

3.0L V6 - VIN [H]

1993 Mitsubishi Montero

1993 CHRYSLER CORP./MITSUBISHI ENGINES
3.0L V6

Dodge: Ram-50
Mitsubishi: Montero, Pickup

ENGINE IDENTIFICATION

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

Engine may be identified by Vehicle Identification Number (VIN) stamped on a metal pad located near lower left corner of windshield. The eighth character identifies the engine model. Engine code number is stamped on front upper edge of cylinder block, below cylinder head, or on vehicle information plate on firewall. Engine serial number is stamped near the engine code number.

ENGINE IDENTIFICATION CODES TABLE

Application	Engine Code	VIN Code
Montero, Pickup & Ram-50 3.0L V6	6G72	H

ADJUSTMENTS

VALVE CLEARANCE ADJUSTMENT

NOTE: All engines are equipped with hydraulic lash adjusters. Adjustment is not required.

REMOVAL & INSTALLATION

* PLEASE READ 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

Perform these steps to release fuel system pressure:

- * Disconnect fuel pump harness connector at fuel tank.
- * Start engine. After it stalls, turn ignition switch to OFF position.
- * Disconnect battery (-) terminal. Reconnect fuel pump harness.
- * Wrap shop towels around fuel return and high pressure hoses to prevent fuel splashing on engine. Disconnect fuel return hose

and high pressure fuel hose to drain any residual fuel.

ENGINE

Removal

1) Remove hood. Drain cooling system. Remove radiator. Remove skid plate and splash shields. Release fuel system pressure. See FUEL PRESSURE RELEASE. Disconnect negative battery cable.

2) Remove air cleaner ducts. Remove accessory drive belts. Remove and support A/C compressor and power steering pump, leaving hoses connected. Disconnect oil cooler hoses. Cover fuel hose with shop towel, and disconnect high pressure fuel hose and "O" ring. Disconnect fuel return hose.

3) Label and disconnect all vacuum hoses. Disconnect cooling system hoses. Label and unplug all electrical connections from engine. Remove heat shield from motor mounts. Remove motor mount bolts. Ensure all hoses and wires are disconnected and set aside.

4) Disconnect exhaust pipe from exhaust manifolds. Remove starter. Attach engine hoist to engine. Support transmission. Disconnect engine from transmission. See appropriate information in CLUTCH article in the CLUTCHES section, or refer to procedures described in TRANSMISSION SERVICING - M/T article in the MANUAL TRANSMISSION SERVICING section. Remove engine.

Installation

To install, reverse removal procedure. Install new "O" rings onto fuel lines. Install new exhaust gaskets and nuts. See TORQUE SPECIFICATIONS TABLE at the end of this article. Replenish fluids.

CAUTION: DO NOT allow foreign material into turbocharger air intake hoses or pipes.

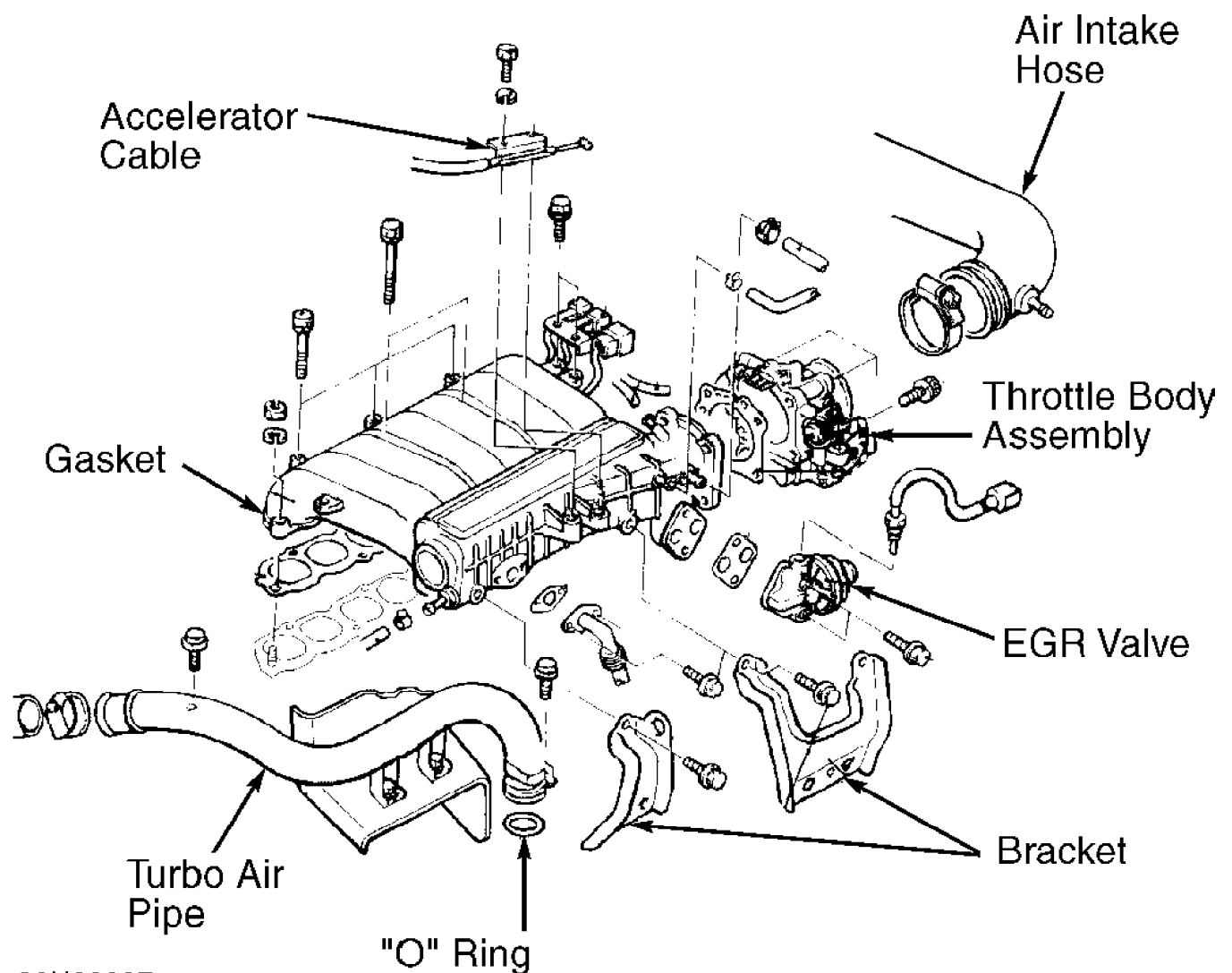
INTAKE MANIFOLD

CAUTION: Fuel system is under pressure. Fuel pressure must be released before disconnecting fuel lines. See FUEL PRESSURE RELEASE.

Removal

1) Release fuel pressure. Drain cooling system. Remove throttle body. Remove EGR valve and tube (if equipped). Remove front and rear manifold brackets. Remove upper intake manifold. See Fig. 1.

2) Remove spark plug cables, spark plugs, distributor, and coil. Remove fuel pressure regulator, fuel injectors, fuel rails, and grommets. Remove coolant and heater hoses. Remove temperature sensors and thermoswitch. Remove coolant outlet fitting and thermostat. Remove retaining nuts and intake manifold.

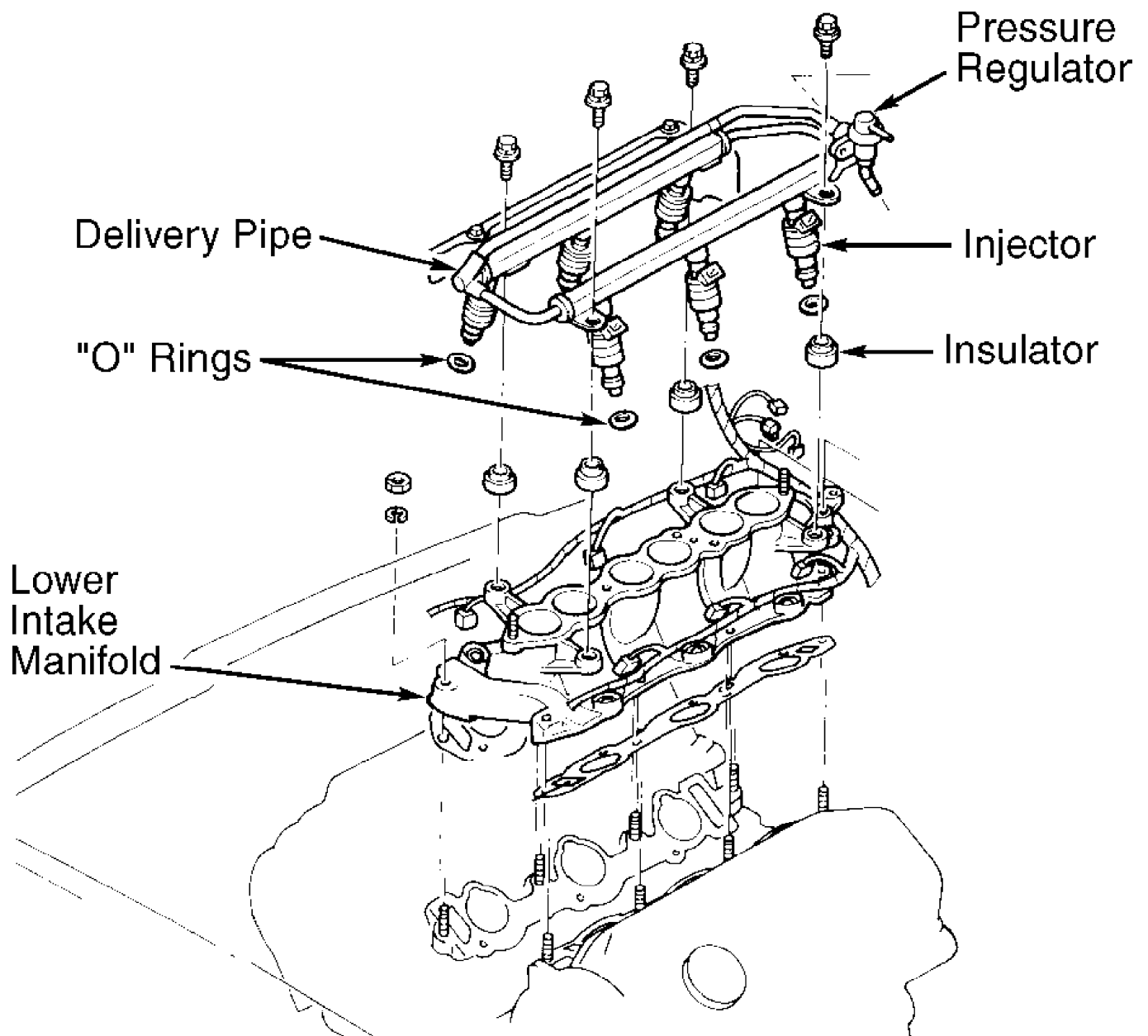


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Fig. 1: View Of Typical Upper Intake Manifold Components
Courtesy of Mitsubishi Motor Sales of America, Inc.

Installation

Clean all gasket mating surfaces. Inspect for damage and cracks on all mounting surfaces. To install, reverse removal procedure using, new gaskets and "O" rings. Tighten bolts and nuts to specification. See TORQUE SPECIFICATIONS TABLE at the end of this article.



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Fig. 2: Exploded View Of Typical Lower Intake Manifold
 Courtesy of Mitsubishi Motor Sales of America, Inc.

EXHAUST MANIFOLDS

Removal

1) Remove O2 sensor. Disconnect exhaust pipes from manifolds. Lower exhaust pipes. Remove heat shields. Before removing right manifold, remove decking hook and alternator brace.

2) Before removing left exhaust manifold, remove EGR tube (if equipped) and gasket. Remove front intake manifold plenum bracket. Remove exhaust manifolds and gaskets.

Installation

To install, reverse removal procedure. Install new gaskets. Lubricate new dipstick tube "O" ring with engine oil before installation. Install manifold nuts and washers in original locations. On all models, tighten nuts to specification. See TORQUE SPECIFICATIONS TABLE at the end of this article.

CYLINDER HEADS

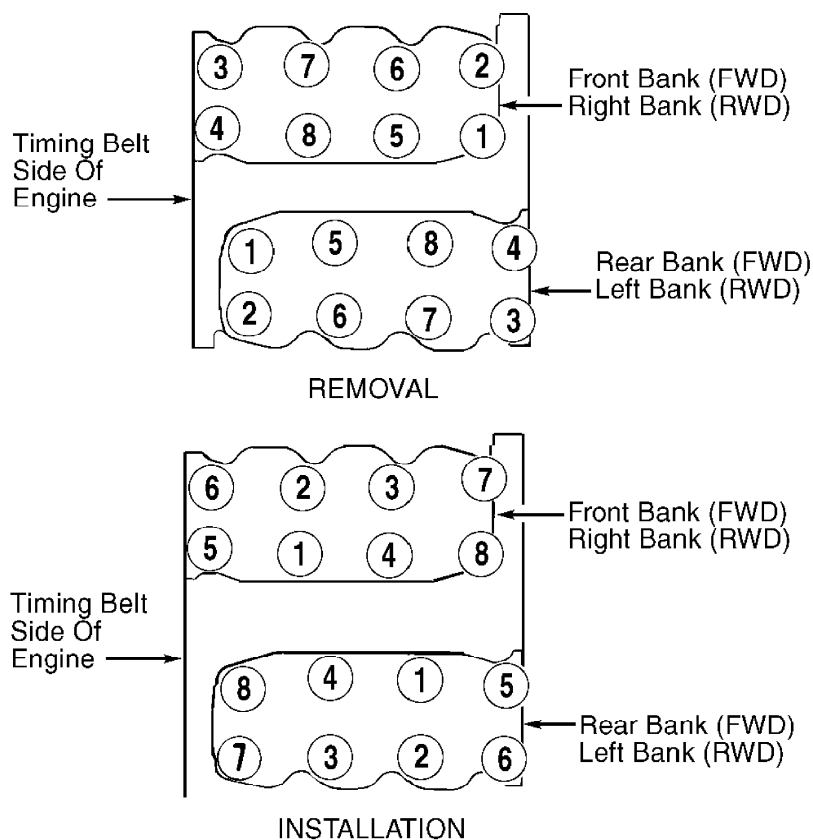
Removal

1) Drain cooling system. Remove intake manifolds and brackets. See INTAKE MANIFOLD. Remove spark plug wires. Remove splash shields. Disconnect O2 sensor. Remove heat shields and exhaust manifolds. See EXHAUST MANIFOLDS.

2) Remove distributor. Remove timing belt outer covers, camshaft sprockets, timing belt, and timing belt inner covers. See TIMING BELT. Remove accessory bracket bolts from front of cylinder head. Remove rocker cover and gasket.

NOTE: To prevent cylinder head warpage and cracking, loosen cylinder head bolts in 2 or 3 stages in proper sequence.

3) Using Socket (MD998051), unscrew cylinder head bolts in 2 or 3 stages in proper sequence. See Fig. 3. Remove cylinder head and camshaft assemblies. Note orientation of washers under cylinder head bolts.



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Fig. 3: Removing & Installing Cylinder Head Bolts
Courtesy of Mitsubishi Motor Sales of America, Inc.

Inspection

Measure cylinder head height. Measure warpage at gasket and

manifold surfaces. Resurface head if warpage exceeds specification. See CYLINDER HEAD table under ENGINE SPECIFICATIONS. Replace cylinder head if it is not within specification after resurfacing.

Installation

1) Ensure mating surfaces are clean and dry. Note identification mark located on front of head gasket. Identification mark is "R". Install head gasket with identification mark toward timing belt side of engine, facing upward.

2) Install cylinder head. Install washers cylinder head bolts with chamfered side toward bolt head. Using proper sequence, tighten bolts to specification in 2 or 3 stages in proper sequence. See Fig. 3. See TORQUE SPECIFICATIONS TABLE at the end of this article.

3) Apply sealant to rocker cover sealing surfaces before installation. See Fig. 4. Align rocker cover gasket projections with notches in rocker cover. Lubricate all "O" rings with engine oil before installation. Install new "O" rings onto distributor adapter and oil dipstick tube.

4) Lubricate camshaft area with oil prior to installing distributor adapter. To complete installation, reverse removal procedure. Tighten bolts and nuts to specification. See TORQUE SPECIFICATIONS TABLE at the end of this article. After engine reaches normal operating temperature, allow engine to cool. Retighten cylinder head bolts to specification.

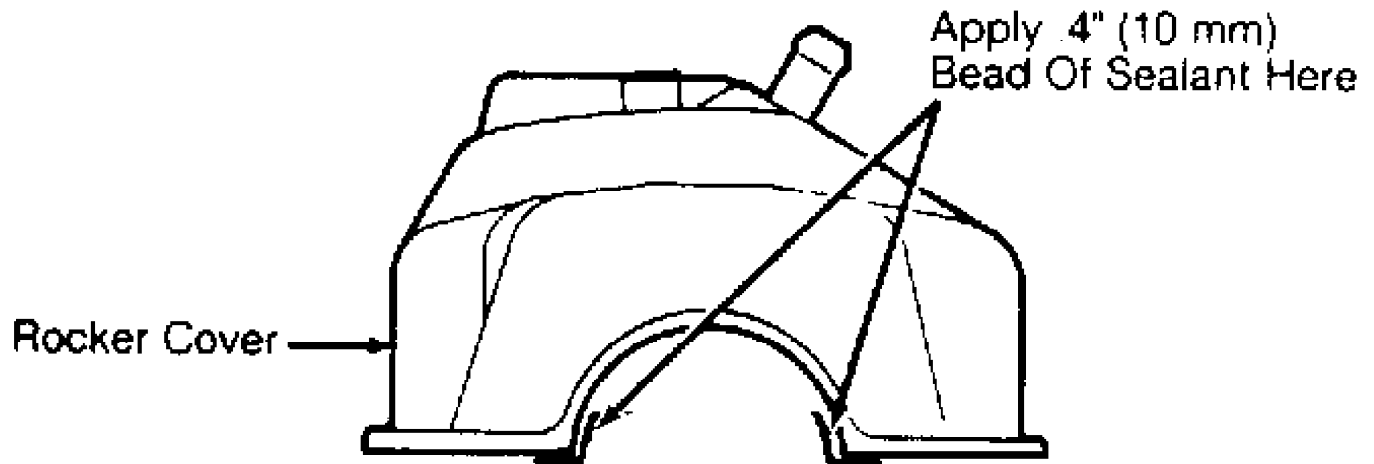


Fig. 4: Applying Sealant To Rocker Cover
Courtesy of Mitsubishi Motor Sales of America, Inc.

FRONT CRANKSHAFT OIL SEAL

Removal & Installation

Remove timing belt and crankshaft sprocket. See TIMING BELT. Pry oil seal from oil pump. Before installation, coat seal lip with grease. Using Seal Driver (MD998717), install seal in oil pump. Install remaining components. See TORQUE SPECIFICATIONS TABLE at the end of this article.

TIMING BELT

Removal

1) Drain cooling system. Disconnect upper radiator hose. Remove upper radiator shroud. Remove cooling fan and fan clutch assembly. Remove cooling fan pulley. Remove drive belts. Remove power steering pump, leaving hoses connected. Set power steering pump aside.

2) Remove power steering pump brackets. Remove A/C tensioner

pulley and mounting bracket. Remove A/C compressor with hoses connected, and remove mounting bracket. Remove cooling fan bracket assembly. Note location and length of bolts for reassembly reference.

NOTE: "V" belt will be damaged by tool. DO NOT use engine "V" belt to hold crankshaft pulley unless belt is to be replaced.

3) Remove upper timing belt covers and gaskets. See Fig. 6. Remove lower timing belt cover and gaskets. Using Holder (MB998747) and a used "V" belt, remove crankshaft pulley bolt. Remove crankshaft pulley.

4) Remove flange. See Fig. 6. Rotate crankshaft to align all timing marks. See Fig. 7. Loosen belt tensioner bolt, and rotate belt tensioner counterclockwise to relieve belt tension.

5) If reusing timing belt, place arrow on belt to indicate belt running direction. Remove timing belt and belt tensioner. If camshaft sprocket requires removal, install Holder (MB990775) onto camshaft sprocket. Remove retaining bolt and camshaft sprocket. Remove rear timing belt cover if necessary.

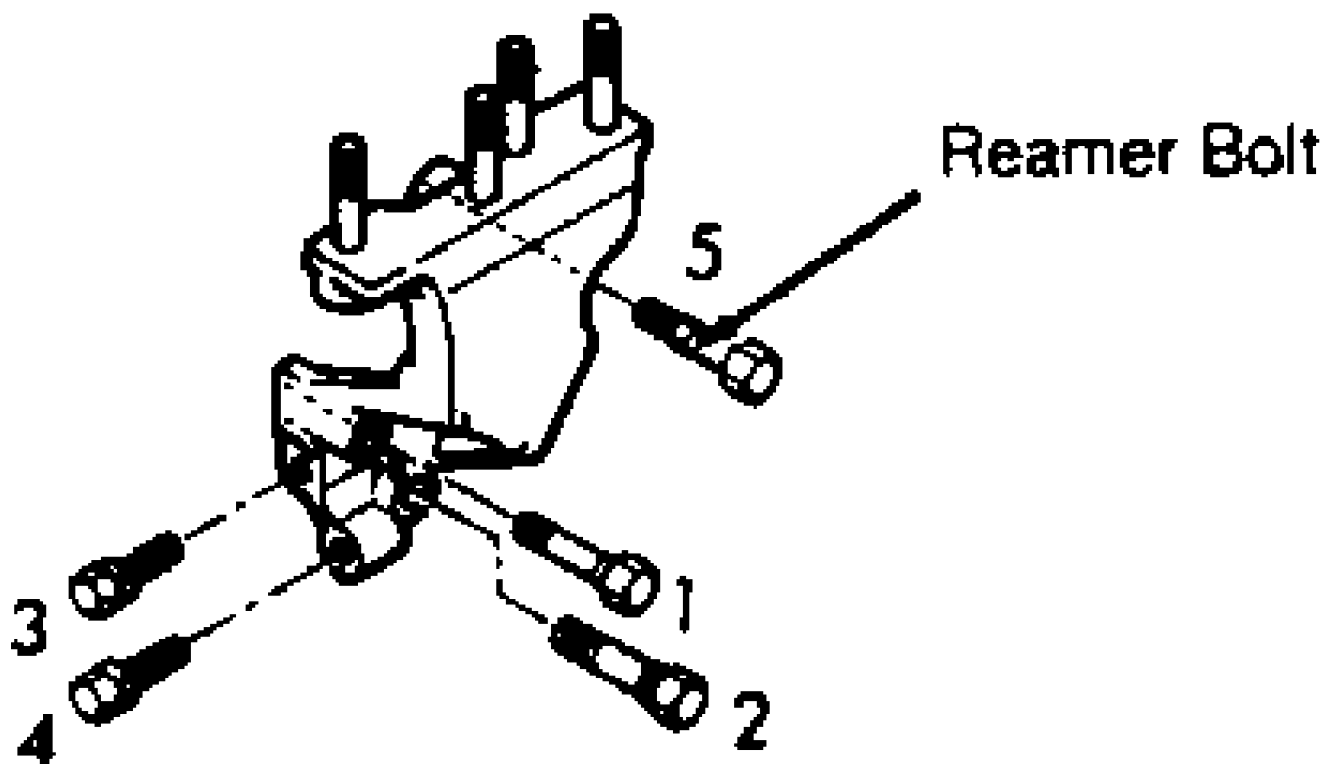
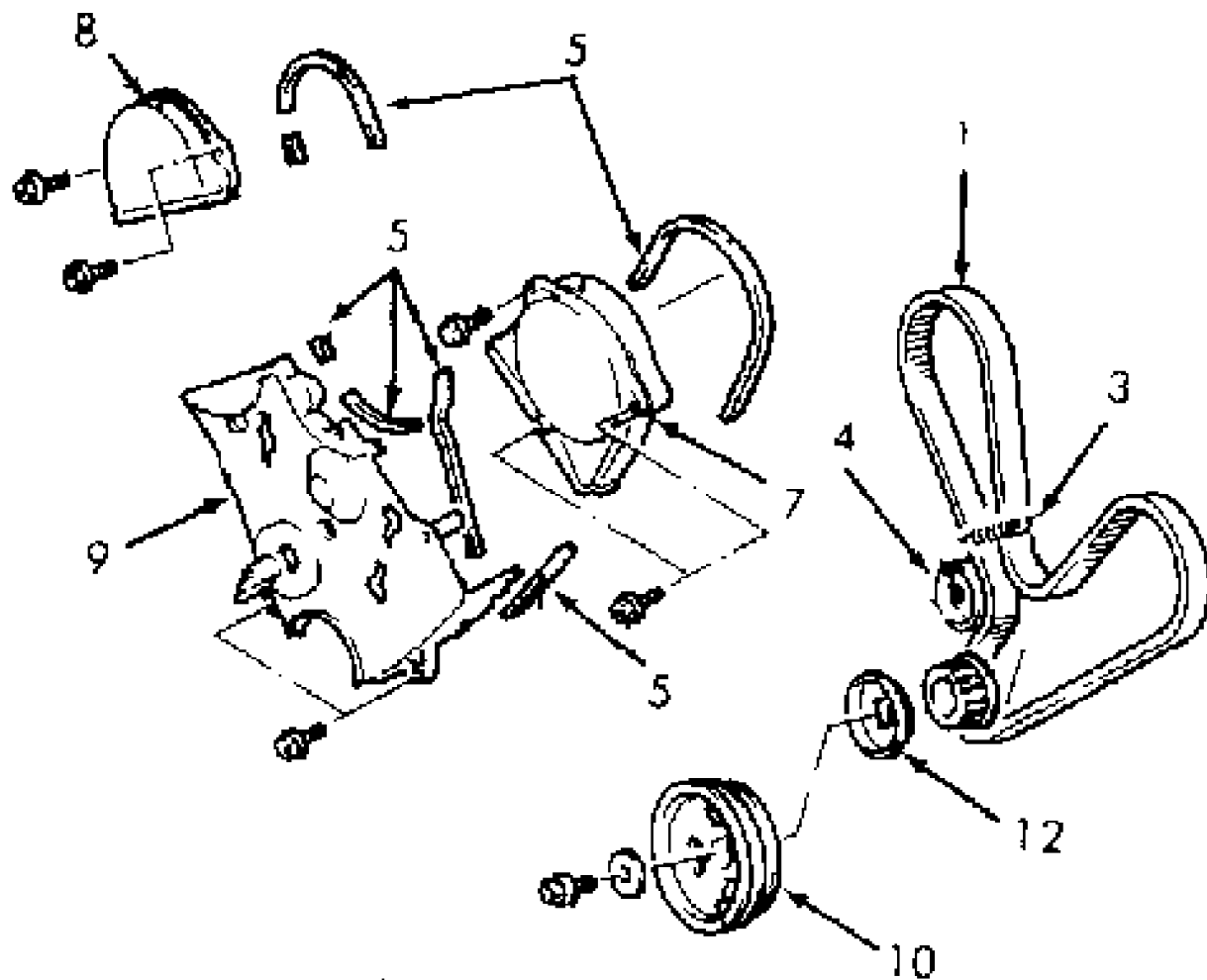


Fig. 5: Removing Engine Support Bracket
Courtesy of Mitsubishi Motor Sales of America, Inc.



MONTERO & RAIDER

1. Timing Belt	8. No. 1 Upper Outer Cover
2. Engine Support Bracket	9. Lower Outer Cover
3. Tensioner Spring	10. Crankshaft Pulley
4. Belt Tensioner Bolt	11. Cover Cap
5. Gasket	12. Flange
6. Belt Tensioner	13. Cover
7. No. 2 Upper Outer Cover	

Fig. 6: Exploded View Of Timing Belt Components
 Courtesy of Mitsubishi Motor Sales of America, Inc.

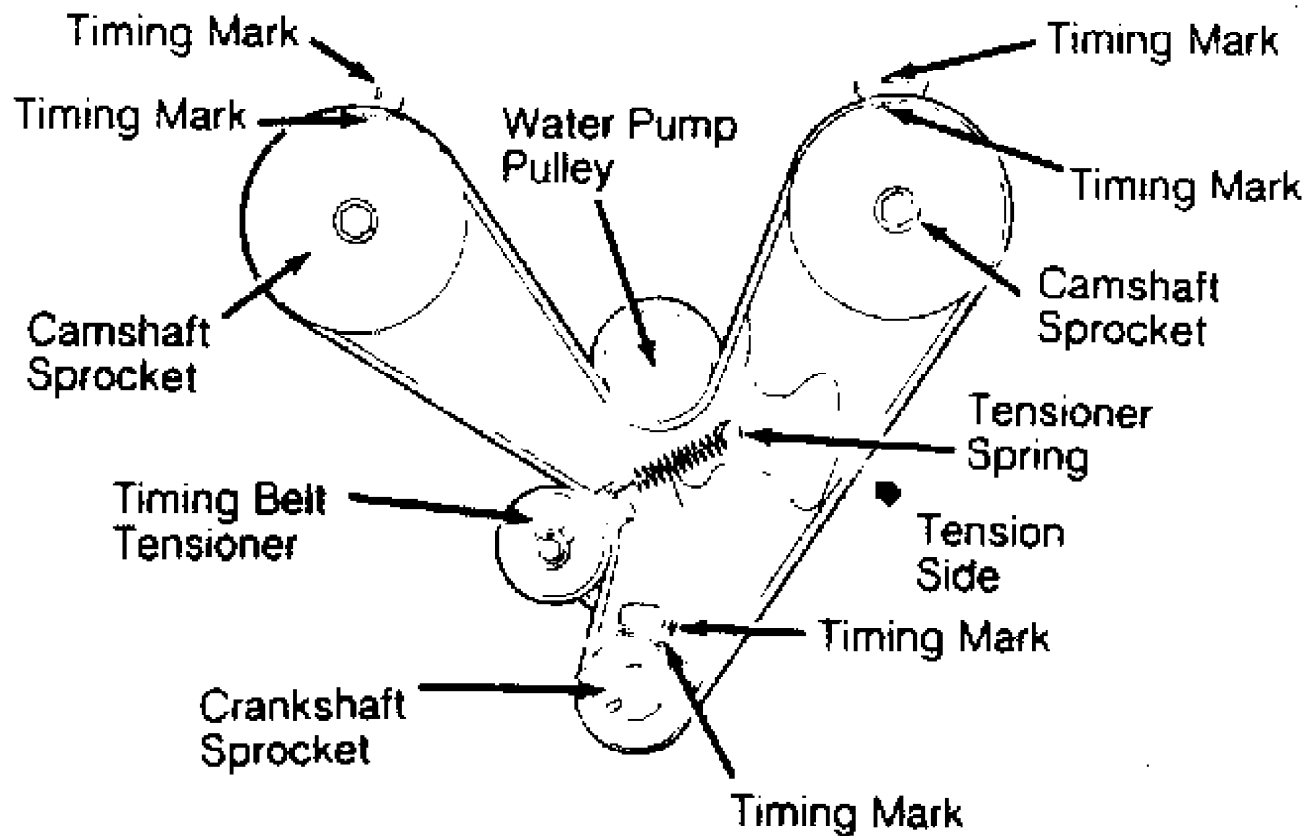
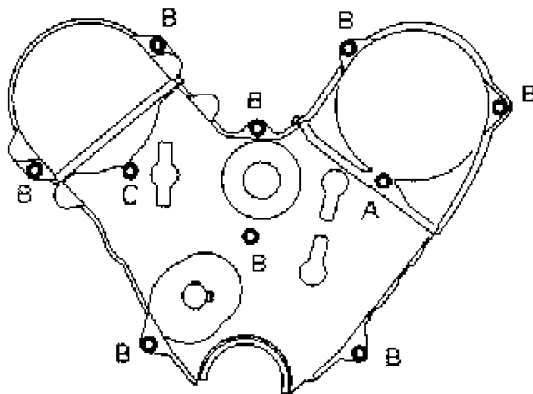


Fig. 7: Aligning Timing Marks
 Courtesy of Mitsubishi Motor Sales of America, Inc.



Note: Bolt measurements indicated in millimeters.

Thread Diameter & Length

A - 6x60mm

B - 6x20mm

C - 6x55mm

Fig. 8: Identifying Timing Belt Cover Bolt Lengths
 Courtesy of Mitsubishi Motor Sales of America, Inc.

Installation

1) Install rear timing belt cover. Tighten bolts to

specification. See TORQUE SPECIFICATIONS TABLE at the end of this article. Install camshaft sprockets (if removed). Using holder, hold camshaft and tighten retaining bolt to specification.

2) Install belt tensioner and spring. Ensure spring is secured on pin of water pump and engaged in hole of belt tensioner, with hook of spring pointing away from cylinder block.

3) Rotate belt tensioner counterclockwise as far as possible, and temporarily tighten bolt. Align all timing marks with No. 1 cylinder at TDC of compression stroke. See Fig. 7.

4) Install timing belt onto crankshaft sprocket first, then onto left camshaft sprocket, with all slack removed from tension side of belt. Route timing belt onto water pump pulley, right camshaft sprocket, and tensioner. Remove any slack from belt by rotating left and then right camshaft sprockets counterclockwise.

5) Ensure belt is installed in original direction of rotation, and all timing marks are aligned. Install flange on crankshaft. Loosen belt tensioner bolts slightly, and allow tensioner to apply belt tension.

6) Using Crankshaft Socket (MD998716), rotate crankshaft 2 revolutions clockwise. DO NOT rotate counterclockwise. Realign all timing marks. Tighten belt tensioner bolts to specification. Using belt tension gauge, measure belt tension halfway between crankshaft sprocket and camshaft sprocket on side opposite belt tensioner.

7) Belt tension should be 57-84 lbs. (26-38 kg). To install remaining components, reverse removal procedure. Install bolts in proper holes. See Fig. 8. Tighten bolts to specification. See TORQUE SPECIFICATIONS TABLE at the end of this article.

CAMSHAFT & ROCKER ARMS

Removal

1) Remove PCV valve and breather hoses. Remove timing belt, camshaft sprocket, and rear timing belt cover. See TIMING BELT. Remove rocker covers and gaskets. Remove circular packing from rear of camshafts.

2) Remove camshaft oil seal from front of cylinder head or distributor adapter. Remove distributor adapter and "O" ring. Install Valve Lash Adjuster Holder (MD998443) onto rocker arm. See Fig. 9. Note arrow marks on bearing caps and cylinder head. See Fig. 10.

3) Bearing cap location number is stamped on front side of bearing cap. Remove bearing cap bolts. Keep components in order for reassembly reference. Remove rocker arm assembly. Remove camshaft from cylinder head.

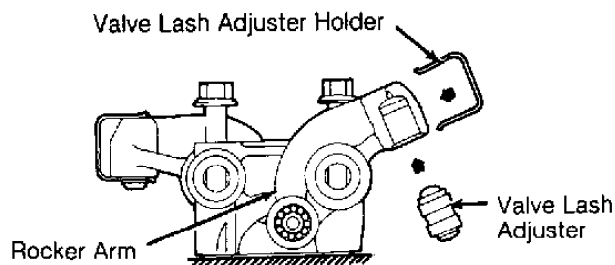


Fig. 9: Installing Valve Lash Adjuster Holder
Courtesy of Mitsubishi Motor Sales of America, Inc.

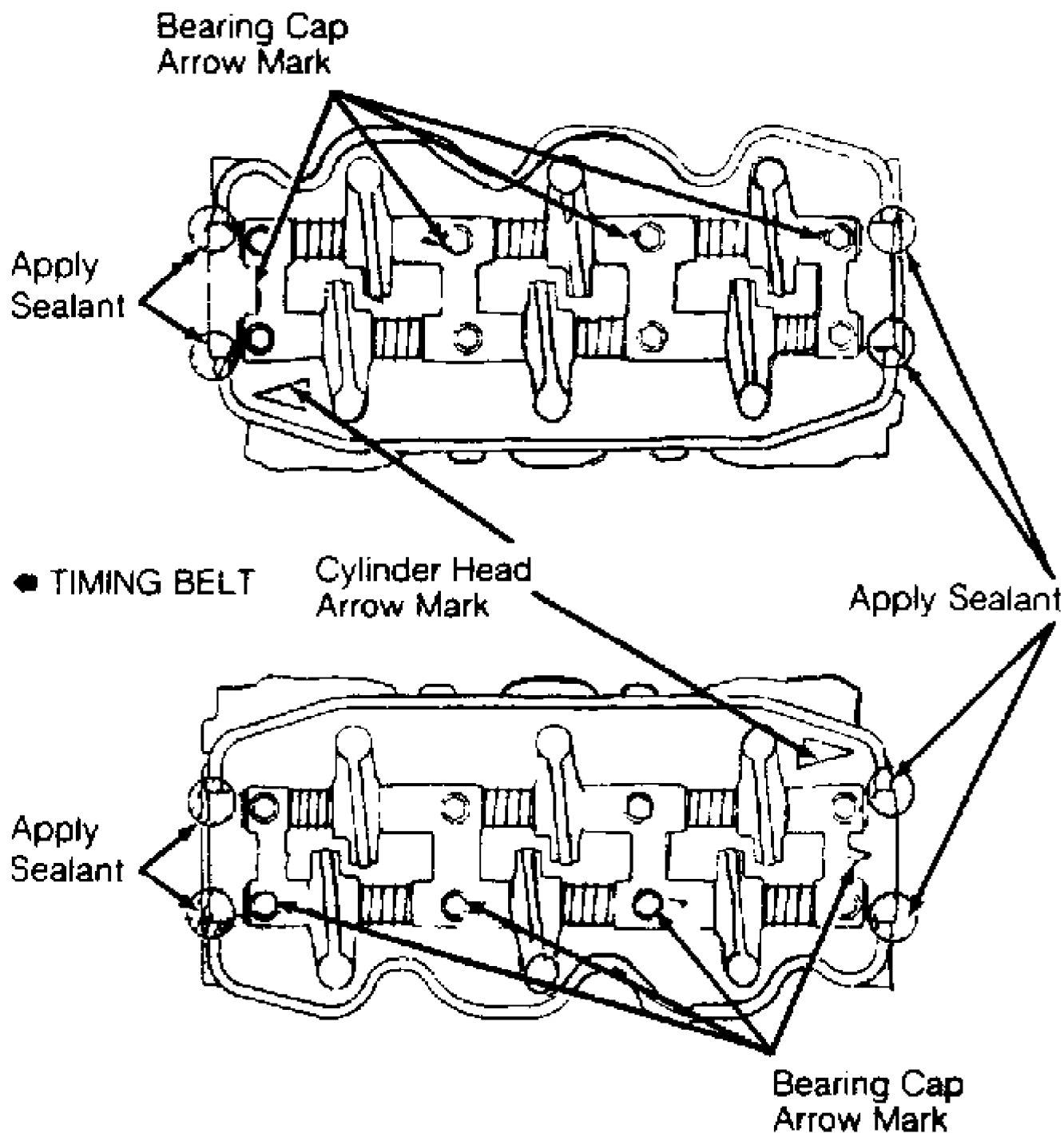


Fig. 10: Identifying Bearing Cap & Sealant Locations
 Courtesy of Mitsubishi Motor Sales of America, Inc.

Inspection

1) Remove bearing caps, rocker arms, and springs from shafts. Mark component location for reassembly reference. Inspect rocker arm and shaft for damaged roller and flaking. Measure rocker arm I.D. and rocker arm shaft O.D. Determine oil clearance. Measure spring free length. Replace components if not within specification. See **ROCKER ARM & SHAFT SPECIFICATIONS** table.

2) Inspect camshaft and distributor gear for damage. Measure camshaft end play, journal diameter, and lobe height. Replace camshaft if it is not within specification. See CAMSHAFT table under ENGINE SPECIFICATIONS.

3) Lubricate components with engine oil. Reassemble rocker arms, springs, and bearing caps. Install bearing caps with identification number toward camshaft sprocket. Ensure oil holes and notch of shafts are properly positioned. See Fig. 11.

ROCKER ARM & SHAFT SPECIFICATIONS TABLE

Application	In. (mm)
Oil Clearance	(1) .0004-.0016 (.010-.041)
Rocker Arm I.D.	.7444 (18.91)
Rocker Arm Shaft O.D.	.7440 (18.90)
Spring Free Length	2.173 (55.19)

(1) - Maximum clearance is .004" (.10 mm).

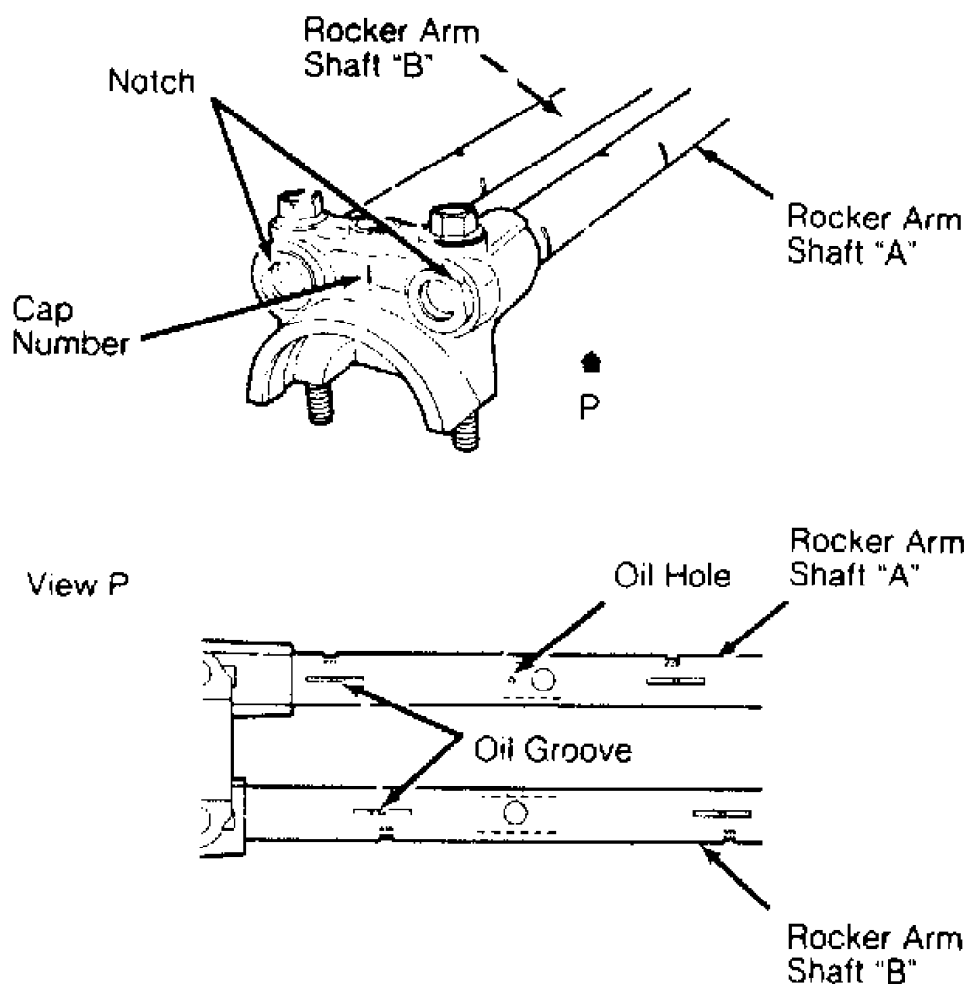


Fig. 11: Installing Rocker Arm Shafts
Courtesy of Mitsubishi Motor Sales of America, Inc.

Installation

1) Lubricate camshaft with engine oil, and install into

cylinder head. Install valve lash adjusters and valve lash adjuster holders (if removed). See Fig. 9.

2) Apply 3M Sealant (4171) to designated areas of cylinder head. See Fig. 10. Use care so sealant does not get onto camshaft or camshaft bearings. Install rocker arm assembly. Ensure arrow on bearing cap faces same direction as arrow on cylinder head. See Fig. 10. Tighten bearing cap bolts to specification. See TORQUE SPECIFICATIONS TABLE at the end of this article. Remove valve lash adjuster holders.

3) Lubricate camshaft oil seal area with engine oil. Using Seal Driver (MD998713), install camshaft oil seal. Using Circular Packing Installer (MD998306), install circular packing to press-in depth of .02" (.5 mm).

4) Apply Three Bond (1212D) sealant to rocker cover sealing surfaces before installation. See Fig. 4. Lubricate new "O" ring with oil, and install onto distributor adapter (if removed).

5) Lubricate camshaft area with oil before installing distributor adapter. To complete installation, reverse removal procedure. Tighten bolts to specification. See TORQUE SPECIFICATIONS TABLE at the end of this article.

REAR CRANKSHAFT OIL SEAL

Removal

Remove transaxle/transmission. See appropriate article in TRANSMISSION SERVICING or CLUTCHES. Remove flywheel or drive plate. Remove rear oil seal housing. Pry seal from seal housing.

Installation

Lubricate seal lip with engine oil. Using Seal Driver (MD998718), install seal into seal housing. Apply sealant to sealing surface of seal case. Install seal case. Install flywheel or drive plate. Tighten bolts to specification. See TORQUE SPECIFICATIONS TABLE at the end of this article. To complete installation, reverse removal procedure.

WATER PUMP

Removal

Drain cooling system. Remove timing belt and crankshaft sprocket. See TIMING BELT. Remove coolant ducts to water pump if necessary. Remove water pump bolts, noting length and location for reassembly reference. Remove water pump.

Installation

To install, reverse removal procedure, using new gasket and "O" rings. Coat all "O" rings with water before installation. Install water pump and gasket. Tighten bolts to specification. See TORQUE SPECIFICATIONS TABLE at the end of this article.

OIL PAN

Removal (Montero)

1) Remove hood. Remove skid plate and lower covers. Raise and support vehicle. Disconnect and remove exhaust pipe from exhaust manifolds. Drain engine oil. Remove starter cover and starter. Unplug oil pressure sending unit connector. Remove front suspension crossmember.

2) Remove transmission braces. Remove ground cable. Remove engine mount heat shields. Attach engine hoist. Remove motor mount bolts. Raise engine and insert a 1" wood spacer between front insulator and mounts. Lower engine onto wood blocks.

3) Raise and support vehicle. Remove oil pan bolts. Using

Seal Cutter (MD998727), separate oil pan from cylinder block. Remove oil pan.

Removal (Pickup & Ram-50)

1) Remove skid plate and lower covers. Raise and support vehicle. Drain engine oil. Using Steering Linkage Puller (C-3894-A or MB990635), disconnect relay rod from idler arm and steering box.

2) Remove oil pan bolts. Using Seal Cutter (MD998727), separate oil pan from cylinder block. Remove pan from vehicle.

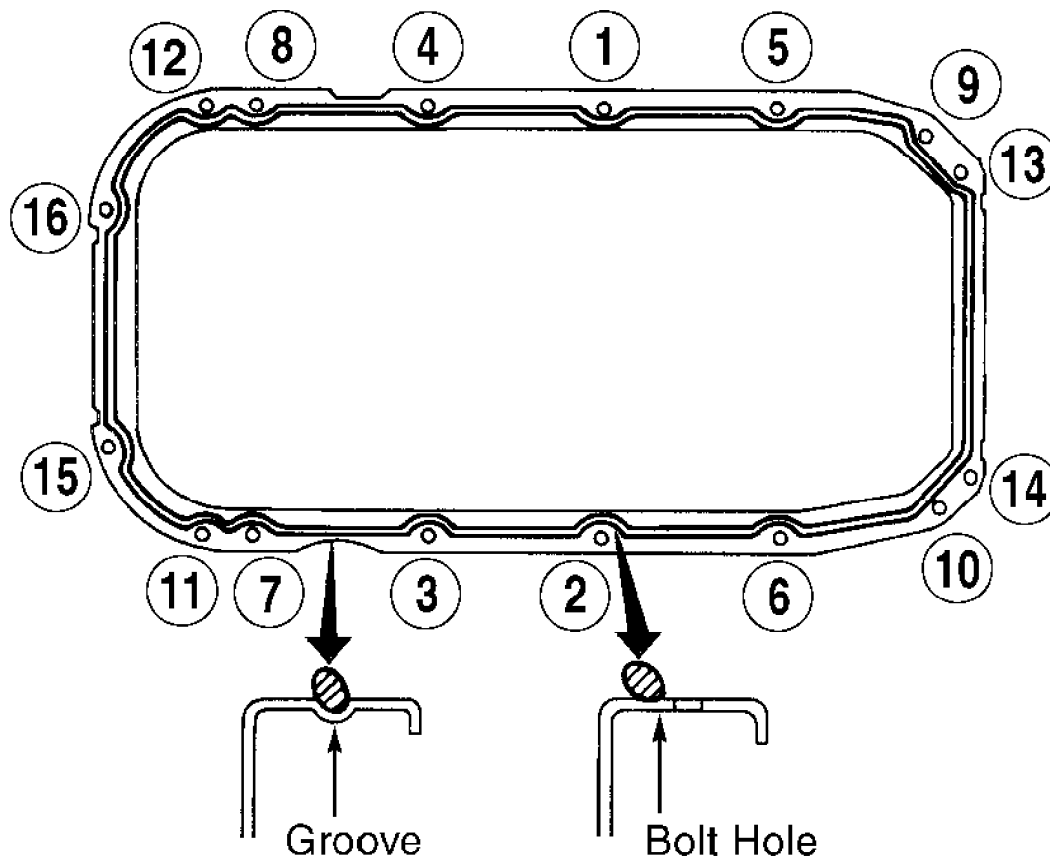
Inspection (All Models)

Clean sealant from mating surfaces on engine block and oil pan. Inspect oil pan for cracks and damage. Inspect sealing surface for damage and deformation. Inspect oil pick-up screen for damage.

Installation (All Models)

1) To install, reverse removal procedure. Apply sealant to oil pan flange in a continuous .16" (4 mm) diameter bead. See Fig. 12. Install oil pan within 15 minutes of applying sealant.

2) Tighten bolts to specification in proper sequence. See TORQUE SPECIFICATIONS TABLE at the end of this article. Wait at least 30 minutes before adding oil and starting engine. On AWD models, refill transfer assembly with GL-4 hypoid gear oil. On all models, complete installation by reversing removal procedure.



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Fig. 12: Applying Sealant & Tightening Oil Pan Bolts
Courtesy of Mitsubishi Motor Sales of America, Inc.

CYLINDER HEAD

Cylinder Head

Measure cylinder head height. Measure warpage at gasket and manifold surfaces. Resurface head if warpage exceeds specification. See appropriate CYLINDER HEAD table under ENGINE SPECIFICATIONS. Replace cylinder head if it is not within specification after resurfacing.

NOTE: Install valve springs with enamel-coated side toward valve spring retainer.

Valve Springs

Measure free length of valve springs. Measure spring pressure at specified height. Replace springs if not within specification. See appropriate VALVES & VALVE SPRINGS table under ENGINE SPECIFICATIONS. Inspect valve spring for squareness. Replace spring if out-of-square exceeds 4 degrees.

Valve Stem Oil Seals

With valves removed, remove oil seals from cylinder head. Lubricate new seals with engine oil. Using Valve Stem Oil Seal Installer (MD998377 for Montero, MD998729 for Pickup, Ram-50), install valve stem oil seal.

Valve Guides

1) Measure valve stem oil clearance. Replace valve guide if not within specification. See appropriate VALVES & VALVE SPRINGS table under ENGINE SPECIFICATIONS.

2) Using rod of Valve Guide Remover/Installer (MD998115), drive out valve guide toward combustion chamber side of cylinder head. Note length of valve guides.

3) On all models, cylinder head must be bored to install oversized valve guide once guide is removed. DO NOT install valve guide of same O.D. as old guide. Bore cylinder head to specification for oversize valve guide. See appropriate OVERSIZE VALVE GUIDE SPECIFICATIONS table.

4) Install proper length valve guide. Intake guide is 1.73" (43.9 mm) long; exhaust guide is 1.89" (48.0 mm) long. On all models, position cylinder head with combustion chamber downward.

5) Using valve guide remover/installer, install valve guide. Remover/installer sets valve guide height. On all models, ensure valve slides smoothly in valve guide. Recondition valve seat.

OVERSIZE VALVE GUIDE SPECIFICATIONS TABLE

Oversize: In. (mm)	Size Mark	Bore Size: In. (mm)
.002 (.05)	5 ...	.5138-.5147 (13.050-13.073)
.010 (.25)	25 ...	.5217-.5224 (13.251-13.269)
.020 (.51)	50 ...	.5315-.5323 (13.500-13.520)

Valve Seat

1) Measure valve spring installed height after valve and valve seat have been reconditioned and lightly lapped. With valve assembly installed, measure installed height of valve spring between spring seat and retainer. Valve seat must be replaced if measurement exceeds 1.63" (41.4 mm).

2) To replace seat, grind wall until seat can be removed. Machine cylinder head to accommodate an oversize valve seat. See OVERSIZE VALVE SEAT SPECIFICATIONS table. Heat cylinder head to

approximately 480°F (250°C), and install valve seat. Grind valve seat using 45-degree stone. Use 30-degree and 60-degree stones to set seat height.

OVERSIZE VALVE SEAT SPECIFICATIONS TABLE

Application In. (mm)	Specification In. (mm)
Intake	
Bore Depth	
.012 (.3) Oversize	.311-.319 (7.9-8.1)
.024 (.6) Oversize	.323-.331 (8.2-8.4)
Bore Diameter	
.012 (.3) Oversize	1.7441-1.7453 (44.300-44.330)
.024 (.6) Oversize	1.7559-1.7571 (44.600-44.630)
Exhaust	
Bore Depth	
.012 (.3) Oversize	.311-.319 (7.9-8.1)
.024 (.6) Oversize	.323-.331 (8.2-8.4)
Bore Diameter	
.012 (.3) Oversize	1.5079-1.5091 (38.300-38.331)
.024 (.6) Oversize	1.5197-1.5209 (38.600-38.630)

Valves

Disassemble cylinder head. Measure valve stem diameter, valve margin, and overall length. See appropriate VALVES & VALVE SPRINGS table under ENGINE SPECIFICATIONS. Inspect valve for worn stem tip. Measure valve margin after grinding valves. Replace valves if not within specification.

Lash Adjusters

Before installation, submerge lash adjuster in diesel fuel. Using a small wire, hold down internal check valve. Pump plunger up and down 4 or 5 times to bleed air from lash adjuster.

CYLINDER BLOCK ASSEMBLY

Cylinder Block

1) Inspect cylinder block for cracks, warpage, cylinder bore taper, and out-of-round. Replace or repair cylinder block if it is not within specification. See CYLINDER BLOCK table under ENGINE SPECIFICATIONS.

2) Measure cylinder bore and piston skirt diameter. Piston skirt diameter should be measured at 90-degree angle to piston pin. Clearance between piston and cylinder bore must be within specification. See appropriate PISTONS, PINS & RINGS table under ENGINE SPECIFICATIONS.

Piston & Rod Assembly

1) Remove cylinder heads and oil pan. See CYLINDER HEADS and OIL PAN under REMOVAL & INSTALLATION. Remove cylinder ridge. Mark connecting rod and cap for cylinder identification.

2) Note front mark on piston and connecting rod. See Fig. 13. Mark is positioned toward timing belt side of engine. Remove rod cap and piston assembly.

3) Piston ring end gap and side clearance must be within specification. See appropriate PISTONS, PINS & RINGS table under ENGINE SPECIFICATIONS. Install rings onto piston with ring code identification marks toward top of piston. Top ring is marked T1, and No. 2 ring is marked 2R. Lubricate piston, rings, and cylinder bore with engine oil.

NOTE: Front mark "R" on piston indicates installation in cylinders No. 1, 3, or 5; front mark "L" indicates installation in cylinders No. 2, 4, or 6. Ensure front mark on piston and connecting rod are toward timing belt side of engine. See Fig. 13.

4) Distribute ring end gaps properly around piston. See Fig. 13. Install piston and rod into cylinder bore, with front mark toward timing belt side of engine.

5) Measure bearing clearance using Plastigage. Tighten rod cap nuts to specification. See TORQUE SPECIFICATIONS TABLE at the end of this article. Connecting rod must move freely on crankshaft. Measure connecting rod side play. Repair or replace connecting rod if not within specification. See CONNECTING RODS table under ENGINE SPECIFICATIONS.

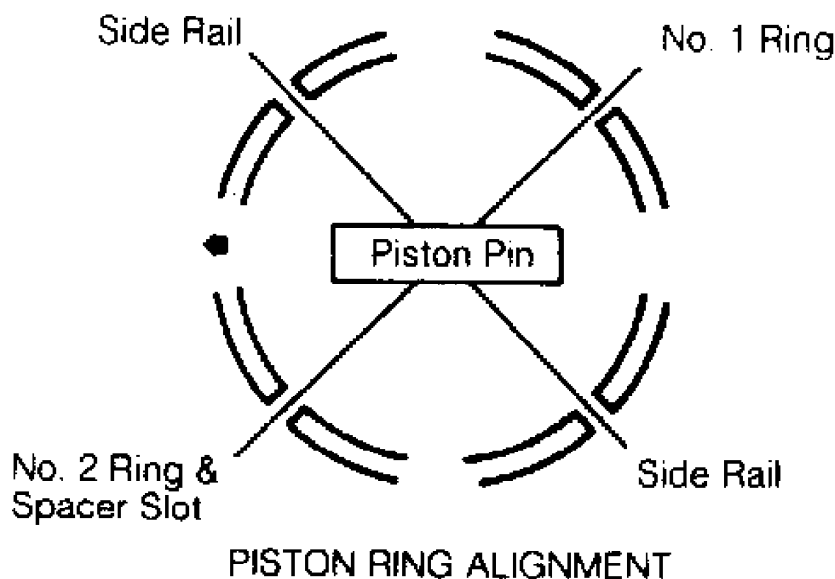
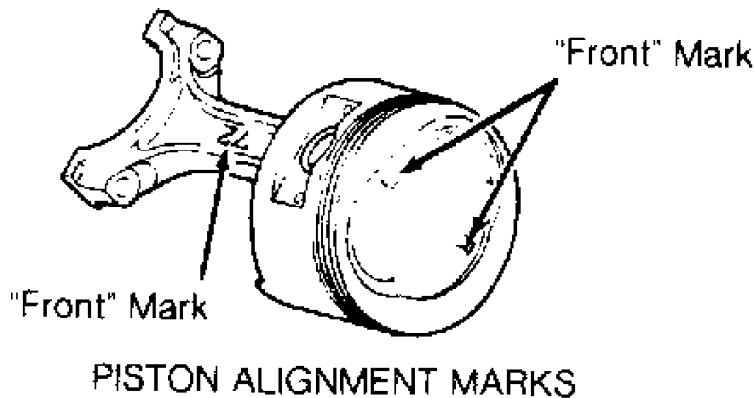


Fig. 13: Aligning Piston & Rings
Courtesy of Mitsubishi Motor Sales of America, Inc.

Fitting Pistons

Measure cylinder bore and piston skirt diameter. Piston skirt

diameter should be measured at 90-degree angle to piston pin. Clearance between piston and cylinder bore must be within specification. See appropriate PISTONS, PINS & RINGS table under ENGINE SPECIFICATIONS.

Piston Pin Replacement

- 1) Note reference mark on top of piston and connecting rod. See Fig. 13. Using press and Piston Pin Remover/Installer (MD998184), remove pin.
- 2) Inspect piston for cracks and damage. Measure ring side clearance. Replace piston if not within specification. See appropriate PISTONS, PINS & RINGS table under ENGINE SPECIFICATIONS.
- 3) Measure connecting rod for bend and twist. Replace connecting rod if twist exceeds .004" (.10 mm) or bend exceeds .002" (.05 mm).

NOTE: Install piston with reference mark aligned with connecting rod reference mark. See Fig. 13.

- 4) Position piston onto connecting rod. Align reference marks on top of piston and connecting rod. See Fig. 13. Lubricate all components with oil. Press piston pin into piston and connecting rod. To install, reverse removal procedure. Ensure piston pin is centered in piston.

Crankshaft & Main Bearings

- 1) Remove flywheel or drive plate. Remove transaxle/transmission mounting plate and rear seal case. Remove oil pump, oil pan, and oil pick-up tube. Mark connecting rod and main bearing caps for location.
- 2) Remove connecting rod caps and bearings. Note direction of arrow on main bearing cap. Remove main bearing cap. See Fig. 14. Remove crankshaft. Remove main bearings from cylinder block. Mark bearings for location.
- 3) Inspect crankshaft for cracks and damaged gear or threads. Measure crankshaft for taper and out-of-round. Replace or repair crankshaft if it is not within specification. See CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS table under ENGINE SPECIFICATIONS.
- 4) Install upper main bearings into cylinder block. Ensure oil holes are aligned, and bearings are properly seated. Lubricate bearings with engine oil. Install thrust bearing with oil grooves toward crankshaft thrust surface.
- 5) Install crankshaft into block. Install thrust bearing with oil grooves toward crankshaft thrust surface. Install main bearing caps with arrow toward front of engine.
- 6) Measure oil clearance using Plastigage. Tighten bolts to specification in proper sequence. See Fig. 14. See TORQUE SPECIFICATIONS TABLE at the end of this article. Clearance must be within specification. See CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS table. If oil clearance is not within specification, replace bearings or crankshaft.
- 7) Ensure crankshaft rotates freely with main bearing cap installed. Measure crankshaft end play. See CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS table.
- 8) Install connecting rod caps and bearings. Install components in original locations. Tighten rod nuts to specification. See TORQUE SPECIFICATIONS TABLE at the end of this article. To complete installation, reverse removal procedure. Tighten bolts to specification.

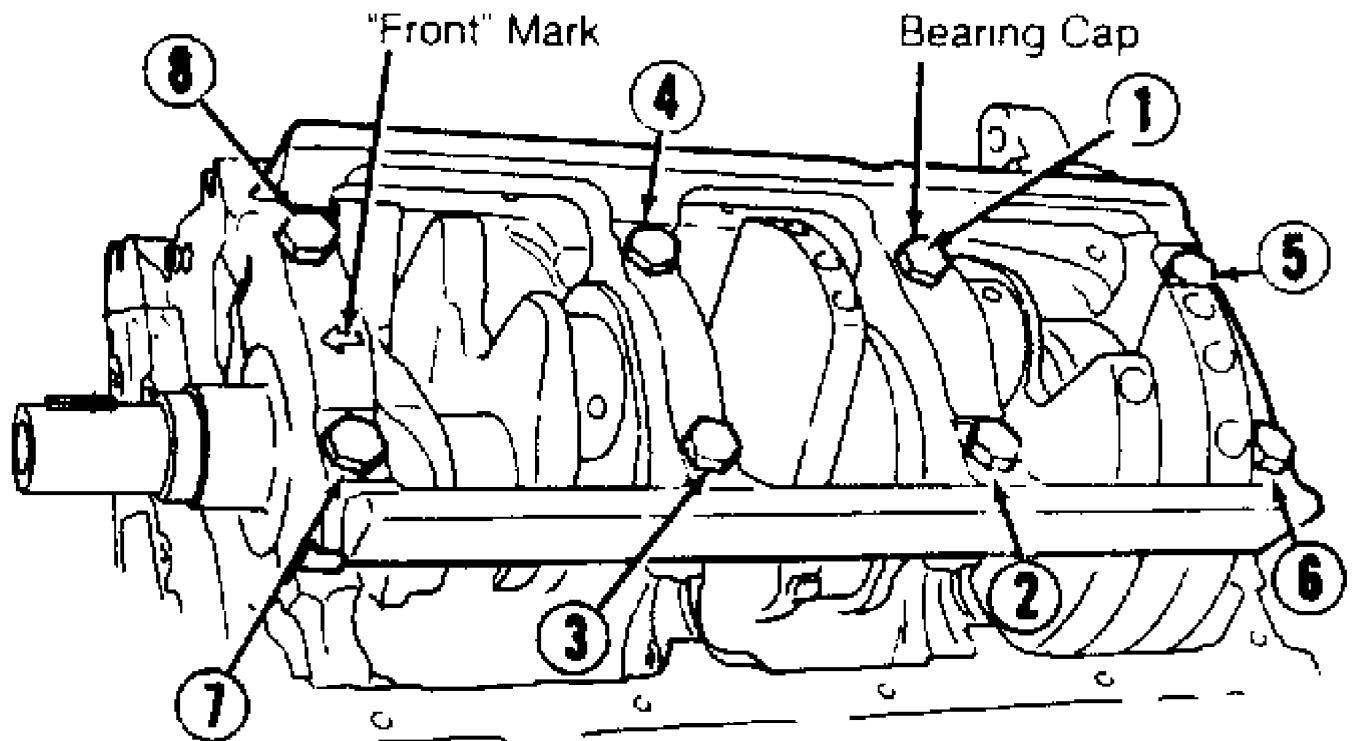


Fig. 14: Tightening Sequence For Main Bearing Cap Bolts
 Courtesy of Mitsubishi Motor Sales of America, Inc.

Connecting Rod Bearings

1) Mark bearing cap and connecting rod for location. Remove connecting rod cap and bearing. Install replacement bearing.

2) Align reference marks on rod cap and connecting rod. Measure bearing clearance with Plastigage. Connecting rods must move freely on crankshaft. Measure connecting rod side play. See CONNECTING RODS table under ENGINE SPECIFICATIONS.

Crankshaft End Play

If end play is not within specification, inspect thrust bearings and crankshaft. Replace thrust bearing or crankshaft to obtain correct end play. See CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS table under ENGINE SPECIFICATIONS.

ENGINE OILING

ENGINE LUBRICATION SYSTEM

Oil pressure is provided by a rotor-type pump driven by crankshaft. Pressure relief valve is located in oil pump body.

Crankcase Capacity

Montero, Pickup, and Ram-50 oil capacity is 5.0 qts. (4.7L). Add .5 qt. (.4L) when filter is replaced. Add .5 qt. (.4L) with oil cooler.

Oil Pressure

Oil pressure should be at least 11 psi (.8 kg/cm²) at idle and engine oil temperature of 167-194°F (75-90°C).

OIL PUMP

Removal

Remove timing belt and crankshaft sprocket. See TIMING BELT under REMOVAL & INSTALLATION. Remove oil pan. See OIL PAN under REMOVAL & INSTALLATION. Remove oil filter and mounting bracket. Remove oil pump and gasket from cylinder block. Note bolt length and location for installation reference.

Disassembly & Inspection

1) Disassemble pump. Inspect for scoring and cracks. Install rotors into pump body. Measure clearance between driven rotor and pump body. See OIL PUMP SPECIFICATIONS table.

2) Measure rotor side clearance. Replace rotor set or pump assembly if not within specification. Ensure relief valve slides freely in pump body bore. Inspect relief valve spring for damage.

OIL PUMP SPECIFICATIONS TABLE

Application	In. (mm)
Driven Rotor-To-Pump Body	.0039-.0071 (.099-.180)
Rotor Side Clearance	.0016-.0037 (.041-.094)

Reassembly & Installation

1) Reassemble pump. Tighten pump rear cover bolts to specification. See TORQUE SPECIFICATIONS TABLE at the end of this article. Install oil pump and gasket. Align splined teeth of oil pump with crankshaft. Install bolts, and tighten to specification.

2) If oil seal was removed, coat new seal with grease. Using Seal Driver (MD998717), install seal in oil pump until flush with case. Install remaining components.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS TABLE

Application	Ft. Lbs. (N.m)
Air Intake Plenum Stay Bolts	11-14 (15-19)
Camshaft Bearing Cap Bolt	14-15 (19-20)
Camshaft Sprocket Bolt	58-72 (79-98)
Connecting Rod Nut	37-38 (50-52)
Crankshaft Pulley Bolt	
Montero	108-116 (146-157)
Pickup & Ram-50	130-137 (176-186)
Cylinder Head Bolt (1) (Cold Engine)	65-72 (88-98)
Drive Plate Bolt	53-55 (72-75)
Exhaust Manifold Nut	11-16 (15-22)
Flywheel Bolt	53-55 (72-75)
Intake Manifold Bolts	11-15 (15-20)
Left Engine Support Bracket Bolt	15-21 (20-30)
Main Bearing Cap Bolt	55-61 (75-83)
Oil Pick-Up Tube Bolt	11-15 (15-20)
Rear Engine Support Bracket-To-Engine Bolt	13-18 (18-25)
Relief Valve Plug	29-36 (39-49)
Right Engine Support Bracket Bolt	
10 x 22-mm	25-36 (34-49)
12 x 22-mm & 12 x 32 mm	47-61 (64-83)
Rocker Shaft	14-15 (19-20)
Timing Belt Tensioner Bolt	16-21 (22-29)

Water Pump Bolt 14-20 (19-27)

INCH Lbs. (N.m)

Delivery Pipe Bolt 84-108 (9-12)
Distributor Adapter Bolt 108-132 (12-15)
Oil Filter Bracket Bolt 108-120 (12-14)
Oil Pan Bolt 48-60 (5-7)
Oil Pump Cover Bolt 72-108 (8-12)
Oil Pump Mounting Bolt 108-120 (12-14)
Rear Seal Case Bolt 84-108 (9-12)
Rocker Cover Bolt 72-84 (8-9)
Throttle Body Bolt 84-108 (9-12)
Timing Belt Cover Bolt 84-108 (9-12)
Transmission Mounting Plate Bolt 84-108 (9-12)

(1) - Tighten in 2 stages in proper sequence. See Fig. 3.

ENGINE SPECIFICATIONS

GENERAL ENGINE SPECIFICATIONS

GENERAL ENGINE SPECIFICATIONS TABLE

Application	Specification
Displacement	181.4 Cu. In. (3.0L)
Bore	3.587" (91.1 mm)
Stroke	2.992" (76.0 mm)
Compression Ratio	8.9:1
Fuel System	PFI
Horsepower @ RPM	143 @ 5000
Torque Ft. Lbs. @ RPM	168 @ 2500

CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS SPECS

CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS SPECS TABLE

Application	In. (mm)
Crankshaft	
End Play	
Standard	.0020-.0098 (.050-.250)
Limit	.012 (.30)
Main Bearings	
Journal Diameter	2.36 (59.9)
Journal Out-Of-Round	.0002 (.005)
Journal Taper	.0002 (.005)
Oil Clearance	
Standard	.0008-.0020 (.020-.051)
Limit	.004 (.10)
Connecting Rod Bearings	
Journal Diameter	1.965 (49.91)
Journal Out-Of-Round	.0002 (.005)
Journal Taper	.0002 (.005)
Oil Clearance	
Standard	.0008-.0020 (.020-.051)
Limit	.004 (.10)

CONNECTING RODS SPECIFICATIONS

CONNECTING RODS SPECIFICATIONS TABLE

Application	In. (mm)
Maximum Bend	.002 (.05)
Maximum Twist (Total Rod Length)	.004 (.10)
Side Play	
Standard	.0039-.0099 (.099-.251)
Limit	.016 (.41)

PISTONS, PINS & RINGS SPECIFICATIONS

PISTONS, PINS & RINGS SPECIFICATIONS TABLE

Application	In. (mm)
Pistons	
Clearance	.0008-.0016 (.020-.040)
Diameter	3.587 (91.11)
Pins	
Piston Fit	(1)
Rod Fit	(2)
Rings	
No. 1	
End Gap	
Standard	.0118-.0177 (.300-.450)
Limit	.031 (.79)
Side Clearance	
Standard	.0020-.0035 (.051-.089)
Limit	.004 (.10)
No. 2	
End Gap	
Standard	.0098-.0157 (.249-.399)
Limit	.031 (.79)
Side Clearance	
Standard	.0008-.0024 (.020-.060)
Limit	.004 (.10)
No. 3 (Oil)	
End Gap	
Standard	.008-.024 (.20-.60)
Limit	.039 (.99)

(1) - Slip.

(2) - At press load of 1653-3858 lbs. (750-1750 kg).

CYLINDER BLOCK SPECIFICATIONS

CYLINDER BLOCK SPECIFICATIONS TABLE

Application	In. (mm)
Cylinder Bore	
Standard Diameter	3.590 (91.19)
Maximum Taper & Out-Of-Round	.0008 (.020)
Maximum Deck Warpage	
Standard	.002 (.05)
Limit	.0040 (.102)

VALVES & VALVE SPRINGS SPECIFICATIONS

VALVES & VALVE SPRINGS SPECIFICATIONS TABLE

Application	Specification
Intake Valves	
Face Angle	45-45.5 °
Minimum Margin	.028" (.71 mm)
Standard Length	4.055" (103.00 mm)
Stem Diameter	.3134-.3140" (7.960-7.976 mm)
Exhaust Valves	
Face Angle	45-45.5 °
Minimum Margin	.059" (1.50 mm)
Standard Length	4.043" (102.70 mm)
Stem Diameter	.3122-.3130" (7.930-7.950 mm)
Valve Springs	
Free Length	
Standard	1.960" (49.78 mm)
Limit	1.920" (48.77 mm)
Installed Height	1.591" (40.41 mm)
Out-Of-Square	
Standard	2 °
Limit	4 °
Pressure (Valve Closed) ..	(1) 74 @ 1.591 (33.6 @ 40.41)

(1) - Lbs. @ In. (kg @ mm).

CYLINDER HEAD SPECIFICATIONS

CYLINDER HEAD SPECIFICATIONS TABLE

Application	Specification
Cylinder Head Height	3.310" (84.07 mm)
Maximum Warpage	.008" (.20 mm)
Valve Seats (Intake & Exhaust)	
Seat Angle	45 °-45.5
Seat Width	.035-.051" (.90-1.30 mm)
Seat Bore Diameter	1.732-1.742" (44.00-44.25 mm)
Valve Guides	
Intake Valve	
Valve Guide Cylinder	
Head Bore I.D.	.5118-.5189" (13.00-13.18 mm)
Valve Guide Length	1.732" (44 mm)
Stem-To-Guide Clearance	
Standard	.0012-.0024" (.030-.060 mm)
Limit	.004" (.10 mm)
Exhaust Valve	
Valve Guide Cylinder	
Head Bore I.D.	.5118-.5189" (13.00-13.18 mm)
Valve Guide Length	1.890" (48 mm)
Stem-To-Guide Clearance	
Standard	.0020-.0035" (.050-.090 mm)
Limit	.006" (.15 mm)

CAMSHAFT SPECIFICATIONS

CAMSHAFT SPECIFICATIONS TABLE

Application	In. (mm)

End Play	
Standard	004-.008 (0.1-0.2)
Limit	015 (0.4)
Journal Diameter	 1.34 (34.0)
Lobe Height	
Standard	 1.620 (41.15)
Limit	 1.600 (40.64)
Oil Clearance	0020-.0035 (.050-.090)

ABBREVIATIONS

1993 Mitsubishi Montero

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/cm ²	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 OIL CHECKING

1993 Mitsubishi Montero

1993 GENERAL SERVICING
Compressor Refrigerant Oil Checking

* PLEASE READ THIS FIRST *

NOTE: For compressor applications, see COMPRESSOR APPLICATIONS TABLE below. DO NOT exceed A/C system refrigerant oil capacity, when servicing system. See REFRIGERANT OIL & REFRIGERANT SPECIFICATIONS TABLE.

COMPRESSOR APPLICATION

NOTE: Due to late changes, always refer to underhood A/C specification label in engine compartment or A/C compressor label while servicing A/C system. If A/C Specification label and specifications in this article differ, always use label specifications.

COMPRESSOR APPLICATION TABLE

Application	Compressor
Acura	Nippondenso 10-Cyl.
Audi	
90	Zexel 6-Cyl.
100	Zexel 6-Cyl.
BMW	Nippondenso Or Seiko-Seiki
Chrysler Motors/Eagle	
Colt & Summit	Sanden FX105V Scroll
Colt Vista & Summit Wagon	Nippondenso 10PA15 10-Cyl.
Stealth	Sanden FX105VS Scroll
Ram-50	Sanden FX80 Scroll
Ford Motor Co.	
Capri	Nippondenso 10-Cyl.
Festiva	Nippondenso 6-Cyl.
General Motors & Geo	
LeMans	Harrison V5 5-Cyl.
Metro & Tracker	Nippondenso 10-Cyl.
Prizm	Nippondenso 10PA15 10-Cyl.
Storm	Diesel Kiki KC-50 Rotary Vane
Honda	
Accord	Nippondenso 10-Cyl. Or Hadsys RC-17S 7-Cyl.
Civic	Sanden Scroll
Civic Del Sol	Sanden Scroll
Prelude	Sanden Scroll
Hyundai	
Elantra	Sanden TRF-090 Scroll
Excel	Sanden SD-709 7-Cyl.
Scoupe	Nippondenso 10PA15C 10-Cyl.
Sonata	Ford FX-15 10-Cyl.
Infiniti	
G20	Atsugi NVR 140S Rotary Vane
J30	Calsonic V6 6-Cyl.
Q45	Calsonic V5 5-Cyl.
Isuzu (R-12)	
Amigo	Diesel Kiki DKS-13CH 6-Cyl.
Pickup	

4-Cylinder	Diesel Kiki DKS-13CH	6-Cyl.
V6	Harrison R4	4-Cyl. Radial
Stylus	Diesel Kiki DKV-14D	Rotary Vane
Rodeo		
4-Cylinder	Diesel Kiki DKS-17CH	6-Cyl.
V6	Diesel Kiki DKV-14D	Rotary Vane
Trooper	Diesel Kiki DKV-14D	Rotary Vane
Isuzu (R-134a Option) (1)		
Amigo, Pickup, Rodeo & Trooper		
2.3L & 2.6L Engine	Zexel R-134a	6-Cyl.
3.1L Engine	Harrison R-134a R-4	4-Cyl. Radial
3.2L Engine	Zexel R-134a	Rotary Vane
Jaguar		
XJS	Sanden SD-709	7-Cyl.
XJ6	Sanden SD-7H15	7-Cyl.
Lexus	Nippondenso 10PA20	10-Cyl.
Mazda		
B2200 & B2600i	Sanden	5-Cyl.
Miata	Nippondenso TV12	Rotary Vane
MPV	Nippondenso	10-Cyl.
MX-6 & 626	Panasonic	Rotary Vane
Navajo	Ford FX-15	10-Cyl.
MX-3, Protege & 323	Panasonic	Rotary Vane
929	Panasonic	Rotary Vane
RX7	Nippondenso TV12	Rotary Vane
Mercedes-Benz		
190E	Nippondenso 10PA15	10-Cyl.
300D/E, 400E & 500E	Nippondenso 10PA17	10-Cyl.
300SE/SD, 400SE & 500SEL	Nippondenso 10PA20	10-Cyl.
Mitsubishi		
Diamante		
R-12	Sanden FX105VS	Scroll
R-134a	Sanden MSC105	
Diamante Wagon	Nippondenso 10PA17C	10-Cyl.
Galant & Mirage	Sanden FX105V	Scroll
Eclipse	Nippondenso 10PA17	10-Cyl.
Expo/Expo LRV	Nippondenso 10PA17C	10-Cyl.
Pickup	Sanden FX80	Scroll
Montero	Nippondenso 10PA15	10-Cyl.
Precis	Sanden SD-709	7-Cyl.
3000GT		
R-12	Sanden FX105VS	Scroll
R-134a	Sanden MSC105	
Nissan		
Altima	Zexel DKV-14C	Rotary Vane
Maxima & 300ZX	Zexel DKS-16H	6-Cyl.
Quest	Ford FX-15	10-Cyl.
Pathfinder & Pickup	Zexel DKV-14C	Rotary Vane
Sentra & NX	Zexel DKV-14D	Rotary Vane
240SX	Calsonic V5	5-Cyl.
Porsche		
911 America Roadster,		
RS America & Carrera 2/4	Nippondenso	10-Cyl.
Saab		
900	Sanden	5-Cyl.
9000	Seiko-Seiki SS121	DN1 Rotary Vane
Subaru		
Impreza	Zexel	Rotary Vane
Legacy	Zexel DKS-15CH	5-Cyl.
	Calsonic V5-15C	5-Cyl.
Loyale	Hitachi MJS170-5DP	6-Cyl.
SVX	Calsonic V5	5-Cyl.
Suzuki	Nippondenso	10-Cyl.

Toyota		
Camry	Nippondenso 10PA17C	10-Cyl.
Celica		
4A-FE Engine	Nippondenso 10PA15C	10-Cyl.
3S-GTE & 5S-FE Engine	Nippondenso 10PA17C/VC	10-Cyl.
Corolla	Nippondenso 10PA15	10-Cyl.
Land Cruiser	Nippondenso 10PA17	10-Cyl.
MR2	Nippondenso 10P13C	10-Cyl.
Paseo	Matsushita Rotary Vane	
Pickup & 4Runner	Nippondenso	10-Cyl.
Previa	Nippondenso 10PA17E	10-Cyl.
Supra	Nippondenso	10-Cyl.
Tercel	Matsushita TV10B Rotary Vane	
T100	Nippondenso 10PA15	10-Cyl.
Volkswagen		
Cabriolet	Sanden SD-508	5-Cyl.
	Or SD-709	7-Cyl.
Corrado SLC	Sanden SD-709	7-Cyl.
EuroVan	Sanden SD7H15	7-Cyl.
Golf, GTI & Jetta	Sanden SD7-V16/SD7-V16L	7-Cyl.
Fox	Nippondenso	6-Cyl.
Passat	Sanden SD7-V16/SD7-V16L	7-Cyl.
Volvo		
240	Seiko-Seiki SS-121DS5	
850	Zexel DKS-15CH	6-Cyl.
940 & 960	Sanden SD-510	5-Cyl.,
	Sanden SD-709	7-Cyl. Or
	Seiko-Seiki SS-121DS5	

(1) - Standard equipment on some models built after 5/1/93.

REFRIGERANT OIL & REFRIGERANT CAPACITY

REFRIGERANT OIL & REFRIGERANT CAPACITY (ACURA THROUGH INFINITI)

Application	(1) Oil Ounces	Refrigerant Ounces
Acura		
Integra	(2) 2.0-3.4	32-34
Legend		
Sedan	(2) (3) 4.7	(4) 24.7-26.5
Coupe	(3) 4.7	24.7-26.5
Vigor	(2) 4.7-4.9	26.5-28.0
Audi		
90	7.8-9.2	(5) 23.0-24.8
100	7.8-9.2	(5) 21.0-22.8
BMW		
318 & 325 Series	3.4-4.8	(6) 35-36
525i & 535i	4.7-6.1	(6) 53.0-55.5
740i & 740iL	4.7-6.1	(6) 53.0-55.5
Chrysler Motors/Eagle		
Colt & Summit	(2) 4.4-5.1	26-30
Colt Vista & Summit		
Wagon	(2) 2.0-3.4	30
Ram-50	(2) 4.4-5.1	30
Stealth	(2) 4.6-6.0	29
Ford Motor Co.		
Capri	2.4-3.0	23-27
Festiva	10	25
General Motors & Geo		

LeMans	8.0	35
Metro	2.7	18
Prizm & Prizm LSi	6.0	25
Storm	5.1	21
Tracker	2.7	21
Honda		
Accord		
Nippondenso	3.0-4.1	28-30
Hadsys	4.1-4.3	28-30
Civic	4.0-4.7	21-23
Civic Del Sol	4.0-4.7	21-23
Prelude	(7) 4.3-5.0	21-23
Hyundai		
Excel	8.1	30-32
Scoupe	2-3	28-32
Elantra	4.0	32
Sonata	6.9-7.7	30-32
Infiniti		
G20	6.8	24-29
J30	8.5	(8) 24-26
Q45	9.7	38-42

- (1) - Total system capacity, unless otherwise noted.
(2) - Compressor refrigerant oil capacity.
(3) - Capacity revised by manufacturer in Acura Service News bulletin number ASN 0793-02.
(4) - Use R-134a refrigerant and ND-Oil 8 (Part No. 38899-PR7-003).
(5) - Use R-134a refrigerant and Polyalkylene Glycol (PAG) oil.
(6) - Use R-134a and Polyalkylene Glycol Oil (Part No. 81-22-9-407-724).
(7) - Use R-134a refrigerant and PAG Refrigerant Oil (Part No. 38899-P13-003).
(8) - Use R-134a refrigerant and Type "S" Oil (Part No. KLH00-PAGS0).

REFRIGERANT OIL & REFRIGERANT CAPACITY (ISUZU THROUGH MERCEDES)

Application	(1) Oil Ounces	Refrigerant Ounces
Isuzu (R-12)		
Amigo	5.0	26
Pickup		
2.3L & 2.6L Engine	5.0	26
3.1L Engine	6.0	26
Rodeo		
2.6L Engine	5.0	26
3.2L Engine	5.0	26
Stylus	5.0	21
Trooper	5.0	30
Isuzu (R-134a Option) (3)		
Amigo & Pickup		
2.3L & 2.6L Engine	5.0	23
3.1L Engine	7.5-8.5	23
Rodeo	5.0	23
Trooper	5.0	26
Jaguar		
XJS	(2) 4.6	40
XJ6	(2) 4.5	(4) 40
Lexus		
ES300	(2) 3.5	32-35

GS300	.....	(2)	4.0	.....	(5)	28-32
LS400	.....	(2)	2.8-3.5	.....	(5)	32
SC300 & SC400	.....	(2)	4.0	.....		32-35
Mazda						
B2200 & B2600i	.....	(2)	4.5	.....		28
Miata	.....	(2)	2.7-3.3	.....		28
MPV						
Dual Unit	.....	(2)	2.7-3.3	.....		51
Single Unit	.....	(2)	2.7-3.3	.....		37
MX-3	.....	(2)	5.0	.....		28
MX-6 & 626	.....	(2)	4.3	.....		26
Protege & 323	.....	(2)	3.9-4.6	.....		28
Navajo	.....		7.0	.....		28-29
929	.....		3.6	.....		28
RX7	.....		3.4-4.7	.....		21
Mercedes-Benz						
190E	.....	(2)	4.0	.....		36
300D/E, 400E & 500E	.....	(2)	5.4	.....	(6)	36
300SE/SD, 400SE & 500SEL	.....	(2)	5.4	.....	(7)	43

- (1) - Total system capacity, unless otherwise noted.
- (2) - Compressor refrigerant oil capacity.
- (3) - Standard equipment on some models built after 5/1/93.
Use R-134a Swash Plate Compressor Oil (Part No. 2-90188-300-0) on 2.3L and 2.6L engine. Use R-134a R-4 Compressor Oil (Part No. 2-90222-320-0) on 3.1L engine. Use R-134a Rotary Vane Compressor Oil (Part No. 2-90188-301-0) on 3.2L engine.
- (4) - Use R-134a refrigerant and PAG SP20 refrigerant oil.
- (5) - Use R-134a refrigerant and ND-Oil 8 (Part No. 38899-PR7-003).
- (6) - Use R-134a refrigerant and Densooil 8 (Part No. A 001 989 08 03).
- (7) - Use R-134a refrigerant and Densooil 8 (Part No. A 001 989 08 03). Use 50 ounces if equipped with rear passenger compartment A/C-heater system.

REFRIGERANT OIL & REFRIGERANT CAPACITY (MITSUBISHI THRU SUBARU)

Application	(1) Oil Ounces	Refrigerant Ounces
Mitsubishi		
Diamante		
R-12	5.4-6.0	34-38
R-134a	(3) 5.7-6.4	26-28
Diamante Wagon	5.4	28
Eclipse	(2) 2.0-3.4	33
Expo/Expo LRV		
1.8L	(2) 3.4-4.0	30
2.4L	(2) 2.0-3.4	30
Galant	(2) 5.0-5.7	33
Mirage	(2) 4.4-5.1	26-30
Pickup	(2) 4.4-5.1	30
Montero	(2) 2.0-3.4	28
Precis	8.1	30-32
3000GT		
R-12	4.7-6.0	29
R-134a	(3) 4.7-6.0	26-28
Nissan		
Altima	(4) 6.8	25-28

Maxima	(5) 6.8	30-33
Pathfinder & Pickup	(4) 6.8	26-30
Quest		
Front A/C	7.0	36
Front & Rear A/C	10	56
Sentra & NX	6.8	23-26
240SX	8.0	29-32
300ZX	6.8	26-30
Porsche		
911 America Roadster, RS		
America & Carrera 2/4	4.6	(6) 29.5
Saab		
900	5.9	34-36
9000	6.6	(3) 33-34
Subaru		
Impreza	6.1	23-26
Legacy		
Zexel	(2) 2.4	29-32
Calsonic	(2) 3.2	29-32
Loyale	(2) 2.4	26-28
SVX	(2) 2.4	(7) 22-23

(1) - Total system capacity, unless otherwise noted.

(2) - Compressor refrigerant oil capacity.

(3) - Use SUN PAG 56 refrigerant oil.

(4) - Use R-134a refrigerant and Type "R" Oil (Part No. KLH00-PAGR0).

(5) - Use R-134a refrigerant and Type "S" Oil (Part No. KLH00-PAGS0).

(6) - Use R-134a refrigerant and Nippondenso ND8 refrigerant oil.

(7) - Use R-134a refrigerant and ZXL100 PG (DH-PS) Type "S" Oil (Part No. K0010PS000).

REFRIGERANT OIL & REFRIGERANT CAPACITY (SUZUKI THROUGH VOLVO)

Application	(1) Oil Ounces	Refrigerant Ounces
Suzuki		
Samurai	2.0-3.4	18
Sidekick	2.0-3.4	21-23
Swift	2.0-3.4	18
Toyota		
Camry	(2) 3.5	32-35
Celica	3.4-4.1	24-27
Corolla	3.4-4.1	25-28
Land Cruiser	3.4-4.1	30-34
MR2	3.4-4.1	28-32
Paseo	3.4-4.1	25-28
Pickup	3.4-4.1	24-29
Previa		
Without Rear A/C	3.4-4.7	32-35
With Rear A/C	3.4-4.7	41-44
Supra	(2) 4.1	(3) 23-27
Tercel	3.4-4.1	25-28
T100	3.4-4.1	(3) 21-25
4Runner	3.4-4.1	27-30
Volkswagen		
Cabriolet	4.6	30.0-31.8
Corrado SLC	3.9-4.4	35.0-36.8
EuroVan		
Without Rear A/C	4.6	(4) 34-35

With Rear A/C	8.2	(4) 48-49
Fox	5.7	41-42
Golf, GTI & Jetta	3.9	(4) 28-30
Passat	3.9-4.4	(4) 41.0-42.8
Volvo		
240	7.4	(5) 26
850		
Cold Climates	7.0	(5) 29
Hot Climates	7.0	(5) 26
940 & 960		
Sanden SD-510	4.8	(6) 32-34
Sanden SD-709	8.5	(6) 32-34
Seiko-Seiki	7.8	(6) 32-34

- (1) - Total system capacity, unless otherwise noted.
 - (2) - Compressor refrigerant oil capacity.
 - (3) - Use R-134a refrigerant and ND-Oil 8 (Part No. 38899-PR7-003).
 - (4) - Use R-134a refrigerant and SP-10 PAG Oil (Part No. G 052 154 A2).
 - (5) - Use R-134a refrigerant and ZXL 100 PG Oil (Part No. 8708581-7).
 - (6) - Use R-134a refrigerant and PAG Oil (Part No. 8708581-9).
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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. Always follow recovery/recycling equipment manufacturer's instructions. After refrigerant recovery process is completed, the amount of compressor oil removed must be measured and the same amount added to A/C system.

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 caps until connections of lines and fittings are completed.

CONNECTING LINES & FITTINGS

NOTE: All R-134a based systems use 1/2-16 ACME threaded fittings. Ensure all replacement parts match the connections of the system being worked on.

Always use a new gasket or "O" ring when connecting lines or fittings. Coat "O" ring with refrigerant oil and ensure it is not twisted during installation. Always use 2 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, evacuate system thoroughly with a vacuum pump. Charge system with proper amount of refrigerant and perform leak test. See REFRIGERANT OIL & REFRIGERANT SPECIFICATIONS article in GENERAL SERVICING for system capacities. Check all fittings that have been opened. After system has been leak tested, check system performance.

NOTE: Most compressors are pre-charged with a fixed amount of refrigerant (shipping) oil. Drain compressor oil from new compressor and add refrigerant oil to new compressor according to amount removed from old compressor. Always refer to underhood A/C specification label or A/C compressor label while servicing A/C system.

ATSUGI

ROTARY VANE

1) Before checking and adjusting oil level, operate engine at 1200 RPM. Set controls at maximum cooling and high blower motor speed for 10 minutes to return oil to compressor.

2) Stop engine. Discharge refrigerant and remove compressor from vehicle. See SERVICING PRECAUTIONS. Drain compressor oil through compressor discharge port and measure oil amount.

3) If amount drained is less than 3 ounces, conduct leak tests at system connections. Repair or replace faulty parts as necessary. Check purity of oil and adjust oil level as follows.

4) If amount drained is 3 ounces or more, oil level is okay. Fill with same amount drained, using new oil. If amount drained is less than 3 ounces, pour in 3 ounces of new refrigerant oil.

COMPONENT REFRIGERANT OIL CAPACITIES (ATSUGI ROTARY VANE)

Component	Ounces
Condenser	1.0-1.7
Evaporator	1.5-2.5
Receiver-Drier	0.5-0.8
Refrigerant Lines (1)	1.0-1.7

(1) - Add only if a refrigerant oil leak is indicated.

BOSCH

6-CYLINDER

1) Before checking and adjusting oil level, operate compressor at engine idle speed, and set controls at maximum cooling and high blower motor speed for 20-30 minutes to return oil to compressor.

2) Stop engine and discharge refrigerant. See SERVICING PRECAUTIONS. Remove refrigerant oil level inspection plug on side of compressor. Oil should be at lower lip of threaded hole. If oil level is low, add new refrigerant oil as necessary. Replace inspection plug and tighten to 10-12 ft. lbs. (14-16 N.m).

CALSONIC

V5 5-CYLINDER & V6 6-CYLINDER

Infiniti & Nissan

1) Before checking and adjusting oil level, operate engine at 1200 RPM. Set controls at maximum cooling and high blower motor speed for 10 minutes to return oil to compressor.

2) Stop engine. Discharge refrigerant. See SERVICING PRECAUTIONS. Measure the amount of oil drained/discharged into refrigerant recovery/recycling equipment.

3) Remove compressor from vehicle. Drain compressor oil from compressor drain plug and measure oil amount. Add this amount to amount drained in step 2), to obtain total amount drained.

4) Fill compressor with total amount drained, using new oil. If any major components of the system were also replaced, determine the amount of additional oil needed. See appropriate COMPONENT REFRIGERANT OIL CAPACITIES table for specified amount.

COMPONENT REFRIGERANT OIL CAPACITIES (CALSONIC V5)

Component	Ounces
Condenser	1.0-1.7
Evaporator	1.5-2.5
Receiver-Drier	0.5-0.8
Refrigerant Lines (1)	1.0-1.7

(1) - Add only if a refrigerant oil leak is indicated.

COMPONENT REFRIGERANT OIL CAPACITIES (CALSONIC V6)

Component	Ounces
Condenser	2.5
Evaporator	2.5
Receiver-Drier	0.2
Refrigerant Lines (1)	1.0

(1) - Add only if a refrigerant oil leak is indicated.

Subaru

1) Before checking and adjusting oil level, operate engine at 1000-1500 RPM. Set controls at maximum cooling and high blower motor speed for 20 minutes to return oil to compressor.

2) Stop engine. Discharge refrigerant and remove compressor from vehicle. See SERVICING PRECAUTIONS. Drain compressor oil from compressor drain plug and measure oil amount.

3) Fill compressor with total amount drained, using new oil. If any major components of the system were also replaced, determine the amount of additional oil needed. See appropriate SUBARU COMPONENT REFRIGERANT OIL CAPACITIES table for specified amount.

SUBARU COMPONENT REFRIGERANT OIL CAPACITIES (LEGACY)

Component	Ounces
Compressor	2.4
Condenser	1.7

Evaporator	2.4
Refrigerant Lines (1)	1.7

(1) - Add only if a refrigerant oil leak is indicated.

SUBARU COMPONENT REFRIGERANT OIL CAPACITIES (SVX)

Component	Ounces
Compressor	2.4
Condenser	1.7
Evaporator	2.4
Refrigerant Lines (1)	1.7

(1) - Add only if a refrigerant oil leak is indicated.

DIESEL KIKI

ROTARY VANE

1) Before checking and adjusting oil level, operate engine at 800-1000 RPM. Set controls at maximum cooling and high blower motor speed for 20 minutes to return oil to compressor.

2) Stop engine. Discharge refrigerant and remove compressor from vehicle. See SERVICING PRECAUTIONS. Remove oil drain plug and measure amount of oil drained.

3) If amount drained is less than 3 ounces (1.7 ounces on Geo Storm), conduct leak tests at system connections. Repair or replace faulty parts as necessary.

4) If amount drained is more 3 ounces (1.7 ounces on Geo Storm), oil level is okay. Fill compressor with same amount drained, using new oil. If amount drained is less than 3 ounces (1.7 ounces on Geo Storm), pour in 3 (1.7) ounces of new refrigerant oil.

5) When replacing other A/C system components, add the following amount(s) of refrigerant oil. See COMPONENT REFRIGERANT OIL CAPACITIES (DIESEL KIKI ROTARY VANE) table.

COMPONENT REFRIGERANT OIL CAPACITIES (DIESEL KIKI ROTARY VANE)

Component	Ounces
Condenser	1.7
Evaporator	1.0
Receiver-Drier	1.0
Refrigerant Lines	0.3

5 & 6-CYLINDER

1) Before checking and adjusting oil level, operate engine at 800-1000 RPM. Set controls at maximum cooling and high blower motor speed for 20 minutes to return oil to compressor.

2) Stop engine. Discharge refrigerant and remove compressor from vehicle. See SERVICING PRECAUTIONS. Remove oil drain plug and measure amount of oil drained.

3) If amount drained is less than 3 ounces, conduct leak tests at system connections. Repair or replace faulty parts as necessary.

4) If amount drained is more 3 ounces, oil level is okay. Fill compressor with same amount drained, using new oil.

5) When replacing other A/C system components, add the following amount(s) of refrigerant oil. See COMPONENT REFRIGERANT OIL CAPACITIES (DIESEL KIKI 5 & 6-CYLINDER) table.

COMPONENT REFRIGERANT OIL CAPACITIES (DIESEL KIKI 5 & 6-CYLINDER)

Component	Ounces
Condenser	1.0
Evaporator	1.7
Receiver-Drier	1.0
Refrigerant Lines	0.3

FORD

FX-15 10-CYLINDER

1) Slowly discharge system. See SERVICING PRECAUTIONS. Remove A/C compressor. Drain compressor oil from suction and discharge ports. Measure amount drained and discard oil.

2) If amount drained from removed (old) compressor is between 3 and 5 ounces, add drained amount of new refrigerant oil into the NEW compressor through suction port.

3) If amount drained is less than 3 ounces, add 3 ounces to the NEW compressor. If amount drained is more than 5 ounces, add 5 ounces. Use new "O" rings on refrigerant lines. Install A/C compressor. Evacuate and recharge system. Perform leak test.

4) When replacing other A/C system components, add the following amount(s) of refrigerant oil. See COMPONENT REFRIGERANT OIL CAPACITIES (FX-15 10-CYLINDER) table.

COMPONENT REFRIGERANT OIL CAPACITIES (FX-15 10-CYLINDER)

Component	Ounces
Condenser	1.0
Evaporator	3.0
Receiver-Drier	(1) 2.0
Refrigerant Lines	(2) 1.0

(1) - On Hyundai Sonata and Mazda Navajo, drain oil from old receiver-drier. Add amount drained to amount specified.

(2) - Add only if a large oil leak is indicated.

HADSYS

7-CYLINDER

Honda (Accord)

1) Discharge system. See SERVICING PRECAUTIONS. Remove compressor from vehicle. Drain all oil from NEW compressor and fill compressor with 4 ounces of clean refrigerant oil.

2) Add one ounce of refrigerant oil when replacing evaporator. Add 1/2 ounce when replacing condenser. When replacing receiver-drier or hoses, add 1/3 ounce per component replaced.

HARRISON

R4 4-CYLINDER

1) Before checking and adjusting oil level, operate engine at 800-1000 RPM. Set controls at maximum cooling and high blower motor speed for 20 minutes to return oil to compressor.

2) Stop engine. Discharge refrigerant and remove compressor from vehicle. See SERVICING PRECAUTIONS. Remove oil drain plug and measure amount of oil drained.

3) If amount drained is less than one ounce, conduct leak tests at system connections. Repair or replace faulty parts as necessary. Fill compressor with 2 ounces, using new refrigerant oil.

4) If amount drained is more one ounce, oil level is okay. Fill compressor with same amount drained, using new oil.

5) When replacing other A/C system components, add the following amount(s) of refrigerant oil. See COMPONENT REFRIGERANT OIL CAPACITIES (HARRISON R4 4-CYLINDER) table.

COMPONENT REFRIGERANT OIL CAPACITIES (HARRISON R4 4-CYLINDER)

Component	Ounces
Condenser	1.0
Evaporator	1.7
Receiver-Drier	1.0
Refrigerant Lines	0.3

V5 5-CYLINDER

1) If system is operable, run A/C system for several minutes to stabilize system. Turn off engine. Discharge system and remove compressor. See SERVICING PRECAUTIONS. Remove drain plug and measure oil.

2) If one ounce or more is drained, add same amount. If less than one ounce is drained, add 2 ounces of new refrigerant oil to compressor.

3) If condenser is replaced, add one ounce. Add 3.5 ounces if accumulator is replaced. If evaporator is replaced or if a large refrigerant leak occurred, add 3 ounces of new refrigerant oil.

HITACHI

6-CYLINDER

1) Before checking and adjusting oil level, operate compressor at 1000-1500 engine RPM, and set controls at maximum cooling and high blower motor speed for about 10 minutes to return oil to compressor.

2) Stop engine. Discharge refrigerant and remove compressor from vehicle. See SERVICING PRECAUTIONS. Drain oil from compressor through suction port. Measure amount of oil drained.

3) If amount drained is 2.4 ounces or more, fill with same amount using new oil. If amount drained is less than 2.4 ounces, fill with 2.4 ounces. Install compressor and recharge.

4) If A/C components are replaced, add refrigerant oil to system. Add 1.7 ounces if condenser is replaced. Add 2.4 ounces if evaporator is replaced. Oil does not need to be added if receiver-drier is replaced. Add 1.7 ounces of refrigerant oil only if a refrigerant oil leak is indicated.

MATSUSHITA

ROTARY VANE

Geo (Prizm)

1) If system is operable, run A/C system for several minutes to stabilize system. Turn off engine. Discharge system and remove compressor. See SERVICING PRECAUTIONS. Remove drain plug and measure oil.

2) If one ounce or more is drained, add same amount. If less than one ounce is drained, add 2 ounces of new refrigerant oil to compressor.

3) If condenser is replaced, add one ounce. Add 3.5 ounces if receiver-drier is replaced. If evaporator is replaced or if a large refrigerant leak occurred, add 3 ounces of new refrigerant oil.

Toyota

Discharge system. See SERVICING PRECAUTIONS. Remove compressor from vehicle. Drain oil from compressor through inlet and outlet ports. Fill compressor with 3.4-4.1 ounces of oil through suction port. Add 0.7 ounces if receiver-drier was replaced. When replacing condenser or evaporator, add 1.4-1.7 ounces of refrigerant oil.

NIPPONDENSO

ROTARY VANE

1) Before checking and adjusting oil level, operate compressor at engine idle speed, and set controls at maximum cooling and high blower motor speed for 20-30 minutes to return oil to compressor.

2) Stop engine. Discharge refrigerant and remove compressor from vehicle. See SERVICING PRECAUTIONS. Drain compressor oil through compressor intake and discharge ports. Measure amount drained.

3) Fill compressor with same amount as drained, plus one ounce. When replacing condenser, add one ounce. When replacing evaporator, add 1 1/2 ounces. When replacing receiver-drier, add 1/3 ounce of new refrigerant oil.

6 & 10-CYLINDER

NOTE: Porsche and Suzuki compressor oil checking procedures are not available from manufacturer.

Acura & Honda

1) Discharge system. See SERVICING PRECAUTIONS. Remove compressor from vehicle. Drain all oil from NEW compressor and fill compressor with 3-4 ounces of clean refrigerant oil.

2) On Accord, add 5/6 ounce of refrigerant oil when replacing evaporator. Add 1/3 ounce when replacing condenser. When replacing receiver-drier or hoses, add 1/3 ounce per component replaced.

3) On Legend, add 2 ounces of refrigerant oil when replacing evaporator. Add one ounce when replacing condenser. When replacing receiver-drier or hoses, add 1/3 ounce per component replaced.

4) On Integra, add one ounce of refrigerant oil when replacing evaporator. When replacing condenser, receiver-drier or hoses, add 1/3 ounce per component replaced.

5) On Vigor, add 1/2 ounce of refrigerant oil when replacing evaporator. Add 2/3 ounce when replacing condenser. When replacing receiver-drier or hoses, add 1/3 ounce per component replaced.

Chrysler Corp. (Colt Vista/Summit Wagon)

Add 2 ounces of refrigerant oil when replacing evaporator. Add one ounce when replacing condenser. When replacing receiver-drier or hoses, add 1/3 ounce per component replaced.

Ford Motor Co.

On Capri, add 2-3 ounces when replacing compressor. Add one ounce of refrigerant oil when replacing condenser or evaporator. When replacing receiver-drier, add 1/2 ounce. On Festiva, drain and measure oil from receiver-drier. Add the amount drained plus one ounce. Add one ounce when replacing condenser. Add 3 ounces of refrigerant oil when replacing evaporator.

Geo, Hyundai & Mazda

Add one ounce of refrigerant oil when replacing condenser. Add 1-1 1/2 ounce when replacing evaporator. When replacing receiver-drier or hoses, add 1/3 ounce per component replaced.

Lexus & Toyota

The use of refrigerant recovery/recycling is recommended by manufacturer. After refrigerant recovery process is completed, the amount of compressor oil removed must be measured and the same amount added to A/C system. Add 1 1/2 ounces of refrigerant oil when replacing condenser. Add 1 1/2 ounces when replacing evaporator. When replacing receiver-drier or hoses, add 1/2 ounce per component replaced.

Mercedes-Benz

Add 2/3 ounce of refrigerant oil when replacing condenser. Add 1 1/3 ounces when replacing evaporator. When replacing receiver-drier or hoses, add 1/3 ounce per component replaced. If A/C system line has broken (sudden discharge), add 1 1/3 ounces of refrigerant oil.

NOTE: On Mercedes-Benz vehicles with rear A/C, add 2/3 ounce of refrigerant oil when replacing rear condenser. When replacing rear A/C lines, add 1/3 ounce per line replaced.

Mitsubishi

1) On Eclipse, add 2/3 ounce of refrigerant oil when replacing condenser. Add one ounce when replacing evaporator. When replacing receiver-drier or hoses, add 1/3 ounce per component replaced.

2) On Expo/Expo LRV and Montero, add one ounce of refrigerant oil when replacing condenser. Add 2 ounces when replacing evaporator. When replacing receiver-drier or hoses, add 1/3 ounce per component replaced.

Volkswagen (Fox)

1) The use of refrigerant recovery/recycling is recommended by manufacturer. After refrigerant recovery process is completed, the amount of compressor oil removed must be measured and the same amount added to A/C system.

2) Add 1 1/2 ounce of refrigerant oil when replacing evaporator. When replacing condenser, add 1 1/3 ounce of refrigerant oil. Add one ounce of refrigerant oil when replacing receiver-drier (1 1/2 ounces if relief valve on receiver-drier has burst).

PANASONIC

ROTARY VANE

Mazda

Add 1 1/3 ounce of refrigerant oil when replacing condenser (1/2 ounce on MX-6 and 626). Add 2 ounces when replacing evaporator. When replacing receiver-drier or hoses, add 1/3 ounce of refrigerant oil.

SANDEN

SCROLL

Chrysler/Mitsubishi

1) On Colt, Galant, Mirage, Pickup, Ram-50 and Summit, add 1/2 ounce of refrigerant oil when replacing condenser. Add 1 1/2 ounces when replacing evaporator. When replacing receiver-drier or hoses, add 1/3 ounce per component replaced.

2) On Stealth and 3000GT, add 1/2 ounce of refrigerant oil when replacing condenser. Add 2 ounces when replacing evaporator. When replacing receiver-drier or low-pressure hose, add 1/3 ounce per component replaced.

Honda

1) Discharge system. See SERVICING PRECAUTIONS. Remove compressor from vehicle. Drain all oil from NEW compressor and fill compressor with 4 ounces of clean refrigerant oil.

2) On Civic and Civic Del Sol, add 1 1/2 ounce of refrigerant oil when replacing evaporator. Add 2/3 ounce when replacing condenser. When replacing receiver-drier or hoses, add 1/3 ounce per component replaced.

3) On Prelude, add one ounce of refrigerant oil when replacing evaporator. When replacing other A/C components, add 1/3 ounce per component replaced (including hoses).

Hyundai

Add 1 1/2 ounces of refrigerant oil when replacing evaporator. Add one ounce when replacing condenser. When replacing receiver-drier, add 1/3 ounce of refrigerant oil.

5-CYLINDER

Mazda

Add one ounce of refrigerant oil when replacing condenser. Add 1 2/3 ounce when replacing evaporator. When replacing receiver-drier, add 1/2 ounce of refrigerant oil.

NOTE: Saab and Volvo (Sanden 5 or 7-cylinder) compressor oil checking procedures are not available from manufacturer.

7-CYLINDER

Hyundai & Mitsubishi (Excel & Precis)

1) Before checking and adjusting oil level, operate compressor at engine idle speed, and set controls at maximum cooling and high blower motor speed for 20-30 minutes to return oil to compressor.

2) Stop engine. Discharge refrigerant and remove compressor from vehicle. See SERVICING PRECAUTIONS. Remove oil drain plug and drain oil. Measure amount of oil drained. Install drain plug with new "O" ring.

3) If amount drained is 2.3 ounces or more, fill compressor with same amount using new oil. If amount drained is less than 2.3 ounces, fill with 2.3 ounces. Install filler plug. Install compressor and recharge system.

COMPONENT REFRIGERANT OIL CAPACITIES (SANDEN 7-CYLINDER)

Component	Ounces
Condenser	1.0
Evaporator	3
Receiver-Drier	1

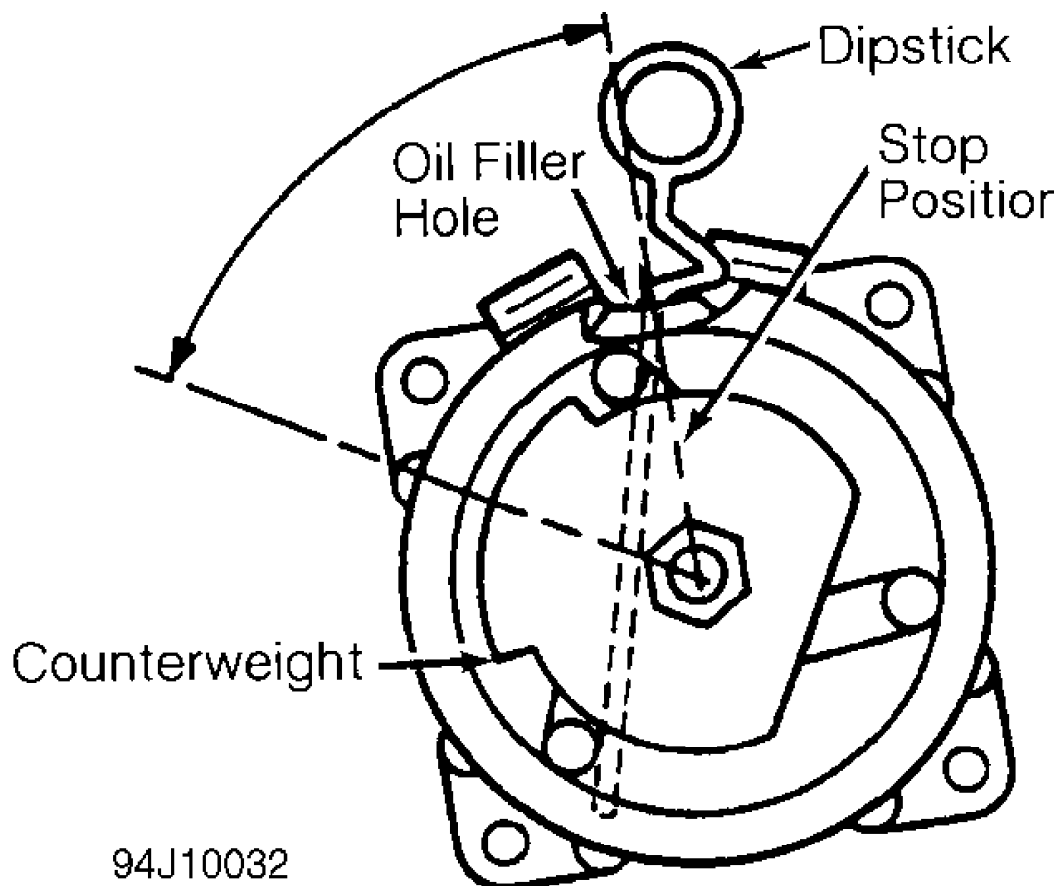
Jaguar (XJS)

1) Operate engine at idle speed for 10 minutes, to return refrigerant oil to compressor. Stop engine. Discharge refrigerant. See SERVICING PRECAUTIONS. Clean area around compressor filler plug and remove plug slowly.

2) Determine angle at which compressor is mounted. Insert compressor dipstick diagonally until stop on dipstick contacts filler plug surface. See Fig. 1. Remove dipstick and note oil fill level. Each increment on dipstick represents one ounce of oil.

3) Determine amount of oil needed according to mounting angle. See COMPRESSOR OIL CAPACITIES (JAGUAR XJS) table for specified amount.

4) If necessary, correct compressor oil level. Install compressor oil plug, and tighten it to 72-108 INCH lbs. (8-12 N.m). Evacuate and recharge A/C system. Perform leak test.



94J10032

Fig. 1: Checking Jaguar XJS Compressor Oil Level (Sanden 7-Cylinder)
Courtesy of Jaguar Cars, Inc.

COMPRESSOR OIL CAPACITIES (JAGUAR XJS)

Mounting Angle (In Degrees)	Oil Level In Increments
0	3-5
10	4-6
20	5-7
30	6-8
40	7-9
50	8-10
60	9-11
90	10-12

Volkswagen

1) The use of refrigerant recovery/recycling is recommended by manufacturer. After refrigerant recovery process is completed, the amount of compressor oil removed must be measured and the same amount added to A/C system.

2) On Cabriolet, add 2/3 ounce of refrigerant oil when replacing evaporator. When replacing condenser or receiver-drier, add 1/3 ounce of refrigerant oil per component replaced.

3) On Corrado SLC, Golf, GTI, Jetta and Passat, add 2/3 ounce of refrigerant oil when replacing evaporator. When replacing condenser or receiver-drier, add 1/3 ounce of refrigerant oil per component replaced.

4) On EuroVan, add one ounce of refrigerant oil when replacing evaporator. Add 1/2 ounce when replacing condenser (2/3 ounce on vehicles with rear A/C). When replacing receiver-drier, add 1/3 ounce (2/3 ounce on vehicles with rear A/C).

SEIKO-SEIKI

ROTARY VANE

Saab (9000)

The A/C system is filled with 6.6 ounces of compressor oil. The compressor must be topped off with the specified amount. See COMPONENT REFRIGERANT OIL CAPACITIES (SEIKO-SEIKI ROTARY VANE) table. Topping off should be carried out on the high pressure side of the compressor.

COMPONENT REFRIGERANT OIL CAPACITIES (SEIKO-SEIKI ROTARY VANE)

Component	Ounces
Compressor	(1) 2.3
Condenser	1.3
Expansion Valve	0.6
Evaporator	1.3
Receiver-Drier	1.3
Refrigerant Lines	0.6

(1) - To avoid an excessive amount of oil in the A/C system, oil must be drained from the compressor before it is installed.

ZEXEL

NOTE: Isuzu and Subaru compressor oil checking procedures are not available from manufacturer.

ROTARY VANE

Nissan

1) Before checking and adjusting oil level, operate engine at 1200 RPM. Set controls at maximum cooling and high blower motor speed for 10 minutes to return oil to compressor.

2) Stop engine. Discharge refrigerant. See SERVICING PRECAUTIONS. Measure the amount of oil drained/discharged into refrigerant recovery/recycling equipment.

3) Remove compressor from vehicle. Drain compressor oil from compressor drain plug and measure oil amount. Add this amount to amount drained in step 2), to obtain total amount drained.

4) Fill compressor with total amount drained, using new oil. If any major components of the system were also replaced, determine the amount of additional oil needed. See COMPONENT REFRIGERANT OIL CAPACITIES (ZEXEL ROTARY VANE & 6-CYLINDER) table for specified amount.

COMPONENT REFRIGERANT OIL CAPACITIES (ZEXEL ROTARY VANE & 6-CYLINDER)

Component	Ounces
Condenser	
Altima & Maxima	2.5
NX, Pickup, Sentra & 300ZX	1.0-1.7
Evaporator	
Altima & Maxima	2.5
NX, Pickup, Sentra & 300ZX	1.5-2.5
Receiver-Drier	
Altima & Maxima	0.2
NX, Pickup, Sentra & 300ZX	0.5-0.8
Refrigerant Lines (1)	1.0

(1) - Add only if a refrigerant oil leak is indicated.

6-CYLINDER

Audi

1) The use of refrigerant recovery/recycling is recommended by manufacturer. After refrigerant recovery process is completed, the amount of compressor oil removed must be measured and the same amount added to A/C system.

2) Add one ounce of refrigerant oil when replacing accumulator. When replacing condenser, add amount drained from condenser plus 1/3 ounce of refrigerant oil. When replacing evaporator, add amount drained from evaporator plus 2/3 ounce of refrigerant oil.

Nissan

1) Before checking and adjusting oil level, operate engine at 1200 RPM. Set controls at maximum cooling and high blower motor speed for 10 minutes to return oil to compressor.

2) Stop engine. Discharge refrigerant. See SERVICING PRECAUTIONS. Measure the amount of oil drained/discharged into refrigerant recovery/recycling equipment.

3) Remove compressor from vehicle. Drain compressor oil from compressor drain plug and measure oil amount. Add this amount to amount drained in step 2), to obtain total amount drained.

4) Fill compressor with total amount drained, using new oil. If any major components of the system were also replaced, determine the amount of additional oil needed. See COMPONENT REFRIGERANT OIL CAPACITIES (ZEXEL ROTARY VANE & 6-CYLINDER) table for specified amount.

Volvo (850)

1) Discharge refrigerant. See SERVICING PRECAUTIONS. Remove compressor from vehicle. Drain compressor oil from compressor drain plug and measure oil amount. Add the same amount of oil as was drained from the old compressor.

2) Add 1 2/3 ounce of refrigerant oil when replacing evaporator. When replacing condenser or hoses, add 2/3 ounce of refrigerant oil per component replaced. Add 3 ounce of refrigerant oil when replacing receiver-drier.

A/C COMPRESSOR SERVICING

1993 Mitsubishi Montero

1993 AIR CONDITIONING & HEAT
Compressor Servicing

READ THIS FIRST

NOTE: The purpose of this article is to provide GENERAL servicing overview. For more specific information, refer to the AUTO A/C-HEAT SYSTEM, MANUAL A/C-HEAT SYSTEM, or HEATER SYSTEM articles in this section.

NOTE: Due to variety of clutch and shaft seal configurations, obtain appropriate A/C compressor service tools for compressor being serviced.

ATSUGI ROTARY VANE CLUTCH COIL R & I

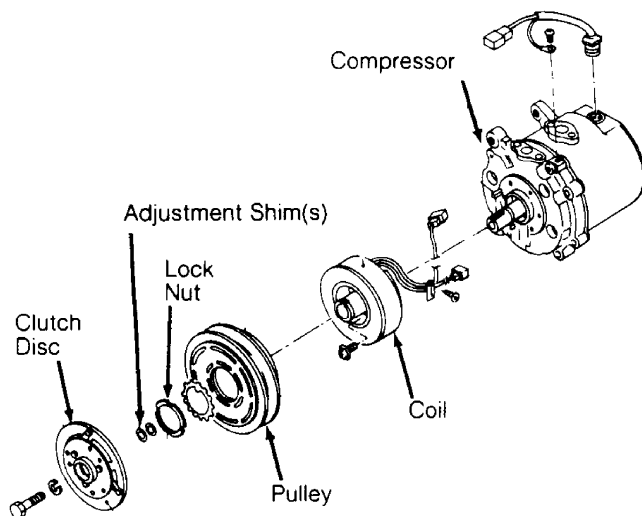
Removal

When replacing compressor clutch, be careful not to scratch shaft or bend pulley. When removing center bolt, hold clutch disc with Clutch Holder (KV99231010). Using Hub Puller (KV998VR001), remove clutch disc. When removing pulley, remove lock nut with Hub Socket (KV99235160).

Installation

1) Tighten center bolt to 81-104 INCH lbs. (9.1-11.8 N.m). Tighten lock nut to 21-29 ft. lbs. (29-39 N.m). Using feeler gauge, ensure clearance between clutch disc and pulley is .012-.024" (.30-.60 mm).

2) If clearance is not correct, replace adjustment shim(s). See Fig. 1. Break-in clutch by engaging and disengaging clutch about 30 times.



103223

Fig. 1: Exploded View Of Compressor (Atsugi Rotary Vane)
Courtesy of Nissan Motor Co., U.S.A.

BOSCH 6-CYLINDER CLUTCH COIL R & I

Removal

1) Hold clutch plate and remove shaft nut. Using Clutch Plate Remover (64 5 00), remove clutch plate. Using snap ring pliers, remove circlip and remove pulley assembly.

2) If pulley bearing is being replaced, remove circlip at rear of pulley. Press bearing and spacer from pulley. Press in new bearing with spacer and replace circlip.

Installation

1) Clean all surfaces. Install pulley assembly on compressor and install circlip. Ensure clutch plate shim is in place on shaft. Install clutch plate and nut. Tighten nut to 13-15 ft. lbs. (18-20 N. m).

2) Using a feeler gauge, check clutch plate-to-pulley clearance. Clearance should be .028-.051" (.7-1.3 mm). If clearance is not correct, remove clutch plate and replace clutch plate shim. See Fig. 2.

BOSCH 6-CYLINDER SHAFT SEAL R & I

Removal

Remove clutch plate. Remove shaft key and circlip. Using Seal Seat Remover/Installer (64 5 030), remove seal seat. Using Seal Remover/Installer (64 5 040), turn seal slightly clockwise to disengage tangs and pull out shaft seal. Remove "O" ring seal.

Installation

1) Coat new "O" ring seal with refrigerant oil and install. Coat new shaft seal with refrigerant oil and install seal on Seal Remover/Installer (64 5 040). Ensure shaft seal and shaft machine surfaces align. Insert shaft seal and turn slightly counterclockwise to secure on shaft.

2) Using sleeve from Seal Seat Remover/Installer (64 5 030), push seal seat into compressor and install circlip. Install shaft key and clutch plate. Check compressor oil level before charging system.

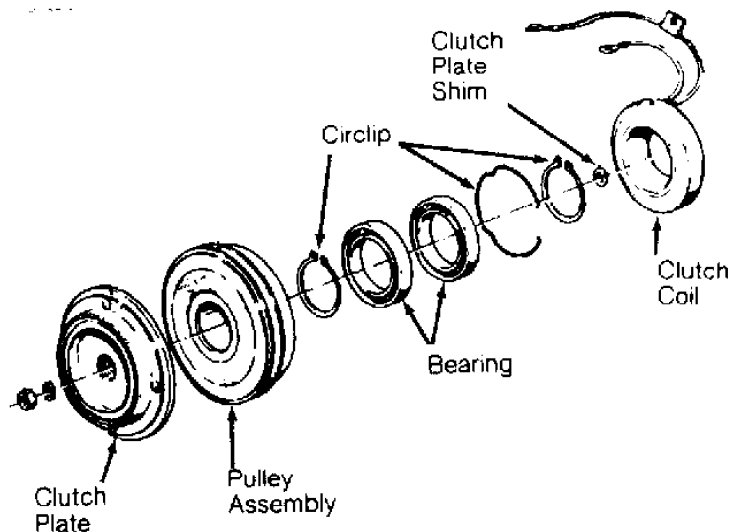


Fig. 2: Exploded View Of Compressor Clutch (Bosch 6-Cylinder)
Courtesy of BMW of North America, Inc.

CALSONIC V5 & V6 CLUTCH COIL R & I

NOTE: Calsonic V6 compressor servicing procedure is not available from manufacturer.

Removal

1) Remove shaft nut while holding clutch plate with Clutch Disc Wrench (J-39072). Install clutch disc Puller Set (J-39073-4, J-33013-1, J-33013-3) and remove clutch plate.

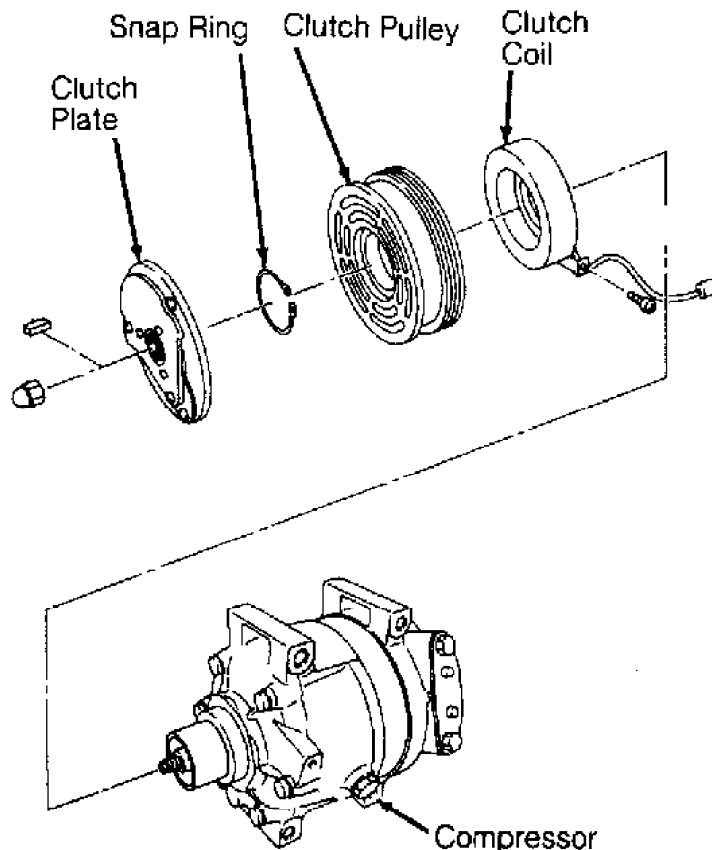
2) Remove snap ring. Use a universal gear puller to remove clutch pulley. See Fig. 3. Remove screw from clutch coil lead. Use puller to remove clutch coil.

Installation

1) To install clutch coil, reverse removal procedure. Ensure coil lead is installed in original position. Using puller set and Coil Jig (J-39073-1), carefully press clutch coil into place.

2) Install a new clutch pulley snap ring, being careful not to damage shaft seal. Press clutch plate into place. Install shaft nut and torque to 89-106 INCH lbs. (10-12 N.m).

3) Use a feeler gauge to check clutch plate-to-pulley clearance. Clearance should be .012-.024" (.30-.60 mm). If clearance is too large, remove shaft nut and again press in clutch plate. If clearance is too small, increase gap by pulling up clutch plate. DO NOT remove shaft nut.



92C02496

Fig. 3: Exploded View Of Compressor Clutch (Calsonic V5)
Courtesy of Nissan Motor Co., U.S.A.

Removal

1) Hold clutch disc using Clutch Holder (J-33939) and remove center bolt. Using Puller (J-33944-A) and Forcing Bolt (J-33944-4), remove clutch disc. Remove adjustment shim(s) and snap ring.

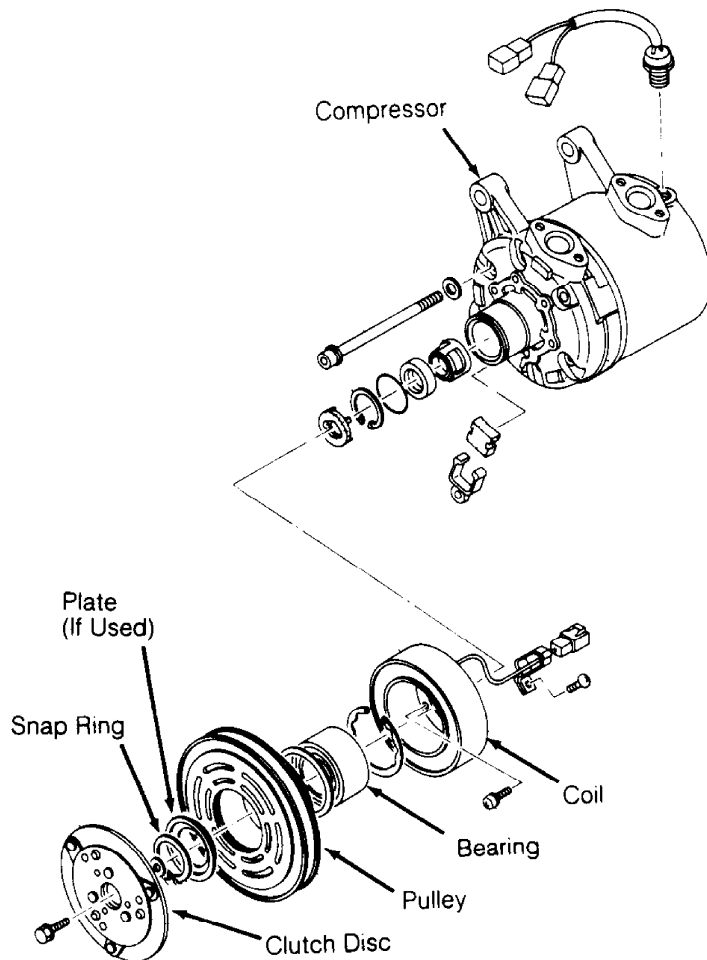
2) Remove pulley using Pilot (J-38424) and universal puller. Remove coil lead screw, clutch coil screws and coil. Remove snap ring and bearing if necessary.

Installation

1) Ensure coil lead is installed in original position.

Install and tighten coil screws to 35-53 INCH lbs. (4-6 N.m). Press pulley onto compressor using Pulley Installer (J-33940). Install snap ring and adjustment shim(s).

2) Install clutch disc and tighten center bolt to 106-133 INCH lbs. (12-15 N.m). Using feeler gauge, ensure clearance between clutch disc and pulley is .012-.024" (.30-.60 mm). If clearance is incorrect, add or remove shim(s) as necessary. Break-in clutch by engaging and disengaging clutch 30 times.



103225

Fig. 4: Exploded View Of Compressor (Diesel Kiki Rotary Vane)
Courtesy of Nissan Motor Co., U.S.A.

NOTE: Due to variety of clutch and shaft seal configurations, obtain appropriate A/C compressor service tools for compressor being serviced.

Removal & Installation

1) Using Clutch Holder (J-33939) to prevent clutch disc from rotating, remove shaft bolt. Using Clutch Disc Puller (J-33944-A) and Forcing Bolt (J-33944-4), remove clutch disc. Remove shim(s) from compressor drive shaft or clutch disc. See Fig. 5.

2) Remove snap ring, cover and pulley. With Puller Guide (J-33943-A) in center of pulley, attach Crossbar (J-8433) to outside diameter of pulley. Tighten crossbar bolt against puller guide to remove pulley. Remove coil lead, screws, and coil.

3) To install, reverse removal procedure. Install cover snap ring with beveled side facing out. Install clutch disc and tighten center bolt to 133 INCH lbs. (15 N.m).

4) Using feeler gauge, ensure clearance between clutch disc and pulley is .012-.024" (.30-.60 mm). If clearance is incorrect, add or remove shim(s) as necessary.

DIESEL KIKI SHAFT SEAL R & I

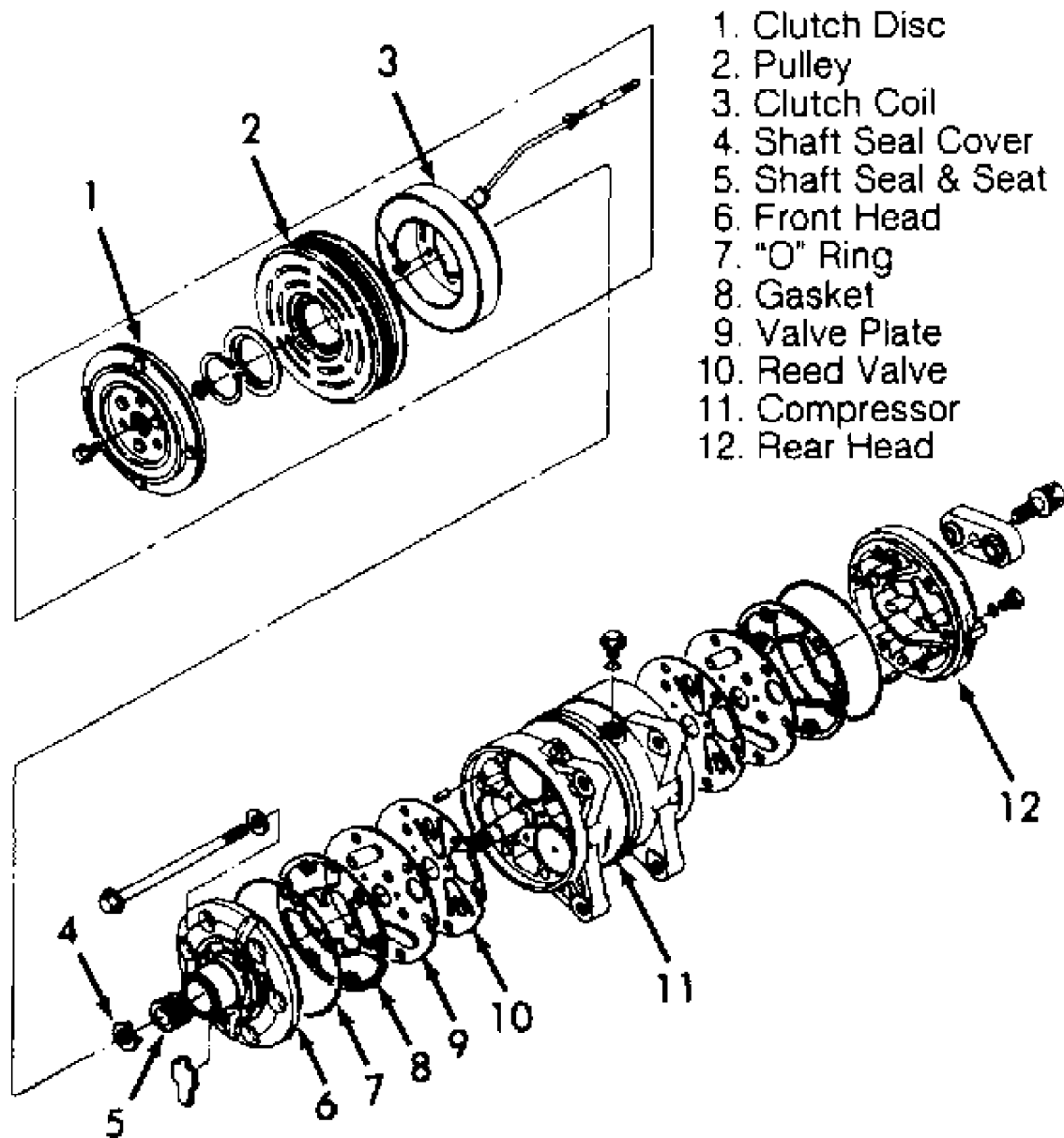
Removal & Installation

1) Remove clutch coil. Remove and discard felt. Using Shaft Seal Cover Remover/Installer (J-33942), push down and turn remover clockwise to engage tangs to cover. Slowly remove seal cover from bore.

2) Remove shaft seal snap ring. Use Shaft Seal Remover (J-33942-B) to remove seal. Remove compressor through bolts, front head and "O" ring. If necessary, replace front and rear valve plates, reed valves, and "O" rings.

3) To install, reverse removal procedure. Coat "O" ring, shaft seal and seal seat with refrigerant oil. Place Shaft Seal Guide (J-34614) over end of compressor shaft. Ensure chamfered portion of shaft seal retainer aligns with chamfered portion on compressor shaft.

4) Install front head and tighten compressor through bolts, in a crisscross pattern, to 16 ft. lbs. (22 N.m). Install shaft seal cover and felt. See Fig. 5. Rotate compressor drive shaft 2-3 times to ensure compressor operates smoothly.



93G19261

Fig. 5: Exploded View Of Compressor (Diesel Kiki 6-Cylinder)
 Courtesy of Isuzu Motor Co.

Removal

1) Using Clutch Holder (000 41 0812 05), remove clutch plate bolt. Using an 8-mm bolt threaded into clutch plate, remove clutch plate and shim(s). See Fig. 6.

2) Remove snap ring and pulley assembly. Install Shaft Protector (49 UN01 047) over shaft seal opening. Use a 2-jaw puller to remove clutch coil from compressor.

Installation

1) Ensure clutch coil mounting surface is clean. Use Coil Installer (49 UN01 046) and 2-jaw puller engaged to rear side of compressor front mounts to press coil into place.

2) Install pulley assembly. Install pulley assembly snap ring with bevel side of snap ring facing out. Install shim(s) and clutch plate. Install a new clutch plate bolt and tighten to 97-115 INCH lbs. (11-13 N.m).

3) Use a feeler gauge to check clearance between clutch plate and pulley assembly. Clearance should be .018-.033" (.46-.84 mm). If clearance is incorrect, add or remove shims as necessary.

FORD FX-15 SHAFT SEAL R & I

Removal

1) Using Clutch Holder (000 41 0812 05), remove clutch plate bolt. Using an 8-mm bolt threaded into clutch plate, remove clutch plate and shim(s). See Fig. 6.

2) Remove shaft felt seal. Thoroughly clean seal area of compressor. Remove shaft seal snap ring. Position Shaft Seal Remover (49 UN01 044) over compressor shaft.

3) Push shaft seal remover downward against seal. Ensure end of shaft seal remover is engaged with inside of seal. Rotate shaft seal remover clockwise to expand remover tip inside seal. Pull shaft seal from compressor.

Installation

1) Lubricate shaft seal protector and shaft seal with refrigerant oil. Install shaft seal on shaft seal protector so lip seal is toward compressor (large end of shaft seal protector).

2) Install shaft seal protector on compressor shaft. Using Shaft Seal Installer (49 UN01 043), push shaft seal down seal protector until seal is seated.

3) Remove shaft seal installer and protector. Install a new shaft seal retaining snap ring and shaft seal felt. Install shim(s) and clutch plate. Install a new clutch plate retaining bolt and tighten to 97-115 INCH lbs. (11-13 N.m).

4) Use a feeler gauge to check clearance between clutch plate and pulley assembly. Clearance should be .018-.033" (.46-.84 mm). If clearance is incorrect, add or remove shims as necessary.

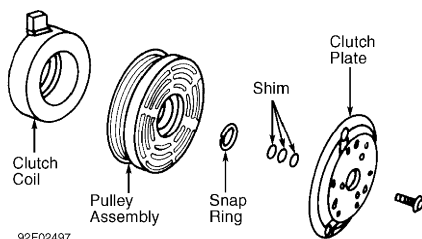


Fig. 6: Exploded View Of Compressor Clutch (Ford FX-15)
Courtesy of Mazda Motors Corp.

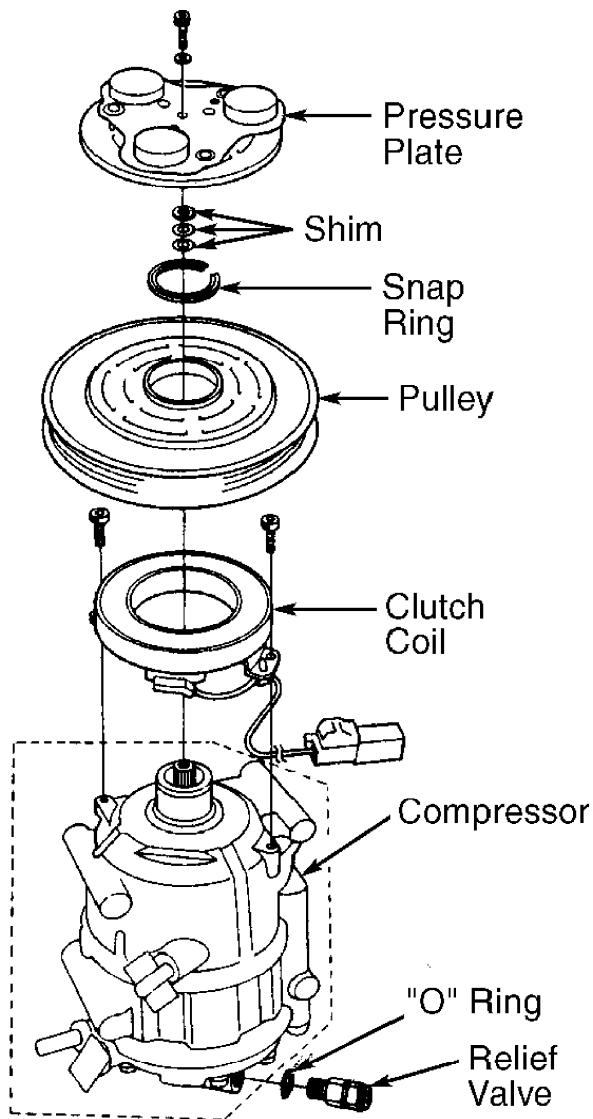
HADSYS 7-CYLINDER CLUTCH COIL R & I

Removal

Using Clutch Holder (J-37872), hold pressure plate and remove shaft bolt. Remove pressure plate and adjustment shim(s). See Fig. 7. Remove snap ring. Using universal puller, remove compressor pulley. Remove clutch coil.

Installation

Install clutch coil in reverse order of removal. Ensure snap ring is properly seated. Apply locking compound to shaft bolt and tighten it to 62 INCH lbs. (7 N.m). Ensure clearance between pressure plate and pulley is 0.012-0.024" (.30-.60 mm). If clearance is incorrect, add or remove shim(s) as necessary.



94E10060

Fig. 7: Exploded View Of Compressor (Hadsys 7-Cylinder)
Courtesy of American Honda Motor Co., Inc.

Removal

1) Clamp Holding Fixture (J-25008-A) in vise. Attach compressor to holding fixture. Use Clutch Hub Holder (J-33027) to hold clutch and remove shaft nut.

2) Thread Hub and Drive Plate Assembly Remover/Installer (J-37707) into hub. Hold body of remover with wrench and turn center bolt into remover body to remove clutch plate and hub assembly. Remove shaft key and save for installation.

3) Remove snap ring. Place Puller Guide (J-25031-1) in center of pulley housing. Engage universal puller to outer diameter of pulley (clutch rotor). See Fig. 8. Hold puller and tighten screw to remove pulley.

4) Invert pulley and place on work bench. Press out rotor bearing using handle and Bearing Remover (J-9398-A). Attach universal puller to outside diameter of clutch coil. Tighten bolt against puller guide to remove clutch coil.

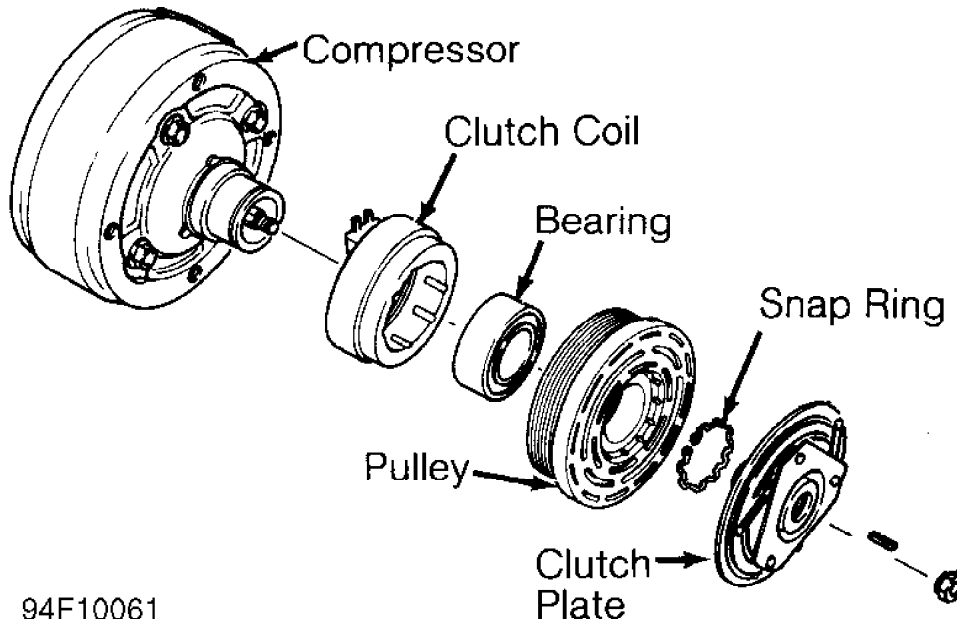
CAUTION: DO NOT drive or pound on clutch hub or shaft.

Installation

1) Ensure clutch coil is installed in original position. Press pulley onto compressor using Installer (J-9481-A) and handle. Install shaft key into hub key groove. Allow key to project approximately 3/16" (4.8 mm) out of keyway.

2) Ensure frictional surface of clutch plate and clutch rotor are clean before installing clutch plate and hub assembly. Align shaft key with shaft keyway and place clutch plate and hub assembly onto compressor shaft.

3) Hold hub and drive plate remover/installer with wrench and tighten nut to press hub into shaft until there is a .020-.040" (.5-1.0 mm) air gap between plate and clutch rotor. Install a new shaft nut and tighten to 10 ft. lbs. (14 N.m). Ensure rotor is not rubbing on clutch plate.



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Fig. 8: Exploded View Of Compressor (Harrison R4 4-Cylinder)
Courtesy of Isuzu Motor Co.

Removal

1) Clamp Holding Fixture (J-34992) in vise. Attach compressor to holding fixture. Use Clutch Hub Holder (J-33027-A) to hold clutch. Remove shaft nut using Socket (J-33022). See Fig. 9.

2) Thread Clutch Plate and Hub Assembly Remover (J-33013-B) into hub. Hold body of remover with wrench and turn center bolt to remove clutch plate and hub assembly. Remove snap ring. Remove shaft key and save for installation.

3) Place Puller Guide (J-33023-A) in center of pulley housing. Engage Rotor/Bearing Puller (J-33020) to inner circle of slots in pulley (rotor). Hold rotor/bearing puller in place and tighten screw to remove pulley.

4) Remove screw from rotor/bearing puller. Invert assembly and place on work bench with rotor/bearing puller still engaged. Remove hub bearing using handle and Bearing Remover (J-9398-A).

5) With puller guide in place, attach Crossbar (J-8433-1) and Puller (J-33025) to outside diameter of clutch coil. Tighten crossbar Bolt (J-8433-3) against puller guide to remove clutch coil.

Installation

1) Ensure clutch coil is installed in original position. Press coil into position using crossbar, clutch Coil Installer (J-33024) and Through Bolts (J-34992-2). Stake compressor housing 120 degrees apart to secure coil.

2) Position Rotor/Bearing Installer (J-33017) and puller guide over inner race of bearing. Using through bolts, assemble crossbar over puller pilot and tighten through bolts onto holding fixture. Tighten crossbar bolt to press pulley/bearing assembly onto compressor.

3) Install shaft key into hub key groove. Allow key to project approximately 1/8" (3.2 mm) out of keyway. Align shaft key with shaft keyway and place clutch plate and hub assembly onto compressor shaft.

CAUTION: Do not drive or pound on clutch hub or compressor shaft, as compressor could be damaged internally.

4) Hold hex portion of Hub Installer (J-33013) with a wrench. Tighten center screw to press hub into shaft until there is .020-.030" (.50-.76 mm) air gap between frictional plate and clutch rotor.

5) Install new shaft nut with small diameter boss of nut against crankshaft shoulder. Use Socket (J-33022) and Clutch Hub Holder (J-33027-A). Tighten shaft nut to 12 ft. lbs. (16 N.m). Ensure pulley does not rub on clutch plate. See Fig. 9.

HARRISON V5 5-CYLINDER SHAFT SEAL R & I

Removal

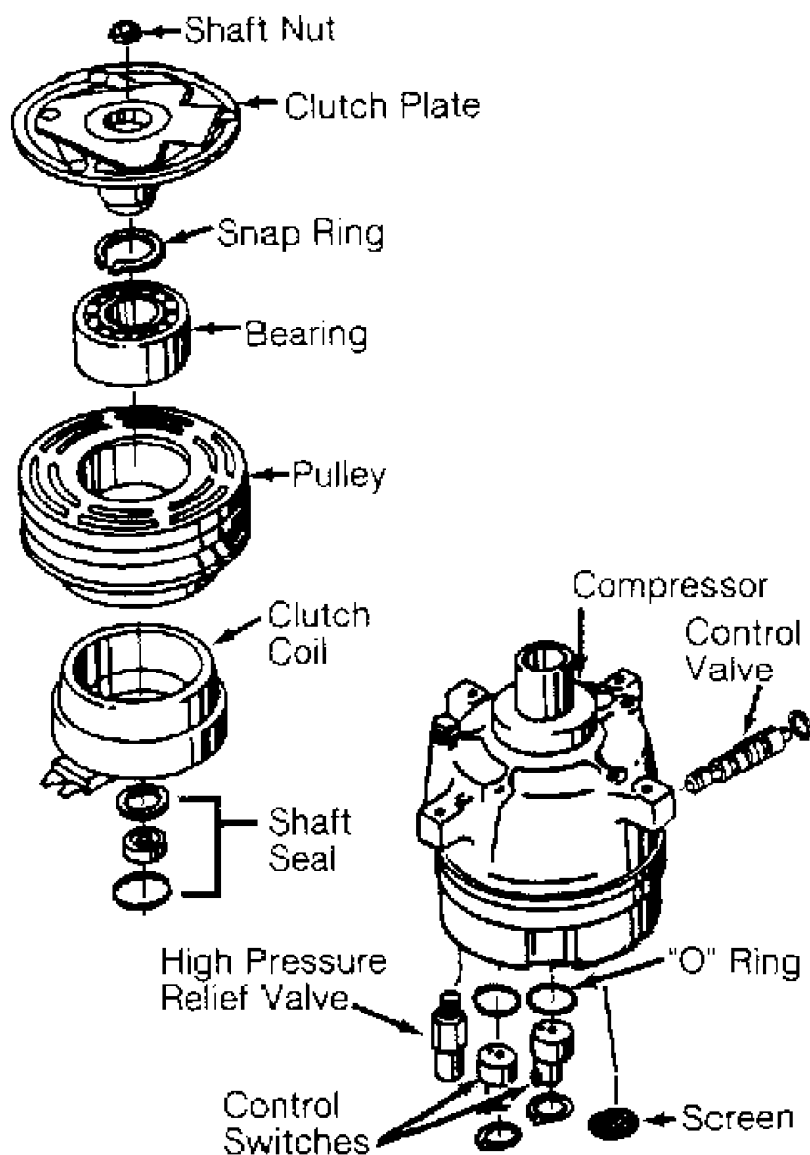
Remove clutch plate and hub assembly. Remove shaft seal snap ring. Thoroughly clean inside of compressor neck area around shaft and seal. Engage tangs of Seal Remover/Installer (J-23128-A) into recessed portion of seal and remove seal. Remove and discard "O" ring from compressor neck. Thoroughly clean inside of compressor neck and "O" ring groove.

Installation

1) Coat new "O" ring with refrigerant oil and install on "O" Ring Installer (J-33011). Install "O" ring into groove in compressor neck. Attach new seal to seal remover/installer. Dip shaft seal in clean refrigerant oil.

2) Place Seal Protector (J-34614) over compressor shaft. Push

new seal over shaft protector. Install new seal snap ring with flat side against seal. Install clutch plate assembly.



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Fig. 9: Exploded View Of Compressor (Harrison V5 5-Cylinder)
Courtesy of General Motors Corp.

HITACHI 6-CYLINDER CLUTCH COIL AND SEAL R & I

Removal

1) Hold clutch hub with Clutch Tightener (925770000). Remove shaft nut from shaft. Using Clutch Hub Remover (926130000), remove clutch hub. Use snap ring pliers to remove inner snap ring.

2) Remove pulley and bearing assembly. Remove screws securing clutch coil lead. Remove inner snap ring from clutch coil. Remove clutch coil from front cover.

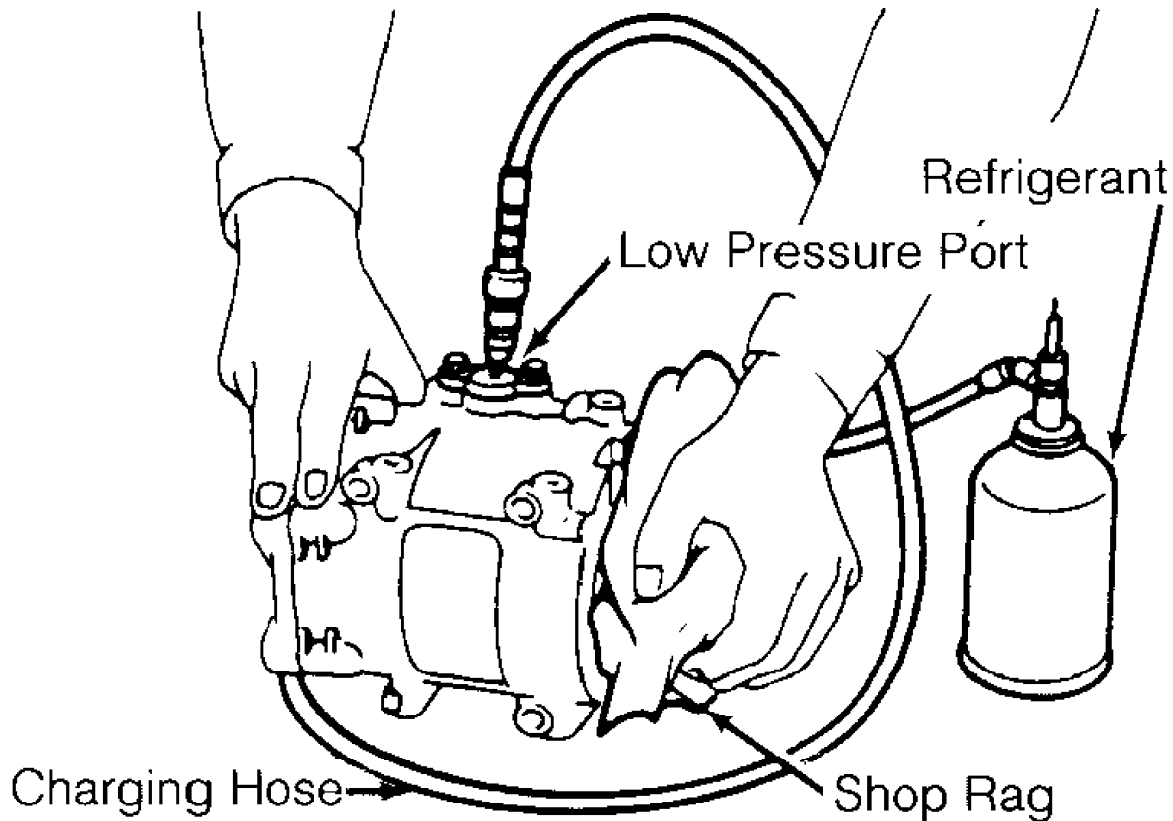
3) Remove shaft key. Use snap ring pliers to remove shaft seal snap ring. Wrap a rag around compressor shaft. Using Injector Needle (92619000) and refrigerant can, slowly pressurize compressor at low pressure (suction) service port. See Fig. 10. Catch shaft seal seat in rag.

4) Insert Shaft Seal Remover/Installer (926120000) through open end of front cover. Slowly pull out remover/installer to remove shaft seal.

Installation

1) Ensure shaft seal contact surface is free of dirt. Lubricate with refrigerant oil. Using shaft seal remover/installer, insert shaft seal.

2) To install clutch coil and hub, reverse removal procedure. Tighten shaft nut to 14-15 ft. lbs. (19-21 N.m). Ensure clearance between pressure plate and pulley is 0.020-0.031" (.50-.80 mm).



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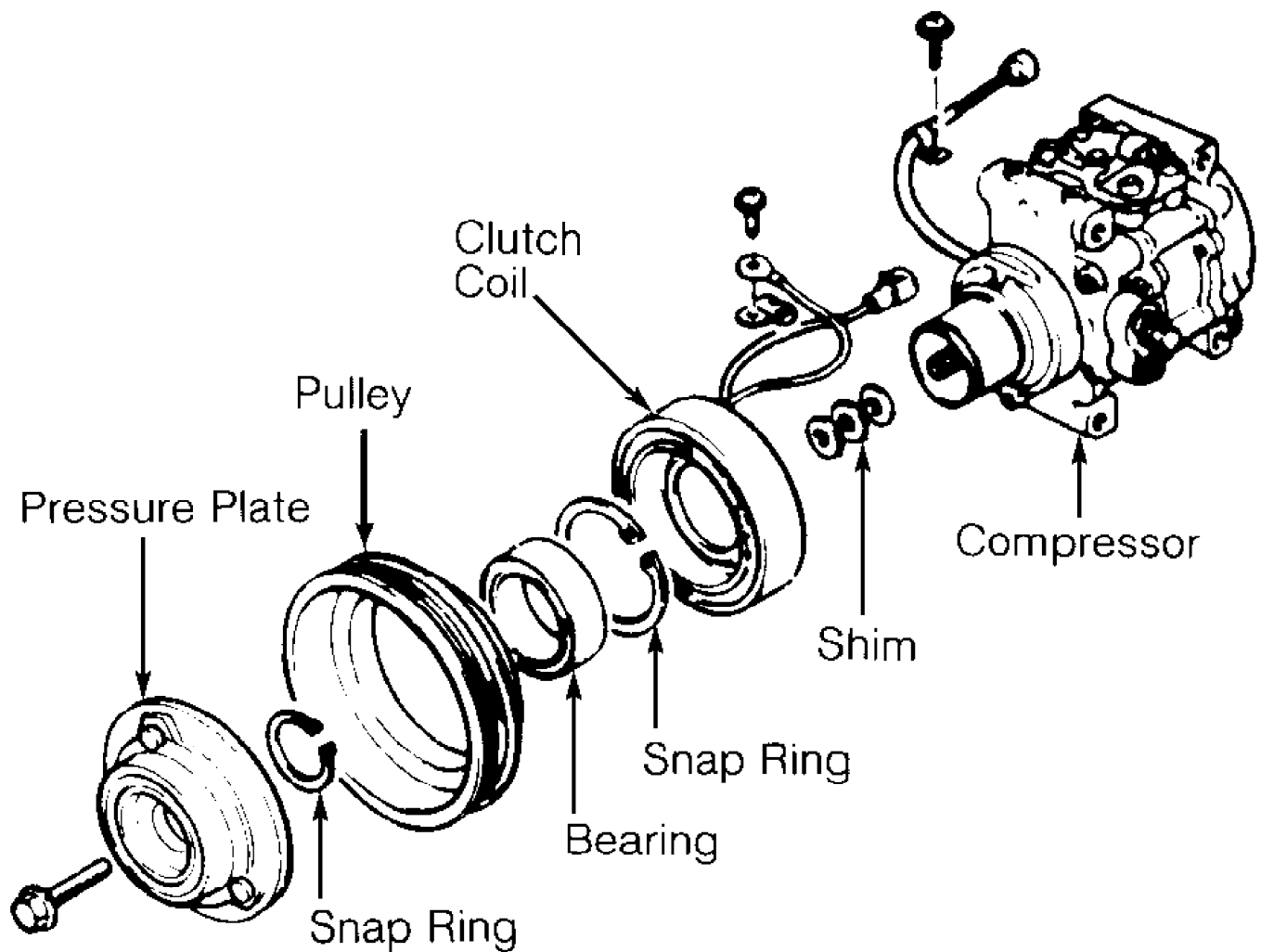
Fig. 10: Removing Compressor Shaft Seal Seat (Hitachi 6-Cylinder)
Courtesy of Subaru of America, Inc.

Removal & Installation

1) Using Pressure Plate Holder (J-7624) and socket, remove center bolt. Thread Puller (J-34878) onto pressure plate. Hold pressure plate with pressure plate holder and tighten puller to remove pressure plate.

2) Remove shim(s) from shaft. Remove snap ring and, using a plastic hammer, tap pulley off. Remove screw for clutch coil lead. Remove snap ring and clutch coil. See Fig. 11.

3) To install, reverse removal procedure. Tighten shaft bolt to 10 ft. lbs (14 N.m). Using feeler gauge, ensure clearance between pressure plate and pulley is .014-.026" (.35-.65 mm). If clearance is incorrect, add or remove shim(s) as necessary.



93H19262

Fig. 11: Exploded View Of Compressor (Matsushita Rotary Vane)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

NIPPONDENSO TV12 ROTARY VANE CLUTCH COIL R & I

Removal

1) Hold clutch disc with Clutch Holder (00007-10331) and remove shaft nut. Install Clutch Disc Remover (4992-02-020) and remove clutch disc and shims. See Fig. 12.

2) Remove pulley snap ring and tap pulley (with bearing) off of compressor with plastic hammer. Remove screw for clutch coil lead. Remove snap ring and clutch coil.

Installation

To install, reverse removal procedure. Ensure pulley-to-clutch disc clearance is .016-.024" (.40-.60 mm). If clearance is incorrect, add or remove shim(s) as necessary.

NIPPONDENSO TV12 DISCHARGE VALVE & SHAFT SEAL R & I

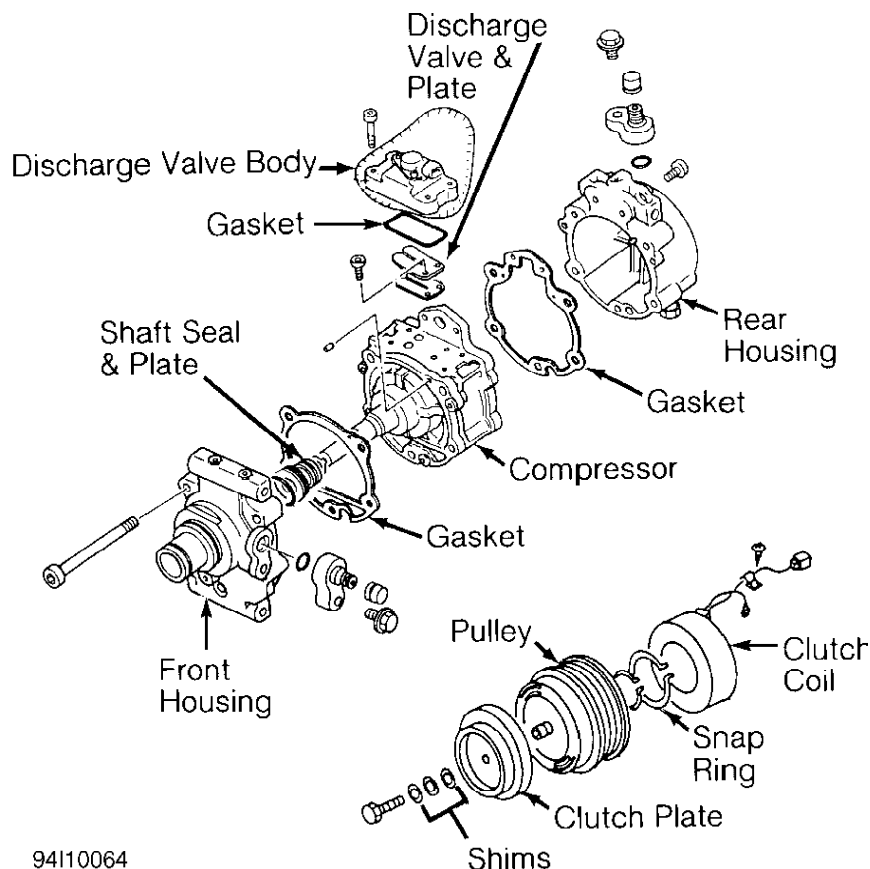
Removal

1) Drain and measure compressor oil in compressor. Remove discharge valve body through bolts. Remove discharge valve body bolts and body. Remove discharge valve plate and discharge valve.

2) Remove compressor through bolts and front and rear housing (oil separator case). Remove pins and gaskets. Remove shaft seal from shaft. Press shaft seal plate off of front housing (head cover).

Installation

To install components, reverse removal procedure. Tighten compressor through bolts to 19 ft. lbs. (26 N.m). Tighten discharge valve bolts to 41 INCH lbs. (4.6 N.m). Tighten discharge valve body and body through bolts to 96 INCH lbs. (10.8 N.m).



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Fig. 12: Exploded View Of Compressor (Nippondenso TV12 Rotary Vane)
Courtesy of Mazda Motors Corp.

NIPPONDENSO 6 & 10-CYLINDER CLUTCH COIL AND BEARING R & I

NOTE: Due to variety of clutch and shaft seal configurations, obtain appropriate A/C compressor service tools for compressor being serviced.

Removal

1) Hold clutch plate stationary and remove shaft bolt (or nut). Remove clutch plate using puller. Remove shim(s) from shaft and snap ring. Tap pulley off shaft with plastic hammer. If pulley cannot be removed by hand, use commercially available puller.

2) Remove snap ring, bearing, and seal (if equipped) from pulley. See Fig. 13. Remove screw for clutch coil lead. Remove snap ring and clutch coil.

Installation

To install, reverse removal procedure. Ensure snap rings are installed with beveled side facing out. Tighten shaft bolt (or nut) to 13-14 ft. lbs. (17-19 N.m) on Fox, MR2 and Scoupe; 10-13 ft. lbs. (14-17 N.m) on all others. Ensure air gap between clutch plate and pulley is .024-.040" (.60-1.00 mm) on Fox and MR2; .014-.026" (.36-.66 mm) on all others. If air gap is incorrect, add or remove shim(s) as necessary.

NOTE: To check air gap, place a dial indicator on clutch plate. Apply voltage to clutch coil. Check air gap between clutch plate and drive pulley. Ensure air gap is as specified.

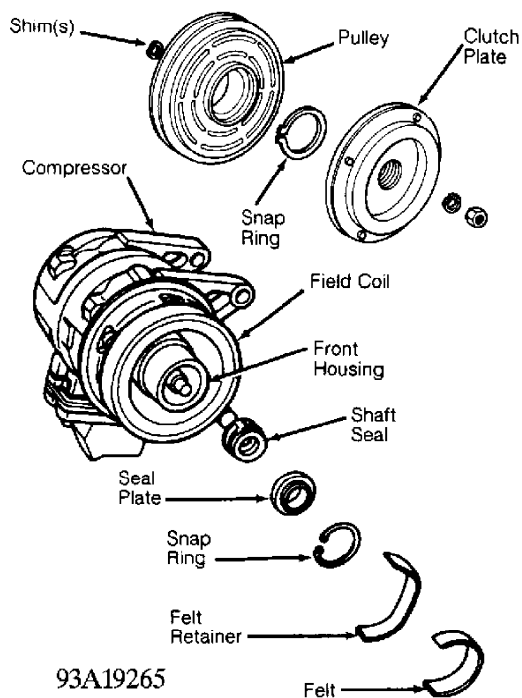


Fig. 13: Exploded View Of Compressor (Nippondenso 10-Cylinder)
Courtesy of Ford Motor Co.

NOTE: On Chrysler and Mitsubishi, remove compressor through bolts and front housing to remove shaft seal. See Fig. 14. Alternately tighten through bolts to 18-21 ft. lbs. (24-28 N.m).

Removal

1) Remove clutch plate and pulley. Remove shim(s) from shaft. Remove clutch coil if necessary. Remove felt and felt retainer (if equipped). Place shaft key remover on shaft and turn to remove key.

2) Remove seal plate snap ring. Engage plate remover on seal plate and pull up to remove seal plate. Engage shaft seal remover/installer to shaft seal and pull up to remove shaft seal from front housing.

Installation

1) Apply clean refrigerant oil to compressor housing bore. Lubricate shaft seal with refrigerant oil and install in front housing. Lubricate seal plate and install in front housing.

2) Install shaft key, snap ring, felt retainer and felt. With clutch plate installed, ensure air gap between clutch plate and pulley is .024-.040" (.60-1.00 mm) on Fox and MR2; .014-.026" (.36-.66 mm) on all others. If air gap is incorrect, add or remove shim(s) as necessary.

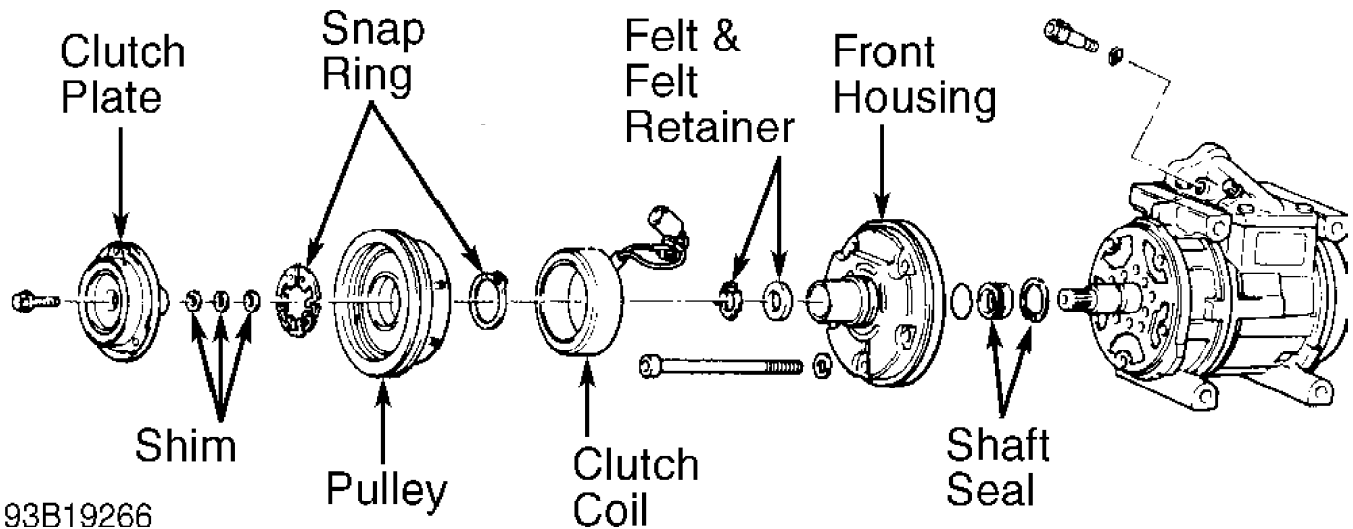


Fig. 14: Exploded View Of Compressor (Nippondenso 10PA15 10-Cylinder)
Courtesy of Chrysler Corp.

PANASONIC ROTARY VANE CLUTCH COIL R & I

Removal

Hold clutch disc stationary and remove shaft bolt. Remove clutch disc and shim(s) from shaft. Remove snap ring. Using a puller, remove pulley. Remove screw from clutch coil lead. Remove screws and field coil.

Installation

To install, reverse removal procedure. Tighten field coil screws to 30-57 INCH lbs. (3.4-6.4 N.m). Ensure pulley-to-armature gap is .016-.020" (.40-.50 mm). If air gap is incorrect, add or remove shim(s) as necessary. Tighten shaft bolt to 97-115 INCH lbs. (11-13 N.m).

PANASONIC ROTARY VANE DISCHARGE VALVE R & I

Removal & Installation

Remove compressor head cover. Remove discharge valve stopper and discharge valve. See Fig. 15. Install replacement discharge valve and stopper, reversing removal procedure. Tighten discharge valve bolts to 27-34 INCH lbs. (3.0-3.8 N.m). Tighten compressor head cover bolts to 89 INCH lbs. (10 N.m).

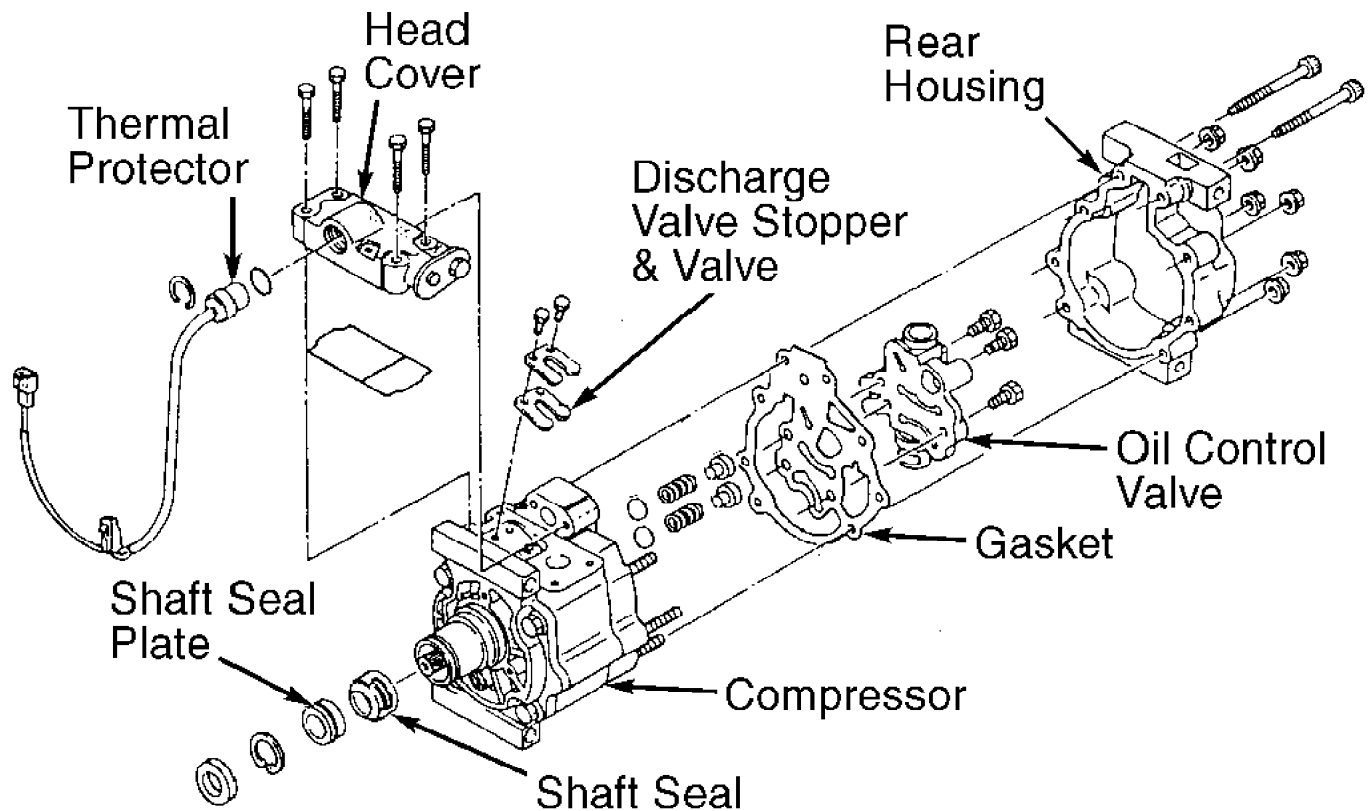


Fig. 15: Exploded View Of Compressor (Panasonic Rotary Vane)
Courtesy of Mazda Motors Corp.

PANASONIC ROTARY VANE OIL CONTROL VALVE R & I

Removal & Installation

Remove compressor rear cover. Remove oil control valve. Remove springs, valve, and rear cover seal. To install components, reverse removal procedure. Tighten oil control valve bolts to 89 INCH lbs. (10 N.m). Tighten rear cover nuts to 21 ft. lbs. (29 N.m) and bolts to 89 INCH lbs. (10 N.m).

PANASONIC ROTARY VANE SHAFT SEAL R & I

Removal & Installation

Remove clutch disc and shim(s). Remove felt seal and snap ring. Using Seal Plate Remover (49 B061 005), engage and remove shaft seal plate. Remove shaft seal with Seal Remover/Installer (49 B061 006). To install, reverse removal procedure. Coat new seal plate and seal with clean refrigerant oil. DO NOT touch seal surfaces with fingers.

SANDEN SCROLL CLUTCH COIL AND SHAFT SEAL R & I

NOTE: Due to variety of clutch and shaft seal configurations, obtain appropriate A/C compressor service tools for compressor being serviced.

Removal (Chrysler & Mitsubishi Except Galant & Mirage)

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. 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.

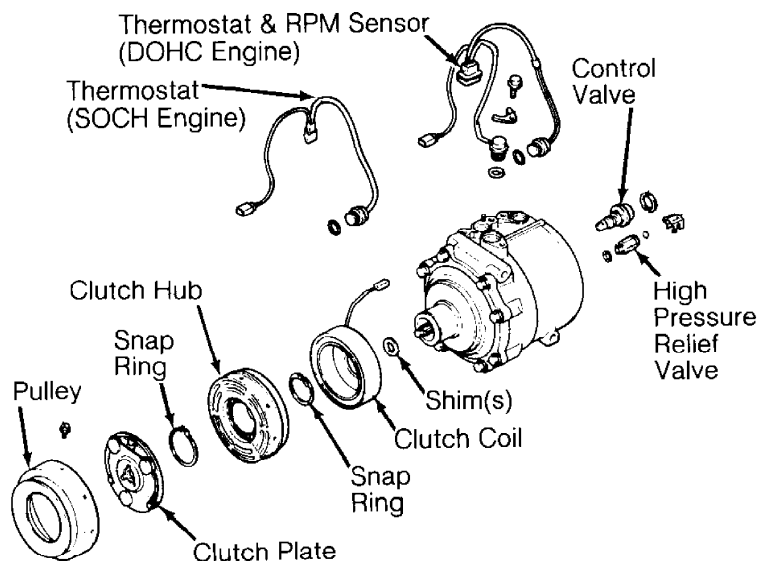
4) Tighten bearing remover bolt to withdraw bearing from compressor. Engage grooves of Shaft Seal Remover/Installer (MB991458) and pull straight up on shaft seal.

Installation (Chrysler & Mitsubishi Except Galant & Mirage)

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 clearance between pressure plate and pulley is .016-.024" (.40-0.60 mm). If clearance is incorrect, add or remove shim(s) as necessary.



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Fig. 16: Exploded View Of Compressor (Sanden Scroll)
Courtesy of Chrysler Corp.

Removal (Chrysler & Mitsubishi Galant & Mirage)

1) Hold clutch plate by securing 2 box-end wrenches with two

6-mm bolts, 1" (25 mm) or longer. Holding bow-end wrenches, use a ratchet and socket to remove clutch hub nut.

2) Remove clutch plate. See Fig. 17. Remove snap ring with internal snap ring pliers. Remove clutch hub. Remove snap ring and clutch coil.

3) Remove front housing bolts. Remove front housing and "O" ring from compressor. Remove shaft seal from shaft. Remove snap ring from back side of front housing. Remove seal plate. Use brass drift and hammer to lightly tap shaft bearing from front housing. Remove felt seal.

NOTE: DO NOT touch sealing surfaces of shaft seal carbon ring and shaft seal plate.

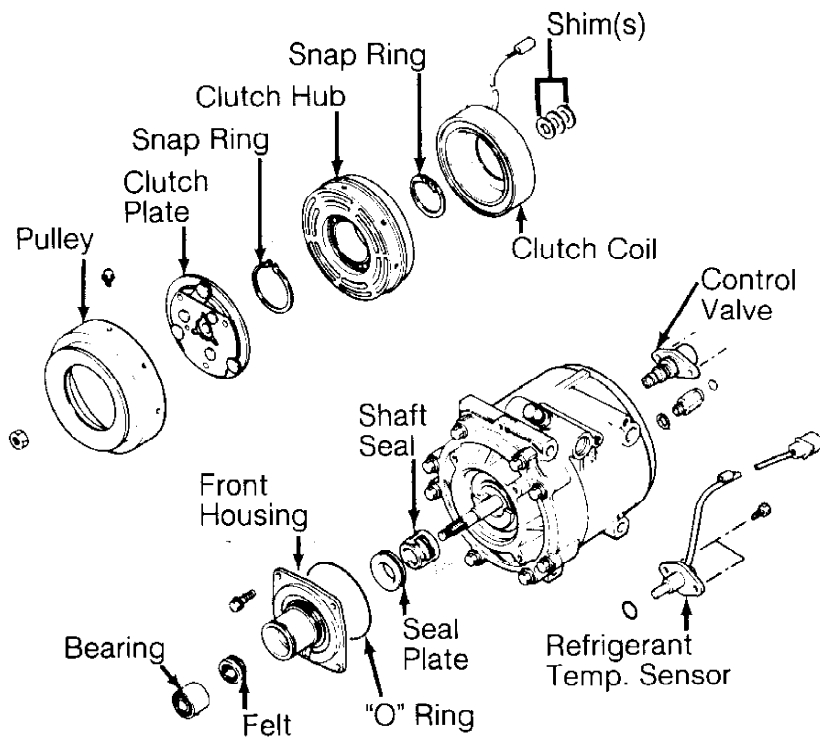
Installation (Chrysler & Mitsubishi Galant & Mirage)

1) Lubricate shaft seal with compressor oil. Align notches on shaft seal with notches on shaft. Install shaft seal plate on front housing. Install front seal housing to compressor.

2) Use Drift (MB991301) to install felt into front housing. Ensure metal ring on felt faces up. Use drift to press bearing into front housing.

3) Align and install clutch coil. Install snap ring so tapered surface faces outward. Install clutch hub. Install snap ring. Align clutch plate mark with shaft; where there are no splines on shaft.

4) Tighten clutch hub nut to 12 ft. lbs. (16 N.m). Using feeler gauge, measure clutch plate-to-clutch hub gap. If gap is not .012-.024" (.30-.60 mm), remove clutch assembly and add or remove shim(s).



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Fig. 17: Exploded View Of Compressor (Sanden FX105V Scroll)
Courtesy of Chrysler Corp.

Removal & Installation (Honda & Hyundai)

1) Remove shaft nut while holding clutch plate with Armature

Holder (J-37872). Using Puller (07935-8050003), remove pressure plate and shim(s). See Fig. 16. Remove snap ring.

2) Place Seal Driver (07945-4150200) in center of pulley. Engage universal puller to outer diameter of pulley. DO NOT engage puller on belt area. Hold puller in place and tighten screw to remove pulley. Remove screw for clutch coil lead. Remove snap ring and clutch coil.

3) To install clutch coil, reverse removal procedure. Align lug on clutch coil with hole in compressor. Install snap rings with chamfered side facing out. Tighten shaft nut to 12-14 ft. lbs. (16-19 N.m). Using feeler gauge, ensure clearance between pressure plate and pulley is .014-.026" (.35-.65 mm). If clearance is incorrect, add or remove shim(s) as necessary.

NOTE: Shaft seal removal and installation procedures not available from Honda or Hyundai.

SANDEN 5-CYLINDER CLUTCH COIL R & I

Removal

1) Hold clutch plate, using Holder (0000-41-0809-01), and remove shaft nut. Remove clutch plate using Puller (0000-41-0809-02). Remove shaft key and shim(s). Remove external front housing snap ring and internal bearing snap ring (if used).

2) Install Clutch Pilot (0000-41-0810-77), Pulley/Clutch Remover (0000-41-0810-76), and Puller (0000-41-0804-51/57) to remove pulley assembly. Remove snap ring and drive bearing out of pulley. Remove screw for clutch coil lead. Remove snap ring and clutch coil.

Installation

1) Install new bearing, ensuring Bearing Installer (000-41-0804-43) contacts outer race of bearing. Install snap ring and ensure bearing turns freely.

2) Install clutch coil, ensuring lug on coil aligns with hole in front housing. Support compressor on rear mounting ears. Align rotor on front housing hub. Use bearing installer and Driver (0000-41-0810-59) to install pulley. With pulley seated, install snap ring(s). Install shim(s) and shaft key.

3) Place clutch plate over shaft and, using Shaft Protector (0000-41-0809-10), tap clutch plate into place. Install and tighten shaft nut to 25-32 ft. lbs. (34-44 N.m). Using feeler gauge, ensure clearance between clutch plate and pulley is .016-.032" (.40-.80 mm). If clearance is incorrect, add or remove shim(s) as necessary.

SANDEN 5-CYLINDER CYLINDER HEAD & VALVE PLATE R & I

Removal & Installation

Remove compressor cylinder head (rear cover) bolts. Carefully pry cylinder head of compressor. Remove reed valve plate and gasket. To install components, reverse removal procedure. Tighten compressor cylinder head bolts, in a crisscross pattern, to 21-29 ft. lbs. (29-39 N.m).

SANDEN 5-CYLINDER SHAFT SEAL R & I

Removal

Remove shaft nut and clutch plate. Remove shaft key and shim(s). Carefully remove felt ring. Remove shaft seal seat snap ring. Using Seal Seat Remover/Installer (0000-41-0810-73), carefully remove seal seat. Using Shaft Seal Remover/Installer (0000-41-0812-11), carefully remove shaft seal.

Installation

1) Install Seal Protector (0000-41-0812-13) over shaft. Place new seal on remover/installer. DO NOT touch carbon sealing surface with fingers. Dip seal in refrigerant oil and install. Remove seal installer by turning counterclockwise.

2) Coat seal seat with refrigerant oil. Install seal seat using remover/installer. Install seal seat snap ring (with flat side down). Install shim(s), felt ring and shaft key. Install shaft nut and clutch plate. Ensure clearance between clutch plate and pulley is .016-.032" (.40-.80 mm). If clearance is incorrect, add or remove shim(s) as necessary.

SANDEN 7-CYLINDER CLUTCH COIL AND BEARING R & I

NOTE: Due to variety of clutch and shaft seal configurations, obtain appropriate A/C compressor service tools for compressor being serviced.

Removal

1) Install two 6-mm bolts, 1" (25 mm) or longer, in clutch plate holes. Using 2 box-end wrenches to hold bolts and to prevent clutch plate from turning, remove shaft nut.

2) Remove clutch plate using Clutch Plate Puller (09977-21100). Remove clutch shim(s) and bearing dust cover. Remove external front housing snap ring. See Fig. 18.

3) Remove pulley using universal puller. Detach clutch coil lead from compressor housing. Remove clutch coil snap ring and clutch coil. If necessary, remove snap ring and bearing.

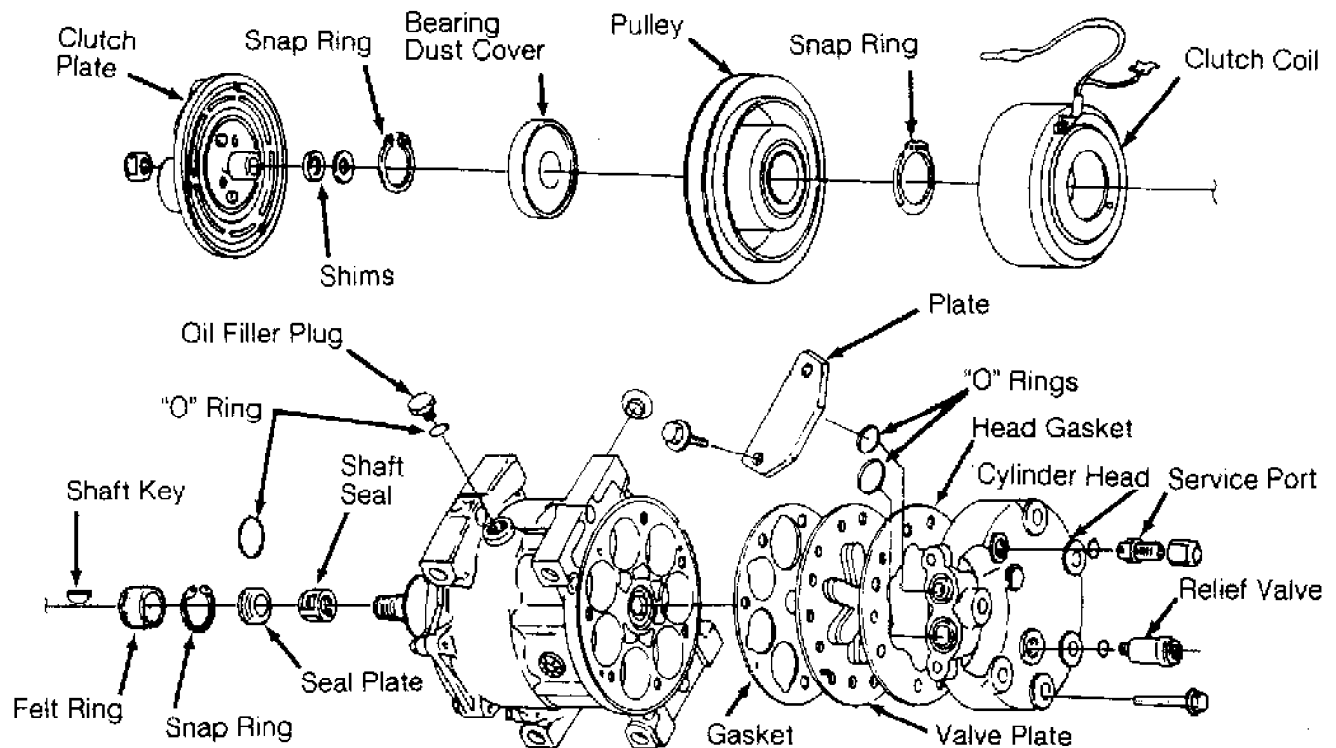
Installation

1) Align clutch coil lug with hole in compressor housing, and install clutch coil. Install clutch coil snap ring. Install drive pulley using Drive Pulley Installer (09977-21811).

2) Install external bearing snap ring. Using Seal Installer (09977-21800), install bearing dust cover. After dust cover installation, ensure there is no contact between cover and front housing.

3) Install clutch shim(s) and clutch plate. Tighten shaft nut to 13-14 ft. lbs. (17-19 N.m). Using a dial indicator, check air gap between clutch plate and drive pulley. Apply voltage to clutch coil. Ensure air gap is .016-.032" (.40-.80 mm). If clearance is incorrect, add or remove shim(s) as necessary.

NOTE: If compressor valve plate is serviced, tighten compressor cylinder head bolts to 25-26 ft. lbs. (34-35 N.m).



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Fig. 18: Exploded View Of Compressor (Sanden 7-Cylinder)
Courtesy of Hyundai Motor Co.

SANDEN 7-CYLINDER SHAFT SEAL R & I

NOTE: Check compressor refrigerant oil level when replacing seals.
See COMPRESSOR OIL CHECKING article in GENERAL SERVICING.

Removal

- 1) Remove clutch plate, shim(s) and bearing dust cover. Tap shaft key out of slot in compressor shaft. Remove seal retainer felt ring.
- 2) Remove shaft seal seat snap ring. Insert Seal Seat Remover/Installer (09977-21400) into front housing and turn to engage tangs on seat. Lift seal seat out.
- 3) Insert Seal Remover/Installer (09977-21510) into front housing and turn to engage tangs on seal. Carefully lift shaft seal out without scratching compressor shaft.

Installation

- 1) Install Shaft Seal Guide Sleeve (09977-21700) over compressor shaft. Dip seal in refrigerant oil and install seal on sleeve. Using seal remover/installer, rotate seal clockwise until seal is engaged. Remove seal remover/installer by turning it counterclockwise.
- 2) Coat seal seat with refrigerant oil and install seal with seal seat remover/installer. Remove shaft seal guide sleeve. Install snap ring with beveled edge facing out. Install seal retainer felt

ring using seal seat remover/installer.

3) Install shaft key and clutch plate. Tighten shaft nut to 13-14 ft. lbs. (17-19 N.m). Using a dial indicator, check air gap between clutch plate and drive pulley. Apply voltage to clutch coil. Ensure air gap is .016-.032" (.40-.80 mm). If clearance is incorrect, add or remove shim(s) as necessary.

SEIKO-SEIKI ROTARY VANE

NOTE: Volvo Seiko-Seiki compressor servicing procedure is not available from manufacturer.

ZEXEL ROTARY VANE CLUTCH COIL AND BEARING R & I

Removal

1) Hold clutch disc using Clutch Disc Wrench (KV99231260) and remove center bolt. Using Clutch Disc Puller (KV99232340), remove drive plate and adjustment shim(s).

2) Remove snap ring. Remove pulley using Pilot (J-39023) and universal puller. Remove clutch coil. If necessary, remove snap ring and bearing. See Fig. 19.

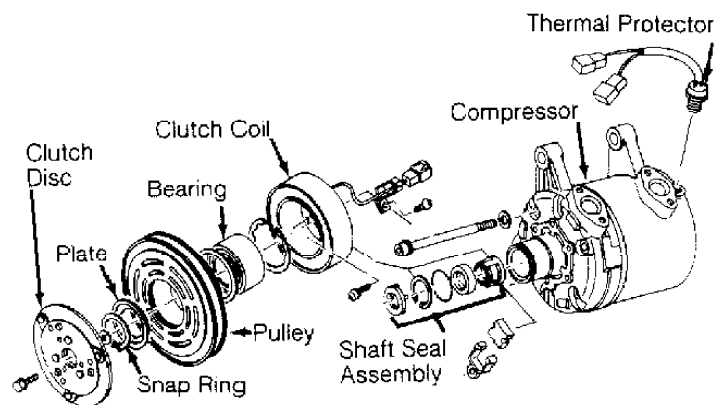
Installation

1) Ensure coil lead is installed in original position.

Install and tighten coil screws. Press pulley onto compressor using Pulley Installer (J-33940). Install snap ring and adjustment shim(s).

2) Install clutch disc and tighten center bolt to 11-13 ft. lbs. (15-18 N.m). Using feeler gauge, ensure clearance between clutch disc and pulley is .012-.024" (.30-.60 mm). If clearance is incorrect, add or remove shim(s) as necessary. Break-in clutch by engaging and disengaging clutch 30 times.

NOTE: Shaft seal assembly servicing procedure is not available from manufacturer. Use exploded view as a guide. See Fig. 19. Tighten thermal protector, if removed, to 11-13 ft.lbs. (15-18 N.m).



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Fig. 19: Exploded View Of Compressor (Zexel Rotary Vane)
Courtesy of Nissan Motor Co., U.S.A.

ZEXEL 6-CYLINDER CLUTCH COIL AND BEARING R & I

NOTE: Volvo Zexel compressor servicing procedure is not available from manufacturer.

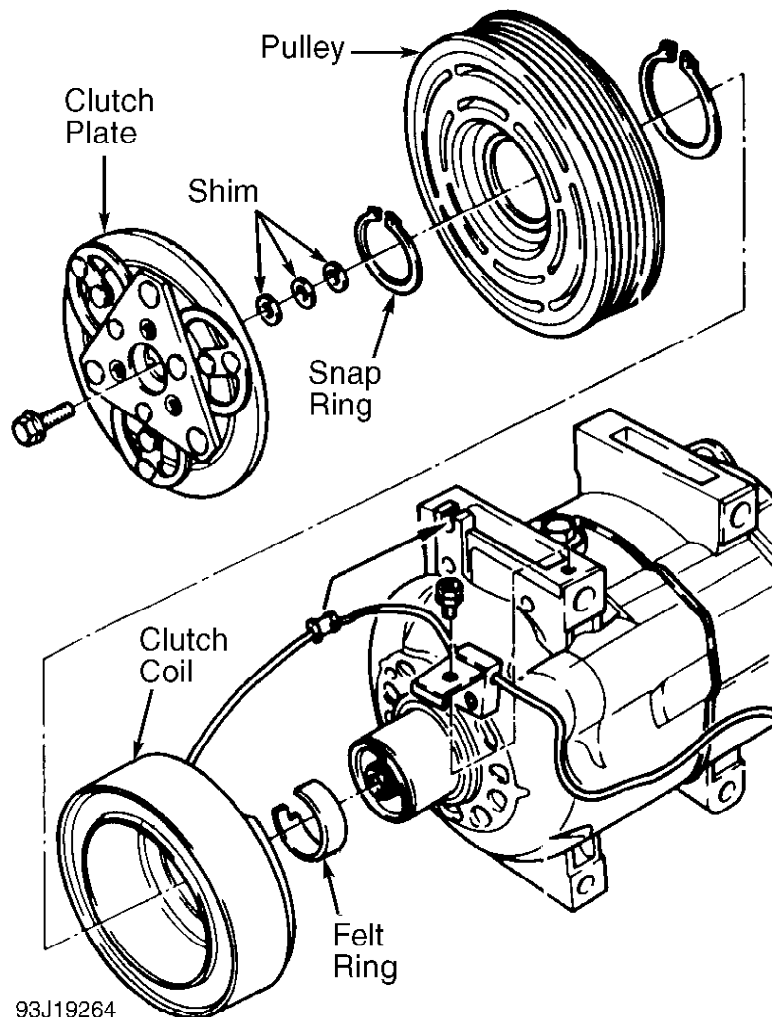
Removal (Audi)

1) Using Spanner Wrench (44-4), hold clutch hub stationary and remove shaft bolt. Remove clutch plate and shim(s) using Puller (VAG 1719) and Spanner Wrench (3212). See Fig. 20. Remove snap ring.

2) Place Spacer (VAG 1719/1) in center of pulley cavity. Attach Puller (US 1078) to outer diameter of pulley and remove pulley. Remove snap ring, bearing, and clutch coil as necessary.

Installation (Audi)

Ensure clutch coil lug fits into hole on compressor housing. Using Installer (VAG 1719/2), press on pulley and install snap ring. Install shim(s) and clutch plate. Tighten shaft bolt to 11 ft. lbs. (15 N.m). Using feeler gauge, ensure air gap between pulley and clutch disc is .012-.024" (.30-.60 mm). If clearance is incorrect, add or remove shim(s) as necessary.



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Fig. 20: Exploded View Of Compressor (Zexel 6-Cylinder)
Courtesy of Audi of America, Inc.

Removal (Nissan)

1) Using Clutch Disc Wrench (J-37877), hold clutch hub

stationary and remove shaft nut. Remove adjustment shim(s) and clutch disc using Clutch Disc Puller (J-26571-A).

2) Bend lock washer away from lock nut. See Fig. 21. Remove lock nut with Wrench (J-37882). Remove pulley by hand or, if difficult to remove, use Pilot (J-26720-A) and universal puller. Remove snap ring, bearing, and clutch coil as necessary.

Installation (Nissan)

1) Ensure key is installed in compressor shaft keyway. Install pulley, lock washer and pulley. Tighten lock nut to 25-29 ft. lbs. (34-39 N.m). Bend lock washer against lock nut.

2) Install clutch disc and tighten shaft nut to 10-12 ft. lbs (14-16 N.m). Using feeler gauge, ensure air gap between pulley and clutch disc is .012-.024" (.30-.60 mm). If clearance is incorrect, add or remove shim(s) as necessary. Break-in compressor clutch assembly by engaging and disengaging clutch 30 times.

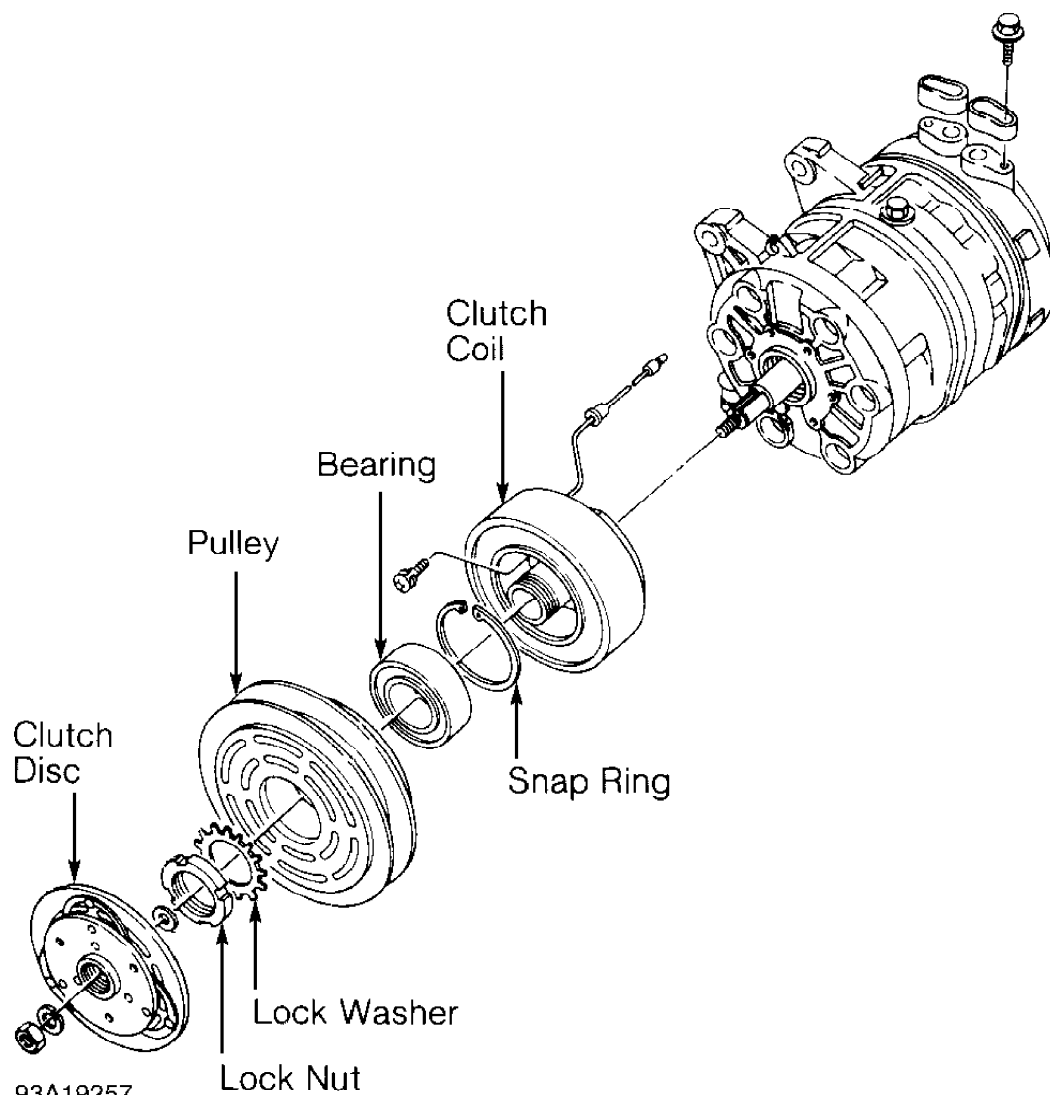


Fig. 21: Exploded View Of Compressor (Zexel DKS-16H 6-Cylinder)
Courtesy of Nissan Motor Co., U.S.A.

A/C-HEATER SYSTEM - MANUAL

1993 Mitsubishi Montero

1993 MANUAL A/C-HEATER SYSTEMS
Chrysler Motors/Mitsubishi

Mitsubishi; Montero

SPECIFICATIONS

SPECIFICATIONS TABLE

Application	Specification
Compressor Type	Nippondenso 10PA15 10-Cyl.
Compressor Belt Deflection (1)	
New	.20-.24" (5.0-6.0 mm)
Used	.26-.30" (6.5-7.5 mm)
Compressor Oil Capacity	2.0-3.4 ozs.
Refrigerant (R-12) Capacity	28 ozs.
System Operating Pressures (2)	
High Side	149-185 psi (10.5-13 kg/cm ²)
Low Side	17-33 psi (1.2-2.3 kg/cm ²)
(1) - With 22 lbs. (100 N.m) force applied midway on longest span of belt.	
(2) - With ambient temperature at about 80°F (27°C).	

DESCRIPTION

Slight variations exist among manual A/C-heater systems used. Either Sanden Scroll or Nippondenso 10-cylinder compressor is used. On some models, cycling of compressor clutch is controlled by an automatic A/C Control Unit (ACCU). On other models, cycling of compressor clutch is controlled by switches, which monitor temperatures and pressures.

Compressors will only operate within normal operating temperatures and pressures set for each model. An electric condenser fan operates whenever A/C system is operating. System components used vary depending upon model. Most systems include an ACCU, fan switch, evaporator, temperature sensor, high and low pressure switches, dual-pressure switch, engine coolant temperature switch, compressor, condenser, receiver-drier and various pipes and hoses.

OPERATION

A/C CONTROL UNIT (ACCU)

ACCU controls cycling of compressor clutch based on information received from air thermosensor and air inlet sensor, A/C switch and refrigerant temperature sensor. ACCU is attached to evaporator housing top (if equipped).

A/C SWITCH

On Montero, A/C switch is located at top left of control panel. See Fig. 1. When switch is turned on, air conditioning will operate if blower motor control lever is in a position other than OFF.

When activated, A/C switch allows A/C compressor clutch to engage and operate the compressor.

AIR SELECTOR LEVER

On Montero, the air selector lever is located in lower left corner of control panel. The lever moves horizontally to select source of air used inside passenger compartment. Lever moves from OFF position on left to outside air mode. Third position allows a mixture of outside and inside air. Fourth position (full right) allows recirculation of inside air. Lever should normally be set in recirculation mode for maximum A/C cooling. See Fig. 1.

BLOWER MOTOR CONTROL SWITCH/LEVER

Blower motor control switch is located on upper left corner of control panel and rotates to select blower motor speeds. As switch is rotated from left or OFF position, increasing speeds of blower operation are selected. In order for A/C system to operate, blower motor control switch must be in a position other than OFF. See Fig. 1.

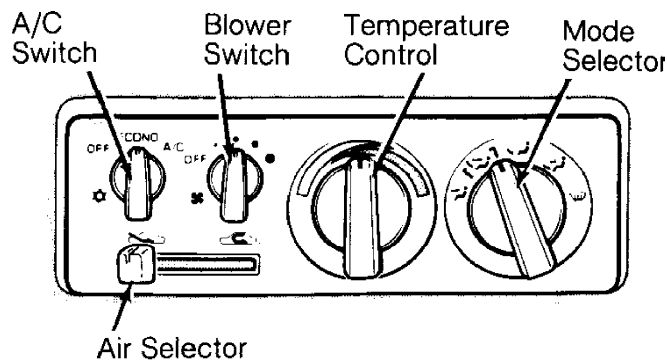
MODE SELECTOR KNOB/LEVER

Mode selector knob is located in upper right corner of control panel. Six modes are available to achieve desired distribution of air from various outlets.

When knob is rotated fully to left (counterclockwise), airflow is directed to upper passenger area. In second position (clockwise) airflow is directed to upper passenger area and slightly to leg area. Position 3 directs air mostly to leg area and slightly to upper passenger area. Position 4 directs air exclusively to leg area. Position 5 directs air to leg area and to windshield and door windows. Position 6 directs air exclusively to windshield and door windows. See Fig. 1.

TEMPERATURE CONTROL KNOB/LEVER

Temperature control knob operates blend-air door in heater/air conditioning unit, mixing cooled and heated air so that selected air temperature can be obtained. The system will provide cooled air when A/C switch is in ON position and blower motor is in any position other than OFF. Temperature control knob should be on far left (maximum cooling) side of temperature selection scale when maximum A/C cooling is desired. See Fig. 1.



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Fig. 1: Identifying A/C-Heater Control Panel (Montero)
Courtesy of Mitsubishi Motor Sales of America.

DUAL-PRESSURE SWITCH

The dual-pressure switch, mounted on receiver-drier, is wired in series with compressor clutch. Whenever system pressures drop below or increase above control points of switch, power supplied to compressor will be cut and compressor function will cease, until pressures are back to normal operating ranges.

ENGINE COOLANT TEMPERATURE SWITCH

The engine coolant temperature switch, located on thermostat housing, is wired in series with compressor clutch. When coolant temperature is greater than switch control temperature, power to compressor is cut and compressor is turned off until temperature returns to operating range. Switch will turn on at 226°F (108°C) and off at 234-244°F (112-118°C).

EVAPORATOR THERMISTOR

The evaporator thermistor, attached to evaporator fins, is wired in series with compressor clutch and prevents evaporator freezing. Power to compressor clutch is cut if control temperature is exceeded, allowing evaporator to thaw. When temperature returns to operating range, thermistor again allows power to compressor clutch.

FUSIBLE PLUG

A fusible plug, located on receiver-drier, melts and allows refrigerant to escape when ambient temperature in engine compartment reaches 221°F (105°C). Once fusible plug has blown, it cannot be reused and must be replaced.

ADJUSTMENTS

NOTE: For adjustment procedures, see HEATER SYSTEM article in the AIR CONDITIONING & HEAT section.

TROUBLE SHOOTING

AIR NOT COOL

1) Ensure compressor clutch is operating. If compressor clutch is not operating, check fuses and relay. Check A/C switch. Check high and low pressure switches or triple-pressure switch. Check thermistor, thermosensor relay or Electronic Cycling Clutch Switch (ECCS). Check blower switch and relay. Check A/C compressor clutch coil.

2) Ensure system is properly charged with correct amount of refrigerant. Add refrigerant or evacuate and recharge system as necessary. Ensure receiver-drier is not clogged. Check compressor belt for proper tension. Check for clogged expansion valve. Check compressor operation. Repair or replace components 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 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. Ensure receiver-drier is not clogged. Ensure sufficient airflow through condenser 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

NOTE: For testing procedures not covered in this article, see HEATER SYSTEM article in the AIR CONDITIONING & HEAT section.

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.

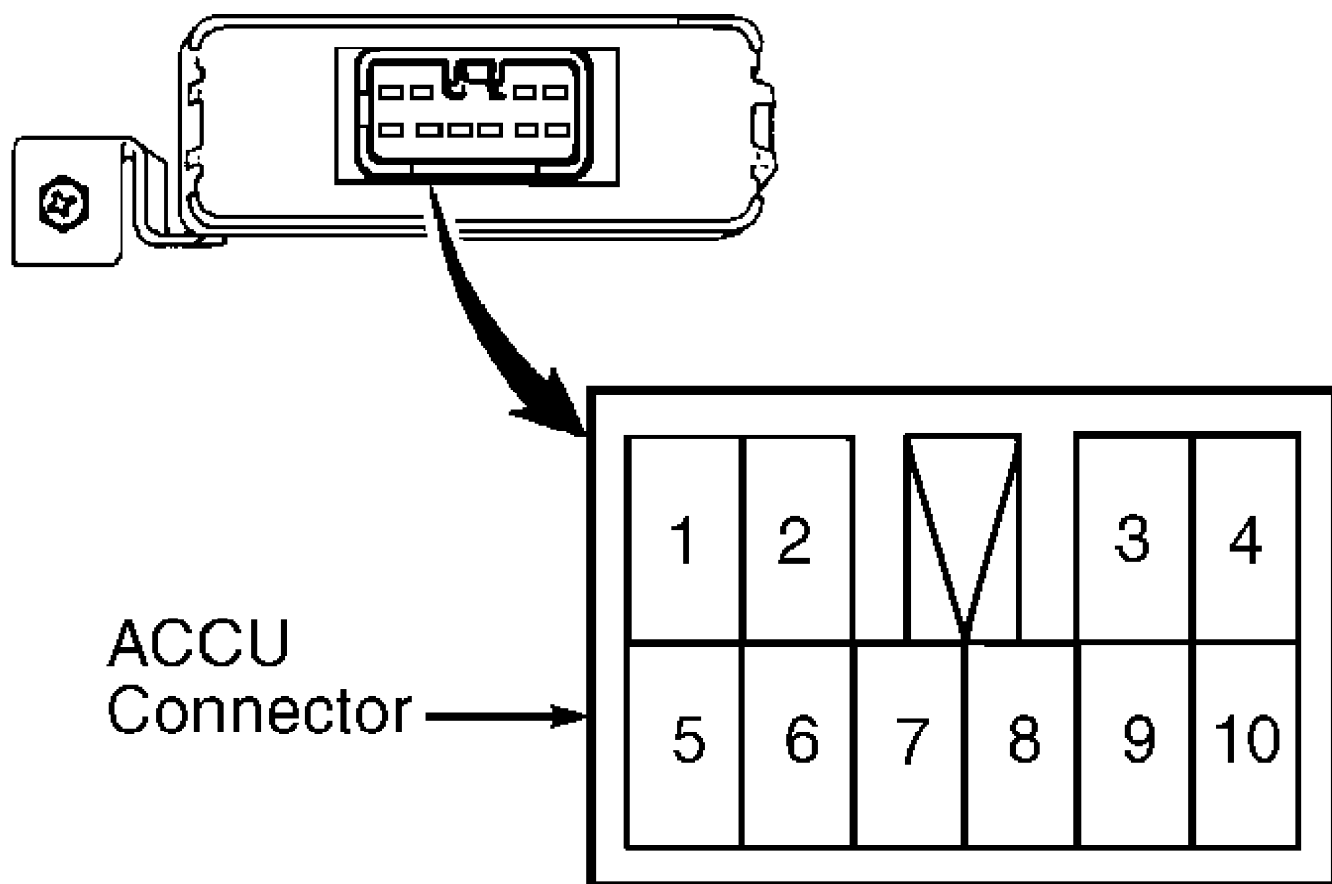
2) Set blower/fan on high speed and close doors and windows. Insert thermometer in center vent. Operate system for 20 minutes to allow system to stabilize. Measure temperature. Temperature must be 37-42°F (3-6°C) at center vent, with high side and low side pressures within specification. See SPECIFICATIONS table at beginning of article.

A/C CONTROL UNIT (ACCU)

Disconnect ACCU, found on top of evaporator case, and conduct tests on wire harness side of connector. See Fig. 2. Testing is done with ignition on, A/C switch on, temperature control lever at MAX COOL and blower switch on HI. If voltage is not as specified, replace control unit. See A/C CONTROL UNIT (ACCU) VOLTAGE TESTS (MONTERO) table.

A/C CONTROL UNIT (ACCU) VOLTAGE TESTS TABLE

Terminal No.	Terminal Voltage
1 (A/C Output)	Battery Voltage
3 (A/C Switch)	Battery Voltage
4 (Air Inlet Sensor +)	5.5 Volts
5 (A/C Switch: ECONO Or A/C)	Battery Voltage
6 (Lever Position Switch)	Zero Volts
7 (ACCU Ground)	Zero Volts
8 (Air Thermosensor -)	3.6 Volts
9 (Air Inlet Sensor -)	1.5 Volts
10 (Air Thermosensor +)	5.5 Volts



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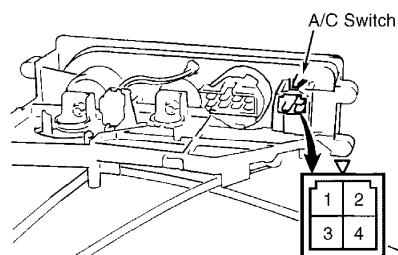
Fig. 2: Testing ACCU (Montero)
Courtesy of Mitsubishi Motor Sales of America.

A/C SWITCH

1) Disconnect A/C switch harness connector. Using wiring diagram as a guide, jumper appropriate terminals of A/C switch wiring harness connector. See WIRING DIAGRAMS.

2) Turn blower on and momentarily turn ignition on without starting engine. Listen for compressor clutch engagement. If compressor clutch does not engage, check fuse and other components wired in series with compressor clutch.

3) Using an ohmmeter, check continuity of switch. See Fig. 3. If continuity is not as specified, replace switch. See A/C SWITCH CONTINUITY TEST (MONTERO) table.



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

A/C SWITCH CONTINUITY TEST TABLE

Switch Position	Terminal No.	Continuity
OFF	(1)	No
ECONO	1 & 3	Yes
A/C	1, 3 & 4	Yes

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

AIR THERMOSENSOR & AIR INLET SENSOR

1) Disconnect sensor connector at evaporator case. Using an ohmmeter, measure resistance between sensor terminals. See AIR THERMOSENSOR & AIR INLET SENSOR SPECIFICATIONS (MONTERO) table.

2) If resistance is not within specifications, faulty sensor must be replaced. If resistance is within specifications and all other components are okay, replace A/C compressor control unit. See Fig. 14.

AIR THERMOSENSOR & AIR INLET SENSOR SPECIFICATIONS TABLE

Sensor Temperature °F (°C)	Ohms
-20 (-4)	12,000
32 (0)	4800
50 (10)	2800
68 (20)	1800
86 (30)	1000
104 (40)	800

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.	Approximate Ohms
1 & 2	0.95
2 & 3	0.33
2 & 4	1.96

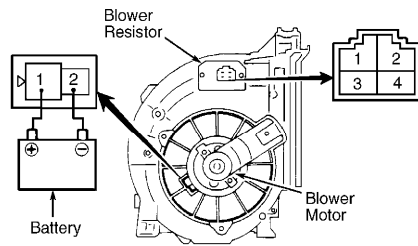
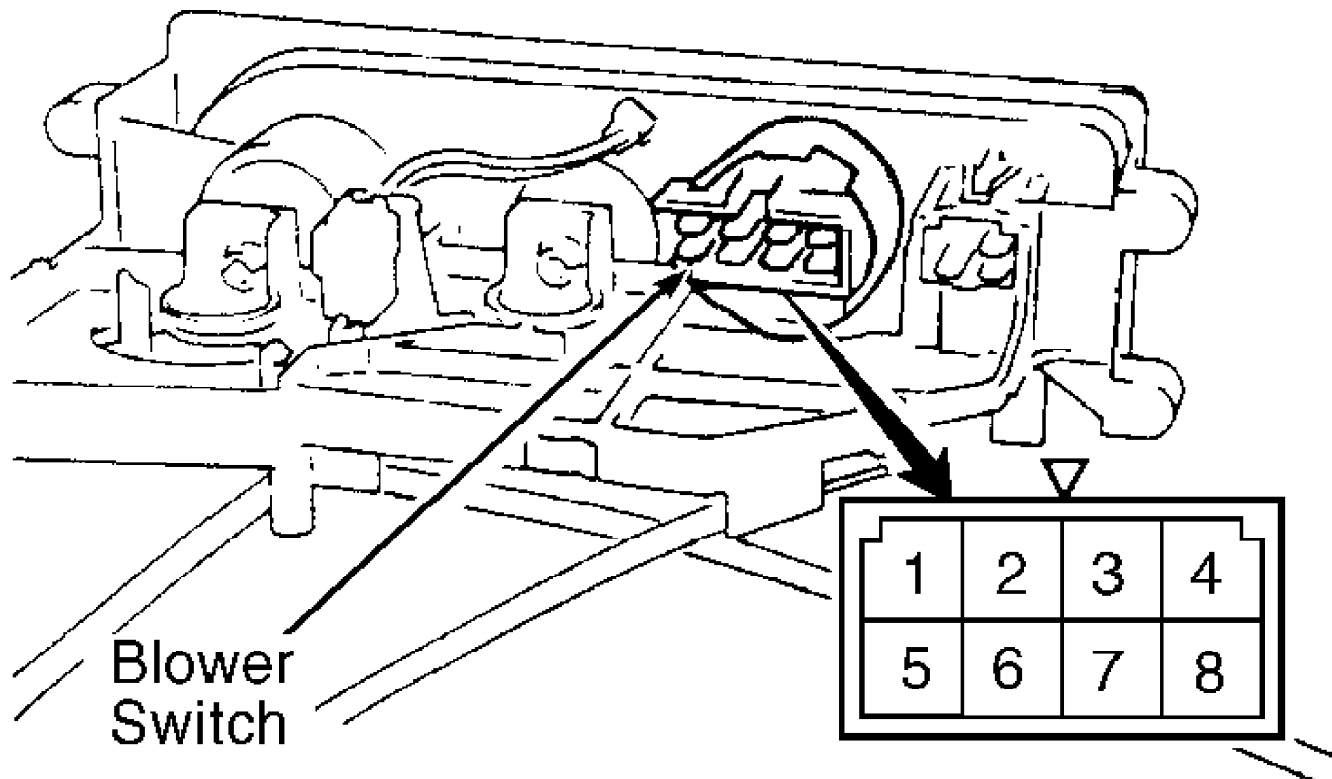


Fig. 4: Testing Blower Resistor
Courtesy of Mitsubishi Motor Sales of America.

BLOWER SWITCH

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



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

BLOWER SWITCH CONTINUITY TEST TABLE

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

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

DUAL-PRESSURE SWITCH

1) With engine off, disconnect harness connector at dual-pressure switch (located on receiver-drier). Connect a jumper wire across harness connector. Turn A/C switch and blower switch on. Momentarily turn ignition on while listening for compressor clutch to engage.

2) If compressor clutch does not engage, connect manifold gauge set to system, and check operating pressures. Dual-pressure switch should allow compressor operation if system pressures are 30-384 psi (2-27 kg/cm²). If dual-pressure switch does not operate within specified pressure range, discharge A/C system using approved

refrigerant recovery/recycling equipment and replace switch.

3) After replacing switch, recharge system and monitor pressures for proper compressor function. If dual-pressure switch cuts power to compressor clutch while driving, even though temperatures inside vehicle have not yet decreased, it is possible that high pressure side of dual-pressure switch has been activated. Go to next step.

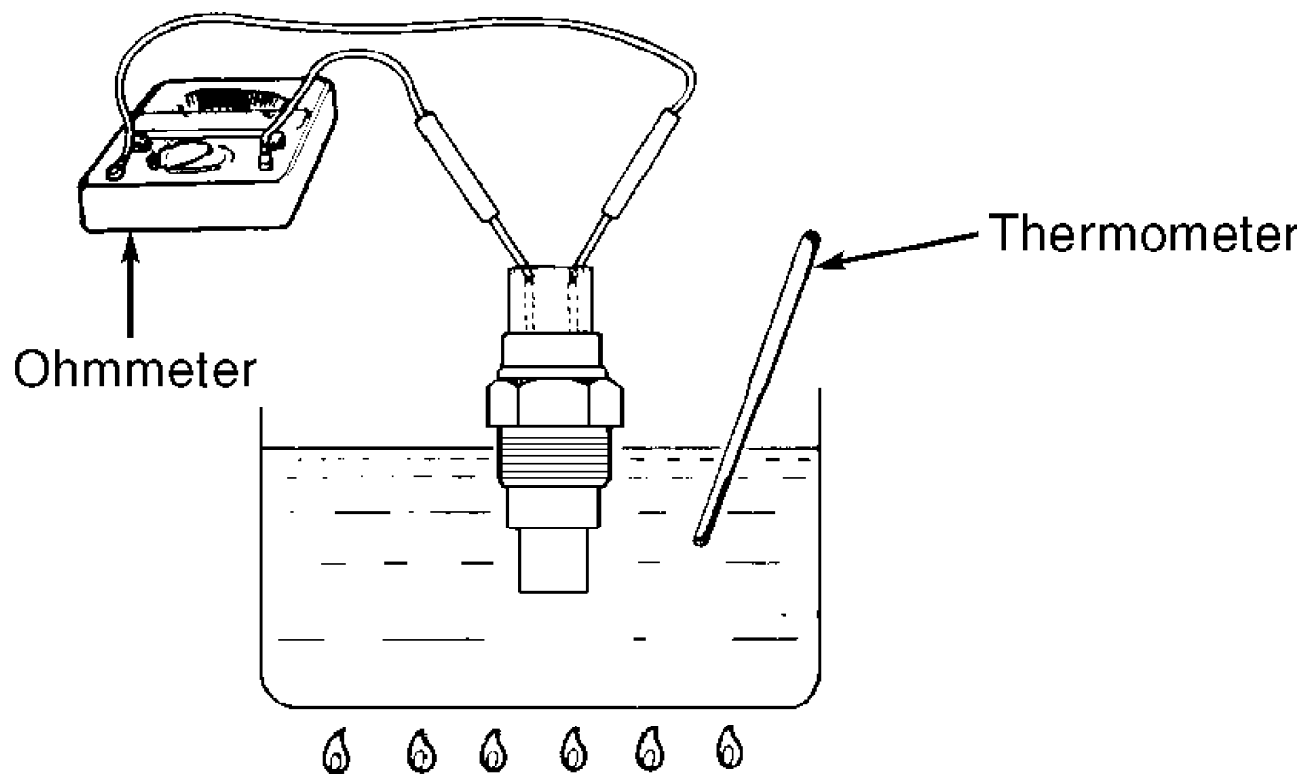
4) Discharge A/C system using approved refrigerant recovery/recycling equipment. Replace dual-pressure switch, and recharge system. Ensure compressor clutch is operating within pressure range given in step 2), and check for sufficient system cooling.

A/C COOLANT TEMPERATURE SWITCH

1) With engine off, disconnect connector at engine coolant temperature switch. Jumper wires on harness side of connector. If vehicle uses a single connector, ground connector.

2) Turn A/C switch and blower switch to ON position. Momentarily turn ignition on and listen for compressor clutch engagement. Clutch should engage. If clutch does not engage, check fuse and other components wired in series with compressor clutch. If okay, go to next step.

3) Remove coolant temperature switch and immerse in oil. See Fig. 6. With an ohmmeter, check continuity as oil temperature changes under heat. Switch will turn on at 226°F (108°C) and off at 234-244°F (112-118°C). Replace switch if it fails to operate in normal ranges.



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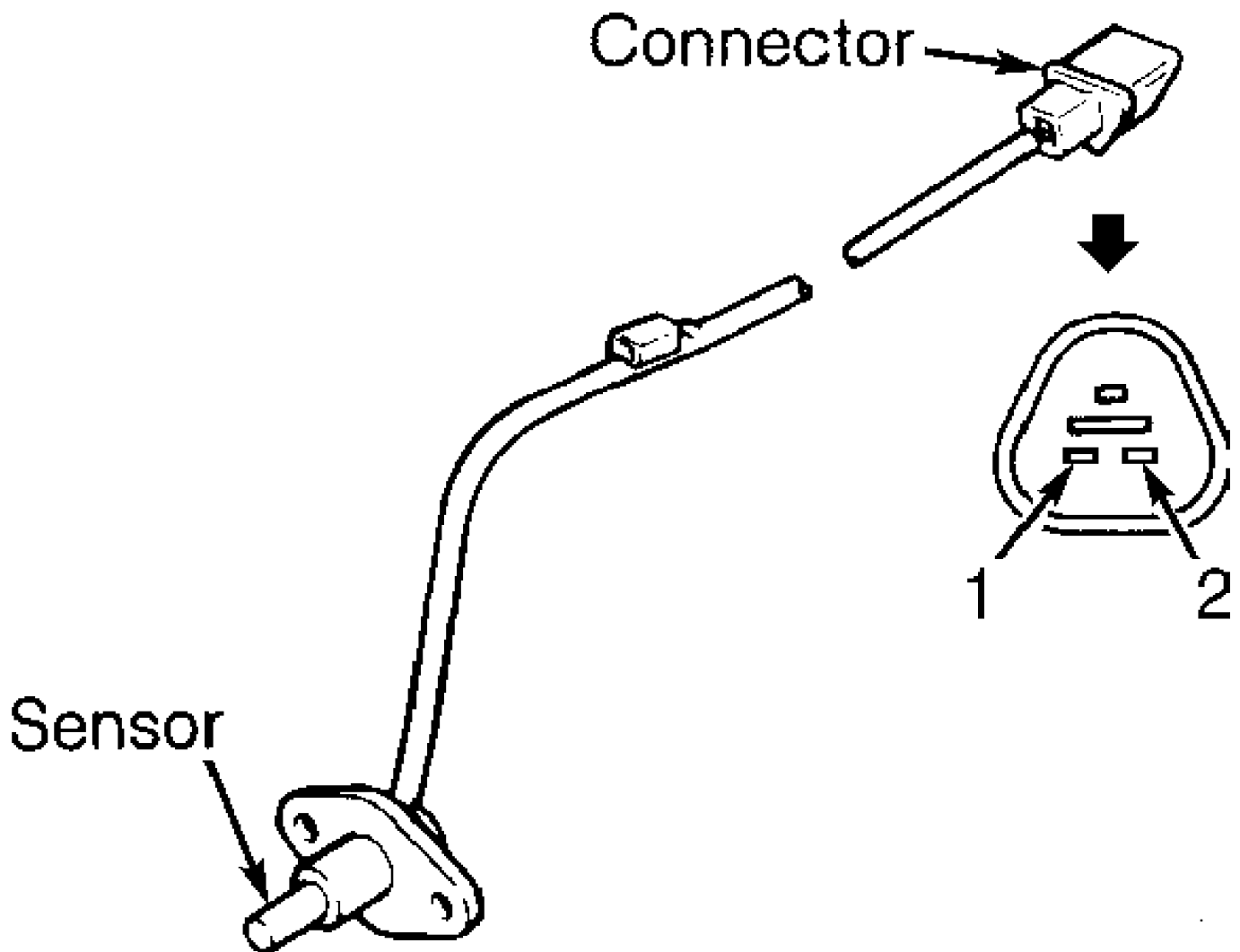
Fig. 6: Testing Engine Coolant Temperature Switch
Courtesy of Mitsubishi Motor Sales of America.

COMPRESSOR CLUTCH

Disconnect wiring to compressor clutch. Connect battery voltage directly to A/C compressor clutch wiring harness terminals. If click is heard, clutch engagement is okay. If click is not heard, pulley and armature are not making contact. Repair or replace as necessary.

REFRIGERANT TEMPERATURE SENSOR

Refrigerant temperature sensor should open and de-energize magnetic clutch if temperature of refrigerant exceeds 347°F (175°C). If sensor is suspect, measure resistance between terminals No. 1 and 2. See Fig. 7. Normal resistance is 80,470 ohms at 77°F (25°C). If resistance deviates greatly from norm, replace sensor.



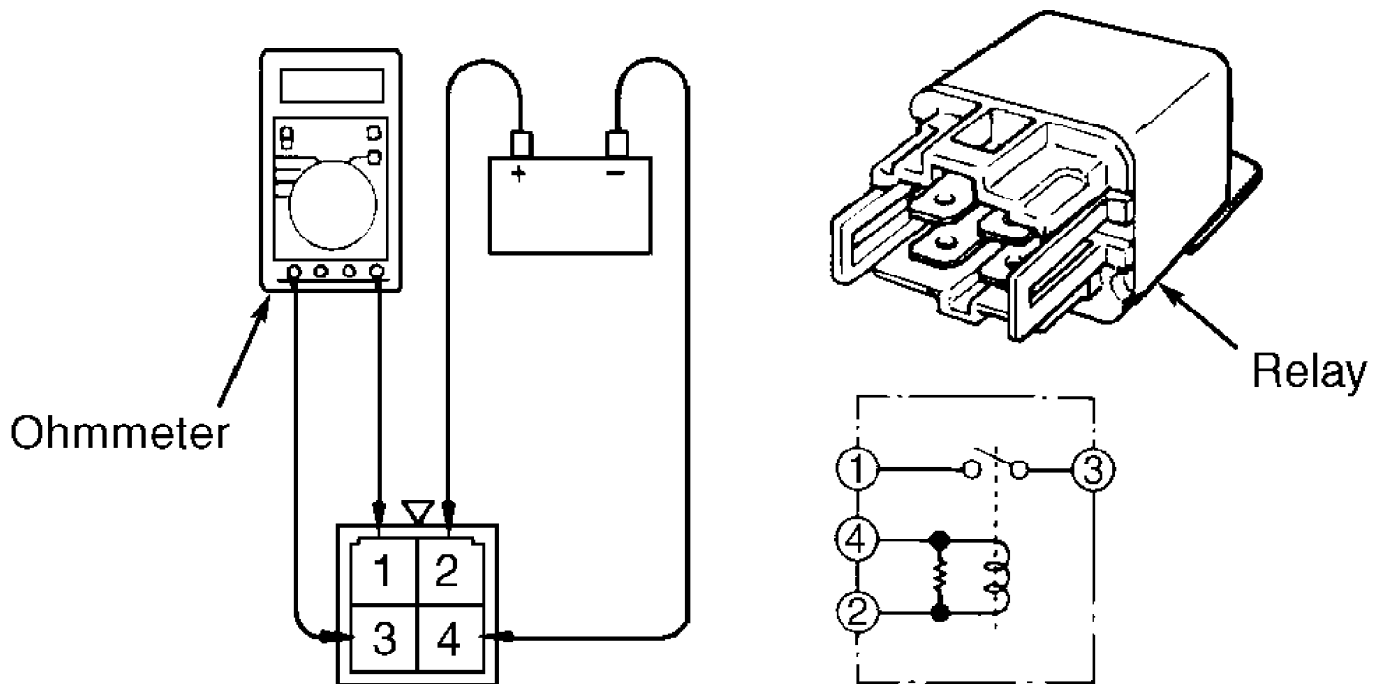
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Fig. 7: Testing Refrigerant Temperature Sensor
Courtesy of Mitsubishi Motor Sales of America.

RELAYS

1) Remove relay from relay box located in engine compartment. Using an ohmmeter, ensure continuity exists between terminals No. 2 and 4 and does not exist between terminals No. 1 and 3. See Fig. 8.

2) Connect battery voltage to terminal No. 2, and ground terminal No. 4. Ensure continuity exists between terminals No. 1 and 3. If continuity is not as specified, replace relay.



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Fig. 8: Testing Relay
Courtesy of Mitsubishi Motor Sales of America.

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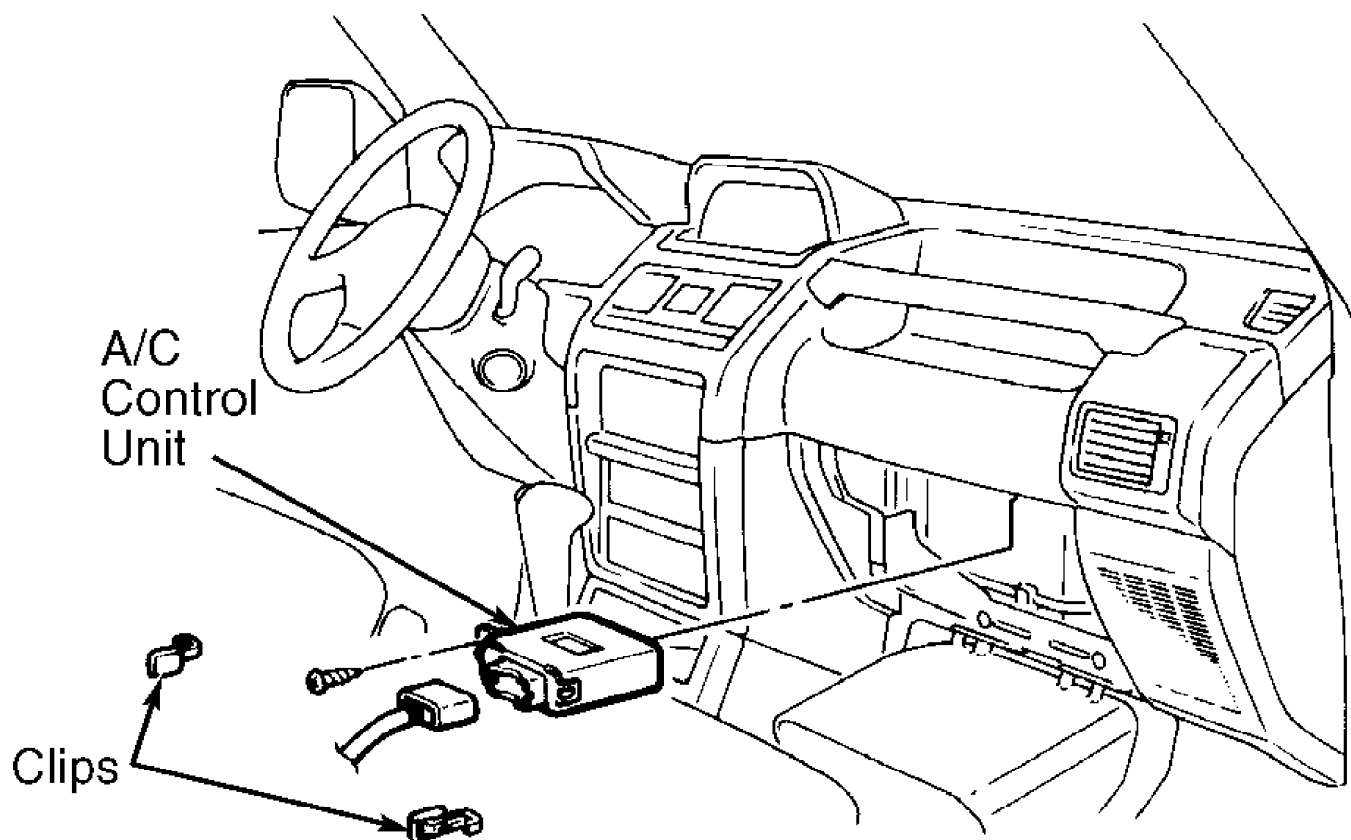
REMOVAL & INSTALLATION

NOTE: For removal and installation procedures not covered in this article, see HEATER SYSTEM article in the AIR CONDITIONING & HEAT section.

A/C CONTROL UNIT (ACCU)

Removal & Installation

Remove 2 clips on top of evaporator and remove ACCU. Disconnect wiring harness from ACCU. To install, reverse removal procedure. See Fig. 9.



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Fig. 9: Locating A/C Control Unit
Courtesy of Mitsubishi Motor Sales of America.

A/C SWITCH

Removal & Installation

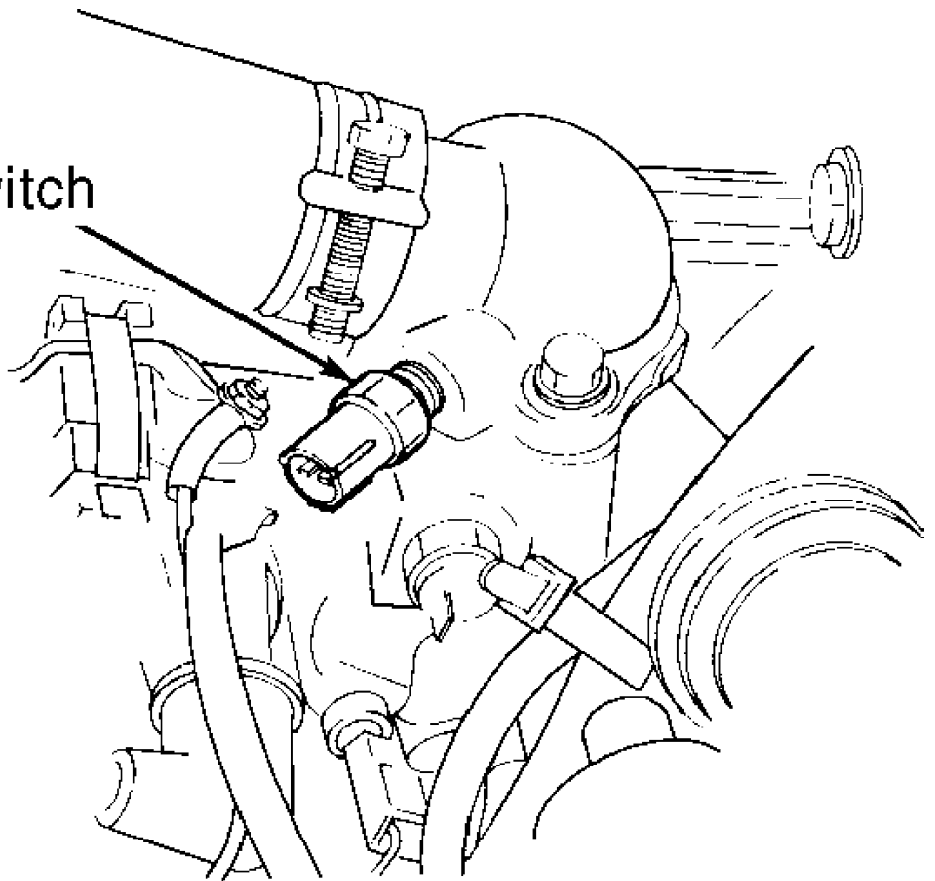
From back side of control panel, push right control panel clip aside while pushing control panel out of dash panel. Allow control panel to hang. Remove side bracket. Push temperature switch control assembly to left, and then remove A/C switch. To install, reverse removal procedure.

A/C COOLANT TEMPERATURE SWITCH

Removal & Installation

Drain coolant below level of thermostat housing. Remove coolant temperature switch wire connector and unscrew coolant temperature switch from thermostat housing. To install, reverse removal procedure. Tighten coolant switch to specification. See TORQUE SPECIFICATIONS table. See Fig. 10.

A/C Coolant Temperature Switch



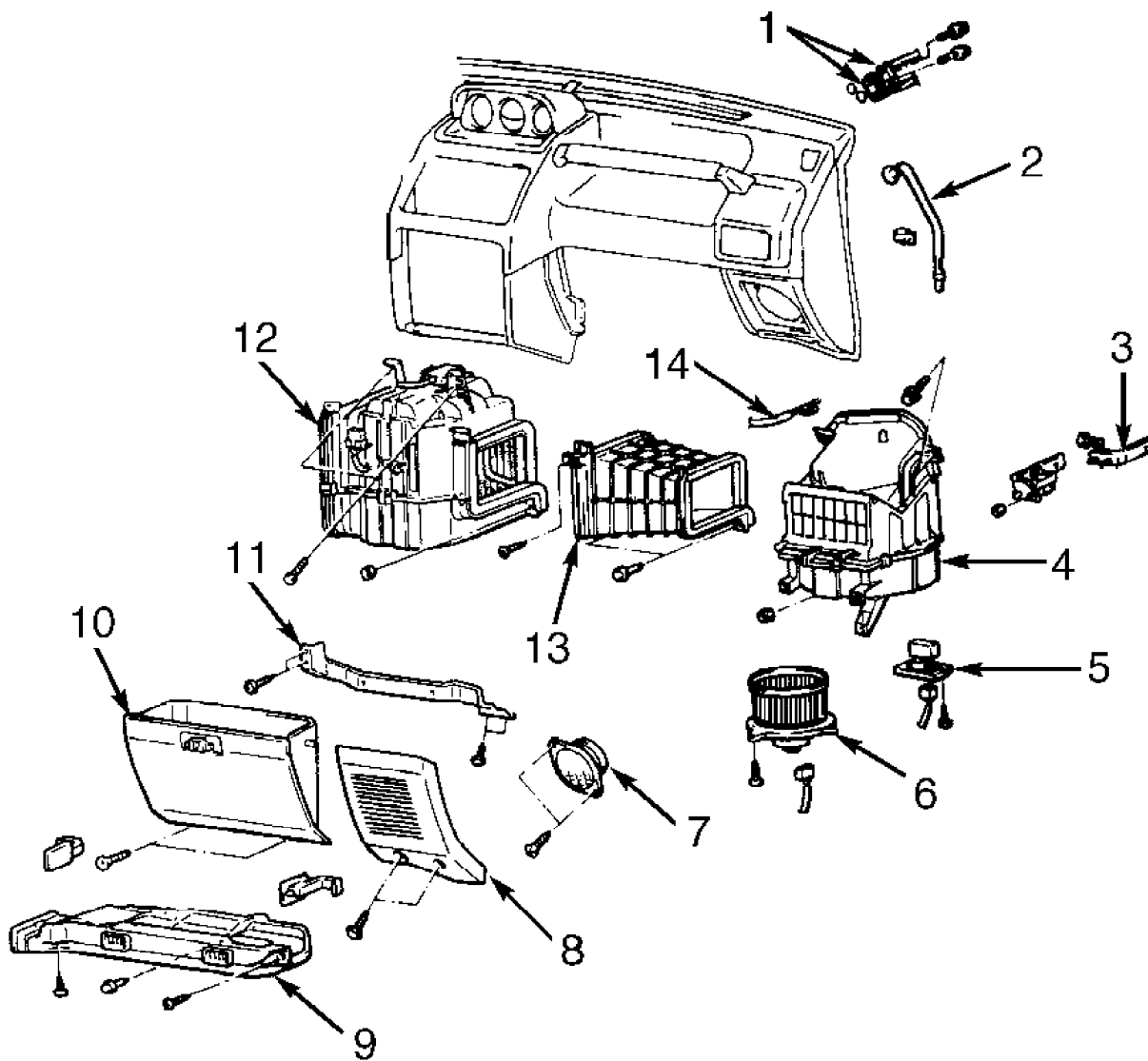
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Fig. 10: Locating A/C Coolant Temperature Switch
Courtesy of Mitsubishi Motor Sales of America.

BLOWER MOTOR & RESISTOR

Removal & Installation

- 1) Remove glove box. Resistor is visible with glove box removed. Remove 2 screws, and remove resistor. See Fig. 11.
- 2) Remove right speaker cover, cowl trim, knee protector and glove box frame. Disconnect ventilator outlet at right side of blower housing. Disconnect electrical connector at blower motor. Remove engine control unit. Remove 3 screws, and remove blower motor assembly. To install, reverse removal procedure.



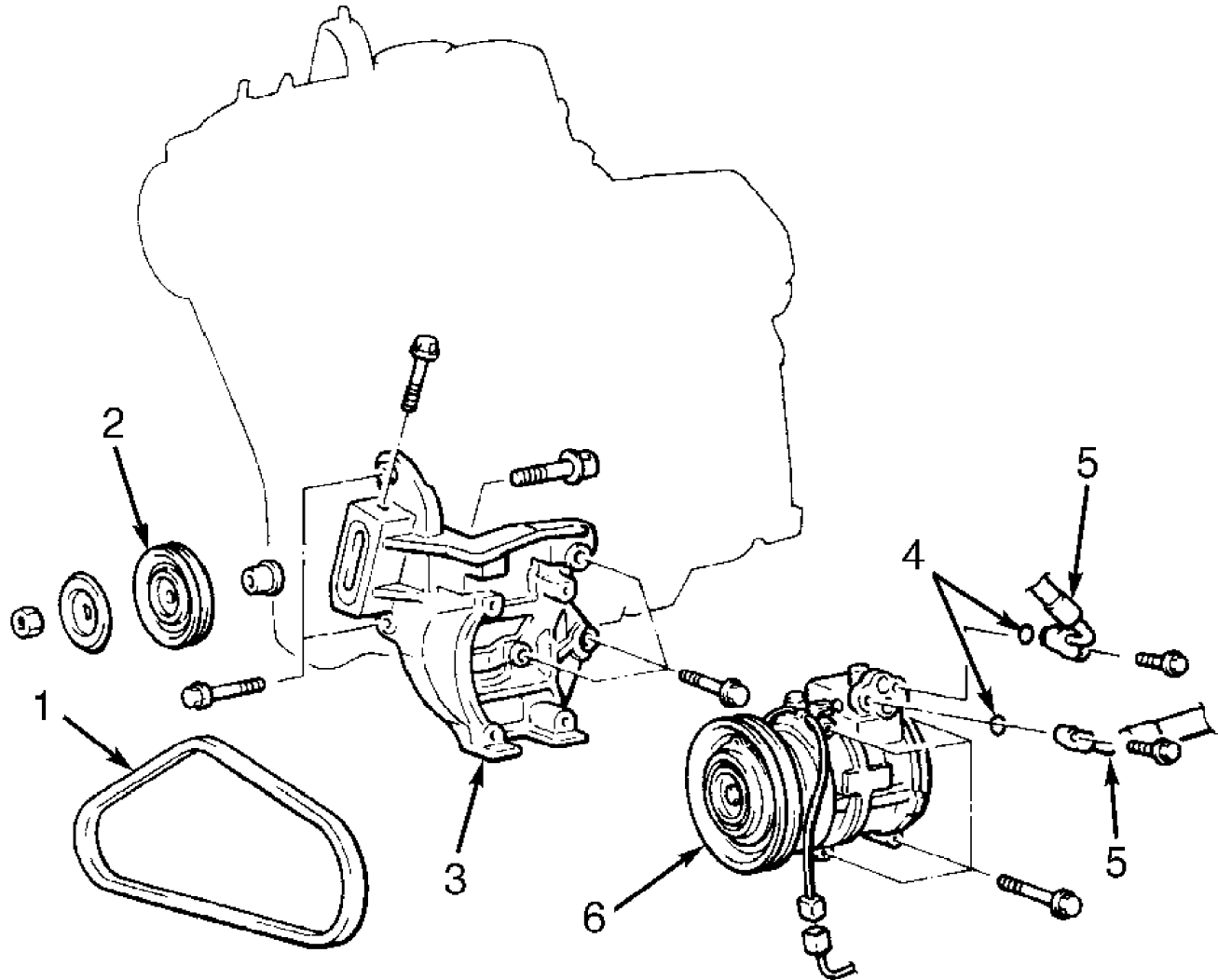
1. A/C Hose Connections	8. Speaker Cover
2. Drain Hose	9. Foot Shower Duct
3. Engine Control Relay	10. Glove Box
4. Blower Case	11. Lower Frame
5. Blower Resistor	12. Evaporator
6. Blower Motor	13. Joint Duct
7. Speaker	14. Air Selector Connection

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 Fig. 11: Exploded View Of Blower Assembly
 Courtesy of Mitsubishi Motor Sales of America.

COMPRESSOR

Removal & Installation

Discharge A/C system using approved refrigerant recovery/recycling equipment. Loosen idler pulley, and remove 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. See Fig. 12.



- 1. Drive Belt
- 2. Tension Pulley
- 3. Compressor Bracket

- 4. "O" Ring
- 5. Hose Connections
- 6. Compressor

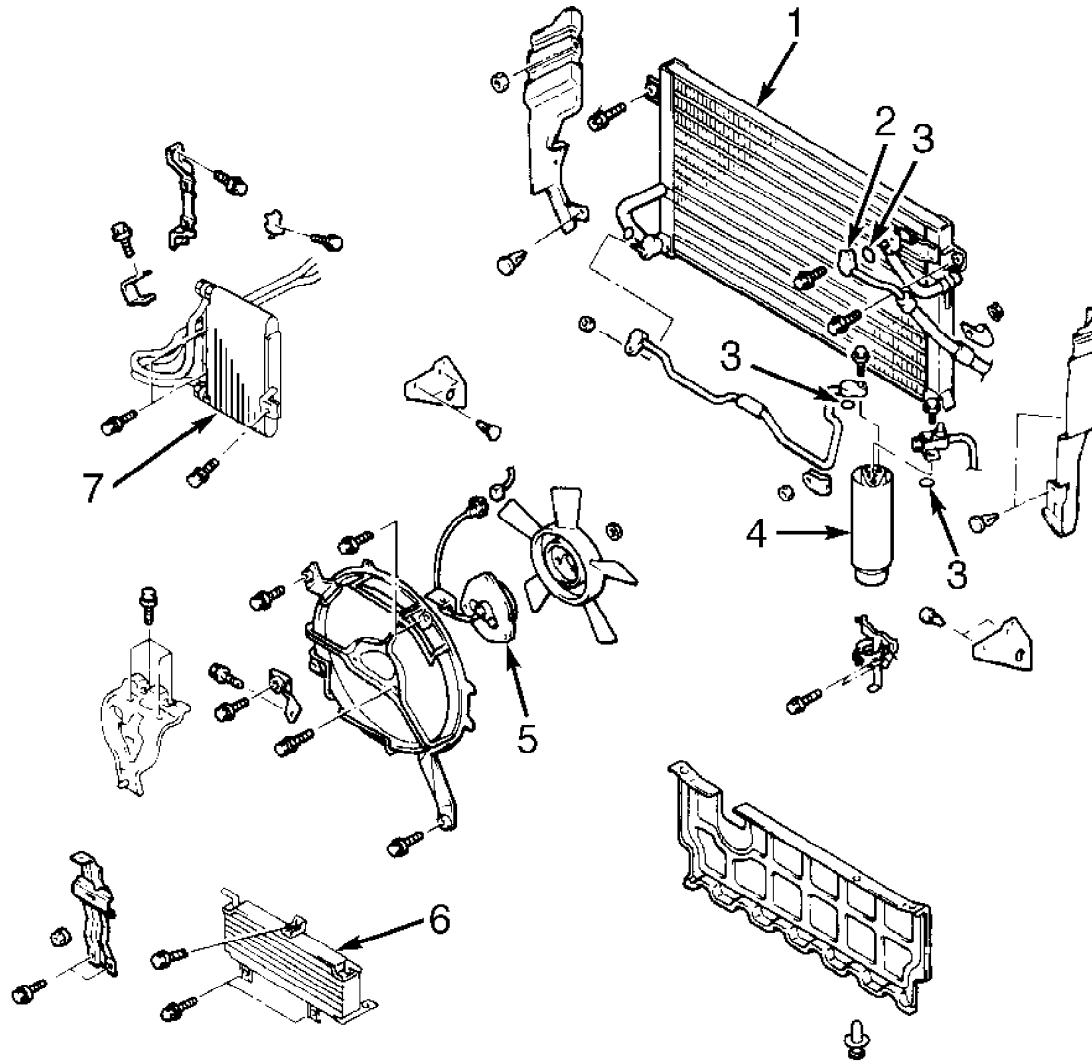
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Fig. 12: Exploded View Of Compressor Mounting (Typical)
Courtesy of Mitsubishi Motor Sales of America.

CONDENSER

Removal & Installation

Discharge A/C system using approved refrigerant recovery/recycling equipment. Remove front grille and grille brackets. Remove front end cover and condenser harness. Disconnect electrical fan connector. Slowly disconnect pressure lines from condenser. Remove 2 condenser mounting bolts. Lift up and remove condenser from vehicle. To install, reverse removal procedure. See Fig. 13.



1. Condenser

2. High Pressure Hose

3. "O" Ring

4. Receiver-Drier

5. Condenser Fan Motor

6. A/T Oil Cooler

7. Engine Oil Cooler

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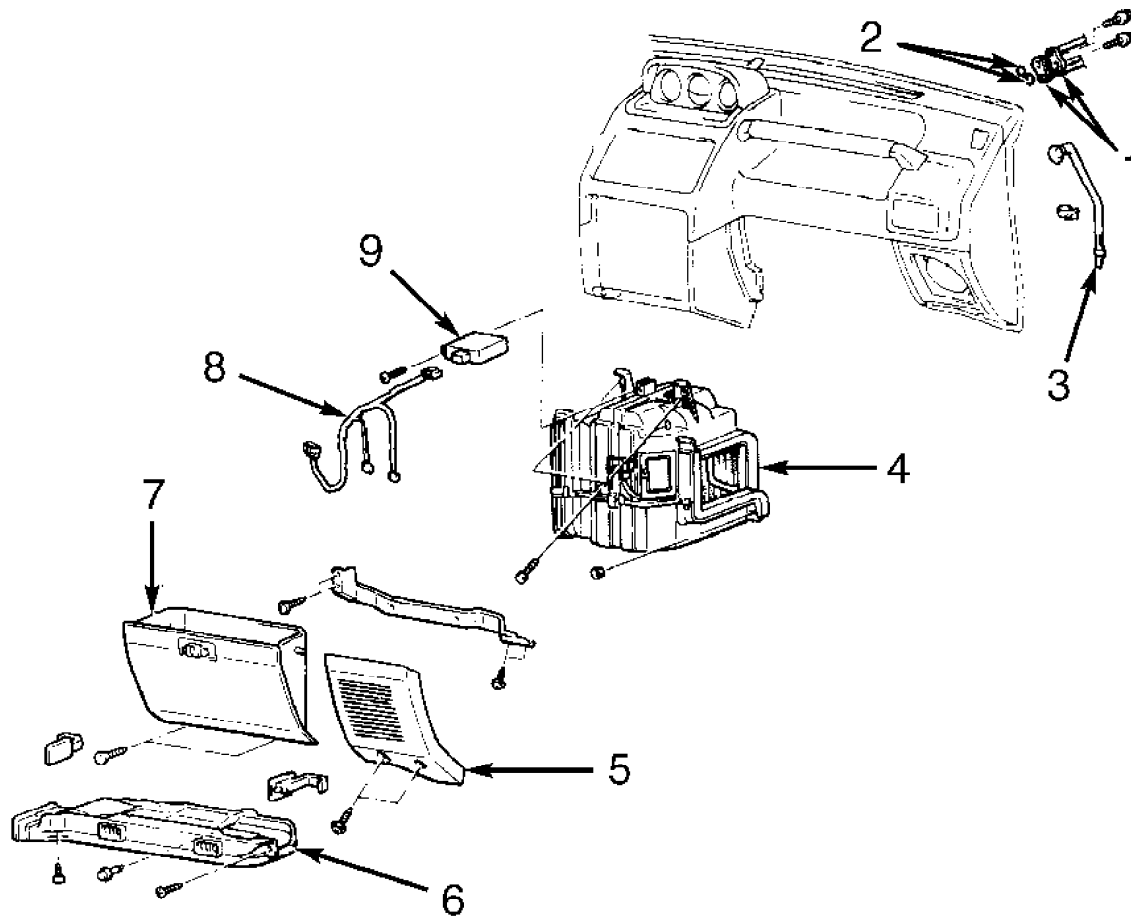
Fig. 13: Exploded View Of Condenser & Condenser Fan Motor
Courtesy of Mitsubishi Motor Sales of America.

EVAPORATOR ASSEMBLY

Removal & Installation

1) Discharge A/C system using approved refrigerant recovery/recycling equipment. Remove glove box with lower frame attached. Loosen duct joint bolt to free duct joint. Disconnect A/C switch harness. Disconnect evaporator drain hose.

2) Disconnect refrigerant lines at firewall side of engine compartment. Remove evaporator top attaching bolts in passenger compartment. Remove evaporator assembly. To install, reverse removal procedure. See Figs. 14 and 15.

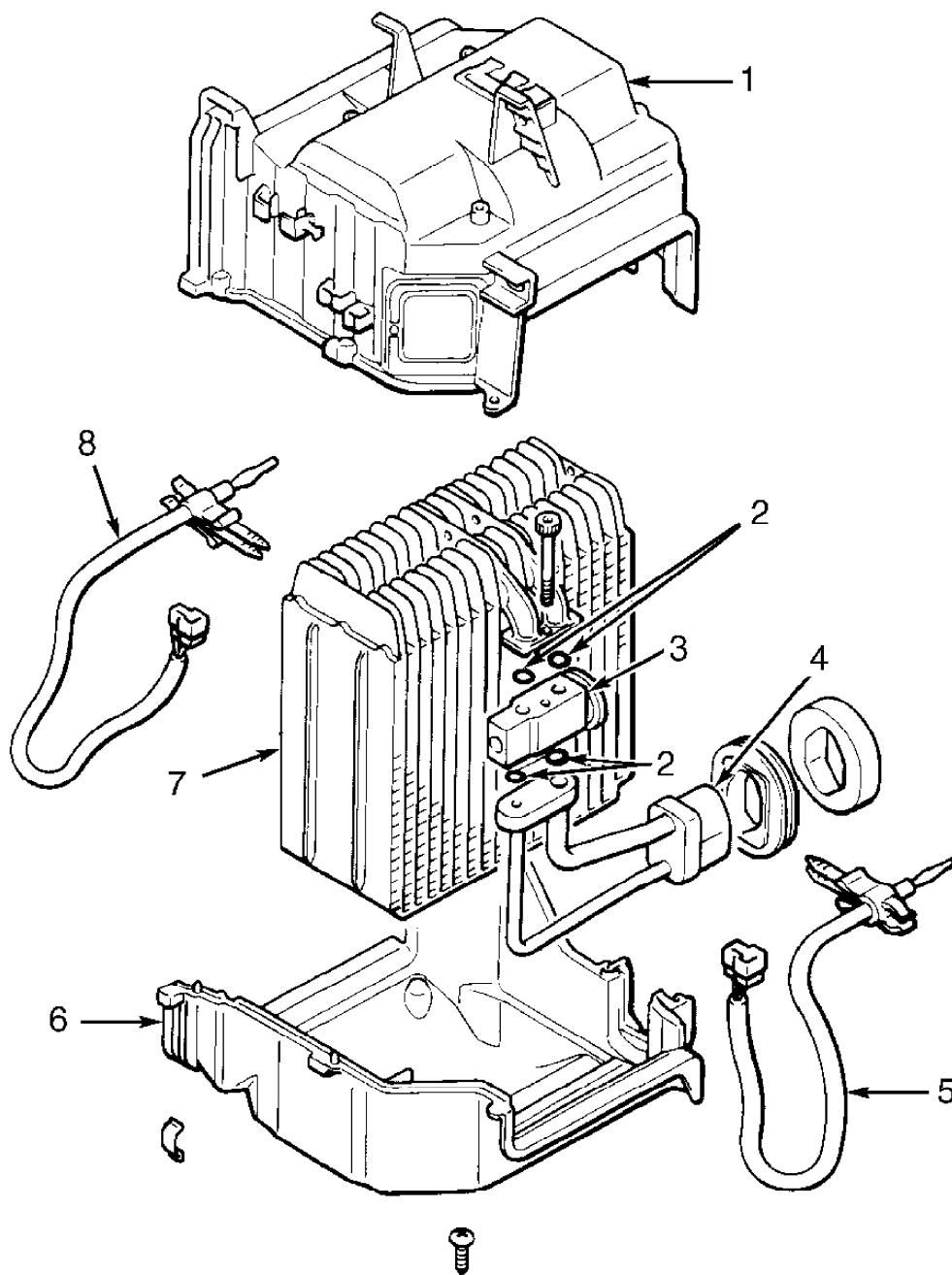


- 1. High & Low Pressure Hoses
- 2. "O" Ring
- 3. Drain Hose
- 4. Evaporator
- 5. Speaker Cover

- 6. Foot Shower Duct
- 7. Glove Box
- 8. A/C Wiring Harness
- 9. A/C Control Unit

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Fig. 14: Removing Evaporator Assembly
Courtesy of Mitsubishi Motor Sales of America.



1. Upper Evaporator Case

2. "O" Ring

3. Expansion Valve

4. High/Low Pressure Pipe

5. Air Inlet Sensor

6. Lower Evaporator Case

7. Evaporator

8. Air Thermosensor

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Fig. 15: Exploded View Of Evaporator Assembly
Courtesy of Mitsubishi Motor Sales of America.

REFRIGERANT TEMPERATURE SENSOR

Removal & Installation

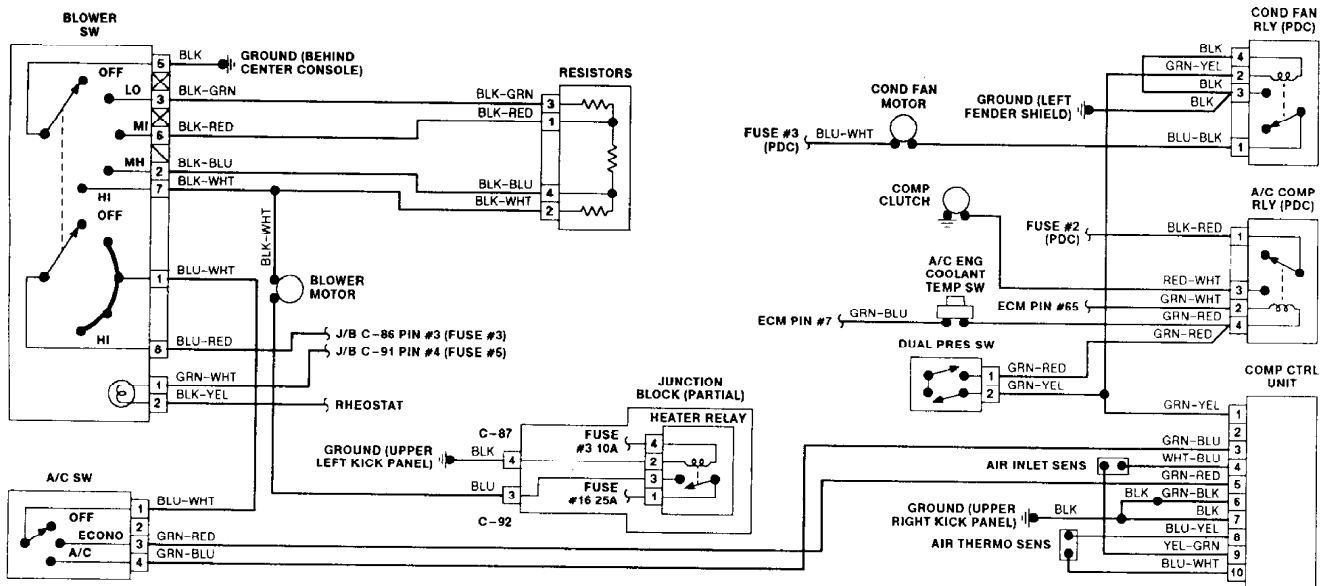
Discharge A/C system using approved refrigerant recovery/recycling equipment. Disconnect refrigerant temperature sensor wiring connector. Remove 2 bolts securing temperature sensor to compressor. Remove temperature sensor from compressor. To install, reverse removal procedure using new "O" ring on temperature sensor.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS TABLE

Application	Ft. Lbs. (N.m)
A/C Compressor Bolt/Nut	17-20 (23-27)
A/C Compressor Bracket Bolt/Nut	37 (50)
A/C Compressor Clutch Coil Nut	12 (16)
A/C Coolant Temperature Switch	26 (35)
	INCH Lbs. (N.m)
Blower Motor Bolts/Nuts	44 (5)
Condenser Bolts/Nuts	106 (12)
Dual Pressure Switch	89 (10)
Evaporator Assembly (Or Case) Bolts/Nuts	44 (5)
Heater Assembly (Or Case) Bolts/Nuts	44 (5)

WIRING DIAGRAMS



94B10661

Fig. 16: Manual A/C-Heater Wiring Diagram

*** A/C-HEATER SYSTEM UNIFORM INSPECTION GUIDELINES ***

1993 Mitsubishi Montero

GENERAL INFORMATION

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Standards For Automotive Repair

All Makes and Models

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SERVICE PORTS
SPRING LOCK COUPLINGS
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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:

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.

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.

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.
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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

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.

required.

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		

(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.

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

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.

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 DIAGNOSTIC PROCEDURES

1993 Mitsubishi Montero

1993 AIR CONDITIONING & HEAT A/C General Diagnostic Procedures

Diagnosis is an important first step in A/C system servicing. To save time and effort, systems should be carefully checked to identify the causes of poor performance. By using the following diagnostic charts, defective components or system problems can be quickly located. To identify problems that are specific to one system, refer to the repair section of this manual. The charts in this section apply to all systems.

PREPARATION FOR TESTING

- 1) Attach Low and High pressure gauges.
- 2) Start engine and allow to warm up.
- 3) Set system to COOL and blower to HIGH.
- 4) Open car doors and hood.
- 5) Run engine at fast idle for 2-3 minutes.

AIR CONDITIONING SYSTEM PERFORMANCE CHECK

AIR CONDITIONING SYSTEM PERFORMANCE CHECK TABLE

PERFORM TESTS:	SHOULD BE:	IF:
Temperature Check		Temperature Check Is:
* Switch to LOW blower.		
* Close doors.		
* Check outlet temperature.	35-45° F	Too warm - Check control lever operation, heater water valve, cooling system and gauge readings.
PERFORM TESTS:	SHOULD BE:	IF:
Visual Check		Visual Check Shows:
* Compressor	Quiet with no leaks	Noisy - Check belts, oil level, seals, gaskets, reed valves.
* Condenser	Free of obstructions	Blocked - Clean off. Plugged - Flush or replace.
* Receiver-Drier	Dry and warm to touch	Frosty - Check for restriction, replace desiccant.
* Sight Glass	Clear or few bubbles	Bubbly, foamy or streaks - Check gauge readings.
* High Side Lines	Dry and warm to touch	Frosty or very hot - Check for restriction or overcharge.

* Low Side Lines	Dry and cool to touch	Frosty or warm - Check for restriction, low charge or bad valve.
* Expansion Valve	Dry	Frosty - Check for moisture or restriction. Check sensing bulb.
* STV	Dry and cool to touch	Frosty or warm - Check gauge readings for valve malfunction.
* Evaporator	Dry and cold to touch	Freezing or warm - Check expansion valve, STV or thermostswitch.

PERFORM TESTS:	SHOULD BE:	IF:
Gauge Readings		Gauge Readings are:
* High Side Gauge	See Pressure Chart	Above or below normal - See A/C Diagnosis.
* Low Side Gauge	See Pressure Chart	Above or below normal

AMBIENT TEMPERATURE/PRESSURE

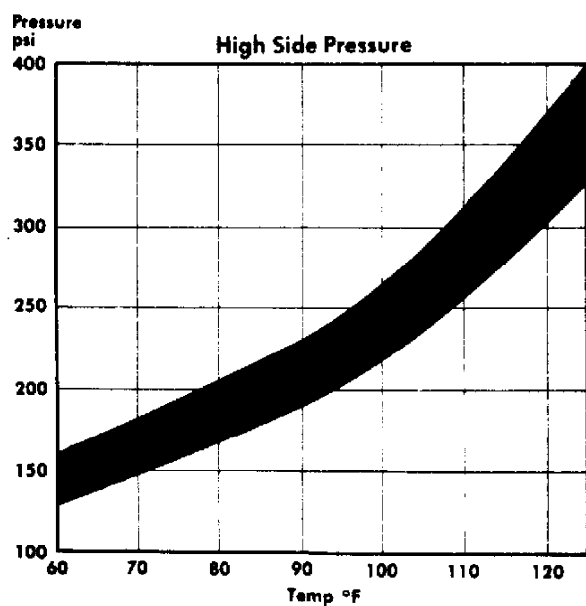


Fig. 1: Ambient Temperature/Pressure (R-12)

EVAPORATOR TEMPERATURE/PRESSURE

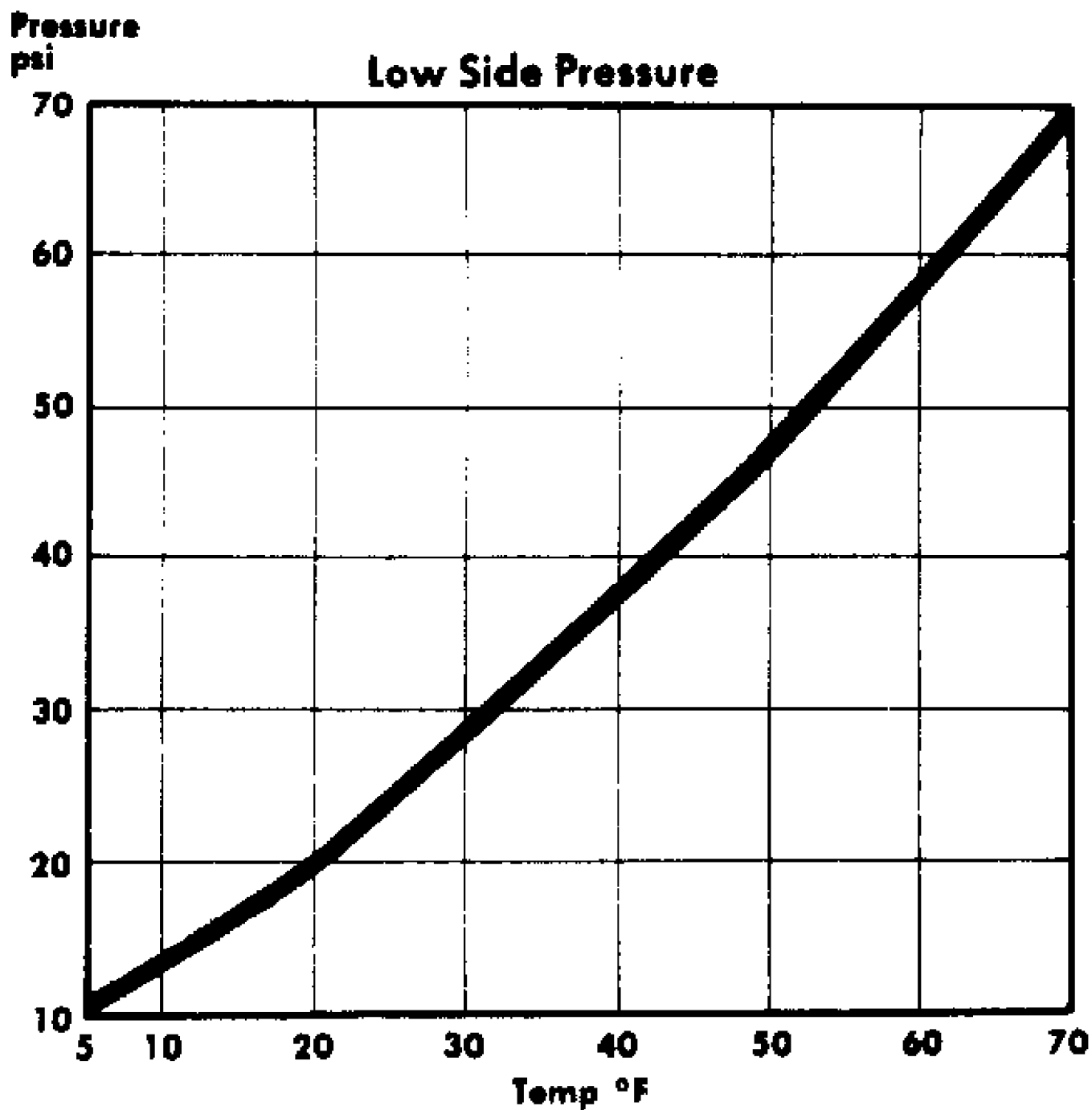


Fig. 2: Evaporator Temperature/Pressure (R-12)

A/C DIAGNOSIS W/GAUGES FOR SYS. W/INSUFFICIENT OR NO COOLING

A/C DIAGNOSIS W/GAUGES FOR SYS. W/INSUFFICIENT OR NO COOLING TABLE

Low Side Gauge	High Side Gauge	Other Symptoms (1)	Diagnosis

NORMAL	NORMAL	No or few bubbles in sight glass. High side gauge may go high. Low side gauge does not fluctuate with compressor on/off cycle.	Some Air & Moisture in System
NORMAL	NORMAL	Cools okay in morning but not during hot part of day. Bubbles in sight glass. Discharge air warm when low side gauge drops into vacuum.	Excessive Moisture in System
NORMAL	NORMAL	Thermostatic sw. sys. only-compressor cycles off & on too rapidly.	Defective Thermostatic Sw.
NORMAL to HIGH	NORMAL	Cycling clutch sys only - compressor doesn't turn on soon enough. Discharge air becomes warm as low side pressure rises.	Misadjusted Thermostatic Sw. or Defective Pressure Sensing Switch
LOW	LOW	Bubbles in sight glass. Outlet air slightly cool.	Low R-12 Charge
LOW	LOW	Sight glass clear. Outlet air very warm.	Excessively Low R-12 Charge
LOW	LOW	Outlet air slightly cool. Sweating or frost at expansion valve.	Expansion Valve Stuck Closed Screen Plugged or Sensing Bulb Malfunction
LOW	LOW	Outlet air slightly cool. High side line cool to touch. Sweating or frost on high side.	Restriction on High Side
LOW	HIGH	Evaporator outlet pipe cold. Low side goes into vacuum when blower is disconnected.	STV Stuck Open
HIGH	LOW	Evaporator outlet pipe warm. Outlet air warm.	STV Stuck Closed
HIGH	LOW	Noise from compressor.	Compressor Malfunction
HIGH	HIGH	Outlet air warm. Liquid line very hot. Bubbles in sight glass.	Compressor Malfunction or R-12 Overcharge
HIGH	HIGH	Outlet air slightly cool. Bubbles in sight glass.	Large Amount of Air of Air & Moisture in System
HIGH	HIGH	Outlet air warm. Evaporator outlet sweating and frost.	Expansion Valve Stuck Open

- (1) - If equipped with a low refrigerant charge protection system, compressor operation may have stopped.

AIR CONDITIONING GENERAL TROUBLE SHOOTING

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.

HEATING GENERAL TROUBLE SHOOTING

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.

Airflow 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.

A/C SYSTEM GENERAL SERVICING

1993 Mitsubishi Montero

1993 GENERAL SERVICING
General Servicing Procedures

USING R-12 & R-134a REFRIGERANT

HANDLING/SAFETY PRECAUTIONS

1) Always work in a well-ventilated, clean area. Refrigerant R-134a is colorless and is invisible as a gas. Refrigerant (R-12 or R-134a) is heavier than oxygen and will displace oxygen in a confined area. Avoid breathing refrigerant vapors. Exposure may irritate eyes, nose and throat.

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

3) Refrigerant evaporates quickly when exposed to atmosphere, freezing anything it contacts. If liquid refrigerant contacts eyes or skin, 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% 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).

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% of the container's gross weight rating. Store refrigerant containers at temperature less than 125°F (52°C).

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

9) R-12 and R-134a refrigerants must never be mixed, as their desiccants and lubricants are not compatible. If the 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 R-12 or R-134a refrigerants.

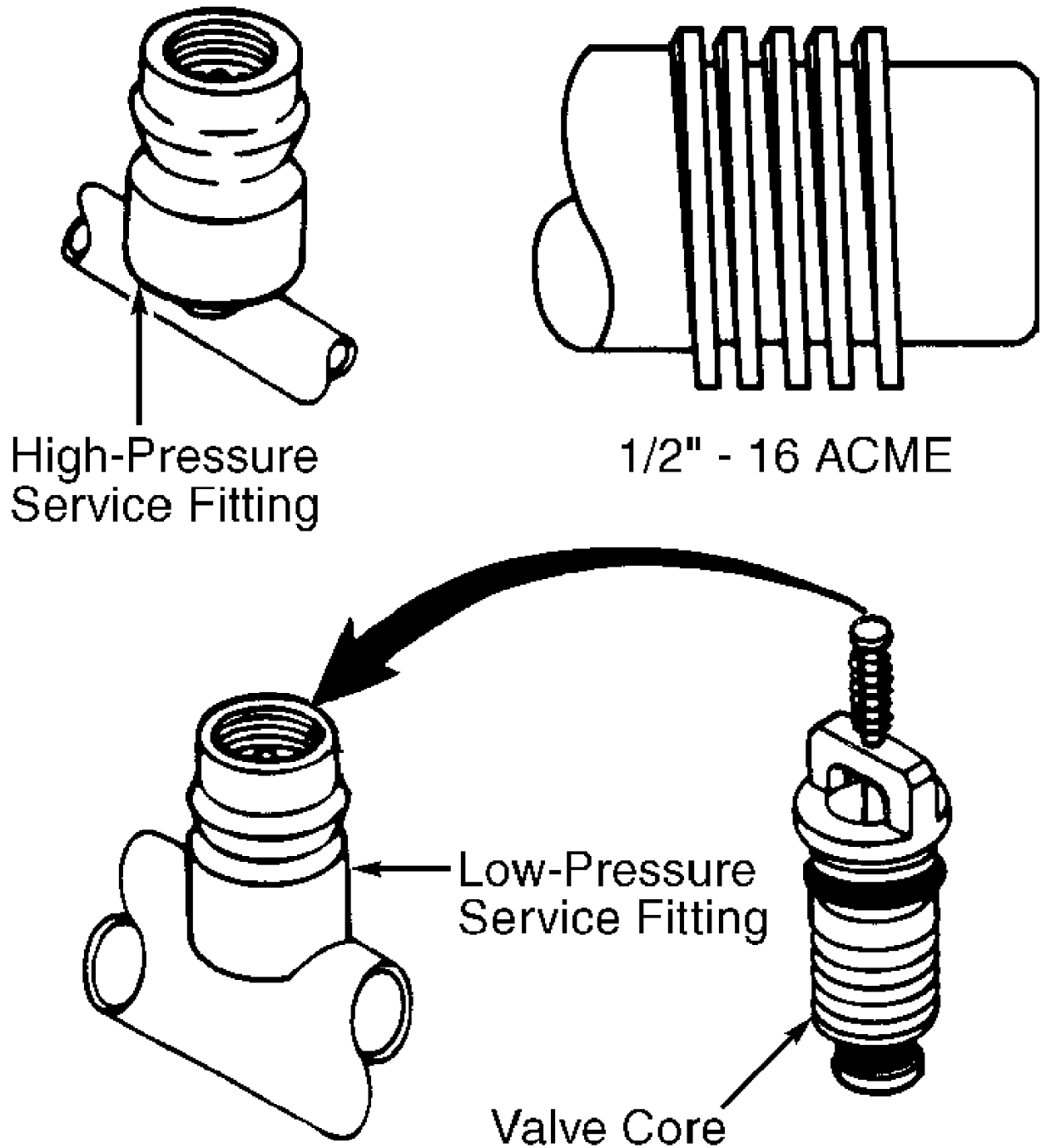
IDENTIFYING R-134a SYSTEMS & COMPONENTS

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" - 16" ACME 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.



93H19254

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

Underhood A/C Specification Labels
Most R-134a based systems will be identified through the use

of Green or Light Blue underhood labels, or with R-134a refrigerant clearly printed on labels. See Fig. 2. Some manufacturers will identify R-12 based systems with White, Red, Silver or Gold underhood labels. Before servicing an A/C system, always determine which refrigerant is being used.

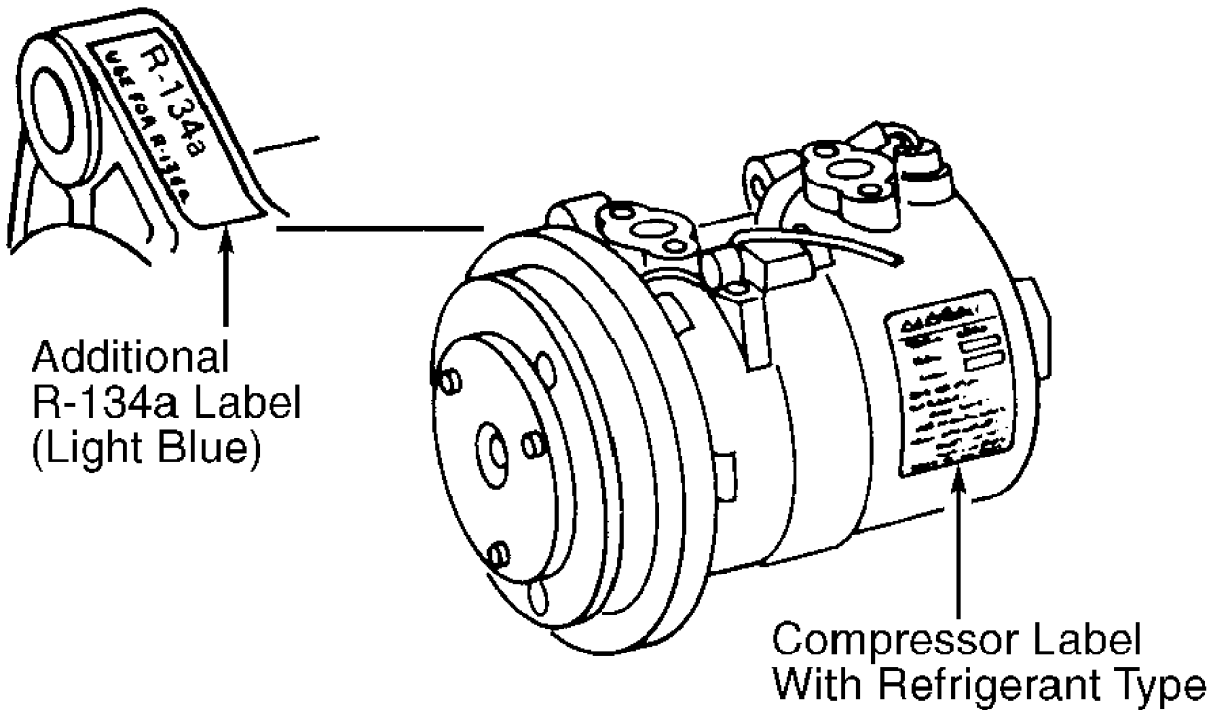
AIR CONDITIONER		NISSAN
	REFRIGERANT	COMPRESSOR LUBRICANT
TYPE (PART NO.)	R134a	NISSAN A/C SYSTEM OIL TYPE - S (KLH00-PAGS0)
AMOUNT	0.75 ± 0.05 kg (1.65 ± 0.11 lbs)	250 ml (8.5 fl. oz)

CAUTION

- REFRIGERANT UNDER HIGH PRESSURE.
- SYSTEM TO BE SERVICED BY QUALIFIED PERSONNEL.
- IMPROPER SERVICE METHODS MAY CAUSE PERSONAL INJURY.
- CONSULT SERVICE MANUAL.
- THIS AIR CONDITIONER SYSTEM COMPLIES WITH SAE J-639.

Nissan Motor Corporation in USA, Carson, CA

- A/C
Specification
Label



93119255

Fig. 2: Underhood A/C Specification Labels (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, R-134a systems have no sight glass.

Audi, Mercedes-Benz and Volkswagen use Green bands/labels on condenser, refrigerant lines, receiver-drier and expansion valve. Lexus A/C system hoses and line connectors have a groove, a White line and "R-134a" marked on them. See Fig. 3.

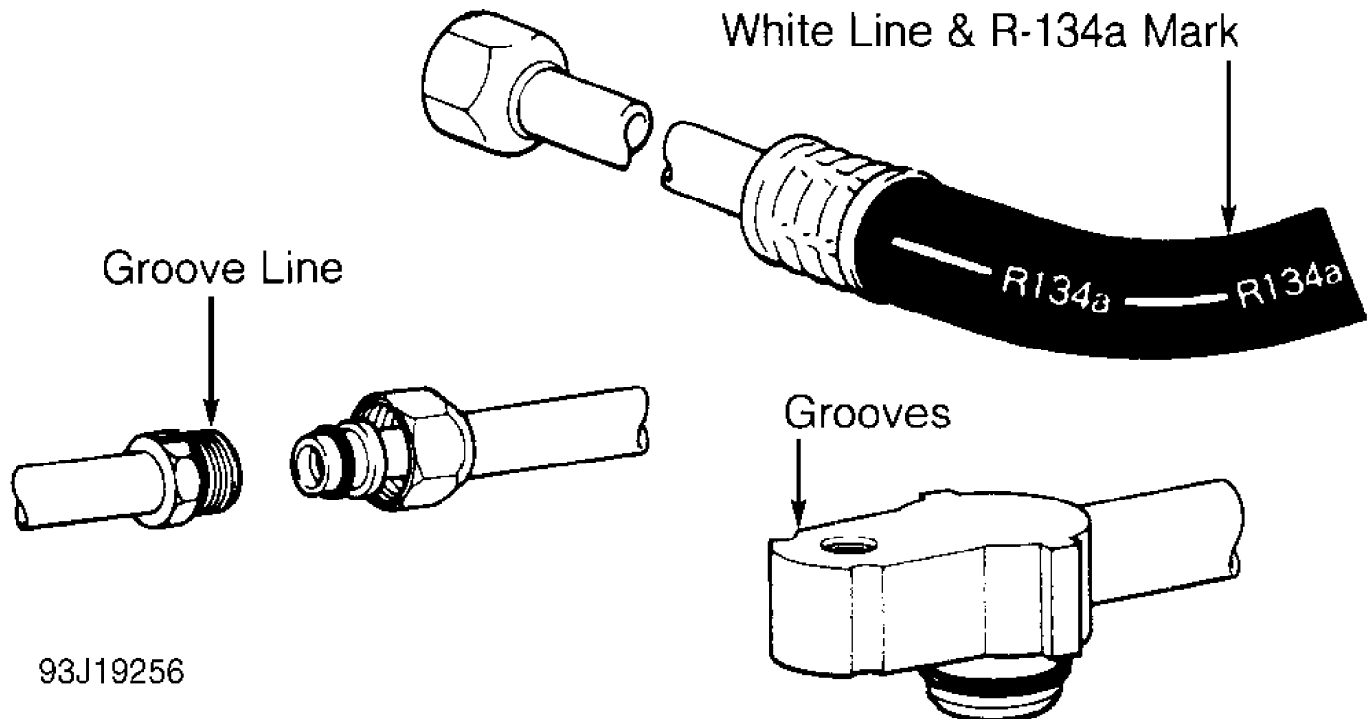


Fig. 3: Identifying R-134a Hose & Line Connectors (Lexus)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

REFRIGERANT OILS

Refrigerant R-12 based systems use mineral oil, while R-134a systems use synthetic/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.

Use ONLY specified oil for the appropriate system and A/C compressor. Always check the underhood A/C specification label or A/C compressor label before adding refrigerant oil to A/C compressor/system. See Fig. 2. The following R-134a refrigerant oils are currently available.

Lexus

PAG Refrigerant Oil (ND-OIL 8) with 10P/10PA swashplate (piston) compressor. Synthetic Refrigerant Oil (ND-OIL 9) with through-vane (rotary vane) compressor.

Mercedes-Benz

PAG Refrigerant Oil (001 989 08 03).

Nissan

PAG Refrigerant Oil (KLH00-PAGR0) with rotary vane compressor. PAG Refrigerant Oil (KLH00-PAGS0) with piston (swashplate) compressor.

Saab
PAG Refrigerant Oil (40 74 787).

NOTE: Synthetic/PAG oils absorb moisture very rapidly, 2.3-5.6% by weight, as compared to a mineral oil absorption rate of .005% by weight.

SERVICE EQUIPMENT

Because R-134a is not interchangeable with R-12, separate sets of hoses, manifold gauge set and recovery/recycling equipment are required to service vehicles. This is necessary to avoid cross-contaminating and damaging system.

All equipment used to service systems using R-134a must meet SAE standard J1991. 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.

NOTE: Refrigerant R-12 service hoses will ONLY be labeled SAE J2196.

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-134 or R-134a on gauge face
- * 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. R-134a valve cores can be easily identified by use of "O" rings and external spring. See Fig. 1.

SERVICE VALVE LOCATIONS

SERVICE VALVE LOCATIONS TABLE

Vehicle	High	Low

Audi	(12)	(13)
Acura	(2)	(3)
BMW	(4)	(5)
Chrysler, Eagle & Mitsubishi		
Colt, Mirage & Summit	(10)	(5)
Colt Vista & Summit Wagon	(10)	(11)
Diamante	(4)	(5)
Eclipse & Expo	(10)	(11)
Galant	(10)	(11)
Montero	(11)	(11)
Pickup & Ram-50	(10)	(11)
Precis	(10)	(10)
Stealth & 3000GT		
R-12	(1)	(1)
R-134a	(1)	(5)
Ford Motor Co.	(4)	(5)
General Motors	(12)	(12)
Geo	(4)	(5)
Honda	(4)	(5)
Hyundai		
Elantra & Scoupe	(4)	(5)
Excel & Sonata	(10)	(10)
Infiniti	(4)	(5)
Isuzu	(4)	(5)
Jaguar	(4)	(5)
Lexus	(4)	(5)
Mazda		
B2200 & B2600i	(8)	(8)
Miata, MPV Protege & 323	(4)	(5)
Navajo	(6)	(7)
All Others	(1)	(1)
Mercedes-Benz	(4)	(5)
Nissan	(4)	(5)
Porsche	(8)	(8)
Saab	(8)	(8)
Subaru		
Impreza	(1)	(1)
Legacy & Loyale	(4)	(5)
SVX	(9)	(9)
Suzuki	(4)	(5)
Toyota		
Pickup & 4Runner	(11)	(11)
All Others	(4)	(5)
Volkswagen	(4)	(5)
Volvo		
240	(4)	(5)
850	(1)	(5)
940 & 960	(14)	(14)

- (1) - Information is not available from manufacturer.
- (2) - On high pressure line (near top of condenser on Integra; near receiver-drier on Legend; on receiver-drier on Vigor). Use High-Side Adapter (J-25498).
- (3) - On low pressure line (near battery on Integra; near right rear of engine on Legend; near compressor on Vigor).
- (4) - On high pressure (discharge) hose/line.
- (5) - On low pressure (suction) hose/line.
- (6) - On high pressure line, between compressor and condenser.
- (7) - On suction accumulator/drier.
- (8) - On low and high pressure hoses, behind compressor.
- (9) - On receiver/drier and low pressure hose (near

- compressor).
- (10) - On compressor discharge hose and accumulator.
 - (11) - On compressor discharge and suction ports.
 - (12) - Front of condenser on right side.
 - (13) - Towards rear of compressor.
 - (14) - Single service valve on suction accumulator/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 system and follow instructions provided with the system.

The removed refrigerant is filtered, dried and stored in a tank within the recovery/recycling system until it is ready to be pumped back into the vehicle's A/C system. With refrigerant stored in the recovery/recycling system, 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. On systems with R-134a refrigerant, use Polyalkylene Glycol (PAG) wax-free refrigerant oil.

D - ADJUSTMENTS

1993 Mitsubishi Montero

1993 ENGINE PERFORMANCE

Chrysler Corp./Mitsubishi On-Vehicle Adjustments

Dodge; Ram-50

Mitsubishi; Montero, Pickup

ENGINE MECHANICAL

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

VALVE CLEARANCE

NOTE: These models use hydraulic lash adjusters and do not require periodic valve adjustment.

VALVE ADJUSTMENT

CAUTION: DO NOT rotate crankshaft in opposite direction of normal engine rotation.

CHECKING HYDRAULIC VALVE LIFTERS

1) Warm engine to normal operating temperature. Remove valve cover. Position cylinder No. 1 at TDC on compression stroke. Check intake rockers on cylinders No. 1 and 2. Check exhaust rockers on cylinders No. 1 and 3.

2) Push downward on end of rocker arm above lash adjuster. Rotate crankshaft 360 degrees and check intake rockers on cylinders No. 3 and 4. Check exhaust rockers on cylinders No. 2 and 4. 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 leak, 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 adjustments with engine at normal operating temperature, cooling fan and accessories off, transmission in Park or Neutral, and front wheels in straight-ahead position.

NOTE: Adjustment of ignition timing cannot be performed on vehicles equipped with Distributorless Ignition Systems (DIS). If ignition timing is not within specification, see CRANKSHAFT POSITION SENSOR in I - SYS/COMP TESTS article in this section.

1) Locate ignition timing adjustment connector. See IGNITION TIMING ADJUSTMENT CONNECTOR LOCATION table. Connect jumper wire

between ignition timing adjustment connector and ground. Check ignition basic timing.

2) If ignition basic timing is not within specification, loosen distributor and rotate to adjust timing if necessary. See IGNITION TIMING SPECIFICATIONS table. Remove jumper wire from ignition timing adjustment connector.

IGNITION TIMING SPECIFICATIONS TABLE (Degrees BTDC @ RPM)

Application	(1) Basic	(2) (3) Actual
2.4L	3-7 @ 600-800	8 @ 600-800
3.0L		
Montero	3-7 @ 600-800	15 @ 600-800
Pickup & Ram-50 ...	3-7 @ 650-850	15 @ 650-850

- (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. Ignition timing may fluctuate.
- (3) - If vehicle altitude is more than 2300 ft. above sea level, actual timing may be advanced.

IGNITION TIMING ADJUSTMENT CONNECTOR LOCATION

Application	(1) (2) Wire Color	Location
Montero	White/Yellow	(3)
Pickup & Ram-50		
2.4L	Black/Blue	(4)
3.0L	White/Yellow	(4)

- (1) - Remove waterproof female connector (if equipped) for access to wire.
- (2) - Ground connector at wire end for basic timing adjustment.
- (3) - On main wiring harness, near wiper motor on firewall.
- (4) - Near left rear corner of engine compartment, below cruise control actuator (if equipped).

IDLE SPEED & MIXTURE

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.

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 I - SYS/COMP TESTS article in this section. If IAC system

is okay, adjust basic idle speed. See BASIC IDLE SPEED.

BASIC IDLE SPEED

NOTE: ALWAYS check TPS adjustment after adjusting basic idle speed. See THROTTLE POSITION SENSOR (TPS).

NOTE: For Data Link Connector (DLC) location, see G - TESTS W/CODES article in this section.

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

1) Insert paper clip or appropriate probe into tachometer connector. See TACHOMETER CONNECTOR LOCATION table. Connect a primary voltage detecting type tachometer to paper clip.

2) Connect a jumper wire between data link terminal No. 10 and vehicle ground. See Fig. 1. Connect a jumper wire between ignition timing adjustment connector and vehicle ground. See IGNITION TIMING ADJUSTMENT CONNECTOR LOCATION table under IGNITION TIMING.

3) Start and run engine at idle. Check basic idle speed. See IDLE SPEED SPECIFICATIONS table. If idle speed is not within specifications, turn engine speed adjusting screw until correct engine speed is obtained. See Fig. 2. Access to speed adjusting screw is obtained by removing rubber plug on throttle body.

4) If idle speed cannot be lowered by adjusting engine speed adjusting screw, determine if fixed speed adjusting screw (stop screw contacting throttle lever) has been adjusted. See FIXED SPEED ADJUSTING SCREW for procedure.

5) After all adjustments are verified correct, possible cause of incorrect idle speed is deterioration of fast idle air control motor. Throttle valve must be replaced to correct symptom. Disconnect jumper wires and recheck idle speed.

TACHOMETER CONNECTOR LOCATION TABLE

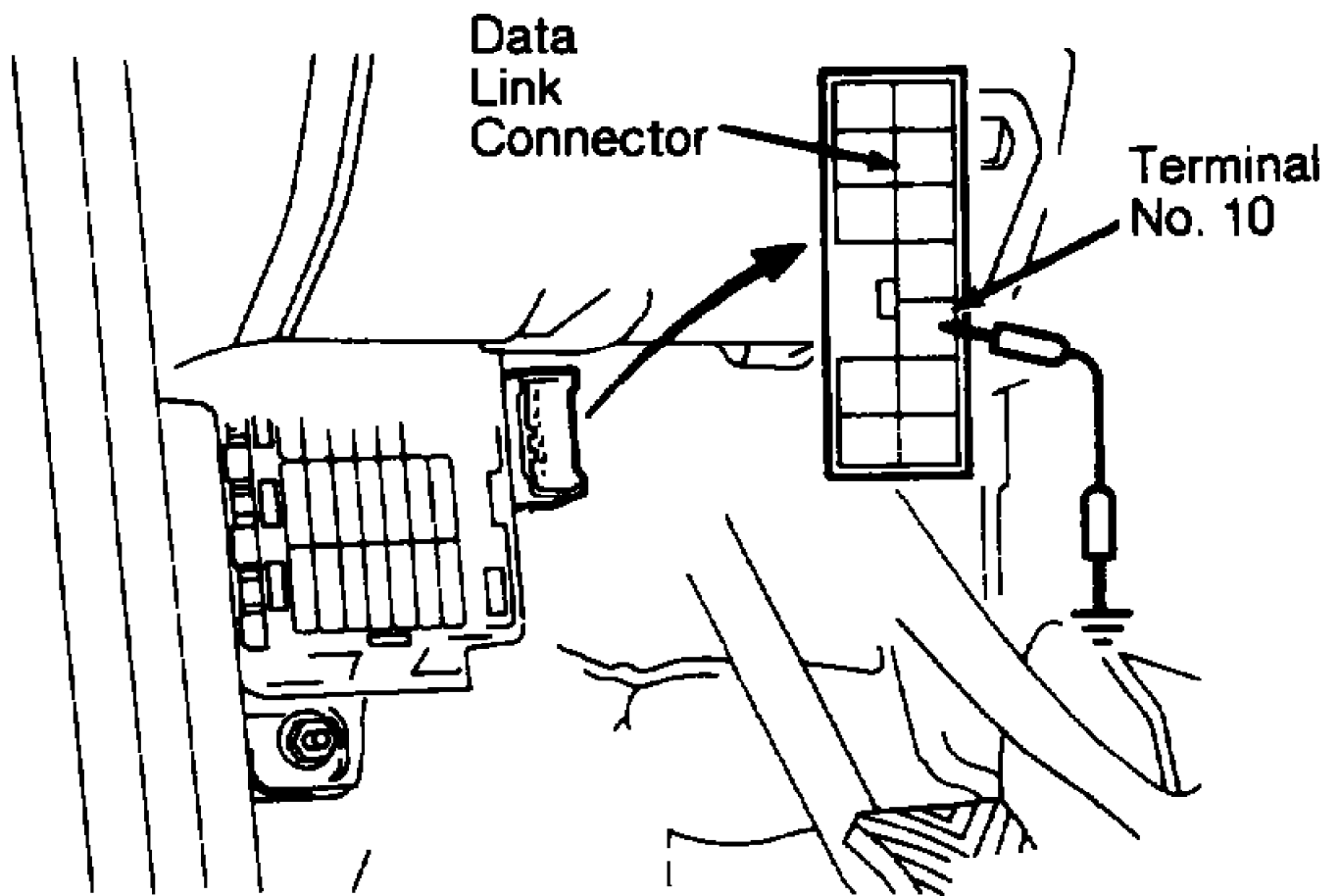
Application	Type	Location
3.0L	1-Pin	(1)
2.4L	1-Pin	(2)

(1) - Backprobe connector to noise filter (White/Black wire) mounted on ignition coil bracket.

(2) - On main harness, on firewall to left of Vehicle Identification Plate.

IDLE SPEED SPECIFICATIONS TABLE

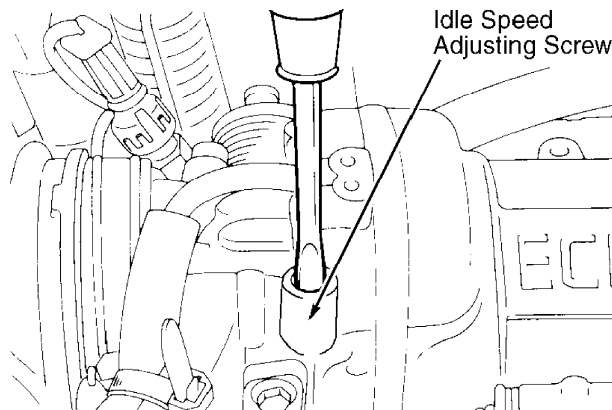
Application	Curb Idle	Basic Idle
2.4L	600-800	600-800
3.0L		
Montero	600-800	600-800
Pickup & Ram-50	650-850	650-850



12-PIN CONNECTOR

93E78133

Fig. 1: Locating Data Link Connector (Typical)
Courtesy of Mitsubishi Motor Sales of America.



93F78134

Fig. 2: Adjusting Idle Speed (Typical)
Courtesy of Mitsubishi Motor Sales of America.

FIXED SPEED ADJUSTING SCREW

NOTE: Fixed Speed Adjusting Screw (FSAS) is preset by manufacturer and usually does not require adjustment. Only adjust FSAS if other adjustment procedures require it, or if manufacturer's original setting has been changed.

(3.0L)

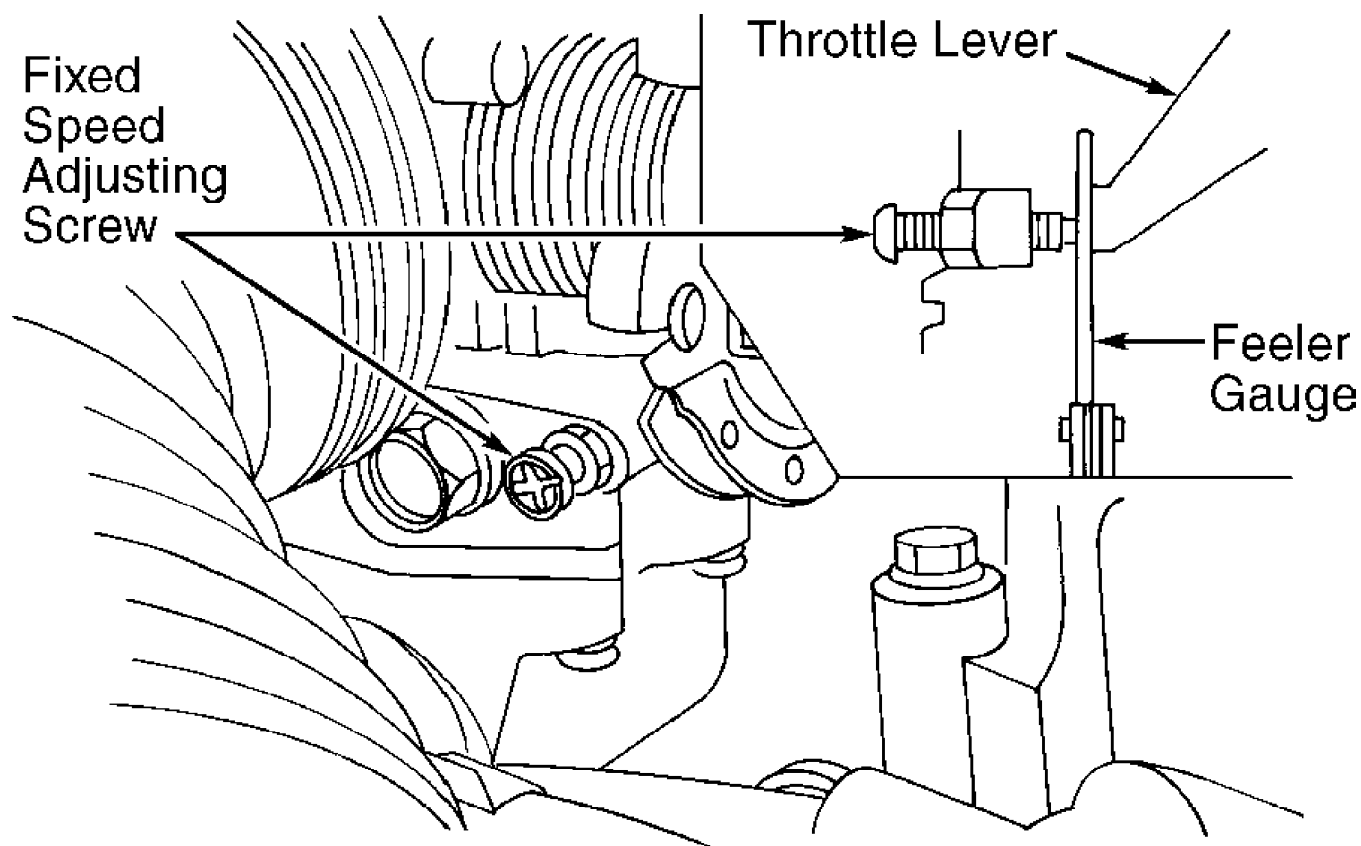
1) Loosen throttle cable. Loosen FSAS lock nut. See Fig. 3. Turn FSAS counterclockwise until throttle valve is fully closed. Turn FSAS clockwise until throttle valve begins to open. Turn FSAS clockwise 1 1/4 turns after throttle valve begins to open.

2) Tighten lock nut while holding FSAS in position. Adjust throttle cable. Adjust basic idle speed. See BASIC IDLE SPEED under IDLE SPEED & MIXTURE. Adjust throttle position sensor. See THROTTLE POSITION SENSOR (TPS).

NOTE: Eclipse 2.0L DOHC uses an idle position switch as the Fixed Speed Adjusting Screw (FSAS). For adjustment, see IDLE POSITION SWITCH under THROTTLE POSITION SENSOR (TPS).

(2.4L)

To adjust Fixed Speed Adjusting Screw (FSAS), adjust basic idle speed. See BASIC IDLE SPEED under IDLE SPEED & MIXTURE.



93H78136

Fig. 3: 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 specifications are not

available from manufacturer.

THROTTLE POSITION SENSOR (TPS)

TPS ADJUSTMENT

NOTE: Ensure basic idle speed is set to specification before adjusting TPS. 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.

TPS SPECIFICATIONS TABLE

Application	(1) Volts
Pickup (3.0L), Ram-50 (2.4L)	.48-.52
Montero	.4-1.0

(1) - At idle.

Montero

1) Disconnect TPS connector. Using external ohmmeter, measure resistance between TPS terminals No. 1 and 2. See Fig. 4. Insert .256" (.65 mm) feeler gauge between fixed speed adjusting screw and throttle lever.

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

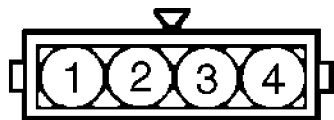
3) Turn ignition on. Using external voltmeter, measure TPS output voltage between terminals No. 1 and 3. See TPS SPECIFICATION table. If voltage is not within specifications, check harness and sensor. See I - SYS/COMP TESTS article in this section.

Pickup, Ram-50

1) Disconnect TPS connector. Using external ohmmeter, measure resistance between TPS terminals No. 3 and 4. See Fig. 4. Insert .256" (.65 mm) feeler gauge between fixed speed adjusting screw and throttle lever.

2) Loosen TPS mounting screws and rotate TPS fully clockwise. Ensure there is continuity between terminals No. 3 and 4. Rotate TPS counterclockwise until there is no continuity and tighten screws. Install Test Harness (MB991348) between TPS and harness connector.

3) Turn ignition on. Using external voltmeter, measure TPS output voltage between terminals No. 2 and 4. See TPS SPECIFICATIONS table. If voltage is not within specification, check harness and sensor. See I - SYS/COMP TESTS article in this section.



93I78137

Fig. 4: Identifying TPS Connector
Courtesy of Mitsubishi Motor Sales of America.

IDLE POSITION SWITCH

NOTE: Idle position switch is preset by manufacturer. Adjustment is usually not necessary. If other procedures require adjustment of idle position switch or if switch setting has been changed, adjust switch as follows.

Idle position switch is incorporated into IAC motor and is automatically adjusted when TPS is adjusted. See TPS ADJUSTMENT.

ALTERNATOR & REGULATOR

1993 Mitsubishi Montero

1993 ELECTRICAL
Mitsubishi Alternators & Regulators

Montero

DESCRIPTION

Mitsubishi alternators 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.

Alternator relay or resistor with diode is used to ensure charging of battery even if charging indicator light is defective.

ADJUSTMENTS

ALTERNATOR BELT ADJUSTMENT TABLE

Application		Deflection In. (mm)
New Belt (1)	.....	.25-.31 (6.4-7.9)
Used Belt (1)	.....	.35 (8.9)
(1) - With 22 lbs. (10 kg) pressure applied midway on belt run.		

TROUBLE SHOOTING

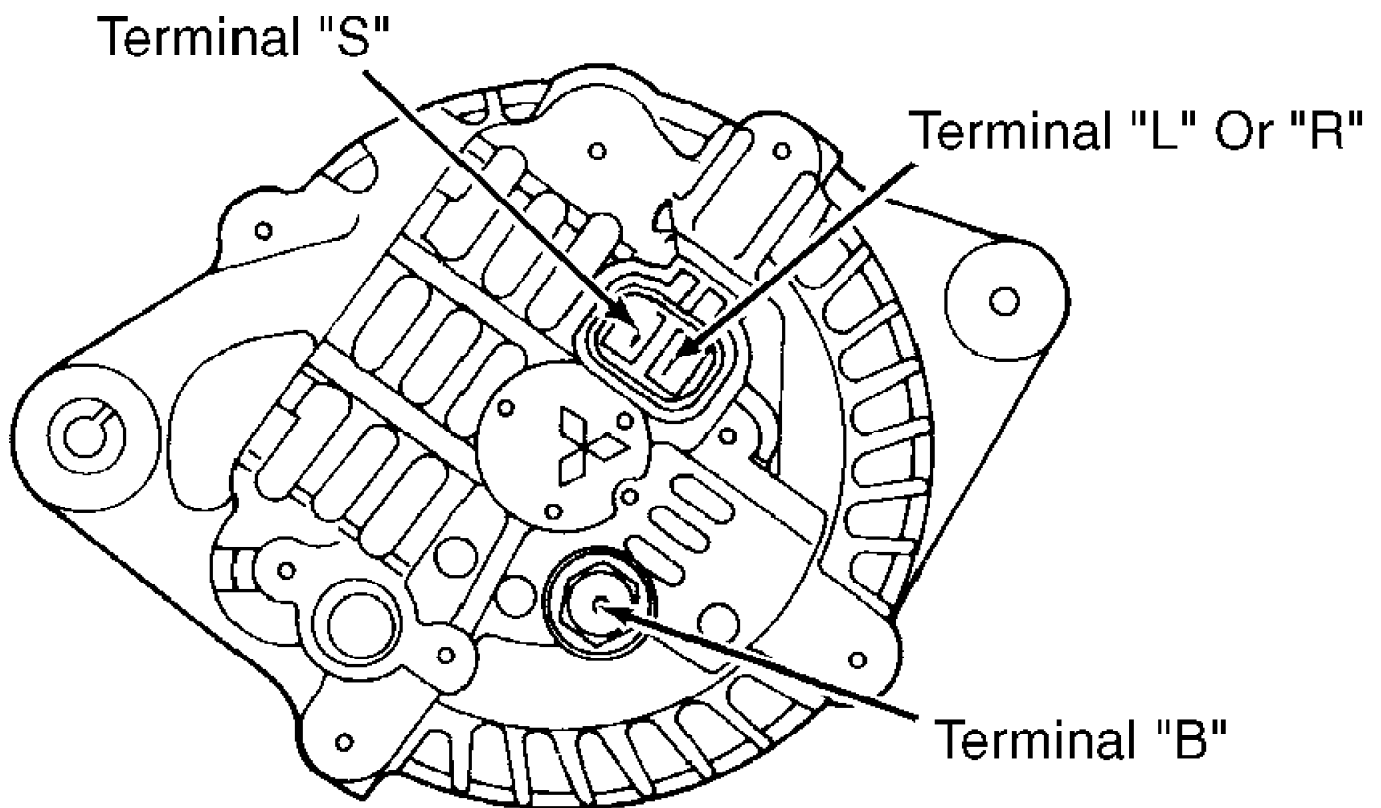
NOTE: See TROUBLE SHOOTING - BASIC PROCEDURES article in the GENERAL INFORMATION Section.

ON-VEHICLE TESTING

ALTERNATOR TO BATTERY CONTINUITY TEST

NOTE: Check alternator wiring harness connections and drive belt tension and ensure battery is fully charged before performing test.

1) Turn ignition switch to OFF position. Disconnect negative battery cable. Remove output lead from alternator terminal "B". See Fig. 1. Install a 100-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.



90C08766

Fig. 1: Alternator Terminal ID
 Courtesy of Mitsubishi Motor Sales of America.

2) Install a digital voltmeter between alternator terminal "B" and positive battery terminal. Install positive voltmeter lead to terminal "B" and negative lead to positive battery terminal. Reconnect negative battery cable.

3) Start engine. Turn accessories on and adjust engine speed until ammeter indicates 20 amps, and note voltmeter reading. If voltmeter indicates .2 volt or less, system is okay.

4) If voltage is greater than .2 volt, wiring is defective between alternator terminal "B", fusible link and positive battery terminal. Disconnect negative battery cable, and remove test equipment.

ALTERNATOR OUTPUT TEST

NOTE: During alternator output test, a slightly discharged battery should be used as a fully charged battery may not allow full alternator output.

1) Turn ignition switch to OFF position. Disconnect negative battery cable. Disconnect alternator output wire from terminal "B". Install 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.

2) Connect positive voltmeter lead (0-20 volts) to alternator

terminal "B" and negative lead to ground. Install tachometer, and reconnect negative battery cable.

3) Ensure voltmeter indicates battery voltage. If no voltage exists, an open circuit is present in wire between alternator terminal "B" and negative battery terminal. Check grounds and fusible link.

4) Turn headlights on, and start engine. Set headlights at high beam and heater switch on HIGH. Quickly accelerate engine speed to 2500 RPM and note alternator output current on ammeter. Minimum output should be within specification. See ALTERNATOR 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 alternator or ambient temperature is excessive. Allow alternator or temperature to cool, and recheck output. Alternator output is stamped on metal plate attached to alternator case.

5) If minimum output is not obtained and alternator wiring is okay, repair alternator. Disconnect negative battery cable, and remove test equipment.

ALTERNATOR MINIMUM OUTPUT SPECIFICATIONS TABLE

Application	Amps
Montero	52.5

REGULATED VOLTAGE TEST

NOTE: Ensure battery is fully charged and proper drive belt tension exists.

1) Turn ignition switch to OFF position. Disconnect negative battery cable. Connect positive voltmeter lead to terminal "S" of alternator. See Fig. 1. Connect negative voltmeter lead to ground.

2) Disconnect alternator output wire from terminal "B". Install a 100-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. Install a tachometer, and reconnect negative battery cable.

3) Turn ignition switch to ON position and ensure voltmeter indicates battery voltage. If no voltage exists, there is an open in wire between alternator terminal "S" and positive battery terminal or fusible link is blown.

4) Start engine. Ensure all lights and accessories are off. Operate engine at 2500 RPM and read voltmeter when alternator 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

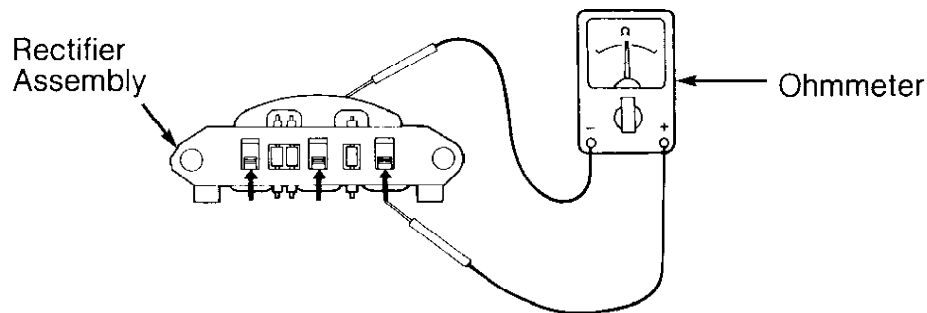
Ambient Temperature	Voltage
-4°F (-20°C)	14.2-15.4
68°F (20°C)	13.9-14.9
140°F (60°C)	13.4-14.6
176°F (80°C)	13.1-14.5

BENCH TESTING

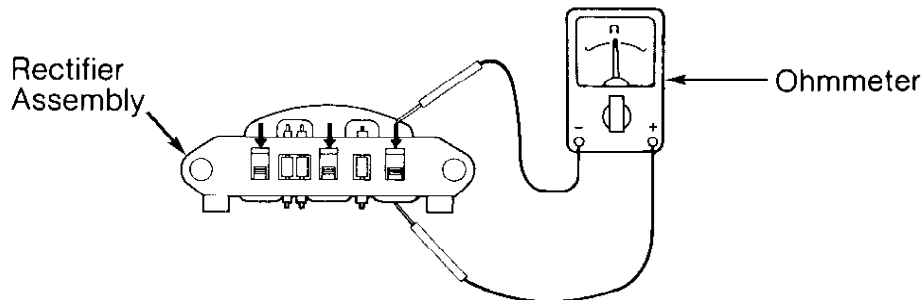
RECTIFIER ASSEMBLY

1) Using ohmmeter, check for continuity between diodes and stator coil lead connection. See Fig. 2. Reverse leads. If continuity exists in both directions, diode is shorted. Replace rectifier assembly.

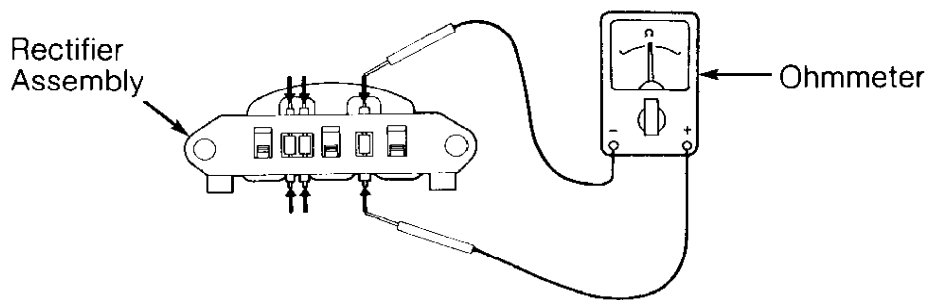
2) To check entire diode assembly, use an ohmmeter to check for continuity between both ends of each diode. See Fig. 2. Switch ohmmeter leads. Continuity should exist in one direction only. If no continuity exists or continuity exists in both directions, diode is defective. Replace rectifier assembly.



TESTING POSITIVE DIODES



TESTING NEGATIVE DIODES



TESTING DIODE ASSEMBLY

90E08767

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 no continuity exists or resistance is not within specification.

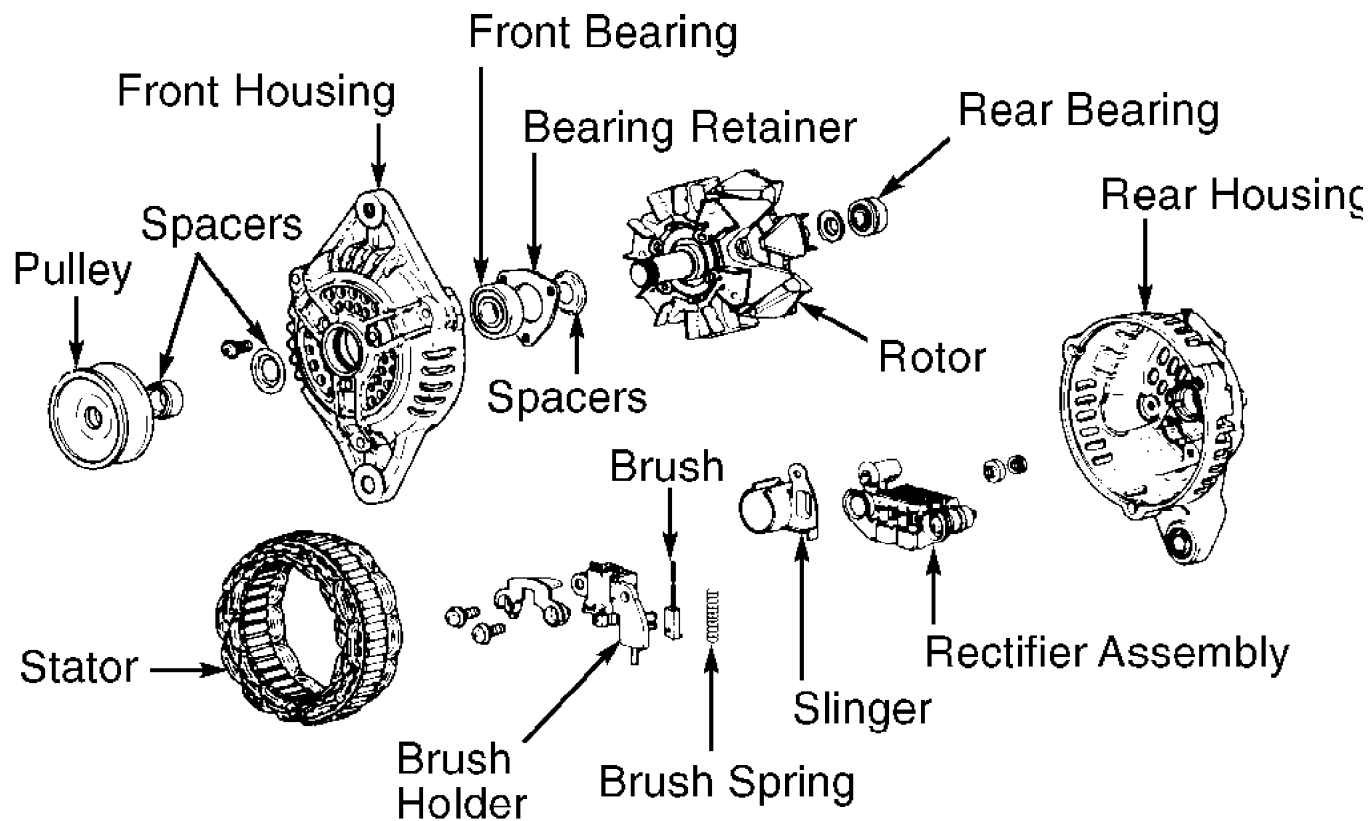
2) Check continuity between individual slip rings and rotor shaft. If continuity exists, rotor coil or slip ring is grounded. Replace rotor.

STATOR

Ensure no continuity exists between stator coil leads and stator core. Check continuity between leads of stator coil. If no continuity exists 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.



90G08768

Fig. 3: Exploded View Of Typical Mitsubishi Alternator
Courtesy of Mitsubishi Motor Sales of America.

WIRING DIAGRAMS

See appropriate WIRING DIAGRAM in the WIRING DIAGRAMS Section.

ANTI-LOCK BRAKE SAFETY PRECAUTIONS

1993 Mitsubishi Montero

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 hydraulic 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 recommended brake fluids. DO NOT use silicone brake fluids in an ABS equipped vehicle.
- * When installing transmission 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

1993 Mitsubishi Montero

1993 BRAKES
Mitsubishi Anti-Lock Brakes

Montero

DESCRIPTION

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. Major components are hydraulic unit, wheel speed sensors, "G" sensor, Electronic Control Unit (ECU) and ANTI-LOCK warning light. ABS has a self-diagnostic system to indicate a system malfunction and for use in system trouble shooting.

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

OPERATION

Each wheel sensor sends an AC electrical signal to the Electronic Control Unit (ECU). The ECU reads 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 drops to 4 MPH. Minor lock-up may occur at this point.

With engine running and vehicle speed greater 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.

CAUTION: See ANTI-LOCK BRAKE SAFETY PRECAUTIONS below.

ANTI-LOCK BRAKE SAFETY PRECAUTIONS

- * 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 hydraulic system without first referring to the appropriate article.
- * Only use specially designed brake hoses/lines on ABS-equipped vehicles.
- * DO NOT tap on speed sensor components (sensor, sensor rings). Speed rings must be pressed, 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 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 recommended brake fluids. DO NOT use silicone brake fluids in an ABS-equipped vehicle.
- * When installing transmitting 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).

BLEEDING BRAKE SYSTEM

BLEEDING PROCEDURES

When bleeding hydraulic system, follow normal manual or pressure bleeding procedures. Bleed brake system in following order: right rear, left rear, Load-Sensing Proportioning Valve (LSPV), right front and left front.

ADJUSTMENTS

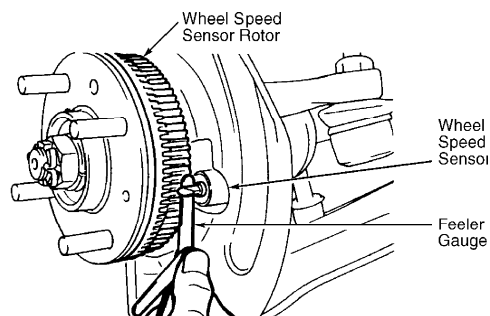
NOTE: For adjustment information for brake pedal height, free play, parking brake and stoplight switch, see BRAKE SYSTEM article in BRAKES section.

WHEEL SPEED SENSOR

Sensor-To-Rotor Gap Adjustment

1) Raise and support vehicle. Remove wheel assembly. On rear axle, remove caliper assembly and support with wire. Remove rotor. Inspect sensor pole piece for damage. Repair if necessary. If sensor pole piece is okay, check wheel speed sensor-to-rotor gap.

2) Using a feeler gauge, check clearance between speed sensor pole and rotor tooth surface. See Fig. 1. Front sensor clearance should be .008-.390" (0.2-1.0 mm). Rear sensor clearance should be .012-.035" (0.3-0.9 mm). If clearance is not within specification, loosen sensor mounting bolt. Adjust sensor position until clearance is within specification. Tighten sensor mounting bolt to 84 INCH lbs. (120 N.m).



91C08035
Fig. 1: Checking Wheel Speed Sensor-To-Rotor Gap (Typical)
Courtesy of Mitsubishi Motor Sales of America.

TROUBLE SHOOTING

ANTI-LOCK WARNING LIGHT

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

2) When ignition switch is turned from START to ON position, warning light should illuminate for one second, and then go out. If warning light functions as specified, go to step 3). If warning light does not function as specified, see appropriate trouble shooting test:

- * ANTI-LOCK WARNING LIGHT INOPERATIVE.
- * IGNITION SWITCH IN ON POSITION, WARNING LIGHT REMAINS ON.
- * IGNITION SWITCH IN START POSITION, WARNING LIGHT INOPERATIVE.
- * IGNITION SWITCH IN ON POSITION, WARNING LIGHT BLINKS TWICE. IN START POSITION, WARNING LIGHT STAYS ON. WHEN IGNITION SWITCH IS CYCLED FROM START TO ON POSITION, WARNING LIGHT BLINKS ONCE.

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 above 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) Ensure wheel speed sensor rotor gap is correct. See WHEEL SPEED SENSOR under ADJUSTMENTS. Check for faulty wheel speed sensor. See WHEEL SPEED SENSOR under COMPONENT TESTING. Replace sensor as necessary. See WHEEL SPEED SENSOR under REMOVAL & INSTALLATION. Inspect ECU wiring. If testing indicates no mechanical or electrical failures, substitute ECU with known good unit and retest.

6) Enter ABS self-diagnostics, and retrieve codes. See RETRIEVING CODES under DIAGNOSIS & TESTING. If no codes are displayed, fault may be intermittent. Attempt to make malfunction reoccur. If no diagnostic output exists, check for faulty wiring harness between ECU and self-diagnostic connector. Repair or replace as necessary.

NOTE: Trouble shoot warning light in following sequence:

- * Instrument Cluster Circuit
- * ECU and Valve Relay.

ANTI-LOCK Warning Light Inoperative

1) If all other warning lights illuminate with ignition on, go to step 3). If other warning lights do not illuminate, check fuse No. 11 in main fuse panel. If fuse is blown, correct cause of blown fuse, and replace fuse. If fuse is okay, go to next step.

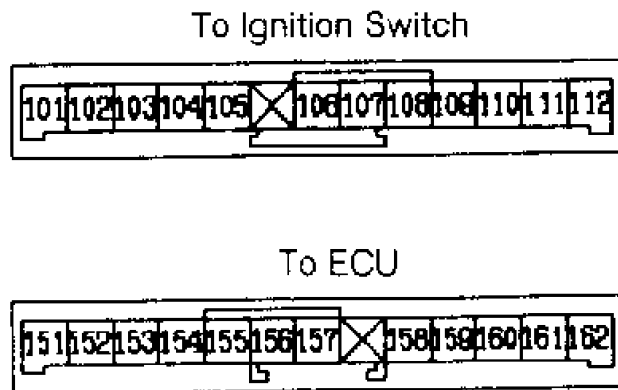
2) Remove instrument cluster. Turn ignition on. Using DVOM, measure voltage between vehicle ground and instrument cluster ABS warning light terminal No. 107. See Fig. 2. If battery voltage is present, repair or replace instrument cluster. If battery voltage is not present, repair wire harness between junction block and instrument cluster.

3) Turn ignition off. Check for faulty warning light bulb. Replace bulb as necessary. If bulb is okay, using an ohmmeter, check for continuity between instrument cluster connector terminals No. 107 and 158. See Fig. 2. If continuity exists, clean and/or repair connector terminals. If connector terminals are okay, check for open circuit to ECU and valve relay. Go to steps 4) and 5). If continuity does not exist, replace instrument cluster.

4) To check ECU, turn ignition off. Remove ECU connector. ECU is located on right rear wheelwell. See Fig. 17. Turn ignition on. Measure voltage between terminal No. 13 and vehicle ground. See Fig. 3. If battery voltage is not present, repair circuit between warning light and ECU. If battery voltage is present, substitute ECU with known good unit and retest.

5) To check valve relay, see HYDRAULIC UNIT RELAYS under COMPONENT TESTING. If relay is okay, remove hydraulic unit connector. Turn ignition on. Measure voltage between terminal No. 8 and vehicle ground. See Fig. 4. If battery voltage is present, go to next step. If battery voltage is not present, repair circuit between ABS warning light and hydraulic unit.

6) Turn ignition off. Check for continuity between terminal No. 9 and vehicle ground. If continuity does not exist, repair circuit between hydraulic unit and vehicle ground. If continuity exists, check for continuity between terminals No. 8 and 9. If continuity exists, check for defective connector. If continuity does not exist, replace hydraulic unit.



93D02430

Fig. 2: Identifying Instrument Cluster Connector Terminals
 Courtesy of Mitsubishi Motor Sales of America.

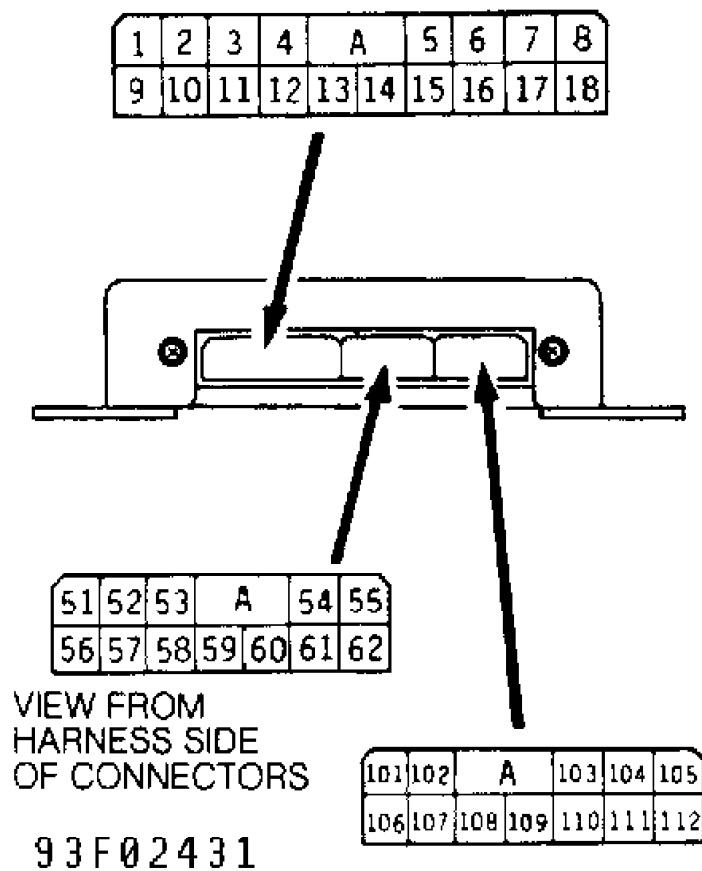
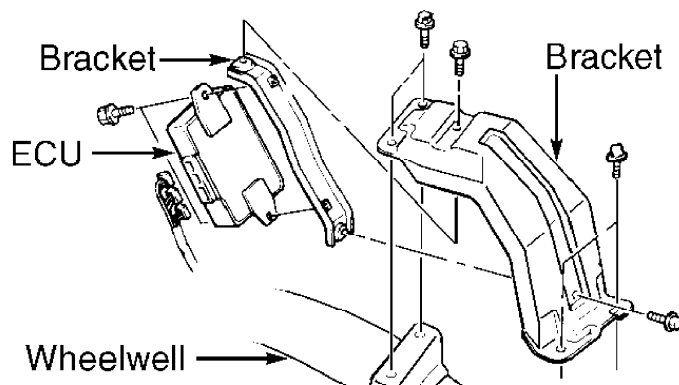


Fig. 3: Identifying ECU Connector Terminals
Courtesy of Mitsubishi Motor Sales of America.



93B02434
Fig. 4: Identifying Hydraulic Unit 10-Pin Connector Terminals
Courtesy of Mitsubishi Motor Sales of America.

Ignition Switch In ON Position, Warning Light Remains On
(ECU Power Circuit)

1) Enter ABS self-diagnostics. See RETRIEVING CODES under DIAGNOSIS & TESTING. If diagnostic output exists, go to step 9). If no diagnostic output exists, connect Multi-Use Tester (MUT) to another electronic control system.

2) If MUT can communicate with another electronic control system, go to next step. If MUT cannot communicate with another electronic control system, tester is malfunctioning. Inspect diagnostic connector for damaged terminals and correct hook-up. Repair as necessary. If diagnostic connector is okay, replace MUT.

3) Check fuse No. 7 in main fuse panel. If fuse is okay, go to next step. If fuse is blown, correct cause of blown fuse, and replace fuse.

4) Turn ignition on. ABS power relay should energize. Listen if power relay makes a click noise. Power relay is located behind radio. If noise is not heard, go to next step. If noise is heard, go to step 6).

5) Remove ABS power relay. See ABS POWER RELAY under REMOVAL & INSTALLATION. Test ABS power relay. See ABS POWER RELAY under COMPONENT TESTING. Replace relay if faulty.

6) Disconnect ECU wiring harness connector. Turn ignition on. Measure voltage between terminal No. 6 and vehicle ground. See Fig. 3. If battery voltage is present, go to next step. If battery voltage is not present, repair open circuit between power relay and ECU.

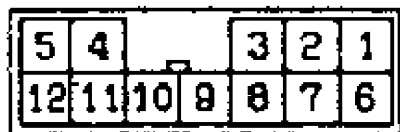
7) Check for continuity between vehicle ground and terminals No. 9, 10, 11 and 112. If continuity exists, go to next step. If continuity does not exist in any circuit, check for open in vehicle ground circuit. Repair or replace wiring harness as necessary.

8) Check for continuity between terminal No. 14 of ECU connector and terminal No. 4 of diagnostic connector. Also check for continuity between terminal No. 15 of ECU connector and terminal No. 10 of diagnostic connector. See Fig. 5. If continuity does not exist, check for open between ECU and diagnostic connector. Repair as necessary. If continuity exists, replace ECU and go to next step.

9) Check for trouble codes. See TROUBLE CODE DEFINITION under DIAGNOSIS & TESTING. If no trouble codes are present, go to next step. If any trouble codes are present, see appropriate CODE under DIAGNOSIS & TESTING.

10) Disconnect ECU connector. If warning light is no longer illuminated, substitute ECU with known good unit and retest. If warning light is still illuminated, disconnect hydraulic unit connector.

11) If warning light is still illuminated, repair wiring harness or replace instrument cluster. If warning light is no longer illuminated, test valve relay. See HYDRAULIC UNIT RELAYS under COMPONENT TESTING. Replace valve relay if defective. If valve relay is okay, replace hydraulic unit.



93H02432

Fig. 5: Identifying Diagnostic Connector Terminals
Courtesy of Mitsubishi Motor Sales of America.

Ignition Switch In START Position, Warning Light Inoperative
1) Remove ABS power relay fuse No. 7 from junction block.

Disconnect hydraulic unit 10-pin connector. Turn ignition on. Using DVOM, measure voltage between hydraulic unit harness connector terminal No. 8 and vehicle ground. See Fig. 4. If battery voltage is present, go to next step. If battery voltage is not present, repair circuit between ABS warning light and hydraulic unit.

2) Using ohmmeter, check for continuity between terminal No. 9 and vehicle ground. If continuity exists, go to next step. If continuity does not exist, repair hydraulic unit circuit.

3) Check continuity between hydraulic unit connector terminals No. 8 and 9. If continuity exists, go to next step. If continuity does not exist, replace valve relay.

4) Remove valve relay from hydraulic unit. Check for continuity between relay terminals No. 87a and 30. See Fig. 14. If continuity does not exist, replace valve relay. If continuity exists, hydraulic unit wiring harness is faulty. Replace hydraulic unit.

Ignition Switch In ON Position, Warning Light Blinks Twice.
In START Position, Warning Light Stays On. When Ignition Switch Is Cycled From START To ON Position, Warning Light Blinks Once

1) Disconnect hydraulic unit wiring harness connector.

Disconnect ECU wiring harness connector. Inspect connector terminals and repair as necessary.

2) Turn ignition on. Measure voltage between ECU connector terminal No. 13 and vehicle ground. See Fig. 3. If battery voltage is not present, repair open or shorted circuit between ABS warning light and ECU. If battery voltage is present, substitute ECU with known good unit and retest.

DIAGNOSIS & TESTING

RETRIEVING CODES

Scan Tool

1) With ignition off, connect Multi-Use Tester (MB991341) and ROM Pack (MB991423) to diagnostic connector, located under driver's side of dash, and to cigarette lighter socket. See Fig. 6.

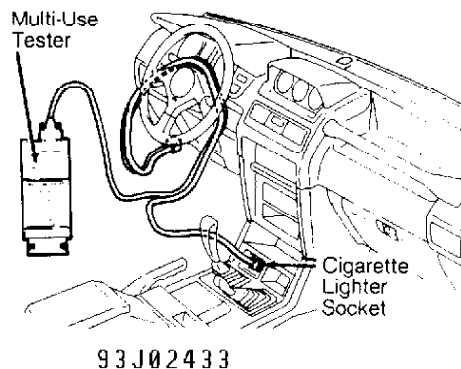


Fig. 6: Connecting Multi-Use Tester
Courtesy of Mitsubishi Motor Sales of America.

2) Turn ignition on. ABS warning light should come on as ABS goes into self-diagnostic mode. Read and record all diagnostic output

(trouble) codes from ECU memory. Refer to Multi-Use Tester (MUT) instructions for specific trouble code retrieval procedure.

3) After all trouble codes have been retrieved and recorded, clear codes from ECU memory. Refer to Multi-Use Tester (MUT) instructions for specific trouble code clearing instructions. See TROUBLE CODE DEFINITION and appropriate CODE under DIAGNOSIS & TESTING for servicing procedure.

4) If trouble codes cannot be cleared, ECU is currently detecting a malfunction. If codes can be cleared, problem is either intermittent or only appears while driving.

Voltmeter

1) To retrieve stored trouble codes, locate diagnostic connector under left side of dash. Turn ignition off. Connect analog voltmeter between diagnostic terminal No. 4 and vehicle ground terminal No. 12 of diagnostic connector. See Fig. 5. Start engine.

2) Stored trouble codes will be indicated by sweeps of voltmeter needle. Long sweeps indicate first digit of code; short sweeps indicate second digit of code. If more than one fault is present, lowest number code will be given first. After trouble code has been retrieved, test indicated component and/or related circuit (if necessary). See TROUBLE CODE DEFINITION and appropriate CODE under DIAGNOSIS & TESTING for servicing procedure.

CLEARING TROUBLE CODES

To clear trouble codes after repairs, disconnect negative battery cable for at least 10 seconds. Reconnect battery cable and repeat RETRIEVING CODES to confirm that failure has been corrected.

TROUBLE CODE DEFINITION

TROUBLE CODES TABLE

Code	(1) System Affected
11	Right Front Wheel Sensor (Open)
12	Left Front Wheel Sensor (Open)
13	Right Rear Wheel Sensor (Open)
14	Left Rear Wheel Sensor (Open)
15	Sensor Output Signal Fault
16	ECU Power Voltage
21	Right Front Wheel Sensor (Short)
22	Left Front Wheel Sensor (Short)
23	Right Rear Wheel Sensor (Short)
24	Left Rear Wheel Sensor (Short)
25-27	4WD Power Circuit Fault
31	"G" Sensor Power Voltage
32	"G" Sensor Output Voltage
33	Stoplight Switch Circuit
41, 43, or 45	Solenoid Valve Circuit
51	Valve Relay
53	Motor Relay
63	Faulty ECU
64	Faulty ECU

(1) - See appropriate CODE under DIAGNOSIS & TESTING.

CODE 11, 12, 13 OR 14

Faulty Wheel Speed Sensor Input

1) Trouble code will set if ECU detects wheel speed sensor

has no input signal. Trouble code will also set if wheel sensor voltage output is low while driving vehicle.

2) Inspect wheel sensor wiring harness for open or poor connection. Repair or replace if necessary. If no open circuit or poor connection is found, go to next step.

3) Test wheel speed sensor. See WHEEL SPEED SENSOR under COMPONENT TESTING. Replace speed sensor as necessary. Ensure wheel speed sensor-to-rotor gap is within specification. See WHEEL SPEED SENSOR under ADJUSTMENTS.

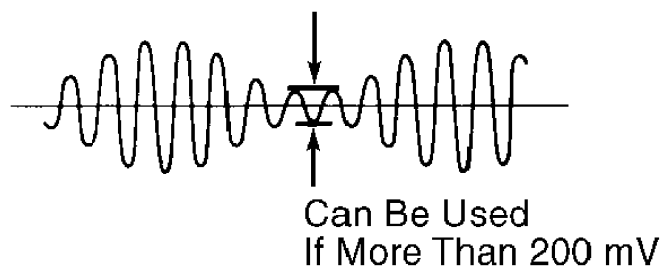
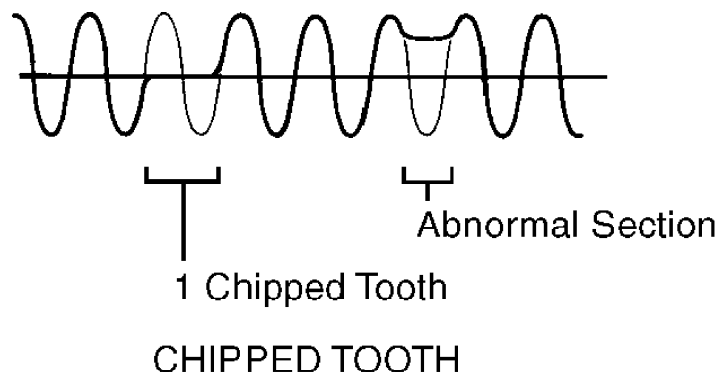
CODE 15

Faulty Wheel Speed Sensor Output

1) Test each sensor. See WHEEL SPEED SENSOR under COMPONENT TESTING. If all sensor voltages and resistances are within specification, go to next step. If any sensor is malfunctioning, replace speed sensor. See WHEEL SPEED SENSOR under REMOVAL & INSTALLATION.

2) Check each wheel speed sensor-to-rotor gap. See WHEEL SPEED SENSOR under ADJUSTMENTS. If all gaps are within specification, go to next step. If any gaps are not within specification, adjust sensor-to-rotor gap.

3) Inspect all wheel speed sensor rotors for damaged and missing teeth. Replace any damaged rotors. Using an oscilloscope, check wave-form patterns. See Fig. 7. If all rotors are okay, replace ECU. Ensure trouble code does not reset.



93B00266

Fig. 7: Identifying Abnormal ABS Rotor Wave-Form Patterns
Courtesy of Mitsubishi Motor Sales of America.

CODE 16

ECU Power Voltage

Start engine. Measure voltage between ECU terminal No. 6 and vehicle ground. See Fig. 3. If less than 10 volts is present, check fuse contacts and ECU connector. If 10 volts or more is present, measure voltage between ECU terminal No. 62 and vehicle ground. If less than 10 volts is present, check fuse contacts and ECU connector. If fuse contacts and ECU connector are okay, substitute ECU with known good unit and retest.

CODE 21, 22, 23 OR 24

Faulty Wheel Speed Sensor Output

1) Test each sensor. See WHEEL SPEED SENSOR under COMPONENT TESTING. If all sensor voltages and resistances are within specification, go to next step. If any sensor is malfunctioning, replace sensor. See WHEEL SPEED SENSOR under REMOVAL & INSTALLATION.

2) Remove ECU connector. Check wheel speed circuit at ECU connector. See Fig. 3. See ECU CONNECTOR TERMINAL RESISTANCE SPECIFICATION table. If resistance values are not as specified, repair wiring harness. If resistance values are within specifications, go to next step.

3) Check each wheel speed sensor-to-rotor gap. See WHEEL SPEED SENSOR under ADJUSTMENTS. If all gaps are within specification, go to next step. If any gaps are not within specification, adjust sensor-to-rotor gap.

4) Inspect all wheel speed sensor rotors for damaged and missing teeth. Replace any damaged rotors. Using an oscilloscope, check wave-form patterns and output voltage. See Fig. 8. Output voltage should be 0.2 volt (200 mV). If all rotors and wheel speed sensors are okay, substitute ECU with known good unit and retest.

ECU CONNECTOR TERMINAL RESISTANCE SPECIFICATION TABLE

Application	ECU Terminals No.	Ohms
LF Wheel Speed Sensor	52 & 57	900-1100
RF Wheel Speed Sensor	51 & 56	900-1100
LR Wheel Speed Sensor	8 & 18	1300-2100
RR Wheel Speed Sensor	53 & 58	1300-2100

CODE 25

Free-Wheel Engage Switch Circuit

1) Start engine. Ensure center differential indicator light operates correctly when transfer shift lever is moved to desired 4WD positions. If indicator light operates correctly, go to step 3). If indicator light does not operate correctly, go to next step.

2) Turn engine off. Check wiring harness between 4WD indicator control unit, located behind radio, and free-wheel engage switch, located on right side of front differential housing near carrier assembly. If circuit is okay, replace 4WD indicator control unit.

3) Disconnect ECU connector. Turn ignition on. Using DVOM, check voltage between terminal No. 55 and vehicle ground. See Fig. 3.

In 2WD battery voltage should exist. Battery voltage should not exist in 4WD. If voltage is as described, substitute ECU with known good unit and retest. See ELECTRONIC CONTROL UNIT (ECU) under REMOVAL & INSTALLATION. If voltage is not as described, repair harness between ECU and free-wheel engage switch.

CODE 26

Center Differential Lock Switch Circuit

1) Start engine. Ensure center differential indicator light operates correctly when transfer shift lever is moved to desired 4WD positions. If indicator light does not operate correctly, go to step 3). If indicator light operates correctly, disconnect ECU connector. Using DVOM, check voltage between terminal No. 107 and vehicle ground. See Fig. 3.

2) When center differential is locked, battery voltage should not be present. When center differential is unlocked, battery voltage should be present. If voltage is as described, substitute ECU with known good unit and retest. If voltage is not as described, repair wiring harness between ECU and center differential lock detection switch. See Fig. 8. Lock switch can be identified by Brown connector.

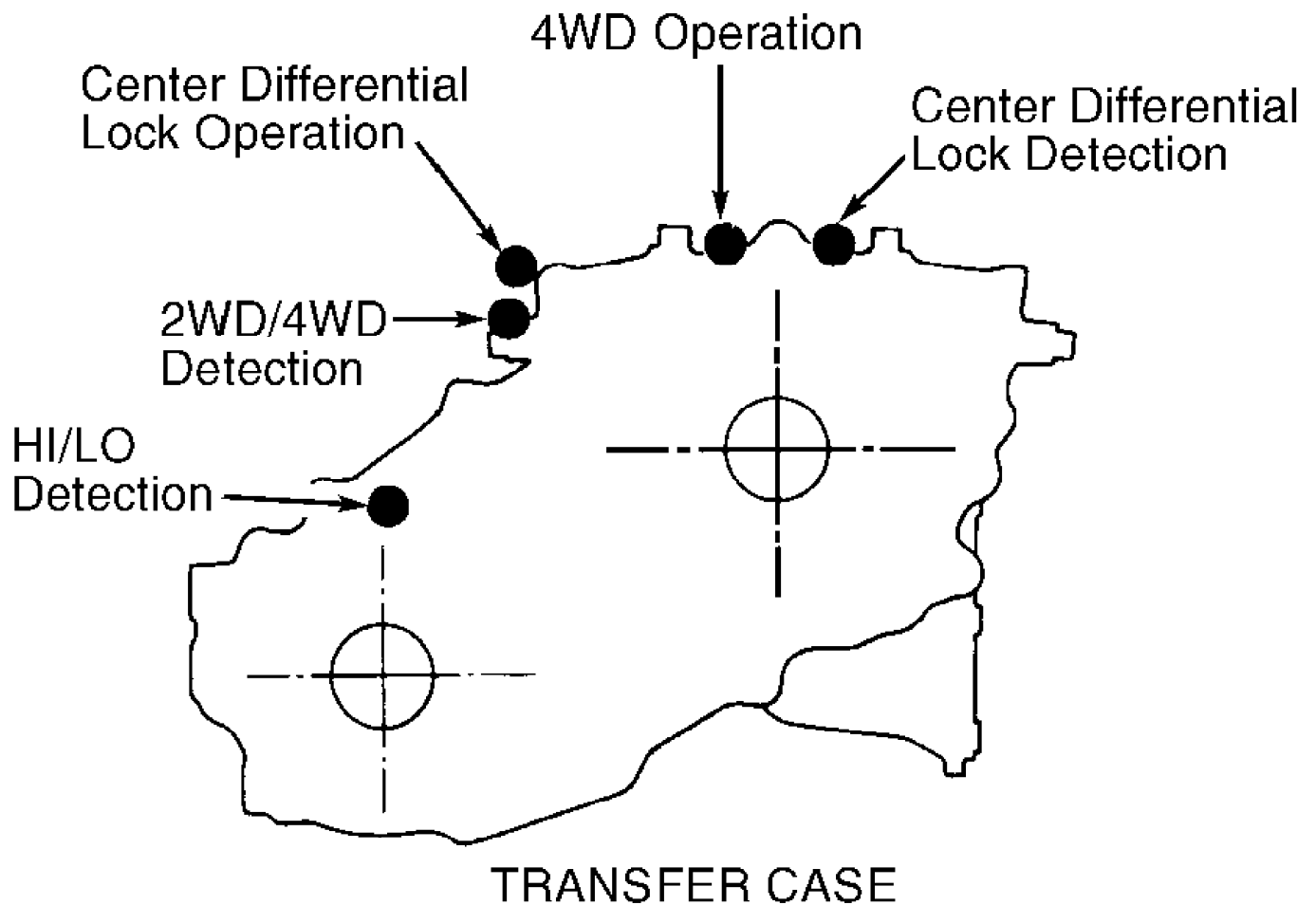
3) If no indicator lights illuminate, repair 4WD indicator power circuit, or check for faulty 4WD indicator control unit. See 4WD CONTROL UNIT under COMPONENT TESTING. If center differential light illuminates, regardless of position of transfer shift lever, check the following:

- * Check for short in center differential lock switch circuit.
- * Check for faulty center differential lock switch.
- * Check for short in ECU circuit or faulty ECU.
- * Check for short in indicator control unit circuit or faulty 4WD indicator control unit. Repair wiring harness or replace component as necessary.

NOTE: When checking for short in ECU circuit, remove ECU connector and ensure 4WD indicator light operates correctly. If 4WD indicator light operates correctly, replace faulty ECU. If 4WD indicator light does not operate correctly, replace faulty 4WD indicator control unit.

4) If center differential light does not illuminate with transfer shift lever in "4H" position, repair wiring harness between 4WD indicator control unit, and center differential lock switch. Check for faulty 4WD indicator control unit.

5) If front wheel indicator light does not illuminate with transfer shift lever in "4H" position, repair wiring harness between 4WD indicator control unit and free-wheel engage switch. Check vehicle ground wire at engage switch. Check for faulty free-wheel engage switch.



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Fig. 8: Identifying 4WD Indicator Switch Location
Courtesy of Mitsubishi Motor Sales of America.

CODE 27

Rear Differential Lock Circuit (With Differential Lock)

1) Start engine. Ensure rear differential indicator light illuminates when top of rear differential lock switch, (located below radio) is pushed. If indicator light illuminates, go to next step. If indicator light does not illuminate, turn engine off. Check wiring harness between rear differential lock control unit and rear differential lock switch. Check rear differential lock control unit power circuit. See REAR DIFFERENTIAL CONTROL UNIT under COMPONENT TESTING. If circuit is okay, replace rear differential lock control unit.

2) Disconnect ECU connector. Turn ignition on. Using DVOM, check voltage between terminal No. 108 and vehicle ground. See Fig. 3. When rear differential is locked, battery voltage should not be present. When rear differential is unlocked, battery voltage should be present. If voltage is as described, substitute ECU with known good unit and retest. If voltage is not as described, repair wiring harness between ECU and rear differential lock switch.

Rear Differential Without Differential Lock

Check fuse No. 18 in main fuse block. Replace if necessary.

Disconnect ECU connector. Turn ignition on. Using DVOM, check voltage at terminal No. 108 and vehicle ground. See Fig. 3. If battery voltage is present, substitute ECU with known good unit and retest. If battery voltage is not present, check for open circuit between ECU and fuse block. Repair wiring harness as necessary.

CODE 31

"G" Sensor Power Voltage

1) If Code 31 is present, and Code 32 is not present, substitute ECU with known good unit and retest. If Code 31 and Code 32 are both present, disconnect "G" sensor wiring harness connector. "G" sensor is located under center console. See Fig. 18. Turn ignition to ACC switch position. Using ohmmeter, check continuity between "G" sensor harness connector terminal No. 1 (Blue wire) and vehicle ground. If continuity does not exist, replace "G" sensor. If continuity exists, disconnect ECU connector.

2) Check continuity between terminal No. 1 and vehicle ground. If continuity exists, repair wiring harness between ECU and "G" sensor. If continuity does not exist, replace faulty ECU.

CODE 32

"G" Sensor Output Signal

1) Park vehicle on level surface. Using Multi-Use Tester, check "G" sensor voltage. Refer to Multi-Use Tester (MUT) instructions for specific test procedure. Voltage should be 2 - 3 volts. If voltage is not as described, go to step 3). If voltage is as described, note top center position of "G" sensor, and remove "G" sensor, located under center console next to shifter. See "G" SENSOR under REMOVAL & INSTALLATION.

2) Check voltage when sensor is tilted 50 degrees to the left of center. Voltage should be 0.3-0.7 volt. Tilt sensor 50 degrees to right of center and check voltage. Voltage should be 4.3-4.7 volts. If voltage is as described, substitute ECU with known good unit and retest. If voltage is not as described, replace "G" sensor.

3) If "G" sensor voltage is less than 0.2 volt, go to next step. If "G" sensor voltage is more than 4.8 volts, go to step 9). If "G" sensor voltage is 0.3-4.7 volts, check for poor vehicle ground connection (loose mounting bolt) at sensor. Repair as necessary. If connection is okay, replace "G" sensor.

4) Turn ignition on. Using DVOM, check for 7.0-7.5 volts at ECU connector terminal No. 103. See Fig. 3. If voltage is as described, go to next step. If voltage is not as described, turn ignition off. Disconnect ECU and "G" sensor connectors. Using ohmmeter, check continuity between ECU connector terminal No. 103 and vehicle ground. If continuity exists, repair wiring harness between ECU and "G" sensor. If continuity does not exist, substitute ECU with known good unit and retest. See ELECTRONIC CONTROL UNIT (ECU) under REMOVAL & INSTALLATION. See Fig. 17.

5) Disconnect "G" sensor connector. Turn ignition on. Check for 7.0-7.5 volts between terminal No. 1 (Blue wire) and vehicle ground. If voltage is as described, go to next step. If voltage is not as described, repair wiring harness between ECU and "G" sensor.

6) Connect "G" sensor connector. Check voltage at terminal No. 3 (Blue/White wire) and vehicle ground. Voltage should be 2-3 volts. If voltage is as described, go to step 8). If voltage is not as described, turn ignition to switch ACC position. Disconnect "G" sensor connector. Using ohmmeter, check resistance between terminal No. 3 (Blue/White) and vehicle ground. Resistance should be 500 ohms or more. If resistance is as described, replace "G" sensor.

7) If resistance is not 500 ohms or more, turn ignition off. Disconnect "G" sensor and ECU connectors. Check continuity between

terminal No. 3 and vehicle ground. If continuity does not exist, substitute ECU with known good unit and retest. If continuity exists, repair wiring harness between ECU and "G" sensor.

8) Turn ignition on. Using DVOM, check voltage at ECU terminal No. 110 and vehicle ground. See Fig. 3. Voltage should be 2-3 volts. If voltage is as described, substitute ECU with known good unit and retest. If voltage is not as described, repair wiring harness between ECU and "G" sensor.

9) Disconnect "G" sensor connector. Using ohmmeter, check continuity between terminal No. 2 (Black/Red) and vehicle ground. If continuity exists, replace "G" sensor. If continuity does not exist, check continuity between ECU terminal No. 111 and vehicle ground. If continuity exists, repair wiring harness between ECU and "G" sensor. If continuity does not exist, substitute ECU with known good unit and retest.

CODE 33

Stoplight Switch Circuit

1) Check if stoplights are functioning correctly. If stoplights function correctly, go to next step. If stoplights do not function correctly, check stoplight circuit and repair as necessary.

2) Disconnect ECU connector. Using DVOM, measure voltage between terminal No. 109 and vehicle ground while depressing brake pedal. See Fig. 3. If battery voltage is not present, repair or replace wiring harness between stoplight switch and ECU. See appropriate wiring diagram. If battery voltage is present, stoplight switch circuit is okay. Replace ECU.

CODE 41, 43 OR 45

Solenoid Valve Circuit

1) Disconnect hydraulic unit 10-pin connector. Using ohmmeter, measure resistance between hydraulic unit terminal No. 7 and terminals No. 3, 5 and 6. See Fig. 4.

2) Resistance should be 1000-1300 ohms. If resistance is within specification, go to next step. If resistance is not within specification, replace faulty hydraulic unit. See HYDRAULIC UNIT under REMOVAL & INSTALLATION.

3) Connect hydraulic unit 10-pin connector. Disconnect ECU wiring harness connector. Measure resistance between ECU terminal No. 62 and terminals No. 1, 2 and 3. See Fig. 3.

4) Resistance should be 1000-1300 ohms. If resistance is not within specification, repair or replace wiring harness. If all resistance tests are within specification, solenoid valve circuit is okay. Replace ECU.

CODE 51

Valve Relay Circuit

1) Remove and test valve relay. See HYDRAULIC UNIT RELAYS under COMPONENT TESTING. Replace relay if faulty. If relay is okay, reinstall valve relay and go to next step.

2) Check pump motor, and repair if necessary. Turn ignition on. Disconnect hydraulic unit 2-pin connector. Measure voltage between terminal No. 52 and vehicle ground. See Fig. 9.

3) If battery voltage is not present, repair wiring harness between fusible link and hydraulic unit 2-pin connector. If battery voltage is present, turn ignition off. Using ohmmeter, check for continuity between hydraulic unit 10-pin connector terminals No. 7 and 8. See Fig. 4. If continuity exists, go to next step. If continuity does not exist, repair or replace hydraulic unit.

4) Connect hydraulic unit connector. Disconnect ECU

connector. Using ohmmeter, measure resistance between ECU connector terminals No. 4 and 5. See Fig. 3. Resistance should be 60-120 ohms. If resistance is within specification, go to next step. If resistance is not within specification, repair wiring harness between hydraulic unit and ECU.

5) Turn ignition on. Measure voltage between ECU connector terminal No. 62 and vehicle ground. If battery voltage is not present, repair or replace faulty wiring harness between hydraulic unit and ECU. If battery voltage is present, replace faulty ECU.



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Fig. 9: Identifying Hydraulic Unit 2-Pin Connector
Courtesy of Mitsubishi Motor Sales of America.

CODE 53

Motor Relay Circuit

1) Using MUT, perform hydraulic unit actuator test. If motor is not operating, go to next step. If motor is still operating, repair or replace wiring harness between hydraulic unit and ECU.

2) Remove and test motor relay. See HYDRAULIC UNIT RELAYS under COMPONENT TESTING. If relay is okay, go to next step. Replace relay if faulty.

3) Check pump motor vehicle ground connection. Ensure vehicle ground wire has a clean, tight connection. Repair ground connection if necessary. If vehicle ground connection is okay, go to next step.

4) Install motor relay. Turn ignition on. Disconnect hydraulic unit 2-pin connector. Measure voltage between terminal No. 51 and vehicle ground. See Fig. 9. If battery voltage is present, go to next step. If battery voltage is not present, repair harness between fusible link and hydraulic unit 2-pin connector.

5) Connect hydraulic unit wiring harness. Disconnect ECU

wiring harness connector. Using ohmmeter, measure resistance between ECU harness connector terminals No. 5 and 12. See Fig. 3. Resistance should be 30-60 ohms. If resistance is not within specification, repair or replace wiring harness between hydraulic unit and ECU. If resistance is within specification, go to next step.

6) Using ohmmeter, measure resistance between ECU connector terminal No. 106 and vehicle ground. Resistance should be .1-.3 ohm. If resistance is not within specification, repair or replace wiring harness between hydraulic unit and ECU. If resistance is within specification, replace faulty ECU.

CODE 63 OR 64

If Code 63 or Code 64 is present, replace faulty ECU.

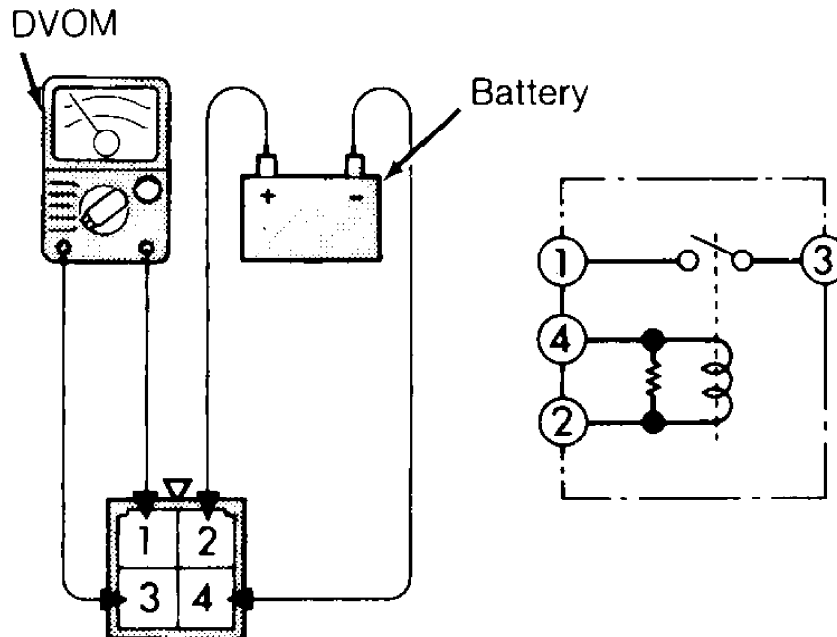
COMPONENT TESTING

ABS POWER RELAY

1) Remove ABS power relay. Relay is located behind radio. Disconnect relay connector. Using ohmmeter, check for continuity between terminals No. 1 and 3. See Fig. 10. If continuity exists, replace relay.

2) If continuity does not exist, check for continuity between terminals No. 2 and 4. If continuity exists, go to next step. If continuity does not exist, replace relay.

3) Apply battery voltage to terminal No. 2, and vehicle ground terminal No. 4. Check for continuity between terminals No. 1 and 3. If continuity exists, relay is okay. If continuity does not exist, replace relay.

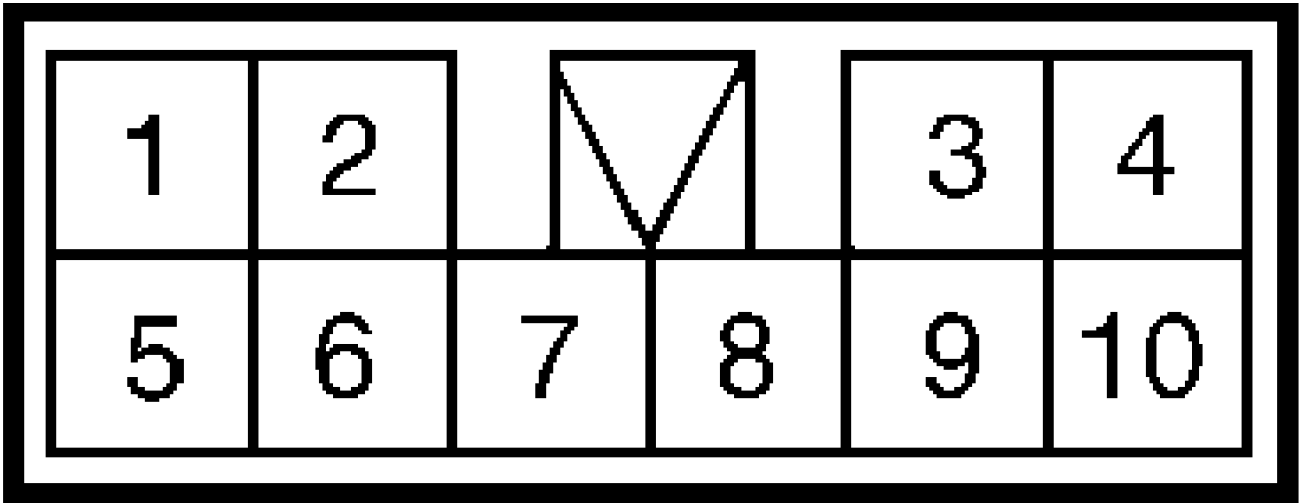


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Fig. 10: Testing ABS Power Relay
Courtesy of Mitsubishi Motor Sales of America.

4WD CONTROL UNIT

Remove radio and remove 4WD control unit. Disconnect control unit harness connector. Backprobe harness connector. Measure voltage between each individual terminal and ground terminal No. 8 (Black wire). See Figs. 11 and 12. If after all tests have been completed system is not operating properly, substitute 4WD control unit with known good unit and retest.



93B82421

Fig. 11: Identifying 4WD Control Unit Connector
 Courtesy of Mitsubishi Motor Sales of America.

	Terminal ID.	Function/Description	Voltage Value (DC Volts Unless Otherwise Specified)
Yellow/Blue	1	HI/LO Detection Switch	KOEO – 9-11 Volts With Transfer In "N" KOEO – 0 Volt In "4HLc" Or "4LLc"
Blue/Orange	2	4WD Operation Detection Switch	KOEO – 9-11 Volts In "2H" KOEO – 0 Volt "4H"
Blue/Yellow	3	Ignition Switch (IG2)	Ignition Off – 0 Volt Ignition On – Battery Voltage
Blue/Green	4	Center Differential Lock Indicator Light	KOEO – Battery Voltage With Transfer In "4H" KOEO – 0-1.5 Volts With Transfer In "4HLc"
Blue/White	5	Center Differential Lock Detection Switch	KOEO – 9-11 Volts With Transfer In "4H" KOEO – 0 Volt With Transfer In "4HLc"
Yellow/Green	6	Free Wheel Engage Switch	KOEO – 9-11 Volts With Vehicle in 2WD KOEO – 0 Volt With Vehicle in 4WD
Yellow/Blue	7	Center Differential Lock Operation Detection Switch	KOEO – 9-11 Volts With Transfer In "4H" KOEO – 0 Volt With Transfer In "4HLc"
Yellow/Black	9	Rear Wheel Indicator Light	KOEO – 0 Volt With Transfer In "N" KOEO – 9-11 Volts In "4HLc" Or "4LLc"
Yellow/Red	10	Front Wheel Indicator Light	KOEO – 0 Volt With Vehicle In 2WD KOEO – 9-11 Volts With Vehicle In 4WD

93C82422
 Fig. 12: 4WD Control Unit Pin Voltage Chart
 Courtesy of Mitsubishi Motor Sales of America.

4WD INDICATOR SWITCHES

All switches are mounted to transfer case. See Fig. 8. Switches use single harness lead and ground to transfer case. See 4WD INDICATOR SWITCH CONTINUITY CHECK table. Ensure all appropriate grounding straps are connected to vehicle body or frame.

4WD INDICATOR SWITCH CONTINUITY CHECK

Switch (1)	Transfer Control Lever Position	Specification
Center Differential Lock Detection Switch	4H	No Continuity
	4HLc	Continuity
Center Differential Lock Operation Detection Switch	4H	No Continuity
Operation Detection Switch	4HLc	Continuity
4WD Operation Detection Switch	2H	No Continuity
	4H	Continuity
HI/LO Detection Switch	4HLc	Continuity
	N	No Continuity
	4LLc	Continuity
2WD/4WD Detection Switch	2H	Continuity
	4H	No Continuity

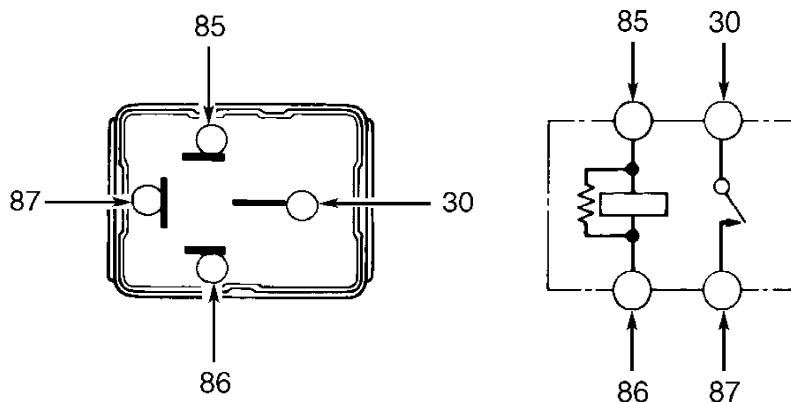
(1) - See Fig. 8 for switch location.

HYDRAULIC UNIT RELAYS

Motor Relay

1) Remove motor relay. Using ohmmeter, measure resistance between relay terminals No. 85 and 86. See Fig. 13. Resistance should be 30-60 ohms. Check for continuity between relay terminals No. 30 and 87. Continuity should not exist.

2) Apply battery voltage to relay terminal No. 85, and vehicle ground terminal No. 86. Check for continuity between terminals No. 30 and 87. Continuity should exist. If relay does not test as specified, replace relay.



91108043

Fig. 13: Identifying Motor Relay Terminals
Courtesy of Mitsubishi Motor Sales of America.

Valve Relay

1) Remove valve relay. Using ohmmeter, measure resistance

between relay terminals No. 85 and 86. See Fig. 14. Resistance should be 60-120 ohms.

2) Check for continuity between relay terminals No. 30 and 87a. Continuity should exist. Check for continuity between relay terminals No. 30 and 87. Continuity should not exist.

3) Apply battery voltage to relay terminal No. 85, and vehicle ground terminal No. 86. Check for continuity between terminals No. 30 and 87. Continuity should exist. Check for continuity between terminals No. 30 and 87a. Continuity should not exist. If relay does not test as specified, replace relay.

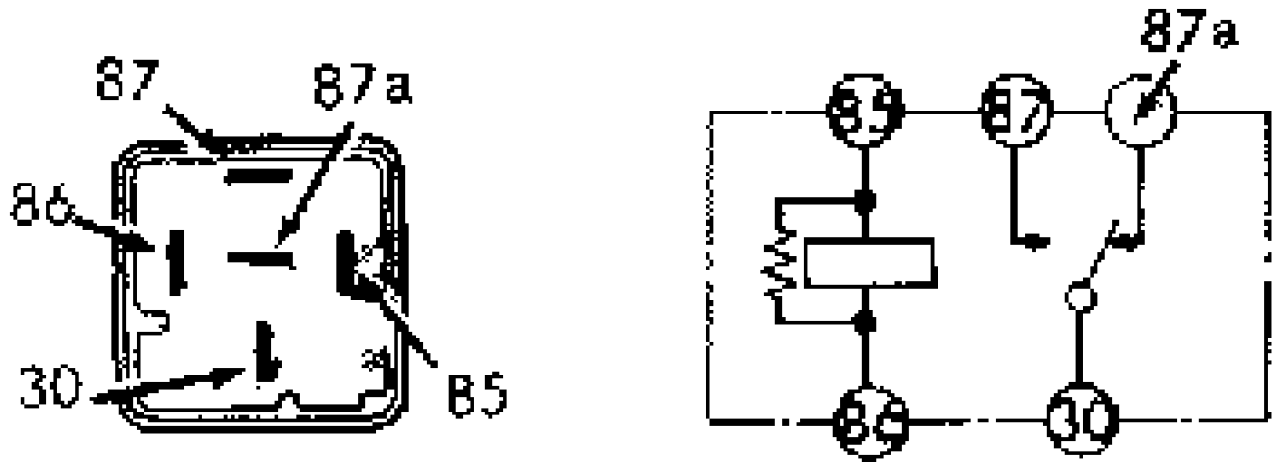
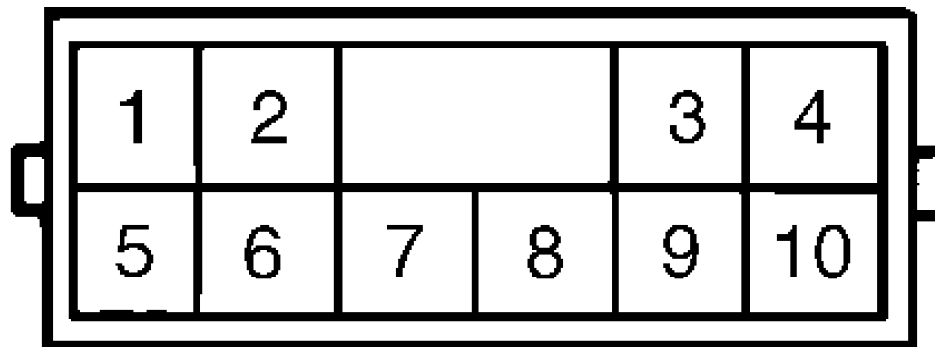


Fig. 14: Identifying Valve Relay Terminals
 Courtesy of Mitsubishi Motor Sales of America.

REAR DIFFERENTIAL CONTROL UNIT

Remove rear seat and remove rear differential control unit. Do not disconnect control unit harness connector. Backprobe harness connector. Measure voltage between each individual terminal and ground terminal No. 6 (Black wire). See Figs. 15 and 16. If after all tests have been completed system is not operating properly, substitute rear differential control unit with known good unit and retest.



93D82423

Fig. 15: Identifying Rear Differential Control Unit Connector
 Courtesy of Mitsubishi Motor Sales of America.

	Terminal ID.	Function/Description	Voltage Value (DC Volts Unless Otherwise Specified)
Blue/Red →	1	Rear Differential Lock Switch (OFF)	KOEO – Battery Voltage With Transfer In "N"
Yellow/White →	2	Vehicle Speed Sensor	KOER – 5 Volts With Wheels Rotating
Blue/Yellow →	3	Ignition Switch (IG1)	Ignition Off – 0 Volt Ignition On – Battery Voltage
Red →	4	Rear Differential Lock Air Pump	KOEO – Battery Voltage When Pumping Air KOEO – 0 Volt When Releasing Air
Blue/White →	5	Center Differential Lock Switch	KOEO – Battery Voltage With Transfer Unlocked KOEO – 0 Volt With Transfer Locked
Red/Blue →	8	Rear Differential Lock Detection Switch	KOEO – Bat. Voltage/Differential Unlocked KOEO – 0 Volt With Differential Locked
Blue/Yellow →	9	Rear Differential Lock Switch (ON)	KOEO – 0 Volt
Red/Yellow →	10	Rear Differential Lock Indicator Light	KOEO – 0 Volt With Differential Locked KOEO – Battery Voltage With Differential Locked

93E82424

Fig. 16: Rear Differential Control Unit Pin Voltage Chart
Courtesy of Mitsubishi Motor Sales of America.

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. If pole piece is damaged, replace sensor.

2) Disconnect sensor connector. Inspect sensor wiring harness for broken and pinched wires. Repair or replace harness as necessary. Using ohmmeter, measure sensor resistance at wiring connector. Front sensor resistance should be 900-1100 ohms. Rear resistance should be 1300-2100 ohms. If resistance is not within specification, replace sensor. If resistance is within specification, go to GROUND CIRCUIT TEST.

Ground Circuit Test

Disconnect wheel speed sensor wiring harness connector. Measure resistance between wheel speed sensor terminals and sensor housing. Resistance should be more than 100,000 ohms. If resistance is less than specification, replace wheel speed sensor.

REMOVAL & INSTALLATION

ABS POWER RELAY

Removal & Installation

ABS power relay is located behind radio. Disconnect negative battery cable. Remove front center console, located in front of shift lever. Remove radio. Disconnect relay connector, and remove relay. To install, reverse removal procedure.

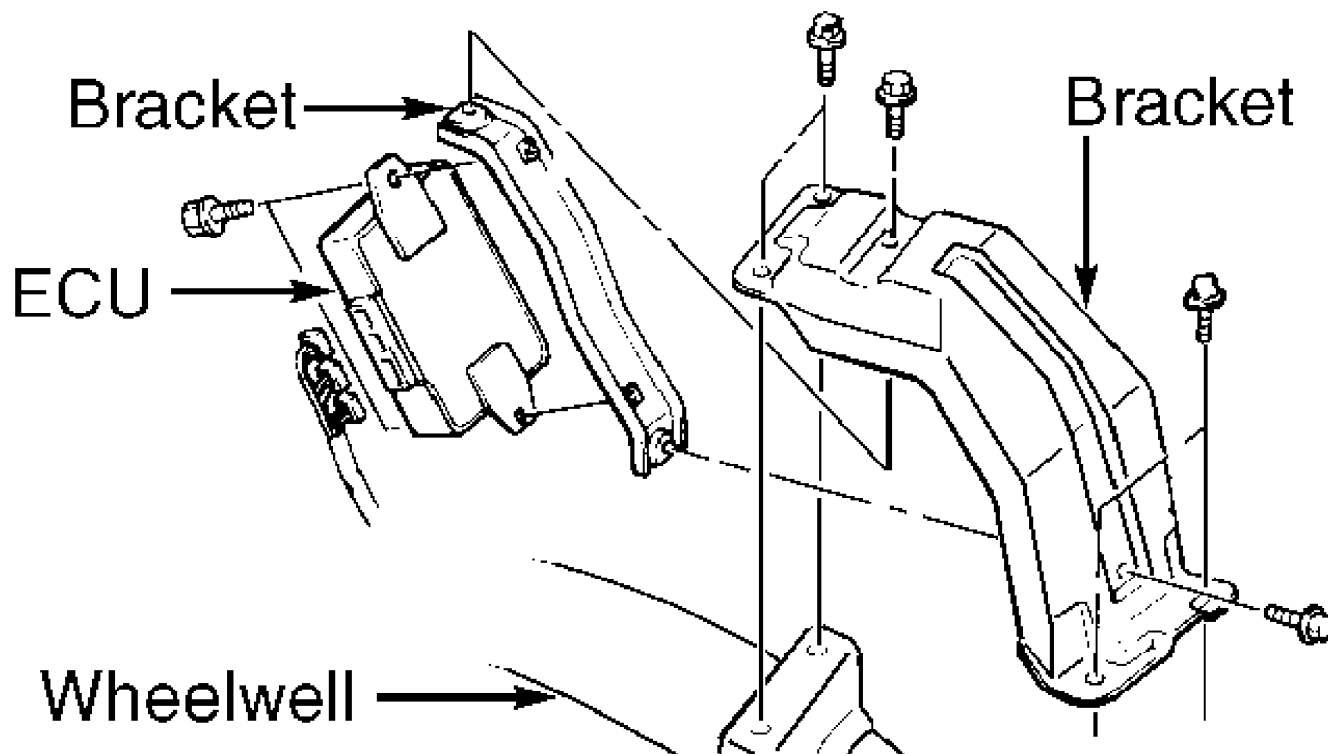
ELECTRONIC CONTROL UNIT (ECU)

Removal & Installation

1) ECU is located behind right rear quarter panel trim. See Fig. 17. Disconnect negative battery cable. Remove quarter panel

mounting screws and trim clip.

2) Carefully remove quarter panel trim. Disconnect ECU wiring harness connector. Remove ECU mounting bolts/nuts and ECU. To install, reverse removal procedure.



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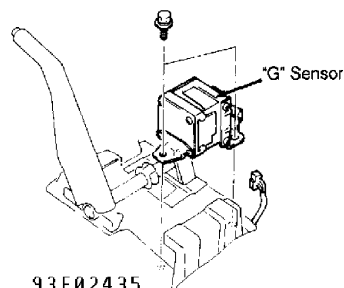
Fig. 17: Locating Electronic Control Unit (ECU)
Courtesy of Mitsubishi Motor Sales of America.

"G" SENSOR

CAUTION: DO NOT turn "G" sensor upside-down or lay unit on its side.
DO NOT drop "G" sensor. DO NOT disassemble unit.
Replace "G" sensor as an assembly.

Removal & Installation

Sensor is located under center console, near shifter. See Fig. 18. Remove center console assembly. Disconnect sensor wiring harness connector. Remove sensor. To install, reverse removal procedure. Tighten bolts to 80 INCH lbs. (12 N.m).



93E02435

Fig. 18: Locating "G" Sensor
Courtesy of Mitsubishi Motor Sales of America.

HYDRAULIC UNIT

Removal

Remove brakelines from hydraulic unit. Remove relay box cover. See Fig. 19. Disconnect vehicle ground wire and wiring harness connectors from hydraulic unit. Remove hydraulic unit retaining nuts. Carefully remove hydraulic unit.

Installation

To install, reverse removal procedure. Install hydraulic unit brakelines. Ensure brakelines are installed in correct location. Bleed brake system. See BLEEDING BRAKE SYSTEM.

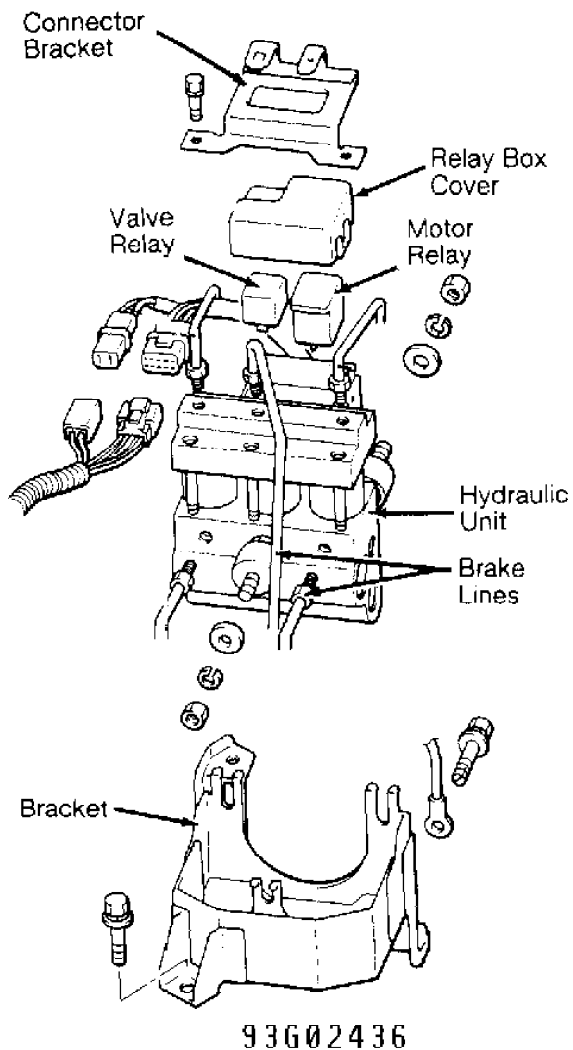


Fig. 19: Exploded View Of Hydraulic Unit & Components
Courtesy of Mitsubishi Motor Sales of America.

WHEEL SPEED SENSOR

Removal & Installation

Unplug wheel sensor connector. Remove sensor bolts. Remove speed sensor from vehicle. To install, reverse removal procedure. Sensors are not interchangeable. Adjust wheel speed sensor-to-rotor gap. See WHEEL SPEED SENSOR under ADJUSTMENTS. To complete installation, reverse removal procedure.

WHEEL SENSOR ROTOR

Removal & Installation

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.

OVERHAUL

HYDRAULIC UNIT

DO NOT attempt to overhaul or disassemble hydraulic unit. If hydraulic unit is defective, replace entire assembly.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS TABLE

Application	INCH Lbs. (N.m)
"G" Sensor Mounting Bolt	80 (12)
Wheel Speed Sensor Bolt	84-120 (9-14)

WIRING DIAGRAM

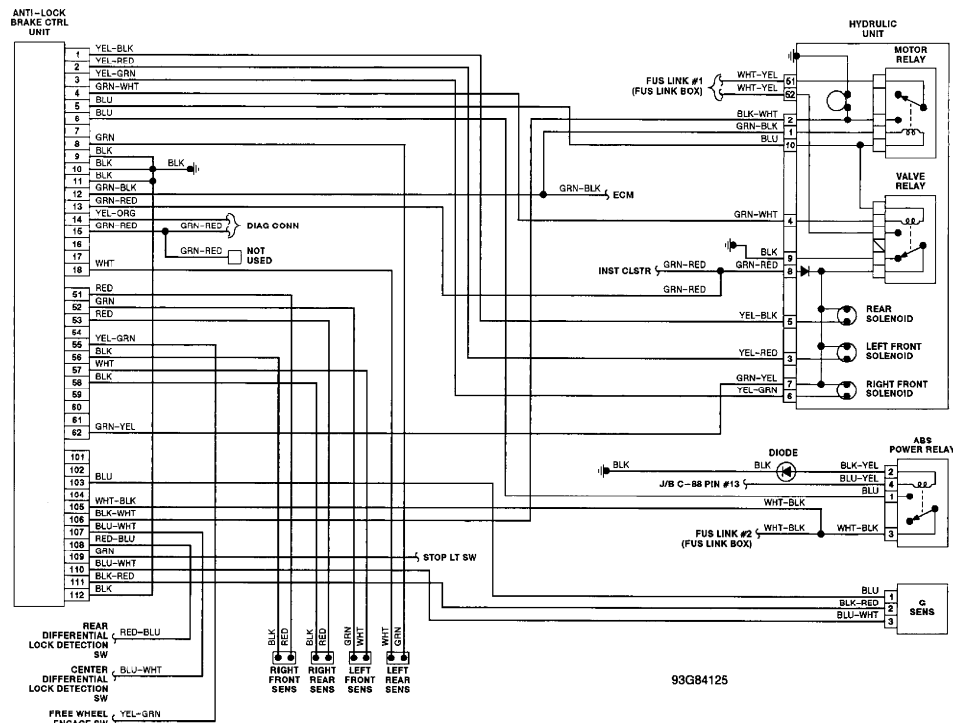


Fig. 20: Anti-Lock Brake System (ABS) Wiring Diagram

F - BASIC TESTING

1993 Mitsubishi Montero

1993 ENGINE PERFORMANCE

Chrysler Corp./Mitsubishi Basic Diagnostic Procedures

Dodge; Ram-50
Mitsubishi; Montero, Pickup

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 in this section 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.

COMPRESSION SPECIFICATIONS TABLE

Application (1)		psi (kg/cm ²)
Compression Pressure		
2.4L (VIN G)	.....	171 psi (12.0 kg/cm ²)
3.0L (VIN H)	.....	171 psi (12.0 kg/cm ²)
Maximum Variation Between		
Cylinders	.....	14 psi (1.0 kg/cm ²)

(1) - See A - ENGINE/VIN ID article in this section for VIN information.

Exhaust System Backpressure

Exhaust system can be checked with a vacuum or pressure gauge. Remove O2 sensor 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 1 3/4 - 2 psi, exhaust system or catalytic converter is plugged.

If using a vacuum gauge, connect vacuum gauge hose to intake manifold vacuum port and start engine. Observe vacuum gauge. Open throttle part way and hold steady. If vacuum gauge reading slowly drops after stabilizing, exhaust system should be checked for a restriction.

FUEL SYSTEM

WARNING: ALWAYS relieve fuel pressure before disconnecting any fuel injection-related component. DO NOT allow fuel to contact engine or electrical components.

FUEL PRESSURE

Relieving Fuel Pressure

1) On Ram-50, and Pickup, disconnect fuel pump harness connector at fuel tank from underneath vehicle. On Montero, 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 terminal. Connect fuel pump harness connector. Reinstall rear seat (if 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.

Pressure Testing

1) Disconnect high pressure fuel hose at fuel delivery pipe. Remove throttle body bracket (if necessary). Connect fuel pressure gauge with adapter between fuel delivery pipe and high pressure hose. See Fig. 1.

2) Connect negative battery terminal. 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 to fuel pump test terminal.

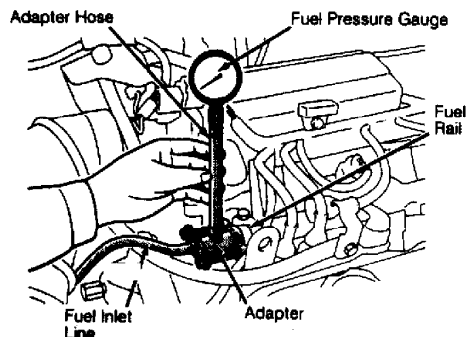


Fig. 1: Installing Fuel Pressure Tester (Typical)
Courtesy of Mitsubishi Motor Sales of America.

3) Start engine and let 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. On all models, 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 higher 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 hose. Check for fuel leaks.

FUEL PUMP TEST TERMINAL LOCATION TABLE

Application	Wire Color	Location
Montero	White	(1)
Ram-50 & Pickup	Blue	(2)

(1) - On main wiring harness, near wiper motor on firewall.

(2) - Near left rear corner of engine compartment, below cruise control actuator (if equipped).

FUEL PUMP PERFORMANCE TABLE

Application	At Idle	
	W/Vacuum (1) psi (kg/cm ²)	W/O Vacuum (2) psi (kg/cm ²)
All Models	38 (2.6)	47-50 (3.3-3.5)

(1) - With vacuum at pressure regulator.

(2) - Without vacuum at pressure regulator.

MPI Control Relay

Multipurpose relay switches power to vehicle sensors and actuators including airflow sensor, crank angle sensor, idle speed control, injectors and fuel pump. When ignition switch is turned to ON position, ECM energizes coils controlling injectors, airflow sensor and idle speed control. When ignition switch is turned to START position, ECM energizes coils (through inhibitor switch on A/T models) to supply power to fuel pump. Relay failure will cause a no-start

condition. For testing procedure, refer to I SYS/COMP TESTS article in this section.

IGNITION CHECKS

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. For wire resistance specification, see C - SPECIFICATIONS article in this section.

CRANKSHAFT POSITION SENSOR

For crank position sensor testing procedure, see I - SYS/COMP TESTS article in this section.

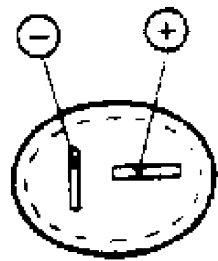
OPTICAL IGNITION

Ignition Coil Resistance

Using a DVOM, measure primary coil resistance between positive and negative terminals of coil. See Fig. 2, 3, or 4. 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.

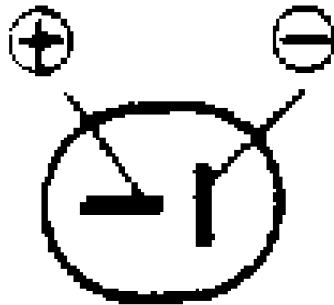
IGNITION COIL RESISTANCE TABLE - Ohms @ 68°F (20°C)

Application	Primary	Secondary
2.4L (VIN G)		
Pickup & Ram-50	.72-.88	10,300-13,900
3.0L (VIN H)		
Montero	.72-.88	10,300-13,900



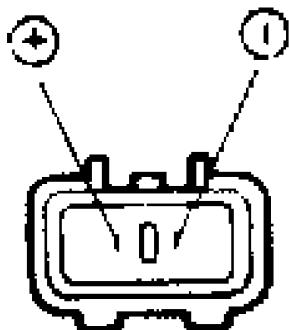
93H78177

Fig. 2: Ignition Coil Connectors ID (Montero)
Courtesy of Mitsubishi Motor Sales of America.



93C78180

Fig. 3: Ignition Coil Connectors ID (Pickup 3.0L)
 Courtesy of Mitsubishi Motor Sales of America.



93D78181

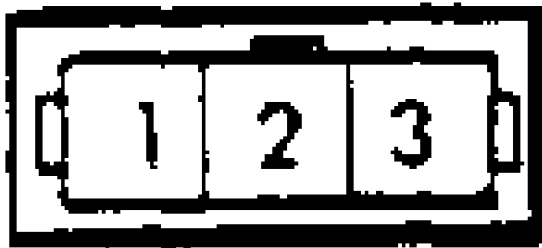
Fig. 4: Ignition Coil Connectors ID (Ram-50, Pickup 2.4L)
 Courtesy of Mitsubishi Motor Sales of America.

Power Transistor

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. 5.

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.



93G78184

Fig. 5: Identifying Power Transistor Connectors (Typical)
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 in this section.

IGNITION TIMING TABLE (Degrees BTDC @ RPM)

Application	(1) Basic	(2) (3) Actual
2.4L		
Pickup & Ram-50	3-7 @ 600-800	8 @ 600-800
3.0L		
Montero	3-7 @ 600-800	15 @ 600-800
Pickup & Ram-50	3-7 @ 650-850	15 @ 650-850

- (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. Ignition timing may fluctuate.
- (3) - If vehicle altitude is more than 2300 ft. above sea level, actual timing may be advanced.

SUMMARY

If no faults were found while performing F - BASIC TESTING, proceed to G - TESTS W/ CODES article in this section. If no hard codes are found in G - TESTS W/ CODES, proceed to H - TESTS W/O CODES article in this section for diagnosis by symptom (i.e., ROUGH IDLE, NO START, etc.) or intermittent diagnostic procedures.

BRAKE SYSTEM

1993 Mitsubishi Montero

1993 BRAKES
Mitsubishi- Brake System
Montero

INTRODUCTION

This article contains information on repair and service of basic hydraulic brake system. If vehicle is equipped with anti-lock brakes, also see ANTI-LOCK BRAKE SYSTEM article in the BRAKES section.

DESCRIPTION

Brake system consists of a master cylinder, vacuum power brake unit, proportioning valve and self-adjusting assembly. Montero has a Load-Sensing Proportioning Valve (LSPV) and is 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.

BRAKE LINE BLEEDING SEQUENCE TABLE

Application	Sequence
Montero	RR, LR, LSPV, RF, LF

ADJUSTMENTS

BRAKE PEDAL HEIGHT & FREE PLAY

1) Separate connector from stoplight switch, and loosen lock nut. Position switch so it does not contact brake pedal arm. Adjust brake pedal height by rotating master cylinder push rod (yoke, if equipped) until distance from top of brake pedal, with pedal released, is within specification. See BRAKE PEDAL SPECIFICATIONS table.

2) DO NOT depress push rod. 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.

3) Using hand pressure, depress brake pedal to measure free play before resistance is felt. Free play distance is .12-.31" (3.0-7.9 mm). If distance is not within specification, bleed system and check for misadjusted brakes.

BRAKE PEDAL SPECIFICATIONS TABLE

Application	Pedal Height In. (mm)

Montero	7.3-7.7 (185-196)

LOAD-SENSING PROPORTIONING VALVE (LSPV)

Park vehicle on level surface. Remove excess weight from vehicle. Ensure lever is not against stopper bolt. Check spring length. If spring length is not within specification, adjust cable or support until correct length is obtained. See LOAD-SENSING SPRING LENGTH table. See Fig. 1.

LOAD-SENSING SPRING LENGTH TABLE

Application	In. (mm)
Montero	8.8-9.0 (224-229)

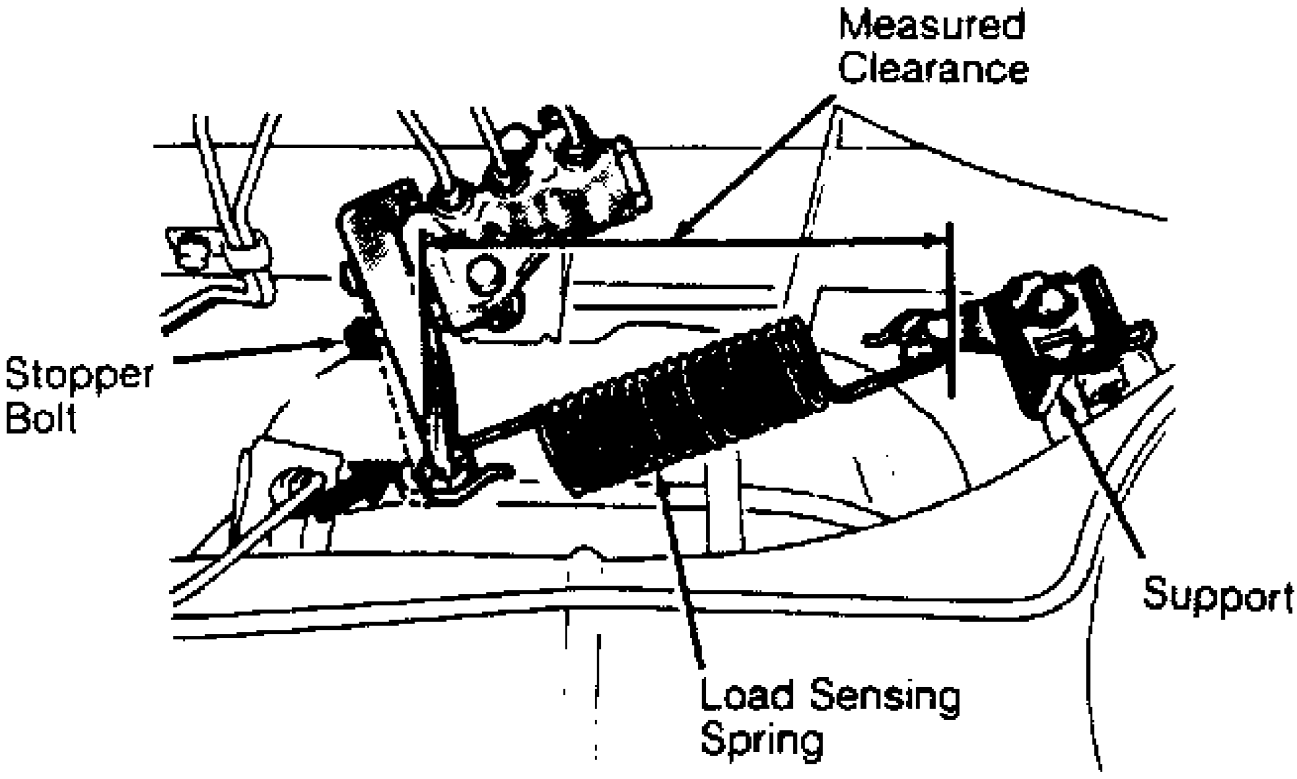
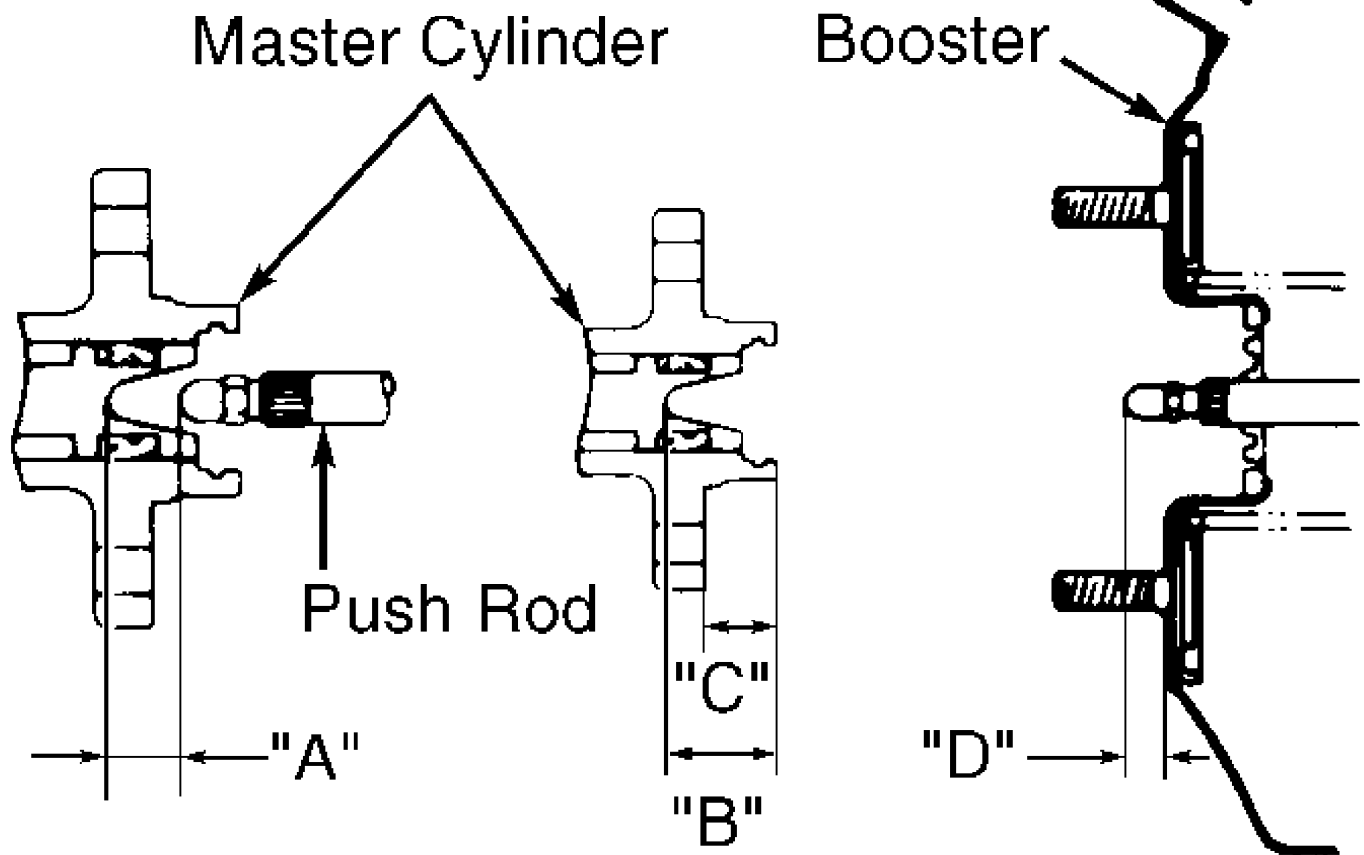


Fig. 1: Adjusting Load-Sensing Proportioning Valve Spring
 Courtesy of Mitsubishi Motor Sales of America.

MASTER CYLINDER PUSH ROD

Check and adjust clearance between back of master cylinder piston and master cylinder push rod. See Fig. 2. See PUSH ROD CLEARANCE SPECIFICATIONS table. After adjusting push rod clearance, adjust pedal height and bleed brake system.

Push Rod Clearance "A" "A" = "B" - "C" - "D"



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Fig. 2: Adjusting Push Rod Clearance
 Courtesy of Mitsubishi Motor Sales of America.

PUSH ROD CLEARANCE SPECIFICATIONS TABLE

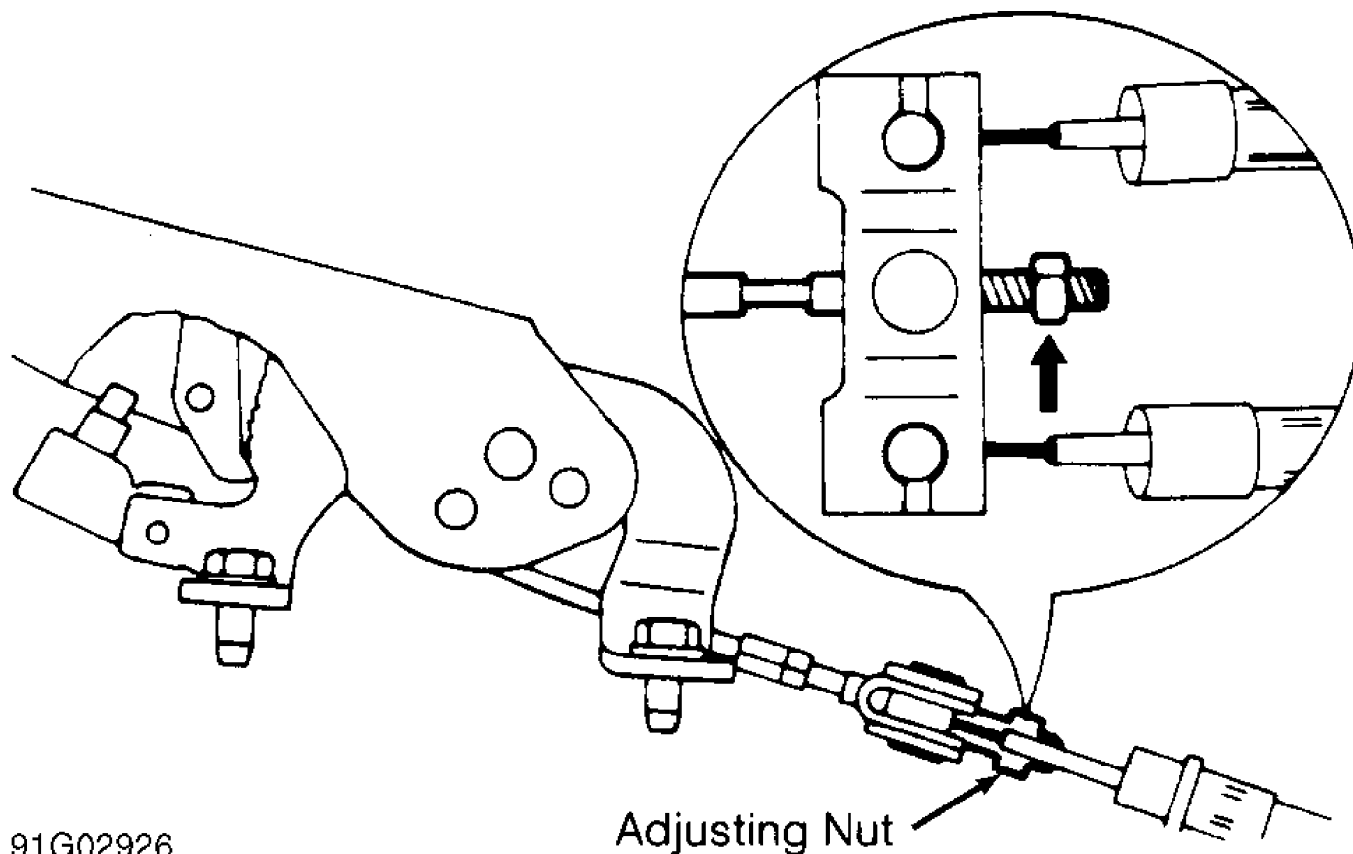
Application (1)	In. (mm)
Montero	.026-.035 (0.66-0.89)
(1) - Front half-shell is smaller than rear half-shell on models using boosters with 2 diameters.	

PARKING/EMERGENCY BRAKE

NOTE: Adjust service brake before adjusting parking brake.

Except Pickup & Ram-50

Start engine, and apply brake pedal. Pull parking brake lever with a force of 44-45 lbs. (20.0-20.4 kg). Parking brake lever should move up 4-6 notches. If adjustment is necessary, turn adjusting nut located under console or at end of cable rod. See Fig. 3.



91G02926

Fig. 3: Adjusting Parking/Emergency Brake (Typical)
 Courtesy of Mitsubishi Motor Sales of America.

REAR BRAKE SHOES

To facilitate adjustment of brake shoe clearance, set adjustment assembly so brake shoes lightly contact brake drum. With brake drum installed, fully release parking brake and depress brake pedal several times to center shoes and adjust brake shoe clearance. 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 .02-.04" (0.5-1.0 mm). Tighten lock nut. DO NOT depress master cylinder push rod during stoplight switch adjustment.

TESTING

POWER BRAKE UNIT

Check Valve Inspection

Remove vacuum hose from power brake unit. Using a vacuum pump, ensure airflow is in direction of intake manifold only.

System Check

1) Run engine for 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 unit is okay. If pedal height remains steady, power brake unit is faulty.

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 unit is okay. If pedal height does not change, power brake unit is faulty.

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 height falls, power brake unit is faulty.

LOAD-SENSING PROPORTIONING VALVE (LSPV)

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. 4. Bleed brake system. See BLEEDING BRAKE SYSTEM.

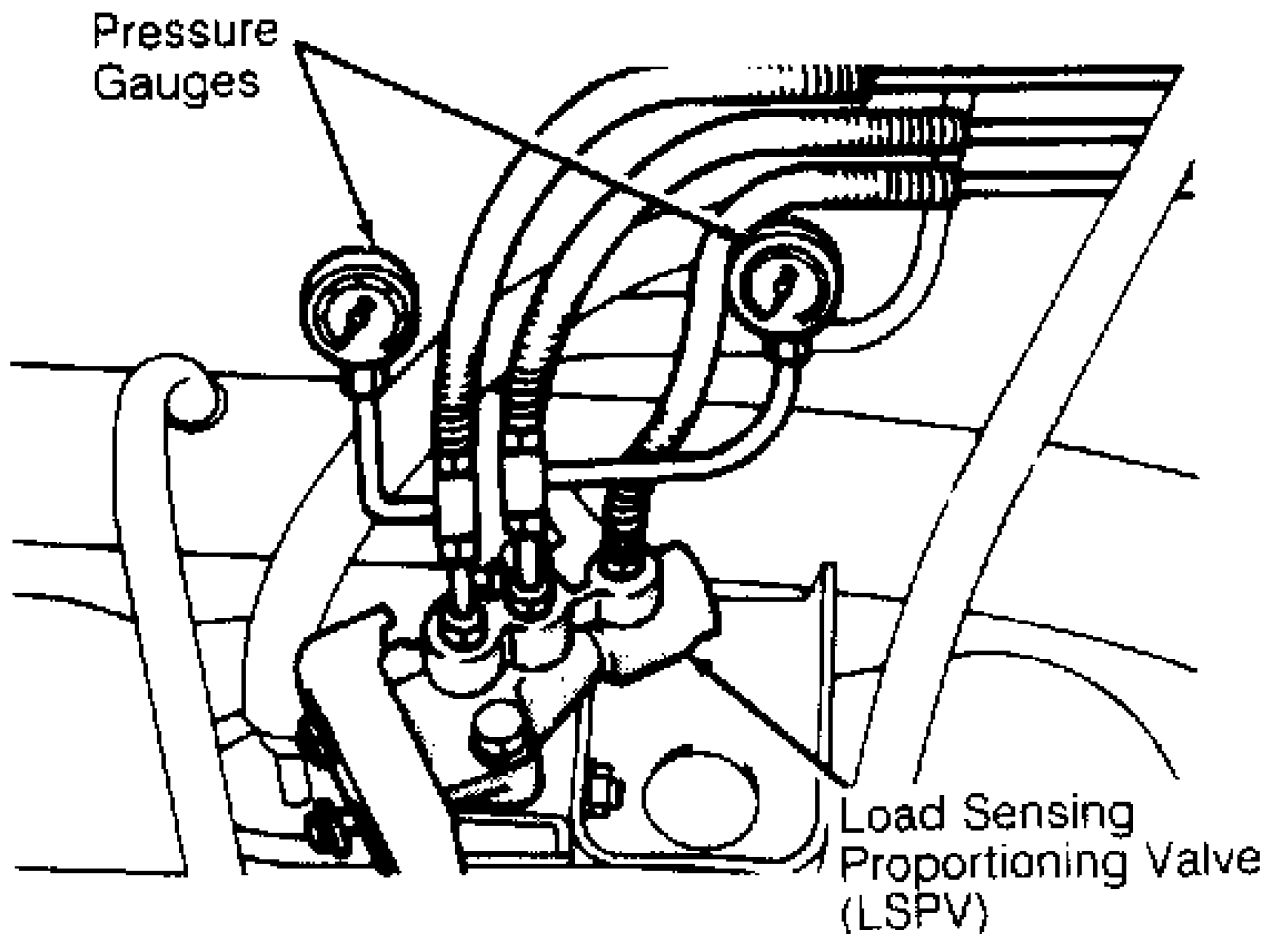


Fig. 4: Connecting Pressure Gauges To LSPV
Courtesy of Mitsubishi Motor Sales of America.

3) Disconnect spring at support and pull spring and lever toward support until spring length is 8.9" (226 mm). See Fig. 1.

Without depressing brake pedal, check readings on pressure gauges. See LSPV PRESSURE SPECIFICATIONS table. Push lever away from support until spring length is 10.1" (257 mm). Without depressing brake pedal, check readings on pressure gauges. If fluid pressure is not within specification, replace LSPV assembly.

4) Slowly depress brake pedal. Check readings on pressure gauges. See LSPV PRESSURE SPECIFICATIONS table. If fluid pressure is not within specification, replace LSPV assembly.

LSPV PRESSURE SPECIFICATIONS TABLE

Application	Inlet Pressure psi (kg/cm ²)	Outlet Pressure psi (kg/cm ²)
LSPV Spring Pulled		
Test 1	1422 (100)	873-1002 (61-70)
Test 2	2560 (180)	1129-1314 (79-92)
LSPV Lever Pushed	2560 (180)	(1) 1863-2148 (131-151)

(1) - Maximum side-to-side pressure differential is 57 psi (4kg/cm²).

REMOVAL & INSTALLATION

FRONT DISC BRAKE PADS

CAUTION: DO NOT remove or contaminate special grease coating on lock pins.

Removal

1) Raise and support vehicle. Remove front wheel(s). Remove lower lock pin or sleeve bolt. See Fig. 5. Lift caliper body upward.

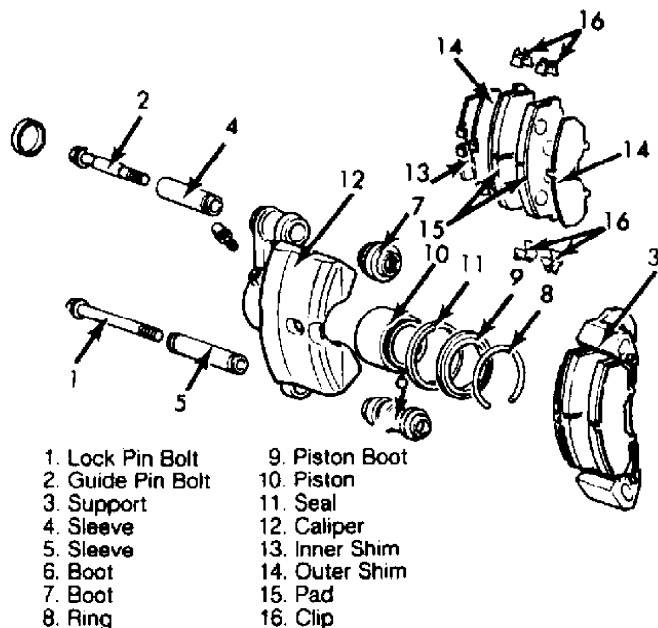


Fig. 5: Exploded View Of Front Disc Brake Assembly (Typical Single Piston)

Courtesy of Mitsubishi Motor Sales of America.

2) Support caliper aside. Remove shim(s), shim holder (if

equipped), anti-squeak shim and pad assembly from support mounting. Remove pad clips.

Installation

If installing new pads, compress piston to bottom of bore. Install retaining clips, pad assembly, shim(s), shim holder (if equipped) and anti-squeak shim onto support mounting. Start engine. Depress brake pedal several times to expand caliper piston. Check brake fluid level.

FRONT BRAKE CALIPER

Removal

1) Raise and support vehicle. Remove front wheel(s). Separate rubber flexhose from hydraulic line at brake hose mount, located on strut housing. Secure end of hydraulic line to prevent spillage of brake fluid.

2) Remove hose clip from brake hose mount. 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

Raise and support vehicle. Remove and support brake calipers. Remove drive hub cover. Remove snap ring, shim and hub from drive axle. See Fig. 6. Remove lock washer. Remove lock nut using Lock Nut Wrench (MB990954). Remove front hub assembly.

Installation

1) 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. Reverse removal procedure for remaining components.

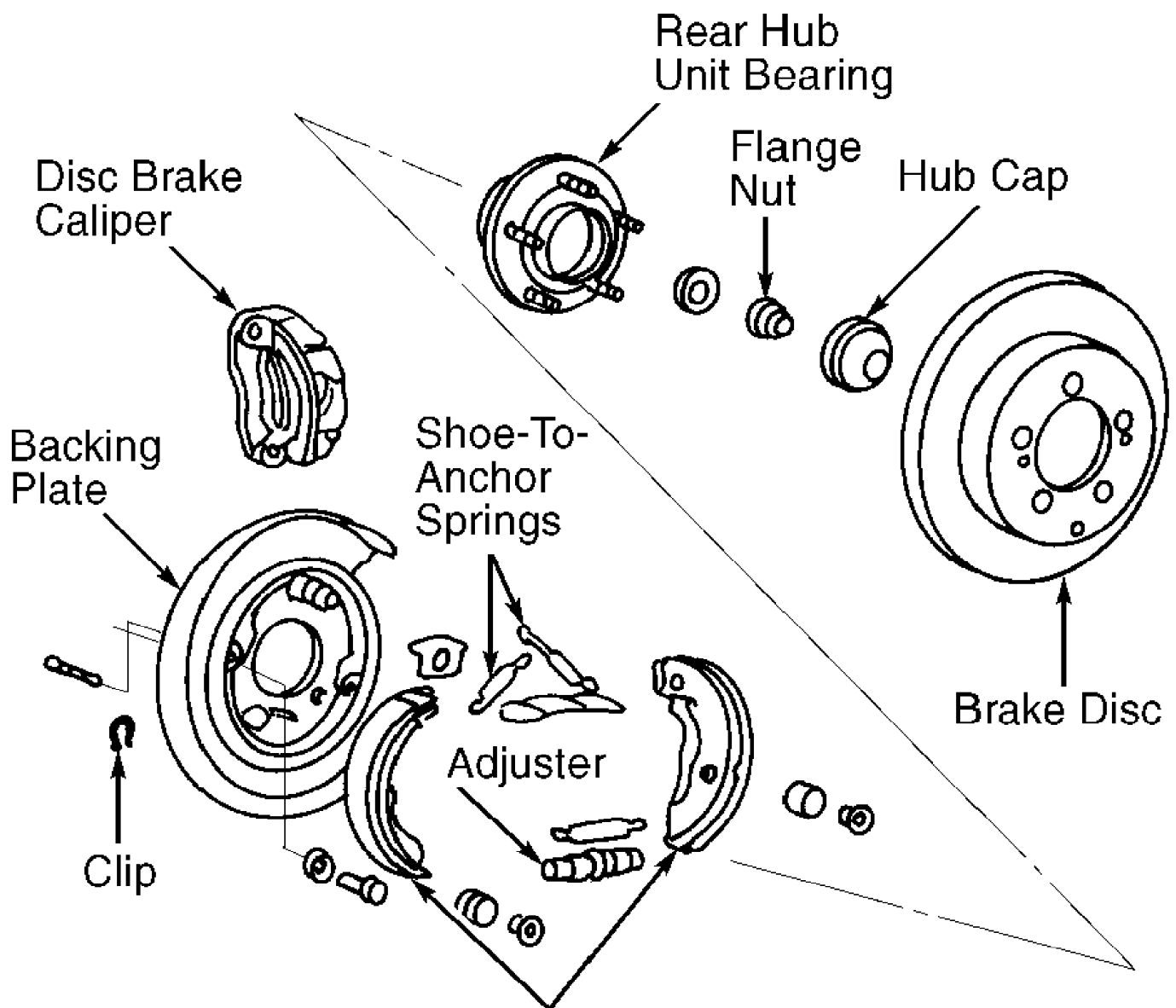
2) After installation is complete, check drive axle-to-hub clearance. Using feeler gauge, clearance should be .016-.028" (.4-.7 mm). Use appropriate shim to obtain correct clearance. Shim is located behind snap ring on end of drive axle. Install shim, and recheck clearance.

PARKING BRAKE SHOES

Removal

1) Raise and support vehicle. Remove rear wheel(s). Disconnect rear speed sensor. Remove rear disc brake calipers and rotors. See Fig. 6.

2) Remove rear hub/bearing assembly. 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.



92I00214

Parking Brake Shoes

Fig. 6: Exploded View Of Parking Brake Assembly (FWD)
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) After installing speed sensor, ensure gap between rotor teeth and sensor pole piece is .008-.028" (0.20-0.71 mm).

REAR DISC BRAKE PADS

NOTE: Replace inner and outer pads at same time.

Removal

Raise and support vehicle. Remove rear wheel(s), and disconnect parking brake cable. Remove lower lock pin bolt. Lift caliper body upward. Using a wire, support caliper from underbody. Remove inner shim(s), 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 shim(s) and anti-squeak shim onto support mounting. Lower caliper body, and install lock pin.

REAR BRAKE CALIPER

Removal

Raise and support vehicle. Remove rear wheel(s). Disconnect parking brake cable connection. Disconnect brake hose from caliper. Secure end of hydraulic line to prevent spillage of brake fluid. 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 and rotor. To install, reverse removal procedure.

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 brakelines from master cylinder, and install plugs to prevent brake fluid spillage. Remove master cylinder from booster unit, 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 UNIT

Removal

Remove brake master cylinder. See MASTER CYLINDER. Disconnect vacuum hose from power brake unit. Disconnect clevis pin attaching brake pedal to power brake unit push rod. From inside vehicle, remove 4 nuts attaching power brake unit to firewall. Remove power brake unit.

Installation

To install, reverse removal procedure. Install master cylinder. Bleed brake system if necessary.

POWER BRAKE UNIT CHECK VALVE

NOTE: To test check valve before removal, stop engine and apply service brake to ensure air flows toward intake manifold only.

Removal & Installation

Remove vacuum hose with check valve from power brake unit. Coat end(s) of check valve with sealant before installation. Install valve with arrow (identification mark) pointing toward intake manifold.

REAR AXLE BEARINGS & OIL SEAL

Removal

1) With disc or drum removed, disconnect brakeline from 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.

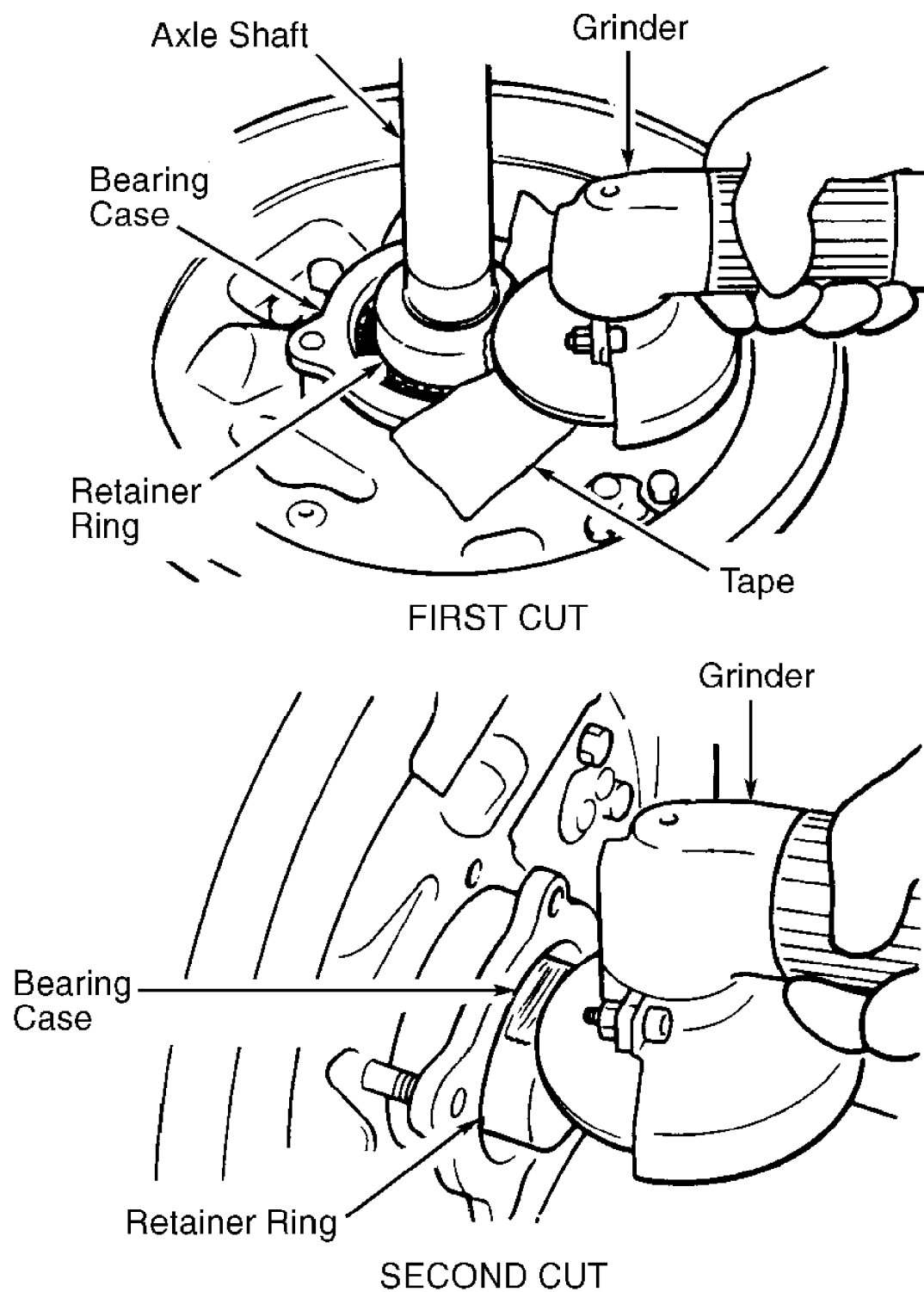
2) Remove shims, "O" ring and snap ring. Retain shims for installation. Secure axle shaft assembly in a vise, and remove one retainer bolt from backing plate. Push bearing case completely to side of dust cover. Place adhesive tape around edge of bearing case at retainer bolt hole to prevent damage.

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 .04-.06" (1.0-1.5 mm) on axle shaft side and .08" (2.0 mm) on bearing side. See Fig. 7.

4) Change angle of grind, and remove remaining .08" (2.0 mm) of retainer ring wall on bearing side. See Fig. 7. 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.



92A00216
 Fig. 7: Grinding Bearing Retainer Ring
 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 .0065" (.166 mm). If clearance exceeds specification, install a new snap ring to bring clearance to specification. See SNAP RING THICKNESS SPECIFICATION table.

SNAP RING THICKNESS SPECIFICATION TABLE

Thickness In. (mm)	Color
.060 (1.52)	Red
.067 (1.70)	Purple
.073 (1.85)	Blue
.079 (2.01)	Yellow
.085 (2.16)	Neutral

4) Adjust clearance between bearing case and rear axle by inserting .04" (1.0 mm) shim and "O" ring into left rear axle housing. Apply semi-drying sealant to mating surface of bearing case. Install left axle shaft into rear housing, and tighten nuts diagonally to 36-43 ft. lbs. (49-58 N.m).

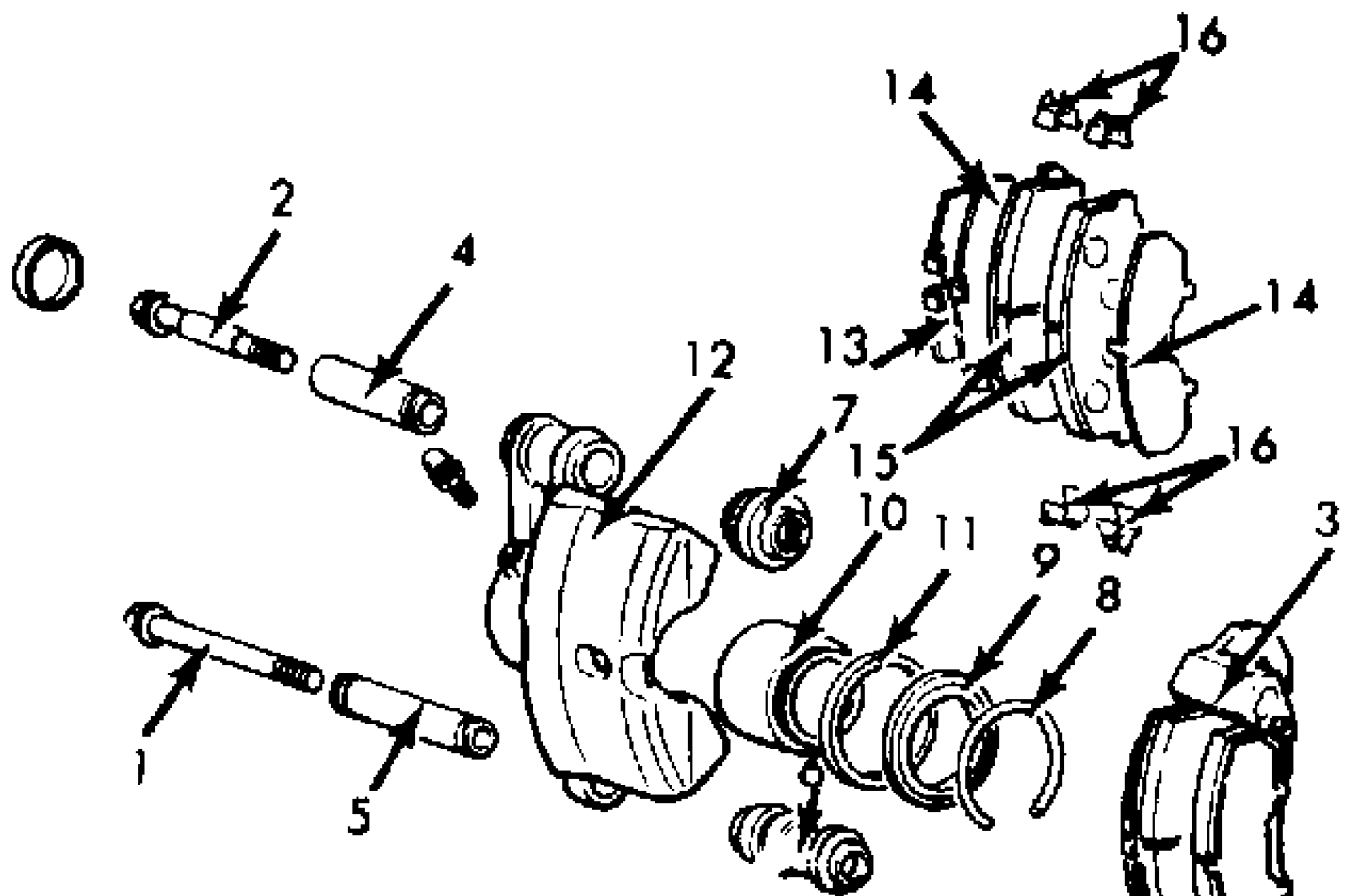
5) Install right axle shaft without shims and "O" ring. Temporarily tighten axle shaft nuts to about 53 INCH lbs. (6 N.m). Using a feeler gauge, measure clearance between bearing case and rear axle housing.

6) Remove right axle shaft. Install shims to equal bearing case-to-axle housing clearance plus .002-.008" (.05-.20 mm). Install "O" ring to right rear axle housing. Apply sealant to mating surface of bearing case.

7) Install axle into housing, tightening nuts diagonally to 36-43 ft. lbs. (49-58 N.m). Check axle shaft for .002-.008" (.05-.20 mm) end play using dial indicator. If end play is not within specification, change shims to obtain correct end play. To install remaining components, reverse removal procedure. Adjust parking brake, and bleed brake system. See BLEEDING BRAKE SYSTEM.

OVERHAUL

NOTE: For exploded views of front disc brake calipers, see Fig. 5
For exploded views of rear brake calipers, see Fig. 9.
For exploded view of master cylinder, see Fig. 8.



1. Lock Pin Bolt	9. Piston Boot
2. Guide Pin Bolt	10. Piston
3. Support	11. Seal
4. Sleeve	12. Caliper
5. Sleeve	13. Inner Shim
6. Boot	14. Outer Shim
7. Boot	15. Pad
8. Ring	16. Clip

Fig. 8: Exploded View Of Front Disc Brake Assembly (Typical Single Piston)
 Courtesy of Mitsubishi Motor Sales of America.

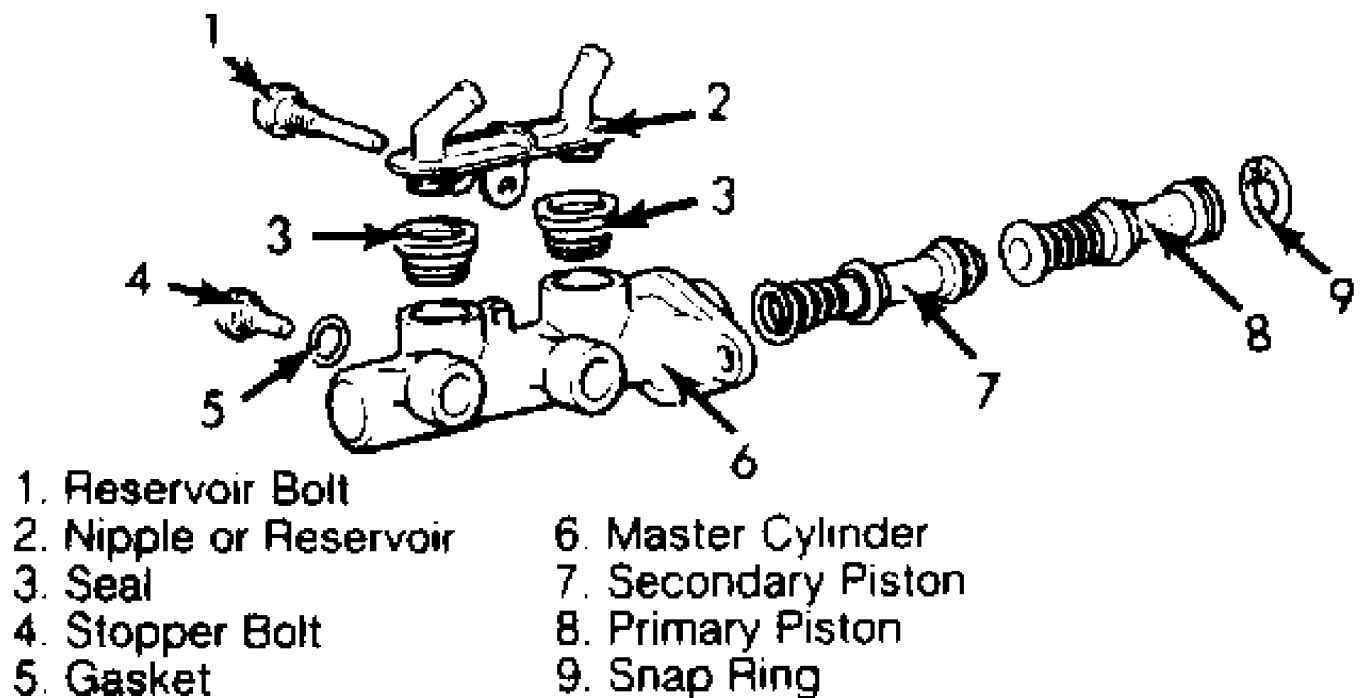


Fig. 9: Exploded View Of Master Cylinder (Typical)
 Courtesy of Mitsubishi Motor Sales of America.

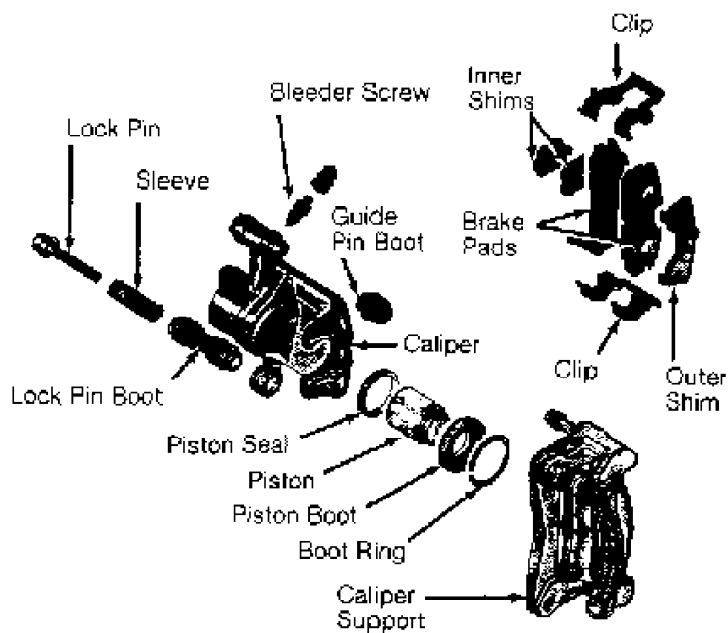


Fig. 10: Exploded View Of Rear Disc Brake Caliper Assembly
 Courtesy of Mitsubishi Motor Sales of America.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS TABLE

Application	Ft. Lbs. (N.m)
Caliper Guide Or Lock Pin Bolt	54 (73)
Caliper Mounting Bolts	65 (90)
Front Wheel Bearing Nut	
FWD	144-188 (195-254)
RWD & 4WD	(1)
Locking or Full-Time Hub Bolt	36-43 (49-60)
Rear Wheel Bearing Nut	(1)
Rotor-To-Hub Bolts Or Nuts	36-43 (49-60)
Wheel Lug Nut	72-87 (98-118)
	INCH Lbs. (N.m)

Master Cylinder-To-Power Brake Unit Nut 72-108 (8-12)

(1) - See REAR AXLE HUB BEARINGS or FRONT BRAKE ROTOR under
REMOVAL & INSTALLATION.

DISC BRAKE SPECIFICATIONS

DISC BRAKE SPECIFICATIONS TABLE

Application	In. (mm)
Disc Diameter	9.0 (229)
Lateral Runout	.006 (.15)
Parallelism	(1)
Original Thickness	
Front	.94 (24)
Rear	.71 (18)
Master Cylinder Diameter	.938 (23.83)
Minimum Refinish Thickness	
Front	.88 (22.4)
Rear	.65 (16.5)
Discard Thickness	(1)

(1) - Information is not available from manufacturer.

DRUM BRAKE SPECIFICATIONS

DRUM BRAKE SPECIFICATIONS TABLE

Application	In. (mm)
Drum Width	(1)
Master Cylinder Diameter	(2)
Drum Discard Diameter	(1)

(1) - Information is not available from manufacturer.

(2) - See DISC BRAKE SPECIFICATIONS table under DISC BRAKE
SPECIFICATIONS.

*** BRAKE SYSTEM UNIFORM INSPECTION GUIDELINES ***

1993 Mitsubishi Montero

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	3 ..	Suggest flushing and refilling with correct fluid.
overhaul or replacement		
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.

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

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.

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.
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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.

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 HARNESSSES

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

1993 Mitsubishi Montero

1993 Clutch

Dodge Ram-50, Mitsubishi Montero, Pickup

DESCRIPTION

All models use diaphragm spring, single-disc type clutches. Clutch is cable-operated on RWD models, and hydraulically operated on 4WD models.

ADJUSTMENTS

CLUTCH PEDAL HEIGHT & FREE PLAY

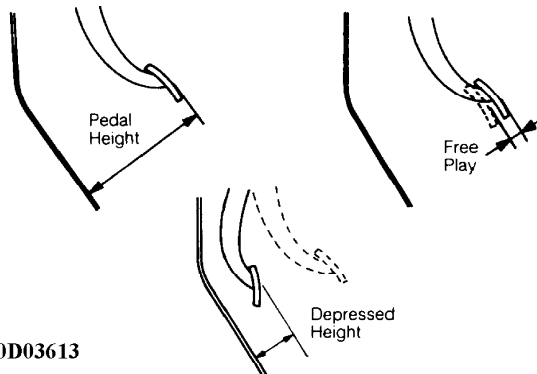
Pedal Adjustment (RWD)

1) To adjust pedal height, loosen stopper bolt lock nut or clutch switch at top of pedal, and rotate stopper or switch until correct pedal height is obtained. Measure distance between face of clutch pedal and floor board. See CLUTCH PEDAL SPECIFICATIONS TABLE. See Figs. 1-4.

CLUTCH PEDAL SPECIFICATIONS TABLE

Application	In. (mm)
Montero	
Free Play	.24-.51 (6-13)
Pedal Height	
Pedal Depressed (1)	1.4 (35)
Pedal Released	7.3-7.5 (185-190)
Pickup & Ram-50	
2.4L Free Play	.8-1.4 (20-35)
Pedal Height	
Pedal Depressed (1)	2.4 (60)
Pedal Released	6.5-6.7 (166-171)
3.0L Free Play	.31-.67 (8-17)
Pedal Height	
Pedal Depressed (1)	2.4 (60)
Pedal Released	6.5-6.7 (166-171)

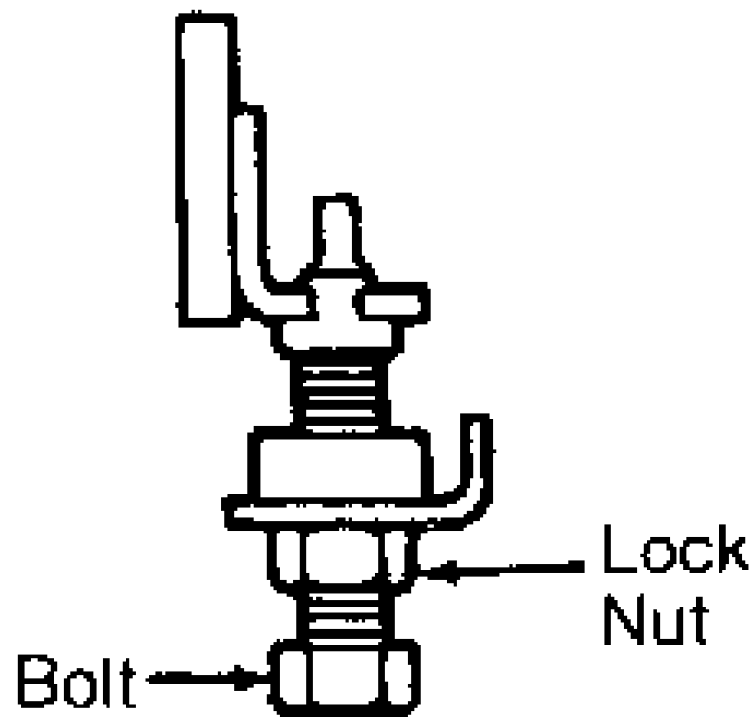
(1) - Specification given is minimum distance.



50D03613

Fig. 1: Measuring Pedal Free Play & Height
Courtesy of Mitsubishi Motor Sales of America.

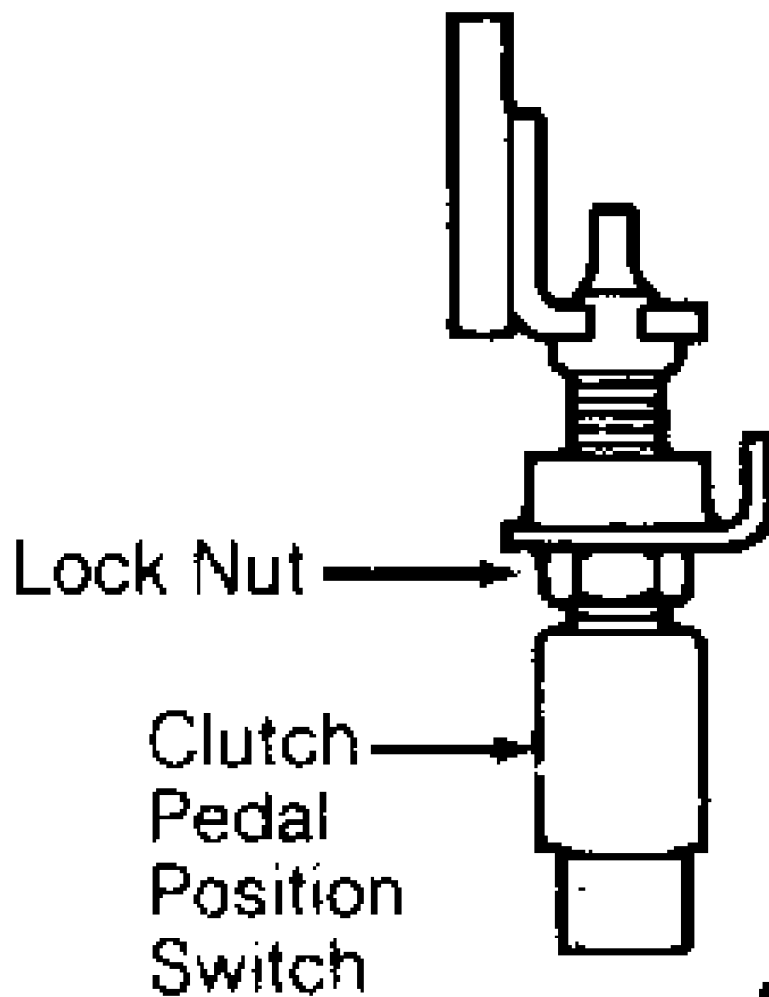
VEHICLES WITHOUT CRUISE CONTROL



93F00211

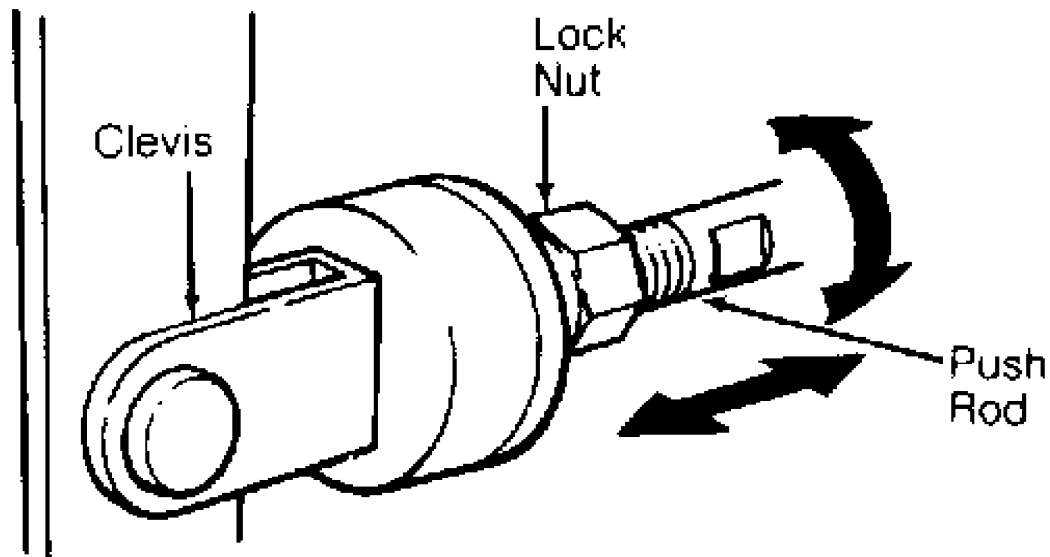
Fig. 2: Adjusting Lock Nut (Without Cruise Control)
Courtesy of Mitsubishi Motor Sales of America.

VEHICLES WITH CRUISE CONTROL



93G00212

Fig. 3: Adjusting Lock Nut (With Cruise Control)
Courtesy of Mitsubishi Motor Sales of America.



93H00213

Fig. 4: Adjusting Push Rod
Courtesy of Mitsubishi Motor Sales of America.

2) Measure clutch pedal free play. See CLUTCH PEDAL SPECIFICATIONS TABLE. See Figs. 1-4. If pedal free play adjustment is necessary, pull clutch cable housing toward engine compartment. Rotate cable adjusting nut until .12-.16" (3.0-4.0 mm) clearance is obtained between adjusting nut and insulator holder. See Fig. 5.

3) After making adjustments, depress pedal several times and hold down. Measure distance between face of clutch pedal and floor board. If depressed pedal height is less than specification, check clutch components for damage and deformation. See CLUTCH PEDAL SPECIFICATIONS TABLE.

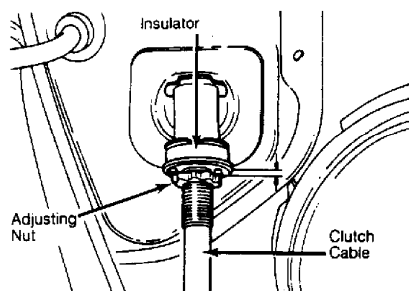


Fig. 5: Adjusting Clutch Pedal Free Play (RWD)
Courtesy of Mitsubishi Motor Sales of America.

Pedal Adjustment (4WD)

1) To adjust pedal height, loosen lock nut and rotate pedal

stop bolt or switch at top of pedal assembly until correct pedal height is obtained. Measure distance between face of clutch pedal and floor board. See CLUTCH PEDAL SPECIFICATIONS TABLE. See Figs. 1 to 4.

2) Measure clutch pedal free play. See Figs. 1-4. See CLUTCH PEDAL SPECIFICATIONS TABLE. If pedal free play needs to be adjusted, loosen lock nut on master cylinder push rod and rotate push rod to obtain correct free play. See CLUTCH PEDAL SPECIFICATIONS TABLE. Tighten lock nut. See Figs. 1-4.

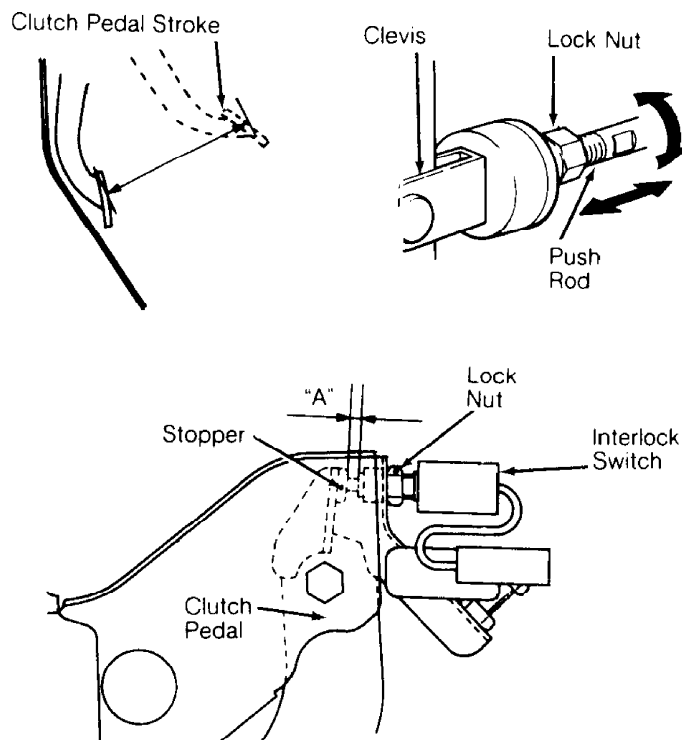
3) After making adjustments, depress pedal several times and hold down. Measure distance between face of clutch pedal and floor board. If depressed pedal height is not as specified, bleed system and inspect hydraulic and clutch components. See CLUTCH PEDAL SPECIFICATIONS TABLE.

INTERLOCK SWITCH

Interlock Switch Adjustment

1) Check and adjust pedal height and free play. See CLUTCH PEDAL HEIGHT & FREE PLAY. See Figs. 1-4. Measure clutch pedal full stroke. Full stroke should be 5.72" (145 mm). If full stroke is out of tolerance, adjust by turning push rod. See Fig. 6.

2) Measure clearance "A" with clutch pedal fully depressed (full stroke). See Fig. 6. Clearance "A" should be .177-.217" (4.5-5.5 mm). If clearance is out of tolerance, adjust by loosening interlock switch lock nut and turning interlock switch in appropriate direction. When clearance "A" is correct, tighten lock nut to 115 INCH lbs. (13 N.m).



50F03614

Fig. 6: Adjusting Interlock Switch
Courtesy of Mitsubishi Motor Sales of America.

REMOVAL & INSTALLATION

CLUTCH ASSEMBLY

Removal (4WD)

1) Remove switch panel from rear console. Remove suspension control switch or hole cover. Disconnect rear console harness connector. Remove side panel. Remove rear console assembly. Remove shift lever knob(s). Remove floor console harness connector. Remove front console assembly.

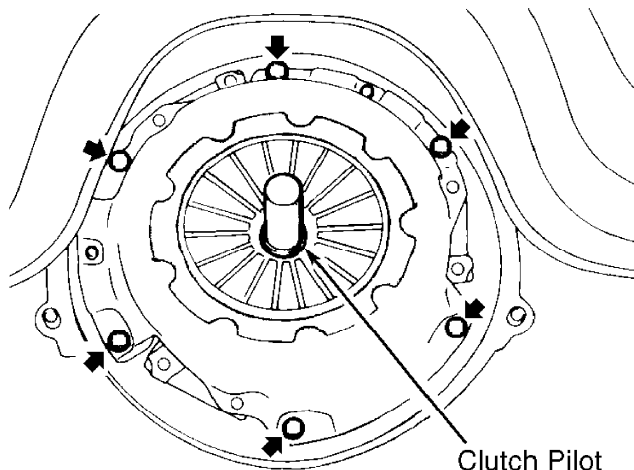
2) Move transmission lever to neutral position and transfer lever to 4H (4WD high range) position on Montero or 2H (RWD high range) on Pickup and Ram-50. Remove control lever boot retainer and boot. Remove transmission and transfer control lever assemblies. Remove control lever bushing (transmission), gaskets and stopper plates.

3) Raise and support vehicle. Remove skid plate and front exhaust pipe. Drain transmission and transfer case fluid. Index mark front and rear drive shaft flanges. Remove front and rear drive shafts.

4) Remove drive shaft dust seals. Disconnect HI/LO and 2WD/4WD detection switch connectors. Disconnect back-up light switch connector. Disconnect center differential lock detection switch connector. Disconnect center differential lock operation switch connector. Disconnect 4WD operation detection switch. Disconnect speedometer cable. Remove clutch slave cylinder heat shield. Remove clutch slave cylinder (without disconnecting hydraulic line) and wire aside. Remove starter and starter cover. Remove heat shield and both transmission stays and then bellhousing lower cover.

5) Support transmission with transmission jack. Remove transfer case roll stopper and bracket. Remove crossmember and engine mounting rear insulator. Remove transfer case protector bracket and mass damper. Remove remaining bell housing bolts. Pull toward rear of vehicle to free transmission input shaft from clutch. Lower transmission/transfer case from vehicle.

6) Insert a clutch pilot to prevent pressure plate and clutch disc from dropping. Diagonally loosen pressure plate bolts to avoid warping pressure plate flange during removal. Remove pressure plate and clutch disc. See Fig. 7.



93B00217

Fig. 7: Removing & Installing Clutch On Flywheel
Courtesy of Mitsubishi Motor Sales of America.

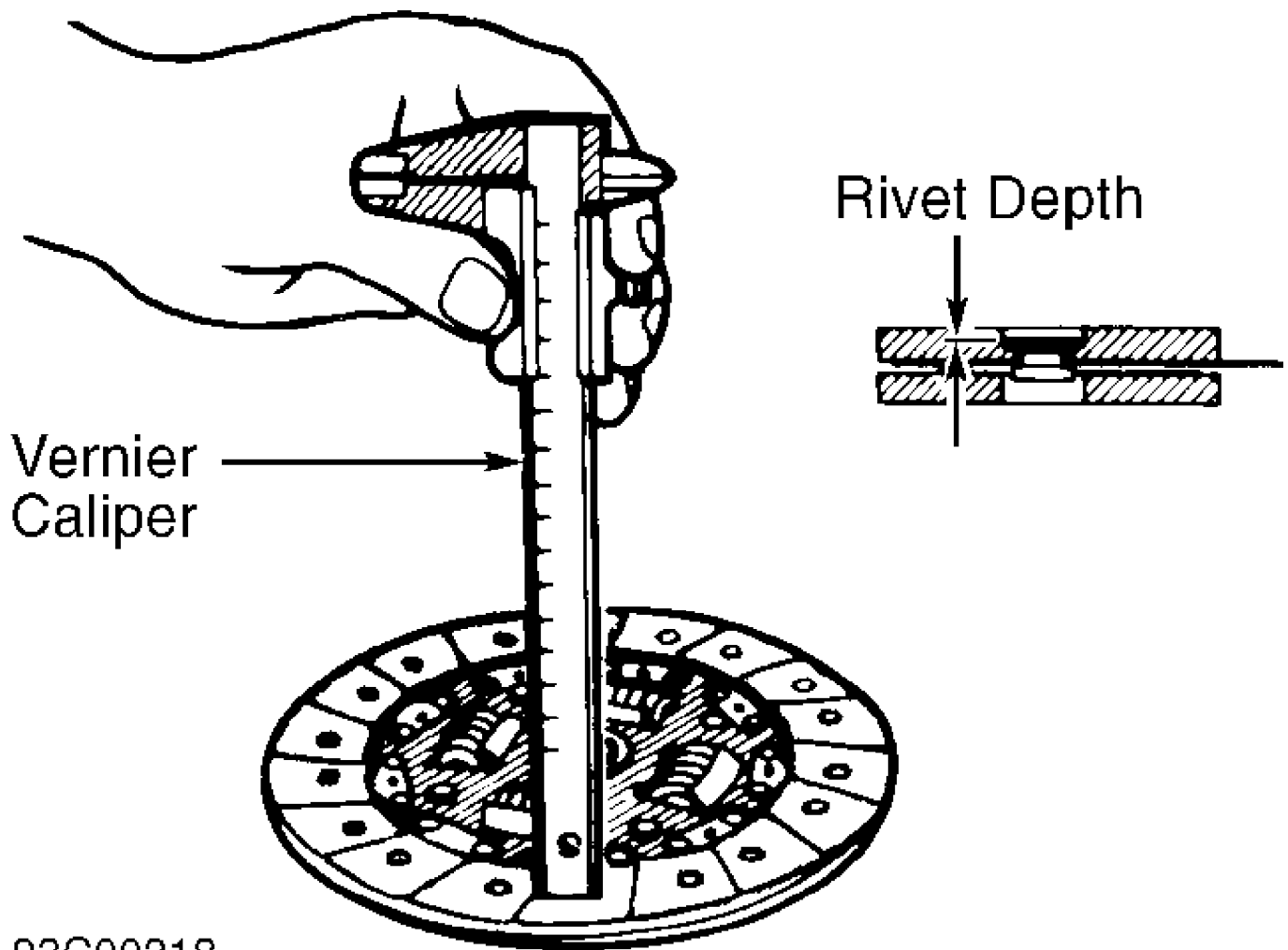
Inspection (4WD)

1) Check release bearing and release fork for damage or wear.

DO NOT clean 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. Check clutch disc rivets and replace assembly if loose. 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 depth from clutch disc surface to head of rivet. Replace clutch disc if measurement is less than .012" (.30 mm). See Fig. 8. Replace worn or defective components as necessary.



93C00218

Fig. 8: Measuring Clutch Disc

Courtesy of Mitsubishi Motor Sales of America.

CAUTION: Install clutch disc with manufacturer's stamp mark (located near hub of clutch disc) toward pressure plate.

Installation (4WD)

1) Using clutch pilot, install pressure plate and clutch disc. Tighten bolts evenly in a crisscross pattern to specification. See TORQUE SPECIFICATIONS TABLE at the end of this article.

2) Clean release bearing sliding surface. Apply a light coating of multipurpose grease to release bearing sliding surface.

Apply a very light coating of grease to input shaft splines. DO NOT allow grease or dirt on clutch disc or pressure plate surfaces.

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 & FREE PLAY under ADJUSTMENTS. See Figs. 1-4.

Removal (RWD)

1) Disconnect battery negative cable. Remove shift knob, dust cover retaining plate, gaskets, stopper plate and control lever assembly. Raise and support vehicle.

2) Remove front exhaust pipe. drain transmission oil. Index mark drive shaft flange and remove drive shaft.

3) Disconnect back-up light switch connector, speedometer cable connection and exhaust pipe mounting bracket. Remove lower bell housing cover. Disconnect clutch cable from clutch lever.

4) Support transmission with jack. Remove rear engine mount nuts and bolts from transmission. Remove crossmember with rear engine mount. Remove remaining bellhousing bolts, move transmission toward rear and lower from vehicle.

5) Index mark pressure plate to flywheel for installation reference. Install a clutch pilot to prevent pressure plate and clutch disc from dropping. Diagonally loosen pressure plate bolts gradually to avoid warping pressure plate flange during removal. Remove pressure plate and clutch disc. See Fig. 7.

Inspection (RWD)

1) Check release bearing and release fork for damage or wear. DO NOT clean bearing assembly in solvent.

2) Inspect pressure plate surface for wear, cracks, and/or discoloration. Check clutch disc rivets and replace assembly if loose. 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. See Fig. 8.

CAUTION: Install clutch disc with manufacturer's stamp mark (located near hub of clutch disc) toward pressure plate.

Installation (RWD)

1) Using clutch pilot, install pressure plate and clutch disc. If reusing pressure plate, ensure index marks are aligned. Tighten bolts evenly in a crisscross pattern to specification. See TORQUE SPECIFICATIONS TABLE at the end of this article. See Fig. 7.

2) Clean release bearing sliding surface. DO NOT clean release bearing with solvent. Apply a light coat of multipurpose grease to release bearing sliding surface. Apply a very light coating of grease to input shaft splines. DO NOT allow grease or dirt on clutch disc or pressure plate surfaces.

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 & FREE PLAY under ADJUSTMENTS. See Figs. 1-4.

CLUTCH CABLE (RWD)

Removal

Pull lightly on clutch cable while loosening cable adjusting wheel from inside engine compartment. Remove cable end from control lever on transmission housing. Remove cable end from pedal lever.

Disconnect insulator from cable and remove cable.

Installation

Apply grease to contact areas between clutch pedal lever and cable end, and release lever and cable end. Install insulator onto cable end. Reverse removal procedure to complete installation. Adjust clutch pedal free play. See CLUTCH PEDAL HEIGHT & FREE PLAY under ADJUSTMENTS. See Figs. 1 and 2.

CLUTCH RELEASE BEARING & SHIFT ARM OR RELEASE FORK

Removal (RWD)

1) Remove transmission. See CLUTCH ASSEMBLY under REMOVAL & INSTALLATION. Remove return clips, release bearing and carrier. Use a punch to remove shift arm spring pin and release lever assembly. Remove shift arm, felt packing and 2 return springs. See Fig. 9.

2) Ensure release bearing turns freely and smoothly under light load. Replace bearing if noise, roughness or dryness is present. DO NOT clean bearing in solvent. Use shop towel or compressed air only.

Installation (RWD)

1) Insert lever and shaft into left side of transmission case. Place shift arm, felt packing and return springs on shaft assembly. Apply grease to inside of bushing and oil seal lips. Apply oil to felt packing.

2) Align shift arm pin and control shaft pin holes. Drive spring pins into position, with slit area upward. Reverse removal procedure to complete installation. Check pedal height and free play. Adjust if necessary. See CLUTCH PEDAL HEIGHT & FREE PLAY under ADJUSTMENTS.

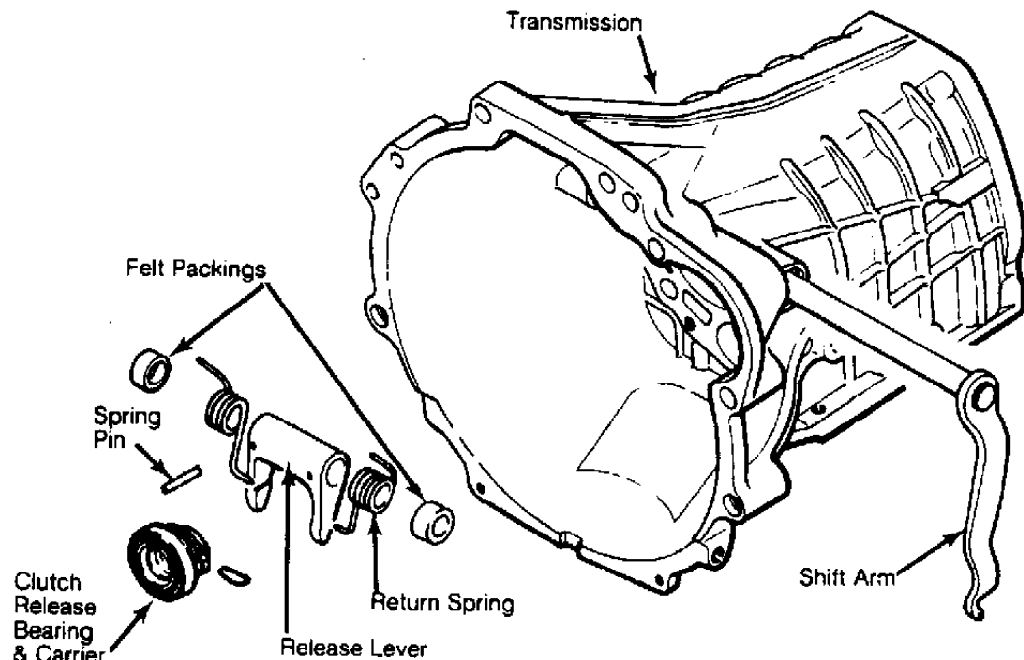


Fig. 9: View Of Clutch Release Bearing & Shift Arm Assembly (RWD)
Courtesy of Mitsubishi Motor Sales of America.

Removal (4WD)

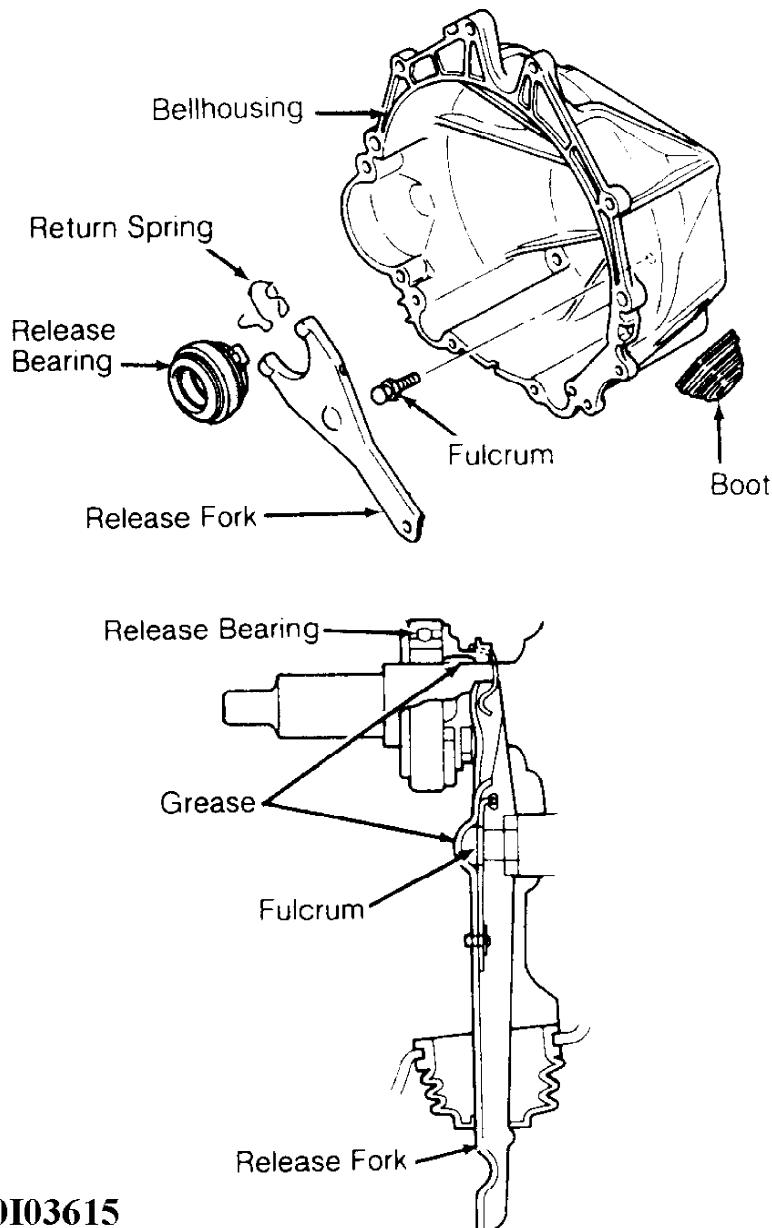
1) Remove transmission. See CLUTCH ASSEMBLY under REMOVAL & INSTALLATION. Remove return spring or clips, and remove release

bearing.

2) Slide release fork toward outside of transmission and disengage from fulcrum ball. DO NOT slide release fork toward inside of case, or damage to fulcrum ball clip will result. Remove release fork boot.

Installation (4WD)

To install, reverse removal procedure. Apply grease to fulcrum ball contact area of release fork before installing. Fill groove of release bearing inside diameter with grease before installing. See Fig. 10.



50I03615

Fig. 10: View Of Clutch Release Bearing & Shift Arm Assembly (4WD)
Courtesy of Mitsubishi Motor Sales of America.

CLUTCH MASTER CYLINDER (4WD)

Removal & Installation

1) Drain master cylinder. Remove cotter pin, washer and clevis pin. Disconnect push rod from clutch pedal. Remove and plug hydraulic line at clutch master cylinder.

2) Remove retaining nuts, clutch master cylinder and gasket. To install, reverse removal procedure. Apply grease to clevis pin before installing. Fill reservoir and bleed clutch system.

CLUTCH RELEASE CYLINDER (4WD)

Removal & Installation

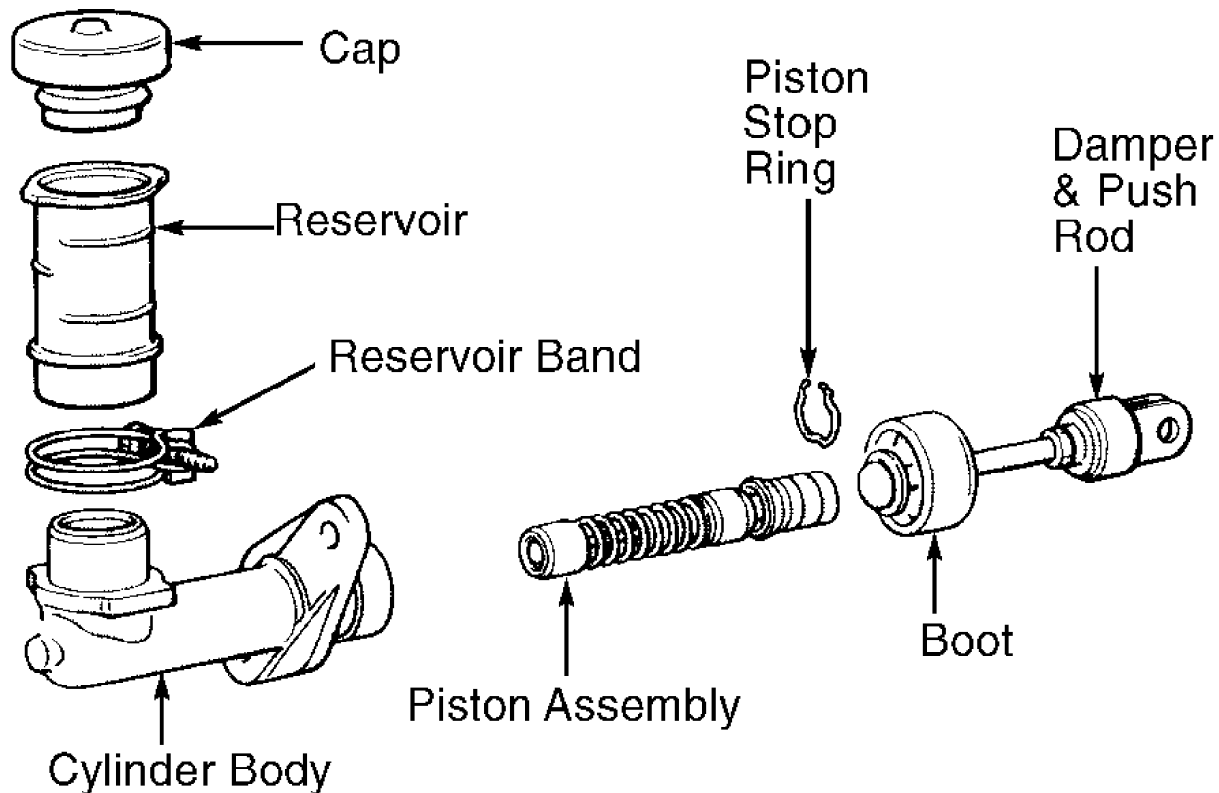
Remove and plug hydraulic line at release cylinder. Remove cylinder-to-transmission bolts. Remove clutch release cylinder. To install, reverse removal procedure. Apply grease to push rod-to-release fork contact area. Bleed clutch system.

OVERHAUL

CLUTCH MASTER CYLINDER (4WD)

Disassembly

Remove piston stop ring, damper and push rod assembly. See Fig. 11. Remove piston assembly. Note position of reservoir band for reassembly reference. Remove reservoir.



90F02450

Fig. 11: Exploded View Of Clutch Master Cylinder (Typical)
Courtesy of Mitsubishi Motor Sales of America.

Inspection & Reassembly

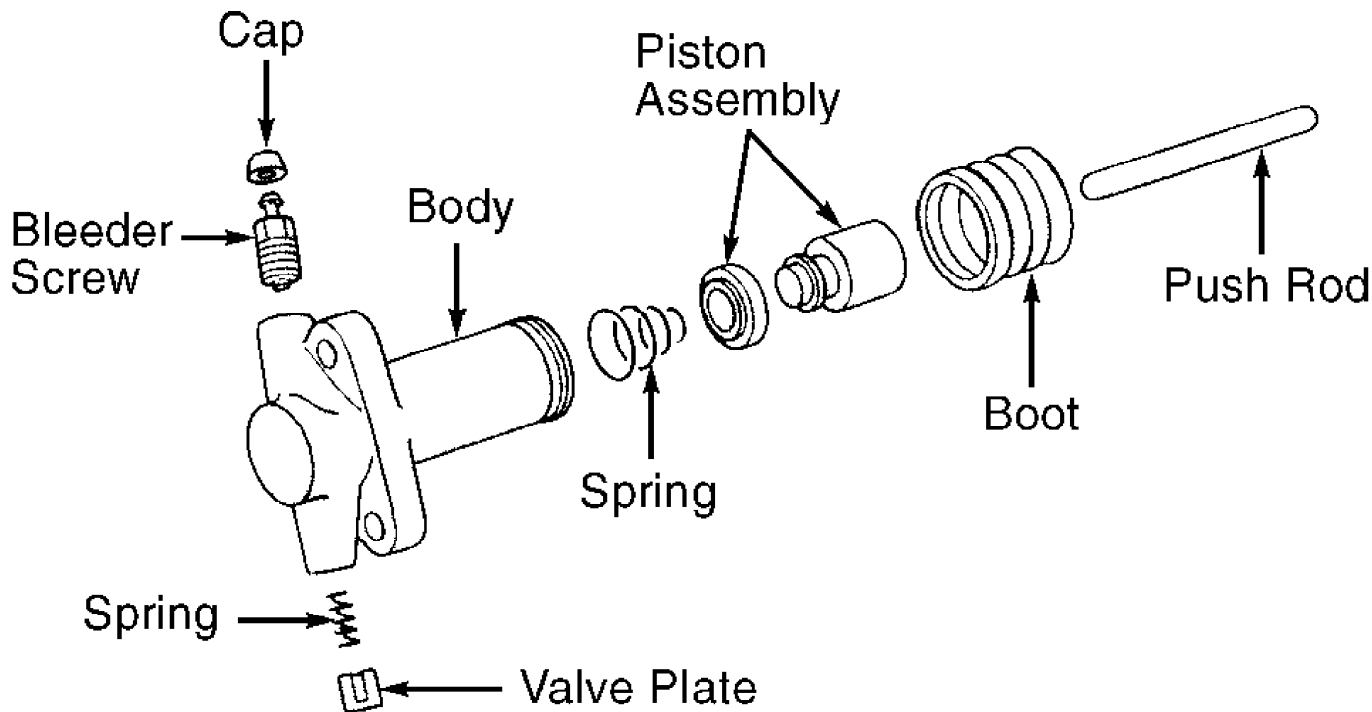
Inspect components for corrosion, scoring or damage. Replace

if necessary. Apply DOT 3 brake fluid to components during reassembly. To reassemble, reverse disassembly procedure. Ensure piston moves freely in bore.

CLUTCH RELEASE CYLINDER (4WD)

Disassembly

Remove valve plate and spring. See Fig. 12. Remove push rod and boot. Cover piston assembly opening with a rag. Slowly apply air pressure to hydraulic line opening to force piston from body.



90H02451

Fig. 12: Exploded View Of Clutch Release Cylinder (Typical)
 Courtesy of Mitsubishi Motor Sales of America.

Inspection & Reassembly

Inspect components for corrosion, scoring or damage. Replace if necessary. Apply DOT 3 brake fluid to components during reassembly. To reassemble, reverse disassembly procedure. Ensure piston moves freely in bore.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS TABLE

Application	Ft. Lbs. (N.m)
Flexhose-To-Release Cylinder Bolt	14-18 (19-24)
Flywheel Bolt	
2.4L Engines	94-101 (127-137)
3.0L Engines	53-55 (72-75)
Fulcrum Ball	22-30 (30-41)
Gearshift-To-Transfer Case Bolt	11-15 (15-20)
Hydraulic Line-To-Master Cylinder	10-12 (14-16)
Pressure Plate Bolt	11-15 (15-20)

Release Cylinder-To-Transmission Bolt	22-30 (30-41)
Transmission-To-Engine Bolt	
2.4L Engines	
8 x 25 mm & 8 x 55 mm	15-20 (20-27)
10 x 40 mm & 10 x 65 mm	31-40 (42-54)
10 x 60 mm	20-25 (27-34)
3.0L Engines	
10 x 35 mm	24-36 (33-49)
10 x 40 mm	22-30 (30-41)
10 x 55 mm	20-25 (27-34)
12 x 35 mm, 12 x 40 mm & 12 x 50 mm	47-61 (64-83)
12 x 55 mm	58-72 (79-98)

COMPUTER RELEARN PROCEDURES

1993 Mitsubishi Montero

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

1993 Mitsubishi Montero

1993 ENGINE COOLING

Chrysler/Mitsubishi Cooling System Specifications

Chrysler Corp.: Ram-50

Mitsubishi: Montero & Pickup

COOLING SYSTEM SPECIFICATIONS

COOLING SYSTEM SPECIFICATIONS TABLE

Application	Specification
Coolant Replacement Interval	. 30,000 Miles Or 24 Months
Coolant Capacity (Includes Heater & Reserve Tank)	
Montero	10.0 Qts. (9.5L)
Pickup & Ram-50	
2WD	
Automatic Transmission	6.4 Qts. (6.1L)
Manual Transmission	6.3 Qts. (6.0L)
4WD	
2.4L	
Automatic Transmission	6.4 Qts. (6.1L)
Manual Transmission	6.6 Qts. (6.2L)
3.0L	
Automatic Transmission	8.8 Qts. (8.3L)
Manual Transmission	8.9 Qts. (8.4L)
Pressure Cap	11-15 psi
Thermostat Opens	
Starts	180 °F (82 °C)
Fully Open	212 °F (100 °C)

CRUISE CONTROL SYSTEM

1993 Mitsubishi Montero

1993 ACCESSORIES & EQUIPMENT
Mitsubishi Cruise Control Systems

Montero

DESCRIPTION & OPERATION

The cruise control system is electronically and vacuum controlled. System components include a control unit, actuator, vacuum pump, cruise control switch, clutch pedal switch, cruise indicator light, diode, inhibitor switch (A/T), stoplight switch, vehicle speed sensor and A/T control unit.

The system has self-diagnostic capability. When self-diagnostic mode is activated, each switch and sensor is checked for defects. When cruise control system has been canceled without using a normal cancel method, a code will be set and stored in control unit. Codes can be retrieved to help determine which circuit is malfunctioning.

PRELIMINARY INSPECTION

Before performing TROUBLE SHOOTING steps, inspect linkage assembly, actuator, cables and vacuum hoses. Ensure linkage and cables move smoothly. Ensure cables do not have excessive slack or tension.

TROUBLE SHOOTING

NOTE: For further trouble shooting information, see CHECK RESULTS & SYMPTOM CHARTS. See Figs. 5-7.

SYSTEM CANCELS OR WILL NOT RESET AFTER CANCELLATION

1) Check trouble codes, see SELF-DIAGNOSTICS under DIAGNOSIS & TESTING. If no trouble codes are stored, ensure cruise control can be set.

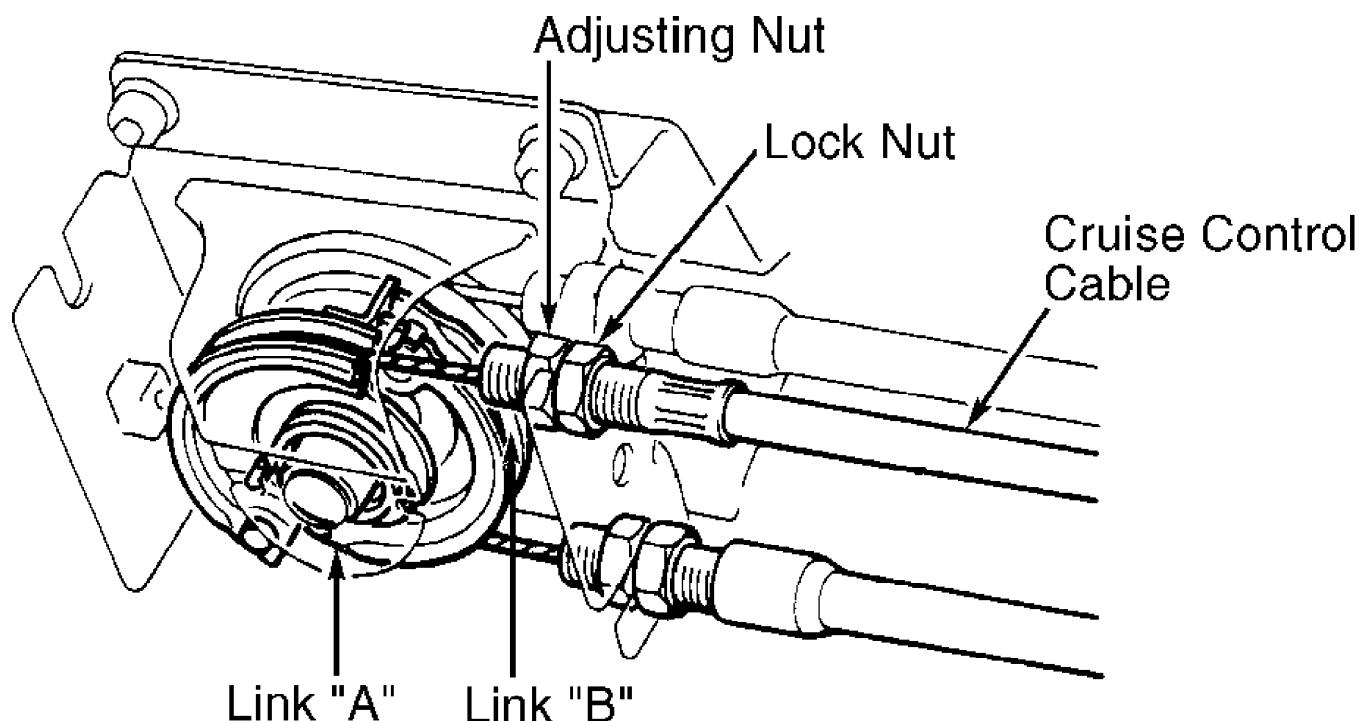
2) If cruise control can be set, system may have canceled because of driving on steep hills or loose wiring connection. If cruise control still cannot be set, perform SYSTEM INPUT TESTS under DIAGNOSIS & TESTING.

3) If SYSTEM INPUT TESTS check okay, check vacuum pump circuit. See TEST NO. 6 under CIRCUIT TESTS. If SYSTEM INPUT TESTS do not check okay, see INPUT CODE CHART. See Fig. 4.

ADJUSTMENTS

CRUISE CONTROL CABLE

Remove link protector. Loosen lock nut. Hold link "A" so that it touches link "B". Adjust free play by turning adjusting nut until free play is .04-.08" (1-2 mm). Tighten lock nut. See Fig. 1.



93H02205

Fig. 1: Adjusting Cruise Control Cable
Courtesy of Mitsubishi Motor Sales of America

DIAGNOSIS & TESTING

CRUISE CONTROL SWITCH FUNCTION TEST

NOTE: If vehicle speed decreases approximately 9 MPH below 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 ignition on. Turn cruise control switch to ON position. Ensure switch indicator light comes on.

NOTE: Speed will not set beyond system limit of 90 MPH.

2) With cruise control switch in ON position, drive vehicle between 25 and 90 MPH. Press and release SET button. Vehicle speed should stay at set speed. Instrument cluster cruise indicator light should come on. To increase set speed, turn 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 from ON to OFF position. Vehicle speed should return to previous setting before cancellation. Set speed should cancel when any of the following occurs:

- * Brake pedal is pressed.
- * Clutch pedal is pressed.
- * Transmission is shifted to Neutral or Park.
- * Cruise control main switch is turned to OFF position.
- * Ignition switch is turned to OFF position.

SELF-DIAGNOSTICS

1) Self-diagnostics should be performed when cruise control cancels without the driver using normal cancel modes. Diagnosis connector is located on right side of fuse box. Use analog voltmeter or Scan Tester (MB991341) for code retrieval.

2) Use scan tester according to operating instructions provided with tester. Connect leads of analog voltmeter between cruise control terminal and ground terminal of data link connector. See Fig. 2. Read voltmeter needle sweeps to determine trouble code.

3) Once trouble codes have been displayed, see SELF-DIAGNOSTIC CODE CHART to determine appropriate CIRCUIT TEST. See Fig. 3.

4) To clear trouble codes, either disconnect battery cable or turn ignition on. Turn main cruise control switch and set switch to ON position. Within one second turn resume switch to ON position.

5) Hold stoplight switch and cruise control switch in ON position for more than 5 seconds. Verify codes are cleared.

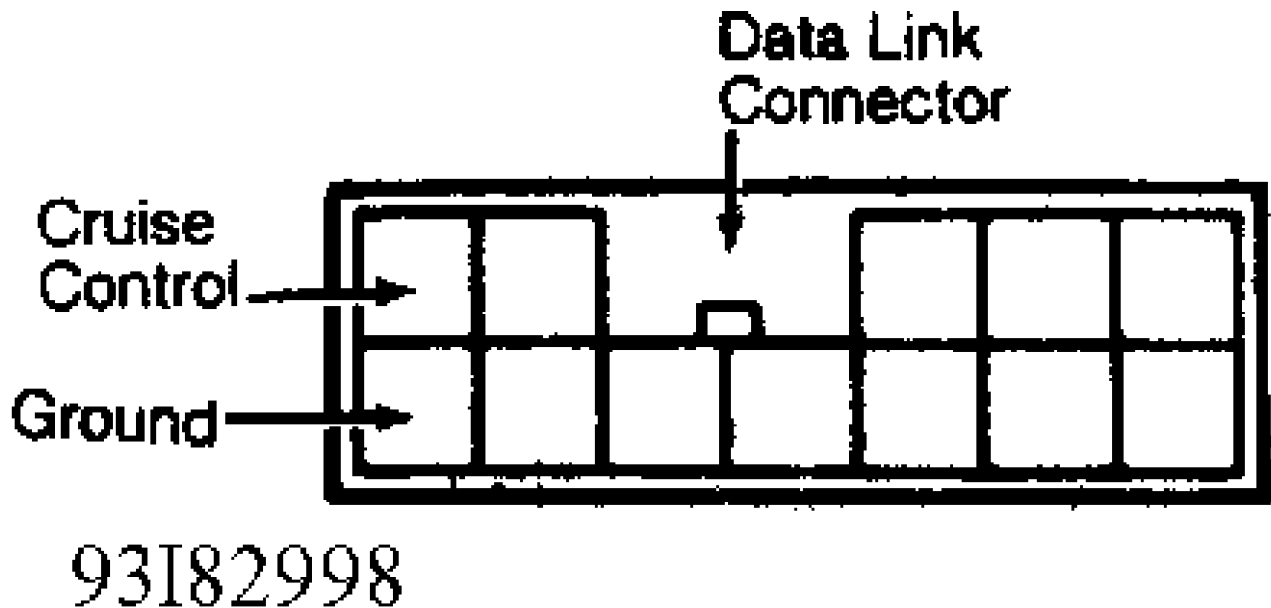


Fig. 2: Data Link Connector Terminal ID
Courtesy of Mitsubishi Motor Sales of America

Code No.	Display patterns (output codes) (Use with voltmeter)	Probable cause	Circuit Test
11		Abnormal condition of motor-driven vacuum pump system	No. 6
12		Abnormal condition of vehicle-speed signal system	No. 5
15		Control switch malfunction (when SET and RESUME switches switched ON simultaneously.)	No. 2, 3
16		Abnormal condition of ECU	No. 7, 8, 9
17		Abnormal condition of throttle position sensor Abnormal condition of idle switch	No. 11

93E02195

Fig. 3: Self-Diagnostic Code Chart
Courtesy of Mitsubishi Motor Sales of America

SYSTEM INPUT TESTS

1) System input tests should be performed if no trouble codes are stored when performing SELF-DIAGNOSTICS. System input tests cycle each cruise control switch and sensor.

2) Use Scan Tester (MB991341) for system input check. Use scan tester according to operating instructions provided with tester. Connect leads of analog voltmeter between cruise control terminal and ground terminal of data link connector. See Fig. 2. Turn ignition switch to ON position. Follow INPUT CODE CHART sequence. See Fig. 4.

3) To display results of input check, move SET switch to ON position. Then turn MAIN switch to ON position. Within one second, activate RESUME switch. Codes will display if circuit tested is okay.

Check No	Input operation	Code No	Display patterns (output codes) (with voltmeter)	Check results
1	SET switch ON	21		SET switch circuit normal
2	RESUME switch ON	22		RESUME switch circuit normal
3	Stop light switch (brake pedal depressed)	23		Stop light switch normal
4	Driving at approximately to 40 km/h (25 mph) or higher	24		When both No. 4 and No. 5 can be confirmed, vehicle-speed sensor circuit normal.
5	Driving at less than approximately to 40 km/h (25 mph)	25		
6	1. Clutch switch ON (clutch pedal depressed) <M/T> 2. Inhibitor switch ON (selector lever to "N" range) <A/T>	26		Clutch switch or inhibitor switch normal
7	CANCEL switch ON	27		CANCEL switch circuit normal
8	Throttle position sensor output (when the accelerator pedal is pressed more than half way)	28		Throttle position sensor normal
9	Idle switch OFF (accelerator pedal depressed)	29		idle switch normal

93I02197

Fig. 4: Input Code Chart
Courtesy of Mitsubishi Motor Sales of America

Check results	Probable cause	Remedy	Circuit Test
Code 21 remains even though SET switch is set to OFF.	SET switch ON malfunction	Replace the control switch.	No. 2
	SET switch input line short-circuit	Repair the harness.	
Code 22 remains even though RESUME switch is set to OFF.	RESUME switch ON malfunction	Replace the control switch.	No. 3
	RESUME switch input line short-circuit	Repair the harness.	
Code 23 remains even if the stop light switch is turned OFF by releasing the brake pedal.	Malfunction of stop light switch circuit.	Replace stop light switch or repair harness.	No. 7
Code 25 remains, and code 24 does not appear, even though vehicle speed reaches approximately 40 km/h (25 mph) or higher.	Malfunction of the vehicle-speed sensor circuit (damaged or disconnected wiring, or short-circuit)	Check or repair the vehicle speed sensor circuit.	No. 5
Code 26 remains even if the clutch switch is turned OFF by releasing the clutch pedal. <M/T>	Malfunction of clutch switch circuit.	Replace clutch switch or repair harness.	No. 8
Code 26 remains even if the selector lever is moved to anything but N, P. <A/T>	Malfunction of inhibitor switch circuit.	Replace inhibitor switch or repair harness.	No. 9
Code 27 remains even though CANCEL switch is set to OFF.	Malfunction of CANCEL switch circuit.	Replace the control switch or repair harness.	No. 4
Code 28 remains even if the accelerator is released.	Malfunction of throttle position sensor circuit.	Replace the sensor or repair harness.	No. 11
Code 29 remains even though the idle switch is set to ON.	Malfunction of idle switch circuit	Replace the switch or repair harness.	No. 11

93I02201

Fig. 5: Check Results Chart
 Courtesy of Mitsubishi Motor Sales of America

Trouble symptom	Probable cause	Circuit Test	Remedy
- The set vehicle speed varies greatly upward or downward. "Hunching" (repeated alternating acceleration and deceleration) occurs after setting is made.	Malfunction of the vehicle speed sensor circuit	No. 5	Repair the vehicle speed sensor system, or replace the part.
	Malfunction of the speedometer cable or speedometer drive gear		
	Motor-driven vacuum pump circuit poor contact	No. 6	Repair the motor-driven vacuum pump or replace the part.
	Malfunction of the motor-driven vacuum pump		
	Malfunction of the ECU	—	Replace the ECU.
The auto-cruise control system is not canceled when the brake pedal is depressed.	Damaged or disconnected wiring of the stop light switch input circuit or stop light switch (for auto-cruise control) poor contact (short-circuit)	No. 7	Repair the harness or replace the stop light switch.
	Motor-driven vacuum pump drive circuit short-circuit	No. 6	Repair the harness or replace the motor-driven vacuum pump.
	Malfunction of the ECU	—	Replace the ECU.
The auto-cruise control system is not canceled when the clutch pedal is depressed. <M/T> (It is canceled, however, when the brake pedal is depressed.)	Damaged or disconnected wiring of clutch switch input circuit	No. 8	Repair the harness, or repair or replace the clutch switch.
	Clutch switch improper installation (won't switch ON)		
	Malfunction of the ECU	—	Replace the ECU.
The auto-cruise control system is not canceled when the selector lever is moved to the "N" position. <A/T> (It is canceled, however, when the brake pedal is depressed.)	Damaged or disconnected wiring of inhibitor switch input circuit	No. 9	Repair the harness, or repair or replace the inhibitor switch.
	Improper adjustment of inhibitor switch		
	Malfunction of the ECU	—	Replace the ECU.

93A02202

Fig. 6: Symptom Chart (1 Of 2)
 Courtesy of Mitsubishi Motor Sales of America

Trouble symptom	Probable cause	Circuit Test	Remedy
Cannot decelerate by using the SET switch	Temporary damaged or disconnected wiring of SET switch input circuit	No. 2	Repair the harness or replace the control switch.
	Motor-driven vacuum pump circuit poor contact	No. 6	Repair the harness or replace the motor-driven vacuum pump.
	Malfunction of the auto-cruise actuator		
	Malfunction of the ECU	—	Replace the ECU.
Cannot accelerate or resume speed by using the RESUME switch.	Damaged or disconnected wiring, or short-circuit, of RESUME switch input circuit	No. 3	Repair the harness or replace the control switch.
	Motor-driven vacuum pump circuit poor contact	No. 6	Repair the harness or replace the motor-driven vacuum pump.
	Malfunction of the motor-driven vacuum pump		
	Malfunction of the ECU	—	Replace the ECU.
Auto-cruise control system can be set while traveling at a vehicle speed of less than 40 km/h (25 mph), or there is no automatic cancellation at that speed.	Malfunction of the vehicle-speed sensor circuit	No. 5	Repair the vehicle-speed sensor system, or replace the part.
	Malfunction of the speedometer cable or the speedometer drive gear		
	Malfunction of the ECU	—	Replace the ECU.
The indicator light of the main switch does not illuminate. (But auto-cruise control system is normal.)	Damaged or disconnected bulb of indicator light or malfunction of the main switch	—	Repair the harness or replace the main switch.
	Harness damaged or disconnected		
Overdrive is not canceled during fixed speed driving. <A/T>	Malfunction of circuit related to overdrive cancelation, or malfunction of ECU	No. 10	Repair the harness or replace the part.
No shift to overdrive during manual driving. <A/T>			

93C02203

Fig. 7: Symptom Chart (2 Of 2)

Courtesy of Mitsubishi Motor Sales of America

CIRCUIT TESTS

NOTE: To identify circuit connector terminals, see Figs. 8-15. See appropriate wiring diagram in the WIRING DIAGRAMS section.

Test No. 1 (Power & Ground Circuit)

1) Turn ignition on. When cruise control main switch is turned to ON position, battery voltage should be present on terminal No. 2 of cruise control unit connector.

2) If voltage is not present, check fuse No. 11 and replace as necessary. If fuse is okay, check and repair harness as necessary. Terminal No. 8 should be grounded at all times. If terminal No. 8 is not grounded, repair harness.

Test No. 2 (Set Switch Circuits)

When set switch is turned to ON position, 3 volts should be present on terminal No. 18 of cruise control unit. When set switch is turned to OFF position, voltage should not be present on terminal No. 18 of cruise control unit. If circuit does not test correctly, replace switch as necessary or repair harness.

Test No. 3 (Resume Switch Circuit)

When resume switch is turned to ON position, 6 volts should be present on terminal No. 18 of cruise control unit. When resume switch is turned to OFF position, voltage should not be present on terminal No. 18 of cruise control unit. If circuit does not test correctly, replace switch as necessary or repair harness.

Test No. 4 (Cancel Switch Circuit)

When cancel switch is turned to On position, battery voltage should be present on terminal No. 18 of cruise control unit. When cancel switch is in OFF position, voltage should not be present on terminal No. 18 of cruise control unit. If circuit does not test correctly, replace switch as necessary or repair harness.

Test No. 5 (Vehicle Speed Sensor Circuit)

When vehicle moves slowly, voltage should alternate between zero and 2 or more volts at terminal No. 19 of cruise control unit. If circuit does not test correctly, replace sensor as necessary or repair harness.

Test No. 6 (Vacuum Pump Circuit)

1) When cruise system is in deceleration or release mode, battery voltage should be present on terminals No. 26 and 13 of cruise control unit. If circuit does not test correctly, replace vacuum pump as necessary or repair harness.

2) When cruise system is in release mode, battery voltage should be present on terminal No. 12 of cruise control unit. When cruise system is in hold mode, voltage on terminals No. 12, 13 and 26 will go from battery voltage to zero volts depending on driving conditions. If circuit does not test correctly, replace vacuum pump as necessary or repair harness.

Test No. 7 (Stoplight Switch Circuit)

When brake pedal is pressed, battery voltage should be present on terminal No. 15 of cruise control unit. If voltage is not present, adjust or replace brake switch. If circuit does not test correctly, replace switch as necessary or repair harness.

Test No. 8 (Clutch Switch Circuit)

When clutch pedal is pressed, battery voltage should be present at terminal No. 1 of cruise control unit. If circuit does not test correctly, replace switch as necessary or repair harness.

Test No. 9 (Inhibitor Switch Circuit)

When transmission is in Neutral position, battery voltage should be present on terminal No. 1 of cruise control unit. If circuit does not test correctly, replace switch as necessary or repair

harness.

Test No. 10 (Overdrive Switch Circuit)

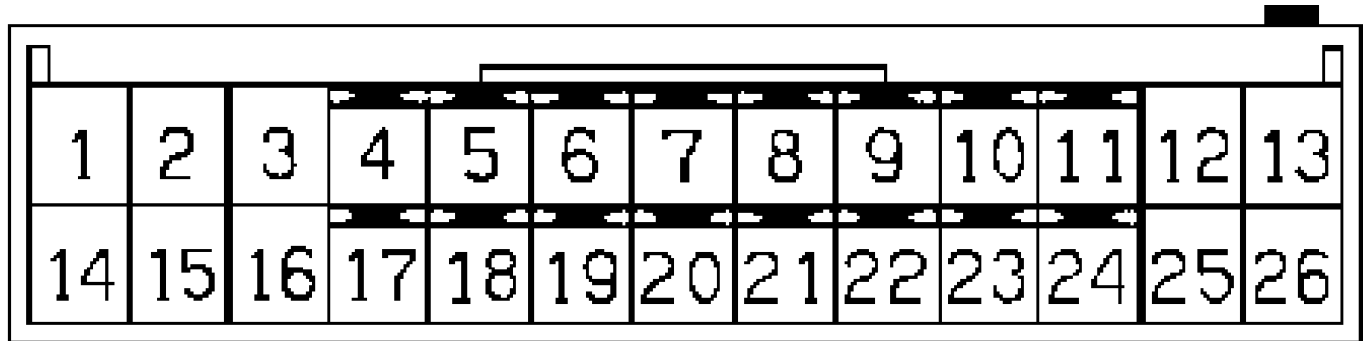
When overdrive switch is pushed to ON position, battery voltage should be present on terminal No. 11 of cruise control unit. If circuit does not test correctly, replace switch as necessary or repair harness.

Test No. 11 (Idle Switch & Throttle Position Sensor Circuit)

1) When accelerator pedal is pressed, 4.5-5.5 volts should be present on terminal No. 4 (idle switch) of cruise control unit. When accelerator pedal is released, voltage should not be present on terminal No. 4 of cruise control unit.

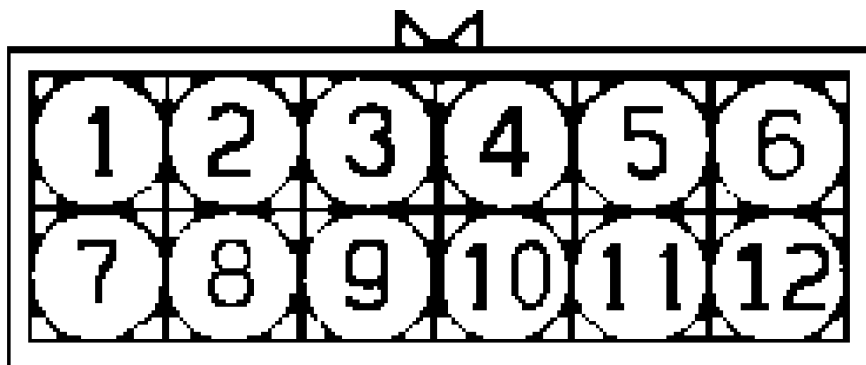
2) When accelerator pedal is pressed to wide open throttle, 4.0-5.5 volts should be present on terminal No. 5 (throttle position sensor) of cruise control unit. When accelerator pedal is released, .5-.7 volt should be present on terminal No. 5 of cruise control unit. If circuit does not test correctly, replace sensor as necessary or repair harness.

CRUISE CONTROL CONNECTOR ID



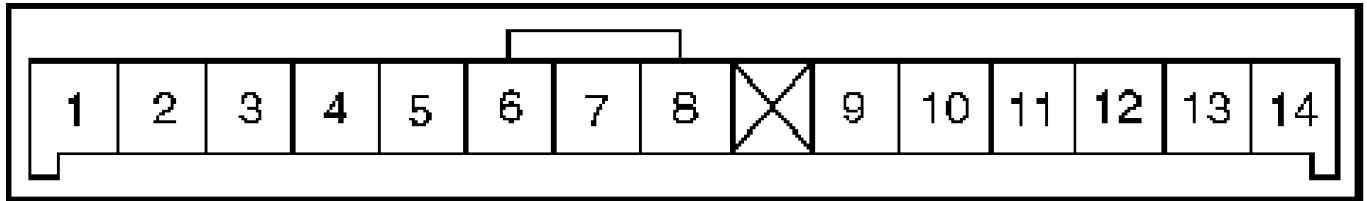
93J02211

Fig. 8: Cruise Control Unit Connector Terminal ID
 Courtesy of Mitsubishi Motor Sales of America.



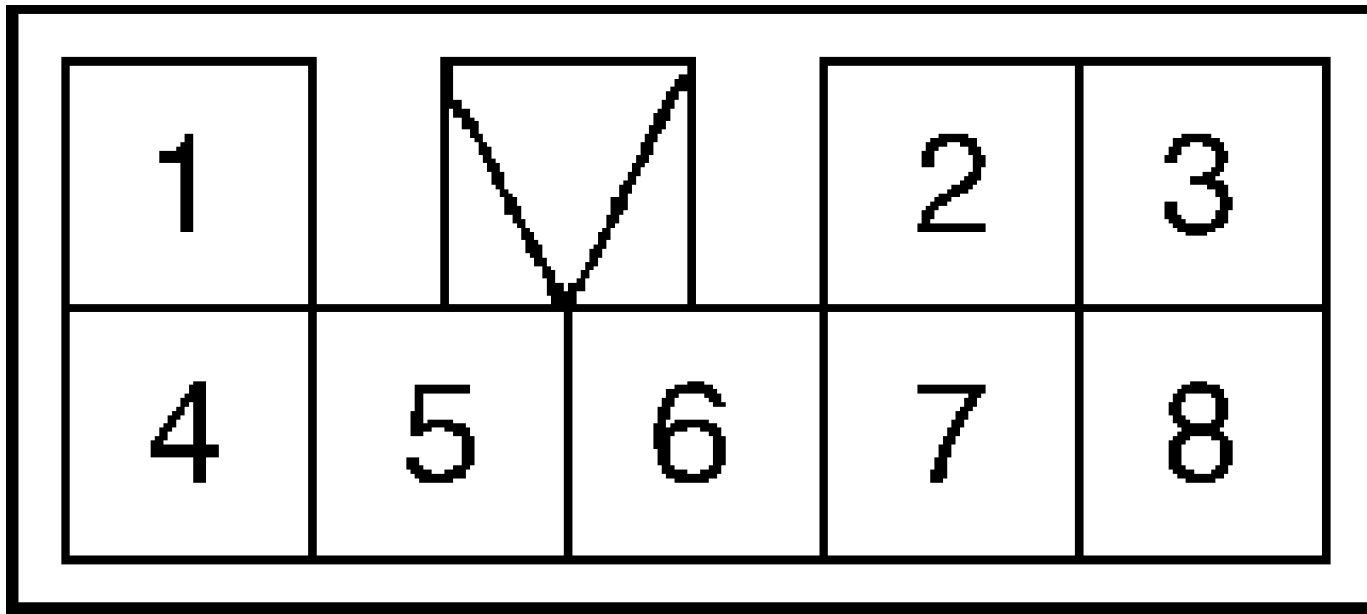
93C02217

Fig. 9: Main Cruise Control Switch Connector Terminal ID
 Courtesy of Mitsubishi Motor Sales of America.



93I02215

Fig. 10: Stoplight Switch Connector Terminal ID
 Courtesy of Mitsubishi Motor Sales of America.



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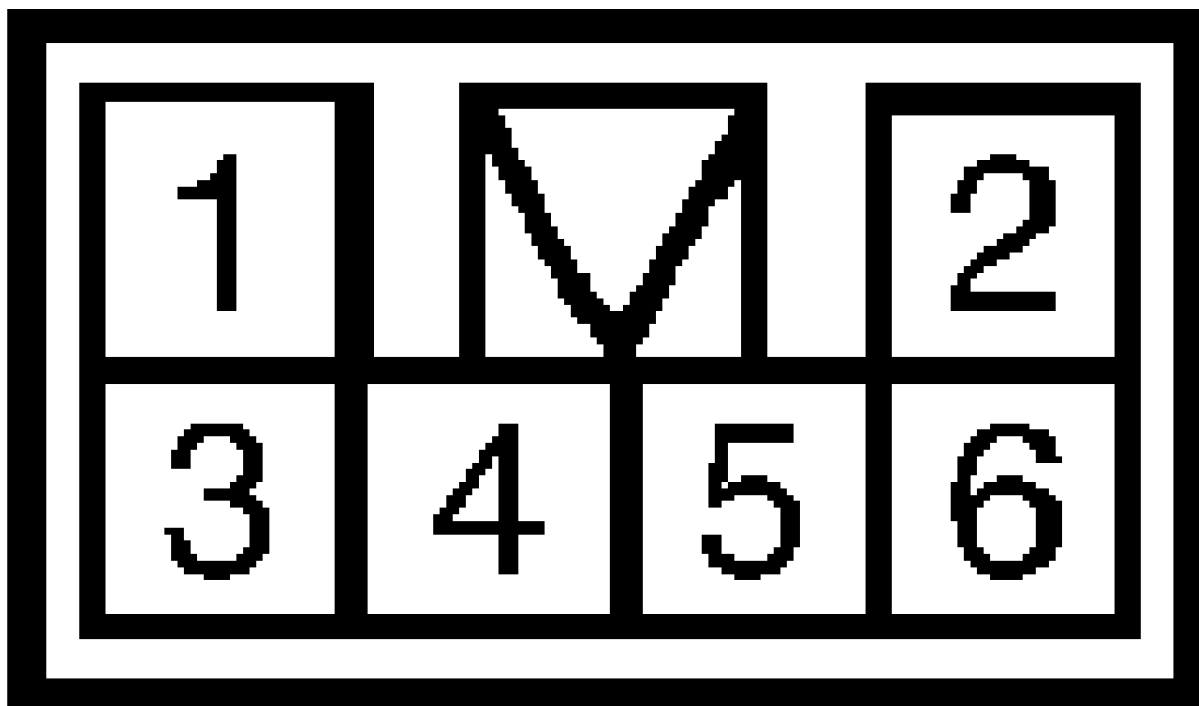
Fig. 11: Vacuum Pump Connector Terminal ID
 Courtesy of Mitsubishi Motor Sales of America.



OVERDRIVE SWITCH
 CONNECTOR

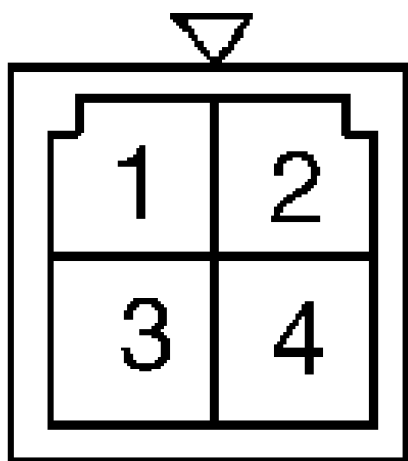
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Fig. 12: Instrument Cluster Connector Terminal ID
 Courtesy of Mitsubishi Motor Sales of America.



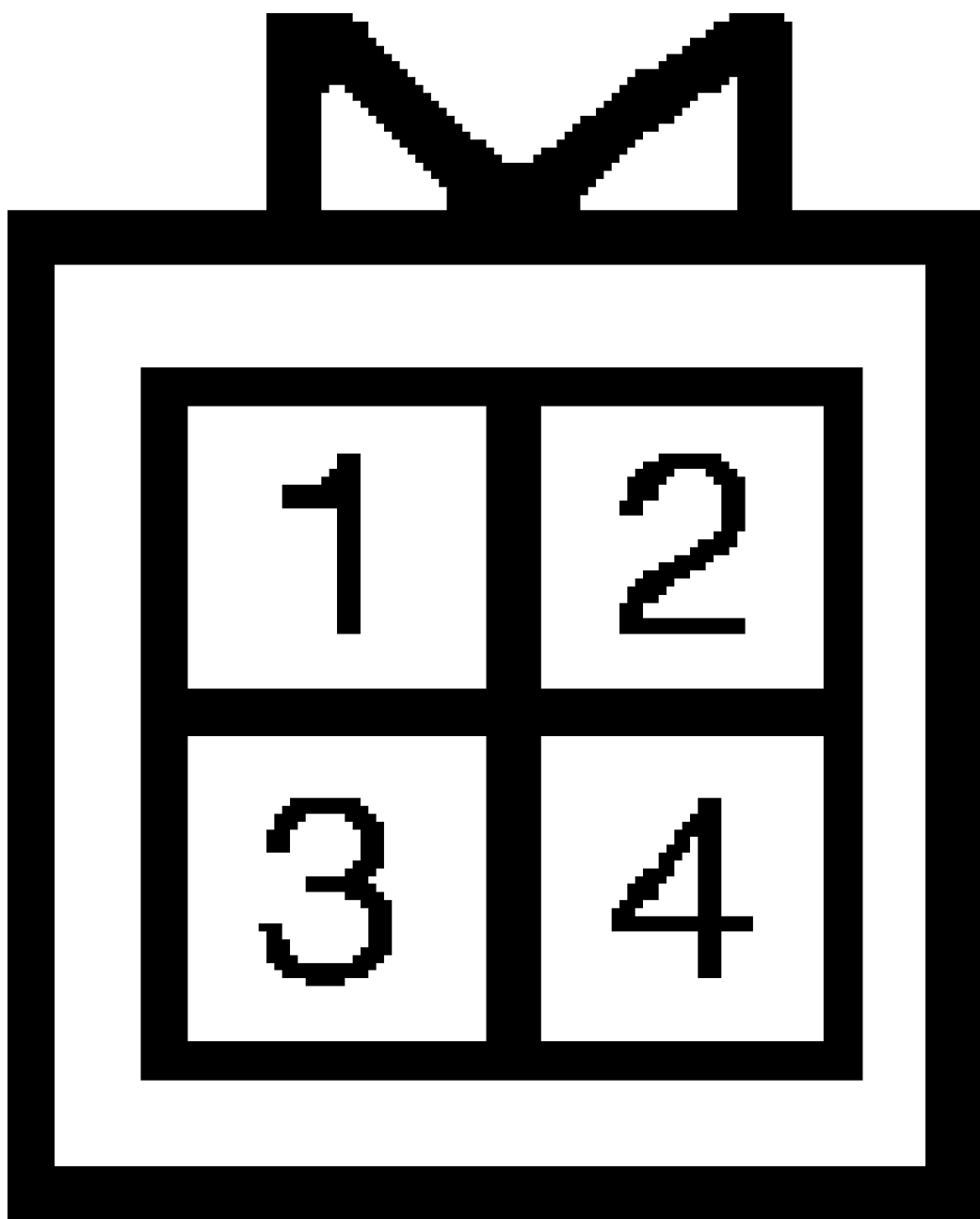
93E02218

Fig. 13: Overdrive Switch Connector Terminal ID
Courtesy of Mitsubishi Motor Sales of America.



93D02213

Fig. 14: Inhibitor Switch Connector Terminal ID
Courtesy of Mitsubishi Motor Sales of America.



93F02214

Fig. 15: Throttle Position Sensor & Idle Switch Connector Terminal ID
Courtesy of Mitsubishi Motor Sales of America.

CRUISE CONTROL SWITCH TESTS

Set & Resume Switches

1) Remove lower steering column cover. Disconnect 2-pin switch connector. Operate and test switch. When cancel switch is operated, continuity should be present between terminals No. 1 and 2. Zero ohms resistance should be indicated.

2) When resume switch is operated, 820 ohms resistance should be present between terminals No. 1 and 2. When set switch is operated, 2700 ohms resistance should be present between terminals No. 1 and 2. Replace cruise control switch if it does not test correctly.

Main Switch

1) In each switch position, continuity should be present between terminals No. 2 and 7 for switch illumination. See Fig. 9. When switch is moved to Neutral position, continuity should be present between terminals No. 1 and 4.

2) When switch is moved to ON position, continuity should be present between terminals No. 1, 4 and 5. Connect battery voltage to terminal No. 5 and ground terminal No. 4.

3) Battery voltage should be present on terminal No. 1 when main switch is moved to ON position. Replace switch if it does not test correctly.

BRAKELIGHT/STOPLIGHT SWITCH TEST

Disconnect switch connector. When brake pedal is pressed, continuity should be present between terminals No. 2 and 3. See Fig. 10. When brake pedal is released, continuity should be present between terminals No. 1 and 4. Replace switch if it does not test correctly.

IDLE SWITCH & THROTTLE POSITION SENSOR TESTS

Throttle Position Sensor

1) Disconnect sensor connector. Resistance between terminals No. 1 and 4 should be 3500–6500 ohms. Use an analog ohmmeter to measure resistance between terminals No. 1 and 3. See Fig. 15.

2) Slowly open throttle valve to wide open throttle. Resistance should change smoothly as throttle is opened. Replace throttle position sensor if it does not test correctly.

Idle Switch

1) Disconnect throttle position sensor connector. Continuity should be present between terminals No. 1 and 2 with accelerator pedal released. See Fig. 15. Continuity should not be present with accelerator pedal pressed.

2) If continuity is not present with accelerator released, loosen throttle position sensor mounting screw. Turn throttle position sensor completely clockwise. Recheck continuity. Replace throttle position sensor if idle switch does not test correctly.

INHIBITOR SWITCH TEST

Disconnect switch connector. Shift transaxle into Neutral and Park positions. Continuity should be present between terminals No. 7 and 12. See Fig. 14. If continuity is not present, adjust inhibitor switch. If switch is adjusted properly, replace switch.

VACUUM PUMP TEST

1) Remove vacuum pump connector. Resistance should be 50–60 ohms between terminal No. 1 and terminals No. 2 and 3. See Fig. 11. Ensure solenoid valve makes operating noise when battery voltage is

applied between terminal No. 1 and terminals No. 2 and 3.

2) If solenoid valve does not make noise, replace vacuum pump assembly. Apply battery voltage to terminals No. 1 and 4, motor should operate. Replace vacuum pump if motor does not operate.

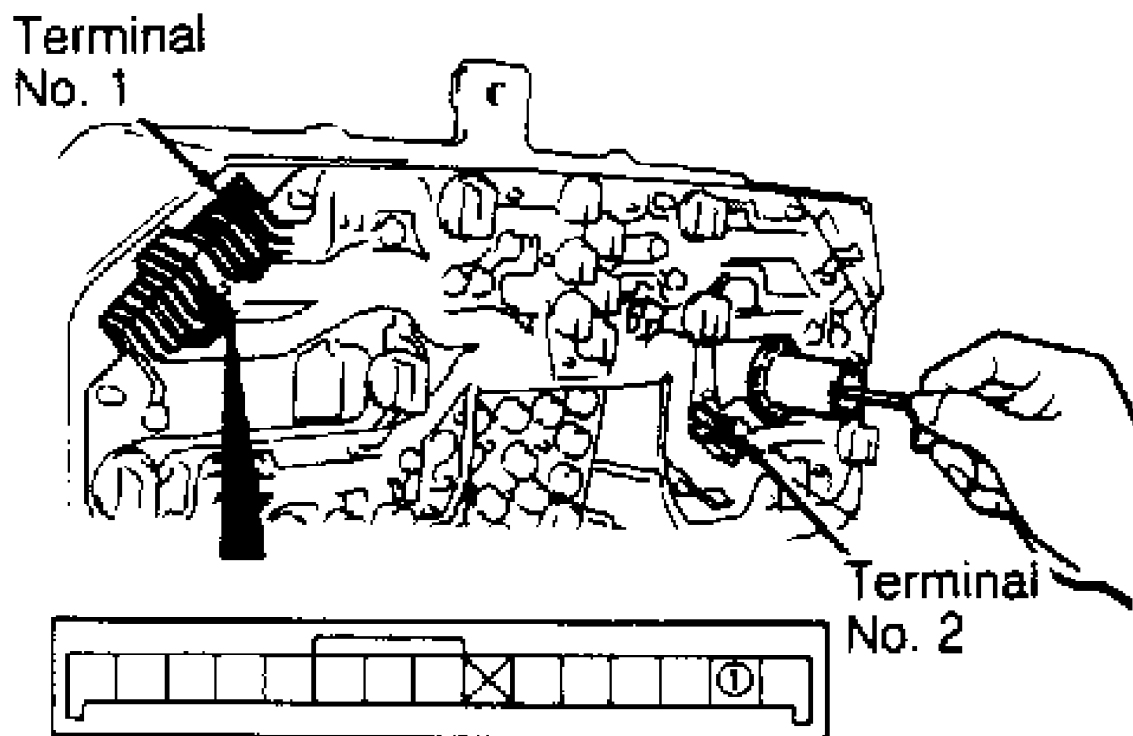
ACTUATOR TESTS

Remove actuator. Apply vacuum to actuator. Actuator linkage holder should move more than 1.38" (35 mm). Actuator diaphragm should hold vacuum. Replace actuator if actuator does not test correctly.

VEHICLE SPEED SENSOR TEST

1) Remove instrument cluster. See INSTRUMENT CLUSTER under REMOVAL & INSTALLATION. Check continuity between vehicle speed sensor terminals at instrument cluster. See Fig. 16.

2) Ensure continuity pulses on and off 4 times per revolution of speedometer shaft connection. If continuity is not as specified, replace vehicle speed sensor.



93I02220

MONTERO

Fig. 16: Checking Speed Sensor Circuit
Courtesy of Mitsubishi Motor Sales of America

REMOVAL & INSTALLATION

ACTUATOR

Removal & Installation

Disconnect cruise control cable from link. Disconnect actuator wiring connector. Remove vacuum pump and vacuum pump bracket. Remove actuator and actuator bracket. To install, reverse removal procedure.

CRUISE CONTROL SWITCH

Removal & Installation

Remove lower steering column cover. Disconnect electrical connectors. Remove screws attaching cruise control switch to steering column. Remove switch. To install, reverse removal procedure.

VEHICLE SPEED SENSOR

Removal & Installation

Remove instrument cluster. See INSTRUMENT CLUSTER. Speed sensor is a part of speedometer.

INSTRUMENT CLUSTER

Removal & Installation

Disconnect negative battery cable. Remove cluster cover. Disconnect speedometer cable. Remove instrument cluster. To install, reverse removal procedure.

CONTROL UNIT

Removal & Installation

Cruise control unit is located behind center of dash panel. Remove center trim panel and radio or radio plug bezel. Remove control unit. To install, reverse removal procedure.

WIRING DIAGRAMS

See appropriate chassis wiring diagram in the WIRING DIAGRAMS section.

DEFOGGER - REAR WINDOW

1993 Mitsubishi Montero

1993 ACCESSORIES/SAFETY EQUIPMENT
Mitsubishi Rear Window Defoggers

Montero

DESCRIPTION & OPERATION

The rear window defogger is a heating filament grid bonded to the inside of the window. Heat is regulated by a control switch located on the instrument panel.

TROUBLE SHOOTING

DEFOGGER DOES NOT WORK

Check for blown fuse, poor contact, defective defogger switch, poor connection or open wire.

DEFOGGER TIMER INOPERATIVE

Check defogger switch. Timer is integrated into defogger switch.

INDICATOR LIGHT DOES NOT WORK

Check for burned out bulb, open wire or poor connection.

INDICATOR LIGHT IS DIM

Check rheostat or indicator bulb.

TESTING

NOTE: Testing information for all components on all vehicles is not available from manufacturer.

DEFOGGER RELAY TEST

1) Remove defogger relay, located in right front corner of engine compartment. Ground relay terminal No. 3, and apply battery voltage to terminal No. 5. 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. 1 and 2. Ensure continuity exists between terminals No. 3 and 5. See Fig. 1. Replace relay if it does not test as specified.



DIAMANTE, ECLIPSE,
MONTERO, STEALTH
& 3000GT

93D82340

Fig. 1: Defogger Relay Terminal ID
Courtesy of Mitsubishi Motor Sales of America.

DEFOGGER SWITCH TEST

NOTE: Remove window defogger switch and disconnect switch connector for the following test.

Turn defogger switch to OFF position. Check switch continuity using ohmmeter. 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, 4 and 5, and between terminals No. 2 and 6. See Fig. 2. Replace Switch if it does not test as specified.



DIAMANTE, ECLIPSE,
GALANT & MONTERO

93H82336

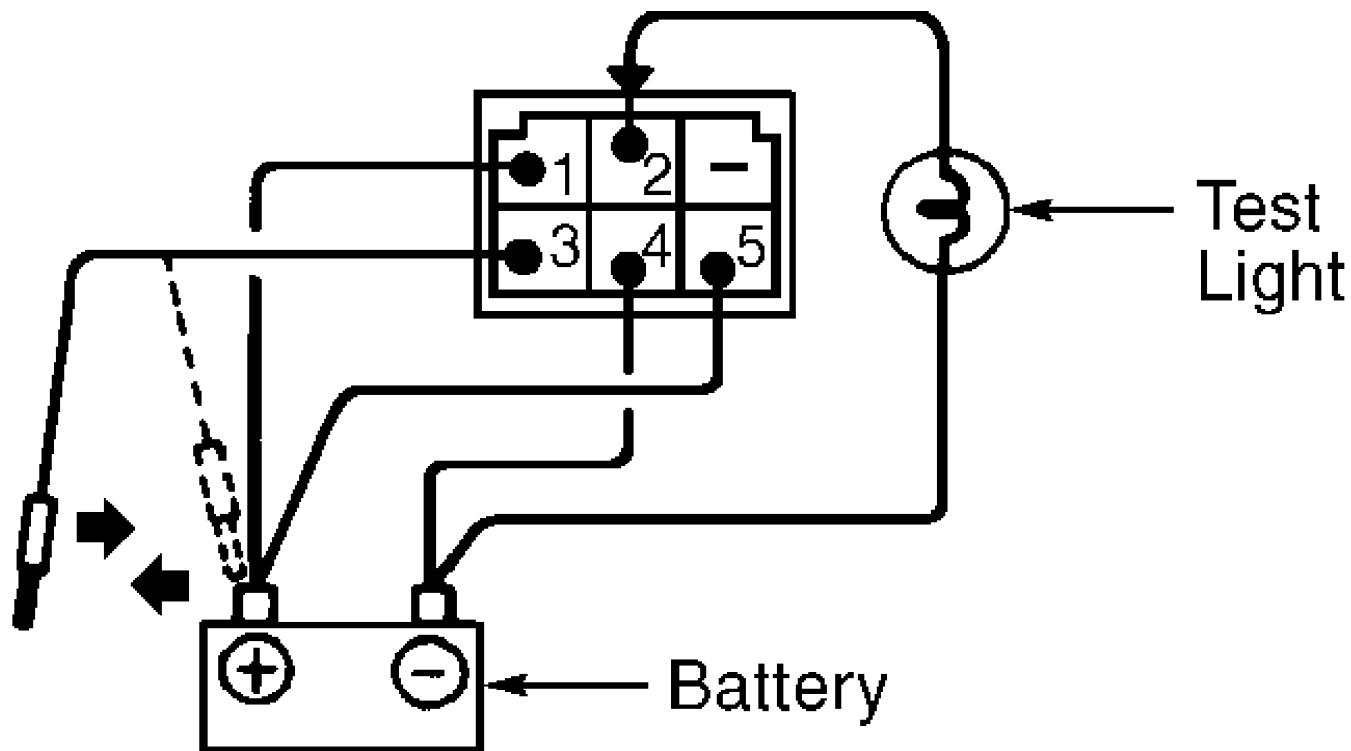
Fig. 2: Defogger Switch Terminal ID
Courtesy of Mitsubishi Motor Sales of America.

DEFOGGER TIMER TEST

1) Remove defogger timer from interior relay block. Connect battery voltage and test light to timer. See Fig. 3. Ensure test light

illuminates for approximately 11 seconds when battery voltage is applied to terminal No. 3.

2) Reapply battery voltage to terminal No. 3. and observe test light. Test light should go off. Replace timer if it does not test as specified.



93F82342

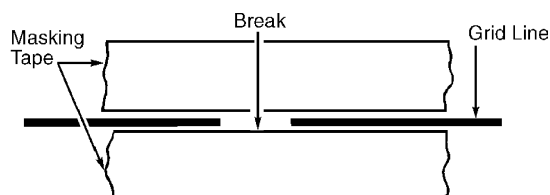
Fig. 3: Defogger Timer Terminal ID
Courtesy of Mitsubishi Motor Sales of America.

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 grid filament.

2) If voltage is approximately 6 volts, grid filament is okay. If voltage is approximately 12 volts, an open is present in the negative circuit. Move probe slowly toward the negative terminal to determine location of open circuit.

3) If voltage is zero volt, an open is present in the positive circuit. Move probe slowly toward the positive terminal to determine location of open circuit. Repair grid as necessary. See Fig. 4.



G92A01033

Fig. 4: Repairing Rear Defogger Grid Element

WIRING DIAGRAMS

See appropriate chassis wiring diagram in the WIRING DIAGRAMS section.

DIFFERENTIAL & AXLE SHAFTS - FRONT

1993 Mitsubishi Montero

1993 Drive Axles - Differentials & Axle Shafts - Front

Ram-50 4WD, Montero, Pickup 4WD

DESCRIPTION & OPERATION

Front axle assembly consists of differential carrier, housing tube, inner shaft and drive axles. See Fig. 1. A full-floating axle design is used. Drive axles are flexible assemblies made up of inner and outer CV joints. Birfield Joints (BJ) and Double Offset Joints (DOJ) are used at opposite ends of each drive axle.

AXLE RATIO & IDENTIFICATION

AXLE RATIO SPECIFICATIONS TABLE

Application	Ratio
Montero	
LT31X10.50R15 Tire	4.88:1
P235/75R15 Tire	4.63:1
Pickup & Ram-50	4.22:1

LUBRICATION

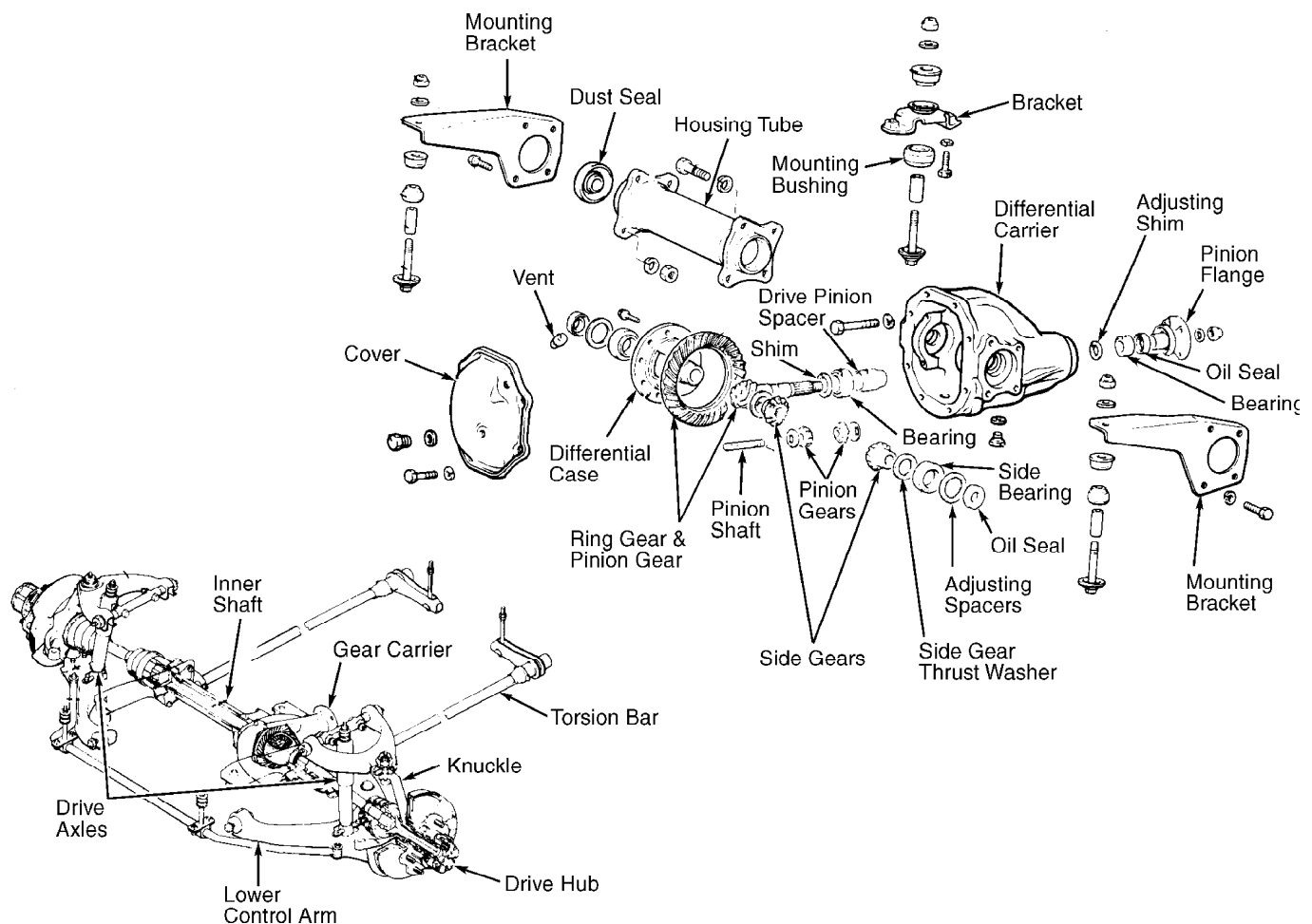
CAPACITY

DIFFERENTIAL FLUID CAPACITY TABLE

Application	Specification
Montero	2.6 Pts. (1.2L)
Pickup & Ram-50	2.3 Pts. (1.1L)

FLUID TYPE

All models use fluid type SAE 80W-90/API GL-5.



93101145
Fig. 1: View Of Front Differential Assembly & Suspension Components
Courtesy of Mitsubishi Motor Sales of America.

TROUBLE SHOOTING

See TROUBLE SHOOTING - BASIC PROCEDURES article in GENERAL INFORMATION section.

REMOVAL & INSTALLATION

DRIVE AXLES

Removal

1) Raise and support vehicle. Remove wheels and undercover. Ensure hub is in free-wheeling position. Place transfer case in 2H position. Remove drive hub cover, snap ring and shim from drive axle. See Fig. 2. Remove brake calipers and support aside.

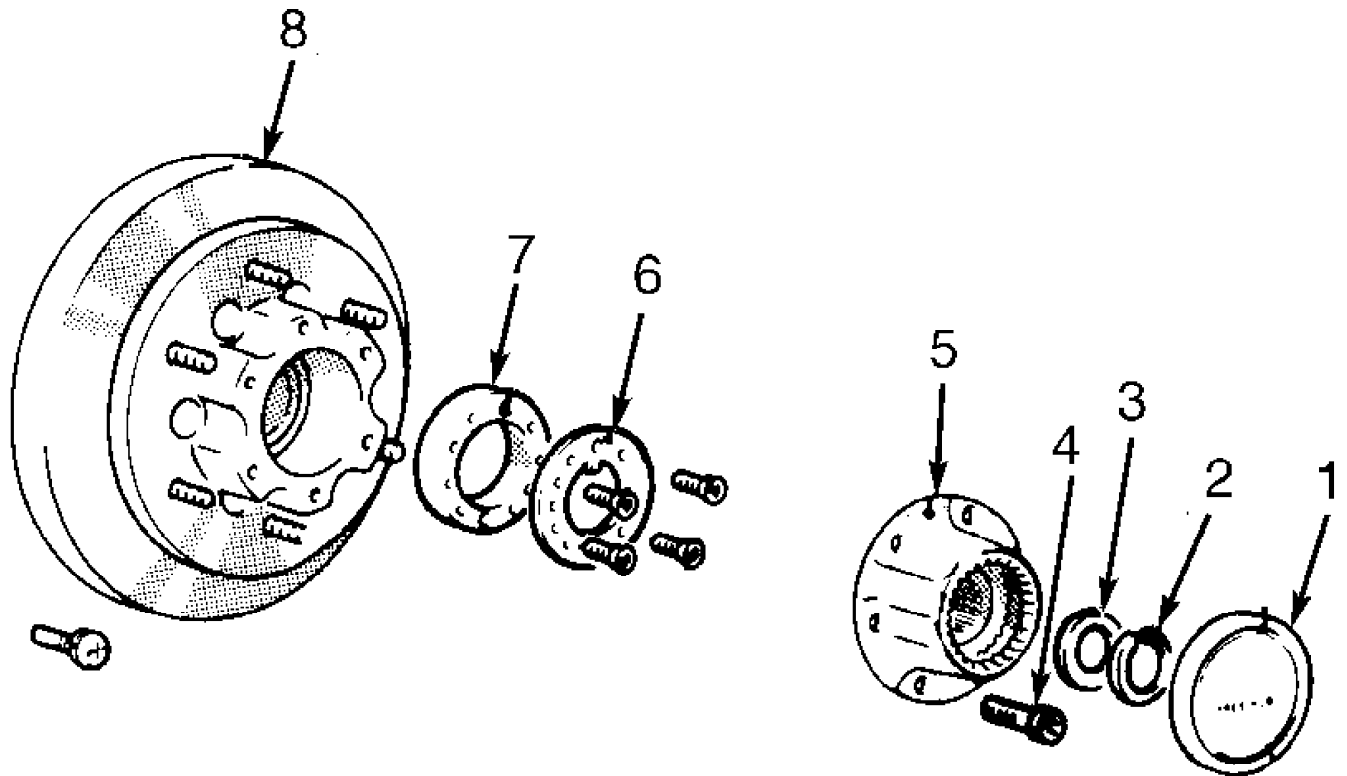
2) Disconnect tie rod assembly. Support lower control arm with jack. Separate ball joints from knuckle. Remove knuckle and front hub assembly. Using flat-blade pry bar, carefully remove left drive axle from differential carrier. DO NOT damage oil seal. On right drive axle, remove drive axle-to-inner shaft flange retaining bolts. Remove right drive axle.

CAUTION: Replace circlips on BJ/DOJ splined shaft end.

Installation

1) Install right drive axle on inner shaft flange. Install new circlip on DOJ side of left drive axle. Carefully install left drive axle into differential. DO NOT damage oil seal.

2) Reinstall knuckle with front hub assembly. To complete installation, reverse removal procedure. Install shim and snap ring. Check axle end play. See Figs. 3 and 4. End play should be .016-.028" (.4-.7 mm) on Montero, .008-.020" (.2-.5 mm) on Pickup and Ram-50. If end play is not within specification, install correct shim.



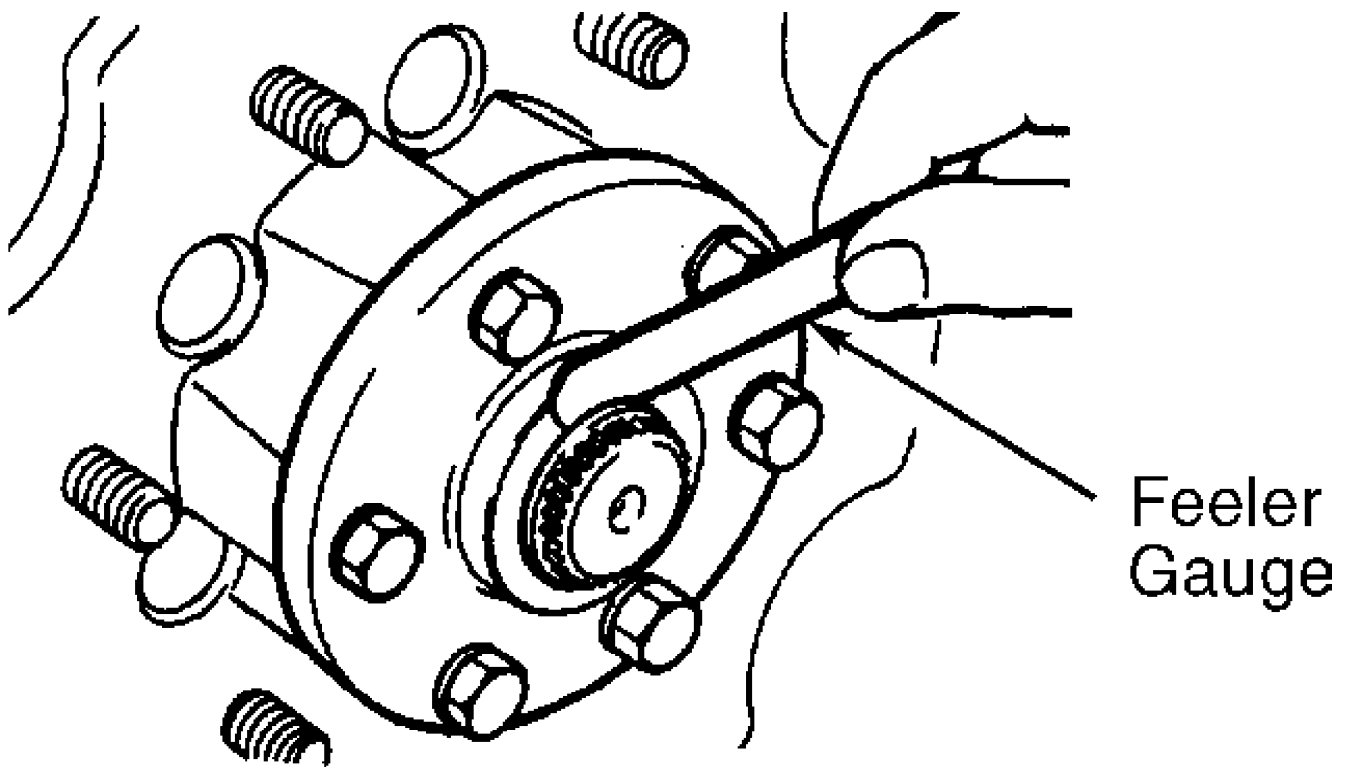
1. Hub Cover
2. Snap Ring
3. Shim
4. Bolt

5. Free Wheel Hub Assembly
6. Lock Washer
7. Lock Nut
8. Hub & Disc Assembly

93A01146

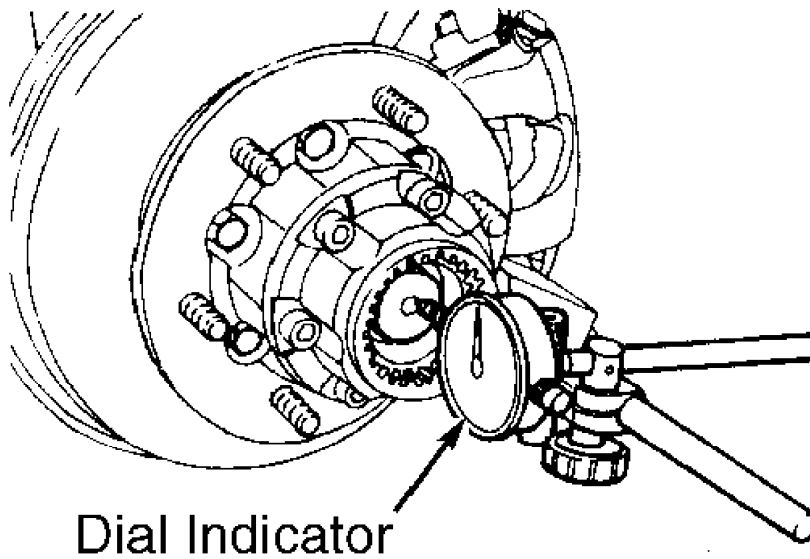
Fig. 2: Exploded View Of Auto-Locking Hub Assembly (Pickup & Ram-50 Shown, Montero Similar)

Courtesy of Mitsubishi Motor Sales of America.



93I82659

Fig. 3: Measuring Axle Shaft End Play (Montero)
 Courtesy of Mitsubishi Motor Sales of America.



93B82660

Fig. 4: Measuring Axle Shaft End Play (Pickup & Ram-50)
 Courtesy of Mitsubishi Motor Sales of America.

DIFFERENTIAL CARRIER ASSEMBLY

Removal

1) Raise and support vehicle. Drain gear oil. Support differential carrier. Remove the drive axles and inner shaft. See DRIVE AXLES and INNER SHAFT & BEARING under REMOVAL & INSTALLATION. Place alignment mark on drive shaft and pinion companion flange for reassembly reference.

2) Remove drive shaft. Remove differential mounting brackets at differential and frame. See Fig. 1. Disconnect front crossmember from frame. Remove differential carrier assembly and front crossmember. Remove differential carrier from front crossmember.

Installation

To install, reverse removal procedure. Align marks on drive shaft and pinion companion flange.

INNER SHAFT & BEARING

Removal

Remove right drive axle. See DRIVE AXLES under REMOVAL & INSTALLATION. Using slide hammer, remove inner shaft from differential carrier. If dust seal replacement is required, pry dust seal from housing tube assembly using a screwdriver. See Fig. 1. To remove bearing, bend outer area of dust cover inward on inner shaft. Press shaft out of bearing. Remove dust cover from shaft.

Inspection

Inspect inner shaft for damaged splines or threads. Inspect bearing for roughness or damage.

Installation

1) Install housing tube. Using Seal Installer (MB990955) and Handle (C-4171), install new dust seal in housing tube. Dust seal must be even with housing tube. Coat seal lip with grease.

2) Using a pipe with O.D. of 2.95" (74.3 mm), wall thickness of .16" (4.0 mm) and overall length of 1.97" (50.0 mm), install dust cover on shaft. Coat inside of dust cover with grease. Press bearing on shaft. Install new circlip on inner shaft. Carefully drive inner shaft into differential. DO NOT damage oil seal. To complete installation, reverse removal procedure.

OVERHAUL

DRIVE AXLES & BEARINGS

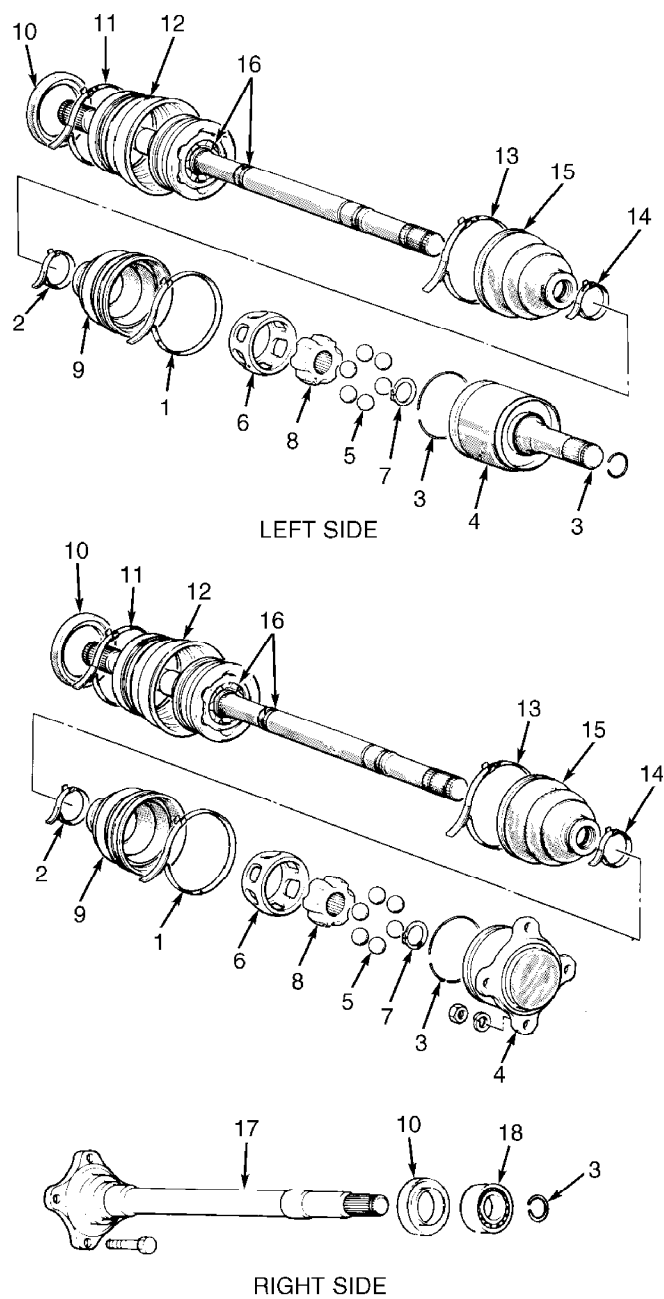
NOTE: References to BJ and DOJ refer to Birfield Joint and Double Offset Joint, respectively.

Disassembly

1) Remove boot bands. Remove circlip from DOJ outer race. Separate drive axle from DOJ outer race. Remove balls from DOJ cage. Remove DOJ cage from DOJ inner race in direction of BJ. See Fig. 5.

2) Remove snap ring from drive axle shaft. Remove DOJ inner race from shaft. Remove circlip from shaft. Wrap tape around splines of shaft to prevent boot damage during removal. Remove DOJ boot. Note size of boot. Remove dust cover from shaft. Move boot protector toward BJ side of shaft and remove. Remove BJ boot.

CAUTION: Drive axle and BJ are serviced as a unit. DO NOT attempt to disassemble BJ and drive axle.



1. Boot Band	10. Dust Cover
2. Boot Band	11. Boot Protector Band
3. Circlip	12. Boot Protector
4. DOJ Outer Race	13. Boot Band
5. Balls	14. Boot Band
6. DOJ Cage	15. BJ Boot
7. Snap Ring	16. Drive Shaft & BJ Assembly
8. DOJ Inner Race	17. Inner Shaft
9. DOJ Boot	18. Bearing

93C01147
 Fig. 5: Exploded View Of Drive Axles
 Courtesy of Mitsubishi Motor Sales of America.

Reassembly

- 1) Coat shaft with light coat of grease. Wrap splines with

tape. Install BJ boot, bands and DOJ boot on shaft. Ensure correct size boot is installed in proper location.

2) Pack proper amount of grease in the BJ and BJ boot. See CV JOINT GREASE CAPACITY table. Boot bands must be installed so lever is pulled toward rear of vehicle when band is tightened.

3) Place DOJ cage on shaft with smaller diameter installed first. Install circlip, DOJ inner race and snap ring on shaft. Apply grease to DOJ inner race and cage. Install balls into cage. Apply proper amount of grease to outer DOJ race. See CV JOINT GREASE CAPACITY table. Install shaft into DOJ outer race. Install circlip.

4) Place DOJ boot over DOJ outer race. Install boot bands so lever is pulled toward rear of vehicle when band is tightened. Adjust DOJ boot bands to have proper distance between center line of boot bands. See BOOT BAND SPECIFICATIONS table. This distance is necessary to control air in DOJ boot. Tighten boot bands. Install boot protector and band. Install dust cover on shaft.

CV JOINT GREASE CAPACITY TABLE

Application	Ozs. (g)
BJ Boot	
Montero	(1)
Pickup & Ram-50	(1)
DOJ Outer Race	
Montero	3.5 (100)
Pickup & Ram-50	3.9 (110)

(1) - Boots, bands and grease are packaged as a kit.
No specifications given by manufacturer.

BOOT BAND SPECIFICATIONS TABLE

Application	In. (mm)
All Models	3.03-3.27 (76.9-83.0)

DIFFERENTIAL ASSEMBLY

Disassembly

1) Remove the differential carrier from vehicle. See DIFFERENTIAL CARRIER ASSEMBLY under REMOVAL & INSTALLATION. Remove cover. Mark bearing caps for reassembly reference. Remove bearing caps. Remove differential case assembly from carrier.

CAUTION: Ensure adjusting spacers, bearing caps, gears and side bearings are marked for reassembly reference. Components must be installed in original location.

2) Using bearing puller, remove differential case side bearings. Loosen ring gear retaining bolts in diagonal sequence. Remove ring gear. Remove drive pinion shaft lock pin from ring gear side. Remove pinion shaft and pinion gears. Remove side gears and thrust spacers.

Drive Pinion Removal

Remove pinion flange nut. Scribe alignment mark on pinion companion flange and drive pinion. Remove flange. Using soft-faced hammer, drive out pinion. Remove rear bearing and oil seal from carrier. Remove rear adjusting shim from pinion. See Fig. 1. Press front bearing from pinion. Remove front adjusting shim and spacer from

pinion.

Cleaning & Inspection

Use cleaning solvent to rinse gears and components. Check bearings for wear or discoloration. Check gear carrier for cracks or damage. Check pinion, side gear and flange splines for excessive wear. Check ring gear, pinion and side gears for wear or damage. Replace components as necessary.

Reassembly & Adjustments

1) Place side gear thrust spacers behind side gears in original position. Assemble side gears in differential case. Install pinion gears and washers. Rotate pinion gears to mesh with side gears.

2) Install pinion shaft without lock pin. Check pinion and side gear backlash. Install wooden wedge to lock side gears. Using dial indicator, measure gear backlash. See Fig. 6.

3) Backlash must be within specification. See PINION & SIDE GEAR BACKLASH SPECIFICATIONS table. Adjust backlash by using different side gear spacers. Ensure both sides are equally shimmed. If backlash cannot be adjusted within specifications, replace side and pinion gears as matched set.

4) Install pinion shaft lock pin. Using a punch, securely stake lock pin in 2 places. Ensure adhesive is removed from ring gear mounting bolts and gear mounting surface. Clean internal threads with tap.

5) Install ring gear on differential case. Ensure alignment marks on differential case and ring gear are aligned. Apply Loctite 271 to bolts and install bolts. Tighten bolts alternately in diagonal sequence to specification. See TORQUE SPECIFICATIONS table.

PINION & SIDE GEAR BACKLASH SPECIFICATIONS TABLE

Application	In. (mm)
Standard	.003 (.08)
Wear Limit	.008 (.20)

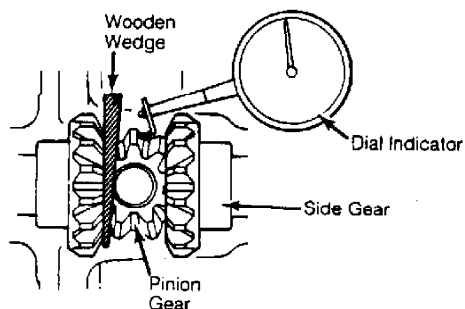


Fig. 6: Checking Pinion & Side Gear Backlash
Courtesy of Mitsubishi Motor Sales of America.

Drive Pinion Depth

1) Install pinion bearing races in carrier housing. Ensure

aces are fully seated. Install Pinion Height Gauge (MB990901-01) with pinion bearings. See Fig. 7. DO NOT install oil seal.

2) Using INCH-lb. torque wrench, measure pinion rotating torque. Gradually tighten pinion height gauge to increase rotating torque to proper specification. See PINION ROTATING TORQUE SPECIFICATIONS table. Install Cylinder Gauge (MB990903-01). Ensure flat areas are aligned and gauge contacts carrier bearing bores firmly. See Fig. 7.

3) Select adjusting shim with same thickness as gap between cylinder gauge and pinion height gauge. Use minimum amount of adjusting shims. Install selected adjusting shims between drive pinion gear and rear drive pinion bearing. Using Bearing Installer (MB990802-01), install rear pinion bearing.

PINION ROTATING TORQUE SPECIFICATIONS TABLE

Application	INCH Lbs. (N.m)
Oil Seal Not Installed	
With Lubrication	1.3-2.2 (.15-.25)
Without Lubrication	2.6-4.3 (.30-.50)
Oil Seal Installed	
With Lubrication	3.1-3.9 (.35-.45)
Without Lubrication	4.3-6.1 (.50-.70)

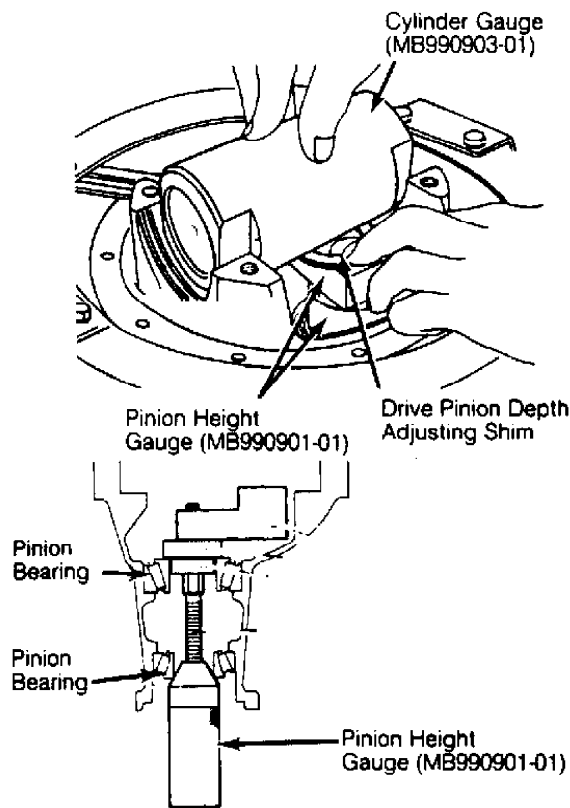


Fig. 7: Setting Drive Pinion Depth
Courtesy of Mitsubishi Motor Sales of America.

Drive Pinion Preload

1) Install drive pinion in differential carrier. Install

spacer, pinion front shim(s) and front pinion bearing. DO NOT install oil seal at this time. Install pinion companion flange, washer and retaining nut. Tighten nut to 137 ft. lbs. (190 N.m).

2) Using INCH-lb. torque wrench, check pinion rotating torque without pinion oil seal. See PINION ROTATING TORQUE SPECIFICATIONS table. Adjust rotating torque by replacing drive pinion front shims or spacer. Once correct rotating torque is obtained, install oil seal. Coat seal lip with grease.

3) Install pinion flange so alignment marks are correct. Apply light coat of grease to flange washer contact area. Install new retaining nut. Check pinion rotating torque with pinion oil seal installed. Rotating torque must be within proper specification. See PINION ROTATING TORQUE SPECIFICATIONS table.

Side Bearing Installation

1) Using Bearing Installer (MB990802-01), install bearings on differential case. Select 2 side bearing adjusting shims thinner than those removed. Shims must be equal in thickness on both sides. Install shims on each side of case assembly. Install case assembly in differential carrier housing.

2) Push case assembly fully to one side of carrier. Using 2 feeler gauges (feeler gauges 180 degrees opposed), measure clearance between carrier and side bearing. Remove shims from one side of differential carrier.

3) Measure thickness of shims removed. Add .002" (.05 mm) to 50% of measured clearance and then add thickness measurement of removed shim. This is thickness of new shim that should be installed on each side of case. Install equal thickness shims on each side of case assembly.

NOTE: Ensure zero clearance exists between gear carrier and adjusting shim.

4) Install side bearing shims and differential case assembly in differential carrier. Using brass drift, tap shims to fit them to side bearing outer race. Install bearing caps. Tighten bolts to specification. See TORQUE SPECIFICATIONS table. Check ring gear backlash.

Ring Gear Backlash

1) Lock drive pinion in place. Using dial indicator, check ring gear backlash at heel of ring gear tooth. Measure at 4 locations of ring gear. Gear backlash should be .004-.006" (.10-.15 mm).

2) If backlash is not within specification, change side bearing adjusting shims and recheck backlash. See GEAR TOOTH CONTACT PATTERNS article in GENERAL INFORMATION. Check gear tooth contact using Prussian Blue.

CAUTION: When changing shims, total thickness of all shims must remain constant to ensure correct bearing preload.

Ring Gear Runout

Using dial indicator, measure runout at back side of ring gear. Runout should be .002" (.05 mm). If runout is excessive, change ring gear-to-differential case mounting position. Ensure ring gear mounting bolts are tightened to correct specification. Recheck runout. Install cover and gasket.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS TABLE

Application	Ft. Lbs. (N.m)
Brake Caliper Bolt	58-72 (79-98)
Carrier-To-Housing Tube Bolt	58-72 (79-98)
Cover Bolt	11-16 (15-22)
Drain Plug	43-51 (58-69)
Drive Shaft Flange Bolt	36-43 (49-58)
Fill Plug	29-43 (39-58)
Front Crossmember Bolt	72-87 (98-118)
Hub Cover Bolt	13-25 (18-34)
Knuckle-To-Ball Joint Nut	
Upper	43-65 (58-88)
Lower	87-130 (118-176)
Mounting Bracket-To-Frame Bolt	58-80 (79-108)
Mounting Bracket-To-Housing Tube Bolt	58-72 (79-98)
Pinion Flange Nut	137-159 (186-220)
Right Drive Axle-To-Inner Shaft Bolt	36-43 (49-58)
Ring Gear-To-Case Bolt	58-65 (79-88)
Side Bearing Cap Bolt	40-47 (54-64)
Tie Rod-To-Knuckle Nut	33 (45)
Wheel Lug Nuts	
Montero	72-87 (98-118)
Pickup & Ram-50	87-101 (118-137)
	INCH Lbs. (N.m)
Undercover-To-Frame Bolts (Montero)	84-108 (9.5-12.2)

DOOR LOCKS - POWER

1993 Mitsubishi Montero

1993 ACCESSORIES & EQUIPMENT
Mitsubishi Power Door Locks

Montero

DESCRIPTION & OPERATION

On Montero, power door lock actuator receives signal from individual control relay that is operated by a switch incorporated in actuator. All door locks are actuated with the operation of one lock.

TROUBLE SHOOTING

POWER DOOR LOCK INOPERATIVE

Operate door lock(s) with ignition switch in OFF position. If door lock(s) do not operate, check for following possible causes:

- * Burned fuse, circuit breaker or fusible link caused by short to body ground.
- * Wire connector or pin inside connector disengaged at any connector or component in system.
- * Defective door lock switch, relay or actuator.
- * Subfreezing weather conditions, mechanical failure or corroded or misaligned assemblies.

TESTING

DOOR LOCK ACTUATOR

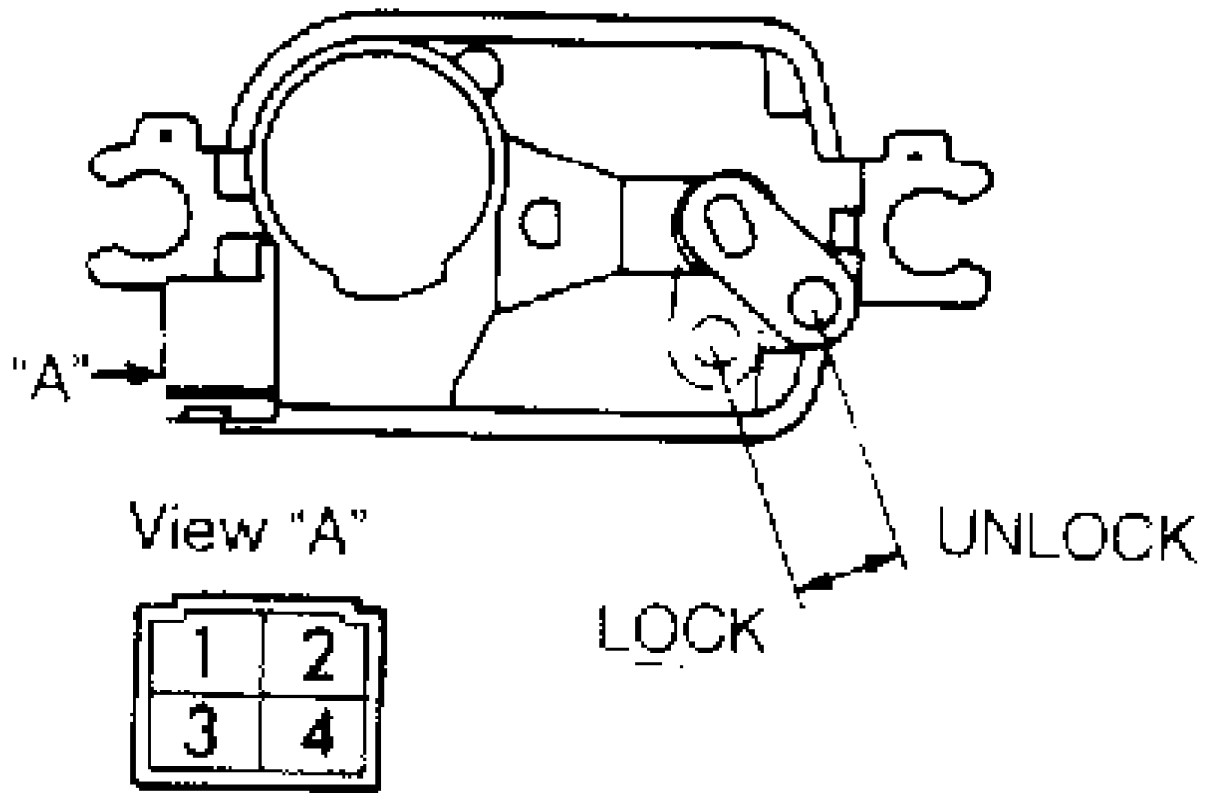
1) Access left front or right rear door lock actuator. See DOOR LOCK ACTUATOR under REMOVAL & INSTALLATION. Disconnect harness connector. Set actuator to LOCK position. Connect positive lead of 12-volt power source to terminal No. 1 of actuator. See Fig. 1. Actuator should operate to UNLOCK position when terminal No. 3 is connected to negative lead.

2) With actuator set to UNLOCK position, connect positive lead of 12-volt power source to terminal No. 3 of actuator. See Fig. 1. Actuator should operate to LOCK position when terminal No. 1 is connected to negative lead.

3) Access right front or left rear door lock actuator. See DOOR LOCK ACTUATOR under REMOVAL & INSTALLATION. Disconnect harness connector. Set actuator to LOCK position. Connect positive lead of 12-volt power source to terminal No. 3 of actuator. See Fig. 1. Actuator should operate to UNLOCK position when terminal No. 1 is connected to negative lead.

4) With actuator set to UNLOCK position, connect positive lead of 12-volt power source to terminal No. 1 of actuator. See Fig. 1. Actuator should operate to LOCK position when terminal No. 3 is connected to negative lead.

5) On left or right door lock actuator, there should be continuity between terminals No. 2 and 4 when actuator is in UNLOCK position. There should be no continuity in LOCK position. Replace actuator if it fails any preceding tests.



EXCEPT PICKUP & RAM-50

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Fig. 1: Identifying Actuator Connectors
Courtesy of Mitsubishi Motor Sales of America.

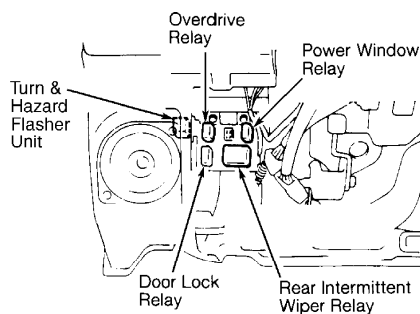


Fig. 2: Locating Door Lock Relays
Courtesy of Mitsubishi Motor Sales of America.

REAR DOOR LOCK ACTUATOR

Access door lock actuator. See DOOR LOCK ACTUATOR under REMOVAL & INSTALLATION. Disconnect rear door release solenoid harness connector. Remove solenoid if needed. Connect positive lead of 12-volt power source to solenoid connector. Solenoid should operate when negative lead contacts solenoid housing. Replace solenoid as needed.

REMOVAL & INSTALLATION

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.

DOOR LOCK ACTUATOR

All Except Rear Door Or Hatch

Remove inner door panel. Remove delta cover (access to mirror mounting). Remove door light, switch panel and armrest. Remove mounting screws and slide panel up to remove. Remove waterproof film. Remove actuator. To install, reverse removal procedure.

Rear Door Or Hatch

Remove door pull handle. Remove window trim. Remove door release handle trim. Remove tool kit (if equipped). Remove door panel and waterproof film. Remove actuator solenoid. To install, reverse removal procedure.

WIRING DIAGRAMS

See appropriate chassis wiring diagram in the WIRING DIAGRAMS section.

DRIVE AXLE - REAR NON-INTEGRAL

1993 Mitsubishi Montero

1993 Drive Axles - Differentials & Axle Shafts -
Rear Non-Integral

Ram-50, Montero & Pickup

DESCRIPTION

Rear axle features a rigid banjo-type housing with semi-floating axle shafts. Differential consists of hypoid reduction gears and straight bevel differential gears. Limited Slip Differential (LSD) is available on Montero RS (w/o ABS), Pickup 4WD and Ram-50 4WD. Locking rear differential is available on Montero SR model.

AXLE RATIO & IDENTIFICATION

Ratio is determined by dividing number of ring gear teeth by number of drive pinion teeth.

AXLE RATIO SPECIFICATIONS TABLE

Application	Ratio
Montero	
LT31X10.50R15 Tire	4.88:1
P235/75R15 Tire	4.63:1
Pickup & Ram-50	
2WD	3.91:1
4WD	4.22:1

LUBRICATION

CAPACITY

REAR AXLE GEAR OIL CAPACITY TABLE

Application	Pts. (L)
Montero	5.5 (2.6)
Pickup & Ram-50	
Conventional	
2WD	3.2 (1.5)
4WD	5.5 (2.6)
Limited Slip Differential	5.5 (2.6)

FLUID TYPE

Conventional differentials use SAE 80W or SAE 90W API GL-5. Limited slip differentials use Mitsubishi Gear Oil (8149630 EX), or Mopar Gear Oil (4318058) and Mopar Friction Modifier (4318060).

TROUBLE SHOOTING

See TROUBLE SHOOTING - BASIC PROCEDURES article in GENERAL INFORMATION section.

TESTING & INSPECTION

AXLE SHAFT END PLAY

Pickup & Ram-50

Using dial indicator, check axle shaft end play. End play should be .002-.008" (.05-.20 mm). If end play is not within specification, change shims to obtain correct end play. See AXLE SHAFT under REMOVAL & INSTALLATION.

Montero

Using dial indicator, check axle shaft end play. End play should be .010" (.25 mm). If end play is not within specification, replace axle bearing. See AXLE SHAFT under OVERHAUL.

AXLE TOTAL BACKLASH

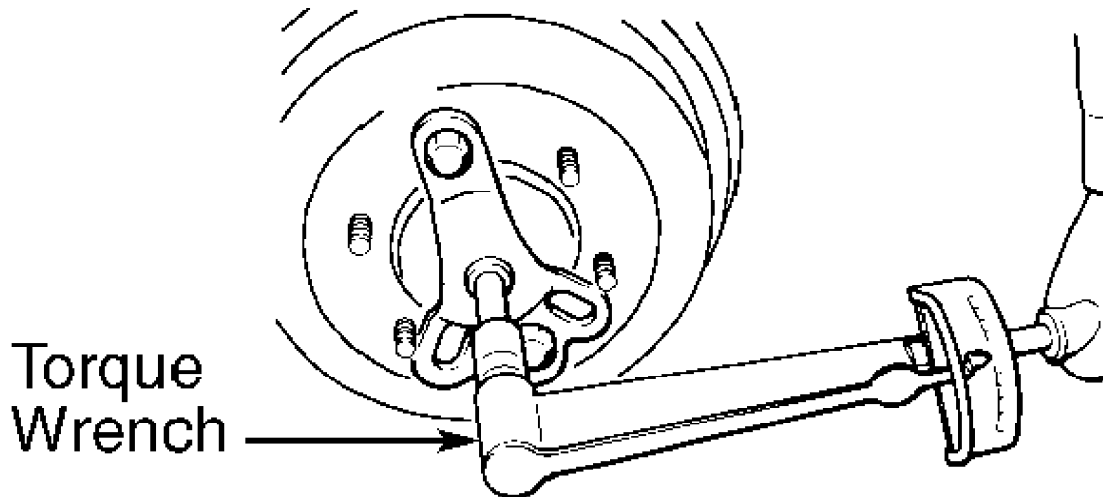
1) Raise and support rear axle. Place transmission in Neutral. Apply parking brake. Rotate drive shaft clockwise. Place reference marks on pinion dust cover and differential housing.

2) Rotate drive shaft counterclockwise, and measure distance between reference marks. Differential must be removed and backlash adjusted if distance exceeds 0.2" (5 mm). See RING GEAR BACK-LASH procedure under DIFFERENTIAL ASSEMBLY (LIMITED SLIP) under OVERHAUL.

LIMITED SLIP DIFFERENTIAL PRELOAD

1) Place transmission in Neutral. Block front wheels. Raise one rear wheel off ground and remove wheel. Release parking brake.

2) Using torque wrench and axle puller adapter, measure starting torque while rotating wheel in forward direction. See Fig. 1. Differential must be repaired if torque is less than 18 ft. lbs. (25 N.m).



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Fig. 1: Testing Limited Slip Differential Preload
Courtesy of Mitsubishi Motor Sales of America.

LOCKING DIFFERENTIAL

Air Pump

Connect air pressure gauge in-line to air hose from air pump. Air pump is located in right storage area, under rear seat. Connect battery voltage to air pump (positive lead to Red wire). The air pump is operating correctly when the following sequences occur:

- * Pump should operate for no more than 5 seconds.
- * Pressure should be 4-6 psi (28-41 kPa) within 10-20 seconds after pump has stopped.
- * After air pump has stopped operating, it should not restart operating for 5 minutes.

Center Differential Lock Operation Switch
See ANTI-LOCK - MONTERO article in BRAKES.

Differential Lock Switch
Remove switch from center console. To test switch operation, see Fig. 2. Replace as needed.

Differential Lock Control Unit
See ANTI-LOCK BRAKE SYSTEM article in BRAKES.

Lock Detection Switch

1) Raise and support vehicle. Disconnect air hose connection near rear differential. Connect air source with pressure regulator and pressure gauge. Apply 4 psi (25 kPa) pressure. Disconnect lock detection switch harness connector.

2) Using ohmmeter, check if continuity exists with air pressure applied. Continuity should exist with air pressure applied. If continuity exists, ensure axle is locked by attempting to turn rear wheels separately of each other.

3) If continuity does not exist, go to step 4). If continuity does exist but axles are not locked, see CARRIER ASSEMBLY under REMOVAL & INSTALLATION and inspect locking assembly.

4) Remove detection switch from housing. Using ohmmeter, check continuity of switch. Continuity should exist with switch plunger extended. With plunger in neutral position, continuity should not exist. Replace switch as needed.



Terminal	5	3	2	6	1
Switch position					
ON	○		○		
OFF		○	○	○	○

NOTE

- ○—○ indicates that there is continuity between the terminals.

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Fig. 2: Checking Differential Lock Switch Continuity
Courtesy of Mitsubishi Motor Sales of America.

REMOVAL & INSTALLATION

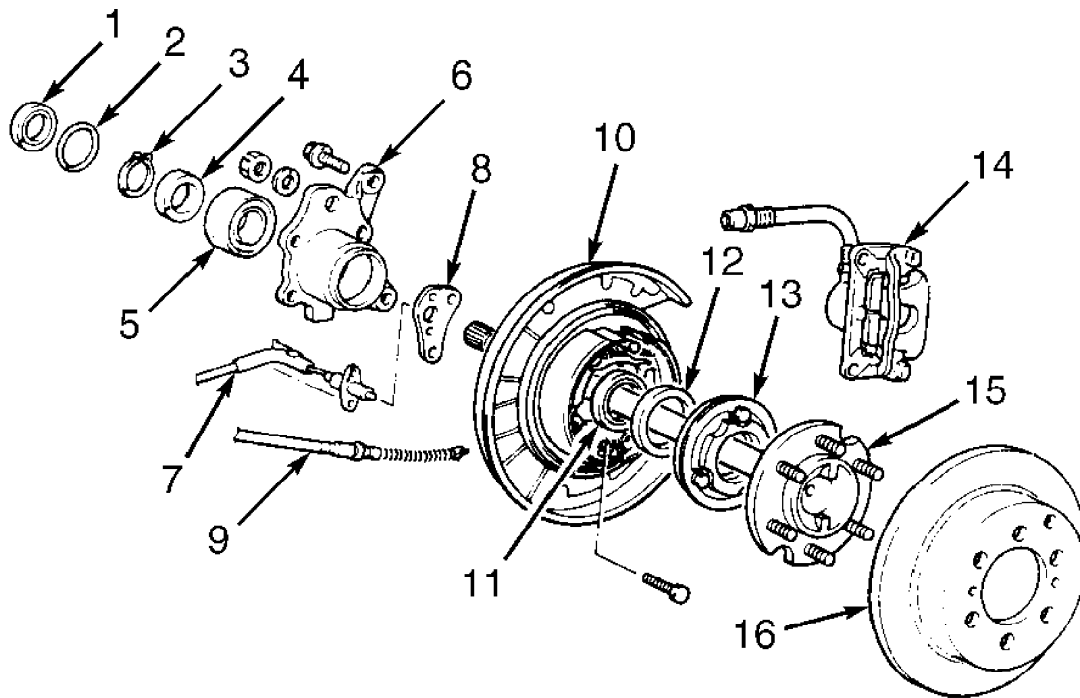
AXLE SHAFT

Removal (Montero)

Block front wheels. Raise and support rear axle housing. Remove brake caliper and rotor. See Fig. 3. Remove parking brake cable attaching bolts. Remove connection for parking brake cable end from rear brake assembly. Remove ABS speed sensor (if equipped). Unbolt backing plate with bearing housing from rear axle housing. Using Puller (MB990241) and Slide Hammer (MB990211), remove axle assembly. DO NOT damage oil seal. Remove "O" ring. Replace if necessary.

Installation (Montero)

Install new oil seal in axle housing as needed. To install axle assembly, reverse removal procedure.



1. Oil Seal	9. Parking Brake Cable
2. "O" Ring	10. Dust Shield
3. Snap Ring	11. Parking Brake Assembly
4. Retainer	12. Oil Seal
5. Bearing	13. ABS Sensor Rotor
6. Bearing Case	14. Brake Caliper
7. ABS Speed Sensor	15. Axle
8. Speed Sensor Bracket	16. Brake Rotor

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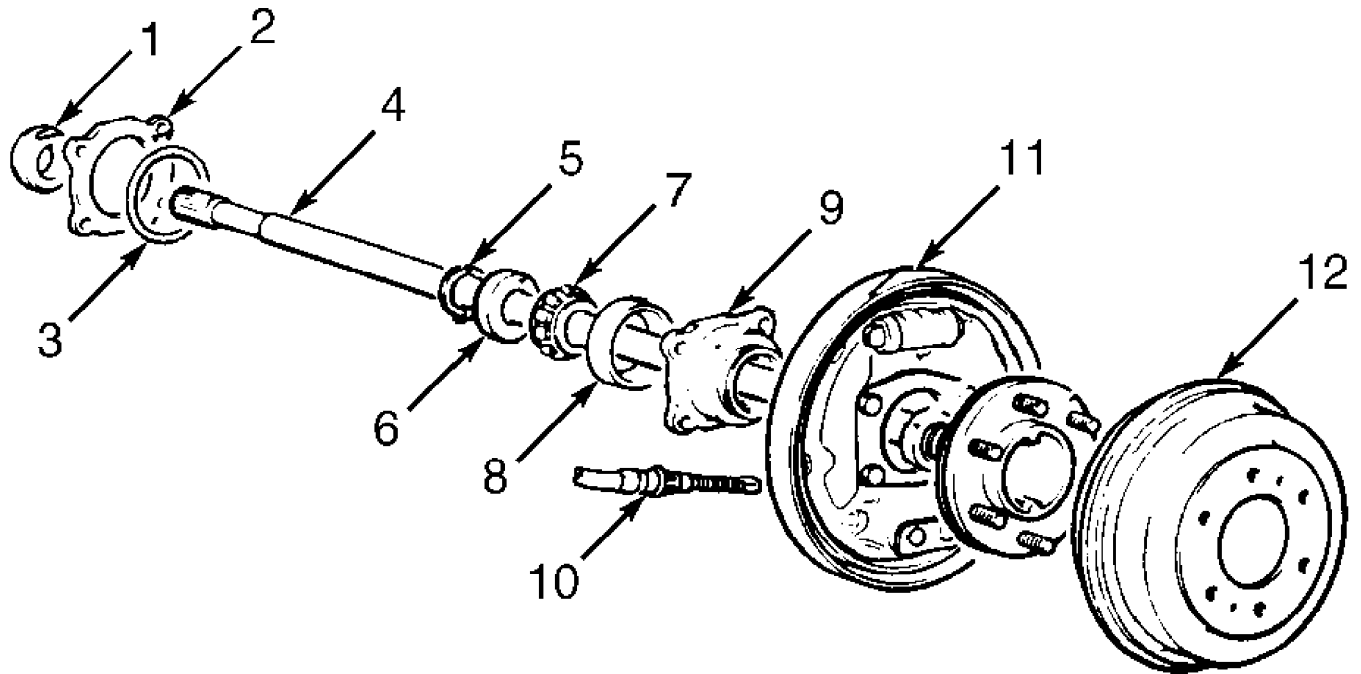
Fig. 3: Exploded View Of Axle Shaft (Montero)
Courtesy of Mitsubishi Motor Sales of America.

Removal (Pickup & Ram-50)

- 1) Block front wheels. Raise and support rear axle housing.

Remove brake drum. See Fig. 4. Remove parking brake cable attaching bolts. Remove connection for parking brake cable end from rear brake assembly. Drain brake fluid from bleeder screw at left side of rear brake, and disconnect brake tubes.

2) Remove flange nuts and rear axle shaft assembly. Use Puller (MB990241) and Slide Hammer (MB990211) if necessary. DO NOT damage oil seal. Remove shim(s) and "O" ring. Replace if necessary.



1. Oil Seal
2. Shim
3. "O" Ring
4. Axle
5. Snap Ring
6. Retainer Ring

7. Bearing
8. Outer Race
9. Bearing Case
10. Parking Brake Cable
11. Backing Plate
12. Brake Drum

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Fig. 4: Exploded View Of Axle Shaft (Pickup & Ram-50)
Courtesy of Mitsubishi Motor Sales of America.

Installation (Pickup & Ram-50)

1) Insert new "O" ring and shim of .04" (1.0 mm) thickness into left side axle housing. Install left axle shaft assembly into axle housing and tighten nuts to the proper specification. See TORQUE SPECIFICATIONS table.

2) Install right axle shaft assembly into axle housing without shim or "O" ring. Temporarily tighten nuts in diagonal sequence to 51.6 INCH lbs. (5.8 N.m) in 2 stages. Measure clearance between bearing case of right axle and rear axle housing end with feeler gauge.

3) Select shims equal to sum of measured clearance plus .002-.008" (.05-.20 mm). Remove right axle shaft, and install selected shim(s) and "O" ring into right axle housing end. Install right axle

shaft assembly into rear axle housing. Tighten nuts in diagonal sequence to specification. See TORQUE SPECIFICATIONS table.

4) Using dial indicator, check end play of axle shaft. End play should be .002-.008" (.05-.20 mm). If end play is not within specification, change shim(s) to obtain correct end play. Reverse removal procedure to install remaining components. Adjust parking brake, and bleed brake system.

CARRIER ASSEMBLY

Removal

Raise and support vehicle. Drain gear oil. Mark drive shaft flange-to-pinion flange position. Remove drive shaft. Remove axle shafts. See AXLE SHAFT under REMOVAL & INSTALLATION. Support differential carrier with jack. Remove differential carrier retaining nuts. Remove differential carrier.

Inspection

Check for leaks at vent plug, differential carrier companion flange and where carrier joins axle housing.

Installation

Apply sealant to axle housing surface. To install, reverse removal procedure. Align marks on drive shaft and pinion flange.

DRIVE SHAFT

Removal

Make match marks on drive shaft yoke flange and pinion flange. Remove bolts and drive shaft from vehicle.

Installation

To install, reverse removal procedure. Ensure match marks are aligned. Tighten bolts to specification. See TORQUE SPECIFICATIONS table.

OVERHAUL

AXLE SHAFT

Removal

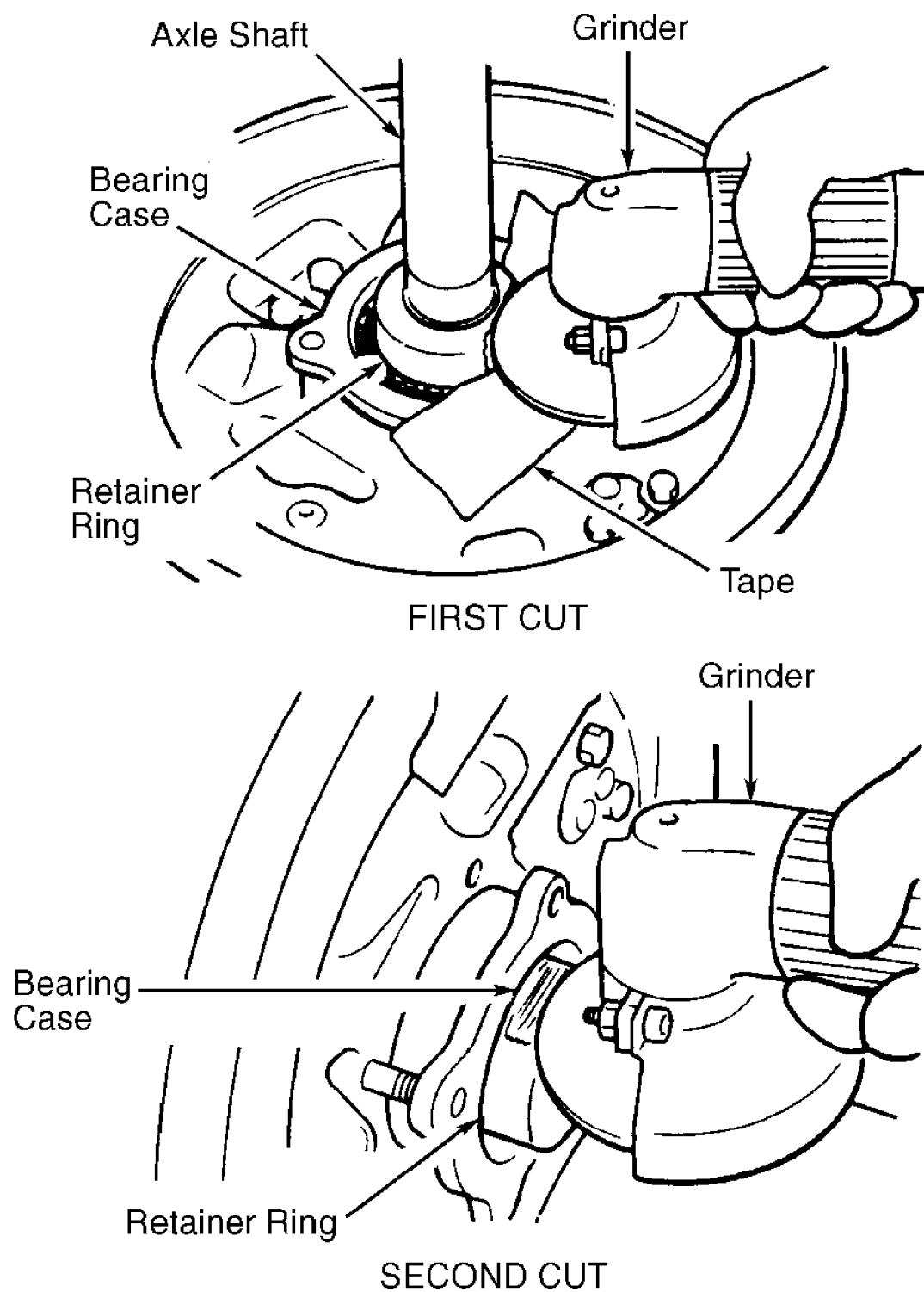
1) Secure axle shaft assembly in a vise, and remove one retainer bolt from backing plate. Push bearing case completely to side of dust cover. Place adhesive tape around edge of bearing case at retainer bolt hole to prevent damage.

CAUTION: DO NOT damage bearing case or axle shaft when grinding or chiseling retainer ring.

2) Secure axle shaft, and grind retainer ring until retainer ring wall thickness is .04-.06" (1.0-1.5 mm) on axle shaft side and .08" (2.0 mm) on bearing side. See Fig. 5.

3) Change angle of grind, and remove remaining .08" (2.0 mm) of retainer ring wall on bearing side. See Fig. 5. Using a chisel, cut retainer ring. Remove ring. DO NOT damage axle shaft.

4) Install Puller (MB990787-01) to remove bearing case from axle shaft. See Fig. 6. 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.



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Fig. 5: Grinding Bearing Retainer Ring
Courtesy of Mitsubishi Motor Sales of America.

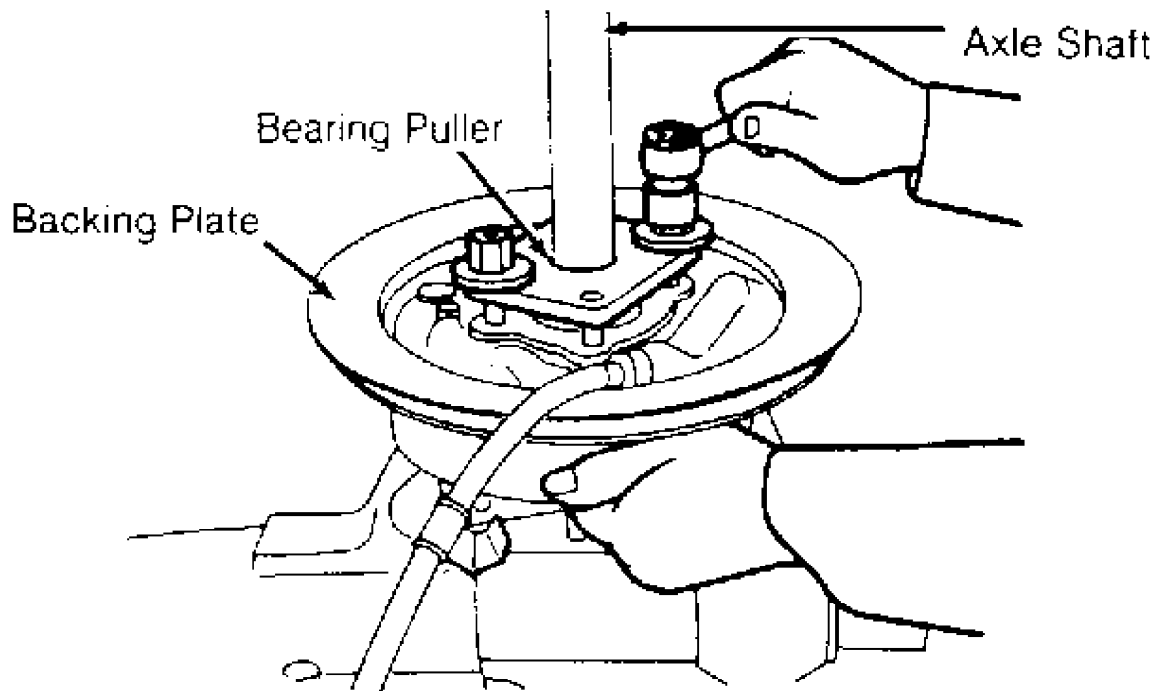


Fig. 6: Removing Bearing Case From Axle Shaft
 Courtesy of Mitsubishi Motor Sales of America.

Inspection

Inspect bearings for roughness, pitting or damage. Inspect axle shaft for damaged splines or flange. Inspect bearing case for cracks or damage.

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 bearing on axle shaft. Install rear brake assembly with bearing case onto axle. On Montero, install inner bearing on axle. On all models, install new retainer ring. DO NOT exceed 22,046 lbs. (100,00 N) on Montero, 17,637 lbs. (80,000 N) on Pickup and Ram-50 when pressing on retainer ring. Install new snap ring.

3) Using a feeler gauge, measure clearance between snap ring and new retainer ring. Clearance should be less than .007" (.17 mm). If clearance exceeds specification, install correct snap ring. See SNAP RING THICKNESS SPECIFICATION table.

SNAP RING THICKNESS SPECIFICATION TABLE

Thickness In. (mm)	Color
.060 (1.52)	Red
.067 (1.70)	Purple
.073 (1.85)	Blue

.079 (2.01)	.....	Yellow
.085 (2.16)	.....	Neutral

DIFFERENTIAL ASSEMBLY (CONVENTIONAL)

Pre-Disassembly Inspection

1) Secure differential assembly in appropriate holder. Secure drive pinion from turning. Mount dial indicator on case and check ring gear backlash at 4 positions. See Fig. 7. Backlash should be .004-.006" (.11-.16 mm) on Pickup 2WD and Ram-50 2WD models, .005-.007" (.13-.18 mm) on Montero, Pickup 4WD & Ram-50 4WD models.

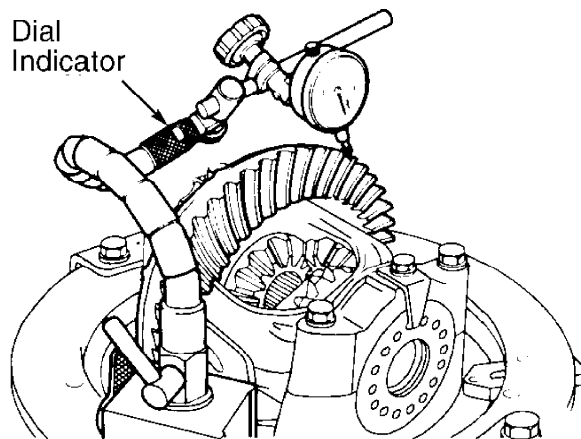
2) Remount dial indicator and measure ring gear runout. See Fig. 8. On all models, runout should not exceed .002" (.05 mm). Remount dial indicator and measure pinion gear backlash on models without limited slip differential. See Fig. 9. Secure side gear from turning with wedge. Backlash should be .0004-.0030" (.010-.080 mm) on Pickup 2WD and Ram-50 2WD models, 0-.003" (0-.08 mm) on Montero, Pickup 4WD & Ram-50 4WD models. On all models, pinion gear backlash service limit is .008" (.20 mm).

3) Check gear tooth contact pattern between ring gear and drive pinion gear. Apply Prussian Blue to both surfaces of ring gear teeth. Insert brass rod between differential housing and carrier assembly to provide resistance while turning drive pinion.

4) Turning resistance of drive pinion should be 28-33 INCH lbs. (2.5-3.0 N.m). Rotate drive pinion until ring gear completes one revolution. Reverse direction of rotation and return to original starting point. Check wear pattern. See GEAR TOOTH CONTACT PATTERN in GENERAL INFORMATION.

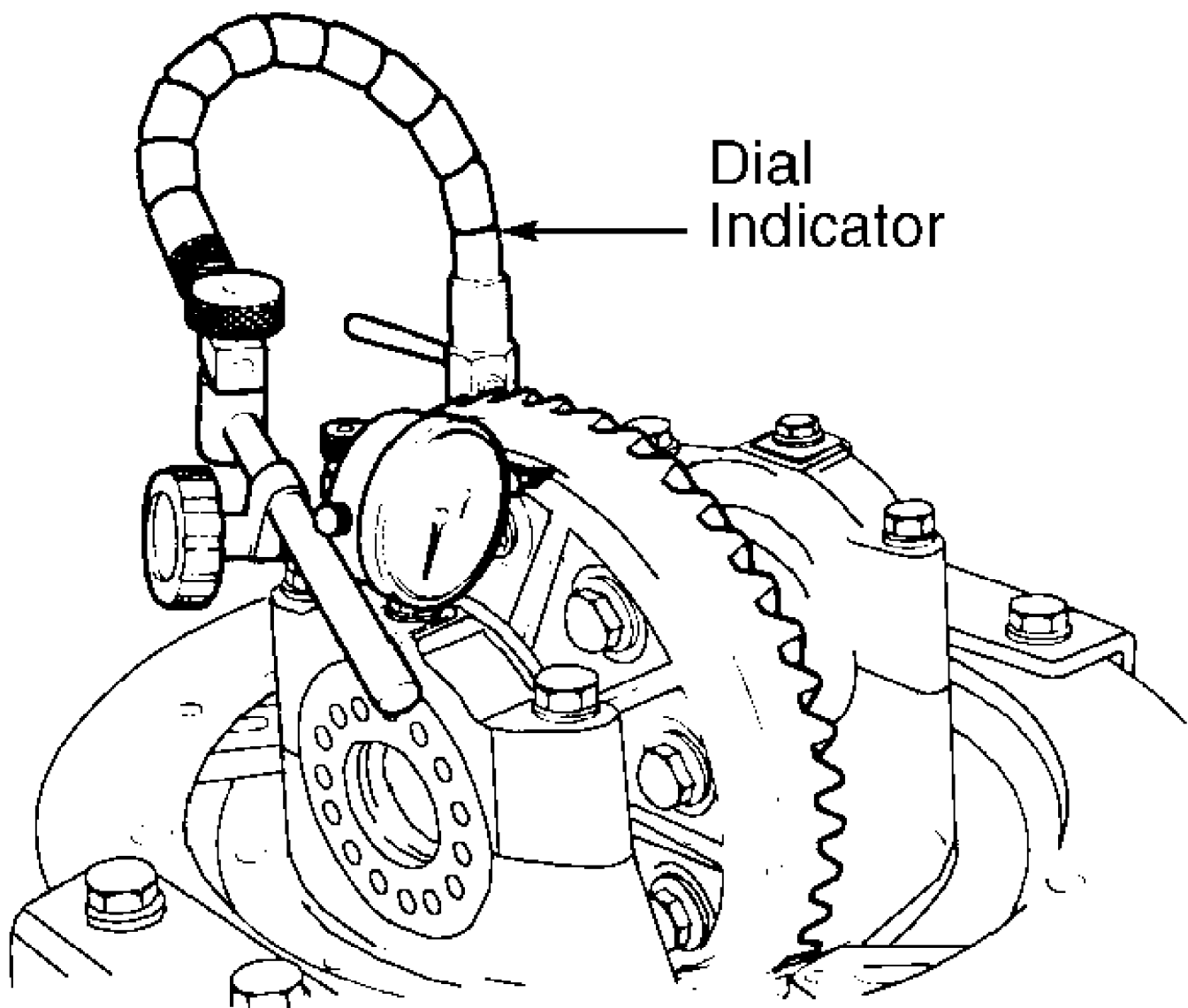
5) On Montero models with differential lock, connect air supply hose with pressure gauge and regulator to actuator air pipe. Apply 4 psi (25 kPa) of pressure. Using Adapter Shaft (MB990992), turn side gear on one side of carrier assembly only. Locking mechanism should engage. To disengage, release air pressure and turn side gear 1/4-1/2 turn.

6) With lock mechanism engaged, measure turning torque of drive pinion. Turning torque should not be less than 36 ft. lbs. (50 N.m). With lock mechanism disengaged, turning torque should not be more than 36 ft. lbs. (50 N.m).



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Fig. 7: Measuring Ring Gear Backlash
Courtesy of Mitsubishi Motor Sales of America.



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Fig. 8: Measuring Ring Gear Runout
Courtesy of Mitsubishi Motor Sales of America.

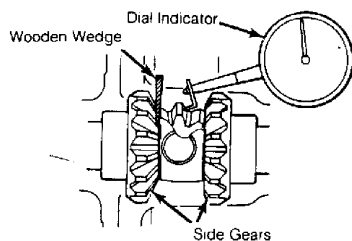
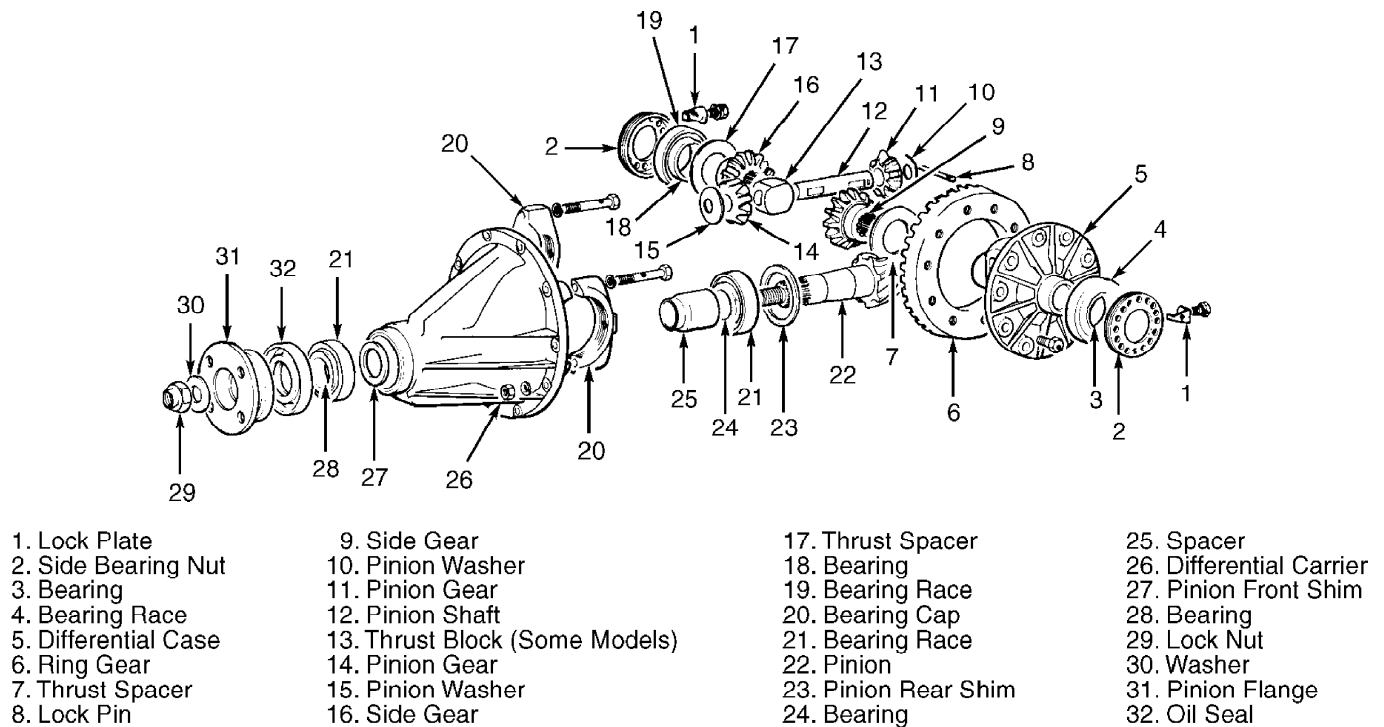


Fig. 9: Checking Pinion & Side Gear Backlash
Courtesy of Mitsubishi Motor Sales of America.

NOTE: See DIFFERENTIAL ASSEMBLY (LIMITED SLIP) for carrier assembly and drive pinion installation.

Carrier Assembly & Drive Pinion Removal

1) Remove differential carrier from axle housing. Remove lock plates. Mark location of side bearing nuts for reassembly. Remove side bearing nuts. See Fig. 10. Mark location of bearing caps for reassembly. Remove bearing caps. Remove differential carrier assembly from differential housing.



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Fig. 10: Exploded View Of Conventional Rear Differential
Courtesy of Mitsubishi Motor Sales of America.

2) Secure drive pinion companion flange from turning. Remove companion flange retaining nut. Scribe alignment marks on drive pinion and companion flange for reassembly. Using soft-faced hammer, drive pinion out of housing. Remove front adjusting shim and spacer from pinion.

3) Using bearing splitter and press, remove rear bearing from pinion. Remove rear adjusting shim from drive pinion. Remove oil seal and bearing races from differential housing.

Disassembly (Carrier Assembly)

1) Using bearing splitter and press, remove differential case side bearings. Place alignment marks on ring gear and differential case for reassembly. Loosen ring gear bolts in diagonal sequence. Remove ring gear.

2) Remove pinion shaft lock pin from differential carrier. Remove differential pinion shaft and thrust block (if equipped). Remove pinion gears and washers. Remove side gears and thrust spacers. Mark components for reassembly reference.

Inspection

Wash parts in clean solvent and dry with compressed air. Inspect bearings for discoloration and/or flaking. Check all gears for

irregular wear or damage. Ring gear and drive pinion must be replaced as matched set. Side gears and pinion gears must be replaced as matched set.

Reassembly & Adjustment

1) Install thrust spacers, side gears, pinion washers and pinion gears in differential case. DO NOT install thrust block (if equipped) at this time.

2) Install pinion shaft without lock pin. Check pinion and side gear backlash. Install wooden wedge to lock side gears. See Fig. 9. Using dial indicator, measure gear backlash. Backlash should be .0004-.0030" (.010-.080 mm). Service limit is .008" (.20 mm).

3) Adjust backlash by using different side gear spacers. Ensure both sides are equally shimmed. Install thrust block (if equipped) once correct backlash is obtained. Install pinion shaft lock pin from ring gear side of carrier housing. Securely stake pin in 2 places. Ensure adhesive is removed from ring gear mounting bolts and gear mounting surface. Clean internal threads with tap.

4) Ensure alignment marks on differential case and ring gear align. Apply Loctite 271 to bolts, and install ring gear on differential case. Tighten bolts in diagonal sequence to specification. See TORQUE SPECIFICATIONS table. Using appropriate adapter, press on carrier side bearings.

DIFFERENTIAL ASSEMBLY (LIMITED SLIP)

NOTE: Manufacturer does not provide disassembly or reassembly procedures for locking type differential. See Figs. 12 and 13 for exploded views of assembly.

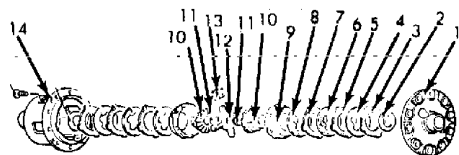
NOTE: See PRE-DISASSEMBLY INSPECTION under DIFFERENTIAL ASSEMBLY (CONVENTIONAL) before disassembling carrier assembly. For carrier assembly and drive the pinion removal, see DIFFERENTIAL ASSEMBLY (CONVENTIONAL).

Disassembly

1) Once ring gear is removed, loosen carrier housing screws in diagonal pattern. Separate cases and remove components. See Fig. 11. Maintain parts in order of disassembly. Clean all parts in new solvent.

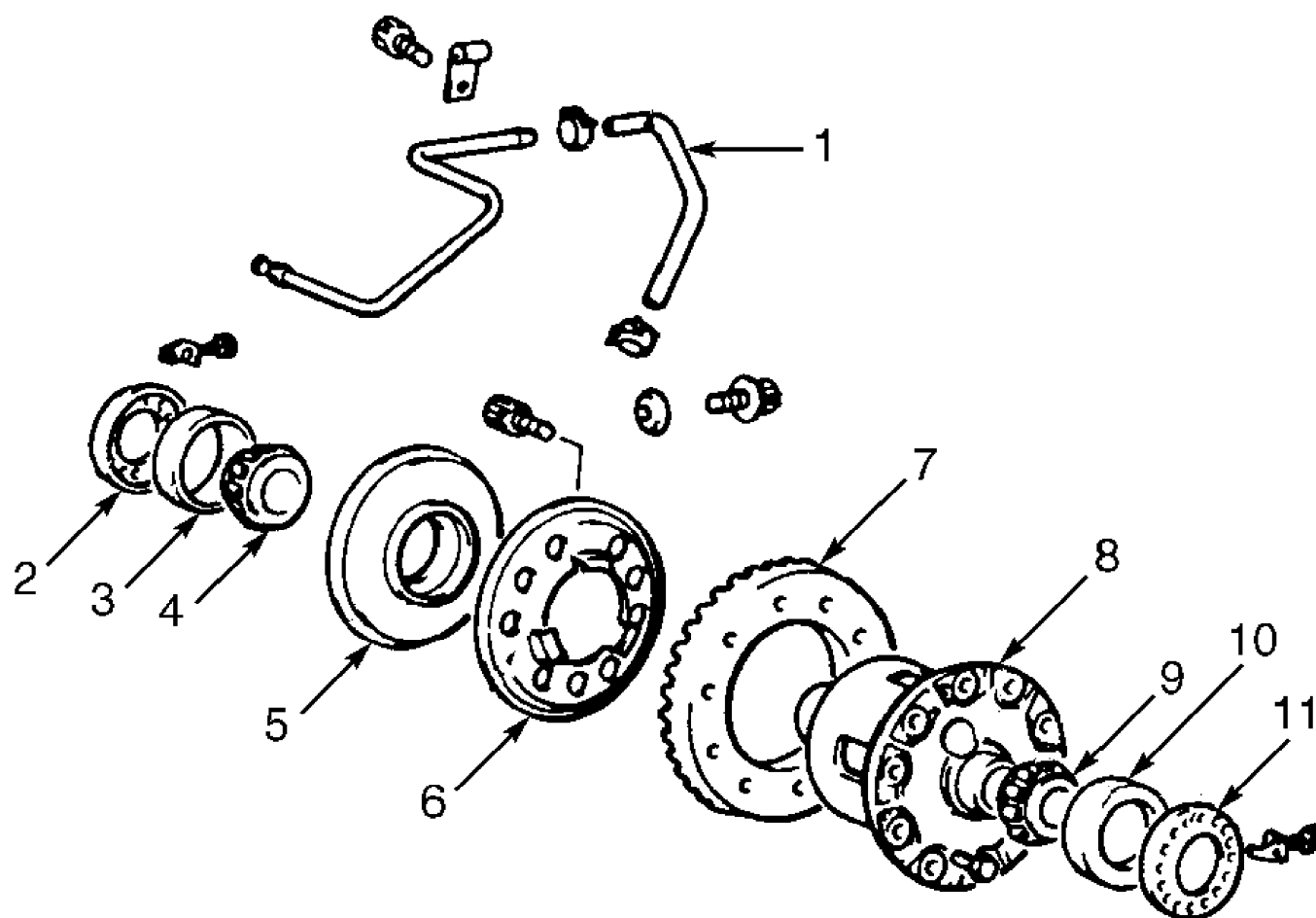
2) Inspect condition of friction and spring plates and friction discs. Replace disc and/or plates if worn or heat damaged. Distortion of discs will cause incorrect clutch pressure. Scratches, nicks or burrs on components can be repaired with an oil stone.

3) Discs must be flat and free of distortion. Check discs on surface plate with dial indicator. Maximum warpage of friction plate or disc is .003" (.08 mm). Inspect thickness of discs and plates. Thickness limit between discs and plates is .004" (.10 mm).



1. Differential Case Cover	8. Friction Disc
2. Thrust Washer	9. Pressure Ring
3. Spring Plate	10. Side Gear
4. Spring Disc	11. Thrust Block
5. Friction Plate	12. Pinion Shaft
6. Friction Disc	13. Pinion Gear
7. Friction Plate	14. Differential Case

Fig. 11: Exploded View Of Limited Slip Differential
Courtesy of Mitsubishi Motor Sales of America.

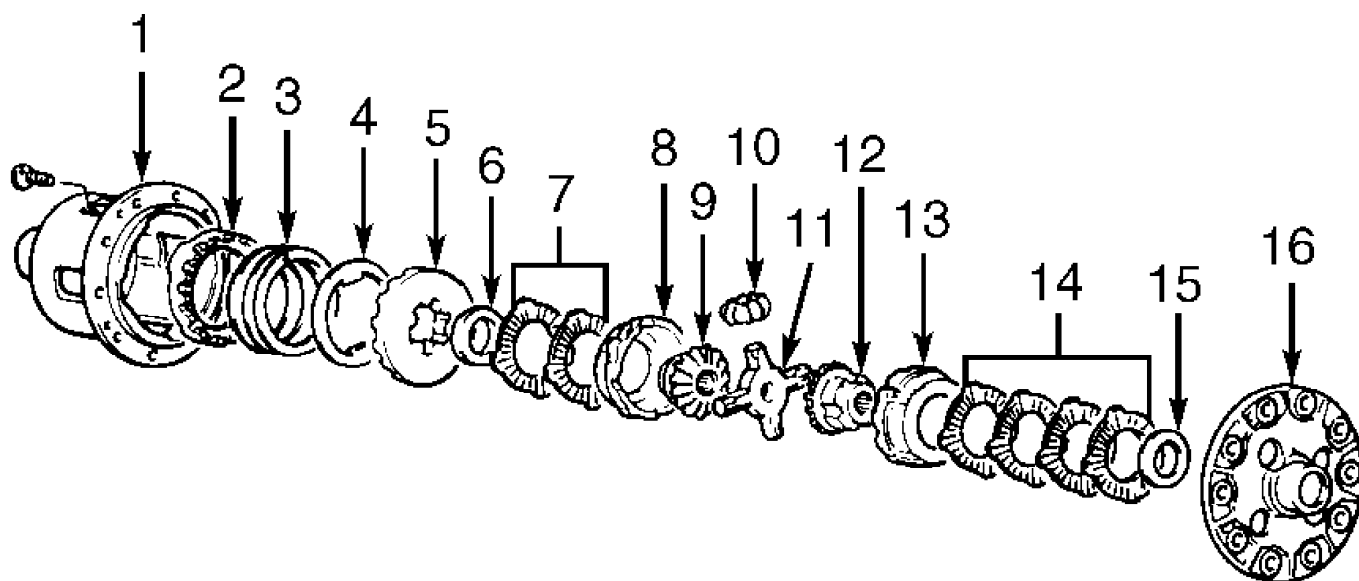


- 1. Air Pipe
- 2. Side Bearing Nut
- 3. Bearing Race
- 4. Bearing
- 5. Actuator Assembly
- 6. Pressure Plate

- 7. Ring Gear
- 8. Differential Case
- 9. Bearing
- 10. Race
- 11. Side Bearing Nut

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Fig. 12: Exploded View Of Locking Differential Actuator Assembly
 Courtesy of Mitsubishi Motor Sales of America.



1. Differential Case	9. Side Gear
2. Drive Cam	10. Pinion Gear
3. Spring	11. Pinion Shaft
4. Spring Washer	12. Side Gear
5. Driven Cam	13. Pressure Ring
6. Thrust Washer	14. Friction Plate
7. Friction Plate	15. Thrust Washer
8. Pressure Ring	16. Differential Case Cover

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Fig. 13: Exploded View Of Locking Differential
Courtesy of Mitsubishi Motor Sales of America.

Reassembly

1) Arrange friction plates and discs of each side of differential. Measure each assembly thickness. Assembled discs and plates should not exceed a difference of .002" (.05 mm). Replace discs or plates as needed.

2) Assemble one spring plate and one spring disc on each side. Measure assembly thickness. Assemble disc and plates to obtain minimum difference in thickness between each assembly.

3) Assemble clutch assemblies, pressure rings, pinion gears, side gears and pinion shaft. Measure overall width of assembly plus spring plates and spring discs (dimension "C"). See Fig. 14.

4) Determine depth of differential case (dimension "D"). On 2,4L, dimension "D" = "E" + "F" - "G"; on 3.0L, dimension "D" = "E" + "H".

See Fig. 15 or 16. Subtract "C" from "D" to determine spring plate-to-case clearance. Adjust spring disc thickness to obtain proper spring plate-to-case clearance. Correct clearance is .0024-.0079" (.060-.200 mm).

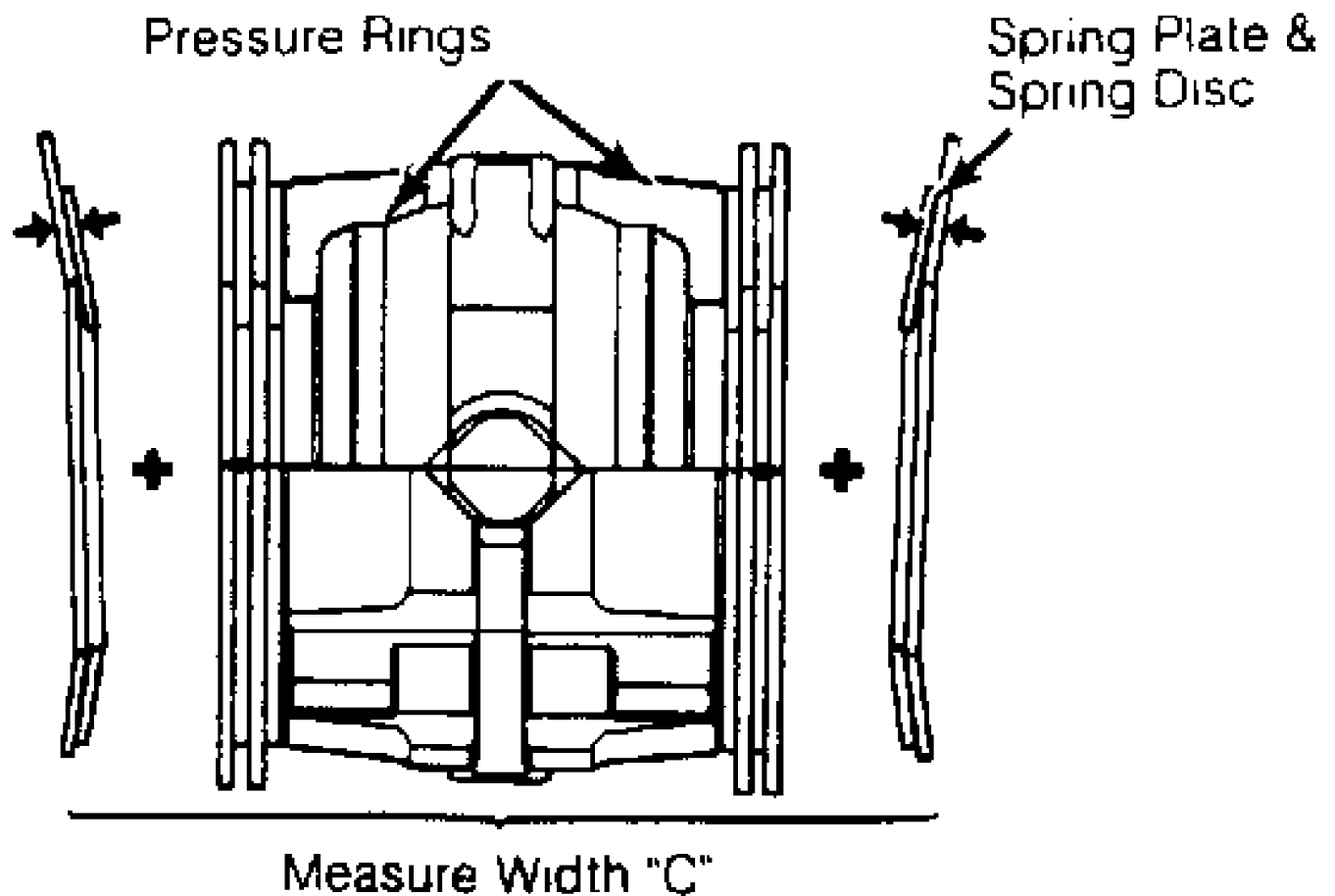


Fig. 14: Measuring Clutch Assembly Width
 Courtesy of Mitsubishi Motor Sales of America.

Differential Case Cover

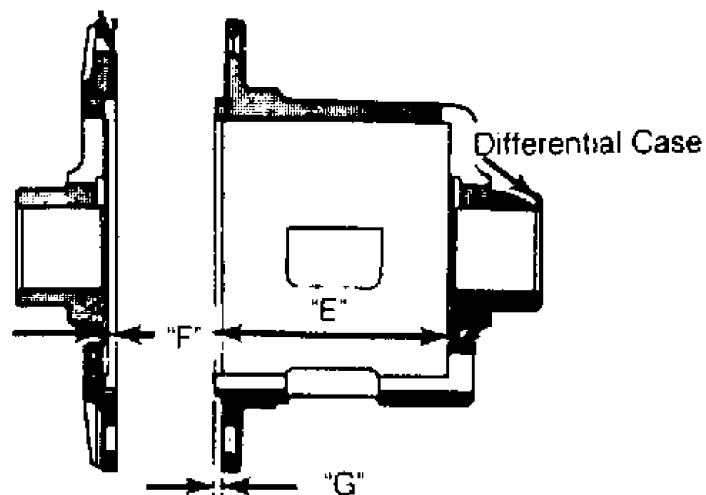
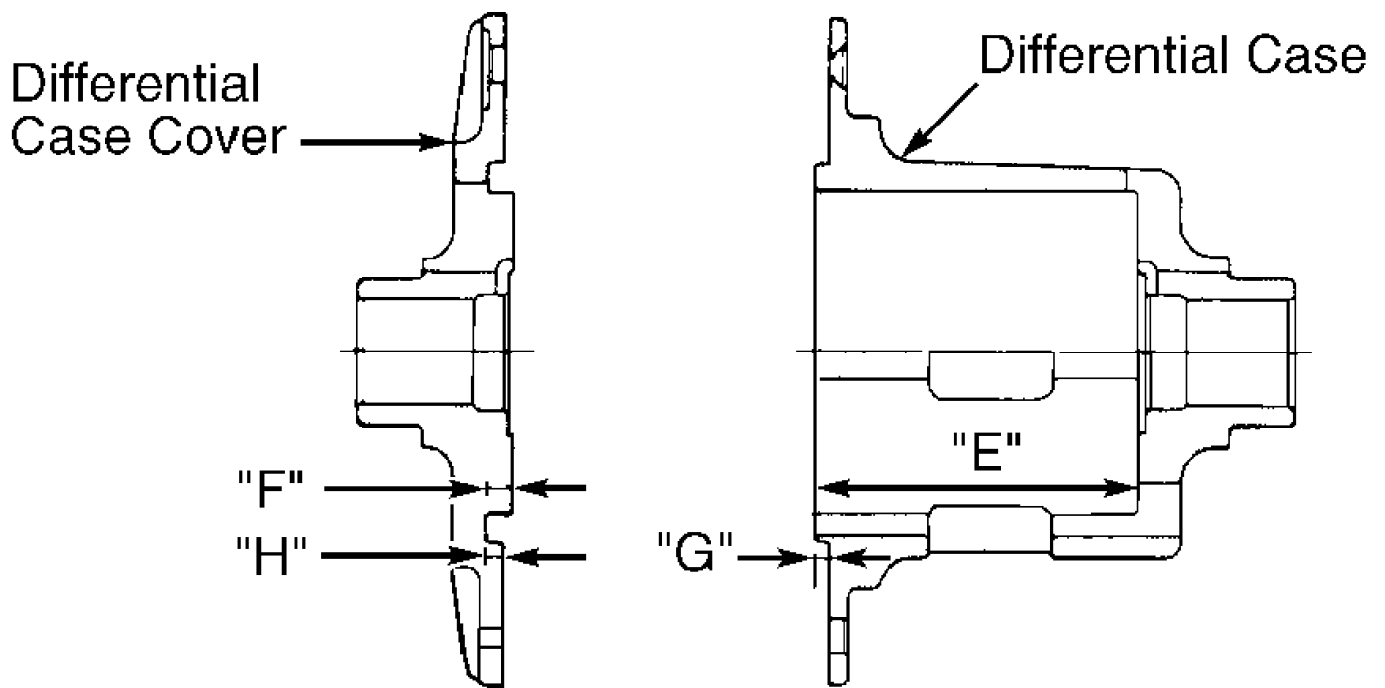


Fig. 15: Measuring Limited Slip Case Depth (Pickup & Ram-50 - 2.4L)
 Courtesy of Mitsubishi Motor Sales of America.



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Fig. 16: Measuring Limited Slip Case Depth (3.0L)
 Courtesy of Mitsubishi Motor Sales of America.

5) Remove spring plates, spring discs, friction plates and friction disc from pressure rings. Mark components for location. Install thrust washers on each end of pressure rings. See Fig. 17.

6) Measure clearance from end of thrust washer to rear face of pressure ring. Clearance should be .002" (.05 mm) or less. If clearance is not as specified, select proper thickness thrust washers to obtain correct clearance.

7) Once correct thrust washers are determined, install thrust washers on pressure rings. Squeeze pressure rings together, and measure width (dimension "H") from end of thrust washer to remaining thrust washer. See Fig. 17.

8) Determine distance between thrust washer surfaces when differential case is assembled (dimension "I"). Dimension "I" = "J" + "K" + "L". Dimension "J" is the same as dimension "D" in step 4).

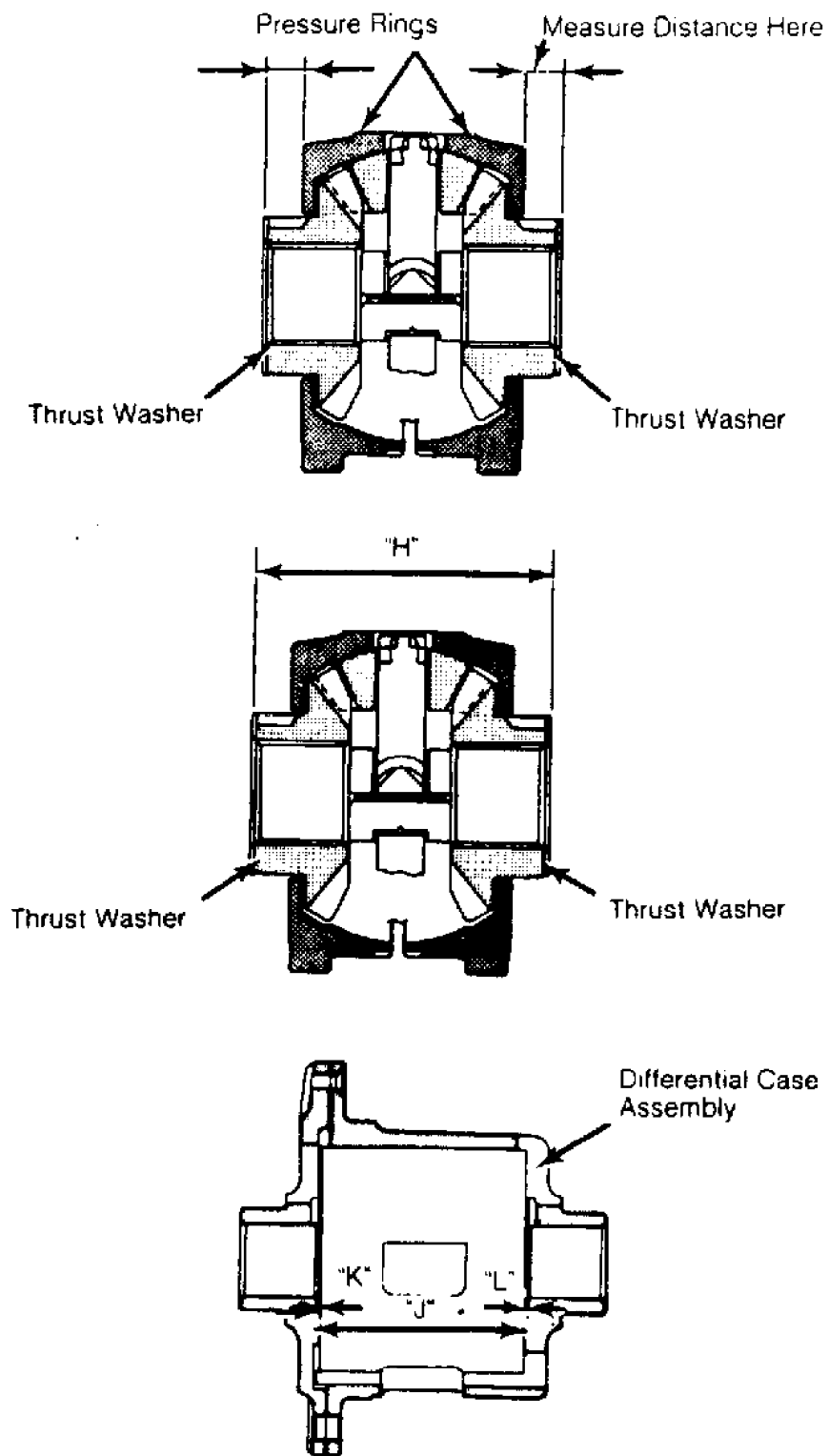


Fig. 17: Measuring Thrust Washer Clearance
 Courtesy of Mitsubishi Motor Sales of America.

9) Subtract "H" from "I". This is the clearance between thrust washer and differential case. Correct clearance is .002-.008"

(.05-.20 mm). If clearance is not within specification, change thrust washer to obtain correct clearance.

10) Apply gear oil and friction modifier to all components. Install components in differential case. Ensure assembly order and direction of clutch components are correct. See Fig. 18.

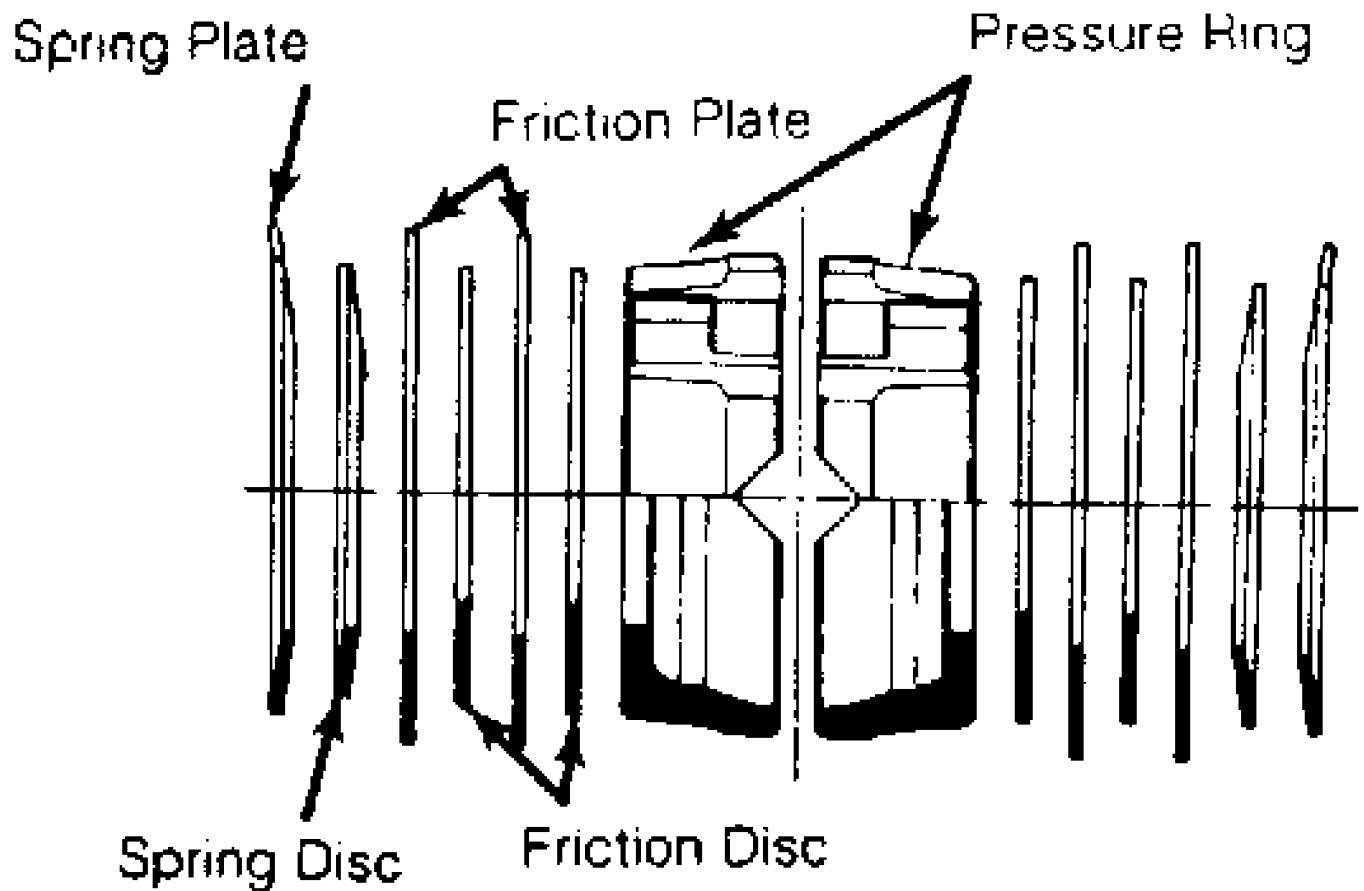


Fig. 18: Limited Slip Differential Assembly
Courtesy of Mitsubishi Motor Sales of America.

11) Install differential case cover with reference marks aligned. Tighten screws to specification in several steps. See TORQUE SPECIFICATIONS table. Ensure cases contact each other completely when fully assembled. Check for incorrect clutch assembly if gap exists.

12) Using Clutch Plate Preload Tool (MB990988), Shaft (MB990989) and torque wrench, measure starting torque. See Fig. 19. Rotate unit slightly before measuring starting torque.

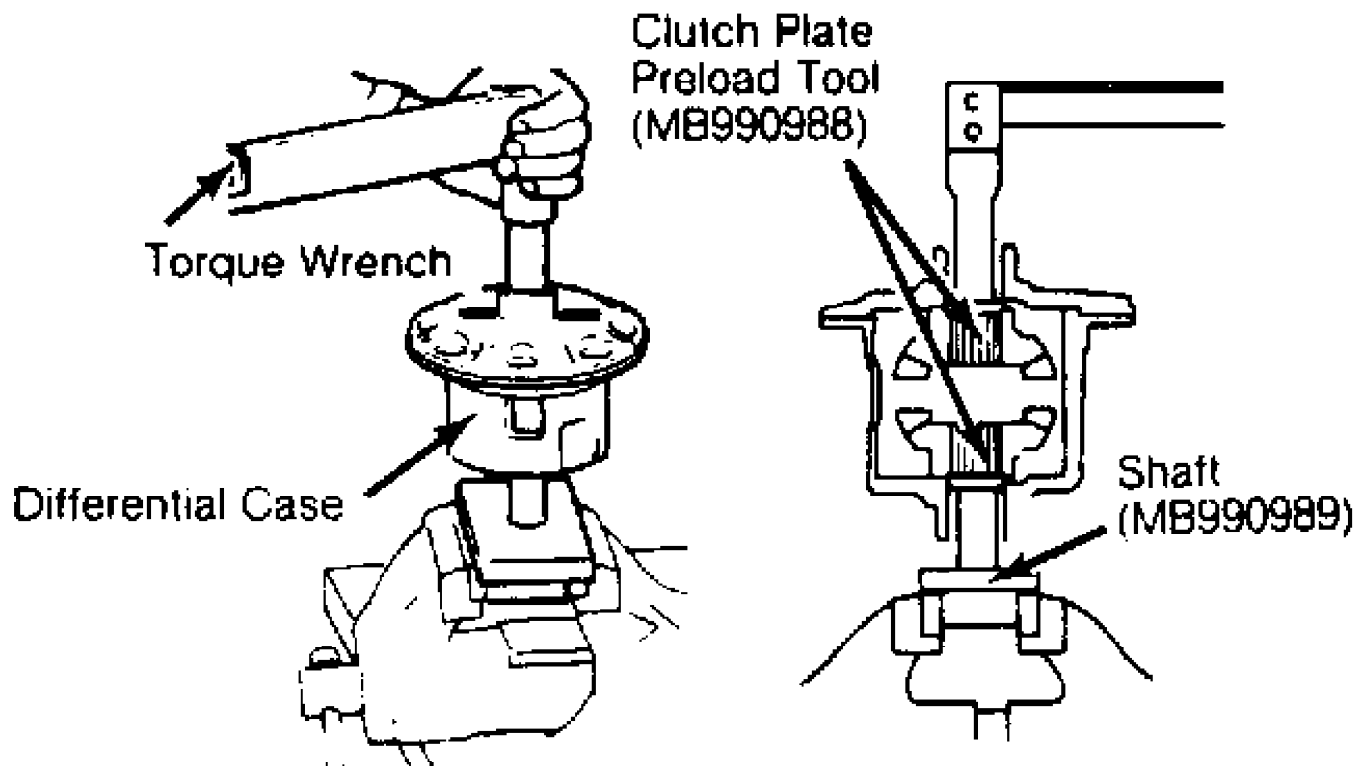


Fig. 19: Checking Differential Starting Torque
Courtesy of Mitsubishi Motor Sales of America.

13) Ensure starting torque is within specification. See STARTING TORQUE table. Ensure adhesive is removed from ring gear mounting bolts and gear mounting surface. Clean internal threads with tap.

14) Ensure alignment marks on differential case and ring gear align. Apply Loctite 271 to bolts, and install ring gear on differential case. Tighten bolts in diagonal sequence to specification. See TORQUE SPECIFICATIONS table.

STARTING TORQUE TABLE

Application	Ft. Lbs. (N.m)
Used Clutch Plates	29-54 (40-75)
New Clutch Plates	18-54 (25-75)

Carrier Assembly & Drive Pinion Installation

1) Install pinion bearing races in differential housing. Ensure races are fully seated. Install Pinion Height Gauge (MB990901) and pinion bearings. See Fig. 20. DO NOT install oil seal.

2) Using torque wrench, measure pinion rotating torque. Gradually tighten pinion height gauge to increase rotating torque. See PINION ROTATING TORQUE SPECIFICATIONS table.

PINION ROTATING TORQUE SPECIFICATIONS TABLE

Application	INCH Lbs. (N.m)
Oil Seal Not Installed	
With Lubrication	3.5-4.3 (.4-.5)

Without Lubrication	5.2-7.8 (.6-.9)
Oil Seal Installed	
With Lubrication	5.6-6.5 (.65-.75)
Without Lubrication	7.4-10.0 (.85-1.15)

3) Install cylinder gauge in side bearing seats. Ensure flat areas align, and gauge contacts side bearing seat firmly. See Fig. 20. Select adjusting shim with same thickness as gap between cylinder gauge and pinion height gauge.

4) Use minimum amount of adjusting shims. Install selected adjusting shims between drive pinion gear and rear pinion bearing. See Fig. 20. Using bearing installer and press, install rear pinion bearing.

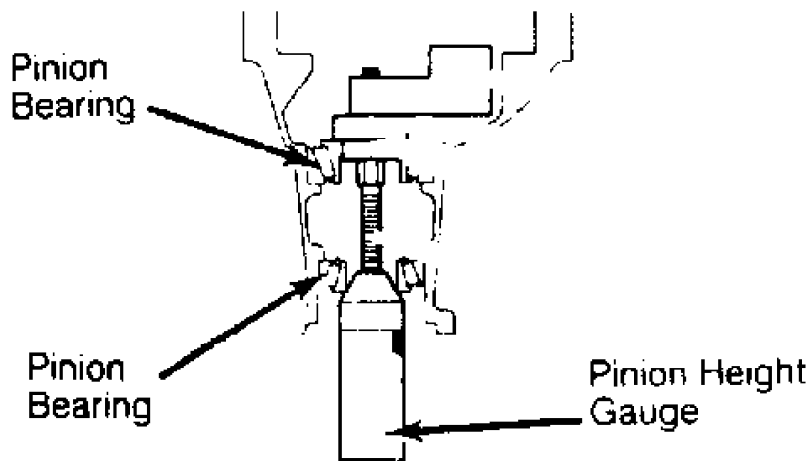
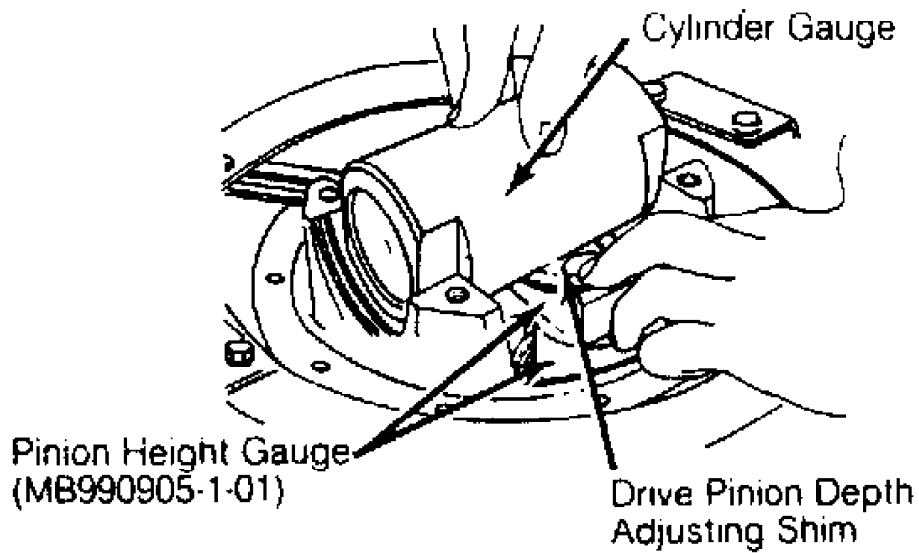


Fig. 20: Setting Pinion Height
Courtesy of Mitsubishi Motor Sales of America.

5) Install drive pinion in differential housing. Install spacer, pinion front shim(s) and front pinion bearing. DO NOT install

oil seal. Install pinion companion flange, washer and retaining nut. Tighten nut to specification. See TORQUE SPECIFICATIONS table.

6) Check pinion rotating torque. See PINION ROTATING TORQUE SPECIFICATIONS table. Adjust rotating torque by replacing drive pinion front shims or spacer. Once correct rotating torque is obtained, install oil seal. Coat seal lip with grease. Install pinion companion flange so alignment marks are correct. Apply light coat of grease to contact area of pinion flange washer.

7) Install new retaining nut. Recheck pinion rotating torque. Ensure rotating torque is within specification. Press side bearings onto differential case. Install outer races. Install differential carrier into differential housing. Align bearing cap index marks, and snug carrier cap bolts. Ensure outer races and bearing caps are installed in original location.

8) Install side bearing nuts. Tighten bearing cap bolts to specification. See TORQUE SPECIFICATIONS table. Tighten bearing nuts until bearing outer races are seated against bearings. Adjust ring gear backlash.

Ring Gear Backlash

1) Secure drive pinion in place. Using dial indicator, check ring gear backlash at heel of ring gear tooth. See Fig. 7. Measure at 4 locations of ring gear. Gear backlash must be within specification. Backlash should be .004-.006" (.11-.16 mm) on Pickup 2WD and Ram-50 2WD models, .005-.007" (.13-.18 mm) on Montero, Pickup 4WD & Ram-50 4WD models.

2) If backlash is less than specification, loosen side bearing nut at back of ring gear, and tighten side bearing nut on tooth side of ring gear by same amount. If backlash exceeds specification, loosen side bearing nut at tooth side of ring gear, and tighten side bearing nut at back of ring gear by same amount.

3) After adjusting backlash, tighten both side bearing nuts half the distance between 2 adjacent holes on side bearing nut. Recheck backlash. Ensure bearing cap bolts are tightened to specification. See TORQUE SPECIFICATIONS table.

4) Lock plates are of 2 designs for hole location of side bearing nuts. Install proper type lock plate. Tighten lock plate bolt to specification. See TORQUE SPECIFICATIONS table. Check gear tooth contact pattern. See GEAR TOOTH CONTACT PATTERNS article in GENERAL INFORMATION.

Ring Gear Runout

Using dial indicator, measure runout at back side of ring gear. See Fig. 8. Runout must be within .002" (.05 mm). If runout is excessive, change ring gear-to-differential case mounting position. Recheck runout.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS TABLE

Application	Ft. Lbs. (N.m)
Bearing Cap Bolt	40-47 (54-64)
Bearing Case-To-Axle Housing Bolt	36-43 (49-58)
Brake Tube Flare Nut	10-12 (14-16)
Differential Carrier-To-Axle Housing Nut	
2.4L (2WD)	18-22 (24-30)
3.0L (4WD)	29-40 (39-54)
Drain Plug	43-50 (58-68)
Drive Shaft-To-Flange Bolt	36-43 (49-58)
Filler Plug	29-43 (39-58)

Lock Plate Bolt	11-16 (15-22)
Pinion Flange Nut	137-181 (186-245)
Ring Gear Bolt	58-65 (79-88)
Side Bearing Lock Plate Bolts	11-16 (15-22)
Wheel Lug Nut	
Montero	72-87 (98-118)
Pickup & Ram-50	87-101 (118-137)

DRIVE BELT ROUTING

1993 Mitsubishi Montero

1993 ENGINE COOLING
Chrysler/Mitsubishi Drive Belt Routing

Chrysler Corp.: Ram-50
Mitsubishi: Montero & Pickup

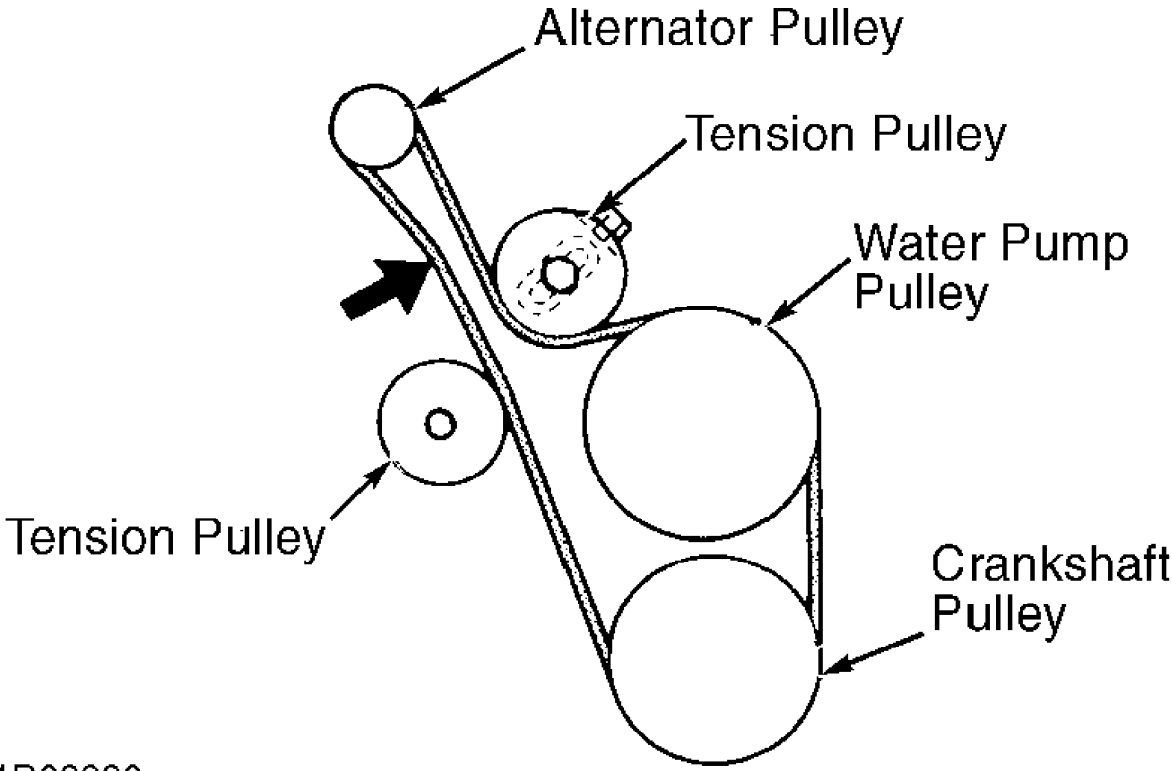
BELT ADJUSTMENT

NOTE: For belt alignment, see Fig. 1.

BELT ADJUSTMENT TABLE

Application	Deflection (1) In. (mm)
Montero (2)	.20-.24 (5.1-6.1)
Pickup & Ram-50	
2.4L	.27-.39 (6.8-9.9)
3.0L (2)	.32-.39 (8.1-9.9)

(1) - With 22 lbs. (10 kg) pressure applied midway on belt run.
(2) - For serpentine belt routing, see Fig. 1.



91D02920

Fig. 1: Routing Serpentine Belt
Courtesy of Mitsubishi Motor Sales of America.

*** DRIVETRAIN SYSTEMS UNIFORM INSPECTION GUIDELINES ***

1993 Mitsubishi Montero

GENERAL INFORMATION

Drivetrain/Transmission Motorist Assurance Program
Standards For Automotive Repair

All Makes and Models

INTRODUCTION TO MOTORIST ASSURANCE PROGRAM (MAP)

CONTENTS

OVERVIEW OF MOTORIST ASSURANCE PROGRAM
OVERVIEW OF SERVICE REQUIREMENTS & SUGGESTIONS

Drive/Power Train Assemblies

AUTOMATIC TRANSMISSION/TRANSAXLE ASSEMBLIES
DIFFERENTIAL AND FINAL DRIVE ASSEMBLIES
MANUAL TRANSMISSION/TRANSAXLE ASSEMBLIES
TRANSFER CASE ASSEMBLIES

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 HARNESES 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:

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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.

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.

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 HARNESSSES 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.

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		

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.

P - EGR FUNCTION TESTING

1993 Mitsubishi Montero

1989-95 ENGINE PERFORMANCE

Chrysler Motors/Mitsubishi Corp. EGR Function Testing

All Models

EGR FUNCTION TESTING

Colt Wagon 1.8L, Montero (A/T), Raider (A/T), Sigma, Van/Wagon & All Other Federal Models (Ported EGR Valve)

1) Disconnect Green-striped hose from throttle body and connect a vacuum pump to hose end. Plug nipple where hose was connected to throttle body. With engine temperature 122°F (50°C) or less, and engine idling, apply vacuum to hose. If idle does not change and vacuum leaks down, system is functioning properly.

2) With engine temperature 176-205°F (80-95°C) and engine idling, apply 2 in. Hg to hose. If idle does not change, and vacuum holds, system is functioning properly.

3) Apply 7.7 in. Hg. If vacuum holds and idle becomes unstable or engine stalls, EGR system is functioning properly.

Montero (M/T), Raider (M/T) & All Other California Models (Ported EGR Valve)

1) Connect a vacuum tee into Green-striped hose from EGR valve and connect a vacuum pump to vacuum tee. With engine temperature 68°F (20°C) or less and engine idling, snap throttle opened and closed. If no change in vacuum reading on vacuum pump gauge is detected, system is functioning properly.

2) With engine temperature 158°F (70°C) or higher and engine idling, snap throttle open to race engine. If vacuum is now indicated on vacuum pump gauge, system is functioning properly.

3) Using a vacuum pump, apply specified vacuum to open EGR valve. See appropriate EGR VALVE SPECIFICATIONS table. If idle becomes unstable or engine stalls, EGR system is functioning properly.

EGR VALVE SPECIFICATIONS TABLE (1989 Models)

Application	Closed In. Hg	Open In. Hg
Colt, Colt Wagon, Mirage	1.8	7.7
Colt Vista	2.1	6.8
Galant, Sigma	1.7	7.5
Montero, Raider, Van/Wagon	1.9	6.7

EGR VALVE SPECIFICATIONS TABLE (1990 Models)

Application	Closed In. Hg	Open In. Hg
Colt, Colt 200, Mirage & Colt Wagon	1.8	7.7
Colt Vista	2.1	6.8
Eclipse	1.8	8.5
Galant	1.7	7.5
Pickup, Ram-50	1.2	9.4
Precis	1.0	3.3
Sigma	1.6	8.7

Van/Wagon	1.9	6.7

EGR VALVE SPECIFICATIONS TABLE (1991 Models)

Application	Closed In. Hg	Open In. Hg
Colt, Colt 200, Colt Vista, Mirage & Summit	2.1	6.8
Eclipse	1.8	8.5
Galant	1.7	7.5
Montero	2.4	6.7
Pickup, Ram-50	1.2	9.4
Precis	1.0	3.3
Stealth & 3000GT	1.8	9.1

EGR VALVE SPECIFICATIONS TABLE (1992-94 Models)

Application	Closed In. Hg	Open In. Hg
Colt, Colt 200, Mirage & Summit	2.1	6.8
Diamante, Stealth & 3000GT	1.8	9.1
Eclipse	1.8	8.5
Expo, Summit Wagon & Vista Wagon	1.6	7.9
Galant	1.7	7.5
Montero	2.4	6.7
Pickup, Ram-50	1.2	9.4
Precis	1.0	3.3

ELECTRICAL COMPONENT LOCATOR

1993 Mitsubishi Montero

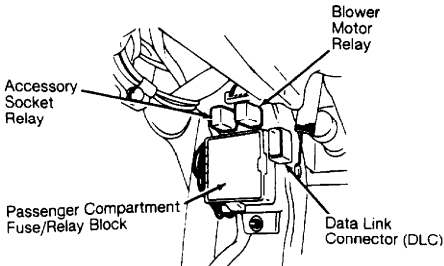
1993 ELEC COMPONENT LOCATION
Chrysler Corp. & Mitsubishi Electrical Component Location
Montero

SAFETY PRECAUTION

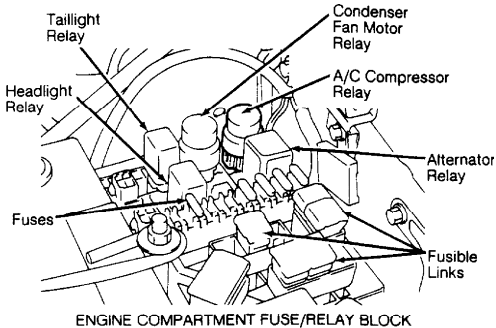
WARNING: When working on vehicles equipped with Supplemental Restraint System (SRS), never apply electrical voltage to the system. This could cause the SRS (air bag) to be deployed.

BUZZERS, RELAYS & TIMERS

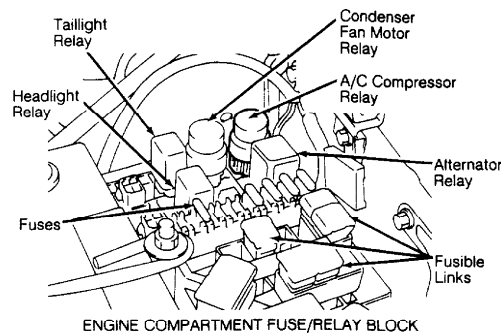
Component	Component Location
ABS Motor Relay	On top of ABS actuator assembly.
ABS Power Relay	Behind center of dash.
ABS Valve Relay	On top of ABS actuator assembly.



94I31334 Accessory Socket Relay	On bracket, above passenger compartment fuse/relay block.



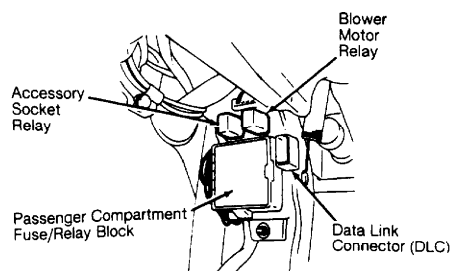
94J31335 A/C Compressor Relay	In engine compartment fuse/relay block.



94J31335

Alternator Relay

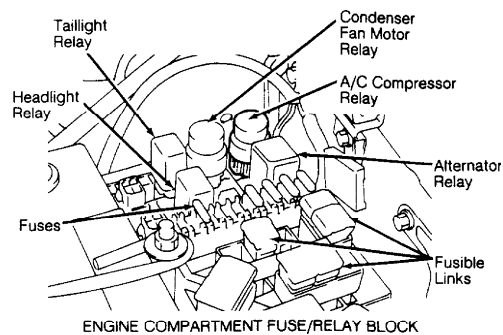
In engine compartment fuse/relay block.



94I31334

Blower Motor Relay

Behind left side of dash, above fuse/relay block.



94J31335

Condenser Fan Motor Relay

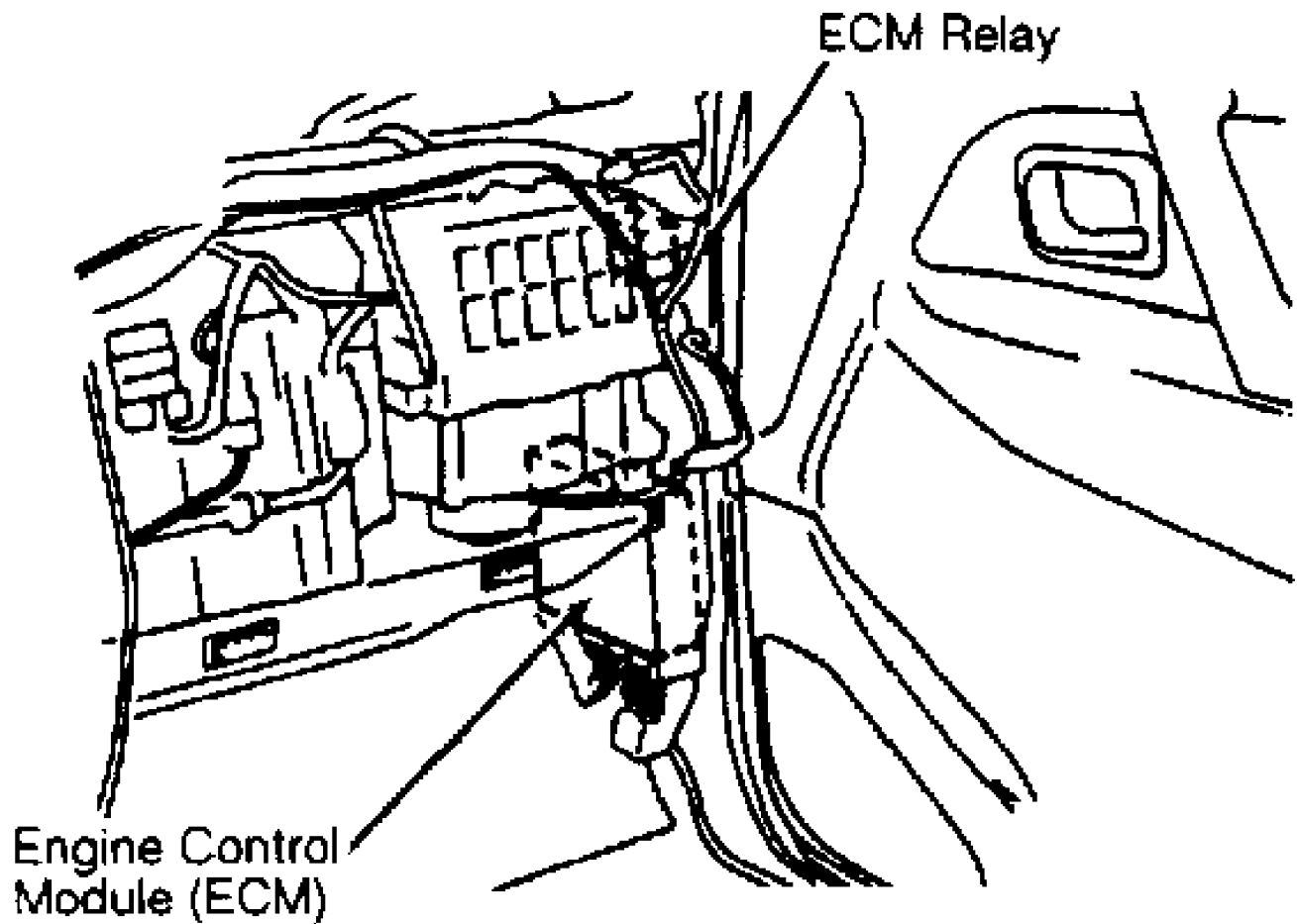
In engine compartment fuse/relay block.

Defogger Relay

Behind left side of dash.

Defogger Timer

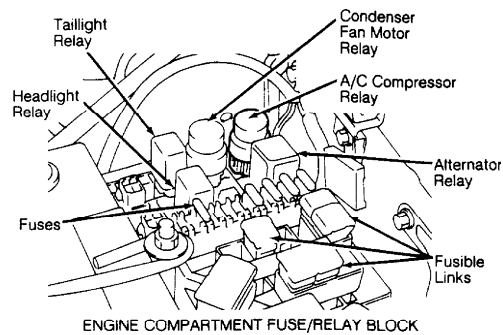
Behind left side of dash.



94A31336

ECM Relay

Behind right side of dash,
above ECM.



94J31335

Headlight Relay

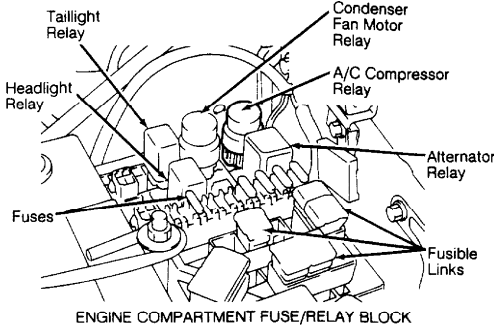
In engine compartment
fuse/relay block.

Headlight Washer Relay

On bracket, behind left side
of dash.

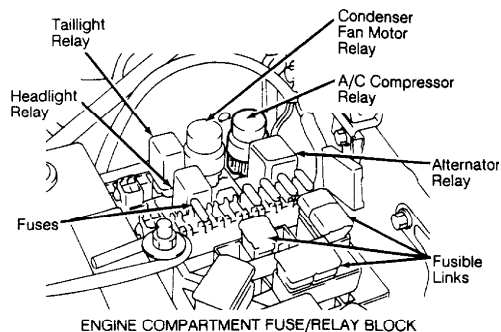
Ignition Key Illumination Timer

Behind center console.

Intermittent Wiper Relay Front	Built-in steering column switch.
Rear	In passenger compartment fuse/relay block.
Overdrive Control Relay (A/T)	In passenger compartment fuse/relay block.
Power Door Lock Relay	In passenger compartment fuse/relay block.
Power Window Relay	In passenger compartment fuse/relay block.
Starter Relay	Behind center console.
 94J31335	
Taillight Relay	In engine compartment fuse/relay block.
Turn Signal/Hazard Flasher Relay	In passenger compartment fuse/relay block.
Warning Buzzer (Key, Lights & Seat Belt)	Behind center of dash, on reinforcement bracket.

CIRCUIT PROTECTION DEVICES

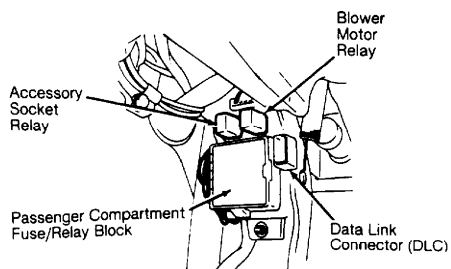
Component	Component Location



94J31335

Engine Compartment Fuse/
Relay Block

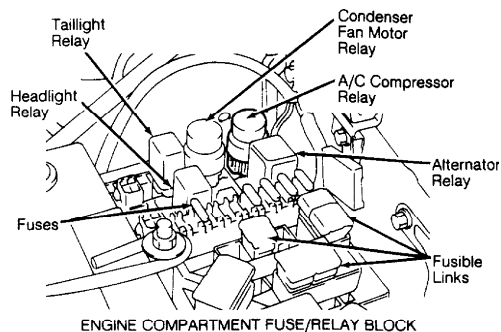
On left inner fender panel,
behind battery.



94I31334

Passenger Compartment Fuse/
Relay Block

Behind left side of dash.



94J31335

Fusible Links

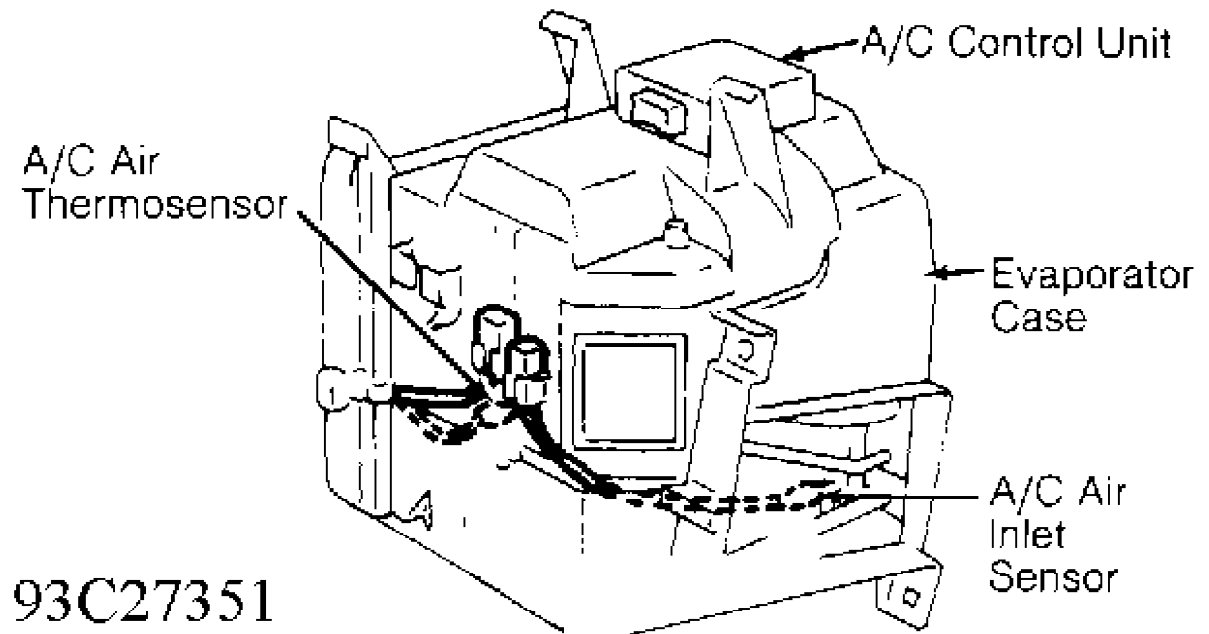
In engine compartment
fuse/relay block.

Power Seat Relay Block

Under driver's seat.

CONTROL UNITS

Component	Component Location
ABS Control Unit	Mounted on top of right rear wheelwell, under metal plate.
Air Bag Diagnostic Control Unit	Behind center console.



93C27351

A/C Control Unit

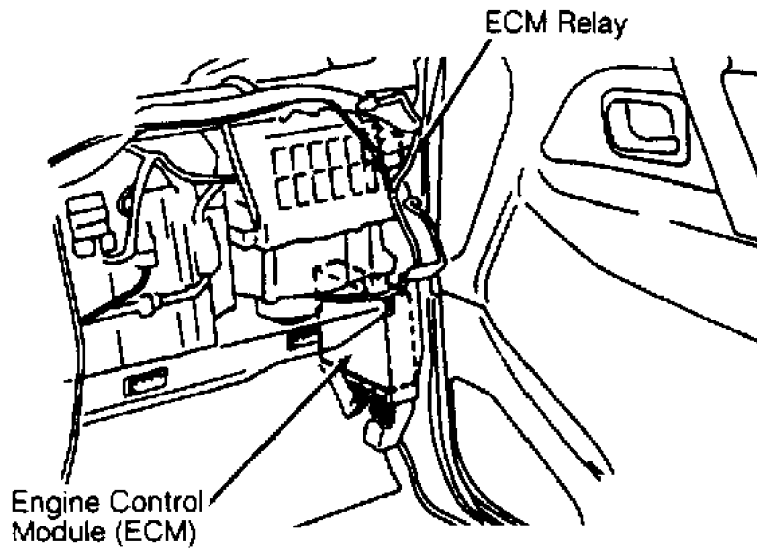
On top of evaporator case.

A/T Control Unit (4-Speed)

Behind left side of dash.

Cruise Control Unit

Behind center console.



94A31336

Engine Control Module (ECM)

Behind right kick panel.

Keyless Entry Control Unit

Behind right side quarterpanel.

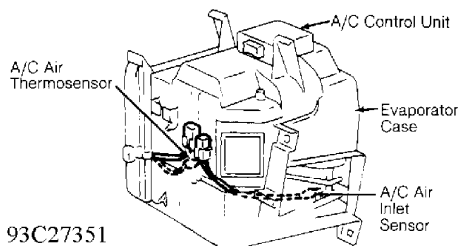
Power Antenna Control Unit	Behind center console.
Power Door Lock Control Unit	Behind left side of dash.
Rear Differential Lock Control Unit	Mounted on top of rear right wheelwell, under metal plate.
Sun Roof Control Unit	On center of roof, behind sun roof.
Variable Shock Absorber Control Unit	Behind left rear wheelwell, behind quarterpanel.
4WD Indicator Control Unit	Behind center of dash.

MOTORS

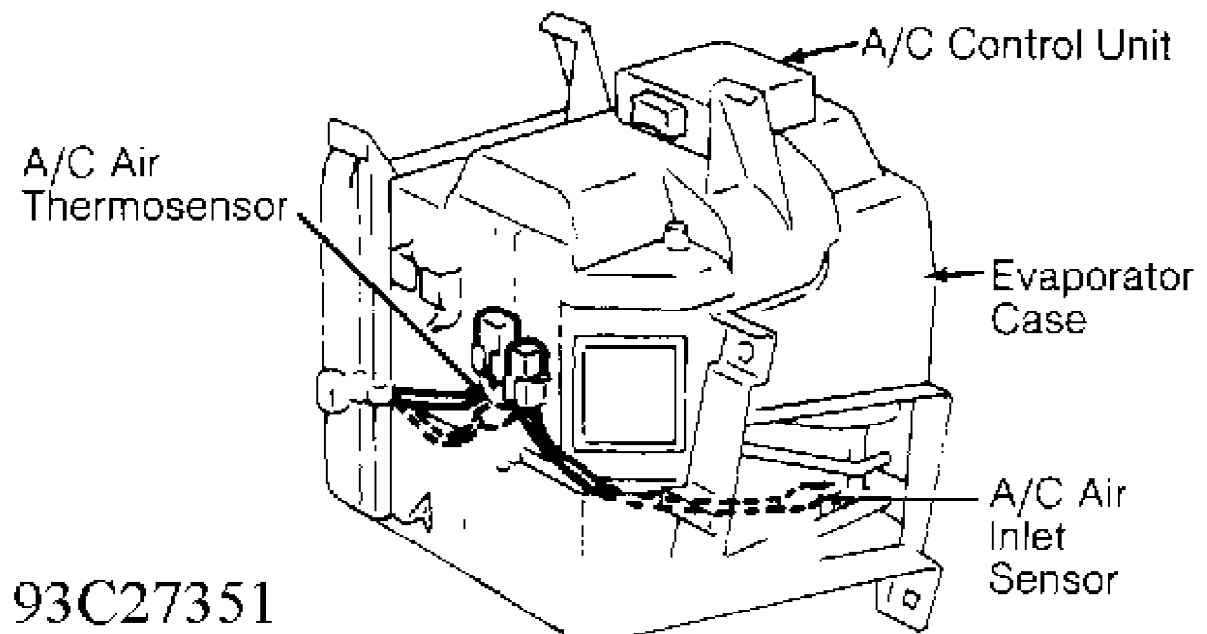
Component	Component Location
A/C-Heater Blower Motor	Behind right side of dash.
Idle Speed Control (ISC) Motor	On throttle body.
Rear Differential Lock Air Pump Motor	Mounted on top of rear right wheelwell, under metal plate.
Windshield Washer Motor	Bottom of windshield washer reservoir.
Windshield Wiper Motor Front	On left side of firewall.
Rear	On center of tailgate.

SENDING UNITS & SENSORS

Component	Component Location
ABS G-Sensor	In center console, rear of parking brake lever.
ABS Wheel Speed Sensors	On bracket, on each wheel hub.



A/C System Air Inlet Sensor	In evaporator air duct.



A/C System Air Thermosensor

Mounted on outside of evaporator case.

In-Vehicle Temp. Sensor

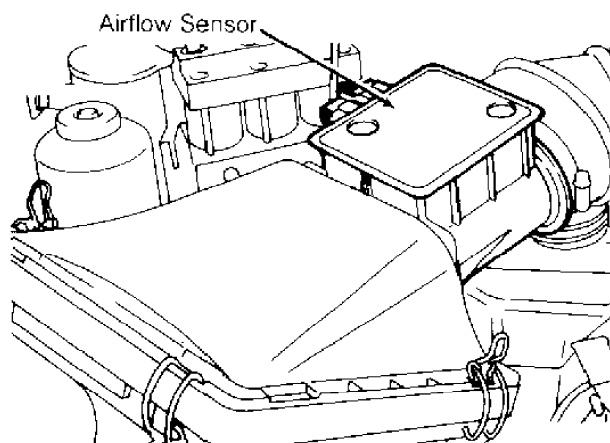
Under steering column.

Outside Temperature Sensor

Below left headlight.

Air Bag Impact Sensors

On left and right front of inner fender panel.



93F27354

Airflow Sensor

In air cleaner duct (includes intake air temp. & baro. sensors).

Barometric Pressure Sensor

Built-in to airflow sensor

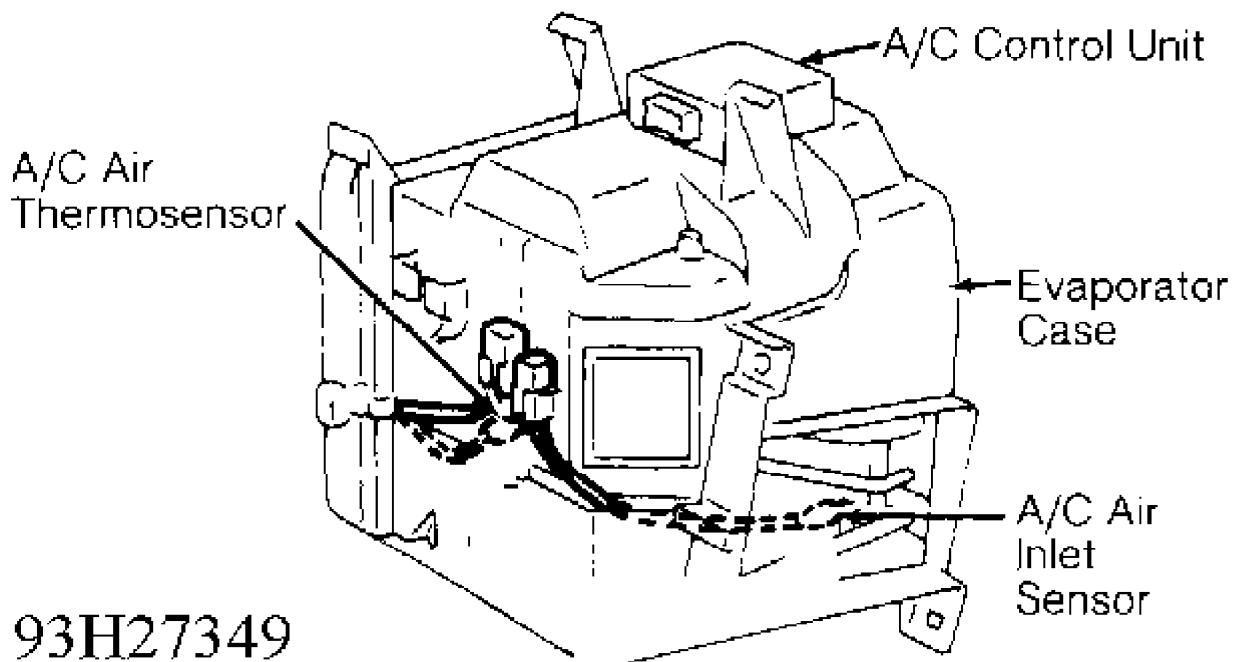
assembly.

Camshaft Position Sensor (DOHC)

On bottom of left camshaft gear.

Coolant Temp. Sensor (DOHC)

On top front of intake manifold.



93H27349

Coolant Temp. Sensor (SOHC)

On thermostat housing.

Crank/TDC Sensor (SOHC)

Inside distributor assembly.

Crankshaft Position Sensor (DOHC)

On crankshaft gear.

EGR Temperature Sensor

On base of EGR valve.

Geomagnetic Sensor (Compass)

On top center of dash.

Knock Sensor

On top center of intake manifold.

Intake Air Temperature Sensor

Built-in to airflow sensor assembly.

Oil Pressure Sending Unit

Near oil filter.

Temperature Gauge Sending Unit

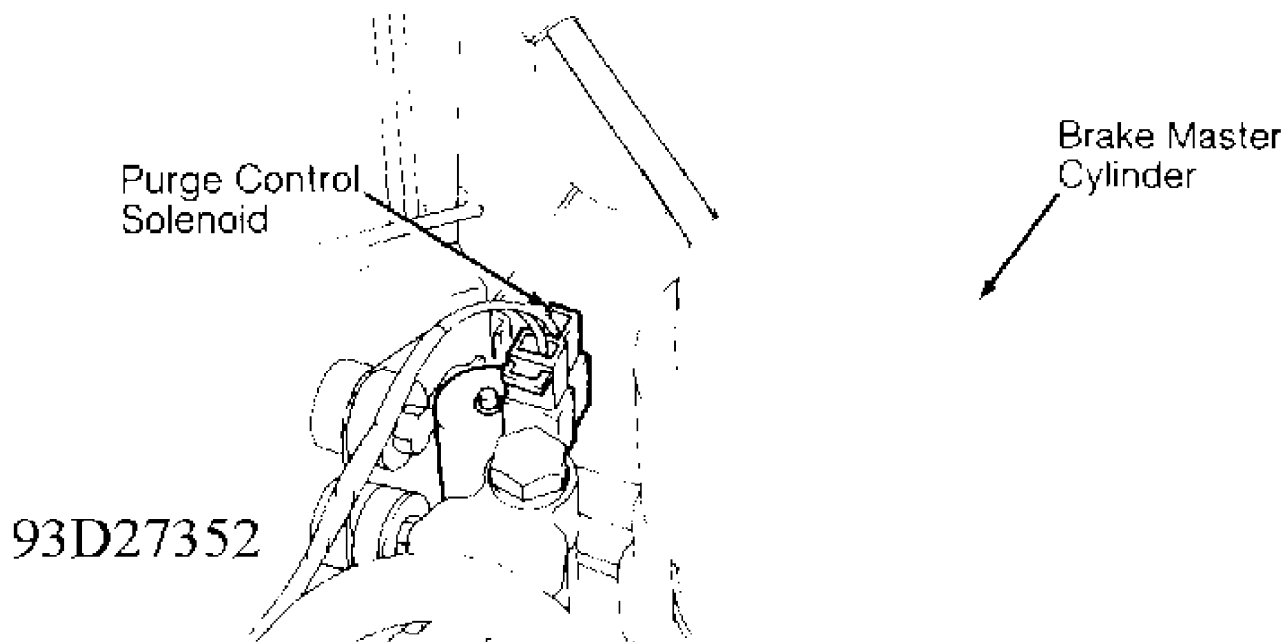
On thermostat housing.

Vehicle Speed Sensor (VSS)

In speedometer assembly and on transmission tailshaft.

SOLENOIDS & SOLENOID VALVES

Component	Component Location
ABS Actuator Solenoids	On ABS actuator assembly.
A/T Solenoids	On side of transmission assembly.
EGR Solenoid	On right rear of front inner fender panel.



Purge Control Solenoid	On left side of firewall, near master cylinder.
Variable Induction Solenoid	On top front of engine.

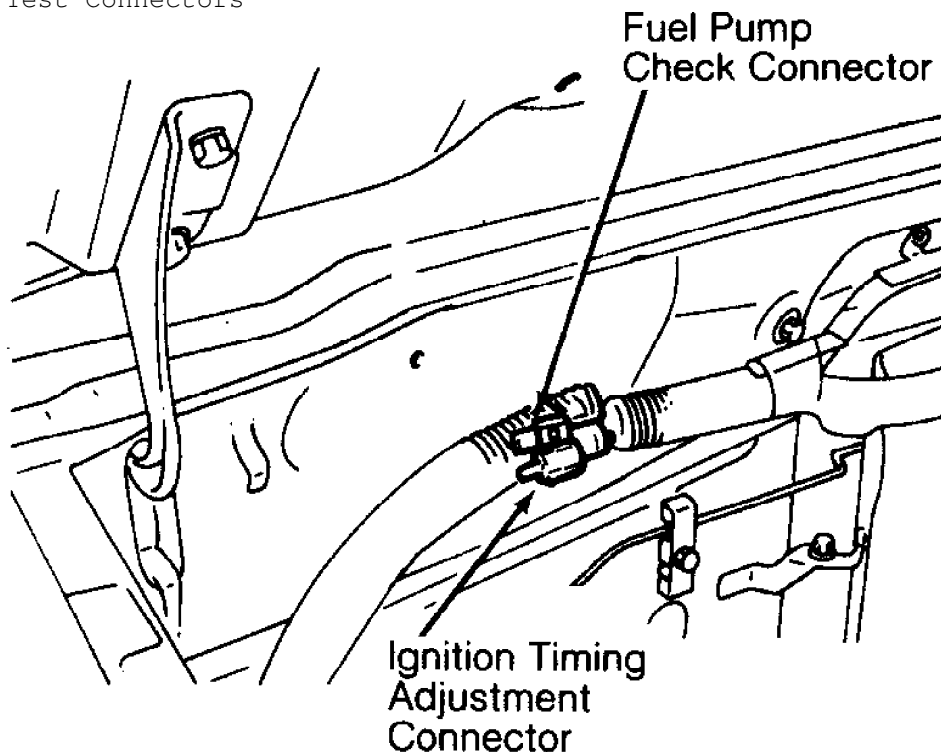
SWITCHES

Component	Component Location
A/C Dual-Pressure Switch	On high pressure line, on receiver-drier.
A/T Temperature Switch	On right side of transmission, near shift rod.
Brake Fluid Level Switch	In brake master cylinder reservoir.

Brake/Cruise Switch	On bracket, above brake pedal.
Clutch/Cruise Switch	On bracket, above brake pedal.
Inhibitor Switch (A/T)	On transmission, at base of shift lever.
Parking Brake Switch	At base of parking brake lever.
Power Steering Pressure Switch	On power steering pump.
Rear Differential Lock Detection Sw.	On right front of rear differential carrier.
Seat Belt Warning Switch	On driver-side seat belt buckle.

MISCELLANEOUS

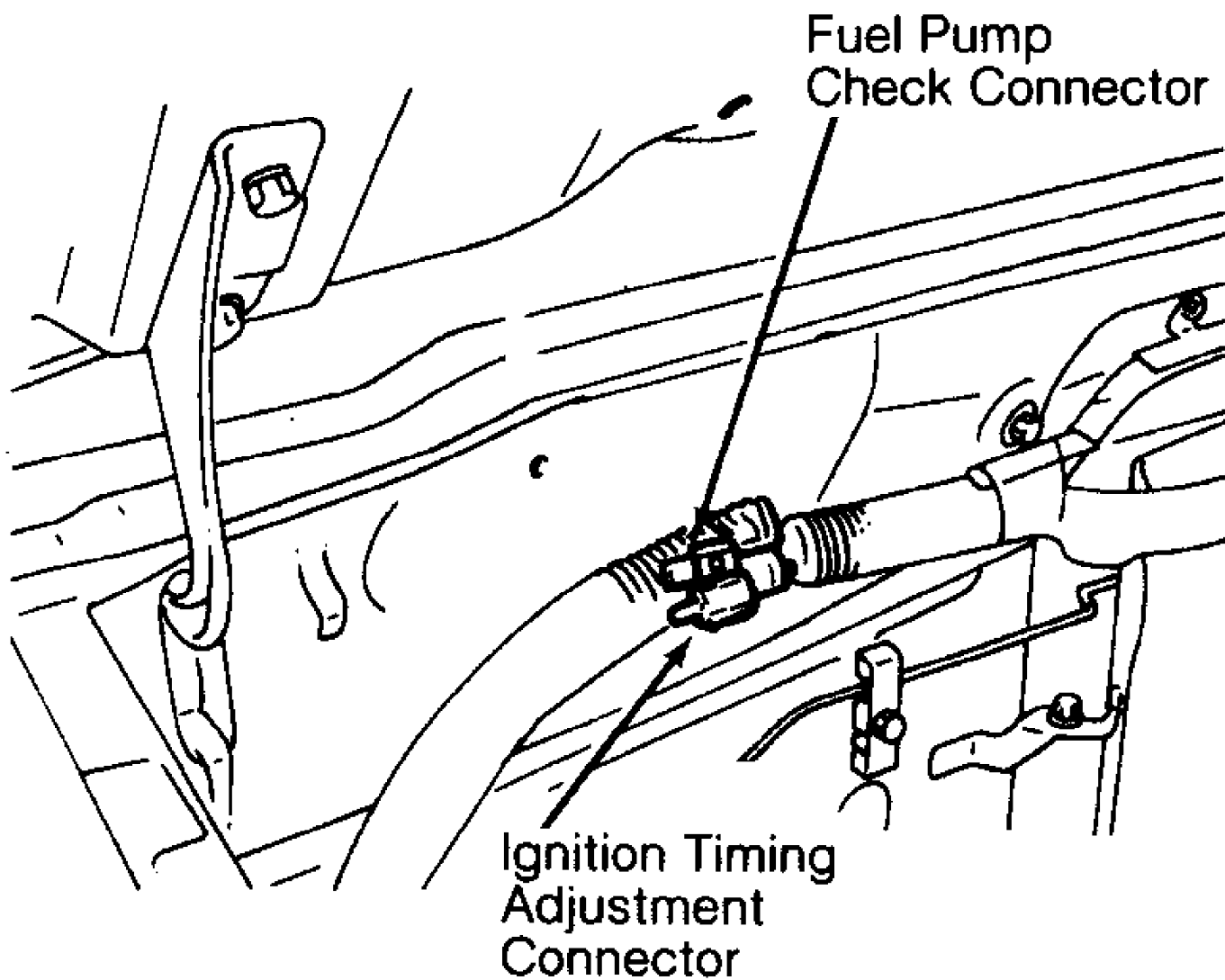
Component	Component Location
Blower Motor Resistor	On blower motor housing.
Check/Test Connectors	



93B27350

Fuel Pump Check Connector

Taped to wiring harness, on right side of firewall.



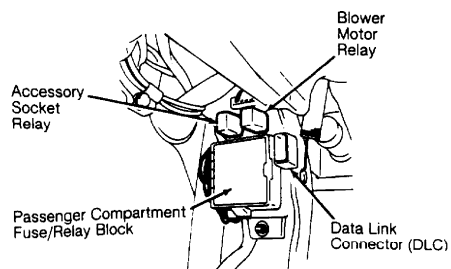
93B27350

Ignition Timing Adjustment
Connector

Taped to wiring harness, on
right side of firewall.

RPM/Tach (DOHC) Check Connector

Taped to wiring harness, on
right side of firewall.



94I31334

Data Link Connector (DLC)

Behind left side of dash,
near fuse/relay block.

Diodes

ABS Circuit	On wiring harness, behind center console.
4WD Active Suspension	On wiring harness, behind left side of dash.
Maintenance Reminder Light Reset	Behind instrument panel.
Radio Noise Capacitor/Filter	Mounted on ignition coil bracket.

*** ELECTRICAL SYSTEM UNIFORM INSPECTION GUIDELINES ***

1993 Mitsubishi Montero

GENERAL INFORMATION

Electrical System Motorist Assurance Program
Standards For Automotive Repair

All Makes and Models

INTRODUCTION TO MOTORIST ASSURANCE PROGRAM (MAP)

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BATTERY TRAYS AND HOLD DOWN HARDWARE
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CRUISE CONTROL VACUUM HOSES, TUBES AND RESERVOIRS
CRUISE CONTROL VEHICLE SPEED SENSORS
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DEFROSTERS
DELAYS
DIMMERS
ELECTRIC HEATERS
EQUALIZERS
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FUSE BOXES AND BLOCKS
FUSES, FUSIBLE LINKS AND CIRCUIT BREAKERS
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GENERATORS
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KEYLESS ENTRY TRANSMITTERS
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LENSES
MICROPHONES
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ODOMETERS, SPEEDOMETERS AND TACHOMETERS (CABLE-DRIVEN)
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RECEIVERS, AMPLIFIERS, EQUALIZERS AND SUB-WOOFER VOLUME CONTROLS
RELAY BOXES
RELAYS
SEALED BEAMS
SEAT HEATERS
SECURITY ALARM SENSORS
SIRENS
SOLENOIDS
SPEAKERS AND MICROPHONES
SPEEDOMETER AND TACHOMETER LINKAGES AND CABLES
SPEEDOMETER CABLES
SPEEDOMETERS
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TACHOMETERS
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VACUUM RESERVOIRS
VOLTAGE REGULATORS
WASHER FLUID LEVEL SENDERS
WASHER PUMPS
WIPER ARMS AND BLADES
WIPER BLADES
WIPER HOSES AND NOZZLES
WIPER LINKAGES
WIPER NOZZLES
WIPER PUMP RESERVOIRS
WIRING HARNESSES AND CONNECTORS

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:

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.

ELECTRICAL SYSTEMS

SERVICE PROCEDURES REQUIRED AND SUGGESTED FOR PROPER VEHICLE OPERATION

NOTE: When working on electrical systems, if a potentially hazardous condition is observed, require repair or replacement of affected components prior to performing further work.

ACTUATOR MOTORS (SOLENOIDS) (ELECTRIC)

ACTUATOR MOTOR (SOLENOIDS) (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.
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.
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.
Missing	C	.....	Require replacement.
Noisy	2	..	Suggest repair or replacement.
Out of adjustment	B	..	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.

ACTUATOR MOTORS (VACUUM)

ACTUATOR MOTOR (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	A	.....	(1) Require 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 BAGS

For all air bag components and conditions, refer to vehicle manufacturer's specifications for diagnosis and parts replacement.

ALTERNATORS AND GENERATORS

NOTE: If components have been added that increase vehicle electrical load requirement (for example, sound systems, air conditioning, alarm systems, etc.), charging system output must meet the increased demand.

ALTERNATOR AND GENERATOR INSPECTION

Condition	Code	Procedure
Alternator output meets OEM specification but is insufficient for add-on		

electrical load	2	...	Suggest upgrade of alternator or removal of excess electrical load.
Alternator's rated output is below OEM specification	B	.....	Require replacement.
Attaching hardware broken	A	...	Require repair or replacement of hardware.
Attaching hardware missing	C	.....	Require replacement of hardware.
Attaching hardware non-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.
Diode inoperative	A	.....	(2) Require repair or 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	.....	(2) Require repair or replacement.
Noisy	2	..	Suggest repair or replacement.
Pulley incorrect	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.
Terminal resistance (voltage drop) out of specification	A	..	Require repair or replacement.
Threads damaged	A	..	Require repair or replacement.
Threads stripped (threads missing)	A	.....	Require replacement.
Voltage drop out of specification	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.

AMPLIFIERS

See
RECEIVERS, AMPLIFIERS, EQUALIZERS AND SUB-WOOFER VOLUME CONTROLS.

ANTENNAS

ANTENNA 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.
Bent	2	.. Suggest repair or replacement.
Binding	2	.. Suggest repair or 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 damaged, conductors exposed	A	.. Require repair or replacement.
Insulation damaged, conductors not exposed ..	1	 Suggest replacement.
Missing	C	 Require replacement.
Motor runs continuously ..	A	 Require or replacement.
Power antenna noisy	2	.. Suggest repair or replacement.
Sticking	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) - Inoperative includes intermittent operation or out of
specification.

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. If battery does not meet specifications, require replacement. If battery is sealed type (non-removable filler caps), require replacement.
- (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 CABLES

See BATTERY CABLES, WIRES AND CONNECTORS.

BATTERY CABLES, WIRES AND CONNECTORS

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 HOLD DOWN HARDWARE

See BATTERY TRAYS AND HOLD DOWN HARDWARE.

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.

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.
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.

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.	
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.	
Broken	A	..	Require 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	.....	(1) 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.	
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 replacement of part.				

BULBS, SEALED BEAMS AND LEDS

NOTE: Does not include soldered-in components.

BULB, SEALED BEAM AND LED INSPECTION

Condition	Code	Procedure
Adjustment out of specification	B	.. Require repair or replacement.
Application incorrect ...	B	 (1) 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.
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 leaking	A	..	Require repair or replacement.
Base loose, affecting performance	B	..	Require repair or replacement.
Base loose, not affecting performance	1	..	Suggest repair or replacement.
Base melted	A	.....	(2) Require 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.
Burned out	A	.....	Require replacement.
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.
Corroded, affecting performance	A	..	Require repair or replacement.
Corroded, not affecting performance	2	..	Suggest repair or replacement.
Cracked	A	.....	Require replacement.
Intermittent	A	.....	Require replacement.
Lamp base melted	A	.....	(2) Require replacement.
Leaking	A	..	Require repair or 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.
Threads damaged	A	..	Require repair or replacement.
Threads stripped (threads missing)	A	.....	Require replacement.
(1) - Application incorrect includes wrong bulb coating or color.			
(2) - Determine cause and correct prior to repair or replacement of part.			

CD PLAYERS

See TAPE PLAYERS AND CD PLAYERS.

CIGARETTE LIGHTER ASSEMBLIES

CIGARETTE LIGHTER ASSEMBLY 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.
Loose	A	..	Require repair or replacement.
Missing	2	.....	Suggest replacement.
Sticking	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) - Inoperative includes intermittent operation or out of OEM specification.			
(2) - Determine cause and correct prior to repair or replacement of part.			

CIRCUIT BREAKERS

See FUSES, FUSIBLE LINKS AND CIRCUIT BREAKERS.

CLUTCH SWITCHES

See SWITCHES.

CONNECTORS

See WIRING HARNESSES AND CONNECTORS.

CONTROL MODULES

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	A	(2) Require 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.
- (4) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

CRUISE CONTROL BRAKE SWITCHES

See SWITCHES.

CRUISE CONTROL CABLES

See CRUISE CONTROL LINKAGES AND CABLES.

CRUISE CONTROL CLUTCH SWITCHES

See SWITCHES.

CRUISE CONTROL LINKAGES AND CABLES

CRUISE CONTROL 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	.....	(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.

(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.

CRUISE CONTROL RESERVOIRS

See CRUISE CONTROL VACUUM HOSES, TUBES AND RESERVOIRS.

CRUISE CONTROL TUBES

See CRUISE CONTROL VACUUM HOSES, TUBES AND RESERVOIRS.

CRUISE CONTROL VACUUM DUMP RELEASE VALVES

CRUISE CONTROL VACUUM DUMP RELEASE 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.
Broken	A	.. Require repair or replacement.
Inoperative	A	 (1) Require replacement.
Leaking	2	 Suggest replacement.
Out of adjustment	B	 (2) Further inspection required.

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

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

CRUISE CONTROL VACUUM HOSES, TUBES AND RESERVOIRS

CRUISE CONTROL VACUUM HOSE, TUBE AND RESERVOIR 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.

CRUISE CONTROL VEHICLE SPEED SENSORS

CRUISE CONTROL VEHICLE SPEED SENSOR INSPECTION

Condition	Code	Procedure
Air gap incorrect	B	(1) Require adjustment to vehicle manufacturer's specifications.
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.
Housing cracked	A	Require replacement.
Internal resistance does not meet specifications	B	(2) Require replacement.
Lead routing incorrect ..	B ..	Require rerouting according to vehicle manufacturer's specifications.
Loose	B	(3) Require adjustment to vehicle manufacturer's specifications.
Missing	C	Require replacement.
Output signal incorrect ..	B	(2) Require repair or replacement.
Surface contaminated	2 ..	Suggest cleaning; identify and correct source.
Tip bent	B	Require replacement.
Tip broken	B	Require replacement.
Tip missing	B	Require replacement.
Wire lead burned	A	Require replacement.
Wire lead conductors exposed	B	Require replacement.
Wire lead corroded	A	Require replacement.
Wire lead open	A	Require replacement.
Wire lead shorted	A	Require replacement.

(1) - If a sensor is not adjustable, further inspection is required to identify and correct cause.

(2) - Component failure may be caused by water intrusion into the wiring harness. Always check insulation for damage

and wiring for excessive resistance.
 (3) - Some integral bearing assemblies with sensors may require replacement.

DEFOGGERS

See
 HEATING ELEMENTS (DEFROSTERS, DEFOGGERS, ELECTRIC HEATERS AND SEATS) .

DEFROSTERS

See
 HEATING ELEMENTS (DEFROSTERS, DEFOGGERS, ELECTRIC HEATERS AND SEATS) .

DELAYS

DELAY 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.
Inoperative	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.
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.

DIMMERS

DIMMER 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.
Inoperative	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.
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.

ELECTRIC HEATERS

See
HEATING ELEMENTS (DEFROSTERS, DEFOGGERS, ELECTRIC HEATERS AND SEATS) .

EQUALIZERS

See
RECEIVERS, AMPLIFIERS, EQUALIZERS AND SUB-WOOFER VOLUME CONTROLS .

FUSE BLOCKS

See FUSE BOXES AND BLOCKS .

FUSE BOXES AND BLOCKS

FUSE BOX AND BLOCK 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, affecting performance	A	Require replacement.
Broken, not affecting performance .....	.. ..	No service suggested or required.
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 (Weatherpack type) leaking	A ..	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Cover missing	C ..	Require replacement of cover.
Cracked, affecting performance	A ..	Require repair or replacement.
Cracked, not affecting performance	1 ..	Suggest repair or replacement.
Melted, affecting performance	A	(1) Require replacement.

Melted, not affecting performance	2	.....	(1) 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.

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

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 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 repair or replacement of part.

(2) - Inoperative includes intermittent operation.

FUSIBLE LINKS

See FUSES, FUSIBLE LINKS AND CIRCUIT BREAKERS.

GAUGES

NOTE: Includes odometers, speedometers and tachometers (except cable-driven).

GAUGE 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.
-

GENERATORS

See ALTERNATORS AND GENERATORS.

GROUND CABLES AND STRAPS

GROUND CABLE AND STRAP 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 performance	A ..	Require repair or replacement.
Corroded, not affecting performance	2 ..	Suggest repair or replacement.
Insulation damaged, exposing conductors	2	Suggest replacement.
Loose	A	Require repair.
Missing	C	Require replacement.
Open	A ..	Require repair or replacement.
Resistance high	A ..	Require repair or replacement.
Terminal resistance (voltage drop) is out of specification	B ..	Require repair or replacement.
Voltage drop out of specification	B ..	Require repair or replacement.

GROUND STRAPS

See GROUND CABLES AND STRAPS.

HEADLIGHT ADJUSTERS

HEADLIGHT ADJUSTER 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, preventing adjustment	A ..	Require repair or replacement.
Broken	A ..	Require repair or replacement.
Indicator broken	A	Require replacement.
Indicator missing	C	Require replacement.
Missing	C	Require replacement of

				adjusters.
Seized	A	..	Require repair or replacement.	
Threads damaged	A	..	Require repair or replacement.	
Threads stripped (threads missing)	A	.....	Require replacement.	

HEATING ELEMENTS (DEFROSTERS, DEFOGGERS, ELECTRIC HEATERS AND SEATS)

HEATING ELEMENT (DEFROSTER, DEFOGGER, ELECTRIC HEATER AND SEAT) 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.
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) - Inoperative includes intermittent operation or out of OEM specification.

HORNS AND SIRENS

HORN AND SIREN 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.
Inoperative	A	.....	(2) Require repair or replacement.
Missing	C	.....	Require replacement.
Out of adjustment	B	.....	Require adjustment.
Sound quality poor	A	..	Require repair or replacement. 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.
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.

IGNITION SWITCHES

See SWITCHES.

INDICATOR LIGHTS

INDICATOR LIGHT INSPECTION

Condition	Code	Procedure
Does not come on during bulb check	..	(1) Further inspection required.
Fails to function properly during test mode	..	(1) Further inspection required.
On constantly	..	(1) Further inspection required.

On intermittently (1) Further inspection
required.

(1) - See service manual for further information.

KEYLESS ENTRY KEYPADS AND TRANSMITTERS

KEYLESS ENTRY KEYPAD AND TRANSMITTER 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.
Malfunctioning	A	(2) 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.
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) - Malfunctioning includes inoperative, intermittent
operation, or failure to perform all functions.

KEYLESS ENTRY TRANSMITTERS

See KEYLESS ENTRY KEYPADS AND TRANSMITTERS.

LEDS

See BULBS, SEALED BEAMS AND LEDS.

LENSES

LENSE INSPECTION

Condition	Code	Procedure
Adjustment out of specification	B	Require repair.
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.

MICROPHONES

See SPEAKERS AND MICROPHONES.

MIRRORS (ELECTROCHROMATIC AND HEATED)

MIRROR (ELECTROCHROMATIC AND HEATED) 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.
Connector broken	A ..	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Cracked	A	Require replacement.
Inoperative	A	(2) Require 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 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.

MOTORS

MOTOR INSPECTION

Condition		Code		Procedure
Amperage draw out of specification	.....	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	.....	A	..	Require repair or replacement.
Bracket broken	.....	A	..	Require repair or replacement.
Bracket cracked	.....	A	..	Require 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 missing	.....	C	.....	Require replacement.
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.
Drive mechanism damaged, affecting performance	..	A	.....	(2) Require repair or replacement.
Drive mechanism damaged, not affecting performance	.....	2	.....	(2) Suggest repair or replacement.
Fails to disengage	.....	A	..	Require repair or replacement.

Housing broken, affecting performance	2	..	Suggest 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	.....	(3) Require repair or replacement.
Linkage bent, affecting performance	A	...	Require repair or replacement of linkage.
Linkage bent, not affecting performance ..	..	..	 No service suggested or required.
Linkage binding, affecting performance	A	...	Require repair or replacement of linkage.
Linkage binding, not affecting performance ..	2	...	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	B	.....	(4) Further inspection required.
Resistance out of specification	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.
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) - Further inspection required to determine cause.
- (3) - Inoperative includes intermittent operation.

- (4) - Follow OEM recommended adjustment procedures. Repair or replace if out of specification.

NEUTRAL SAFETY SWITCHES

See SWITCHES.

ODOMETERS

See GAUGES.

ODOMETERS, SPEEDOMETERS AND TACHOMETERS (CABLE-DRIVEN)

ODOMETER, SPEEDOMETER AND TACHOMETER (CABLE-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.
Drive cable broken	A	Require replacement.
Drive cable noisy	2 ..	Suggest repair or replacement.
Inoperative	A	(2) Further inspection required.
Leaking	A	Require replacement.
Lens broken	A	(3) Require repair or replacement.
Lens cloudy	2	(3) Suggest repair or replacement.
Lens missing	C	(3) 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.

- (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.

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.
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.

RECEIVERS, AMPLIFIERS, EQUALIZERS AND SUB-WOOFER VOLUME CONTROLS

RECEIVER, AMPLIFIER, EQUALIZER AND SUB-WOOFER VOLUME CONTROL 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.
Malfunctioning	A	(2) Require repair or replacement.
Missing	C	Require replacement.
Sound quality poor	A	(3) 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.
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) - Malfunctioning includes inoperative, intermittent operation, or failure to perform all functions.
- (3) - Make sure poor sound quality is not caused by ignition/charging system or other forms of electrical interference.

RELAY BOXES

RELAY BOX 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, affecting performance	A	... Require replacement.
Broken, not affecting performance	..	... No service suggested or required.
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 (Weatherpack type) leaking	A	.. Require repair or replacement.
Connector melted	A	... (1) Require repair or replacement.
Connector missing	C	... Require replacement.
Cover missing	C	... Require replacement of cover.
Cracked, affecting performance	A	.. Require repair or replacement.
Cracked, not affecting performance	1	.. Suggest repair or replacement.
Melted, affecting performance	A	... (1) Require replacement.
Melted, not affecting		

performance	2	.....	(1) 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.

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

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.
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.

SEALED BEAMS

See BULBS, SEALED BEAMS AND LEDS.

SEAT HEATERS

See

HEATING ELEMENTS (DEFROSTERS, DEFOGGERS, ELECTRIC HEATERS AND SEATS) .

SECURITY ALARM SENSORS

SECURITY ALARM 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 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.

SIRENS

See HORNS AND SIRENS.

SOLENOIDS

See ACTUATOR MOTORS (SOLENOIDS) (ELECTRIC) .

NOTE: For starter solenoids that are integral to the starter assembly, see STARTERS.

NOTE: For starter relays, see RELAYS.

SPEAKERS AND MICROPHONES

SPEAKER AND MICROPHONE 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.
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.
Membrane torn	A	 Require replacement.
Missing	C	 Require replacement.
Polarity reversed	A	 Require repair.
Sound quality poor	A	 (3) Require repair or replacement. 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.

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

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

(3) - Make sure poor sound quality is not caused by ignition/charging system or other forms of electrical

interference.

SPEEDOMETER AND TACHOMETER LINKAGES AND CABLES

SPEEDOMETER AND TACHOMETER 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	(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.

SPEEDOMETER CABLES

See SPEEDOMETER AND TACHOMETER LINKAGES AND CABLES.

SPEEDOMETERS

See GAUGES.

STARTERS

NOTE: To prevent misdiagnosis, care should be taken to eliminate the possibilities of mechanical problems or high resistance in power and/or ground circuits.

STARTER INSPECTION

Condition	Code	Procedure
Amperage draw does not meet OEM specifications	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	(1) 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.
Drive gear damaged, affecting performance ..	A	(2) Require repair or replacement.
Drive gear damaged, not affecting performance ..	2	(2) Suggest repair or replacement.
Fails to disengage	A ..	Require repair or replacement.
Housing broken, affecting performance	2 ..	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 ..	2 ..	Suggest repair or replacement.
Inoperative	A	(3) Require repair or replacement.
Noisy	2 ..	Suggest repair or replacement.
Shimmed incorrectly	B	Require repair.
Starter shaft bushing missing	C	(4) Require replacement.
Starter shaft bushing worn, affecting performance	A	Require replacement.
Starter shaft bushing worn, not affecting performance	1	Suggest replacement.
Terminal broken	A ..	Require repair or replacement.
Terminal burned, affecting performance	A	(5) 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) - Inspect block or bell housing mounting surface.
(2) - Further inspection required to determine cause. Require inspection of ring gear.
(3) - Inoperative includes intermittent operation.
(4) - Bushing may be in bell housing.
(5) - Determine cause and correct prior to repair or replacement of part.

SUB-WOOFER VOLUME CONTROLS

See

RECEIVERS, AMPLIFIERS, EQUALIZERS AND SUB-WOOFER VOLUME CONTROLS.

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.

TACHOMETER CABLES

See SPEEDOMETER AND TACHOMETER LINKAGES AND CABLES.

TACHOMETERS

See GAUGES.

TAPE PLAYERS AND CD PLAYERS

TAPE PLAYER AND CD PLAYER 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.
Malfunctioning	A	.....	(2) Require repair or replacement.
Missing	C	.....	Require replacement.
Skips	A	..	Require repair or replacement.
Sound quality poor	A	.....	(3) Require repair or replacement.
Speed incorrect	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.
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) - Malfunctioning includes inoperative, intermittent operation, or failure to perform all functions.
- (3) - Make sure poor sound quality is not caused by ignition/charging system or other forms of electrical interference.

TENSIONERS

TENSIONER 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.	

TIMERS

TIMER 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.
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.
Inoperative	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.
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.

TIRE PRESSURE SENSORS

TIRE 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.
Inoperative	A	(1) Require repair or replacement.
Loose	A ..	Require repair or replacement.
Missing	C	Require replacement.

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

TRANSCIEVERS

TRANSCIEVER 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.
Malfunctioning	A	(2) Require repair or replacement.
Missing	C	Require replacement.
Sound quality poor	A	(3) 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.
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) - Malfunctioning includes inoperative, intermittent operation, or failure to perform all functions.
- (3) - Make sure poor sound quality is not caused by ignition/charging system or other forms of electrical interference.

TRANSDUCERS

TRANSDUCER 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.
Drive mechanism damaged, affecting performance ..	A	 (2) Require repair or replacement.
Drive mechanism damaged, not affecting performance	2	 (2) Suggest repair or replacement.
Inoperative	A	 (3) Require repair or replacement.
Leaking (vacuum/fluid/air)	A	 Require replacement.
Linkage bent, affecting performance	A	... Require repair or replacement of linkage.
Linkage bent, not affecting performance ..	..	 No service suggested or required.
Linkage binding, affecting performance	A	... Require repair or replacement of linkage.
Linkage binding, not affecting performance ..	2	... 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	.....	(4) 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.		

- (1) - Determine cause and correct prior to repair or replacement of part.
- (2) - Further inspection required to determine cause.
- (3) - Inoperative includes intermittent operation or out of specification.
- (4) - Follow OEM recommended adjustment procedures. Repair or replace if out of specification.

VACUUM ACCUMULATORS (RESERVOIRS)

VACUUM ACCUMULATOR (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.
Leaking	A	.. Require repair or replacement.

VACUUM RESERVOIRS

See VACUUM ACCUMULATORS (RESERVOIRS) .

VOLTAGE REGULATORS

VOLTAGE REGULATOR 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.
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) - NOTE: Inoperative includes intermittent operation or out of OEM specification.

WASHER FLUID LEVEL SENDERS

WASHER FLUID 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.

WASHER PUMPS

WASHER 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.
Connector broken	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 externally	A	.. Require repair or replacement.
Leaking internally	A	.. Require repair or replacement.
Noisy	2	.. Suggest repair or 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.

WIPER ARMS AND BLADES

NOTE: Windshield coatings or waxes can cause blades to not function as intended. Clean surface before making final judgment about blade replacement.

WIPER ARM AND BLADE 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.
Attaching socket stripped	A	 Require replacement.
Bent	A	.. Require repair or replacement.
Loose	2	.. Suggest repair or replacement.
Missing	C	 Require replacement.
Noisy	2	.. Suggest repair or replacement.
Size incorrect	2	 Suggest replacement.
Tension insufficient	B	.. Require repair or replacement.
Torn	A	 Require replacement.
Worn, affecting performance	A	 Require replacement.
Worn, not affecting performance	1	 Suggest replacement.

WIPER BLADES

See WIPER ARMS AND BLADES.

WIPER HOSES AND NOZZLES

WIPER HOSE AND NOZZLE 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.
Blocked	A	.. Require repair or replacement.

Leaking	A	..	Require repair or replacement.
Missing	C	.....	Require replacement.
Oil-soaked (spongy)	1	.....	Suggest replacement.
Spray pattern incorrect .	2	..	Suggest repair or replacement.
Surface cracks (dry-rotted)	1	.....	Suggest replacement.

WIPER LINKAGES

WIPER 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.
Attaching stud stripped .	A	 Require replacement.
Bent	A	.. Require repair or replacement.
Inoperative	A	 (1) Require replacement.
Loose	2	.. Suggest repair or replacement.
Missing	C	 Require replacement.
Noisy	2	.. Suggest repair or replacement.
Tension insufficient	B	.. Require repair or replacement.
Worn, affecting performance	A	 Require replacement.
Worn, not affecting performance	1	 Suggest replacement.

(1) - Inoperative includes intermittent operation.

WIPER NOZZLES

See WIPER HOSES AND NOZZLES.

WIPER PUMP RESERVOIRS

WIPER PUMP 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.
Cap missing	C	 Require replacement.
Leaking	A	.. Require repair or replacement.
Missing	C	 Require replacement.

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.		

ELECTROSTATIC DISCHARGE WARNING - BASIC INFORMATION

1993 Mitsubishi Montero

GENERAL INFORMATION

Electrostatic Discharge (ESD) Warning - Basic Information

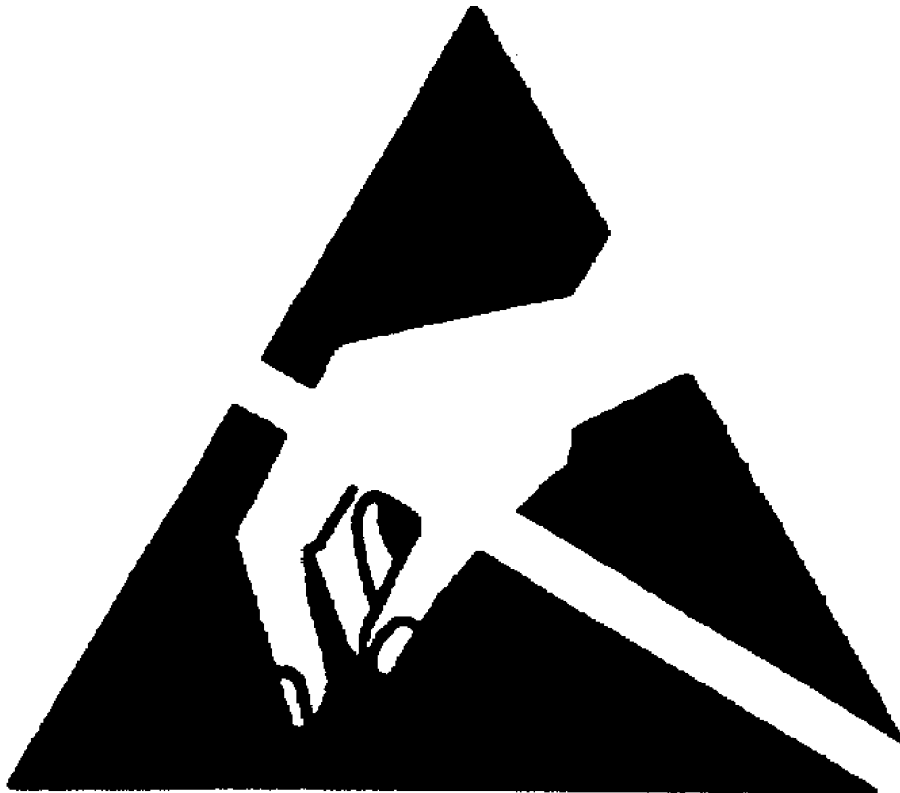
All Makes and Models

* 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 manufacturers may display different symbols to represent ESD sensitive devices, the handling and measuring precautions and procedures are the same.



50112680

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.

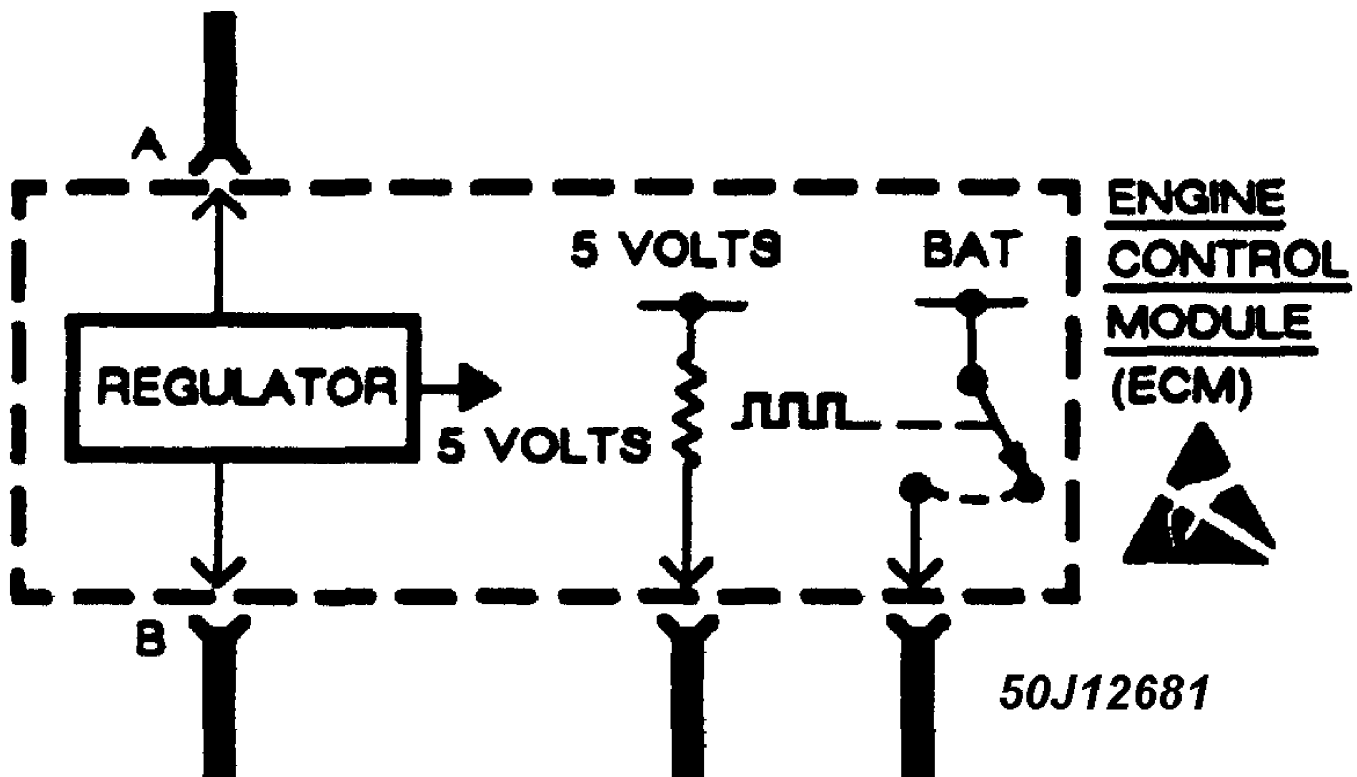


Fig. 2: Sample Schematic Showing Typical ESD Sensitive Device

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.

B - EMISSION APPLICATION

1993 Mitsubishi Montero

1993 ENGINE PERFORMANCE
Mitsubishi Emission Applications

3000GT, Diamante, Eclipse, Expo, Expo LRV, Galant, Mirage
Montero, Pickup, Precis

EMISSION APPLICATIONS

EMISSION APPLICATIONS TABLE

Engine & Fuel System	Emission Control Systems & Devices
Diamante	
3.0L V6 MPI	
Major Control Systems & Devices	 PCV, EVAP, TWC, FR, (1) EGR, SPK, HO2S, CEC, MIL
Components & Other Related Devices	... EGR-CS, EGR-TS, EVAP-CPCS, SPK-CC, EVAP-VC
Eclipse	
1.8L 4-Cyl. MPI	
Major Control Systems & Devices	 PCV, EVAP, TWC, FR, EGR, SPK, O2, CEC, MIL
Components & Other Related Devices	 (1) EGR-CS, (1) EGR-TS, EVAP-CPCS, SPK-CC, EVAP-VC
2.0L 4-Cyl. Turbo & Non-Turbo MPI	
Major Control Systems & Devices	 PCV, EVAP, TWC, FR, EGR, SPK, (1) HO2S, CEC, MIL
Components & Other Related Devices	 (1) EGR-CS, (1) EGR-TS, EVAP-CPCS, (3) EVAP-CS, (2) EGR-TVV, SPK-CC, EVAP-VC
Expo/Expo LRV	
1.8L 4-Cyl. MPI	
Major Control Systems & Devices	... PCV, EVAP, TWC, FR, EGR, SPK, (1) HO2S, (2) O2, CEC, MIL
Components & Other Related Devices	 (1) EGR-CS, (1) EGR-TS, EVAP-CPCS, SPK-CC, EVAP-VC
2.4L 4-Cyl. MPI	
Major Control Systems & Devices	... PCV, EVAP, TWC, FR, EGR, SPK, (1) HO2S, (2) O2, CEC, MIL
Components & Other Related Devices	 EGR-CS, (1) EGR-TS, EVAP-CPCS, EGR-TVV, SPK-CC, EVAP-VC
Galant	
2.0L 4-Cyl. MPI	
Major Control Systems & Devices	 PCV, EVAP, TWC, FR, EGR, SPK, O2, CEC, MIL,
Components & Other Related Devices	 (1) EGR-CS, (1) EGR-TS, EVAP-CPCS, (3) EVAP-CS, (2) EGR-TVV, SPK-CC, EVAP-VC
Mirage	
1.5L 4-Cyl. MPI	
Major Control Systems & Devices	 PCV, EVAP, TWC, FR, (1) EGR, SPK, (1) HO2S, (2) O2, CEC, MIL
Components & Other Related Devices	 (1) EGR-CS, (1) EGR-TS, EVAP-CPCS, SPK-CC, EVAP-VC
1.8L 4-Cyl. MPI	

Major Control Systems & Devices	.....	PCV, EVAP, TWC, FR, EGR, SPK, (1) HO2S, (2) O2, CEC, MIL
Components & Other Related Devices	.....	(1) EGR-CS, (1) EGR-TS, EVAP-CPCS, SPK-CC, EVAP-VC

Montero

3.0L V6 MPI		
Major Control Systems & Devices	.....	PCV, EVAP, TWC, FR, SPK, HO2S, CEC, MIL
Components & Other Related Devices	.....	EVAP-CPCS, EVAP-CS, SPK-CC, EVAP-VC

Pickup

2.4L 4-Cyl. MPI		
Major Control Systems & Devices	.....	PCV, EVAP, TWC, FR, EGR, SPK, HO2S, CEC, MIL
Components & Other Related Devices	.....	EGR-CS, (1) EGR-TS, EVAP-CPCS, SPK-CC, EVAP-VC
3.0L V6 MPI		
Major Control Systems & Devices	....	PCV, EVAP, TWC, FR, (1) EGR, SPK, HO2S, CEC, MIL
Components & Other Related Devices	...	EGR-CS, EGR-TS, EVAP-CPCS, SPK-CC, EVAP-VC

Precis

1.5L 4-Cyl. MPI		
Major Control Systems & Devices	.....	PCV, EVAP, TWC, FR, EGR, SPK, O2, CEC, MIL
Components & Other Related Devices	.....	(1) EGR-CS, (1) EGR-TS, EVAP-CPCS, EGR-TVV, SPK-CC, EVAP-VC

3000GT

3.0L V6 Turbo & Non-Turbo MPI		
Major Control Systems & Devices	.....	PCV, EVAP, TWC, FR, EGR, SPK, HO2S, CEC, MIL
Components & Other Related Devices	.....	(1) EGR-CS, (1) EGR-TS, EVAP-CPCS, (3) EVAP-CS, SPK-CC, EVAP-VC

(1) - Calif.
(2) - Federal.
(3) - Turbo.

ABBREVIATION DEFINITIONS

ABBREVIATION DEFINITION TABLE

Abbreviation	Definition
CEC	Computerized Engine Control
EGR	Exhaust Gas Recirculation
EGR-CS	EGR Control Solenoid
EGR-TS	EGR Temperature Sensor
EGR-TVV	EGR Thermal Vacuum Valve
EVAP	Fuel Evaporative System
EVAP-CS	EVAP Control Solenoid
EVAP-CPCS	EVAP Canister Purge Control Solenoid
EVAP-VC	EVAP Vapor Canister
FR	Fill Pipe Restrictor
HO2S	Heated Oxygen Sensor

MIL	.....	Malfunction Indicator Light
MPI	.....	Multiport Fuel Injection
O2	.....	Oxygen Sensor
PCV	.....	Positive Crankcase Ventilation
SPK	.....	Spark Controls
SPK-CC	.....	SPK Computer Controlled
TWC	.....	Three-Way Catalyst

EMISSION CONTROL VISUAL INSPECTION PROCEDURES

1993 Mitsubishi Montero

1983-98 GENERAL INFORMATION
Emission Control Visual Inspection Procedures

All Models

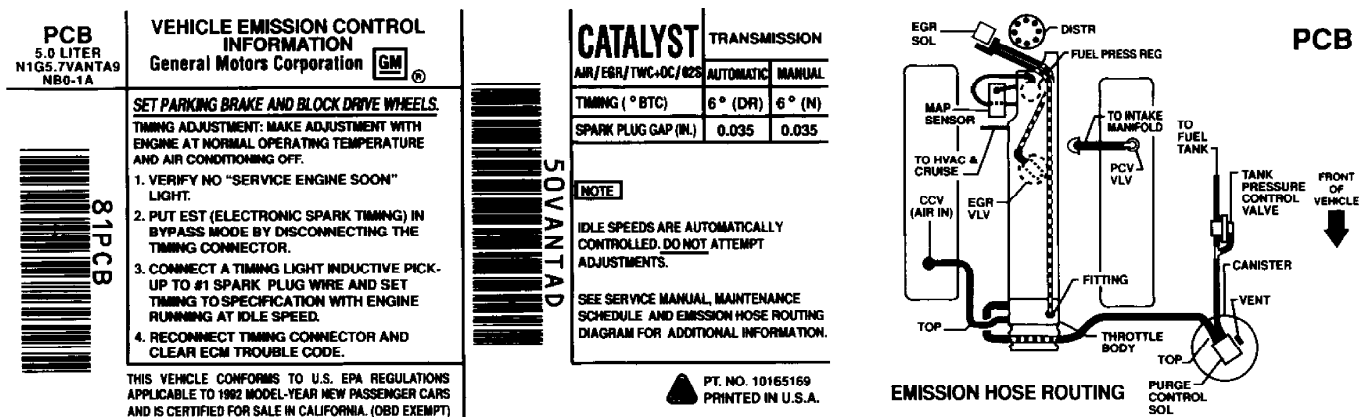
* PLEASE READ THIS FIRST *

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.



93D04127

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.

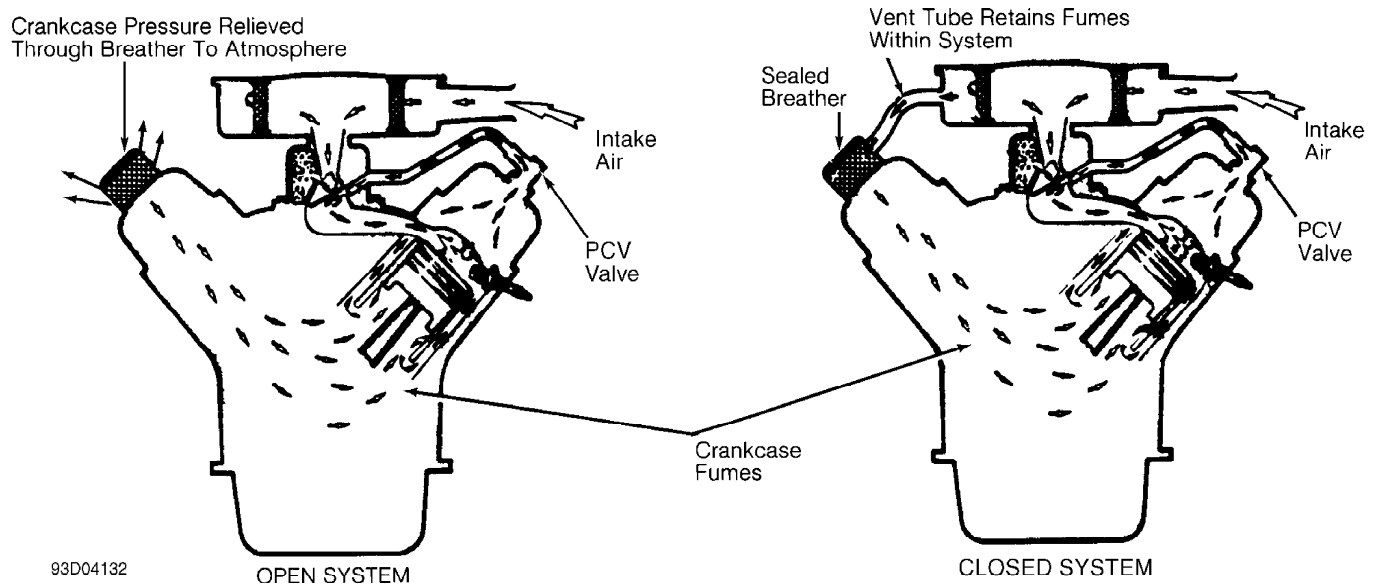
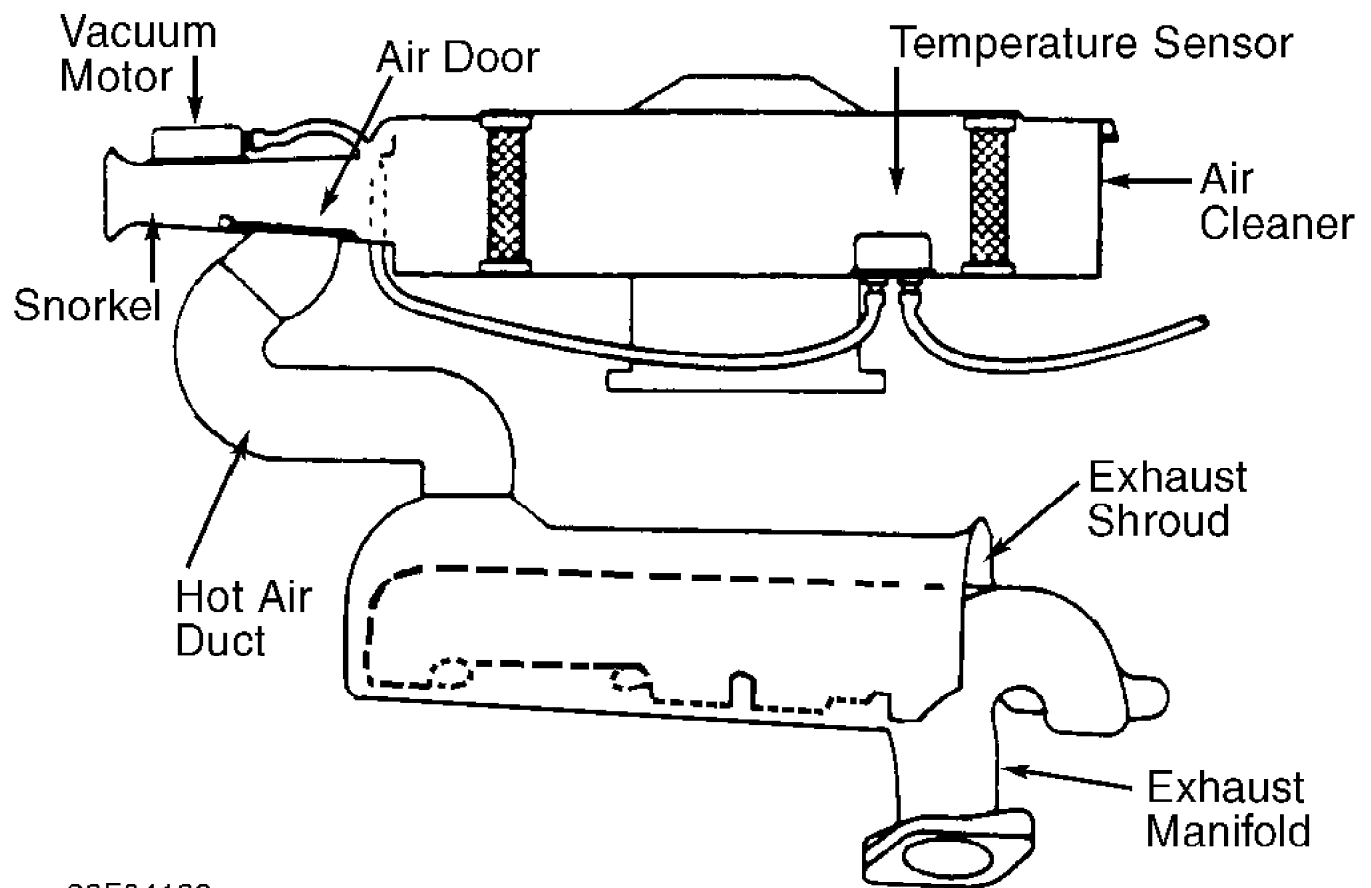


Fig. 2: Typical Open & Closed Type PCV System

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.



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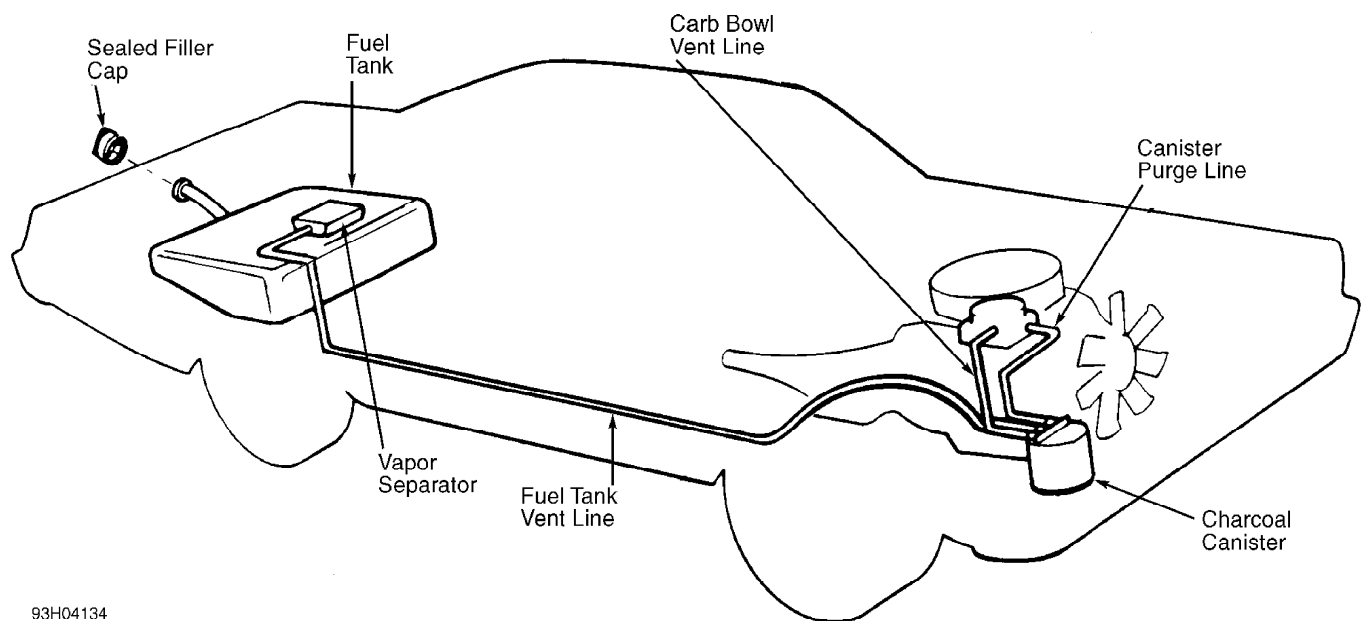
Fig. 3: Typical Thermostatic Air Cleaner System

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.



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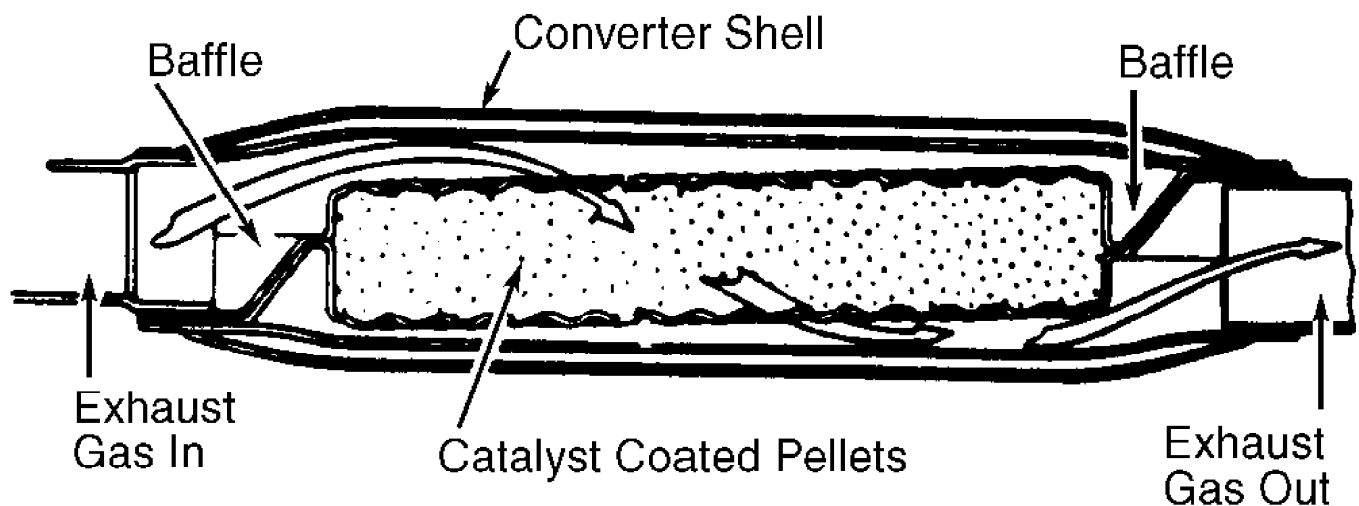
Fig. 4: Typical Fuel Evaporative System

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.



93A04135

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

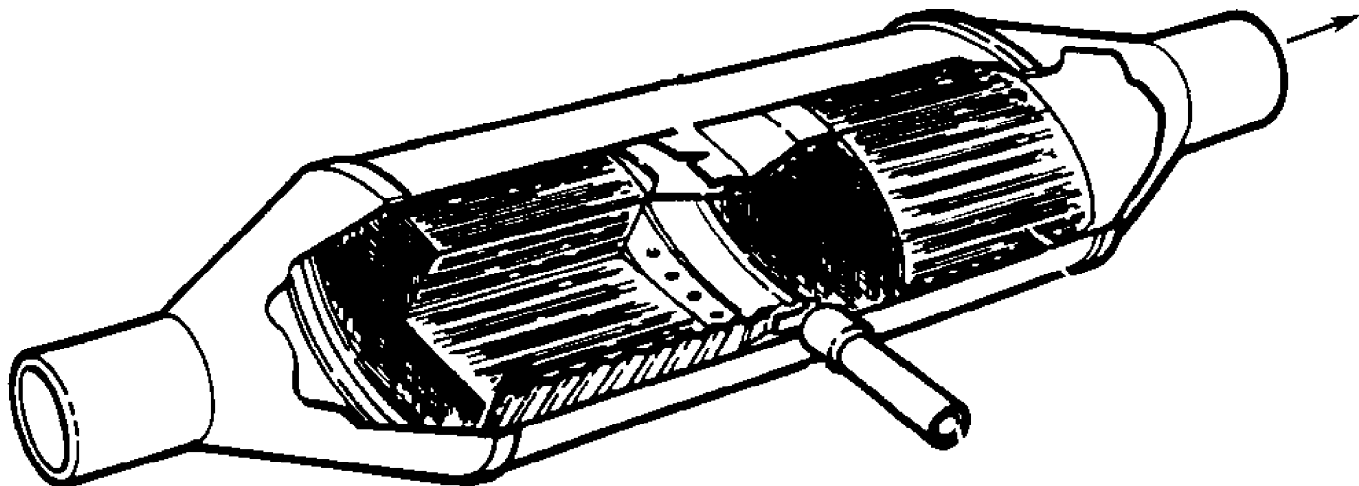
converter with the exception of the catalyst. See Fig. 5. The TWC converter uses rhodium, with or without platinum, as its catalyst. Rhodium helps reduce NO_x emissions, as well as HC and CO.

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).

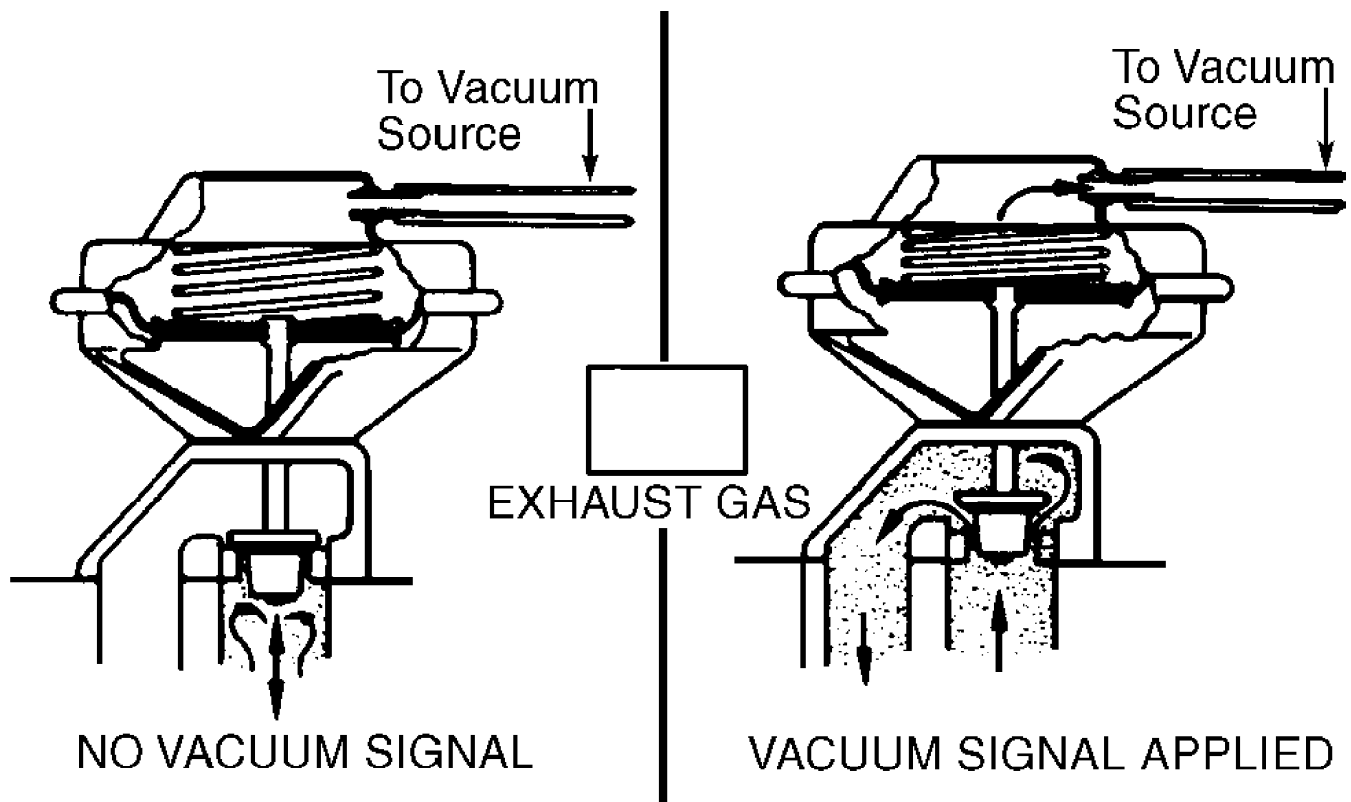
Visually inspect fill pipe restrictor(s) for tampering, i.e., restrictor is oversize or the flapper is non-functional. If vehicle is equipped with an auxiliary fuel tank, ensure auxiliary fuel tank is also equipped with a fill pipe restrictor.

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.



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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.

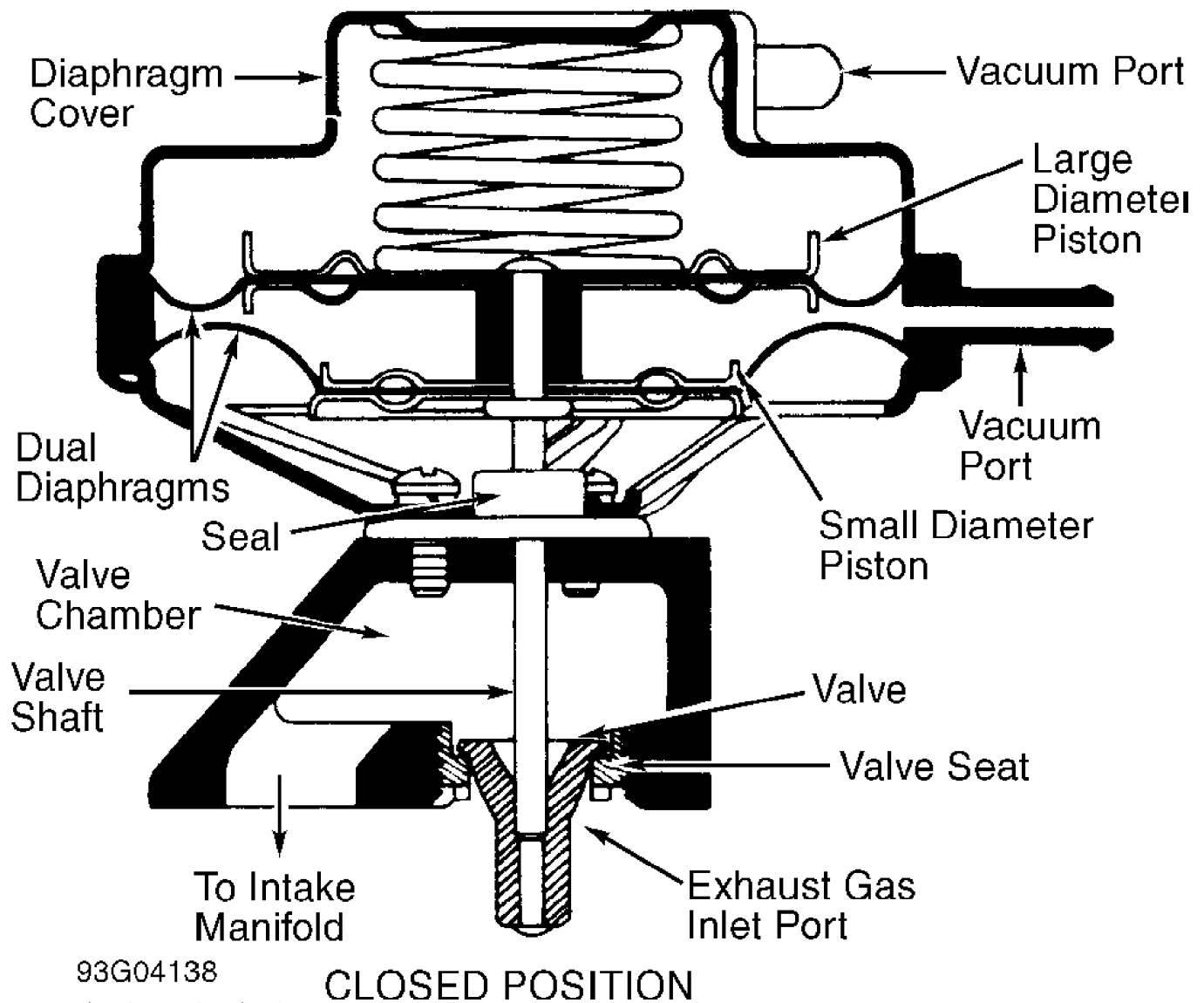


Fig. 8: Typical Dual Diaphragm EGR Valve
Courtesy of General Motors Corp.

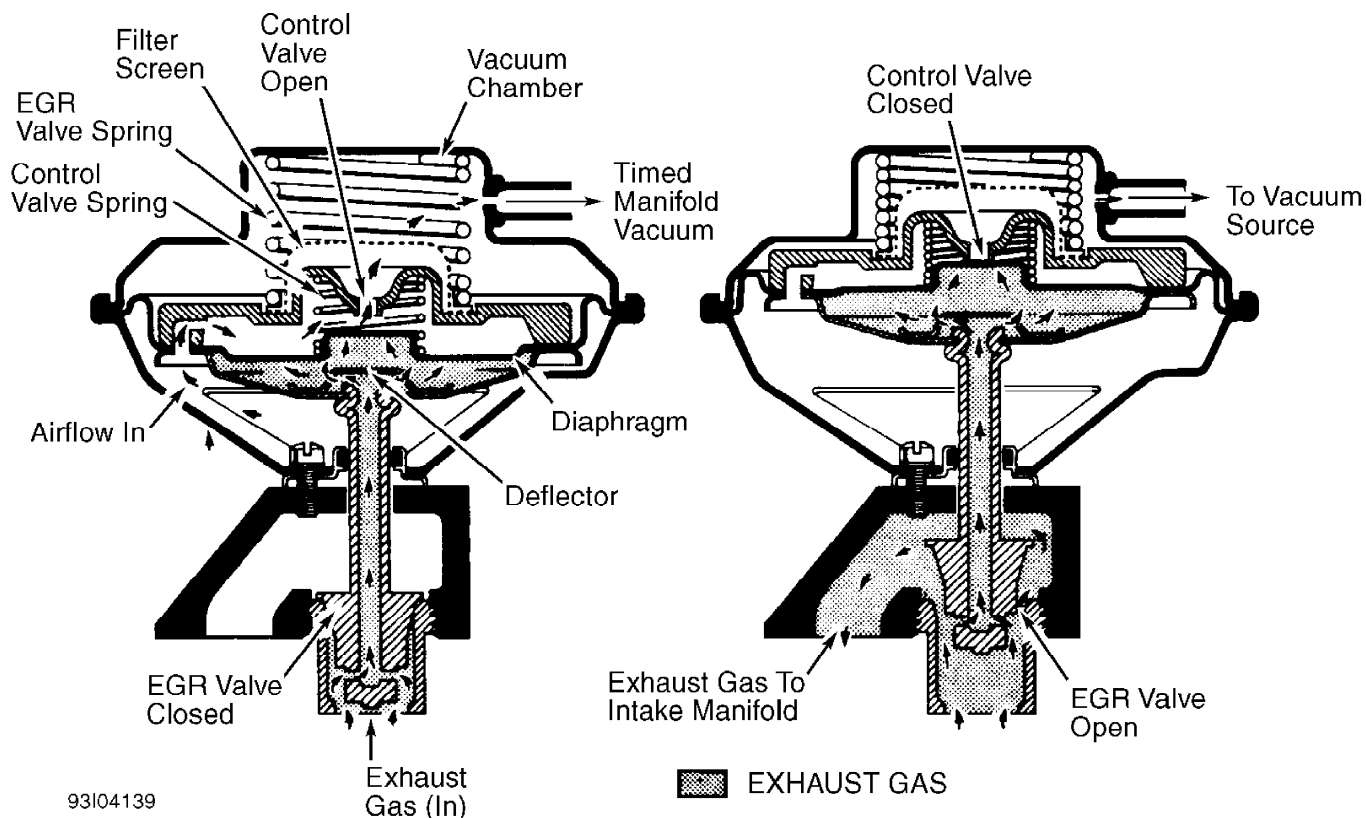
Positive Backpressure EGR (BP/EGR) Valve

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.



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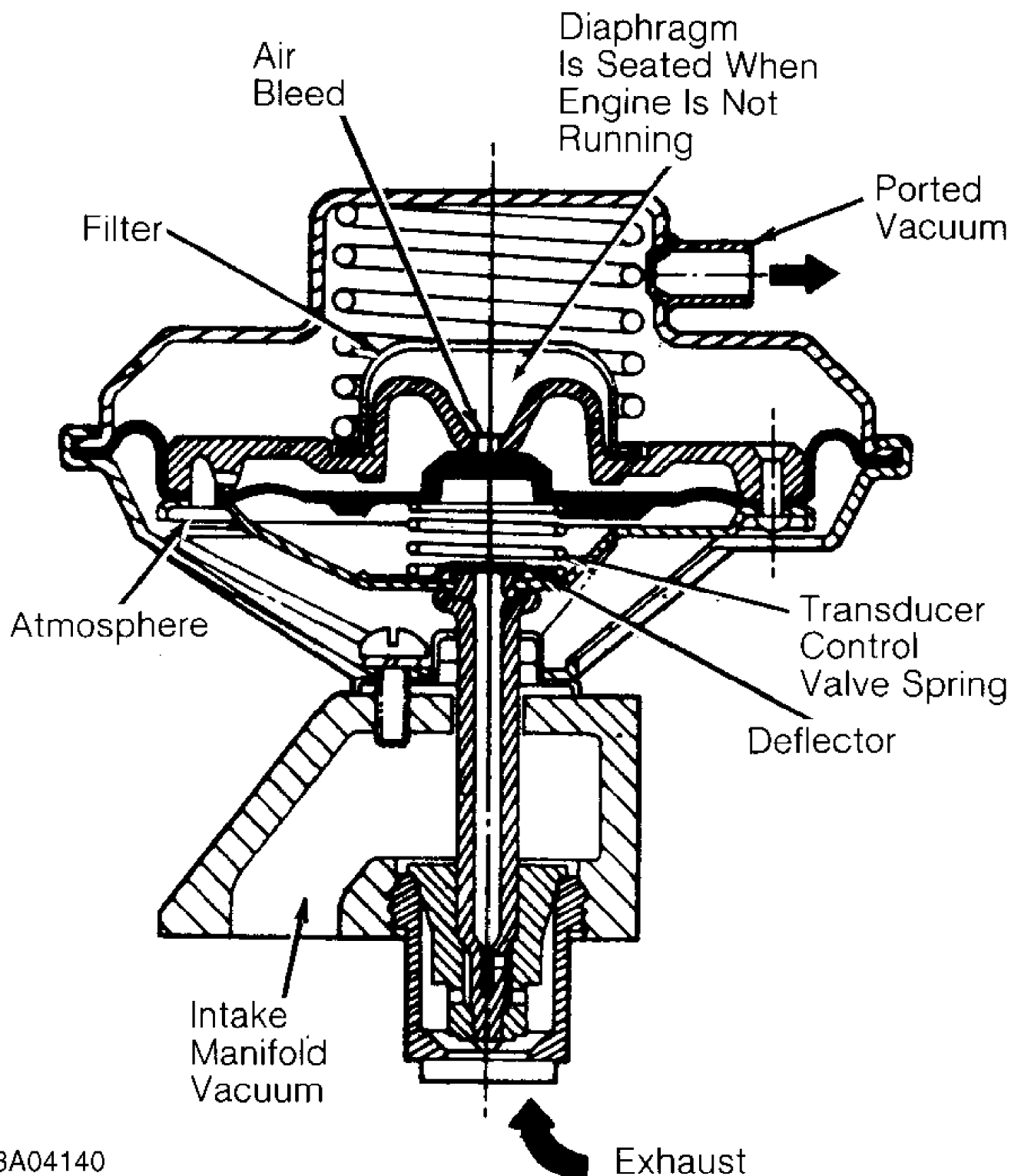
Fig. 9: Typical Positive Backpressure EGR Valve
Courtesy of General Motors Corp.

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.



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Fig. 10: Typical Negative Backpressure EGR Valve
Courtesy of General Motors Corp.

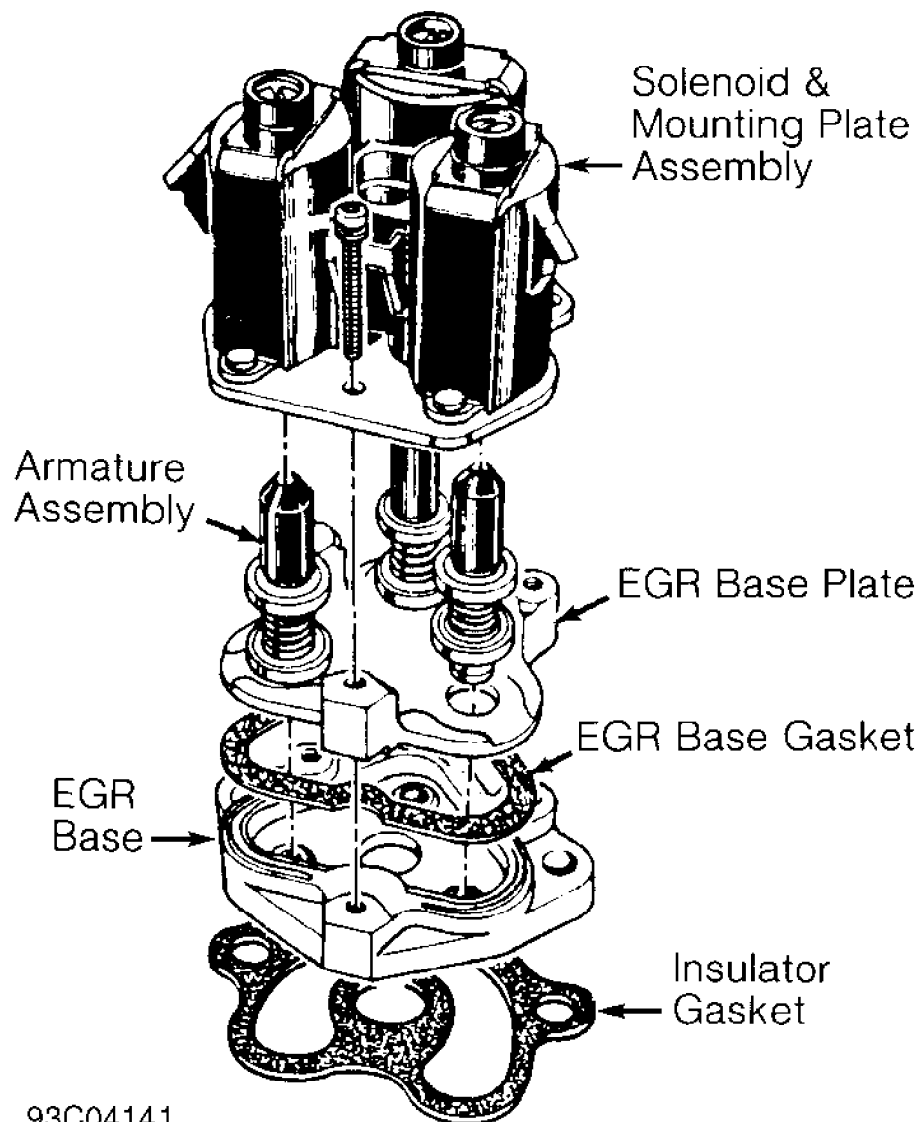
Digital EGR Valve

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.



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Fig. 11: Typical Digital EGR Valve
Courtesy of General Motors Corp.

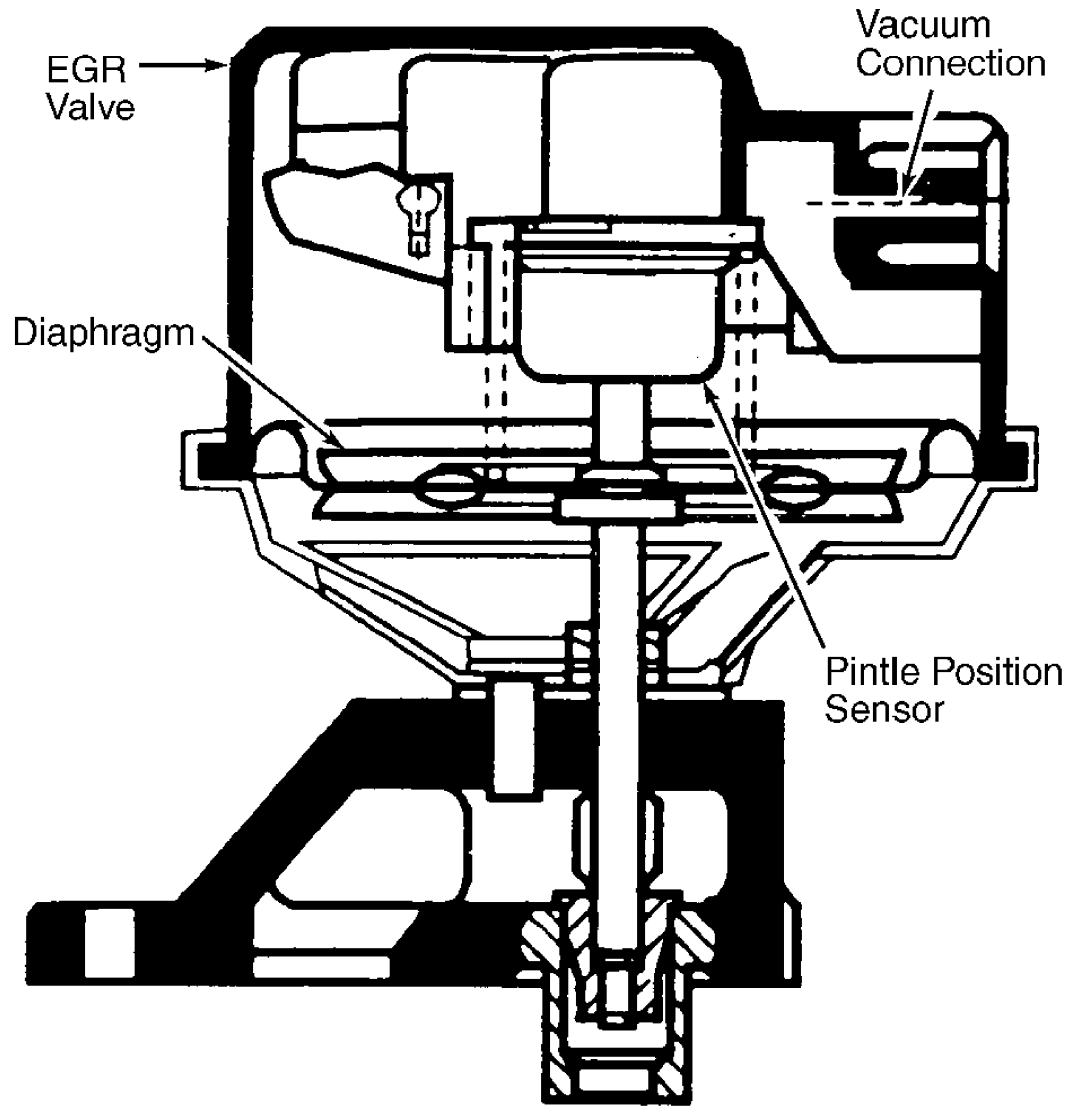
Integrated Electronic EGR Valve

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 CONTROLS (SPK)

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.

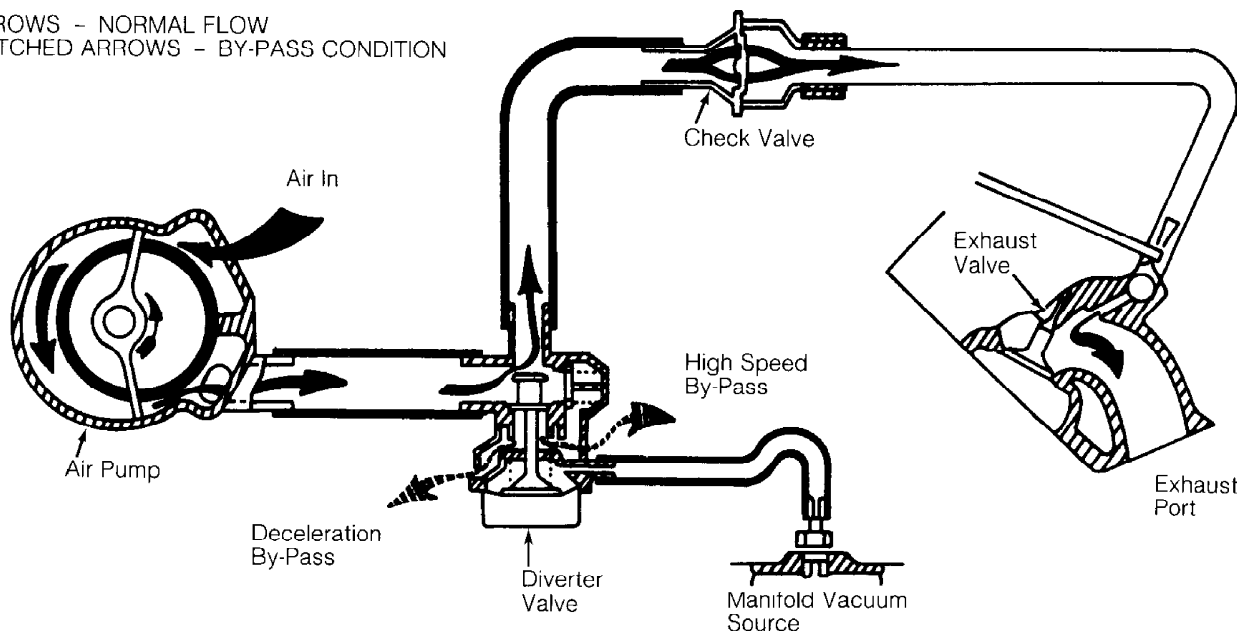
AIR INJECTION SYSTEM (AIS)

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.

BLACK ARROWS - NORMAL FLOW
CROSS HATCHED ARROWS - BY-PASS CONDITION



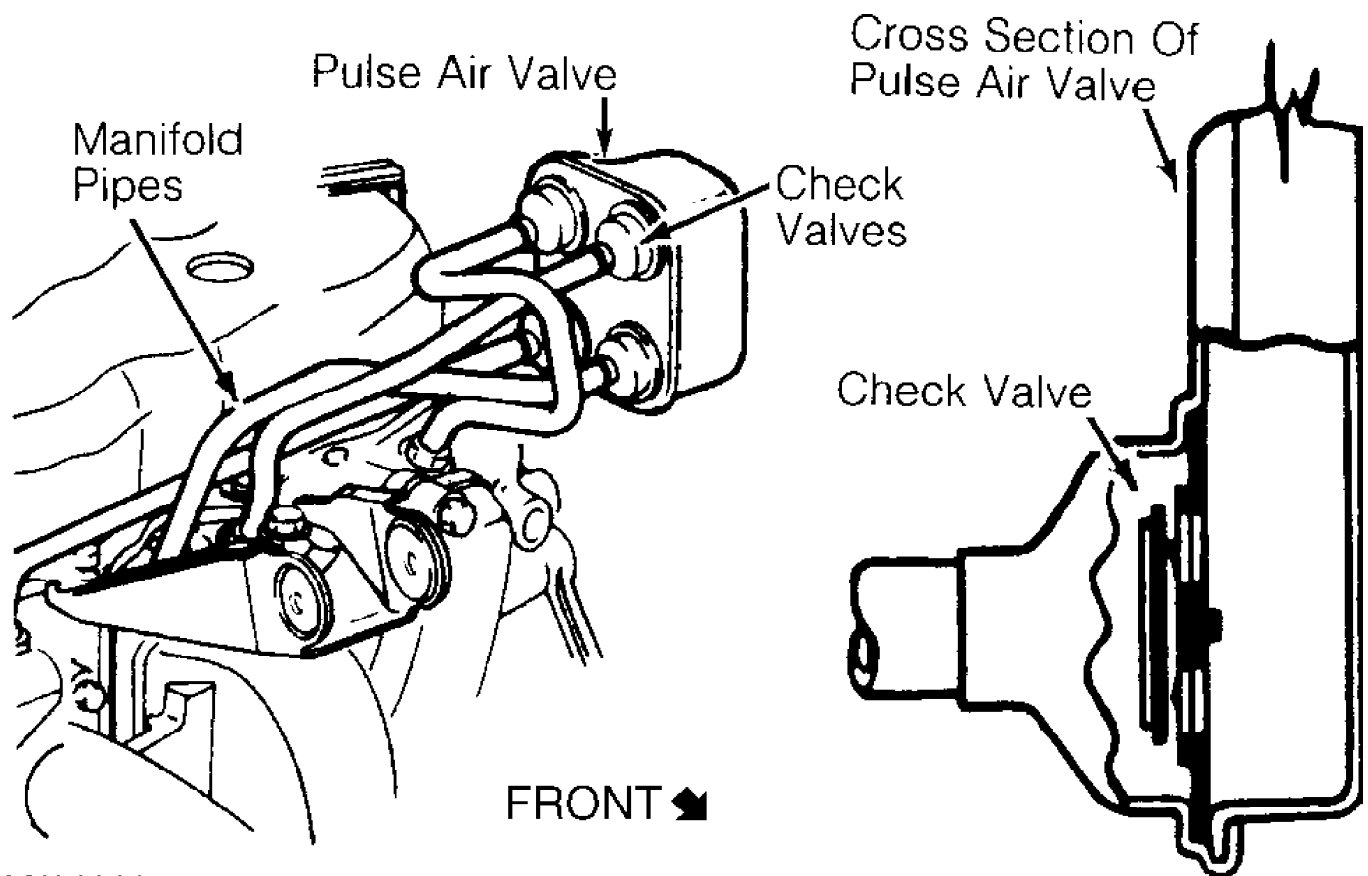
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Fig. 13: Typical Air Pump Injection System
Courtesy of General Motors Corp.

Pulsed Secondary Air Injection (PAIR) System

PAIR eliminates the need for an air pump and most of the associated hardware. Most systems consist 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.



93I04144

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)

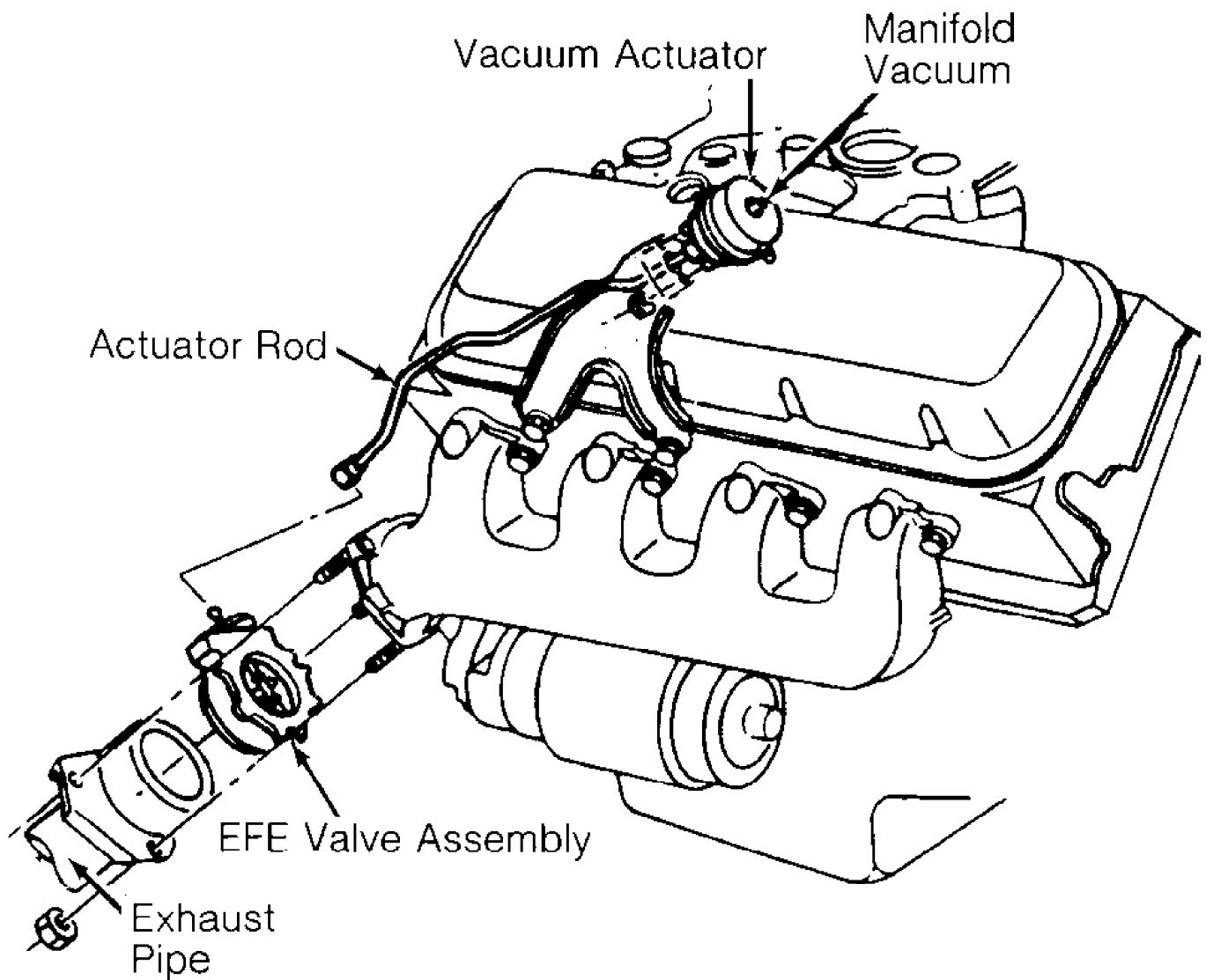
The CEC system monitors and controls a variety of engine/vehicle functions. The CEC system is primarily an emission control system designed to maintain a 14.7:1 air/fuel ratio under most operating conditions. When the ideal air/fuel ratio is maintained, the catalytic converter can control oxides of nitrogen (NO_x), 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.



93B04145

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.

ENGINE COOLING FAN

1993 Mitsubishi Montero

1993 ENGINE COOLING
Specifications & Electric Cooling Fans

Chrysler Corp.: Ram-50
Mitsubishi: Montero & Pickup

COMPONENT TESTING

Motor

Disconnect electric cooling fan motor at junction. Using 2 jumper wires, ground one lead and apply battery voltage to other. Fan should rotate. If fan does not rotate, replace motor.

Radiator Fan Switch

Using an ohmmeter, check switch continuity in hot water. Switch should be open at less than 180°F (82°C) and continuity should exist at more than 185°F (85°C). Replace radiator fan switch if it does not test as specified.

Electric Cooling Fan Relay

Remove relay from relay box in front of right suspension tower. Connect battery between terminals No. 1 and 2. See Fig. 1. Continuity should exist between terminals No. 3 and 4. With battery disconnected, continuity should exist between terminals No. 1 and 2 and should not exist between terminals No. 3 and 4. Replace relay if it does not test as specified.

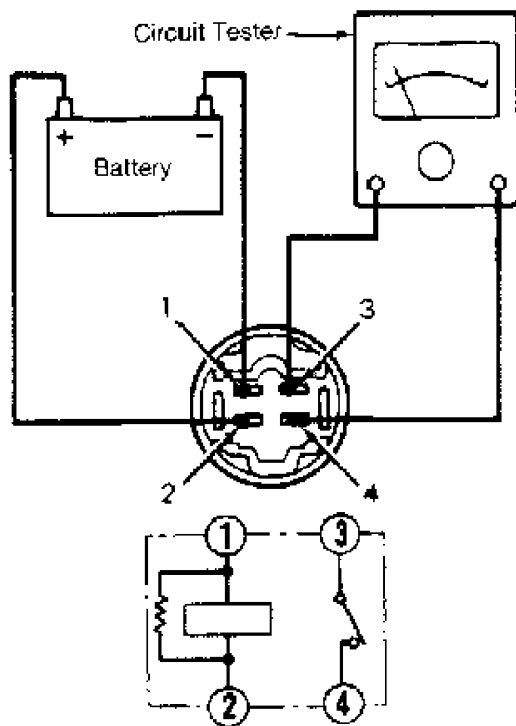


Fig. 1: Testing Electric Cooling Fan Relay
Courtesy of Mitsubishi Motor Sales of America.

NOTE: For appropriate wiring diagram, see WIRING DIAGRAMS.

ENGINE OVERHAUL PROCEDURES - GENERAL INFORMATION

1993 Mitsubishi Montero

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 left 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

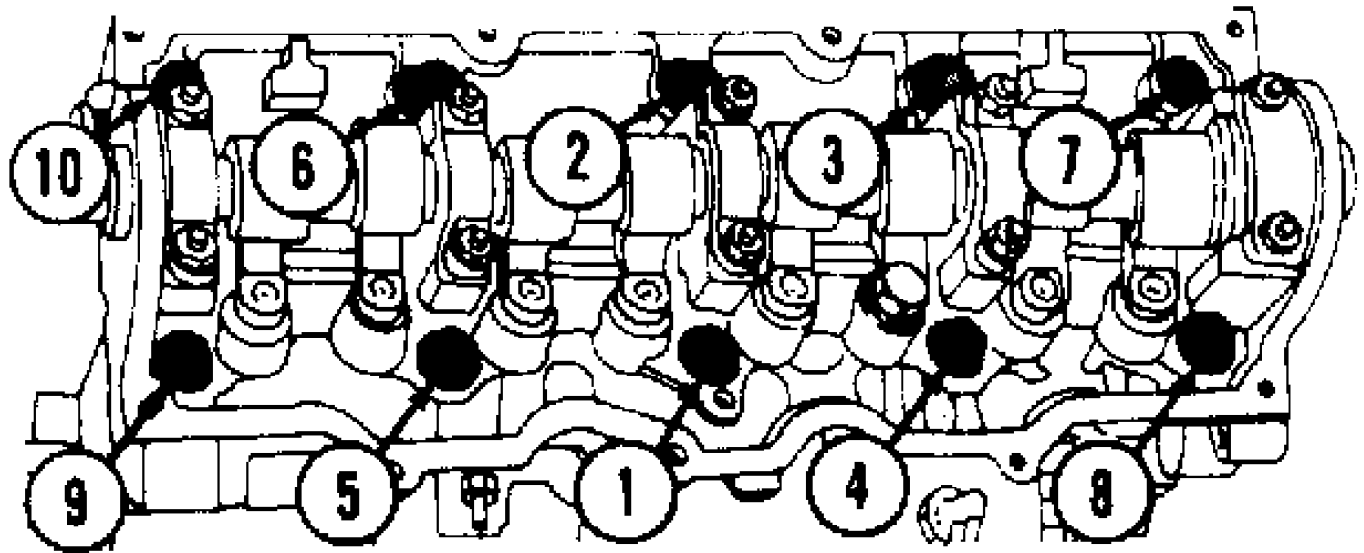
*** PLEASE READ THIS FIRST ***

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.



● FRONT OF VEHICLE

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.

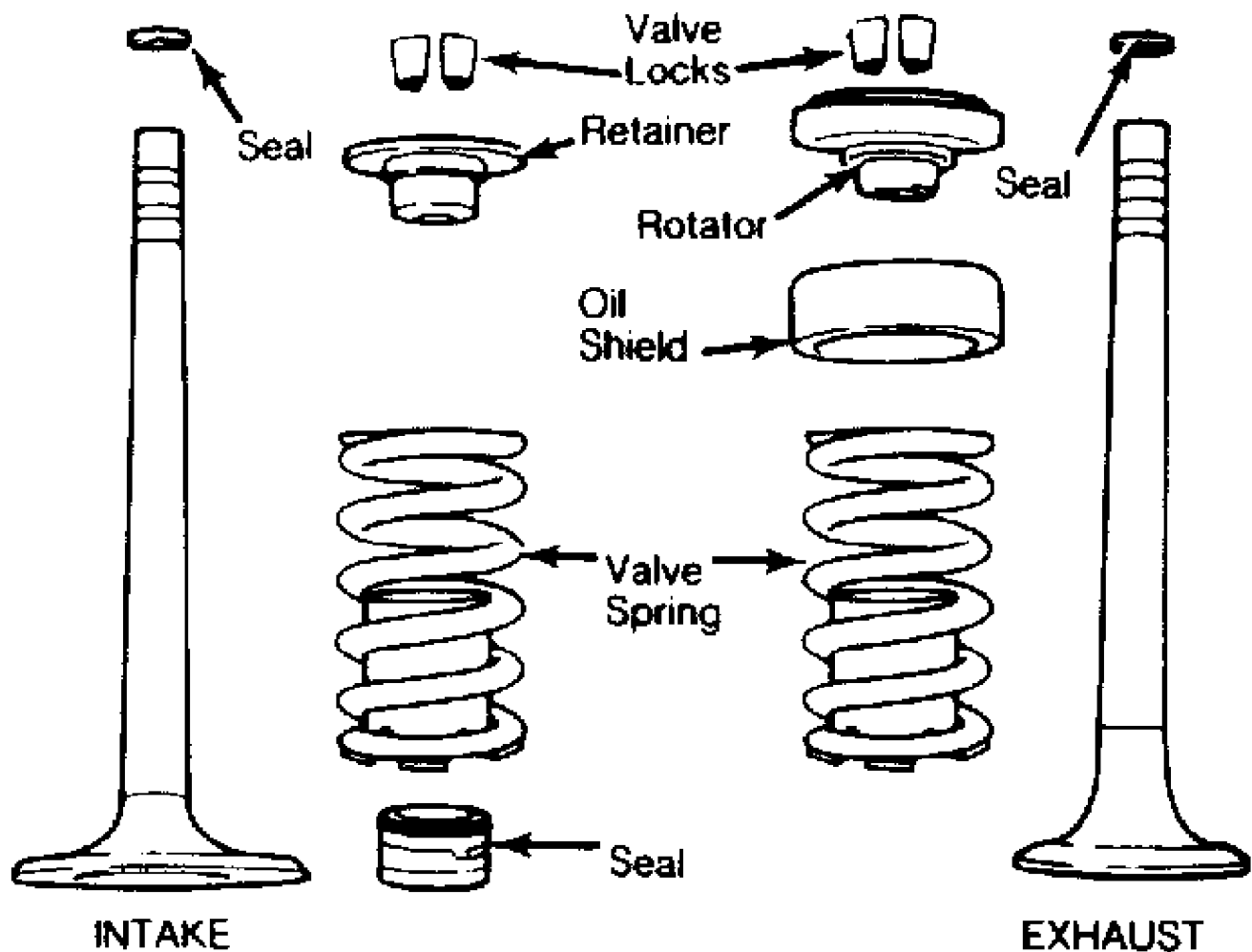


Fig. 2: Exploded View of Intake & Exhaust Valve Assemblies - Typical
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CLEANING & INSPECTION

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.

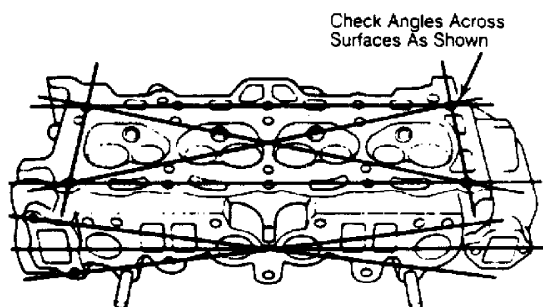


Fig. 3: Checking Cylinder Head for Warpage - Typical
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On cast cylinder heads, if warpage exceeds .003" (.08 mm) in a 6" span, or .006" (.15 mm) over total length, cylinder head must be resurfaced. On most aluminum cylinder heads, if warpage exceeds .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.

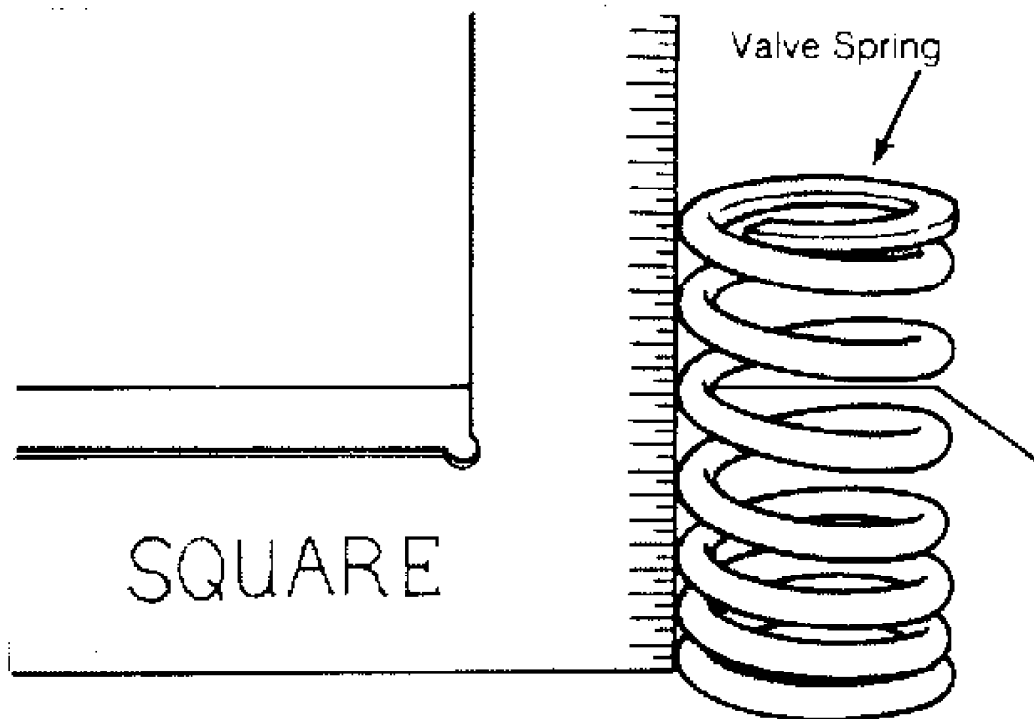


Fig. 4: Checking Valve Spring Squareness - Typical
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Using vernier caliper, measure free length of all valve springs. Replace springs if not within specification. Using valve

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.

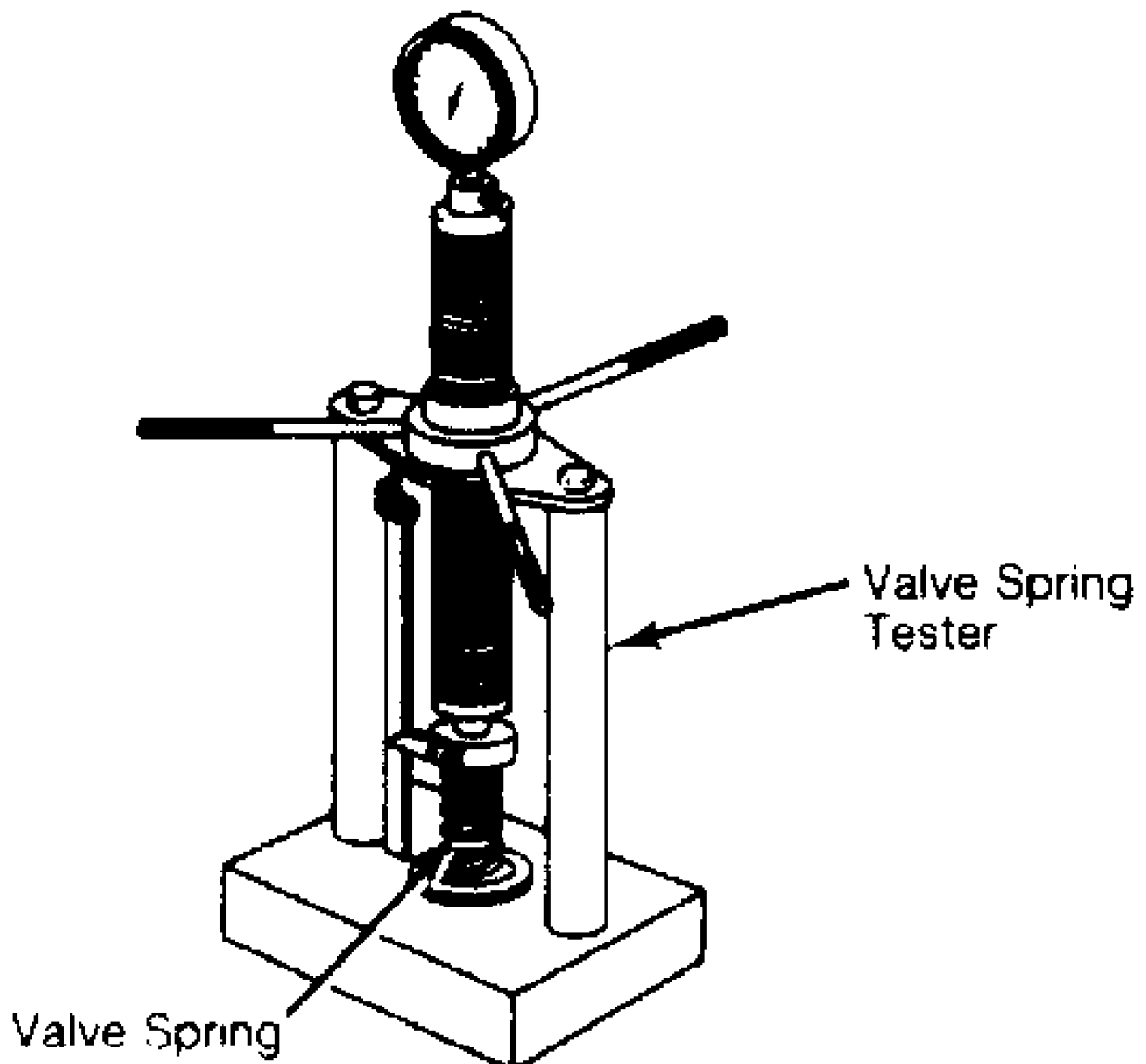


Fig. 5: Checking Valve Spring Pressure - Typical
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VALVE GUIDE

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.

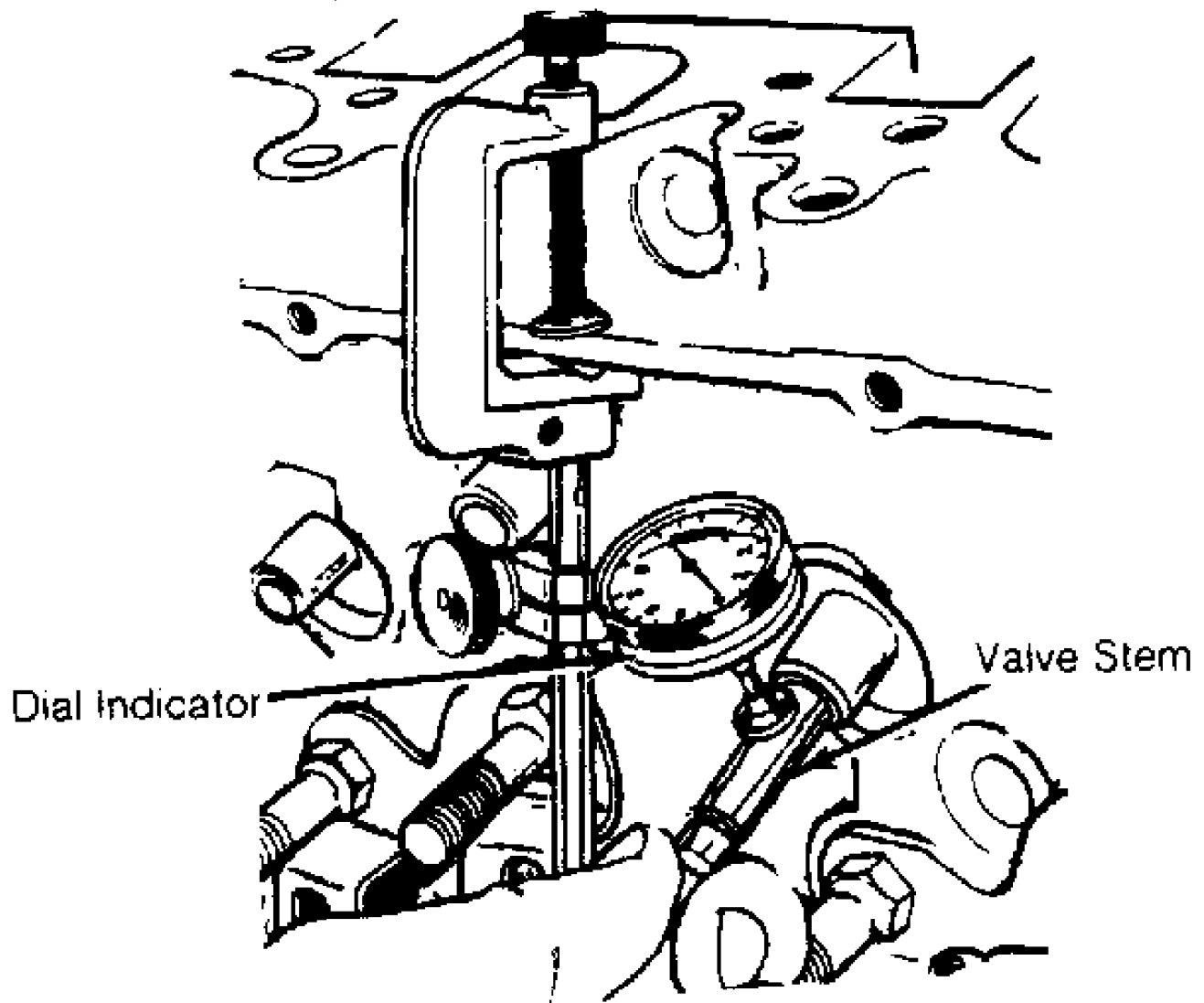


Fig. 6: Measuring Valve Stem-to-Guide Clearance - Typical
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Lower valve approximately $\frac{1}{16}$ " below valve seat. Push valve stem against valve guide as far as possible. Adjust dial indicator to zero. Push valve stem in opposite direction and 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.

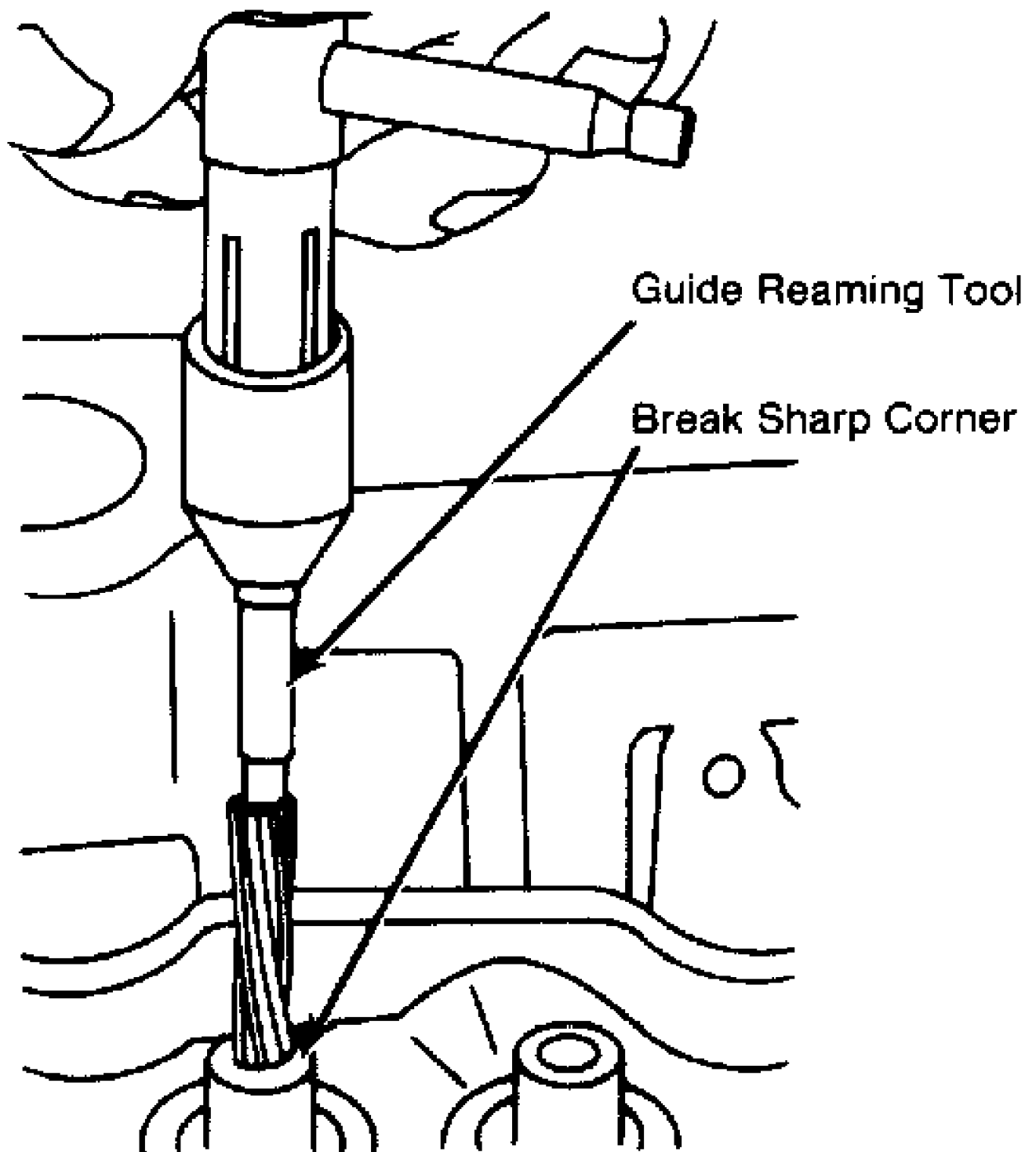


Fig. 7: Reaming Valve Guides - Typical
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Replacing Valve Guide

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.

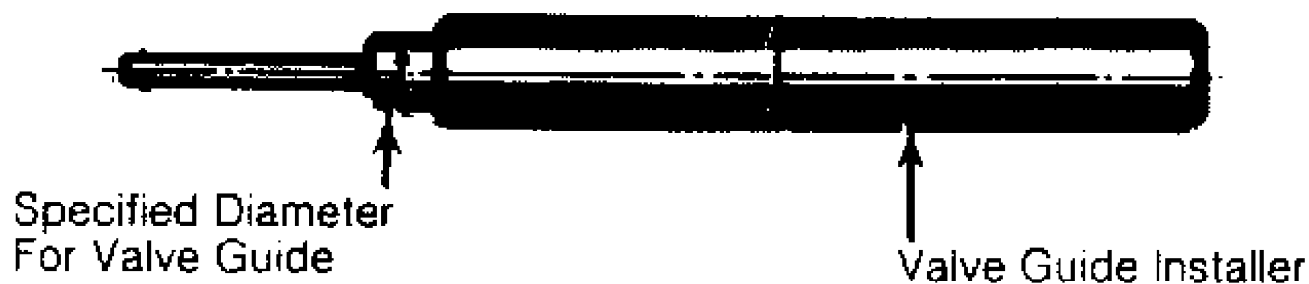


Fig. 8: Typical Valve Guide Remover & Installer
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VALVES & VALVE SEATS

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.

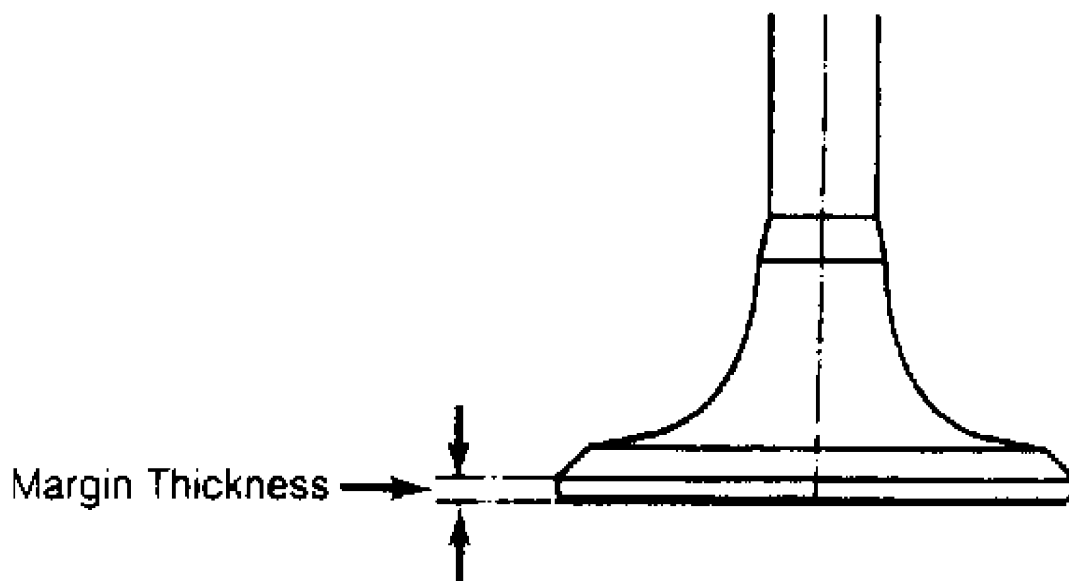


Fig. 9: Measuring Valve Head Margin - Typical
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If valve margin is less than specification, this will burn the valves. Valve must be replaced. Due to minimum margin dimensions

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.

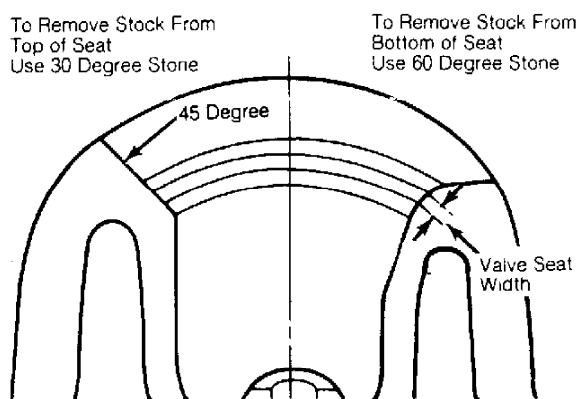


Fig. 10: Adjusting Valve Seat Width - Typical
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Valve Seat Replacement

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.

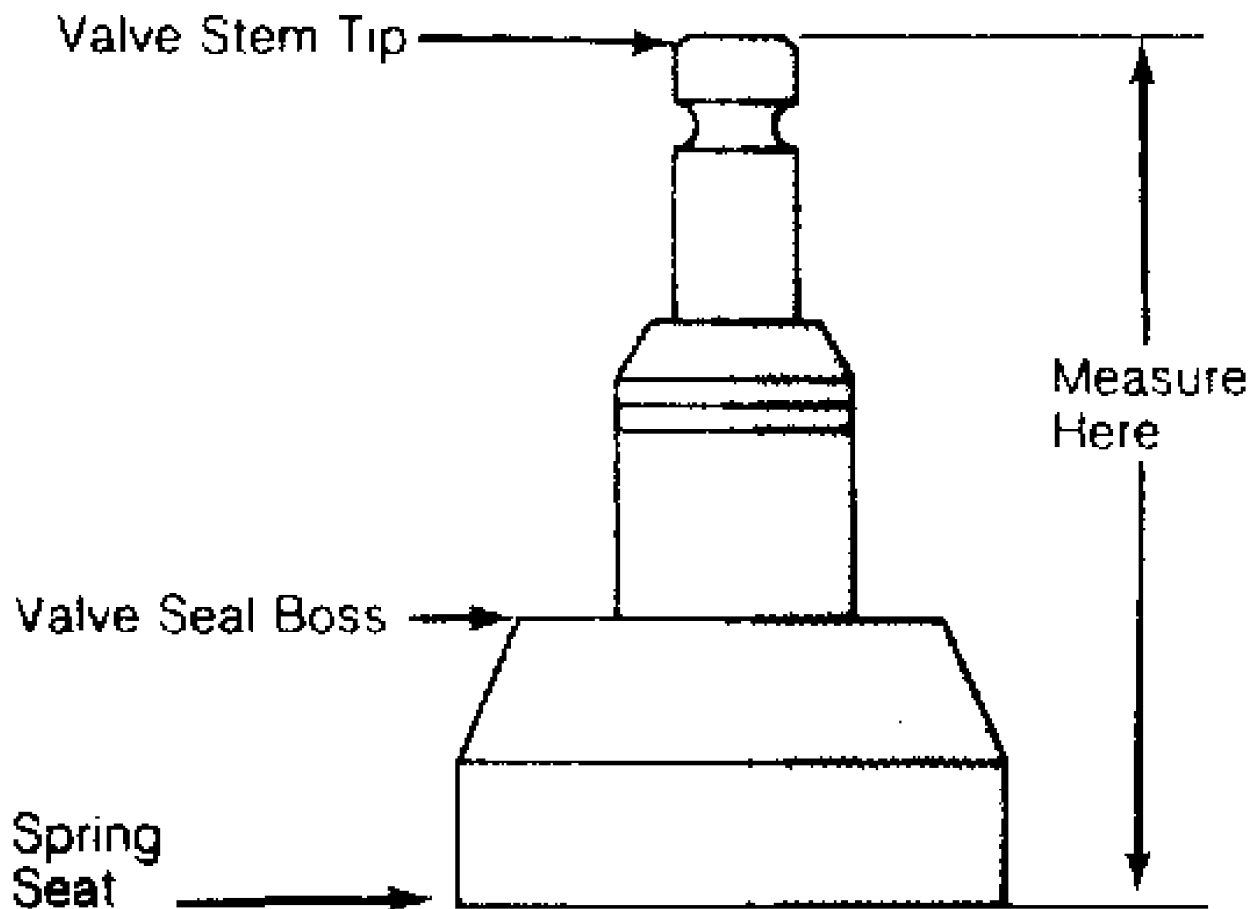


Fig. 11: Measuring Valve Stem Installed Height - Typical
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Remove valve and grind valve stem tip if height exceeds specification. Valve tips are surface hardened. DO NOT remove more

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/cm²) 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.

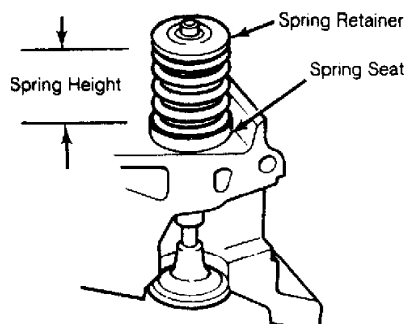


Fig. 12: Measuring Valve Spring Installed Height - Typical
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ROCKER ARMS & ASSEMBLIES

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.

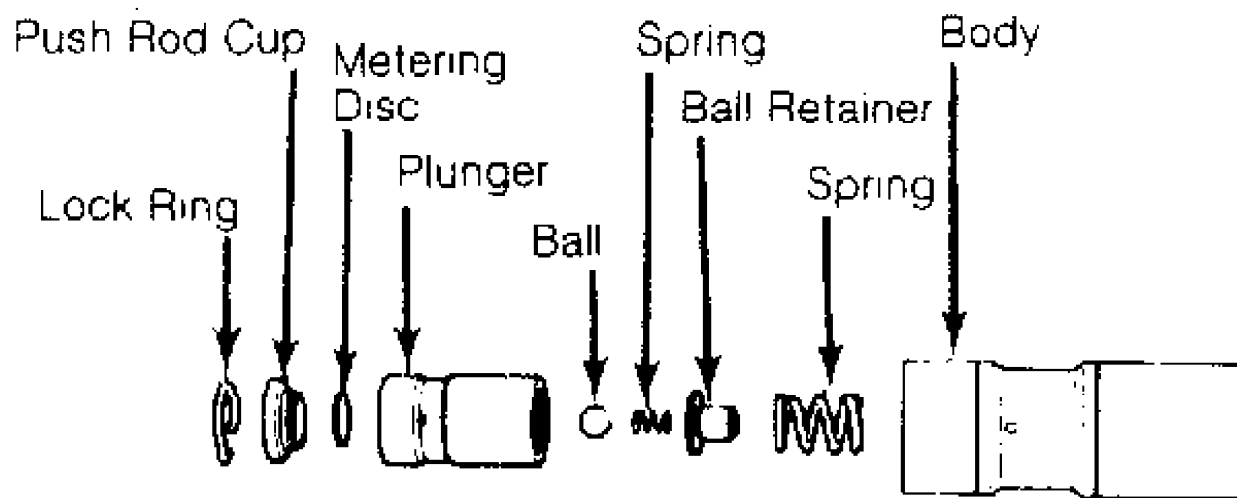
Check push rod for straightness. Roll push rod on a flat surface. Using feeler gauge, check clearance at center. Replace push rod if bent. The push rod can also be supported at each end and rotated. A dial indicator is used to detect bends in the push rod.

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.

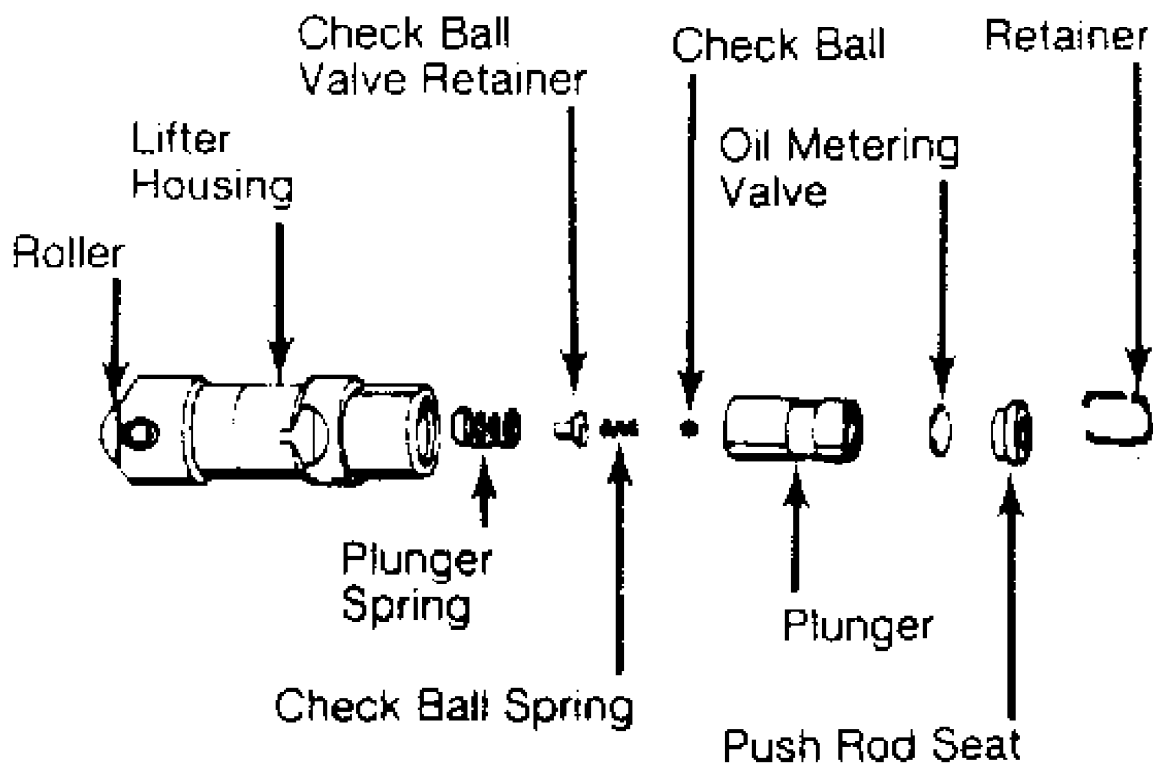
LIFTERS

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.



FLAT LIFTER



ROLLER LIFTER

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.

Ensure Piston Floats
During Installation Operation

Cylinder Number

"FRONT" Indicator
Of Piston

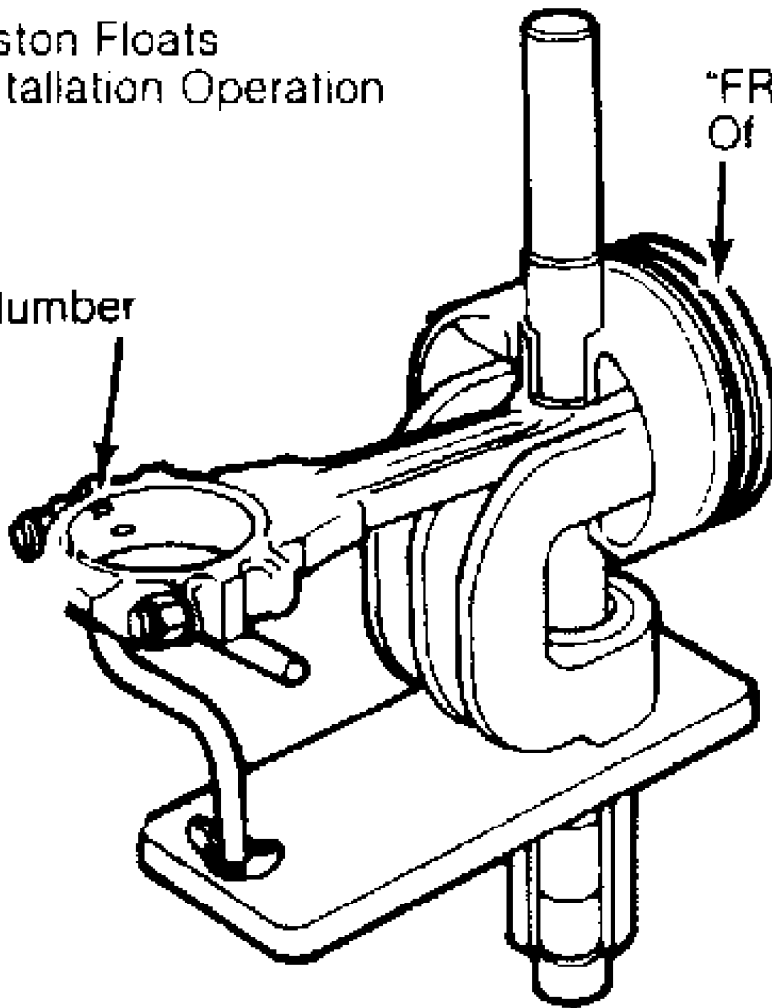


Fig. 14: Piston Pin Installation - Typical
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Lubricate piston pin and install in connecting rod. Ensure piston pin retainers are fully seated (if equipped). On pressed type piston pins, follow manufacturer's recommended procedure to avoid distortion 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.

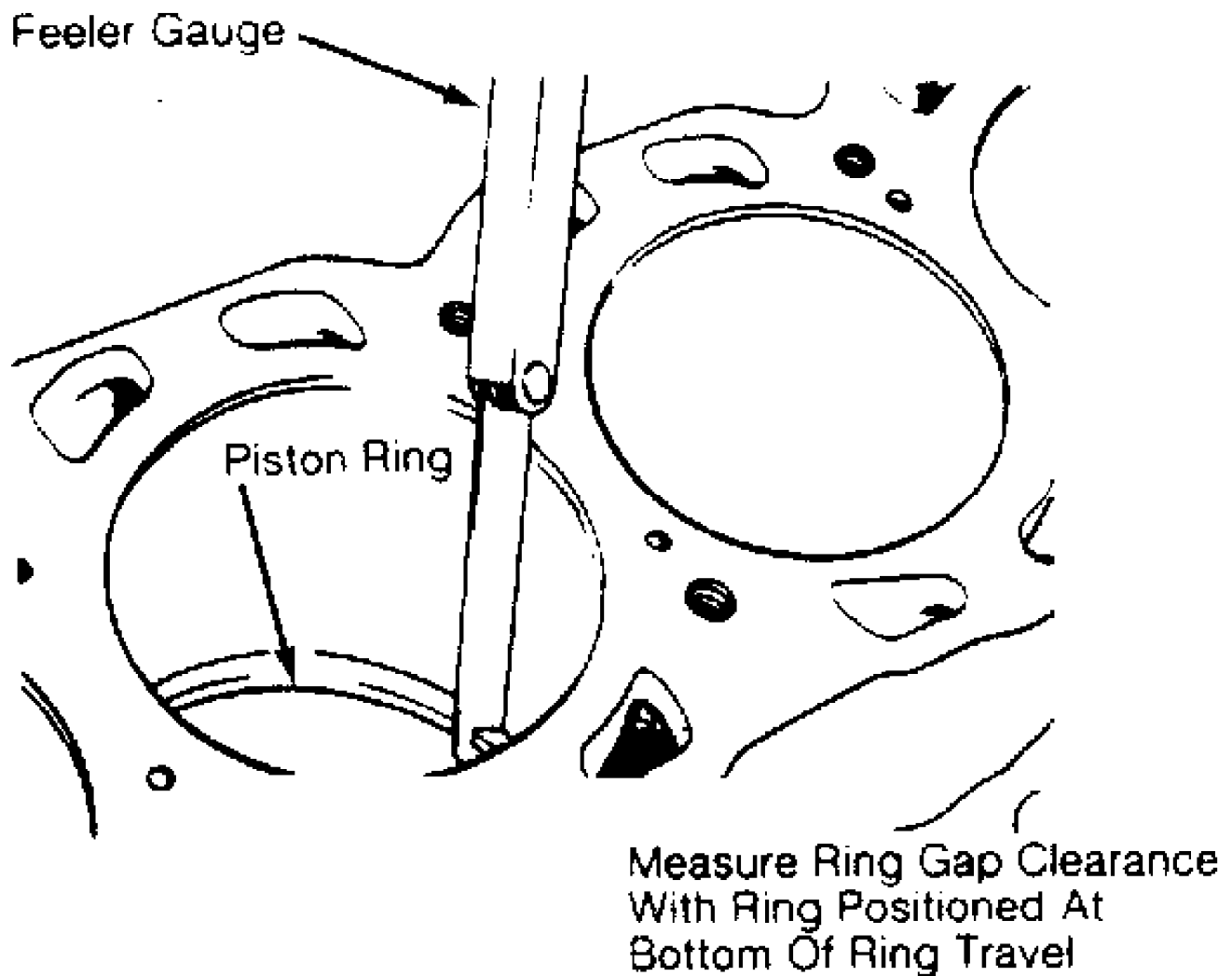


Fig. 15: Checking Piston Ring End Gap - Typical
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For checking side clearance, install rings on piston. Using feeler gauge, measure clearance between piston ring and piston ring land. Check side clearance in several areas around piston. Side clearance 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.

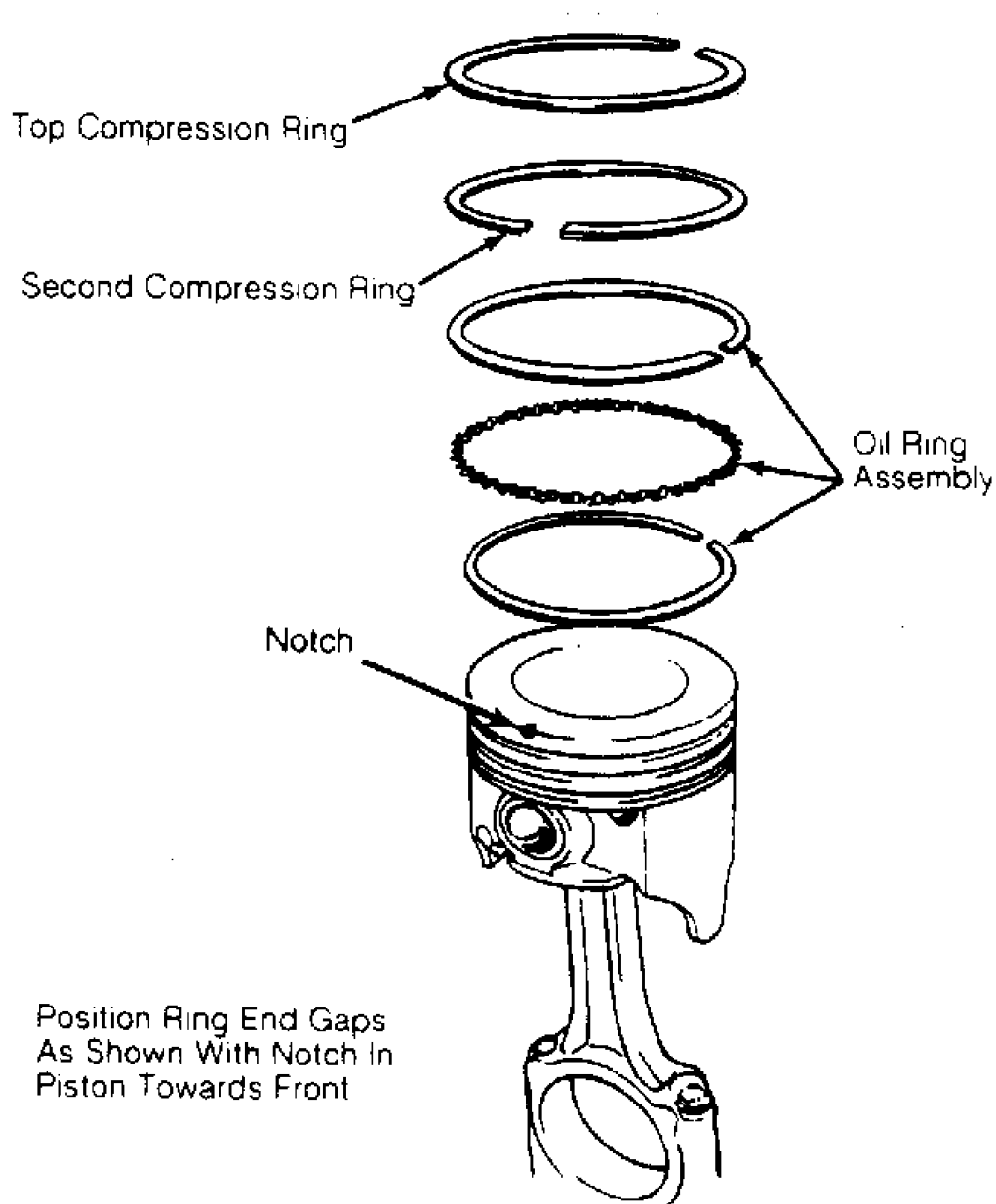


Fig. 16: Typical Piston Ring End Gap Positioning - Typical
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Install ring compressor. Use care not to rotate piston rings. Compress rings with ring compressor. Install plastic tubing protectors

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.

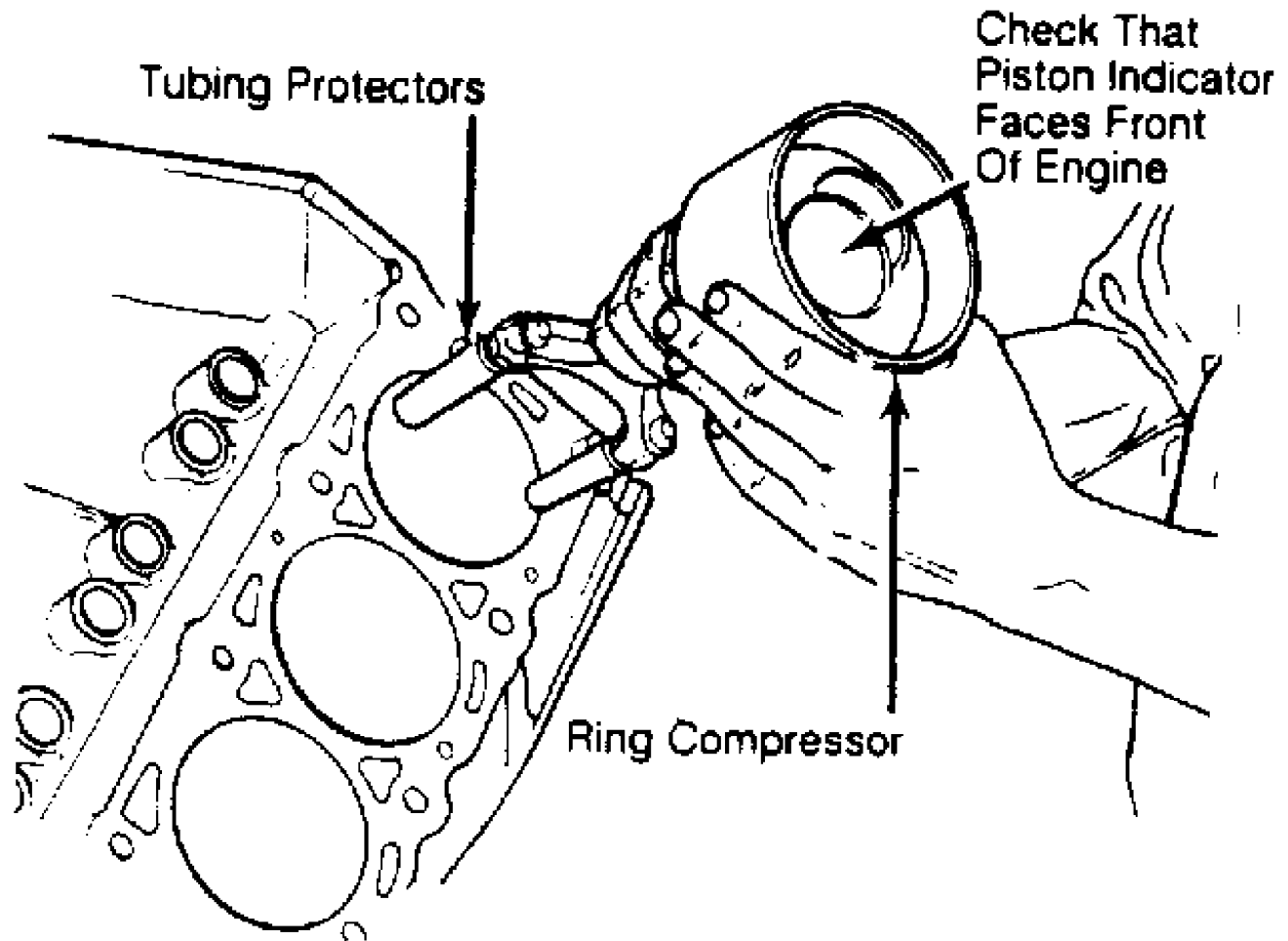


Fig. 17: Installing Piston & Connecting Rod Assembly - Typical
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Carefully tap piston into cylinder until rod bearing is seated on crankshaft journal. Remove protectors. Install rod cap and bearing. Lightly tighten connecting rod bolts. Repeat procedure 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.

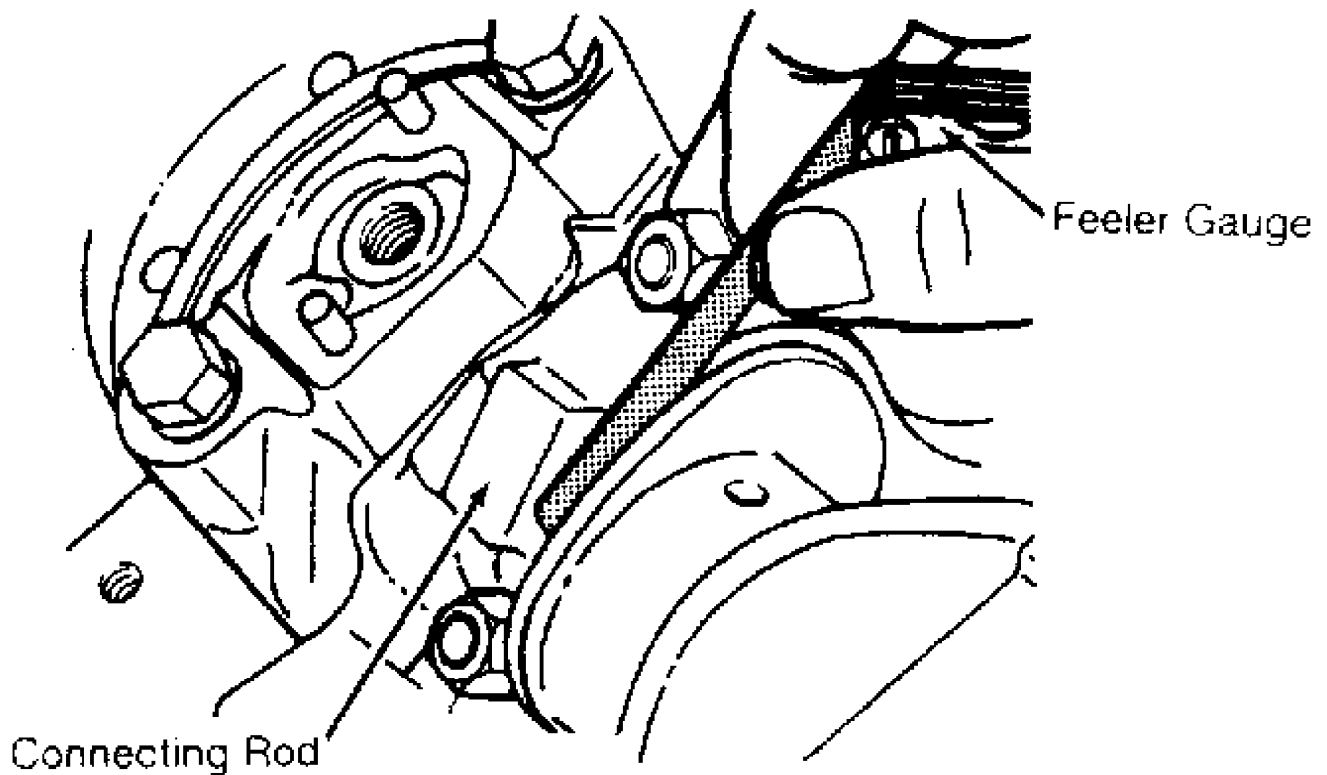


Fig. 18: Measuring Connecting Rod Side Clearance - Typical
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Check for improper bearing installation, wrong bearing cap or insufficient bearing clearance if side clearance is insufficient. Connecting rod may require machining to obtain proper clearance. 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.

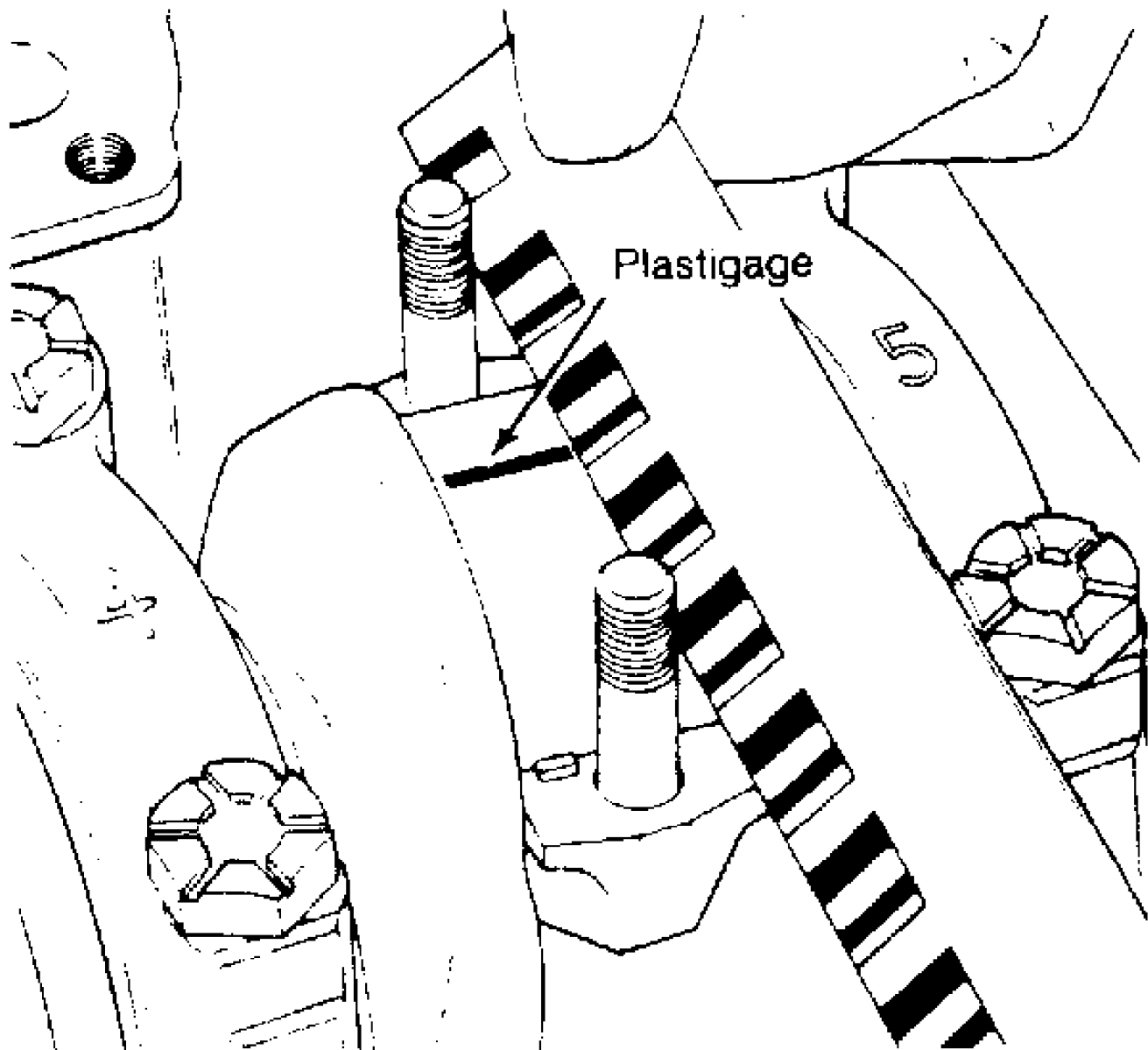


Fig. 19: Measuring Bearing Clearance - Typical
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Micrometer & Telescopic Gauge Method

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.

- A - B = Vertical Taper
- C - D = Horizontal Taper
- A - C & B - D = Out-Of-Round

Check For Out-Of-Round At Each End Of Journal

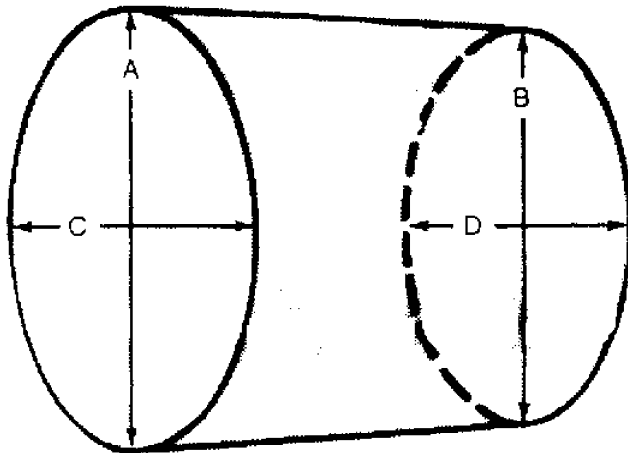


Fig. 20: Measuring Crankshaft Journal - Typical
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Crankshaft journal runout should be checked. Install crankshaft in "V" blocks or bench center. Position dial indicator

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.

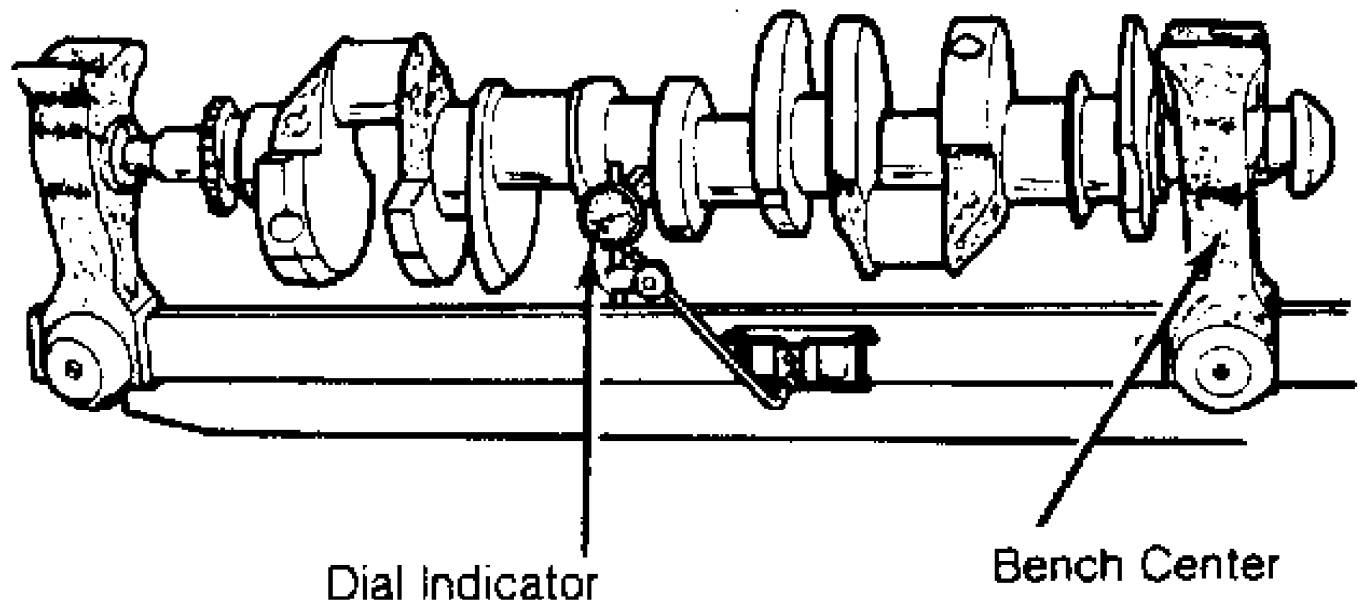


Fig. 21: Measuring Crankshaft Main Bearing Journal Runout - Typical
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INSTALLATION

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.

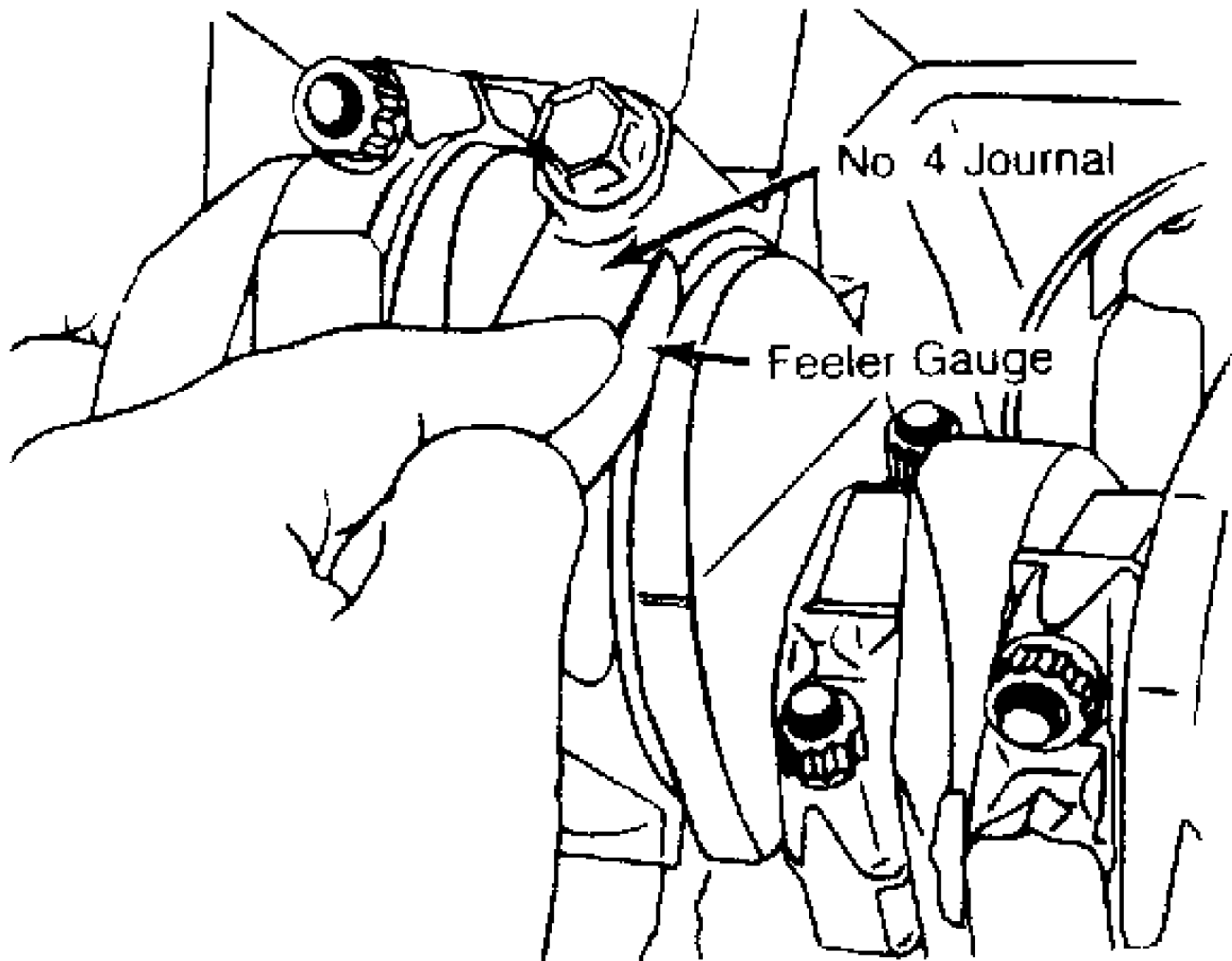


Fig. 22: Checking Crankshaft End Play - Typical
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Crankshaft end play must be within specification. If end play is not within specification, check for faulty thrust bearing installation or worn crankshaft. Some applications offer oversized thrust bearings.

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.

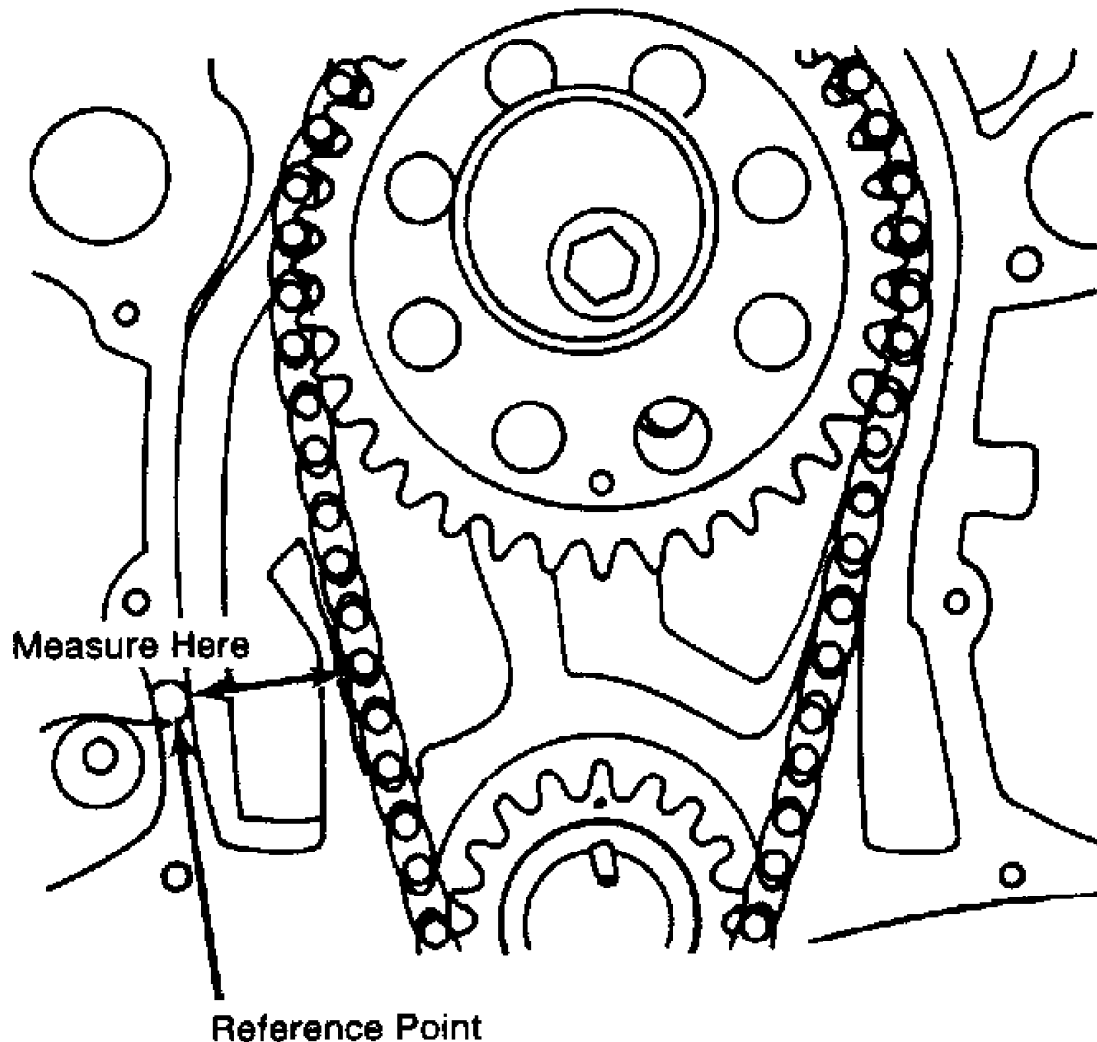
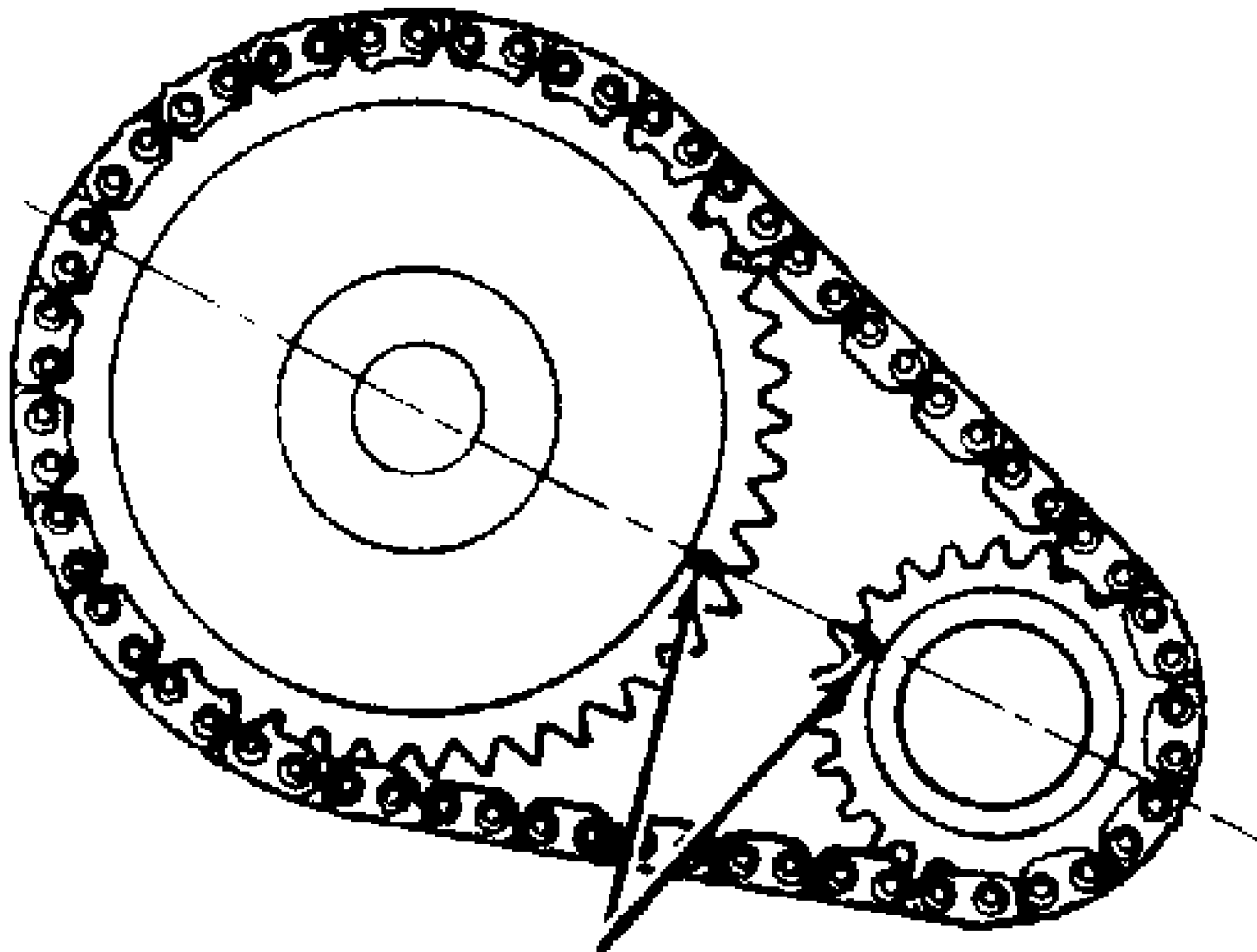


Fig. 23: Measuring Timing Chain Stretch - Typical
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Timing chains must be installed so that timing marks on camshaft gear and crankshaft gear are aligned according to

manufacturer. See Fig. 24.



Timing Marks

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.

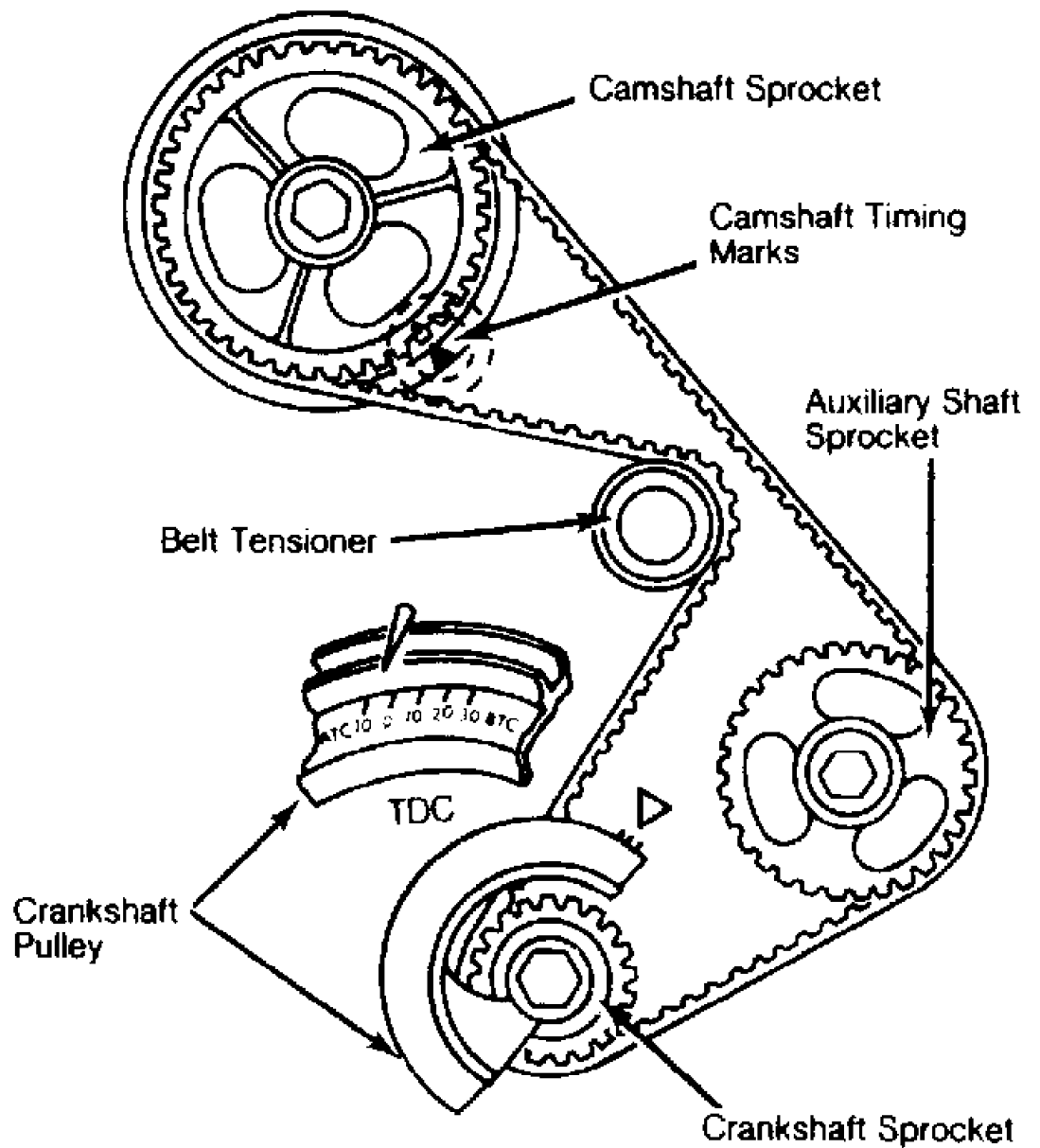


Fig. 25: Timing Belt Sprocket Alignment - Typical
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TENSION ADJUSTMENTS

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.

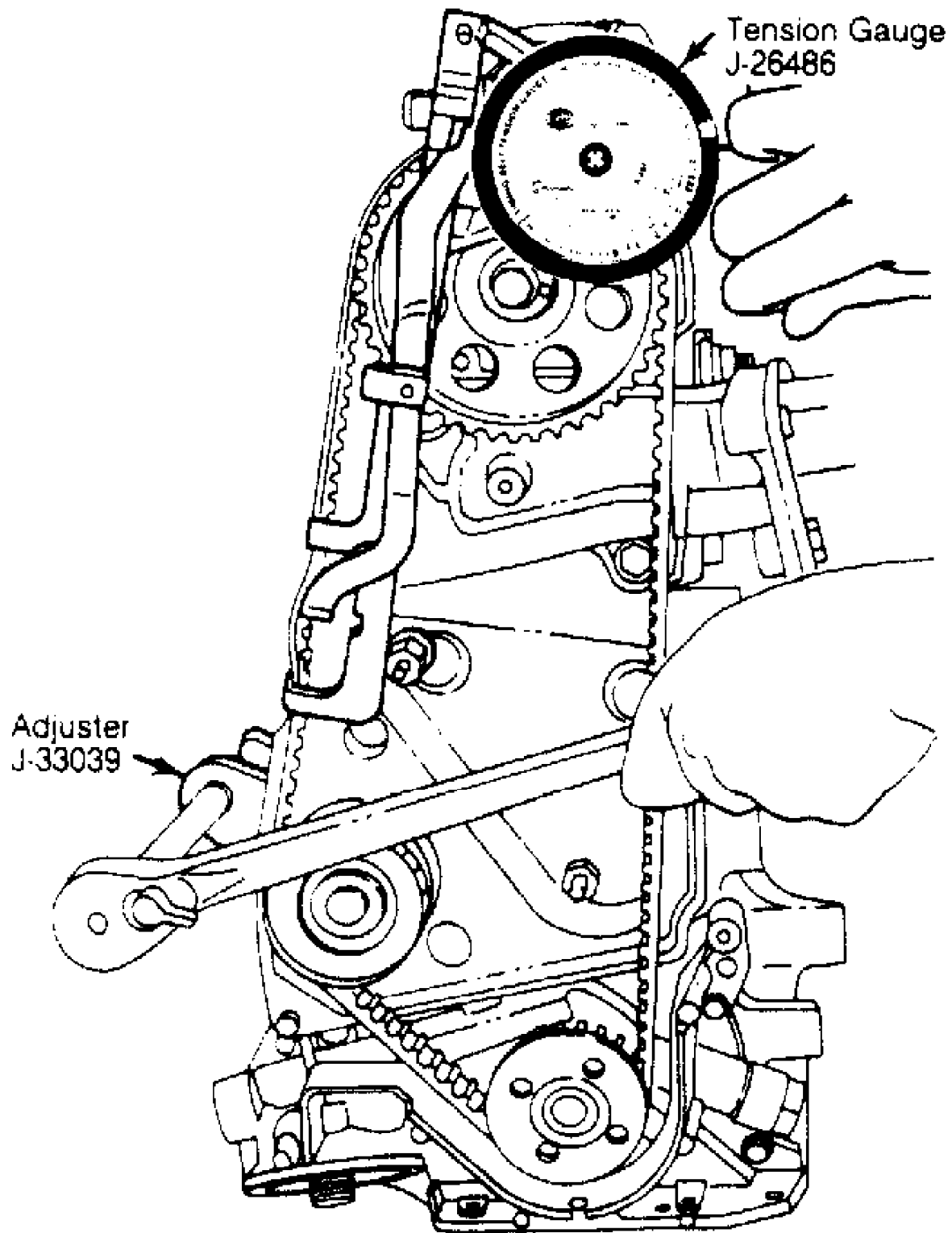


Fig. 26: Timing Belt Tension Adjustment - Typical
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TIMING GEARS

*** 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.

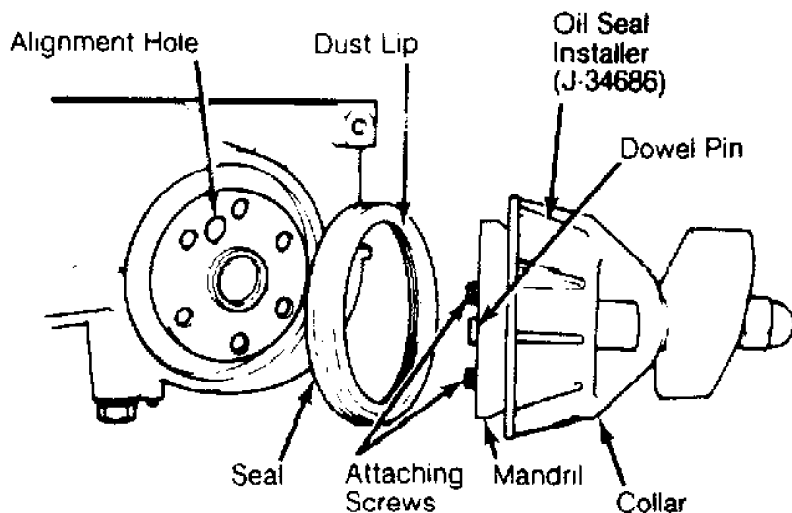


Fig. 27: Installing Typical One-Piece Oil Seal
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Rope Type Seal

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.

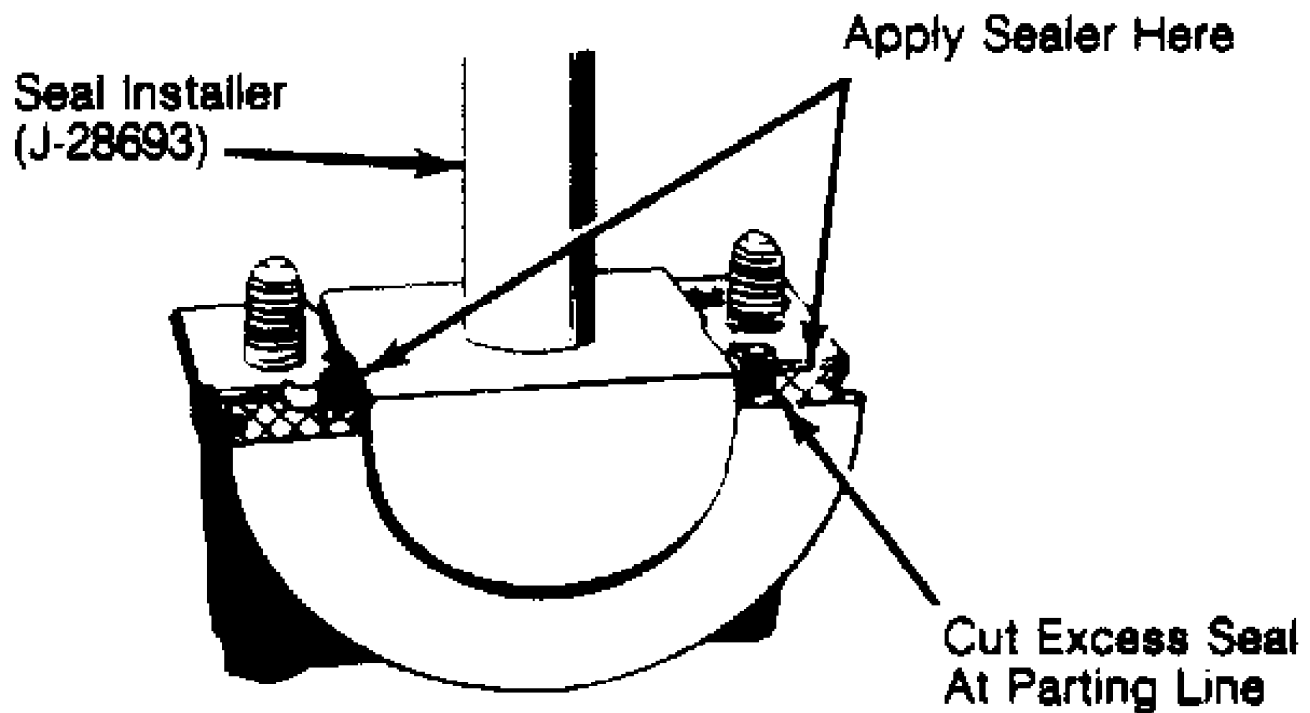


Fig. 28: Typical Rope Seal Installation
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Split-Rubber Type Seal

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.

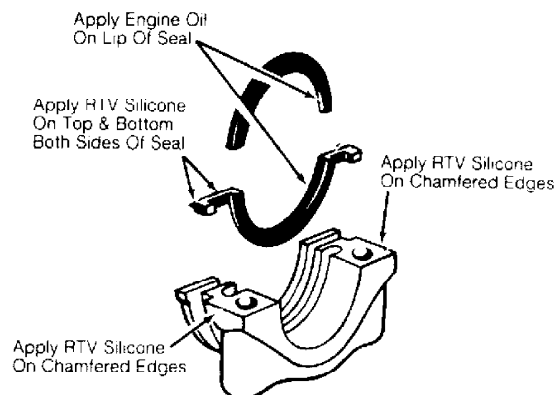


Fig. 29: Typical Split-Rubber Seal Installation
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OIL PUMP

*** 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.

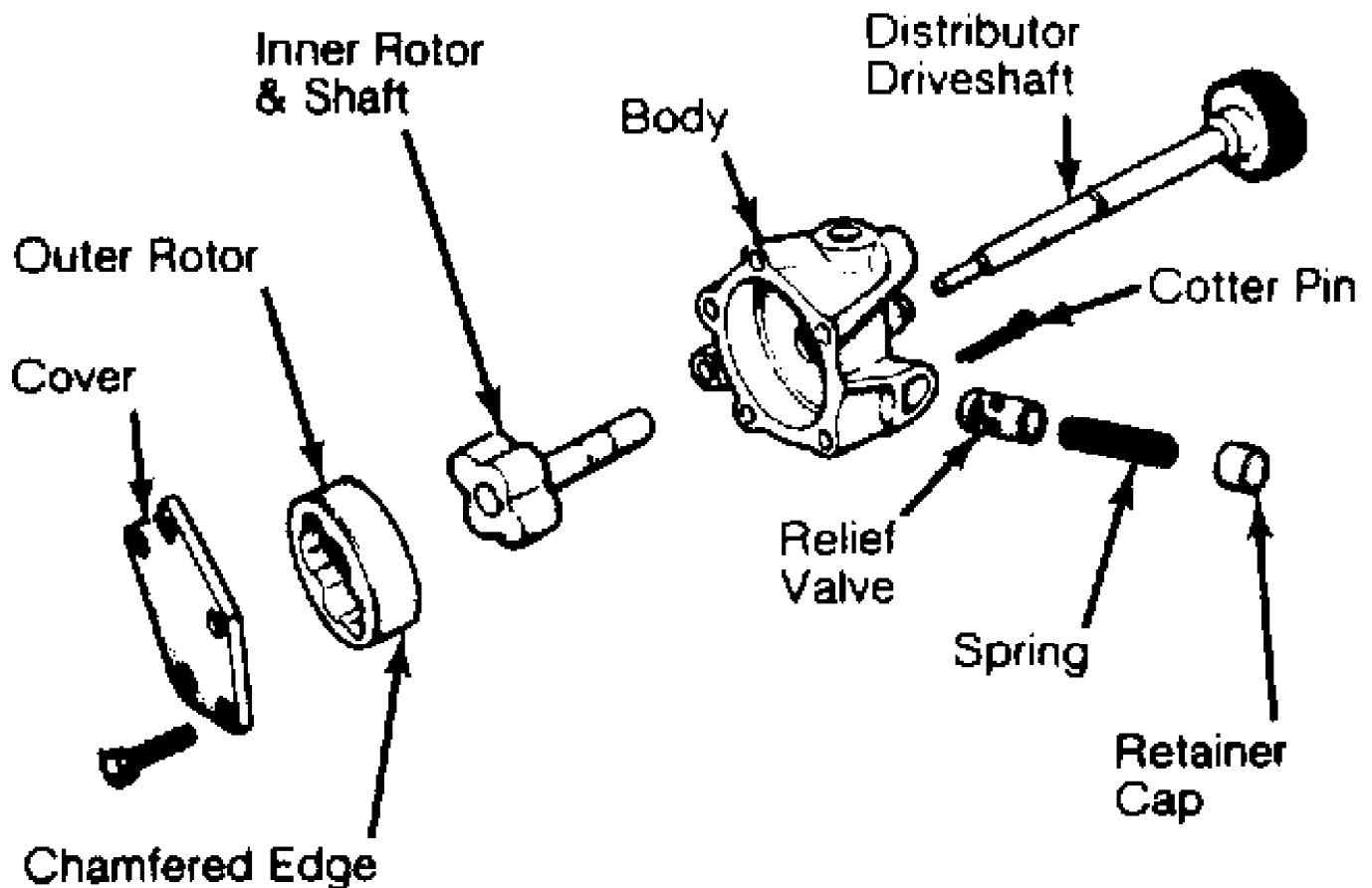


Fig. 30: Typical Rotor Type Oil Pump
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Measure outer rotor-to-body clearance. Replace pump assembly if clearance exceeds specification. Measure clearance between rotors. See Fig. 31. Replace shaft and both rotors if clearance exceeds specifications.

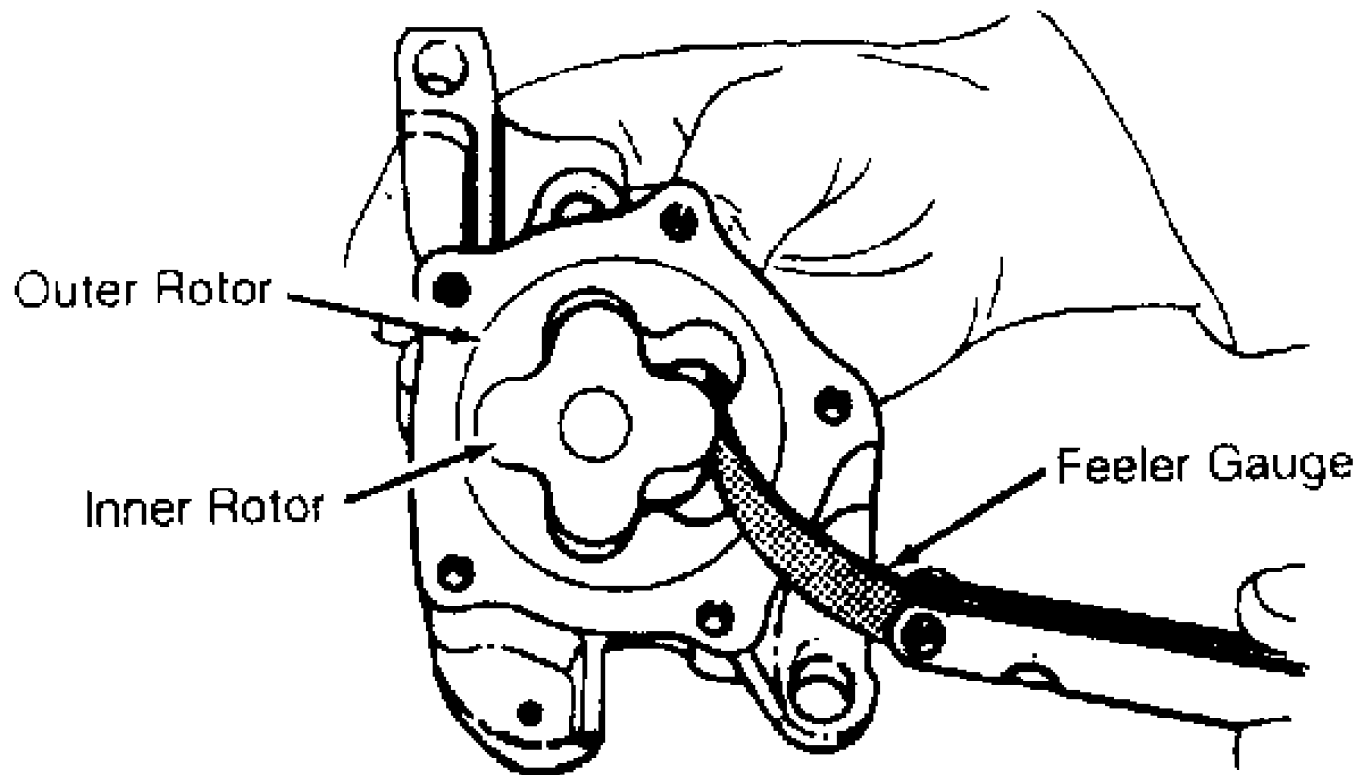


Fig. 31: Measuring Rotor Clearance - Typical
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Install rotors in pump body. Position straightedge across pump body. Using feeler gauge, measure clearance between rotors and straightedge. Pump cover wear is measured using a straightedge and feeler gauge. 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.

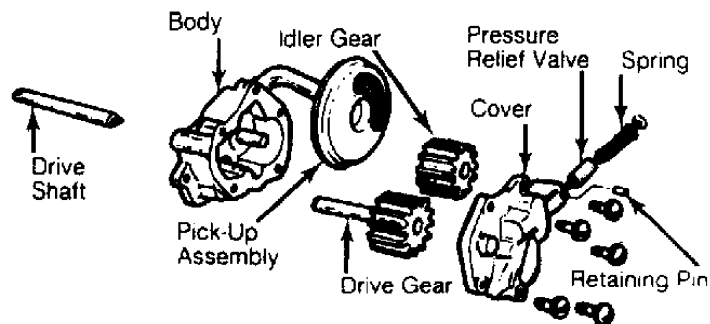


Fig. 32: Typical Gear Type Oil Pump
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Measure gear diameter and length. Measure gear housing cavity depth and diameter. See Fig. 33. Replace components if worn or

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.

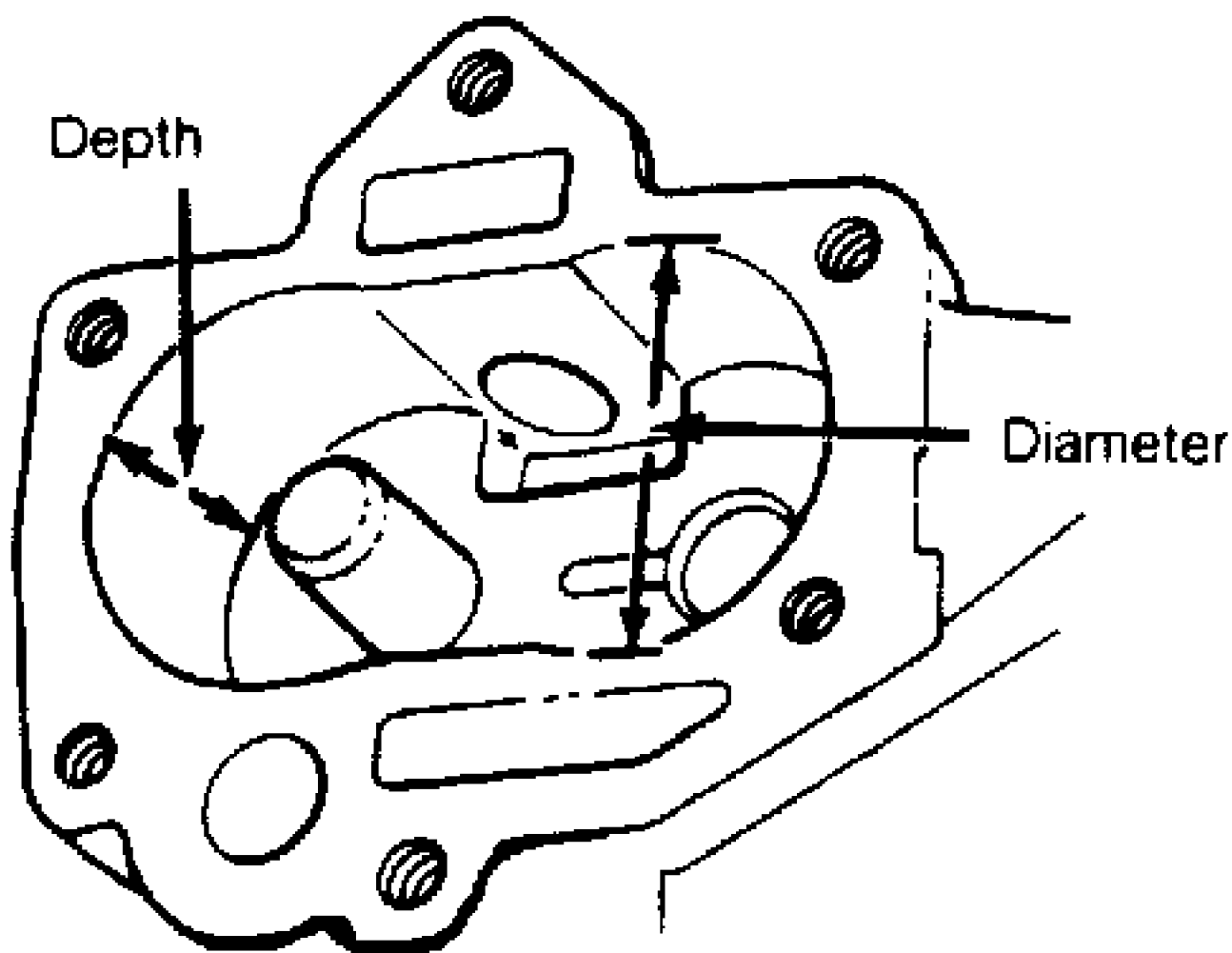


Fig. 33: Measuring Oil Pump Gear Cavity - Typical
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BREAK-IN-PROCEDURE

* 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 ***

1993 Mitsubishi Montero

GENERAL INFORMATION

Engine Performance and Maintenance Motorist Assurance Program
Standards For Automotive Repair

All Makes and Models

INTRODUCTION TO MOTORIST ASSURANCE PROGRAM (MAP)

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EXHAUST GAS RECIRCULATION FEEDBACK DEVICES
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IGNITION TERMINALS
IGNITION WIRES, BOOTS, COIL TOWERS AND TERMINALS (SECONDARY)
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INERTIA FUEL SHUT-OFF SWITCHES
INTAKE AIR TEMPERATURE SENSORS
INTAKE MANIFOLDS
INTERCOOLERS
KNOCK SENSORS
LIQUID VAPOR SEPARATORS
MANIFOLD ABSOLUTE PRESSURE (MAP) SENSORS
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OIL PUMPS
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PCV ORIFICES
PCV VALVES
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POWERTRAIN CONTROL PROM
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RADIATOR FAN CLUTCHES
RADIATORS
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SPARK PLUGS
SPRING LOCKS

SUPER CHARGERS
SWITCHES
THERMAL VACUUM VALVES
THERMOSTATIC AIR DOOR ASSEMBLIES
THERMOSTATS AND HOUSINGS
THROTTLE BODIES
THROTTLE CABLES
THROTTLE LINKAGES AND CABLES
THROTTLE POSITION SENSORS
THROTTLE POSITION SWITCHES
TIMING BELT SPROCKETS
TIMING BELTS
TORQUE STRUTS
TRANSMISSION RANGE SWITCHES
TUBE CLAMPS
TUBE CONNECTORS
TUBE COUPLERS
TUBES
TURBO CHARGERS
VACUUM CONNECTIONS
VACUUM HOSES, TUBES AND CONNECTIONS (NON-METALLIC)
VACUUM REGULATOR SOLENOIDS
VACUUM TUBES
VEHICLE SPEED SENSORS
VOLUME AIR FLOW SENSORS
WASTE GATE CONTROL SOLENOIDS
WASTE GATES AND BOOST CONTROL MECHANISMS
WATER PUMPS (ELECTRIC)
WATER PUMPS (NON-ELECTRIC)
WIRING HARNESSSES AND CONNECTORS

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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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.

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

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	 (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.

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.
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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 CABLES, WIRES AND CONNECTORS

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 of 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		

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

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.

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.

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.

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 SENDERS

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,		

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.

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.

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

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.

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.

				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

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 UNITS

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

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.		

A - ENGINE/VIN ID

1993 Mitsubishi Montero

1993 ENGINE PERFORMANCE
Mitsubishi

MODEL IDENTIFICATION

MITSUBISHI MODEL IDENTIFICATION

MODEL IDENTIFICATION TABLE (MITSUBISHI)

MODEL	BODY CODE (1)	ENGINE (2)	ENGINE ID (3)	FUEL SYSTEM	IGNITION SYSTEM (4)
Diamante	7	3.0L V6 (6G72) SOHC	H	MPI	Optical
		3.0L V6 (6G72) DOHC	J	MPI	DIS
Eclipse	4	1.8L 4-Cyl. (4G37) SOHC	T	MPI	Optical
		2.0L 4-Cyl. (4G63) SOHC	R	MPI	DIS
		2.0L 4-Cyl. (4G63) DOHC Turbo	F	MPI	DIS
Expo	0, 4, 9	1.8L 4-Cyl. (4G93) SOHC	C	MPI	Hall Effect
		2.4L 4-Cyl. (4G64) SOHC	G	MPI	Hall Effect
Galant	6	2.0L 4-Cyl. (4G63) SOHC	D	MPI	Optical
		2.0L 4-Cyl. (4G63) DOHC	E	MPI	Optical
Mirage	1, 6	1.5L 4-Cyl. (4G15) SOHC	A	MPI	Optical
		1.8L 4-Cyl. (4G93) SOHC	Y	MPI	Optical
Montero	1	3.0L V6 (6G72) SOHC	H	MPI	Optical
Pickup	4, 5, 9	2.4L 4-Cyl. (4G64)	G	MPI	Optical
		3.0L V6 (6G72) SOHC	H	MPI	Optical
Precis	A, D, F	1.5L 4-Cyl. (G4AJK) SOHC	J	MPI	Optical
3000GT	D, E	3.0L V6 (6G72) DOHC	J	MPI	DIS

		3.0L V6 (6G72) DOHC Turbo	K	MPI	DIS
(1) - Body code is 5th character of Vehicle Identification Number (VIN), located on upper left corner of instrument panel. (2) - See ENGINE CODE LOCATION. (3) - Engine ID is 8th character of VIN. (4) - Ignition timing is computer controlled. On all models with Distributorless Ignition System (DIS), crankshaft position sensor is mounted in place of distributor. (5) - Canadian Model.					

VIN DEFINITION (EXCEPT PRECIS)

(VIN) J B 3 C U 1 4 X 1 P U 1 2 3 4 5 6
 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17

- 1 - Indicates Nation of Origin.
- 2 - Indicates Manufacturer.
- 3 - Indicates Vehicle Type.
- 4 - Indicates Restraint System. (1)
- 5 - Indicates Model.
- 6 - Indicates Vehicle Series.
- 7 - Indicates Body Type. (2)
- 8 - Indicates Engine Type and Make.
- 9 - Indicates Check Digit.
- 10 - Indicates Model Year.
- 11 - Indicates Assembly Plant.
- 12-17 - Indicates Plant Sequential Number.

- (1) - On Pickup and Montero, fourth character of VIN indicates GVWR
- (2) - On Pickup and Montero, seventh character of VIN indicates restraint system.

VIN DEFINITION (PRECIS)

(VIN) K P H V D 3 2 J 0 P K 0 0 0 0 4 7
 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17

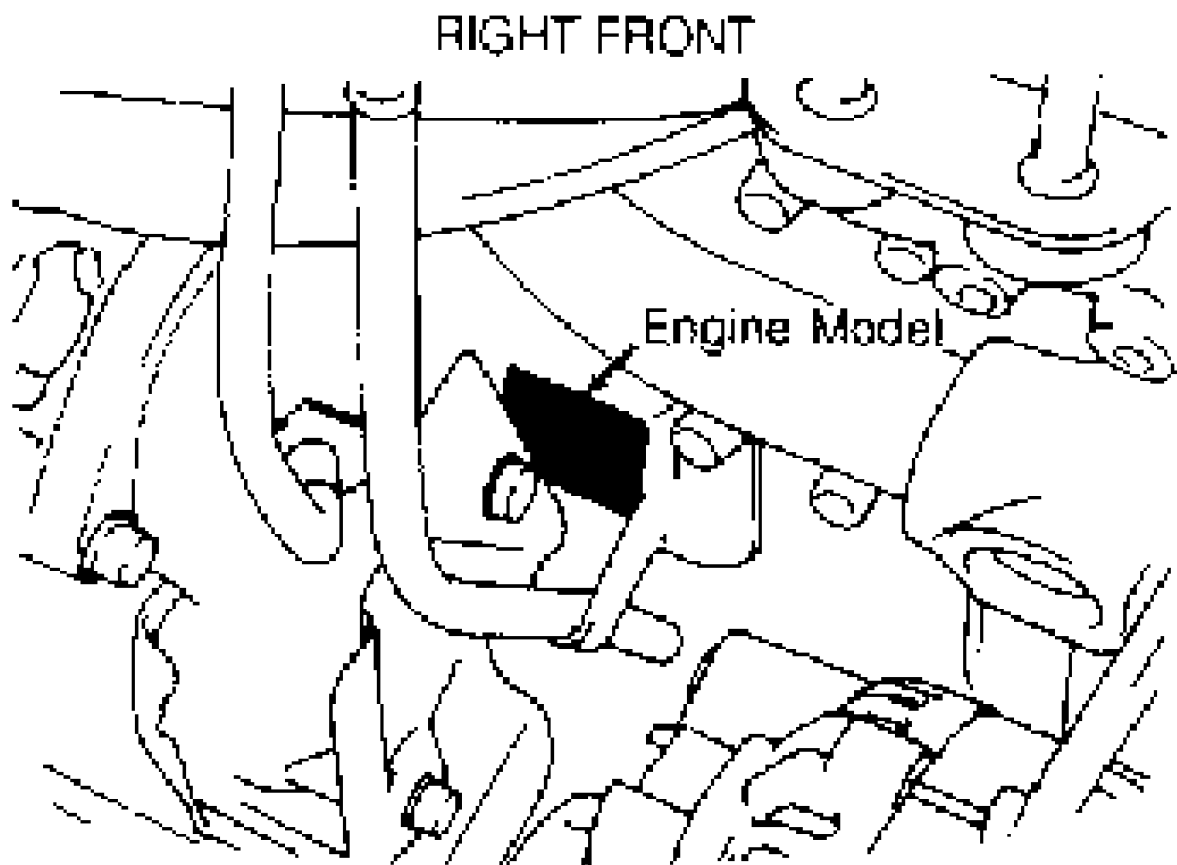
- 1 - Indicates Nation of Origin.
- 2 - Indicates Manufacturer.
- 3 - Indicates Vehicle Type.
- 4 - Indicates Restraint System.
- 5 - Indicates Body Type.
- 6 - Indicates Vehicle Series.
- 7 - Indicates Restraint Type.
- 8 - Indicates Engine Type and Make.
- 9 - Indicates Check Digit.
- 10 - Indicates Model Year.
- 11 - Indicates Assembly Plant.
- 12-17 - Indicates Plant Sequential Number.

MODEL YEAR VIN CODE APPLICATION TABLE

VIN Code		Model Year
M	.....	1991
N	.....	1992
P	.....	1993

ENGINE CODE LOCATION

ECLIPSE & MIRAGE 1.5L, 1.6L, 1.8L & 2.0L

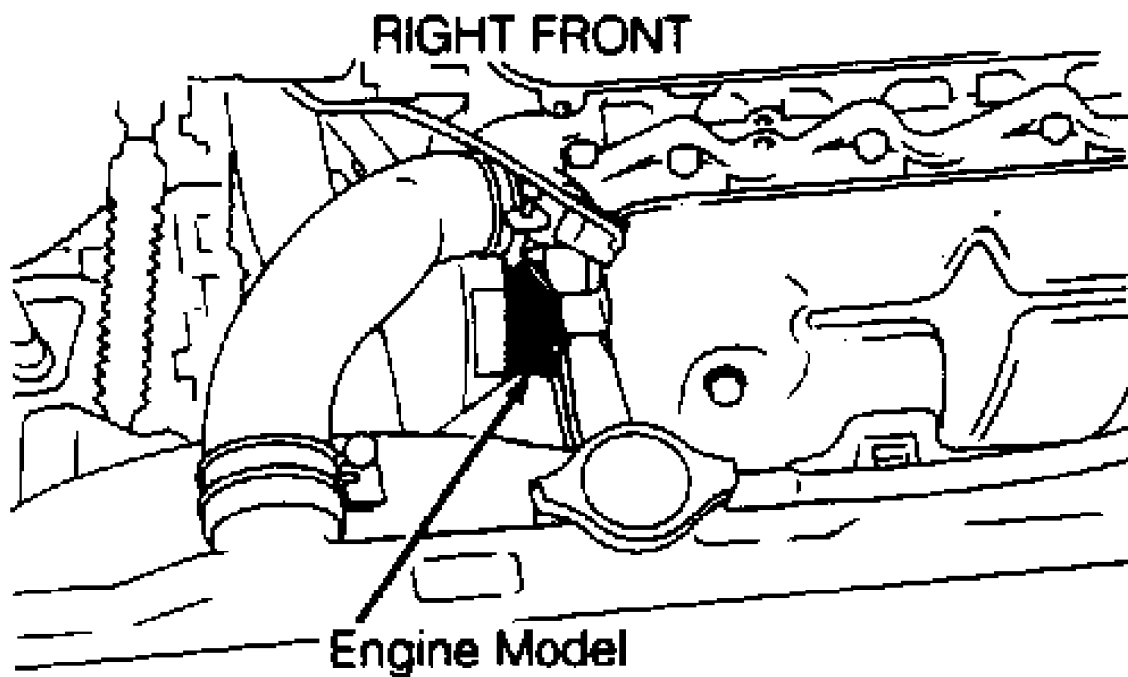


**COLT, COLT 200, ECLIPSE, MIRAGE & SUMMIT
1.5L, 1.6L, 1.8L & 2.0L**

90117341

Fig. 1: Engine Code Location (Eclipse & Mirage)
Courtesy of Chrysler Motors.

EXPO & EXPO LRV 1.8L



COLT VISTA, EXPO & SUMMIT WAGON 1.8L

92D25570

Fig. 2: Engine Code Location (Expo/Expo LRV 1.8L)
Courtesy of Chrysler Motors.

EXPO & EXPO LRV 2.4L

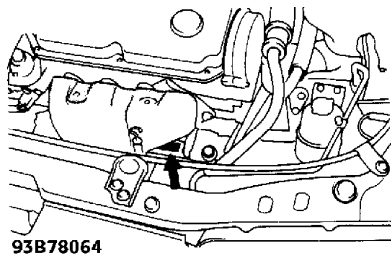


Fig. 3: Engine Code Location (Expo/Expo LRV 2.4L)
Courtesy of Chrysler Motors.

DIAMANTE 3.0L

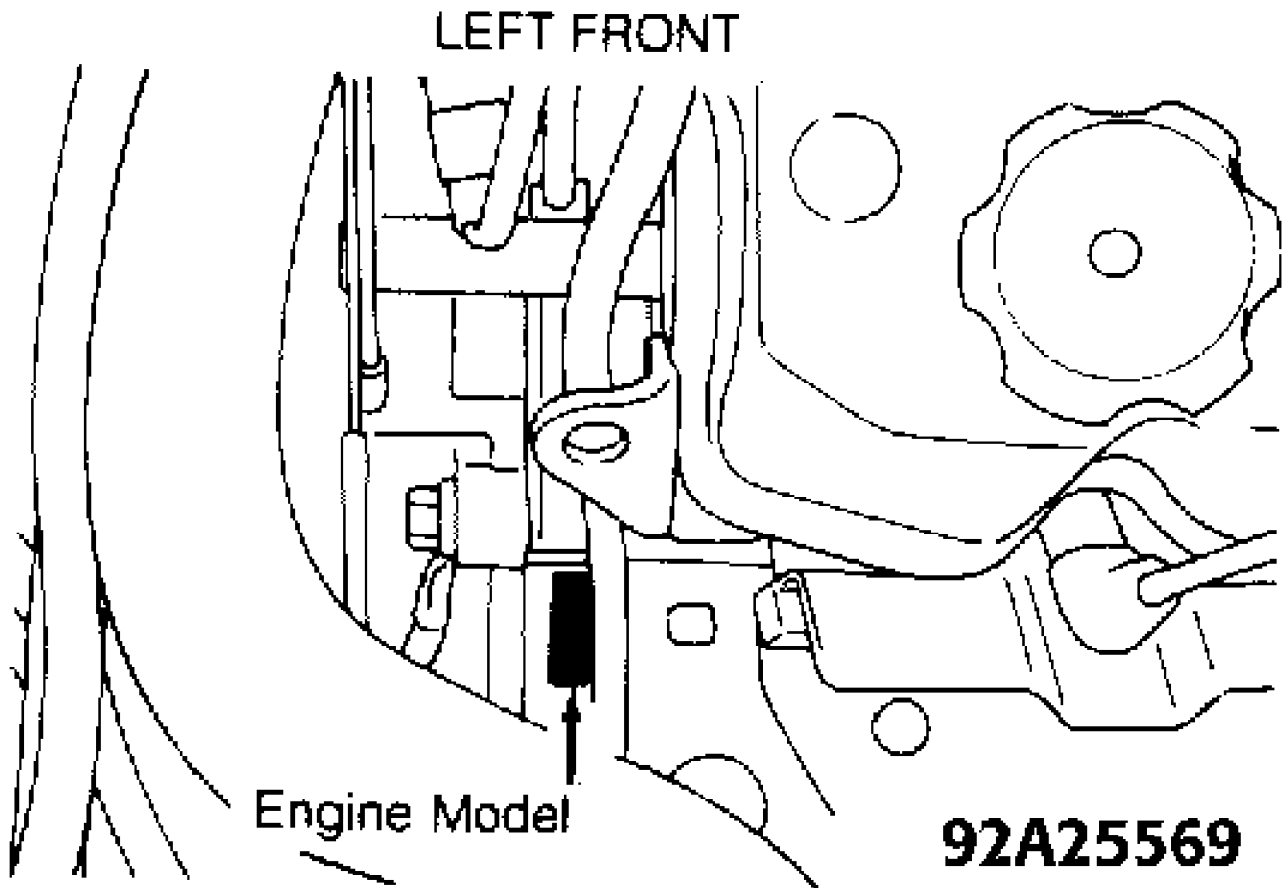


Fig. 4: Engine Code Location (Diamante 3.0L)
Courtesy of Chrysler Motors.

GALANT 2.0L

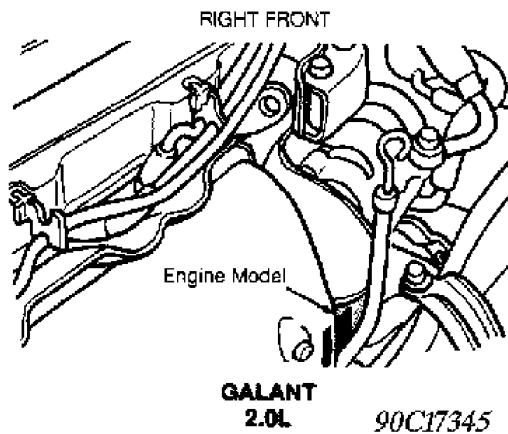
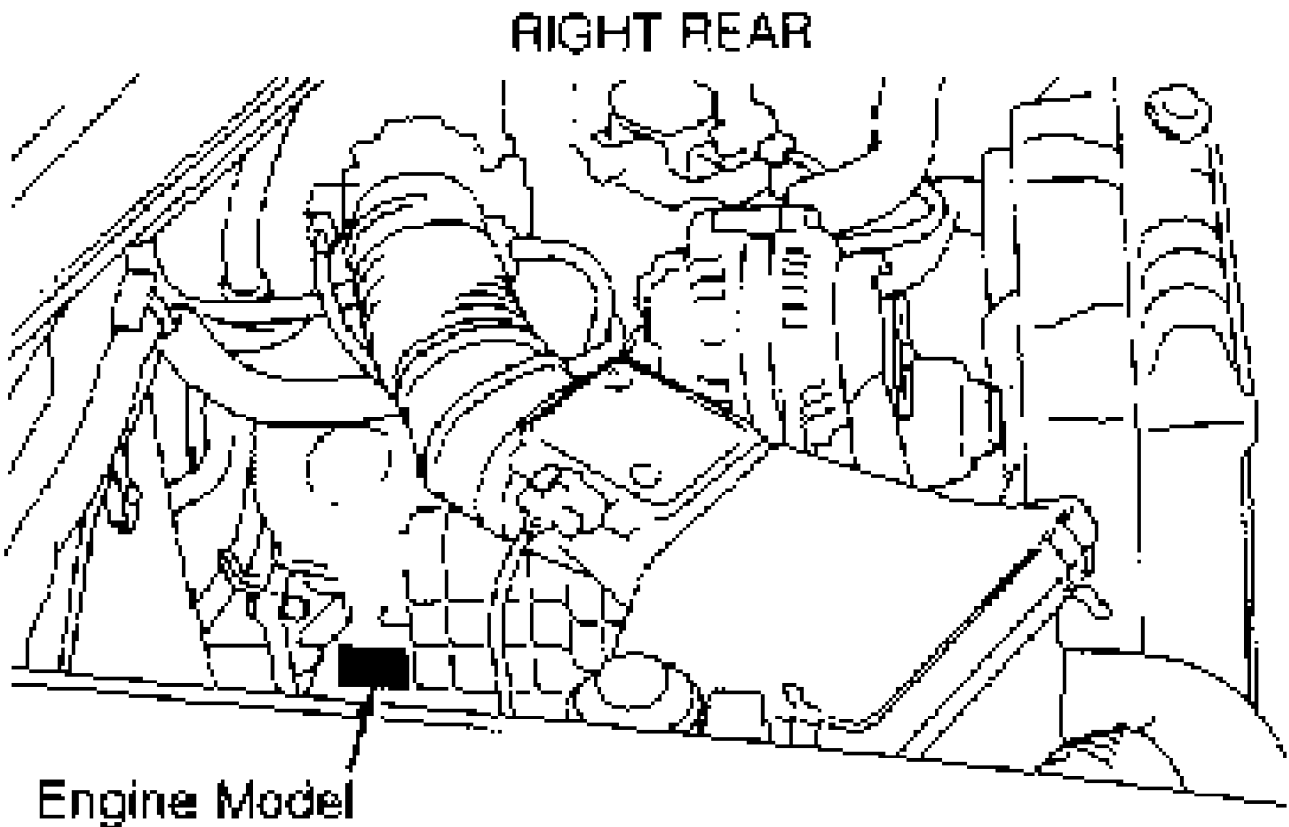


Fig. 5: Engine Code Location (Galant 2.0L)
Courtesy of Chrysler Motors.

MONTERO 3.0L



**MONTERO
3.0L**

92F25572

Fig. 6: Engine Code Location (Montero 3.0L)
Courtesy of Chrysler Motors.

PICKUP 2.4L

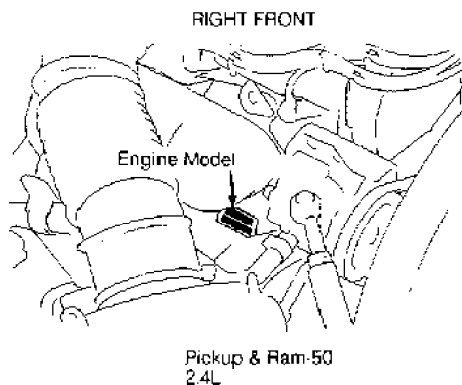
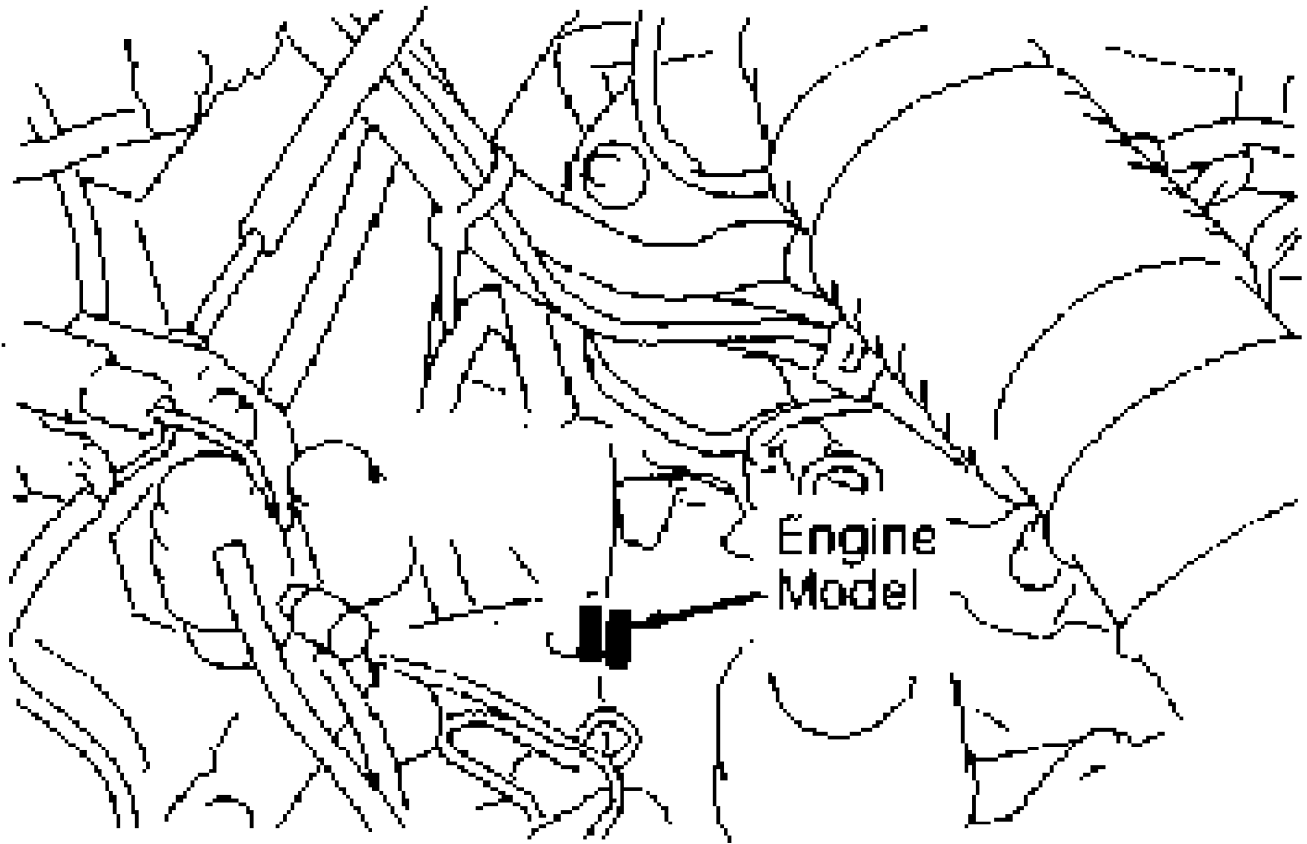


Fig. 7: Engine Code Location (Pickup 2.4L)
Courtesy of Chrysler Motors.

PICKUP 3.0L

RIGHT SIDE



Pickup & Ram-50 3.0L

Fig. 8: Engine Code Location (Pickup 3.0L)
Courtesy of Chrysler Motors.

PRECIS 1.5L

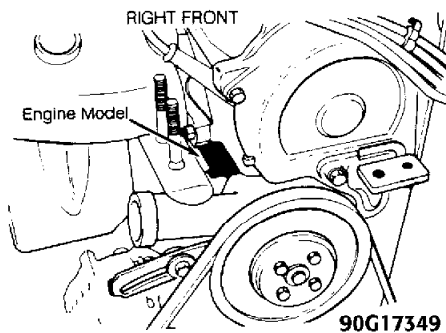
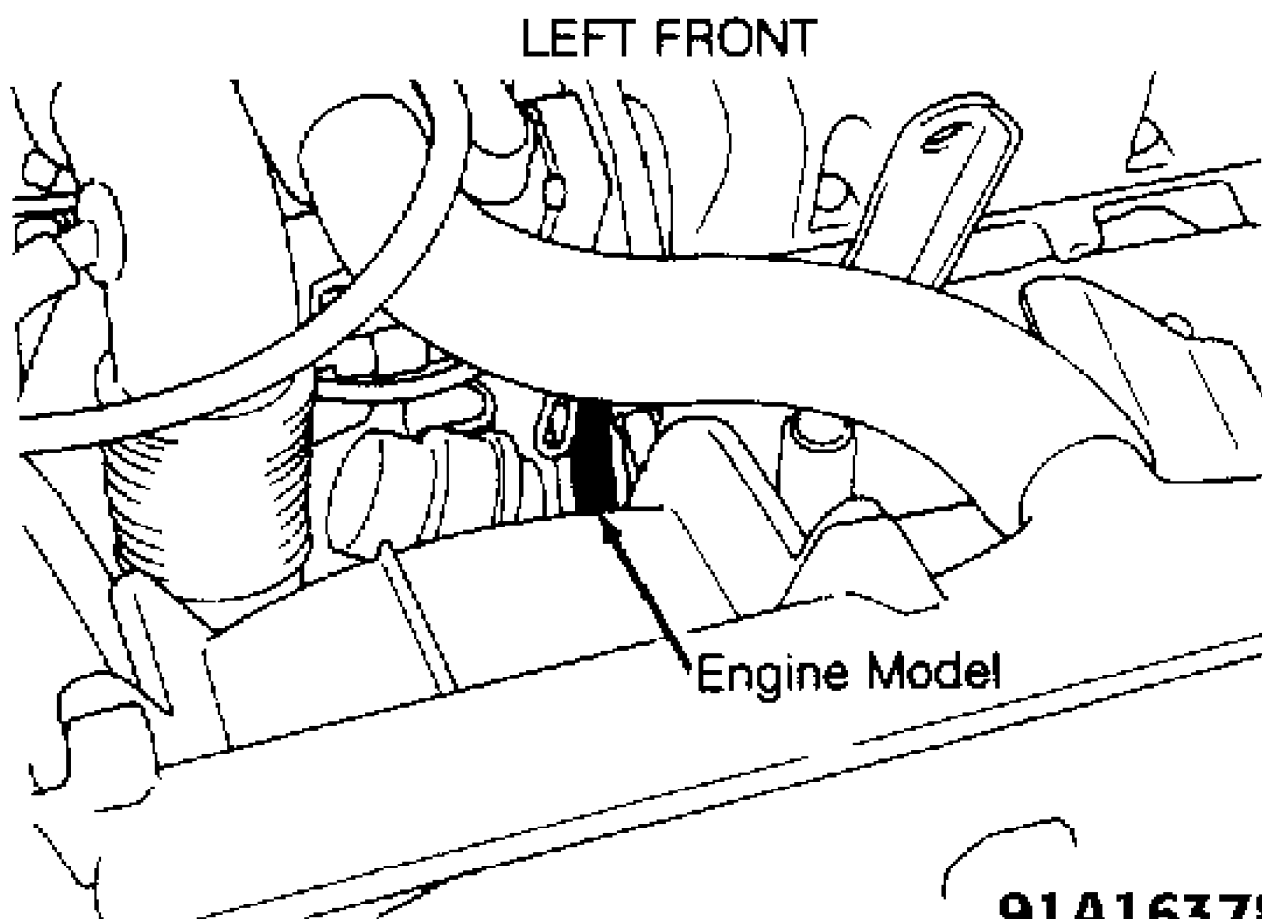


Fig. 9: Engine Code Location (Precis 1.5L)
Courtesy of Chrysler Motors.

3000GT 3.0L



91A16378

Fig. 10: Engine Code Location (3000GT 3.0L)
Courtesy of Chrysler Motors.

*** EXHAUST SYSTEM UNIFORM INSPECTION GUIDELINES ***

1993 Mitsubishi Montero

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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Motorist Assurance Program (MAP)

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EXHAUST CONNECTIONS
HANGERS
HEAT RISERS (MECHANICAL EFE DEVICES)
HEAT SHIELDS
MANIFOLDS (CAST AND TUBE TYPE)
MECHANICAL EFE DEVICES
MUFFLERS AND RESONATORS

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:

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 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.

FUSES & CIRCUIT BREAKERS

1993 Mitsubishi Montero

Fuses & Circuit Breakers
1992-95 Mitsubishi

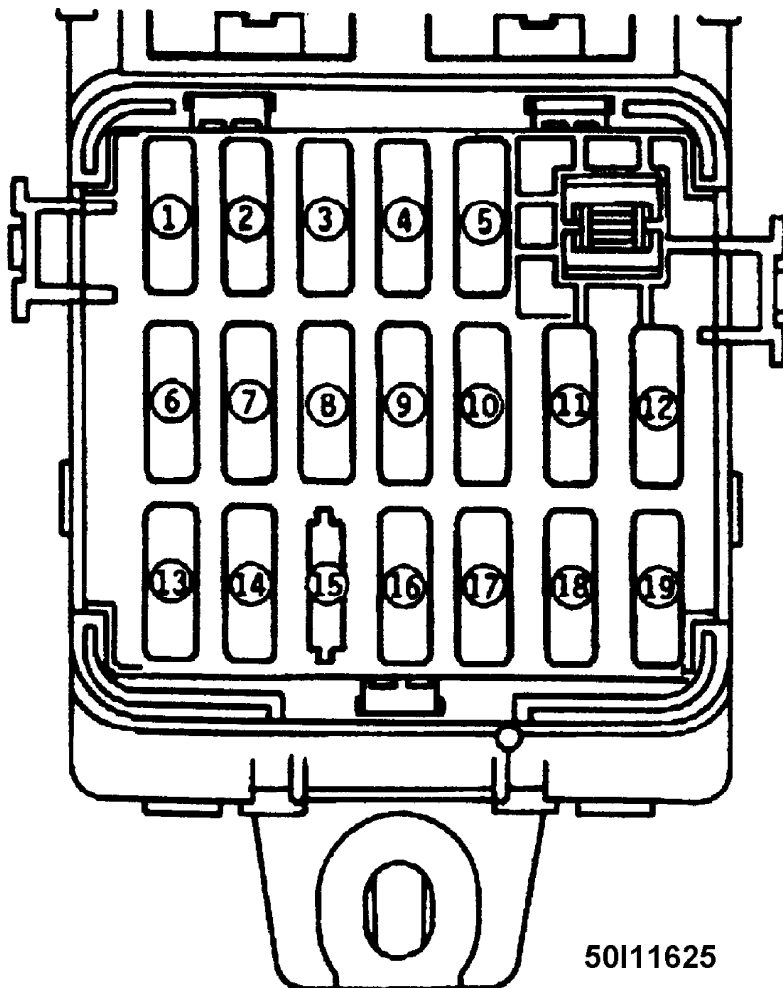
Montero

FUSES & CIRCUIT BREAKERS

FUSE PANEL LOCATION

The electrical system is protected against shorts by fuses that are designed to fail, to prevent damage to the wire harness. 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 (1992-94)



5011625

Fig. 1: Fuse Panel Identification (1992-94)
Courtesy of Mitsubishi Motor Sales of America, Inc.

WARNING: Always disconnect battery ground cable before servicing "high-current fuses. It is recommended that "high-current"

fuses be replaced by a qualified technician.

Fuse & Circuit Breaker Identification

- 1 - 20 Amp
Not Used
- 2 - Not Used
10 Amp (1994)
ELC-4 A/T Control Module, Cruise Control Unit
- 3 - 10 Amp
Blower Motor Relay, Headlight Washer Relay, Defogger Relay,
Car Telephone (1992-93)
- 4 - 10 Amp
Radio Clock, Accessory Socket Relay,
Cruise Control Unit (1994), Data Link Connector (1994)
- 5 - 15 Amp
Remote Controlled Mirror, Cigarette Lighter
Accessory Socket Relay (1992-93)
- 6 - 15 Amp
Door Lock Relay, Door Lock Control Unit (1994)
- 7 - 10 Amp
Overdrive Relay, Variable Shock Absorber Control Unit,
4WD Indicator Control Unit, ABS Power Relay (1992-93),
ABS Control Unit (1994), Combination Meter (1994)
- 8 - 10 Amp
Power Window Relay
- 9 - 15 Amp
Wiper, Washer, Sunroof
- 10 - 10 Amp
Horn, Cruise Control Unit (1992-93)
- 11 - 10 Amp
Combination Meter, Multi-meter, Motor Antenna Control Unit,
Buzzer Assembly
- 12 - 15 Amp
Turn Signal Light, Hazard Light, SRS Diagnosis Unit
- 13 - 10 Amp
Not Used
- 14 - 15 Amp
Accessory Socket
- 15 - Not Used
- 16 - 25 Amp
Blower Motor
- 17 - 15 Amp
Stoplight
- 18 - 10 Amp
Back-up Light, Rear Differential Lock Control Unit
- 19 - 10 Amp
Engine Control Module, Dome Light, Reading Light,
Cargo Light, Combination Meter, Clock, Door Lock Relay,
Cruise Control Unit, Car Telephone (1992-93)
ELC-4 A/T Control Module (1994), Ignition Key Illumination
Light Timer (1994)

GEAR TOOTH CONTACT PATTERNS

1993 Mitsubishi Montero

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.

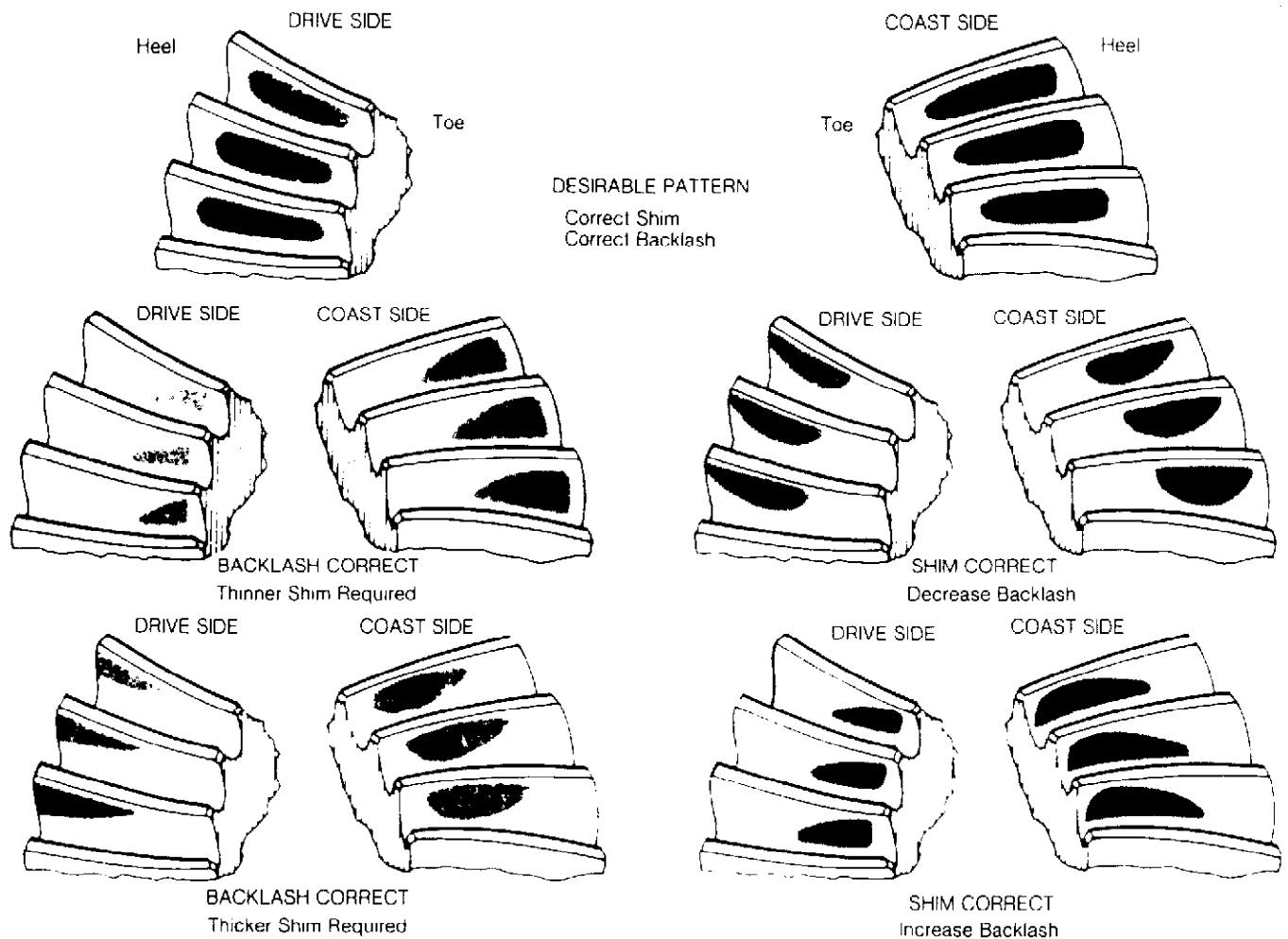


Fig. 1: Drive Axle Gear Tooth Patterns

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

1993 Mitsubishi Montero

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.

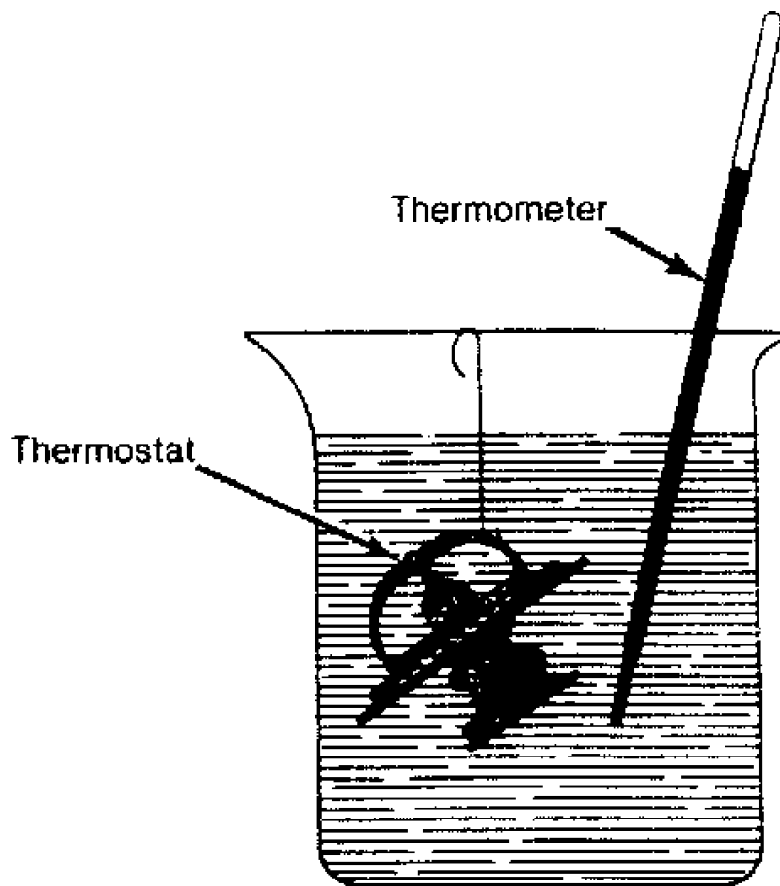


Fig. 1: Testing Thermostat in Anti-Freeze/Water Solution

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.

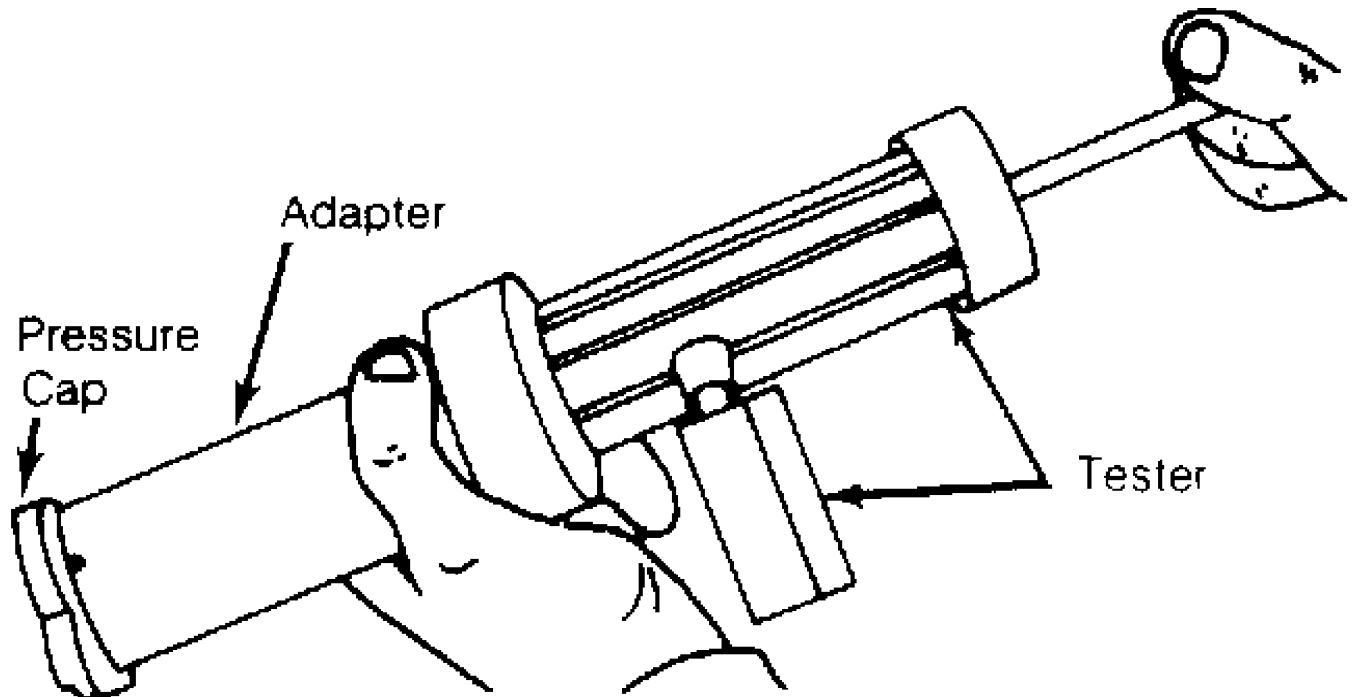


Fig. 2: Testing Radiator Pressure Cap

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.

HEATER SYSTEM

1993 Mitsubishi Montero

1993 HEATER SYSTEMS
Chrysler Motors/Mitsubishi

Mitsubishi; Montero

DESCRIPTION

Heater assembly is located in passenger compartment. A heater control valve is used to regulate coolant flow and heat output. Heater assembly contains heater core, heater control valve, air ducts, blower motor and intake ducts. See Fig. 1. Heater systems are blend-air type.

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 BAGS article in ACCESSORIES & ELECTRICAL section.

OPERATION

Heater and fresh air operations are controlled by control knobs and/or levers, which regulate airflow source, temperature setting, airflow direction and blower speed.

AIR SELECTOR LEVER

This lever is used to select source of airflow. With lever at fresh air setting, outside air is allowed to enter and/or pass through heater. With lever at recirculated air setting, air is recirculated inside passenger compartment.

BLOWER SWITCH

The blower switch controls fan speeds to regulate amount of airflow. Fan speed increases as switch is turned/moved to the right.

COOL AIR BY-PASS KNOB

Montero

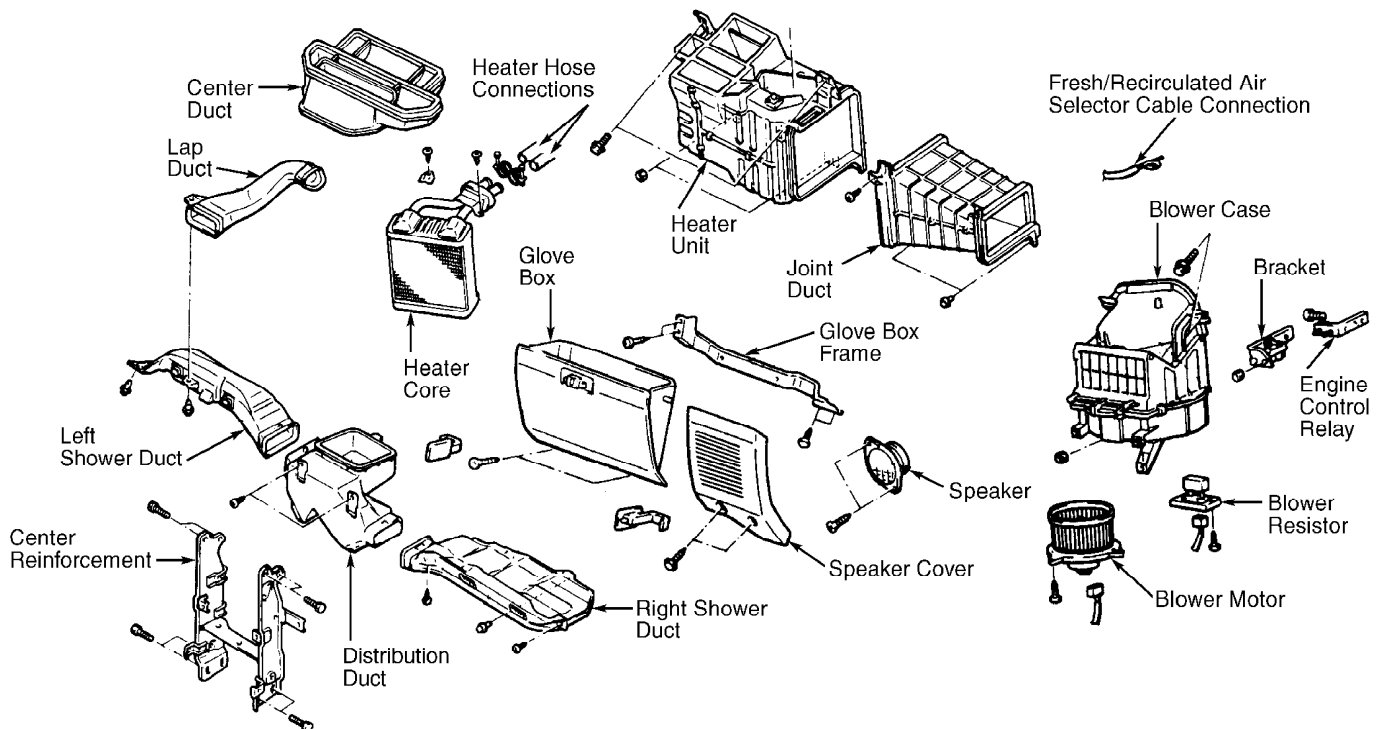
With heater in floor, defrost/floor or defrost mode, turning knob to the left allows cool air to enter passenger compartment through center vent.

MODE SELECTOR KNOB/LEVER

Depending on position selected, airflow can be directed to different areas of passenger compartment. Airflow selection capabilities include individual areas or a combination of windshield, upper body, knee and/or foot area.

TEMPERATURE CONTROL LEVER/KNOB

Temperature level is selected by moving lever or turning knob left or right. The temperature control cable opens and closes heater control valve, which determines heat output. Highest heat setting is attained when lever/knob is at right most position. With temperature lever/knob at cool setting, ambient air is used for ventilating.



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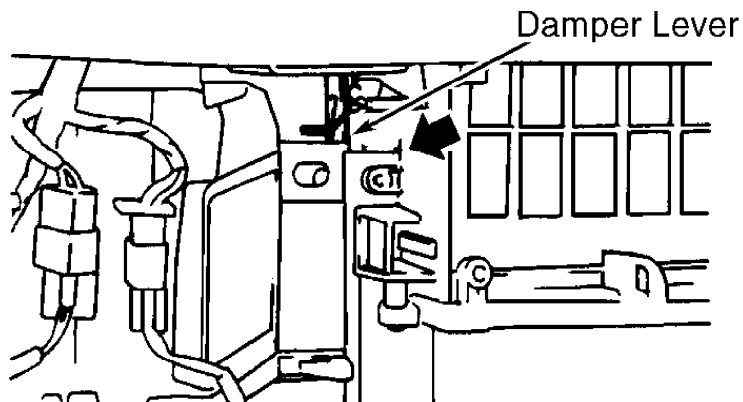
Fig. 1: Exploded View Of Heater System Components (Montero)
Courtesy of Mitsubishi Motor Sales of America.

ADJUSTMENTS

FRESH/RECIRCULATED AIR SELECTOR CABLE

Montero

Place air selector lever at recirculated air setting. Press damper lever inward, in direction of arrow. See Fig. 2. Connect inner wire of fresh/recirculated air selector cable to damper lever. Secure outer wire of selector cable with clip.



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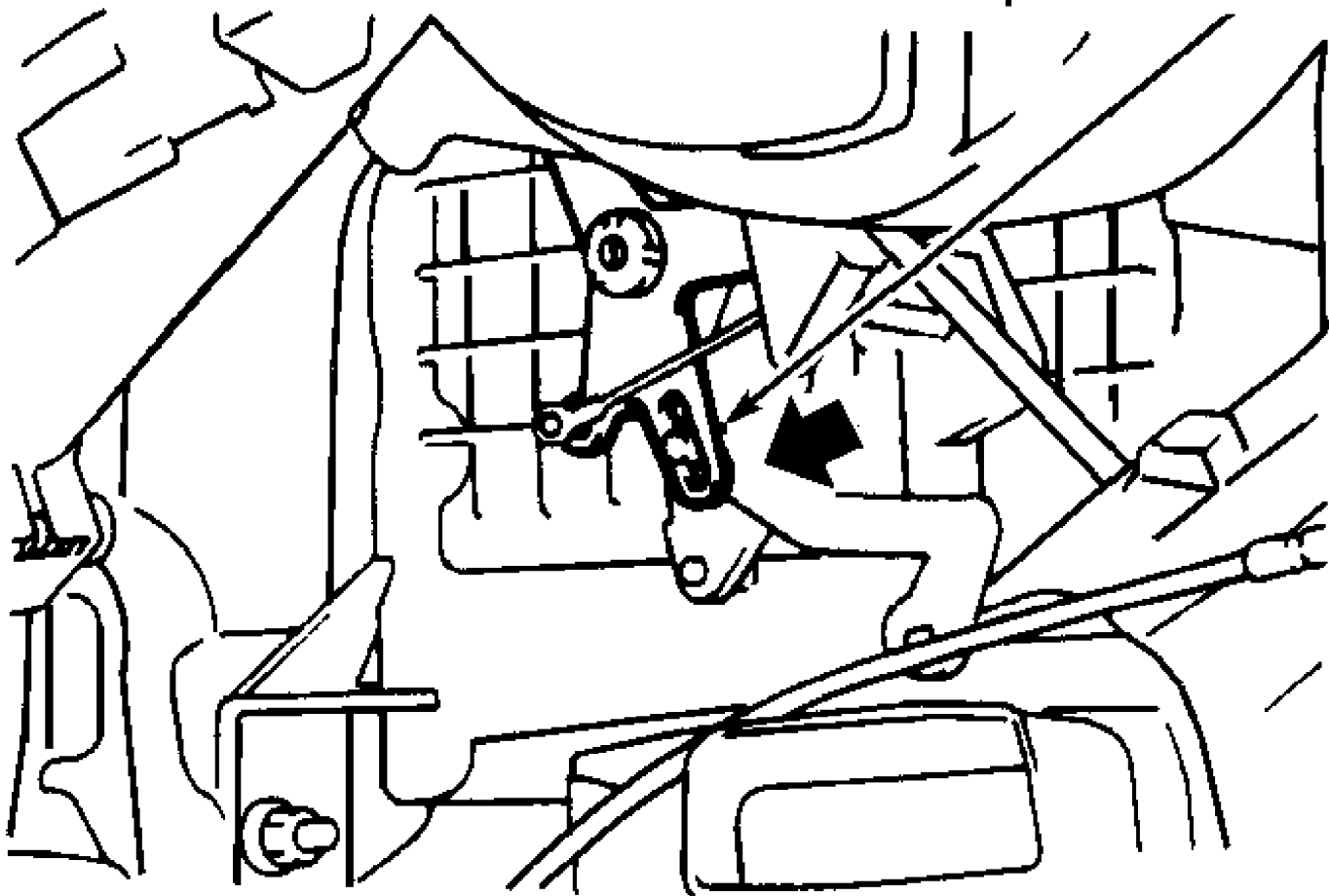
Fig. 2: Adjusting Fresh/Recirculated Air Selector Cable (Montero)
Courtesy of Mitsubishi Motor Sales of America.

MODE SELECTOR CABLE

Montero

Place mode selector knob at defrost setting. Press damper lever inward, in direction of arrow. See Fig. 3. Connect inner cable of mode selector cable to damper lever. Secure outer wire of selector cable with clip.

Damper Lever



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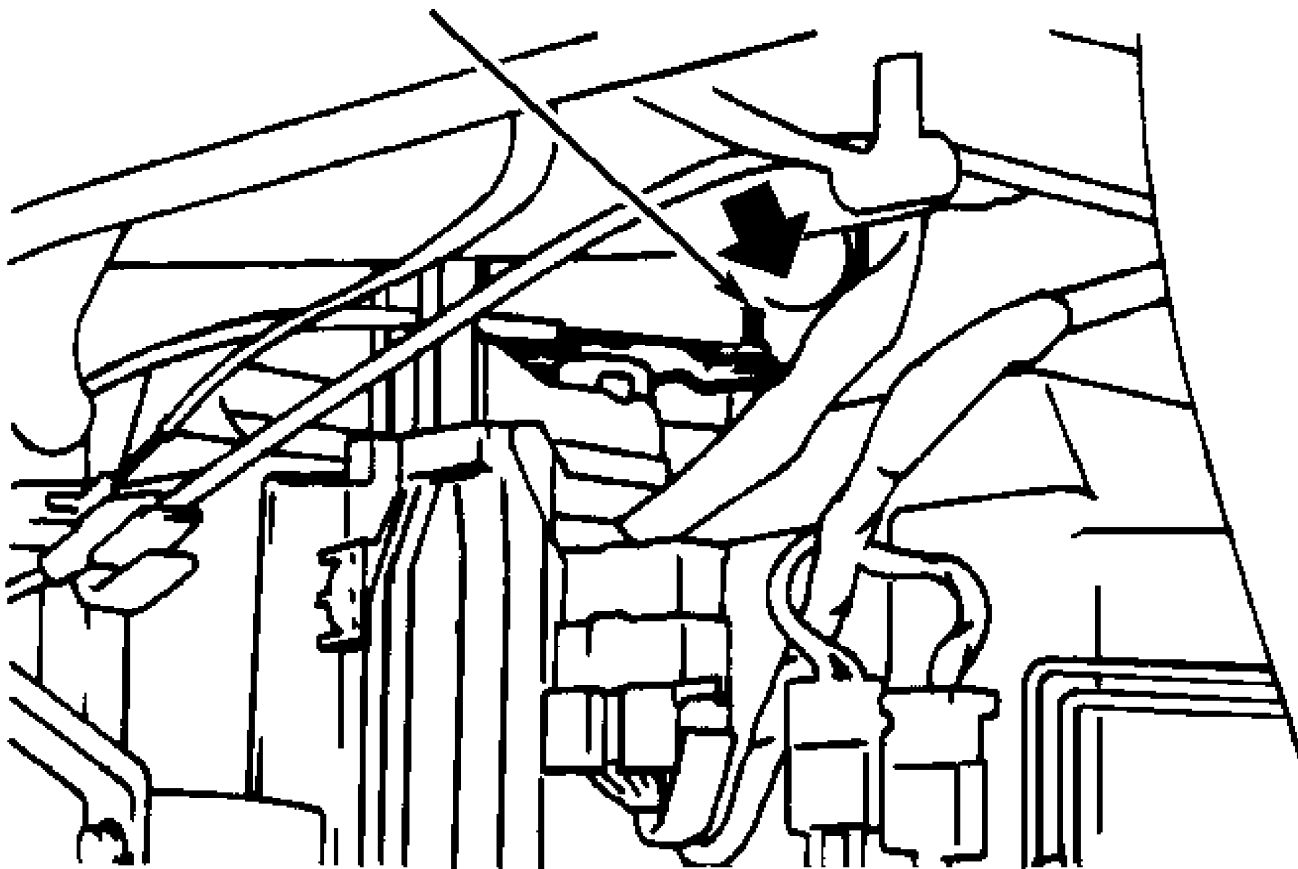
Fig. 3: Adjusting Mode Selector Cable (Montero)
Courtesy of Mitsubishi Motor Sales of America.

TEMPERATURE CONTROL CABLE

Montero

Move temperature control knob to the extreme right position. Press blend-air damper lever completely downward, in direction of arrow. See Fig. 4. Connect inner wire of temperature control cable to damper lever. Secure outer wire of control cable with clip.

Blend-Air Damper Lever



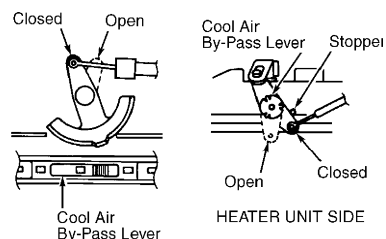
94F10053

Fig. 4: Adjusting Temperature Control Cable (Montero)
Courtesy of Mitsubishi Motor Sales of America.

VENTILATION CONTROL CABLE

Montero

Turn cool air by-pass knob all the way to the right (closed position). See Fig. 5. Move cool air by-pass lever to the closed position. Lever should slightly touch stopper. Connect ventilation control cable, and secure with clip.



94H10055

Fig. 5: Adjusting Ventilation Control Cable (Montero)
Courtesy of Mitsubishi Motor Sales of America.

TROUBLE SHOOTING

INSUFFICIENT HEAT

Obstructed floor outlets or heater hoses. Bound or improperly adjusted dampers. Improperly adjusted control cable. Plugged heater core.

NO VENTILATION

Improper damper adjustment. Incorrect mode selector cable installation. Improper duct connection.

TESTING

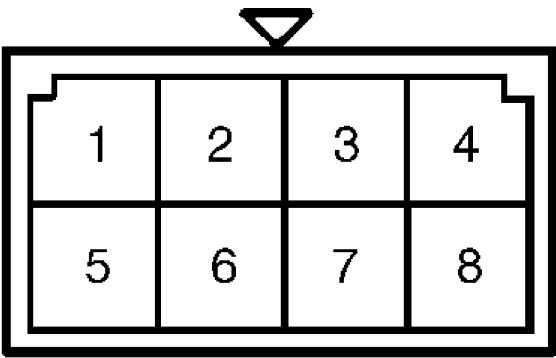
WARNING: To avoid injury from accidental air bag deployment, read and carefully follow all SERVICE PRECAUTIONS and DISABLING & ACTIVATING AIR BAG SYSTEM procedures in AIR BAGS article in ACCESSORIES & ELECTRICAL section.

BLOWER SWITCH

Operate switch, and check continuity between indicated terminals using ohmmeter. See BLOWER SWITCH CONTINUITY table. See Fig. 6.

BLOWER SWITCH CONTINUITY TABLE

Switch Position	Continuity Between Terminal No.
Low	1 & 8, 3 & 5
Medium-Low	1 & 8, 5 & 6
Medium-High	1 & 4, 1 & 8, 2 & 5
High	1 & 4, 1 & 8, 5 & 7



COMPONENT SIDE VIEW

91H04351

Fig. 6: Identifying Blower 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. Reverse polarity, and ensure blower motor operates smoothly in the reverse direction. Replace blower motor if it does not function as specified.

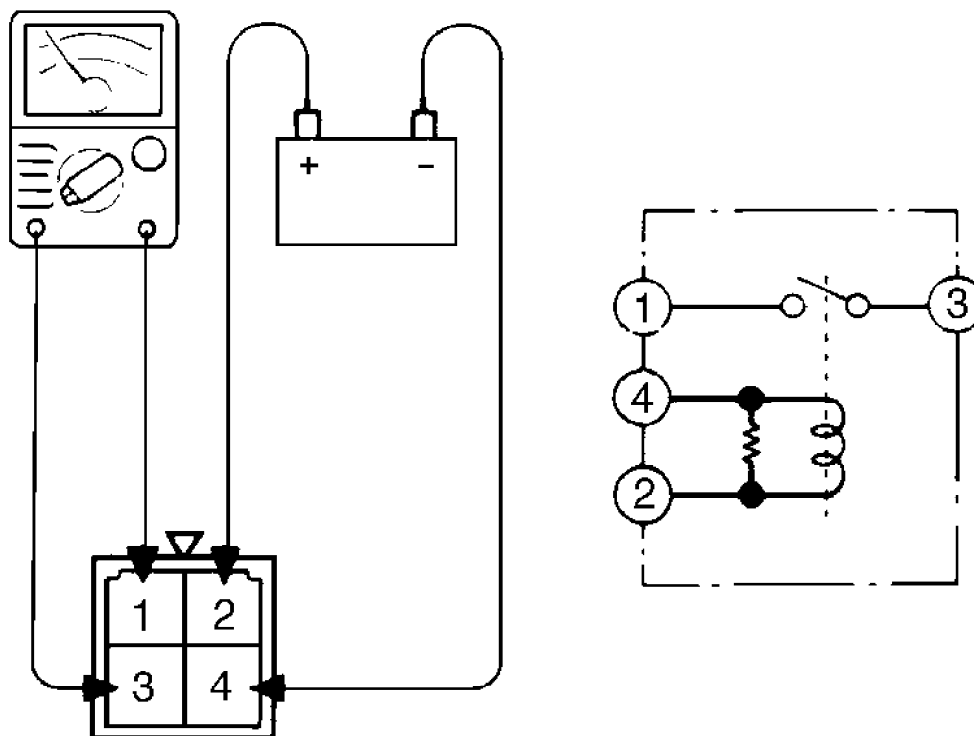
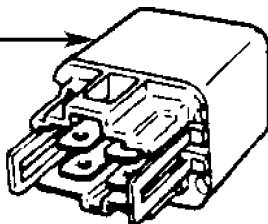
BLOWER MOTOR RELAY

Montero

1) Remove blower motor relay from junction block. Using ohmmeter, check continuity between terminals No. 1 and 3. See Fig. 7. Continuity should not be present.

2) Check continuity between terminals No. 2 and 4. Ensure continuity is present. Connect 12-volt battery to terminals No. 2 and 4. See Fig. 7. Ensure continuity exists between terminals No. 1 and 3 with voltage applied. If continuity is not as specified, replace relay.

Blower Motor Relay



92H02658

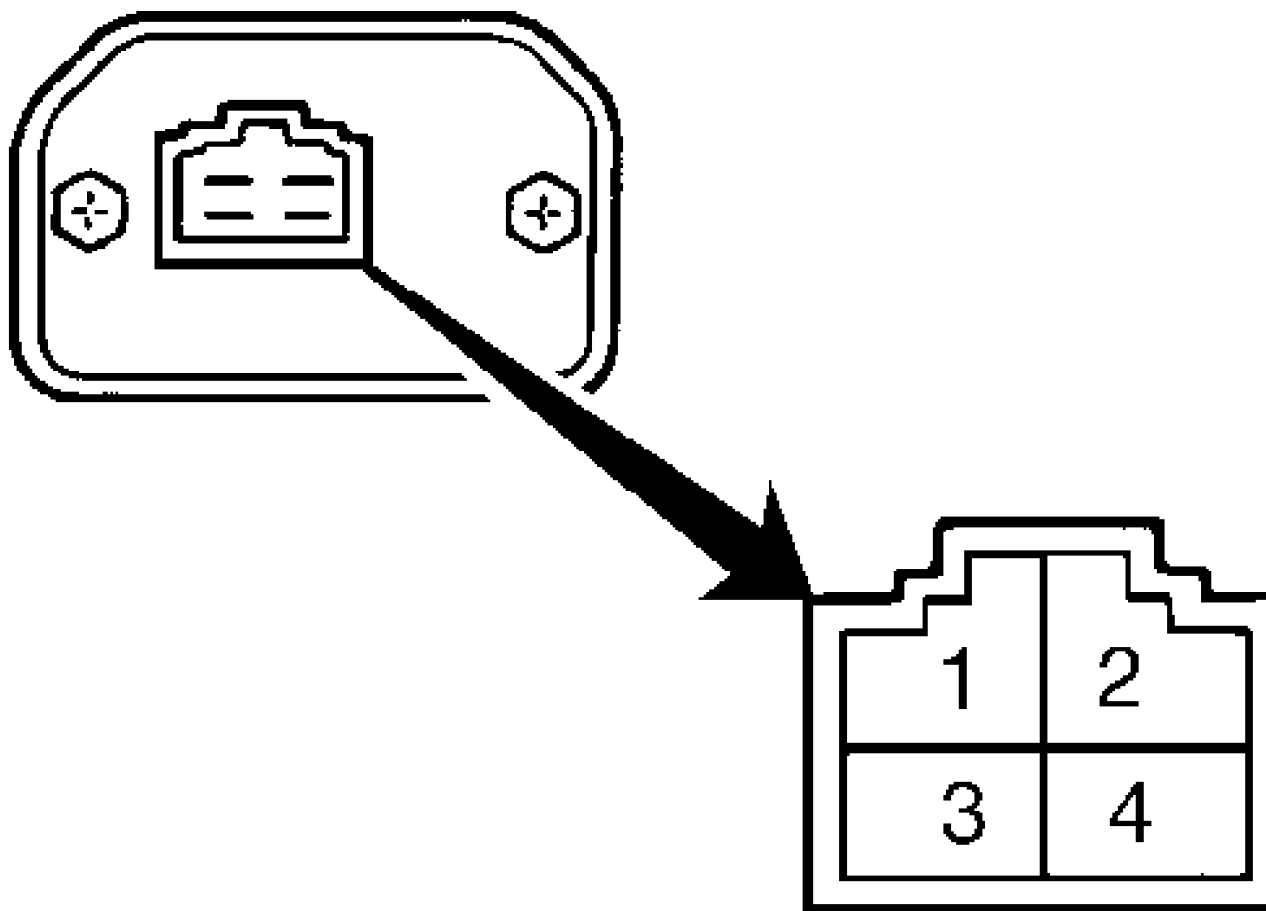
Fig. 7: Identifying Blower Relay Terminals (Montero)
Courtesy of Mitsubishi Motor Sales of America.

BLOWER MOTOR RESISTOR

Disconnect harness connector from resistor, located in blower assembly. See Fig. 1. Using ohmmeter, check resistance between indicated terminals. See BLOWER MOTOR RESISTOR RESISTANCE table. See Fig. 8. If resistance is not as specified, replace resistor.

BLOWER MOTOR RESISTOR RESISTANCE TABLE

Terminal No.		Ohms
Montero		
1 & 2	.....	0.88-1.02
2 & 3	.....	0.31-0.35
2 & 4	.....	1.82-2.10



COMPONENT SIDE VIEW

93C19408

Fig. 8: Identifying Blower Motor Resistor Terminals (Montero)
 Courtesy of Mitsubishi Motor Sales of America.

REMOVAL & INSTALLATION

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 BAGS article in ACCESSORIES & ELECTRICAL section.

HEATER UNIT & HEATER CORE

Removal (Montero)

1) Move temperature control lever to warm setting. Drain coolant from vehicle. Disconnect heater hoses from heater unit. See Fig. 1.

NOTE: On A/T models, when removing front floor console, set A/T selector lever in "L" position.

2) Remove front and rear floor consoles. Remove hood release handle. Remove fuel door release handle. Remove instrument panel undercover and speaker covers. Remove glove box door stop and glove box. Remove heater control panel cover. Remove heater control panel and radio. Remove plug from instrument cluster cover. Remove instrument cluster cover and instrument cluster.

3) Disconnect speedometer cable at transmission. Remove lock of speedometer cable adapter from instrument panel. Pull cable slightly toward vehicle's interior, and remove cable adapter. Remove steering column cover. Remove clock or plug. Remove side defroster covers. Remove side mirror control switch.

4) Remove front speakers. Remove rheostat, rear wiper/washer switch, and door lock switch. Disconnect ventilation control cable and harness connector. Remove steering column bolts and instrument panel.

5) Remove shower ducts, lap duct, joint duct and center duct. See Fig. 1. Remove center reinforcement. Remove heater unit. Remove distribution duct. Remove heater core.

Installation (Montero)

Install heater core, distribution duct, heater unit and center reinforcement. Install remaining ducts in reverse order of removal. Install instrument panel. Tighten steering column bolts to 16 ft. lbs. (22 N.m). Install and adjust ventilation control cable. See ADJUSTMENTS. To complete installation, reverse removal procedure.

HEATER CONTROL PANEL

Removal & Installation (Montero)

1) Remove glove box door stops. Disconnect fresh/recirculated air selector cable and temperature control cable. Remove knee protector. Remove lap duct and left shower duct. See Fig. 1. Disconnect mode selector wire.

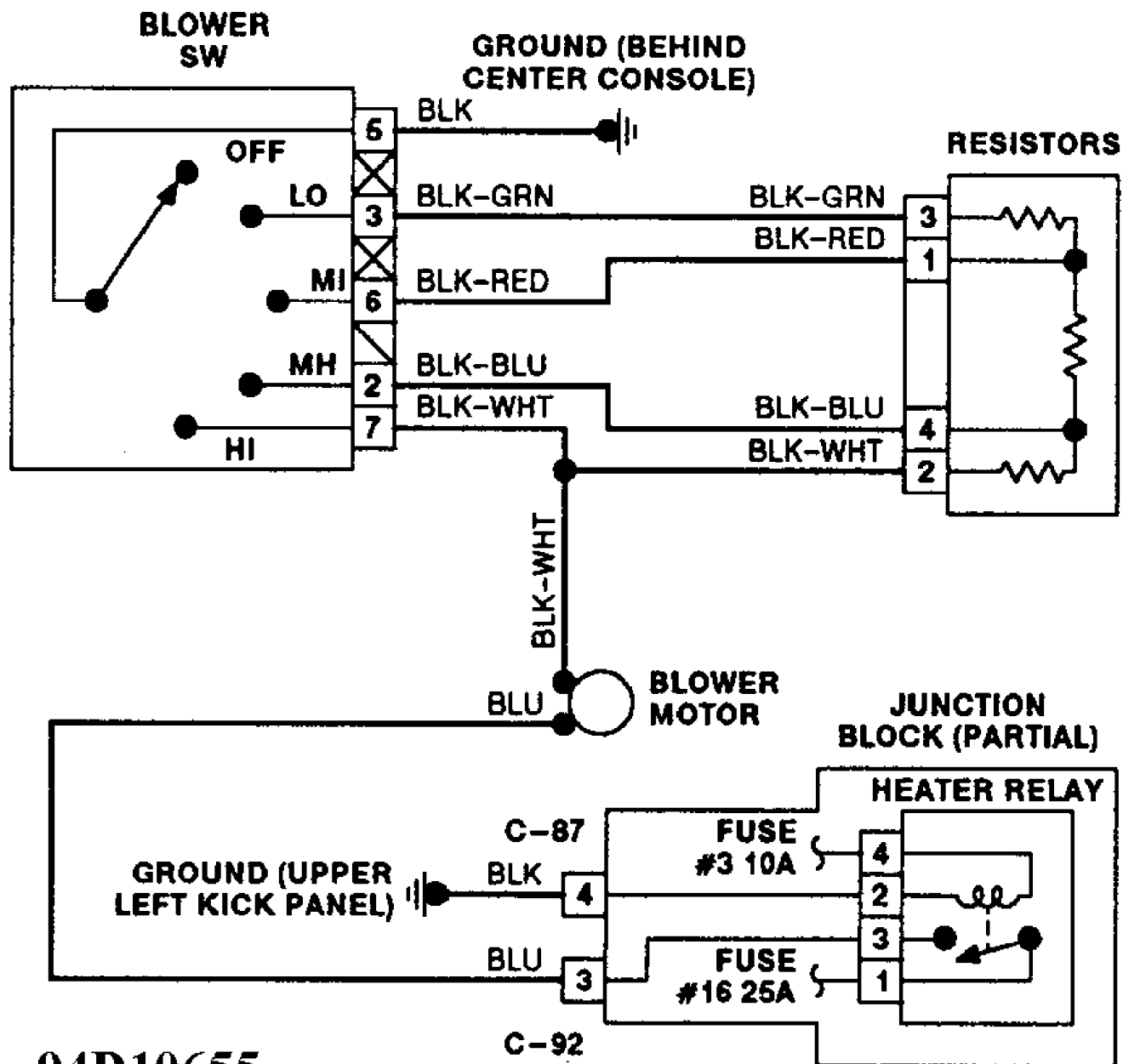
2) Remove heater control panel cover and panel. Remove heater control panel bezel and knobs. Remove blower switch. Using a screwdriver, remove wire clip. Remove heater control cables from heater control panel. To install, reverse removal procedure. Adjust heater control cables while installing. See ADJUSTMENTS.

BLOWER ASSEMBLY

Removal & Installation (Montero)

Remove glove box, speaker cover and speaker. See Fig. 1. Remove glove box frame. Disconnect right shower duct. Remove engine control relay and bracket. Disconnect fresh/recirculated air selector cable and joint duct. Remove blower assembly. To install, reverse removal procedure. Adjust air selector cable. See ADJUSTMENTS.

WIRING DIAGRAMS



94D10655

Fig. 9: Heater System Wiring Diagram (Montero)

HOW TO USE SYSTEM WIRING DIAGRAMS

1993 Mitsubishi Montero

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

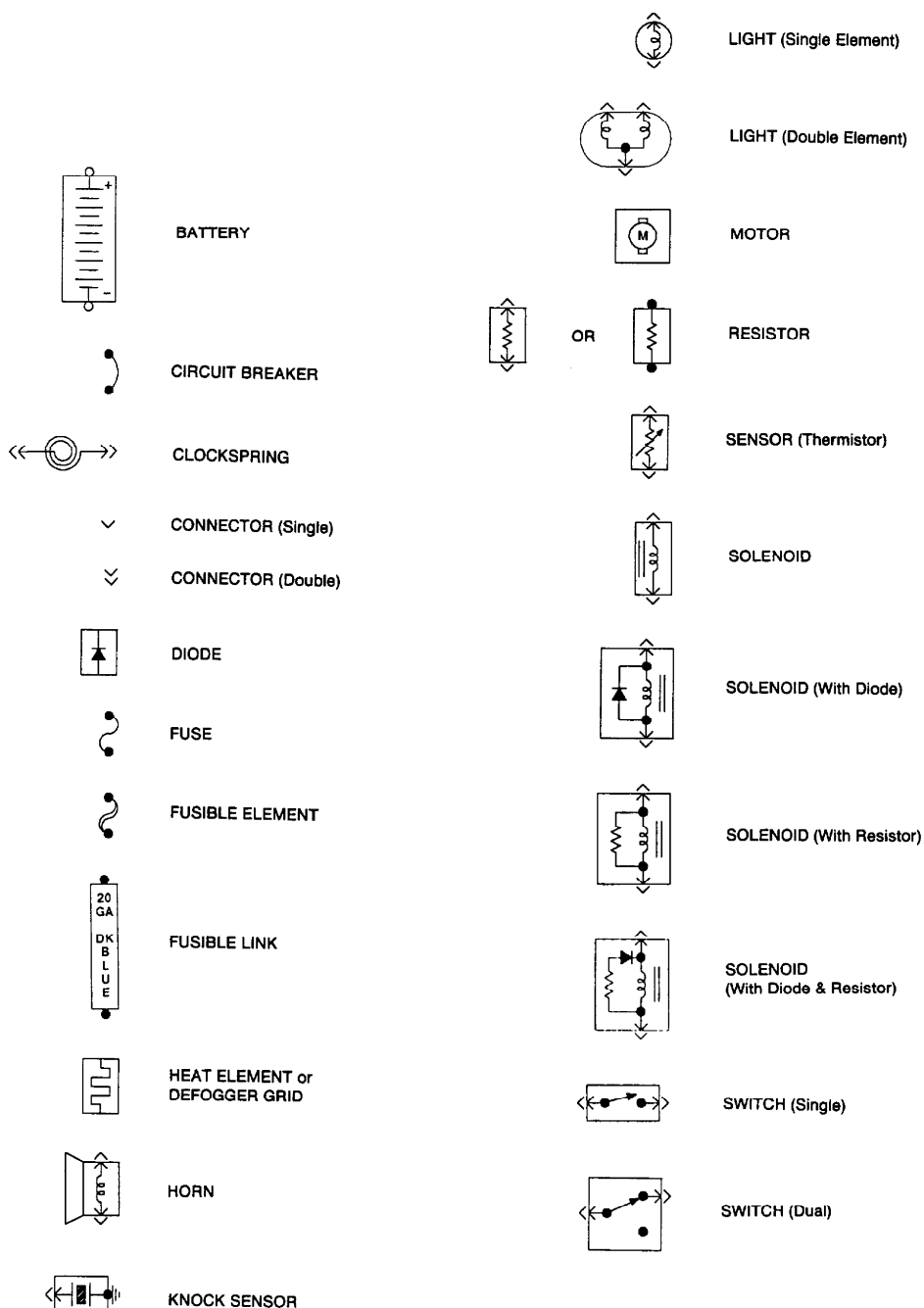
IDENTIFYING WIRING DIAGRAM ABBREVIATIONS

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.



50E03637

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

INSTRUMENT PANEL

1993 Mitsubishi Montero

1993 ACCESSORIES & EQUIPMENT
Mitsubishi Instrument Panels

Montero

DESCRIPTION & OPERATION

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 a shunt-type ammeter, oil pressure gauge, tachometer, voltmeter and/or turbo boost pressure gauge. Oil pressure gauge uses full battery voltage. The tachometer operates by pulse feed.

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

Ensure speedometer cable is properly connected and correctly routed. If speedometer pointer and/or odometer still do not work, replace speedometer as an assembly.

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.

TESTING

FUEL TANK SENDING UNIT

Resistance Test

Remove fuel tank sending unit from fuel tank. Measure resistance between appropriate terminals with fuel float in FULL and EMPTY positions. See Fig. 1. Compare resistance reading to FUEL TANK SENDING UNIT RESISTANCE SPECIFICATIONS table. If resistance is not to specification, replace fuel tank sending unit.

FUEL TANK SENDING UNIT RESISTANCE SPECIFICATIONS TABLE

Application	Specification
Empty	103.0–117.0
Full	1.0–5.0

FUEL GAUGE

CAUTION: Gauge coils can be damaged if wire is grounded 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. 1.

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, check and repair fuel gauge circuit.

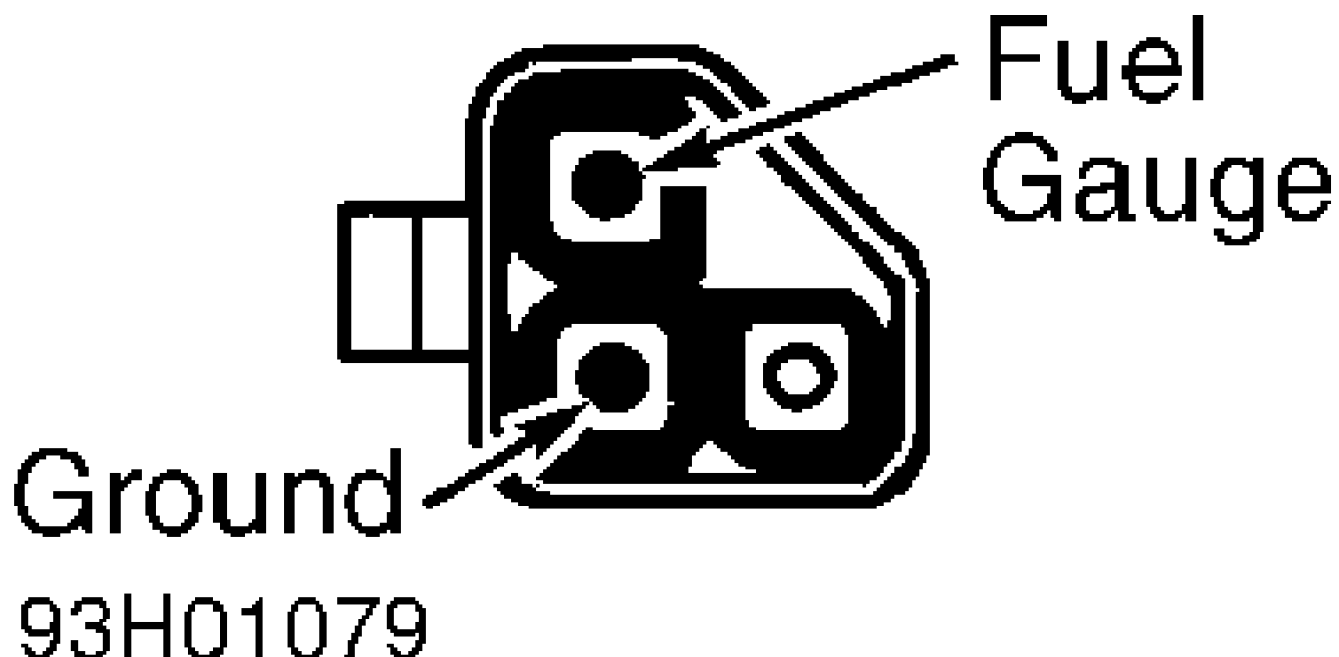


Fig. 1: Fuel Gauge Test Connection ID
Courtesy of Mitsubishi Motor Sales of America.

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.

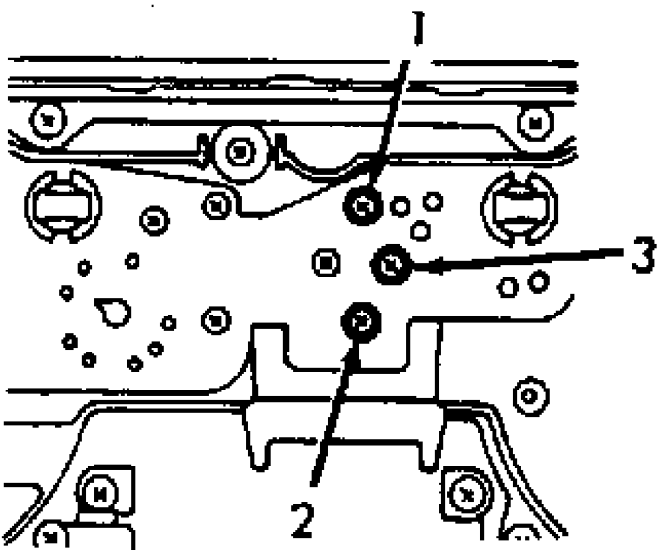
Resistance Test

1) Remove instrument cluster. See INSTRUMENT CLUSTER under REMOVAL & INSTALLATION.

2) Measure resistance between appropriate terminals of instrument cluster. See Fig. 2. See FUEL GAUGE RESISTANCE SPECIFICATIONS table. If resistance readings are not to specification, replace fuel gauge.

FUEL GAUGE RESISTANCE SPECIFICATIONS TABLE

Terminals	Ohms
No. 2 & 3	209.7-256.3
No. 1 & 2	77.4-94.6



MONTERO

Fig. 2: Instrument Panel Fuel Gauge Resistance Check Terminal ID
Courtesy of Mitsubishi Motor Sales of America.

OIL PRESSURE GAUGE

Circuit Test

- 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

- 1) Remove instrument cluster from instrument panel. See INSTRUMENT CLUSTER under REMOVAL & INSTALLATION.
- 2) Check continuity between oil pressure gauge terminals. See Fig. 3. 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
Montero	50

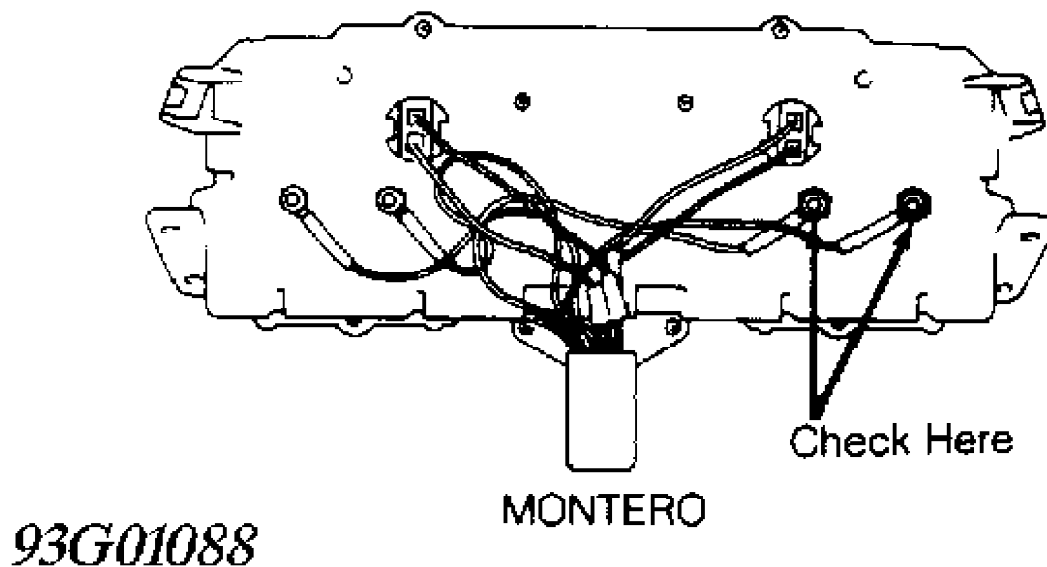


Fig. 3: Oil Pressure Gauge Resistance Test Terminal ID
Courtesy of Mitsubishi Motor Sales of America.

REED SWITCH

Continuity Check

1) Remove instrument cluster. See INSTRUMENT CLUSTER under REMOVAL & INSTALLATION. Check continuity between reed switch terminals no. 1 and 2. See Fig. 4.

2) Ensure continuity pulses on and off 4 times per revolution of speedometer shaft connection. If continuity is not as specified, replace reed switch.

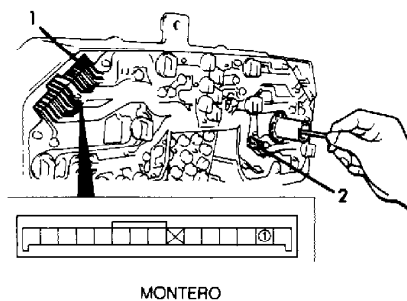


Fig. 4: Reed Switch Test Terminal ID
Courtesy of Mitsubishi Motor Sales of America.

SPEEDOMETER

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)

TACHOMETER

NOTE: DO NOT reverse polarity when installing tachometer; diode and transistor may be damaged.

Calibration Test

Connect a calibrated, reliable tach-dwell meter 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

Engine Speed (RPM)	Allowable Variation (RPM)
1000	900-1100
3000	2850-3150
5000	4750-5250
6000	5700-6300

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 Coolant Temperature Sensor (CTS) from engine. Sensor is located on intake manifold. Place sending unit in 158°F (70°C) water. Check sensor resistance using ohmmeter.

2) CTS resistance should be 90-117 ohms. If CTS resistance is okay, go to GAUGE RESISTANCE TEST. Replace CTS if resistance is not as specified.

Gauge Resistance Test

1) Remove instrument cluster from instrument panel. See INSTRUMENT CLUSTER under REMOVAL & INSTALLATION.

2) Measure resistance between temperature gauge terminals at

rear of cluster. See TEMPERATURE GAUGE RESISTANCE SPECIFICATIONS table. See Fig. 5.

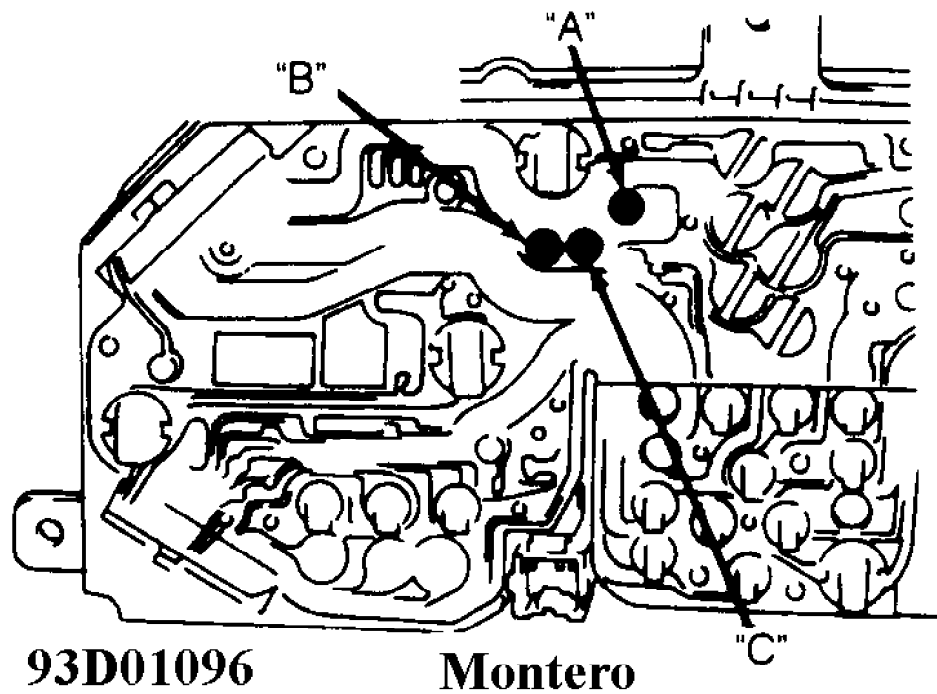


Fig. 5: Temperature Gauge Resistance Test Terminal ID
Courtesy of Mitsubishi Motor Sales of America.

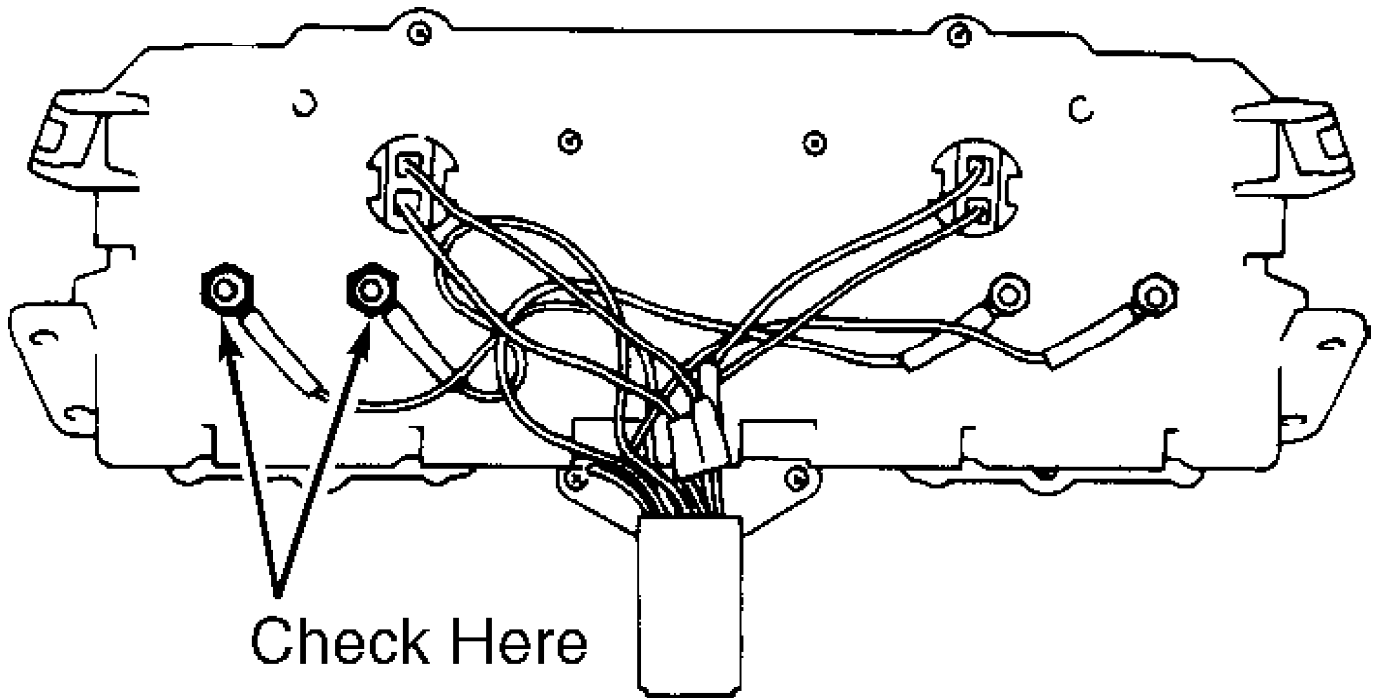
TEMPERATURE GAUGE RESISTANCE SPECIFICATIONS TABLE

Terminals	Ohms
"A" & "B"	67.5-82.5
"A" & "C"	132.3-161.7
"B" & "C"	199.8-244.2

VOLTMETER

Resistance Test

Using an ohmmeter, measure resistance between voltmeter terminals. See Fig. 6. Resistance should be 380-460 ohms.



93D01100

Fig. 6: Voltmeter Resistance Test Terminal ID
Courtesy of Mitsubishi Motor Sales of America.

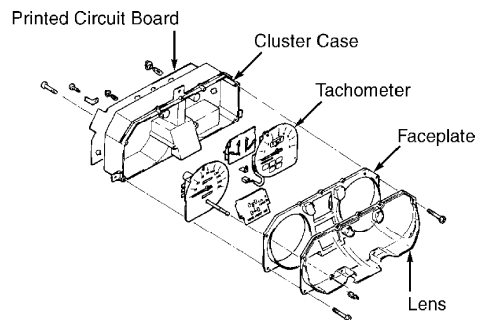
REMOVAL & INSTALLATION

INSTRUMENT CLUSTER

Removal & Installation

1) Disconnect negative battery cable. Remove instrument cluster cover plug. Remove cluster cover. Remove screws from instrument cluster.

2) Disconnect speedometer cable from back of instrument cluster. Disconnect all connectors attaching cluster. Remove cluster. To install, reverse removal procedure. See Fig. 7.



93J01099

Fig. 7: Instrument Cluster Components
Courtesy of Mitsubishi Motor Sales of America.

SPEEDOMETER CABLE

NOTE: When routing speedometer cable, DO NOT bend cable sharply. Minimum bending radius is 6" (150 mm). Speedometer cable length varies with transmission type.

Removal

Disconnect speedometer cable from transmission or transaxle. Remove instrument cluster from instrument panel. See INSTRUMENT CLUSTER. Disconnect speedometer cable from instrument cluster and/or adapter (if equipped). Remove speedometer cable from firewall grommet.

Installation

1) Install new cable. Insert cable until stopper seats properly in groove on rear of speedometer housing. Pull speedometer cable through firewall grommet until cable marking is visible from engine compartment.

NOTE: An improperly installed cable can cause fluctuating meter, noise or damaged harness inside instrument panel.

2) Install adapter onto speedometer cable (if equipped). Install instrument cluster. See INSTRUMENT CLUSTER. Install cable onto transmission or transaxle. Check for proper operation.

WIRING DIAGRAMS

See appropriate chassis wiring diagram in the WIRING DIAGRAMS section.

INTERFERENCE VERIFICATION CHECK FOR OHC ENGINE

1993 Mitsubishi Montero

Maintenance & Service Information
1983-96 Mitsubishi - Timing Belt Information

Cordia, Diamante, Eclipse, Expo, Expo LRV, Galant, Mirage,
Montero, Pickup, Precis, Sigma, Tredia, Van, 3000GT

TIMING BELT INTERFERENCE VERIFICATION INFORMATION

TIMING BELT INTERFERENCE CAUTION

NOTE: CAMSHAFT DRIVE BELTS OR TIMING BELTS - 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 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 shown in this section reflect these changes. Belts or components should be inspected and replaced if any of the following conditions exist:

- * Crack Or Tears In Belt Surface
- * Missing, Damaged, Cracked Or Rounded Teeth
- * Oil Contamination
- * Damaged Or Faulty Tensioners
- * Incorrect Tension Adjustment

TIMING BELT INTERFERENCE CHECK MENU

TIMING BELT INTERFERENCE VERIFICATION TABLE (1)

Application	Engine	Replacement Interval (Miles)
Passenger Cars		
Cordia		
1983-88	1.8L 4-Cyl.	(4) 60,000
	2.0L 4-Cyl.	(4) 60,000
Diamante		
1992-96	(2) 3.0L V6 (DOHC)	60,000
	3.0L V6 (SOHC)	(4) 60,000
Eclipse		
1990-94	1.8L 4-Cyl.	(4) 60,000
1990-95	(2) 2.0L 4-Cyl.	(4) 60,000
1990-94	(2) 2.0L 4-Cyl. Non-Turbo	(4) 60,000
1990-96	(2) 2.0L 4-Cyl. Turbo	(4) 60,000
1996	(2) 2.4L 4-Cyl.	(4) 60,000
Expo		
1992-95	1.8L 4-Cyl.	60,000
	(2) 2.4L 4-Cyl.	(4) 60,000
Expo LRV		
1995	1.8L 4-Cyl.	60,000
	(2) 2.4L 4-Cyl.	(4) 60,000
Galant		

1985-87	.....	(2)	2.4L 4-Cyl.	.....	(4)	60,000
1988	.....		3.0L V6	.....	(3)	60,000
1989-93	....	(2)	2.0L 4-Cyl. (DOHC)	.....	(4)	60,000
			2.0L 4-Cyl. (SOHC)	.....	(4)	60,000
1994-96	....	(2)	2.4L 4-Cyl. (DOHC)	.....	(4)	60,000
			2.4L 4-Cyl. (SOHC)	.....	(4)	60,000
Mirage						
1985-96	.....	(2)	1.5L 4-Cyl.	.....		60,000
1985-88	....	(2)	1.6L 4-Cyl. Turbo	.....		60,000
1989, 1991	....	(2)	1.6L 4-Cyl.	.....		60,000
1993-96	.....		1.8L 4-Cyl	.....		60,000
Precis						
1987-93	.....	(2)	1.5L 4-Cyl.	.....		60,000
Sigma						
1989-90	.....		3.0L V6	.....	(3)	60,000
Tredia						
1983-88	.....		1.8L 4-Cyl.	.....	(4)	60,000
			2.0L 4-Cyl.	.....	(4)	60,000
3000GT						
1991-96	.....	(2)	3.0L V6	.....		60,000
Light Trucks						
Montero						
1985-96	.....		3.0L V6	.....	(3)	60,000
1994-96	.....		3.5L V6	.....	(3)	60,000
Pickup						
1983-89	.....		2.0L 4-Cyl.	.....	(3)	60,000
1983-86	...	(2)	2.3L 4-Cyl. Turbo Diesel	..	(4)	60,000
1990-96	.....		2.4L 4-Cyl.	.....	(4)	60,000
			3.0L V6	.....	(3)	60,000
Van						
1987-90	.....		2.4L 4-Cyl.	.....	(4)	60,000

- (1) - Other interference engine applications may exist which are not indicated here.
 - (2) - Interference engine. Check for possible damage to piston(s) or valve(s) if there has been a timing belt failure.
 - (3) - Although the vehicle manufacturer does not recommend a specific scheduled maintenance interval, aftermarket belt manufacturers suggest the belt be replaced at 60,000 mile intervals.
 - (4) - Vehicle manufacturer recommends replacing all belts at the same time.
-

JACKING & HOISTING

1993 Mitsubishi Montero

1993 WHEEL ALIGNMENT
Mitsubishi Specifications & Procedures

Montero

JACKING & HOISTING

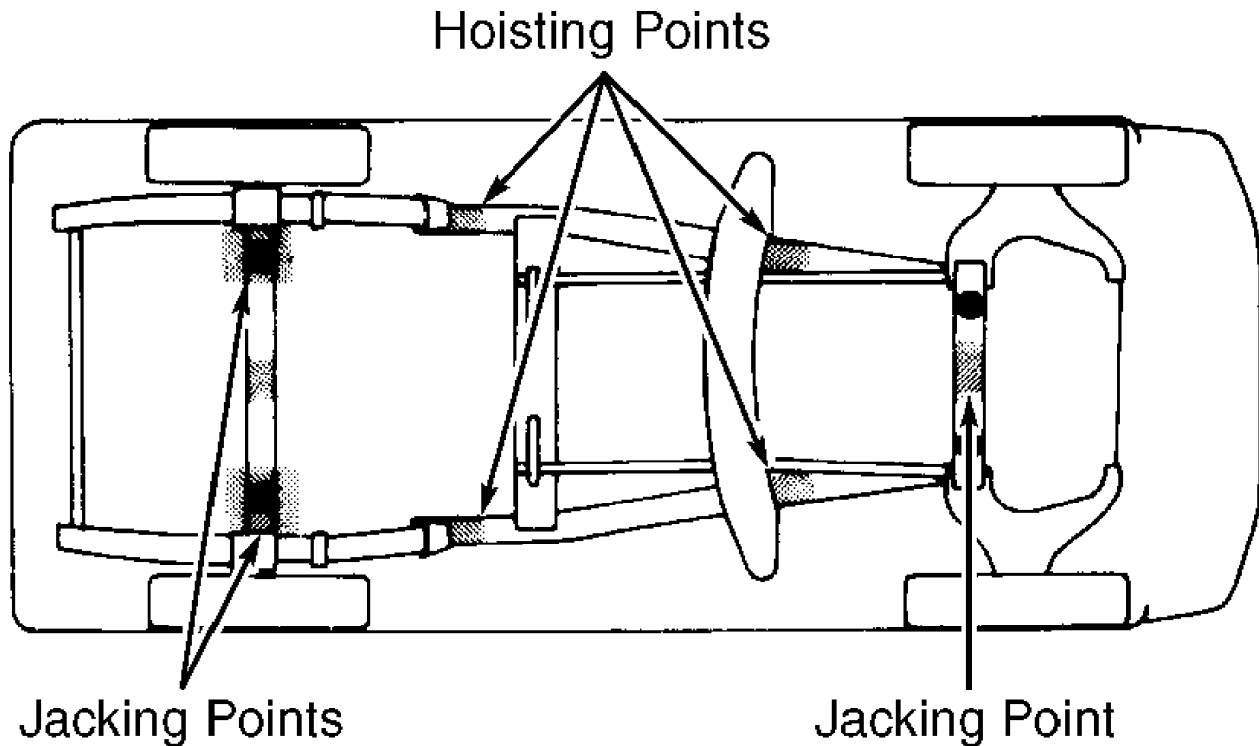
NOTE: Following illustrations are given to provide reference points only. Illustrations do not represent exact structure of vehicle frame, underbody or body outline.

EMERGENCY JACKING

Points on outline of body were designated to be used specifically with vehicle jack. If using floor jack or hoist at these points, use extreme care to avoid damaging outer body shell. See Fig. 1.

FLOOR JACK & HOIST

Following illustrations indicate points for jacking and hoisting vehicle. These points are indicated by shaded areas on frame and underbody.



90G00329

Fig. 1: Identifying Jacking & Hoisting Points
Courtesy of Mitsubishi Motor Sales of America.

96V143000: LEFT AND RIGHT FRONT WHEEL BRAKE HOSES

1993 Mitsubishi Montero

NHTSA RECALL BULLETIN

Model(s) : 1991-94 Mitsubishi 3000GT
1992-93 Mitsubishi Montero
1992-95 Mitsubishi Diamante
Campaign No: 96V143000
Number of Affected Vehicles: 103000
Beginning Date of Manufacture: 1990 JUL
Ending Date of Manufacture: 1995 May

VEHICLE DESCRIPTION:

Sedan and Wagons Equipped with Anti-lock Braking System (ABS) and Multi-Purpose Passenger Vehicles equipped with or without ABS brakes.

DESCRIPTION OF DEFECT:

Under conditions of full lock steering and full suspension travel, the left or right front wheel-side brake hose can crack, resulting in brake fluid leakage.

SYSTEM:

Brakes; Hydraulic; Lines; Hose; Non-metallic.

FAULT:

Left and Right Front Wheel Brake Hoses.

CONSEQUENCE OF DEFECT:

Brake fluid leakage will cause illumination of the brake warning lamp and reduction in braking efficiency increasing the risk of a vehicle accident.

CORRECTIVE ACTION:

Dealers will replace the left and right front wheel-side brake hoses with revised hose assemblies.

OWNER NOTIFICATION:

Owner notification is expected to begin in August 1996.

NOTE:

Owners who take their vehicles to an authorized dealer on an agreed upon service date and do not receive the free remedy within a reasonable time should contact Mitsubishi at 1-800-222-0037 or Mitsubishi of Caribbean at 1-787-251-8715. Also contact the National Highway Traffic Safety Administration's Auto Safety Hotline at 1-800-424-9393.

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.

LOCKING HUBS

1993 Mitsubishi Montero

1993 Drive Axles - Locking Hubs

Ram-50, Montero & Pickup

DESCRIPTION

Montero is equipped with an automatic locking clutch. Locking clutch engages, providing full time AWD operation, when 4WD (4H) is selected at transfer case, at speeds up to 62 MPH. Selecting center differential lock position (4HLc or 4HLLc), while in AWD at 4 MPH or less, provides 4WD operation. Center differential lock disengages when 4H or 2H are selected. Locking clutch disengages when 2H is selected.

On Pickup and Ram-50, automatic locking hubs are engaged by rotational force of axle shaft when 4WD is selected at transfer case. Locking hubs disengage when 2WD is selected or vehicle is driven in Reverse. Cams, brakes and springs are used to lock or unlock locking hubs.

Engagement is accomplished through gears and spring actions within hub. When hub is locked, hub brake engages inner hub, which is connected to axle shaft by inner splines of hub. Hub brake is connected to hub body by outer splines.

REMOVAL & INSTALLATION

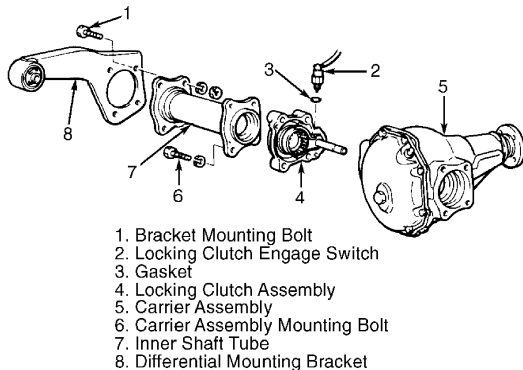
AUTOMATIC LOCKING HUBS

Removal & Installation (Montero)

1) Remove right side inner shaft for automatic locking clutch removal. See INNER SHAFT & BEARING in DIFFERENTIALS & AXLE SHAFTS - FRONT article. With inner shaft removed, remove locking clutch engage switch. See Fig. 1.

2) Remove 4 inner shaft tube-to-differential mounting bracket bolts. Pivot differential mounting bracket. Remove 4 inner shaft tube-to-differential carrier assembly mounting bolts. Pull inner shaft tube and automatic locking clutch out of differential carrier assembly.

3) To install, reverse removal procedure. Tighten inner shaft tube bolts to 65 ft. lbs. (90 N.m) and locking clutch engage switch to 26 ft. lbs. (36 N.m).



93G01149
Fig. 1: Removing Automatic Locking Clutch (Montero)
Courtesy of Mitsubishi Motor Sales of America.

Removal (Pickup & Ram-50)

1) Hub must be unlocked. To unlock hub, place transfer case

lever in 2H position, and move vehicle in Reverse approximately 4-6 feet.

2) Remove cover from locking hub. If hub cover cannot be loosened by hand, wrap shop towel around cover, and use an oil filter wrench to loosen cover.

3) Raise and support vehicle. Remove wheel assembly. Using snap ring pliers, remove snap ring and shim from end of axle. Remove locking hub retaining bolts. Remove locking hub.

Installation (Pickup & Ram-50)

1) To install, reverse removal procedure. Apply sealant to contact areas between locking hub assembly and rotor assembly. DO NOT apply sealant on outer areas of rotor assembly, toward brake contact areas.

2) Align locking hub assembly key with steering knuckle key way. Loosely install locking hub assembly on rotor assembly. Ensure locking hub assembly fully contacts rotor assembly.

3) Install locking hub retaining bolts and tighten to 36-43 ft. lbs. (49-58 N.m). Using spring scale attached to wheel stud, measure turning resistance required to rotate hub assembly.

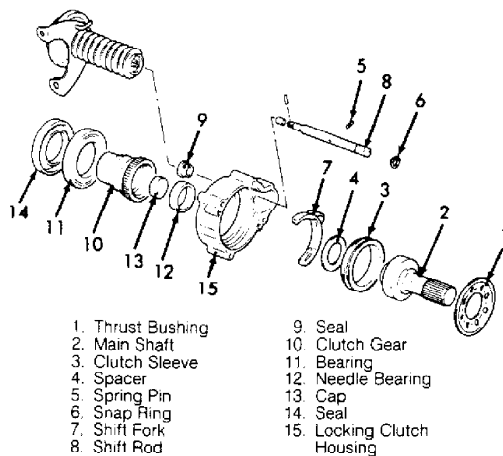
4) Turning resistance should not exceed 3.1 lbs. (1.4 kg). If turning resistance exceeds specification, check for incorrect installation of locking hub assembly or components.

5) Install shim and snap ring on drive axle. Rotate drive axle until maximum end play is obtained. Using a dial indicator, check drive axle end play.

6) Drive axle end play should be .008-.020" (.20-.51 mm). If axle end play is not within specification, adjust end play by changing axle shaft shim. Install hub cover. Tighten hub cover bolts to 13-25 ft. lbs. (18-34 N.m).

OVERHAUL

NOTE: Locking clutch overhaul procedure for Montero is not available from manufacturer. See Fig. 2 for exploded view of locking clutch.



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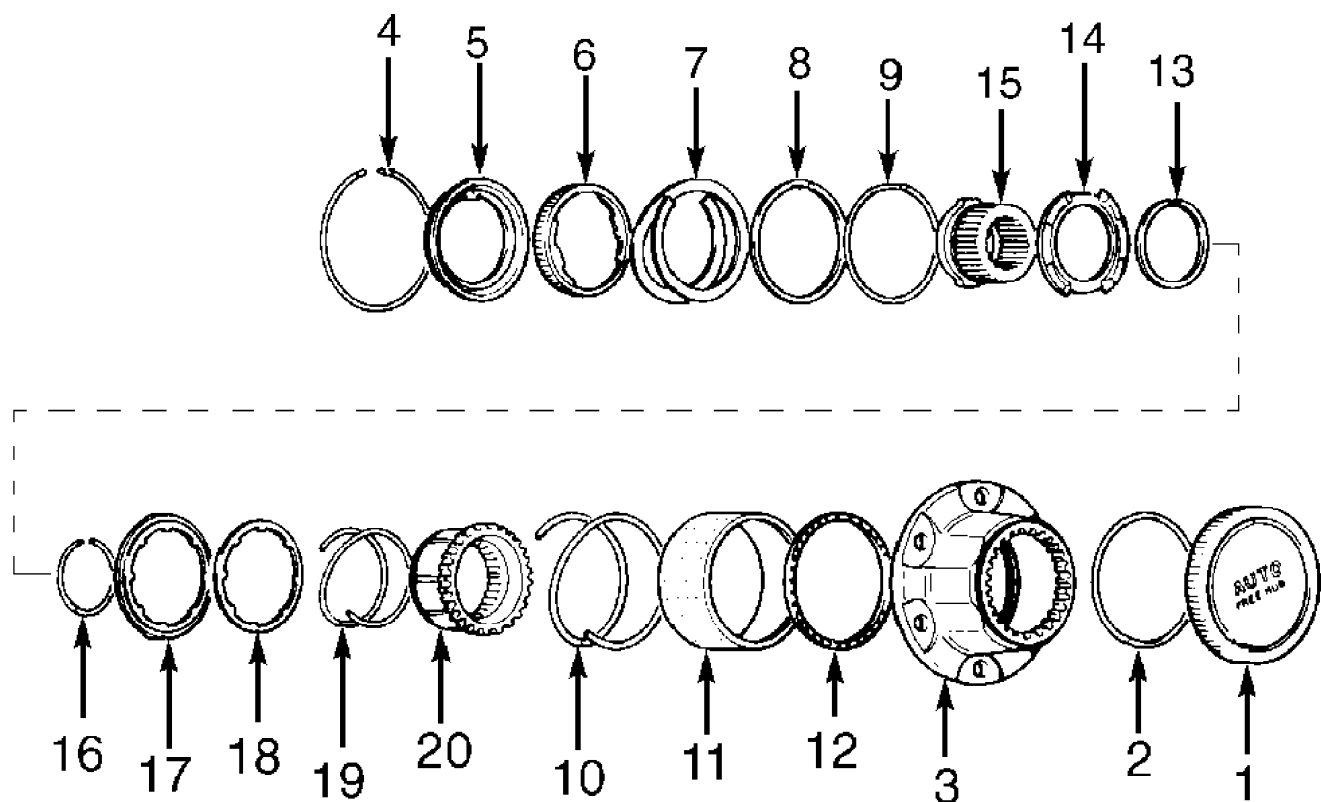
Fig. 2: Exploded View Of Locking Clutch (Montero)
Courtesy of Mitsubishi Motor Sales of America.

Disassembly (Pickup & Ram-50)

1) Remove locking hub. AUTOMATIC LOCKING HUBS under REMOVAL &

INSTALLATION. Push brake "B" in hub housing, and remove housing "C" ring. See Fig. 3. Using Adapter (MB990811-01), lightly press drive gear assembly, and remove "C" ring from retainer "B". Slowly release drive gear assembly.

2) Remove drive gear assembly, slide gear assembly and return spring. Remove slide gear "C" ring. Remove shift spring.



1. Hub Cover	11. Retainer "B"
2. "O" Ring	12. Retainer Bearing
3. Housing	13. Drive Gear Snap Ring
4. Housing "C" Ring	14. Retainer "A"
5. Brake "B"	15. Drive Gear
6. Brake "A"	16. Slide Gear "C" Ring
7. Brake Spring	17. Cam
8. Housing Snap Ring	18. Spring Holder
9. "C" Ring For Retainer "B"	19. Shift Spring
10. Return Spring	20. Slide Gear

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Fig. 3: Exploded View Of Locking Hub
Courtesy of Mitsubishi Motor Sales of America.

Inspection (Pickup & Ram-50)

1) Check drive gear and slide gear splines for damage. Check

cam portion of retainer "A" for wear or damage. Check cam for wear and damage. Check slide gear and housing tooth surfaces for damage. Check retainer "B" and housing contact surfaces for wear and damage.

2) Check brake assembly thickness. See Fig. 4. Assemble brake "A" and brake "B". Using slide calipers, measure thickness of assembled brake at both brake "A" lugs.

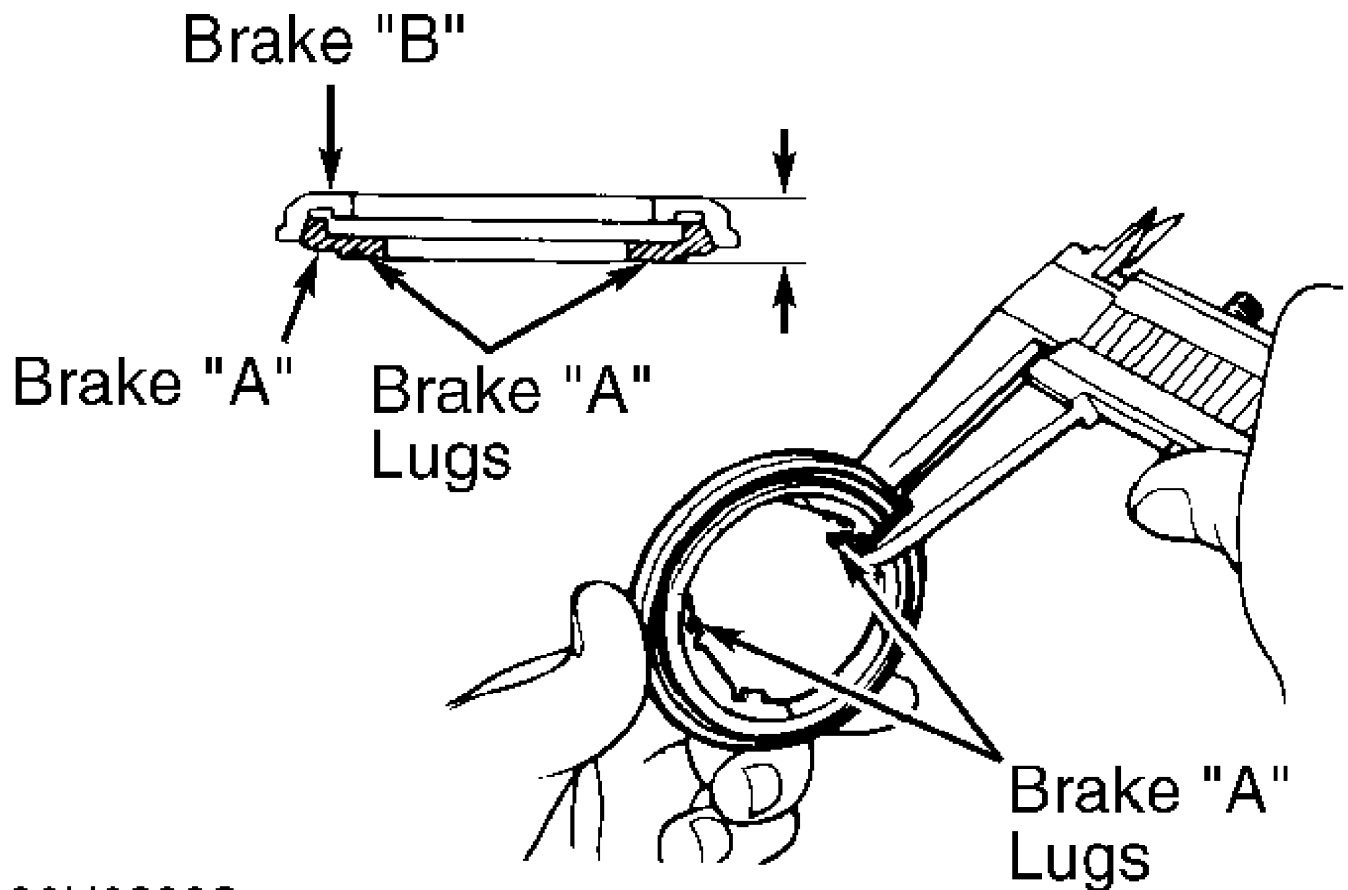
3) Standard thickness is .413" (10.49 mm). Minimum thickness is .378" (9.60 mm). If measured thickness is less than minimum thickness, replace brake "A" and brake "B".

4) Measure length "A" of return spring. See Fig. 5. Ensure length "A" is 1.38" (35.1 mm). If length "A" is not as specified, replace return spring.

5) Measure length "B" of shift spring. See Fig. 5. Ensure length "B" is 1.18" (30.0 mm). If length "B" is not as specified, replace shift spring.

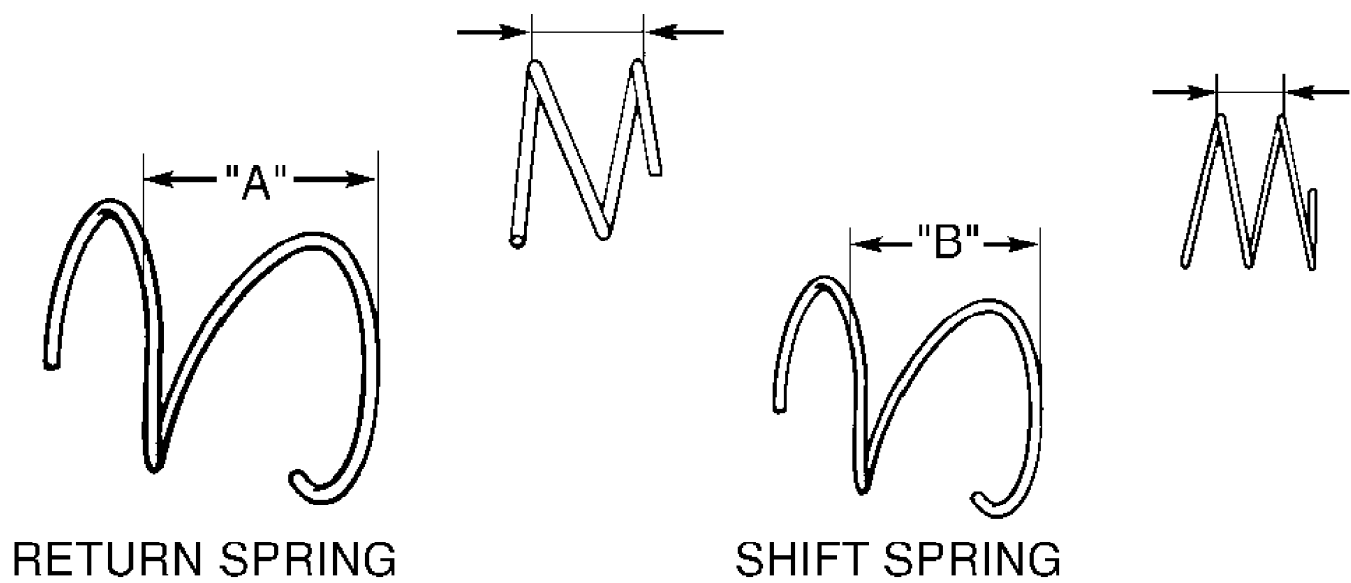
Reassembly (Pickup & Ram-50)

Pack grooves of retainer "B" with multipurpose grease, and apply grease to attaching surfaces of all components. To complete assembly, reverse disassembly procedure.



90H02998

Fig. 4: Measuring Brake Assembly Thickness
Courtesy of Mitsubishi Motor Sales of America.



90J02999

Fig. 5: Measuring Lengths Of Return Spring & Shift Spring
 Courtesy of Mitsubishi Motor Sales of America.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS TABLE

Application	Ft. Lbs. (N.m)
Hub Cover	13-25 (18-34)
Locking Hub Bolts	36-43 (49-58)

1993 Mitsubishi Montero

Montero

ENGINE CONTROL MODULE (ECM) (3.0L)



Fig. 1: ¹⁻²⁻³⁻⁴⁻⁵⁻⁶ Wiring Diagram (3.0L)

MAINTENANCE INFORMATION

1993 Mitsubishi Montero

1983-96 MAINTENANCE
Mitsubishi Maintenance Information

Montero

* 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 - 1983-86
- * SCHEDULED SERVICES - 1987-95
- * SCHEDULED SERVICES - 1996

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	4	F	J	4	3	E	1	H	J	0	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
- 2 - Manufacturer
 - A * Mitsubishi Motor Corp.
- 3 - Vehicle Type
 - 4 * Multi-Purpose Vehicle
 - 7 * Truck
- 4 - GVW & Brake Type
 - F * 4001-5000 Lbs., Hydraulic Brakes
 - G * 5001-6000 Lbs., Hydraulic Brakes
- 5 - Vehicle Line
 - J, K Or R * Montero
- 6 - Vehicle Series
 - 2 * Low
 - 3 * Medium

- 4 * High
- 5 * Premium
- 7 - Body Type
 - 1 * 5-Door Wagon
 - 2 * 2-Door Canvas Top
 - 3 * 2-Door Metal Top (1983-86)
 - 3 * 3-Door Metal Top Or Van (1987 & Newer Models)
- 8 - Engine Type
 - E * 2.6L 4-Cylinder
 - H * 3.0L V6
 - M * 3.5L V6
 - S * 3.0L V6
 - 7 * 2.6L 4-Cylinder (1983)
- 9 - VIN Check Digit
 - * 1 Through 9 Or X
- 10 - Vehicle Model Year
 - D * 1983
 - E * 1984
 - F * 1985
 - G * 1986
 - H * 1987
 - J * 1988
 - K * 1989
 - L * 1990
 - M * 1991
 - N * 1992
 - P * 1993
 - R * 1994
 - S * 1995
 - T * 1996
- 11 - Assembly Plant
 - Y * Ohye, Japan (1983)
 - Y * Nagoya, Japan (1984)
 - J * Nagoya, Japan (1985-96)
- 12 - Transmission Code (1983-85)
 - 4 * 5-Speed M/T (1984-85 Federal Vehicles)
 - 5 * 5-Speed M/T (1984-85 California Vehicles)
 - 7 * 5-Speed M/T (1983 Federal Vehicles)
 - 7 * A/T (1984-85 Federal Vehicles)
 - 8 * A/T (1984-85 California Vehicles)
- 12-17 - Serial Number (1986-96)
 - * Sequential Production Number
- 13-17 - Serial Number (1983-85)
 - * 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)

- * Short Trips In Freezing Temperatures
- * Towing Or Commercial Use
- * Driving Off-Road Or In Salty Or Sandy Areas
- * Severe Dust Conditions
- * Hot Weather, Stop-And-Go Driving
- * Extensive Idling

CAMSHAFT TIMING BELT

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

Replace camshaft timing belt at 60,000 mile intervals.

SERVICE POINT LOCATIONS

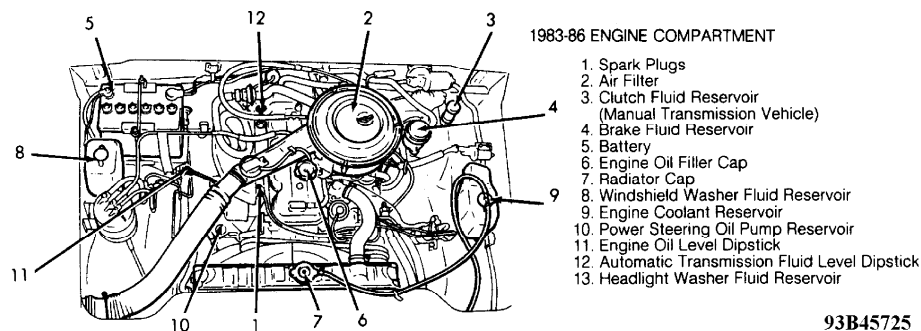
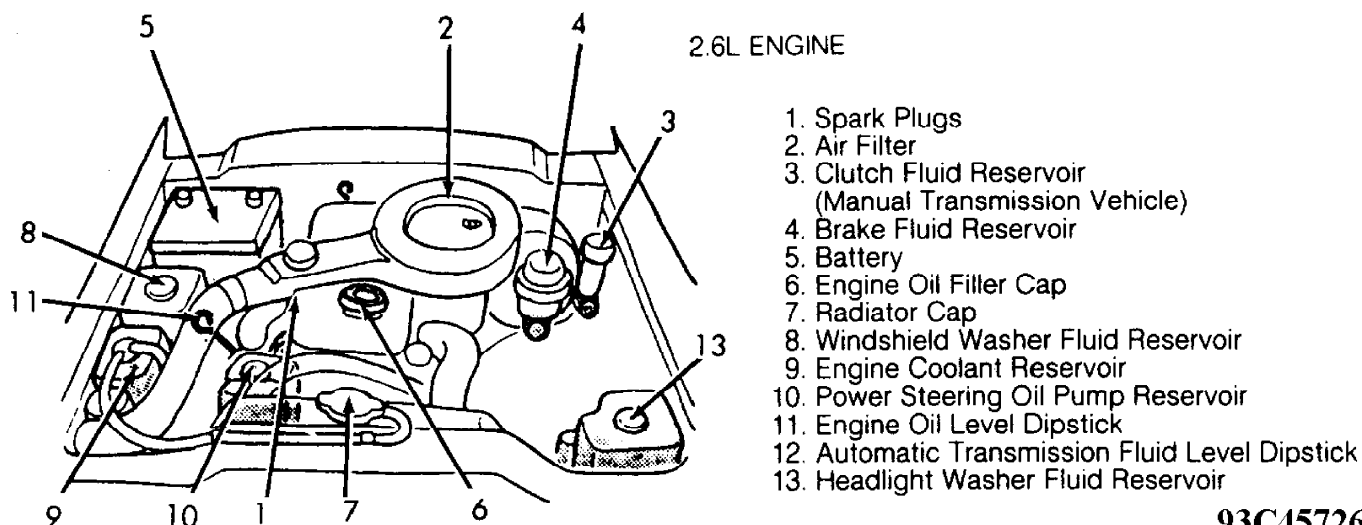
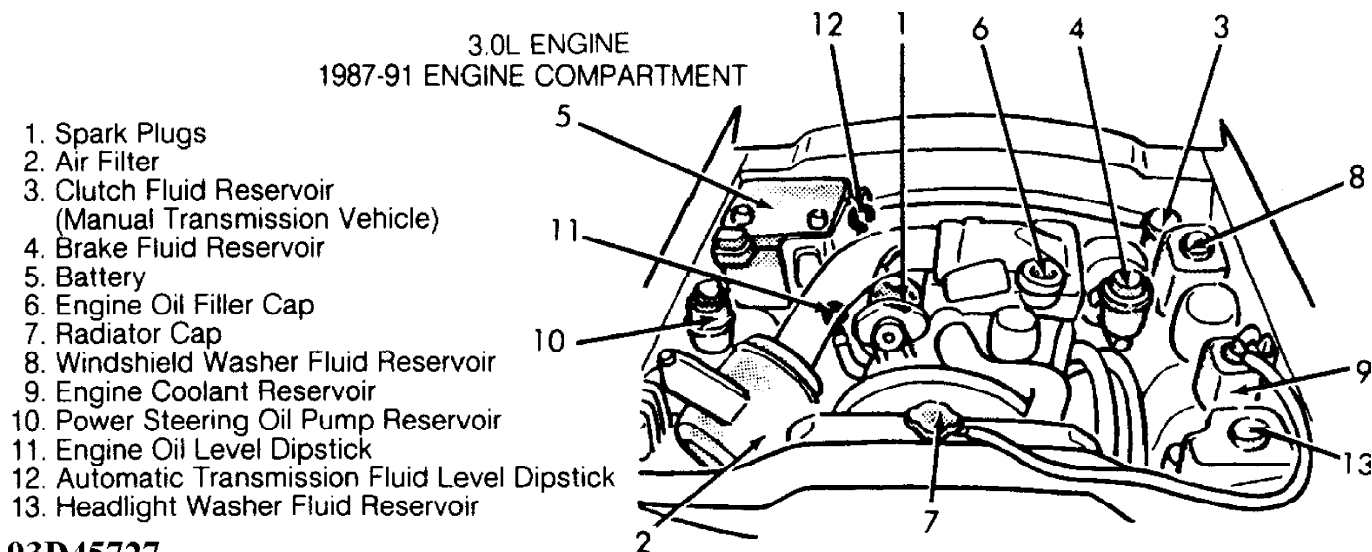


Fig. 1: Service Point Locations (1983-86 2.6L 4-Cylinder Engine)
Courtesy of Mitsubishi Motor Sales of America.



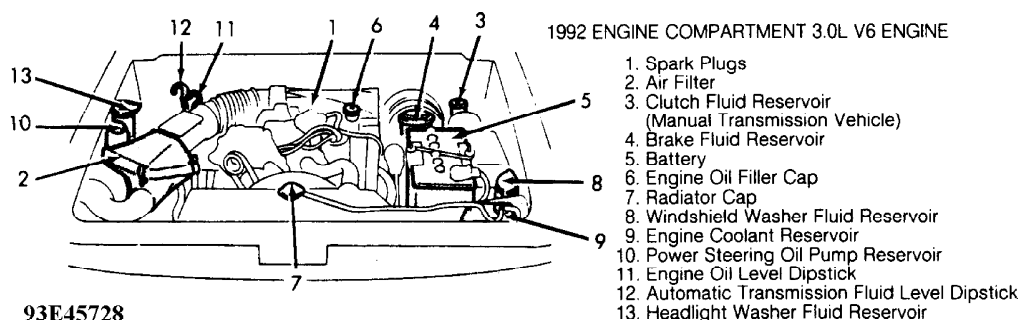
93C45726

Fig. 2: Service Point Locations (1987-91 2.6L 4-Cylinder Engine)
Courtesy of Mitsubishi Motor Sales of America.



93D45727

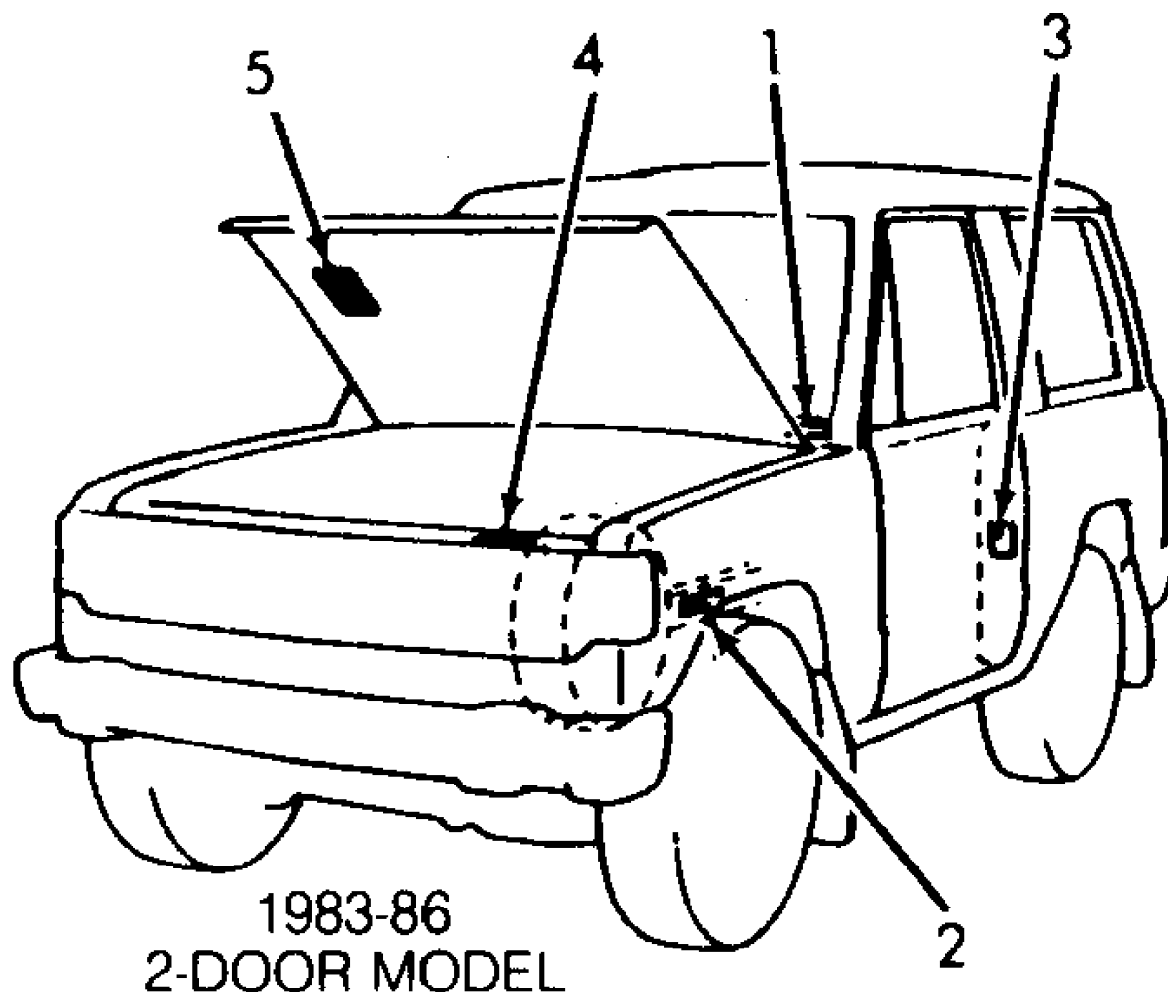
Fig. 3: Service Point Locations (1987-91 3.0L V6 Engine)
Courtesy of Mitsubishi Motor Sales of America.



93E45728

Fig. 4: Service Point Locations (1992 3.0L V6 Engine)
Courtesy of Mitsubishi Motor Sales of America.

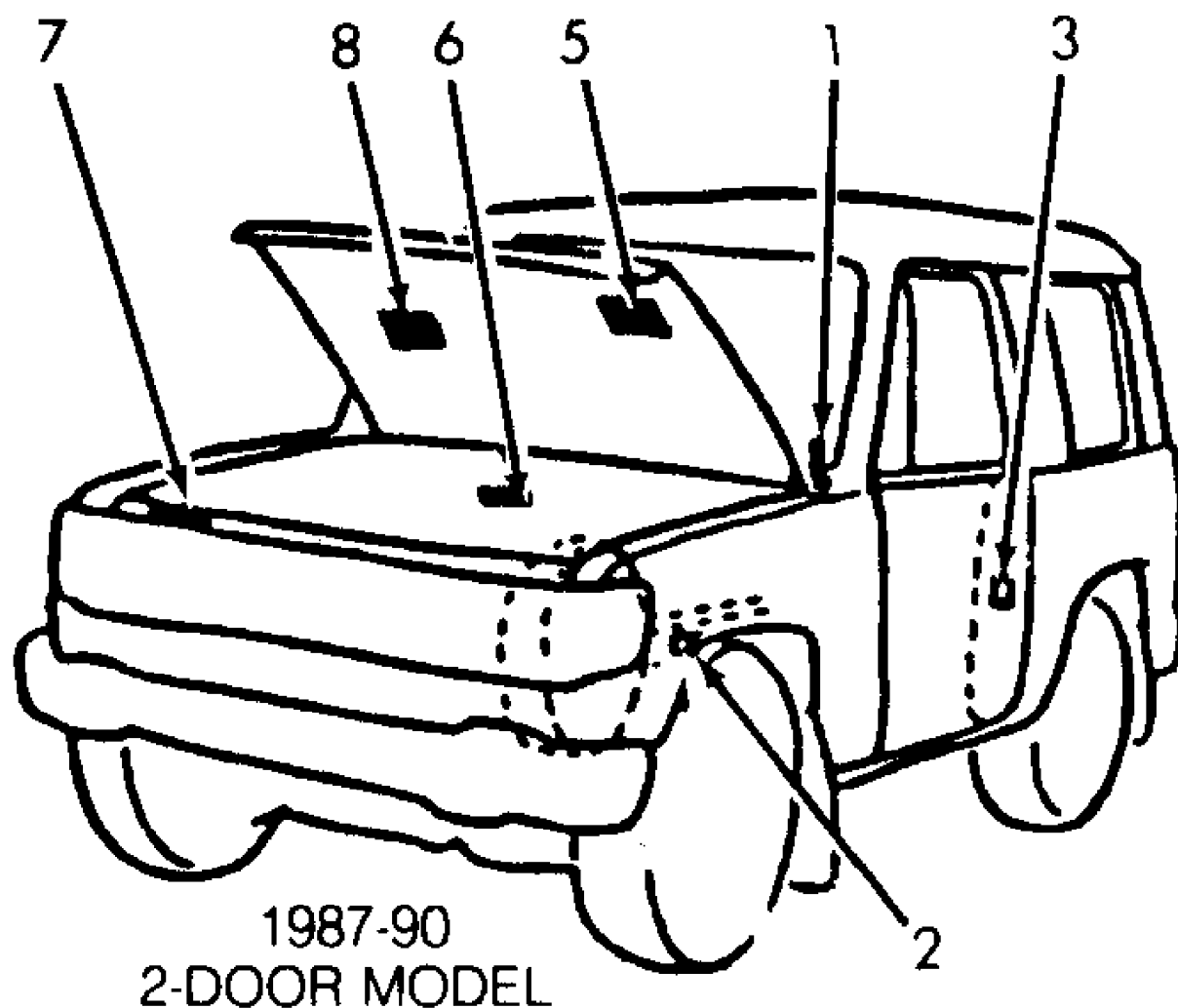
INFORMATION LABEL LOCATIONS



1. Vehicle Identification Number (VIN) Plate
2. Chassis Number
3. Certification Label
4. Body Color Label (Some Models)
5. Vehicle Emission Control Information Label
6. Vehicle Information Code Plate (2.6L)
7. Vehicle Information Code Plate (3.0L)
8. Service Points Label (Some Models)

93F45729

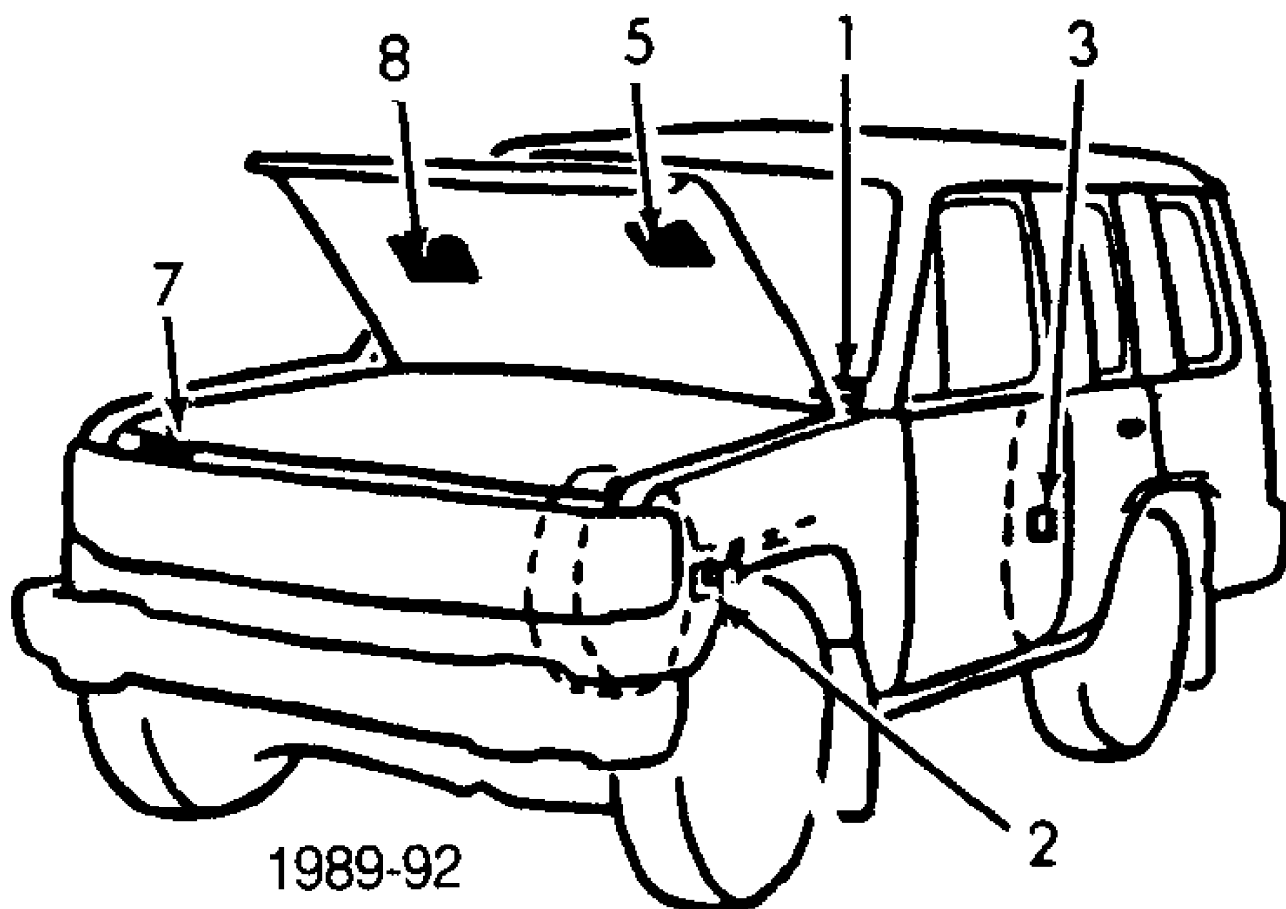
Fig. 5: Information Label Locations (1983-86 2-Door Models)
Courtesy of Mitsubishi Motor Sales of America.



- 1987-90
2-DOOR MODEL
1. Vehicle Identification Number (VIN) Plate
 2. Chassis Number
 3. Certification Label
 4. Body Color Label (Some Models)
 5. Vehicle Emission Control Information Label
 6. Vehicle Information Code Plate (2.6L)
 7. Vehicle Information Code Plate (3.0L)
 8. Service Points Label (Some Models)

93I45730

Fig. 6: Information Label Locations (1987-90 2-Door Models)
Courtesy of Mitsubishi Motor Sales of America.



1989-92

4-DOOR MODEL

1. Vehicle Identification Number (VIN) Plate
2. Chassis Number
3. Certification Label
4. Body Color Label (Some Models)
5. Vehicle Emission Control Information Label
6. Vehicle Information Code Plate (2.6L)
7. Vehicle Information Code Plate (3.0L)
8. Service Points Label (Some Models)

93J45731

Fig. 7: Information Label Locations (1989-92 4-Door Models)
Courtesy of Mitsubishi Motor Sales of America.

SERVICE LABOR TIMES

SERVICE LABOR TIMES TABLE (HOURS)

30,000 (60,000)

50,000

Application	Mile Service	Mile Service
1983-86 2.6L 4-Cylinder		
Automatic Transmission	7.9 (8.2)	5.2
Manual Transmission	6.9 (7.2)	5.2
1987-90 2.6L 4-Cylinder		
Automatic Transmission	7.9 (8.9)	2.6
Manual Transmission	6.9 (7.9)	2.6
1989-96 3.0L V6		
Automatic Transmission	6.1 (10.6)	2.6
Manual Transmission	5.1 (9.6)	2.6

LUBRICATION SPECIFICATIONS

LUBRICATION SPECIFICATIONS TABLE

Application	Fluid Specifications
Brake & Clutch Fluid	DOT 3 Or DOT 4
Engine Coolant	Ethylene-Glycol Antifreeze Coolant
Engine Oil (1)	
Minimum Temperature	
Greater Than 32°F (0°C)	SAE 20W-40 Or 20W-50 API SG/CD
Greater Than -10°F (-23°C)	SAE 10W-30 Or 10W-40 API SG/CD
Maximum Temperature	
Less Than 60°F (16°C)	SAE 5W-30 Or 5W-40 API SG/CD
Front Axle & Conventional Rear Axle	
Minimum Temperature	
Greater Than -10°F (-23°C)	SAE 85W-90, 80W-90 API GL-5
Maximum Temperature	
Less Than -30°F (-34°C)	SAE 75W API GL-5
Power Steering Fluid	Dexron-IIe ATF
Rear Axle (With Limited Slip Differential)	Hypoid Gear Oil (8149630EX) Or Equivalent
Transmission	
Automatic	Dexron-IIe ATF
Manual Transaxle & Transfer Case (4WD)	SAE 75W-85W, 75W-90 API GL-5

(1) - Since temperature ranges for different oil grades overlap, brief fluctuations in outside temperatures are no cause for concern.

FLUID CAPACITIES

FLUID CAPACITIES TABLE

Application	Quantity
A/C System R-12 Refrigerant	
1983-87	24-26 Ozs.
1988-91	32 Ozs.
1992-93	28 Ozs.
A/C System R-134a Refrigerant (1)	
1994-96	21-23 Ozs.
Automatic Transmission	
1984-86	(2) 7.2 Qts. (6.8L)
1987-93	7.6 Qts. (7.2L)
1994-96 (3.0L SOHC)	7.6 Qts. (7.2L)

1994-96 (3.0L DOHC & 3.5L)	9.0 Qts. (8.5L)
Cooling System	
1983-88	8.5 Qts. (8.0L)
1989-96	
2.6L	9.7 Qts. (9.2L)
3.0L	10.0 Qts. (9.5L)
3.5L	10.0 Qts. (9.5L)
Differential	
1983-88	1.9 Qts. (1.8L)
1989-93	
2.6L	1.9 Qts. (1.8L)
3.0L	2.7 Qts. (2.6L)
1994-96	
3.0L & 3.5L	2.7 Qts. (2.6L)
Engine Oil	
1983-86	6.0 Qts. (5.8L)
1987	5.2 Qts. (5.0L)
1988	5.0 Qts. (4.8L)
1989-91	5.5 Qts. (5.3L)
1992-96	5.2 Qts. (4.9L)
Power Steering	1.1 Qts. (1.0L)
Fuel Tank	
1983-88	15.9 Gals. (60L)
1989-90	
2.6L 2-Door	15.9 Gals. (60L)
3.0L 2-Door	19.9 Gals. (75L)
2.6L & 3.0L 4-Door	24 Gals. (92L)
1991-96	24 Gals. (92L)
Manual Transmission	
1983-91	2.3 Qts. (2.2L)
1992	2.4 Qts. (2.3L)
1993-96	2.6 Qts. (2.5L)
Transfer Case	
1983-91	2.3 Qts. (2.2L)
1992-96	2.4 Qts. (2.3L)

- (1) - Use of R12 in a R134a system will result in SEVERE DAMAGE.
(2) - 1983 model equipped with manual transmission only.

WHEEL & TIRE SPECIFICATIONS

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. These pressures provide the best combination of ride comfort, tire wear and stability under normal conditions.

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. When using snow tires, they must be used in set of four for maneuverability and safety. DO NOT use tire chains on front wheels.

TIRE & WHEEL SPECIFICATIONS TABLE

Wheel Size	Tire Size
1983-86	
15 x 6JJ (Steel)	215 SR15
1987-88	

15 x 6JJ (Steel)	P225/75 R15
1989-1996	
15 x 6JJ (Steel)	P225/75 R15
15 x 6JJ (Steel or Aluminum)	P235/75 R15
15 X 7JJ (Aluminum)	31-10.50R15

TIRE INFLATION SPECIFICATIONS TABLE

Application	Pressure psi (kg/cm ²)
1983-88	
Front (1)	26 (1.8)
Rear	34 (2.3)
Rear	(2) 26 (1.8)
1989-91	
Front (1)	26 (1.8)
Rear	35 (2.4)
Rear	(2) 26 (1.8)
1992-96	
P235/75R15	
Front	26 (1.8)
Rear	35 (2.4)
31-10.50R15	
Front	29 (2.1)
Rear	40 (2.8)

- (1) - No chain clearance.
(2) - Inflation pressure for better ride comfort when driving with no cargo.

WHEEL TIGHTENING

WHEEL TIGHTENING SPECIFICATIONS TABLE

Application	Ft. Lbs. (N.m.)
1983	50-57 (70-80)
1984-96	72-87 (100-120)

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.

Battery is maintenance-free and does not normally require additional water. However, under severe conditions it is advisable to check battery fluid periodically. Use only distilled water to fill battery cell should it become necessary to add water. Charge condition can be checked by a visual test indicator on top of battery.

BATTERY REPLACEMENT SPECIFICATIONS TABLE

Application	BCI Group Number

2.6L Engine	45
2.6L Optional	45
3.0L V6	(1) 24
3.5L V6	(1) 24

(1) - Check hood clearance on 1986 and newer models.

CAUTIONS & WARNINGS

SUPPLEMENTAL RESTRAINT SYSTEM (SRS) AIR BAG SYSTEM

NOTE: See the AIR BAG RESTRAINT SYSTEM article in the ACCESSORIES/SAFETY EQUIPMENT Section.

The SRS has no user-servicable parts. Always have servicing done by an authorized dealer.

When performing maintenance on air bag equipped vehicles always observe proper safety precautions.

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

ANTI-LOCK BRAKE SYSTEM (ABS)

CAUTION: Never mix different diameter tires. On loose or uneven surfaces, the ABS system may require longer stopping distances than conventional brake systems. Exercise caution when removing mud or snow from the wheels so as not to damage the ABS wiring or speed sensors.

BATTERY WARNING

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 appropriate COMPUTER RELEARN PROCEDURES article in the GENERAL INFORMATION section below.

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.

CATALYTIC CONVERTER

Continued operation of vehicle with a severe malfunction could cause converter to overheat, resulting in possible damage to converter and vehicle.

COOLANT (PROPYLENE-GLYCOL FORMULATIONS)

CAUTION: To avoid possible damage to vehicle use only ethylene-glycol based coolants with a mixture ratio from 44-68% anti-freeze. DO NOT use 100% anti-freeze as it will cause the formation of cooling system deposits. This results in coolant temperatures of over 300° F (149°C) which can melt plastics. 100% anti-freeze has a freeze point of only -8° F (-22°C).

CAUTION: Propylene-Glycol Mixtures has a smaller temperature range than Ethylene-Glycol. The temperature range (freeze-boil) of a 50/50 Anti-Freeze/Water Mix is as follows:

Propylene-Glycol	-26° F (-32°C)	-	257° F (125°C)
Ethylene-Glycol	-35° F (-37°C)	-	263° F (128°C)

CAUTION: Propylene-Glycol/Ethylene-Glycol Mixtures can cause the destabilization of various corrosion inhibitors. Also Propylene-Glycol/Ethylene-Glycol has a different specific gravity than Ethylene-Glycol coolant, which will result in inaccurate freeze point calculations.

ELECTROSTATIC DISCHARGE SENSITIVE (ESD) PARTS

WARNING: Many solid state electrical components can be damaged by static electricity (ESD). Some will display a warning label, but many will not. Discharge personal static electricity by touching a metal ground point on the vehicle prior to servicing any ESD sensitive component.

ENGINE OIL

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: Always refer to customer's copy of warranty information for specific model application and/or coverage limitations.

NEW VEHICLE LIMITED WARRANTY

Covers all manufacturer-installed parts and components for any repairs, replacements or adjustments needed to correct defects in materials or workmanship under normal use and maintenance for 36 months or 36,000 miles, whichever comes first, from date of delivery to the first retail buyer or first date of use.

POWERTRAIN LIMITED WARRANTY

Upon expiration of New Vehicle Limited Warranty, this warranty covers powertrain against defects in materials or workmanship up to a maximum of 36 months or 50,000 miles, whichever occurs first. On 1991-96 models, warranty period is extended to 5 years or 60,000 miles, whichever occurs first. See copy of warranty for specific components covered.

BATTERY WARRANTY

Covers replacement of original battery for 12 months or 12,000 miles, whichever occurs first.

AIR CONDITIONER WARRANTY

Covers manufacturer's air conditioners for 36 months or 36,000 miles, whichever occurs first. Air conditioner refrigerant charge is covered for the first 12 months or 12,000 miles, whichever occurs first. On 1992-96 models, refrigerant is covered only as part of a warranty repair.

ANTI-CORROSION PERFORATION LIMITED WARRANTY

Covers any body sheet metal panel found to have developed perforation (rust-through) due to corrosion for 5 years regardless of mileage. Outer panel coverage extends to 7 years or 100,000 miles, whichever occurs first, on 1992-96 models.

EMISSION SYSTEM DEFECT WARRANTY (EXCEPT CALIFORNIA)

Warrants that the vehicle was designed, built and equipped to conform at the time of sale with all applicable U.S. emission standards. Covers any repairs needed to correct defects in materials or workmanship which would cause the vehicle not to meet these standards for 5 years or 50,000 miles, whichever occurs first.

EMISSION SYSTEM PERFORMANCE WARRANTY (EXCEPT CALIFORNIA)

Covers all repairs, adjustments, or replacements if vehicle has been maintained in accordance with the prescribed scheduled maintenance instructions and fails to conform to applicable emission standards and such failure results or will result in the vehicle owner having to bear any penalty or other sanctions under local, state or

federal law. Warranty period is 5 years or 50,000 miles, whichever occurs first. Covers remedy of non-conformity if vehicle fails to pass an EPA approved emissions test during the first 24 months or 24,000 miles of this warranty. During the remainder of the warranty period, covers remedy of non-conformity resulting from failure of certain emission-related components. See copy of warranty for specific components covered.

EMISSION SYSTEM WARRANTY (CALIFORNIA)

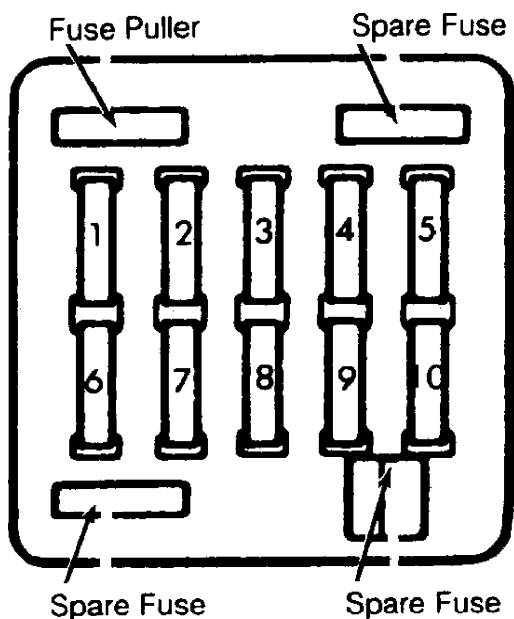
Warrants that the vehicle was designed, built and equipped to conform at the time of sale with all applicable U.S. and California emission standards, and that the emission control system is free from defects in materials or workmanship which would cause the vehicle not to meet these standards for 5 years or 50,000 miles, whichever occurs first. On 1990 and later models, warranty coverage is 3 years or 50,000 miles, whichever occurs first, with certain emission-related components covered for 7 years or 70,000 miles, whichever occurs first. See copy of warranty for specific components covered.

FUSES & CIRCUIT BREAKERS

FUSE PANEL LOCATION

The electrical system is protected against shorts by fuses that are designed to fail, to prevent damage to the wire harness. 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 (1983-91)

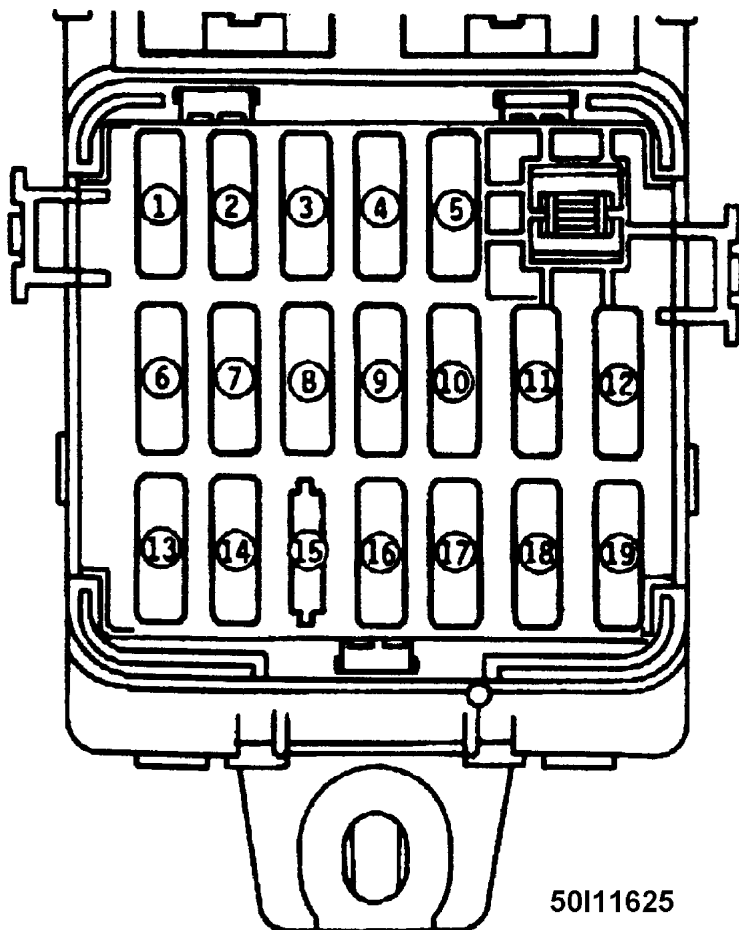


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Fig. 8: Fuse Panel Identification (1983-91)
Courtesy of Mitsubishi Motor Sales of America, Inc.

- 1 - 20 Amp (Yellow)
Hazard Light, Dome Light, Clock
- 2 - 10 Amp (Red)
Taillights
- 3 - 10 Amp (Red)
Turn Signal Lights
- 4 - 10 Amp (Red)
Back-Up Lights, Gauges
- 5 - 15 Amp (Light Blue)
Defogger
- 6 - 20 Amp (Yellow)
Heater
- 7 - 15 Amp (Light Blue)
Stoplights
- 8 - 15 Amp (Light Blue)
Horn, Wiper, Washer
- 9 - 10 Amp (Red)
Rear Wiper, Rear Washer
- 10 - 15 Amp (Light Blue)
Cigarette Lighter, Radio

FUSE PANEL IDENTIFICATION (1992-96)



50111625

Fig. 9: Fuse Panel Identification (1992-96)
Courtesy of Mitsubishi Motor Sales of America, Inc.

- 1 - 20 Amp
Not Used
- 2 - Not Used
10 Amp (1994-96)
ELC-4 A/T Control Module, Cruise Control Unit
- 3 - 10 Amp
Blower Motor Relay, Headlight Washer Relay, Defogger Relay,
Car Telephone (1992-93)
- 4 - 10 Amp
Radio Clock, Accessory Socket Relay,
Cruise Control Unit (1994-96), Data Link Connector (1994-96)
- 5 - 15 Amp
Remote Controlled Mirror, Cigarette Lighter
Accessory Socket Relay (1992-93)
- 6 - 15 Amp
Door Lock Relay, Door Lock Control Unit (1994-96)
- 7 - 10 Amp
Overdrive Relay, Variable Shock Absorber Control Unit,
4WD Indicator Control Unit, ABS Power Relay (1992-93),
ABS Control Unit (1994-96), Combination Meter (1994-96)
- 8 - 10 Amp
Power Window Relay
- 9 - 15 Amp
Wiper, Washer, Sunroof
- 10 - 10 Amp
Horn, Cruise Control Unit (1992-93)
- 11 - 10 Amp
Combination Meter, Multi-meter, Motor Antenna Control Unit,
Buzzer Assembly
- 12 - 15 Amp
Turn Signal Light, Hazard Light, SRS Diagnosis Unit
- 13 - 10 Amp
Not Used
- 14 - 15 Amp
Accessory Socket
- 15 - Not Used
- 16 - 25 Amp
Blower Motor
- 17 - 15 Amp
Stoplight
- 18 - 10 Amp
Back-up Light, Rear Differential Lock Control Unit
- 19 - 10 Amp
Engine Control Module, Dome Light, Reading Light,
Cargo Light, Combination Meter, Clock, Door Lock Relay,
Cruise Control Unit, Car Telephone (1992-93)
ELC-4 A/T Control Module (1994-96), Ignition Key Illumination
Light Timer (1994-96)

MAINTENANCE REMINDER LIGHT RESET PROCEDURES

1993 Mitsubishi Montero

1983-96 MAINTENANCE

Chrysler Motors/Mitsubishi Maintenance Reminder Lights

Dodge; Challenger, Colt, Colt Vista, Conquest, Raider, Ram-50

Eagle; Summit, Summit Wagon

Plymouth; Colt, Colt Vista, Sapporo

Mitsubishi; 3000GT, Cordia, Diamante, Eclipse, Expo/Expo LRV, Galant, Mirage, Montero, Pickup, Precis, Sigma, Starion, Tredia, Van/Wagon

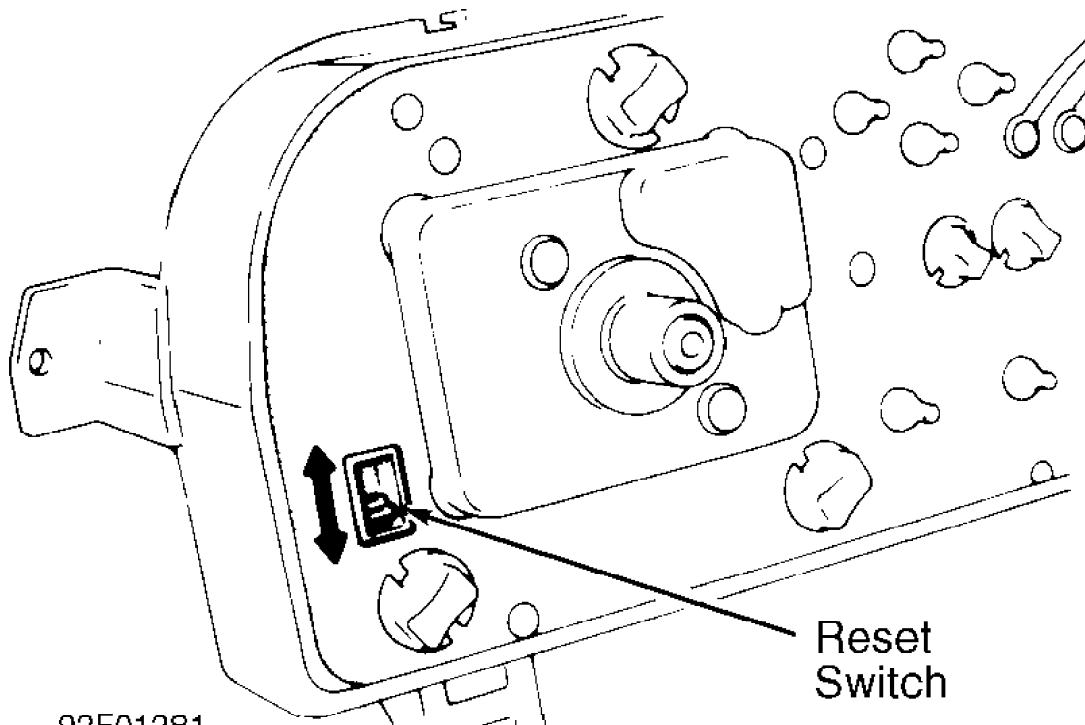
EGR/MAINTENANCE REQUIRED WARNING LIGHT

1) On some models, an EGR or MAINTENANCE REQUIRED warning light in dash will come on as a reminder to have EGR system serviced (each 50,000 miles), oxygen sensor replaced (each 80,000 miles) or evaporative carbon canister replaced (100,000 miles).

2) After servicing or replacing components, reset mileage counter. On all models except 1987-95 Pickup and 1987-93 Ram-50, reset switch is located on back of instrument cluster.

3) On 1987-95 Pickup and 1987-93 Ram-50, reset switch is on lower right corner of instrument cluster, behind instrument cluster face trim. Slide switch to other side to reset indicator light.

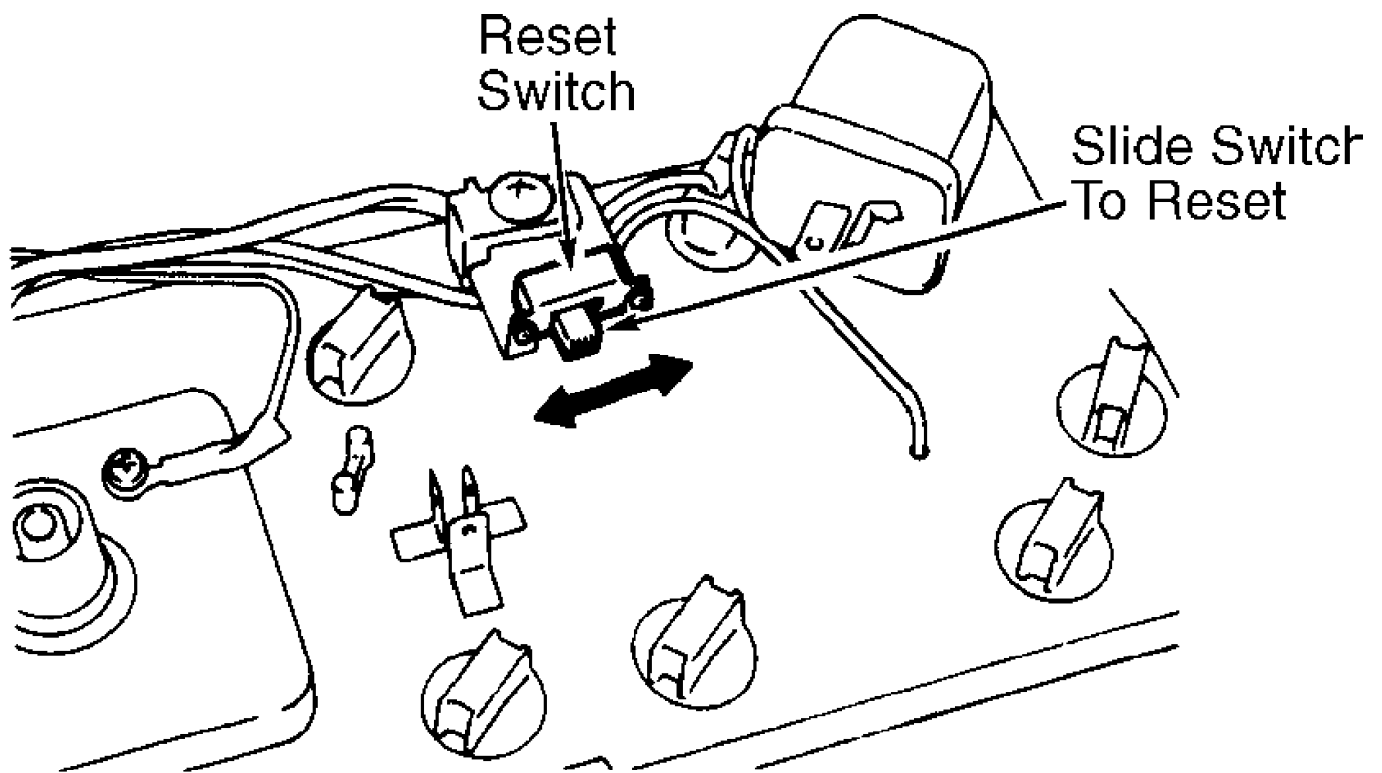
4) Remove warning light bulb after 150,000 mile servicing on Colt Vista and Wagon. Remove bulb after 120,000 mile servicing on Ram-50.



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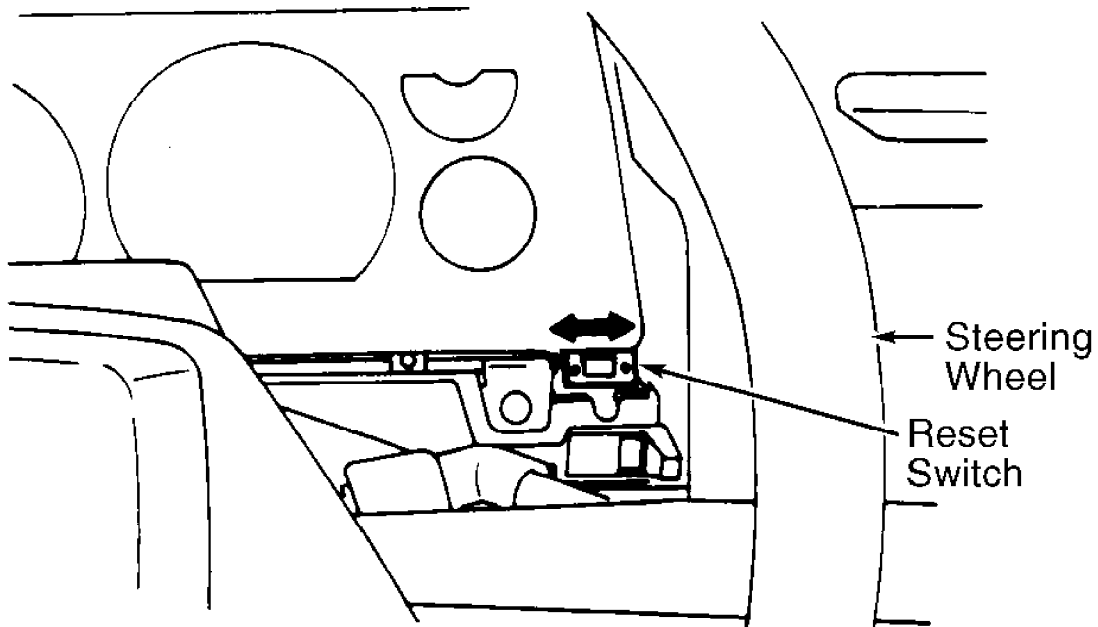
Fig. 1: Locating Warning Light Reset Switch (Colt Vista; Colt Wagon is Similar)

Courtesy of Chrysler Motors.



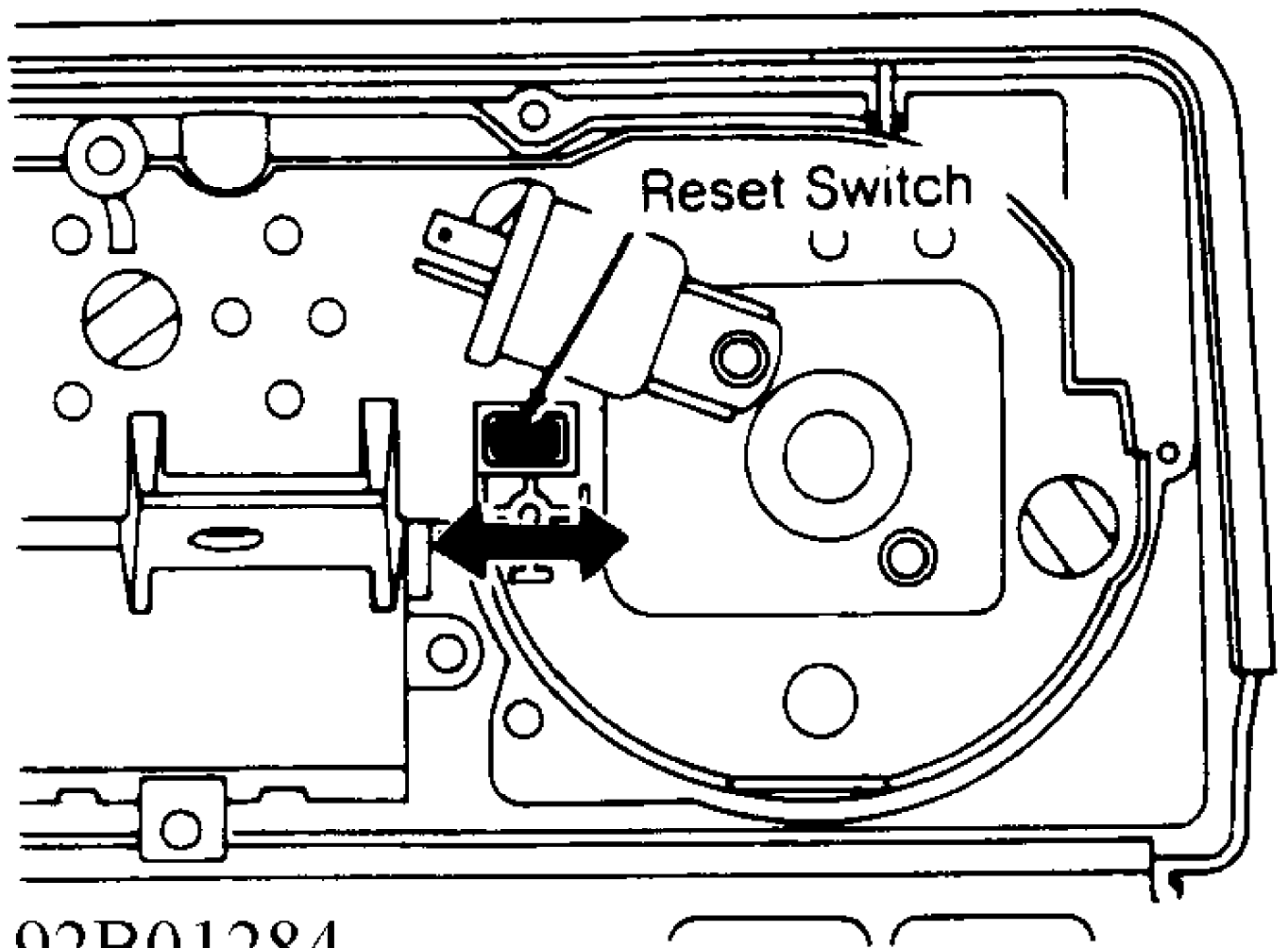
92H01282

Fig. 2: Locating Warning Light Reset Switch (1985-86 Pickup & Ram-50)
Courtesy of Chrysler Motors.



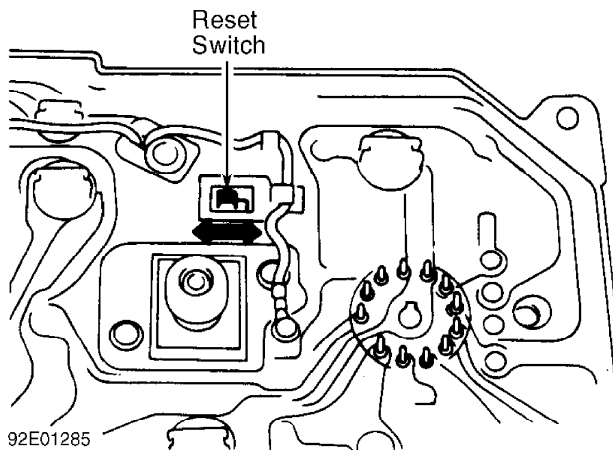
92J01283

Fig. 3: Locating Warning Light Reset Switch (1987-92 Pickup & Ram-50)
Courtesy of Chrysler Motors.



92B01284

Fig. 4: Locating Warning Light Reset Switch (Raider)
Courtesy of Chrysler Motors.



92E01285

Fig. 5: Locating Warning Light Reset Switch (Van & Wagon)
Courtesy of Chrysler Motors.

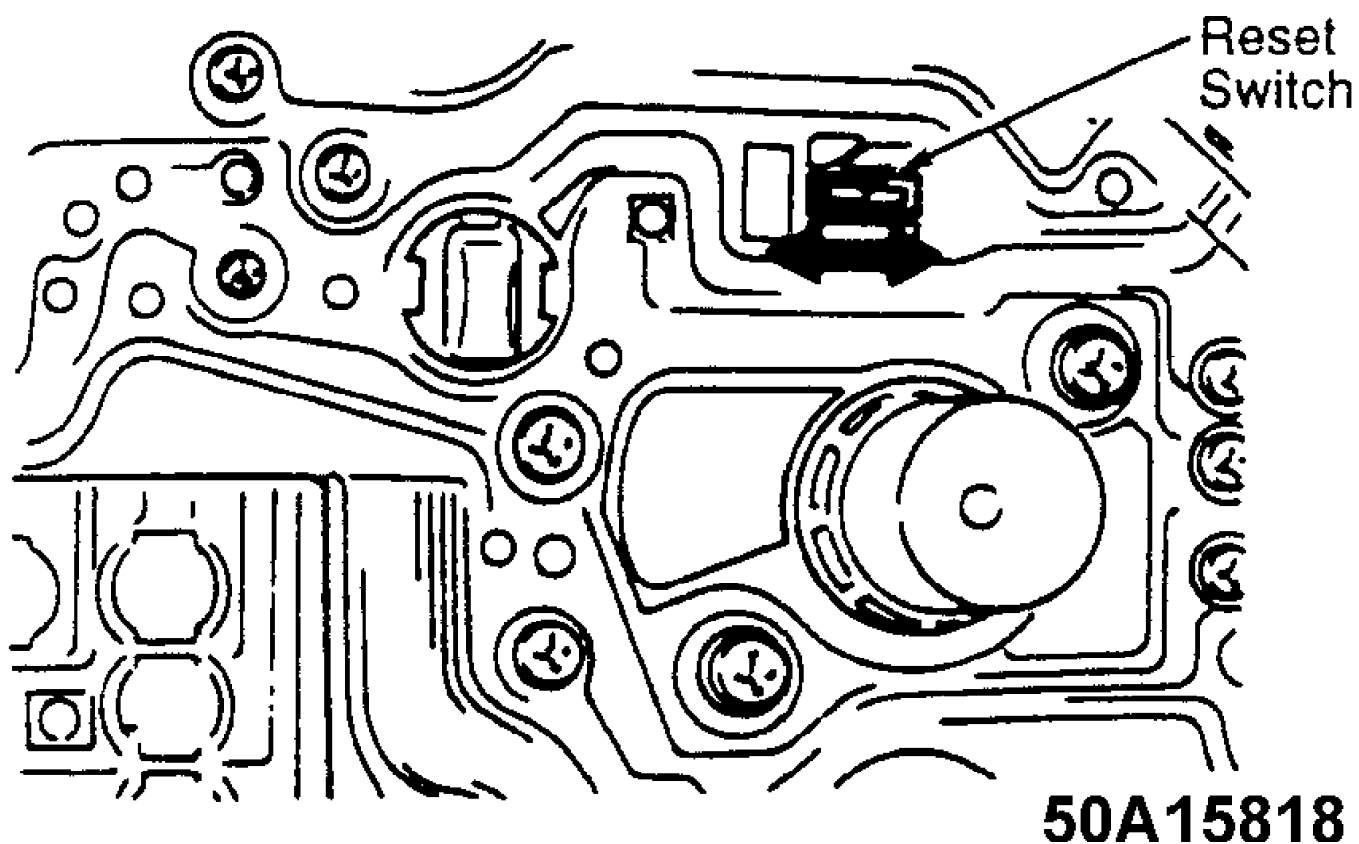


Fig. 6: Locating Warning Light Reset Switch (1983-93 Montero)
Courtesy of Chrysler Motors.

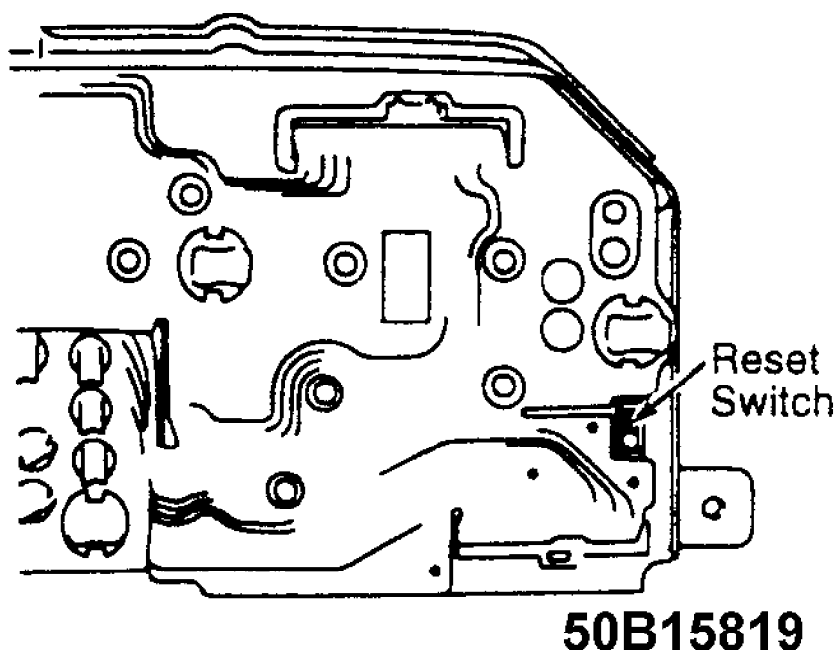


Fig. 7: Locating Warning Light Reset Switch (1994-96 Montero)
Courtesy of Chrysler Motors.

METRIC CONVERSIONS

1993 Mitsubishi Montero

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 $1 \text{ kg}/\text{cm}^2$.
- * 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	$(^{\circ}\text{C} \times 9) / 5 + 32$
Fahrenheit Degrees	Centigrade Degrees	$(^{\circ}\text{F} - 32) \times (5) / 9$

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	9.922
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

1993 Mitsubishi Montero

1993 ACCESSORIES & EQUIPMENT
Mitsubishi Power Mirrors

Montero

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 No. 5, faulty power mirror switch or faulty power mirror motor.

TESTING

POWER MIRROR MOTOR TEST

Connect 12-volt power source to mirror connector terminals. See Figs. 1 and 2. Replace mirror as necessary.



COLT, COLT 200, ECLIPSE, GALANT,
MIRAGE, MONTERO, PICKUP, RAM-50, SUMMIT,
& STEALTH & 3000GT (WITHOUT HEATER)

93H83292

Fig. 1: Identifying Power Mirror Connector
Courtesy of Mitsubishi Motor Sales of America.

Direction of operation \ Connection	Battery		Terminal		
	⊕	⊖	1	2	3
Up	○	○	○		○
Down	○	○	○		○
Left	○	○	○	○	
Right	○	○	○	○	

COLT, COLT VISTA, COLT 200, EXPO,
MIRAGE, MONTERO, SUMMIT & SUMMIT WAGON

93183293

Fig. 2: Power Mirror Operational Test Chart
Courtesy of Mitsubishi Motor Sales of America.

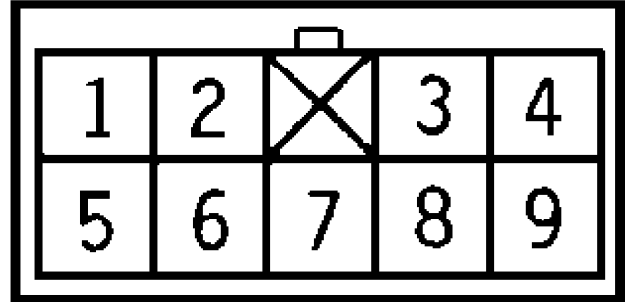
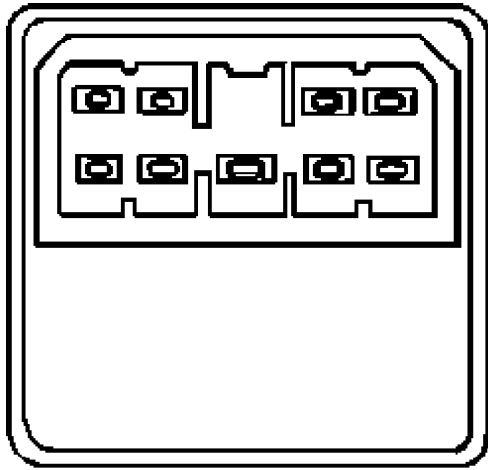
POWER MIRROR SWITCH TEST

Remove mirror switch. Using ohmmeter, check continuity of switch. See appropriate POWER MIRROR SWITCH CONTINUITY CHART. See Fig. 3. Replace switch as necessary if switch continuity is not as specified.

POWER MIRROR SWITCH CONTINUITY CHART

Switch Position	(1) Check Continuity Between
Left Side	
UP	Pins 4 & 8; Pins 6 & 7
DOWN	Pins 4 & 7; Pins 6 & 8
LEFT	Pins 3 & 6; Pins 4 & 7
RIGHT	Pins 3 & 4; Pins 6 & 7
Right Side	
UP	Pins 2 & 4; Pins 6 & 7
DOWN	Pins 2 & 6; Pins 4 & 7
LEFT	Pins 4 & 7; Pins 6 & 9
RIGHT	Pins 4 & 9; Pins 6 & 7

(1) - See Fig. 3.



93D83298

Fig. 3: Power Mirror Switch Terminal ID
Courtesy of Mitsubishi Motor Sales of America.

REMOVAL & INSTALLATION

POWER MIRROR ASSEMBLY

Remove delta cover (trim cover), screws and electrical connector. Remove mirror assembly. To install, reverse removal procedure.

WIRING DIAGRAMS

See appropriate chassis wiring diagram in the WIRING DIAGRAMS section.

POWER WINDOWS

1993 Mitsubishi Montero

1993 ACCESSORIES & EQUIPMENT
Mitsubishi Power Windows

Montero

DESCRIPTION & OPERATION

With the ignition switch in RUN position, battery voltage is applied to the master power window switch located on the driver's door. The master power window switch provides power and ground for all power window switches and motors. The master power window switch offers one-touch operation of driver's window. A solid state control unit, incorporated in the 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.

TROUBLE SHOOTING

POWER WINDOWS INOPERATIVE

Check for faulty sub fusible link No. 10, faulty power window relay or faulty power window switches.

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 master or passenger side power window switch is pressed, but does operate when both switches are pressed, check power window switch that is inoperative.

ONE-TOUCH SWITCH FUNCTION INOPERATIVE

Replace master power window switch.

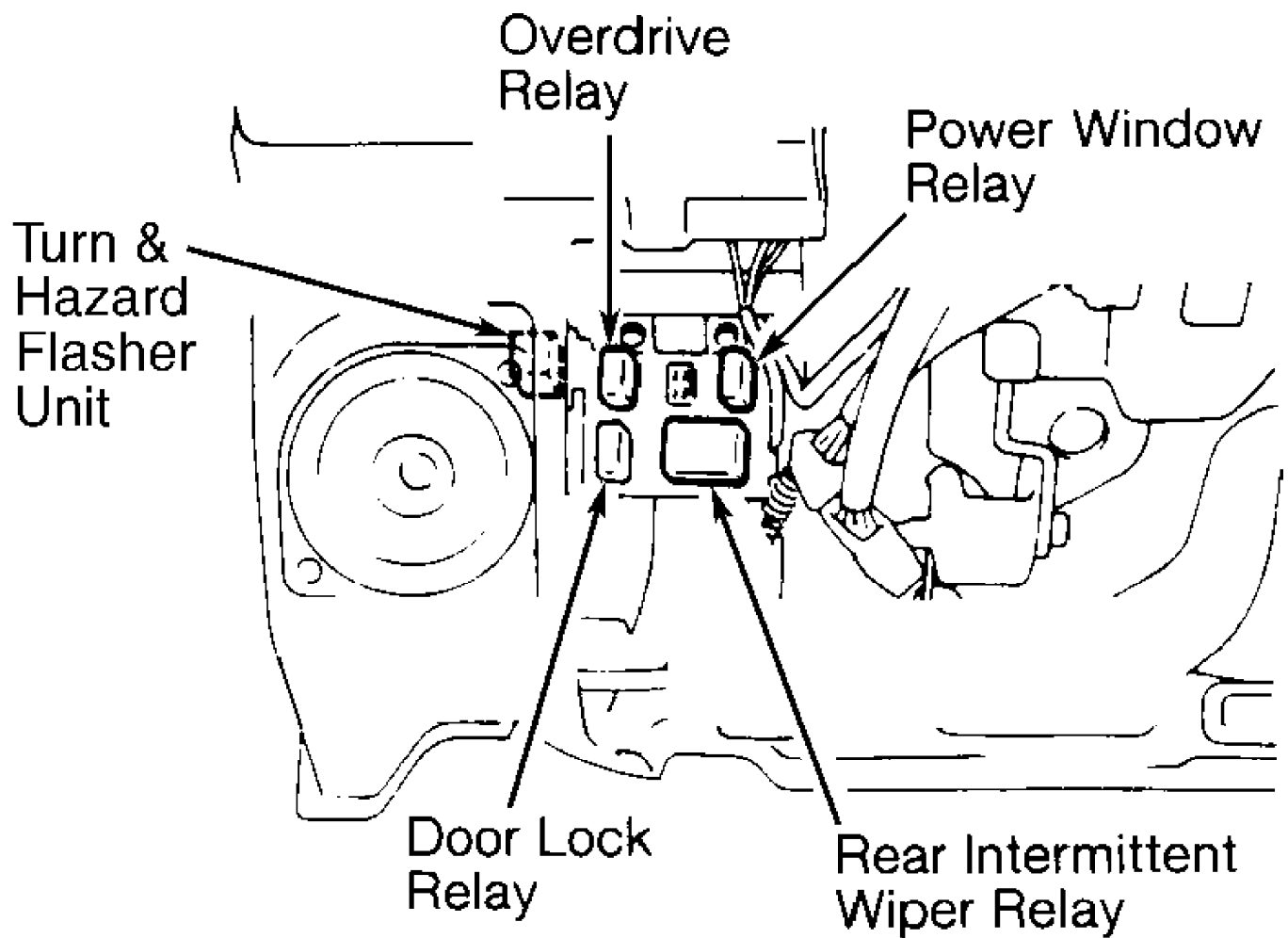
TESTING

CIRCUIT BREAKER TEST

Press UP switch to fully close window. Continue to press switch for 10 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.

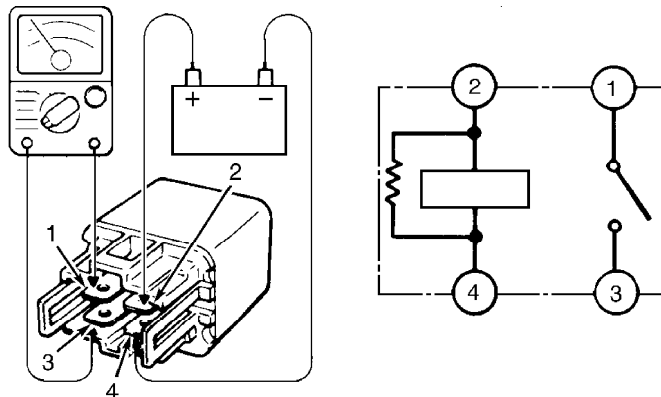
POWER WINDOW RELAY TEST

- 1) Remove power window relay from fuse/relay block, located in engine compartment. See Fig. 1. Check continuity between power window relay terminals No. 2 and No. 4. Continuity should be present.
- 2) Connect positive lead of a 12-volt battery to power window relay terminal No. 2, and negative lead of test battery to terminal No. 4. See Fig. 2. Continuity should be present between terminals No. 1 and No. 3 with voltage applied. Replace power window relay if continuity is not as specified.



93F83126

Fig. 1: Locating Power Window Relay
 Courtesy of Mitsubishi Motor Sales of America.



93140988

Fig. 2: Power Window Relay Terminal ID
 Courtesy of Mitsubishi Motor Sales of America.

POWER WINDOW MOTOR TEST

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, inspect wiring. If wiring is okay, replace motor. Reverse test battery leads again to complete full function test of motor.

POWER WINDOW SWITCH TEST

Remove control switch from trim panel. Using ohmmeter, check continuity of switch. See appropriate WINDOW SWITCH CONTINUITY CHART. See Figs. 3-5. Replace appropriate switch as necessary if switch continuity is not as specified.

MASTER WINDOW SWITCH CONTINUITY CHART

Switch Position (1)	Check Continuity Between
Normal Position	
Left Front OFF	Pins 2, 8 & 13
Left Rear OFF	Pins 4, 11 & 13
Left Front UP	Pins 2 & 9; Pins 8 & 13
Left Rear UP	Pins 4 & 9; 11 & 13
Left Front DOWN	Pins 2 & 13; Pins 8 & 9
Left Rear DOWN	Pins 4 & 13; Pins 9 & 11
Right Front OFF	Pins 1, 7 & 13
Right Rear OFF	Pins 5, 12 & 13
Right Front UP	Pins 1 & 9; Pins 7 & 13
Right Rear UP	Pins 5 & 9; Pins 12 & 13
Right Front DOWN	Pins 1 & 13; Pins 7 & 9
Right Rear DOWN	Pins 5 & 13; Pins 9 & 12
Lock Position	
Left Front OFF	Pins 2, 8 & 13
Left Rear OFF	Pins 4 & 11
Left Front UP	Pins 2 & 9; Pins 8 & 13
Left Rear UP	Pins 4 & 9
Left Front DOWN	Pins 2 & 13; Pins 8 & 9
Left Rear DOWN	Pins 9 & 11
Right Front OFF	Pins 1 & 7
Right Rear OFF	Pins 5 & 12
Right Front UP	Pins 1 & 9
Right Rear UP	Pins 5 & 9
Right Front DOWN	Pins 7 & 9
Right Rear DOWN	Pins 9 & 12

(1) - Left side of vehicle refers to driver's side.

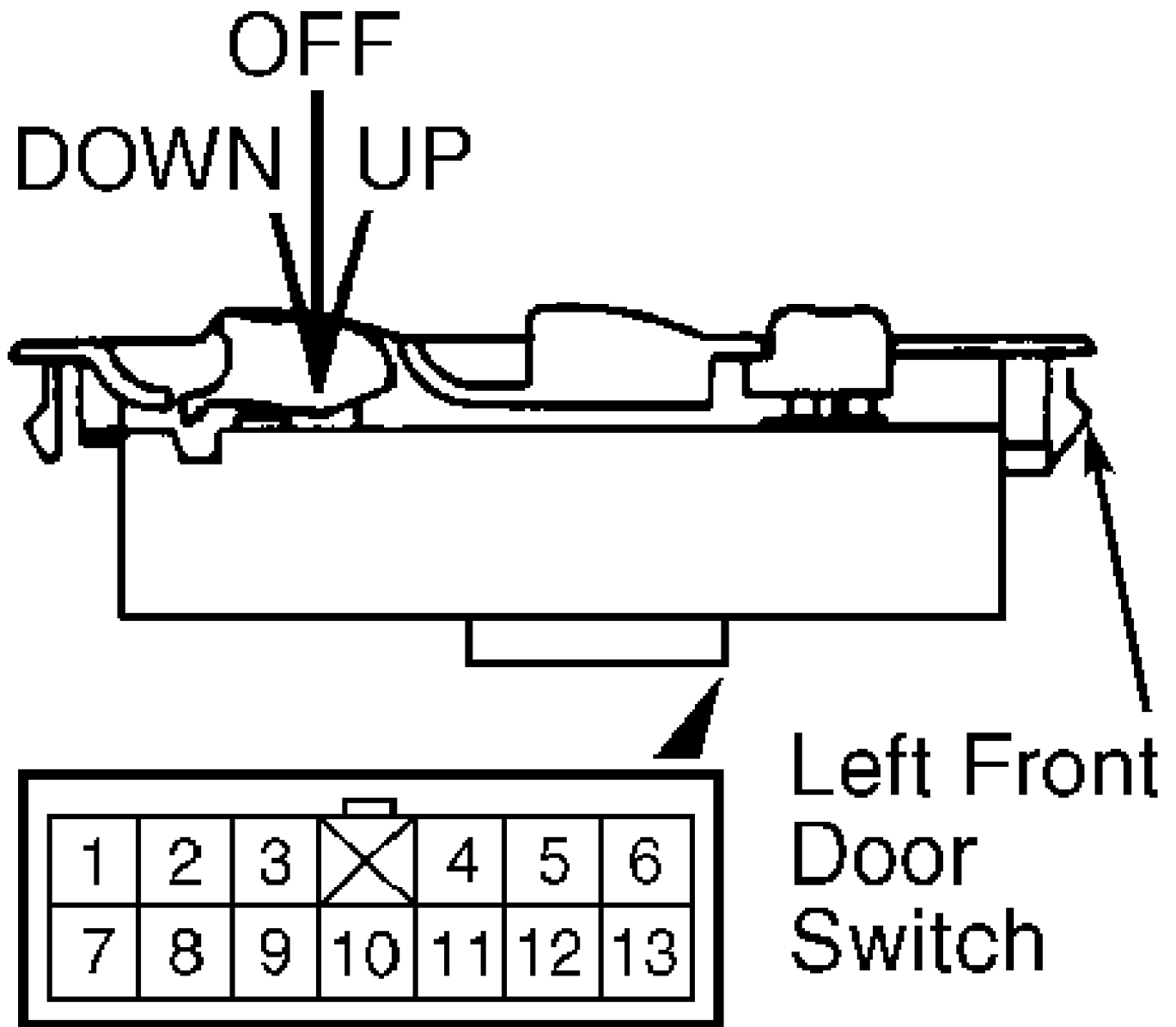
RIGHT FRONT SIDE WINDOW SWITCH CONTINUITY CHART

Switch Position	Check Continuity Between
OFF	Pins 1 & 7; Pins 2 & 5
UP	Pins 2 & 5; Pins 6 & 7
DOWN	Pins 1 & 7; Pins 5 & 6

REAR DOOR SIDE WINDOW SWITCH CONTINUITY CHART

Switch Position	Check Continuity Between

OFF	Pins 1 & 2; Pins 3 & 5
UP	Pins 1 & 2; Pins 3 & 4
DOWN	Pins 2 & 4; Pins 3 & 5



93E83182

Fig. 3: Driver's Power Window Switch Connector Terminal ID
 Courtesy of Mitsubishi Motor Sales of America.

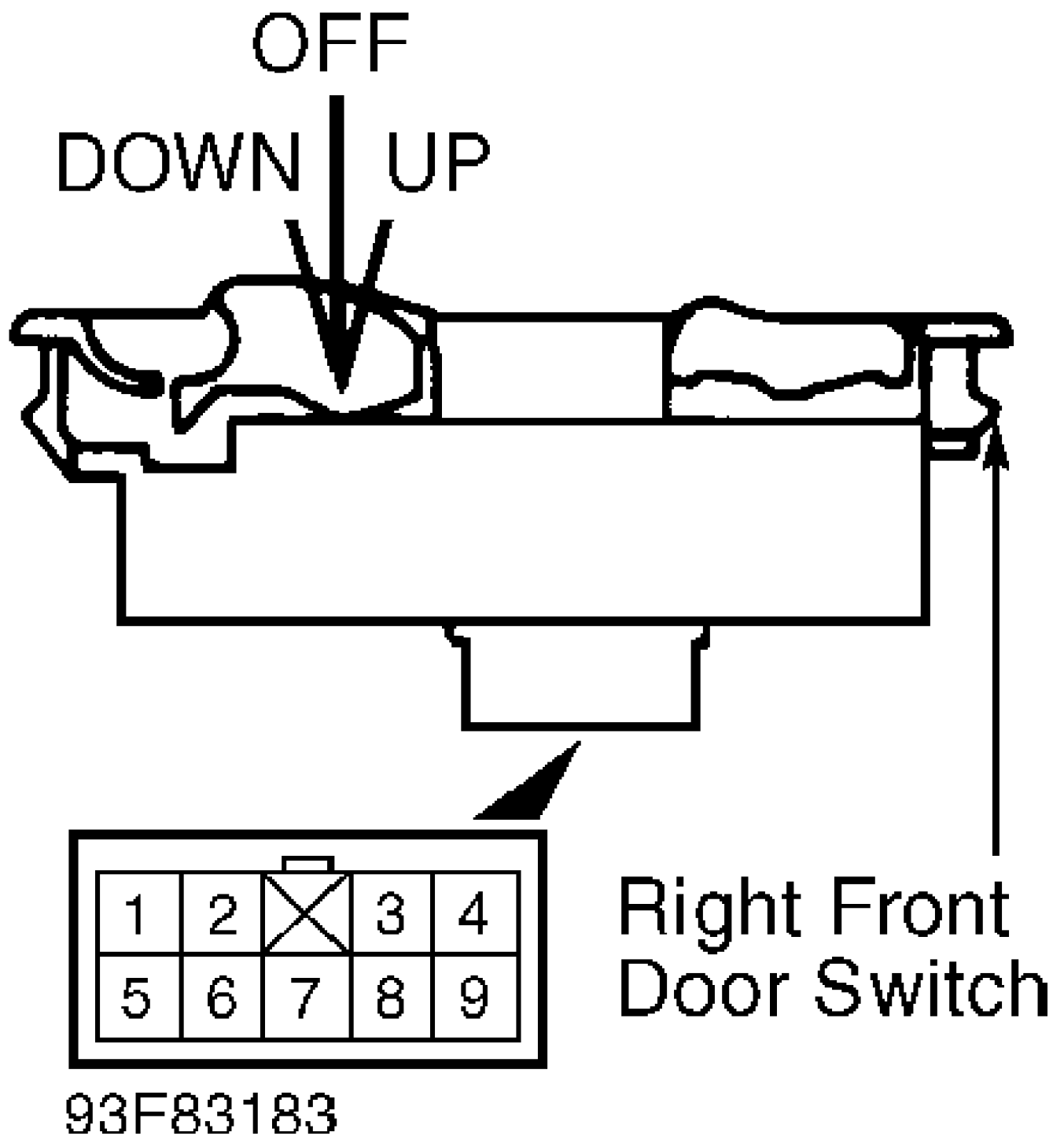
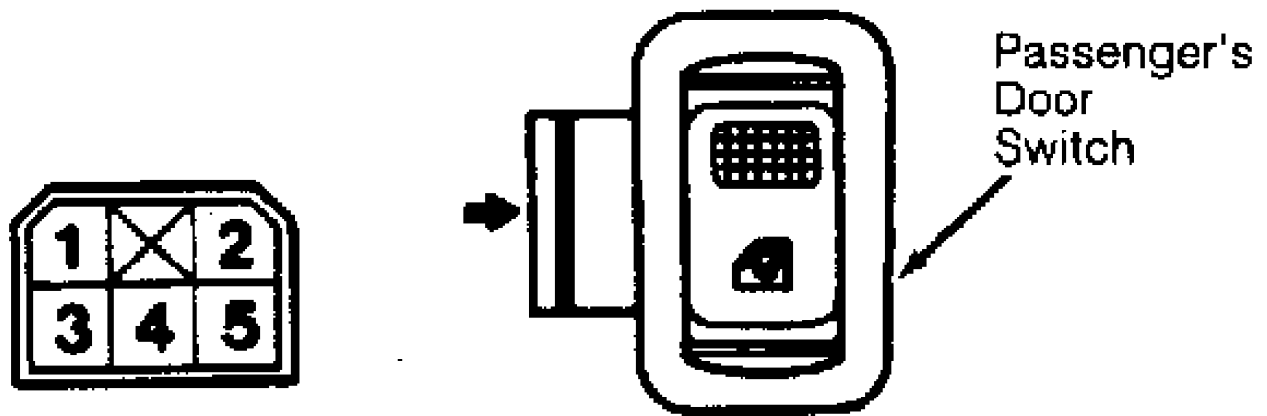


Fig. 4: Right Front Power Window Switch Connector Terminal ID
Courtesy of Mitsubishi Motor Sales of America.



COLT VISTA, EXPO, EXPO LRV,
GALANT, MONTERO & SUMMIT WAGON

93C83180

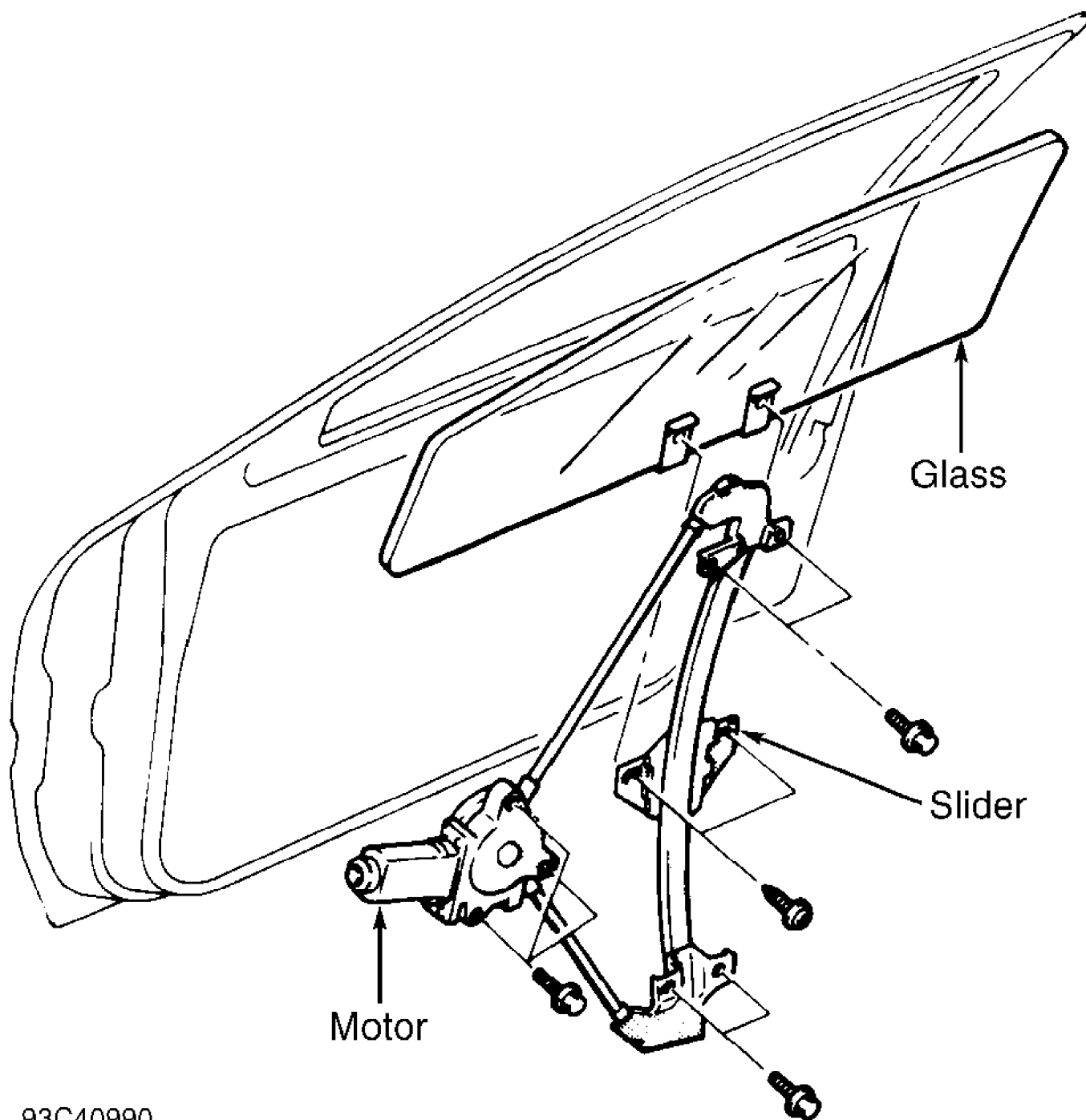
Fig. 5: Rear Door Power Window Switch Connector Terminal ID
Courtesy of Mitsubishi Motor Sales of America.

REMOVAL & INSTALLATION

POWER WINDOW MOTOR

Removal & Installation

Remove door trim panel and waterproof shield. Remove glass retaining screws and glass. See Fig. 6. Remove motor and slider assembly retaining bolts and remove motor and slider assembly from door. To install, reverse removal procedure.



93C40990

Fig. 6: Removing Power Window Motor & Slider Assembly
Courtesy of Mitsubishi Motor Sales of America.

WIRING DIAGRAMS

See appropriate chassis wiring diagram in the WIRING DIAGRAMS section.

PRE-ALIGNMENT CHECKS

1993 Mitsubishi Montero

Wheel Alignment
PRE-ALIGNMENT INSPECTION PROCEDURES

PRE-ALIGNMENT CHECKS

Before making wheel alignment adjustment, perform the following checks:

- 1) Tires should be equal in size and runout must not be excessive. Tires and wheels should be in balance, and inflated to manufacturer's specifications.
- 2) Wheel bearings must be properly adjusted. Steering linkage and suspension must not have excessive looseness. Check for wear in tie rod ends and ball joints.
- 3) Steering gear box must not have excessive play. Check and adjust to manufacturer's specifications.
- 4) Vehicle must be at curb height with full fuel load and spare tire in vehicle. No extra load should be on vehicle.
- 5) Vehicle must be level with floor and with suspension settled. Jounce front and rear of vehicle several times and allow it to settle to normal curb height.
- 6) If steering wheel is not centered with front wheels in straight-ahead position, correct by shortening one tie rod adjusting sleeve and lengthening opposite sleeve equal amounts.
- 7) Ensure wheel lug nuts are tightened to torque specifications.

RIDING HEIGHT ADJUSTMENT

1993 Mitsubishi Montero

1993 WHEEL ALIGNMENT
Mitsubishi Specifications & Procedures

Montero

RIDING HEIGHT ADJUSTMENT

NOTE: On vehicles with electronic chassis controls, ensure all systems are functional before attempting to adjust riding height or wheel alignment.

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.

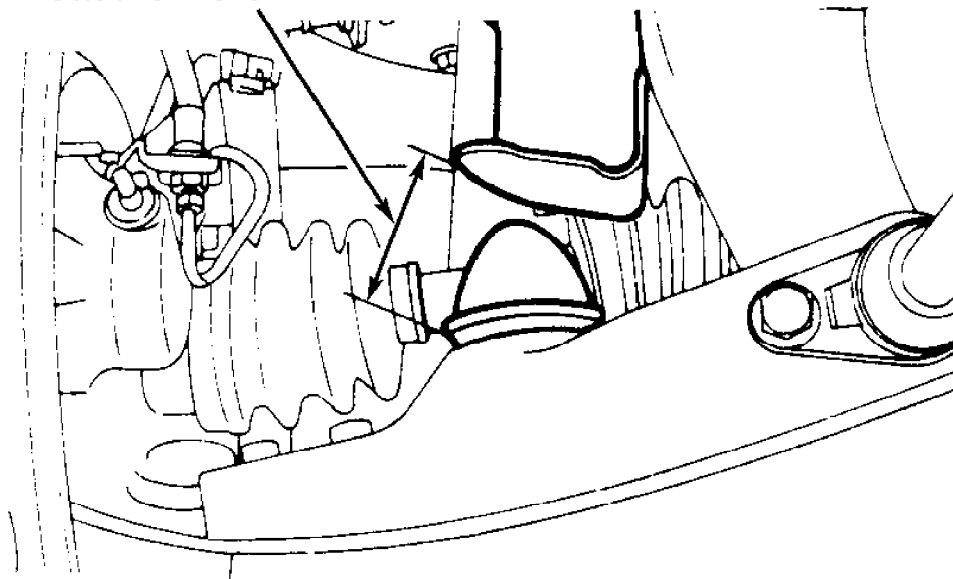
2) Check riding height from front to rear and from side to side. If riding height is not as specified, adjust torsion bar anchor arm nut until correct height is obtained. See RIDING HEIGHT SPECIFICATIONS (FRONT) table.

RIDING HEIGHT SPECIFICATIONS TABLE (FRONT)

Application	(1) In. (mm)
Montero	0.83-0.91 (21.0-23.0)

(1) - Distance between lower control bumper and bracket.
See Fig. 1.

Measure Here



92E00228

Fig. 1: Measuring Riding Height (Pickup 4WD & Ram-50 4WD Shown; Montero Is Similar)
Courtesy of Mitsubishi Motor Sales of America.

SCHEDULED SERVICES

1993 Mitsubishi Montero

1987-95 MAINTENANCE
Mitsubishi Maintenance & Service Intervals

Montero

* PLEASE READ THIS FIRST *

- NOTE: All SERVICE SCHEDULES are listed for normal service vehicles. If vehicle is operated under severe service conditions, see SEVERE SERVICE REQUIREMENTS (PERFORM W/SERVICE SCHEDULES) for items requiring additional maintenance.
- NOTE: This article contains scheduled maintenance service information. Fluid types and capacities listed with each service in this article are only those necessary to perform that scheduled service. For specifications pertaining to fluid capacities for the entire vehicle, fuse and circuit breaker identification, wheel and tire size, battery type, warranty information, or model identification refer to the MAINTENANCE INFORMATION article in this section.

CAUTIONS & WARNINGS

SUPPLEMENTAL RESTRAINT SYSTEM (AIR BAG)

- NOTE: See the AIR BAG RESTRAINT SYSTEM 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: 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: 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 the appropriate A/C SYSTEM GENERAL SERVICING article in the AIR CONDITIONING & HEAT section.

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.

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.

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.

BATTERY WARNING

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 appropriate COMPUTER RELEARN PROCEDURES article in the GENERAL INFORMATION section below.

BRAKE FLUID

For vehicles equipped with a traction control system, idle engine while pouring brake fluid into reservoir.

CATALYTIC CONVERTER

Continued operation of vehicle with a severe malfunction could cause converter to overheat, resulting in possible damage to converter and vehicle.

ELECTROSTATIC DISCHARGE SENSITIVE (ESD) PARTS

WARNING: Many solid state electrical components can be damaged by static electricity (ESD). Some will display a warning label, but many will not. Discharge personal static electricity by

touching a metal ground point on the vehicle prior to servicing any ESD sensitive component.

ENGINE OIL

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

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.

POWER STEERING FLUID

When adding power steering fluid, avoid spilling. Damage to alternator, located beneath power steering reservoir, could result.

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.

SERVICE POINT LOCATIONS

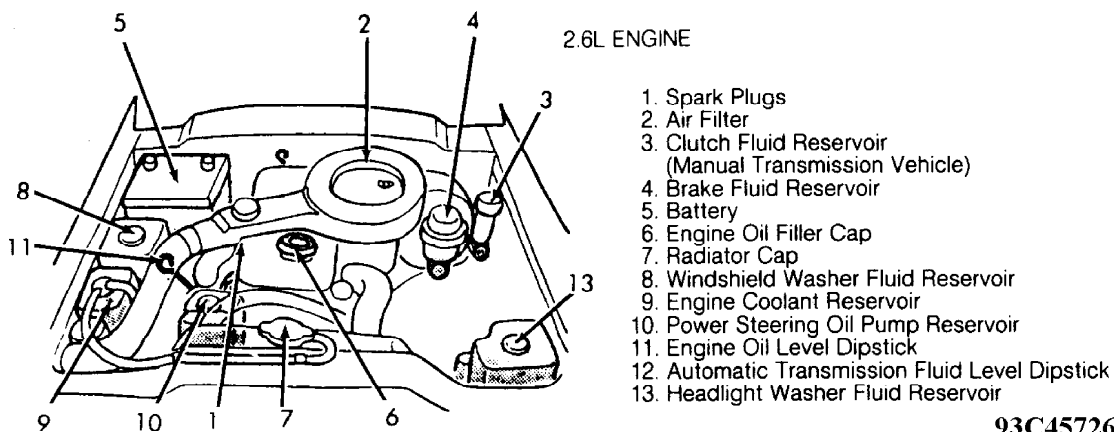


Fig. 1: Service Point Locations (1987-91 2.6L 4-Cylinder Engine)
Courtesy of Mitsubishi Motor Sales of America.

93C45726

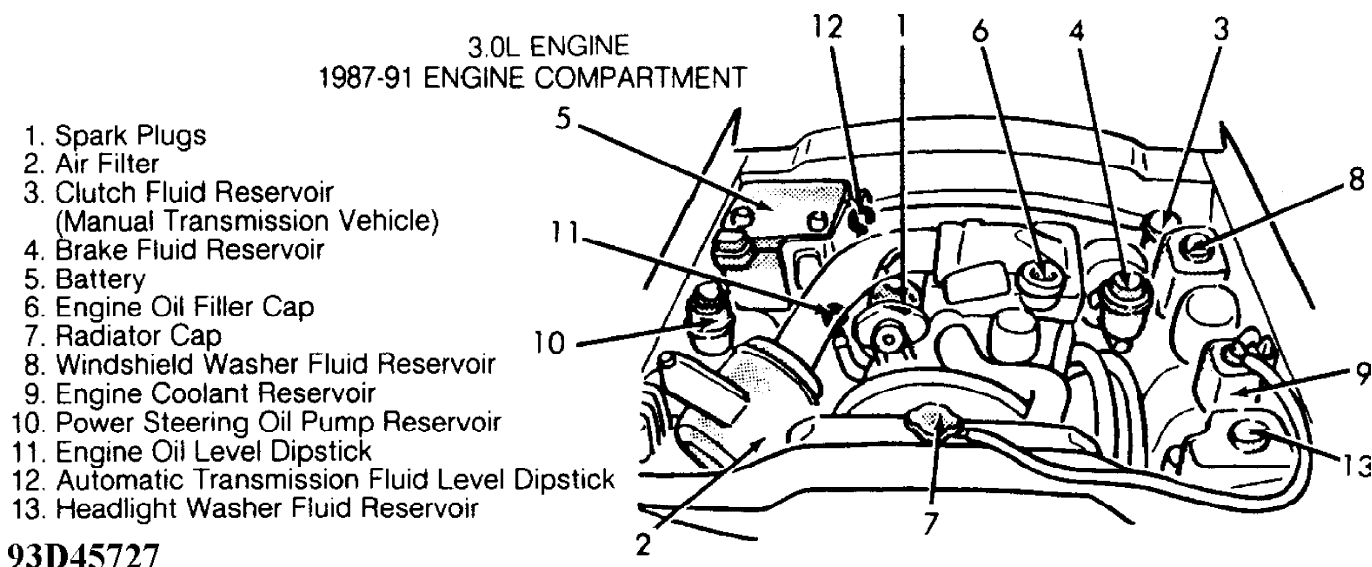


Fig. 2: Service Point Locations (1987-91 3.0L V6 Engine)
Courtesy of Mitsubishi Motor Sales of America.

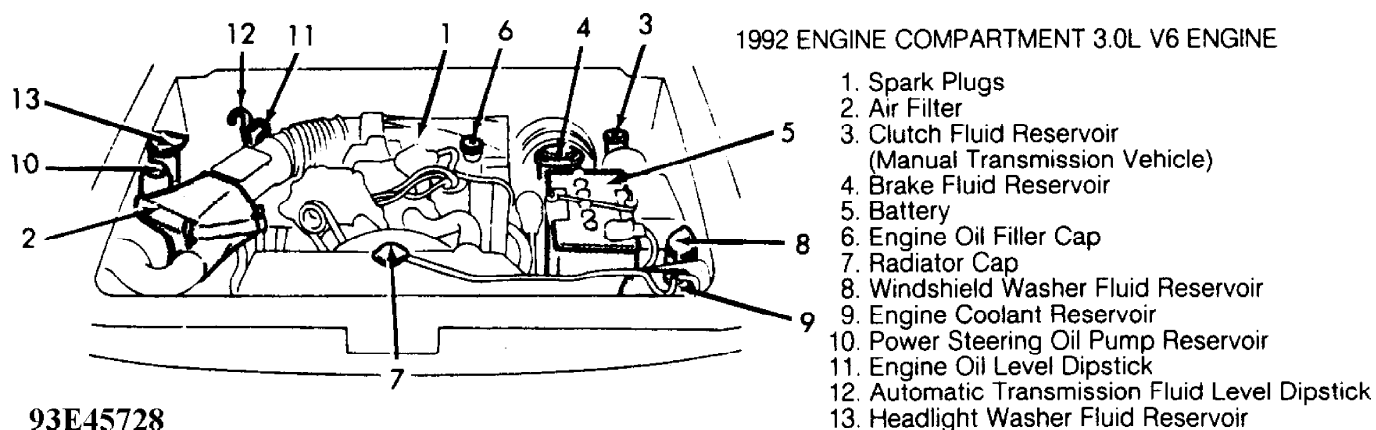
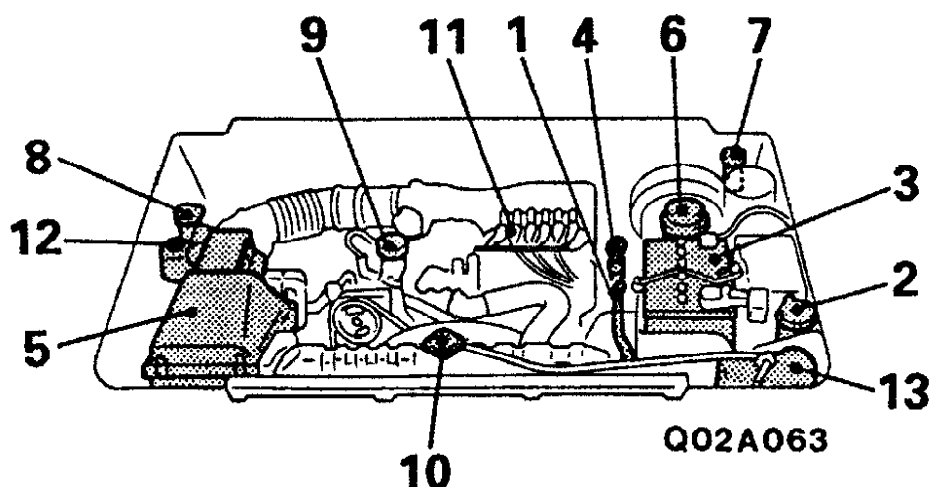


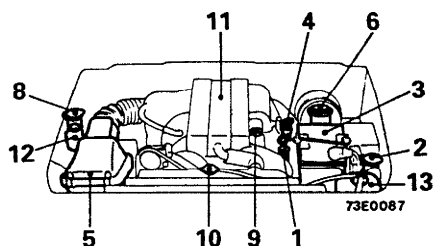
Fig. 3: Service Point Locations (1992-95 3.0L V6 Engine)
Courtesy of Mitsubishi Motor Sales of America.



1 – Engine oil level dipstick	8 – Headlight washer reservoir (if so equipped)
2 – Windshield washer reservoir	9 – Engine oil filler cap
3 – Battery	10 – Radiator cap
4 – Automatic transmission fluid level dipstick (vehicles with an automatic transmission)	11 – Spark plug
5 – Air cleaner element	12 – Power steering fluid reservoir
6 – Brake fluid reservoir	13 – Engine coolant reservoir
7 – Clutch fluid reservoir (vehicle with a manual transmission)	

50F13362

Fig. 4: Service Point Locations (1994-95 3.0L V6 Engine - 24 Valve)
Courtesy of Mitsubishi Motor Sales of America.



1 – Engine oil level dipstick	8 – Headlight washer reservoir (if so equipped)
2 – Windshield washer reservoir	9 – Engine oil filler cap
3 – Battery	10 – Radiator cap
4 – Automatic transmission fluid level dipstick (vehicles with an automatic transmission)	11 – Spark plug
5 – Air cleaner element	12 – Power steering fluid reservoir
6 – Brake fluid reservoir	13 – Engine coolant reservoir

50G13363

Fig. 5: Service Point Locations (1994-95 3.5L V6 Engine)
Courtesy of Mitsubishi Motor Sales of America.

CAMSHAFT TIMING BELT REPLACEMENT INFORMATION

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

Replace camshaft timing belt at 60,000 mile intervals.

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)

- * Short Trips In Freezing Temperatures
- * Towing Or Commercial Use
- * Driving Off-Road Or In Salty Or Sandy Areas
- * Severe Dust Conditions
- * Hot Weather, Stop-And-Go Driving
- * Extensive Idling

SEVERE SERVICE REQUIREMENTS (PERFORM W/SERVICE SCHEDULES)

NOTE: The following services are to be performed on vehicles subjected to severe service. See SEVERE & NORMAL SERVICE DEFINITIONS. This service is to be performed in addition to the normal services listed in the NORMAL MAINTENANCE SERVICE SCHEDULES.

SEVERE SERVICE CONDITIONS/ACTIONS TABLE

Condition	Action	Item	Perform Every (1)

Short Trips In Freezing Temperatures	Replace	Engine Oil	3,000 Miles or 3 Months
	Inspect	Cooling System	6,000 Miles or 6 Months
	Replace	Engine Oil Filter	6,000 Miles or 6 Months
	Inspect	Throttle Position	ONLY ONCE AT FIRST: 15,000 Miles
	Inspect	Drive Belt Tension	START AT: 15,000 Miles; REPEAT EVERY SUBSEQUENT: 30,000 Miles
	Replace	A/T Fluid	30,000 Miles
	Replace	M/T Fluid	30,000 Miles
	Replace	Transfer Case Fluid	30,000 Miles
Towing Or Commercial Use	Replace	Engine Oil	3,000 Miles or 3 Months
	Inspect	Cooling System	6,000 Miles or 6 Months
	Replace	Engine Oil Filter	6,000 Miles or 6 Months
	Inspect	Throttle Position	ONLY ONCE AT FIRST: 15,000 Miles
	Inspect	Drive Belt Tension	START AT: 15,000 Miles; REPEAT EVERY SUBSEQUENT: 30,000 Miles
	Replace	A/T Fluid	30,000 Miles
	Replace	M/T Fluid	30,000 Miles
	Replace	Transfer Case Fluid	30,000 Miles
Driving Off-Road Or In Salty Or Sandy Areas	Replace	Engine Oil	3,000 Miles or 3 Months
	Inspect	Cooling System	6,000 Miles or 6 Months
	Replace	Engine Oil Filter	6,000 Miles or 6 Months
	Inspect	Throttle Position	ONLY ONCE AT FIRST: 15,000 Miles
	Inspect	Drive Belt Tension	START AT: 15,000 Miles; REPEAT EVERY SUBSEQUENT: 30,000 Miles
	Replace	A/T Fluid	30,000 Miles
	Replace	M/T Fluid	30,000 Miles

	Replace	Transfer Case Fluid	30,000 Miles
Severe Dust Conditions	Replace	Engine Oil	3,000 Miles or 3 Months
	Inspect	Cooling System	6,000 Miles or 6 Months
	Replace	Engine Oil Filter	6,000 Miles or 6 Months
	Inspect	Throttle Position	ONLY ONCE AT FIRST: 15,000 Miles
	Inspect	Drive Belt Tension	START AT: 15,000 Miles; REPEAT EVERY SUBSEQUENT: 30,000 Miles
	Replace	A/T Fluid	30,000 Miles
	Replace	M/T Fluid	30,000 Miles
	Replace	Transfer Case Fluid	30,000 Miles
Hot Weather, Stop-And-Go Driving	Replace	Engine Oil	3,000 Miles or 3 Months
	Inspect	Cooling System	6,000 Miles or 6 Months
	Replace	Engine Oil Filter	6,000 Miles or 6 Months
	Inspect	Throttle Position	ONLY ONCE AT FIRST: 15,000 Miles
	Inspect	Drive Belt Tension	START AT: 15,000 Miles; REPEAT EVERY SUBSEQUENT: 30,000 Miles
	Replace	A/T Fluid	30,000 Miles
	Replace	M/T Fluid	30,000 Miles
	Replace	Transfer Case Fluid	30,000 Miles
Extensive Idling	Replace	Engine Oil	3,000 Miles or 3 Months
	Inspect	Cooling System	6,000 Miles or 6 Months
	Replace	Engine Oil Filter	6,000 Miles or 6 Months
	Inspect	Throttle Position	ONLY ONCE AT FIRST: 15,000 Miles
	Inspect	Drive Belt Tension	START AT: 15,000 Miles; REPEAT EVERY SUBSEQUENT: 30,000 Miles

	Replace	A/T Fluid	30,000 Miles
	Replace	M/T Fluid	30,000 Miles
	Replace	Transfer Case Fluid	30,000 Miles
(1) - Perform these services at the mileage or number of months (since the last time), whichever comes first.			

NORMAL MAINTENANCE SERVICE SCHEDULES

The following service schedules refer to vehicles driven under normal operating conditions. For vehicles driven under severe conditions, additional services may be necessary. See SEVERE SERVICE REQUIREMENTS (PERFORM W/SERVICE SCHEDULES) above in this article for additional service requirements.

7500 MILE (12,000 KM) SERVICE

7500 MILE (12,000 KM) SERVICE

Service Or Inspect	
	Change Engine Oil
Lubrication Specifications	
Application	Specification
Engine Oil (1)	
Minimum Temperature	
Greater Than 32°F (0°C)	 SAE 20W-40 Or 20W-50 API SG/CD
Greater Than -10°F (-23°C)	 SAE 10W-30, 10W-40 API SG/CD
Maximum Temperature	
Less Than 60°F (16°C)	 SAE 5W-30 Or 5W-40 API SG/CD
(1) - Since temperature ranges for different oil grades overlap, brief fluctuations in outside temperatures are no cause for concern.	
Fluid Capacities	
Application	Quantity
Engine Oil	
1987	5.2 Qts. (5.0L)
1988	5.0 Qts. (4.8L)
1989-92	5.5 Qts. (5.3L)
1993-95	5.2 Qts. (4.9L)

15,000 MILE (24,000 KM) SERVICE

15,000 MILE (24,000 KM) SERVICE

Service Or Inspect	
	Verify Last Major Service Was Performed

	Fluid Levels
	Braking System
	Drive Shaft Boots
	Replace
	Engine Oil
	Oil Filter
	Lubrication Specifications
Application	Specification
Brake & Clutch Fluid	DOT 3 Or DOT 4
Engine Coolant	Ethylene-Glycol Antifreeze Coolant
Engine Oil (1)	
Minimum Temperature	
Greater Than 32°F (0°C)	SAE 20W-40 Or 20W-50 API SG/CD
Greater Than -10°F (-23°C)	SAE 10W-30, 10W-40 API SG/CD
Maximum Temperature	
Less Than 60°F (16°C)	SAE 5W-30 Or 5W-40 API SG/CD
Front Axle & Conventional Rear Axle	
Minimum Temperature	
Greater Than -10°F (-23°C)	SAE 90, 85W-90, 80W-90 API GL-5
Maximum Temperature	
Less Than -30°F (-34°C)	SAE 75W API GL-5
Power Steering Fluid	Dexron-II ATF
Rear Axle (With Limited Slip Differential)	Hypoid Gear Oil (8149630EX) Or Equivalent
Transmission	
Automatic	Dexron-II ATF
Manual Transaxle & Transfer Case (4WD)	SAE 75W-85W, 75W-90 API GL-4 Or GL-5
(1) - Since temperature ranges for different oil grades overlap, brief fluctuations in outside temperatures are no cause for concern.	
	Fluid Capacities
Application	Quantity
Automatic Transmission	
1987-93	7.6 Qts. (7.2L)
1994 (3.0L SOHC)	7.6 Qts. (7.2L)
1994 (3.0L DOHC & 3.5L)	9.0 Qts. (8.5L)
1995	7.9 Qts. (7.5L)
Cooling System	
1987-88	8.5 Qts. (8.0L)
1989-95	
2.6L	9.7 Qts. (9.2L)
3.0L	10.0 Qts. (9.5L)
1994-95	
3.5L	10.0 Qts. (9.5L)
Differential	
1987-88	1.9 Qts. (1.8L)

1989-94		
2.6L	.....	1.9 Qts. (1.8L)
3.0L	.....	2.7 Qts. (2.6L)
1994		
3.5L	.....	2.7 Qts. (2.6L)
1995		
3.0L	.....	2.7 Qts. (2.6L)
3.5L	.....	3.3 Qts. (3.2L)
Engine Oil		
1987	.....	5.2 Qts. (5.0L)
1988	.....	5.0 Qts. (4.8L)
1989-92	.....	5.5 Qts. (5.3L)
1993-94	.....	5.2 Qts. (4.9L)
Manual Transmission		
1987-91	.....	2.3 Qts. (2.2L)
1992	.....	2.4 Qts. (2.3L)
1993-94	.....	2.6 Qts. (2.5L)
Transfer Case		
1987-91	.....	2.3 Qts. (2.2L)
1992-94	.....	2.4 Qts. (2.3L)

22,500 MILE (36,000 KM) SERVICE

22,500 MILE (36,000 KM) SERVICE

Service Or Inspect	
	Verify Last Major Service Was Performed
	Change Engine Oil
Lubrication Specifications	
Application	Specification
Engine Oil (1)	
Minimum Temperature	
Greater Than 32°F (0°C)	 SAE 20W-40 Or 20W-50 API SG/CD
Greater Than -10°F (-23°C)	 SAE 10W-30, 10W-40 API SG/CD
Maximum Temperature	
Less Than 60°F (16°C)	 SAE 5W-30 Or 5W-40 API SG/CD
(1) - Since temperature ranges for different oil grades overlap, brief fluctuations in outside temperatures are no cause for concern.	
Fluid Capacities	
Application	Quantity
Engine Oil	
1987	 5.2 Qts. (5.0L)
1988	 5.0 Qts. (4.8L)
1989-92	 5.5 Qts. (5.3L)
1993-94	 5.2 Qts. (4.9L)

30,000 MILE (48,000 KM) SERVICE

30,000 MILE (48,000 KM) SERVICE

Service Or Inspect	
	Verify Last Major Service Was Performed
	Valve Clearance (Jet Valve Only)
	Manual Transmission Oil & Transfer Case
	Carburetor Choke Mechanism & Linkage (If Equipped)
	Disc Brake Pads
	Drum Brake Linings & Rear Wheel Cylinders
	Brake Hoses
	Fuel & Vapor Hoses
	Steering Linkage Seals & Drive Shaft Boots
	Lubricate Ball Joint
	Power Steering Fluid (If Equipped)
	Power Steering Hoses (If Equipped)
	Lubricate Front Wheel Bearing
	Drive Axle Fluid (Without Limited-Slip Differential)
	Lubricate Drive Shaft Joints
	Exhaust System
	Lubricate Upper Control Arm Bushings
	Drive Belt (Water Pump & Alternator)
Replace	
	Air Filter
	Spark Plugs
	Drive Axle Fluid (With Limited-Slip Differential)
	Automatic Transmission & Transfer Case Fluids
	Engine Oil & Filter
	Engine Coolant
Lubrication Specifications	
Application	Specification
Brake & Clutch Fluid	DOT 3 Or DOT 4
Engine Coolant	Ethylene-Glycol Antifreeze Coolant
Engine Oil (1)	
Minimum Temperature	
Greater Than 32°F (0°C)	SAE 20W-40 Or 20W-50 API SG/CD
Greater Than -10°F (-23°C)	SAE 10W-30, 10W-40 API SG/CD
Maximum Temperature	

Less Than 60°F (16°C) SAE 5W-30 Or 5W-40 API SG/CD
 Front Axle & Conventional Rear Axle
 Minimum Temperature
 Greater Than -10°F (-23°C) SAE 90, 85W-90, 80W-90
 API GL-5
 Maximum Temperature
 Less Than -30°F (-34°C) SAE 75W API GL-5
 Power Steering Fluid Dexron-II ATF
 Rear Axle (With Limited
 Slip Differential) Hypoid Gear Oil (8149630EX) Or
 Equivalent
 Transmission
 Automatic Dexron-II ATF
 Manual Transaxle &
 Transfer Case (4WD) SAE 75W-85W, 75W-90 API
 GL-4 Or GL-5

(1) - Since temperature ranges for different oil grades overlap,
 brief fluctuations in outside temperatures are no cause for
 concern.

Fluid Capacities

Application	Quantity
Automatic Transmission	
1987-93	7.6 Qts. (7.2L)
1994 (3.0L SOHC)	7.6 Qts. (7.2L)
1994 (3.0L DOHC & 3.5L)	9.0 Qts. (8.5L)
1995	7.9 Qts. (7.5L)
Cooling System	
1987-88	8.5 Qts. (8.0L)
1989-95	
2.6L	9.7 Qts. (9.2L)
3.0L	10.0 Qts. (9.5L)
1994-95	
3.5L	10.0 Qts. (9.5L)
Differential	
1987-88	1.9 Qts. (1.8L)
1989-94	
2.6L	1.9 Qts. (1.8L)
3.0L	2.7 Qts. (2.6L)
1994	
3.5L	2.7 Qts. (2.6L)
1995	
3.0L	2.7 Qts. (2.6L)
3.5L	3.3 Qts. (3.2L)
Engine Oil	
1987	5.2 Qts. (5.0L)
1988	5.0 Qts. (4.8L)
1989-92	5.5 Qts. (5.3L)
1993-94	5.2 Qts. (4.9L)
Manual Transmission	
1987-91	2.3 Qts. (2.2L)
1992	2.4 Qts. (2.3L)
1993-94	2.6 Qts. (2.5L)
Transfer Case	
1987-91	2.3 Qts. (2.2L)
1992-94	2.4 Qts. (2.3L)

37,500 MILE (60,000 KM) SERVICE

37,500 MILE (60,000 KM) SERVICE

Service Or Inspect	
	Verify Last Major Service Was Performed
	Change Engine Oil
Lubrication Specifications	
Application	Specification
Engine Oil (1)	
Minimum Temperature	
Greater Than 32°F (0°C)	 SAE 20W-40 Or 20W-50 API SG/CD
Greater Than -10°F (-23°C)	 SAE 10W-30, 10W-40 API SG/CD
Maximum Temperature	
Less Than 60°F (16°C)	 SAE 5W-30 Or 5W-40 API SG/CD
(1) - Since temperature ranges for different oil grades overlap, brief fluctuations in outside temperatures are no cause for concern.	
Fluid Capacities	
Application	Quantity
Engine Oil	
1987	5.2 Qts. (5.0L)
1988	5.0 Qts. (4.8L)
1989-92	5.5 Qts. (5.3L)
1993-94	5.2 Qts. (4.9L)

45,000 MILE (72,000 KM) SERVICE

45,000 MILE (72,000 KM) SERVICE

Service Or Inspect	
	Verify Last Major Service Was Performed
	Fluid Levels
	Braking System
	Drive Shaft Boots
Replace	
	Engine Oil
	Oil Filter
Lubrication Specifications	
Application	Specification
Brake & Clutch Fluid	DOT 3 Or DOT 4
Engine Coolant	Ethylene-Glycol Antifreeze Coolant
Engine Oil (1)	

Minimum Temperature
 Greater Than 32°F (0°C) SAE 20W-40 Or 20W-50 API SG/CD
 Greater Than -10°F (-23°C) SAE 10W-30, 10W-40 API SG/CD
 Maximum Temperature
 Less Than 60°F (16°C) SAE 5W-30 Or 5W-40 API SG/CD
 Front Axle & Conventional Rear Axle
 Minimum Temperature
 Greater Than -10°F (-23°C) SAE 90, 85W-90, 80W-90
 API GL-5
 Maximum Temperature
 Less Than -30°F (-34°C) SAE 75W API GL-5
 Power Steering Fluid Dexron-II ATF
 Rear Axle (With Limited
 Slip Differential) Hypoid Gear Oil (8149630EX) Or
 Equivalent
 Transmission
 Automatic Dexron-II ATF
 Manual Transaxle &
 Transfer Case (4WD) SAE 75W-85W, 75W-90 API
 GL-4 Or GL-5
 (1) - Since temperature ranges for different oil grades overlap,
 brief fluctuations in outside temperatures are no cause for
 concern.

Fluid Capacities

Application	Quantity
Automatic Transmission	
1987-93	7.6 Qts. (7.2L)
1994 (3.0L SOHC)	7.6 Qts. (7.2L)
1994 (3.0L DOHC & 3.5L)	9.0 Qts. (8.5L)
1995	7.9 Qts. (7.5L)
Cooling System	
1987-88	8.5 Qts. (8.0L)
1989-95	
2.6L	9.7 Qts. (9.2L)
3.0L	10.0 Qts. (9.5L)
1994-95	
3.5L	10.0 Qts. (9.5L)
Differential	
1987-88	1.9 Qts. (1.8L)
1989-94	
2.6L	1.9 Qts. (1.8L)
3.0L	2.7 Qts. (2.6L)
1994	
3.5L	2.7 Qts. (2.6L)
1995	
3.0L	2.7 Qts. (2.6L)
3.5L	3.3 Qts. (3.2L)
Engine Oil	
1987	5.2 Qts. (5.0L)
1988	5.0 Qts. (4.8L)
1989-92	5.5 Qts. (5.3L)
1993-94	5.2 Qts. (4.9L)
Manual Transmission	
1987-91	2.3 Qts. (2.2L)
1992	2.4 Qts. (2.3L)
1993-94	2.6 Qts. (2.5L)
Transfer Case	
1987-91	2.3 Qts. (2.2L)
1992-94	2.4 Qts. (2.3L)

50,000 MILE (80,000 KM) SERVICE (1987-90)

50,000 MILE (80,000 KM) SERVICE (1987-90)

Service Or Inspect			
	Verify Last Major Service Was Performed		
	Fuel System (Tank, Lines & Connections)		
	Carburetor Or Throttle Body Mounting		
Replace			
	Fuel Filter		
	Fuel, Water & Vapor Hoses		
	EGR Valve		
	Oxygen Sensor		
Service Labor Times			
Application		Hours	
		30,000 (60,000)	50,000
Application		Mile Service	Mile Service
2.6L 4-Cylinder			
Automatic Transmission		 7.9 (8.9)	 2.6
Manual Transmission		 6.9 (7.9)	 2.6
3.0L V6			
Automatic Transmission		 6.1 (10.6)	 2.6
Manual Transmission		 5.1 (9.6)	 2.6

52,500 MILE (84,000 KM) SERVICE

52,500 MILE (84,000 KM) SERVICE

Service Or Inspect	
	Verify Last Major Service Was Performed
	Change Engine Oil
Lubrication Specifications	
Application	Specification
Engine Oil (1)	
Minimum Temperature	
Greater Than 32°F (0°C)	 SAE 20W-40 Or 20W-50 API SG/CD
Greater Than -10°F (-23°C)	 SAE 10W-30, 10W-40 API SG/CD
Maximum Temperature	
Less Than 60°F (16°C)	 SAE 5W-30 Or 5W-40 API SG/CD
(1) - Since temperature ranges for different oil grades overlap, brief fluctuations in outside temperatures are no cause for	

concern.

Fluid Capacities

Application	Quantity
Engine Oil	
1987	5.2 Qts. (5.0L)
1988	5.0 Qts. (4.8L)
1989-92	5.5 Qts. (5.3L)
1993-94	5.2 Qts. (4.9L)

60,000 MILE (96,000 KM) SERVICE

60,000 MILE (96,000 KM) SERVICE

Service Or Inspect	
	Verify Last Major Service Was Performed
	Valve Clearance (Jet Valve Only)
	Manual Transmission Oil & Transfer Case
	Carburetor Choke Mechanism & Linkage (2.6L Engine)
	Crankcase Emission Control System (PCV Valve)
	Evaporative Emission Control System
	Distributor Cap, Rotor & Spark Advanced System
	Intake Temperature Control System
	Secondary Air System
	Front Disc Pads
	Rear Drum Brake Linings & Wheel & Cylinders
	Brake Hoses
	Steering Linkage Seals & Drive Shaft Boots
	Lubricate Ball Joints
	Lubricate Front Wheel Bearing
	Drive Axle Fluid (Without Limited-Slip Differential)
	Lubricate Drive Shaft Joints
	Exhaust System
	Drive Belt (Water Pump & Alternator)
	Vacuum, Water, Crankcase Ventilation & Secondary Air Hoses
Replace	
	Air Filter

	Fuel Filter
	Spark Plugs
	Ignition Cables
	Camshaft Timing Belt
	Engine Coolant
	Drive Axle Fluid (With Limited-Slip Differential)
	Engine Oil & Filter
	Automatic Transmission & Transfer Case Fluids
	Vacuum Control System Solenoid Valve Air Filter
Lubrication Specifications	
Application	Specification
Brake & Clutch Fluid	DOT 3 Or DOT 4
Engine Coolant	Ethylene-Glycol Antifreeze Coolant
Engine Oil (1)	
Minimum Temperature	
Greater Than 32°F (0°C)	SAE 20W-40 Or 20W-50 API SG/CD
Greater Than -10°F (-23°C)	SAE 10W-30, 10W-40 API SG/CD
Maximum Temperature	
Less Than 60°F (16°C)	SAE 5W-30 Or 5W-40 API SG/CD
Front Axle & Conventional Rear Axle	
Minimum Temperature	
Greater Than -10°F (-23°C)	SAE 90, 85W-90, 80W-90 API GL-5
Maximum Temperature	
Less Than -30°F (-34°C)	SAE 75W API GL-5
Power Steering Fluid	Dexron-II ATF
Rear Axle (With Limited Slip Differential)	Hypoid Gear Oil (8149630EX) Or Equivalent
Transmission	
Automatic	Dexron-II ATF
Manual Transaxle & Transfer Case (4WD)	SAE 75W-85W, 75W-90 API GL-4 Or GL-5
(1) - Since temperature ranges for different oil grades overlap, brief fluctuations in outside temperatures are no cause for concern.	
Fluid Capacities	
Application	Quantity
Automatic Transmission	
1987-93	7.6 Qts. (7.2L)
1994 (3.0L SOHC)	7.6 Qts. (7.2L)
1994 (3.0L DOHC & 3.5L)	9.0 Qts. (8.5L)
1995	7.9 Qts. (7.5L)
Cooling System	
1987-88	8.5 Qts. (8.0L)
1989-95	

2.6L	9.7 Qts. (9.2L)
3.0L	10.0 Qts. (9.5L)
1994-95	
3.5L	10.0 Qts. (9.5L)
Differential	
1987-88	1.9 Qts. (1.8L)
1989-94	
2.6L	1.9 Qts. (1.8L)
3.0L	2.7 Qts. (2.6L)
1994	
3.5L	2.7 Qts. (2.6L)
1995	
3.0L	2.7 Qts. (2.6L)
3.5L	3.3 Qts. (3.2L)
Engine Oil	
1987	5.2 Qts. (5.0L)
1988	5.0 Qts. (4.8L)
1989-92	5.5 Qts. (5.3L)
1993-95	5.2 Qts. (4.9L)
Manual Transmission	
1987-91	2.3 Qts. (2.2L)
1992	2.4 Qts. (2.3L)
1993-95	2.6 Qts. (2.5L)
Transfer Case	
1987-91	2.3 Qts. (2.2L)
1992-95	2.4 Qts. (2.3L)

Service Labor Times

Application	Hours	
	30,000 (60,000)	50,000
Application	Mile Service	Mile Service
2.6L 4-Cylinder		
Automatic Transmission	7.9 (8.9)	2.6
Manual Transmission	6.9 (7.9)	2.6
3.0L V6		
Automatic Transmission	6.1 (10.6)	2.6
Manual Transmission	5.1 (9.6)	2.6

67,500 MILE (108,000 KM) SERVICE

67,500 MILE (108,000 KM) SERVICE

Service Or Inspect	
☐	Verify Last Major Service Was Performed
☐	Change Engine Oil
Lubrication Specifications	
Application	Specification
Engine Oil (1)	
Minimum Temperature	
Greater Than 32°F (0°C)	SAE 20W-40 Or 20W-50 API SG/CD
Greater Than -10°F (-23°C)	SAE 10W-30, 10W-40 API SG/CD
Maximum Temperature	
Less Than 60°F (16°C)	SAE 5W-30 Or 5W-40 API SG/CD

(1) - Since temperature ranges for different oil grades overlap, brief fluctuations in outside temperatures are no cause for concern.

Fluid Capacities

Application	Quantity
Engine Oil	
1987	5.2 Qts. (5.0L)
1988	5.0 Qts. (4.8L)
1989-92	5.5 Qts. (5.3L)
1993-95	5.2 Qts. (4.9L)

75,000 MILE (120,000 KM) SERVICE

75,000 MILE (120,000 KM) SERVICE

Service Or Inspect	
	Verify Last Major Service Was Performed
	Fluid Levels
	Braking System
	Drive Shaft Boots
Replace	
	Engine Oil
	Oil Filter
Lubrication Specifications	
Application	Specification
Brake & Clutch Fluid	DOT 3 Or DOT 4
Engine Coolant	Ethylene-Glycol Antifreeze Coolant
Engine Oil (1)	
Minimum Temperature	
Greater Than 32°F (0°C)	SAE 20W-40 Or 20W-50 API SG/CD
Greater Than -10°F (-23°C)	SAE 10W-30, 10W-40 API SG/CD
Maximum Temperature	
Less Than 60°F (16°C)	SAE 5W-30 Or 5W-40 API SG/CD
Front Axle & Conventional Rear Axle	
Minimum Temperature	
Greater Than -10°F (-23°C)	SAE 90, 85W-90, 80W-90 API GL-5
Maximum Temperature	
Less Than -30°F (-34°C)	SAE 75W API GL-5
Power Steering Fluid	Dexron-II ATF
Rear Axle (With Limited	
Slip Differential)	Hypoid Gear Oil (8149630EX) Or Equivalent
Transmission	
Automatic	Dexron-II ATF
Manual Transaxle &	
Transfer Case (4WD)	SAE 75W-85W, 75W-90 API

GL-4 Or GL-5

(1) - Since temperature ranges for different oil grades overlap, brief fluctuations in outside temperatures are no cause for concern.

Fluid Capacities

Application	Quantity
Automatic Transmission	
1987-93	7.6 Qts. (7.2L)
1994 (3.0L SOHC)	7.6 Qts. (7.2L)
1994 (3.0L DOHC & 3.5L)	9.0 Qts. (8.5L)
1995	7.9 Qts. (7.5L)
Cooling System	
1987-88	8.5 Qts. (8.0L)
1989-95	
2.6L	9.7 Qts. (9.2L)
3.0L	10.0 Qts. (9.5L)
1994-95	
3.5L	10.0 Qts. (9.5L)
Differential	
1987-88	1.9 Qts. (1.8L)
1989-94	
2.6L	1.9 Qts. (1.8L)
3.0L	2.7 Qts. (2.6L)
1994	
3.5L	2.7 Qts. (2.6L)
1995	
3.0L	2.7 Qts. (2.6L)
3.5L	3.3 Qts. (3.2L)
Engine Oil	
1987	5.2 Qts. (5.0L)
1988	5.0 Qts. (4.8L)
1989-92	5.5 Qts. (5.3L)
1993-95	5.2 Qts. (4.9L)
Manual Transmission	
1987-91	2.3 Qts. (2.2L)
1992	2.4 Qts. (2.3L)
1993-95	2.6 Qts. (2.5L)
Transfer Case	
1987-91	2.3 Qts. (2.2L)
1992-95	2.4 Qts. (2.3L)

82,500 MILE (132,000 KM) SERVICE

82,500 MILE (132,000 KM) SERVICE

Service Or Inspect	
	Verify Last Major Service Was Performed
	Change Engine Oil
Lubrication Specifications	
Application	Specification
Engine Oil (1)	
Minimum Temperature	

Greater Than 32°F (0°C)	.....	SAE 20W-40 Or 20W-50 API SG/CD
Greater Than -10°F (-23°C)	.....	SAE 10W-30, 10W-40 API SG/CD
Maximum Temperature		
Less Than 60°F (16°C)	.....	SAE 5W-30 Or 5W-40 API SG/CD
(1) - Since temperature ranges for different oil grades overlap, brief fluctuations in outside temperatures are no cause for concern.		
Fluid Capacities		
Application	Quantity	
Engine Oil		
1987	.....	5.2 Qts. (5.0L)
1988	.....	5.0 Qts. (4.8L)
1989-92	.....	5.5 Qts. (5.3L)
1993-95	.....	5.2 Qts. (4.9L)

90,000 MILE (144,000 KM) SERVICE

90,000 MILE (144,000 KM) SERVICE

Service Or Inspect	
	Verify Last Major Service Was Performed
	Valve Clearance (Jet Valve Only)
	Manual Transmission Oil & Transfer Case
	Carburetor Choke Mechanism & Linkage (If Equipped)
	Disc Brake Pads
	Drum Brake Linings & Rear Wheel Cylinders
	Brake Hoses
	Fuel & Vapor Hoses
	Steering Linkage Seals & Drive Shaft Boots
	Lubricate Ball Joint
	Power Steering Fluid (If Equipped)
	Power Steering Hoses (If Equipped)
	Lubricate Front Wheel Bearing
	Drive Axle Fluid (Without Limited-Slip Differential)
	Lubricate Drive Shaft Joints
	Exhaust System
	Lubricate Upper Control Arm Bushings
	Drive Belt (Water Pump & Alternator)

Replace	
Air Filter	
Spark Plugs	
Drive Axle Fluid (With Limited-Slip Differential)	
Automatic Transmission & Transfer Case Fluids	
Engine Oil & Filter	
Engine Coolant	
Lubrication Specifications	
Application	Specification
Brake & Clutch Fluid	DOT 3 Or DOT 4
Engine Coolant	Ethylene-Glycol Antifreeze Coolant
Engine Oil (1)	
Minimum Temperature	
Greater Than 32°F (0°C)	SAE 20W-40 Or 20W-50 API SG/CD
Greater Than -10°F (-23°C)	SAE 10W-30, 10W-40 API SG/CD
Maximum Temperature	
Less Than 60°F (16°C)	SAE 5W-30 Or 5W-40 API SG/CD
Front Axle & Conventional Rear Axle	
Minimum Temperature	
Greater Than -10°F (-23°C)	SAE 90, 85W-90, 80W-90 API GL-5
Maximum Temperature	
Less Than -30°F (-34°C)	SAE 75W API GL-5
Power Steering Fluid	Dexron-II ATF
Rear Axle (With Limited Slip Differential)	Hypoid Gear Oil (8149630EX) Or Equivalent
Transmission	
Automatic	Dexron-II ATF
Manual Transaxle & Transfer Case (4WD)	SAE 75W-85W, 75W-90 API GL-4 Or GL-5
(1) - Since temperature ranges for different oil grades overlap, brief fluctuations in outside temperatures are no cause for concern.	
Fluid Capacities	
Application	Quantity
Automatic Transmission	
1987-93	7.6 Qts. (7.2L)
1994 (3.0L SOHC)	7.6 Qts. (7.2L)
1994 (3.0L DOHC & 3.5L)	9.0 Qts. (8.5L)
1995	7.9 Qts. (7.5L)
Cooling System	
1987-88	8.5 Qts. (8.0L)
1989-95	
2.6L	9.7 Qts. (9.2L)
3.0L	10.0 Qts. (9.5L)
1994-95	
3.5L	10.0 Qts. (9.5L)
Differential	

1987-88	1.9 Qts. (1.8L)
1989-94	
2.6L	1.9 Qts. (1.8L)
3.0L	2.7 Qts. (2.6L)
1994	
3.5L	2.7 Qts. (2.6L)
1995	
3.0L	2.7 Qts. (2.6L)
3.5L	3.3 Qts. (3.2L)
Engine Oil	
1987	5.2 Qts. (5.0L)
1988	5.0 Qts. (4.8L)
1989-92	5.5 Qts. (5.3L)
1993-95	5.2 Qts. (4.9L)
Manual Transmission	
1987-91	2.3 Qts. (2.2L)
1992	2.4 Qts. (2.3L)
1993-95	2.6 Qts. (2.5L)
Transfer Case	
1987-91	2.3 Qts. (2.2L)
1992-95	2.4 Qts. (2.3L)

Service Labor Times

Application	Hours	
	30,000 (60,000)	50,000
Application	Mile Service	Mile Service
2.6L 4-Cylinder		
Automatic Transmission	7.9 (8.9)	2.6
Manual Transmission	6.9 (7.9)	2.6
3.0L V6		
Automatic Transmission	6.1 (10.6)	2.6
Manual Transmission	5.1 (9.6)	2.6

97,500 MILE (156,000 KM) SERVICE

97,500 MILE (156,000 KM) SERVICE

Service Or Inspect	
☐	Verify Last Major Service Was Performed
☐	Change Engine Oil
Lubrication Specifications	
Application	Specification
Engine Oil (1)	
Minimum Temperature	
Greater Than 32°F (0°C)	SAE 20W-40 Or 20W-50 API SG/CD
Greater Than -10°F (-23°C)	SAE 10W-30, 10W-40 API SG/CD
Maximum Temperature	
Less Than 60°F (16°C)	SAE 5W-30 Or 5W-40 API SG/CD
(1) - Since temperature ranges for different oil grades overlap, brief fluctuations in outside temperatures are no cause for concern.	

Fluid Capacities

Application	Quantity
Engine Oil	
1987	5.2 Qts. (5.0L)
1988	5.0 Qts. (4.8L)
1989-92	5.5 Qts. (5.3L)
1993-95	5.2 Qts. (4.9L)

105,000 MILE (168,000 KM) SERVICE

105,000 MILE (168,000 KM) SERVICE

Service Or Inspect	
	Verify Last Major Service Was Performed
	Fluid Levels
	Braking System
	Drive Shaft Boots
Replace	
	Engine Oil
	Oil Filter
Lubrication Specifications	
Application	Specification
Brake & Clutch Fluid	DOT 3 Or DOT 4
Engine Coolant	Ethylene-Glycol Antifreeze Coolant
Engine Oil (1)	
Minimum Temperature	
Greater Than 32°F (0°C)	SAE 20W-40 Or 20W-50 API SG/CD
Greater Than -10°F (-23°C)	SAE 10W-30, 10W-40 API SG/CD
Maximum Temperature	
Less Than 60°F (16°C)	SAE 5W-30 Or 5W-40 API SG/CD
Front Axle & Conventional Rear Axle	
Minimum Temperature	
Greater Than -10°F (-23°C)	SAE 90, 85W-90, 80W-90 API GL-5
Maximum Temperature	
Less Than -30°F (-34°C)	SAE 75W API GL-5
Power Steering Fluid	Dexron-II ATF
Rear Axle (With Limited Slip Differential)	Hypoid Gear Oil (8149630EX) Or Equivalent
Transmission	
Automatic	Dexron-II ATF
Manual Transaxle & Transfer Case (4WD)	SAE 75W-85W, 75W-90 API GL-4 Or GL-5
(1) - Since temperature ranges for different oil grades overlap, brief fluctuations in outside temperatures are no cause for concern.	

Fluid Capacities	
Application	Quantity
Automatic Transmission	
1987-93	7.6 Qts. (7.2L)
1994 (3.0L SOHC)	7.6 Qts. (7.2L)
1994 (3.0L DOHC & 3.5L)	9.0 Qts. (8.5L)
1995	7.9 Qts. (7.5L)
Cooling System	
1987-88	8.5 Qts. (8.0L)
1989-95	
2.6L	9.7 Qts. (9.2L)
3.0L	10.0 Qts. (9.5L)
1994-95	
3.5L	10.0 Qts. (9.5L)
Differential	
1987-88	1.9 Qts. (1.8L)
1989-94	
2.6L	1.9 Qts. (1.8L)
3.0L	2.7 Qts. (2.6L)
1994	
3.5L	2.7 Qts. (2.6L)
1995	
3.0L	2.7 Qts. (2.6L)
3.5L	3.3 Qts. (3.2L)
Engine Oil	
1987	5.2 Qts. (5.0L)
1988	5.0 Qts. (4.8L)
1989-92	5.5 Qts. (5.3L)
1993-95	5.2 Qts. (4.9L)
Manual Transmission	
1987-91	2.3 Qts. (2.2L)
1992	2.4 Qts. (2.3L)
1993-95	2.6 Qts. (2.5L)
Transfer Case	
1987-91	2.3 Qts. (2.2L)
1992-95	2.4 Qts. (2.3L)

110,000 MILE (176,000 KM) SERVICE (1987-90)

110,000 MILE (176,000 KM) SERVICE (1987-90)

Service Or Inspect	
	Verify Last Major Service Was Performed
	Fuel System (Tank, Lines & Connections)
	Carburetor Or Throttle Body Mounting
Replace	
	Fuel Filter
	Fuel, Water & Vapor Hoses
	EGR Valve
	Oxygen Sensor

Service Labor Times				
Application			Hours	
			30,000 (60,000)	50,000
Application			Mile Service	Mile Service
2.6L 4-Cylinder				
Automatic Transmission	....	7.9 (8.9)	.....	2.6
Manual Transmission	.....	6.9 (7.9)	.....	2.6
3.0L V6				
Automatic Transmission	....	6.1 (10.6)	.....	2.6
Manual Transmission	.....	5.1 (9.6)	.....	2.6

112,500 MILE (180,000 KM) SERVICE

112,500 MILE (180,000 KM) SERVICE

Service Or Inspect	
	Verify Last Major Service Was Performed
	Change Engine Oil
Lubrication Specifications	
Application	Specification
Engine Oil (1)	
Minimum Temperature	
Greater Than 32°F (0°C)	 SAE 20W-40 Or 20W-50 API SG/CD
Greater Than -10°F (-23°C)	 SAE 10W-30, 10W-40 API SG/CD
Maximum Temperature	
Less Than 60°F (16°C)	 SAE 5W-30 Or 5W-40 API SG/CD
(1) - Since temperature ranges for different oil grades overlap, brief fluctuations in outside temperatures are no cause for concern.	
Fluid Capacities	
Application	Quantity
Engine Oil	
1987	5.2 Qts. (5.0L)
1988	5.0 Qts. (4.8L)
1989-92	5.5 Qts. (5.3L)
1993-95	5.2 Qts. (4.9L)

120,000 MILE (192,000 KM) SERVICE

120,000 MILE (192,000 KM) SERVICE

Service Or Inspect	
	Verify Last Major Service Was Performed
	Valve Clearance (Jet Valve Only)

	Manual Transmission Oil & Transfer Case
	Carburetor Choke Mechanism & Linkage (2.6L Engine)
	Crankcase Emission Control System (PCV Valve)
	Evaporative Emission Control System
	Distributor Cap, Rotor & Spark Advanced System
	Intake Temperature Control System
	Secondary Air System
	Front Disc Pads
	Rear Drum Brake Linings & Wheel & Cylinders
	Brake Hoses
	Steering Linkage Seals & Drive Shaft Boots
	Lubricate Ball Joints
	Lubricate Front Wheel Bearing
	Drive Axle Fluid (Without Limited-Slip Differential)
	Lubricate Drive Shaft Joints
	Exhaust System
	Drive Belt (Water Pump & Alternator)
	Vacuum, Water, Crankcase Ventilation & Secondary Air Hoses
	Replace
	Air Filter
	Fuel Filter
	Spark Plugs
	Ignition Cables
	Camshaft Timing Belt
	Engine Coolant
	Drive Axle Fluid (With Limited-Slip Differential)
	Engine Oil & Filter
	Automatic Transmission & Transfer Case Fluids
	Vacuum Control System Solenoid Valve Air Filter
	Lubrication Specifications
Application	Specification
Brake & Clutch Fluid	DOT 3 Or DOT 4

Engine Coolant Ethylene-Glycol Antifreeze Coolant

Engine Oil (1)

Minimum Temperature

Greater Than 32°F (0°C) SAE 20W-40 Or 20W-50 API SG/CD

Greater Than -10°F (-23°C) SAE 10W-30, 10W-40 API SG/CD

Maximum Temperature

Less Than 60°F (16°C) SAE 5W-30 Or 5W-40 API SG/CD

Front Axle & Conventional Rear Axle

Minimum Temperature

Greater Than -10°F (-23°C) SAE 90, 85W-90, 80W-90
API GL-5

Maximum Temperature

Less Than -30°F (-34°C) SAE 75W API GL-5

Power Steering Fluid Dexron-II ATF

Rear Axle (With Limited
Slip Differential) Hypoid Gear Oil (8149630EX) Or
Equivalent

Transmission

Automatic Dexron-II ATF

Manual Transaxle &
Transfer Case (4WD) SAE 75W-85W, 75W-90 API
GL-4 Or GL-5

(1) - Since temperature ranges for different oil grades overlap,
brief fluctuations in outside temperatures are no cause for
concern.

Fluid Capacities

Application	Quantity
Automatic Transmission	
1987-93	7.6 Qts. (7.2L)
1994 (3.0L SOHC)	7.6 Qts. (7.2L)
1994 (3.0L DOHC & 3.5L)	9.0 Qts. (8.5L)
1995	7.9 Qts. (7.5L)
Cooling System	
1987-88	8.5 Qts. (8.0L)
1989-95	
2.6L	9.7 Qts. (9.2L)
3.0L	10.0 Qts. (9.5L)
1994-95	
3.5L	10.0 Qts. (9.5L)
Differential	
1987-88	1.9 Qts. (1.8L)
1989-94	
2.6L	1.9 Qts. (1.8L)
3.0L	2.7 Qts. (2.6L)
1994	
3.5L	2.7 Qts. (2.6L)
1995	
3.0L	2.7 Qts. (2.6L)
3.5L	3.3 Qts. (3.2L)
Engine Oil	
1987	5.2 Qts. (5.0L)
1988	5.0 Qts. (4.8L)
1989-92	5.5 Qts. (5.3L)
1993-95	5.2 Qts. (4.9L)
Manual Transmission	
1987-91	2.3 Qts. (2.2L)
1992	2.4 Qts. (2.3L)
1993-95	2.6 Qts. (2.5L)
Transfer Case	

1987-91	2.3 Qts. (2.2L)
1992-95	2.4 Qts. (2.3L)

Service Labor Times	
Application	Hours
	30,000 (60,000) 50,000
Application	Mile Service Mile Service
2.6L 4-Cylinder	
Automatic Transmission	7.9 (8.9) 2.6
Manual Transmission	6.9 (7.9) 2.6
3.0L V6	
Automatic Transmission	6.1 (10.6) 2.6
Manual Transmission	5.1 (9.6) 2.6

LUBRICATION SPECIFICATIONS TABLE

Application	Fluid Specifications
Brake & Clutch Fluid	DOT 3 Or DOT 4
Engine Coolant	Ethylene-Glycol Antifreeze Coolant
Engine Oil (1)	
Minimum Temperature	
Greater Than 32°F (0°C)	SAE 20W-40 Or 20W-50 API SG/CD
Greater Than -10°F (-23°C) ..	SAE 10W-30 Or 10W-40 API SG/CD
Maximum Temperature	
Less Than 60°F (16°C)	SAE 5W-30 Or 5W-40 API SG/CD
Front Axle & Conventional Rear Axle	
Minimum Temperature	
Greater Than -10°F (-23°C)	SAE 85W-90, 80W-90 API GL-5
Maximum Temperature	
Less Than -30°F (-34°C)	SAE 75W API GL-5
Power Steering Fluid	Dexron-IIe ATF
Rear Axle (With Limited Slip Differential)	Hypoid Gear Oil (8149630EX) Or Equivalent
Transmission	
Automatic	Dexron-IIe ATF
Manual Transaxle & Transfer Case (4WD)	SAE 75W-85W, 75W-90 API GL-5

(1) - Since temperature ranges for different oil grades overlap, brief fluctuations in outside temperatures are no cause for concern.

FLUID CAPACITIES

FLUID CAPACITIES TABLE

Application	Quantity
A/C System R-12 Refrigerant	
1983-87	24-26 Ozs.
1988-91	32 Ozs.
1992-93	28 Ozs.
A/C System R-134a Refrigerant (1)	
1994-95	21-23 Ozs.
Automatic Transmission	

1984-86	(2)	7.2 Qts.	(6.8L)
1987-93		7.6 Qts.	(7.2L)
1994 (3.0L SOHC)		7.6 Qts.	(7.2L)
1994 (3.0L DOHC & 3.5L)		9.0 Qts.	(8.5L)
1995		7.9 Qts.	(7.5L)
Cooling System			
1983-88		8.5 Qts.	(8.0L)
1989-95			
2.6L		9.7 Qts.	(9.2L)
3.0L		10.0 Qts.	(9.5L)
1994-95			
3.5L		10.0 Qts.	(9.5L)
Differential			
1983-88		1.9 Qts.	(1.8L)
1989-93			
2.6L		1.9 Qts.	(1.8L)
3.0L		2.7 Qts.	(2.6L)
1994			
3.0L & 3.5L		2.7 Qts.	(2.6L)
1995			
3.0L		2.7 Qts.	(2.6L)
3.5L		3.3 Qts.	(3.2L)
Engine Oil			
1983-86		6.0 Qts.	(5.8L)
1987		5.2 Qts.	(5.0L)
1988		5.0 Qts.	(4.8L)
1989-91		5.5 Qts.	(5.3L)
1992-95		5.2 Qts.	(4.9L)
Power Steering		1.1 Qts.	(1.0L)
Fuel Tank			
1983-88		15.9 Gals.	(60L)
1989-90			
2.6L 2-Door		15.9 Gals.	(60L)
3.0L 2-Door		19.9 Gals.	(75L)
2.6L & 3.0L 4-Door		24 Gals.	(92L)
1991-95		24 Gals.	(92L)
Manual Transmission			
1983-91		2.3 Qts.	(2.2L)
1992		2.4 Qts.	(2.3L)
1993-95		2.6 Qts.	(2.5L)
Transfer Case			
1983-91		2.3 Qts.	(2.2L)
1992-95		2.4 Qts.	(2.3L)

(1) - Use of R12 in a R134a system will result in SEVERE DAMAGE.
(2) - 1983 model equipped with manual transmission only.

K - SENSOR RANGE CHARTS

1993 Mitsubishi Montero

1993 ENGINE PERFORMANCE

Chrysler Corp./Mitsubishi Sensor Operating Range Charts

Dodge; Colt, Colt 200, Ram-50, Stealth
Eagle; Summit, Summit Wagon
Mitsubishi; Diamante, Eclipse, Expo/Expo LRV, Galant,
Mirage, Montero, Pickup, Precis, 3000GT
Plymouth; Colt, Colt 200, Colt Vista

INTRODUCTION

Sensor operating range information can help determine if a sensor is out of calibration. An out-of-calibration sensor may not set a trouble code, but it may cause driveability problems.

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 and terminal identification, see L - WIRING DIAGRAMS article in this section.

AIRFLOW METER HERTZ TEST TABLE (1)

Condition	Hz
Colt, Colt 200, Mirage & Summit	
1.8L	
700 RPM	23-49
2000 RPM	51-91
Diamante	
700 RPM	21-47
2000 RPM	51-97
Eclipse	
1.8L	
700 RPM	25-40
2000 RPM	67-88
2.0L	
750 RPM	25-50
2000 RPM	
Non-Turbo	70-90
Turbo	60-85
Colt Vista, Expo & Summit Wagon	
1.8L	
750 RPM	23-49
2000 RPM	51-91
2.4L	
750 RPM	18-44
2000 RPM	43-83
Galant	
SOHC	
750 RPM	18-44
2000 RPM	64-104
Montero	
700 RPM	22-48
2000 RPM	60-100
Pickup & Ram-50	
2.4L	
750 RPM	40-60
2000 RPM	85-105
3.0L	

700 RPM	25-45
2000 RPM	70-90
Precis	
750 RPM	27-33
2000 RPM	60-80
Stealth & 3000GT	
700 RPM	25-50
2000 RPM	70-100

(1) - Measure hertz frequency with Multi-Use Tester (MUT).

COOLANT TEMPERATURE SENSOR RESISTANCE TABLE

Temperature °F (°C)	Ohms
Eclipse	
68 (20)	2200-2600
176 (80)	264-328
Pickup 2.4L & Ram-50 2.4L	
32 (0)	5900
68 (20)	2500
104 (40)	1100
176 (80)	300
All Others	
32 (0)	5800
68 (20)	2400
104 (40)	1100
176 (80)	300

EGR TEMPERATURE SENSOR RESISTANCE TEST TABLE (1) (2)

Temperature °F (°C)	Ohms
122 (50)	60-83
212 (100)	11-14

(1) - Measure resistance across disconnected sensor terminals.
(2) - Specifications apply to all models except Montero.

INTAKE AIR TEMPERATURE SENSOR RESISTANCE TABLE

Temperature °F (°C)	Ohms
Precis	
32 (0)	5400-6600
68 (20)	2300-2970
176 (80)	310-430
All Others	
32 (0)	6000
68 (20)	2700
176 (80)	400

OXYGEN SENSOR VOLTAGE TEST TABLE (1) (2)

Application	Volts

All Models	
Lean	0.1
Rich	1.0

(1) - Measure between sensor terminal No. 1 and ground.

(2) - Test at normal operating temperature.

THROTTLE POSITION SENSOR (TPS)

Measure total and variable resistance between specified TPS connector terminals. See TPS TEST TERMINALS 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.

TPS TEST TERMINALS TABLE

Application	Terminals No.
Total Resistance	
Eclipse 1.8L	1 & 2
Eclipse 2.0L	2 & 3
All Others	1 & 4
Variable Resistance	
Colt Vista, Expo, Montero, Pickup 3.0L, Precis, Ram-50 3.0L & Summit Wagon	1 & 3
Eclipse 1.8L	2 & 3
Eclipse 2.0L	3 & 4
All Others	2 & 4

VEHICLE SPEED SENSOR CONTINUITY TEST TABLE (1)

Application	(2) Continuity
All Models	4 Changes Per Revolution
(1) - Measure continuity at back of speedometer. See appropriate wiring diagram in L - WIRING DIAGRAMS article in this section.	
(2) - With ECM connector disconnected, turn speedometer cable to cycle reed switch on and off.	

VEHICLE SPEED SENSOR VOLTAGE TEST TABLE (1)

Application	(2) Volts
All Models	
Ignition Switch Off	1 Or Less
Ignition Switch On	4.5-4.9
(1) - Measure voltage at back of speedometer. See appropriate wiring diagram in L - WIRING DIAGRAMS article in this section.	
(2) - With ECM connector disconnected, turn speedometer cable to cycle reed switch on and off.	

C - SPECIFICATIONS

1993 Mitsubishi Montero

1993 ENGINE PERFORMANCE

Chrysler Corp./Mitsubishi Service & Adjustment Specifications

Dodge; Ram-50
Mitsubishi; Montero, Pickup

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

Application	Group Size	CCA Rating
2.4L	24F	430
3.0L	26R	490

NOTE: Refill capacities are approximate. Correct fluid level should be determined by mark on dipstick, if applicable.

FLUID CAPACITIES

Application	Quantity
Automatic Transmission (1)	
Montero	7.7 Qts. (7.3L)
Pickup & Ram-50	7.4 Qts. (7.0L)
Cooling System (Includes Heater & Reserve Tank)	
Montero	10.0 Qts. (9.5L)
Pickup, Ram-50	
2WD	
Automatic Transmission	6.3 Qts. (6.0L)
Manual Transmission	6.3 Qts. (6.0L)
4WD	8.9 Qts. (8.4L)
Crankcase (Includes Filter)	
Montero	5.5 Qts. (4.9L)
Pickup, Ram-50	
4 Cylinder	4.0 Qts. (3.8L)
V6	5.0 Qts. (4.6L)
Differential (SAE 80W-90/API GL-5)	
Montero	
Front	1.3 Qts. (1.2L)
Rear	2.7 Qts. (2.6L)
Pickup & Ram-50	
2WD	1.6 Qts. (1.5L)
4WD	
Front	1.2 Qts. (1.1L)
Rear	2.7 Qts. (2.6L)
Manual Transmission (SAE 75W-85/API GL-4)	
Montero	2.6 Qts. (2.5L)
Pickup & Ram-50	
2WD	2.4 Qts. (2.3L)
4WD	2.6 Qts. (2.5L)

Power Steering (Dexron-II)		
Pickup, Precis, Ram-50	.....	1.9 Pts. (.9L)
Montero	.....	2.1 Pts. (1.0L)
Transfer Case (SAE 75W-85/API GL-4)		
Montero, Pickup & Ram-50	.....	4.7 Pts. (2.2L)
(1) - Fill with Mitsubishi Plus, Mopar Plus, or Dexron-II type automatic transmission fluid.		

QUICK-SERVICE

SERVICE INTERVALS & SPECIFICATIONS

REPLACEMENT INTERVALS - MONTERO

Component	Miles
Air Filter	30,000
Automatic Transmission Fluid	30,000
Coolant	30,000
Front & Rear Axle Fluid	30,000
Oil	7500
Oil Filter	15,000
O2 Sensor (1)	80,000
Spark Plugs	30,000
Spark Plug Wires (1)	60,000
Timing Belt	60,000
Transfer Case Fluid	30,000
Vapor Canister (1)	100,000
(1) - Federal models only.	

REPLACEMENT INTERVALS - PICKUP & RAM-50

Component	Miles
Air Filter	30,000
Automatic Transmission Fluid	30,000
Coolant	30,000
EGR Valve (2.4L) (1)	50,000
Front & Rear Axle Fluid	30,000
Oil	7500
Oil Filter	15,000
O2 Sensor (1)	80,000
Spark Plugs	30,000
Spark Plug Wires (1)	60,000
Timing Belt	60,000
Transfer Case Fluid	30,000
Vapor Canister (1)	100,000
(1) - Federal models only.	

BELT ADJUSTMENT - MONTERO

Application	(1) Deflection	(1) Deflection
	New Belt - In. (mm)	Used Belt - In. (mm)
Alternator	.25-.31 (6.3-7.8)	.35 (8.8)
P/S	.31 (7.8)	.39 (10.0)

A/C 19-.23 (4.8-5.8) 25-.29 (6.3-7.3)
 (1) - With 22 lbs. (10 kg) pressure applied midway on belt run.

BELT ADJUSTMENT - PICKUP & RAM-50

Application	(1) Deflection New Belt - In. (mm)	(1) Deflection Used Belt - In. (mm)
2.4L		
Alternator ...	.27-.39 (6.8-10.0)	 (2)
P/S	.23-.35 (5.8-8.8)	 (2)
A/C	.33-.39 (8.3-10.0)	 (2)
3.0L		
Alternator ...	.31-.39 (7.8-10.0)	 (2)
P/S	.35-.47 (8.8-12.0)	 (2)
A/C	.33-.39 (8.3-10.0)	 (2)

(1) - With 22 lbs. (10 kg) pressure applied midway on belt run.
 (2) - Information is not available from manufacturer.

MECHANICAL CHECKS

ENGINE COMPRESSION

Check engine compression with engine at normal operating temperature at specified cranking speed, all spark plugs removed and throttle wide open.

COMPRESSION SPECIFICATIONS

Application (1)	Specification
Compression Ratio	
2.4L (VIN G)	8.5:1
3.0L (VIN H)	8.9:1
Compression Pressure	
2.4L (VIN G)	171 psi (12.0 kg/cm ²)
3.0L (VIN H)	171 psi (12.0 kg/cm ²)
Maximum Variation Between Cylinders ..	14 psi (1.0 kg/cm ²)

(1) - See A - ENGINE/VIN ID article in this section for VIN information.

VALVE CLEARANCE

NOTE: These models do not require periodic valve adjustment.

IGNITION SYSTEM

IGNITION COIL

IGNITION COIL RESISTANCE - Ohms @ 68°F (20°C)

Application	Primary	Secondary
2.4L (VIN G)	.72-.88	10,300-13,900
3.0L (VIN H)	.72-.88	10,300-13,900

HIGH TENSION WIRE RESISTANCE

HIGH TENSION WIRE RESISTANCE - 2.4L (VIN G)

Application (1)	Ohms
Coil Wire	3000
No. 1 Wire	10,000
No. 2 Wire	12,000
No. 3 Wire	12,000
No. 4 Wire	14,000

(1) - See A - ENGINE/VIN ID article in this article for VIN information.

HIGH TENSION WIRE RESISTANCE - 3.0L (VIN H)

Application (1)	Ohms
Coil Wire	3000
No. 1 Wire	9000
No. 2 Wire	8500
No. 3 Wire	10,000
No. 4 Wire	9000
No. 5 Wire	12,000
No. 6 Wire	10,000

(1) - See A - ENGINE/VIN ID article in this article for VIN information.

SPARK PLUGS

SPARK PLUG TYPE

Application	Nippondenso No.
2.4L (VIN G, 8 Valve)	W20EPR-11
2.4L (VIN G, 16 Valve)	K16EPR-11
3.0L (VIN H)	W16EPR-11

SPARK PLUG SPECIFICATIONS

Application	Gap In. (mm)	Torque Ft. Lbs. (N.m)
All Models	.039-.043 (1.0-1.1)	 15-21 (20-30)

FIRING ORDER & TIMING MARKS

WARNING: On the 3.0L V6, the firing order and the spark plug connection order on the top of the distributor do not match. Circuits internal to the distributor cap differ from the external spark plug wire connections. This is intentional and is done to avoid spark plug wires crossover. See Fig. 2.

● FRONT OF VEHICLE

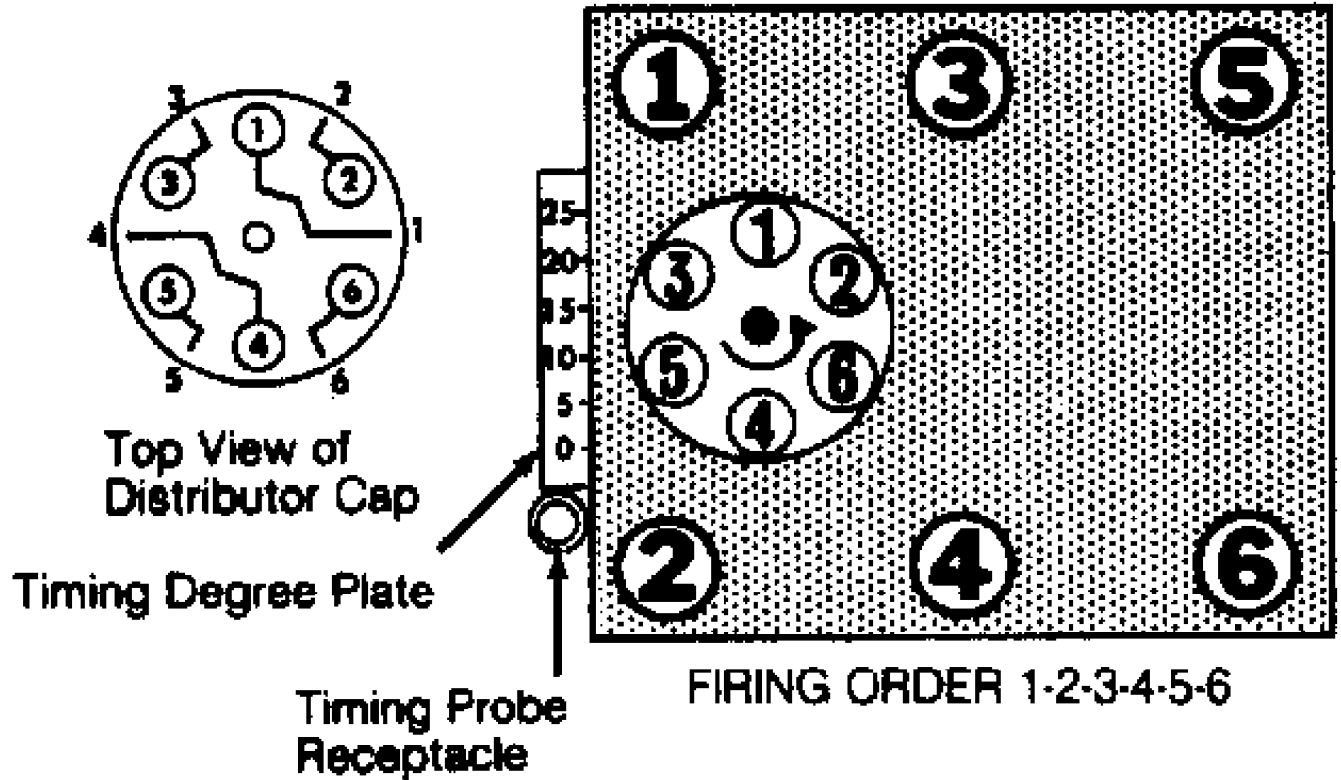


Fig. 1: Firing Order & Distributor Rotation (2.4L)

● FRONT OF VEHICLE

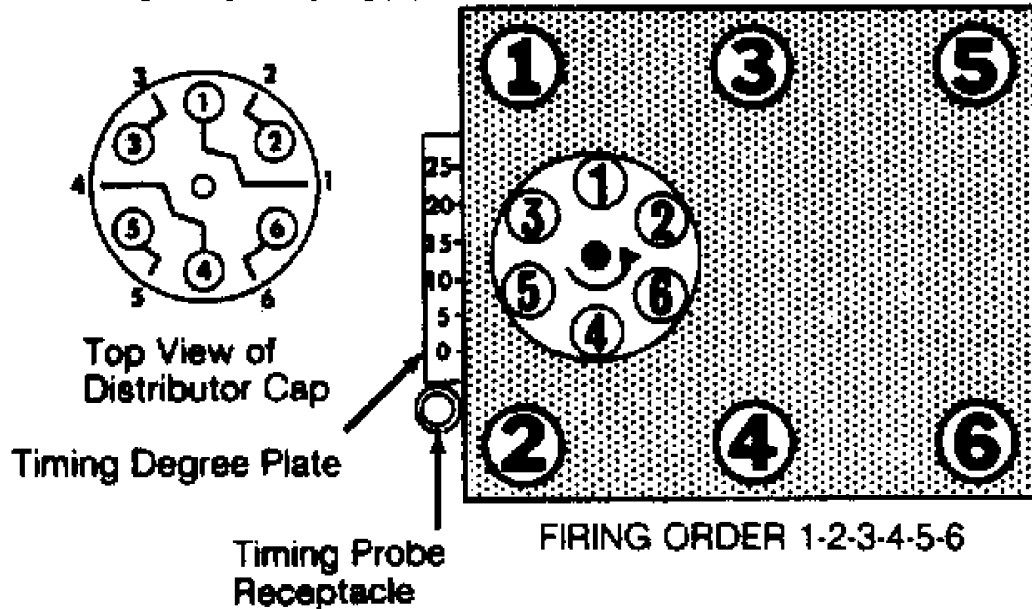


Fig. 2: Firing Order & Distributor Rotation (3.0L)

IGNITION TIMING

IGNITION TIMING (Degrees BTDC @ RPM)

Application	(1) Basic	(2) (3) Actual
2.4L	3-7 @ 600-800	8 @ 600-800
3.0L		
Montero	3-7 @ 600-800	15 @ 600-800
Pickup & Ram-50	3-7 @ 650-850	15 @ 650-850
(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. Ignition timing may fluctuate.		
(3) - If vehicle altitude is more than 2300 ft. above sea level, actual timing may be advanced.		

FUEL SYSTEM

FUEL PUMP

REGULATED FUEL PRESSURE

Application	At Idle w/Vacuum psi (kg/cm ²)	At Idle w/o Vacuum psi (kg/cm ²)
All Models	38 (2.6)	47-50 (3.3-3.5)

INJECTOR RESISTANCE

INJECTOR RESISTANCE

Application	Ohms
All Models	13-16

THROTTLE POSITION SENSOR (TPS)

TPS SPECIFICATIONS

Application	(1) Volts
2.4L	.48-.52
3.0L	.4-1.0
(1) - At idle.	

STARTER

1993 Mitsubishi Montero

1993 ELECTRICAL
Mitsubishi Starters

Montero

DESCRIPTION

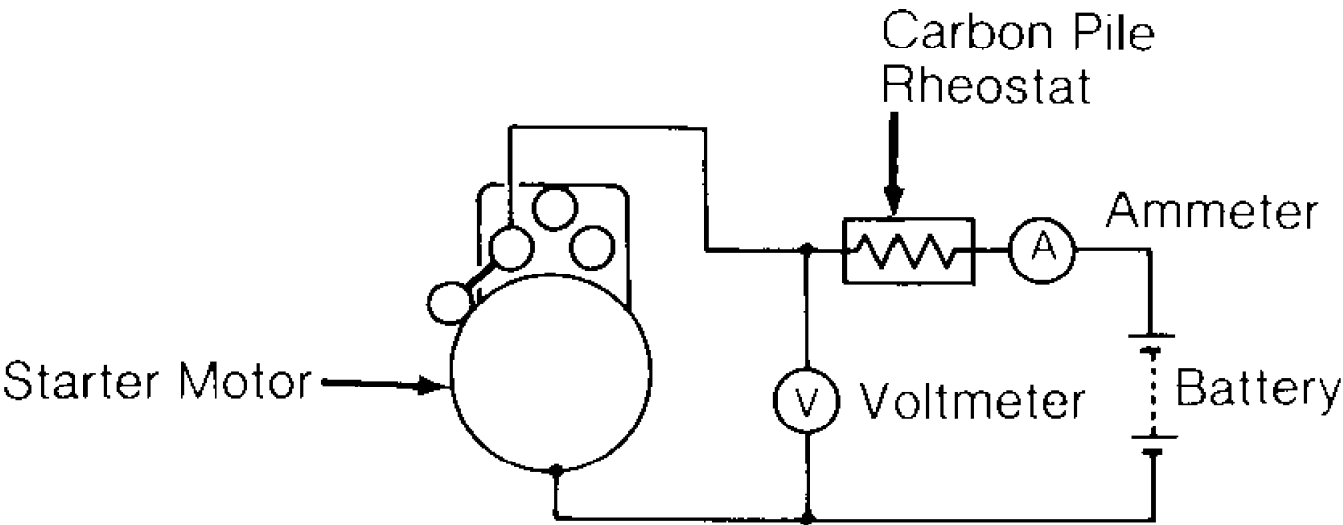
The starter is a conventional 12-volt, 4-pole brush-type motor, with gear reduction drive. The starter-mounted solenoid shifts overrunning clutch and pinion into flywheel when starter is energized.

BENCH TESTING

STARTER NO-LOAD TEST

CAUTION: Perform tests in less than 10 seconds to prevent coil damage.

- 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. 1.
- 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. See STARTER NO-LOAD TEST SPECIFICATIONS table.
- 3) Ensure maximum amperage is as specified and starter rotates smoothly. See STARTER NO-LOAD TEST SPECIFICATIONS table.



90I08769

Fig. 1: Performing Starter No-Load Test
Courtesy of Mitsubishi Motor Sales of America.

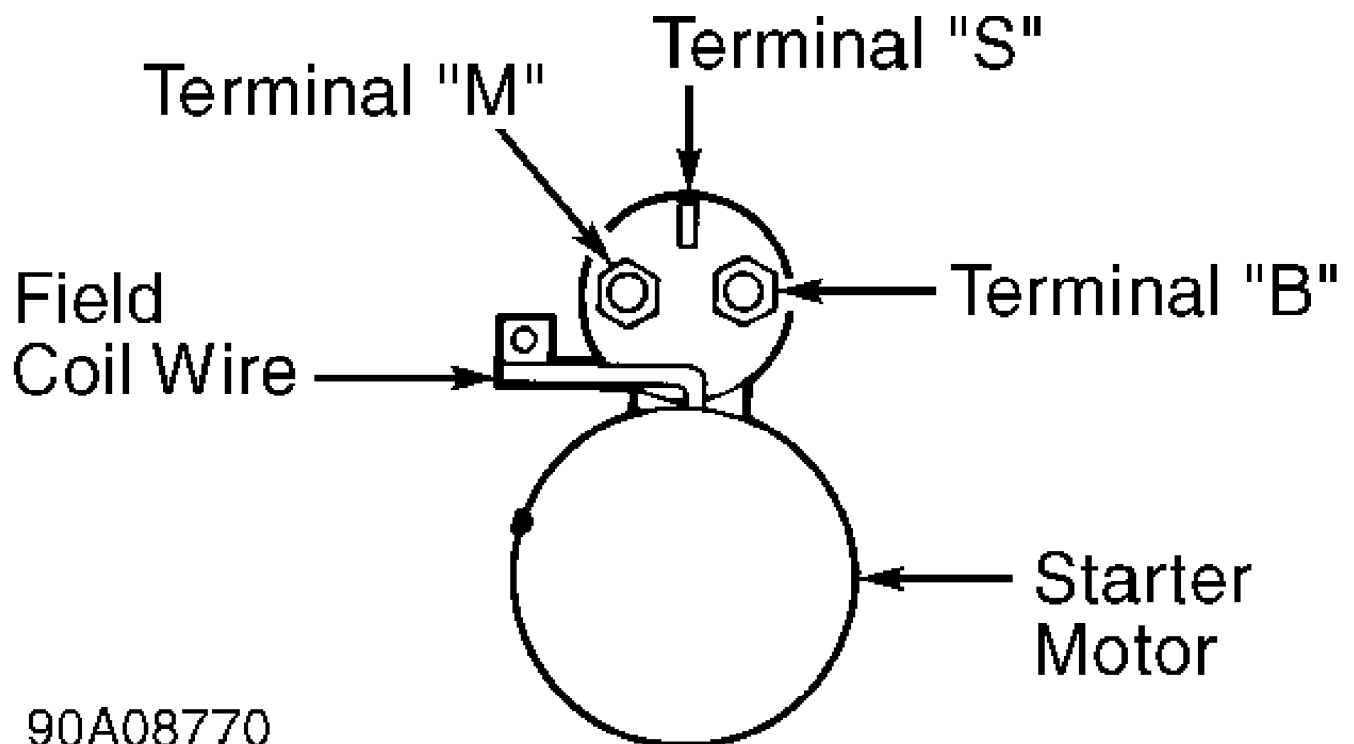
STARTER NO-LOAD TEST SPECIFICATIONS TABLE

Application	Test Voltage	Maximum Amps @ Minimum RPM

PULL-IN COIL TEST

1) Disconnect field coil wire from terminal "M" at starter solenoid. See Fig. 2. 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.



90A08770

Fig. 2: Starter Solenoid Terminal ID
Courtesy of Mitsubishi Motor Sales of America.

HOLD-IN COIL TEST

1) Disconnect field coil wire from terminal "M" at starter solenoid. See Fig. 2. 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.

RETURN TEST

1) Disconnect field coil wire from terminal "M" at starter solenoid. See Fig. 2. Connect jumper wire between positive battery terminal of 12-volt battery and terminal "M" of starter solenoid.

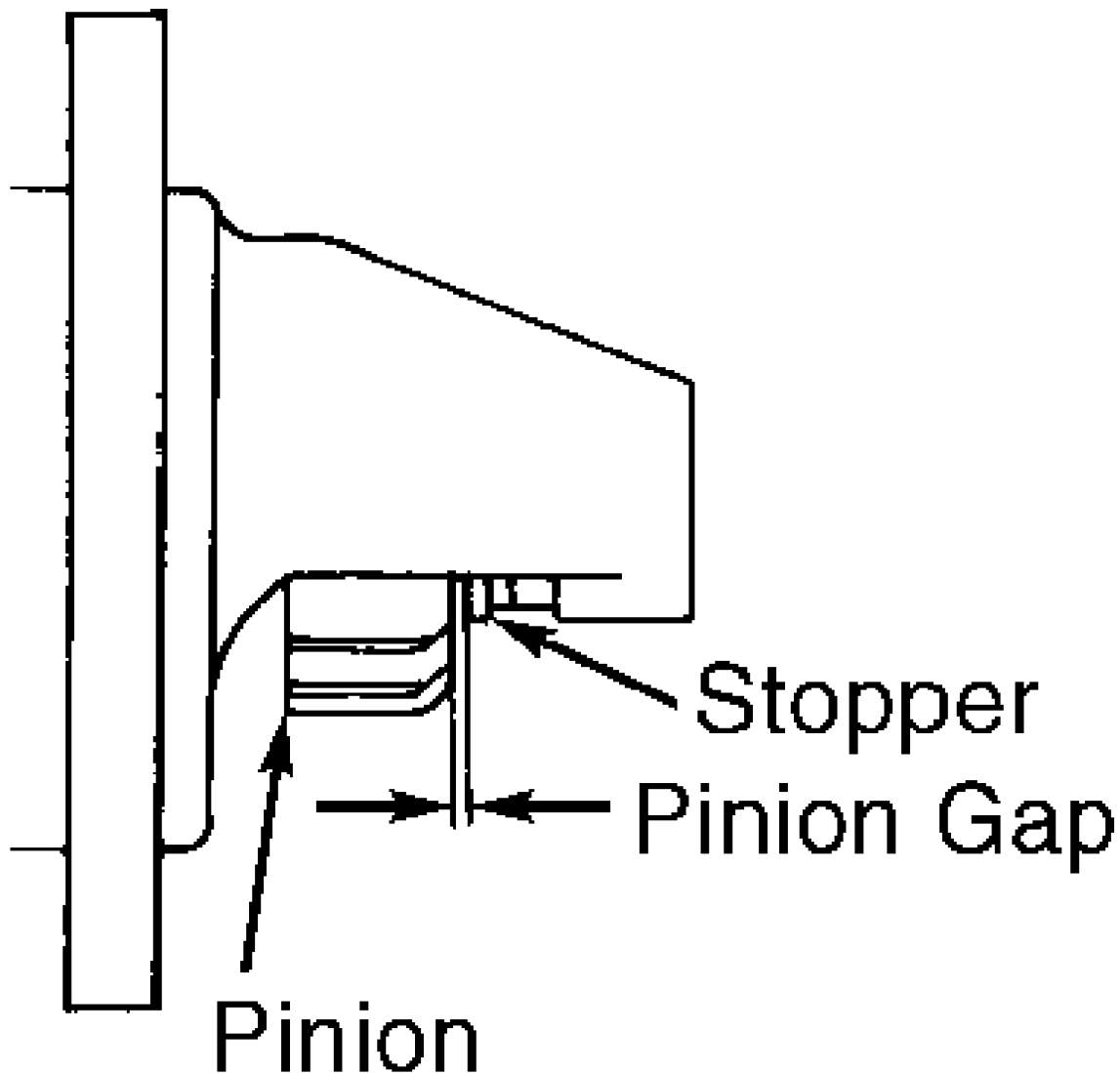
2) Connect a second jumper wire from negative battery terminal and touch starter case. Pull pinion outward and release it. Replace solenoid if pinion remains out.

PINION GAP MEASUREMENT

1) Disconnect field coil wire from terminal "M" at starter solenoid. See Fig. 2. 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. Measure clearance between pinion and stopper. See Fig. 3.

3) Clearance should be within specification. See STARTER SPECIFICATIONS table. Adjust clearance by adding or removing gaskets between solenoid and front housing.



91G00017

Fig. 3: Measuring Pinion Gap
Courtesy of Mitsubishi Motor Sales of America.

REMOVAL & INSTALLATION

Removal & Installation

Disconnect negative battery cable. If necessary, raise vehicle on hoist. Remove starter mounting bolts and starter. To install, reverse removal procedure.

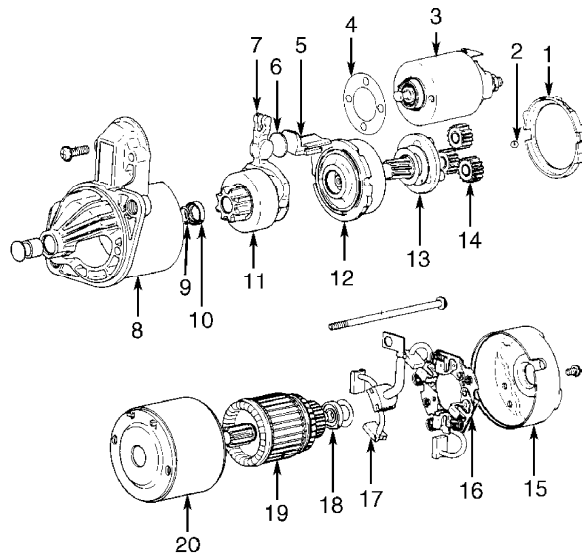
NOTE: On Montero with A/T, it may be necessary to disconnect transmission oil cooler line for starter removal.

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 Fig. 4.

STARTER SPECIFICATIONS TABLE

Application	In. (mm)
Commutator Maximum Runout	.002 (.05)
Commutator Minimum Diameter	1.16 (29.4)
Commutator Undercut Depth	.020 (.51)
Pinion Gap	.020-.079 (.51-2.01)



1. Packing	11. Pinion
2. Ball	12. Internal Gear
3. Starter Solenoid	13. Planetary Gear Holder
4. Gasket	14. Planetary Gear
5. Packing	15. Rear Housing
6. Plate	16. Brush Holder
7. Lever	17. Brush
8. Front Housing	18. Rear Bearing
9. Snap Ring	19. Armature
10. Stopper	20. Yoke Assembly

90108774

Fig. 4: Exploded View Of Gear Reduction Starter
Courtesy of Mitsubishi Motor Sales of America.

WIRING DIAGRAMS

See appropriate chassis wiring diagram in WIRING DIAGRAMS.

STEERING COLUMN

1993 Mitsubishi Montero

1993 STEERING
Mitsubishi - Steering Columns

Montero

DESCRIPTION & OPERATION

Steering column consists of a collapsible steering shaft with lower joint assembly.

REMOVAL & INSTALLATION

STEERING WHEEL & HORN PAD

Removal

Remove screws retaining horn pad. Remove horn pad. 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.

CAUTION: DO NOT hammer on steering wheel during servicing, as it may damage steering column.

Installation

To install, reverse removal procedure. Ensure reference marks are aligned. Tighten steering wheel nut to specification. See TORQUE SPECIFICATIONS.

COMBINATION SWITCH

Removal & Installation

Remove horn pad and steering wheel. See STEERING WHEEL & HORN PAD under REMOVAL & INSTALLATION. Remove lower heater duct (if equipped). Remove upper and lower steering column covers. Disconnect combination switch electrical connectors. Remove screws and combination switch. To install, reverse removal procedure.

IGNITION SWITCH

Removal & Installation

1) Remove lower instrument cover and heater duct (if equipped). Remove upper and lower steering column covers. Disconnect harness connector from ignition switch. Insert ignition key into cylinder and turn key to ACC position.

2) Using small punch or awl, press down on locks pin located in cylinder lock housing. Remove ignition switch assembly. To install, reverse removal procedure.

STEERING COLUMN

CAUTION: Applying excessive pressure or causing impact to steering shaft during service may cause column to collapse. Before removing steering column, ensure wheels are in straight-ahead position. Note steering wheel location for installation reference.

Removal

1) Remove steering wheel and combination switch (if

necessary). See STEERING WHEEL & HORN PAD and COMBINATION SWITCH under REMOVAL & INSTALLATION.

2) Remove air ducts and lower instrument panel covers (if equipped). Disconnect all electrical connections. Disconnect brake pedal return spring (if equipped).

3) Remove bolts for dust cover at firewall. Remove bolt from clamp at steering gear. DO NOT separate lower steering shaft from steering column (if equipped). Remove steering column bolts and remove steering column.

Installation

To install, reverse removal procedure. Apply sealant to dust cover bolts before installing. Tighten bolts to specification. See TORQUE SPECIFICATIONS.

OVERHAUL

STEERING COLUMN

Disassembly

1) Remove steering column from vehicle. See STEERING COLUMN under REMOVAL & INSTALLATION. Remove clamp bolt from joint assembly. See Fig. 1. Remove return springs, clevis pin, bolts and bushings from upper steering column.

2) Remove snap ring, stopper and bearing spacer from upper steering column. Using ignition switch, unlock steering wheel. Remove upper steering shaft. Remove dust seal, bushing and upper steering column.

3) To remove steering lock, use a hacksaw to cut bolts at steering lock bracket side. Remove steering lock and bracket. Remove dust cover. Remove column tube clamp and lower steering column.

4) Remove column bushing, column tube and lower steering shaft. Remove snap ring from lower steering shaft. Remove clip and bearing from column tube. Remove split pin, tilt lever and snap ring. Remove lock plate. Remove lower boot, upper boot and dust cover from joint assembly.

mounting plate. Check joint bearing and steering shaft for wear. Check cover and teeth of plate assembly for damage. Replace components if necessary.

Reassembly

- 1) To reassemble, reverse disassembly procedure. Install upper boot on joint assembly. Install lower boot and dust cover on joint assembly. Leave boots on shafts without assembling them to universal joint.
- 2) Apply multipurpose grease to universal joints of joint assembly. When installing upper boot, lower boot and dust cover, ensure arrows on boots align with slit area on yoke. When assembling lever assembly and plate assembly, apply grease to cam area of lever assembly, plate clevis pin, and space between clevis pin and return spring.
- 3) Apply grease to dust cover grommet, dust seal and upper steering shaft before installing. Align steering lock with column boss. Ensure steering lock is operational. Tighten bolt until bolt head breaks off.
- 4) When installing upper steering shaft in steering column, ensure projected area on dust seal aligns with notch of upper steering column. Apply grease to steering shaft bushings before installing.
- 5) Assemble upper steering column with lower steering column. Ensure mating mark on lower steering shaft aligns with yoke groove in upper steering shaft. See Fig. 2. Apply thread sealant to bolts and nuts of lower steering column.
- 6) Install NEW clevis pin until pin is even with lower steering column. Align mating mark on lower steering shaft with yoke groove of joint assembly. See Fig. 2.

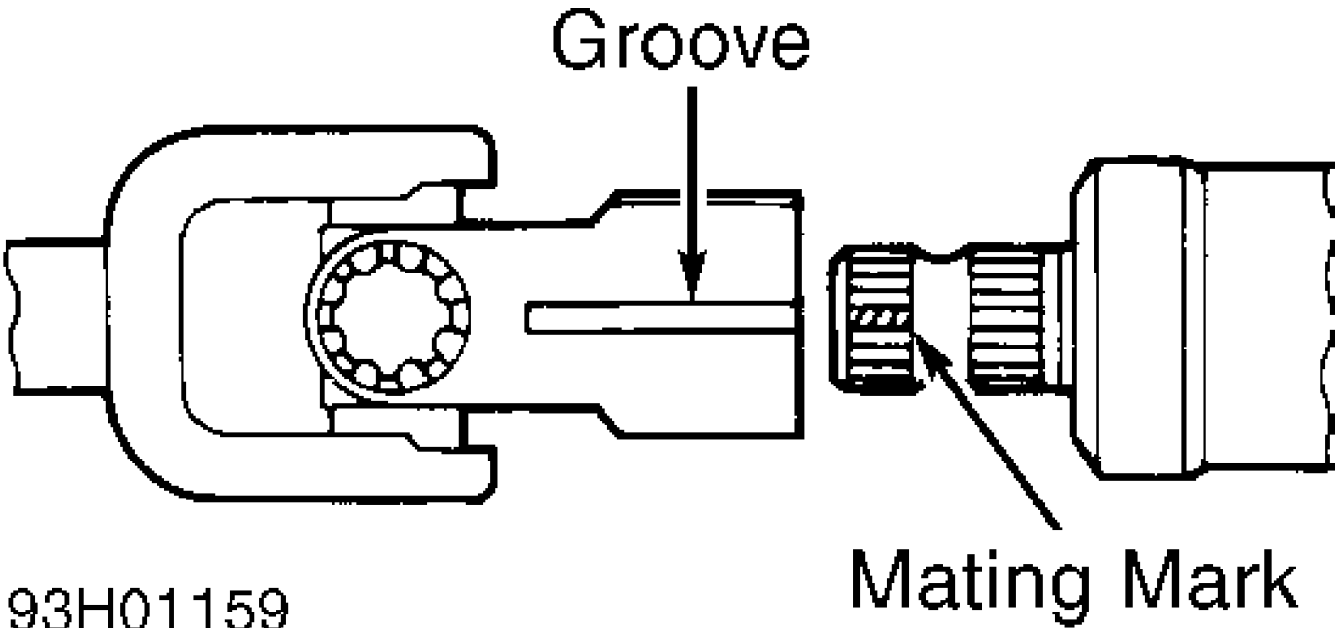


Fig. 2: Aligning Mating Mark
Courtesy of Mitsubishi Motor Sales of America.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS TABLE

Application	Ft. Lbs. (N.m)

Column Bracket Bolts	16	(22)
Lower Steering Shaft Clamp Bolt	22-25	(30-34)
Steering Gear Clamp Bolt	22-25	(30-34)
Steering Wheel Nut	29	(40)
Upper Column Side Bolt	17	(23)
Upper Shaft Assembly Clamp Bolt	13	(18)

INCH Lbs. (N.m)

Dust Cover Bolt	36	(4)
Horn Pad Bolt	17-26	(2-3)
Steering Column Tube Clamp	39	(4.5)
Tilt Lever Bolt	108	(12)

STEERING COLUMN SWITCHES

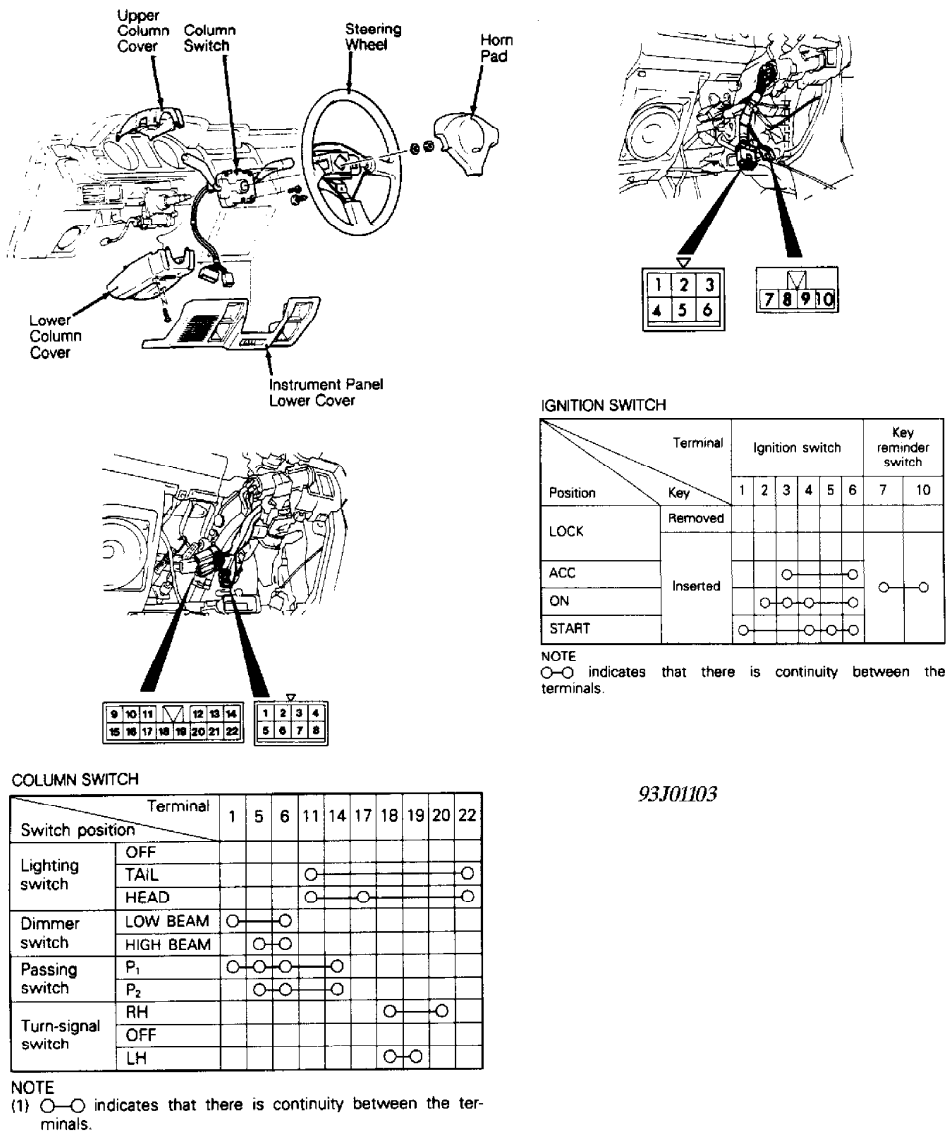
1993 Mitsubishi Montero

1993 ACCESSORIES & EQUIPMENT
Mitsubishi Steering Column Switches

Montero

TESTING

For steering column switch testing, see Fig. 1.



93J01103

Fig. 1: Testing, Removing & Installing Steering Column Switches
Courtesy of Mitsubishi Motor Sales of America.

REMOVAL & INSTALLATION

IGNITION SWITCH

Removal & Installation

Remove instrument panel under-cover. Remove upper and lower column covers. See Fig. 1. Remove ignition switch. To install, reverse removal procedure.

STEERING COLUMN SWITCH

WARNING: DO NOT hammer on steering wheel. Collapsible steering column mechanism may be damaged.

Removal & Installation

Remove instrument panel under cover. Remove horn pad. Remove steering wheel. Remove upper and lower steering column covers. See Fig. 1. Remove column switch. To install, reverse removal procedure.

WIRING DIAGRAMS

See appropriate chassis wiring diagram in the WIRING DIAGRAMS section.

STEERING SYSTEM - POWER

1993 Mitsubishi Montero

1993 STEERING
Mitsubishi - Power Recirculating Ball

Montero

DESCRIPTION & OPERATION

STEERING GEAR

The power steering gear displaces fluid to provide hydraulic pressure assist while turning. A one-piece rack piston nut is geared to cross shaft. Backlash is adjusted with an adjusting screw.

STEERING LINKAGE

Linkage consists of an idler arm, relay rod, steering knuckles and adjustable tie rods. Components are connected by ball joints. Linkage assembly is connected to steering gear by pitman arm.

LUBRICATION

FLUID TYPE

Recommended fluid type is Dexron or Dexron-II ATF.

FLUID LEVEL CHECK

Place vehicle in level position. Start engine and let idle. Turn steering wheel left and right. Replace fluid if it has bubbles or has become white. Fluid level should be between MIN and MAX marks on dipstick. Fill to proper level.

FLUID REPLACEMENT

CAUTION: DO NOT crank engine for more than 15-20 seconds.

1) Remove reservoir cap. Disconnect return hose at reservoir. Drain fluid. Disconnect coil high tension wire. Raise and support vehicle.

2) Turn steering wheel lock-to-lock several times while cranking engine to drain fluid from steering gear. Reconnect all hoses. Fill power steering system with fluid. Bleed system. See HYDRAULIC SYSTEM BLEEDING.

HYDRAULIC SYSTEM BLEEDING

CAUTION: DO NOT crank engine for more than 15-20 seconds.

1) Ensure reservoir is filled before bleeding. Add fluid (if necessary) during bleeding. Raise and support front of vehicle. Disconnect coil high tension wire.

2) While cranking engine, turn steering wheel lock-to-lock 5 or 6 times. Lower vehicle. Install a hose approximately 20" long to breather screw of steering gear.

3) Place other end of hose in container. Connect coil wire. Start engine and let idle. Turn steering wheel to left lock. Loosen breather screw. Turn steering wheel lock-to-lock until no more bubbles

appear in container.

4) Tighten breather screw. Remove hose. Check fluid level. Add fluid (if necessary). Turn steering wheel lock-to-lock. Fluid level should not change more than .20" (5.0 mm). If fluid level changes more than specified, repeat bleeding procedure.

ADJUSTMENTS

BELT TENSION ADJUSTMENT SPECIFICATIONS

BELT ADJUSTMENT TABLE

Application	(1) Deflection	
	In.	(mm)
Montero	.35-.57	(9.0-14.5)
(1) - With 22 lbs. (10 kg) pressure applied midway on longest belt run.		

STEERING WHEEL PLAY

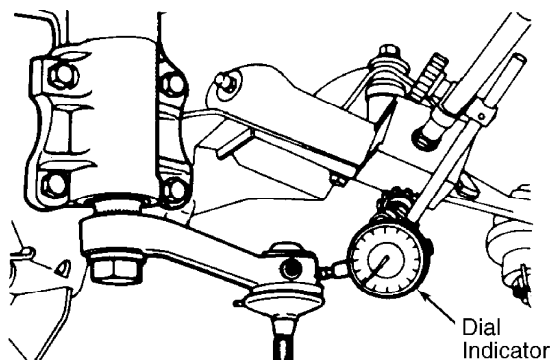
Raise and support vehicle. Start engine and let idle. With steering wheel in center position, ensure free play is 2.0" (51 mm) or less. If measured value exceeds specification, check steering gear backlash and linkage ball joint end play. See STEERING GEAR BACKLASH and LINKAGE BALL JOINT END PLAY under ADJUSTMENTS.

STEERING GEAR BACKLASH

NOTE: On 2WD models, use Adjustment Wrench (MB991149) and Side Cover Spanner (MB990914) to adjust steering gear backlash.

1) Set steering wheel in straight-ahead position. Raise and support vehicle. Disconnect relay rod from pitman arm. Using a dial indicator, measure steering gear backlash at top end of pitman arm.

2) Steering gear backlash should not exceed .02" (.51 mm). If measured value exceeds limit, turn steering gear box adjusting bolt until steering wheel free play is within specification.



93H82088

Fig. 1: Measuring Steering Gear Backlash
Courtesy of Mitsubishi Motor Sales of America.

LINKAGE BALL JOINT END PLAY

Hold ball joint with pliers. Using a caliper, measure ball joint end play while compressing ball joint. See Fig. 2. End play should not exceed .06" (1.5 mm). If measured value exceeds specification, replace ball joint.

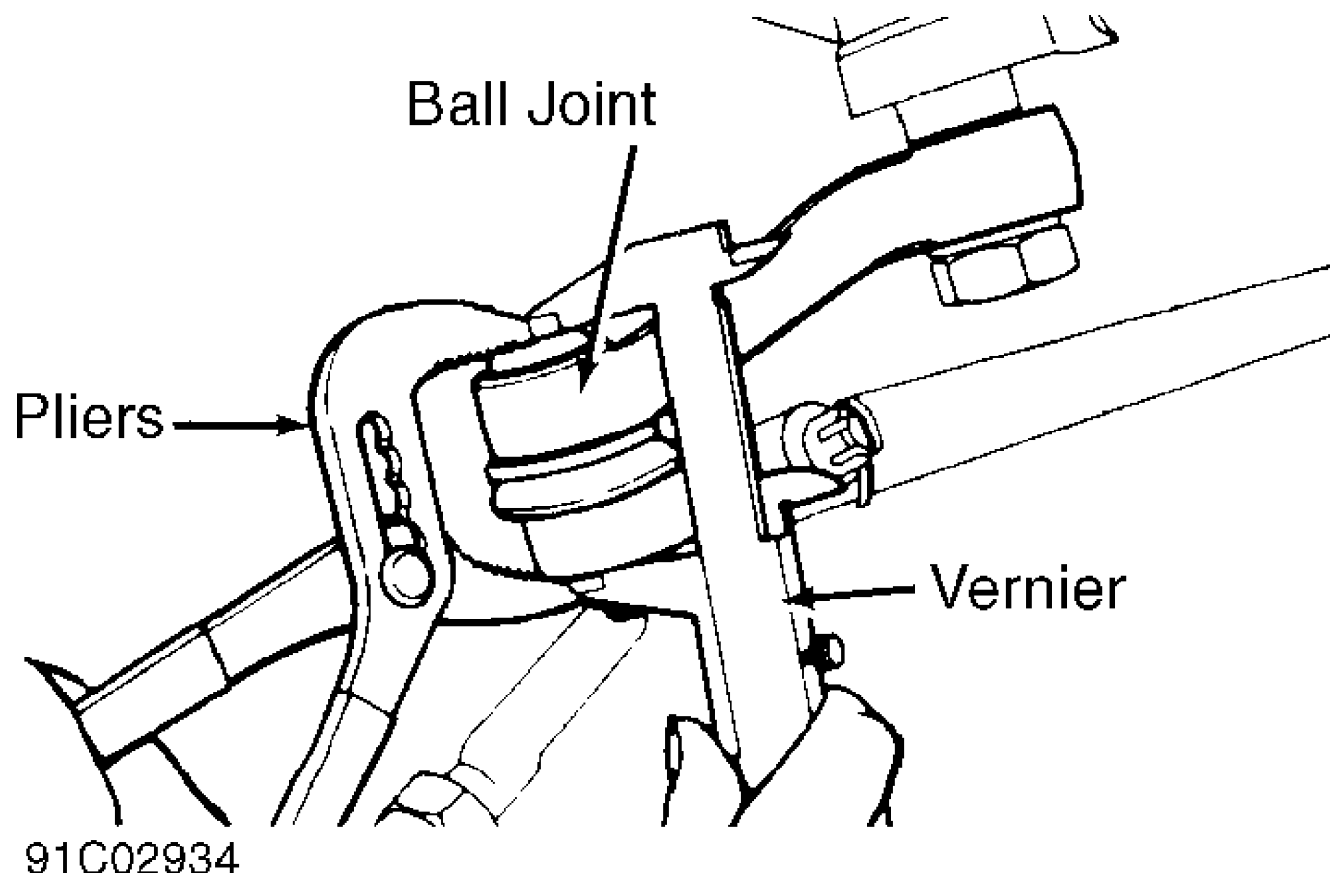


Fig. 2: Measuring Linkage Ball Joint End Play
Courtesy of Mitsubishi Motor Sales of America.

TESTING

HYDRAULIC SYSTEM PRESSURE TEST

1) Disconnect pressure hose from oil pump. Attach Pressure Gauge (MB990662-01) and Adapters (MB990993-01 and MB990994-01). See Fig. 3. Tighten fittings to 22-29 ft. lbs. (30-39 N.m).

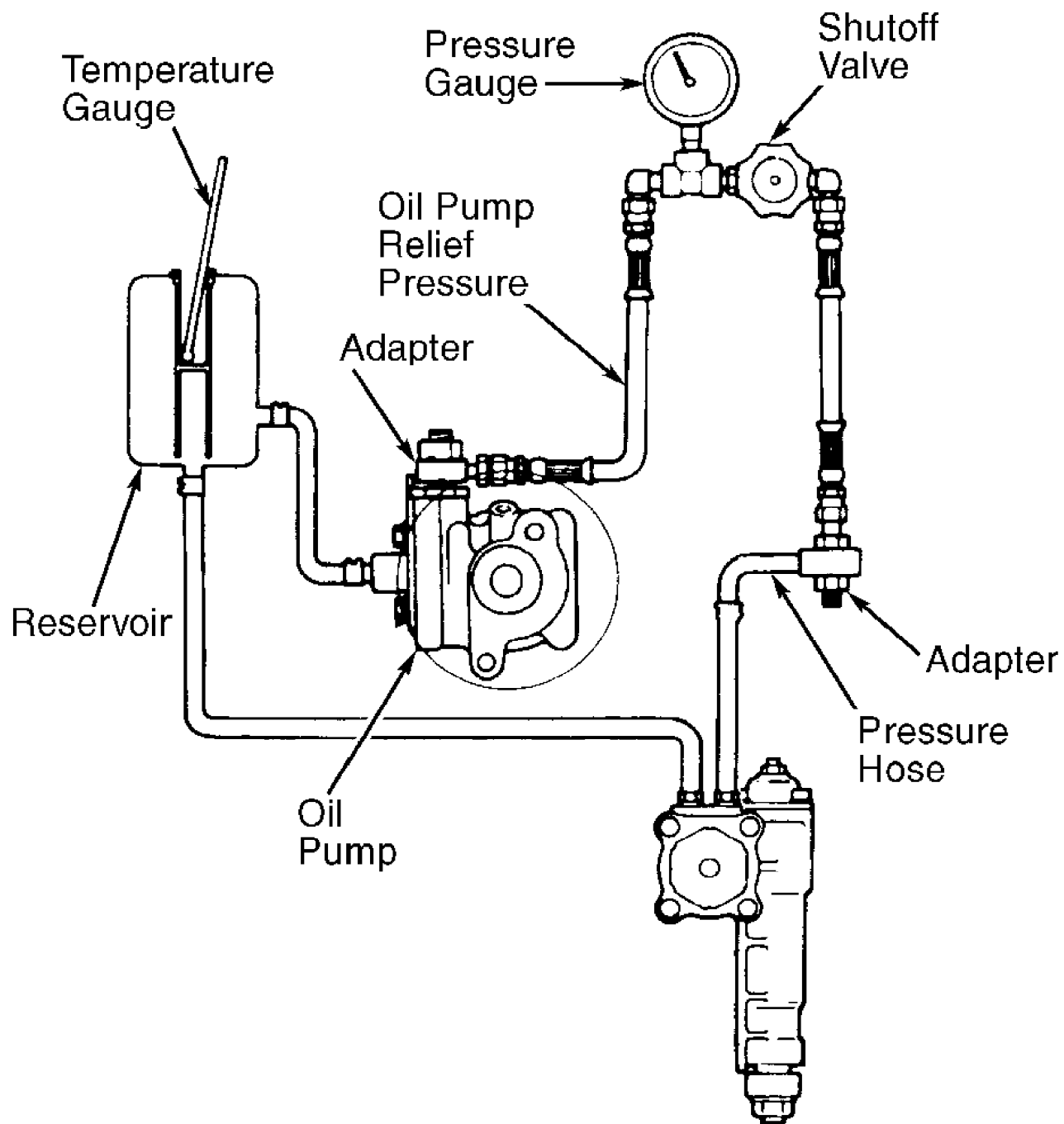
2) Bleed system. See HYDRAULIC SYSTEM BLEEDING under LUBRICATION. Close gauge valve 3 times to bleed air from gauge. Start engine and let idle. Place thermometer in reservoir. Check fluid level. Add fluid as necessary.

3) When fluid temperature reaches 131°F (55°C), check pressure. See OIL PUMP PRESSURE SPECIFICATIONS table. Reinstall pressure hose. Do not twist hose or let hose interfere with adjacent parts. Replace oil pump if pressure is not within specification.

CAUTION: DO NOT keep shutoff valve closed more than 3 seconds at a time. DO NOT keep steering wheel turned to lock position for more than 10 seconds at a time.

OIL PUMP PRESSURE SPECIFICATIONS TABLE

Application	psi (kg/cm ²)
Valve Closed	1067-1166 (75-82)
Valve Open (Standard)	114-142 (8-10)



93F82094

Fig. 3: Connecting Pressure Gauge & Shutoff Valve
 Courtesy of Mitsubishi Motor Sales of America.

STEERING WHEEL TURNING FORCE

Stationary Test

1) Position vehicle on level surface. Place steering wheel in straight-ahead position. Start engine and let idle. Using a spring scale, measure steering wheel turning force clockwise and counterclockwise.

2) Turning force should be 8.15 lbs. (3.7 kg/cm²) or less. If turning force exceeds specification, check for loose or damaged belt, insufficient oil, air in power steering fluid, and collapsed or twisted hoses. Repair or replace as necessary.

REMOVAL & INSTALLATION

IDLER ARM

Removal

Remove relay rod-to-idler arm lock nut. Using a puller, separate idler arm from relay rod. Remove idler arm bracket-to-frame bolts and nuts. Remove idler arm and bracket. Loosen, but DO NOT remove idler arm-to-bracket nut. Press arm from bracket and remove nut and arm.

Inspection

Check idler arm bushings for damage or wear. Check idler arm ball stud for looseness.

Installation

1) Apply multipurpose grease to inside surface of bushing and idler arm support shaft. Insert bushing in idler arm. Insert idler arm support in idler arm.

2) Install washer (knurled side toward bushing) and new lock nut. Tighten lock nut to specification. See TORQUE SPECIFICATIONS. Place idler arm assembly in vise. Using a spring gauge, measure turning resistance.

3) Turning resistance should be 3-17 INCH lbs. (.3-2.0 N.m). If turning resistance is not within specification, loosen or tighten lock nut to obtain proper resistance. Install idler arm bracket-to-frame bolts and nuts. Install relay rod-to-idler arm. See TORQUE SPECIFICATIONS.

POWER STEERING GEAR

Removal & Installation

1) Drain power steering fluid. See FLUID REPLACEMENT under LUBRICATION. Remove steering shaft-to-steering gear clamp bolt. Disconnect pressure and return hoses from steering gear.

2) Remove cotter pin and castle nut from pitman arm. Using Puller (C-3894-A), separate pitman arm from relay rod. Remove relay rod. See RELAY ROD under REMOVAL & INSTALLATION.

3) Remove steering gear mounting nuts. Disconnect steering shaft from steering gear. Remove steering gear. To install, reverse removal procedure.

POWER STEERING PUMP & RESERVOIR

Removal

Drain power steering fluid. See FLUID REPLACEMENT under LUBRICATION. Disconnect hoses from reservoir. Remove reservoir. Disconnect hoses from pump. Loosen pump retaining bolts. Remove belt. Remove pump and mounting bracket(s).

Installation

To install, reverse removal procedure. Check oil pump bracket

for slack. Tighten bracket (if necessary). Fill and bleed reservoir. See FLUID REPLACEMENT and HYDRAULIC SYSTEM BLEEDING under LUBRICATION. Start engine and turn steering wheel lock-to-lock to check for fluid leaks.

RELAY ROD

Removal

Remove inner tie rod end cotter pins and lock nuts. Separate tie rod ends from relay rod. Remove cotter pins and castle nuts from idler arm and pitman arm. Using a puller, separate relay rod from idler arm and pitman arm.

Installation

To install relay rod, reverse removal procedure. Ensure dust covers are well greased and lower edge of covers are coated with packing sealer. Tighten relay rod-to-idler arm and relay rod-to-pitman arm castle nuts to specification. See TORQUE SPECIFICATIONS TABLE.

TIE ROD ASSEMBLY

Removal

1) Remove skid plate (if necessary). Remove cotter pins and lock nuts from tie rod ball studs at steering knuckle and relay rod end.

2) Using a puller, separate tie rod ends from knuckle and relay rod end. Loosen tie rod adjusting sleeve lock nuts, and unscrew tie rod ends.

Inspection

Check tie rod ends for damage and ball studs for loose-ness. Measure ball stud starting torque. See TIE ROD BALL STUD STARTING TORQUE table. If ball stud starting torque exceeds specification, replace tie rod.

TIE ROD BALL STUD STARTING TORQUE TABLE

Application	INCH Lbs. (N.m)
2WD	4-13 (.5-1.5)
4WD	9-26 (1.0-3.0)

Installation

1) Install "O" ring on ball socket. Grease inside of tie rod end dust cover. Coat lower edge of cup with packing sealer. Install tie rod ends into adjusting sleeves.

2) Measure center-to-center distance between tie rod studs for both tie rod assemblies. Adjust center-to-center distance to specification. See TIE ROD INSTALLATION LENGTH table.

3) An equal number of threads should be visible on each side of adjusting sleeve. Install tie rod ends in steering knuckle and relay rod. Install tie rod end castle nuts and new cotter pins. Tighten castle nuts to specification. See TORQUE SPECIFICATIONS TABLE. Adjust toe-in. See WHEEL ALIGNMENT SPECIFICATIONS & PROCEDURES article in WHEEL ALIGNMENT section.

TIE ROD INSTALLATION LENGTH TABLE

Application	In. (mm)
Montero	12.05 (306.0)

OVERHAUL

POWER STEERING GEAR

Disassembly

1) Remove fluid hoses. Remove pitman arm nut. Using a puller, remove pitman arm. Remove breather screw, and drain steering gear oil. Remove side cover bolts. See Fig. 4. Loosen adjusting bolt lock nut, and screw in adjusting bolt so side cover raises slightly.

2) With mainshaft and cross shaft placed in straight-ahead position, tap bottom of cross shaft with plastic hammer. Remove cross shaft and side cover as an assembly. Remove side cover from cross shaft by turning adjusting bolt.

3) Remove valve housing and rack piston as an assembly. See Fig. 4. Turn rack piston counterclockwise. Carefully remove rack piston from mainshaft without losing balls inside rack piston.

4) Remove cross shaft oil seal from gear box housing. Using Spanner Wrench (MB990201-01), remove lock nut. Remove mainshaft while applying pressure to bearing race to prevent balls from falling out. Drive out bearing and oil seal.

NOTE: DO NOT remove cross shaft "U" packing at rear of needle bearing unless fluid leakage is found coming from adjusting bolt threads. If leakage exists, replace "U" packing.

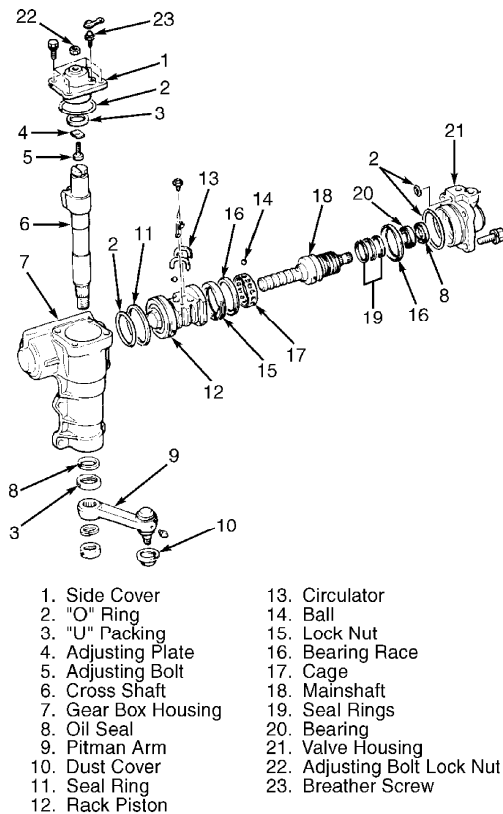


Fig. 4: Exploded View Of Power Recirculating Ball Steering Gear
Courtesy of Mitsubishi Motor Sales of America.

Inspection

Check mainshaft for wear and damage. Check tooth surface of

cross shaft and rack piston for wear and damage. Check contact part of adjusting bolt for uneven wear. Check dust seal, oil seal and "O" rings for wear and damage.

Reassembly

1) Install new cross shaft lower "U" packing (if removed). Press lower cross shaft oil seal into gear box housing. See Fig. 4. Press bearing and oil seal into top cover. Install bearing race and "O" ring.

2) Apply transmission fluid to seal ring contact areas on mainshaft, and install seal rings firmly into valve grooves. Wrap serrated part of mainshaft with vinyl tape. Mount valve body to valve housing. Install cage and align hole in cage with channel in mainshaft. Install bearing race and insert balls.

3) Install mainshaft into valve housing while pressing on bearing race to prevent balls from falling out. Using spanner wrench, install lock nut and tighten until it contacts bearing race.

4) Tighten lock nut while measuring mainshaft starting torque using Preload Socket (MB990228-01) and an INCH-lb. torque wrench. When mainshaft starting torque is 3-8 INCH lbs. (.4-1.0 N.m), use a punch to crimp circumference of lock nut.

5) Apply transmission fluid to "O" ring and piston seal ring, and install into gear box housing. Install rack piston until it contacts edge of mainshaft. Rotate mainshaft to align ball raceway with insertion hole. Install 19 balls.

NOTE: Insert balls so no clearance exists between balls.

6) Place remaining 7 balls in circulator and install circulator to rack piston. Install circulator holder. Install new cross shaft upper "U" packing (if removed). Install upper cross shaft "O" ring. Apply transmission fluid to rack piston seal ring and insert valve housing. Rotate mainshaft until rack piston is centered (neutral position).

7) Install adjusting plate so beveled part is facing upward. Using a feeler gauge, measure clearance between adjusting bolt and cross shaft. If clearance is greater than .002" (.05 mm), replace with appropriate adjusting plate.

8) Apply multipurpose grease to seal surface of "U" packing. Apply transmission fluid to cross shaft teeth and side cover "O" ring. Install cross shaft to side cover, and temporarily tighten adjusting bolt lock nut.

CAUTION: DO NOT rotate side cover during installation, or damage to cross shaft oil seal may result.

9) Apply transmission fluid to rack piston teeth and shaft areas. Apply multipurpose grease to oil seal lip. Install side cover assembly (with cross shaft) to gear box.

10) Position mainshaft in straight-ahead position. While turning adjusting bolt, measure mainshaft combined starting torque using Preload Socket (MB990228-01) and an INCH-lb. torque wrench. Combined starting torque should be 4.0-11.0 INCH lbs. (.5-1.3 N.m).

11) Tighten adjusting bolt lock nut to specification. See TORQUE SPECIFICATIONS. Install pitman arm with mating marks aligned.

POWER STEERING PUMP

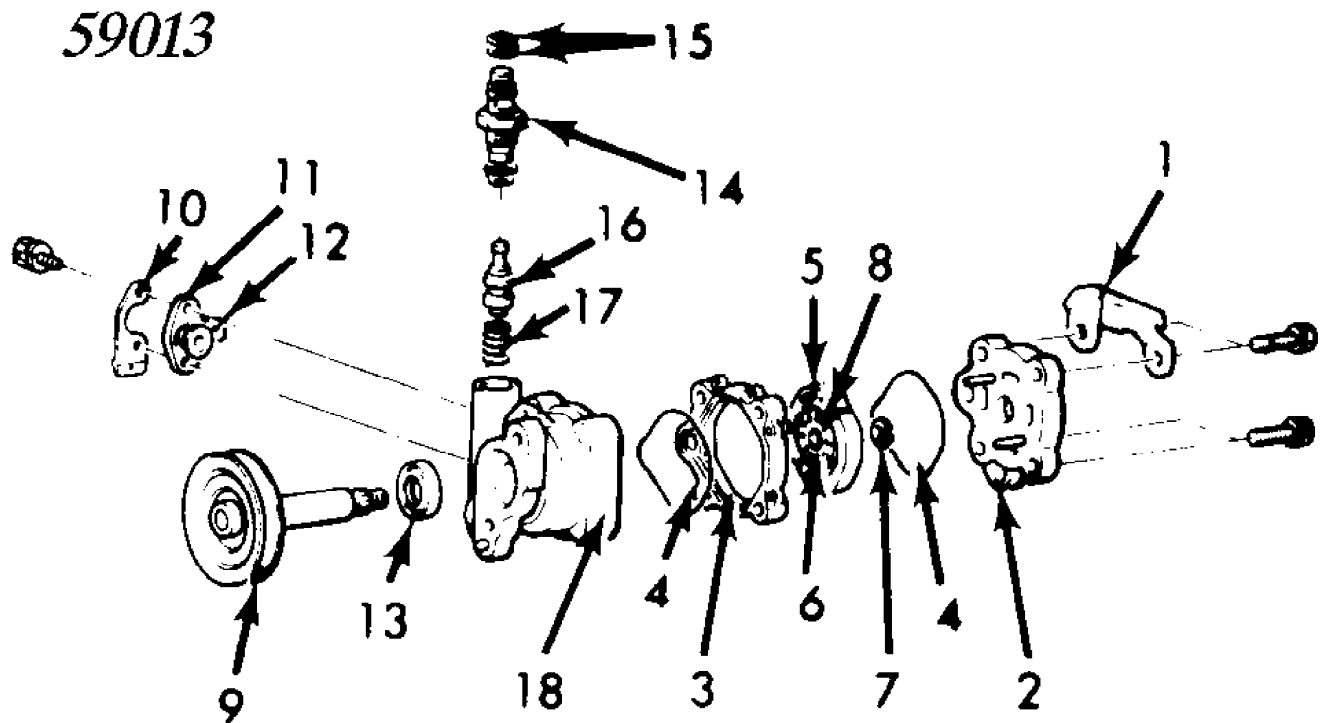
Disassembly

1) Remove suction connector bolts. Mount pump in a soft-jawed vise. Remove pump cover bolts and cover. Using a plastic mallet, tap pulley assembly shaft from pump housing. See Fig. 5.

2) Remove cam ring, vanes, shaft assembly and "O" rings.

Remove snap ring from shaft assembly. Remove collar, rotor and side plate from shaft.

3) Pry oil seal out of housing. Remove pressure connector. Remove flow control valve assembly, flow control spring and 2 "O" rings. DO NOT disassemble flow control valve assembly.



1. Reservoir Bracket
2. Pump Cover
3. Cam Case
4. "O" Ring
5. Cam Ring
6. Rotor Vanes
7. Snap Ring
8. Rotor
9. Pulley Assembly

10. Suction Connector Bracket
11. Suction Connector Plate
12. Suction Tube
13. Oil Seal
14. Pressure Connector
15. "O" Ring
16. Flow Control Valve
17. Spring
18. Pump Body

Fig. 5: Exploded View Of Power Steering Pump
Courtesy of Mitsubishi Motor Sales of America.

Inspection

1) Inspect pump shaft oil seal lip and bushing end for damage. Inspect groove of rotor vane and cam surface for stepped wear. Check vane for damage. Install vane into rotor groove. Measure clearance between vane and rotor groove. If clearance exceeds .0024" (.061 mm), replace entire assembly.

2) Check ring and rotor sides for damage. Replace entire assembly if any damage is present. Check sliding surfaces of control valve for obstructions. Replace parts as required. If control valve is

replaced, always use valve with same identification mark as one being replaced. Check oil pressure.

Reassembly

1) Lubricate "O" rings and internal pump components with ATF before reassembly. Install flow control valve spring and control valve in housing.

2) Install and tighten pressure connector. Depress control valve to check for smooth operation. Apply grease to lip of oil seal. Install oil seal into pump body. Install pulley assembly into pump body.

3) Install rotor to pulley assembly with punch mark at pump cover side. Install snap ring. Lift rotor to ensure that snap ring is in countersunk part of shaft. Align cam ring dowel holes and install cam ring with punch mark on pump body side.

4) Apply transmission fluid to vanes, and install vanes onto rotor with rounded edges outward. Install "O" ring, cam case and pump cover. Install and tighten suction connector.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS TABLE

Application	Ft. Lbs. (N.m)
Adjusting Bolt Lock Nut	27 (38)
Idler Arm Bracket-To-Frame Bolt & Nut	
2WD	25-40 (34-54)
4WD	40-47 (54-64)
Idler Arm-To-Bracket Lock Nut	33 (45)
Oil Pump Cover Bolts	14 (20)
Pitman Arm-To-Cross Shaft Nut	108-123 (146-167)
Pressure Hose In-Line Fitting	25 (34)
Relay Rod-To-Idler Arm Nut	33 (45)
Relay Rod-To-Pitman Arm Nut	33 (45)
Side Cover Bolts	36 (50)
Steering Gear Hose Fittings	11 (15)
Steering Gear-To-Frame Bolts	40-47 (54-64)
Tie Rod Adjusting Sleeve Lock Nuts	53 (73)
Tie Rod End Castle Nuts	
2WD	25-33 (34-45)
4WD	33 (45)
Valve Housing Bolts	36 (50)
Valve Housing Lock Nut	(1)

INCH Lbs. (N.m)

Breather Screw

24-36 (3-4)

(1) - Tighten lock nut until it contacts bearing race.

*** STEERING UNIFORM INSPECTION GUIDELINES ***

1993 Mitsubishi Montero

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 BEARINGS, RACES AND SEALS

Wheel Alignment

WHEEL ALIGNMENT

Wheels and Tires

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

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 HARNESSSES

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

Splines damaged	.....	A	... of seal and/or mating part. 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.

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		

- (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 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.

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.

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.

SUN ROOF - POWER

1993 Mitsubishi Montero

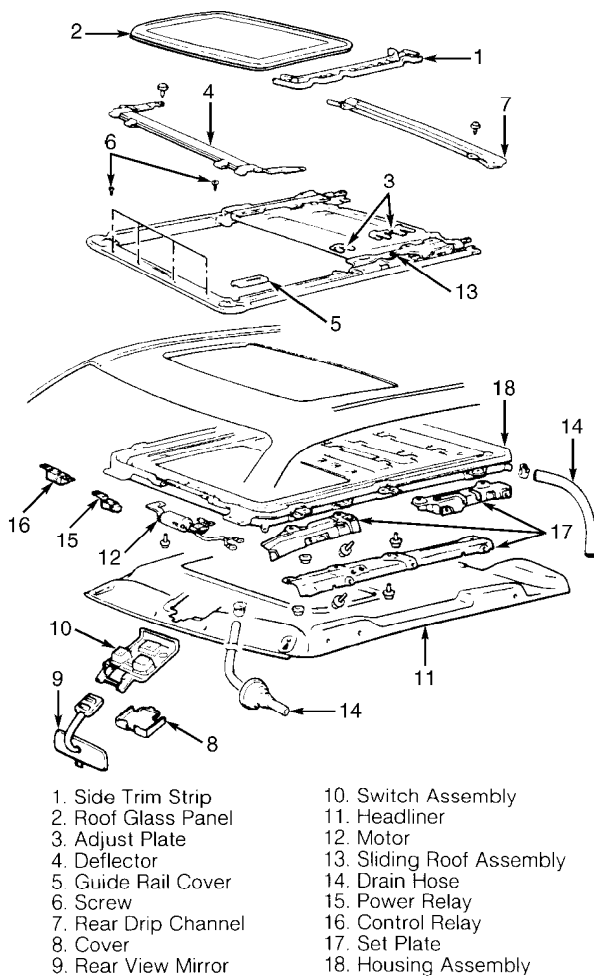
1993 ACCESSORIES & EQUIPMENT
Mitsubishi Power Sun Roof

Montero

DESCRIPTION & OPERATION

The sun roof is actuated by a overhead console mounted switch. The motor, located near the switch, moves the sun roof panel by means of drive cables. If necessary, sun roof can be closed manually, using crank handle stored in tool pouch.

Sun roof motor incorporates feature to initially limit opening or closing of roof glass panel (safety feature). For example, sun roof will not fully close from fully open position without releasing, then depressing slide switch during operation. Sun roof initially stops approximately 8" short of fully closed position.



93B83445
Fig. 1: Exploded View Of Sun Roof Assembly (Typical)
Courtesy of Mitsubishi Motor Sales of America.

MAINTENANCE

LUBRICATION

NOTE: Manufacturer only provides lubrication procedures during reassembly of sliding roof assembly components.

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.
- * Control relay.
- * Power relay.

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 LINKS

- * 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.

TESTING

DRIVE MOTOR

Remove drive motor. See DRIVE MOTOR under REMOVAL & INSTALLATION. Using 12-volt power supply, apply voltage to left side terminals of 4-terminal connector (connector latch upward). Reverse power supply leads to reverse motor direction. Replace motor as

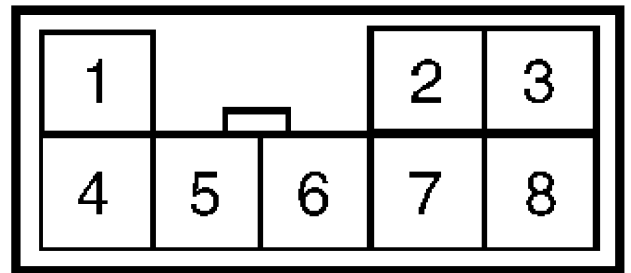
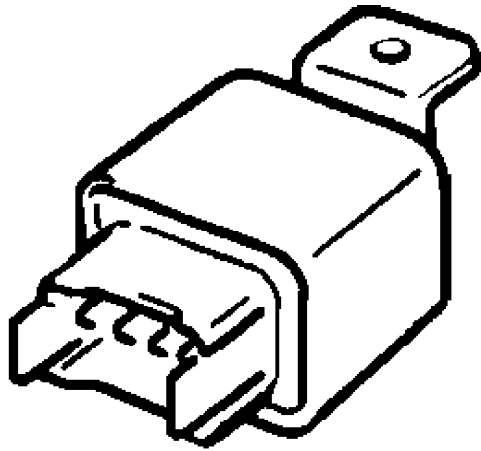
needed.

DRIVE MOTOR LIMIT SWITCH

Using ohmmeter, check continuity of limit switch. When intermittent gear cam of drive motor depresses switch lever, continuity should exist between right side terminals of drive motor 4-terminal connector (connector latch upward). Replace drive motor if switch fails test.

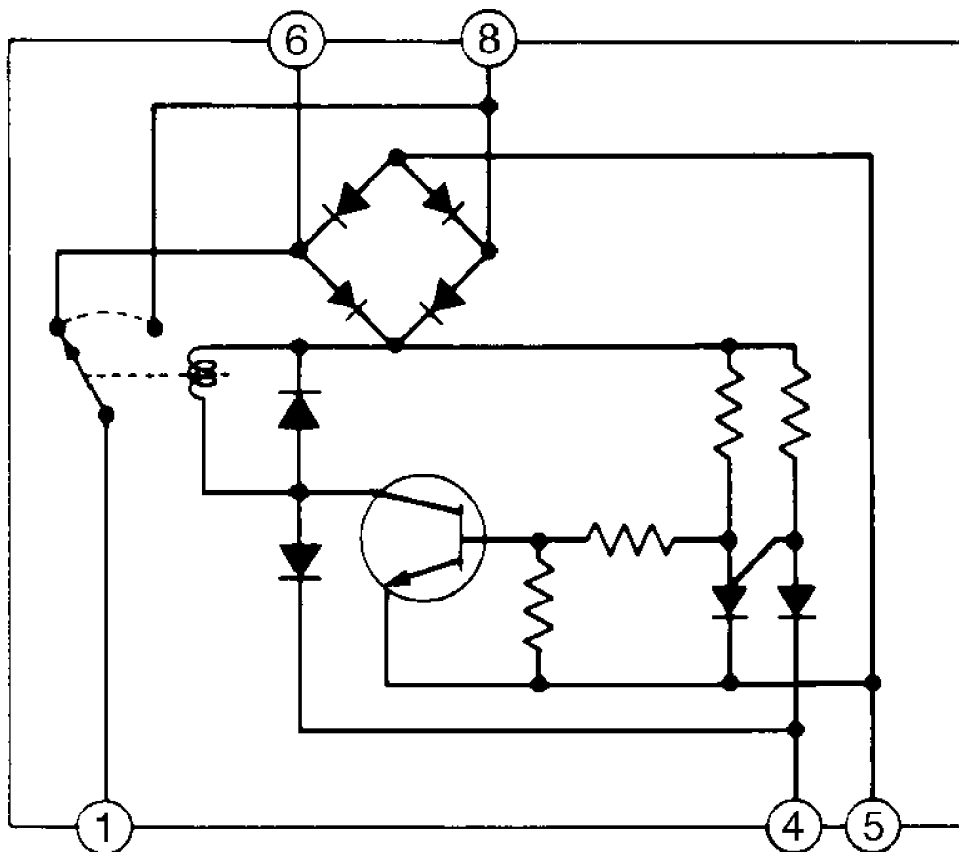
SUN ROOF CONTROL RELAY

To gain access to control relay, see CONTROL RELAY/POWER RELAY under REMOVAL & INSTALLATION. Disconnect harness connector. Using ohmmeter, check continuity of control relay. See Figs. 2 and 3. Replace relay as needed.



93G83416

Fig. 2: Control Relay Terminal ID
Courtesy of Mitsubishi Motor Sales of America.



Battery positive voltage	Terminal	1	8	6	5	4
When there is no current		○ ⊕ ⊖	○ ⊕ ⊖	○ ⊕ ⊖	⊖	⊕
When there is current		○	⊕ ⊖	⊖ ⊕		

NOTE

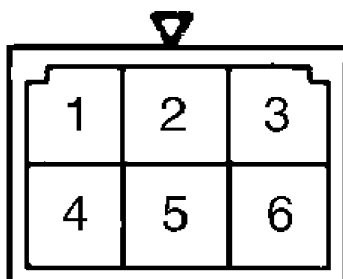
- (1) ○—○ indicates that there is continuity between the terminals.
- (2) ⊕—⊖ indicates that there is continuity when the (+) is connected to the tester plus terminal, and the (−) is connected to the tester minus terminal.
- (3) ⊕—⊖ indicates terminals to which battery positive voltage is applied.

93H83417

Fig. 3: Testing Control Relay
Courtesy of Mitsubishi Motor Sales of America.

SUN ROOF SWITCH

Using ohmmeter, check continuity between selected switch terminals. See Fig. 4. Replace switch as needed.



Switch \ Terminal	1	2	3	5	6
OPEN					
OFF					
CLOSED					

NOTE

  Indicates that there is continuity between the terminals.

93183418

Fig. 4: Inspecting Sun Roof Switch Continuity
Courtesy of Mitsubishi Motor Sales of America.

REMOVAL & INSTALLATION

CONTROL RELAY/POWER RELAY

Removal & Installation

Remove overhead switch assembly. Lower headliner to gain access to relays. See DRIVE MOTOR under REMOVAL & INSTALLATION. Remove relays. To install, reverse removal procedure.

DRIVE CABLES

Removal & Installation

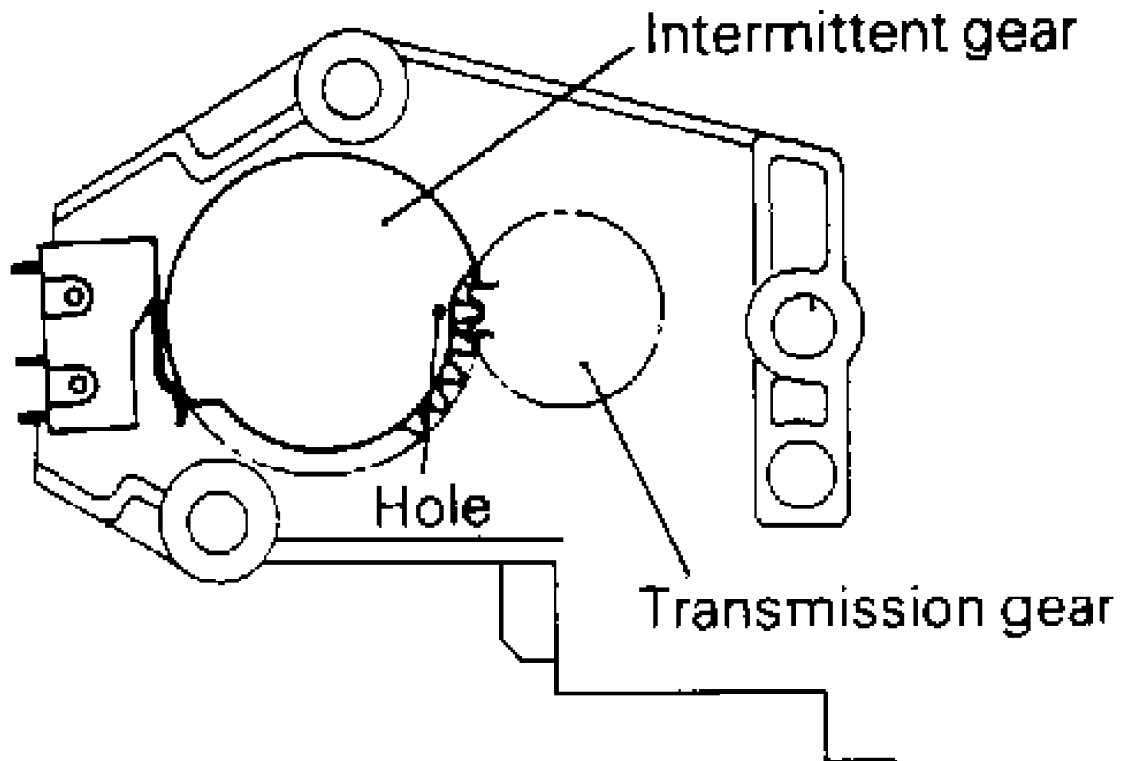
1) With sun roof assembly removed from vehicle, remove plastic mounting cover and roof glass panel. Remove front guide bracket and deflector assembly. Remove front guide rail end cover. Remove set plate and guide rail assembly. Remove sun shade and drive cable tube. Remove lifter assembly and slider assembly from housing assembly.

2) Ensure guide rail, sliding assembly and drive cables are clean before reassembly. To reassemble, reverse disassembly procedure. Apply multipurpose grease to all moving components. To install sliding roof assembly, reverse removal procedure.

DRIVE MOTOR

Removal & Installation

Remove sun roof switch assembly. Remove drive motor. To install, open roof glass panel approximately 7.9" (200 mm). Using manual closure wrench, rotate drive motor until alignment hole of intermittent gear is aligned with center of drive gear. See Fig. 5. To complete installation, reverse removal procedure.



93H46240

Fig. 5: Aligning Sun Roof Motor Drive Gears
Courtesy of Mitsubishi Motor Sales of America.

SUN ROOF

Removal & Installation

1) Remove decoration 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 hose, reverse removal procedure. To install, reverse removal procedure. See

DRIVE MOTOR for installation procedures.

WIRING DIAGRAMS

See appropriate chassis wiring diagram in the WIRING DIAGRAMS section.

SUSPENSION - FRONT (4WD)

1993 Mitsubishi Montero

1993 SUSPENSION
Mitsubishi - Front - 4WD

Montero

DESCRIPTION

Independent front suspension is double wishbone construction with torsion bar. Components used with this system include upper control arm, lower control arm, shock absorber, stabilizer bar and steering knuckle. See Fig. 1.

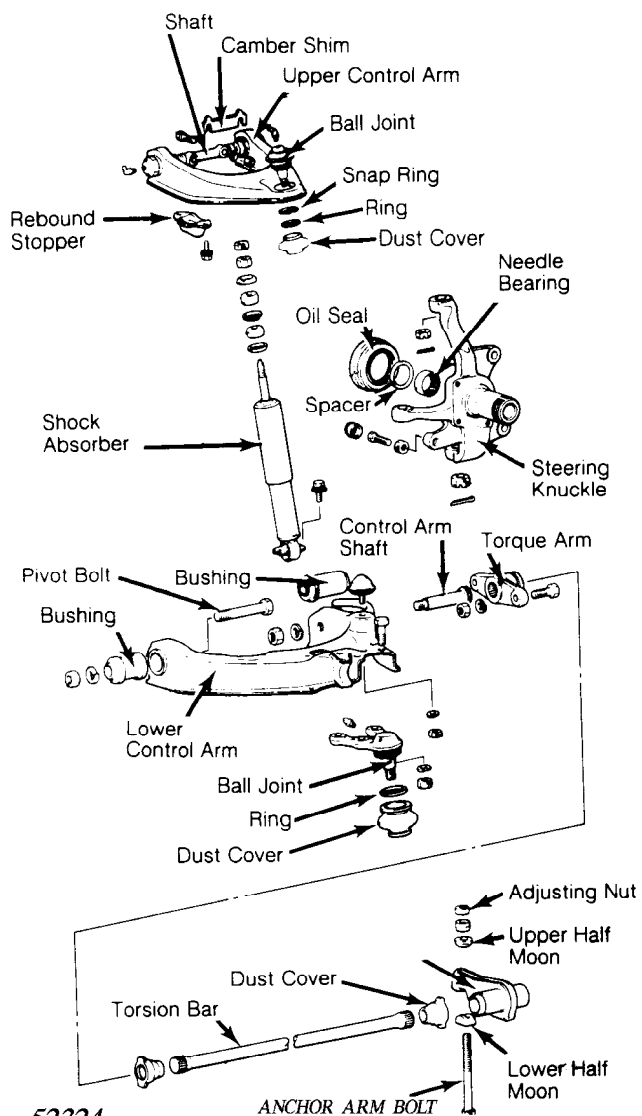


Fig. 1: Exploded View Of 4WD Front Suspension
Courtesy of Mitsubishi Motor Sales of America.

ADJUSTMENTS & INSPECTION

WHEEL ALIGNMENT SPECIFICATIONS & PROCEDURES

NOTE: See WHEEL ALIGNMENT SPECIFICATIONS & PROCEDURES article in WHEEL ALIGNMENT section.

WHEEL BEARING

Preload

1) Remove locking hub assembly. See LOCKING HUB under REMOVAL & INSTALLATION. Remove lock washer screws. Remove lock washer. See Fig. 2. Remove brake caliper.

2) Using Socket (MB990954-01) and torque wrench, rotate front hub while tightening lock nut to 95-145 ft. lbs. (130-200 N.m). Loosen nut. Retighten nut to 18 ft. lbs. (24 N.m).

3) Loosen nut 30-40 degrees. Install lock washer. If lock washer hole is not aligned with lock nut hole, lock nut may be rotated up to 20 degrees to obtain alignment. After setting preload, check hub turning resistance and axial play.

Hub Turning Resistance & Axial Play

1) Using dial indicator, check front hub axial play. Axial play should be .002" (.05 mm) or less. Using INCH-lb. torque wrench or spring scale attached to wheel stud, measure hub turning resistance. Turning resistance should be 1-4 lbs. (0.45-1.80 kg) if measured using spring scale or 2.6-11.3 INCH lbs. (0.3-1.3 N.m) if measured using torque wrench.

2) Adjust wheel bearing so turning resistance and axial play are within specification. If turning resistance and axial play cannot be adjusted to specification, check wheel bearing condition and installation.

Drive Axle End Play

Install drive axle shim and snap ring. See Fig. 2. Measure clearance between shim and snap ring. If clearance is not .016-.028" (.40-.70 mm) replace shim to bring clearance into specification.

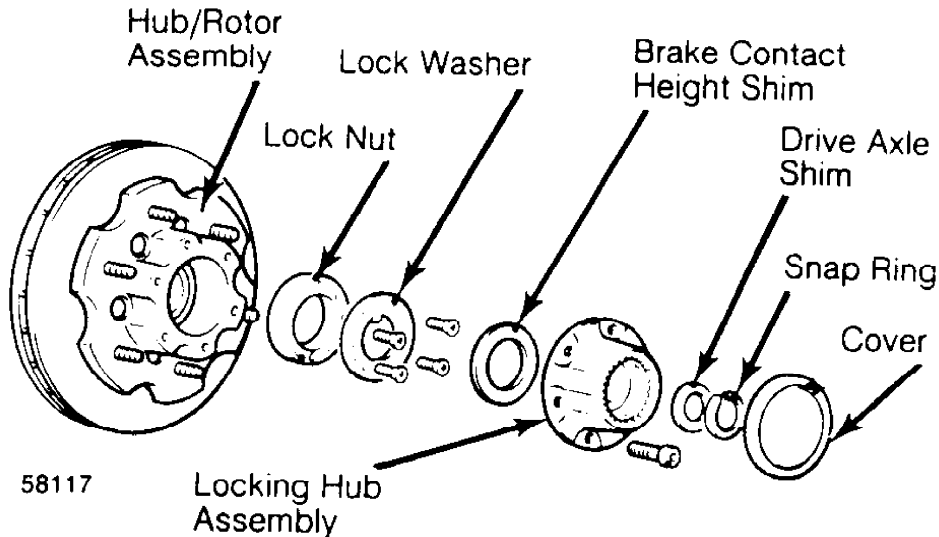


Fig. 2: Exploded View Of Automatic Locking Hub (Typical)
Courtesy of Chrysler Motors.

BALL JOINT CHECKING

Lower Ball Joint

Place ball joint in soft-jawed vise. Install dial indicator with stem resting on end of ball joint stud. Measure ball joint stud end play. Replace ball joint if end play exceeds .02" (.5 mm). For ball joint replacement, see LOWER BALL JOINT under REMOVAL & INSTALLATION.

Upper Ball Joint

1) Disconnect ball joint from steering knuckle. Place nut on ball joint stud. Using INCH-lb. torque wrench, measure starting torque required to rotate ball joint stud.

2) Starting torque should be 7-30 INCH lbs. (0.8-3.4 N.m). Replace ball joint if starting torque is not within specification. For ball joint replacement, see UPPER BALL JOINT under REMOVAL & INSTALLATION.

TROUBLE SHOOTING

VARIABLE SHOCK ABSORBERS

Variable Shock Absorber (VSA) Indicator Light Does Not Illuminate In Soft (S) Mode

1) Turn ignition on. Push VSA mode selector switch to soft (S) position. Switch is located on center console. If indicator light illuminates, circuit is functioning normally. If indicator light does not illuminate, remove control switch.

2) Disconnect VSA mode selector switch. Connect jumper wire between VSA mode selector switch harness connector terminal No. 4 (Red/Green wire) and vehicle ground. If indicator light illuminates, go to next step. If light does not illuminate, go to step 4).

3) Check continuity of VSA mode selector switch ground circuit. Using ohmmeter, check resistance between VSA mode selector switch harness connector terminal No. 2 (Black wire) and vehicle ground. If continuity exists, replace VSA mode selector switch. If continuity does not exist, inspect and repair circuit as needed.

4) Inspect condition of fuse No. 11. Fuse block is located behind left corner of driver's dash. Replace fuse as needed. If fuse is okay, inspect condition of indicator light (LED). Replace as needed. If light is okay, check resistance between indicator light harness connector terminal No. 201 (Red/Green wire) and VSA mode selector switch harness connector terminal No. 4 (Red/Green wire). If continuity does not exist, inspect and repair circuit as needed.

Variable Shock Absorber (VSA) Indicator Light Does Not Illuminate In Medium (M) Mode

1) Turn ignition on. Push VSA mode selector switch to medium (M) position. Switch is located on center console. If indicator light illuminates, circuit is functioning normally. If indicator light does not illuminate, remove control switch.

2) Disconnect VSA mode selector switch. Connect jumper wire between VSA mode selector switch harness connector terminal No. 5 (Red/Yellow wire) and vehicle ground. If indicator light illuminates, go to next step. If light does not illuminate, go to step 4).

3) Check continuity of VSA mode selector switch ground circuit. Using ohmmeter, check resistance between VSA mode selector switch harness connector terminal No. 2 (Black wire) and vehicle ground. If continuity exists, replace VSA mode selector switch. If continuity does not exist, inspect and repair circuit as needed.

4) Inspect condition of fuse No. 11. Fuse block is located behind left corner of driver's dash. Replace fuse as needed. If fuse is okay, inspect condition of indicator light (LED). Replace as needed. If light is okay, check resistance between indicator light

harness connector terminal No. 206 (Red/Yellow wire) and VSA mode selector switch harness connector terminal No. 5 (Red/Yellow wire). If continuity does not exist, inspect and repair circuit as needed.

Variable Shock Absorber (VSA) Indicator Light Does Not Illuminate In Hard (H) Mode

1) Turn ignition on. Push VSA mode selector switch to hard (H) position. Switch is located on center console. If indicator light illuminates, circuit is functioning normally. If indicator light does not illuminate, remove control switch.

2) Disconnect VSA mode selector switch. Connect jumper wire between VSA mode selector switch harness connector terminal No. 6 (Red wire) and vehicle ground. If indicator light illuminates, go to next step. If light does not illuminate, go to step 4).

3) Check continuity of VSA mode selector switch ground circuit. Using ohmmeter, check resistance between VSA mode selector switch harness connector terminal No. 2 (Black wire) and vehicle ground. If continuity exists, replace VSA mode selector switch. If continuity does not exist, inspect and repair circuit as needed.

4) Inspect condition of fuse No. 11. Fuse block is located behind left corner of driver's dash. Replace fuse as needed. If fuse is okay, inspect condition of indicator light (LED). Replace as needed. If light is okay, check resistance between indicator light harness connector terminal No. 203 (Red wire) and VSA mode selector switch harness connector terminal No. 6 (Red wire). If continuity does not exist, inspect and repair circuit as needed.

NOTE: If damping force does not change for all shock absorbers, malfunction of wiring harness should be diagnosed first.

Damping Force Does Not Change With Mode Selector Switch Change

1) Turn ignition on. Have an assistant conduct a bounce test on each corner of vehicle as VSA mode selector switch is changed between each mode. If damping force does not change on a individual shock absorber, disconnect and remove actuator from malfunctioning shock.

2) Switch actuator removed with known good actuator and reinspect system operation. Replace actuator if malfunction of shock appears at other wheel. If initial shock absorber still does not function properly, remove actuator.

3) Turn control rod of shock absorber. Replace shock absorber, if rod does not turn easily without binding. If rod turns freely, disconnect actuator harness connector.

4) Using DVOM, measure voltage between actuator harness connector terminal No. 1 (Blue wire) and vehicle ground. If battery voltage does not exist, inspect condition of fuse No. 7. Fuse block is located behind left corner of driver's dash. Replace fuse as needed. If fuse is okay, inspect and repair power supply circuit between VSA control unit and actuator harness connector. VSA control unit is located in left rear corner of vehicle. See appropriate wiring diagram.

5) Replace VSA control unit if power supply circuit is okay. Check continuity of remaining ground circuits. See appropriate wiring diagram. Inspect and repair ground circuits as needed.

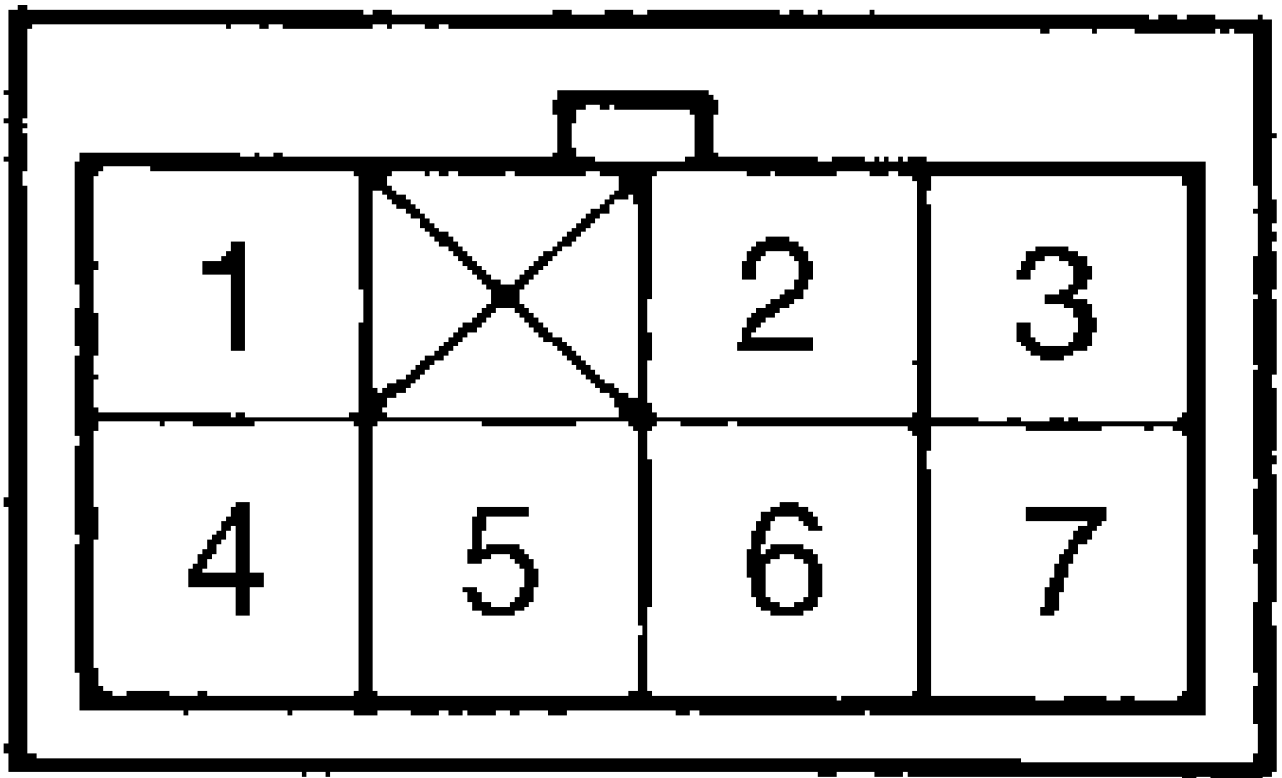
No Damping Force Change At All Wheels

Disconnect VSA control module. Control module is located in left rear corner of vehicle. Perform circuit continuity and voltage check. See VSA CONTROL MODULE CIRCUIT INSPECTION table. All continuity and voltage checks are between VSA control module terminal and vehicle ground. If all circuits test okay, replace VSA control module.

VSA CONTROL MODULE CIRCUIT INSPECTION TABLE

Terminal No. (1)	Mode Selection	Measurement
1	All	Continuity
2	Soft Or Medium	No Continuity
2	Hard	Continuity
3	Medium Or Hard	No Continuity
3	Soft	Continuity
4 (2)	Ignition Off	Zero Volts
4 (2)	Ignition On	Battery Voltage
6 (3)	Any Selection (4) ..	Battery Voltage
7	Soft Or Hard	No Continuity
7	Medium	Continuity

- (1) - See Fig. 3.
(2) - Power Supply (voltage measurement).
(3) - Terminal number 5 is not used.
(4) - Battery voltage is temporarily present 5 seconds after operating VSA mode selector switch.



93D82167

Fig. 3: Identifying VSA Control Module Connector
Courtesy of Mitsubishi Motor Sales of America.

REMOVAL & INSTALLATION

STEERING KNUCKLE

Removal

1) Raise and support vehicle. Remove wheel assembly. Remove brake caliper. Remove hub/rotor assembly. See WHEEL BEARING under REMOVAL & INSTALLATION. Remove dust cover from steering knuckle.

2) Disconnect tie rod end from steering knuckle. Mark torsion bar adjusting nut for installation reference. Loosen torsion bar anchor arm assembly adjusting nut. Loosen, but DO NOT remove, ball joint-to-steering knuckle nuts.

3) Using ball joint separator, separate ball joints from steering knuckle. Detach upper and lower ball joints from steering knuckle. Remove steering knuckle from drive axle. Remove oil seal and spacer from steering knuckle.

Inspection

Inspect steering knuckle for cracks. Inspect spindle for wear and heat damage.

Installation

1) If needle bearing needs replacement, drive bearing from steering knuckle. Use Bearing Driver (MB990956-01) and Handle (MB9909938-01) to install needle bearing.

NOTE: DO NOT reuse steering knuckle needle bearing if it is removed.

2) Using bearing installer and handle, install NEW needle bearing until it is even with steering knuckle end face. Lubricate bearing roller surface and spacer-to-steering knuckle contact areas. Install spacer with chamfered side toward inside of vehicle.

3) Using Seal Installer (MB990985-01) and handle, install seal in steering knuckle until seal is even with steering knuckle end face. Apply grease to seal lip area and inside of seal. To complete installation, reverse removal procedure. Tighten bolts to specification. See TORQUE SPECIFICATIONS.

LOWER BALL JOINT

Removal

1) Raise and support vehicle. Remove skid plate (if equipped). Remove wheel assembly. Mark torsion bar adjusting nut for reassembly reference. Release torsion bar tension.

2) Loosen, but DO NOT remove, lower ball joint stud nut. Using ball joint separator, separate ball joint from steering knuckle. Remove ball joint stud nut. Remove ball joint-to-lower control arm bolts. Remove ball joint.

Installation

Lubricate ball joint. Reverse removal procedure to complete installation. Tighten bolts to specification. See TORQUE SPECIFICATIONS.

LOWER CONTROL ARM

Removal

1) Raise and support vehicle. Remove wheel assembly. Remove front skid plate and undercover (if equipped). Remove torsion bar. See TORSION BAR. Remove stabilizer bar bolt from control arm.

2) Remove shock absorber-to-control arm bolts. Loosen, but DO NOT remove, lower ball joint-to-steering knuckle nut. Using ball joint fork, separate lower ball joint from steering knuckle.

3) Remove ball joint stud nut from steering knuckle. Remove

control arm shaft. See Fig. 1. Remove torque arm. Remove lower control arm pivot bolt. Remove lower control arm.

Inspection

1) Inspect control arm for cracks and deformation. Check ball joints. See BALL JOINT CHECKING under ADJUSTMENTS & INSPECTION.

2) Inspect ball joint dust covers for damage. Replace damaged dust covers. Inspect control arm bushing and frame bracket bushing for damage. Replace bushings if necessary.

NOTE: Differential carrier may require detachment in order to replace left bracket bushing.

3) Use press and Bushing Remover/Installer (MB990883-01) if control arm bushing needs replacement. Press bushing from control arm. See Fig. 4.

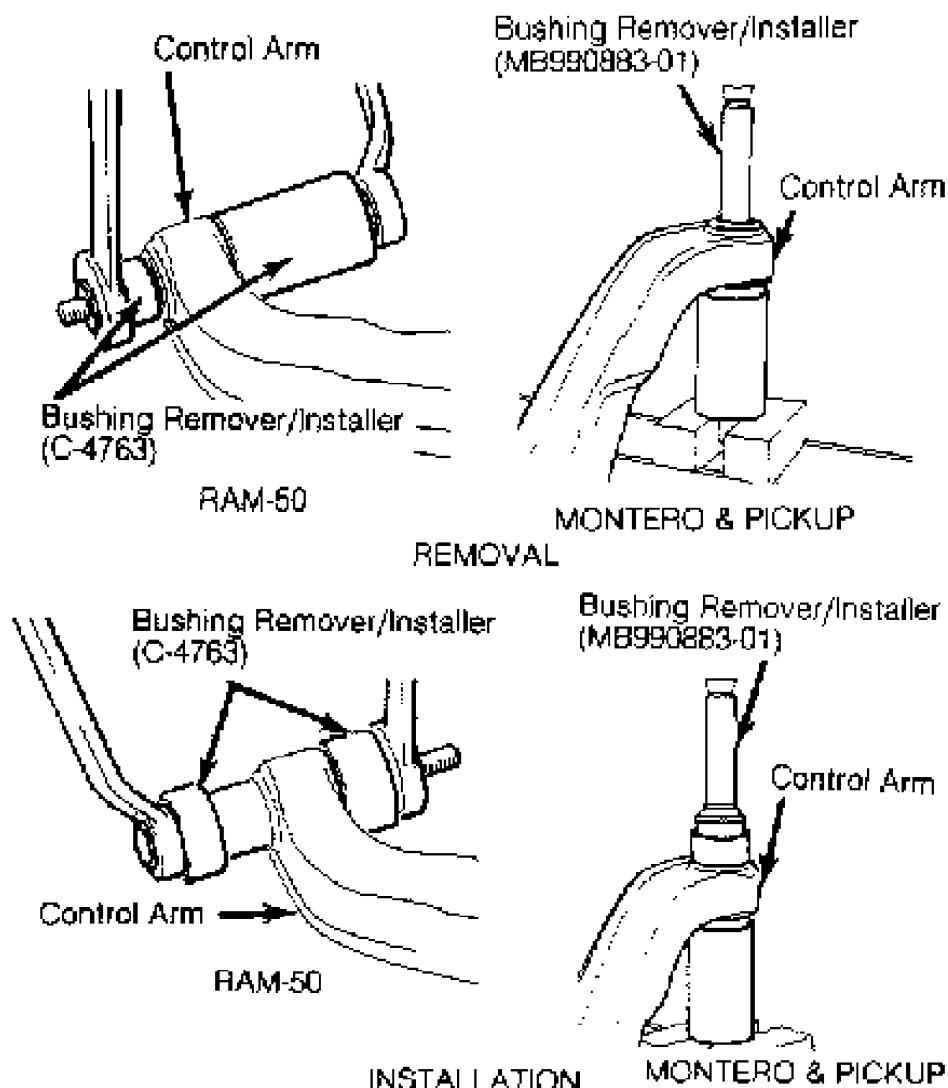


Fig. 4: Replacing Lower Control Arm Bushing
Courtesy of Mitsubishi Motor Sales of America.

4) Coat bushing and control arm with soapy solution. Using press and bushing remover/installer, press bushing into control arm.

Position bushing so distance from bushing to control arm is equal at both ends.

5) Reverse bushing remover/installer to install bushing.

Position bushing so distance from bushing to control arm is equal at both ends.

NOTE: Tighten lower control arm shaft and pivot bolt to specification with vehicle at normal operating height.

Installation

To install, reverse removal procedure. Tighten bolts to specification. See TORQUE SPECIFICATIONS table at end of article. Tighten lower control arm shaft and pivot bolt to specification with vehicle at normal operating height.

STABILIZER BAR

Removal

Remove skid plate (if equipped). Remove stabilizer bar bolt from lower control arm. Remove stabilizer bar clamp-to-hanger bolts. Remove stabilizer bar and bushings. Remove stabilizer bar-to-frame hangers (if necessary).

Installation

1) To install, reverse removal procedure. Install stabilizer bar-to-frame hangers and stabilizer bar-to-control arm bolt using new nuts.

2) Tighten hanger-to-frame nut and stabilizer bar-to-control arm nut until distance from threaded end of bolt to nut is .16-.20" (4.0-5.0 mm).

TORSION BAR

NOTE: Mark torsion bar and anchor arm location for reassembly reference before removing.

Removal

1) Raise and support vehicle. Support lower control arm using jackstand. Loosen anchor arm adjusting bolt lock nut. Remove heat protector from frame (right side only). Loosen anchor arm bolt to release torsion bar tension.

2) Mark front of torsion bar and torque arm for reassembly reference. Remove anchor arm. See Fig. 1. Remove dust covers from torsion bar. Remove heat cover (left side only) located between dust cover and torsion bar. Remove torsion bar.

Inspection

Inspect all splined areas for damage. Inspect dust covers for cracks and damage. Check for bent anchor arm bolts. Replace components as necessary.

Installation

1) Apply grease to splined areas of torsion bar, anchor arm, torque arm splines, anchor arm bolt threads and inside of dust cover. Check for left and right identification marks on torsion bar ends. Ensure torsion bars are installed in correct locations.

2) Install torsion bar in torque arm, with identification mark toward front of vehicle. Align mark on torque arm with mating mark on torsion bar. When installing a new torsion bar, align White paint spline with index mark on front torque arm.

3) Tighten anchor arm bolt adjusting nut to obtain correct final bolt protrusion. See FINAL ANCHOR ARM BOLT PROTRUSION table. Final bolt protrusion depends upon curb weight of vehicle.

FINAL ANCHOR ARM BOLT PROTRUSION TABLE

Application	Right Bolt In. (mm)	Left Bolt In. (mm)
Montero	3.15 (80.0)	3.15 (80.0)

4) To complete installation, reverse removal procedure. Tighten bolts to specification. See TORQUE SPECIFICATIONS table at end of article. Check riding height and front wheel alignment. See WHEEL ALIGNMENT SPECIFICATIONS & PROCEDURES article in WHEEL ALIGNMENT section.

UPPER BALL JOINT

Removal

1) Raise and support vehicle. Remove wheel assembly. Mark torsion bar adjusting nut for reassembly reference. Release torsion bar tension. Loosen, but DO NOT remove, upper ball joint-to-steering knuckle nut.

2) Using ball joint separator, separate ball joint from steering knuckle. Remove ball joint nut from steering knuckle. Remove ball joint-to-upper control arm bolts. Remove ball joint.

Installation

Lubricate ball joint. Reverse removal procedure to complete installation. Tighten bolts to specification. See TORQUE SPECIFICATIONS.

UPPER CONTROL ARM

Removal

1) Support lower control arm using jackstand. Remove wheel assembly. Mark anchor arm bolt for reassembly reference. Loosen anchor arm bolt to release torsion bar tension. Disconnect and plug brake hose at frame mount bracket.

2) Remove cotter pin from ball joint stud. Loosen, but DO NOT remove, ball joint stud nut. Using ball joint fork, loosen ball joint from steering knuckle. Remove ball joint stud nut. Remove rebound stopper and brake hose support from control arm.

3) Remove ABS sensor bracket (if equipped). Remove upper control arm mounting bolts and shim(s). Note direction of bolt installation and locations of camber adjustment shims. Remove control arm. If clearance is inadequate for control arm removal, remove shock absorber.

Inspection

Inspect control arm for cracks and deformation. Check ball joints. See BALL JOINT CHECKING under ADJUSTMENTS & INSPECTION. Inspect ball joint dust cover for damage, and replace cover as necessary.

Installation

1) To install, reverse removal procedure. Install control arm bolts from outside of frame, with nuts against control arm.

2) Ensure alignment shims are placed in original locations.

3) Tighten shock absorber upper nut to end of threads, and install lock nut. Tighten shock absorber upper nut until distance from end of threads to nut is .04-.08" (1.0-2.0 mm). Install lock nut.

4) Tighten bolts to specification. See TORQUE SPECIFICATIONS. Bleed brakes. Adjust anchor arm bolt to proper torsion bar setting.

See TORSION BAR under REMOVAL & INSTALLATION. Check wheel alignment, and adjust it if necessary. See WHEEL ALIGNMENT SPECIFICATIONS & PROCEDURES article in WHEEL ALIGNMENT section.

WHEEL BEARING

Removal

1) Raise and support vehicle. Remove wheel assembly. Remove brake caliper assembly. Remove locking hub. See LOCKING HUB.

2) Remove lock washer. Using Socket (MB990954-01), remove lock nut. Remove front hub assembly from steering knuckle. Remove oil seal and bearings from hub. If bearing races need to be replaced, drive bearing races from hub using brass drift and hammer.

Installation

1) Lubricate bearings. Install bearing races in hub. Ensure bearing races are fully seated. To complete installation, reverse removal procedure. Adjust wheel bearings. See WHEEL BEARING under ADJUSTMENTS & INSPECTION.

2) Install seal in hub using Seal Installer (MB990955-01). Install seal until it is even with hub surface. Apply sealant to locking hub-to-front hub contact surface. Apply sealant to front hub-to-cover surface.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Anchor Arm Bolt Lock Nut	29-36 (39-49)
Automatic Hub Cover	13-25 (18-34)
Ball Joint Nut	
Lower	87-130 (118-176)
Upper	43-65 (58-88)
Ball Joint-To-Lower Control Arm Bolt	39-54 (53-73)
Caliper Bolt	58-72 (79-98)
Control Arm-To-Frame Bolt/Nut	
Lower	(1) 101-116 (137-157)
Upper	72-87 (98-118)
Locking Hub-To-Hub/Rotor Bolt	36-43 (49-58)
Manual Hub Cover Bolt	10 (14)
Shock Absorber Lower Mount Bolt	11-16 (15-22)
Shock Absorber Shaft Nut	10-13 (14-18)
Tie Rod Nut	33 (45)
Torque Arm Nut	69-87 (94-118)
	INCH Lbs. (N.m)
Stabilizer Bar Clamp Bolt	84-108 (8-12)
(1) - Tighten with vehicle at normal operating height.	

*** SUSPENSION UNIFORM INSPECTION GUIDELINES ***

1993 Mitsubishi Montero

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

TIRES
VALVE STEMS
WHEEL ATTACHMENT HARDWARE
WHEELS (RIMS)

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

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 HARNESSSES

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

Splines damaged	.....	A	... of seal and/or mating part. 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.

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		

- (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 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.

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.

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 ***

1993 Mitsubishi Montero

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?

- ☐ Regular UL ☐ Mid range UL ☐ Premium Unleaded
- ☐ Gasohol ☐ Ethanol ☐ Methanol
- ☐ Diesel #1 ☐ Diesel #2 ☐ Various brands

What Brand? _____

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

BRAKES - STEERING - SUSPENSION**SYMPTOM**

☐ Vehicle pulls right - When _____	☐ Suspension bottoms out	☐ Sits uneven
☐ Vehicle pulls left - When _____	☐ Leans or sways in corners	☐ "Dog" tracks
☐ Steering wheel vibrates at _____ MPH	☐ Brake light on	☐ ABS light on
☐ Excessive play in steering	☐ Traction control light on	☐ Soft ride
☐ Erratic steering when braking	☐ Uneven tire wear	
☐ Poor steering wheel return after cornering		

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 maneuvers	☐ 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

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)	
	☐ 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#:

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

EXPLAIN: _____

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

COMMENTS:

CUSTOMER NAME:

PHONE NO.:

REPAIR ORDER NO:

SHOP USE ONLY:

VIN#:

MILES:

TECHNICIAN:

ADVISOR#:

50.115064

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		<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th colspan="3" style="background-color: #f2f2f2; padding: 5px;">Shimmy/vibration (check box below for location)</th> </tr> </thead> <tbody> <tr> <td>☐ Front</td> <td>☐ Rear</td> <td>☐ Don't know</td> </tr> <tr> <td>☐ Seat</td> <td>☐ Floor</td> <td>☐ Other _____</td> </tr> </tbody> </table>		Shimmy/vibration (check box below for location)			☐ Front	☐ Rear	☐ Don't know	☐ Seat	☐ Floor	☐ Other _____
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 ☐ Parking maneuvers ☐ Hot days ☐ At road speed ☐ Wet/rain ☐ Accelerating ☐ All the time ☐ Decelerating ☐ Intermittent												
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 ☐ Max A/C ☐ Heater ☐ Automatic Temperature Control ☐ Defroster ☐ Mix/blend ☐ Vent ☐ Economy ☐ Bi-Level ☐ All ☐ Fan/blower			
SYMPTOM ☐ Does not work ☐ Noisy (explain) ☐ Leaks ☐ Blows wrong temperature air ☐ Broken ☐ Insufficient heat or cool ☐ No air comes out of vents ☐ Air comes from wrong outlets ☐ Other (explain below) ☐ Rapid cycling ☐ Blows fuse			
WHEN DOES IT OCCUR? ☐ All the time ☐ When change controls only ☐ Hot ☐ Other (explain below) ☐ Cold ☐ Intermittent ☐ Right after startup ☐ 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

EXPLAIN: _____

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

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

1993 Mitsubishi Montero

1993 ENGINE PERFORMANCE

Chrysler Corp./Mitsubishi System & Component Testing

Dodge; Ram-50

Mitsubishi; Montero, Pickup

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.

Before testing separate components or systems, perform procedures in F - BASIC TESTING article in this section. Since many computer-controlled and monitored components set a trouble code if they malfunction, also perform procedures in G - TESTS W/CODES article in this section.

COMPUTERIZED ENGINE CONTROLS

CONTROL UNIT

NOTE: For Engine Control Module (ECM) location, see ENGINE CONTROL MODULE (ECM) LOCATION table. To identify ECM power and ground circuits, see appropriate L - WIRING DIAGRAMS article in this section.

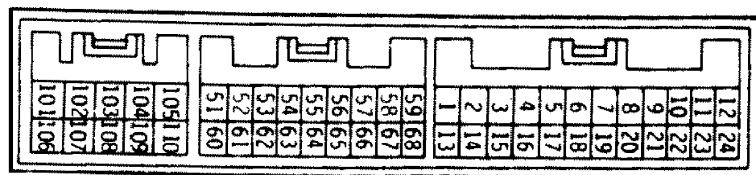
Ground Circuits

1) Turn ignition off. Using an ohmmeter, check continuity between chassis ground and ECM ground terminals. See GROUND TERMINAL ID table. Ohmmeter should indicate zero ohms. If reading is not zero ohms, check and repair open circuit between ECM connector and ground.

2) Connect voltmeter negative lead to chassis ground. Connect positive lead to ECM ground terminals. See GROUND TERMINAL ID table. See Fig. 1. With engine running, voltmeter should indicate less than one volt. If voltmeter reading is greater than one volt, check for open, corrosion or loose connection in ground circuit.

Power Circuits

Turn ignition on. Check for battery voltage on ECM power terminals. See POWER TERMINAL ID table. If battery voltage is not present, check operation of MPI control relay. See RELAYS under MOTORS, RELAYS & SOLENOIDS.



93J78252

Fig. 1: ECM Connectors ID

GROUND TERMINAL ID TABLE

Application

ECM Terminals

All Models	101 & 106

POWER TERMINAL ID TABLE

Application	ECM Terminals
All Models	102 & 107

ENGINE CONTROL MODULE (ECM) LOCATION TABLE

Application	Location
All Models	Near Right Kick Panel

ENGINE SENSORS & SWITCHES

BAROMETRIC PRESSURE SENSOR

Sensor is a part of airflow sensor assembly. See G - TESTS W/CODES article in this section.

CAMSHAFT POSITION SENSOR

See G - TESTS W/CODES article in this section.

CLOSED THROTTLE POSITION SWITCH

See THROTTLE POSITION SENSOR in G - TESTS W/CODES article in this section.

COOLANT TEMPERATURE SENSOR

See G - TESTS W/CODES article in this section.

CRANKSHAFT POSITION SENSOR

See G - TESTS W/CODES article in this section.

EGR TEMPERATURE SENSOR (CALIFORNIA)

See G - TESTS W/CODES article in this section.

IDLE POSITION SWITCH

See THROTTLE POSITION SENSOR in G - TESTS W/CODES article in this section.

INHIBITOR SWITCH (A/T MODELS)

1) Switch is mounted to automatic transaxle, near shift lever mechanism. Ensure switch is adjusted properly. Switch output can be affected by improper adjustment. Using DVOM, measure resistance between selected terminals to ensure continuity between ignition switch and ECM when shift selector lever is in Park or Neutral position. See INHIBITOR SWITCH CONTINUITY CHECK table.

2) Using DVOM, measure power supply voltage of switch. Disconnect ECM connector. Disconnect inhibitor switch connector. Turn

ignition switch to START position. Measure voltage between inhibitor switch and vehicle ground. On Pickup 2.4L and Ram-50 2.4L, inhibitor switch wire color is Black/White. on all other models, inhibitor switch wire color is Black/Yellow;. Supply voltage should be battery voltage. If voltage is within specification, go to step 3. If voltage is less than battery voltage, check and repair power supply circuit.

3) Using DVOM, measure inhibitor switch terminal input voltage. Connect ECM connector. Ensure inhibitor switch connector is disconnected. Turn ignition switch to ON position. Measure voltage between inhibitor switch and vehicle ground. Input voltage should be battery voltage. If voltage is within specification, go to step 4. If voltage is less than battery voltage, check and repair circuit.

4) Using DVOM, measure input voltage of ECM. Disconnect ECM connector. Connect inhibitor switch connector. Ensure shift selector lever is in "P" position. Turn ignition switch to ON position. Measure voltage between ECM connector and vehicle ground. See ECM TERMINAL ID table. ECM input voltage should be 8 volts or greater. If voltage is within specification, system is okay. If voltage is less than 8 volts, replace ECM.

INHIBITOR SWITCH CONTINUITY CHECK TABLE

Application	(1) Wire Color	(2) Wire Color
All Models	 Black/Yellow	 Black/Blue

- (1) - Ignition switch to inhibitor switch circuit.
 (2) - Inhibitor switch to ECM circuit.

ECM TERMINAL ID TABLE

Application	(1) Terminal Number
All Models	 104

- (1) - See Fig. 1.

INTAKE AIR TEMPERATURE SENSOR

See G - TESTS W/CODES article in this section.

OXYGEN (O2) SENSOR

See G - TESTS W/CODES article in this section.

POWER STEERING OIL PRESSURE SWITCH

1) Disconnect switch connector at pump. Using DVOM, check continuity between switch and vehicle ground. Continuity should not exist with wheels straight ahead and engine idling. Continuity should be present when wheels are turned.

2) Check continuity of circuit between switch and ECM. Disconnect power steering oil pressure switch connector and ECM connector. Connect jumper wire between ECM terminal and vehicle ground. See POWER STEERING PRESSURE SWITCH ECM TERMINAL NUMBER table. Using DVOM, check for continuity between switch harness connector and vehicle ground. Check and repair circuit if no continuity exists. Go to step 3 if continuity exists.

3) Connect ECM connector. Turn ignition on. Using DVOM, measure voltage at switch harness connector. System is okay if battery voltage exists. Replace ECM if voltage does not exist.

POWER STEERING PRESSURE SWITCH ECM TERMINAL NUMBER TABLE

Application	(1) Terminal Number
All Models	5
(1) - See Fig. 1.	

THROTTLE POSITION SENSOR

See G - TESTS W/CODES article in this section.

VEHICLE SPEED SENSOR

See G - TESTS W/CODES article in this section.

MOTORS, RELAYS & SOLENOIDS

MOTORS

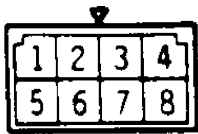
IAC Motor
See IDLE CONTROL SYSTEM.

RELAYS

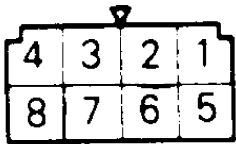
For MPI control relay location, see MPI CONTROL RELAY LOCATION table.

MPI CONTROL RELAY LOCATION TABLE

Application	Location
Montero	Under right corner of dash.
Pickup & Ram-50	Behind kick panel.

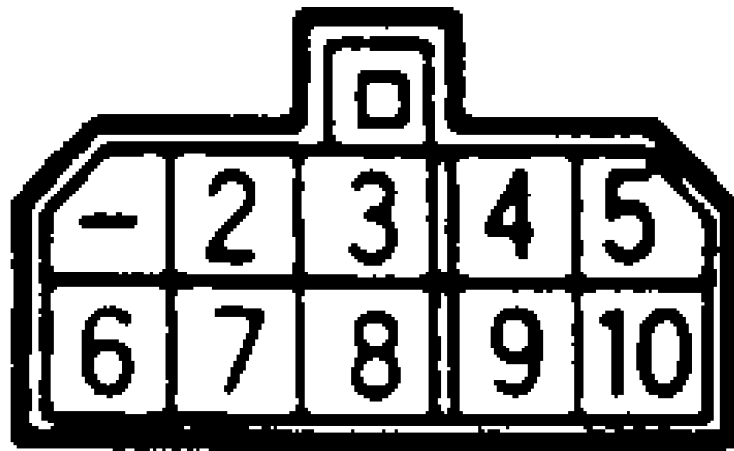


COMPONENT CONNECTOR

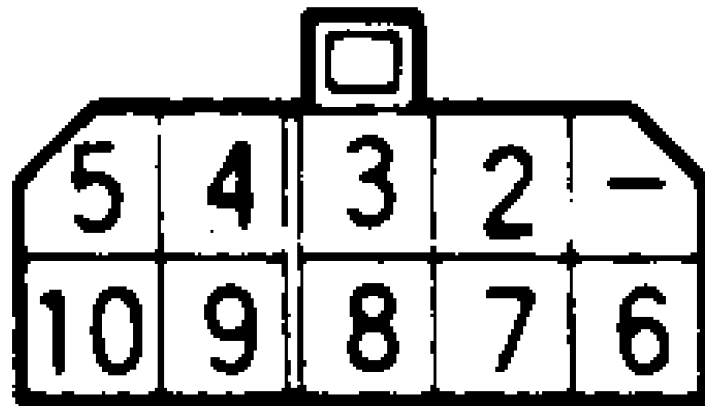


HARNESS CONNECTOR

93C78453
Fig. 2: MPI Control Relay Connector ID (2.4L 4 Cylinder)
Courtesy of Mitsubishi Motor Sales of America.



COMPONENT CONNECTOR



HARNESS CONNECTOR

93D78454

Fig. 3: MPI Control Relay Connector ID (V6)
Courtesy of Mitsubishi Motor Sales of America.

MPI Control Relay (2.4L)

1) This step checks ignition switch supply voltage of control relay. Disconnect control relay connector. Turn ignition on. Using

DVOM, measure voltage between terminal No. 8 of relay harness connector and vehicle ground. See Fig. 2. If voltage is battery voltage, go to step 2. If voltage is not battery voltage, check and repair circuit between ignition switch and control relay.

2) This step checks continuity of control relay ground circuit. Turn ignition off. Using DVOM, check continuity between control relay harness connector terminal No. 6 and vehicle ground. If continuity exists, go to step 3. If continuity does not exist, check and repair circuit between control relay and vehicle ground.

3) This step checks battery supply voltage of control relay. Using DVOM, measure voltage between terminal No. 4 of relay harness connector and vehicle ground. If voltage is battery voltage, go to step 4. If voltage is not battery voltage, check and repair circuit between battery and control relay.

4) This step checks continuity of circuit between control relay and ECM. Disconnect ECM connector. Using DVOM, check continuity between control relay harness connector terminal No. 3 and ECM connector terminals No. 12 and 25. See Figs. 1 and 2. If continuity exists, go to step 5. If continuity does not exist, check and repair circuits between control relay harness connector and ECM.

5) This step checks supply voltage to control relay actuator. Connect ECM and MPI control relay connectors. Using DVOM, backprobe control relay terminal No. 2. With engine cranking, voltage should be 8 volts or greater. Start engine and run at 2500 RPM or greater. If voltage is battery voltage, harness is okay. If voltage is not battery voltage, go to step 6.

6) If control relay tests okay in steps 6 through 8, replace ECM. Removal of relay may assist in testing. Continuity should exist between terminals No. 5 and 7. Measure resistance between terminals No. 6 and 8. Continuity should exist in only one direction. Replace control relay if continuity is not as specified.

7) Connect 12-volt power source between relay terminals No. 5 and 7. Connect positive lead to terminal No. 7. With relay energized, battery voltage should exist between terminals No. 1 and 5. With power source removed, voltage should not exist.

8) Move 12-volt power source to relay terminals No. 6 and 8. Connect positive lead to terminal No. 8. With relay energized, continuity should exist between terminals No. 2 and 4 and between terminals No. 3 and 4. With power source removed, continuity should not exist. Replace control relay if measurements are not as specified.

MPI Control Relay (3.0L)

1) This step checks ignition supply voltage to ECM. Disconnect ECM harness connector. Turn ignition on. Measure voltage between ECM harness connector terminal No. 110 and vehicle ground. See Fig. 1. If voltage is battery voltage, go to step 2. If voltage is not battery voltage, repair circuit between ignition switch and ECM harness connector.

2) This step checks battery supply voltage of control relay. Measure voltage between terminal No. 10 of relay harness connector and vehicle ground. See Fig. 3. If voltage is battery voltage, go to step 3. If voltage is not battery voltage, check and repair circuit between battery and control relay.

3) This step checks continuity of circuit between control relay and ECM. Disconnect ECM connector. Check continuity between control relay harness connector terminal No. 8 and ECM connectors No. 63 and 66. If continuity exists, go to step 4. If continuity does not exist, check and repair circuits between control relay harness connector and ECM.

4) This step checks continuity of circuit between control relay and ECM. Check continuity between control relay harness connector terminal No. 4 and ECM harness connector terminals No. 102 and 107. If continuity exists, go to step 5. If continuity does not

exist, check and repair circuits between control relay harness connector and ECM.

5) Connect 12-volt power source between relay terminals No. 8 and 10. Connect positive lead to terminal No. 10. With relay energized, battery voltage should exist between terminals No. 4 and 8 and between terminals No. 5 and 8. With power source removed, voltage should not exist.

6) Move 12-volt power source to relay terminals No. 6 and 9. Connect positive lead to terminal No. 6. With relay energized, continuity should exist between terminals No. 2 and 3. With power source removed, continuity should not exist.

7) Move 12-volt power source to relay terminals No. 3 and 7. Connect positive lead to terminal No. 3. With relay energized, voltage should exist between terminals No. 2 and 7. With power source removed, voltage should not exist. Replace control relay if any measurements are not as specified.

FUEL SYSTEM

FUEL DELIVERY

NOTE: For fuel system pressure testing, see F - BASIC TESTING article in this section.

FUEL CONTROL

Fuel Injectors

See G - TESTS W/CODES article in this section.

IDLE CONTROL SYSTEM

ELECTRICAL LOAD SWITCH

IDLE AIR CONTROL (IAC) MOTOR

CAUTION: DO NOT apply more than 6 volts to IAC motor.

NOTE: For diagnosis and testing information concerning IAC motor position sensor, see G - TESTS W/CODES article in this section.

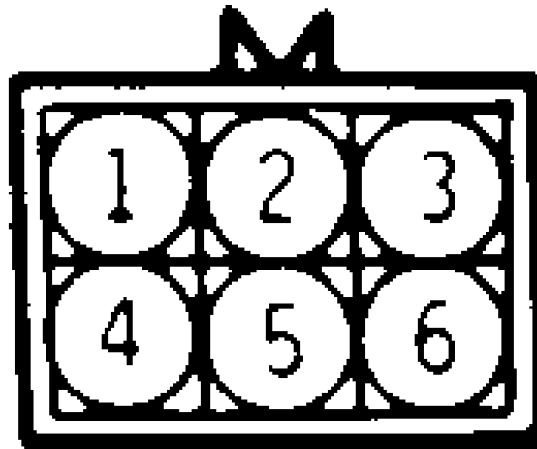
2.4L

1) Using a stethoscope, listen for operating sound of IAC motor when ignition switch is placed in ON position. If no operating sound can be heard, proceed with following tests.

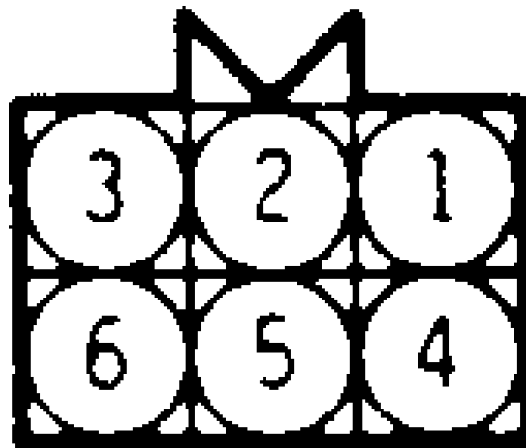
2) This step checks for continuity between IAC motor and ECM. Disconnect IAC motor harness connector and ECM harness connector. Connect a jumper wire between ECM harness connector terminal No. 4 and vehicle ground. See Fig. 1. Using DVOM, check continuity between IAC harness connector No. 5 and vehicle ground. See Fig. 4.

3) Move jumper wire to ECM harness connector terminal No. 17 and vehicle ground. Using DVOM, check continuity between IAC harness connector No. 6 and vehicle ground. If continuity does not exist, check and repair appropriate circuit. If continuity exists, go to step 4.

4) If preceding tests do not show any system or component malfunction and ECM is suspected, replace ECM and retest system.



COMPONENT CONNECTOR



HARNESS CONNECTOR

93G78473

Fig. 4: IAC Motor Connector ID (2.4L)
Courtesy of Mitsubishi Motor Sales of America.

NOTE: Procedures are provided by manufacturer for component testing using an engine analyzer with oscilloscope capability. Refer to manufacturer's operation manual for instructions in use of oscilloscope. Go to step 10 for test procedures using oscilloscope.

3.0L

1) Using a stethoscope, listen for operating sound of IAC motor when ignition switch is placed in ON position. If no operating sound can be heard, proceed with following tests.

2) Disconnect IAC harness connector. Install Test Harness (MD998463-01) if necessary to aid testing. Using DVOM, measure resistance between IAC terminals No. 1 and 2 and between terminals No. 1 and 3. See Fig. 5. Resistance should be 28-33 ohms.



COMPONENT CONNECTOR



HARNESS CONNECTOR

93178475

Fig. 5: Identifying IAC Motor Connectors (V6)
Courtesy of Mitsubishi Motor Sales of America.

3) Measure resistance between terminals No. 4 and 5 and between terminals No. 5 and 6. Resistance should be 28-33 ohms. If resistance measurements are not within specification, replace IAC motor. Go to step 4 if IAC motor is within specification.

4) Remove throttle body. See N - REMOVE/INSTALL/OHAUL article in this section. Remove stepper motor from throttle body. Connect Test Harness (MD998463-01) to IAC motor.

5) Hold IAC motor in hand. Place thumb on top of plunger. Connect positive lead of 6-volt power source to White and Green clips of test harness. Individually connect, then disconnect, negative lead of power source to Red and Black clips, Blue and Black clips, Blue and Yellow clips, and Red and Yellow clips. Finish by connecting negative lead to Red and Black clips again.

6) Connect negative lead to test leads in reverse sequence of step 5. Stepper motor should vibrate with each connection. Replace IAC motor if vibration is not felt with each connection.

7) Ensure MPI control relay is functioning properly. See RELAYS under MOTORS, RELAYS & SOLENOIDS. Disconnect IAC motor harness connector. Turn ignition on. Using DVOM, check for battery voltage between terminal No. 2 and vehicle ground and terminal No. 5 and vehicle ground. If voltage is not battery voltage, check and repair circuits between MPI control relay and IAC motor. If battery voltage exists, go to step 8.

8) This step checks for continuity between MPI control relay and IAC motor. Check for continuity between MPI control relay terminals No. 4 and 5 and IAC motor terminals No. 2 and 5. See Figs. 3 and 6. If continuity exists, go to step 9. If continuity does not exist, check and repair circuits.

9) This step checks for continuity between ECM and IAC motor. Disconnect ECM harness connector. Check continuity of specified circuits. See Figs. 1 and 5. See IAC TO ECM CIRCUIT CONTINUITY CHECK table. Check and repair any circuits without continuity.

IAC TO ECM CIRCUIT CONTINUITY CHECK TABLE

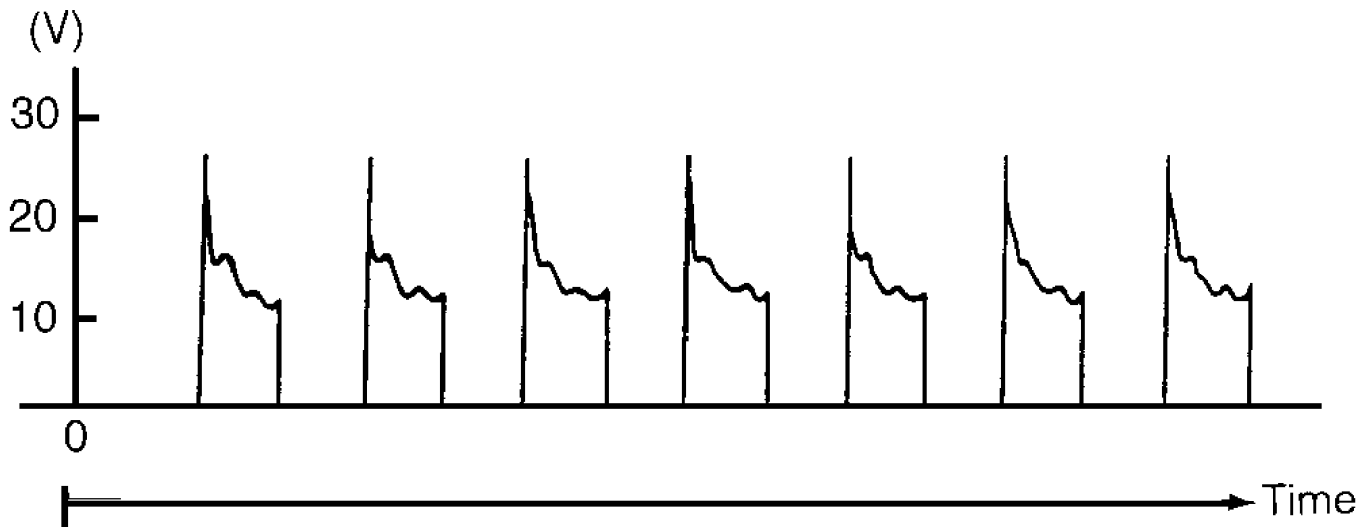
IAC Terminal Number	ECM Terminal Number
All Models	
1	58
3	59

4	.....	68
6	.....	67

10) Connect ECM harness connector. Install harness connector and Test Harness (MB998463-01). Using engine analyzer with oscilloscope capability, connect special patterns probe to selected leads of test harness. Leads used are Red, Green, Black and Yellow clips.

11) Start engine, and allow it to idle. Connect special patterns probe to one test lead. Turn A/C on. When IAC motor operates to increase engine speed to compensate for A/C system, a waveform should be displayed. Conduct test with each remaining test lead and compare pattern to illustration. See Fig. 6.

12) If waveform is different, replace IAC motor. If all preceding tests do not show any system or component malfunction and ECM is suspected, replace ECM and retest system.



93H78474
Fig. 6: Good IAC Motor Waveform ID
Courtesy of Mitsubishi Motor Sales of America.

IDLE SPEED CONTROL MOTOR

NOTE: For diagnosis and testing information concerning ISC motor position sensor, see G - TESTS W/CODES article in this section.

IGNITION SYSTEM

NOTE: For basic ignition checks, see F - BASIC DIAGNOSTIC TESTING article in this section.

TIMING CONTROL SYSTEMS

Camshaft Position Sensor
See G - TESTS W/CODES article in this section.

Crankshaft Position Sensor
See G - TESTS W/CODES article in this section.

Knock Sensor

See G - TESTS W/CODES article in this section.

EMISSION SYSTEMS & SUB-SYSTEMS

EXHAUST GAS RECIRCULATION (EGR)

See G - TESTS W/CODES article in this section.

FUEL EVAPORATION

Purge Control Solenoid Valve (3.0L)

1) Label and disconnect both vacuum hoses from solenoid valve. Disconnect electrical connector. Connect hand vacuum pump to solenoid valve nipple where Red-striped hose was connected. Apply vacuum to solenoid valve. Vacuum should hold.

2) Apply battery voltage to terminals of solenoid valve. Vacuum should bleed down when voltage is applied to terminals. Using an ohmmeter, check resistance across solenoid valve terminals. Reading should be 36-44 ohms at 68°F (20°C). If reading is not within specification, replace valve.

3) This step checks voltage at purge solenoid. Disconnect purge solenoid harness connector. Turn ignition on. Using DVOM, measure voltage at harness connector terminal No. 1 (horizontal terminal). If voltage is battery voltage, go to step 4. If voltage is not battery voltage, check and repair circuit between purge solenoid and MPI control relay.

4) This step checks continuity between ECM and purge solenoid. Disconnect ECM harness connector. Connect jumper wire between ECM terminal No. 9 (No. 62 on Montero, Pickup and Ram-50) and vehicle ground.

5) Using DVOM, check for continuity between purge solenoid harness connector terminal No. 2 (vertical terminal) and vehicle ground. If continuity exists, harness is good. If continuity does not exist, check and repair circuit.

6) If preceding tests do not show any system or component malfunction and ECM is suspected, replace ECM and retest system.

ECM TERMINAL ID TABLE

Application	Terminal Number
All Models	9

POSITIVE CRANKCASE VENTILATION (PCV)

PCV Valve

Remove PCV valve. Shake valve by hand. Valve should rattle if moving freely. Apply air pressure to valve. Air should flow in one direction only. Connect PCV valve to vacuum hose and start engine. Ensure vacuum is flowing through valve.

MISCELLANEOUS CONTROLS

NOTE: Although some of the controlled devices listed here are not technically engine performance components, they can affect driveability if they malfunction.

A/C Switch & Compressor Clutch Relay

Using DVOM, measure power supply voltage of ECM. Disconnect ECM connector. Turn A/C switch and ignition switch to ON positions.

Measure voltage between specified ECM terminals and vehicle ground.
See A/C POWER ECM TERMINAL LOCATION table. Voltage should be 6 volts
or greater. If voltage is not battery voltage, check and repair
circuit.

A/C POWER ECM TERMINAL LOCATION TABLE

Application	Wire Color	(1) Terminal No.
Montero	Green/Blue	7
	Green/White	65
Pickup & Ram-50	Green/Red	7
	Blue	65

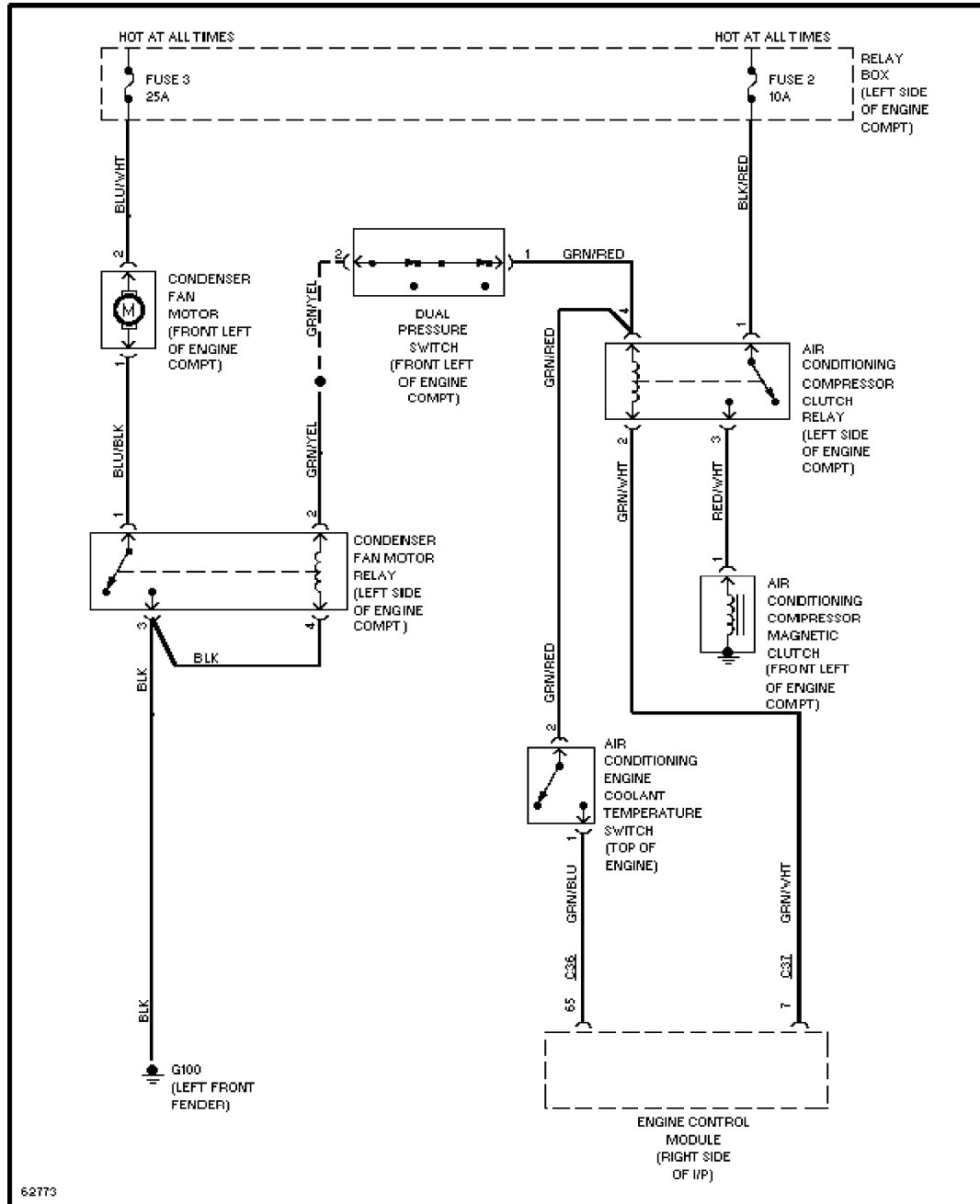
(1) - See Fig. 1.

SYSTEM WIRING DIAGRAMS

1993 Mitsubishi Montero

1993 System Wiring Diagrams
Mitsubishi - Montero

COOLING FAN

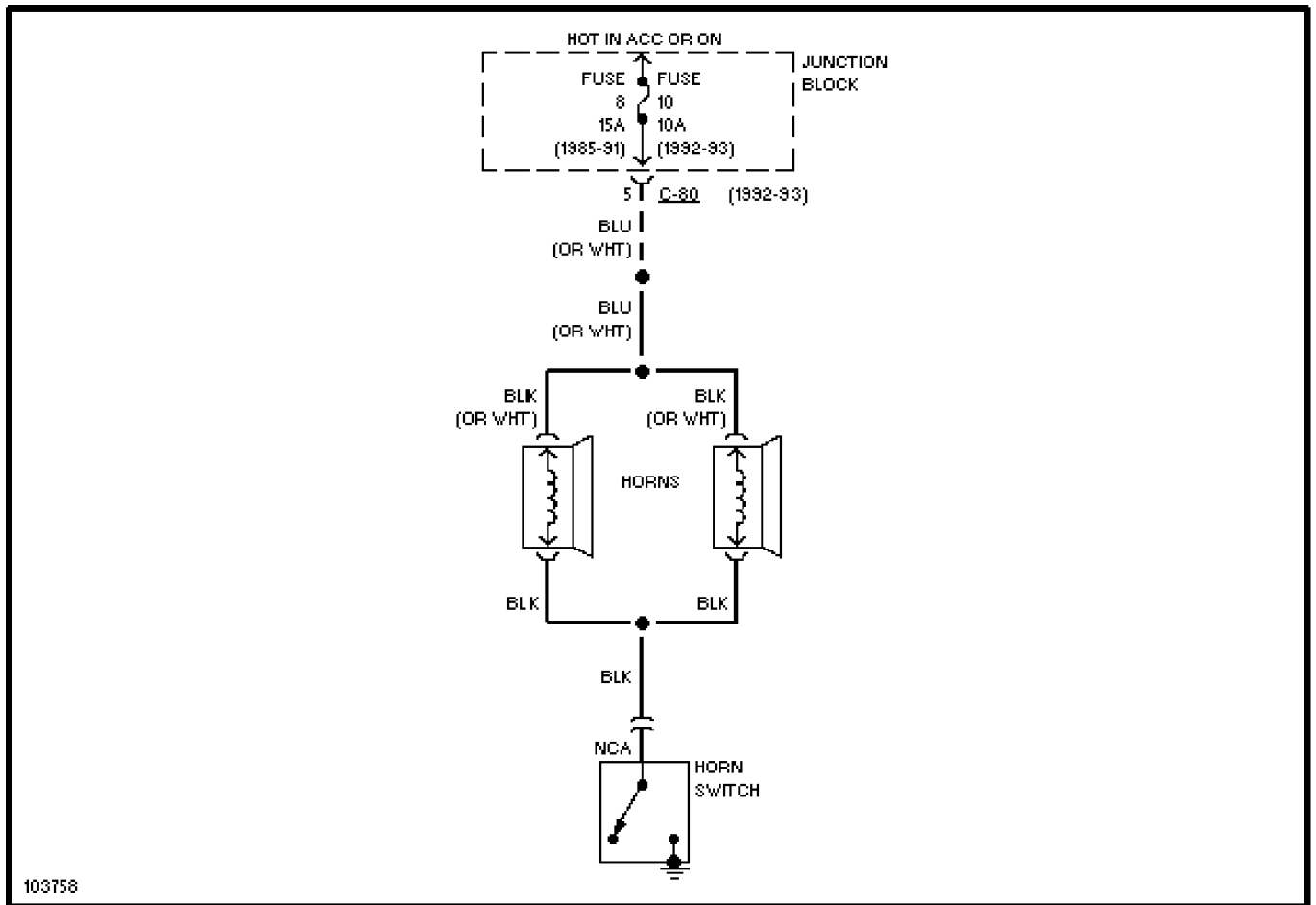


Cooling Fan Circuit

DEFOGGERS

Defogger Circuit

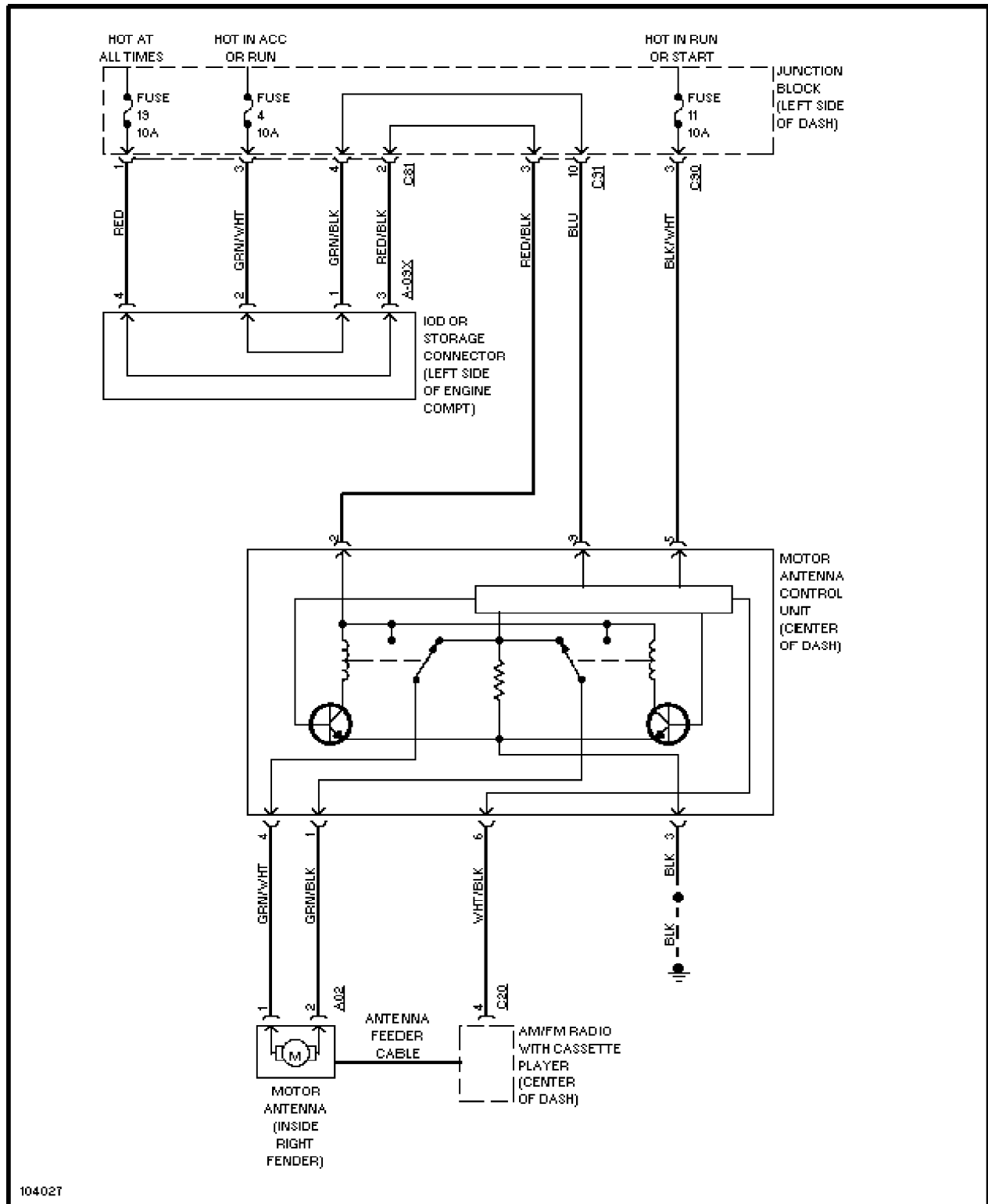
HORN



103758

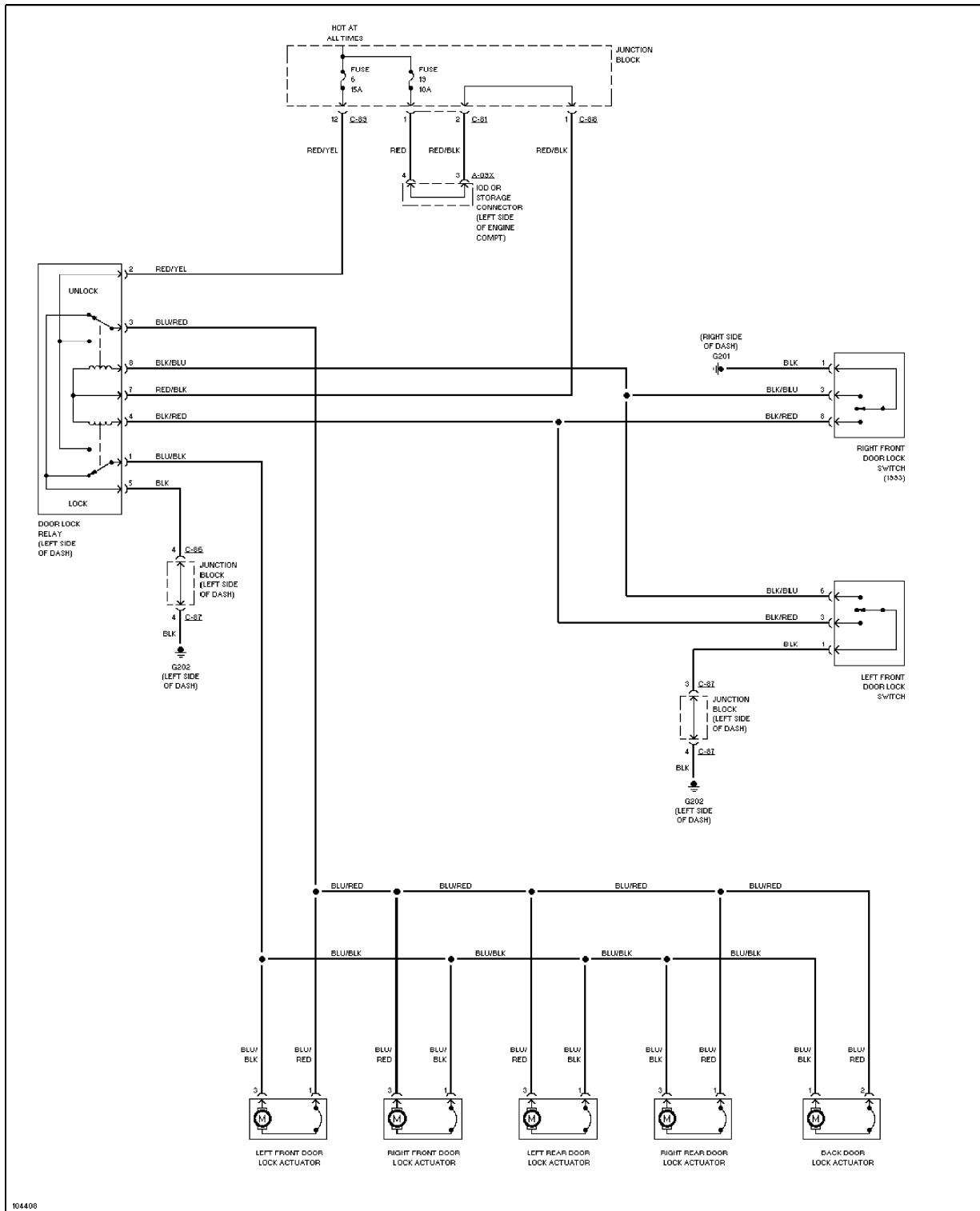
Horn Circuit

POWER ANTENNA



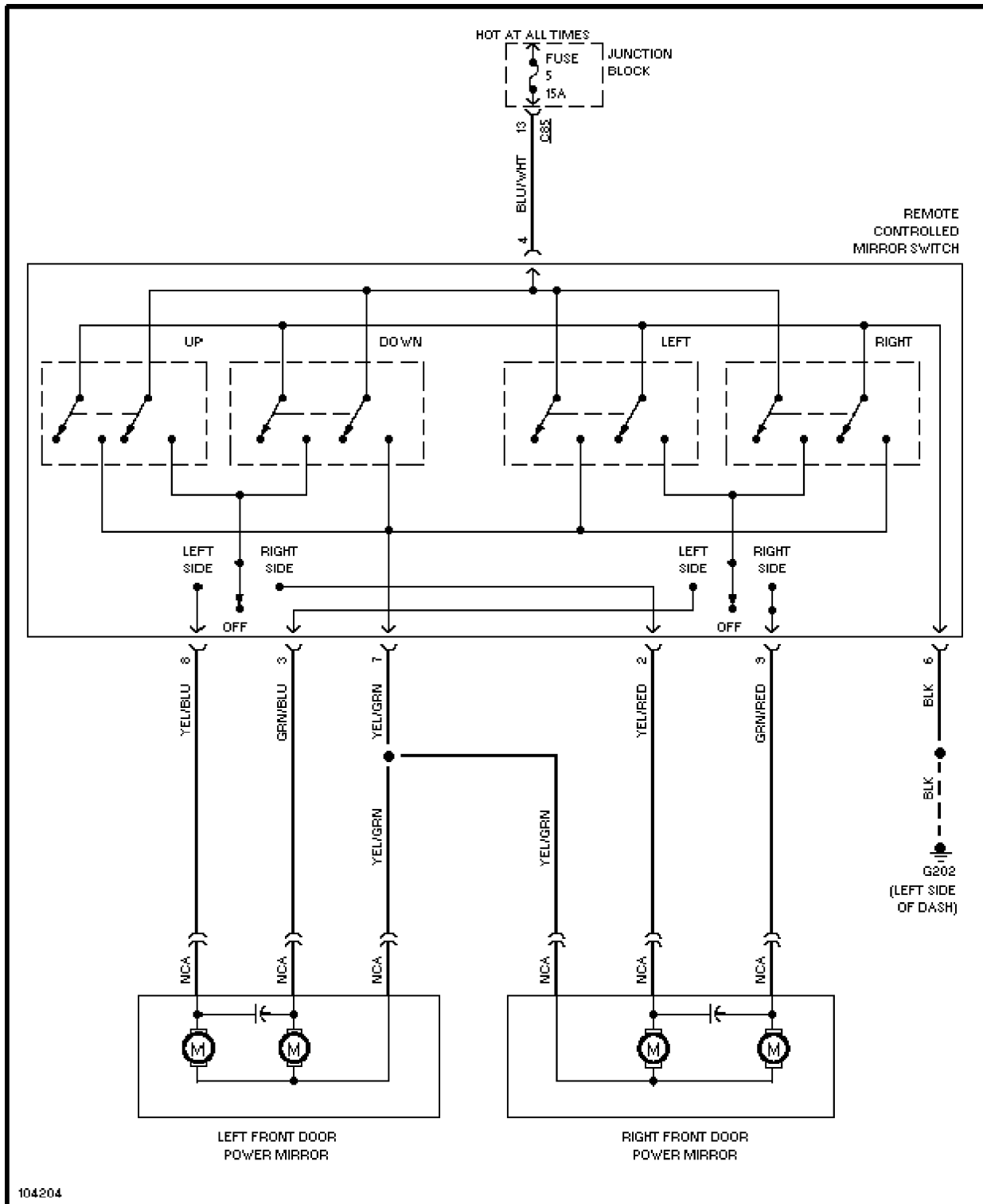
Power Antenna Circuit

POWER DOOR LOCKS



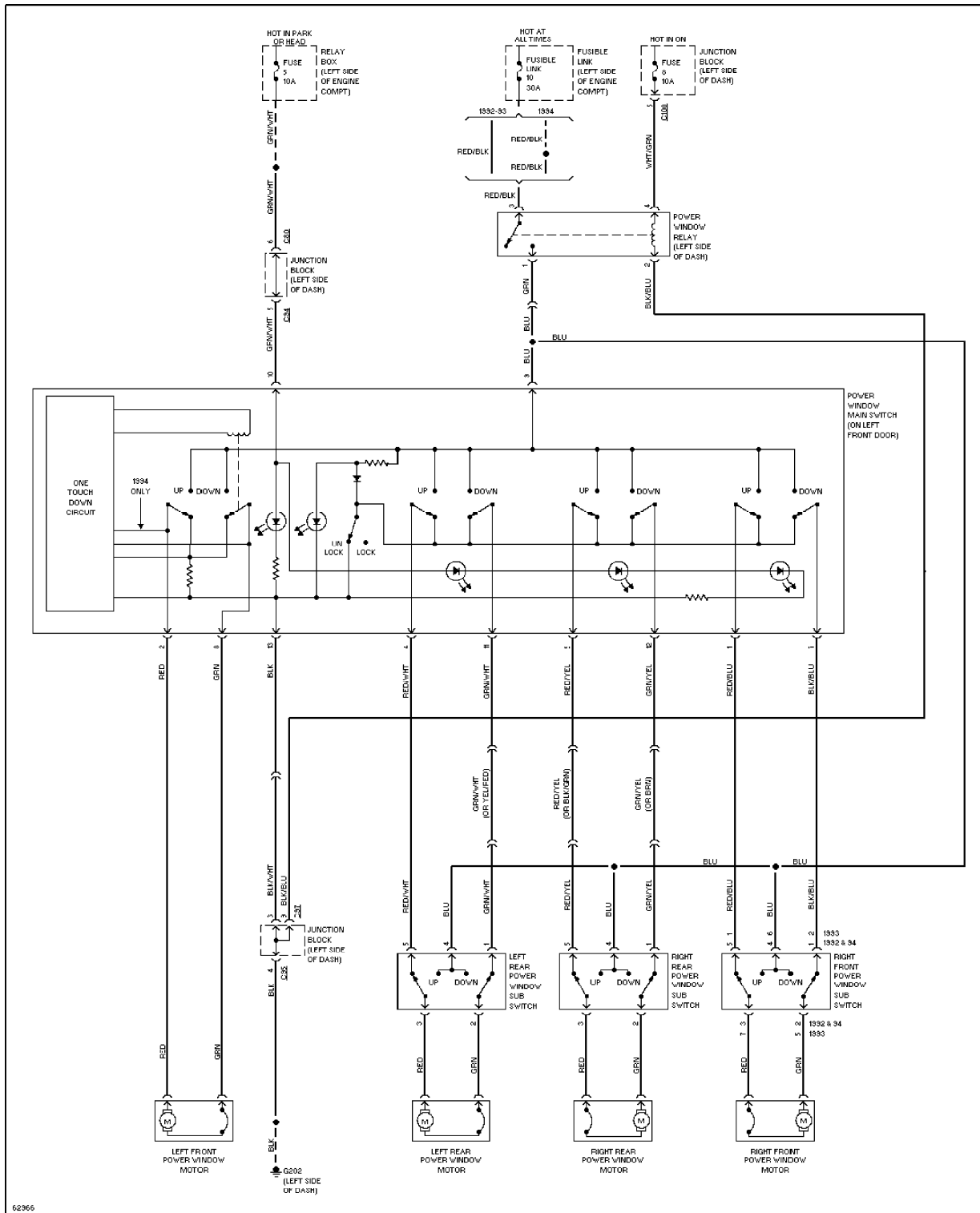
Power Door Lock Circuit

POWER MIRRORS



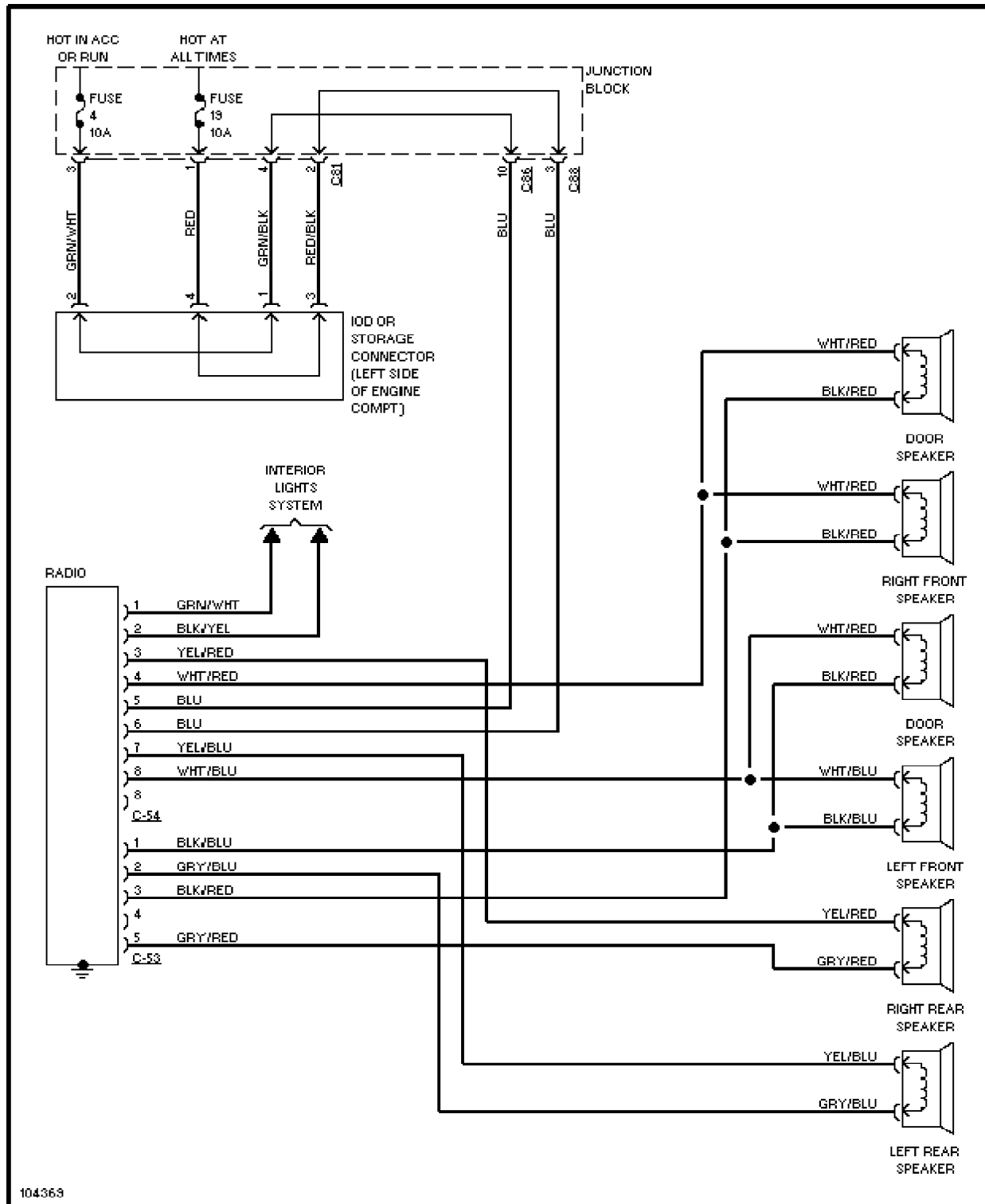
Power Mirror Circuit

POWER WINDOWS



Power Window Circuit

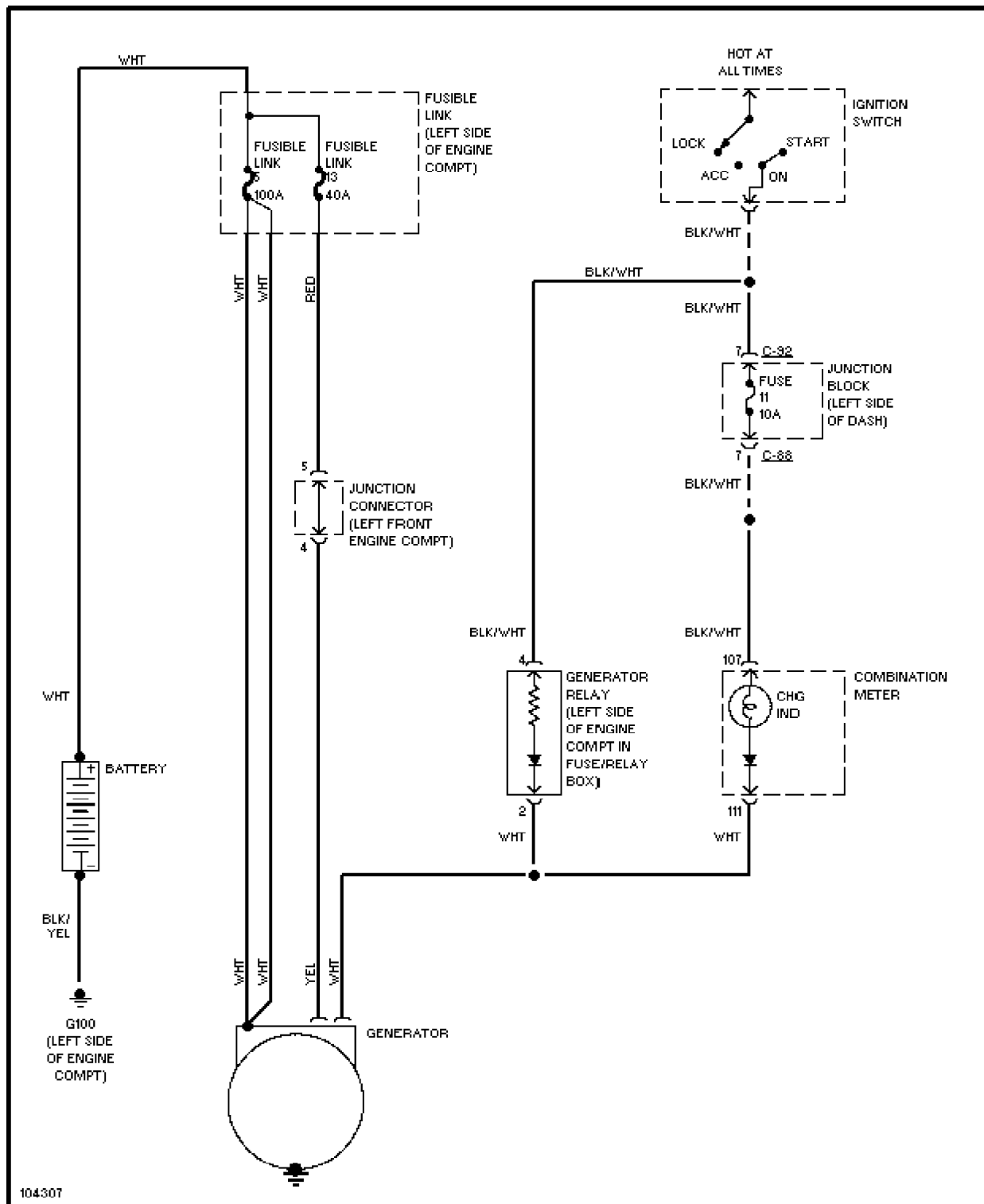
RADIO



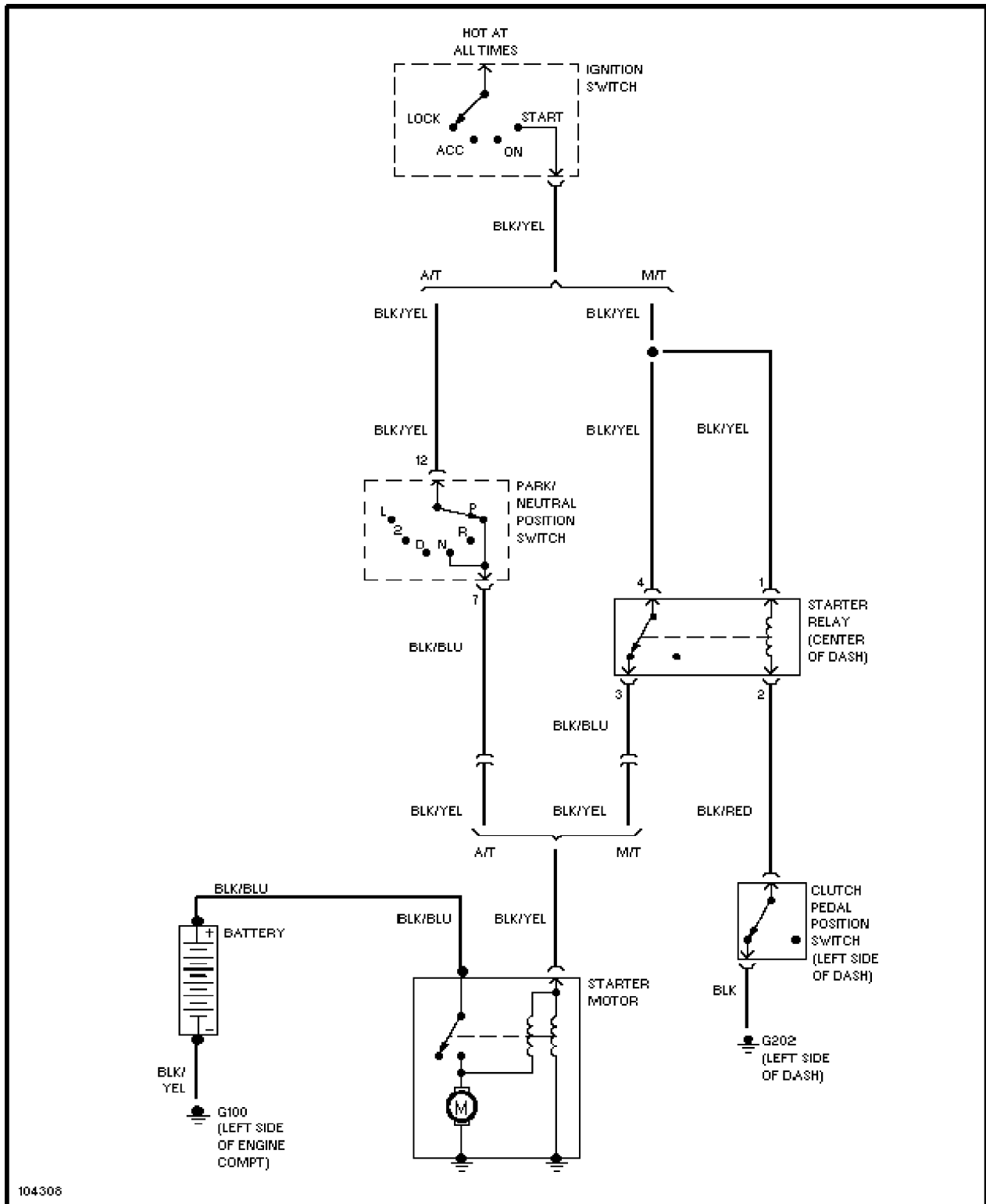
104363

Radio Circuits

STARTING/CHARGING



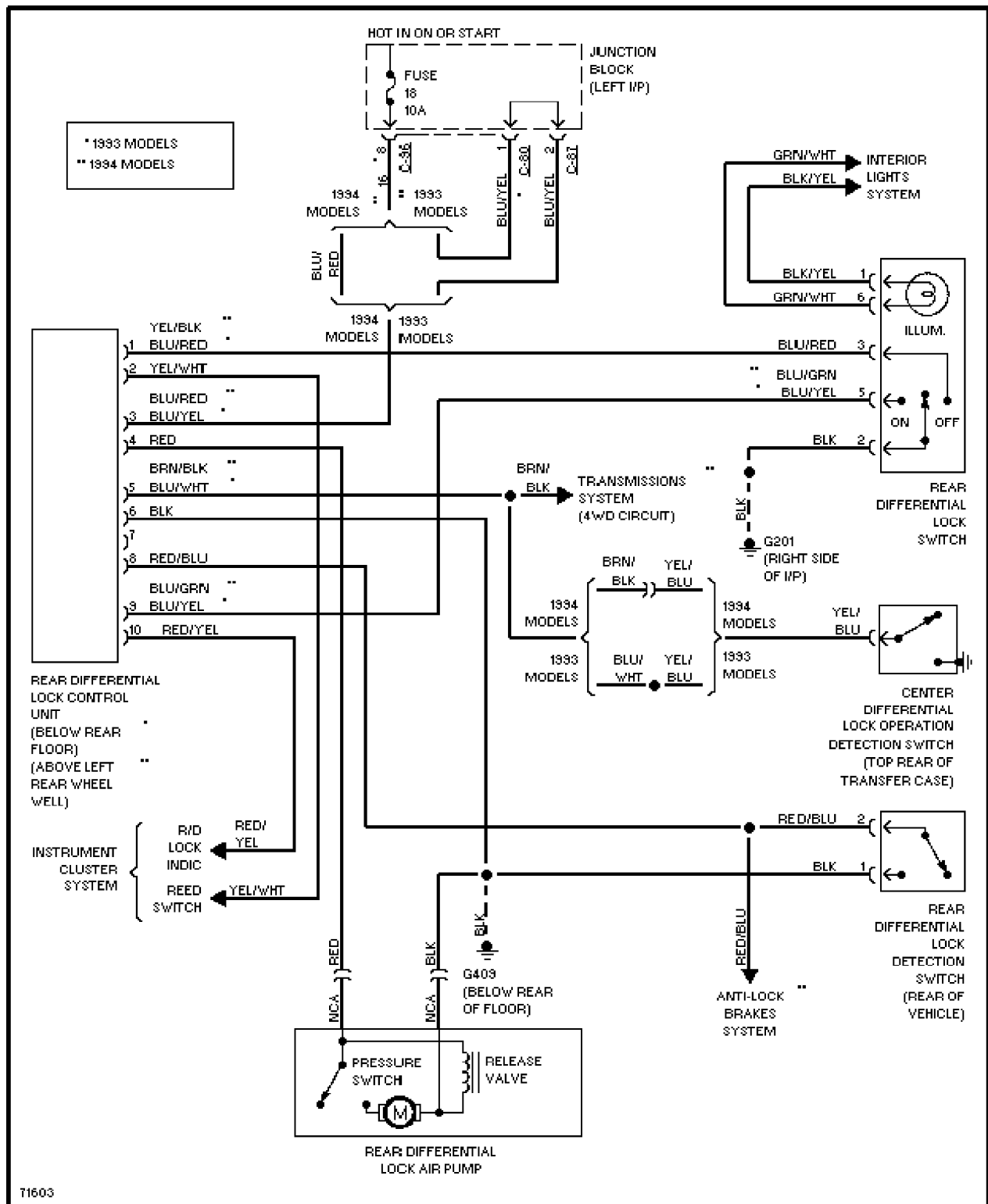
Charging Circuit



Starting Circuit

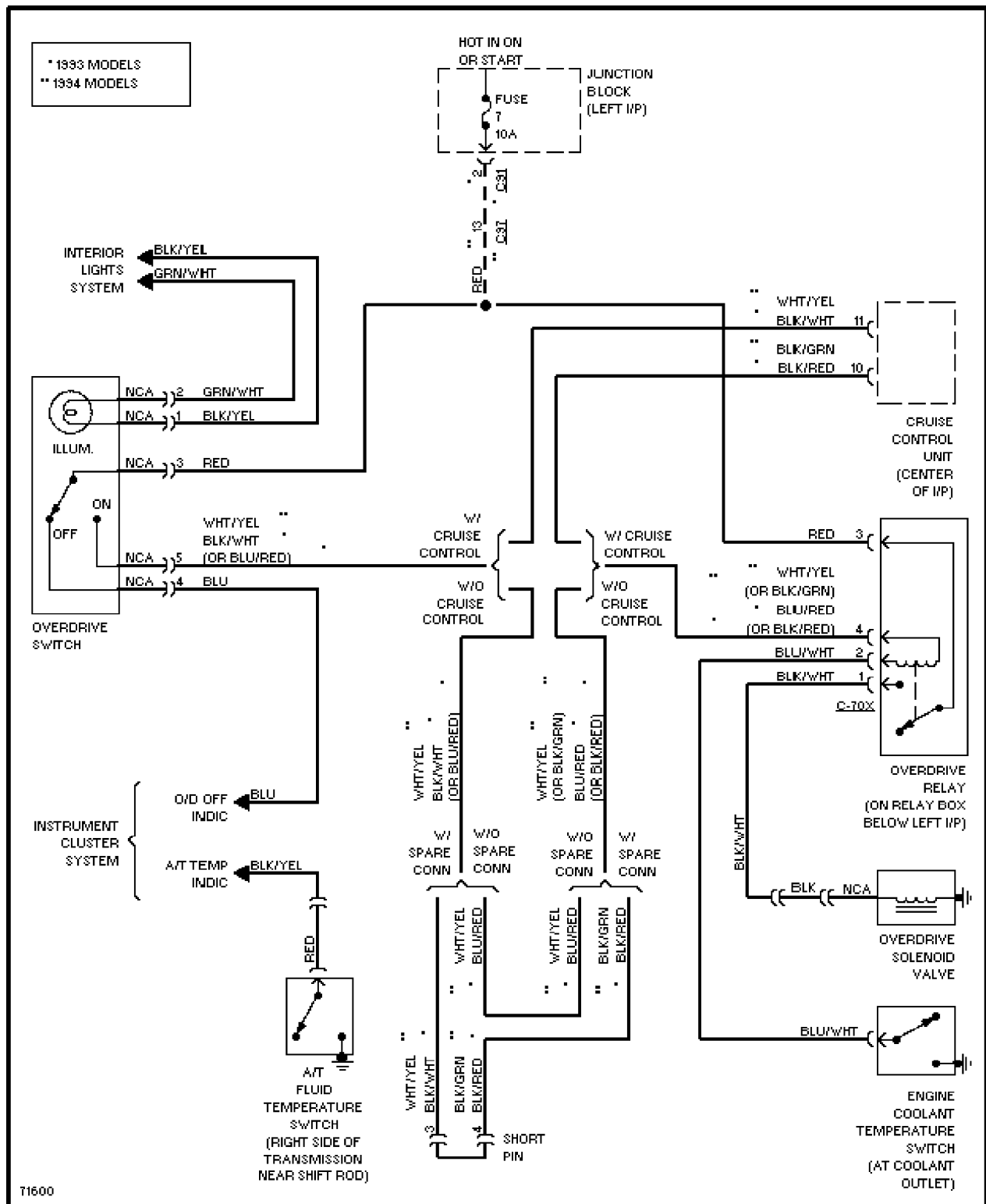
TRANSMISSION





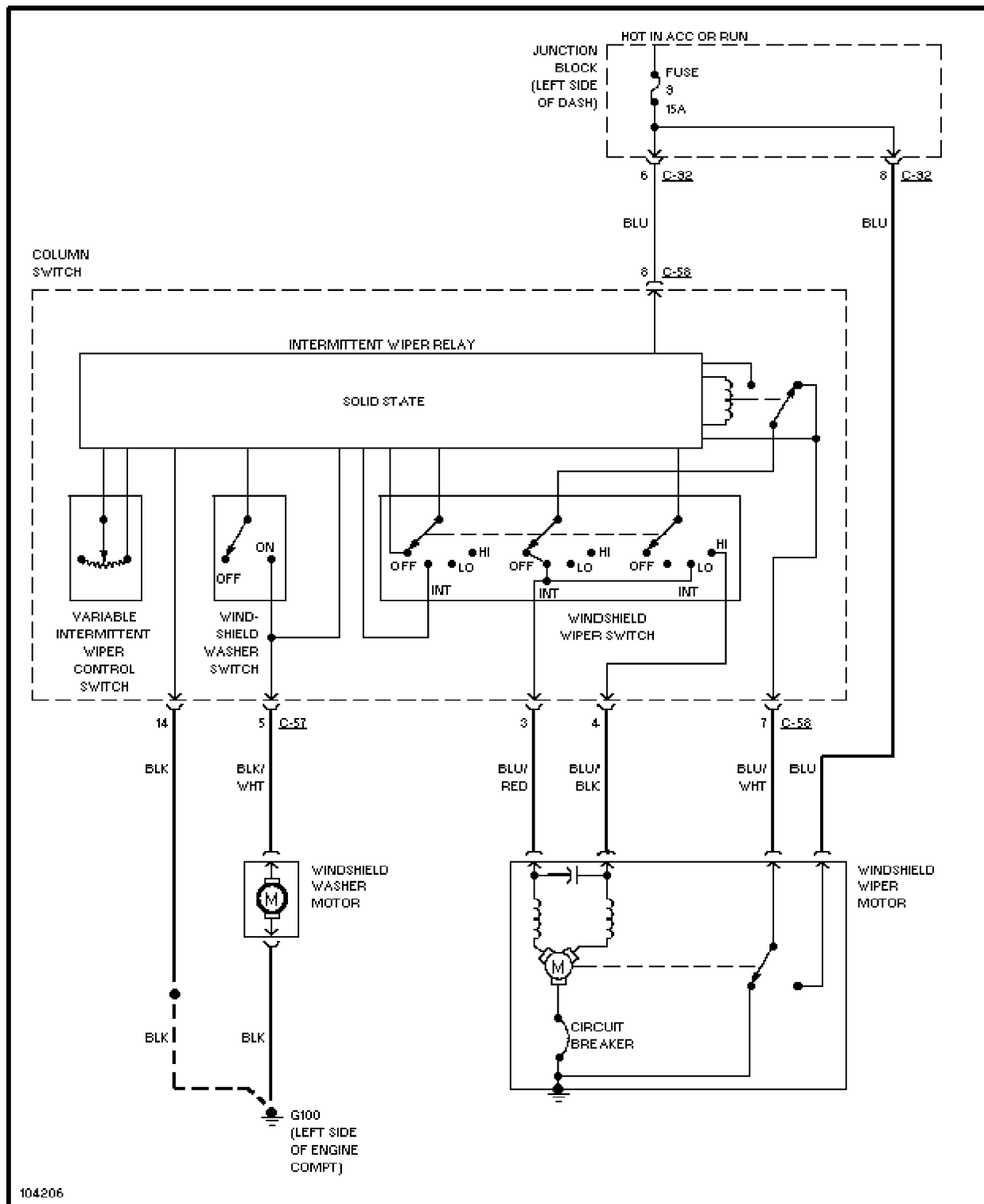
T1603

Rear Differential Lock Circuit



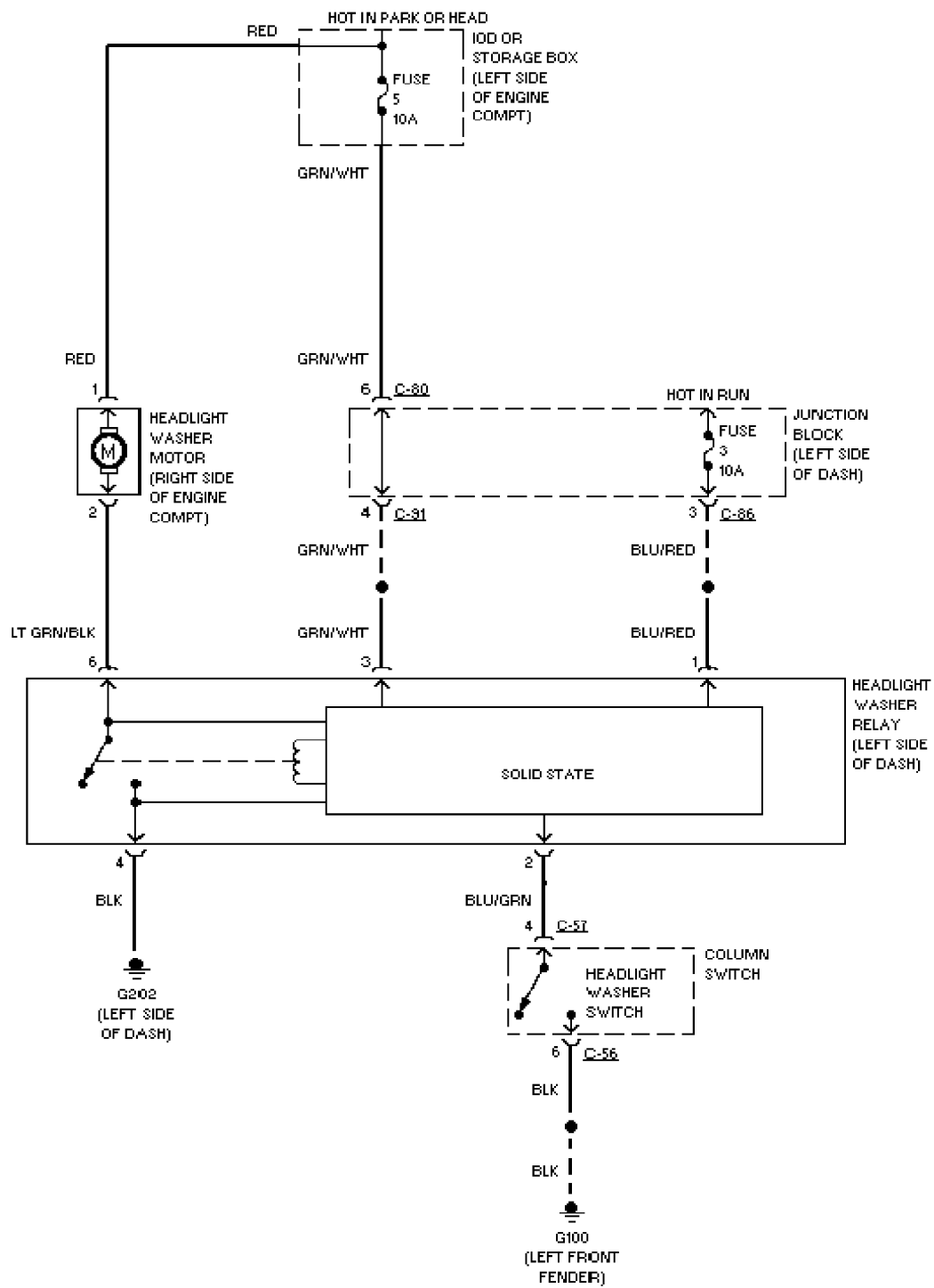
Transmission Circuit

WIPER/WASHER



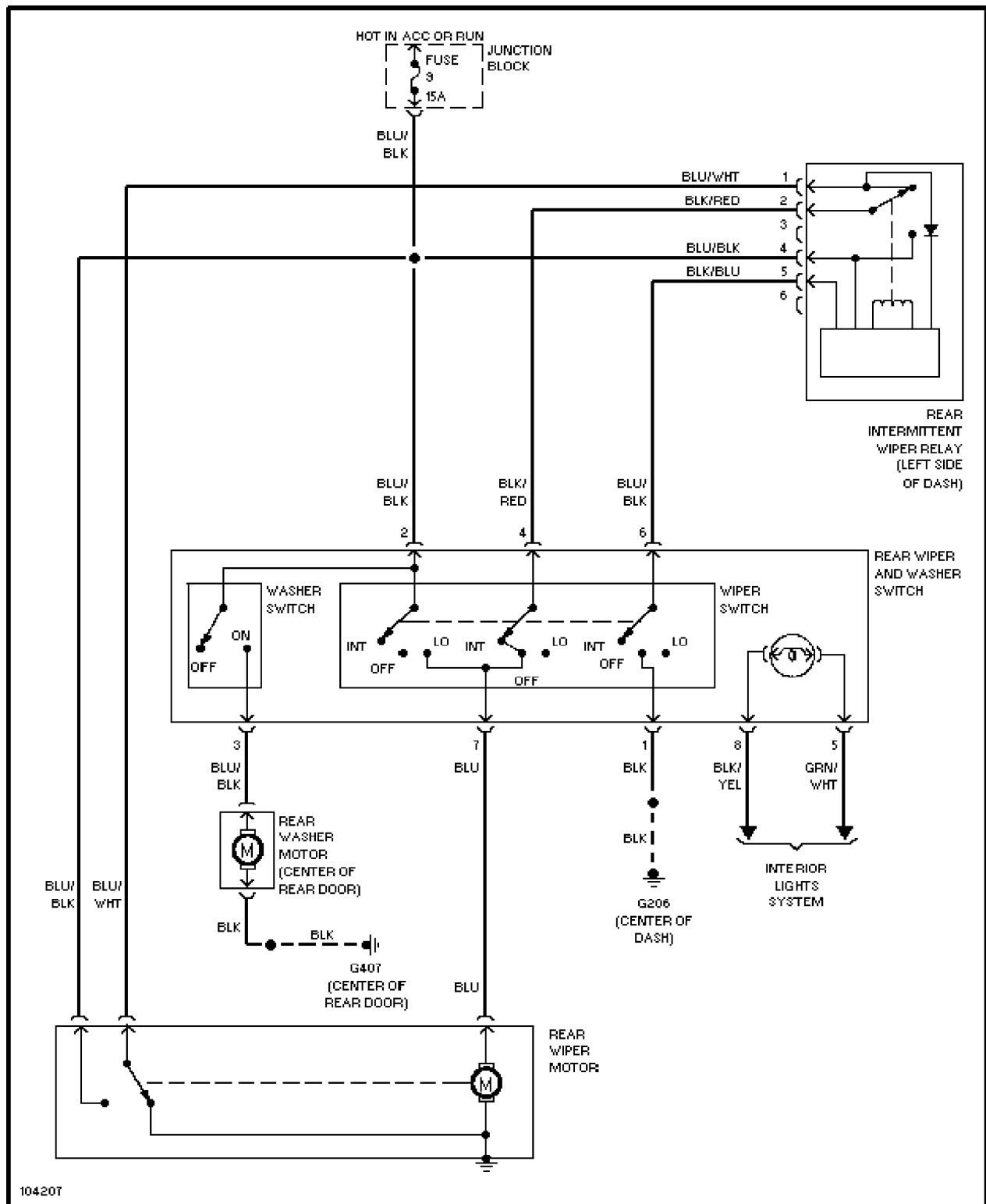
104206

Front Washer/Wiper Circuit



104206

Headlamp Washer Circuit



104207

Rear Washer/Wiper Circuit

G - TESTS W/CODES

1993 Mitsubishi Montero

1993 ENGINE PERFORMANCE
Chrysler Corp./Mitsubishi Self-Diagnostics

Dodge; Ram-50
Mitsubishi; Montero, Pickup

INTRODUCTION

If no faults were found while performing F - BASIC TESTING, proceed with self-diagnostics. If no fault codes or only pass codes are present after entering self-diagnostics, proceed to H - TESTS W/O CODES article in this section for diagnosis by symptom (i.e., ROUGH IDLE, NO START, etc.).

SELF-DIAGNOSTIC SYSTEM

SYSTEM DIAGNOSIS

System diagnosis can be accomplished using a voltmeter or appropriate scan tester. See RETRIEVING CODES. Engine Control Module (ECM) monitors several different engine control system circuits. If an abnormal input signal occurs, a fault code is stored in ECM memory and assigned a fault code number. Each circuit has its own fault number and message. A specific fault code indicates a particular system failure, but it does not indicate that cause of failure is necessarily within system.

A fault code does not condemn any specific component; it simply points out a probable malfunctioning area. If a fault code is set, ECM will turn on Malfunction Indicator Light (MIL). Fault codes can be confirmed by using a voltmeter. System malfunctions encountered are identified as either hard failures or intermittent failures as determined by ECM.

Hard Failures

Hard failures cause Malfunction Indicator Light (MIL) to glow and remain on until malfunction is repaired. If MIL comes on and remains on (MIL may flash) during vehicle operation, cause of malfunction may be determined by using fault codes. See FAULT CODES. If a sensor fails, ECM will use a substitute value in its calculations to continue engine operation. In this condition, vehicle is functional, but loss of good driveability may result.

Intermittent Failures

Intermittent failures may cause Malfunction Indicator Light (MIL) to flicker or glow and go out after intermittent fault goes away. However, corresponding trouble code will be retained in ECM memory. If related fault does not reoccur within a certain time frame, related trouble code will be erased from ECM memory. Intermittent failures may be caused by a sensor, connector or wiring problems. See INTERMITTENTS in H - TESTS W/O CODES article in this section.

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 ECM. This will erase any fault codes stored in ECM.
- * DO NOT cause short circuits when performing electrical tests. This will set additional fault codes, 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 ECM may result.
- * DO NOT prolong testing of fuel injectors. Engine may hydrostatically (liquid) lock.
- * When a vehicle has multiple fault codes, always repair lowest number fault code first.

RETRIEVING CODES

Using Scan Tester

1) Refer to manufacturer's operation manual for instructions in use of scan tester. Before entering on-board diagnostics, see SERVICE PRECAUTIONS. Turn ignition switch to OFF position. Locate Data Link Connector (DLC), next to fuse block. Connect power source terminal of scan tester to cigarette lighter socket.

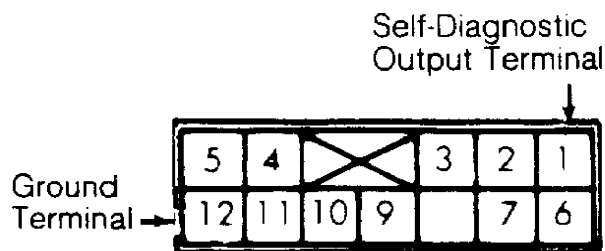
2) Connect scan tester to DLC. See Fig. 1. Turn ignition switch to ON position. Read and record scan tester self-diagnosis output. Perform necessary repair(s). See FAULT CODES.

Using Voltmeter

1) Before entering on-board diagnostics, see SERVICE PRECAUTIONS. Turn ignition switch to OFF position. Locate Data Link Connector (DLC), next to fuse block. Connect volt-meter positive lead to DLC terminal No. 1 and negative lead to terminal No. 12 (ground). See Fig. 1.

2) Turn ignition switch to ON position. Disclosure of ECM memory will begin. If 2 or more systems are non-functional, they are indicated by order of increasing code number. Indication is made by 12-volt pulses of voltmeter pointer. A constant repetition of short 12-volt pulses indicates system is normal. If system is abnormal, voltmeter will pulse between zero and 12 volts.

3) 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 3 short pulses indicate Code 43. After recording fault code(s), perform necessary repair(s) to indicated circuit(s). See FAULT CODES.



92C25959

Fig. 1: Data Link Connector (DLC) Terminal ID
Courtesy of Mitsubishi Motor Sales of America.

FAULT CODES

NOTE: Codes listed in FAULT CODES are not used on all vehicles.

MIL Stays On
ECM fault. Possible cause: faulty ECM.

Code 11
Oxygen (O2) sensor fault. Possible causes: faulty O2 sensor, connector or harness, low or high fuel pressure, defective injector(s), intake air leaks.

Code 12
Airflow sensor fault. Possible causes: faulty airflow sensor, connector or harness.

Code 13
Intake air temperature sensor fault. Possible causes: faulty intake air temperature sensor, connector or harness.

Code 14
Throttle Position Sensor (TPS) fault. Possible causes: faulty TPS, connector or harness, closed throttle position switch.

Code 15
Idle Speed Control (ISC) motor position sensor fault.
Possible causes: faulty ISC motor position sensor, faulty throttle position sensor, connector or harness.

Code 21
Coolant temperature sensor fault. Possible causes: faulty coolant temperature sensor, connector or harness.

Code 22
Crankshaft Position (CKP) sensor fault. Possible causes: faulty distributor assembly (if equipped), faulty CKP sensor, connector or harness.

Code 23
Camshaft Position (CMP) sensor fault. Possible causes: faulty distributor assembly (if equipped), faulty CMP sensor, connector or harness.

Code 24
Vehicle Speed Sensor (VSS) fault. Possible causes: faulty VSS, connector or harness.

Code 25
Barometric (BARO) pressure sensor fault. Possible causes: faulty BARO pressure sensor, connector or harness.

Code 31
Knock sensor fault. Possible causes: faulty knock sensor, connector or harness.

Code 32
MAP sensor faulty. Possible causes: faulty MAP sensor, connector or harness.

Code 36
Ignition timing adjustment signal fault. Possible causes: connector or harness.

Code 39
Oxygen (O2) sensor fault. Possible causes: faulty O2 sensor,

faulty O2 sensor heater, connector or harness, low or high fuel pressure, defective injector(s), intake air leaks.

Code 41

Injector(s) fault. Possible causes: low or high injector coil resistance, connector or harness.

Code 42

Fuel pump fault. Possible causes: faulty ECM, faulty MPI relay, connector or harness.

Code 43

EGR fault. Possible causes: faulty EGR valve, faulty EGR temperature sensor, faulty EGR solenoid, faulty EGR vacuum control, connector or harness.

Code 44

Ignition coil (cylinders No. 1 and 4) fault. Possible causes: faulty ignition coil, faulty ignition power transistor unit, connector or harness.

Code 52

Ignition coil (cylinders No. 2 and 5) fault. Possible causes: faulty ignition coil, faulty ignition power transistor unit, connector or harness.

Code 53

Ignition coil (cylinders No. 3 and 6) fault. Possible causes: faulty ignition coil, faulty ignition power transistor unit, connector or harness.

Code 55

Idle Air Control (IAC) valve position sensor fault. Possible causes: faulty IAC valve position sensor, faulty IAC motor assembly, faulty ECM, connector or harness.

Code 59

Rear Oxygen (O2) sensor fault. Possible causes: faulty O2 sensor, faulty O2 sensor heater, faulty ECM, connector or harness.

Code 61

Transaxle control module torque reduction signal fault. Possible causes: faulty transaxle control module, connector or harness.

Code 62

Variable Induction Control (VIC) Valve position sensor fault. Possible causes: faulty VIC valve position sensor, connector or harness.

Code 71

Traction Control (TC) vacuum valve solenoid fault. Possible causes: faulty TC vacuum valve solenoid, connector or harness.

Code 72

Traction Control (TC) vent valve solenoid fault. Possible causes: faulty TC vent valve solenoid, connector or harness.

CLEARING CODES

NOTE: To clear codes using a scan tester, refer to owners manual supplied with scan tester.

Fault codes may be cleared by disconnecting negative battery cable for at least 10 seconds, allowing ECM to clear fault codes. Reconnect negative battery cable and check for codes to confirm repair.

ECM LOCATION

ECM LOCATION TABLE

Application	Location
All Models	Behind Right Side of Instrument Panel

TERMINAL IDENTIFICATION

NOTE: The following terminals are shown as viewed from component side.

TERMINAL ID DIRECTORY TABLE

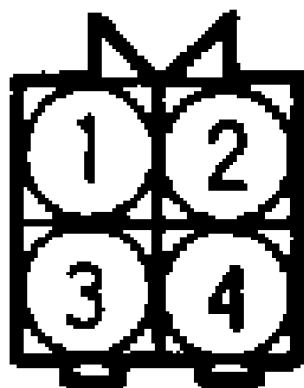
Connector	See Fig.
Airflow Sensor	Fig. 2
CKP/CMP Sensor	Fig. 3
Coolant Temperature Sensor	Fig. 4, 5
ECM	Fig. 6, 7
EGR Temperature Sensor	Fig. 8
Fuel Injector	Fig. 9
Fuel Pump	Fig. 10
Idle Air Control Valve Position Sensor	Fig. 11
Idle Speed Control Motor & Position Sensor	Fig. 12
Ignition Coil	Fig. 13
Induction Control Valve Position Sensor	Fig. 14
Knock Sensor	Fig. 15
MAP Sensor	Fig. 16
MPI Relay	Fig. 17
Oxygen (O2) Sensor	Fig. 18, 19
Throttle Position Sensor	Fig. 20
Traction Control Vacuum Solenoid	Fig. 21
Traction Control Vent Solenoid	Fig. 22
Transaxle Control Module	Fig. 23



ALL OTHER MODELS

93D45107

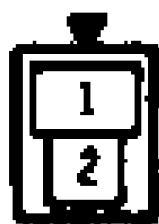
Fig. 2: Airflow Sensor Terminal ID
 Courtesy of Mitsubishi Motor Sales of America.



PICKUP & RAM-50 (2.4L - 4WD)

93D45123

Fig. 3: CKP/CMP Sensor Terminal ID
Courtesy of Mitsubishi Motor Sales of America.



PICKUP & RAM-50 (2.4L - 4WD)

93F45125

Fig. 4: Coolant Temperature Sensor Terminal ID (2.4L)
Courtesy of Mitsubishi Motor Sales of America.



ALL OTHER MODELS

93G45126

Fig. 5: Coolant Temperature Sensor Terminal ID (3.0L)
Courtesy of Mitsubishi Motor Sales of America.

105 110				51 60				1 13			
104 109				52 61				2 14			
103 108				53 62				3 15			
102 107				54 63				4 16			
101 106				55 64				5 17			
				56 65				6 18			
				57 66				7 19			
				58 67				8 20			
				59 68				9 21			
								10 22			
								11 23			
								12 24			

ECLIPSE, MONTERO, PICKUP 3.0L & RAM-50 3.0L

93E45108

Fig. 6: ECM Terminal ID (3.0L)
Courtesy of Mitsubishi Motor Sales of America.

61	72
60	71
59	70
58	69
57	68
56	67
55	66
54	65
53	64
52	63
51	62
108	116
107	115
106	114
105	113
104	112
103	111
102	110
101	109
13	26
12	25
11	24
10	23
9	22
8	21
7	20
6	19
5	18
4	17
3	16
2	15
1	14

ALL OTHER MODELS

93F45109

Fig. 7: ECM Terminal ID (2.4L)
Courtesy of Mitsubishi Motor Sales of America.



93J80258

Fig. 8: EGR Temperature Sensor Terminal ID
Courtesy of Mitsubishi Motor Sales of America.



ALL OTHER MODELS

93B45113

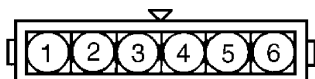
Fig. 9: Fuel Injector Terminal ID
Courtesy of Mitsubishi Motor Sales of America.



PICKUP & RAM-50

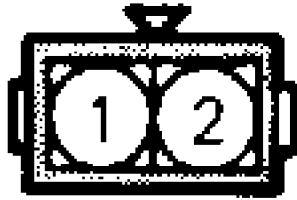
93J45129

Fig. 10: Fuel Pump Terminal ID (Pickup & Ram-50)
Courtesy of Mitsubishi Motor Sales of America.

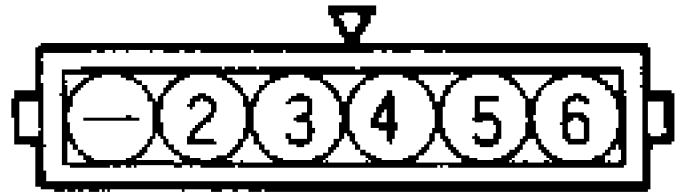


93E80261

Fig. 11: Idle Air Control Valve Position Sensor Terminal ID
Courtesy of Mitsubishi Motor Sales of America.



ISC MOTOR



ISC POSITION SENSOR

93F80262

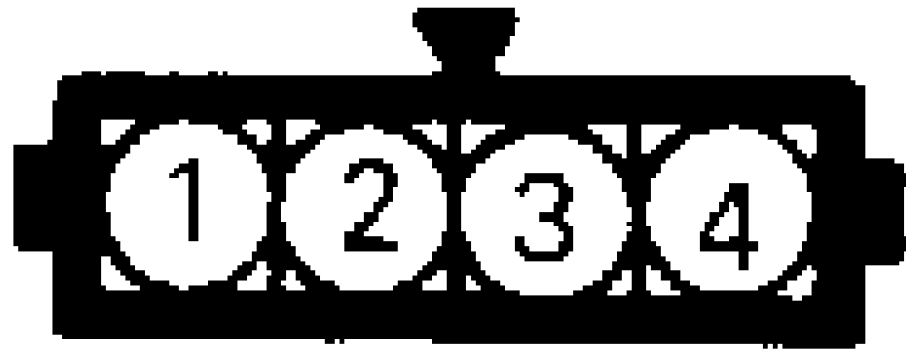
Fig. 12: Idle Speed Control Motor & Position Sensor Terminal ID
 Courtesy of Mitsubishi Motor Sales of America.



ALL OTHER MODELS

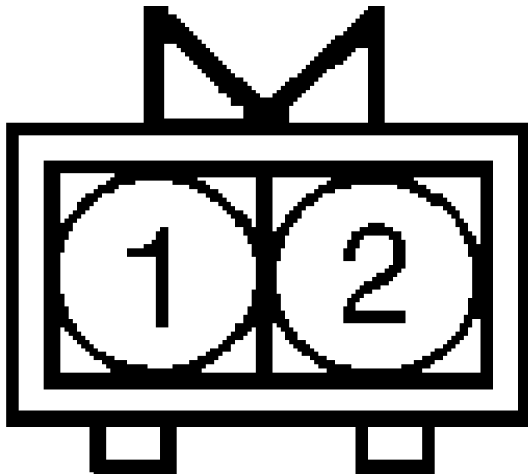
93D45115

Fig. 13: Ignition Coil Terminal ID
 Courtesy of Mitsubishi Motor Sales of America.



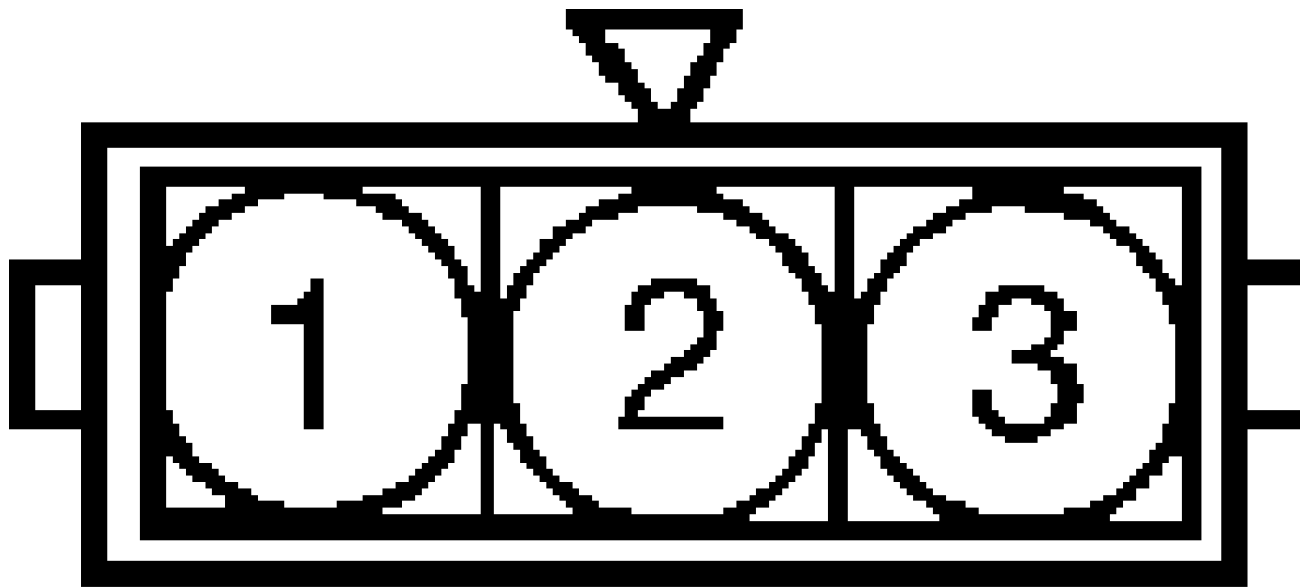
93H80264

Fig. 14: Induction Control Valve Position Sensor Terminal ID
Courtesy of Mitsubishi Motor Sales of America.



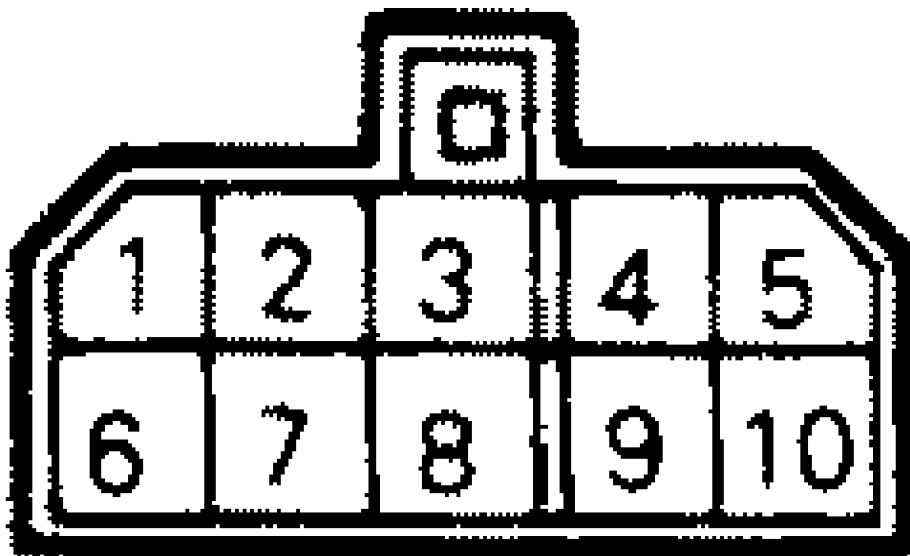
93I80265

Fig. 15: Knock Sensor Terminal ID
Courtesy of Mitsubishi Motor Sales of America.



93J80266

Fig. 16: Map Sensor Terminal ID
Courtesy of Mitsubishi Motor Sales of America.



93A80267

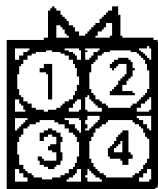
Fig. 17: MPI Relay Terminal ID
Courtesy of Mitsubishi Motor Sales of America.



ALL OTHER MODELS (2-WIRE)

93F45117

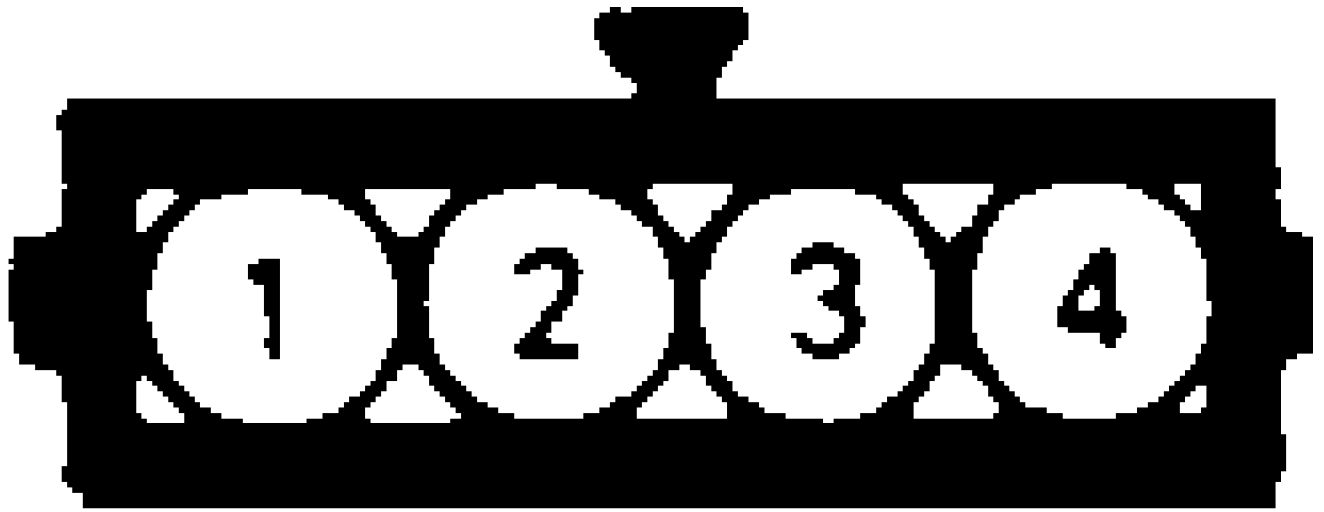
Fig. 18: Oxygen (O₂) Sensor Terminal ID (All Models, 2-Wire)
Courtesy of Mitsubishi Motor Sales of America.



ALL OTHER MODELS

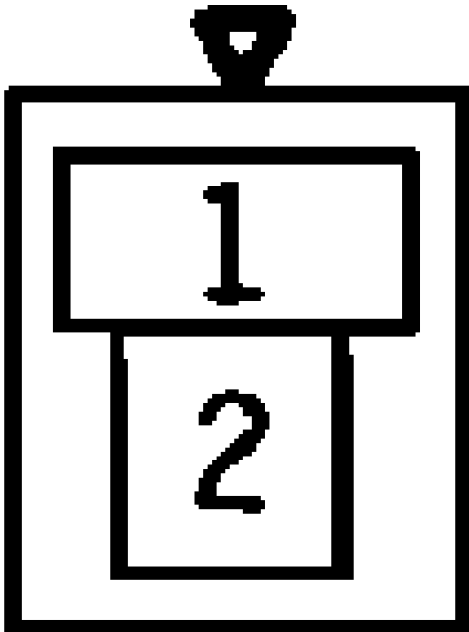
93A45120

Fig. 19: Oxygen (O₂) Sensor Terminal ID
Courtesy of Mitsubishi Motor Sales of America.



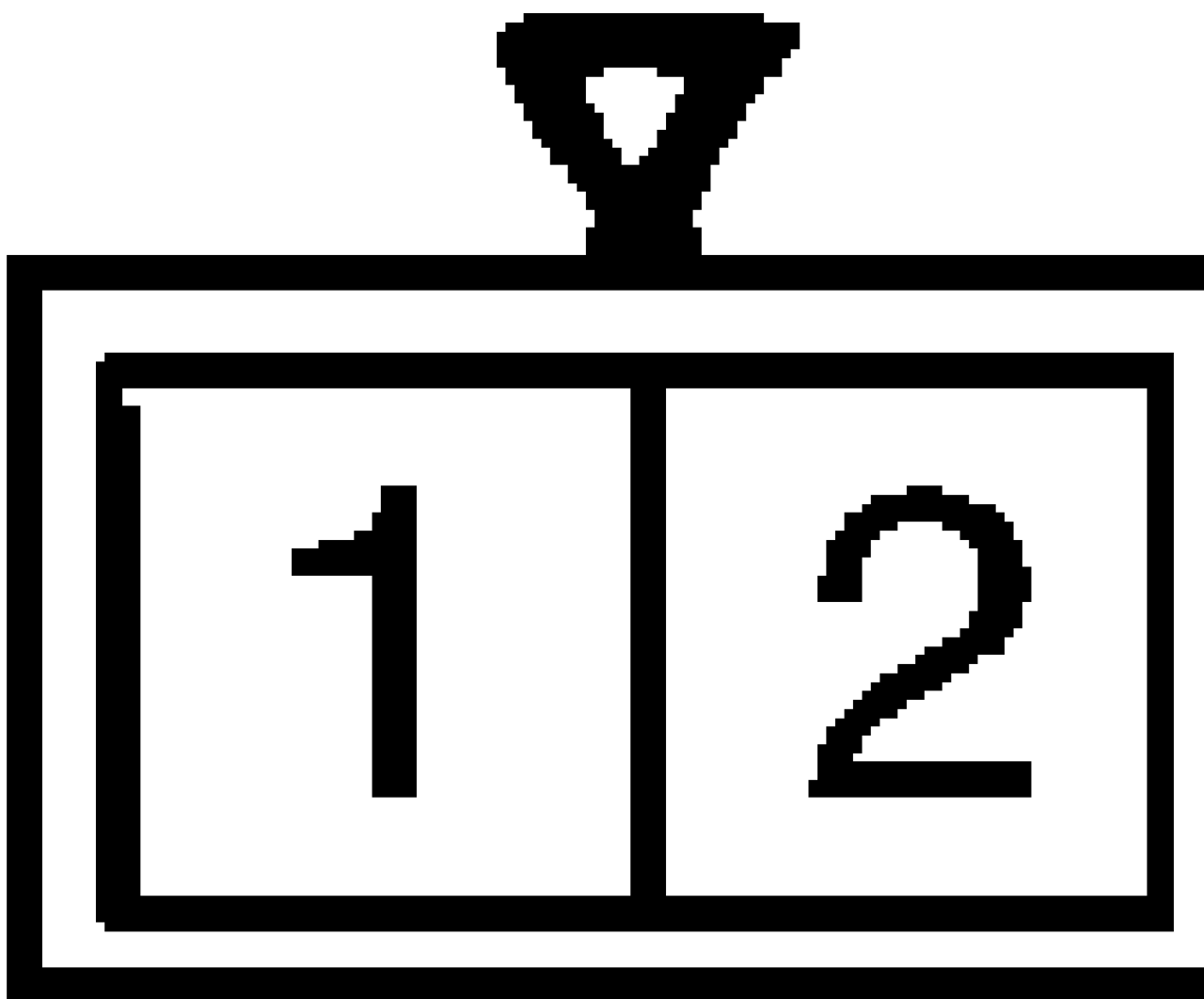
93C80269

Fig. 20: Throttle Position Sensor Terminal ID
 Courtesy of Mitsubishi Motor Sales of America.



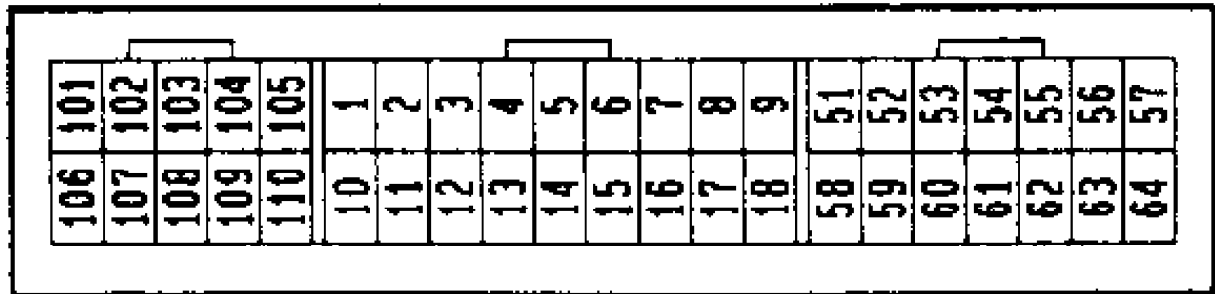
93F80270

Fig. 21: Traction Control Vacuum Solenoid Terminal ID
 Courtesy of Mitsubishi Motor Sales of America.



93G80271

Fig. 22: Traction Control Vent Solenoid Terminal ID
Courtesy of Mitsubishi Motor Sales of America.



93H80272

Fig. 23: Transaxle Control Module Terminal ID
Courtesy of Mitsubishi Motor Sales of America.

DIAGNOSTIC TESTS

CAUTION: Ensure ignition switch is in OFF position when performing resistance tests.

NOTE: Perform all resistance and voltage tests using a Digital Volt-Ohmmeter (DVOM) with a minimum 10-megohms impedance, unless stated otherwise in test procedures.

Clear fault codes after each repair. See CLEARING CODES under SELF-DIAGNOSTIC SYSTEM. Recheck for codes to confirm repair. See RETRIEVING CODES under SELF-DIAGNOSTIC SYSTEM.

CODE 11: OXYGEN (O2) SENSOR, ONE-WIRE O2 SENSOR

NOTE: For component terminal identification, see TERMINAL IDENTIFICATION. For wiring diagrams, see L - WIRING DIAGRAMS article in this section.

1) If using scan tester, go to step 2. Start and warm engine to operating temperature. Disconnect O2 sensor connector. Connect DVOM between chassis ground and O2 sensor terminal. While repeatedly racing engine, measure O2 sensor output voltage. If voltage is not .6-1.0 volt, replace O2 sensor. If voltage is within specification, go to step 4.

2) Using scan tester, read O2 sensor voltage. While monitoring scan tester, accelerate to 4000 RPM. Suddenly decelerate. Scan tester should read .3 volt or less. Suddenly accelerate. Scan tester should read .5-1.0 volt. If voltage is not as specified, replace O2 sensor. If voltage is as specified, go to next step.

3) While monitoring scan tester, accelerate to 2000 RPM and decelerate to 700 RPM (idle). Scan tester should switch between .6-1.0 volt and .4 volt or less. If voltage is not as specified, replace O2 sensor. If voltage is as specified, go to next step.

4) Disconnect O2 sensor connector and ECM connector. Using DVOM, check for continuity between O2 sensor terminal and ECM connector terminal No. 4. If continuity does not exist, repair wiring harness as necessary. If continuity exists, condition required to set fault is not present at this time. Test is complete. Intermittent

problem may exist. See H - TESTS W/O CODES article in this section.

CODE 11: OXYGEN (O2) SENSOR, 2-WIRE O2 SENSOR

NOTE: For component terminal identification, see TERMINAL IDENTIFICATION. For wiring diagrams, see L - WIRING DIAGRAMS article in this section.

1) If using scan tester, go to step 2. Start and warm engine to operating temperature. Disconnect O2 sensor connector. Connect DVOM between chassis ground and O2 sensor terminal No. 1. While repeatedly racing engine, measure O2 sensor output voltage. If voltage is not .6-1.0 volt, replace O2 sensor. If voltage is within specification, go to step 4.

2) Using scan tester, read O2 sensor voltage. While monitoring scan tester, accelerate to 4000 RPM. Suddenly decelerate. Scan tester should read .3 volt or less. Suddenly accelerate. Scan tester should read .5-1.0 volt. If voltage is not as specified, replace O2 sensor. If voltage is as specified, go to next step.

3) While monitoring scan tester, accelerate to 2000 RPM and decelerate to 700 RPM (idle). Scan tester should switch between .6-1.0 volt and .4 volt or less. If voltage is not as specified, replace O2 sensor. If voltage is as specified, go to next step.

4) Disconnect O2 sensor connector and ECM connector. Using DVOM, check for continuity between O2 sensor terminal No. 1 and ECM connector terminal No. 4. If continuity does not exist, repair wiring harness as necessary. If continuity exists, go to next step.

5) Using DVOM, check continuity between chassis ground and O2 sensor connector terminal No. 2. If continuity does not exist, replace O2 sensor. If continuity exists, condition required to set fault is not present at this time. Test is complete. Intermittent problem may exist. See H - TESTS W/O CODES article in this section.

CODE 11: OXYGEN (O2) SENSOR, 4-WIRE O2 SENSOR

NOTE: For component terminal identification, see TERMINAL IDENTIFICATION. For wiring diagrams, see L - WIRING DIAGRAMS article in this section.

1) If using scan tester, go to step 3. Disconnect O2 sensor connector. On all models Pickup and Ram-50, install Test Harness (MB998464) between O2 sensor and O2 sensor connector. On all models, use DVOM to check resistance between specified O2 sensor connector heater terminals. See O2 SENSOR 4-WIRE CONNECTOR TERMINAL ID table. O2 sensor resistance should be 20 ohms at 68°F (20°C). If resistance is not as specified, replace O2 sensor. If resistance is as specified, go to next step.

2) Using jumper wires, apply 12 volts to specified O2 sensor connector heater terminals. See O2 SENSOR 4-WIRE CONNECTOR TERMINAL ID table. Using DVOM, check voltage between specified O2 sensor connector output terminals, while repeatedly racing engine. If voltage is not .6-1.0 volt, replace O2 sensor. If voltage is .6-1.0 volt, go to step 5.

O2 SENSOR 4-WIRE CONNECTOR TERMINAL ID TABLE

Application	(1) Heater Terminals	Output Terminals
Montero	1 & 3	2 & 4
Pickup, Ram-50	2 & 4	1 & 3

(1) - First terminal listed is positive. Second terminal

listed is negative.

3) Start and warm engine to operating temperature. Using scan tester, read O2 sensor voltage. While monitoring scan tester, accelerate to 4000 RPM. Suddenly decelerate. Scan tester should read .3 volt or less. Suddenly accelerate. Scan tester should read .5-1.0 volt. If voltage is not as specified, replace O2 sensor. If voltage is as specified, go to next step.

4) While monitoring scan tester, accelerate to 2000 RPM and decelerate to 700 RPM (idle). Scan tester should switch between .6-1.0 volt and .4 volt or less. If voltage is not as specified, replace O2 sensor. If voltage is as specified, go to next step.

5) Disconnect O2 sensor connector. On Pickup 3.0L, Ram-50 3.0L, go to next step. On all other models, disconnect MPI relay connector. Using DVOM, check for continuity between specified O2 sensor connector terminals and MPI connector terminals. See O2 SENSOR TO MPI WIRING HARNESS TERMINAL ID table. If continuity does not exist, repair wiring harness as necessary. If continuity exists, go to step 7.

O2 SENSOR TO MPI WIRING HARNESS TERMINAL ID TABLE

Application	O2 Sensor Terminals	MPI Terminals
Montero	1	5
Pickup, Ram-50	2	2

6) Turn ignition switch to ON position. Using DVOM, check voltage between specified O2 sensor connector terminal and chassis ground. See O2 SENSOR CONNECTOR VOLTAGE CIRCUIT ID table. If system voltage does not exist, repair wiring harness as necessary. If system voltage exists, go to next step.

O2 SENSOR CONNECTOR VOLTAGE CIRCUIT ID TABLE

Application	Terminal No.
Pickup 3.0L & Ram-50 3.0L	2

7) Using DVOM, check for continuity between specified O2 sensor connector terminals and ECM connector terminals. See O2 SENSOR TO ECM WIRING HARNESS TERMINAL ID table. If continuity does not exist on either circuit, repair appropriate circuit for open or short to ground as necessary. If continuity exists, go to next step.

O2 SENSOR TO ECM WIRING HARNESS TERMINAL ID TABLE

Application	O2 Sensor Terminals	ECM Terminals
Pickup, Ram-50	3	56
	4	35
Montero	4	4

8) Disconnect O2 sensor connector. Using DVOM, check for continuity between specified O2 sensor connector terminal and chassis ground. See O2 SENSOR CONNECTOR GROUND CIRCUIT ID table. If continuity does not exist, repair wiring harness as necessary. If no system or

component malfunctions occur in preceding tests, condition required to set fault is not present at this time. Test is complete. Intermittent problem may exist. See H - TESTS W/O CODES article in this section.

O2 SENSOR CONNECTOR GROUND CIRCUIT ID TABLE

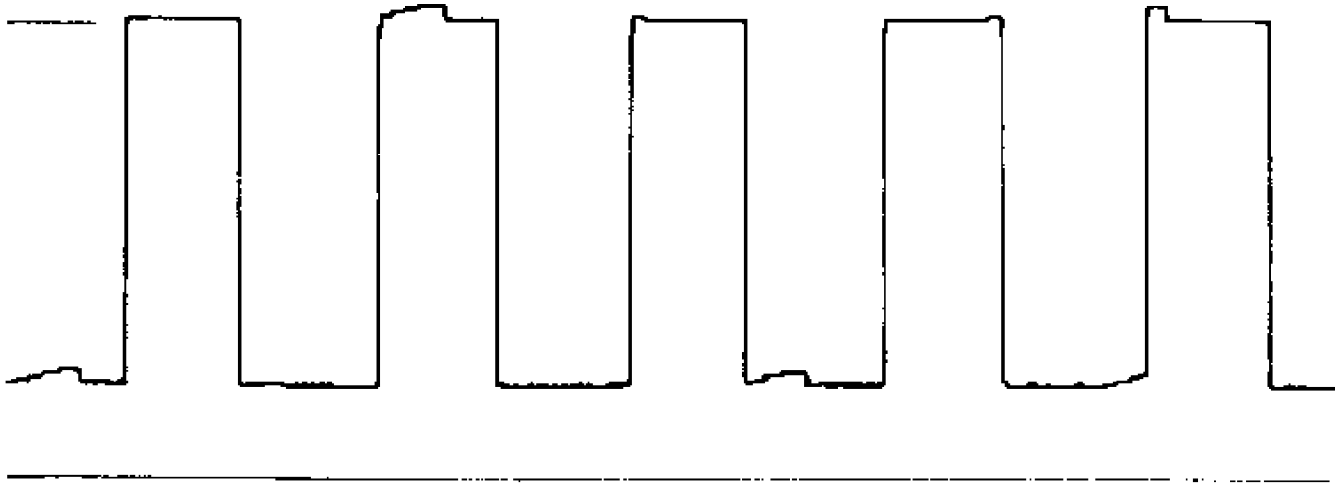
Application	Terminal No.
Pickup, Ram-50	1
Montero	2

CODE 12: AIRFLOW SENSOR

NOTE: For component terminal identification, see TERMINAL IDENTIFICATION. For wiring diagrams, see L - WIRING DIAGRAMS article in this section.

NOTE: Procedures are provided by manufacturer for component testing using an engine analyzer with oscilloscope capability. Refer to manufacturer's operation manual for instructions in use of oscilloscope. If using a scan tester, go to step 3.

- 1) If using scan tester, go to step 3. Disconnect Airflow Sensor (AFS) connector. Install Test Harness (MB991348) between AFS and AFS connector. Using engine analyzer with oscilloscope capability, connect special patterns probe to AFS connector terminal No. 3.
- 2) Start engine. Verify that wave form high frequency and low frequency patterns are of approximately the same length (time). See Fig. 24. Verify that wave length decreases and frequency increases as engine RPM increases. If conditions are not as specified, replace AFS. If conditions are as specified, go to step 4.



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Fig. 24: Known-Good Airflow Sensor Wave Pattern ID
Courtesy of Mitsubishi Motor Sales of America

- 3) Warm vehicle to normal operating temperature. Ensure headlights and accessories are off. Ensure steering wheel is in straight-ahead position. Using scan tester, read Airflow Sensor (AFS) volume (frequency) value. See AIRFLOW SENSOR VALUES table. Frequency should increase when engine is raced. If values are not as specified, replace AFS. If values are as specified, go to next step.

AIRFLOW SENSOR VALUES TABLE

Application	Hz @ 700 RPM	Hz @ 2000 RPM
2.4L	40-60	85-105
3.0L		
Montero	22-48	60-100
Pickup & Ram-50	25-45	70-90

4) On Pickup 2.4L (4WD) and 3.0L, Ram-50 2.4L (4WD), go to step 8. On all other models, disconnect AFS connector and MPI relay connector. Using DVOM, check for continuity between specified AFS connector terminal and MPI relay connector terminal. See AFS TO MPI TERMINAL WIRING HARNESS ID table. If continuity does not exist, repair wiring harness as necessary. If continuity exists, go to next step.

AFS TO MPI TERMINAL WIRING HARNESS ID TABLE

Application	AFS Terminal No.	MPI Terminal No.
Montero	4	4
Pickup, Ram-50	4	3

5) Using DVOM, check for continuity between chassis ground and AFS connector terminal No. 5. If continuity does not exist, repair wiring harness as necessary. If continuity exists, go to next step.

6) Disconnect AFS connector and ECM connector. Using DVOM, check for continuity between specified AFS connector terminal and ECM connector terminal. See AFS TO ECM WIRING HARNESS TERMINAL ID table. If continuity does not exist on specified circuit(s), repair appropriate circuit for open or short to ground as necessary. If continuity exists, go to next step.

AFS TO ECM WIRING HARNESS TERMINAL ID TABLE

Application	AFS Terminal No.	ECM Terminal No.
Montero	3	10
	7	57
Pickup, Ram-50	3	70
	7	19

7) Turn ignition switch to ON position. Using DVOM, check voltage between chassis ground and AFS harness connector terminal No. 3 on all models. If voltage is not 4.8-5.2 volts, replace ECM. If voltage is as specified, condition required to set fault is not present at this time. Test is complete. Intermittent problem may exist. See H - TESTS W/O CODES article in this section.

8) Disconnect AFS connector. Turn ignition switch to ON position. Using DVOM, check voltage between specified terminal and chassis ground. See AFS CONNECTOR POWER SUPPLY CIRCUIT ID table. If system voltage does not exist, repair wiring harness as necessary. If system voltage exists, go to next step.

AFS CONNECTOR POWER SUPPLY CIRCUIT ID TABLE

Application	Terminal No.
2.4L (4WD), 3.0L	5

9) With ignition switch in ON position, use DVOM to check voltage between specified terminal and chassis ground. See AFS CONNECTOR VOLTAGE CIRCUIT ID table. If voltage is not 4.8-5.2 volts, repair wiring harness as necessary. If voltage is as specified, go to next step.

AFS CONNECTOR VOLTAGE CIRCUIT ID TABLE

Application	Terminal No.
All Models	3

10) Using DVOM, check for continuity between specified AFS connector terminal and chassis ground. See AFS CONNECTOR GROUND CIRCUIT ID table. If continuity does not exist, repair wiring harness as necessary. Intermittent problem may exist. See H - TESTS W/O CODES article in this section. On all other models, go to next step.

AFS CONNECTOR GROUND CIRCUIT ID

Application	Terminal No.
All Models	5

11) Disconnect AFS connector and ECM connector. Using DVOM, check for continuity between specified AFS connector terminal and ECM connector terminal. See ECM TO AFS WIRING HARNESS TERMINAL ID table. If continuity does not exist on specified circuit(s), repair appropriate circuit for open or short to ground as necessary. If continuity exists, condition required to set fault is not present at this time. Test is complete. Intermittent problem may exist. See H - TESTS W/O CODES article in this section.

ECM TO AFS WIRING HARNESS TERMINAL TABLE

Application	ECM Terminal No.	AFS Terminal No.
All Models	57	7

CODE 13: INTAKE AIR TEMPERATURE SENSOR

NOTE: On all models, intake air temperature sensor is built into airflow sensor. For code 13 test purposes, the airflow sensor will be referred to as the intake air temperature sensor. For component terminal identification, see AIRFLOW SENSOR under TERMINAL ID. For wiring diagrams, see L - WIRING DIAGRAMS article in this section.

1) If using scan tester, go to step 3. Disconnect Intake Air Temperature (IAT) sensor connector. Using a thermometer, check engine compartment ambient temperature. Using DVOM, check resistance between specified IAT sensor terminals. See IAT SENSOR TERMINAL ID table. Resistance should be 6000 ohms at 32°F (0°C), 2700 ohms at 68°F (20°C) or 400 ohms at 176°F (80°C). If resistance is not as specified,

replace IAT sensor. If resistance is as specified, go to next step.

IAT SENSOR TERMINAL ID TABLE

Application	Terminals No.
All Models	5 & 6

2) Using a hair dryer, warm IAT sensor while monitoring DVOM. Resistance should decrease evenly as temperature rises. If resistance remains unchanged, replace IAT sensor. If resistance changes, go to step 4.

3) Turn ignition switch to ON or RUN position. Using a thermometer, check engine compartment ambient temperature. Using scan tester, read Intake Air Temperature (IAT) sensor temperature. See IAT SENSOR TEMPERATURE table. If temperatures are not as specified, replace IAT sensor. If temperatures are as specified, go to next step.

IAT SENSOR TEMPERATURE TABLE

Ambient Temperature	Standard Value
-4°F (-20°C)	-20 °C
32°F (0°C)	0 °C
68°F (20°C)	20 °C
104°F (40°C)	40 °C
176°F (80°C)	80 °C

4) Disconnect IAT sensor connector. Using DVOM, check for continuity between chassis ground and specified IAT sensor connector terminal. See IAT SENSOR GROUND CIRCUIT TERMINAL ID table. If continuity does not exist, repair wiring harness as necessary. If continuity exists, go to next step.

IAT SENSOR GROUND CIRCUIT TERMINAL ID TABLE

Application	Terminal No.
All Models	5

5) On Pickup 2.4L (4WD) and 3.0L, Ram-50 2.4L (4WD), go to next step. On all other models, with IAT sensor connector and ECM connector disconnected, check for continuity between specified IAT sensor connector terminal and ECM connector terminal. See IAT TO ECM WIRING HARNESS TERMINAL ID table. If continuity does not exist, repair wiring harness as necessary. If continuity exists, go to next step.

IAT TO ECM WIRING HARNESS TERMINAL ID TABLE

Application	IAT Connector Terminal No.	ECM Connector Terminal No.
Montero	6	8
Pickup, Ram-50	6	52

6) Turn ignition switch to ON position. Check voltage between chassis ground and specified IAT sensor connector. See IAT SENSOR CONNECTOR VOLTAGE SUPPLY CIRCUIT TERMINAL ID table. If voltage is not 4.5-4.9 volts, replace ECM. If voltage is as specified, replace IAT

sensor.

IAT SENSOR CONNECTOR VOLTAGE SUPPLY CIRCUIT TERMINAL ID TABLE

Application	Terminal No.
All Models	6

CODE 14: THROTTLE POSITION SENSOR

NOTE: For component terminal identification, see TERMINAL IDENTIFICATION. For wiring diagrams, see L - WIRING DIAGRAMS article in this section.

1) If using scan tester, go to step 3. Disconnect Throttle Position Sensor (TPS) connector. Using DVOM, check resistance between TPS terminals No. 1 and 4. If resistance is not 3500-6500 ohms, replace TPS. If resistance is as specified, go to next step

2) Check resistance between specified TPS terminals. See TPS TERMINAL ID table. While monitoring DVOM, slowly open throttle from idle to fully open position. If resistance does not change smoothly, replace TPS. If resistance changes smoothly, go to step 4.

TPS TERMINAL ID TABLE

Application	Terminals No.
3.0L	1 & 3
2.4L	2 & 4

3) Turn ignition switch to ON position. Using scan tester, read Throttle Position Sensor (TPS) voltage. With throttle at idle, voltage should read .3-1.0 volt. Voltage should increase while slowly opening throttle. At wide open throttle, voltage should read 4.5-5.5 volts. If voltage is not as specified, replace TPS. If voltage is as specified, go to next step.

4) On Pickup 2.4L (4WD) and 3.0L, Ram-50 2.4L (4WD), go to step 7. On all other models, disconnect TPS connector. Using DVOM, check continuity between chassis ground and specified TPS connector terminal. See TPS CONNECTOR GROUND CIRCUIT ID table. If continuity does not exist, repair wiring harness as necessary. If continuity exists, go to next step.

TPS CONNECTOR GROUND CIRCUIT ID TABLE

Application	Terminal No.
Montero	1
Pickup, Ram-50	4

5) Disconnect TPS connector and ECM connector. Check for continuity between specified TPS connector terminal and ECM connector terminal. See TPS TO ECM WIRING HARNESS TERMINAL ID table. If continuity does not exist, repair wiring harness as necessary. If continuity exists, go to next step.

TPS TO ECM WIRING HARNESS TERMINAL ID TABLE

Application	TPS Terminal No.	ECM Terminal No.

Pickup 2.4L (RWD)			
& Ram-50 2.4L (RWD)	1	64	
	2	61	
Montero	3	19	
	4	23	

6) Check voltage between chassis ground and specified TPS connector terminal. See TPS VOLTAGE CIRCUIT ID table. If voltage is not 4.8-5.2 volts, replace ECM. If voltage is as specified, condition required to set fault is not present at this time. Test is complete. Intermittent problem may exist. H - TESTS W/O CODES article in this section.

TPS VOLTAGE CIRCUIT ID TABLE

Application	TPS Terminal No.
Pickup 2.4L (RWD), Ram-50 2.4L (RWD)	1
Montero	4

7) Disconnect TPS connector. Turn ignition switch to ON position. Using DVOM, check voltage between chassis ground and specified TPS connector terminal. See TPS VOLTAGE SUPPLY ID table. If voltage is not 4.8-5.2 volts, repair wiring harness as necessary. If voltage is as specified, go to next step.

TPS VOLTAGE SUPPLY ID TABLE

Application	TPS Terminal No.
Pickup & Ram-50	
2.4L (4WD)	4
3.0L	1

8) Check continuity between chassis ground and specified TPS connector terminal. See TPS CONNECTOR GROUND CIRCUIT ID table. If continuity does not exist, repair wiring harness as necessary. If continuity exists, go to next step.

TPS CONNECTOR GROUND CIRCUIT ID TABLE

Application	Terminal No.
Pickup 3.0L	1
Montero, Ram-50	4

9) With TPS connector and ECM connector disconnected, check for continuity between specified TPS connector terminal and ECM connector terminal. See ECM TO TPS HARNESS ID table. If continuity does not exist, repair wiring harness as necessary. If continuity exists, condition required to set fault is not present at this time. Test is complete. Intermittent problem may exist. See H - TESTS W/O CODES article in this section.

ECM TO TPS HARNESS ID TABLE

Application	ECM Terminal No.	TPS Terminal No.

Pickup 3.0L	19	.....	3
Montero, Ram-50	9	.....	2

CODE 15: IDLE SPEED CONTROL POSITION SENSOR

NOTE: For component terminal identification, see TERMINAL IDENTIFICATION. For wiring diagrams, see L - WIRING DIAGRAMS article in this section.

1) If using scan tester, go to step 3. Disconnect Idle Speed Control (ISC) motor position sensor connector. Using DVOM, check resistance between ISC motor position sensor terminals No. 2 and 3. If resistance is not 4000-6000 ohms, replace ISC motor position sensor. If resistance is as specified, go to next step.

CAUTION: Apply only 6 volts DC or less to ISC motor connector. Higher voltage could cause servo gears to lock up.

2) Disconnect ISC motor connector. Connect a 6-volt DC power supply between ISC motor connector terminals No. 1 and 2 to operate ISC motor. Check resistance between ISC motor position sensor terminals No. 3 and 5. Ensure ISC motor position sensor resistance changes smoothly as motor extends and retracts. If resistance does not change smoothly, replace ISC motor assembly. If resistance changes smoothly, go to step 4.

3) Ensure engine coolant temperature is 185-205°F (85-95°C). Place transmission in Park or Neutral. Turn off all accessories except A/C. Ensure A/C clutch is operating when A/C system is on. With engine at idle, use scan tester to read Idle Speed Control (ISC) motor position sensor voltage. See ISC VOLTAGE SPECIFICATIONS table. If voltage is not as specified, replace IAC motor position sensor. If voltage is as specified, go to next step.

ISC VOLTAGE SPECIFICATIONS TABLE

Application	A/C Switch Position	Standard Voltage
All Models	Off	.5-1.3
	On	.9-2.3
	(1)	.9-2.3

(1) - On A/T models only, apply brakes, place transmission selector in "D" position and A/C switch in ON position.

4) Disconnect ISC motor position sensor connector. Turn ignition switch to ON position. Using DVOM, check voltage between chassis ground and sensor connector terminal No. 2. Check voltage between chassis ground and sensor connector terminal No. 6. Voltage should be 4.8-5.2 volts on both circuits. If voltage is not as specified, repair appropriate wiring harness circuit(s) as necessary. If voltage is as specified, go to next step.

5) Check for continuity between chassis ground and sensor connector terminal No. 3. If continuity does not exist, repair wiring harness as necessary. If continuity exists, condition required to set fault is not present at this time. Test is complete. Intermittent problem may exist. See H - TESTS W/O CODES article in this section.

CODE 21: COOLANT TEMPERATURE SENSOR

NOTE: For component terminal identification, see TERMINAL IDENTIFICATION. For wiring diagrams, see L - WIRING DIAGRAMS article in this section.

1) If using scan tester, go to step 2. Remove Coolant Temperature Sensor (CTS) from intake manifold. Submerge temperature sensing portion of CTS in hot water. Using DVOM, check resistance across CTS terminals. See CTS RESISTANCE SPECIFICATIONS table. If resistance is not as specified, replace CTS. If resistance is as specified, go to step 3.

CTS RESISTANCE SPECIFICATIONS TABLE

Water Temperature	Approximate Ohms
32°F (0°C)	5800
68°F (20°C)	2400
104°F (40°C)	1100
176°F (80°C)	300

2) Turn ignition switch to ON or RUN position. Using a thermometer, check engine compartment ambient temperature. Using scan tester, read Coolant Temperature Sensor (CTS) voltage. See CTS VOLTAGE SPECIFICATIONS table. If voltage is not within specifications, replace CTS. If voltage is within specification, go to next step.

CTS VOLTAGE SPECIFICATIONS TABLE

Ambient Temperature	Standard Value °F (°C)
-4°F (-20°C)	-20 °C
32°F (0°C)	0 °C
68°F (20°C)	20 °C
104°F (40°C)	40 °C
176°F (80°C)	80 °C

3) Disconnect CTS connector. Using DVOM, check continuity between chassis ground and specified connector terminal. See CTS GROUND CIRCUIT TERMINAL ID table. If continuity does not exist, repair wiring harness as necessary. If continuity exists, go to next step.

CTS GROUND CIRCUIT TERMINAL ID TABLE

Application	Terminal No.
Pickup 2.4L (4WD) & Ram-50 2.4L (4WD)	1
All Other Models	2

4) On Pickup 2.4L (4WD) and 3.0L, Ram-50 2.4L (4WD) go to next step. On all other models, Disconnect CTS connector and ECM connector. Check continuity between specified CTS connector terminals and ECM connector terminals. See CTS TO ECM WIRING HARNESS TERMINAL ID table. If continuity does not exist, repair wiring harness as necessary. If continuity exists, go to next step.

CTS TO ECM WIRING HARNESS TERMINAL ID TABLE

CTS	ECM

Application	Terminal No.	Terminal No.
Montero	1	20
Pickup, Ram-50	1	63

5) Turn ignition switch to ON position. Check voltage between chassis ground and specified CTS connector terminal. See CTS VOLTAGE CIRCUIT ID table. If voltage is not 4.5-4.9 volts, replace ECM. If voltage is as specified, condition required to set fault is not present at this time. Test is complete. Intermittent problem may exist. See H - TESTS W/O CODES article in this section.

CTS VOLTAGE CIRCUIT ID TABLE

Application	Terminal No.
Pickup & Ram-50 (2.4L - 4WD)	1
3.0L	2

CODE 22: CRANKSHAFT POSITION SENSOR

NOTE: For component terminal identification, see TERMINAL IDENTIFICATION. For wiring diagrams, see L - WIRING DIAGRAMS article in this section.

NOTE: Procedures are provided by manufacturer for component testing using an engine analyzer with oscilloscope capability. Refer to manufacturer's operation manual for instructions in use of oscilloscope. If using a scan tester, go to step 3.

1) On all models except Pickup, Ram-50, disconnect Crankshaft/Camshaft Position (CKP/CMP) sensor connector. Install Test Harness (MB991348) between sensor and connector. On all models, using engine analyzer with oscilloscope capability, connect special patterns probe to specified connector terminal. See CKP PATTERN PICKUP TERMINAL ID table.

CKP PATTERN PICKUP TERMINAL ID TABLE

Application	Terminal No.
3.0L	2
2.4L	1

2) Start engine. Compare oscilloscope wave pattern with known-good wave pattern. See Fig. 25. Verify that wave length (time) decreases as engine RPM increases. If a wave pattern is output and it fluctuates to left or right, check for loose timing belt or an abnormality in sensor pickup disc. If a rectangular wave pattern is output even when engine is not started, substitute known-good CKP sensor. Repeat test. If wave pattern is still abnormal, go to step 5.



Fig. 25: Known-Good CKP Sensor Wave Pattern ID
Courtesy of Mitsubishi Motor Sales of America

3) Connect an engine tachometer. Crank engine. Ensure ignition coil primary current toggles on and off. Using tachometer and scan tester, compare cranking speed and scan tester read out. If engine fails to start and tachometer reads zero RPM when engine is cranked, check for broken timing belt or faulty CKP sensor. If CKP sensor is suspected, substitute known-good CKP sensor. Repeat test procedure. If engine fails to start, tachometer reads zero RPM, and ignition coil primary current fails to toggle on and off, check for faulty ignition coil, ignition circuit or power transistor. If engine starts and readouts agree, go to next step.

4) Ensure A/C switch is in ON position to activate closed throttle position switch. Allow engine to idle. Check coolant temperature. Using scan tester, read idle speed. See IDLE RPM SPECIFICATIONS table. If RPM is not to specification, check for faulty coolant temperature sensor, basic idle speed adjustment, or idle air control motor. If RPM is within specifications, go to next step.

IDLE RPM SPECIFICATIONS TABLE

Coolant Temperature	Engine RPM
-4°F (-20°C)	
Pickup, Ram-50	1460-1660
2.4L	1300-1500
3.0L	1500-1700
Montero	1500-1700
32°F (0°C)	
Pickup, Ram-50	
2.4L	1300-1500
3.0L	1250-1450
Montero	1250-1450
68°F (20°C)	
Pickup, Ram-50	
2.4L	1150-1350
Montero, Pickup 3.0L,	
Ram-50 3.0L	1050-1250
104°F (40°C)	
Pickup, Ram-50	
2.4L	950-1150
3.0L	850-1050
Montero	850-1050
176°F (80°C)	
Pickup, Ram-50	
2.4L	650-850
3.0L	600-800
Montero	600-800

5) Disconnect CKP/CMP sensor connector and Ignition (IG) switch connector. Using DVOM, check for continuity between CKP/CMP sensor connector terminal No. 2 and IG switch connector terminal No. 3. See Fig. 26. If continuity does not exist, repair wiring harness as necessary. If continuity exists, go to step 8.

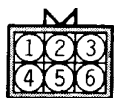


Fig. 26: Ignition Switch Terminal ID
Courtesy of Mitsubishi Motor Sales of America

6) On all other models except Montero, go to next step. Disconnect CKP/CMP connector and MPI relay connector. Using DVOM,

check for continuity between CKP/CMP connector terminal No. 3 and MPI relay connector terminal No. 5. If continuity does not exist, repair wiring harness as necessary. If continuity exists, go to step 8.

7) On all other models, disconnect CKP/CMP sensor connector. Turn ignition switch to ON position. Using DVOM, check voltage between chassis ground and specified CKP/CMP sensor connector terminal. See CKP SENSOR VOLTAGE TERMINAL ID table. If battery voltage does not exist, repair ignition circuit between CKP/CMP sensor connector and Ignition switch. If battery voltage exists, go to next step.

CKP SENSOR VOLTAGE TERMINAL ID TABLE

Application	Terminal No.
All Models	3

8) With CKP/CMP sensor connector disconnected, check for continuity between chassis ground and specified CKP/CMP sensor connector terminal. See CKP SENSOR GROUND CIRCUIT TERMINAL ID table. If continuity does not exist, repair wiring harness as necessary. If continuity exists, go to next step.

CKP SENSOR GROUND CIRCUIT TERMINAL ID TABLE

Application	Terminal No.
3.0L	4
2.4L	2

9) On Pickup 2.4L (4WD) and 3.0L, Ram-50 2.4L (4WD), go to next step. On all other models, with CKP/CMP sensor connector and ECM connector disconnected, check for continuity between specified CKP/CMP sensor connector terminal and ECM connector terminal. See CKP TO ECM CONNECTOR TERMINAL ID table. If continuity does not exist, repair wiring harness as necessary. If continuity exists, go to next step.

CKP TO ECM CONNECTOR TERMINAL ID TABLE

Application	CKP Terminal No.	ECM Terminal No.
Montero	1	22
	2	21
Pickup 2.4L (RWD) & Ram-50 2.4L (RWD)	1	69
All Other Models	3	69

10) With ignition switch in ON position, check for voltage between chassis ground and specified CKP/CMP sensor connector terminal. See CKP SENSOR SUPPLY CIRCUIT ID table. If 4.8-5.2 volts do not exist, replace ECM. If voltage is to specification and CKP sensor is suspected, replace CKP sensor.

CKP SENSOR SUPPLY CIRCUIT ID TABLE

Application	Terminal No.
3.0L	2
2.4L	1

CODE 23: CAMSHAFT POSITION SENSOR

NOTE: For component terminal identification, see TERMINAL IDENTIFICATION. For wiring diagrams, see L - WIRING DIAGRAMS article in this section.

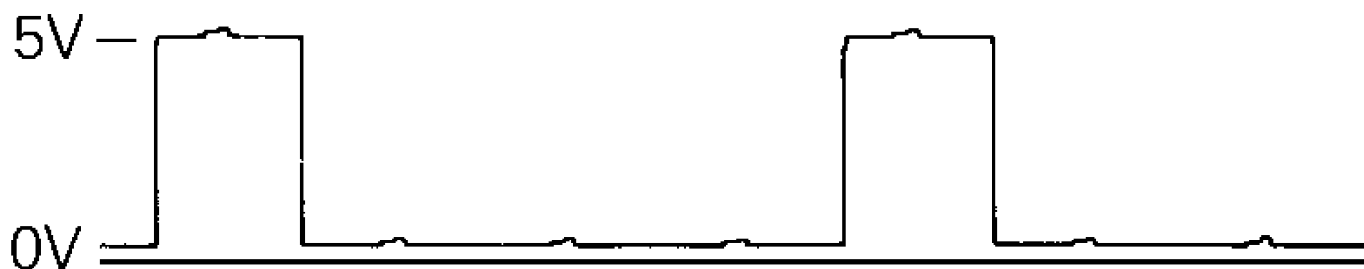
NOTE: Procedures are provided by manufacturer for component testing using an engine analyzer with oscilloscope capability. Refer to manufacturer's operation manual for instructions in use of oscilloscope. Manufacturer does not provide procedures for testing component using a scan tester.

1) On all models except Pickup, Ram-50, disconnect Crankshaft/Camshaft Position (CKP/CMP) sensor connector. Install Test Harness (MB991348) between sensor and connector. On all models, using engine analyzer with oscilloscope capability, connect special patterns probe to specified connector terminal. See CMP PATTERN PICKUP TERMINAL ID table.

CMP PATTERN PICKUP TERMINAL ID TABLE

Application	Terminal No.
3.0L	1
2.4L	4

2) Start engine. Compare oscilloscope wave pattern with known-good wave pattern. See Fig. 27. Verify that wave length (time) decreases as engine RPM increases. If a wave pattern is output and it fluctuates to left or right, check for loose timing belt or an abnormality in sensor pickup disc. If a rectangular wave pattern is output even when engine is not started, substitute known-good CMP sensor. Repeat test. If wave pattern is still abnormal, go to next step.



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Fig. 27: Known-Good CMP Sensor Wave Pattern ID
Courtesy of Mitsubishi Motor Sales of America

3) Disconnect CKP/CMP sensor connector and Ignition (IG) switch connector. Using DVOM, check for continuity between CKP/CMP sensor connector terminal No. 2 and IG switch connector terminal No. 3. See Fig. 26. If continuity does not exist, repair wiring harness as necessary. If continuity exists, go to step 6.

4) On all other models except Montero, go to next step. Disconnect CKP/CMP connector and MPI relay connector. Using DVOM, check for continuity between CKP/CMP connector terminal No. 3 and MPI relay connector terminal No. 5. If continuity does not exist, repair wiring harness as necessary. If continuity exists, go to step 6.

5) On all other models, disconnect CKP/CMP sensor connector.

Turn ignition switch to ON position. Using DVOM, check voltage between chassis ground and specified CKP/CMP sensor connector terminal. See CMP SENSOR VOLTAGE TERMINAL ID table. If battery voltage does not exist, repair ignition circuit between CKP/CMP sensor connector and Ignition switch. If battery voltage exists, go to next step.

CMP SENSOR VOLTAGE TERMINAL ID TABLE

Application	Terminal No.
All Models	3

6) With CKP/CMP sensor connector disconnected, check for continuity between chassis ground and specified CKP/CMP sensor connector terminal. See CMP SENSOR GROUND CIRCUIT TERMINAL ID table. If continuity does not exist, repair wiring harness as necessary. If continuity exists, go to next step.

CMP SENSOR GROUND CIRCUIT TERMINAL ID TABLE

Application	Terminal No.
3.0L	4
2.4L	2

7) On Pickup 2.4L (4WD) and 3.0L, Ram-50 2.4L (4WD), go to next step. On all other models, with CKP/CMP sensor connector and ECM connector disconnected, check for continuity between specified CKP/CMP sensor connector terminal and ECM connector terminal. See CMP TO ECM CONNECTOR TERMINAL ID table. If continuity does not exist, repair wiring harness as necessary. If continuity exists, go to next step.

CMP TO ECM CONNECTOR TERMINAL ID TABLE

Application	CMP Terminal No.	ECM Terminal No.
Montero	1	22
	2	21
All Other Models	4	68

8) With ignition switch in ON position, check for voltage between chassis ground and specified CKP/CMP sensor connector terminal. See CMP SENSOR SUPPLY CIRCUIT ID table. If 4.8-5.2 volts do not exist, replace ECM. If voltage is as specified, condition required to set fault is not present at this time. Test is complete. Intermittent problem may exist. See H - TESTS W/O CODES article in this section.

CMP SENSOR SUPPLY CIRCUIT ID TABLE

Application	Terminal No.
3.0L	1
2.4L	4

CODE 24: VEHICLE SPEED SENSOR

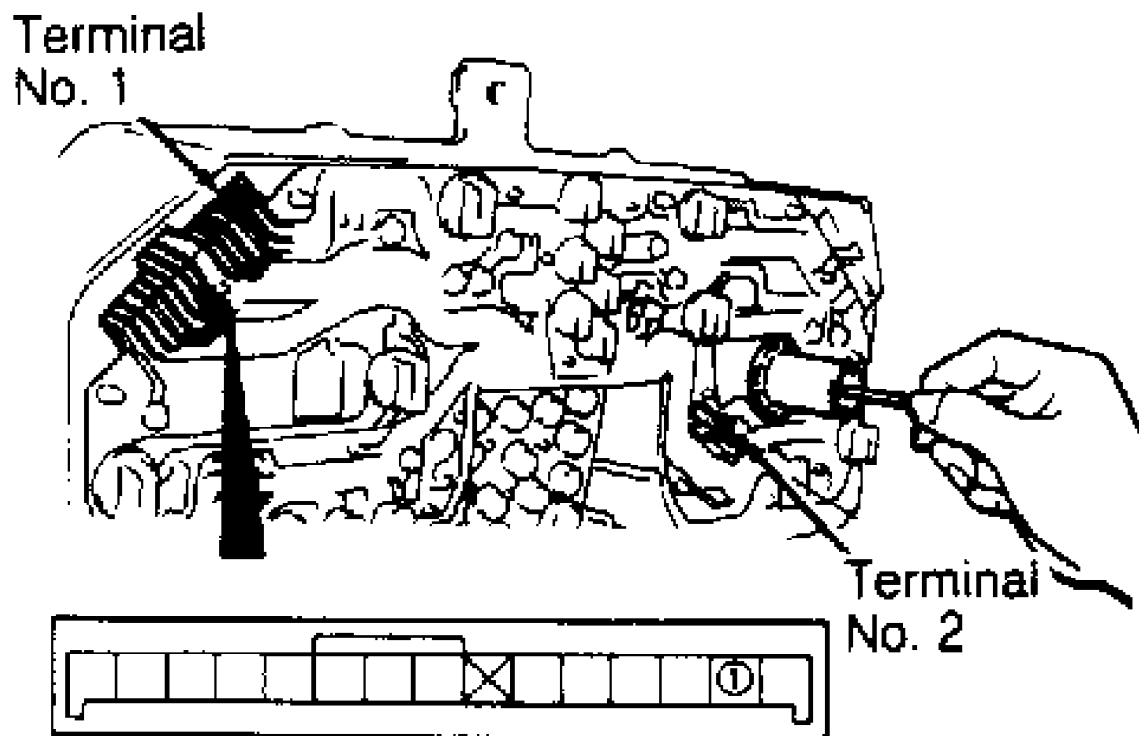
NOTE: For component terminal identification, see TERMINAL

IDENTIFICATION. For wiring diagrams, see L - WIRING DIAGRAMS article in this section.

1) Manufacturer does not provide Vehicle Speed Sensor (VSS) testing procedures using scan tester. VSS is located in speedometer. VSS component testing procedures using DVOM require removal of instrument panel. Removal and installation of instrument panel is basically an unbolt and bolt-on procedure.

2) On all other models, use DVOM to check continuity between indicated VSS terminals. See Fig. 28 or 29. Ensure continuity pulses on and off 4 times per speedometer shaft revolution. If continuity is not as specified, replace VSS. If continuity is as specified, go to step 4.

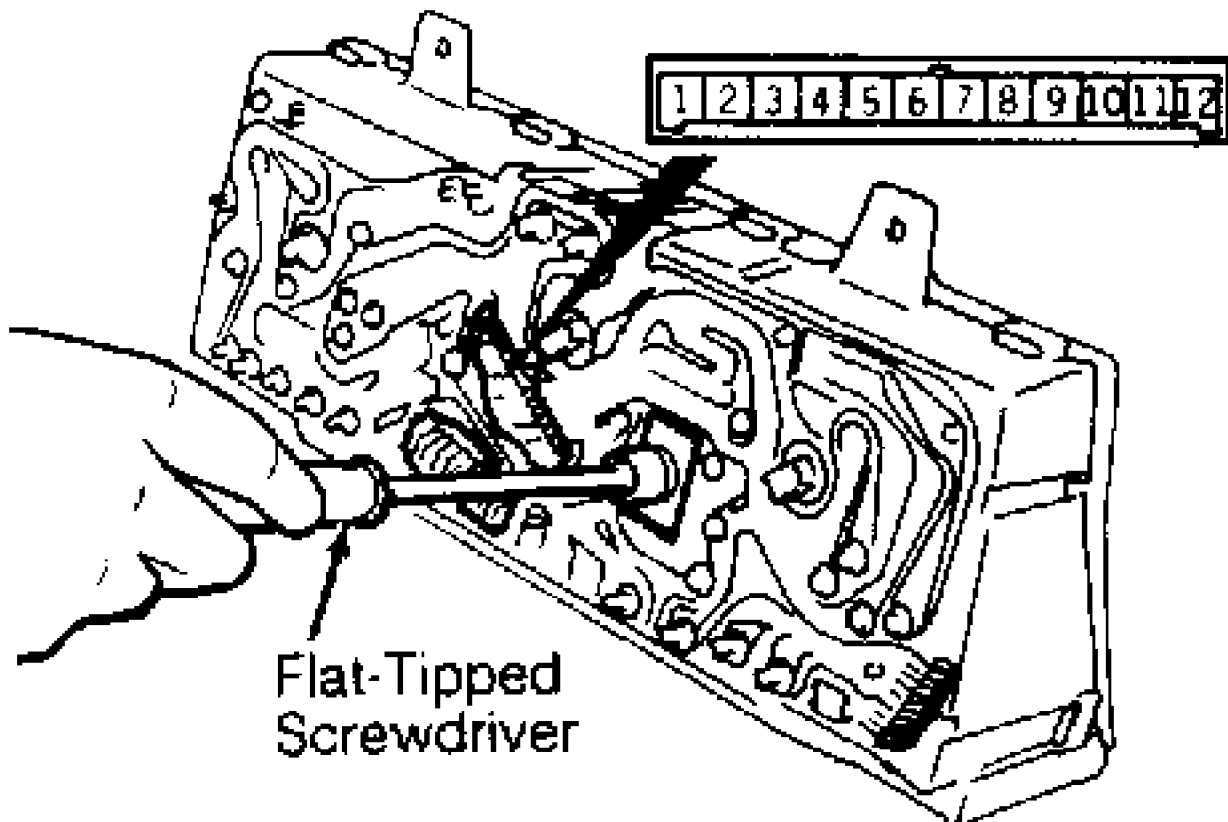
3) Remove VSS. Connect battery, resistor (3-10 ohms) and voltmeter to indicated terminals. See Fig. 28 or 29. Ensure voltage pulses 4 times per speedometer shaft revolution. If voltage is not as specified, replace VSS. If voltage is as specified, go to next step.



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MONTERO

Fig. 28: VSS Test Terminal ID (Montero)
Courtesy of Mitsubishi Motor Sales of America.



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PICKUP & RAM-50

Fig. 29: VSS Test Terminal ID (Pickup & Ram-50)
Courtesy of Mitsubishi Motor Sales of America.

4) Disconnect ECM connector. Using DVOM, check continuity between chassis ground and specified ECM connector terminal. See VSS OUTPUT CIRCUIT ID table. Move vehicle. Ensure continuity pulses on and off 4 times per tire revolution. If continuity is not as specified on Pickup 2.4L (4WD) and 3.0L, Ram-50 2.4L (4WD) and 3.0L, go to step 6. On all other models, go to next step.

VSS OUTPUT CIRCUIT ID TABLE

Application	Terminal No.
All Models	18

5) With ECM connector disconnected, disconnect VSS connector. Ground ECM connector VSS output terminal. See VSS OUTPUT CIRCUIT ID table. Using DVOM, check for continuity between chassis ground and specified VSS connector terminal. See ECM TO VSS CIRCUIT ID table. If continuity does not exist, repair wiring harness as necessary. If continuity exists, go to next step.

ECM TO VSS CIRCUIT ID TABLE

Application	Terminal No.

Montero, Pickup 2.4L (RWD) &	
Ram-50 2.4L (RWD)	1
All Other Models	9

6) With VSS connector disconnected, check for continuity between chassis ground and specified VSS connector terminal. See VSS GROUND CIRCUIT ID table. If continuity does not exist, repair wiring harness as necessary. If continuity exists, go to next step.

VSS GROUND CIRCUIT ID TABLE

Application	Terminal No.
Montero	13
Pickup & Ram-50	10

7) With VSS connector and ECM connector disconnected, turn ignition switch to ON position. Using DVOM, check for voltage between chassis ground and specified VSS connector terminal. See VSS VOLTAGE FEED CIRCUIT ID table. If voltage is not 4.5-4.9 volts, replace ECM. If voltage is as specified, condition required to set fault is not present at this time. Test is complete. Intermittent problem may exist. See H - TESTS W/O CODES article in this section.

VSS VOLTAGE FEED CIRCUIT ID TABLE

Application	Terminal No.
All Models	1

CODE 25: BAROMETRIC PRESSURE SENSOR

NOTE: Barometric (BARO) pressure sensor is built into airflow sensor. For code 25 test purposes, the airflow sensor will be referred to as the BARO pressure sensor. For component terminal identification, see AIRFLOW SENSOR under TERMINAL IDENTIFICATION. For wiring diagrams, see L - WIRING DIAGRAMS article in this section.

1) Manufacturer does not provide component testing procedure without scan tester. Turn ignition switch to ON position. Using scan tester, read sensor pressure. See BARO PRESSURE SENSOR SPECIFICATIONS table. If pressure is not as specified, replace BARO pressure sensor. If pressure is as specified, go to next step.

BARO PRESSURE SENSOR SPECIFICATIONS TABLE

Altitude Ft. (M)	Pressure In. Hg
0 (0)	29.92
1969 (600)	27.95
3937 (1200)	25.98
5906 (1800)	24.02

2) Disconnect BARO pressure sensor connector. Using DVOM, check for continuity between chassis ground and specified BARO pressure sensor connector terminal. See BARO PRESSURE SENSOR GROUND

CIRCUIT ID table. If continuity does not exist, repair wiring harness as necessary. If continuity exists, go to next step.

BARO PRESSURE SENSOR GROUND CIRCUIT ID TABLE

Application	Terminal No.
All Models	5

3) On Pickup 2.4L (4WD) and 3.0L, Ram-50 2.4L (4WD), go to step 5. On all other models, with BARO pressure sensor disconnected, disconnect ECM connector. Check for continuity between specified ECM connector terminal and BARO pressure sensor connector terminal. See BARO PRESSURE SENSOR TO ECM CIRCUIT ID table. If continuity does not exist, repair wiring harness as necessary. If continuity exists, go to next step.

BARO PRESSURE SENSOR TO ECM CIRCUIT ID TABLE

Application	BARO Terminal No.	ECM Terminal No.
Montero	1	23
	2	16
All Other Models	2	65

4) With BARO pressure sensor connector and ECM connector disconnected, turn ignition switch to ON position. Check for voltage between chassis ground and BARO pressure sensor connector terminal No. 1. If voltage is not 4.8-5.2 volts, replace ECM. If voltage is as specified, condition required to set code is not present at this time. Test is complete. Intermittent problem may exist. See H - TESTS W/O CODES article in this section.

5) With BARO pressure sensor connector disconnected, turn ignition switch to ON position. Check for voltage between chassis ground and specified BARO pressure sensor connector terminal. See BARO PRESSURE SENSOR POWER SUPPLY CIRCUIT ID table. If voltage is not 4.8-5.2 volts, repair wiring harness as necessary. If voltage is as specified, go to next step.

BARO PRESSURE SENSOR POWER SUPPLY CIRCUIT ID TABLE

Application	Terminal No.
All Models	1

6) With BARO pressure sensor connector and ECM connector disconnected, ground ECM connector terminal No. 16. Using DVOM, check for continuity between chassis ground and specified BARO pressure sensor connector terminal. See ECM TO BARO PRESSURE SENSOR GROUND CIRCUIT ID table. If continuity does not exist, repair wiring harness as necessary. If continuity exists, condition required to set code is not present at this time. Test is complete. Intermittent problem may exist. See H - TESTS W/O CODES article in this section.

ECM TO BARO PRESSURE SENSOR GROUND CIRCUIT ID TABLE

Application	Terminal No.
Pickup, Ram-50	1

CODE 31: KNOCK SENSOR

NOTE: For component terminal identification, see TERMINAL IDENTIFICATION. For wiring diagrams, see L - WIRING DIAGRAMS article in this section.

1) Manufacturer does not provide component testing procedure using scan tester. Go to next step.

2) Connect oscilloscope special patterns pickup between ECM and ECM connector at ECM terminal No. 9. Start engine. Accelerate engine to 5000 RPM. Compare oscilloscope wave pattern with known-good wave pattern. See Fig. 30. If wave pattern is abnormal, replace knock sensor. If wave pattern is normal, go to next step.



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Fig. 30: Known-Good Knock Sensor Wave Pattern ID
Courtesy of Mitsubishi Motor Sales of America.

3) Using DVOM, check voltage between chassis ground and knock sensor connector terminal No. 1. If voltage is not 8.0-11.0 volts, repair wiring harness as necessary. If voltage is as specified, go to step 5.

4) Disconnect knock sensor connector and ECM connector. Ground ECM connector terminal No. 58. Using DVOM, check continuity between chassis ground and knock sensor connector terminal No. 1. If continuity does not exist, repair wiring harness as necessary. If continuity exists, go to next step.

5) With knock sensor connector disconnected, check for continuity between chassis ground and knock sensor connector terminal No. 2. If continuity does not exist, repair wiring harness as necessary. If continuity exists, condition required to set code is not present at this time. Test is complete.

CODE 32: MAP SENSOR

NOTE: For component terminal identification, see TERMINAL IDENTIFICATION. For wiring diagrams, see L - WIRING DIAGRAMS article in this section.

1) Manufacturer does not provide component testing procedure without scan tester. Ensure coolant temperature is 176-203°F (80-95°C). Ensure all accessories are off, transmission is in Neutral, and ignition switch is in ON position. Using scan tester, read intake manifold plenum pressure. See INTAKE MANIFOLD PLENUM PRESSURE SPECIFICATIONS table. If conditions are not as specified, replace Manifold Absolute Pressure (MAP) sensor. If conditions are as specified, go to next step.

INTAKE MANIFOLD PLENUM PRESSURE SPECIFICATIONS TABLE

Engine State	Altitude Ft. (M)	Pressure In. Hg
Off	0 (0)	29.92
	1969 (600)	27.95
	3937 (1200)	25.98
	5906 (1800)	24.02
Idle (750 RPM)		6.70-10.62
Suddenly Raced		(1)

(1) - Pressure should increase.

2) Disconnect MAP sensor connector. Using DVOM, check continuity between chassis ground and MAP sensor connector terminal No. 3. If continuity does not exist, repair wiring harness as necessary. If continuity exists, go to next step.

3) With MAP sensor connector disconnected, disconnect ECM connector. Ground ECM connector terminal No. 70. Using DVOM, check continuity between chassis ground and MAP sensor connector terminal No. 2. If continuity does not exist, repair wiring harness as necessary. If continuity exists, go to next step.

4) With MAP sensor connector and ECM connector disconnected, turn ignition switch to ON position. Check voltage between chassis ground and MAP sensor connector terminal No. 1. If 4.8-5.2 volts do not exist, replace ECM. If voltage is as specified, condition required to set code is not present at this time. Test is complete. Intermittent problem may exist. See H - TESTS W/O CODES article in this section.

CODE 36: IGNITION TIMING ADJUSTMENT SIGNAL

NOTE: For component terminal identification, see TERMINAL IDENTIFICATION. For wiring diagrams, see L - WIRING DIAGRAMS article in this section.

Turn ignition switch to ON position. Using DVOM, check voltage at ignition timing adjustment terminal (located at firewall) with terminal grounded and ungrounded. With terminal grounded, voltage should be 0-1.0 volt. With terminal ungrounded, voltage should be 4.0-5.5 volts. If voltage is not as specified, repair ignition timing adjustment terminal wiring harness or connector as necessary. If voltage is as specified, replace ECM.

CODE 39: OXYGEN (O2) SENSOR

NOTE: For component terminal identification, see TERMINAL IDENTIFICATION. For wiring diagrams, see L - WIRING DIAGRAMS article in this section.

1) If using scan tester, go to step 3. Disconnect O2 sensor

connector. Install Test Harness (MB998464) between O2 sensor and O2 sensor connector. Using DVOM, check resistance between O2 sensor connector terminals No. 1 and 3. O2 sensor resistance should be 20 ohms at 68°F (20°C). If resistance is not as specified, replace O2 sensor. If resistance is as specified, go to next step.

2) Start and warm engine to operating temperature. Using jumper wires, ground O2 sensor connector terminal No. 3 and apply 12 volts to O2 sensor connector terminal No. 1. Using DVOM, check voltage between O2 sensor connector terminals No. 2 and 4 while repeatedly racing engine. If voltage is not .6-1.0 volt, replace O2 sensor. If voltage is as specified, go to step 5.

3) Start and warm engine to operating temperature. Using scan tester, read O2 sensor voltage. While monitoring scan tester, accelerate to 4000 RPM. Suddenly decelerate. Scan tester should read .2 volt or less. Suddenly accelerate. Scan tester should read .6-1.0 volt. If voltage is not as specified, replace O2 sensor. If voltage is as specified, go to next step.

4) While monitoring scan tester, accelerate to 2000 RPM and decelerate to 700 RPM (idle). Scan tester should switch between .6-1.0 volt and .4 volt or less. If voltage is not as specified, replace O2 sensor. If voltage is as specified, go to next step.

5) With O2 sensor connector disconnected, turn ignition switch to ON position. Using DVOM, check voltage between chassis ground and O2 sensor connector terminal No. 1. If system voltage does not exist, repair wiring harness as necessary. If system voltage exists, go to next step.

6) Using DVOM, check for continuity between O2 sensor connector terminal No. 4 and ECM connector terminal No. 56. If continuity does not exist, repair wiring harness as necessary. If continuity exists, go to next step.

7) With O2 sensor connector disconnected, check for continuity between chassis ground O2 sensor connector terminal No. 2. If continuity does not exist, repair wiring harness as necessary. If continuity exists, condition required to set fault is not present at this time. Test is complete. Intermittent problem may exist. See H - TESTS W/O CODES article in this section.

CODE 41: FUEL INJECTOR

NOTE: For component terminal identification, see TERMINAL IDENTIFICATION. For wiring diagrams, see L - WIRING DIAGRAMS article in this section.

1) Using a stethoscope or long-bladed screwdriver, listen for clicking sound from each injector while engine is running or being cranked. If no sound is heard from injector(s), check injector connections. If connections are not okay, repair connections as necessary. If connections are okay, go to next step.

2) Disconnect injector connector. Using DVOM, check resistance across injector terminals. If resistance is not 13-16 ohms, replace injector. If resistance is as specified, go to next step.

3) Using scan tester, read injector drive time while cranking engine. See INJECTOR CRANKING DRIVE TIME SPECIFICATIONS table. Go to next step.

INJECTOR CRANKING DRIVE TIME SPECIFICATIONS TABLE

Coolant Temperature	Drive Time
32°F (0°C)	
2.4L	17-20 ms
3.0L	14-16 ms
68°F (20°C)	

All Models	38-41 ms
176°F (80°C)	
All Models	9-10 ms

4) Ensure coolant temperature is at 176-205°F (80-95°C), all accessories are off and transaxle is in Neutral position. Using scan tester, read injector drive time under specified engine conditions. See INJECTOR OPERATING DRIVE TIME SPECIFICATIONS table. Go to next step.

INJECTOR OPERATING DRIVE TIME SPECIFICATIONS TABLE

Engine State	Drive Time
750 RPM	
Montero	2.4-3.6
Pickup 2.4L & Ram-50 2.4L	(1)
2000 RPM	
Montero	2.3-3.5
Pickup 3.0L & Ram-50 3.0L	2.6-3.1 ms
All Other Models	2.0-3.3 ms
Suddenly Accelerated	
All Models	(2)
(1) - On 2.4L, drive time is 3.0-4.0 ms. On 3.0L, drive time is 2.7-3.2 ms.	
(2) - Drive time should increase.	

5) Allow engine to idle after warm up. Using scan tester, shut off injectors in sequence. Idle should change when good injectors are shut off. If idle state does not change, check injector connection, spark plug and cable, and cylinder compression. If conditions are not as specified in preceding steps, go to next step.

6) On Pickup 2.4L (4WD) and 3.0L, Ram-50 2.4L (4WD), go to step 8. On all other models, disconnect MPI relay connector and injector connector at faulty injector. Using DVOM, check for continuity between specified MPI relay connector terminal and injector connector terminal. See MPI TO FUEL INJECTOR HARNESS TERMINAL ID table. If continuity does not exist, repair wiring harness as necessary. If continuity exists, go to next step.

MPI TO FUEL INJECTOR HARNESS TERMINAL ID TABLE

Application	MPI Terminal No.	Fuel Injector Terminal No.
All Models	2	1

7) Using a DVOM, check for continuity between injector connector terminal No. 2, and specified ECM connector terminal. See INJECTOR TO ECM CIRCUIT ID table. If continuity does not exist, repair wiring harness as necessary. If continuity exists, condition required to set code is not present at this time. Intermittent problem may exist. See H - TESTS W/O CODES article in this section.

INJECTOR TO ECM CIRCUIT ID TABLE

Application	Injector No.	ECM Terminal No.
Montero	1	51

	2	.....	52
	3	.....	60
	4	.....	61
	5	.....	105
	6	.....	109
All Other Models	1	.....	1
	2	.....	14
	3	.....	2
	4	.....	15

8) Disconnect injector connector at faulty injector. Turn ignition switch to ON position. Using DVOM, check for voltage between chassis ground and injector connector terminal No. 1 (terminal No. 2 on Pickup 3.0L and Ram-50 3.0L). If battery voltage does not exist, repair wiring harness as necessary. If battery voltage exists, go to next step.

9) With injector connector disconnected, disconnect ECM connector. Check for continuity between injector connector terminal No. 2 and ECM connector terminal No. 51 for injector No. 1, No. 52 for injector No. 2, No. 60 for injector No. 3, or No. 61 for injector No. 4 (ECM connector terminal No. 105 for injector No. 5 or terminal No. 109 for injector No. 6 on Pickup 3.0L and Ram-50 3.0L). If continuity does not exist, repair wiring harness as necessary. If continuity exists, condition required to set code is not present at this time. Test is complete. Intermittent problem may exist. See H - TESTS W/O CODES article in this section.

10) Turn ignition switch to ON position. With MPI relay connector connected, check for voltage between chassis ground and MPI relay connector terminals No. 4 and 5. If battery voltage does not exist, check MPI relay. If battery voltage exists: go to step 13.

11) Disconnect MPI relay resistor connector. Turn ignition switch to ON position. Check for voltage between chassis ground and relay resistor connector terminal No. 3. If battery voltage does not exist, repair wiring harness between MPI relay and relay resistor. If battery voltage exists, go to next step.

12) With relay resistor connector disconnected and injector connector connected, check resistance between relay resistor terminals No. 3 and 1 for injector No. 1, No. 3 and 4 for injector No. 2, No. 3 and 5 for injector No. 3, or No. 3 and 6 for injector No. 4. If resistance is not 5.5-6.5 ohms at 68°F (20°C), replace relay resistor. If resistance is as specified, go to next step.

13) Disconnect injector connector at faulty injector. Using DVOM, check voltage between chassis ground and injector connector terminal No. 1. If battery voltage does not exist, repair wiring harness as necessary. If battery voltage exists, go to next step.

14) With injector connector disconnected, disconnect ECM connector. Ground ECM connector terminal No. 51 for injector No.1, No. 52 for injector No. 2, No. 60 for injector No. 3, or No. 61 for injector No. 4. Check for continuity between chassis ground and injector connector terminal No. 1. If continuity does not exist, repair wiring harness as necessary. If continuity exists, condition required to set code is not present at this time. Test is complete. Intermittent problem may exist. See H - TESTS W/O CODES article in this section.

15) Disconnect MPI relay resistor connector. Turn ignition switch to ON position. Using DVOM, check for voltage between chassis ground and resistor connector terminal No. 2. See Fig. 31. If battery voltage does not exist, repair wiring harness as necessary between MPI relay resistor connector and MPI relay. If battery voltage exists, reconnect MPI relay resistor connector. Go to next step.



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Fig. 31: MPI Relay Resistor Terminal ID
Courtesy of Mitsubishi Motor Sales of America

16) If faulty injector is on rear injector bank, go to next step. Disconnect injector connector at faulty front injector. Turn ignition switch to ON position. Using DVOM, check voltage between chassis ground and injector connector terminal No. 1. If battery voltage does not exist, repair wiring harness as necessary between injector connector and MPI relay. If voltage exists, go to step 18.

17) Disconnect rear bank injector connector. Using DVOM, check voltage between chassis ground and injector connector terminal 1. If battery voltage does not exist, repair wiring harness as necessary between injector connector and MPI relay. If voltage exists, go to step 19.

18) With injector connector disconnected, disconnect ECM connector. Ground ECM connector terminal No. 1 for injector No. 1, No. 2 for injector No. 3, or No. 3 for injector No. 3. Using DVOM, check for continuity between chassis ground and injector connector terminal No. 2. If continuity does not exist, repair wiring harness as necessary between appropriate injector connector and ECM connector terminal. If continuity exists, condition required to set code is not present at this time. Test is complete. Intermittent problem may exist. See H - TESTS W/O CODES article in this section.

19) With rear bank injector connector disconnected, disconnect ECM connector. Ground ECM connector terminal No. 14 for injector No. 2, No. 15 for injector No. 4, or No. 16 for injector No. 6. Using DVOM, check for continuity between chassis ground and rear bank injector connector terminal No. 2 for injector No. 2, No. 3 for injector No. 4, or No. 4 for injector No. 6. If continuity does not exist, repair wiring harness between rear bank injector connector and ECM connector. If continuity exists, condition required to set code is not present at this time. Test is complete. Intermittent problem may exist. See H - TESTS W/O CODES article in this section.

CODE 42: FUEL PUMP

NOTE: For component terminal identification, see TERMINAL IDENTIFICATION. For wiring diagrams, see L - WIRING DIAGRAMS article in this section.

1) Turn ignition switch to ON position. Using a scan tester, actuate fuel pump. Crank engine with fuel pump actuated. Operating noise should be heard. Pinch fuel pump return hose and feel for fuel flow pulsations. If operating noise is not heard or fuel flow is not felt, replace fuel pump. If conditions are as specified, go to next

step.

2) Apply 12 volts to fuel pump check terminal. See Fig. 32.
If fuel pump operates, go to step 5. If fuel pump does not operate, go to next step.

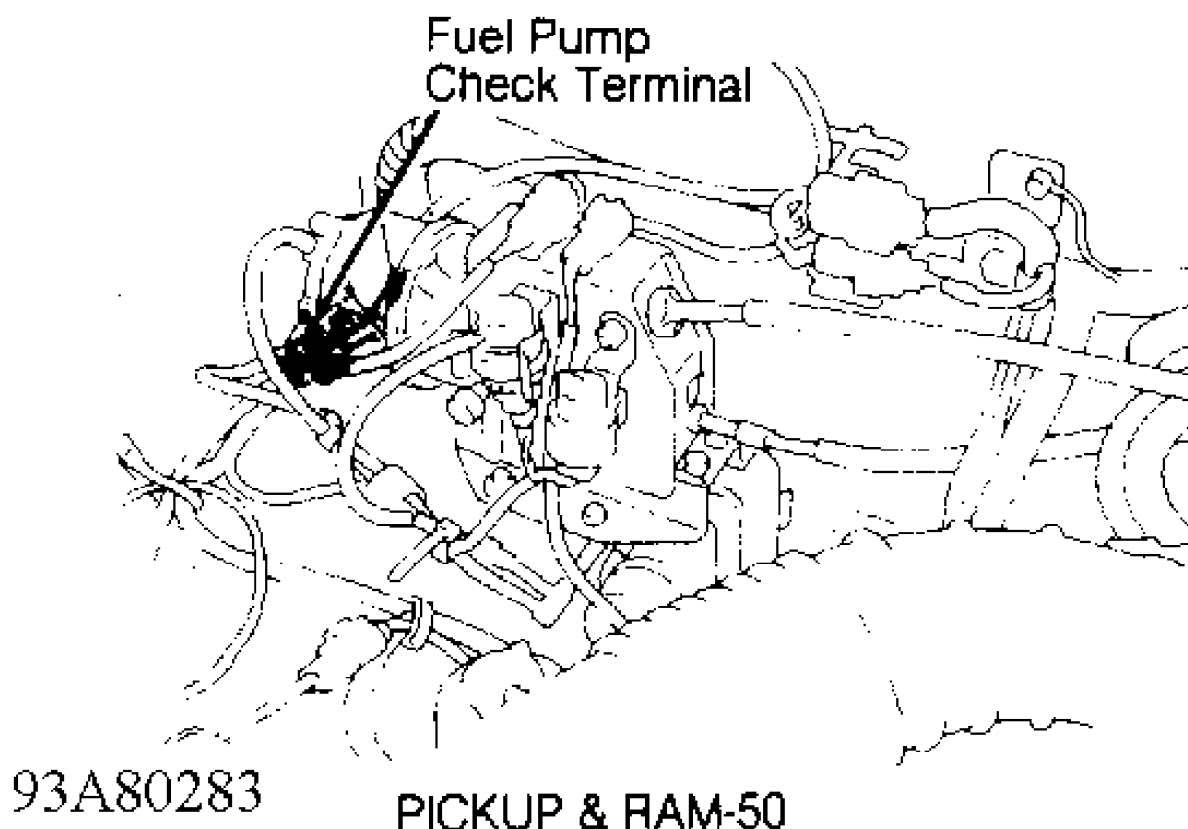


Fig. 32: Locating Fuel Pump Check Terminal (Pickup & Ram-50)
Courtesy of Mitsubishi Motor Sales of America

3) Disconnect fuel pump connector, located at front of fuel tank. Using DVOM, check for continuity between chassis ground and specified fuel pump connector terminal. See FUEL PUMP GROUND CIRCUIT ID table. If continuity does not exist, repair wiring harness as necessary. If continuity exists, go to next step.

FUEL PUMP GROUND CIRCUIT ID TABLE

Application	Terminal No.
All Models	1

4) Ground fuel pump check terminal. With fuel pump connector disconnected, disconnect MPI relay connector. Check for continuity between chassis ground and specified fuel pump connector terminal. See FUEL PUMP DRIVE CIRCUIT ID table. If continuity does not exist, repair wiring harness as necessary. If continuity exists, go to next step.

FUEL PUMP DRIVE CIRCUIT ID TABLE

Application	Terminal No.
All Models	2

5) Disconnect MPI relay connector. Check voltage between chassis ground and specified MPI relay connector terminal. See MPI RELAY VOLTAGE SUPPLY TERMINAL ID table. With ignition switch in OFF position, voltage should be zero. With engine cranking, voltage should be 8.0 volts or more. If voltage is not as specified, repair ignition switch or wiring harness as necessary. If voltage is as specified, go to next step.

MPI RELAY VOLTAGE SUPPLY TERMINAL ID TABLE

Application	Terminal No.
All Models	7

6) Turn ignition to OFF position. With MPI connector disconnected, disconnect ECM connector. Ground specified ECM connector terminal and check continuity between chassis ground and specified MPI relay connector terminal. See ECM TO MPI GROUND CIRCUIT ID table. If continuity does not exist, repair wiring harness as necessary. If continuity exists, go to next step.

ECM TO MPI GROUND CIRCUIT ID TABLE

Application	ECM Terminal No.	MPI Terminal No.
Pickup & Ram-50	56	5

7) On Pickup 4WD and Ram-50 4WD, go to next step. On all other models, with fuel pump connector and MPI relay connector disconnected, ground fuel pump check terminal. Check for continuity between chassis ground and MPI relay connector terminal No. 1. If continuity does not exist, repair wiring harness as necessary. If continuity exists, go to step 9.

8) With ECM connector disconnected and MPI relay connector disconnected, ground fuel pump check terminal. Check resistance between chassis ground and ECM connector terminal No. 109, and between chassis ground and MPI relay connector terminal No. 1. If continuity does not exist, repair wiring harness as necessary. If continuity exists, go to next step.

9) With fuel pump connector and MPI relay connector disconnected, ground MPI relay connector terminal No. 1. Check for continuity between chassis ground and fuel pump connector terminal No. 2. If continuity does not exist, repair wiring harness as necessary. If continuity exists, go to next step.

10) On Pickup RWD, Ram-50 RWD, go to next step. On all other models, with MPI relay connector disconnected, check for continuity between chassis ground and MPI relay connector terminal No. 6. If continuity does not exist, repair wiring harness as necessary. If continuity exists, condition required to set code is not present at this time. Test is complete. Intermittent problem may exist. See H - TESTS W/O CODES article in this section.

11) Reconnect ECM connector and MPI relay connector. While cranking engine, check voltage between chassis ground and MPI

connector terminal No. 1. Voltage should be 8 volts or more. Race engine. Voltage should be 12 volts or more. If voltage is not as specified, replace MPI relay. Repeat step 11. If voltage is still not as specified, replace ECM. If voltage is as specified, condition required to set code is not present at this time. Test is complete. Intermittent problem may exist. See H - TESTS W/O CODES article in this section.

CODE 43: EGR TEMPERATURE SENSOR

NOTE: For component terminal identification, see TERMINAL IDENTIFICATION. For wiring diagrams, see L - WIRING DIAGRAMS article in this section.

1) If using scan tester, go to step 2. Remove EGR temperature sensor from intake manifold. Submerge temperature sensing portion of EGR temperature sensor in hot water. Using DVOM, check resistance across sensor terminals. Resistance should be 60,000-83,000 ohms at 122°F (50°C), 11,000-14,000 at 212°F (100°C). If resistance is not as specified, replace EGR temperature sensor. If resistance is as specified, go to step 3.

2) Warm engine to operating temperature. Allow engine to idle for 2 minutes. Squeeze green-striped hose between EGR valve and EGR solenoid. Using scan tester, read EGR temperature sensor temperature. At 700-750 RPM, scan tester should read 212°F (100°C) or less. At 3500-4000 RPM, scan tester should read 158°F (70°C) or more. On all other models, scan tester should read 248°F (120°C) or more. If reading is not as specified, replace EGR temperature sensor. If reading is as specified, go to next step.

3) Disconnect EGR temperature sensor connector. Using DVOM, check continuity between chassis ground and EGR temperature sensor terminal No. 2, Pickup 3.0L and Ram-50 3.0L (terminal No. 1 on all other models). If continuity does not exist, repair wiring harness as necessary. If continuity exists, go to next step.

4) On Pickup 2.4L (4WD) and 3.0L, Ram-50 2.4L (4WD), go to next step. On all other models, with EGR temperature sensor disconnected, disconnect ECM connector. Check for continuity between EGR temperature sensor connector terminal No. 2 and ECM connector terminal No. 53. If continuity does not exist, repair wiring harness as necessary. If continuity exists, go to next step.

5) On all models, with EGR temperature sensor connector and ECM connector disconnected, turn ignition switch to ON position. Check voltage between chassis ground and EGR connector terminal No. 2 on Pickup 3.0L and Ram-50 3.0L (terminal No. 1 on all other models). Voltage should be 3.3-4.7 volts. If voltage is not as specified on Pickup 2.4L (4WD) and 3.0L, Ram-50 2.4L (4WD), repair wiring harness as necessary. If voltage is not as specified on all other models, replace ECM. If voltage is as specified, condition required to set code is not present at this time. Test is complete. Intermittent problem may exist. See H - TESTS W/O CODES article in this section.

CODE 55: IDLE AIR CONTROL POSITION SENSOR

NOTE: For component terminal identification, see TERMINAL IDENTIFICATION. For wiring diagrams, see L - WIRING DIAGRAMS article in this section.

1) Manufacturer does not provide component testing procedure without using scan tester. Ensure engine coolant temperature is 185-205°F (85-95°C). Place transmission in Park or Neutral. Turn off all accessories except A/C. Ensure A/C clutch is operating when A/C system is on. Allow engine to idle.

2) Using scan tester, read Idle Air Control (IAC) position

sensor step. See IAC POSITION SENSOR STEP SPECIFICATIONS table. If scan tester does not read as specified, replace IAC position sensor. If readings are as specified, go to next step.

IAC POSITION SENSOR STEP SPECIFICATIONS TABLE

A/C Switch Position	Standard Step Value
Off	2-20
On	Increase From 8-50
(1)	Increase From 3-40
(1) - For A/T models. Brakes applied, transmission selector in "D" and A/C on.	

3) Disconnect ECM connector and IAC position sensor connector. Ground specified ECM connector terminal and using DVOM, check continuity between chassis ground and specified IAC connector terminal. See ECM TO IAC HARNESS CIRCUIT ID table. If continuity does not exist, repair wiring harness as necessary. If continuity exists, go to next step.

ECM TO IAC HARNESS CIRCUIT ID TABLE

Application	ECM Terminal No.	IAC Terminal No.
All Models	5	4
	18	2
	61	1

4) With IAC position sensor connector disconnected, check continuity between chassis ground and IAC position sensor connector terminal No. 3. If continuity does not exist, repair wiring harness as necessary. If continuity exists, go to next step.

5) With IAC position sensor connector disconnected and ECM connector connected, turn ignition switch to ON position. Check for voltage between chassis ground and IAC connector terminals No. 2 and 4. If voltage is not 4.8-5.2 volts on either circuit, replace ECM. If voltage is as specified, go to next step.

6) Check voltage between chassis ground and IAC position sensor connector terminal No. 1. If voltage is not 4.8-5.2 volts, replace ECM. If voltage is as specified, condition required to set code is not present at this time. Test is complete. Intermittent problem may exist. See H - TESTS W/O CODES article in this section.

CODE 59: REAR OXYGEN (O2) SENSOR

NOTE: For component terminal identification, see TERMINAL IDENTIFICATION. For wiring diagrams, see L - WIRING DIAGRAMS article in this section.

1) If using scan tester, go to next step. Disconnect O2 sensor connector. Using DVOM, check continuity between O2 sensor terminals. 3 and 4. If continuity does not exist, replace O2 sensor. If continuity exists, go to step 3.

2) With an assistant, road test vehicle. Drive vehicle with wide open throttle in 2nd gear (M/T) or "L" position (A/T). Using scan tester, read O2 sensor voltage. If O2 sensor voltage is not .6-1.0 volt at 3500 RPM, replace O2 sensor. If voltage is as specified, go to

next step.

3) Disconnect O2 sensor connector and MPI relay connector. Using DVOM, check for continuity between O2 sensor connector terminal No. 3 and MPI relay connector No. 2. If continuity does not exist, repair wiring harness as necessary. If continuity exists, go to next step.

4) With O2 sensor connector disconnected, disconnect ECM connector. Check for continuity between O2 sensor connector terminal No. 1 and ECM connector terminal No. 55. If continuity does not exist, repair wiring harness as necessary. If continuity exists, go to next step.

5) With O2 sensor connector disconnected, check for continuity between chassis ground and O2 sensor connector terminals No. 2 and 4. If continuity does not exist on either circuit, repair wiring harness as necessary. If continuity exists and preceding test procedure did not discover any faults, replace O2 sensor.

CODE 61: TRANSAXLE CONTROL MODULE SIGNAL

NOTE: For component terminal identification, see TERMINAL IDENTIFICATION. For wiring diagrams, see L - WIRING DIAGRAMS article in this section.

1) Disconnect Transaxle Control Module (TCM) and ECM connectors. Ground TCM connector terminal No. 7. Using DVOM, check continuity between chassis ground and ECM connector terminal No. 116. If continuity does not exist, repair wiring harness as necessary. If continuity exists, go to next step.

2) Ground TCM connector terminal No. 9. Check continuity between chassis ground and ECM connector terminal No. 59. If continuity does not exist, repair wiring harness as necessary. If continuity exists, go to next step.

3) Ground TCM connector terminal No. 108 to ground. Check continuity between chassis ground and ECM connector terminal No. 7. If continuity does not exist, repair wiring harness as necessary. If continuity exists, test is complete. Intermittent problem may exist. See H - TESTS W/O CODES article in this section.

CODE 62: INDUCTION CONTROL VALVE POSITION SENSOR

NOTE: For component terminal identification, see TERMINAL IDENTIFICATION. For wiring diagrams, see L - WIRING DIAGRAMS article in this section. Induction control valve position sensor is built into induction control motor.

1) Disconnect induction control motor connector and ECM connector. Ground ECM connector terminal No. 61. Using DVOM, check continuity between chassis ground and induction control motor connector terminal No. 1.

2) Ground ECM connector terminal No. 111. Check continuity between chassis ground and induction control motor connector terminal No. 2.

3) Ground ECM connector terminal No. 103. Check continuity between chassis ground and induction control motor connector terminal No. 4.

4) If continuity exists in previous steps, go to next step. If continuity does not exist in previous steps, check for open or short to ground in appropriate circuit between ECM connector and induction control motor.

5) With induction control motor connector disconnected, check continuity between chassis ground and induction control motor connector terminal No. 3. If continuity does not exist, repair wiring harness as necessary. If continuity exists, go to next step.

6) Turn ignition switch to ON position. Ensure control motor connector is disconnected and ECM connector is connected. Using DVOM, check voltage at induction control motor connector terminals No. 2 and 4. If voltage is not 4.8-5.2 volts, repair wiring harness as necessary. If wiring harness is okay, replace ECM. If voltage is as specified, go to next step.

7) Ensure ignition switch is in ON position. Ensure control motor connector is disconnected and ECM connector is connected. Using DVOM, check voltage at induction control motor connector terminal No. 1. If voltage is not 4.8-5.2 volts, repair wiring harness as necessary. If wiring harness is okay, replace ECM. If voltage is as specified, test is complete. Intermittent problem may exist. See appropriate H - TESTS W/O CODES article in this section. If wiring harness, connectors and induction control motor are okay, replace air intake plenum assembly. See appropriate article in ENGINES section.

CODE 71: TRACTION CONTROL VACUUM SOLENOID

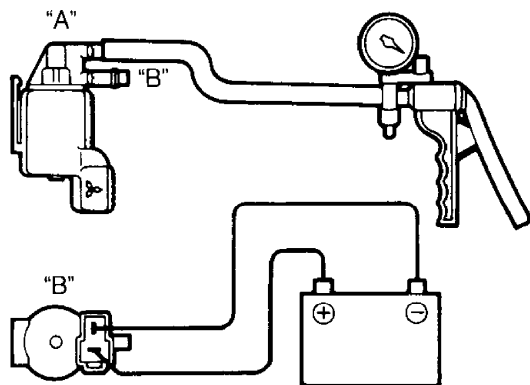
NOTE: For component terminal identification, see TERMINAL IDENTIFICATION. For wiring diagrams, see L - WIRING DIAGRAMS article in this section.

1) Turn ignition switch to ON position. Using a scan tester, actuate vacuum solenoid. With solenoid actuated, operating noise should be heard. If operating noise is not heard, go to next step. If operating noise is heard, go to step 4.

2) Disconnect vacuum solenoid and fuel injection relay connectors. Using DVOM, check for continuity between vacuum solenoid connector terminal No. 1 and fuel injection relay connector terminal No. 5. If continuity does not exist, repair wiring harness between fuel injection relay and vacuum solenoid as necessary. If continuity exists, go to next step.

3) Disconnect ECM connector. Ground ECM connector terminal No. 102. Check continuity between chassis ground and vacuum solenoid connector terminal No. 2. If continuity does not exist, repair wiring harness as necessary. If continuity exists, check solenoid vacuum. Go to next step.

4) Remove vacuum hoses from solenoid. Ensure solenoid harness connector is disconnected. Connect a vacuum pump to solenoid nipple "A". Use jumper wires to connect battery voltage to solenoid terminals. See Fig. 33. With vacuum applied, nipple "B" unplugged, and negative jumper wire disconnected, solenoid should hold vacuum.



93C80285

Fig. 33: Testing Traction Control Vacuum Solenoid
Courtesy of Mitsubishi Motor Sales of America

5) With vacuum applied, nipple "B" unplugged, and negative jumper wire connected, solenoid should not hold vacuum. With vacuum

applied, nipple "B" plugged, and negative jumper wire connected, solenoid should hold vacuum.

6) If solenoid tests as described, check resistance between solenoid terminals. Resistance should be 36-44 ohms at 68°F (20°C). If resistance is not as specified, replace solenoid. If resistance is as specified, inspect throttle valve operation. Clean or repair as necessary.

7) Connect a vacuum pump to 90 degree vacuum nipple on vacuum tank. Apply 19.8" Hg of vacuum to tank and ensure vacuum holds. Connect vacuum pump to straight nipple on vacuum tank. Plug 90 degree nipple. Apply 19.8" Hg of vacuum. Unplug 90 degree nipple and ensure vacuum releases. Replace tank as necessary.

8) Remove Green stripe vacuum hose from vacuum actuator, located near throttle valve. Connect vacuum pump to actuator. With accelerator pedal depressed, apply 7.9" Hg of vacuum to actuator. Ensure actuator rod is pulled upward and vacuum is held. Repair actuator as necessary.

CODE 72: TRACTION CONTROL VENT SOLENOID

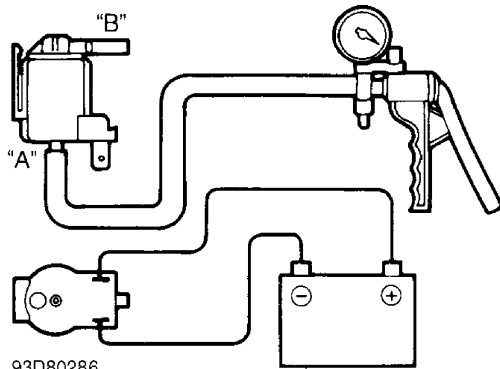
NOTE: For component terminal identification, see TERMINAL IDENTIFICATION. For wiring diagrams, see L - WIRING DIAGRAMS article in this section.

1) Turn ignition switch to ON position. Using a scan tester, actuate ventilation solenoid. With solenoid actuated, operating noise should be heard. If operating noise is not heard, go to next step. If operating noise is heard, go to step 4.

2) Disconnect ventilation solenoid and fuel injection relay connectors. Using DVOM, check for continuity between ventilation solenoid connector terminal No. 1 and fuel injection relay connector terminal No. 5. If continuity does not exist, repair wiring harness as necessary. If continuity exists, go to next step.

3) Disconnect ECM connector. Ground ECM connector terminal No. 105. Check continuity between chassis ground and ventilation solenoid connector terminal No. 2. If continuity does not exist, repair wiring harness as necessary. If continuity exists, check solenoid vacuum. Go to next step.

4) Remove vacuum hoses from solenoid. Ensure solenoid harness connector is disconnected. Connect a vacuum pump to solenoid nipple "A". Use jumper wires to connect battery voltage to solenoid terminals. See Fig. 34. With vacuum applied, nipple "B" unplugged, and negative jumper wire connected, solenoid should hold vacuum.



93D80286

Fig. 34: Testing Traction Control Vent Solenoid
Courtesy of Mitsubishi Motor Sales of America

5) With vacuum applied, nipple "B" unplugged, and negative jumper wire disconnected, solenoid should not hold vacuum. With vacuum

applied, nipple "B" plugged, and negative jumper wire disconnected, solenoid should hold vacuum.

6) If solenoid tests as described, check resistance between solenoid terminals. If resistance is not 36-44 ohms at 68°F (20°C), replace solenoid. If resistance is as specified, go to Code 71: TRACTION CONTROL VACUUM SOLENOID.

SUMMARY

If no hard fault codes (or only pass codes) are present, driveability symptoms exist, or intermittent codes exist, proceed to H - TESTS W/O CODES article in this section for diagnosis by symptom (i. e., ROUGH IDLE, NO START, etc.) or intermittent diagnostic procedures.

H - TESTS W/O CODES

1993 Mitsubishi Montero

1993 ENGINE PERFORMANCE

Chrysler Corp./Mitsubishi Trouble Shooting - No Codes

Dodge; Colt, Colt 200, Ram-50, Stealth
Eagle; Summit, Summit Wagon
Mitsubishi; Diamante, Eclipse, Expo/Expo LRV, Galant,
Mirage, Montero, Pickup, Precis, 3000GT
Plymouth; Colt, Colt 200, Colt Vista

INTRODUCTION

Before diagnosing symptoms or intermittent faults, perform steps in F - BASIC TESTING and G - TESTS W/ CODES in the ENGINE PERFORMANCE section. Use this article to diagnose driveability problems existing when a hard fault code is not present.

NOTE: Some driveability problems may have been corrected by manufacturer with a revised Engine Control Module (ECM). Check with manufacturer for latest ECM.

Symptom checks can direct the 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 a soft (intermittent) trouble code was present, but no problem was found during self-diagnostic testing.

NOTE: For specific testing procedures, see I - SYS/COMP TESTS in the ENGINE PERFORMANCE section. For specifications, see D - ADJUSTMENTS or C - SPECIFICATIONS in the ENGINE PERFORMANCE section.

SYMPTOMS

SYMPTOM DIAGNOSIS

Symptom checks cannot be used unless problem occurs while vehicle is being tested. To reduce diagnostic time, ensure steps in F - BASIC TESTING and G - TESTS W/ CODES in the ENGINE PERFORMANCE section were performed before diagnosing a symptom. Following symptoms are available for diagnosis.

- * Difficult To Start/No Start (Crank OK)
- * 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 speed control servo (if applicable).
- * Check stepper motor (if applicable).
- * Check ignition switch.
- * Check TDC sensor.
- * Check crankshaft position sensor.
- * Check inhibitor switch (A/T).

- * Check airflow sensor.
- * Check coolant temperature sensor.
- * Check idle position switch.
- * Check power supply to ECM ground.
- * Check fuel pressure.
- * Check for disconnected or damaged vacuum hoses.
- * Check for control relay malfunction.
- * Check for MPI system malfunction.
- * Check for fuel pump drive control system malfunction.
- * Check for ignition coil malfunction.
- * Check for ignition timing malfunction.
- * Check for power transistor malfunction.
- * Check for fuel injector malfunction.
- * Check for ECM malfunction.
- * Ensure electrical harness, connectors and wires are not broken or loose.

ROUGH OR UNSTABLE IDLE

- * Check intake air temperature sensor.
- * Check purge control solenoid valve (if applicable).
- * Check vehicle speed sensor.
- * Check engine coolant temperature sensor.
- * Check barometric pressure sensor.
- * Check ignition switch.
- * Check idle position switch.
- * Check throttle position sensor.
- * Check TDC sensor.
- * Check crankshaft position sensor.
- * Check power steering oil pressure switch.
- * Check A/C switch and power relay (if applicable).
- * Check inhibitor switch.
- * Check oxygen sensor.
- * Check airflow sensor.
- * Check motor position sensor (if equipped).
- * Check fuel pressure.
- * Check for disconnected or damaged vacuum hoses.
- * Check MPI system malfunction.
- * Check for stepper motor malfunction (if applicable).
- * Check for fuel injector malfunction.
- * Check for power transistor malfunction.
- * Check for vehicle speed switch malfunction.
- * Check for ECM malfunction.
- * Ensure electrical harness, connectors and wires are not broken or loose.

ENGINE HESITATES OR POOR ACCELERATION

- * Check intake air temperature sensor.
- * Check engine coolant temperature sensor.
- * Check barometric pressure sensor.
- * Check ignition switch.
- * Check ignition coil.
- * Check EGR control solenoid valve (if applicable).
- * Check idle position switch.
- * Check throttle position sensor.
- * Check TDC sensor.
- * Check crankshaft position sensor.
- * Check power steering oil pressure switch.
- * Check A/C switch (if applicable).
- * Check inhibitor switch (A/T).
- * Check oxygen sensor.
- * Check airflow sensor.

- * Check motor position sensor (if applicable).
- * Check fuel pressure.
- * Check for disconnected or damaged vacuum hoses.
- * Check for MPI system malfunction.
- * Check for stepper motor malfunction (if applicable).
- * Check for fuel injector malfunction.
- * Check for power transistor malfunction.
- * Check for A/C power relay control system malfunction.
- * Check for ECM malfunction.
- * Ensure electrical harness, connectors and wires are not broken or loose.

ENGINE SURGES

- * Check coolant temperature sensor.
- * Check idle position switch.
- * Check EGR control solenoid valve (if applicable).
- * Check fuel pressure.
- * Check for fuel injector malfunction.

DETONATION OR KNOCKING

- * Check airflow sensor.
- * Check for cooling system problems.
- * Check fuel quality.
- * Check intake air temperature sensor.
- * Check barometric pressure sensor.
- * Check ignition coil.
- * Check power transistor.
- * Check for EGR system malfunction.

POOR FUEL MILEAGE

- * Check intake air temperature sensor.
- * Check engine coolant temperature sensor.
- * Check barometric pressure sensor.
- * Check ignition switch.
- * Check idle position switch.
- * Check throttle position sensor.
- * Check TDC sensor.
- * Check crankshaft position sensor.
- * Check power steering oil pressure switch.
- * Check A/C switch (if applicable).
- * Check inhibitor switch (A/T).
- * Check oxygen sensor.
- * Check airflow sensor.
- * Check motor position sensor (if applicable).
- * Check fuel pressure.
- * Check for MPI system malfunction.
- * Check for stepper motor malfunction.
- * Check for fuel injector malfunction.
- * Check for power transistor malfunction.

INTERMITTENTS

INTERMITTENT PROBLEM DIAGNOSIS

Intermittent fault testing requires duplicating circuit or component failure to identify problem. These procedures may lead to computer setting a fault code (on some systems) which may help in diagnosis.

If problem vehicle does not produce fault codes, 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. When monitoring voltage, ensure ignition switch is in ON position or engine is running. Ensure ignition switch is in OFF position or negative battery cable is disconnected 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. If engine is running, monitor for self-diagnostic codes. Use test results to identify a faulty component or circuit.

E - THEORY/OPERATION

1993 Mitsubishi Montero

1993 ENE PERFORMANCE

Chrysler Corp./Mitsubishi Theory & Operation

Dodge; Colt, Colt 200, Ram-50, Stealth
Eagle; Summit, Summit Wagon
Mitsubishi; Diamante, Eclipse, Expo, Expo LRV, Galant,
Mirage, Montero, Pickup, Precis, 3000GT
Plymouth; Colt, Colt Vista, Colt 200

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.

1993 TERMINOLOGY

Due to Federal government requirements, manufacturers may use names and acronyms for systems and components different than those used in previous years. The following table will help eliminate confusion when dealing with these components and systems. Only relevant components and systems whose names have changed from previous Chrysler Corp./Mitsubishi terminology have been listed. See REVISED TERMINOLOGY table.

REVISED TERMINOLOGY CHART

1992 & Earlier	1993
CHECK ENGINE Light	Malfunction Indicator Light (MIL)
Crank Angle Sensor	Crankshaft Position Sensor
Engine Control Unit (ECU)	Engine Control Module (ECM)
Idle Speed Control (ISC Or AIS)	Idle Air Control (IAC)
Self-Diagnostic Connector	Data Link Connector (DLC)

AIR INDUCTION SYSTEM

NON-TURBOCHARGED ENGINES

All Chrysler Corp./Mitsubishi engines with Multi-Point Injection (MPI) use same basic air induction system. Remote air filter (with airflow sensor) is ducted to a plenum-mounted throttle body.

TURBOCHARGED ENGINES

In addition to basic air induction system used on all other models, turbocharging system components include turbocharger(s), air-to-air intercooler(s), air by-pass valve(s), wastegate actuator(s), wastegate control solenoid valve(s) and intake duct.

Wastegate Control Solenoid Valve

Engine Control Module (ECM) energizes solenoid valve, controlling leakage rate of turbocharger pressure to wastegate actuator.

COMPUTERIZED ENGINE CONTROLS

Multi-Point Injection (MPI) is a computerized engine control system, which controls fuel injection, ignition timing, idle speed and emission control systems.

ENGINE CONTROL MODULE (ECM)

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, ECM sends signals to various components, which control fuel injection, ignition timing, idle speed and emission control systems. For ECM location, see ECM LOCATION table.

ECM LOCATION TABLE

Application	Location
Chrysler Corp.	Behind Right Side Of Instrument Panel, Next To Blower Motor
Mitsubishi	
Diamante, Expo, Galant, Mirage, Montero & Pickup	Behind Right Side Of Instrument Panel
Eclipse & 3000GT	Behind Radio Console
Precis	Behind Left Side Of Instrument Panel

NOTE: Components are grouped into 2 categories. The first category covers INPUT DEVICES, which control or produce voltage signals monitored by Engine Control Module (ECM). The second category covers OUTPUT SIGNALS, which are components controlled by ECM.

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 in this section. The following are available input devices.

Air Conditioner Switch

When A/C is turned on, signal is sent to ECM. With engine at idle, ECM increases idle speed through Idle Air Control (IAC) motor.

Airflow Sensor

Incorporated in airflow sensor assembly, airflow sensor is a Karmen vortex-type sensor which measures intake airflow rate. Intake air flows through tunnel in airflow sensor assembly. Airflow sensor transmits radio frequency signals across direction of incoming airflow, downstream of vortex. Intake air encounters vortex, causing turbulence in tunnel.

Turbulence disrupts radio frequency, causing variations in transmission. Airflow sensor converts frequency transmitted into a proportionate electrical signal, which is sent to ECM.

Airflow Sensor Assembly

Assembly is mounted inside air cleaner, and incorporates airflow sensor, atmospheric pressure sensor and intake air temperature sensor.

Atmospheric (Barometric) Pressure Sensor

Sensor is incorporated in airflow sensor assembly. Sensor converts atmospheric pressure to electrical signal, which is sent to ECM. ECM adjusts air/fuel ratio and ignition timing according to altitude.

Closed Throttle Position Switch

Closed throttle position switch located in Throttle Position Sensor (TPS), senses whether accelerator pedal is depressed or not. High voltage (open) or low voltage (closed) signal is input to ECM, which then controls IAC motor based on input signal.

Coolant Temperature Sensor

Sensor converts coolant temperature to electrical signal for use by ECM. ECM uses coolant temperature information to control fuel enrichment when engine is cold.

Crankshaft Position & TDC Sensor Assembly

Assembly is located in distributor on SOHC engines. On DOHC engines, which use Direct (or Distributorless) Ignition System (DIS), assembly is a separate unit mounted in place of distributor. Assembly consists of triggering disc (mounted on shaft) and stationary optical sensing unit. Camshaft drives shaft, triggering optical sensing unit. ECM determines crankshaft position and TDC based on signals received from optical sensing unit.

Electrical Load Switch

Electrical load switch inputs on/off state of taillight relay, defogger relay and stoplight relay to ECM. ECM signals IAC to increase or decrease RPM depending on on/off state of relays.

Engine Speed (Tach Signal)

ECM uses ignition coil tach signal to determine engine speed.

Heated Oxygen Sensor (HO2S)

HO2S detects oxygen content in exhaust gas and sends this information to ECM. ECM uses input signals from sensor to vary duration of fuel injection. Oxygen sensor heater stabilizes sensor temperature regardless of exhaust gas temperature to allow for more accurate exhaust oxygen content readings.

Idle Position Switch

On all DOHC engines, idle position switch is a separate switch mounted on throttle body. On all other models, idle position switch is incorporated in IAC motor or throttle position sensor, depending on vehicle application. When throttle valve is closed, switch is activated. When throttle valve is at any other position, switch is deactivated. This input from idle position switch is used by ECM for controlling fuel delivery time during deceleration.

Ignition Timing Adjustment Terminal

Used for adjusting base ignition timing. When terminal is grounded, ECM timing control function is by-passed, allowing base timing to be adjusted.

Inhibitor Switch (Automatic Transmission)

Inhibitor switch senses position of transmission select lever, indicating engine load due to automatic transmission engagement. Based on this signal, ECM commands IAC motor to increase throttle angle, maintaining optimum idle speed.

Intake Air Temperature Sensor

Sensor is incorporated in airflow sensor assembly. This resistor-based sensor measures temperature of incoming air and supplies air density information to ECM.

Knock Sensor (Turbo)

Sensor is located in cylinder block and senses engine vibration during detonation (knock). Sensor converts vibration into electrical signal. ECM retards ignition timing based on this signal.

Motor Position Sensor (MPS)

Sensor is incorporated in IAC motor (or separate unit on some models). MPS senses IAC motor plunger position and sends electrical signal to ECM.

Oxygen (O2) Sensor

O2 sensor is located in exhaust system and generates an output voltage. Output voltage varies with oxygen content of exhaust gas stream. ECM adjusts air/fuel mixture based on signals from O2 sensor.

Power Steering Oil Pressure Switch

Switch detects increase in power steering oil pressure. When power steering oil pressure increases, switch contacts close, signaling ECM. ECM commands IAC motor, raising idle speed to compensate for drop in engine RPM due to power steering load.

TDC Sensor

See CRANKSHAFT POSITION & TDC SENSOR ASSEMBLY under INPUT DEVICES.

Throttle Position Sensor (TPS)

TPS is a variable resistor mounted on throttle body. ECM uses voltage signal from TPS to determine throttle plate angle.

Vehicle Speed Sensor

Sensor is located in speedometer in instrument cluster, and uses a reed switch to sense speedometer gear revolutions. ECM uses gear revolutions to determine vehicle speed.

OUTPUT SIGNALS

NOTE: Vehicles are equipped with various combinations of computer-controlled components. Not all components listed below are used on every vehicle. For theory and operation on each output component, refer to system indicated after component.

Accelerator Pedal Position Sensor (APPS)

See MISCELLANEOUS CONTROLS.

Data Link Connector

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 Speed Control Servo
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.

Variable Induction Control (VIC) Motor Sensor
See MISCELLANEOUS CONTROLS.

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 Multi-Point Injection (MPI) 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, ECM applies voltage to fuel pressure control solenoid valve for 2 minutes after engine restart. 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). ECM controls amount of fuel metered through injectors based on information received from sensors.

IDLE SPEED

Air Conditioner Relay

When A/C is turned on with engine at idle, ECM signals IAC motor to increase idle speed. To prevent A/C compressor from switching on before idle speed has increased, ECM momentarily opens A/C relay circuit.

Idle Air Control (IAC) Motor

Motor controls pintle-type air valve (DOHC engines) or throttle plate angle (SOHC engines) to regulate volume of intake air at idle.

During start mode, ECM controls idle intake air volume according to coolant temperature 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 coolant temperature input.

ECM 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.

Fast Idle Air Control Valve

Some models use a coolant temperature-sensitive fast idle air control valve, located on throttle body, to admit additional intake air volume during engine warm-up. Control valve closes as temperature increases, restricting by-pass airflow rate. At engine warm-up, valve closes completely.

IGNITION SYSTEMS

DIRECT IGNITION SYSTEM (DOHC ENGINES)

Depending on number of cylinders, ignition system is a 2 or 3-coil distributorless ignition system. Crankshaft position and TDC sensor assembly, mounted in place of distributor, are optically controlled.

Power Transistors & Ignition Coils

Based on crankshaft position and TDC sensor inputs, ECM 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.

ELECTRONIC IGNITION SYSTEM (SOHC ENGINES)

Breakerless electronic ignition system uses a disc and optical sensing unit to trigger power transistor.

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. ECM 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 ECM. ECM adjusts timing based on various conditions such as engine temperature, altitude and detonation (turbo).

EMISSION SYSTEMS

EXHAUST GAS RECIRCULATION (EGR) CONTROL

Federal (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 thermovalve 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 & Turbo

ECM controls EGR operation by activating EGR control solenoid valve according to engine load. When engine is cold, ECM signals EGR control solenoid valve to deactivate EGR.

California models are equipped with an EGR temperature sensor. When EGR malfunction occurs, EGR temperature decreases and ECM illuminates MIL (CHECK ENGINE light).

EGR Control Solenoid Valve

Valve denies or allows vacuum supply to EGR valve based on ECM commands.

Thermovalve

Thermovalve denies or allows vacuum supply to EGR valve based on coolant temperature.

EVAPORATIVE CONTROL

Fuel evaporation system prevents fuel vapor from entering atmosphere. System consists of the following: 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, ECM energizes purge control solenoid valve, allowing vacuum to purge valve.

Canister vapors are then drawn through purge 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.

HIGH ALTITUDE CONTROL (HAC)

HAC system compensates for variations in altitude. When

atmospheric (barometric) pressure sensor determines vehicle is at altitude greater than preset value, ECM compensates by adjusting air/fuel mixture and ignition timing. If HAC system is inoperative, there will be an increase in 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.

MISCELLANEOUS CONTROLS

NOTE: Although not considered true engine performance-related systems, some controlled devices may affect driveability if they malfunction.

ACCELERATOR PEDAL POSITION SENSOR (APPS)

ECM supplies one end of APPS resistor with a 5-volt signal. The other end of resistor is grounded at ECM. Accelerator pedal position sensor converts amount accelerator pedal is depressed into variable voltage input to traction control module for traction control.

VARIABLE INDUCTION CONTROL (VIC) MOTOR SENSOR

ECM controls VIC valve opening or closing. VIC valve controls length of intake air path to intake manifold. VIC valve closes at higher RPM to shorten intake air path and opens at lower RPM to lengthen intake air path. The result is more engine torque in a wider RPM range.

SELF-DIAGNOSTIC SYSTEM

NOTE: ECM 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 ECM is disconnected.

Self-diagnostic system monitors input and output signals through the data link connector. On all models, codes can be read using analog voltmeter. Scan tester can be used to read codes on some models. For additional information, see G - TESTS W/ CODES article in this section.

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, ECM 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 ECM detects malfunction during system operation.

TRANSFER CASE

1993 Mitsubishi Montero

1991-94 TRANSFER CASES
Mitsubishi

Dodge; Ram-50
Mitsubishi; Pickup, Montero

APPLICATION

TRANSFER CASE APPLICATIONS TABLE

Application	(1) Transmission Model
Dodge	
1991-93 Ram-50 (2.4L)	V5M21-1
1991-93 Ram-50 (3.0L M/T)	V5MT1-2
1991-93 Ram-50 (3.0L A/T)	V4AC1-2
Mitsubishi	
1991-92 Pickup	V5MT1-2
1991 Montero (M/T)	V5MT1-2
1991 Montero (A/T)	V4AW2-2
1992 Montero (M/T)	(2) V5MT1-3
1992 Montero (A/T)	(2) V4AW2-3
1993-94 Montero (M/T)	(2) V5MT1-2
1993-94 Montero (A/T)	(2) R4AC1

(1) - Transfer case is indicated by a -2 or -3 following the transmission model number.

(2) - Transfer cases for Montero are identical for automatic and manual transmission models.

DESCRIPTION

Transfer case is a part-time, 2-speed unit with a 3-piece aluminum case. Transfer case has a floor-mounted shifter and integral speedometer gear. In Montero a Viscous Coupling Unit (VCU) and center differential allows 2WD-to-4WD shifting at speeds under 62 MPH and full-time 4WD operation.

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 the COMPUTER RELEARN PROCEDURES article in the GENERAL INFORMATION section.

TESTING

4WD INDICATOR CONTROL UNIT (MONTERO)

The 4WD indicator control unit is located behind radio or CD player. Remove 4WD indicator control unit and disconnect harness. Backprobe harness connector and measure voltage between terminal No. 8 (ground) and each respective terminal. Compare test results with chart. See Fig. 1.

DETECTION SWITCH

NOTE: With switch removed, check continuity between switch connector terminal and switch body. With switch installed, check continuity between switch connector terminal and transfer case.

4WD Indicator Light Switch (RAM-50)

With switch removed, check continuity between connector terminal and switch body. With switch end pressed, there should be no continuity. With switch end released, there should be continuity.

Center Differential Lock Operation Detection Switch (Montero)

Check continuity between terminals at Brown wire connector terminal on top of transfer case. With transfer control lever in "4H" position, there should be no continuity. With transfer control lever in "4HLc" position, there should be continuity. See Fig. 2.

4WD Operation Detection Switch (Montero)

Check continuity between terminals at Black wire connector terminal on top of transfer case. With transfer control lever in "2H" position, there should be no continuity. With transfer control lever in "4H" position, there should be continuity. See Fig. 2.

Center Differential Lock Detection Switch (Montero)

Check continuity between terminals at Brown wire connector terminal on side of transfer case. With transfer control lever in "4H" position, there should be no continuity. With transfer control lever in "4HLc" position, there should be continuity. See Fig. 2.

2WD-4WD Detection Switch (Montero)

Check continuity between terminals at Black wire connector terminal on side of transfer case. With transfer control lever in "4H" position, there should be no continuity. With transfer control lever in "2H" position, there should be continuity. See Fig. 2.

HI/LO Detection Switch (Montero)

Check continuity between terminals at White wire connector terminal on side of transfer case. With transfer control lever in "N" (between "4HLc" and "4LLc") position, there should be no continuity. With transfer control lever in "4HLc" position, there should be continuity. With transfer control lever in "4LLc" position, there should be continuity. See Fig. 2.



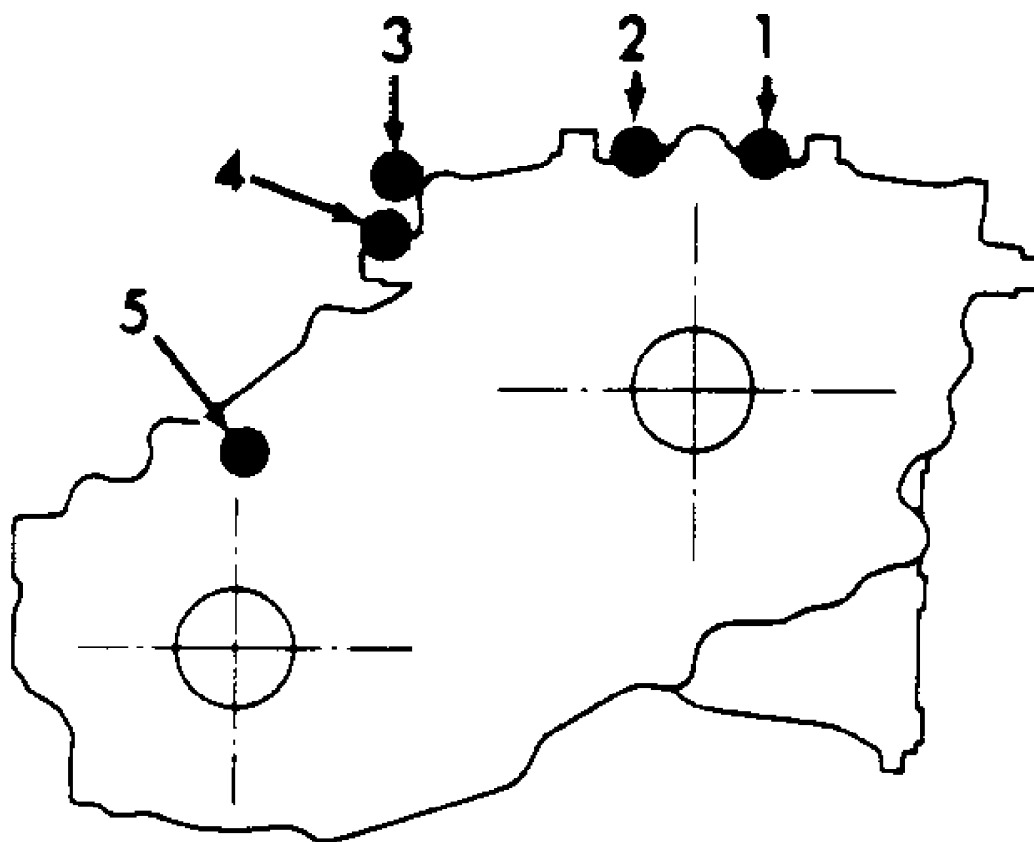
CONTROL UNIT SIDE

NOTE: Battery positive voltage marked with (*) is 1-2 volts lower than actual battery positive voltage.

Terminal No.	Inspection item		Inspection condition			Terminal voltage
3	Ignition switch (IG2)		Ignition switch (IG2)		OFF	0 V
					ON	Battery positive voltage
4	Combination meter (4WD indicator lamp)	Center differential lock indicator lamp	Ignition switch: ON	Transfer lever position	4H	Battery positive voltage
					4HLc	Less than 1.5V
10		Front wheel lamp	Ignition switch: ON		In 2WD	0 V
					In 4WD	Battery positive voltage*
9		Rear wheel lamp	Ignition switch: ON	Transfer lever position	N	0 V
					4HLc, 4LLc	Battery positive voltage*
6	Free-wheel engage switch		Ignition switch: ON		In 2WD	Battery positive voltage*
					In 4WD	0 V
1	HI/LOW detection switch		Ignition switch: ON	Transfer lever position	N	Battery positive voltage*
					4HLc, 4LLc	0 V
2	4WD operation detection switch		Ignition switch: ON	Transfer lever position	2H	Battery positive voltage*
					4H	0 V
5	Center differential lock detection switch		Ignition switch: ON	Transfer lever position	4H	Battery positive voltage*
					4HLc	0 V
7	Center differential lock operation detection switch		Ignition switch: ON	Transfer lever position	4H	Battery positive voltage*
					4HLc	0 V

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Fig. 1: 4WD Indicator Control Unit Testing (Montero)
Courtesy of Mitsubishi Motor Sales of America.



1. Center Differential Lock Operation Detection Switch.
2. 4WD Operation Detection Switch.
3. Center Differential Lock Detection Switch.
4. 2WD-4WD Detection Switch.
5. HI/LO Detection Switch.

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Fig. 2: Detection Switch Testing Locations (Montero)
 Courtesy of Mitsubishi Motor Sales of America.

REMOVAL & INSTALLATION

Removal

1) Remove negative battery cable. Remove transfer case skid plate (if equipped). Scribe alignment marks and remove both drive shafts. Drain oil from transfer case. Disconnect wiring harness from back-up light switch, all 4WD switches and any other electrical connectors (if equipped).

2) Disconnect speedometer cable from drive. Unclip cable from case. Place transfer case shifter in "2H" position and transmission in Neutral. Remove 6 bolts holding control lever assembly. Remove control lever assembly and gasket.

3) Remove select plunger bore plug at right side of case. Remove select spring and plunger. Remove change shifter spring pin. Remove change shifter. Remove transfer case mount. Remove 4 bolts and 2 nuts holding transfer case to adapter. Remove transfer case from vehicle.

Installation

1) Position transmission shifter in Neutral and transfer case lever in "2H" position. Install neutral return plungers and springs in holes on top of adapter. Tighten plug until it is flush with adapter surface. Cover plug threads with sealant.

2) Coat inside of change shifter with grease. Ensure change shifter pin protrudes 1/8" above change shifter when installed. Mount detent plunger spring and install plug (if equipped). To complete installation, reverse removal procedure. Fill transfer case with API GL-4 or higher 75W-90 or 75W-85W gear oil.

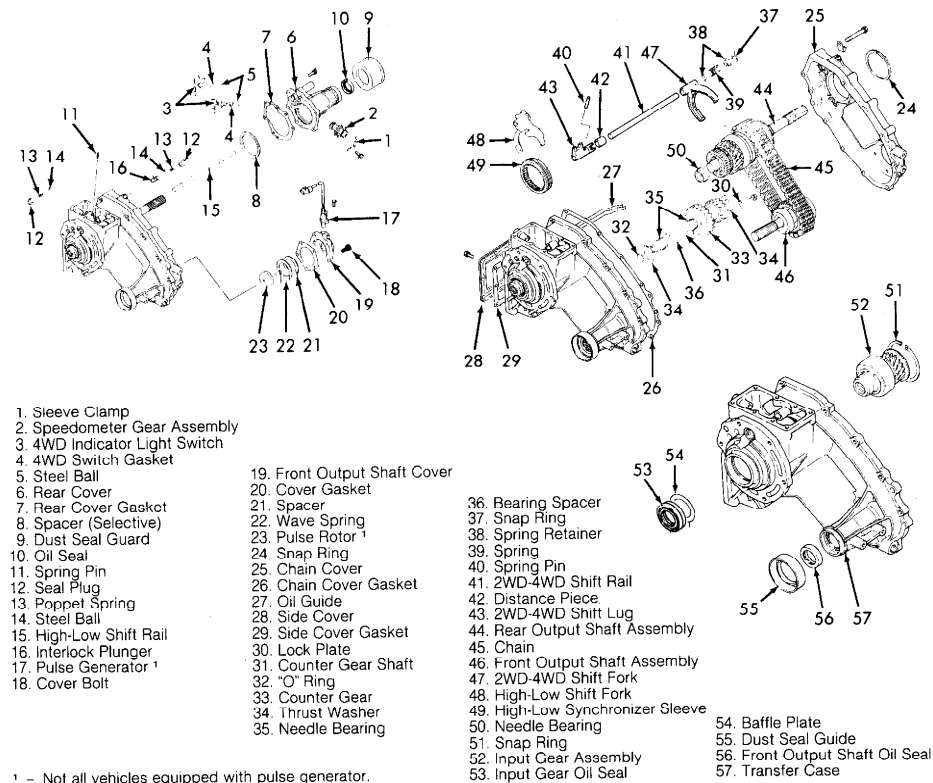
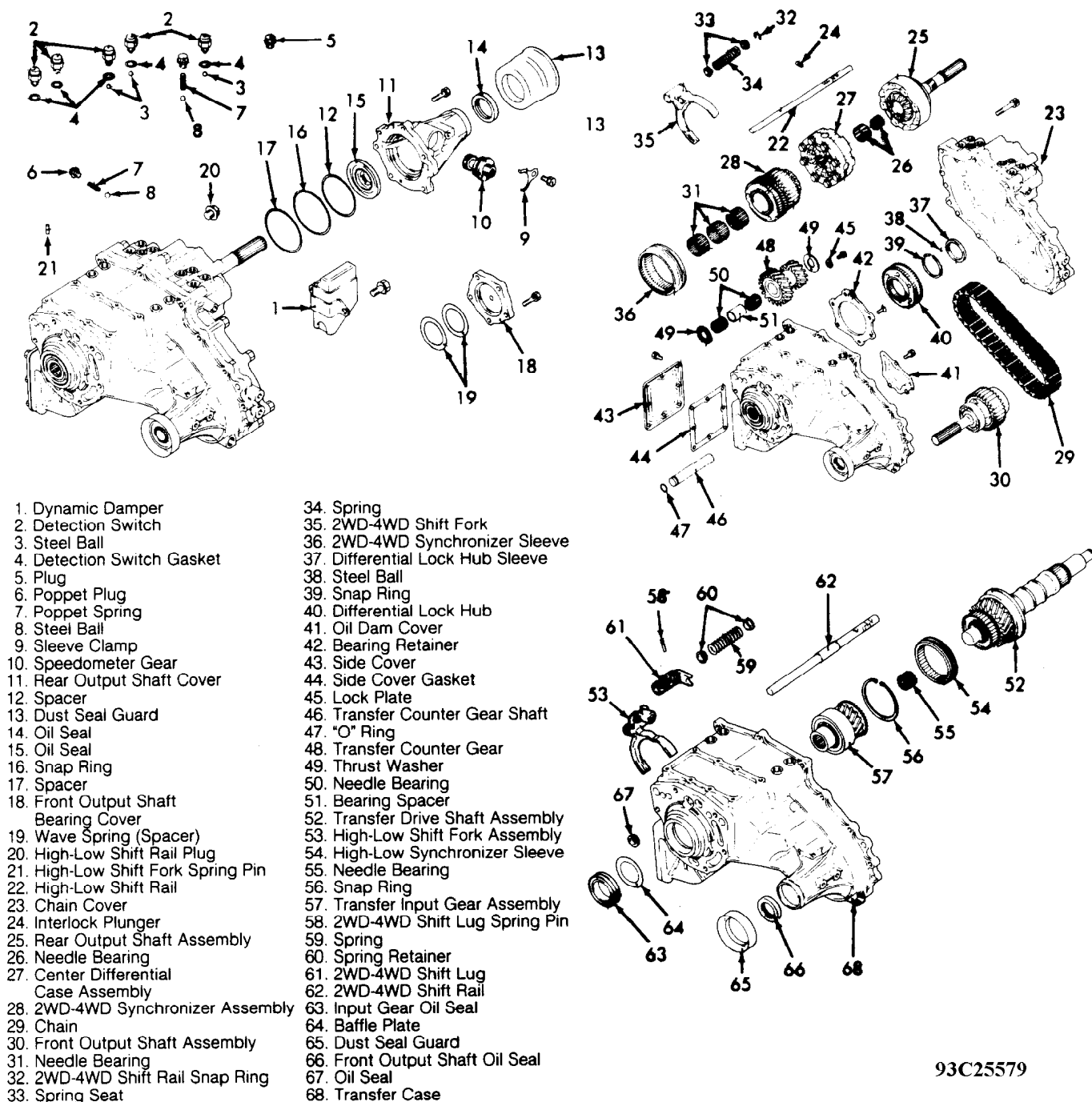


Fig. 3: Exploded View Of Transfer Case (Ram-50)
Courtesy of Mitsubishi Motor Sales of America.



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Fig. 4: Exploded View Of Transfer Case (Montero)
 Courtesy of Mitsubishi Motor Sales of America.

TRANSFER CASE DISASSEMBLY

Disassembly (Ram-50)

1) Remove both 4WD indicator switches and steel balls. Remove speedometer gear assembly. Remove output shaft cover, gasket, wave spring and spacer. See Fig. 3. Remove rear cover, rear cover gasket and spacer from chain cover. Drive roll pin out of high-low shift fork.

2) Remove 2 seal plugs. Remove 2 poppet springs and steel balls. Shift transfer case to "4WD" and pull high-low shift rail out, in rear cover direction. Remove interlock plunger. Remove pulse generator (if equipped), front output shaft cover and pulse rotor (if equipped). Remove snap ring from rear bearing on output shaft. Remove chain cover, oil guide and side cover. Remove countershaft locking plate. Remove countershaft.

3) Remove countergear, 2 thrust washers, 2 needle bearings and spacer through side cover opening. Remove snap ring, spring retainers and spring from 2WD-4WD shift rail. Remove front output shaft, rear output shaft and chain as assembly.

4) Remove 2WD-4WD shift fork and distance piece. Drive out 2WD-4WD shift rail spring pin. Remove 2WD-4WD shift rail and lug. Remove high-low shift fork and high-low synchronizer sleeve. Remove needle bearing and snap ring from input gear. Remove input gear assembly.

5) If either control shaft or input gear oil seals are to be replaced, drive out roll pin from transmission control change shifter. Separate transfer case from adapter. See Fig. 3.

Disassembly (Montero)

1) Remove dynamic damper, 5 detection switches and 3 steel balls. Remove poppet plug, spring and steel ball. Remove speedometer gear assembly. Remove output shaft rear cover, spacers, dust seal guard and oil seals. Front output shaft cover, wave spring and spacer (if equipped).

2) Remove high-low shift rail plug and high-low shift fork spring pin. Shift transfer case to "4WD". Remove rear cover and high-low shift rail. Remove interlock plunger. Remove rear output shaft (viscous coupling) assembly and center differential assembly. Remove 2WD-4WD synchronizer assembly, chain and front output shaft from transmission as a unit. With White paint make match marks in grooves of 2WD-4WD synchronizer in 3 places. With White paint make match marks on spline projections of 2WD-4WD synchronizer sleeve in 3 places. Refer to match marks during reassembly.

3) Remove snap ring, spring seat, spring, 2WD-4WD shift fork and 2WD-4WD synchronizer sleeve. Remove differential lock hub, oil dam cover and bearing retainer. Remove side cover and gasket. Remove transfer counter gear shaft, transfer counter gear, thrust washer, needle bearings and spacer. Remove transfer drive shaft assembly. Remove high-low shift fork assembly and clutch sleeve. Remove transfer input gear assembly.

4) Remove 2WD-4WD shift lug spring pin, spring, spring retainer 2WD-4WD shift lug and shift rail. Remove input gear oil seal, baffle plate, dust seal guard and front output shaft oil seal. See Fig. 4.

COMPONENT DISASSEMBLY & REASSEMBLY

OUTPUT SHAFT ASSEMBLY (MONTERO)

Disassembly & Reassembly (Rear Shaft)

Remove snap ring and press ball bearing off without putting pressure on viscous coupling. Remove viscous coupling. To install, reverse removal procedure. When installing new snap ring, select thickest ring that will fit into groove. Acceptable clearance is 0-.003" (0-.08 mm).

Disassembly & Reassembly (Front Shaft)

Remove front bearing. Remove rear bearing. To install reverse removal procedure.

OUTPUT SHAFT ASSEMBLY (RAM-50)

Disassembly

1) Remove snap ring from rear of output shaft. Remove high-low synchronizer hub by hand or when low speed gear is pressed off. Remove bearing spacer and needle bearing. Remove staking from lock nut on rear output shaft. See Fig. 5. Remove lock nut. Remove ball bearing from below lock nut. Remove sprocket spacer and steel ball.

2) Remove drive sprocket, 2 needle bearings, sprocket sleeve and steel ball. Remove 2WD-4WD synchronizer sleeve, hub, stopper plate and ball bearing.

Reassembly

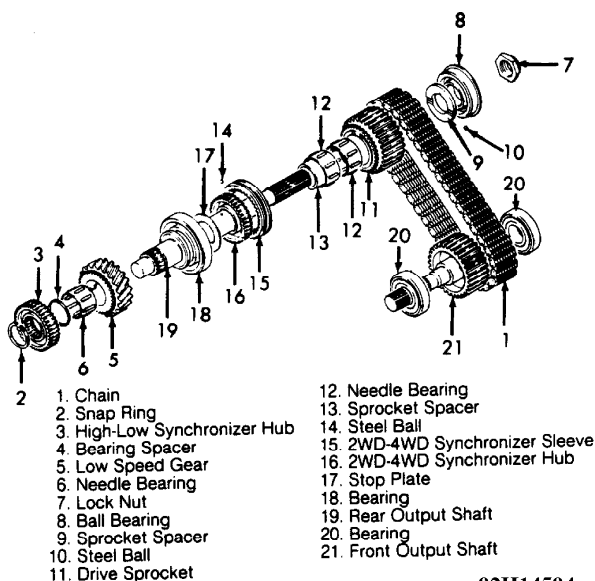
1) Press ball bearing and stopper plate on front output shaft, pushing against inner race. After fitting, ensure bearing rotates smoothly. Install 2WD-4WD synchronizer hub and sleeve. Ensure hub and sleeve face correct direction. Install steel ball (for sprocket sleeve positioning) on rear output shaft. Install sprocket sleeve.

2) Install 2 needle bearings on outer circumference of sprocket sleeve. Install drive sprocket. Install steel ball and sprocket spacer. Install ball bearing (press may not be needed as bearing may be loose). Check for smooth rotation.

3) Tighten sprocket retaining lock nut to specification. See the TORQUE SPECIFICATIONS table. Stake lock nut with punch. After lock nut is tightened, ensure drive sprocket rotates smoothly. Install needle bearing, thrust washer and low speed gear on rear of rear output shaft.

4) Install needle bearing, thrust washer and low speed gear on rear output shaft. Mount high-low synchronizer hub. Ensure hub faces correct direction.

5) Mount high-low synchronizer hub snap ring on front end of rear output shaft. Selective fit snap rings are available in 5 thicknesses. Use thickest snap ring that will fit into output shaft groove. Acceptable clearance is 0-.003" (0-.08 mm). See Fig. 5.



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Fig. 5: Exploded View Of Output Shaft Assembly (Ram-50)
Courtesy of Mitsubishi Motor Sales of America.

TRANSFER DRIVE SHAFT (MONTERO)

Disassembly & Reassembly

Remove snap ring, high-low synchronizer hub and low speed gear. Remove bearing spacer, needle bearing and ball bearing. To assemble, reverse disassembly procedure. Use thickest snap ring that will fit into output shaft groove. Acceptable clearance is 0-.003" (0-.08 mm). See Fig. 4.

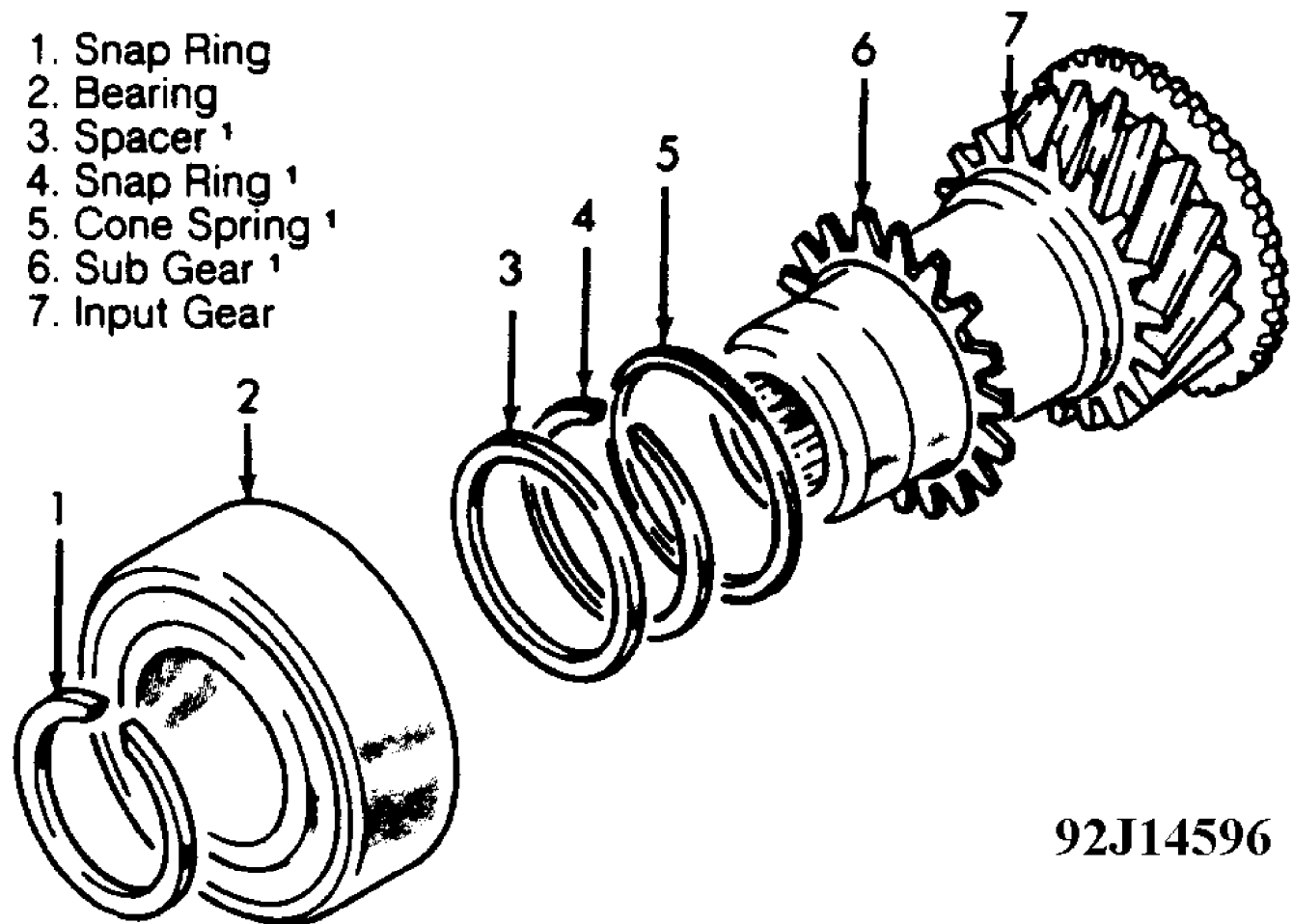
INPUT SHAFT ASSEMBLY (RAM-50)

Disassembly & Reassembly

1) Remove snap ring from input shaft. Support bearing in press. Press input shaft out to remove bearing.

2) On manual transmission models, remove spacer and snap ring from below bearing. Remove cone spring and sub gear. See Fig. 6. For reassembly, reverse disassembly procedures.

3) Press bearing into input shaft, pushing against inner race. After fitting, ensure bearing rotates smoothly. Fit snap ring over front end of input shaft. Snap rings are available in selective thicknesses. Select thickest snap ring that will fit in groove.



1 - Transfer cases used with manual transmission only.

Fig. 6: Exploded View Of Input Shaft Assembly (Ram-50 - Manual Shown, Automatic Similar)

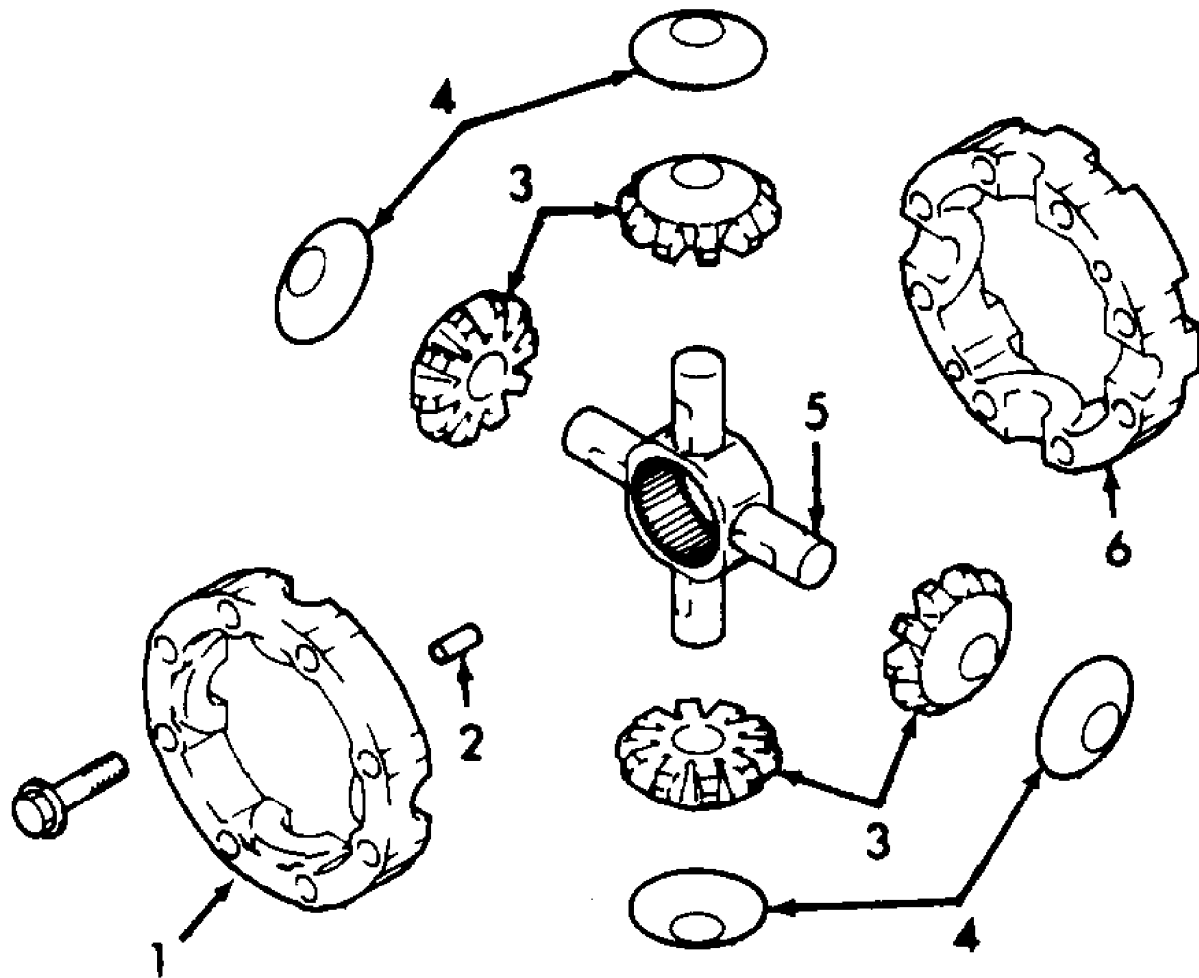
Courtesy of Mitsubishi Motor Sales of America.

CENTER DIFFERENTIAL CASE (MONTERO)

Disassembly & Reassembly

Separate center differential case front from rear case.

Remove pinion shaft, pinions, thrust washers and dowel pins. Inspect for excessive wear and replace parts as needed. Align dowel pins and match marks on outer case circumferences. Assemble front and rear center differential cases. See the TORQUE SPECIFICATIONS table. Also, see Fig. 7.



1. Center Differential Case Front
2. Dowel Pin
3. Pinion
4. Thrust Washer
5. Pinion Shaft
6. Center Differential Case Rear

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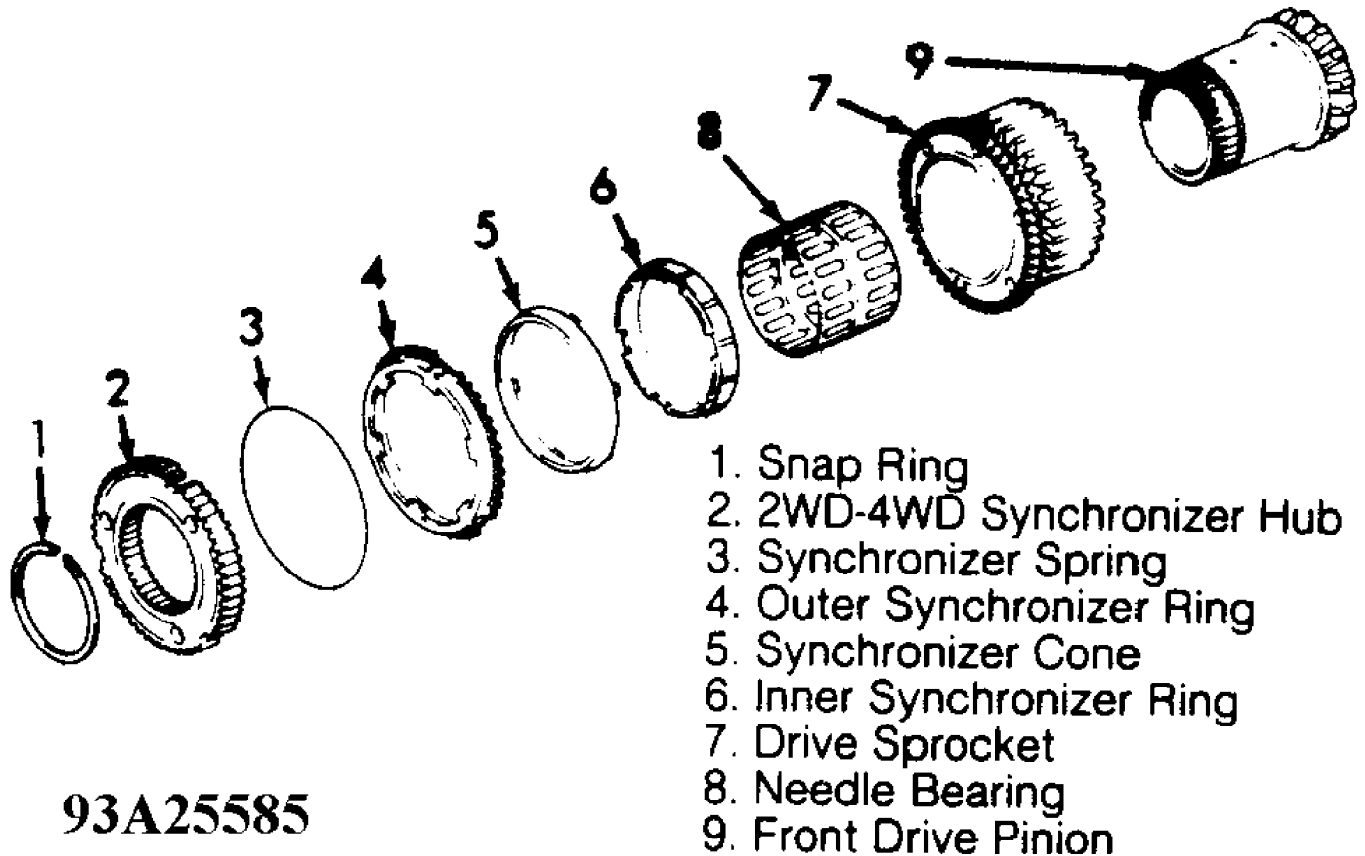
Fig. 7: Exploded View Of Center Differential (Montero)
Courtesy of Mitsubishi Motor Sales of America.

Disassembly

Remove snap ring, 2WD-4WD synchronizer hub and synchronizer spring. Remove outer synchronizer ring, synchronizer cone and inner synchronizer ring. Remove drive sprocket and needle bearing from front drive pinion. Inspect inner and outer synchronizer rings and cone for excessive wear. Install inner and outer synchronizer rings and cone onto drive sprocket. Measure distance between drive sprocket and outer synchronizer. If distance is less than .0118" (.300 mm) replace synchronizer parts as a set.

Reassembly

Install drive sprocket and needle bearing onto front drive pinion. Apply transfer case gear oil to contacting surfaces of inner and outer synchronizer rings and synchronizer cone. Install inner and outer synchronizer rings and synchronizer cone. Install synchronizer spring, 2WD-4WD synchronizer hub and snap ring to complete assembly. When installing new snap ring, select thickest ring that will fit into groove. Acceptable snap ring clearance is 0-.003" (0-.080 mm).



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Fig. 8: Exploded View Of 2WD-4WD Synchronizer (Montero)
Courtesy of Mitsubishi Motor Sales of America.

TRANSFER CASE REASSEMBLY

NOTE: ALWAYS replace all gaskets, oil seals, snap rings and spring pins with new parts. Coat both sides of gaskets and bolt threads with sealant. Lubricate all sliding and rotating parts with transfer case gear oil before assembling.

Reassembly (Ram-50)

1) Install input gear and front output shaft oil seals into transfer case housing. Pack grease between lips of seals and press seal circumference uniformly.

2) Install input gear assembly in transfer case. See Figs. 3 and 6. Input gear assembly snap ring is available in selective thicknesses. Use thickest snap ring that will fit into input shaft groove. Allowed snap ring clearance is 0-.0024" (0-.060 mm).

3) Insert needle bearing onto rear output shaft assembly. Install high-low synchronizer sleeve and shift fork. Install 2WD-4WD shift fork. Engage chain securely on front and rear output shaft sprockets. Assemble 2WD-4WD synchronizer sleeve with 2WD-4WD shift fork. Install assembly over 2WD-4WD shift rail. Install front and rear output shafts with chain as an assembly.

4) Install 2WD-4WD shift lug, distance piece, 2WD-4WD shift rail and spring pin. Ensure slit in spring pin is in line with 2WD-4WD shift rail. Install 2 spring retainers with spring on 2WD-4WD shift rail. Install snap ring to end of 2WD-4WD shift rail. See Fig. 3.

5) Insert 2 needle bearings and spacer into countergear. Install one thrust washer at each end of countergear. Ensure tab on thrust washers fits into groove of transfer case. Install countergear shaft assembly with "O" ring.

6) Install side cover and gasket. Install oil guide. Apply sealant to both sides of gasket and install gasket and chain cover. Ensure oil guide end fits into chain cover opening. Fit snap ring into groove of rear bearing on rear output shaft. Tighten bolts to specification. See TORQUE SPECIFICATIONS.

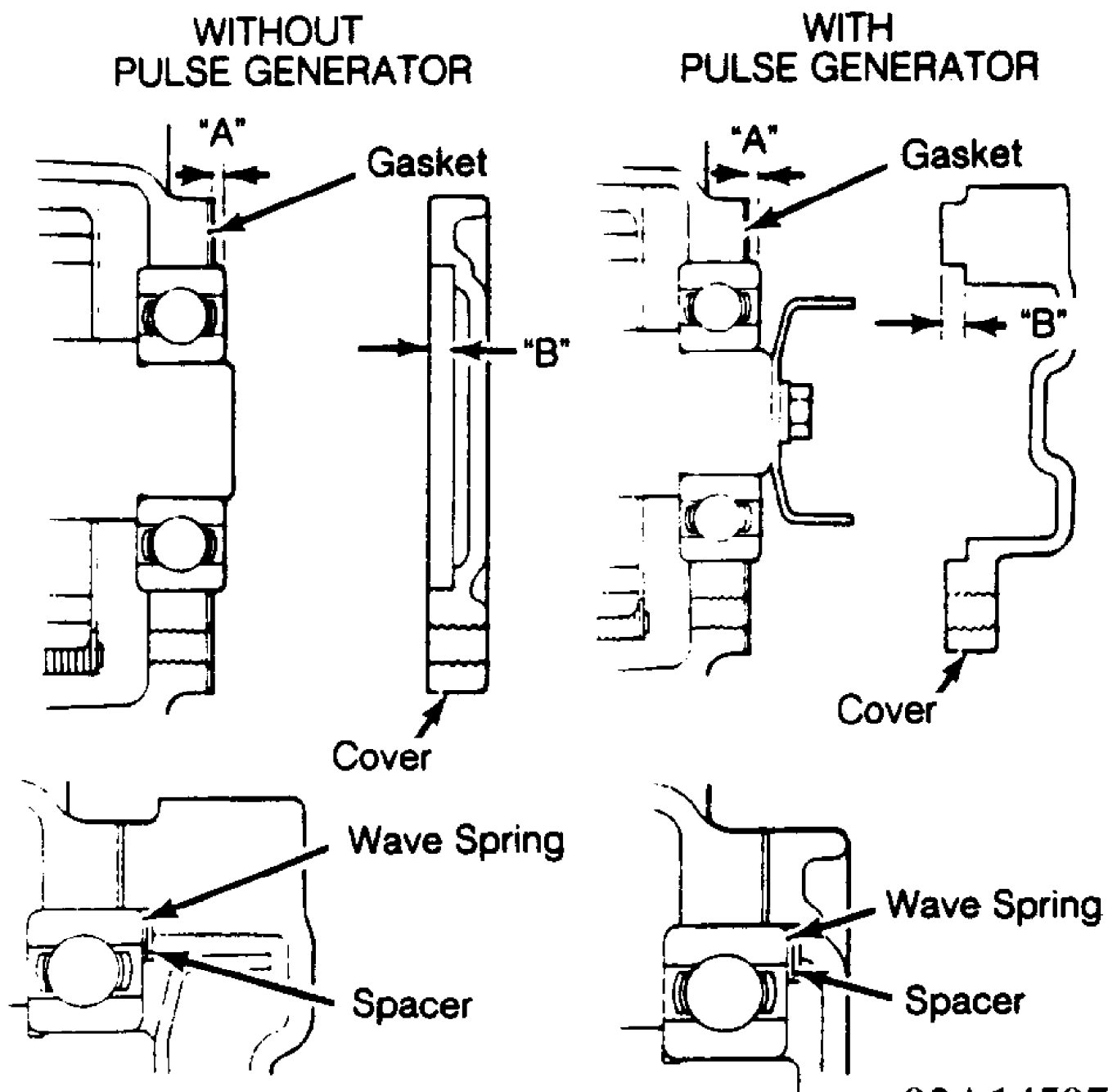
7) Install interlock plunger. Shift 2WD-4WD shift rail to 4WD position. Install high-low shift rail through high-low shift fork in case. Install 2 poppet balls and springs. Install seal plugs. When installing poppet springs, smaller end must be toward ball.

8) On models with pulse generator, install pulse rotor, wave spring and spacer. Measure protrusion "A" of front output shaft rear bearing and recess "B" of cover and calculate clearance. See Fig. 9. If clearance is greater than .079" (2.0 mm), select and install spacer to bring clearance within specification. If clearance is less than .079" (2.0 mm), use wave spring alone. Apply sealant to both sides of gasket and install gasket and cover. Install pulse generator (if equipped).

9) On all models, align high-low shift fork and shift rail spring holes and drive in roll pin with punch. Roll pin should be installed with slit on center line of shift rail. Install wave spring on rear of rear output shaft bearing. Apply sealant to both sides of rear cover gasket. Install gasket and cover.

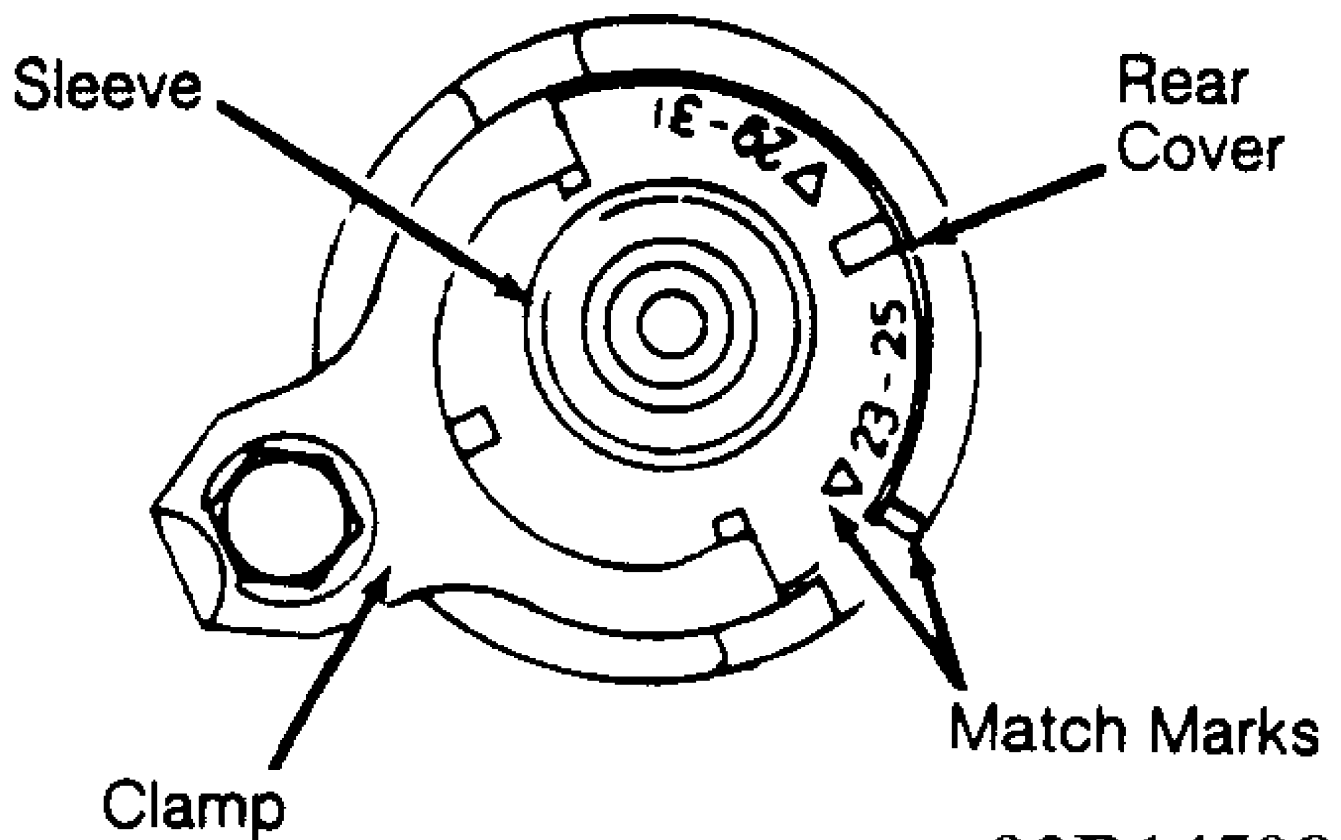
10) Check output shaft end play. Measure protrusion "A" of rear output shaft rear bearing and recess "B" of cover and calculate clearance. Ensure end play is 0-.004" (0-.10 mm). Apply sealant to both sides of gasket and install gasket and cover. See Fig. 9.

11) Install speedometer sleeve assembly in rear cover. Align match mark on speedometer sleeve assembly in rear cover. See Fig. 10. Align match mark on speedometer sleeve with mark on case according to number of teeth on speedometer driven gear. Install speedometer driven gear sleeve clamp and tighten bolt to specification. Install both 4WD indicator light switches with steel balls. See TORQUE SPECIFICATIONS.



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Fig. 9: Measuring Rear Output Shaft Bearing Clearance (Ram-50)
Courtesy of Mitsubishi Motor Sales of America.



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Fig. 10: Aligning Speedometer Sleeve
Courtesy of Mitsubishi Motor Sales of America.

Reassembly (Montero)

1) Install input gear and front output shaft oil seals into transfer case housing. Install transfer input gear assembly baffle plate and input gear seal. Pack grease between lips of seals and press seal circumference uniformly.

2) Install 2WD-4WD shift lug into transfer case. Install spring retainer and spring to shift rail and install into shift lug. Press on shift rail to align spring pin holes in shift rail and shift lug. While holding shift rail, tap spring pin into place with slit facing center of shift rail.

3) Install transfer input gear assembly and snap ring. Select thickest snap ring that will fit into groove. Allowed snap ring clearance is 0-.0024" (0-.060 mm). Insert needle bearing onto transfer drive shaft assembly. Install high-low synchronizer sleeve and shift fork assembly. Install transfer drive shaft assembly.

4) Install transfer countergear shaft thrust washers, needle bearings, bearing spacer and transfer countergear. Install one thrust washer at each end of transfer countergear. Ensure tab on thrust washers fits into groove of transfer case. Install counter gear shaft from transmission case side so lock plate groove is aligned with lock plate. Install lock plate. Install side cover and gasket.

5) Install bearing retainer. If reusing bearing retainer bolts, apply Locking Adhesive (3M 4170 Stud Lock) to threads. Install oil dam cover. Install differential lock hub, snap ring, steel ball and sleeve. Select thickest snap ring that will fit into groove. Allowed snap ring clearance is 0-.003" (0-.08 mm). Install 2WD-4WD synchronizer sleeve, 2WD-4WD shift fork, spring, spring seat and 2WD-

4WD shift rail snap ring.

6) Assemble front output shaft assembly, chain and 2WD-4WD synchronizer assembly. Align match marks made during disassembly. Link chain tightly onto 2WD-4WD synchronizer and front output shaft sprockets. Install both sprockets and chain to transfer case at same time, while keeping them as far apart as possible.

7) Install center differential case assembly, rear output shaft assembly needle bearings and rear output shaft assembly. Install interlock plunger so it does not interfere with 2WD-4WD shift rail. Evenly apply sealant to chain cover and install chain cover.

8) Install high-low shift rail through high-low shift rail hole into shift fork. Align spring pin holes in high-low shift rail and shift fork. Tap in spring pin so slit is facing shift rail shaft center. Install and tighten high-low shift rail plug to specification. See TORQUE SPECIFICATIONS.

9) Before installing front output shaft cover, measure protrusion "A" of front output shaft rear bearing and recess "B" of cover and calculate clearance. See Fig. 11. If clearance is greater than .079" (2.00 mm), select and install spacer to bring clearance within specification. If clearance is less than .079" (2.00 mm), use wave spring alone. Apply sealant to both sides of gasket and install gasket and cover. Apply Locking Adhesive (3M 4170 Stud Lock) to bolts and tighten to specification. See TORQUE SPECIFICATIONS.

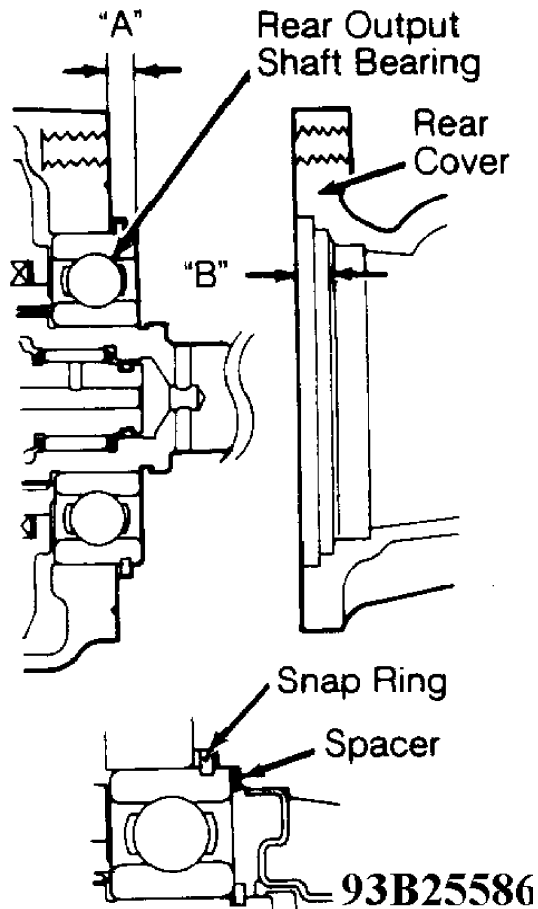


Fig. 11: Measuring Rear Output Shaft Bearing Clearance (Montero)
Courtesy of Mitsubishi Motor Sales of America.

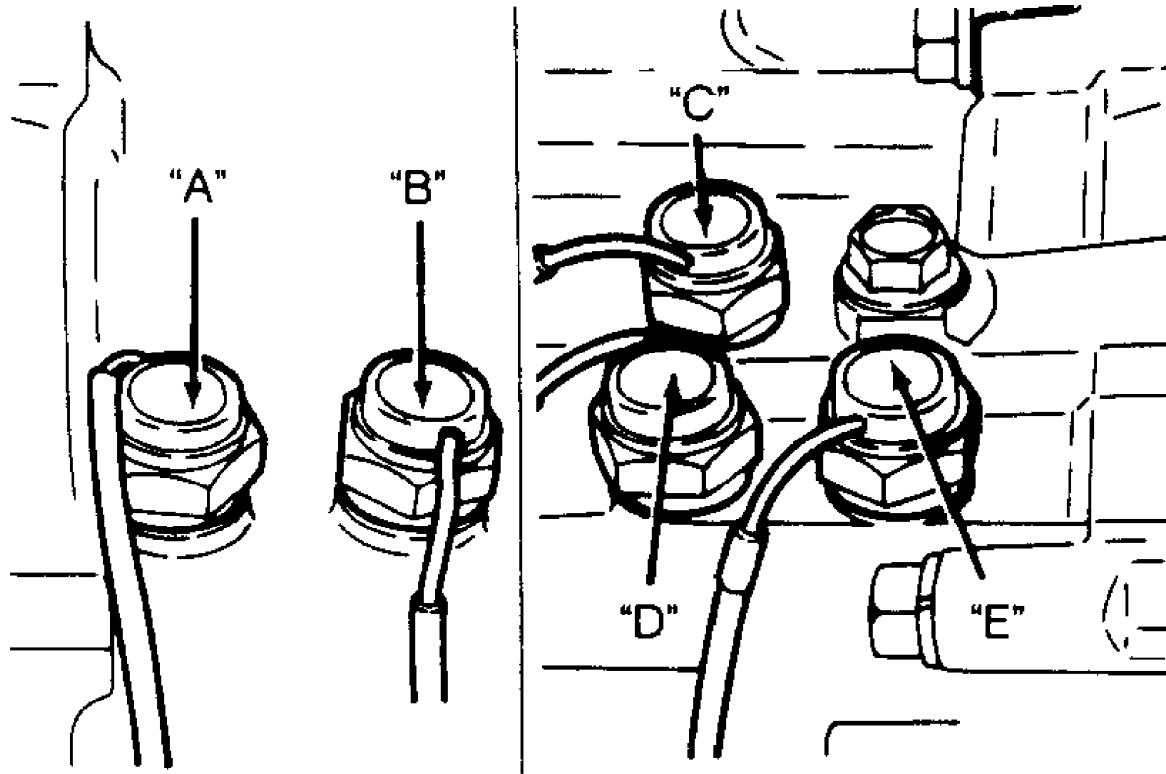
10) Install rear output shaft ball bearing snap ring. Measure clearance between chain cover and snap ring. Add .0008-.0039" (.02-.10

mm) to clearance measured and install spacer of similar thickness. Install rear output shaft oil seal (apply grease to lip of seal). Install rear cover oil seal (apply grease to lip of seal).

11) Before installing rear cover, snap ring and spacer thicknesses must be determined. Measure protrusion of rear output shaft bearing. Measure inset of both stages of cover. Subtract inset recess from rear bearing protrusion. Select a snap ring which adjusts difference between inset recess and rear bearing protrusion, and spacer thickness to 0-.004" (0-0.10 mm). Evenly apply sealant to rear cover and install cover. Tighten bolts to specification. Refer to the TORQUE SPECIFICATIONS table.

12) Install speedometer gear, ensuring mating marks match according to number of gear teeth. Install speedometer gear sleeve clamp and tighten bolt to specification. See Fig. 10.

13) Apply sealant to poppet plug threads. Install poppet steel balls, springs and poppet plugs and tighten to specification. Install detection switches, steel balls and gaskets. See Fig. 12. Install dynamic damper and tighten bolts to specification.



- "A" - Ball Built-In, Brown Connector
- "B" - Ball Built-In, Black Connector
- "C" - Ball Separate, Brown Connector
- "D" - Ball Separate, Black Connector
- "E" - Ball Separate, White Connector

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Fig. 12: Installation Of Detection Switches (Montero)
Courtesy of Mitsubishi Motor Sales of America.

TORQUE SPECIFICATIONS

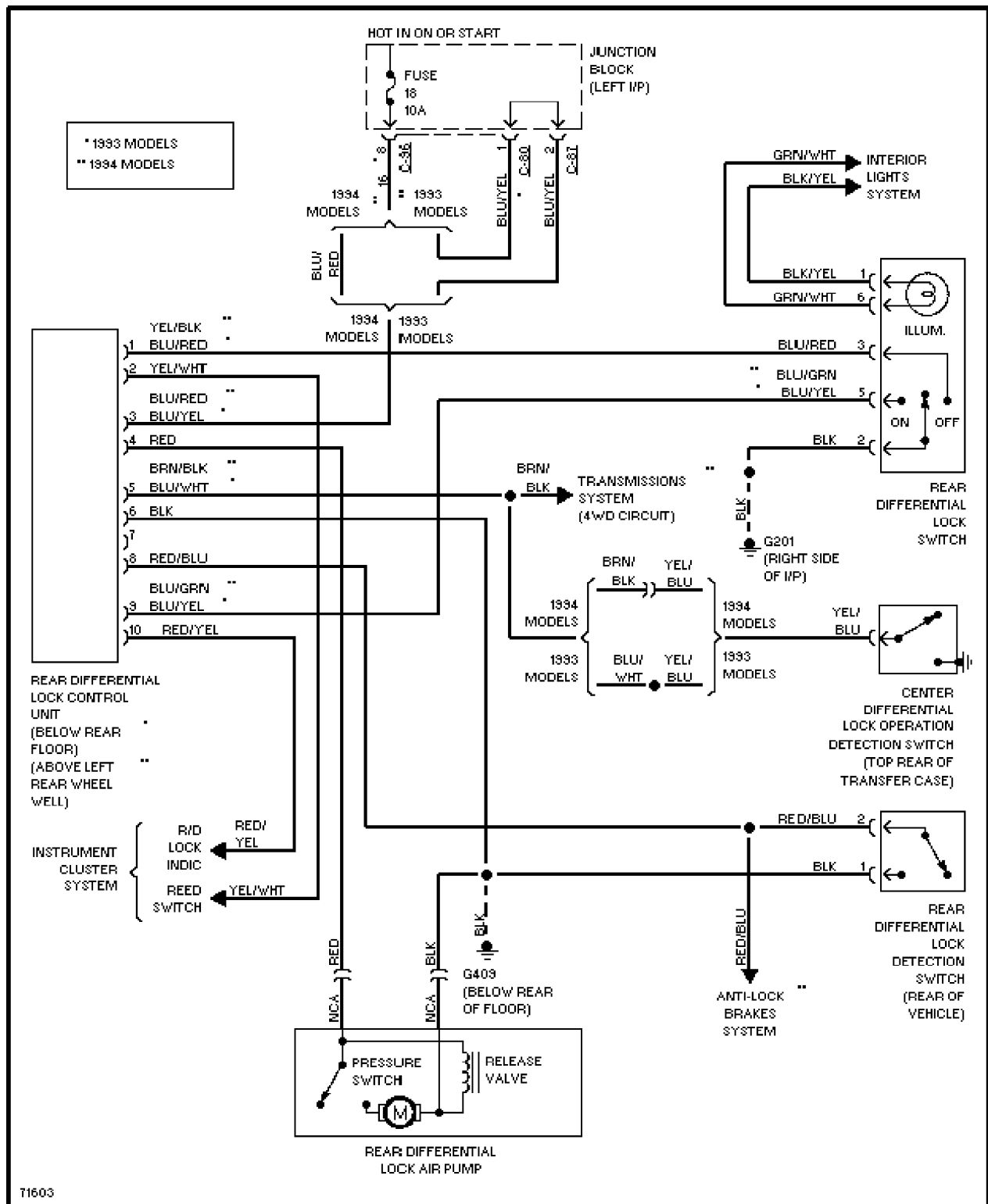
TORQUE SPECIFICATIONS TABLE

Application	Ft. Lbs. (N.m)
Adapter-To-Transfer Bearing Retainer	(1) 14 (19)
Case Nuts & Bolts	22-31 (30-42)
Center Differential Case Bolts	48 (65)
Chain Cover Bolt	22-31 (30-42)
Detection Switch	(1) 27 (36)
Drain Plug	22-26 (30-35)
Dynamic Damper	52 (70)
High-Low Shift Rail Plug	(1) 24 (33)
Interlock Plunger Plug	(1) 22-26 (30-35)
Lock Plate Bolts	11-16 (15-22)
Oil Dam Cover	(1) 14 (19)
Oil Filler Plug	22-26 (30-35)
Output Shaft Cover Bolt	11-16 (15-22)
Poppet Plug	(1) 27 (36)
Pulse Rotor Bolt	(2) 11-16 (15-22)
Rear Cover Bolt	11-16 (15-22)
Rear Output Shaft Lock Nut	74-96 (100-130)
Seal Plug	(2) 22-31 (30-42)
Speedometer Sleeve Clamp Bolt	11-16 (15-22)
4WD Indicator Light Switch	(2) 22 (33)
	INCH Lbs. (N.m)
Pulse Generator Bolt	(2) 89-106 (10-12)
Side Cover Bolt	71-89 (8-10)

(1) - Montero.

(2) - Ram-50.

WIRING DIAGRAMS



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Fig. 13: Rear Differential Lock Circuit (Montero)

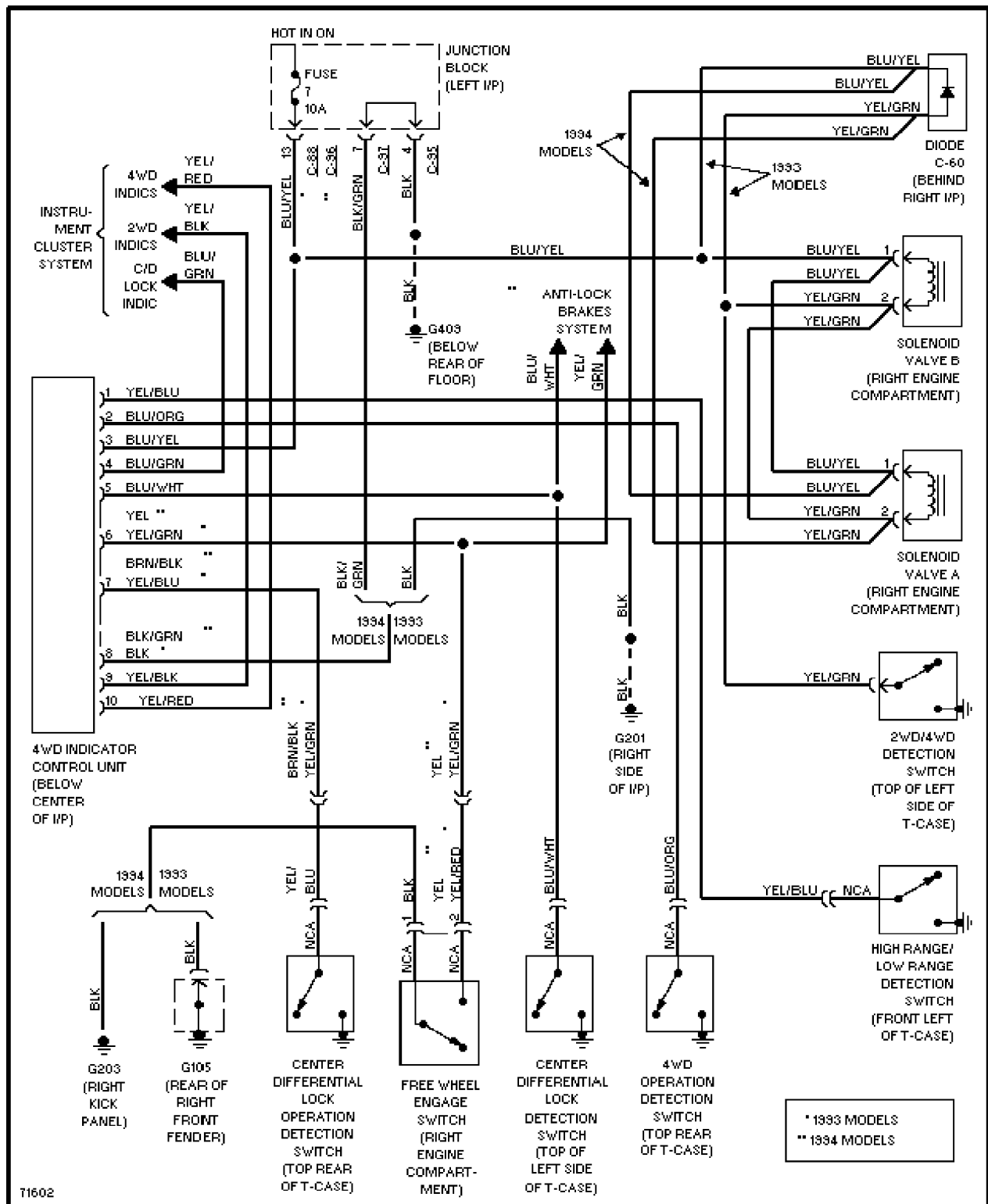


Fig. 14: Active Trac 4WD Circuit (Montero)

TRANSMISSION REMOVAL & INSTALLATION - A/T

1993 Mitsubishi Montero

1993 TRANSMISSION SERVICING
Chrysler/Mitsubishi Transmission Removal & Installation

Dodge; Colt, Ram-50 & Stealth
Eagle; Summit & Summit Wagon
Mitsubishi; Diamante, Eclipse, Expo, Galant,
Mirage, Montero, Pickup, Precis & 3000GT
Plymouth; Colt Vista

MANUAL

NOTE: For manual transmission/transaxle replacement procedures, see appropriate article in CLUTCHES.

AUTOMATIC

FWD MODELS

Removal

1) Remove battery and battery tray. On Diamante, Stealth and 3000GT, remove undercover(s). On turbo models, drain and remove intercooler. On all models, remove air cleaner and case. Raise and support vehicle. Remove wheels. Disconnect control cables at transaxle. Drain transaxle fluid.

2) On Mirage 1.8L, disconnect tension rod. 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) On models equipped with electronically controlled suspension, remove air compressor and bracket. Disconnect front height sensor rod at lower control arm.

4) On all models, remove upper transaxle-to-engine bolts. Remove engine undercover (if equipped). Remove drive axle shafts. See FWD AXLE SHAFTS article in DRIVE AXLES. Separate lower control arms from struts for access to axle shafts (if necessary).

5) Remove front exhaust pipe (if necessary). On Eclipse AWD, Stealth and 3000GT, remove right member and gusset. On AWD models, separate transfer assembly from transaxle. Reference mark transfer assembly-to-drive shaft and remove transfer assembly.

6) 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.

7) On all 4-cylinder models, support engine. On all models, support transaxle with jack. Remove transaxle mounts bolts, 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 TABLE at the end of this article.

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. Adjust all control cables. See AUTOMATIC TRANSMISSION SERVICING article.

RWD MODELS

Removal

- 1) Disconnect negative battery cable. Remove front exhaust pipe. On Montero, 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) 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.
- 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 TABLE at the end of this article. 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. Adjust all control cables. See AUTOMATIC TRANSMISSION SERVICING article.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS TABLE

Applications	Ft. Lbs. (N.m)
FWD Models	
Torque Converter-To-Drive Plate Bolt	
Precis	53-55 (72-76)
All Others	34-38 (46-52)
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	
(Diamante, Stealth & 3000GT)	54 (73)
Lower Coupling Bolts	
(Diamante, Stealth & 3000GT)	65 (88)

RWD Models

Torque Converter-To-Drive Plate Bolt		
Montero	25-30	(34-41)
Pickup & Ram-50	33-38	(45-52)
Transmission-To-Engine Block Bolt		
Montero		
10 x 40-mm Bolt	22-30	(30-41)
12 x 40-mm Bolt	47-61	(64-83)
12 x 55-mm Bolt	58-72	(79-98)
Pickup & Ram-50		
10 x 16-mm Bolt	22-30	(30-41)
10 x 50-mm Bolt	31-40	(42-54)
10 x 70-mm Bolt	31-40	(42-54)

(1) - Tighten to 84-108 INCH lbs. (10-12 N.m) .

TRANSMISSION SERVICING - A/T

1993 Mitsubishi Montero

1993 TRANSMISSION SERVICING
Chrysler/Mitsubishi Automatic Transmission

Dodge; Ram-50
Mitsubishi: Montero & Pickup

IDENTIFICATION

AUTOMATIC TRANSMISSION APPLICATIONS TABLE

Model	Transmission/Transaxle
Ram-50	
RWD & 4WD	Model R4AC1 Transmission
Montero	Model V4AW2 Transmission
Pickup	
RWD & 4WD	Model R4AC1 Transmission

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

Lubricant level should be to bottom of fill hole on side of transfer case.

RECOMMENDED FLUID

Transaxle/Transmission

Use Chrysler Plus/Mitsubishi Plus ATF, Dexron or Dexron-II ATF.

Transfer Cases
Use SAE 75W-85 gear oil with API GL-4 rating or higher.

FLUID CAPACITIES

TRANSAXLE/TRANSMISSION REFILL CAPACITIES TABLE

Application	Refill Qts. (L)	Dry Fill Qts. (L)
Montero	5.8 (5.5)	7.4 (7.0)
Pickup & Ram-50	(1) 4.2 (4.0)	7.4 (7.0)

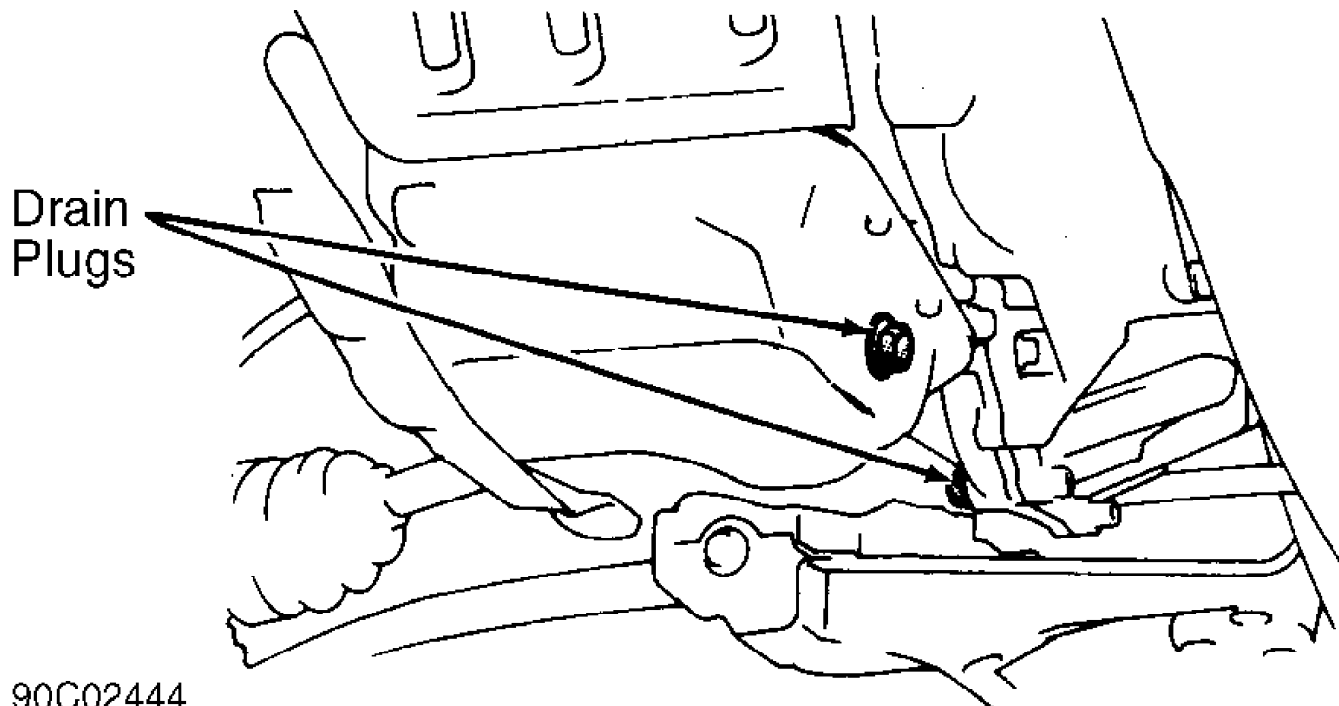
(1) - Idle engine in Neutral, then add fluid to bring level
between notches at "H" mark.

TRANSFER CASE REFILL CAPACITIES TABLE

Application	Pts. (L)
Montero	4.9 (2.3)
Pickup & Ram-50	4.6 (2.2)

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.



90C02444

Fig. 1: Locating Drain Plugs
Courtesy of Mitsubishi Motor Sales of America.

Transmission

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 TABLE at the end of this article. Clean oil pan, replace gasket, and install oil pan. Tighten oil pan bolts and drain plug to specification. See TORQUE SPECIFICATIONS TABLE at the end of this article. Fill transmission, through filler tube, with 5.3 qts. (5.0L) of Dexron-II ATF on Montero, or 2.0 qts. (1.9L) on all others. 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 BAND

Pickup & Ram-50

1) Locate kickdown band adjusting screw on left side of transmission case. Loosen lock nut, and back off 5 turns. Ensure adjusting screw turns freely in transmission case.

2) Using torque wrench, tighten adjusting screw to 72 INCH lbs. (8 N.m). Back off adjusting screw 2 7/8 turns. Hold adjuster screw in this position, and tighten lock nut to 30 ft. lbs. (41 N.m).

LOW-REVERSE BAND

Pickup & Ram-50

1) Raise vehicle, drain transmission, and remove oil pan. Loosen adjusting screw lock nut, and back off nut 5 turns. Ensure adjusting screw turns freely in lever.

2) Using torque wrench, tighten band adjusting screw to 30 INCH lbs. (3.5 N.m). Back off adjusting screw 6 turns. Hold adjusting screw in this position, and tighten lock nut to 25 ft. lbs. (34 N.m).

3) Reinstall oil pan using new gasket. Tighten pan bolts to 150 INCH lbs. (17 N.m). Refill transmission with specified fluid.

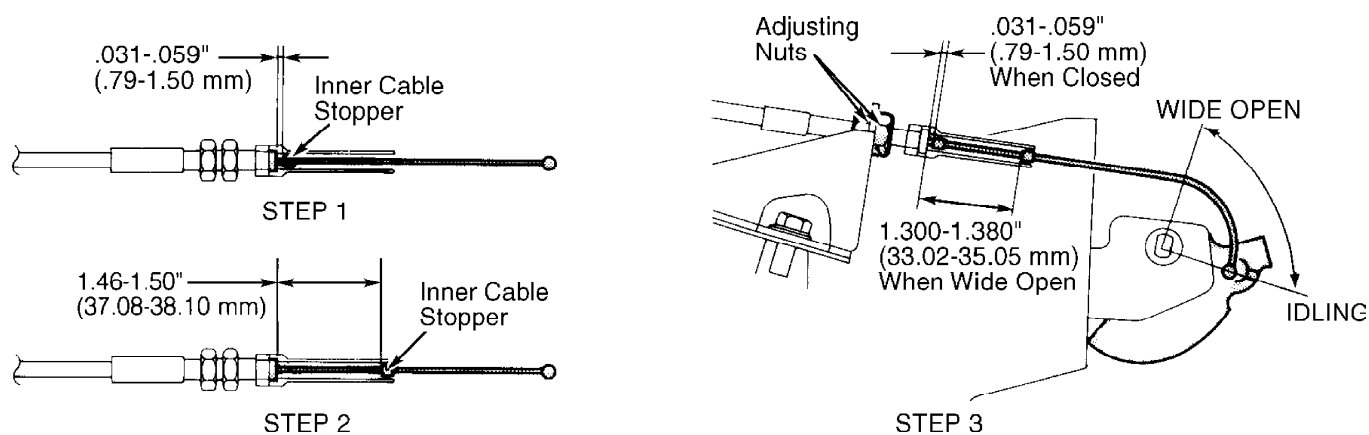
TRANSMISSION THROTTLE CONTROL

CAUTION: On Pickup and Ram-50, always adjust throttle control cable whenever idle is adjusted.

Pickup & Ram-50

1) Ensure engine idle is adjusted correctly. Ensure throttle lever and throttle cable bracket are not bent. Pull lightly on inner throttle cable.

2) While in closed throttle position, measure gap between inner cable stopper and outer cable housing. Adjust cable as necessary to obtain a gap of .031-.059" (.79-1.50 mm). See Fig. 2 (STEP 1).



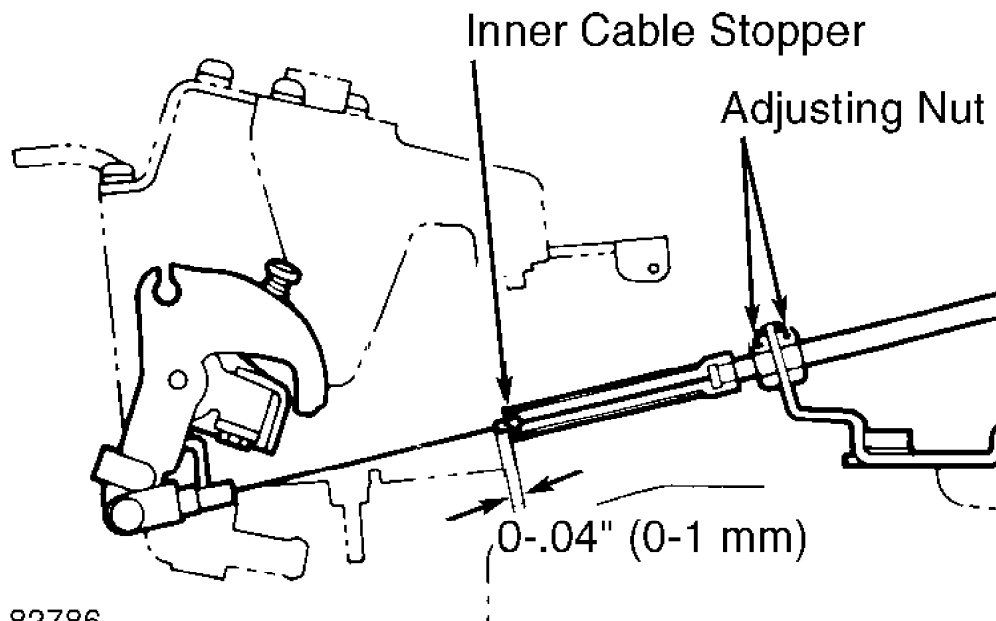
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Fig. 2: Adjusting Kickdown Cable (Pickup & Ram-50)
Courtesy of Mitsubishi Motor Sales of America.

3) While holding throttle in wide open position, pull on inner throttle cable. Adjust bellcrank as necessary to obtain a gap of 1.46-1.50" (37.08-38.10 mm) between inner cable stopper and outer cable. See Fig. 2 (STEP 2).

4) With throttle fully closed, recheck gap between inner cable stopper and outer cable housing. Gap should be .031-.059" (.79-1.50 mm). See Fig. 2 (STEP 3). While holding throttle in wide open position, pull on inner throttle cable. Check for a gap of 1.30-1.38" (33.02-35.05 mm).

Montero

Ensure throttle lever and throttle cable bracket are not bent. Ensure distance between inner cable stopper end and dust cover is 0-.04" (0-1.0 mm). See Fig. 3.



82786
Fig. 3: Adjusting Throttle Cable (Montero)
Courtesy of Mitsubishi Motor Sales of America.

Montero

Loosen swivel nut on transmission control rod. See Fig. 4.
Ensure shift and transmission levers are both in Neutral. Tighten
swivel nut.

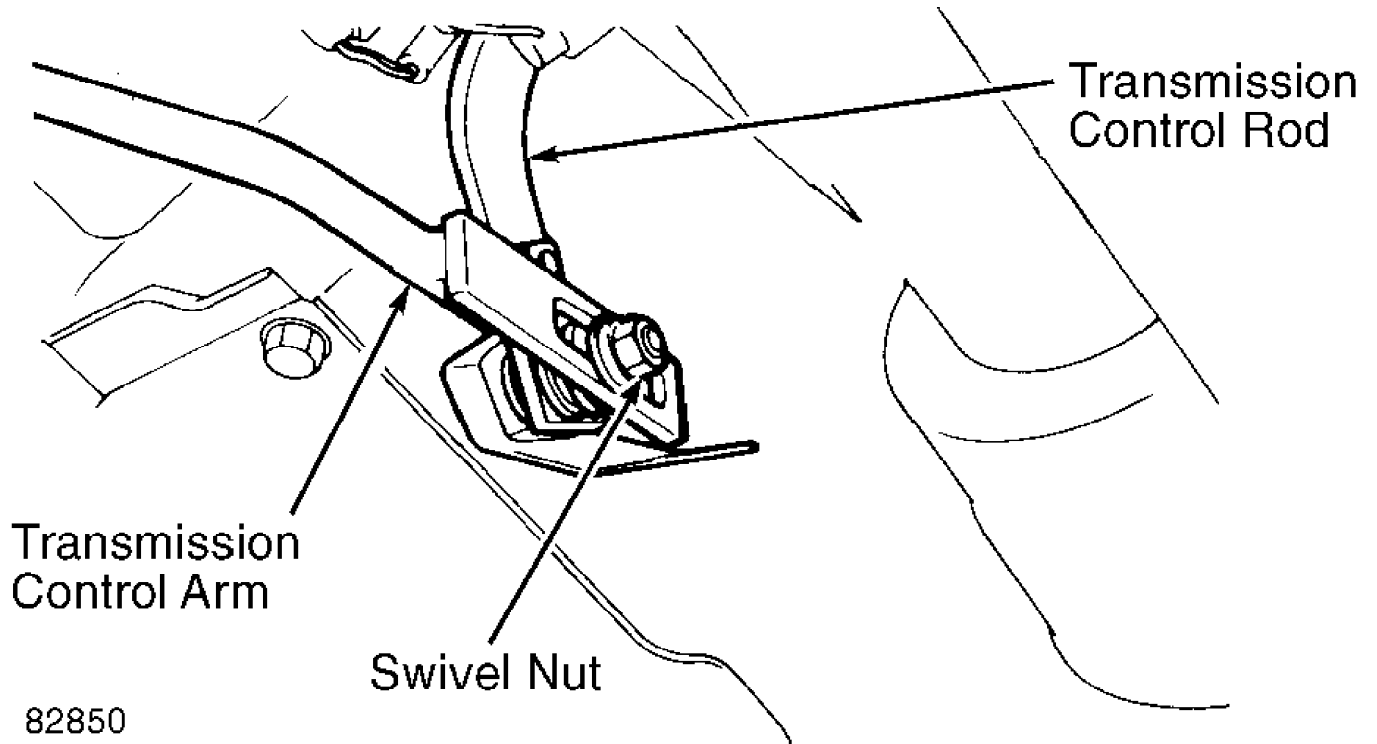


Fig. 4: Adjusting Shift Linkage (Montero)
Courtesy of Mitsubishi Motor Sales of America.

Pickup & Ram-50

Adjust shift cable at transaxle/transmission end of cable.
Place shift lever in Neutral. Ensure shift lever and neutral safety
switch are in Neutral position. If cable was replaced, ensure toothed
washer is installed. See Fig. 5. Turn adjuster at cable end so it fits
into manual lever on transaxle/transmission, and no slack exists in
cable. See Fig. 5.

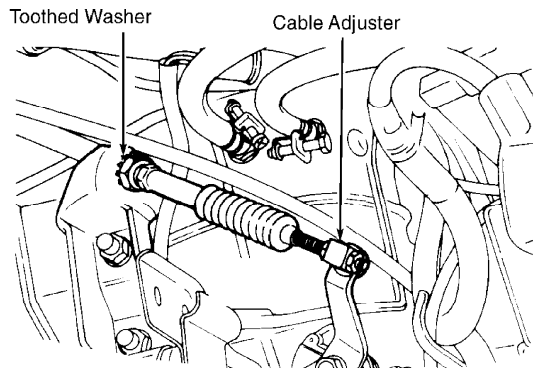


Fig. 5: Adjusting Shift Cable (Pickup & Ram-50)
Courtesy of Mitsubishi Motor Sales of America.

SHIFT LEVER SLEEVE

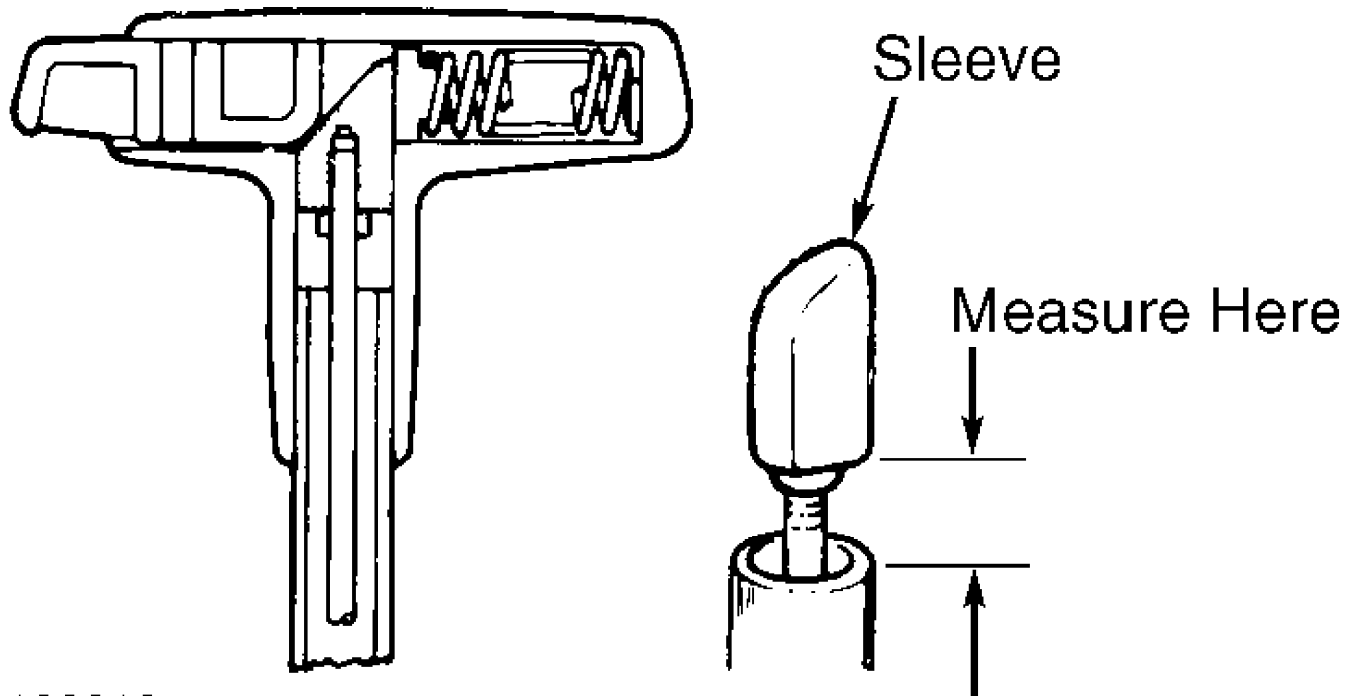
NOTE: Pickup and Ram-50 do not have shift lever sleeve.

Montero

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. 6. Ensure beveled side of sleeve faces toward push button (if equipped).

SHIFT LEVER SLEEVE CLEARANCE SPECIFICATION TABLE

Application	Clearance In. (mm)
Montero	.72-.74 (18.2-18.9)



100010

Fig. 6: Adjusting Shift Lever Sleeve (Montero)
Courtesy of Mitsubishi Motor Sales of America.

NEUTRAL SAFETY SWITCH

Montero

1) Neutral safety switch is located under shift lever console. Remove neutral safety switch connector. See Fig. 7.

2) Using an ohmmeter, check continuity for each position of transmission control lever. See Fig. 7.

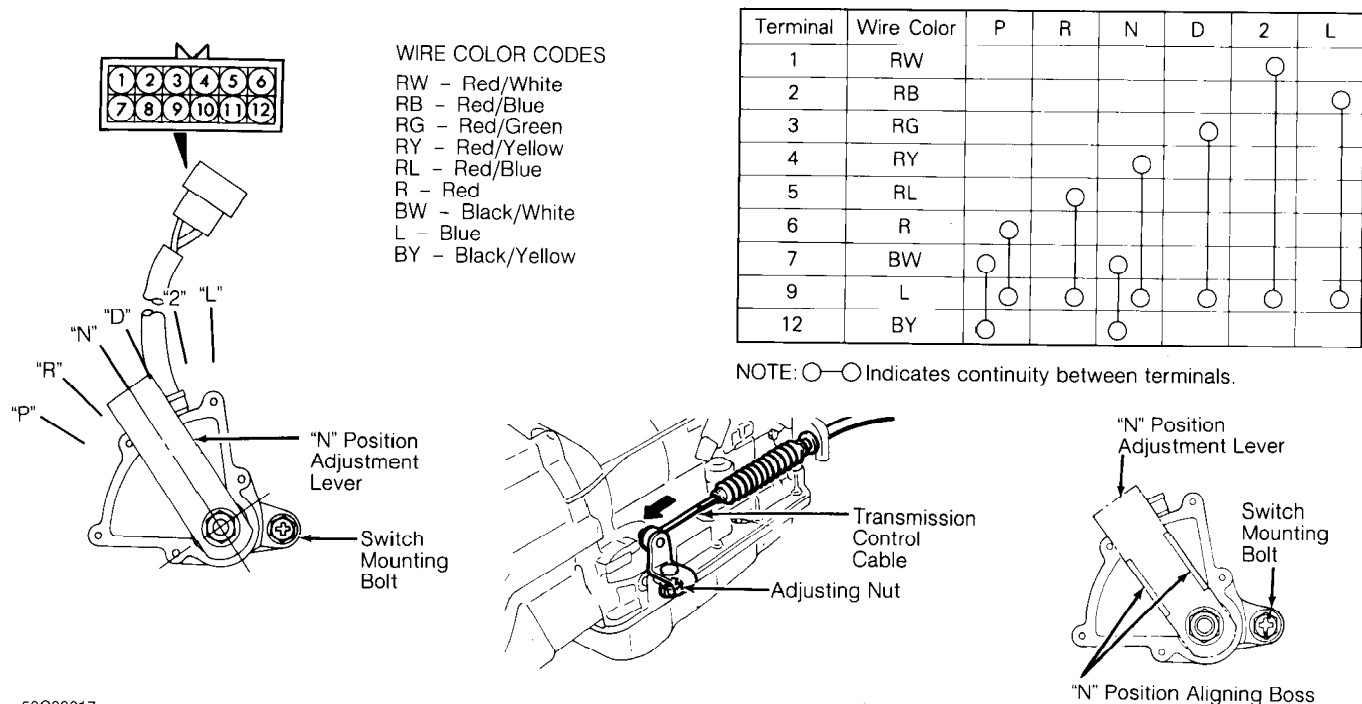
3) After ensuring correct continuity in all positions, move selector lever to "N" position. Loosen adjusting nut of control cable. Loosen park/neutral switch mounting bolt.

4) Adjust neutral safety switch by turning park/neutral switch so that the bosses for aligning "N" position on park/neutral switch are aligned with the "N" position adjustment lever. Tighten park/neutral switch mounting bolt to specification. See TORQUE SPECIFICATIONS TABLE at the end of this article.

5) Gently pull end of transmission control cable in direction of arrow. See Fig. 7. Tighten adjusting nut to specification. See

TORQUE SPECIFICATIONS TABLE at the end of this article.

6) Ensure selector lever is in "N" position after adjustment.
 Ensure each range of the transmission functions correctly at appropriate position of the selector lever.



50C03617
 Fig. 7: Adjusting Neutral Safety Switch (Montero)
 Courtesy of Mitsubishi Motor Sales of America.

Pickup & Ram-50
 Neutral safety switch is part of transmission-mounted neutral safety/back-up light switch assembly, and is non-adjustable.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS TABLE

Application	Ft. Lbs. (N.m)
Drain Plug	
Transaxle/Transmission	
Montero	13-17 (18-24)
Pickup & Ram-50	22-25 (30-35)
Transfer Case	22-25 (30-35)
Transmission Control Cable	
Adjusting Nut	17 (24)
	INCH Lbs. (N.m)
Oil Filter/Screen Bolt	
Montero	43-52 (4.9-5.9)
Pickup & Ram-50	36 (4.0)
Oil Pan Bolt	
Montero	36-42 (4.0-4.8)
Pickup & Ram-50	156 (18)
Park/Neutral Switch Mounting Bolt (Montero)	48 (5.4)

TRANSMISSION SERVICING - M/T

1993 Mitsubishi Montero

1993 MANUAL TRANSMISSION SERVICING
Chrysler/Mitsubishi

Dodge; Ram-50 Pickup
Mitsubishi; Montero & Pickup

IDENTIFICATION

MANUAL TRANSMISSION APPLICATIONS TABLE

Model	Transmission (Model)
Ram-50	
RWD	5-Speed (R5M21)
4WD	5-Speed (V5MT1)
Montero	5-Speed (V5MT1)
Pickup	
RWD	5-Speed (R5M21)
4WD	5-Speed (V5MT1)

LUBRICATION

SERVICE INTERVALS

Check transmission and transfer case fluid level every 30,000 miles. Change fluid at 30,000 miles if operated under severe conditions.

CHECKING FLUID LEVEL

Transmission

Check fluid level at fill hole on side of 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

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

TRANSMISSION REFILL CAPACITIES TABLE

Application	Pts. (L)
Montero	5.3 (2.5)
Pickup & Ram-50	
RWD	4.9 (2.3)
4WD	5.3 (2.5)

TRANSFER CASE REFILL CAPACITIES TABLE

Application	Pts. (L)
Montero	4.9 (2.3)
Pickup & Ram-50	4.9 (2.3)

ADJUSTMENTS

SHIFT LINKAGE

In-service adjustment of shift linkage is not necessary.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS TABLE

Application	Ft. Lbs. (N.m)
Drain Plug & Filler Plug	
RWD	22-25 (30-34)
4WD	40-61 (54-83)

TROUBLE SHOOTING - BASIC PROCEDURES

1993 Mitsubishi Montero

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

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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

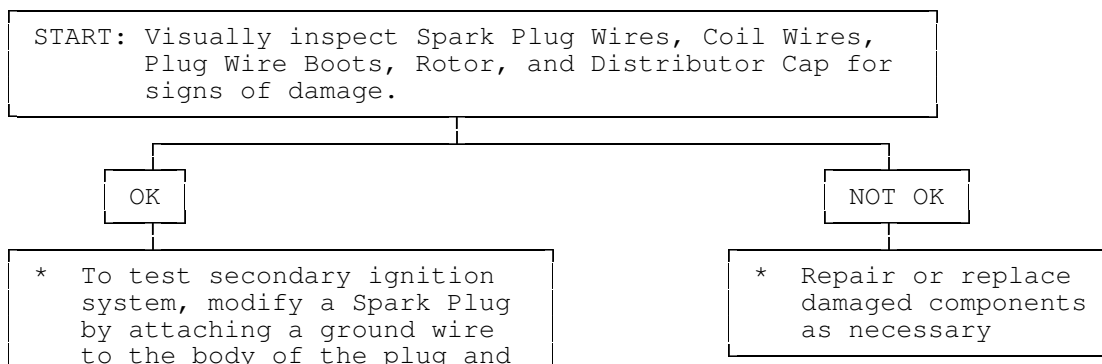
		ALTERNATOR article
Alternator Light Stays Off With Ignition Switch ON	Blown fuse	See WIRING DIAGRAMS
	Defective alternator	See Testing in ALTERNATOR article
	Defective indicator light bulb or socket	See Indicator Warning Lights in STANDARD INSTRUMENTS in the ACCESSORIES & EQUIPMENT section
Alternator 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

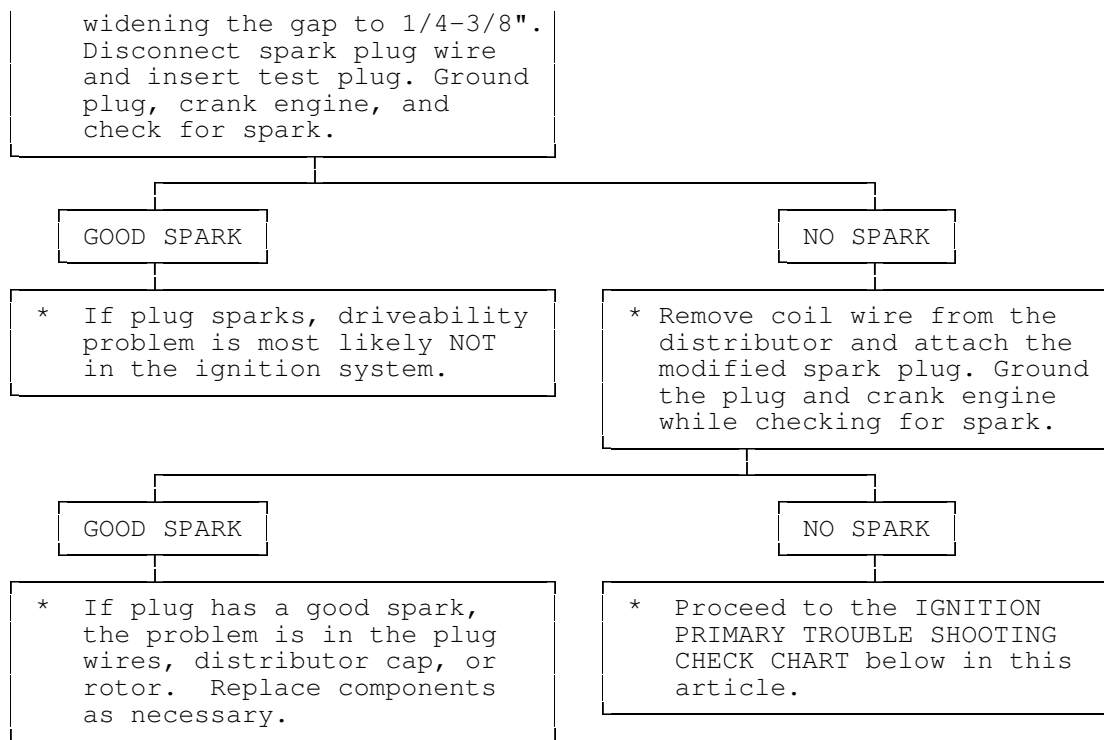
	Defective diodes or stator	See Bench Test in ALTERNATOR article
Battery Does Stay Charged	Loose or worn drive belt	Check alternator drive belt tension and condition. See Belt Adjustment in appropriate TUNE-UP article in the TUNE-UP section
	Loose or corroded battery connections	Check all charging system 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

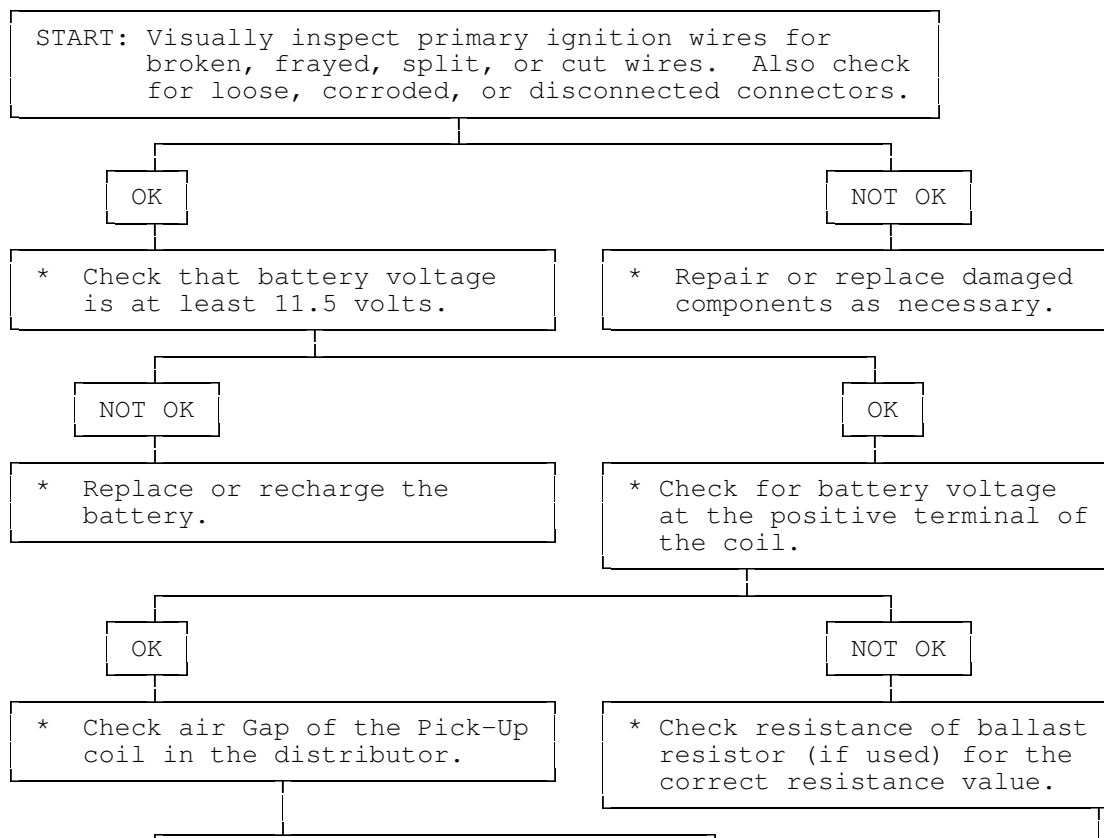
NOTE: This is GENERAL information. This article is not intended to be specific to any unique situation or individual vehicle configuration. The purpose of this Trouble Shooting information is to provide a list of common causes to problem symptoms. For model-specific Trouble Shooting, refer to SUBJECT, DIAGNOSTIC, or TESTING articles available in the section(s) you are accessing.

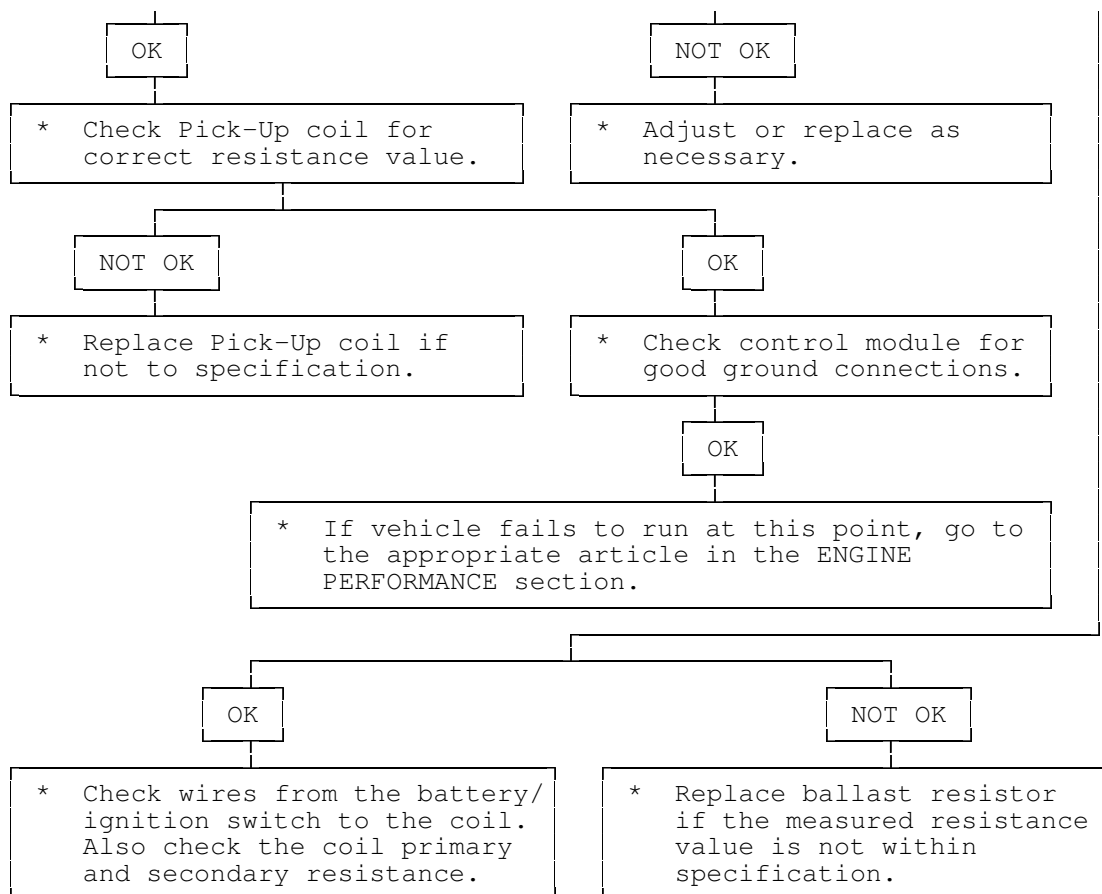
Ignition Secondary Trouble Shooting Chart





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
Starter Relay Operates but Solenoid Does Not	Ignition starter switch contacts sticking	Replace ignition switch
	Faulty solenoid switch, switch connections or	Check all wiring between relay and solenoid or replace relay or solenoid as necessary
Solenoid Plunger Vibrates When Switch is Engaged	Broken lead or loose soldered connections	Repair wire or wire connections as necessary
	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
Low Current Draw	Open hold-in wire	Replace solenoid
	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 Flywheel runout contributes
released. Engine to the intermittent nature
Fires and Cranks
Normally

AIR CONDITIONING & HEAT

AIR CONDITIONING TROUBLE SHOOTING

WARNING: 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 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 Incorrect parking brake adjustment	Check line routing 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 specification, 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

	Bad starter connections or bad starter	batteries 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 Incorrect or contaminated fuel Injector nozzle malfunction	Bleed air from system Replace fuel Check nozzles, see FUEL SYSTEMS
Engines Starts and Idles Rough W/out Smoke or Noise, But Clears After Warm-Up	Injection pump timing incorrect Engine not fully broken in Air in system Injector nozzle malfunction	Reset pump timing, see FUEL SYSTEMS Put more miles on engine Bleed air from system Check nozzles, see FUEL SYSTEMS
Engine Idles Correctly, Misfires Above Idle	Blocked fuel filter Injection pump timing incorrect Incorrect or contaminated fuel	Replace fuel filter Reset pump timing, see FUEL SYSTEMS Replace fuel
Engine Won't Return To Idle	Fast idle adjustment incorrect Internal injection pump malfunction External linkage binding	Reset fast idle, see TUNE-UP Replace injection pump, see FUEL SYSTEMS Check linkage and remove binding
Fuel Leaks On Ground	Loose or broken fuel line Internal injection pump seal leak	Check lines and connections Replace injection pump, see FUEL SYSTEMS
Cylinder Knocking Noise	Injector nozzles sticking open Very low nozzle opening pressure	Test injectors, see FUEL SYSTEMS Test injectors and/or replace
Loss of Engine Power	Restricted air intake EGR valve malfunction Blocked or damaged exhaust system Blocked fuel tank filter Restricted fuel filter Block vent in gas cap Tank-to-injection pump fuel supply blocked Blocked fuel return system Incorrect or contaminated fuel Blocked injector nozzles Low compression	Remove restriction Replace EGR valve Remove restriction and/or replace components Replace filter Remove restriction and/or replace filter Remove restriction and/or replace cap Check fuel lines and connections Remove restriction Replace fuel Check nozzle for blockage, see FUEL SYSTEMS Check valves, rings, pistons, see ENGINES
Loud Engine Noise With Black Smoke	Basic timing incorrect EGR valve malfunction Internal injection pump malfunction	Reset timing, see FUEL SYSTEMS Replace EGR valve 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 (Crank 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

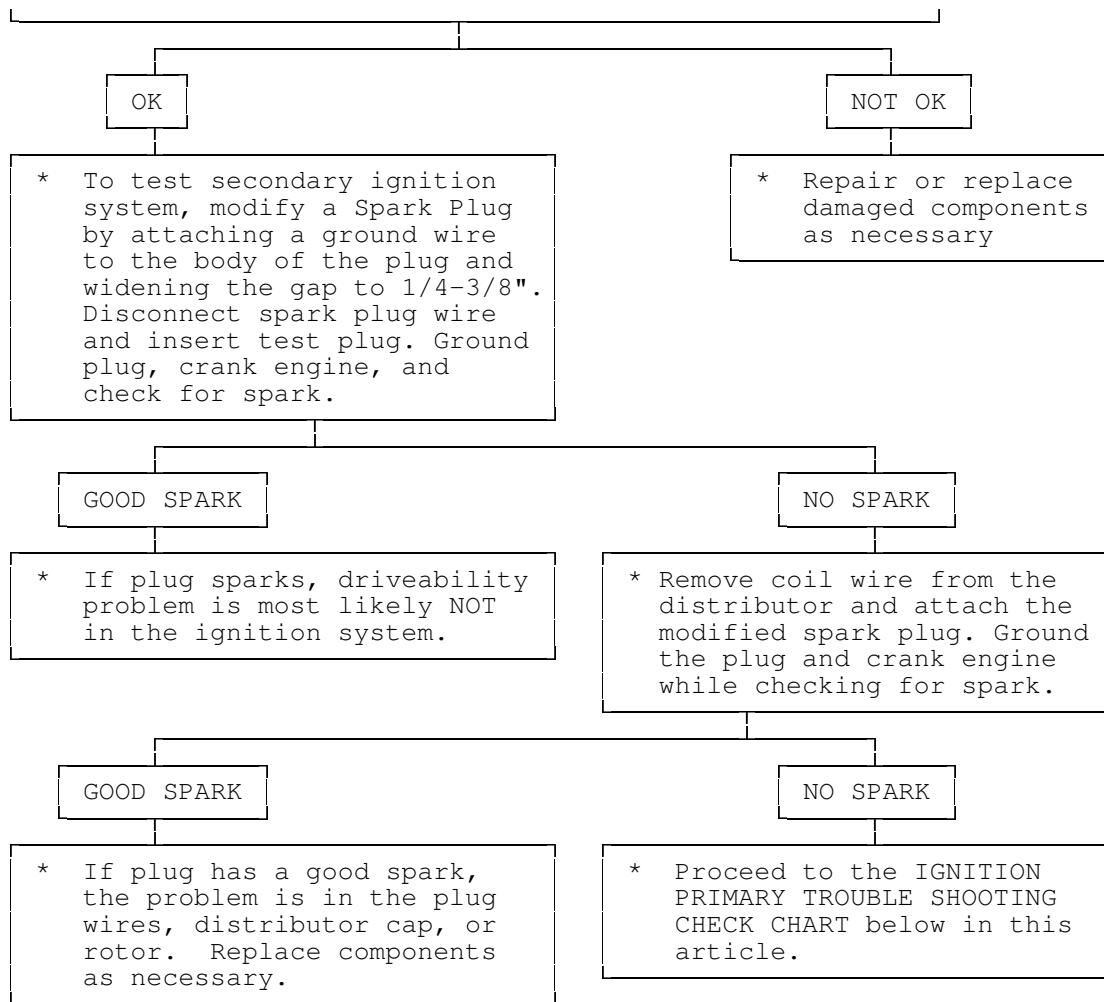
NOTE: For additional electronic fuel injection trouble shooting information, see the appropriate article in the ENGINE PERFORMANCE section (not all vehicles have Computer Engine Control articles). Information is provided there for diagnosing fuel system problems on vehicles with electronic fuel injection.

IGNITION SYSTEM TROUBLE SHOOTING

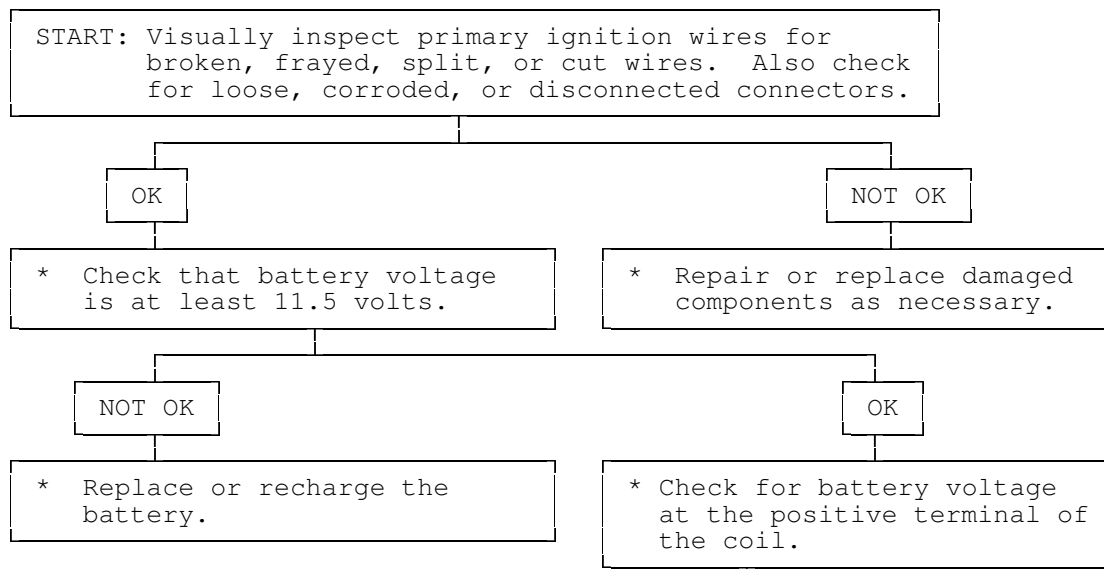
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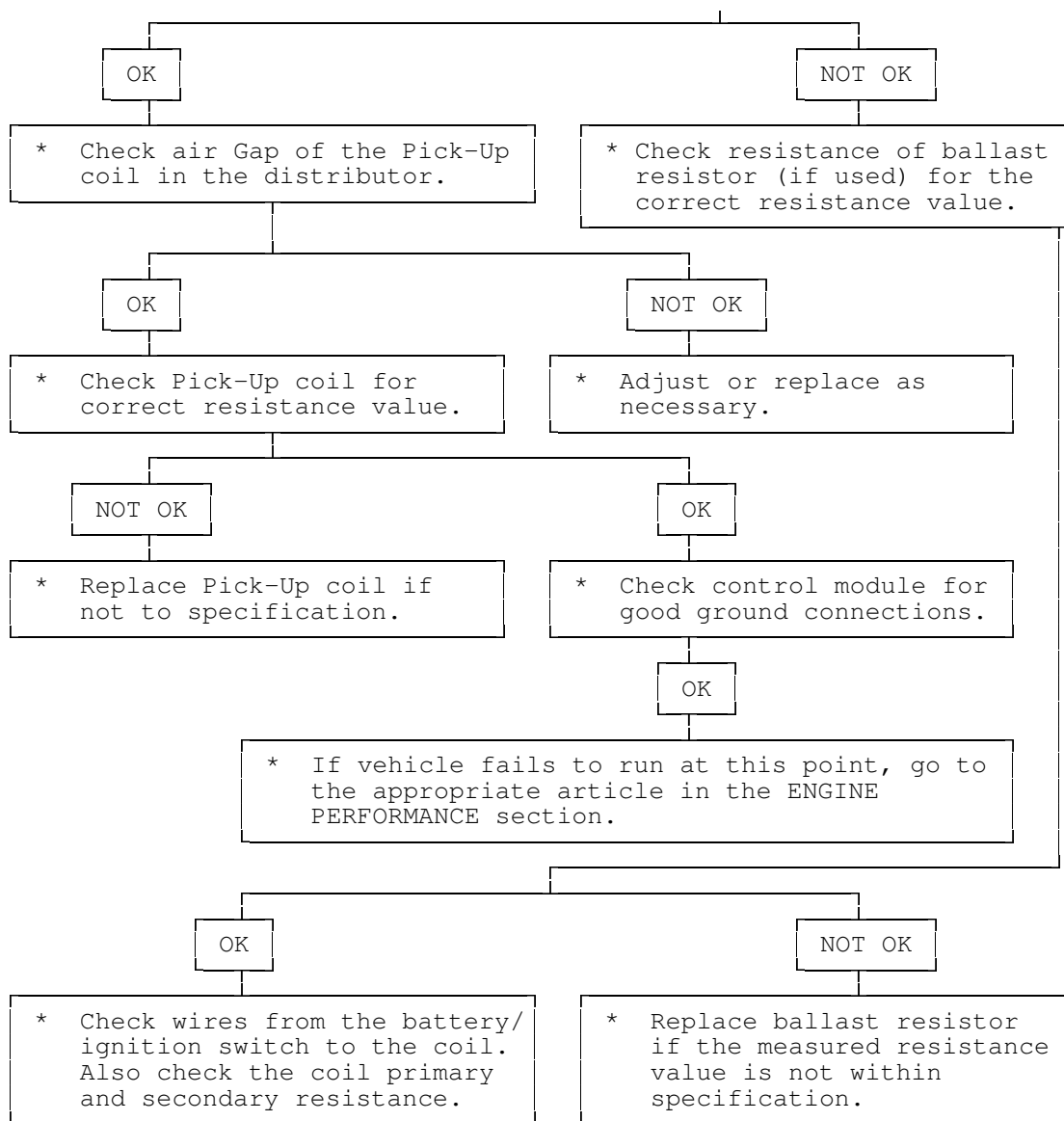
Ignition Secondary Trouble Shooting Chart

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 Combustion 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	Carb 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
Cylinders Not Firing	Corroded spark plugs	Replace spark plugs
	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

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. For definitions of listed noises or sounds, see DRIVE AXLE - NOISE DIAGNOSIS under POWERTRAIN.

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

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 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

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 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

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 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 Wheel Fast Foaming, Milky Power Steering Fluid, Low Fluid Level or Low Pressure	High internal pump leakage	See POWER STEERING PUMP article
	Power steering pump belt slipping	Adjust or replace if necessary
	Low fluid level	Check and fill to proper level
	Engine idle speed too 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 Trans. Shifting	Improper adjustment of shift levers	See STEERING COLUMN article
	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
Pulls to One Side	Tires out of balance	Check tire balance
	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
Vehicle "Wanders"	Bent steering knuckle or supports	See SUSPENSION section
	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

1993 Mitsubishi Montero

1993 ENGINE PERFORMANCE
Chrysler Corp./Mitsubishi Vacuum Diagrams

Dodge; Ram-50
Mitsubishi; Montero, Pickup

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 in this section. This will assist in identifying improperly routed vacuum hoses, which cause driveability and/or computer-indicated malfunctions.

NOTE: Always refer to Emission Control label in engine compartment before attempting service. If manual and label differ, always use emission label specifications.

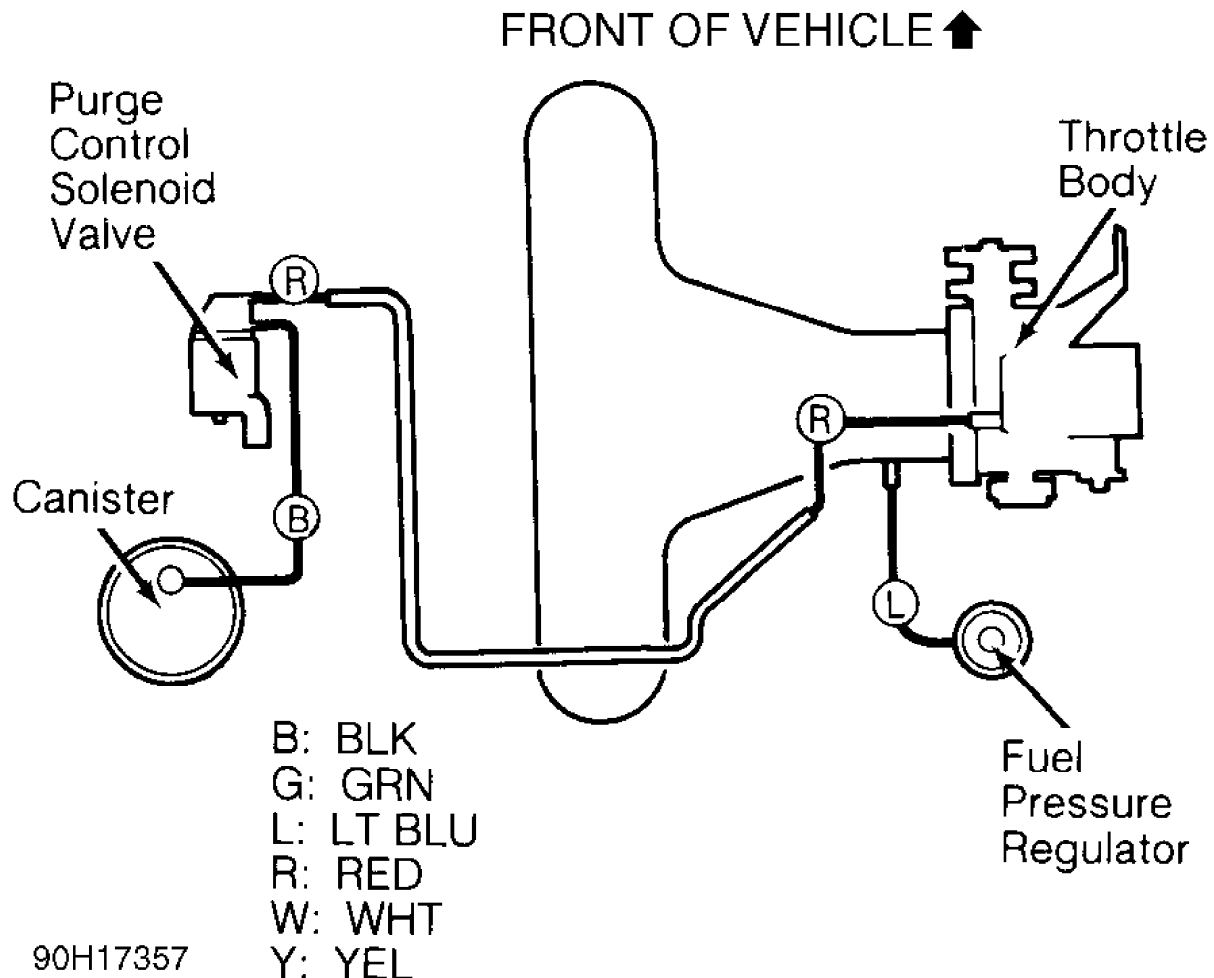


Fig. 1: Vacuum Diagram (Montero California & Federal)
Courtesy of Mitsubishi Motor Sales of America.

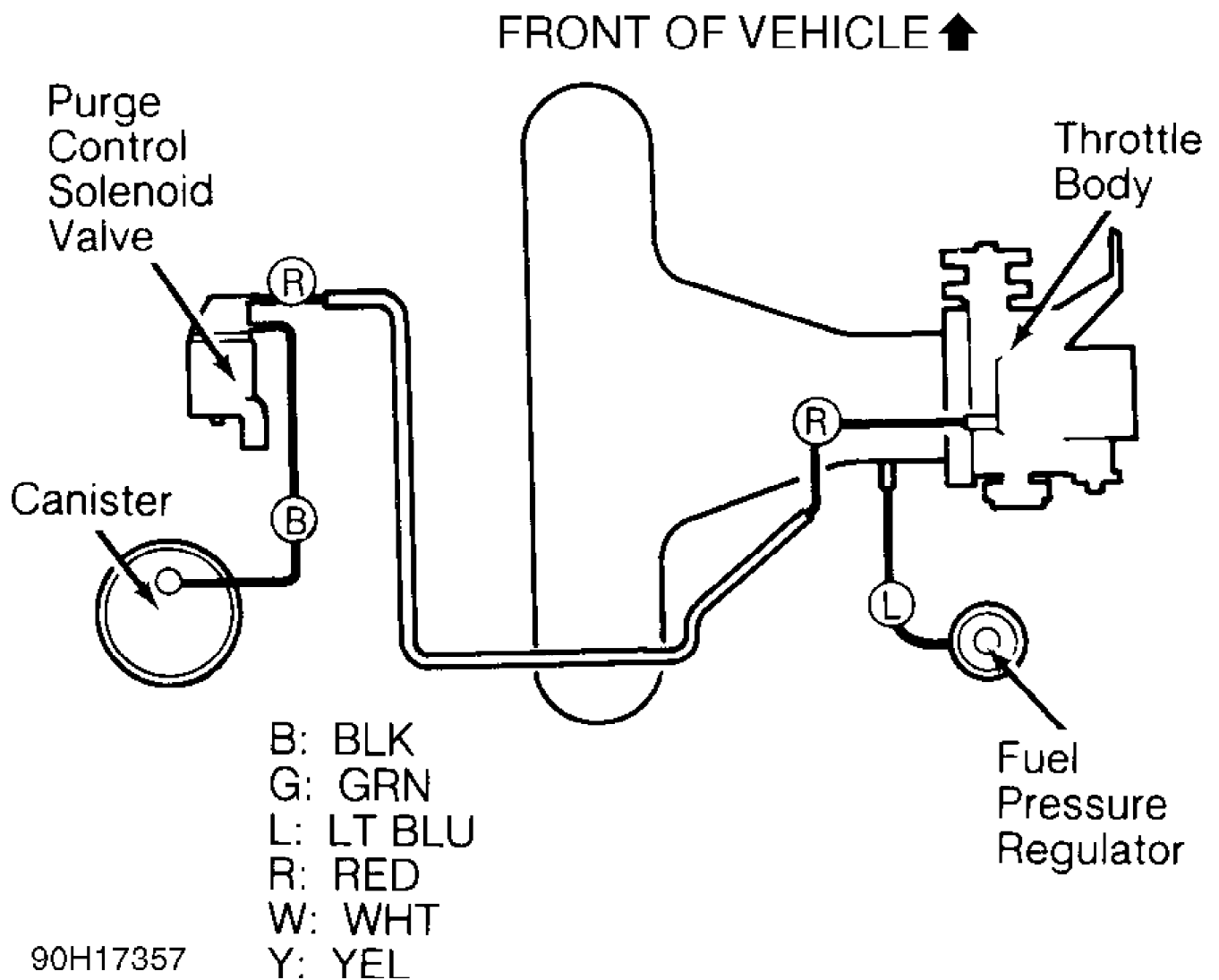


Fig. 2: Vacuum Diagram (Pickup 3.0L & Ram-50 3.0L Federal)
Courtesy of Mitsubishi Motor Sales of America.

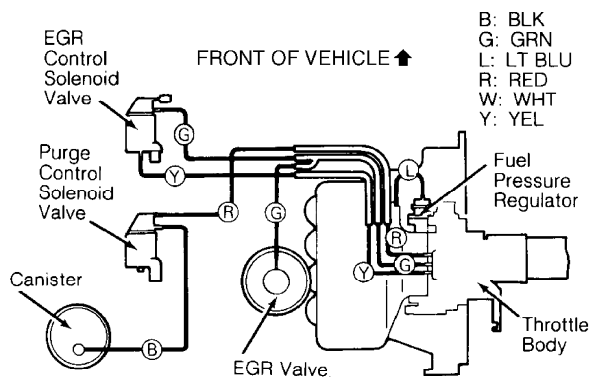


Fig. 3: Vacuum Diagram (Pickup 2.4L & Ram-50 2.4L Calif. & Federal)
Courtesy of Mitsubishi Motor Sales of America.

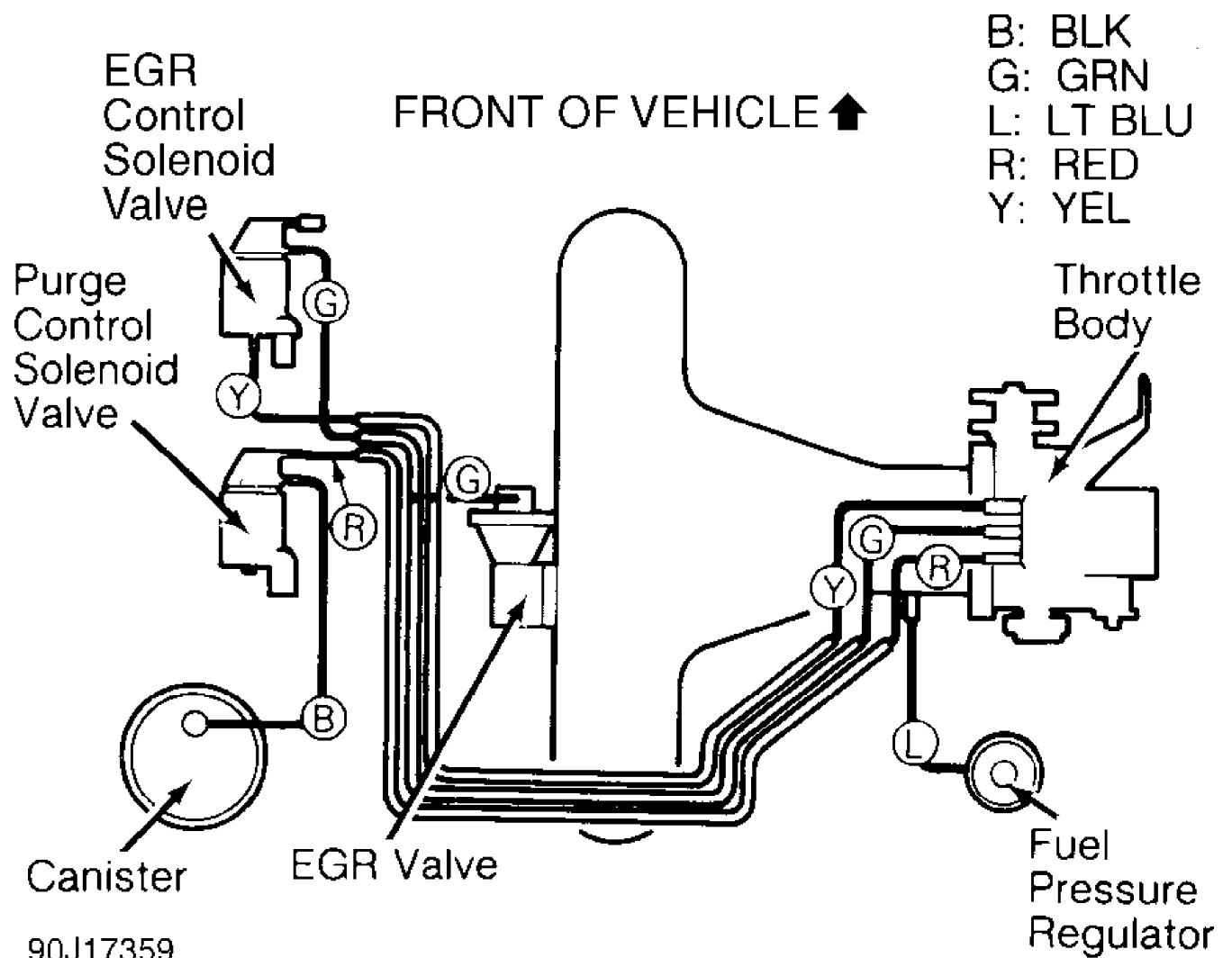


Fig. 4: Vacuum Diagram (Pickup 3.0L & Ram-50 3.0L California)
 Courtesy of Mitsubishi Motor Sales of America

WAVEFORMS - INJECTOR PATTERN TUTORIAL

1993 Mitsubishi Montero

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 understand

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 a 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.

VOLTAGE-CONTROLLED TYPE

CURRENT-CONTROLLED TYPE

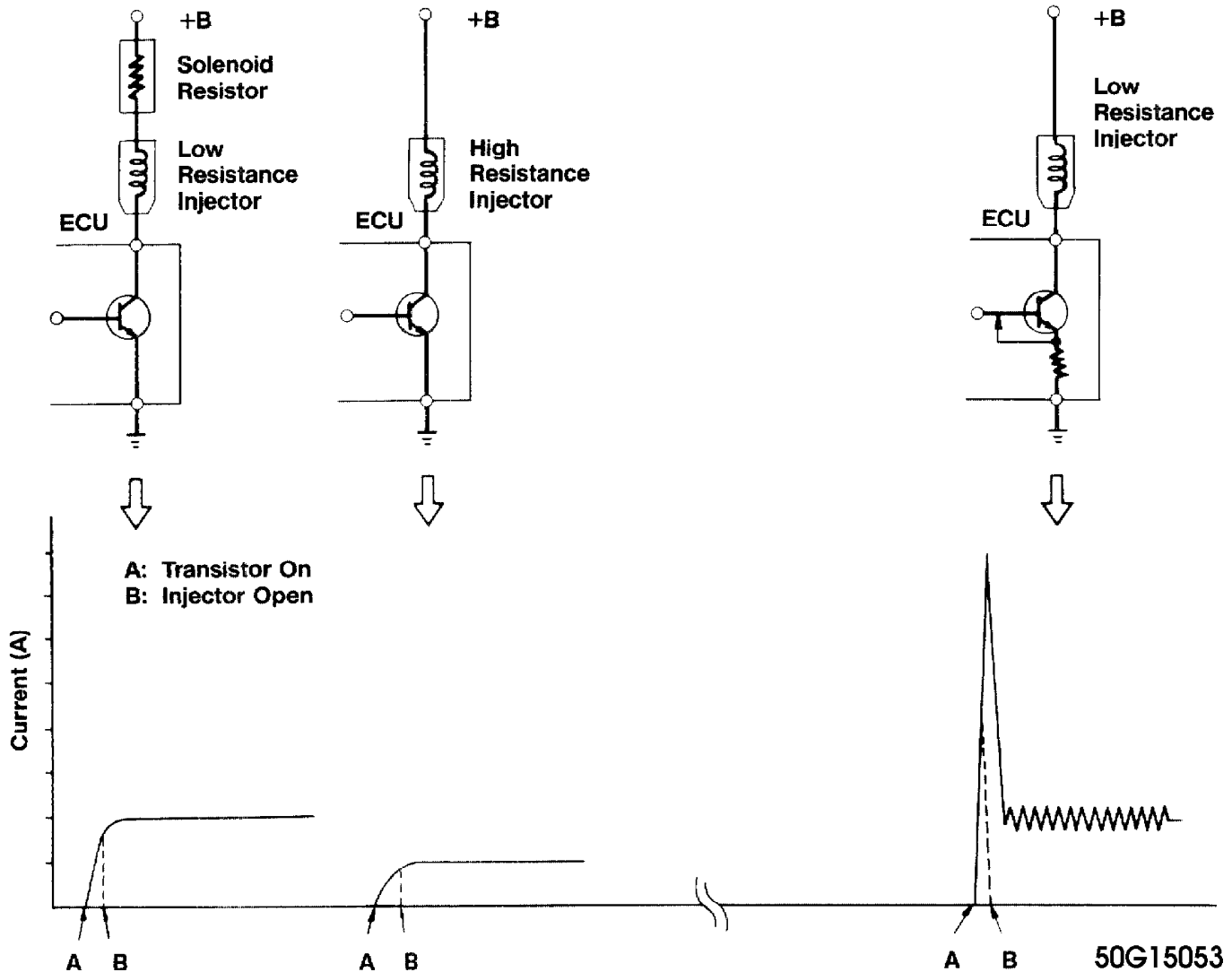


Fig. 1: Injector Driver Types - Current and Voltage

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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.

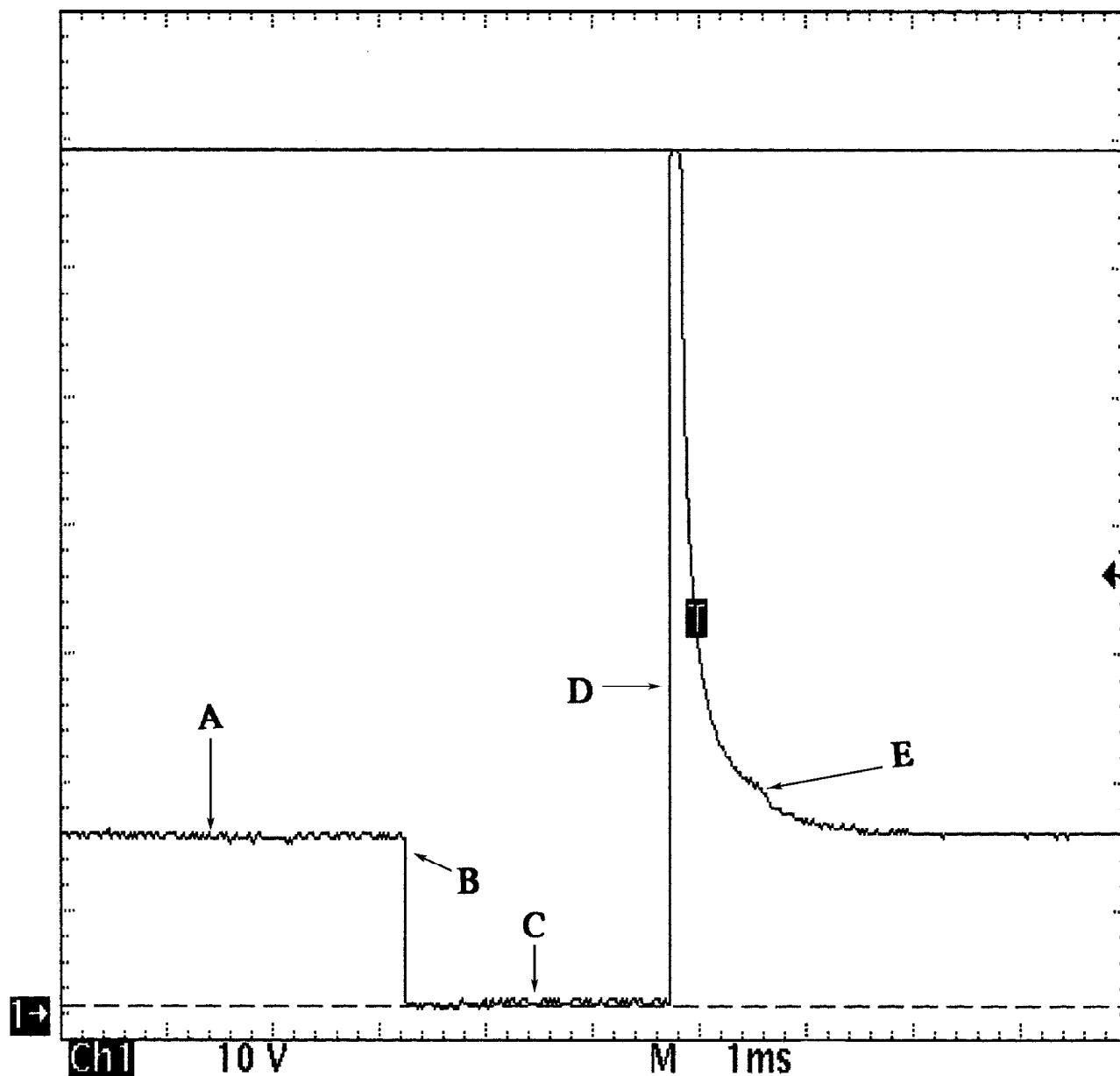
Point "E" brings us to a very interesting section. As you can see, the voltage dissipates back to supply value after the peak of the inductive kick. Notice the slight hump? This is actually the mechanical injector pintle closing. Recall that moving an iron core through a magnetic field will create a 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.



95B23862
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.

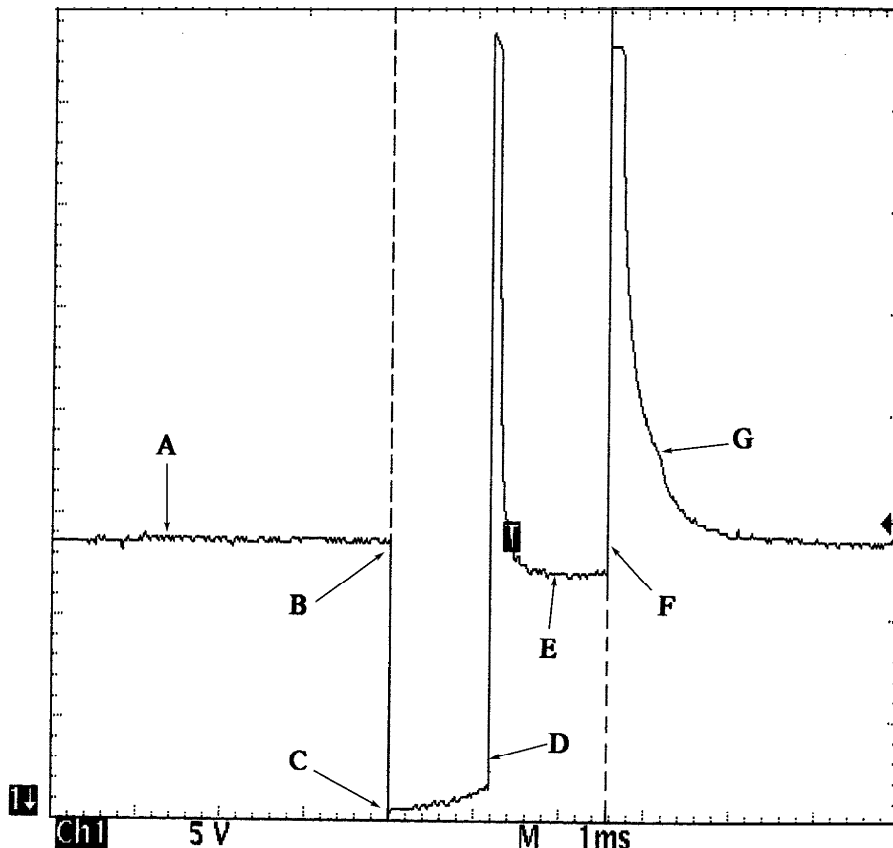


Fig. 3: Identifying Current Controlled Type Injector Pattern

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 millamp draw of the known-good injector. A subsequent check with a DVOM found 8.2 ohms, which is under the 12 ohm specification.

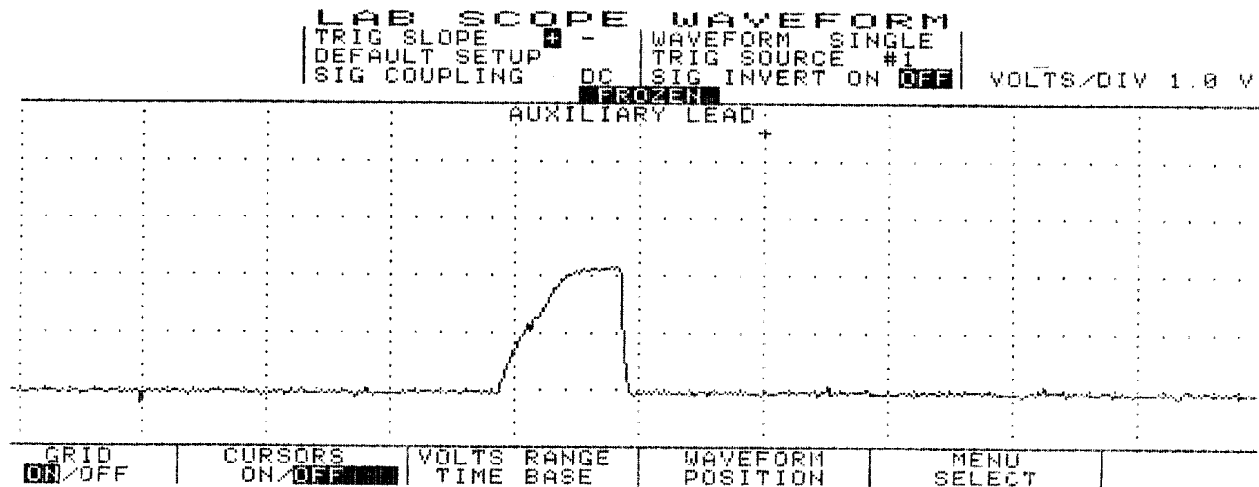
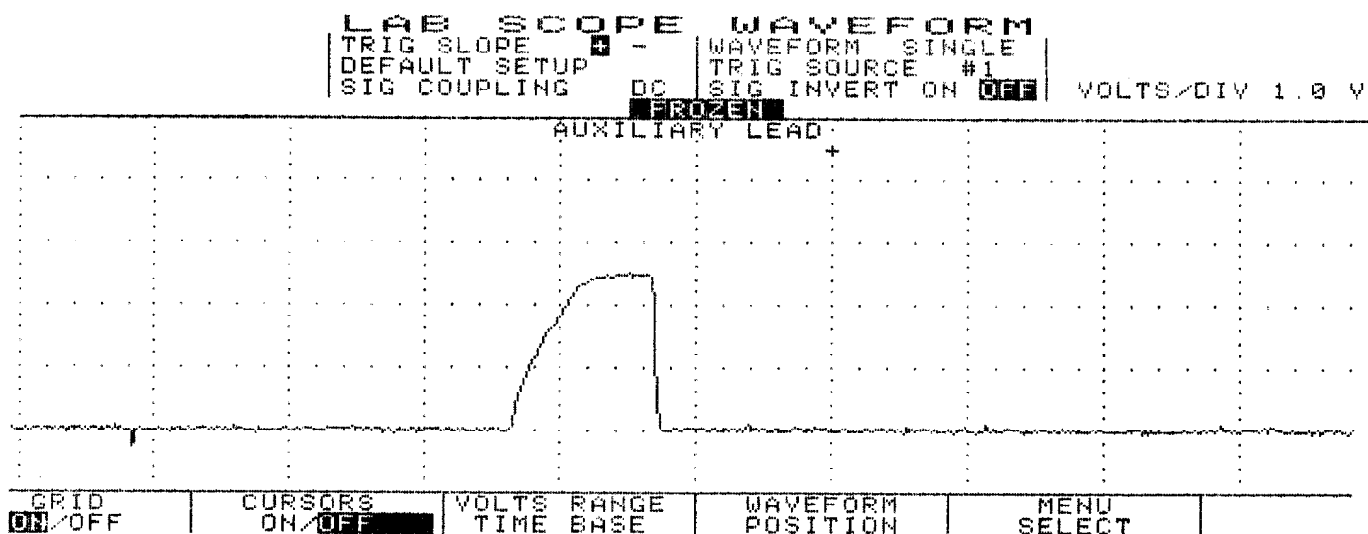
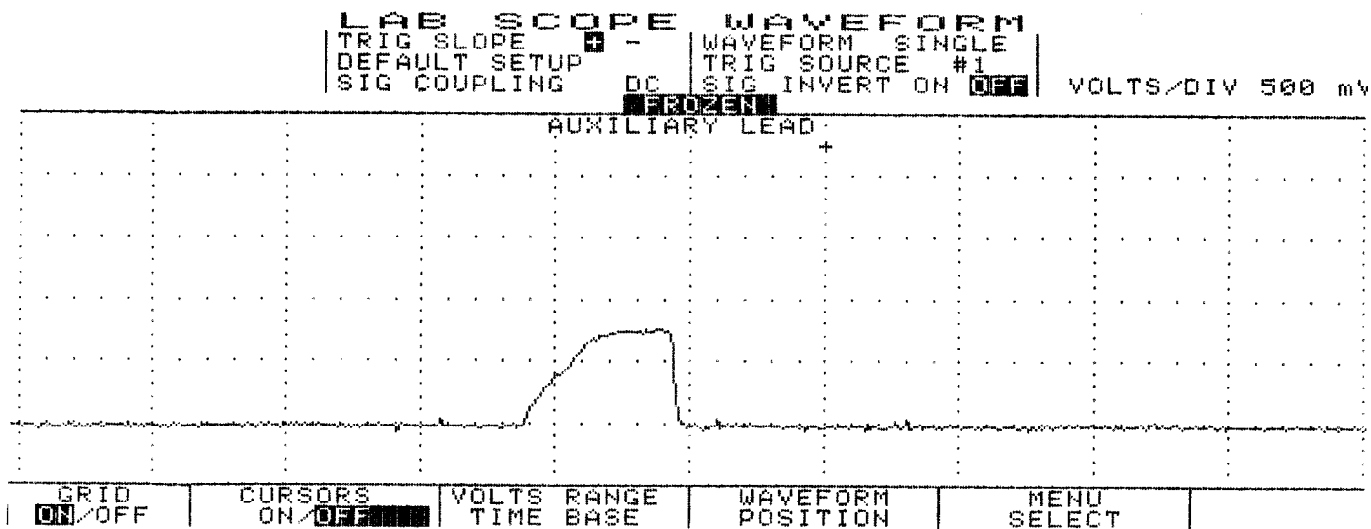


Fig. 4: Injector Bank w/Normal Current Flow - Current Pattern



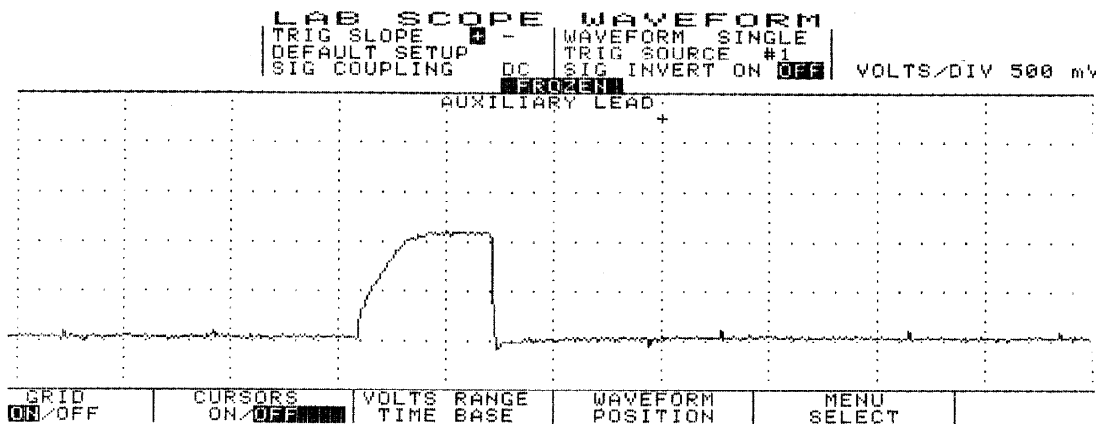
95E23865

Fig. 5: Injector Bank w/Excessive Current Flow - Current Pattern



95F23866

Fig. 6: Single Injector w/Normal Current Flow - Current Pattern



95G23867

Fig. 7: Single Injector w/Excessive Current Flow - Current Pattern

EXAMPLE #2 - VOLTAGE CONTROLLED DRIVER

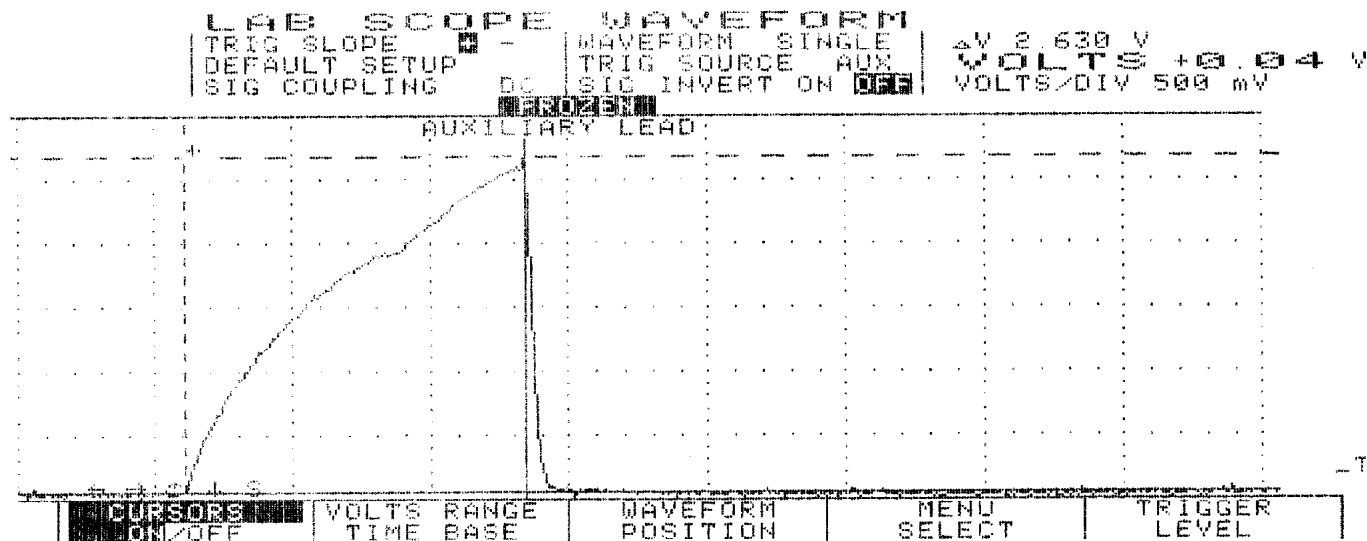
This time we will look at a GM 3.1L V6 VIN [T]. Fig. 8 shows the 1, 3, 5 (odd) injector bank with the current waveform indicating about a 2.6 amp draw at idle. This pattern, taken from a known good vehicle, correctly stays at or below the maximum 2.6 amps current range. Ideally, the current for each 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.

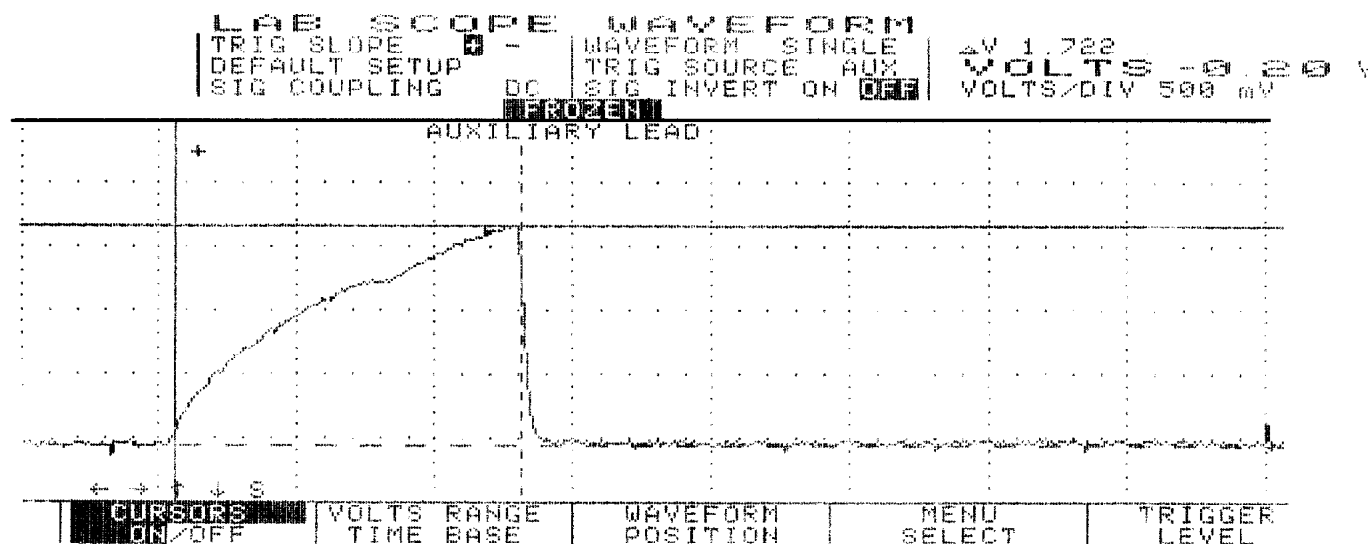
Now we are going to take a look at the even bank of injectors; injectors 2, 4, and 6. See Fig. 9. Notice this bank peaked at 1.7 amps at idle as compared to the 2.6 amps peak of the odd bank (Fig. 8). Current flow between even and odd injectors banks is not uniform, yet it is not causing a driveability 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.



95E23873

Fig. 8: Injector Odd Bank w/Normal Current Flow - Current Pattern



95F23874

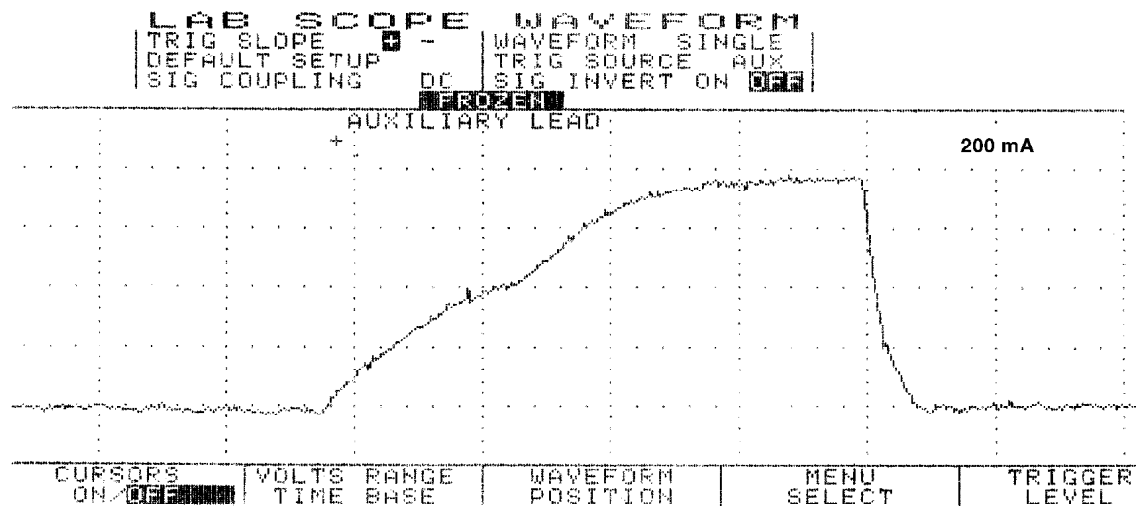
Fig. 9: Injector Even Bank w/Normal Current Flow - Current Pattern

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.

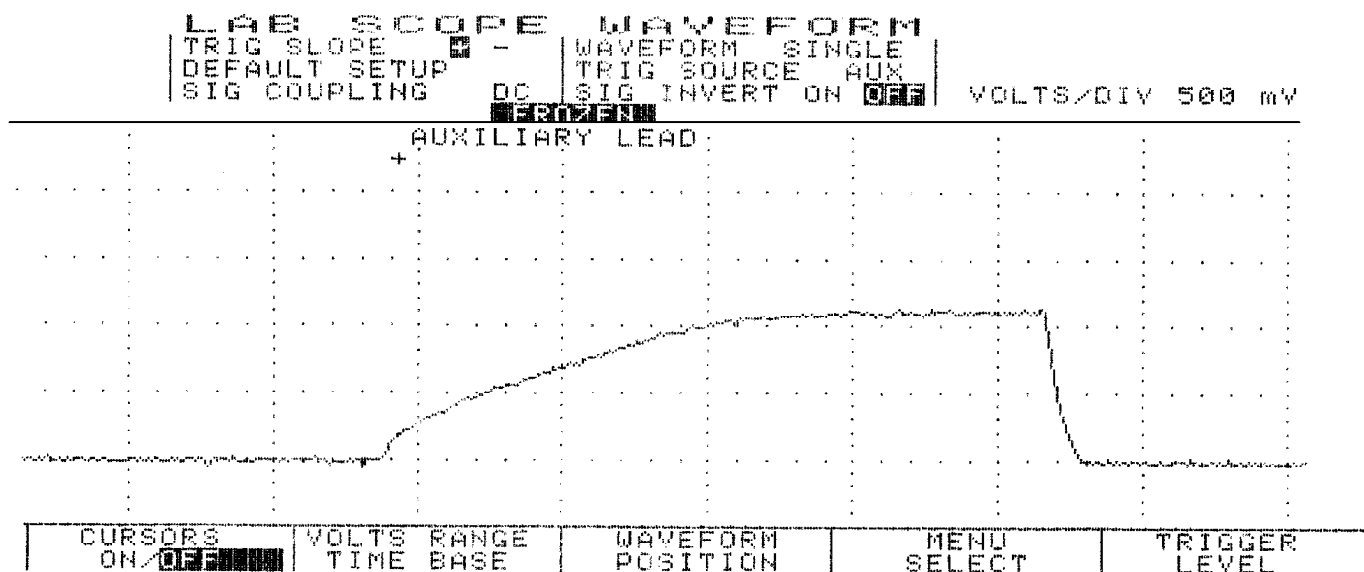
The next waveform pattern in Fig. 11 shows an abnormality with another injector. With the Lab Scope set on 500 milliamps per division, you can see that the current waveform indicates a 1200 milliamp draw. This is a faulty injector.

Abnormally low resistance injectors create excessive current draw, causing rough idle, and possible computer driver damage.



95G23875

Fig. 10: Single Injector w/Normal Current Flow - Current Pattern

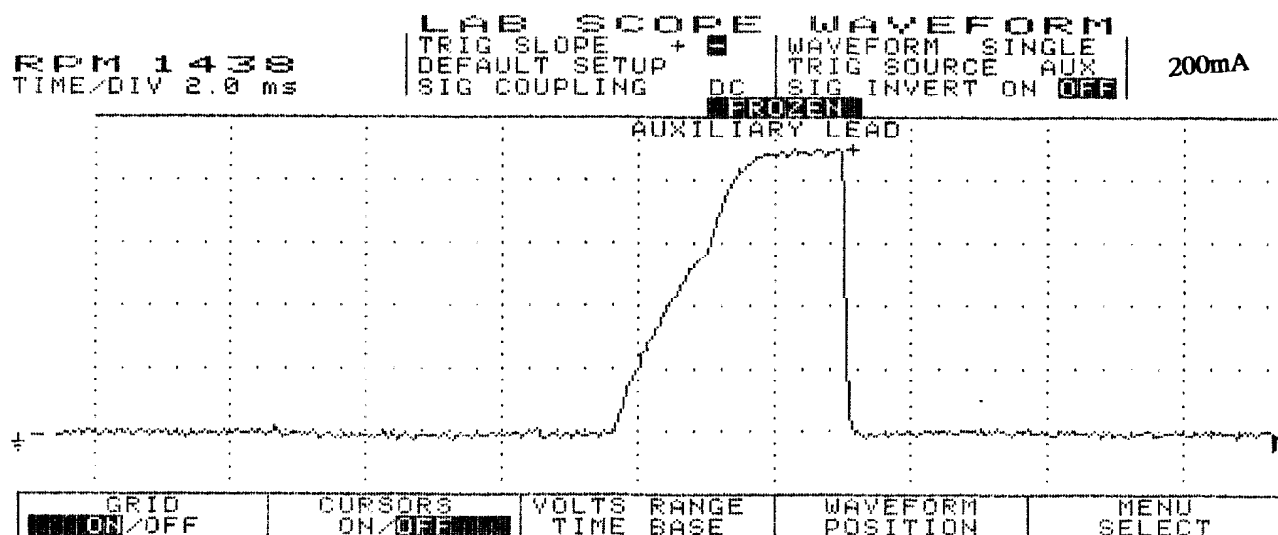


95H23876
Fig. 11: Single Injector w/Excessive Current Flow - Current Pattern

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.

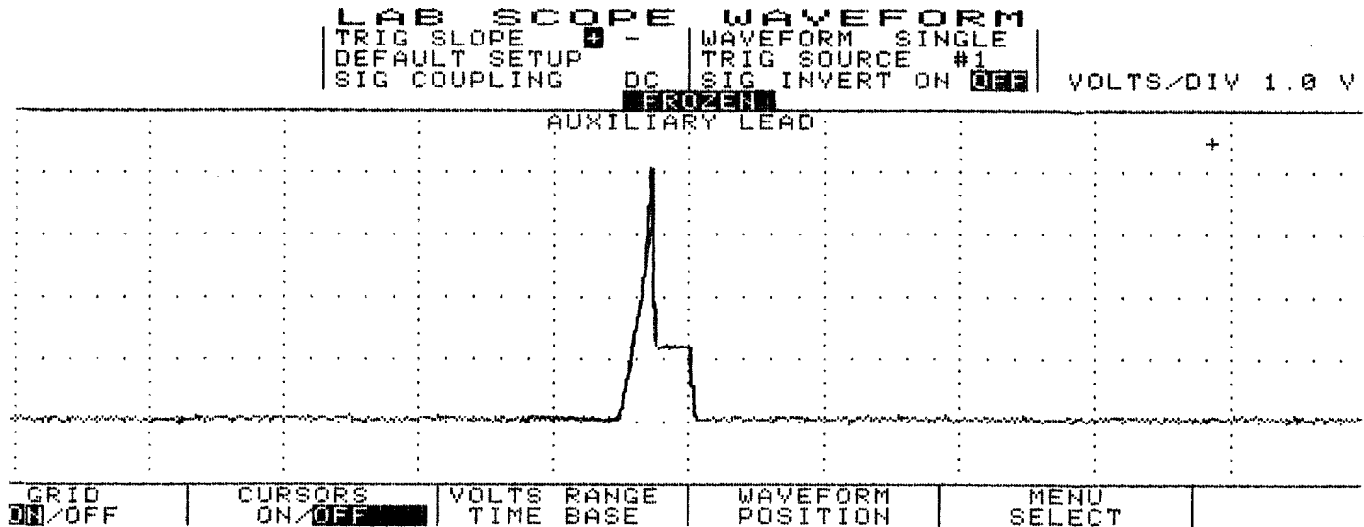


95D23872
Fig. 12: Single Injector w/Normal Current Flow - Current Pattern

EXAMPLE #5 - CURRENT CONTROLLED DRIVER

The known-good waveform in Fig. 13 is from a Chrysler 3.0L V6

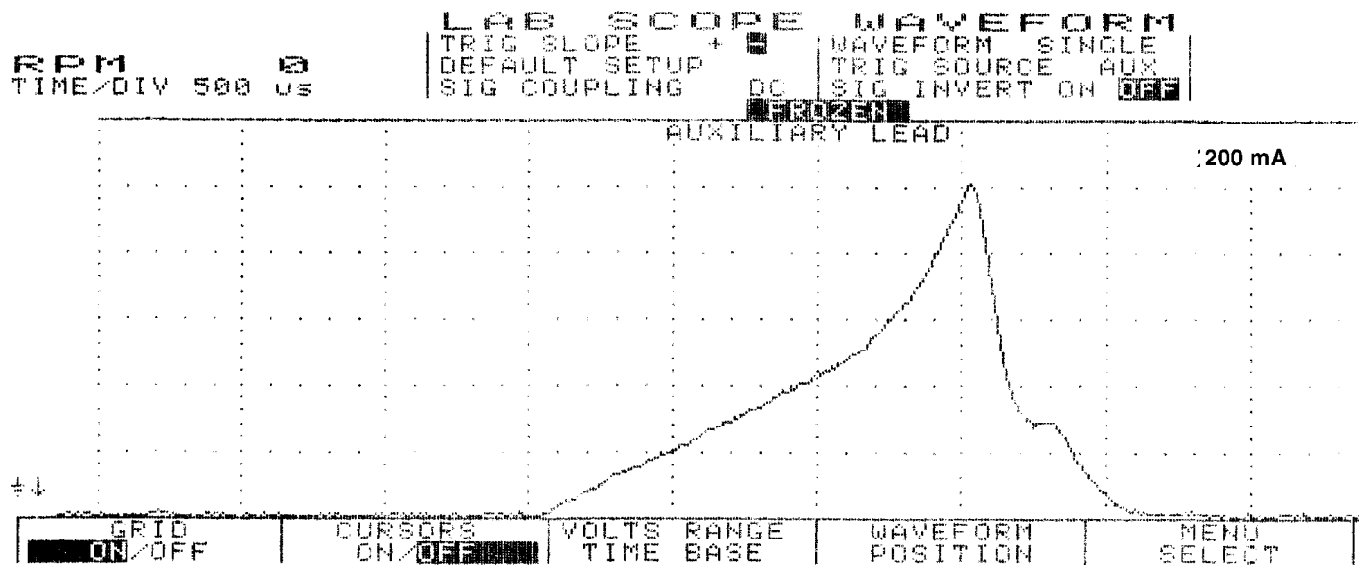
PFI VIN [3]. It is a perfect example of the peak and hold theory. The waveform shows a 1-amp per division current flow, ramping to 4 amps and then decreasing to 1-amp to hold the injector open.



95H23868
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.

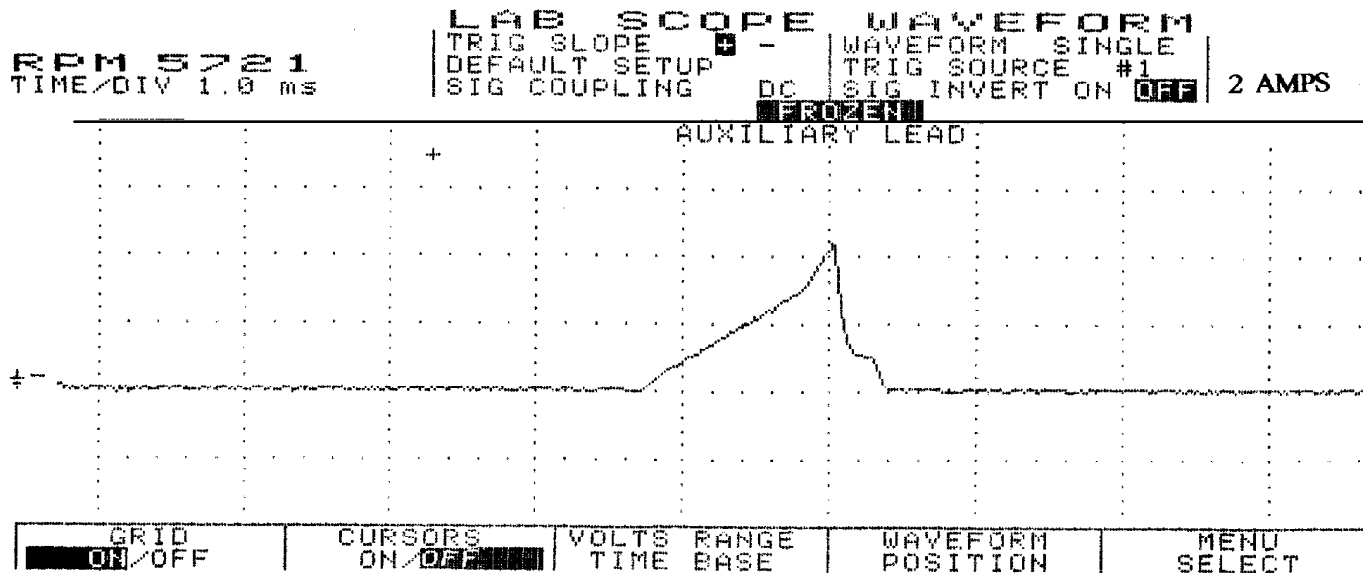


95I23869
Fig. 14: Single Injector w/Normal Current Flow - Current Pattern

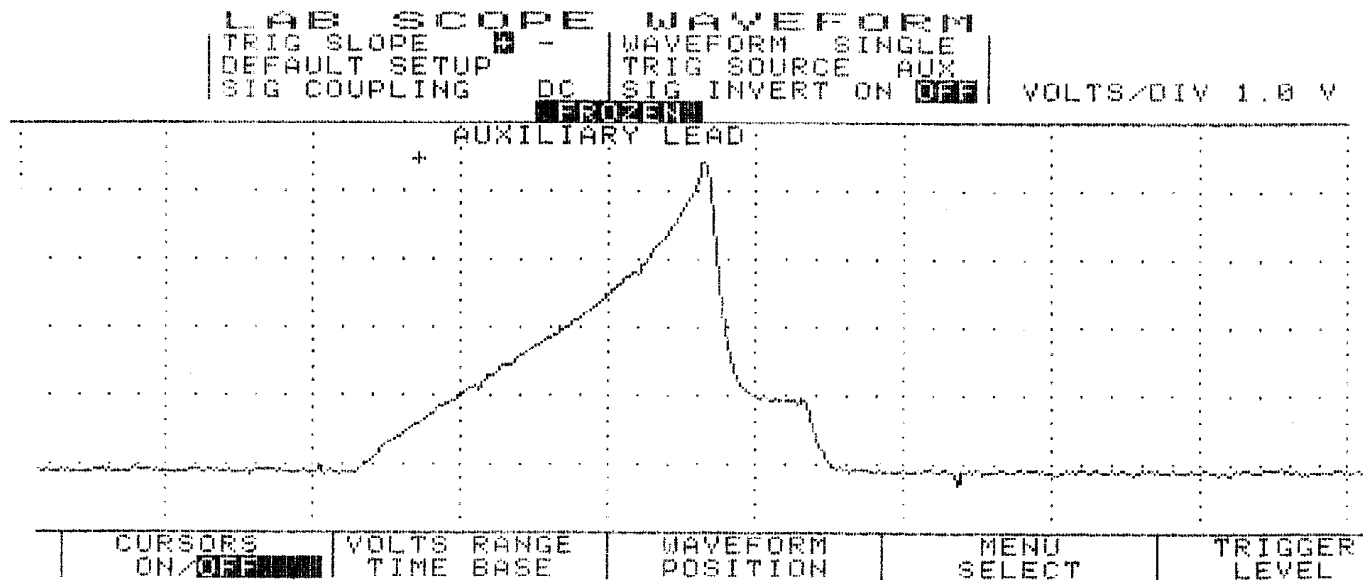
EXAMPLE #7 - CURRENT CONTROLLED DRIVER

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.



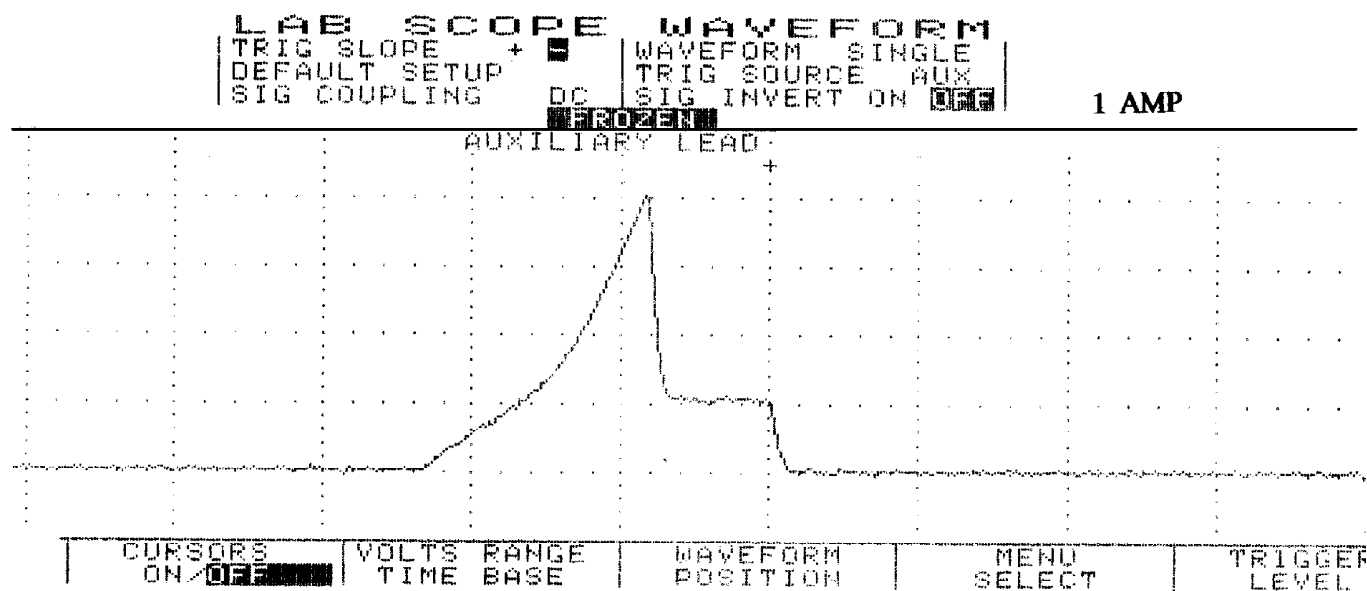
95C23871
Fig. 15: Single Injector w/Normal Current Flow - Current Pattern



95I23877
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.



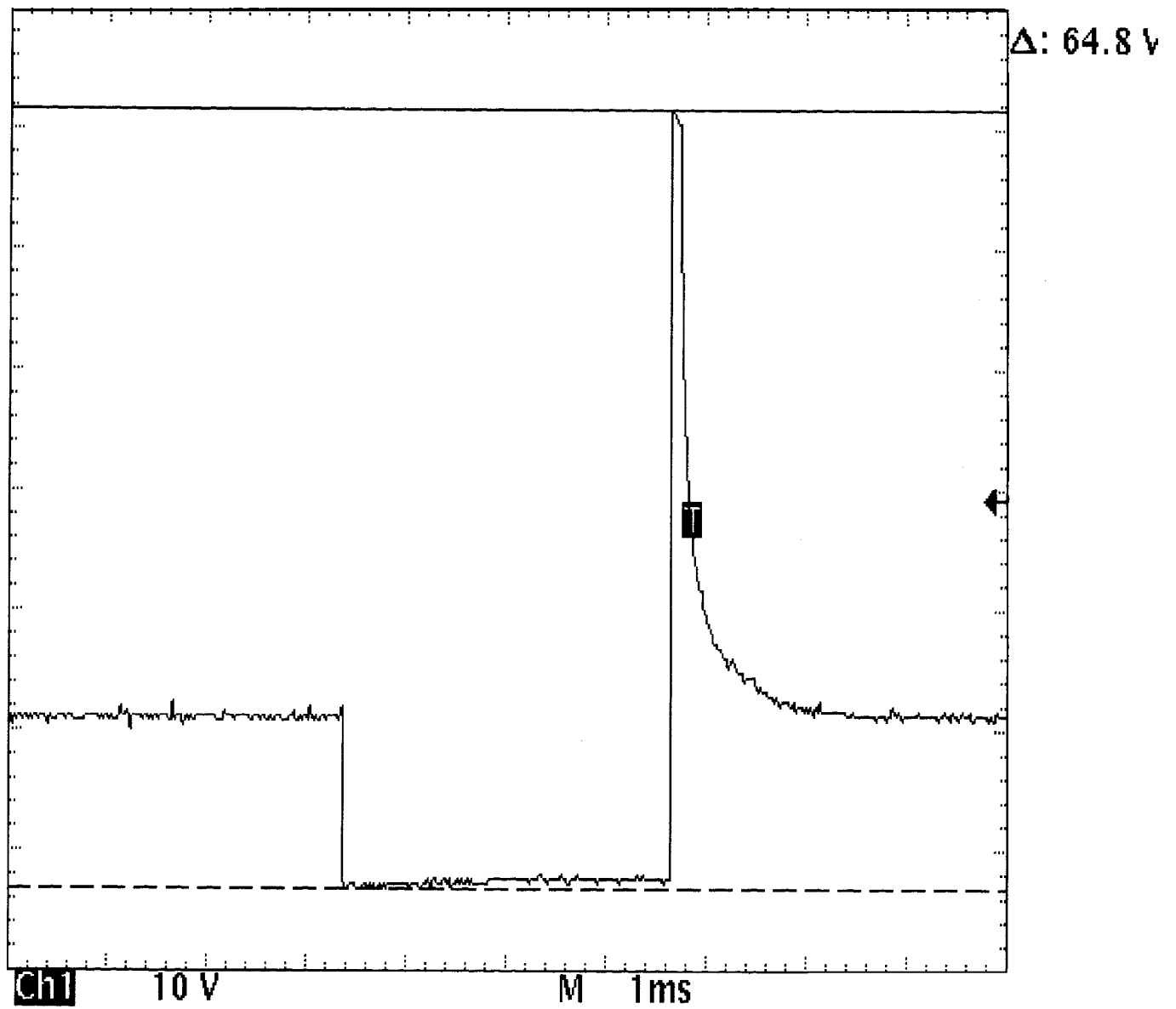
95B23870

Fig. 17: Single Injector w/Normal Current Flow - Current Pattern

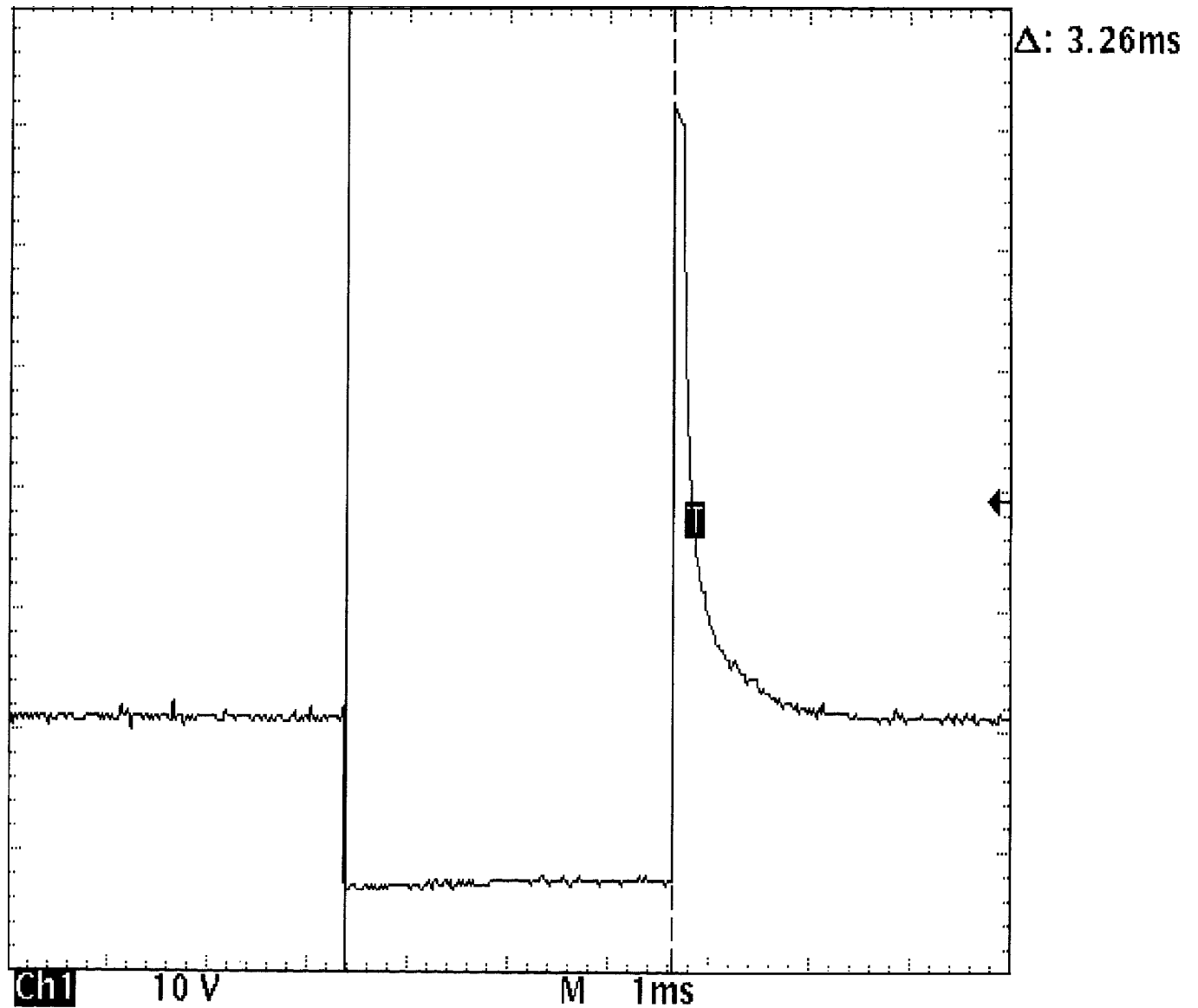
VOLTAGE WAVEFORM SAMPLES

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.



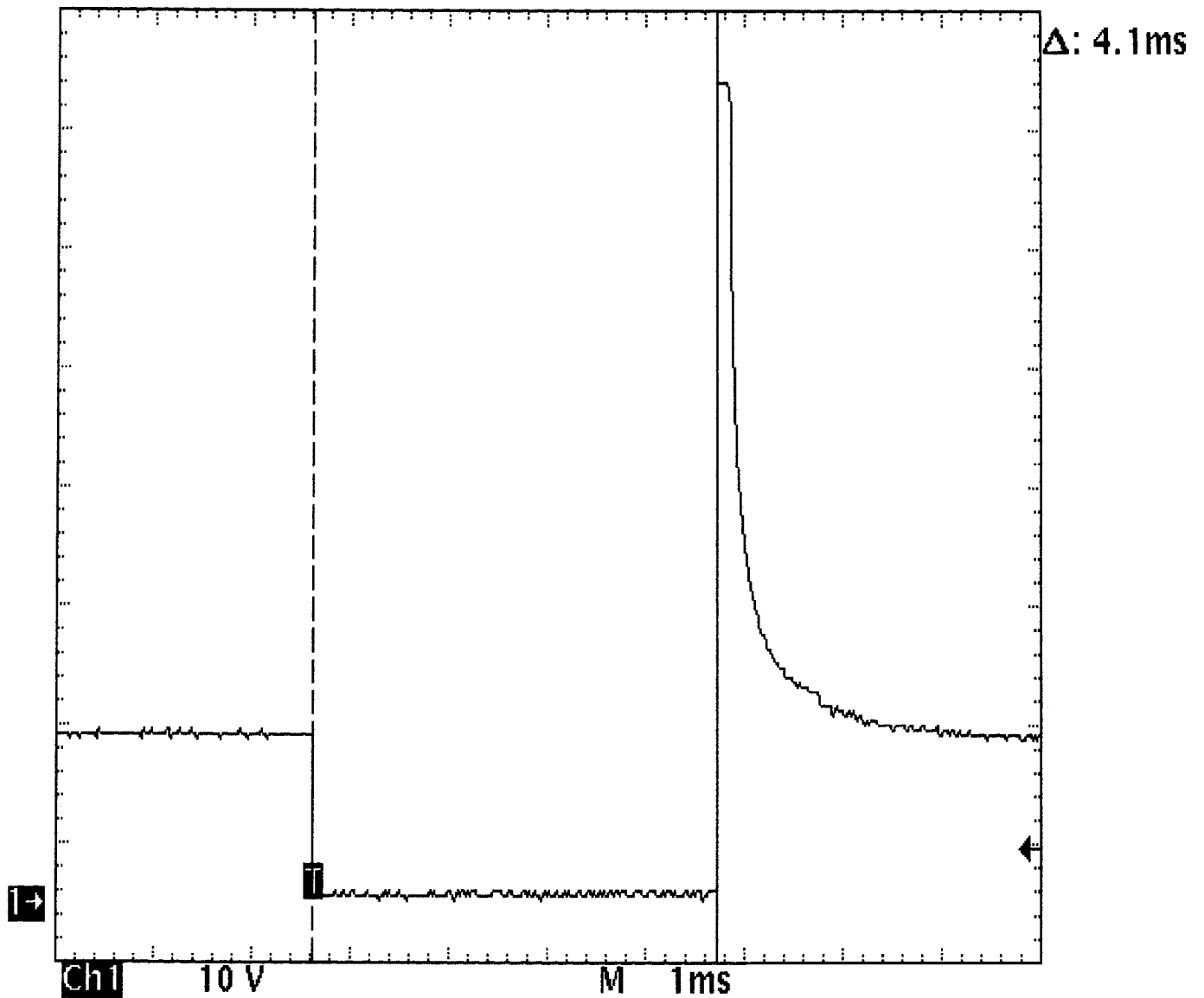
95E23857
Fig. 18: Injector Bank - Known Good - Voltage Pattern



95F23858
Fig. 19: Injector Bank - Known Good - Voltage Pattern

EXAMPLE #2 - VOLTAGE CONTROLLED DRIVER

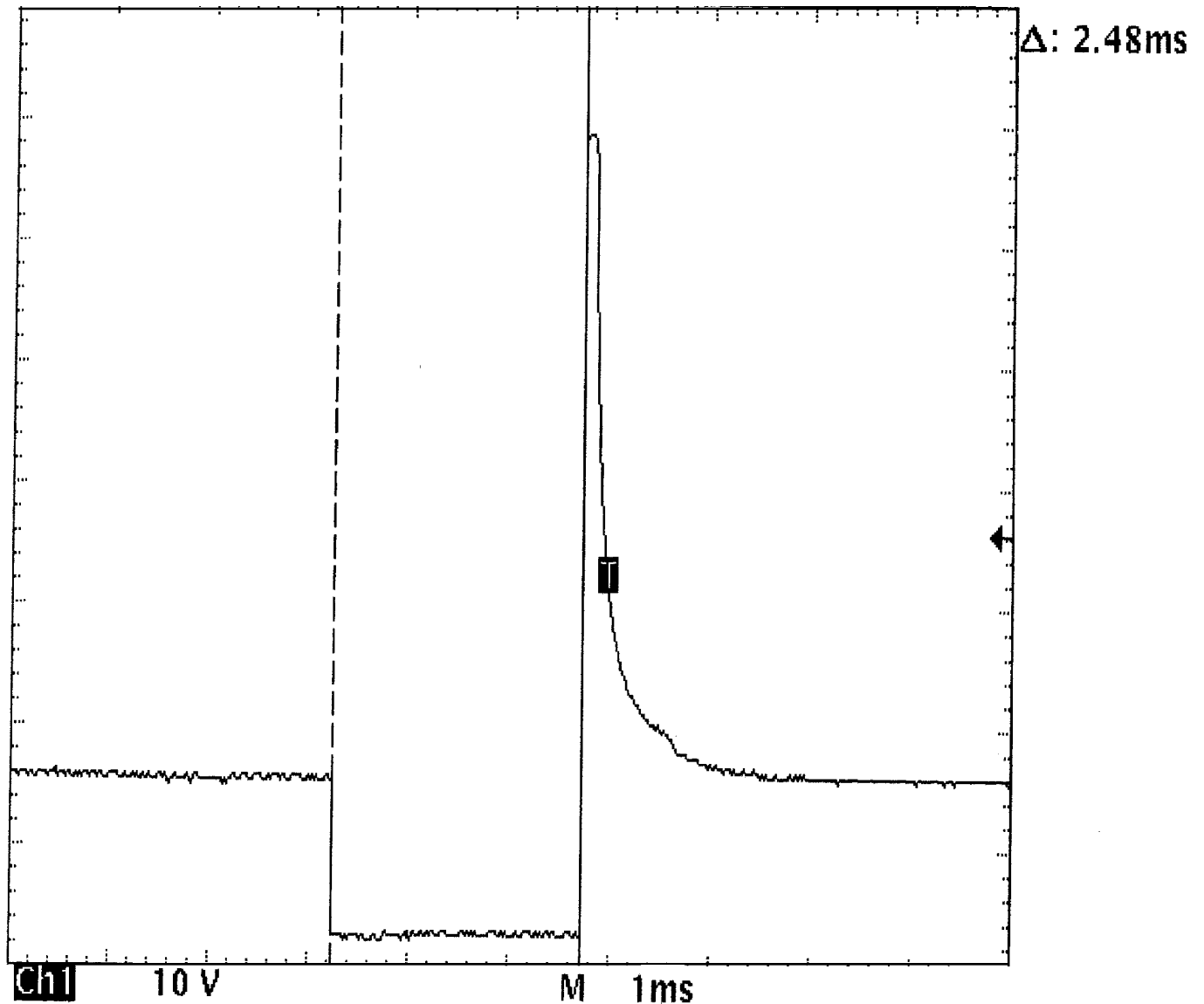
The known-good waveform pattern in Fig. 20 is from a GM 3.8L V6 PFI VIN [3]. It was taken during hot idle, closed loop and no load.



95123851
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.

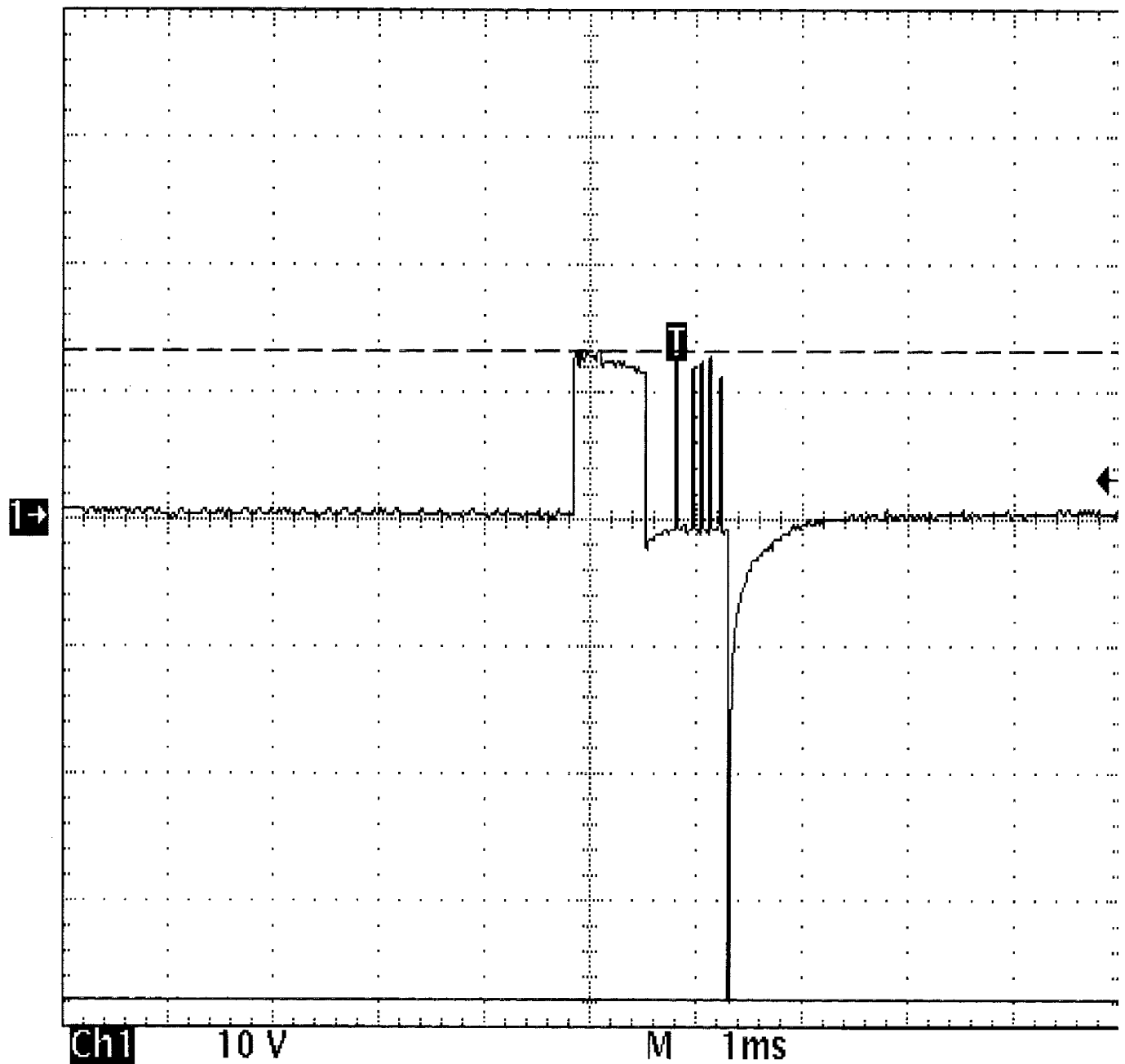


95G23859
Fig. 21: Injector Bank - Known Good - Voltage Pattern

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.



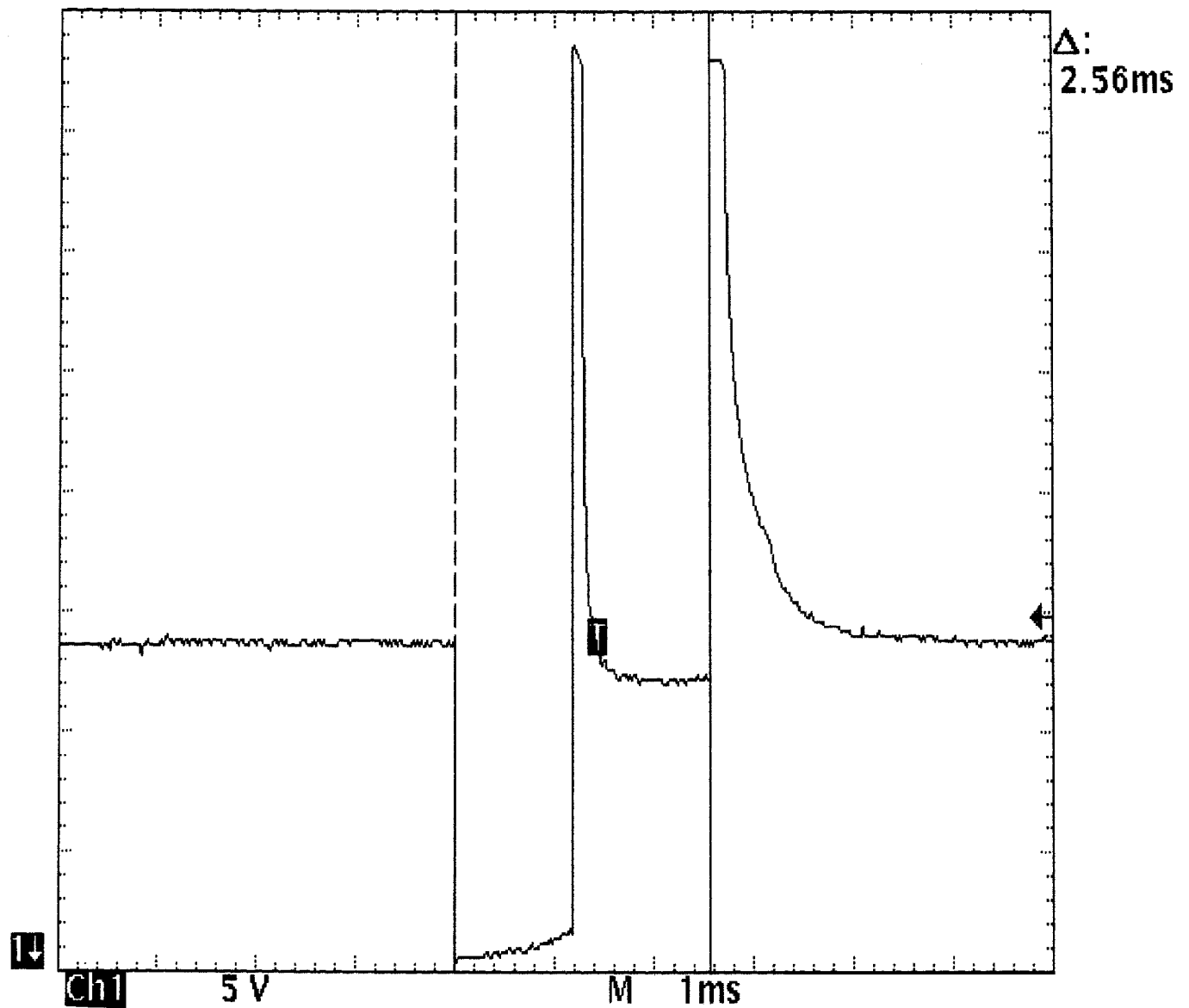
95J23860
Fig. 22: Single Injector - Known Good - Voltage Pattern

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.



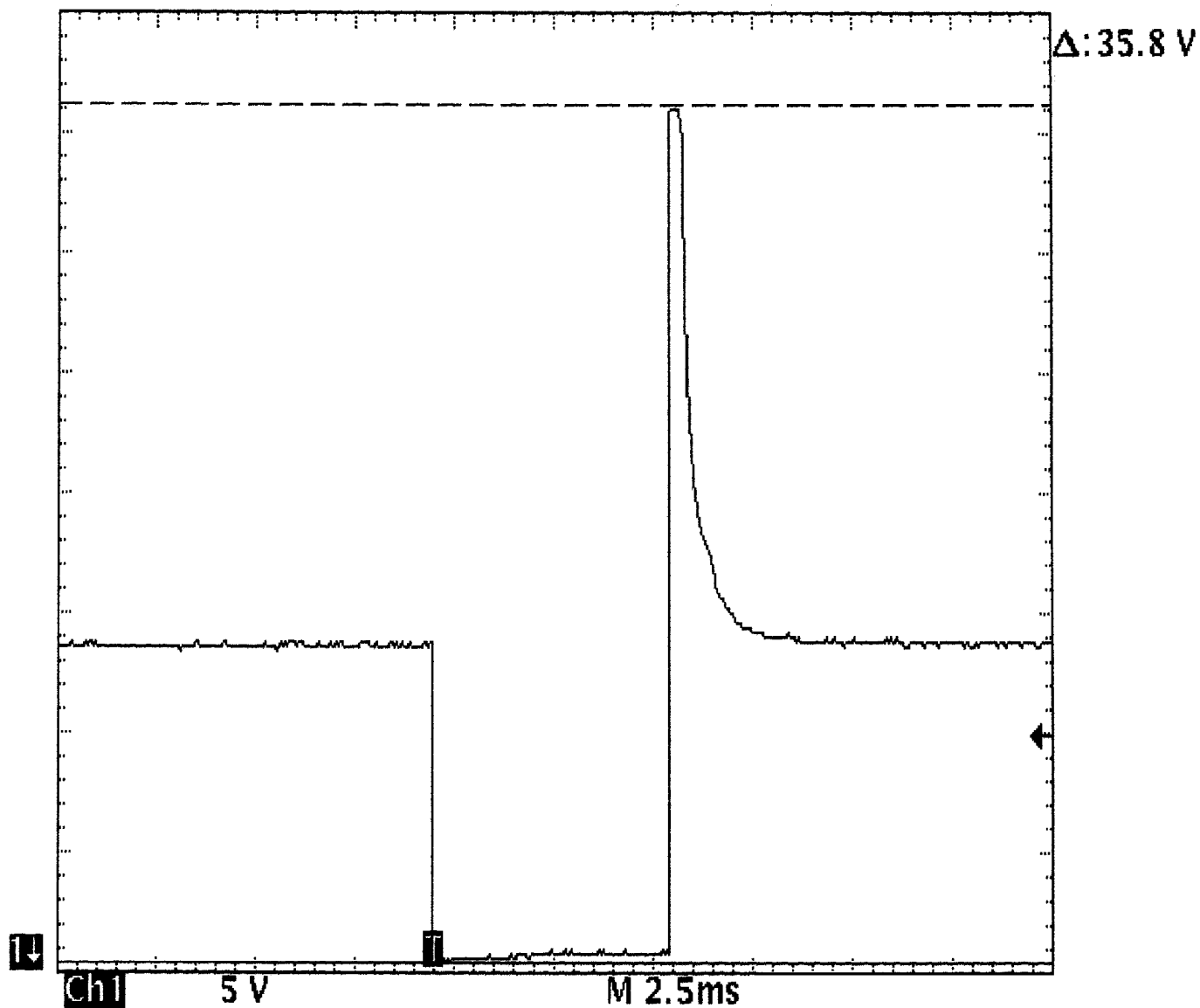
95A23861
Fig. 23: Injector Bank - Known Good - Voltage Pattern



95B23854
Fig. 24: Injector Bank - Known Good - Voltage Pattern

EXAMPLE #6 - CURRENT CONTROLLED DRIVER

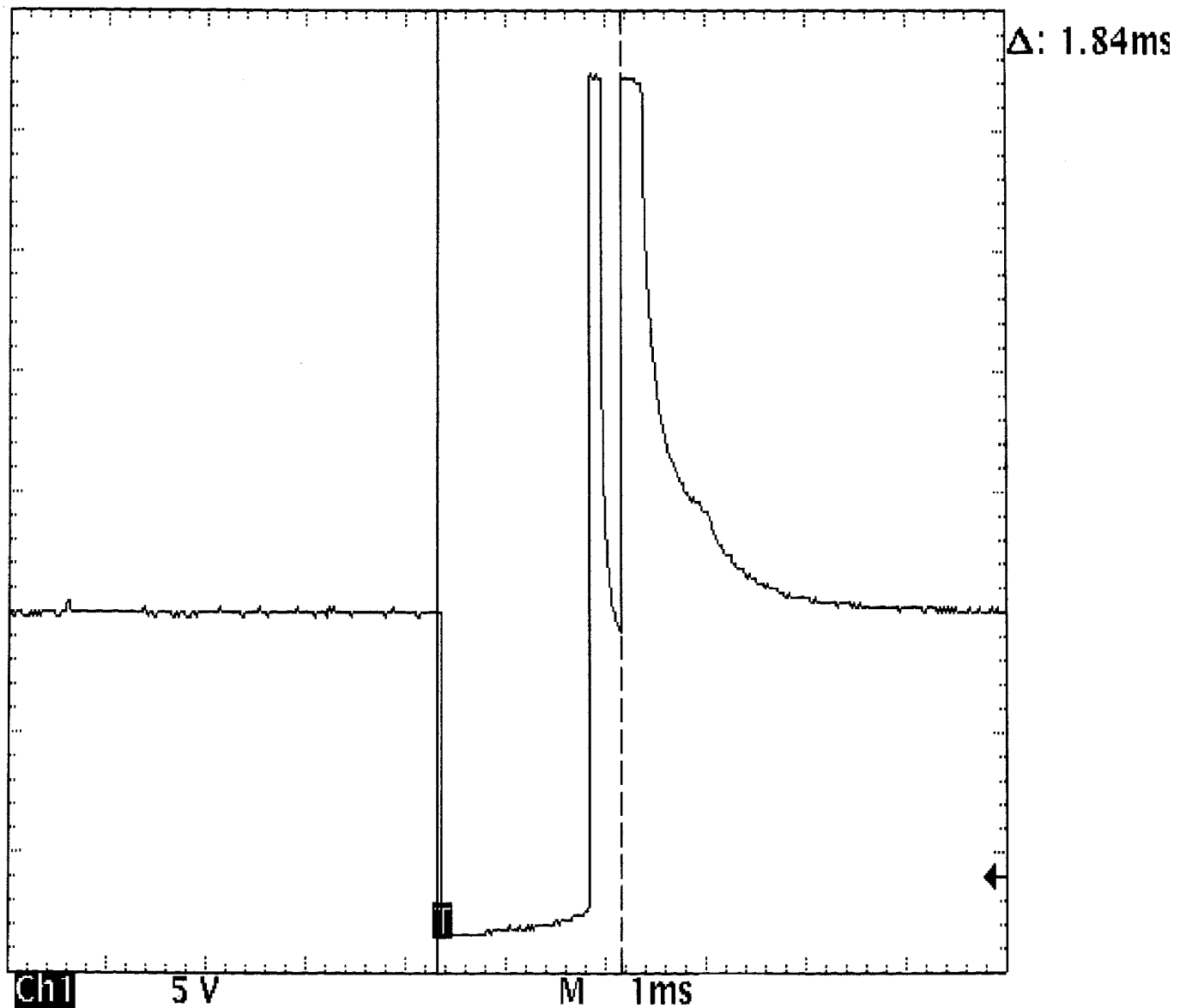
This known-good pattern from a Ford 3.0L V6 PFI VIN [U] illustrates that a zener diode inside the computer is used to clamp the injector's inductive kick to 35-volts on this system. See Fig. 25.



95J23852
Fig. 25: Injector Bank - Known Good - Voltage Pattern

EXAMPLE #7 - CURRENT CONTROLLED DRIVER

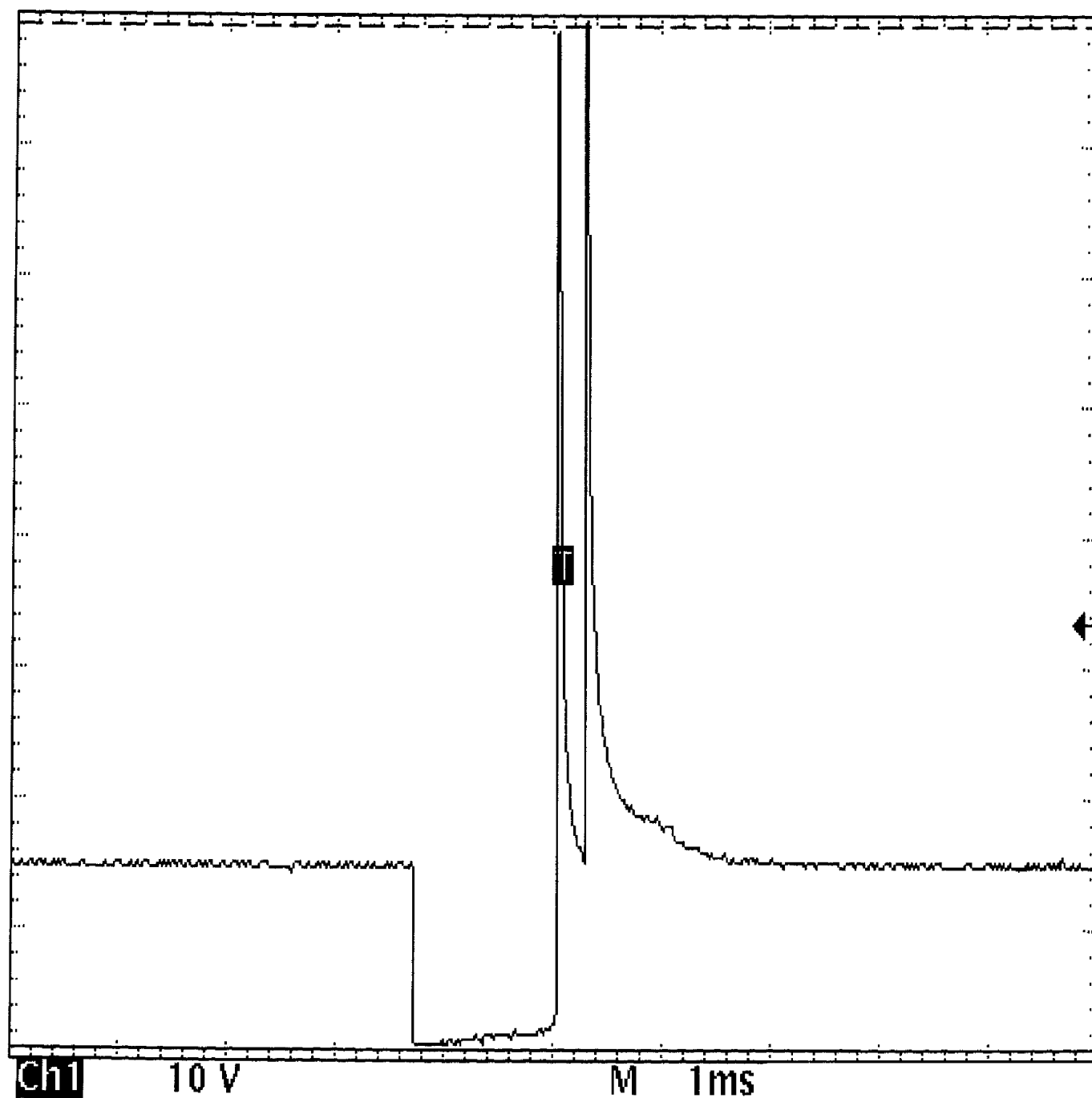
This known-good waveform from a Ford 5.0L V8 CFI VIN [F] was taken during hot idle, closed loop, and no load. See Fig. 26.



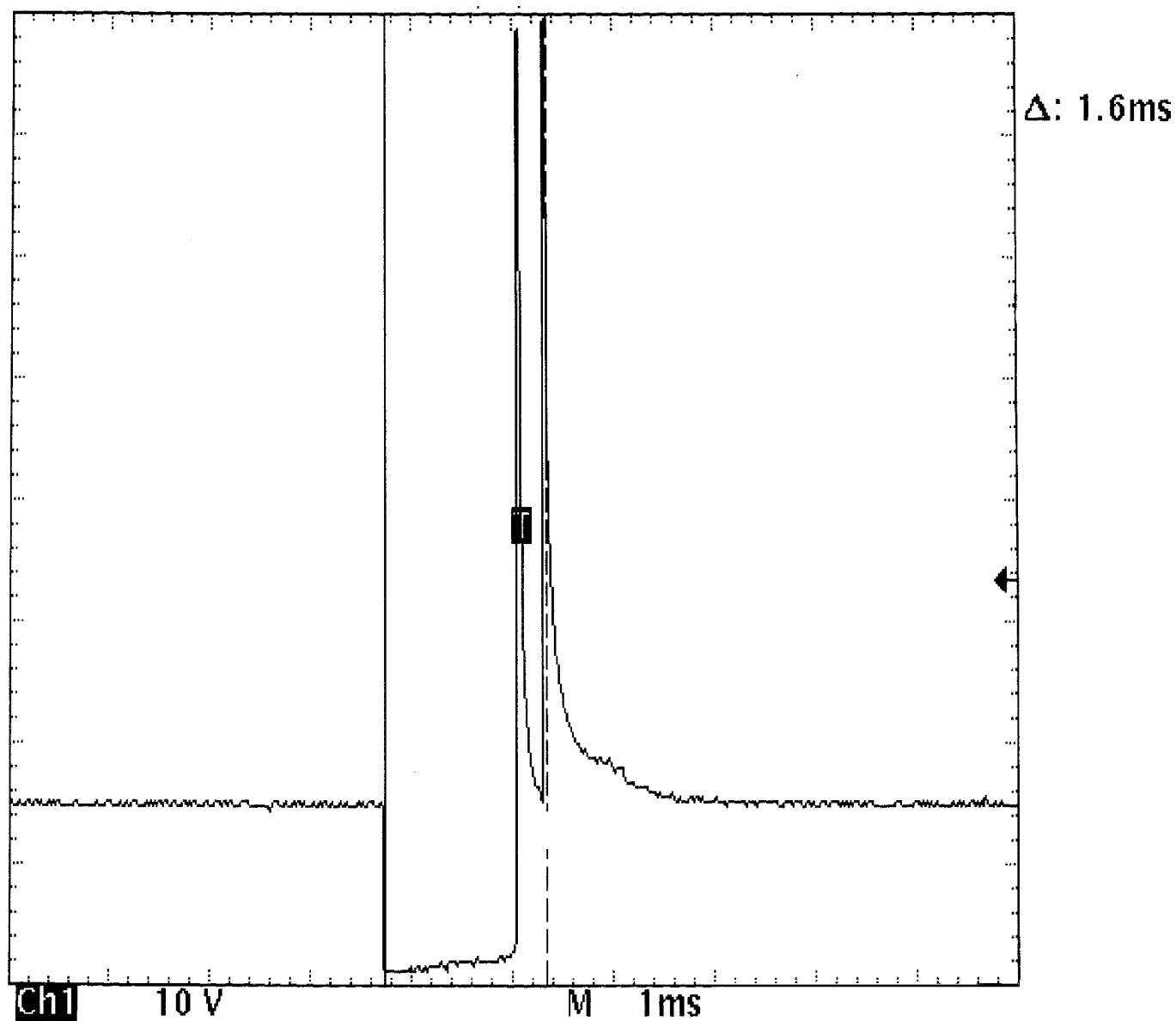
95D23856
Fig. 26: Single Injector - Known Good - Voltage Pattern

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 SPECIFICATIONS & PROCEDURES

1993 Mitsubishi Montero

1993 WHEEL ALIGNMENT
Mitsubishi - Specifications & Procedures

Montero

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 section.

WHEEL ALIGNMENT PROCEDURES

CAMBER ADJUSTMENT

1) Check camber. See appropriate WHEEL ALIGNMENT SPECIFICATIONS table. 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 .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 camber by increasing or decreasing shims between upper arm shaft and crossmember. See Fig. 1.

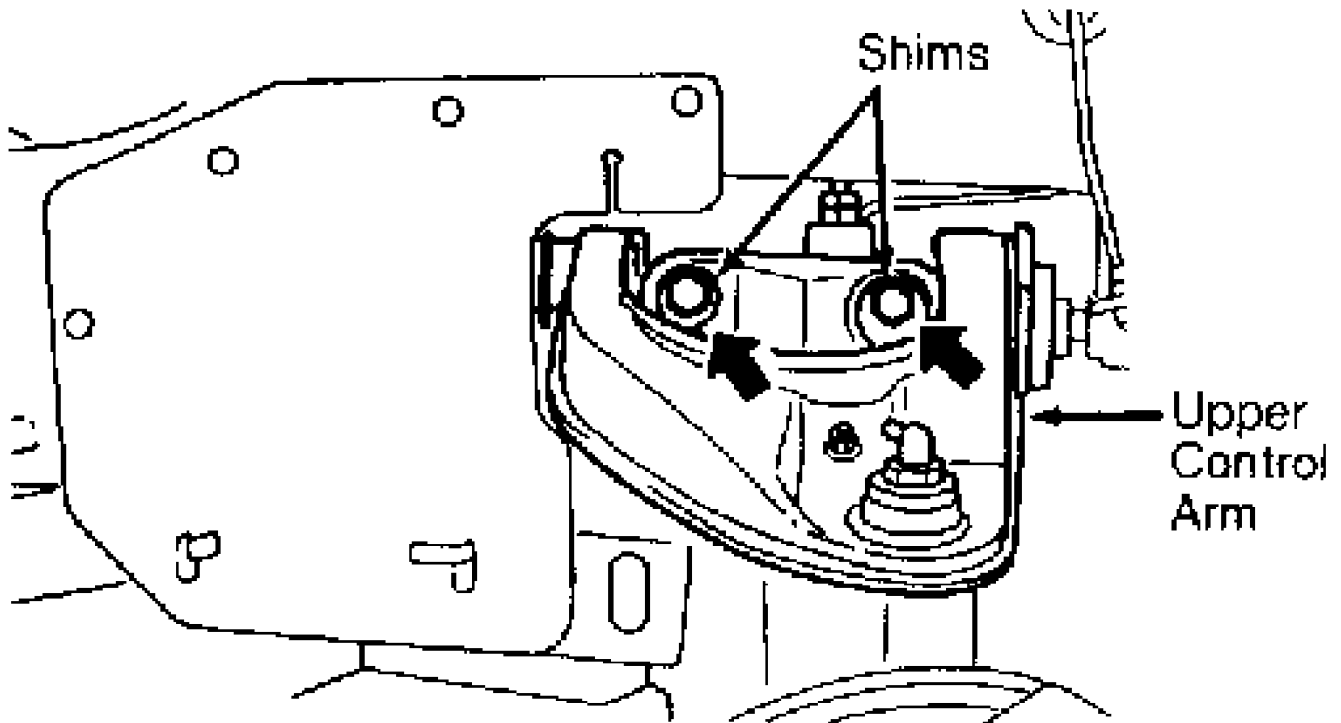


Fig. 1: Adjusting Camber & Caster (Typical)
Courtesy of Mitsubishi Motor Sales of America.

CASTER ADJUSTMENT

Check caster. See appropriate WHEEL ALIGNMENT SPECIFICATIONS table. If caster is not within specification, replace damaged or bent parts.

TOE-IN ADJUSTMENT

Front

Check front toe-in. See appropriate WHEEL ALIGNMENT SPECIFICATIONS table. 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

Check rear toe-in. See appropriate WHEEL ALIGNMENT SPECIFICATIONS table. If rear toe-in is not within specification, replace damaged or bent parts.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS TABLE

Application	Ft. Lbs. (N.m)
Shock Absorber-To-Crossmember Nut	10-13 (14-18)
Shock Absorber-To-Lower Arm Bolt	11-16 (15-22)
Upper Arm Shaft To Crossmember	72-87 (98-118)
Wheel Lug Nut	72-87 (98-118)

WHEEL ALIGNMENT SPECIFICATIONS

WHEEL ALIGNMENT SPECIFICATIONS TABLE

Application	Preferred	Range
Camber (1)		
Front	0.67	0.17 To 1.17
Rear	0	.....
Caster (1)	3	2 To 4
Toe-In (1)		
Front	0.28	0 To 0.56
Rear	0	.....
Toe-In (2)		
Front	0.14 (3.5)	0 To 0.28 (0 To 7)
Rear	0	.....
Toe-Out On Turns (1)		
Inner	21.93	.....
Outer	20	.....

(1) - Measurement in degrees.

(2) - Measurement in inches (mm).

WHEEL ALIGNMENT THEORY/OPERATION

1993 Mitsubishi Montero

GENERAL INFORMATION

Wheel Alignment Theory & Operation

ALL MODELS

* PLEASE READ THIS FIRST *

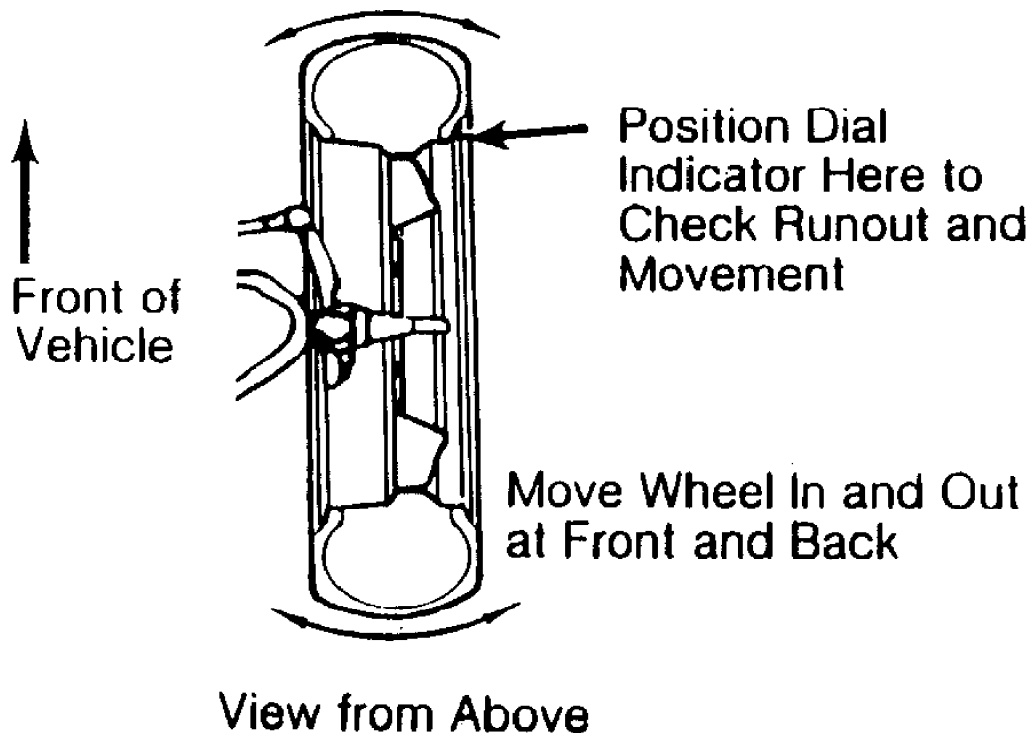
NOTE: This article is intended for general information purposes only. This information may not apply to all makes and models.

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.



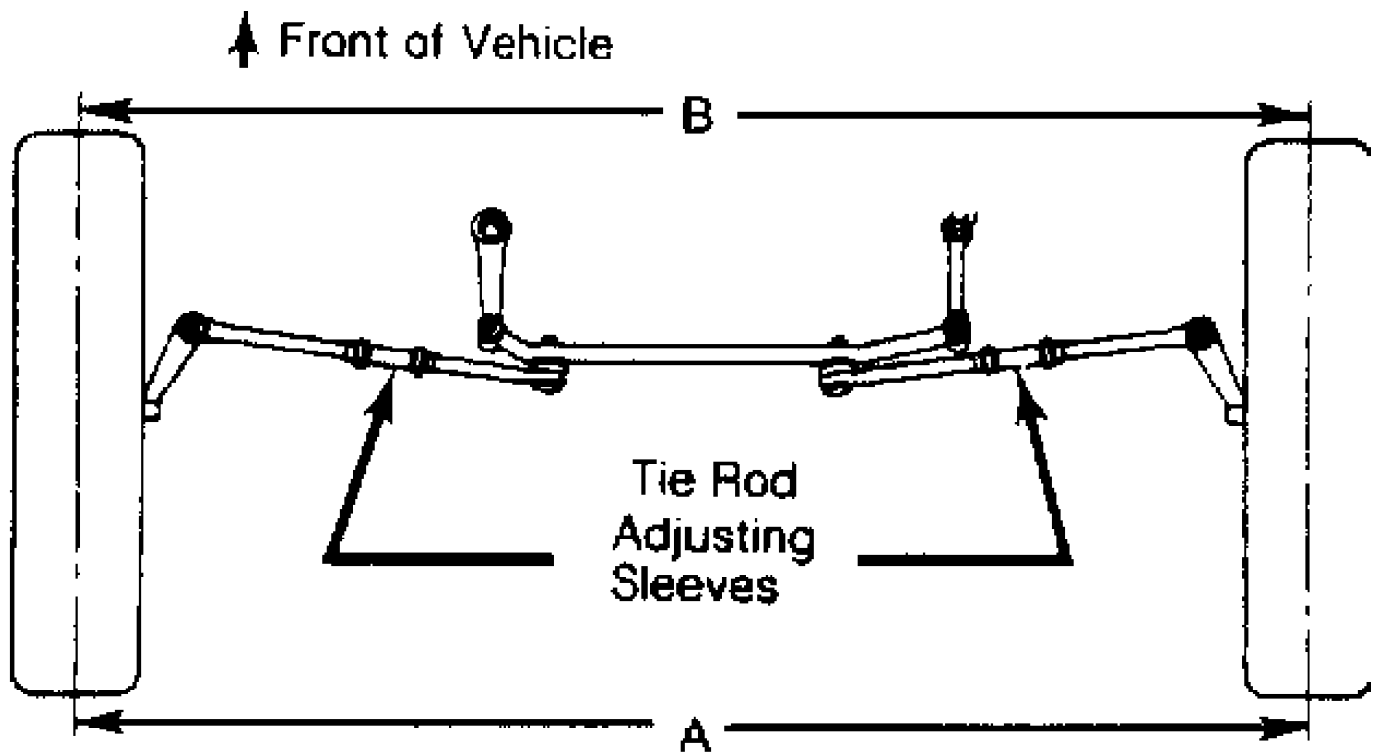
26694

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.



26695

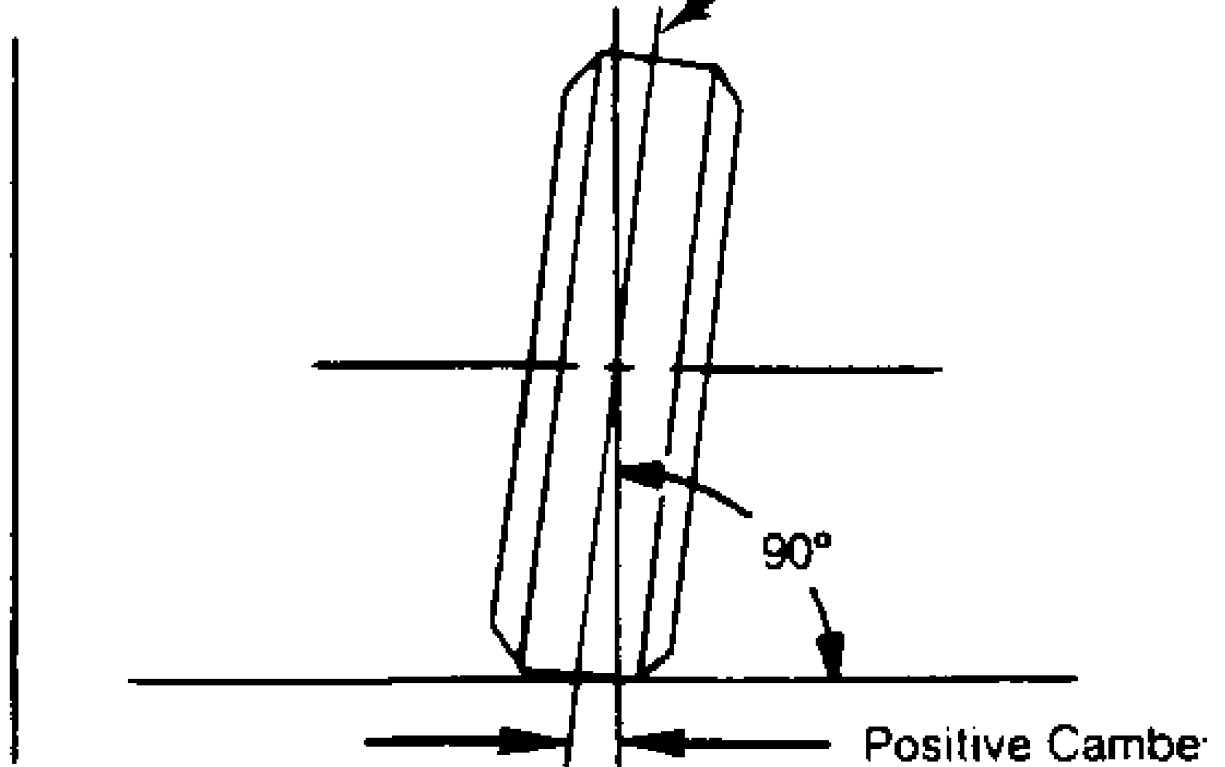
Fig. 2: Adjusting Tie Rod Sleeves (Top View)

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 tilt 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.

Centerline of Vehicle

Centerline of Wheel



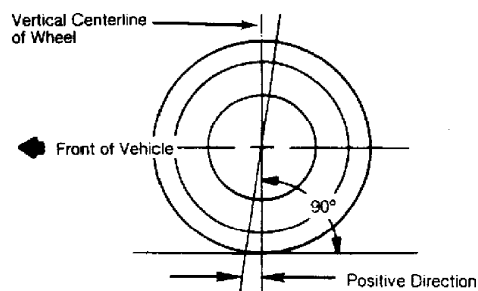
26696

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.



26697

Fig. 4: Determining Caster Angle

TOE-IN ADJUSTMENT

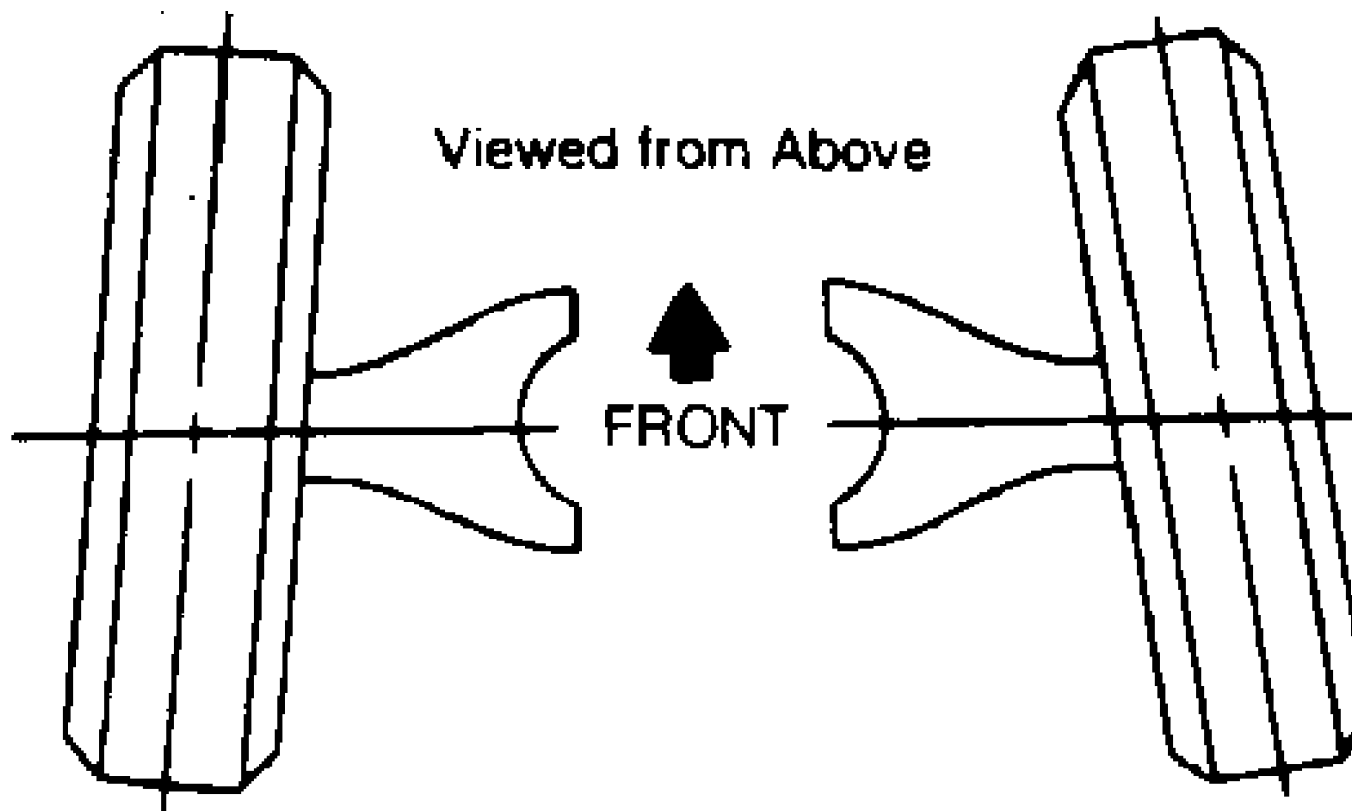
Toe-in is the width measured at the rear of the tires

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.



26698

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.

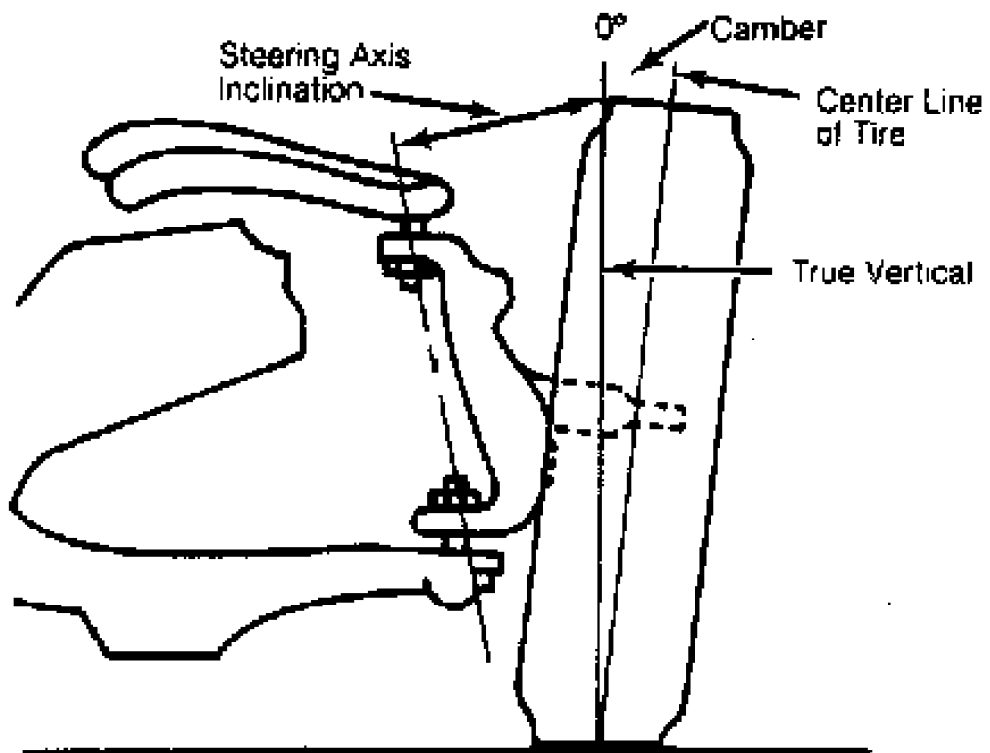


Fig. 6: Checking Steering Axis Inclination

WIPER/WASHER SYSTEM

1993 Mitsubishi Montero

1993 ACCESSORIES & EQUIPMENT
Mitsubishi Wiper/Washer Systems

Montero

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.

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

Application	Specification In. (mm)
Driver's Side	.98-1.38 (25-35)
Passenger's Side	1.38-1.77 (35-45)

(1) - Information is not available from manufacturer.

REAR WIPER ARM ADJUSTMENT

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

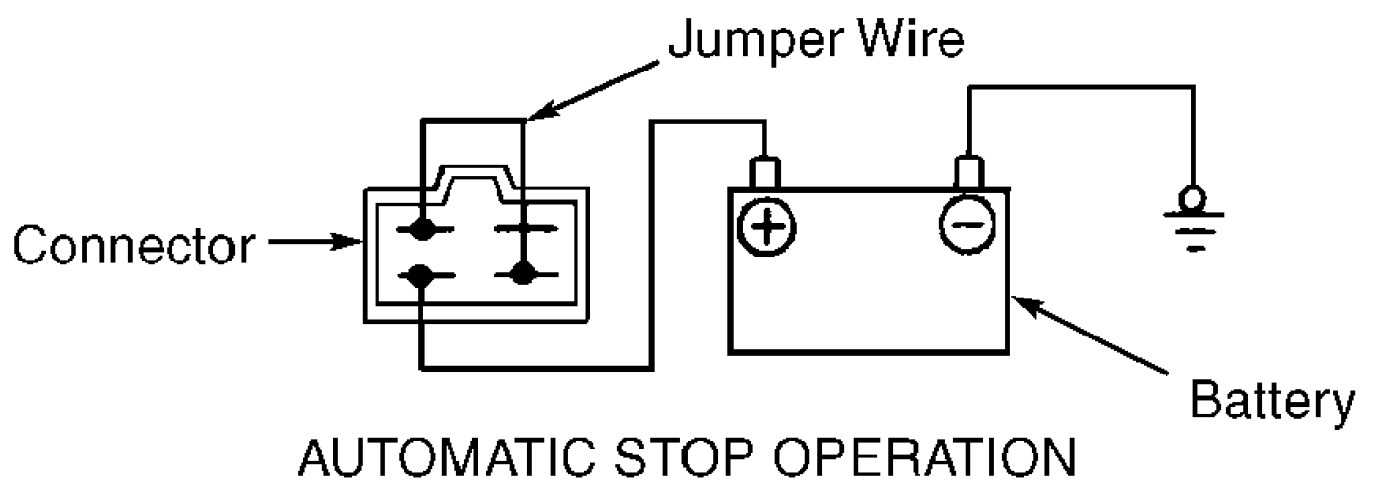
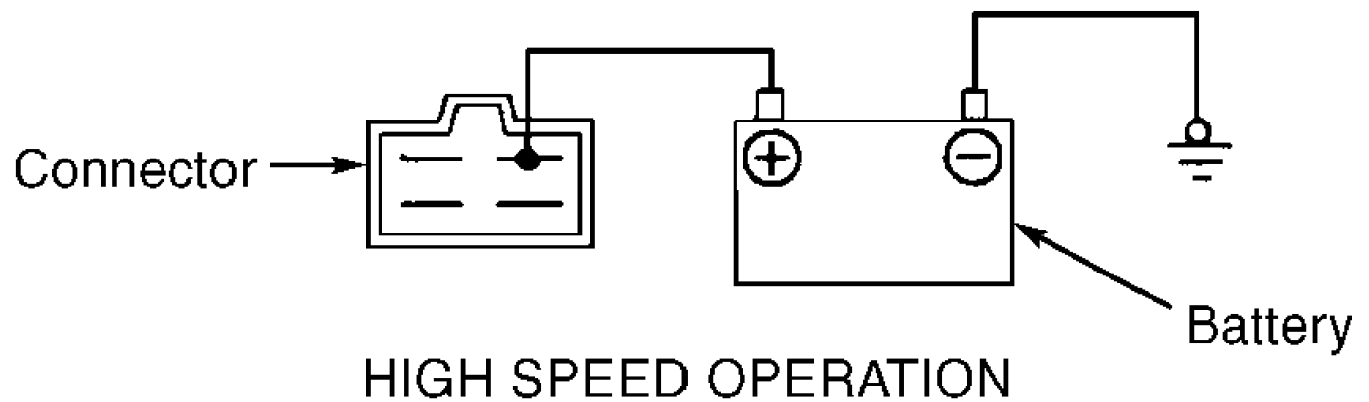
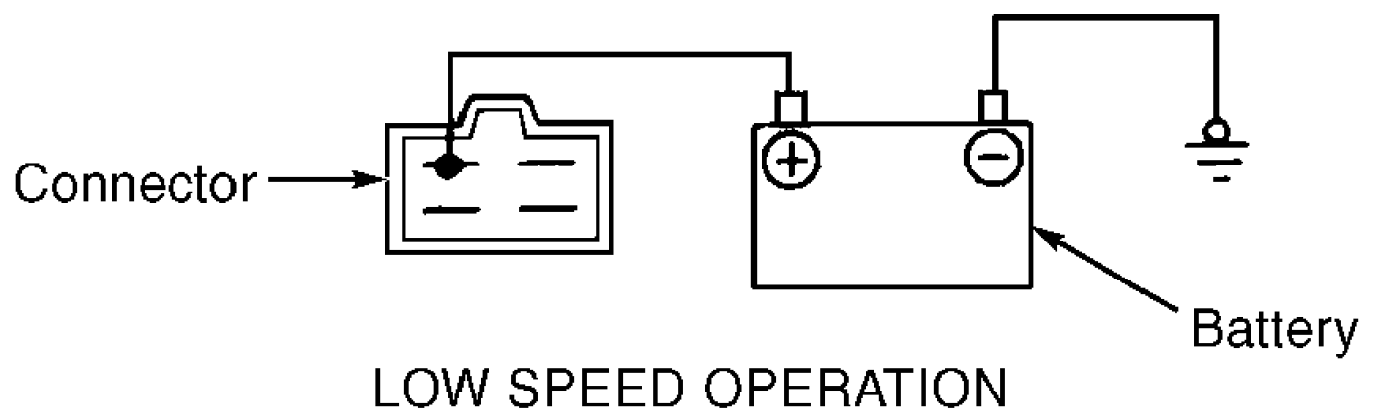
Model	In. (mm)
Montero	2.56-2.95 (65-75)

TESTING

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.



92F00203

Fig. 1: Checking Front Wiper Motor Operation
Courtesy of Mitsubishi Motor Sales of America.

Checking Automatic Stop

1) Operate wiper motor at low speed. See Fig. 1. Disconnect battery voltage during operation to stop motor.

2) Using a jumper wire, connect terminals as shown. See Fig. 1. Connect 12 volts to indicated terminal, and ground wiper motor

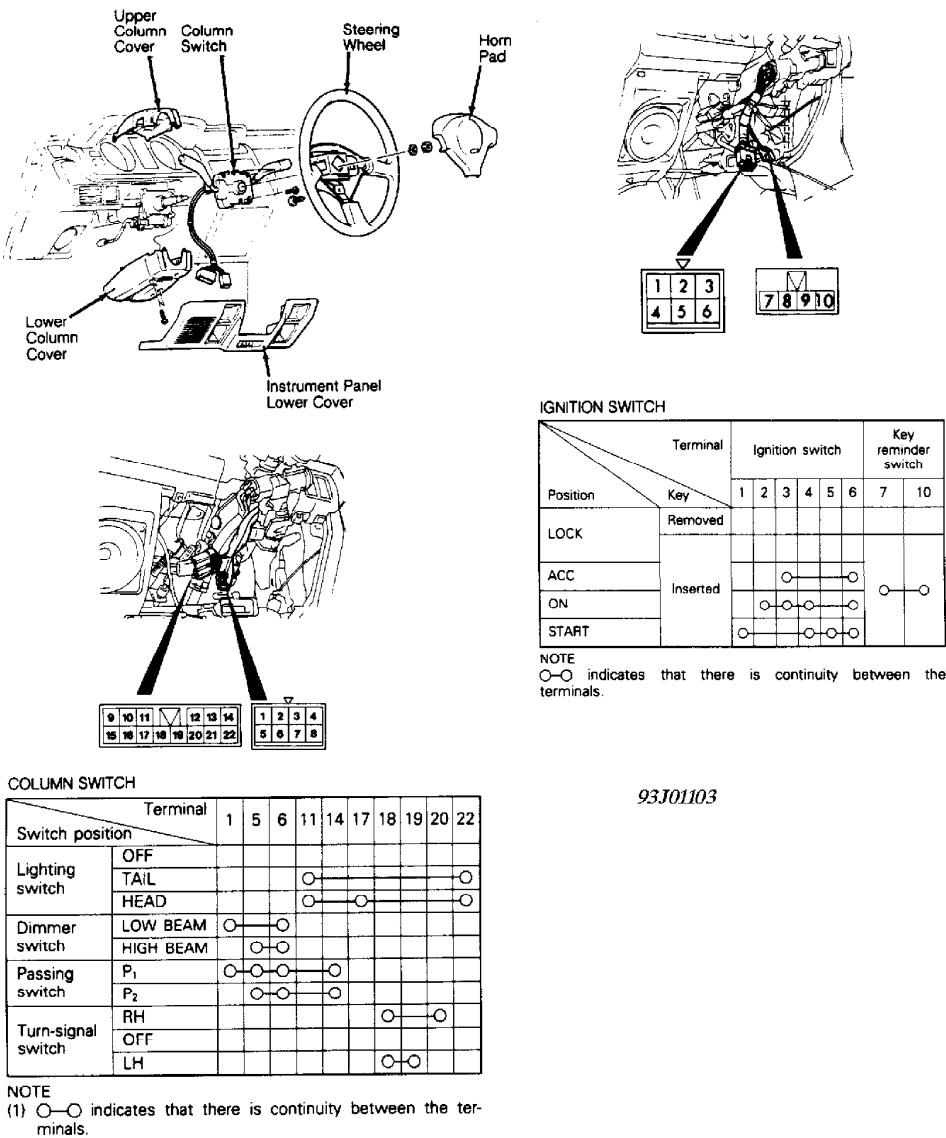
bracket. Ensure wiper arm is correctly parked.

INTERMITTENT WIPER RELAY (FRONT) TEST

NOTE: Intermittent wiper relay is incorporated into wiper switch. Information on testing is not available from manufacturer.

FRONT WIPER SWITCH TEST

Front wiper switch is part of combination switch on steering column. For steering column switch testing, see Fig. 2.



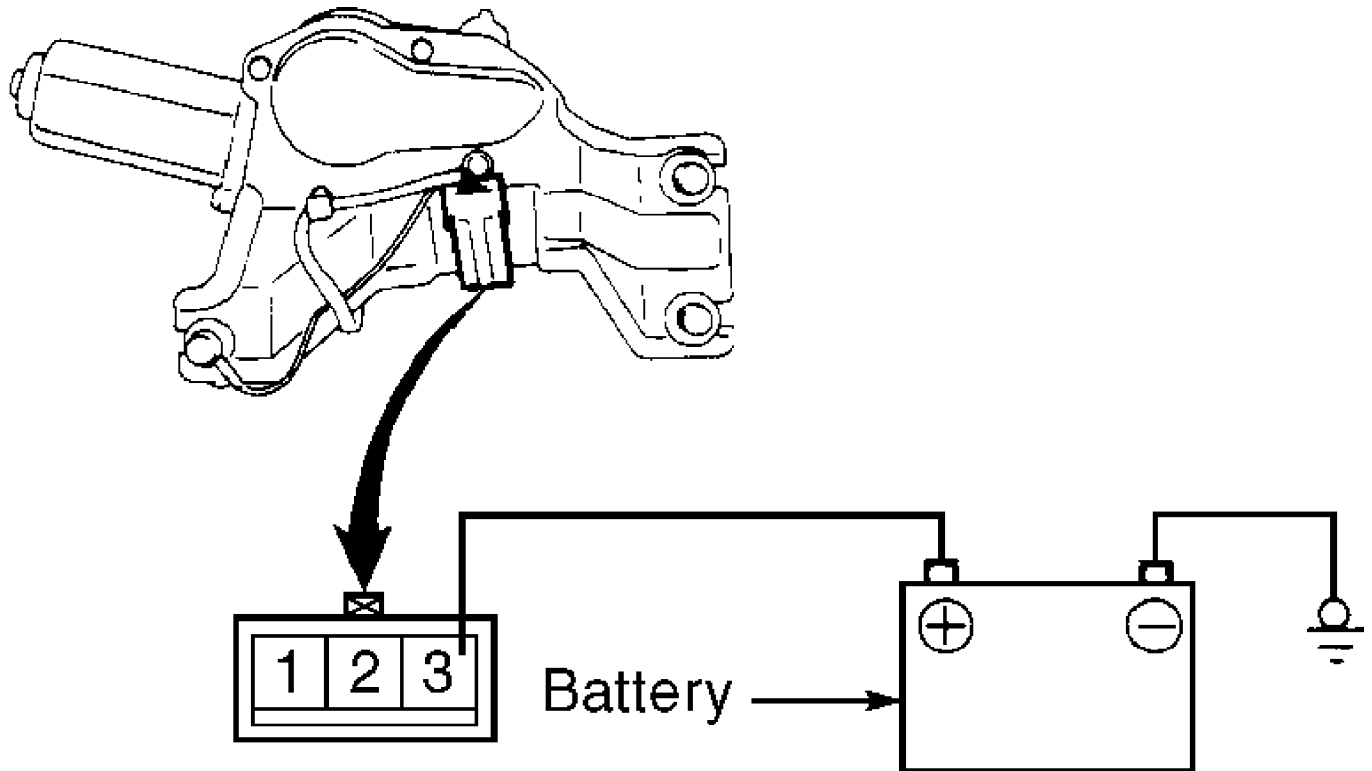
93J01103

Fig. 2: Testing, Removing & Installing Steering Column Switches
Courtesy of Mitsubishi Motor Sales of America.

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 well grounded. Motor should run at low speed. See Fig. 3.

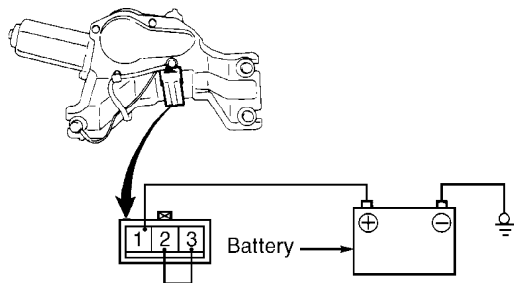


93A01108

Fig. 3: Rear Wiper Motor Operational Check
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 well grounded. See Fig. 4. Motor should return to park position.



93I01126

Fig. 4: Rear Wiper Motor Automatic Stop Check
Courtesy of Mitsubishi Motor Sales of America

REAR WIPER RELAY TEST

Operational Check

1) Relay is on left side of steering column, behind dash. Disconnect relay from wiring harness. Connect positive voltmeter lead to terminal No. 2. Connect negative voltmeter lead to terminal No. 5. Connect battery voltage to terminal No. 4 and ground terminal No. 5. See Figs. 5-7.

2) Jumper terminals No. 1 and 4 for 2 seconds. Remove jumper. Jumper terminals No. 1 and 5 for about 8 seconds. Voltmeter should show zero volts. After terminals No. 1 and 5 have been connected for at least 8 seconds, battery voltage should be present on terminal No. 2. Replace relay if voltage is not as specified.

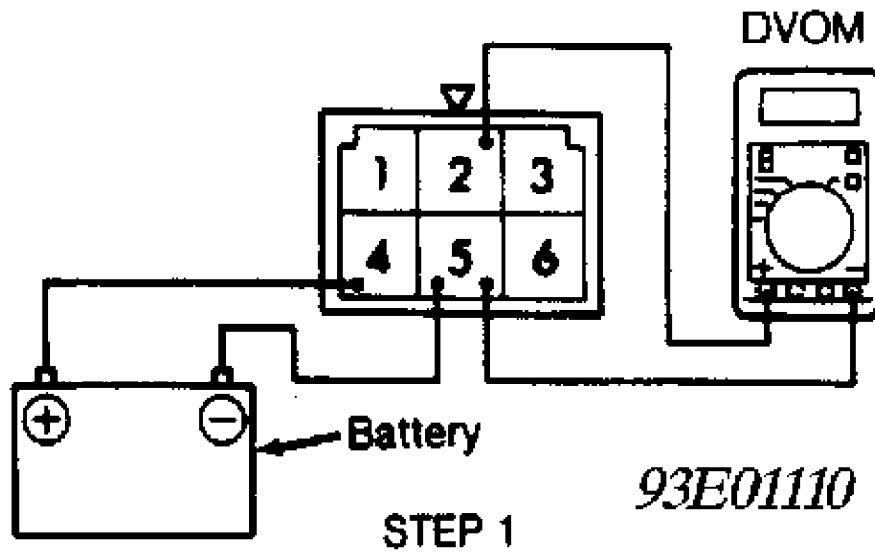


Fig. 5: Rear Wiper Relay Terminal ID (Step 1)
Courtesy of Mitsubishi Motor Sales of America.

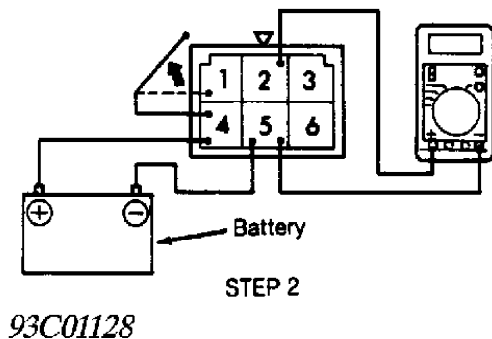


Fig. 6: Rear Wiper Relay Terminal ID (Step 2)
Courtesy of Mitsubishi Motor Sales of America.

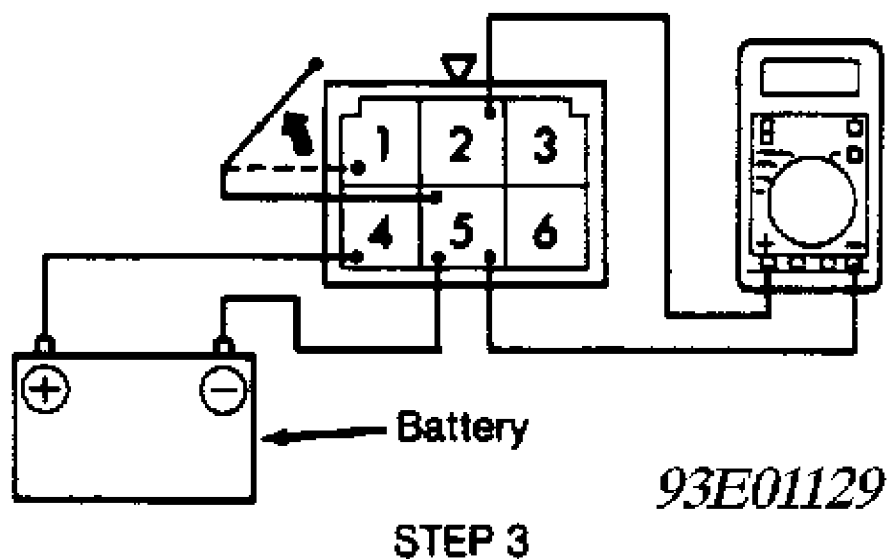
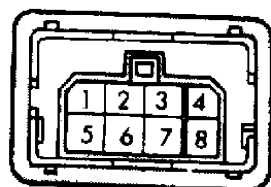


Fig. 7: Rear Wiper Relay Terminal ID (Step 3)
Courtesy of Mitsubishi Motor Sales of America.

REAR WIPER SWITCH TEST

Remove wiper switch from instrument panel and disconnect wiper switch. Place wiper switch in OFF position. Continuity should exist between terminals No. 4 and 7. See Fig. 8. Place wiper switch in ON position. Continuity should exist between terminals No. 2 and 7. Place wiper switch in INT position. Continuity should exist between terminals No. 4 and 7, and between terminals No. 1 and 6. Depress washer switch. Continuity should exist between terminals No. 2 and 3.



MONTERO

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Fig. 8: Rear Wiper Switch Terminal ID
Courtesy of Mitsubishi Motor Sales of America.

REMOVAL & INSTALLATION

FRONT WIPER MOTOR

Removal & Installation

Remove wiper motor bolts. Pull motor out just slightly. Disconnect wiper linkage from motor assembly and remove motor. To install, reverse removal procedure.

FRONT WIPER SWITCH

WARNING: DO NOT hammer on steering wheel. Collapsible steering column mechanism may be damaged.

Removal & Installation

Remove instrument panel under cover. Remove horn pad. Remove steering wheel. Remove upper and lower steering column covers. See Fig. 2. Remove column switch. To install, reverse removal procedure.

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 RELAY

Removal & Installation

Relay is located on left side of steering column, behind dash.

REAR WIPER SWITCH

Removal & Installation

Pry rear wiper switch from instrument panel and disconnect wiper switch. To install switch, reverse removal procedure.

WIRING DIAGRAMS

See appropriate chassis wiring diagram in the WIRING DIAGRAMS section.

WIRING DIAGRAMS

1993 Mitsubishi Montero

1993 WIRING DIAGRAMS
Mitsubishi Wiring Diagrams

Mitsubishi; Montero

IDENTIFICATION

COMPONENT LOCATION MENU

COMPONENT LOCATIONS TABLE

Component	Figure No. (Location)
A/C COMPRESSOR RELAY	5 (D-E 19)
A/C ENGINE COOLANT TEMPERATURE SWITCH	5 (E 18)
A/C SWITCH	5 (E 16)
ANTI-LOCK BRAKE SYSTEM (ABS) POWER RELAY	5 (B-C 19)
ALTERNATOR	1 (C 3)
ALTERNATOR RELAY	1 (C 3)
ANTI-LOCK BRAKE CONTROL UNIT	5 (A-C 16)
BACK-UP LIGHT SWITCH (M/T)	9 (B 35)
BATTERY	1 (A 2)
BRAKE FLUID LEVEL SWITCH	9 (D 35)
BUZZER	9 (C 35)
CARGO LIGHT	10 (D 36)
CENTER DIFFERENTIAL LOCK DETECTION SWITCH	6 (B 22)
CIG LIGHTER/CIG LIGHTER LIGHT	8 (D 28)
CLOCK	3 (A 8)
CLUTCH SWITCH	1 (B 3)
COMPRESSOR CONTROL UNIT	5 (E 19)
CONDENSER FAN MOTOR	5 (D 18)
CONDENSER FAN RELAY	5 (D 19)
CRUISE CONTROL MAIN SWITCH	6 (D 20)
CRUISE CONTROL UNIT	6 (C-E 23)
DEFOGGER RELAY	7 (E 27)
DEFOGGER SWITCH	7 (D 27)
DEFOGGER TIMER	7 (E 27)
DIAGNOSTIC CONNECTOR	2 (E 7)
DIM/PASS SWITCH (COLUMN SWITCH)	8 (B 31)
DIRECTIONAL SWITCH (COLUMN SWITCH)	8 (A 31)
DIRECTIONAL/HAZARD FLASHER	8 (B 28)
DOME LIGHT	10 (C 36)
DOOR SWITCHES	10 (C-D 38-39)
ENGINE CONTROL MODULE (ECM)	2 (A 6-7)
ENGINE CONTROL MODULE RELAY	2 (B 4)
ENGINE COOLANT TEMP SENSOR	9 (C 34)
FREE WHEEL ENGAGE SWITCH	6 (B 22)
FRONT ACCESSORY SOCKET	4 (C 15)
FRONT WIPER MOTOR	8 (D-E 28)
FUEL PUMP	2 (C 4)
FUEL TANK UNIT	9 (E 35)
FUSIBLE LINK BOX	1 (B 3)
FUSE #9	4 (E 14-15)
GEAR SELECTOR SWITCH	9 (A 35)
HAZARD SWITCH	8 (B-C 28)
HEADLIGHT RELAY	8 (A 28)
HEADLIGHT SWITCH (COLUMN SWITCH)	8 (A 28)
HEADLIGHT WASHER MOTOR/RELAY	8 (C 29-30)
HEATER RELAY	3 (A 8)

HORN RELAY	4 (C 14)
HYDRAULIC UNIT	5 (A-B 19)
IGNITION COIL	2 (E 4)
IGNITION POWER TRANSISTOR	2 (D 4)
IGNITION SWITCH	9 (A-B 32)
INSTRUMENT CLUSTER	9 (C-E 32-33)
IOD OR STORAGE CONNECTOR	3 (A 9)
JUMPER CONNECTOR	8 (C-D 30)
JUNCTION BLOCK (J/B)	3 (B-D 8-14)
KEY REMINDER SWITCH	9 (B-C 35)
MULTI METER CIRCUIT	10 (A-B 36)
NOISE FILTER	2 (E 6)
OXYGEN (O2) SENSOR	2 (B-C 7)
OIL PRESSURE SWITCH	9 (D 35)
OVERDRIVE SWITCH	6 (C 20)
PHONE CONNECTOR	7 (D-E 24-25)
POWER ANTENNA CONTROL UNIT	11 (B-C 40)
POWER DISTRIBUTION CENTER (PDC)	1 (D-E 2-3)
POWER DOOR LOCKS	10 (D-E 36-39)
POWER MIRROR SWITCH	11 (A-B 40)
POWER WINDOW RELAY	11 (E 41-42)
POWER WINDOW SWITCH	11 (C-E 40)
REAR ACCESSORY SOCKET	4 (C-D 15)
REAR DIFFERENTIAL LOCK CONTROL UNIT	6 (A-B 20)
REAR DIFFERENTIAL LOCK SWITCH	6 (A 20)
REAR DIFFERENTIAL OPERATION DETECTION SWITCH	6 (B 21)
REAR WASHER MOTOR	8 (D 30)
REAR WIPER/WASHER SWITCH	8 (D-E 31)
RELAY BOX	4 (E 15)
RHEOSTAT	8 (C 28)
SEAT BELT SWITCH	9 (C-D 35)
SOLENOID (B)	6 (A 23)
STARTER MOTOR	1 (A 3)
STARTER RELAY	1 (A 3)
STOP LIGHT SWITCH	6 (E 20)
SUNROOF SWITCH	10 (A-B 39)
TAILLIGHT RELAY	8 (A 28)
THROTTLE POSITION SENSOR	2 (C 7)
VANITY MIRROR LIGHTS	10 (C 39)
VARIABLE SHOCK ABSORBER CONTROL SWITCH	7 (A 24)
VARIABLE SHOCK ABSORBER CONTROL UNIT	7 (A-B 24)
WIPER/WASHER SWITCH (COLUMN SWITCH)	8 (C 31)
4WD INDICATOR CONTROL UNIT	6 (A-B 23)

GROUND LOCATION MENU

GROUND LOCATIONS TABLE

Component	Figure No. (Location)
GROUND A: (TRANSMISSION HOUSING TO UNDERBODY)	1 (A 1)
GROUND B: (UNDERBODY TO TRANSMISSION HOUSING)	1 (A 1)
GROUND C: (REAR OF LEFT FENDER SHIELD)	1 (A 1)
GROUND D: (RIGHT FENDER SHIELD)	1 (A 1)
GROUND E: (FRONT OF LEFT FENDER SHIELD)	1 (B 1)
GROUND F: (UPPER RIGHT KICK PANEL)	3 (E 11)
GROUND G: (LEFT KICK PANEL)	4 (A 15)
GROUND H: (LEFT REAR QUARTER PANEL)	4 (B 15)
GROUND I: (ON FIREWALL)	5 (B 18)
GROUND J: (BEHIND CENTER CONSOLE)	5 (C 19)
GROUND K: (LOCATION UNAVAILABLE)	6 (D 23)

GROUND L: (LOCATION UNAVAILABLE) 7 (E 26)
GROUND M: (BACK DOOR) 11 (C 42)

WIRING DIAGRAMS

COMPONENT LOCATOR:

A/C COMPRESSOR RELAY	D-E 19
A/C COOLANT TEMP SW	E 19
ALT SW	B-C 19
ABS POWER RELAY	C 3
ALTERNATOR	C 3
ANTI-LOCK BRAKE CTRL UNIT	A-C 18
BACK-UP LT SW (M/T)	B 35
BATTERY	D 35
BRAKE FLUID LEVEL SW	D 35
BUEZZER	D 35
CARGO LT	D 35
CENTER DIFFERENTIAL	D 35
LOCK DETECTION SW	D 35
CIG LTR/CIG LTR LT	B 22
CLOCK	A 6
CLUTCH SW	B 3
COMPRESSOR CTRL UNIT	E 19
CONDENSER FAN MOTOR	D 19
CONDENSER FAN RELAY	D 19
CRUISE CTRL MAIN SW	D 20
CRUISE CTRL UNIT	C-E 29
DEFOG RELAY	E 27
DEFOG SW	E 27
DEFOG TIMER	E 27
DIAGNOSTIC CONN	E 7
DIM/PASS SW (COLUMN SW)	A 31
DIR SW (COLUMN SW)	A 31
DIR/HAZ FLASHER	B 28
DOOR LT	C-D 38-39
ENGINE CONTROL MODULE (ECM)	B 4
ENGINE CONTROL MODULE RELAY	B 4
ENGINE COOLANT TEMP SENSOR	C 34
FIREWHEEL ENGAGE SW	B 22
FRONT ACCESSORY SOCKET	C 15
FRONT WIPER MOTOR	D-E 28
FUEL PUMP	C 4
FUEL TANK UNIT	E 35
FUS LINK BOX	B 3
FUSE #9	E 14-15
GEAR SEL SW	A 35
GROUND A	A 1
GROUND B	A 1
GROUND C	A 1
GROUND D	A 1
GROUND E	B 1
GROUND F	A 15
GROUND G	B 15
GROUND H	B 15
GROUND I	B 15
GROUND J	C 19
GROUND K	E 28
GROUND L	E 28
GROUND M	C 42
HAZARD SW	B-C 29-30
HEADLIGHT RELAY	A 28
HEADLIGHT SW (COLUMN SW)	A 28
HEADLIGHT WASHER MOTOR/RELAY	C 28-30
HEATER RELAY	A 8
HORN RELAY	A 8
HYDRAULIC UNIT	A-B 19
IGNITION COIL	E 4
IGNITION POWER TRANSISTOR	D 4
IGNITION SW	A-B 32
INSTRUMENT CLUSTER	C-E 32-33
IOD OR STORAGE CONN	A 9
JUMPER CONN	C-D 30
KEY REMINDER SW	B-C 35
MULTI METER CIRCUIT	A-B 36
NOISE FILTER	A-B 36
O2 SENSOR	B-C 7
OIL TID SW	B 35
OVERDRIVE SW	C 20
PHONE CONN	D-E 24-25
POWER ANTENNA CTRL UNIT	B-C 40
POWER DISTRIBUTION CENTER (PDC)	D-E 2-3
POWER DOOR LOCKS	D-E 36-39
POWER MIRROR SW	A-B 40
POWER WINDOW RELAY	E 41-42
POWER WINDOW SW	C-E 40
REAR ACCESSORY SOCKET	C-D 15
REAR DIFFERENTIAL	A-B 20
LOCK CTRL UNIT	A-B 20
REAR DIFFERENTIAL LOCK SW	A-B 20
REAR DIFFERENTIAL OPERATION	A-B 20
DEFLECTION SW	D 30
REAR WASHER MOTOR	D 30
REAR WIPER/WASHER SW	D-E 31
RELAY BOX	E 15
RHEOSTAT	C 28
SEAT BELT SW	C-D 35
SOLENOID (B)	A 3
STARTER MOTOR	A 3
STARTER RELAY	A 3
STOP LT SW	E 20
SUNROOF SW	A-B 39
TAILLIGHT RELAY	E 29
THROTTLE POSITION SENSOR	C 7
VANITY MIRROR LTS	C 39
VARIABLE SHOCK	A 24
ABSORBER CTRL SW	A-B 24
CTRL UNIT	A-B 24
WIPER/WASHER SW (COLUMN SW)	C 31
WIPER INDICATOR CTRL UNIT	A-B 23

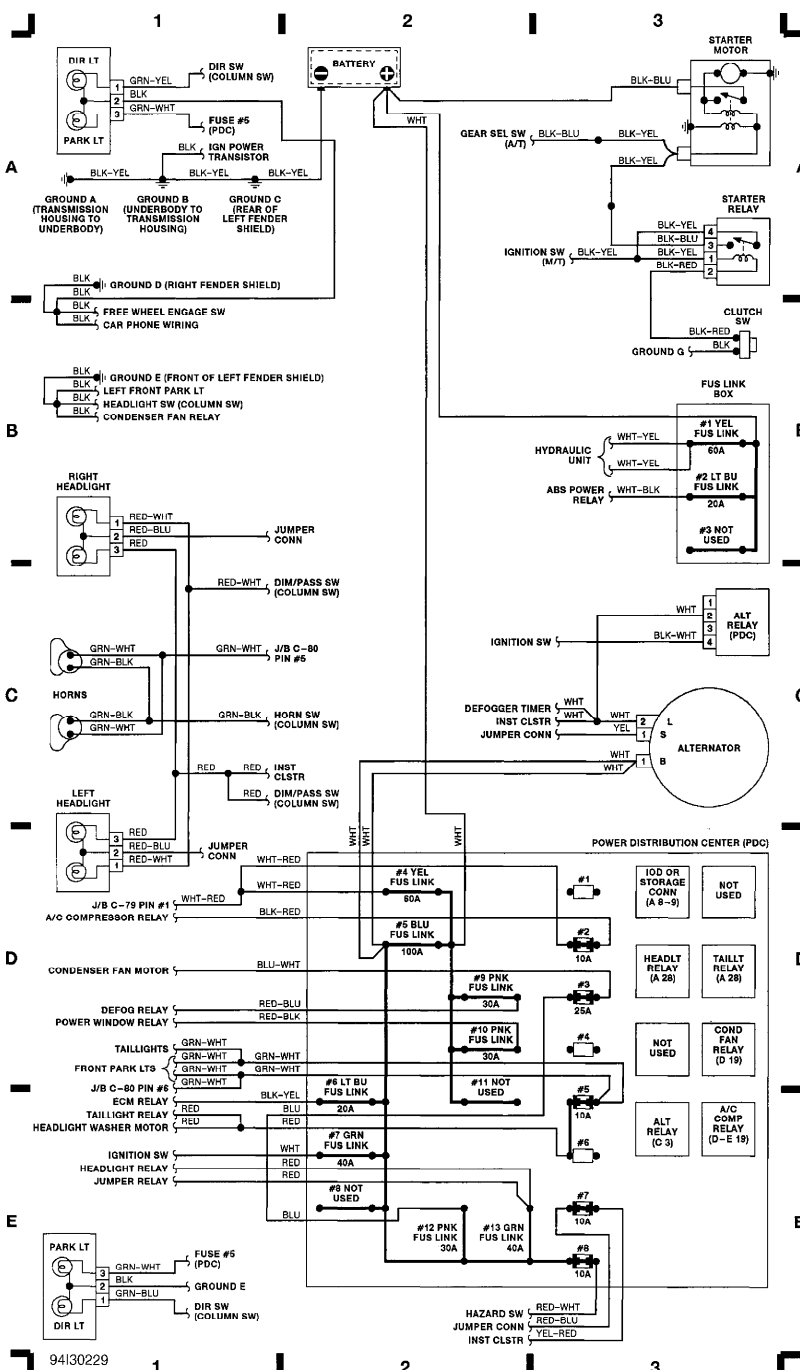


Fig. 1: Engine Compartment, Power Distribution Center (Grid 1-3)

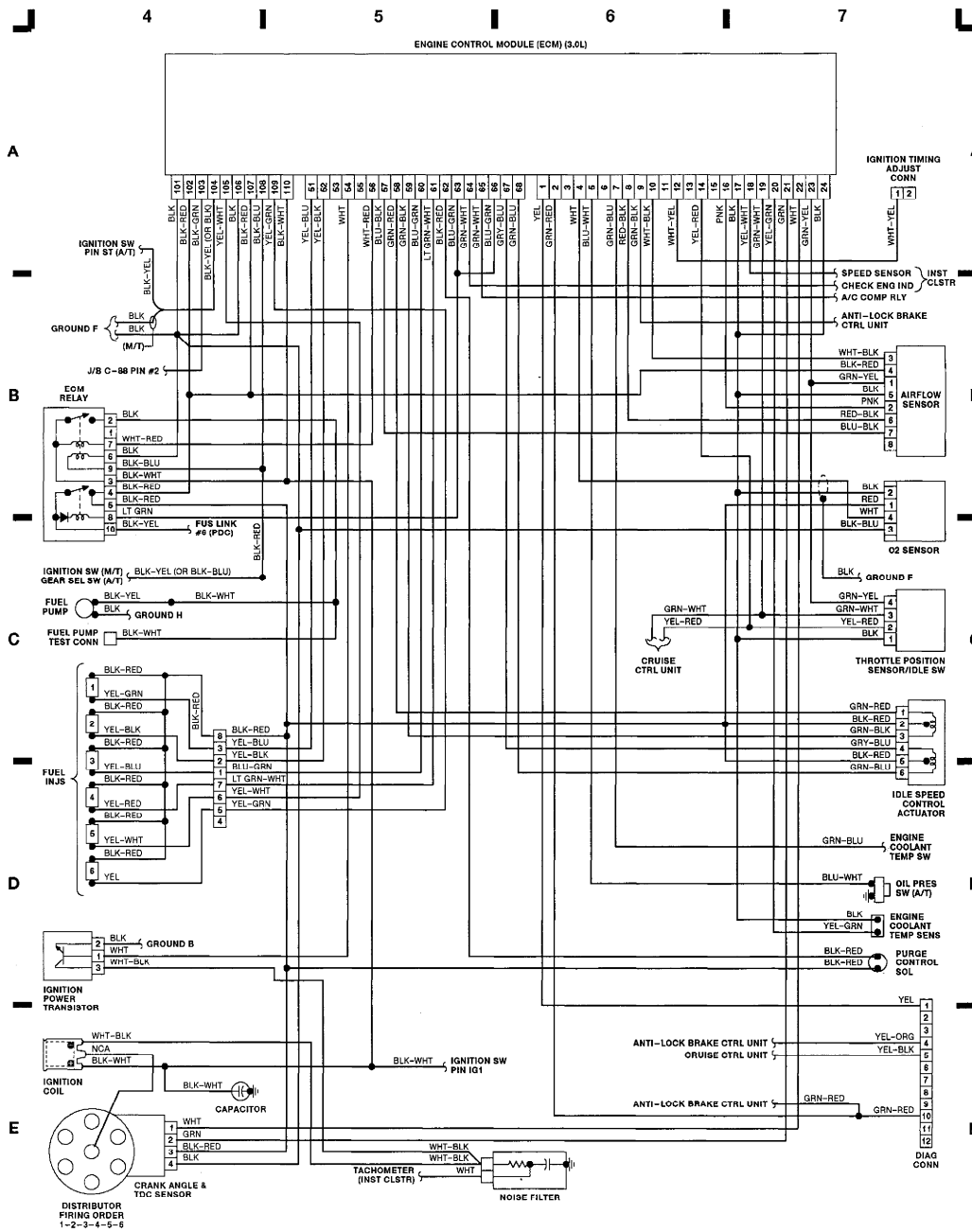


Fig. 2: Engine Control Unit (3.0L) (Grid 4-7)

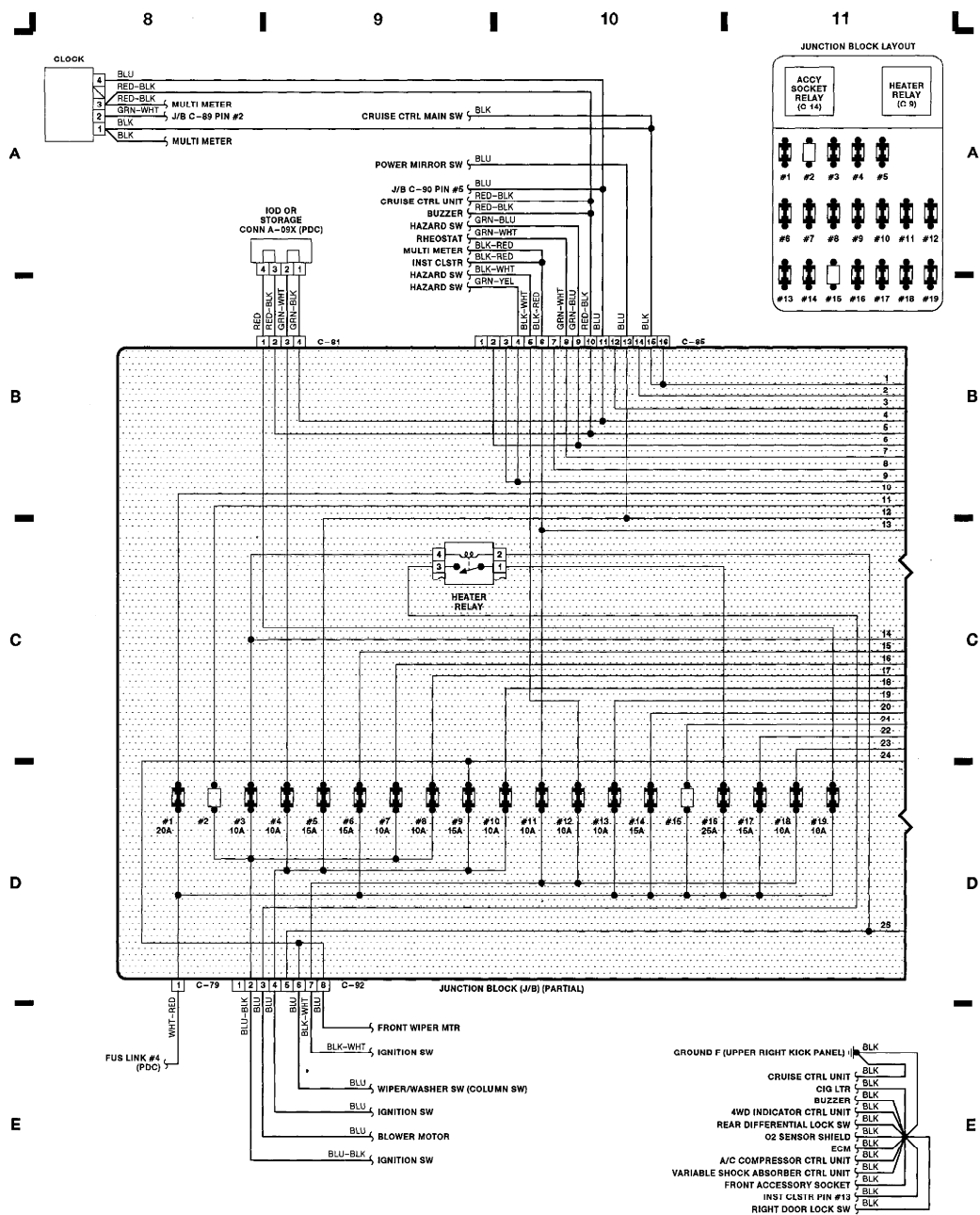


Fig. 3: Junction Block (Partial), Clock (Grid 8-11)

Fig. 4: Junction Block (Cont.), Relay Box (Interior) (Grid 12-15)

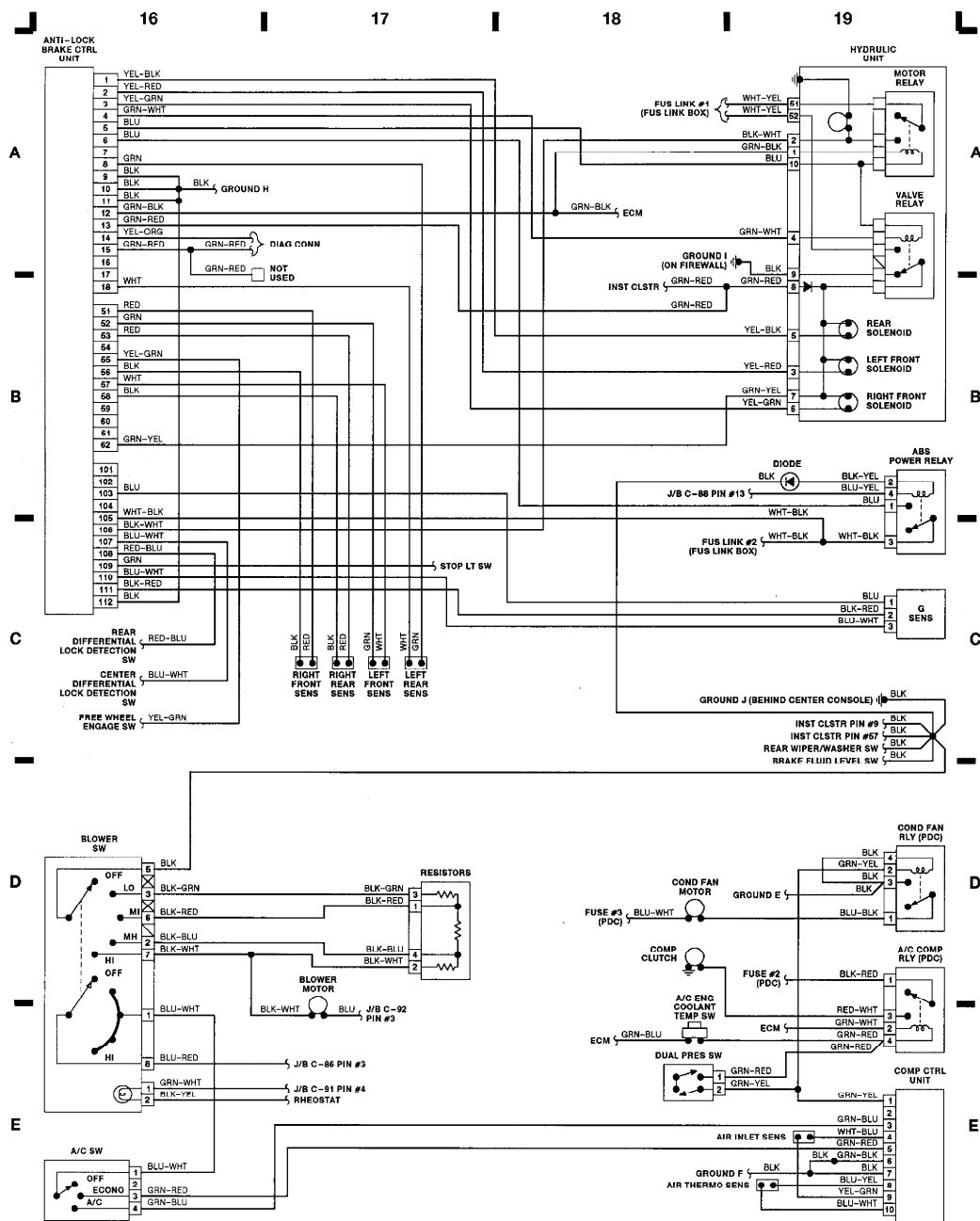


Fig. 5: ABS System, A/C & Heater System (Grid 16-19)

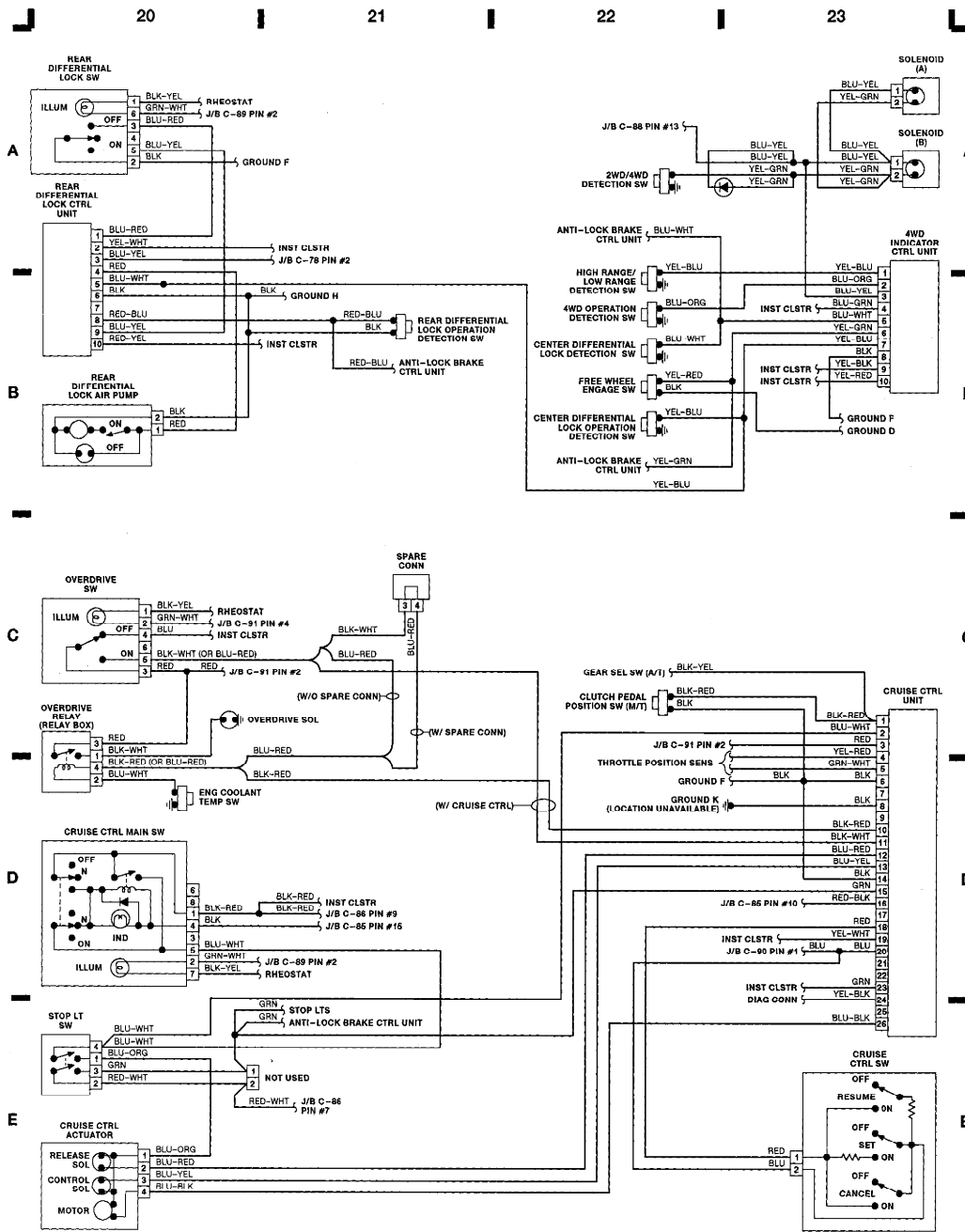


Fig. 6: Cruise Control, Differential Lock, O/D Sw. (Grid 20-23)

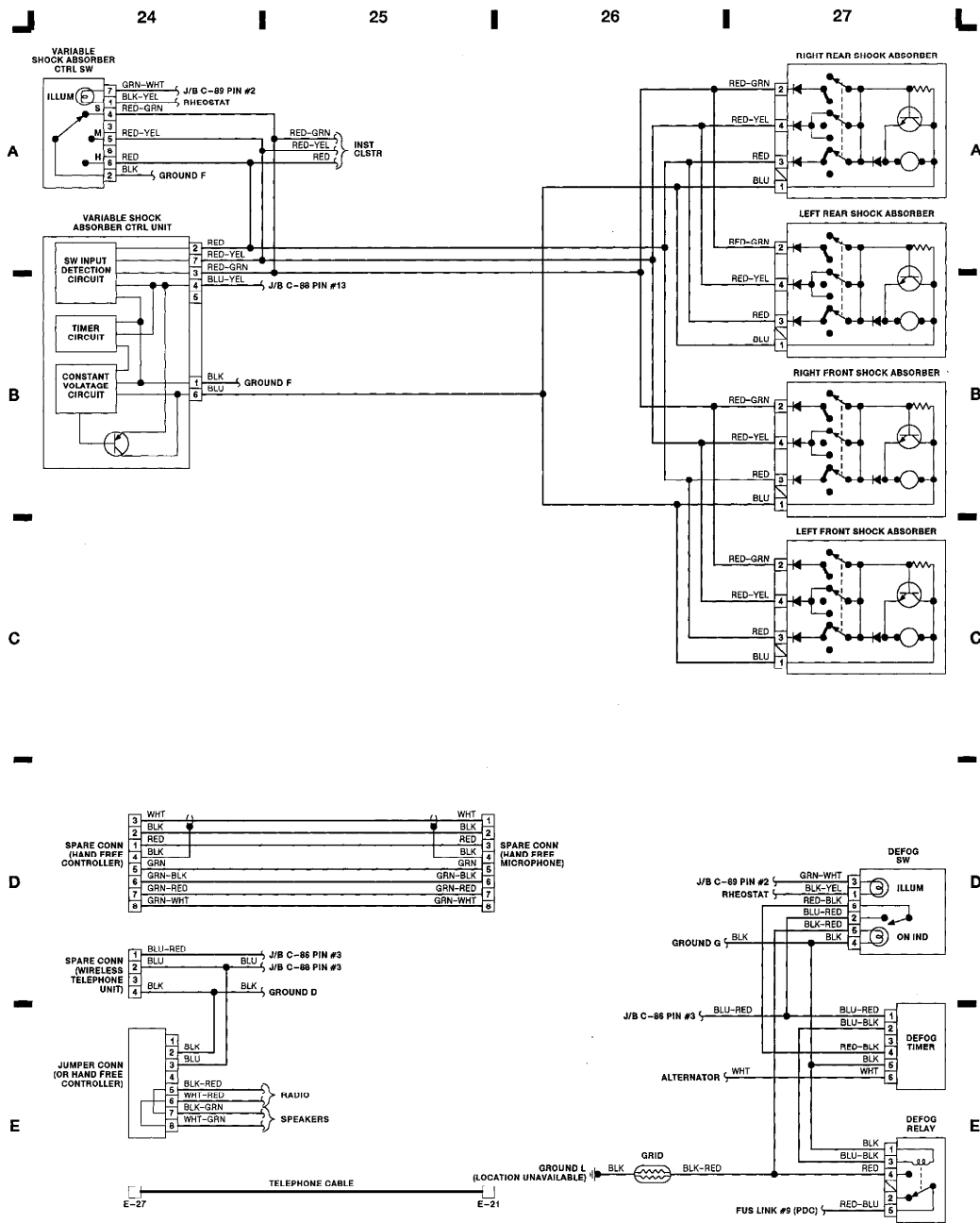


Fig. 7: Variable Shock Absorber Control, Defogger (Grid 24-27)

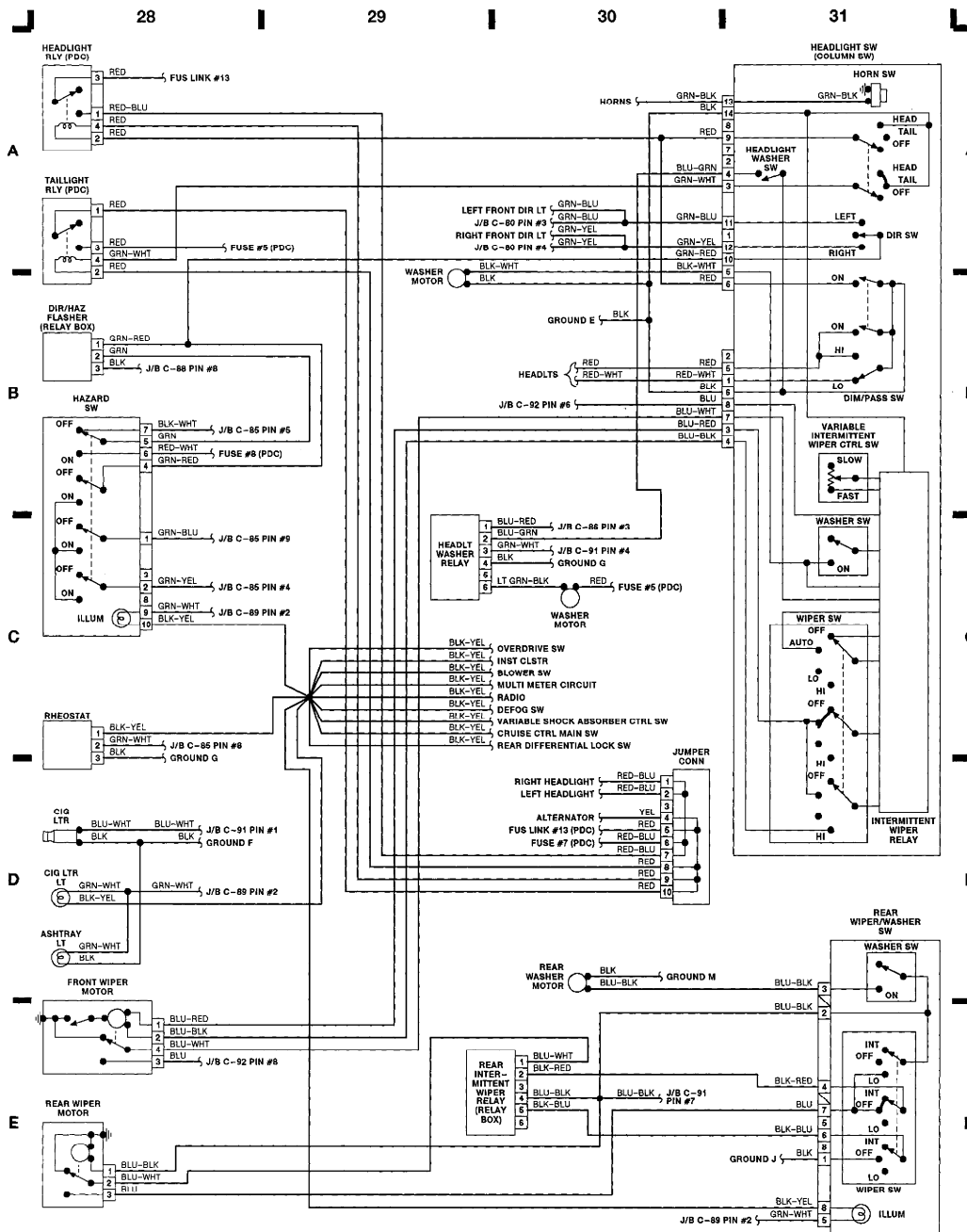


Fig. 8: Combination Switch, Wiper/Washer System (Grid 28-31)

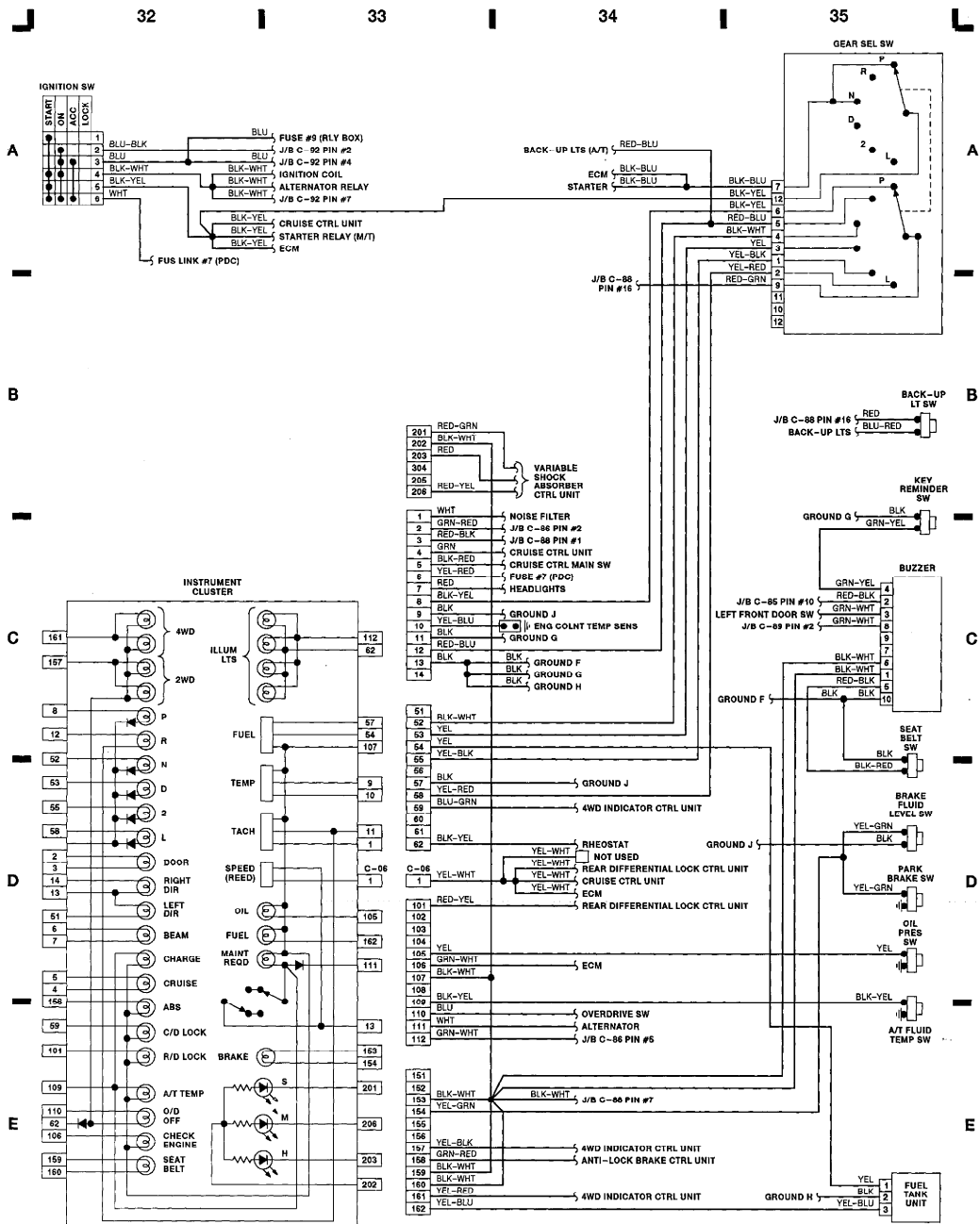


Fig. 9: Instrument Cluster, Ignition Switch, Gear Select (Grid 32-35)

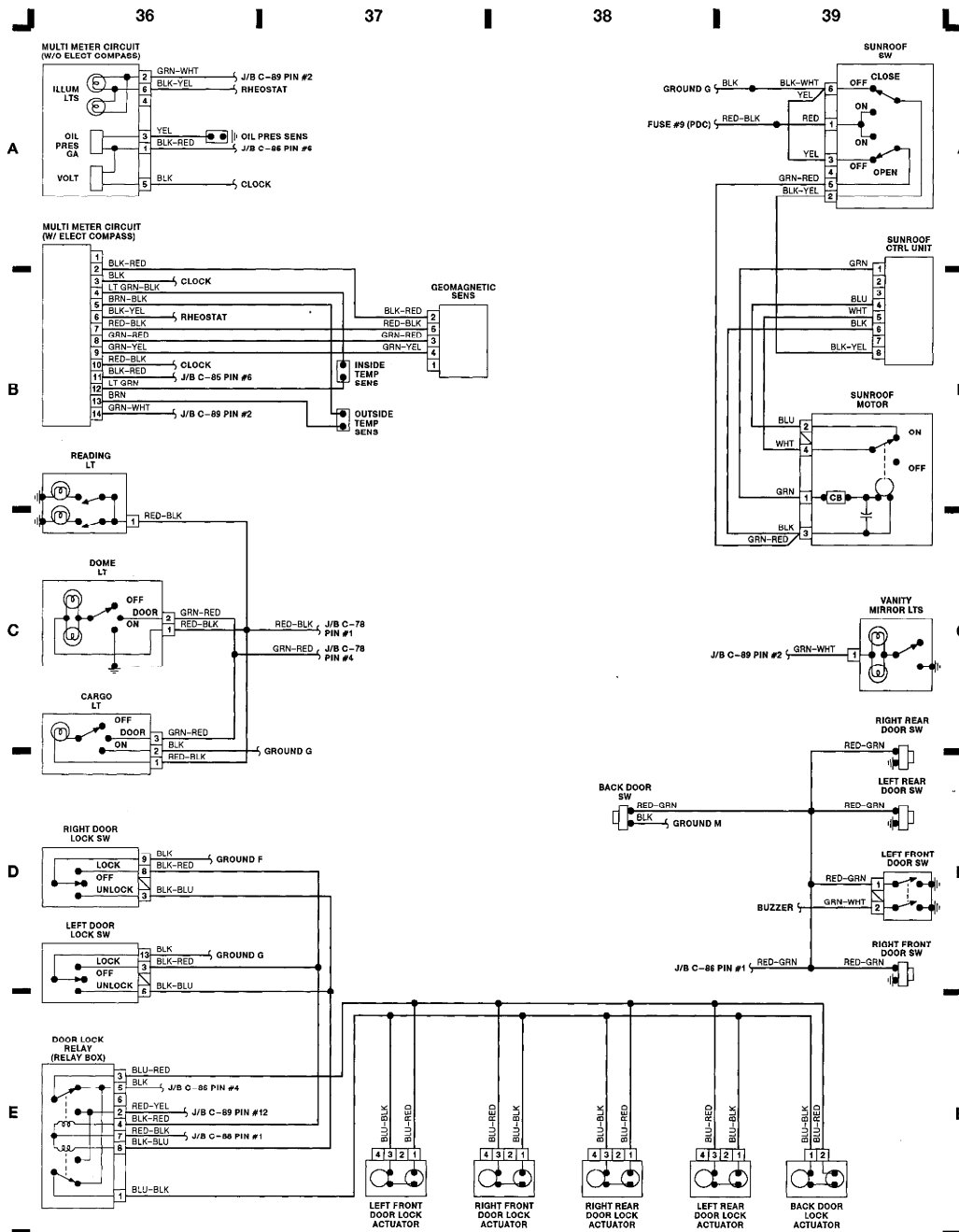


Fig. 10: Courtesy Lights, Multi Meter, Door Locks (Grid 36-39)

WIRING DIAGRAM SYMBOLS

1993 Mitsubishi Montero

WIRING DIAGRAMS
How To Use The Wiring Diagrams

WIRING DIAGRAMS

INTRODUCTION

The wiring diagrams and technical service bulletins, containing wiring diagram changes, are obtained from the domestic and import manufacturers. These are checked for accuracy and are all redrawn into a consistent format for easy use.

All diagrams are arranged with the front of the vehicle at the left side of the first page and the rear of the vehicle at the right side of the last page. Accessories are shown near the end of the diagram.

Components are shown in their approximate location on the vehicle. Due to the constantly increasing number of components on vehicles today, it is impossible to show exact locations.

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 diagrams now follow a much improved format, which permits space for internal switch details and connector shapes.

Any wires that don't connect directly to their components are identified on the diagram to indicate where they go. There is a legend on the first page of each diagram, detailing component location. It refers you to sub-systems, using grid NUMBERS at the top and bottom of the page and grid LETTERS on each side. This grid system works in a manner similar to that of a road map.

HOW TO USE THE WIRING DIAGRAMS

1) On the first page of the diagram, you will find a listing of major electrical components or systems. Locate the specific component or system you wish to trace. A grid number and letter will follow the component's name.

2) Use the grid NUMBERS (arranged horizontally across the top and bottom of each page) to find the page of the wiring diagram that contains the component you're seeking. When you reach this page, use the grid LETTERS on the side of the page to determine the component's vertical location.

3) Locate the circuit you need to service. The internals are shown for switches and relays to assist you in understanding how the circuit operates.

NOTE: In some of the newer wiring diagram articles in this product, there is a Legend for the wiring diagrams that has been created to make locating components easier. For these articles, there will be a COMPONENT LOCATION MENU title in the article main menu. These articles will also have the original legend available on the first graphic.

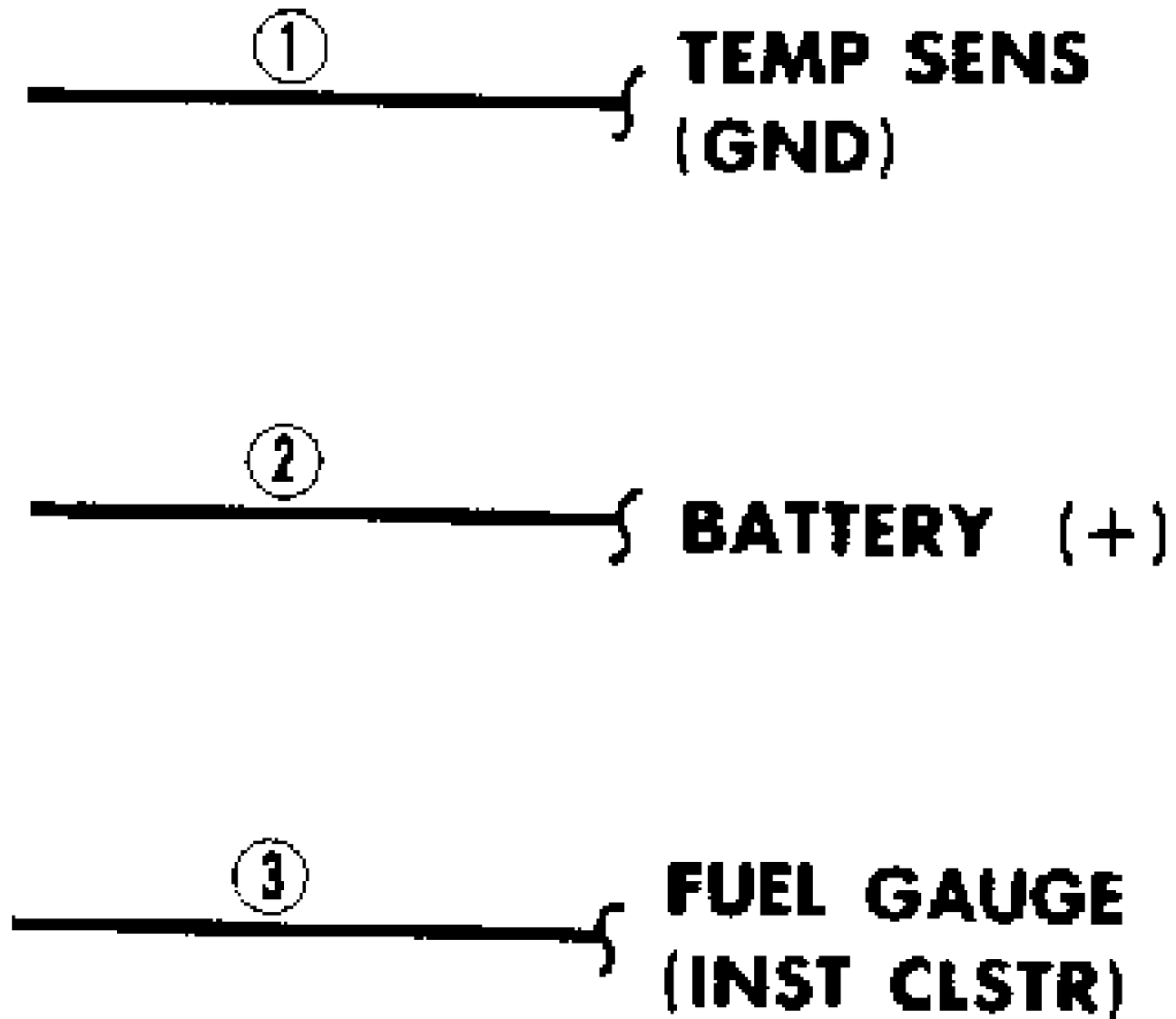


Fig. 1: Identifying Tie-Off Symbols

4) If the wires are not drawn all the way to another component (across several pages), a reference will tell you their final destination.

5) Again, use the legend on the first page of the wiring diagram to determine the grid number and letter of the referenced component. You can then turn directly to it without tracing wires across several pages.

6) The symbols shown in Fig. 1 are called tie-offs. The first tie-off shown indicates that the circuit goes to the temperature sensor, and is also a ground circuit.

7) The second symbol indicates that the circuit goes to a battery positive parallel circuit. The third symbol leads to a particular component and the location is also given.

8) The lines shown in Fig. 2 are called options. Which path or option to take depends on what engine or systems the vehicle has.

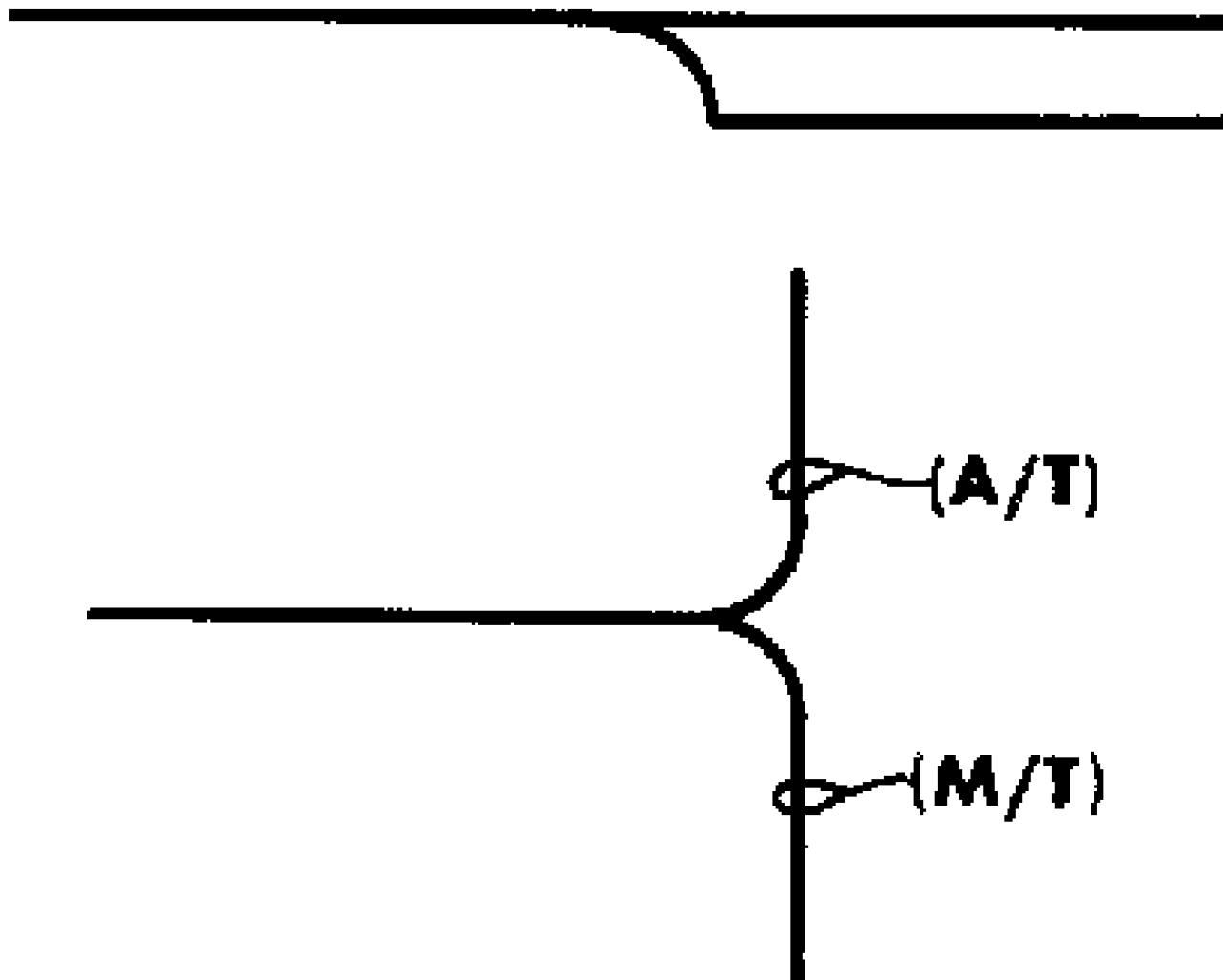


Fig. 2: Identifying Option Symbols

COLOR ABBREVIATIONS IDENTIFICATION

COLOR ABBREVIATIONS

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
Voilet	VIO	VI

White	.....	WHT	.....	WT
Yellow	.....	YEL	.....	YL

WIRING DIAGRAM SYMBOL IDENTIFICATION

NOTE: Standard wiring symbols are used on diagrams. The list 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.

WIRING DIAGRAM SYMBOLS

Views of the symbols used in the WIRING DIAGRAM articles are in the following graphics. See Figs. 3 through 25.



CIRCUIT BREAKER

Fig. 3: Circuit Breaker



COIL (Internal)

Fig. 4: Coil (Internal)



CONNECTOR

Fig. 5: Connector



DIODE (In-Line)

Fig. 6: Diode (In-Line)



Fig. 7: Diode (Internal)



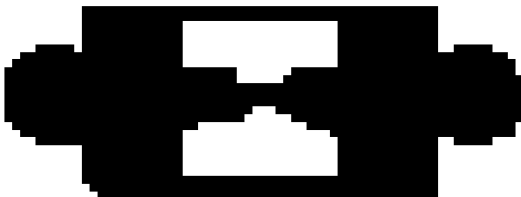
DIODE (Light Emitting)

Fig. 8: Diode (Light Emitting)



DEFOGGER GRID

Fig. 9: Defogger Grid



FUSE

Fig. 10: Fuse



FUSIBLE LINK

Fig. 11: Fusible Link



GROUND

Fig. 12: Ground



**GLOW PLUG, RESISTOR (In-Line)
MIRROR HEATER**

Fig. 13: Glow Plug Resistor (In-Line) or Mirror Heater



INJECTOR, PHOTOCELL

Fig. 14: Injector (Diesel) or Photocell (Gasoline)



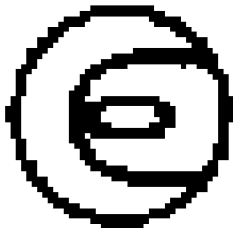
**INTERNAL FUSE,
THERMAL LIMITER**

Fig. 15: Internal Fuse, Thermal Limiter



LAMP (Dual Element)

Fig. 16: Lamp (Dual Element)

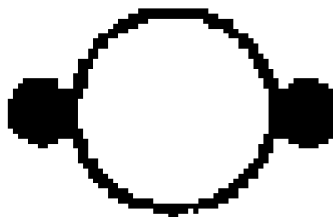


LAMP (Single Element)

Fig. 17: Lamp (Single Element)



OR



MOTOR

Fig. 18: Motor



RESISTOR (Internal)

Fig. 19: Resistor (Internal)



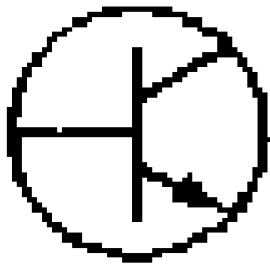
SENSOR, THERMISTOR

Fig. 20: Sensor, Thermistor



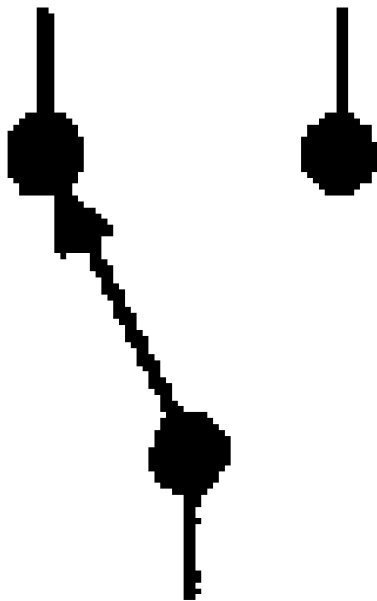
SOLENOID

Fig. 21: Solenoid



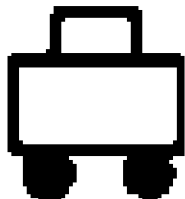
**SOLID STATE DEVICE,
TRANSISTOR**

Fig. 22: Solid State Device, Transistor



SWITCH (Internal)

Fig. 23: Switch (Internal)



TWO PIN SWITCH

Fig. 24: Two Pin Switch



**VARIABLE RESISTOR
OR POTENTIOMETER**

Fig. 25: Variable Resistor or Potentiometer

