Removal & Installation

Diamante, Eclipse, Galant, Mirage, Montero, 3000GT

REMOVAL & INSTALLATION

AWD & FWD MODELS

Removal

1) On all models except Galant, remove battery and battery tray. On 3000GT, remove washer tank. On all models, remove air cleaner cover with air inlet hose assembly. Raise and support vehicle. Remove wheels. Remove undercover(s) (if equipped). Disconnect control cables at transaxle. Drain transaxle fluid.

2) On AWD models, remove front exhaust pipe. On all models, disconnect neutral safety switch connector, oil cooler hoses and electrical connectors from transaxle. Disconnect speedometer cable and throttle control cable (if equipped). Remove starter motor.

3) Separate tie rod end. Separate lower ball joint. Separate stabilizer bar connection (if necessary). Remove axle shafts. See appropriate AXLE SHAFTS article in DRIVE AXLES. Remove center crossmember assembly.

4) On AWD models, separate transfer assembly from transaxle. Reference mark transfer assembly-to-drive shaft and remove transfer assembly.

5) On all models, remove transmission inspection (dust) cover. Place index mark on torque converter and drive plate for reassembly reference. Remove torque converter-to-drive plate bolts. Push torque converter away from engine into transaxle.

6) On all 4-cylinder models, support engine. On all models, support transaxle with jack. Remove bolts from transaxle mounts. Remove mounting brackets and remaining transaxle-to-engine bolts. Slide transaxle assembly to right and lower to remove.

CAUTION: Ensure torque converter is fully seated in transaxle before installation. Always install new snap rings on inner constant velocity joints.

Installation

1) To install, reverse removal procedure. Tighten transaxle-to-engine bolts and torque converter-to-drive plate bolts to specification. See TORQUE SPECIFICATIONS.

2) Ensure reference marks on torque converter-to-drive plate and transfer assembly-to-drive shaft align. Tighten mounting bolts with weight of engine and transaxle on mounts. Refill transaxle fluid to specified level. See LUBRICATION in TRANSMISSION SERVICING - A/T article. Adjust all control cables. See ADJUSTMENTS in TRANSMISSION SERVICING - A/T article.

RWD & 4WD MODELS

Removal

1) Disconnect negative battery cable. On Montero 4WD, remove transfer case shift lever knob, dust boot and retainer plate or console. Remove transfer case gearshift assembly.

2) On all models, raise and support vehicle. Remove undercarriage cover and/or skid plate(s). Drain transmission and transfer case (if applicable). Place reference mark on drive shaft(s)

and remove. Disconnect all external solenoid and switch connections.

3) On Montero 4WD, remove catalytic converter and front exhaust pipe. On all models, disconnect speedometer cable and control cables at transmission. Remove starter and bellhousing cover. Place reference mark on torque converter and drive plate for reassembly reference. Remove torque converter bolts. Push torque converter back and away from drive plate.

4) Disconnect transmission cooler lines. Remove oil filler tube. Secure transmission on a jack. Raise transmission slightly to take weight off mount. Remove crossmember-to-mount bolts and crossmember.

5) Remove transfer case mounting bracket and mount (if equipped). Remove transmission-to-engine mounting bolts. Carefully lower transmission from vehicle.

CAUTION: Ensure torque converter is fully seated in transmission before installation.

Installation

1) To install, reverse removal procedure. Tighten transmission-to-engine bolts and torque converter-to-drive plate bolts to specification. See TORQUE SPECIFICATIONS. Tighten mount bolts with weight of engine and transmission on mounts. Ensure reference marks on drive shaft(s) and torque converter-to-drive plate are matched.

2) Apply sealant to transfer case gearshift assembly gasket before installation. Coat transmission oil filler tube "O" ring with transmission fluid before installation. Refill transmission fluid to specified level. See LUBRICATION in TRANSMISSION SERVICING - A/T article. Adjust all control cables. See ADJUSTMENTS in TRANSMISSION SERVICING - A/T article.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS - FWD MODELS

Applications	Ft. Lbs. (N.m)
Ball Joint Nut	74 (100)
Center Crossmember Assembly Front Bolt	69 (93)
Center Crossmember Assembly Rear Bolt	52 (70)
Starter Bolts	22 (30)
Tie Rod End Nut	21 (28)
Torque Converter-To-Drive Plate Bolt	33-38 (45-52)
Transaxle-To-Engine Block Bolt	
8-mm Bolt	(1)
10-mm Bolt	22-25 (30-34)
12-mm Bolt	31-40 (42-54)
Upper Coupling Bolts	
2.4L	35 (48)
3.0L	54 (73)
Lower Coupling Bolts	
2.4L	35 (48)
3.0L	65 (88)

(1) - Tighten to 84-108 INCH lbs. (10-12 N.m).

TORQUE SPECIFICATIONS - RWD MODELS

Applications	Ft. Lbs. (N.m)
Engine-To-Transmission Bolt	65 (88)

Torque Converter-To-Drive Plate Bolt	30 (41)
Transmission-To-Engine Block Bolt	55 (74)

TRANSMISSION SERVICING - A/T

1998 Mitsubishi Galant

1997-98 TRANSMISSION SERVICING
Mitsubishi Automatic Transmission

Diamante, Eclipse, Galant, Mirage, Montero, 3000GT

IDENTIFICATION

AUTOMATIC TRANSMISSION APPLICATIONS

Model	Transmission/Transaxle
Diamante	Model F4A51 Transaxle
Eclipse	
AWD	Model W4A33 Transaxle
FWD	
2.0L Non-Turbo	Model F4AC1 Transaxle
2.0L Turbo	Model F4A33 Transaxle
2.4L	Model F4A23 Transaxle
Galant	Model F4A23 Transaxle
Mirage	
1.5L	Model F4A41 Transaxle
1.8L	Model F4A42 Transaxle
Montero	
2WD	Model R4AW3 Transmission
4WD	Model V4AW3 Transmission
3000GT	Model F4A33 Transaxle

LUBRICATION

SERVICE INTERVALS

Transaxle/Transmission
Check fluid level every 12 months or 15,000 miles. Change fluid and filter every 30,000 miles. If vehicle is operated under severe conditions, change fluid more often. If severe darkening of fluid and strong odor are noted, bands should also be adjusted.

Transfer Case
On 4WD and AWD models, change transfer case fluid every 30,000 miles.

CHECKING FLUID LEVEL

Transaxle/Transmission
1) Park vehicle on level area. Ensure oil is at normal operating temperature, parking brake is engaged, and engine is at idle. Move gear selector through each position, stopping briefly at each selection.
2) Place gear selector in Neutral, and clean area around dipstick tube. Ensure fluid level is between lower and upper marks, but never over upper mark, in HOT range. Add or drain fluid if necessary.

CAUTION: If severe darkening of fluid and strong odor are noted, change fluid and filter, and adjust bands.

Transfer Case (All Others)

Lubricant level should be to bottom of fill hole on side of transfer case.

RECOMMENDED FLUID

Transaxle/Transmission
Except Montero, use Diamond ATF SP-II. On Montero, use Dexron-II ATF.

Transfer Cases
Use SAE 75W-85 gear oil with API GL-4 rating or higher.

FLUID CAPACITIES

TRANSAXLE/TRANSMISSION REFILL CAPACITIES

Application	Qts. (L)
Diamante	9.0 (8.5)
Eclipse	
2.0L Non-Turbo	9.1 (8.6)
2.0L Turbo	7.1 (6.7)
2.4L	6.4 (6.1)
Galant	6.3 (6.0)
Mirage	8.2 (7.8)
Montero	10.4 (9.8)
3000GT	7.9 (7.5)

TRANSFER CASE REFILL CAPACITIES

Application	Pts. (L)
Eclipse AWD	1.0 (.5)
Montero	5.3 (2.5)
Montero Sport	4.9 (2.3)
3000GT	.6 (.3)

DRAINING & REFILLING

NOTE: Although manufacturer recommends changing only fluid, the oil filter/screen may also require replacement. If replacing oil filter/screen, note length and location of all bolts.

Transaxle (Except Montero)
1) Remove drain plug(s), and drain fluid. Some models may contain a drain plug located in housing below axle shaft, in oil pan. Remove oil pan. Remove oil filter/screen if necessary.
2) If oil filter/screen is replaced, tighten bolts to specification. See TORQUE SPECIFICATIONS. Clean oil pan, replace gasket, and install oil pan. Tighten oil pan bolts and drain plug to specification. See TORQUE SPECIFICATIONS. Ensure dipstick hole area is clean. Fill transmission with Diamond ATF SP-II, through filler tube, until COLD level is reached on dipstick.
3) Start engine and allow to idle for 2 minutes. Shift transaxle to each position, ending in Neutral. Add sufficient fluid to reach lower mark. After reaching normal operating temperature, fluid should be between upper and lower marks of HOT range on dipstick.

Transmission (Montero)
1) Remove drain plug (if equipped) from transmission pan, and allow fluid to drain. On models without drain plug, oil pan must be

removed to drain fluid. Remove oil filter/screen if necessary.

2) If oil filter/screen is replaced, tighten bolts to specification. See TORQUE SPECIFICATIONS. Clean oil pan, replace gasket, and install oil pan. Tighten oil pan bolts and drain plug to specification. See TORQUE SPECIFICATIONS. Ensure dipstick hole area is clean. Fill transmission with Dexron-II ATF, through filler tube, until COLD level is reached on dipstick. Start engine, and allow to idle for 2 minutes.

3) Shift transmission into each position, ending in Neutral. Check fluid level with engine running at idle. If necessary, add sufficient fluid to bring level to lower mark of dipstick. Recheck fluid level after transmission is at normal operating temperature.

Transfer Case

Drain plug is located on bottom of transfer case. Change drain plug gasket whenever fluid is changed. Lubricant level should be at bottom of fill hole on side of transfer case.

ADJUSTMENTS

KICKDOWN SERVO

Eclipse, Galant & 3000 GT

1) Remove all dirt and grease around kickdown servo switch. Remove snap ring and kickdown servo switch.

2) To prevent servo piston from turning, install Adapter (MD998915) and Kickdown Servo Wrench (MD998918) so tab of wrench engages with notch of piston. See Fig. 1.

CAUTION: DO NOT push servo piston inward while installing adapter and servo wrench. Install adapter in brake pressure port by hand ONLY. DO NOT use wrench to tighten adapter.

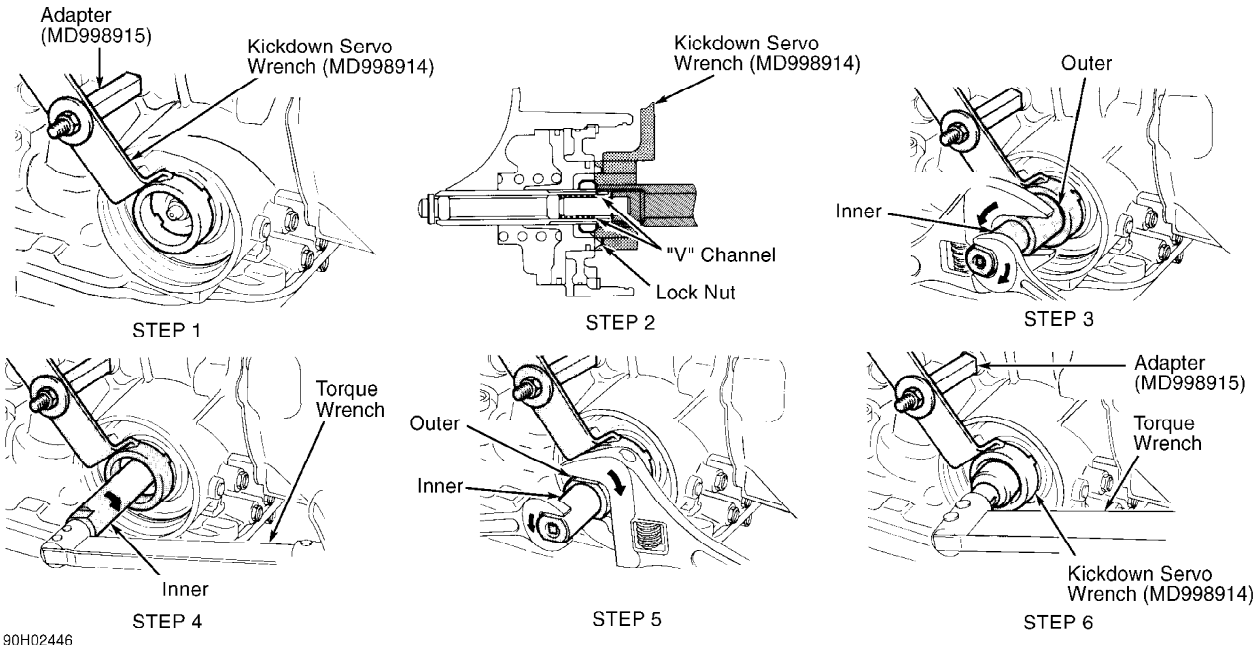


Fig. 1: Adjusting Kickdown Servo (Eclipse, Galant & 3000 GT) Courtesy of Mitsubishi Motor Sales of America.

3) Loosen lock nut to "V" channel of adjuster rod. Tighten inner section of Kickdown Service Adjustment Assembly (MD998916) until

it contacts lock nut. See Fig. 1.

4) Install outer section of kickdown service adjustment assembly on lock nut. Rotate outer section to left and inner section to right to contact lock nut with inner section.

5) Using an INCH-lb. torque wrench on inner section, tighten inner section to 89 INCH lbs. (10 N.m), and then loosen inner section. Tighten inner section to 44 INCH lbs. (5 N.m).

CAUTION: Before tightening lock nut with torque wrench, tighten it by hand until it contacts piston. If torque wrench is used initially, lock nut and adjustment rod may rotate together.

6) Back off outer section 2-2 1/4 turns. Rotate outer section to right and inner section to left until inner section is free of lock nut. Tighten lock nut by hand until it contacts piston. Using torque wrench, tighten lock nut to 18-23 ft. lbs. (25-32 N.m).

7) Remove adapter and kickdown servo wrench. Install new "O" ring in groove around switch. Install switch and snap ring.

SHIFT LINKAGE

Except Montero

1) Ensure shift and transaxle/transmission levers are both in Neutral position. Loosen adjusting nut on control cable. See Fig. 2. Loosen park/neutral position switch body bolts. Rotate park/neutral position switch until hole in end of transmission manual control lever is aligned with hole (cross section A-A) in flange of park/neutral position switch body. Tighten park/neutral position switch body bolts. Ensure holes in park/neutral position switch flange and transmission manual control lever stay aligned.

2) Gently pull control cable from dust cover. Make sure shift lever is still in Neutral. Tighten adjusting nut. Check transaxle/transmission operation through all ranges. Readjust control cable if necessary.

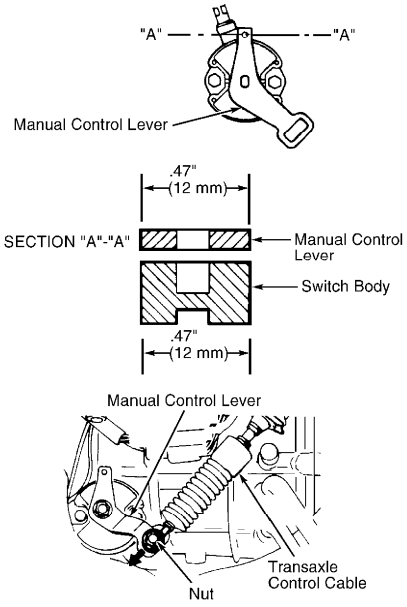


Fig. 2: Adjusting Shift Cable (Except Montero)
Courtesy of Mitsubishi Motor Sales of America.

Montero

Ensure shift and transmission levers are both in Neutral

position. Loosen adjusting nut on control cable. See Fig. 3. Gently pull control cable from dust cover. Make sure shift lever is still in Neutral. Tighten adjusting nut. Check transmission operation through all ranges. Readjust control cable if necessary.

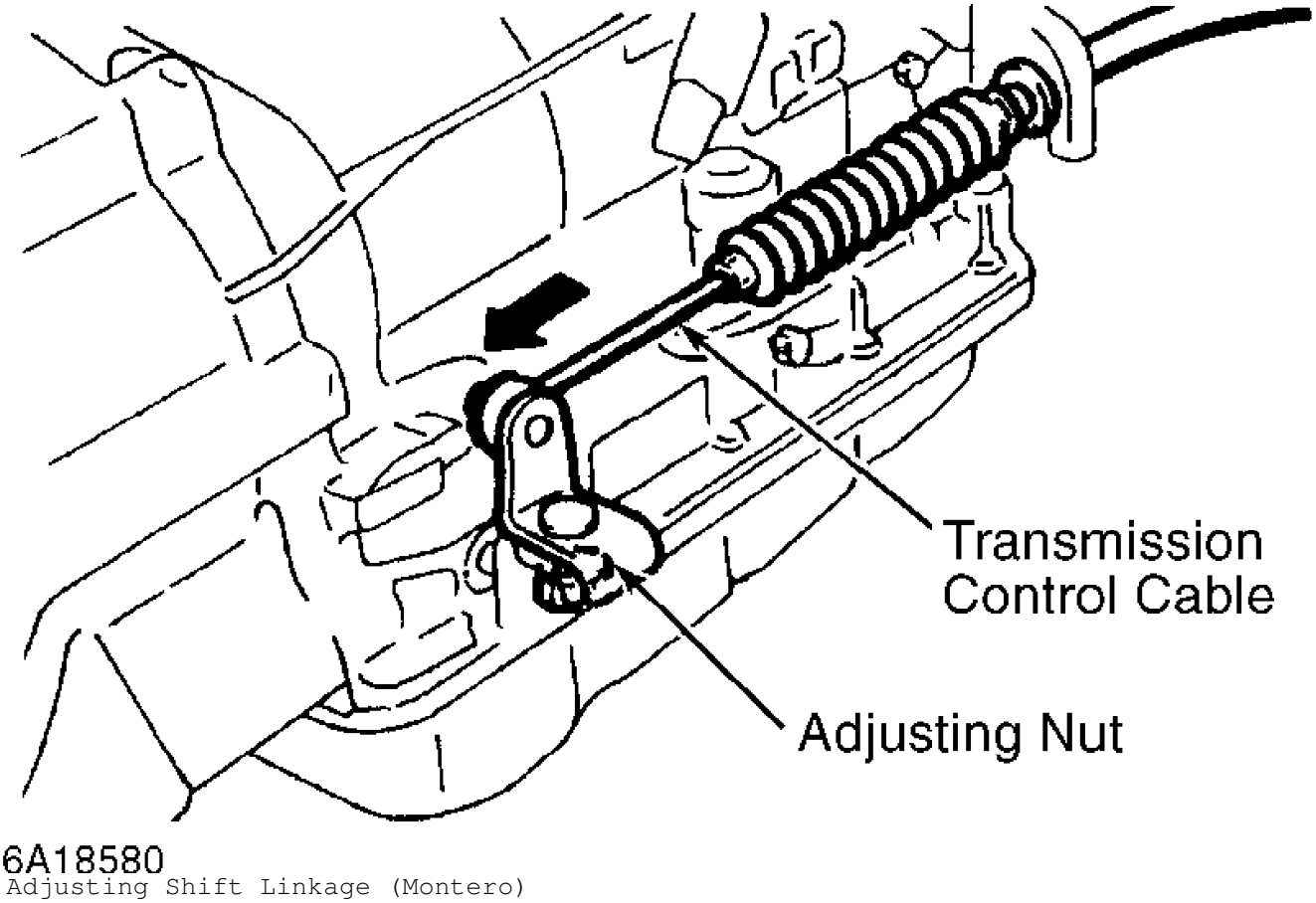


Fig. 3: Adjusting Shift Linkage (Montero)
Courtesy of Mitsubishi Motor Sales of America.

SHIFT LEVER SLEEVE

Eclipse & Galant

To adjust shift lever sleeve, remove shift handle on top of shift lever. With lever in Neutral, turn sleeve so distance between sleeve and lever end is within specification. See SHIFT LEVER SLEEVE CLEARANCE SPECIFICATION table. See Fig. 4. Ensure beveled side of sleeve faces toward push button (if equipped).

SHIFT LEVER SLEEVE CLEARANCE SPECIFICATION

Application	Clearance In. (mm)
Eclipse & Galant	.62-.64 (15.7-16.3)

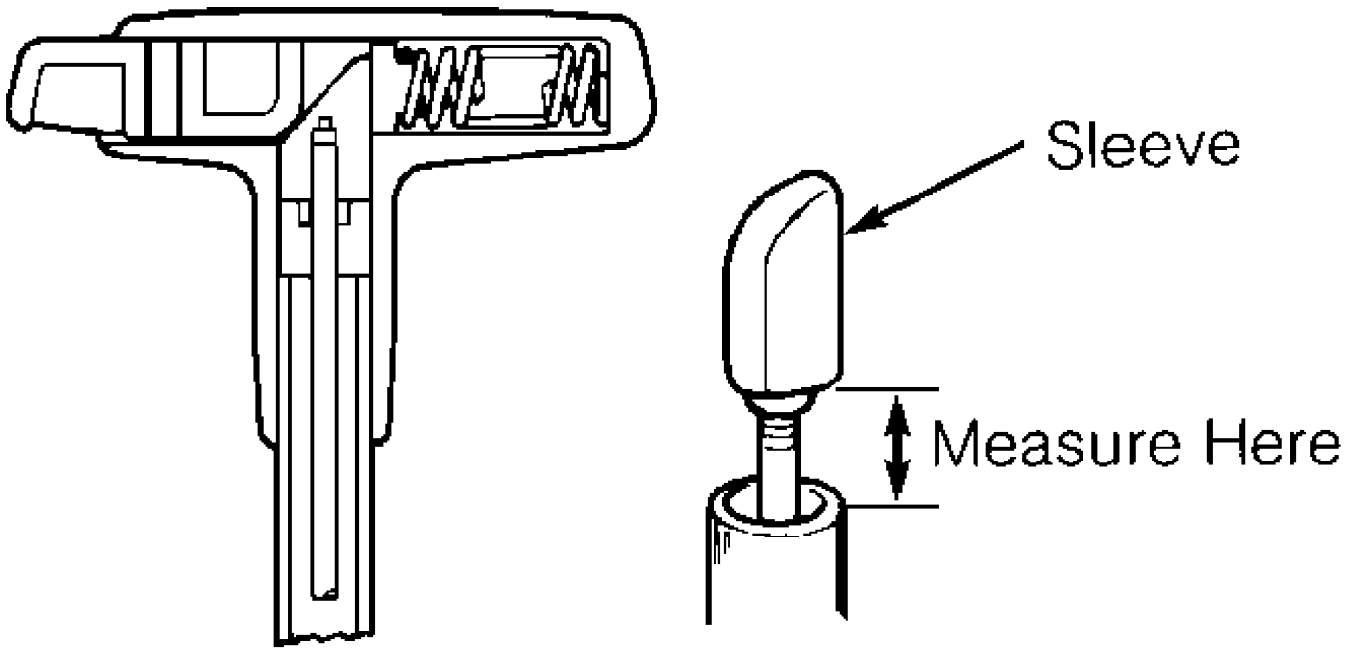


Fig. 4: Adjusting Shift Lever Sleeve (Eclipse & Galant)
Courtesy of Mitsubishi Motor Sales of America.

NEUTRAL SAFETY SWITCH

All Models

Neutral safety switch is adjusted along with shift linkage. See SHIFT LINKAGE.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Drain Plug	
Transaxle/Transmission	
Except Montero	22-25 (30-35)
Montero	13-17 (18-24)
Transfer Case	24 (32)
Rear Cover	17 (23)
	INCH Lbs. (N.m)
Kickdown Servo Lock Nut	121 (29)
Oil Filter/Screen Bolt	
Except Montero	48-60 (5.4-6.8)
Montero	61 (6.9)
Oil Pan Bolt	
Except Montero	84-108 (9.5-12.2)
Montero	69 (7.8)
Park/Neutral Switch Mounting Bolt (Except Montero)	97 (11)
Park/Neutral Switch Mounting Bolt (Montero)	115 (13)
Transmission Control Cable Adjusting Nut	115 (13)
Valve Body Cover	97 (11)

TRANSMISSION SERVICING - M/T

1998 Mitsubishi Galant

1997-98 TRANSMISSION SERVICING
Mitsubishi Manual Transmission

Eclipse, Galant, Mirage, Montero, 3000GT

IDENTIFICATION

MANUAL TRANSMISSION APPLICATIONS

Model	Transmission/Transaxle (Model)
Eclipse	
AWD	5-Speed Transaxle (W5M33)
FWD	
2.0L Non-Turbo	5-Speed Transaxle (F5MC1)
2.0L Turbo	5-Speed Transaxle (F5M33)
2.4L	5-Speed Transaxle (F5M31)
Galant	5-Speed Transaxle (F5M31)
Mirage	
1.5L	5-Speed Transaxle (F5M41)
1.8L	5-Speed Transaxle (F5M42)
Montero	
2WD	5-Speed Transmission (R5M21)
4WD	5-Speed Transmission (V5MT1)
3000GT	
SOHC & DOHC Non-Turbo	5-Speed Transaxle (F5M33)
DOHC Turbo	6-Speed Transaxle (W6MG1)

LUBRICATION

SERVICE INTERVALS

Check transaxle/transmission and transfer case fluid level every 30,000 miles. Change fluid at 30,000 miles if operated under severe conditions.

CHECKING FLUID LEVEL

Transaxle/Transmission
Check fluid level at fill hole on side of transaxle or transmission. Lubricant must be at bottom of fill hole.

Transfer Case
Transfer case contains separate drain and fill plugs. Lubricant must be at bottom of fill hole.

RECOMMENDED FLUID

Transaxle/Transmission
Use API classification GL-4 or higher SAE 75W-85W gear oil.

Transfer Case
Use API classification GL-4 or higher SAE 75W-85W gear oil.

FLUID CAPACITIES

TRANSAXLE/TRANSMISSION REFILL CAPACITIES

Application	Pts. (L)
Eclipse	
2.0L	4.2 (2.0)
2.0L Turbo	4.9 (2.3)
2.4L	4.9 (2.3)
Galant	4.6 (2.2)
Mirage	
1.5L	4.4 (2.1)
1.8L	4.6 (2.2)
Montero	
2.4L	4.9 (2.3)
3.0L	5.3 (2.5)
3000GT	
Non-Turbo	4.2 (2.0)
Turbo	5.0 (2.4)

TRANSFER CASE REFILL CAPACITIES

Application	Pts. (L)
Eclipse	1.1 (0.5)
Montero	
2.4L	5.3 (2.5)
3.0L	4.9 (2.3)
3000GT	1.3 (0.6)

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Except Montero 4WD	
Transfer Case Drain Plug & Filler Plug	24 (33)
Transmission Drain Plug & Filler Plug	24 (33)
Montero 4WD	
Transfer Case Drain Plug & Filler Plug	24 (33)
Transmission Drain Plug & Filler Plug	51 (69)

TROUBLE SHOOTING - BASIC PROCEDURES

1998 Mitsubishi Galant

GENERAL TROUBLE SHOOTING

*** PLEASE READ THIS FIRST ***

NOTE: This is GENERAL information. This article is not intended to be specific to any unique situation or individual vehicle configuration. The purpose of this Trouble Shooting information is to provide a list of common causes to problem symptoms. For model-specific Trouble Shooting, refer to SUBJECT, DIAGNOSTIC, or TESTING articles available in the section(s) you are accessing.

ACCESSORIES & ELECTRICAL

CHARGING SYSTEM TROUBLE SHOOTING

NOTE: This is GENERAL information. This article is not intended to be specific to any unique situation or individual vehicle configuration. The purpose of this Trouble Shooting information is to provide a list of common causes to problem symptoms. For model-specific Trouble Shooting, refer to SUBJECT, DIAGNOSTIC, or TESTING articles available in the section(s) you are accessing.

BASIC CHARGING SYSTEM TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
Vehicle Will Not Start	Dead battery	Check battery cells, alternator belt tension and alternator output
	Loose or corroded battery connections	Check all charging system connections
	Ignition circuit or switch malfunction	Check and replace as necessary
Alternator Light Stays On With Engine Running	Loose or worn alternator drive belt	Check alternator drive tension and condition, See Belt Adjustment in TUNE-UP article in the TUNE-UP section
	Loose alternator wiring connections	Check all charging system connections
	Short in alternator light wiring	See Indicator Warning Lights in STANDARD INSTRUMENTS in the ACCESSORIES & EQUIPMENT section
	Defective alternator stator or diodes	See Bench Tests in ALTERNATOR article
	Defective regulator	See Regulator Check in

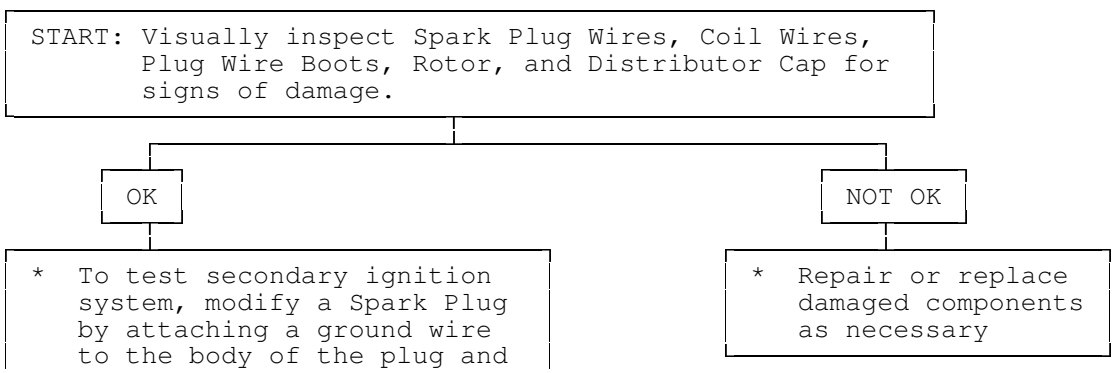
		ALTERNATOR article
Alternator Light Stays Off With Ignition Switch ON	Blown fuse	See WIRING DIAGRAMS
	Defective alternator	See Testing in ALTERNATOR article
	Defective indicator light bulb or socket	See Indicator Warning Lights in STANDARD INSTRUMENTS in the ACCESSORIES & EQUIPMENT section
Alternator Light Stays OFF With Ignition Switch ON	Short in alternator wiring	See On-Vehicle Tests in ALTERNATOR article
	Defective rectifier bridge	See Bench Tests in ALTERNATOR article
Lights or Fuses Burn Out Frequently	Defective alternator wiring	See On-Vehicle Tests in ALTERNATOR article
	Defective regulator	See Regulator Check in ALTERNATOR article
	Defective battery	Check and replace as necessary
Ammeter Gauge Shows Discharge	Loose or worn drive belt	Check alternator drive belt tension and condition. See Belt Adjustment in TUNE-UP article in the TUNE-UP section
	Defective wiring	Check all wires and wire connections
	Defective alternator or regulator	See Bench Tests and On-Vehicle Tests in ALTERNATOR article
	Defective ammeter, or improper ammeter wiring connection	See Testing in STANDARD INSTRUMENTS in the ACCESSORIES & EQUIPMENT section
Noisy Alternator	Loose drive pulley	Tighten drive pulley attaching nut
	Loose mounting bolts	Tighten all alternator mounting bolts
	Worn or dirty bearings	See Bearing Replacement ALTERNATOR article

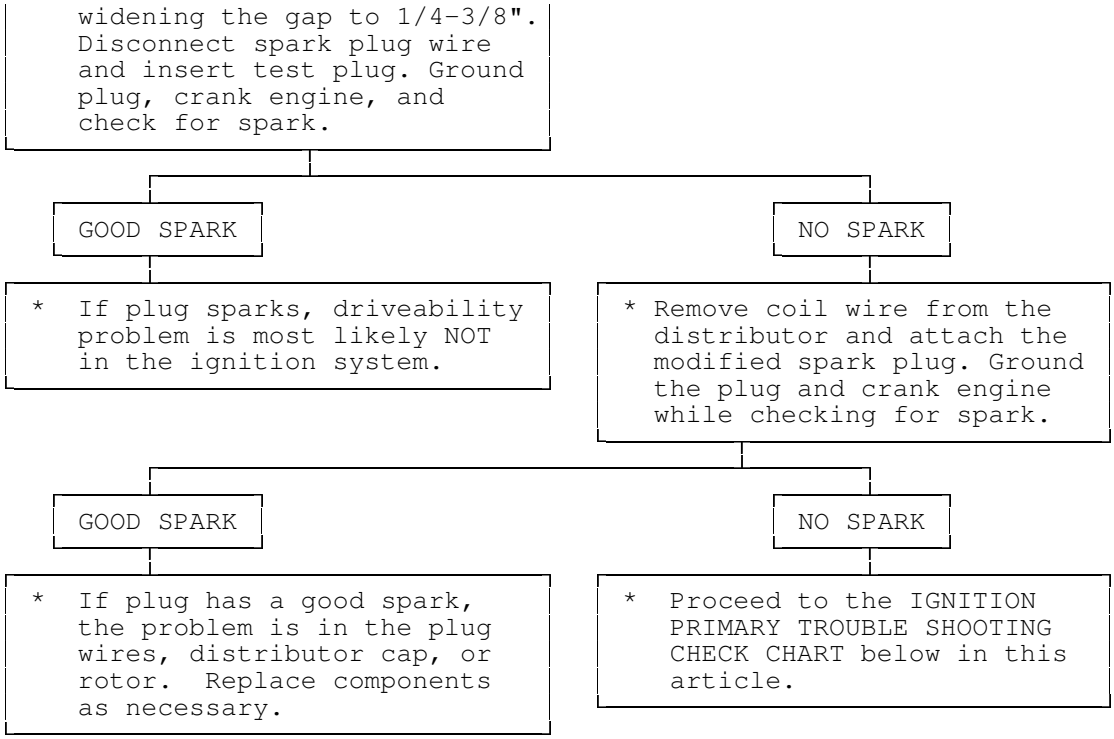
	Defective diodes or stator	See Bench Test in ALTERNATOR article
Battery Does Stay Charged	Loose or worn drive belt	Check alternator drive belt tension and condition. See Belt Adjustment in appropriate TUNE-UP article in the TUNE-UP section
	Loose or corroded battery connections	Check all charging system connections
	Loose alternator connections	Check all charging system connections
	Defective alternator or battery	See On-Vehicle Tests and Bench Tests in ALTERNATOR article
	Add-on electrical accessories exceeding alternator capacity	Install larger alternator
Battery Overcharged-Uses Too Much Water	Defective battery	Check alternator output and repair as necessary
	Defective alternator	See On-Vehicle Test and Bench Tests in ALTERNATOR article
	Excessive alternator voltage	Check alternator output and repair as necessary

IGNITION SYSTEM TROUBLE SHOOTING

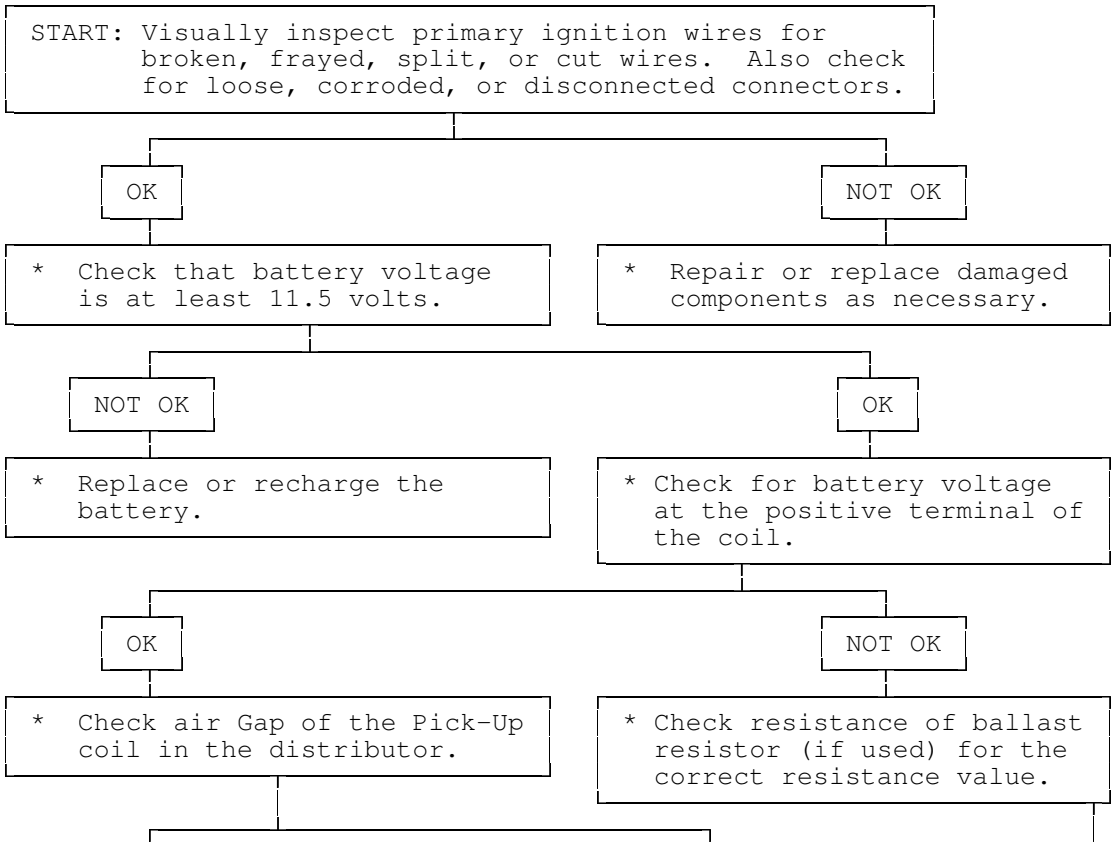
NOTE: This is GENERAL information. This article is not intended to be specific to any unique situation or individual vehicle configuration. The purpose of this Trouble Shooting information is to provide a list of common causes to problem symptoms. For model-specific Trouble Shooting, refer to SUBJECT, DIAGNOSTIC, or TESTING articles available in the section(s) you are accessing.

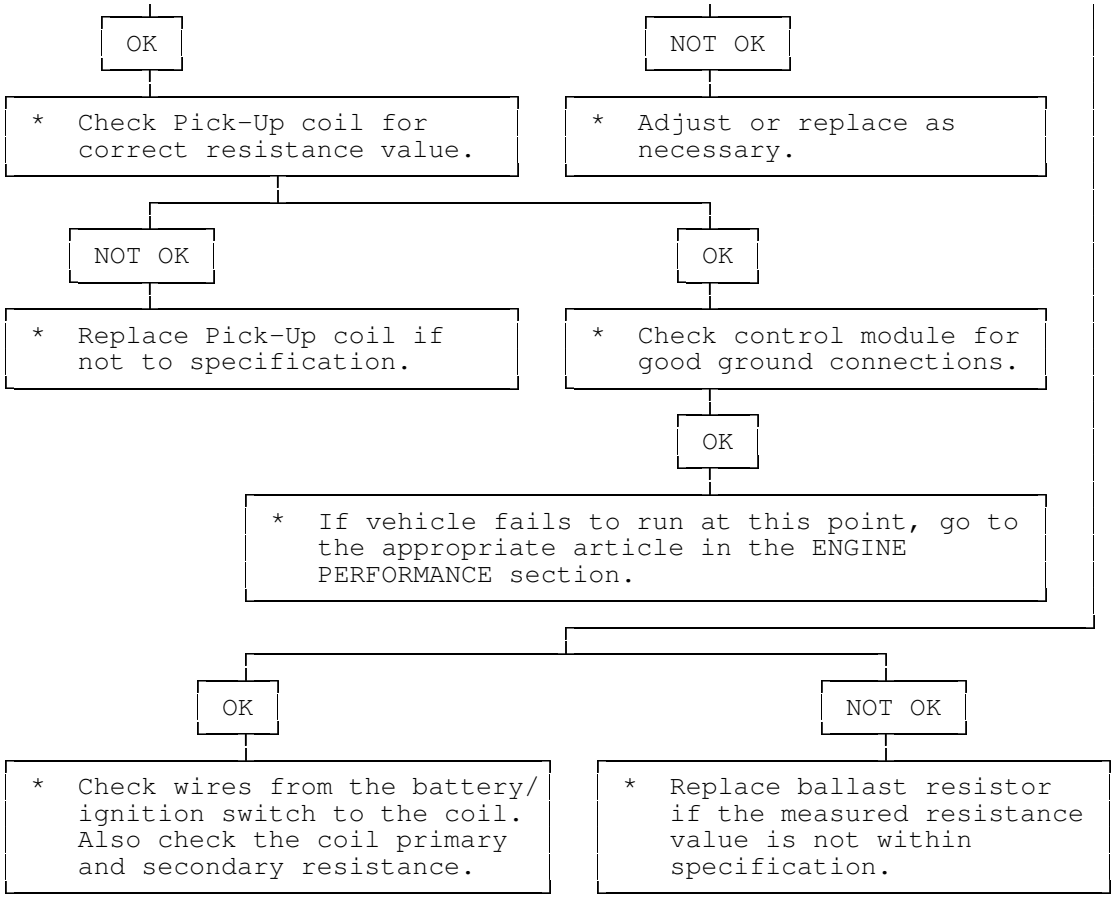
Ignition Secondary Trouble Shooting Chart





Ignition Primary Trouble Shooting Chart





STARTER TROUBLE SHOOTING

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BASIC STARTER TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
Starter Fails to Operate	Dead battery or bad connections between starter and battery	Check battery charge and all wires and connections to starter
	Ignition switch faulty or misadjusted	Adjust or replace ignition switch
	Open circuit between starter switch ignition terminal on starter relay	Check and repair wires and connections as necessary
	Starter relay or starter defective	See Testing in STARTER article

	Open solenoid pull-in wire	See Testing in STARTER article
Starter Does Not Operate and Headlights Dim	Weak battery or dead cell	Charge or replace battery as necessary
	Loose or corroded battery connections	Check that battery connections are clean and tight
	Internal ground in starter windings	See Testing in STARTER article
	Grounded starter fields	See Testing in STARTERS
	Armature rubbing on pole shoes	See STARTER article
Starter Turns but Engine Does Not Rotate	Starter clutch slipping	See STARTER article
	Broken clutch housing	See STARTER article
	Pinion shaft rusted or dry	See STARTER article
	Engine basic timing incorrect	See Ignition Timing in TUNE-UP article
	Broken teeth on engine flywheel	Replace flywheel and check for starter pinion gear damage
Starter Will Not Crank Engine	Faulty overrunning clutch	See STARTER article
	Broken clutch housing	See STARTER article
	Broken flywheel teeth	Replace flywheel and check for starter pinion gear damage
	Armature shaft sheared or reduction gear teeth stripped	See STARTER article
	Weak battery	Charge or replace battery as necessary
	Faulty solenoid	See On-Vehicle Tests in STARTER article
	Poor grounds	Check all ground connections for tight and clean connections
	Ignition switch faulty or misadjusted	Adjust or replace ignition switch as necessary
Starter Cranks Engine Slowly	Battery weak or defective	Charge or replace battery as necessary

	Engine overheated	See ENGINE COOLING SYSTEM article
	Engine oil too heavy	Check that proper viscosity oil is used
	Poor battery-to-starter connections	Check that all between battery and starter are clean and tight
	Current draw too low or too high	See Bench Tests in STARTER article
	Bent armature, loose pole shoes screws or worn bearings	See STARTER article
	Burned solenoid contacts	Replace solenoid
	Faulty starter	Replace starter
Starter Engages Engine Only Momentarily	Engine timing too far advanced	See Ignition Timing in TUNE-UP article
	Overrunning clutch not engaging properly	Replace overrunning clutch. See STARTER article
	Broken starter clutch	See STARTER article
	Broken teeth on engine flywheel	Replace flywheel and check starter pinion gear for damage
	Weak drive assembly thrust spring	See STARTER article
	Weak hold-in coil	See Bench Tests in STARTER article
Starter Drive Will Not Engage	Defective point assembly	See Testing in STARTER article
	Poor point assembly ground	See Testing in STARTER article
	Defective pull-in coil	Replace starter solenoid
Starter Relay Does Not Close	Dead battery	Charge or replace battery as necessary
	Faulty wiring	Check all wiring and connections leading to relay
	Neutral safety switch faulty	Replace neutral safety switch
	Starter relay faulty	Replace starter relay

Starter Drive Will Not Disengage	Starter motor loose on mountings	Tighten starter attach bolts
	Worn drive end bushing	See STARTER article
	Damaged engine flywheel teeth	Replace flywheel and starter pinion gear for damage
	Drive yolk return spring broken or missing	Replace return spring
	Faulty ignition switch	Replace ignition switch
	Insufficient clearance between winding leads to solenoid terminal and main contact in solenoid	Replace starter solenoid
	Starter clutch not disengaging	Replace starter clutch
	Ignition starter switch contacts sticking	Replace ignition switch
Starter Relay Operates but Solenoid Does Not	Faulty solenoid switch, switch connections or	Check all wiring between relay and solenoid or replace relay or solenoid as necessary
	Broken lead or loose soldered connections	Repair wire or wire connections as necessary
Solenoid Plunger Vibrates When Switch is Engaged	Weak battery	Charge or replace battery as necessary
	Solenoid contacts corroded	Clean contacts or replace solenoid
	Faulty wiring	Check all wiring leading to solenoid
	Broken connections inside switch cover	Repair connections or replace solenoid
	Open hold-in wire	Replace solenoid
Low Current Draw	Worn brushes or weak	Replace brushes or brush springs as necessary
High Pitched Whine During Cranking Before Engine Fires but Engine Fires and Cranks Normally	Distance too great between starter pinion and flywheel	Align starter or check that correct starter and flywheel are being used
High Pitched Whine After Engine	Distance too small between starter pinion and flywheel	

Fires With Key released. Engine Fires and Cranks Normally	Flywheel runout contributes to the intermittent nature

AIR CONDITIONING & HEAT

AIR CONDITIONING TROUBLE SHOOTING

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BASIC AIR CONDITIONING TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE
Compressor Not Working	• Compressor clutch circuit open. • Compressor clutch coil inoperative. • Poor clutch ground connection. • Fan belts loose. • Thermostatic switch inoperative. • Thermostatic switch not adjusted. • Ambient temperature switch open. • Superheat fuse blown.
Excessive Noise or Vibration	• Missing or loose mounting bolts. • Bad idler pulley bearings. • Fan belts not tightened correctly. • Compressor clutch contacting body. • Excessive system pressure. • Compressor oil level low. • Damaged clutch bearings. • Damaged reed valves. • Damaged compressor.
Insufficient or No Cooling; Compressor Working	• Expansion valve inoperative. • Heater control valve stuck open. • Low system pressure. • Blocked condenser fins. • Blocked evaporator fins. • Vacuum system leak. • Vacuum motors inoperative. • Control cables improperly adjusted. • Restricted air inlet. • Mode doors binding. • Blower motor inoperative. • Temperature above system capacity.

HEATER SYSTEM TROUBLE SHOOTING

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problem symptoms. For model-specific Trouble Shooting, refer to DIAGNOSTIC, or TESTING articles available in the section(s) you are accessing.

BASIC HEATER SYSTEM TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE
Insufficient, Erratic, or No Heat	• Low Coolant Level • Incorrect thermostat. • Restricted coolant flow through heater core. • Heater hoses plugged. • Misadjusted control cable. • Sticking heater control valve. • Vacuum hose leaking. • Vacuum hose blocked. • Vacuum motors inoperative. • Blocked air inlet. • Inoperative heater blower motor. • Oil residue on heater core fins. • Dirt on heater core fins.
Too Much Heat	• Improperly adjusted cables. • Sticking heater control valve. • No vacuum to heater control valve. • Temperature door stuck open.
Air Flow Changes During Acceleration	• Vacuum system leak. • Bad check valve or reservoir.
Air From Defroster At All Times	• Vacuum system leak. • Improperly adjusted control cables. • Inoperative vacuum motor.
Blower Does Not Operate Correctly	• Blown fuse. • Blower motor windings open. • Resistors burned out. • Motor ground connection loose. • Wiring harness connections loose. • Blower motor switch inoperative. • Blower relay inoperative. • Fan binding or foreign object in housing. • Fan blades broken or bent.

BRAKES

BRAKE SYSTEM TROUBLE SHOOTING

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BRAKE SYSTEM TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
Brakes Pull Left or Right	Incorrect tire pressure	Inflate tires to proper pressure
	Front end out of alignment	See WHEEL ALIGNMENT
	Mismatched tires	Check tires sizes
	Restricted brake lines or hoses	Check hose routing
	Loose or malfunctioning caliper	See DISC BRAKES or BRAKE SYSTEM
	Bent shoe or oily linings	See DRUM BRAKES or BRAKE SYSTEM
	Malfunctioning rear brakes	See DRUM, DISC BRAKES or BRAKE SYSTEM
	Loose suspension parts	See SUSPENSION
Noises Without Brakes Applied	Front linings worn out	Replace linings
	Dust or oil on drums or rotors	See DRUM, DISC BRAKES or BRAKE SYSTEM
Noises With Brakes Applied	Insulator on outboard shoe damaged	See DISC BRAKES or BRAKE SYSTEM
	Incorrect pads or linings	Replace pads or linings
Brake Rough, Chatters or Pulsates	Excessive lateral runout	Check rotor runout
	Parallelism not to specifications	Reface or replace rotor
	Wheel bearings not adjusted	See SUSPENSION
	Rear drums out-of-round	Reface or replace drums
	Disc pad reversed, steel against rotor	Remove and reinstall pad
Excessive Pedal Effort	Malfunctioning power unit	See POWER BRAKES or BRAKE SYSTEM
	Partial system failure	Check fluid and pipes
	Worn disc pad or lining	Replace pad or lining
	Caliper piston stuck or	

	sluggish	See DISC BRAKES or BRAKE SYSTEM
	Master cylinder piston stuck	See MASTER CYLINDERS or BRAKE SYSTEM
	Brake fade due to incorrect pads for linings	Replace pads or linings
	Linings or pads glazed	Replace pads or linings
	Worn drums	Reface or replace drums
Excessive Pedal Travel	Partial brake system failure	Check fluid and pipes
	Insufficient fluid in master cylinder	See MASTER CYLINDERS or BRAKE SYSTEM
	Air trapped in system	See BRAKE BLEEDING or BRAKE SYSTEM
	Rear brakes not adjusted	See Adjustments in DRUM BRAKES or BRAKE SYSTEM
	Bent shoe or lining	See DRUM BRAKES or BRAKE SYSTEM
	Plugged master cylinder cap	See MASTER CYLINDERS or BRAKE SYSTEM
	Improper brake fluid	Replace brake fluid
Pedal Travel Decreasing	Compensating port plugged	See MASTER CYLINDERS or BRAKE SYSTEM
	Swollen cup in master cylinder	See MASTER CYLINDERS or BRAKE SYSTEM
	Master cylinder piston not returning	See MASTER CYLINDERS or BRAKE SYSTEM
	Weak shoe retracting springs	See DRUM BRAKES BRAKE SYSTEM
	Wheel cylinder piston sticking	See DRUM BRAKES or BRAKE SYSTEM
Dragging Brakes	Master cylinder pistons not returning	See MASTER CYLINDERS BRAKE SYSTEM
	Restricted brake lines or hoses	Check line routing
	Incorrect parking brake adjustment	See DRUM BRAKES BRAKE SYSTEM

	Parking Brake cables frozen	See DRUM BRAKES BRAKE SYSTEM
	Incorrect installation of inboard disc pad	Remove and replace correctly
	Power booster output rod too long	See POWER BRAKE UNITS BRAKE SYSTEM
	Brake pedal not returning freely	See DISC, DRUM BRAKES BRAKE SYSTEM
Brakes Grab or Uneven Braking Action	Malfunction of combination valve	See CONTROL VALVE or BRAKE SYSTEM
	Malfunction of power brake unit	See POWER BRAKE UNITS or BRAKE SYSTEM
	Binding brake pedal	See DISC, DRUM BRAKES or BRAKE SYSTEM
Pulsation or Roughness	Uneven pad wear caused by caliper	See DISC BRAKES or BRAKE SYSTEM
	Uneven rotor wear	See DISC BRAKES or BRAKE SYSTEM
	Drums out-of-round	Reface or replace drums

ENGINE MECHANICAL

COOLING SYSTEM TROUBLE SHOOTING

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COOLING SYSTEM TROUBLE SHOOTING

CONDITION	POSSIBLE CAUSE	CORRECTION
Overheating	Coolant Leak	Fill/Pressure Test System
	A/C Condenser Fins Clogged	Remove/Clean Condenser
	Radiator Fins Clogged	Remove/Clean Radiator
	Thermostat Stuck Closed	Replace Thermostat
	Clogged Cooling System Passages	Clean/Flush Cooling System

	Water Pump Malfunction	Replace Water Pump
	Fan Clutch Malfunction	Replace Fan Clutch
	Retarded Ignition Timing	Reset Ignition Timing
	Cooling Fan Malfunction	Test Cooling Fan/ Circuit
	Cooling Fan Motor Malfunction	Test Fan Motor
	Cooling Fan Relay Malfunction	Test Fan Relay
	Faulty Radiator Cap	Replace Radiator Cap
	Broken/Slipping Fan Belt	Replace Fan Belt
	Restricted Exhaust	Repair Exhaust System
Corrosion	Impurities In Coolant	Clean/Flush System
Coolant Leakage	Damaged hose	Replace Hose
	Leaky Water Pump	Replace Water Pump
	Damaged Radiator Seam	Replace/Repair Radiator
	Leaky Thermostat Cover	Replace Thermostat Cover
	Cylinder Head Problem	Check Head/Head Gasket
	Leaky Freeze Plugs	Replace Freeze Plugs
Recovery System Inoperative		
	Loose and/or Defective Radiator Cap	Replace Radiator Cap
	Overflow Tube Clogged and/or Leaking	Repair Tube
	Recovery Bottle Vent Restricted	Clean Vent
No Heater Core Flow		
	Collapsed Heater Hose	Replace Heater Hose
	Plugged Heater Core	Clean/Replace Heater Core
	Faulty Heater Valve	Replace Heater Valve

GASOLINE ENGINE - MECHANICAL TROUBLE SHOOTING

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in the section(s) you are accessing.

BASIC GASOLINE ENGINE - MECHANICAL TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
Engine Lopes At Idle	Intake manifold-to-head leaks	Replace manifold gasket, See ENGINES
	Blown head gasket	Replace head gasket, See ENGINES
	Worn timing gears, chain or sprocket	Replace gears, chain or sprocket
	Worn camshaft lobes	Replace camshaft, See ENGINES
	Overheated engine	Check cooling system, See COOLING
	Blocked crankcase vent valve	Remove restriction
	Leaking EGR valve	Repair leak and/or replace valve
	Faulty fuel pump	Replace fuel pump
Engine Has Low Power	Leaking fuel pump	Repair leak and/or replace fuel pump
	Excessive piston-to-bore clearance	Install larger pistons, See ENGINES
	Sticking valves or weak valve springs	Check valve train components, See ENGINES
	Incorrect valve timing	Reset valve timing, See ENGINES
	Worn camshaft lobes	Replace camshaft, See ENGINES
	Blown head gasket	Replace head gasket. See ENGINES.
	Clutch slipping	Adjust pedal and/or replace components, See ENGINES
	Engine overheating	Check cooling system, See COOLING
	Auto. Trans. pressure regulator valve faulty	Replace pressure regulator valve
	Auto. Trans. fluid level too low	Add fluid as necessary
	Improper vacuum diverter valve operation	Replace vacuum diverter valve
	Vacuum leaks	Inspect vacuum system and repair as required
	Leaking piston rings	Replace piston rings, See ENGINES
Faulty High Speed Operation	Low fuel pump volume	Replace fuel pump
	Leaking valves or worn	Replace valves and/or springs, See ENGINES
	Incorrect valve timing	Reset valve timing,See ENGINES
	Intake manifold restricted	Remove restriction
	Worn distributor shaft	Replace distributor
Faulty Acceleration	Improper fuel pump stroke	Remove pump and reset pump stroke

	Incorrect ignition timing	Reset ignition timing, See TUNE-UP
	Leaking valves	Replace valves, See ENGINES
	Worn fuel pump diaphragm or piston	Replace diaphragm or piston
Intake Backfire	Improper ignition timing	Reset ignition timing, See TUNE-UP
	Faulty accelerator pump discharge	Replace accelerator pump
	Improper choke operation	Check choke and adjust as required
	Defective EGR valve	Replace EGR valve
	Fuel mixture too lean	Reset air/fuel mixture, See TUNE-UP
	Choke valve initial clearance too large	Reset choke valve initial clearance
Exhaust Backfire	Vacuum leak	Inspect and repair vacuum system
	Faulty vacuum diverter valve	Replace vacuum diverter valve
	Faulty choke operation	Check choke and adjust as required
	Exhaust system leak	repair exhaust system leak
Engine Detonation	Ignition timing too far advanced	Reset ignition timing, See TUNE-UP
	Faulty ignition system	Check ignition timing, See TUNE-UP
	Spark plugs loose or faulty	Retighten or replace plugs
	Fuel delivery system clogged	Inspect lines, pump and filter for clog
	EGR valve inoperative	Replace EGR valve
	PCV system inoperative	Inspect and/or replace hoses or valve
	Vacuum leaks	Check vacuum system and repair leaks
	Excessive combustion chamber deposits	Remove built-up deposits
	Leaking, sticking or broken valves	Inspect and/or replace valves
External Oil Leakage	Fuel pump improperly seated or worn gasket	Remove pump, replace gasket and seat properly
	Oil pan gasket broken or pan bent	Straighten pan and replace gasket
	Timing chain cover gasket broken	Replace timing chain cover gasket
	Rear main oil seal worn	Replace rear main oil seal
	Oil pan drain plug not seated properly	Remove and reinstall drain plug
	Camshaft bearing drain hole blocked	Remove restriction
	Oil pressure sending switch leaking	Remove and reinstall sending switch

Excessive Oil Consumption	Worn valve stems or guides	Replace stems or guides, See ENGINES
	Valve "O" ring seals damaged	Replace "O" ring seals, See ENGINES
	Plugged oil drain back holes	Remove restrictions
	Improper PCV valve operation	Replace PCV valve
	Engine oil level too high	Remove excess oil
	Engine oil too thin	Replace thicker oil
	Valve stem oil deflectors damaged	Replace oil deflectors
	Incorrect piston rings	Replace piston rings, See ENGINES
	Piston ring gaps not staggered	Reinstall piston rings, See ENGINES
	Insufficient piston ring tension	Replace rings, See ENGINES
	Piston ring grooves or oil return slots clogged	Replace piston rings, See ENGINES
	Piston rings sticking in grooves	Replace piston rings, See ENGINES
	Piston ring grooves excessively worn	Replace piston and rings, See ENGINES
	Compression rings installed upside down	Replace compression rings correctly, See ENGINES
	Worn or scored cylinder walls	Rebore cylinders or replace block
	Mismatched oil ring expander and rail	Replace oil ring expander and rail, See ENGINES
	Intake gasket dowels too long	Replace intake gasket dowels
	Excessive main or connecting rod bearing clearance	Replace main or connecting rod bearings, See ENGINES
No Oil Pressure	Low oil level	Add oil to proper level
	Oil pressure sender or gauge broken	Replace sender or gauge
	Oil pump malfunction	Remove and overhaul oil pump, See ENGINES
	Oil pressure relief valve sticking	Remove and reinstall valve
	Oil pump passages blocked	Overhaul oil pump, See ENGINES
	Oil pickup screen or tube blocked	remove restriction
	Loose oil inlet tube	Tighten oil inlet tube
	Loose camshaft bearings	Replace camshaft bearings, See ENGINES
	Internal leakage at oil passages	Replace block or cylinder head
Low Oil Pressure	Low engine oil level	Add oil to proper level
	Engine oil too thin	Remove and replace with thicker oil
	Excessive oil pump clearance	Reduce oil pump clearance, See ENGINES
	Oil pickup tube or screen blocked	Remove restrictions
	Main, rod or cam bearing clearance excessive	Replace bearing to reduce clearance, See

		ENGINES
High Oil Pressure	Improper grade of oil	Replace with proper oil
	Oil pressure relief valve stuck closed	Eliminate binding
	Oil pressure sender or gauge faulty	Replace sender or gauge
Noisy Main Bearings	Inadequate oil supply	Check oil delivery to main bearings
	Excessive main bearing clearance	Replace main bearings, See ENGINES
	Excessive crankshaft end play	Replace crankshaft, See ENGINES
	Loose flywheel or torque converter	Tighten attaching bolts
	Loose or damaged vibration damper	Tighten or replace vibration damper
	Crankshaft journals out-of-round	Re-grind crankshaft journals
	Excessive belt tension	Loosen belt tension
Noisy Connecting Rods	Excessive bearing clearance or missing bearing	Replace bearing, See ENGINES
	Crankshaft rod journal out-of-round	Re-grind crankshaft journal
	Misaligned connecting rod or cap	Remove rod or cap and realign
	Incorrectly tightened rod bolts	Remove and re-tighten rod bolts
Noisy Pistons and Rings	Excessive piston-to-bore clearance	Install larger pistons, See ENGINES
	Bore tapered or out-of-round	Rebore block
	Piston ring broken	Replace piston rings, See ENGINES
	Piston pin loose or seized	Replace piston pin, See ENGINES
	Connecting rods misaligned	Realign connecting rods
	Ring side clearance too loose or tight	Replace with larger or smaller rings
	Carbon build-up on piston	Remove carbon
Noisy Valve Train	Worn or bent push rods	Replace push rods, See ENGINES
	Worn rocker arms or bridged pivots	Replace push rods, See ENGINES
	Dirt or chips in valve lifters	Remove lifters and remove dirt/chips
	Excessive valve lifter leak-down	Replace valve lifters, See ENGINES
	Valve lifter face worn	Replace valve lifters, See ENGINES
	Broken or cocked valve springs	replace or reposition springs
	Too much valve stem-to-guide clearance	Replace valve guides, See ENGINES
	Valve bent	Replace valve, See ENGINES
	Loose rocker arms	Retighten rocker arms, See ENGINES
	Excessive valve seat run-out	Reface valve seats, See ENGINES

	Missing valve lock	Install new valve lock
	Excessively worn camshaft lobes	Replace camshaft, See ENGINES
	Plugged valve lifter oil holes	Eliminate restriction or replace lifter
	Faulty valve lifter check ball	Replace lifter check ball, See ENGINES
	Rocker arm nut installed upside down	Remove and reinstall correctly
	Valve lifter incorrect for engine	Remove and replace valve lifters
	Faulty push rod seat or lifter plunger	Replace plunger or push rod
Noisy Valves	Improper valve lash	Re-adjust valve lash, See ENGINES
	Worn or dirty valve lifters	Clean and/or replace lifters
	Worn valve guides	Replace valve guides, See ENGINES
	Excessive valve seat or face run-out	Reface seats or valve face
	Worn camshaft lobes	Replace camshaft, See ENGINES
	Loose rocker arm studs	Re-tighten rocker arm studs, See ENGINES
	Bent push rods	Replace push rods, See ENGINES
	Broken valve springs	Replace valve springs, See ENGINES
Burned,Sticking or Broken Valves	Weak valve springs or warped valves	Replace valves and/or springs, See ENGINES
	Improper lifter clearance	Re-adjust clearance or replace lifters
	Worn guides or improper guide clearance	Replace valve guides, See ENGINES
	Out-of-round valve seats or improper seat width	Re-grind valve seats
	Gum deposits on valve stems, seats or guides	Remove deposits
	Improper spark timing	Re-adjust spark timing
Broken Pistons/Rings	Undersize pistons	Replace with larger pistons, See ENGINES
	Wrong piston rings	Replace with correct rings, See ENGINES
	Out-of-round cylinder bore	Re-bore cylinder bore
	Improper connecting rod alignment	Remove and realign connecting rods
	Excessively worn ring grooves	Replace pistons, See ENGINES
	Improperly assembled piston pins	Re-assemble pin-to -piston, See ENGINES
	Insufficient ring gap clearance	Install new rings, See ENGINES
	Engine overheating	Check cooling system
	Incorrect ignition timing	Re-adjust ignition timing, See TUNE-UP
Excessive Exhaust Noise	Leaks at manifold to head, or to pipe	Replace manifold or pipe gasket
	Exhaust manifold	Replace exhaust

	cracked or broken	manifold, See ENGINES

ENGINE PERFORMANCE

CARBURETOR TROUBLE SHOOTING:

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BASIC COLD START SYMPTOMS TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
Engine Won't Start	Choke not closing	Check choke operation, see FUEL SYSTEMS
	Choke linkage bent	Check linkage, see FUEL SYSTEM
Engine Starts, Then Dies	Choke vacuum kick setting too wide	Check setting and adjust see, FUEL SYSTEMS
	Fast idle RPM too low	Reset RPM to specif-ication, see TUNE-UP
	Fast idle cam index incorrect	Reset fast idle cam index, see FUEL SYSTEMS
	Vacuum leak	Inspect vacuum system for leaks
	Low fuel pump outlet	Repair or replace pump, see FUEL SYSTEMS
	Low carburetor fuel level	Check float setting see FUEL SYSTEM
Engine Quits Under Load	Choke vacuum kick setting incorrect	Reset vacuum kick setting,see FUEL SYSTEMS
	Fast idle cam index incorrect	Reset fast idle cam index, see FUEL SYSTEM
	Incorrect hot fast idle speed RPM	Reset fast idle RPM, see TUNE-UP
Engine Starts, Runs Up,Then Idles, Slowly With Black Smoke	Choke vacuum kick set too narrow	Reset vacuum kick, see FUEL SYSTEMS
	Fast idle cam index	Reset fast idle cam

	incorrect	index, see FUEL SYSTEMS
	Hot fast idle RPM too low	Reset fast idle RPM, see TUNE-UP

BASIC HOT START SYMPTOMS TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
Engine Won't Start	Engine flooded	Allow fuel to evaporate

BASIC COLD ENGINE DRIVEABILITY SYMPTOMS TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
Engine Stalls in Gear	Choke vacuum kick setting incorrect	Reset choke vacuum kick, see FUEL SYSTEMS
	Fast idle RPM incorrect	Reset fast idle RPM, see TUNE-UP
	Fast idle cam index incorrect	Reset fast idle cam see FUEL SYSTEMS
Acceleration Sag or Stall	Defective choke control switch	Replace choke control switch
	Choke vacuum kick setting incorrect	Reset choke vacuum kick see, FUEL SYSTEMS
	Float level incorrect (too low)	Adjust float level, FUEL SYSTEMS
	Accelerator pump defective	Repair or replace pump see FUEL SYSTEMS
	Secondary throttles not closed	Inspect lockout adjustment,see FUEL SYSTEMS
Sag or Stall After Warmup	Defective choke control switch	Replace choke control switch, see FUEL SYSTEMS
	Defective accelerator pump	Replace pump, see FUEL SYSTEMS
	Float level incorrect (too low)	Adjust float level, see FUEL SYSTEMS
Backfiring & Black Smoke	Plugged heat crossover system	Remove restriction

BASIC WARM ENGINE DRIVEABILITY SYMPTOMS TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
Hesitation With Small Amount of Gas Pedal Movement	Vacuum leak	Inspect vacuum lines
	Accelerator pump weak or inoperable	Replace pump, see FUEL SYSTEMS
	Float level setting too low	Reset float level, see,FUEL SYSTEMS
	Metering rods sticking or binding	Inspect and/or replace rods, see FUEL SYSTEMS
	Carburetor idle or transfer system plugged	Inspect system and remove restriction
	Frozen or binding heated air inlet	Inspect heated air door for binding
Hesitation With Heavy Gas Pedal Movement	Defective accelerator pump	Replace pump, see FUEL SYSTEMS
	Metering rod carrier sticking or binding	Remove restriction
	Large vacuum leak	Inspect vacuum system and repair leak
	Float level setting too low	Reset float level, see FUEL SYSTEMS
	Defective fuel pump, lines or filter	Inspect pump, lines and filter
	Air door setting incorrect	Adjust air door setting, see FUEL

DIESEL ENGINE TROUBLE SHOOTING

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NOTE: Diesel engines mechanical diagnosis is the same as gasoline engines for items such as noisy valves, bearings, pistons, etc. The following trouble shooting covers only items pertaining to diesel engines.

BASIC DIESEL ENGINE TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
Engine Won't Crank	Bad battery connections or dead batteries	Check connections and/or replace

		batteries
	Bad starter connections or bad starter	Check connections and/or replace batteries
Engine Cranks Slowly, Won't Start	Bad battery connections or dead batteries	Check connections and/or replace batteries
	Engine oil too heavy	Replace engine oil
Engine Cranks Normally, But Will Not Start	Glow plugs not functioning	Check glow plug system, see FUEL SYSTEMS
	Glow plug control not functioning	Check controller, see FUEL SYSTEMS
	Fuel not injected into cylinders	Check fuel injectors, see FUEL SYSTEMS
	No fuel to injection pump	Check fuel delivery system
	Fuel filter blocked	Replace fuel filter
	Fuel tank filter blocked	Replace fuel tank filter
	Fuel pump not operating	Check pump operation and/or replace pump
	Fuel return system blocked	Inspect system and remove restriction
	No voltage to fuel solenoid	Check solenoid and connections
	Incorrect or contaminated fuel	Replace fuel
	Incorrect injection pump timing	Re-adjust pump timing, see FUEL SYSTEMS
	Low compression	Check valves, pistons, rings, see ENGINES
	Injection pump malfunction	Inspect and/or replace injection pump
Engine Starts, Won't Idle	Incorrect slow idle adjustment	Reset idle adjustment, see TUNE-UP
	Fast idle solenoid malfunctioning	Check solenoid and connections
	Fuel return system blocked	Check system and remove restrictions
	Glow plugs go off too soon	See glow plug diagnosis in FUEL SYSTEMS
	Injection pump timing incorrect	Reset pump timing, see FUEL SYSTEMS
	No fuel to injection pump	Check fuel delivery system
	Incorrect or contaminated fuel	Replace fuel
	Low compression	Check valves, piston, rings, see ENGINES
	Injection pump malfunction	Replace injection pump, see FUEL SYSTEMS
	Fuel solenoid closes in RUN position	Check solenoid and connections
Engines Starts/ Idles Rough W/out Smoke or Noise	Incorrect slow idle adjustment	Reset slow idle, see TUNE-UP
	Injection line fuel leaks	Check lines and connections
	Fuel return system blocked	Check lines and connections

	Air in fuel system	Bleed air from system
	Incorrect or contaminated fuel	Replace fuel
	Injector nozzle malfunction	Check nozzles, see FUEL SYSTEMS
Engines Starts and Idles Rough W/out Smoke or Noise, But Clears After Warm-Up	Injection pump timing incorrect	Reset pump timing, see FUEL SYSTEMS
	Engine not fully broken in	Put more miles on engine
	Air in system	Bleed air from system
	Injector nozzle malfunction	Check nozzles, see FUEL SYSTEMS
Engine Idles Correctly, Misfires Above Idle	Blocked fuel filter	Replace fuel filter
	Injection pump timing incorrect	Reset pump timing, see FUEL SYSTEMS
	Incorrect or contaminated fuel	Replace fuel
Engine Won't Return To Idle	Fast idle adjustment incorrect	Reset fast idle, see TUNE-UP
	Internal injection pump malfunction	Replace injection pump, see FUEL SYSTEMS
	External linkage binding	Check linkage and remove binding
Fuel Leaks On Ground	Loose or broken fuel line	Check lines and connections
	Internal injection pump seal leak	Replace injection pump, see FUEL SYSTEMS
Cylinder Knocking Noise	Injector nozzles sticking open	Test injectors, see FUEL SYSTEMS
	Very low nozzle opening pressure	Test injectors and/or replace
Loss of Engine Power	Restricted air intake	Remove restriction
	EGR valve malfunction	Replace EGR valve
	Blocked or damaged exhaust system	Remove restriction and/or replace components
	Blocked fuel tank filter	Replace filter
	Restricted fuel filter	Remove restriction and/or replace filter
	Block vent in gas cap	Remove restriction and/or replace cap
	Tank-to-injection pump fuel supply blocked	Check fuel lines and connections
	Blocked fuel return system	Remove restriction
	Incorrect or contaminated fuel	Replace fuel
	Blocked injector nozzles	Check nozzle for blockage, see FUEL SYSTEMS
	Low compression	Check valves, rings, pistons, see ENGINES
Loud Engine Noise With Black Smoke	Basic timing incorrect	Reset timing, see FUEL SYSTEMS
	EGR valve malfunction	Replace EGR valve
	Internal injection pump malfunction	Replace injection pump, see FUEL SYSTEMS

	Incorrect injector pump housing pressure	Check pressure, see FUEL SYSTEMS
Engine Overheating	Cooling system leaks	Check cooling system and repair leaks
	Belt slipping or damaged	Check tension and/or replace belt
	Thermostat stuck closed	Remove and replace thermostat, see ENGINE COOLING
	Head gasket leaking	Replace head gasket
Oil Light on at Idle	Low oil pump pressure	Check oil pump operation, see ENGINES
	Oil cooler or line restricted	Remove restriction and/or replace cooler
Engine Won't Shut Off	Injector pump fuel solenoid does not return fuel valve to OFF position	Remove and check solenoid and replace if needed
	VACUUM PUMP DIAGNOSIS	
Excessive Noise	Loose pump-to-drive assembly screws	Tighten screws
	Loose tube on pump assembly	Tighten tube
	Valves not functioning properly	Replace valves
Oil Leakage	Loose end plug	Tighten end plug
	Bad seal crimp	Remove and re-crimp seal

FUEL INJECTION TROUBLE SHOOTING

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BASIC FUEL INJECTION TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
Engine Won't Start (Cranks Normally)	Cold start valve inoperative	Test valve and circuit
	Poor connection;vacuum or wiring	Check vacuum and electrical connections
	Contaminated fuel	Test fuel for water or alcohol
	Defective fuel pump relay or circuit	Test relay and wiring
	Battery too low	Charge and test battery

	Low fuel pressure	Test pressure regulator and fuel pump, check for restricted lines and filters
	No distributor reference pulses	Repair ignition system as necessary
	Open coolant temperature sensor circuit	Test sensor and wiring
	Shorted W.O.T. switch in T.P.S.	Disconnect W.O.T. switch, engine should start
	Defective ECM	Replace ECM
	Fuel tank residual pressure valve leaks	Test for fuel pressure drop after shut down
Hard Starting	Disconnected hot air tube to air cleaner	Reconnect tube and test control valve
	Defective Idle Air Control (IAC) valve	Test valve operation and circuit
	Shorted, open or misadjusted T.P.S.	Test and adjust or replace T.P.S.
	EGR valve open	Test EGR valve and control circuit
	Poor Oxygen sensor signal	Test for shorted or circuit
	Incorrect mixture from PCV system	Test PCV for flow, check sealing of oil filter cap
Poor High Speed Operation	Low fuel pump volume	Faulty pump or restricted fuel lines or filters
	Poor MAP sensor signal	Test MAP sensor, vacuum hose and wiring
	Poor Oxygen sensor signal	Test for shorted or open sensor or circuit
	Open coolant temperature sensor circuit	Test sensor and wiring
	Faulty ignition operation	Check wires for cracks or poor connections, test secondary voltage with oscilloscope
	Contaminated fuel	Test fuel for water

		or alcohol
	Intermittent ECM ground	Test ECM ground connection for resistance
	Restricted air cleaner	Replace air cleaner
	Restricted exhaust system	Test for exhaust manifold back pressure
	Poor MAF sensor signal	Check leakage between sensor and manifold
	Poor VSS signal	If tester for ALCL hook-up is available check that VSS reading matches speedometer
Ping or Knock on Acceleration	Poor Knock sensor signal	Test for shorted or open sensor or circuit
	Poor Baro sensor signal	Test for shorted or open sensor or circuit
	Improper ignition timing	See VEHICLE EMISSION CONTROL LABEL (where applicable)
	Check for engine overheating problems	Low coolant, loose belts or electric cooling fan inoperative

NOTE: For additional electronic fuel injection trouble shooting information, see the appropriate article in the ENGINE PERFORMANCE section (not all vehicles have Computer Engine Control articles). Information is provided there for diagnosing fuel system problems on vehicles with electronic fuel injection.

IGNITION SYSTEM TROUBLE SHOOTING

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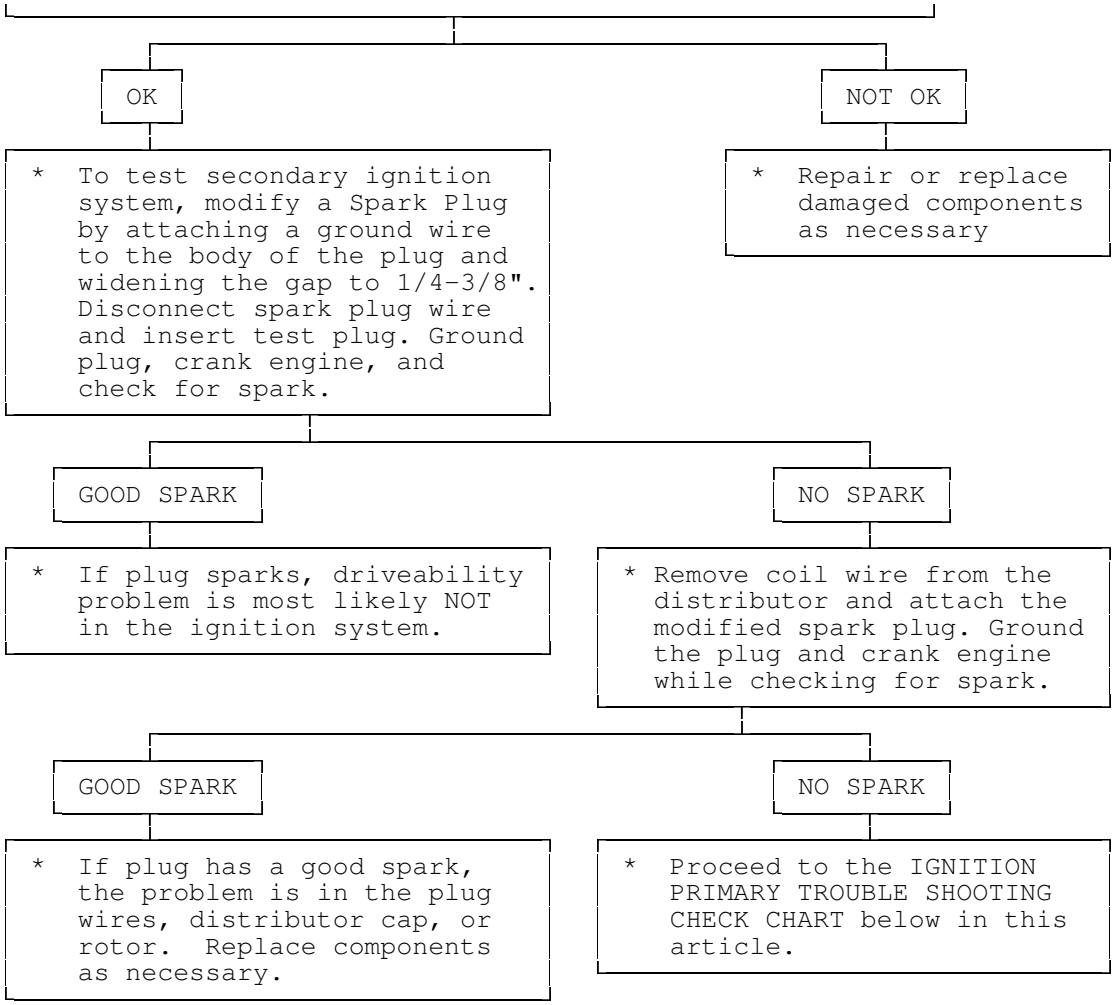
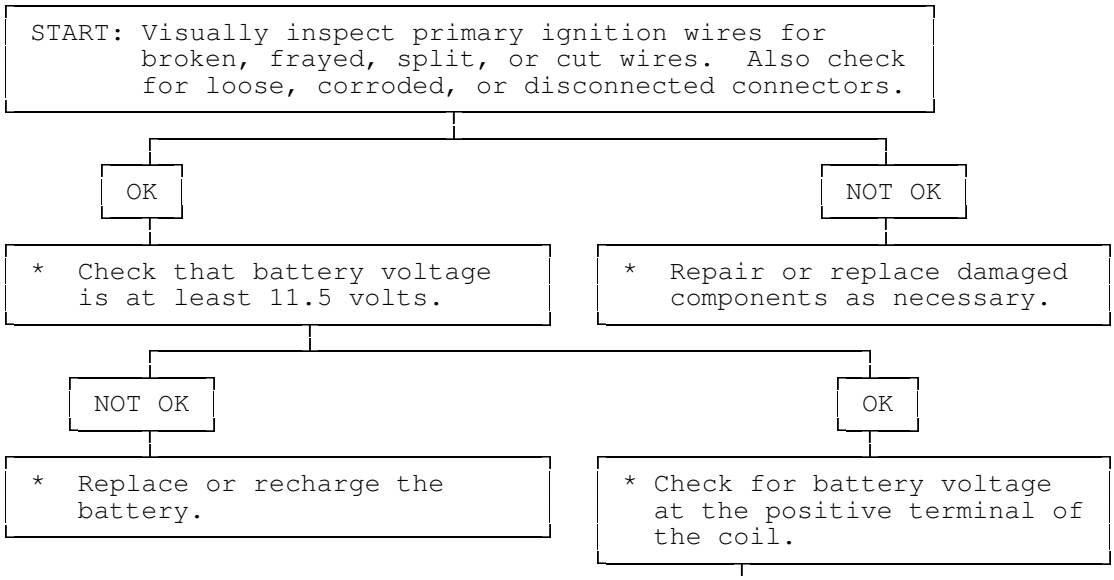
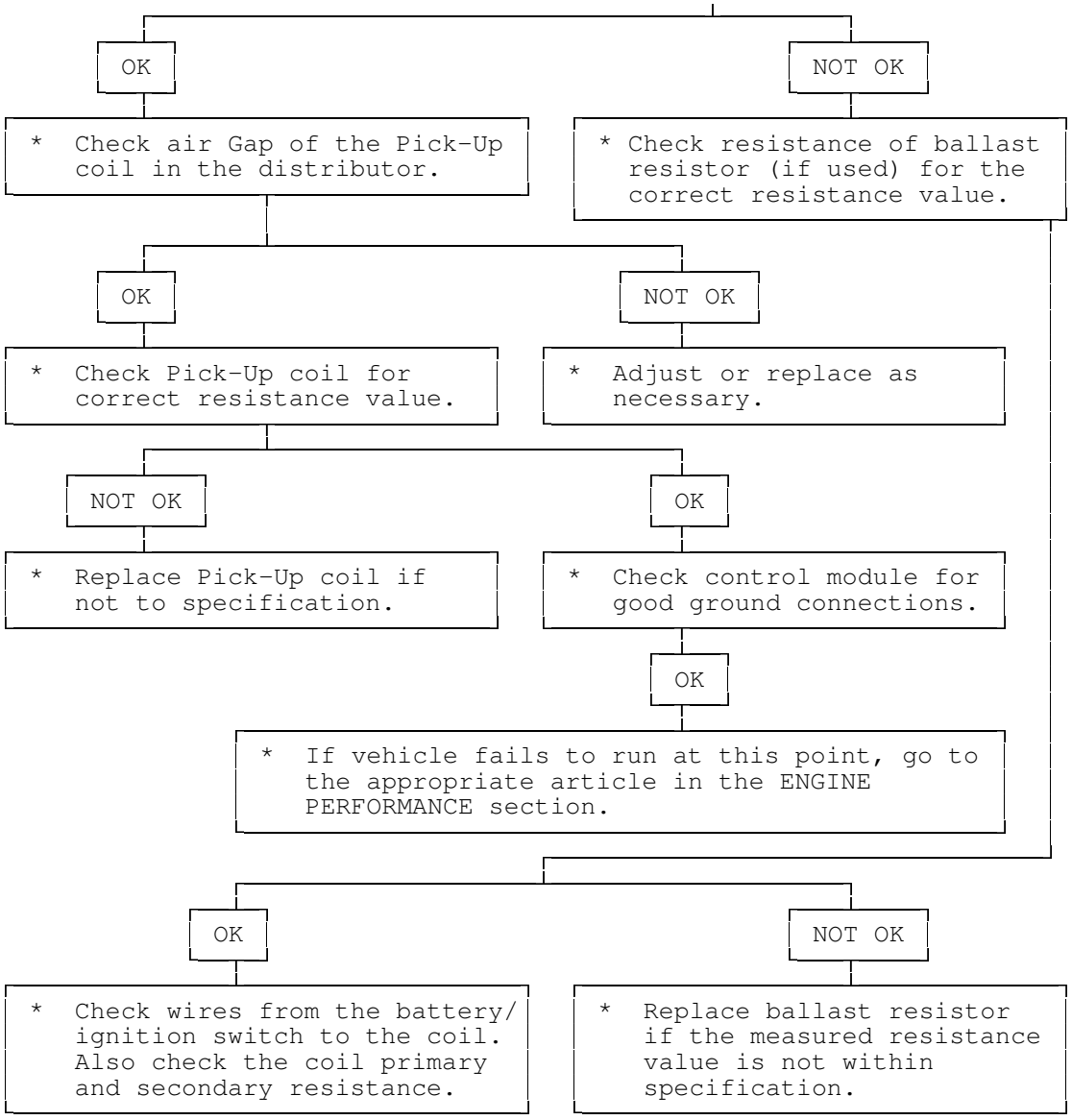
Ignition Secondary Trouble Shooting Chart

START: Visually inspect Spark Plug Wires, Coil Wires, Plug Wire Boots, Rotor, and Distributor Cap for signs of damage.



Ignition Primary Trouble Shooting Chart





STARTER TROUBLE SHOOTING

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BASIC STARTER TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
Starter Fails to Operate	Dead battery or bad connections between starter and battery	Check battery charge and all wires and connections to starter

	Ignition switch faulty or misadjusted	Adjust or replace ignition switch
	Open circuit between starter switch ignition terminal on starter relay	Check and repair wires and connections as necessary
	Starter relay or starter defective	See Testing in STARTER article
	Open solenoid pull-in wire	See Testing in STARTER article
Starter Does Not Operate and Headlights Dim	Weak battery or dead cell	Charge or replace battery as necessary
	Loose or corroded battery connections	Check that battery connections are clean and tight
	Internal ground in starter windings	See Testing in STARTER article
	Grounded starter fields	See Testing in STARTERS
	Armature rubbing on pole shoes	See STARTER article
Starter Turns but Engine Does Not Rotate	Starter clutch slipping	See STARTER article
	Broken clutch housing	See STARTER article
	Pinion shaft rusted or dry	See STARTER article
	Engine basic timing incorrect	See Ignition Timing in TUNE-UP article
	Broken teeth on engine flywheel	Replace flywheel and check for starter pinion gear damage
Starter Will Not Crank Engine	Faulty overrunning clutch	See STARTER article
	Broken clutch housing	See STARTER article
	Broken flywheel teeth	Replace flywheel and check for starter pinion gear damage
	Armature shaft sheared or reduction gear teeth stripped	See STARTER article
	Weak battery	Charge or replace battery as necessary
	Faulty solenoid	See On-Vehicle Tests in STARTER article
	Poor grounds	Check all ground

		connections for tight and clean connections
	Ignition switch faulty or misadjusted	Adjust or replace ignition switch as necessary
Starter Cranks Engine Slowly	Battery weak or defective	Charge or replace battery as necessary
	Engine overheated	See ENGINE COOLING SYSTEM article
	Engine oil too heavy	Check that proper viscosity oil is used
	Poor battery-to-starter connections	Check that all between battery and starter are clean and tight
	Current draw too low or too high	See Bench Tests in STARTER article
	Bent armature, loose pole shoes screws or worn bearings	See STARTER article
	Burned solenoid contacts	Replace solenoid
	Faulty starter	Replace starter
Starter Engages Engine Only Momentarily	Engine timing too far advanced	See Ignition Timing in TUNE-UP article
	Overrunning clutch not engaging properly	Replace overrunning clutch. See STARTER article
	Broken starter clutch	See STARTER article
	Broken teeth on engine flywheel	Replace flywheel and check starter pinion gear for damage
	Weak drive assembly thrust spring	See STARTER article
	Weak hold-in coil	See Bench Tests in STARTER article
Starter Drive Will Not Engage	Defective point assembly	See Testing in STARTER article
	Poor point assembly ground	See Testing in STARTER article
	Defective pull-in coil	Replace starter solenoid
Starter Relay	Dead battery	Charge or replace

Does Not Close		battery as necessary
	Faulty wiring	Check all wiring and connections leading to relay
	Neutral safety switch faulty	Replace neutral safety switch
	Starter relay faulty	Replace starter relay
Starter Drive Will Not Disengage	Starter motor loose on mountings	Tighten starter attach bolts
	Worn drive end bushing	See STARTER article
	Damaged engine flywheel teeth	Replace flywheel and starter pinion gear for damage
	Drive yolk return spring broken or missing	Replace return spring
	Faulty ignition switch	Replace ignition switch
	Insufficient clearance between winding leads to solenoid terminal and main contact in solenoid	Replace starter solenoid
	Starter clutch not disengaging	Replace starter clutch
	Ignition starter switch contacts sticking	Replace ignition switch
Starter Relay Operates but Solenoid Does Not	Faulty solenoid switch, switch connections or	Check all wiring between relay and solenoid or replace relay or solenoid as necessary
	Broken lead or loose soldered connections	Repair wire or wire connections as necessary
Solenoid Plunger Vibrates When Switch is Engaged	Weak battery	Charge or replace battery as necessary
	Solenoid contacts corroded	Clean contacts or replace solenoid
	Faulty wiring	Check all wiring leading to solenoid
	Broken connections inside switch cover	Repair connections or replace solenoid
	Open hold-in wire	Replace solenoid
Low Current Draw	Worn brushes or weak	Replace brushes or brush springs as necessary

High Pitched Whine During Cranking Before Engine Fires but Engine Fires and Cranks Normally	Distance too great between starter pinion and flywheel	Align starter or check that correct starter and flywheel are being used
High Pitched Whine After Engine Fires With Key released. Engine Fires and Cranks Normally	Distance too small between starter pinion and flywheel Flywheel runout contributes to the intermittent nature	

TUNE-UP TROUBLE SHOOTING - GAS ENGINE VEHICLES

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BASIC SPARK PLUG TROUBLE SHOOTING CHARTS

CONDITION	POSSIBLE CAUSE	CORRECTION
Normal Spark Plug Condition	Light Tan or Gray deposits	No Action
	Electrode not burned or fouled	No Action
	Gap tolerance not changed	No Action
Cold Fouling or Carbon Deposits	Overrich air/fuel mixture	Adjust air/fuel mixture, see ENGINE PERFORMANCE section
	Faulty choke	Replace choke assembly, see ENGINE PERFORMANCE section
	Clogged air filter	Clean and/or replace air filter
	Incorrect idle speed or dirty carburetor	Reset idle speed and/ or clean carburetor
	Faulty ignition wires	Replace ignition wiring
	Prolonged operation at idle	Shut engine off during long idle
	Sticking valves or worn valve guide seals	Check valve train
Wet Fouling or Oil Deposits	Worn rings and pistons	Install new rings and pistons

	Excessive cylinder wear	Rebore or replace block
	Excessive valve guide clearance	Worn or loose bearing
Gap Bridged	Deposits in combustion chamber becoming fused to electrode	Clean combustion chamber of deposits
Blistered Electrode	Engine overheating	Check cooling system
	Wrong type of fuel	Replace with correct fuel
	Loose spark plugs	Retighten spark plugs
	Over-advanced ignition timing	Reset ignition timing see ENGINE PERFORMANCE
Pre-Ignition or Melted Electrodes	Incorrect type of fuel	Replace with correct fuel
	Incorrect ignition timing	Reset ignition timing see ENGINE PERFORMANCE
	Burned valves	Replace valves
	Engine Overheating	Check cooling system
	Wrong type of spark plug, too hot	Replace with correct spark plug, see ENGINE PERFORMANCE
Chipped Insulators	Severe detonation	Check for over-advanced timing or combustion
	Improper gapping procedure	Re-gap spark plugs
Rust Colored Deposits	Additives in unleaded fuel	Try different fuel brand
Water In Combus-tion Chamber	Blown head gasket or cracked head	Repair or replace head or head gasket

NOTE: Before diagnosing an electronic ignition system, ensure that all wiring is connected properly between distributor, wiring connector and spark plugs. Ignition problem will show up either as: Engine Will Not Start or Engine Runs Rough.

BASIC ELECTRONIC IGNITION TROUBLE SHOOTING CHARTS

CONDITION	POSSIBLE CAUSE	CORRECTION
Engine Won't Start	Open circuit between distributor and bulkhead connector	Repair circuit
	Open circuit between bulkhead connector and	Repair circuit

	ignition switch	
	Open circuit between ignition switch and starter solenoid	Repair circuit
Engine Runs Rough	Fuel lines leaking or clogged	Tighten fitting, remove restriction
	Initial timing incorrect	Reset ignition timing see ENGINE PERFORMANCE
	Centrifugal advance malfunction	Repair distributor advance
	Defective spark plugs or wiring	Replace plugs or plug wiring
Component Failure	Spark arc-over on cap, rotor or coil	Replace cap, rotor or or coil
	Defective pick-up coil	Replace pick-up coil
	Defective ignition coil	Replace ignition coil
	Defective vacuum unit	Replace vacuum unit
	Defective control module	Replace control module

BASIC ELECTRONIC IGNITION TROUBLE SHOOTING CHARTS - USING OSCILLOSCOPE PATTERNS

CONDITION	POSSIBLE CAUSE	CORRECTION
Firing Voltage Lines are the Same, but Abnormally High	Retarded ignition timing	Reset ignition timing, see ENGINE PERFORMANCE section
	Fuel mixture too lean	Readjust carburetor, see ENGINE PERFORMANCE
	High resistance in coil wire	Replace coil wire
	Corrosion in coil tower terminal	Clean and/or replace coil
	Corrosion in distributor coil terminal	Clean and/or replace distributor cap
Firing Voltage Lines are the Same but Abnormally Low	Fuel mixture too rich	Readjust carburetor, see ENGINE PERFORMANCE
	Breaks in coil wire causing arcing	Replace coil wire
	Cracked coil tower causing arcing	Replace coil
	Low coil output	Replace coil
	Low engine compression	Determine cause and

		repair
One or More, But Not All Firing Voltage Lines are Higher Than Others	Carburetor idle mixture not balanced	Readjust carburetor, see ENGINE PERFORMANCE
	EGR valve stuck open	Clean and/or replace valve
	High resistance in spark plug wires	Replace spark plug wires
	Cracked or broken spark plug insulator	Replace spark plugs
	Intake vacuum leak	Repair leak
	Defective spark plugs	Replace spark plugs
	Corroded spark plug terminals	Replace spark plugs
One or More, But Not All Firing Voltage Lines Are Lower Than Others	Curb idle mixture not balanced	Readjust carburetor, see ENGINE PERFORMANCE
	Breaks in plug wires causing arcing	Replace plug wires
	Cracked coil tower causing arcing	Replace coil
	Low compression	Determine cause and repair
	Defective spark plugs	Replace spark plugs
	Corroded spark plugs	Replace spark plugs
Cylinders Not Firing	Cracked distributor cap terminals	Replace distributor cap
	Shorted spark plug wire	Determine cause and repair
	Mechanical problem in engine	Determine cause and repair
	Defective spark plugs	Replace spark plugs
	Spark plugs fouled	Replace spark plugs

BASIC DRIVEABILITY PROBLEMS TROUBLE SHOOTING TABLE

CONDITION	POSSIBLE CAUSE	CORRECTION
Hard Starting	Binding carburetor linkage	Eliminate binding
	Binding choke linkage	Eliminate binding
	Binding choke piston	Eliminate binding
	Restricted choke vacuum	Check vacuum lines for blockage

	Worn or dirty needle valve and seat	Clean carburetor, see ENGINE PERFORMANCE
	Float sticking	Readjust or replace float see the ENGINE PERFORMANCE section
	Incorrect choke adjustment	Reset choke adjustment see ENGINE PERFORMANCE
	Defective coil	Replace coil
	Improper spark plug gap	Regap spark plugs
	Incorrect ignition timing	Reset ignition timing see ENGINE PERFORMANCE
Detonation	Over-advanced ignition timing	Reset ignition timing see ENGINE PERFORMANCE
	Defective spark plugs	Replace spark plugs
	Fuel lines clogged	Clean fuel lines
	EGR system malfunction	Check and repair EGR system
	PCV system malfunction	Repair PCV system
	Vacuum leaks	Check and repair vacuum system
	Loose fan belts	Tighten or replace fan belts, see ENGINE PERFORMANCE
	Restricted airflow	Remove restriction
	Vacuum advance malfunction	Check distributor operation
Dieseling	Binding carburetor linkage	Eliminate binding
	Binding throttle linkage	Eliminate blinding
	Binding choke linkage or fast idle cam	Eliminate binding
	Defective idle solenoid	Replace idle solenoid see ENGINE PERFORMANCE
	Improper base idle speed	Reset idle speed, see see ENGINE PERFORMANCE
	Incorrect ignition timing	Reset ignition timing see ENGINE PERFORMANCE
	Incorrect idle mixture setting	Reset idle mixture, see ENGINE PERFORMANCE
Faulty Acceleration	Incorrect ignition timing	Reset ignition timing see ENGINE PERFORMANCE

	Engine cold and choke too lean	Adjust choke and allow engine to warm-up
	Defective spark plugs	Replace spark plugs
	Defective coil	Replace coil
Faulty Low Speed Operation	Clogged idle transfer slots	Clean idle transfer slots, see FUEL
	Restricted idle air bleeds and passages	Disassemble and clean carburetor, see FUEL
	Clogged air cleaner	Replace air filter
	Defective spark plugs	Replace spark plugs
	Defective ignition wires	Replace ignition wire see ENGINE PERFORMANCE
	Defective distributor cap	Replace distributor cap
Faulty High Speed Operation	Incorrect ignition timing	Reset ignition timing see ENGINE PERFORMANCE
	Defective distributor centrifugal advance	Replace advance mechanism
	Defective distributor vacuum advance	Replace advance unit
	Incorrect spark plugs or plug gap	Check gap and/or replace spark plugs
	Faulty choke operation	Check choke and repair as required
	Clogged vacuum passages	Remove restrictions
	Improper size or clogged main jet	Check jet size and clean, see FUEL
	Restricted air cleaner	Check filter and replace as necessary
	Defective distributor cap, rotor or coil	Replace cap, rotor or coil
Misfire at All Speeds	Defective spark plugs	Replace spark plugs
	Defective spark plug wires	Replace spark plug wires
	Defective distributor cap, rotor, or coil	Replace cap, rotor, or coil
	Cracked or broken vacuum hoses	Replace vacuum hoses

	Vacuum leaks	Repair vacuum leaks
	Fuel lines clogged	Remove restriction
Hesitation	Cracked or broken vacuum hoses	Replace vacuum hoses
	Vacuum leaks	Repair Vacuum leaks
	Binding carburetor linkage	Eliminate binding
	Binding throttle linkage	Eliminate binding
	Binding choke linkage or fast idle cam	Eliminate binding
	Improper float setting	Readjust float setting, see FUEL
	Cracked or broken ignition wires	Replace ignition wires
Rough idle, Missing or Stalling	Incorrect curb idle or fast idle speed	Reset idle speed, see see ENGINE PERFORMANCE
	Incorrect basic timing	Reset ignition timing see ENGINE PERFORMANCE
	Improper idle mixture adjustment	Reset idle mixture, see ENGINE PERFORMANCE
	Improper feedback system operation	Check feedback system see ENGINE PERFORMANCE
	Incorrect spark plug gap	Reset spark plug gap, see ENGINE PERFORMANCE
	Moisture in ignition components	Dry components
	Loose or broken ignition wires	Replace ignition wires
	Damaged distributor cap or or rotor	Replace distributor cap or rotor
	Faulty ignition coil	Replace ignition coil
	Fuel filter clogged or worn	Replace fuel filter
	Damaged idle mixture screw	Replace idle mixture screw, see FUEL
	Improper fast idle cam adjustment	Reset fast idle cam adjustment, see TUNE- see ENGINE PERFORMANCE
	Improper EGR valve operation	Replace EGR valve
	Faulty PCV valve air flow	Replace PCV valve
	Choke binding or improper choke setting	Reset choke or eliminate binding

	Vacuum leak	Repair vacuum leak
	Improper float bowl fuel level	Reset float adjustment, see FUEL
	Clogged air bleed or idle passages	Clean carburetor passages, see FUEL
	Clogged or worn air cleaner filter	Replace air filter
	Faulty choke vacuum diaphragm	Replace diaphragm, see ENGINE PERFORMANCE
	Exhaust manifold heat valve inoperative	Replace heat valve
	Improper distributor spark advance	Check distributor operation
	Leaking valves or valve components	Check and repair valvetrain
	Improper carburetor mounting	Remove and remount carburetor
	Excessive play in distributor shaft	Replace distributor
	Loose or corroded wiring connections	Repair or replace as required
Engine Surges	Improper PCV valve airflow	Replace PCV valve
	Vacuum leaks	Repair vacuum leaks
	Clogged air bleeds	Remove restriction
	EGR valve malfunction	Replace EGR valve
	Restricted air cleaner filter	Replace air filter
	Cracked or broken vacuum hoses	Replace vacuum hoses
	Cracked or broken ignition wires	Replace ignition wires
	Vacuum advance malfunction	Check unit and replace as necessary
	Defective or fouled spark plugs	Replace spark plugs
Ping or Spark Knock	Incorrect ignition timing	Reset ignition timing see ENGINE PERFORMANCE
	Distributor centrifugal or vacuum advance malfunction	Check operation and replace as necessary
	Carburetor setting too lean	Readjust mixture

		setting, see ENGINE PERFORMANCE
	Vacuum leak	Eliminate vacuum leak
	EGR valve malfunction	Replace EGR valve
Poor Gasoline Mileage	Cracked or broken vacuum hoses	Replace vacuum hoses
	Vacuum leaks	Repair vacuum leaks
	Defective ignition wires	Replace wires
	Incorrect choke setting	Readjust setting, see ENGINE PERFORMANCE
	Defective vacuum advance	Replace vacuum advance
	Defective spark plugs	Replace spark plugs
	Binding carburetor power piston	Eliminate binding
	Dirt in carburetor jets	Clean and/or replace jets
	Incorrect float adjustment	Readjust float setting, see FUEL
	Defective power valve	Replace power valve, see ENGINE PERFORMANCE
	Incorrect idle speed	Readjust idle speed
Engine Stalls	Improper float level	Readjust float level
	Leaking needle valve and seat	Replace needle valve and seat
	Vacuum leaks	Eliminate vacuum leaks

VACUUM PUMP - DIESEL TROUBLE SHOOTING

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NOTE: Diesel engines mechanical diagnosis is the same as gasoline engines for items such as noisy valves, bearings, pistons, etc. The following trouble shooting covers only items pertaining to diesel engines.

VACUUM PUMP (DIESEL) TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE	CORRECTION

Excessive Noise	Loose pump-to-drive assembly screws	Tighten screws
	Loose tube on pump assembly	Tighten tube
	Valves not functioning properly	Replace valves
Oil Leakage	Loose end plug	Tighten end plug
	Bad seal crimp	Remove and re-crimp seal

MANUAL TRANSMISSION

MANUAL TRANSMISSION TROUBLE SHOOTING

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MANUAL TRANSMISSION/TRANSAXLE TROUBLE SHOOTING

Condition	Possible Cause
Noisy In Forward Gears	.Low gear oil level, .Loose bell housing bolts, .Worn bearings or gears
Clunk On Deceleration (FWD Only)	.Loose engine mounts, .Worn inboard CV joints, .Worn differential pinion shaft, .Side gear hub counterbore in case worn oversize
Gear Clash When Shifting Forward Gears	.Clutch Out Of Adjustment, .Shift linkage damaged or out of adjustment, .Gears or synchronizers damaged, .Low gear oil level
Transmission Noisy When Moving (RWD Only) Quiet In Neutral With Clutch Engaged	.Worn rear outputshaft bearing
Gear Rattle	.Worn bearings, .Wrong gear oil, .Low gear oil, .Worn gears
Steady Ticking At Idle (Increases With RPM)	.Broken tooth on gear
Gear Clash When Shifting Forward Gears	.Worn or broken synchronizers
Loud Whine In Reverse	.Normal condition (1)

Noise When Stepping On Clutch	.Bad release bearing, .Worn pilot bearing
Ticking Or Screeching As Clutch Is Engaged	.Faulty release bearing, .Uneven pressure plate fingers
Click Or Snap When Clutch Is Engaged	.Worn clutch fork, .Worn or broken front bearing retainer
Transmission Shifts Hard	.Clutch not releasing, .Shift mechanism binding, .Clutch installed backwards
Will Not Shift Into One Gear, Shifts Into All Others	.Bent shift fork, .Worn detent balls
Locked Into Gear, Cannot Shift	.Clutch adjustment, .Worn detent balls
Transmission Jumps Out Of Gear	.Pilot bearing worn, .Bent shift fork, .Worn gear teeth or face .Excessive gear train end play .Worn synchronizers .Missing detent ball spring .Shift mechanism worn or out of adjustment .Engine or transmission mount bolts loose or out of adjustment .Transmission not aligned
Shift Lever Rattle	.Worn shift lever or detents .Worn shift forks .Worn synchronizers sleeve
Shift Lever Hops Under Acceleration	.Worn engine or transmission mounts
(1) - Most units use spur cut gears in reverse and are noisy	

POWERTRAIN

CLUTCH TROUBLE SHOOTING

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BASIC CLUTCH TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
Chattering or Grabbing	Incorrect clutch adjustment	Adjust clutch
	Oil, grease or glaze on facings	Disassemble and clean or replace
	Loose "U" joint flange	See DRIVE AXLES article
	Worn input shaft spline	Replace input shaft
	Binding pressure plate	Replace pressure plate
	Binding release lever	See CLUTCH article
	Binding clutch disc hub	Replace clutch disc
	Unequal pressure plate contact	Replace worn/misaligned components
	Loose/bent clutch disc	Replace clutch disc
	Incorrect transmission alignment	Realign transmission
	Worn pressure plate, disc or flywheel	Replace damaged components
	Broken or weak pressure springs	Replace pressure plate
	Sticking clutch pedal	Lubricate clutch pedal & linkage
	Incorrect clutch disc facing	Replace clutch disc
	Engine loose in chassis	Tighten all mounting bolts
Failure to Release	Oil or grease on clutch facings	Clean or replace clutch clutch disc
	Incorrect release lever or pedal adjustment	See CLUTCH article
	Worn or broken clutch facings	Replace clutch disc
	Bent clutch disc or pressure plate	Replace damaged components
	Clutch disc hub binding on input shaft	Clean or replace clutch disc and/or input shaft
	Binding pilot bearing	Replace pilot bearing
	Sticking release bearing sleeve	Replace release bearing and/or sleeve
	Binding clutch cable	See CLUTCH article

	Defective clutch master	Replace master cylinder
	Defective clutch slave	Replace slave cylinder
	Air in hydraulic system	Bleed hydraulic system
Rattling	Weak or broken release lever spring	Replace spring and check alignment
	Damaged pressure plate	Replace pressure plate
	Broken clutch return spring	Replace return spring
	Worn splines on clutch disc or input shaft	Replace clutch disc and/or input shaft
	Worn clutch release bearing	Replace release bearing
	Dry or worn pilot bearing	Lubricate or replace pilot bearing
	Unequal release lever contact	Align or replace release lever
	Incorrect pedal free play	Adjust free play
	Warped or damaged clutch disc	Replace damaged components
Slipping	Pressure springs worn or	Release pressure plate
	Oily, greasy or worn facings	Clean or replace clutch disc
	Incorrect clutch alignment	Realign clutch assembly
	Warped clutch disc or pressure plate	Replace damaged components
	Binding release levers or clutch pedal	Lubricate and/or replace release components
Squeaking	Worn or damaged release	Replace release bearing
	Dry or worn pilot or release bearing	Lubricate or replace assembly
	Pilot bearing turning in crankshaft	Replace pilot bearing and/or crankshaft
	Worn input shaft bearing	Replace bearing and seal
	Incorrect transmission alignment	Realign transmission
	Dry release fork between pivot	Lubricate release fork and pivot
Heavy and/or Stiff Pedal	Sticking release bearing sleeve	Replace release bearing and/or sleeve

	Dry or binding clutch pedal hub	Lubricate and align components
	Floor mat interference with pedal	Lay mat flat in proper area
	Dry or binding ball/fork pivots	Lubricate and align components
	Faulty clutch cable	Replace clutch cable
Noisy Clutch Pedal	Faulty interlock switch	Replace interlock switch
	Self-adjuster ratchet noise	Lubricate or replace self-adjuster
	Speed control interlock switch	Lubricate or replace interlock switch
Clutch Pedal Sticks Down	Binding clutch cable	See CLUTCH article
	Springs weak in pressure plate	Replace pressure plate
	Binding in clutch linkage	Lubricate and free linkage
Noisy	Dry release bearing	Lubricate or replace release bearing
	Dry or worn pilot bearing	Lubricate or replace bearing
	Worn input shaft bearing	Replace bearing
Transmission Click	Weak springs in pressure plate	Replace pressure plate
	Release fork loose on ball stud	Replace release fork and/or ball stud
	Oil on clutch disc damper	Replace clutch disc
	Broken spring in slave cylinder	Replace slave cylinder

DRIVE AXLE - NOISE DIAGNOSIS

Unrelated Noises

Some driveline trouble symptoms are also common to the engine, transmission, wheel bearings, tires, and other parts of the vehicle. Ensure cause of trouble actually is in the drive axle before adjusting, repairing, or replacing any of its parts.

Non-Drive Axle Noises

A few conditions can sound just like drive axle noise and have to be considered in pre-diagnosis. The 4 most common noises are exhaust, tires, CV/universal joints and wheel trim rings.

In certain conditions, the pitch of the exhaust gases may sound like gear whine. At other times, it may be mistaken for a wheel bearing rumble.

Tires, especially radial and snow, can have a high-pitched tread whine or roar, similar to gear noise. Also, some non-standard tires with an unusual tread construction may emit a roar or whine.

Defective CV/universal joints may cause clicking noises or excessive driveline play that can be improperly diagnosed as drive axle problems.

Trim and moldings also can cause a whistling or whining noise. Ensure none of these components are causing the noise before disassembling the drive axle.

Gear Noise

A "howling" or "whining" noise from the ring and pinion gear can be caused by an improper gear pattern, gear damage, or improper bearing preload. It can occur at various speeds and driving conditions, or it can be continuous.

Before disassembling axle to diagnose and correct gear noise, make sure that tires, exhaust, and vehicle trim have been checked as possible causes.

Chuckle

This is a particular rattling noise that sounds like a stick against the spokes of a spinning bicycle wheel. It occurs while decelerating from 40 MPH and usually can be heard until vehicle comes to a complete stop. The frequency varies with the speed of the vehicle.

A chuckle that occurs on the driving phase is usually caused by excessive clearance due to differential gear wear, or by a damaged tooth on the coast side of the pinion or ring gear. Even a very small tooth nick or a ridge on the edge of a gear tooth is enough the cause the noise.

This condition can be corrected simply by cleaning the gear tooth nick or ridge with a small grinding wheel. If either gear is damaged or scored badly, the gear set must be replaced. If metal has broken loose, the carrier and housing must be cleaned to remove particles that could cause damage.

Knock

This is very similar to a chuckle, though it may be louder, and occur on acceleration or deceleration. Knock can be caused by a gear tooth that is damaged on the drive side of the ring and pinion gears. Ring gear bolts that are hitting the carrier casting can cause knock. Knock can also be due to excessive end play in the axle shafts.

Clunk

Clunk is a metallic noise heard when an automatic transmission is engaged in Reverse or Drive, or when throttle is applied or released. It is caused by backlash somewhere in the driveline, but not necessarily in the axle. To determine whether driveline clunk is caused by the axle, check the total axle backlash as follows:

1) Raise vehicle on a frame or twinpost hoist so that drive wheels are free. Clamp a bar between axle companion flange and a part of the frame or body so that flange cannot move.

2) On conventional drive axles, lock the left wheel to keep it from turning. On all models, turn the right wheel slowly until it is felt to be in Drive condition. Hold a chalk marker on side of tire about 12" from center of wheel. Turn wheel in the opposite direction until it is again felt to be in Drive condition.

3) Measure the length of the chalk mark, which is the total

axle backlash. If backlash is one inch or less, drive axle is not the source of clunk noise.

Bearing Whine

Bearing whine is a high-pitched sound similar to a whistle. It is usually caused by malfunctioning pinion bearings. Pinion bearings operate at drive shaft speed. Roller wheel bearings may whine in a similar manner if they run completely dry of lubricant. Bearing noise will occur at all driving speeds. This distinguishes it from gear whine, which usually comes and goes as speed changes.

Bearing Rumble

Bearing rumble sounds like marbles being tumbled. It is usually caused by a malfunctioning wheel bearing. The lower pitch is because the wheel bearing turns at only about 1/3 of drive shaft speed.

Chatter On Turns

This is a condition where the entire front or rear of vehicle vibrates when vehicle is moving. The vibration is plainly felt as well as heard. Extra differential thrust washers installed during axle repair can cause a condition of partial lock-up that creates this chatter.

Axle Shaft Noise

Axle shaft noise is similar to gear noise and pinion bearing whine. Axle shaft bearing noise will normally distinguish itself from gear noise by occurring in all driving modes (Drive, cruise, coast and float), and will persist with transmission in Neutral while vehicle is moving at problem speed.

If vehicle displays this noise condition, remove suspect axle shafts, replace wheel seals and install a new set of bearings. Re-evaluate vehicle for noise before removing any internal components.

Vibration

Vibration is a high-frequency trembling, shaking or grinding condition (felt or heard) that may be constant or variable in level and can occur during the total operating speed range of the vehicle.

The types of vibrations that can be felt in the vehicle can be divided into 3 main groups:

* Vibrations of various unbalanced rotating parts of the vehicle.
* Resonance vibrations of the body and frame structures caused by rotating of unbalanced parts.
* Tip-in moans of resonance vibrations from stressed engine or exhaust system mounts or driveline flexing modes.

DRIVE AXLE - RWD TROUBLE SHOOTING

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DRIVE AXLE (RWD) TROUBLE SHOOTING

CONDITION	POSSIBLE CAUSE	CORRECTION

Knocking or Clunking		
	Differential Side Gear Clearance	Check Clearance
	Worn Pinion Shaft	Replace Pinion Shaft
	Axle Shaft End Play	Check End Play
	Missing Gear Teeth	Check Differential/ Replace Gear
	Wrong Axle Backlash	Check Backlash
	Misaligned Driveline	Realign Driveline
Clinking During Engagement		
	Side Gear Clearance	Check Clearance
	Ring and Pinion Backlash	Check Backlash
	Worn/Loose Pinion Shaft	Replace Shaft/Bearing
	Bad "U" Joint	Replace "U" Joint
	Sticking Slip Yoke	Lube Slip Yoke
	Broken Rear Axle Mount	Replace Mount
	Loose Drive Shaft Flange	Check Flange
Click/Chatter On Turns		
	Differential Side Gear Clearance	Check Clearance
	Wrong Turn On Plates (1)	Replace Clutch Plates
	Wrong Differential Lubricant (1)	Change Lubricant
Knock Or Click	Flat Spot on Rear Wheel Bearing	Replace Wheel Bearing
Low Vibration At All Speeds		
	Faulty Wheel Bearing	Replace Wheel Bearing
	Faulty "U" Joint	Replace "U" Joint
	Faulty Drive Shaft	Balance Drive Shaft
	Faulty Companion Flange	Replace Flange
	Faulty Slip Yoke Flange	Replace Flange

(1) - Limited slip differential only.

FWD AXLE SHAFTS & CV JOINTS TROUBLE SHOOTING

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BASIC FWD AXLE SHAFTS & CV JOINTS TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE
Grease Leaks	CV boot torn or cracked
Clicking Noise on Cornering	Damaged outer CV
Clunk Noise on Acceleration	Damaged inner CV
Vibration or Shudder on Acceleration	Sticking, damaged or worn CV Misalignment or spring height

STEERING & SUSPENSION

MANUAL STEERING GEAR TROUBLE SHOOTING

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BASIC MANUAL STEERING GEAR TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
Rattle or Chucking Noise in Rack and Pinion	Rack and pinion mounting bracket loose	Tighten all mounting bolts
	Lack of/or incorrect lubricant	Correct as necessary
	Steering gear mounting bolts loose	Tighten all mounting bolts
Excessive Play	Front wheel bearing improperly adjusted	See FRONT SUSPENSION article
	Loose or worn steering linkage	See STEERING LINKAGE article
	Loose or worn steering gear shift	See MANUAL STEERING GEAR article
	Steering arm loose on gear shaft	See MANUAL STEERING GEAR article
	Steering gear housing bolts loose	Tighten all mounting bolts
	Steering gear adjustment too loose	See MANUAL STEERING GEAR article
	Steering arms loose on	Tighten and check

	knuckles	steering linkage
	Rack and pinion mounting loose	Tighten all mounting bolts
	Rack and pinion out of adjustment	See adjustment in STEERING article
	Tie rod end loose	Tighten and check steering linkage
	Excessive Pitman shaft-to-ball nut lash	Repair as necessary
Poor Returnability	Lack of lubricant in ball joint or linkage	Lubricate and service systems
	Binding in linkage or ball joints	See STEERING LINKAGE and SUSPENSION article
	Improper front end alignment	See WHEEL ALIGNMENT article
	Improper tire pressure	Inflate to proper pressure
	Tie rod binding	Inflate to proper pressure
	Shaft seal rubbing shaft	See STEERING COLUMN article
Excessive Vertical Motion	Improper tire pressure	Inflate to proper pressure
	Tires, wheels or rotors out of balance	Balance tires then check wheels and rotors
	Worn or faulty shock absorbers	Check and replace if necessary
	Loose tie rod ends or steering	Tighten or replace if necessary
	Loose or worn wheel bearings	See SUSPENSION article
Steering Pulls to One Side	Improper tire pressure	Inflate to proper pressure
	Front tires are different sizes	Rotate or replace if necessary
	Wheel bearings not adjusted properly	See FRONT SUSPENSION article
	Bent or broken suspension components	See FRONT SUSPENSION article
	Improper wheel alignment	See WHEEL ALIGNMENT article

	Brakes dragging	See BRAKES article
Instability	Low or uneven tire pressure	Inflate to proper pressure
	Loose or worn wheel bearings	See FRONT SUSPENSION article
	Loose or worn idler arm bushing	See FRONT SUSPENSION article
	Loose or worn strut bushings	See FRONT SUSPENSION article
	Incorrect front wheel alignment	See WHEEL ALIGNMENT article
	Steering gear not centered	See MANUAL STEERING GEARS article
	Springs or shock	Check and replace if necessary
	Improper cross shaft	See MANUAL STEERING GEARS article

POWER STEERING TROUBLE SHOOTING

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BASIC POWER STEERING TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
Rattle or Chucking Noise	Pressure hoses touching engine parts	Adjust to proper clearance
	Loose Pitman shaft	Adjust or replace if necessary
	Tie rods ends or Pitman arm loose	Tighten and check system
	Rack and pinion mounts loose	Tighten all mounting bolts
	Free play in worm and	See POWER STEERING GEAR article
	Loose sector shaft or thrust bearing adjustment	See POWER STEERING GEAR
	Free play in pot coupling	See STEERING COLUMN article

	Worn shaft serrations	See STEERING COLUMN article
Growl in Steering Pump	Excessive pressure in hoses	Restricted hoses, see POWER STEERING GEAR article
	Scored pressure plates	See POWER STEERING GEAR article
	Scored thrust plates or rotor	See POWER STEERING GEAR article
	Extreme wear of cam ring	See POWER STEERING GEAR article
Rattle in Steering Pump	Vanes not installed	See POWER STEERING PUMP article
	Vanes sticking in rotor	See POWER STEERING PUMP article
Swish noise in Pump	Defective flow control valve	See POWER STEERING PUMP article
Groan in Steering Pump	Air in fluid	See POWER STEERING PUMP article
	Poor pressure hose connection	Tighten and check, replace if necessary
Squawk When Turning	Damper "O" ring on valve spool cut	See POWER STEERING PUMP article
Moan or Whine in Pump	Pump shaft bearing scored	Replace bearing and fluid
	Air in fluid or fluid level low	See POWER STEERING PUMP article
	Hose or column grounded	Check and replace if necessary
	Cover "O" ring missing or damaged	See POWER STEERING PUMP article
	Valve cover baffle missing or damaged	See POWER STEERING PUMP article
	Interference of components in pump	See POWER STEERING PUMP article
	Loose or poor bracket alignment	Correct or replace if necessary
Hissing When Parking	Internal leakage in steering gear	Check valved assembly first
Chirp in Steering Pump	Loose or worn power steering belt	Adjust or replace if necessary
Buzzing When Not Steering	Noisy pump	See POWER STEERING PUMP article

	Free play in steering shaft bearing	See STEERING COLUMN article
	Bearing loose on shaft serrations	See STEERING COLUMN article
Clicking Noise in Pump	Pump slippers too long	See POWER STEERING PUMP article
	Broken slipper springs	See POWER STEERING PUMP article
	Excessive wear or nicked rotors	See POWER STEERING PUMP article
	Damaged cam contour	See POWER STEERING PUMP article
Poor Return of Wheel	Wheel rubbing against turn signal	See STEERING COLUMN SWITCHES article
	Flange rubbing steering gear adjuster	See STEERING COLUMN article
	Tight or frozen steering shaft bearing	See STEERING COLUMN article
	Steering gear out of adjustment	See POWER STEERING GEAR article
	Sticking or plugged spool valve	See POWER STEERING PUMP article
	Improper front end alignment	See WHEEL ALIGNMENT article
	Wheel bearings worn or loose	See FRONT SUSPENSION article
	Ties rods or ball joints binding	Check and replace if necessary
	Intermediate shaft joints binding	See STEERING COLUMN article
	Kinked pressure hoses	Correct or replace if necessary
	Loose housing head spanner nut	See POWER STEERING GEAR article
	Damaged valve lever	See POWER STEERING GEAR article
	Sector shaft adjusted too tight	See ADJUSTMENTS in POWER STEERING GEAR article
	Worm thrust bearing adjusted too tight	See ADJUSTMENTS in POWER STEERING GEAR article
	Reaction ring sticking in cylinder	See POWER STEERING GEAR article

	Reaction ring sticking in housing head	See POWER STEERING GEAR article
	Steering pump internal leakage	See POWER STEERING PUMP article
	Steering gear-to-column misalignment	See STEERING COLUMN article
	Lack of lubrication in linkage	Service front suspension
	Lack of lubrication in ball joints	Service front suspension
Increased Effort When Turning	High internal pump leakage	See POWER STEERING PUMP article
Wheel Fast Foaming, Milky Power Steering Fluid, Low Fluid Level or Low Pressure	Power steering pump belt slipping	Adjust or replace if necessary
	Low fluid level	Check and fill to proper level
	Engine idle speed to low	Adjust to correct setting
	Air in pump fluid system	See POWER STEERING PUMP article
	Pump output low	See POWER STEERING PUMP article
	Steering gear malfunctioning	See POWER STEERING GEAR article
Wheel Surges or Jerks	Low fluid level	Check and fill to proper level
	Loose fan belt	Adjust or replace if necessary
	Insufficient pump pressure	See POWER STEERING PUMP article
	Sticky flow control valve	See POWER STEERING PUMP article
	Linkage hitting oil pan at full turn	Replace bent components
Kick Back or Free Play	Air in pump fluid system	See POWER STEERING PUMP article
	Worn poppet valve in steering gear	See POWER STEERING PUMP article
	Excessive over center lash	See POWER STEERING GEAR article
	Thrust bearing out of adjustment	See POWER STEERING GEAR article

	Free play in pot coupling	See POWER STEERING PUMP article
	Steering gear coupling loose on shaft	See POWER STEERING PUMP article
	Steering disc mounting bolts loose	Tighten or replace if necessary
	Coupling loose on worm shaft	Tighten or replace if necessary
	Improper sector shaft adjustment	See POWER STEERING GEAR article
	Excessive worm piston side play	See POWER STEERING GEAR article
	Damaged valve lever	See POWER STEERING GEAR article
	Universal joint loose	Tighten or replace if necessary
	Defective rotary valve	See POWER STEERING GEAR article
No Power When Parking	Sticking flow control valve	See POWER STEERING PUMP article
	Insufficient pump pressure output	See POWER STEERING PUMP article
	Excessive internal pump leakage	See POWER STEERING PUMP article
	Excessive internal gear leakage	See POWER STEERING PUMP article
	Flange rubs against gear adjust plug	See STEERING COLUMN article
	Loose pump belt	Adjust or replace if necessary
	Low fluid level	Check and add proper amount of fluid
	Engine idle too low	Adjust to correct setting
	Steering gear-to-column misaligned	See STEERING COLUMN article
No Power, Left Turn	Left turn reaction seal "O" ring worn	See POWER STEERING GEAR article
	Left turn reaction seal damaged/missing	See POWER STEERING GEAR article
	Cylinder head "O" ring damaged	See POWER STEERING PUMP article

No Power, Right Turns	Column pot coupling bottomed	See STEERING COLUMN article
	Right turn reaction seal "O" ring worn	See POWER STEERING GEAR article
	Right turn reaction seal damaged	See POWER STEERING GEAR article
	Internal leakage through piston end plug	See POWER STEERING GEAR article
	Internal leakage through side plugs	See POWER STEERING GEAR article
Lack of Effort in Turning	Left and/or right reaction seal sticking in cylinder head	Replace, see POWER STEERING GEAR article
Wanders to One Side	Front end alignment incorrect	See WHEEL ALIGNMENT article
	Unbalanced steering gear valve	See POWER STEERING GEAR article
Low Pressure Due to Steering Pump	Flow control valve stuck or inoperative	See POWER STEERING PUMP article
	Pressure plate not flat against cam ring	See POWER STEERING PUMP article
	Extreme wear of cam ring	Replace and check adjustments
	Scored plate, thrust plate or rotor	See POWER STEERING PUMP article
	Vanes not installed properly	See POWER STEERING PUMP article
	Vanes sticking in rotor slots	See POWER STEERING PUMP article
	Cracked/broken thrust or pressure plate	See POWER STEERING PUMP article

STEERING COLUMN TROUBLE SHOOTING

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BASIC STEERING COLUMN TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
Noise in Steering	Coupling pulled apart	See STEERING COLUMNS article

	Column not correctly aligned	See STEERING COLUMNS article
	Broken lower joint	Replace joint
	Horn contact ring not	See STEERING COLUMN article
	Bearing not lubricated	See STEERING COLUMN article
	Shaft snap ring not properly seated	Reseat or replace snap ring
	Plastic spherical joint not lubricated	See STEERING COLUMN article
	Shroud or housing loose	Tighten holding screws
	Lock plate retaining ring not seated	See STEERING COLUMN article
	Loose sight shield	Tighten holding screws
High Steering Shaft Effort	Column assembly misaligned	See STEERING COLUMN article
	Improperly installed dust shield	Adjust or replace
	Tight steering universal joint	See STEERING COLUMN article
High Shift Effort	Column is out of alignment	See STEERING COLUMN article
	Improperly installed dust shield	Adjust or replace
	Seals or bearings not lubricated	See STEERING COLUMNS article
	Mounting bracket screws too long	Replace with new shorter screws
	Burrs on shift tube	Remove burrs or replace tube
	Lower bowl bearing assembled wrong	See STEERING COLUMN article
	Shift tube bent or broken	Replace as necessary
	Improper adjustment of shift levers	See STEERING COLUMN article
Improper Trans. Shifting	Sheared shift tube joint	Replace as necessary
	Sheared lower shaft lever	Replace as necessary
	Improper shift lever adjustment	See STEERING COLUMN article

	Improper gate plate adjustment	See STEERING COLUMN article
Excess Play in Column	Instrument panel bracket bolts loose	Tighten bolts and check bracket
	Broken weld nut on jacket	See STEERING COLUMN article
	Instrument bracket capsule sheared	See STEERING COLUMN article
	Column bracket/jacket bolts loose	Tighten bolts and check bracket
Steering Locks in Gear	Release lever mechanism	See STEERING COLUMN article

SUSPENSION TROUBLE SHOOTING

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BASIC SUSPENSION TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
Front End Noise	Loose or worn wheel	See Wheel Bearing Adjustment in SUSPENSION
	Worn shocks or shock mountings	Replace struts or strut mountings
	Worn struts or strut mountings	Replace struts or strut mountings
	Loose or worn lower control arm	See SUSPENSION
	Loose steering gear-to-frame bolts	See STEERING
	Worn control arm bushings	See SUSPENSION
	Ball joints not lubricated	Lubricate ball joints & see Ball Joint Checking in SUSPENSION
Front Wheel Shake, Shimmy, or Vibration	Tires or wheels out of balance	Check tire balance
	Incorrect wheel alignment	See WHEEL ALIGNMENT
	Drive shaft unbalanced	Check drive shaft balance

	Loose or worn wheel bearings	See WHEEL ALIGNMENT
	Loose or worn tie rod ends	See SUSPENSION
	Worn upper ball joints	See Ball Joint Checking in SUSPENSION
	Worn shock absorbers	Replace shock absorbers
	Worn strut bushings	Replace strut bushings
Car Pulls to One Side	Mismatched or uneven tires	Check tire condition
	Broken or sagging springs	See SUSPENSION
	Loose or worn strut bushings	See SUSPENSION
	Improper wheel alignment	See WHEEL ALIGNMENT
	Improper rear axle alignment	Check rear axle alignment
	Power steering gear unbalanced	See STEERING
	Front brakes dragging	See BRAKES
Abnormal Tire Wear	Unbalanced tires	Check tire balance & rotation
	Sagging or broken springs	See SUSPENSION
	Incorrect front end alignment	See WHEEL ALIGNMENT
	Faulty shock absorbers	Replace chock absorbers
Scuffed Tires	Toe-In incorrect	See WHEEL ALIGNMENT
	Suspension arm bent or twisted	See appropriate SUSPENSION article
Springs Bottom or Sag	Bent or broken springs	See SUSPENSION
	Leaking or worn shock absorbers	Replace shock absorbers
	Frame misalignment	Check frame for damage
Spring Noises	Loose "U" Bolts	See SUSPENSION
	Loose or worn bushings	See SUSPENSION
	Worn or missing interliners	See SUSPENSION
Shock Absorber Noise	Loose shock mountings	Check & tighten mountings
	Worn bushings	Replace bushings

	Air in system	Bleed air from system
	Undercoating on shocks	Remove undercoating
Car Leans or Sways on Corners	Loose stabilizer bar	See SUSPENSION
	Faulty shocks or mountings	Replace shocks or mountings
	Broken or sagging springs	See SUSPENSION
Shock Absorbers Leaking	Worn seals or reservoir tube crimped	See SUSPENSION
Broken Springs	Loose "U" bolts	See SUSPENSION
	Inoperative shock absorbers	Replace shock absorbers

WHEEL ALIGNMENT TROUBLE SHOOTING

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BASIC WHEEL ALIGNMENT TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
Premature Tire Wear	Improper tire inflation	Check tire pressure
	Front alignment out of tolerance	See ALIGNMENT SPECS in WHEEL ALIGNMENT section
	Suspension components worn	See SUSPENSION section
	Steering system components worn	See STEERING section
	Improper standing height	See WHEEL ALIGNMENT
	Uneven or sagging springs	See SUSPENSION section
	Bent wheel	See WHEEL ALIGNMENT
	Improper torsion bar adjustment	See SUSPENSION section
	Loose or worn wheel bearings	See WHEEL BEARING ADJ. in SUSPENSION section
	Worn or defective shock	Replace shock absorbers
	Tires out of balance	Check tire balance
Pulls to One Side	Improper tire inflation	Check tire pressure
	Brake dragging	See BRAKE section

	Mismatched tires	See WHEEL ALIGNMENT
	Broken or sagging spring	See SUSPENSION section
	Broken torsion bar	See SUSPENSION section
	Power steering valve not centered	See STEERING section
	Front alignment out of tolerance	See WHEEL ALIGNMENT section
	Defective wheel bearing	See WHEEL BEARINGS in SUSPENSION section
	Uneven sway bar links	See SUSPENSION section
	Frame bent	Check for frame damage
	Steering system bushing worn	See STEERING section
Hard Steering	Idler arm bushing too tight	See STEERING LINKAGE in STEERING section
	Ball joint tight or seized	See SUSPENSION section
	Steering linkage too tight	See STEERING LINKAGE in STEERING section
	Power steering fluid low	Add proper amount of fluid
	Power steering drive belt loose	See STEERING section
	Power steering pump defective	See STEERING section
	Steering gear out of adjustment	See STEERING section
	Incorrect wheel alignment	See WHEEL ALIGNMENT
	Damaged steering gear	See STEERING section
	Damaged suspension	See SUSPENSION section
	Bent steering knuckle or supports	See SUSPENSION section
Vehicle "Wanders"	Strut rod or control arm bushing worn	See SUSPENSION section
	Loose or worn wheel bearings	See WHEEL BEARINGS in SUSPENSION section
	Improper tire inflation	Check tire pressure
	Stabilizer bar missing or defective	See SUSPENSION section

	Wheel alignment out of tolerance	See Adjustment in WHEEL ALIGNMENT section
	Broken spring	See SUSPENSION section
	Defective shock absorbers	Replace shock absorbers
	Worn steering & suspension components	See SUSPENSION section
Front End Shimmy	Tire out of balance/round	Check tire balance
	Excessive wheel runout	See WHEEL ALIGNMENT
	Insufficient or improper caster	See WHEEL ALIGNMENT section
	Worn suspension or steering components	See SUSPENSION section
	Defective shock absorbers	Replace shock absorber
	Wheel bearings worn or loose	See WHEEL BEARING ADJ. in SUSPENSION section
	Power steering reaction Bracket loose	See STEERING section
	Steering gear box (rack) mounting loose	See STEERING section
	Steering gear adjustment loose	See STEERING section
	Worn spherical joints	See SUSPENSION section
Toe-In Not Adjustable	Lower control arm bent	See SUSPENSION section
	Frame bent	Check frame for damage
Camber Not Adjustable	Control arm bent	See SUSPENSION section
	Frame bent	Check frame for damage
	Hub & bearing not seated properly	See SUSPENSION section

M - VACUUM DIAGRAMS

1998 Mitsubishi Galant

1998 ENGINE PERFORMANCE
Mitsubishi - Vacuum Diagrams

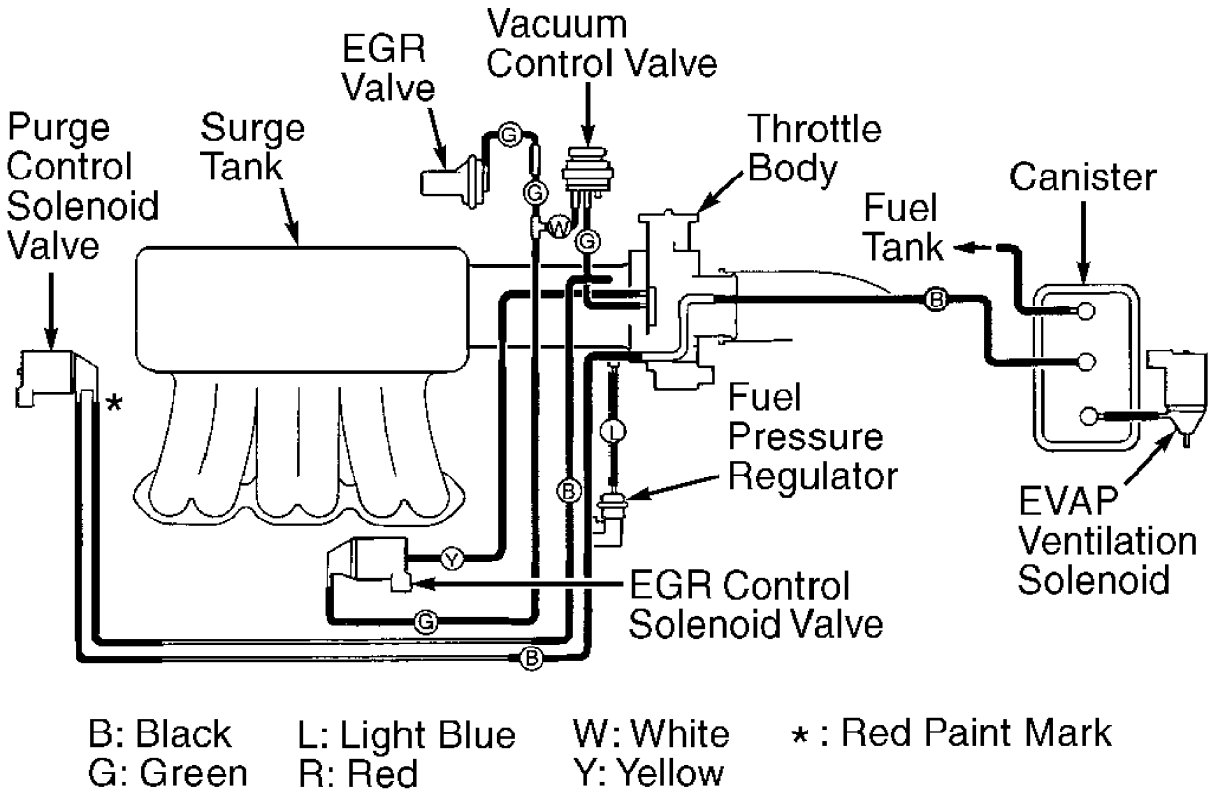
Diamante, Eclipse, Galant, Mirage, Montero, Montero Sport, 3000GT

INTRODUCTION

This article contains underhood views or schematics of vacuum hose routing. Use these vacuum diagrams during the visual inspection in F - BASIC TESTING article. This will assist in identifying improperly routed vacuum hoses, which cause driveability and/or computer-indicated malfunctions.

NOTE: California and Federal applies to installed emission equipment, which may be verified by underhood Emission Control label. California emissions may be available in other states.

NOTE: Always refer to Emission Control label in engine compartment before attempting service. If manual and label differ, always use emission label specifications.



98J12566

Fig. 1: Vacuum Diagram (Diamante)
Courtesy of Mitsubishi Motor Sales of America

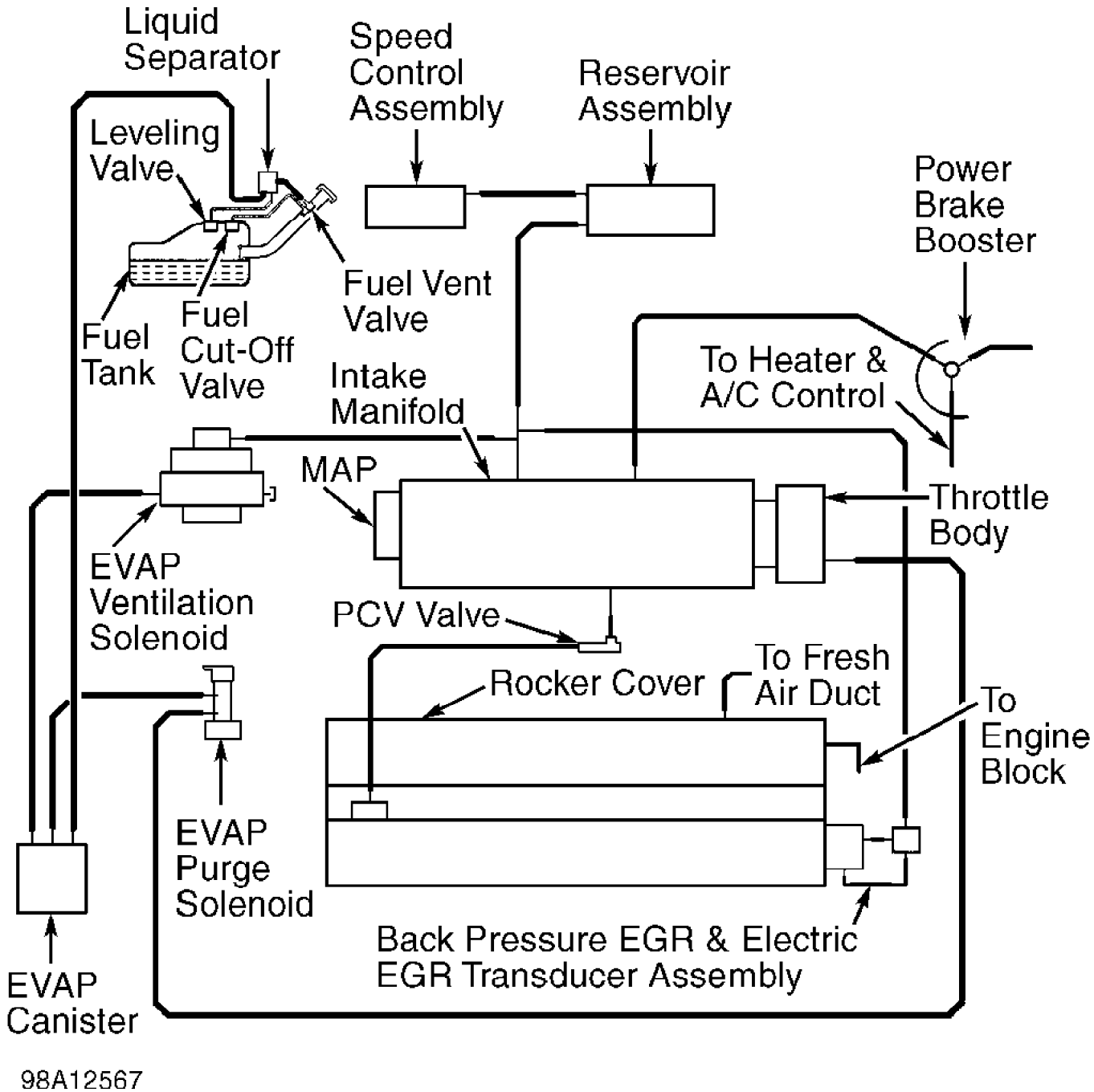


Fig. 2: Vacuum Diagram (Eclipse 2.0L Non-Turbo)
Courtesy of Mitsubishi Motor Sales of America

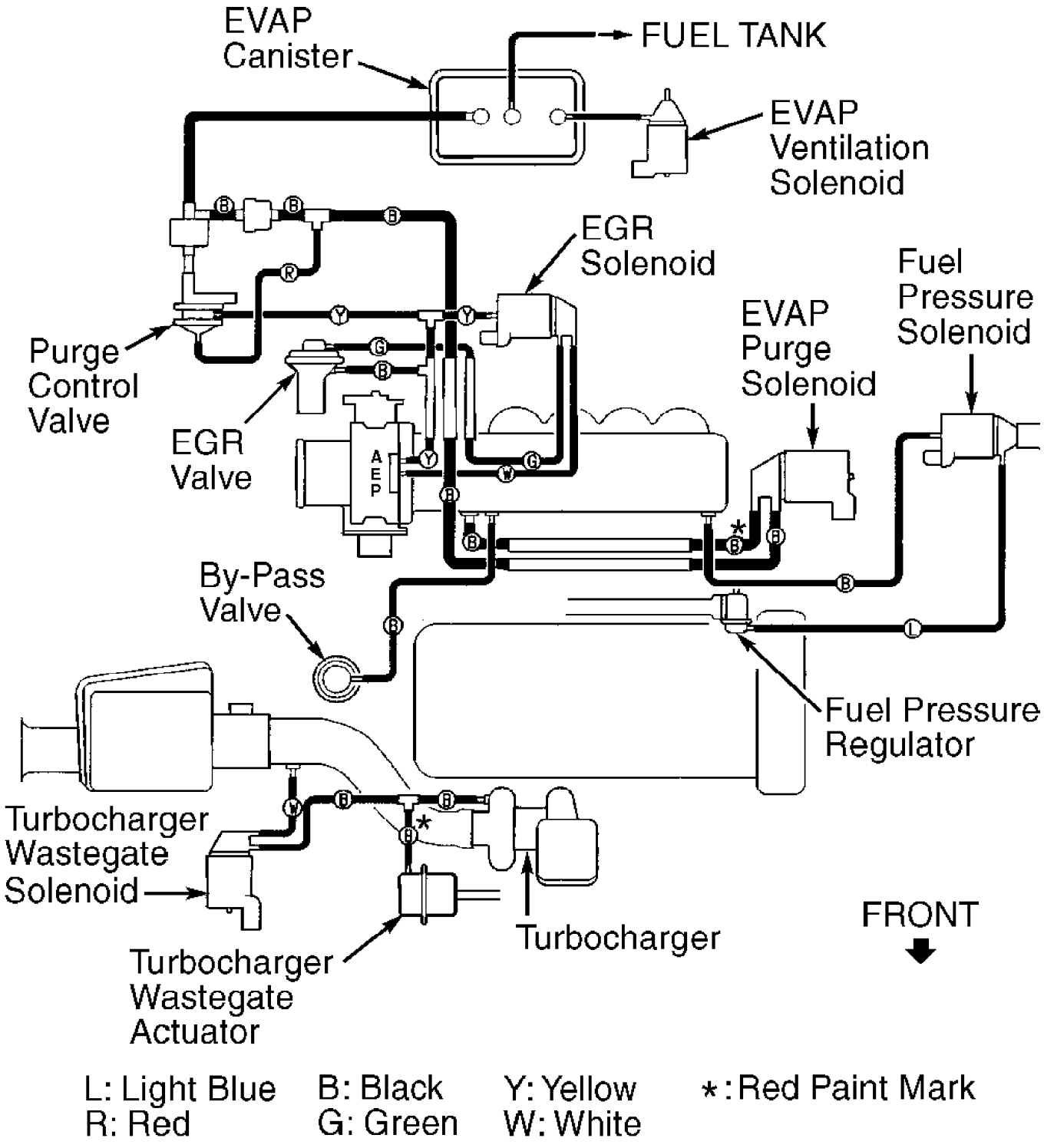


Fig. 3: Vacuum Diagram (Eclipse 2.0L Turbo)
Courtesy of Mitsubishi Motor Sales of America

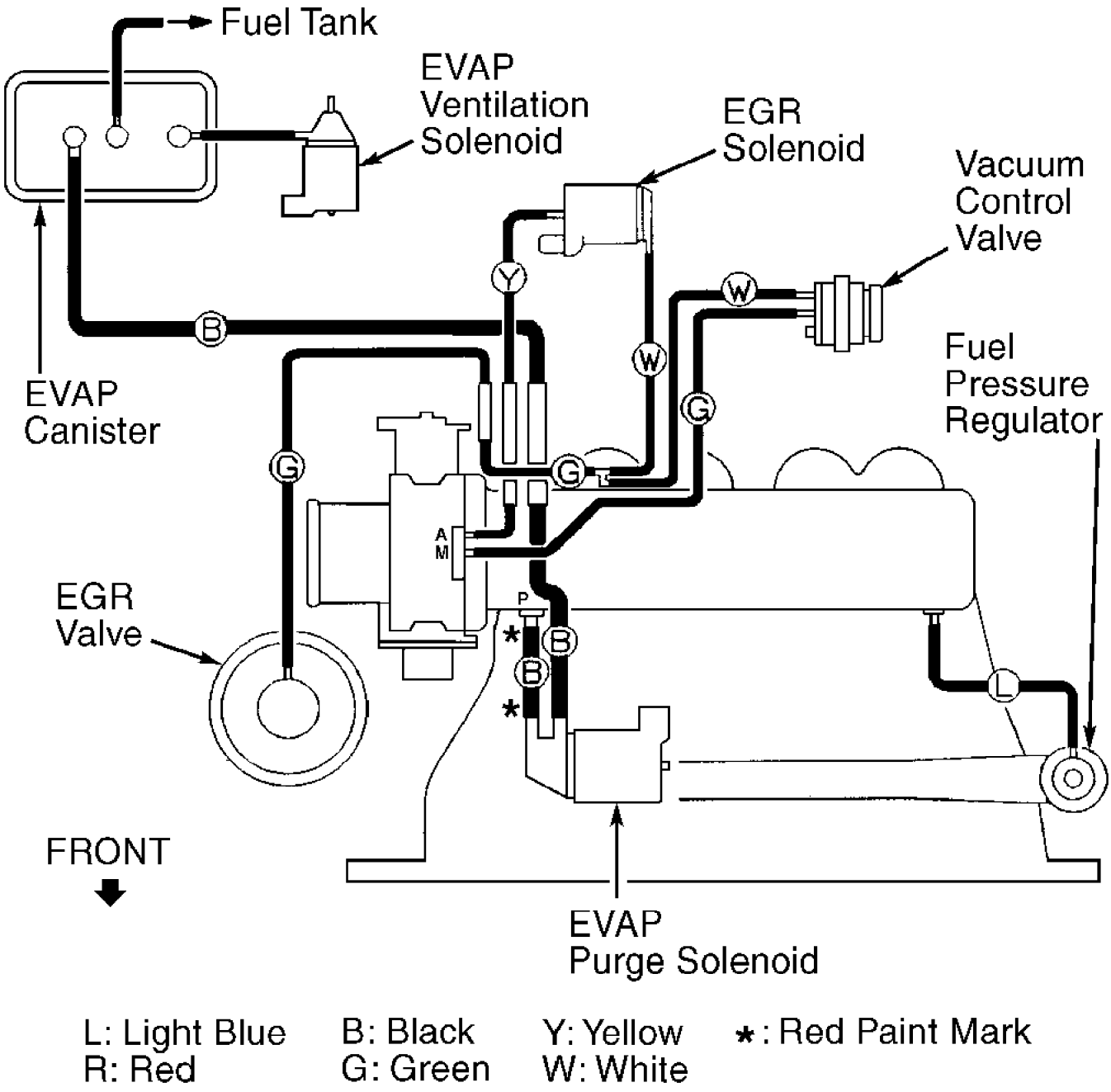


Fig. 4: Vacuum Diagram (Eclipse 2.4L)
Courtesy of Mitsubishi Motor Sales of America

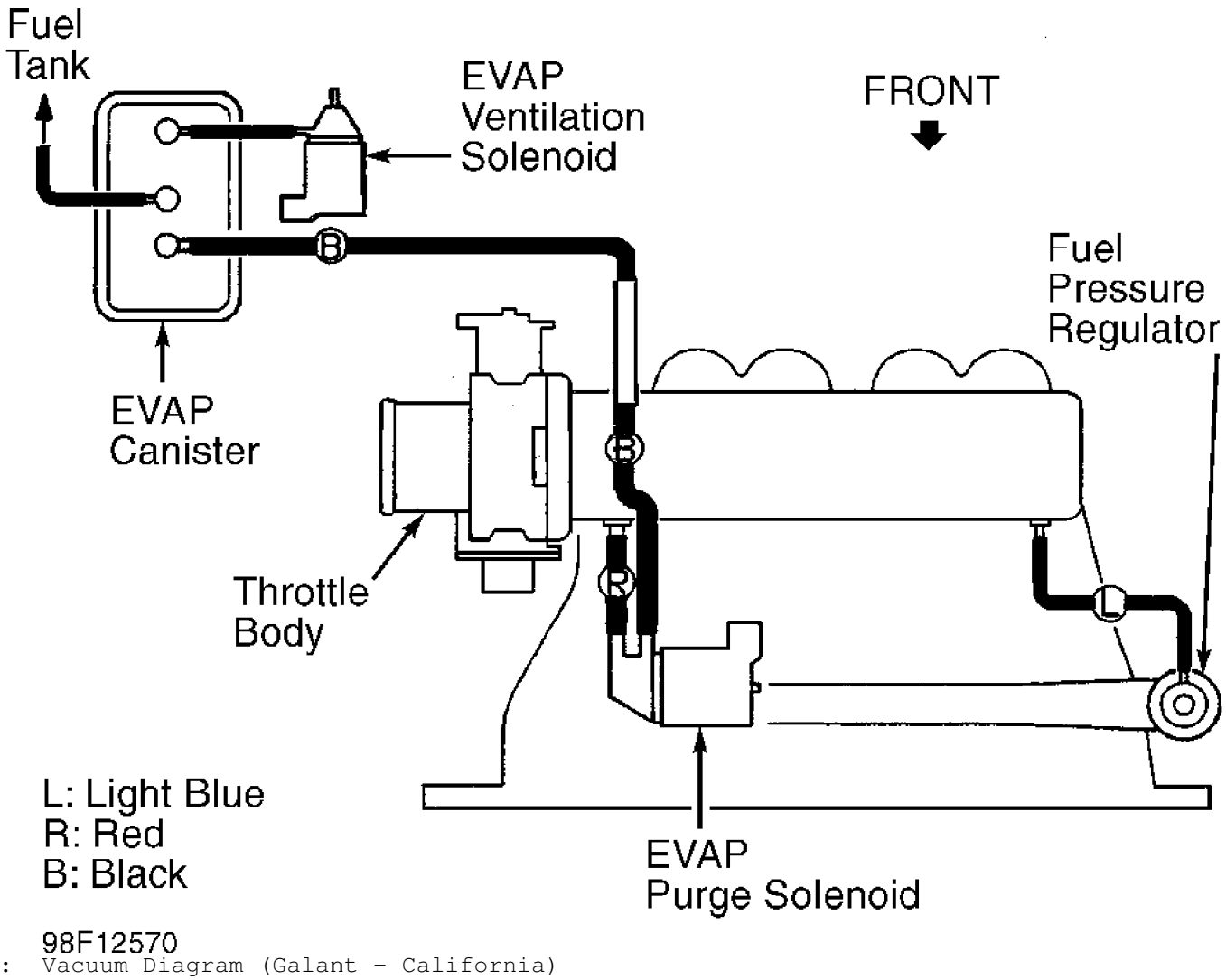


Fig. 5: Vacuum Diagram (Galant - California)
Courtesy of Mitsubishi Motor Sales of America

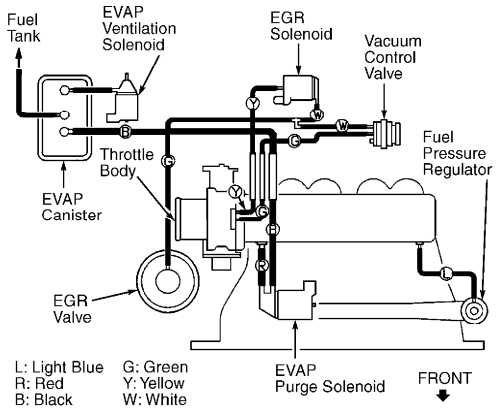


Fig. 6: Vacuum Diagram (Galant - Federal)
Courtesy of Mitsubishi Motor Sales of America

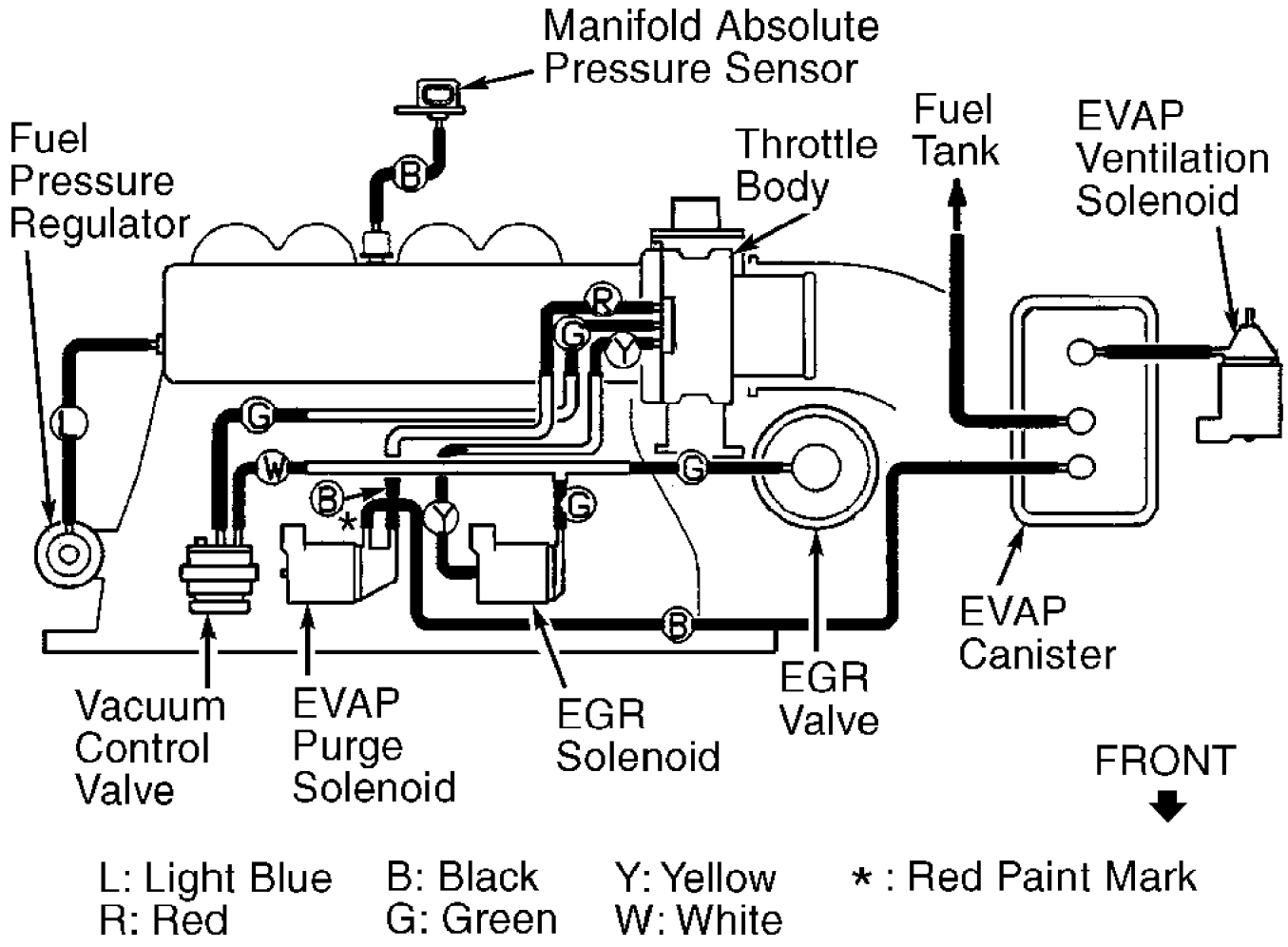


Fig. 7: Vacuum Diagram (Mirage 1.5L)
Courtesy of Mitsubishi Motor Sales of America

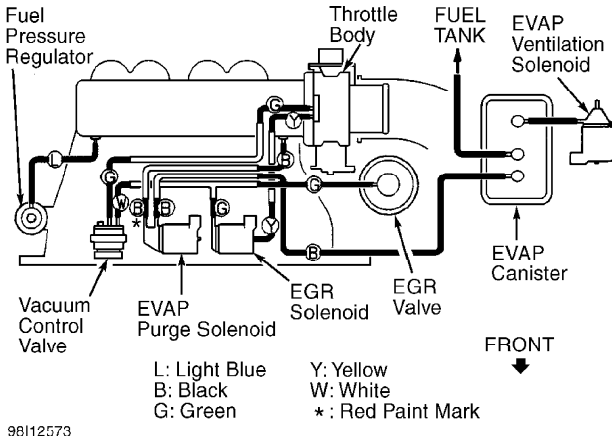


Fig. 8: Vacuum Diagram (Mirage 1.8L)
Courtesy of Mitsubishi Motor Sales of America

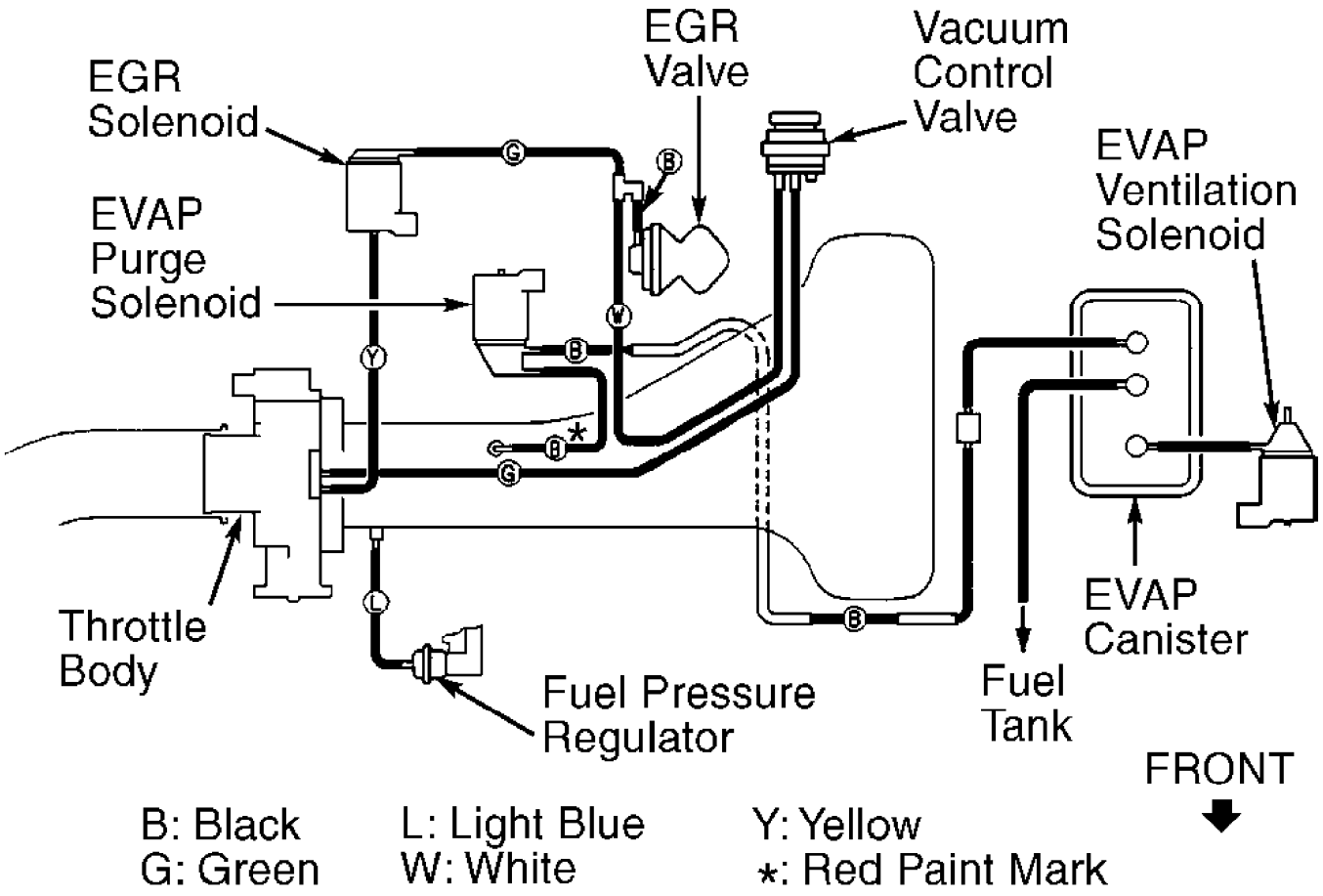


Fig. 9: Vacuum Diagram (Montero)
Courtesy of Mitsubishi Motor Sales of America

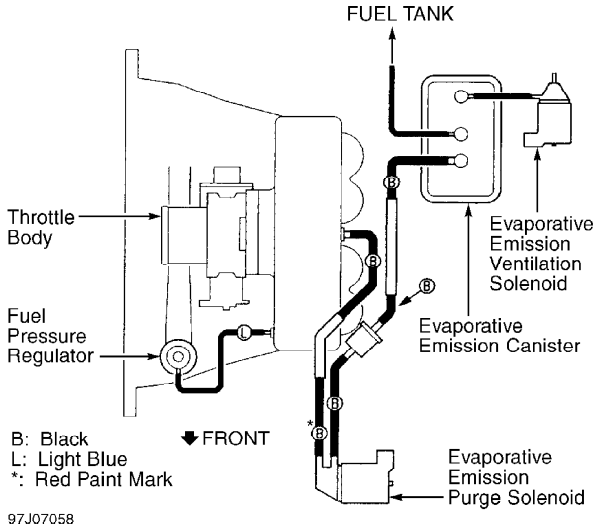


Fig. 10: Vacuum Diagram (Montero Sport 2.4L - California)
Courtesy of Mitsubishi Motor Sales of America

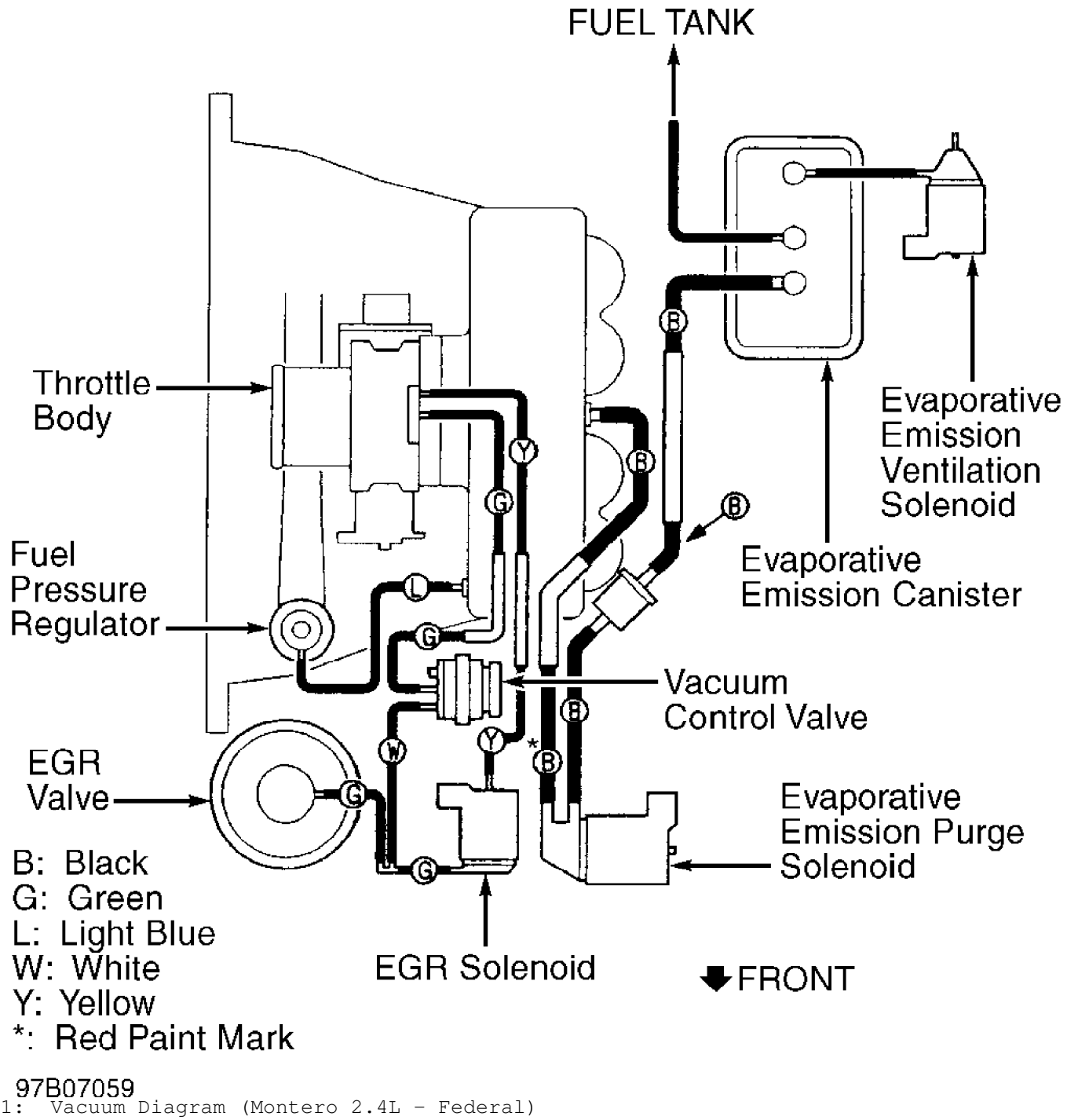


Fig. 11: Vacuum Diagram (Montero 2.4L - Federal)
Courtesy of Mitsubishi Motor Sales of America

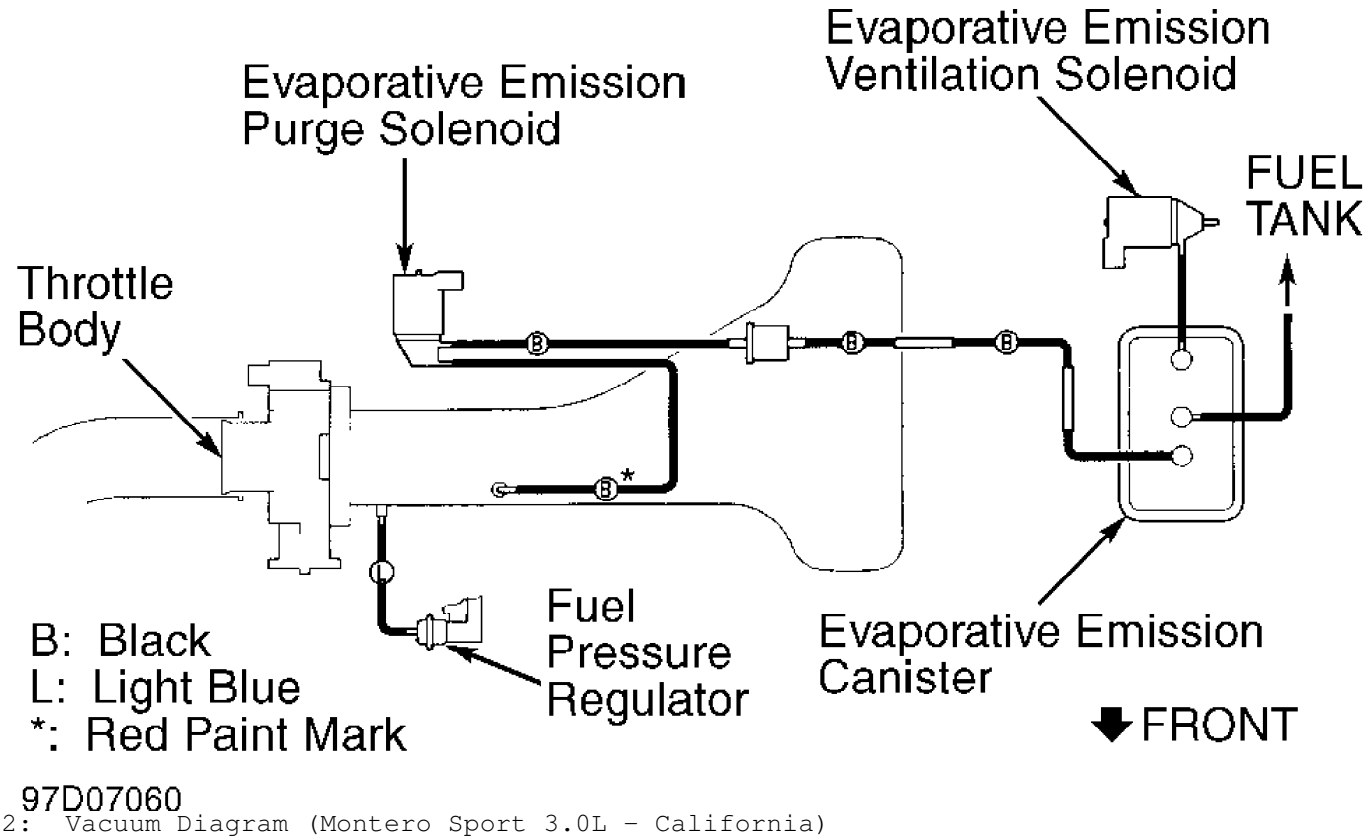


Fig. 12: Vacuum Diagram (Montero Sport 3.0L - California)
Courtesy of Mitsubishi Motor Sales of America

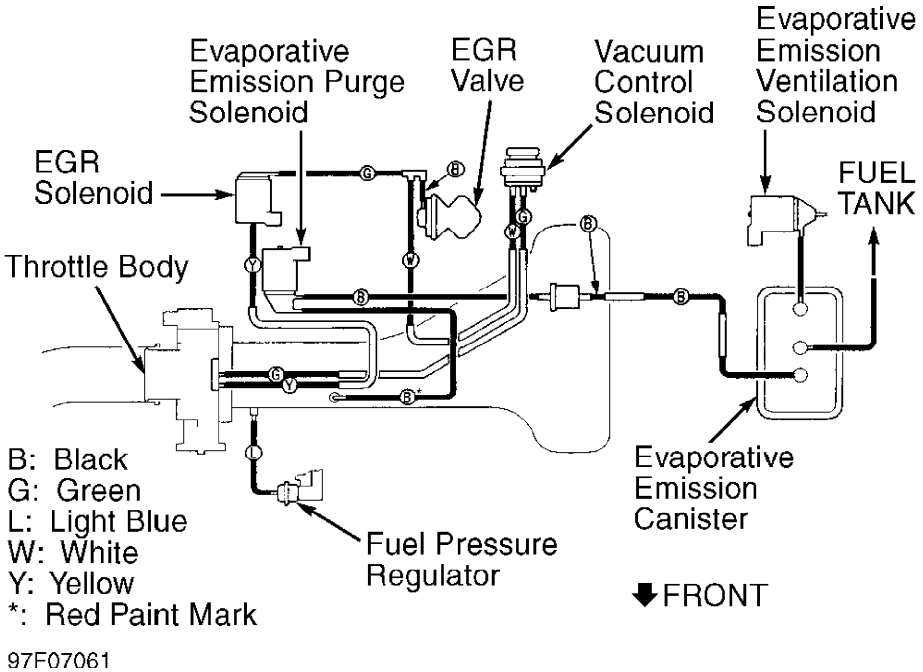


Fig. 13: Vacuum Diagram (Montero Sport 3.0L - Federal)
Courtesy of Mitsubishi Motor Sales of America

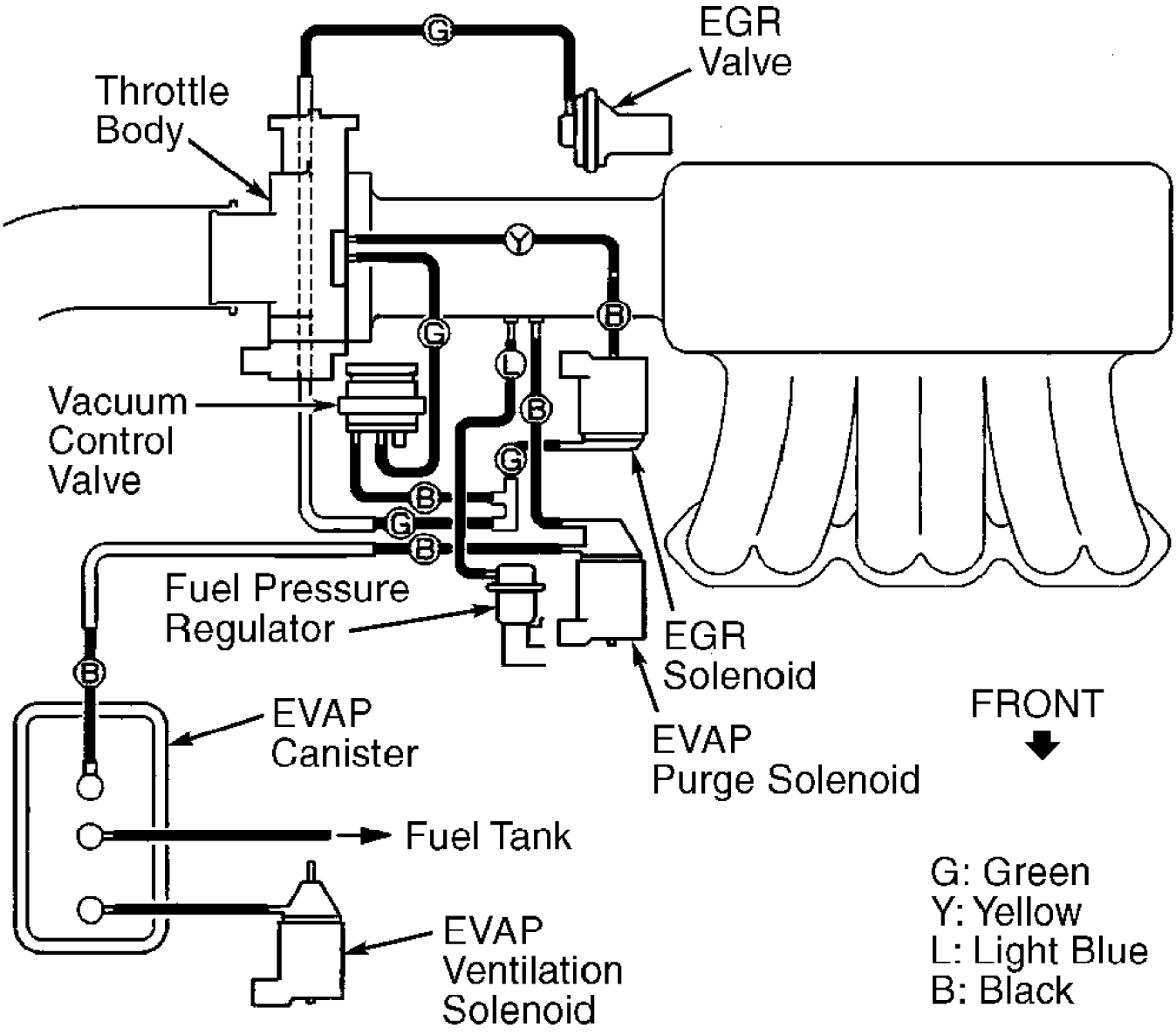


Fig. 14: Vacuum Diagram (3000GT SOHC)
Courtesy of Mitsubishi Motor Sales of America

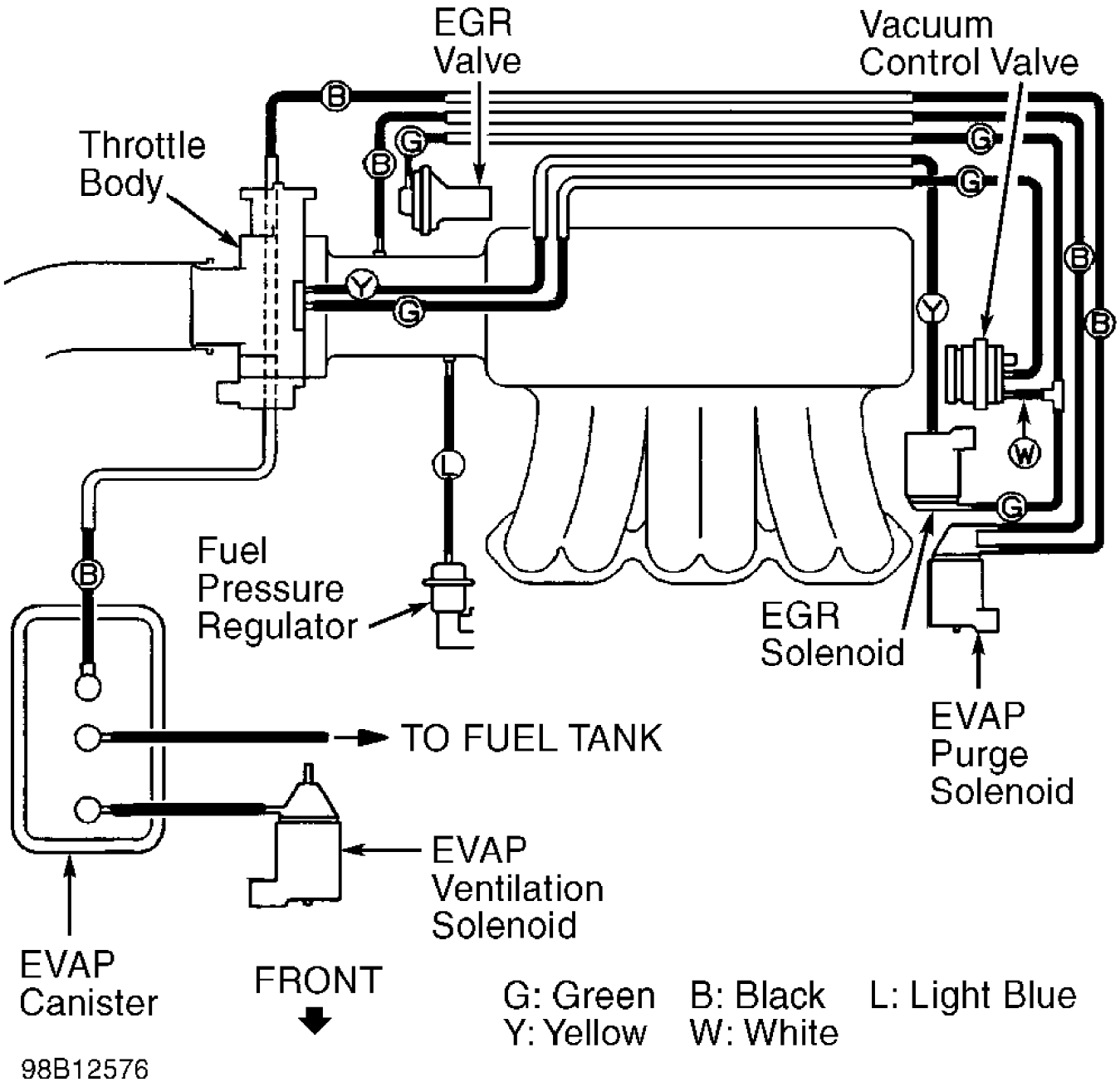


Fig. 15: Vacuum Diagram (3000GT DOHC Non-Turbo)
Courtesy of Mitsubishi Motor Sales of America

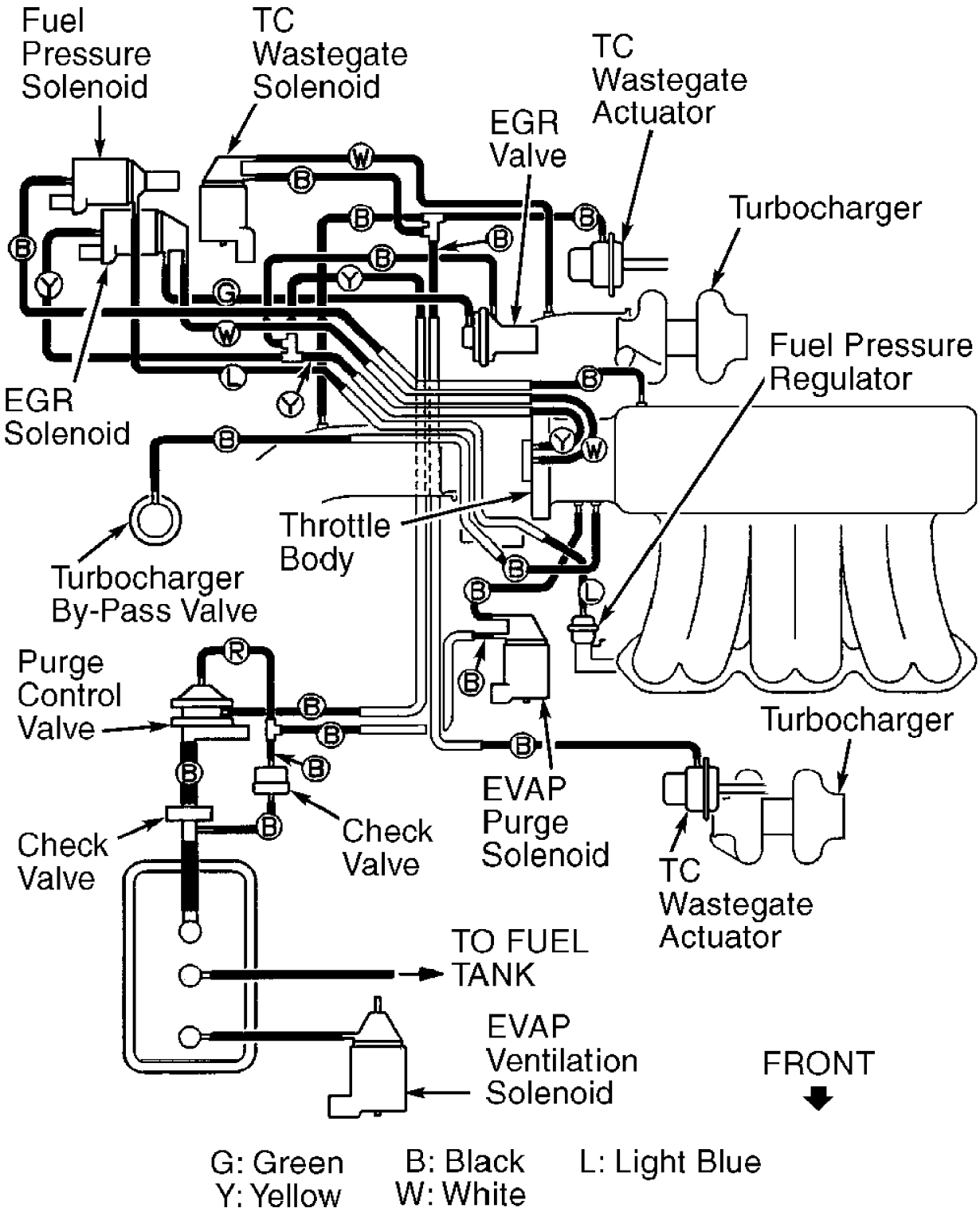


Fig. 16: Vacuum Diagram (3000GT DOHC Turbo)
Courtesy of Mitsubishi Motor Sales of America

WAVEFORMS - INJECTOR PATTERN TUTORIAL

1998 Mitsubishi Galant

GENERAL INFORMATION
Waveforms - Injector Pattern Tutorial

*** PLEASE READ THIS FIRST ***

NOTE: This article is intended for general information purposes only. This information may not apply to all makes and models.

PURPOSE OF THIS ARTICLE

Learning how to interpret injector drive patterns from a Lab Scope can be like learning ignition patterns all over again. This article exists to ease you into becoming a skilled injector pattern interpreter.

You will learn:

* How a DVOM and noid light fall short of a lab scope.
* The two types of injector driver circuits, voltage controlled & current controlled.
* The two ways injector circuits can be wired, constant ground/switched power & constant power/switched ground.
* The two different pattern types you can use to diagnose with, voltage & current.
* All the valuable details injector patterns can reveal.

SCOPE OF THIS ARTICLE

This is NOT a manufacturer specific article. All different types of systems are covered here, regardless of the specific year/make/model/engine.

The reason for such broad coverage is because there are only a few basic ways to operate a solenoid-type injector. By understanding the fundamental principles, you will understand all the major points of injector patterns you encounter. Of course there are minor differences in each specific system, but that is where a waveform library helps out.

If this is confusing, consider a secondary ignition pattern. Even though there are many different implementations, each still has a primary voltage turn-on, firing line, spark line, etc.

If specific waveforms are available in On Demand for the engine and vehicle you are working on, you will find them in the Engine Performance section under the Engine Performance category.

IS A LAB SCOPE NECESSARY?

INTRODUCTION

You probably have several tools at your disposal to diagnose injector circuits. But you might have questioned "Is a lab scope necessary to do a thorough job, or will a set of noid lights and a multifunction DVOM do just as well?"

In the following text, we are going to look at what noid lights and DVOMs do best, do not do very well, and when they can mislead you. As you might suspect, the lab scope, with its ability to look inside an active circuit, comes to the rescue by answering for the deficiencies of these other tools.

OVERVIEW OF NOID LIGHT

The noid light is an excellent "quick and dirty" tool. It can usually be hooked to a fuel injector harness fast and the flashing light is easy to understand. It is a dependable way to identify a no-pulse situation.

However, a noid light can be very deceptive in two cases:

* If the wrong one is used for the circuit being tested. Beware: Just because a connector on a noid light fits the harness does not mean it is the right one.
* If an injector driver is weak or a minor voltage drop is present.

Use the Right Noid Light

In the following text we will look at what can happen if the wrong noid light is used, why there are different types of noid lights (besides differences with connectors), how to identify the types of noid lights, and how to know the right type to use.

First, let's discuss what can happen if the incorrect type of noid light is used. You might see:

* A dimly flashing light when it should be normal.
* A normal flashing light when it should be dim.

A noid light will flash dim if used on a lower voltage circuit than it was designed for. A normally operating circuit would appear underpowered, which could be misinterpreted as the cause of a fuel starvation problem.

Here are the two circuit types that could cause this problem:

* Circuits with external injector resistors. Used predominately on some Asian & European systems, they are used to reduce the available voltage to an injector in order to limit the current flow. This lower voltage can cause a dim flash on a noid light designed for full voltage.
* Circuits with current controlled injector drivers (e.g. "Peak and Hold"). Basically, this type of driver allows a quick burst of voltage/current to flow and then throttles it back significantly for the remainder of the pulse width duration. If a noid light was designed for the other type of driver (voltage controlled, e.g. "Saturated"), it will appear dim because it is expecting full voltage/current to flow for the entire duration of the pulse width.

Let's move to the other situation where a noid light flashes normally when it should be dim. This could occur if a more sensitive noid light is used on a higher voltage/amperage circuit that was weakened enough to cause problems (but not outright broken). A circuit with an actual problem would thus appear normal.

Let's look at why. A noid light does not come close to consuming as much amperage as an injector solenoid. If there is a partial driver failure or a minor voltage drop in the injector circuit, there can be adequate amperage to fully operate the noid light BUT NOT ENOUGH TO OPERATE THE INJECTOR.

If this is not clear, picture a battery with a lot of corrosion on the terminals. Say there is enough corrosion that the starter motor will not operate; it only clicks. Now imagine turning on the headlights (with the ignition in the RUN position). You find they light normally and are fully bright. This is the same idea as noid light: There is a problem, but enough amp flow exists to operate the headlights ("noid light"), but not the starter motor ("injector").

How do you identify and avoid all these situations? By using the correct type of noid light. This requires that you understanding

the types of injector circuits that your noid lights are designed for. There are three. They are:

* Systems with a voltage controlled injector driver. Another way to say it: The noid light is designed for a circuit with a "high" resistance injector (generally 12 ohms or above).
* Systems with a current controlled injector driver. Another way to say it: The noid light is designed for a circuit with a low resistance injector (generally less than 12 ohms) without an external injector resistor.
* Systems with a voltage controlled injector driver and an external injector resistor. Another way of saying it: The noid light is designed for a circuit with a low resistance injector (generally less than 12 ohms) and an external injector resistor.

NOTE: Some noid lights can meet both the second and third categories simultaneously.

If you are not sure which type of circuit your noid light is designed for, plug it into a known good car and check out the results. If it flashes normally during cranking, determine the circuit type by finding out injector resistance and if an external injector resistor is used. You now know enough to identify the type of injector circuit. Label the noid light appropriately.

Next time you need to use a noid light for diagnosis, determine what type of injector circuit you are dealing with and select the appropriate noid light.

Of course, if you suspect a no-pulse condition you could plug in any one whose connector fit without fear of misdiagnosis. This is because it is unimportant if the flashing light is dim or bright. It is only important that it flashes.

In any cases of doubt regarding the use of a noid light, a lab scope will overcome all inherent weaknesses.

OVERVIEW OF DVOM

A DVOM is typically used to check injector resistance and available voltage at the injector. Some techs also use it check injector on-time either with a built-in feature or by using the dwell/duty function.

There are situations where the DVOM performs these checks dependably, and other situations where it can deceive you. It is important to be aware of these strengths and weaknesses. We will cover the topics above in the following text.

Checking Injector Resistance

If a short in an injector coil winding is constant, an ohmmeter will accurately identify the lower resistance. The same is true with an open winding. Unfortunately, an intermittent short is an exception. A faulty injector with an intermittent short will show "good" if the ohmmeter cannot force the short to occur during testing.

Alcohol in fuel typically causes an intermittent short, happening only when the injector coil is hot and loaded by a current high enough to jump the air gap between two bare windings or to break down any oxides that may have formed between them.

When you measure resistance with an ohmmeter, you are only applying a small current of a few milliamps. This is nowhere near enough to load the coil sufficiently to detect most problems. As a result, most resistance checks identify intermittently shorted injectors as being normal.

There are two methods to get around this limitation. The first is to purchase an tool that checks injector coil windings under

full load. The Kent-Moore J-39021 is such a tool, though there are others. The Kent-Moore costs around $240 at the time of this writing and works on many different manufacturer's systems.

The second method is to use a lab scope. Remember, a lab scope allows you to see the regular operation of a circuit in real time. If an injector is having an short or intermittent short, the lab scope will show it.

Checking Available Voltage At the Injector

Verifying a fuel injector has the proper voltage to operate correctly is good diagnostic technique. Finding an open circuit on the feed circuit like a broken wire or connector is an accurate check with a DVOM. Unfortunately, finding an intermittent or excessive resistance problem with a DVOM is unreliable.

Let's explore this drawback. Remember that a voltage drop due to excessive resistance will only occur when a circuit is operating? Since the injector circuit is only operating for a few milliseconds at a time, a DVOM will only see a potential fault for a few milliseconds. The remaining 90+% of the time the unloaded injector circuit will show normal battery voltage.

Since DVOMs update their display roughly two to five times a second, all measurements in between are averaged. Because a potential voltage drop is visible for such a small amount of time, it gets "averaged out", causing you to miss it.

Only a DVOM that has a "min-max" function that checks EVERY MILLISECOND will catch this fault consistently (if used in that mode). The Fluke 87 among others has this capability.

A "min-max" DVOM with a lower frequency of checking (100 millisecond) can miss the fault because it will probably check when the injector is not on. This is especially true with current controlled driver circuits. The Fluke 88, among others fall into this category.

Outside of using a Fluke 87 (or equivalent) in the 1 mS "min-max" mode, the only way to catch a voltage drop fault is with a lab scope. You will be able to see a voltage drop as it happens.

One final note. It is important to be aware that an injector circuit with a solenoid resistor will always show a voltage drop when the circuit is energized. This is somewhat obvious and normal; it is a designed-in voltage drop. What can be unexpected is what we already covered--a voltage drop disappears when the circuit is unloaded. The unloaded injector circuit will show normal battery voltage at the injector. Remember this and do not get confused.

Checking Injector On-Time With Built-In Function

Several DVOMs have a feature that allows them to measure injector on-time (mS pulse width). While they are accurate and fast to hookup, they have three limitations you should be aware of:

* They only work on voltage controlled injector drivers (e.g "Saturated Switch"), NOT on current controlled injector drivers (e.g. "Peak & Hold").
* A few unusual conditions can cause inaccurate readings.
* Varying engine speeds can result in inaccurate readings.

Regarding the first limitation, DVOMs need a well-defined injector pulse in order to determine when the injector turns ON and OFF. Voltage controlled drivers provide this because of their simple switch-like operation. They completely close the circuit for the entire duration of the pulse. This is easy for the DVOM to interpret.

The other type of driver, the current controlled type, start off well by completely closing the circuit (until the injector pintle opens), but then they throttle back the voltage/current for the duration of the pulse. The DVOM understands the beginning of the pulse

but it cannot figure out the throttling action. In other words, it cannot distinguish the throttling from an open circuit (de-energized) condition.

Yet current controlled injectors will still yield a millisecond on-time reading on these DVOMs. You will find it is also always the same, regardless of the operating conditions. This is because it is only measuring the initial completely-closed circuit on-time, which always takes the same amount of time (to lift the injector pintle off its seat). So even though you get a reading, it is useless.

The second limitation is that a few erratic conditions can cause inaccurate readings. This is because of a DVOM's slow display rate; roughly two to five times a second. As we covered earlier, measurements in between display updates get averaged. So conditions like skipped injector pulses or intermittent long/short injector pulses tend to get "averaged out", which will cause you to miss important details.

The last limitation is that varying engine speeds can result in inaccurate readings. This is caused by the quickly shifting injector on-time as the engine load varies, or the RPM moves from a state of acceleration to stabilization, or similar situations. It too is caused by the averaging of all measurements in between DVOM display periods. You can avoid this by checking on-time when there are no RPM or load changes.

A lab scope allows you to overcome each one of these limitations.

Checking Injector On-Time With Dwell Or Duty

If no tool is available to directly measure injector millisecond on-time measurement, some techs use a simple DVOM dwell or duty cycle functions as a replacement.

While this is an approach of last resort, it does provide benefits. We will discuss the strengths and weaknesses in a moment, but first we will look at how a duty cycle meter and dwell meter work.

How A Duty Cycle Meter and Dwell Meter Work

All readings are obtained by comparing how long something has been OFF to how long it has been ON in a fixed time period. A dwell meter and duty cycle meter actually come up with the same answers using different scales. You can convert freely between them. See RELATIONSHIP BETWEEN DWELL & DUTY CYCLE READINGS TABLE.

The DVOM display updates roughly one time a second, although some DVOMs can be a little faster or slower. All measurements during this update period are tallied inside the DVOM as ON time or OFF time, and then the total ratio is displayed as either a percentage (duty cycle) or degrees (dwell meter).

For example, let's say a DVOM had an update rate of exactly 1 second (1000 milliseconds). Let's also say that it has been measuring/tallying an injector circuit that had been ON a total of 250 mS out of the 1000 mS. That is a ratio of one-quarter, which would be displayed as 25% duty cycle or 15° dwell (six-cylinder scale). Note that most duty cycle meters can reverse the readings by selecting the positive or negative slope to trigger on. If this reading were reversed, a duty cycle meter would display 75%.

Strengths of Dwell/Duty Meter

The obvious strength of a dwell/duty meter is that you can compare injector on-time against a known-good reading. This is the only practical way to use a dwell/duty meter, but requires you to have known-good values to compare against.

Another strength is that you can roughly convert injector mS on-time into dwell reading with some computations.

A final strength is that because the meter averages everything together it does not miss anything (though this is also a

severe weakness that we will look at later). If an injector has a fault where it occasionally skips a pulse, the meter registers it and the reading changes accordingly.

Let's go back to figuring out dwell/duty readings by using injector on-time specification. This is not generally practical, but we will cover it for completeness. You NEED to know three things:

* Injector mS on-time specification.
* Engine RPM when specification is valid.
* How many times the injectors fire per crankshaft revolution.

The first two are self-explanatory. The last one may require some research into whether it is a bank-fire type that injects every 360° of crankshaft rotation, a bank-fire that injects every 720°, or an SFI that injects every 720°. Many manufacturers do not release this data so you may have to figure it out yourself with a frequency meter.

Here are the four complete steps to convert millisecond on-time:

1) Determine the injector pulse width and RPM it was obtained at. Let's say the specification is for one millisecond of on-time at a hot idle of 600 RPM.

2) Determine injector firing method for the complete 4 stroke cycle. Let's say this is a 360° bank-fired, meaning an injector fires each and every crankshaft revolution.

3) Determine how many times the injector will fire at the specified engine speed (600 RPM) in a fixed time period. We will use 100 milliseconds because it is easy to use.

Six hundred crankshaft Revolutions Per Minute (RPM) divided by 60 seconds equals 10 revolutions per second.

Multiplying 10 times .100 yields one; the crankshaft turns one time in 100 milliseconds. With exactly one crankshaft rotation in 100 milliseconds, we know that the injector fires exactly one time.

4) Determine the ratio of injector on-time vs. off-time in the fixed time period, then figure duty cycle and/or dwell. The injector fires one time for a total of one millisecond in any given 100 millisecond period.

One hundred minus one equals 99. We have a 99% duty cycle. If we wanted to know the dwell (on 6 cylinder scale), multiple 99% times .6; this equals 59.4° dwell.

Weaknesses of Dwell/Duty Meter

The weaknesses are significant. First, there is no one-to-one correspondence to actual mS on-time. No manufacturer releases dwell/duty data, and it is time-consuming to convert the mS on-time readings. Besides, there can be a large degree of error because the conversion forces you to assume that the injector(s) are always firing at the same rate for the same period of time. This can be a dangerous assumption.

Second, all level of detail is lost in the averaging process. This is the primary weakness. You cannot see the details you need to make a confident diagnosis.

Here is one example. Imagine a vehicle that has a faulty injector driver that occasionally skips an injector pulse. Every skipped pulse means that that cylinder does not fire, thus unburned O2 gets pushed into the exhaust and passes the O2 sensor. The O2 sensor indicates lean, so the computer fattens up the mixture to compensate for the supposed "lean" condition.

A connected dwell/duty meter would see the fattened pulse width but would also see the skipped pulses. It would tally both and likely come back with a reading that indicated the "pulse width" was within specification because the rich mixture and missing pulses offset each other.

This situation is not a far-fetched scenario. Some early GM

3800 engines were suffering from exactly this. The point is that a lack of detail could cause misdiagnosis.

As you might have guessed, a lab scope would not miss this.

RELATIONSHIP BETWEEN DWELL & DUTY CYCLE READINGS TABLE (1)

Dwell Meter (2)	Duty Cycle Meter
1°	1%
15°	25%
30°	50%
45°	75%
60°	100%

(1) - These are just some examples for your understanding. It is okay to fill in the gaps.
(2) - Dwell meter on the six-cylinder scale.

THE TWO TYPES OF INJECTOR DRIVERS

OVERVIEW

There are two types of transistor driver circuits used to operate electric fuel injectors: voltage controlled and current controlled. The voltage controlled type is sometimes called a "saturated switch" driver, while the current controlled type is sometimes known as a "peak and hold" driver.

The basic difference between the two is the total resistance of the injector circuit. Roughly speaking, if a particular leg in an injector circuit has total resistance of 12 or more ohms, a voltage control driver is used. If less than 12 ohms, a current control driver is used.

It is a question of what is going to do the job of limiting the current flow in the injector circuit; the inherent "high" resistance in the injector circuit, or the transistor driver. Without some form of control, the current flow through the injector would cause the solenoid coil to overheat and result in a damaged injector.

VOLTAGE CONTROLLED CIRCUIT ("SATURATED SWITCH")

The voltage controlled driver inside the computer operates much like a simple switch because it does not need to worry about limiting current flow. Recall, this driver typically requires injector circuits with a total leg resistance of 12 or more ohms.

The driver is either ON, closing/completing the circuit (eliminating the voltage-drop), or OFF, opening the circuit (causing a total voltage drop).

Some manufacturers call it a "saturated switch" driver. This is because when switched ON, the driver allows the magnetic field in the injector to build to saturation. This is the same "saturation" property that you are familiar with for an ignition coil.

There are two ways "high" resistance can be built into an injector circuit to limit current flow. One method uses an external solenoid resistor and a low resistance injector, while the other uses a high resistance injector without the solenoid resistor. See the left side of Fig. 1.

In terms of injection opening time, the external resistor voltage controlled circuit is somewhat faster than the voltage controlled high resistance injector circuit. The trend, however, seems to be moving toward use of this latter type of circuit due to its lower cost and reliability. The ECU can compensate for slower opening

times by increasing injector pulse width accordingly.

NOTE: Never apply battery voltage directly across a low resistance injector. This will cause injector damage from solenoid coil overheating.

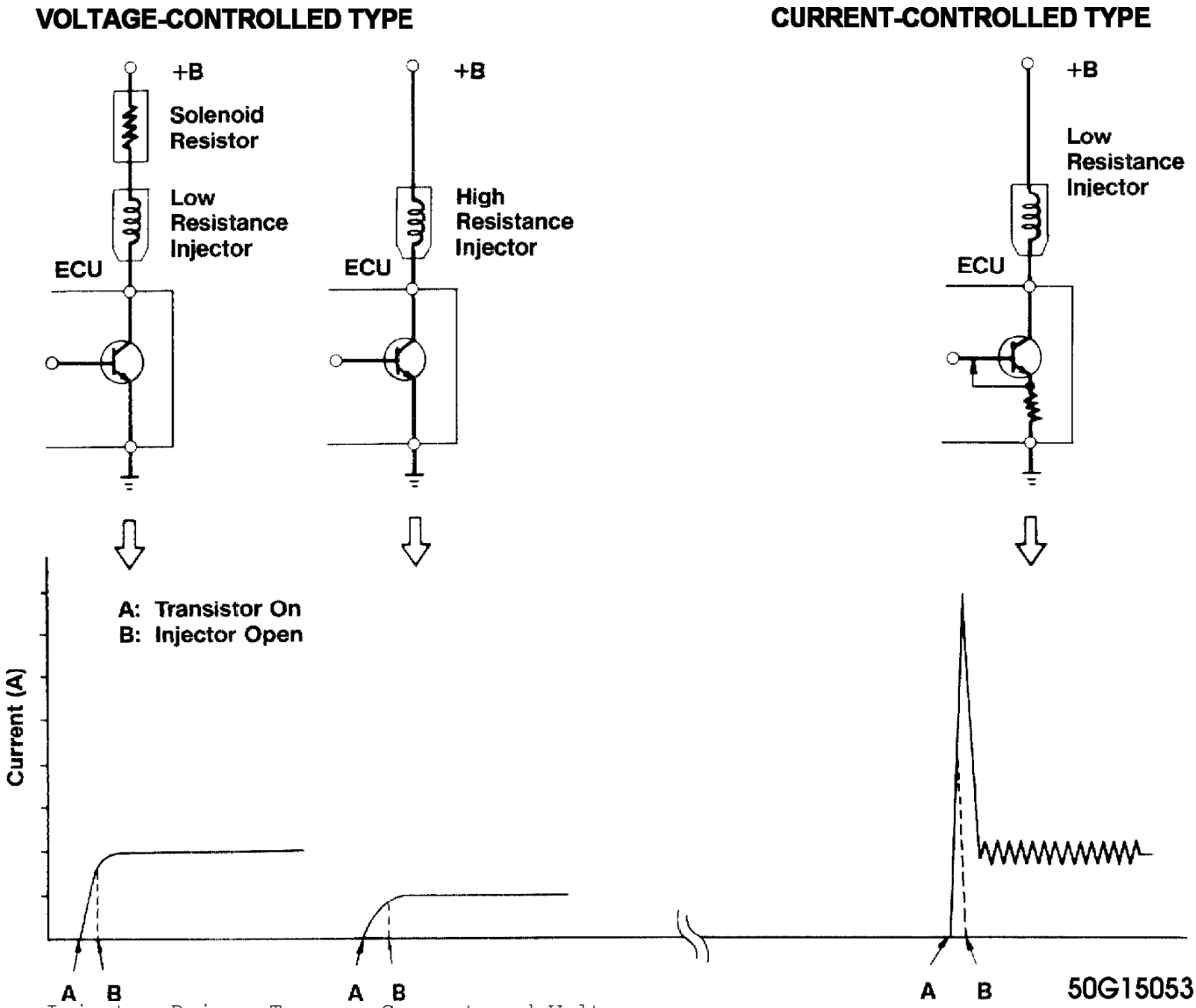


Fig. 1: Injector Driver Types - Current and Voltage

CURRENT CONTROLLED CIRCUIT ("PEAK & HOLD")

The current controlled driver inside the computer is more complex than a voltage controlled driver because as the name implies, it has to limit current flow in addition to its ON-OFF switching function. Recall, this driver typically requires injector circuits with a total leg resistance of less than 12 ohms.

Once the driver is turned ON, it will not limit current flow until enough time has passed for the injector pintle to open. This period is preset by the particular manufacturer/system based on the amount of current flow needed to open their injector. This is typically between two and six amps. Some manufacturers refer to this

as the "peak" time, referring to the fact that current flow is allowed to "peak" (to open the injector).

Once the injector pintle is open, the amp flow is considerably reduced for the rest of the pulse duration to protect the injector from overheating. This is okay because very little amperage is needed to hold the injector open, typically in the area of one amp or less. Some manufacturers refer to this as the "hold" time, meaning that just enough current is allowed through the circuit to "hold" the already-open injector open.

There are a couple methods of reducing the current. The most common trims back the available voltage for the circuit, similar to turning down a light at home with a dimmer.

The other method involves repeatedly cycling the circuit ON-OFF. It does this so fast that the magnetic field never collapses and the pintle stays open, but the current is still significantly reduced. See the right side of Fig. 1 for an illustration.

The advantage to the current controlled driver circuit is the short time period from when the driver transistor goes ON to when the injector actually opens. This is a function of the speed with which current flow reaches its peak due to the low circuit resistance. Also, the injector closes faster when the driver turns OFF because of the lower holding current.

NOTE: Never apply battery voltage directly across a low resistance injector. This will cause injector damage from solenoid coil overheating.

THE TWO WAYS INJECTOR CIRCUITS ARE WIRED

Like other circuits, injector circuits can be wired in one of two fundamental directions. The first method is to steadily power the injectors and have the computer driver switch the ground side of the circuit. Conversely, the injectors can be steadily grounded while the driver switches the power side of the circuit.

There is no performance benefit to either method. Voltage controlled and current controlled drivers have been successfully implemented both ways.

However, 95% percent of the systems are wired so the driver controls the ground side of the circuit. Only a handful of systems use the drivers on the power side of the circuit. Some examples of the latter are the 1970’s Cadillac EFI system, early Jeep 4.0 EFI (Renix system), and Chrysler 1984-87 TBI.

INTERPRETING INJECTOR WAVEFORMS

INTERPRETING A VOLTAGE CONTROLLED PATTERN

NOTE: Voltage controlled drivers are also known as "Saturated Switch" drivers. They typically require injector circuits with a total leg resistance of 12 ohms or more.

NOTE: This example is based on a constant power/switched ground circuit.

* See Fig. 2 for pattern that the following text describes.

Point "A" is where system voltage is supplied to the injector. A good hot run voltage is usually 13.5 or more volts. This point, commonly known as open circuit voltage, is critical because the injector will not get sufficient current saturation if there is a voltage shortfall. To obtain a good look at this precise point, you

will need to shift your Lab Scope to five volts per division.

You will find that some systems have slight voltage fluctuations here. This can occur if the injector feed wire is also used to power up other cycling components, like the ignition coil(s). Slight voltage fluctuations are normal and are no reason for concern. Major voltage fluctuations are a different story, however. Major voltage shifts on the injector feed line will create injector performance problems. Look for excessive resistance problems in the feed circuit if you see big shifts and repair as necessary.

Note that circuits with external injector resistors will not be any different because the resistor does not affect open circuit voltage.

Point "B" is where the driver completes the circuit to ground. This point of the waveform should be a clean square point straight down with no rounded edges. It is during this period that current saturation of the injector windings is taking place and the driver is heavily stressed. Weak drivers will distort this vertical line.

Point "C" represents the voltage drop across the injector windings. Point "C" should come very close to the ground reference point, but not quite touch. This is because the driver has a small amount of inherent resistance. Any significant offset from ground is an indication of a resistance problem on the ground circuit that needs repaired. You might miss this fault if you do not use the negative battery post for your Lab Scope hook-up, so it is HIGHLY recommended that you use the battery as your hook-up.

The points between "B" and "D" represent the time in milliseconds that the injector is being energized or held open. This line at Point "C" should remain flat. Any distortion or upward bend indicates a ground problem, short problem, or a weak driver. Alert readers will catch that this is exactly opposite of the current controlled type drivers (explained in the next section), because they bend upwards at this point.

How come the difference? Because of the total circuit resistance. Voltage controlled driver circuits have a high resistance of 12+ ohms that slows the building of the magnetic field in the injector. Hence, no counter voltage is built up and the line remains flat.

On the other hand, the current controlled driver circuit has low resistance which allows for a rapid magnetic field build-up. This causes a slight inductive rise (created by the effects of counter voltage) and hence, the upward bend. You should not see that here with voltage controlled circuits.

Point "D" represents the electrical condition of the injector windings. The height of this voltage spike (inductive kick) is proportional to the number of windings and the current flow through them. The more current flow and greater number of windings, the more potential for a greater inductive kick. The opposite is also true. The less current flow or fewer windings means less inductive kick. Typically you should see a minimum 35 volts at the top of Point "D".

If you do see approximately 35 volts, it is because a zener diode is used with the driver to clamp the voltage. Make sure the beginning top of the spike is squared off, indicating the zener dumped the remainder of the spike. If it is not squared, that indicates the spike is not strong enough to make the zener fully dump, meaning the injector has a weak winding.

If a zener diode is not used in the computer, the spike from a good injector will be 60 or more volts.

Point "E" brings us to a very interesting section. As you can see, the voltage dissipates back to supply value after the peak of the inductive kick. Notice the slight hump? This is actually the mechanical injector pintle closing. Recall that moving an iron core through a magnetic field will create a voltage surge. The pintle is

the iron core here.

This pintle hump at Point "E" should occur near the end of the downward slope, and not afterwards. If it does occur after the slope has ended and the voltage has stabilized, it is because the pintle is slightly sticking because of a faulty injector

If you see more than one hump it is because of a distorted pintle or seat. This faulty condition is known as "pintle float".

It is important to realize that it takes a good digital storage oscilloscope or analog lab scope to see this pintle hump clearly. Unfortunately, it cannot always be seen.

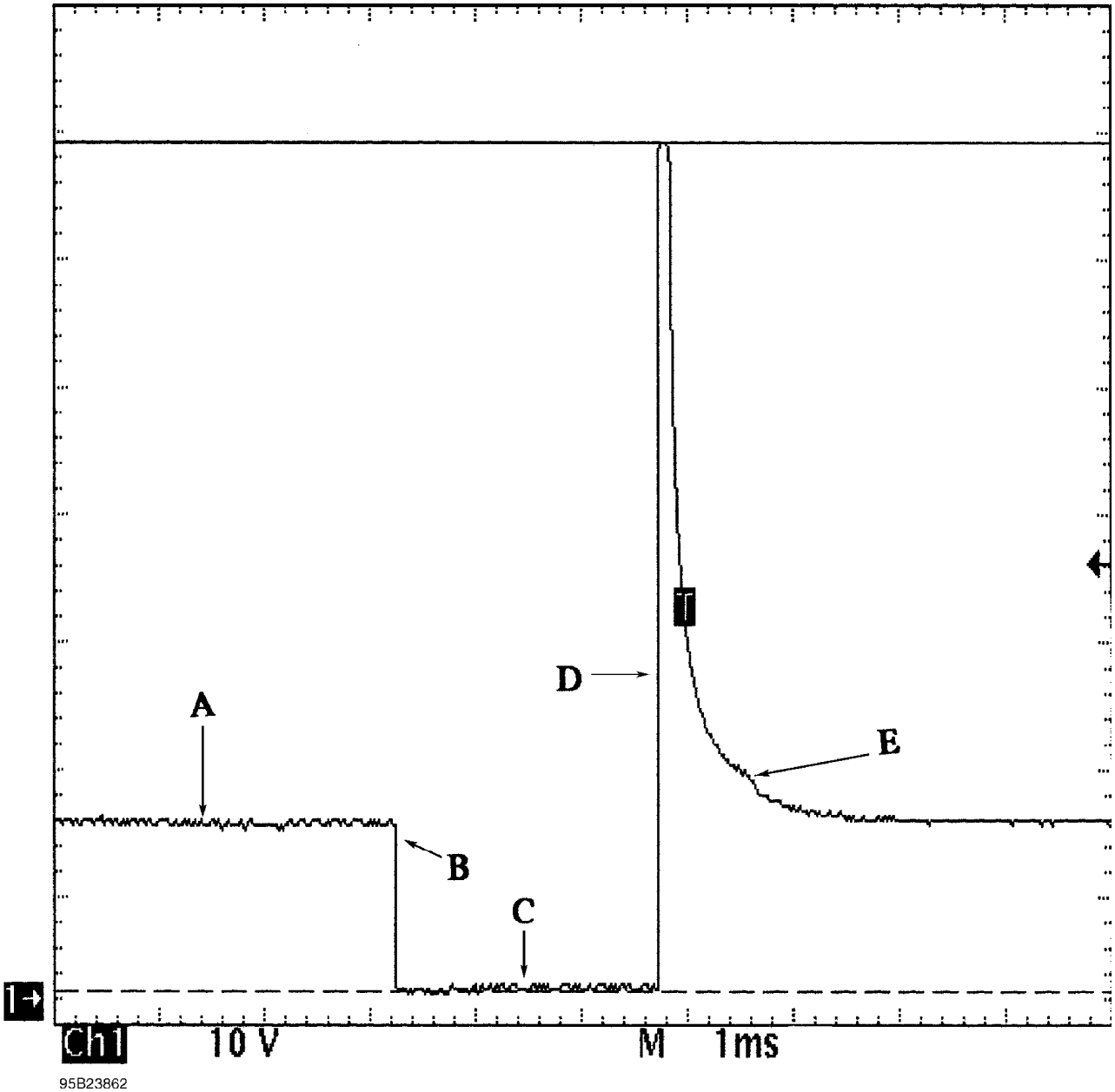


Fig. 2: Identifying Voltage Controlled Type Injector Pattern

INTERPRETING A CURRENT CONTROLLED PATTERN

NOTE: Current controlled drivers are also known as "Peak and Hold"

drivers. They typically require injector circuits with a total leg resistance with less than 12 ohm.

NOTE: This example is based on a constant power/switched ground circuit.

* See Fig. 3 for pattern that the following text describes.

Point "A" is where system voltage is supplied to the injector. A good hot run voltage is usually 13.5 or more volts. This point, commonly known as open circuit voltage, is critical because the injector will not get sufficient current saturation if there is a voltage shortfall. To obtain a good look at this precise point, you will need to shift your Lab Scope to five volts per division.

You will find that some systems have slight voltage fluctuations here. This could occur if the injector feed wire is also used to power up other cycling components, like the ignition coil(s). Slight voltage fluctuations are normal and are no reason for concern. Major voltage fluctuations are a different story, however. Major voltage shifts on the injector feed line will create injector performance problems. Look for excessive resistance problems in the feed circuit if you see big shifts and repair as necessary.

Point "B" is where the driver completes the circuit to ground. This point of the waveform should be a clean square point straight down with no rounded edges. It is during this period that current saturation of the injector windings is taking place and the driver is heavily stressed. Weak drivers will distort this vertical line.

Point "C" represents the voltage drop across the injector windings. Point "C" should come very close to the ground reference point, but not quite touch. This is because the driver has a small amount of inherent resistance. Any significant offset from ground is an indication of a resistance problem on the ground circuit that needs repaired. You might miss this fault if you do not use the negative battery post for your Lab Scope hook-up, so it is HIGHLY recommended that you use the battery as your hook-up.

Right after Point "C", something interesting happens. Notice the trace starts a normal upward bend. This slight inductive rise is created by the effects of counter voltage and is normal. This is because the low circuit resistance allowed a fast build-up of the magnetic field, which in turn created the counter voltage.

Point "D" is the start of the current limiting, also known as the "Hold" time. Before this point, the driver had allowed the current to free-flow ("Peak") just to get the injector pintle open. By the time point "D" occurs, the injector pintle has already opened and the computer has just significantly throttled the current back. It does this by only allowing a few volts through to maintain the minimum current required to keep the pintle open.

The height of the voltage spike seen at the top of Point "D" represents the electrical condition of the injector windings. The height of this voltage spike (inductive kick) is proportional to the number of windings and the current flow through them. The more current flow and greater number of windings, the more potential for a greater inductive kick. The opposite is also true. The less current flow or fewer windings means less inductive kick. Typically you should see a minimum 35 volts.

If you see approximately 35 volts, it is because a zener diode is used with the driver to clamp the voltage. Make sure the beginning top of the spike is squared off, indicating the zener dumped the remainder of the spike. If it is not squared, that indicates the spike is not strong enough to make the zener fully dump, meaning there is a problem with a weak injector winding.

If a zener diode is not used in the computer, the spike from

a good injector will be 60 or more volts.

At Point "E", notice that the trace is now just a few volts below system voltage and the injector is in the current limiting, or the "Hold" part of the pattern. This line will either remain flat and stable as shown here, or will cycle up and down rapidly. Both are normal methods to limit current flow. Any distortion may indicate shorted windings.

Point "F" is the actual turn-off point of the driver (and injector). To measure the millisecond on-time of the injector, measure between points "C" and "F". Note that we used cursors to do it for us; they are measuring a 2.56 mS on-time.

The top of Point "F" (second inductive kick) is created by the collapsing magnetic field caused by the final turn-off of the driver. This spike should be like the spike on top of point "D".

Point "G" shows a slight hump. This is actually the mechanical injector pintle closing. Recall that moving an iron core through a magnetic field will create a voltage surge. The pintle is the iron core here.

This pintle hump at Point "E" should occur near the end of the downward slope, and not afterwards. If it does occur after the slope has ended and the voltage has stabilized, it is because the pintle is slightly sticking. Some older Nissan TBI systems suffered from this.

If you see more than one hump it is because of a distorted pintle or seat. This faulty condition is known as "pintle float".

It is important to realize that it takes a good digital storage oscilloscope or analog lab scope to see this pintle hump clearly. Unfortunately, it cannot always be seen.

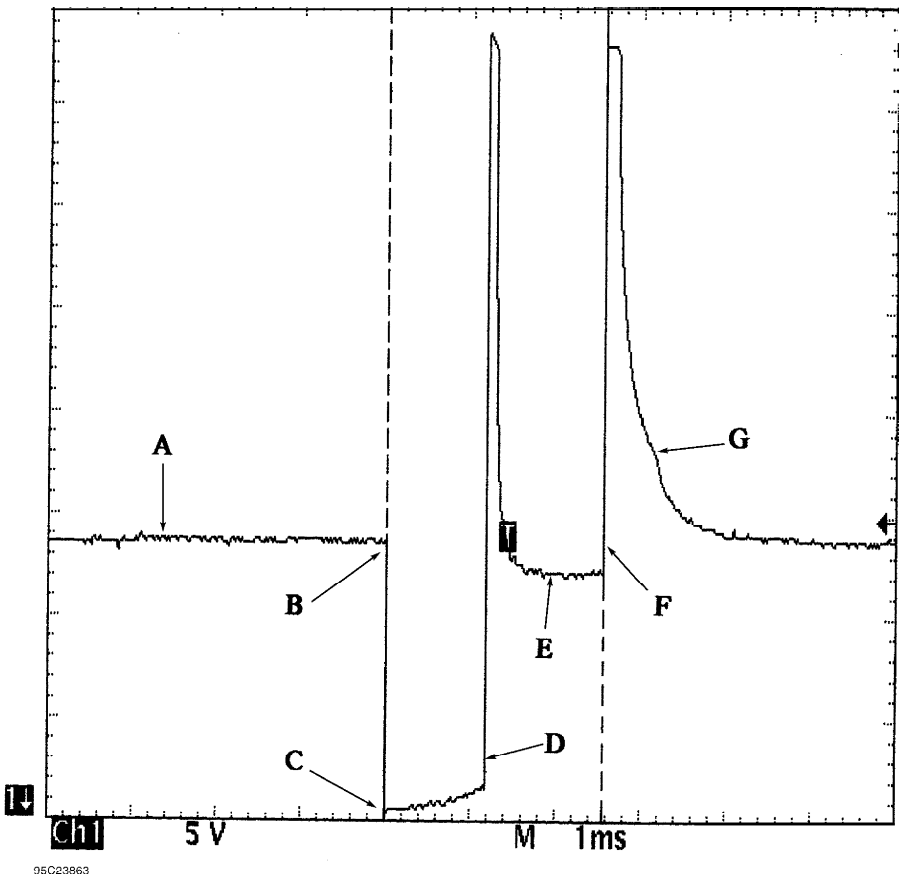


Fig. 3: Identifying Current Controlled Type Injector Pattern

CURRENT WAVEFORM SAMPLES

EXAMPLE #1 - VOLTAGE CONTROLLED DRIVER

The waveform pattern shown in Fig. 4 indicate a normal current waveform from a Ford 3.0L V6 VIN [U] engine. This voltage controlled type circuit pulses the injectors in groups of three injectors. Injectors No. 1, 3, and 5 are pulsed together and cylinders 2, 4, and 6 are pulsed together. The specification for an acceptable bank resistance is 4.4 ohms. Using Ohm's Law and assuming a hot run voltage of 14 volts, we determine that the bank would draw a current of 3.2 amps.

However this is not the case because as the injector windings become saturated, counter voltage is created which impedes the current flow. This, coupled with the inherent resistance of the driver's transistor, impedes the current flow even more. So, what is a known good value for a dynamic current draw on a voltage controlled bank of injectors? The waveform pattern shown below indicates a good parallel injector current flow of 2 amps. See Fig. 4.

Note that if just one injector has a resistance problem and partially shorts, the entire parallel bank that it belongs to will draw more current. This can damage the injector driver.

The waveform pattern in Fig. 5 indicates this type of problem with too much current flow. This is on other bank of injectors of the same vehicle; the even side. Notice the Lab Scope is set on a one amp per division scale. As you can see, the current is at an unacceptable 2.5 amps.

It is easy to find out which individual injector is at fault. All you need to do is inductively clamp onto each individual injector and compare them. To obtain a known-good value to compare against, we used the good bank to capture the waveform in Fig. 6. Notice that it limits current flow to 750 milliamps.

The waveform shown in Fig. 7 illustrates the problem injector we found. This waveform indicates an unacceptable current draw of just over one amp as compared to the 750 milliamp draw of the known-good injector. A subsequent check with a DVOM found 8.2 ohms, which is under the 12 ohm specification.

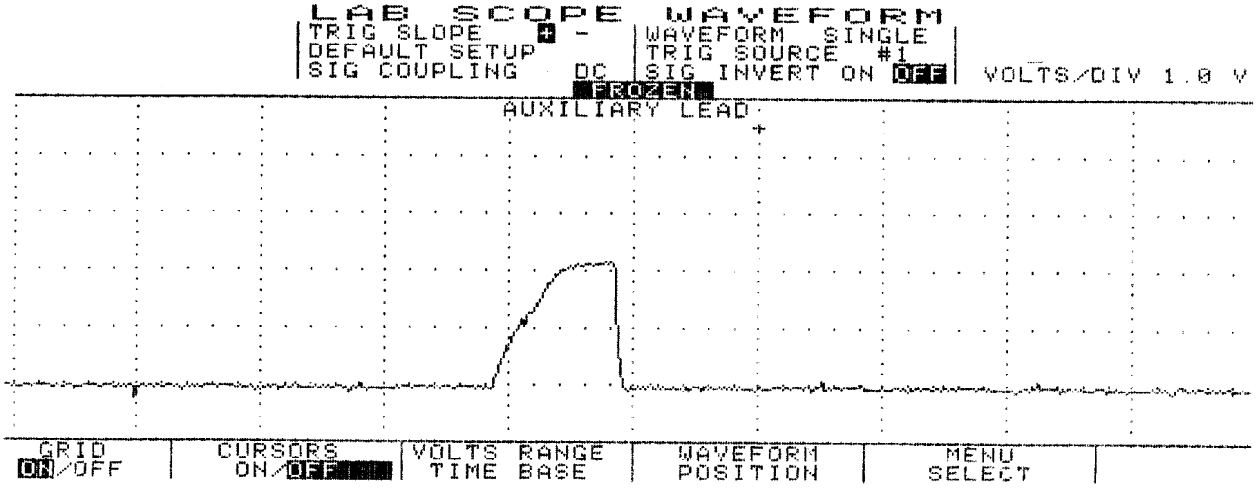


Fig. 4: Injector Bank w/Normal Current Flow - Current Pattern

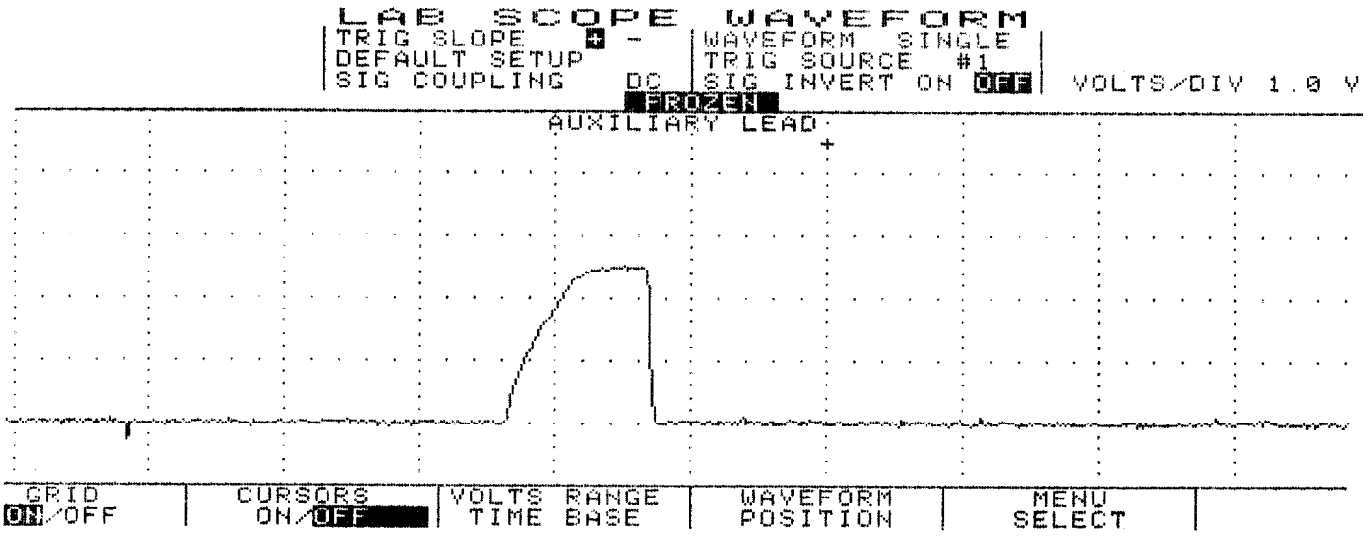


Fig. 5: Injector Bank w/Excessive Current Flow - Current Pattern

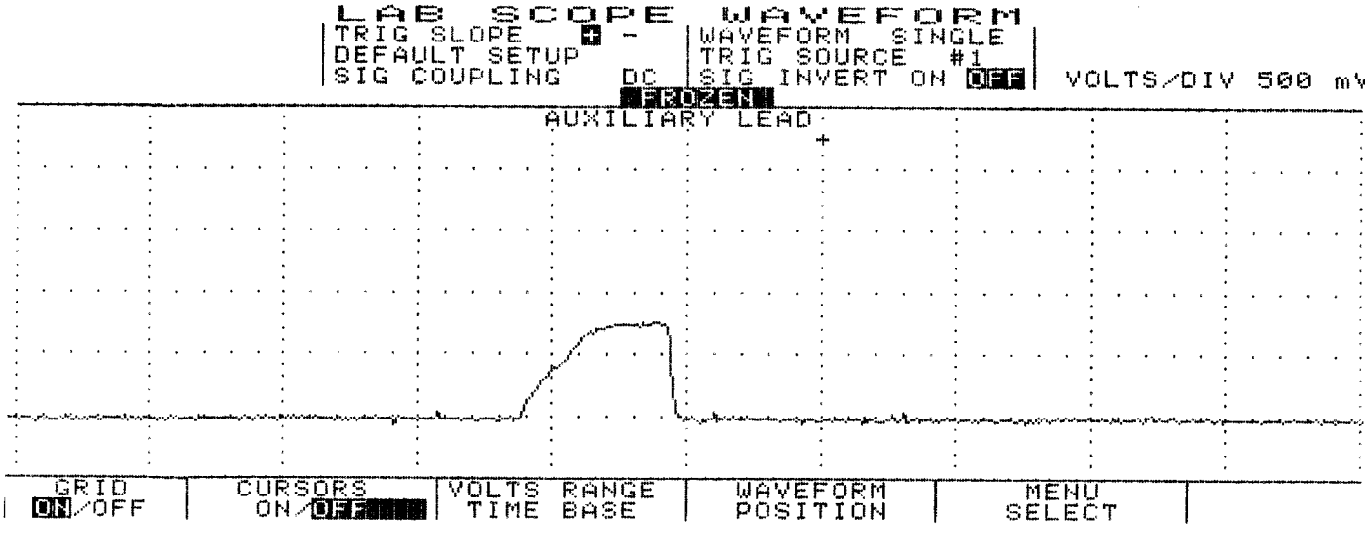


Fig. 6: Single Injector w/Normal Current Flow - Current Pattern

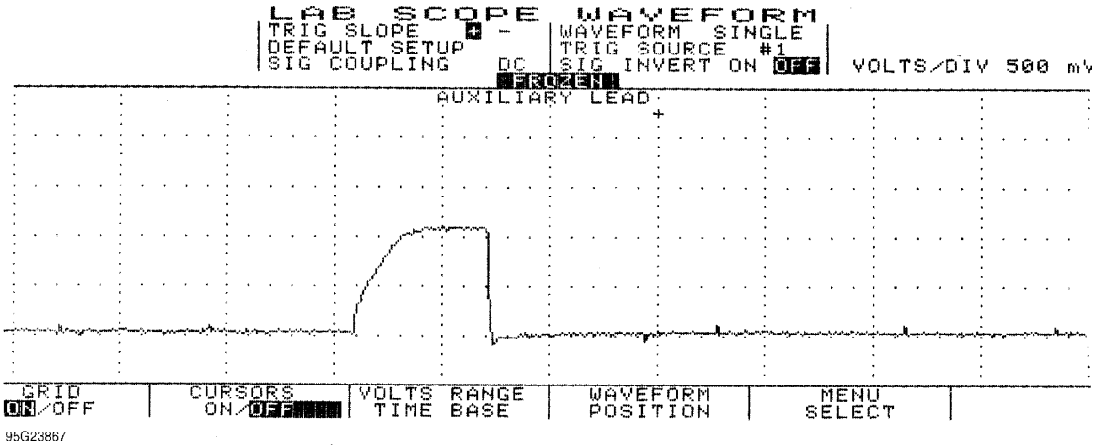


Fig. 7: Single Injector w/Excessive Current Flow - Current Pattern

EXAMPLE #2 - VOLTAGE CONTROLLED DRIVER

This time we will look at a GM 3.1L V6 VIN [T]. Fig. 8 shows the 1, 3, 5 (odd) injector bank with the current waveform indicating about a 2.6 amp draw at idle. This pattern, taken from a known good vehicle, correctly stays at or below the maximum 2.6 amps current range. Ideally, the current for each bank should be very close in comparison.

Notice the small dimple on the current flow's rising edge. This is the actual injector opening or what engineers refer to as the "set point." For good idle quality, the set point should be uniform between the banks.

When discussing Ohm's Law as it pertains to this parallel circuit, consider that each injector has specified resistance of 12.2 ohms. Since all three injectors are in parallel the total resistance of this parallel circuit drops to 4.1 ohms. Fourteen volts divided by four ohms would pull a maximum of 3.4 amps on this bank of injectors. However, as we discussed in EXAMPLE #1 above, other factors knock this value down to roughly the 2.6 amp neighborhood.

Now we are going to take a look at the even bank of injectors; injectors 2, 4, and 6. See Fig. 9. Notice this bank peaked at 1.7 amps at idle as compared to the 2.6 amps peak of the odd bank (Fig. 8). Current flow between even and odd injectors banks is not uniform, yet it is not causing a driveability problem. That is because it is still under the maximum amperage we figured out earlier. But be aware this vehicle could develop a problem if the amperage flow increases any more.

Checking the resistance of this even injector group with a DVOM yielded 6.2 ohms, while the odd injector group in the previous example read 4.1 ohms.

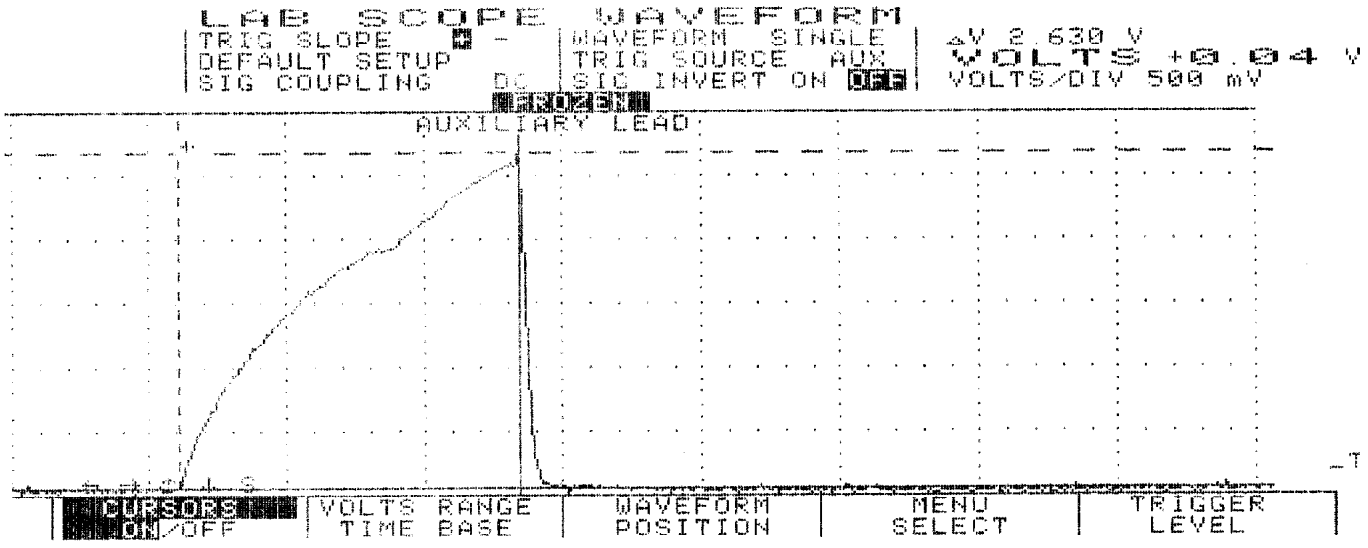


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Fig. 8: Injector Odd Bank w/Normal Current Flow - Current Pattern

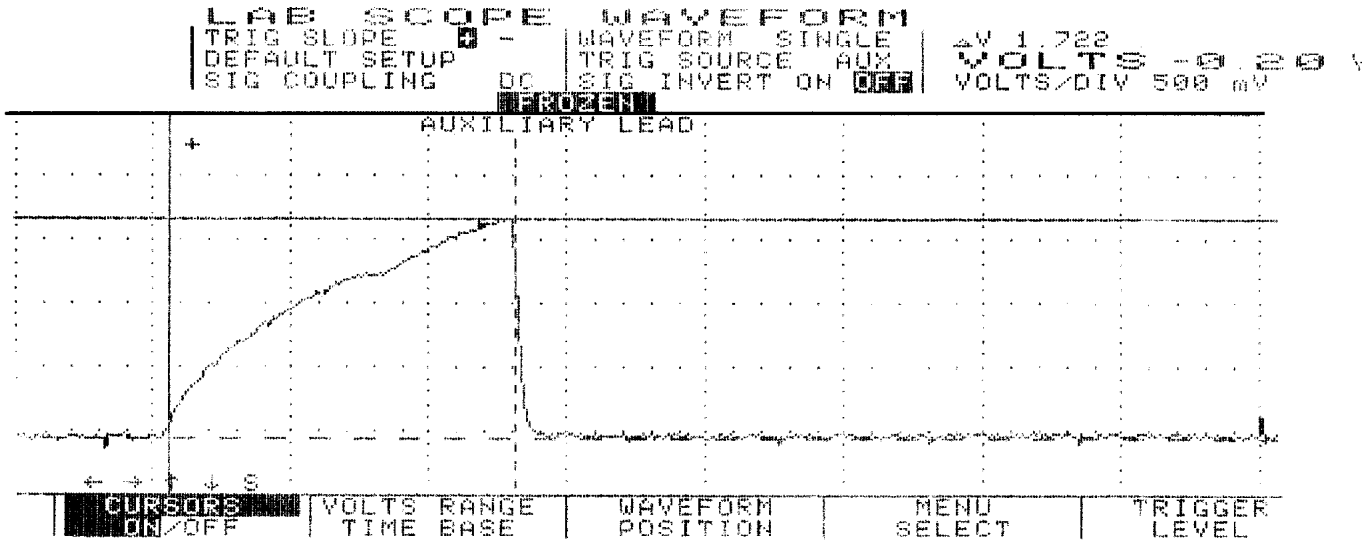

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Fig. 9: Injector Even Bank w/Normal Current Flow - Current Pattern

EXAMPLE #3 - VOLTAGE CONTROLLED DRIVER

Example #3 is of a Ford 5.0L V8 SEFI. Fig. 10 shows a waveform of an individual injector at idle with the Lab Scope set on 200 milliamps per division. Notice the dimple in the rising edge. This dimple indicates the actual opening of the injector (set point) occurred at 400 milliamps and current peaked at 750 milliamps. This is a good specification for this engine.

The next waveform pattern in Fig. 11 shows an abnormality with another injector. With the Lab Scope set on 500 milliamps per division, you can see that the current waveform indicates a 1200 milliamp draw. This is a faulty injector.

Abnormally low resistance injectors create excessive current draw, causing rough idle, and possible computer driver damage.

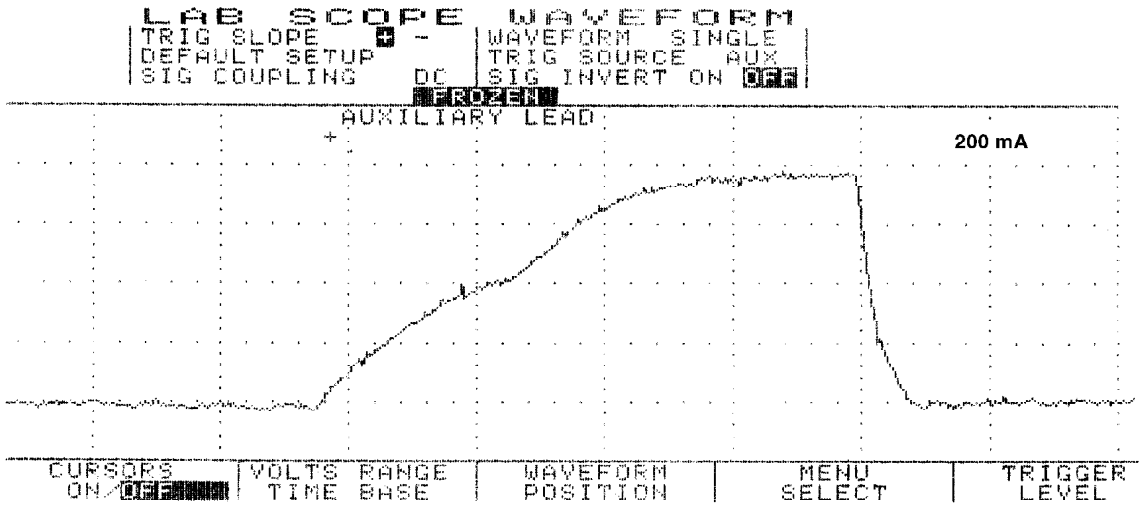

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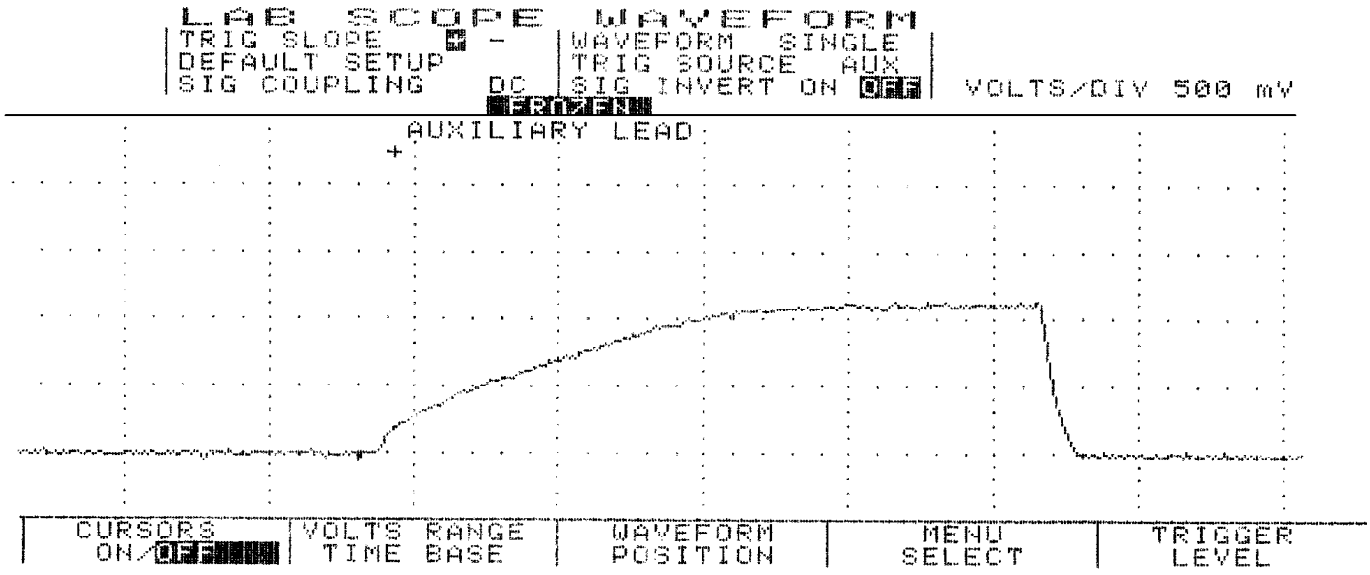
Fig. 10: Single Injector w/Normal Current Flow - Current Pattern



95H23876

Fig. 11: Single Injector w/Excessive Current Flow - Current Pattern

EXAMPLE #4 - CURRENT CONTROLLED DRIVER

Example #4 is of a Ford 4.6L SEFI VIN [W]. See Fig. 12 for the known-good waveform pattern. This Ford system is different from the one above in EXAMPLE #3 as it peaks at 900 milliamps and the actual opening of the injector (set point) is just below 600 milliamps.

This is offered as a comparison against the Ford pattern listed above, as they are both Ford SEFI injectors but with different operating ranges. The point is that you should not make any broad assumptions for any manufacturer.

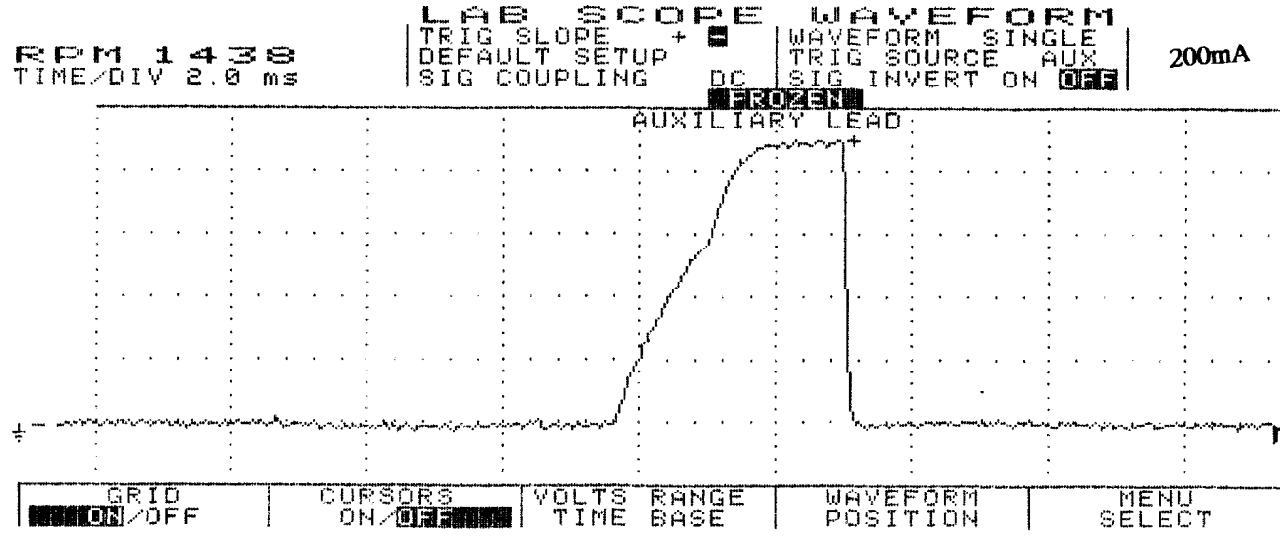


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Fig. 12: Single Injector w/Normal Current Flow - Current Pattern

EXAMPLE #5 - CURRENT CONTROLLED DRIVER

The known-good waveform in Fig. 13 is from a Chrysler 3.0L V6

PFI VIN [3]. It is a perfect example of the peak and hold theory. The waveform shows a 1-amp per division current flow, ramping to 4 amps and then decreasing to 1-amp to hold the injector open.

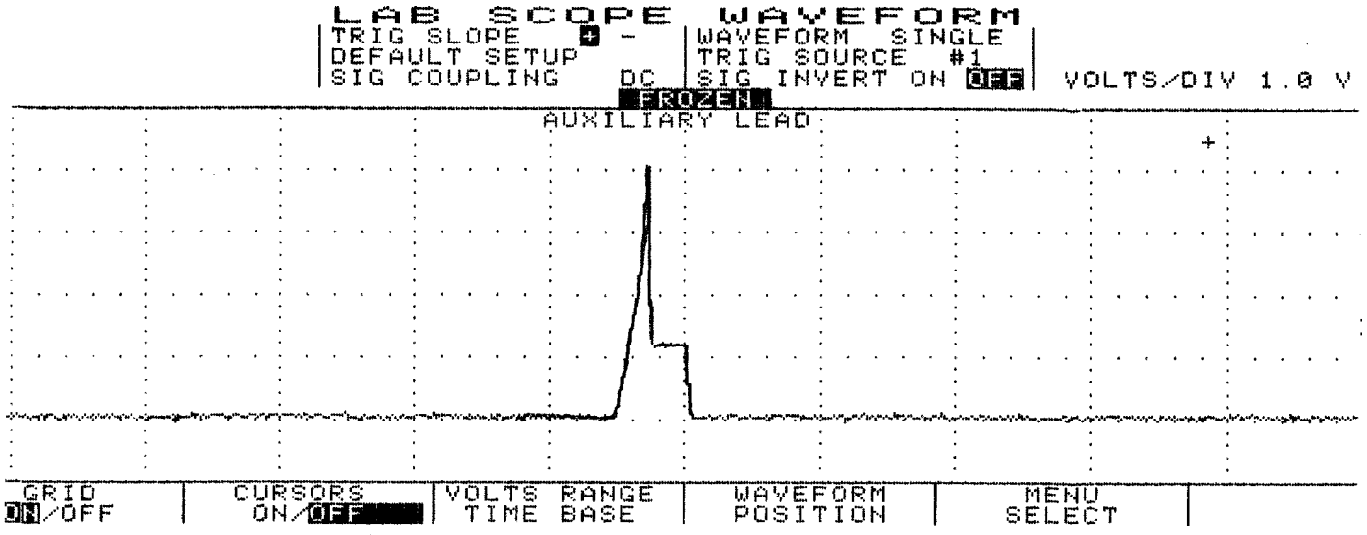

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Fig. 13: Injector Bank w/Normal Current Flow - Current Pattern

EXAMPLE #6 - CURRENT CONTROLLED DRIVER

This next known-good waveform is from a Ford 5.0L V8 CFI VIN [F]. See Fig. 14. The pattern, which is set on a 250 milliamps scale, indicates a 1.25 amp peak draw and a hold at 350 milliamps.

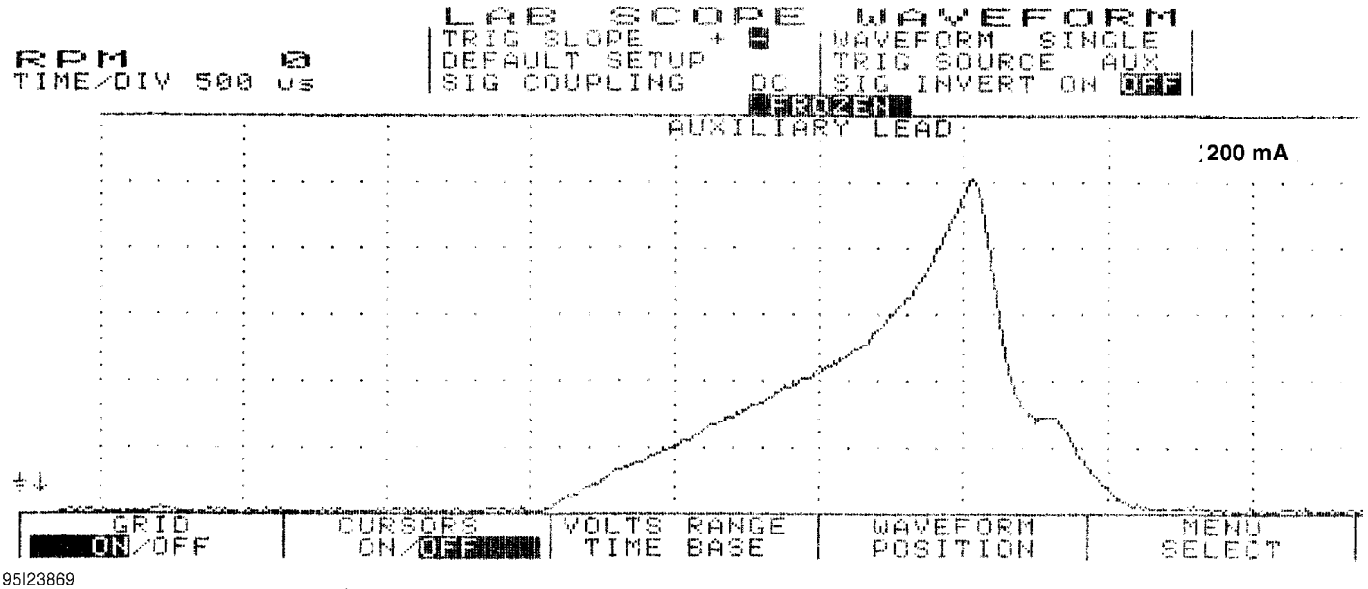

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Fig. 14: Single Injector w/Normal Current Flow - Current Pattern

EXAMPLE #7 - CURRENT CONTROLLED DRIVER

The known-good current controlled type waveform in Fig. 15 is from a GM 2.0L TBI VIN [1]. With the lab scope set at 2 amps per division, notice that this system peaks at 4 amps and holds at 1 amp.

The next waveform is from the same type of engine, except

that it shows a faulty injector. See Fig. 16. Notice that the current went to almost 5 amps and stayed at 1 amp during the hold pattern. Excessive amounts of current flow from bad injectors are a common source of intermittent computer shutdown. Using a current waveform pattern is the most accurate method of pinpointing this problem.

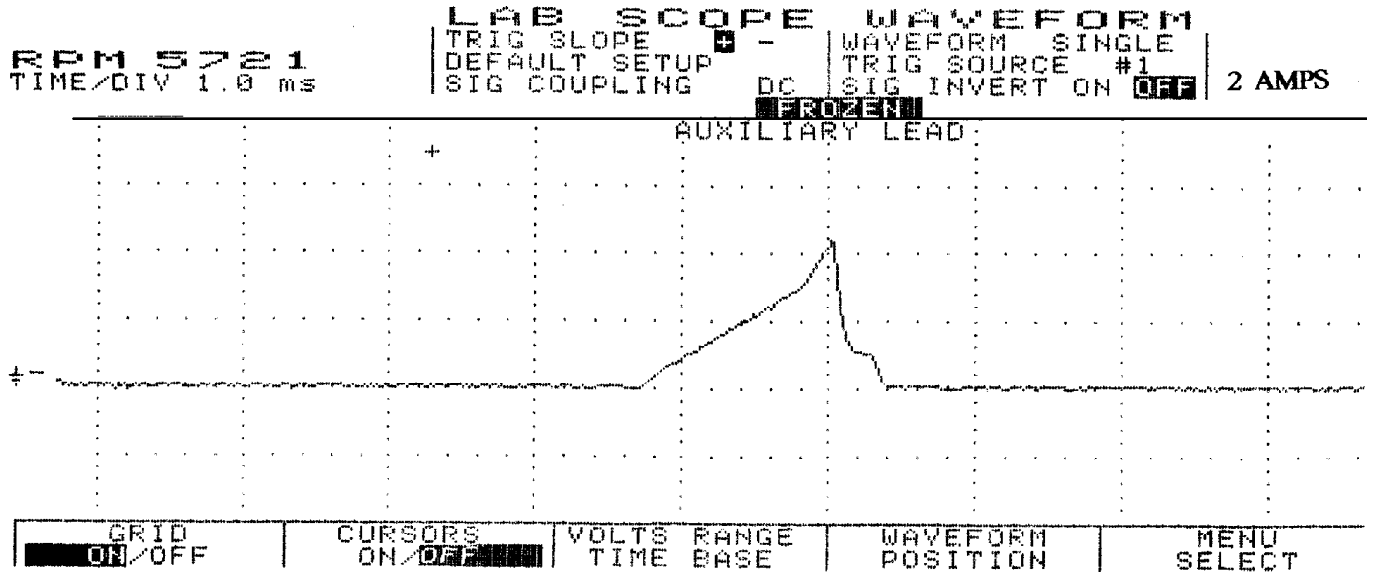


Fig. 15: Single Injector w/Normal Current Flow - Current Pattern

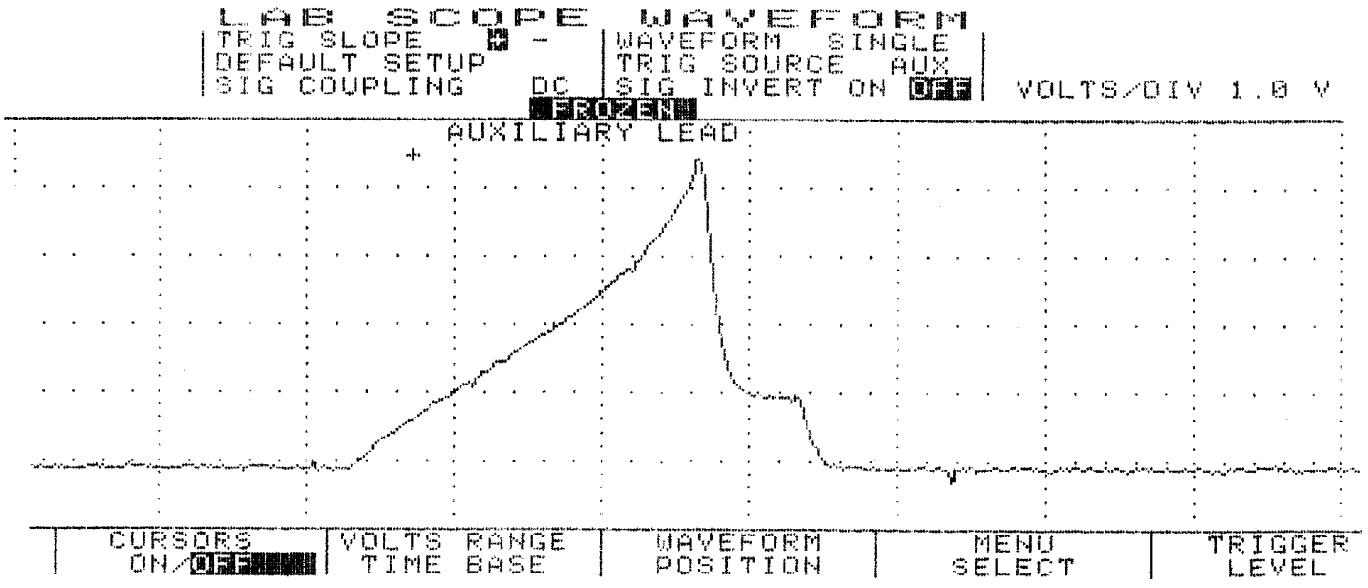
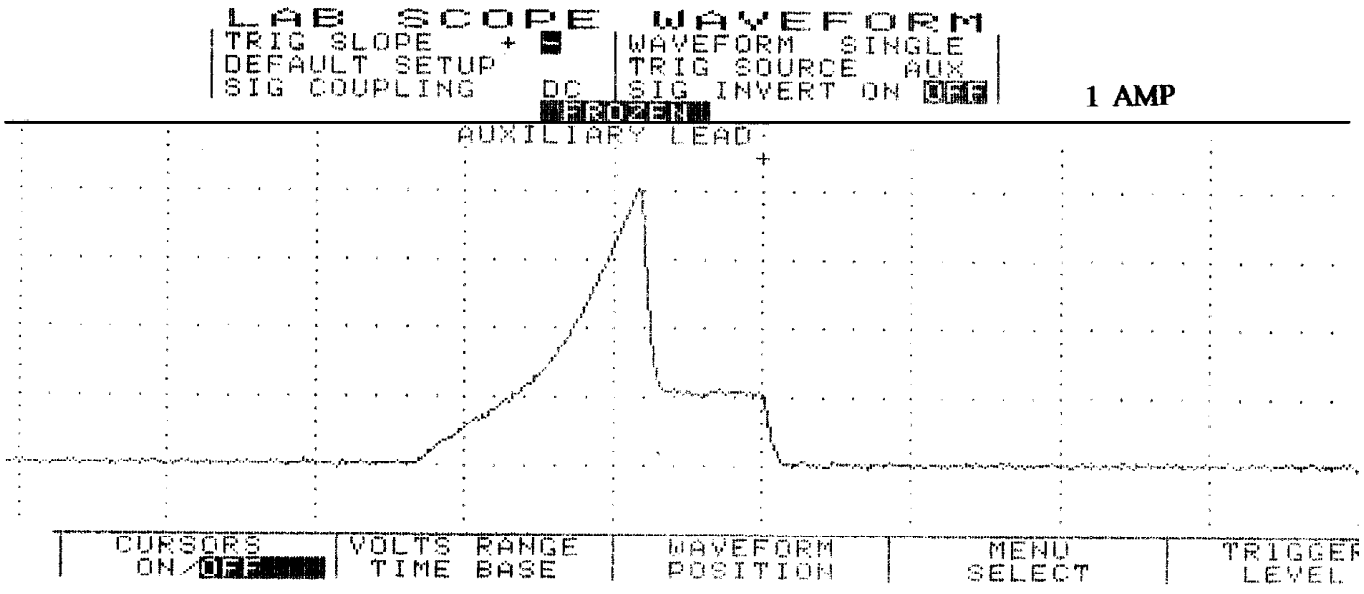


Fig. 16: Single Injector w/Excessive Current Flow - Current Pattern

EXAMPLE #8 - CURRENT CONTROLLED DRIVER

This known-good CPI system waveform from a GM 4.3L V6 CPI VIN [W] peaks at 4 amps and holds at 1-amp. See Fig. 17 for waveform.



95B23870

Fig. 17: Single Injector w/Normal Current Flow - Current Pattern

VOLTAGE WAVEFORM SAMPLES

EXAMPLE #1 - VOLTAGE CONTROLLED DRIVER

These two known-good waveform patterns are from a Ford 4.6L V8 VIN [W]. Fig. 18 illustrates the 64 volt inductive kick on this engine, indicating no clamping is occurring. The second pattern, Fig. 19, was taken during hot idle, closed loop, and no load.

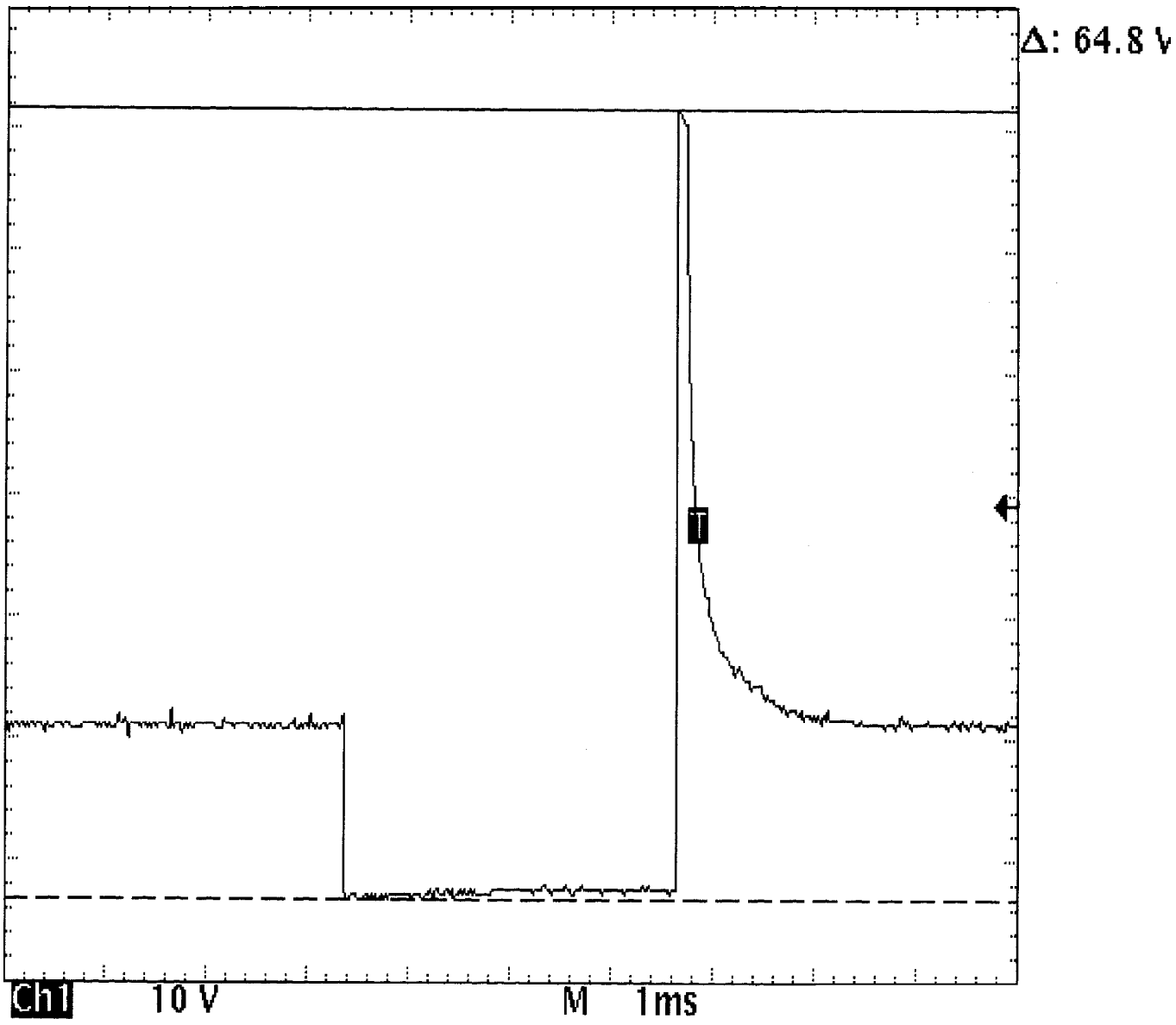


Fig. 18: Injector Bank - Known Good - Voltage Pattern

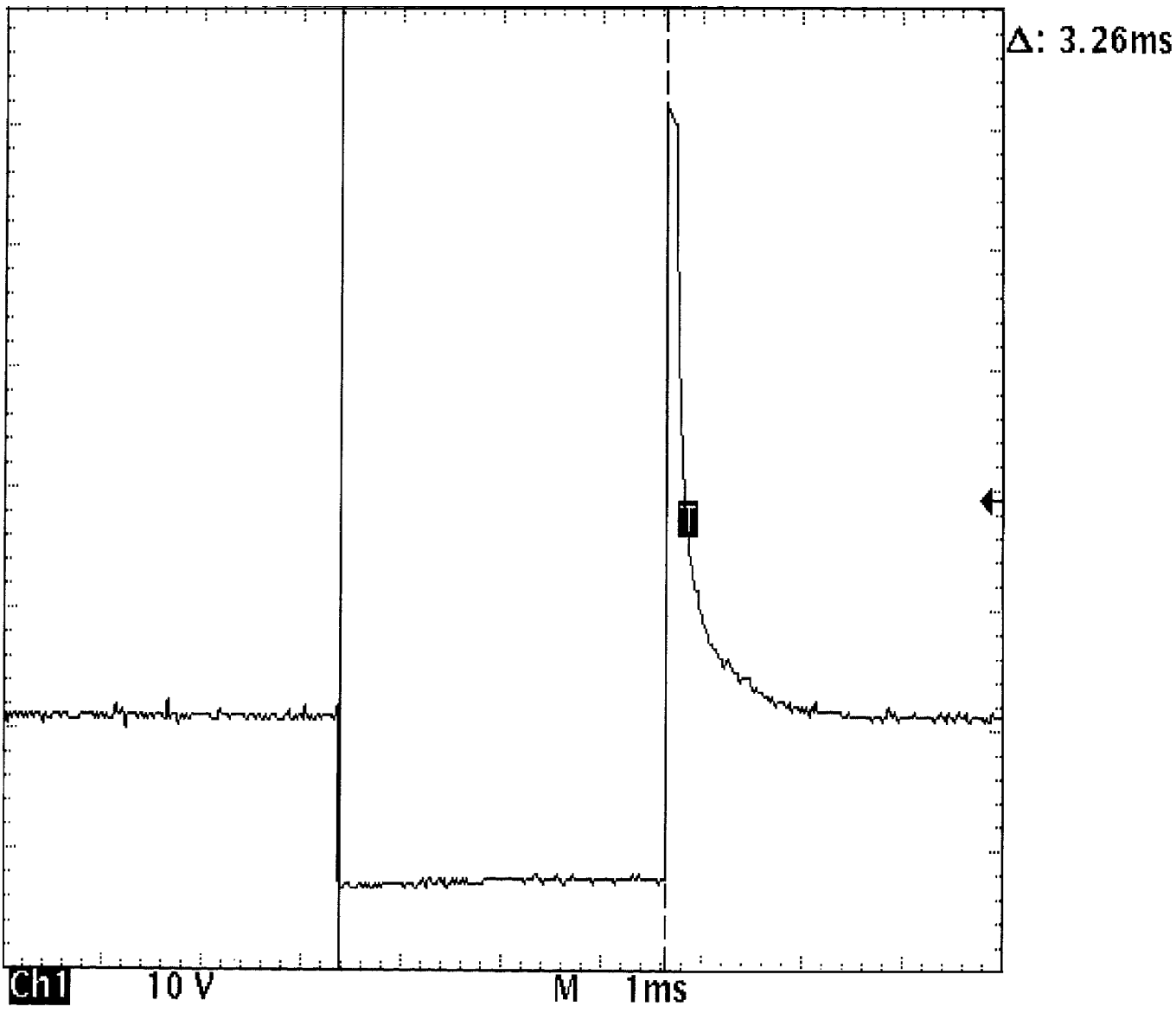
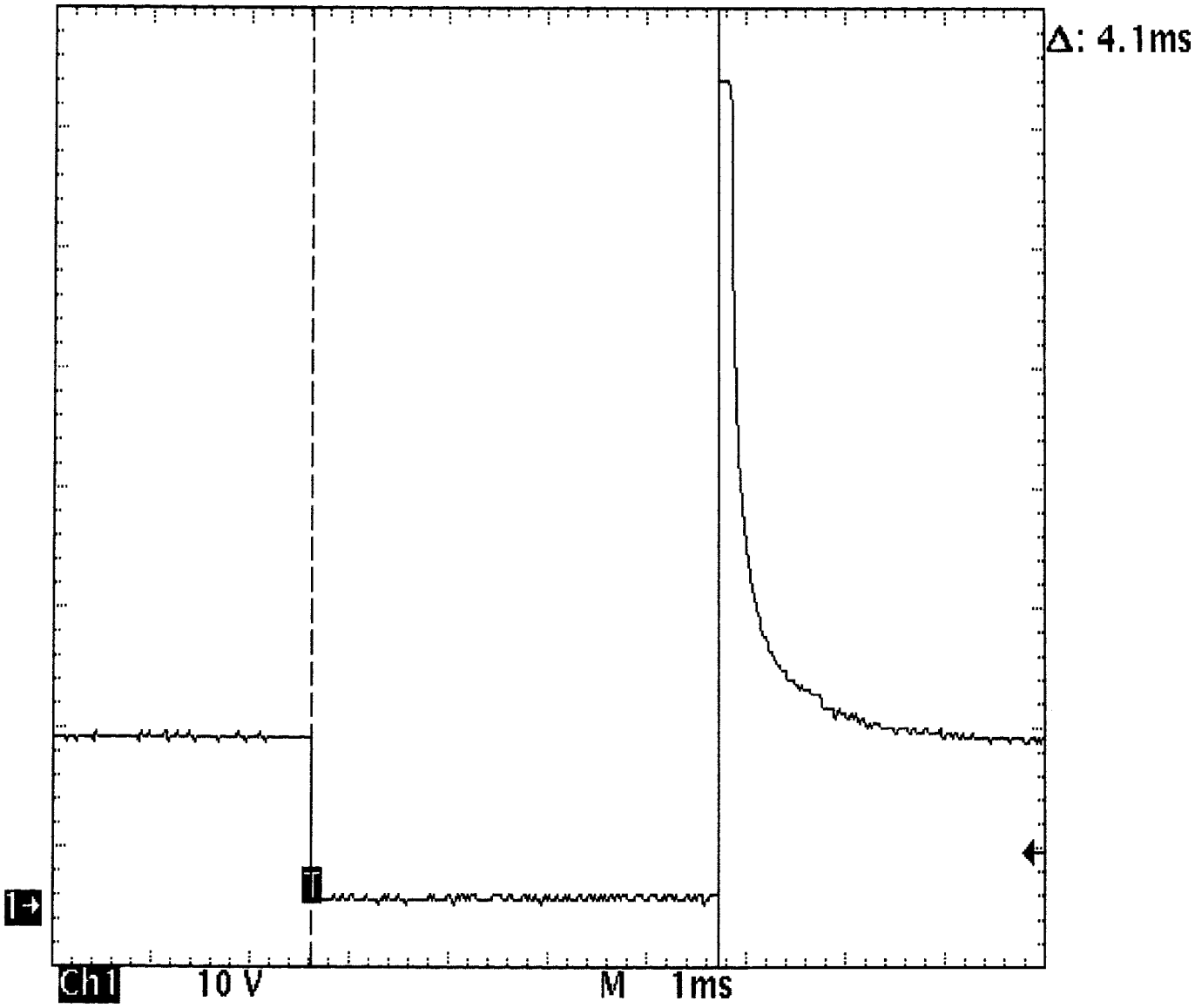


Fig. 19: Injector Bank - Known Good - Voltage Pattern

EXAMPLE #2 - VOLTAGE CONTROLLED DRIVER

The known-good waveform pattern in Fig. 20 is from a GM 3.8L V6 PFI VIN [3]. It was taken during hot idle, closed loop and no load.



95I23851

Fig. 20: Injector Bank - Known Good - Voltage Pattern

EXAMPLE #3 - VOLTAGE CONTROLLED DRIVER

This known-good waveform pattern, Fig. 21, is from a GM 5.0L V8 TPI VIN [F]. It was taken during hot idle, closed loop and no load.

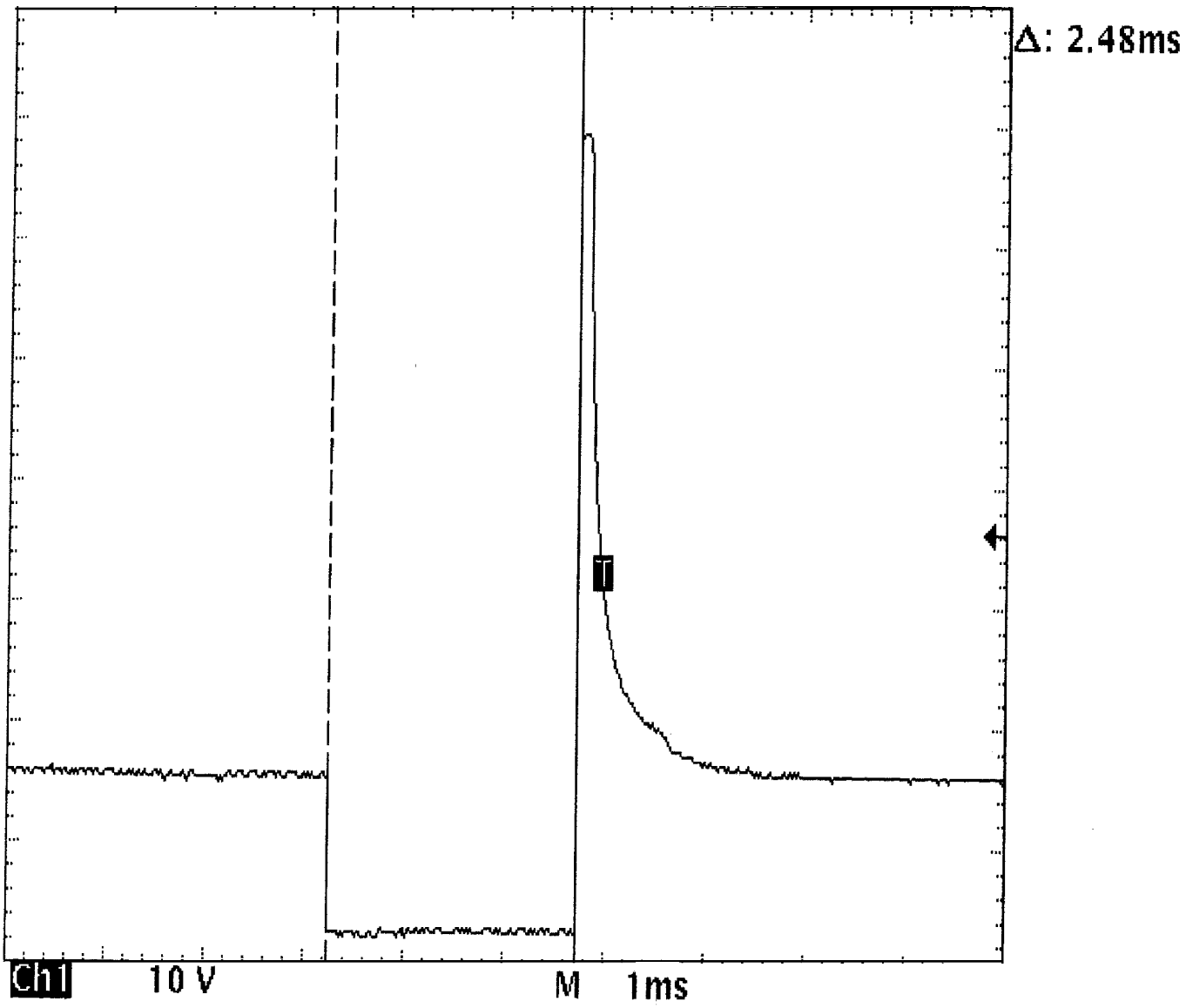
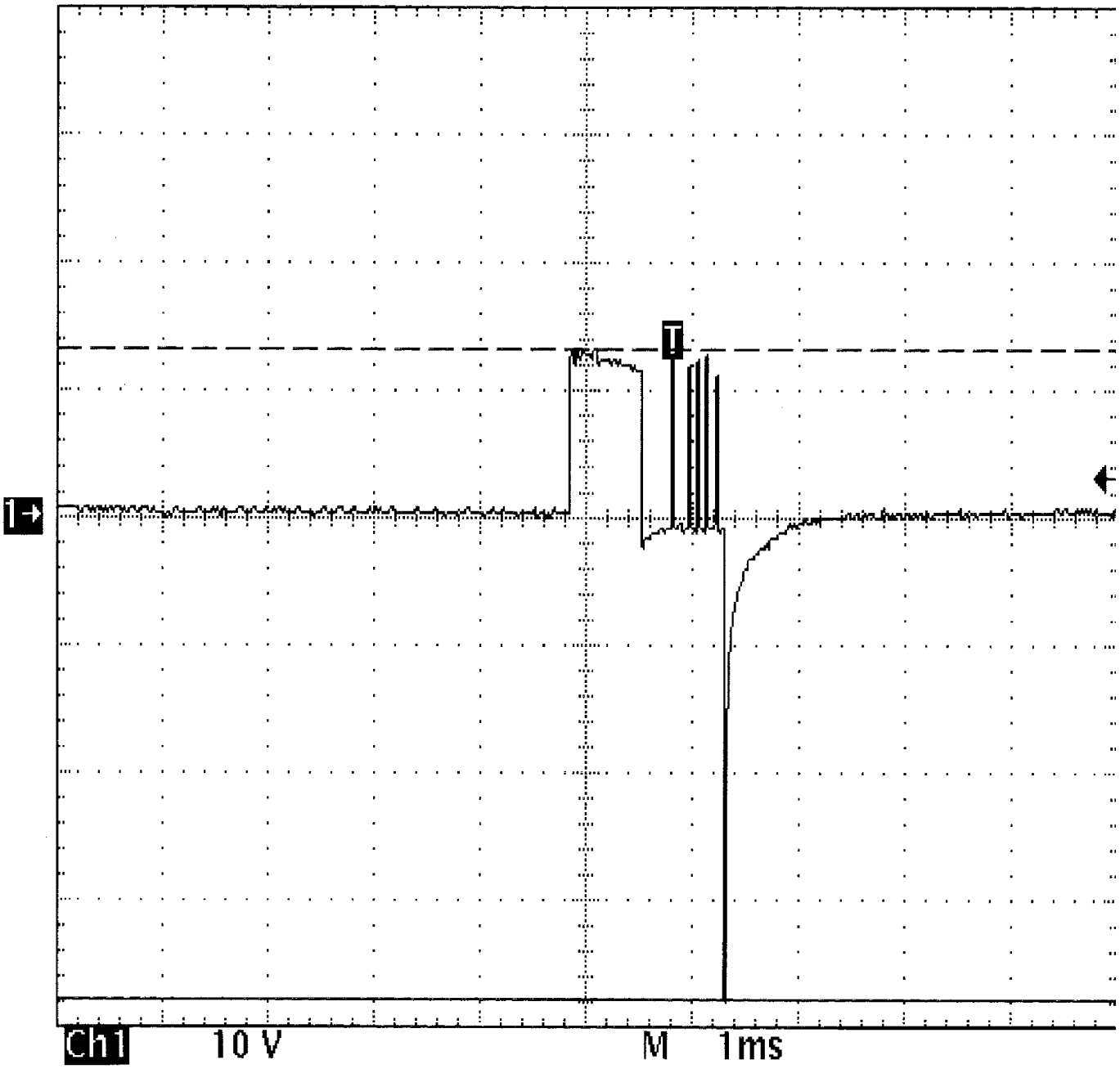


Fig. 21: Injector Bank - Known Good - Voltage Pattern

EXAMPLE #4 - CURRENT CONTROLLED DRIVER

From 1984 to 1987, Chrysler used this type injector drive on their TBI-equipped engines. See Fig. 22 for a known-good pattern. Instead of the ground side controlling the injector, Chrysler permanently grounds out the injector and switches the power feed side. Most systems do not work this way.

These injectors peak at 6 amps of current flow and hold at 1 amp.



95J23860
Fig. 22: Single Injector - Known Good - Voltage Pattern

EXAMPLE #5 - CURRENT CONTROLLED DRIVER

These two known-good waveform patterns are from a Chrysler 3.0L V6 VIN [3]. The first waveform, Fig. 23, is a dual trace pattern that illustrates how Chrysler uses the rising edge of the engine speed signal to trigger the injectors. The second waveform, Fig. 24, was taken during hot idle, closed loop, and no load.

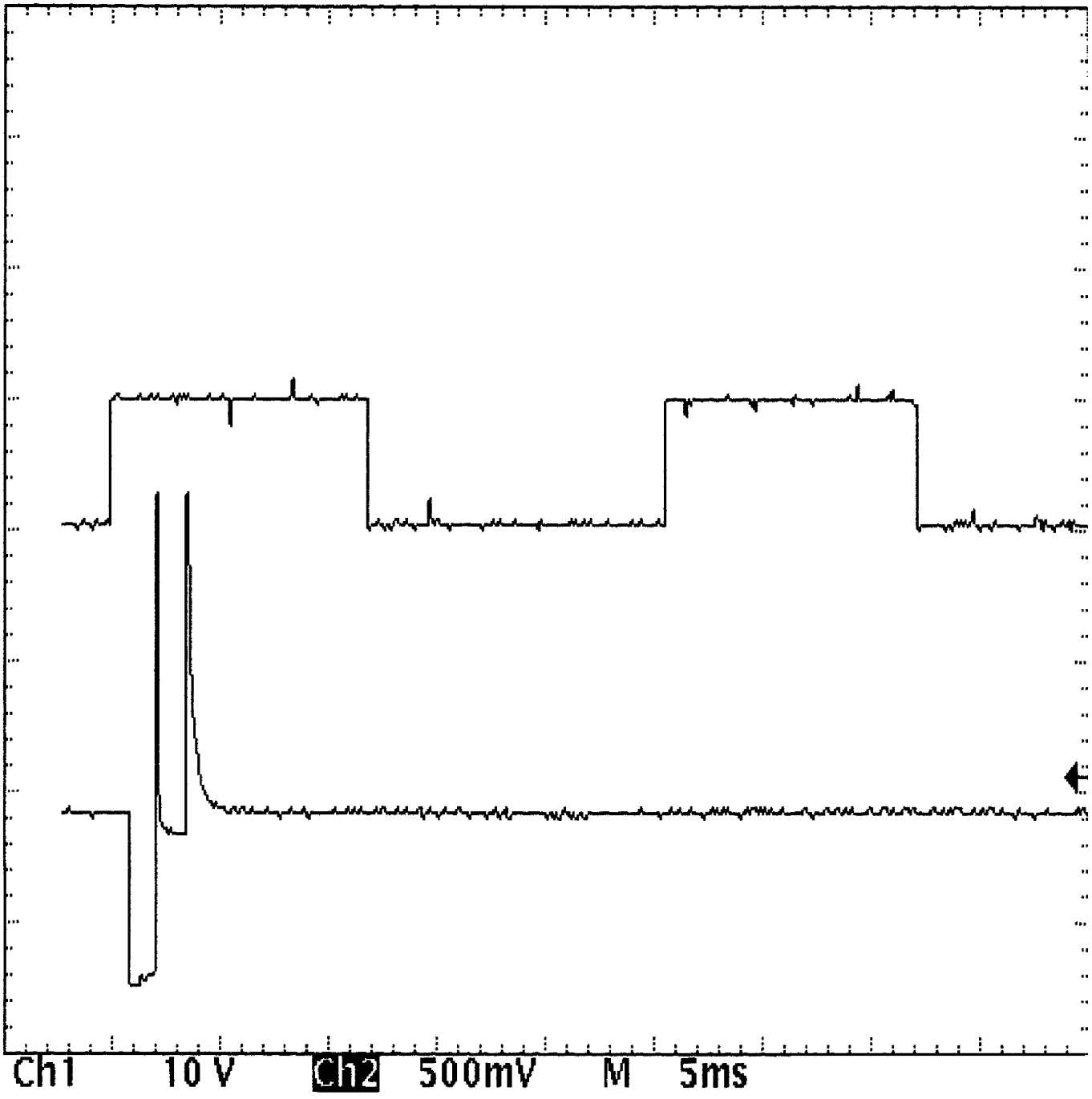
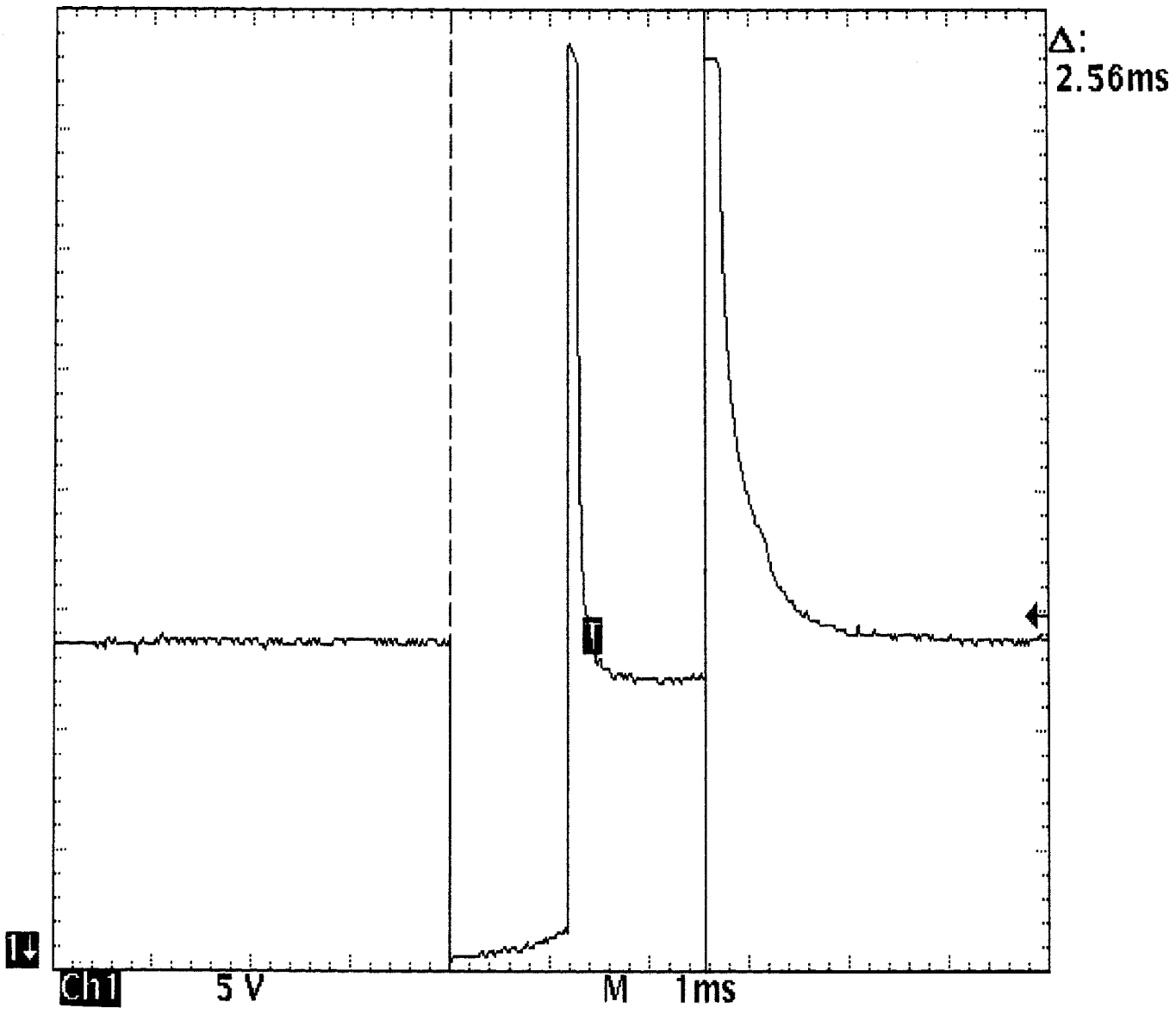


Fig. 23: Injector Bank - Known Good - Voltage Pattern



95B23854
Fig. 24: Injector Bank - Known Good - Voltage Pattern

EXAMPLE #6 - CURRENT CONTROLLED DRIVER

This known-good pattern from a Ford 3.0L V6 PFI VIN [U] illustrates that a zener diode inside the computer is used to clamp the injector's inductive kick to 35-volts on this system. See Fig. 25.

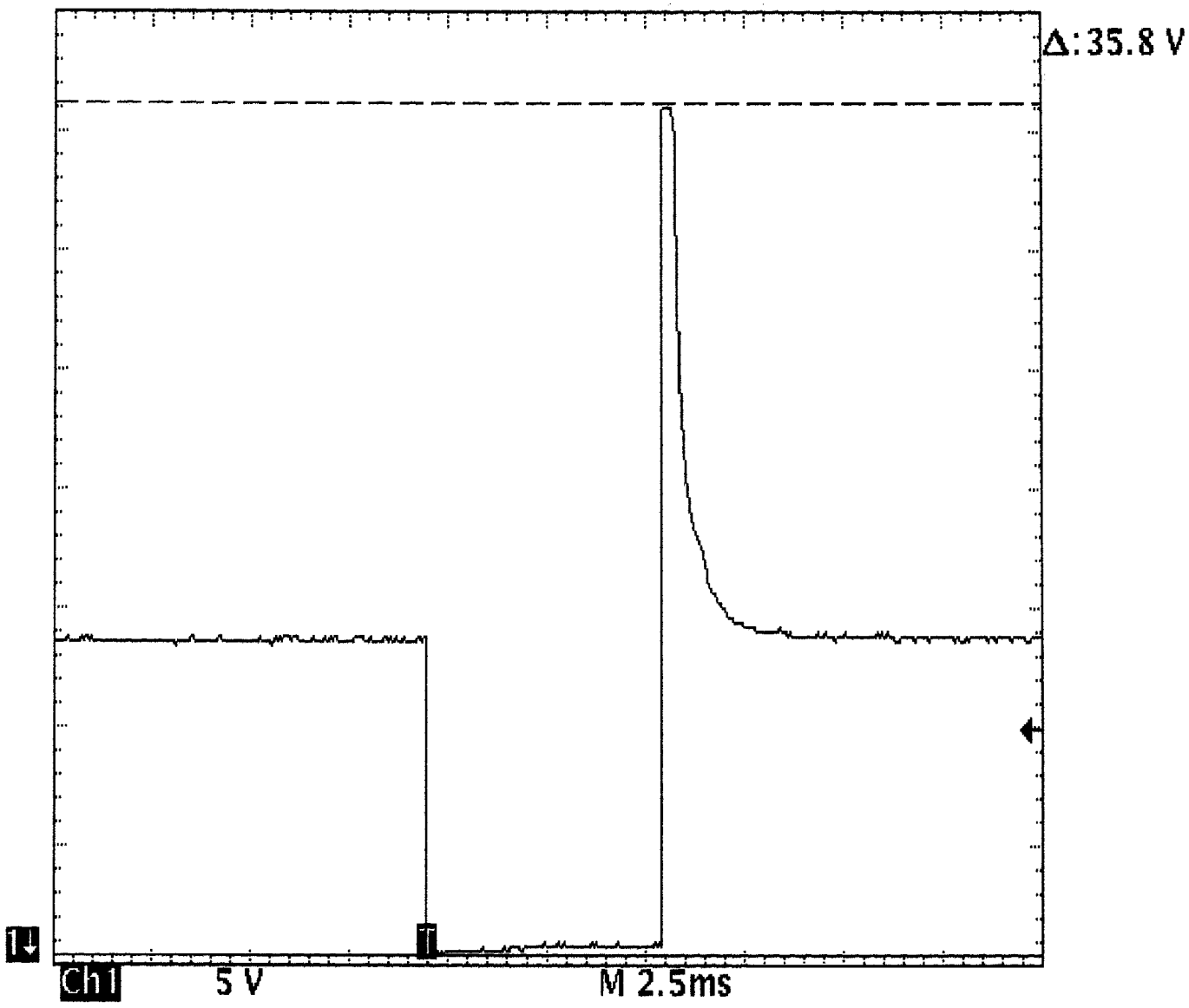


Fig. 25: Injector Bank - Known Good - Voltage Pattern

EXAMPLE #7 - CURRENT CONTROLLED DRIVER

This known-good waveform from a Ford 5.0L V8 CFI VIN [F] was taken during hot idle, closed loop, and no load. See Fig. 26.

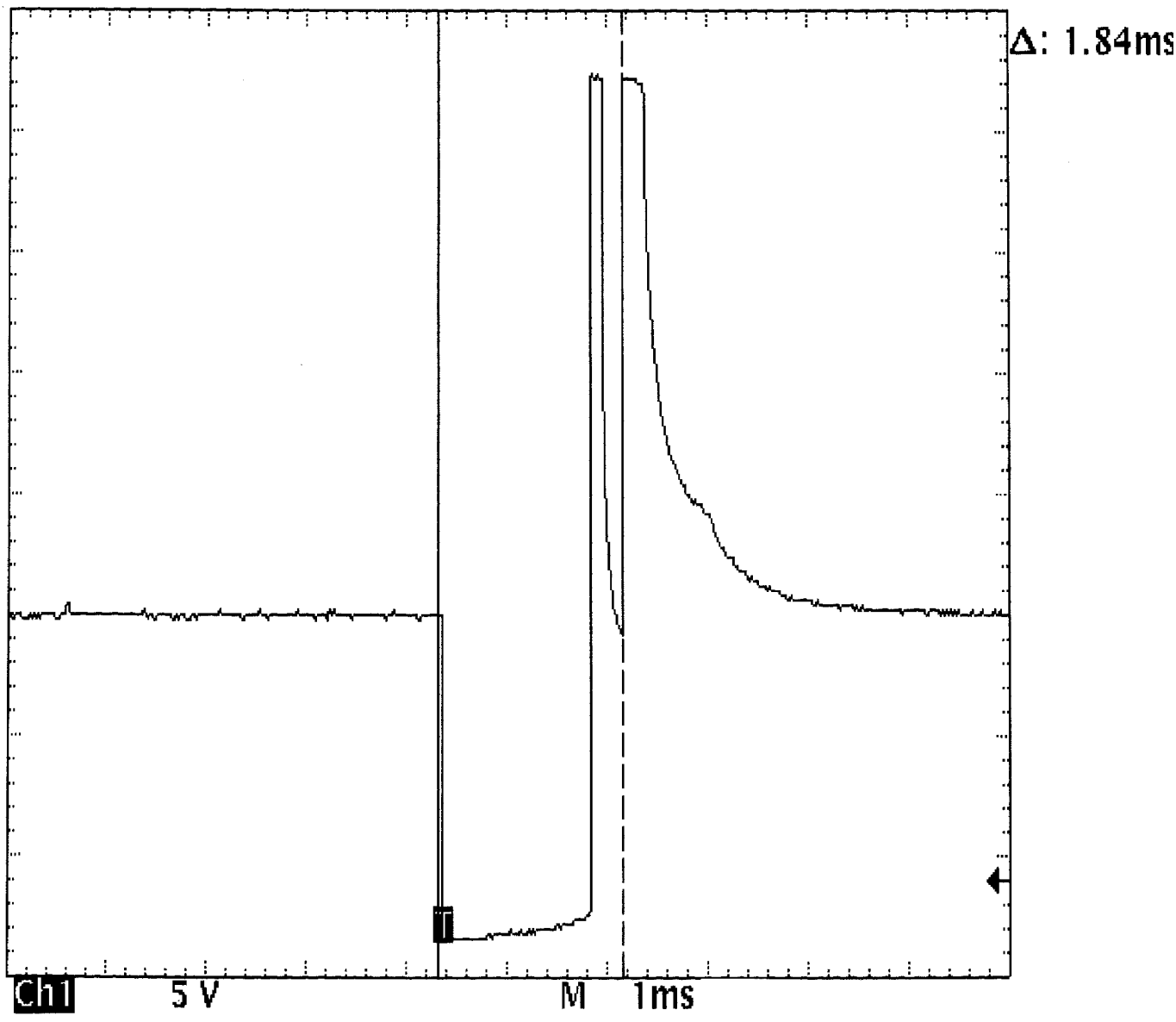
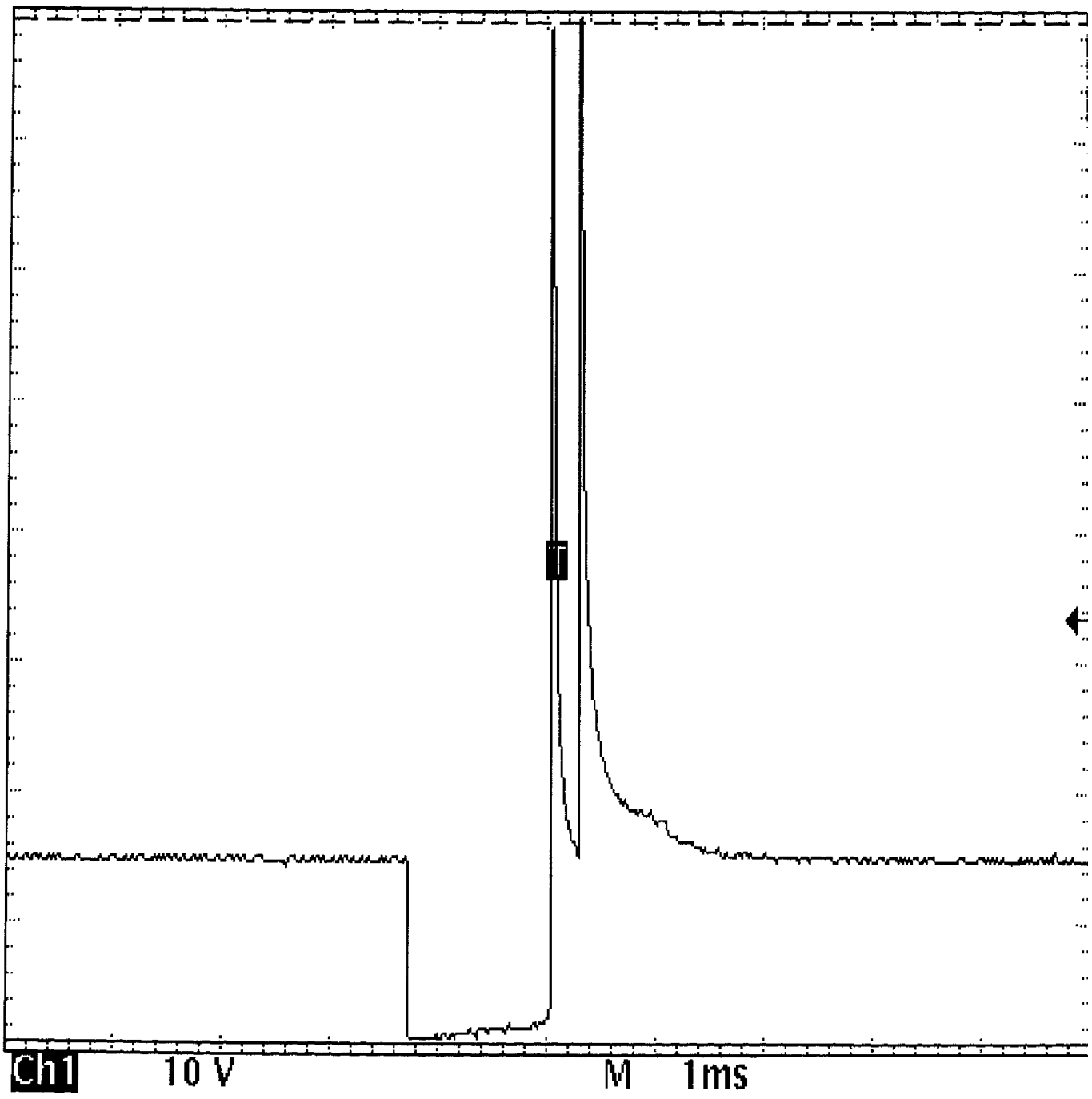


Fig. 26: Single Injector - Known Good - Voltage Pattern

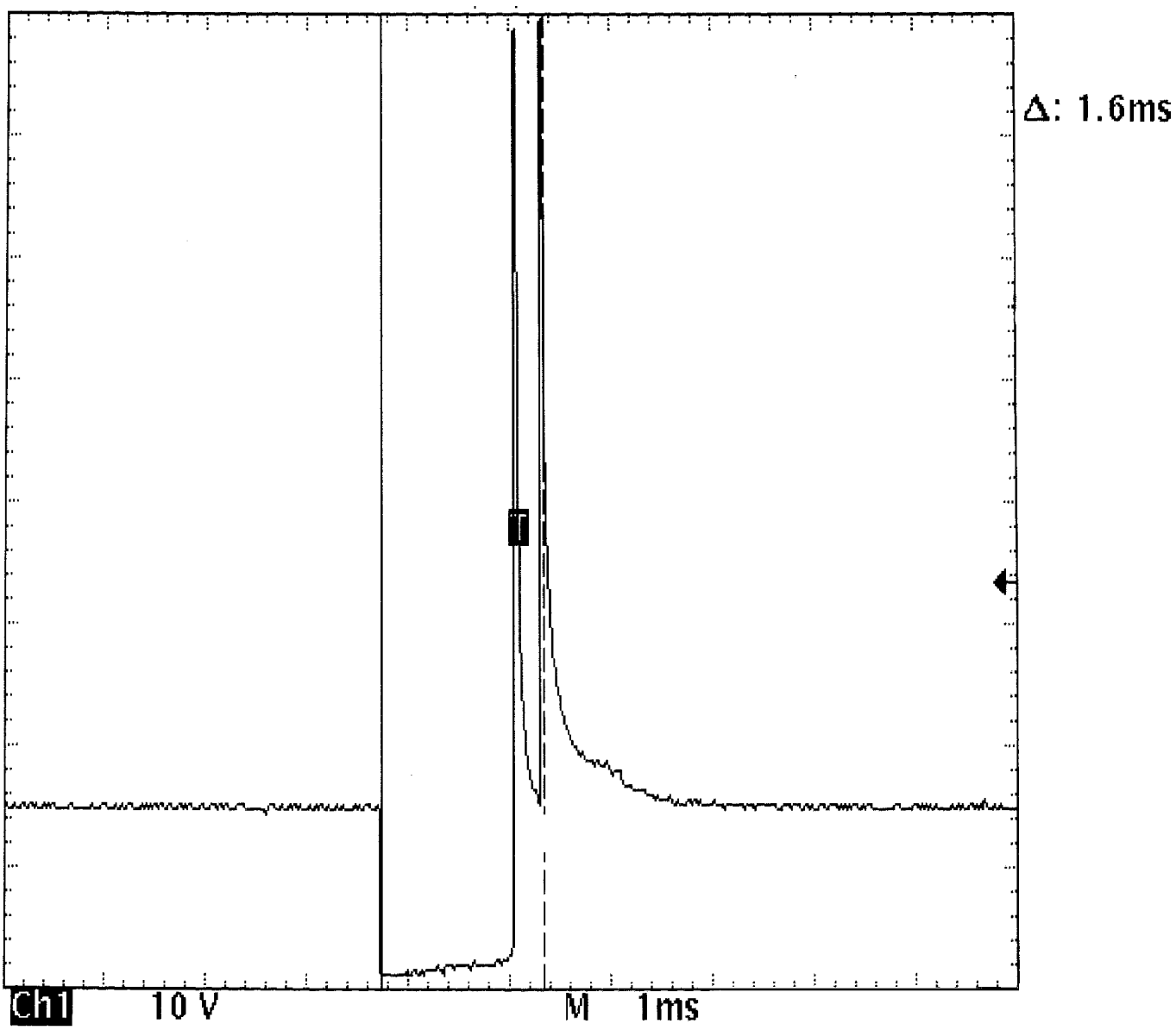
EXAMPLE #8 - CURRENT CONTROLLED DRIVER

These two known-good waveform patterns are from a GM 2.0L In-Line 4 VIN [1]. Fig. 27 illustrates the 78 volt inductive spike that indicates a zener diode is not used. The second waveform, Fig. 28, was taken during hot idle, closed loop, and no load.



95D23849

Fig. 27: Single Injector - Known Good - Voltage Pattern



95H23850

Fig. 28: Single Injector - Known Good - Voltage Pattern

WHEEL ALIGNMENT THEORY/OPERATION

1998 Mitsubishi Galant

GENERAL INFORMATION
Wheel Alignment Theory & Operation

ALL MODELS

*** PLEASE READ THIS FIRST ***

NOTE: This article is intended for general information purposes only. This information may not apply to all makes and models.

PRE-ALIGNMENT INSTRUCTIONS

GENERAL ALIGNMENT CHECKS

Before adjusting wheel alignment, check the following:

* Each axle uses tires of same construction and tread style, equal in tread wear and overall diameter. Verify that radial and axial runout is not excessive. Inflation should be at manufacturer's specifications.
* Steering linkage and suspension must not have excessive play. Check for wear in tie rod ends and ball joints. Springs must not be sagging. Control arm and strut rod bushings must not have excessive play. See Fig. 1.

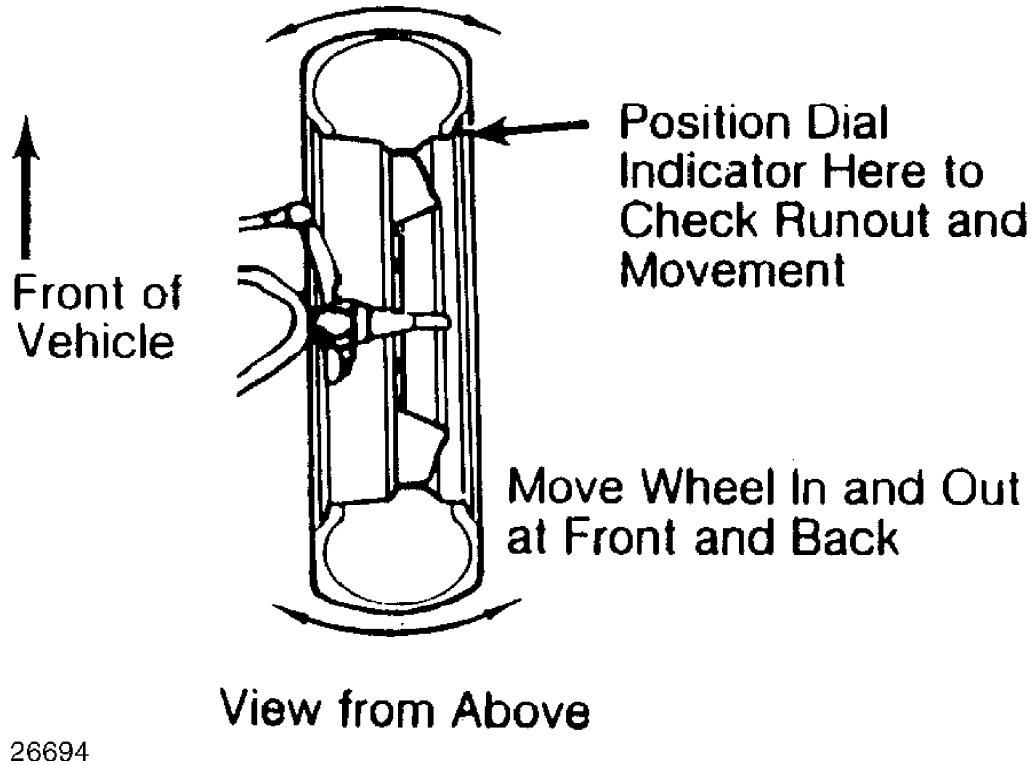


Fig. 1: Checking Steering Linkage

* Vehicle must be on level floor with full fuel tank, no passenger load, spare tire in place and no load in trunk. Bounce front and rear end of vehicle several times. Confirm

vehicle is at normal riding height.

* Steering wheel must be centered with wheels in straight ahead position. If required, shorten one tie rod adjusting sleeve and lengthen opposite sleeve (equal amount of turns). See Fig. 2.
* Wheel bearings should have the correct preload and lug nuts must be tightened to manufacturer's specifications. Adjust camber, caster and toe-in using this sequence. Follow instructions of the alignment equipment manufacturer.

CAUTION: Do not attempt to correct alignment by straightening parts. Damaged parts must be replaced.

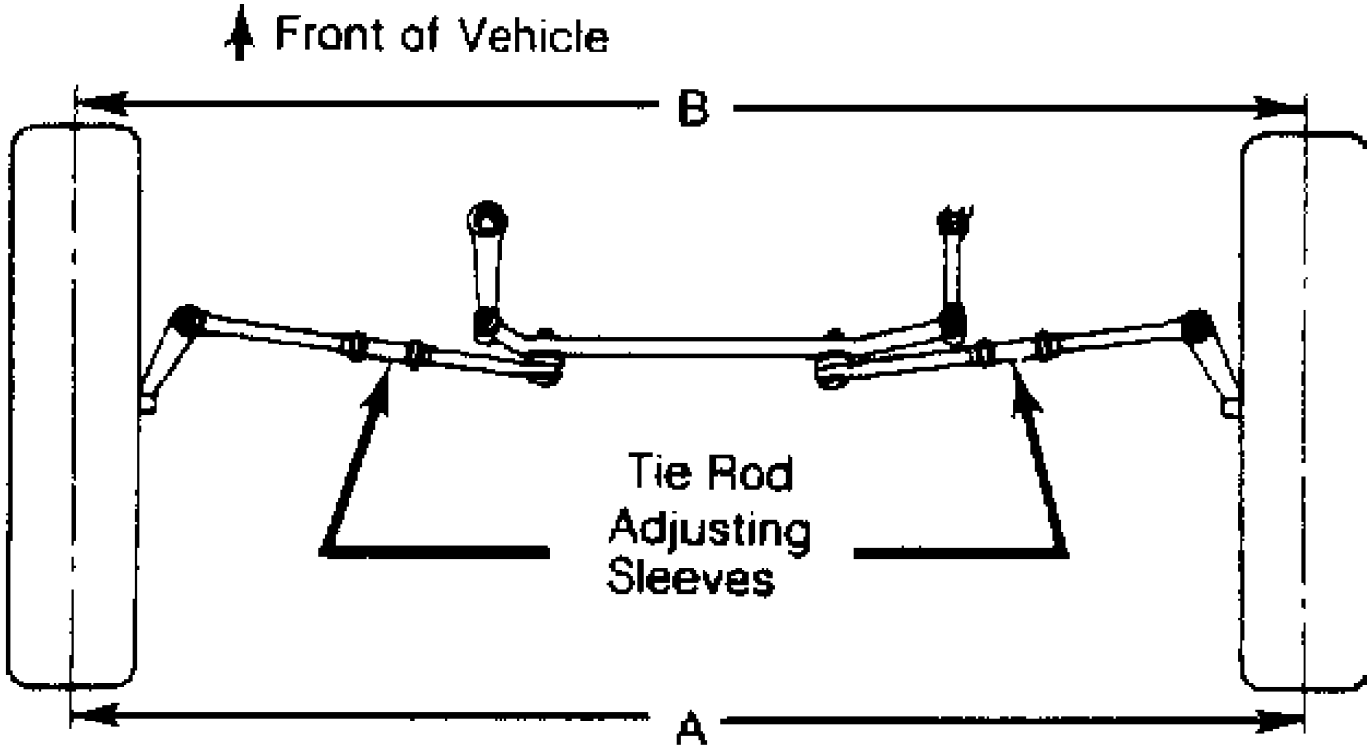


Fig. 2: Adjusting Tie Rod Sleeves (Top View)

CAMBER

1) Camber is the tilting of the wheel, outward at either top or bottom, as viewed from front of vehicle. See Fig. 3.

2) When wheels tilts outward at the top (from centerline of vehicle), camber is positive. When wheels tilt inward at top, camber is negative. Amount of tilt is measured in degrees from vertical.

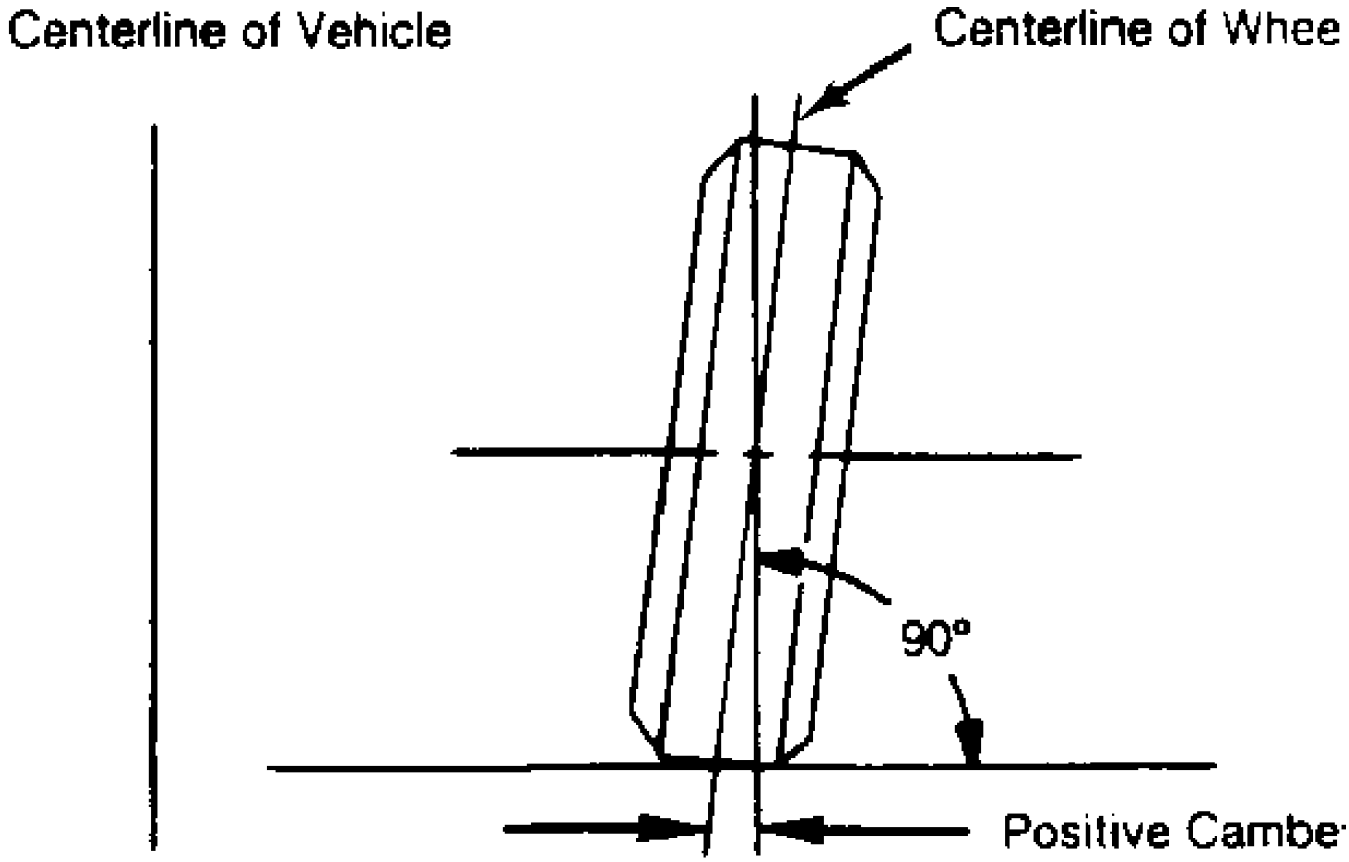


Fig. 3: Determining Camber Angle

CASTER

1) Caster is tilting of front steering axis either forward or backward from vertical, as viewed from side of vehicle. See Fig. 4.

2) When axis is tilted backward from vertical, caster is positive. This creates a trailing action on front wheels. When axis is tilted forward, caster is negative, causing a leading action on front wheels.

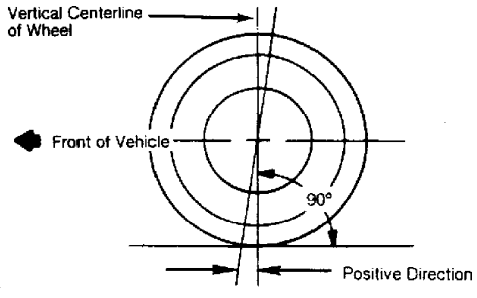


Fig. 4: Determining Caster Angle

TOE-IN ADJUSTMENT

Toe-in is the width measured at the rear of the tires

subtracted by the width measured at the front of the tires at about spindle height. A positive figure would indicate toe-in and a negative figure would indicate toe-out. If the distance between the front and rear of the tires is the same, toe measurement would be zero. To adjust:

1) Measure toe-in with front wheels in straight ahead position and steering wheel centered. To adjust toe-in, loosen clamps and turn adjusting sleeve or adjustable end on right and left tie rods. See Figs. 2 and 5.

2) Turn equally and in opposite directions to maintain steering wheel in centered position. Face of tie rod end must be parallel with machined surface of steering rod end to prevent binding.

3) When tightening clamps, make certain that clamp bolts are positioned so there will be no interference with other parts throughout the entire travel of linkage.

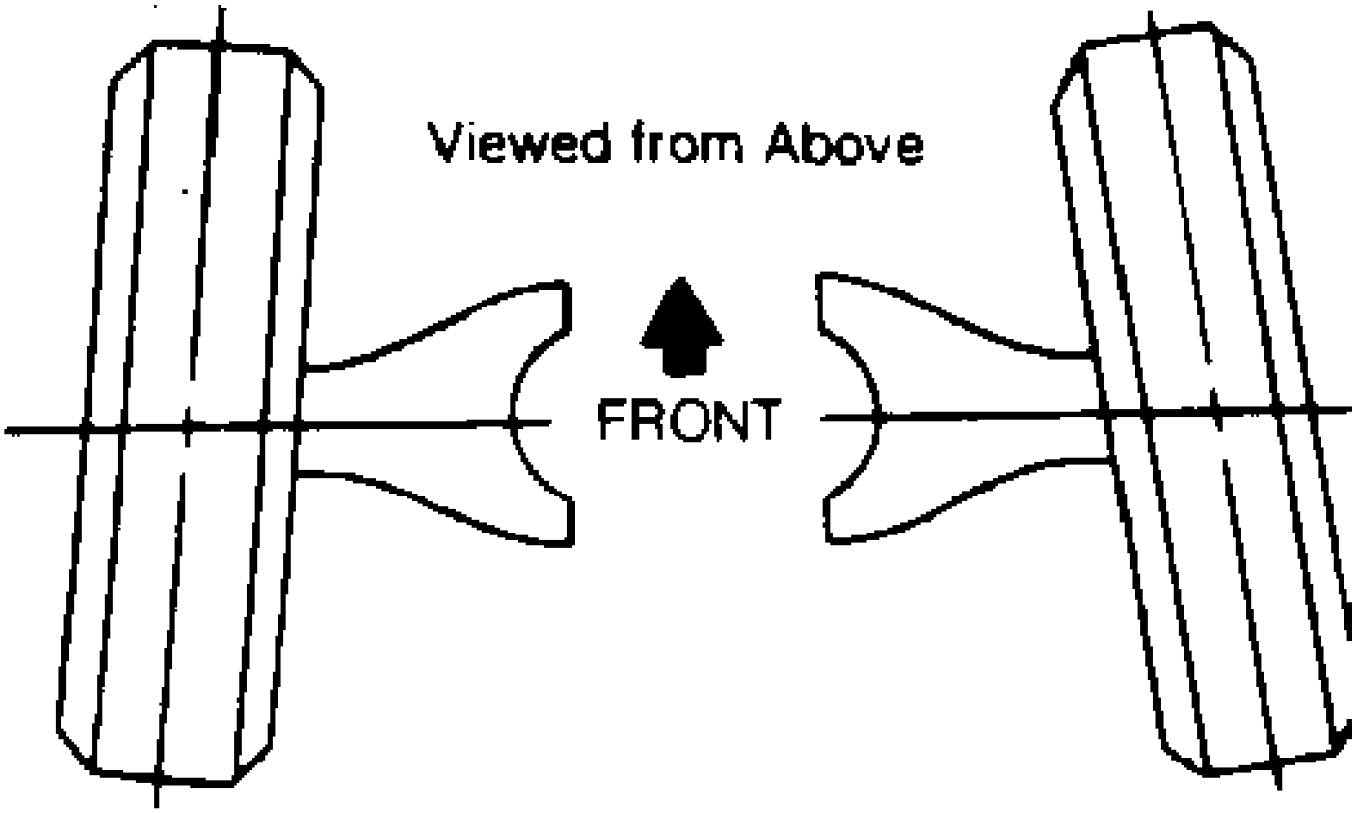


Fig. 5: Wheel Toe-In (Dimension A Less Dimension B)

TOE-OUT ON TURNS

1) Toe-out on turns (turning radius) is a check for bent or damaged parts, and not a service adjustment. With caster, camber, and toe-in properly adjusted, check toe-out with weight of vehicle on wheels.

2) Use a full floating turntable under each wheel, repeating test with each wheel positioned for right and left turns. Incorrect toe-out generally indicates a bent steering arm. Replace arm, if necessary, and recheck wheel alignment.

STEERING AXIS INCLINATION

1) Steering axis inclination is a check for bent or damaged parts, and not a service adjustment. Vehicle must be level and camber should be properly adjusted. See Fig. 6.

2) If camber cannot be brought within limits and steering axis inclination is correct, steering knuckle is bent. If camber and steering axis inclination are both incorrect by approximately the same amount, the upper and lower control arms are bent.

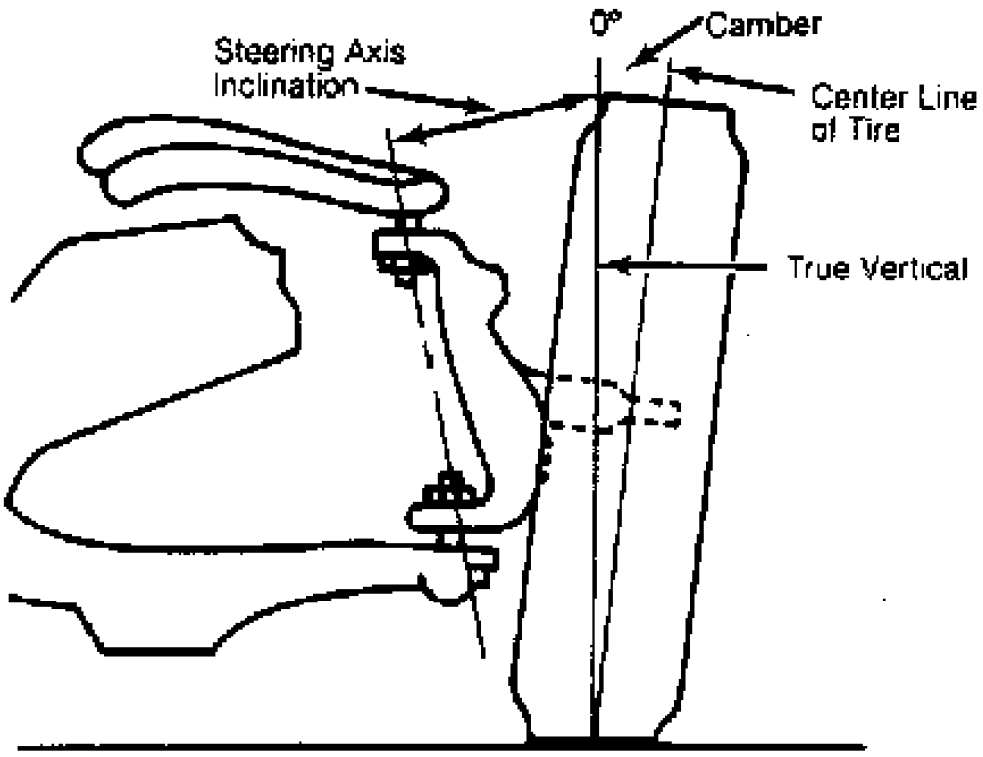


Fig. 6: Checking Steering Axis Inclination

WHEEL ALIGNMENT SPECIFICATIONS & PROCEDURES

1998 Mitsubishi Galant

1997-98 WHEEL ALIGNMENT
Mitsubishi - Specifications & Procedures

Diamante, Eclipse, Galant, Mirage,
Montero, Montero Sport, 3000GT

RIDING HEIGHT ADJUSTMENT

NOTE: Prior to performing wheel alignment, perform preliminary visual and mechanical inspection of wheels, tires and suspension components. See PRE-ALIGNMENT INSTRUCTIONS in WHEEL ALIGNMENT THEORY & OPERATION article in GENERAL INFORMATION.

NOTE: On vehicles with electronic chassis controls, ensure all systems are functional before attempting to adjust riding height or wheel alignment. See appropriate ELECTRONIC article under SUSPENSION.

1) Before adjusting wheel alignment, visually inspect vehicle. Remove any heavy items from passenger and luggage compartments. Ensure tires are properly inflated and vehicle is level. Bounce vehicle several times, and allow suspension to settle.

2) Check riding height from front to rear and from side to side. If riding height is not as specified on Montero and Montero Sport, adjust torsion bar anchor arm nut until correct height is obtained. See RIDING HEIGHT SPECIFICATIONS (FRONT) table. On all other models, riding height for left and right sides of vehicle should not vary more than 1.0" (25.4 mm). If riding height is not within specification, check and repair suspension before adjusting alignment.

RIDING HEIGHT SPECIFICATIONS (FRONT)

Application	(1) In. (mm)
Montero	.83-.91 (21.0-23.0)
Montero Sport	2.7 (68)

(1) - Distance between lower control bumper stop and bracket. See Fig. 1.

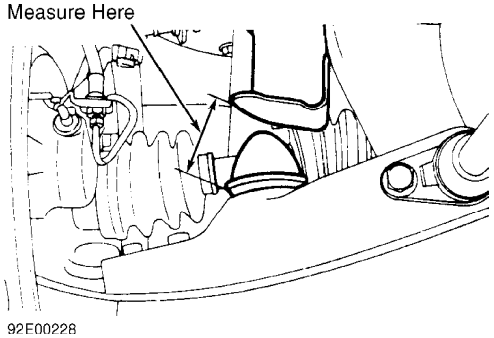


Fig. 1: Measuring Riding Height (Montero & Montero Sport)
Courtesy of Mitsubishi Motor Sales of America.

JACKING & HOISTING

* PLEASE READ FIRST *

NOTE: Following illustrations are given to provide reference points only. Illustrations do not represent exact structure of vehicle frame, underbody or body outline.

EMERGENCY JACKING

Points on outline of body were designated to be used specifically with vehicle jack. See Fig. 2. If using floor jack or hoist at these points, use extreme care to avoid damaging outer body shell.

FLOOR JACK & HOIST

Following illustrations indicate points for jacking and hoisting vehicle. These points are indicated by shaded areas on frame and underbody. See Figs. 3-5.

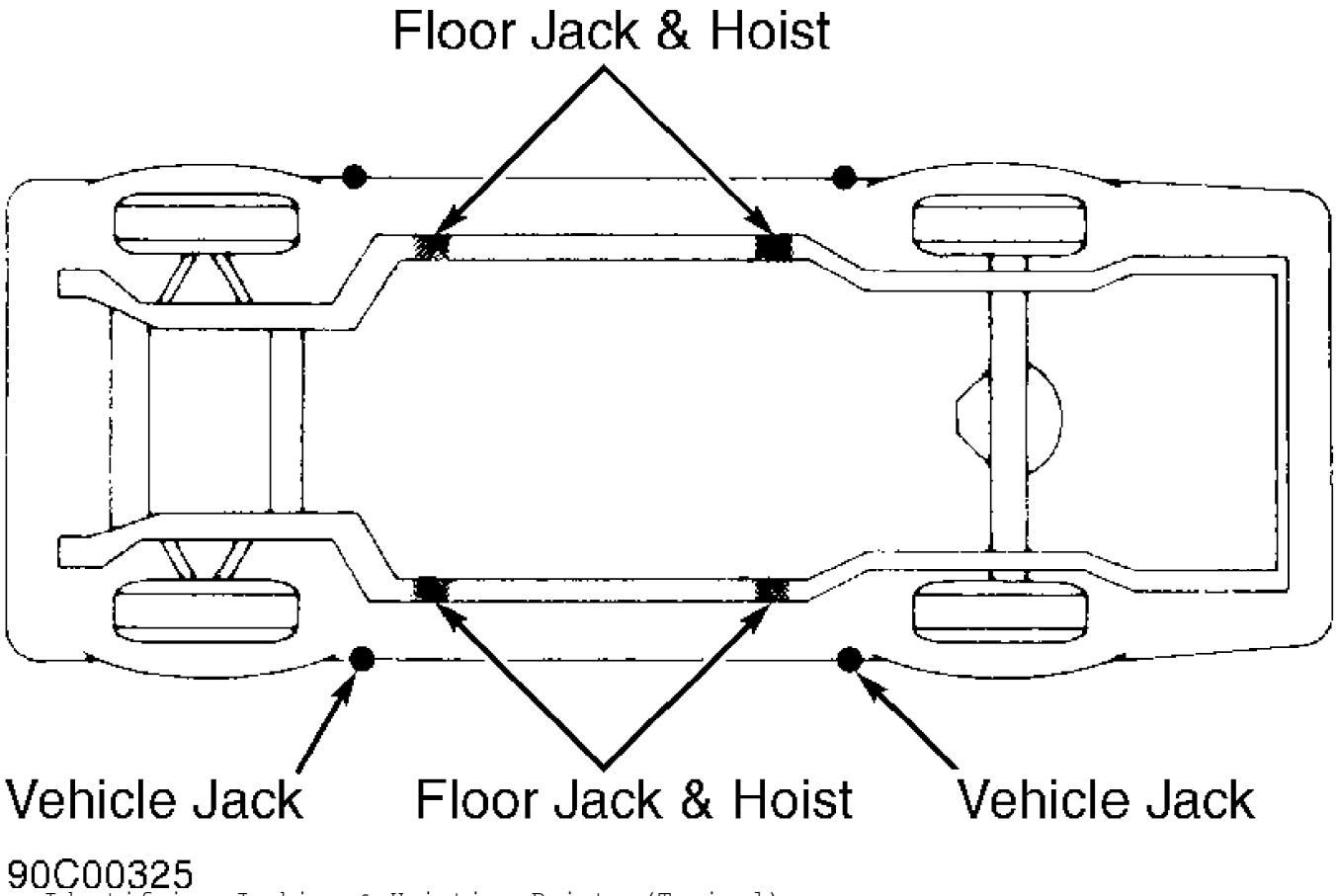


Fig. 2: Identifying Jacking & Hoisting Points (Typical)

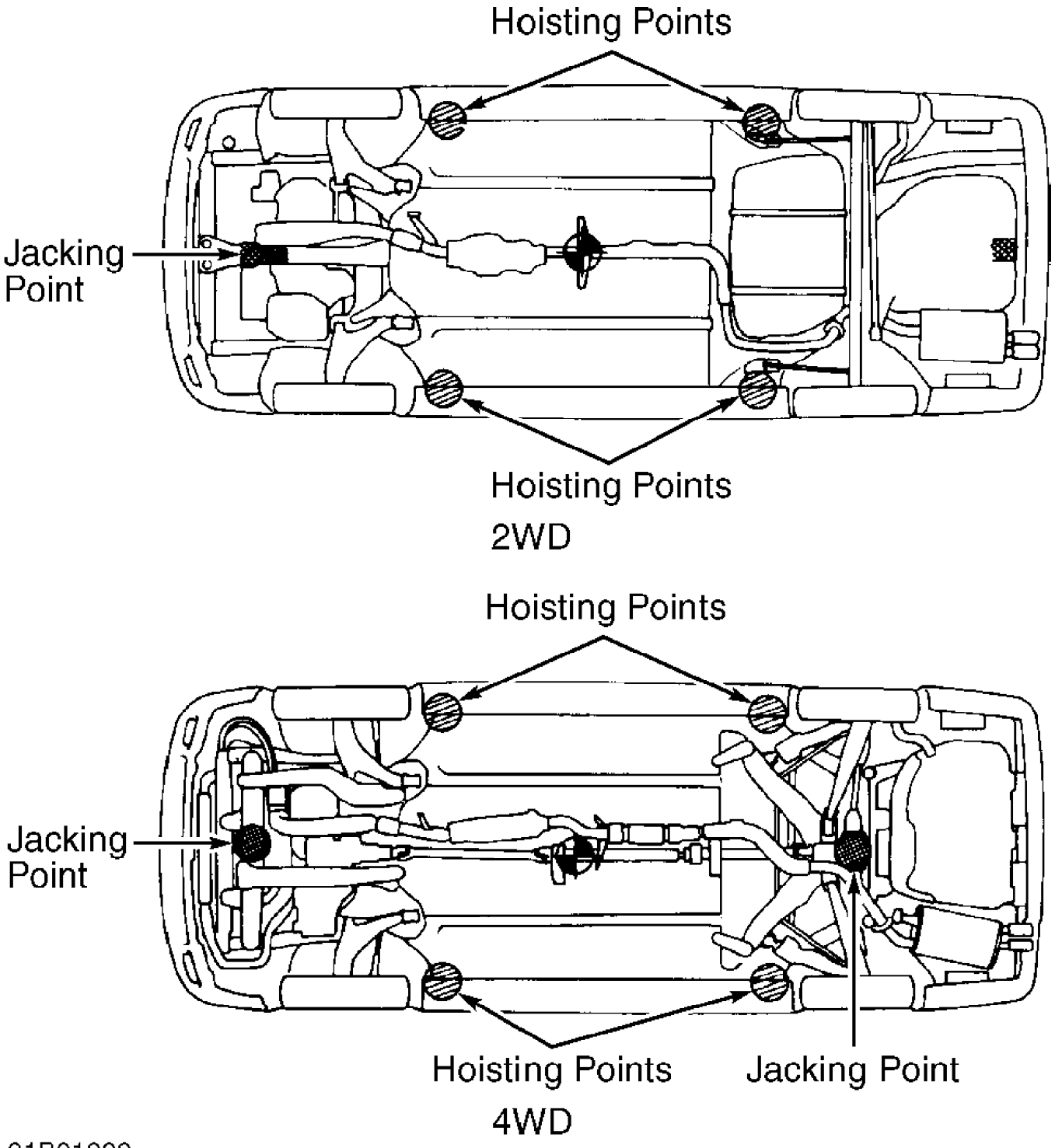


Fig. 3: Identifying Jacking & Hoisting Points (Except Montero, Montero Sport & 3000GT)
Courtesy of Mitsubishi Motor Sales of America.

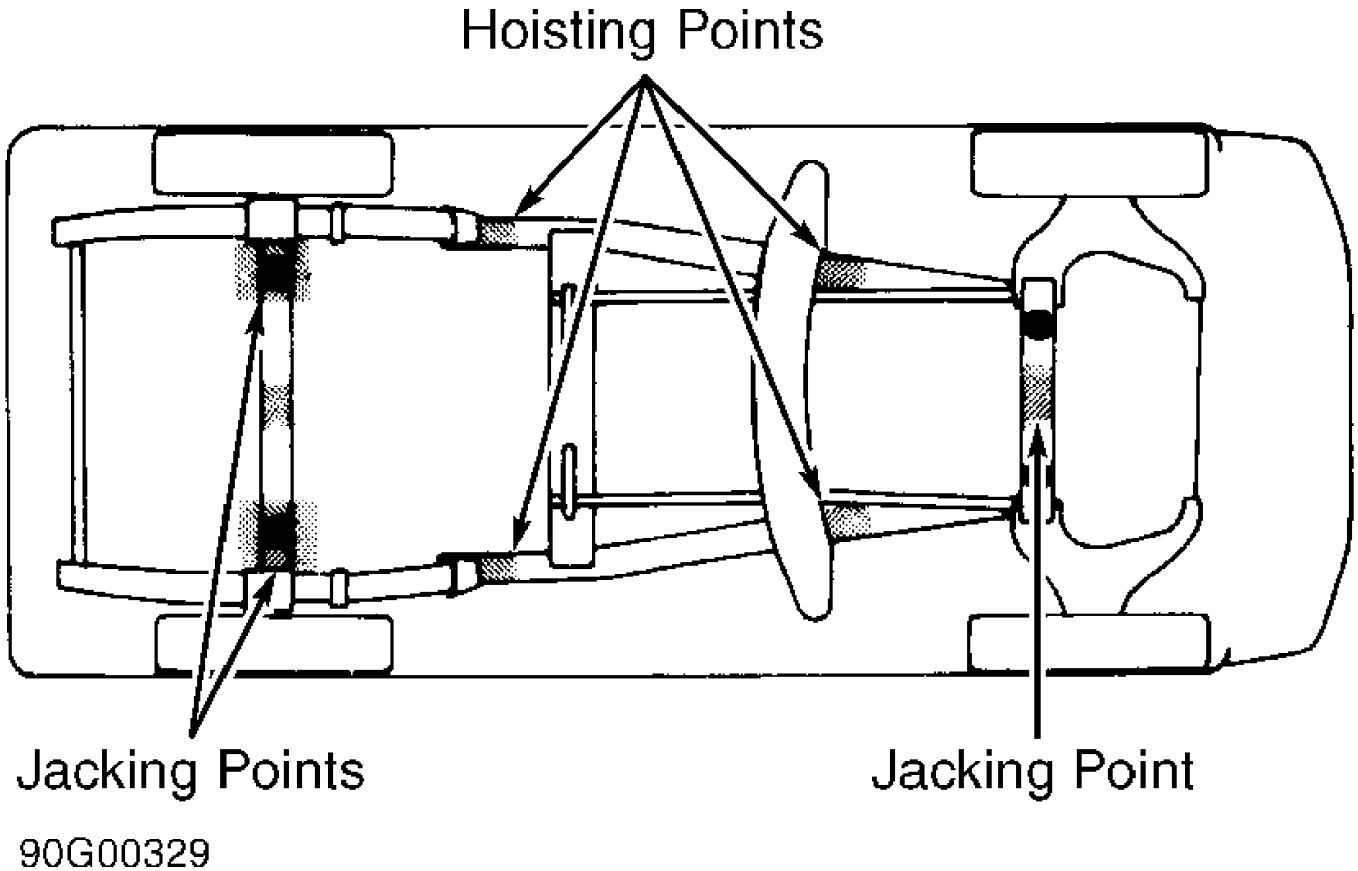


Fig. 4: Identifying Jacking & Hoisting Points (Montero & Montero Sport)
Courtesy of Mitsubishi Motor Sales of America.

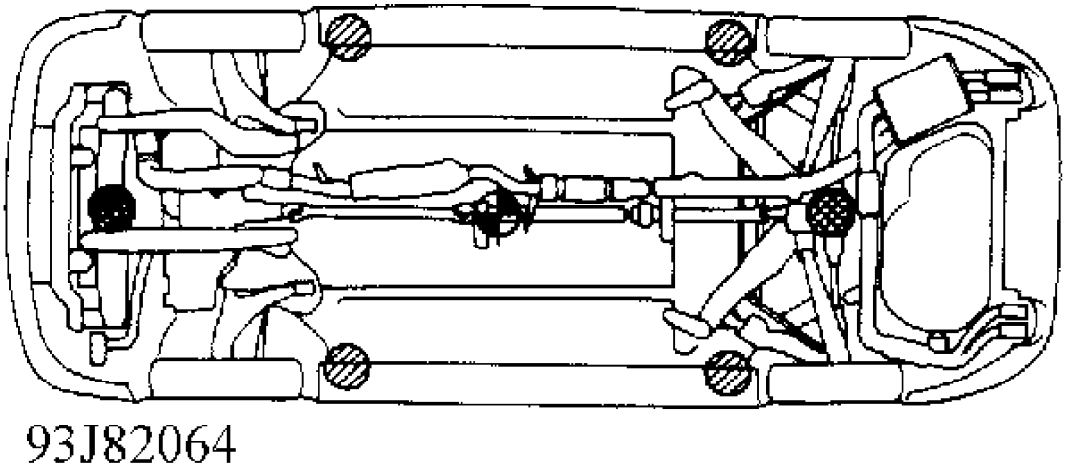


Fig. 5: Identifying Jacking & Hoisting Points (3000GT AWD Shown; FWD Is Similar)
Courtesy of Mitsubishi Motor Sales of America.

WHEEL ALIGNMENT PROCEDURES

CAMBER ADJUSTMENT

Except Montero, Montero Sport & 3000GT

Camber is preset and cannot be adjusted. Check camber. See appropriate table under WHEEL ALIGNMENT SPECIFICATIONS. If camber is not within specification, replace damaged or bent parts.

Montero & Montero Sport

1) Check camber. See appropriate table under WHEEL ALIGNMENT SPECIFICATIONS. If camber is not within specification, remove shock absorber mounting nut and lock nut.

CAUTION: Difference in shim thickness between front and rear must not exceed 0.16" (4.0 mm). DO NOT use more than 3 shims at onelocation.

2) Compress shock absorber, and loosen upper arm mounting bolts and nuts. Adjust camber by increasing or decreasing shims between upper arm shaft and crossmember. See Fig. 6.

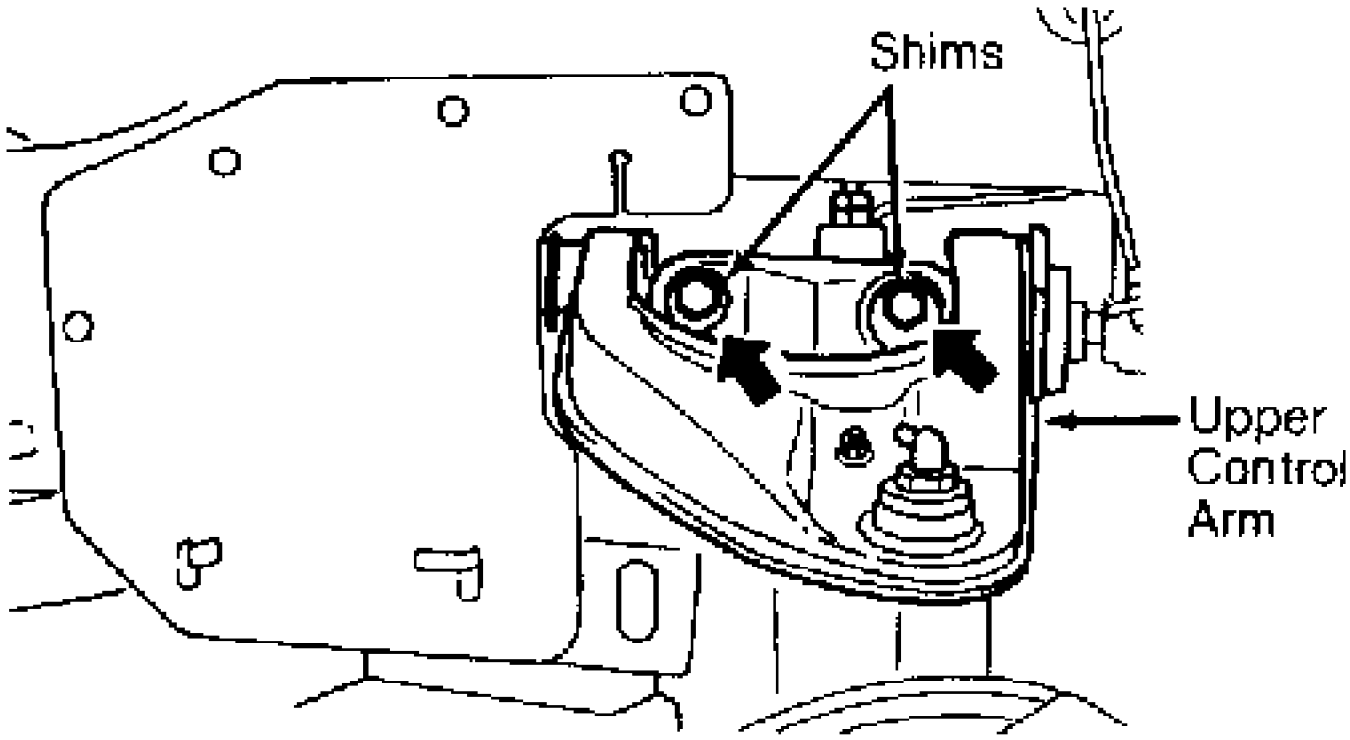


Fig. 6: Adjusting Camber & Caster (Montero Sport Shown; Montero Is Similar)
Courtesy of Mitsubishi Motor Sales of America.

3000GT

Check camber. See WHEEL ALIGNMENT SPECIFICATIONS (3000GT) table. If camber is not within specification, loosen eccentric cam nut. Rotate eccentric cam bolt to obtain correct camber. See Fig. 7. Each marking represents a change of .12-.25 degree of camber.

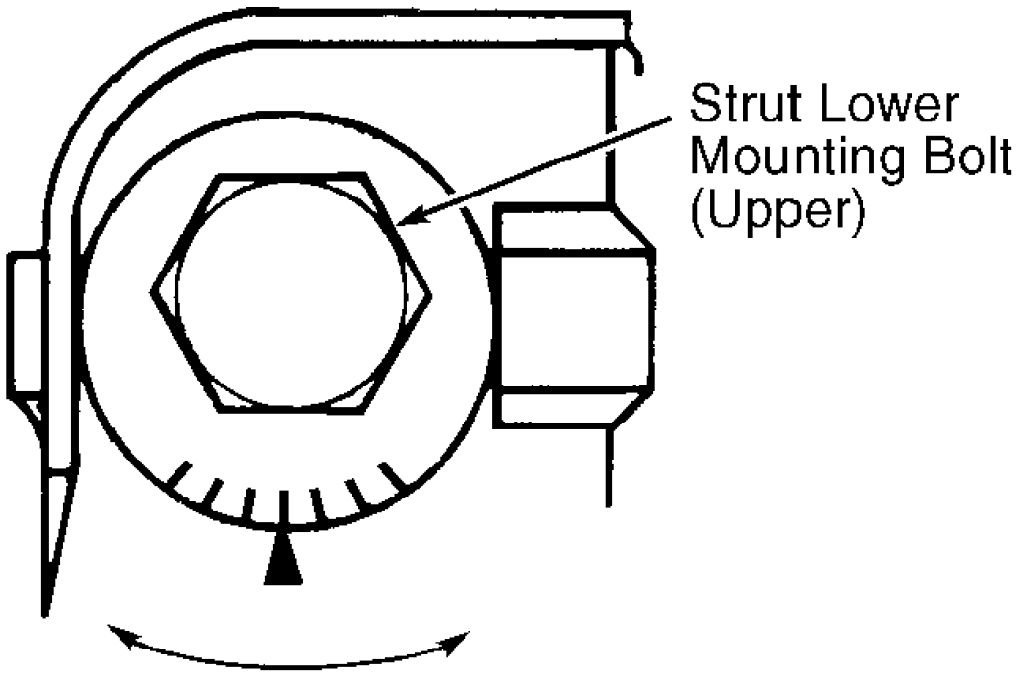


Fig. 7: Adjusting Camber (3000GT)
Courtesy of Mitsubishi Motor Sales of America.

CASTER ADJUSTMENT

Except Montero & Montero Sport
Check caster. See appropriate table under WHEEL ALIGNMENT SPECIFICATIONS. If caster is not within specification, replace damaged or bent parts.

Montero & Montero Sport
1) Check caster. See appropriate table under WHEEL ALIGNMENT SPECIFICATIONS. If caster is not within specification, remove shock absorber mounting nut and lock nut.

CAUTION: Difference in shim thickness between front and rear must not exceed .16" (4.0 mm). DO NOT use more than 3 shims at one location.

2) Compress shock absorber, and loosen upper arm mounting bolts and nuts. Adjust caster by increasing or decreasing shims between upper arm shaft and crossmember. See Fig. 6.

TOE-IN ADJUSTMENT

Front
Check front toe-in. See appropriate table under WHEEL ALIGNMENT SPECIFICATIONS. If front toe-in is not within specification, remove clips. Turn tie rods or turnbuckles same amount, but in opposite directions. Recheck front toe-in.

Rear (Montero & Montero Sport)
Check rear toe-in. See appropriate table under

WHEEL ALIGNMENT SPECIFICATIONS. If rear toe-in is not within specification, replace damaged or bent parts.

Rear (3000GT AWD)
Check rear toe-in. See appropriate table under WHEEL ALIGNMENT SPECIFICATIONS. If rear toe-in is not within specification, loosen both trailing arm eccentric cam nuts. Turn trailing arm eccentric cam bolts equal amount to obtain correct rear toe-in. See Fig. 8.

Rear (Except Montero, Montero Sport & 3000GT AWD)
Check rear toe-in. See appropriate table under WHEEL ALIGNMENT SPECIFICATIONS. If rear toe-in is not within specification, loosen both assist link eccentric cam nuts. Turn assist link eccentric cam bolts equal amount to obtain correct rear toe-in. See Fig. 9.

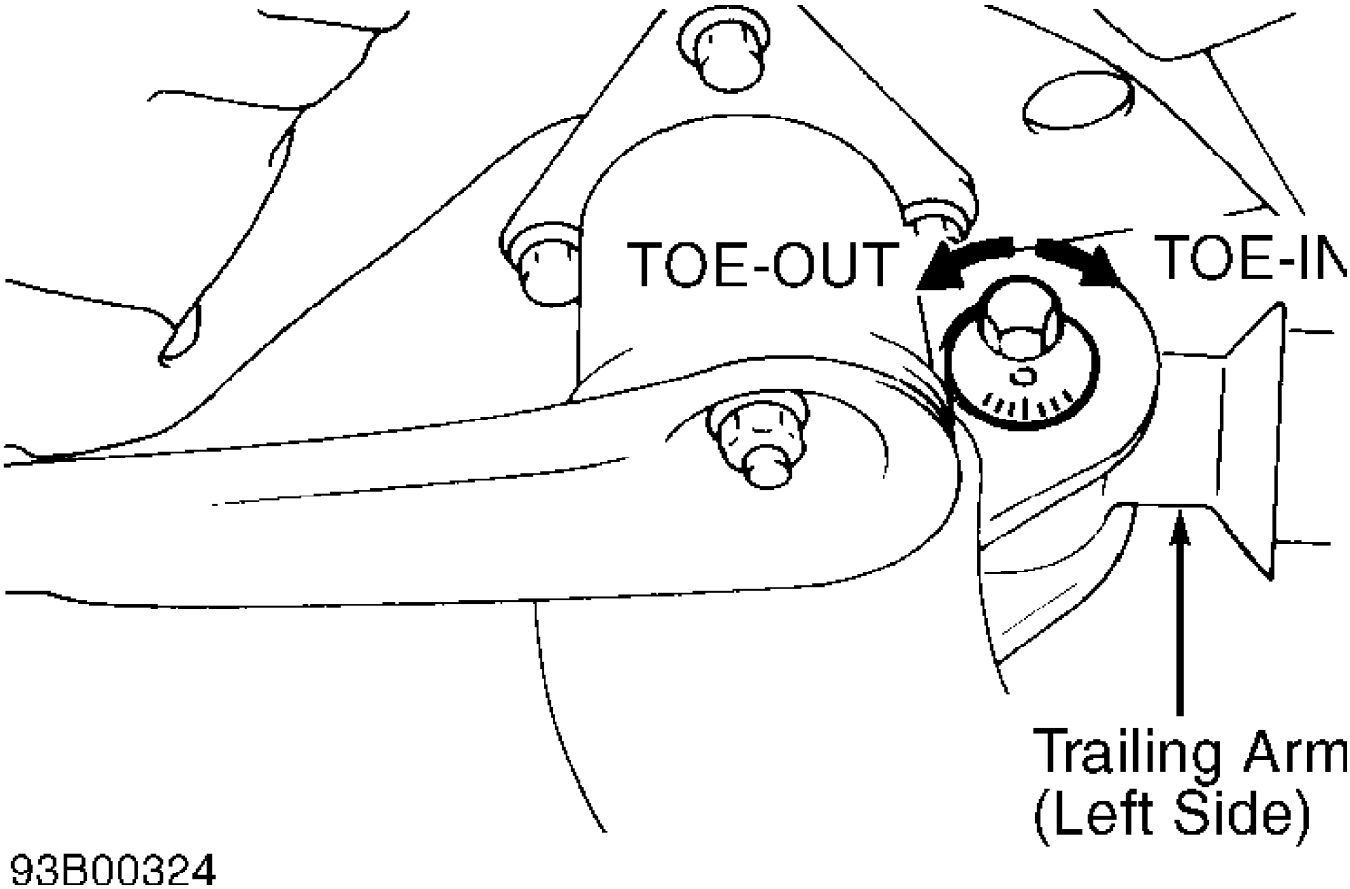


Fig. 8: Adjusting Rear Toe-In (3000GT AWD)
Courtesy of Mitsubishi Motor Sales of America.

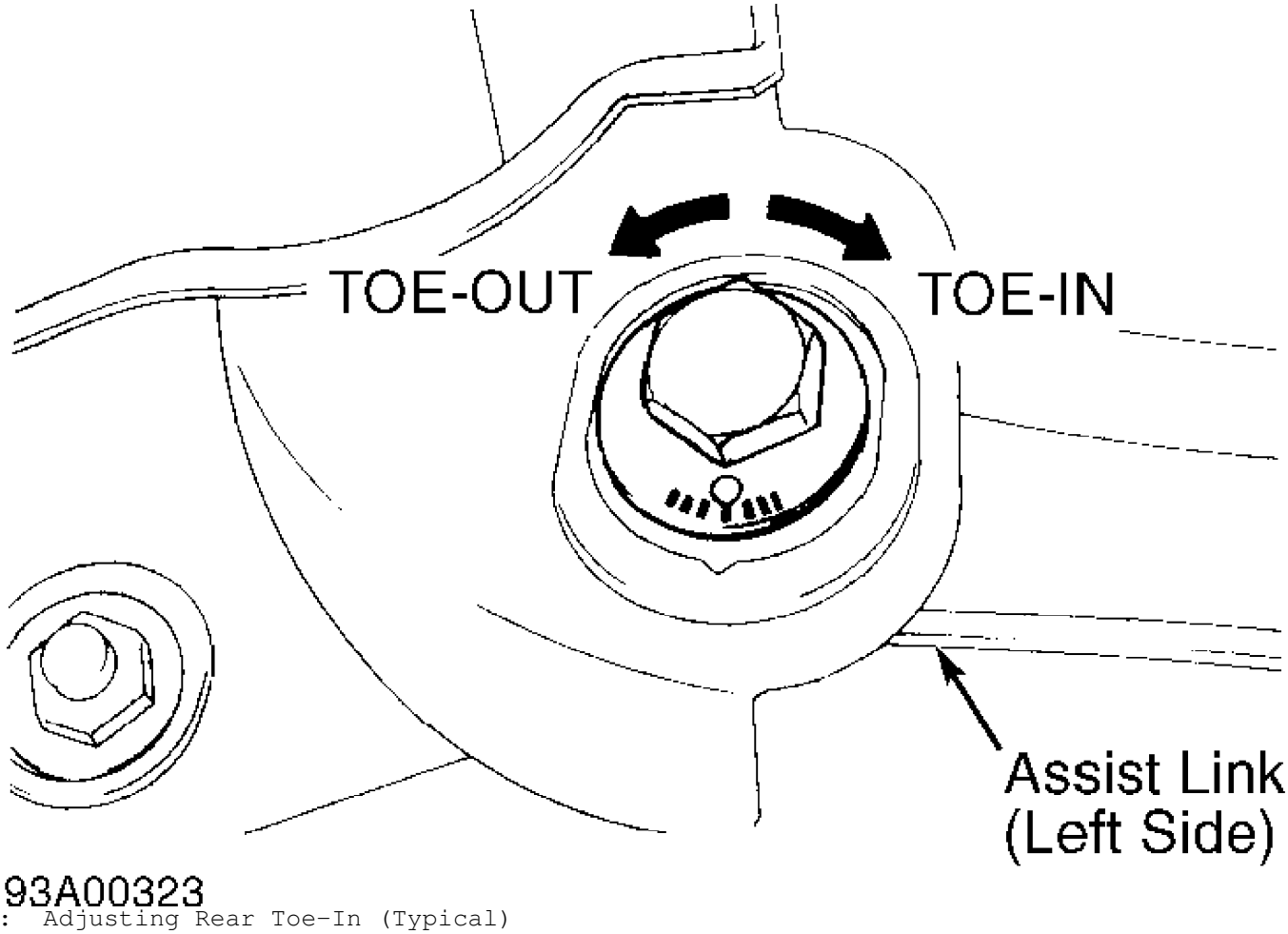


Fig. 9: Adjusting Rear Toe-In (Typical)
Courtesy of Mitsubishi Motor Sales of America.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Shock Absorber-To-Lower Control Arm Bolt	
Montero	65-76 (88-103)
Montero Sport	(1)
Upper Arm Shaft To Crossmember Nut	
Montero	80 (108)
Montero Sport	72-87 (98-118)
Wheel Lug Nut	
Diamante, Galant & Mirage	65-80 (88-108)
Eclipse & 3000GT	87-101 (118-137)
Montero	72-87 (98-118)
Montero Sport	
With 6" Wide Wheel (6JJ)	87-101 (118-137)
With 7" Wide Wheel (7JJ)	73-86 (99-117)
	INCH Lbs. (N.m)
Shock Absorber-To-Crossmember Nut	
Montero	133 (15)

Montero Sport	106-159 (12-18)

(1) - 80-124 INCH Lbs. (9-14 N.m).

WHEEL ALIGNMENT SPECIFICATIONS

WHEEL ALIGNMENT SPECIFICATIONS (DIAMANTE)

Application	Preferred	Range
Camber (1)		
Front	0	-0.5 To 0.5
Rear		
15" Wheel	-.67	-1.17 To -.17
16" Wheel	-.83	-1.33 To -.33
Caster (Front) (1)	3	2.5 To 3.5
Toe-In (1)		
Front	0	-0.24 To 0.24
Rear	0	-0.24 To 0.24
Toe-In (2)		
Front	0 (0)	-0.12 To 0.12 (-3 To 3)
Rear	0 (0)	-0.12 To 0.12 (-3 To 3)

(1) - Measurement in degrees.
(2) - Measurement in inches (mm).

WHEEL ALIGNMENT SPECIFICATIONS (ECLIPSE)

Application	Preferred	Range
2WD		
14" & 17" Wheels		
Camber (1)		
Front	-0.33	-0.83 To 0.17
Rear	-1.33	-1.83 To -0.83
Caster (1)	4.67	3.67 To 5.67
Toe-In (1)		
Front	0	-0.24 To 0.24
Rear	0.24	0 To 0.48
Toe-In (2)		
Front	0 (0)	-0.12 To 0.12 (-3 To 3)
Rear	0.12 (3)	0 To 0.24 (0 To 6)
Toe-Out On Turns (1)		
Inner	32.5	N/A
Outer	27	N/A
16" Wheel		
Camber (1)		
Front	-0.33	-0.83 To 0.17
Rear	-1.67	-2.17 To -1.17
Caster (1)	4.67	3.67 To 5.67
Toe-In (1)		
Front	0	-0.24 To 0.24
Rear	0.24	0 To 0.48
Toe-In (2)		
Front	0 (0)	-0.12 To 0.12 (-3 To 3)
Rear	0.12 (3)	0 To 0.24 (0 To 6)
Toe-Out On Turns (1)		
Inner	32.5	N/A
Outer	27	N/A
AWD		

Camber (1)		
Front	-0.33	-0.83 To 0.17
Rear	-1.33	-1.83 To -0.83
Caster (1)	4.67	3.67 To 5.67
Toe-In (1)		
Front	0 (0)	-0.12 To 0.12 (-3 To 3)
Rear	0.12 (3)	0 To 0.24 (0 To 6)
Toe-In (2)		
Front	0	-0.24 To 0.24
Rear	0.24	0 To 0.48
Toe-Out On Turns (1)		
Inner	32.5	N/A
Outer	27	N/A

(1) - Measurement in degrees.
(2) - Measurement in inches (mm).

WHEEL ALIGNMENT SPECIFICATIONS (GALANT)

Application	Preferred	Range
Camber (1)		
Front	0	-0.50 To 0.50
Rear	-1.33	-1.83 To -0.83
Caster (1)	4.33	3.83 To 4.83
Toe-In (1)		
Front	0	-0.24 To 0.24
Rear	0.24	0 To 0.48
Toe-In (2)		
Front	0 (0)	-0.12 To 0.12 (-3 To 3)
Rear	.12 (3)	0 To .24 (0 To 6)
Toe-Out On Turns (1)		
Inner	39	N/A
Outer	30.5	N/A

(1) - Measurement in degrees.
(2) - Measurement in inches (mm).

WHEEL ALIGNMENT SPECIFICATIONS (MIRAGE)

Application	Preferred	Range
Camber (1)		
Front	0	-0.5 To 0.5
Rear	-0.67	-1.17 To -0.17
Caster (1)	2.85	2.35 To 3.35
Toe-In (1)		
Front	0	-0.24 To 0.24
Rear	0.24	0.08 To 0.40
Toe-In (2)		
Front	0 (0)	-0.12 To 0.12 (-3 To 3)
Rear	0.12 (3)	0.04 To 0.20 (1 To 5)
Toe-Out On Turns (1)		
Inner	37.3	N/A
Outer	31	N/A

(1) - Measurement in degrees.
(2) - Measurement in inches (mm).

WHEEL ALIGNMENT SPECIFICATIONS (MONTERO)

Application	Preferred	Range
Camber (1)		
Front	0.67	0.17 To 1.17
Caster (1)	3	2 To 4
Toe-In (1)		
Front	0.28	0 To 0.56
Toe-In (2)		
Front	0.14 (3.5)	0 To 0.28 (0 To 7)
Toe-Out On Turns (1)		
Inner	21.93	N/A
Outer	20	N/A

(1) - Measurement in degrees.
(2) - Measurement in inches (mm).

WHEEL ALIGNMENT SPECIFICATIONS (MONTERO SPORT)

Application	Preferred	Range
Camber		
Front (1)	0.67	0.17 To 1.17
Caster (1)	2.67	1.67 To 3.67
Toe-In (1)		
Front	0.28	0 To 0.56
Toe-In (2)		
Front	0.14 (3.5)	0 To 0.28 (0 To 7)

(1) - Measurement in degrees.
(2) - Measurement in inches (mm).

WHEEL ALIGNMENT SPECIFICATIONS (3000GT)

Application	Preferred	Range
Camber (1)		
Front	0	-0.5 To 0.5
Rear		
FWD	0	-0.5 To 0.5
AWD	-0.17	-0.67 To 0.33
Caster (1)	3.92	3.42 To 4.42
Toe-In (1)		
Front	0	-0.24 To 0.24
Rear	-0.02	-0.16 To 0.20
Toe-In (2)		
Front	0 (0)	-0.12 To 0.12 (-3 To 3)
Rear	0.01 (0.5)	-0.08 To 0.10 (-2 To 3)
Toe-Out On Turns (1)		
Inner	33.75	N/A
Outer	28.35	N/A

(1) - Measurement in degrees.
(2) - Measurement in inches (mm).

WIPER/WASHER SYSTEM

1998 Mitsubishi Galant

1998 ACCESSORIES & EQUIPMENT
Mitsubishi - Wiper/Washer Systems

Diamante, Eclipse, Galant, Mirage, Montero, Montero Sport, 3000GT

DESCRIPTION & OPERATION

All models are equipped with a 2-speed wiper motor with an optional intermittent wiper feature. Some models are equipped with a rear wiper/washer.

Galant is equipped with a wiper system that varies intermittent setting speed with vehicle speed. System uses ignition switch, wiper switch, intermittent switch, washer switch, vehicle speed sensor, and Electronic Time Alarm Control System (ETACS) ECU.

COMPONENT LOCATIONS

COMPONENT LOCATIONS TABLE

Component	Location
Assist-ECU (Diamante)	Above Right Kick Panel
ETACS-ECU	Behind Left Side Of Dash
Wiper Relay	
Front	
Except Diamante & 3000GT	Integral With Steering Column Switch
Rear	
Eclipse	Within Rear Wiper/Washer Switch
Montero & Montero Sport	On Relay Block, Behind Left Side Of Dash
3000GT	Behind Left Rear Quarter Panel

ADJUSTMENTS

FRONT WIPER ARM ADJUSTMENT

Ensure wiper motor is in park position. Position wiper arm and blade assembly so tip of blade is specified distance above front window trim. See FRONT WIPER ADJUSTMENT SPECIFICATIONS table.

FRONT WIPER ADJUSTMENT SPECIFICATIONS TABLE

Model	Driver's Side In. (mm)	Passenger's Side In. (mm)
Diamante	2.56-3.15 (65-80)	.79-1.38 (20-35)
Eclipse	.19-.59 (5-15)	1.65-2.05 (42-52)
Galant	.39-.79 (10-20)	.39-.79 (10-20)
Mirage	.79-1.18 (20-30)	.79-1.18 (20-30)
Montero	.98-1.38 (25-35)	1.38-1.77 (35-45)
Montero Sport	.98-1.20 (25-31)	1.20-1.50 (31-38)
3000GT	.59-.79 (15-20)	.59-.79 (15-20)

REAR WIPER ARM ADJUSTMENT

NOTE: Diamante, Galant and Mirage are not equipped with rear wipers.

Ensure wiper motor is in park position. Position wiper arm and blade assembly so tip of blade is specified distance from edge of window. See REAR WIPER ADJUSTMENT SPECIFICATIONS table.

REAR WIPER ADJUSTMENT SPECIFICATIONS TABLE

Model	In. (mm)
Eclipse	4.98-5.38 (125-135)
Montero & Montero Sport	2.56-2.95 (65-75)
3000GT	(1)

(1) - Position blade tip along ceramic edge of window.

COMPONENT TESTS

* PLEASE READ THIS FIRST *

NOTE: For headlight washer switch testing on Montero, see STEERING COLUMN SWITCHES article.

WASHER MOTOR TEST (FRONT & REAR)

1) Ensure washer reservoir fluid is at proper level. Turn ignition switch to ON position. Press washer button on wiper/washer switch. If fluid does not spray on windshield, turn ignition off. Check for plugged washer hoses from washer reservoir to windshield nozzle. Repair as necessary.

2) If washer hoses are not plugged, disconnect washer motor electrical connector. Check for poor connection or connector damage. Repair as necessary. If connector is okay, connect battery power to washer motor terminals. Washer motor should operate. Replace motor as necessary.

FRONT WIPER MOTOR TEST

Checking Wiper Motor Operation

Disconnect wiring connector from wiper motor. Connect battery voltage to wiper motor connector as shown, and ensure wiper motor operates at low and high speeds. See Fig. 1 or 2. Replace motor as necessary.

Checking Automatic Stop

1) Operate wiper motor at low speed. See Fig. 1 or 2. Disconnect battery voltage during operation to stop motor.

2) Using a jumper wire, connect terminals as shown. See Fig. 1 or 2. Connect 12 volts to indicated terminal, and ground wiper motor bracket. Ensure wiper arm is correctly parked. Replace motor as necessary.

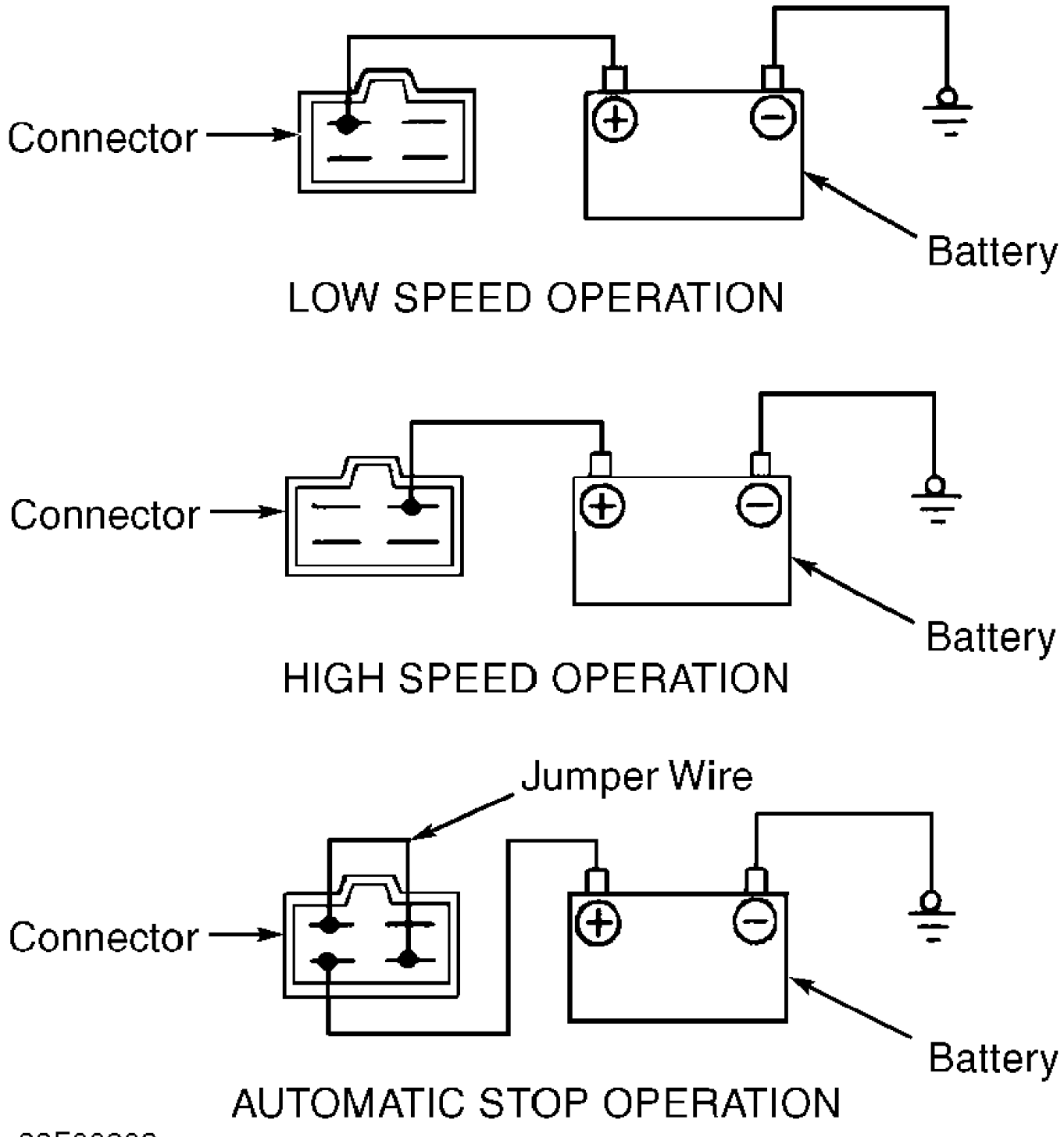


Fig. 1: Checking Front Wiper Motor Operation (Except Eclipse)
Courtesy of Mitsubishi Motor Sales of America

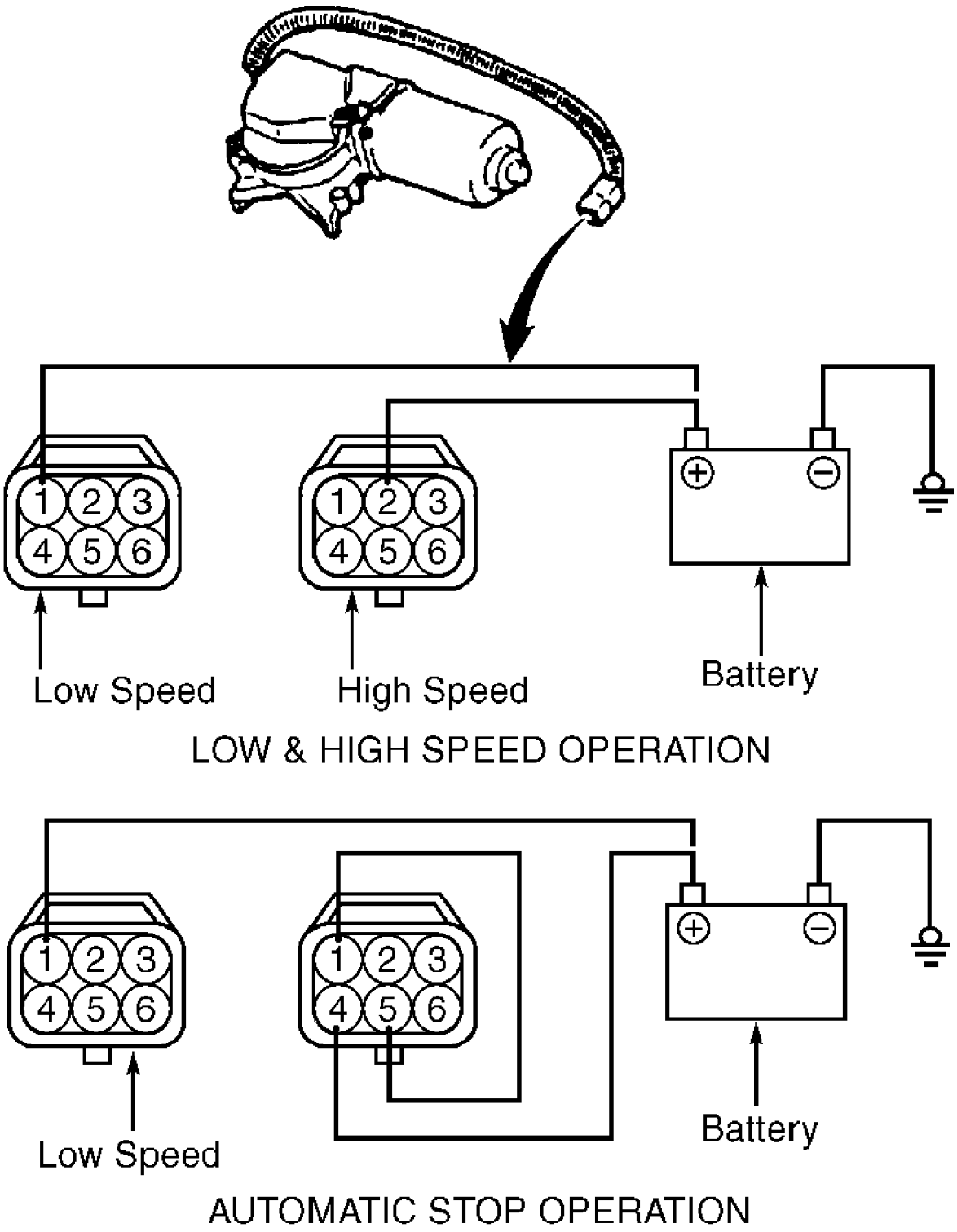


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Fig. 2: Checking Front Wiper Motor Operation (Eclipse)
Courtesy of Mitsubishi Motor Sales of America

INTERMITTENT WIPER RELAY (FRONT) TEST

NOTE: On Diamante, assist-ECU controls wiper circuit. On all models except 3000GT, intermittent wiper relay is incorporated into wiper switch. Information on testing is not available from manufacturer at time of publication.

Continuity & Voltage Check (3000GT)

1) Disconnect column switch connector. Ensure continuity is present between terminals No. 5 and 11, and between terminals No. 6 and 10. See Fig. 3. Ensure there is no continuity between terminals No. 6 and 11.

2) Connect battery voltage to relay terminal No. 5 and ground terminal No. 11. Battery voltage should be present on terminal No. 6. Replace relay if continuity and voltage is not as specified.

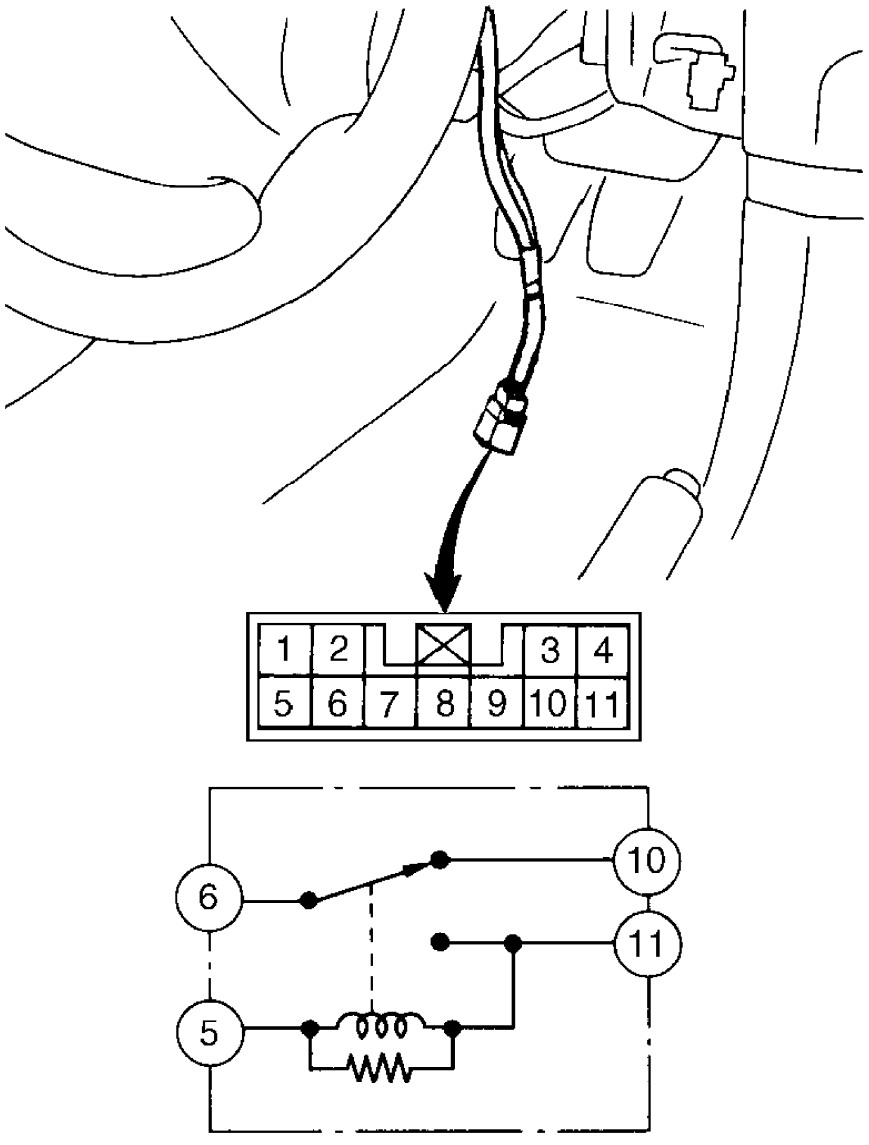

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Fig. 3: Identifying Front Wiper Relay Terminals (3000GT)
Courtesy of Mitsubishi Motor Sales of America

FRONT WIPER SWITCH TEST

NOTE: Front wiper switch is part of combination switch on steering column. For diagnosis, see STEERING COLUMN SWITCHES article.

REAR WIPER MOTOR TEST

Operational Check

Disconnect wiring connector from wiper motor. Connect battery voltage to wiper motor connector as shown, and ensure motor housing is grounded. Motor should run at low and high speed. See Fig. 4, 5, 6 or 7. Replace motor as necessary.

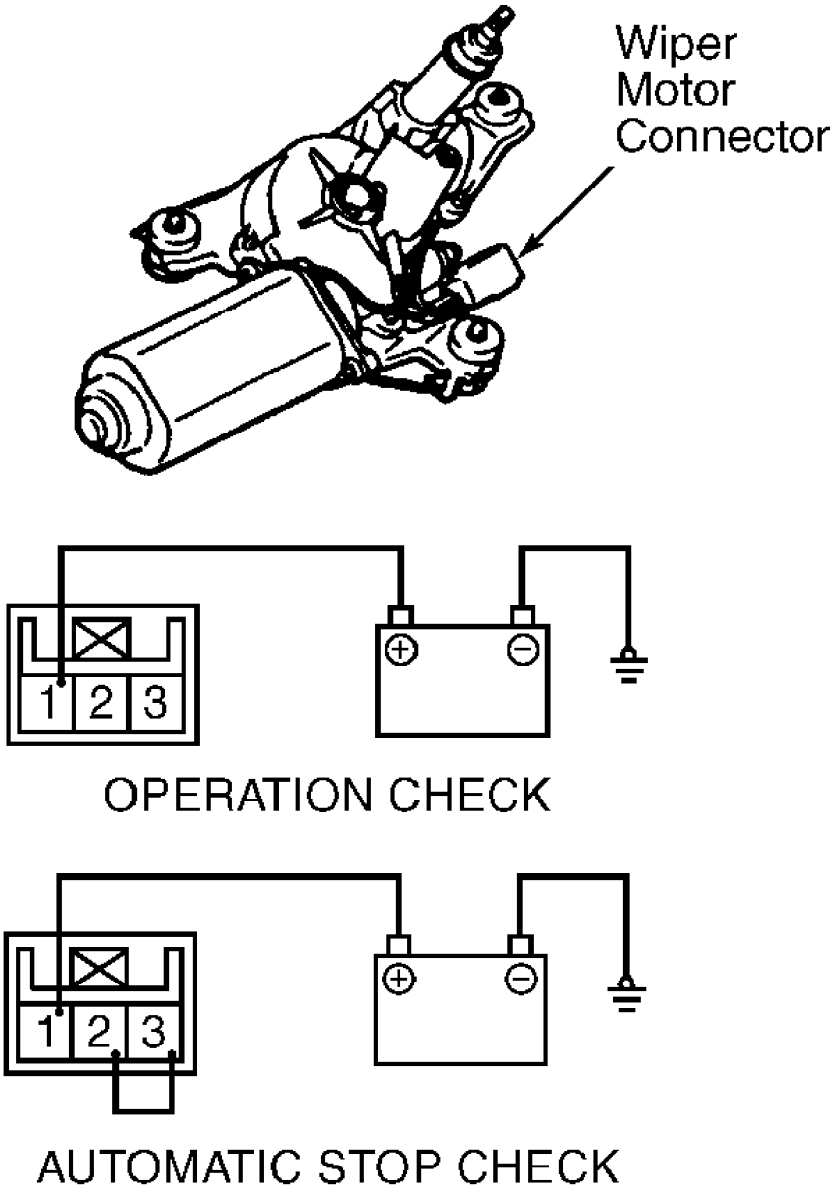

Fig. 4: Checking Rear Wiper Motor Operation & Automatic Stop (Eclipse)
Courtesy of Mitsubishi Motor Sales of America

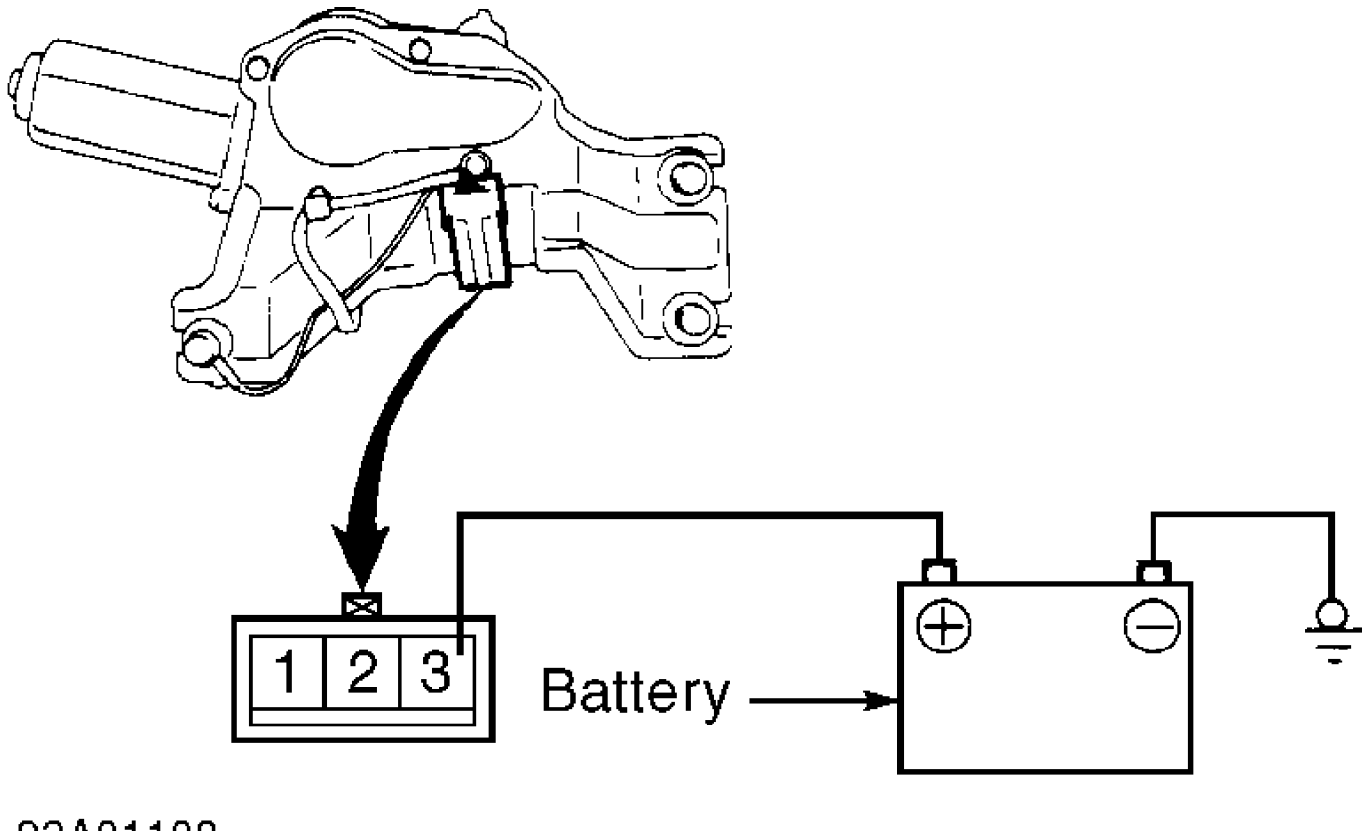

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Fig. 5: Checking Rear Wiper Motor Operation (Montero)
Courtesy of Mitsubishi Motor Sales of America

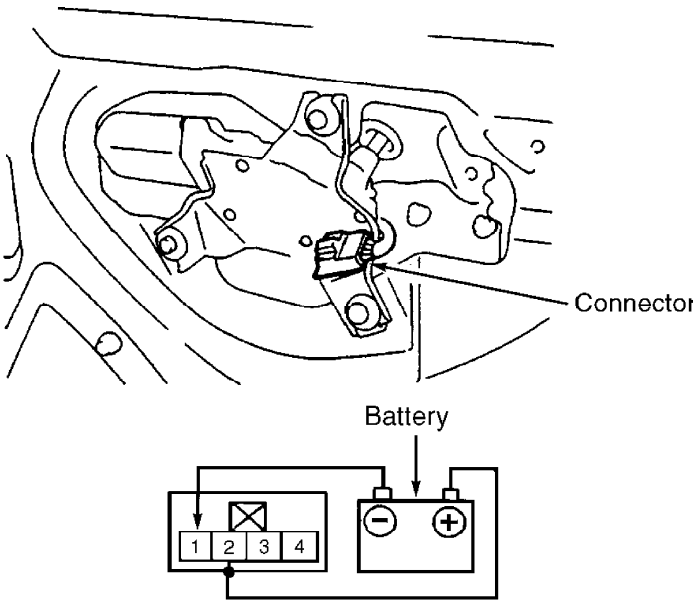

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Fig. 6: Checking Rear Wiper Motor Operation (Montero Sport)
Courtesy of Mitsubishi Motor Sales of America

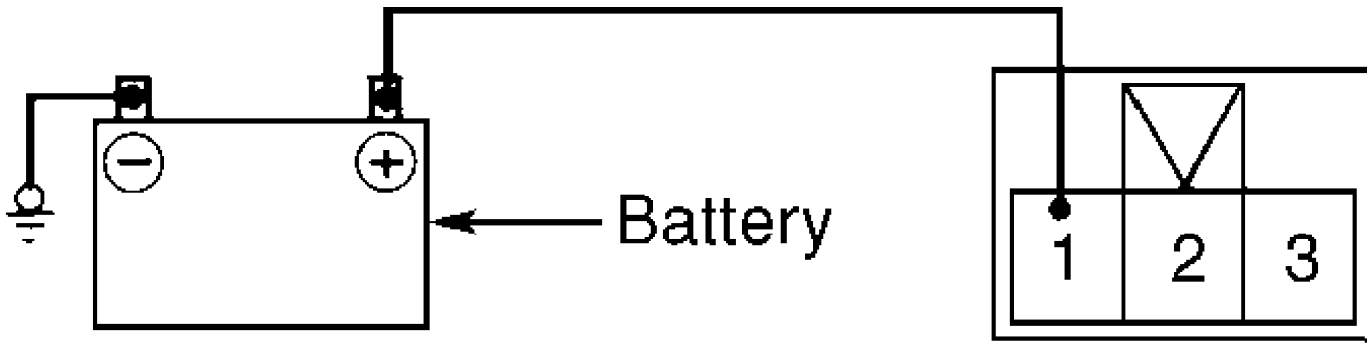


Fig. 7: Checking Rear Wiper Motor Operation (3000GT)
Courtesy of Mitsubishi Motor Sales of America

Automatic Stop Check

Operate wiper motor, and then disconnect wiring connector from wiper motor to stop motor operation at a point other than park position. Connect battery voltage and jumper wire to wiper motor connector as shown, and ensure motor housing is grounded. See Fig. 4, 8, 9 or 10. Motor should return to park position. Replace motor as necessary.

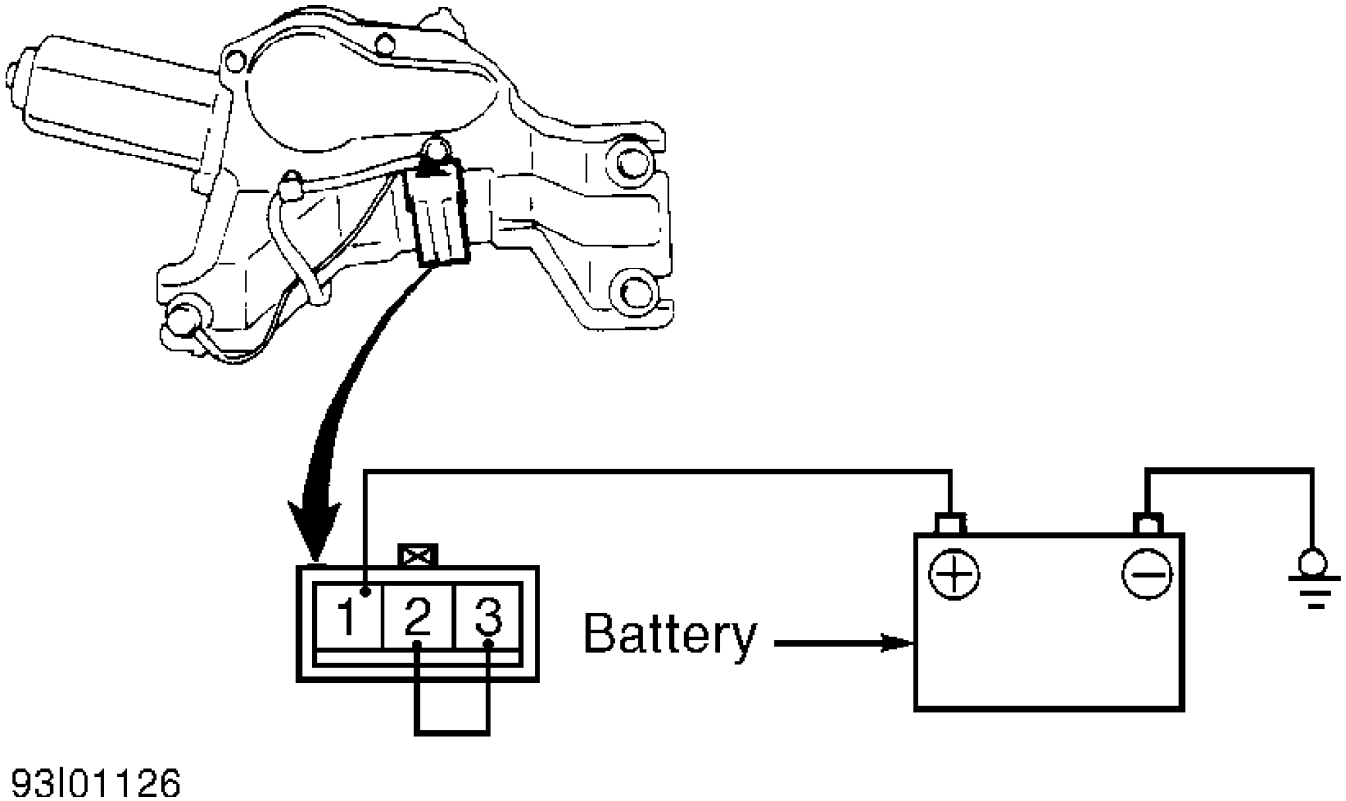


Fig. 8: Checking Rear Wiper Motor Automatic Stop (Montero)
Courtesy of Mitsubishi Motor Sales of America

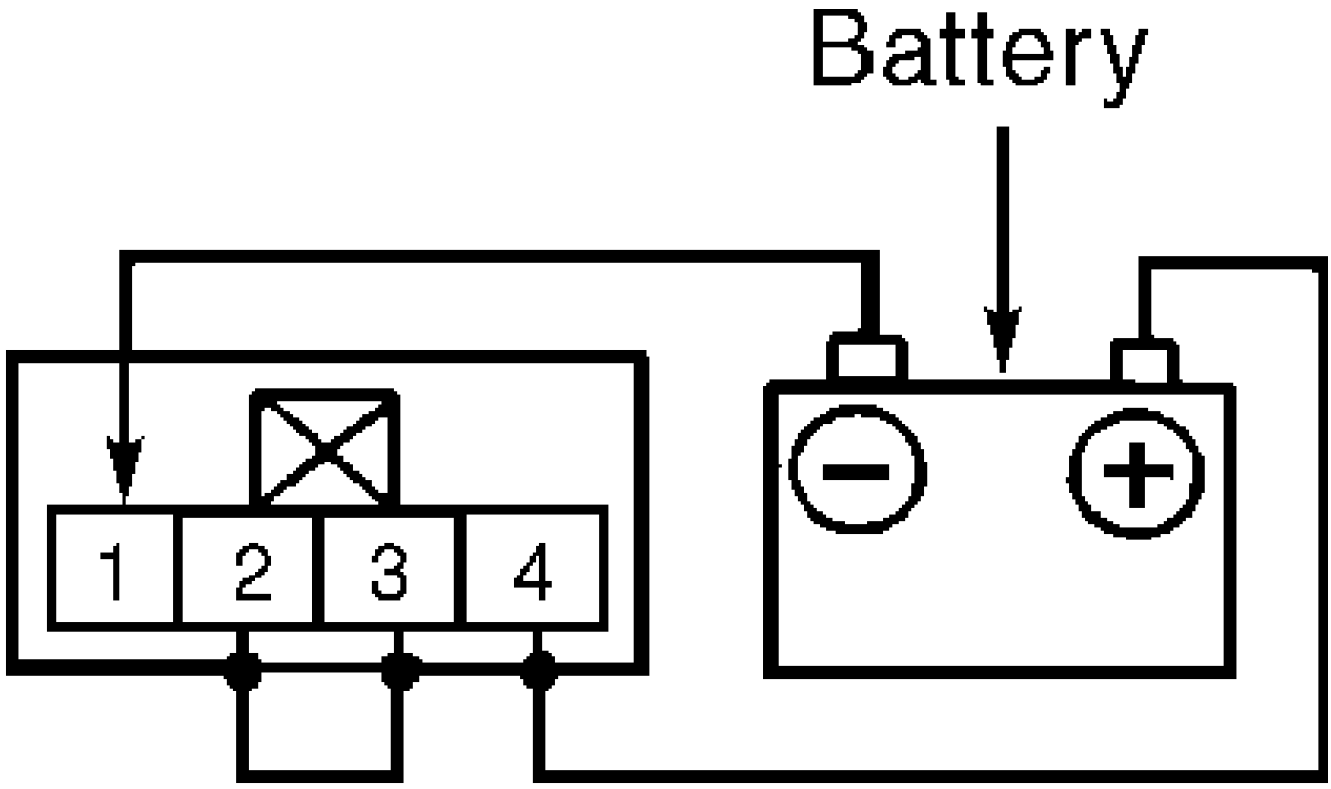


Fig. 9: Checking Rear Wiper Motor Automatic Stop (Montero Sport)
Courtesy of Mitsubishi Motor Sales of America

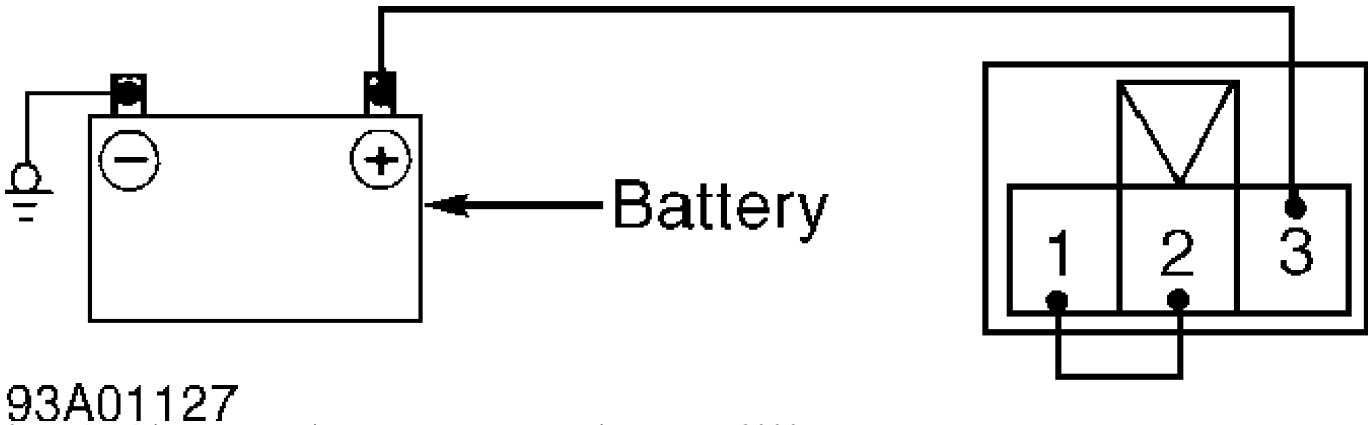


Fig. 10: Checking Rear Wiper Motor Automatic Stop (3000GT)
Courtesy of Mitsubishi Motor Sales of America

REAR WIPER RELAY TEST

NOTE: Rear wiper relay test information for Eclipse is not available from manufacturer at time of publication.

Operational Check (Montero)
1) Relay is located in relay box under left side of dash. Remove relay from lower right corner of relay box. Connect positive

voltmeter lead to terminal No. 2. Connect negative voltmeter lead to terminal No. 7. Ensure battery voltage is present, when battery voltage is connected to terminals No. 4 and 8, and terminal No. 7 is grounded. See Fig. 12.

2) With voltmeter connected to terminals No. 2 and 7, ensure battery voltage is present for intermittent periods of 8 seconds when positive battery terminal is connected to terminals No. 4 and 5, and negative battery terminal is connected to terminal No. 7.

3) With voltmeter connected to terminals No. 2 and 7, ensure battery voltage is present when positive battery terminal is connected to terminals No. 4 and 6, and negative battery terminal is connected to terminal No. 7. Replace relay if voltage is not as specified.

Operational Check (Montero Sport)

1) Relay is located in relay box under left side of dash. Remove relay from lower left corner of relay box. Check for continuity between terminals No. 1 and 2. See Fig. 12. Continuity should exist.

2) Connect terminals No. 4 and 5 to positive battery terminal. Ensure battery voltage is present at terminal No. 2 for intermittent periods of 8 seconds when terminal No. 7 is connected to negative battery terminal. Replace relay if voltage is not as specified.

Operational Check (3000GT)

Remove quarter trim. Leave intermittent relay connected to wiring harness. Operate rear wiper and check voltage at terminal No. 2. See Fig. 11. Zero volts should be present when rear wiper stops. There should be 12 volts when rear wiper operates.

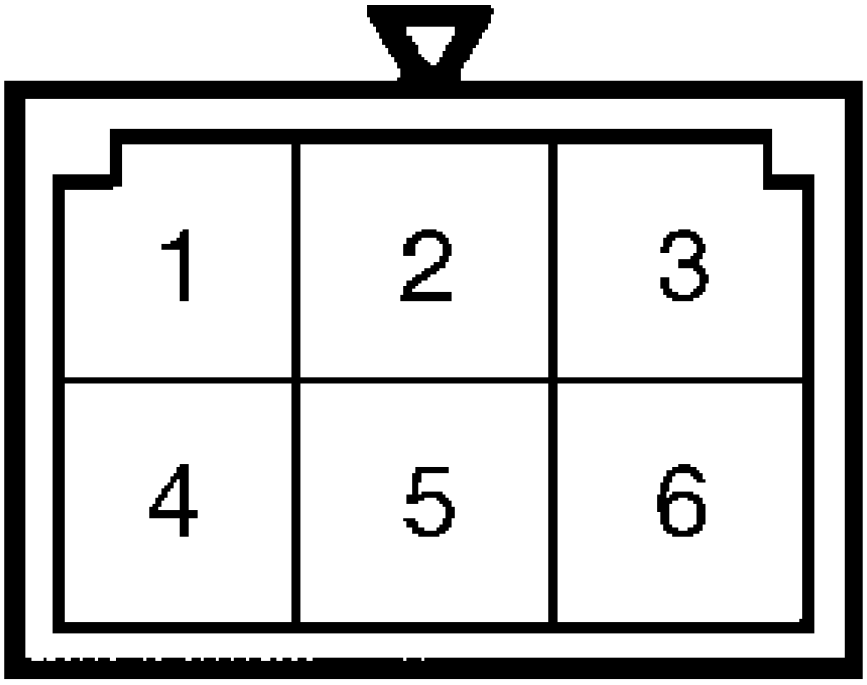


Fig. 11: Identifying Rear Wiper Relay Terminals (3000GT)
Courtesy of Mitsubishi Motor Sales of America

REAR WIPER SWITCH TEST

Eclipse

1) Remove wiper switch from instrument panel and disconnect wiper switch wiring connector. Place wiper switch in OFF position. Continuity should exist between terminals No. 5 and 6. See Fig. 12. Place wiper switch in LO position. Continuity should exist between terminals No. 6 and 7.

2) Place wiper switch in INT position. Continuity should exist between terminals No. 3 and 7, and between terminals No. 5 and 6. Depress washer switch. Continuity should exist between terminals No. 7 and 8. Continuity between terminals No. 1 and 4 should exist in all positions (light circuit). Replace wiper switch if continuity is not as specified.

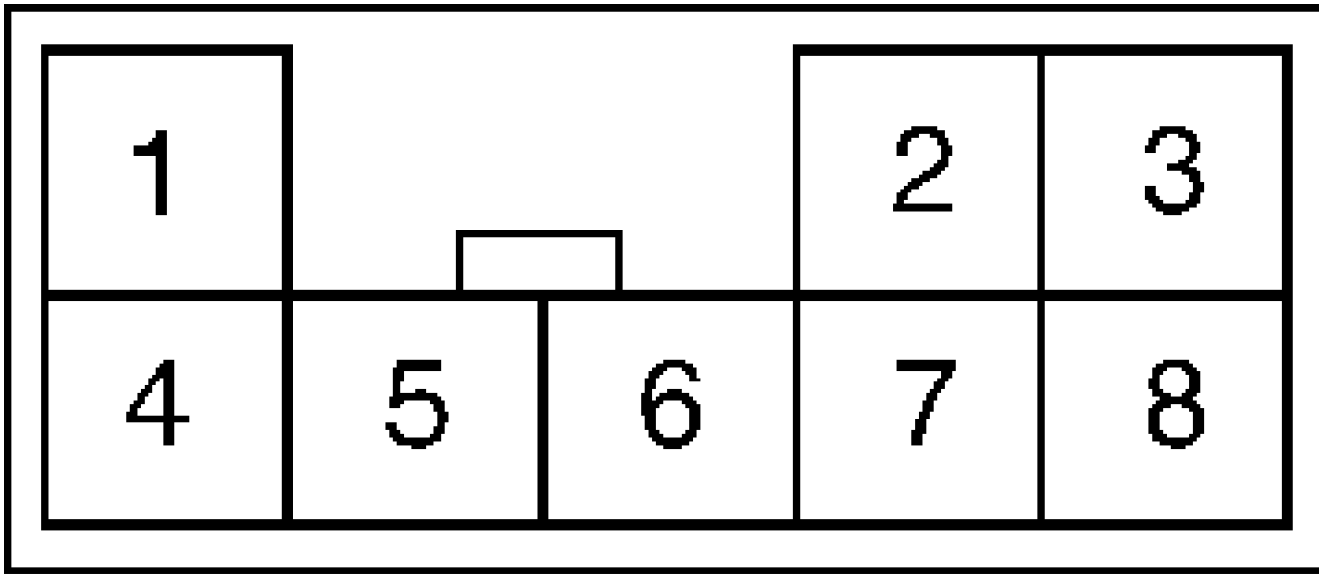
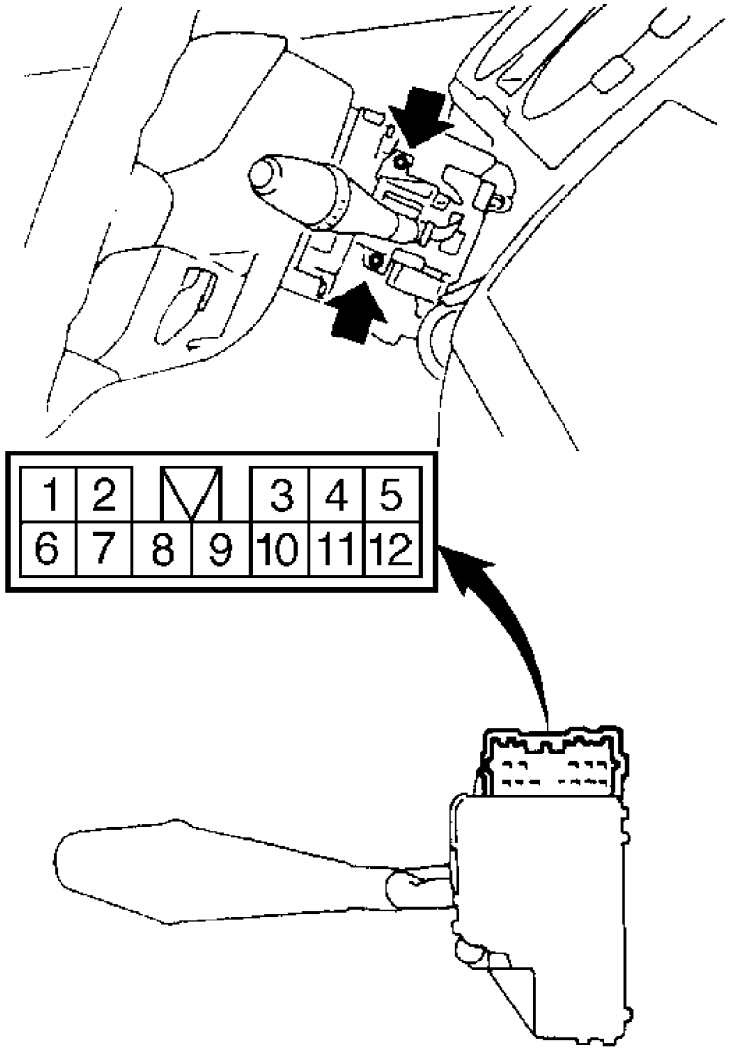


Fig. 12: Identifying Rear Wiper Switch & Relay Terminals
Courtesy of Mitsubishi Motor Sales of America

Montero & Montero Sport

Remove lower column cover. Remove upper column cover. Loosen screws indicated by arrow in illustration. See Fig. 13. Remove rear wiper/washer switch. Operate switch and check continuity according to illustration. See Fig. 13.



Switch position		Terminal			
		2	3	4	10
Wiper switch	OFF				
	INT		○		○
	ON			○	○
Washer switch	ON	○			○

96G06948

Fig. 13: Inspecting Rear Wiper/Washer Switch (Montero Shown; Montero Sport Is Similar)
Courtesy of Mitsubishi Motor Sales of America

1) Remove wiper switch from instrument panel and disconnect wiper switch. Place wiper switch in OFF position. Continuity should exist between terminals No. 4 and 5. See Fig. 12. Place wiper switch in ON position. Continuity should exist between terminals No. 5 and 6.

2) Place wiper switch in INT position. Continuity should exist between terminals No. 4 and 5, and between terminals No. 7 and 8. Depress washer switch. Continuity should exist between terminals No. 2 and 6. Continuity between terminals No. 1 and 3 should exist in all positions (light circuit).

REMOVAL & INSTALLATION

FRONT WIPER MOTOR

Removal & Installation

Remove wiper motor bolts. Pull motor out slightly. Disconnect wiper linkage from motor assembly and remove motor. To install, reverse removal procedure.

FRONT WIPER SWITCH

NOTE: Front wiper switch is part of combination switch on steering column. See STEERING COLUMN SWITCHES article.

REAR WIPER MOTOR

Removal & Installation

Remove wiper blade and arm assembly. Remove tailgate trim, 2 bolts and wiper motor. To install, reverse removal procedure. Ensure grommet is in good condition.

REAR WIPER SWITCH

Removal & Installation

Pry rear wiper switch from instrument panel and disconnect wiper switch wiring connector. To install switch, reverse removal procedure.

WIRING DIAGRAMS

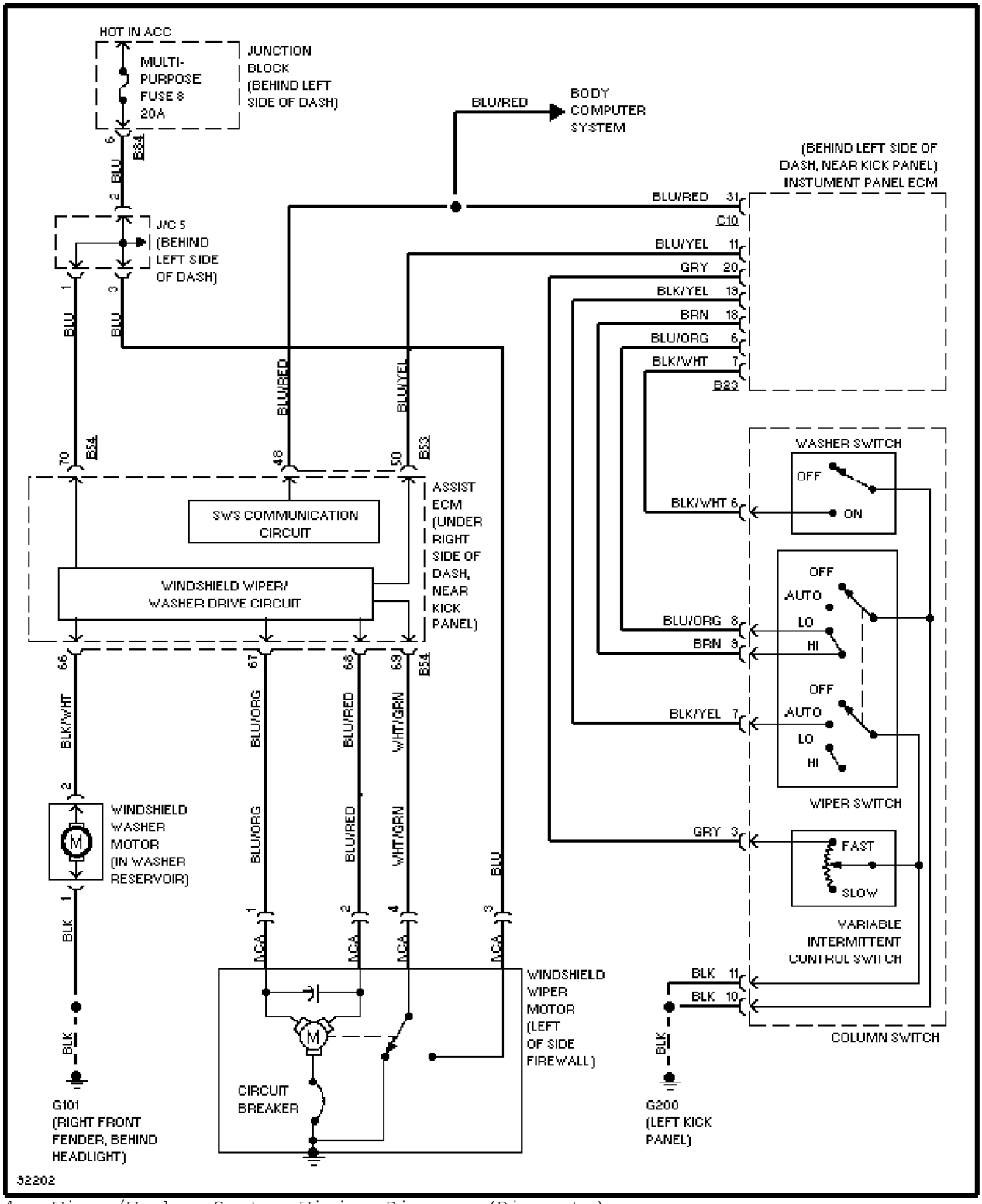


Fig. 14: Wiper/Washer System Wiring Diagram (Diamante)

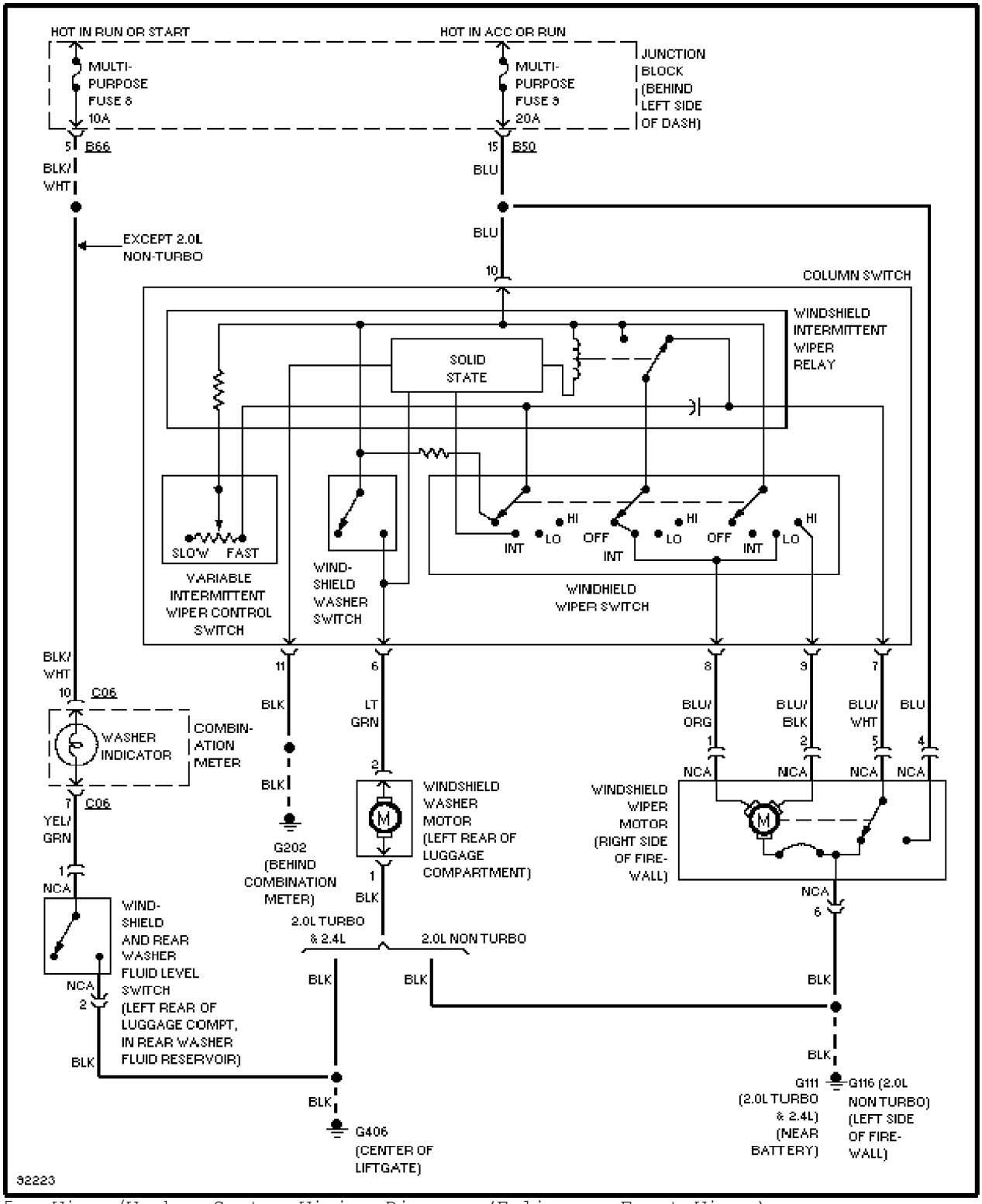


Fig. 15: Wiper/Washer System Wiring Diagram (Eclipse - Front Wiper)

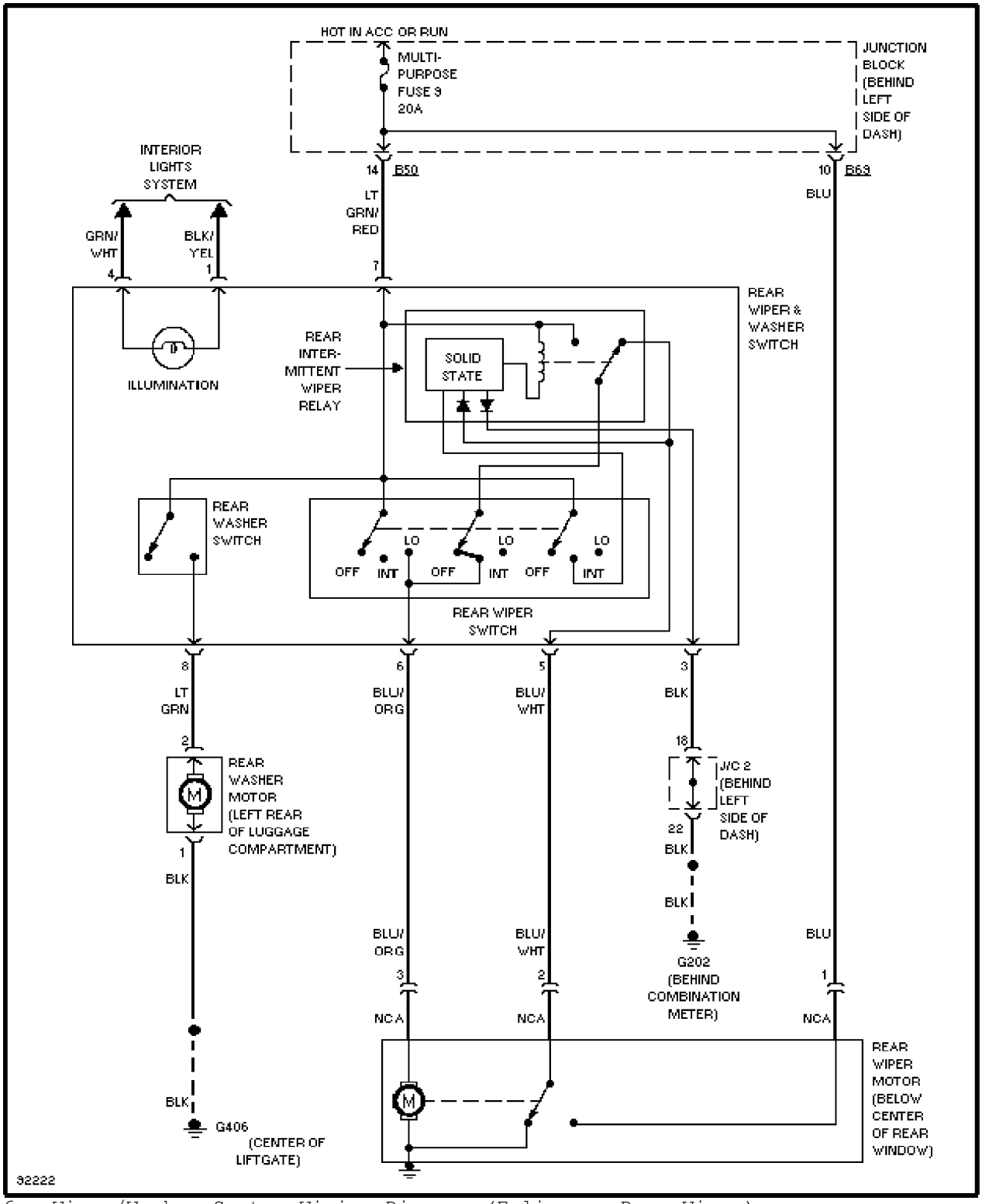


Fig. 16: Wiper/Washer System Wiring Diagram (Eclipse - Rear Wiper)

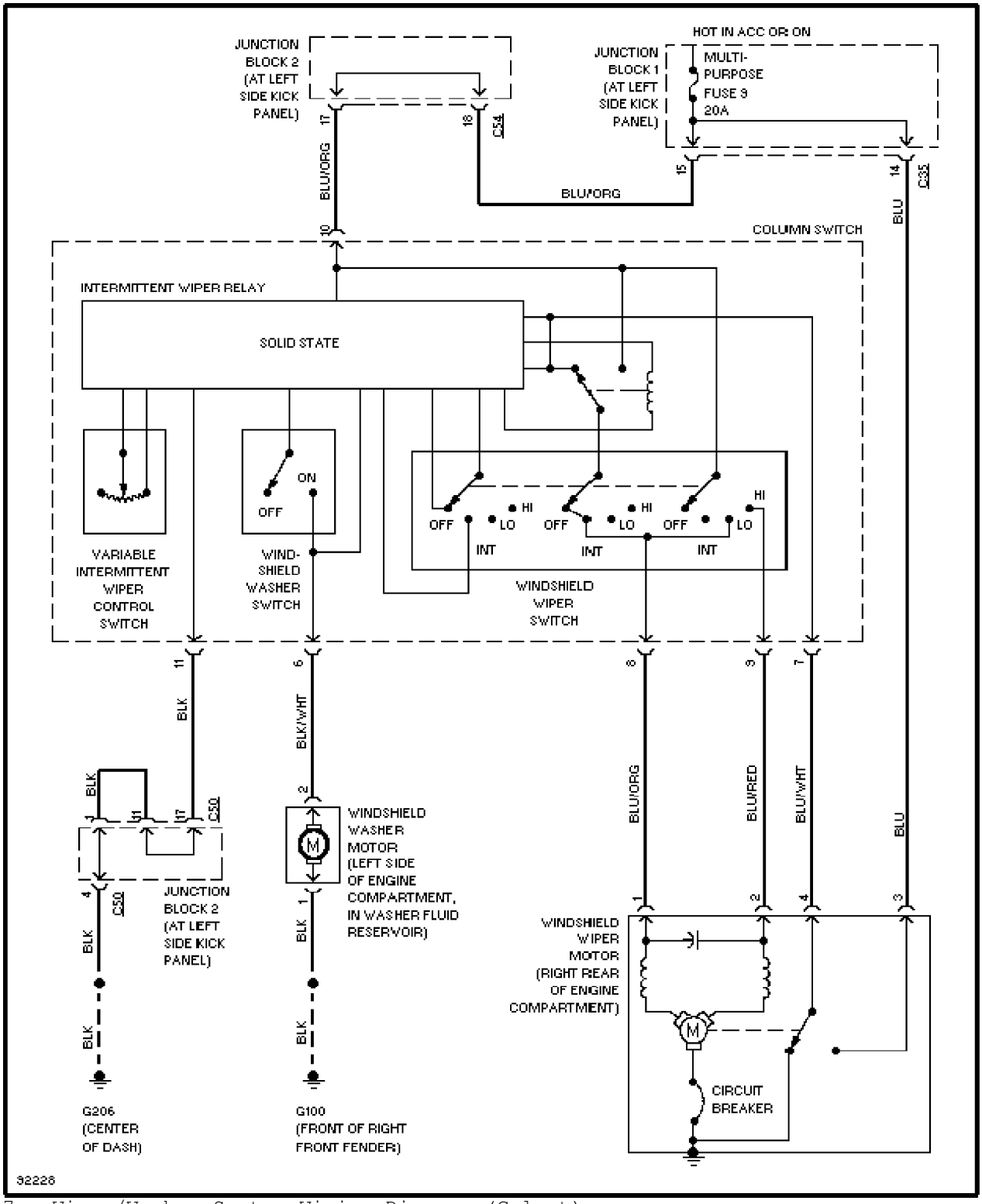


Fig. 17: Wiper/Washer System Wiring Diagram (Galant)

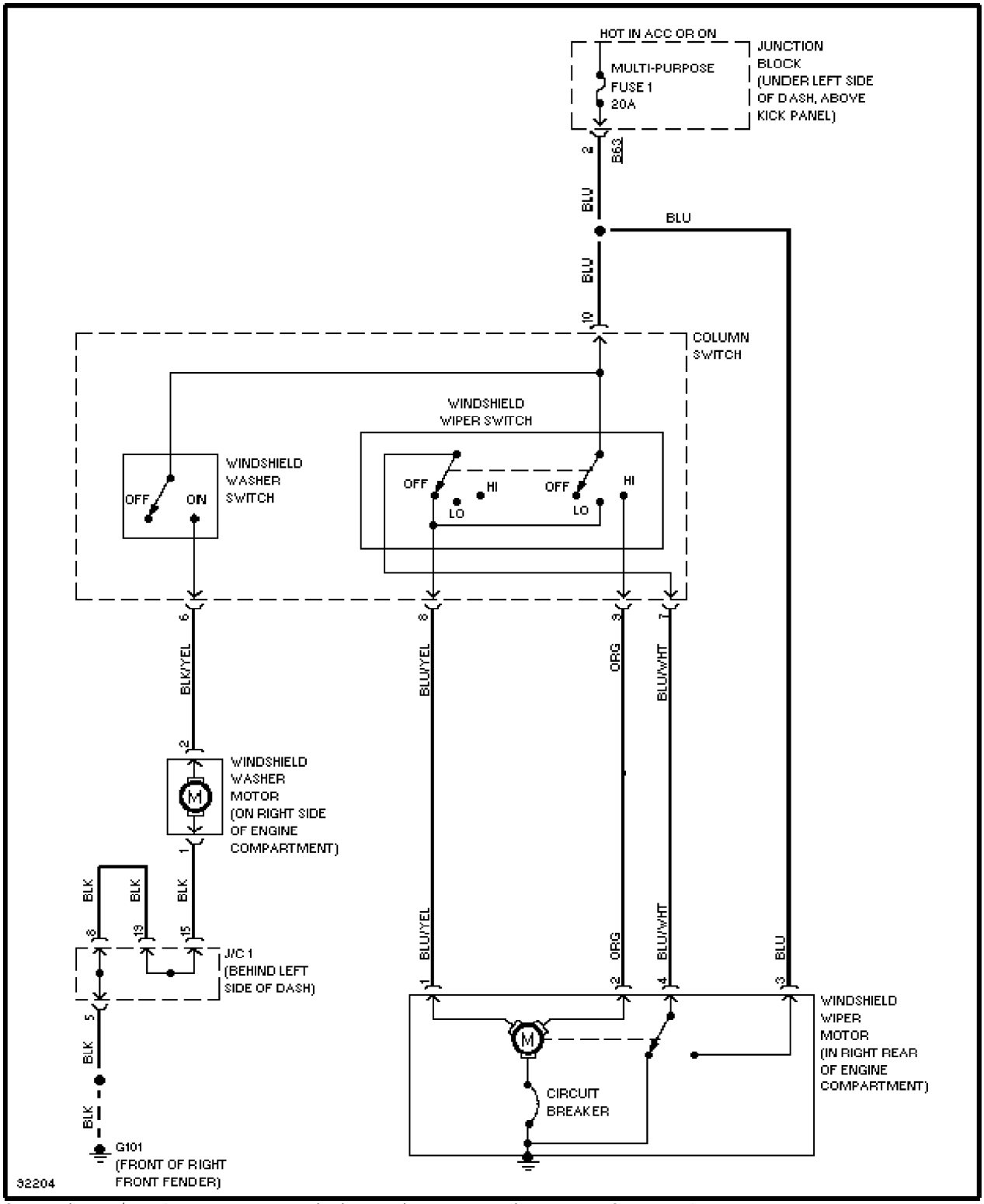


Fig. 18: Wiper/Washer System Wiring Diagram (Mirage - 2-Speed)

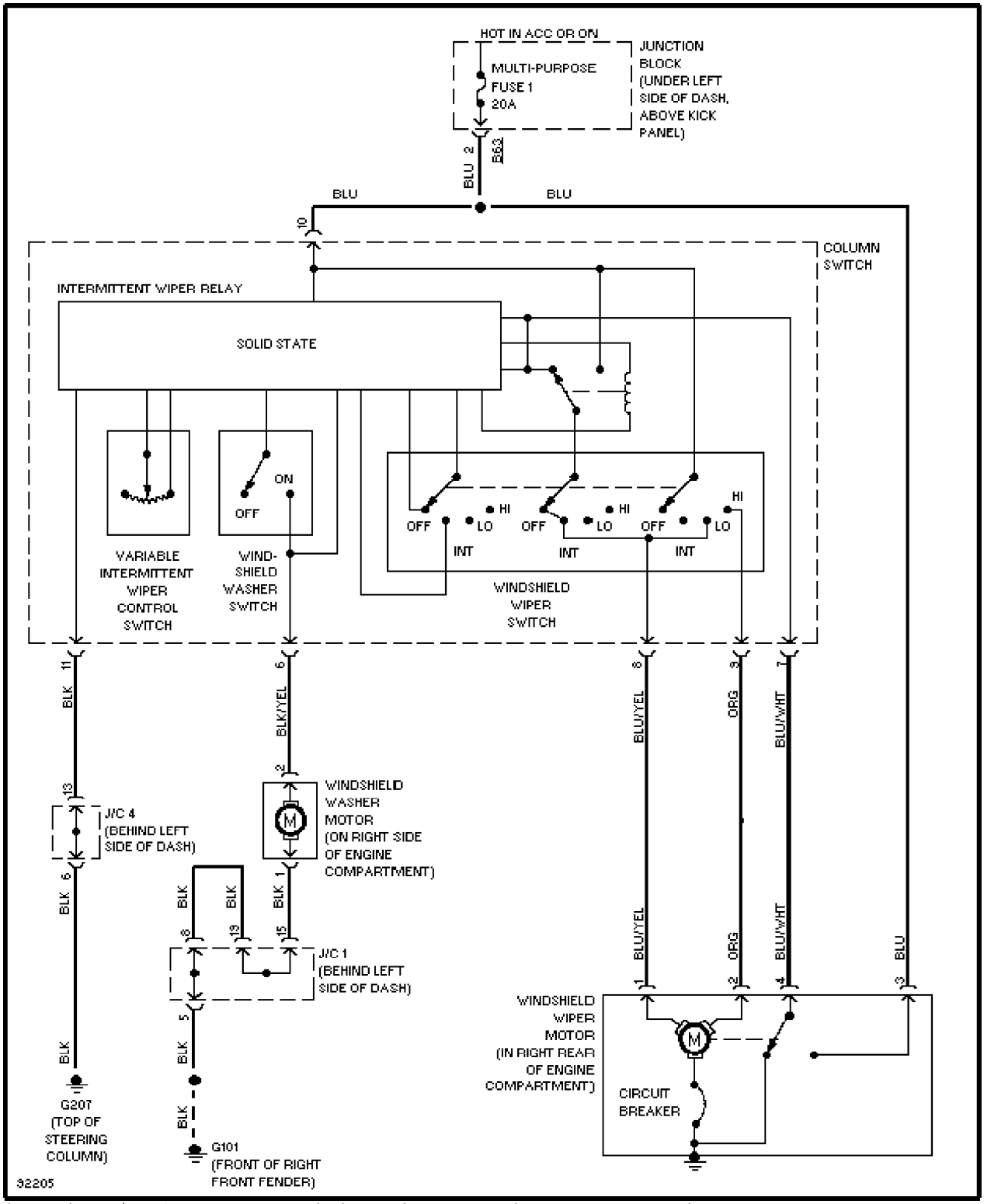


Fig. 19: Wiper/Washer System Wiring Diagram (Mirage - Intermittent)

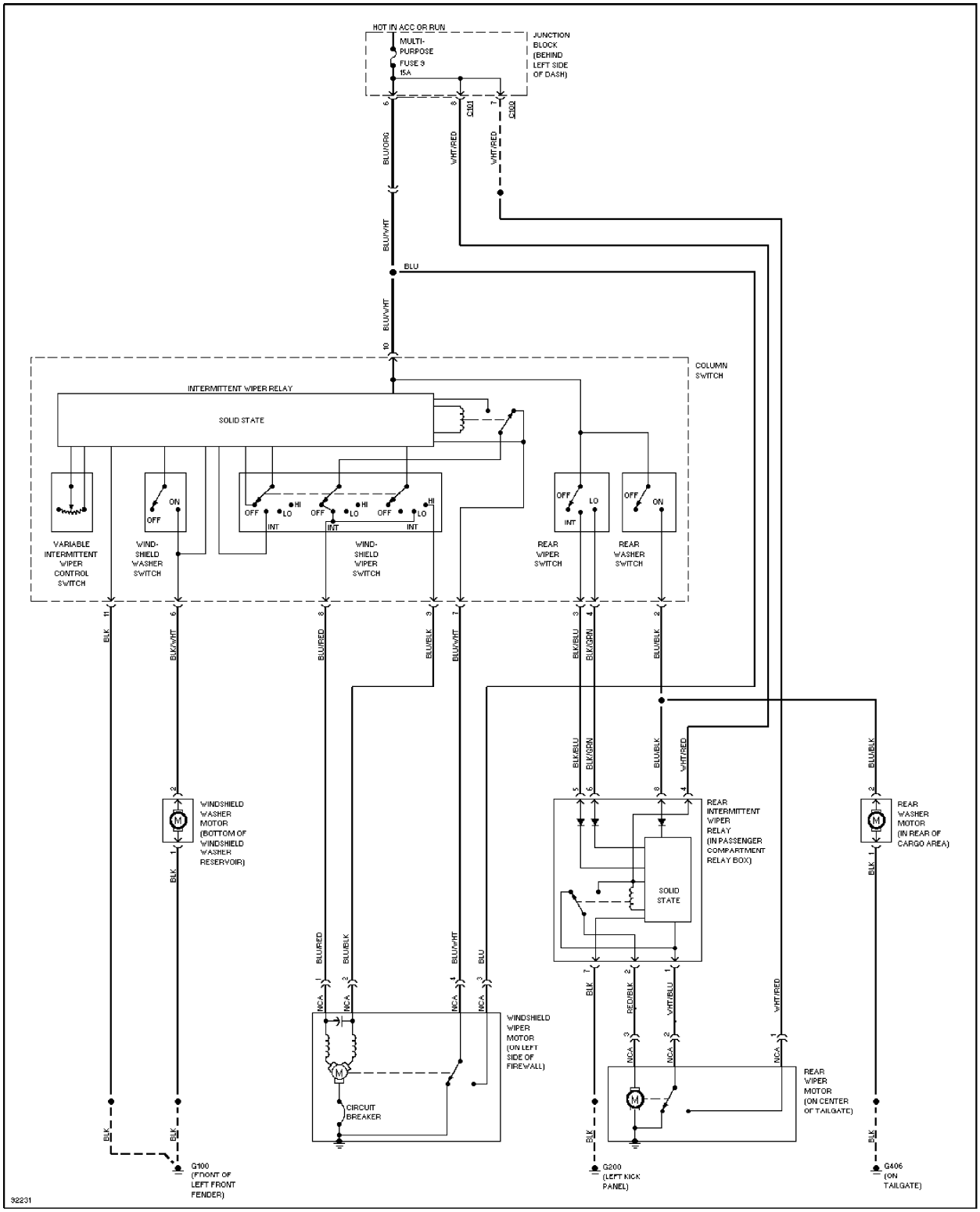


Fig. 20: Wiper/Washer System Wiring Diagram (Montero - Front & Rear Wipers)

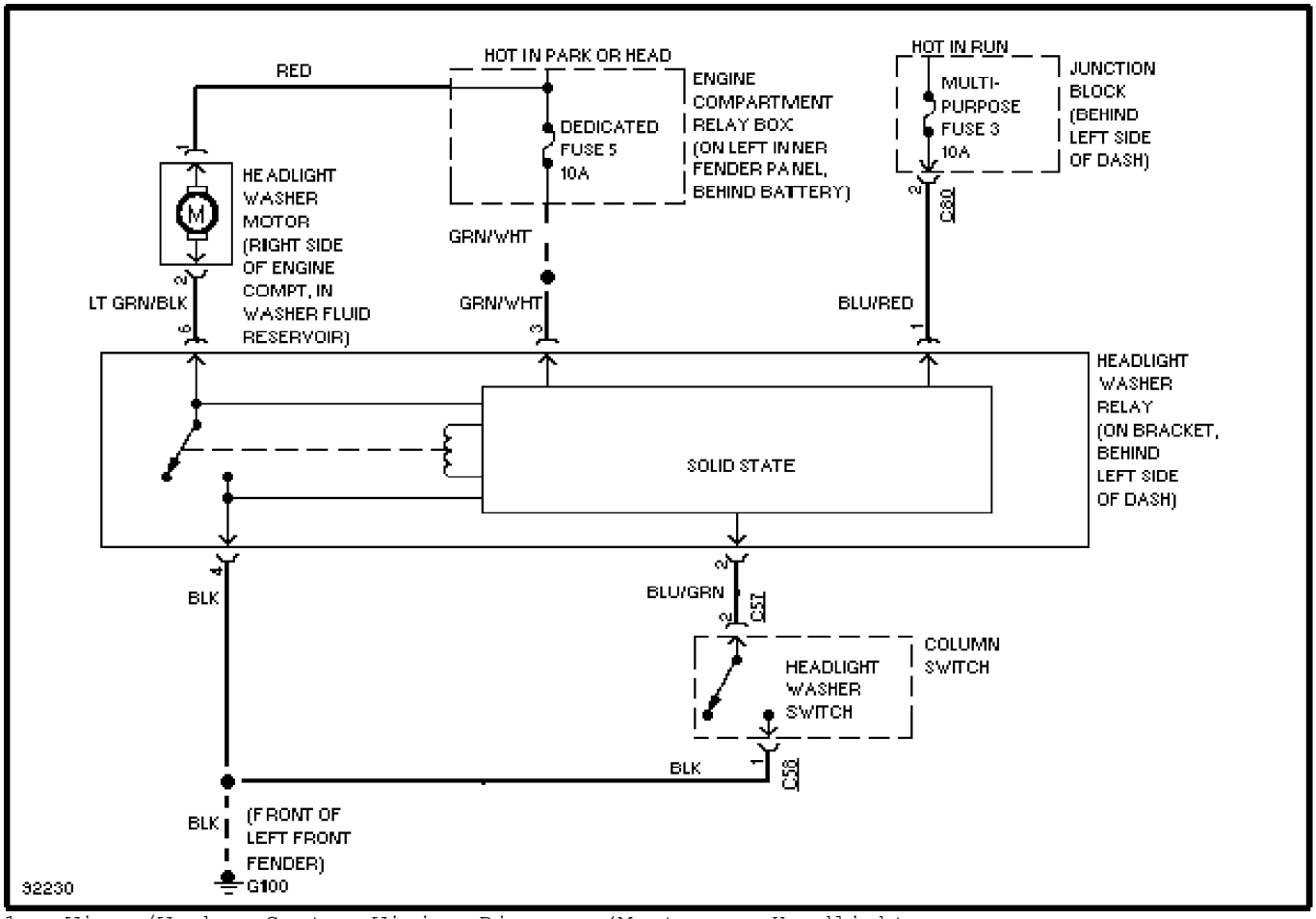


Fig. 21: Wiper/Washer System Wiring Diagram (Montero - Headlight Washers)

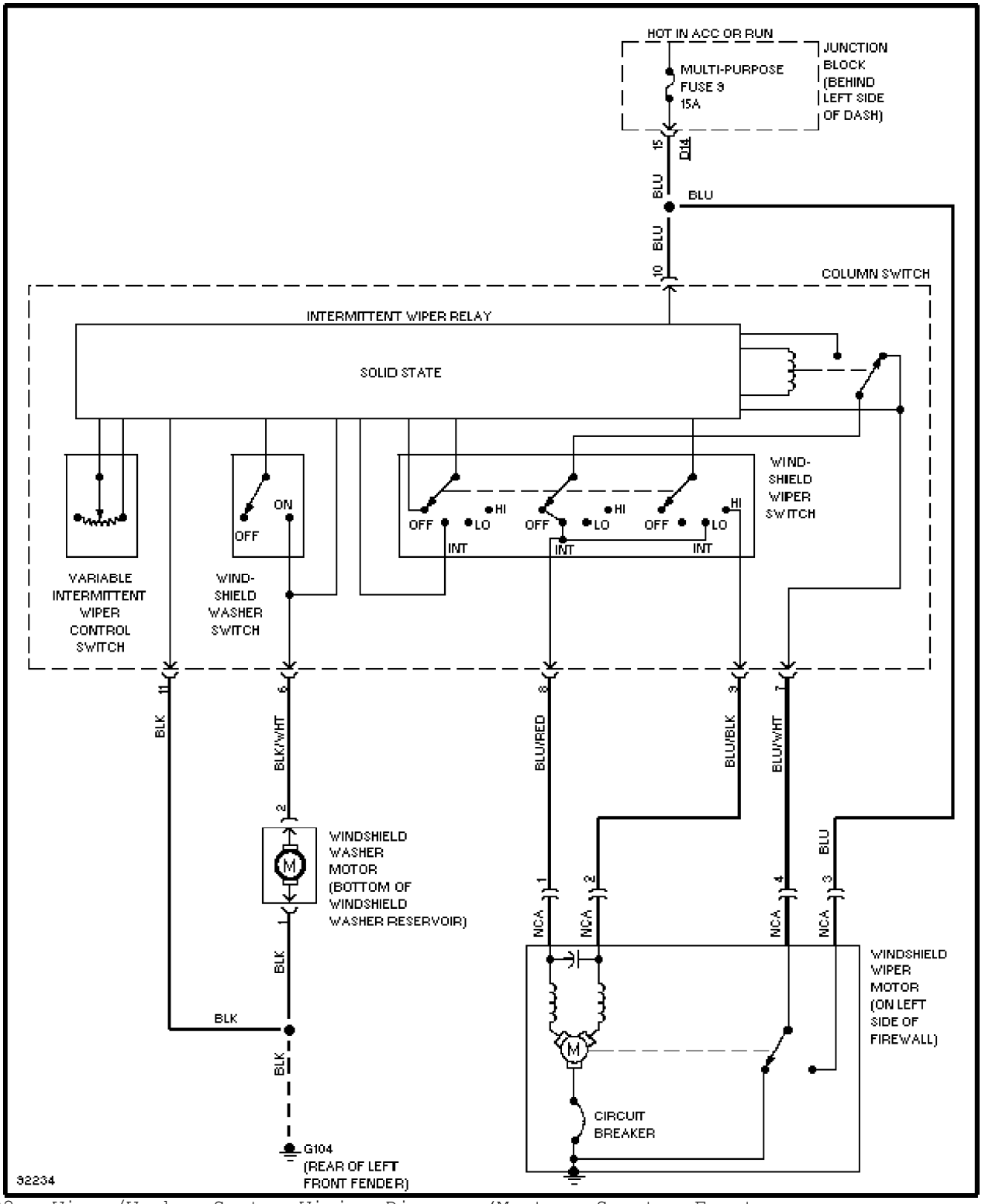


Fig. 22: Wiper/Washer System Wiring Diagram (Montero Sport - Front Wiper)

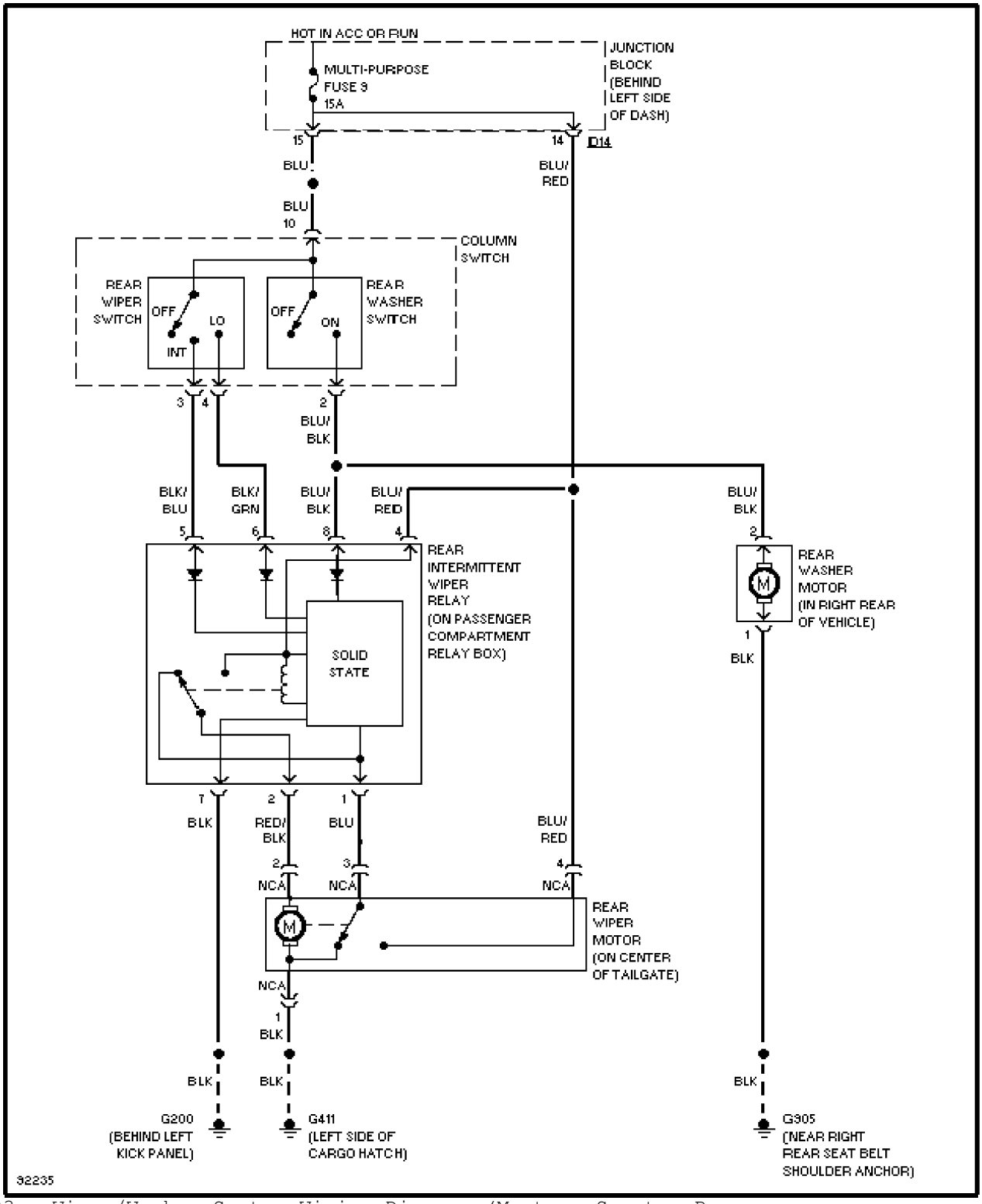


Fig. 23: Wiper/Washer System Wiring Diagram (Montero Sport - Rear Wiper)

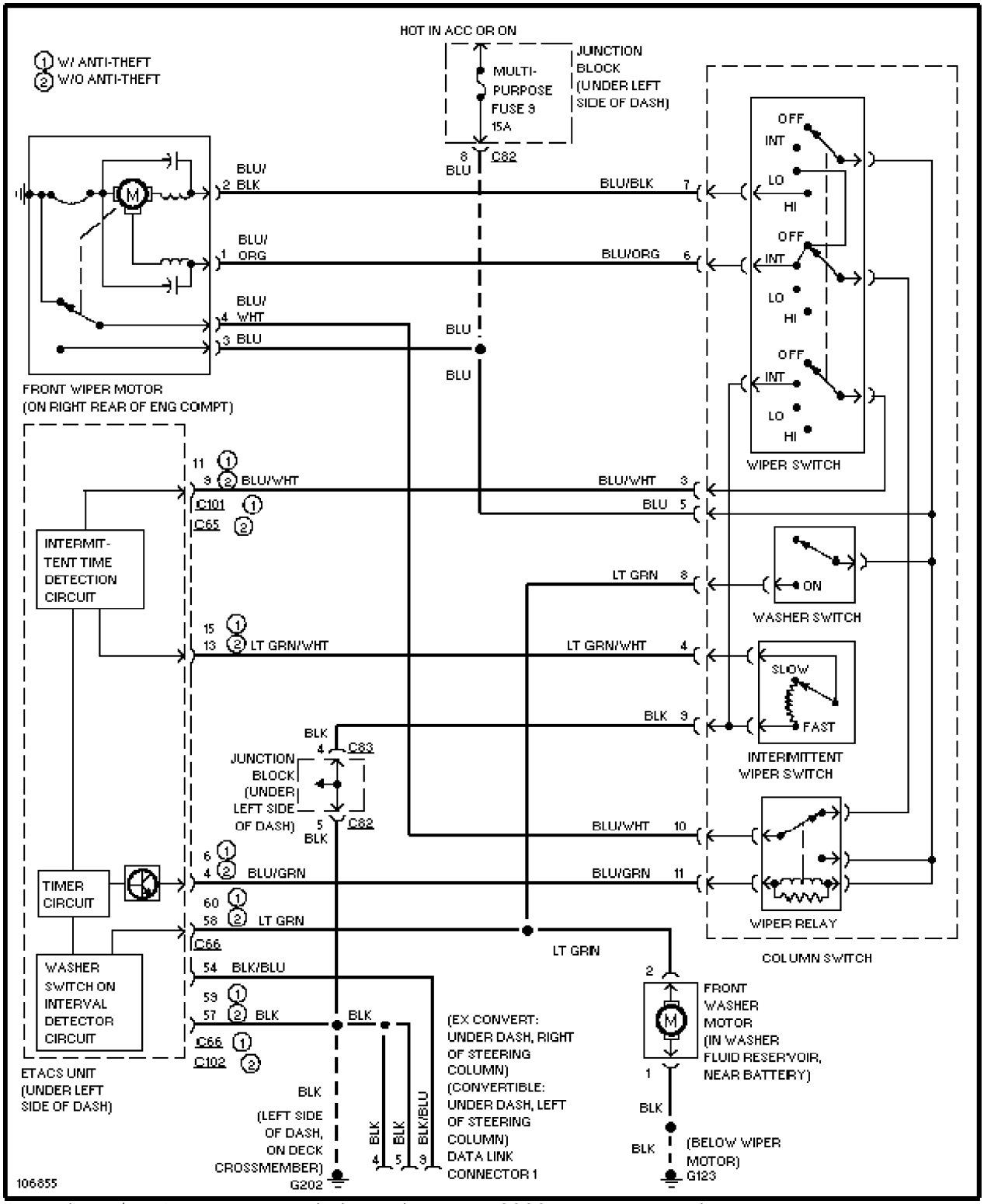


Fig. 24: Wiper/Washer System Wiring Diagram (3000GT - Front Wiper)

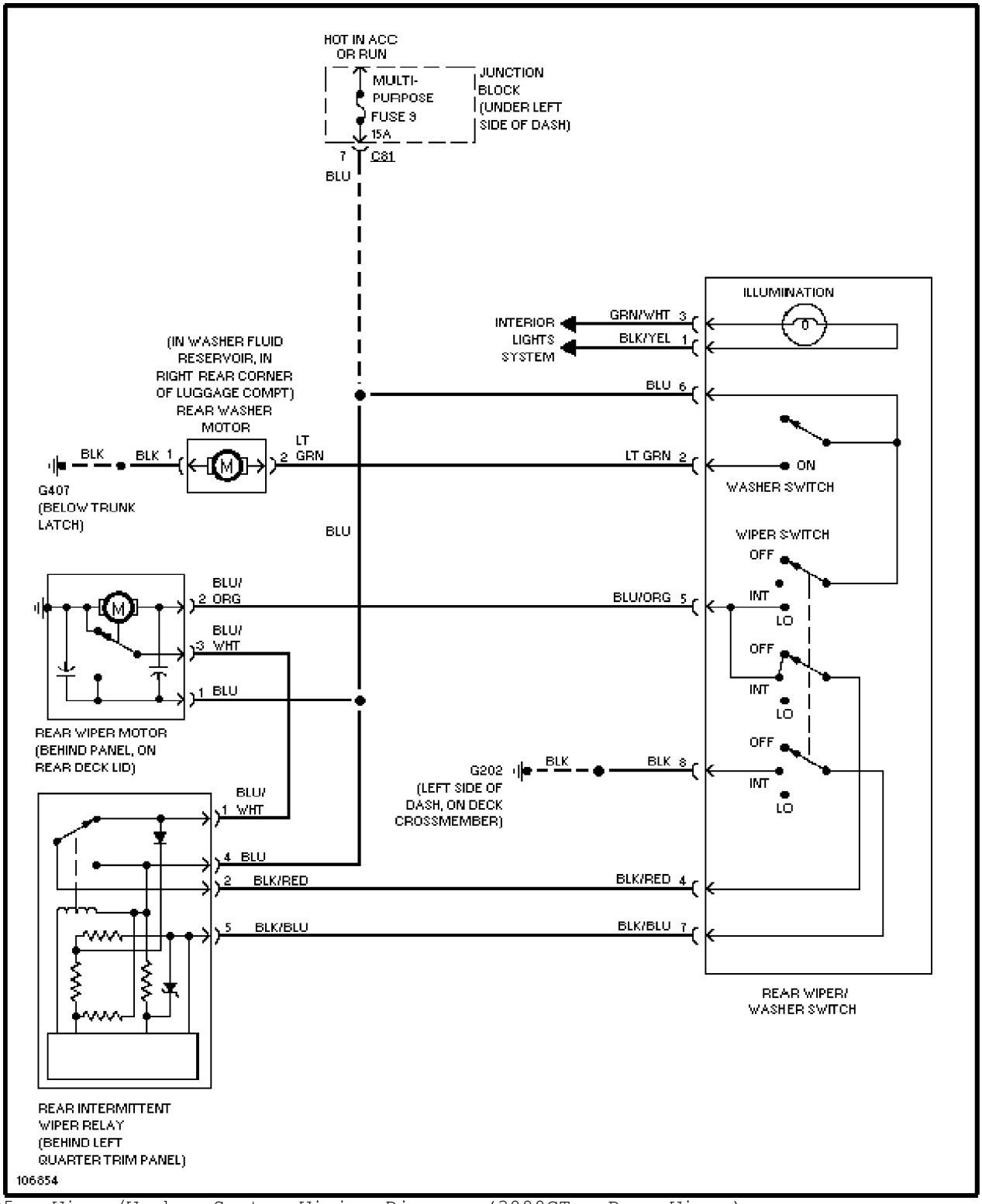


Fig. 25: Wiper/Washer System Wiring Diagram (3000GT - Rear Wiper)