4.3L V6 - VINS [W,X]

1997 Chevrolet Blazer

1996-97 ENGINES
General Motors Corp. 4.3L V6 - VIN [W] & VIN [X]

Chevrolet; Astro, Blazer, "C" & "K" Pickup,
"S" & "T" Pickup, Commercial Van, Express, Sierra
Suburban, Van
GMC; Jimmy, Safari, Savana, Sierra, Sonoma
Oldsmobile; Bravada

*** PLEASE READ THIS FIRST ***

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

ENGINE IDENTIFICATION

Engine is identified by eighth character of Vehicle Identification Number (VIN). VIN is stamped on a metal tag on top left end of instrument panel, near windshield. See ENGINE IDENTIFICATION CODES table.

Engine can also be identified by engine identification (ID) number. Number is stamped on front of cylinder block, immediately forward of right cylinder head or on left side of cylinder block, on engine-to-transmission mating flange.

ENGINE IDENTIFICATION CODES

Engine	(1) VIN Code	Engine ID
CSI	W	L35
CSI	X	LB4

(1) - Eighth character of VIN.

ADJUSTMENTS

VALVE CLEARANCE ADJUSTMENT

NOTE: Although valve clearance adjustment is not usually required (engine uses hydraulic valve lifters), perform the following procedure after servicing valve train.

Engine uses screw-in rocker arm studs with a shoulder. Tighten rocker arm nuts to specification. See TORQUE SPECIFICATIONS.

SHIFT CABLE ADJUSTMENT

NOTE: When installing shift cable, DO NOT pull shift lever ball stud forward of transmission shift lever ball stud.

Express, "C" & "K" Pickup, Savana, Sierra, Suburban, Tahoe & Yukon

1) Ensure transmission shift lever is in mechanical park position. Rotate control lever clockwise until it reaches it’s final stop position. Apply parking brake. Raise and support vehicle.

2) Slide Black retaining clip forward on shift cable end far

enough to allow White lock button to be pushed out. Push White lock button on shift cable end out far enough to free metal core adjust body inside cable end. DO NOT push White lock button completely out.

3) Inspect metal core adjust body on shift cable end for dirt or debris that may restrict its travel. If travel of metal core adjust body remains restricted, shift cable assembly must be replaced. Lower vehicle. Ensure parking brake is applied.

4) Turn ignition switch to ON position. Move transmission shift lever from Park to One and back to Park position 10 times. Place shift lever to Park. Turn ignition switch to OFF position. Raise and support vehicle. Ensure transmission control lever is in mechanical park position.

5) Rotate control lever clockwise until it reaches it's final stop position. Push White lock button in to secure core adjuster body inside shift cable end. Slide Black retainer clip rearward over shift cable end until it covers White lock button and locks in place over shift cable end. Ensure parking brake is applied. Lower vehicle.

Astro & Safari

1) Ensure shift cable is not restricted. Place steering column shift lever into Neutral. Position shift cable to assume a natural routing. Shift cable must be free to move .80" (20 mm) during adjustment.

2) Pull cable end completely forward and release it. When cable is pulled completely forward and released, adjustment spring will position cable to its most rearward position. Connect end of shift cable to transmission shift lever stud ball.

REMOVAL & INSTALLATION

WARNING: On vehicles equipped with air bag restraint system, see appropriate AIR BAG RESTRAINT SYSTEM article before servicing steering wheel or column. Use extreme caution to avoid personal injury and vehicle damage.

CAUTION: When battery is disconnected, vehicle computer and memory systems may lose memory data. Driveability problems may exist until computer systems have completed a relearn cycle. See COMPUTER RELEARN PROCEDURES article in GENERAL INFORMATION before disconnecting battery.

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

Disconnect battery terminals. Loosen fuel tank cap to relieve tank pressure. Connect one end of fuel gauge hose to pressure relief fitting at rear of intake manifold. Place other end of hose in a container. Open relief valve to release pressure.

COOLING SYSTEM BLEEDING

1) Fill radiator to base of filler neck. Start engine. Place A/C-heater control in any position except MAX. Select highest temperature setting. Idle engine until lower radiator hose is hot.

2) Increase engine speed to 3000 RPM and then back to idle. Do this 5 times to expel any air trapped in system. Fill radiator as necessary. Install radiator cap. Allow engine to cool. Fill coolant recovery reservoir as necessary.

3) Crush and add 2 Coolant Sealant Pellets (GM P/N 3634621) or equivalent to radiator (if reservoir is not pressurized) or coolant reservoir (if reservoir is pressurized).

POWER STEERING BLEEDING

NOTE: If air was introduced into hydraulic system during servicing, bleed system. Aerated fluid, which appears Light Tan in color, results in poor steering performance and will cause pump damage.

1) Turn ignition off. Raise and support vehicle with front wheels off ground. Using steering wheel, turn wheels fully to left. Add power steering fluid to FULL COLD mark on dipstick. Turn wheels from side to side at least 20 times, but DO NOT touch steering stops. Add fluid as necessary to maintain level at FULL COLD mark.

2) Start engine. With engine idling, check fluid level. Add fluid as necessary to bring fluid level to FULL COLD mark. Return wheels to center position. Lower vehicle. Continue to run engine for 2 to 3 minutes to raise temperature of fluid and eliminate trapped air. Turn steering wheel in both directions.

3) Road test vehicle. Check for leaks. Ensure fluid level is at FULL HOT mark when fluid is stabilized at operating temperature.

ENGINE

CAUTION: Minimal clearance exists between oil pump pick-up tube and bottom of oil pan. DO NOT place jack under oil pan, crankshaft pulley or any sheet metal when lifting engine.

WARNING: Provide addition support for opposite end from which components are being removed. When removing major components of vehicle, vehicle frame should be chained to hoist pads at same end as removed components to prevent tip-off. Failure to follow these precautionary measures could result in vehicle damage or serious personal injury.

NOTE: Flush out oil and engine cooling system when installing new engine.

Removal (Astro & Safari)

1) On this vehicle, engine must be remove out of bottom of vehicle. Release fuel system pressure. See FUEL PRESSURE RELEASE. Remove battery. Remove air filter assembly and if equipped, disconnect cruise control cable from throttle body. Disconnect cruise control stepper motor electrical connector. Drain cooling system. Raise and support vehicle.

2) Remove rear drive shaft. Disconnect transfer case vent hose. Disconnect exhaust pipes from manifolds and behind catalytic converter. Remove park brake bracket from frame. Disconnect rear brake line from metering proportioning valve (combination valve). Remove flywheel cover, 3 torque converter bolts (A/T), starter and oil filter. Disconnect shift linkage. Disconnect engine wiring harness from transmission and frame.

3) Disconnect fuel lines from frame. Disconnect transmission fluid lines and engine oil cooler lines from radiator. Remove lower fan shroud bolts. Disconnect power steering cooler from front air deflector. Disconnect air bag sensor connector. Remove motor mount through-bolts. Lower vehicle. Remove front bumper.

4) Remove headlight bezels and grille. Remove lower radiator close-out panel, radiator support braces and radiator cross brace. Remove hood latch mechanism. Discharge A/C system (if equipped) using approved refrigerant recovery/recycling equipment. Remove upper fan

shroud, upper radiator core support and radiator.

5) Remove radiator filler panels. Remove engine cover. Disconnect A/C hose from accumulator and condenser. Remove A/C compressor and bracket. Remove power steering pump. Disconnect master cylinder and tie to oil fill tube. Disconnect steering shaft. Disconnect wheel housing splash shields. If equipped, disconnect rear A/C lines at rear crossmember.

6) Disconnect vacuum hoses as necessary. Disconnect fuse box and wiring harness from bulkhead connector, and all related electrical connectors. Lay harness on engine. Remove right kick panel. Remove CPI or TBI unit from intake manifold. Push connector and harness through firewall. Remove distributor cap and A/C accumulator. Disconnect fuel line from injection unit. Pull fuel lines through crossmember and lay lines on transmission. Remove fuel tank electrical connector.

7) Remove transmission dipstick tube (A/T). Disconnect heater hose from heater core. Remove horn. Attach side lift hoist. Attach Body Protection Hoist Adapter Set (J41602), Twin Post Hoist Frame Support (J41617), and Universal Lift Bracket (J41427). Support transmission. On 4WD, disconnect transfer case to engine block support brace. Remove 9 bellhousing bolts. Lower engine from vehicle.

Installation

To install, reverse removal procedure. Tighten 6 frame mounting bolts in sequence. See Fig. 1. Fill crankcase and cooling system. Bleed cooling system. See COOLING SYSTEM BLEEDING. Evacuate and charge A/C system. Bleed power steering. See POWER STEERING BLEEDING. If necessary adjust shift cable. See SHIFT CABLE ADJUSTMENT. Tighten bolts to specification. See TORQUE SPECIFICATIONS.

Removal (Pickup, Sierra, Suburban, Tahoe & Yukon)

1) Release fuel system pressure. See FUEL PRESSURE RELEASE. Remove hood. Remove air cleaner, accessory drive belt, fan and water pump pulley.

2) Drain cooling system. Remove fan shroud and radiator. Disconnect heater hoses from engine. Disconnect fuel lines, electrical connectors, vacuum hoses, coolant hoses and control cables as necessary. Discharge A/C system (if equipped) using approved refrigerant recovery/recycling equipment. Remove A/C compressor and power steering pump with hoses attached and position aside (if equipped).

3) Mark and remove distributor. Raise and support vehicle. Drain crankcase. Disconnect exhaust pipes from manifolds. Disconnect strut rods. Remove flywheel cover. Remove starter. Remove torque converter bolts (A/T). Lower vehicle.

4) Support transmission. Attach engine hoist. Remove bellhousing bolts. Remove front engine mount-to-frame bolts. Remove engine.

Installation

To install, reverse removal procedure. Fill crankcase and cooling system. Bleed cooling system. See COOLING SYSTEM BLEEDING. Evacuate and charge A/C system. Bleed power steering. See POWER STEERING BLEEDING. If necessary adjust shift cable. See SHIFT CABLE ADJUSTMENT. Tighten bolts to specification. See TORQUE SPECIFICATIONS.

Removal & Installation (Commercial Van)

1) Release fuel system pressure. See FUEL PRESSURE RELEASE. Drain crankcase and cooling system. Remove engine cover and floor panel sections.

2) Remove air cleaner, duct and exhaust heat stove pipe. Remove distributor cap and position aside. Disconnect all engine

harness electrical connectors and position aside. Disconnect fuel lines from injection unit. Remove fuel line clamps from transmission and position fuel lines aside. Disconnect electrical connectors, vacuum hoses, coolant hoses and control cables as necessary.

3) Disconnect ground strap from rear end of left cylinder head. Disconnect all transmission harness electrical connectors and position harness aside. Remove transmission shifter (if necessary). Discharge A/C system (if equipped) using approved refrigerant recovery/recycling equipment. Remove A/C compressor. Remove upper radiator hose, all accessory drive belts, fan, fan pulley, fan shroud, lower radiator hose and radiator.

4) Remove engine oil filler tube. Remove clutch adjuster rod, return spring and pivot arm assembly (M/T). Disconnect exhaust pipes from manifolds. Disconnect battery cable from clamp on cylinder block. Disconnect drive shaft from transmission. Remove transmission mount.

5) Disconnect oil cooler lines from oil filter adapter and oil cooler line clamps from engine. Remove torque converter bolts. Attach engine hoist. Remove engine mount through-bolts. Remove engine.

Installation

To install, reverse removal procedure. Fill crankcase and cooling system. Bleed cooling system. See COOLING SYSTEM BLEEDING. Evacuate and charge A/C system. Bleed power steering. See POWER STEERING BLEEDING. If necessary adjust shift cable. See SHIFT CABLE ADJUSTMENT. Tighten bolts to specification. See TORQUE SPECIFICATIONS.

Removal (Blazer, Bravada, Jimmy, Sonoma & Pickup)

1) Release fuel system pressure. See FUEL PRESSURE RELEASE. Remove hood. Raise and support vehicle. Remove underbody shield. Drain crankcase and cooling system. Remove braces from engine to transmission. Disconnect exhaust pipe from exhaust manifolds. Disconnect slave cylinder or hydraulic line if cylinder is mounted inside bellhousing.

2) Disconnect fuel line clamp at bellhousing. Remove starter. Disconnect torque convertor bolts from flywheel. On 4WD, disconnect front drive shaft. On all vehicles, remove oil filter. Remove transmission to engine bolts. Remove all transmission to engine bolts except for upper left bolt. Remove front engine mount through-bolts.

3) Remove rear engine mount crossbar nut and washer. Lower vehicle. Remove battery ground cable at engine. Remove water pump pulley. Discharge A/C system (if equipped) using approved refrigerant recovery/recycling equipment. Remove A/C condenser. Remove A/C compressor and brace.

4) Remove radiator. Disconnect power steering hoses from pump and cap them. Disconnect heater hoses from engine. Disconnect wiring harnesses, vacuum lines, throttle cable and fuel lines. Mark and remove distributor. Support transmission and remove final transmission-to-engine bolt. Remove engine.

Installation

To install, reverse removal procedure. Fill crankcase and cooling system. Bleed cooling system. See COOLING SYSTEM BLEEDING. Evacuate and charge A/C system. Bleed power steering. See POWER STEERING BLEEDING. If necessary adjust shift cable. See SHIFT CABLE ADJUSTMENT. Tighten bolts to specification. See TORQUE SPECIFICATIONS.

Removal & Installation (Express & Savana)

1) Release fuel system pressure. See FUEL PRESSURE RELEASE. Drain cooling system. Remove engine cover and air cleaner. Remove power steering fluid reservoir.

2) Remove upper fan shroud, fan, fan pulley, radiator and

lower fan shroud. Remove engine coolant reservoir. Discharge A/C system (if equipped) using approved refrigerant recovery/recycling equipment. Remove A/C condenser. Remove A/C compressor and brace. Remove generator and bracket. Remove 2 ground straps. Remove cruise control servo (if equipped).

3) Disconnect fuel lines, electrical connectors, vacuum hoses, coolant hoses and control cables as necessary. Remove injection unit. Remove distributor cap with wires attached. Remove diverter valve assembly and pipe.

4) Remove ignition coil and manifold absolute pressure sensor. Remove upper half of engine oil dipstick tube. Remove engine oil filler tube. Remove headlight bezels, grille and upper radiator support (sheet metal cross panel support). Remove front bumper. Remove intake manifold. See appropriate INTAKE MANIFOLD.

5) Raise and support vehicle. Drain crankcase. Disconnect exhaust pipes from manifolds. Remove strut rods. Remove flywheel cover. Disconnect oil cooler lines from engine. Remove transmission shift cable. Remove starter, torque converter bolts (A/T) and engine mount through-bolts.

6) Lower vehicle. Attach engine hoist. Remove bellhousing bolts. Support transmission. Remove engine.

Installation

To install, reverse removal procedure. Fill crankcase and cooling system. Bleed cooling system. See COOLING SYSTEM BLEEDING. Evacuate and charge A/C system. Bleed power steering. See POWER STEERING BLEEDING. If necessary, adjust shift cable. See SHIFT CABLE ADJUSTMENT. Tighten bolts to specification. See TORQUE SPECIFICATIONS.

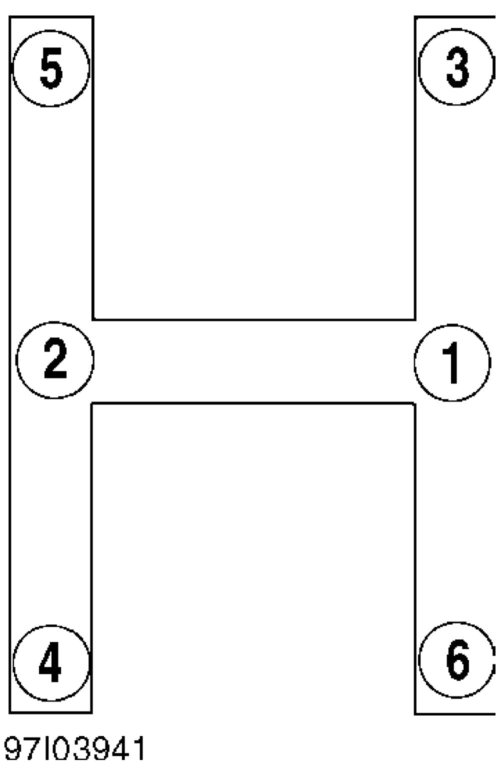


Fig. 1: Tightening frame mounting bolts in sequence (Astro & Safari 4.3L).
Courtesy of General Motors Corp.

INTAKE MANIFOLD (UPPER)

Removal

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

2) Disconnect fuel lines, electrical connectors, vacuum hoses, coolant hoses and control cables as necessary. Remove upper intake manifold and gasket. See Fig. 2. Remove generator bracket, A/C compressor (with hoses attached) and cruise control servo as necessary.

3) Remove distributor cap. Mark distributor rotor in relation to distributor housing. Mark base of distributor housing in relation to lower intake manifold. Remove distributor. Remove electrical connectors, fuel rails and fuel injectors. Remove lower intake manifold bolts, lower intake manifold and gaskets.

Installation

1) Install gaskets on cylinder heads. Apply a 3/16" bead of RTV silicone sealant to front and rear lower intake manifold-to-cylinder block mounting surfaces. See Fig. 3. Extend bead 1/2" beyond cylinder block-to-cylinder head junction.

2) Install lower intake manifold onto cylinder block. Tighten bolts in sequence to specification. See Fig. 4. Install fuel injectors, fuel rails and electrical connectors removed during disassembly.

3) Install distributor, A/C compressor and cruise control servo (if equipped). Install gasket and upper intake manifold. Tighten bolts in sequence to specification. See Fig. 4. See TORQUE SPECIFICATIONS. To complete installation, reverse removal procedure. Fill cooling system.

INTAKE MANIFOLD (LOWER)

Removal

Remove upper intake manifold. See INTAKE MANIFOLD (UPPER). Remove distributor cap. Mark distributor rotor in relation to distributor housing. Mark base of distributor housing in relation to intake manifold. Remove distributor. Remove upper radiator hose at thermostat housing. Remove water pump by-pass hose and heater hose. Remove fuel line brackets and rail. Remove lower intake manifold bolts, lower intake manifold and gaskets.

Installation

1) Apply a 3/16" (5 mm) bead of RTV (GM P/N 1052289) or equivalent to 4 sealing corners of block. Extend bead 1/2" (13 mm) up each cylinder head. Apply Loctite(R) 242 (GM P/N 12345382) or equivalent to lower intake manifold bolt threads. Tighten bolts in sequence to specification. See TORQUE SPECIFICATIONS. To complete installation, reverse removal procedure. Fill and bleed cooling system. See COOLING SYSTEM BLEEDING.

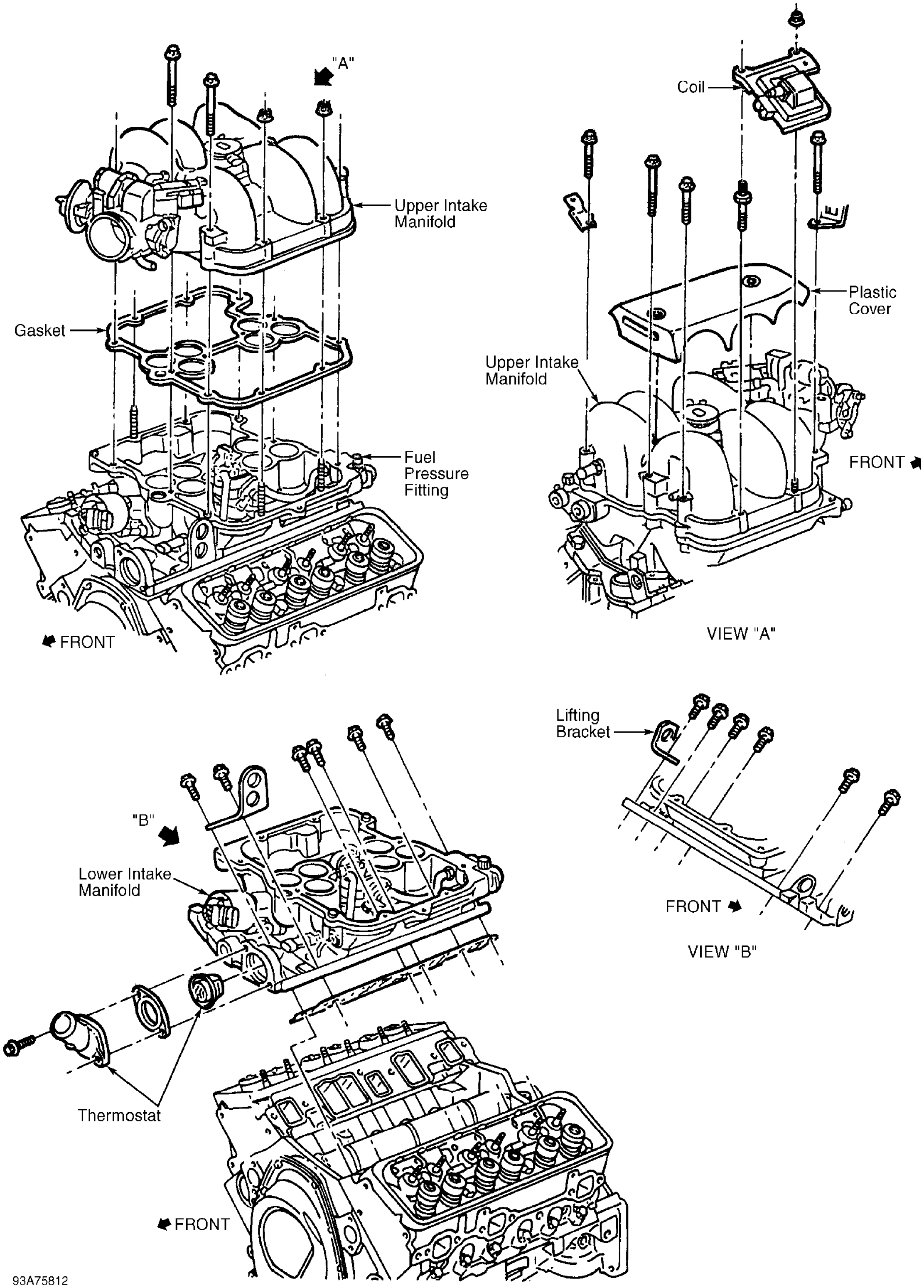


Fig. 2: Exploded View Of Intake Manifold Assembly (4.3L VIN W)
Courtesy of General Motors Corp.

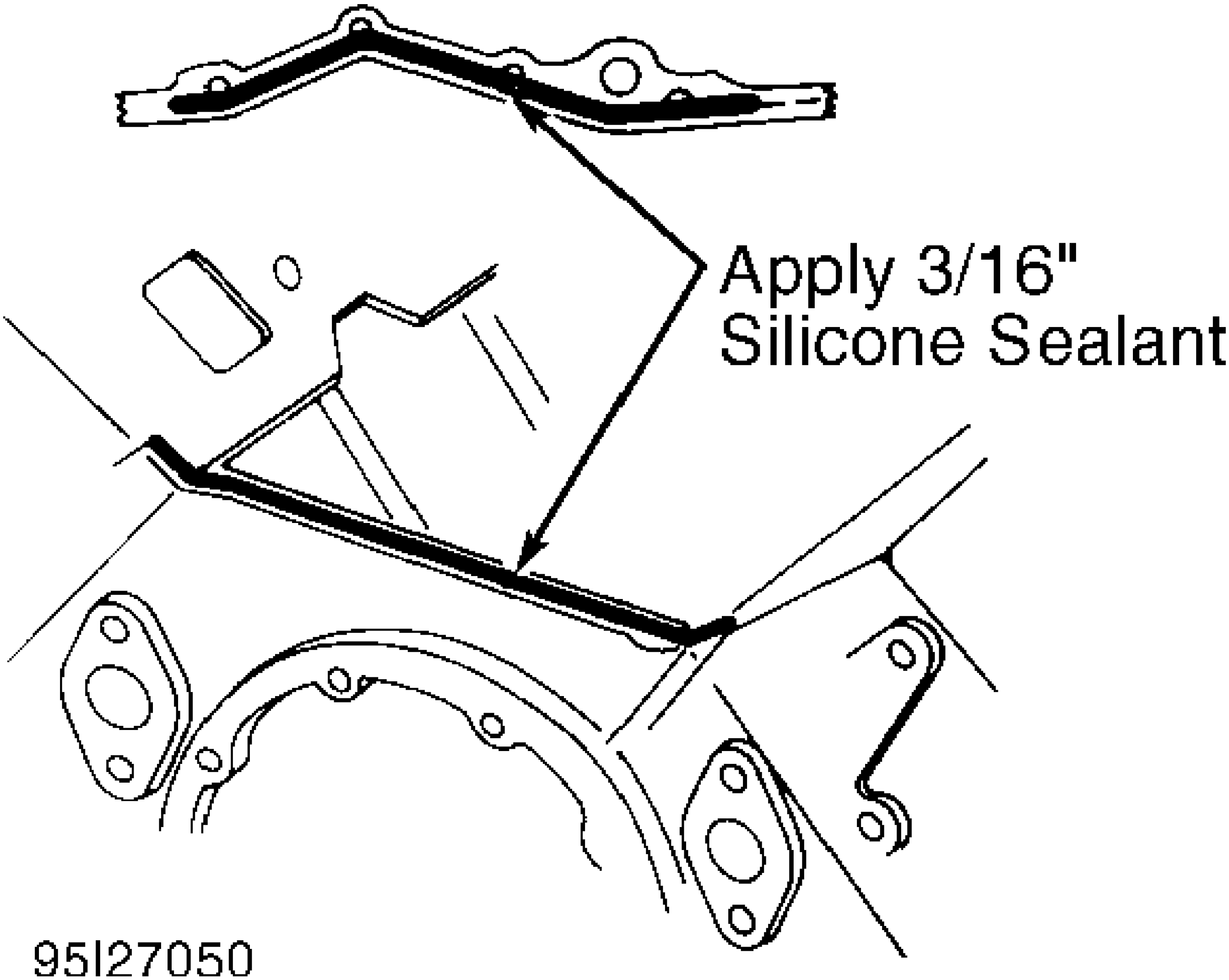


Fig. 3: Applying RTV Sealant Before Installing Intake Manifold (4.3L)
Courtesy of General Motors Corp.

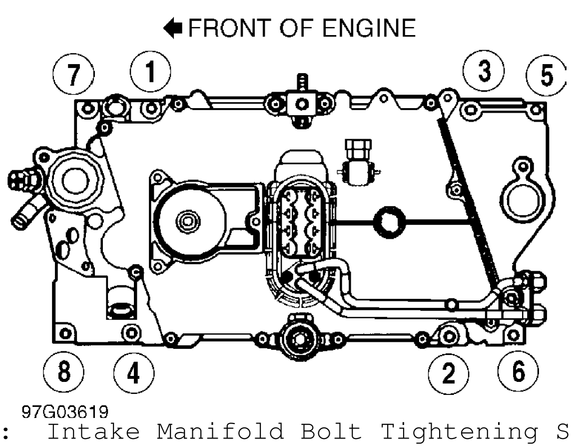


Fig. 4: Intake Manifold Bolt Tightening Sequence (4.3L)
Courtesy of General Motors Corp.

EXHAUST MANIFOLD

Removal

Remove engine cover or floor panel. Remove negative battery cable. Remove oil level indicator tube and EGR inlet pipe. Remove spark plugs and spark pug heat shields. Remove exhaust pipe at manifold. Remove exhaust manifold bolts and exhaust manifold.

Installation

Install manifold. Tighten bolts to specification. See TORQUE SPECIFICATIONS. To complete installation, reverse removal procedure.

CYLINDER HEAD

Removal

Remove negative battery cable. Remove engine cover or floor panel. Remove intake manifold. See appropriate INTAKE MANIFOLD. Discharge A/C system (if equipped) using approved refrigerant recovery/recycling equipment and remove A/C compressor and bracket (if equipped). Remove generator and brackets. Remove spark plugs.

Installation

1) Clean gasket surfaces, bolt threads and bolt holes. If using steel head gasket, thinly coat both sides of gasket with sealant. DO NOT apply sealant to composite (steel/asbestos) head gaskets. Position head gasket on cylinder block. Ensure all holes align. Coat head bolt threads with GM Sealant (1052080).

2) Install cylinder head with bolts finger-tight. Tighten head bolts in sequence to specification. See Fig. 5. See TORQUE SPECIFICATIONS. Lubricate valve tip, rocker arm pivot and push rod socket with Molykote.

3) To complete installation, reverse removal procedure. Adjust valves. See VALVE CLEARANCE ADJUSTMENT under ADJUSTMENTS.

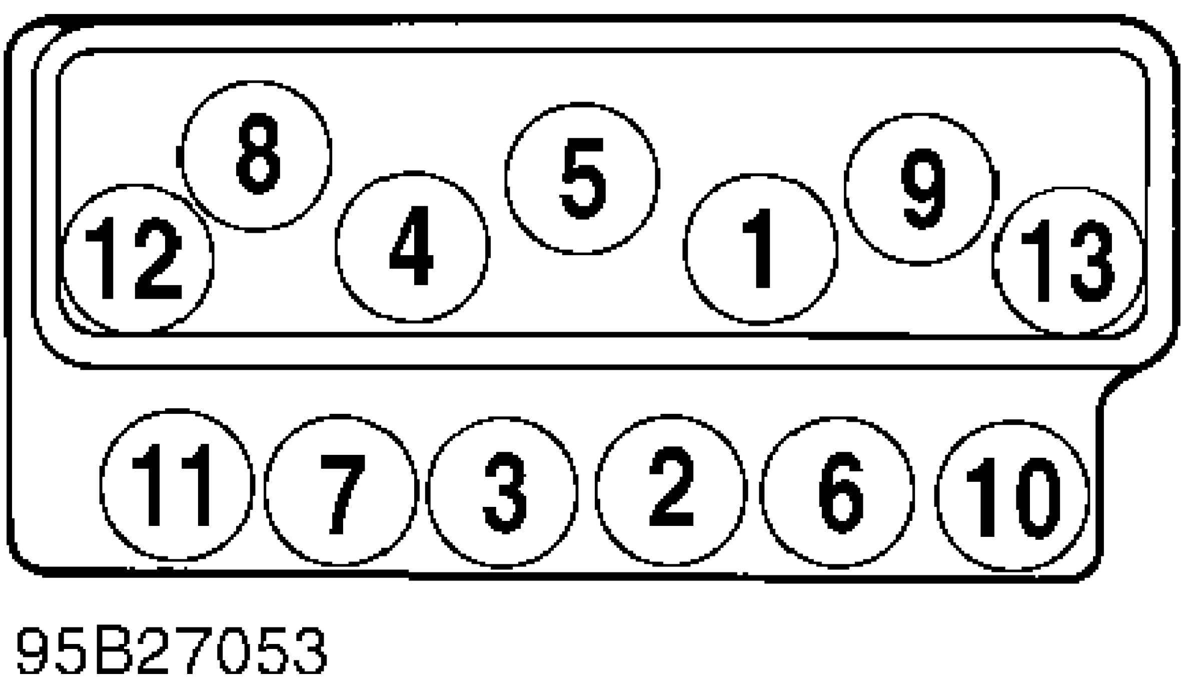


Fig. 5: Cylinder Head Bolt Tightening Sequence 4.3L
Courtesy of Toyota Motor Sales, U.S.A., Inc.

ROCKER ARMS & PUSHRODS

Removal

Remove negative battery cable. On Commercial Van, remove engine cover of floor panel. Remove PCV valve and tube. Remove EGR inlet tube. Remove purge solenoid and spark plug wires. Remove valve cover. Remove rocker arm bolts. If pushrods are to be replaced only, back off valve rocker arm bolts until valve rocker arm can be swung away from pushrod and remove pushrod.

Installation

Coat bearing surfaces with High Viscosity Oil/Zinc (GM P/N 12345501). Valve cover gaskets are reusable. Replace gaskets only if damaged. Tighten to specification. See TORQUE SPECIFICATIONS. To install remaining components, reverse removal procedure.

FRONT COVER OIL SEAL

Removal

Remove negative battery cable. If equipped, remove engine cover or floor pan. Remove engine cooling fan. Remove accessory drive belt(s) and pulley. Remove crankshaft damper bolt. On all models except Commercial Van, use Damper Puller/Installer (J-39046), remove crankshaft damper. On Commercial Van, use Damper Puller/Installer (J-23523-F), remove crankshaft damper. On all models, pry seal from cover.

Installation

1) Coat seal lip with engine oil. Using Seal Installer (J-35468), install NEW seal in front cover with seal lip facing engine. Apply RTV sealant to Woodruff keyway in crankshaft damper.

2) On Commercial Van, use Damper Puller/Installer (J-23523-F) to install crankshaft damper. On all models, tighten bolts to specification. See TORQUE SPECIFICATIONS. To install remaining components, reverse removal procedure.

FRONT COVER

NOTE: DO NOT distort front cover when prying cover loose.

NOTE: If crankshaft sensor reluctor ring is removed. a new crankshaft sensor reluctor ring must be installed.

Removal

Remove negative battery cable. If equipped, remove engine cover or floor pan. Remove engine cooling fan. Remove accessory drive belt(s) and pulley. Remove crankshaft damper bolt. On all models except Commercial Van, use Damper Puller/Installer (J-39046), remove crankshaft damper. Remove water pump. See WATER PUMP. Remove oil pan. See OIL PAN. Drop front of oil pan down. Remove front cover bolts and front cover. Inspect front cover for distortion and damage. Replace cover if necessary.

Installation

Install cover seal with open end of oil seal lasing inside engine. Coat seal with engine oil. Install crankshaft damper using Damper Puller/Installer (J-39046). Tighten to specification. See TORQUE SPECIFICATIONS. To install remaining components, reverse removal procedure.

TIMING CHAIN & SPROCKETS

Removal

1) Disconnect battery. Drain cooling system. If necessary, remove radiator shroud. Remove accessory drive belts, fan and pulley.

Remove crankshaft damper bolt. Using Damper Puller/Installer (J-39046), remove crankshaft damper.

2) Remove all mounting brackets and coolant hoses attached to water pump. Remove water pump. Remove oil pan. See OIL PAN. Remove front cover and gasket. See FRONT COVER.

3) Rotate crankshaft until timing marks on camshaft and crankshaft sprockets are aligned. See Fig. 6. Remove camshaft sprocket and timing chain. To remove crankshaft sprocket, use Sprocket Puller (J-5825-A).

Installation

1) Install Woodruff key in crankshaft (if removed). Using Crankshaft Sprocket Installer (J-5590), install crankshaft sprocket. Install camshaft sprocket and timing chain. Ensure timing marks on sprockets are aligned. See Fig. 6.

CAUTION: On 4.3L with balance shaft, timing gear sprocket marks align at TDC of cylinder No. 4.

2) Balance shaft drive gear, driven gear and gear bolt are serviced as a set. Install and tighten camshaft sprocket bolts to specification. See TORQUE SPECIFICATIONS. Install gasket to front cover with gasket sealant. Install front cover and gasket.

3) Apply RTV sealant to Woodruff keyway in crankshaft damper. Install crankshaft damper. Install crankshaft damper bolt and tighten to specification. See TORQUE SPECIFICATIONS. To complete installation, reverse removal procedure.

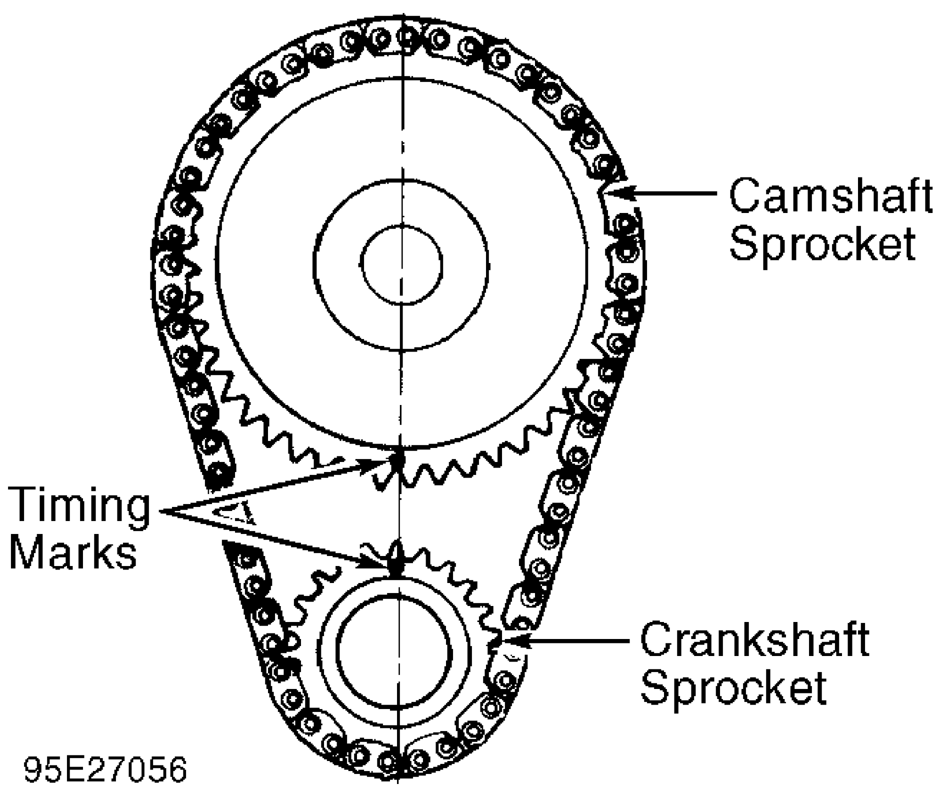


Fig. 6: Aligning Timing Marks
Courtesy of General Motors Corp.

ROCKER ARM STUDS

CAUTION: On models equipped with press in rocker arm studs, ream stud bore before installing oversize rocker arm stud, or cylinder head may be damaged.

Removal & Installation

Unscrew rocker arm stud from cylinder head. To install, insert NEW rocker arm stud. Tighten to 35 ft. lbs. (47 N.m).

VALVE LIFTERS

Removal

Remove upper and lower intake manifold. See INTAKE MANIFOLD (UPPER) and INTAKE MANIFOLD (LOWER). Remove valve covers. Remove push rods. See ROCKER ARMS & PUSH RODS. Remove stuck valve lifter using Valve Lifter Remover (J-9290-01).

Installation

Coat lifter base or roller (if equipped) and body with High Viscosity Oil/Zinc (12345501) or equivalent. Install lifters in original location. To complete installation, reverse removal procedure. Replace oil and filter, and add High Viscosity Oil/Zinc (GM P/N 12345501) or equivalent.

CAMSHAFT

Removal

Remove front cover. See FRONT COVER. Remove timing chain and sprockets. See TIMING CHAIN & SPROCKETS. Install three 5/16" X 18 bolts (4-5 inches long) into camshaft threaded holes. Use bolts to remove and install camshaft.

Installation

Coat camshaft lobes and bearing journals with High Viscosity Oil/Zinc (12345501). Ensure bearing oil holes align with oil holes in block. On engines where oil holes are difficult to see, use a piece of 3/32" rod to check alignment. Install outer camshaft bearing first. Install camshaft. To complete installation, reverse removal procedure.

BALANCE SHAFT (IF EQUIPPED)

Removal

1) Remove radiator. Discharge A/C system (if equipped) using approved refrigerant recovery/recycling equipment and remove A/C condenser (if equipped) and grille. Remove valve lifters. See VALVE LIFTERS.

2) Remove timing chain and camshaft sprocket. See TIMING CHAIN & SPROCKETS. Remove balance shaft gears. Remove balance shaft retainer plate.

3) Remove intake manifold. See INTAKE MANIFOLD. Using a soft-faced hammer, tap balance shaft out toward front of engine.

NOTE: Front bearing is removed with balance shaft. Replace front bearing and balance shaft as a set only. Replace balance shaft timing gears as a set only.

Installation

1) Apply oil to balance shaft bearings. Using Installers (J-36996 and J-8092), install balance shaft in block. See Fig. 7. Install lifter retainer (if equipped). Ensure balance shaft turns.

2) Install thrust plate. Install balance shaft gears. Ensure timing marks on balance shaft gears are aligned. See Fig. 8. Install balance shaft timing gear bolt. Tighten bolt to 15 ft. lbs. (20 N.m), then tighten bolt an additional 35 degrees. To complete installation,

reverse removal procedure.

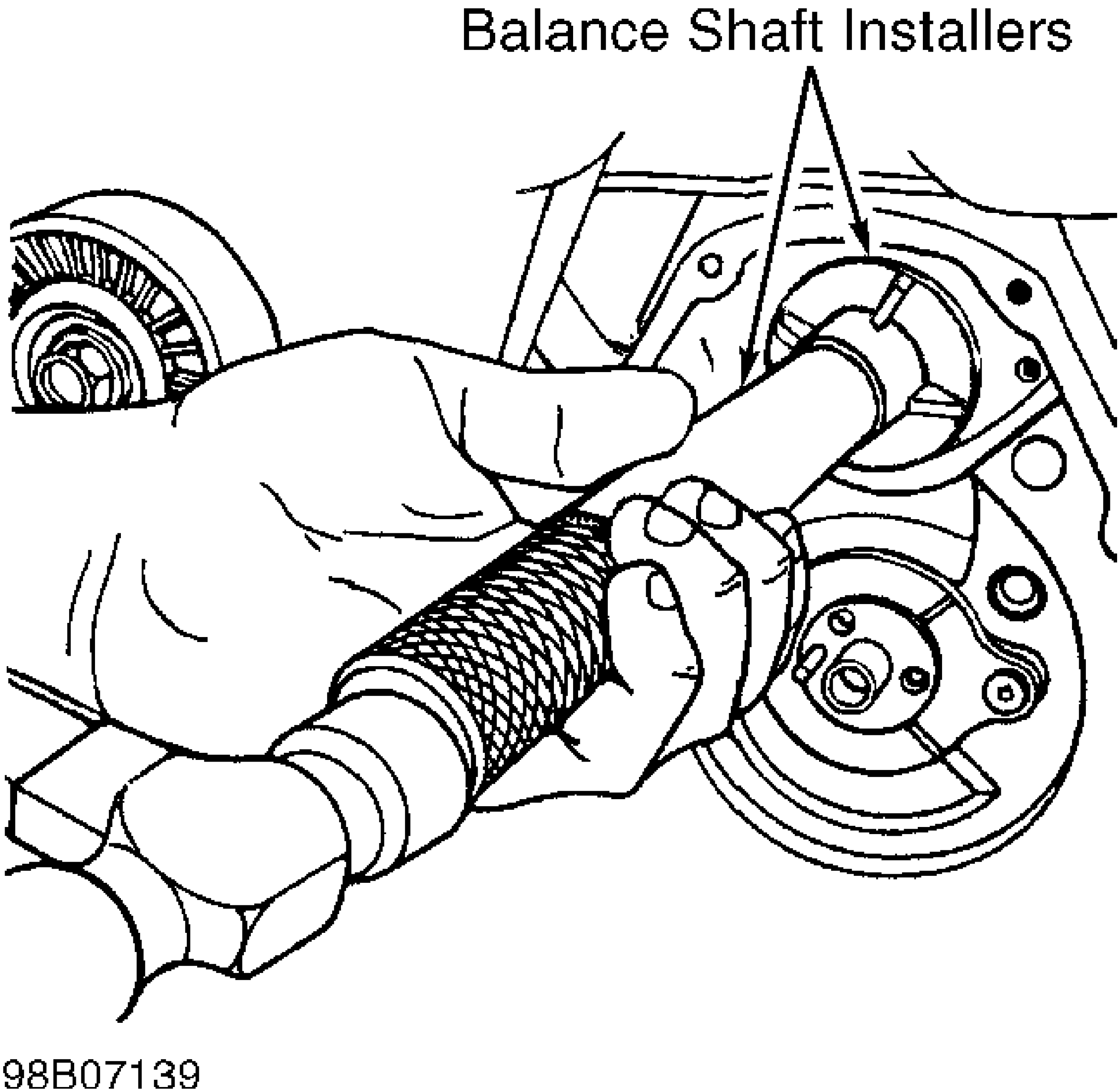


Fig. 7: Installing Balance Shaft
Courtesy of General Motors Corp.

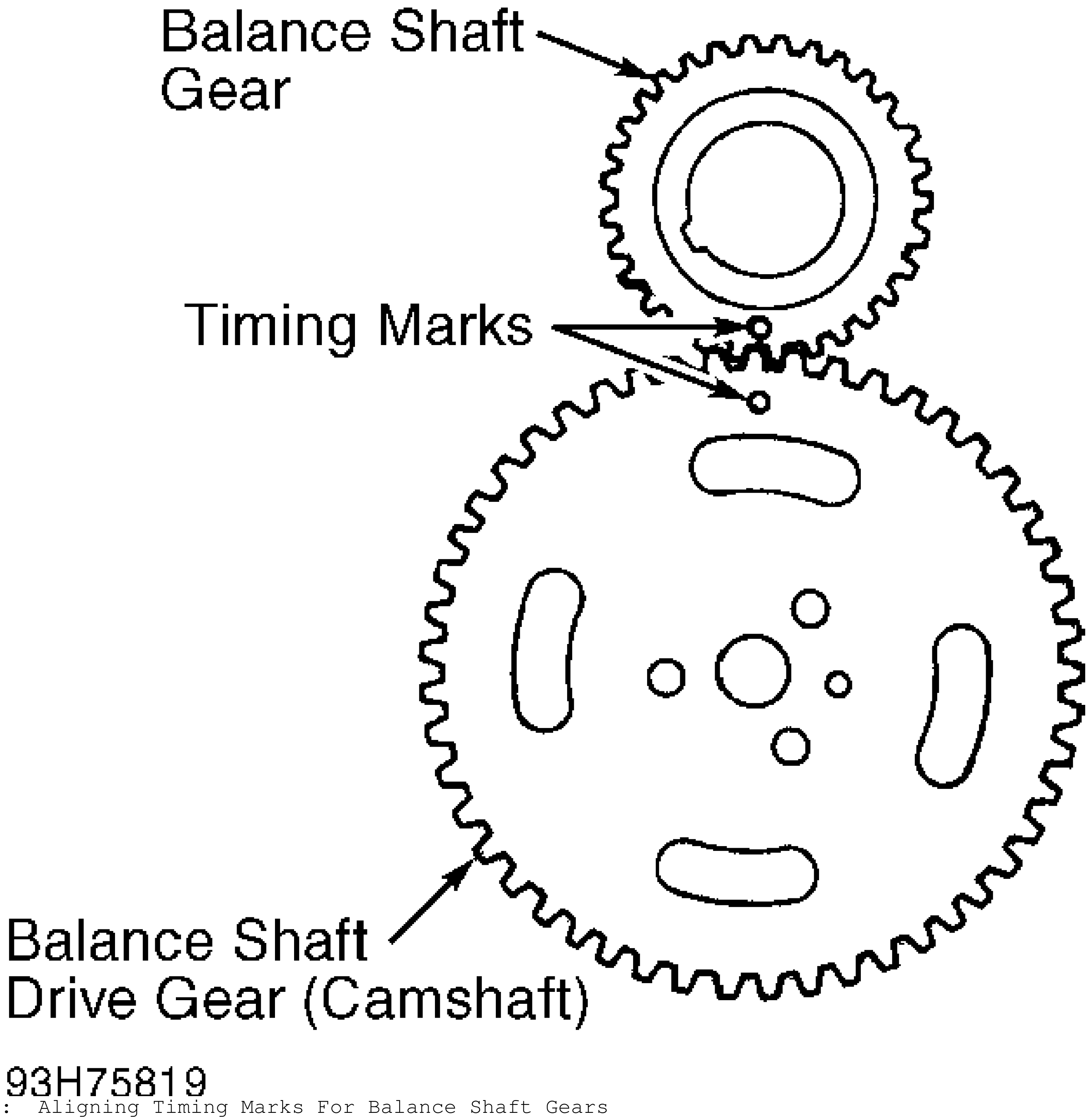


Fig. 8: Aligning Timing Marks For Balance Shaft Gears
Courtesy of General Motors Corp.

REAR CRANKSHAFT OIL SEAL

Removal

Remove transmission, clutch (M/T) and flywheel. On A/T see TRANSMISSION REMOVAL & INSTALLATION - A/T article in TRANSMISSION SERVICING. On M/T see CLUTCH article in M/T. Pry seal from housing.

Installation

1) Lubricate inner and outer diameter of seal with engine oil. Place seal on Seal Installer (J-35621). Position seal against crankshaft as indicated in illustration. See Fig. 9.

2) Thread attaching screws into crankshaft flange and tighten with screwdriver. This squares seal with crankshaft. Rotate seal installer handle until it bottoms. Remove seal installer. Install flywheel, clutch (M/T) and transmission.

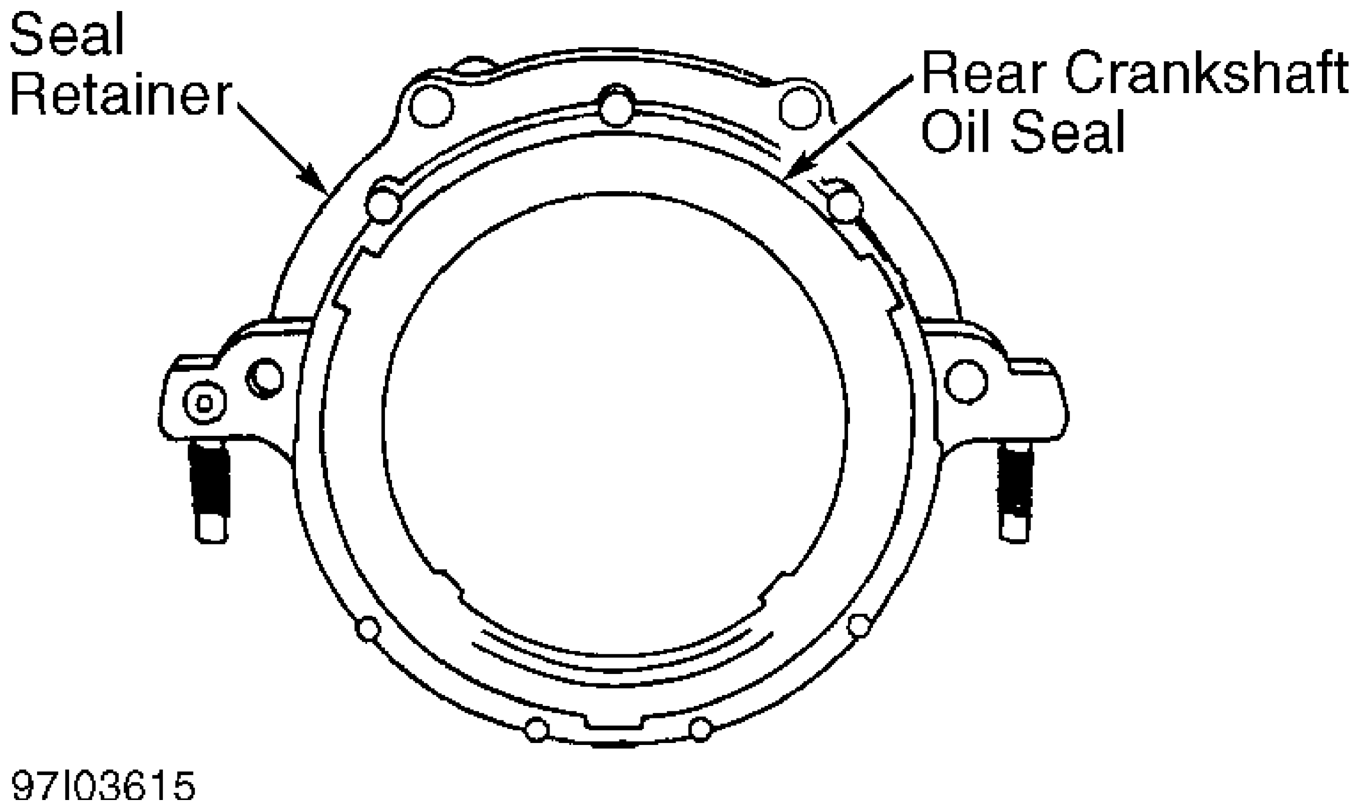


Fig. 9: Installation Position Of Rear Crankshaft Oil Seal.
Courtesy of General Motors Corp.

WATER PUMP

NOTE: DO NOT immerse water pump in solvent. Solvent may cause premature bearing failure.

Removal

Disconnect battery. Drain cooling system. Remove all drive belts, coolant hoses and mounting brackets attached to water pump. If necessary, remove fan shroud. Remove fan and pulley. Remove water pump and gaskets.

Installation

Install water pump with NEW gaskets. Tighten water pump bolts to specification. See TORQUE SPECIFICATIONS. To complete installation, reverse removal procedure.

OIL PAN

CAUTION: Minimal clearance exists between oil pump pick-up tube and bottom of oil pan. DO NOT place jack under oil pan, crankshaft pulley or any sheet metal when lifting engine.

Removal (Except "S" & "T" Series)

1) Disconnect battery. Raise and support vehicle. Drain crankcase. Remove exhaust crossover pipe, strut rods, strut rod brackets and flywheel cover.

2) Remove starter. Remove or disconnect engine oil cooler lines and/or transmission fluid lines as necessary. Remove oil pan bolts, oil pan and gasket.

Removal ("S" Series Pickup, Jimmy & Sonoma 2WD)

Raise and support vehicle. Drain crankcase. Remove engine. See ENGINE. Remove oil pan bolts, oil pan and gasket.

Removal ("T" Series Pickup, Jimmy & Sonoma 4WD)

1) Disconnect battery. Remove engine oil dipstick and accessory drive belt splash shield. Raise and support vehicle. Drain crankcase. Remove front axle shield and transfer case shield. Remove brake line clips from crossmember.

2) Remove second crossmember. Remove converter hanger bolts and exhaust pipe clamp from converter. Disconnect exhaust pipes from manifolds. Slide exhaust pipe rearward. Disconnect front drive shaft from differential.

3) Remove flywheel cover. Remove starter motor. Remove idler arm-to-frame bolts. Remove differential housing mounting bolts from bracket (right side) and frame (left side).

4) Move differential housing forward. Remove front engine mount through-bolts. Raise and support engine. Remove oil pan bolts, oil pan and gasket.

NOTE: If transmission and oil pans are removed at same time. Transmission pan must be installed before oil pan.

Installation

1) Apply RTV sealant to front cover-to-cylinder block junction and rear main bearing-to-cylinder block junction.

2) Using feeler gauge check clearance between 3 oil pan-to-transmission contact points. If clearance exceeds .0100" (.025 mm) at any of 3 points, repeat installation steps until clearance is within specification. See Fig. 10. Install oil pan. Tighten oil pan bolts to specification. See
TORQUE SPECIFICATIONS. To complete installation, reverse removal procedure. Fill crankcase.

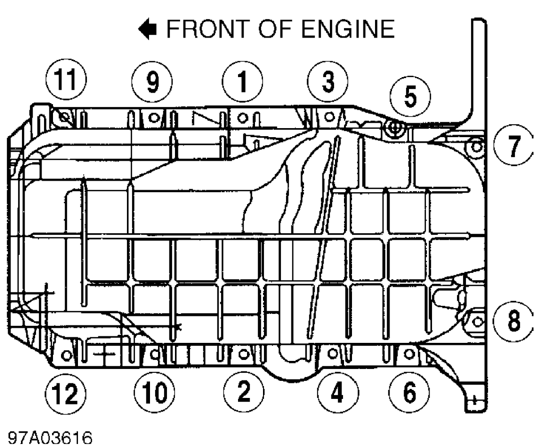


Fig. 10: Oil Pan Bolts Tightening Sequence (4.3L).
Courtesy of General Motors Corp.

OVERHAUL

CYLINDER HEAD

Valve Springs

1) Measure valve spring free length, installed height and pressure (tension). Replace valve spring if measurement is not within specification. See VALVES & VALVE SPRINGS table under ENGINE SPECIFICATIONS.

2) Measure installed height between cylinder head spring seat (or top of shim, if shimmed) and top of spring shield. If installed height exceeds specification, install shims as necessary to bring installed height to specification.

Valve Stem Oil Seals

1) Intake valve uses upper "O" ring seal and lower umbrella seal; exhaust valve uses upper "O" ring seal.

2) When installing umbrella seal, seat seal against valve guide boss on cylinder head. If equipped, coat upper "O" ring seal with engine oil before installation and ensure seal is not twisted when installed. A gap of .040-.080" (1-2 mm) must exist between edge of oil seal and valve guide. See Fig. 11.

Valve Guides

Valve guides are part of cylinder head (not replaceable). Measure valve guide oil clearance. See CYLINDER HEAD table under ENGINE SPECIFICATIONS. If not within specification, ream valve guide and install valves with oversize stems.

Valves

Replace valve if margin is less than .031" (.8 mm).

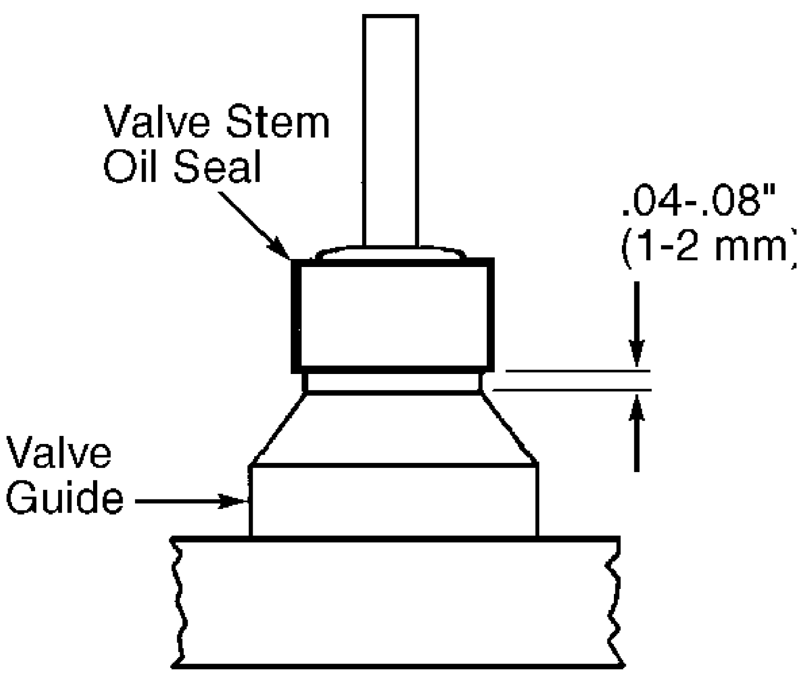


Fig. 11: Installation Of Valve Stem Oil Seal
Courtesy of General Motors Corp.

VALVE TRAIN

Rocker Arm Assembly

Clean push rods, rocker arms, balls and nuts with solvent and blow dry. Inspect rocker arms and balls at mating surface. Surface should be smooth and free of damage. Inspect push rods for bends or wear. Ensure oil passages are clear.

CYLINDER BLOCK ASSEMBLY

Piston & Rod Assembly

1) Mark piston in relation to cylinder bore before removal. Piston pin is press-fit in connecting rod. Mark piston in relation to connecting rod before separating components.

2) Replace piston and piston pin as matched set. Install piston in bore with notch on top of piston toward front of engine.

Fitting Pistons

1) Measure piston diameter at 90-degree angle to piston pin, on piston pin center line. Measure cylinder bore diameter 2 1/2" below cylinder block deck. Determine piston clearance.

2) If piston clearance is not within specification, replace piston and/or machine cylinder bore as necessary. See CYLINDER BLOCK table and PISTONS, PINS & RINGS table under ENGINE SPECIFICATIONS.

Piston Rings

Measure piston ring end gap and side clearance. If measurement is not within specification, replace piston and/or rings as necessary. See PISTONS, PINS & RINGS table under ENGINE SPECIFICATIONS. Install rings with mark on ring facing upward. Position ring end gaps around circumference of piston as shown. See Fig. 12.

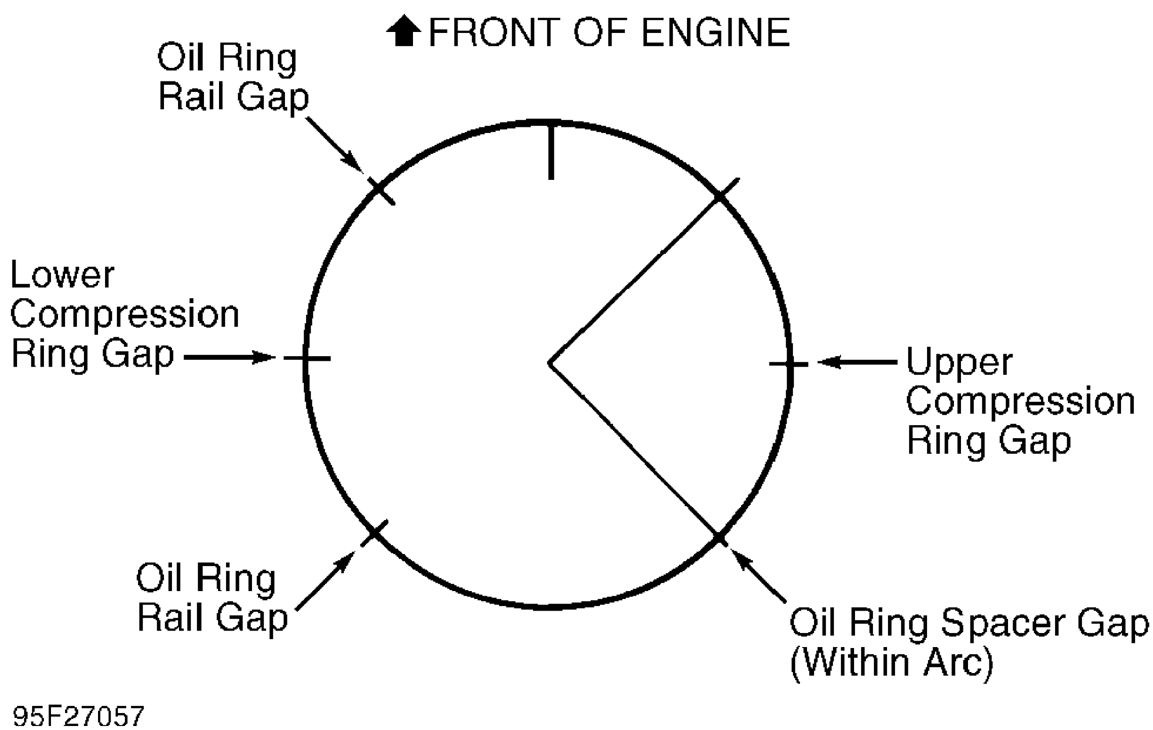


Fig. 12: Positioning Piston Ring End Gaps
Courtesy of General Motors Corp.

Rod Bearings

1) Measure rod bearing journal out-of-round, taper and oil

clearance. If measurement is not within specification, replace rod bearings and/or machine crankshaft. See CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS table under ENGINE SPECIFICATIONS.

2) Ensure rod side play is within specification. See CONNECTING RODS table under ENGINE SPECIFICATIONS.

Crankshaft & Main Bearings

1) Mark bearing caps for reassembly. Measure journal diameter, out-of-round, taper and oil clearance. If measurement is not within specification, replace main bearings and/or machine crankshaft. See CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS table under ENGINE SPECIFICATIONS.

2) Align thrust bearing surfaces, and measure crankshaft end play. See THRUST BEARING. Main bearing caps are press fit. Using Tool (J-6125-B and J-41348), carefully remove caps for service. Install main bearings and main caps. Tap bearing caps into cylinder block cavity using a brass, lead, or leather mallet before installing attaching bolts.

3) DO NOT use cap bolts to pull crankshaft bearing caps into seats. Tighten NEW main cap bolts evenly.

CAUTION: On some 4.3L engines, the distance between rear main bearing thrust faces is .008" (.20 mm) wider than standard (identified by .008" stamped on crankshaft rear counterweight). When replacing rear main bearings on these engines, use only .008" (.20 mm) wider bearings.

Thrust Bearing

1) Install main bearing caps (except rear), and tighten cap bolts to specification. See TORQUE SPECIFICATIONS. Install rear main bearing cap and tighten cap bolts to 10 ft. lbs. (14 N.m).

2) Tap crankshaft rearward then forward to align thrust surfaces. Tighten rear main bearing cap bolts to specification. Measure crankshaft end play at forward thrust surface of rear main bearing cap. See CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS table under ENGINE SPECIFICATIONS.

Cylinder Block

Measure cylinder bore out-of-round and taper. If measurement is not within specification, machine cylinder bore and/or replace piston. See CYLINDER BLOCK table under ENGINE SPECIFICATIONS. Finish bore with a 45-65 degree cross-hatch pattern.

ENGINE OILING

ENGINE LUBRICATION SYSTEM

Gear-type oil pump delivers full pressure lubrication through full-flow oil filter to main oil gallery. Main oil gallery feeds crankshaft and camshaft bearings through drilled passages in block.

Valve lifter oil gallery feeds valve lifters. From lifters, oil is routed through hollow push rods to upper valve train components. Timing chain and sprockets are lubricated by oil drainage from No. 1 camshaft bearing. Pistons and piston pins are lubricated by oil splash. Non-adjustable oil pressure regulator is located in oil pump body.

Crankcase Capacity

See CRANKCASE CAPACITY table.

CRANKCASE CAPACITY (1)

Application	Qts. (L)
4.3L	4.5 (4.26)

(1) - Capacity includes oil filter.

Oil Pressure

Measure oil pressure with engine at operating temperature and specified RPM. See OIL PRESSURE SPECIFICATIONS table.

OIL PRESSURE SPECIFICATIONS (1)

Application	psi (kg/cm^2)
1000 RPM	6 (0.4)
2000 RPM	18 (1.3)
4000 RPM	24 (1.7)

(1) - Minimum specification.

OIL PUMP

NOTE: Pick-up tube is serviceable; however, unless tube is damaged, DO NOT remove tube from pump body.

Removal & Disassembly

1) Remove oil pan. See OIL PAN under REMOVAL & INSTALLATION. Remove oil pump bolt. Remove pump and extension shaft. If necessary, remove pick-up tube.

2) Remove pump cover. Mark relationship between gears at a meshing point for reassembly. Remove gears. Remove pressure regulator valve retaining pin. Remove pressure regulator valve and spring.

Remove oil pump-to-rear crankshaft bearing cap bolt. Remove oil pump, retainer and driveshaft from rear crankshaft bearing cap.

Inspection

Inspect pump body and cover for cracks or excessive wear. Inspect pump gears for damage or wear. Check drive gear shaft for looseness in pump body. Check pressure regulator valve for fit in bore. Replace entire pump assembly if damaged. Inspect inlet tube and screen assembly for damage.

Reassembly & Installation

1) Install pump gears into pump body with marked gear teeth indexed. If pick-up tube was removed, apply sealant to tube end. Tap tube end into pump using plastic hammer. Reassemble remaining components in reverse order of disassembly.

2) Prime oil pump with engine oil. Install pump and extension shaft, ensuring slot on top of extension shaft engages with drive tang on end of distributor shaft. Tighten oil pump bolt to specification. See TORQUE SPECIFICATIONS. Install oil pan.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Balance Shaft Gear Bolt	
Step 1	15 (20)

```
  Step 2  ..........................  Additional 35 Degrees
Bellhousing Bolt  ................................  32 (44)
Camshaft Sprocket Bolt  ..........................  18 (25)
Connecting Rod Cap Nut
  Step 1  ........................................  20 (27)
  Step 2  ..........................  Additional 70 Degrees
Crankshaft Damper Bolt  ......................... 74 (100)
Crankshaft Oil Deflector Bolt/Nut  ...............  27 (36)
Cylinder Head Bolt (1)
  Step 1  ........................................  22 (30)
  Step 2
   Short Bolts
     (No. 2, 3, 6, 7, 10, 11)  ......  Additional 55 Degrees
      Medium Bolts (No. 12, 13)  ....  Additional 65 Degrees
     Long Bolts
      (No. 1, 4, 5, 8, 9)  ..........  Additional 75 Degrees
Exhaust Manifold Bolt
  Step 1  ........................................  11 (15)
  Step 2  ........................................  22 (30)
Flywheel Bolt  .................................. 74 (100)
Main Bearing Cap Bolt  .......................... 78 (106)
Oil Filter Adapter Bolt  .........................  16 (22)
Oil Pan Nut/Bolt  ................................  18 (25)
Oil Pump Bolt  ...................................  66 (90)
Rear Crankshaft Oil Seal Retainer Bolt  ..........  11 (15)
Rocker Arm
  With Press-In Studs
   Rocker Stud  ..................................  35 (47)
   Rocker Nut  ...................................  18 (25)
  With Screw-In Studs
   Rocker Stud  ..................................  35 (47)
   Rocker Nut  ...................................  19 (26)
Valve Lifter Retainer Bolt  ......................  12 (16)
Water Pump Bolt  .................................  33 (45)

                                        INCH Lbs. (N.m)

Balance Shaft Retainer Plate Bolts  ............. 106 (12)
Camshaft Retainer Bolt  ......................... 106 (12)
Front Cover Bolt  ............................... 106 (12)
Intake Manifold (2)
  Upper
   Step 1  ........................................  44 (5)
   Step 2  .......................................  89 (10)
  Lower
   Step 1  ........................................  27 (3)
   Step 2  ...................................... 106 (12)
   Step 3  ...................................... 133 (15)
Oil Pump Cover Bolt  ............................ 106 (12)
Valve Cover Bolt  ................................  89 (10)

(1) - Apply GM Sealant (1052080) to head bolt threads.
      Tighten bolts in sequence. See Fig. 6.
(2) - Tighten bolts in sequence. See Fig. 4.
```

ENGINE SPECIFICATIONS

GENERAL SPECIFICATIONS

GENERAL SPECIFICATIONS

Application	Specification
Displacement	262 Cu. In.
Bore	4.00" (101.6 mm)
Stroke	3.48" (88.4 mm)
Compression Ratio	9.2:1
Fuel System	
VIN W	CSI
VIN X	CSI
Horsepower @ RPM	
2WD	
VIN W	180 @ 4400
VIN X	175 @ 4400
4WD	
VIN W	190 @ 4400
VIN X	180 @ 4400
Torque Ft. Lbs. @ RPM	
2WD	
VIN W	245 @ 2800
VIN X	240 @ 2800
4WD	
VIN W	250 @ 2800
VIN X	240 @ 2800

CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS

CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS

Application	In. (mm)
Crankshaft End Play	.002-.008 (.05-.20)
Main Bearings	
Journal Diameter	
No. 1	2.4488-2.4495 (62.199-62.217)
No. 2 & 3	2.4485-2.4494 (62.191-62.215)
No. 4	2.4480-2.4489 (62.179-62.203)
Journal Out-Of-Round	.0002-.001 (.005-.03)
Journal Taper (Maximum)	.0003 (.008)
Oil Clearance	
Standard	
No. 1	.0008-.0020 (.020-.051)
No. 2, 3 & 4	.0009-.0024 (.023-.061)
Connecting Rod Bearings	
Journal Diameter	2.2487-2.2497 (57.117-57.142)
Journal Out-Of-Round	.0002 (.005)
Service Limit	.001 (.03)
Journal Taper	.0003 (.008)
Service Limit	.001 (.03)
Oil Clearance	.0013-.0035 (.033-.089)
Service Limit	.001-.0030 (.03-.076)
Side Clearance	.006-.017 (.15-.43)

CONNECTING RODS

CONNECTING RODS

Application	In. (mm)
Side Play	.015-.046 (.38-1.17)

PISTONS, PINS & RINGS

PISTONS, PINS & RINGS

Application	In. (mm)
Pistons	
Clearance	.0007-.0020 (.018-.051)
Pins	
Diameter	.9270-.9271 (23.545-23.548)
Piston Fit	
Standard	.0002-.0007 (.005-.018)
Rod Fit	.0013-.0019 (.033-.048) Interference
Rings	
No. 1	
End Gap	.010-.016 (.25-.41)
Side Clearance	.001-.003 (.03-.08)
No. 2	
End Gap	.018-.026 (.46-.66)
Side Clearance	.001-.003 (.03-.08)
No. 3 (Oil)	
End Gap	.015-.055 (.38-1.40)
Side Clearance	.002-.007 (.05-.18)

CYLINDER BLOCK

CYLINDER BLOCK

Application	In. (mm)
Cylinder Bore	
Diameter	4.0007-4.0017 (101.618-101.643)
Maximum Taper	(1) .0005 (.013)
Maximum Out-Of-Round	(2) .001 (.03)

(1) - Specification is for thrust side. Relief side is .001" (.03 mm).
(2) - Production specification is given. Maximum service specification is .002" (.05 mm).

VALVES & VALVE SPRINGS

VALVES & VALVE SPRINGS

Application	Specification
Valves	
Face Angle	45°
Minimum Margin	.031" (.79 mm)
Valve Springs	
Free Length	2.02" (51.3 mm)
Installed Height	1.69-1.71" (42.9-43.4 mm)
	Lbs. @ In. (Kg @ mm)
Pressure	
Valve Closed	76-84 @ 1.70 (34-38 @ 43.2)
Valve Open	187-203 @ 1.27 (85-92 @ 32.3)

CYLINDER HEAD

CYLINDER HEAD

Application	Specification
Valve Seats	
Intake Valve	
Seat Angle	46°
Seat Width	.035-.060" (.88-1.52 mm)
Maximum Seat Runout	.002" (.05 mm)
Exhaust Valve	
Seat Angle	46°
Seat Width	.062-.093" (1.58-2.36 mm)
Maximum Seat Runout	.002" (.05 mm)
Valve Guide Oil Clearance	.001-.003" (.03-.07 mm)
Warpage	.004" (.10 mm)

CAMSHAFT

CAMSHAFT

Application	In. (mm)
End Play	.001-.009 (.03-.23)
Journal Diameter	1.8682-1.8692 (47.452-47.478)
Lobe Lift	
Intake	.286-.290 (.0726-.0736)
Exhaust	.292-.296 (.0741-.0751)

BALANCE SHAFT

BALANCE SHAFT

Application	In. (mm)
Journal Diameter	
Front Journal	2.1648-2.1654 (54.986-55.001)
Rear Journal	1.4994-1.5000 (38.085-38.100)
Oil Clearance (Rear Journal)	.001-.004 (.03-.10)

ABBREVIATIONS

1997 Chevrolet Blazer

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 CLUTCH CONTROLS

1997 Chevrolet Blazer

1997 A/C GENERAL SERVICING
General Motors Corp. - A/C Compressor Clutch Controls

2.2L
Chevrolet; S10 Pickup
GMC; Sonoma

4.3L
Chevrolet; Blazer, S10 Pickup
GMC; Jimmy, Sonoma
Oldsmobile; Bravada

* PLEASE READ THIS FIRST *

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

DESCRIPTION & OPERATION

NOTE: Powertrain Control Module (PCM) may also be known as Vehicle Control Module (VCM).

The A/C compressor clutch relay is controlled by the PCM. The PCM improves idle quality by delaying A/C compressor clutch engagement until idle speed is increased, or disengages A/C compressor clutch when idle speed is too low. A/C compressor clutch is cycled by PCM. PCM smooths cycling of A/C compressor clutch by adding fuel the instant A/C compressor clutch is applied.

TROUBLE SHOOTING

NOTE: This article contains testing that is part of General Motors Computerized Engine Controls. Only testing procedures required to test A/C compressor clutch control circuit is included. Other diagnostic information may be referenced while performing A/C compressor clutch control diagnosis. For complete information on General Motors Computerized Engine Control systems, see G - TESTS W/CODES article in the ENGINE PERFORMANCE section.

RELAY LOCATION

A/C COMPRESSOR CLUTCH RELAY LOCATION TABLE

Application	Location
S/T Series	In Engine Compartment, On Bracket At Center Of Firewall

SCAN TOOL

A variety of information is transmitted through Data Link Connector (DLC). This data is transmitted at a high frequency which requires a Tech 1 scan tool, appropriate cartridge kit and vehicle interface module kit, or other scan tool for interpretation. Several scan tools are available for diagnostic work. Scan tools other than Tech 1 scan tool will function and provide information for diagnostic work.

WARNING: Vehicles may be equipped with a PCM using an Electronically Erasable Programmable Read Only Memory (EEPROM). When replacing PCM, the new PCM must be programmed.

NOTE: To help save diagnostic time, ALWAYS check for blown fuses or fusible links before proceeding with any testing. If fuses are blown, locate and repair short circuit before replacing fuses. Ensure all related relay and wire harness connections are clean and tight. Repair as necessary.

A/C CLUTCH CIRCUIT DIAGNOSIS (2.2L VIN 4 - S10 & SONOMA ONLY)

Description

PCM receives an A/C request signal from Instrument Panel Cluster (IPC) over serial data line. When A/C is requested, PCM provides a ground path to A/C clutch relay control circuit. When relay circuit is grounded, A/C compressor clutch relay is energized. After A/C request has been selected, PCM will delay grounding A/C compressor relay control circuit for .3 second. This allows PCM to adjust engine idle RPM for additional load.

PCM will temporarily de-energize A/C compressor clutch relay for a hot engine restart, wide open throttle, engine speed greater than 6000 RPM, or Idle Air Control (IAC) valve reset. A/C compressor (DTC) P0530 is set, or there is no A/C request signal due to an open A/C select switch circuit.

Compressor Clutch Control Circuit Diagnosis

1) If On-Board Diagnostic (OBD) System Check has not been performed, see the G - TESTS W/CODES article in the ENGINE PERFORMANCE section and go to OBD SYSTEM CHECK. If OBD SYSTEM CHECK has been performed, go to next step.

2) Install scan tool. Check if DTC P0530 is set. If DTC P0530 is set, see the G - TESTS W/CODES article in the ENGINE PERFORMANCE section. If DTC P0530 is not set, go to next step.

3) Turn ignition on, engine off. Check if A/C compressor clutch is engaged. If A/C compressor clutch is engaged, go to next step. If A/C compressor clutch is not engaged, go to step 5).

4) Disconnect A/C relay. If A/C compressor clutch disengages, go to step 6). If A/C compressor clutch does not disengage, go to step 7).

5) Start engine and allow it to reach normal operating temperature. Cycle A/C selector switch on, then off. If A/C compressor clutch cycles on, then off, go to step 8). If A/C compressor clutch does not cycle on, then off, go to step 9).

6) Using a test light connected to battery voltage, probe A/C relay control circuit (Dark Green/White wire). If test light comes on, go to step 10). If test light does not come on, go to step 11).

7) Disconnect A/C compressor clutch harness connector. If A/C compressor clutch disengages, go to step 12). If A/C compressor clutch does not disengage, go to step 13).

8) Turn ignition on, engine off. Install A/C manifold gauge set. Observe A/C high-side pressure readings on gauge set and scan tool. If high-side pressures are within 20 psi (1.4 kg/cm^2) of each other, go to step 36). If high-side pressures are not as specified, go to step 14).

9) Turn A/C on, then off. If scan tool indicates that A/C was requested, then not requested, go to step 15). If operation is not as specified, go to step 16).

10) Check A/C compressor clutch relay control circuit (Dark Green/White wire) for a short to ground. Repair as necessary. Go to step 36). If no problem is found, go to step 22).

11) Replace A/C compressor clutch relay. Go to step 36).

12) Repair short to power in A/C compressor clutch ignition feed circuit (Dark Green wire). Go to step 36).

13) Replace faulty A/C compressor clutch assembly. Go to step 36).

14) Turn ignition on, engine off. Disconnect A/C refrigerant pressure sensor harness connector. Using a voltmeter, measure voltage between battery positive and Black wire at A/C refrigerant pressure sensor harness connector. If reading is battery voltage, go to step 18). If reading is not as specified, go to step 19).

15) With ignition on, engine off, observe A/C HIGH-SIDE pressure reading on scan tool. If reading is 40-430 psi (2.8-30.2 kg/cm^2), go to step 20). If reading is not as specified, go to step 21).

16) Turn ignition off. Disconnect PCM harness connectors. Turn ignition on. Using a test light connected to ground, probe A/C selector switch input circuit (Light Green wire) at PCM harness connector. Cycle A/C selector switch on, then off. If test light toggles on, then off, go to next step. If operation is not as specified, go to step 23).

17) Check Light Green wire for a poor connection at PCM. Repair as necessary. Go to step 36). If no problem is found, go to step 22).

18) Replace A/C refrigerant pressure sensor. Go to step 36).

19) Repair open or poor connection in A/C refrigerant pressure sensor ground circuit (Black wire). Go to step 36).

20) Disconnect A/C relay. Using a test light connected to ground, probe A/C relay ignition feed circuits (Orange and Pink wires). If test light comes on for both circuits, go to step 24). If test light does not come on for both circuits, go to step 25).

21) Install A/C manifold gauge set. With ignition on, engine off, observe A/C high-side pressure readings on gauge set and scan tool. If high-side pressures are within 20 psi (1.4 kg/cm^2) of each other, see the A/C-HEATER SYSTEM - MANUAL article. If high-side pressures are not as specified, go to step 18).

22) Replace PCM. Go to step 36).

23) Repair A/C request signal circuit (Light Green wire) from A/C selector switch. Go to step 36).

24) Connect a fused jumper wire between A/C relay harness connector cavities No. 87 (Orange wire) and No. 30 (Dark Green wire). If A/C compressor clutch engages, go to step 26). If A/C compressor clutch does not engage, leave jumper wire installed and go to step 27).

25) If test light did not come on at Orange wire, check for a short to ground in A/C compressor clutch ignition feed circuit (Dark Green wire), or for a faulty A/C compressor clutch diode. Repair as necessary. Go to step 36). If no problem is found, go to step 28).

26) Remove jumper wire. Start engine and let idle. Using a test light connected to battery positive, probe A/C relay harness connector cavity No. 85 (Dark Green/White wire). Using scan tool, command A/C relay on. If test light comes on, go to step 11). If test light does not come on, go to step 29).

27) Disconnect A/C compressor clutch harness connector. Using a test light connected to ground, probe Dark Green wire at A/C compressor clutch harness connector. If test light comes on, go to step 30). If test light does not come on, go to step 31).

28) Repair open in Orange wire or Pink wire to A/C relay. Go to step 36).

29) Using a test light connected to ground, probe A/C relay harness connector cavity No. 85 (Dark Green/White wire). If test light

comes on, go to step 32). If test light does not come on, go to step 33).

30) Using a test light connected to battery positive, probe A/C compressor clutch ground circuit (Black wire) at A/C compressor clutch harness connector. If test light comes on, go to step 34). If test light does not come on, go to step 35).

31) Repair open in A/C compressor clutch ignition feed circuit (Dark Green wire). Go to step 36).

32) Check A/C compressor clutch relay control circuit (Dark Green/White wire) for a short to power. Repair as necessary. Go to step 36). If no problem is found, go to step 17).

33) Check A/C compressor clutch relay control circuit (Dark Green/White wire) for an open or poor connection. Repair as necessary. Go to step 36). If no problem is found, go to step 17).

34) Replace A/C compressor clutch coil. Go to step 36).

35) Repair open or poor connection in A/C compressor clutch ground circuit (Black wire). Go to next step.

36) Start engine and let idle. Cycle A/C selector switch on, then off. If A/C compressor clutch cycles on, then off, system is okay at this time.See DIAGNOSTIC AIDS. If operation is not as specified, go to step 2).

Diagnostic Aids

If DTC P0530 is set, do not perform this diagnostic procedure. Diagnose appropriate DTC before proceeding. See the G - TESTS W/CODES article in the ENGINE PERFORMANCE section.

A/C refrigerant pressure less than 43 psi (3.0 kg/cm^2), or greater than 428 psi (30.1 kg/cm^2) will cause PCM to disable A/C compressor clutch. With engine running and A/C on, use scan tool to monitor A/C high-side system pressure for 2 minutes. If pressure goes out of range, see the A/C-HEATER SYSTEM TROUBLE SHOOTING - MANUAL article.

A/C CLUTCH CIRCUIT DIAGNOSIS (4.3L VIN W & X - ALL MODELS)

Description

Vehicle Control Module (VCM) controls A/C clutch to improve idle quality and performance by delaying clutch engagement until idle speed is increased, releasing clutch when idle speed is too low, and smooths cycling of compressor by providing additional fuel the instant clutch is applied.

Turning on A/C supplies battery voltage through pressure switches to VCM. When VCM receives voltage on A/C request signal, A/C enable relay circuit is grounded. As a result, A/C compressor clutch engages.

Compressor Clutch Control Circuit Diagnosis

1) Before performing diagnosis, ensure A/C system is adequately charged. If system is not adequately charged, evacuate and recharge system. If system is adequately charged, go to next step.

2) Start engine and allow it to reach normal operating temperature. Turn A/C on, then off. If A/C clutch engages, then disengages within 20 seconds, go to the A/C-HEATER SYSTEM TROUBLE SHOOTING - MANUAL article for A/C system diagnosis. If operation is not as specified, go to step 3).

3) Connect scan tool. Turn A/C on. Monitor A/C REQUEST data. If display reads YES, go to next step. If display does not read YES, go to step 8).

4) Disconnect A/C compressor clutch harness connector. Connect a test light between A/C clutch signal circuit (Dark Green wire) and ground circuit (Black wire) of A/C compressor clutch harness connector. If test light comes on, go to next step. If test light does not come on, go to step 12).

5) Check for a faulty A/C compressor clutch harness connector. Repair as necessary. Go to next step. If no problem is found, go to step 7).

6) Repair A/C compressor clutch harness connector. Go to step 27).

7) Replace A/C compressor clutch. Go to step 27).

8) Turn ignition off. Disconnect VCM connector C3. Turn ignition on. Using a test light connected to ground, probe A/C request signal circuit (Dark Green/White wire) at VCM harness connector C3. If test light comes on, go to next step. If test light does not come on, go to step 11).

9) Check for poor connection at VCM harness connector C3. If a problem is found, go to next step. If no problem is found, go to step 26).

10) Repair VCM harness connector C3. Go to step 27).

11) Repair open or short to ground in Dark Green/White wire to A/C pressure switch and/or A/C control switch. Go to step 27).

12) Using a test light connected to ground, probe A/C compressor clutch signal circuit (Dark Green wire) at A/C compressor clutch harness connector. If test light comes on, go to next step. If test light does not come on, go to step 14).

13) Repair open in A/C compressor clutch ground circuit (Black wire). Go to step 27).

14) Install scan tool. Turn ignition on, engine off. Using scan tool, command A/C relay on. If A/C relay clicks, go to step 23). If A/C relay does not click, go to next step.

15) Disconnect A/C relay. Using a test light connected to ground, probe A/C relay harness connector cavity No. 85 (Pink wire). If test light comes on, go to step 17). If test light does not come on, go to next step.

16) Repair open or short to ground in A/C relay ignition feed circuit (Pink wire). Go to step 27).

17) Connect a test light between A/C relay harness connector cavities No. 85 (Pink wire) and No. 86 (Dark Green/White wire). Using scan tool, command A/C relay on. If test light comes on, go to next step. If test light does not come on, go to step 19).

18) Replace A/C relay. Go to step 27).

19) Check for a faulty connection at VCM harness connector C3. If a problem is found, go to next step. If no problem is found, go to step 21).

20) Repair faulty connection at VCM connector C3. Go to step 27).

21) Check for an open Dark Green/White wire between A/C relay harness connector cavity No. 86 and VCM harness connector C3, terminal No. 9. If a problem is found, go to next step. If no problem is found, go to step 26).

22) Repair open in Dark Green/White wire between A/C relay harness connector cavity No. 86 and VCM connector C3, terminal No. 9. Go to step 27).

23) Remove A/C relay. Using a fused jumper wire, jumper A/C relay harness connector cavities No. 30 (Orange wire) and No. 87 (Dark Green wire) together. If A/C compressor clutch engages, go to next step. If A/C compressor clutch does not engage, go to step 25).

24) Replace A/C relay. Go to step 27).

25) Repair open or short to ground in A/C compressor clutch control circuit (Dark Green wire). Go to step 27).

26) Replace VCM. Go to next step.

27) Using scan tool, select DTC CLEAR INFO. Start engine and allow it to reach normal operating temperature. Select DTC SPECIFIC, then enter DTC number that was set. Operate vehicle within conditions that may have set this DTC. If DTC does not reset, go to next step. If DTC resets, go to step 2).

28) Using scan tool, select CAPTURE INFO, REVIEW INFO. If any

DTCs are displayed that have not been diagnosed, perform diagnosis for applicable DTC. See the G - TESTS W/CODES article in the ENGINE PERFORMANCE section. If no DTCs are displayed, testing is complete.

A/C COMPRESSOR REFRIGERANT OIL CHECKING

1997 Chevrolet Blazer

1997 GENERAL SERVICING
General Motors Corp. - Compressor Refrigerant Oil Checking

Chevrolet, GMC, Oldsmobile, Pontiac: Trucks/Vans

* PLEASE READ THIS FIRST *

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

BODY DESIGNATIONS

BODY DESIGNATIONS TABLE

Model	(1) Body Designation
Astro & Safari	
2WD	"M" Series
4WD	"L" Series
Blazer, Bravada, Jimmy, Pickup & Sonoma	
2WD	"S" Series
4WD	"T" Series
Commercial Van & Chassis	"P" Series
Express & Savanna (Van)	"G" Series
Pickup, Sierra, Suburban Tahoe & Yukon	
2WD	"C" Series
4WD	"K" Series
Silhouette, Trans Sport & Venture	"U" Series

(1) - Series codes determined by fifth character of VIN code.

REFRIGERANT OIL & REFRIGERANT CAPACITY SPECIFICATIONS

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

REFRIGERANT OIL & R-134a REFRIGERANT CAPACITY TABLE

Application (1)	(2) Oil Ounces	Refrigerant Ounces
"C" & "K" Series		
Pickup & Sierra	(3) 8.0	32.0
Crew Cab & Utility	(3) 8.0	36.0
Suburban, Tahoe & Yukon		
With Rear Unit	(3) 11.0	64.0
Without Rear Unit	(3) 8.0	36.0
"G" Series		
With Rear Unit	(3) 11.0	78.0
Without Rear Unit	(3) 8.0	48.0
"L" & "M" Series		
Without Rear Unit	(3) 8.0	32.0
With Rear Unit	(3) 11.0	48.0
"P" Series	(3) 8.0	48.0

"S" & "T" Series		
2.2L	(3) 9.0	32.0
4.3L	(3) 8.0	32.0
"U" Series		
With Rear Unit	(3) 11.0	46.0
Without Rear Unit	(3) 8.0	32.0

(1) - Series codes determined by fifth character of VIN code.
(2) - Total system capacity, unless otherwise noted.
(3) - Use PAG Oil (Part No. 12345923).

REFRIGERANT OILS

NOTE: Use ONLY the specified oil for the A/C system or compressor. Always check the underhood A/C specification label or A/C compressor label before adding refrigerant oil to A/C compressor/system.

Use only new, moisture-free refrigerant oil in A/C systems. Refrigerant oil is highly refined with a very low moisture content. Oil container must be tightly closed when not in use, or moisture from air will be absorbed into refrigerant oil.

Refrigerant R-134a systems use Polyalkylene Glycol (PAG) refrigerant oil. Using a mineral oil based lubricant with R-134a systems will result in A/C compressor failure due to lack of proper lubrication.

Different compressors have different lubrication requirements and use different specified Polyalkylene Glycol (PAG) refrigerant oils. Use only specified PAG refrigerant 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 the REFRIGERANT OIL APPLICATION table for specific refrigerant oil applications.

NOTE: PAG oil absorbs moisture very rapidly, 2.3-5.6 percent by weight as compared to a mineral oil absorption rate of .005 percent by weight.

REFRIGERANT OIL APPLICATION TABLE

Application	Refrigerant Oil
All Models	PAG Refrigerant Oil (Part No. 12345923)

SERVICING PRECAUTIONS

DISCHARGING SYSTEM

Discharge A/C system, using approved refrigerant recovery/recycling equipment before loosening any fittings. Follow refrigerant recovery/recycling equipment manufacturer's instructions.

DISCONNECTING LINES & FITTINGS

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

CONNECTING LINES & FITTINGS

Always use new gasket or "O" ring when connecting lines or fittings. Coat "O" ring with refrigerant oil, and ensure it is not twisted during installation. To prevent damage to lines and fittings, always use 2 wrenches. Keep refrigerant oil off fitting threads. Long term contact of oil on threads may cause future damage to threads.

PLACING SYSTEM IN OPERATION

After component service or replacement has been completed, evacuate system thoroughly with a vacuum pump. Charge system with proper amount of refrigerant. See
REFRIGERANT OIL & R-134a REFRIGERANT CAPACITY table. Perform leak test. After system has been leak tested, check system operation.

NOTE: A/C systems normally will not need additional refrigerant oil unless oil loss has occurred due to ruptured lines, leaking compressor seals, compressor overhaul or component replacement.

CHECKING COMPRESSOR OIL

HARRISON HD6/HT6, HD6/HR-6HE 6-CYLINDER & V5 5-CYLINDER

1) Operate system for several minutes to stabilize system, if possible. Turn engine off. Discharge A/C system, using approved refrigerant recovery/recycling equipment. Remove compressor. Drain refrigerant oil from compressor through suction and discharge ports, and drain plug. Measure amount of oil drained.

2) If no oil leaks exist and more than one ounce is drained, add drained amount using new oil. If less than one ounce is drained from compressor, add 2 ounces of new oil.

3) If replacing A/C components, add specified amount of refrigerant oil to system. See HD6/HT6, HD6/HR-6HE & V5 COMPONENT REFRIGERANT OIL CAPACITIES table. Install drain plug and compressor. Evacuate and charge system. Perform leak test.

NOTE: Approximately 3 ounces of refrigerant oil, suspended in refrigerant, will be lost due to a large, abrupt leak. When replacing faulty component, add required amount of oil for component plus 3 ounces of oil to component. If oil cannot be easily added to component, add to accumulator/receiver-drier.

HD6/HT6, HD6/HR-6HE & V5 COMPONENT REFRIGERANT OIL CAPACITIES

Component	Ounces
Accumulator/Receiver-Drier	(1)
Condenser	1.0
Evaporator	3.0
"U" Series	
Rear Evaporator	2.0
Rear Evaporator Lines	1.0

(1) - Add one ounce more than was drained from oil
      accumulator/receiver-drier.

A/C-HEATER SYSTEM TROUBLE SHOOTING - MANUAL

1997 Chevrolet Blazer

1997 A/C-HEATER SYSTEMS
General Motors - Manual A/C-Heater System Trouble Shooting

Chevrolet, Buick, GMC, Oldsmobile, Pontiac;
All Models Cars, Trucks & Vans

MODEL IDENTIFICATION

BODY DESIGNATIONS TABLE

Body Code	Models
Cars (1)	
"F"	Camaro, Firebird
"H"	Boneville, Eighty Eight, LeSabre, LSS, Regency
"J"	Cavalier, Sunfire
"L/N"	Achieva, Cutlass, Grand Am, Malibu, Skylark
"W"	Century, Cutlass Supreme, Grand Prix
"W"	Lumina, Monte Carlo, Regal
"Y"	Corvette
Trucks/Vans (2)	
"C"	2WD Pickup, Sierra, Suburban, Tahoe & Yukon
"G"	Express, Savanna & Van
"K"	4WD Pickup, Sierra, Suburban, Tahoe & Yukon
"L"	AWD Astro & Safari
"M"	2WD Astro & Safari
"P"	Commercial Van/Motorhome
"S"	2WD Blazer, Jimmy, Pickup & Sonoma
"T"	4WD Blazer, Bravada, Jimmy, Pickup & Sonoma
"U"	Silhouette, Trans Sport & Venture

(1) - Body codes determined by fourth character of VIN code.
(2) - Vehicle series is fifth character of VIN code.

OPERATIONAL TESTING

When trouble shooting and diagnosing an air conditioning system, always refer to appropriate vacuum and wiring diagrams for the system involved. See appropriate A/C-HEATER SYSTEM - MANUAL article.

If blower operates at all speeds and compressor clutch engages, electrical circuits are functioning properly. If evaporator inlet pipe and accumulator surface appear to be the same temperature when felt by hand, system is properly charged with refrigerant. Ensure vacuum and diaphragm function properly when moving selector control.

ELECTRICAL TROUBLE SHOOTING

BLOWER MOTOR WILL NOT RUN

Check fuses. Turn ignition switch to RUN position. Check for voltage at function control switch. Switch blower switch to HI position. Check for voltage at switch and at high-speed blower relay. Ground blower motor with ignition switch in RUN position. If blower operates, motor is okay.

BLOWER DOES NOT OPERATE IN HI

Check for voltage at high-speed blower relay with ignition switch in RUN position and blower switch in HI position. If voltage is not present, check for voltage at blower switch.

BLOWER OPERATES ONLY IN HI

Check blower resistors for open condition. Check blower switch for voltage at each position.

A/C DOES NOT WORK

With engine running and function control switch at NORM position, check for voltage at pressure cycling switch. Check for voltage between pressure cycling switch and compressor clutch. Ground compressor clutch circuit. If clutch engages, check wide-open throttle cut-out switch and A/C compressor cut-off switch.

REFRIGERANT SYSTEM DIAGNOSIS

INSUFFICIENT COOLING

NOTE: Quick check procedure may be used to check for proper refrigerant charge, provided ambient temperature is more than 70°F (21°C). On vehicles with Cycling Clutch Orifice Tube (CCOT) system, compressor will cycle on and off to meet system requirements.

Quick Check Procedure

1) Engine must be at normal operating temperature. Open vehicle doors and hood. Select MAX A/C or RECIRC mode. Move temperature lever to COLD position. Blower switch in HIGH position. Engine should be at normal idle speed.

2) While compressor is engaged, feel temperature of accumulator surface and evaporator inlet pipe. If temperature of both components is the same, system is normal. If evaporator inlet pipe is frosted or feels cooler than accumulator surface, refrigerant charge is low.

3) Add refrigerant in 4-ounce increments, allowing system to stabilize between additions, until accumulator and inlet pipe are the same temperature. Add an additional 14 ounces of refrigerant.

Thorough Check Procedures

Begin diagnosis at V5/TXV SYSTEM DIAGNOSIS (STEP 1) or V5/VDOT SYSTEM DIAGNOSIS (STEP 1). For further diagnosis, go to appropriate trouble shooting chart. See TROUBLE SHOOTING CHART DIRECTORY.

V5/TXV SYSTEM DIAGNOSIS (STEP 1)

Preliminary Checks

Check and repair the following:

* Connect Tech 1 Scan Tool. Check for stored trouble codes. If codes are found, see the G - TESTS W/CODES article in the ENGINE PERFORMANCE section.
* Check A/C fuse.
* Check A/C blower operation.
* On vehicles with cable operated temperature door, move temperature lever rapidly from cold to hot. Listen for temperature door hitting travel stops at each end. Adjust as necessary.
* Check A/C compressor clutch coil connection.

* Check A/C pressure transducer connection.
* Check compressor belt condition. Adjust or replace as necessary.
* Check cooling fan operation.
* Check for restricted airflow across condenser.
* Check Technical Service Bulletins (TSBs) for A/C system updates.

V5/VDOT SYSTEM DIAGNOSIS (STEP 1)

Preliminary Checks
Check and repair the following:

* Check A/C fuse.
* Check A/C blower operation.
* On vehicles with cable operated temperature door, move temperature lever rapidly from cold to hot. Listen for temperature door hitting travel stops at each end. Adjust as necessary.
* Check clutch coil and connections at rear head switch(es).
* Check compressor belt condition. Adjust or replace as necessary.
* Check cooling fan operation.
* Check for restricted airflow across condenser.
* Check Technical Service Bulletins (TSBs) for A/C system updates.

If discharge air temperature with A/C on is normal after making repairs, system is operating properly. If further trouble shooting is required, go to appropriate trouble shooting chart. See TROUBLE SHOOTING CHART DIRECTORY.

TROUBLE SHOOTING CHART DIRECTORY (1)

Application	Figures
CCOT System	1-5
V5/TXV System	6-12
V5/VDOT System	13-19

(1) - Vehicles with Harrison V5 5-cylinder compressor use a Variable Displacement Orifice Tube (VDOT) or Thermal Expansion Valve (TXV) system, referred to as V5/VDOT and V5/TXV systems. Vehicles with any other compressor use the Cycling Clutch Orifice Tube (CCOT) system.

COMPRESSOR APPLICATIONS

COMPRESSOR APPLICATIONS TABLE (CARS)

Application (1)	Compressor
"C" Body	Harrison V5 5-Cyl.
"E" Body	Harrison HD6/HR-6HE 6-Cyl.
"K" Body	Harrison HD6/HR-6HE 6-Cyl.
"F" Body	
3.8L V6	Harrison V5 5-Cyl.
5.7L V8	Harrison HD6/HT6 6-Cyl.
"G" Body	Harrison HD6/HT6 6-Cyl.
"H" Body	Harrison HD6/HT6 6-Cyl.
"J" Body	Harrison V5 5-Cyl.

"L/N" Body	Harrison V5 5-Cyl.
"V" Body	Harrison V5 5-Cyl.
"W" Body	Harrison V5 5-Cyl.
"Y" Body	Harrison V5/V7
"Z" Body (Saturn)	Zexel Rotary Vane

(1) - Body codes determined by fourth character of VIN code.

COMPRESSOR APPLICATIONS TABLE (LIGHT TRUCKS & VANS)

Application (1)	Compressor
"C" & "K" Series	Harrison HD6/HT6 6-Cyl.
"G" Series	Harrison HD6/HT6 6-Cyl.
"L" & "M" Series	Harrison HD6/HT6 6-Cyl.
"P" Series	Harrison HD6/HT6 6-Cyl.
"S" & "T" Series	
2.2L	Harrison V5 5-Cyl.
4.3L	Harrison HD6/HT6 6-Cyl.
"U" Series	Harrison V5 5-Cyl.

(1) - Series codes determined by fifth character of VIN code.

INSUFFICIENT COOLING DIAGNOSIS CHARTS - (CCOT)

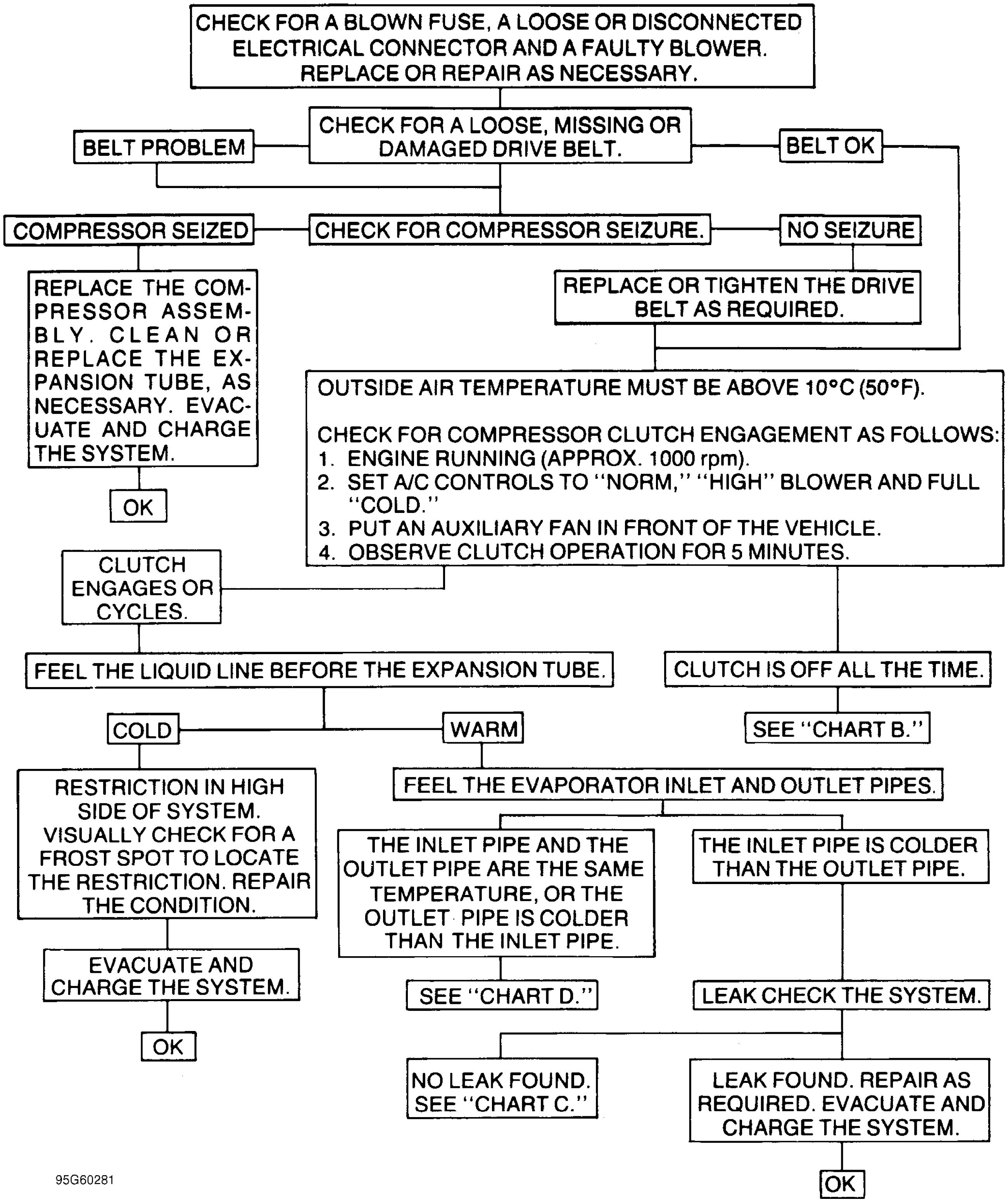


Fig. 1: Insufficient Cooling Chart "A" (CCOT)
Courtesy of General Motors Corp.

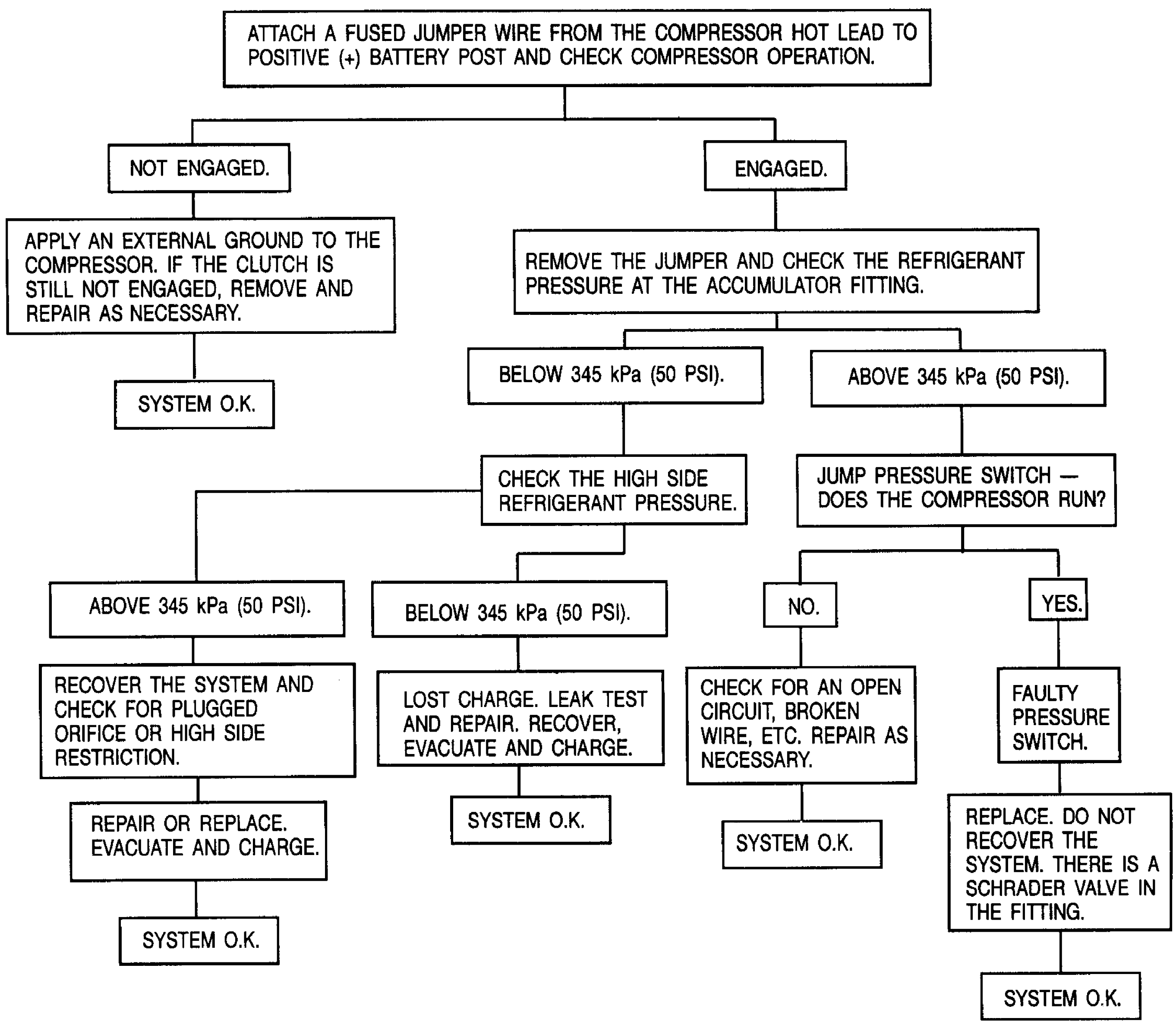


Fig. 2: Insufficient Cooling Chart "B" (CCOT)
Courtesy of General Motors Corp.

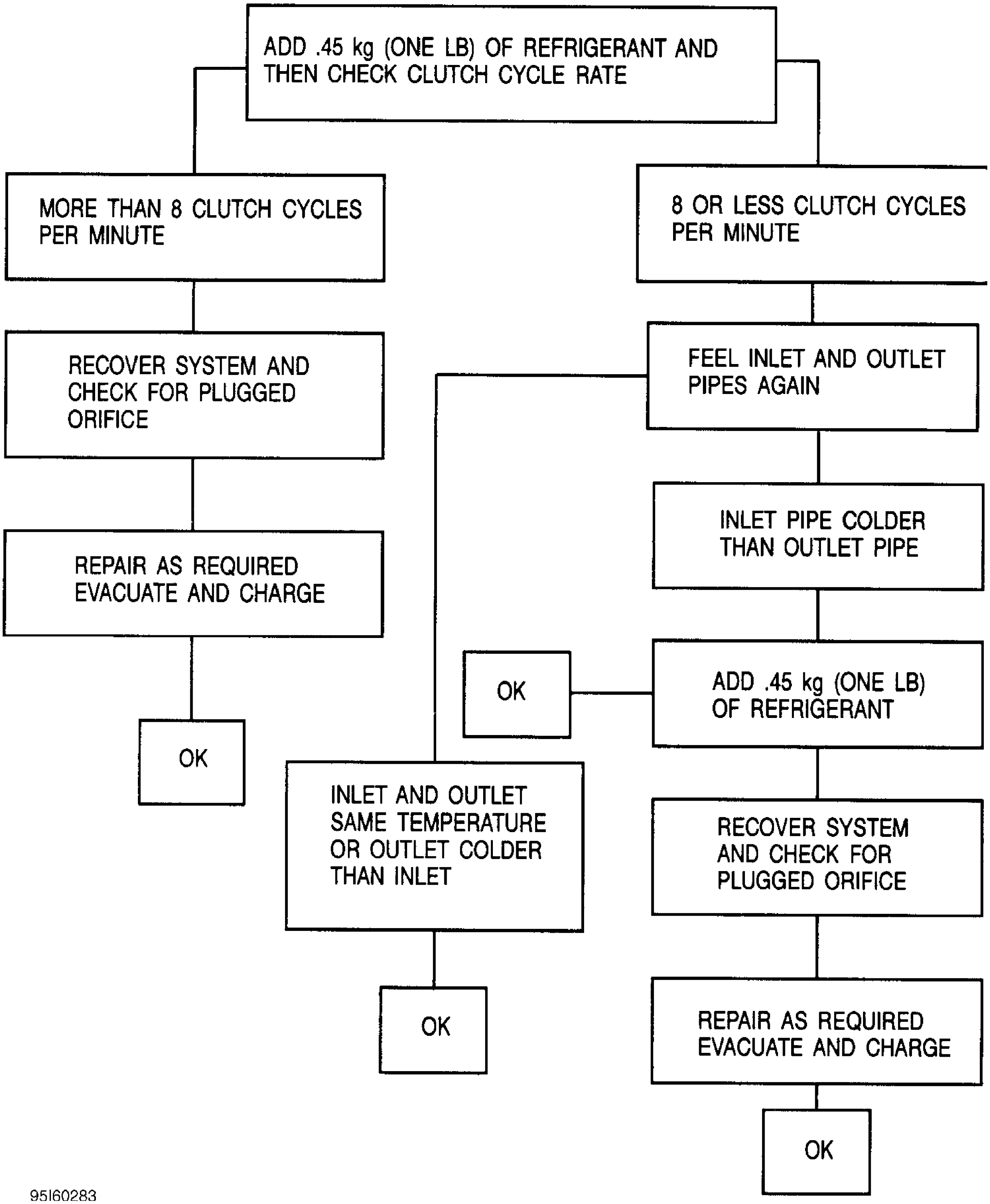
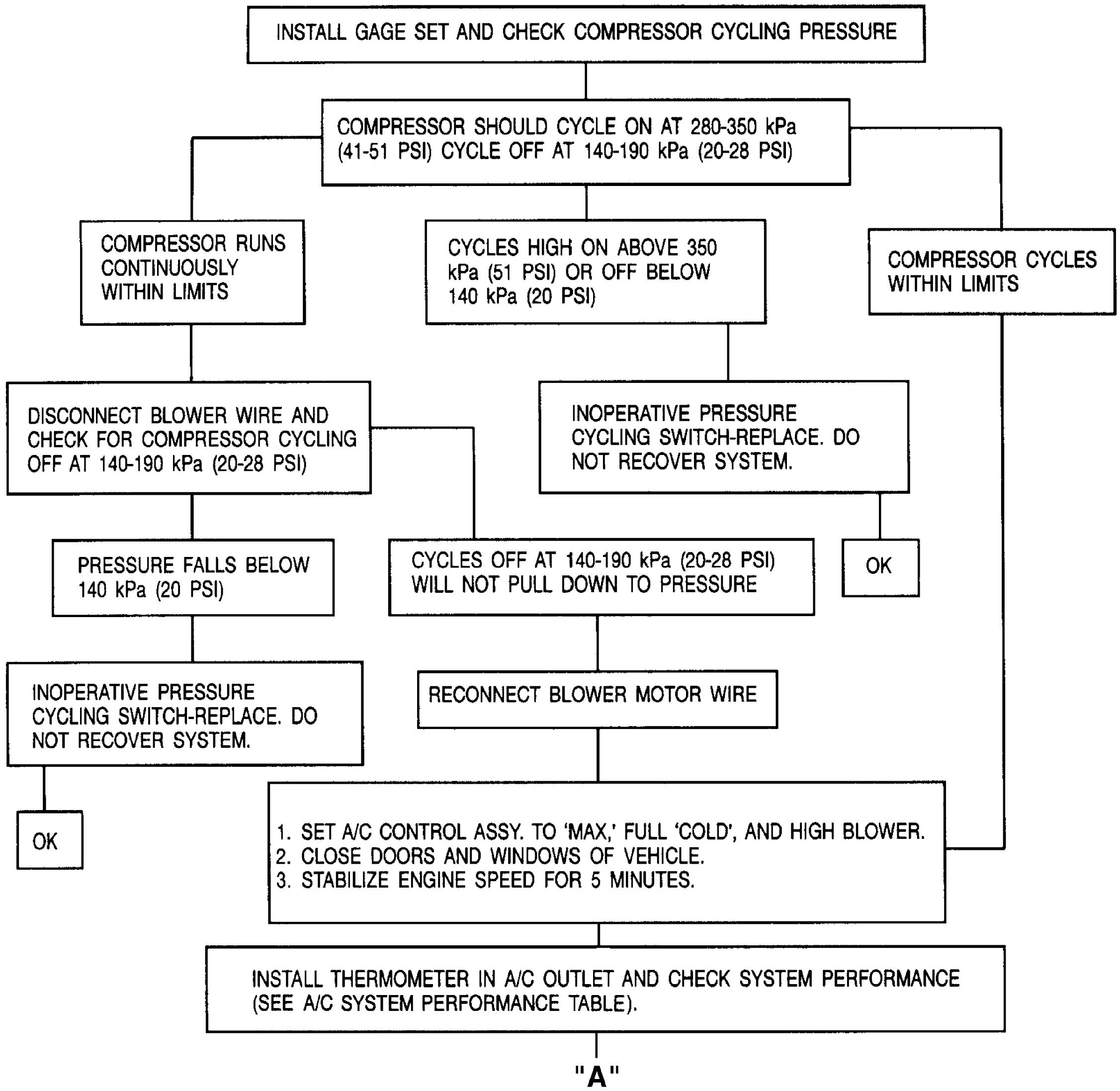


Fig. 3: Insufficient Cooling Chart "C" (CCOT)
Courtesy of General Motors Corp.



A/C SYSTEM PERFORMANCE

Relative Humidity %	Ambient Temp. °F (°C)	Max Outlet Temp. °F (°C)
20	70 (21)	43 (6)
	80 (27)	44 (7)
	90 (32)	50 (10)
	100 (38)	51 (11)
30	70 (21)	45 (7)
	80 (27)	47 (8)
	90 (32)	54 (12)
	100 (38)	57 (14)
40	70 (21)	46 (8)
	80 (27)	50 (10)
	90 (32)	57 (14)
	100 (38)	63 (17)
50	70 (21)	48 (9)
	80 (27)	53 (12)
	90 (32)	60 (16)
	100 (38)	69 (21)
60	70 (21)	50 (10)
	80 (27)	56 (13)
	90 (32)	63 (17)
	100 (38)	75 (24)
70	70 (21)	52 (11)
	80 (27)	59 (15)
	90 (32)	67 (19)
80	70 (21)	53 (12)
	80 (27)	62 (17)
	90 (32)	70 (21)
90	70 (21)	55 (13)
	80 (27)	65 (18)

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Fig. 4: Insufficient Cooling Chart "D" (CCOT)
Courtesy of General Motors Corp.

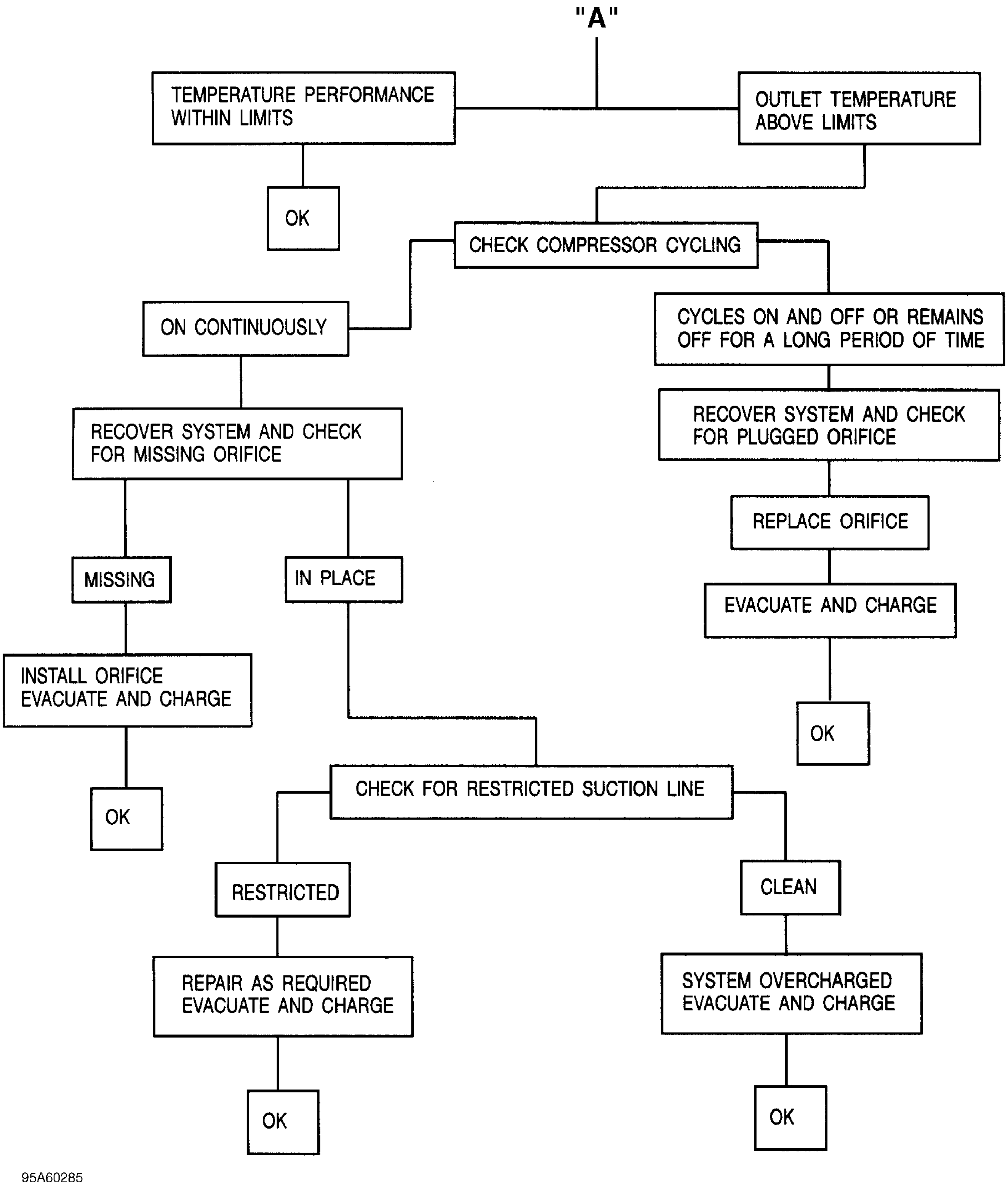

Fig. 5: Insufficient Cooling Chart "E" (CCOT)
Courtesy of General Motors Corp.

CHECKING REFRIGERANT CHARGE - STEP 2 - (V5/TXV)

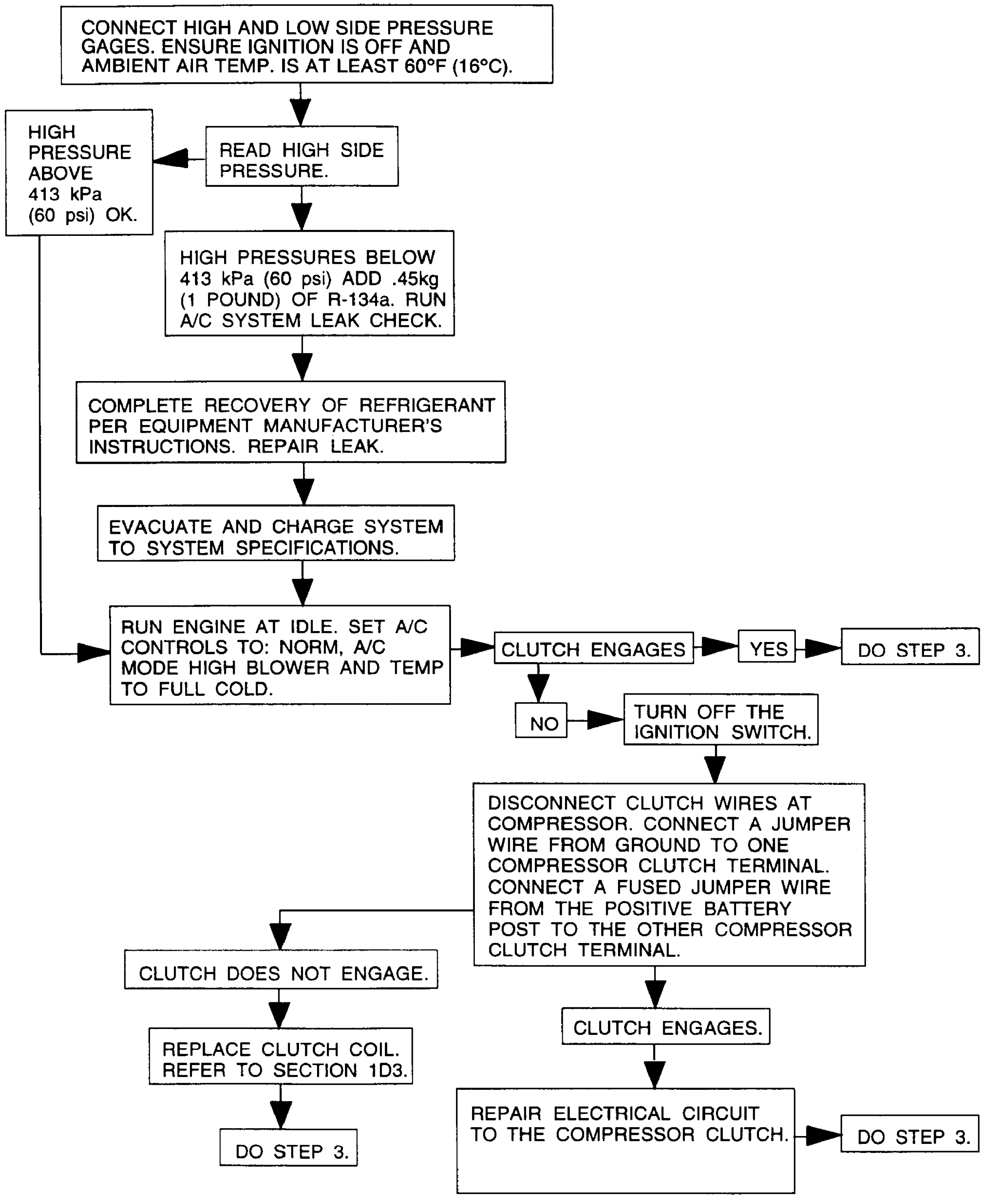

Fig. 6: Checking Refrigerant Charge - Step 2 (V5/TXV)
Courtesy of General Motors Corp.

CHECKING COMPRESSOR CLUTCH ENGAGEMENT - STEP 3 - (V5/TXV)

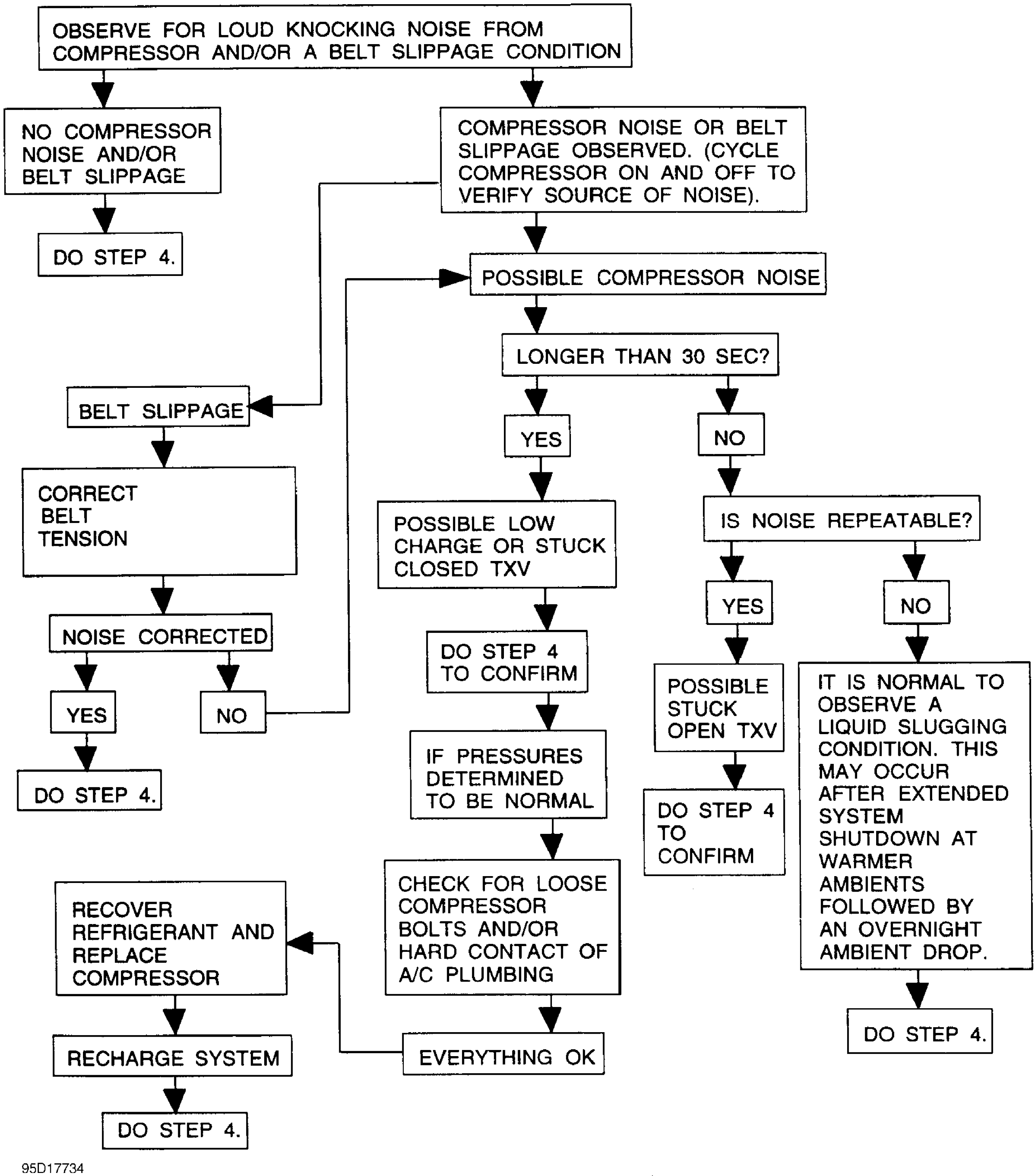

Fig. 7: Checking Compressor Clutch Engagement - Step 3 (V5/TXV)
Courtesy of General Motors Corp.

CHECKING PERFORMANCE - STEP 4 - (V5/TXV)

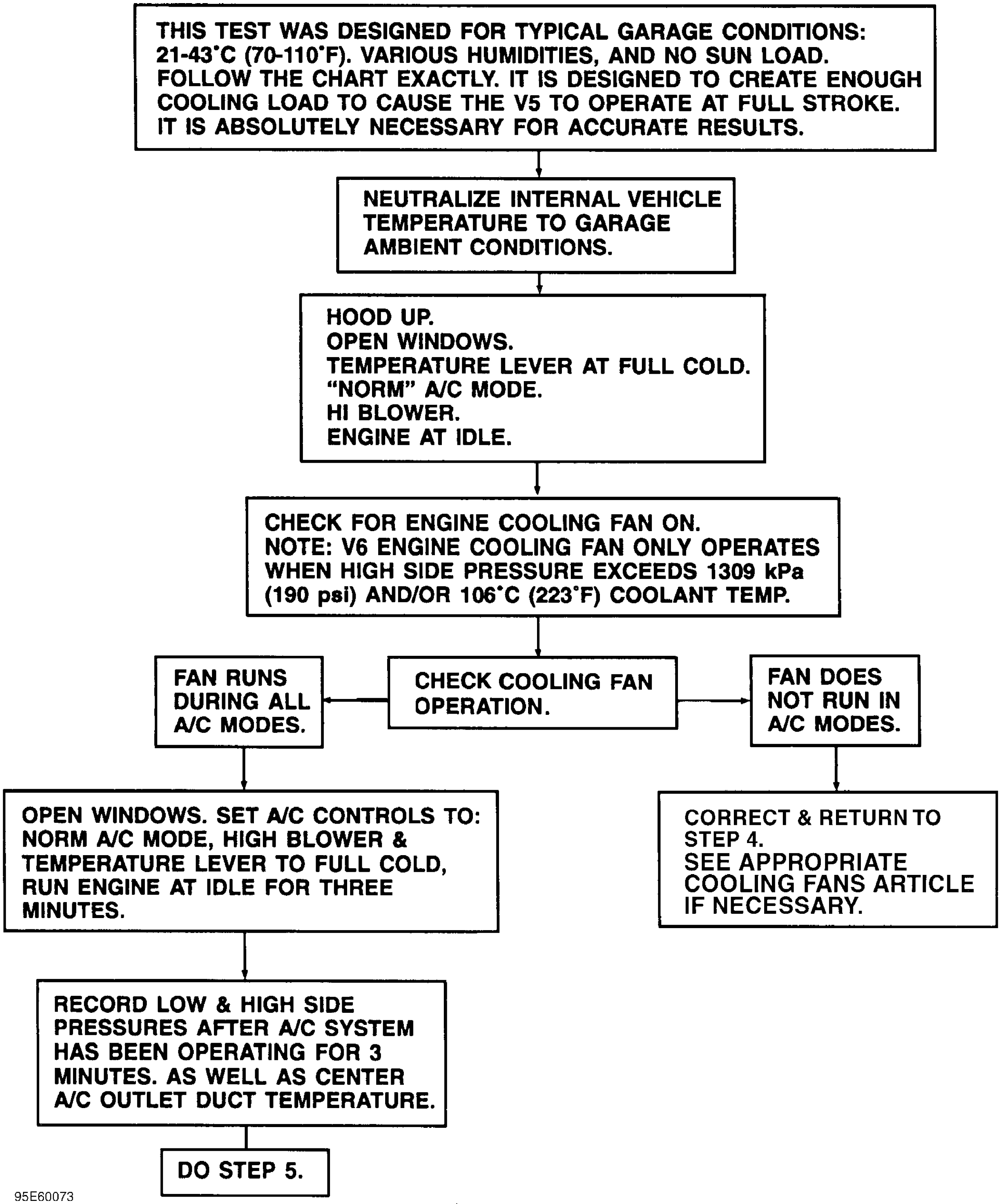

Fig. 8: Checking Performance - Step 4 (V5/TXV)
Courtesy of General Motors Corp.

PERFORMANCE DIAGNOSTIC CHART - STEP 5 - (V5/TXV)

1. USE THE CHART BELOW WHICH CORRESPONDS TO THE PRESENT AMBIENT TEMPERATURE.
2. READ THE HIGH SIDE AND LOW SIDE PRESSURES AND NOTE THE LETTER CODED AREA IN WHICH THEY INTERSECT.
3. MATCH THE LETTER CODE WITH THE CORRESPONDING LETTER CODE ON THE FOLLOWING PAGE (STEP 6) AND CONTINUE WITH THE DIAGNOSTIC CODE PROCEDURES.

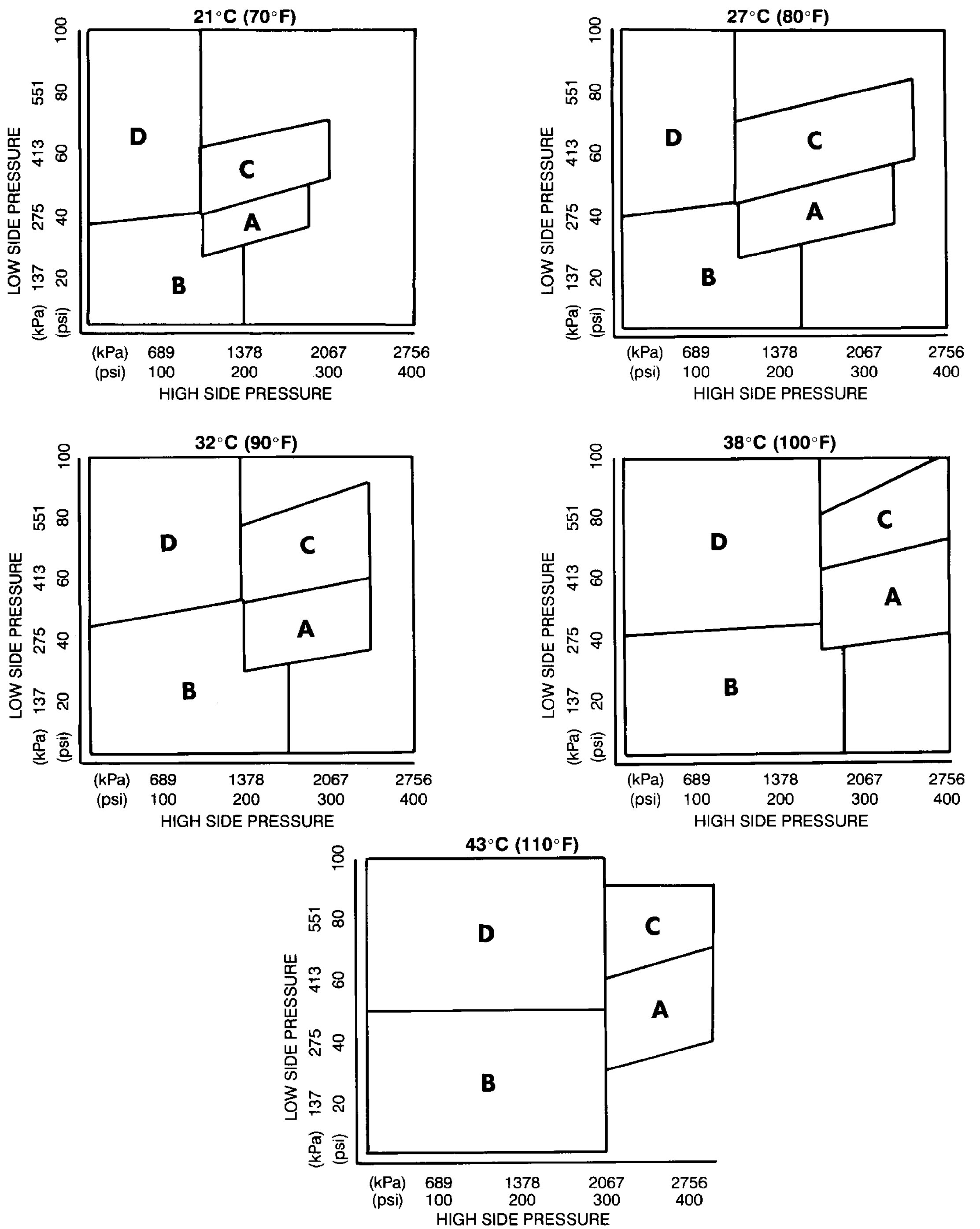

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Fig. 9: Performance Diagnostic Chart - Step 5 (V5/TXV)
Courtesy of General Motors Corp.

DIAGNOSTIC CODE PROCEDURES - STEP 6 - (V5/TXV)

Refer to appropriate diagnostic code chart (Step 5) for ambient garage conditions.

IF you find...	**THEN the problem may be...**
1. High and Low pressures intersect in area **'A'**	No Problem – Normal System – Rule of Thumb: Outlet temperature is typically 20°F less than outside air temperatures.
2. High and Low pressures intersect in area **'B'** – may also hear a "motorboat"-like noise inside the vehicle with windows up and with the blower motor on low speed – may also see rapid fluctuation of low side gage	Low Charge OR Failed Closed TXV – Evacuate system and weigh charge; if less than 0.8 kg (1.75 lbs.) is removed and there was no rapid fluctuation of the low side gage, then recharge the system to specifications. – If the charge removed is within specifications, and rapid fluctuation of the low side gage was noted, then replace TXV
3. High and Low pressures intersect in area **'C'** – high and low side pressures equalize quickly upon turning A/C off. – may also be accompanied with a "slugging" noise upon vehicle start-up	Stuck Open TXV – Replace TXV
4. High and Low pressures intersect in area **'D'**	Destroked Compressor OR No-Pump Compressor – Do Step 7 (Next Page) to confirm and follow procedures listed in the diagnostic tree
5. High and Low pressures are higher than normal and the compressor cycles off due to high side pressure in excess of 425 psi. The compressor may re-engage after a period of time and then cycle off again	High Charge – Complete recovery per equipment manufacture's instructions, evacuate and charge to system specifications
6. An abrupt drop in temperature along the high side plumbing, condenser, or receiver/dryer. The high side should be warm/hot from the compressor discharge all the way to the TXV	High Side Restriction – Replace component where restriction is occurring
7. System appears to perform normally, but may go warm temporarily on extended drives and recorrect itself after vehicle shut-down at which time a large puddle of water will be noticed under the vehicle	Evaporator Core Freeze-Up – Do Step 8 (On page following the next page) to confirm compressor control valve failed low

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Fig. 10: Diagnostic Code Procedures - Step 6 (V5/TXV)
Courtesy of General Motors Corp.

CHECKING FOR NO STROKE COMPRESSOR - STEP 7 - (V5/TXV)

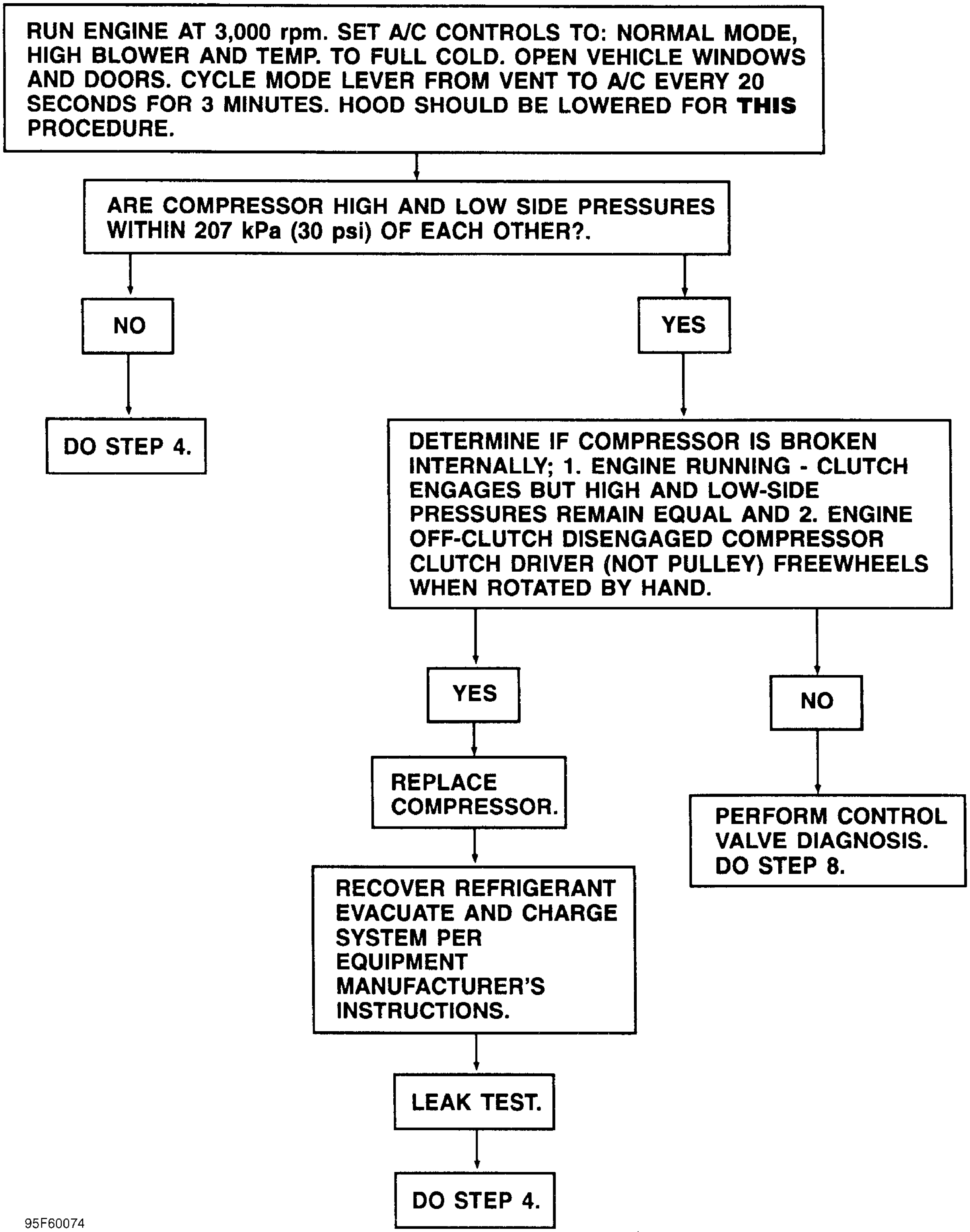

Fig. 11: Checking For No Stroke Compressor - Step 7 (V5/TXV)
Courtesy of General Motors Corp.

CONTROL VALVE DIAGNOSIS - STEP 8 - (V5/TXV)

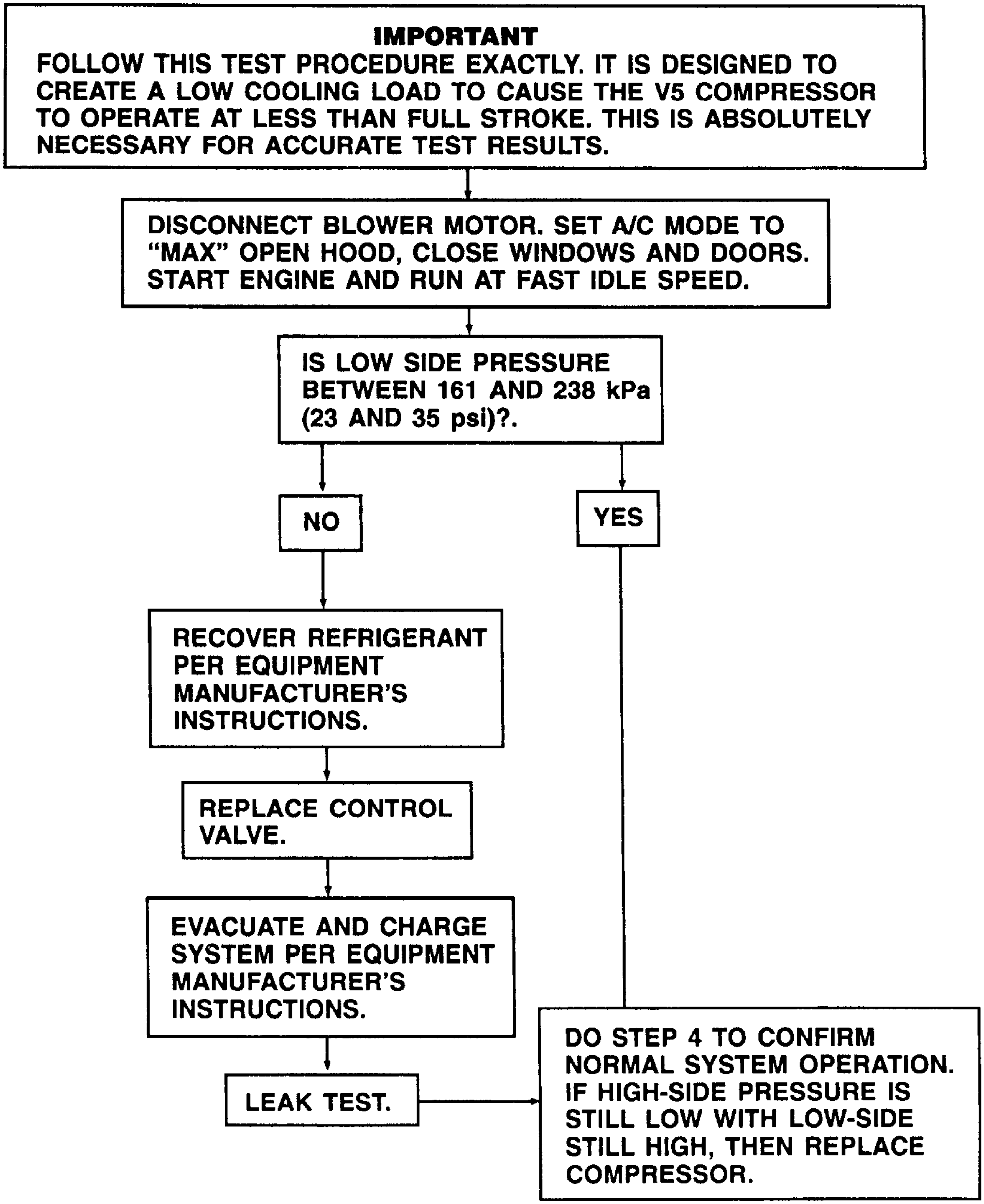

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Fig. 12: Control Valve Diagnosis - Step 8 (V5/TXV)
Courtesy of General Motors Corp.

CHECKING REFRIGERANT CHARGE - STEP 2 - (V5/VDOT)

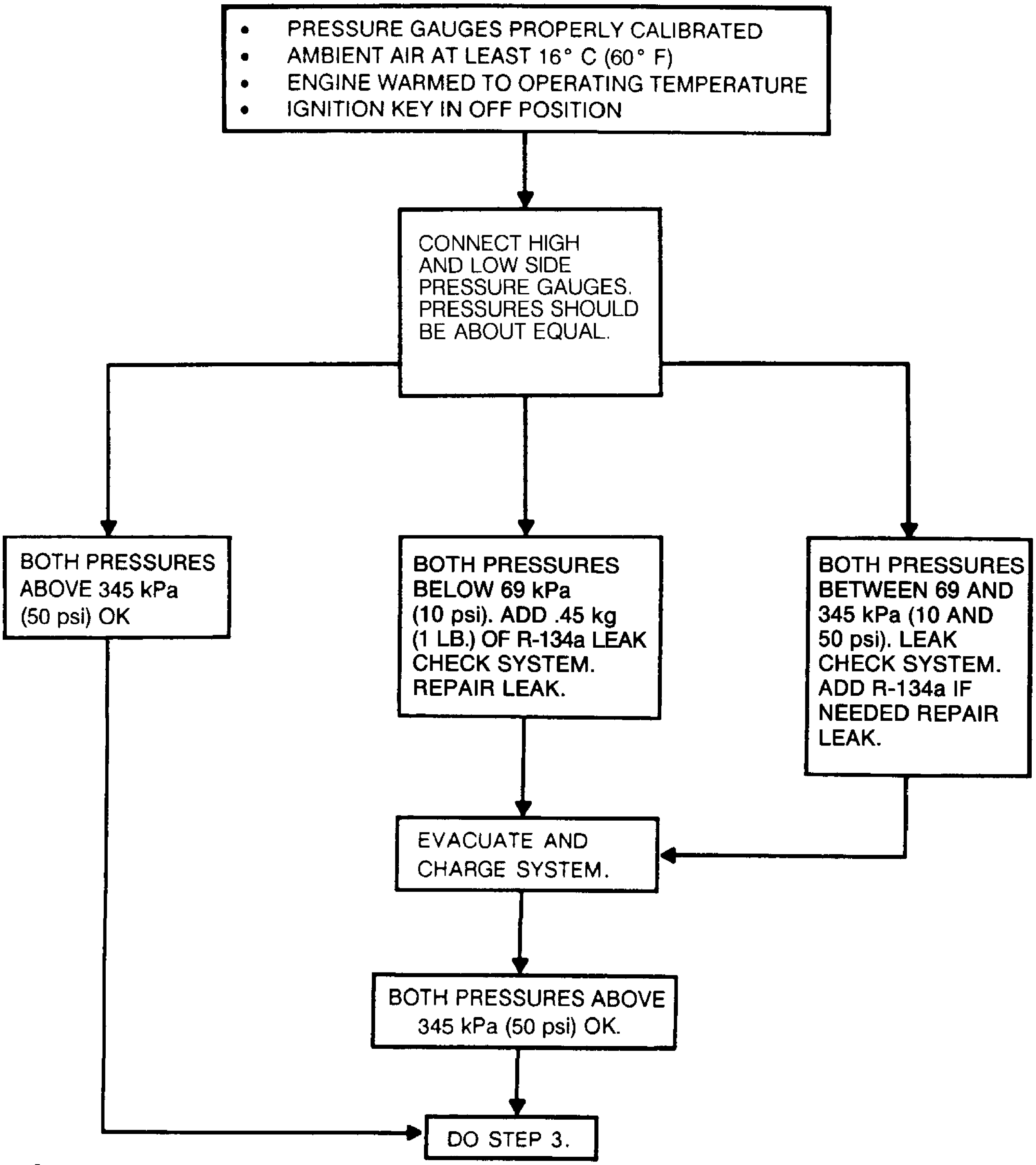

Fig. 13: Checking Refrigerant Charge - Step 2 (V5/VDOT)
Courtesy of General Motors Corp.

CHECKING COMPRESSOR CLUTCH ENGAGEMENT - STEP 3 - (V5/VDOT)

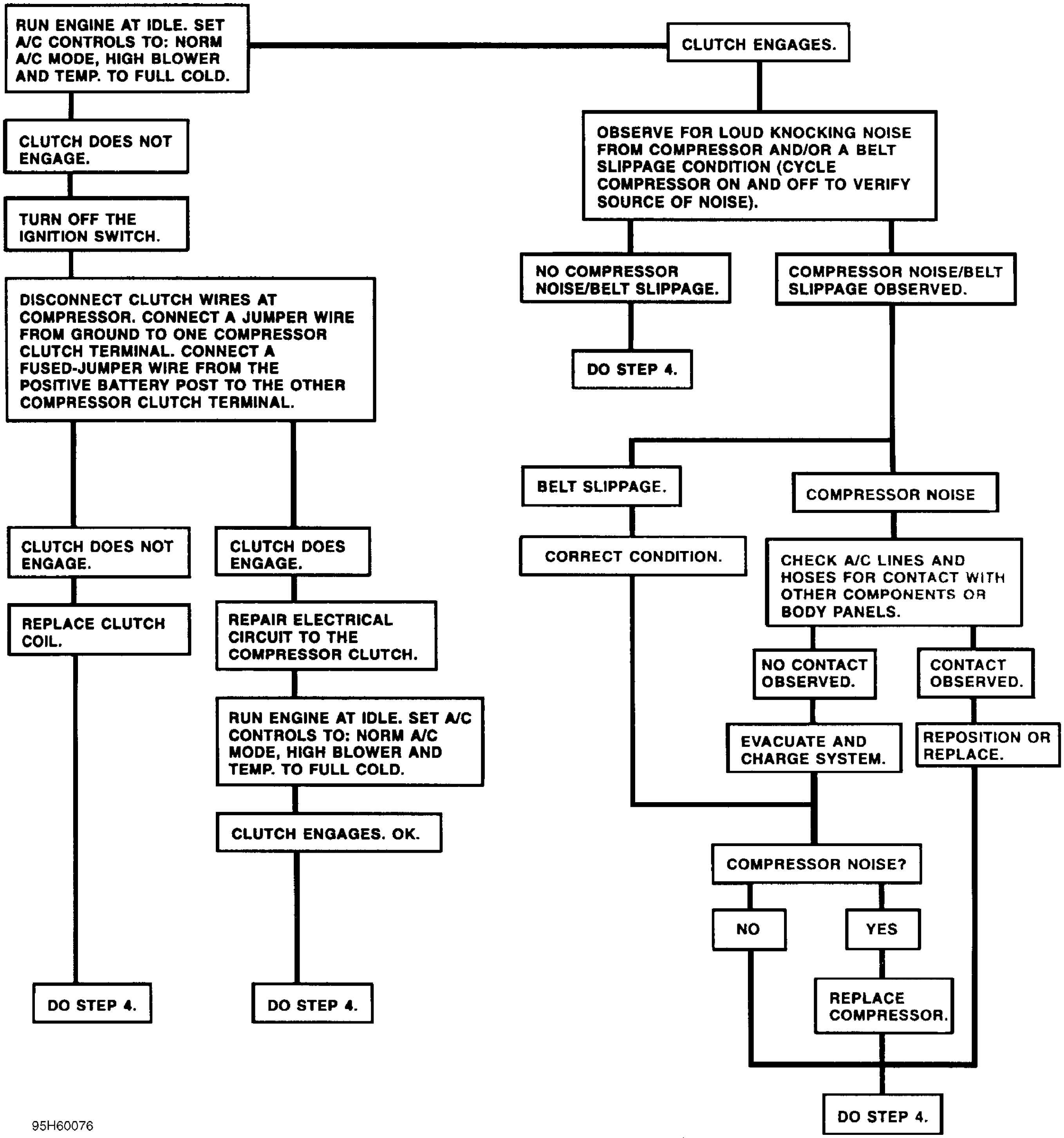

Fig. 14: Checking Compressor Clutch Engagement - Step 3 (V5/VDOT)
Courtesy of General Motors Corp.

CHECKING PERFORMANCE - STEP 4 - (V5/VDOT)

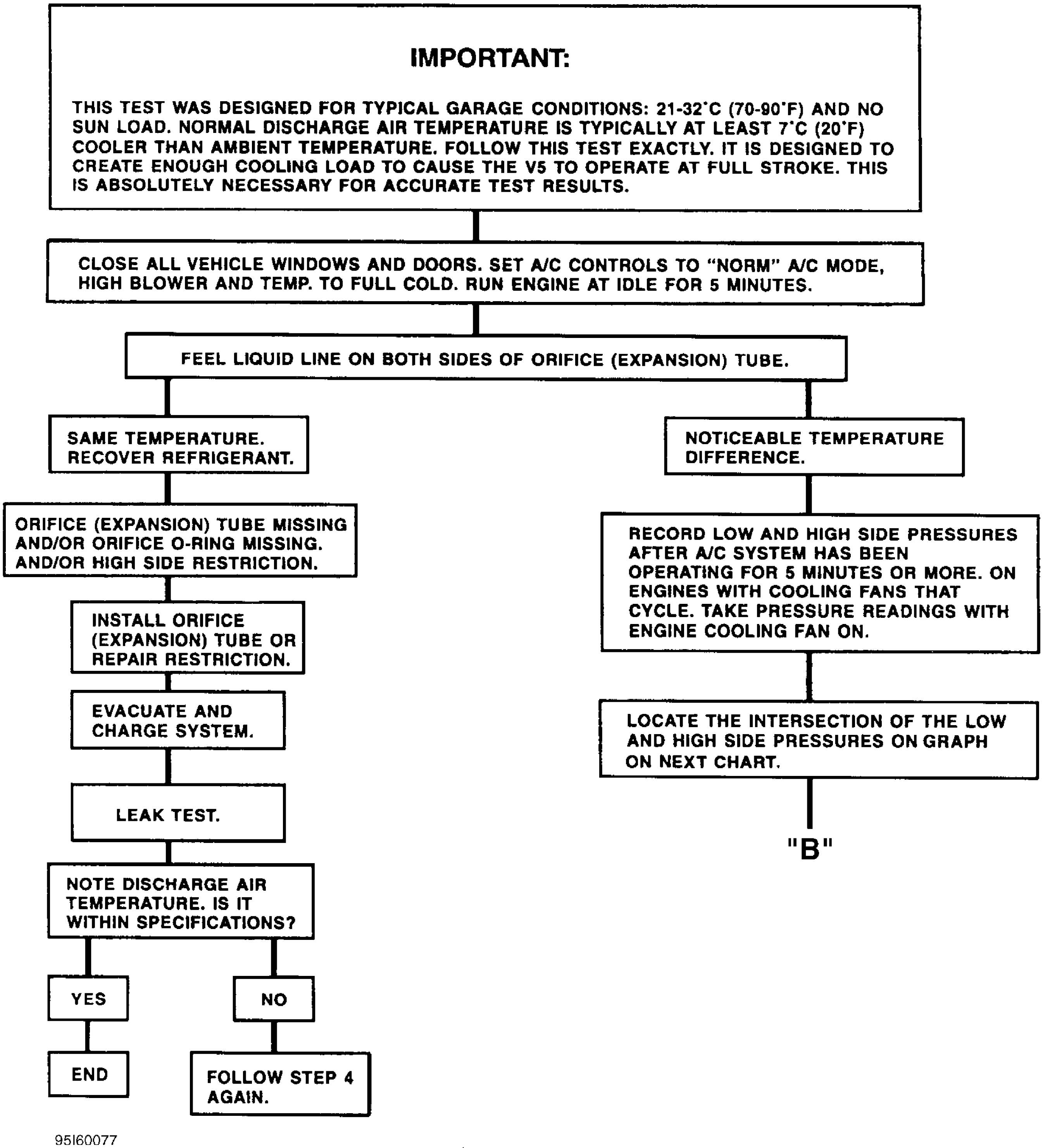

Fig. 15: Checking Performance - Step 4 (V5/VDOT - 1 Of 2)
Courtesy of General Motors Corp.

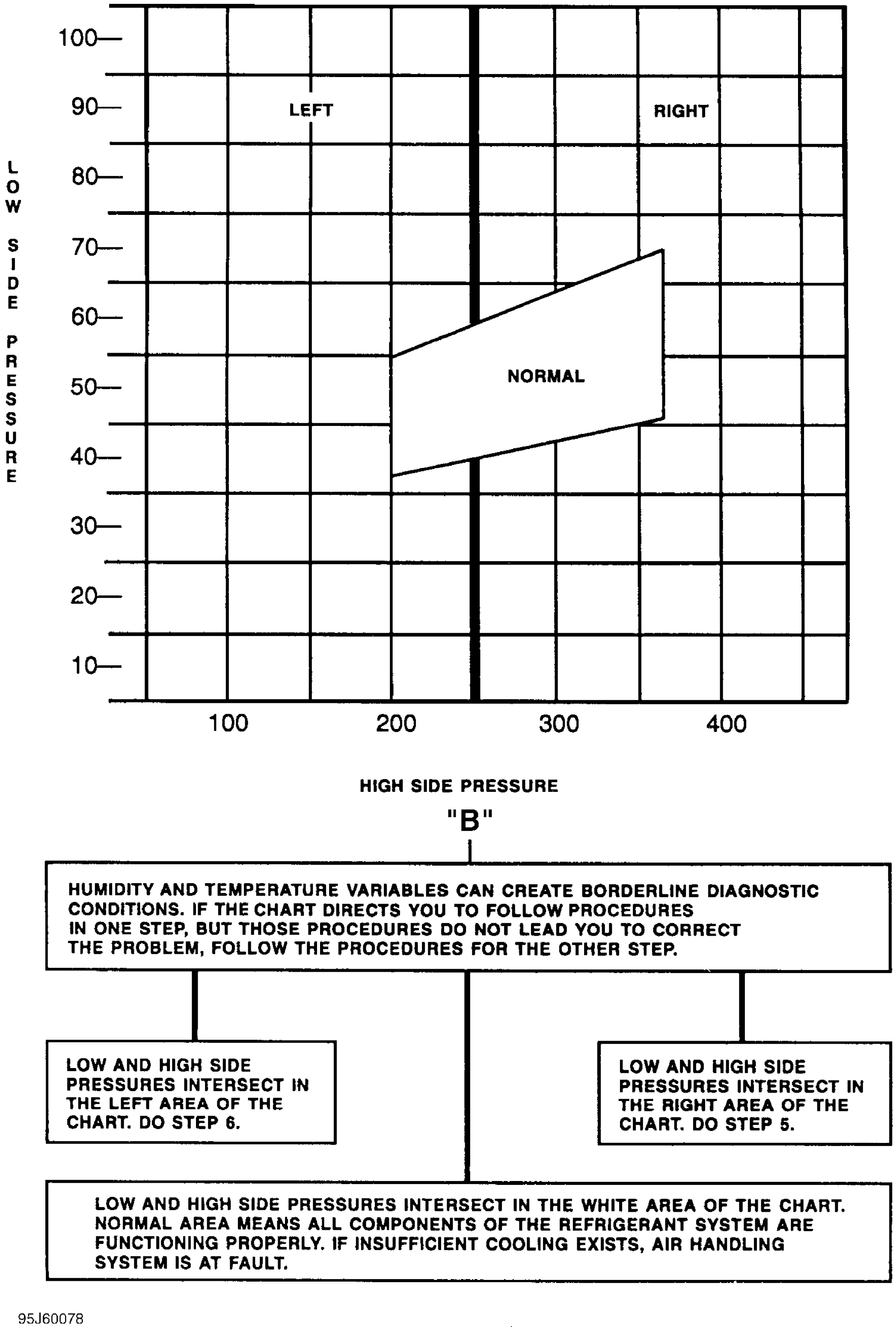

Fig. 16: Checking Performance - Step 4 (V5/VDOT - 2 Of 2)
Courtesy of General Motors Corp.

RIGHT AREA DIAGNOSIS & SERVICE - STEP 5 - (V5/VDOT)

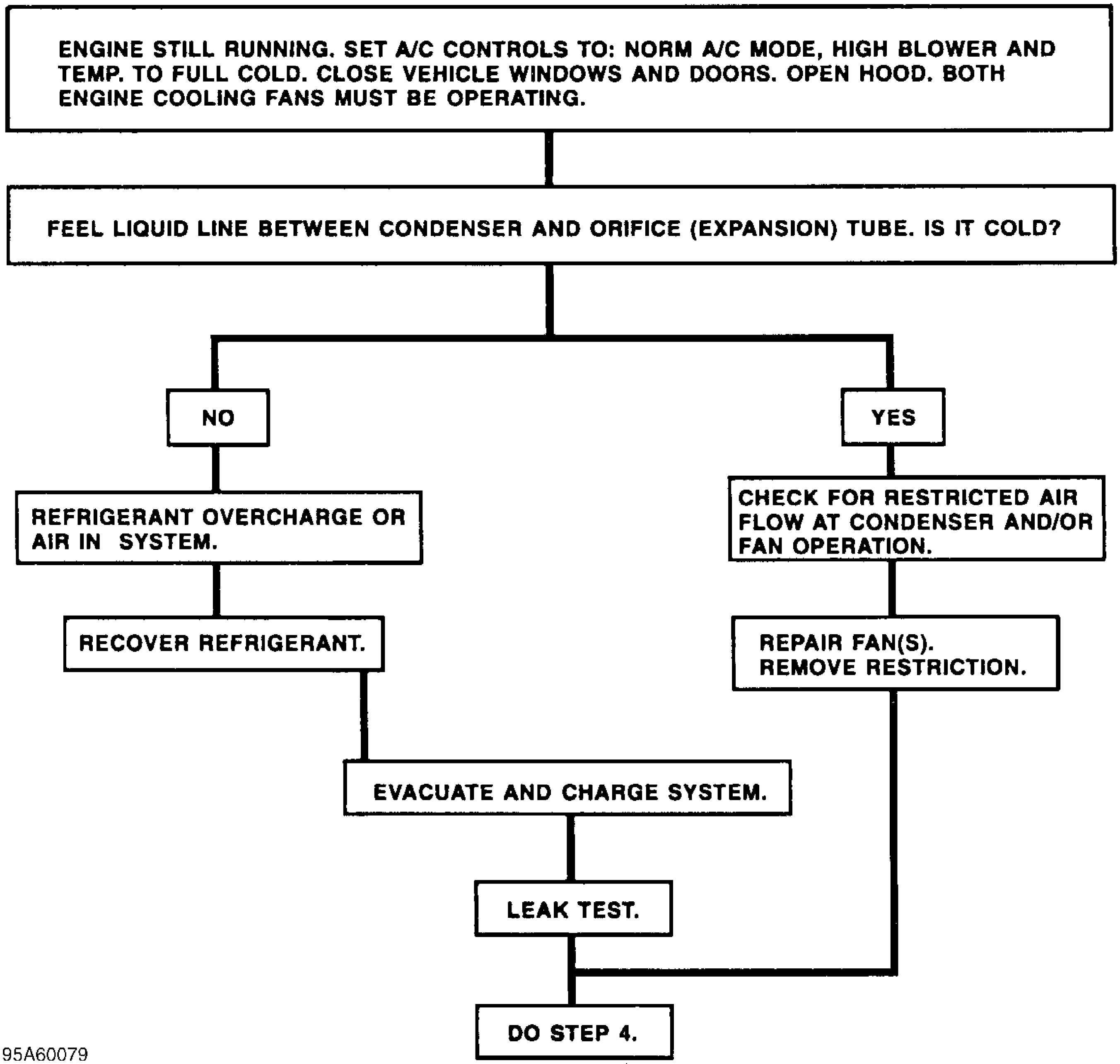

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Fig. 17: Right Area Diagnosis & Service - Step 5 (V5/VDOT)
Courtesy of General Motors Corp.

LEFT AREA DIAGNOSIS & SERVICE - STEP 6 - (V5/VDOT)

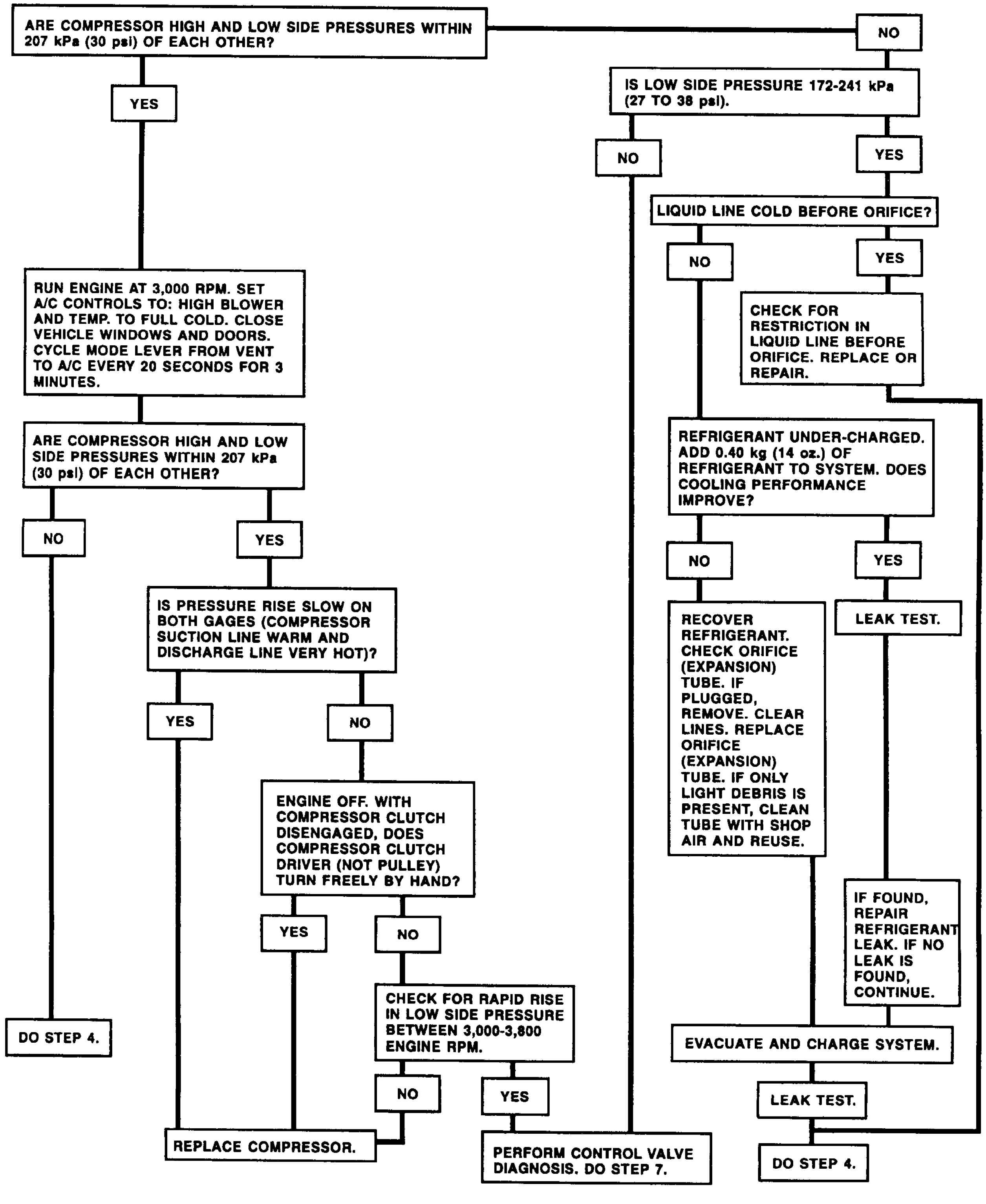

Fig. 18: Left Area Diagnosis & Service - Step 6 (V5/VDOT)
Courtesy of General Motors Corp.

CONTROL VALVE DIAGNOSIS - STEP 7 - (V5/VDOT)

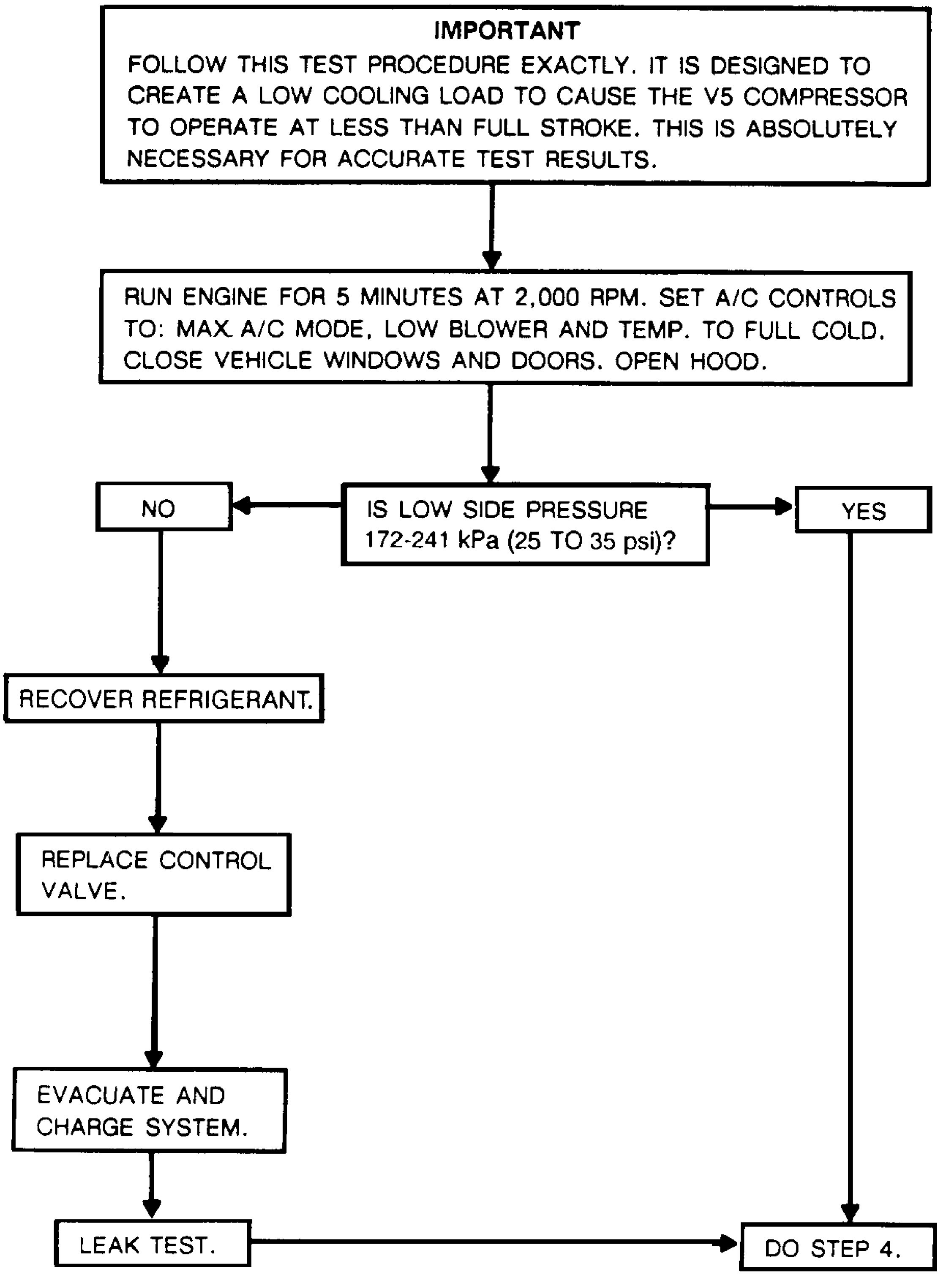

Fig. 19: Control Valve Diagnosis - Step 7 (V5/VDOT)
Courtesy of General Motors Corp.

* A/C-HEATER SYSTEM UNIFORM INSPECTION GUIDELINES *

1997 Chevrolet Blazer

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

All Makes and Models

INTRODUCTION TO MOTORIST ASSURANCE PROGRAM (MAP)

CONTENTS

HEATER HOSES
HIGH PRESSURE RELIEF VALVES (HPRV)
IDLERS
IN-LINE FILTERS
METAL FITTINGS
METAL LINES
MIX AND AIR CONTROL DOORS (BLEND DOORS)
O-RINGS
ORIFICE TUBES
PILOT-OPERATED ABSOLUTES (POAS)
PLENUMS
PRESSURE CONTROL VALVES
PRESSURE SENSORS
PULLEYS
RADIATORS
RECEIVER-DRIERS
REFRIGERANT
REFRIGERANT OIL
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SEALS
SERVICE PORTS
SPRING LOCK COUPLINGS
SUCTION THROTTLING VALVES (STVS)
SWITCHES (ELECTRICAL)
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THERMISTORS AND PRESSURE SENSORS
THERMOSTATS AND HOUSINGS
VACUUM HOSES AND TUBES
VACUUM RESERVOIRS
VACUUM TUBES
VALVES IN RECEIVER (VIRS)
WATER PUMPS (ELECTRIC AUXILIARY)
WIRING HARNESSES AND CONNECTORS

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.

BLEND DOORS

See PLENUMS.

BLOWER FANS (BLOWER WHEEL OR SQUIRREL CAGE)

BLOWER FAN (BLOWER WHEEL OR SQUIRREL CAGE) INSPECTION

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

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

BLOWER MOTORS

BLOWER MOTOR INSPECTION

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

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

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

BLOWER RESISTORS

BLOWER RESISTOR INSPECTION

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

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

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

BLOWER SWITCHES

See SWITCHES.

CABIN AIR FILTERS

CABIN AIR FILTER INSPECTION

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

CIRCUIT BREAKERS

See FUSES, FUSIBLE LINKS AND CIRCUIT BREAKERS.

COMPRESSOR CLUTCH ASSEMBLIES

COMPRESSOR CLUTCH ASSEMBLY INSPECTION

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

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

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

COMPRESSORS

COMPRESSOR INSPECTION

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

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

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

CONDENSER AIR SEALS

CONDENSER AIR SEAL INSPECTION

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

CONDENSER FAN MOTORS

See COOLING FAN MOTORS.

CONDENSERS

CONDENSER INSPECTION

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

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

CONNECTORS

See WIRING HARNESSES AND CONNECTORS.

CONTROL CABLES

CONTROL CABLE INSPECTION

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

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

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

CONTROL HEADS (FUNCTION SELECTORS)

CONTROL HEAD (FUNCTION SELECTOR) INSPECTION

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

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

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

CONTROL LINKAGES

CONTROL LINKAGE INSPECTION

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

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

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

CONTROL MODULES

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

CONTROL MODULE INSPECTION

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

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

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

COOLANT

COOLANT INSPECTION

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

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

COOLING FAN BLADES

COOLING FAN BLADE INSPECTION

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

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

COOLING FAN CLUTCHES

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

COOLING FAN CLUTCH INSPECTION

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

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

COOLING FAN MOTORS

COOLING FAN MOTOR INSPECTION

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

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

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

EVAPORATOR DRAIN TUBES

EVAPORATOR DRAIN TUBE INSPECTION

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

EVAPORATOR PRESSURE REGULATORS (EPRS)

EVAPORATOR PRESSURE REGULATOR (EPR) INSPECTION

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

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

EVAPORATORS

EVAPORATOR INSPECTION

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

(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.

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

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

WIRING HARNESSES AND CONNECTORS

WIRING HARNESS AND CONNECTOR INSPECTION

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

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

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

A/C-HEATER SYSTEM

1997 Chevrolet Blazer

1997 A/C-HEATER SYSTEMS
General Motors Corp. - Manual A/C-Heater System

Chevrolet; Blazer, S10 Pickup
GMC; Jimmy, Sonoma
Oldsmobile; Bravada

* PLEASE READ THIS FIRST *

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

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

A/C SYSTEM SPECIFICATIONS

A/C SYSTEM SPECIFICATIONS TABLE

Application	Specification
Compressor Type	
2.2L	Harrison V5 5-Cyl.
4.3L	Harrison HT6 6-Cyl.
Compressor Belt Tension	(1)
System Oil Capacity (2)	
2.2L	9 ozs.
4.3L	8 ozs.
Refrigerant (R-134a) Capacity	32 ozs.
System Operating Pressures (3)	
High Side	299 psi (21 kg/cm²)
Low Side	26 psi (1.8 kg/cm²)

(1) - Tighten serpentine belt until indicator mark on movable portion of belt tensioner is within limits of slotted area on stationary portion of belt tensioner.
(2) - Use PAG Oil.
(3) - Specification is with ambient temp at 80°F (27°C), relative humidity at 60 percent and engine speed at 1500 RPM.

DESCRIPTION

A/C-heater system is a blend-air system. Air entering vehicle must pass through evaporator core and through and/or around heater core to obtain desired temperature.

Compressor operation on 6-cylinder compressor is controlled by a pressure cycling switch located on top of accumulator. Compressor operation on 5-cylinder compressor is controlled by Powertrain Control Module (PCM) through A/C compressor clutch relay based on A/C related inputs to PCM.

OPERATION

A/C-HEATER CONTROL PANEL

Temperature Control Knob

An electric motor controls the temperature door based on the temperature knob position. When temperature knob is in the Blue (cold) position, air delivered by system is unheated. When temperature knob is in Red (hot) position, all air passing through heater module is heated before it is discharged. Intermediate position of temperature knob results in a mixture of heated and unheated air to provide more moderate air temperatures.

Mode Selector Knob

Mode selector knob positions are OFF, MAX A/C, NORM A/C, BI-LEV A/C, VENT, HEAT, BLEND and DEFROST. Mode selector knob operates a rotary vacuum switch that routes engine vacuum to specific hoses in the vacuum harness. These hoses control various vacuum actuators on A/C-heater system. Each actuator operates an air valve (a door-like hinged deflector) that routes airflow to various outlets through the system.

Blower Switch

Blower switch provides a choice of various blower speeds. Blower switch receives power through a fuse in fuse block when ignition is on. In various speed positions, circuit continues through wiring harness to blower motor resistor, near blower motor. There are 4-positions: LO, HI and 2 intermediate positions. Blower operates in any mode position except OFF.

TROUBLE SHOOTING

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

NOTE: Also see the A/C-HEATER SYSTEM TROUBLE SHOOTING - MANUAL article.

A/C COMPRESSOR CLUTCH CONTROLS

See the A/C COMPRESSOR CLUTCH CONTROLS article.

BLOWER MOTOR INOPERATIVE

1) Turn ignition switch to RUN position. Place mode selector in VENT position. Place blower switch in LO position. Connect test light from Purple wire at blower motor relay connector to ground. If test light does not glow, go to next step. If test light glows, check for poor connection at blower motor and relay connectors. If connections are okay, check for open Purple wire or Black wire between blower motor relay connector and blower motor connector. If wires are okay, replace blower motor.

2) Disconnect blower motor relay connector. Connect test light from Dark Blue wire at blower motor relay connector to ground. If test light does not glow, go to next step. If test light glows, check for poor connection at blower motor relay connector. If connection is okay, replace blower motor relay.

3) Connect test light from Brown wire (mode selector control to fuse block wire) at mode selector control to ground. If test light does not glow, repair open Brown wire between mode selector control and fuse block. If test light glows, check for poor connections at

blower motor relay connector and mode selector control connector. If connections are okay, replace control panel.

BLOWER MOTOR DOES NOT OPERATE IN HIGH SPEED

1) Turn ignition switch to RUN position. Place mode selector in VENT position. Place blower switch in HIGH position. Connect test light from Orange wire at blower motor relay connector to ground. If test light glows, go to next step. If test light does not glow, check for poor connection at blower switch connector of control panel. If connection is okay, replace control panel.

2) Connect test light from Red wire at blower motor relay connector to ground. If test light does not glow, repair open Red wire between blower motor relay connector and battery junction block. If test light glows, check for poor connection at blower motor relay connector or open Black wire between blower motor relay connector and ground. If connection and wire are okay, replace blower motor relay.

BLOWER MOTOR DOES NOT OPERATE IN MEDIUM SPEEDS

1) Turn ignition switch to RUN position. Place mode selector in VENT position. Place blower switch in medium-low (M1) position. Connect test light from Tan wire at blower motor resistor connector to ground. If test light glows, go to next step. If test light does not glow, check for poor connection at blower switch connector of control panel or open Tan wire. If connection and wire are okay, replace control panel.

2) Place blower switch in medium-high (M2) position. Connect test light from Light Blue wire at blower motor resistor connector to ground. If test light does not glow, check for poor connection at blower switch connector or open Light Blue wire. If connection and wire are okay, replace blower switch. If test light glows, check for poor connection at blower motor resistor connector. If connection is okay, replace blower motor resistor.

BLOWER MOTOR DOES NOT OPERATE IN LOW SPEED

Turn ignition switch to RUN position. Place mode selector in VENT position. Place blower switch in LO position. Disconnect blower motor resistor. Connect test light from Brown wire at blower motor resistor connector to ground. If test light does not glow, check Brown wire for high resistance or open. If wire is okay, replace control panel. If test light glows, check for poor connections at blower motor resistor. If connections are okay, replace blower motor resistor.

BLOWER MOTOR OPERATES IN HIGH SPEED ONLY

1) Turn ignition switch to RUN position. Place mode selector in VENT position. Place blower switch in LO position. Using a DVOM, measure voltage between Dark Blue wire at blower motor relay connector and ground. If voltage is less than 4 volts, go to next step. If voltage is greater than 4 volts, check for poor connection at blower motor relay connector. If connection is okay, replace blower motor relay.

2) Disconnect blower motor resistor connector. Connect test light from Brown wire at blower motor resistor connector to ground. If test light does not glow, check for open Brown wire or for poor connection at blower switch connector of control panel. If wire and connection are okay, replace control panel. If test light glows, check Dark Blue wire for high resistance or open. If wire is okay, replace blower motor resistor.

TESTING

A/C SYSTEM PERFORMANCE

1) Park vehicle out of direct sunlight. Open windows or door to ventilate interior. Vent engine exhaust, if necessary. Install manifold gauge set. Note ambient temperature and humidity.

2) Close all windows and doors. Place mode selector lever in MAX A/C position, blower switch lever in HIGH position, and temperature control lever in full cold position.

3) Insert thermometer into right center vent. Place transmission in Park or Neutral. Start engine and allow it to run at 1500 RPM until temperature tester reaches lowest temperature (approximately 3 minutes). See A/C SYSTEM SPECIFICATIONS table.

A/C SYSTEM SPECIFICATIONS TABLE (1)

Ambient Temperature °F (°C)	Low Side Pressure psi (kg/cm^2)	High Side Pressure psi (kg/cm^2)	Air Outlet Temperature °F (°C)
70 (21)	21 (1.5)	261 (18)	40 (4)
80 (27)	26 (1.8)	299 (21)	45 (7)
90 (32)	35 (2.5)	385 (27)	56 (13)

(1) - Specifications are with relative humidity at 60 percent.

REMOVAL & INSTALLATION

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

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

ACCUMULATOR

Removal & Installation

1) Disconnect negative battery cable. Discharge A/C system, using approved refrigerant recovery/recycling equipment. Disconnect electrical connections (if necessary). Disconnect accumulator lines, and plug openings. On 4.3L engines, remove accumulator bracket screws and accumulator. On 2.2L engines, remove clamp bolt remove accumulator from clamp. See Fig. 1.

2) To install, reverse removal procedure. Add 3 ounces of clean refrigerant oil to NEW accumulator before installation. Lubricate NEW "O" rings with clean refrigerant oil before installation. Evacuate, charge, and leak test system.

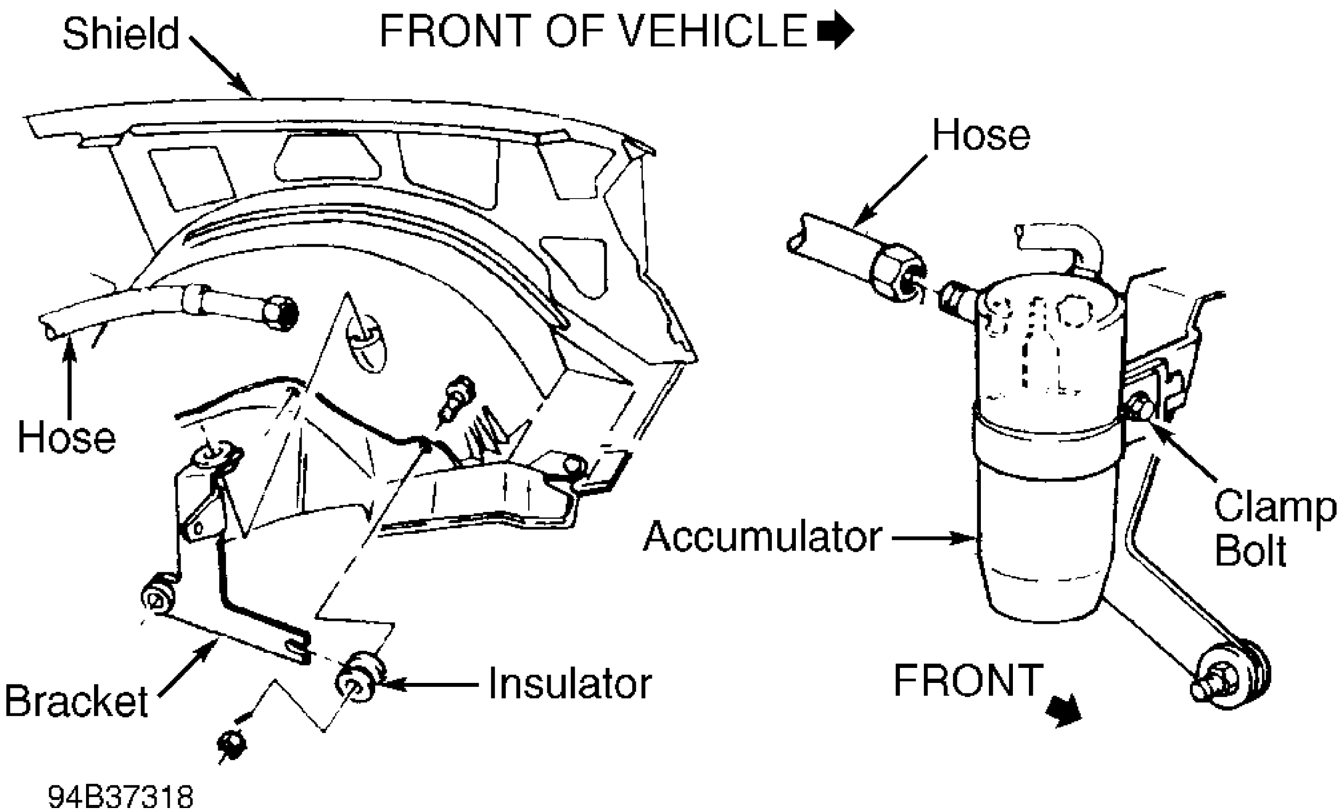

Fig. 1: Exploded View Of Accumulator Assembly
Courtesy of General Motors Corp.

BLOWER MOTOR & FAN

Removal & Installation

1) Disconnect negative battery cable. Disconnect blower motor electrical connections. Remove Vehicle Control Module (VCM), if necessary. Remove coolant recovery reservoir and blower motor cooling tube. Remove blower motor mounting screws.

2) Cut access cover along dotted lines. See Fig. 2. Remove upper half of access cover, tearing remaining portion of access cover. Remove blower motor. Remove nut attaching blower fan to blower motor shaft, and remove fan.

3) To install, reverse removal procedure. Apply a bead of Black weatherstrip adhesive to cut and tear lines for access cover.

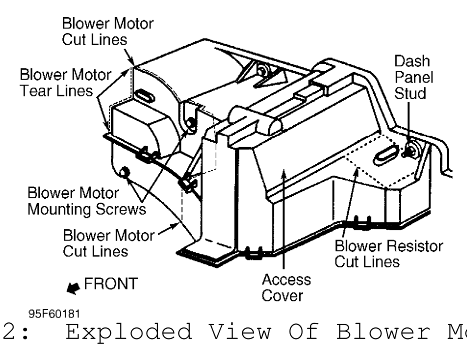

Fig. 2: Exploded View Of Blower Motor & Evaporator Assembly
Courtesy of General Motors Corp.

COMPRESSOR

Removal & Installation

1) Disconnect negative battery cable. Discharge A/C system, using approved refrigerant recovery/recycling equipment. Remove electrical connections, as necessary.

2) Remove drive belt. Remove refrigerant hoses from compressor, and cap openings. Remove compressor from bracket (if equipped).

3) To install, reverse removal procedure. Drain and measure oil from old compressor. If less than one ounce is drained, add 2 ounces of refrigerant oil to NEW compressor. If more than one ounce is drained, add the same amount to NEW compressor. Evacuate, charge, and leak test system.

CONDENSER

Removal & Installation

1) Disconnect negative battery cable. Discharge A/C system, using approved refrigerant recovery/recycling equipment. Remove upper fan shroud. Drain engine coolant. Remove radiator. Disconnect inlet and outlet lines at condenser, and cap openings. Remove condenser from vehicle.

2) To install, reverse removal procedure. Lubricate NEW "O" rings with clean refrigerant oil before installation. Add one ounce of clean refrigerant oil to condenser. Fill cooling system, and check for leaks. Evacuate, charge, and leak test A/C system.

CONTROL PANEL

Removal & Installation

Disconnect negative battery cable. Remove instrument panel center bezel. Remove control panel screws. Remove control cable. Disconnect vacuum and electrical connectors at control panel. Remove control panel. To install, reverse removal procedure.

EVAPORATOR CORE

Removal & Installation

1) Disconnect negative battery cable. Discharge A/C system, using approved refrigerant recovery/recycling equipment. Remove A/C control relay and bracket and set aside. Remove blower motor resistor harness. Remove stud from dash panel above blower motor resistor.

2) Cut access cover along dotted lines. See Fig. 2. Remove 3 remove blower motor resistor retaining screws and remove blower motor resistor.

Disconnect condenser-to-evaporator line. Remove hoses from accumulator. Remove accumulator. See ACCUMULATOR.

3) Remove evaporator and blower motor assembly screws and nuts. Remove evaporator and blower motor assembly. Remove case screws and nuts. Separate case halves, and remove evaporator core. See Fig. 2 .

4) To install, reverse removal procedure. Lubricate NEW "O" rings with clean refrigerant oil before installation. Add 3 ounces of clean refrigerant oil to evaporator core. Apply a bead of Black weatherstrip adhesive to cut lines. Evacuate, charge, and leak test system.

HEATER CORE

CAUTION: Heater core can be damaged if too much force is applied to heater core pipes during hose removal.

Removal & Installation

1) Disable air bag system. See the AIR BAG RESTRAINT SYSTEM article in the ACCESSORIES/SAFETY EQUIPMENT section. Drain engine coolant. Remove heater hoses at core, and plug core openings.

2) Remove instrument cluster trim plate. Move tilt steering column down (if equipped), set parking brake and move automatic transmission gear selector to low (if equipped).

3) Remove left underdash hush panel. Remove Data Link Connector (DLC) and Remote Keyless Entry (RKE) module connectors. Remove center underdash hush panel. Disconnect park brake release cable from instrument panel. Disconnect park brake cable from ratchet mechanism.

4) Remove right underdash hush panel. Remove lighter and accessory outlets, if equipped. Remove courtesy light. Remove knee bolster. Partially pull A/C-heater control panel and radio to disconnect connectors on back of A/C-heater control panel and radio.

5) Remove 4 steering column retaining bolts and lower steering column. Remove speaker and defroster grilles. Remove 9 instrument panel support bolts, including brake pedal bracket support bolt. See Fig. 3. Remove electrical connectors. Remove instrument panel.

6) Remove core cover attaching screws. Remove retainers at end of core. Remove heater core. To install, reverse removal procedure. Fill cooling system, and check for leaks.

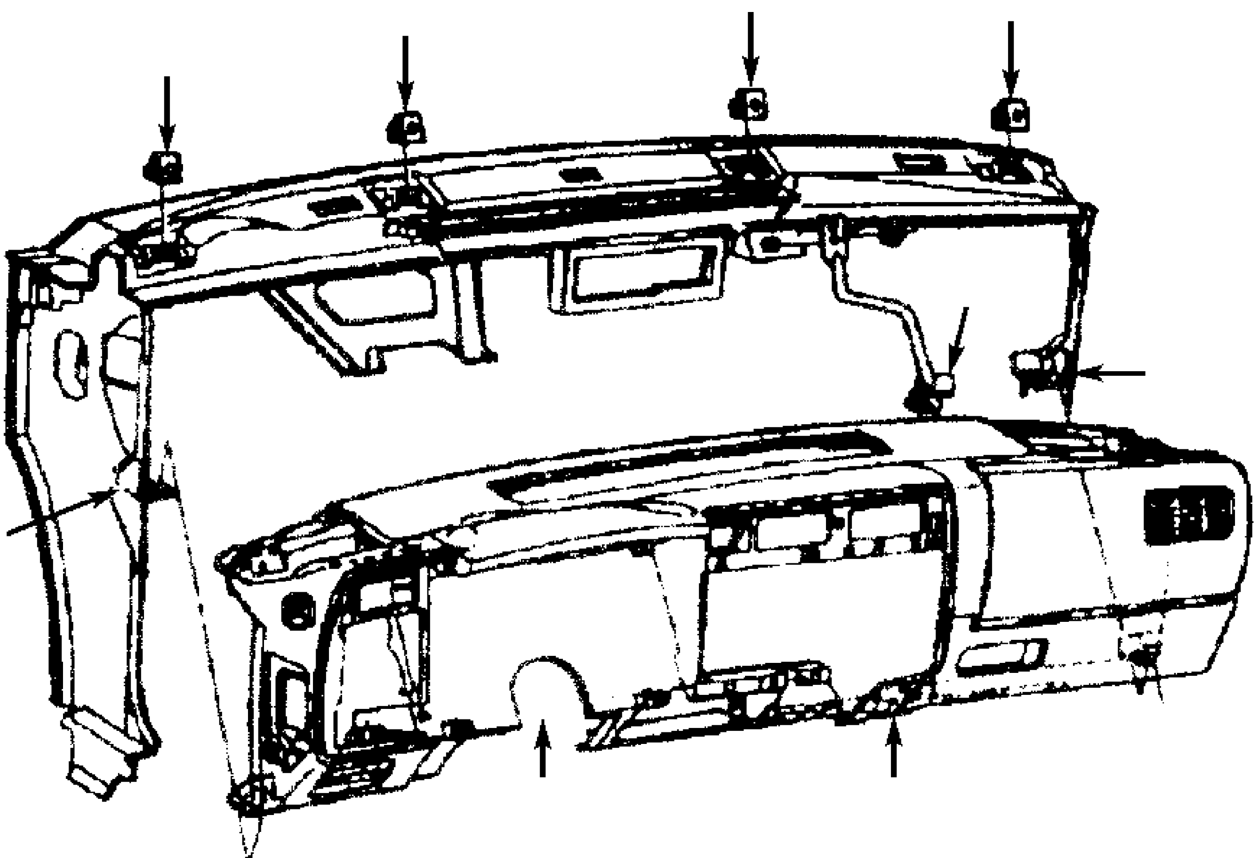

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Fig. 3: Locating Instrument Panel Support Bolts
Courtesy of General Motors Corp.

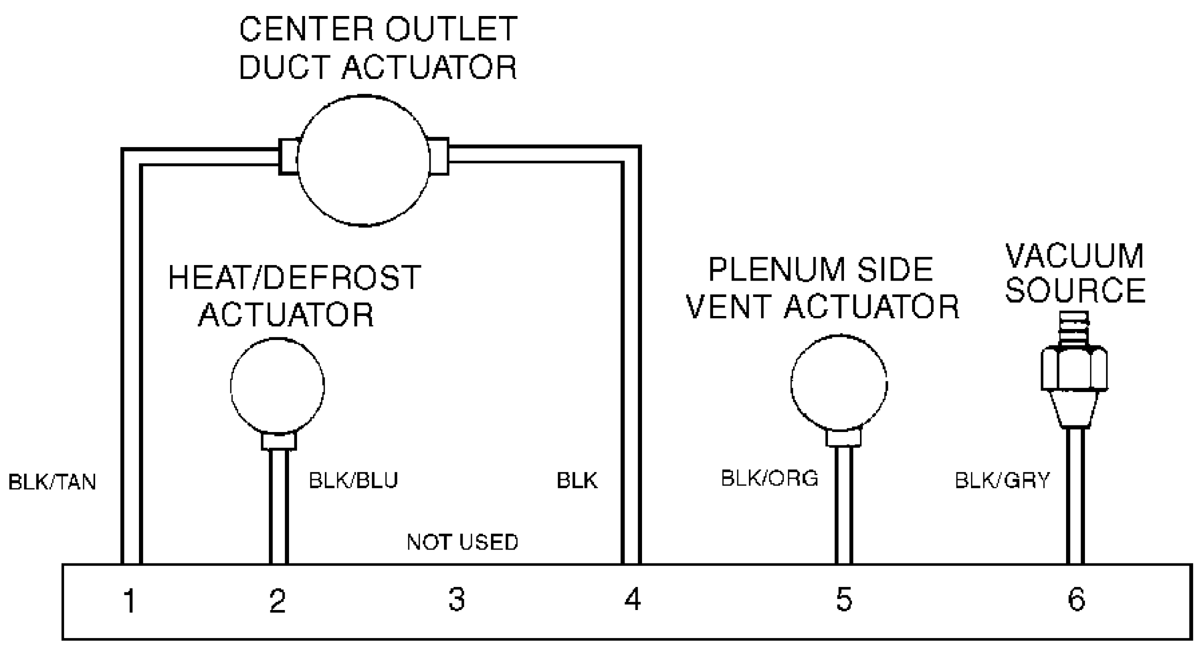
TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS TABLE

Application	Ft. Lbs. (N.m)
Accumulator Inlet Fitting	30 (41)
Compressor Bolts	
2.2L	37 (50)
4.3L	24 (33)
Compressor Hose Assembly Bolt (1)	24 (33)
Compressor-To-Bracket Bolt	23 (31)
Condenser Inlet Fitting	18 (24)
Evaporator-To-Accumulator Fitting	30 (41)
Evaporator-To-Condenser Line Fittings	13 (18)

(1) - Use NEW sealing washers.

VACUUM DIAGRAM



A/C-HEATER VACUUM SELECTOR VALVE OPERATING CHART

CONNECTION	PORT	OFF	MAX	NORM	BI-LEV	VENT	HTR	BLEND	DEF
DEFROST	1	VENT	VAC	VAC	VENT	VAC	VENT	VENT	VAC
A/C	2	VENT	VAC	VAC	VAC	VAC	VENT	VENT	VENT
NOT USED	3	VENT	VENT	VENT	VENT	VENT	VENT	VENT	VENT
HEAT	4	VAC	VENT	VENT	VENT	VENT	VAC	VENT	VENT
RECIRC	5	VENT	VAC	VENT	VENT	VENT	VENT	VENT	VENT
SOURCE	6	VAC	VAC	VAC	VAC	VAC	VAC	VAC	VAC

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Fig. 4: Manual A/C-Heater System Vacuum Diagram
Courtesy of General Motors Corp.

WIRING DIAGRAMS

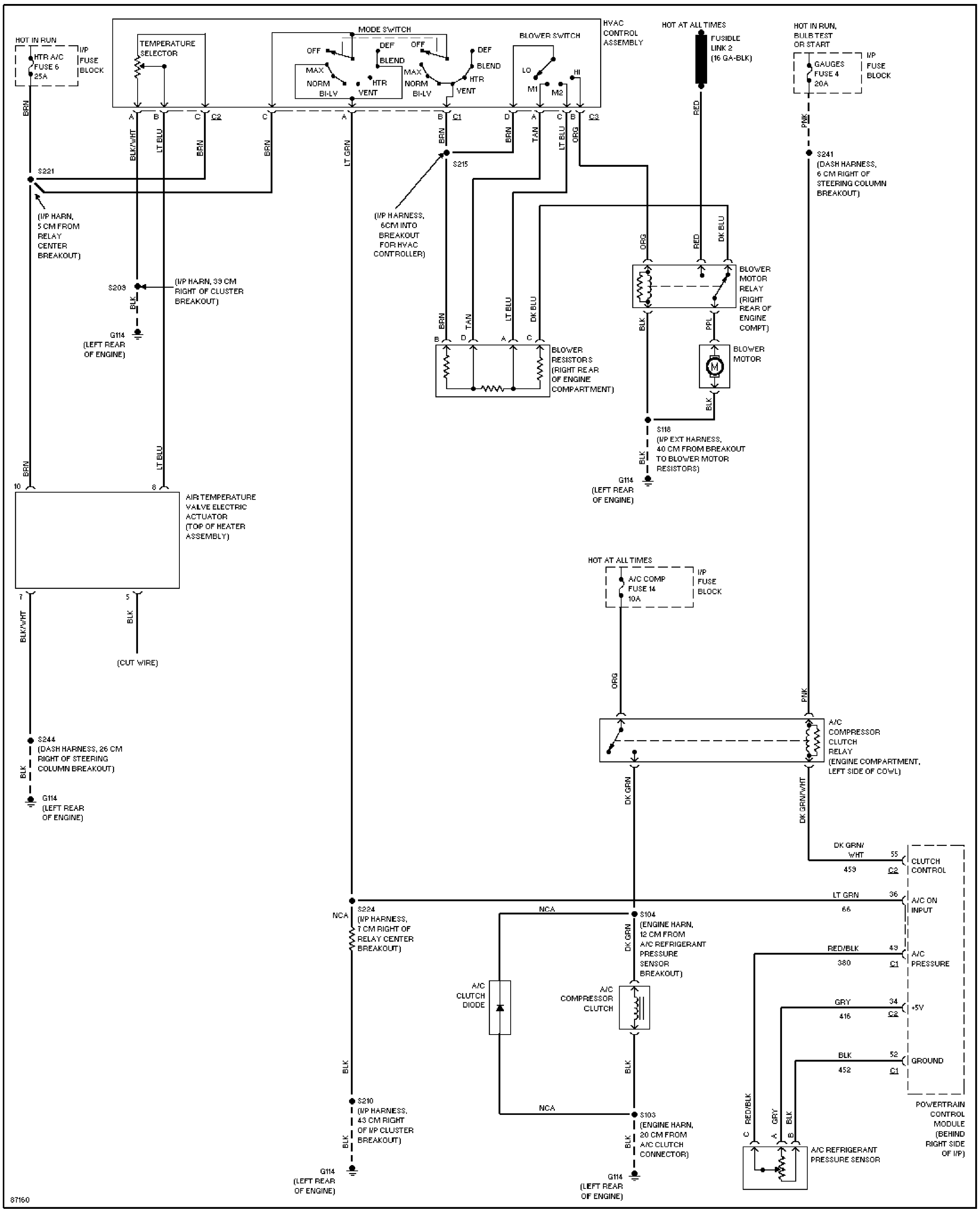

Fig. 5: Manual A/C-Heater System Wiring Diagram (2.2L)

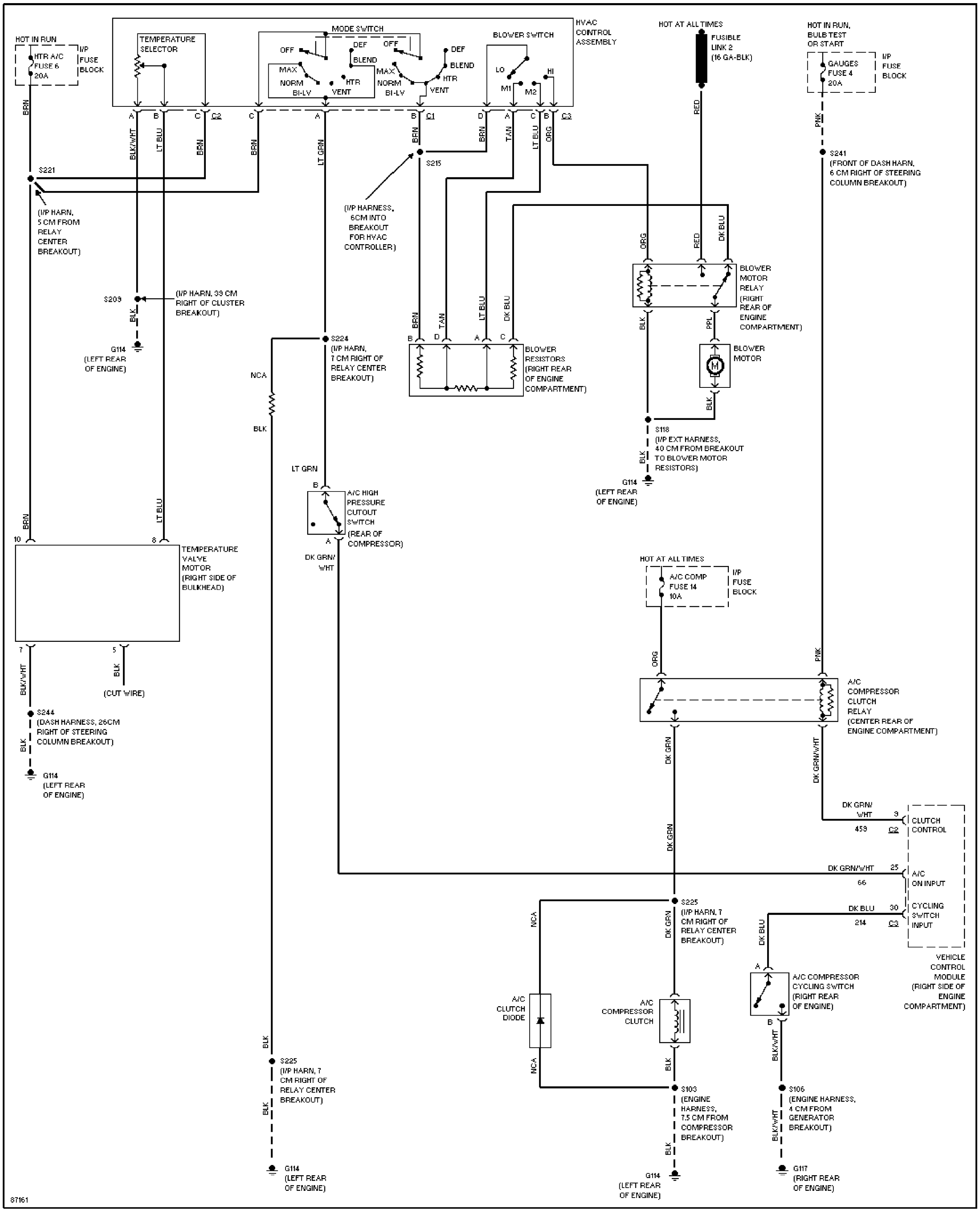

Fig. 6: Manual A/C-Heater System Wiring Diagram (4.3L)

A/C SYSTEM GENERAL SERVICING

1997 Chevrolet Blazer

1997 GENERAL SERVICING
General Motors - General Servicing Procedures - Trucks/Vans

Chevrolet, GMC, Oldsmobile, Pontiac

* PLEASE READ THIS FIRST *

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

USING R-134a REFRIGERANT

REFRIGERANT OIL & REFRIGERANT CAPACITY SPECIFICATIONS

REFRIGERANT OIL & REFRIGERANT CAPACITY SPECIFICATIONS TABLE

Application (1)	(2) Oil Ounces	Refrigerant Ounces
"C" & "K" Series		
Pickup & Sierra	(3) 8.0	32.0
Crew Cab & Utility	(3) 8.0	36.0
Suburban, Tahoe & Yukon		
With Rear Unit	(3) 11.0	64.0
Without Rear Unit	(3) 8.0	36.0
"G" Series		
With Rear Unit	(3) 11.0	78.0
Without Rear Unit	(3) 8.0	48.0
"L" & "M" Series		
Without Rear Unit	(3) 8.0	32.0
With Rear Unit	(3) 11.0	48.0
"P" Series	(3) 8.0	48.0
"S" & "T" Series		
2.2L	(3) 9.0	32.0
4.3L	(3) 8.0	32.0
"U" Series		
With Rear Unit	(3) 11.0	46.0
Without Rear Unit	(3) 8.0	32.0

(1) - Series codes determined by fifth character of VIN code.
(2) - Total system capacity, unless otherwise noted.
(3) - Use PAG Oil (Part No. 12345923).

HANDLING/SAFETY PRECAUTIONS

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

2) Always wear eye protection when working around A/C system and refrigerant. The system's high pressure can cause severe injury to eyes and skin if a hose were to burst. 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 (frostbite), DO NOT rub eyes or skin. Immediately flush affected area with cool water for 15 minutes and consult a doctor or hospital.

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

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

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

6) Use care when handling refrigerant containers. DO NOT drop, strike, puncture, or incinerate containers. Use Department Of Transportation (DOT) approved (DOT 4BW or DOT 4BA) refrigerant containers.

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

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

9) Refrigerant R-12 and R-134a must never be mixed, as they and their desiccants and lubricants are not compatible. If 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) Read and follow equipment manufacturer's instructions for all service equipment to be used. The Material Safety Data Sheet (MSDS), provided by refrigerant manufacturer/supplier, contains valuable information regarding the safe handling of 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 ports. See Fig. 1.

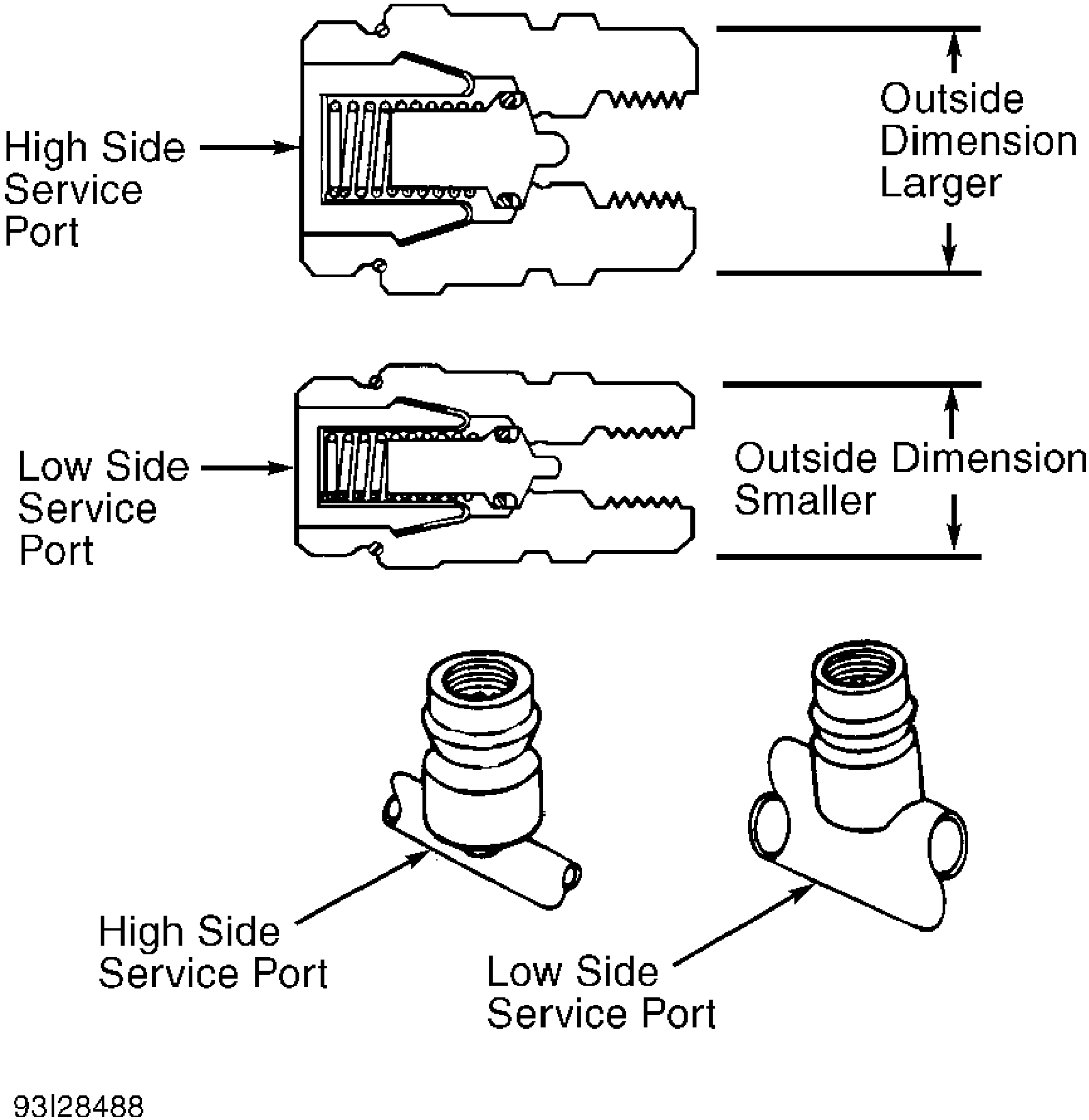

Fig. 1: Identifying R-134a Service Ports
Courtesy of Chrysler Corp.

Underhood A/C Specification Labels

Most R-134a based systems will be identified through the use of underhood labels with R-134a refrigerant clearly printed on labels. See Fig. 2. Most manufacturers will identify refrigerant type with labels affixed to compressor. Before servicing an A/C system, always determine which refrigerant is being used.

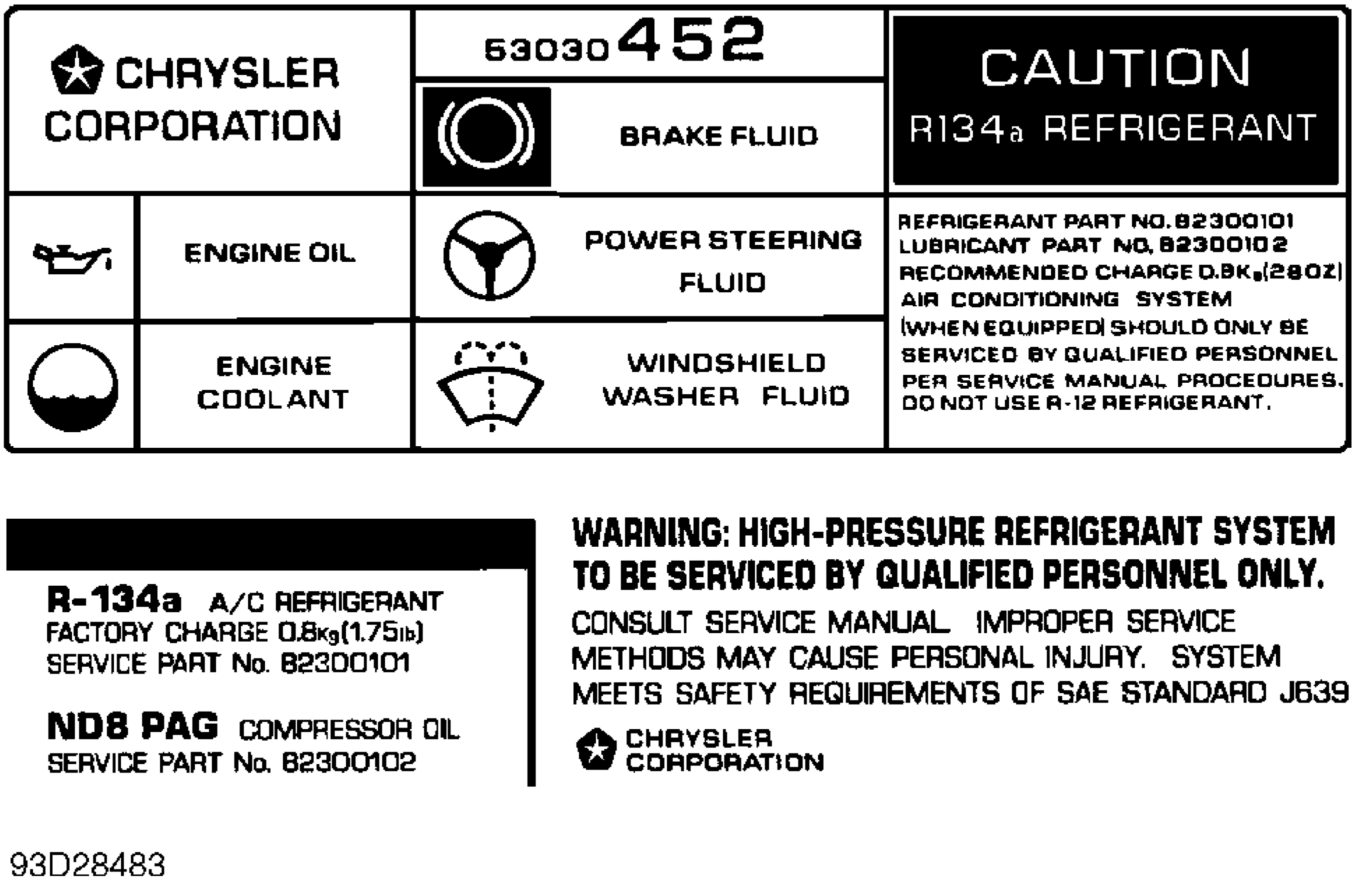

Fig. 2: Underhood Refrigerant Identification Labels (Typical)
Courtesy of Chrysler Corp.

REFRIGERANT OILS

CAUTION: Use ONLY the specified oil for the appropriate system or 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.

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. See the REFRIGERANT OIL APPLICATION table for specific refrigerant oil applications.

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

REFRIGERANT OIL APPLICATION TABLE

Application	Refrigerant Oil
All Models	PAG Refrigerant Oil (Part No. 12345923)

SYSTEM SERVICE VALVES

SCHRADER-TYPE VALVES

CAUTION: 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. See Fig. 3. When a test gauge hose is attached (hose has built-in valve core depressor), Schrader stem is pushed inward to the open position and allows system pressure to reach the gauge.

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

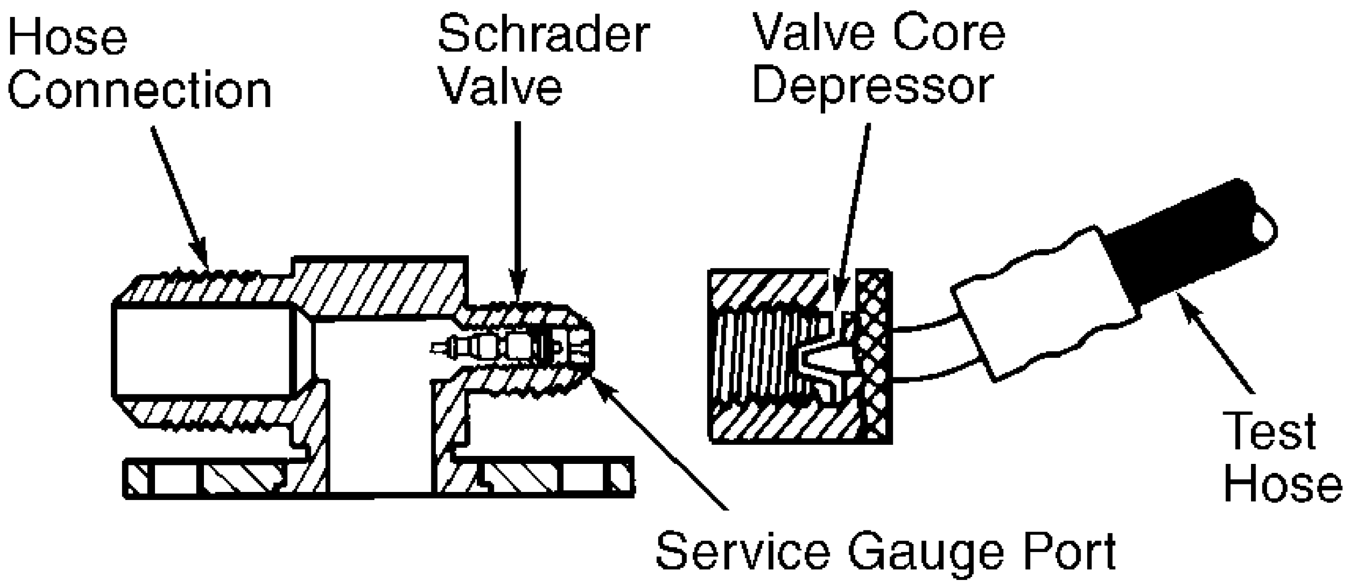

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Fig. 3: Schrader Service Valve (Compressor Location Shown)

SPECIAL VALVE CONNECTORS

On some models, thread size on high-side service valve (3/8" - 24 threads) is different from thread size on low-side service valve (7/16" - 20 threads). Special adapters are required to make this connection. See Fig. 4. These adapters are available in 45-degree and 90-degree angles in addition to straight-fixed and flexible adapters.

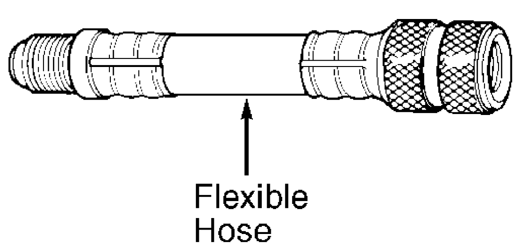

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Fig. 4: Flexible High Side Adapter

R-134a SERVICE VALVES/PORTS

All vehicles with R-134a refrigerant use quick-disconnect service valves/ports. All R-134a systems use quick-disconnect fittings with sealing caps that thread into inside of service port instead of onto outside of service port.

The high side uses a large service port, and the low side uses a small service port. See Fig. 1. The R-134a service ports have internal metric threads to help prevent the accidental connection of R-12 servicing equipment.

There are 2 types of quick-disconnect service couplings which can be used on R-134a systems. One type of service coupling depresses service port valve when connection is made. The other type connects onto service port but will not depress service port valve until a knob is rotated. See Fig. 5.

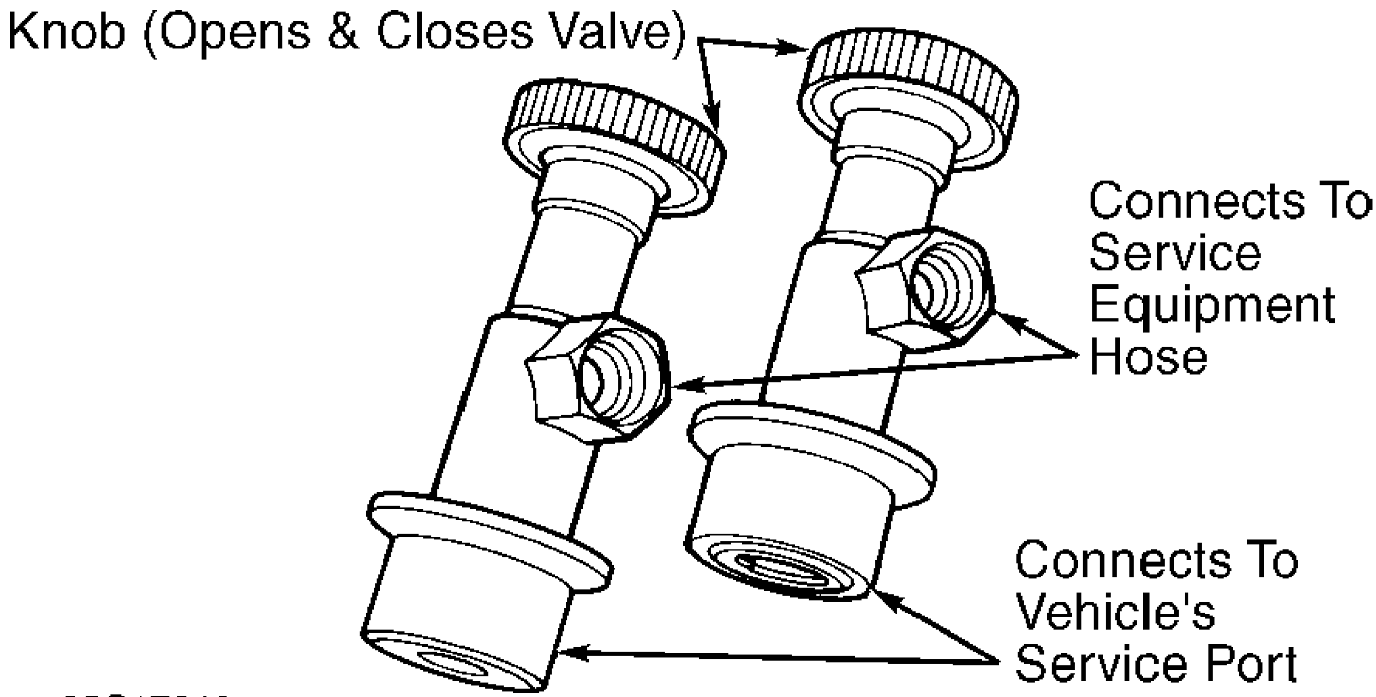


Fig. 5: R-134a Service Couplings
Courtesy of Chrysler Corp.

SERVICE VALVE LOCATIONS

For service valve locations, see the SERVICE VALVE LOCATIONS table.

SERVICE VALVE LOCATIONS TABLE

Vehicle	High	Low
"C" & "K" Series	(1)	(2)
"G" Series	(4)	(4)
"L" & "M" Series	(1)	(3)
"P" Series	(4)	(4)
"S" & "T" Series	(4)	(4)
"U" Series	(1)	(3)

(1) - In discharge (high pressure) line, near condenser.
(2) - In suction line between evaporator and compressor.
(3) - On accumulator-drier.
(4) - Information not available at time of publication.

SERVICE EQUIPMENT

Because R-134a is not interchangeable with R-12, separate sets of hoses, gauges and recovery/recycling equipment are required to service vehicles. This is necessary to avoid cross-contamination 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 their length and be clearly labeled SAE J2196/134a. The low pressure test hose is Blue with a Black stripe. The high pressure test hose is Red with a Black stripe. The center test hose is Yellow with a Black stripe.

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

All 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.

MANIFOLD GAUGE SET

A manifold gauge set is used to determine system's high-side and low-side pressures, correct refrigerant charge, system diagnosis and operating efficiency. High (discharge) and low (suction) pressures must be compared to determine system operation. Manifold gauge sets for the 2 refrigerant types are basically the same except for fittings at ends of hoses. Fittings are different to ensure connection only to appropriate refrigerant system.

Low-Side Gauge

Low-side gauge, which may have a Blue identifying feature, is used to measure low-side (suction) pressure. Low-side gauge is also called a compound gauge because it can measure pressure and vacuum. Pressure scale ranges from 0 to 150 psi; vacuum scale ranges from 0 to 30 in. Hg.

High-Side Gauge

High-side gauge, which may have a Red identifying feature, is used to measure high-side (discharge) pressure. Gauge scale ranges from 0 to 500 psi.

CONNECTING GAUGE SET

NOTE: R-134a quick disconnect service couplings are connected in the same sequence as Schrader-type service valves.

Schrader-Type Valves

1) Put on safety goggles, and cover vehicle's fender. Slowly

remove protective caps from Schrader valves to check for leaky valves.

CAUTION: Ensure hand valves on manifold gauge set and the hose-end shutoff valves are closed before attaching test hoses to Schrader valves.

2) Ensure service hoses are equipped with valve core depressor to match Schrader valve. If not, install special adapters for this purpose. If the high-side service hose connector will not fit on high-side Schrader valve, a special adapter must be used. See SPECIAL VALVE CONNECTORS.

3) Ensure both manifold gauge hand valves are closed. Connect low-side service hose to low-side (suction) service valve, and finger tighten connections. Connect high-side service hose to high-side (discharge) service valve, and finger tighten connections.

NOTE: After test gauges are installed, test hoses must be purged of all air before proceeding with testing.

PURGING TEST HOSES

1) Ensure high-side and low-side hoses are properly connected to service valves, and all hose connections are tight. Place a clean shop towel over end of center service hose.

2) Purge high-side test hose by opening hand valve on high-side gauge for 3-5 seconds. This allows system's refrigerant to force air through test hoses and out of center service hose into the shop towel. Immediately close high-side gauge hand valve.

3) Purge low-side test hose in the same manner using hand valve of low-side gauge. Close hand valve after 3-5 seconds. Purging of test hoses is now complete, and system is ready for testing.

NOTE: If manifold gauge set is to be used in conjunction with refrigerant recovery/recycling equipment, use instructions provided with the recovery/recycling equipment to properly purge test hoses.

STABILIZING A/C SYSTEM

1) Once manifold gauge set is attached to system and test hoses have been purged, system is ready for testing. Place all test hoses, gauge set and other equipment away from all moving parts of engine.

2) Start engine, and turn A/C controls to maximum cooling position (full cold or MAX A/C). Set blower fan on high speed. Open doors and/or windows. Operate system for 5-10 minutes. System should now be stabilized and ready for test readings.

PRESSURE-TEMPERATURE RELATIONSHIP

A refrigerant, when confined in an enclosed space, increases in pressure as the temperature increases. Conversely, if the temperature is lowered, the pressure also decreases.

Depending on temperature, a corresponding pressure will exist in such an enclosed space. For example, at 70°F (21.1°C) a gauge will indicate about 71.0 psi (5.0 kg/cm^2). The R-134a PRESSURE-TEMPERATURE RELATIONSHIP table shows this relationship.

R-134a PRESSURE-TEMPERATURE RELATIONSHIP TABLE

Temperature °F (°C)	(1) psi (kg/cm^2)

20 (-6.7)	18 (1.3)
30 (-1.1)	26 (1.8)
40 (4.4)	35 (2.5)
45 (7.2)	40 (2.8)
50 (10.0)	45 (3.2)
55 (12.8)	51 (3.6)
60 (15.6)	57 (4.0)
65 (18.3)	64 (4.5)
70 (21.1)	71 (5.0)
75 (23.9)	79 (5.6)
80 (26.7)	87 (6.1)
85 (29.4)	95 (6.7)
90 (32.2)	104 (7.3)
95 (35.0)	114 (8.0)
100 (37.8)	124 (8.7)
110 (43.3)	147 (10.3)
120 (48.9)	171 (12.0)
130 (54.4)	199 (14.0)
140 (60.0)	229 (16.1)
150 (65.6)	263 (18.5)
160 (71.1)	300 (21.1)

(1) - Pressure readings are provided as a general guideline and may not represent actual readings.

PRESSURE GAUGE READINGS

The pressure gauge readings used represent an expansion valve type system using a Nippondenso 10-cylinder compressor. See Figs. 6-14. Gauge indications will vary depending on system configuration and compressor application.

Temperature and humidity, as well as other factors, affect pressure gauge readings. Compared to R-12 systems, pressure readings on R-134a systems are generally lower for low-side pressure and higher for high-side pressure. Pressure gauge readings should be used only as a guide.

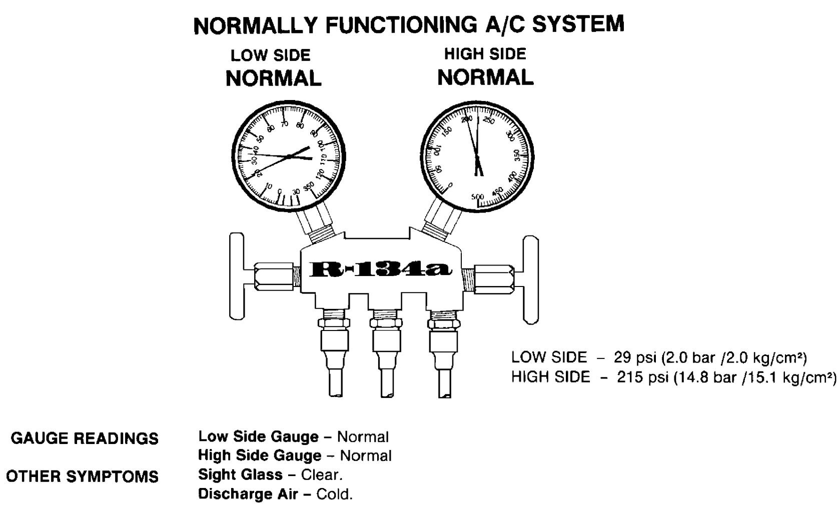
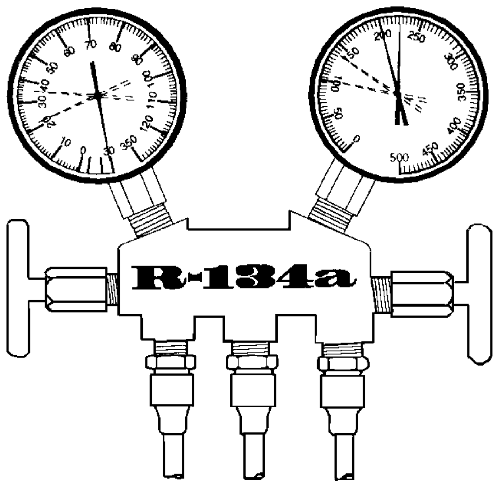


Fig. 6: Normally Functioning R-134a A/C System

SOME MOISTURE IN SYSTEM

LOW SIDE	HIGH SIDE
NORMAL-TO-LOW	**NORMAL-TO-HIGH**



LOW SIDE - -30 psi (-2.1 bar /-2.1 kg/cm²)
HIGH SIDE - 214 psi (14.8 bar /15.0 kg/cm²)

GAUGE READINGS **Low Side Gauge -** Normal, then sometimes drops to below zero
High Side Gauge - Normal, then sometimes goes high

DIAGNOSIS **Moisture In System Freezes Temporarily Stopping Cycle, However Normal System Operation Returns When Ice Melts.**

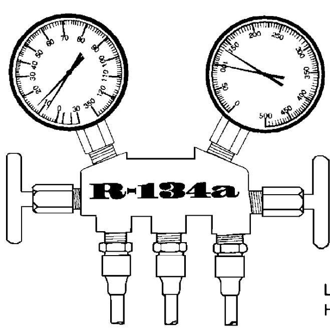
CORRECTION
1) Evacuate A/C system.
2) Replace receiver-drier.
3) Remove moisture by repeatedly evacuating system.
4) Charge system with R-134a.
5) Operate system and check performance.

95F17645

Fig. 7: Some Moisture In R-134a System

LOW R-134a CHARGE

LOW SIDE	HIGH SIDE
LOW	**LOW**



LOW SIDE - 11 psi (.76 bar /.77 kg/cm²)
HIGH SIDE - 121 psi (8.3 bar /8.5 kg/cm²)

GAUGE READINGS **Low Side Gauge** - Low
High Side Gauge - Low

OTHER SYMPTOMS **Sight Glass** - Bubbles continuously visible.

DIAGNOSIS **System Slightly Low On R-134a Due To Leak Or Incorrect Charge.**

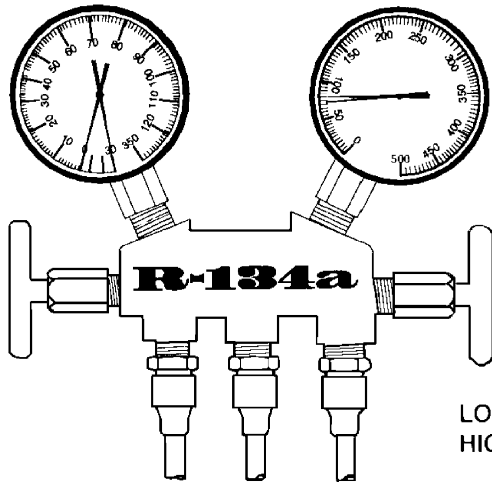
CORRECTION
1) Leak test system.
2) Evacuate A/C system.
3) Repair system leaks.
4) Charge system with R-134a.
5) Operate system and check performance.

95G17646

Fig. 8: Low R-134a Charge

POOR REFRIGERANT CIRCULATION

LOW SIDE **ZERO-TO-NEGATIVE** — HIGH SIDE **LOW**



LOW SIDE - -15 psi (-1.0 bar /-1.1 kg/cm²)
HIGH SIDE - 78 psi (5.4 bar /5.5 kg/cm²)

GAUGE READINGS — **Low Side Gauge -** Zero-to-negative
High Side Gauge - Low

OTHER SYMPTOMS — **Receiver-Drier -** Frost on tubes from receiver-drier to evaporator unit.

DIAGNOSIS — **Refrigerant Flow Obstructed By Dirt, Receiver-Drier Clogged.**

CORRECTION

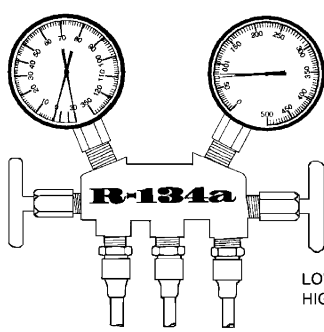
1) Evacuate A/C system.
2) Replace receiver-drier.
3) Charge system with R-134a.
4) Operate system and check performance.

95H17647

Fig. 9: Poor R-134a Refrigerant Circulation

NO REFRIGERANT CIRCULATION

LOW SIDE **ZERO-TO-NEGATIVE** — HIGH SIDE **LOW**



LOW SIDE - -15 psi (-1.0 bar /-1.1 kg/cm²)
HIGH SIDE - 78 psi (5.4 bar /5.5 kg/cm²)

GAUGE READINGS — **Low Side Gauge -** Zero-to-negative
High Side Gauge - Low

OTHER SYMPTOMS — **Receiver-Drier -** Frost or moisture on tubes before and after receiver-drier.

DIAGNOSIS — **Refrigerant Flow Obstructed By Dirt Or Moisture Or Refrigerant Flow Obstructed By Gas Leakage From Expansion Valve Heat Sensing Tube.**

CORRECTION

1) Evacuate A/C system.
2) Check heat sensing tube at expansion valve. Replace expansion valve if necessary.
3) Remove expansion valve and attempt removal of dirt. If dirt cannot be removed, replace expansion valve.
4) Replace receiver-drier.
5) Charge system with R-134a.
6) Operate system and check performance.

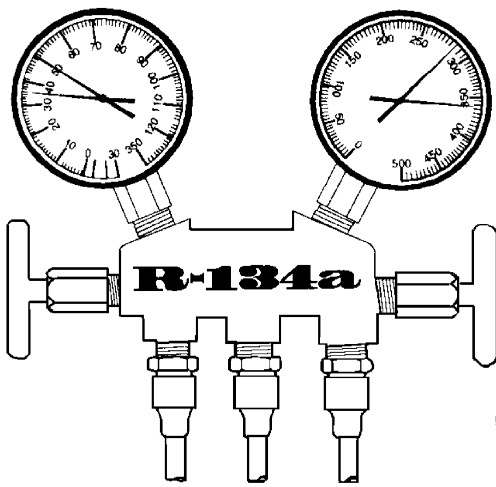
95I17648

Fig. 10: No R-134a Refrigerant Circulation

INSUFFICIENT COOLING OF CONDENSER OR REFRIGERANT OVERCHARGE

LOW SIDE **HIGH**

HIGH SIDE **HIGH**



LOW SIDE - 43 psi (3.0 bar /3.0 kg/cm²)
HIGH SIDE - 320 psi (22.1 bar /22.5 kg/cm²)

GAUGE READINGS	**Low Side Gauge -** High **High Side Gauge -** High
OTHER SYMPTOMS	**Sight Glass** - No bubbles visible even after lowering engine RPM.
DIAGNOSIS	**Refrigerant Overcharge, Condenser Cooling Fins Clogged With Dirt Or Cooling Fans Malfunctioning.**
CORRECTION	**1)** Clean condenser cooling fins. **2)** Check cooling fan operation. **3)** Evacuate A/C system. **4)** Charge system with R-134a. **5)** Operate system and check performance.

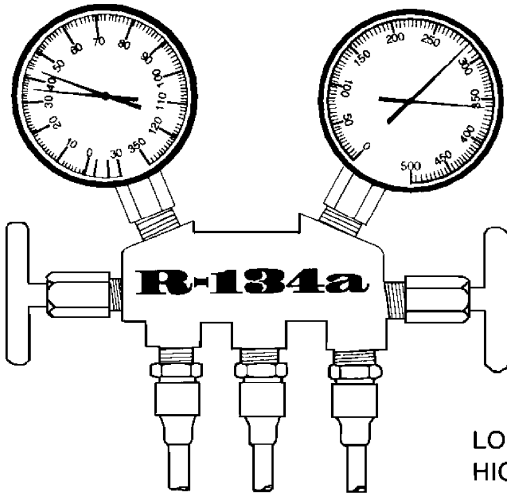
95J17649

Fig. 11: Insufficient Cooling Of Condenser Or R-134a Refrigerant Overcharge

AIR IN SYSTEM

LOW SIDE
HIGH

HIGH SIDE
HIGH



LOW SIDE - 40 psi (2.8 bar /2.8 kg/cm²)
HIGH SIDE - 320 psi (22.1 bar /22.5 kg/cm²)

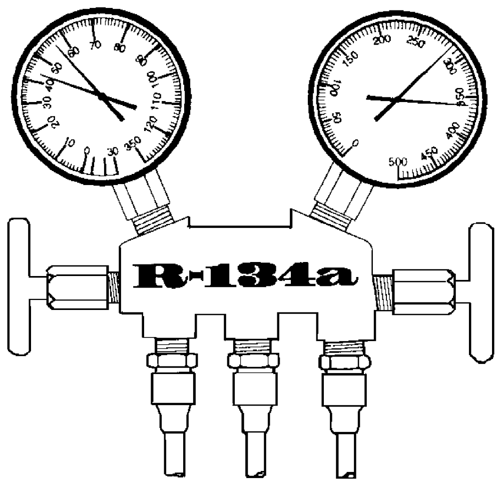
GAUGE READINGS	**Low Side Gauge -** High **High Side Gauge -** High
OTHER SYMPTOMS	**Sight Glass -** Bubbles visible during system operation. **Pipes** - Low pressure pipes are hot to the touch.
DIAGNOSIS	**Air Is Present In System Possibly From Inadequate Evacuation Procedure.**
CORRECTION	**1)** Evacuate A/C system. **2)** Check compressor oil for contamination. Check compressor for proper oil amount. Correct if necessary. **3)** Charge system with R-134a. **4)** Operate system and check performance.

95D17650

Fig. 12: Air In R-134a System

EXPANSION VALVE IMPROPERLY MOUNTED OR HEAT SENSING TUBE DEFECTIVE (OPENING TOO WIDE)

LOW SIDE HIGH | **HIGH SIDE HIGH**



LOW SIDE - 50 psi (3.5 bar /3.5 kg/cm²)
HIGH SIDE - 320 psi (22.1 bar /22.5 kg/cm²)

GAUGE READINGS **Low Side Gauge -** High
High Side Gauge - High

OTHER SYMPTOMS **Pipes -** Large amount of frost or moisture on low side pipes.

DIAGNOSIS **Excessive Refrigerant In Low Side Pipes Possibly From Expansion Valve Being Opened Too Wide.**

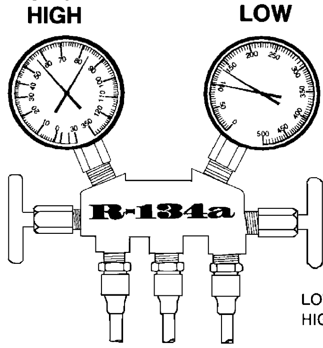
CORRECTION
1) Check heat sensing tube for proper installation.
2) If heat sensing tube is properly positioned, evacuate A/C system.
3) Check expansion valve and replace if defective.
4) Charge system with R-134a.
5) Operate system and check performance.

95E17651

Fig. 13: Expansion Valve Improperly Mounted Or Heat Sensing Tube Defective (Opening Too Wide)

COMPRESSOR MALFUNCTION

LOW SIDE HIGH | **HIGH SIDE LOW**



LOW SIDE - 71 psi (4.9 bar /5.0 kg/cm²)
HIGH SIDE - 121 psi (8.3 bar /8.5 kg/cm²)

GAUGE READINGS **Low Side Gauge -** High
High Side Gauge - Low

DIAGNOSIS **Internal Compressor Leak Or Compressor Mechanically Broken.**

CORRECTION
1) Evacuate A/C system.
2) Repair or replace compressor.
3) Charge system with R-134a.
4) Operate system and check performance.

95F17652

Fig. 14: Compressor Malfunction

ORIFICE TUBE REPLACEMENT

Removal

1) Locate orifice tube. See ORIFICE TUBE LOCATION & REMOVER/INSTALLER APPLICATION table. Discharge A/C system, using approved recovery/recycling equipment. Disconnect liquid line at evaporator inlet.

2) Remove orifice tube, and disconnect liquid line at evaporator and/or condenser. Remove orifice tube using needle-nose pliers or orifice tube remover.

3) If difficulty is encountered during removal of a plugged or restricted orifice tube, remove as much residue as possible. Using a heat gun, carefully heat inlet pipe. If inlet pipe has small dimples, apply heat1/4" from dimples. Be careful not to overheat pipe.

NOTE: If system has a pressure switch near orifice tube location, remove switch before heating inlet pipe to avoid damaging switch.

4) While heat is being applied, install orifice tube extractor. Use a turning motion along with a push or pull motion to loosen and remove orifice tube.

NOTE: On some models, it may be necessary to use Dual "O" Ring Joint Separator (J-38042) to hold refrigerant line nut while loosening or tightening fitting.

Installation

1) To install orifice tube, coat inside of inlet pipe with refrigerant oil. Lubricate new orifice tube and "O" ring with refrigerant oil and insert them into inlet pipe.

2) Install orifice tube with shorter screen end first (toward evaporator). To complete installation, reverse removal procedure. Evacuate, charge and test system for proper operation.

ORIFICE TUBE LOCATION & REMOVER/INSTALLER APPLICATION

Application	Orifice Tube Location	Orifice Tube Remover/Installer
"C" & "K" Series	Condenser	J-26549-E
"G" & "P" Series	Evaporator	J-26549-D
"L" & "M" Series	Evaporator	J-26549-E
"S" & "T" Series	Evaporator	J-26549-D
"U" Series	(1)	J-26549-E

(1) - In condenser-to-evaporator core refrigerant lines, near support clamp or high-side service valve.

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, ALWAYS follow instructions provided with the refrigerant recovery/recycling equipment being used.

The removed refrigerant is filtered, dried and stored in a tank within the recovery/recycling equipment until it is ready to be pumped back into the vehicle's A/C system.

CAUTION: Separate sets of hoses, gauges and refrigerant recovery/recycling equipment MUST be used for R-12 and

R-134a systems. DO NOT mix R-12 and R-134a refrigerants, as their refrigerant oils and desiccants are NOT compatible.

1) Ensure A/C Refrigerant Recovery, Recycling And Recharging (ACR4) System (J-39500) is not plugged into wall socket. Close both valves on manifold gauge set. Connect manifold gauge set to high-side (Red hose) and low-side (Blue hose) to A/C system fitting using quick disconnect couplers. See SERVICE VALVE LOCATIONS under SYSTEM SERVICE VALVES. Open coupler valves and check high-side and low-side gauges. If there is no pressure in the system, the system is empty.

NOTE: If A/C system is empty, do not continue recovery operation. Air will be drawn into recovery tank and contaminate recovered refrigerant.

2) Open both high-side and low-side valves on control panel of ACR4 system. Open both Red and Blue valves on recovery tank. Slowly open oil drain valve and allow any oil in oil separator to drain into catch bottle. Empty catch bottle.

3) Plug ACR4 into wall socket and turn MAIN POWER switch to ON position. Start engine. Turn A/C on for about 2 minutes to stabilize system. Turn ignition off. Connect a battery charger to vehicle battery. Turn ignition to RUN position. Turn blower motor to HIGH, which will increase refrigerant recovery rate.

4) Press RECOVER button on ACR4 keypad to begin refrigerant recovery. Before recovery begins ACR4 will clear itself of refrigerant. CL-L will be displayed and after 30-180 seconds, recovery will begin. Keep blower motor in HIGH until automatic recovery process is complete.

5) When ACR4 clearing is complete, recovery will begin. RECOVER mode of AUTOMATIC cycle will be indicated along with weight of refrigerant recovered. ACR4 compressor will shut off when initial recovery has occurred, at approximately 17 in. Hg. vacuum. When initial recovery process is completed, CPL and then OIL/OZ (OIL/GMS) will be alternately displayed.

NOTE: OIL/OZ (OIL/GMS) will be displayed as a reminder to check oil separator catch bottle for oil removed from system. It is important to replace any oil removed with the same amount of NEW oil.

6) Wait 5 minutes. Check ACR4 control panel low side gauge. If A/C system has maintained a vacuum, recovery is complete. If low side gauge pressure is greater than zero, system contains more refrigerant. If low side pressure is greater than zero, press HOLD/CONT button on control panel to recover additional refrigerant. Repeat this procedure until system maintains vacuum for at least 2 minutes.

NOTE: If FULL is displayed during recovery process, and ACR4 shuts off, the tank is full. Replace tank with an empty one or lower amount of refrigerant in tank by charging another vehicle.

FLUSHING A/C SYSTEM

NOTE: A/C system flushing or filtering should be performed to remove contaminates resulting from a compressor failure.

1) Manufacturer does not recommend flushing A/C system. If system is contaminated, discharge system and install a liquid line filter between condenser and evaporator.

2) Filter may be an integral part of the line, or line may need to be cut and filter installed (non-integral type). Filters may or may not contain orifice. See Fig. 15.

3) Filter with orifice is installed on low pressure side of orifice tube. Remove original orifice tube if installing filter with orifice. Filter without orifice must be installed on high pressure side of orifice tube.

4) To install liquid line filter, discharge A/C system using approved recovery/recycling equipment. Remove liquid line. Using a tubing cutter, cut section from liquid line to allow installation of liquid line filter. Clean all burrs, and smooth surfaces.

5) Install nut over line. Install ferrule on line with small end toward nut. DO NOT install "O" ring at this time.

6) Push line into fitting until it bottoms on filter assembly. Tighten nuts on each joint to 11 ft. lbs. (15 N.m). Disassemble joint assembly.

7) Lubricate new "O" rings with refrigerant oil and install them on lines. Install filter assembly. Ensure arrow on filter indicates proper flow of refrigerant. Tighten nuts to 11 ft. lbs. (15 N.m). Evacuate and charge system. Check system for leaks.

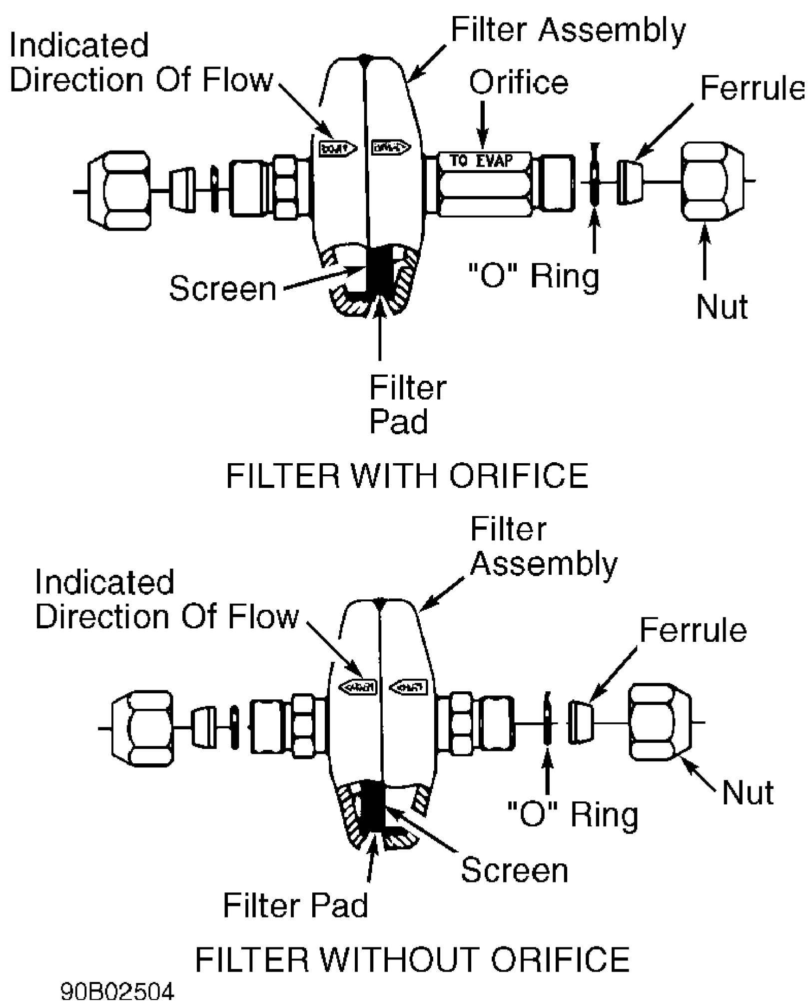


Fig. 15: Exploded View Of Liquid Line Filter & Components
Courtesy of General Motors Corp.

EVACUATING A/C SYSTEM

1) To ensure ACR4 tank contains sufficient refrigerant to charge system, press RESET and ENTER buttons at the same time to enter diagnostic mode. When in diagnostic mode, press "7" button. If less than 8 lbs. (3.6 kg) is displayed add new refrigerant to tank.

2) Connect high-side and low-side hoses to vehicle A/C system and open both high-side (Red) and low-side (Blue) valves on ACR4 control panel. Open both Red and Blue valves on tank.

3) ARC4 will begin an automatic programmed evacuation time. If a longer evacuation time is desired, enter longer time and press ENTER button. Display will begin to blink, indicating data input. Press VACUUM button to activate vacuum pump. Time display will count down from 15 minutes to zero, indicating operating time remaining. RECYCLE will display 5 seconds after pump activates and will continue until process is complete.

NOTE: A pressure release sound may be heard as non-condensable gases, such as air, are automatically vented from tank during recycling process. MOISTURE INDICATOR must be Green during recycling process, verifying refrigerant moisture content is within specification. Yellow indicates a wet condition, requiring ACR4 filter/drier cartridge replacement.

4) After vacuum pump has been running for about 3 minutes (12 minutes run time remaining), press HOLD/CONT button to stop vacuum pump. If vacuum pressure is zero, there is a system leak. Repair leak and begin evacuation procedure again. If vacuum pressure is 27-30 in. Hg., close low-side and high-side valves and watch vacuum pressure for a possible leak. If vacuum is not maintained, find and replace A/C system leak.

5) If vacuum pressure is maintained at 27-30 in. Hg., open high-side and low-side valve and press HOLD/CONT button to restart vacuum pump. When vacuum sequence is completed, CPL will be displayed indicating evacuation is complete.

NOTE: Every 10 hours of operation vacuum pump oil must be changed. If OIL warning light flashes during operation, press CONT button and change oil before next operation.

CHARGING A/C SYSTEM

NOTE: Ensure LB/KG switch on the back of the ACR4 unit is set for desired refrigerant measurement unit (pounds or kilograms). Operate switch with main power off.

1) Ensure engine is off. With ACR4 connected (from evacuation procedure), close low-side valve on ACR4 control panel. Open high-side valve on ACR4 control panel. Press CHG button and enter amount of refrigerant charge specified. When entering amount of refrigerant, ensure correct unit of weight is used. See REFRIGERANT OIL & REFRIGERANT CAPACITY SPECIFICATIONS for system capacities.

2) After entering specified amount of refrigerant, press ENTER button. Display will blink indicating charge amount is in ACR4 memory. Press CHG button to begin charging process. ACR4 will display AUTOMATIC and show amount of refrigerant programmed for charging. Display will count down to zero until CPL is displayed indicating process is completed. If charging process is successful, go to next step. If charging process stops before system charge is complete, go to step 5).

3) Close ACR4 high-side valve on control panel (both valves should be closed). Start engine, turn A/C system on and run until

high-side and low-side gauges stabilize. Ensure high-side and low-side pressures are within specification. Ensure evaporator outlet temperatures are within specifications.

4) With A/C running, close high-side coupler valve and disconnect high-side hose from vehicle. Open both high-side and low-side valves on ACR4 control panel. Refrigerant from both hoses will be drawn into A/C system through low-side hose. Close low-side coupler valve and disconnect from vehicle. Ensure proper A/C system operation.

5) Charging process will stop before system charge is complete. If refrigerant tank pressure and A/C system pressure are about the same, ACR4 will emit an audible signal and display amount of refrigerant remaining to be transferred. If this occurs, go to next step. If charging process will not complete and CHECK REFRIGERANT is displayed, there is not enough refrigerant to complete process. If this occurs, go to step 7).

6) Close high-side valve and open low-side valve. With engine running, start A/C system and press HOLD/CONT button. Reminder of refrigerant should go into A/C system. When charging process is complete, go to step 3).

7) Press HOLD/CONT button to interrupt cycle. Press RESET button to reset ACR4. Recover refrigerant that has been charged into system. Fill refrigerant tank, evacuate and charge A/C system. See EVACUATING A/C SYSTEM and CHARGING A/C SYSTEM. Perform leak test procedure. See LEAK TESTING.

LEAK TESTING

TYPES OF LEAK DETECTORS

Bubble Solution Detector

This is a solution applied externally at suspected leak points. Leaking refrigerant will cause the detector to form bubbles and foam. A soap and water solution also works well.

Dye Solution

This is a colored solution that may be introduced into the A/C system. The dye will show up and color components at leak points. Some manufacturers offer refrigerant containing a Red dye. This dye-containing refrigerant is installed by normal charging procedures. Other dye solutions are visible with a Black light only.

Electronic Detector

This instrument will draw in any leaking refrigerant through a test probe, and then sound an alarm or create a flashing light if refrigerant is found. It is the most sensitive of the leak detectors used. See Fig. 16.

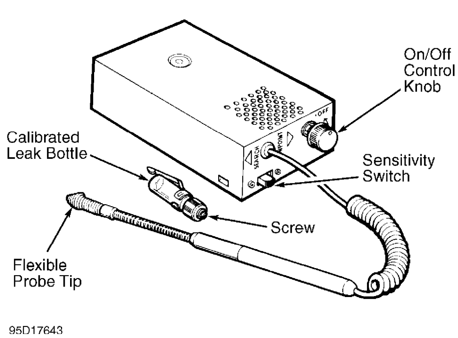


Fig. 16: Electronic Leak Detector

PREPARATION FOR LEAK TESTING

Connect manifold gauge set to air conditioning system. Ensure low-side and high-side gauge set valves are closed. Check system pressure. It should be at least 50 psi (3.5 kg/cm^2). If low, add just enough refrigerant to bring system to 50 psi (3.5 kg/cm^2).

Ensure all joints, connections, and fittings are free of oil dirt and other contaminants. Using a refrigerant leak detector, check all refrigerant line connections for leaks. Check condenser and compressor seal area.

Refrigerants are heavier than air. Always check for leaks at bottom of refrigerant lines and components. Refrigerant oil will leak with refrigerant. Visually check all connections and compressor clutch area for oil stains. If compressor shaft seal is leaking, a fresh oil streak will normally be seen on underside of hood, above compressor clutch.

Always perform leak testing after A/C service. Move refrigerant leak detector slowly to check for leaks, as leaks will not be detected if leak testing is performed too quickly.

BUBBLE DETECTOR LEAK TESTING PROCEDURE

This leak detection method is recommended when it is impossible or difficult to determine the exact location of the leak using other methods. Although commercial bubble detectors are more effective, household soap solutions may be used.

Using the dauber that comes with the commercial soap solution, apply the solution to all joints, connections, fittings or controls where a leak might be suspected. If high-suds household solutions are used, apply them with a small brush. Wherever bubbles form, leaks are present and must be repaired. check the entire system as there may be more than one leak.

ELECTRONIC LEAK TESTING PROCEDURE

NOTE: Some electronic leak detectors will function on only R-12 systems or on only R-134a systems, and some will function on both R-12 and R-134a systems. Familiarize yourself with the tester being used and know what type of system you are leak testing.

Electronic leak detectors should be used in well ventilated areas. Avoid using them around explosive gases. Always follow manufacturer’s instructions for the specific tester being used. If none are available, proceed as follows:

1) Turn all controls and the sensitivity knob to the OFF position or zero setting. Plug the leak detector into an approved source of voltage if not battery operated. Turn the switch ON, and allow the unit to warm up for approximately 5 minutes.

2) Check operation of tester by positioning the probe in a reference source where refrigerant is known to be present in small amounts. Adjust controls and sensitivity knob until detector reacts properly. Move probe away from refrigerant source and the reaction should stop. If it continues, adjust the sensitivity knob to a lower setting.

3) When tester reacts properly, leak test air conditioning system by moving probe under all components, fittings and connections. Keep the probe moving. DO NOT hold it in constant contact with refrigerant. When leaks are found, repair them as necessary. Keep in mind that there may be more than one leak.

DYE SOLUTION LEAK TESTING PROCEDURES

CAUTION: Dye-charged refrigerant cans are available to be used as internal leak detectors. The use of this type of solution may void some manufacturer's warranties. Be sure to check with the A/C system manufacturer concerning the use of dye-charged leak detectors. Dyes which work in R-12 systems will not work in R-134a systems.

The following procedure is for introducing a dye solution, not dye-charged refrigerant, into the air conditioning system.

1) Connect manifold gauge set to air conditioning system in a normal manner. Remove center hose from manifold gauge set, and replace it with a short piece (6" long) of 1/4" tubing using two 1/4" flare nuts. Connect a container of dye solution to the tubing.

2) Connect one end of the gauge set's center hose to the dye solution. Connect a container of refrigerant to the other end of the hose. Operate the engine at idle speed. Set the air conditioning system for maximum cooling. Slowly open the low-side hand valve to allow the dye solution to enter the system.

3) Charge the system to at least 50% capacity. Operate the system for 15 minutes, and then shut off both the air conditioning system and the engine. Check all connections for signs of the colored dye solution. Check the vehicle again 24 hours later. If leaks are found, repair as necessary.

A/C SYSTEM SPECIFICATIONS

1997 Chevrolet Blazer

1997 A/C-HEATER SYSTEMS
General Motors Corp. - A/C System Specifications

Chevrolet; Blazer, S10 Pickup
GMC; Jimmy, Sonoma
Oldsmobile; Bravada

A/C SYSTEM SPECIFICATIONS

A/C SYSTEM SPECIFICATIONS TABLE

Application	Specification
Compressor Type	
2.2L	Harrison V5 5-Cyl.
4.3L	Harrison HT6 6-Cyl.
Compressor Belt Tension	(1)
System Oil Capacity (2)	
2.2L	9 ozs.
4.3L	8 ozs.
Refrigerant (R-134a) Capacity	32 ozs.
System Operating Pressures (3)	
High Side	299 psi (21 kg/cm²)
Low Side	26 psi (1.8 kg/cm²)

(1) - Tighten serpentine belt until indicator mark on movable portion of belt tensioner is within limits of slotted area on stationary portion of belt tensioner.
(2) - Use PAG Oil.
(3) - Specification is with ambient temp at 80°F (27°C), relative humidity at 60 percent and engine speed at 1500 RPM.

1997 ENGINE PERFORMANCE
General Motors - On-Vehicle Adjustments - 4.3L

Chevrolet; Blazer, S10 Pickup
GMC; Jimmy, Sonoma
Oldsmobile; Bravada

ENGINE MECHANICAL

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

VALVE CLEARANCE

NOTE: All models are equipped with hydraulic lifters. Adjustments are not required.

IGNITION TIMING

NOTE: Ignition timing is controlled by control module and is not adjustable.

IDLE SPEED & MIXTURE

NOTE: DO NOT attempt to adjust idle mixture and idle speed. Both are controlled by Powertrain Control Module (PCM). Incorrect idle speeds are normally caused by dirty throttle plate or vacuum leaks. Ensure all vacuum components are functioning properly.

NOTE: Controlled idle speed and IAC count can be checked using scan tool. See CONTROLLED IDLE SPEED & IAC COUNT table.

Controlled Idle Speed Check

1) Ensure no trouble code(s) are present, IAC system is okay, and ignition timing is correct. Block drive wheels. Apply parking brake. Connect Tech 1 scan tool to Data Link Connector (DLC). Put scan tool into OPEN mode.

2) Start engine and bring to normal operating temperature. Check for correct state of transmission range switch on scan tool. Check if idle speed and IAC valve pintle position (counts) are as specified. See CONTROLLED IDLE SPEED & IAC COUNT table.

3) If idle speed is not within specification, refer to the H - TESTS W/O CODES - 4.3L article.

CONTROLLED IDLE SPEED & IAC COUNT TABLE

Application	Idle RPM	(1) IAC Counts
Under 8500 GVW		
Auto. Trans. (2)	565-615	50-30
Man. Trans. (3)	525-575	50-30
Over 8500 GVW		
Auto. Trans. (2)	625-675	50-30
Man. Trans. (3)	675-725	50-30

(1) - Add 2 counts for engines with less than 500 miles.

Add 2 counts for every 1000 ft. above sea level.
(2) - Automatic transmission in Drive.
(3) - Manual transmission in Neutral. Tech 1 scan tool will display "RDL" with transmission in Neutral.

THROTTLE POSITION (TP) SENSOR

TP sensor output voltage should be .85 volt or less at idle (closed throttle) and is not adjustable.

AIR BAG RESTRAINT SYSTEM

1997 Chevrolet Blazer

1997 ACCESSORIES/SAFETY EQUIPMENT
General Motors - Air Bag Restraint System

Chevrolet; S10 Pickup, Blazer
GMC; Jimmy, Sonoma
Oldsmobile; Bravada

* PLEASE READ THIS FIRST *

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

DESCRIPTION & OPERATION

SUPPLEMENTAL INFLATABLE RESTRAINT (SIR) SYSTEM

The Supplemental Inflatable Restraint (SIR) system is designed to protect the driver in a frontal collision. The air bag will deploy only upon frontal or near frontal impact of no more than 30 degrees off the center line of vehicle. System is not designed to deploy in rear impacts, side impacts, or rollovers. A frontal impact of sufficient severity (comparable to a collision into a solid wall at approximately 14 MPH or more) will cause sensors in vehicle to detect this sudden deceleration. These sensors, in turn, trigger the air bag module.

DIAGNOSTIC ENERGY RESERVE MODULE (DERM)

DERM performs diagnostic monitoring of all system components, stores both current and past SIR system fault code information, warns driver of SIR system faults by controlling AIR BAG warning light, and records SIR system status during a vehicle accident. In addition, DERM maintains a 36-Volt Loop Reserve (36VLR) energy supply to provide sufficient deployment energy for about 2 minutes if vehicle system voltage is low or is lost in an accident.

A 24-pin connector connects DERM to SIR harness. Harness connector uses terminals and shorting bar in terminal contact area. DERM connector also has a shorting bar that connects AIR BAG warning input to ground when the DERM connector is disconnected. With DERM disconnected, AIR BAG warning light remains on when ignition switch is in RUN, BULB TEST, or START positions. DERM is located under or behind instrument panel.

AIR BAG WARNING LIGHT

When ignition switch is in RUN, BULB TEST, or START positions, battery voltage is applied to AIR BAG warning light. DERM illuminates this light by providing a ground to a lamp driver. DERM transmits a request to turn on AIR BAG warning light via the serial data line. When ignition is first turned on, AIR BAG warning light verifies light and DERM operation by flashing 7 times. Light is also used to warn driver of SIR electrical system faults which could potentially affect SIR system operation. AIR BAG warning light is the key to driver notification of SIR system faults.

In addition, the light provides diagnostic information by flashing Diagnostic Trouble Codes (DTCs) when the flash code diagnostic mode is entered on models without on-board diagnosis. AIR BAG warning light notifies driver of SIR system faults.

ARMING SENSOR

Arming sensor is a protective switch located in power feed side (positive side) of deployment loop. It is calibrated to close at low-level velocity changes (lower than discriminating sensors). This assures that the air bag module is connected directly to 36VLR output of DERM or ignition voltage when either of the discriminating sensors close.

Arming sensor consists of a sensing element, normally open switch contacts, a diagnostic resistor, and 2 diodes. Sensing element closes switch contacts when velocity of vehicle changes at a rate indicating potential need for deployment. A diagnostic resistor is connected in parallel with normally open switch contacts and allows for a small amount of current flow through deployment loop during normal undeployed conditions. This small current flow results in voltage drops across each component within loop.

DERM monitors these voltage drops to detect circuit or component faults. The 2 diodes provide isolation between 36VLR output of DERM and ignition voltage.

DISCRIMINATING SENSORS

SIR systems have 2 discriminating sensors: the left forward discriminating sensor and the right forward discriminating sensor. Discriminating sensors are wired in parallel on the ground side of deployment loop. These sensors are calibrated to close when deceleration velocity changes are severe enough to warrant deployment.

Sensors consist of a sensing element, normally open switch contacts, and a diagnostic resistor. Sensing element closes the normally open switch contacts when vehicle velocity changes are severe enough to warrant deployment.

A diagnostic resistor is connected in parallel with the normally open switch contacts within each of the sensors. These parallel resistors supply the ground path for current passing through the deployment loop during normal undeployed conditions. This small current flow results in a voltage drop across each component within loop. DERM monitors these voltage drops to detect circuit or component faults.

SIR COIL ASSEMBLY

SIR coil assembly consists of 2 current-carrying coils. It is installed in steering column and allows rotation of steering wheel while maintaining continuous (directly wired) contact of deployment loop through steering wheel air bag module. Slip rings are not used in SIR system to transmit current from column to steering wheel.

Terminals and a shorting bar are used on coil assembly lower steering column Yellow 2-way connector. Shorting bar shorts the circuits to main coil and steering wheel air bag module when lower steering column connector is disconnected. This shorts the circuit to the air bag module, preventing unwanted deployment of the air bags when servicing the steering column or other SIR components.

AIR BAG MODULE

When the vehicle is in an accident of sufficient force to simultaneously close the arming sensor and at least one discriminating sensor, nitrogen gas inflates the cloth bag packed inside the steering wheel hub. As air bag is contacted by driver or passenger, the gas is vented through openings in the bag, which deflates almost as soon as it is completely deployed.

There is a shorting bar on the air bag module side of the upper steering column connector which connects the SIR coil to the air bag module. The shorting bar shorts the air bag module circuit when the upper steering column connector is disconnected. The circuit to the air bag module is shorted in this way to help prevent unwanted deployment of the air bag when servicing the air bag module or steering column.

SYSTEM OPERATION CHECK

If system is functioning normally, air bag warning light flashes 7 times when ignition switch is turned to ON position and goes out.

Four possible warning light conditions can indicate a system failure:

* Light does not illuminate at all.
* Light comes on while vehicle is driven.
* Light flashes 7 times, and remains on.
* Light does not flash but remains lit when ignition is turned on.

SIR system faults are usually due to a disconnected/loose electrical connector caused by previous service on vehicle. Always check Yellow SIR connector at base of steering column for loose or damaged wiring.

SERVICE PRECAUTIONS

* PLEASE READ THIS FIRST *

The following precautions should be observed when working with SIR system:

* The DERM maintains sufficient voltage to cause air bag deployment for up to 2 minutes after ignition is turned OFF, battery is disconnected, or fuse powering DERM is removed. In order to begin servicing immediately, air bag modules must be removed from the deployment loop. See DISABLING SYSTEM.
* After repairs, ensure AIR BAG warning light is working properly and no system faults are indicated. See SYSTEM OPERATION CHECK.
* Always wear safety glasses when servicing or handling an air bag module.
* Air bag module must be stored in its original special container until used for service. It must be stored in a clean, dry place, away from sources of extreme heat, sparks, or high electrical energy.
* Air bag modules or DERMs should not be subjected to temperatures above 150°F (65°C).
* Air bag modules or DERMs should not be used if they have been dropped from a height of 3 ft (0.9 m) or greater.
* When placing a live air bag module on a bench or other surface, always make certain that the trim cover (finished side) is up and away from surface. This will reduce motion of module if accidentally deployed.
* After deployment, air bag surface may contain deposits of sodium hydroxide, which can irritate skin. Always wear safety glasses, rubber gloves and long-sleeved shirt during clean-up, and wash hands using mild soap and water. Follow

correct disposal procedures. See DISPOSAL PROCEDURES.

* At no time should any electrical source be allowed near inflator on back of air bag module.
* DO NOT apply power to SIR system unless all components are connected or a diagnostic chart requests it, as this will set a diagnostic trouble code.
* When carrying a live air bag module, trim cover should be pointed away from your body to minimize injury in case of accidental deployment.
* DO NOT attempt to service DERM, front end discriminating sensor, SIR coil assembly, or air bag modules. If defective, these parts must be replaced.
* DO NOT probe a wire through insulator; this will damage it and eventually cause failure due to corrosion.
* When performing electrical tests, prevent accidental shorting of terminals. Such mistakes can damage fuses or components and may cause a second fault code to set, making diagnosis of original problem more difficult.
* When using diagnostic charts to diagnose SIR system, under no circumstances should a volt/ohmmeter, test light or any type of electrical equipment not specified by manufacturer be used. See SPECIAL TOOLS.
* If SIR system is not fully functional for any reason, vehicle should not be driven until system is repaired. DO NOT remove bulbs, modules, sensors or other components or in any way disable system from operating normally. If SIR system is not functional, park vehicle until repairs can be made.

SPECIAL TOOLS

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

SIR RECOMMENDED TOOLS TABLE

Tool Name	Tool Number
Connector Test Adapter Kit	J-35616
Digital Volt/Ohmmeter	J-39200
Air Bag Module & Steering Column Replacement Load	J-38715-A
Wire Repair Kit	J-38125-A
Scan Tool	Tech 2

DISABLING & ACTIVATING SIR SYSTEM

* PLEASE READ THIS FIRST *

WARNING: Wait about 2 minutes after disabling air bag system. The SDM maintains system voltage for about 2 minutes after battery is disconnected. Servicing air bag system before 2 minutes may cause accidental air bag deployment, possibly causing personal injury.

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. Record customer radio stations, as memory will be lost. Code equipped radios may also lock. Obtain code from customer. See COMPUTER RELEARN PROCEDURES in GENERAL INFORMATION before disconnecting battery.

DISABLING SYSTEM

1) Turn steering wheel to place vehicle wheels in straight-ahead position. Turn ignition switch to LOCK position.

2) Remove AIR BAG fuse. Remove I/P sound insulator. Remove Connector Position Assurance (CPA) clip and disconnect Yellow 2-way SIR connector at base of steering column.

3) Wait 2 minutes before beginning service. All connectors in SIR system use CPA clips to ensure connector retention. Even if system is disconnected, use caution when working near air bags.

ACTIVATING SYSTEM

Connect Yellow 2-way SIR connector at base of steering column. Install CPA clips, fuse and light I/P sound insulator. Turn ignition switch to RUN position and ensure AIR BAG warning light flashes 7 times and then goes out.

DISPOSAL PROCEDURES

* PLEASE READ THIS FIRST *

WARNING: Undeployed air bag module contains substances that can cause illness or injury if handled improperly. Disposing of an air bag module without first deploying it may violate federal, state and/or local laws. This also applies to vehicles being scrapped. After deployment, air bag module can be disposed of as would any other part. Wear safety glasses and gloves when handling an air bag module.

AIR BAG DEPLOYMENT

NOTE: If vehicle is to be scrapped, perform on-vehicle air bag deployment procedure.

WARNING: During deployment, air bag module can become hot enough to burn you. Wait 30 minutes after deployment before touching the assembly.

On-Vehicle

1) Before proceeding, read service precautions. See SERVICE PRECAUTIONS. Ensure air bag assemblies are securely mounted to steering wheel. Turn ignition to LOCK position, remove key and put on safety glasses. Remove all loose objects from front seats. Disconnect air bag module Yellow 2-way connector located at base of steering column.

2) Cut air bag module Yellow 2-way harness connector from instrument panel harness. Leave at least 6 inches (16 cm) of wire at connector. Strip .5 inch (13 mm) of insulation from each wire lead of connector. Cut 2 15 foot (4.6 meters) deployment wires from 18 gauge (.8 mm) or thicker multi strand wire. These wires will be used to fabricate deployment harness. Strip .5 inch (13 mm) of insulation from both ends of the wires.

3) Twist together one connector wire lead to one deployment wire. The connection should be mechanically secure. Bend twisted connection flat and wrap tightly with electrical tape to insulate and secure. Twist together, bend and tape remaining connector wire to the remaining deployment wire. Connect deployment harness to air bag

module, Yellow 2-way connector at base of steering column. Route deployment harness out of driver-side of vehicle.

WARNING: Never connect deployment wires to any power source before connecting to air bag module leads. The air bag will immediately deploy when a power source is connected to it.

4) Verify that inside of vehicle and area surrounding vehicle area are clear of all people and loose or flammable objects.

5) Stretch driver and passenger deployment harness to full length. Completely cover windshield area and front door window openings with a drop cloth to reduce possibility of injury due to fragmentation of glass or other objects.

6) Notify all people in the area that you are going to deploy the air bags and that the deployment will be accompanied by a substantial noise.

7) Separate the two ends of the deployment harness wires. Connect driver-side deployment wires to a 12 volt minimum, 2 amps minimum power source. A vehicle battery is suggested. The driver-side air bag will immediately deploy.

WARNING: Observe safety precautions when handling a deployed air bag module. After deployment, metal surfaces of assembly will be very hot. Allow air bag module to cool before handling any metal portion of it. Do not place hot deployed assembly near any flammable objects.

8) Short deployment harness wires by twisting together one end from each. Carefully remove drop cloth from vehicle and clean off any fragments or discard drop cloth entirely.

9) In the unlikely event that either or both of the air bag assemblies did not deploy after following these procedures, remove undeployed air bag module from vehicle. See AIR BAG MODULE under REMOVAL & INSTALLATION. Temporarily store air bag module with air bag opening facing up, away from surface upon which it rest.

NOTE: Before proceeding, read service precautions. See SERVICE PRECAUTIONS. The following procedure requires the use of the SRS Deployment Harness (J 38826) with the appropriate pigtail adapter. Do not attempt procedure without the SRS Deployment Harness (J 38826) and adapter.

WARNING: Never connect deployment wires to any power source before connecting to air bag module leads. The air bag will immediately deploy when a power source is connected to it.

Off-Vehicle

1) Turn ignition to "LOCK", remove key and put on safety glasses. Using SRS Deployment Harness (J 38826), short the two SRS deployment leads by fully seating one banana plug into the other. Connect appropriate pigtail adapter to SRS deployment harness. Remove air bag module from vehicle. See AIR BAG MODULE under REMOVAL & INSTALLATION.

2) Place air bag module on work bench away from all loose or flammable objects with trim cover facing up. Clear a space on ground about 6 feet (183 cm) around area where air bag will be deployed. Place driver-side air bag module, with trim cover facing up, on ground in center of 6 foot area just cleared.

3) Stretch SRS Deployment Harness and pigtail adapter to its full length and place a power source near the shorted end of the SRS deployment harness. A vehicle battery is suggested. Connect air bag module to pigtail adapter. Deployment harness should remain shorted

and not be connected to power source until air bag is to be deployed. The air bag module will deploy immediately when a power source is connected.

NOTE: Ensure pigtail adapter is firmly seated into driver-side air bag module connector. Failure to fully seat connectors may leave shorting bar functioning (shorted) and result in non-deployment of driver air bag module.

NOTE: Notify all people in immediate area that you are about to deploy the driver-side air bag. The deployment will make a substantial noise.

WARNING: Never connect deployment wires to any power source before connecting to air bag module leads. The air bag will immediately deploy when a power source is connected to it.

4) Separate the two banana plugs on the SRS deployment harness. Connect SRS deployment harness wires to power source to immediately deploy drive-side air bag. Disconnect SRS deployment harness from power source and short together the two deployment harness leads by fully seating one banana plug into the other.

WARNING: During deployment, air bag module can become hot enough to burn you. Wait 30 minutes after deployment before touching the assembly.

NOTE: Disconnect pigtail adapter from air bag module as soon after deployment as possible. This will prevent damage to adapter or harness due to possible contact with hot air bag assembly canister. Be sure to inspect harness and pigtail for damage before reuse.

POST-COLLISION INSPECTION

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

REMOVAL & INSTALLATION

* PLEASE READ THIS FIRST *

WARNING: Failure to follow air bag service precautions may result in air bag deployment and personal injury. Refer to SERVICE PRECAUTIONS. After component replacement, perform a system operational check to ensure proper system operation. See SYSTEM OPERATION CHECK.

DERM

Removal

1) Before proceeding, follow air bag service precautions. See SERVICE PRECAUTIONS. Disable the air bag restraint system. Refer to DISABLING & ACTIVATING SIR SYSTEM.

2) Remove right sound insulator, sill plate, and cowl side trim plate. Remove CPA clip and disconnect DERM electrical connector from DERM. Remove DERM after electrical connections have been disconnected. See Fig. 1.

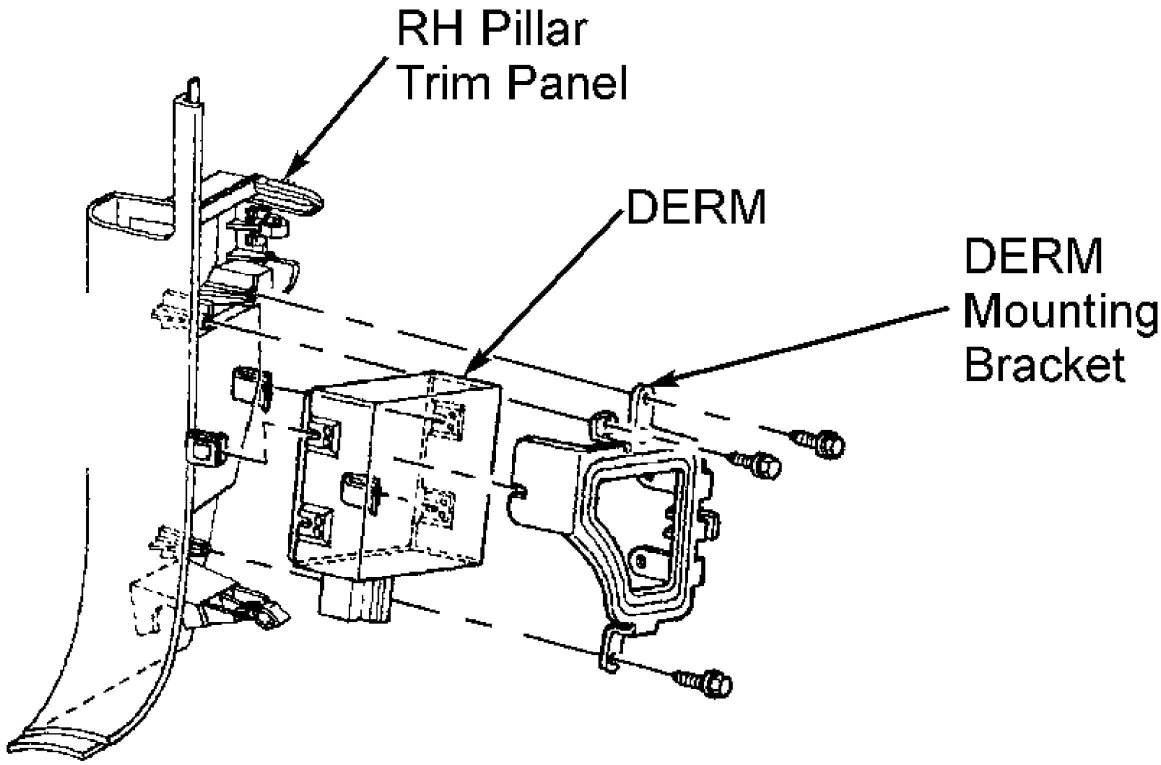


Fig. 1: Removing DERM
Courtesy of General Motors Corp.

Installation

To install, reverse removal procedure. See Fig. 1. Reactivate air bag system. See DISABLING & ACTIVATING SIR SYSTEM. Check AIR BAG warning light to ensure system is functioning properly. See SYSTEM OPERATION CHECK.

ARMING SENSOR

Removal

1) Before proceeding, follow air bag service precautions. Refer to SERVICE PRECAUTIONS. Disable the air bag restraint system. See DISABLING & ACTIVATING SIR SYSTEM.

2) Remove sensor connector from retainer. Remove CPA clip. Disconnect sensor connector. Remove fasteners and sensor. See Fig. 2.

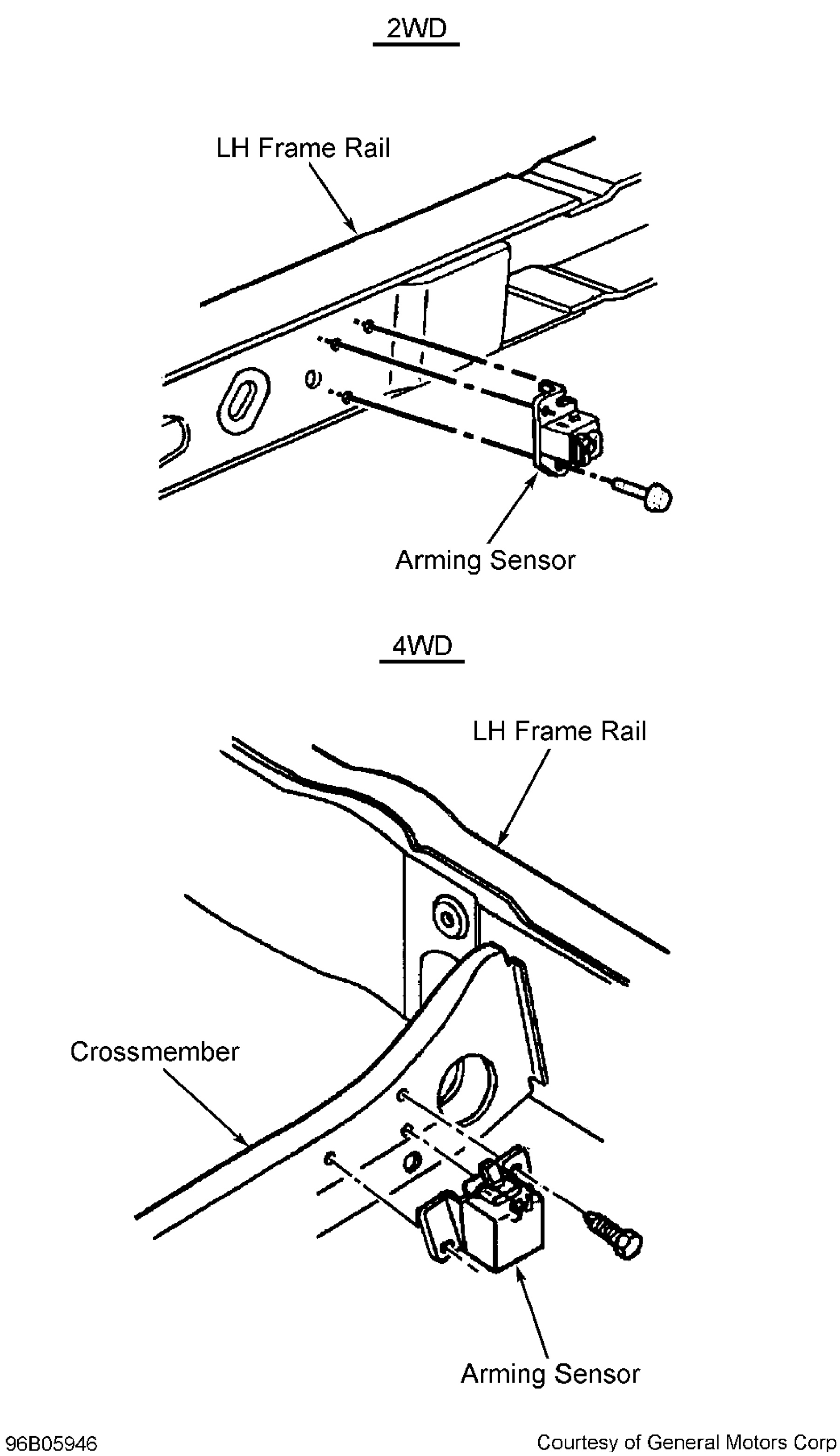


Fig. 2: Removing Arming Sensor
Courtesy of General Motors Corp.

Installation

To install, reverse removal procedure. See Fig. 2. Reactivate air bag system. See DISABLING & ACTIVATING SIR SYSTEM. Check AIR BAG warning light to ensure system is functioning properly. See SYSTEM OPERATION CHECK.

FORWARD DISCRIMINATING SENSORS

Removal

1) Before proceeding, follow air bag service precautions. Refer to SERVICE PRECAUTIONS. Disable the air bag restraint system. See DISABLING & ACTIVATING SIR SYSTEM.

2) Drill out mounting bolts. Remove CPA clip from connector and disconnect sensor electrical connector. Remove sensor. See Fig. 3.

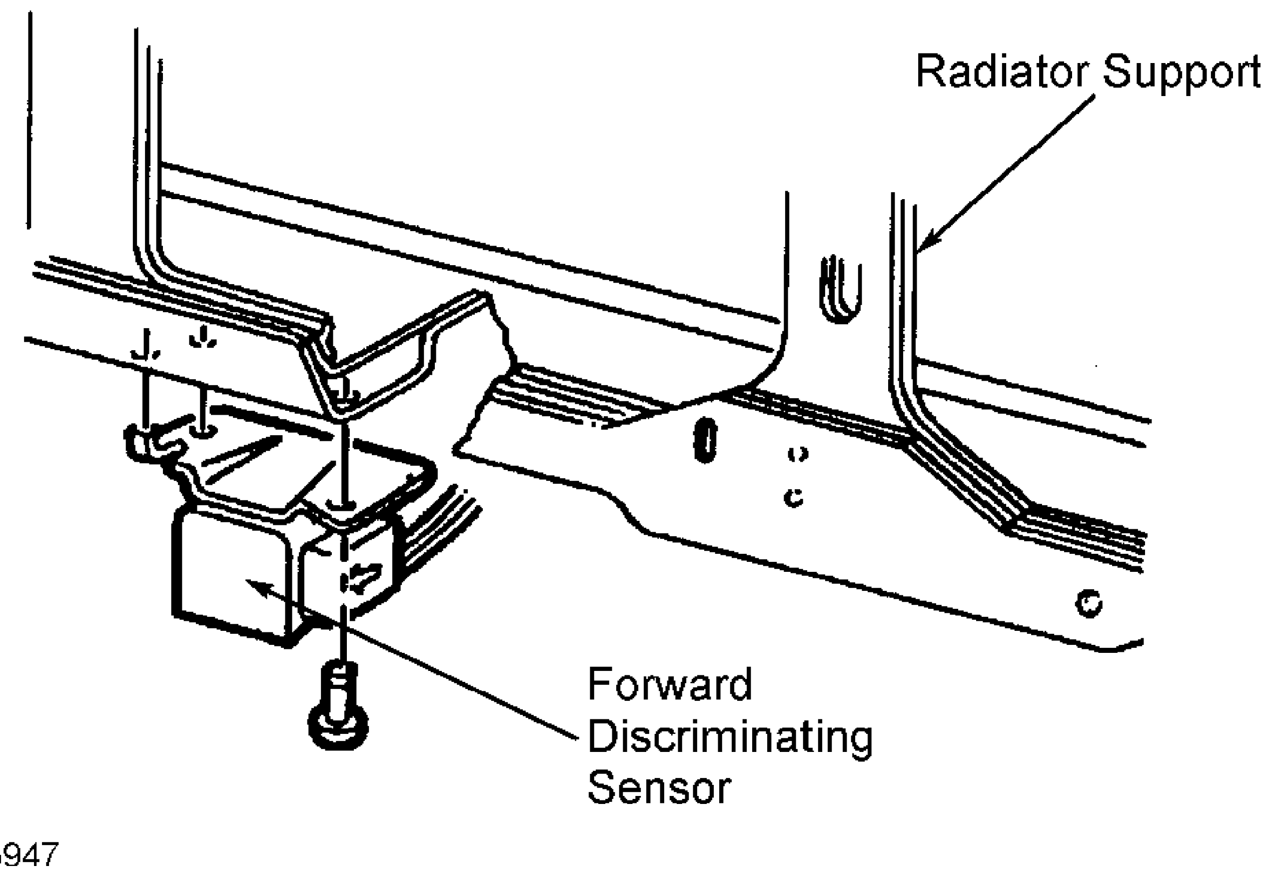


Fig. 3: Removing Forward Discriminating Sensor
Courtesy of General Motors Corp.

Installation

To install, reverse removal procedure. See Fig. 3. Ensure arrow on sensor is installed pointing forward. Reactivate air bag system. See DISABLING & ACTIVATING SIR SYSTEM. Check AIR BAG warning light to make sure the system is functioning properly. Refer to SYSTEM OPERATION CHECK.

STEERING WHEEL

Removal

1) Before proceeding, follow air bag service precautions. Refer to SERVICE PRECAUTIONS. Disable the air bag restraint system. See DISABLING & ACTIVATING SIR SYSTEM.

2) Remove air bag module. See AIR BAG MODULE under REMOVAL & INSTALLATION. Remove steering wheel locking nut. Horn plunger contact.

Using Steering Wheel Puller (J-1859-03), remove steering wheel. See Fig. 4. DO NOT install puller bolts too far, as damage to coil assembly can result.

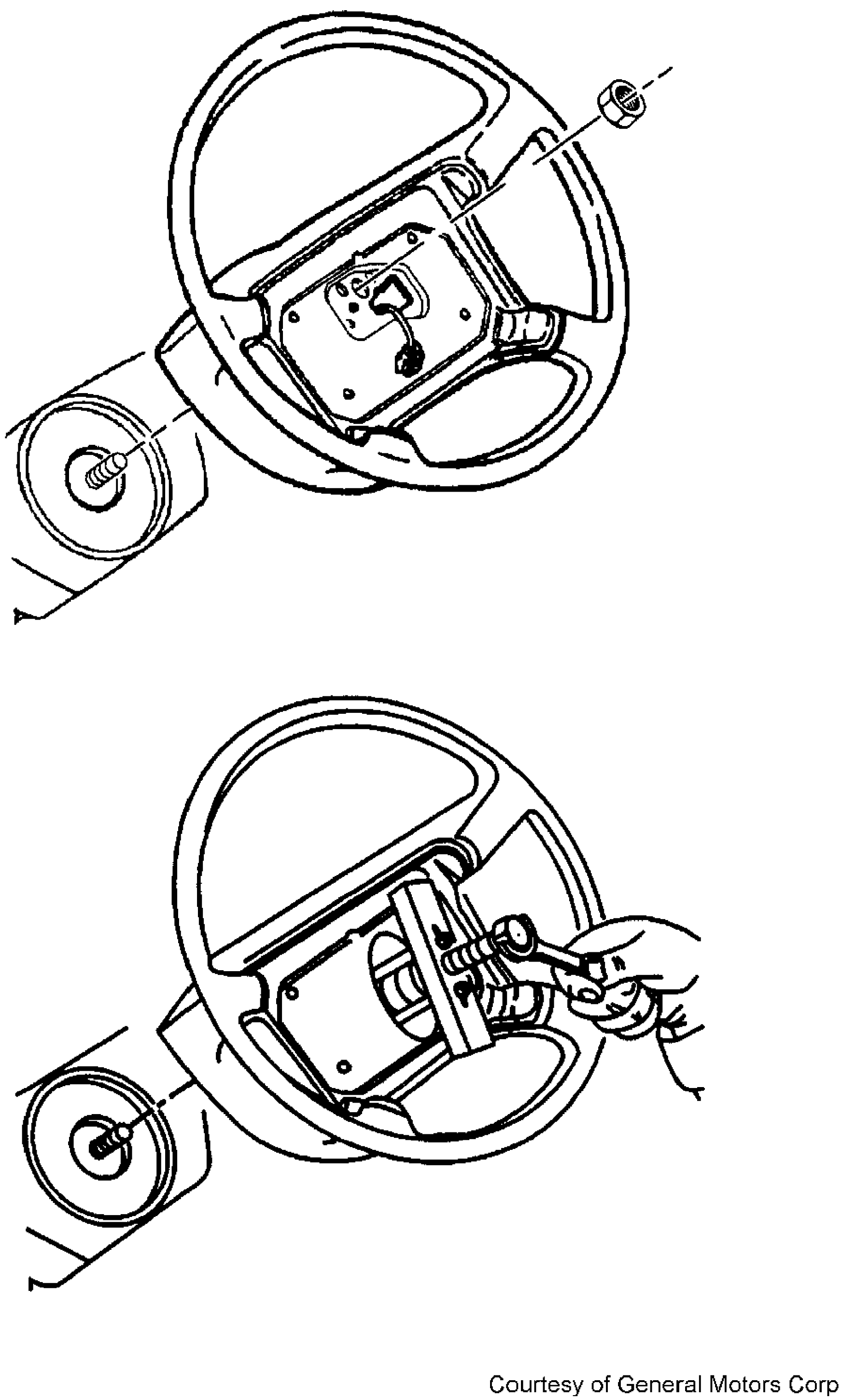


Fig. 4: Removing Steering Wheel
Courtesy of General Motors Corp.

Installation

To install, reverse removal procedure. See Fig. 4. Tighten locking nut. See TORQUE SPECIFICATIONS. Reactivate air bag system. See DISABLING & ACTIVATING SIR SYSTEM. Check AIR BAG warning light to make sure the system is functioning properly. Refer to SYSTEM OPERATION CHECK.

SIR COIL ASSEMBLY

Removal

1) Before proceeding, follow air bag service precautions. Refer to SERVICE PRECAUTIONS. Disable the air bag restraint system. See DISABLING & ACTIVATING SIR SYSTEM. Ensure front wheels are in straight ahead position.

2) Lower or remove steering column from vehicle. Remove lower column shroud. Lift upper shroud to gain access to lock cylinder hole. Hold key in START position. Using wrench, push on lock cylinder retaining pin. Release key to RUN position and pull steering column lock cylinder set from lock module assembly. Remove upper column shroud.

2) Remove air bag module. See AIR BAG MODULE. Remove steering wheel. See STEERING WHEEL. DO NOT install puller bolts too far, as damage to coil assembly can result. Remove retaining ring and coil assembly. See Fig. 5. Remove wave washer and two wire harness straps from steering column wire harness.

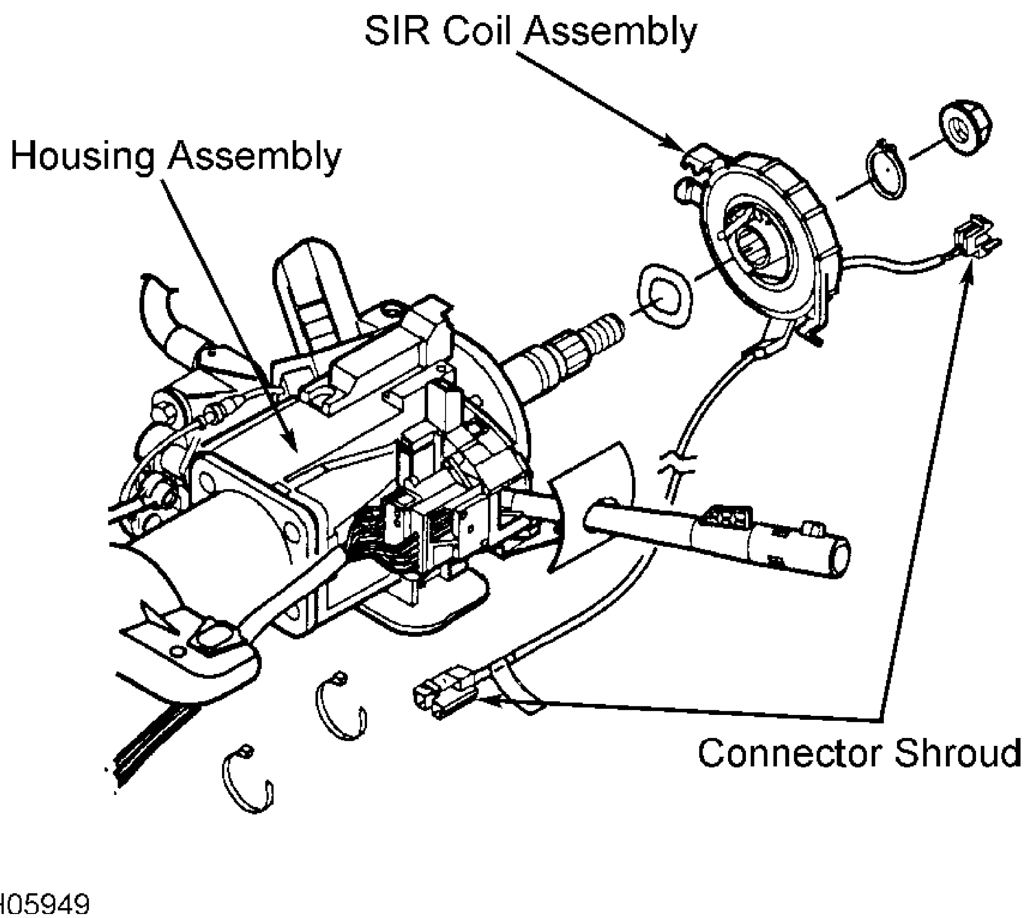


Fig. 5: Removing SIR Coil Assembly
Courtesy of General Motors Corp.

NOTE: New SIR coil assembly comes pre-centered. Remove and dispose centering tab when installing.

Installation

1) Ensure coil assembly hub and steering shaft are centered. Coil assembly will become uncentered if column is separated from steering gear and is allowed to rotate, or if centering spring is depressed, allowing hub to rotate while coil assembly is removed from column. To center coil assembly, see CENTERING COIL ASSEMBLY under ADJUSTMENTS.

2) Ensure front wheels are in straight ahead position and turn ignition to LOCK position. Install wave washer. To install coil assembly, align coil assembly with horn tower and slide onto shaft. See Fig. 5. Install retaining ring securely in groove on shaft. Route lower coil wire along steering column jacket assembly.

3) Install two wire straps to steering column wire harness. Move shift and multifunction lever seal to ease installation of column shrouds. Install upper column shroud and steering lock cylinder set. Install lower column shroud. Move shift and multifunction lever seal into position.

4) Install steering wheel and air bag module. See STEERING WHEEL and AIR BAG MODULE. Reactivate air bag system. See procedures under DISABLING & ACTIVATING SIR SYSTEM. Check AIR BAG warning light for proper system function. See SYSTEM OPERATION CHECK.

AIR BAG MODULE

Removal

1) Before proceeding, follow air bag service precautions. Refer to SERVICE PRECAUTIONS. Disable the air bag restraint system. See DISABLING & ACTIVATING SIR SYSTEM.

2) Turn steering wheel 90 degrees to access rear shroud holes to air bag module. Insert screw driver and push leaf spring to release pin. Turn steering wheel 180 degrees to access remaining rear shroud holes. Insert screw driver and push leaf spring to release pin. Remove air bag module. Disconnect SIR lead wire from clip on air bag module and steering wheel. Remove CPA clip and retainer from air bag module. See Fig. 6.

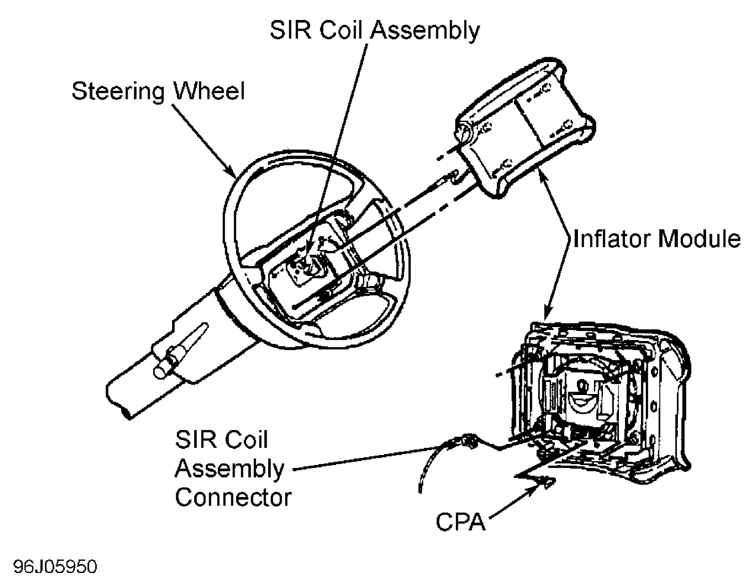


Fig. 6: Removing Driver-Side Air Bag Module
Courtesy of General Motors Corp.

Installation

1) Install CPA clip and retainer to air bag module. Connect

SIR lead wire to clip on steering wheel and air bag module. Install air bag module by pressing it firmly into steering wheel enough to engage and latch all four notched pins in the leaf spring. Do not pinch wires. See Fig. 6.

2) Reactivate air bag system. See DISABLING & ACTIVATING SIR SYSTEM. Check AIR BAG warning light to ensure system is functioning properly. See SYSTEM OPERATION CHECK.

ADJUSTMENTS

CENTERING COIL ASSEMBLY

While holding coil assembly housing, depress spring lock and rotate hub in direction of arrow until it stops. Coil assembly should now be wound up snug against center hub. Rotate coil assembly hub in opposite direction approximately 2 1/2 turns. Release spring lock between locking tabs in front of arrow. See Fig. 7.

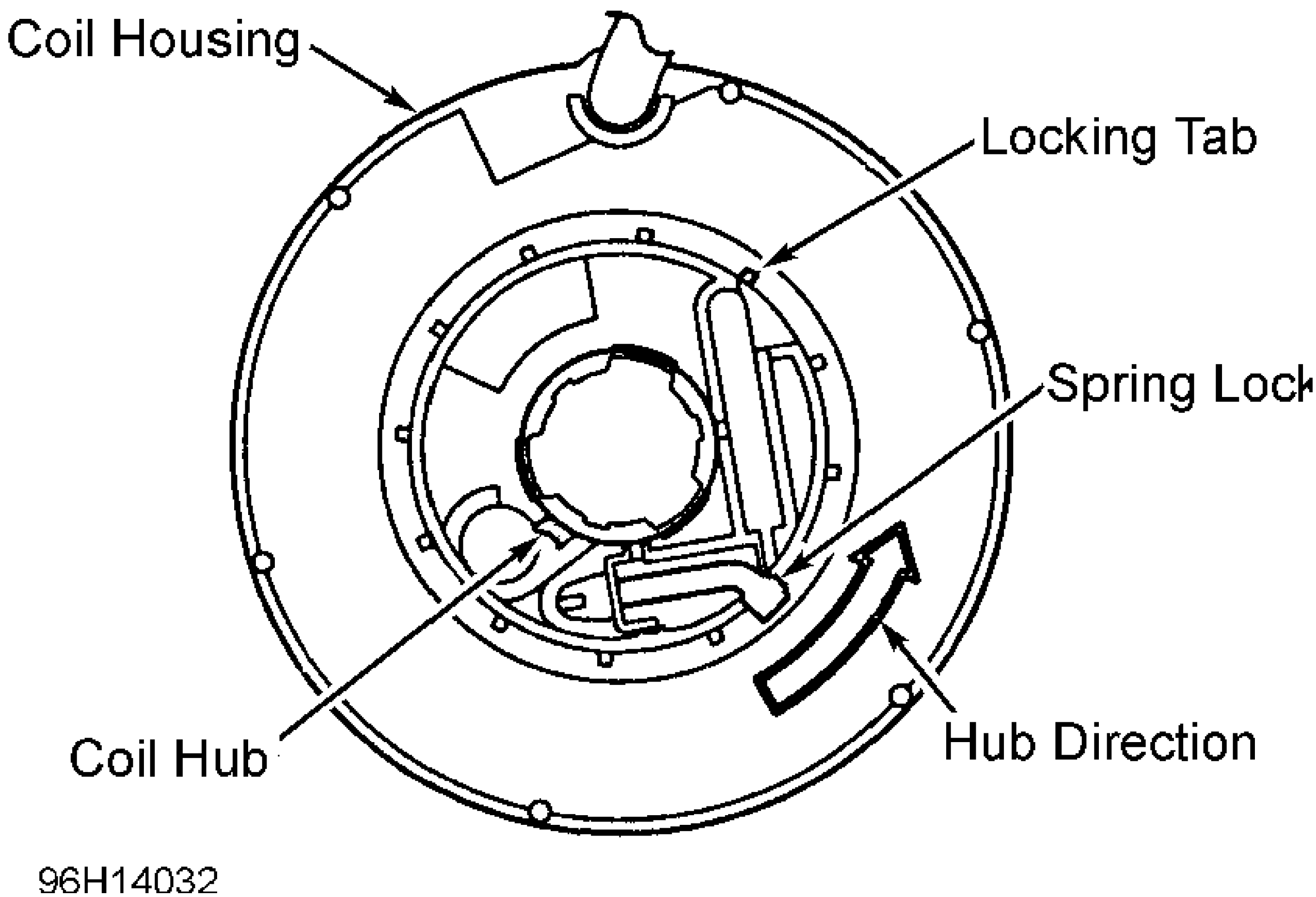


Fig. 7: Centering SIR Coil Assembly
Courtesy of General Motors Corp.

CONNECTOR IDENTIFICATION

NOTE: To identify SIR wiring connector terminals, see Fig. 8.

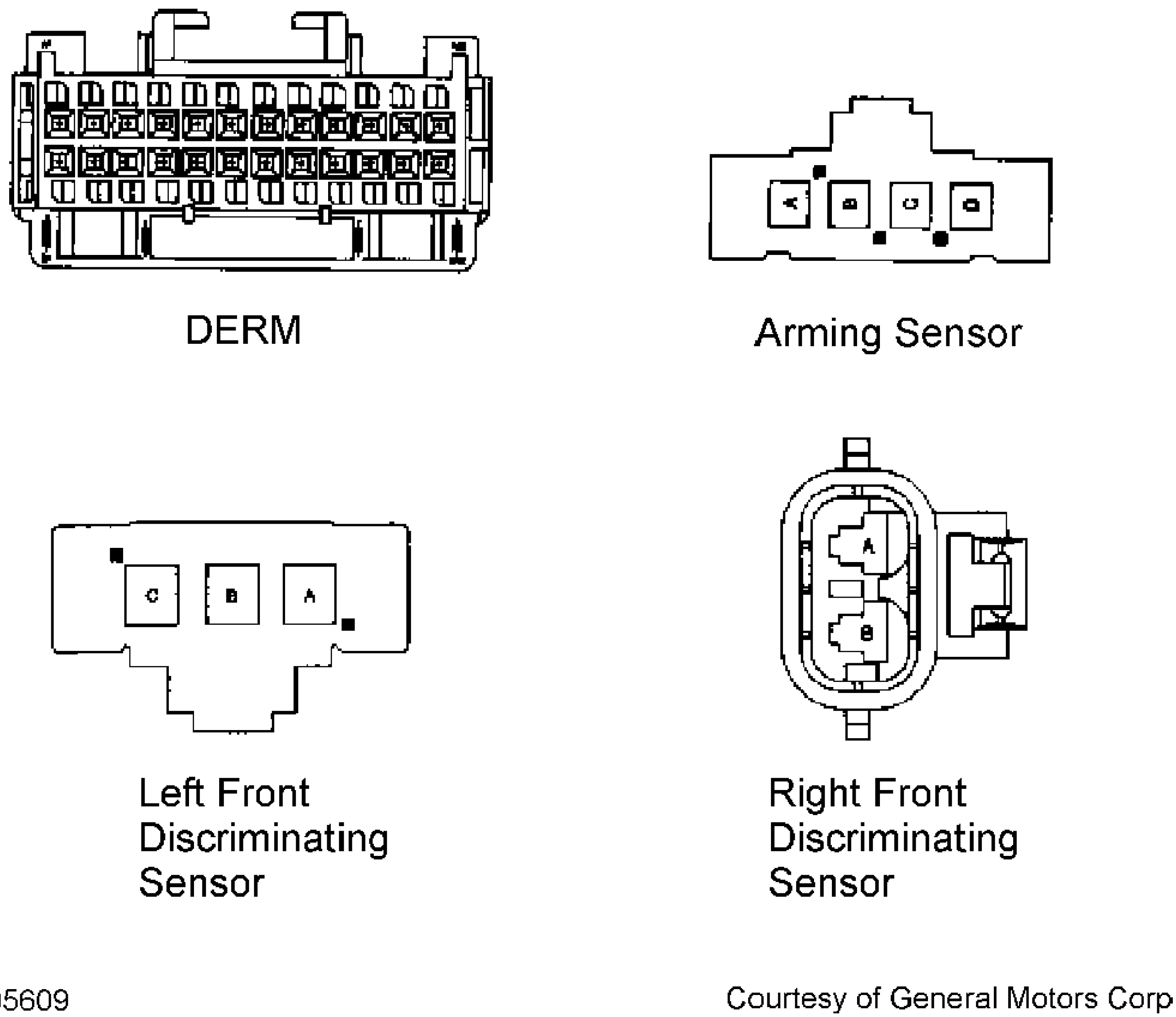


Fig. 8: Connector Terminal Identification
Courtesy of General Motors Corp.

DIAGNOSIS & TESTING

* PLEASE READ THIS FIRST *

WARNING: Failure to follow service precautions may result in air bag deployment and personal injury. See SERVICE PRECAUTIONS. After component replacement, check system operation. See SYSTEM OPERATION CHECK.

SELF-DIAGNOSIS

Diagnostic Trouble Codes (DTCs)

Diagnostic Energy Reserve Module (DERM) provides a record of DTCs stored according to type. Current DTCs are faults presently being detected. Current DTCs are stored in Random Access Memory (RAM) and are erased when fault is corrected. Current DTCs can be read using a scan tester such as Tech 1.

Scan Tester Diagnostics

A scan tester will read and clear current codes and history codes. Ensure scan tester contains correct cartridge for SIR diagnostics. To use scan tester, connect it to DLC connector, plug in power source and turn ignition switch to ON position. Follow scan tester manufacturer instructions for communication with SIR system. Scan tester reads serial data from DERM data link output to DLC connector.

NOTE: Failure to follow diagnostic procedures may result in extended diagnostic time and incorrect diagnosis and parts replacement.

Diagnostic Procedure

1) SIR SYSTEM DIAGNOSTIC CHECK should always be starting point of SIR diagnostics. See SIR DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC TABLES. SIR DIAGNOSTIC SYSTEM CHECK checks for proper INFLATABLE RESTRAINT indicator light operation and SIR trouble codes using flash code and scan tester methods.

2) SIR DIAGNOSTIC SYSTEM CHECK will lead to correct diagnostic table to diagnose SIR problems. Always perform SIR DIAGNOSTIC SYSTEM CHECK after repair or diagnostic procedures to ensure repair is correct and no other problems are present.

DIAGNOSTIC TABLES

SIR DIAGNOSTIC SYSTEM CHECK

WARNING: To avoid air bag deployment and injury when trouble shooting system, only use test equipment specified in diagnostic tables. Under no circumstances should battery powered test equipment or test light be used. Carefully follow all instructions.

Description

When ignition switch is turned ON, IGNITION 1 voltage is applied from AIR BAG fuse to DERM at IGNITION 1 input terminal Nos. A9 and A10 and from GAUGES fuse to DERM at REDUNDANT INDICATOR IGNITION 1 input terminal No. B2. DERM responds by flashing AIR BAG indicator 7 times then turning off while performing tests on SIR system.

When engine is being cranked, system voltage is applied from CRANK fuse to DERM at CRANK input terminal No. B10. DERM responds by grounding SIR Indicator output terminal No. B1 until system voltage is removed from CRANK input. This results in AIR BAG indicator being on steady during cranking. After cranking, DERM will flash AIR BAG indicator 6 times and perform test on SIR system.

Diagnostic Aids

The order in which diagnostic trouble codes are diagnosed is important. Failure to diagnose the DTCs in order specified may result in extended diagnostic time, incorrect diagnosis, or incorrect parts replacement.

NOTE: Test numbers refer to test numbers on diagnostic table. For circuit number identification, see WIRING DIAGRAM.

1) AIR BAG indicator should flash 7 times after ignition switch is turned to ON.

2) AIR BAG indicator should remain on steady during cranking.

3) After cranking, AIR BAG indicator should flash 6 times then turn off.

4) This test checks for proper operation of Serial Data line.

Test also will determine whether history diagnostic trouble codes are stored and, if so, identify them.

5) This test checks for DERM ability to communicate through the Serial Data line.

6) This test refers to appropriate DTC table for diagnosis of history DTCs set to memory in DERM.

7) When AIR BAG warning light flashes four times during BULB TEST, this indicates a malfunction in redundant lamp driver circuitry. These malfunctions are diagnosed by DTC B1062 table.

8) Improper operation of AIR BAG indicator is indicated. This test differentiates an indicator stays ON condition from an indicator does not come ON condition.

SIR DIAGNOSTIC SYSTEM CHECK

Step	Action	Yes	No
1	1. Note the "AIR BAG" warning lamp as the ignition switch is turned "ON". 2. Does the "AIR BAG" warning lamp flash seven times?	Go to Step 2	Go to Step 7
2	1. Note the "AIR BAG" warning lamp as the engine is started. 2. Does the "AIR BAG" warning lamp come "ON" steady during cranking?	Go to Step 3	Go to Table D
3	1. Note the "AIR BAG" warning lamp after starting. 2. Does the "AIR BAG" warning lamp flash six times, then go "OFF"?	Go to Step 4	Go to Step 9
4	1. Connect a scan tool to the Data Link Connector and follow directions given in the scan tool instruction manual. 2. Request the SIR Diagnostic Trouble Code display. 3. Is a (are) history Diagnostic Trouble Code(s) displayed?	Go to Step 6	Go to Step 5
5	1. Does the scan tool indicate no data received?	Diagnose Electrical System	System OK
6	1. Record all the displayed Diagnostic Trouble Codes on the repair order specifying as history. 2. Ignition switch "OFF." 3. Refer to "Diagnostic Aids" for the indicated diagnostic trouble code. A history Diagnostic Trouble Code indicates the malfunction has been repaired (but DTCs were not cleared) or is intermittent. 4. Has the diagnosis been performed and DTCs cleared?	Go to Step 1	—
7	1. Does the "AIR BAG" warning lamp flash four times?	Go to DTC 62	Go to Step 8
8	1. Does the "AIR BAG" warning lamp come "ON" steady?	Go to Table B	Go to Table C
9	1. Connect a scan tool to the Data Link Connector and follow directions given in the scan tool instruction manual. 2. Request the SIR Diagnostic Trouble Code display. 3. Is a (are) current Diagnostic Trouble Code(s) displayed?	Go to Step 10	Go to Step 5
10	1. Record all the displayed Diagnostic Trouble Codes on the repair order specifying as current or history. 2. When DTC 51 is set, diagnose as directed by DTC 51 table. 3. Diagnose all the remaining current Diagnostic Trouble Codes from lowest to highest. 4. Has Current DTC diagnosis been performed and all current DTC(s) cleared?	Go to Step 11	—
11	1. Is a (are) history Diagnostic Trouble Code(s) recorded on the repair order?	Go to Step 6	

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Fig. 9: SIR Diagnostic System Check
Courtesy of General Motors Corp.

TABLE A - DERM INTEGRITY CHECK

WARNING: To avoid air bag deployment and injury when trouble shooting system, only use test equipment specified in diagnostic tables. Under no circumstances should battery powered test equipment or test light be used. Carefully follow all instructions.

Description

When DERM recognizes IGNITION 1 voltage applied to terminal Nos. A9 and A10 is in normal operating voltage range, AIR BAG indicator is flashed 7 times to verify operation. At this time DERM performs Turn ON tests followed by CONTINUOUS MONITORING tests. When no malfunctions are detected, DERM proceeds to INITIATOR ASSEMBLY RESISTANCE test. When a malfunction is detected, DERM sets a current diagnostic trouble code and turns AIR BAG indicator on. DERM will clear current diagnostic trouble codes and move them to a history file when malfunction is not longer detected and/or ignition switch is cycled, except for DTC B1051. DTC B1051 can only be cleared using a scan tool clear codes command.

NOTE: Test numbers refer to test numbers on diagnostic table. For circuit number identification, see WIRING DIAGRAM.

1) The SIR DIAGNOSTIC SYSTEM CHECK must be starting point for all diagnostics.

2) This test confirms a current malfunction. If no current malfunction is occurring (History DTC set) Diagnostic Aids for appropriate diagnostic trouble code should be referenced. DERM should not be replaced for a History DTC, except when directed by appropriate diagnostic table.

3) This test checks for a malfunction introduced into SIR system during diagnostic process. It is extremely unlikely that a malfunctioning DERM would cause a new malfunction to occur during diagnostic process.

4) When all circuitry outside DERM has been found to operate properly, as indicated by appropriate diagnostic table, then and only then should DERM be replaced.

5) The symptom or DTC is no longer occurring. The condition may be intermittent or inadvertently repaired during diagnosis of SIR system.

TABLE A - DERM INTEGRITY CHECK

THIS TABLE ASSUMES THAT THE "SIR DIAGNOSTIC SYSTEM CHECK" AND EITHER A SYMPTOM TABLE OR A DIAGNOSTIC TROUBLE CODE TABLE DIAGNOSIS HAVE BEEN PERFORMED. WHEN ALL CIRCUITRY OUTSIDE THE DERM HAS BEEN FOUND TO OPERATE PROPERLY, AS INDICATED BY THE APPROPRIATE DIAGNOSTIC TABLE, AND THE SYMPTOM OR DTC REMAINS CURRENT, THE FOLLOWING DIAGNOSTIC PROCEDURES MUST BE PERFORMED TO VERIFY THE NEED FOR DERM REPLACEMENT.

Step	Action	Yes	No
1	1. Were you sent here from a Symptom Table or a Diagnostic Trouble Code Table?	Go to Step 2	Go to "SIR Diagnostic System Check"
2	1. Ignition switch "OFF." 2. Reconnect all the SIR system components. 3. Ensure the ignition switch has been "OFF" for at least two minutes. 4. Note the "AIR BAG" warning lamp as ignition switch is turned "ON." 5. Does the "AIR BAG" warning lamp flash seven times and go "OFF"?	Go to Step 5	Go to Step 3
3	1. Using a scan tool, request the Diagnostic Trouble Code display. 2. Is the same symptom or DTC occurring as was when the "SIR Diagnostic Check" was first performed?	Go to Step 4	Go to indicated table
4	1. Clear the SIR Diagnostic Trouble Codes. 2. Turn the ignition switch "OFF" for at least two minutes. 3. Note the "AIR BAG" warning lamp as the ignition switch is turned "ON." 4. Does the "AIR BAG" warning lamp flash seven times and then go "OFF"?	System OK	Go to Step 6
5	1. The symptom or DTC is no longer occurring. 2. Clear the SIR Diagnostic Trouble Codes. 3. Have the SIR Diagnostic Trouble Codes been cleared?	Go to "SIR Diagnostic System Check"	—
6	1. Ignition switch "OFF".. 2. Replace the DERM. Refer to ON-VEHICLE SERVICE, DIAGNOSTIC ENERGY RESERVE MODULE (DERM). 3. Has the DERM been replaced?	Go to "SIR Diagnostic System Check"	—

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Fig. 10: Table A - DERM Integrity Check
Courtesy of General Motors Corp.

TABLE B - AIR BAG INDICATOR COMES ON STEADY

WARNING: To avoid air bag deployment and injury when trouble shooting system, only use test equipment specified in diagnostic tables. Under no circumstances should battery powered test equipment or test light be used. Carefully follow all instructions.

Description

When ignition switch is first turned ON, IGNITION 1 voltage is applied from GAUGES fuse to REDUNDANT INDICATOR IGNITION 1 terminal No. B2 and to AIR BAG indicator which is connected to SIR INDICATOR terminal No. B1. AIR BAG fuse applies voltage to IGNITION 1 terminal Nos. A9 and A10. DERM responds by flashing AIR BAG indicator 7 times. If IGNITION 1 voltage is outside of normal operating voltage range, AIR BAG indicator will come on steady with no DTCs set.

When engine is cranked, IGNITION 1 voltage is applied from CRANK fuse to DERM at CRANK input. DERM responds by grounding SIR INDICATOR output until IGNITION 1 voltage is removed from CRANK input. This results in AIR BAG indicator being on during cranking. After cranking, DERM will flash AIR BAG indicator 6 times.

NOTE: Test numbers refer to test numbers on diagnostic table. For circuit number identification, see WIRING DIAGRAM.

1) The SIR DIAGNOSTIC SYSTEM CHECK must be starting point for all diagnostics.

2) An open AIR BAG fuse would cause AIR BAG indicator to come on steady.

3) A disconnected DERM harness connector will cause AIR BAG indicator to come on steady via shorting bar from terminal No. A1 to terminal No. B1.

9) This test checks for an open in ground circuit to DERM.

11) This test checks for an open in CKT 1139.

16) This test checks for short from CRANK input circuit to B+.

17) This test isolates the short to B+ in CKT 806/1035 to one side of connector C203.

TABLE B - AIR BAG WARNING LIGHT COMES ON STEADY (1 OF 3)

WHEN MEASUREMENTS ARE REQUESTED IN THIS TABLE, USE J 39200 DVM WITH CORRECT TERMINAL ADAPTER FROM J 35616-A. WHEN A CHECK FOR PROPER CONNECTION IS REQUESTED REFER TO "INTERMITTENTS AND POOR CONNECTIONS" IN SECTION 8A-4. WHEN A WIRE, CONNECTOR OR TERMINAL REPAIR IS REQUESTED USE J 38125-A AND REFER TO "WIRING REPAIR" IN THIS SECTION.

Step	Action	Yes	No
1	1. Was the "SIR Diagnostic System Check" performed?	Go to Step 2	Go to "SIR Diagnostic System Check"
2	1. Ignition switch "OFF." 2. Remove and inspect the "AIR BAG" fuse. 3. Is the fuse good?	Go to Step 3	Go to Step 20
3	1. Inspect the DERM electrical harness connector connection to the DERM. 2. Is the connector securely connected to the DERM?	Go to Step 4	Go to Step 24
4	1. Disconnect the DERM. 2. Check for proper connection to the DERM at terminals "A1," "A9," "A10" and "A12." 3. Is the DERM harness connector damaged or corroded?	Go to Step 6	Go to Step 7
5	1. Check for proper connection to the DERM at terminals "A1," "A9," "A10" and "A12." 2. Are the DERM terminals damaged or corroded?	Go to Step 8	Go to Step 30
6	1. Repair the DERM electrical harness connector. 2. Has the connector been repaired?	Go to Step 5	—
7	1. Check for proper connection to the DERM at terminals "A1," "A9," "A10" and "A12." 2. Are the DERM terminals damaged or corroded?	Go to Step 8	Go to Step 9

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Fig. 11: Table B - Air Bag Indicator Comes On Steady (1 Of 3)
Courtesy of General Motors Corp.

TABLE B - AIR BAG WARNING LIGHT COMES ON STEADY (2 OF 3)

WHEN MEASUREMENTS ARE REQUESTED IN THIS TABLE, USE J 39200 DVM WITH CORRECT TERMINAL ADAPTER FROM J 35616-A. WHEN A CHECK FOR PROPER CONNECTION IS REQUESTED REFER TO "INTERMITTENTS AND POOR CONNECTIONS" IN SECTION 8A-4. WHEN A WIRE, CONNECTOR OR TERMINAL REPAIR IS REQUESTED USE J 38125-A AND REFER TO "WIRING REPAIR" IN THIS SECTION.

Step	Action	Yes	No
8	1. Replace the DERM. 2. Has the DERM been replaced?	Go to Step 30	—
9	1. Measure resistance from DERM harness connector terminal "A1" to ground. 2. Is either measurement 5.0 ohms or less?	Go to Step 11	Go to Step 10
10	1. Repair open in CKT 1751. 2. Has open in CKT 1751 been repaired?	Go to Step 30	—
11	1. Measure resistance from each terminal of the "AIR BAG" fuse holder to the DERM electrical harness connector terminal "A9 " and "A10" 2. Is either measurement 5.0 ohms or less?	Go to Step 12	Go to Step 25
12	1. Install the "AIR BAG" fuse. 2. Disconnect the yellow 2-way electrical connector at the base of the steering column. 3. Connect the DERM harness connector to J 38715-A SIR Driver/Passenger Load Tool. 4. Ignition switch "ON." 5. Does the "AIR BAG" warning lamp come "ON"?	Go to Step 13	Go to Step 16
13	1. Ignition switch "OFF." 2. Disconnect electrical connector (C203, terminal D7). 3. Ignition switch "ON." 4. Does the "AIR BAG" warning lamp come "ON"?	Go to Step 15	Go to Step 14
14	1. Ignition switch "OFF." 2. Disconnect J 38715-A. 3. Repair the short to ground CKT 358 between C203 and DERM. 4. Has the short CKT been repaired?	Go to Step 30	—
15	1. Ignition switch "OFF." 2. Disconnect J 38715-A. 3. Repair the short to ground CKT 358 between C203 and I/P Cluster. 4. Has the short CKT been repaired?	Go to Step 30	—
16	1. Ignition switch "OFF." 2. Disconnect J 38715-A. 3. Ignition switch "ON." 4. Measure the voltage on the DERM electrical harness connector from terminal "B10" to terminal "A1" (ground). 5. Is the voltage 1 volt or less?	Go to Table A	Go to Step 17
17	1. Ignition switch "OFF." 2. Disconnect electrical connector (C203, terminal A8). 3. Ignition switch "ON." 4. Measure the voltage on the DERM electrical harness connector from terminal "B10" to terminal "A1" (ground). 5. Is the voltage 1 volt or less?	Go to Step 18	Go to Step 19
18	1. Ignition switch "OFF." 2. Repair the short B+ in CKT 806/1035 between C203 and Crank fuse. 3. Has the short CKT been repaired?	Go to Step 30	—

97J05610 Courtesy of General Motors Corp.

Fig. 12: Table B - Air Bag Indicator Comes On Steady (2 Of 3)
Courtesy of General Motors Corp.

TABLE B - AIR BAG WARNING LIGHT COMES ON STEADY (3 OF 3)

WHEN MEASUREMENTS ARE REQUESTED IN THIS TABLE, USE J 39200 DVM WITH CORRECT TERMINAL ADAPTER FROM J 35616-A. WHEN A CHECK FOR PROPER CONNECTION IS REQUESTED REFER TO "INTERMITTENTS AND POOR CONNECTIONS" IN SECTION 8A-4. WHEN A WIRE, CONNECTOR OR TERMINAL REPAIR IS REQUESTED USE J 38125-A AND REFER TO "WIRING REPAIR" IN THIS SECTION.

Step	Action	Yes	No
19	1. Ignition switch "OFF." 2. Repair the short B+ in circuit 806/1035 between terminal A8 and B10. 3. Has the short CKT been repaired?	Go to Step 30	—
20	1. Replace the "AIR BAG" fuse. 2. Ignition switch "ON." 3. Wait 10 seconds. 4. Ignition switch "OFF." 5. Remove and inspect the "AIR BAG" fuse. 6. Is the fuse good?	Go to Step 30	Go to Step 21
21	1. Disconnect the arming sensor. 2. Replace the "AIR BAG" fuse. 3. Ignition switch "ON." 4. Wait 10 seconds. 5. Ignition switch "OFF." 6. Remove and inspect the "AIR BAG" fuse. 7. Is the fuse good?	Go to Step 22	Go to Step 23
22	1. Replace the Arming Sensor. 2. Has the sensor been replaced?	Go to Step 30	—
23	1. Repair the short to ground in CKT 1139. 2. Has the short CKT been repaired?	Go to Step 30	—
24	1. Properly connect the DERM electrical harness connector to the DERM. 2. Has the connector been properly connected to the DERM?	Go to Step 30	—
25	1. Disconnect electrical connector (C200) terminal "S." 2. Check for proper connection at terminal "S." 3. Is the connector damaged or corroded?	Go to Step 26	Go to Step 27
26	1. Repair electrical connector (C200) terminal "S." 2. Has the connector been repaired?	Go to Step 30	—
27	1. Ignition switch "ON." 2. Measure the voltage on the fuse side of connector (C200) at terminal "S." 3. Does J 39200 display battery voltage?	Go to Step 28	Go to Step 29
28	1. Repair the open in CKT 1139 between terminal "S", "A9" and "A10". 2. Has the open CKT been repaired?	Go to Step 30	—
29	1. Repair the open in CKT 1139 between terminal "S" and AIR BAG fuse. 2. Has the open CKT been repaired?	Go to Step 30	—
30	1. Reconnect all the SIR system components. 2. Ensure the components are properly mounted. 3. Have all the SIR components been reconnected and properly mounted?	Go to Step 31	—
31	1. Clear the SIR Diagnostic Trouble Codes. 2. Have the SIR Diagnostic Trouble Codes been cleared?	Go to "SIR Diagnostic System Check"	—

97B05611 Courtesy of General Motors Corp.

Fig. 13: Table B - Air Bag Indicator Comes On Steady (3 Of 3)
Courtesy of General Motors Corp.

TABLE C - AIR BAG INDICATOR DOES NOT COME ON

WARNING: To avoid air bag deployment and injury when trouble shooting system, only use test equipment specified in diagnostic tables. Under no circumstances should battery powered test equipment or test light be used. Carefully follow all instructions.

Description

When ignition switch is first turned ON, IGNITION 1 voltage is applied from GAUGES fuse to REDUNDANT INDICATOR IGNITION 1, terminal No. B2 and to AIR BAG indicator which is connected to SIR INDICATOR terminal No. B1. AIR BAG fuse applies system voltage to IGNITION 1 inputs, terminal Nos. A9 and A10. DERM responds by flashing AIR BAG indicator 7 times.

When engine is being cranked, Ignition 1 voltage is applied from CRANK fuse to DERM at CRANK input. DERM responds by grounding SIR INDICATOR output until IGNITION 1 voltage is removed from CRANK input. This results in AIR BAG indicator being on during cranking. After cranking, DERM will flash AIR BAG indicator 6 times.

NOTE: Test numbers refer to test numbers on diagnostic table. For circuit number identification, see WIRING DIAGRAM.

1) The SIR DIAGNOSTIC SYSTEM CHECK must be starting point for all diagnostics.

2) This test determines whether malfunction is in DERM circuit or in instrument cluster power feed circuit.

8) This test checks for open in SIR INDICATOR circuit, instrument cluster circuit and AIR BAG indicator circuit.

9) This test determines if malfunction is a short from SIR INDICATOR circuit to B+.

16) This test checks if open is due to bad bulb.

18) This test determines if malfunction is an open in SIR INDICATOR circuit or an open in instrument cluster.

22) This test determines where open in CKT 358 is located.

26) This test determines if blown fuse was result of fatigue or a circuit short.

28) This test determines if short to ground is due to a short in wiring or a malfunctioning DERM.

34) This test checks whether malfunction is due to an open power feed circuit from GAUGES fuse to instrument cluster or an open power feed to GAUGES fuse.

TABLE C - AIR BAG WARNING LIGHT DOES NOT COME ON (1 OF 4)

WHEN MEASUREMENTS ARE REQUESTED IN THIS TABLE, USE J 39200 DVM WITH CORRECT TERMINAL ADAPTER FROM J 35616-A. WHEN A CHECK FOR PROPER CONNECTION IS REQUESTED REFER TO "INTERMITTENTS AND POOR CONNECTIONS" IN SECTION 8A-4. WHEN A WIRE, CONNECTOR OR TERMINAL REPAIR IS REQUESTED USE J 38125-A AND REFER TO "WIRING REPAIR" IN THIS SECTION.

Step	Action	Yes	No
1	1. Was the "SIR Diagnostic System Check" performed?	Go to Step 2	Go to "SIR Diagnostic System Check"
2	1. Apply the parking brake. 2. Ignition switch "ON." 3. Does the "BRAKE" warning lamp come "ON"?	Go to Step 3	Go to Step 25
3	1. Ignition switch to "OFF." 2. Disconnect the DERM. 3. Check for proper connection to the DERM at terminal "B1." 4. Is the DERM electrical harness connector damaged or corroded?	Go to Step 4	Go to Step 6
4	1. Repair the DERM electrical harness connector. 2. Has the connector been repaired?	Go to Step 5	—
5	1. Check for proper connection to the DERM at terminal "B1." 2. Are the DERM terminals damaged or corroded?	Go to Step 7	Go to Step 37
6	1. Check for proper connection to the DERM at terminal "B1." 2. Are the DERM terminals damaged or corroded?	Go to Step 7	Go to Step 8

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Fig. 14: Table C - Air Bag Indicator Does Not Come On (1 Of 4)
Courtesy of General Motors Corp.

TABLE C - AIR BAG WARNING LIGHT DOES NOT COME ON (2 OF 4)

WHEN MEASUREMENTS ARE REQUESTED IN THIS TABLE, USE J 39200 DVM WITH CORRECT TERMINAL ADAPTER FROM J 35616-A. WHEN A CHECK FOR PROPER CONNECTION IS REQUESTED REFER TO "INTERMITTENTS AND POOR CONNECTIONS" IN SECTION 8A-4. WHEN A WIRE, CONNECTOR OR TERMINAL REPAIR IS REQUESTED USE J 38125-A AND REFER TO "WIRING REPAIR" IN THIS SECTION.

Step	Action	Yes	No
7	1. Replace the DERM. 2. Has the DERM been replaced?	Go to Step 37	—
8	1. Measure the resistance on the DERM electrical harness connector from terminal "B2" to terminal "B1." 2. Is the resistance 5.0 ohms to 25 ohms?	Go to Step 9	Go to Step 12
9	1. Disconnect the instrument cluster. 2. Connect the DERM electrical harness connector to J 38715-A SIR Driver/Passenger Load Tool DERM connector. 3. Ignition switch "ON." 4. Measure the voltage from instrument cluster electrical harness connector terminal "6" to ground. 5. Is the voltage 1 volt or less?	Go to Step 10	Go to Step 11
10	1. Install the instrument cluster. 2. Has the instrument cluster been installed?	Go to Table A	—
11	1. Repair the short from CKT to 358 to B+. 2. Has the short CKT been repaired?	Go to Step 37	—
12	1. Remove the instrument cluster. 2. Check for proper connection to the instrument cluster at terminal "6." 3. Is the instrument cluster electrical harness connector damaged or corroded?	Go to Step 13	Go to Step 14
13	1. Repair the instrument cluster harness electrical connector. 2. Has the connector been repaired?	Go to Step 14	—
14	1. Check for proper connection to the instrument cluster at terminal "6." 2. Are the instrument cluster terminals damaged or corroded?	Go to Step 15	Go to Step 16
15	1. Service or replace instrument cluster as needed. 2. Install the instrument cluster. 3. Has the instrument cluster been installed?	Go to Step 37	—
16	1. Remove and inspect the "AIR BAG" bulb. 2. Is the bulb good?	Go to Step 18	Go to Step 17
17	1. Replace the "AIR BAG" bulb. 2. Install the instrument cluster. 3. Has the instrument cluster been installed?	Go to Step 37	—
18	1. Install the "AIR BAG" bulb. 2. Measure the resistance from the instrument cluster electrical harness connector terminal "6" to the DERM electrical harness connector terminal "B1." 3. Is the resistance 5.0 ohms or less?	Go to Step 19	Go to Step 20
19	1. Service the instrument cluster. 2. Install the instrument cluster. 3. Has the instrument cluster been installed?	Go to Step 37	—
20	1. Disconnect electrical connector (C203, terminal D7). 2. Check for proper connection at terminal "D7." 3. Is the connector damaged or corroded?	Go to Step 21	Go to Step 22

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Courtesy of General Motors Corp.

Fig. 15: Table C - Air Bag Indicator Does Not Come On (2 Of 4)
Courtesy of General Motors Corp.

TABLE C - AIR BAG WARNING LIGHT DOES NOT COME ON (3 OF 4)

WHEN MEASUREMENTS ARE REQUESTED IN THIS TABLE, USE J 39200 DVM WITH CORRECT TERMINAL ADAPTER FROM J 35616-A. WHEN A CHECK FOR PROPER CONNECTION IS REQUESTED REFER TO "INTERMITTENTS AND POOR CONNECTIONS" IN SECTION 8A-4. WHEN A WIRE, CONNECTOR OR TERMINAL REPAIR IS REQUESTED USE J 38125-A AND REFER TO "WIRING REPAIR" IN THIS SECTION.

Step	Action	Yes	No
21	1. Repair electrical connector (C203, terminal D7). 2. Has the electrical connector been repaired?	Go to Step 37	—
22	1. Measure the resistance of CKT 358 from electrical connector C203 terminal "D7" to the DERM electrical harness connector terminal "B1." 2. Is the resistance 5.0 ohms or less?	Go to Step 23	Go to Step 24
23	1. Repair the open in CKT 358 from C203 to I/P. 2. Has the open CKT been repaired?	Go to Step 37	—
24	1. Repair the open in CKT 358 from C203 to DERM. 2. Has the open CKT been repaired?	Go to Step 37	—
25	1. Ignition switch "OFF." 2. Remove and inspect the "GAUGES" fuse. 3. Is the fuse good?	Go to Step 30	Go to Step 26
26	1. Replace the "GAUGES" fuse. 2. Ignition switch "ON." 3. Wait ten seconds. 4. Ignition switch "OFF." 5. Remove and inspect the "GAUGES" fuse. 6. Is the fuse good?	Go to Step 27	Go to Step 28
27	1. Install the "GAUGES" fuse. 2. Has the fuse been installed?	Go to Step 37	—
28	1. Disconnect the yellow 2-way electrical connector at the base of the steering column. 2. Disconnect the DERM. 3. Replace the "GAUGES" fuse. 4. Ignition switch "OFF." 5. Wait 10 seconds. 6. Ignition switch "OFF." 7. Remove and inspect the "GAUGES" fuse. 8. Is the fuse good?	Go to Table A	Go to Step 29
29	1. Repair the short to ground in CKT 39 or the instrument cluster. 2. Has the short been repaired?	Go to Step 37	—
30	1. Disconnect the instrument cluster. 2. Check for proper connection to the instrument cluster at terminal "28." 3. Is the instrument cluster electrical harness connector damaged or corroded?	Go to Step 31	Go to Step 32
31	1. Repair the instrument cluster electrical harness connector. 2. Has connector been repaired?	Go to Step 32	—
32	1. Check for proper connection to the instrument cluster at terminal "28." 2. Are the instrument cluster terminals damaged or corroded?	Go to Step 33	Go to Step 34
33	1. Service or replace the instrument cluster as needed. 2. Install the instrument cluster. 3. Has the instrument cluster been installed?	Go to Step 37	—

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Fig. 16: Table C - Air Bag Indicator Does Not Come On (3 Of 4)

TABLE C - AIR BAG WARNING LIGHT DOES NOT COME ON (4 OF 4)

WHEN MEASUREMENTS ARE REQUESTED IN THIS TABLE, USE J 39200 DVM WITH CORRECT TERMINAL ADAPTER FROM J 35616-A. WHEN A CHECK FOR PROPER CONNECTION IS REQUESTED REFER TO "INTERMITTENTS AND POOR CONNECTIONS" IN SECTION 8A-4. WHEN A WIRE, CONNECTOR OR TERMINAL REPAIR IS REQUESTED USE J 38125-A AND REFER TO "WIRING REPAIR" IN THIS SECTION.

Step	Action	Yes	No
34	1. Measure the resistance from instrument cluster electrical harness connector terminal "28" to each terminal of the "GAUGES" fuse holder. 2. Is either measurement 5.0 ohms or less?	Go to Step 36	Go to Step 35
35	1. Repair open in CKT 39 between the instrument cluster and the "GAUGES" fuse holder. 2. Has the open CKT been repaired?	Go to Step 37	—
36	1. Repair the open in power feed to the "GAUGES" fuse holder wire. 2. Has the open CKT been repaired?	Go to Step 37	—
37	1. Reconnect all the SIR system components. 2. Ensure the components are properly mounted. 3. Have all the SIR system components been reconnected and properly mounted?	Go to Step 38	—
38	1. Clear all the SIR Diagnostic Trouble Codes. 2. Have the SIR Diagnostic Trouble Codes been cleared?	Go to "SIR Diagnostic System Check"	—

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Fig. 17: Table C - Air Bag Indicator Does Not Come On (4 Of 4)
Courtesy of General Motors Corp.

TABLE D -AIR BAG INDICATOR DOES NOT COME ON STEADY DURING CRANK

WARNING: To avoid air bag deployment and injury when trouble shooting system, only use test equipment specified in diagnostic tables. Under no circumstances should battery powered test equipment or test light be used. Carefully follow all instructions.

Description

When ignition switch is first turned ON, IGNITION 1 voltage is applied from GAUGES fuse to REDUNDANT INDICATOR IGNITION 1, terminal No. B2 and to AIR BAG indicator which is connected to SIR INDICATOR terminal No. B1. AIR BAG fuse applies system voltage to IGNITION 1 inputs, terminal Nos. A9 and A10. DERM responds by flashing AIR BAG indicator 7 times.

When engine is being cranked, Ignition 1 voltage is applied from CRANK fuse to DERM at CRANK input. DERM responds by grounding SIR INDICATOR output until IGNITION 1 voltage is removed from CRANK input. This results in AIR BAG indicator being on during cranking. After cranking, DERM will flash AIR BAG indicator 6 times.

NOTE: Test numbers refer to test numbers on diagnostic table. For circuit number identification, see WIRING DIAGRAM.

1) The SIR DIAGNOSTIC SYSTEM CHECK must be starting point for all diagnostics.

2) This test checks whether malfunction is due to an open CRANK fuse.

9) This test determines if lack of proper crank signal is due to an open CRANK input circuit or an open power feed to CRANK fuse.

13) This test determines where open in CKT 806/1035 is located.

16) This test checks whether CRANK fuse is open due to short

to ground in CRANK input circuit.

17) This test checks whether short to ground is in wiring harness.

TABLE D - AIR BAG WARNING LIGHT DOES NOT COME ON STEADY DURING CRANK (1 OF 3)

WHEN MEASUREMENTS ARE REQUESTED IN THIS TABLE, USE J 39200 DVM WITH CORRECT TERMINAL ADAPTER FROM J 35616-A. WHEN A CHECK FOR PROPER CONNECTION IS REQUESTED REFER TO "INTERMITTENTS AND POOR CONNECTIONS" IN SECTION 8A-4. WHEN A WIRE, CONNECTOR OR TERMINAL REPAIR IS REQUESTED USE J 38125-A AND REFER TO "WIRING REPAIR" IN THIS SECTION.

Step	Action	Yes	No
1	1. Was the "SIR Diagnostic System Check" performed?	Go to Step 2	Go to "SIR Diagnostic System Check"
2	1. Ignition switch "OFF." 2. Remove and inspect the "CRANK" fuse. 3. Is the fuse good?	Go to Step 3	Go to Step 16
3	1. Install "CRANK" fuse. 2. Disconnect yellow 2-way connector located near the base of the steering column. 3. Disconnect the DERM. 4. Check for proper connection to the DERM at terminal "B10." 5. Is the DERM electrical harness connector damaged or corroded?	Go to Step 4	Go to Step 6
4	1. Repair the DERM electrical harness connector. 2. Has the connector been repaired?	Go to Step 5	—
5	1. Check for proper connection to the DERM at terminal "B10." 2. Are the DERM terminals damaged or corroded?	Go to Step 7	Go to Step 19
6	1. Check for proper connection to the DERM at terminal "B10." 2. Are the DERM terminals damaged or corroded?	Go to Step 7	Go to Step 8
7	1. Replace the DERM. 2. Has the DERM been replaced?	Go to Step 19	—

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Fig. 18: Table D - Air Bag Indicator Does Not Come On Steady During Crank (1 Of 3)

Courtesy of General Motors Corp.

TABLE D - AIR BAG WARNING LIGHT DOES NOT COME ON STEADY DURING CRANK (2 OF 3)

WHEN MEASUREMENTS ARE REQUESTED IN THIS TABLE, USE J 39200 DVM WITH CORRECT TERMINAL ADAPTER FROM J 35616-A. WHEN A CHECK FOR PROPER CONNECTION IS REQUESTED REFER TO "INTERMITTENTS AND POOR CONNECTIONS" IN SECTION 8A-4. WHEN A WIRE, CONNECTOR OR TERMINAL REPAIR IS REQUESTED USE J 38125-A AND REFER TO "WIRING REPAIR" IN THIS SECTION.

Step	Action	Yes	No
8	1. Install the "CRANK" fuse. 2. Disconnect the yellow 2-way electrical connector at the base of the steering column. 3. Measure the voltage on the DERM electrical harness connector from terminal "B10" to terminal "A1" (ground) while starting engine. 4. Is the voltage greater than 7.25 volts?	Go to Table A	Go to Step 9
9	1. Igntion switch "OFF." 2. Remove the "CRANK" fuse. 3. Measure the resistance from each terminal of the fuse holder to the DERM electrical harness connector terminal "B10." 4. Is either measurement 5.0 ohms or less?	Go to Step 10	Go to Step 11
10	1. Repair the open in the power feed to the "CRANK" fuse. 2. Has the power feed been repaired?	Go to Step 19	—
11	1. Disconnect electrical connector 2. Check terminal "A8" for proper connection. 3. Is the connector damaged or corroded?	Go to Step 12	Go to Step 13
12	1. Repair electrical connector 2. Has the connector been repaired?	Go to Step 19	—
13	1. Measure the resistance of CKT 806/1035 from DERM electrical harness connector terminal "B10" to electrical connector C203 terminal "A8." 2. Is the resistance 5.0 ohms or less?	Go to Step 14	Go to Step 15
14	1. Repair the open in CKT 806/1035 between connector C203 and "CRANK" fuse. 2. Has the open CKT been repaired?	Go to Step 19	—
15	1. Repair the open in CKT 806/1035 between DERM terminal B10 and connector C203. 2. Has the open CKT been repaired?	Go to Step 19	—
16	1. Replace the "CRANK" fuse. 2. Start the engine. 3. Ignition switch "OFF." 4. Remove and inspect the "CRANK" fuse. 5. Is the fuse good?	Go to Step 19	Go to Step 17
17	1. Disconnect the yellow 2-way electrical connector at the base of the steering column. 2. Disconnect the DERM. 3. Replace the "CRANK" fuse. 4. Start the engine. 5. Ignition switch "OFF." 6. Remove and inspect the "CRANK" fuse. 7. Is the fuse good?	Go to Table A	Go to Step 18
18	1. Repair the short from CKT 806/1035 to ground. 2. Has the short CKT been repaired?	Go to Step 19	—

97H05614 Courtesy of General Motors Corp.

Fig. 19: Table D - Air Bag Indicator Does Not Come On Steady During Crank (2 Of 3)

Courtesy of General Motors Corp.

TABLE D - AIR BAG WARNING LIGHT DOES NOT COME ON STEADY DURING CRANK (3 OF 3)

WHEN MEASUREMENTS ARE REQUESTED IN THIS TABLE, USE J 39200 DVM WITH CORRECT TERMINAL ADAPTER FROM J 35616-A. WHEN A CHECK FOR PROPER CONNECTION IS REQUESTED REFER TO "INTERMITTENTS AND POOR CONNECTIONS" IN SECTION 8A-4. WHEN A WIRE, CONNECTOR OR TERMINAL REPAIR IS REQUESTED USE J 38125-A AND REFER TO "WIRING REPAIR" IN THIS SECTION.

Step	Action	Yes	No
19	1. Reconnect all the SIR components. 2. Ensure the components are properly mounted. 3. Have all the SIR components been reconnected and properly mounted?	Go to Step 20	—
20	1. Clear the SIR Diagnostic Trouble Codes. 2. Have the SIR Diagnostic Trouble Codes been cleared?	Go to "SIR Diagnostic System Check"	—

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Fig. 20: Table D - Air Bag Indicator Does Not Come On Steady During Crank (3 Of 3)
Courtesy of General Motors Corp.

DTC B1014 - ARMING SENSOR DISCONNECTED

WARNING: To avoid air bag deployment and injury when trouble shooting system, only use test equipment specified in diagnostic tables. Under no circumstances should battery powered test equipment or test light be used. Carefully follow all instructions.

Description

DERM monitors voltage at DRIVER SOURCE SENSE terminal No. A5, DRIVER-SIDE HIGH terminal No. B9 and DRIVER-SIDE LOW terminal No. B8 during CONTINUOUS MONITORING tests. When all voltages are simultaneously below a specified value for 500 milliseconds, DTC B1014 sets.

DTC Will Set

When voltages at terminal Nos. A5, B9 and B8 of DERM harness connector are simultaneously below a specified value for 500 milliseconds.

Action Taken

DERM turns on AIR BAG indicator and sets a diagnostic trouble code.

DTC Will Clear

When voltage at terminal Nos. A5, B9 and B8 of DERM harness connector is above a specified value for 500 milliseconds.

Diagnostic Aids

It is highly unlikely that an intermittent condition has set this diagnostic trouble code as this would require a poor connection at terminal Nos. A and B or terminal Nos. C and D.

NOTE: Test numbers refer to test numbers on diagnostic table. For circuit number identification, see WIRING DIAGRAM.

1) The SIR DIAGNOSTIC SYSTEM CHECK must be starting point for

all diagnostics.

2) This test checks for proper connection at arming sensor jumper harness electrical connector.

3) This test checks for proper connection of arming sensor to SIR wiring harness.

DTC B1014 - ARMING SENSOR DISCONNECTED

WHEN MEASUREMENTS ARE REQUESTED IN THIS TABLE, USE J 39200 DVM WITH CORRECT TERMINAL ADAPTER FROM J 35616-A. WHEN A CHECK FOR PROPER CONNECTION IS REQUESTED REFER TO "INTERMITTENTS AND POOR CONNECTIONS" IN SECTION 8A-4. WHEN A WIRE, CONNECTOR OR TERMINAL REPAIR IS REQUESTED USE J 38125-A AND REFER TO "WIRING REPAIR" IN THIS SECTION.

Step	Action	Yes	No
1	1. Was the "SIR Diagnostic System Check" performed?	Go to Step 2	Go to "SIR Diagnostic System Check"
2	1. Ignition switch "OFF." 2. Disconnect the yellow 2-way electrical connector at the base of the steering column. 3. Disconnect the Arming Sensor jumper harness electrical connector C110 and reconnect. 4. Reconnect the yellow 2-way electrical connector at the base of the steering column. 5. Ignition switch "ON." 6. Is DTC B1014 current?	Go to Step 3	Go to Step 4
3	1. Ignition switch "OFF." 2. Disconnect the yellow 2-way electrical connector at the base of the steering column. 3. Disconnect the Arming Sensor electrical harness connector from the Arming Sensor and reconnect. 4. Reconnect the yellow 2-way electrical connector at the base of the steering column. 5. Ignition switch "ON." 6. Is DTC B1014 current?	Go to Table A	Go to Step 4
4	1. Clear the SIR Diagnostic Trouble Codes. 2. Have the SIR Diagnostic Trouble Codes been cleared?	Go to "SIR Diagnostic System Check"	—

97A05615 Courtesy of General Motors Corp.

Fig. 21: DTC B1014 - Arming Sensor Disconnected
Courtesy of General Motors Corp.

DTC B1021 - DRIVER INITIATOR CIRCUIT RESISTANCE HIGH

WARNING: To avoid air bag deployment and injury when trouble shooting system, only use test equipment specified in diagnostic tables. Under no circumstances should battery powered test equipment or test light be used. Carefully follow all instructions.

Description

During INITIATOR ASSEMBLY RESISTANCE test, DERM grounds DRIVER-SIDE LOW terminal No. B8 and turns on driver current source at DRIVER-SIDE HIGH terminal No. B9. This causes a known amount of current flow through driver initiator circuit. By monitoring difference between voltage at DRIVER-SIDE HIGH terminal No. B9 and DRIVER-SIDE LOW terminal No. B8, DERM calculates combined resistance of driver-side air bag module, SIR coil assembly, harness wiring CKTs 347 and 348 and connector terminal contact.

DTC Will Set

When the combined resistance of the driver-side air bag module, SIR coil assembly, harness wiring CKTs 347 and 348 and connector terminal contact is above a specified value. This test is run once each ignition cycle during INITIATOR ASSEMBLY RESISTANCE test when:

1) No higher priority faults are detected during Turn ON.
2) No higher priority faults are detected during CONTINUOUS MONITORING for 1 second.
3) No CRANK signal present.
4) IGNITION 1 voltage is above a specified value.

Action Taken

DERM turns on AIR BAG indicator and sets a diagnostic trouble code.

DTC Will Clear

When ignition switch is turned OFF.

Diagnostic Aids

An intermittent condition is likely to be caused by poor connection at Yellow 2-way connector at base of steering column, DERM terminal Nos. B8 or B9, or connection at top of steering column to driver-side air bag module. The test for this diagnostic trouble code is only run while AIR BAG indicator is performing BULB TEST. When scan tool CLEAR CODES command is issued and malfunction is still present, DTC will not reappear until next ignition cycle.

NOTE: Test numbers refer to test numbers on diagnostic table. For circuit number identification, see WIRING DIAGRAM.

1) The SIR DIAGNOSTIC SYSTEM CHECK must be starting point for all diagnostics.
7) This test checks for terminal deformation or contamination.
8) This test checks whether malfunction is in driver-side air bag module circuit or in DERM wiring harness circuit.
9) This test determines whether the malfunction is in driver-side air bag module or in SIR coil assembly.
16) This test checks for high resistance in DRIVER-SIDE LOW circuit.
18) This test checks for high resistance in DRIVER-SIDE HIGH circuit.

DTC B1021 - DRIVER INITIATOR CIRCUIT RESISTANCE HIGH (1 OF 2)

WHEN MEASUREMENTS ARE REQUESTED IN THIS TABLE, USE J 39200 DVM WITH CORRECT TERMINAL ADAPTER FROM J 35616-A. WHEN A CHECK FOR PROPER CONNECTION IS REQUESTED REFER TO "INTERMITTENTS AND POOR CONNECTIONS" IN SECTION 8A-4. WHEN A WIRE, CONNECTOR OR TERMINAL REPAIR IS REQUESTED USE J 38125-A AND REFER TO "WIRING REPAIR" IN THIS SECTION.

Step	Action	Yes	No
1	1. Was the "SIR Diagnostic System Check" performed?	Go to Step 2	Go to "SIR Diagnostic System Check"
2	1. Ignition switch "OFF." 2. Disconnect the yellow 2-way electrical connector at the base of the steering column. 3. Check for proper connection at terminals "A" and "B" on the harness side of the 2-way electrical connector. 4. Are the terminals damaged or corroded?	Go to Step 3	Go to Step 5
3	1. Repair the yellow 2-way electrical connector at the base of the steering column. 2. Has the connector been repaired?	Go to Step 4	—
4	1. Check for proper connection at terminals "A" and "B" on the SIR coil assembly side of the 2-way connector. 2. Are the terminals damaged or corroded?	Go to Step 6	Go to Step 20
5	1. Check for proper connection at terminals "A" and "B" on the SIR coil assembly side of the 2-way connector. 2. Are the terminals damaged or corroded?	Go to Step 6	Go to Step 7
6	1. Replace the SIR coil assembly. 2. Has the SIR coil assembly been replaced?	Go to Step 20	—
7	1. Reconnect the yellow 2-way electrical connector at the base of the steering column. 2. Ignition switch "ON." 3. Is DTC B1021 current?	Go to Step 8	Go to Step 3
8	1. Ignition switch "OFF." 2. Disconnect the yellow 2-way electrical connector at the base of the steering column and connect harness side to J 38715-A SIR Driver/Passenger Load Tool. 3. Ignition switch "ON." 4. Is DTC B1021 current?	Go to Step 11	Go to Step 9

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Fig. 22: DTC B1021 - Driver Initiator Circuit Resistance High (1 Of 2)
Courtesy of General Motors Corp.

DTC B1021 - DRIVER INITIATOR CIRCUIT RESISTANCE HIGH (2 OF 2)

WHEN MEASUREMENTS ARE REQUESTED IN THIS TABLE, USE J 39200 DVM WITH CORRECT TERMINAL ADAPTER FROM J 35616-A. WHEN A CHECK FOR PROPER CONNECTION IS REQUESTED REFER TO "INTERMITTENTS AND POOR CONNECTIONS" IN SECTION 8A-4. WHEN A WIRE, CONNECTOR OR TERMINAL REPAIR IS REQUESTED USE J 38125-A AND REFER TO "WIRING REPAIR" IN THIS SECTION.

Step	Action	Yes	No
9	1. Ignition switch "OFF." 2. Remove the Inflator Module from the steering wheel. 3. Reconnect yellow 2-way electrical connector at the base of the steering column. 4. Connect J 38715-A to SIR coil assembly connector on the steering column. 5. Ignition switch "ON." 6. Is DTC B1021 current?	Go to Step 6	Go to Step 10
10	1. Ignition switch "OFF." 2. Replace the Inflator Module. 3. Has the Inflator Module been replaced?	Go to Step 20	—
11	1. Ignition switch "OFF." 2. Disconnect J 38715-A. 3. Disconnect the DERM. 4. Check for proper connection to the DERM at terminals "B8" and "B9." 5. Is the DERM electrical harness connector damaged or corroded?	Go to Step 12	Go to Step 14
12	1. Repair the DERM electrical harness connector. 2. Has the connector been repaired?	Go to Step 13	—
13	1. Check for proper connection to the DERM at terminals "B8" and "B9." 2. Are the DERM terminals damaged or corroded?	Go to Step 15	Go to Step 20
14	1. Check for proper connection to the DERM at terminals "B8" and "B9." 2. Are the DERM terminals damaged or corroded?	Go to Step 15	Go to Step 16
15	1. Ignition switch "OFF." 2. Replace the DERM. 3. Has the DERM been replaced?	Go to Step 20	—
16	1. Measure the resistance from the DERM electrical harness connector terminal "B8" to the yellow 2-way electrical connector terminal "B." 2. Is the resistance 1.0 ohm or less?	Go to Step 18	Go to Step 17
17	1. Repair the high resistance in CKT 348. 2. Has the high resistance been repaired?	Go to Step 20	—
18	1. Measure the resistance from the DERM electrical harness connector terminal "B9" to the yellow 2-way electrical connector terminal "A." 2. Is the resistance 1.0 ohm or less?	Go to Table A	Go to Step 19
19	1. Repair the high resistance in CKT 347. 2. Has the high resistance been repaired?	Go to Step 20	—
20	1. Reconnect all the SIR system components. 2. Ensure the components are properly mounted. 3. Have all the SIR components been reconnected and properly mounted?	Go to Step 21	—
21	1. Clear the SIR Diagnostic Trouble Codes. 2. Have the SIR Diagnostic Trouble Codes been cleared?	Go to "SIR Diagnostic System Check"	—

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Fig. 23: DTC B1021 - Driver Initiator Circuit Resistance High (2 Of 2)
Courtesy of General Motors Corp.

DTC B1022 - DRIVER INITIATOR CIRCUIT RESISTANCE LOW

WARNING: To avoid air bag deployment and injury when trouble shooting system, only use test equipment specified in diagnostic tables. Under no circumstances should battery powered test equipment or test light be used. Carefully follow all instructions.

Description

During INITIATOR ASSEMBLY RESISTANCE test, DERM grounds DRIVER-SIDE LOW terminal No. B8 and turns on driver current source at DRIVER-SIDE HIGH terminal No. B9. This causes a known amount of current flow through driver initiator circuit. By monitoring difference between voltage at DRIVER-SIDE HIGH terminal No. B9 and DRIVER-SIDE LOW terminal No. B8, DERM calculates combined resistance of driver-side air bag module, SIR coil assembly, harness wiring CKTs 347 and 348 and connector terminal contact.

DTC Will Set

When the combined resistance of the driver-side air bag module, SIR coil assembly, harness wiring CKTs 347 and 348 and connector terminal contact is above a specified value. This test is run once each ignition cycle during INITIATOR ASSEMBLY RESISTANCE test when:

1) No higher priority faults are detected during Turn ON.
2) No higher priority faults are detected during CONTINUOUS MONITORING for 1 second.
3) No CRANK signal is present.
4) IGNITION 1 voltage is above a specified value

Action Taken

DERM turns on AIR BAG indicator and sets a diagnostic trouble code.

DTC Will Clear

When ignition switch is turned OFF.

Diagnostic Aids

An intermittent condition is likely to be caused by a short between CKT 347 and CKT 348, or a malfunctioning shorting bar on driver-side air bag module or SIR coil assembly which would require replacement of component. The test for this diagnostic trouble code is only run while AIR BAG indicator is performing BULB TEST. When scan tool CLEAR CODES command is issued and malfunction is still present, DTC will not reappear until next ignition cycle.

NOTE: Test numbers refer to test numbers on diagnostic table. For circuit number identification, see WIRING DIAGRAM.

1) The SIR DIAGNOSTIC SYSTEM CHECK must be starting point for all diagnostics.
2) This test checks for proper connector engagement.
3) This test determines if problem is in steering column or SIR harness.
4) This test checks for short between CKTs 347 and 348.
6) This test isolates the malfunction to either the SIR coil assembly or air bag module.

DTC B1022 - DRIVER INITIATOR CIRCUIT RESISTANCE LOW (1 OF 2)

WHEN MEASUREMENTS ARE REQUESTED IN THIS TABLE, USE J 39200 DVM WITH CORRECT TERMINAL ADAPTER FROM J 35616-A. WHEN A CHECK FOR PROPER CONNECTION IS REQUESTED REFER TO "INTERMITTENTS AND POOR CONNECTIONS" IN SECTION 8A-4. WHEN A WIRE, CONNECTOR OR TERMINAL REPAIR IS REQUESTED USE J 38125-A AND REFER TO "WIRING REPAIR" IN THIS SECTION.

Step	Action	Yes	No
1	1. Was the "SIR Diagnostic System Check" performed?	Go to Step 2	Go to "SIR Diagnostic System Check"
2	1. Ignition switch "OFF." 2. Disconnect the yellow 2-way electrical connector at the base of the steering column. 3. Reconnect the yellow 2-way electrical connector at the base of the steering column. 4. Ensure connector is properly seated and CPA is installed properly. 5. Ignition switch "ON." 6. Is DTC B1022 current?	Go to Step 3	Go to Step 9
3	1. Ignition switch "OFF." 2. Disconnect the yellow 2-way electrical connector at the base of the steering column. 3. Connect J 38715-A Driver/Passenger Load Tool to harness side of the yellow 2-way electrical connector at the base of the steering column. 4. Ignition switch "ON." 5. Is DTC B1022 current?	Go to Step 4	Go to Step 6
4	1. Ignition switch "OFF." 2. Disconnect J 38715-A (**DO NOT** reconnect yellow 2-way connector at the base of the steering column). 3. Disconnect the DERM. 4. Measure the resistance on the DERM electrical harness connector from terminal "B8" to terminal "B9." 5. Does J 39200 display "OL" (infinite)?	Go to Table A	Go to Step 5
5	1. Repair the short from CKT 347 to CKT 348. 2. Has the short been repaired?	Go to Step 9	—
6	1. Ignition switch "OFF." 2. Disconnect J 38715-A. 3. Remove the Inflator Module from the steering wheel. 4. Connect J 38715-A to inflator module connector on steering column and reconnect yellow 2-way connector at the base of the steering column. 5. Ignition switch "ON." 6. Is DTC B1022 current?	Go to Step 7	Go to Step 8

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Fig. 24: DTC B1022 - Driver Initiator Circuit Resistance Low (1 Of 2)

DTC B1022 - DRIVER INITIATOR CIRCUIT RESISTANCE LOW (2 OF 2)

WHEN MEASUREMENTS ARE REQUESTED IN THIS TABLE, USE J 39200 DVM WITH CORRECT TERMINAL ADAPTER FROM J 35616-A. WHEN A CHECK FOR PROPER CONNECTION IS REQUESTED REFER TO "INTERMITTENTS AND POOR CONNECTIONS" IN SECTION 8A-4. WHEN A WIRE, CONNECTOR OR TERMINAL REPAIR IS REQUESTED USE J 38125-A AND REFER TO "WIRING REPAIR" IN THIS SECTION.

Step	Action	Yes	No
7	1. Ignition switch "OFF." 2. Replace the SIR coil assembly. 3. Has the SIR coil assembly been replaced?	Go to Step 9	—
8	1. Ignition switch "OFF." 2. Replace the Inflator Module. 3. Has the Inflator Module been replaced?	Go to Step 9	—
9	1. Reconnect all the SIR system components. 2. Ensure the component are properly mounted. 3. Have all the SIR components been reconnected and properly mounted?	Go to Step 10	—
10	1. Clear the SIR Diagnostic Trouble Codes. 2. Have the SIR Diagnostic Trouble Codes been cleared?	Go to "SIR Diagnostic System Check"	—

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Fig. 25: DTC B1022 - Driver Initiator Circuit Resistance Low (2 Of 2)
Courtesy of General Motors Corp.

DTC B1023 - DRIVER INITIATOR CIRCUIT VOLTAGE HIGH

WARNING: To avoid air bag deployment and injury when trouble shooting system, only use test equipment specified in diagnostic tables. Under no circumstances should battery powered test equipment or test light be used. Carefully follow all instructions.

Description

During normal, non-deployment operation, a small amount of current flows through driver deployment loop. Diagnosis resistors within arming sensor and discriminating sensors, along with resistance of air bag module, cause voltage drops within deployment loop. DERM monitors voltage at DRIVER-SIDE LOW terminal No. B8 to detect shorts or opens within driver deployment loop. When measured voltage is above a specified percentage of DRIVER 36 VLR for 500 milliseconds, DTC B1023 will set.

DTC Will Set

When voltage measured at DRIVER-SIDE LOW terminal No. B8 is above a specified percentage of DRIVER 36 VLR for 500 milliseconds during CONTINUOUS MONITORING and DTC B1035 is not set.

Action Taken

DERM turns on AIR BAG indicator and sets a diagnostic trouble code.

DTC Will Clear

When voltage measured at DRIVER-SIDE LOW terminal No. B8 is within a specified percentage of DRIVER 36 VLR for 500 milliseconds during CONTINUOUS MONITORING.

Diagnostic Aids

An intermittent condition is likely to be caused by backed out or shorted terminals on arming sensor harness connector, poor connection at any of the discriminating sensor terminals, a short from CKT 236 to CKT 347 or CKT 348, a short from CKT 347 to CKT 1400, or an open or high resistance in CKTs 348.

NOTE: Test numbers refer to test numbers on diagnostic table. For circuit number identification, see WIRING DIAGRAM.

1) The SIR DIAGNOSTIC SYSTEM CHECK must be starting point for all diagnostics.

2) This test checks whether malfunction is due to a component or the wiring.

3) This test checks for short from DRIVER 36 VLR circuit to DRIVER-SIDE LOW circuit.

5) This test checks for short from DRIVER 36 VLR circuit to DRIVER-SIDE HIGH circuit.

6) This test determines where the short from DRIVER 36 VLR circuit to DRIVER-SIDE HIGH circuit is located.

13) This test checks for open between driver-side air bag module and discriminating sensor network.

16) This test determines where the open in CKT 348 is located.

19) This test checks for open in left forward discriminating sensor between terminal Nos. A and B.

20) This test checks for short inside arming sensor.

23) This test checks for short in DRIVER-SIDE HIGH circuit to the DRIVER-SIDE LOW circuit.

26) This test determines where the short from DRIVER-SIDE HIGH circuit to the DRIVER-SIDE LOW circuit is located.

29) This test checks for partial short inside arming sensor.

32) This test checks for increased resistance of discriminating sensor intermediate harness and/or the left forward discriminating sensor.

37) This test checks for increased resistance of left forward discriminating sensor.

38) This test checks for increased resistance of discriminating sensor intermediate harness and/or the right forward discriminating sensor.

43) This test checks for increased resistance of right forward discriminating sensor.

DTC B1023 - DRIVER INITIATOR CIRCUIT VOLTAGE HIGH (1 OF 5)

WHEN MEASUREMENTS ARE REQUESTED IN THIS TABLE, USE J 39200 DVM WITH CORRECT TERMINAL ADAPTER FROM J 35616-A. WHEN A CHECK FOR PROPER CONNECTION IS REQUESTED REFER TO "INTERMITTENTS AND POOR CONNECTIONS" IN SECTION 8A-4. WHEN A WIRE, CONNECTOR OR TERMINAL REPAIR IS REQUESTED USE J 38125-A AND REFER TO "WIRING REPAIR" IN THIS SECTION.

Step	Action	Yes	No
1	1. Was the "SIR Diagnostic System Check" performed?	Go to Step 2	Go to "SIR Diagnostic System Check"
2	1. Ignition switch "ON." 2. Using the Tech-1 SIR Data List function select "DRIVER LO." 3. Is the displayed voltage 30.0 volts or more?	Go to Step 3	Go to Step 21
3	1. Ignition switch "OFF." 2. Disconnect the yellow 2-way electrical connector at the base of the steering column. 3. Disconnect the Arming Sensor. 4. Disconnect the DERM. 5. Measure the resistance on the DERM electrical harness connector from terminal "A4" to terminal "B8." 6. Does J 39200 display "OL" (infinite)?	Go to Step 5	Go to Step 4
4	1. Repair the short from CKT 236 to CKT 348 or 349. 2. Has the short from CKT 236 to CKT 348 or 349 been repaired?	Go to Step 47	—
5	1. Measure the resistance on the DERM electrical harness connector from terminal "A4" to terminal "B9." 2. Does J 39200 display "OL" (infinite)?	Go to Step 9	Go to Step 6

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Fig. 26: DTC B1023 - Driver Initiator Circuit Voltage High (1 Of 5)
Courtesy of General Motors Corp.

DTC B1023 - DRIVER INITIATOR CIRCUIT VOLTAGE HIGH (2 OF 5)

WHEN MEASUREMENTS ARE REQUESTED IN THIS TABLE, USE J 39200 DVM WITH CORRECT TERMINAL ADAPTER FROM J 35616-A. WHEN A CHECK FOR PROPER CONNECTION IS REQUESTED REFER TO "INTERMITTENTS AND POOR CONNECTIONS" IN SECTION 8A-4. WHEN A WIRE, CONNECTOR OR TERMINAL REPAIR IS REQUESTED USE J 38125-A AND REFER TO "WIRING REPAIR" IN THIS SECTION.

Step	Action	Yes	No
6	1. Disconnect the Arming Sensor jumper harness electrical connector (C106). 2. Measure the resistance on the DERM electrical harness connector from terminal "A4" to terminal "B9." 3. Does J 39200 display "OL" (infinite)?	Go to Step 7	Go to Step 8
7	1. Repair the short from CKT 236 to CKT 347. 2. Has the short from CKT 236 to CKT 347 been repaired?	Go to Step 47	—
8	1. Repair the short from CKT 236 to CKT 347. 2. Has the short from CKT 236 to CKT 347 been repaired?	Go to Step 47	—
9	1. Disconnect the LH Forward Discriminating Sensor. 2. Check for proper connection on the LH Forward Discriminating Sensor electrical harness connector terminals. 3. Is the connector damaged or corroded?	Go to Step 11	Go to Step 10
10	1. Check for proper connection at the LH Forward Discriminating Sensor terminals. 2. Are the LH Forward Discriminating Sensor terminals damaged or corroded?	Go to Step 44	Go to Step 13
11	1. Repair the LH Forward Discriminating Sensor electrical harness connector. 2. Has the connector been repaired?	Go to Step 12	—
12	1. Check for proper connection on the LH Forward Discriminating Sensor terminals. 2. Are the LH Forward Discriminating Sensor terminals damaged or corroded?	Go to Step 44	Go to Step 47
13	1. Measure the resistance from the harness side of the yellow 2-way electrical connector at the base of the steering column terminal "B" to the LH Forward Discriminating Sensor electrical harness electrical connector terminal "A." 2. Is the resistance 5.0 ohms or less?	Go to Step 19	Go to Step 14
14	1. Disconnect the Discriminating Sensor jumper harness electrical connector C109. 2. Check for proper connection at terminal "A" of the Discriminating Sensor jumper harness electrical connector. 3. Is the connector damaged or corroded?	Go to Step 15	Go to Step 16
15	1. Repair the Discriminating Sensor jumper harness electrical connector C109. 2. Has the connector been repaired?	Go to Step 47	—
16	1. Measure the resistance of CKT 348 from the harness side of the yellow 2-way electrical connector at the base of the steering column terminal "B" to the Discriminating Sensor jumper harness electrical connector C109. terminal "A." 2. Is the resistance 5.0 ohms or less?	Go to Step 17	Go to Step 18
17	1. Repair the open in CKT 348. 2. Has the open CKT been repaired?	Go to Step 47	—
18	1. Repair the open in CKT 348. 2. Has the open CKT 348 been repaired?	Go to Step 47	—

97C05616 Courtesy of General Motors Corp.

Fig. 27: DTC B1023 - Driver Initiator Circuit Voltage High (2 Of 5)
Courtesy of General Motors Corp.

DTC B1023 - DRIVER INITIATOR CIRCUIT VOLTAGE HIGH (3 OF 5)

WHEN MEASUREMENTS ARE REQUESTED IN THIS TABLE, USE J 39200 DVM WITH CORRECT TERMINAL ADAPTER FROM J 35616-A. WHEN A CHECK FOR PROPER CONNECTION IS REQUESTED REFER TO "INTERMITTENTS AND POOR CONNECTIONS" IN SECTION 8A-4. WHEN A WIRE, CONNECTOR OR TERMINAL REPAIR IS REQUESTED USE J 38125-A AND REFER TO "WIRING REPAIR" IN THIS SECTION.

Step	Action	Yes	No
19	1. Measure the resistance on the LH Forward Discriminating Sensor from terminal "A" to terminal "B." 2. Is the resistance 5.0 ohms or less?	Go to Step 20	Go to Step 44
20	1. Measure the resistance on the Arming Sensor from terminal "C" to terminal "D." 2. Is the resistance 7.5k ohms or less?	Go to Step 46	Go to Table A
21	1. Ignition switch "OFF." 2. Disconnect the yellow 2-way electrical connector at the base of the steering column. 3. Disconnect the Arming Sensor. 4. Disconnect the DERM. 5. Inspect the Arming Sensor electrical harness connector for backed out and/or shorted terminals. 6. Is the Arming Sensor electrical harness connector damaged or shorted?	Go to Step 22	Go to Step 23
22	1. Repair the Arming Sensor electrical harness connector. 2. Has the connector been repaired?	Go to Step 47	—
23	1. Measure the resistance on the Arming Sensor electrical harness connector from terminal "C" to terminal "D." 2. Does J 39200 display "OL" (infinite)?	Go to Step 29	Go to Step 24
24	1. Disconnect the Arming Sensor jumper harness electrical connector C110. 2. Inspect the Arming Sensor jumper harness electrical connector C110 for backed out and/or shorted terminals. 3. Is the connector damaged or shorted?	Go to Step 25	Go to Step 26
25	1. Repair the Arming Sensor jumper harness connector C110. 2. Has the connector been repaired?	Go to Step 47	—
26	1. Measure the resistance on the Arming Sensor jumper harness electrical connector (bulkhead side) from terminal "C" to terminal "D." 2. Does J 39200 display "OL" (infinite)?	Go to Step 28	Go to Step 27
27	1. Repair the short from CKT 347 to CKT 1400. 2. Has the short CKT been repaired?	Go to Step 47	—
28	1. Repair the short from CKT 347 to CKT 1400. 2. Has the short from CKT 347 to CKT 1400 been repaired?	Go to Step 47	—
29	1. Measure the resistance on the Arming Sensor from terminal "C" to terminal "D." 2. Is the resistance 7.5k ohms or less?	Go to Step 46	Go to Step 30
30	1. Disconnect the Discriminating Sensor jumper harness electrical connector C109. 2. Inspect the Discriminating Sensor jumper harness electrical connector C109. 3. Are the connector terminals damaged or corroded?	Go to Step 31	Go to Step 32
31	1. Repair the Discriminating Sensor jumper harness electrical connector C109. 2. Has the connector been repaired?	Go to Step 47	—

97E05617 Courtesy of General Motors Corp.

Fig. 28: DTC B1023 - Driver Initiator Circuit Voltage High (3 Of 5)
Courtesy of General Motors Corp.

DTC B1023 - DRIVER INITIATOR CIRCUIT VOLTAGE HIGH (4 OF 5)

WHEN MEASUREMENTS ARE REQUESTED IN THIS TABLE, USE J 39200 DVM WITH CORRECT TERMINAL ADAPTER FROM J 35616-A. WHEN A CHECK FOR PROPER CONNECTION IS REQUESTED REFER TO "INTERMITTENTS AND POOR CONNECTIONS" IN SECTION 8A-4. WHEN A WIRE, CONNECTOR OR TERMINAL REPAIR IS REQUESTED USE J 38125-A AND REFER TO "WIRING REPAIR" IN THIS SECTION.

Step	Action	Yes	No
32	1. Measure the resistance at the Discriminating Sensor jumper harness electrical connector C109 (engine harness side) from terminal "A" to terminal "B." 2. Is the resistance 8.54k ohms or more?	Go to Step 33	Go to Step 38
33	1. Disconnect the LH Forward Discriminating Sensor. 2. Check for proper connection on the LH Forward Discriminating Sensor electrical harness connector terminals "A," "B" and "C." 3. Are the connector terminals damaged or corroded?	Go to Step 34	Go to Step 36
34	1. Repair the LH Forward Discriminating Sensor electrical harness connector. 2. Has the connector been repaired?	Go to Step 35	—
35	1. Check for proper connection on the LH Forward Discriminating Sensor connector terminals "A," "B" and "C." 2. Are the connector terminals damaged or corroded?	Go to Step 44	Go to Step 47
36	1. Check for proper connection on the LH Forward Discriminating Sensor connector terminals "A," "B" and "C." 2. Are the connector terminals damaged or corroded?	Go to Step 44	Go to Step 37
37	1. Measure the resistance on the LH Forward Discriminating Sensor from terminal "A" to terminal "C." 2. Is the resistance 8.54k ohms or more?	Go to Step 44	Go to Step 38
38	1. Reconnect LH Foward Discriminating Sensor if disconnected. 2. Measure the resistance at the Discriminating Sensor jumper harness electrical connector C109 (engine harness side) from terminal "A" to terminal "C." 3. Is the resistance 8.54k ohms or more?	Go to Step 39	Go to Table A
39	1. Disconnect the RH Forward Discriminating Sensor. 2. Check for proper connection to the RH Forward Discriminating Sensor electrical harness connector at terminals "A" and "B." 3. Are the connector terminals damaged or corroded?	Go to Step 40	Go to Step 42
40	1. Repair the RH Forward Discriminating Sensor electrical harness connector. 2. Has the connector been repaired?	Go to Step 41	—
41	1. Check for proper connection on the RH Forward Discriminating Sensor connector terminals "A" and "B." 2. Is the connector damaged or corroded?	Go to Step 45	Go to Step 47
42	1. Check for proper connection on the RH Forward Discriminating Sensor connector terminals "A" and "B." 2. Is the connector damaged or corroded?	Go to Step 45	Go to Step 43
43	1. Measure the resistance on the RH Forward Discriminating Sensor from terminal "A" to terminal "B." 2. Is the resistance 8.54k ohms or more?	Go to Step 45	Go to Table A
44	1. Replace the LH Forward Discriminating Sensor. 2. Has the sensor been replaced?	Go to Step 47	—

97G05618 Courtesy of General Motors Corp.

Fig. 29: DTC B1023 - Driver Initiator Circuit Voltage High (4 Of 5)
Courtesy of General Motors Corp.

DTC B1023 - DRIVER INITIATOR CIRCUIT VOLTAGE HIGH (5 OF 5)

WHEN MEASUREMENTS ARE REQUESTED IN THIS TABLE, USE J 39200 DVM WITH CORRECT TERMINAL ADAPTER FROM J 35616-A. WHEN A CHECK FOR PROPER CONNECTION IS REQUESTED REFER TO "INTERMITTENTS AND POOR CONNECTIONS" IN SECTION 8A-4. WHEN A WIRE, CONNECTOR OR TERMINAL REPAIR IS REQUESTED USE J 38125-A AND REFER TO "WIRING REPAIR" IN THIS SECTION.

Step	Action	Yes	No
45	1. Replace the RH Forward Discriminating Sensor. 2. Has the sensor been replaced?	Go to Step 47	—
46	1. Replace the Arming Sensor. 2. Has the sensor been replaced?	Go to Step 47	—
47	1. Reconnect all the SIR system components. 2. Ensure the components are properly mounted. 3. Have all the SIR system components been reconnected and properly mounted?	Go to Step 48	—
48	1. Clear the SIR Diagnostic Trouble Codes. 2. Have the SIR Diagnostic Trouble Codes been cleared?	Go to "SIR Diagnostic System Check"	—

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Fig. 30: DTC B1023 - Driver Initiator Circuit Voltage High (5 Of 5)
Courtesy of General Motors Corp.

DTC B1024 - DRIVER INITIATOR CIRCUIT VOLTAGE LOW

WARNING: To avoid air bag deployment and injury when trouble shooting system, only use test equipment specified in diagnostic tables. Under no circumstances should battery powered test equipment or test light be used. Carefully follow all instructions.

Description

During normal, non-deployment operation, a small amount of current flows through driver deployment loop. Diagnostic resistors within arming sensor and discriminating sensors, along with resistance of air bag module, cause voltage drops within deployment loop. DERM monitors voltage at DRIVER-SIDE LOW terminal No. B8 to detect shorts or opens within driver deployment loop. When measured voltage is below a specified percentage of DRIVER 36 VLR for 500 milliseconds, DTC B1024 will set.

DTC Will Set

When voltage measured at DRIVER-SIDE LOW terminal No. B8 is below a specified percentage of DRIVER 36 VLR for 500 milliseconds during CONTINUOUS MONITORING.

Action Taken

DERM turns on AIR BAG indicator and sets a diagnostic trouble code.

DTC Will Clear

When voltage measured at DRIVER-SIDE LOW terminal No. B8 is within a specified percentage of DRIVER 36 VLR for 500 milliseconds during CONTINUOUS MONITORING.

Diagnostic Aids

An intermittent condition is likely to be caused by a poor connection at DERM terminal No. A4, arming sensor or arming sensor jumper harness electrical connector terminal Nos. B or D, water intrusion in either discriminating sensor, an open in CKT 347, or a short to ground on CKT 347, CKT 348 or 349. Refer to DTC B1025 to diagnose possible short to B+. When malfunction occurs during an ignition cycle, DTC B1024 will set. If malfunction is present at beginning of next ignition cycle, DTC B1025 will set and DTC B1024 will be moved to history file.

NOTE: Test numbers refer to test numbers on diagnostic table. For circuit number identification, see WIRING DIAGRAM.

1) The SIR DIAGNOSTIC SYSTEM CHECK must be starting point for all diagnostics.

2) This test determines if malfunction is in steering column circuitry.

4) This test checks whether malfunction is due to a component or the wiring.

17) This test checks for increased resistance of arming sensor.

18) This test checks for partial short inside left forward discriminating sensor.

20) This test checks for partial short inside right forward discriminating sensor.

24) This test checks for open in CKT 347.

26) This test determines where the open in CKT 347 is located.

29) This test checks for short from DRIVER-SIDE HIGH circuit to ground.

31) This test checks for short from DRIVER-SIDE LOW circuit to ground.

33) This test checks for short from discriminating sensor interconnect circuit to ground.

35) This test checks for short inside left forward discriminating sensor.

36) This test checks for short inside right forward discriminating sensor.

DTC B1024 - DRIVER INITIATOR CIRCUIT VOLTAGE LOW (1 OF 4)

WHEN MEASUREMENTS ARE REQUESTED IN THIS TABLE, USE J 39200 DVM WITH CORRECT TERMINAL ADAPTER FROM J 35616-A. WHEN A CHECK FOR PROPER CONNECTION IS REQUESTED REFER TO "INTERMITTENTS AND POOR CONNECTIONS" IN SECTION 8A-4. WHEN A WIRE, CONNECTOR OR TERMINAL REPAIR IS REQUESTED USE J 38125-A AND REFER TO "WIRING REPAIR" IN THIS SECTION.

Step	Action	Yes	No
1	1. Was the "SIR Diagnostic System Check" performed?	Go to Step 2	Go to "SIR Diagnostic System Check"
2	1. Ignition switch "OFF." 2. Disconnect the yellow 2-way electrical connector at the base of the steering column. 3. Connect J 38715-A SIR Driver/Passenger Load Tool to harness side of yellow 2-way electrical connector. 4. Ignition switch "ON." 5. Is DTC B1024 current?	Go to Step 4	Go to Step 3
3	1. Ignition switch "OFF." 2. Disconnect J 38715-A. 3. Remove the Inflator Module from the steering wheel. 4. Remove and inspect the SIR coil assembly. 5. Determine and repair the cause of damage. 6. Replace the SIR coil assembly. 7. Has the SIR coil assembly been replaced?	Go to Step 37	—
4	1. Using the Tech-1 SIR Data List function select "DRIVER LO." 2. Is the voltage displayed 1.0 volt or less?	Go to Step 22	Go to Step 5
5	1. Ignition switch "OFF." 2. Disconnect the DERM. 3. Check for proper connection to the DERM at terminal "A4." 4. Is the DERM electrical harness connector terminal "A4" damaged or corroded?	Go to Step 6	Go to Step 8
6	1. Repair the DERM electrical harness connector. 2. Has the connector been repaired?	Go to Step 7	—

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Fig. 31: DTC B1024 - Driver Initiator Circuit Voltage Low (1 Of 4)

DTC B1024 - DRIVER INITIATOR CIRCUIT VOLTAGE LOW (2 OF 4)

WHEN MEASUREMENTS ARE REQUESTED IN THIS TABLE, USE J 39200 DVM WITH CORRECT TERMINAL ADAPTER FROM J 35616-A. WHEN A CHECK FOR PROPER CONNECTION IS REQUESTED REFER TO "INTERMITTENTS AND POOR CONNECTIONS" IN SECTION 8A-4. WHEN A WIRE, CONNECTOR OR TERMINAL REPAIR IS REQUESTED USE J 38125-A AND REFER TO "WIRING REPAIR" IN THIS SECTION.

Step	Action	Yes	No
7	1. Check for proper connection to the DERM at terminal "A4." 2. Are the DERM terminals damaged or corroded?	Go to Step 9	Go to Step 37
8	1. Check for proper connection to the DERM at terminal "A4." 2. Are the DERM terminals damaged or corroded?	Go to Step 9	Go to Step 10
9	1. Replace the DERM. ENERGY RESERVE 2. Has the DERM been replaced?	Go to Step 37	—
10	1. Disconnect the Arming Sensor jumper harness electrical connector C110. 2. Check the Arming Sensor jumper harness electrical connector C110 for proper connection. 3. Is the connector C110 damaged or corroded?	Go to Step 11	Go to Step 12
11	1. Repair the Arming Sensor jumper harness electrical connector C110. 2. Has the connector been repaired?	Go to Step 37	—
12	1. Disconnect the Arming Sensor. 2. Check for proper connection to the Arming Sensor at terminals "B" and "D." 3. Is the Arming Sensor electrical harness connector damaged or corroded?	Go to Step 13	Go to Step 15
13	1. Repair the Arming Sensor electrical harness connector. 2. Has the connector been repaired?	Go to Step 14	—
14	1. Check for proper connection to the Arming Sensor at terminals "B" and "D." 2. Are the Arming Sensor terminals damaged or corroded?	Go to Step 16	Go to Step 37
15	1. Check for proper connection to the Arming Sensor at terminals "B" and "D." 2. Are the Arming Sensor terminals damaged or corroded?	Go to Step 16	Go to Step 17
16	1. Replace the Arming Sensor. 2. Has the Arming Sensor been replaced?	Go to Step 37	—
17	1. Measure the resistance of the Arming Sensor from terminal "C" to terminal "D." 2. Is the resistance 7.67k ohms or more?	Go to Step 16	Go to Step 18
18	1. Disconnect the Discriminating Sensor jumper harness electrical connector C109. 2. Measure resistance on Discriminating Sensor jumper harness electrical connector C109 (engine harness side) from terminal "A" to terminal "B." 3. Is resistance 8.36k ohms or less?	Go to Step 19	Go to Step 20
19	1. Replace the LH Forward Discriminating Sensor. Refer to ON-VEHICLE, FORWARD DISCRIMINATING SENSORS (RH AND LH). 2. Has the LH Forward Discriminating Sensor been replaced?	Go to Step 37	—
20	1. Measure the resistance on the Discriminating Sensor jumper harness electrical connector C109 (engine harness side) from terminal "A" to terminal "C." 2. Is the resistance 8.36k ohms or less?	Go to Step 21	Go to Table A

97I05619 Courtesy of General Motors Corp.

Fig. 32: DTC B1024 - Driver Initiator Circuit Voltage Low (2 Of 4)
Courtesy of General Motors Corp.

DTC B1024 - DRIVER INITIATOR CIRCUIT VOLTAGE LOW (3 OF 4)

WHEN MEASUREMENTS ARE REQUESTED IN THIS TABLE, USE J 39200 DVM WITH CORRECT TERMINAL ADAPTER FROM J 35616-A. WHEN A CHECK FOR PROPER CONNECTION IS REQUESTED REFER TO "INTERMITTENTS AND POOR CONNECTIONS" IN SECTION 8A-4. WHEN A WIRE, CONNECTOR OR TERMINAL REPAIR IS REQUESTED USE J 38125-A AND REFER TO "WIRING REPAIR" IN THIS SECTION.

Step	Action	Yes	No
21	1. Replace the RH Forward Discriminating Sensor. 2. Has the RH Forward Discriminating Sensor been replaced?	Go to Step 37	—
22	1. Ignition switch "OFF." 2. Disconnect the DERM. 3. Disconnect the Arming Sensor. 4. Check for proper connection on the Arming Sensor electrical harness connector terminal "D." 5. Are the Arming Sensor electrical harness connector terminals damaged or corroded?	Go to Step 13	Go to Step 23
23	1. Check for proper connection on the Arming Sensor at terminal "D." 2. Are the Arming Sensor terminals damaged or corroded?	Go to Step 16	Go to Step 24
24	1. Disconnect J 38715-A Driver/Passenger Load Tool. 2. Measure the resistance from the Arming Sensor electrical harness connector terminal "D" to harness side of the yellow 2-way connector at the base of the steering column terminal "A." 3. Is the resistance 5.0 ohms or less?	Go to Step 29	Go to Step 25
25	1. Disconnect the Arming Sensor jumper harness electrical connector C110. 2. Check for proper connection at Arming Sensor jumper harness electrical connector C110. 3. Are the connector terminals damaged or corroded?	Go to Step 11	Go to Step 26
26	1. Measure the resistance of CKT 347 from the harness side of the yellow 2-way electrical connector at the base of the steering column terminal "A" to the bulk head side of the Arming Sensor jumper harness electrical connector C110 terminal "D." 2. Is the resistance 5.0 ohms or less?	Go to Step 27	Go to Step 28
27	1. Repair the open in CKT 347 in arming sensor jumper harness. 2. Has the open CKT been repaired?	Go to Step 37	—
28	1. Repair open in CKT 347 in SIR wiring harness. 2. Has open CKT been repaired?	Go to Step 37	—
29	1. Measure the resistance on the DERM electrical harness connector from terminal "B9" to "A1" (ground). 2. Does J 39200 display "OL" (infinite)?	Go to Step 31	Go to Step 30
30	1. Repair the short from CKT 347 to ground. 2. Has the short to ground been repaired?	Go to Step 37	—
31	1. Disconnect the LH Forward Discriminating Sensor. 2. Measure the resistance on the DERM electrical harness connector from terminal "B8" to terminal "A1" (ground). 3. Does J 39200 display "OL" (infinite)?	Go to Step 33	Go to Step 32
32	1. Repair the short from CKT 348 to ground. 2. Has the short to ground been repaired?	Go to Step 37	—
33	1. Disconnect the RH Forward Discriminating Sensor. 2. Measure the resistance on the LH Forward Discriminating Sensor electrical harness connector from terminal "B" to terminal "C" (ground). 3. Does J 39200 display "OL" (infinite)?	Go to Step 35	Go to Step 34

97A05620 Courtesy of General Motors Corp.

Fig. 33: DTC B1024 - Driver Initiator Circuit Voltage Low (3 Of 4)
Courtesy of General Motors Corp.

DTC B1024 - DRIVER INITIATOR CIRCUIT VOLTAGE LOW (4 OF 4)

WHEN MEASUREMENTS ARE REQUESTED IN THIS TABLE, USE J 39200 DVM WITH CORRECT TERMINAL ADAPTER FROM J 35616-A. WHEN A CHECK FOR PROPER CONNECTION IS REQUESTED REFER TO "INTERMITTENTS AND POOR CONNECTIONS" IN SECTION 8A-4. WHEN A WIRE, CONNECTOR OR TERMINAL REPAIR IS REQUESTED USE J 38125-A AND REFER TO "WIRING REPAIR" IN THIS SECTION.

Step	Action	Yes	No
34	1. Repair the short from CKT 349 to ground. 2. Has the short to ground been repaired?	Go to Step 37	—
35	1. Reconnect the RH Forward Discriminating Sensor. 2. Measure the resistance of the LH Forward Discriminating Sensor from terminal "A" to terminal "C." 3. Is the resistance 8.36k ohms or less?	Go to Step 19	Go to Step 36
36	1. Measure the resistance on the LH Forward Discriminating Sensor electrical harness connector from terminal "B" to terminal "C." 2. Is resistance 8.36k ohms or less?	Go to Step 21	Go to Table A
37	1. Reconnect all the SIR system components. 2. Ensure the components are properly mounted. 3. Have all the SIR system components been reconnected and properly mounted?	Go to Step 38	—
38	1. Clear the SIR Diagnostic Trouble Codes. 2. Have the SIR Diagnostic Trouble Codes been cleared?	Go to "SIR Diagnostic System Check	—

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Fig. 34: DTC B1024 - Driver Initiator Circuit Voltage Low (4 Of 4)
Courtesy of General Motors Corp.

DTC B1025 - DRIVER INITIATOR CIRCUIT SHORT TO IGNITION

WARNING: To avoid air bag deployment and injury when trouble shooting system, only use test equipment specified in diagnostic tables. Under no circumstances should battery powered test equipment or test light be used. Carefully follow all instructions.

Description

During INITIATOR ASSEMBLY RESISTANCE TEST, DERM grounds DRIVER-SIDE LOW terminal No. B8 through internal resistor and measures voltage at DRIVER-SIDE LOW. For properly operating circuit the voltage measurement will be below a specified value. When voltage measured at DRIVER-SIDE LOW is above a specified value, DTC B1025 will set.

DTC Will Set

When voltage measured at DRIVER-SIDE LOW terminal No. B8 is above a specified value while DERM attempts to ground terminal. This test is run during INITIATOR ASSEMBLY RESISTANCE TEST and 10 MINUTE LOOP TEST when:

1) No higher priority faults are detected during Turn ON.
2) No higher priority faults are detected during CONTINUOUS MONITORING for 1 second.
3) No CRANK signal present.

4) IGNITION 1 is above a specified value.

Action Taken

DERM turns on AIR BAG indicator and sets a diagnostic trouble code.

DTC Will Clear

When voltage measured at DRIVER-SIDE LOW terminal No. B8 is below a specified value while DERM grounds terminal..

Diagnostic Aids

This diagnostic trouble code can only be set when malfunction is present as ignition switch is turned ON. After INITIATOR ASSEMBLY RESISTANCE TEST is completed, a short to B+ in steering column, CKT 347, CKT 348 or CKT 349 will cause DTC B1024 to set. When a scan tool clear codes command is issued and malfunction is still present, DTC B10will not reappear for 10 minutes or until next ignition cycle.

NOTE: Test numbers refer to test numbers on diagnostic table. For circuit number identification, see WIRING DIAGRAM.

1) The SIR DIAGNOSTIC SYSTEM CHECK must be starting point for all diagnostics.
2) This test determines whether malfunction is occurring in steering column wiring.
4) This test checks for short from DRIVER-SIDE HIGH circuit to B+.
6) This test checks for short from DRIVER-SIDE LOW circuit to B+.
8) This test checks for short from discriminating sensor interconnect circuit to B+.

DTC B1025 - DRIVER INITIATOR CIRCUIT SHORT TO IGNITION (1 OF 2)

WHEN MEASUREMENTS ARE REQUESTED IN THIS TABLE, USE J 39200 DVM WITH CORRECT TERMINAL ADAPTER FROM J 35616-A. WHEN A CHECK FOR PROPER CONNECTION IS REQUESTED REFER TO "INTERMITTENTS AND POOR CONNECTIONS" IN SECTION 8A-4. WHEN A WIRE, CONNECTOR OR TERMINAL REPAIR IS REQUESTED USE J 38125-A AND REFER TO "WIRING REPAIR" IN THIS SECTION.

Step	Action	Yes	No
1	Was the "SIR Diagnostic System Check" performed?	Go to Step 2	Go to "SIR Diagnostic System Check"
2	1. Ignition switch "OFF." 2. Disconnect the yellow 2-way electrical connector at the base of the steering column. 3. Connect J 38715-A SIR Driver/Passenger Load Tool to harness side of the yellow 2-way electrical connector at the base of the steering column. 4. Ignition switch "ON." 5. Is DTC B1025 current?	Go to Step 4	Go to Step 3
3	1. Ignition switch "OFF." 2. Disconnect J 38715-A. 3. Remove the Inflator Module from the steering wheel. 4. Remove the SIR coil assembly. 5. Inspect the SIR coil assembly for damage. 6. Determine the cause of the damage and repair. 7. Replace the SIR coil assembly. 8. Has the SIR coil assembly been replaced?	Go to Step 10	—
4	1. Ignition switch "OFF." 2. Disconnect the DERM. 3. Disconnect the Arming Sensor. 4. Disconnect the LH Forward Discriminating Sensor. 5. Disconnect J 38715-A. 6. Ignition switch "ON." 7. Measure the voltage on the DERM electrical harness connector from terminal "B9" to terminal "A1" (ground). 8. Is the voltage 1.0 volt or less?	Go to Step 6	Go to Step 5
5	1. Ignition switch "OFF." 2. Repair the short from CKT 347 to B+. 3. Has the short CKT been repaired?	Go to Step 10	—
6	1. Measure the voltage on the DERM electrical harness connector from terminal "B8" to termainal "A1" (ground). 2. Is the voltage 1.0 volt or less?	Go to Step 8	Go to Step 7

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Fig. 35: DTC B1025 - Driver Initiator Circuit Short to Ignition (1 Of 2)
Courtesy of General Motors Corp.

DTC B1025 - DRIVER INITIATOR CIRCUIT SHORT TO IGNITION (2 OF 2)

WHEN MEASUREMENTS ARE REQUESTED IN THIS TABLE, USE J 39200 DVM WITH CORRECT TERMINAL ADAPTER FROM J 35616-A. WHEN A CHECK FOR PROPER CONNECTION IS REQUESTED REFER TO "INTERMITTENTS AND POOR CONNECTIONS" IN SECTION 8A-4. WHEN A WIRE, CONNECTOR OR TERMINAL REPAIR IS REQUESTED USE J 38125-A AND REFER TO "WIRING REPAIR" IN THIS SECTION.

Step	Action	Yes	No
7	1. Ignition switch "OFF." 2. Repair the short from CKT 348 to B+. 3. Has the short CKT been repaired?	Go to Step 10	—
8	1. Measure the voltage on the LH Forward Discriminating Sensor electrical harness connector from terminal "B" to terminal "C" (ground). 2. Is the voltage 1.0 volt or less?	Go to Table A	Go to Step 9
9	1. Ignition switch "OFF." 2. Repair the short from CKT 349 to B+. 3. Has the short circuit been repaired?	Go to Step 10	—
10	1. Reconnect all the SIR components. 2. Ensure the components are properly mounted. 3. Have all the SIR components been reconnected and properly mounted?	Go to Step 11	—
11	1. Clear the SIR Diagnostic Trouble Codes. 2. Have the SIR Diagnostic Trouble Codes been cleared?	Go to "SIR Diagnostic System Check"	—

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Fig. 36: DTC B1025 - Driver Initiator Circuit Short to Ignition (2 Of 2)
Courtesy of General Motors Corp.

DTC B1026 - DRIVER INITIATOR CIRCUIT OPEN

WARNING: To avoid air bag deployment and injury when trouble shooting system, only use test equipment specified in diagnostic tables. Under no circumstances should battery powered test equipment or test light be used. Carefully follow all instructions.

Description

When there is an open in driver-side air bag module or SIR coil assembly, resistance between DRIVER-SIDE HIGH terminal No. B9 and DRIVER-SIDE LOW terminal No. B8 increases. This causes a larger voltage drop from DRIVER-SIDE HIGH to DRIVER-SIDE LOW across a resistor inside DERM which connects these 2 terminals. The increase in voltage difference between DRIVER-SIDE HIGH and DRIVER-SIDE low is detected by DERM during CONTINUOUS MONITORING tests and DTC B1026 will set.

DTC Will Set

When voltage difference between DRIVER-SIDE HIGH terminal No. B9 and DRIVER-SIDE LOW terminal No. B8 is above or equal to a specified value for 500 milliseconds.

Action Taken

DERM turns on AIR BAG indicator and sets a diagnostic trouble code.

DTC Will Clear

When voltage difference between DRIVER-SIDE HIGH terminal No. B9 and DRIVER-SIDE LOW terminal No. B8 is below a specified value for 500 milliseconds.

Diagnostic Aids

This diagnostic trouble code will only set when there is an improper connection of either the Yellow 2-way connector at the base of the steering column or the Yellow 2-way connector at the top of the steering column, an open SIR coil assembly or an open air bag module.

NOTE: Test numbers refer to test numbers on diagnostic table. For circuit number identification, see WIRING DIAGRAM.

1) The SIR DIAGNOSTIC SYSTEM CHECK must be starting point for all diagnostics.

7) This test determines whether a steering column malfunction is occurring.

8) This test determines whether malfunction is occurring in air bag module or SIR coil assembly.

DTC B1026 - DRIVER INITIATOR CIRCUIT OPEN

WHEN MEASUREMENTS ARE REQUESTED IN THIS TABLE, USE J 39200 DVM WITH CORRECT TERMINAL ADAPTER FROM J 35616-A. WHEN A CHECK FOR PROPER CONNECTION IS REQUESTED REFER TO "INTERMITTENTS AND POOR CONNECTIONS" IN SECTION 8A-4. WHEN A WIRE, CONNECTOR OR TERMINAL REPAIR IS REQUESTED USE J 38125-A AND REFER TO "WIRING REPAIR" IN THIS SECTION.

Step	Action	Yes	No
1	Was the "SIR Diagnostic System Check" performed?	Go to Step 2	Go to "SIR Diagnostic System Check"
2	1. Ignition switch "OFF." 2. Disconnect the yellow 2-way electrical connector at the base of the steering column. 3. Check for proper connection on the SIR coil assembly electrical harness connector. 4. Are connector terminals damaged or corroded?	Go to Step 6	Go to Step 4
3	1. Ignition switch "OFF." 2. Replace the SIR coil assembly. 3. Has the SIR Coil assembly been replaced?	Go to Step 10	—
4	1. Check for proper connection on the SIR coil assembly connector. 2. Is connector damaged or corroded?	Go to Step 3	Go to Step 7
5	1. Check for proper connection on the SIR coil assembly connector. 2. Is the connector damaged or corroded?	Go to Step 3	Go to Step 10
6	1. Repair the SIR coil assembly electrical harness connector. 2. Has connector been repaired?	Go to Step 5	—
7	1. Connect J 38715-A SIR Driver/Passenger Load Tool to yellow 2-way electrical connector at the base of the steering column. 2. Ignition switch "ON." 3. Is DTC B1026 current?	Go to Table A	Go to Step 8
8	1. Ignition switch "OFF." 2. Disconnect J 38715-A. 3. Remove the Inflator Module from the steering wheel. 4. Connect J 38715-A to Inflator Module electrical connector on the steering column. 5. Reconnect the yellow 2-way connector at the base of the steering column. 6. Ignition switch "ON." 7. Is DTC B1026 current?	Go to Step 3	Go to Step 9
9	1. Ignition switch "OFF." 2. Replace the Inflator Module. 3. Has the Inflator Module been replaced?	Go to Step 10	—
10	1. Reconnect all the SIR components. 2. Ensure the components are properly mounted. 3. Have all the SIR components been reconnected and properly mounted?	Go to Step 11	—
11	1. Clear the SIR Diagnostic Trouble Codes. 2. Have the SIR Diagnostic Trouble Codes been cleared?	Go to "SIR Diagnostic System Check"	—

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Fig. 37: DTC B1026 - Driver Initiator Circuit Open
Courtesy of General Motors Corp.

DTC B1028 - CURRENT SINK OR SOURCE FAILURE

WARNING: To avoid air bag deployment and injury when trouble shooting system, only use test equipment specified in diagnostic tables. Under no circumstances should battery powered test equipment or test light be used. Carefully follow all instructions.

Description

During INITIATOR ASSEMBLY RESISTANCE test, DERM grounds DRIVER-SIDE LOW terminal No. B8 and turns on driver current source at

DRIVER-SIDE HIGH terminal No. B9. During this test, DERM monitors voltage at DRIVER-SIDE LOW and difference between DRIVER-SIDE HIGH and DRIVER-SIDE LOW. When measured voltages are outside expected range, DTC B1028 will set.

DTC Will Set

When voltage measured at DRIVER-SIDE LOW is below a specified value while its initiator resistance is in range or when voltage measured at DRIVER-SIDE LOW is above a specified value. This test is run once each ignition cycle during INITIATOR ASSEMBLY RESISTANCE TEST when:

1) No higher priority faults are detected during Turn ON.
2) No higher priority faults are detected during CONTINUOUS MONITORING for 1 second.
3) No CRANK signal present.
4) IGNITION 1 voltage is above a specified value.

Action Taken

DERM turns on AIR BAG indicator and sets a diagnostic trouble code.

DTC Will Clear

When ignition switch is turned OFF.

Diagnostic Aids

During INITIATOR ASSEMBLY RESISTANCE test, DERM checks for proper resistance of CKT 347, 348, SIR coil assembly and air bag module. This test is performed by causing a known amount of current through a known amount of resistance causing a known amount of voltage at DRIVER-SIDE LOW. When measured resistance is in range and voltage at DRIVER-SIDE LOW is too high or too low, DTC B1028 will set.

DTC B1028 - CURRENT SINK OR SOURCE FAILURE

WHEN MEASUREMENTS ARE REQUESTED IN THIS TABLE, USE J 39200 DVM WITH CORRECT TERMINAL ADAPTER FROM J 35616-A. WHEN A CHECK FOR PROPER CONNECTION IS REQUESTED REFER TO "INTERMITTENTS AND POOR CONNECTIONS" IN SECTION 8A-4. WHEN A WIRE, CONNECTOR OR TERMINAL REPAIR IS REQUESTED USE J 38125-A AND REFER TO "WIRING REPAIR" IN THIS SECTION.

Step	Action	Yes	No
1	1. Was the "SIR Diagnostic System Check" performed?	Go to Step 2	Go to "SIR Diagnostic System Check"
2	1. Replace the DERM. 2. Has the DERM been replaced?	Go to "SIR Diagnostic System Check"	—

96C14367 Courtesy of General Motors Corp.

Fig. 38: DTC B1028 - Current Sink Or Source Failure
Courtesy of General Motors Corp.

DTC B1031 - DRIVER LOOP ENERGY RESERVE FEED OPEN

WARNING: To avoid air bag deployment and injury when trouble shooting system, only use test equipment specified in diagnostic tables. Under no circumstances should battery powered test equipment or test light be used. Carefully follow all instructions.

Description

During CONTINUOUS MONITORING tests, DERM monitors voltage at

DRIVER SOURCE SENSE terminal No. A5. When circuit is operating normally the measured voltage will be slightly less than DRIVER 36 VLR. If DRIVER 36 VLR circuit opens, voltage measured at DRIVER SOURCE SENSE will decrease to slightly less than IGNITION 1 voltage. When voltage measured at DRIVER SOURCE SENSE is within a specified range of IGNITION 1 for 500 milliseconds, DTC is set.

DTC Will Set

When voltage measured at DRIVER SOURCE SENSE terminal No. A5 is within a specified range of IGNITION 1 for 500 milliseconds during CONTINUOUS MONITORING.

Action Taken

DERM turns on AIR BAG indicator and sets a diagnostic trouble code.

DTC Will Clear

When voltage measured at DRIVER SOURCE SENSE terminal No. A5 is outside a specified range of IGNITION 1 for 500 milliseconds.

Diagnostic Aids

An intermittent condition is likely to be caused by a poor connection at arming sensor or arming sensor jumper harness electrical connector (C110) terminal Nos. B or C, poor connection at DERM terminal Nos. A4 or A5, an open in CKT 236 or CKT 1400 to B+, or high resistance inside arming sensor.

NOTE: Test numbers refer to test numbers on diagnostic table. For circuit number identification, see WIRING DIAGRAM.

1) The SIR DIAGNOSTIC SYSTEM CHECK must be starting point for all diagnostics.

12) This test checks for an open in DRIVER 36 VLR circuit between the DERM and arming sensor connector.

15) This test checks for an open in DRIVER 36 VLR circuit between the DERM and arming sensor jumper harness connector.

18) This test checks for high resistance in DRIVER SOURCE SENSE circuit between DERM and arming sensor connector.

21) This test checks for high resistance in DRIVER SOURCE SENSE circuit between DERM and arming sensor jumper harness electrical connector (C110).

24) This test checks for a short from DRIVER SOURCE SENSE circuit to B+.

DTC B1031 - DRIVER LOOP ENERGY RESERVE FEED OPEN (1 OF 3)

WHEN MEASUREMENTS ARE REQUESTED IN THIS TABLE, USE J 39200 DVM WITH CORRECT TERMINAL ADAPTER FROM J 35616-A. WHEN A CHECK FOR PROPER CONNECTION IS REQUESTED REFER TO "INTERMITTENTS AND POOR CONNECTIONS" IN SECTION 8A-4. WHEN A WIRE, CONNECTOR OR TERMINAL REPAIR IS REQUESTED USE J 38125-A AND REFER TO "WIRING REPAIR" IN THIS SECTION.

Step	Action	Yes	No
1	1. Was the "SIR Diagnostic System Check" performed?	Go to Step 2	Go to "SIR Diagnostic System Check"
2	1. Ignition switch "OFF." 2. Disconnect the yellow 2-way electrical connector at the base of the steering column. 3. Disconnect the Arming Sensor. 4. Check for proper connection to Arming Sensor at terminals "B" and "C." 5. Are the Arming Sensor electrical harness connector terminals damaged or corroded?	Go to Step 3	Go to Step 4
3	1. Repair the Arming Sensor electrical harness connector. 2. Has the connector been repaired?	Go to Step 5	—
4	1. Check for proper connection to the Arming Sensor at terminals "B" and "C." 2. Are the Arming Sensor terminals damaged or corroded?	Go to Step 6	Go to Step 7
5	1. Check for proper connection to the Arming Sensor at terminals "B" and "C." 2. Are the Arming Sensor terminals damaged or corroded?	Go to Step 6	Go to Step 27
6	1. Replace the Arming Sensor. 2. Has the Arming Sensor been replaced?	Go to Step 27	—
7	1. Disconnect the DERM. 2. Check for proper connection to the DERM at terminals "A4" and "A5." 3. Are the DERM electrical harness connector terminals damaged or corroded?	Go to Step 8	Go to Step 9
8	1. Repair the DERM electrical harness connector. 2. Has the connector been repaired?	Go to Step 10	—
9	1. Check for proper connection to the DERM at terminals "A4" and "A5." 2. Are the DERM terminals damaged or corroded?	Go to Step 11	Go to Step 12

96D14368 Courtesy of General Motors Corp.

Fig. 39: DTC B1031 - Driver Loop Energy Reserve Feed Open (1 Of 3)
Courtesy of General Motors Corp.

DTC B1031 - DRIVER LOOP ENERGY RESERVE FEED OPEN (2 OF 3)

WHEN MEASUREMENTS ARE REQUESTED IN THIS TABLE, USE J 39200 DVM WITH CORRECT TERMINAL ADAPTER FROM J 35616-A. WHEN A CHECK FOR PROPER CONNECTION IS REQUESTED REFER TO "INTERMITTENTS AND POOR CONNECTIONS" IN SECTION 8A-4. WHEN A WIRE, CONNECTOR OR TERMINAL REPAIR IS REQUESTED USE J 38125-A AND REFER TO "WIRING REPAIR" IN THIS SECTION.

Step	Action	Yes	No
10	1. Check for proper connection to the DERM at terminals "A4" and "A5." 2. Are the DERM terminals damaged or corroded?	Go to Step 11	Go to Step 27
11	1. Replace the DERM. 2. Has the DERM been replaced?	Go to Step 27	—
12	1. Measure the resistance from the DERM electrical harness connector terminal "A4" to the Arming Sensor electrical harness connector terminal "B." 2. Is the resistance 5.0 ohms or less?	Go to Step 18	Go to Step 13
13	1. Disconnect the Arming Sensor jumper harness electrical connector C110. 2. Is the connector terminal "B" damaged or corroded?	Go to Step 14	Go to Step 15
14	1. Repair the Arming Sensor jumper harness electrical connector 2. Has the connector been repaired?	Go to Step 27	—
15	1. Measure the resistance of CKT 236 from the DERM electrical harness connector terminal "A4" to the Arming Sensor jumper harness electrical connector C110 terminal "B." 2. Is the resistance 5.0 ohms or less?	Go to Step 16	Go to Step 17
16	1. Repair the open in CKT 236 in arming sensor jumper harness. 2. Has the open CKT been repaired?	Go to Step 27	—
17	1. Repair the open in CKT 236 in SIR wiring harness. 2. Has the open CKT been repaired?	Go to Step 27	—
18	1. Measure the resistance of CKT 1400 from the DERM electrical harness connector terminal "A5" to the Arming Sensor electrical harness connector terminal "C." 2. Is the resistance 5.0 ohms or less?	Go to Step 24	Go to Step 19
19	1. Disconnect the Arming Sensor jumper harness electrical connector C110. 2. Is the connector terminal "C" damaged or corroded?	Go to Step 20	Go to Step 21
20	1. Repair Arming Sensor jumper harness electrical connector 2. Has the connector been repaired?	Go to Step 27	—
21	1. Measure the resistance of CKT 1400 from the DERM electrical harness connector terminal "A5" to the Arming Sensor jumper harness electrical connector C110 terminal "C." 2. Is the resistance 5.0 ohms or less?	Go to Step 22	Go to Step 23
22	1. Repair the high resistance in CKT 1400 in arming sensor jumper harness. 2. Has the high resistance been repaired?	Go to Step 27	—
23	1. Repair the high resistance in CKT 1400 in SIR wiring harness. 2. Has the high resistance been repaired?	Go to Step 27	—
24	1. Ignition switch "ON." 2. Measure the voltage on the DERM electrical harness connector from terminal "A5" to terminal "A12" (ground). 3. Is the voltage 1 volt or less?	Go to Step 26	Go to Step 25

96E14369

Courtesy of General Motors Corp.

Fig. 40: DTC B1031 - Driver Loop Energy Reserve Feed Open (2 Of 3)
Courtesy of General Motors Corp.

DTC B1031 - DRIVER LOOP ENERGY RESERVE FEED OPEN (3 OF 3)

WHEN MEASUREMENTS ARE REQUESTED IN THIS TABLE, USE J 39200 DVM WITH CORRECT TERMINAL ADAPTER FROM J 35616-A. WHEN A CHECK FOR PROPER CONNECTION IS REQUESTED REFER TO "INTERMITTENTS AND POOR CONNECTIONS" IN SECTION 8A-4. WHEN A WIRE, CONNECTOR OR TERMINAL REPAIR IS REQUESTED USE J 38125-A AND REFER TO "WIRING REPAIR" IN THIS SECTION.

Step	Action	Yes	No
25	1. Ignition switch "OFF." 2. Repair the short from CKT 1400 to B+. 3. Has the short CKT been repaired?	Go to Step 27	—
26	1. Ignition switch "OFF." 2. Replace the Arming Sensor. 3. Has the Arming Sensor been replaced?	Go to Table A	—
27	1. Reconnect all the SIR components. 2. Ensure the components are properly mounted. 3. Have all the SIR components been reconnected and properly mounted?	Go to Step 28	—
28	1. Clear the SIR Diagnostic Trouble Codes. 2. Have the SIR Diagnostic Trouble Codes been cleared?	Go to "SIR Diagnostic System Check"	—

96H14370 Courtesy of General Motors Corp.

Fig. 41: DTC B1031 - Driver Loop Energy Reserve Feed Open (3 Of 3)
Courtesy of General Motors Corp.

DTC B1034 - ARMING SENSOR IGNITION FEED OPEN

WARNING: To avoid air bag deployment and injury when trouble shooting system, only use test equipment specified in diagnostic tables. Under no circumstances should battery powered test equipment or test light be used. Carefully follow all instructions.

Description

During Turn ON tests, performed at beginning of each ignition cycle, DERM delays charging of DRIVER 36 VLR power supply. While delay is active, DERM measures voltage at DRIVER 36 VLR terminal No. A4 and DRIVER SOURCE SENSE terminal No. A5. When voltage measured at DRIVER 36 VLR power supply indicates it is in a discharged state and voltage measured at DRIVER SOURCE SENSE is a specified amount below IGNITION 1 voltage, DTC B1034 is set.

DTC Will Set

With DRIVER 36 VLR power supply in a discharged state, voltage measured at DRIVER SOURCE SENSE terminal No. A5 is a specified amount below IGNITION 1 voltage and no higher priority faults are detected. This test is run once each ignition cycle during Turn ON tests while 36 VLR delay is active.

Action Taken

DERM turns on AIR BAG indicator and sets a diagnostic trouble code.

DTC Will Clear

When DRIVER 36 VLR power supply is in a discharged state, voltage measured at DRIVER SOURCE SENSE terminal No. A5 is within specified range of IGNITION 1 voltage. When neither the set nor clear conditions are met, the state of the diagnostic trouble code from the previous ignition cycle is used.

Diagnostic Aids

An intermittent condition is likely to be caused by a poor connection at arming sensor terminal Nos. A or C, poor connection at DERM terminal No. A5, open ignition feed to arming sensor, open DRIVER SOURCE SENSE circuit or a malfunctioning arming sensor diode. The test for this diagnostic trouble code is only run while AIR BAG indicator is performing BULB TEST. When a scan tool clear codes command is issued and malfunction is still present, DTC will not reappear until ignition switch is turned off for at least 2 minutes with entire SIR system connected, and then the ignition switch is turned ON.

NOTE: Test numbers refer to test numbers on diagnostic table. For circuit number identification, see WIRING DIAGRAM.

1) The SIR DIAGNOSTIC SYSTEM CHECK must be starting point for all diagnostics.

7) This test checks whether a malfunction is occurring.

13) This test checks for an open in arming sensor ignition feed circuit.

16) This test locates the open in arming sensor ignition feed circuit.

19) This test determines whether malfunction is an open in DRIVER SOURCE SENSE circuit or an open in arming sensor.

22) This test locates open in DRIVER SOURCE SENSE circuit.

DTC B1034 - ARMING SENSOR IGNITION FEED OPEN (1 OF 3)

WHEN MEASUREMENTS ARE REQUESTED IN THIS TABLE, USE J 39200 DVM WITH CORRECT TERMINAL ADAPTER FROM J 35616-A. WHEN A CHECK FOR PROPER CONNECTION IS REQUESTED REFER TO "INTERMITTENTS AND POOR CONNECTIONS" IN SECTION 8A-4. WHEN A WIRE, CONNECTOR OR TERMINAL REPAIR IS REQUESTED USE J 38125-A AND REFER TO "WIRING REPAIR" IN THIS SECTION.

Step	Action	Yes	No
1	Was the "SIR Diagnostic System Check" performed?	Go to Step 2	Go to "SIR Diagnostic System Check"
2	1. Ignition switch "OFF." 2. Disconnect the yellow 2-way electrical connector at the base of the steering column. 3. Disconnect the DERM and check for proper connection at terminal "A5." 4. Is the DERM electrical harness connector damaged or corroded?	Go to Step 3	Go to Step 4
3	1. Repair the DERM electrical harness connector. 2. Has the connector been repaired?	Go to Step 5	—
4	1. Check for proper connection to DERM at terminal "A5." 2. Are the DERM terminals damaged or corroded?	Go to Step 6	Go to Step 7
5	1. Check for proper connection to DERM at terminal "A5." 2. Are the DERM terminals damaged or corroded?	Go to Step 6	Go to Step 25
6	1. Replace the DERM. 2. Has the DERM been replaced?	Go to Step 25	—
7	1. Ignition switch "ON." 2. Measure the voltage on the DERM electrical harness connector from terminal "A5" to terminal "A12" (ground). 3. Does meter indicate system voltage?	Go to Table A	Go to Step 8
8	1. Ignition switch "OFF." 2. Disconnect the Arming Sensor and check for proper connection at terminals "A" and "C". 3. Is the Arming Sensor electrical harness connector damaged or corroded?	Go to Step 9	Go to Step 10
9	1. Repair the Arming Sensor electrical harness connector. 2. Has the connector been repaired?	Go to Step 11	—
10	1. Check for proper connection to the Arming Sensor at terminals "A" and "C." 2. Are the Arming Sensor terminals damaged or corroded?	Go to Step 12	Go to Step 13

96I14371 Courtesy of General Motors Corp.

Fig. 42: DTC B1034 - Arming Sensor Ignition Feed Open (1 Of 3)
Courtesy of General Motors Corp.

DTC B1034 - ARMING SENSOR IGNITION FEED OPEN (2 OF 3)

WHEN MEASUREMENTS ARE REQUESTED IN THIS TABLE, USE J 39200 DVM WITH CORRECT TERMINAL ADAPTER FROM J 35616-A. WHEN A CHECK FOR PROPER CONNECTION IS REQUESTED REFER TO "INTERMITTENTS AND POOR CONNECTIONS" IN SECTION 8A-4. WHEN A WIRE, CONNECTOR OR TERMINAL REPAIR IS REQUESTED USE J 38125-A AND REFER TO "WIRING REPAIR" IN THIS SECTION.

Step	Action	Yes	No
11	1. Check for proper connection to the Arming Sensor at terminals "A" and "C." 2. Are the Arming Sensor terminals damaged or corroded?	Go to Step 12	Go to Step 25
12	1. Replace the Arming Sensor. 2. Has the Arming Sensor been replaced?	Go to Step 25	—
13	1. Ignition switch "ON." 2. Measure the voltage from the Arming Sensor electrical harness connector terminal "A" to the DERM electrical harness connector terminal "A12" (ground). 3. Does meter indicate system voltage?	Go to Step 19	Go to Step 14
14	1. Ignition switch "OFF." 2. Disconnect the Arming Sensor jumper harness electrical connector C110. 3. Check for proper connection of the Arming Sensor jumper harness electrical connector 4. Are the connector terminals damaged or corroded?	Go to Step 15	Go to Step 16
15	1. Repair the Arming Sensor jumper harness electrical connector 2. Has the connector been repaired?	Go to Step 25	—
16	1. Ignition switch "ON." 2. Measure the voltage from the Arming Sensor jumper harness electrical connector C110 (bulk head side of the harness) terminal "A" to the DERM electrical harness connector terminal "A12" (ground). 3. Does meter indicate system voltage?	Go to Step 17	Go to Step 18
17	1. Repair the open in CKT 1139 in arming sensor jumper harness. 2. Has the open CKT been repaired?	Go to Step 25	—
18	1. Repair open in CKT 1139 between arming sensor connector and S260. 2. Has the open CKT been repaired?	Go to Step 25	—
19	1. Ignition switch "OFF." 2. Measure the resistance from the Arming Sensor harness electrical connector terminal "C" to the DERM electrical harness connector terminal "A5." 3. Is the resistance 5.0 ohms or less?	Go to Step 12	Go to Step 20
20	1. Disconnect the Arming Sensor jumper harness electrical connector C110. 2. Check for proper connection of the Arming Sensor jumper harness electrical connector C110. 3. Is the connector terminal "C" damaged or corroded?	Go to Step 21	Go to Step 22
21	1. Repair the Arming Sensor jumper harness electrical connector C110. 2. Has the connector been repaired?	Go to Step 25	—
22	1. Ignition switch "OFF." 2. Measure the resistance of CKT 1400 from the Arming Sensor jumper harness electrical connector (C106) terminal "C" to the DERM electrical harness connector terminal "A5." 3. Is the resistance 5.0 ohms or less?	Go to Step 23	Go to Step 24
23	1. Repair the high resistance in CKT 1400. 2. Has the high resistance been repaired?	Go to Step 25	—

97C05621 Courtesy of General Motors Corp.

Fig. 43: DTC B1034 - Arming Sensor Ignition Feed Open (2 Of 3)
Courtesy of General Motors Corp.

DTC B1034 - ARMING SENSOR IGNITION FEED OPEN (3 OF 3)

WHEN MEASUREMENTS ARE REQUESTED IN THIS TABLE, USE J 39200 DVM WITH CORRECT TERMINAL ADAPTER FROM J 35616-A. WHEN A CHECK FOR PROPER CONNECTION IS REQUESTED REFER TO "INTERMITTENTS AND POOR CONNECTIONS" IN SECTION 8A-4. WHEN A WIRE, CONNECTOR OR TERMINAL REPAIR IS REQUESTED USE J 38125-A AND REFER TO "WIRING REPAIR" IN THIS SECTION.

Step	Action	Yes	No
24	1. Repair the high resistance in CKT 1400I 2. Has the high resistance been repaired?	Go to Step 25	—
25	1. Reconnect all the SIR components. 2. Ensure the components are properly mounted. 3. Have all the SIR components been reconnected and properly mounted?	Go to Step 26	—
26	1. Clear the SIR Diagnostic Trouble Codes. 2. Have the SIR Diagnostic Trouble Codes been cleared?	Go to "SIR Diagnostic System Check	—

96A14373 Courtesy of General Motors Corp.

Fig. 44: DTC B1034 - Arming Sensor Ignition Feed Open (3 Of 3)
Courtesy of General Motors Corp.

DTC B1035 - DISCRIMINATING SENSOR OPEN OR MISSING

WARNING: To avoid air bag deployment and injury when trouble shooting system, only use test equipment specified in diagnostic tables. Under no circumstances should battery powered test equipment or test light be used. Carefully follow all instructions.

Description

During normal non-deployment operation a small amount of current flows through driver deployment loop. Diagnostic resistors within arming sensor and discriminating sensors, along with resistance of air bag module, cause voltage drops within deployment loop. DERM monitors voltage at DRIVER-SIDE LOW terminal No. B8 to detect shorts or opens within deployment loop. When measured voltage is within a specified percentage of DRIVER 36 VLR power supply for 500 milliseconds, DTC B1035 is set.

DTC Will Set

When voltage measured at DRIVER-SIDE LOW terminal No. B8 is within a specified percentage of DRIVER 36 VLR power supply voltage for 500 milliseconds during CONTINUOUS MONITORING.

Action Taken

DERM turns on AIR BAG indicator and sets a diagnostic trouble code.

DTC Will Clear

When voltage measured at DRIVER-SIDE LOW terminal No. B8 is above or below percentage of DRIVER 36 VLR power supply voltage which sets DTC B1035.

Diagnostic Aids

An intermittent condition is likely to be an improper connection at any of the discriminating sensor terminals, an open in either ground feed to discriminating sensors, an open discriminating sensor interconnect circuit, increased resistance of either discriminating sensor or decreased resistance of arming sensor.

NOTE: Test numbers refer to test numbers on diagnostic table. For circuit number identification, see WIRING DIAGRAM.

1) The SIR DIAGNOSTIC SYSTEM CHECK must be starting point for all diagnostics.

7) This test checks for increased resistance of left forward discriminating sensor.

8) This test checks for open in ground feed to left forward discriminating sensor.

11) This test locates open in ground feed to left forward discriminating sensor.

19) This test checks for increased resistance of right forward discriminating sensor.

21) This test checks for open in ground feed to right forward discriminating sensor.

24) This test locates open in ground feed to right forward discriminating sensor.

27) This test checks for open in discriminating sensor interconnect circuit.

29) This test checks arming sensor loop resistance.

DTC B1035 - DISCRIMINATING SENSOR OPEN OR MISSING (1 OF 3)

WHEN MEASUREMENTS ARE REQUESTED IN THIS TABLE, USE J 39200 DVM WITH CORRECT TERMINAL ADAPTER FROM J 35616-A. WHEN A CHECK FOR PROPER CONNECTION IS REQUESTED REFER TO "INTERMITTENTS AND POOR CONNECTIONS" IN SECTION 8A-4. WHEN A WIRE, CONNECTOR OR TERMINAL REPAIR IS REQUESTED USE J 38125-A AND REFER TO "WIRING REPAIR" IN THIS SECTION.

Step	Action	Yes	No
1	1. Was the "SIR Diagnostic System Check" performed?	Go to Step 2	Go to "SIR Diagnostic System Check"
2	1. Disconnect the yellow 2-way connector at the base of the steering column. 2. Disconnect the LH Forward Discriminating Sensor. 3. Check for proper connection to the LH Forward Discriminating Sensor at terminals "A", "B", and "C". 4. Is the LH Forward Discriminating Sensor electrical harness connector damaged or corroded?	Go to Step 3	Go to Step 5
3	1. Repair LH forward Discriminating Sensor electrical harness connector. 2. Has the connector been repaired.	Go to Step 4	—
4	1. Check for proper connection to the LH Forward Discriminating Sensor. 2. Are the LH Forward Discriminating Sensor terminals damaged or corroded?	Go to Step 6	Go to Step 31
5	1. Check for proper connection to the LH Forward Discriminating Sensor. 2. Are the LH Forward Discriminating Sensor terminals damaged or corroded?	Go to Step 6	Go to Step 7
6	1. Replace the LH Forward Discriminating Sensor. 2. Has the sensor been replaced?	Go to Step 31	—
7	1. Measure the resistance on the LH Forward Discriminating Sensor from terminal "A" to terminal "C." 2. Is the resistance 8.54k ohms or more?	Go to Step 6	Go to Step 8
8	1. Measure the resistance from the LH Forward Discriminating Sensor electrical harness connector terminal "C" to ground. 2. Is the resistance 5.0 ohms or less?	Go to Step 14	Go to Step 9

96B14374

Courtesy of General Motors Corp.

Fig. 45: DTC B1035 - Discriminating Sensor Open Or Missing (1 Of 3)
Courtesy of General Motors Corp.

DTC B1035 - DISCRIMINATING SENSOR OPEN OR MISSING (2 OF 3)

WHEN MEASUREMENTS ARE REQUESTED IN THIS TABLE, USE J 39200 DVM WITH CORRECT TERMINAL ADAPTER FROM J 35616-A. WHEN A CHECK FOR PROPER CONNECTION IS REQUESTED REFER TO "INTERMITTENTS AND POOR CONNECTIONS" IN SECTION 8A-4. WHEN A WIRE, CONNECTOR OR TERMINAL REPAIR IS REQUESTED USE J 38125-A AND REFER TO "WIRING REPAIR" IN THIS SECTION.

Step	Action	Yes	No
9	1. Disconnect the Discriminating Sensor jumper harness electrical connector C109. 2. Check for proper connection of the Discriminating Sensor jumper harness electrical connector C109. 3. Is the Discriminating Sensor jumper harness electrical connector damaged or corroded?	Go to Step 10	Go to Step 11
10	1. Repair the Discriminating Sensor jumper harness electrical connector C109. 2. Has the connector been repaired?	Go to Step 31	—
11	1. Measure the resistance of CKT 1751 from the LH Forward Discriminating Sensor harness electrical connector terminal "C" to the Discriminating Sensor jumper harness connector C109 terminal "B." 2. Is the resistance 5.0 ohms or less?	Go to Step 12	Go to Step 13
12	1. Repair the open in CKT 1751 between C109 and S233. 2. Has the open CKT been repaired?	Go to Step 31	—
13	1. Repair the open in CKT 1751 between sensor connector C109. 2. Has open CKT been repaired?	Go to Step 31	—
14	1. Disconnect the RH Forward Discriminating Sensor. 2. Check for proper connection to the RH Forward Discriminating Sensor at terminals "A" and "B." 3. Is the RH Forward Discriminating Sensor electrical harness connector damaged or corroded?	Go to Step 15	Go to Step 17
15	1. Repair the RH Forward Discriminating Sensor electrical harness connector. 2. Has the connector been repaired?	Go to Step 16	—
16	1. Check for proper connection to the RH Forward Discriminating Sensor. 2. Are the RH Forward Discriminating Sensor terminals damaged or corroded?	Go to Step 18	Go to Step 31
17	1. Check for proper connection to the RH Forward Discriminating Sensor. 2. Are the RH Forward Discriminating Sensor terminals damaged or corroded?	Go to Step 18	Go to Step 19
18	1. Replace the RH Forward Discriminating Sensor. 2. Has the sensor been replaced?	Go to Step 31	—
19	1. Measure the resistance on the RH Forward Discriminating Sensor electrical connector from terminal "A" to terminal "B." 2. Is the resistance 8.54k ohms or more?	Go to Step 20	Go to Step 21
20	1. Replace the RH Forward Discriminating Sensor. 2. Has the sensor been replaced?	Go to Step 31	—
21	1. Measure the resistance from the RH Forward Discriminating Sensor electrical harness connector terminal "B" to ground. 2. Is the resistance 5.0 ohms or less?	Go to Step 27	Go to Step 22

97E05622

Courtesy of General Motors Corp.

Fig. 46: DTC B1035 - Discriminating Sensor Open Or Missing (2 Of 3)
Courtesy of General Motors Corp.

DTC B1035 - DISCRIMINATING SENSOR OPEN OR MISSING (3 OF 3)

WHEN MEASUREMENTS ARE REQUESTED IN THIS TABLE, USE J 39200 DVM WITH CORRECT TERMINAL ADAPTER FROM J 35616-A. WHEN A CHECK FOR PROPER CONNECTION IS REQUESTED REFER TO "INTERMITTENTS AND POOR CONNECTIONS" IN SECTION 8A-4. WHEN A WIRE, CONNECTOR OR TERMINAL REPAIR IS REQUESTED USE J 38125-A AND REFER TO "WIRING REPAIR" IN THIS SECTION.

Step	Action	Yes	No
22	1. Disconnect the Discriminating Sensor jumper harness electrical connector C109. 2. Check for proper connection of the Discriminating Sensor jumper harness electrical connector C109. 3. Is the Discriminating Sensor jumper harness electrical connector C109 damaged or corroded?	Go to Step 23	Go to Step 24
23	1. Repair the Discriminating Sensor jumper harness electrical connector C109. 2. Has the connector been repaired?	Go to Step 31	—
24	1. Measure the resistance of CKT 1751 from the RH Forward Discriminating Sensor electrical harness connector terminal "B" to the Discriminating Sensor jumper harness electrical connector terminal "C." 2. Is the resistance 5.0 ohms or less?	Go to Step 25	Go to Step 26
25	1. Repair the open in CKT 1751 between C109 and S233. 2. Has the open CKT been repaired?	Go to Step 31	—
26	1. Repair the open in CKT 1751 between sensor connector C109. 2. Has the open CKT been repaired?	Go to Step 31	—
27	1. Measure the resistance of CKT 349 from the RH Forward Discriminating Sensor electrical harness connector terminal "A" to the LH Forward Discriminating Sensor electrical harness connector terminal "B." 2. Is the resistance 5.0 ohms or less?	Go to Step 29	Go to Step 28
28	1. Repair the open in CKT 349. 2. Has the open CKT been repaired?	Go to Step 31	—
29	1. Disconnect the Arming Sensor. 2. Measure the resistance on the Arming Sensor from terminal "C" to terminal "D." 3. Is the resistance 7.5k ohms or less?	Go to Step 30	Go to Table A
30	1. Replace the Arming Sensor. 2. Has the sensor been replaced?	Go to Step 31	—
31	1. Reconnect all the SIR components. 2. Ensure the components are properly mounted. 3. Have all the SIR components been reconnected and properly mounted?	Go to Step 32	—
32	1. Clear the SIR Diagnostic Trouble Codes. 2. Have the SIR Diagnostic Trouble Codes been cleared?	Go to "SIR Diagnostic System Check"	—

97G05623 Courtesy of General Motors Corp.

Fig. 47: DTC B1035 - Discriminating Sensor Open Or Missing (3 Of 3) Courtesy of General Motors Corp.

DTC B1042 - LOOP ENERGY RESERVE VOLTAGE LOW

WARNING: To avoid air bag deployment and injury when trouble shooting system, only use test equipment specified in diagnostic tables. Under no circumstances should battery powered test equipment or test light be used. Carefully follow all instructions.

Description

During Turn ON tests, performed at beginning of each ignition cycle, DERM delays charging of DRIVER 36 VLR terminal No. A4 power supply. After delay has expired the DRIVER 36 VLR power supply is allowed to charge. DERM monitors DRIVER 36 VLR power supply to ensure it has charged to a voltage above a specified value within 10 seconds after IGNITION 1 voltage is first applied to DERM. When DRIVER 36 VLR power supply does not reach specified voltage within allowed time or, once reaching voltage, falls below it for 500 milliseconds, DTC B1042 is set.

DTC Will Set

When voltage measured at DRIVER 36 VLR power supply does not exceed a specified value within 10 seconds after IGNITION 1 voltage is first applied to DERM or, once having reached the specified value, falls below specified value for 500 milliseconds during CONTINUOUS MONITORING.

Action Taken

DERM turns on AIR BAG indicator and sets a diagnostic trouble code.

DTC Will Clear

When voltage measured at DRIVER 36 VLR terminal No. A4 is above a specified value for 500 milliseconds during CONTINUOUS MONITORING.

Diagnostic Aids

An intermittent condition is likely to be caused by a short from DRIVER 36 VLR to B+ or ground or a short inside arming sensor.

NOTE: Test numbers refer to test numbers on diagnostic table. For circuit number identification, see WIRING DIAGRAM.

1) The SIR DIAGNOSTIC SYSTEM CHECK must be starting point for all diagnostics.
2) This test checks whether diagnostic trouble code has set falsely.
3) This test checks whether a malfunctioning arming sensor is preventing DRIVER 36 VLR from charging. This test will cause DTC B1014 (Arming Sensor Disconnected) to set.
5) This test checks whether a short to B+ is preventing DRIVER 36 VLR from charging.
6) This test locates short to B+ that is preventing DRIVER 36 VLR from charging.
9) This test checks whether a short to ground is preventing DRIVER 36 VLR from charging.
10) This test checks locates short to ground that is preventing DRIVER 36 VLR from charging.

DTC B1042 - LOOP ENERGY RESERVE VOLTAGE LOW (1 OF 2)

WHEN MEASUREMENTS ARE REQUESTED IN THIS TABLE, USE J 39200 DVM WITH CORRECT TERMINAL ADAPTER FROM J 35616-A. WHEN A CHECK FOR PROPER CONNECTION IS REQUESTED REFER TO "INTERMITTENTS AND POOR CONNECTIONS" IN SECTION 8A-4. WHEN A WIRE, CONNECTOR OR TERMINAL REPAIR IS REQUESTED USE J 38125-A AND REFER TO "WIRING REPAIR" IN THIS SECTION.

Step	Action	Yes	No
1	1. Was the "SIR Diagnostic System Check" performed?	Go to Step 2	Go to "SIRDiagn-ostic System Check"
2	1. Ignition switch "ON." 2. Using the TECH 1 SIR Data List Function select "Driver 36 VLR." 3. Is the displayed voltage 32.5 volts or more?	Go to Table A	Go to Step 3
3	1. Record the displayed voltage on the repair order. 2. Ignition switch "OFF." 3. Disconnect the yellow two-way electrical connector at the base of the steering column. 4. Disconnect the Arming Sensor. 5. Ignition switch "ON." 6. Using the TECH 1 Data List Function select "Driver 36 VLR." 7. Is the displayed voltage about the same as the recorded voltage?	Go to Step 5	Go to Step 4
4	1. Ignition switch "OFF." 2. Replace the Arming Sensor. 3. Has the sensor been replaced?	Go to Step 13	—
5	1. Using the TECH 1 SIR Data List Function select "Ignition." 2. Is the displayed voltage about the same as the recorded voltage?	Go to Step 6	Go to Step 9
6	1. Ignition switch "OFF." 2. Disconnect the Arming Sensor jumper harness electrical connector C109. 3. Ignition switch "ON." 4. Using the TECH 1 SIR Data List Function select "Ignition." 5. Is the displayed voltage about the same as the recorded voltage?	Go to Step 7	Go to Step 8
7	1. Ignition switch "OFF." 2. Repair the short from CKT 236 to B+. 3. Has the short CKT been repaired?	Go to Step 13	—
8	1. Ignition switch "OFF." 2. Repair the short from CKT 236 to B+. 3. Has the short CKT been repaired?	Go to Step 13	—

97I05624 Courtesy of General Motors Corp.

Fig. 48: DTC B1042 - Loop Energy Reserve Voltage Low (1 Of 2)
Courtesy of General Motors Corp.

DTC B1042 - LOOP ENERGY RESERVE VOLTAGE LOW (2 OF2)

WHEN MEASUREMENTS ARE REQUESTED IN THIS TABLE, USE J 39200 DVM WITH CORRECT TERMINAL ADAPTER FROM J 35616-A. WHEN A CHECK FOR PROPER CONNECTION IS REQUESTED REFER TO "INTERMITTENTS AND POOR CONNECTIONS" IN SECTION 8A-4. WHEN A WIRE, CONNECTOR OR TERMINAL REPAIR IS REQUESTED USE J 38125-A AND REFER TO "WIRING REPAIR" IN THIS SECTION.

Step	Action	Yes	No
9	1. Ignition switch "OFF." 2. Is the recorded voltage on the repair order 1.0 volt or less?	Go to Step 10	Go to Table A
10	1. Disconnect the Arming Sensor jumper harness electrical connector C109. 2. Ignition switch "ON." 3. Using the TECH 1 SIR Data List Function select "Driver 36 VLR." 4. Does the scan tool display 1.0 volt or less?	Go to Step 11	Go to Step 12
11	1. Repair the short from CKT 236 to ground. 2. Has the short CKT been repaired?	Go to Step 13	—
12	1. Repair the short from CKT 236 to ground. 2. Has the short CKT been repaired?	Go to Step 13	—
13	1. Reconnect all the SIR components. 2. Ensure the components are properly mounted. 3. Have all the SIR components been reconnected and properly mounted?	Go to Step 14	—
14	1. Clear the SIR Diagnostic Trouble Codes. 2. Have the SIR Diagnostic Trouble Codes been cleared?	Go to "SIR Diagnostic System Check"	—

97B05625 Courtesy of General Motors Corp.

Fig. 49: DTC B1042 - Loop Energy Reserve Voltage Low (2 Of 2)
Courtesy of General Motors Corp.

DTC B1043 - DRIVER SOURCE FEED LOW

WARNING: To avoid air bag deployment and injury when trouble shooting system, only use test equipment specified in diagnostic tables. Under no circumstances should battery powered test equipment or test light be used. Carefully follow all instructions.

Description

During normal non-deployment operation of SIR system, DERM monitors voltage supplied through arming sensor to high side of driver deployment loop at DRIVER SOURCE SENSE terminal No. A5. This measured voltage will have a value approximately equal; to DRIVER 36 VLR. When voltage measured at DRIVER-SIDE LOW terminal No. B8 is in its normal operating range, indicating driver deployment loop integrity has been maintained, while simultaneously the voltage measured at DRIVER SOURCE SENSE terminal No. A5 is a specified amount below DRIVER 36 VLR for 500 milliseconds, DTC B1043 will set.

DTC Will Set

When voltage measured at DRIVER-SIDE LOW terminal No. B8 is within a specified percentage of DRIVER 36 VLR while simultaneously voltage measured at DRIVER SOURCE SENSE terminal No. A5 is a specified amount below DRIVER 36 VLR for 500 milliseconds during CONTINUOUS MONITORING.

Action Taken

DERM turns on AIR BAG indicator and sets a diagnostic trouble code.

DTC Will Clear

When voltage measured at DRIVER-SIDE LOW terminal No. B8 is within a specified percentage of DRIVER 36 VLR while simultaneously voltage measured at DRIVER SOURCE SENSE terminal No. A5 is within a specified amount of DRIVER 36 VLR for 500 milliseconds during CONTINUOUS MONITORING.

Diagnostic Aids

An intermittent condition is likely to be caused by a poor connection to DERM at terminal No. A5, a poor connection to arming sensor or arming sensor jumper harness electrical connector at terminal No. C, an open or short to ground in CKT 1400 or increased resistance of arming sensor.

NOTE: Test numbers refer to test numbers on diagnostic table. For circuit number identification, see WIRING DIAGRAM.

1) The SIR DIAGNOSTIC SYSTEM CHECK must be starting point for all diagnostics.

12) This test checks for open in DRIVER SOURCE SENSE circuit.

15) This test locates open in DRIVER SOURCE SENSE circuit.

18) This test checks for a short in DRIVER SOURCE SENSE circuit to ground.

19) This test checks for a short in DRIVER SOURCE SENSE circuit to ground.

22) This test determines whether malfunction is due to increased resistance across DRIVER SOURCE SENSE resistor in arming sensor.

DTC 43 - DRIVER SOURCE FEED LOW (1 OF 2)

WHEN MEASUREMENTS ARE REQUESTED IN THIS TABLE, USE J 39200 DVM WITH CORRECT TERMINAL ADAPTER FROM J 35616-A. WHEN A CHECK FOR PROPER CONNECTION IS REQUESTED REFER TO "INTERMITTENTS AND POOR CONNECTIONS" IN SECTION 8A-4. WHEN A WIRE, CONNECTOR OR TERMINAL REPAIR IS REQUESTED USE J 38125-A AND REFER TO "WIRING REPAIR" IN THIS SECTION.

Step	Action	Yes	No
1	1. Was the "SIR Diagnostic System Check" performed?	Go to Step 2	Go to "SIR Diagnostic System Check"
2	1. Ignition switch "OFF." 2. Disconnect the yellow 2-way electrical connector at the base of the steering column. 3. Disconnect the DERM. 4. Check for proper connection to the DERM terminal "A5." 5. Is the DERM electrical harness connector damaged or corroded?	Go to Step 3	Go to Step 5
3	1. Repair the DERM electrical harness connector. 2. Has the connector been repaired?	Go to Step 4	—
4	1. Check for proper connection to the DERM at terminal "A5." 2. Are the DERM terminals damaged or corroded?	Go to Step 6	Go to Step 23
5	1. Check for proper connection to the DERM at terminal "A5." 2. Are the DERM terminals damaged or corroded?	Go to Step 6	Go to Step 7
6	1. Replace the DERM. Refer to ON-VEHICLE SERVICE, DIAGNOSTIC ENERGY RESERVE MODULE (DERM). 2. Has the DERM been replaced?	Go to Step 23	—
7	1. Disconnect the Arming Sensor. 2. Check for proper connection to the Arming Sensor at terminal "C." 3. Is the Arming Sensor electrical harness connector damaged or corroded?	Go to Step 8	Go to Step 9
8	1. Repair the Arming Sensor electrical harness connector. 2. Has the connector been repaired?	Go to Step 9	—
9	1. Check for proper connection to the Arming Sensor at terminal "C." 2. Are the Arming Sensor terminals damaged or corroded?	Go to Step 11	Go to Step 23
10	1. Check for proper connection to the Arming Sensor at terminal "C." 2. Are the Arming Sensor terminals damaged or corroded?	Go to Step 11	Go to Step 12
11	1. Replace the Arming Sensor. Refer to ON-VEHICLE SERVICE, ARMING SENSOR. 2. Has the sensor been replaced?	Go to Step 23	—

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Fig. 50: DTC B1043 - Driver Source Feed Low (1 Of 2)
Courtesy of General Motors Corp.

DTC B1043 - DRIVER SOURCE FEED LOW (2 OF 2)

WHEN MEASUREMENTS ARE REQUESTED IN THIS TABLE, USE J 39200 DVM WITH CORRECT TERMINAL ADAPTER FROM J 35616-A. WHEN A CHECK FOR PROPER CONNECTION IS REQUESTED REFER TO "INTERMITTENTS AND POOR CONNECTIONS" IN SECTION 8A-4. WHEN A WIRE, CONNECTOR OR TERMINAL REPAIR IS REQUESTED USE J 38125-A AND REFER TO "WIRING REPAIR" IN THIS SECTION.

Step	Action	Yes	No
12	1. Measure the resistance from the DERM electrical harness connector terminal "A5" to the Arming Sensor electrical harness connector terminal "C." 2. Is the resistance 5.0 ohms or less?	Go to Step 18	Go to Step 13
13	1. Disconnect the Arming Sensor jumper harness electrical connector C110. 2. Check for proper connection at the Arming Sensor jumper harness electrical connector C110. 3. Is the Arming Sensor jumper harness electrical connector C110 terminal "C" damaged or corroded?	Go to Step 14	Go to Step 15
14	1. Repair the Arming Sensor jumper harness electrical connector C110. 2. Has the connector been repaired?	Go to Step 23	—
15	1. Measure the resistance of CKT 1400 from the DERM electrical harness connector terminal "A5" to the Arming Sensor jumper harness electrical connector terminal "C." 2. Is the resistance 5.0 ohms or less?	Go to Step 16	Go to Step 17
16	1. Repair the open in CKT 1400 in arming sensor jumper harness. 2. Has the open CKT been repaired?	Go to Step 23	—
17	1. Repair the open in CKT 1400 in SIR wiring harness. 2. Has the open CKT been repaired?	Go to Step 23	—
18	1. Measure the resistance on the DERM electrical harness connector from terminal "A5" to terminal "A1" (ground). 2. Does J 39200 Display "OL" (infinite)?	Go to Step 22	Go to Step 19
19	1. Disconnect the Arming Sensor jumper harness electrical connector C110. 2. Measure the resistance on the DERM electrical harness connector from terminal "A5" to terminal "A1" (ground). 3. Does J 39200 Display "OL" (infinite)?	Go to Step 20	Go to Step 21
20	1. Repair the short in CKT 1400 to ground. 2. Has the short CKT been repaired?	Go to Step 23	—
21	1. Repair the short in CKT 1400 to ground. 2. Has the short CKT been repaired?	Go to Step 23	—
22	1. Measure the resistance of the Arming Sensor from terminal "C" to terminal "D." 2. Is the resistance 7.67k ohms or more?	Go to Step 11	Go to Table A
23	1. Reconnect all the SIR system components. 2. Ensure the components are properly mounted. 3. Have all the SIR components been reconnected and properly mounted?	Go to Step 24	—
24	1. Clear the SIR Diagnostic Trouble Codes. 2. Have the SIR Diagnostic Trouble Codes been cleared?	Go to "SIR Diagnostic System Check"	—

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Courtesy of General Motors Corp.

Fig. 51: DTC B1043 - Driver Source Feed Low (2 Of 2)
Courtesy of General Motors Corp.

DTC B1051 - FRONTAL CRASH DETECTED

WARNING: To avoid air bag deployment and injury when trouble shooting system, only use test equipment specified in diagnostic tables. Under no circumstances should battery powered test equipment or test light be used. Carefully follow all instructions.

Description

Closure of arming sensor is detected when voltage measured at DRIVER-SIDE HIGH terminal No. B9 is within a specified amount of its deployment loop supply voltage. Closure of either discriminating sensor is detected when voltage measured at DRIVER-SIDE LOW terminal No. B8 is within a specified amount of ground potential. When both conditions are met simultaneously for not less than 250 microseconds, CRASH DATA is recorded and DTC B1051 is set.

DTC Will Set

When closure of arming sensor and at least one of the discriminating sensors is detected simultaneously for not less than 250 microseconds.

Action Taken

DERM turns on AIR BAG indicator, records CRASH DATA and sets a diagnostic trouble code.

DTC Will Clear

A scan tool clear codes command is received by DERM.

NOTE: Test numbers refer to test numbers on diagnostic table. For circuit number identification, see WIRING DIAGRAM.

1) The SIR DIAGNOSTIC SYSTEM CHECK must be starting point for all diagnostics.

2) When DTC B1042 and DTC B1051 are set simultaneously, perform DTC B1042 diagnosis first.

3) If air bag module has not deployed, DTC B1051 may have set falsely.

4) If DTC B1051 has set with no signs of frontal impact, diagnostic trouble code has set falsely.

5) When frontal crash has occurred, it is necessary to perform indicated procedures to ensure SIR system is fully functional.

6) This test checks for a DERM malfunction setting diagnostic trouble code.

7) This test checks for a DERM malfunction setting diagnostic trouble code.

8) This test determines whether diagnostic trouble code was set inadvertently during diagnosis or by DERM malfunction.

DTC 51 - FRONTAL CRASH DETECTED

WHEN MEASUREMENTS ARE REQUESTED IN THIS TABLE, USE J 39200 DVM WITH CORRECT TERMINAL ADAPTER FROM J 35616-A. WHEN A CHECK FOR PROPER CONNECTION IS REQUESTED REFER TO "INTERMITTENTS AND POOR CONNECTIONS" IN SECTION 8A-4. WHEN A WIRE, CONNECTOR OR TERMINAL REPAIR IS REQUESTED USE J 38125-A AND REFER TO "WIRING REPAIR" IN THIS SECTION.

Step	Action	Yes	No
1	1. Was the "SIR Diagnostic System Check" performed?	Go to Step 2	Go to "SIR Diagnostic System Check"
2	1. Using the scan tool, request the SIR Diagnostic Trouble Code Display. 2. Is the DTC 42 current?	Go to DTC B1042	Go to Step 3
3	1. Ignition switch "OFF." 2. Has the Inflator Module deployed?	Go to Step 5	Go to Step 4
4	1. Inspect the front of the vehicle and undercarriage for signs of impact. 2. Are there signs of impact?	Go to Step 5	Go to Step 6
5	1. Replace the components and perform inspections as directed in the "REPAIRS AND INSPECTIONS REQUIRED AFTER AN ACCIDENT" in this section. 2. Have the accident repairs been completed?	Go to Step 9	—
6	1. Ignition switch "ON." 2. Using the TECH 1 SIR Data List Function select "Deploy Command." 3. Is the deploy command "Active"?	Go to Table A	Go to Step 7
7	1. Ignition switch "ON." 2. Clear the SIR Diagnostic Trouble Codes. 3. Is DTC 51 set?	Go to Table A	Go to Step 8
8	1. Ignition switch "OFF." 2. Was DTC 51 set when the "SIR Diagnostic System Check" was first performed?	Go to Table A	Go to "SIR Diagnostic System Check"
9	1. Reconnect all the SIR system components. 2. Ensure the components are properly mounted. 3. Have all the SIR system components been reconnected and properly mounted?	Go to Step 10	—
10	1. Clear the SIR Diagnostic Trouble Codes. 2. Have the SIR Diagnostic Trouble Codes been cleared?	Go to "SIR Diagnostic System Check"	—

96A14381

Fig. 52: DTC B1051 - Frontal Crash Detected
Courtesy of General Motors Corp.

DTC B1052 - DATA AREA FULL

WARNING: To avoid air bag deployment and injury when trouble shooting system, only use test equipment specified in diagnostic tables. Under no circumstances should battery powered test equipment or test light be used. Carefully follow all instructions.

Description

When there is a frontal crash of sufficient force to activate arming sensor and at least one discriminating sensor simultaneously, DTC B1051 is set. At this time, DERM will record information regarding SIR system status and vehicle status in EEPROM. DTC B1052 will set when DERM has stored information regarding eight frontal crash events.

DTC Will Set

When DERM attempts to store frontal crash information and finds EEPROM data area full.

Action Taken

DERM turns on AIR BAG indicator and sets a diagnostic trouble code.

DTC Will Clear

DERM receives scan tool clear codes command. If, at next ignition ON after receiving clear codes command DERM detects data area is full, a history diagnostic trouble code is set. This allows AIR BAG indicator to illuminate should any additional malfunctions be detected.

DTC B1052 - DATA AREA FULL

WHEN MEASUREMENTS ARE REQUESTED IN THIS TABLE, USE J 39200 DVM WITH CORRECT TERMINAL ADAPTER FROM J 35616-A. WHEN A CHECK FOR PROPER CONNECTION IS REQUESTED REFER TO "INTERMITTENTS AND POOR CONNECTIONS" IN SECTION 8A-4. WHEN A WIRE, CONNECTOR OR TERMINAL REPAIR IS REQUESTED USE J 38125-A AND REFER TO "WIRING REPAIR" IN THIS SECTION.

Step	Action	Yes	No
1	1. Was the "SIR Diagnostic System Check" performed?	Go to Step 2	Go to "SIR Diagnostic System Check"
2	1. Replace the DERM. 2. Has the DERM been replaced?	Go to "SIR Diagnostic System Check"	—

96B14832 Courtesy of General Motors Corp.

Fig. 53: DTC B1052 - Data Area Full
Courtesy of General Motors Corp.

DTC B1053 - DERM DRIVER INITIATOR CIRCUITS HIGH RESISTANCE

WARNING: To avoid air bag deployment and injury when trouble shooting system, only use test equipment specified in diagnostic tables. Under no circumstances should battery powered test equipment or test light be used. Carefully follow all instructions.

Description

During INITIATOR ASSEMBLY RESISTANCE test, DERM grounds DRIVER-SIDE LOW terminal No. B8 and turns on driver current source at DRIVER-SIDE HIGH terminal No. B9. This causes a known amount of current to flow through driver initiator circuit. By monitoring difference between voltage at DRIVER-SIDE HIGH terminal No. B9 and DRIVER-SIDE LOW terminal No. B8, DERM calculates combined resistance of driver-side air bag module, SIR coil assembly, harness wiring CKTs 347 and 348 and connector terminal contact.

DTC Will Set

When voltage difference between DRIVER-SIDE HIGH terminal No. B9 and DRIVER-SIDE LOW terminal No. B8 is above a specified value and voltage at DRIVER-SIDE LOW is within a specified range. This test is run once each ignition cycle during INITIATOR ASSEMBLY RESISTANCE TEST when:

1) No higher priority faults are detected during Turn ON.
2) No higher priority faults are detected during CONTINUOUS MONITORING.
3) No CRANK signal is present.
4) IGNITION 1 voltage is above a specified value

Action Taken

DERM turns on AIR BAG indicator and sets a diagnostic trouble code.

DTC Will Clear

When ignition switch is turned OFF.

Diagnostic Aids

An intermittent condition is likely to be caused by a poor connection at DERM terminal No. B8 or B9, an open in CKT 347 or CKT 348. The test for this diagnostic trouble code is only run while AIR BAG indicator is performing BULB TEST. When scan tool clear codes command is issued and malfunction is still present, DTC will not reappear until next ignition cycle.

NOTE: Test numbers refer to test numbers on diagnostic table. For circuit number identification, see WIRING DIAGRAM.

1) The SIR DIAGNOSTIC SYSTEM CHECK must be starting point for all diagnostics.
7) This test checks whether malfunction is due to high resistance or open in DRIVER-SIDE LOW circuit.
9) This test checks whether malfunction is due to high resistance or open in DRIVER-SIDE HIGH circuit.

DTC B1053 - DERM DRIVER INITIATOR CIRCUIT HIGH RESISTANCE (1 OF 2)

WHEN MEASUREMENTS ARE REQUESTED IN THIS TABLE, USE J 39200 DVM WITH CORRECT TERMINAL ADAPTER FROM J 35616-A. WHEN A CHECK FOR PROPER CONNECTION IS REQUESTED REFER TO "INTERMITTENTS AND POOR CONNECTIONS" IN SECTION 8A-4. WHEN A WIRE, CONNECTOR OR TERMINAL REPAIR IS REQUESTED USE J 38125-A AND REFER TO "WIRING REPAIR" IN THIS SECTION.

Step	Action	Yes	No
1	1. Was the "SIR Diagnostic System Check" performed?	Go to Step 2	Go to "SIR Diagnostic System Check"
2	1. Ignition switch "OFF." 2. Disconnect the yellow 2-way electrical connector at the base of the steering column. 3. Disconnect the DERM. 4. Check for proper connection to DERM at terminals "B8" and "B9." 5. Are the DERM electrical harness connector terminals damaged or corroded?	Go to Step 3	Go to Step 5
3	1. Repair the DERM electrical harness connector. 2. Has the connector been repaired?	Go to Step 4	—
4	1. Check for proper connection to the DERM at terminals "B8" and "B9." 2. Are the DERM terminals damaged or corroded?	Go to Step 6	Go to Step 11
5	1. Check for proper connection to the DERM at terminals "B8" and "B9." 2. Are the DERM terminals damaged or corroded?	Go to Step 6	Go to Step 7
6	1. Replace the DERM. 2. Has the DERM been replaced?	Go to Step 11	—
7	1. Measure the resistance from the DERM electrical harness connector terminal "B8" to the yellow 2-way electrical connector at the base of the steering column terminal "B." 2. Is the resistance 5.0 ohms or less?	Go to Step 9	Go to Step 8
8	1. Repair the open or high resistance in CKT 348. 2. Has the open CKT been repaired?	Go to Step 11	—
9	1. Measure the resistance from the DERM electrical harness connector terminal "B9" to the yellow 2-way electrical connector at the base of the steering column terminal "A." 2. Is the resistance 5.0 ohms or less?	Go to Table A	Go to Step 10

96C14383 Courtesy of General Motors Corp.

Fig. 54: DTC B1053 - DERM Driver Initiator Circuits High Resistance (1 Of 2)
Courtesy of General Motors Corp.

DTC B1053 - DERM DRIVER INITIATOR CIRCUIT HIGH RESISTANCE (2 OF 2)

WHEN MEASUREMENTS ARE REQUESTED IN THIS TABLE, USE J 39200 DVM WITH CORRECT TERMINAL ADAPTER FROM J 35616-A. WHEN A CHECK FOR PROPER CONNECTION IS REQUESTED REFER TO "INTERMITTENTS AND POOR CONNECTIONS" IN SECTION 8A-4. WHEN A WIRE, CONNECTOR OR TERMINAL REPAIR IS REQUESTED USE J 38125-A AND REFER TO "WIRING REPAIR" IN THIS SECTION.

Step	Action	Yes	No
10	1. Repair the open or high resistance in CKT 347 2. Has the open CKT been repaired?	Go to Step 11	—
11	1. Reconnect all the SIR components. 2. Ensure the components are properly mounted. 3. Have all the SIR components been reconnected and properly mounted?	Go to Step 12	—
12	1. Clear the SIR Diagnostic Trouble Codes. 2. Have the SIR Diagnostic Trouble Codes been cleared?	Go to "SIR Diagnostic System Check"	—

97D14384 Courtesy of General Motors Corp.

Fig. 55: DTC B1053 - DERM Driver Initiator Circuits High Resistance (2 Of 2)
Courtesy of General Motors Corp.

DTC B1055 - DERM INCOMPATIBILITY

WARNING: To avoid air bag deployment and injury when trouble shooting system, only use test equipment specified in diagnostic tables. Under no circumstances should battery powered test equipment or test light be used. Carefully follow all instructions.

Description

When IGNITION 1 voltage is first applied to DERM it will perform Turn ON tests followed by CONTINUOUS MONITORING for one second. DERM also monitors DRIVER-SIDE LOW terminal No. B8 to ensure voltage is being applied to air bag module and monitors DRIVER SOURCE SENSE terminal No. A5 to ensure DRIVER 36 VLR is supplying voltage to deployment loop. Ground is applied at terminal No. B7 (passenger-side low for a Driver/Passenger DERM) and voltage is measured at DRIVER-SIDE LOW and at terminal No. A6 (passenger source sense for a Driver/Passenger DERM). When grounding terminal No. B7 grounds DRIVER-SIDE LOW or voltage is measured at terminal No. A6, DTC B1055 is set.

DTC Will Set

When circuit descriptions indicate a Driver/Passenger DERM has been installed in vehicle. This test is run once each ignition cycle during INITIATOR ASSEMBLY RESISTANCE TEST when:

1) No higher priority faults are detected during Turn ON.
2) No higher priority faults are detected during CONTINUOUS MONITORING for 1 second.
3) No CRANK signal present.
4) IGNITION 1 voltage is above a specified value.

Action Taken

DERM turns on AIR BAG indicator and sets a diagnostic trouble code.

DTC Will Clear

When ignition switch is turned OFF.

DTC B1055 - DERM INCOMPATIBILITY

WHEN MEASUREMENTS ARE REQUESTED IN THIS TABLE, USE J 39200 DVM WITH CORRECT TERMINAL ADAPTER FROM J 35616-A. WHEN A CHECK FOR PROPER CONNECTION IS REQUESTED REFER TO "INTERMITTENTS AND POOR CONNECTIONS" IN SECTION 8A-4. WHEN A WIRE, CONNECTOR OR TERMINAL REPAIR IS REQUESTED USE J 38125-A AND REFER TO "WIRING REPAIR" IN THIS SECTION.

Step	Action	Yes	No
1	1. Was the "SIR Diagnostic System Check" performed?	Go to Step 2	Go to "SIR Diagnostic System Check"
2	1. Replace the DERM. 2. Has the DERM been replaced?	Go to "SIR Diagnostic System Check"	—

96E14385

Courtesy of General Motors Corp.

Fig. 56: DTC B1055 - DERM Incompatibility
Courtesy of General Motors Corp.

DTC B1061 - SIR INDICATOR CIRCUIT FAILURE

WARNING: To avoid air bag deployment and injury when trouble shooting system, only use test equipment specified in diagnostic tables. Under no circumstances should battery powered test equipment or test light be used. Carefully follow all instructions.

Description

When ignition switch is first turned ON, battery voltage is applied to AIR BAG indicator and to IGNITION 1 input terminal Nos. A9 and A10. DERM responds by flashing AIR BAG indicator 7 times alternating between primary and redundant lamp drivers. DERM monitors primary lamp driver output by comparing output state at AIR BAG indicator terminal No. B1 to microprocessor commanded state. When IGNITION 1 is above a specified value and output state does not match commanded state of primary lamp driver for 400 milliseconds, DTC B1061 is set.

DTC Will Set

When IGNITION 1 voltage is above a specified value and output state at AIR BAG indicator terminal No. B1 does not match commanded state of primary lamp driver for 400 milliseconds during CONTINUOUS MONITORING.

Action Taken

DERM attempts to turn on AIR BAG indicator using redundant lamp driver and sets a diagnostic trouble code.

DTC Will Clear

When ignition switch is turned OFF.

Diagnostic Aids

See TABLE B and TABLE C to diagnose warning lamp circuit malfunctions.

NOTE: Test numbers refer to test numbers on diagnostic table. For circuit number identification, see WIRING DIAGRAM.

1) The SIR DIAGNOSTIC SYSTEM CHECK must be starting point for all diagnostics.

2) When DERM is configured for a serial data controlled warning lamp (smart cluster), DTC B1061 will set. Clearing SIR diagnostic trouble codes will reset DERM allowing lamp driver in DERM

to control AIR BAG indicator.

DTC B1061 - SIR INDICATOR CIRCUIT FAILURE

MALFUNCTIONS WITHIN THE "AIR BAG" WARNING LAMP CIRCUITRY WILL SET THIS DIAGNOSTIC TROUBLE CODE. THESE MALFUNCTIONS ARE ADDRESSED IN THE "SIR DIAGNOSTIC SYSTEM CHECK" VIA TABLE B AND TABLE C. FAILURE TO PROPERLY PERFORM THE "SIR DIAGNOSTIC SYSTEM CHECK" MAY RESULT IN MISDIAGNOSIS OF A MALFUNCTIONING DERM.

Step	Action	Yes	No
1	1. Was the "SIR Diagnostic System Check" performed?	Go to Step 2	Go to "SIR Diagnostic System Check"
2	1. Ignition switch "ON." 2. Clear the SIR Diagnostic Trouble Codes. 3. Is DTC B1061 set?	Go to Table A	Go to "SIR Diagnostic System Check"

96F14386 Courtesy of General Motors Corp.

Fig. 57: DTC B1061 - SIR Indicator Circuit Failure
Courtesy of General Motors Corp.

DTC B1062 - REDUNDANT SIR INDICATOR CIRCUIT FAILURE

WARNING: To avoid air bag deployment and injury when trouble shooting system, only use test equipment specified in diagnostic tables. Under no circumstances should battery powered test equipment or test light be used. Carefully follow all instructions.

Description

When ignition switch is first turned ON, battery voltage is applied to AIR BAG indicator and to IGNITION 1 input terminal Nos. A9 and A10. DERM responds by flashing AIR BAG indicator 7 times alternating between primary and redundant lamp drivers. DERM monitors redundant lamp driver output by comparing output state at AIR BAG indicator terminal No. B1 to microprocessor commanded state. When IGNITION 1 is above a specified value and output state does not match commanded state of primary lamp driver for 400 milliseconds, DTC B1062 is set.

DTC Will Set

When IGNITION 1 voltage is above a specified value and output state at AIR BAG indicator terminal No. B1 does not match commanded state of redundant lamp driver for 400 milliseconds during CONTINUOUS MONITORING.

Action Taken

DERM attempts to turn on AIR BAG indicator using primary lamp driver and sets a diagnostic trouble code.

DTC Will Clear

When ignition switch is turned OFF.

Diagnostic Aids

An intermittent condition is likely to be caused by a poor connection to DERM at terminal Nos. A2 or B2, an open in CKT 1851 or an open in CKT 39.

NOTE: Test numbers refer to test numbers on diagnostic table. For circuit number identification, see WIRING DIAGRAM.

1) The SIR DIAGNOSTIC SYSTEM CHECK must be starting point for all diagnostics.

8) This test checks for an open in REDUNDANT INDICATOR ground circuit.

10) This test checks for an open in REDUNDANT INDICATOR IGNITION 1 circuit.

13) This test locates open in REDUNDANT INDICATOR IGNITION 1 circuit.

DTC 62 - REDUNDANT SIR INDICATOR CIRCUIT FAILURE (1 OF 2)

WHEN MEASUREMENTS ARE REQUESTED IN THIS TABLE, USE J 39200 DVM WITH CORRECT TERMINAL ADAPTER FROM J 35616-A. WHEN A CHECK FOR PROPER CONNECTION IS REQUESTED REFER TO "INTERMITTENTS AND POOR CONNECTIONS" IN SECTION 8A-4. WHEN A WIRE, CONNECTOR OR TERMINAL REPAIR IS REQUESTED USE J 38125-A AND REFER TO "WIRING REPAIR" IN THIS SECTION.

Step	Action	Yes	No
1	1. Was the "SIR Diagnostic System Check" performed?	Go to Step 2	Go to "SIR Diagnostic System Check"
2	1. Is DTC 61 also set?	Go to DTC B1061	Go to Step 3
3	1. Ignition switch "OFF." 2. Disconnect the yellow 2-way electrical connector at the base of the steering column. 3. Disconnect the DERM. 4. Check for proper connection to the DERM at terminals "A2" and "B2." 5. Are the DERM electrical harness connector terminals damaged or corroded?	Go to Step 4	Go to Step 6
4	1. Repair the DERM electrical harness connector. 2. Has the connector been repaired?	Go to Step 5	—
5	1. Check for proper connection to the DERM at terminals "A2" and "B2." 2. Are the DERM terminals damaged or corroded?	Go to Step 7	Go to Step 16

96G14387

Fig. 58: DTC B1062 - Redundant SIR Indicator Circuit Failure (1 Of 2)
Courtesy of General Motors Corp.

DTC B1062 - REDUNDANT SIR INDICATOR CIRCUIT FAILURE (2 0F 2)

WHEN MEASUREMENTS ARE REQUESTED IN THIS TABLE, USE J 39200 DVM WITH CORRECT TERMINAL ADAPTER FROM J 35616-A. WHEN A CHECK FOR PROPER CONNECTION IS REQUESTED REFER TO "INTERMITTENTS AND POOR CONNECTIONS" IN SECTION 8A-4. WHEN A WIRE, CONNECTOR OR TERMINAL REPAIR IS REQUESTED USE J 38125-A AND REFER TO "WIRING REPAIR" IN THIS SECTION.

Step	Action	Yes	No
6	1. Check for proper connection to the DERM at terminals "A2" and "B2." 2. Are the DERM terminals damaged or corroded?	Go to Step 7	Go to Step 8
7	1. Replace the DERM. 2. Has the DERM been replaced?	Go to Step 16	—
8	1. Measure the resistance on the DERM electrical harness connector from terminal "A2" (ground) to terminal "A12" (ground). 2. Is the resistance 5.0 ohms or less?	Go to Step 10	Go to Step 9
9	1. Repair the open in CKT 1851. 2. Has the open CKT been repaired?	Go to Step 16	—
10	1. Ignition switch "ON." 2. Measure the voltage on the DERM electrical harness connector from terminal "B2" to terminal "A12" (ground). 3. Is the voltage 1 volt or less?	Go to Step 11	Go to Table A
11	1. Disconnect connector C203. 2. Check for proper connection at terminal "G3." 3. Is connector C203 damaged or corroded?	Go to Step 12	Go to Step 13
12	1. Repair connector C203. 2. Has the connector been repaired?	Go to Step 16	—
13	1. Ignition switch "ON." 2. Measure the voltage on the fuse side of connector (C200) terminal "G3." 3. Is the voltage 1 volt or less?	Go to Step 14	Go to Step 15
14	1. Ignition switch "OFF." 2. Repair the open in CKT 39. 3. Has the open CKT been repaired?	Go to Step 16	—
15	1. Ignition switch "OFF." 2. Repair the open in CKT 39 between the DERM and connector C203 terminal "G3." 3. Has the open CKT been repaired?	Go to Step 16	—
16	1. Reconnect all the SIR components. 2. Ensure the components are properly mounted. 3. Have all the SIR components been reconnected and properly mounted?	Go to Step 17	—
17	1. Clear the SIR Diagnostic Trouble Codes. 2. Have the SIR Diagnostic Trouble Codes been cleared?	Go to "SIR Diagnostic System Check"	—

97F05627 Courtesy of General Motors Corp.

Fig. 59: DTC B1062 - Redundant SIR Indicator Circuit Failure (2 Of 2)
Courtesy of General Motors Corp.

DTC B1071 AND/OR 75 - INTERNAL DERM FAULT

WARNING: To avoid air bag deployment and injury when trouble shooting system, only use test equipment specified in diagnostic tables. Under no circumstances should battery powered test equipment or test light be used. Carefully follow all instructions.

Description

DTC B1071 and/or DTC B1075 is an indication of an internal DERM malfunction and will set if any of the following conditions are detected:

1) DERM energy reserve voltage discharge time failure for 3

consecutive ignition cycles.
2) DERM unable to read from or write to EEPROM.
3) DRIVER 36 VLR power supply voltage is above a specified value for 500 milliseconds.
4) DERM calculated number for vehicle in which it is installed does not match value stored in EEPROM.

DTC Will Set

When any of the indicated malfunctions are detected by the DERM. The malfunctions are tested at different times:
1) At Turn ON.
2) Asynchronously
3) During CONTINUOUS MONITORING.
4) At Turn ON.

Action Taken

DERM turns ON AIR BAG indicator and sets a diagnostic trouble code.

DTC Will Clear

The indicated malfunctions are not detected by DERM.

DTC B1071/75 - INTERNAL DERM FAULT

WHEN MEASUREMENTS ARE REQUESTED IN THIS TABLE, USE J 39200 DVM WITH CORRECT TERMINAL ADAPTER FROM J 35616-A. WHEN A CHECK FOR PROPER CONNECTION IS REQUESTED REFER TO "INTERMITTENTS AND POOR CONNECTIONS" IN SECTION 8A-4. WHEN A WIRE, CONNECTOR OR TERMINAL REPAIR IS REQUESTED USE J 38125-A AND REFER TO "WIRING REPAIR" IN THIS SECTION.

Step	Action	Yes	No
1	1. Was the "SIR Diagnostic System Check" performed?	Go to Step 2	Go to "SIR Diagnostic System Check"
2	1. Replace the DERM. 2. Has the DERM been replaced?	Go to "SIR Diagnostic System Check"	—

96I14389 Courtesy of General Motors Corp.

Fig. 60: DTC B1071 And/Or 75 - Internal DERM Fault
Courtesy of General Motors Corp.

DTC B1083 - DRIVER RESERVE DIODE SHORTED

WARNING: To avoid air bag deployment and injury when trouble shooting system, only use test equipment specified in diagnostic tables. Under no circumstances should battery powered test equipment or test light be used. Carefully follow all instructions.

Description

During Turn ON tests, performed at beginning of each ignition cycle, DERM delays charging of DRIVER 36 VLR power supply. While delay is active, DERM measures voltage at DRIVER 36 VLR terminal No. A4 and DRIVER SOURCE SENSE terminal No. A5. When driver reserve diode is shorted, IGNITION 1 voltage is measured at DRIVER 36 VLR from forward biased driver ignition diode. When voltage is measured at DRIVER 36 VLR is within a specified range of IGNITION 1 voltage for 8 consecutive Turn ON tests, history DTC B1083 is set.

DTC Will Set

When voltage measured at DRIVER 36 VLR terminal No. A4 is within a specified range of IGNITION 1 voltage for 8 consecutive turn on tests and no higher priority faults are detected. This test is run once each ignition during Turn ON test while 36 VLR delay is active.

Action Taken
DERM sets a history diagnostic trouble code.

DTC Will Clear
When voltage measured at DRIVER 36 VLR terminal No. A4 indicates that power supply is in a discharged state during Turn ON tests.

Diagnostic Aids
This diagnostic trouble code will not set as a current DTC. Follow DTC table to diagnose malfunction.

NOTE: Test numbers refer to test numbers on diagnostic table. For circuit number identification, see WIRING DIAGRAM.

2) This test determines if malfunction is due to a shorted driver reserve diode within arming sensor.

DTC B1083 - DRIVER RESERVE DIODE SHORTED

WHEN MEASUREMENTS ARE REQUESTED IN THIS TABLE, USE J 39200 DVM WITH CORRECT TERMINAL ADAPTER FROM J 35616-A. WHEN A CHECK FOR PROPER CONNECTION IS REQUESTED REFER TO "INTERMITTENTS AND POOR CONNECTIONS" IN SECTION 8A-4. WHEN A WIRE, CONNECTOR OR TERMINAL REPAIR IS REQUESTED USE J 38125-A AND REFER TO "WIRING REPAIR" IN THIS SECTION.

Step	Action	Yes	No
1	1. Was the "SIR Diagnostic System Check" performed?	Go to Step 2	Go to "SIR Diagnostic System Check"
2	1. Ignition switch "OFF." 2. Disconnect the yellow 2-way electrical connector at the base of the steering column and connect the harness side of the connector to SIR Driver/Passenger load tool J 38715-A. 3. Disconnect the DERM. 4. Ignition switch "ON." 5. Measure the voltage on the DERM electrical harness connector from terminal "A4" to terminal "A12" (ground). 6. Is the voltage 1 volt or less?	Go to Table A	Go to Step 3
3	1. Ignition switch "OFF." 2. Disconnect J 38715-A. 3. Replace the Arming Sensor. 4. Has the sensor been replaced?	Go to Step 4	—
4	1. Reconnect all the SIR components. 2. Ensure the components are properly mounted. 3. Have all the SIR components been reconnected and properly mounted?	Go to Step 5	—
5	1. Clear the SIR Diagnostic Trouble Codes. 2. Have the SIR Diagnostic Trouble Codes been cleared?	Go to "SIR Diagnostic System Check"	—

96B14390 Courtesy of General Motors Corp.

Fig. 61: DTC B1083 - Driver Reserve Diode Shorted
Courtesy of General Motors Corp.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS TABLE

Application	Ft. Lbs. (N.m)
Steering Wheel Nut	30 (41)

	INCH Lbs. (N.m)
Air Bag Module Nut/Screw	
Driver-Side	27 (3)
SIR Coil Mounting Screw	30 (3.4)
Turn Signal Switch Screw	30 (3.4)
Turn Signal Switch Arm Screw	20 (2.3)

WIRING DIAGRAM

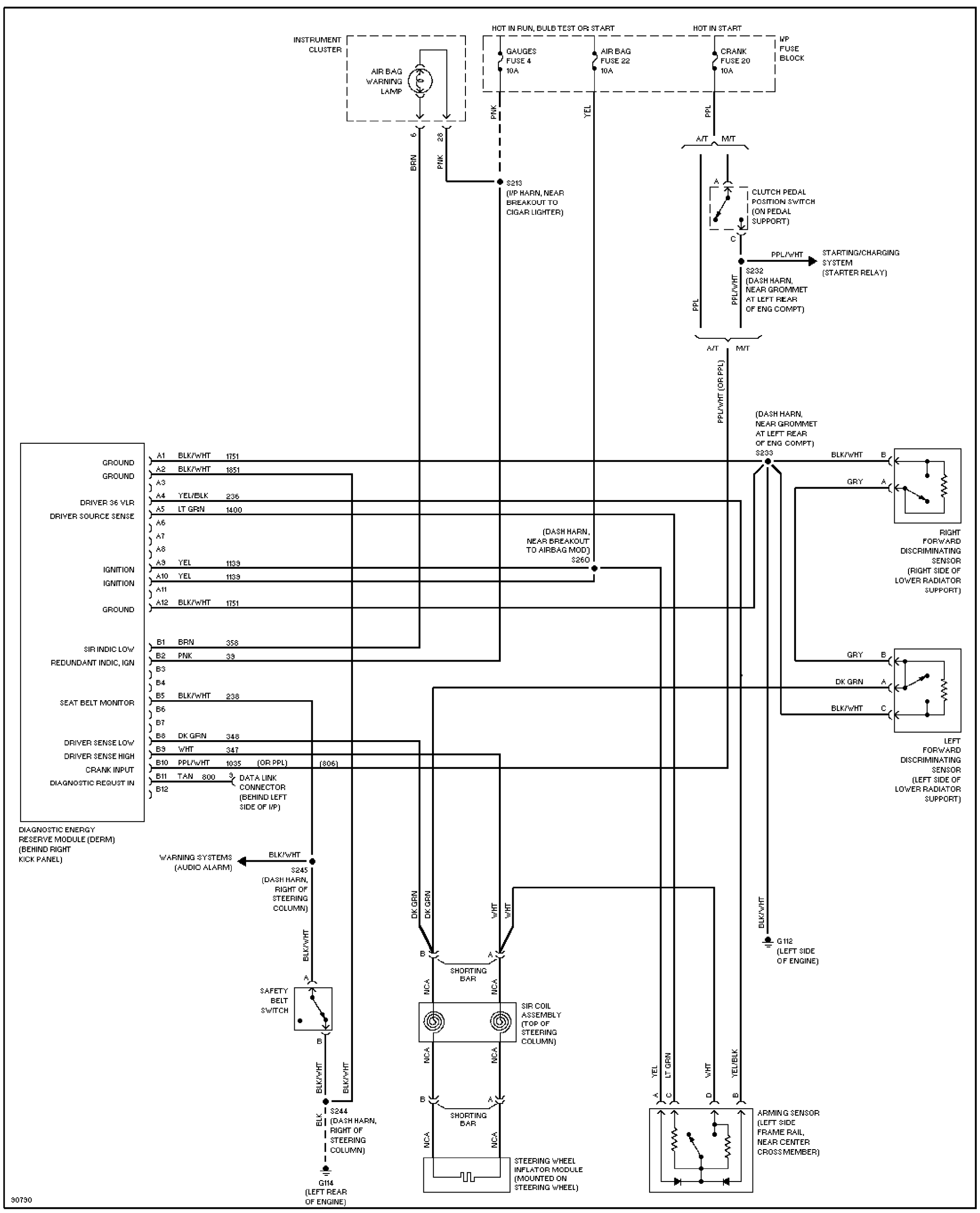


Fig. 62: SIR System Wiring Diagram

ANTI-LOCK BRAKE SAFETY PRECAUTIONS

1997 Chevrolet Blazer

GENERAL INFORMATION
Anti-Lock Brake Safety Precautions

* PLEASE READ THIS FIRST *

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

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

ANTI-LOCK BRAKE SAFETY PRECAUTIONS

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

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

ANTI-LOCK BRAKE SYSTEM

1997 Chevrolet Blazer

1997 BRAKES
General Motors - Anti-Lock - 4WAL

Chevrolet; Blazer & S/T Series Pickup
GMC; Jimmy & Sonoma
Oldsmobile; Bravada

DESCRIPTION

The Kelsey-Hayes 4-Wheel Anti-Lock (4WAL) brake system is used to prevent wheel lock-up during heavy braking. This allows driver to maintain steering control while stopping vehicle in shortest distance possible. The system consists of Brake Pressure Modulator Valve (BPMV), Vehicle Speed Sensor (VSS), Powertrain Control Module (PCM) or Vehicle Control Module (VCM), Wheel Speed Sensors (WSS), warning lights, electrical wiring and hydraulic lines.

The Electro-Hydraulic Control Unit (EHCU) is the entire unit, including the BPMV, Electronic Brake Control Module (EBCM) and combination valve. The EBCM is the electronic control portion of the ABS assembly. It is mounted on top of the BPMV located on left side of engine compartment, above fender well.

OPERATION

When ignition is turned on, Yellow ANTI-LOCK and Red BRAKE warning lights will illuminate for 2 seconds as a bulb check. VCM performs a self-check of the 4WAL system, once each ignition cycle, when vehicle speed reaches 8 MPH. If faults are detected by VCM, ANTI-LOCK light will illuminate (in most cases) and 4WAL functions will be disabled while ANTI-LOCK light is on. A related Diagnostic Trouble Code (DTC) will be stored. The Red BRAKE light illuminates if parking brake is applied or a mechanical brake problem is detected.

When brake pedal is depressed, brake switch voltage to VCM drops from 12 volts to one volt. At this point, VCM monitors wheel speed through an AC signal generated by speed sensors located at each wheel. If the deceleration rate of wheel speed reaches a preprogrammed rate, PCM/VCM will activate various control valves to prevent wheel lock-up by increasing or decreasing hydraulic pressure to each channel: left front, right front or rear wheels.

BLEEDING BRAKE SYSTEM

ABS BLEEDING PROCEDURE

NOTE: Bleeding ABS system requires the use of Tech 1 scan tool. An assistant is required when performing bleeding procedures.

1) Raise and support vehicle. Begin bleeding at right rear wheel. Install a clear plastic hose to bleed screw. Immerse other end of hose in container that is partially filled with clean brake fluid.

2) Open bleed screw 1/2 to 1 full turn. Have assistant slowly depress brake pedal until it reaches full travel. Hold pedal until bleed screw is closed. Release brake pedal and wait 10-15 seconds. Repeat until clean bubble-free brake fluid is present at wheel bleed screw.

3) Check master cylinder fluid level every 4-6 strokes of brake pedal to avoid running system dry. Repeat steps 2) and 3) on left rear, then right front, then left front. After bleeding all 4

wheels, go to next step.

4) Using scan tool in FUNCTION TEST, run FUNCTION TEST 4 times consecutively while applying the brake pedal firmly. Release brake pedal between each test.

5) Rebleed all 4 wheels using steps 2) and 3) to remove remaining air from brake system. Ensure brake pedal feel is appropriate before attempting to drive vehicle. Rebleed as many times as necessary to obtain appropriate pedal feel.

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. See COMPUTER RELEARN PROCEDURES article in GENERAL INFORMATION before disconnecting battery.

BRAKE PRESSURE MODULATOR VALVE (BPMV) & COMBINATION VALVE

Removal & Installation

1) Disconnect negative battery terminal. Remove bolts to shield and mounting bracket to BPMV and EBCM. Disconnect harness connector from BPMV. Remove brake lines from BPMV. Remove bolts to separate combination valve and BPMV. Remove 2 transfer tubes.

NOTE: DO NOT reuse transfer tubes.

2) To install, reverse removal procedure. Bleed brake system, including BPMV. See BLEEDING BRAKE SYSTEM. DO NOT overtighten BPMV-to-bracket bolts during installation. This may cause excessive noise transfer into vehicle. See TORQUE SPECIFICATIONS.

ELECTRONIC BRAKE CONTROL MODULE (EBCM)

Removal & Installation

1) Disconnect negative battery terminal. Disconnect harness connector from EBCM and combination valve. Remove 4 module retaining screws.

2) To install, reverse removal procedure. DO NOT use RTV or any other type of sealant on EBCM gasket or mating surfaces.

FRONT WHEEL SPEED SENSOR

NOTE: For installation purposes, note speed sensor wire routing before removing. Misrouted wiring may cause electromagnetic interference failures.

Removal & Installation (2WD)

1) Remove wheel. Remove brake caliper and wire aside. Remove hub and rotor. Disconnect speed sensor connector. Remove splash shield and speed sensor assembly. To install, reverse removal procedure. Tighten wheel bearing nut to 12 ft. lbs. (16 N.m), then back off until just loose.

2) Hand tighten wheel bearing nut. Back off wheel bearing nut no more than 1/2 of a flat, until hole in spindle aligns with slot in wheel bearing nut. If wheel bearing nut is adjusted properly, hub end play should be .001-.005" (.03-.13 mm). If hub end play is not within specification, repeat procedure. Speed sensor air gap is non-adjustable.

Removal & Installation (4WD)

1) Remove wheel. Remove brake caliper and wire aside. Remove

drive axle nut. Disconnect speed sensor electrical connector. Remove speed sensor wire from clip on upper control arm. Remove bolts retaining hub and bearing. Remove splash shield bolts. Using a puller, remove hub and bearing.

2) Remove splash shield and speed sensor assembly. Remove speed sensor from splash shield. Remove speed sensor wire harness from splash shield. To install, reverse removal procedure. Ensure drive axle nut is properly tightened.

3) DO NOT move drive axle nut more than 1/6 of a turn to align cotter pin. If speed sensor is being replaced, drill out rivet in splash shield, and replace rivet with a small bolt, nut and washer. Speed sensor air gap is non-adjustable.

VEHICLE SPEED SENSOR (VSS)

Removal & Installation

1) Vehicle Speed Sensor (VSS) is located in left rear of transmission (2WD) or transfer case (4WD). Ensure ignition is off. Raise and support vehicle. Disconnect VSS electrical connector. Place a container under VSS mounting area to catch transmission fluid when VSS is removed.

2) Remove VSS mounting bolt. Remove VSS and "O" ring using J-38417. To install, coat NEW "O" ring with transmission fluid. Install "O" ring onto VSS. Install VSS and "O" ring into transmission using J-38417. Tighten mounting nuts or bolts to specification. See TORQUE SPECIFICATIONS table.

DIAGNOSIS & TESTING

NOTE: When testing and diagnosing 4WAL system, use of Tech 1 scan tool is required.

The Vehicle Control Module (VCM) contains a self-diagnostic capability to detect system failures. When a DTC is set, the VCM may disable 4WAL system and illuminate ANTI-LOCK light for duration of ignition cycle. DTCs stored by VCM can be displayed using Tech 1 and appropriate cartridge.

Before diagnosing 4WAL system, perform a comprehensive visual inspection of system by checking wiring harness connectors, harness routing (pay particular attention to wheel speed sensor wiring harness routing), applicable fuses in fuse block, and ground connections. Ensure brake fluid level in master cylinder reservoir is full.

Start 4WAL system diagnosis using DIAGNOSTIC SYSTEM CHECK. If failures are found when performing diagnostic system check, you will be directed to enter diagnostics to retrieve DTCs or perform SYMPTOM TESTS. DIAGNOSTIC SYSTEM CHECK may indicate that system is functioning properly.

RETRIEVING DTCS

Connect Tech 1 scan tool to DLC located under steering column. Access 4WAL brake DTCs. Repair DTCs in the order they appear. See 4WAL DIAGNOSTIC TROUBLE CODE (DTC) table for diagnosis. Before diagnosing DTC(s), perform DIAGNOSTIC SYSTEM CHECK first.

4WAL DIAGNOSTIC TROUBLE CODE (DTC) TABLE

DTC	(1) Definition
C0021	Right Front Wheel Speed Sensor Circuit Open Or Shorted To Battery Voltage

C0022	Right Front Wheel Speed Sensor Signal Missing
C0023	Right Front Wheel Speed Sensor Signal Erratic
C0025	Left Front Wheel Speed Sensor Circuit Open Or
***	Shorted To Battery Voltage
C0026	Left Front Wheel Speed Sensor Signal Missing
C0027	Left Front Wheel Speed Sensor Signal Erratic
C0029	Simultaneous Dropout Of Front
***	Wheel Speed Sensor Signal
C0035	Rear Speed Sensor Signal Circuit Open Or Grounded
C0036	Rear Speed Sensor Signal Missing
C0037	Rear Speed Sensor Signal Erratic
C0038	Wheel Speed Signal Malfunction
C0041	Right Front Isolation Solenoid Circuit Open
C0042	Right Front Dump Solenoid Circuit Open
C0043	Right Front Isolation Solenoid Circuit Shorted
C0044	Right Front Dump Solenoid Circuit Shorted
C0045	Left Front Isolation Solenoid Circuit Open
C0046	Left Front Dump Solenoid Circuit Open
C0047	Left Front Isolation Solenoid Circuit Shorted
C0048	Left Front Dump Solenoid Circuit Shorted
C0051	Rear Isolation Solenoid Circuit Open
C0052	Rear Dump Solenoid Circuit Open
C0053	Rear Isolation Solenoid Circuit Shorted
C0054	Rear Dump Solenoid Circuit Shorted
C0065	Pump Motor Relay Circuit Open
C0066	Pump Motor Relay Circuit Shorted
C0067	Pump Motor Circuit Open
C0068	Pump Motor Locked Or Pump Motor Circuit Shorted
C0071	EBCM Internal Fault
C0072	EBCM Internal Fault
C0073	EBCM Internal Fault
C0074	EBCM Internal Fault
C0081	Stoplight Switch Always Closed Or Shorted
C0086	Anti-Lock Indicator Light Circuit Shorted To
***	Battery Voltage
C0088	Brake Warning Light Circuit
***	Shorted To Battery Voltage

(1) - Always perform DIAGNOSTIC SYSTEM CHECK before performing DTC tests.

CLEARING DTCS

A DTC set in a current ignition cycle will not clear during that same ignition cycle. Cycle ignition switch off for 10 seconds and then on to clear a DTC set in current ignition cycle. If ANTI-LOCK light is staying on, DTCs can be cleared with a scan tool. Verify DTCs are cleared. See RETRIEVING DTCS.

DIAGNOSTIC SYSTEM CHECK

NOTE: For circuit reference, see WIRING DIAGRAMS.

System Description

The diagnostic system check is an organized approach to identifying a problem created by an ABS malfunction. It must be the starting point of any ABS complaint diagnosis because it directs to the next logical step in diagnosing the complaint.

Serial data is exchanged by EBCM through harness connector C1, terminal "F", and Class 2 data is exchanged through harness connector C1, terminal "G". EBCM is supplied switched ignition voltage through harness connector C1, terminal "A", and ground is provided through harness connector C1, terminal "J".

Diagnostic Procedures

1) Verify all EBCM connectors are connected properly. Install scan tool with proper cartridge. Turn ignition switch to RUN position. Using scan tool, select FO: DATA LIST. If data is being received from EBCM, go to step 7). If data is not received from EBCM, go to next step.

2) Observe scan tool. If scan tool displays WAITING FOR DATA, go to next step.

3) Ensure scan tool is properly connected to DLC. If connection is okay, go to next step. If not, go to step 5).

4) Turn ignition off. Remove and inspect 10A brake fuse. If fuse is open, go to step 11). If fuse is okay, go to step 6).

5) Reconnect scan tool to DLC connector and repeat step 1).

6) Turn ignition off. Install brake fuse. Disconnect negative battery terminal. Disconnect 10-pin EBCM harness connector C1. Check resistance between negative battery terminal and 10-pin EBCM harness connector C1 terminal "J". If resistance is 0-2 ohms, go to step 14). If resistance is not 0-2 ohms, go to step 17).

7) Using scan tool, select DTC(s). If DTC(s) are present, go to appropriate DTC test. If DTC(s) are not present, go to next step.

8) Turn ignition off for 10 seconds. Turn ignition switch to RUN position. If ABS warning light illuminates for 3 seconds, and then goes off, go to next step. If not, go to step 10).

9) Select DTC HISTORY. If DTC(s) are present, diagnose affected DTC(s). Go to DIAGNOSTIC TROUBLE CODES (DTC). If DTC(s) are not present, system is okay.

10) Observe ABS warning light. If warning light stays on, go to TEST "B" under SYMPTOM TESTS. If warning light does not stay on, go to TEST "A" under SYMPTOM TESTS.

11) Replace brake fuse. Turn ignition switch to RUN position for 10 seconds. Turn ignition off. Remove and inspect fuse. If fuse is blown, go to next step. If fuse is okay, go to step 19).

12) Disconnect 10-pin EBCM harness connector C1. Replace brake fuse. Turn ignition switch to RUN position for 10 seconds. Turn ignition off. Remove and inspect fuse. If fuse is blown, go to step 20). If fuse is okay, go to next step.

13) Inspect ignition and brake switch input circuits and 10-pin EBCM harness connector C1 for physical damage which could cause a short to ground with EBCM harness connector connected to EBCM. Repair as necessary. After repairs, reconnect all connectors. Turn ignition switch to RUN position for 10 seconds. Turn ignition off. Remove and inspect fuse. If fuse is blown, go to step 21). If fuse is okay, check for intermittent or poor connections.

14) Reconnect negative battery terminal. Turn ignition switch to RUN position. Check voltage between 10-pin EBCM harness connector C1 terminal "A" and ground. If voltage reading is 10-15 volts, go to next step. If not, go to step 22).

15) Turn ignition off. Disconnect positive battery terminal. Turn ignition switch to RUN position. Check resistance between positive battery cable and 10-pin EBCM connector C1, terminal "A". If resistance is 0-2 ohms, go to next step. If resistance is not 0-2 ohms, go to step 22).

16) Inspect EBCM and EBCM harness connector terminals for poor contact. Inspect battery terminals and battery cable terminals for poor connection. Repair as necessary. After repairs, go to step 24). If connections or terminals are okay, go to step 25).

17) Repair open or high resistance in EBCM ground circuit. See WIRING DIAGRAMS. After repairs, repeat step 1).

18) Repair short to ground in brakelight control circuit. After repairs, repeat step 1).

19) Check and repair short to ground in battery feed circuit. After repairs, install fuse and repeat step 1).

20) Check and repair short to ground in ignition input or battery circuit to EBCM. See WIRING DIAGRAMS. After repairs, repeat step 1).

21) Replace EBCM and brake fuse. After repairs, repeat step 1).

22) Repair open in ignition input or battery circuit to EBCM. See WIRING DIAGRAMS. After repairs, repeat step 1).

23) Repair open or high resistance in ignition input circuit or battery circuit to EBCM. After repairs, repeat step 1).

24) Replace terminals or repair poor connection. After repairs, repeat step 1).

25) Reconnect EBCM harness connectors and battery terminals. If communications cannot be established between scan tool and EBCM, try scan tool on similar vehicle with the same system to determine if scan too is malfunctioning or if Class 2 data line is faulty. See appropriate SYSTEM WIRING DIAGRAM article in the WIRING DIAGRAMS section. Repair or replace as necessary.

SYMPTOM TESTS

TEST A: ANTI-LOCK LIGHT DOES NOT ILLUMINATE - NO DTCS

NOTE: For circuit reference, see WIRING DIAGRAMS.

Circuit Description

The EBCM controls the ANTI-LOCK indicator light by supplying ground to turn on or battery voltage to turn off the indicator light.

If indicator light is off constantly, check for an open or short to voltage in the light circuit between indicator light and EBCM. Also check for open in GAUGES fuse or faulty light bulb.

Diagnostic Procedures

1) Perform Diagnostic System Check. If diagnostic system check has been performed, go to next step. If not, go to DIAGNOSTIC SYSTEM CHECK.

2) Turn ignition off. Disconnect 10-pin EBCM harness connector. Using a fused jumper wire, jumper terminal "B" of 10-pin harness connector to ground. Turn ignition switch to RUN position. If ANTI-LOCK indicator light illuminates, go to next step. If not, go to step 4).

3) Inspect 10-pin EBCM harness connector for damage or corrosion. If connector is okay, go to step 9). If connector is not okay, go tostep 8).

4) Inspect jumper wire fuse. If fuse is blown, go to step 10). If fuse is okay, go to next step.

5) Inspect 10-amp GAUGE fuse. If fuse is blown, go to next step. If fuse is okay, go to step 7).

6) Turn ignition off. Replace fuse. Turn ignition switch to RUN position. Remove and inspect GAUGE fuse. If fuse is blown, go to step 13). If fuse is okay, go to step 14).

7) Remove and inspect ANTI-LOCK indicator light bulb. If bulb is okay, go to step 12). If bulb is faulty, go to step 11).

8) Repair 10-pin EBCM harness connector. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

9) Replace EBCM. After replacing EBCM, perform DIAGNOSTIC SYSTEM CHECK.

10) Repair short to voltage in ANTI-LOCK indicator light circuit between EBCM and instrument cluster. See WIRING DIAGRAMS. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

11) Replace ANTI-LOCK indicator light bulb. After replacing

light bulb, perform DIAGNOSTIC SYSTEM CHECK.

12) Repair open in circuit between fuse block and instrument cluster, or ANTI-LOCK indicator light control circuit between instrument cluster and EBCM. See WIRING DIAGRAMS. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

13) Repair short to ground in brake warning light control circuit between instrument cluster and EBCM. See WIRING DIAGRAMS. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

14) Problem is an intermittent short to ground in brake warning light control circuit between instrument cluster and EBCM. See WIRING DIAGRAM. Repair as necessary. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

TEST B: ANTI-LOCK LIGHT IS ON AT ALL TIMES - NO DTCS

NOTE: For circuit reference, see WIRING DIAGRAMS.

Circuit Description

The EBCM controls the ANTI-LOCK indicator light by supplying ground to turn on or battery voltage to turn off the indicator light.

If indicator light is on constantly, check for short to ground in the light circuit between indicator light and EBCM, or EBCM is not capable of turning off indicator light.

Diagnostic Procedures

1) Perform Diagnostic System Check. If diagnostic system check has been performed, go to next step. If not, go to DIAGNOSTIC SYSTEM CHECK.

2) Turn ignition off. Disconnect 10-pin EBCM harness connector from EBCM. Turn ignition switch to RUN position. If ANTI-LOCK indicator light illuminates and stays illuminated, go to step 4). If not, go to next step.

3) Replace EBCM. After replacing EBCM, perform DIAGNOSTIC SYSTEM CHECK.

4) Repair short to ground in ANTI-LOCK indicator light control circuit between instrument cluster and EBCM. See WIRING DIAGRAMS. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

DIAGNOSTIC TROUBLE CODES (DTCS)

DTC C0021: RIGHT FRONT WHEEL SPEED SENSOR CIRCUIT OPEN OR SHORTED TO BATTERY VOLTAGE

NOTE: For circuit reference, see WIRING DIAGRAMS.

Circuit Description

As a toothed ring passes by the Wheel Speed Sensor (WSS), changes in electromagnetic field cause wheel speed sensor to produce an AC voltage signal. Voltage signal frequency and amplitude are proportional to wheel speed. The magnitude of this signal is directly related to wheel speed and proximity of wheel speed sensor to toothed ring, often referred to as the air gap.

Conditions for setting DTC:

* No output signal from right front wheel sensor for one second.
* Excessive right front wheel speed sensor resistance for one second.

Diagnostic Procedures

1) Perform diagnostic system check. See DIAGNOSTIC SYSTEM CHECK. After performing diagnostic system check, go

to next step.

2) Turn ignition off. Disconnect 4-pin EBCM harness connector. Check resistance between 4-pin harness connector terminals "C" and "E". See WSS TEMPERATURE-VS-SENSOR RESISTANCE table. If resistance is as specified, go to step 5). If not, go to next step.

3) Disconnect right WSS harness connector. Using a fused jumper wire, jumper sensor harness connector terminals "A" and "B". Using DVOM, check resistance between 4-pin EBCM harness connector terminals "C" and "E". If resistance is 0-2 ohms, go to next step. If not, go to step 10).

4) Check resistance between right WSS harness connector terminals "A" and "B". See WSS TEMPERATURE-VS-SENSOR RESISTANCE table. If resistance is as specified, go to step 7). If not, go to step 11).

5) Inspect 4-pin EBCM harness connector for signs of damage or corrosion. If damage is present, go to step 8). If no signs of damage are present, go to next step.

6) Reconnect all harness connectors. Test drive vehicle at speed greater than 15 MPH. If DTC C0021 sets, go to step 9). If not, go to next step.

7) Malfunction is intermittent. Check all connectors and harnesses for damage which may result in high resistance when components are connected. See DIAGNOSTIC AIDS. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

8) Repair 4-pin EBCM harness connector. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

9) Replace EBCM. After replacing EBCM, perform DIAGNOSTIC SYSTEM CHECK.

10) Repair open or high resistance in wheel speed sensor circuits between sensor and EBCM. See WIRING DIAGRAMS. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

11) Replace wheel speed sensor. After replacing sensor, perform DIAGNOSTIC SYSTEM CHECK.

Diagnostic Aids

An intermittent malfunction may be caused by a poor connection, rubbed through wire insulation, or a wire broken inside the insulation. Also, check sensor terminals harness connectors.

WSS TEMPERATURE-VS-SENSOR RESISTANCE TABLE

Temperature °F (°C)	Ohms
AWD	
-40 To 40 (-40 To 4)	089-1630
41-110 (5-43)	1337-1900
111-200 (44-93)	1560-2230
201-302 (94-150)	1850-2651
2WD & 4WD	
-40 To 40 (-40 To 4)	920-1440
41-110 (5-43)	1125-1700
111-200 (44-93)	1305-2000
201-302 (94-150)	1530-2310

DTC C0022: RIGHT FRONT WHEEL SPEED SENSOR SIGNAL MISSING

NOTE: For circuit reference, see WIRING DIAGRAMS.

Circuit Description

As a toothed ring passes by the Wheel Speed Sensor (WSS), changes in the electromagnetic field cause the wheel speed sensor to produce an AC voltage signal. Voltage signal frequency and amplitude are proportional to wheel speed. The magnitude of this signal is directly related to wheel speed and proximity of wheel speed sensor to toothed ring, often referred to as the air gap.

Conditions for setting DTC:

* Right front wheel speed is less than 4 MPH.
* All other wheel speeds are greater than 8 MPH.
* Unexpected wheel acceleration/deceleration. Anything that keeps the right front wheel speed sensor signal low while vehicle is moving at greater than 8 MPH.

Diagnostic Procedures

1) Perform diagnostic system check. See DIAGNOSTIC SYSTEM CHECK. After performing diagnostic system check, go to next step.

2) Turn ignition off. Inspect right front wheel speed sensor, sensor cable and connectors for signs of damage or corrosion. Inspect wheel sensor toothed ring for looseness. Inspect 4-pin EBCM harness connector. If any damage is found, go to step 7). If no damage is found, go to next step.

3) Raise and support vehicle. Disconnect right front WSS harness connector. Using DVOM, check resistance between sensor terminals "A" and "B". See WSS TEMPERATURE-VS-SENSOR RESISTANCE table. If resistance is as specified, go to next step. If not, go to step 8).

4) Select AC scale on DVOM. Connect DVOM to sensor terminals "A" and "B". Spin wheel by hand while observing voltage reading on DVOM. If DVOM reads greater than 100 mV, go to next step. If not, go to step 8).

5) Disconnect 4-pin EBCM harness connector. Check resistance between harness connector terminals "C" and "E". If reading is infinite, go to next step. If reading is not infinite, go to step 10).

6) Reconnect all harness connectors. Test drive vehicle at speed greater than 15 MPH. If DTC C0022 sets, go to step 9). If not, go to step 11).

7) Make necessary repairs. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

8) Replace right front wheel speed sensor. After replacing sensor, perform DIAGNOSTIC SYSTEM CHECK.

9) Replace EBCM. After replacing EBCM, perform DIAGNOSTIC SYSTEM CHECK.

10) Repair short between wheel speed sensor circuits. See WIRING DIAGRAMS. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

11) Malfunction is intermittent. Inspect all connectors and harnesses for damage which may result in high resistance when all components are connected. See DIAGNOSTIC AIDS. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

Diagnostic Aids

An intermittent malfunction may be caused by a poor connection, rubbed through wire insulation, or a wire broken inside the insulation. Also, check sensor terminals harness connectors.

DTC C0023: RIGHT FRONT WHEEL SPEED SENSOR SIGNAL ERRATIC

NOTE: For circuit reference, see WIRING DIAGRAMS.

Circuit Description

As a toothed ring passes by the Wheel Speed Sensor (WSS), changes in the electromagnetic field cause the wheel speed sensor to produce an AC voltage signal. Voltage signal frequency and amplitude are proportional to wheel speed. The magnitude of this signal is directly related to wheel speed and proximity of wheel speed sensor to toothed ring, often referred to as the air gap.

Conditions for setting DTC:

* Average wheel speed for all wheel speed signals is greater than 25 MPH.
* Average right front wheel speed is greater than 25 MPH.
* No output from right front wheel speed signal for 15 milliseconds. Anything which suddenly prevents (intermittent) the right front wheel speed signal to drop to zero wile vehicle is moving greater than 25 MPH.

Diagnostic Procedures

1) Perform diagnostic system check. See DIAGNOSTIC SYSTEM CHECK. After performing diagnostic system check, go to next step.

2) Turn ignition off. Disconnect 4-pin EBCM harness connector and inspect for signs of corrosion or damage. Inspect wheel speed sensor, sensor cable and connectors for signs of damage or corrosion. If connections are okay, go to next step. If connections are damaged or corroded, go to step 6).

3) Using DVOM, check resistance between 4-pin EBCM harness connector terminals "C" and "E". Wiggle harness in various locations while monitoring DVOM reading. See WSS TEMPERATURE-VS-SENSOR RESISTANCE table. If resistance is as specified and does not fluctuate, go to step 5). If not, go to next step.

4) Disconnect wheel speed sensor harness connector. Check resistance between wheel sensor terminals "A" and "B". See WSS TEMPERATURE-VS-SENSOR RESISTANCE table. If resistance is as specified, go to step 7). If not, go to step 8).

5) Reconnect all harness connectors. Remove right front tire, hub and rotor. Verify right front wheel speed sensor is securely mounted and tone wheel is in good condition. If damage is not found, go to step 9). If damage is found, go to step 10).

6) Make necessary repairs. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

7) Repair open, short or high resistance in wheel speed sensor circuits. See WIRING DIAGRAMS. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

8) Replace wheel speed sensor. After replacing sensor, perform DIAGNOSTIC SYSTEM CHECK.

9) Malfunction is intermittent. Inspect all connectors and harnesses for damage which may result in high resistance when all components are connected. See DIAGNOSTIC AIDS. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

10) Make necessary repairs. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

Diagnostic Aids

An intermittent malfunction may be caused by a poor connection, rubbed through wire insulation, or a wire broken inside the insulation. Also, check sensor terminals harness connectors.

DTC C0025: LEFT FRONT WHEEL SPEED SENSOR CIRCUIT OPEN OR SHORTED TO BATTERY VOLTAGE

NOTE: For circuit reference, see WIRING DIAGRAMS.

Circuit Description

As a toothed ring passes by the Wheel Speed Sensor (WSS), changes in the electromagnetic field cause the wheel speed sensor to produce an AC voltage signal. Voltage signal frequency and amplitude are proportional to wheel speed. The magnitude of this signal is directly related to wheel speed and proximity of wheel speed sensor to toothed ring, often referred to as the air gap.

Conditions for setting DTC:

* No output signal from left front wheel sensor for one second.
* Excessive left front wheel speed sensor resistance for one second.

Diagnostic Procedures

1) Perform diagnostic system check. See DIAGNOSTIC SYSTEM CHECK. After performing diagnostic system check, go to next step.

2) Turn ignition off. Disconnect 4-pin EBCM harness connector. Check resistance between 4-pin harness connector terminals "A" and "D". See WSS TEMPERATURE-VS-SENSOR RESISTANCE table. If resistance is as specified, go to step 5). If not, go to next step.

3) Disconnect left WSS harness connector. Using a fused jumper wire, jumper sensor harness connector terminals "A" and "B". Using DVOM, check resistance between 4-pin EBCM harness connector terminals "A" and "D". If sensor resistance is 0-2 ohms, go to next step. If not, go to step 10).

4) Check resistance between right WSS harness connector terminals "A" and "B". See WSS TEMPERATURE-VS-SENSOR RESISTANCE table. If resistance is as specified, go to step 7). If not, go to step 11).

5) Inspect 4-pin EBCM harness connector for signs of damage or corrosion. If damage is present, go to step 8). If no signs of damage are present, go to next step.

6) Reconnect all harness connectors. Test drive vehicle at speed greater than 15 MPH. If DTC C0025 sets, go to step 9). If not, go to next step.

7) Malfunction is intermittent. Check all connectors and harnesses for damage which may result in high resistance when components are connected. See DIAGNOSTIC AIDS. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

8) Repair 4-pin EBCM harness connector. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

9) Replace EBCM. After replacing EBCM, perform DIAGNOSTIC SYSTEM CHECK.

10) Repair open or high resistance in wheel speed sensor circuits. See WIRING DIAGRAMS. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

11) Replace wheel speed sensor. After replacing sensor, perform DIAGNOSTIC SYSTEM CHECK.

Diagnostic Aids

An intermittent malfunction may be caused by a poor connection, rubbed through wire insulation, or a wire broken inside the insulation. Also, check sensor terminals harness connectors.

DTC C0026: LEFT FRONT WHEEL SPEED SENSOR SIGNAL MISSING

NOTE: For circuit reference, see WIRING DIAGRAMS.

Circuit Description

As a toothed ring passes by the Wheel Speed Sensor (WSS), changes in the electromagnetic field cause the wheel speed sensor to produce an AC voltage signal. Voltage signal frequency and amplitude are proportional to wheel speed. The magnitude of this signal is directly related to wheel speed and proximity of wheel speed sensor to toothed ring, often referred to as the air gap.

Conditions for setting DTC:

* Left front wheel speed is less than 4 MPH.
* All other wheel speeds are greater than 8 MPH.
* No unexpected wheel acceleration/deceleration. Anything that

keeps the left front wheel speed sensor signal low while vehicle is moving at greater than 8 MPH.

Diagnostic Procedures

1) Perform diagnostic system check. See DIAGNOSTIC SYSTEM CHECK. After performing diagnostic system check, go to next step.

2) Turn ignition off. Inspect left front wheel speed sensor, sensor cable and connectors for signs of damage or corrosion. Inspect wheel sensor toothed ring for looseness. Inspect 4-pin EBCM harness connector. If any damage is found, go to step 7). If no damage is found, go to next step.

3) Raise and support vehicle. Disconnect left front WSS harness connector. Using DVOM, check resistance between sensor terminals "A" and "B". See WSS TEMPERATURE-VS-SENSOR RESISTANCE table. If resistance is as specified, go to next step. If not, go to step 8).

4) Select AC scale on DVOM. Connect DVOM to sensor terminals "A" and "B". Spin wheel by hand while observing voltage reading on DVOM. If DVOM reads greater than 100 mV, go to next step. If not, go to step 8).

5) Disconnect 4-pin EBCM harness connector. Check resistance between harness connector terminals "A" and "D". If reading is infinite, go to next step. If reading is not infinite, go to step 10).

6) Reconnect all harness connectors. Test drive vehicle at speed greater than 15 MPH. If DTC C0026 sets, go to step 9). If not, go to step 11).

7) Make necessary repairs. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

8) Replace left front wheel speed sensor. After replacing sensor, perform DIAGNOSTIC SYSTEM CHECK.

9) Replace EBCM. After replacing EBCM, perform DIAGNOSTIC SYSTEM CHECK.

10) Repair short between wheel speed sensor circuits. See WIRING DIAGRAMS. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

11) Malfunction is intermittent. Inspect all connectors and harnesses for damage which may result in high resistance when all components are connected. See DIAGNOSTIC AIDS. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

Diagnostic Aids

An intermittent malfunction may be caused by a poor connection, rubbed through wire insulation, or a wire broken inside the insulation. Also, check sensor terminals harness connectors.

DTC C0027: LEFT FRONT WHEEL SPEED SENSOR SIGNAL ERRATIC

NOTE: For circuit reference, see WIRING DIAGRAMS.

Circuit Description

As a toothed ring passes by the Wheel Speed Sensor (WSS), changes in the electromagnetic field cause the wheel speed sensor to produce an AC voltage signal. Voltage signal frequency and amplitude are proportional to wheel speed. The magnitude of this signal is directly related to wheel speed and proximity of wheel speed sensor to toothed ring, often referred to as the air gap.

Conditions for setting DTC:

* Average wheel speed for all wheel speed signals is greater than 25 MPH.
* Average left front wheel speed is greater than 25 MPH.
* No output from left front wheel speed signal for 15 milliseconds. Anything which suddenly prevents (intermittent) the right front wheel speed signal to drop to zero while

vehicle is moving greater than 25 MPH.

Diagnostic Procedures

1) Perform diagnostic system check. See DIAGNOSTIC SYSTEM CHECK. After performing diagnostic system check, go to next step.

2) Turn ignition off. Disconnect 4-pin EBCM harness connector and inspect for signs of corrosion or damage. Inspect wheel speed sensor, sensor cable and connectors for signs of damage or corrosion. If connections are okay, go to next step. If connections are damaged or corroded, go to step 6).

3) Using DVOM, check resistance between 4-pin EBCM harness connector terminals "A" and "D". Wiggle harness in various locations while monitoring DVOM reading. See WSS TEMPERATURE-VS-SENSOR RESISTANCE table. If resistance is as specified and does not fluctuate, go to step 5). If not, go to next step.

4) Disconnect wheel speed sensor harness connector. Check resistance between wheel sensor terminals "A" and "B". See WSS TEMPERATURE-VS-SENSOR RESISTANCE table. If resistance is as specified, go to step 7). If not, go to step 8).

5) Reconnect all harness connectors. Remove left front tire, hub and rotor. Verify right front wheel speed sensor is securely mounted and tone wheel is in good condition. If damage is not found, go to step 9). If damage is found, go to step 10).

6) Make necessary repairs. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

7) Repair open, short or high resistance between wheel speed sensor circuits. See WIRING DIAGRAMS. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

8) Replace wheel speed sensor. After replacing sensor, perform DIAGNOSTIC SYSTEM CHECK.

9) Malfunction is intermittent. Inspect all connectors and harnesses for damage which may result in high resistance when all components are connected. See DIAGNOSTIC AIDS. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

10) Make necessary repairs. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

Diagnostic Aids

An intermittent malfunction may be caused by a poor connection, rubbed through wire insulation, or a wire broken inside the insulation. Also, check sensor terminals harness connectors.

DTC C0029: SIMULTANEOUS DROPOUT OF FRONT WHEEL SPEED SENSOR SIGNALS

NOTE: For circuit reference, see WIRING DIAGRAMS.

Circuit Description

As a toothed ring passes by the Wheel Speed Sensor (WSS), changes in the electromagnetic field cause the wheel speed sensor to produce an AC voltage signal. Voltage signal frequency and amplitude are proportional to wheel speed. The magnitude of this signal is directly related to wheel speed and proximity of wheel speed sensor to toothed ring, often referred to as the air gap.

Conditions for setting DTC:

* EBCM losing both front wheel speed signals when vehicle is at speeds greater than 12 MPH (brake released) or 20 MPH (brake applied).

Diagnostic Procedures

1) Perform diagnostic system check. See DIAGNOSTIC SYSTEM CHECK. After performing diagnostic system check, go to next step.

2) Turn ignition off. Disconnect 4-pin EBCM harness connector. Inspect harness connector and terminals for damage or corrosion. If harness or terminal is damaged or corroded, go to step 4). If harness and terminal are okay, go to next step.

3) Reconnect harness connector. Clear DTC. Road test vehicle at speeds greater than 15 MPH. Retrieve DTCs. If DTC C0029 resets, go to step 5). If DTC does not reset, go to step 6).

4) Make necessary repairs to harness connector or terminals. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

5) Replace EBCM. After replacing EBCM, perform DIAGNOSTIC SYSTEM CHECK.

6) Malfunction is intermittent. Inspect all connectors and harnesses for damage which may result in high resistance when all components are connected. See DIAGNOSTIC AIDS. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

Diagnostic Aids

An intermittent malfunction may be caused by a poor connection, rubbed through wire insulation, or a wire broken inside the insulation. Also, check sensor terminals harness connectors.

DTC C0035: REAR SPEED SENSOR SIGNAL CIRCUIT OPEN OR GROUNDED

NOTE: For circuit reference, see WIRING DIAGRAMS.

Circuit Description

The rear wheel speed sensor signal originates from the VSS which is connected to the PCM/VCM. The EBCM receives the rear wheel speed sensor signal from the PCM/VCM.

Conditions for setting DTC:

* EBCM not seeing the correct voltage level from the PCM/VCM at start-up.

Diagnostic Procedures

1) Perform diagnostic system check. See DIAGNOSTIC SYSTEM CHECK. After performing diagnostic system check, go to next step.

2) Turn ignition off. Disconnect 10-pin EBCM harness connector. Turn ignition switch to RUN position. Check voltage between 10-pin EBCM harness connector terminal "E" and ground. If voltage is greater than 10 volts, go to step 4). If not, go to next step.

3) Turn ignition off. Disconnect PCM/VCM harness connector C1. Check resistance between 10-pin EBCM harness connector terminal "E" and PCM/VCM harness connector terminal No. 15. If resistance is 0-2 ohms, go to step 5). If not, go to step 8).

4) Turn ignition off. Reconnect PCM/VCM harness connector. Turn ignition switch to RUN position. Using scan tool, clear DTCs. Test drive vehicle at speed greater than 15 MPH. Check for DTCs. If DTC C0035 resets, go to step 6). If DTC does not reset, go to step 7).

5) Check resistance between 10-pin EBCM harness connector terminal "E" and ground. If resistance is infinite, check VSS. If resistance is not infinite, go to step 9).

6) Replace EBCM. After replacing EBCM, perform DIAGNOSTIC SYSTEM CHECK.

7) Malfunction is intermittent. Inspect all connectors and harnesses for damage which may result in high resistance when all components are connected. See DIAGNOSTIC AIDS. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

8) Repair open in VSS signal circuit between VCM and EBCM. See WIRING DIAGRAMS. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

9) Repair short to ground in VSS signal circuit. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

Diagnostic Aids

This DTC can be set by a faulty VSS or a fault in VSS signal circuit.

DTC C0036: REAR SPEED SENSOR SIGNAL MISSING

NOTE: For circuit reference, see WIRING DIAGRAMS.

Circuit Description

The rear wheel speed sensor signal originates from the VSS which is connected to the PCM/VCM. The EBCM receives the rear wheel speed sensor signal from the PCM/VCM.

Conditions for setting DTC:

* EBCM losing rear wheel speed signal for at least 5 seconds at speeds greater than 8 MPH with brake pedal released. If DTC C0035 is also present, diagnose that DTC first.

Diagnostic Procedures

1) Perform diagnostic system check. See DIAGNOSTIC SYSTEM CHECK. After performing diagnostic system check, go to next step.

2) Turn ignition off. Disconnect 10-pin EBCM harness connector. Turn ignition switch to RUN position. Check voltage between 10-pin EBCM harness connector terminal "E" and ground. If voltage is greater than 10 volts, go to step 4). If not, go to next step.

3) Turn ignition off. Disconnect PCM/VCM harness connector C1. Check resistance between 10-pin EBCM harness connector terminal "E" and PCM/VCM harness connector terminal No. 15 (terminal No. 70 on 2.2L engines). If resistance is 0-2 ohms, go to step 5). If not, go to step 8).

4) Turn ignition off. Reconnect PCM/VCM harness connector. Turn ignition switch to RUN position. Using scan tool, clear DTCs. Test drive vehicle at speed greater than 15 MPH. Check for DTCs. If DTC C0036 resets, go to step 6). If DTC does not reset, go to step 7).

5) Check resistance between 10-pin EBCM harness connector terminal "E" and ground. If resistance is infinite, check VSS. If resistance is not infinite, go to step 9).

6) Replace EBCM. After replacing EBCM, perform DIAGNOSTIC SYSTEM CHECK.

7) Malfunction is intermittent. Inspect all connectors and harnesses for damage which may result in high resistance when all components are connected. See DIAGNOSTIC AIDS. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

8) Repair open in VSS signal circuit between VCM and EBCM. See WIRING DIAGRAMS. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

9) Repair short to ground in VSS signal circuit. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

Diagnostic Aids

This DTC can be set by a faulty VSS or a fault in VSS signal circuit between EBCM and VCM.

DTC C0037: REAR SPEED SENSOR SIGNAL ERRATIC

NOTE: For circuit reference, see WIRING DIAGRAMS.

Circuit Description

The rear wheel speed sensor signal originates from the VSS which is connected to the VCM. The EBCM receives the rear wheel speed sensor signal from the VCM.

Conditions for setting DTC:

* EBCM seeing the rear speed signal line drop out and return. This DTC can be caused by a malfunction in the VSS or a fault in VSS signal circuit.

Diagnostic Procedures

1) Perform diagnostic system check. See DIAGNOSTIC SYSTEM CHECK. After performing diagnostic system check, go to next step.

2) Turn ignition off. Disconnect 10-pin EBCM harness connector. Turn ignition switch to RUN position. Check voltage between 10-pin EBCM harness connector terminal "E" and ground. If voltage is greater than 10 volts, go to step 4). If not, go to next step.

3) Turn ignition off. Disconnect VCM harness connector C1. Check resistance between 10-pin EBCM harness connector terminal "E" and VCM harness connector terminal No. 15 (VSS signal output circuit). If resistance is 0-2 ohms, go to step 5). If not, go to step 8).

4) Turn ignition off. Reconnect VCM harness connector. Turn ignition switch to RUN position. Using scan tool, clear DTCs. Test drive vehicle at speed greater than 15 MPH. Check for DTCs. If DTC C0037 resets, go to step 6). If DTC does not reset, go to step 7).

5) Check resistance between 10-pin EBCM harness connector terminal "E" and ground. If resistance is infinite, check VSS. If resistance is not infinite, go to step 9).

6) Replace EBCM. After replacing EBCM, perform DIAGNOSTIC SYSTEM CHECK.

7) Malfunction is intermittent. Inspect all connectors and harnesses for damage which may result in high resistance when all components are connected. See DIAGNOSTIC AIDS. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

8) Repair open in VSS signal circuit between EBCM and VCM. See WIRING DIAGRAMS. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

9) Repair short to ground in VSS signal circuit. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

Diagnostic Aids

This DTC can be set by a faulty VSS or a fault in VSS signal circuit between EBCM and VCM.

DTC C0038: WHEEL SPEED SIGNAL MALFUNCTION

NOTE: For circuit reference, see WIRING DIAGRAMS.

Circuit Description

As a toothed ring passes by the Wheel Speed Sensor (WSS), changes in the electromagnetic field cause the wheel speed sensor to produce an AC voltage signal. Voltage signal frequency and amplitude are proportional to wheel speed. The magnitude of this signal is directly related to wheel speed and proximity of wheel speed sensor to toothed ring, often referred to as the air gap.

Conditions for setting DTC:

* Any wheel speed differing from the vehicle speed for any of the following causes:

  - One mismatched wheel speed more than double or less than half the other 3 wheel speeds.
  - All 4 wheel speeds differing from each other by 8 percent.

* Vehicle speed greater than 12 MPH.
* No unexpected wheel acceleration. Anything that generates consistent differences between wheel speeds signals.

Diagnostic Procedures

1) Perform diagnostic system check. See DIAGNOSTIC SYSTEM CHECK. After performing diagnostic system check, go to next step.

2) Inspect vehicle tires for variation in tire size. If all 4 tires are the same, go to next step.

3) Clear DTCs using scan tool. Test drive vehicle. While test driving vehicle, use DATA LIST function on scan tool to monitor wheel speeds. If scan tool indicates a faulty sensor, go to affected DTC test to diagnose problem. If scan tool does not indicate a faulty sensor, problem is intermittent.

DTC C0041: RIGHT FRONT ISOLATION SOLENOID CIRCUIT OPEN

NOTE: For circuit reference, see WIRING DIAGRAMS.

Circuit Description

When right front isolation solenoid is needed, EBCM will ground solenoid circuit to energize coil within solenoid. This will close isolation valve by magnetic force created by solenoid coil.

Conditions for setting DTC:

* ANTI-LOCK indicator light check complete.
* Low voltage on EBCM solenoid driver circuit when expected to be high (solenoid not energized).

Diagnostic Procedures

1) Perform diagnostic system check. See DIAGNOSTIC SYSTEM CHECK. After performing diagnostic system check, go to next step.

2) Turn ignition off. Disconnect 2-pin EBCM harness connector. Inspect connector for damage or corrosion which could cause loss of power to EBCM. If connector is okay, go to next step. If connector is not okay, go to step 6).

3) Check resistance between ground and 2-pin EBCM harness connector terminal "B". If resistance is 0-2 ohms, go to next step. If not, go to step 7).

4) Check voltage between ground and 2-pin EBCM harness connector terminal "A". If voltage reading is greater than 10 volts, go to step 8). If not, go to next step.

5) Inspect ABS fusible link. If fusible link is open, go to step 9). If fusible link is okay, go to step 10).

6) Repair 2-pin EBCM harness connector as necessary. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

7) Repair open or high resistance in ground circuit to EBCM. See WIRING DIAGRAMS. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

8) Replace EBCM. After replacing EBCM, perform DIAGNOSTIC SYSTEM CHECK.

9) Repair short to ground in battery circuit between underhood fuse/relay block and EBCM. See WIRING DIAGRAMS. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

10) Repair open or high resistance in battery circuit. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

DTC C0042: RIGHT FRONT DUMP SOLENOID CIRCUIT OPEN

NOTE: For circuit reference, see WIRING DIAGRAMS.

Circuit Description

When right front dump solenoid is needed, EBCM will ground solenoid circuit to energize coil within solenoid. This will open dump valve by magnetic force created by solenoid coil.

Conditions for setting DTC:

* ANTI-LOCK indicator light check complete.
* Low voltage on EBCM solenoid driver circuit when expected to be high (solenoid not energized).

Diagnostic Procedures

1) Perform diagnostic system check. See DIAGNOSTIC SYSTEM CHECK. After performing diagnostic system check, go to next step.

2) Turn ignition off. Disconnect 2-pin EBCM harness connector. Inspect connector for damage or corrosion which could result in loss of power to EBCM. If connector is okay, go to next step. If connector is not okay, go to step 6).

3) Check resistance between ground and 2-pin EBCM harness connector terminal "B". If resistance is 0-2 ohms, go to next step. If not, go to step 7).

4) Check voltage between ground and 2-pin EBCM harness connector terminal "A". If voltage reading is greater than 10 volts, go to step 8). If not, go to next step.

5) Inspect ABS fusible link. If fusible link is open, go to step 9). If fusible link is okay, go to step 10).

6) Repair 2-pin EBCM harness connector as necessary. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

7) Repair open or high resistance in ground circuit to EBCM. See WIRING DIAGRAMS. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

8) Replace EBCM. After replacing EBCM, perform DIAGNOSTIC SYSTEM CHECK.

9) Repair short to ground in battery circuit between underhood duse/relay block and EBCM. See WIRING DIAGRAMS. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

10) Repair open or high resistance in battery circuit. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

DTC C0043: RIGHT FRONT ISOLATION SOLENOID CIRCUIT SHORTED

NOTE: For circuit reference, see WIRING DIAGRAMS.

Circuit Description

When right front isolation solenoid is needed, EBCM will ground solenoid circuit to energize coil within solenoid. This will close isolation valve by magnetic force created by solenoid coil.

Conditions for setting DTC:

* ANTI-LOCK indicator light check complete.
* Low voltage on EBCM solenoid driver circuit when expected to be high (solenoid not energized).

Diagnostic Procedures

1) Perform diagnostic system check. See DIAGNOSTIC SYSTEM CHECK. After performing diagnostic system check, go to next step.

2) Turn ignition off. Disconnect 2-pin EBCM harness connector. Inspect connector for damage or corrosion which could result in loss of power to EBCM. If connector is okay, go to next step. If connector is not okay, go to step 6).

3) Check resistance between ground and 2-pin EBCM harness connector terminal "B". If resistance is 0-2 ohms, go to next step. If not, go to step 7).

4) Check voltage between ground and 2-pin EBCM harness

connector terminal "A". If voltage reading is greater than 10 volts, go to step 8). If not, go to next step.

5) Inspect ABS fuse or fusible link. If fuse or fusible link is open, go to step 9). If fuse or fusible link is okay, go to step 10).

6) Repair 2-pin EBCM harness connector as necessary. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

7) Repair open or high resistance in ground circuit to EBCM. See WIRING DIAGRAMS. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

8) Replace EBCM. After replacing EBCM, perform DIAGNOSTIC SYSTEM CHECK.

9) Repair short to ground in battery circuit between underhood duse/relay block and EBCM. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

10) Repair open or high resistance in battery circuit to EBCM. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

DTC C0044: RIGHT FRONT DUMP SOLENOID CIRCUIT SHORTED

NOTE: For circuit reference, see WIRING DIAGRAMS.

Circuit Description

When right front dump solenoid is needed, EBCM will ground solenoid circuit to energize coil within solenoid. This will open dump valve by magnetic force created by solenoid coil.

Conditions for setting DTC:

* ANTI-LOCK indicator light check complete.
* Low voltage on EBCM solenoid driver circuit when expected to be high (solenoid not energized).

Diagnostic Procedures

1) Perform diagnostic system check. See DIAGNOSTIC SYSTEM CHECK. After performing diagnostic system check, go to next step.

2) Turn ignition off. Disconnect 2-pin EBCM harness connector. Inspect connector for damage or corrosion which could result in loss of power to EBCM. If connector is okay, go to next step. If connector is not okay, go to step 6).

3) Check resistance between ground and 2-pin EBCM harness connector terminal "B". If resistance is 0-2 ohms, go to next step. If not, go to step 7).

4) Check voltage between ground and 2-pin EBCM harness connector terminal "A". If voltage reading is greater than 10 volts, go to step 8). If not, go to next step.

5) Inspect ABS fuse or fusible link. If fuse or fusible link is open, go to step 9). If fuse or fusible link is okay, go to step 10).

6) Repair 2-pin EBCM harness connector as necessary. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

7) Repair open or high resistance in ground circuit to EBCM. See WIRING DIAGRAMS. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

8) Replace EBCM. After replacing EBCM, perform DIAGNOSTIC SYSTEM CHECK.

9) Repair short to ground in battery circuit between underhood fuse/relay block and EBCM. See WIRING DIAGRAMS. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

10) Repair open or high resistance in battery circuit to EBCM. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

DTC C0045: LEFT FRONT ISOLATION SOLENOID CIRCUIT OPEN

NOTE: For circuit reference, see WIRING DIAGRAMS.

Circuit Description

When left front isolation solenoid is needed, EBCM will ground solenoid circuit to energize coil within solenoid. This will close isolation valve by magnetic force created by solenoid coil.

Conditions for setting DTC:

* ANTI-LOCK indicator light check complete.
* Low voltage on EBCM solenoid driver circuit when expected to be high (solenoid not energized).

Diagnostic Procedures

1) Perform diagnostic system check. See DIAGNOSTIC SYSTEM CHECK. After performing diagnostic system check, go to next step.

2) Turn ignition off. Disconnect 2-pin EBCM harness connector. Inspect connector for damage or corrosion which could result in loss of power to EBCM. If connector is okay, go to next step. If connector is not okay, go to step 6).

3) Check resistance between ground and 2-pin EBCM harness connector terminal "B". If resistance is 0-2 ohms, go to next step. If not, go to step 7).

4) Check voltage between ground and 2-pin EBCM harness connector terminal "A". If voltage reading is greater than 10 volts, go to step 8). If not, go to next step.

5) Inspect ABS fuse or fusible link. If fuse or fusible link is open, go to step 9). If fuse or fusible link is okay, go to step 10).

6) Repair 2-pin EBCM harness connector as necessary. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

7) Repair open or high resistance in ground circuit to EBCM. See WIRING DIAGRAMS. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

8) Replace EBCM. After replacing EBCM, perform DIAGNOSTIC SYSTEM CHECK.

9) Repair short to ground in battery circuit between underhood fuse/relay block and EBCM. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

10) Repair open or high resistance in battery circuit to EBCM. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

DTC C0046: LEFT FRONT DUMP SOLENOID CIRCUIT OPEN

NOTE: For circuit reference, see WIRING DIAGRAMS.

Circuit Description

When left front dump solenoid is needed, EBCM will ground solenoid circuit to energize coil within solenoid. This will open dump valve by magnetic force created by solenoid coil.

Conditions for setting DTC:

* ANTI-LOCK indicator light check complete.
* Low voltage on EBCM solenoid driver circuit when expected to be high (solenoid not energized).

Diagnostic Procedures

1) Perform diagnostic system check. See DIAGNOSTIC SYSTEM CHECK. After performing diagnostic system check, go to next step.

2) Turn ignition off. Disconnect 2-pin EBCM harness connector. Inspect connector for damage or corrosion which could result in loss of power to EBCM. If connector is okay, go to next step. If connector is not okay, go to step 6).

3) Check resistance between ground and 2-pin EBCM harness

connector terminal "B". If resistance is 0-2 ohms, go to next step. If not, go to step 7).

4) Check voltage between ground and 2-pin EBCM harness connector terminal "A". If voltage reading is greater than 10 volts, go to step 8). If not, go to next step.

5) Inspect ABS fuse or fusible link. If fuse or fusible link is open, go to step 9). If fuse or fusible link is okay, go to step 10).

6) Repair 2-pin EBCM harness connector as necessary. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

7) Repair open or high resistance in ground circuit to EBCM. See WIRING DIAGRAMS. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

8) Replace EBCM. After replacing EBCM, perform DIAGNOSTIC SYSTEM CHECK.

9) Repair short to ground in battery circuit between underhood fuse/relay block and EBCM. See WIRING DIAGRAMS. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

10) Repair open or high resistance in battery circuit to EBCM. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

DTC C0047: LEFT FRONT ISOLATION SOLENOID CIRCUIT SHORTED

NOTE: For circuit reference, see WIRING DIAGRAMS.

Circuit Description

When left front isolation solenoid is needed, EBCM will ground solenoid circuit to energize coil within solenoid. This will close isolation valve by magnetic force created by solenoid coil.

Conditions for setting DTC:

* ANTI-LOCK indicator light check complete.
* High voltage on EBCM solenoid driver circuit when expected to be low (solenoid not energized).

Diagnostic Procedures

1) Perform diagnostic system check. See DIAGNOSTIC SYSTEM CHECK. After performing diagnostic system check, go to next step.

2) Turn ignition off. Disconnect 2-pin EBCM harness connector. Inspect connector for damage or corrosion which could result in loss of power to EBCM. If connector is okay, go to next step. If connector is not okay, go to step 6).

3) Check resistance between ground and 2-pin EBCM harness connector terminal "B". If resistance is 0-2 ohms, go to next step. If not, go to step 7).

4) Check voltage between ground and 2-pin EBCM harness connector terminal "A". If voltage reading is greater than 10 volts, go to step 8). If not, go to next step.

5) Inspect ABS fuse or fusible link. If fuse or fusible link is open, go to step 9). If fuse or fusible link is okay, go to step 10).

6) Repair 2-pin EBCM harness connector as necessary. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

7) Repair open or high resistance in ground circuit to EBCM. See WIRING DIAGRAMS. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

8) Replace EBCM. After replacing EBCM, perform DIAGNOSTIC SYSTEM CHECK.

9) Repair short to ground in battery circuit between underhood fuse/relay block and EBCM. See WIRING DIAGRAMS. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

10) Repair open or high resistance in battery circuit to EBCM. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

DTC C0048: LEFT FRONT DUMP SOLENOID CIRCUIT SHORTED

NOTE: For circuit reference, see WIRING DIAGRAMS.

Circuit Description

When left front dump solenoid is needed, EBCM will ground solenoid circuit to energize coil within solenoid. This will open dump valve by magnetic force created by solenoid coil.

Conditions for setting DTC:

* ANTI-LOCK indicator light check complete.
* High voltage on EBCM solenoid driver circuit when expected to be low (solenoid not energized).

Diagnostic Procedures

1) Perform diagnostic system check. See DIAGNOSTIC SYSTEM CHECK. After performing diagnostic system check, go to next step.

2) Turn ignition off. Disconnect 2-pin EBCM harness connector. Inspect connector for damage or corrosion which could result in loss of power to EBCM. If connector is okay, go to next step. If connector is not okay, go to step 6).

3) Check resistance between ground and 2-pin EBCM harness connector terminal "B". If resistance is 0-2 ohms, go to next step. If not, go to step 7).

4) Check voltage between ground and 2-pin EBCM harness connector terminal "A". If voltage reading is greater than 10 volts, go to step 8). If not, go to next step.

5) Inspect ABS fuse or fusible link. If fuse or fusible link is open, go to step 9). If fuse or fusible link is okay, go to step 10).

6) Repair 2-pin EBCM harness connector as necessary. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

7) Repair open or high resistance in ground circuit to EBCM. See WIRING DIAGRAMS. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

8) Replace EBCM. After replacing EBCM, perform DIAGNOSTIC SYSTEM CHECK.

9) Repair short to ground in battery circuit between underhood fuse/relay block and EBCM. See WIRING DIAGRAMS. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

10) Repair open or high resistance in battery circuit to EBCM. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

DTC C0051: REAR ISOLATION SOLENOID CIRCUIT SHORTED

NOTE: For circuit reference, see WIRING DIAGRAMS.

Circuit Description

When rear isolation solenoid is needed, EBCM will ground solenoid circuit to energize coil within solenoid. This will close isolation valve by magnetic force created by solenoid coil.

Conditions for setting DTC:

* ANTI-LOCK indicator light check complete.
* Low voltage on EBCM solenoid driver circuit when expected to be high (solenoid not energized).

Diagnostic Procedures

1) Perform diagnostic system check. See DIAGNOSTIC SYSTEM CHECK. After performing diagnostic system check, go to next step.

2) Turn ignition off. Disconnect 2-pin EBCM harness connector. Inspect connector for damage or corrosion which can result

in loss of power to EBCM. If connector is okay, go to next step. If connector is not okay, go to step 6).

3) Check resistance between ground and 2-pin EBCM harness connector terminal "B". If resistance is 0-2 ohms, go to next step. If not, go to step 7).

4) Check voltage between ground and 2-pin EBCM harness connector terminal "A". If voltage reading is greater than 10 volts, go to step 8). If not, go to next step.

5) Inspect ABS fuse or fusible link. If fuse or fusible link is open, go to step 9). If fuse or fusible link is okay, go to step 10).

6) Repair 2-pin EBCM harness connector as necessary. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

7) Repair open or high resistance in ground circuit to EBCM. See WIRING DIAGRAMS. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

8) Replace EBCM. After replacing EBCM, perform DIAGNOSTIC SYSTEM CHECK.

9) Repair short to ground in battery circuit between underhood fuse/relay block and EBCM. See WIRING DIAGRAMS. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

10) Repair open or high resistance in battery circuit to EBCM. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

DTC C0052: REAR DUMP SOLENOID CIRCUIT OPEN

NOTE: For circuit reference, see WIRING DIAGRAMS.

Circuit Description

When rear dump solenoid is needed, EBCM will ground solenoid circuit to energize coil within solenoid. This will open dump valve by magnetic force created by solenoid coil.

Conditions for setting DTC:

* ANTI-LOCK indicator light check complete.
* Low voltage on EBCM solenoid driver circuit when expected to be high (solenoid not energized).

Diagnostic Procedures

1) Perform diagnostic system check. See DIAGNOSTIC SYSTEM CHECK. After performing diagnostic system check, go to next step.

2) Turn ignition off. Disconnect 2-pin EBCM harness connector. Inspect connector for damage or corrosion which could result in loss of power to EBCM. If connector is okay, go to next step. If connector is not okay, go to step 6).

3) Check resistance between ground and 2-pin EBCM harness connector terminal "B". If resistance is 0-2 ohms, go to next step. If not, go to step 7).

4) Check voltage between ground and 2-pin EBCM harness connector terminal "A". If voltage reading is greater than 10 volts, go to step 8). If not, go to next step.

5) Inspect ABS fuse or fusible link. If fuse or fusible link is open, go to step 9). If fuse or fusible link is okay, go to step 10).

6) Repair 2-pin EBCM harness connector as necessary. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

7) Repair open or high resistance in ground circuit to EBCM. See WIRING DIAGRAMS. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

8) Replace EBCM. After replacing EBCM, perform DIAGNOSTIC SYSTEM CHECK.

9) Repair short to ground in battery circuit between underhood fuse/relay block and EBCM. See WIRING DIAGRAMS. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

10) Repair open or high resistance in battery circuit to EBCM. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

DTC C0053: REAR ISOLATION SOLENOID CIRCUIT SHORTED

NOTE: For circuit reference, see WIRING DIAGRAMS.

Circuit Description

When rear isolation solenoid is needed, EBCM will ground solenoid circuit to energize coil within solenoid. This will open isolation valve by magnetic force created by solenoid coil.

Conditions for setting DTC:

* ANTI-LOCK indicator light check complete.
* Low voltage on EBCM solenoid driver circuit when expected to be high (solenoid not energized).

Diagnostic Procedures

1) Perform diagnostic system check. See DIAGNOSTIC SYSTEM CHECK. After performing diagnostic system check, go to next step.

2) Turn ignition off. Disconnect 2-pin EBCM harness connector. Inspect connector for damage or corrosion which could result in loss of power to EBCM. If connector is okay, go to next step. If connector is not okay, go to step 6).

3) Check resistance between ground and 2-pin EBCM harness connector terminal "B". If resistance is 0-2 ohms, go to next step. If not, go to step 7).

4) Check voltage between ground and 2-pin EBCM harness connector terminal "A". If voltage reading is greater than 10 volts, go to step 8). If not, go to next step.

5) Inspect ABS fuse or fusible link. If fuse is open, go to step 9). If fuse is okay, go to step 10).

6) Repair 2-pin EBCM harness connector as necessary. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

7) Repair open or high resistance in ground circuit to EBCM. See WIRING DIAGRAMS. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

8) Replace EBCM. After replacing EBCM, perform DIAGNOSTIC SYSTEM CHECK.

9) Repair short to ground in battery circuit between underhood fuse/relay block and EBCM. See WIRING DIAGRAMS. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

10) Repair open or high resistance in battery circuit to EBCM. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

DTC C0054: REAR DUMP SOLENOID CIRCUIT SHORTED

NOTE: For circuit reference, see WIRING DIAGRAMS.

Circuit Description

When rear dump solenoid is needed, EBCM will ground solenoid circuit to energize coil within solenoid. This will open dump valve by magnetic force created by solenoid coil.

Conditions for setting DTC:

* High voltage on EBCM solenoid driver circuit when expected to be low (solenoid not energized).

Diagnostic Procedures

1) Perform diagnostic system check. See DIAGNOSTIC SYSTEM CHECK. After performing diagnostic system check, go to next step.

2) Turn ignition off. Disconnect 2-pin EBCM harness

connector. Inspect connector for damage or corrosion which could result in loss of power to EBCM. If connector is okay, go to next step. If connector is not okay, go to step 6).

3) Check resistance between ground and 2-pin EBCM harness connector terminal "B". If resistance is 0-2 ohms, go to next step. If not, go to step 7).

4) Check voltage between ground and 2-pin EBCM harness connector terminal "A". If voltage reading is greater than 10 volts, go to step 8). If not, go to next step.

5) Inspect ABS fuse or fusible link. If fuse or fusible link is open, go to step 9). If fuse or fusible link is okay, go to step 10).

6) Repair 2-pin EBCM harness connector as necessary. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

7) Repair open or high resistance in ground circuit to EBCM. See WIRING DIAGRAMS. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

8) Replace EBCM. After replacing EBCM, perform DIAGNOSTIC SYSTEM CHECK.

9) Repair short to ground in battery circuit between underhood fuse/relay block and EBCM. See WIRING DIAGRAMS. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

10) Repair open or high resistance in battery circuit to EBCM. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

DTC C0065: PUMP MOTOR RELAY CIRCUIT OPEN

NOTE: For circuit reference, see WIRING DIAGRAMS.

Circuit Description

The relay supplies power to all 6 solenoid coils (3 isolation solenoid coils and 3 dump solenoid coils) when ABS is required. The relay and the 6 solenoid coils are located within the EBCM.

Conditions for setting DTC:

* EBCM microprocessor commands the relay on.
* Low voltage on all 8 solenoid driver circuits when all are expected to high (solenoid not energized).

Diagnostic Procedures

1) Perform diagnostic system check. See DIAGNOSTIC SYSTEM CHECK. After performing diagnostic system check, go to next step.

2) Turn ignition off. Disconnect 2-pin EBCM harness connector. Inspect connector for damage or corrosion which could result in loss of power to EBCM. If connector is okay, go to next step. If connector is not okay, go to step 6).

3) Check resistance between ground and 2-pin EBCM harness connector terminal "B". If resistance is 0-2 ohms, go to next step. If not, go to step 7).

4) Check voltage between ground and 2-pin EBCM harness connector terminal "A". If voltage reading is greater than 10 volts, go to step 8). If not, go to next step.

5) Inspect ABS fuse or fusible link. If fuse or fusible link is open, go to step 9). If fuse or fusible link is okay, go to step 10).

6) Repair 2-pin EBCM harness connector as necessary. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

7) Repair open or high resistance in ground circuit to EBCM. See WIRING DIAGRAMS. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

8) Replace EBCM. After replacing EBCM, perform DIAGNOSTIC SYSTEM CHECK.

9) Repair short to ground in battery circuit between underhood fuse/relay block and EBCM. After repairs, perform

DIAGNOSTIC SYSTEM CHECK.

10) Repair open or high resistance in battery circuit to EBCM. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

DTC C0066: PUMP MOTOR RELAY CIRCUIT SHORTED

NOTE: For circuit reference, see WIRING DIAGRAMS.

Circuit Description

The relay supplies power to pump motor when ABS is required. The relay is located within the EBCM.

Conditions for setting DTC:

* ANTI-LOCK indicator light check complete.
* High voltage on pump motor driver circuit when all are expected to low (relay not commanded on).

Diagnostic Procedures

1) Perform diagnostic system check. See DIAGNOSTIC SYSTEM CHECK. After performing diagnostic system check, go to next step.

2) Turn ignition off. Disconnect 2-pin EBCM harness connector. Inspect connector for damage or corrosion which could result in loss of power to EBCM. If connector is okay, go to next step. If connector is not okay, go to step 6).

3) Check resistance between ground and 2-pin EBCM harness connector terminal "B". If resistance is 0-2 ohms, go to next step. If not, go to step 7).

4) Check voltage between ground and 2-pin EBCM harness connector terminal "A". If voltage reading is greater than 10 volts, go to step 8). If not, go to next step.

5) Inspect ABS fuse or fusible link. If fuse or fusible link is open, go to step 9). If fuse or fusible link is okay, go to step 10).

6) Repair 2-pin EBCM harness connector as necessary. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

7) Repair open or high resistance in ground circuit to EBCM. See WIRING DIAGRAMS. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

8) Replace EBCM. After replacing EBCM, perform DIAGNOSTIC SYSTEM CHECK.

9) Repair short to ground in battery circuit between underhood fuse/relay block and EBCM. See WIRING DIAGRAMS. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

10) Repair open or high resistance in battery circuit to EBCM. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

DTC C0067: PUMP MOTOR CIRCUIT OPEN

NOTE: For circuit reference, see WIRING DIAGRAMS.

Circuit Description

The pump motor circuit is integral to EBCM. The EBCM energizes relay within EBCM to supply battery voltage to high side of pump motor. When pump motor activation is required, EBCM grounds low side of pump motor.

Conditions for setting DTC:

* EBCM internal relay on.
* Pump motor off.
* Low voltage from low side of pump motor when expected to be high.

Diagnostic Procedures

1) Perform diagnostic system check. See DIAGNOSTIC SYSTEM CHECK. After performing diagnostic system check, go to next step.

2) Turn ignition off. Disconnect 2-pin pump motor pigtail connector from EBCM. Inspect connector and wiring for damage or corrosion that could cause an open circuit between pump motor and EBCM. If connector and wiring are okay, go to next step. If connector or wiring is faulty, go to step 10).

3) Check resistance between terminals No. 1 and 2 of 2-pin pump motor pigtail connector. If resistance is 0.1-0.3 ohm, go to step 15). If not, go to next step.

4) Disconnect 2-pin EBCM harness connector. Inspect connector for damage or corrosion which could cause a loss of power to EBCM. If connector is okay, go to next step. If connector is faulty, go to step 9).

5) Check resistance between ground and terminal No. 2 of 2-pin EBCM harness connector. If resistance is 0-2 ohms, go to next step. If not, go to step 11).

6) Turn ignition switch to RUN position. Check voltage between ground and terminal No. 1 of EBCM harness connector. If voltage reading is 10 volts or greater, go to step 8). If not, go to next step.

7) Check ABS fuse or fusible link. If fuse or fusible link is open, go to step 13). If fuse or fusible link is okay, go to step 14).

8) Inspect 2-pin EBCM harness connector for poor terminal contact or corrosion. Check for open in ground circuit to EBCM. See WIRING DIAGRAMS. Repair as necessary. Reconnect harness connectors. Using scan tool, clear DTC. Test drive vehicle at speed greater than 10 MPH. If DTC C0067 resets as current DTC, go to step 12). If DTC does not reset, malfunction is intermittent. See DIAGNOSTIC AIDS.

9) Repair 2-pin EBCM harness connector as necessary. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

10) Repair 2-pin pump motor pigtail connector or wiring. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

11) Repair open or high resistance in ground circuit to EBCM. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

12) Replace EBCM. After replacing EBCM, perform DIAGNOSTIC SYSTEM CHECK.

13) Repair short to ground in battery circuit between underhood fuse/relay block and EBCM. See WIRING DIAGRAMS. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

14) Repair open or high resistance in battery circuit to EBCM. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

15) Replace BPMV assembly. After replacing assembly, perform DIAGNOSTIC SYSTEM CHECK.

Diagnostic Aids

Pump motor is integral with BPMV assembly and cannot be separately serviced. DTC C0067 can be caused by poor power and ground at the 2-pin EBCM or 2-pin motor harness from the EBCM to the pump motor. The EBCM or BPMV must be replaced if these tests show the pump motor EBCM internal circuitry has failed.

DTC C0068: PUMP MOTOR LOCKED OR PUMP MOTOR CIRCUIT SHORTED

NOTE: For circuit reference, see WIRING DIAGRAMS.

Circuit Description

The pump motor circuit is integral to EBCM. The EBCM energizes the relay within EBCM to supply battery voltage to high side of pump motor. When pump motor activation is required, EBCM grounds low side of pump motor.

Conditions for setting DTC:

* Vehicle speed at 8 MPH or greater.
* EBCM internal relay on.
* Pump motor commanded on and then off.
* High voltage from low side of pump motor for 100 milliseconds when expected to be low.

Diagnostic Procedures

1) Perform diagnostic system check. See DIAGNOSTIC SYSTEM CHECK. After performing diagnostic system check, go to next step.

2) Turn ignition off. Disconnect 2-pin pump motor pigtail connector from EBCM. Inspect connector and wiring for damage or corrosion that could cause an open circuit between pump motor and EBCM. If connector and wiring are okay, go to next step. If connector or wiring is faulty, go to step 10).

3) Check resistance between terminals No. 1 and 2 of 2-pin pump motor pigtail connector. If resistance is 0.1-0.3 ohm, go to step 15). If not, go to next step.

4) Disconnect 2-pin EBCM harness connector. Inspect connector for damage or corrosion which could cause a loss of power to EBCM. If connector is okay, go to next step. If connector is faulty, go to step 9).

5) Check resistance between ground and terminal No. 2 of 2-pin EBCM harness connector. If resistance is 0-2 ohms, go to next step. If not, go to step 11).

6) Turn ignition switch to RUN position. Check voltage between ground and terminal No. 1 of EBCM harness connector. If voltage reading is 10 volts or greater, go to step 8). If not, go to next step.

7) Check ABS fuse. If fuse is open, go to step 13). If fuse is okay, go to step 14).

8) Inspect 2-pin EBCM harness connector for poor terminal contact or corrosion. Check for open in ground circuit to EBCM. See WIRING DIAGRAMS. Repair as necessary. Reconnect harness connectors. Using scan tool, clear DTC. Test drive vehicle at speed greater than 10 MPH. If DTC C0068 resets as current DTC, go to step 12). If DTC does not reset, malfunction is intermittent. See DIAGNOSTIC AIDS.

9) Repair 2-pin EBCM harness connector as necessary. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

10) Repair 2-pin pump motor pigtail connector or wiring. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

11) Repair open or high resistance in ground circuit to EBCM. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

12) Replace EBCM. After replacing EBCM, perform DIAGNOSTIC SYSTEM CHECK.

13) Repair short to ground in battery circuit between underhood fuse/relay block and EBCM. See WIRING DIAGRAMS. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

14) Repair open or high resistance in ground circuit to EBCM. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

15) Replace BPMV assembly. After replacing assembly, perform DIAGNOSTIC SYSTEM CHECK.

Diagnostic Aids

Pump motor is integral with BPMV assembly and cannot be separately serviced. DTC C0067 can be caused by poor power and ground at the 2-pin EBCM or 2-pin motor harness from the EBCM to the pump motor. The EBCM or BPMV must be replaced if these tests show the pump motor EBCM internal circuitry has failed.

DTC C0071, C0072, C0073, C0074: EBCM INTERNAL FAULT

NOTE: For circuit reference, see WIRING DIAGRAMS.

Circuit Description

The EBCM intializes a self-test when ignition switch is turned to RUN position. The EBCM self-test verifies all internal circuitry within the EBCM is operating correctly.

Diagnostic Procedures

1) Perform diagnostic system check. See DIAGNOSTIC SYSTEM CHECK. After performing diagnostic system check, go to next step.

2) Using scan tool, attempt to clear DTCs. If DTCs cleared, go to next step. If not, go to step 4).

3) Check for history DTCs and data. If this is the first time DTC has set, perform DIAGNOSTIC SYSTEM CHECK. If DTC was set before, go to next step.

4) Replace EBCM. After replacing EBCM, perform DIAGNOSTIC SYSTEM CHECK.

DTC C0081: STOPLIGHT SWITCH ALWAYS CLOSED OR SHORTED

NOTE: For circuit reference, see WIRING DIAGRAMS.

Circuit Description

The stoplight switch is a normally closed switch. With ignition switch in the RUN position and brake pedal not depressed, ignition voltage will be present at the EBCM. When brakes are applied, the ignition voltage at the EBCM will be zero.

Conditions for setting DTC:

* Vehicle speed greater than 35 MPH for 10 seconds followed by vehicle at rest for one second.
* Stoplight switch never switching during the described condition.

Diagnostic Procedures

1) Perform diagnostic system check. See DIAGNOSTIC SYSTEM CHECK. After performing diagnostic system check, go to next step.

2) Turn ignition on. Using scan tool, select DATA LIST function. Check the status of the stoplight switch while applying and releasing brake pedal. If scan tool indicates switch is closed (pedal not applied) at all times, go to next step. If not, go to step 4).

3) Turn ignition off. Disconnect stoplight switch connector. Turn ignition switch to RUN position. Using scan tool, check status of stoplight switch. If scan tool indicates switch is closed (pedal not applied), go to step 7). If not, go to step 8).

4) If scan tool indicates that switch is open (pedal applied) at all times, go to next step. If not, go to step 7).

5) Turn ignition off. Disconnect 10-pin EBCM harness connector. Turn ignition switch to RUN position. Using DVOM, check voltage between ground and terminal "C" of 10-pin EBCM harness connector. If voltage reading is greater than 10 volts, go to next step. If not, go to step 8).

6) Turn ignition off. Reconnect all harness connectors. Turn ignition switch to RUN position. Select DATA LIST function on scan tool. Using scan tool, check status of stoplight switch while applying and releasing brake pedal. If scan tool indicates switch is open (pedal applied) at all times, go to step 9). If not, go to next step.

7) Malfunction is intermittent. See DIAGNOSTIC AIDS. After performing necessary repairs, perform DIAGNOSTIC SYSTEM CHECK.

8) Repair faulty stoplight switch or open in stoplight switch circuit between EBCM and stoplight switch. See WIRING DIAGRAMS. After

repairs, perform DIAGNOSTIC SYSTEM CHECK.

9) Replace EBCM. After replacing EBCM, perform DIAGNOSTIC SYSTEM CHECK.

DTC C0086: ANTI-LOCK INDICATOR LIGHT CIRCUIT SHORTED TO BATTERY VOLTAGE

NOTE: For circuit reference, see WIRING DIAGRAMS.

Circuit Description

The ANTI-LOCK indicator light is powered by ignition voltage through the GAUGE fuse. The EBCM output will be high (battery voltage) when indicator light is off, and will be low (ground) when light is on. If DTC C0086 sets, the EBCM will store the code in memory but will not disable the ABS. If DTC C0086 is in memory and a different fault occurs, EBCM will illuminate the BRAKE indicator light to notify operator of the problem.

Conditions for setting DTC:

* High voltage on ANTI-LOCK indicator light circuit when expected to be low (light commanded on).
* Anything that keeps the ANTI-LOCK indicator light circuit high when light is supposed to be illuminated, such as a short to voltage on ABS indicator light circuit between instrument cluster and EBCM. See WIRING DIAGRAMS.

Diagnostic Procedures

1) Perform diagnostic system check. See DIAGNOSTIC SYSTEM CHECK. After performing diagnostic system check, go to next step.

2) Turn ignition switch to RUN position and observe ANTI-LOCK indicator light operation. If indicator light illuminates and then turn off after 3 seconds, go to step 5). If not, go to next step.

3) Turn ignition off. Disconnect 10-pin EBCM harness connector. Using a fused (3-amp) jumper wire, jumper terminal "B" of 10-pin harness connector to ground. Turn ignition switch to RUN position. If ANTI-LOCK indicator light illuminates, go to step 6). If not, go to next step.

4) Inspect jumper wire fuse. If fuse is blown, go to step 7). If fuse is not blown, go to next step.

5) Malfunction is intermittent. Inspect all connectors and harnesses for damage which may result in high resistance when components are connected. See DIAGNOSTIC AIDS. After performing necessary repairs, perform DIAGNOSTIC SYSTEM CHECK.

6) Replace EBCM. After replacing EBCM, perform DIAGNOSTIC SYSTEM CHECK.

7) Repair short to voltage in ANTI-LOCK indicator light circuit between instrumetn cluster and EBCM. See WIRING DIAGRAMS. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

Diagnostic Aids

DTC C0086 is typically set by a shorted ANTI-LOCK indicator light, although it can be set from a short to voltage in the circuit between indicator light and EBCM, or a faulty EBCM.

DTC C0088: BRAKE WARNING LIGHT CIRCUIT SHORTED TO BATTERY VOLTAGE

NOTE: For circuit reference, see WIRING DIAGRAMS.

Circuit Description

The BRAKE warning light is powered by ignition voltage through the GAUGE fuse. The BRAKE warning light can be illuminated by the EBCM, Daytime Running Lights Module (DRL), brake pressure differential switch or by the park/stoplight switch. If DTC C0088 sets, the EBCM will store the code in memory but will not disable the ABS. If DTC C0086 is also in memory, the EBCM will not attempt to perform the bulb check at start-up.

Conditions for setting DTC:

* High voltage on BRAKE warning light circuit when expected to be low (light commanded on).
* Anything that keeps the BRAKE warning light circuit high when light is supposed to be illuminated, such as a short to voltage on BRAKE warning light control circuit.

Diagnostic Procedures

1) Perform diagnostic system check. See DIAGNOSTIC SYSTEM CHECK. After performing diagnostic system check, go to next step.

2) Turn ignition switch to RUN position and observe BRAKE warning light operation. If indicator light illuminates and then turn off after 3 seconds, go to step 5). If not, go to next step.

3) Turn ignition off. Disconnect 10-pin EBCM harness connector. Using a fused (3-amp) jumper wire, jumper terminal "H" of 10-pin harness connector to ground. Turn ignition switch to RUN position. If BRAKE warning light illuminates, go to step 6). If not, go to next step.

4) Inspect jumper wire fuse. If fuse is blown, go to step 7). If fuse is not blown, go to next step.

5) Malfunction is intermittent. Inspect all connectors and harnesses for damage which may result in high resistance when components are connected. See DIAGNOSTIC AIDS. After performing necessary repairs, perform DIAGNOSTIC SYSTEM CHECK.

6) Replace EBCM. After replacing EBCM, perform DIAGNOSTIC SYSTEM CHECK.

7) Repair short to voltage in BRAKE warning light circuit. See WIRING DIAGRAMS. After repairs, perform DIAGNOSTIC SYSTEM CHECK.

Diagnostic Aids

DTC C0088 is typically set by a shorted BRAKE warning light, although it can be set from a short to voltage in the circuit between indicator light and EBCM, or a faulty EBCM.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS TABLE

Application	Ft. Lbs. (N.m)
Axle Nut (4WD)	103 (140)
BPMV Bracket-To-Body Bolt	21 (28)
Brake Caliper Mounting Bolt	37 (50)
Brakeline-To-Combination Valve	22 (29)
Front & Rear	22 (29)
Combination Valve-To-BPMV	12 (16)
Front Wheel Speed Sensor Mounting Bolt (1)	
2WD	19 (26)
4WD	13 (18)
Splash Shield Bolt	12 (16)
Tube Adapters-To-BPMV	23 (31)
Wheel Bearing Nut (2WD) (2)	12 (16)
Wheel Lug Nut	95 (129)

	INCH Lbs. (N.m)
EBCM-To-BPMV	39 (5)
Speed Sensor Harness Clip Bolt	9 (12)

(1) - Not all models have speed sensor mounting bolts. Some models have a speed sensor which is mounted on splash shield.
(2) - See FRONT WHEEL SPEED SENSOR under REMOVAL & INSTALLATION for proper adjustment.

WIRING DIAGRAMS

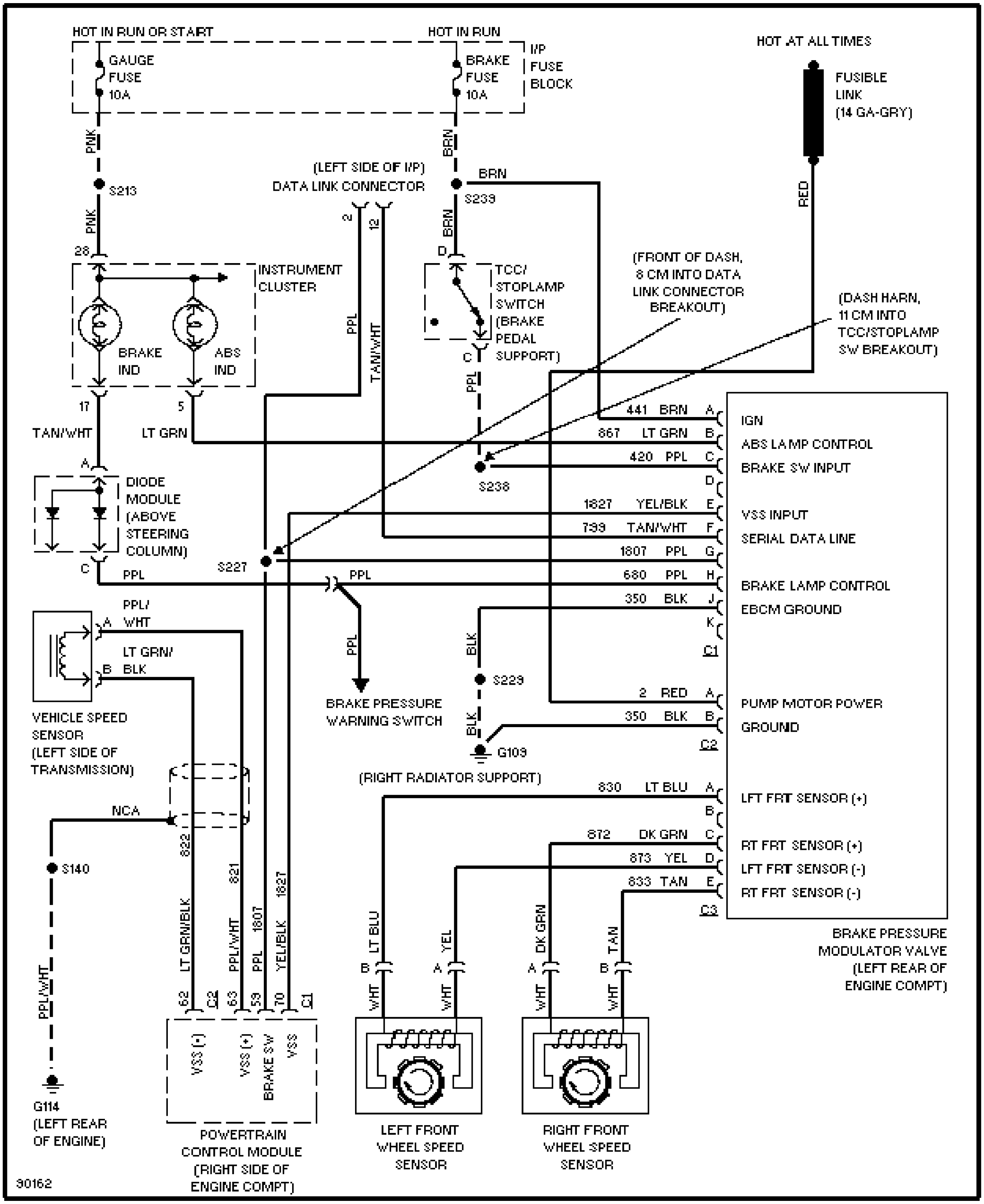


Fig. 1: 4WAL Brake System Wiring Diagram (2.2L)

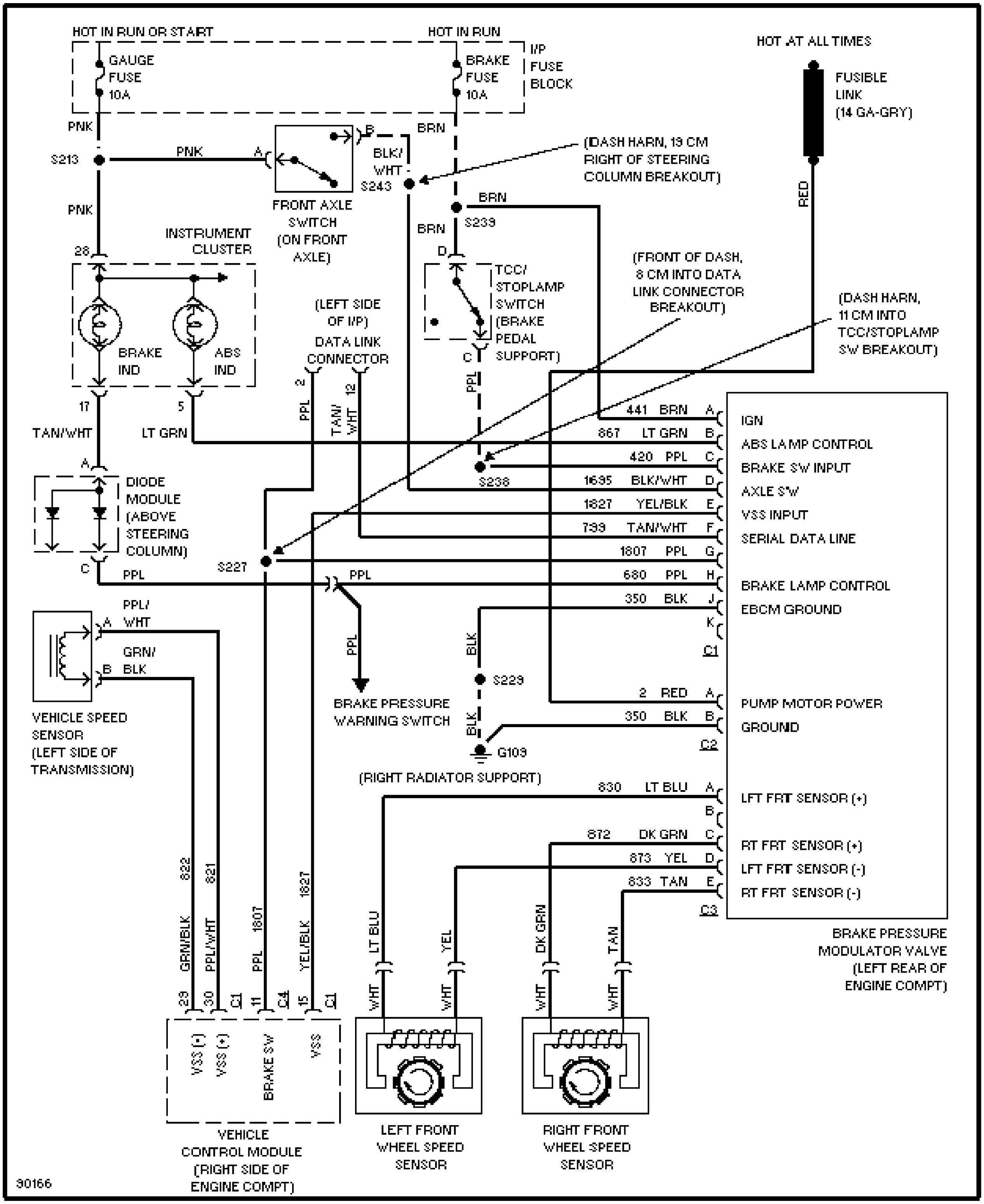


Fig. 2: 4WAL Brake System Wiring Diagram (4.3L)

AUTO TRANS DIAGNOSIS - 4L60-E (4.3L)

1997 Chevrolet Blazer

1997-98 AUTOMATIC TRANSMISSIONS
General Motors Corp. - 4L60-E Electronic Controls - 4.3L

Chevrolet; Blazer, S10
GMC; Jimmy, Sonoma
Isuzu; Hombre
Oldsmobile; Bravada

DESCRIPTION

The 4L60-E transmission uses 2 electric shift solenoids to control transmission upshifts and downshifts. In addition, a pressure control (force motor) solenoid controls hydraulic line pressure, and a Torque Converter Clutch (TCC) solenoid controls TCC application. A TCC Pulse Width Modulated (PWM) solenoid is used to control fluid acting on converter clutch valve, which then controls TCC apply and release. A 3-2 control solenoid modulates hydraulic pressure for the 2-4 band and 3-4 clutch to improve 3-2 downshift. Solenoids are turned on and off by Vehicle Control Module (VCM).

VCM receives signals from various transmission sensors. Sensors include engine speed and throttle position, transmission speed, hydraulic pressure and transmission fluid temperature. VCM has on-board self-diagnostics to help identify any parts or circuits which may need further testing.

OPERATION

Shift solenoid holds hydraulic pressure (solenoid on) or releases hydraulic pressure (solenoid off). This action controls shift valves inside valve body. By switching one or both solenoids on or off, different combinations of clutches, sprags and bands are operated. See CLUTCH & BAND APPLICATION CHART under ELECTRONIC TESTING.

LIMP-IN MODE

If sensor input signals are missing or inadequate for transmission operation, PCM will output preset operating signals to transmission. This mode will keep vehicle operational and allow it to be driven, with reduced transmission function and performance, to a repair facility. Malfunction Indicator Light (MIL) may light if malfunction occurs. Vehicle should not be driven for extended periods in limp-in mode.

COMPONENT DESCRIPTION

VCM

Light trucks are equipped with a Vehicle Control Module (VCM). For VCM locations, see VCM LOCATION table.

VCM utilizes 3 different colored 32-pin connectors and one 24-pin connector. See Figs. 1 and 2.

VCM controls TCC, pressure control solenoid, (hydraulic pressure), PWM solenoid and shift solenoids 1-2 and 2-3. In addition, VCM also controls ignition, fuel and emission devices related to engine.

VCM receives electronic signals from sensors and switches. These signals help VCM determine when to operate various relays and solenoids related to engine and transmission components.

VCM LOCATION TABLE

Application	Location
All Models	Right Side Of Engine Compartment

PCM HARNESS CONNECTOR TERMINALS IDENTIFICATION

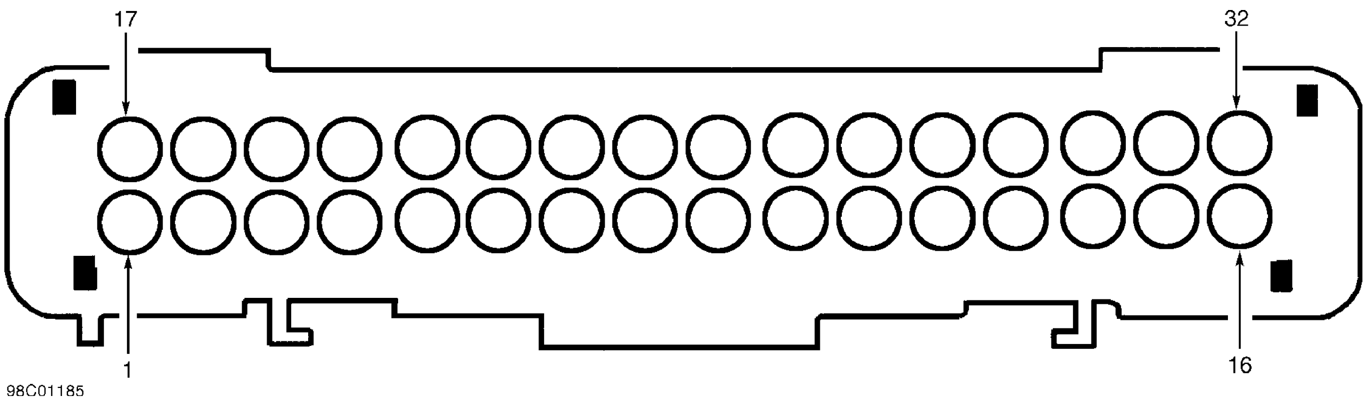


Fig. 1: PCM 32-Pin Harness Connector Terminal ID (C1 - Blue, C2 - Red & C3 - Clear Or Gray)
Courtesy of General Motors Corp.

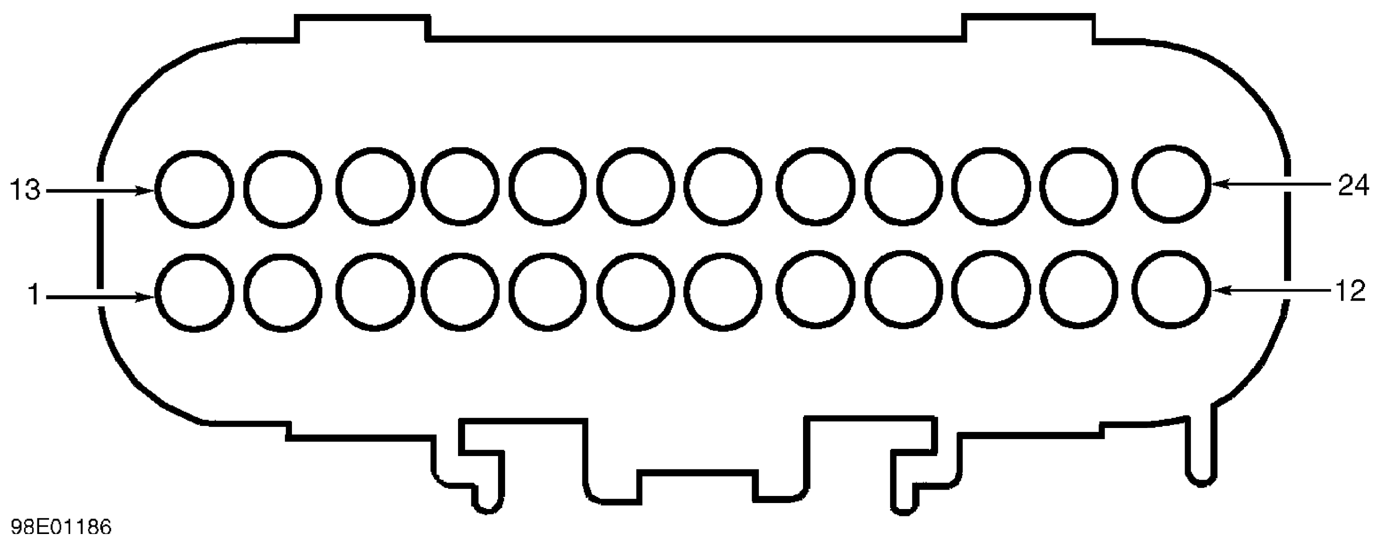


Fig. 2: PCM 24-Pin Harness Connector Terminal ID (C4 - Black)
Courtesy of General Motors Corp.

SENSORS & SWITCHES

VCM controls converter clutch lock-up, upshifts and downshifts based on transmission temperature, system voltage, throttle position, transmission oil pressure switches (5), and transmission output and input (engine) speed sensors. See Fig. 3. System includes several other sensors and switches that are used for engine control (gasoline engines). For additional information and testing of engine components, see appropriate article in ENGINE PERFORMANCE section.

SOLENOIDS

Shift Solenoids 1-2 & 2-3

Transmission is shifted up or down by 2 electric shift solenoids. Both solenoids are located on valve body. See Fig. 3. Ignition power is supplied to each solenoid by transmission fuse. Solenoid 1-2 controls hydraulic pressure to 1-2 shift valve. Solenoid 2-3 controls hydraulic pressure to 2-3 shift valve.

NOTE: The 3-4 shift valve is directly controlled by hydraulic circuits in valve body.

Pressure Control Solenoid

Pressure control (force motor) solenoid has a spool valve and operates pressure regulator valve. See Fig. 3. VCM sends a frequency signal to pressure control solenoid to regulate hydraulic line pressure. Frequency signal (duty cycle) is measured with a dwell meter or lab scope. When duty cycle is zero, line pressure is at maximum, and pressure control solenoid draws zero amps. When duty cycle is 60 percent, line pressure is at minimum, and pressure control solenoid draws 1.1 amps at 4.5 volts.

TCC Solenoid

This solenoid is used to control TCC apply valve. VCM sends a frequency signal to TCC solenoid to gradually apply or release TCC. See Fig. 3.

3-2 Control Solenoid

VCM modulates current (duty cycle) to control 3-2 control solenoid. The 3-2 control solenoid is off in first gear. In all other gears, 3-2 control solenoid is 90 percent on. Hydraulic pressure is regulated to smoothly release 3-4 clutch and 2-4 band during 3-2 downshift.

TCC PWM Solenoid

TCC PWM solenoid is used to control fluid acting on converter clutch valve, which then controls TCC apply and release. See Fig. 3. TCC PWM solenoid is used to provide smooth engagement of torque converter clutch by operating with a duty cycle on time of less than 50 percent.

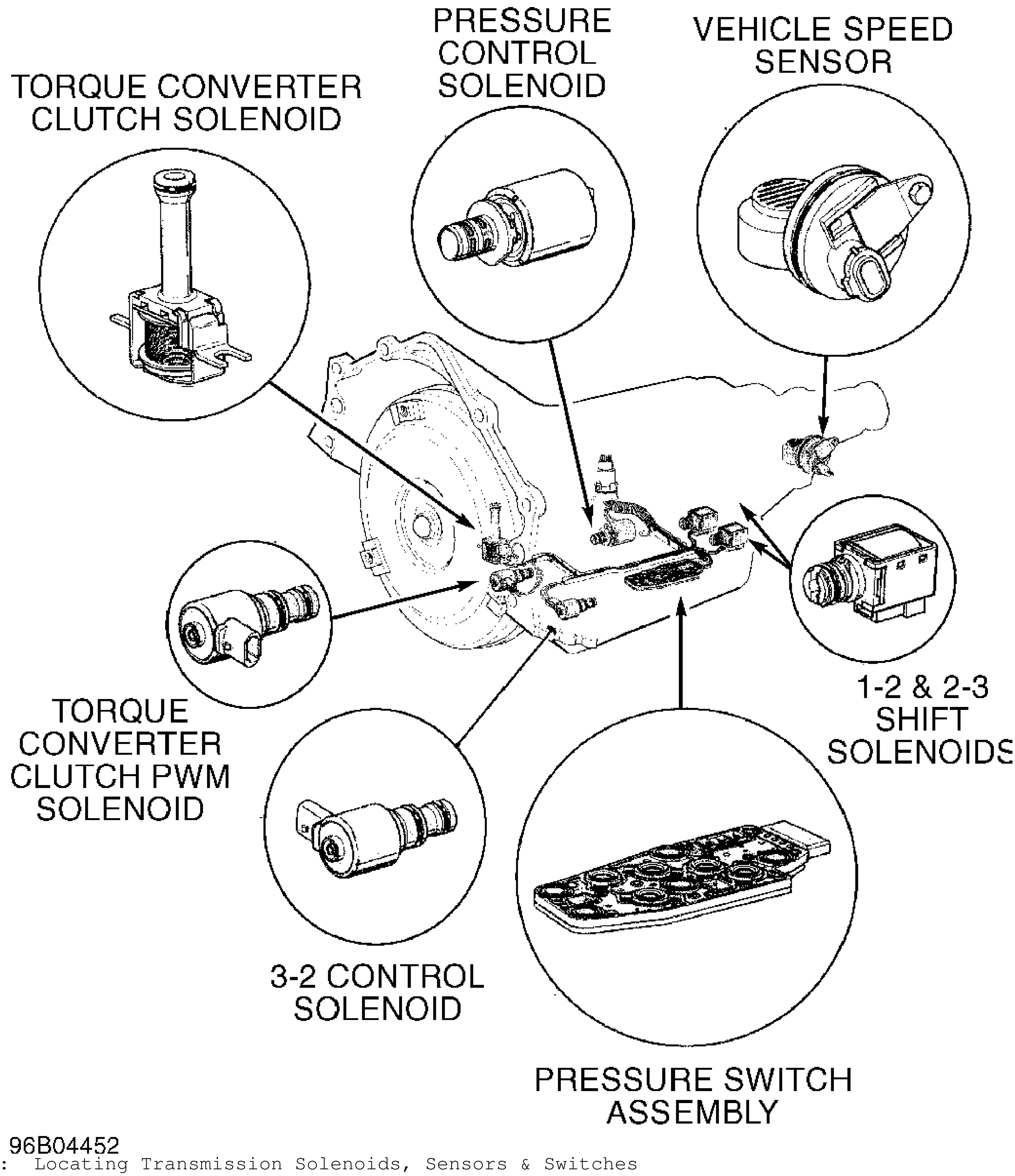


Fig. 3: Locating Transmission Solenoids, Sensors & Switches
Courtesy of General Motors Corp.

SELF-DIAGNOSTICS

VCM constantly monitors all electrical circuits. If VCM detects circuit problems or sensors out of range, it will record a Diagnostic Trouble Code (DTC). If problem continues for a predetermined time, Malfunction Indicator Light (MIL) will glow.

If MIL is on all the time, DTC(s) are currently being detected. If MIL is off, but VCM had detected a circuit or sensor problem, DTC(s) will be stored in computer memory.

Stored DTCs may be retrieved from VCM memory using a scan tool. DTCs CANNOT be retrieved by grounding 16-pin Data Link Connector (DLC).

NOTE: Faulty engine sensors and actuators may cause transmission related DTCs or driveability problems. Engine faults and related DTCs must be diagnosed and repaired before transmission codes are repaired. For additional information on diagnosing and repairing engine related VCM trouble codes, see ENGINE PERFORMANCE section.

ELECTRONIC SELF-DIAGNOSTICS

* PLEASE READ THIS FIRST *

NOTE: To test electronic control of transmission solenoids, sensors and pressure switch assembly without using self-diagnostics or if self-diagnostics does not function, go to COMPONENT TESTS under ELECTRONIC TESTING. After repairs are made, DTCs should be erased from computer memory. See CLEARING TROUBLE CODES under ELECTRONIC SELF-DIAGNOSTICS.

NOTE: If no DTCs are present and vehicle is in limp-in mode, check fused power supply circuit to transmission solenoids. Non-related transmission component system failure may cause this circuit fuse to fail. Fuses such as ERLS or SHIFT SOL fuse supply power to non-related transmission components (A/C clutch, EGR, EVAP, or ABS system) which may have caused fuse to fail.

NOTE: Trouble codes will be recorded at various operating times. Some codes require operation of affected sensor or switch for 5 seconds; others may require operation for 5 minutes or longer at normal operating temperature, road speed and load. Therefore, some codes may not set in a service bay operational mode and may require road testing vehicle in order to duplicate condition under which code will set.

RETRIEVING CODES

NOTE: Stored DTCs may be retrieved from VCM memory using scan tool. DTCs CANNOT be retrieved by grounding 16-pin Data Link Connector (DLC). Plugging scan tool into DLC, located under instrument panel, enables user to read DTCs and check voltages in system on serial data line.

Scan tools may also furnish information on status of output devices (solenoids and relays). However, status parameters are only an indication that output signals have been sent to devices by control module; they do not indicate if devices have responded properly to signal. Check for proper response at output device using a voltmeter or test light.

If trouble codes are not present, this is not necessarily an indication a problem does not exist. Driveability related problems with codes displayed occur about 20 percent of the time, while driveability problems without codes occur about 80 percent of the time. Sensors that are out of specification WILL NOT set a trouble code but WILL cause driveability problems. Using scan tool is the easiest method of checking sensor specifications and other data parameters. Scan tool is also useful in finding intermittent wiring problems by wiggling wiring harness and connections (key on, engine off) while observing scan tool.

DIAGNOSTIC TROUBLE CODE (DTC) DEFINITIONS

NOTE: Only transmission-related trouble codes are listed. For engine-related DTC definitions, see TROUBLE CODE DEFINITIONS article in APPLICATIONS & IDENTIFICATION section. For engine-related DTC diagnosis, see G - TESTS W/CODES article in ENGINE PERFORMANCE section. These DTCs pertain to engine performance and must be repaired first, as engine performance and related component signals will affect transmission operation and diagnosis.

DIAGNOSTIC TROUBLE CODE (DTC) DEFINITIONS TABLE

DTC	Circuit Affected
P0218	Transmission Fluid Overtemp.
P0502	Vehicle Speed Sensor Circuit (Low Input)
P0503	Vehicle Speed Sensor Circuit (Intermittent)
P0711	Trans. Fluid Temp. (TFT) Sensor Circuit (Range/Perf.)
P0712	Trans. Fluid Temp. (TFT) Sensor Circuit (Low Input)
P0713	Trans. Fluid Temp. (TFT) Sensor Circuit (High Input)
P0719	Brake Switch Circuit Low Input (Switch Stuck On)
P0724	Brake Switch Circuit High Input (Switch Stuck Off)
P0740	TCC Solenoid Electrical Malfunction
P0742	TCC Circuit Inoperative (Stuck On)
P0748	Pressure Control Solenoid Electrical Malfunction
P0751	1-2 Shift Solenoid ("A") Performance Malfunction
P0753	1-2 Shift Solenoid ("A") Electrical Malfunction
P0756	2-3 Shift Solenoid ("B") Performance Malfunction
P0758	2-3 Shift Solenoid ("B") Electrical Malfunction
P0785	3-2 Shift Solenoid Electrical Malfunction
P1810	Transmission Fluid Pressure (TFP) Switch Malfunction
P1860	TCC PWM Solenoid Electrical Malfunction
P1870	Tranmission Component Slipping
P1875	4WD-Low Circuit Malfunction

HARD OR INTERMITTENT TROUBLE CODE DETERMINATION

During any diagnostic procedure, it must be determined if codes are hard failure codes or intermittent failure codes. Diagnostic tests will not usually help analyze intermittent codes. To determine hard codes and intermittent codes, proceed as follows:

1) Enter diagnostic mode. See RETRIEVING CODES. Read and record all stored DTCs. Exit diagnostic mode and clear trouble codes. See CLEARING TROUBLE CODES.

2) Apply parking brake and place transmission in Neutral or Park. Block drive wheels and start engine. MIL should go out. Run warm engine at specified curb idle for 2 minutes and note MIL.

3) If MIL comes on, enter diagnostic mode. Read and record DTCs. This will reveal hard failure codes. DTCs may require a road test to reset hard failure after clearing DTCs. If MIL does not come on, all stored DTCs were intermittent failures.

CLEARING TROUBLE CODES

DTCs can be cleared using scan tool. If scan tool is not available, turn ignition switch to OFF position. Remove control module fuse from fuse block for 30 seconds. Replace fuse. If fuse cannot be located, disconnect VCM pigtail at battery for 30 seconds. Codes may also be cleared by disconnecting negative battery cable. However, this may result in loss of other on-board memory data, such as preset radio tuning. After power to VCM is removed, poor driveability may occur until control module "relearns" operating parameters.

DTCs will also be cleared under the following conditions: VCM will turn off MIL after 3 consecutive ignition cycles without a failure reported. VCM will cancel DTC default actions when fault no longer exists and ignition is cycled off long enough to power down VCM. DTC will be cleared when vehicle has achieved 40 warm-up cycles without a failure reported.

ELECTRONIC TESTING

COMPONENT TESTS

Component & Wiring Harness Resistance Check

1) Install Jumper Harness (J-39775) to transmission 20-pin connector. Using an ohmmeter, measure resistance between specified terminals for each component. See Fig. 4. Compare resistance reading to known values. See TRANSMISSION COMPONENT RESISTANCE SPECIFICATIONS table.

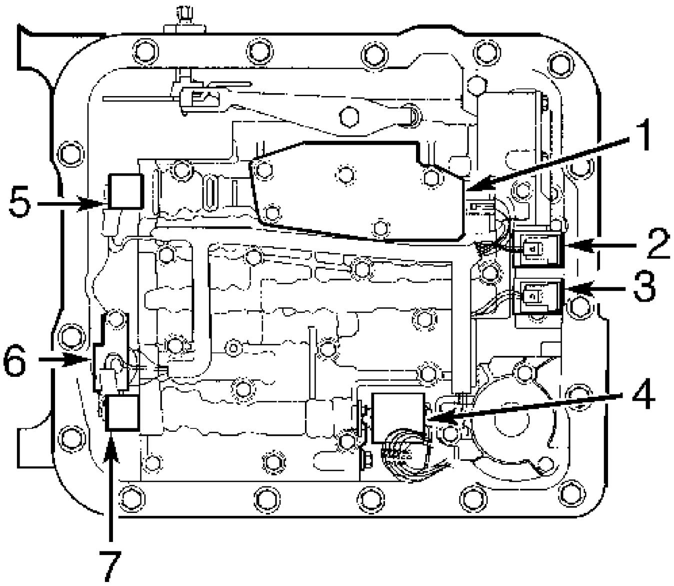
2) If resistance reading is okay, go to next step. If resistance reading is not okay, disconnect wiring harness at component and measure component resistance. Replace component if resistance is not as specified. If resistance is as specified, repair wiring harness between component and 20-pin connector.

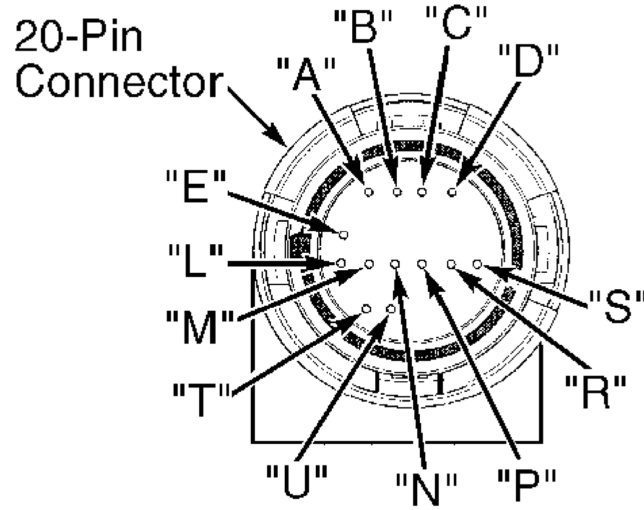
3) Measure resistance between ground and each terminal at transmission 20-pin connector. See Fig. 4. Resistance should be more than 250 k/ohms for each solenoid and more than 10 megohms for fluid temperature sensor and vehicle speed sensor. Resistance for fluid temperature sensor will vary with temperature. If resistance is within specification, problem is intermittent. If resistance is low, disconnect wiring harness at component.

4) Measure resistance between component terminals and ground. If resistance is low, replace component. If resistance is high, inspect wiring harness for short to ground. Repair as necessary.

TRANSMISSION COMPONENT RESISTANCE SPECIFICATIONS TABLE

Component	Ohms
Pressure Control Solenoid	3-7
TCC PWM Solenoid	10-15
TCC Solenoid	21-33
1-2 & 2-3 Shift Solenoids	19-31
3-2 Control Solenoid	20-32
TFT Sensor	
At 68°F (20°C)	3088-3942
At 212°F (100°C)	159-198
Vehicle Speed Sensor	
At 68°F (20°C)	1470-2220
At 212°F (100°C)	1800-2820





CAVITY	FUNCTION
A	1-2 SHIFT SOLENOID (LOW)
B	2-3 SHIFT SOLENOID (LOW)
C	PRESSURE CONTROL SOLENOID (HIGH)
D	PRESSURE CONTROL SOLENOID (LOW)
E	BOTH SHIFT SOLENOIDS, TCC SOLENOID, AND 3-2 CONTROL SOLENOID (HIGH)
L	TRANSMISSION FLUID TEMPERATURE (HIGH)
M	TRANSMISSION FLUID TEMPERATURE (LOW)
N	RANGE SIGNAL "A"
P	RANGE SIGNAL "C"
R	RANGE SIGNAL "B"
S	3-2 CONTROL SOLENOID (LOW)
T	TCC SOLENOID (LOW)
U	TCC PWM SOLENOID

1. Pressure Switch Assembly
2. 1-2 Shift Solenoid
3. 2-3 Shift Solenoid
4. Pressure Control Solenoid
5. 3-2 Control Solenoid
6. TCC Solenoid
7. TCC Control Solenoid

96D04453

Fig. 4: Identifying Component & Connector Terminal Locations
Courtesy of General Motors Corp.

NOTE: Pressure switch assembly is also referred to as Transmission Fluid Pressure (TFP) Valve Position Switch.

Transmission Fluid Pressure (TFP) Valve Position Switch

1) Install Jumper Harness (J39775) to transmission 20-pin

connector. Using DVOM, measure resistance between terminal "N" of transmission 20-pin connector and ground. See Fig. 4. If resistance is less than 50 k/ohms, go to next step. If resistance is more than 50 k/ohms, go to step 3).

2) Disconnect TFP valve position switch connector. Measure resistance between terminal "C" at TFP valve position switch and ground. See WIRING DIAGRAMS. If resistance is more than 50 k/ohms, go to step 16). If resistance is less than 50 k/ohms, replace TFP valve position switch.

3) Measure resistance between terminal "R" of transmission 20-pin connector and ground. If resistance is less than 200 ohms, go to step 5). If resistance is more than 200 ohms, go to next step.

4) Disconnect TFP valve position switch connector. Measure resistance between terminal "E" at TFP valve position switch and ground. See WIRING DIAGRAMS. If resistance is less than 200 ohms, go to step 16). If resistance is more than 200 ohms, replace TFP valve position switch.

5) Measure resistance between terminal "P" of transmission 20-pin connector and ground. See Fig. 4. If resistance is less than 50k/ohms, go to next step. If resistance is more than 50 k/ohms, go to step 7).

6) Disconnect TFP valve position switch connector. Measure resistance between terminal "D" at TFP valve position switch and ground. See WIRING DIAGRAMS. If resistance is more than 50 k/ohms, go to step 16). If resistance is less than 50 k/ohms, replace TFP valve position switch.

7) Start engine and allow to idle. Set parking brake. Place gear selector in Reverse. Measure resistance between terminal "N" of transmission 20-pin connector and ground. If resistance is less than 200 ohms, go to next step. If resistance is more than 200 ohms, go to step 16).

8) Place gear selector in "1" (low) position. Measure resistance between terminal "N" of transmission 20-pin connector and ground. If resistance is less than 200 ohms, go to next step. If resistance is more than 200 ohms, go to step 16).

9) Place gear selector in "3" (3rd gear) position. Measure resistance between terminal "R" of transmission 20-pin connector and ground. If resistance is more than 50 k/ohms, go to next step. If resistance is less than 50 k/ohms, go to step 16).

10) Place gear selector in "D" (overdrive) position. Measure resistance between terminal "P" of transmission 20-pin connector and ground. If resistance is less than 200 ohms, go to next step. If resistance is more than 200 ohms, go to step 16).

11) Place gear selector in "2" (2nd gear) position. Measure resistance between terminal "P" of transmission 20-pin connector and ground. If resistance is more than 50 k/ohms, go to next step. If resistance is less than 50 k/ohms, go to step 16).

12) Turn ignition off. Measure resistance between terminal "L" and terminal "M" at transmission 20-pin connector. If TFT sensor resistance is 3088-3942 ohms at 68°F (20°C) or 159-198 ohms at 212°F (100°C), go to next step. If TFT sensor resistance is not as specified, go to step 14).

13) Measure resistance between terminal "L" of transmission 20-pin connector and ground, and between terminal "M" of transmission 20-pin connector and ground. If both resistance readings are more than 10 megohms, problem is intermittent. Go to step 16). If both resistance readings are less than 10 megohms, go to next step.

14) Disconnect TFP valve position switch connector. Measure resistance between terminal "A" and terminal "B" at TFP valve position switch. If TFT sensor resistance is 3088-3942 ohms at 68°F (20°C) or 159-198 ohms at 212°F (100°C), go to next step. If TFT sensor resistance is not as specified, replace TFP valve position switch.

15) Measure resistance between terminal "A" of TFP valve

position switch and ground, and between terminal "B" of TFP position switch and ground. If both resistance readings are more than 10 megohms, go to next step. If both resistance readings are less than 10 megohms, replace TFP valve position switch.

16) Check for short or high resistance in TFP valve position switch circuits. Check for poor connections at transmission 20-pin connector and at TFP valve position switch. Check for bent, backed out or damaged terminals, or poor terminal tension. If diagnosing for intermittent problem, wiggle wiring harness while observing test equipment for change in value. If short or high resistance is found, verify repair, then repeat test procedure. If short or high resistance is not found, check for open or short to ground in circuits between TFP valve position switch and PCM. Replace wiring harness as necessary. If circuits are okay, replace TFP valve position switch.

CLUTCH & BAND APPLICATION

CLUTCH & BAND APPLICATION CHART

Selector Lever Position	Shift Solenoid Position	Elements In Use
"D" (Overdrive)		
First Gear	1-2 ON/2-3 ON	Forward Clutch, Forward Sprag & Low Roller Clutch
Second Gear	1-2 OFF/2-3 ON	Forward Clutch, Forward Sprag & 2-4 Band
Third Gear	1-2 OFF/2-3 OFF	Forward Clutch, Forward Sprag & 3-4 Clutch
Overdrive	1-2 ON/2-3 OFF	Forward Clutch, 2-4 Band & 3-4 Clutch
"D" (Drive)		
First Gear	1-2 ON/2-3 ON	Forward Clutch, Forward Sprag & Low Roller Clutch
Second Gear	1-2 OFF/2-3 ON	Forward Clutch, Forward Sprag & 2-4 Band
Third Gear	1-2 OFF/2-3 OFF	Forward Clutch, Forward Sprag, Overrun Clutch & 3-4 Clutch
"2" (Intermediate)		
First Gear	1-2 ON/2-3 ON	Forward Clutch, Forward Sprag, Low Roller Clutch & Overrun Clutch
Second Gear	1-2 OFF/2-3 ON	Forward Clutch, Forward Sprag, Overrun Clutch & 2-4 Band
"1" (Low)		

First Gear	1-2 ON/2-3 ON	Forward Clutch, Forward Sprag, Low Reverse Clutch, Low Roller Clutch & Overrun Clutch
Second Gear (1)	1-2 OFF/2-3 ON	Forward Clutch, Forward Sprag, Overrun Clutch & 2-4 Band
"R" (Reverse)	1-2 ON/2-3 ON	Low Reverse Clutch & Reverse Input Clutch
"P" (Park)	1-2 ON/2-3 ON	Low Reverse Clutch
"N" (Neutral)	1-2 ON/2-3 ON	All Clutches & Bands Released Or Ineffective
(1) - Gear is only available above 30-35 MPH.		

DIAGNOSTIC TESTS

DIAGNOSTIC TESTS DESCRIPTION

NOTE: Not all DTCs are applicable to all models.

Diagnostic Tests

Following diagnostic tests are DTC specific. Always perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK prior to performing any diagnostic procedure. For VCM terminal locations, see Fig. 1. See WIRING DIAGRAMS. For engine-related DTCs, see G - TESTS W/CODES article in ENGINE PERFORMANCE section.

Diagnostic Aids

Diagnostic Aids located at end of each diagnostic test, are additional tips used to help diagnose trouble codes when diagnostic procedures do not find a problem.

USING DIAGNOSTIC TESTS & WIRING DIAGRAMS

PCM connector colors and terminal identification may vary with vehicle model and engine size. When using following diagnostic tests, see appropriate wiring diagram to determine which PCM connector(s) to disconnect during test procedure. Locate component being tested and trace specified wiring circuit to determine PCM connector and terminal related to that component.

ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK

NOTE: Use of scan tool is required to perform OBD system check. Perform this test prior to performing any diagnostic procedures in DTC tests.

NOTE: Most problems that exist with the MIL or diagnostic system are engine performance or PCM related. Procedures for repairing these systems and circuits may require additional engine performance repair data. This test contains references to additional procedures not found in this publication.

The OBD System Check determines:

* If Malfunction Indicator Light (MIL) works.
* If PCM is operating and can recognize a fault.
* If any codes are stored.

OBD system check is the starting point for utilizing the self-diagnostic system for determining computer-related problems. After performing necessary tests as described in diagnostic system check, if no codes are indicated and driveability problems still exist, see H - TESTS W/O CODES article in ENGINE PERFORMANCE section.

NOTE: The following steps should be performed first to reduce diagnostic time and prevent replacement of good parts.

1) Turn ignition off for 15 seconds. Turn ignition on. If MIL is on, go to next step. If MIL is off, see MALFUNCTION INDICATOR LIGHT (MIL) in F - BASIC TESTING article in ENGINE PERFORMANCE section.
2) Install scan tool and follow scan tool manufacturer's instructions to proceed with test. Turn ignition on. If scan tool displays VCM data, go to next step. If scan tool does not display VCM data, go to DLC DIAGNOSIS OR NO SCAN TOOL DATA in F - BASIC TESTING article in ENGINE PERFORMANCE section.
3) Using scan tool, command MIL off. If MIL remains on, see MALFUNCTION INDICATOR LIGHT (MIL) in F - BASIC TESTING article in ENGINE PERFORMANCE section. If MIL is off, using scan tool, check for any DTCs stored in Lst Test Fail, Fail This Ign., History or MIL Request. If any DTC is stored, using scan tool, save freeze frame and failure record information as necessary, then go to appropriate diagnostic test. If no DTCs are stored, go to next step.
4) Attempt to start engine. If engine starts and runs, go to next step. If engine does not start or starts and dies, go to NO-START DIAGNOSIS in F - BASIC TESTING article in ENGINE PERFORMANCE section.
5) If DTCs are not present, compare scan tool data with specific component values. If values are not within specified range, check related circuit or component(s). See I - SYSTEM/COMPONENT TESTS article in ENGINE PERFORMANCE section.

DTC P0218: TRANSMISSION FLUID OVERTEMP

NOTE: Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK prior to performing diagnostic procedures. For wire terminal locations, see WIRING DIAGRAMS. Transmission Fluid Pressure (TFP) position switch assembly may also be referred to as Pressure Switch Assembly (PSA).

Circuit Description (1997)

Transmission Fluid Temperature (TFT) sensor is a negative coefficient thermistor within Transmission Fluid Pressure (TFP) position switch. TFT sensor controls signal voltage to PCM. PCM provides a 5 volt reference to sensor on TFT signal circuit. When transmission fluid is cold, sensor resistance is high, and PCM detects high signal voltage. As transmission fluid temperature increases, sensor resistance decreases and voltage decreases. At normal operating temperature of 212°F (100°C), voltage is about 1.5-2 volts. DTC P0218 is set if PCM detects high transmission temperature for long periods of time.

Conditions For Setting DTC P0218

DTC will set under the following conditions:

* DTCs P0711, P0712 or P0713 (TFT sensor) are not present.
* Transmission fluid temperature is more than 266°F (130°C).

* All conditions are met for 15 minutes.

Action Taken By PCM
PCM performs the following if DTC is set:

* Will not light MIL when fault is set.
* Freezes shift adapts from being updated.
* DTC P0218 will be stored in PCM history.

Diagnostic Procedure

1) Check transmission fluid. Fill as needed. Check for engine cooling system problems. Repair as necessary.

2) Connect scan tool to DLC. Turn ignition switch to ON position. DO NOT start engine. Using scan tool, record failure records for reference. Data will be lost when DTCs are cleared later in this test.

3) Using scan tool, check TFT sensor signal voltage. If scan tool displays less than .33 volt, go to next step. If scan tool displays more than .33 volt, see DIAGNOSTIC AIDS.

4) Turn ignition switch off. Disconnect transmission 20-pin connector. If scan tool displays more than 4.92 volts, perform COMPONENT & WIRING HARNESS RESISTANCE CHECK under COMPONENT TESTS. If scan tool displays less than 4.92 volts, go to next step.

5) Check TFT sensor signal circuit for short to ground. Repair circuit as necessary, then go to next step. If circuit is okay, inspect wiring for poor connections at PCM connector. Check for bent, backed out, deformed or damaged terminals. Repair as necessary, then go to next step. If connections and terminals are okay, replace PCM, then go to next step.

6) After repair is complete, select DTC on scan tool. Select "Clear Info" function. Select "Specific DTC" and enter DTC "P0218". Turn ignition switch to ON position. Scan tool must indicate fluid temperature less than 264°F (129°C), for at least 5 seconds. If DTC P0218 is not present, repair is complete. If DTC P0218 is still present, repeat test.

Diagnostic Aids

Inspect wiring for poor connections at PCM and at transmission 20-pin connector. Check for bent, backed out, deformed or damaged terminals. Check for weak terminal tension. Check for chafed wire that could short to bare metal or other wiring. Inspect for broken wire inside insulation. If diagnosing for intermittent short or open condition, move wiring harness while observing scan tool for value change. Check for torque converter stator malfunction. Check for blocked, damaged or pinched cooler lines.

Circuit Description (1998)

Flow of transmission fluid starts in bottom pan and is drawn through filter, control valve body, transmission case and into oil pump assembly. Oil pump assembly pressurizes fluid and directs it to pressure regulator valve, where it becomes the main supply of fluid to various components and hydraulic circuits in transmission. Hot fluid exiting torque converter flows through converter clutch apply valve and into transmission cooler lines to oil cooler and auxiliary cooler, if equipped. From cooler, fluid returns to cool and lubricate front of transmission. In forward drive ranges, "D4" fluid from manual valve is routed through an orificed cup plug in rear of transmission case to feed rear lube fluid circuit. DTC P0218 is set if PCM detects a high transmission fluid temperature for long periods of time.

Conditions For Setting DTC P0218
DTC will set under the following conditions:

* DTCs P0712 or P0713 (TFT sensor) are not present.
* Transmission fluid temperature is more than 266°F (130°C).
* All conditions are met for 10 minutes.

Action Taken By PCM

PCM performs the following if DTC is set:

* Will not light MIL when fault is set.
* Freezes shift adapts from being updated.
* DTC P0218 will be stored in PCM history.

Diagnostic Procedure

1) Ensure fluid level is correct. Fill as needed. Connect scan tool to DLC. Turn ignition switch to ON position. DO NOT start engine. Using scan tool, record failure records for reference. Data will be lost when DTCs are cleared later in this test.

2) If DTC P0711 is also set, see DIAGNOSTIC AIDS. If DTC P0711 is not set, inspect engine and transmission cooling system for restrictions, blockage or debris. Check transmission cooler lines for damage. Repair as necessary, then go to next step. If components are okay, perform line pressure test. See LINE PRESSURE TESTS in AUTO TRANS OVERHAUL - 4L60-E article. If line pressure is within specification, go to next step. If line pressure is not within specification, check torque converter stator for damage. See TORQUE CONVERTER in AUTO TRANS OVERHAUL - 4L60-E article.

3) After repair is complete, select DTC on scan tool. Select "Clear Info" function. Select "Specific DTC" and enter DTC "P0218". Turn ignition switch to ON position. Scan tool must indicate fluid temperature less than 264°F (129°C) for at least 5 seconds. If DTC P0218 is not present, repair is complete. If DTC P0218 is still present, repeat test.

Diagnostic Aids

DTC P0218 may set about 10 minutes after DTC P0711 has set. If DTC P0711 is also set, perform diagnostic procedure for that DTC before diagnosing DTC P0218. Repairing condition that caused DTC P0711 will probably eliminate DTC P0218. Verify driver habits such as towing trailer in "D4". Towing should be performed in "D3".

DTC P0502: VEHICLE SPEED SENSOR CIRCUIT (LOW INPUT)

NOTE: Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK prior to performing diagnostic procedures. For wire circuit ID, see WIRING DIAGRAMS.

Circuit Description

Vehicle speed is signaled to VCM by Vehicle Speed Sensor (VSS). Sensor is a Permanent Magnet (PM) generator mounted to transmission case extension. PM generator produces an AC voltage as speed sensor rotor teeth pass sensor’s magnetic field. VCM converts AC voltage into digital signal. Output voltage varies from a minimum of .5 volt at 100 RPM to more than 100 volts at 8000 RPM. VCM uses vehicle speed to determine shift timing and TCC apply and release. VSS resistance value is 1470-2820 ohms. DTC P0502 is set if PCM detects a low vehicle output speed when vehicle has high engine speed in drive gear.

Conditions For Setting DTC P0502

DTC will set under the following conditions:

* Transmission is not in Park or Neutral.
* DTCs P0107 and P0108 (MAP sensor), or P0122 and P0123 (throttle position sensor) are not present.

* DTC P1810 (trans. fluid pressure position switch) is not present.
* Engine speed more than 3000 RPM.
* Throttle angle is more than 20 percent.
* Output speed is less than 150 RPM.
* All conditions are met for 3 seconds.

Action Taken By VCM

VCM performs the following if DTC is set:

* Will light MIL at first failure signal.
* ommands 2nd gear only.
* Inhibits TCC engagement.
* Freezes shift adapts from being updated.
* Commands maximum line pressure.
* DTC P0502 will be stored in VCM history.

Diagnostic Procedure

1) Connect scan tool to DLC. Turn ignition switch to ON position. DO NOT start engine. Using scan tool, record freeze frame and failure records for reference. Data will be lost when DTCs are cleared later in this test. Raise and support vehicle.

2) Start engine and let idle. Apply brake pedal. Shift gear selector to any forward gear position. Select "Output Speed" on scan tool. With drive wheels rotating, if transmission output speed does not increase when wheel speed increases, go to next step. If transmission output speed increases when wheel speed increases, see DIAGNOSTIC AIDS.

3) Turn ignition off. Disconnect appropriate VCM connector connected to VSS. See WIRING DIAGRAMS. Using an ohmmeter, measure resistance between VSS terminals at appropriate VCM connector. If resistance is 1470-2820 ohms, go to next step. If resistance is not 1470-2820 ohms, check for poor connection or open circuit in VSS wiring. Repair as necessary, then go to step 7). If wiring is okay, go to step 6).

4) Shift transmission into Neutral. Connect DVOM between VSS terminals at appropriate VCM connector. See WIRING DIAGRAMS. Rotate drive wheels and observe voltmeter display. If voltage is less than .5 volt, go to step 6). If voltage is more than .5 volt, reconnect appropriate VCM connector. Disconnect VSS connector. Turn ignition switch to ON position. Using DVOM, measure voltage between VSS connector terminals.

5) If voltage is 4.0-5.1 volts, check VCM connector for damaged or backed out connector terminals, weak terminal tension and poor connections. Repair as necessary, then go to step 7). If terminals and connections are okay, replace VCM, then go to step 7). If voltage is less than 4.0 volts, check VCM connector for damaged or backed out connector terminals, weak terminal tension and poor connections. Repair as necessary, then go to step 7). If terminals and connections are okay, replace VCM, then go to step 7). If voltage is more than 5.1 volts, repair short to voltage in output speed signal circuit, then go to step 7).

6) Remove VSS assembly. Check output shaft speed sensor rotor for damage or misalignment. Repair as necessary, then go to next step. If sensor rotor is okay, replace VSS assembly, then go to next step.

7) After repair is complete, select DTC on scan tool. Select "Clear Info" function. Select "Specific DTC" and enter DTC "P0502". Test drive vehicle. Ensure transmission output speed is more than 151 RPM for 3 seconds. If DTC P0502 is not present, repair is complete. If DTC P0502 is still present, repeat test.

Diagnostic Aids

DTC P0502 sets when no vehicle speed is detected at start-off. Check for Electromagnetic Interferences (EMI) induced on VSS circuits. Check VCM connector and transmission 20-pin connector for bent, backed out or broken terminals or misaligned connectors. Inspect for damaged VSS or for damaged output speed sensor rotor teeth. Ensure VSS is aligned correctly and secured to transmission case properly. An incorrect calibration may set DTC P0502. If diagnosing for intermittent short or open condition, move wiring harness while observing scan tool for value changes.

DTC P0503: VEHICLE SPEED SENSOR CIRCUIT (INTERMITTENT)

NOTE: Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK prior to performing diagnostic procedures. For wire circuit ID, see WIRING DIAGRAMS.

Circuit Description

Vehicle speed is signaled to VCM by Vehicle Speed Sensor (VSS). Sensor is a Permanent Magnet (PM) generator mounted to transmission case extension. PM generator produces an AC voltage as speed sensor rotor teeth pass sensor's magnetic field. VCM converts AC voltage into digital signal. Output voltage varies from a minimum of .5 volt at 100 RPM to more than 100 volts at 8000 RPM. VCM uses vehicle speed to determine shift timing and TCC apply and release. VSS resistance value is 1470-2820 ohms. DTC P0503 is set if PCM detects an unrealistically large drop in vehicle speed.

Conditions For Setting DTC P0503

DTC will set under the following conditions:

* Engine is not in fuel cutoff mode.
* Time since last gear range change is more than 6 seconds.
* DTC P1810 (trans. fluid pressure position switch) is not present.
* Engine speed more than 450 RPM for 5 seconds.
* Transmission output speed rise does not exceed 600 RPM within 6 seconds.
* Transmission output speed drops by more than 1300 RPM for 3 seconds when not in Park or Neutral.

Action Taken By VCM

VCM performs the following if DTC is set:

* Will light MIL at first failure signal.
* Commands 2nd gear only.
* Inhibits TCC engagement.
* Freezes shift adapts from being updated.
* Commands maximum line pressure.
* DTC P0503 will be stored in VCM history.

Diagnostic Procedure

1) Connect scan tool to DLC. Turn ignition switch to ON position. DO NOT start engine. Using scan tool, record freeze frame and failure records for reference. Data will be lost when DTCs are cleared later in this test. Raise and support vehicle.

2) Start engine and let idle. Apply brake pedal. Shift gear selector into "3" (3rd gear) position. Select "Output Speed" on scan tool. With drive wheels rotating, slowly accelerate engine to 2000 RPM and hold steady. If transmission output speed drops or fluctuates more than 1300 RPM, go to next step. If transmission output speed does not drop or fluctuate more than 1300 RPM, see DIAGNOSTIC AIDS.

3) Turn ignition off. Disconnect appropriate VCM connector connected to VSS. See WIRING DIAGRAMS. Using an ohmmeter, measure resistance between VSS terminals at appropriate VCM connector. If

resistance is 1470-2820 ohms, go to next step. If resistance is not 1470-2820 ohms, check for poor connection or open circuit in VSS wiring. Repair as necessary, then go to step 7). If wiring is okay, go to step 6).

4) Shift transmission into Neutral. Connect DVOM between VSS terminals at appropriate VCM connector. See WIRING DIAGRAMS. Hold one rear wheel from turning and rotate other wheel. Observe voltmeter display. If voltage is less than .5 volt, go to step 6). If voltage is more than .5 volt, reconnect appropriate VCM connector. Disconnect VSS connector. Turn ignition switch to ON position. Using DVOM, measure voltage between VSS connector terminals.

5) If voltage is 4.0-5.1 volts, check VCM connector for damaged or backed out connector terminals, weak terminal tension and poor connections. Repair as necessary, then go to step 7). If terminals and connections are okay, replace VCM, then go to step 7). If voltage is less than 4.0 volts, check VCM connector for damaged or backed out connector terminals, weak terminal tension and poor connections. Repair as necessary, then go to step 7). If terminals and connections are okay, replace VCM, then go to step 7). If voltage is more than 5.1 volts, repair short to voltage in output speed signal circuit, then go to step 7).

6) Remove VSS assembly. Check output shaft speed sensor rotor for damage or misalignment. Repair as necessary, then go to next step. If sensor rotor is okay, replace VSS assembly, then go to next step.

7) After repair is complete, select DTC on scan tool. Select "Clear Info" function. Select "Specific DTC" and enter DTC "P0503". Test drive vehicle. Ensure transmission output speed is less than 500 RPM for 2.5 seconds and output speed is more than 600 RPM for 2.5 seconds. If DTC P0503 is not present, repair is complete. If DTC P0503 is still present, repeat test.

Diagnostic Aids

Check VCM connector and transmission 20-pin connector for bent, backed out or broken terminals or misaligned connectors. Inspect for damaged VSS or for damaged output speed sensor rotor teeth. Check for moisture or corrosion. If diagnosing for intermittent short or open condition, move wiring harness while observing scan tool for value changes.

DTC P0711: TRANS. FLUID TEMPERATURE (TFT) SENSOR CIRCUIT (RANGE/PERFORMANCE)

NOTE: Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK prior to performing diagnostic procedures. For wire circuit ID, see WIRING DIAGRAMS.

Circuit Description

Transmission Fluid Temperature (TFT) sensor is a negative coefficient thermistor within TFP valve position switch. TFT sensor controls signal voltage from PCM. PCM supplies a 5-volt reference signal to sensor. When transmission fluid temperature is cold, sensor resistance is high, and PCM detects high signal voltage. As transmission fluid temperature increases, sensor resistance decreases and detected voltage decreases. At transmission normal operating temperature of 212°F (100°C), voltage is about 1.5-2 volts. TFT sensor resistance is 3088-3942. DTC P0711 is set if PCM detects a large change in transmission fluid temperature or if PCM detects a TFT value which remains constant for a period of time in which a measurable amount of change is expected for 2 consecutive ignition cycles.

Conditions For Setting DTC P0711

DTC will set under the following conditions:

* DTCs P0502 or P0503 (vehicle speed sensor) are not present.
* System voltage is 10-16 volts.
* Transmission fluid temperature sensor voltage is .2-4.92 volts.
* Transmission fluid temperature at start-up is -40 to 70 °F (-40 to 21°C).
* DTC P1870 (transmission component slipping) is not present.
* Engine is running for more than 7 minutes.
* Vehicle speed is equal to or more than 5 MPH for 7 minutes or more within a single ignition cycle.
* Transmission fluid temp is equal to or more than 158°F (70°C) and has changed by at least 90°F (50°C) since start-up.
* TCC slip speed is equal to or more than 120 RPM for 7 minutes or more within a single ignition cycle.
* All of the above conditions are met and either of the following failure criteria occur in 2 consecutive ignition cycles:

Failure Criteria (Case No. 1)

Transmission fluid temperature has changed by less than 2.7°F (1.5°C) since start-up and condition is met for 7 minutes or more.

Failure Criteria (Case No. 2)

Transmission fluid temperature has changed by more than 36°F (20°C) within .2 seconds, and condition is met 14 times or more within 7 seconds.

Action Taken By PCM

PCM performs the following if DTC is set:

* Will light MIL at first failure signal.
* Freezes shift adapts from being updated.
* DTC P0711 is stored in PCM history.
* Determines a default transmission fluid temperature using the following information:

Default Temperatures

If any ECT DTC (P0117, P0118, P1114 or P1115) is set, PCM substitutes a transmission fluid temperature default value of 275°F (135°C). If ECT is more than 257°F (125 °C), PCM substitutes a transmission fluid temperature value of 275°F (135°C).

If engine run time is less than 5 minutes, and no IAT DTCs (P0112 or P0113) are set and IAT is available, PCM substitutes a transmission fluid temperature value equal to IAT.

If any IAT DTCs (P0112 or P0113) are set, or IAT is not available, PCM substitutes a transmission fluid temperature default value of 194°F (90°C).

If engine run time is more than 5 minutes, no IAT DTCs (P0112 or P0113) are set, IAT is available, ECT is 104-257°F (40-125°C), and IAT at start-up is less than 59°F (15°C), PCM substitutes a transmission fluid temperature default value equal to ECT plus 8°F (5°C). If IAT at start-up is more than 95°F (35°C), PCM substitutes a transmission fluid temperature default value equal to ECT plus 16°F (10°C). If IAT at start-up is 59-95°F (15-35°C), PCM substitutes a transmission fluid temperature default value equal to ECT.

If engine run time is more than 5 minutes, and any IAT DTCs (P0112 or P0113) is set, or IAT is not available, PCM substitutes a transmission fluid temperature default value equal to ECT.

If engine run time is more than 5 minutes, and ECT is less than 104°F (40°C), PCM substitutes a transmission fluid temperature default value equal to 140°F (60°C).

Diagnostic Procedure

1) Ensure transmission fluid level is correct. Connect scan tool to DLC. Turn ignition switch to ON position. DO NOT start engine. Using scan tool, record freeze frame and failure records for reference. Data will be lost when DTCs are cleared later in this test.

2) Select "TFT" on scan tool. Drive vehicle and observe scan tool for either of the following fail conditions: TFT does not change more than 2.7°F (1.5°C) in 7 minutes since start-up, or TFT changes more than 36°F (20°C) in .200 seconds, 14 times within 7 seconds (out of range change). If either of these conditions occurred, go to next step. If neither of these conditions occurred, cause is intermittent. See DIAGNOSTIC AIDS.

3) If scan tool displays a condition in which TFT does not change by more than 2.7°F (1.5°C) in 7 minutes since start-up, go to step 5). If scan tool does not display a condition in which TFT does not change by more than 2.7°F (1.5°C) in 7 minutes since start-up, go to next step.

4) Turn ignition off. Disconnect transmission 20-pin connector. Install Jumper Harness (J-39775) on engine side of transmission 20-pin connector. Connect test light between terminals "L" and "M". See Fig. 4. Turn ignition switch to ON position. DO NOT start engine. While observing scan tool, wiggle engine wiring harness from appropriate PCM connector to transmission 20-pin connector. If TFT temperature changes by more than 36°F (20°C), go to step 6). If TFT temperature does not change by more than 36°F (20°C), go to step 7).

5) Turn ignition off. Disconnect transmission 20-pin connector. Turn ignition switch to ON position. DO NOT start engine. If scan tool displays a condition in which TFT does not change by more than 2.7°F (1.5°C) in 7 minutes since start-up, replace PCM, then go to step 8). If scan tool does not display a condition in which TFT does not change by more than 2.7°F (1.5°C) in 7 minutes since start-up, replace TFT sensor, then go to step 8).

6) Check for intermittent open or short condition in TFT sensor circuits between PCM connector and transmission 20-pin connector. Repair circuit(s) as necessary, then go to step 8). If circuits are okay, replace PCM, then go to step 8).

7) Check for intermittent open or short condition in TFT sensor circuits between transmission 20-pin connector and TFT sensor. Repair circuit(s) as necessary, then go to next step. If circuits are okay, replace TFT sensor, then go to next step.

8) After repair is complete, select DTC on scan tool. Select "Clear Info" function. Select "Specific DTC" and enter DTC "P0711". Road test vehicle. Monitor transmission fluid temperature. Ensure that rise in fluid temperature is more than 4°F (2.25°C) within 11 seconds since start-up, and fluid temperature does not change by more than 36°F (20°C) within .200 seconds for a period of at least 11 seconds. If DTC P0711 is not present, repair is complete. If DTC P0711 is still present, repeat test.

Diagnostic Aids

If DTC P0218 (transmission fluid overtemp.) is also set, inspect transmission cooling system for blockage and restrictions. DTC P0218 may set about 10 minutes after DTC P0711 has set. If DTC P0711 is also set, perform diagnostic procedure for that DTC before diagnosing DTC P0218. Repairing condition that caused DTC P0711 will probably eliminate DTC P0218. Verify driver habits such as towing trailer in "D4". Towing should be performed in "D3". Inspect wiring for poor connections at PCM and at transmission 20-pin connector. Check for bent, backed out or broken terminals, or misaligned connectors. Check for weak terminal tension. Check for chafed wire that could short to bare metal or other wiring. Check for broken wire inside insulation. Check for moisture and corrosion. If diagnosing for intermittent short or open condition, move wiring harness while observing scan tool for value change.

DTC P0712: TRANS. FLUID TEMPERATURE (TFT) SENSOR CIRCUIT (LOW INPUT)

NOTE: Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK prior to performing diagnostic procedures. For wire circuit ID, see WIRING DIAGRAMS.

Circuit Description

Transmission Fluid Temperature (TFT) sensor is a negative coefficient thermistor within Transmission Fluid Pressure (TFP) position switch. TFP is also referred to as Pressure Switch Assembly (PSA). TFT sensor controls signal voltage from PCM. PCM provides a 5-volt reference to sensor on TFT sensor signal circuit. When transmission fluid is cold, sensor resistance is high, and PCM detects high signal voltage. As transmission fluid temperature increases, sensor resistance decreases and voltage decreases. At normal operating temperature of 212°F (100°C), voltage is about 1.5-2 volts. Check sensor for shifted calibration by using sensor TEMPERATURE-TO-RESISTANCE VALUES table. DTC P0712 is set if PCM detects a continuous short to ground in TFT sensor signal circuit or TFT sensor.

Conditions For Setting DTC P0712

DTC will set under the following conditions:

* System voltage is 10-16 volts.
* Ignition switch is in ON position.
* TFT sensor indicates a voltage less than .2 volt.
* All conditions are met for 10 seconds.

Action Taken By PCM

PCM performs the following if DTC is set:

* Will light MIL after 2 consecutive trips with failure.
* Defaults transmission temperature to 275°F (135°C).
* Freezes shift adapts from being updated.
* Determines a default transmission fluid temperature using the following information:

Default Temperatures

If any ECT DTC (P0117, P0118, P1114 or P1115) is set, PCM substitutes a transmission fluid temperature default value of 275°F (135°C). If ECT is more than 257°F (125 °C), PCM substitutes a transmission fluid temperature value of 275°F (135°C).

If engine run time is less than 5 minutes, and no IAT DTCs (P0112 or P0113) are set and IAT is available, PCM substitutes a transmission fluid temperature value equal to IAT.

If any IAT DTCs (P0112 or P0113) are set, or IAT is not available, PCM substitutes a transmission fluid temperature default value of 194°F (90°C).

If engine run time is more than 5 minutes, no IAT DTCs (P0112 or P0113) are set, IAT is available, ECT is 104-257°F (40-125°C), and IAT at start-up is less than 59°F (15°C), PCM substitutes a transmission fluid temperature default value equal to ECT plus 8°F (5°C). If IAT at start-up is more than 95°F (35°C), PCM substitutes a transmission fluid temperature default value equal to ECT plus 16°F (10°C). If IAT at start-up is 59-95°F (15-35°C), PCM substitutes a transmission fluid temperature default value equal to ECT.

If engine run time is more than 5 minutes, and any IAT DTCs (P0112 or P0113) is set, or IAT is not available, PCM substitutes a transmission fluid temperature default value equal to ECT.

If engine run time is more than 5 minutes, and ECT is less than 104°F (40°C), PCM substitutes a transmission fluid temperature default value equal to 140°F (60°C).

Diagnostic Procedure

1) Ensure transmission fluid level is correct. Connect scan tool to DLC. Turn ignition switch to ON position. DO NOT start engine. Using scan tool, record freeze frame and failure records for reference. Data will be lost when DTCs are cleared later in this test.

2) Read TFT sensor signal voltage on scan tool. If TFT sensor signal voltage is less than .2 volt, go to next step. If TFT sensor signal voltage is more than .2 volt, see DIAGNOSTIC AIDS.

3) Turn ignition off. Disconnect transmission 20-pin connector. Turn ignition switch to ON position. DO NOT start engine. If TFT sensor signal voltage is 4.92 volts, go to next step. If TFT sensor signal voltage is not 4.92 volts, check for short to ground in TFT sensor signal circuit. Repair circuit as necessary, then go to step 7). If circuit is okay, go to step 6).

4) Install Jumper Harness (J-39775) on transmission side of 20-pin connector. Using a DVOM, measure resistance of TFT sensor between TFP position switch terminals of jumper harness. If resistance is 3088-3942 ohms, see DIAGNOSTIC AIDS.

5) If resistance is not 3088-3942 ohms, remove transmission oil pan. Check for short to ground in transmission wiring harness. Repair as necessary. If wiring harness is okay, disconnect TFT sensor connector. Measure resistance between TFT sensor terminals. If resistance is 3088-3942 ohms, see DIAGNOSTIC AIDS. If resistance is not 3088-3942 ohms, replace TFP position switch, then go to step 7).

6) Check PCM connector for damaged or backed out connector terminals, weak terminal tension and poor connections. Repair as necessary, then go to next step. If terminals and connections are okay, replace PCM, then go to next step.

7) After repair is complete, select DTC on scan tool. Select "Clear Info" function. Select "Specific DTC" and enter DTC "P0712". Ensure TFT sensor indicates a voltage more than .2 volt for 10 seconds. If DTC P0712 is not present, repair is complete. If DTC P0712 is still present, repeat test.

Diagnostic Aids

Inspect wiring for poor connections at PCM and at transmission 20-pin connector. Check for bent, backed out, deformed or damaged terminals. Check for weak terminal tension. Check for chafed wire that could short to bare metal or other wiring. Check for broken wire inside insulation. If diagnosing for intermittent short or open condition, move wiring harness while observing scan tool for value change. If DTC P0218 is also set, check transmission cooling system for possible blockage and/or restrictions.

TEMPERATURE-TO-RESISTANCE VALUES TABLE (1)

Temperature °F (°C)	Ohms
212 (100)	177
158 (70)	467
95 (35)	1802
50 (10)	6238
-40 (-40)	110778

(1) - Measure resistance across sensor terminals.

DTC P0713: TRANS. FLUID TEMPERATURE (TFT) SENSOR CIRCUIT (HIGH INPUT)

NOTE: Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK prior to performing diagnostic procedures. For wire circuit ID, see WIRING DIAGRAMS.

Circuit Description

Transmission Fluid Temperature (TFT) sensor is a negative coefficient thermistor within Transmission Fluid Pressure (TFP) position switch. TFT sensor controls signal voltage from PCM. PCM provides a 5-volt reference to sensor on TFT sensor signal circuit. When transmission fluid is cold, sensor resistance is high, and PCM detects high signal voltage. As transmission fluid temperature increases, sensor resistance decreases and voltage decreases. At normal operating temperature of 212°F (100°C), voltage is about 1.5-2 volts. Check sensor for shifted calibration by using sensor TEMPERATURE-TO-RESISTANCE VALUES table. DTC P0713 is set if PCM detects a continuous open or short to voltage in TFT sensor signal circuit or TFT sensor.

Conditions For Setting DTC P0713

DTC will set under the following conditions:

* System voltage is 10-16 volts.
* Ignition switch is in ON position.
* TFT sensor indicates a voltage less than 4.94 volts.
* All conditions are met for 7 minutes.

Action Taken By PCM

PCM performs the following if DTC is set:

* Will light MIL after 2 consecutive trips with failure.
* Defaults transmission temperature to 275°F (135°C).
* Freezes shift adapts from being updated.
* Determines a default transmission fluid temperature using the following information:

Default Temperatures

If any ECT DTC (P0117, P0118, P1114 or P1115) is set, PCM substitutes a transmission fluid temperature default value of 275°F (135°C). If ECT is more than 257°F (125 °C), PCM substitutes a transmission fluid temperature value of 275°F (135°C).

If engine run time is less than 5 minutes, and no IAT DTCs (P0112 or P0113) are set and IAT is available, PCM substitutes a transmission fluid temperature value equal to IAT.

If any IAT DTCs (P0112 or P0113) are set, or IAT is not available, PCM substitutes a transmission fluid temperature default value of 194°F (90°C).

If engine run time is more than 5 minutes, no IAT DTCs (P0112 or P0113) are set, IAT is available, ECT is 104-257°F (40-125°C), and IAT at start-up is less than 59°F (15°C), PCM substitutes a transmission fluid temperature default value equal to ECT plus 8°F (5°C). If IAT at start-up is more than 95°F (35°C), PCM substitutes a transmission fluid temperature default value equal to ECT plus 16°F (10°C). If IAT at start-up is 59-95°F (15-35°C), PCM substitutes a transmission fluid temperature default value equal to ECT.

If engine run time is more than 5 minutes, and any IAT DTCs (P0112 or P0113) is set, or IAT is not available, PCM substitutes a transmission fluid temperature default value equal to ECT.

If engine run time is more than 5 minutes, and ECT is less than 104°F (40°C), PCM substitutes a transmission fluid temperature default value equal to 140°F (60°C).

Diagnostic Procedure

1) Ensure transmission fluid level is correct. Connect scan tool to DLC. Turn ignition switch to ON position. DO NOT start engine. Using scan tool, record freeze frame and failure records for reference. Data will be lost when DTCs are cleared later in this test.

2) Read TFT sensor signal voltage on scan tool. If TFT sensor signal voltage is more than 4.92 volts, go to next step. If TFT sensor signal voltage is less than 4.92 volts, see DIAGNOSTIC AIDS.

3) Turn ignition off. Disconnect transmission 20-pin connector. Install Jumper Harness (J-39775) on engine side of transmission 20-pin connector. Install fused jumper wire between appropriate PCM connector TFT sensor ground terminal, and appropriate PCM connector TFT sensor signal terminal of jumper harness. See WIRING DIAGRAMS. Turn ignition switch to ON position. DO NOT start engine. If TFT sensor signal voltage is less than .2 volt, go to next step. If TFT sensor signal voltage is more than .2 volt, check for open or short to voltage in TFT sensor signal circuit, or for open in TFT ground circuit. Repair circuits as necessary, then go to step 7). If circuits are is okay, go to step 6).

4) Turn ignition off. Remove jumper wire. Disconnect jumper harness from engine side of 20-pin connector. Install jumper harness on transmission side of 20-pin connector. Using a DVOM, measure resistance of TFT sensor harness between TFP position switch terminals of jumper harness. If resistance is 3088-3942 ohms, see DIAGNOSTIC AIDS.

5) If resistance is not 3088-3942 ohms, remove transmission oil pan. Check for open in transmission wiring harness. Repair as necessary, then go to step 7). If wiring harness is okay, disconnect TFT sensor connector. Measure resistance between TFT sensor terminals. If resistance is 3088-3942 ohms, see DIAGNOSTIC AIDS. If resistance is not 3088-3942 ohms, replace TFP position switch, then go to step 7).

6) Check PCM connector for damaged or backed out connector terminals, weak terminal tension and poor connections. Repair as necessary, then go to next step. If terminals and connections are okay, replace PCM, then go to next step.

7) After repair is complete, select DTC on scan tool. Select "Clear Info" function. Select "Specific DTC" and enter DTC "P0713". Ensure TFT sensor indicates a voltage less than 4.92 volts for 2 seconds. If DTC P0713 is not present, repair is complete. If DTC P0713 is still present, repeat test.

Diagnostic Aids

Inspect wiring for poor connections at PCM and at transmission 20-pin connector. Check for bent, backed out, deformed or damaged terminals. Check for weak terminal tension. Check for chafed wire that could short to bare metal or other wiring. Check for broken wire inside insulation. If diagnosing for intermittent short or open condition, move wiring harness while observing scan tool for value change. Check engine and transmission harness for open condition.

DTC P0719: BRAKE SWITCH CIRCUIT LOW INPUT (SWITCH STUCK ON)

NOTE: Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK prior to performing diagnostic procedures. For wire circuit ID, see WIRING DIAGRAMS.

Circuit Description

Torque Converter Clutch (TCC) brake switch is used to indicate brake pedal status to PCM. PCM de-energizes TCC solenoid when brake pedal is applied. DTC P0719 is set if PCM detects an open (stuck on) brake switch during acceleration.

Conditions For Setting DTC P0719

DTC will set under the following conditions:

* DTCs P0502 or P0503 (vehicle speed sensor) are not present.
* Vehicle speed is less than 5 MPH.
* Then vehicle speed is 5-20 MPH for 4 seconds, then vehicle speed is more than 20 MPH for 6 seconds.
* All conditions must occur 7 times with brake switch on for more than 15 minutes without PCM detecting voltage input of 2 seconds or more.

Action Taken By PCM
PCM performs the following if DTC is set:

* Will light MIL after first failure signal.
* Ensures TCC brake switch remains closed with brake pedal released.
* Inhibits TCC engagement.
* Inhibits 4th gear if in hot mode.
* Freezes shift adapts from being updated.
* DTC P0719 is stored in PCM history.

Diagnostic Procedure
1) Connect scan tool to DLC. Turn ignition switch to ON position. DO NOT start engine. Using scan tool, record freeze frame and failure records for reference. Data will be lost when DTCs are cleared later in this test.
2) Apply and release brake pedal while observing scan tool. If scan tool displays brake pedal in correct positions, see DIAGNOSTIC AIDS. If scan tool does not display brake pedal in correct positions, go to next step.
3) Connect test light between ground and ignition feed circuit terminal at brake switch. If test light is off, repair open in ignition feed circuit, then go to step 9). If test light is on, connect test light between ground and brake switch signal terminal at brake switch. If test light is off, go to step 5). If test light is on, go to next step.
4) Apply brake pedal. If test light is off, go to step 6). If test light is on, check brake switch signal circuit for short to voltage. Repair circuit as necessary, then go to step 9). If circuit is okay, go to next step.
5) Ensure brake switch assembly is adjusted properly. Adjust brake switch as necessary, then go to step 9). If adjustment is okay, replace brake switch, then go to step 9).
6) Release brake pedal. Turn ignition off. Disconnect appropriate PCM connector connected to brake switch signal circuit. See WIRING DIAGRAMS. Turn ignition switch to ON position. DO NOT start engine. Connect test light between ground and brake switch signal terminal of appropriate PCM connector. If test light is on, go to next step. If test light is off, check for open in brake switch signal circuit between brake switch and PCM. Repair as necessary, then go to step 9).
7) Turn ignition off. Reconnect appropriate PCM connector. Turn ignition switch to ON position. DO NOT start engine. Apply and release brake pedal. If scan tool displays brake pedal in correct positions, see DIAGNOSTIC AIDS. If scan tool does not display brake pedal in correct positions, go to next step.
8) Check PCM connector for damaged or backed out connector terminals, weak terminal tension and poor connections. Repair as necessary, then go to next step. If terminals and connections are okay, replace PCM, then go to next step.
9) After repair is complete, select DTC on scan tool. Select "Clear Info" function. Select "Specific DTC" and enter DTC "P0719". Ensure TCC brake switch signal indicates zero volts for 2 seconds with brake pedal applied. If DTC P0719 is not present, repair is complete.

If DTC P0719 is still present, repeat test.

Diagnostic Aids

Check TCC brake switch for proper adjustment. Check PCM calibration for current update. Inspect wiring for poor connections at PCM. Check for bent, backed out, deformed or damaged terminals. Check for weak terminal tension. Check for chafed wire that could short to bare metal or other wiring. Check for broken wire inside insulation. If diagnosing for intermittent short or open condition, move wiring harness while observing scan tool for value change.

DTC P0724: BRAKE SWITCH CIRCUIT HIGH INPUT (SWITCH STUCK OFF)

NOTE: Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK prior to performing diagnostic procedures. For wire circuit ID, see WIRING DIAGRAMS.

Circuit Description

Torque Converter Clutch (TCC) brake switch is used to indicate brake pedal status to PCM. PCM de-energizes TCC solenoid when brake pedal is applied. DTC P0724 is set if PCM detects a closed (stuck off) brake switch during deceleration.

Conditions For Setting DTC P0724

DTC will set under the following conditions:

* DTCs P0502 or P0503 (vehicle speed sensor) are not present.
* PCM detects a closed TCC brake switch for 2 seconds and the following events occur 7 consecutive times:
* Vehicle speed is more than 20 MPH for 6 seconds.
* Then vehicle speed is 5-20 MPH for 4 seconds, then vehicle speed is less than 5 MPH.

Action Taken By PCM

PCM performs the following if DTC is set:

* Will not light MIL when fault is set.
* Freezes shift adapts from being updated.
* DTC P0724 will be stored in PCM history.

Diagnostic Procedure

1) Connect scan tool to DLC. Turn ignition switch to ON position. DO NOT start engine. Using scan tool, record freeze frame and failure records for reference. Data will be lost when DTCs are cleared later in this test.

2) Apply and release brake pedal while observing scan tool. If scan tool displays brake pedal in correct positions, see DIAGNOSTIC AIDS. If scan tool does not display brake pedal in correct positions, go to next step.

3) Connect test light between ground and ignition feed circuit terminal at brake switch. If test light is off, repair open in ignition feed circuit, then go to step 8). If test light is on, connect test light between ground and brake switch signal terminal at brake switch. If test light is off, go to step 5). If test light is on, go to next step.

4) Apply brake pedal. If test light is off, go to step 6). If test light is on, check brake switch signal circuit for short to voltage. Repair circuit as necessary, then go to step 8). If circuit is okay, go to next step.

5) Ensure brake switch assembly is adjusted properly. Adjust brake switch as necessary, then go to step 8). If adjustment is okay, replace brake switch, then go to step 8).

6) Apply and release brake pedal. If scan tool displays brake

pedal in correct positions, see DIAGNOSTIC AIDS. If scan tool does not display brake pedal in correct positions, go to next step.

7) Check PCM connector for damaged or backed out connector terminals, weak terminal tension and poor connections. Repair as necessary, then go to next step. If terminals and connections are okay, replace PCM, then go to next step.

8) After repair is complete, select DTC on scan tool. Select "Clear Info" function. Select "Specific DTC" and enter DTC "P0724". Ensure TCC brake switch signal indicates 12 volts for 2 seconds with brake pedal released. If DTC P0724 is not present, repair is complete. If DTC P0724 is still present, repeat test.

Diagnostic Aids

Check TCC brake switch for proper adjustment. Check PCM calibration for current update. Inspect wiring for poor connections at PCM. Check for bent, backed out, deformed or damaged terminals. Check for weak terminal tension. Check for moisture and corrosion. Check for chafed wire that could short to bare metal or other wiring. Check for broken wire inside insulation. If diagnosing for intermittent short or open condition, move wiring harness while observing scan tool for value change.

DTC P0740: TCC SOLENOID ELECTRICAL MALFUNCTION

NOTE: Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK prior to performing diagnostic procedures. For wire circuit ID, see WIRING DIAGRAMS.

Circuit Description

In conjunction with TCC PWM solenoid, TCC solenoid is used to control fluid flow acting on TCC valve. TCC valve controls apply and release of TCC. Solenoid is a normally-open on/off device. Solenoid is attached to transmission case and extends into oil pump cover. PCM monitors TP voltage, vehicle speed and other input devices in order to determine when to energize TCC solenoid. Ignition voltage is supplied directly to solenoid through fused circuit. PCM commands solenoid on or off through ground circuit. DTC P0740 is set if PCM detects a continuous open or short to ground in TCC solenoid circuit.

Conditions For Setting DTC P0740

DTC will set under the following conditions:

* Ignition is on.
* System voltage is 10-17 volts.
* Engine is not in fuel cutoff mode.
* Engine speed is more than 450 RPM for 8 seconds.
* PCM commands solenoid on and voltage remains high (battery voltage).
* PCM commands solenoid off and voltage remains low (zero volts).
* All conditions are met for 5 seconds.

Action Taken By PCM

PCM performs the following if DTC is set:

* Will light MIL at first failure signal.
* Inhibits TCC engagement.
* Inhibits 4th gear if in hot mode.
* Freezes shift adapts from being updated.
* DTC P0740 will be stored in PCM history.

Diagnostic Procedure

1) Connect scan tool to DLC. Turn ignition switch to ON

position. DO NOT start engine. Using scan tool, record freeze frame and failure records for reference. Data will be lost when DTCs are cleared later in this test.

2) If DTCs P0740, P0753, P0758, P0785 and P1860 are not present, go to next step. If DTCs P0740, P0753, P0758, P0785 and P1860 are present, remove appropriate TCC solenoid ignition feed circuit fuse from instrument panel fuse block and inspect fuse. See WIRING DIAGRAMS. Replace fuse if necessary, and check for short to ground in wiring harness between transmission 20-pin connector and fuse. Repair wiring as necessary, then go to step 10). If fuse is okay, check for open in wiring harness between transmission 20-way connector and fuse. Repair wire as necessary, then go to step 10).

3) Turn ignition off. Disconnect transmission 20-pin connector. Install Jumper Harness (J-39775) to PCM side of transmission 20-pin connector. Connect test light between ground and TCC solenoid ignition feed circuit at transmission 20-pin connector. Turn ignition switch to ON position. DO NOT start engine.

4) If test light does not light, check for open or short to ground in ignition feed circuit of TCC solenoid. Repair as necessary, then go to step 10). If test light lights, connect test light between TCC solenoid ground circuit and ignition feed circuit at transmission 20-pin connector. Using scan tool, command TCC solenoid on and off 3 times.

5) If test light cycles on and off, go to next step. If test light does not cycle on and off 3 times, check TCC solenoid ground circuit for open or short to ground. Repair circuit as necessary, then go to step 10). If circuit is okay, inspect wiring for poor connections at PCM connector. Check for bent, backed out, deformed or damaged terminals. Repair as necessary, then go to step 10). If connections and terminals are okay, replace PCM, then go to step 10).

6) Turn ignition off. Disconnect jumper harness from PCM side of transmission 20-pin connector and install harness to transmission side of 20-pin connector. Connect ohmmeter between TCC solenoid ground circuit and ignition feed circuit at transmission 20-pin connector.

7) If resistance is 21-33 ohms, go to next step. If resistance is not 21-33 ohms, disconnect TCC solenoid connector. Measure resistance between TCC solenoid terminals. If resistance is 21-33 ohms, check for open circuit in transmission wiring harness. Repair as necessary, then go to step 10). If resistance is not 21-33 ohms, replace TCC solenoid, then go to step 10).

8) Turn ignition off. Connect ohmmeter between ground and TCC solenoid ground circuit, and between ground and TCC solenoid ignition feed circuit at transmission 20-pin connector. If resistance is more than 250 k/ohms, see DIAGNOSTIC AIDS. If resistance is less than 250 k/ohms, go to next step.

9) Disconnect TCC solenoid connector. Measure resistance between ground and each solenoid terminal. If resistance is more than 250k/ohms, check for short to ground in transmission wiring harness. Repair as necessary, then go to next step. If resistance is less than 250 k/ohms, replace TCC solenoid, then go to next step.

10) After repair is complete, select DTC on scan tool. Select "Clear Info" function. Test drive vehicle. Ensure voltage decreases to zero when TCC solenoid is commanded on, and voltage increases to battery voltage when commanded off. Conditions must be met for 5 seconds. Select "Specific DTC" and enter DTC "P0740". If DTC P0740 is not present, repair is complete. If DTC P0740 is still present, repeat test.

Diagnostic Aids

Inspect wiring for poor connections at PCM and transmission 20-pin connector. Check for bent, backed out, deformed or damaged terminals. Check for weak terminal tension. Check for chafed wire that could short to bare metal or other wiring. Check for broken wire inside insulation. If diagnosing for intermittent short or open condition, move wiring harness while observing scan tool for value change.

DTC P0742: TCC CIRCUIT INOPERATIVE (STUCK ON)

NOTE: Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK prior to performing diagnostic procedures. For wire circuit ID, see WIRING DIAGRAMS. For fluid circuit ID, see the OIL CIRCUIT DIAGRAMS in the AUTO TRANS DIAGNOSIS section.

Circuit Description

Torque Converter Clutch (TCC) solenoid stops converter signal oil exhaust. PCM commands solenoid on and off through ground circuit. When TCC solenoid is de-energized, solenoid will release fluid and release TCC. DTC P0742 is set if PCM detects a low torque converter slip when TCC is off.

Conditions For Setting DTC P0742

DTC will set under the following conditions:

* DTCs P0107 or P0108 (MAP sensor) are not present.
* DTCs P0122 or P0123 (throttle position sensor) are not present.
* DTCs P0502 or P0503 (vehicle speed sensor) are not present.
* DTC P0740 (TCC solenoid) is not present.
* DTC P1810 (TFP position switch) is not present.
* DTC P1860 (TCC PWM solenoid) is not present.
* Throttle position is more than 13 percent.
* Engine speed is more than 450 RPM and less than 5500 RPM for more than 2 seconds.
* Commanded gear is not 1st.
* TCC is commanded off.
* Gear range is D4, D3 or D2.
* TCC slip speed is -20 to 20 RPM for more than 5.6 seconds.

Action Taken By PCM

PCM performs the following if DTC is set:

* Will light MIL at first failure signal.
* Freezes shift adapts from being updated.
* DTC P0742 will be stored in PCM history.

Diagnostic Procedure

1) Connect scan tool to DLC. Turn ignition switch to ON position. DO NOT start engine. Using scan tool, record freeze frame and failure records for reference. Data will be lost when DTCs are cleared later in this test.

2) Using scan tool, verify TP sensor value is within .6-5.0 volts. If TP sensor voltage is as specified, go to next step. If TP sensor voltage is not as specified, see DIAGNOSTIC AIDS.

3) Drive vehicle in "D4" range in 4th gear under steady acceleration with TP angle more than 25 percent. Select "TCC Solenoid" state on scan tool. If scan tool displays TCC slip speed of -20 to 20 RPM in off state, go to next step. If scan tool does not display TCC slip speed of -20 to 20 RPM in off state, see DIAGNOSTIC AIDS.

4) TCC is mechanically stuck on. Inspect TCC for a clogged exhaust orifice in TCC solenoid, converter clutch apply valve stuck in apply position, misaligned or damaged valve body gasket, or a restricted release passage. Repair component as necessary, then go to next step.

5) After repair is complete, select DTC on scan tool. Select "Clear Info" function. Hold throttle angle at 25 percent. Accelerate

vehicle to 55 MPH. If throttle moves more than 3 percent, stop vehicle and start again. Ensure TCC slip speed is between -50 to 2500 RPM for 10 seconds with TCC off. Select "Specific DTC" and enter DTC "P0742". If DTC P0742 is not present, repair is complete. If DTC P0742 is still present, repeat test.

Diagnostic Aids

TCC may mechanically stick on with parking brake applied and any gear range selected. TCC fluid will mechanically apply TCC, which may cause engine to stall. A stuck TP sensor will set DTC P0742.

DTC P0748: PRESSURE CONTROL SOLENOID (PCS) ELECTRICAL MALFUNCTION

NOTE: Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK prior to performing diagnostic procedures. For wire circuit ID, see WIRING DIAGRAMS.

Circuit Description

Pressure Control Solenoid (PCS) is used to regulate transmission line pressure. PCM compares TP voltage, engine RPM and other inputs to determine appropriate line pressure for given load. PCM will regulate pressure by applying varying amperage to PCS. Applied amperage can vary from 0.1-1.0 amps. PCM then monitors amperage. DTC P0748 is set if PCM detects a continuous open or short to ground in PCS circuit.

Conditions For Setting DTC P0748

DTC will set under the following conditions:

* System voltage is 10-17 volts.
* PCM recognizes PCS has reached electrical high or low limit.

Action Taken By PCM

PCM performs the following if DTC is set:

* Will not light MIL when fault is set.
* Freezes shift adapts from being updated.
* DTC P0748 will be stored in PCM history.

Diagnostic Procedure

1) Connect scan tool to DLC. Turn ignition switch to ON position. DO NOT start engine. Using scan tool, record failure records for reference. Data will be lost when DTCs are cleared later in this test.

2) Start engine. Using scan tool, apply 0.1-1.0 amp and observe scan tool display. If PCS actual amperage reading is not within 0.16 amps of desired reference amperage reading, go to next step. If PCS actual amperage reading is within 0.16 amps of desired reference amperage reading, see DIAGNOSTIC AIDS.

3) Turn ignition off. Disconnect transmission 20-pin connector. Install Jumper Harness (J-39775) to transmission side of 20-pin connector. Using an ohmmeter, measure resistance of PCS between PCS terminals of jumper harness. If resistance is 3-7 ohms, go to step 5).

4) If resistance is not 3-7 ohms, remove transmission oil pan. Disconnect PCS connector. Measure resistance between PCS terminals. If resistance is 3-7 ohms, check for open in PCS wiring harness. Repair wiring as necessary, then go to step 6). If resistance is not 3-7 ohms, replace PCS, then go to step 6).

5) Check PCS circuits for poor connection, open or short to ground. Repair circuits as necessary, then go to next step. If circuits are okay, check for damaged or backed out PCM connector

terminals. Repair as necessary, then go to next step. If connector terminals are okay, replace PCM, then go to next step.

6) After repair is complete, select DTC on scan tool. Select "Clear Info" function. Ensure duty cycle is not at low or high limit. Select "Specific DTC" and enter DTC "P0748". If DTC P0748 is not present, repair is complete. If DTC P0748 is still present, repeat test.

Diagnostic Aids

Inspect wiring for poor connections at PCM and at transmission 20-pin connector. Check for bent, backed out, deformed or damaged terminals. Check for weak terminal tension. Check for chafed wire that could short to bare metal or other wiring. Check for broken wire inside insulation. If diagnosing for intermittent short or open condition, move wiring harness while observing scan tool for value change.

DTC P0751: 1-2 SHIFT SOLENOID ("A") PERFORMANCE MALFUNCTION

NOTE: Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK prior to performing diagnostic procedures. For wire circuit ID, see WIRING DIAGRAMS.

Circuit Description

The 1-2 shift solenoid (solenoid "A") is a normally open exhaust valve that is used in conjunction with 2-3 shift solenoid (solenoid "B"), to allow 4 different shifting combinations. Solenoid is attached to control valve body. DTC P0751 is set if PCM detects a 1-1-4-4 or a 2-2-3-3 shift pattern, depending on mechanical failure.

Conditions For Setting DTC P0751

DTC will set under the following conditions:

* DTCs P0122 or P0123 (throttle position sensor) are not present.
* DTCs P0502 or P0503 (vehicle speed sensor) are not present.
* DTC P0742 (TCC stuck on) is not present.
* DTCs P0753 and P0758 (1-2 and 2-3 shift solenoid electrical) are not present.
* DTC P0785 (3-2 shift solenoid) is not present.
* DTC P1810 (Temperature Fluid Pressure position switch) is not present.
* Gear range is "D4".
* Vehicle speed is more than 5 MPH.
* Transmission fluid temperature is 68-266°F (20-130°C).
* Traction control is not active (if equipped).
* All conditions have been met and any combination of the following conditions occur 3 consecutive times:

Condition No. 1:

* Commanded 1-2 shift.
* Throttle angle is 17-42 percent.
* Throttle angle stays constant within 3 percent.
* Vehicle speed is 5-30 MPH.
* Within 2.5 seconds, engine speed in 2nd gear must be 150 RPM more than last speed in 1st gear.

Condition No. 2:

* Commanded 2-3 shift.
* Throttle angle is 17-32 percent.
* Throttle angle stays constant within 5 percent.

* Vehicle speed is 20-45 MPH.
* Within 1.7 seconds, engine speed in 3rd gear must be 75 RPM less than last speed in 2nd gear.

Condition No. 3:

* Commanded 3-4 shift.
* Throttle angle is 17-30 percent.
* Throttle angle stays constant within 3 percent.
* Vehicle speed is 28-65 MPH.
* Within 3 seconds, engine speed in 4th gear must be 20 RPM more than last speed in 3rd gear.

Condition No. 4:

* Commanded 4th gear.
* TCC is on.
* Throttle angle is 13-26 percent.
* Speed ratio (engine speed divided by output speed) is .85-1.2.
* TCC slip speed is 300-2000 RPM for more than 4 seconds.

Condition No. 5:

* Commanded 4th gear.
* TCC is on.
* Throttle angle is 13-26 percent.
* Speed ratio (engine speed divided by output speed) is .5-.79.
* TCC slip speed is between -20 and 20 RPM for more than 4 seconds.

Action Taken By PCM
PCM performs the following if DTC is set:

* Will light MIL at first failure signal.
* Freezes shift adapts from being updated.
* Defaults line pressure to "D2".
* DTC P0751 will be stored in PCM history.

Diagnostic Procedure

1) Connect scan tool to DLC. Turn ignition switch to ON position. DO NOT start engine. Using scan tool, record freeze frame and failure records for reference. Data will be lost when DTCs are cleared later in this test.

2) Start engine and let idle. Apply parking brake. While observing scan tool, shift transmission into each gear position. If gear position matches transmission range switch on scan tool, go to next step. If gear position does not match transmission range switch on scan tool, diagnose Transmission Fluid Pressure (TFP) position switch. Switch is also referred to as Pressure Switch Assembly (PSA). See COMPONENT TESTS.

3) Raise and support vehicle. Shift gear selector into "D4" position. Using scan tool, command 1st, 2nd, 3rd and 4th gears while accelerating vehicle. If a 1-1-4-4 or 2-2-3-3 shift pattern is not detected, see DIAGNOSTIC AIDS. If a 1-1-4-4 or 2-2-3-3 shift pattern is detected, check shift solenoids for damaged seals or internal malfunction. Repair shift solenoids as necessary, then go to next step.

4) After repair is complete, select DTC on scan tool. Select "Clear Info" function. Test drive vehicle. Hold throttle at 20 percent and accelerate vehicle to 55 MPH. If throttle moves more than 3 percent, stop vehicle and start again. Drive vehicle at 55 MPH for 2 miles. Select "Specific DTC" and enter DTC "P0751". If DTC P0751 is

not present, repair is complete. If DTC P0751 is still present, repeat test.

Diagnostic Aids

Verify shift speeds are correct. See AUTO TRANS OVERHAUL - 4L60-E article. More than one shift may occur due to other internal transmission failures.

DTC P0753: 1-2 SHIFT SOLENOID ("A") ELECTRICAL MALFUNCTION

NOTE: Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK prior to performing diagnostic procedures. For wire circuit ID, see WIRING DIAGRAMS.

Circuit Description

The 1-2 shift solenoid (solenoid "A") is used to control fluid flow acting on 1-2 and 3-4 shift valves. Solenoid is a normally open exhaust valve that is used in conjunction with 2-3 shift solenoid (solenoid "B"), to allow 4 different shifting combinations. See SHIFT SOLENOID COMBINATIONS table. Solenoid is attached to control valve body. Ignition voltage is supplied directly to solenoid through fused circuit. PCM commands solenoid on or off through ground circuit. DTC P0753 is set if PCM detects a continuous open or short to ground in 1-2 shift solenoid circuit.

Conditions For Setting DTC P0753

DTC will set under the following conditions:

* Ignition is on.
* System voltage is 10-17 volts.
* Engine is not in fuel cutoff mode.
* Engine speed is more than 450 RPM for 5 seconds.
* PCM commands solenoid on and voltage remains high (battery voltage).
* PCM commands solenoid off and voltage remains low (zero volts).
* All conditions are met for 5 seconds.

Action Taken By PCM

PCM performs the following if DTC is set:

* Will light MIL at first failure signal.
* Freezes shift adapts from being updated.
* Defaults to maximum line pressure.
* DTC P0753 will be stored in PCM history.

SHIFT SOLENOID COMBINATIONS TABLE

Gear	1-2 Shift Solenoid	2-3 Shift Solenoid
1st	On	On
2nd	Off	On
3rd	Off	Off
4th	On	Off

Diagnostic Procedure

1) Connect scan tool to DLC. Turn ignition switch to ON position. DO NOT start engine. Using scan tool, record freeze frame and failure records for reference. Data will be lost when DTCs are cleared later in this test.

2) If DTCs P0740, P0753, P0758, P0785 and P1860 are not

present, go to next step. If DTCs P0740, P0753, P0758, P0785 and P1860 are present, remove appropriate 1-2 shift solenoid ignition feed circuit fuse from underhood electrical center and inspect fuse. See WIRING DIAGRAMS. Replace fuse if necessary, and check for short to ground in wiring harness between transmission 20-pin connector and fuse. Repair wiring as necessary, then go to step 12). If fuse is okay, check for open in wiring harness between transmission 20-way connector and fuse. Repair wire as necessary, then go to step 12).

3) Using scan tool, command 1-2 shift solenoid on and off 3 times while listening at transmission oil pan. If solenoid does not click when commanded on and off, go to next step. If solenoid clicks when commanded on and off, inspect wiring for poor connections at PCM and transmission 20-pin connector. Check for bent, backed out, deformed or damaged terminals. Repair as necessary, then go to step 12). If connections and terminals are okay, see DIAGNOSTIC AIDS.

4) Turn ignition off. Disconnect transmission 20-pin connector. Install Jumper Harness (J-39775) to PCM side of transmission 20-pin connector. Connect test light between ground and 1-2 shift solenoid ignition feed circuit at transmission 20-pin connector. Turn ignition switch to ON position. DO NOT start engine.

5) If test light does not light, check for open or short to ground in ignition feed circuit of 1-2 shift solenoid. Repair as necessary, then go to step 12). If test light lights, connect test light between 1-2 shift solenoid ground circuit and ignition feed circuit at transmission 20-pin connector. Using scan tool, command 1-2 shift solenoid on and off 3 times. If test light cycles on and off, go to step 8). If test light does not cycle on and off 3 times, and test light is always on, go to next step. If test light is always off, go to step 7).

6) Check 1-2 shift solenoid ground circuit for short to ground. Repair circuit as necessary, then go to step 12). If circuit is okay, inspect wiring for poor connections at PCM connector. Check for bent, backed out, deformed or damaged terminals. Repair as necessary, then go to step 12). If connections and terminals are okay, replace PCM, then go to step 12).

7) Check for open in 1-2 shift solenoid ignition feed circuit or poor connection at PCM connector. Repair circuit as necessary, then go to step 12). If circuit is okay, inspect wiring for poor connections at PCM connector. Check for bent, backed out, deformed or damaged terminals. Repair as necessary, then go to step 12). If connections and terminals are okay, replace PCM, then go to step 12).

8) Turn ignition off. Disconnect jumper harness from PCM side of transmission 20-pin connector and install harness to transmission side of 20-pin connector. Connect ohmmeter between 1-2 shift solenoid ground circuit and ignition feed circuit at transmission 20-pin connector.

9) If resistance is 19-31 ohms, go to next step. If resistance is not 19-31 ohms, disconnect 1-2 shift solenoid connector. Measure resistance between 1-2 shift solenoid terminals. If resistance is 19-31 ohms, check for open circuit in transmission wiring harness. Repair as necessary, then go to step 12). If resistance is not 19-31 ohms, replace1-2 shift solenoid, then go to step 12).

10) Turn ignition off. Connect ohmmeter between ground and 1-2 shift solenoid ground circuit, and between ground and 1-2 shift solenoid ignition feed circuit at transmission 20-pin connector. If resistance is more than 250 k/ohms, see DIAGNOSTIC AIDS. If resistance is less than 250 k/ohms, go to next step.

11) Disconnect 1-2 shift solenoid connector. Measure resistance between ground and each solenoid terminal. If resistance is more than 250 k/ohms, check for short to ground in transmission wiring harness. Repair as necessary, then go to next step. If resistance is less than 250 k/ohms, replace 1-2 shift solenoid, then go to next step.

12) After repair is complete, select DTC on scan tool. Select "Clear Info" function. Test drive vehicle. Ensure voltage decreases to zero when 1-2 shift solenoid is commanded on, and voltage increases to battery voltage when commanded off. Conditions must be met for 5 seconds. Select "Specific DTC" and enter DTC "P0753". If DTC P0753 is not present, repair is complete. If DTC P0753 is still present, repeat test.

Diagnostic Aids

Inspect wiring for poor connections at PCM. Check for bent, backed out, deformed or damaged terminals. Check for weak terminal tension. Check for chafed wire that could short to bare metal or other wiring. Check for broken wire inside insulation. If diagnosing for intermittent short or open condition, move wiring harness while observing scan tool for value change.

DTC P0756: 2-3 SHIFT SOLENOID ("B") PERFORMANCE MALFUNCTION

NOTE: Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK prior to performing diagnostic procedures. For wire circuit ID, see WIRING DIAGRAMS.

Circuit Description

The 2-3 shift solenoid (solenoid "B") is a normally open exhaust valve that is used in conjunction with 1-2 shift solenoid (solenoid "A"), to allow 4 different shifting combinations. Solenoid is attached to control valve body. DTC P0756 is set if PCM detects a 1-2-2-1 or a 4-3-3-4 shift pattern, depending on mechanical failure.

Conditions For Setting DTC P0756

DTC will set under the following conditions:

* DTCs P0122 or P0123 (throttle position sensor) are not present.
* DTCs P0502 or P0503 (vehicle speed sensor) are not present.
* DTCs P0712 or P0713 (TFT sensor) are not present.
* DTC P0740 (TCC solenoid) is not present.
* DTC P0742 (TCC stuck on) is not present.
* DTCs P0753 and P0758 (1-2 and 2-3 shift solenoid electrical) are not present.
* DTC P0785 (3-2 shift solenoid) is not present.
* DTC P1810 (temperature fluid pressure position switch) is not present.
* DTC P1860 (TCC PWM solenoid) is not present.
* Gear range is "D4".
* TCC is off.
* Vehicle speed is more than 5 MPH.
* Engine is not in fuel cutoff mode.
* Transmission fluid temperature is 68-266°F (20-130°C).
* Engine speed is more than 450 RPM for 2 seconds and less than 5500 RPM.
* All conditions are met and either one of the following fail conditions occurs:
* Solenoid is stuck on and Conditions No. 2 and 3 occur 3 consecutive times.
* Solenoid is stuck off and Conditions No. 1 and 3 occur 3 consecutive times.

Condition No. 1:

* 1st gear is commanded for 2.5 seconds.
* Throttle angle is more than 25 percent.
* Speed ratio (engine speed divided by output speed) is

.5-2.59.

* TCC slip speed is between -93 and -2000 RPM for 1.6 seconds.
* Transmission output speed is 400-1500 RPM.

Condition No. 2:

* 3rd gear is commanded for one second.
* Throttle angle is 13-55 percent.
* Throttle angle stays constant within 3 percent.
* 3rd gear speed ratio is more than last 2nd gear speed ratio minus .2.
* 3rd gear TCC slip speed is more than or equal to last 2nd gear TCC slip speed plus 200 RPM for 1.3 seconds.
* Discontinue test if time since shift commanded is more than 5 seconds.

Condition No. 3:

* 4th gear is commanded for one second.
* Throttle angle is more than 18 percent.
* Speed ratio (engine speed divided by output speed) is 2.05-8.00.
* TCC slip speed is 1000-4000 RPM for 3 seconds.
* Transmission output speed is 0-8191 RPM.

Action Taken By PCM

PCM performs the following if DTC is set:

* Will light MIL at first failure signal.
* Commands 3rd gear.
* Freezes shift adapts from being updated.
* Commands maximum line pressure.
* DTC P0756 will be stored in PCM history.

Diagnostic Procedure

1) Connect scan tool to DLC. Turn ignition switch to ON position. DO NOT start engine. Using scan tool, record freeze frame and failure records for reference. Data will be lost when DTCs are cleared later in this test.

2) Start engine and let idle. Apply parking brake. While observing scan tool, shift transmission into each gear position. If gear position matches transmission range switch on scan tool, go to next step. If gear position does not match transmission range switch on scan tool, diagnose Transmission Fluid Pressure (TFP) position switch. Switch is also referred to as Pressure Switch Assembly (PSA). See COMPONENT TESTS.

3) Raise and support vehicle. Shift gear selector into "D4" position. Using scan tool, command 1st, 2nd, 3rd and 4th gears while accelerating vehicle. If 1st gear was commanded but not achieved or gear other than 4th gear occurred in 4th gear, check shift solenoids for damaged seals or internal malfunction. Repair shift solenoids as necessary, then go to next step. If all gears commanded were achieved, see DIAGNOSTIC AIDS.

4) After repair is complete, select DTC on scan tool. Select "Clear Info" function. Test drive vehicle. Hold throttle at 50 percent and accelerate vehicle to 55 MPH. If throttle moves more than 3 percent, stop vehicle and start again. Hold throttle at 20 percent and accelerate vehicle to 55 MPH. Select "Specific DTC" and enter DTC "P0756". If DTC P0756 is not present, repair is complete. If DTC P0756 is still present, repeat test.

Diagnostic Aids

Verify shift speeds are correct. See AUTO TRANS OVERHAUL -

4L60-E article. More than one shift may occur due to other internal transmission failures.

DTC P0758: 2-3 SHIFT SOLENOID ("B") ELECTRICAL MALFUNCTION

NOTE: Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK prior to performing diagnostic procedures. For wire circuit ID, see WIRING DIAGRAMS.

Circuit Description

The 2-3 shift solenoid (solenoid "B") is used to control fluid flow acting on 2-3 shift valve. Solenoid is a normally open exhaust valve that is used in conjunction with 1-2 shift solenoid (solenoid "A"), to allow 4 different shifting combinations. See SHIFT SOLENOID COMBINATIONS table. Solenoid is attached to control valve body. Ignition voltage is supplied directly to solenoid through fused circuit. PCM commands solenoid on or off through ground circuit. DTC P0758 is set if PCM detects a continuous open or short to ground in 2-3 shift solenoid circuit.

Conditions For Setting DTC P0758

DTC will set under the following conditions:

* Ignition is on.
* System voltage is 10-17 volts.
* PCM commands solenoid on and voltage remains high (battery voltage).
* PCM commands solenoid off and voltage remains low (zero volts).
* All conditions are met for 5 seconds.

Action Taken By PCM

PCM performs the following if DTC is set:

* Will light MIL at first failure signal.
* Inhibits TCC engagement.
* Freezes shift adapts from being updated.
* Commands maximum line pressure.
* Transmission operates in 3rd gear only.
* DTC P0758 will be stored in PCM history.

Diagnostic Procedure

1) Connect scan tool to DLC. Turn ignition switch to ON position. DO NOT start engine. Using scan tool, record freeze frame and failure records for reference. Data will be lost when DTCs are cleared later in this test.

2) If DTCs P0740, P0753, P0758, P0785 and P1860 are not present, go to next step. If DTCs P0740, P0753, P0758, P0785 and P1860 are present, remove appropriate 2-3 shift solenoid ignition feed circuit fuse from underhood electrical center and inspect fuse. See WIRING DIAGRAMS. Replace fuse if necessary, and check for short to ground in wiring harness between transmission 20-pin connector and fuse. Repair wiring as necessary, then go to step 12). If fuse is okay, check for open in wiring harness between transmission 20-way connector and fuse. Repair wire as necessary, then go to step 12).

3) Using scan tool, command 2-3 shift solenoid on and off 3 times while listening at transmission oil pan. If solenoid does not click when commanded on and off, go to next step. If solenoid clicks when commanded on and off, inspect wiring for poor connections at PCM and transmission 20-pin connector. Check for bent, backed out, deformed or damaged terminals. Repair as necessary, then go to step 12). If connections and terminals are okay, see DIAGNOSTIC AIDS.

4) Turn ignition off. Disconnect transmission 20-pin

connector. Install Jumper Harness (J-39775) to PCM side of transmission 20-pin connector. Connect test light between ground and 2-3 shift solenoid ignition feed circuit at transmission 20-pin connector. Turn ignition switch to ON position. DO NOT start engine.

5) If test light does not light, check for open or short to ground in ignition feed circuit of 2-3 shift solenoid. Repair as necessary, then go to step 12). If test light lights, connect test light between 2-3 shift solenoid ground circuit and ignition feed circuit at transmission 20-pin connector. Using scan tool, command 2-3 shift solenoid on and off 3 times. If test light cycles on and off, go to step 8). If test light does not cycle on and off 3 times, and test light is always on, go to next step. If test light is always off, go to step 7).

6) Check 2-3 shift solenoid ground circuit for short to ground. Repair circuit as necessary, then go to step 12). If circuit is okay, inspect wiring for poor connections at PCM connector. Check for bent, backed out, deformed or damaged terminals. Repair as necessary, then go to step 12). If connections and terminals are okay, replace PCM, then go to step 12).

7) Check for open in 2-3 shift solenoid ignition feed circuit or poor connection at PCM connector. Repair circuit as necessary, then go to step 12). If circuit is okay, inspect wiring for poor connections at PCM connector. Check for bent, backed out, deformed or damaged terminals. Repair as necessary, then go to step 12). If connections and terminals are okay, replace PCM, then go to step 12).

8) Turn ignition off. Disconnect jumper harness from PCM side of transmission 20-pin connector and install harness to transmission side of 20-pin connector. Connect ohmmeter between 2-3 shift solenoid ground circuit and ignition feed circuit at transmission 20-pin connector.

9) If resistance is 19-31 ohms, go to next step. If resistance is not 19-31 ohms, disconnect 2-3 shift solenoid connector. Measure resistance between 2-3 shift solenoid terminals. If resistance is 19-31 ohms, check for open circuit in transmission wiring harness. Repair as necessary, then go to step 12). If resistance is not 19-31 ohms, replace2-3 shift solenoid, then go to step 12).

10) Turn ignition off. Connect ohmmeter between ground and 2-3 shift solenoid ground circuit, and between ground and 2-3 shift solenoid ignition feed circuit at transmission 20-pin connector. If resistance is more than 250 k/ohms, see DIAGNOSTIC AIDS. If resistance is less than 250 k/ohms, go to next step.

11) Disconnect 2-3 shift solenoid connector. Measure resistance between ground and each solenoid terminal. If resistance is more than 250 k/ohms, check for short to ground in transmission wiring harness. Repair as necessary, then go to next step. If resistance is less than 250 k/ohms, replace 2-3 shift solenoid, then go to next step.

12) After repair is complete, select DTC on scan tool. Select "Clear Info" function. Test drive vehicle. Ensure voltage decreases to zero when 2-3 shift solenoid is commanded on, and voltage increases to battery voltage when commanded off. Conditions must be met for 5 seconds. Select "Specific DTC" and enter DTC "P0758". If DTC P0758 is not present, repair is complete. If DTC P0758 is still present, repeat test.

Diagnostic Aids

Inspect wiring for poor connections at PCM. Check for bent, backed out, deformed or damaged terminals. Check for weak terminal tension. Check for chafed wire that could short to bare metal or other wiring. Check for broken wire inside insulation. If diagnosing for intermittent short or open condition, move wiring harness while observing scan tool for value change.

DTC P0785: 3-2 SHIFT SOLENOID ELECTRICAL MALFUNCTION

NOTE: Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK prior to performing diagnostic procedures. For wire circuit ID, see WIRING DIAGRAMS.

Circuit Description

The 3-2 shift solenoid is a normally-closed 3-port on/off device which controls 3-2 downshift. Ignition voltage is supplied directly to solenoid through fused circuit. PCM commands solenoid on or off through ground circuit. During 3-2 downshift, 2-4 band applies as 3-4 clutch releases. PCM varies timing between 3-4 clutch release and 2-4 band apply depending on vehicle speed and throttle position. DTC P0785 is set if PCM detects a continuous open or short to ground in 3-2 shift solenoid circuit.

Conditions For Setting DTC P0785

DTC will set under the following conditions:

* System voltage is 10-17 volts.
* Ignition is on.
* Engine is not in fuel cutoff mode.
* Engine speed is more than 450 RPM for 5 seconds.
* PCM commands solenoid on and voltage remains high (battery voltage).
* PCM commands solenoid off and voltage remains low (zero voltage).
* All conditions are met for 5 seconds.

Action Taken By PCM

PCM performs the following if DTC is set:

* Will light MIL at first failure signal.
* Inhibits TCC engagement.
* Inhibits 4th gear if in hot mode.
* Freezes shift adapts from being updated.
* Commands maximum line pressure.
* Commands a soft landing to 3rd gear.
* DTC P0785 will be stored in PCM history.

Diagnostic Procedure

1) Connect scan tool to DLC. Turn ignition switch to ON position. DO NOT start engine. Using scan tool, record freeze frame and failure records for reference. Data will be lost when DTCs are cleared later in this test.

2) If DTCs P0740, P0753, P0758, P0785 and P1860 are not present, go to next step. If DTCs P0740, P0753, P0758, P0785 and P1860 are present, remove appropriate 3-2 shift solenoid ignition feed circuit fuse from instrument panel fuse block and inspect fuse. See WIRING DIAGRAMS. Replace fuse if necessary, and check for short to ground in wiring harness between transmission 20-pin connector and fuse. Repair wiring as necessary, then go to step 10). If fuse is okay, check for open in wiring harness between transmission 20-way connector and fuse. Repair wire as necessary, then go to step 10).

3) Using scan tool, command 3-2 shift solenoid on and off 3 times while listening at transmission oil pan. If solenoid cycles, see DIAGNOSTIC AIDS. If solenoid does not cycle, turn ignition off. Disconnect transmission 20-pin connector. Install Jumper Harness(J-39775) to PCM side of transmission 20-pin connector. Connect test light between ground and 3-2 shift solenoid ignition feed circuit at transmission 20-pin connector. Turn ignition switch to ON position. DO NOT start engine.

4) If test light does not light, check for open or short to

ground in ignition feed circuit of 3-2 shift solenoid. Repair as necessary, then go to step 10). If test light lights, connect test light between 3-2 shift solenoid ground circuit and ignition feed circuit at transmission 20-pin connector. Using scan tool, command 3-2 shift solenoid on and off 3 times.

5) If test light cycles on and off, go to next step. If test light does not cycle on and off 3 times, check 3-2 shift solenoid ground circuit for open or short to ground. Repair circuit as necessary, then go to step 10). If circuit is okay, inspect wiring for poor connections at PCM connector. Check for bent, backed out, deformed or damaged terminals. Repair as necessary, then go to step 10). If connections and terminals are okay, replace PCM, then go to step 10).

6) Turn ignition off. Disconnect jumper harness from PCM side of transmission 20-pin connector and install harness to transmission side of 20-pin connector. Connect ohmmeter between 3-2 shift solenoid ground circuit and ignition feed circuit at transmission 20-pin connector.

7) If resistance is 20-32 ohms, go to next step. If resistance is not 20-32 ohms, disconnect 3-2 shift solenoid connector. Measure resistance between 3-2 shift solenoid terminals. If resistance is 20-32 ohms, check for open circuit in transmission wiring harness. Repair as necessary, then go to step 10). If resistance is not 20-32 ohms, replace3-2 shift solenoid, then go to step 10).

8) Turn ignition off. Connect ohmmeter between ground and 3-2 shift solenoid ground circuit, and between ground and 3-2 shift solenoid ignition feed circuit at transmission 20-pin connector. If resistance is more than 250 k/ohms, see DIAGNOSTIC AIDS. If resistance is less than 250 k/ohms, go to next step.

9) Disconnect 3-2 shift solenoid connector. Measure resistance between ground and each solenoid terminal. If resistance is more than 250 k/ohms, check for short to ground in transmission wiring harness. Repair as necessary, then go to next step. If resistance is less than 250 k/ohms, replace 3-2 shift solenoid, then go to next step.

10) After repair is complete, select DTC on scan tool. Select "Clear Info" function. Test drive vehicle. Ensure voltage decreases to zero when 3-2 shift solenoid is commanded on, and voltage increases to battery voltage when commanded off. Conditions must be met for 5 seconds. Select "Specific DTC" and enter DTC "P0785". If DTC P0785 is not present, repair is complete. If DTC P0785 is still present, repeat test.

Diagnostic Aids

Inspect wiring for poor connections at PCM and transmission 20-pin connector. Check for bent, backed out, deformed or damaged terminals. Check for weak terminal tension. Check for chafed wire that could short to bare metal or other wiring. Check for broken wire inside insulation. If diagnosing for intermittent short or open condition, move wiring harness while observing scan tool for value change.

DTC P1810: TRANSMISSION FLUID PRESSURE (TFP) POSITION SWITCH ASSEMBLY MALFUNCTION

NOTE: Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK prior to performing diagnostic procedures. For wire terminal ID, see WIRING DIAGRAMS. Transmission Fluid Pressure (TFP) position switch assembly may also be referred to as Pressure Switch Assembly (PSA).

Circuit Description

Transmission Fluid Pressure (TFP) position switch assembly consists of 5 pressure switches and a Transmission Fluid Temperature (TFT) sensor. 2 switches are normally-closed. 3 other switches are normally-open. Complete assembly mounts on control valve body.

PCM supplies battery voltage to each range switch. PCM grounds one or more range switch signal circuit through various combinations of pressure switches. PCM monitors combinations in order to detect what manual valve position has been selected. PCM compares actual voltage combination of switches to TFP position switch combination values stored in memory. TFP position switch cannot distinguish between Park and Neutral because monitored valve body pressures are identical. DTC P1810 is set if PCM detects an invalid state of TFP position switch. See TFP LOGIC TABLE.

TFP LOGIC TABLE TABLE

Gear	Signal "A"	Signal "B"	Signal "C"
Park	Off	On	Off
Reverse	On	On	Off
Neutral	Off	On	Off
Drive/OD	Off	On	On
D3/3rd	Off	Off	On
D2/2nd	Off	Off	Off
D1/Lo	On	Off	Off
Illegal	On	Off	On
Illegal	On	On	On

Conditions For Setting DTC P1810

DTC will set when any one of the following 3 conditions occur:

Condition No. 1:

This condition detects an illegal switch combination.

* System voltage is 10-17 volts
* Engine is running.
* Engine is not in fuel cutoff mode.
* PCM detects an illegal TFP state.
* All conditions are met for one minute.

Condition No. 2:

This condition detects D2, D4 or Reverse during an engine start.

* DTCs P0502 or P0503 (vehicle speed sensor) are not present.
* Engine speed is less than 100 RPM for .3 seconds, then engine speed is between 100-600 RPM for .3 seconds, then engine speed is more than 600 RPM for 3 seconds.
* Vehicle speed is less than 4 MPH.
* Detected gear range is D2, D4 or Reverse.
* All conditions are met for 3 seconds.

Condition No. 3:

This condition detect Park or Neutral when vehicle should be in D4.

* DTCs P0502 or P0503 (vehicle speed sensor) are not present.
* Engine speed is less than 2000 RPM.
* Speed ratio (engine speed divided by output speed) is .39-.80.
* TCC is locked on.
* Detected gear range is Park or Neutral.

* All conditions are met for 5 seconds.

Action Taken By PCM
PCM performs the following if DTC is set:

* Will light MIL after 2 consecutive trips with failure.
* Freezes shift adapts from being updated.
* Defaults line pressure to "D2".
* Defaults shift pattern to "D4".
* DTC P1810 will be stored in PCM history.

Diagnostic Procedure

1) Check transmission fluid. Fill as needed. Ensure transmission shift linkage is adjusted correctly. Diagnose Transmission Fluid Pressure (TFP) position switch. Switch is also referred to as Pressure Switch Assembly (PSA). See COMPONENT TESTS. Connect scan tool to DLC. Turn ignition switch to ON position. DO NOT start engine. Using scan tool, record freeze frame and failure records for reference. Data will be lost when DTCs are cleared later in this test.

2) Start engine and let idle. Apply parking brake. While observing scan tool, shift transmission into each gear position. If gear position matches transmission range switch on scan tool, see DIAGNOSTIC AIDS. If gear position does not match transmission range switch on scan tool, go to next step.

3) Turn ignition off. Disconnect transmission 20-pin connector. Install Jumper Harness (J-39775) on PCM side of transmission 20-pin connector. Turn ignition switch to ON position. DO NOT start engine. Using a DVOM, measure voltage at range input circuits "A", "B" and "C" at transmission 20-pin connector. See WIRING DIAGRAMS. If battery voltage is present at all circuits, go to step 5). If battery voltage is not present at all circuits, go to next step.

4) Check each circuit which did not have battery voltage for open or short to ground. Repair circuit(s) as necessary, then go to step 6). If all circuits are okay, inspect wiring for poor connections at appropriate PCM connector. Check for bent, backed out, deformed or damaged terminals. Repair as necessary, then go to step 6). If connections and terminals are okay, replace PCM, then go to step 6).

5) Ensure circuits are not shorted together. Use a fused jumper to separately ground each circuit while monitoring scan tool TFP position switch A/B/C display. Repair circuits as necessary, then go to next step. If all circuits are okay, diagnose Transmission Fluid Pressure (TFP) position switch. Switch is also referred to as Pressure Switch Assembly (PSA). See COMPONENT TESTS.

6) After repair is complete, select DTC on scan tool. Select "Clear Info" function. Select "Specific DTC" and enter DTC "P1810". Turn ignition switch to ON position for at least 2 seconds. Start vehicle and idle for 5 seconds. Drive vehicle in D4 until TCC locks for 20 seconds. If DTC P1810 is not present, repair is complete. If DTC P1810 is still present, repeat test.

Diagnostic Aids

Inspect wiring for poor connections at PCM and at transmission 20-pin connector. Check for bent, backed out, deformed or damaged terminals. Check for weak terminal tension. Check for chafed wire that could short to bare metal or other wiring. Inspect for broken wire inside insulation. If diagnosing for intermittent short or open condition, move wiring harness while observing scan tool for value change.

DTC P1860: TCC PWM SOLENOID ELECTRICAL MALFUNCTION

NOTE: Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK prior to performing diagnostic procedures. For wire circuit ID, see WIRING DIAGRAMS.

Circuit Description

TCC PWM solenoid is used to control fluid flow acting on converter clutch valve. Solenoid controls TCC apply and release. Solenoid is attached to control valve body. Ignition voltage is supplied directly to solenoid through fused circuit. PCM commands solenoid on or off through ground circuit. TCC PWM solenoid provides a smooth engagement of TCC by operating during duty cycle percent of on time. DTC P1860 is set if PCM detects a continuous open or short to ground in TCC PWM solenoid circuit.

Conditions For Setting DTC P1860

DTC will set under the following conditions:

* 1st gear is commanded.
* Ignition is on.
* DTCs P0751 or P0753 (1-2 shift solenoid) are not present.
* DTCs P0756 or P0758 (2-3 shift solenoid) are not present.
* System voltage is 10-17 volts.
* TCC is at 100 percent duty cycle for more than .1 second.
* TCC is at zero percent duty cycle for more than 5 seconds.
* PCM commands solenoid off and voltage remains low (zero volts).
* All conditions are met for 5 seconds.

Action Taken By PCM

PCM performs the following if DTC is set:

* Will light MIL at first failure signal.
* Inhibits TCC engagement.
* Inhibits 4th gear if in hot mode.
* Freezes shift adapts from being updated.
* DTC P1860 will be stored in PCM history.

Diagnostic Procedure

1) Connect scan tool to DLC. Turn ignition switch to ON position. DO NOT start engine. Using scan tool, record freeze frame and failure records for reference. Data will be lost when DTCs are cleared later in this test.

2) If DTCs P0740, P0753, P0758, P0785 and P1860 are not present, go to next step. If DTCs P0740, P0753, P0758, P0785 and P1860 are present, remove appropriate TCC PWM solenoid ignition feed circuit fuse from instrument panel fuse block and inspect fuse. See WIRING DIAGRAMS. Replace fuse if necessary, and check for short to ground in wiring harness between transmission 20-pin connector and fuse. Repair wiring as necessary, then go to step 10). If fuse is okay, check for open in wiring harness between transmission 20-way connector and fuse. Repair wire as necessary, then go to step 10).

3) Turn ignition off. Disconnect transmission 20-pin connector. Install Jumper Harness (J-39775) to PCM side of transmission 20-pin connector. Connect test light between ground and TCC PWM solenoid ignition feed circuit at transmission 20-pin connector. Turn ignition switch to ON position. DO NOT start engine.

4) If test light does not light, check for open or short to ground in ignition feed circuit of TCC PWM solenoid. Repair as necessary, then go to step 10). If test light lights, connect test light between TCC PWM solenoid ground circuit and ignition feed circuit at transmission 20-pin connector. Using scan tool, command TCC PWM solenoid on and off 3 times.

5) If test light cycles on and off, go to next step. If test

light does not cycle on and off 3 times, check TCC PWM solenoid ground circuit for open or short to ground. Repair circuit as necessary, then go to step 10). If circuit is okay, inspect wiring for poor connections at PCM connector. Check for bent, backed out, deformed or damaged terminals. Repair as necessary, then go to step 10). If connections and terminals are okay, replace PCM, then go to step 10).

6) Turn ignition off. Disconnect jumper harness from PCM side of transmission 20-pin connector and install harness to transmission side of 20-pin connector. Connect ohmmeter between TCC PWM solenoid ground circuit and ignition feed circuit at transmission 20-pin connector.

7) If resistance is 10-15 ohms, go to next step. If resistance is not 10-15 ohms, disconnect TCC PWM solenoid connector. Measure resistance between TCC PWM solenoid terminals. If resistance is 10-15 ohms, check for open circuit in transmission wiring harness. Repair as necessary, then go to step 10). If resistance is not 10-15 ohms, replace TCC PWM solenoid, then go to step 10).

8) Turn ignition off. Connect ohmmeter between ground and TCC PWM solenoid ground circuit, and between ground and TCC PWM solenoid ignition feed circuit at transmission 20-pin connector. If resistance is more than 250 k/ohms, see DIAGNOSTIC AIDS. If resistance is less than 250 k/ohms, go to next step.

9) Disconnect TCC PWM solenoid connector. Measure resistance between ground and each solenoid terminal. If resistance is more than 250 k/ohms, check for short to ground in transmission wiring harness. Repair as necessary, then go to next step. If resistance is less than 250 k/ohms, replace TCC PWM solenoid, then go to next step.

10) After repair is complete, select DTC on scan tool. Select "Clear Info" function. Test drive vehicle. Ensure voltage decreases to zero when TCC PWM solenoid is commanded on, and voltage increases to battery voltage when commanded off. Conditions must be met for 5 seconds. Select "Specific DTC" and enter DTC "P1860". If DTC P1860 is not present, repair is complete. If DTC P1860 is still present, repeat test.

Diagnostic Aids

Inspect wiring for poor connections at PCM and transmission 20-pin connector. Check for bent, backed out, deformed or damaged terminals. Check for weak terminal tension. Check for chafed wire that could short to bare metal or other wiring. Check for broken wire inside insulation. If diagnosing for intermittent short or open condition, move wiring harness while observing scan tool for value change.

DTC P1870: TRANSMISSION COMPONENT SLIPPING

NOTE: Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK prior to performing diagnostic procedures. For wire circuit ID, see WIRING DIAGRAMS.

Circuit Description

PCM monitors difference between engine speed and transmission output speed. In "D3" with TCC engaged, engine speed should closely match transmission output speed. In "D4" with TCC engaged, TCC slip speed should be -20 to 20 RPM. DTC P1870 is set if PCM detects excessive TCC slip when TCC should be engaged.

Conditions For Setting DTC P1870

DTC will set under the following conditions:

* DTCs P0122 or P0123 (throttle position sensor) are not present.
* DTCs P0502 or P0503 (vehicle speed sensor) are not present.

* DTCs P0712 or P0713 (TFT sensor) are not present.
* DTC P0740 (TCC solenoid) is not present.
* DTCs P0751 or P0753 (1-2 shift solenoid) are not present.
* DTCs P0756 or P0758 (2-3 shift solenoid) are not present.
* DTC P1810 (TFP position switch) is not present.
* DTC P1860 (TCC PWM solenoid) is not present.
* Engine speed is less than 5500 RPM.
* Gear range is "D4".
* Vehicle is not in 1st gear.
* Throttle angle is 13-36 percent.
* Transmission fluid temperature is 68-266°F (20-130°C).
* TCC is on for more than .1 second.
* TCC is at maximum apply for .1 second.
* Shift solenoid performance counter is at zero.
* TCC slip speed is more than 130 RPM for more than 8 seconds.

Action Taken By PCM

PCM performs the following if DTC is set:

* Will light MIL at first failure signal.
* Inhibits TCC engagement.
* Inhibits 4th gear if in hot mode.
* Freezes shift adapts from being updated.
* Commands maximum line pressure.
* DTC P1870 will be stored in PCM history.

Diagnostic Procedure

1) Connect scan tool to DLC. Turn ignition switch to ON position. DO NOT start engine. Using scan tool, record freeze frame and failure records for reference. Data will be lost when DTCs are cleared later in this test.

2) Start engine and let idle. Apply parking brake. While observing scan tool, shift transmission into each gear position. If gear position matches transmission range switch on scan tool, go to next step. If gear position does not match transmission range switch on scan tool, diagnose Transmission Fluid Pressure (TFP) position switch. Switch is also referred to as Pressure Switch Assembly (PSA). See COMPONENT TESTS.

3) Drive vehicle in 4th gear while TCC is engaged. If TCC slip speed is more than 130 RPM for 10 seconds, go to TROUBLE SHOOTING in AUTO TRANS OVERHAUL - 4L60-E article. If TCC slip speed is less than 130 RPM for 10 seconds, see DIAGNOSTIC AIDS.

Diagnostic Aids

A TFP position switch (Pressure Switch Assembly) malfunction could set DTC P1870. Ensure final drive ratio matches PCM calibration. The following mechanical conditions could set DTC P1870:

* Shift solenoids.
* TCC solenoid.
* TCC PWM solenoid.
* Internal transmission failures.
* Engine misfire.
* Transmission range switch DTC.

DTC P1875: 4WD LOW CIRCUIT MALFUNCTION

NOTE: Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK prior to performing diagnostic procedures. For wire circuit ID, see WIRING DIAGRAMS.

Circuit Description (Electric Shift)

The 4WD low circuit consists of a transfer case selector switch, Transfer Case Control Module (TCCM) and wiring. When 4WD low is selected, TCCM receives a momentary signal from selector switch. If all conditions for 4WD low are met, TCCM allows electric motor in transfer case to perform shift. When 4WD low is engaged, voltage to VCM changes from ignition voltage to zero. The 4WD low switch signal corrects transmission output speed signal to VCM. This signal compensates for transfer case gear reduction. VCM uses transmission output speed signal to adjust shift points, line pressure and TCC scheduling. DTC P1875 is set if VCM detects a continuous open or short to ground in 4WD circuit.

Circuit Description (Manual Shift)

The 4WD low circuit consists of a 4WD indicator assembly, selector quadrant switch, a front axle switch and wiring. When selector quadrant switch is moved to 4 low, 4WD indicator light glows and voltage to VCM changes from ignition voltage to zero. Front axle switch does not affect circuit signal input to VCM because switch is also closed in 4WD high position. The 4WD low switch signal corrects transmission output speed signal to VCM. This signal compensates for transfer case gear reduction. VCM uses transmission output speed signal to adjust shift points, line pressure and TCC scheduling. DTC P1875 is set if VCM detects a continuous open or short to ground in 4WD circuit.

Conditions For Setting DTC P1875

DTC will set under the following conditions:

* DTCs P0121, P0122 or P0123 (throttle position sensor) are not present.
* DTCs P0502 or P0503 (vehicle speed sensor) are not present.
* DTC P0740 (TCC solenoid) is not present.
* DTC P0742 (TCC stuck on) is not present.
* DTC P0751 or P0753 (1-2 shift solenoid) is not present.
* DTC P0576 or P0758 (2-3 shift solenoid) is not present.
* DTC P1810 (trans. fluid pressure switch) is not present.
* DTC P1860 (TCC PWM solenoid) is not present.
* Engine speed is more than 400 RPM for 8 seconds.
* Not in fuel cutoff mode.
* Gear range is D4.
* Throttle angle is 17-50 percent.
* Transmission fluid temperature is 68-248°F (20-120°C).
* All of the above conditions are met and either of the following fail conditions occur:

Condition No. 1:

* 4WD low is stuck on for 5 seconds.
* TCC slip speed is -50 to -3000 RPM.
* 4WD low is not engaged.
* Speed ratio (engine speed divided by transfer case output speed) is .8-1.2.

Condition No. 2:

* 4WD low is stuck off for 10 seconds.
* TCC is commanded on.
* TCC slip speed is 100-3000 RPM.
* 4WD low is engaged.
* Speed ratio is 2.5-2.9.

Action Taken By VCM

VCM performs the following if DTC is set:

* Will light MIL at first failure signal.
* Commands a normal shift pattern.
* DTC P1875 will be stored in VCM history.

Diagnostic Procedure (Electric Shift)

1) Connect scan tool to DLC. Turn ignition switch to ON position. DO NOT start engine. Using scan tool, record freeze frame and failure records for reference. Data will be lost when DTCs are cleared later in this test.

2) Set parking brake and block drive wheels. Shift transmission into Neutral. While observing scan tool 4WD low display, select 4HI on transfer case selector switch, then select 4LO on transfer case selector switch. If scan tool 4WD low does not display NO when 4HI is selected and YES when 4LO is selected, go to next step. If scan tool 4WD low displays NO when 4HI is selected and YES when 4LO is selected, see DIAGNOSTIC AIDS.

3) Turn ignition off. Disconnect TCCM connector. Turn ignition switch to ON position. Connect test light between ground and Dark Green/White wire terminal at TCCM connector. Select 4LO, then 4HI on transfer case selector switch. If test light does not light when 4LO is selected and lights when 4HI is selected, go to next step. If test light lights when 4LO low is selected and turns off when 4HI is selected, go to step 7).

4) Connect test light between ground and Dark Green/White wire at transfer case selector switch. Select 4LO, then 4HI on selector switch. If test light does not light when 4LO is selected and lights when 4HI is selected, go to next step. If test light lights when 4LO is selected and turns off when 4HI is selected, go to step 6).

5) Connect test light between ground and Pink wire of transfer case selector switch. If test light lights, replace transfer case selector switch, then go to step 9). If test light does not light, check for open or short to ground in ignition feed circuit to transfer case selector switch. Repair circuit as necessary, then go to step 9.

6) Check for open or short to ground in Dark Green/White wire between transfer case selector switch and TCCM. Repair as necessary, then go to step 9).

7) Install a fused jumper between TCCM connector terminals (Dark Green/White wire and Gray/Black wire). If scan tool 4WD low displays YES, replace TCCM, then go to step 9). If scan tool 4WD low does not display YES, turn ignition off. Reconnect TCCM connector. Disconnect appropriate VCM connector connected to 4WD low indicator signal circuit. See WIRING DIAGRAMS. Connect test light between ground and 4WD low indicator signal circuit terminal at VCM connector. If test light lights, go to next step. If test light does not light, check for open or short to ground in 4WD low indicator signal circuit. Repair circuit as necessary, then go to step 9).

8) Check VCM connector for bent, backed out, deformed or damaged terminals. Repair as necessary, then go to next step. If terminals and connections are okay, replace VCM, then go to next step.

9) After repair is complete, select DTC on scan tool. Select "Clear Info" function. Operate vehicle under following conditions. Select 4LO on selector switch. Drive vehicle in 4th gear with TCC on. Speed ratio must be 2.5-3.0 for 5 seconds. Select 4HI on selector switch. Drive vehicle in 4th gear with TCC on. Speed ratio must be .8-1.2 for 5 seconds. Select "Specific DTC" and enter DTC "P1875". If DTC P1875 is not present, repair is complete. If DTC P1875 is still present, repeat test.

Diagnostic Procedure (Manual Shift)

1) Connect scan tool to DLC. Turn ignition switch to ON position. DO NOT start engine. Using scan tool, record freeze frame

and failure records for reference. Data will be lost when DTCs are cleared later in this test.

2) Set parking brake and block drive wheels. Shift transmission into Neutral. While observing scan tool 4WD low display, select 4HI on selector quadrant switch, then select 4LO on selector quadrant switch. If scan tool 4WD low does not display NO when 4HI is selected and YES when 4LO is selected, go to next step. If scan tool 4WD low displays NO when 4HI is selected and YES when 4LO is selected, see DIAGNOSTIC AIDS.

3) Place selector quadrant switch in 4HI position. Using a DVOM, backprobe between ground and voltage input connector (Gray/Black wire) at 4WD indicator assembly. If voltage is 9.6-12.6 volts, go to next step. If voltage is not 9.6-12.6 volts, check for open or short to ground in Gray/Black wire. Repair wire as necessary, then go to step 9). If wire is okay, replace selector quadrant switch, then go to step 9).

4) Place selector quadrant switch in 4LO position. Using a DVOM, backprobe between ground and terminal No. 5 at selector quadrant switch connector to 4WD indicator assembly. If voltage is more than .5 volt, go to next step. If voltage is less than .5 volt, go to step 8).

5) Disconnect selector quadrant switch connector and voltage input connector from 4WD indicator assembly. Using an ohmmeter, measure resistance between voltage input connector terminal No. 5 on 4WD indicator assembly circuit board and selector quadrant switch terminal No. 5 on circuit board. If resistance is less than one ohm, go to next step. If resistance is more than one ohm, replace 4WD indicator assembly, then go step 9).

6) Measure resistance between voltage input connector terminalNo. 2 on 4WD indicator assembly circuit board and selector quadrant switch terminal No. 6 on circuit board. If resistance is less than one ohm, go to next step. If resistance is more than one ohm, replace 4WD indicator assembly, then go step 9).

7) Check for open in Black wire (ground circuit) of 4WD indicator assembly. Repair wire as necessary, then go to step 9). If wire is okay, replace 4WD indicator assembly, then go to step 9).

8) Check VCM connector for bent, backed out, deformed or damaged terminals. Repair as necessary, then go to next step. If terminals and connections are okay, replace VCM, then go to next step.

9) After repair is complete, select DTC on scan tool. Select "Clear Info" function. Operate vehicle under following conditions. Select 4LO on selector quadrant switch. Drive vehicle in 4th gear with TCC on. Speed ratio must be 2.5-3.0 for 5 seconds. Select 4HI on selector quadrant switch. Drive vehicle in 4th gear with TCC on. Speed ratio must be.8-1.2 for 5 seconds. Select "Specific DTC" and enter DTC "P1875". If DTC P1875 is not present, repair is complete. If DTC P1875 is still present, repeat test.

Diagnostic Aids (All Models)

Inspect wiring for poor connections at VCM. Check for bent, backed out, deformed or damaged terminals. Check for weak terminal tension. Check for chafed wire that could short to bare metal or other wiring. Check for broken wire inside insulation. If diagnosing for intermittent short or open condition, move wiring harness while observing scan tool for value change.

TECHNICAL SERVICE BULLETINS

1-2 &/OR 2-3 UPSHIFT SLIP/FLARE, NO 3RD OR 4TH GEAR

(DTC P1870)

1996 GM Trucks, Vans & Oldsmobile Bravada With 4L60-E Transmission (GM Service Bulletin No. 66-71-03A)

Some owner's may complain that vehicle has either a slip or flare on 1-2 and/or 2-3 upshift, or no 3rd or 4th gear. DTC P1870 may also be present. This condition may be caused by a poor internal ground between 2 circuit boards of Vehicle Control Module (VCM), which can cause VCM to command erratic line pressure at pressure control solenoid. To correct this condition, a revised wiring harness (No. 12167310) has been designed to replace current wiring harness at VCM. Corrections were made to VCM beginning February 14, 1996. Corrected VCM's are identified by service number 16244210, located on VCM identification label.

WIRING DIAGRAMS

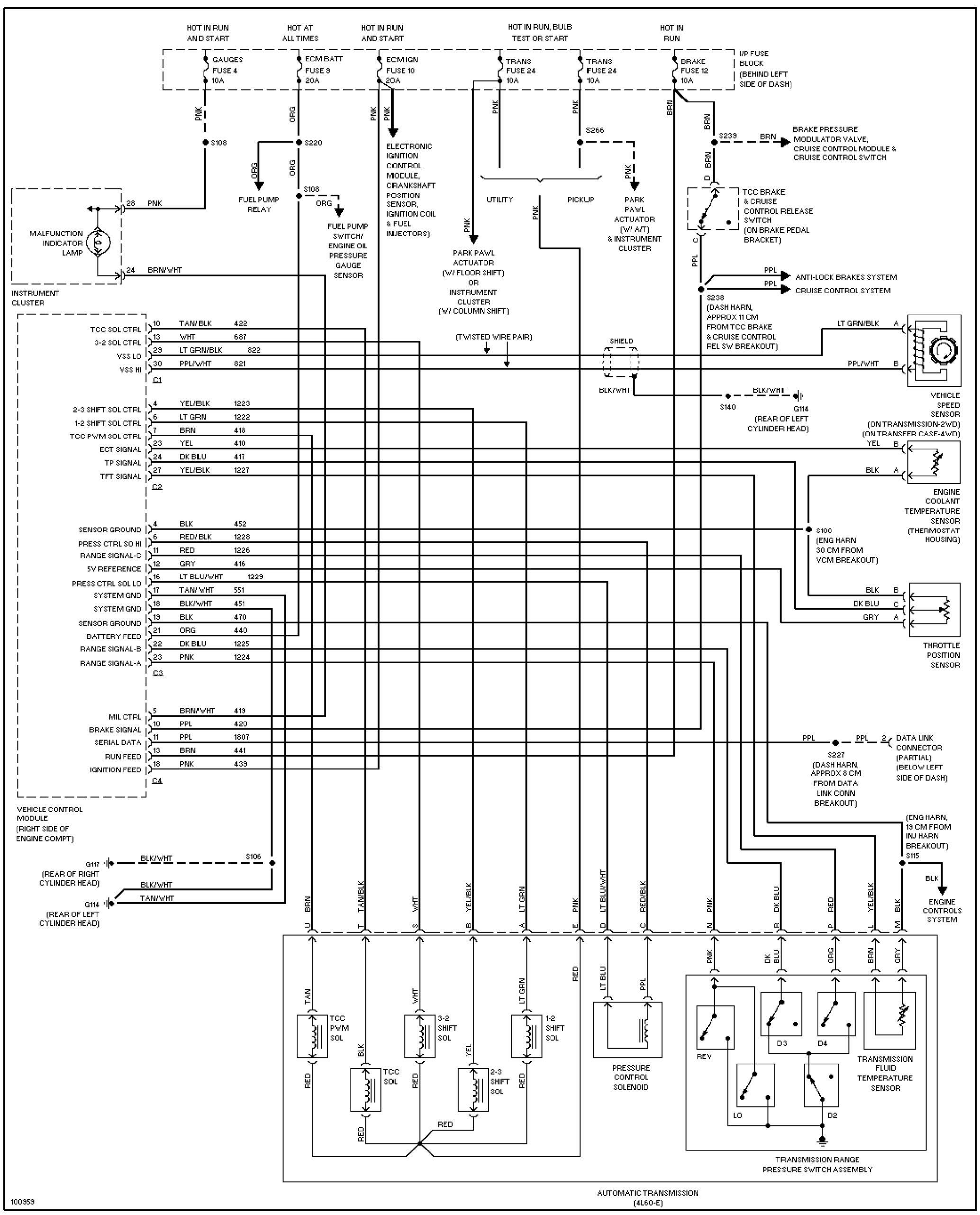


Fig. 5: Wiring Diagram (1997)

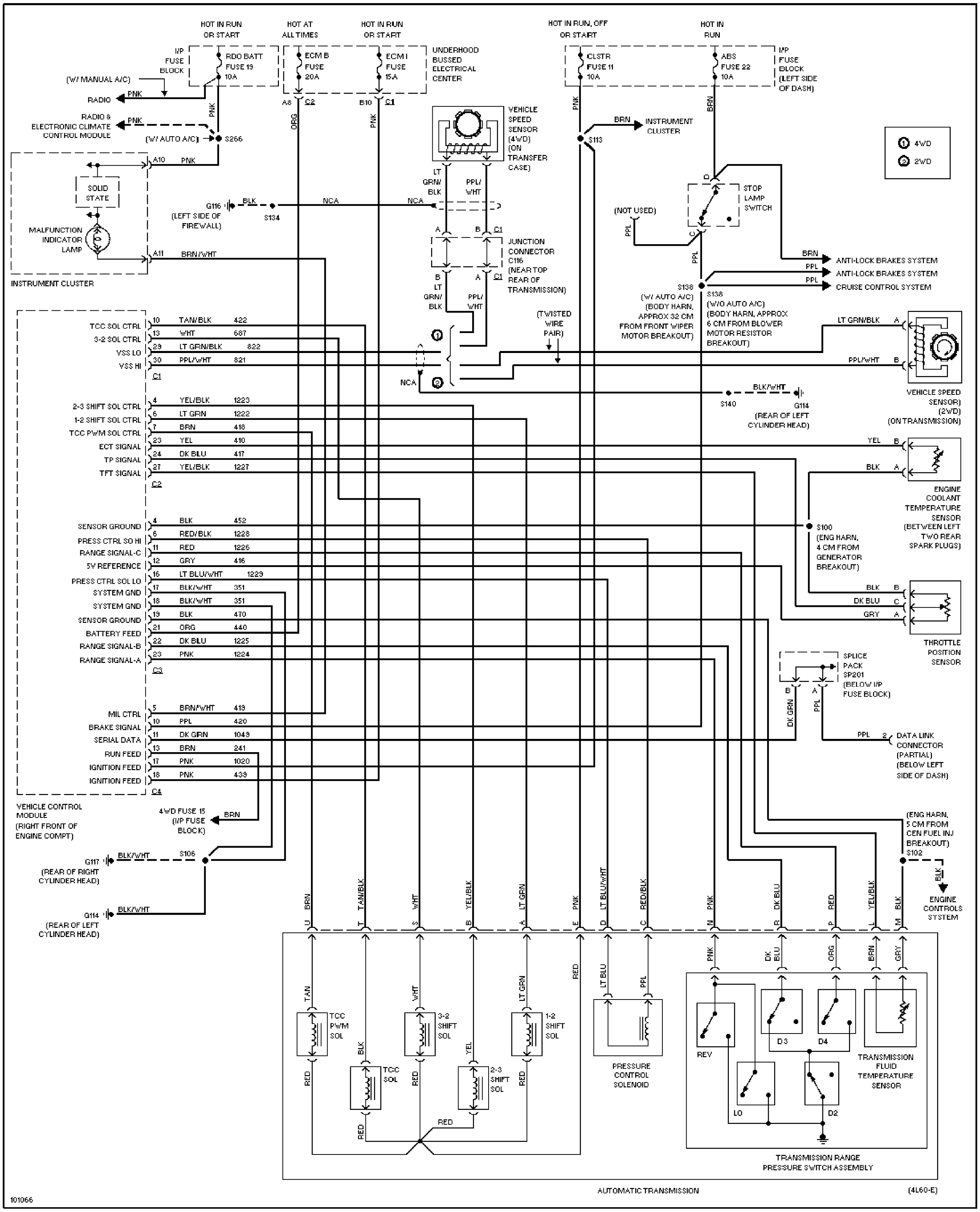


Fig. 6: Wiring Diagram (1998)

F - BASIC TESTING - 4.3L

1997 Chevrolet Blazer

1997 ENGINE PERFORMANCE
General Motors Corp. - Basic Diagnostic Procedures - 4.3L

Chevrolet; Blazer, S10 Pickup
GMC; Jimmy, Sonoma
Oldsmobile; Bravada

INTRODUCTION

The following diagnostic steps help prevent overlooking simple problems. This is also where to begin diagnosis for no-start condition.

The first step in diagnosing any driveability problem is verifying the customer's complaint by test driving vehicle under the conditions in which 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: Unless otherwise instructed in test procedures, perform all voltage tests using a Digital Volt-Ohmmeter (DVOM) with a minimum 10-megohm input impedance.

GENERAL MOTORS REFERENCE TABLE

System Or Component	Diagnostic Information Location
Malfunction Indicator Light (MIL)	See ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK
DLC & MIL On Steady	See ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK
No Scan Tool Data	See ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK
No-Start Diagnosis	See NO START - ENGINE CRANKS OKAY
Injector Circuit Diagnosis	See BASIC FUEL SYSTEM CHECKS
Fuel Pump Relay	See MODULES, MOTORS, RELAYS & SOLENOIDS in I - SYSTEM/COMPONENT TESTS article
Fuel System Diagnosis	See BASIC FUEL SYSTEM CHECKS
Injector Balance Test	See FUEL SYSTEM in I - SYSTEM/COMPONENT TESTS article
MAP Sensor	See ENGINE SENSORS & SWITCHES in I - SYSTEM/COMPONENT TESTS article
Transmission Range Switch	See ENGINE SENSORS & SWITCHES in I - SYSTEM/COMPONENT TESTS article
IAC Valve	See IDLE CONTROL SYSTEM under FUEL SYSTEM in I - SYSTEM/COMPONENT TESTS article
Fuel Evaporation Control	See EMISSION SYSTEMS & SUB-SYSTEMS in I - SYSTEM/COMPONENT TESTS article
Ignition Control Circuit	See IGNITION SYSTEM in I - SYSTEM/COMPONENT TESTS article
Knock Sensor Check	See IGNITION SYSTEM in I - SYSTEM/COMPONENT TESTS article
EGR System	See EMISSION SYSTEMS & SUB-SYSTEMS in I - SYSTEM/COMPONENT TESTS article
Torque Converter Clutch	(1) See MISCELLANEOUS PCM/VCM CONTROLS in I - SYSTEM/COMPONENT TESTS article
Manual Trans. Shift Lights	(1) See MISCELLANEOUS PCM/VCM CONTROLS in I - SYSTEM/COMPONENT TESTS article
A/C Clutch Control	See MISCELLANEOUS PCM/VCM CONTROLS in I - SYSTEM/COMPONENT TESTS article

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Elec.Cooling Fan Control ... (2) See MISCELLANEOUS PCM/VCM CONTROLS in
                                  I - SYSTEM/COMPONENT TESTS article

(1) - Complete coverage in TRANSMISSION SERVICING article.
(2) - Covered in entirety in A/C-HEATER SYSTEM article.
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PRELIMINARY INSPECTION & ADJUSTMENTS

VISUAL INSPECTION

Visually inspect all electrical wiring. Look for chafed, stretched, cut or pinched wiring. Ensure electrical connectors fit tightly and are not corroded. Ensure vacuum hoses are properly routed and not pinched or cut. If necessary, see M - VACUUM DIAGRAMS article to verify routing and connections. 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. For compression specifications, see the C - SPECIFICATIONS article.

WARNING: Because fuel injectors on many models are triggered by ignition switch during cranking mode, DO NOT use ignition switch during compression tests. Use a remote starter to crank engine to prevent fire hazard or engine's oiling system contamination.

Exhaust System Backpressure

Before replacing any components, check exhaust system for restrictions. Use a vacuum gauge or a low-pressure (0-5 psi) gauge to check exhaust system.

If a vacuum gauge is used, connect vacuum gauge hose to intake manifold vacuum port and start engine. Observe vacuum gauge. Partially open throttle and hold steady. If vacuum gauge reading slowly drops after stabilizing, exhaust system should be checked for a restriction. If using a low pressure gauge, connect gauge in the following manner:

* Check At Oxygen Sensor
  Remove oxygen sensor. Install backpressure tester in place of oxygen sensor. After test is completed, coat oxygen sensor threads with anti-seize compound before installation.

Diagnosis

1) Start engine and bring to operating temperature. Increase engine speed to 2000-2500 RPM and note gauge. If reading exceeds 1.25 psi (.09 kg/cm^2), exhaust system is restricted.

2) Check exhaust system for collapsed pipe, heat distress and possible internal muffler failure. If none of these conditions exist, check for restricted catalytic converter. Replace as required.

NO-START DIAGNOSIS

NOTE: For terminal and circuit ID, see the L - WIRING DIAGRAMS article.

Definition

No-start is defined as engine cranks okay but does not start. Engine may fire a few times.

NO START - ENGINE CRANKS OKAY

NOTE: Before performing following tests, check battery condition, engine cranking speed and fuel supply.

General Inspection

1) Ensure proper starting procedure is being used. Visually check vacuum hoses for splits, kinks and proper connections, as shown on Vehicle Emission Control Information label. Check ignition wires for cracking, hardness and proper connections at both coil pack and spark plugs.

2) Remove spark plugs. Check and replace as necessary. In very cold temperatures, ensure oil is proper viscosity and not contaminated with gasoline.

Ignition System

1) Perform On-Board Diagnostic (OBD) System Check. See ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. After performing OBD system check, go to next step.

2) Install Tech 1 scan tool. Using scan tool, monitor Throttle Position (TP) sensor. Ensure is throttle closed. If TP sensor value is greater than 2.5 volts, diagnose using DTC P0123. See the G - TESTS W/CODES article. If TP sensor voltage is less than 2.5 volts, go to next step.

3) Using scan tool, monitor Engine Coolant Temperature (ECT) sensor. If ECT sensor value is less than -30°C, diagnose using DTC P0118. See the G - TESTS W/CODES article. If ECT sensor is greater than -30°C, go to next step.

4) Turn ignition off for 10 seconds. Turn ignition on. Fuel pump should operate for about 2 seconds. If fuel pump operates as specified, go to next step. If fuel pump does not operate as specified, go to FUEL SYSTEM.

5) Turn ignition off. Disconnect injector harness connector at intake manifold. Using a test light connected to ground, probe injector feed circuit. See the L - WIRING DIAGRAMS article. Turn ignition on with engine off. If test light flashes, go to next step. If test light does not flash, go to step 8).

6) Disconnect one spark plug wire. Install Spark Tester (J-26792). Crank engine. If spark is present, go to next step. If spark is not present, diagnose enhanced ignition system.

7) Reconnect spark plug wire. Turn ignition off. Connect fuel pressure gauge. Turn ignition on with engine off. Observe fuel pressure. Fuel pressure should be 55-61 psi (3.9-4.3 kg/cm^2). If fuel pressure is as specified, perform fuel injector balance test. See INJECTOR BALANCE TEST under FUEL SYSTEM in the I - SYSTEM/COMPONENT TESTS article. If fuel pressure is not as specified, diagnose fuel system. See BASIC FUEL SYSTEM CHECKS.

8) Repair injector ignition feed circuit. After repairs, go to next step.

9) Using scan tool, select DTC, CLEAR INFO function. Attempt to start engine. If engine starts and continues to run, go to next step. If engine does not start, or starts and dies, go to step 2).

10) Warm engine to normal operating temperature. Using scan tool, select DTC, FAILED THIS IGN function. If DTC(s) are displayed, diagnose DTC(s). See the G - TESTS W/CODES article. If DTC(s) are not present, go to next step.

11) Select CAPTURE INFO, REVIEW INFO function. If additional DTC(s) are displayed, diagnose DTC(s). See the G - TESTS W/CODES article. If DTC(s) are not present, system is okay.

Fuel System

1) Perform On-Board Diagnostic (OBD) System Check. See ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. After performing OBD system check, go to next step.

2) Turn ignition off for about 10 seconds. Turn ignition on. Fuel pump should operate for about 2 seconds. If fuel pump operates as specified, go to IGNITION SYSTEM check. If fuel pump does not operate as specified, go to next step.

3) Connect a fused jumper wire between battery positive and fuel pump test terminal. If fuel pump operates, go to next step. If fuel pump does not operate, go to step 12).

4) Disconnect jumper wire from test terminal. Turn ignition off for 10 seconds. Turn ignition on. Fuel pump should operate for about 2 seconds. If fuel pump operates as specified, go to step 25). If fuel pump does not operate as specified, go to next step.

5) Remove fuel pump relay. Turn ignition on with engine off. Using a test light connected to ground, probe fuel pump relay harness connector battery feed terminal (Orange wire). If test light illuminates, go to next step. If test light does not illuminate, go to step 14).

6) Connect test light between ground and fuel pump relay harness connector battery feed circuit. See the L - WIRING DIAGRAMS article. If test light illuminates, go to next step. If test light does not illuminate, go to step 15).

7) Connect test light between ground and fuel pump relay terminal. Turn ignition off for 10 seconds. Turn ignition on. If test light illuminates for 2 seconds, then turns off, go to next step. If test light does not illuminate, go to step 16).

8) Check for faulty fuel pump relay harness connector. Repair as necessary. After repairs, go to step 11). If connector is okay, go to next step.

9) Replace fuel pump relay. After repairs, go to next step.

10) Start and warm engine to normal operating temperature. Ensure oil pressure is within normal range. Disconnect fuel pump relay. If engine continues to run, go to next step. If engine stalls/dies, go to step 17).

11) Reinstall fuel pump relay. Turn ignition off. Using a test light connected to ground, probe fuel pump test connector. If test light illuminates, go to step 18). If test light does not illuminate, go to step 25).

12) Disconnect fuel pump harness connector. Using a fused jumper wire connected to battery voltage, jumper fuel pump test terminal. Using a test light connected to ground, probe fuel pump feed circuit. See the L - WIRING DIAGRAMS article. If test light illuminates, go to next step. If test light does not illuminate, go to step 20).

13) Connect test light to fuel pump ground terminal on harness connector. If test light illuminates, go to step 19). If test light does not illuminate, go to step 21).

14) Repair open in battery feed circuit to fuel pump relay harness connector terminal. After repairs, go to step 25).

15) Repair open in fuel pump relay ground circuit. After repairs, go to step 25).

16) Check for faulty connection at VCM connector fuel pump relay control circuit. Check for open or short to ground in harness between fuel pump relay control connector terminal and fuel pump relay control circuit. Repair as necessary. After repairs, go to step 22). If circuits are okay, go to step 24).

17) Check for faulty oil pressure switch connector terminals. Repair as necessary. After repairs, go to step 22). If connector terminals are okay, go to next step.

18) Replace oil pressure switch. After repairs, go to step

25).

19) Replace fuel pump. After repairs, go to step 25).

20) Repair open between fuel pump test terminal and fuel pump feed circuit at fuel pump harness connector. After repairs, go to step 25).

21) Repair open in fuel pump harness ground circuit. After repairs, go to step 25).

22) Repair affected circuit as necessary. After repairs, go to step 25).

23) Repair connectors as necessary. After repairs, go to step 25).

24) Replace VCM. Perform VCM relearn procedures. After repairs, go to next step.

25) Clear DTC(s) using scan tool. Attempt to start engine. If engine starts and continues to run, go to next step. If engine does not start, or starts and stalls/dies, go to step 2).

26) Warm engine to normal operating temperature. Using scan tool, select DTC, FAILED THIS IGN function. If any DTC(s) are present, diagnose DTC. See the G - TESTS W/CODES article. If DTC(s) are not present, go to next step.

27) Select CAPTURE INFO, REVIEW INFO function. If additional DTC(s) are displayed, diagnose DTC(s). See the G - TESTS W/CODES article. If DTC(s) are not present, system is okay.

BASIC FUEL SYSTEM CHECKS

FUEL SYSTEM PRESSURE RELIEF

WARNING: Begin fuel system trouble shooting and diagnosis with fuel system pressure test. Relieve fuel system pressure before disconnecting any components or installing fuel pressure gauge.

Fuel system is under pressure, which must be relieved before servicing fuel system. Fuel pressure may be relieved by the following method:

* Disconnect negative battery cable. Loosen fuel filler cap. Install Fuel Pressure Gauge (J-34730-1A) to fuel pressure test head. Wrap shop towel around pressure connection when installing fuel pressure gauge to absorb fuel leakage. Place gauge bleed hose in container. Open bleed valve to relieve fuel pressure.

FUEL SYSTEM PRESSURE TEST

WARNING: Begin fuel system trouble shooting and diagnosis with fuel system pressure test. Relieve fuel system pressure before disconnecting any components or installing fuel pressure gauge.

1) Perform On-Board Diagnostic (OBD) System Check. See ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. After performing OBD system check, go to next step.

2) Relieve fuel pressure. See FUEL SYSTEM PRESSURE RELIEF. Connect Fuel Pressure Gauge (J-34730-1A) to fuel pressure test port. Turn ignition on with engine off. Fuel pressure should be 60-66 psi (4.2-4.6 kg/cm^2) on CSI fuel system and 56-62 psi (4.0-4.4 kg/cm^2) on SFI fuel system, and should hold steady. If fuel pressure is as specified, go to next step. If fuel pressure is not as specified, go to step 9).

3) Turn ignition off for 10 seconds, then turn ignition on.

Fuel pump should run for 2 seconds. Observe fuel pressure. If pressure is within specification and holds, go to step 5). If pressure is not within specification, or is within specification but does not hold, go to next step.

4) Turn ignition off for 10 seconds. Turn ignition on. Pinch off fuel pressure feed line. If pressure is as specified and holds, go to step 6). If pressure is not as specified, or is as specified but does not hold, go to step 8).

5) Warm engine to normal operating temperature. From idle, open throttle quickly. Observe fuel pressure. If fuel pressure is within specification, see the H - TESTS W/O CODES article. If fuel pressure is not within specification, go to step 8).

6) Check for partially disconnected fuel pulse dampener/pulsator. If dampener/pulsator is partially disconnected, go to next step. If dampener/pulsator is okay, go to step 13).

7) Repair connection at fuel pulse dampener/pulsator. After repairs, go to step 28).

8) Check fuel feed line between pinch and CSI/SFI unit. If fuel feed line is restricted or leaking, go to step 27).

9) Turn ignition off for 10 seconds. Turn ignition on. Fuel pump should operate for about 2 seconds. Observe fuel pressure after fuel pump stops. If pressure is present, go to step 14). If pressure is not present or drops, go to next step.

10) Turn ignition off. Connect a fused jumper wire between battery voltage and fuel pump test terminal. If fuel pump operates, go to next step. If fuel pump does not operate, go to FUEL SYSTEM under NO-START DIAGNOSIS.

11) Check for plugged fuel filter, plugged fuel pump strainer, restricted fuel line or disconnected fuel pulse dampener/pulsator. If a problem is found, go to next step. If a problem is not found, go to step 13).

12) Repair or replace plugged fuel filter, plugged fuel pump strainer, restricted fuel line or disconnected fuel pulse dampener/pulsator. After repairs, go to step 28).

13) Replace fuel pump. After repairs, go to step 28).

14) Turn ignition off for 10 seconds, then turn ignition on. Fuel pump should operate for about 2 seconds. Observe fuel pressure. If fuel pressure is greater than 66 psi (4.6 kg/cm^2) on CSI fuel system or 62 psi (4.4 kg/cm^2) on SFI fuel system, go to next step. If fuel pressure is not greater than specified, go to step 16).

15) Relieve fuel pressure. Disconnect fuel return line. Attach a fuel hose to fuel regulator return line and place in a container. Turn ignition on. Observe fuel pressure within 2 seconds after turning on ignition. If fuel pressure is greater than 60 psi (4.2 kg/cm^2) on CSI fuel system or 56 psi (4.0 kg/cm^2) on SFI fuel system, go to step 17). If fuel pressure is less than as specified, go to step 19).

16) Turn ignition off for 10 seconds. Turn ignition on. Fuel pump should operate for about 2 seconds. Observe fuel pressure. If fuel pressure is less than 60 psi (4.2 kg/cm^2) on CSI fuel system or 56 psi (4.0 kg/cm^2) on SFI fuel system, go to step 20). If fuel pressure is greater than as specified, go to step 28).

17) Check for restricted fuel line from fuel pressure regulator to point where fuel line was disconnected. If fuel line is restricted, go to next step. If fuel line is not restricted, go to step 23).

18) Repair restriction in fuel return line from pressure regulator to the point where fuel line was disconnected. After repairs, go to step 27).

19) Repair restriction in fuel return line to fuel tank. After repairs, go to step 27).

20) Check for restricted fuel line or fuel filter. If a problem is found, go to next step. If a problem is not found, go to

step 22).

21) Repair or replace restricted fuel line or fuel filter. After repairs, go to step 27).

CAUTION: DO NOT allow fuel pressure to exceed 75 psi (5.3 kg/cm^2).

22) Turn ignition off. Connect a fused jumper wire between battery voltage and fuel pump test terminal. Slowly pinch fuel line return hose. Fuel pressure should increase to greater than 66 psi (4.6 kg/cm^2) on CSI fuel system or 62 psi (4.4 kg/cm^2) on SFI fuel system. If fuel pressure increases to greater than as specified, go to next step. If fuel pressure is less than as specified, go to step 24).

23) Replace fuel pressure regulator. After repairs, go to step 28).

24) If fuel pressure is less than 60 psi (4.2 kg/cm^2) on CSI fuel system or 56 psi (4.0 kg/cm^2) on SFI fuel system, go to next step. If fuel pressure is greater than specified, go to step 28).

25) Check for faulty fuel pump, partially disconnected fuel pulse dampener/pulsator, partially restricted fuel pump stainer or incorrect fuel pump. If a problem is found, go to next step. If a problem is not found, go to step 28).

26) Repair or replace fuel pump, partially disconnected fuel pulse dampener/pulsator, partially restricted fuel pump strainer or incorrect fuel pump. After repairs, go to next step.

27) Replace fuel feed/supply line. After repairs, go to next step.

28) Using scan tool, select DTC, CLEAR INFO function. Attempt to start engine. If engine starts and continues to run, go to next step. If engine does not start, or starts and stalls/dies, go to step 2).

29) Warm engine to normal operating temperature. Using DTC, select DTC, FAILED THIS IGN function. If any DTC(s) are displayed, diagnose and clear DTC(s). See the G - TESTS W/CODES article. If DTC(s) are not present, go to next step.

30) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If additional DTC(s) are stored, diagnose and clear DTC(s). See the G - TESTS W/CODES article. If DTC(s) are not present, system is okay.

INJECTOR CIRCUIT DIAGNOSIS

NOTE: This test only applies to vehicles equipped with a VCM.

1) Perform On-Board Diagnostic (OBD) System Check. See ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. After performing OBD system check, go to next step.

2) Disconnect injector connector at intake manifold. Turn ignition on with engine off. Using test light connected to ground, probe ignition feed circuits. See the L - WIRING DIAGRAMS article. If test light illuminates, go to next step. If test light does not illuminate, go to step 7).

3) Install injector test light to each injector circuit, one at a time. Crank engine. If injector test light flashes on each injector, check fuel injector(s). See FUEL SYSTEM in the I - SYSTEM/COMPONENT TESTS article. If injector test light did not flash on an injector circuit, go to next step.

4) If injector test light was on steady on an injector circuit, go to next step. If injector test light did not illuminate on an injector circuit, go to step 6).

5) Install injector test light to affected injector. Turn ignition off. Disconnect Blue and Red VCM connectors. Turn ignition on with engine off. If injector test light turns off, go to step 11). If injector test light stays on, go to step 8).

6) Check for open or short in battery circuit to affected injector. If circuit is open or shorted, go to next step. If circuit is okay, go to step 9).

7) Repair circuit as necessary. After repairs, go to step 12).

8) Repair short to ground in injector control circuit. After repairs, go to step 12).

9) Check terminal contact at VCM connector. If terminal contact is faulty, go to next step. If terminal contact is okay, go to step 11).

10) Repair terminal contact. After repairs, go to step 12).

11) Replace VCM. Reprogram replacement VCM. After replacing VCM, go to next step.

12) Using scan tool, select DTC, CLEAR INFO function. Attempt to start engine. If engine starts and continues to run, go to next step. If engine does not start, or starts and stalls/dies, go to step 2).

13) Warm engine to normal operating temperature. Using scan tool, select DTC, FAILED THIS IGN function. If other DTC(s) are present, diagnose affected DTC(s). If no other DTC(s) are present, go to next step.

14) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If additional undiagnosed DTC(s) are present, diagnose affected DTC(s). If DTC(s) are not present, system is okay.

BASIC IGNITION SYSTEM CHECKS

NOTE: To diagnose ignition system, see appropriate IGNITION SYSTEM test in NO-START DIAGNOSIS.

IDLE SPEED & IGNITION TIMING

Ensure idle speed and ignition timing are set to specifications. For specifications, see C - SPECIFICATIONS article. For adjustment procedures, see D - ADJUSTMENTS article.

ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK

NOTE: Use of Tech 1 scan tool is required to perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK.

The OBD System Check determines:

* If Malfunction Indicator Light (MIL) works.
* If PCM/VCM is operating and can recognize a fault.
* If any Diagnostic Trouble Codes (DTCs) are stored.

After performing procedures in PRELIMINARY INSPECTION & ADJUSTMENTS, BASIC FUEL SYSTEM CHECKS and BASIC IGNITION SYSTEM CHECKS, this is the starting point for utilizing the self-diagnostic system for determining computer-related problems. After performing necessary tests as described in the OBD system circuit check, if no codes are indicated and driveability problems still exist, see the H - TESTS W/O CODES article and SCAN TOOL usage in the G - TESTS W/CODES article.

1) Turn ignition on with engine off. Observe Malfunction Indicator Light (MIL). If MIL illuminates, go to next step. If MIL does not illuminate, go to MALFUNCTION INDICATOR LIGHT (MIL).

2) Turn ignition off. Install Tech 1 scan tool and follow scan tool manufacturer's instructions to proceed with test. Turn

ignition on. If scan tool displays VCM data, go to next step. If scan tool does not display VCM data, go to
DLC DIAGNOSIS OR NO SCAN TOOL DATA.

3) Using scan tool, command MIL to turn off. If MIL turns off, go to next step. If MIL does not turn off, go to
MALFUNCTION INDICATOR LIGHT (MIL).

4) Using scan tool, observe DTC status for MIL REQUEST, FAIL THIS IGN, LAST TST FAIL and HISTORY. If any DTC is stored, save freeze frame and fail record information using scan tool CAPTURE INFO feature. If any of these DTC status are present, refer to affected DTC to diagnose problem. If DTC(s) are not present, go to next step.

5) Crank engine for 10 seconds. If engine starts, go to next step. If engine does not start, go to NO-START DIAGNOSIS.

6) Compare scan tool engine data with actual control system data values. If value is within limits, go to the H - TESTS W/O CODES article. If value is not within limits, go to the I - SYSTEM/COMPONENT TESTS article.

MALFUNCTION INDICATOR LIGHT (MIL)

1) Perform On-Board Diagnostic (OBD) System Check. See
ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. After performing OBD system check, go to next step.

2) Turn engine off for 15 seconds. Turn ignition on with engine off. If Malfunction Indicator Light (MIL) illuminates, go to step 4). If MIL does not illuminate, go to next step.

3) Start engine. If engine starts, go to step 6). If engine does not start, go to step 7).

4) Install Tech 1 scan tool. Turn ignition on. Using scan tool, command MIL to turn on and off. If MIL turns on and off as commanded, go to step 25). If MIL does not turn on and off as commanded, go to next step.

5) Turn ignition off. Disconnect VCM harness connectors. Turn ignition on. If Malfunction Indicator Light (MIL) illuminates, go to step 19). If MIL does not illuminate, go to step 11).

6) Turn ignition off. Disconnect VCM harness connectors. Turn ignition on. Using a fused jumper connected to ground, probe VCM harness connector MIL control circuit. See the L - WIRING DIAGRAMS article. If MIL illuminates, go to step 11). If MIL does not illuminate, go to step 8).

7) Check for open in ignition and battery fuses. If fuses are okay, go to step 9). If fuse(s) is open, go to step 10).

8) Check for open in fused jumper. If fused jumper is okay, go to step 13). If fused jumper is open, go to step 14).

9) Turn ignition off. Disconnect VCM harness connectors. Turn ignition on. Using a test light connected to ground, probe VCM harness connector ignition feed circuit. See the L - WIRING DIAGRAMS article. If test light illuminates, go to step 18). If test light does not illuminate, go to step 20).

10) Check for short to ground in fuse circuit that was open. Repair as necessary and replace fuse. After repairs, go to step 25).

11) Check for faulty VCM connections. If connections faulty okay, go to step 23). If connections are okay, go to step 24).

12) Repair open in ignition feed circuit. After repairs, go to step 25).

13) Repair short to voltage in MIL control circuit. After repairs, go to step 25).

14) Check for open in MIL control circuit. See the L - WIRING DIAGRAMS article. Repair as necessary. After repairs, go to step 23). If circuit is okay, go to next step.

15) Check for open in ignition feed circuit or fuse to MIL. See the L - WIRING DIAGRAMS article. Repair as necessary. After repairs, go to step 23). If circuit or fuse is okay, go to next step.

16) Check for an open MIL bulb. If light bulb is faulty, go to step 23). If light bulb is okay, go to next step.

17) Replace instrument panel assembly. After replacing instrument panel, go to step 25).

18) Turn ignition off. Disconnect VCM harness connectors. Turn ignition on. Using test light connected to ground, probe VCM harness connector battery feed circuit. See the L - WIRING DIAGRAMS article. If test light illuminates, go to step 21). If test light does not illuminate, go to step 22).

19) Repair short to ground in MIL control circuit. After repairs, go to step 25).

20) Repair open in ignition feed circuit. After repairs, go to step 25).

21) Check for faulty VCM ground connection at engine block. Repair as necessary. After repairs, go to step 23). If connections were okay, go to step 11).

22) Repair open in battery feed circuit. After repairs, go to step 25).

23) Repair as necessary. After repairs, go to step 25).

24) Replace VCM. Perform VCM relearn procedures. After repairs, go to next step.

25) Warm engine to normal operating temperature. Check if any DTC(s) are set. Diagnose any DTC present. See the G - TESTS W/CODES article. If DTC(s) are not present, system is okay.

DLC DIAGNOSIS OR NO SCAN TOOL DATA

1) Perform On-Board Diagnostic (OBD) System Check. See ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. After performing OBD system check, go to next step.

2) Using a test light connected to ground, probe DLC battery feed circuit. See the L - WIRING DIAGRAMS article. If test light illuminates, go to next step. If test light does not illuminate, go to step 11).

3) Using a test light connected to battery voltage, probe DLC ground circuit. See the L - WIRING DIAGRAMS article. If test light illuminates on both circuits, go to next step. If test light does not illuminate on both circuits, go to step 12).

4) Check cigarette lighter for power. If power is present at cigarette lighter, go to next step. If power is not present at cigarette lighter, go to step 13).

5) Install and check scan tool operation on another vehicle. If scan tool operates, go to next step. If scan tool does not operate, go to step 14).

6) Using DVOM connected to ground, measure voltage of DLC serial data line circuit. See the L - WIRING DIAGRAMS article. If voltage is less than 7 volts, go to next step. If voltage is more than 7 volts, go to step 16).

7) Using DVOM connected to ground, again measure voltage of DLC serial data line circuit. If voltage is less than one volt, go to next step. If voltage is more than one volt, go to step 16).

8) Turn ignition off. Using DVOM connected to ground, measure resistance of DLC serial data line circuit. If resistance is less than 10 milliohms, go to next step. If resistance is more than 10 milliohms, go to step 10).

9) Disconnect VCM connectors. Using DVOM connected to ground, measure resistance of DLC serial data line circuit. If resistance is less than 10 milliohms, go to step 17). If resistance is more than 10 milliohms, go to step 15).

10) Repair open in serial data line circuit. After repairs, go to step 18).

11) Repair open in DLC battery feed circuit. After repairs, go to step 18).

12) Repair open in circuit that did not cause test light to illuminate. After repairs, go to step 18).

13) Repair cigarette lighter. After repairs, go to step 18).

14) Repair or replace faulty scan tool and/or cables. After repairs, go to step 18).

15) Repair short to ground in serial data line circuit. After repairs, go to step 18).

16) Repair short to voltage in serial data line circuit. After repairs, go to step 18).

17) Replace VCM. Reprogram replacement VCM. After replacing VCM, go to next step.

18) Using scan tool, select DTC, CLEAR INFO function. Attempt to start engine. If engine starts and continues to run, go to next step. If engine does not start, or starts and dies/stalls, go to step 2).

19) Warm engine to normal operating temperature. Using scan tool, select DTC, FAILED THIS IGN function. If any DTC(s) are present, diagnose DTC. See the G - TESTS W/CODES article. If DTC(s) are not present, go to next step.

20) Select CAPTURE INFO, REVIEW INFO function. If additional DTC(s) are displayed, diagnose DTC. See the G - TESTS W/CODES article. If DTC(s) are not present, system is okay.

SUMMARY

If no faults were found while performing BASIC DIAGNOSTIC PROCEDURES, no trouble codes (or only intermittent ones) were found while performing ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK and driveability problems exist, proceed to the H - TESTS W/O CODES article for diagnosis by symptom (i.e., ROUGH IDLE, NO-START, etc.) or intermittent diagnostic procedures.

* BRAKE SYSTEM UNIFORM INSPECTION GUIDELINES *

1997 Chevrolet Blazer

GENERAL INFORMATION
Brake Systems - Motorist Assurance Program
Standards For Automotive Repair

All Makes & Models

CONTENTS

SHOE HARDWARE
SHOES
SOCKETS
SPEED SENSORS (ELECTRONIC WHEEL AND VEHICLE)
STEEL BRAKE LINES
STOPLIGHT SWITCHES
SWITCHES
TIRES
TOOTHED RINGS (TONE WHEEL)
VACUUM BOOSTERS
VACUUM HOSES
VALVES
WHEEL ATTACHING HARDWARE
WHEEL BEARINGS, RACES AND SEALS
WHEEL CYLINDERS
WIRING HARNESSES

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.

BRAKES

SERVICE PROCEDURES REQUIRED & SUGGESTED FOR PROPER VEHICLE OPERATION

Some states may have specifications that differ from OEM. Check your local/state regulations. Where state or local laws are stricter, they take precedence over these guidelines.

ACCELEROMETERS (G SENSOR OR LATERAL)

ACCELEROMETER INSPECTION

Condition	Code	Procedure
Broken	A	Require replacement.
Connector loose	A	Require repair or replacement.
Loose	B	Require repair or replacement.
Missing	C	Require replacement.
Out of position	B	Require re-positioning to vehicle manufacturer's specifications.
Output signal incorrect	B	Require replacement.

ACCUMULATORS

ACCUMULATOR INSPECTION

Condition	Code	Procedure
Leaking	B	Require replacement.
Missing	C	Require replacement.
Pre-charge incorrect	B	Require replacement.

ANCHOR PINS

See BACKING PLATES.

ANTI-LOCK BRAKE SYSTEMS

NOTE: Anti-lock brakes are an integral part of the brake system. It is essential that the anti-lock brakes function properly when brake service is performed.

Anti-lock brake systems are commonly referred to as "ABS" and will be referred to as "ABS" throughout these guidelines. Some ABS components also function as part of a traction control system (TCS).

WARNING: When diagnosing and servicing high pressure components, observe safety procedures and equipment requirements established by the vehicle manufacturer to reduce the possibility of serious personal injury.

NOTE: Intermittent electrical conditions are often caused by a loss of ground, poor connection, or water intrusion into the wiring harness.

NOTE: Electro-magnetic interference (EMI) may be caused by incorrect installation of accessories or components. EMI can result in improper system operation.

BACKING PLATES

BACKING PLATE INSPECTION

Condition	Code	Procedure
Anchor pin bent	B	.. Require repair or replacement.
Anchor pin broken	A	.... Require replacement.
Anchor pin worn, affecting structural integrity ...	B	.... Require replacement.
Backing plate bent	B	.. Require repair or replacement.
Backing plate broken	A	.... Require replacement.
Backing plate cracked ...	B	.. Require repair or replacement.
Corroded, affecting structural integrity	A	.... Require replacement.
Loose	B	.. Require repair or replacement.
Missing	C	.... Require replacement.
Shoe lands worn	A	.. Require repair or replacement.

BRAKE FLUID

CAUTION: Most manufacturers prohibit the use of DOT 5 brake fluid in a system equipped with ABS.

DOT 3, DOT 4, and DOT 5.1 brake fluids are clear or light amber in color. DOT 5 brake fluid is violet in color. Correct fluid required for the brake system is stamped on the master cylinder cover.

BRAKE FLUID INSPECTION

Condition	Code	Procedure
Beyond service interval .	3	.. Suggest flushing and refilling with correct fluid.
Brake fluid type incorrect	B	.. Require flushing and refilling with correct fluid.
Contaminated, for example, fluid other than brake fluid present	A or B	.... (1) Require service.
Hydraulic component ..... overhaul or replacement	3	.. Suggest flushing and refilling with correct fluid.
Rubber master cylinder cover gasket distorted and gummy	A	.... (2) Require replacement of gasket.

(1) - If a fluid other than brake fluid is present in the brake system which DOES affect the rubber parts, the required service is to:

* Remove all components having rubber parts from the system.
* Flush lines with denatured alcohol or brake cleaner
* Repair or replace all components having rubber parts
* Flush and fill with correct brake fluid. (Code A)

If a fluid other than brake fluid is present in the brake system which DOES NOT affect the rubber parts, the required service is to flush and fill with the correct brake fluid. (Code B)

(2) - This condition may indicate contaminated brake fluid.

BRAKE FRICTION MATERIAL

See FRICTION MATERIAL.

BRAKE PADS

See FRICTION MATERIAL.

BRAKE PEDALS

BRAKE PEDAL INSPECTION

Condition	Code	Procedure
Bent, affecting performance	A	Require repair or replacement.
Broken	A	Require repair or replacement.
Pedal pad missing	C	Require replacement of pedal pad.
Pedal pad worn	1	Suggest replacement.
Pivot bushings worn, affecting performance	A	Require replacement of pivot bushings.

BRAKE SHOES

See FRICTION MATERIAL.

BRAKE SHOE HARDWARE

See also SELF-ADJUSTING SYSTEMS.

BRAKE SHOE HARDWARE INSPECTION

Condition	Code	Procedure
Broken	A	Require replacement.
Distorted	A	Require replacement.
Missing	C	Require replacement.
Surfaces rust-pitted	1	Suggest replacement.
Worn, affecting performance	A	Require replacement.

BRAKE STOPLIGHT SWITCHES

BRAKE STOPLIGHT INSPECTION

Condition	Code	Procedure
Bent	B	Require replacement.
Broken	A	Require replacement.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.

Connector melted	A	.... (1) Require replacement.
Connector missing	C	.... Require replacement.
Missing	C	.... Require replacement.
Out of adjustment	B	.... Require adjustment or replacement.
Output signal incorrect .	B	.... Require replacement.
Terminal burned, affecting performance	A	.... (2) Require repair or replacement.
Terminal burned, not affecting performance ..	2	.. Suggest repair or replacement.
Terminal corroded, affecting performance ...	A	.. Require repair or replacement.
Terminal corroded, not affecting performance ...	2	.. Suggest repair or replacement.
Terminal loose, affecting performance	B	.. Require repair or replacement.
Terminal loose, not affecting performance ...	1	.. Suggest repair or replacement.
Threads damaged	A	.. Require repair or replacement.
Threads stripped (threads missing)	A	.... Require replacement.

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

BULB SOCKETS

BULB SOCKET INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	... Require repair or replacement of hardware.
Attaching hardware missing	C	.... Require replacement of hardware.
Attaching hardware not functioning	A	... Require repair or replacement of hardware.
Broken	A	.. Require repair or replacement.
Bulb seized in socket ...	A	.. Require repair or replacement.
Burned, affecting performance	A	.... (1) Require repair or replacement.
Burned, not affecting performance	2	.... (1) Suggest repair or replacement.
Connector broken	A	.. Require repair or replacement.
Connector missing	C	.... Require replacement.
Connector (Weatherpack type) leaking	A	.. Require repair or replacement.
Connector melted	A	.... (2) Require repair or replacement.
Corroded, affecting performance	A	.. Require repair or replacement.
Corroded, not affecting performance	2	.. Suggest repair or replacement.
Leaking	A	.. Require repair or replacement.
Melted	A	.... (2) Require replacement.

Shorted	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(2) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.

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

BULBS AND LEDS

NOTE: Copied from Electrical UIGs and modified. Does not include soldered-in components.

BULB AND LED INSPECTION

Condition	Code	Procedure
Application incorrect	B	(1) Require replacement.
Base burned, affecting performance	A	(2) Require repair or replacement.
Base burned, not affecting performance	2	(2) Suggest repair or replacement.
Base corroded, affecting performance	A	Require repair or replacement.
Base corroded, not affecting performance	2	Suggest repair or replacement.
Base loose, affecting performance	B	Require repair or replacement.
Base loose, not affecting performance	1	Suggest repair or replacement.
Burned out	A	Require replacement.
Intermittent	A	Require replacement.
Missing	C	Require replacement.
Seized in socket	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(2) Require repair or replacement.
Terminal burned, not affecting performance	2	(2) Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.

Terminal loose, not affecting performance	1	Suggest repair or replacement.

(1) - Application incorrect includes wrong bulb coating or color.
(2) - Determine cause and correct prior to repair or replacement of part.

CALIPER HARDWARE

CALIPER HARDWARE INSPECTION

Condition	Code	Procedure
Bent	A	Require repair or replacement.
Broken	A	Require repair or replacement.
Corroded, affecting performance	A	Require repair or replacement.
Dust boots on slider pin (bolt) missing	C	Require replacement of boots.
Dust boots on slider pin (bolt) torn	A	Require replacement of boots.
Missing	C	Require replacement.
Shim bent	A	(1) Require removal or replacement.
Shim (OE standard) missing	C	(2) Require replacement.
Shim out of position	B	(1) Require removal or replacement.
Shim worn	A	(1) Require removal or replacement.
Slider pin (bolt) bent	B	Require replacement of slider pin or bolt and lubricants.
Slider pin (bolt) rust-pitted	A	Require replacement of slider pin or bolt and lubricants.
Slider pin (bolt) worn	A	Require replacement of slider pin or bolt and lubricants.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Worn, affecting performance	A	Require replacement.

(1) - Removal is acceptable if shim is not OE.
(2) - Aftermarket shims may be suggested to reduce noise.

CALIPERS

You are not required to replace or rebuild calipers in axle sets. However, when replacing or rebuilding a caliper due to the conditions that follow, you may suggest servicing, rebuilding, or replacement of the other caliper (on the same axle) for improved performance and preventive maintenance (for example, the part is close to the end of its useful life, replacing the caliper may extend pad life, or contribute to more balanced braking).

CAUTION: When installing loaded calipers, it is required that friction material be matched in axle sets for consistent braking characteristics.

CALIPER INSPECTION

Condition	Code	Procedure
Bleeder port damaged	A	Require repair or replacement of caliper.
Bleeder screw broken off in caliper	A	(1) Require repair or replacement of caliper.
Bleeder screw plugged	A	(1) Require repair or replacement of bleeder screw.
Bleeder screw seized	A	(2) Require replacement of caliper.
Casting corroded, affecting structural integrity	A	Require replacement.
Casting damaged, affecting structural integrity	A	Require replacement.
Dust boot around caliper torn	A	Require replacement of dust boot.
Leaking	A	Require repair or replacement.
Mounting pin threads damaged	A	Require repair or replacement of component with damaged threads.
Mounting pin threads stripped in caliper bracket (threads missing)	A	Require repair or replacement of caliper bracket.
Mounting pin threads stripped in steering knuckle (threads missing)	A	Require repair or replacement of steering knuckle.
Mounting pin threads stripped (threads missing)	A	Require repair or replacement of component with stripped threads.
Parking brake cable support, lever, or return spring bent	A	Require replacement of parts.
Parking brake cable support, lever, or return spring broken	A	Require replacement of parts.
Parking brake mechanism in caliper inoperative	A	Require repair or replacement.
Piston corroded (pitted or peeling chrome plating)	B	Require replacement of piston and rebuilding or replacement of caliper.
Piston damaged, affecting performance	B	Require replacement of piston and rebuilding or replacement of caliper.
Piston damaged, not affecting performance	..	No service suggested or required.
Piston finish worn off	B	Require replacement of piston and rebuilding or replacement

		of caliper.
Piston sticking	A	Require rebuilding or replacement of caliper.
Slide mechanism sticking	A	Require repair or replacement of slide mechanism.

(1) - Only required if the hydraulic system must be opened.
(2) - Seized is defined as a bleeder screw that cannot be removed after a practical attempt at removing. Only required if the hydraulic system must be opened.

CONTROLLERS

See ELECTRONIC CONTROLLERS.

DIGITAL RATIO AXLE CONTROLLERS AND BUFFERS (DRAC AND DRAB)

DIGITAL RATIO AXLE CONTROLLER AND BUFFER INSPECTION

Condition	Code	Procedure
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require replacement.
Connector missing	C	Require replacement.
Missing	C	Require replacement.
Output signal incorrect	B	Require repair or replacement.
Terminal burned, affecting performance	A	(2) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.

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

DISABLE SWITCHES

See SWITCHES.

DRUMS

Determine the need to recondition based upon individual drum conditions that follow. Friction material replacement does not require drum reconditioning unless other justifications exist. DO NOT recondition new drums unless they are being pressed or bolted onto an existing hub. It is not necessary to replace drums in axle sets. However, when replacing or reconditioning a drum due to the conditions that follow, you may suggest reconditioning of the other drum on the same axle to eliminate uneven braking behavior. Always wash drums after servicing or before installing.

DRUM INSPECTION

Condition	Code	Procedure
Balance weight missing	..	No service suggested or required.
Bell-mouthed, affecting performance	A	Require reconditioning or replacement.
Cooling fin broken	..	No service suggested or required.
Cracked	B	Require replacement.
Drum diameter is greater than OEM "machine to" specifications but less than "discard at" specifications, and the drum does not require reconditioning	1	(1) Suggest replacement.
Drum diameter will exceed OEM "machine to" specifications after required reconditioning	B	(2) Require replacement.
Hard-spotted	2	Suggest reconditioning or replacement.
Measured diameter is greater than OEM discard specifications	B	Require replacement.
Out-of-round (runout), affecting performance	A	Require reconditioning or replacement.
Out-of-round (runout), exceeding manufacturer's specifications	B	Require reconditioning or replacement.
Scored	B	Require reconditioning or replacement.
Surface threaded due to improper machining	B	Require reconditioning or replacement.
Tapered, affecting performance	A	Require reconditioning or replacement.

(1) - Only applies to vehicles for which OEM "machine to" specifications exist. If OEM does not supply "machine to" specifications, the drum may be worn to discard specifications.
(2) - If OEM does not supply "machine to" specifications, you may machine to discard specifications.

ELECTRICAL PUMPS AND MOTORS

Copied fuel pump conditions from engine UIGs & deleted pulsator from leaking conditions.

ELECTRICAL PUMP AND MOTOR INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require replacement.
Inoperative	A	(3) Require repair or replacement.
Leaking externally	A	Require repair or replacement.
Leaking internally	A	Require repair or replacement.
Noisy	2	Suggest repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specifications.

ELECTRONIC CONTROLLERS

ELECTRONIC CONTROLLER INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Attaching hardware missing	C	Require replacement of

		hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Code set (if applicable)	A	(1) Further inspection required.
Connector broken	A	Require repair or replacement.
Connector melted	A	(2) Require repair or replacement.
Connector missing	A	Require repair.
Contaminated	A	Require repair or replacement.
Inoperative	B	Require repair or replacement. (3) Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(2) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Refer to manufacturer's diagnostic trouble code procedure and require repair or replacement of affected component(s).
(2) - Determine cause and correct prior to repair or replacement of part.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable. Check for accepted cleaning procedure.

FLUID

See BRAKE FLUID.

FLUID LEVEL SENSOR SWITCHES

See SWITCHES.

FOUR WHEEL DRIVE SWITCHES

See SWITCHES.

FRICTION MATERIAL

NOTE: Original Equipment Manufacturer (OEM) specifications designate replacement at different thicknesses.

CAUTION: It is required that friction material be matched in axle sets for consistent braking characteristics.

FRICTION MATERIAL INSPECTION

Condition	Code	Procedure
Contaminated, for example, fluid that leaked from caliper, wheel cylinder, or axle seal	A	(1) Require replacement.
Cracked through	B	Require replacement.
Flaking or chunking	B	Require replacement.
Glazed (shiny)	..	No service suggested or required.
Grooves or ridges	..	(2) No service suggested or required.
Permanently attached hardware bent	A	Require replacement.
Permanently attached hardware broken	A	Require replacement.
Permanently attached hardware loose	A	Require replacement.
Permanently attached hardware missing	C	Require replacement.
Permanently attached hardware seized	A	Require repair or replacement.
Rivets loose	B	Require replacement.
Separating from backing	B	Require replacement.
Shoe table or web bent	B	Require replacement.
Shoe table or web cracked	A	Require replacement.
Shoe table or web worn, affecting performance	A	Require replacement.
Surface cracking	..	No service suggested or required. Further inspection may be necessary to determine cause.
Tapered wear	B	(3) Suggest replacement.
Thickness of one pad is greater than opposite pad in the same caliper (uneven wear)	..	(4) Replacement of friction material not suggested or required. Further inspection required. See CALIPERS and CALIPER HARDWARE.
Wear indicator device (electronic) contacts rotor	B	(5) Require replacement of appropriate parts.
Wear indicator device (mechanical) bent	..	(6) Further inspection required.
Wear indicator device (mechanical) broken	..	(6) Further inspection required.

Wear indicator device (mechanical) contacts rotor		(6) Further inspection required.
Worn close to minimum specifications	1	(7) Suggest replacement.
Worn to, or below minimum specifications	B	Require replacement.

(1) - Identify and repair cause of contamination prior to replacing friction material.
(2) - When reconditioning or replacing drums or rotors, replacement of friction material may be suggested depending on the severity of the grooves or ridges.
(3) - Some vehicles use pads that are tapered by design. Refer to specific vehicle application. If not normal, require replacement of pads and correction of cause.
(4) - Uneven pad thickness is normal on some vehicles. Refer to specific vehicle applications.
(5) - The pad wear indicator light may come on due to other electrical problems.
(6) - Explain to the customer that the purpose of the wear indicator is to alert him or her to check for friction wear. Wear indicators may be bent or broken. Therefore, the friction material must be measured. The need for friction material replacement is determined based upon the conditions stated in this section. Periodic inspection is suggested.
(7) - When the part appears to be close to the end of its useful life, replacement may be suggested.

G SENSORS

See ACCELEROMETERS.

HOSES

HOSE INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Blistered	B	Require replacement.
Fitting threads damaged	A	Require repair or replacement.
Fitting threads stripped (threads missing)	A	Require replacement.
Incorrectly secured	B	Require repair.
Inner fabric (webbing) cut	B	Require replacement.
Leaking	A	Require replacement.
Missing	C	Require replacement.
Outer covering is cracked to the extent that inner fabric of hose		

is visible	B	Require replacement.
Restricted	A	Require replacement.
Routed incorrectly	B	Require repair.

HYDRAULIC MODULATORS

NOTE: Many modulators can only be replaced as complete assemblies. Whenever possible, replace the failed component part. If replacement of the failed part is not possible, then replace the modulator assembly.

HYDRAULIC MODULATOR INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require replacement.
Connector missing	C	Require replacement.
Disabled	A	Require repair or replacement.
Electrical failure	A	Require repair or replacement.
External leak	A	Require repair or replacement.
Housing cracked	B	Require repair or replacement.
Inoperative (2)	A	Require repair or replacement.
Internal leak	A	Require repair or replacement.
Missing	C	Require replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Valve stuck	A	Require repair or replacement.
Wire lead burned	A	Require repair or replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

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

HYDRO-BOOSTERS

NOTE: Hydro-boosters and hydro-electric boosters are combined.

HYDRO-BOOSTER INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require replacement.
Connector missing	C	Require replacement.
Does not apply assist, or inadequate assist	A	Require repair or replacement.
Leaking	B	Require repair or replacement.
Leaks fluid at fitting	B	Require tightening or replacement.
Leaks fluid at unit	B	Require repair or replacement.
Leaks fluid from pressure hose(s)	B	Require replacement of hose(s).
Leaks fluid into passenger compartment	B	Require repair or replacement.
Threads damaged	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

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

HYDRO-ELECTRIC BOOSTERS (POWERMASTER)

See HYDRO-BOOSTERS.

IGNITION DISABLE SWITCHES

See SWITCHES.

LATERAL ACCELERATION SWITCHES

See ACCELEROMETERS.

LEDS

See BULBS AND LEDS.

LENSES

LENSE INSPECTION

Condition	Code	Procedure
Application incorrect	A	Require replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Broken, affecting performance	A	Require replacement.
Broken, not affecting performance	..	No service suggested or required.
Cracked	A	Require replacement.
Discolored	A	Require replacement.
Leaking	A	Require repair or replacement.
Melted, affecting performance	A	Require replacement.
Melted, not affecting performance	2	Suggest replacement.
Missing	C	Require replacement.

MASTER CYLINDERS

MASTER CYLINDER INSPECTION

Condition	Code	Procedure
Brake fluid leaking from rear of master cylinder bore	B	Require repair or replacement.
Brake pedal drops intermittently	A	(1) Require repair or replacement.
Fluid level low	..	(2) Further inspection required.
Internal valve failure	A	Require repair or replacement.
Master cylinder leaking brake fluid internally	A	Require repair or replacement.
Piston does not return	A	Require repair or replacement.
Ports plugged	A	Require repair or replacement.
Rubber master cylinder cover gasket distorted and gummy	A	(3) Require replacement of the gasket.

(1) - This condition may be normal on some vehicles equipped with anti-lock brakes.
(2) - Refer to OEM procedures for adjusting low fluid level. Inspect for brake hydraulic system leaks and friction material wear.
(3) - This condition may indicate contaminated brake fluid. See BRAKE FLUID.

MODULATORS

See HYDRAULIC MODULATORS.

MOTORS

See ELECTRICAL PUMPS AND MOTORS.

PARKING BRAKE SWITCHES

See SWITCHES.

PARKING BRAKE SYSTEMS

NOTE: The parking brake is an integral part of the brake system. It is important that the parking brake function properly when brake service is performed.

PARKING BRAKE SYSTEM INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Cable improperly adjusted	B	Require cable adjustment.
Cable or individual wires in the cable are broken	A	Require replacement of cable assembly.
Cable sticking	A	Require cable lubrication.
Cable stuck inside conduit and cannot be lubricated so that parking brake functions properly	A	Require replacement of cable assembly.
Inoperative (1)	A	Require replacement of inoperative parts.
Parking brake parts bent	B	Require repair or replacement of bent parts.
Parking brake parts broken	A	Require replacement of broken parts.
Parking brake parts		

missing	C	.. Require replacement of missing parts.
Threads damaged	A	.. Require repair or replacement.
Threads stripped (threads missing)	A	.... Require replacement.

(1) - Inoperative includes intermittent operation.

PADS

See FRICTION MATERIAL.

PEDAL TRAVEL SWITCHES

See SWITCHES.

PEDALS

See BRAKE PEDALS.

POWERMASTER

See HYDRO-BOOSTERS.

PUMPS

See ELECTRICAL PUMPS AND MOTORS.

PRESSURE DIFFERENTIAL SWITCHES

See SWITCHES.

PRESSURE SWITCHES

See SWITCHES.

RELAYS

NOTE: Copied from Electrical UIGs

RELAY INSPECTION

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

Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.

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

ROTORS

Determine the need to recondition based upon individual rotor conditions that follow. Friction material replacement does not require rotor reconditioning unless other justifications exist. DO NOT recondition new rotors unless they are being pressed or bolted onto an existing hub. It is not necessary to replace rotors in axle sets. However, when replacing or reconditioning a rotor due to the conditions that follow, you may suggest reconditioning of the other rotor on the same axle to eliminate uneven braking behavior.

Determine the need to replace based upon the individual rotor conditions that follow. Reconditioning is defined as machining and block sanding, or block sanding only. Block sanding is defined as using 120-150 grit sandpaper with moderate to heavy force for 60 seconds per side. Always wash rotors after servicing or before installing.

ROTOR INSPECTION

Condition	Code	Procedure
Corrosion affecting structural integrity	A	(1) Require replacement.
Cracked	B	Require replacement.
Hard spots	2	Suggest reconditioning or replacement of rotor according to OEM specifications.
Lateral runout (wobble) exceeds OEM specifications	B	Require re-indexing, reconditioning, or replacement according to specifications.
Measured thickness is less than OEM discard specifications	B	Require replacement.
Rotor thickness is less than OEM "machine to" specifications but thicker than "discard at" specifications, and the rotor does not require reconditioning	1	(2) Suggest replacement.
Rotor thickness will be less than OEM "machine to" specifications after required		

reconditioning	B	(3) Require replacement.
Surface is rust-pitted	B	Require reconditioning or replacement of rotor according to OEM specifications.
Surface is scored	B	(4) Require reconditioning or replacement of rotor according to OEM specifications.
Thickness variation (parallelism) exceeds OEM specifications	B	Require reconditioning or replacement of rotor according to OEM specifications.

(1) - Examples of severe corrosion are: composite plate separated from friction surfaces and cooling fins cracked or missing.
(2) - Only applies to vehicles for which OEM "machine to" specifications exist. If OEM does not supply "machine to" specifications, the rotor may be worn to discard specifications.
(3) - If OEM does not supply "machine to" specifications, you may machine to discard specifications.
(4) - Scoring is defined as grooves or ridges in the friction contact surface. Some vehicle manufacturers require machining when scoring exceeds their allowable specifications.

SELF-ADJUSTING SYSTEMS

SELF-ADJUSTING SYSTEM INSPECTION

Condition	Code	Procedure
Bent	A	Require repair or replacement of bent part.
Broken	A	Require repair or replacement of broken part.
Inoperative	A	(1) Require repair or replacement of inoperative parts.
Missing	C	Require replacement of missing part.
Star wheel does not turn freely	A	Require repair or replacement.

(1) - Inoperative includes intermittent operation.

SHOE HARDWARE

See BRAKE SHOE HARDWARE.

SHOES

See FRICTION MATERIAL.

SOCKETS

See BULB SOCKETS.

SPEED SENSORS (ELECTRONIC WHEEL AND VEHICLE)

NOTE: Copied Vehicle Speed Sensors from Engine UIGs & added Air Gap incorrect, loose, and wire lead misrouted. For "contaminated" removed coolant & fuel examples from note.

SPEED SENSOR INSPECTION

Condition	Code	Procedure
Air gap incorrect	B	(1) Require adjustment or replacement.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(2) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(3) Require repair or replacement.
Inoperative	B	(4) Require repair or replacement. Further inspection required.
Lead routing incorrect	B	Require rerouting according to vehicle manufacturer's specifications.
Leaking	A	Require repair or replacement.
Loose	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Sensor housing cracked	2	Suggest replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(2) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead misrouted	B	Require re-routing according to vehicle manufacturer's

		specifications.
Wire lead open	A	.. Require repair or replacement.
Wire lead shorted	A	.. Require repair or replacement.

(1) - If a sensor is not adjustable, further inspection is required to identify and correct cause.
(2) - Determine cause and correct prior to repair or replacement of part.
(3) - Determine source of contamination, such as metal particles or water. Require repair or replacement.
(4) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

STEEL BRAKE LINES

STEEL BRAKE LINE INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	... Require repair or replacement of hardware.
Attaching hardware missing	C	.... Require replacement of hardware.
Attaching hardware not functioning	A	... Require repair or replacement of hardware.
Corroded, affecting structural integrity ...	A	.... Require replacement.
Fitting incorrect (for example, compression fitting)	B	.... Require replacement.
Flare type incorrect	B	.. Require repair or replacement.
Leaking	A	.. Require repair or replacement.
Line material incorrect (copper, etc.)	B	.... Require replacement.
Restricted	A	.... Require replacement.
Routed incorrectly	B	..... Require routing correction.
Rust-pitted	1	.... Suggest replacement.
Threads damaged	A	.. Require repair or replacement.
Threads stripped (threads missing)	A	.... Require replacement.

STOPLIGHT SWITCHES

See BRAKE STOPLIGHT SWITCHES.

SWITCHES

NOTE: Copied from Electrical UIGs & added "float saturated" from old fluid level sensor switches.

STEEL BRAKE LINE INSPECTION

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

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Binding, affecting performance	A	Require repair or replacement.
Binding, not affecting performance	2	Suggest repair or replacement.
Broken	A	Require repair or replacement.
Burned, affecting performance	A	(1) Require repair or replacement.
Burned, not affecting performance	2	(1) Suggest repair or replacement.
Cracked, affecting performance	A	Require repair or replacement.
Cracked, not affecting performance	1	Suggest repair or replacement.
Float saturated	A	Require replacement.
Leaking	A	Require repair or replacement.
Malfunctioning	A	(2) Require repair or replacement.
Melted, affecting performance	A	(1) Require repair or replacement.
Melted, not affecting performance	2	(1) Suggest repair or replacement.
Missing	C	Require replacement.
Out of adjustment	B	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Won't return	A	Require repair or replacement.
Worn	1	Suggest replacement.

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

TIRES

Consult the vehicle owner's manual or vehicle placard for correct size, speed ratings, and inflation pressure of the original tires.

TIRE INSPECTION

Condition	Code	Procedure
Tire diameter incorrect, affecting ABS or TCS	A	Require replacement.
Tire pressure incorrect, affecting ABS or TCS	A	Require repair or replacement.
Tire size incorrect, affecting ABS or TCS	A	Require replacement.

TOOTHED RINGS (TONE WHEEL)

NOTE: Copied from Drivetrain UIGs.

If the toothed ring requires replacement and cannot be replaced as a separate component, replace the assembly of which the ring is a part.

TOOTHED RING INSPECTION

Condition	Code	Procedure
Alignment incorrect	B	Require repair or replacement.
Bent	B	Require replacement.
Contaminated, affecting performance	A	Require repair. Identify and correct cause.
Cracked	B	Require replacement.
Loose	A	Require replacement of worn parts.
Missing	C	Require replacement.
Number of teeth incorrect	B	Require replacement.
Teeth broken	A	Require replacement.
Teeth damaged, affecting performance	A	Require replacement.

VACUUM BOOSTERS

VACUUM BOOSTER INSPECTION

Condition	Code	Procedure
Applies too much assist (oversensitive)	A	Require replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Auxiliary vacuum pump inoperative	A	(1) Require repair or replacement.
Check valve grommet deteriorated, affecting performance	A	Require replacement of grommet.

Condition	Code	Procedure
Check valve grommet deteriorated, not affecting performance	1	Suggest replacement of grommet.
Check valve inoperative	A	(2) Require repair or replacement.
Check valve leaking	A	Require replacement of check valve.
Check valve missing	C	Require replacement of check valve.
Check valve noisy	2	Suggest replacement.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(3) Require replacement.
Connector missing	C	Require replacement.
Leaking	A	Require replacement.
Terminal burned, affecting performance	A	(3) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Vacuum hose filter leaking	A	Require replacement of filter.
Vacuum hose filter restricted	A	Require replacement of filter.
Wire lead burned	A	Require repair or replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

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

VACUUM HOSES

See HOSES.

VALVES

VALVE INSPECTION

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

		hardware.
Attaching hardware not functioning	A	... Require repair or replacement of hardware.
Leaking	B	.. Require repair or replacement.
Linkage bent (rear load valves)	A	... Require repair or replacement of linkage.
Linkage broken (rear load valves)	A	... Require repair or replacement of linkage.
Linkage disconnected (rear load valves)	C	... Require repair or replacement of linkage.
Pressure out of specification	B	...... Require adjustment. If not possible, require replacement.
Seized	A	.... Require replacement.
Sticking	A	.. Require repair or replacement.
Terminal burned, affecting performance ..	A	.... (1) Require repair or replacement.
Terminal burned, not affecting performance ..	2	.. Suggest repair or replacement.
Terminal corroded, affecting performance ..	A	.. Require repair or replacement.
Terminal corroded, not affecting performance ..	2	.. Suggest repair or replacement.
Terminal loose, affecting performance	B	.. Require repair or replacement.
Terminal loose, not affecting performance ..	1	.. Suggest repair or replacement.
Threads damaged	A	.. Require repair or replacement.
Threads stripped (threads missing)	A	.... Require replacement.
Wire lead burned	A	.. Require repair or replacement.
Wire lead conductors exposed	B	.. Require repair or replacement.
Wire lead open	A	.. Require repair or replacement.
Wire lead shorted	A	.. Require repair or replacement.

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

WHEEL ATTACHING HARDWARE

For conditions noted below, also check condition of wheel stud holes.

CAUTION: Proper lug nut torque is essential. Follow manufacturer's torque specifications and tightening sequence. DO NOT lubricate threads unless specified by the vehicle manufacturer.

WHEEL ATTACHING HARDWARE INSPECTION

Condition	Code	Procedure
Bent	A	.... Require replacement.
Broken	A	.... (1) Require replacement.
Loose	B	... Require repair or replacement of affected component.

Lug nut flats rounded ...	A	..... Require replacement of nut.
Lug nut installed backward	B	.... Require repair.
Lug nut mating surface dished	A	..... Require replacement of nut.
Lug nut mating type incorrect	B	..... Require replacement of nut.
Lug nut seized	A	...... Require replacement of nut and/or stud.
Stud incorrect	B	.... Require replacement of stud.
Threads damaged	A	... Require repair or replacement of component with damaged threads.
Threads stripped (threads missing)	A	.... Require replacement of component with stripped threads.

(1) - Some manufacturers require replacement of all studs on any wheel if two or more studs or nuts on the same wheel are broken or missing.

WHEEL BEARINGS, RACES AND SEALS

NOTE: Grease seal replacement is required if seal is removed. You are not required to replace these components in axle sets. Determine the need to replace based upon the individual component conditions that follow.

WHEEL BEARINGS, RACES AND SEALS INSPECTION

Condition	Code	Procedure
Axle seal on drive axle leaking	A	. Require replacement of seal and inspection of axle, bearing, housing, and vent tube.
Bearing end-play exceeds specifications	B	.. Require adjustment of bearing, if possible. If proper adjustment cannot be obtained, require replacement of bearing assembly.
Bearing rollers, balls or races are worn, pitted, or feel rough when rotated as an assembly	B	.. Require replacement of bearing assembly.
Seal leaking	A	...... (1) Require replacement of seal and inspection of bearings.
Spindle worn	B	.. Require replacement of spindle and bearings.

(1) - Require inspection of mating and sealing surface and repair or replace as necessary. Check vent. A plugged vent may force fluid past the seal.

WHEEL CYLINDERS

You are not required to replace or rebuild wheel cylinders in axle sets. However, when rebuilding or replacing a wheel cylinder due to the conditions that follow, you may suggest rebuilding or replacement of the other wheel cylinder (on the same axle) for preventive maintenance, for example, the part is close to the end of its useful life.

Determine the need to rebuild or replace based upon the individual wheel cylinder conditions that follow.

WHEEL CYLINDER INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require replacement of bent parts.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware corroded, affecting structural integrity	A	Require replacement of corroded parts.
Attaching hardware loose	A	Require repair or replacement.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Bleeder port damaged (if non-repairable)	A	Require replacement.
Bleeder screw broken off in wheel cylinder (if non-repairable)	A	(1) Require replacement.
Bleeder screw plugged	A	(1) Require repair or replacement of bleeder screw.
Bleeder screw seized	A	(2) Require replacement.
Bore corroded (pitted)	B	Require replacement.
Bore grooved	A	Require replacement.
Bore oversized	B	Require replacement.
Dust boot missing	C	Require replacement of dust boot.
Dust boot torn	A	(3) Require replacement of dust boot.
Leaking	A	(4) Require rebuilding or replacement.
Piston corroded, affecting performance	B	Require replacement of piston and rebuilding or replacement of wheel cylinder.
Piston finish worn off	B	Require replacement of piston and rebuilding or replacement of wheel cylinder.
Piston stuck in bore	A	Require replacement of wheel cylinder.
Loose	B	Require repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

(1) - Only required if the hydraulic system must be opened.
(2) - Seized is defined as bleeder screw that cannot be removed after a practical attempt at removing. Only required if the hydraulic system must be opened.

(3) - Inspect for conditions related to wheel cylinder.
(4) - Leaking is defined as a drop or more. Dampness is normal.

WIRING HARNESSES

NOTE: Copied from Electrical UIGs.

WIRING HARNESS INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require repair or replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Insulation damaged, conductors exposed	A	Require repair or replacement.
Insulation damaged, conductors not exposed	1	Suggest replacement.
Open	A	Require repair or replacement.
Protective shield (conduit) melted	2	(1) Suggest repair or replacement.
Protective shield (conduit) missing	2	Suggest repair or replacement.
Resistance (voltage drop) out of specification	A	Require repair or replacement.
Routed incorrectly	B	Require repair.
Secured incorrectly	B	Require repair.
Shorted	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Voltage drop out of specification	A	Require repair or replacement.

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

1997 BRAKES
Disc & Drum - General Motors

Chevrolet; Blazer, "S" & "T" Series Pickup
Oldsmobile; Bravada
GMC; Jimmy, Sonoma

NOTE: Information in this article also applies to vehicles equipped with Anti-Lock Brake System (ABS); however, not all information on ABS is included in this article. See ANTI-LOCK BRAKE SYSTEM article.

DESCRIPTION & OPERATION

NOTE: Brake drum can be removed without removing axle shaft.

BRAKE SHOE ASSEMBLY

Vehicles are equipped with dual-servo brakes, identified by adjuster screw hole at bottom of backing plate.

Brake assembly consists of backing plate, brake shoes, return springs, automatic adjusting assembly and a wheel cylinder.

Automatic adjusting assembly consists of an actuator lever, return spring, actuator link, adjusting screw and spring. Automatic adjustment is accomplished through movement of actuating lever and secondary shoe.

BRAKE WARNING LIGHT

Pressure differential warning switch in combination valve energizes brake warning light on instrument panel when front or rear brakes lose hydraulic pressure. After repairing failed side of hydraulic system, depress brake pedal with moderate to heavy pressure to hydraulically center the piston. This will turn off brake warning light.

CALIPERS

Front brakes are floating caliper or sliding caliper design. See Figs. 5 and 8. Rear brakes are sliding caliper design. Caliper is attached to caliper mount. Caliper is mounted to steering knuckle or caliper adapter, depending on application. Caliper assembly slides back and forth in machined cut-outs.

HYDRAULIC CONTROL VALVES

Combination Valve

System uses a combination valve to regulate brake system hydraulic pressure. Combination valve, located in brake lines between master cylinder and wheels, has 3 pressure control functions:

* Metering (or hold-off) section of valve limits pressure to front brakes until pressure of rear brake shoe retractor springs is overcome, then allows pressure to front brakes.
* Warning switch section of valve constantly compares front and rear brake pressures from master cylinder. See BRAKE WARNING LIGHT under DESCRIPTION & OPERATION.
* Proportioning section of valve allows input pressure to rise to predetermined level before allowing output pressure to

rear brakes. This prevents rear wheel lock-up on vehicles with light rear wheel loads.

Combination valve also contains a by-pass feature. This ensures full system pressure is applied to rear brakes if front brakes lose hydraulic pressure (or if rear brakes lose hydraulic pressure, full pressure is applied to front brakes).

BLEEDING BRAKE SYSTEM

MASTER CYLINDER BLEEDING

NOTE: To prevent air from entering brake system, bench bleed master cylinder before installing.

1) Place master cylinder in soft-jawed vise with front end tilted slightly down. DO NOT overtighten vise. Plug both outlet ports of master cylinder. Fill master cylinder reservoir.
2) Press and release piston about 1" (25 mm) several times. As air is bled from master cylinder, the primary piston will not travel the full 1" (25 mm) stroke.
3) Repeat previous step with front end of master cylinder tilted slightly up. Reposition master cylinder in vise to level position. Loosen front outlet plug and push piston into bore to expel air from cylinder. Tighten plug and allow piston to return to original position. Repeat procedure at rear outlet plug.
4) Fill reservoir and install master cylinder. DO NOT fully tighten brake lines at this time. Slowly press brake pedal to floor and hold. Tighten brake lines. Release brake pedal. Bleed brake system. See MANUAL BLEEDING or PRESSURE BLEEDING.

MANUAL BLEEDING

NOTE: Air tends to cling to caliper walls. When bleeding vehicles with disc brakes, lightly tap caliper to help remove air.

1) Deplete vacuum reserve from power brake booster by depressing brake pedal several times with engine off. Fill master cylinder and keep at least half full during bleeding procedure. If master cylinder is not known or suspected to have air in bore, go to step 4). If master cylinder is known or suspected to have air in bore, go to next step.
2) Disconnect forward brakeline fitting at master cylinder. Allow fluid to flow from fitting. Tighten fitting to specification. See TORQUE SPECIFICATIONS. Have an assistant depress brake pedal slowly and hold. Loosen forward fitting. Tighten fitting while pedal is still at floor. Release brake pedal slowly. Wait 15 seconds.

NOTE: Rapid pumping of brake pedal causes master cylinder secondary piston to move into a position that makes bleeding system difficult.

3) Repeat step 2), including 15 second wait, until fluid is clear and free of air bubbles. Repeat procedure at other (rearmost) brakeline fitting on master cylinder. Master cylinder is now bled. If wheel cylinders/calipers are not suspected to have air in them, it is not necessary to bleed them.

NOTE: On vehicles with 4WAL, if Brake Pressure Modulator Valve was replaced, or is suspected to have air trapped inside, it must be bled next. See ANTI-LOCK BRAKE SYSTEM article.

4) If wheel cylinders/calipers are known or suspected to have air in them, raise and support vehicle. Remove bleeder valve cap from right rear wheel. Place proper size box end wrench over bleeder valve. Attach one end of clear tube over valve and submerge other end in container partially filled with clean brake fluid.

5) Have an assistant depress brake pedal slowly and hold. Loosen bleeder valve to purge air from cylinder. Tighten bleeder valve and slowly release brake pedal. Wait 15 seconds. Repeat sequence, including 15 second wait, until all air is removed.

6) Remove tube and wrench. Repeat step 5) at left rear, right front, and left front wheels in this order. Fill master cylinder reservoir, and install cover. Ensure there is no sponginess in brake pedal and that BRAKE warning light is off.

PRESSURE BLEEDING

NOTE: Air tends to cling to caliper walls. When bleeding vehicles with disc brakes, lightly tap caliper to help remove air.

WARNING: DO NOT use rigid clamp to position hold-off valve stem. This may damage valve assembly, causing brake failure.

1) Retain hold-off valve stem of combination valve using Valve Retainer (J-39177). See Fig. 1. This allows brake fluid to flow through combination valve and entire system during bleeding.

2) Clean master cylinder cap and surrounding area. Remove cap. With pressure tank at least 2/3 full, connect pressure bleeder to master cylinder with adapters. Attach bleeder hose to right rear bleeder valve.

NOTE: On vehicles with 4WAL, if Brake Pressure Modulator Valve was replaced, or is suspected to have air trapped inside, it must be bled next. See ANTI-LOCK BRAKE SYSTEM article.

3) Place other end of hose in glass jar partially filled with brake fluid so end of hose is submerged in fluid. Open release valve on pressure bleeder. Set pressure bleeder to 20-25 psi (1.4-1.8 kg/cm^2) or pressure specified by equipment manufacturer.

4) Open bleeder screw 3/4 - 1 turn and note fluid flow. Close bleeder screw when no air bubbles are present in fluid flow. Repeat procedure on left rear, right front, and left front wheels in this order.

5) Check brake pedal operation. Remove pressure bleeder. Remove valve retainer from hold-off valve. Refill master cylinder reservoir, if necessary.

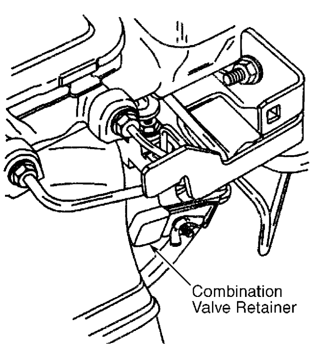


Fig. 1: Positioning Hold-Off Valve On Combination Valve (Typical)
Courtesy of General Motors Corp.

ADJUSTMENTS

PARKING BRAKE

NOTE: Ensure rear brake shoes are adjusted before adjusting parking brake. See REAR BRAKE SHOES under ADJUSTMENTS.

Raise and support vehicle. Loosen parking brake cable adjusting nut. Fully release parking brake pedal. Tighten adjusting nut until wheels will not rotate forward without excessive force. Back off adjusting nut until little or no drag exists when wheels are rotated forward. Lower vehicle.

REAR BRAKE SHOES

1) Ensure parking brake is released. Raise and support vehicle. Knock out lanced area in backing plate with a punch (if not already removed) and remove from brake assembly.

2) Working through hole in backing plate, rotate adjusting screw until brake shoes expand and wheels can just be turned by hand. Ensure drag is equal at both wheels. Back off adjusting screw 24 notches at each wheel.

3) If heavy drag is present after adjusting screw is backed off 12 notches, check parking brake adjustment. See PARKING BRAKE under ADJUSTMENTS. To complete procedure, install plug in backing plate. Check parking brake adjustment.

STOPLIGHT SWITCH

NOTE: Stoplight switch is installed along with brake push rod and is not adjustable.

TESTING

BRAKE WARNING LIGHT

Electrical Circuit

Disconnect wire from switch terminal on combination valve. Connect wire to ground. Turn ignition on. If brake warning light does not come on, repair brake warning light bulb or wiring circuit. If light operates, brake warning light electrical circuit is okay.

Warning Light Switch

1) Fill master cylinder reservoir. Attach bleeder hose to bleeder screw at either rear wheel. Immerse other end of hose in container of brake fluid. Turn ignition on.

2) While depressing brake pedal, open bleeder screw (close bleeder screw before releasing pedal). If light comes on, go to next step. If light does not come on, switch is defective; replace combination valve.

3) Close bleeder screw. Depress brake pedal with moderate to heavy pressure. If light goes out, switch is okay. If light stays on, switch is defective, replace combination valve. Repeat test on front brake system. System should function in same manner as rear.

REMOVAL & INSTALLATION

FRONT BRAKE CALIPER

NOTE: For front disc pad removal and installation, perform FRONT

BRAKE CALIPER removal and installation procedures but do not disconnect brake hose from caliper (hang caliper out of way with wire). Replace all pads on an axle if wear indicator on any pad contacts rotor or if pad is worn to within 1/32" (.8 mm) of pad backing.

Removal (Floating Caliper)

1) Remove two-thirds of brake fluid from master cylinder. Raise and support vehicle. Remove wheel. Using "C" clamp or large pliers, compress caliper piston until it bottoms in its bore.

2) Disconnect brake hose from caliper. Remove caliper guide pins. See Fig. 3. Remove caliper. Remove pads from caliper. Note retainer spring on inner pad (some models) and remove if replacing pads.

Installation

1) Remove caliper sleeves from caliper. See Fig. 3. Apply silicone grease to outer diameter of caliper sleeves and inner diameter of bushings. Insert caliper sleeves into bushings.

2) Install retainer spring on inner pad (if removed). Install pads in caliper. Install caliper. Install guide pins and tighten to specification. See TORQUE SPECIFICATIONS.

3) Connect brake hose to caliper and tighten hose bolt to 32 ft. lbs. (43 N.m). Bleed brake system. See MANUAL BLEEDING or PRESSURE BLEEDING under BLEEDING BRAKE SYSTEM.

4) If outer pads are equipped with locking ears, bend ears toward caliper until ears touch caliper. This prevents movement of outer pad in caliper. See Fig. 2. Install wheel.

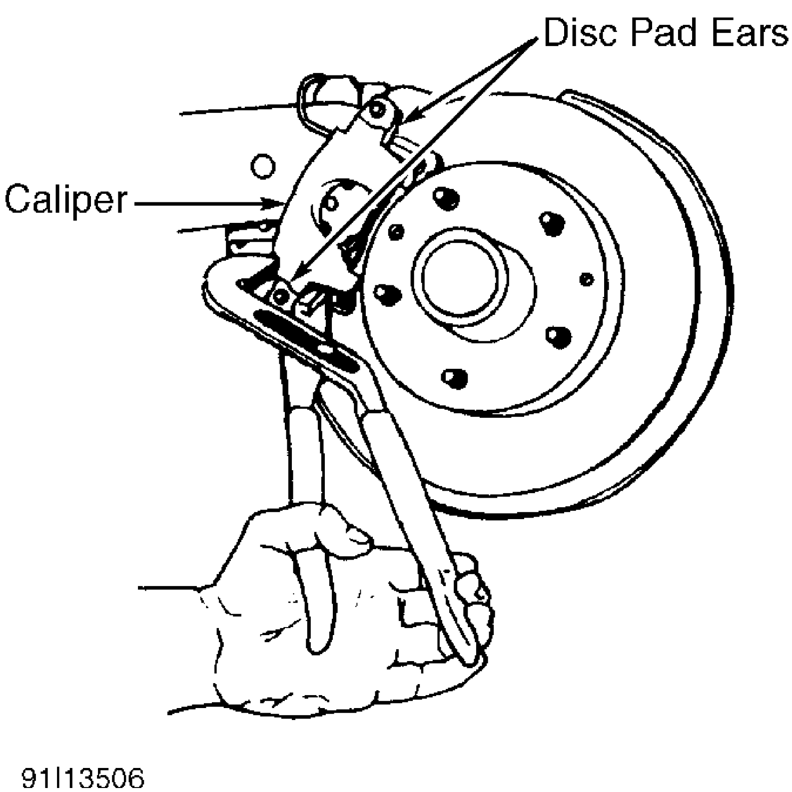


Fig. 2: Bending Outer Pad Ears Toward Caliper
Courtesy of General Motors Corp.

Removal (Sliding Caliper)

1) Remove two-thirds of brake fluid from master cylinder.

Raise and support vehicle. Remove wheel. Using "C" clamp or large pliers, compress caliper piston until it bottoms in its bore.

2) Disconnect brake hose from caliper. Remove caliper support key bolt. See Fig. 5. Using hammer and brass punch, drive out caliper support key and spring. Remove caliper. Remove inner and outer pads.

Installation

1) Using wire brush, clean corrosion from machined ways on caliper and caliper mount. Apply silicone grease to these surfaces. Install inner pad and anti-rattle spring on caliper mount. See Fig. 5. Install outer pad in caliper. Place caliper on caliper mount.

2) Install caliper support key and spring. Install caliper support key bolt, ensuring bolt boss fits into circular cutout on caliper support key. Tighten bolt to 15 ft. lbs. (20 N.m).

3) Connect brake hose to caliper and tighten hose bolt to specification. See TORQUE SPECIFICATIONS. Bleed brake system. See MANUAL BLEEDING or PRESSURE BLEEDING under BLEEDING BRAKE SYSTEM. Install wheel.

FRONT BRAKE ROTOR

Removal (2WD)

Remove brake caliper (DO NOT disconnect brake hose). See FRONT BRAKE CALIPER under REMOVAL & INSTALLATION. Remove grease cap from end of hub. Remove cotter pin, nut, washer and outer bearing. Remove rotor and hub assembly.

Inspection

Inspect rotor lateral runout and parallelism. See DISC BRAKE SPECIFICATIONS. If lateral runout cannot be corrected check hub bearing for excessive lateral runout or looseness. Hub bearing assembly lateral runout cannot exceed .0016" (.040 mm).

Installation

1) Clean and pack wheel bearings. Install rotor and hub assembly. Install outer bearing, washer and nut. Tighten nut to 12 ft. lbs. (16 N.m) while rotating rotor and hub assembly. This seats bearings.

2) Back off nut until it just begins to loosen. Finger-tighten nut. Back off nut until hole in spindle aligns with hole in nut (DO NOT back off more than 1/2 of a flat). Install new cotter pin, bend ends over and ensure ends will not contact grease cap when installed. To complete installation, reverse removal procedure.

Removal & Installation (4WD)

Remove brake caliper (DO NOT disconnect brake hose). See FRONT BRAKE CALIPER under REMOVAL & INSTALLATION. Remove rotor. To install, reverse removal procedure.

REAR BRAKE CALIPER

NOTE: For rear disc pad removal and installation, perform REAR BRAKE CALIPER removal and installation procedures but DO NOT disconnect brake hose from caliper (hang caliper out of way with wire). Replace all pads on an axle if wear indicator on any pad contacts rotor or if pad is worn to within 1/32" (.8 mm) of pad backing.

Removal

1) Remove two-thirds of brake fluid from master cylinder. Raise and support vehicle. Remove wheel. Using "C" clamp or large pliers, compress caliper piston until it bottoms in its bore.

2) Disconnect brake hose from caliper. Remove caliper support

key bolt. See Fig. 5. Drive out caliper support key and spring. Remove caliper. Remove inner and outer pads.

Installation

1) Clean corrosion from machined ways on caliper and caliper mount. Apply silicone grease to these surfaces. Install inner pad and anti-rattle spring on caliper mount. Install outer pad in caliper. Install caliper.

2) Install caliper support key and spring. Install caliper support key bolt, ensuring bolt boss fits into circular cutout on caliper support key. Tighten bolt to 15 ft. lbs. (20 N.m).

3) Connect brake hose to caliper and tighten hose bolt to specification. See TORQUE SPECIFICATIONS. Bleed brake system. See MANUAL BLEEDING or PRESSURE BLEEDING under BLEEDING BRAKE SYSTEM. Install wheel.

REAR BRAKE DRUM

Removal & Installation

Ensure parking brake is released. On Savana and Express, remove left kick panel. Place parking brake lever in full upright position. With an assistant in vehicle, raise and support vehicle. Pull rearward on front of cable strand until parking brake lever reaches its full reset position. Insert a pin into parking brake lever to hold tension. See Fig. 6. On all models, remove wheel. Reference mark rear brake drum-to-axle. Remove brake drum (if necessary, back off adjuster wheel before removing brake drum). To install, reverse removal procedure. Adjust rear brake shoes. See REAR BRAKE SHOES under ADJUSTMENTS.

REAR BRAKE SHOES

NOTE: For rear brake shoe removal and installation, see Figs. 6, 16 and 17. DO NOT interchange left and right adjusting screw assemblies as one side is right-hand thread and other is left-hand thread.

WHEEL CYLINDER

Removal & Installation

Remove rear brake shoes. See REAR BRAKE SHOES under REMOVAL & INSTALLATION. Disconnect brake line from wheel cylinder. Remove brake cylinder retaining bolts and brake cylinder. To install, reverse removal procedure. Bleed brake system. See MANUAL BLEEDING or PRESSURE BLEEDING under BLEEDING BRAKE SYSTEM.

MASTER CYLINDER

Removal

1) With engine off, press brake pedal several times to release vacuum in power brake unit. Clean dirt and grease from master cylinder brake line fittings. Disconnect brake lines from master cylinder and plug line ends.

2) On vehicles with combination valve and bracket attached to master cylinder mounting studs, remove combination valve and bracket. On vehicles without power brake unit, disconnect brake pedal push rod at brake pedal. On all vehicles, remove master cylinder retaining nuts and master cylinder.

Installation

1) Bench bleed master cylinder before installing. See MASTER CYLINDER BLEEDING under BLEEDING BRAKE SYSTEM. Position master

cylinder on mounting studs. Position combination valve and bracket on mounting studs (if applicable). Loosely install master cylinder retaining nuts. Connect brake lines to master cylinder but DO NOT tighten.

2) Tighten master cylinder retaining nuts. Tighten brake lines. Connect brake pedal push rod (if disconnected). Fill fluid reservoir. Bleed brake system. See MANUAL BLEEDING or PRESSURE BLEEDING under BLEEDING BRAKE SYSTEM.

POWER BRAKE BOOSTER

Removal & Installation

1) Remove master cylinder. See MASTER CYLINDER under REMOVAL & INSTALLATION. Ensure no brake fluid contacts ABS control unit or related electrical connectors and wiring.

2) Disconnect vacuum hose from booster. Disconnect booster push rod from brake pedal. Remove booster mounting nuts from inside vehicle. Remove booster and gasket.

3) To install, reverse removal procedure. Bleed brake system if lines were disconnected from master cylinder. See MANUAL BLEEDING or PRESSURE BLEEDING under BLEEDING BRAKE SYSTEM.

REAR AXLE BEARING & OIL SEAL (SEMI-FLOATING AXLE)

Removal

1) Raise and support vehicle. Remove wheels and brake drums. Loosen differential cover plate and drain lubricant from axle. Remove cover plate.

2) Remove pinion shaft lock bolt. See Figs. 3 and 4. Remove pinion shaft. Push axle shaft toward center of vehicle and remove "C" lock from end of axle shaft. Remove axle shaft.

3) Pry seal from axle housing. Using Slide Hammer (J-2619-01) and Axle Bearing Puller (J-22813-01), remove bearing from axle housing.

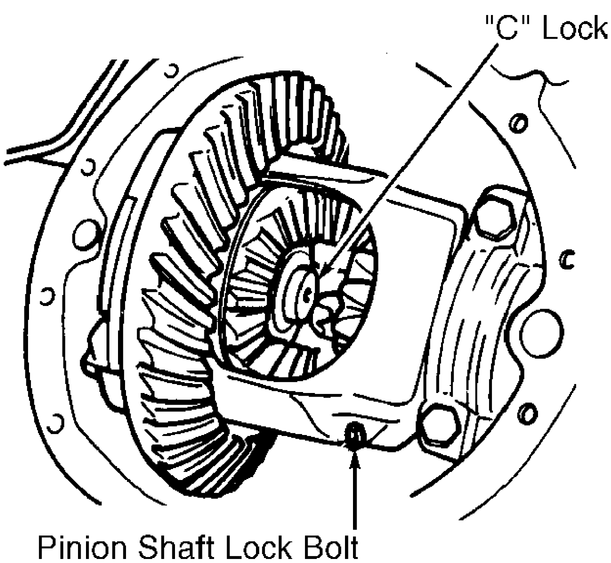


Fig. 3: Locating "C" Lock & Pinion Shaft Lock Bolt
Courtesy of General Motors Corp.

Installation

1) Lubricate bearing with gear lubricant. Using Handle (J-

8092) and Bearing Installer (J-23765), install bearing in axle housing until bearing installer bottoms against shoulder of axle housing.

2) Using Seal Installer (J-23771), install seal until even with surface of axle housing. Lubricate seal lips with gear lubricant. Install axle shaft and "C" lock. See Figs. 3 and 4. Pull axle shaft outward to ensure "C" lock seats in side gear.

3) Install pinion shaft. Install NEW pinion shaft lock bolt. Tighten lock bolt to 25 ft. lbs. (34 N.m). Install differential cover and new gasket. Fill drive axle with gear lubricant.

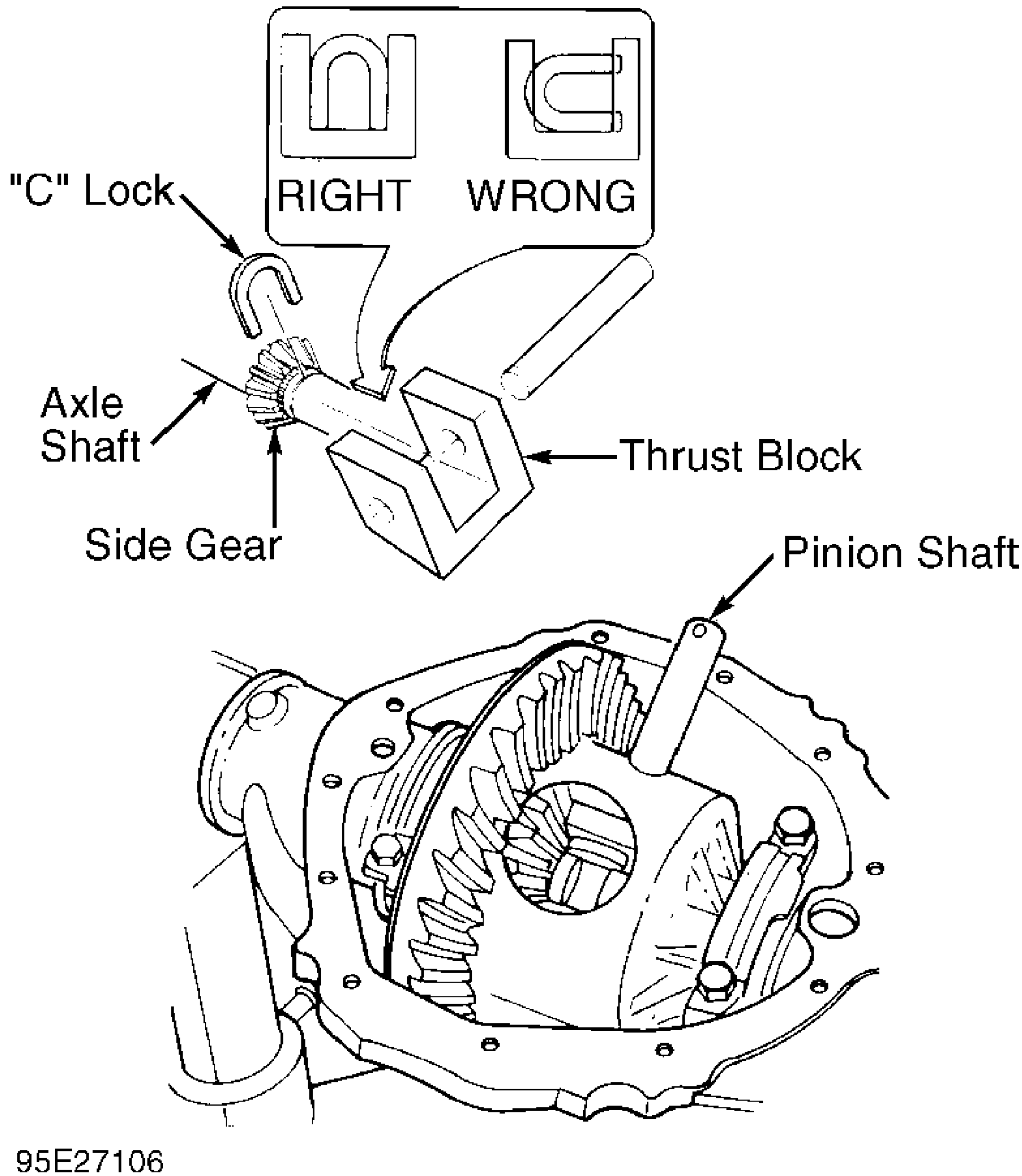


Fig. 4: Removing & Installing "C" Lock & Pinion Shaft On Locking Differential (Typical)
Courtesy of General Motors Corp.

OVERHAUL

NOTE: Use exploded view illustrations for overhaul of brake assemblies. See Figs. 5-12.

WARNING: DO NOT hone master cylinder bore. Honing destroys hardened surface, causing premature piston seal failure. If bore surface is rough or pitted, replace master cylinder.

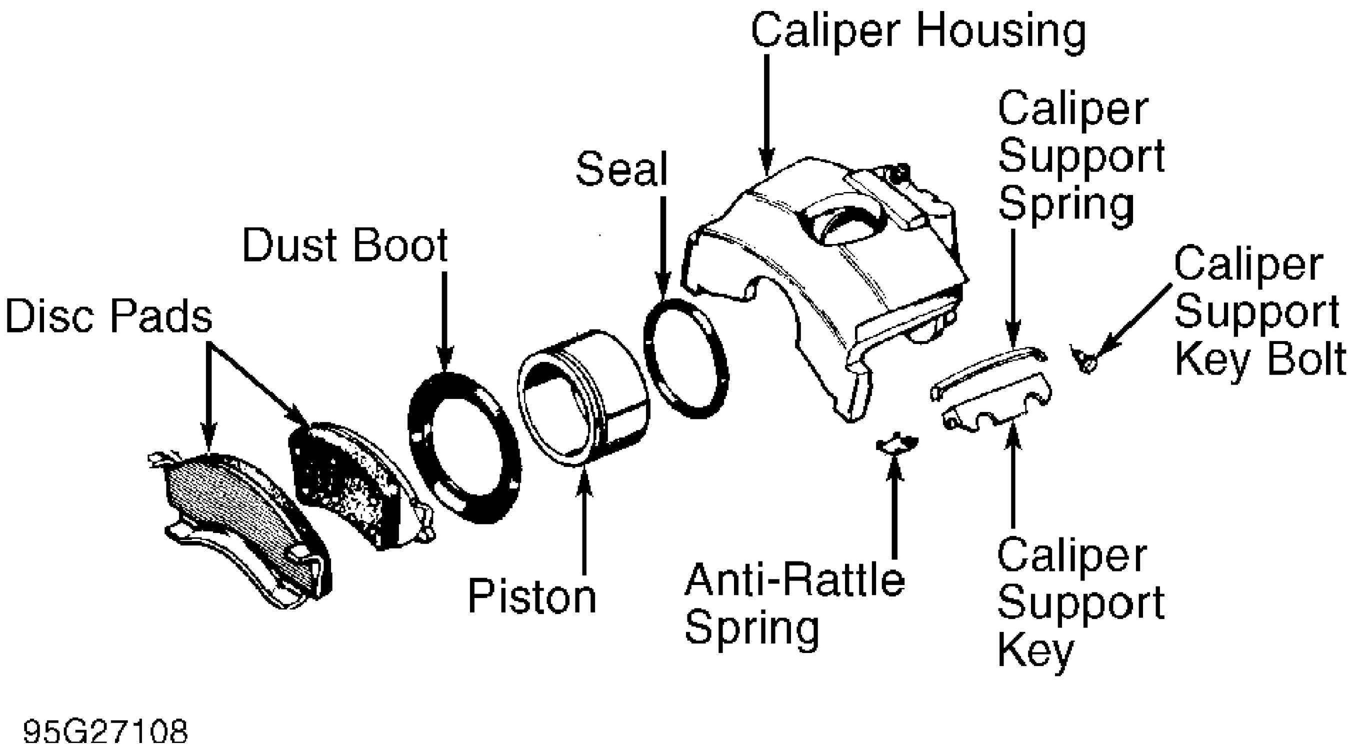


Fig. 5: Exploded View Of Sliding Caliper Assembly (Typical)
Courtesy of General Motors Corp.

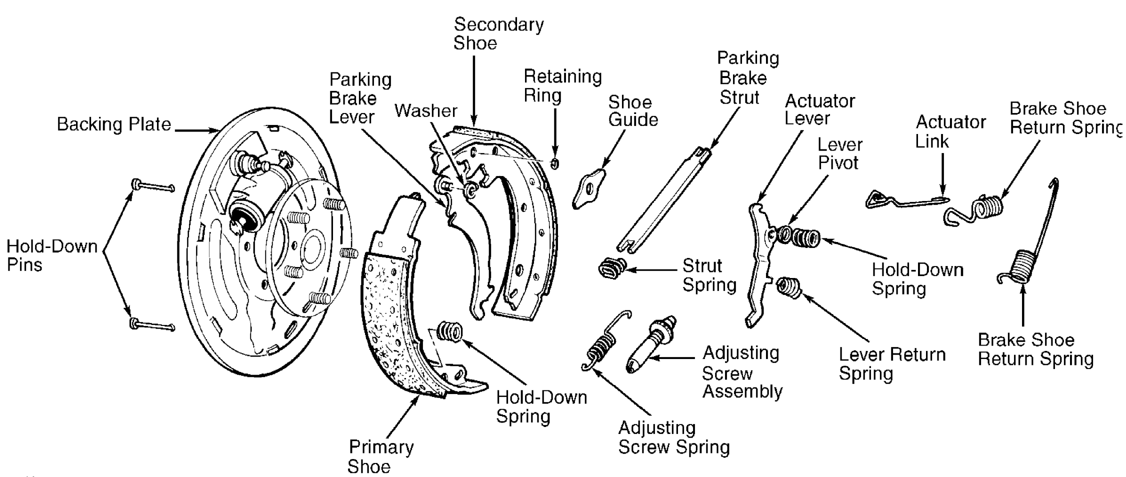
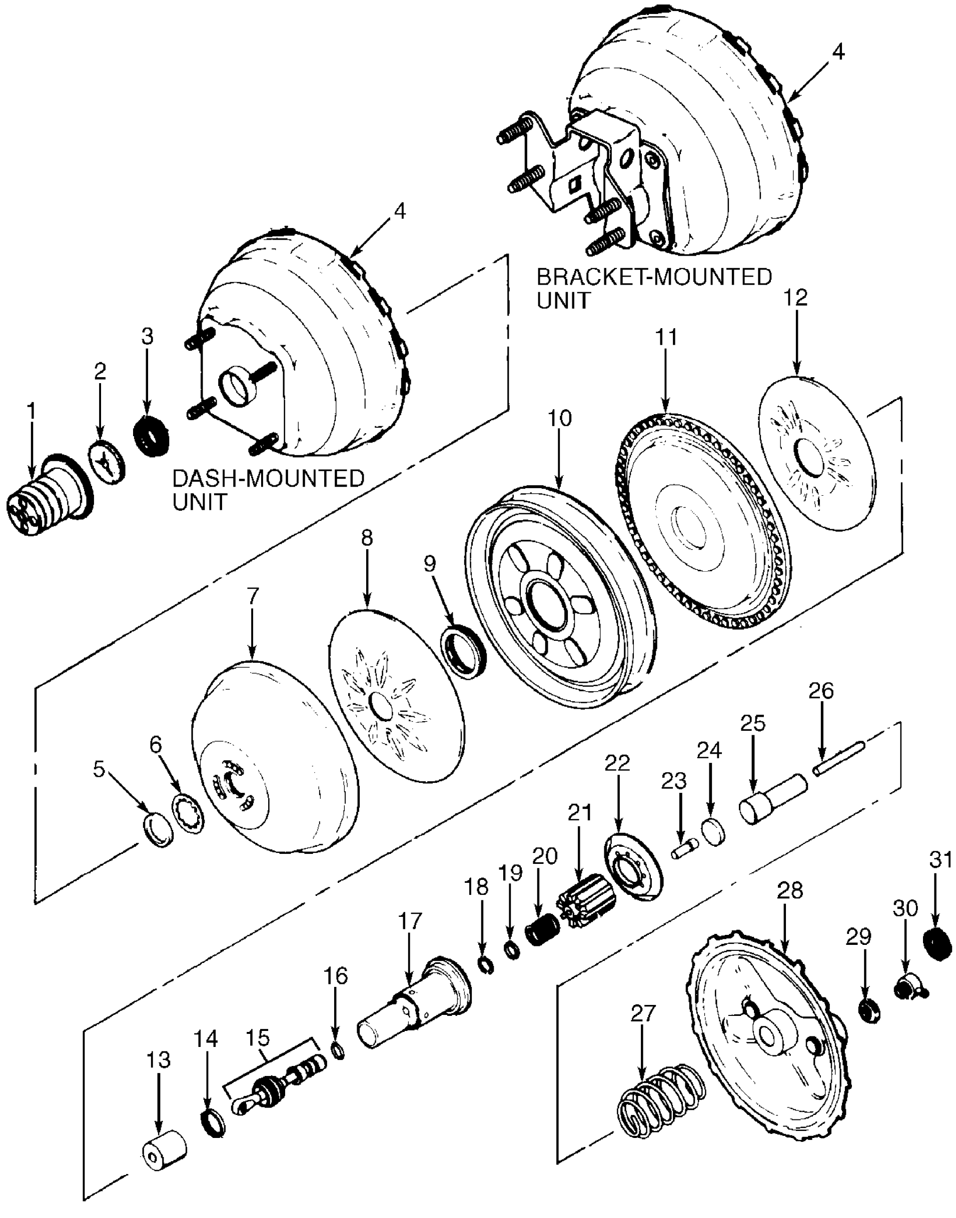


Fig. 6: Exploded View Of Rear Brake Assembly
Courtesy of General Motors Corp.



1. Boot
2. Silencer
3. Primary Piston Bearing
4. Rear Housing
5. Power Head Silencer
6. Diaphragm Retainer
7. Primary Diaphragm
8. Primary Support Plate
9. Secondary Piston Bearing
10. Housing Divider
11. Secondary Diaphragm
12. Secondary Support Plate
13. Filter
14. Retainer
15. Air Valve Push Rod Assembly
16. "O" Ring
17. Power Piston
18. Retaining Ring
19. Reaction Bumper
20. Air Valve Spring
21. Reaction Body
22. Reaction Body Retainer
23. Reaction Piston
24. Reaction Disc
25. Reaction Retainer
26. Piston Rod (Gauged)
27. Return Spring
28. Front Housing
29. Grommet
30. Vacuum Check Valve
31. Front Housing Seal

Fig. 7: Exploded View Of Power Brake Booster (Dual Diaphragm)
Courtesy of General Motors Corp.

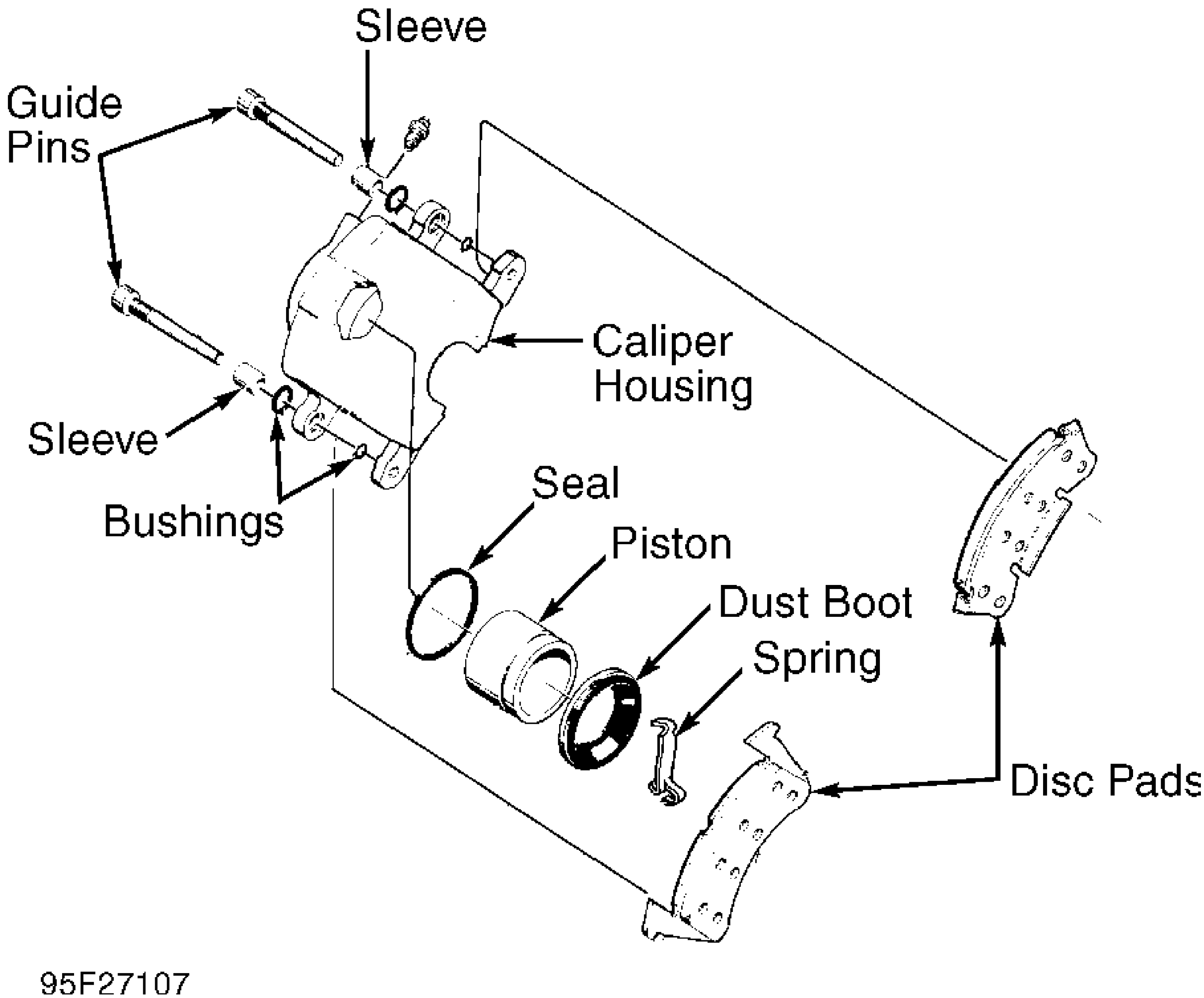
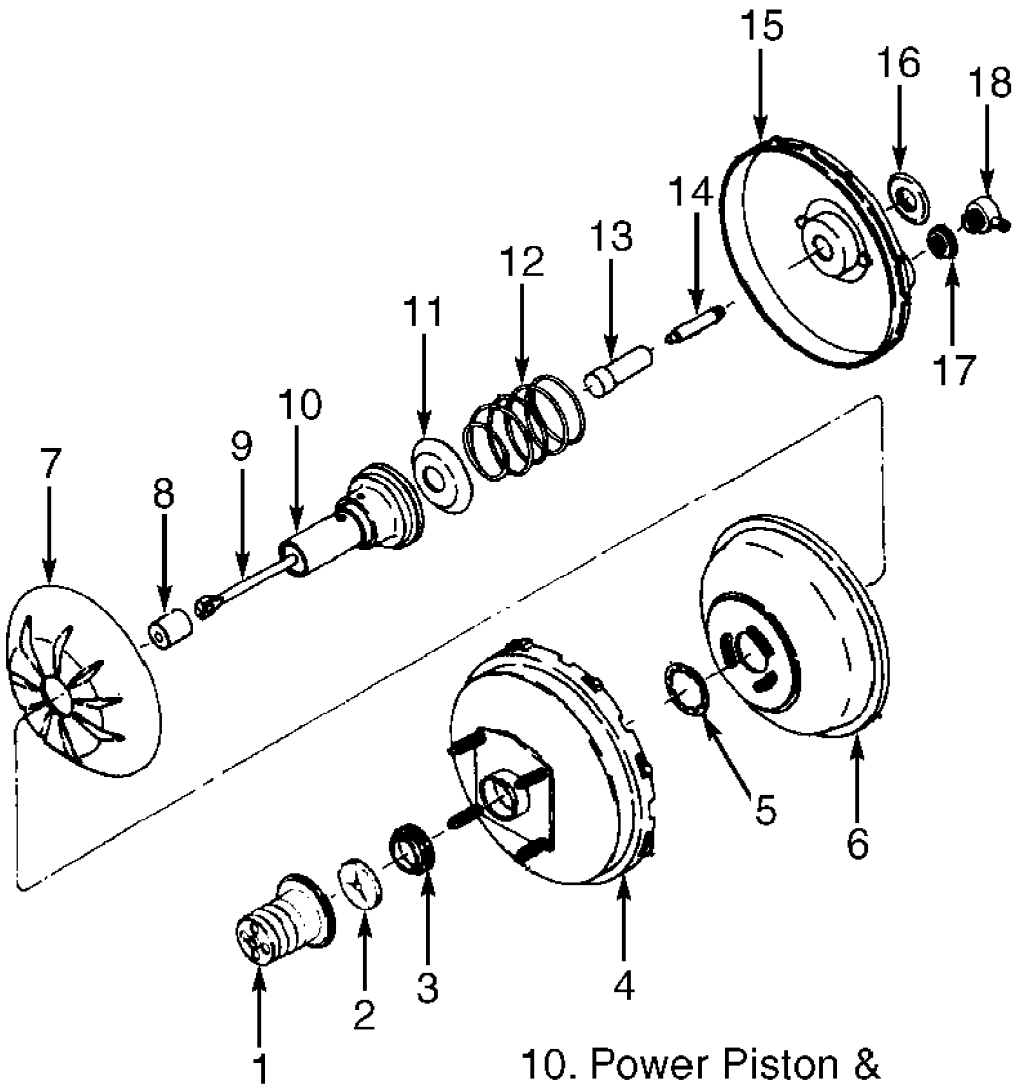


Fig. 8: Exploded View Of Floating Caliper Assembly (Typical)
Courtesy of General Motors Corp.



1. Boot
2. Silencer
3. Power Piston Bearing
4. Rear Housing
5. Diaphragm Retainer
6. Diaphragm
7. Diaphragm Support
8. Filter
9. Push Rod
10. Power Piston & Push Rod Assembly
11. Reaction Body Retainer
12. Return Spring
13. Reaction Retainer
14. Piston Rod (Gauged)
15. Front Housing
16. Front Housing Seal
17. Grommet
18. Vacuum Check Valve

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Fig. 9: Exploded View Of Power Brake Booster (Single Diaphragm)
Courtesy of General Motors Corp.

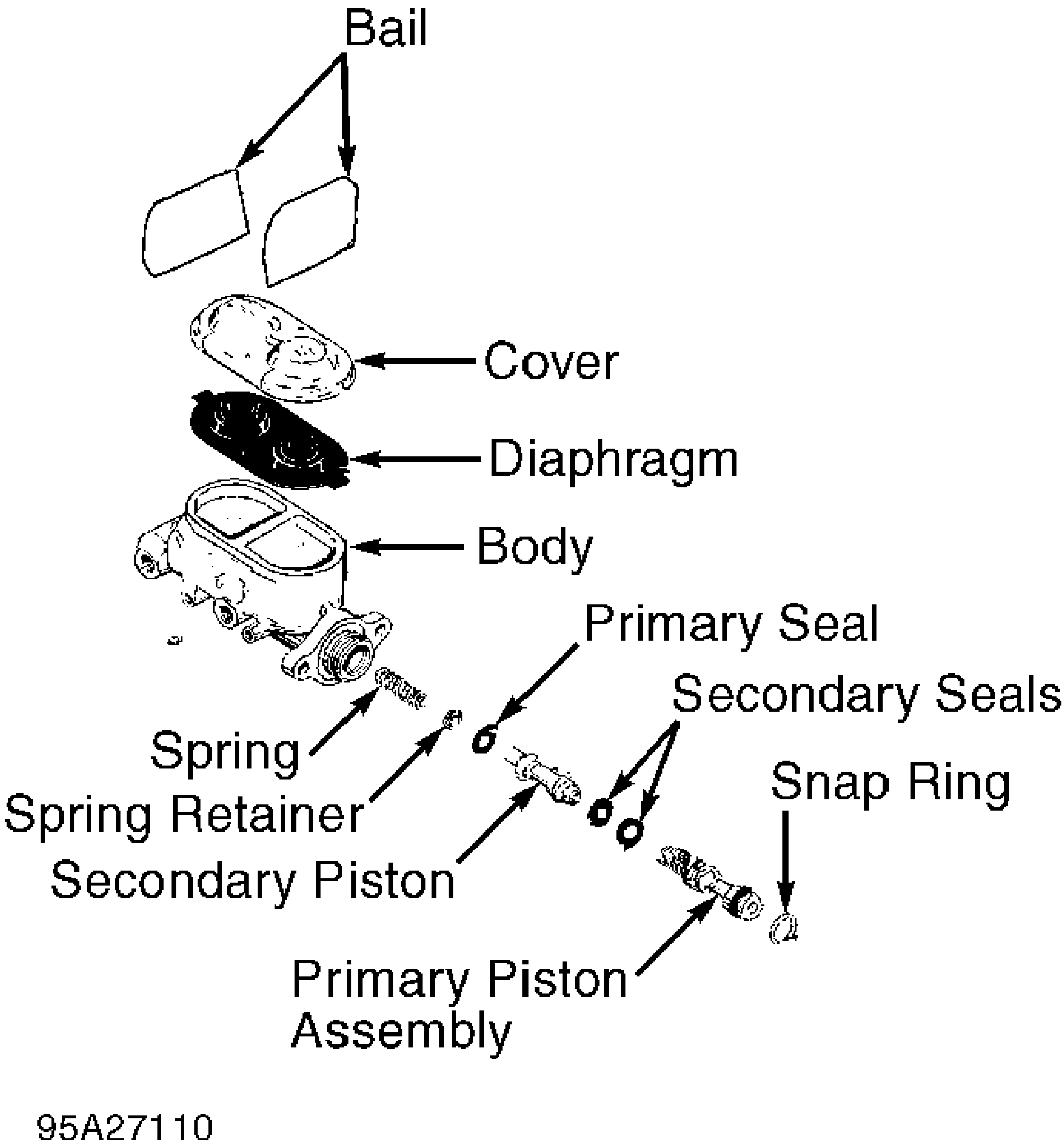

Fig. 10: Exploded View Of Cast Iron Master Cylinder
Courtesy of General Motors Corp.

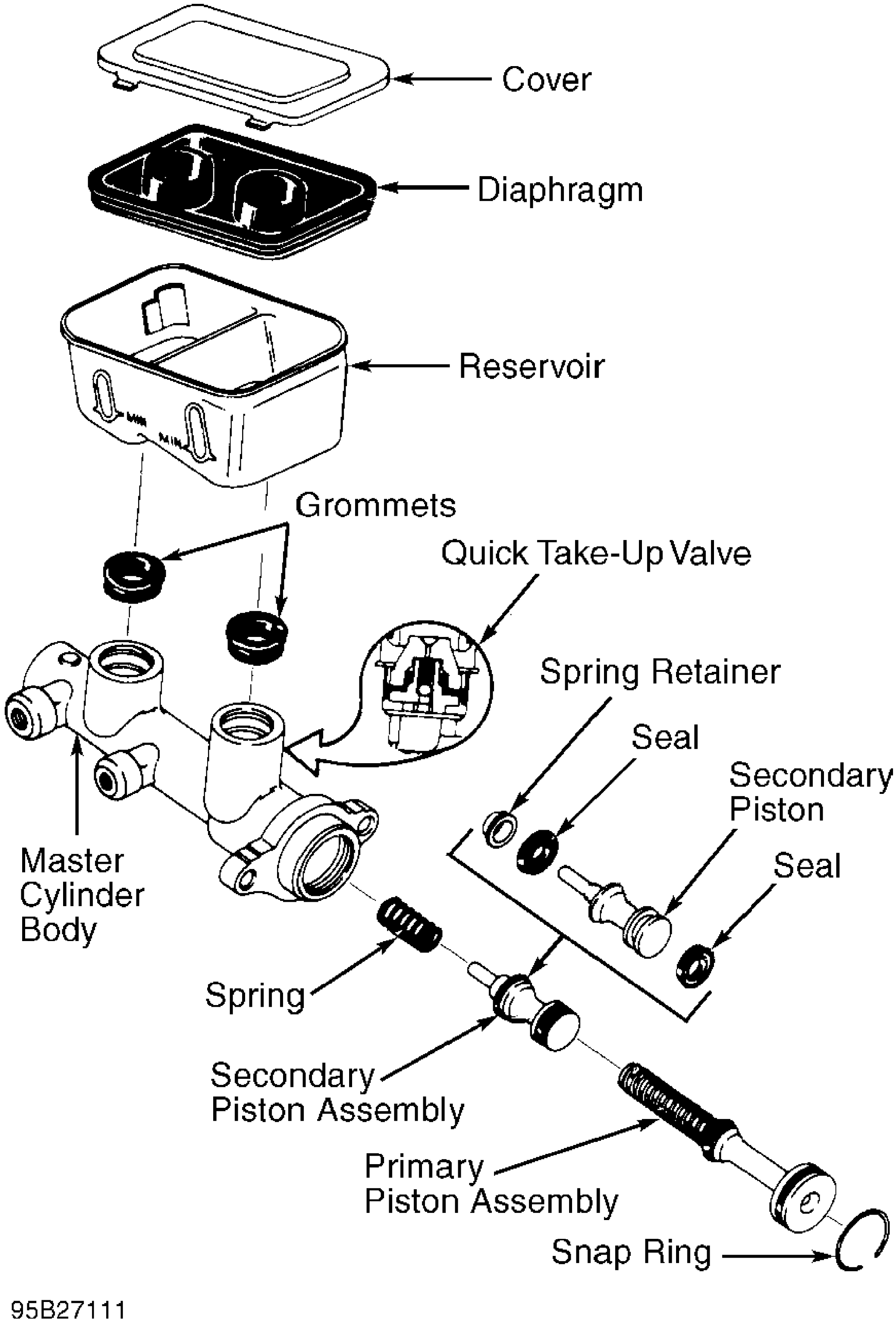

Fig. 11: Exploded View Of Composite Master Cylinder
Courtesy of General Motors Corp.

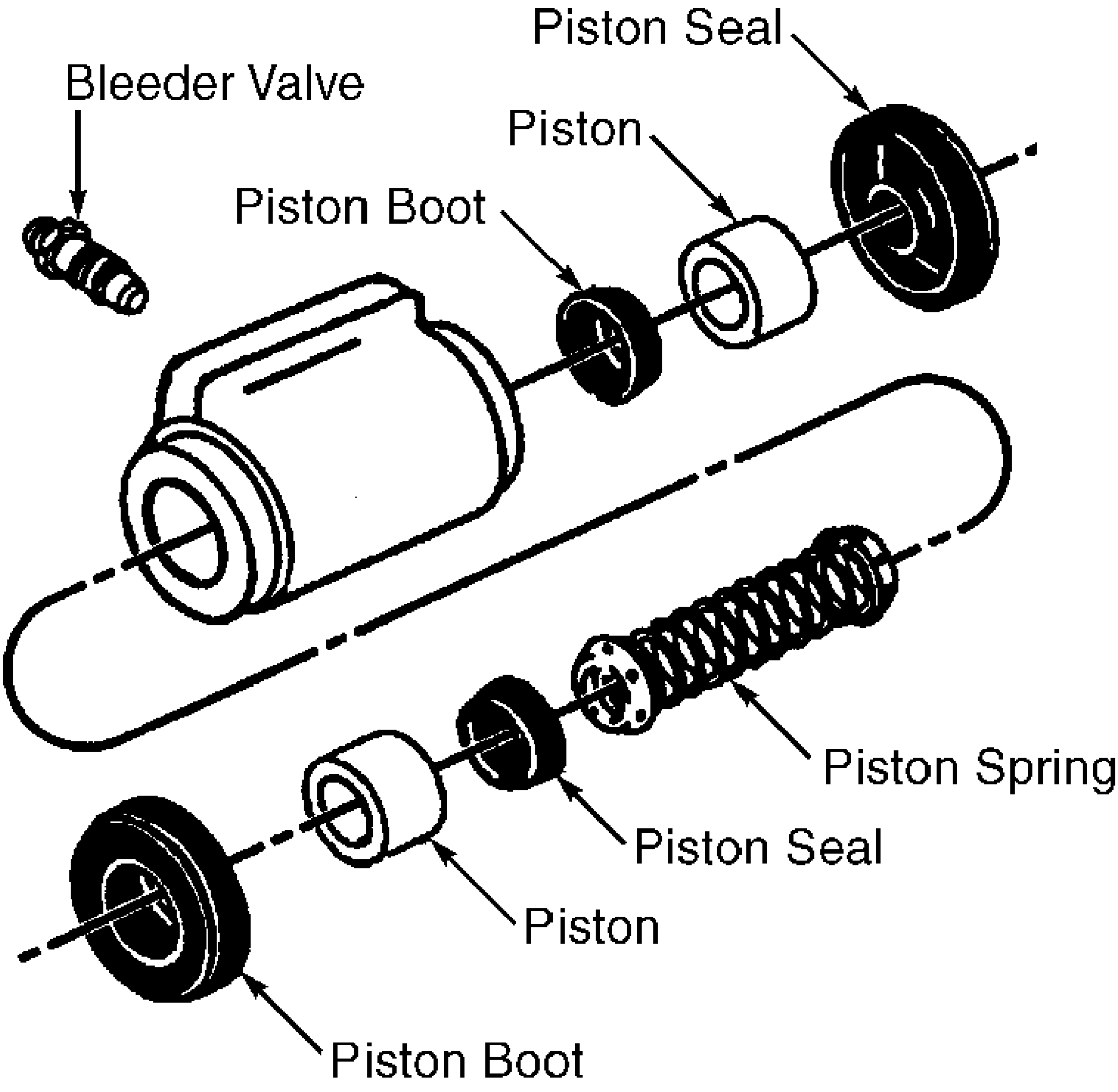

Fig. 12: Exploded View Of Rear Wheel Cylinder (Typical)
Courtesy of General Motors Corp.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS TABLE

Application	Ft. Lbs. (N.m)
Backing Plate Bolts	103 (140)

Brakerake Cylinder Bolts	15 (20)
Brake Line Fittings (Except To EBCM)	22 (30)
Brake Line Fittings (To EBCM)	15 (20)
Brake Hoses	15 (20)
Banjo Bolts-To-Front Caliper	37 (50)
Caliper Guide Pin (Floating Caliper)	37 (50)
Caliper Support Key Bolt (Sliding Caliper)	15 (20)
Combination Valve Allen Bolts	12 (16)
Differential Cover Bolt	20 (27)
Front Brake Hose-To-Caliper Bolt	32 (43)
Pinion Shaft Lock Bolt (1)	
Standard Differential	25 (34)
Locking Differential	
7 5/8", 8 1/2" & 8 5/8 Ring Gear	27 (37)
9 1/2" Ring Gear	37 (50)
Power Booster Nuts	27 (37)
Wheel Lug Nut	95 (130)

(1) - Use NEW pinion shaft lock bolt. DO NOT reuse bolt.

DRUM BRAKE SPECIFICATIONS

DRUM BRAKE SPECIFICATIONS TABLE

Application	In. (mm)
Original Diameter	9.50 (241.3)
Discard Diameter	9.59 (243.6)
Maximum Refinish Diameter	9.56 (242.8)
Width	2.00 (50.8)

DISC BRAKE SPECIFICATIONS

DISC BRAKE SPECIFICATIONS TABLE

Application	In. (mm)
Lateral Runout	.004 (.10)
Parallelism	.0005 (.013)
Original Thickness	1.03 (26.2)
Minimum Refinish Thickness (1)	.980 (24.89)
Discard Thickness	.965 (24.51)

(1) - Use specification stamped on rotor (if available).

1996-97 Clutch
Hydraulic

Chevrolet; Blazer, Commercial Van, Sierra,
"C" & "K" Series Pickup, "S" & "T" Series & Pickup
GMC; Jimmy, "C" & "K" Series Pickup, Commercial Van,
Sierra, Sonoma

DESCRIPTION

The hydraulic clutch system consists of a clutch plate, pressure plate, release bearing and pilot bearing. Hydraulic clutch has a master cylinder with a reservoir. Clutch pedal moves master cylinder push rod which activates a concentric slave (actuator) cylinder located in transmission bellhousing, which moves the release bearing. See Fig. 1.

Hydraulic clutch system provides automatic clutch adjustment. No adjustment of clutch linkage or pedal position is required. Master cylinder, hydraulic line and actuator cylinder assembly is furnished pre-filled and pre-bled.

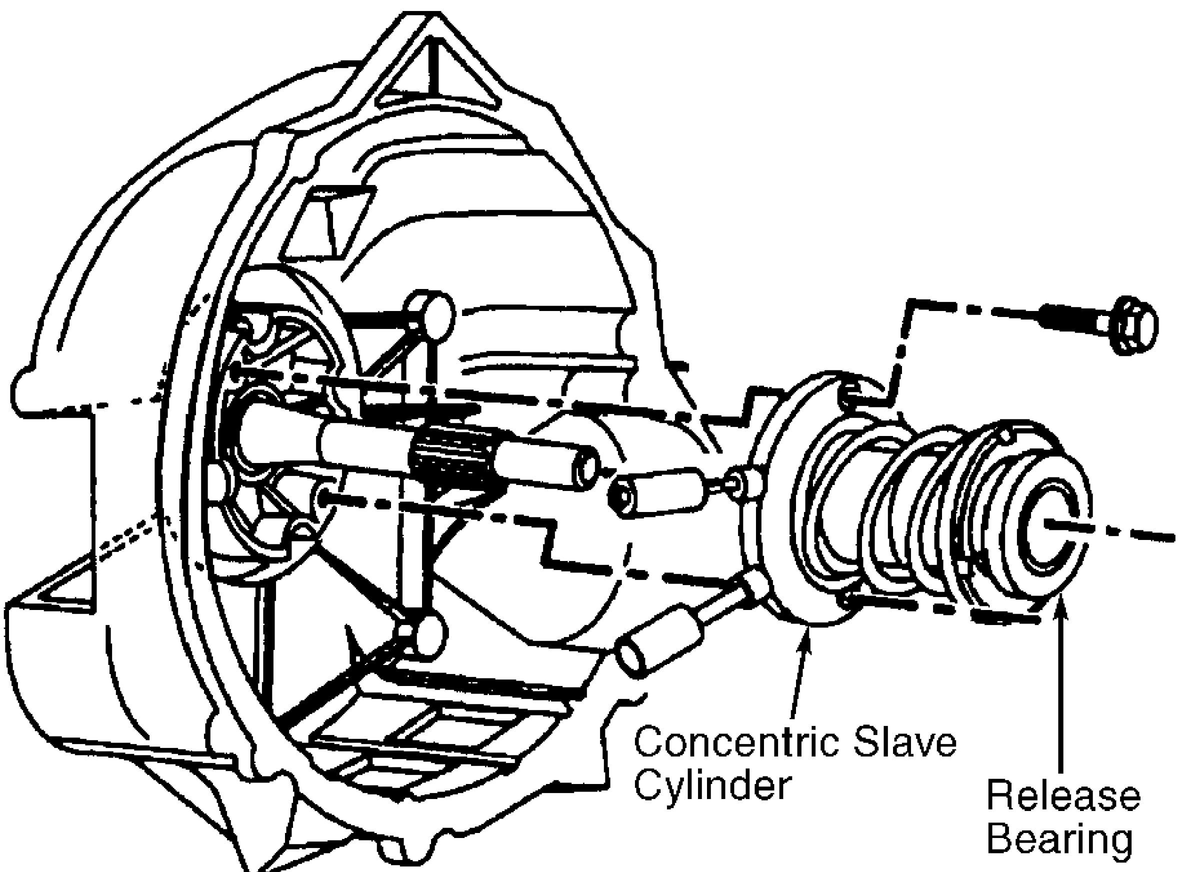

Fig. 1: Identifying Concentric Clutch Slave Cylinder
Courtesy of General Motors Corp.

LUBRICATION

RECOMMENDED FLUID

TRANSMISSION LUBRICATION SPECIFICATIONS

Application	Fluid Type
C/K Series	
NV3500	GM Synchro-Mesh Transmission Oil (12345349)
NV4500	Castrol Syntorq LT Transmission Oil
S/T Series	
NV1500	GM Synchro-Mesh Transmission Oil With Friction Modifier (12377916)
NV3500 "P" Series	GM Synchro-Mesh Transmission Oil (12345349)
NV4500	Castrol Syntorq LT Transmission Oil

TRANSFER CASE LUBRICATION SPECIFICATIONS

Application	Fluid Type
C/K Series	Dexron-III
S/T Series	Dexron-III

ADJUSTMENTS

NOTE: The hydraulic clutch system provides automatic clutch adjustment; no manual clutch adjustments are necessary.

BLEEDING CLUTCH SYSTEM

NOTE: DO NOT reuse fluid that has been bled from system.

1) First clean and then remove reservoir cap. Top-off reservoir with NEW DOT 3 brake fluid.
2) Have an assistant depress and hold clutch pedal. Open bleed screw located on left side of transmission to expel air. Close bleed screw and release clutch pedal.
3) Repeat step 2) until all air is out of system. Check and refill reservoir as needed during bleeding to remove air from system. After bleeding, pump clutch pedal several times. If clutch engagement is not satisfactory, repeat bleeding procedure.
4) If normal bleeding procedure is unsuccessful, perform the following:

* Remove reservoir cap.
* Pump pedal very fast for 30 seconds.
* Stop to allow air to escape.
* Repeat procedure as necessary.

DRIVE SHAFT PARKING BRAKE (C/K SERIES)

1) Remove clevis pin from parking brake lever. Set parking brake by pushing pedal down 18 degrees. Insert a .125" (3 mm) pin into locating hole in pedal assembly. See Fig. 2. Push pedal down until pin contacts parking brake outer flange. Install tension scale with a small length of cable or chain, and a tightening device (i.e. turn buckle) on frame. Install small chain on lever near spring at bottom of lever. See Fig. 3.

2) Tighten tightening device until tension scale reads 50 ft. lb. (222 N.m). Loosen nut and turn clevis until pin slides freely in lever with all slack removed from cable. Install clevis pin and cotter pin. Remove tension scale and all extensions used. Release parking brake. Rotate drum to make sure that there is no drag.

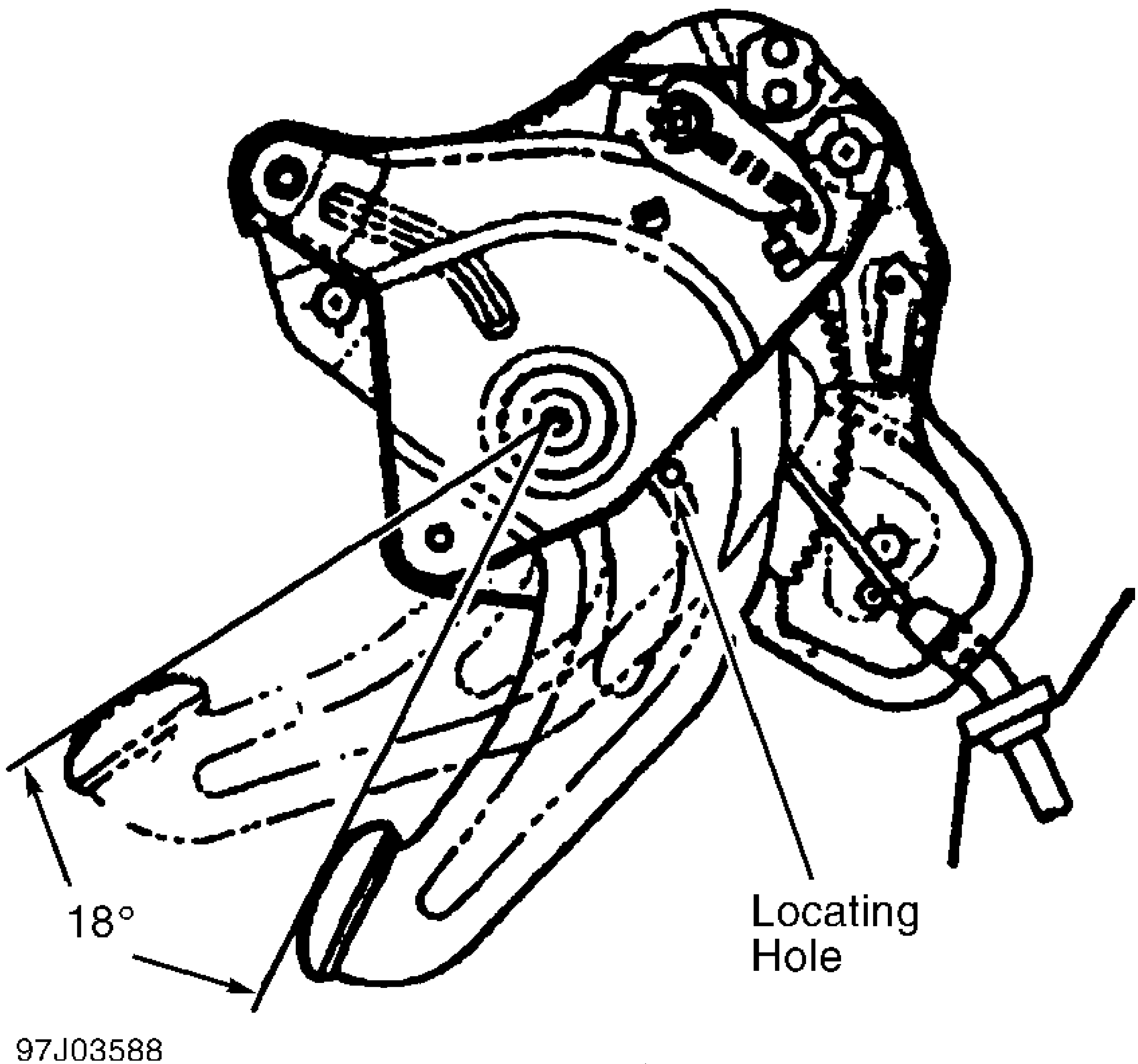

Fig. 2: Identifying Brake Adjustment Locating Hole (C/K Series)
Courtesy of General Motors Corp.

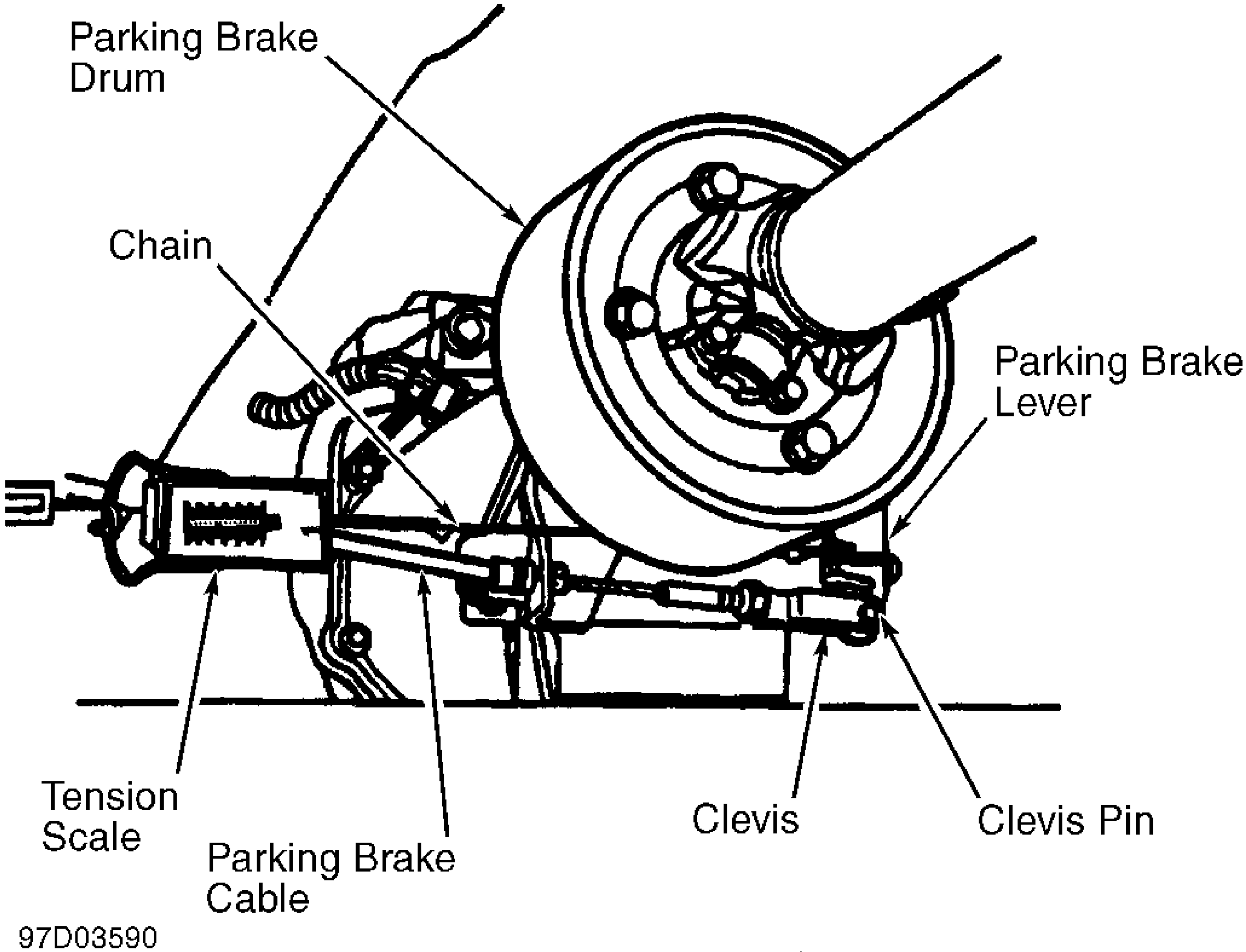

Fig. 3: Identifying Drive Shaft Parking Brake Components (C/K Series)
Courtesy of General Motors Corp.

DRIVE SHAFT PARKING BRAKE ("P" SERIES)

Raise and support vehicle. Install drum over first rivet section, leaving adjuster screw accessible. Place two .010" (.254 mm) shims between both shoes and drum. Shims should be 140-180 degrees apart. Rotate adjuster screw until shims indicate spacing has been met (no clearance). Remove shims and complete drum installation. Rotate drum. Drum should spin freely with only a slight drag.

TRANSFER CASE LINKAGE (C/K SERIES)

Place shift lever in 4-HI position. Raise and support vehicle. Disconnect linkage rod from console shift lever. Shift transfer case into 4-HI position by moving transfer case shift lever in full back position. A clicking sound will indicate that transfer case lever is in full back position. Adjust swivel to align with notch in console shift lever. Connect linkage rod to console shift lever.

TRANSFER CASE CABLE (S/T SERIES)

Remove shift lever knob retainer and shift lever knob. Remove front floor console. Place shift lever in Neutral position. Pry control cable end from shift lever. Loosen control cable lock nut. Ensure transfer case is in Neutral position. Place shift lever in Neutral position. Turn shift lever end of cable in or out, until it is aligned with shift lever. Install control cable to shift lever and control cable lock nut.

TROUBLE SHOOTING

NOTE: For trouble shooting not covered in this article, see TROUBLE SHOOTING - BASIC PROCEDURES article in GENERAL INFORMATION.

Hydraulic system should not require additional fluid under normal circumstances. Reservoir fluid level will increase as normal clutch wear occurs. Avoid overfilling or removing fluid from reservoir. This will cause clutch release problems.

TESTING

Apply parking brake. Block vehicle wheels. Shift transmission into Neutral. Start engine and run at idle. Engage clutch. Disengage clutch. Wait 9 seconds. Shift transmission into Reverse. If grinding noise is heard, see TROUBLE SHOOTING - BASIC PROCEDURES article in GENERAL INFORMATION.

REMOVAL & INSTALLATION

* PLEASE READ THIS FIRST *

CAUTION: When battery is disconnected, vehicle computer and memory systems may lose memory data. Driveability problems may exist until computer systems have completed a relearn cycle. See COMPUTER RELEARN PROCEDURES article in GENERAL INFORMATION before disconnecting battery.

TRANSMISSION

NOTE: DO NOT disassemble transmission shift housing. Internal parts for shift housing are not available. Also, opening shift housing voids warranty.

Removal (C/K & "P" Series)

1) Disconnect negative battery cable. Shift transmission into 3rd or 4th gear. Remove shift lever retainer screws and retainer. Remove 8 shift lever boot mounting screws and boot. Remove shift lever insulator. Remove shift lever. Remove 4 exposed bolts on base of housing, not bolts under rubber boot located at top of housing. Remove insulator from transmission case. Raise and support vehicle. Drain transmission fluid.

2) Mark drive shaft for reassembly reference. Remove drive shaft(s). On 4WD, remove transfer case shield. Drain oil from transfer case. Remove vent hose and electrical connectors. Remove transfer case shift linkage. Using a jack, support transfer case. Remove transfer case and discard transmission adapter gasket.

3) On vehicles equipped with drive shaft parking brake, release parking brake. Raise and support vehicle. Remove nut and washer from center of brake drum. Remove drum yoke assembly, bolts, washers and drum yoke. Remove cotter pin, clevis pin, clevis, and nut from brake cable. Remove parking brake cable grommet, and cable from

bracket.

4) On all vehicles, disconnect exhaust pipes from exhaust manifold, and catalytic converter from muffler assembly (if necessary). Disconnect electrical connectors from speed sensor and back-up light switch. Using Quick Connect Disconnect Tool (J-36221), remove clutch line from concentric slave cylinder quick connect coupling. See Fig. 4. Remove starter and clutch housing cover. Remove transmission vent hose.

5) Support transmission and engine. Remove crossmember. Remove clutch plate and clutch cover from flywheel. Remove transmission-to-engine bolts and studs. Pull transmission straight back on clutch hub splines. Remove clutch and clutch cover plates during transmission-to-engine separation. Remove transmission.

Installation

1) To install reverse removal procedure. If equipped with drive shaft parking brake, adjust parking brake. See DRIVE SHAFT PARKING BRAKE under ADJUSTMENTS. On 4WD, install NEW transmission adapter gasket. Adjust transfer case shift linkage. See TRANSFER CASE LINKAGE under ADJUSTMENTS.

2) Lightly coat input shaft splines with high-temperature grease. Tighten bolts to specifications. See TORQUE SPECIFICATIONS. Fill transmission and transfer case with fluid. See RECOMMENDED FLUID under LUBRICATION.

Removal (S/T Series)

1) Disconnect negative battery cable. Shift transmission into 3rd or 4th gear. Remove shift lever knob and nut. Remove shift lever retainer screws and retainer (if equipped). Remove shift lever boot mounting screws and boot. Remove shift lever and nut.

2) Remove exposed bolts on base of housing. DO NOT remove bolts under rubber boot at top of housing. Remove shift lever housing. Raise and support vehicle. Drain transmission fluid. Remove parking brake cable for clearance. Mark drive shaft(s) for reassembly reference. Remove drive shaft(s).

3) Disconnect electrical connectors from speed sensor and back-up switch. On all models, disconnect exhaust pipe from exhaust manifold. Remove catalytic converter and hanger. If equipped, remove right and left side transfer case-to-transmission braces. On 4WD, place transfer case in 4H position. Remove skid plate. Drain fluid from transfer case. Disconnect vacuum lines and electrical connectors from transfer case (if equipped).

4) Disconnect shift cable from transfer case. Support transfer case with jack. Remove transfer case-to-transmission mounting bolts. Slide transfer case rearward until free of transmission output shaft. Lower and remove transfer case. Remove and discard gasket. Using Quick Connect Disconnect Tool (J-36221), remove clutch line from concentric slave cylinder quick connect coupling. See Fig. 4.

5) Remove clutch housing cover. Remove clutch plate and clutch cover from flywheel. Support transmission. Using a fuel pressure gauge, purge fuel system, and disconnect fuel lines. Remove fuel lines and retainers from rear crossmember. Remove rear crossmember. Move wiring harness away from transmission oil pan.

6) Lower transmission enough to gain access to top of transmission. Remove wiring harness from front crossmember. Remove engine block ground. Remove transmission mounting bolts as necessary. Pull transmission straight back on clutch hub splines, and remove transmission.

Installation

To install, reverse removal procedure. On 4WD, install NEW transmission adapter gasket. Adjust transfer case shift cable. See TRANSFER CASE CABLE under ADJUSTMENTS. Lightly coat input shaft splines with high-temperature grease. Tighten bolts to specifications. See TORQUE SPECIFICATIONS. Fill transmission with fluid. See RECOMMENDED FLUID under LUBRICATION.

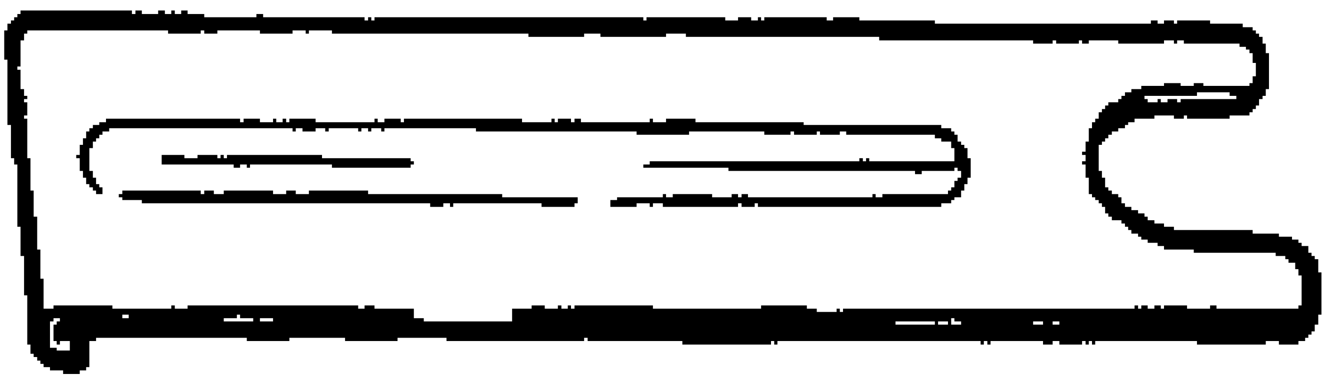

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Fig. 4: Hydraulic Clutch Line Separator
Courtesy of General Motors Corp.

CLUTCH ASSEMBLY & PILOT BEARING

WARNING: DO NOT use compressed air to clean clutch parts. Clutch plate contains asbestos and is harmful when inhaled.

Removal (C/K & "P" Series)

1) Remove transmission. See TRANSMISSION. Install Clutch Alignment Tool (J-5824-01) to support clutch plate. Mark flywheel and pressure plate for reassembly reference. See Fig. 5.

2) Evenly loosen pressure plate bolts 1-2 turns at a time until pressure plate spring tension is released. Remove clutch plate and pressure plate. Remove clutch aligner. Remove pilot bearing, if worn or damaged, using Pilot Bearing Puller (J-23907). Remove concentric slave cylinder and release bearing. See CONCENTRIC SLAVE (ACTUATOR) CYLINDER.

Inspection

1) Clean all components with water-dampened cloth to remove asbestos fibers. Clean flywheel housing with solvent. Release bearing is permanently packed with lubricant and should not be cleaned with solvent.

2) Inspect all components for wear or damage. Inspect all contact surfaces for scoring, warping and damage. Clutch plate runout must not exceed .20" (.508 mm). Inspect friction surfaces for excessive oil. Inspect splines for nicks, burrs and sliding fit. Bellhousing transmission pilot hole runout should not exceed .015" (. 38 mm).

Installation

1) On 4.3L, 5.0L and 5.7L, use brass drift to install NEW pilot bearing into flywheel, if removed. On 6.5L diesel, use Pilot Bearing Driver (J-34140) to install NEW pilot bearing into flywheel, if removed. On 4.3L, 5.0L and 5.7L, lubricate pilot bearing with machine oil. On 6.5L diesel, pilot bearing is sealed and does not require lubrication.

2) Install clutch aligner to support clutch plate. Install clutch plate and pressure plate to flywheel. Ensure reference marks

are aligned. If installing NEW clutch plate and pressure plate, align lightest part of clutch cover, identified by a yellow dot, with heaviest part of flywheel part of flywheel, identified by an "X". Install and tighten NEW spring washers and bolts evenly to avoid distortion. Remove clutch aligner.

3) Lubricate O.D. groove and pack grease into I.D. recess of release bearing. To complete installation, reverse removal procedure. Tighten bolts to specifications. See TORQUE SPECIFICATIONS. Fill reservoir with fluid. See RECOMMENDED FLUID under LUBRICATION. Bleed system. See BLEEDING CLUTCH SYSTEM under IN-VEHICLE SERVICE.

Removal (S/T Series)

1) Remove transmission. See TRANSMISSION. Remove slave cylinder and release bearing. Install Clutch Aligner (J-33169) to support clutch plate. Mark flywheel, clutch plate and pressure plate for reassembly reference.

2) Evenly loosen pressure plate bolts 1-2 turns at a time until clutch plate spring tension is released. Remove clutch plate and pressure plate. Remove clutch aligner. Remove pilot bearing if worn or damaged using Pilot Bearing Puller (J-23907).

Inspection

1) Clean all components with water-dampened cloth to remove asbestos fibers. Clean clutch fork, bellhousing and ball stud with solvent. Release bearing is permanently packed with lubricant and should not be cleaned with solvent.

2) Inspect all components for wear or damage. Inspect all contact surfaces for scoring, warping and damage. Clutch plate runout must not exceed .20" (.508 mm). Inspect friction surfaces for excessive oil. Inspect splines for nicks, burrs and sliding fit.

Installation

1) Use Pilot Bearing Installer (J-26516-A) with Driver Handle (J-8092) to install NEW pilot bearing into flywheel, if removed. See Fig. 1. Lubricate pilot bearing with machine oil. Install Clutch Aligner (J-33169) to support clutch plate. Install clutch plate and pressure plate to flywheel. Ensure reference marks are aligned.

2) Install and tighten NEW spring washers and bolts evenly to avoid distortion. Remove clutch aligner. Lubricate O.D. groove and pack grease into I.D. recess of release bearing.

3) To complete installation, reverse removal procedure. Tighten bolts to specifications. See TORQUE SPECIFICATIONS. Fill reservoir with fluid. See RECOMMENDED FLUID under LUBRICATION. Bleed system. See BLEEDING CLUTCH SYSTEM under IN-VEHICLE SERVICE.

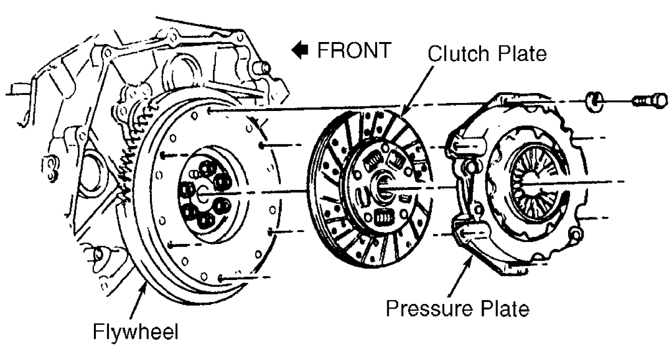

Fig. 5: Identifying Clutch Assembly Components
Courtesy of General Motors Corp.

MASTER CYLINDER & RESERVOIR

WARNING: Vehicles are equipped with air bag supplemental restraint system. Before attempting ANY repairs involving steering column, instrument panel or related components, see SERVICE PRECAUTIONS and DISABLING & ACTIVATING AIR BAG SYSTEM in the appropriate AIR BAG RESTRAINT SYSTEM article. Refer to the following menu:

* For 1996 Blazer, "S/T" Pickup, Jimmy & Sonoma, see: AIR BAG RESTRAINT SYSTEM
* For 1996 "C/K" Pickup, Jimmy & Sierra, see: AIR BAG RESTRAINT SYSTEM
* For 1997 Blazer, "S/T" Pickup, Jimmy & Sonoma, see: AIR BAG RESTRAINT SYSTEM
* For 1997 "C/K" Pickup, Jimmy & Sierra, see: AIR BAG RESTRAINT SYSTEM

NOTE: Master cylinder is serviced as an assembly along with master cylinder reservoir and tubing. Replacement of individual components cannot be performed. A complete pre-filled, pre-bled master cylinder assembly must be installed.

Removal

Disconnect negative battery cable. Separate push rod from clutch pedal. Using Quick Connect Disengagement Tool (J-36221), remove hydraulic line from concentric slave cylinder at transmission. Remove line clips from wiring harness bracket and sheet metal. Rotate master cylinder body 45 degrees clockwise and remove from cowl panel. See Fig. 6.

Installation

To complete installation, reverse removal procedure. Tighten bolts to specifications. See TORQUE SPECIFICATIONS. Top off reservoir with fluid. See RECOMMENDED FLUID under LUBRICATION. Bleed system. See BLEEDING CLUTCH SYSTEM under IN-VEHICLE SERVICE.

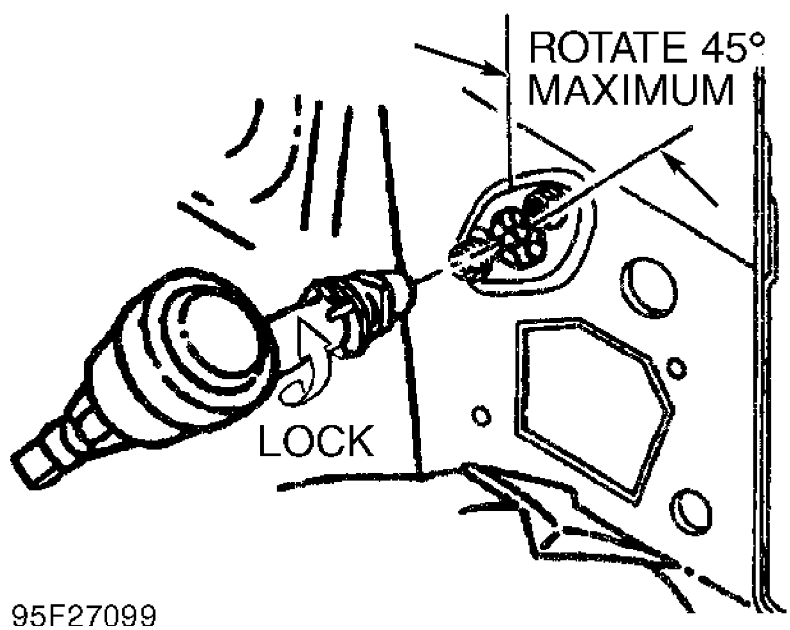

Fig. 6: Master Cylinder Removal
Courtesy of General Motors Corp.

CONCENTRIC SLAVE (ACTUATOR) CYLINDER

Removal & Installation

Using Hydraulic Clutch Line Separator (J-36221), depress the White plastic sleeve to separate coupling. See Figs. 4. Protect both halves of coupling to prevent contamination. Remove transmission. See TRANSMISSION. Remove bolts securing concentric slave cylinder to clutch housing shaft. Remove slave cylinder assembly from transmission input shaft. Remove release bearing from slave cylinder. For installation, reverse removal procedure.

OVERHAUL

NOTE: All master and concentric slave (actuator) cylinders are serviced as an assembly. Rebuilding or overhaul is not possible.

TORQUE SPECIFICATIONS

"C/K" SERIES

TORQUE SPECIFICATIONS ("C/K" SERIES)

Application	Ft. Lbs. (N.m)
Bellhousing-To-Engine Bolts	35 (47)
Bellhousing-To-Transmission Bolts	74 (100)
Crossmember Bolts	38 (51)
Lower PTO Cover Bolt (Oil Drain On NV4500)	27 (37)
Oil Fill Plug (NV4500)	30 (41)
Oil Fill & Drain Plugs (NV3500)	44 (60)
Parking Brake Drum To Yoke Bolts	27 (37)
Parking Brake Yoke Shaft Nut	350 (475)
Pressure Plate-To-Flywheel Bolts	
Gasoline engine	29 (40)
Diesel engine	25 (34)
Shift Housing Bolts	11 (15)
Transfer Case-To-Transmission Bolts	24 (33)
	INCH Lbs. (N.m)
Clutch Housing Cover Bolts	89 (10)
Slave Cylinder Bolts	71 (8)

"P" SERIES

TORQUE SPECIFICATIONS ("P" SERIES)

Application	Ft. Lbs. (N.m)
Lower PTO Cover Bolt (Oil Drain On NV4500)	30 (41)
Oil Fill Plug (NV4500)	30 (41)
Parking Brake Drum To Transmission	65 (88)
Parking Brake Yoke Shaft Nut	325 (441)
Shift Lever Nut	15 (20)
Transmission To Engine Studs	23 (31)
	INCH Lbs. (N.m)
Clutch Housing Cover Bolts	89 (10)
Shift Housing Bolts	89 (10)

"S/T" SERIES

TORQUE SPECIFICATIONS ("S/T" SERIES)

Application	Ft. Lbs. (N.m)
Adapter-To-Transmission Bolts	31 (42)
Bellhousing-To-Engine Bolts	35 (47)
Pressure Plate-To-Flywheel Bolts	29 (40)
Rear Crossmember Bolts	34 (46)
Skid Plate Bolts	25 (34)
Support Brace Bolts	35 (47)
Transfer Case Oil Drain & Fill Plugs	18 (25)
Transfer Case-To-Transmission Bolts	41 (55)
Transmission Brace To Engine Bolts	37 (50)
Transmission Brace To Engine Studs	35 (47)
Transmission Oil Fill & Drain Plugs (NV3500)	44 (60)
Transmission Oil Fill Plug (NV1500)	17 (24)
	INCH Lbs. (N.m)
Clutch Housing Cover Bolts	62 (7)
Concentric Slave Cylinder Bolts	80 (9)
Reservoir Bolts	27 (3)

COMPUTER RELEARN PROCEDURES

1997 Chevrolet Blazer

1997 GENERAL INFORMATION
General Motors - Computer Relearn Procedures

All Models

INTRODUCTION

Vehicles equipped with engine or transmission computers may require a relearn procedure after the vehicle battery is disconnected. Vehicle computers memorize and store vehicle operation patterns for optimum driveability and performance. When the vehicle battery is disconnected, this memory is lost. Default data is used until new data from each key start is stored. As the computer restores its memory from each new key start, driveability is restored.

Driveability problems may occur during the relearn stage. Depending on the vehicle and how it is equipped, the following driveability problems may exist:

* Rough or unstable idle.
* Hesitation or stumble.
* Rich or lean running.
* Poor fuel mileage.
* Harsh or poor transmission shift quality.

To accelerate relearn process after battery removal and installation, vehicle should be road tested in the following manner:

* Vehicle at normal operating temperature (cooling fan cycles).
* Accelerate at normal throttle position (20-50%).
* Cruise at light to medium throttle.
* Decelerate to a stop, downshifting and using brakes normally.

Manufacturers identify specific relearn procedures. See RELEARN PROCEDURES. Always complete the procedure before returning the vehicle to the owner.

RELEARN PROCEDURES

Vehicle Driveability Relearn Procedure

General Motors does not provide a specific procedure for driveability relearn. If a vehicle battery was disconnected for facilitating repairs or a Powertrain Control Module (PCM) was replaced, driving the vehicle will enable the PCM to relearn driveability. Inform your customer that he/she may experience driveability different from what they are accustomed to until the PCM completes it's relearn function.

TP Sensor Learn (Corvette)

If a NEW TP sensor or throttle body is installed, EBTCM must learn new TP sensor idle position voltage. This procedure is necessary to ensure effective engine torque reduction during ASR operations. TP sensor learn procedure requires a Tech 1 scan tester or T-100 (CAMS) unit.

1) Turn ignition off. Connect Tech 1 scan tester with a Mass Storage cartridge. Turn ignition on. Select ABS/ASR feature from menu.

2) Select F5 (TP SENSR LEARN). Press up arrow to begin learn procedure. Wait for Tech 1 scan tester to indicate COMPLETE. Turn ignition off. Disconnect Tech 1 scan tester.

NOTE: Ensure accelerator and brake pedals are free from any obstructions while performing TP sensor/idle learn procedure. PCM will not perform learn function with accelerator pedal or brake pedal obstructions.

COOLING SYSTEM SPECIFICATIONS

1997 Chevrolet Blazer

1996-97 ENGINE COOLING
General Motors Corp. Specifications - Trucks

All Models

MODEL IDENTIFICATION

MODEL IDENTIFICATION

Series (1)	Model
"C"	2WD Pickup, Sierra, Suburban, Tahoe & Yukon
"G"	(2) RWD Van
"K"	4WD Pickup, Sierra, Suburban, Tahoe & Yukon
"L"	AWD Astro & Safari
"M"	2WD Astro & Safari
"P"	Commercial Van/Motorhome
"S"	2WD Blazer, Jimmy, Pickup & Sonoma
"T"	4WD Blazer, Jimmy, Pickup & Sonoma
"T"	AWD Bravada
"U"	Silhouette, Trans Sport & Venture

(1) - Vehicle series is fifth character of VIN.
(2) - Includes Express and Savana.

SPECIFICATIONS

CAUTION: When battery is disconnected, vehicle computer and memory systems may lose memory data. Driveability problems may exist until computer systems have completed a relearn cycle. See COMPUTER RELEARN PROCEDURES article in GENERAL INFORMATION before disconnecting battery.

BELT ADJUSTMENT

BELT ADJUSTMENT

Application	(1) Lbs. (kg)
All Models	(1)

(1) - Serpentine belt tension is maintained automatically by a spring-tensioned idler pulley. No adjustment is necessary.

COOLING SYSTEM SPECIFICATIONS

COOLING SYSTEM SPECIFICATIONS

Application	Specification
Coolant Replacement Interval	
1996	30,000 Miles
1997	(1)
Pressure Cap	15 psi
Thermostat Opens	
Starts	188°F (87°C)

Fully Open	206°F (97°C)
Coolant Capacity (2)	
2.2L	11.6 Qts. (11.0L)
3.4L	
With Rear Heater	12.4 Qts. (11.75L)
Without Rear Heater	11.8 Qts. (11.25L)
4.3L	
"C" & "K" Series	12.7 Qts. (12.3L)
"G" & "P" Series	
With Rear Heater	14.0 Qts. (13.2L)
Without Rear Heater	11.0 Qts. (10.5L)
"L" & "M" Series	
With Rear Heater	16.5 Qts. (15.5L)
Without Rear Heater	14.3 Qts. (13.5L)
"P" Series	13.8 Qts. (13.1L)
"S" & "T" Series	
A/T	11.7 Qts. (11.1L)
M/T	11.9 Qts. (11.3L)
5.0L	
With A/C	18.0 Qts. (17.0L)
Without A/C	17.5 Qts. (16.6L)
5.7L	
Standard	
With A/C	20.0 Qts. (19.0L)
Without A/C	17.5 Qts. (16.6L)
Heavy Duty	
With A/C	27.0 Qts. (25.5L)
Without A/C	26.4 Qts. (25.0L)
6.5L	27.5 Qts. (26.0L)
7.4L	
Standard	
With A/C	27.5 Qts. (26.0L)
Without A/C	25.0 Qts. (23.5L)
Heavy Duty	
With A/C	28.5 Qts. (27.0L)
Without A/C	26.4 Qts. (25.0L)

(1) - No scheduled replacement interval given by manufacturer. Check and replace as necessary.
(2) - Specification is approximate and includes heater capacity.

SERPENTINE BELT ROUTING & ALIGNMENT

NOTE: For serpentine belt routing, see underhood label.

CRUISE CONTROL SYSTEM

1997 Chevrolet Blazer

1997 ACCESSORIES/SAFETY EQUIP
General Motors Corp. - Cruise Control System

Chevrolet; Blazer, "S" & "T" Pickup
GMC; Jimmy & Sonoma
Oldsmobile; Bravada

DESCRIPTION

Cruise control system components include: Powertrain Control Module (PCM) or Vehicle Control Module (VCM), cruise control module (electronic controller and electric stepper motor combined), cruise control switch, vehicle speed sensor, vehicle speed sensor buffer, and brake and clutch release switches.

OPERATION

CRUISE CONTROL MODULE

Cruise control module is mounted to master cylinder. See Fig. 1. Module incorporates an electronic controller and an electric stepper motor. Stepper motor regulates throttle position in response to control module commands. Module is not serviceable.

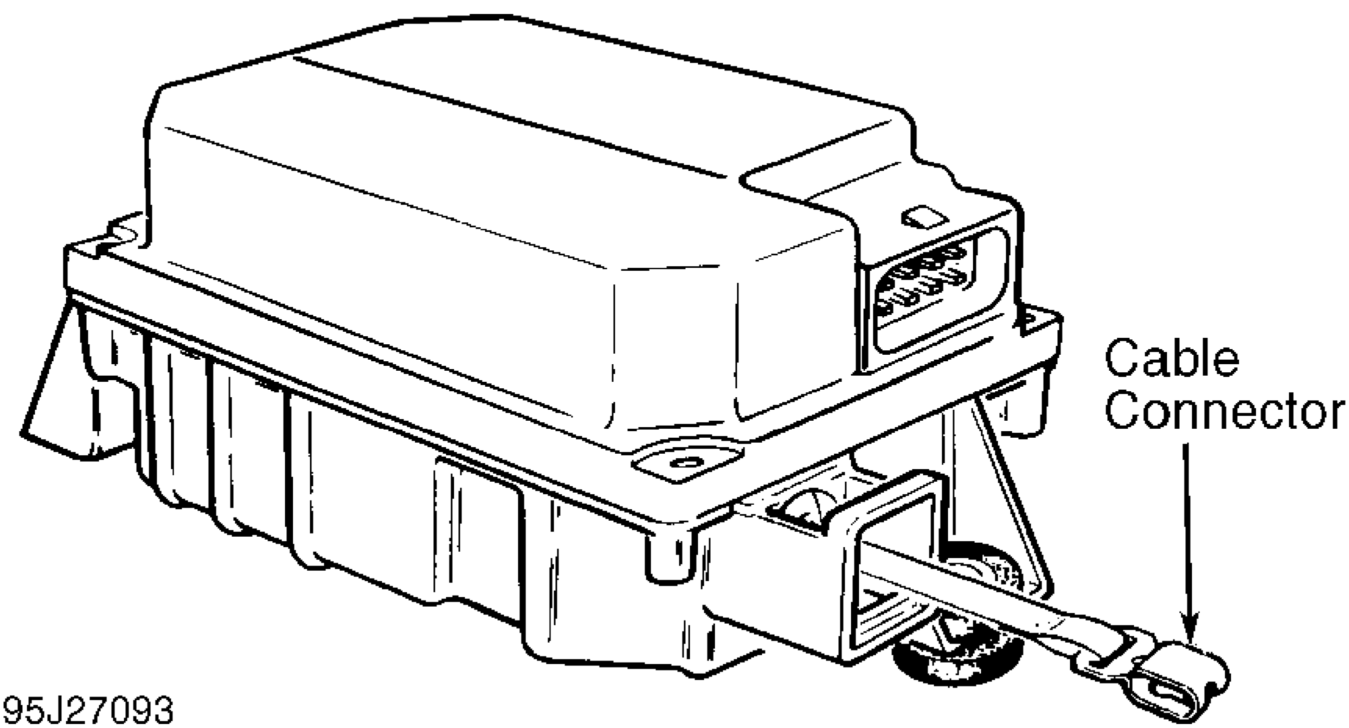

Fig. 1: Electric Motor Cruise Control Module (Typical)
Courtesy of General Motors Corp.

CRUISE CONTROL SWITCH

Cruise control switch, mounted on end of multifunction (turn signal) lever, controls system operational modes.

SET/COAST

To set vehicle speed, turn control switch to ON position. With vehicle speed at 25 MPH or more, press and release SET/COAST button. Vehicle will maintain set speed.

To increase speed during engaged cruise, accelerate to desired speed. Press and release SET/COAST button. Vehicle will maintain new set speed.

To decrease speed during engaged cruise, press and hold SET/COAST button. System will disengage. When vehicle has slowed to desired speed, release SET/COAST button. Vehicle will maintain new set speed.

To decrease speed by one-MPH increments during engaged cruise, tap SET/COAST button (quickly press and release button; DO NOT hold button). Vehicle speed will decrease one MPH for each tap of button.

RESUME/ACCEL

To resume set speed after system has been disengaged by braking, momentarily engage and release RESUME/ACCEL switch. Vehicle will return to set speed. If RESUME/ACCEL switch is engaged for more than one second, vehicle will begin to accelerate. To accelerate using cruise control system, engage and hold RESUME/ACCEL switch until desired speed is reached.

To increase speed by one-MPH increments during engaged cruise, tap RESUME/ACCEL switch (quickly move to RESUME/ACCEL position and release). Vehicle speed will increase one MPH for each tap of switch. After 10 taps, system must be reset to a new speed to continue this function.

BRAKE & CLUTCH RELEASE SWITCHES

Brake and clutch release switches allow current flow to module when brakes and clutch are released. When brake or clutch pedal is depressed, voltage supply to cruise control circuit in PCM/VCM is interrupted. Brake switch may incorporate brakelight and torque converter clutch switch.

VEHICLE SPEED SENSOR

Vehicle Speed Sensor (VSS) is mounted in transmission (2WD) or transfer case (4WD). VSS produces an AC signal with a frequency proportional to speed at which transmission output shaft rotates, which is also proportional to vehicle speed. This signal is then sent to vehicle speed sensor buffer.

VEHICLE SPEED SENSOR BUFFER

Vehicle speed sensor buffer receives and converts AC voltage to a rate of 4000 pulses per mile. This signal is then sent to cruise control module, speedometer, and VCM/PCM. These components convert number of pulses per mile to pulses per second to determine speed of vehicle. Buffer is located on left side of instrument panel, near parking brake.

TROUBLE SHOOTING

1) Check fuses, and replace as necessary. Ensure cruise control cable and throttle linkage move freely. Some problems may be related to vehicle speed sensor circuit. Check for codes. See appropriate G - TESTS W/CODES article in ENGINE PERFORMANCE section. Refer to menu below.

* G - TESTS W/CODES - 2.2L
* G - TESTS W/CODES - 4.3L

2) Check for a broken or partially broken wire inside insulation which could cause system malfunction but prove good in a continuity/voltage check with system disconnected. Visually inspect for broken or open wires. Ensure any aftermarket electronic equipment is properly installed.

TESTING & DIAGNOSIS

NOTE: Cruise control will be disabled if stoplights (including center high mounted stoplight) are not operating properly.

CRUISE CONTROL DOES NOT ENGAGE

1) Ensure BRAKE (10-amp) and STOP/HAZ (20-amp) fuses are okay. Turn ignition off. Disconnect cruise control module connector. Turn ignition on. Connect test light between cruise control module connector terminal "F" (Brown wire) and ground. If test light glows, go to next step. If test light does not glow, repair open or short to ground in Brown wire.

2) Connect test light between cruise control module connector terminals "F" (Brown wire) and "E" (Black/White wire). If test light glows, go to next step. If test light does not glow, repair open in Black/White wire.

3) Turn cruise control on. Connect test light between cruise control module connector terminal "B" (Dark Blue wire) and ground. If test light does not glow, go to next step. If test light glows, check for short to power in Dark Blue wire. If circuit is okay, replace cruise control switch.

4) Connect test light between cruise control module connector terminal "C" (Gray/Black wire) and ground. If test light does not glow, go to next step. If test light glows, check for short to power in Gray/Black wire. If circuit is okay, replace cruise control switch.

5) Connect test light between cruise control module connector terminal "A" (Gray wire) and ground. If test light glows, go to step 7). If test light does not glow, go to next step.

6) Connect test light between cruise control switch connector terminal A13 (Brown wire) and ground. If test light glows, check for open in Gray wire. If circuit is okay, replace cruise control switch. If test light does not glow, repair open in Brown wire.

7) Ensure ignition is on. Connect test light between cruise control module connector terminal "D" (Purple wire on A/T, Brown/White wire on M/T) and ground. If test light glows, go to step 10). If test light does not glow, go to next step (M/T) or step 9) (A/T).

8) Connect test light between clutch pedal position switch connector terminal "B" (Purple wire) and ground. If test light does not glow, go to next step. If test light glows, check for open in Brown/White wire. If circuit is okay, replace clutch pedal position switch.

9) Connect test light between brakelight switch connector terminal "D" (Brown wire) and ground. If test light glows, check for open in Purple wire. If test light does not glow, repair open in Brown wire.

10) Ensure ignition is on. Connect test light between cruise control module connector terminal "B" (Dark Blue wire) and ground. Press and hold SET/COAST button. If test light glows, go to next step. If test light does not glow, check for open in Dark Blue wire. If circuit is okay, replace cruise control switch.

11) Turn ignition switch to OFF position. Connect cruise control module. Disconnect PCM connector C2, or VCM connector C4. Turn

ignition switch to RUN position. Using a DVOM, measure voltage at PCM connector C2, terminal "K" (Brown Wire), or VCM connector C4, terminal No. 3 (Dark Green/White wire). If reading is about 7 volts, go to next step. If reading is not about 7 volts, check for short to ground or open in Brown or Dark Green/White wire. If circuit is okay, replace cruise control module.

12) Turn ignition off. Reconnect VCM/PCM connector. Set parking brake. Start engine. Turn cruise control off. Turn cruise control off. After 3 seconds, press and hold SET/COAST button. Press and hold RESUME/ACCEL switch. Fully depress and hold brake pedal. After 10 seconds, release brake pedal. If engine RPM momentarily increases, check for poor connections at VCM/PCM. If connections are okay, replace VCM/PCM. If engine RPM does not momentarily increase, replace cruise control module.

CRUISE CONTROL DOES NOT RESUME, ACCELERATE, TAP-UP OR TAP-DOWN

Ensure BRAKE and STOP/HAZ fuses are okay. Disconnect cruise control module. Turn ignition on. Turn cruise control on. Connect test light between cruise control module connector terminal "C" (Gray/Black wire) and ground. Press and hold RESUME/ACCEL switch. If test light glows, check for poor connection at cruise control module terminal "C". If connection is okay, replace cruise control module. If test light does not glow, check for open in Gray/Black wire. If circuit is okay, replace cruise control switch.

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. See COMPUTER RELEARN PROCEDURES article in GENERAL INFORMATION before disconnecting battery.

BRAKE & CLUTCH RELEASE SWITCHES

Removal & Installation

Remove electrical connectors from switch. Remove pedal bracket bolt. Remove switch from pedal bracket. To install, reverse removal procedure. Tighten pedal bracket bolt to 13 ft. lbs. (17 N.m).

CRUISE CONTROL CABLE

Removal & Installation (4.3L)

1) Remove and discard retainer. To install, attach cable bead to ribbon end fitting of cruise control module. Snap cable fitting over ferrule on end of conduit until snap is heard. Ensure cable is taut and ribbon is not twisted. Slide cable conduit over ribbon, and install in cruise control module.

2) Install cable fitting into rectangular slot in engine bracket. Snap cable fitting over throttle lever pin. Route cable over accelerator cable through retainer on right rear corner of engine. Flip adjuster lever down to lock cable. Ensure a 0-1 mm clearance exists.

Removal & Installation (2.2L)

1) Remove and discard retainer. To install, attach cable bead to ribbon end fitting of cruise control module. Ensure cable is taut and ribbon is not twisted. Slide cable conduit over ribbon, and install in cruise control module. Route cable over refrigerant line (if equipped).

2) Rotate cam lever. Install cable slug into slot opening in throttle lever, and install wire into pulley groove. DO NOT twist or kink cable. Ensure cable slug is supported by sides of throttle cam lever.

3) Install cable fitting into rectangular slot in engine bracket. Connect cable locator clip to top of routing bracket mounted on rocker cover. Flip adjuster lever (Natural) down to lock cable. Ensure a 0-1 mm clearance exists.

CRUISE CONTROL MODULE

Removal & Installation

Disconnect negative battery cable. Remove cruise control cable. See CRUISE CONTROL CABLE. Disconnect electrical connector from module assembly. Remove cruise control module. To install, reverse removal procedure. Tighten cruise control module fasteners to specification. See TORQUE SPECIFICATIONS.

VEHICLE SPEED SENSOR (VSS)

Removal (A/T Models)

Disconnect negative battery cable. Raise and support vehicle. Disconnect speed sensor electrical connector. Remove speed sensor retainer bolt. Using Speed Sensor Remover/Installer (J-38417), remove speed sensor. Remove speed sensor O-ring from speed sensor.

Installation

To install, reverse removal procedure. Lubricate O-ring with transmission fluid. Tighten speed sensor retainer bolt to 97 INCH lbs. (11 N.m).

Removal (M/T Models)

Disconnect negative battery cable. Raise and support vehicle. Disconnect speed sensor electrical connector. Remove speed sensor retainer bolt. Remove speed sensor. Remove speed sensor O-ring from speed sensor.

Installation

To install, reverse removal procedure. Lubricate O-ring with transmission fluid. Tighten speed sensor bolt to 16 ft. lbs. (22 N.m).

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS TABLE

Application	Ft. Lbs. (N.m)
Pedal Bracket Bolt	13 (18)
	INCH Lbs. (N.m)
Cruise Control Module Screws	40 (4.5)
Vehicle Speed Sensor Bolt	
A/T	97 (11)
M/T	(1)

(1) - Tighten bolt to 16 ft. lbs. (22 N.m).

WIRING DIAGRAMS

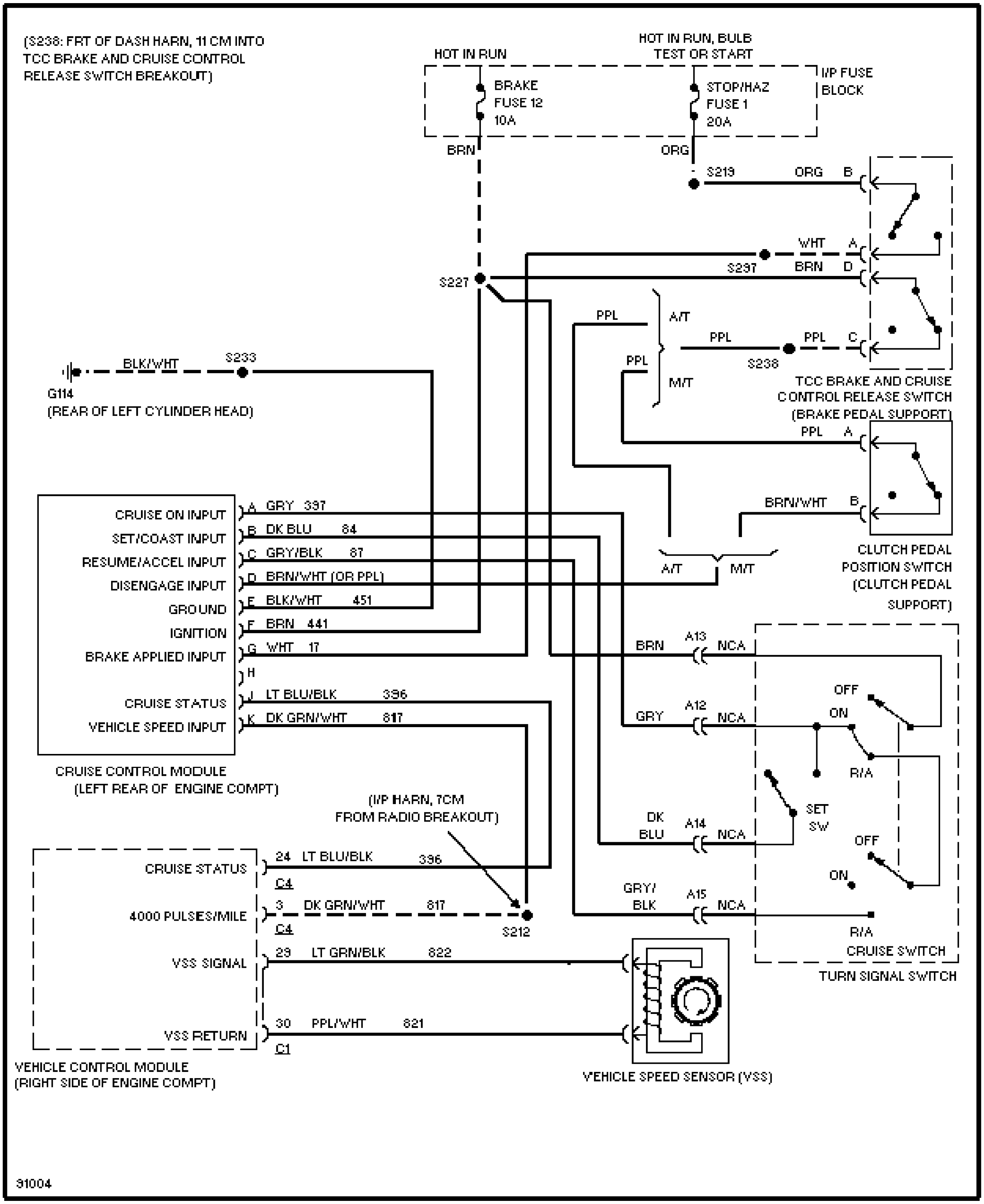

Fig. 2: Cruise Control System Wiring Diagram (4.3L)

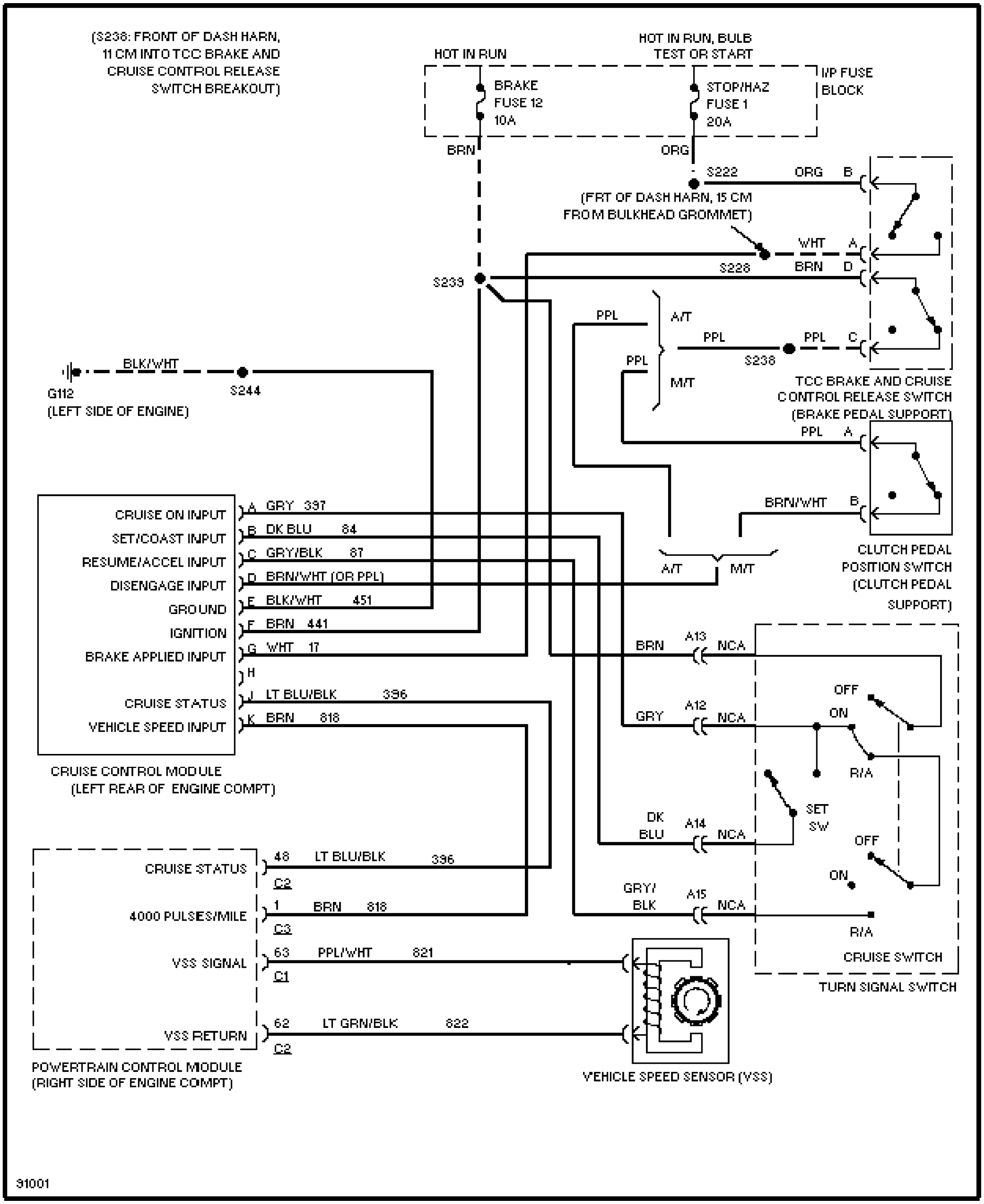

Fig. 3: Cruise Control System Wiring Diagram (2.2L)

DEFOGGER - MIRROR & REAR WINDOW

1997 Chevrolet Blazer

1997 ACCESSORIES/SAFETY EQUIP
General Motors Corp. - Rear Window & Mirror Defoggers

Chevrolet; Blazer, "S" & "T" Pickup
GMC; Jimmy & Sonoma
Oldsmobile; Bravada

DESCRIPTION & OPERATION

Rear window defogger system consists of rear window defogger switch on instrument panel, timer relay, rear defogger grid and heated mirrors (if equipped). Timer relay is incorporated in rear window defogger switch, located on left side of instrument panel. Grid is bonded to inside surface of rear window. Current enters grid on left side and is grounded on right side of cab.

Ignition switch must be on to operate system rear window defogger system. When rear window defogger switch is pressed, timer relay allows current to flow to grid for 10 minutes, then stops current flow to grid. Each time rear window defogger switch is activated after initially activation, timer relay will allow current flow to grid for 5 minutes. If ignition switch is turned off then back on, timer relay resets to 10-minute cycle. Any time rear window defogger switch or ignition switch is turned off, current stops flowing to grid.

TESTING

NOTE: Before testing, ensure fuses and circuit breakers are okay and ground connections are clean and tight. Leave electrical connectors attached and backprobe terminals unless specified otherwise. For references to connectors and terminals see appropriate wiring diagram. See WIRING DIAGRAMS.

GRID FILAMENT TEST

1) Start engine. Turn defogger system on. Ground test light and lightly probe each grid line. Move test light from feed wire side of grid to ground side. See Fig. 1.

2) Test light should gradually dim as it is moved across grid. Be sure to check each grid in at least 2 places to avoid the possibility of bridging a gap with test light.

3) If test light shows full brilliance at both ends of grid, check for loose ground wire contact at cab body. If test light goes out as it is moved across grid, a break has been detected. Use a grease pencil to mark break(s) on outside of window. Go to GRID FILAMENT REPAIR under ON-VEHICLE SERVICE.

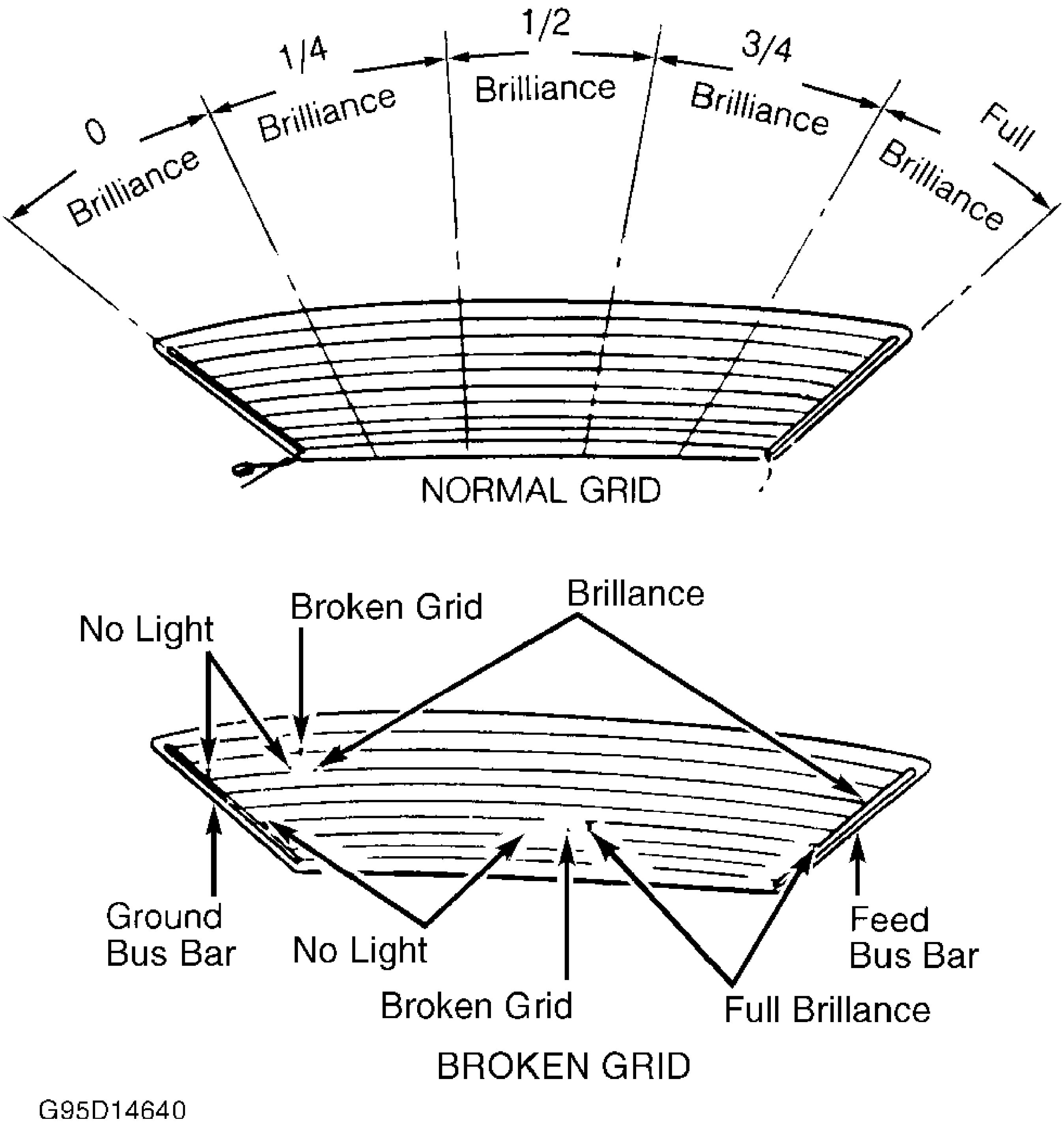

Fig. 1: Examining Grid Brilliance Test Patterns (Typical)
Courtesy of General Motors Corp.

REAR WINDOW DEFOGGER

Indicator Illuminates, But Rear Window Does Not Clear

1) Connect test light between ground and rear window defogger switch terminal "A" (Orange wire). If test light illuminates, go to next step. If test light does not illuminate, repair open in Orange wire between rear window defogger switch and instrument panel fuse

block.

2) Turn rear window defogger switch on. Connect test light between ground and rear window defogger switch terminal "B" (Purple wire). If test light illuminates, go to next step. If test light does not illuminate, replace rear window defogger switch.

3) Connect test light between ground and connector C432 (body harness-to-rear defogger grid pigtail) terminal "A" (Purple wire). If test light illuminates, go to next step. If test light does not illuminate, repair open in Purple wire between connector C432 and rear window defogger switch.

4) Connect test light between connector C432 terminal "A" (Purple wire) and connector C433 (body harness-to-rear defogger grid pigtail) terminal "A" (Black wire). If test light illuminates, repair rear defogger grid as necessary. If test light does not illuminate, repair open in Black wire between connector C433 and ground.

Rear Window Defogger Does Not Operate

1) Turn ignition on. Connect test light between ground and rear window defogger switch terminal "E" (Pink wire). If test light illuminates, go to next step. If test light does not illuminate, repair open in Pink wire between rear window defogger switch and instrument panel fuse block.

2) Connect test light between rear window defogger switch terminals "E" (Pink wire) and "D" (Black wire). If test light illuminates, go to next step. If test light does not illuminate, repair open in Black wire between rear window defogger switch and ground.

3) Connect test light between ground and rear window defogger switch terminal "A" (Orange wire). If test light illuminates, go to next step. If test light does not illuminate, repair open in Orange wire between rear window defogger switch and instrument panel fuse block.

4) Turn rear window defogger switch on. Connect test light between ground and rear window defogger switch terminal "B" (Purple wire). If test light illuminates, go to next step. If test light does not illuminate, replace rear window defogger switch.

5) Connect test light between ground and connector C432 (body harness-to-rear defogger grid pigtail) terminal "A" (Purple wire). If test light illuminates, go to next step. If test light does not illuminate, repair open in Purple wire between connector C432 and rear window defogger switch.

6) Connect test light between connector C432 terminal "A" (Purple wire) and connector C433 (body harness-to-rear defogger grid pigtail) terminal "A" (Black wire). If test light illuminates, repair rear defogger grid as necessary. If test light does not illuminate, repair open in Black wire between connector C433 and ground.

Indicator Inoperative

Turn headlights on. Turn dimmer control to full intensity. Connect test light between ground and rear window defogger switch terminal "C" (Gray wire). If test light illuminates, replace indicator bulb. If test light does not illuminate, repair open in Gray wire between rear window defogger switch and instrument panel fuse block.

ON-VEHICLE SERVICE

GRID FILAMENT REPAIR

1) Turn system off. Disconnect negative battery cable. Gently clean area to be repaired with steel wool. Wipe area clean with denatured alcohol. Be sure to clean 1/4" (6 mm) beyond each side of break.

2) With glass at room temperature of 70-90°F (20-32°C), position masking tape along both side of grid line at damaged area. See Fig. 2. Apply grid repair material to grid and remove masking tape. Holding heat gun 1-2" (25-50 mm) from repair area, apply heat at 500-700°F (260-370°C) for 2-3 minutes. If heat gun is not available, allow repair area to air dry for at least 24 hours.

3) Test defogger operation to verify repair. If repair appears discolored, apply a coating of tincture of iodine. Allow iodine to dry for 30 seconds and carefully wipe off excess.

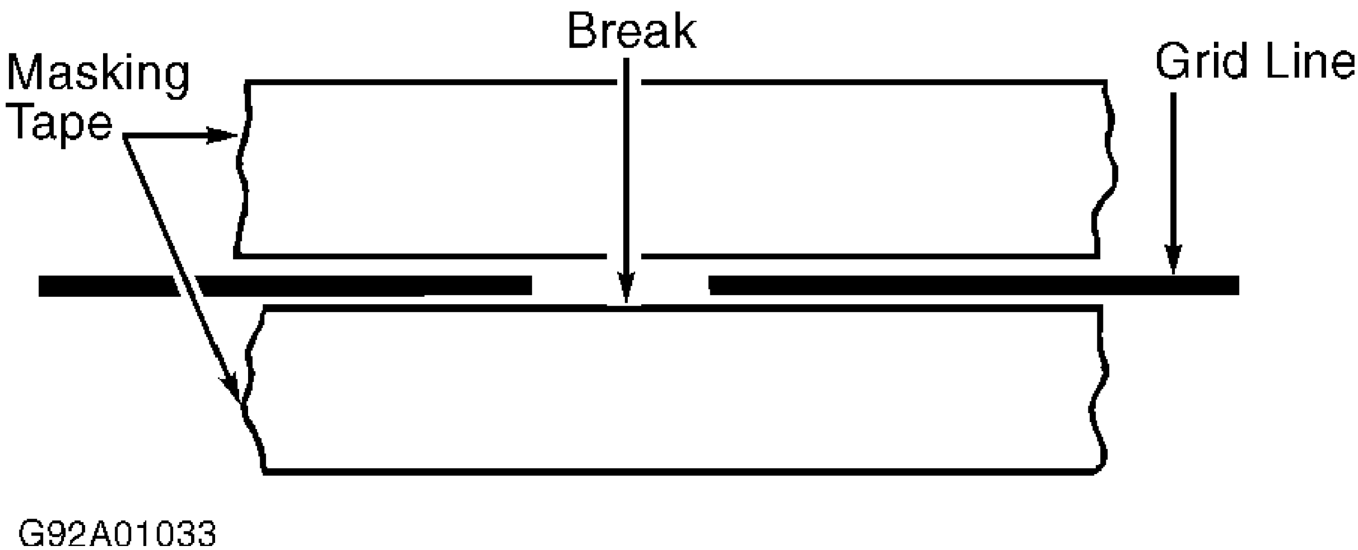

Fig. 2: Repairing Grid Line

REMOVAL & INSTALLATION

WARNING: Before servicing instrument panel components on vehicles with Supplemental Inflatable Restraint (SIR) system, disable SIR system. See DISABLING & ACTIVATING AIR BAG SYSTEM in AIR BAG RESTRAINT SYSTEM article.

NOTE: For removal and installation procedures for mirrors, see MIRRORS - POWER article.

A/C-HEATER CONTROL

Removal & Installation

Disconnect negative battery cable. Remove instrument panel trim panel. Remove A/C-heater control mounting screws. Disconnect electrical and vacuum harnesses. Remove A/C-heater control from vehicle. To install, reverse removal procedure.

WIRING DIAGRAMS

NOTE: For pickup models, see SYSTEM WIRING DIAGRAMS article in WIRING DIAGRAMS section.

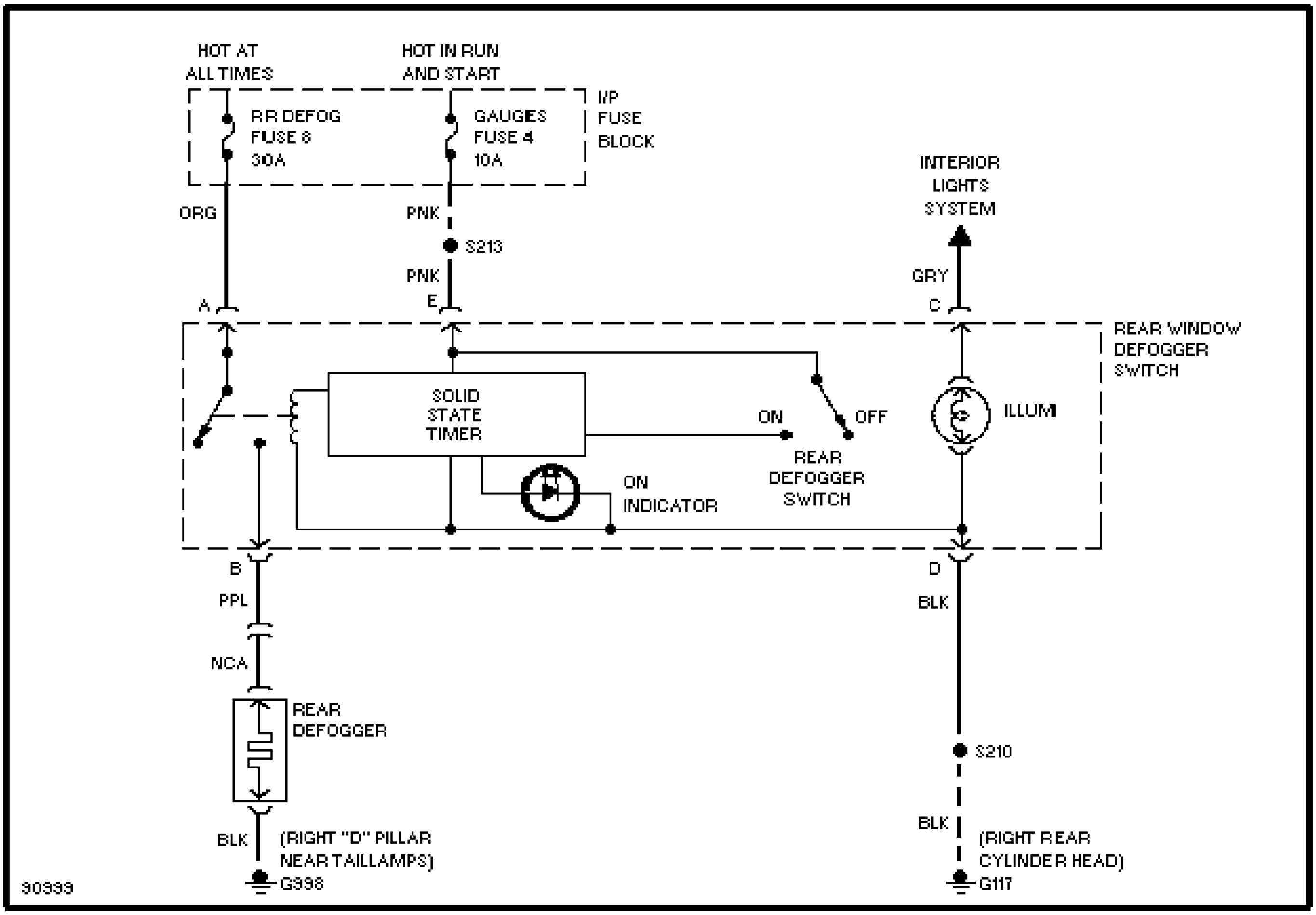

Fig. 3: Rear Window Defogger System Wiring Diagram (Blazer, Bravada & Jimmy)

DIFFERENTIALS - EATON LOCKING

1997 Chevrolet Blazer

1996-97 Drive Axles - Differentials - Eaton Locking

Astro, Blazer, "C" & "K" Pickup, "S" & "T" Pickup, Commercial Van, Express, Suburban, Tahoe, Van, Jimmy, Safari, Savana, Sierra, Sonoma, Yukon, Bravada

MODEL IDENTIFICATION

Vehicle model can be identified by fifth character of Vehicle Identification Number (VIN), stamped on metal pad on top of left end of instrument panel, near windshield. See MODEL IDENTIFICATION table.

MODEL IDENTIFICATION

Series (1)	Model
"C"	2WD Pickup, Sierra, Suburban, Tahoe & Yukon
"G"	(2) RWD Van
"K"	4WD Pickup, Sierra, Suburban, Tahoe & Yukon
"L"	AWD Astro & Safari
"M"	2WD Astro & Safari
"P"	Commercial Van & Motorhome
"S"	2WD Blazer, Jimmy, Pickup & Sonoma
"T"	4WD Blazer, Jimmy, Pickup & Sonoma
"T"	AWD Bravada

(1) - Fifth character of VIN.
(2) - Includes Express, Rally Van and Savana.

DESCRIPTION

This article covers 2 similar locking differentials: those with a 1-piece case (axles with a 10 1/2" ring gear) and those with a 2-piece case (all other axles). The 1-piece case has 2 pinion gears. The 2-piece case has 3-pinion gears. Both types have a clutch disc pack behind each of the side gears.

AXLE RATIO & IDENTIFICATION

Rear axle identification is stamped on forward side of axle tube. The first 3 digits indicate rear axle ratio, the next digit indicates axle assembly build source code and the next 3 digits indicate the day built.

Front axle identification is located on tag attached near axle tube.

REMOVAL & INSTALLATION

See appropriate DRIVE AXLE article.

OVERHAUL

1-PIECE CASE

Disassembly (Differential)

1) Using Governor Remover (J-26252), remove governor bushing. Remove "C" clips holding latching bracket in position on governor shaft. Move latching bracket down shaft.

2) Using governor remover, remove latching bracket bushing. See Fig. 1. Remove latching bracket, shaft, spring and governor from case. Remove stop pin on 9 1/2" ring gear units. See Fig. 1. Remove lock screw and pinion shaft on other ring gear units. Remove pinion gears and thrust washers from case by rotating a side gear.

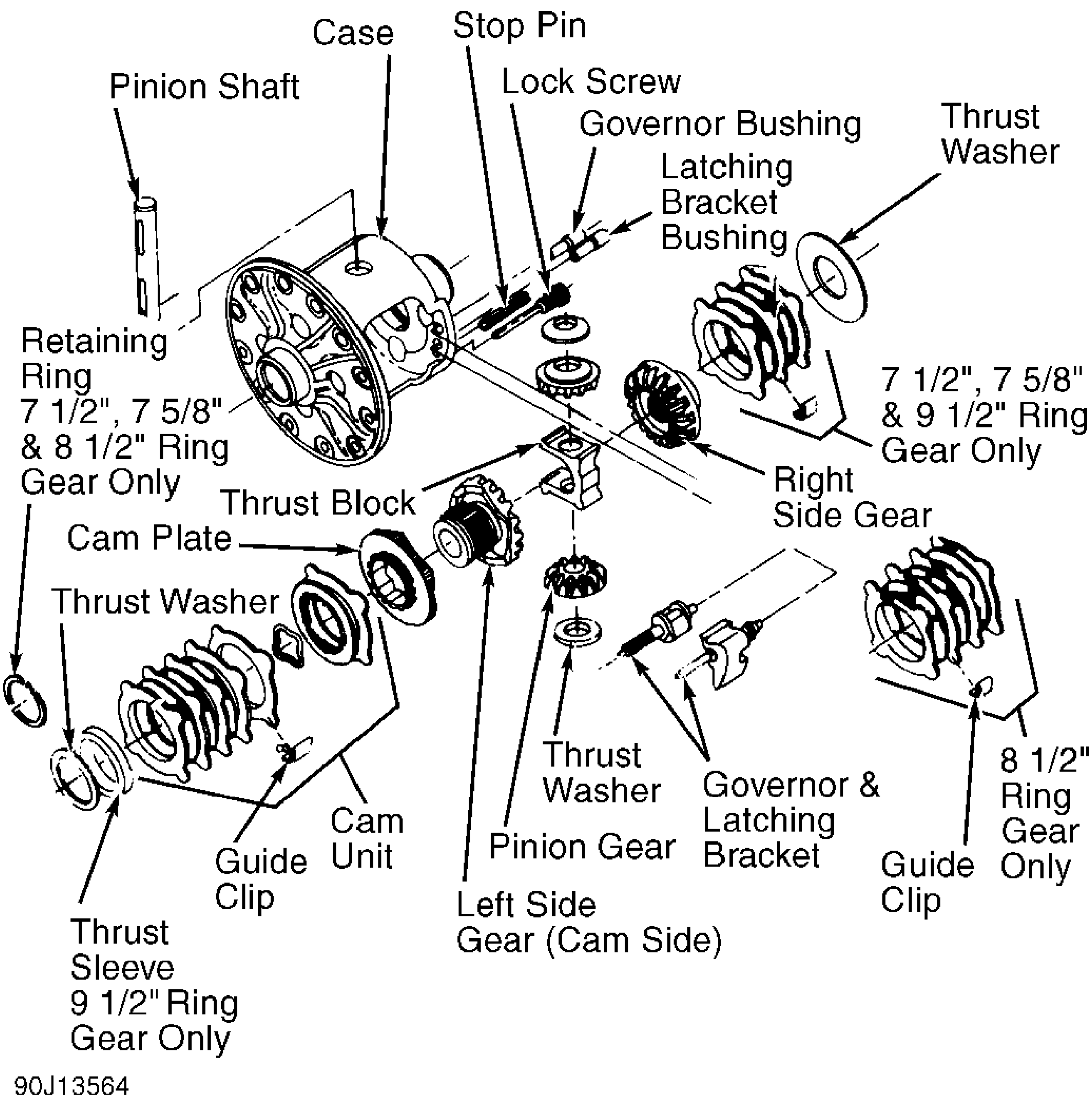

Fig. 1: Exploded View Of 1-Piece Case Locking Differential
Courtesy of General Motors Corp.

3) Remove thrust block, right side gear, clutch pack and thrust washer. Remove left side gear, cam plate and cam unit (clutch

pack) as an assembly. Remove thrust washer.

Disassembly (Cam Unit With 7 5/8" Or 8 1/2" Ring Gear)

Remove retaining ring, clutch plates, guide clips and wave spring. Remove cam plate and left side gear.

Disassembly (Cam Unit With 9 1/2" Ring Gear)

Measure and record overall length of gear assembly from front of gear to back of thrust sleeve, including thrust washer. Remove guide clips. Using press and Bearing Remover (J-22912-01), press thrust sleeve from left side gear. Remove lock plates, wave spring and cam plate from left side gear.

Inspection (All Models)

Clean all parts in solvent. Inspect all gears for cracks and scoring. Inspect all clutch components and thrust washers for damage. Check fit of side gears on axle shafts. Inspect thrust sleeve for wear. Replace components as necessary.

NOTE: If side gears or thrust block are replaced, adjust differential. Check side gear backlash and thrust block clearance. See 1-PIECE CASE under ADJUSTMENTS.

Reassembly (Cam Unit With 7 5/8" Or 8 1/2" Ring Gear)

Install cam plate on left side gear. Install wave spring. On units with 7 5/8" ring gear, install 8 clutch plates. Install 10 clutch plates on8 1/2" ring gear units. Install clutch plates in alternating sequence. See Fig. 1. Install retaining ring. Use grease to hold guide clips in place. Install guide clips on clutch plates.

Reassembly (Cam Unit With 9 1/2" Ring Gear)

1) Install cam plate on left side gear. Install wave spring. Install clutch plates. Install clutch plates in alternating sequence. See Fig. 1. Press thrust sleeve on left side gear until sleeve is even with surface of left side gear disc splines.

2) Use grease to hold guide clips in place. Install guide clips on clutch plates. If side gear or thrust sleeve were replaced, measure and record overall length of gear assembly from front of gear to back of thrust sleeve and thrust washer.

3) Compare new measurement with original measurement taken during disassembly. If difference between 2 measurements is .003" (.07 mm) or more, install NEW thrust washer to obtain measurement nearest to original measurement.

Reassembly (Differential)

1) Install thrust washer and left side gear (cam unit) in case. Install thrust washer for right side gear in case. Install clutch pack for right side gear. Install clutch plates in alternating sequence. See Fig. 1.

2) Use grease to hold guide clips in place. Install guide clips on clutch plates. Install right side gear, thrust block, thrust washers and pinion gears. Install pinion gears in case, 180 degrees apart.

3) Rotate pinion gears and thrust block into case. Ensure open side of thrust block faces small window opening. Install pinion shaft and NEW lock screw. DO NOT tighten lock screw to specification at this time.

NOTE: Once unit is installed in differential housing, tighten lock screw to specification.

4) Place governor assembly and latching bracket into case. Place straight end of latching bracket spring over governor assembly

shaft. See Fig. 2.

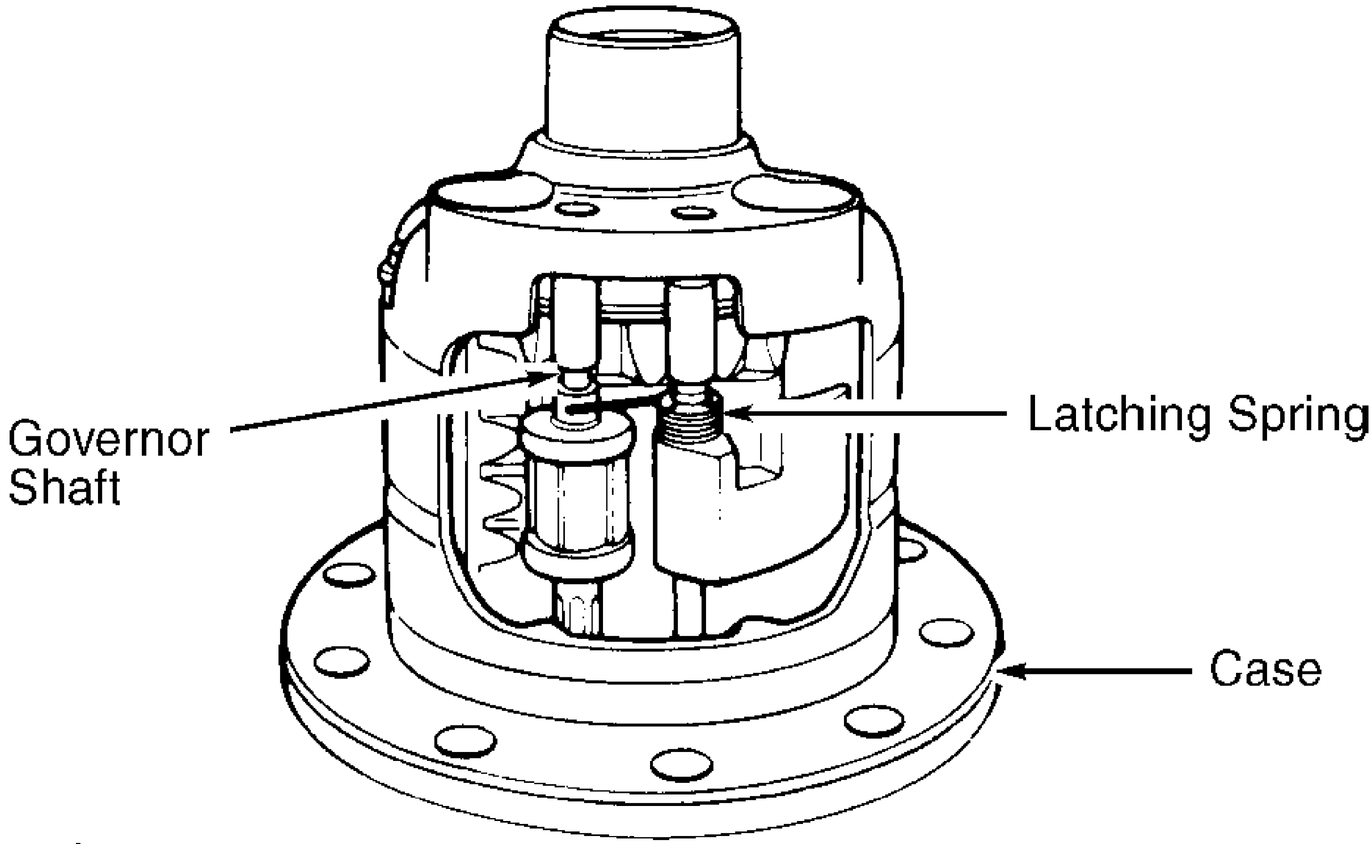

Fig. 2: Installing Governor & Latching Bracket
Courtesy of General Motors Corp.

5) On 9 1/2" ring gear units, install stop pin until pin is even with surface of case.

6) On all ring gear units, latching bracket bushing has a tapered hole; governor bushing has a straight hole. Press governor bushing into case until shaft end play of .004-.020" (.10-.51 mm) exists. Press latching bracket bushing into case so no shaft end play exists. Once unit is installed, tighten lock screw to 37 ft. lbs. (51 N.m) on 9 1/2" ring gear, or 27 ft. lbs. (37 N.m) on all others.

2-PIECE CASE

Disassembly (Differential)

1) With differential removed from housing, remove ring gear and side bearings. Remove screws from front face of ring gear flange. Place differential on right half.

2) Using a screwdriver, gently pry differential case halves apart at yoke hole locations. Remove left half. Hold thumb against inside of gear hub when separating differential case halves to prevent left side gear from falling out.

3) Remove governor and latching bracket assembly. See Fig. 3. Remove left side gear, clutch plates, guide clips and side gear thrust washer. Remove reaction blocks, pinion yoke, pinion gears and pinion thrust washers.

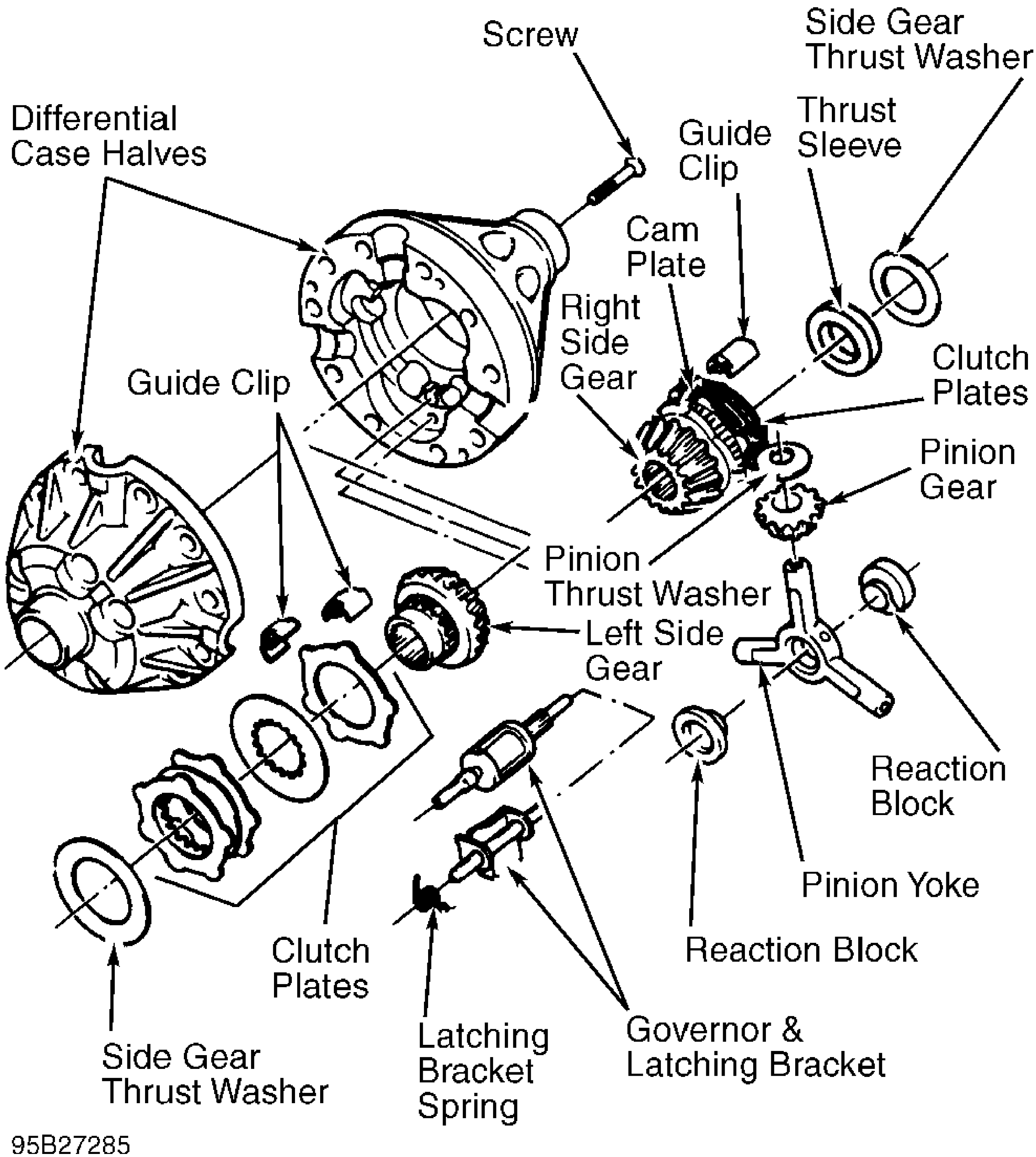

Fig. 3: Exploded View Of 2-Piece Case Locking Differential
Courtesy of General Motors Corp.

Disassembly (Cam Unit)

1) Remove right side gear and side gear thrust washer. Measure and record length of gear assembly from front of gear to back of thrust sleeve, including side gear thrust washer. See Fig. 3.

2) Using press and Bearing Remover (J 22912-01), press thrust sleeve from right side gear. Separate clutch plates, guide clips, wave spring and cam plate from right side gear. See Fig. 4.

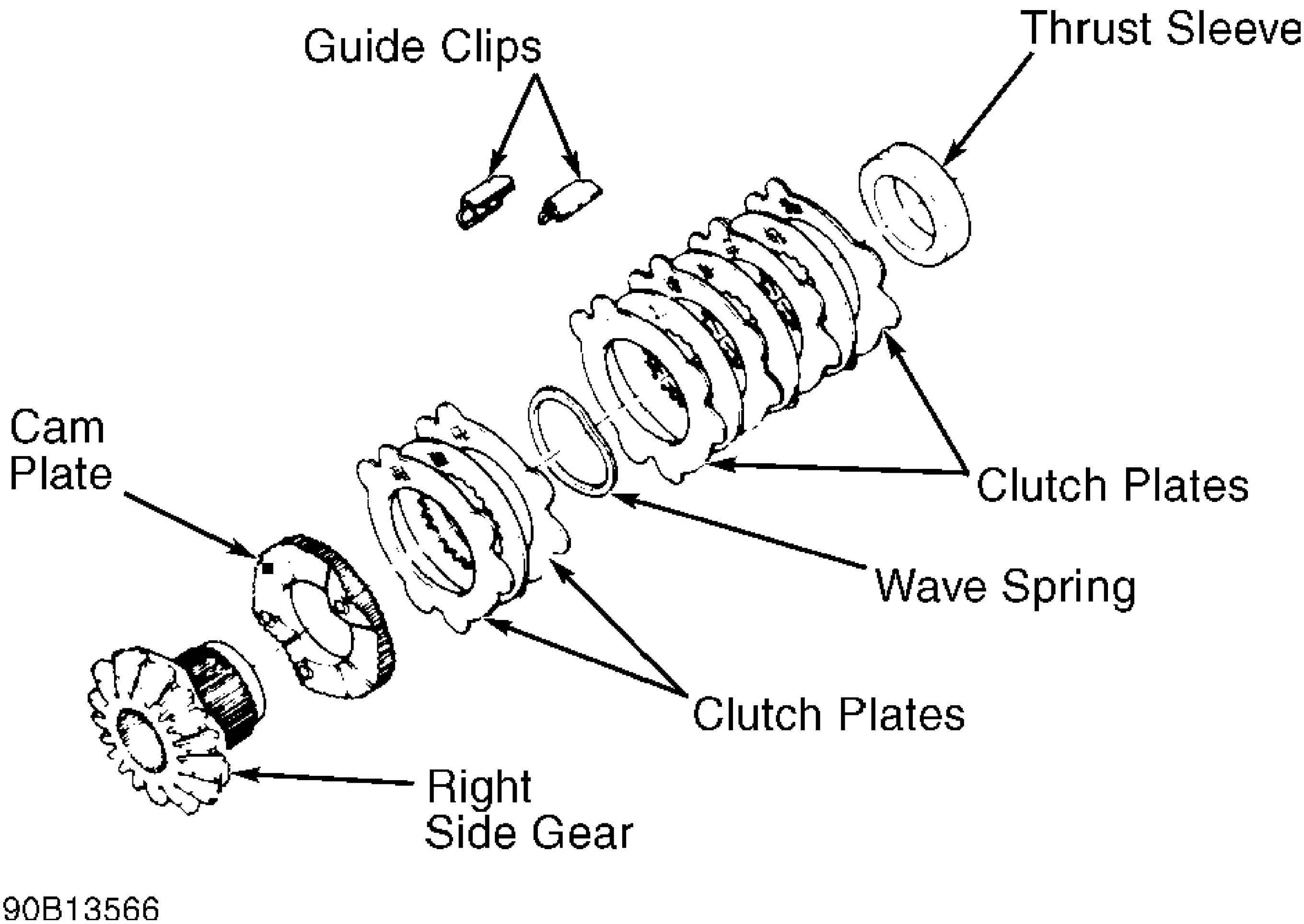

Fig. 4: Exploded View Of Right Side Gear (Cam Unit) & Components
Courtesy of General Motors Corp.

Inspection

Clean all parts in solvent. Inspect all gears for cracks and scoring. Inspect all clutch components and thrust washers for damage. Check fit of side gears on axle shafts. Inspect thrust sleeve for wear. Replace components as necessary.

NOTE: If side gears or reaction blocks were replaced, adjust differential. Check side gear backlash and reaction block clearance. See 2-PIECE CASE under ADJUSTMENTS.

Reassembly (Cam Unit)

1) Install cam plate on right side gear. Install wave spring and clutch plates. Install clutch plates. Install clutch plates in alternating sequence. See Fig. 4.

2) Press thrust sleeve on right side gear until sleeve is even with surface of right side gear disc splines.

3) Use grease to hold guide clips in place. Install guide clips on clutch plates. If side gear or thrust sleeve were replaced, measure and record overall length of gear assembly from front of gear to back of thrust sleeve and thrust washer.

4) Compare new measurement with original measurement taken during disassembly. If difference between the 2 measurements is .003" (.07 mm) or more, install NEW thrust washer to obtain measurement nearest to original measurement.

Reassembly (Differential)

1) Install side gear thrust washer and right side gear in differential case half. Install reaction blocks, pinion yoke, pinion gears and pinion thrust washers.

2) Install left side gear thrust washer and clutch plates in differential case half. Ensure clutch plates are installed in alternating sequence. See Fig. 3. Install left side gear and latching bracket assembly.

3) Install governor assembly. Ensure straight end of latching bracket spring is over governor assembly shaft. See Fig. 2. Hold left side gear in differential case half, and install cases together. Install and tighten retaining bolts.

ADJUSTMENTS

1-PIECE CASE

NOTE: If side gears or thrust block have been replaced, adjust differential. Adjust clearance using correct thickness of selective thrust block and selective side gear thrust washers. Left and right side gear backlash and thrust block clearance must also be adjusted.

Left Side Gear Backlash

1) Install cam unit and thrust washer in flange end of case. Install pinion gears and thrust washer into differential. Ensure thrust washers are aligned with pinion shaft hole.

2) Press side gear downward, and install pinion shaft and lock screw. If side gear cannot be pressed down enough to install pinion shaft, install thinner thrust washer.

3) Rotate pinion gear closest to lock screw so one tooth is pointing downward (perpendicular to ring gear flange). Insert a screwdriver firmly between side gear and pinion shaft.

4) Install dial indicator on ring gear flange, with indicator stem positioned on tooth of pinion gear closest to lock screw.

5) Pull pinion gear against case, rotate pinion gear back and forth, and note backlash reading. Repeat procedure on opposite pinion gear. Backlash should be .010-.018" (.25-.46 mm).

6) Change thrust washer thickness to obtain correct backlash. If backlash is greater than specification, use thicker thrust washer. If backlash is less than specification, use thinner thrust washer.

Right Side Gear Backlash

1) Install clutch plates in alternating sequence. See Fig. 1. Use grease to hold guide clips in place. Install guide clips on clutch plates.

2) Install thrust washer, clutch plates and right side gear into case. Install pinion gears and thrust washers. Ensure gears and washers align with pinion shaft hole.

3) Press side gear downward, and install pinion shaft and lock screw. If side gear cannot be pressed down enough to install pinion shaft, install thinner thrust washer.

4) Rotate pinion gear closest to lock screw or stop pin so one tooth is pointing downward (perpendicular to ring gear flange). Insert a screwdriver firmly between side gear and pinion shaft.

5) Install dial indicator on ring gear flange, with indicator stem positioned on tooth of pinion gear closest to lock screw.

6) Pull pinion gear against case, rotate pinion gear back and forth, and note backlash reading. Repeat procedure on opposite pinion gear. Backlash should be .002-.010" (.05-.25 mm).

7) Change thrust washer thickness to obtain correct backlash. If backlash is greater than specification, use thicker thrust washer. If backlash is less than specification, use thinner thrust washer.

Thrust Block Clearance

1) Install thrust washer, left side gear (cam unit), thrust washer, clutch plates and right side gear in case. Install pinion shaft and lock screw.

2) Insert a screwdriver firmly between each side gear and pinion shaft. Using a 1-2" telescoping gauge, measure distance between faces (not gear teeth) of both side gears.

3) Remove telescoping gauge and measure with a micrometer. This is the side gear spread. With micrometer, measure original thrust block at outer corner. Thrust block thickness should be 0-.006" (0-.15 mm) less than side gear spread.

4) To adjust clearance, select thrust block with different thickness, or reshim right clutch pack. Ensure right side gear backlash remains at .002-.010" (.05-.25 mm).

2-PIECE CASE

NOTE: If side gears or thrust block have been replaced, adjust differential clearance. Adjust clearance using correct thickness of selective thrust block and selective side gear thrust washers. Left and right side gear backlash and thrust block clearance must also be adjusted.

Right Side Gear Clearance

1) Install right side gear (cam unit) and side gear thrust washer in differential case right half. Using washers, long bolt and nut, clamp right side gear unit in differential case.

2) Install pinion gears and thrust washers on pinion yoke. Install pinion yoke in differential case half. Loosen nut on the bolt. Position one pinion gear tooth facing downward (perpendicular to ring gear flange) and tighten nut.

3) Install dial indicator on ring gear flange, with indicator stem positioned on one tooth of pinion gear. Pull pinion gear against differential case half. Rotate pinion gear back and forth, and note backlash reading.

4) Ensure pinion yoke remains seated while checking backlash. Repeat procedure on remaining pinion gears. Backlash should be .010-.018" (.25-.46 mm).

5) Change thrust washer thickness to obtain correct backlash. If backlash is greater than specification, use thicker thrust washer. If backlash is less than specification, use thinner thrust washer.

Left Side Gear Clearance

1) Assemble clutch plates in alternating sequence. See Fig. 3. Use grease to hold guide clips in place, and install guide clips on clutch plates.

2) Install thrust washer, clutch plates and left side gear in differential case half. Using washers, long bolt and nut, clamp left side gear in differential case.

3) Install pinion gears and thrust washers on pinion yoke. Install pinion yoke in differential case half. Loosen nut on bolt. Position one pinion gear tooth facing downward (perpendicular to ring gear flange), and tighten nut.

4) Install dial indicator on ring gear flange, with indicator stem positioned on one tooth of pinion gear. Pull pinion gear against differential case. Rotate pinion gear back and forth, and note

backlash reading.

5) Ensure pinion yoke remains seated while checking backlash. Repeat procedure on remaining pinion gears. Backlash should be .002-.010" (.05-.25 mm).

6) Change thrust washer thickness to obtain correct backlash. If backlash is greater than specification, use thicker thrust washer. If backlash is less than specification, use thinner thrust washer.

Reaction Block Clearance

1) Install left thrust washer, right thrust washer, side gears and clutch plates in differential case halves. Using washers, long bolt and nut, clamp both side gears in differential case.

2) Place straightedge across top of both side gears. Using depth micrometer, measure distance from face of straightedge to surface of differential case half. Subtract straightedge thickness from this measurement.

3) Add measurement of both sides together. This is the side gear spread. Assemble both original reaction blocks together and measure thickness of both reaction blocks.

4) Reaction block thickness should be 0-.006" (0-.15 mm) less than side gear spread. To adjust clearance, select reaction block with different thickness, or reshim left clutch pack. Ensure left side gear backlash remains within specification.

AXLE ASSEMBLY SPECIFICATIONS

AXLE ASSEMBLY SPECIFICATIONS

Application	Measurement In. (mm)
Governor Shaft End Play	.004-.020 (.10-.51)
Pinion Gear Backlash	
1-Piece Case	
Left Side Gear	.010-.018 (.25-.46)
Right Side Gear	.002-.010 (.05-.25)
2-Piece Case	
Left Side Gear	.002-.010 (.05-.25)
Right Side Gear	.010-.018 (.25-.46)

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Pinion Shaft Lock Screw	
Except 9 1/2" Ring Gear	27 (37)
9 1/2" Ring Gear	37 (51)

DOOR LOCKS - POWER

1997 Chevrolet Blazer

1997 ACCESSORIES/SAFETY EQUIP
General Motors Corp. - Power Door Locks

Chevrolet; Blazer, "S" & "T" Pickup
GMC; Jimmy & Sonoma
Oldsmobile; Bravada

DESCRIPTION & OPERATION

When door lock switch is operated, all doors will lock or unlock. Each lock can also be operated manually. Locks are operated by reversible motors. Door lock switches operate to turn motors on by supplying battery voltage to one terminal and ground to the other terminal.

When either door lock switch is moved to LOCK position, it completes a circuit to the motors. Motor in each door runs to operate door locks. When door lock switch is released, circuit is opened and motors turn off. When door lock switch is moved to UNLOCK position, polarity of voltage to motors is reversed.

Door lock switches are usually closed for just a moment. If door lock switches are held closed, a circuit breaker in each motor will open to protect against damage. Circuit breakers close automatically when they cool.

TROUBLE SHOOTING

Before proceeding to TESTING, perform the following visual inspections:

* Check appropriate circuit breakers and fuses. If circuit breakers or fuses are blown, service and repair source of overload. Replace circuit breakers and fuses.
* Check for mechanical failures or binding linkage.
* Check for broken or partially broken wire inside insulation, which could cause system malfunction but prove good in a continuity/voltage check with system disconnected. These circuits may be intermittent or resistive when loaded. Check by monitoring voltage drop with system under load.
* Check for proper installation of aftermarket electronic equipment.

TESTING

CAUTION: When battery is disconnected, vehicle computer and memory systems may lose memory data. Driveability problems may exist until computer systems have completed a relearn cycle. See COMPUTER RELEARN PROCEDURES article in GENERAL INFORMATION before disconnecting battery.

NOTE: See appropriate wiring diagram under WIRING DIAGRAMS to assist in testing procedures.

DOOR LOCKS DO NOT OPERATE FROM EITHER SWITCH (EXCEPT PICKUP)

1) Disconnect left door lock switch connector. Connect a test light between connector Orange wire and ground. If test light illuminates, go to next step. If test light does not illuminate,

repair openin Orange wire.

2) Disconnect door lock relay. Connect test light between door lock relay socket Orange wire and ground. If test light illuminates, go to next step. If test light does not illuminate, repair open in Orange wire.

3) Connect self-powered test light between door lock relay socket Black wire and ground. If test light illuminates, replace door lock relay. If test light does not illuminate, repair open in Black wire.

DOOR LOCKS DO NOT OPERATE FROM EITHER SWITCH (PICKUP)

Disconnect left door lock switch. Connect test light between door lock switch connector Orange wire and ground. If test light illuminates, repair open in Black wire. If test light does not illuminate, repair openin Orange wire.

DOOR LOCKS LOCK & UNLOCK FROM ONE SWITCH ONLY (EXCEPT PICKUP)

1) Disconnect inoperative door lock switch. Connect test light between inoperative door lock switch connector Orange wire and ground. If test light illuminates, go to next step. If test light does not illuminate, repair open in Orange wire.

2) Connect fused jumper wire between inoperative door lock switch connector Orange and Light Blue wires, and then between Orange and White wires. If doors lock and unlock, replace switch. If doors do not lock and unlock, check White and Light Blue wires for an open. Repair as necessary.

DOOR LOCKS LOCK & UNLOCK FROM ONE SWITCH ONLY (PICKUP)

Disconnect inoperative door lock switch. Connect test light between Orange wire at inoperative switch and ground. If test light illuminates, replace inoperative door lock switch. If test light does not illuminate, repair open in Orange wire.

DOOR LOCKS DO NOT LOCK (EXCEPT PICKUP)

Disconnect door lock relay. Connect fused jumper wire between door lock relay socket Light Blue and Gray wires. Connect another jumper wire between door lock relay socket Tan wire and ground. If doors lock, replace relay. If doors do not lock, repair open in Light Blue wire.

DOOR LOCKS DO NOT UNLOCK (EXCEPT PICKUP)

Disconnect door lock relay. Connect fused jumper wire between door lock relay socket White and Tan wires. Connect another jumper wire between Gray wire and ground. If doors unlock, replace relay. If doors do not unlock, repair open in White wire.

DOOR LOCKS DO NOT LOCK OR UNLOCK FROM ENDGATE PUSH BUTTON SWITCH (EXCEPT PICKUP)

1) Disconnect endgate push button switch. Connect test light between switch Orange wire and ground. If test light illuminates, go to next step. If test light does not illuminate, repair open in Orange wire.

2) Connect fused jumper wire between endgate lock switch connector Orange and White wires. If doors lock, replace endgate lock switch. If doors do not lock, repair open in Light Blue wire.

3) Connect fused jumper wire between endgate lock switch

connector Orange and Light Blue wires. If doors lock, replace endgate lock switch. If doors do not lock, repair open in White wire.

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. See COMPUTER RELEARN PROCEDURES article in GENERAL INFORMATION before disconnecting battery.

DOOR LOCK MOTOR

Removal & Installation

1) Disconnect negative battery cable. Remove 2 screws and armrest cover. Remove window crank handle (if equipped). Starting with front edge, pull out lock lever trim. Remove upper corner trim by pulling out at top edge and pivoting down to clear tab at trim panel. Remove 2 caps covering 2 assist handle screws. Remove 2 screws retaining handle to door.

2) Remove screw at front edge of accessory switch mount plate (if equipped). Remove plate from trim panel. Remove electrical connectors from switches on plate. Remove door courtesy light assembly from door panel. Remove trim panel retainers from door. Remove trim panel. See Fig. 1. Remove lock rods from door lock motor. Remove screws or drill out rivets and remove door lock motor. See Figs. 2 and 3. To install, reverse removal procedure.

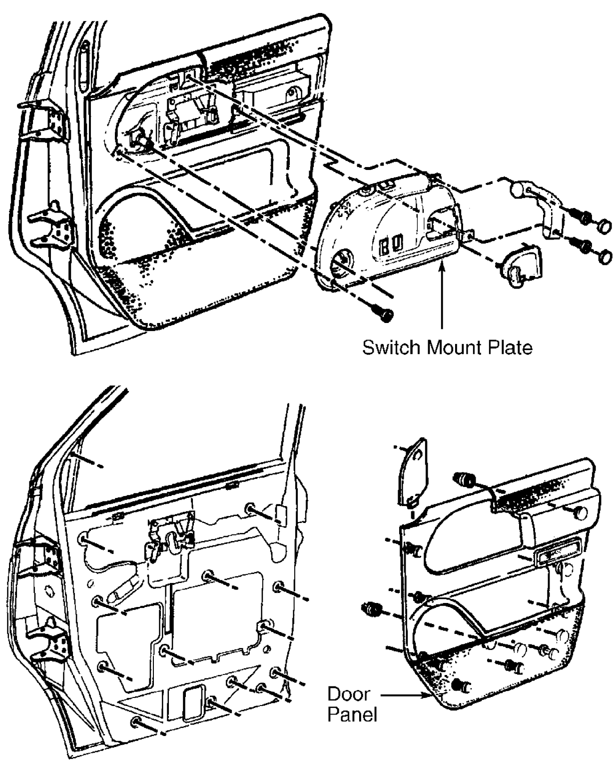

Fig. 1: Removing Switch Mount Plate & Door Panel (Typical)
Courtesy of General Motors Corp.

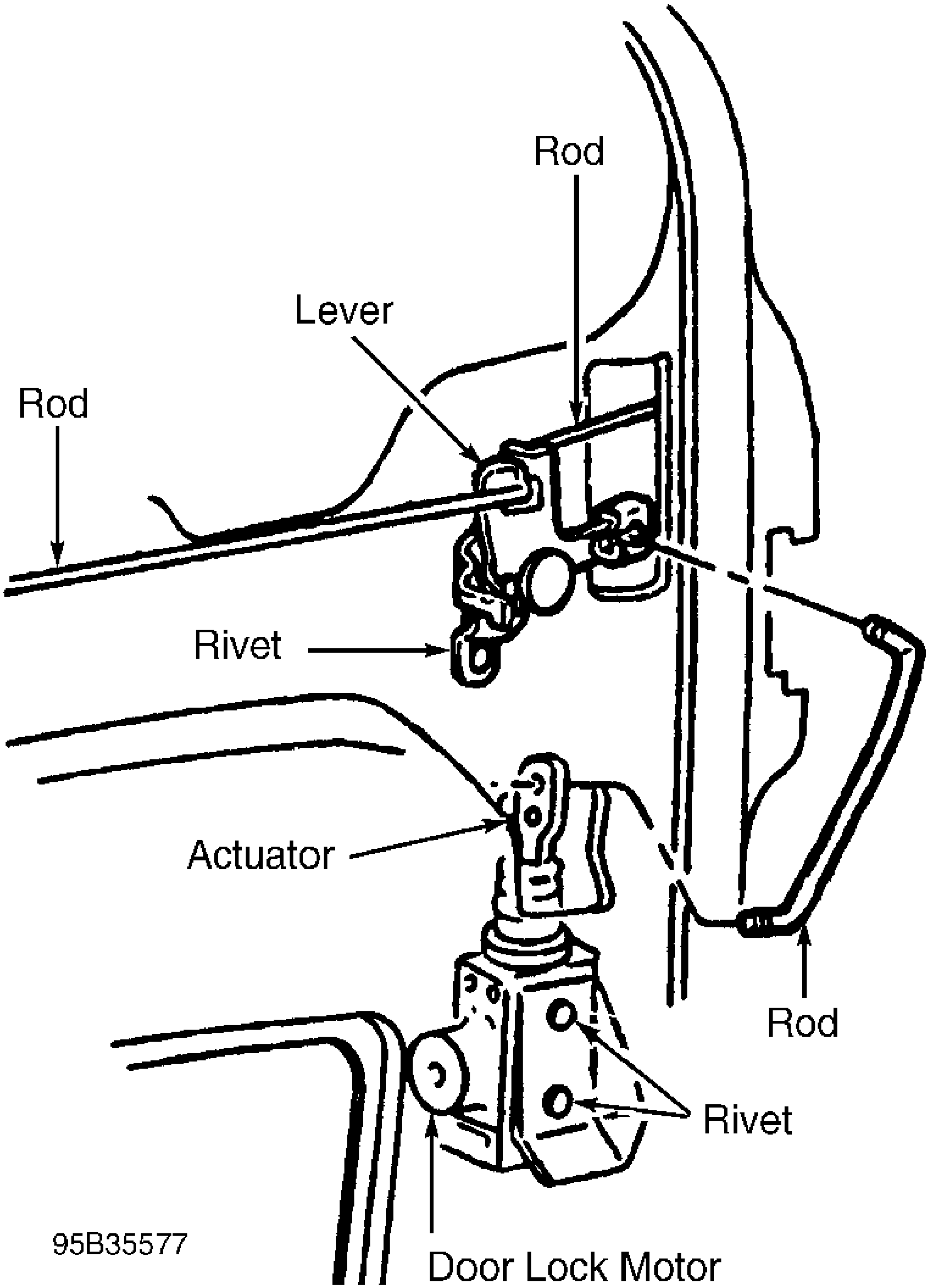

Fig. 2: Removing Front Door Lock Motor (Typical)
Courtesy of General Motors Corp.

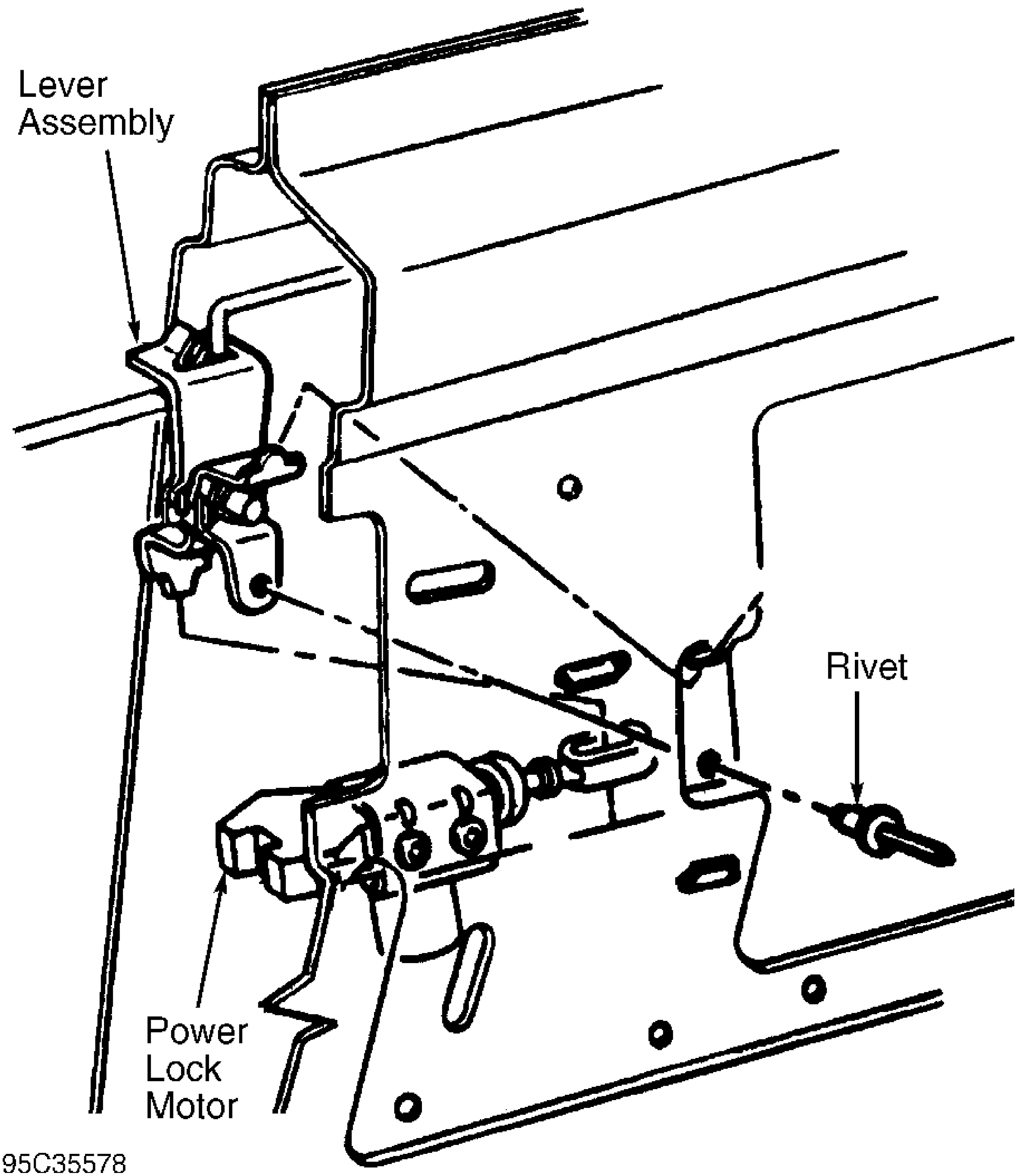

Fig. 3: Removing Side Door Lock Motor (Typical)
Courtesy of General Motors Corp.

DOOR LOCK SWITCH

Removal & Installation

Disconnect negative battery cable. Remove screw at front edge of accessory switch mount plate (if equipped). Using a flat-blade screwdriver, remove plate from trim panel. Press tabs and remove front door switch mount plate. Carefully bend retaining tabs outward while pushing switch out of bezel. Disconnect power door lock switch wiring connector. Remove power door lock switch. To install, reverse removal procedures.

WIRING DIAGRAMS

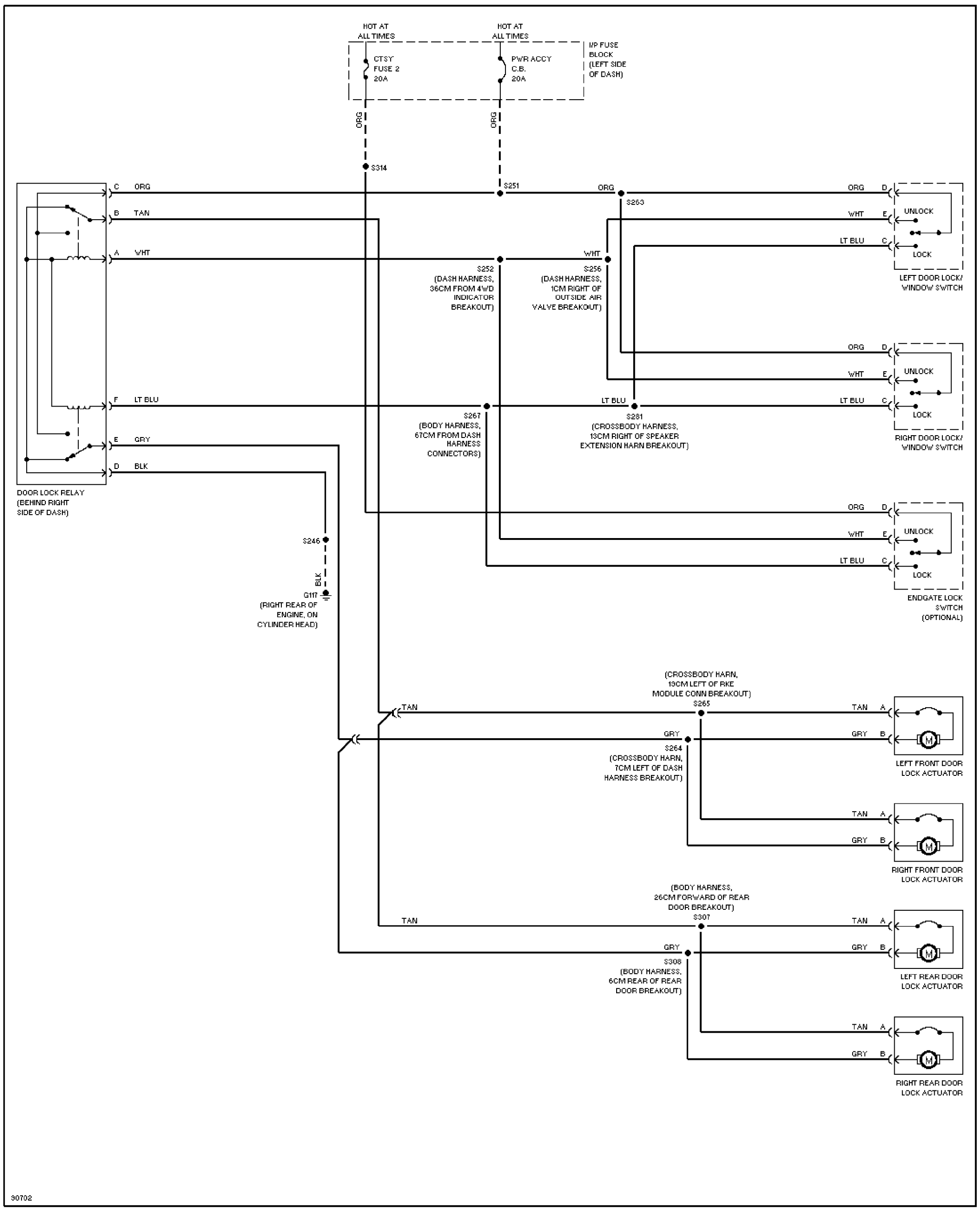

Fig. 4: Power Door Lock System Wiring Diagram (Blazer, Bravada & Jimmy)

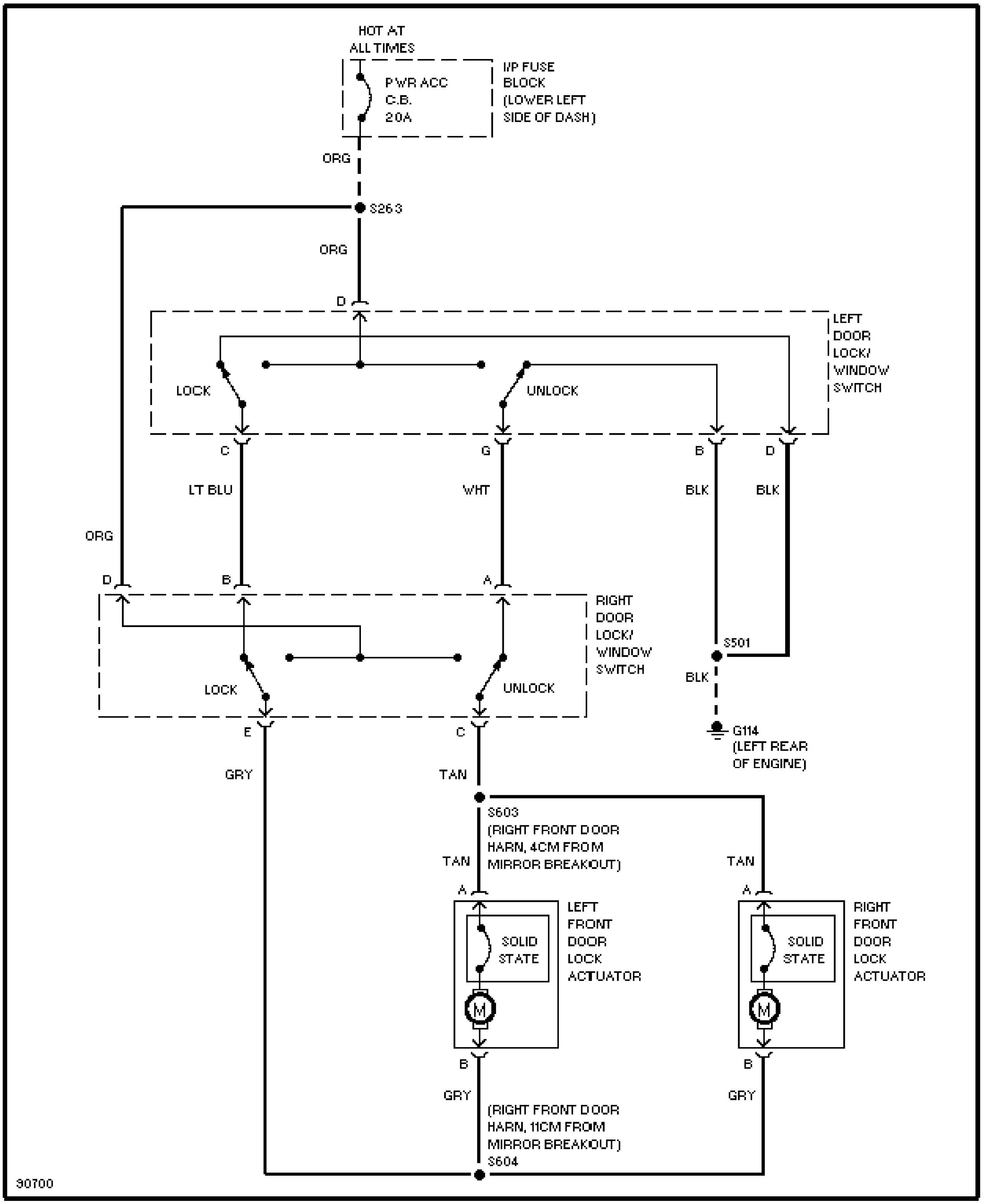

Fig. 5: Power Door Lock System Wiring Diagram (Sonoma & S10)

DRIVE AXLE - FRONT

1997 Chevrolet Blazer

1996-97 DRIVE AXLES
General Motors Corp. "T" Series Front Axle

Chevrolet; Blazer, Pickup
GMC; Jimmy, Pickup, Sonoma
Oldsmobile; Bravada

DESCRIPTION & OPERATION

Front axle assembly on "T" Series models uses a 7 1/4" ring gear. Front axle assembly has an electric 4WD engage/disengage feature which allows shifting in or out of 4WD while vehicle is moving (under most conditions). The 4WD feature is shifted by a vacuum actuation system. See Fig. 1.

The vacuum actuation system consists of a vacuum switch and vacuum actuator. Shift mechanism in transfer case triggers vacuum switch to apply engine vacuum to vacuum actuator after about a 3-second delay. The vacuum actuator, in turn, pulls on shift cable which pulls on shift fork in axle. This connects the right axle output shaft to the front axle differential. Torque is now available to front wheels.

Right side of axle assembly consists of a solid axle shaft which rides inside of a stationary axle tube. A short stub shaft with CV joint attached is bolted to right inner axle shaft flange. Left drive axle shaft consists of a flexible drive shaft using an inner tripod joint and outer CV joint. Left axle tripod joint housing is bolted to axle carrier output shaft drive flange. CV joint splined/threaded shaft on outer end of drive axle shaft slips through steering knuckle/hub assembly. See Fig. 3.

Front axle assembly differential uses a conventional ring and pinion gear set to transmit driving force of engine to the front wheels. Ring and pinion gear set transfers driving force at a 90-degree angle from front drive shaft to drive axle shafts/CV joints.

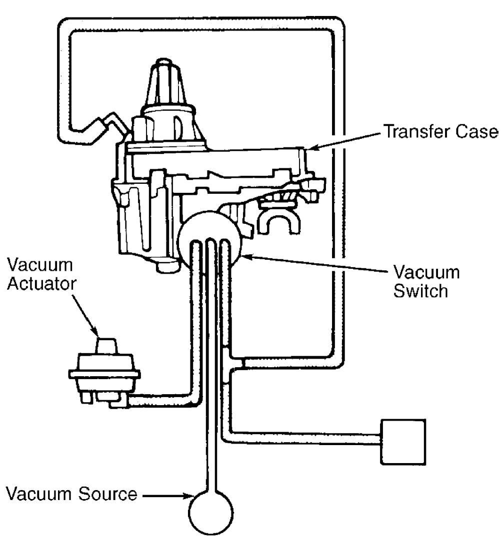

Fig. 1: Vacuum Actuation System
Courtesy of General Motors Corp.

AXLE RATIO & IDENTIFICATION

Front axle identification is located on tag attached near axle tube.

LUBRICATION

Fill differential with 80W or 80W-90 GL-5 gear lubricant to edge of filler hole (warm differential), or to 1/2" (12 mm) below edge of filler hole (cold differential).

TROUBLE SHOOTING

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

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. See COMPUTER RELEARN PROCEDURES article in GENERAL INFORMATION before disconnecting battery.

CARRIER CASE MOUNTING BUSHINGS

Removal & Installation

Remove front axle assembly. See FRONT AXLE ASSEMBLY. Using Carrier Bushing Remover/Installer (J-33791), press bushing out of carrier housing. See Fig. 2. To install, reverse tool and press NEW bushing into housing. Repeat procedure for other mounting bushing.

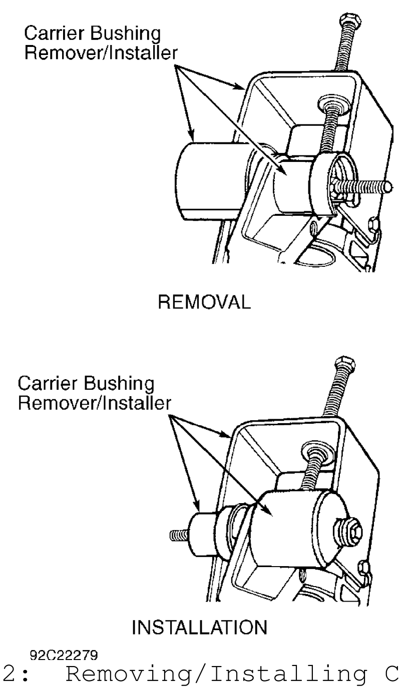

Fig. 2: Removing/Installing Carrier Case Bushing
Courtesy of General Motors Corp.

FRONT AXLE ASSEMBLY

Removal & Installation

1) Disconnect negative battery cable. Remove shift cable from vacuum actuator by disengaging lock spring. Push in actuator diaphragm to release cable.

2) Unlock steering wheel. Raise and support vehicle. Remove engine drive belt shield and front axle skid plate (if equipped). Remove wheels. Remove lower shock absorber bolt, and compress shock to gain access to output shaft flange bolts.

3) Disconnect 4WD indicator light connector from switch. Remove 3 bolts securing cable and switch housing. Pull housing away to gain access to cable locking spring. DO NOT unscrew cable coupling nut unless cable is being replaced. See SHIFT CABLE.

4) Disconnect shift cable from shift fork shaft by lifting spring over slot in shift fork. Disconnect axle vent hose. Disconnect steering relay rod from idler arm and pitman arm, and pull steering linkage forward. Support axle assembly using appropriate transmission jack.

5) Remove 6 right stub shaft-to-output shaft flange bolts, and 6 left drive axle-to-output shaft flange bolts. Wire left drive axle and right stub shaft aside. Mark front of drive shaft to ensure proper installation. Remove bolts and clamps. Wire drive shaft aside.

6) Remove bolts securing right axle tube to frame rail. Remove mounting bolts from axle assembly. Tip axle assembly counterclockwise while lifting to gain clearance from mounting ears and remove axle assembly. To install, reverse removal procedure. Tighten all bolts and nuts to specification. See TORQUE SPECIFICATIONS.

LEFT DRIVE AXLE SHAFT

Removal

1) Raise and support vehicle. Remove engine drive belt shield and front axle skid plate (if equipped). Remove wheel. Remove stabilizer bar from lower control arm. If both ends of stabilizer bar are being removed, DO NOT mix left and right stabilizer bar components.

CAUTION: DO NOT use wedge type remover tool on tie rod end. Damage to tie rod end will result.

2) Disconnect left outer tie rod end from steering knuckle using Steering Linkage Puller (J-24319-01). Wire tie rod end aside. Insert a long drift through caliper and into disc rotor vanes to prevent rotation. Remove cotter pin, retainer, axle hub nut and washer from drive axle shaft CV joint. See Fig. 3. Loosen 6 drive axle shaft flange bolts retaining tripod joint housing to axle carrier output shaft drive flange.

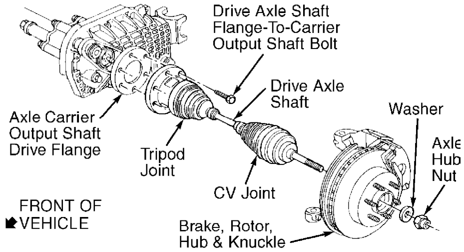

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Fig. 3: Left Drive Axle Shaft With Tripod & CV Joints
Courtesy of General Motors Corp.

3) Remove brakeline bracket from upper control arm. Remove shock absorber from lower control arm mounting bracket. Install floor

stand or jack under lower control arm near ball joint to maintain spring tension and lower control arm position.

4) Remove upper control arm ball joint-to-steering knuckle nut. Separate upper control arm ball joint stud from knuckle. Using shop towel, cover lower shock mount ears on lower control arm to prevent CV joint boot damage when removing axle shaft. Install Puller (J-28733) to rotor to push CV joint splined shaft through hub splines.

5) Remove 6 drive axle shaft flange bolts securing tripod joint housing to axle carrier output shaft drive flange. DO NOT allow drive axle shaft to hang free. Pull slightly outward on top of steering knuckle to enable drive axle shaft removal. DO NOT stretch brake hose. Remove drive axle shaft.

Installation

1) Before installing drive axle shaft, inspect inner wheel bearing seal on rear of knuckle. Replace, if required, using Seal Installer (J-28574). Lube seal lip.

2) To install drive axle shaft, reverse removal procedure. Tighten all bolts and nuts to specification. See TORQUE SPECIFICATIONS.

PINION FLANGE & OIL SEAL

Removal

1) Remove bolts and retainers from pinion flange. Mark position of drive shaft to pinion flange to ensure correct installation. Remove drive shaft from pinion flange, and wire shaft aside.

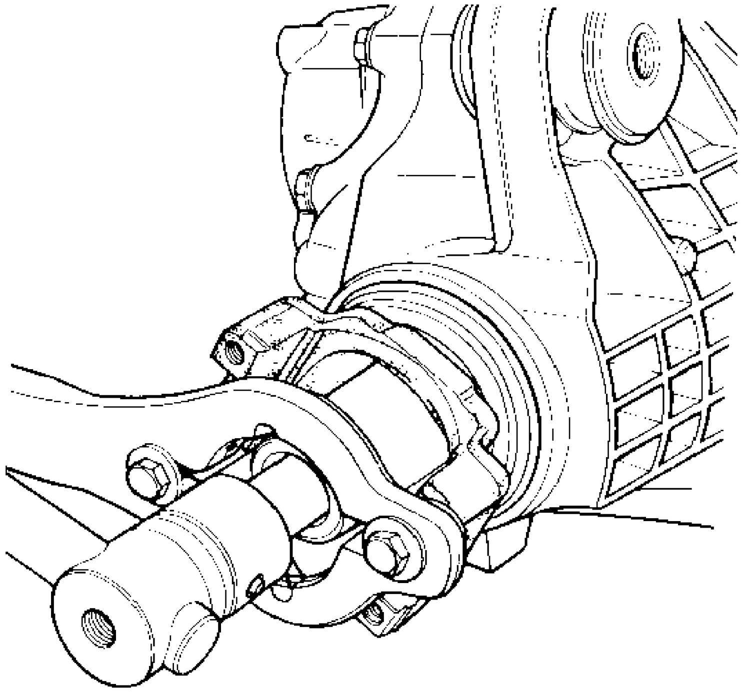
2) Mark pinion flange, pinion shaft and pinion nut to ensure alignment and bearing preload are maintained on installation. Using Pinion Flange Remover Set (J-8614-01), hold pinion flange stationary and remove pinion flange nut and washer. Place drain pan under pinion area of differential carrier. Remove pinion flange and oil seal. See Fig. 4.

3) Clean pinion flange in solvent and inspect seal surface of pinion flange for nicks, burrs or damage (such as a groove worn into pinion flange by oil seal). Repair or replace as necessary.

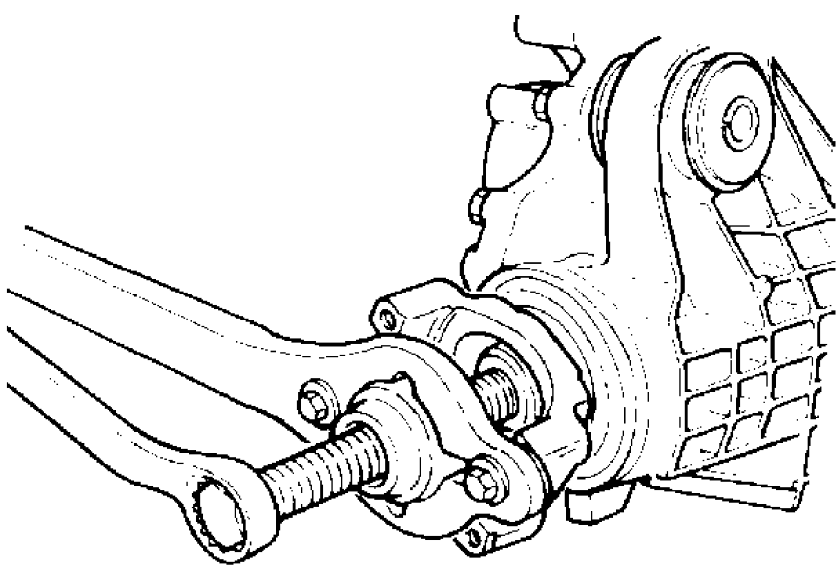
Installation

1) Lubricate pinion flange surface and sealing lip of oil seal. Install oil seal using seal installer. Install pinion flange onto pinion shaft with marks aligned. Install pinion nut and tighten to position marked on pinion shaft.

2) Tighten nut 1/16" beyond alignment marks. Install drive shaft and tighten bolts to specification. See TORQUE SPECIFICATIONS. Check gear oil level.



PINION NUT REMOVAL



PINION FLANGE REMOVAL

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Fig. 4: Removing Pinion Nut & Flange
Courtesy of General Motors Corp.

RIGHT AXLE TUBE & INNER AXLE SHAFT

Removal

1) Disconnect negative battery cable. Remove shift cable from vacuum actuator by disengaging lock spring. Push in actuator diaphragm to release cable.

2) Unlock steering wheel. Raise and support vehicle. Remove engine drive belt shield and front axle skid plate (if equipped). Remove wheel. Remove stabilizer bar from both lower control arms. DO NOT mix left and right stabilizer bar components.

3) Place a support under right lower control arm, and disconnect right upper ball joint. Remove support so control arm can hang free. Remove stub axle shaft flange bolts from inner axle shaft flange.

4) Disconnect 4WD indicator light connector from switch. Remove 3 bolts securing cable and switch housing. Pull housing away to gain access to cable locking spring. DO NOT unscrew cable coupling nut unless cable is being replaced. See SHIFT CABLE.

5) Disconnect shift cable from shift fork shaft by lifting spring over slot in shift fork. Place drain pan under drive axle. Remove drain plug to drain lubricant. Remove bolts securing axle tube to right frame. Remove bolts securing axle tube assembly to carrier.

6) Remove tube assembly by working around drive axle. DO NOT allow sleeve, thrust washers, connector and output shaft to fall out of carrier while removing tube. See Fig. 5.

Installation

1) Install sleeve, thrust washers, connector and output shaft in carrier. Apply Sealant (GM 1052942 or Loctite 518) on axle tube to differential surface. Ensure thrust washer is installed with notch aligned with tab on washer. See Fig. 6. Use wheel bearing grease to hold thrust washer in place.

2) Install tube and shaft assembly to differential and install one bolt at one o'clock position, but DO NOT tighten. Pull assembly down and install cable, switch housing and 4 remaining bolts. Tighten bolts to specification. See TORQUE SPECIFICATIONS.

3) Install 2 bolts securing tube to frame. Tighten bolts to specification. See TORQUE SPECIFICATIONS. Inspect shift mechanism operation. To complete installation, reverse removal procedure.

1. Axle Shaft (Inner)
2. Deflector
3. Seal
4. Bearing
5. Tube
6. Bolt
7. Washer
8. Ring
9. Connector
10. Cable
11. Housing
12. Gasket
13. Switch
14. Spring
15. Seal
16. Spring
17. Shaft
18. Bolt
19. Lock
20. Washer
21. Bearing
22. Sleeve
23. Shaft
24. Washer
25. Plug
26. Washer
27. Pin
28. Bolt
29. Axle Housing
30. Bearing
31. Insert
32. Sleeve
33. Bearing
34. Bolt
35. Differential Housing
36. Screw
37. Ring & Pinion Gears
38. Shim Kit
39. Bearing
40. Spacer
41. Bearing
42. Seal
43. Deflector
44. Flange
45. Washer
46. Nut
47. Plug
48. Bushing
49. Housing
50. Ventilator
51. Connector
52. Shaft
53. Washer
54. Gear
55. Washer
56. Gear
57. Cover
58. Bolt
59. Left Axle Shaft (Inner)

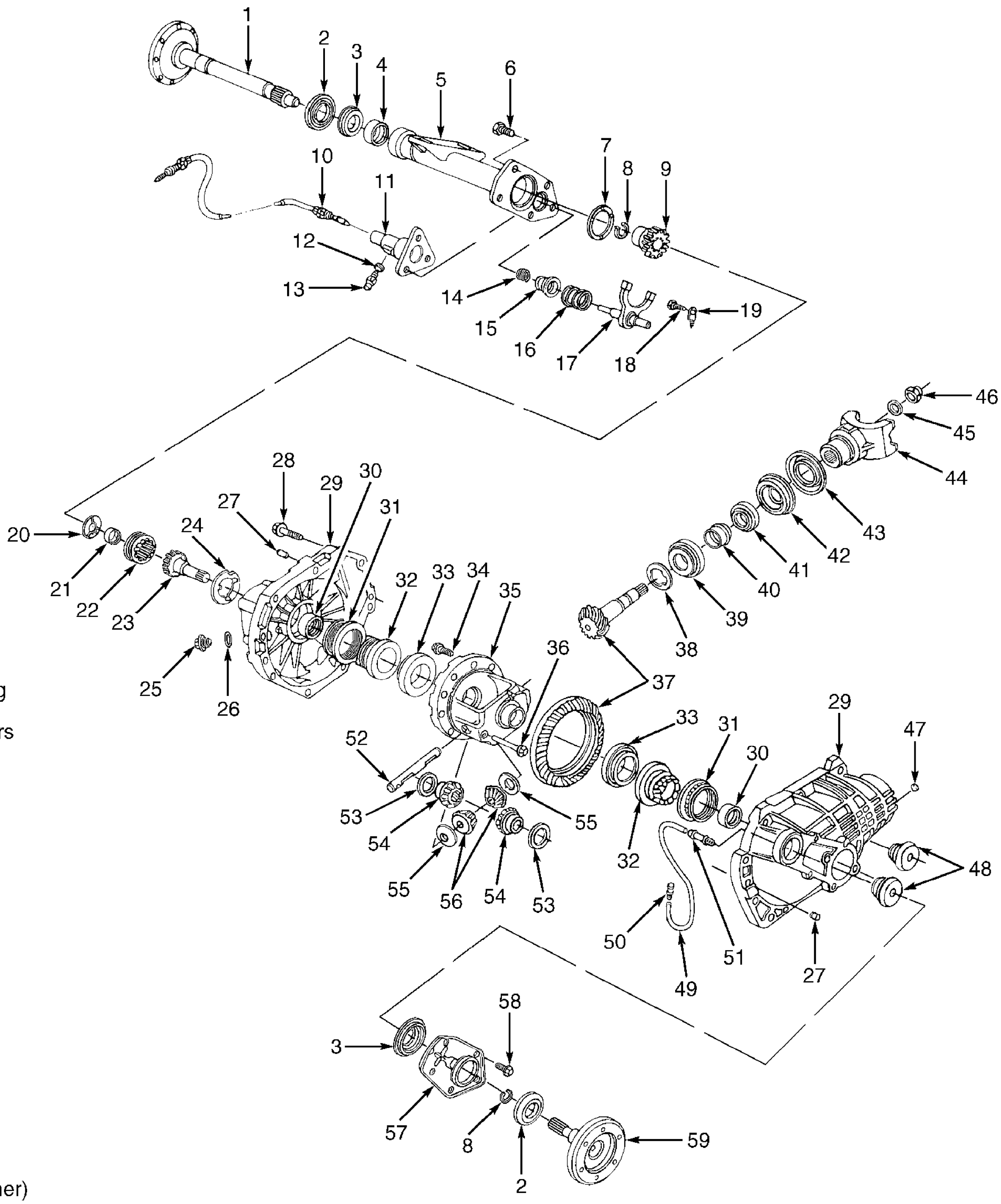

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Fig. 5: Exploded View Of 4WD "T" Series Front Axle Assembly
Courtesy of General Motors Corp.

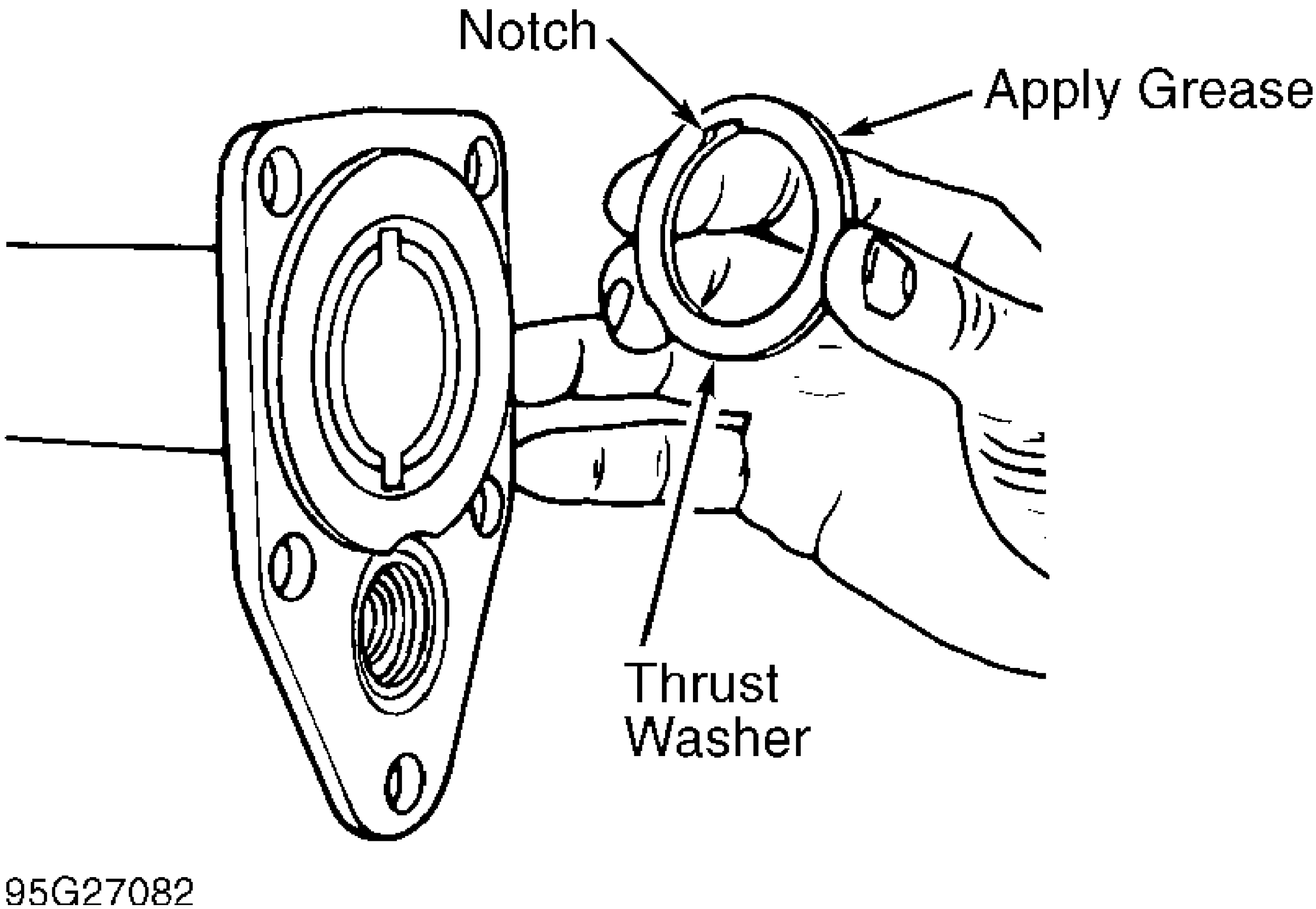


Fig. 6: Installing Axle Tube Thrust Washer
Courtesy of General Motors Corp.

RIGHT SIDE OUTPUT SHAFT PILOT BEARING

Removal & Installation

Remove right axle tube and inner axle shaft assembly. See RIGHT AXLE TUBE & INNER AXLE SHAFT. Remove pilot bearing using Pilot Bearing Remover (J-34011). Lubricate NEW pilot bearing with wheel bearing grease. Install NEW pilot bearing using Pilot Bearing Installer (J-33842). To complete installation, reverse removal procedure.

SHIFT CABLE

Removal

1) Disengage shift cable from vacuum actuator by disengaging locking spring. Push actuator diaphragm in to release cable. Squeeze 2 locking fingers of cable with pliers. Pull cable out of bracket hole.

2) Raise and support vehicle. Remove bolts securing cable and switch housing to carrier. DO NOT unscrew coupling nut at this time. Remove shift cable housing from carrier assembly. Pull out about 3/4" (19 mm) of cable. Remove cable end from shift fork shaft. Bend tang of lock spring, then pull cable end from shift fork shaft.

3) Note cable routing for installation. Unscrew coupler nut and remove shift cable from shift cable housing. Remove cable from vehicle.

Installation

1) Install cable and switch housing to carrier. Tighten mounting bolts to specification. See TORQUE SPECIFICATIONS.

2) Guide cable though switch housing into fork shaft hole and push cable in. Cable will snap into place. Start coupling nut by hand to avoid cross threading. Tighten nut to specification. See TORQUE SPECIFICATIONS. DO NOT overtighten nut.

3) Connect shift cable to vacuum actuator by pressing cable into bracket hole. Cable and housing will snap into place. Check cable operation.

VACUUM ACTUATOR

Removal & Installation

Disconnect vacuum line from actuator. Remove shift cable. See SHIFT CABLE. Remove vacuum actuator bolts and actuator. To install, reverse removal procedure.

OVERHAUL

RIGHT AXLE TUBE ASSEMBLY

Disassembly

1) Place mounting flange of axle tube assembly in a vise. Remove springs, shift shaft/fork, and differential sleeve (No. 22). See Fig. 5. Remove snap ring, connector gear and thrust washer from axle shaft.

2) Using a soft mallet, tap on flange end of axle shaft to remove axle shaft from tube. DO NOT hammer on pilot bearing stem end of axle shaft, severe damage will result. Using a screwdriver, pry out deflector and oil seal.

3) Using a Bearing Remover (J-29369-2) and slide hammer, remove axle bearing from tube.

Cleaning & Inspection

Wash all parts in solvent. Dry using compressed air. Inspect all parts for excessive wear and scoring. Inspect connector gear and axle shaft splines for wear, cracks, and twisted splines.

Reassembly

1) Clean gasket surfaces on axle tube and carrier housing. Lubricate NEW bearing using wheel bearing grease. Using Bearing Installer (J-33844), install axle bearing into tube. Lightly coat lip of NEW seal with grease. Install seal using Seal Installer (J-33893).

2) Install deflector to axle shaft (if removed) and insert axle shaft into axle tube. Install thrust washer, ensuring tube slots align with tabs on washer. See Fig. 6. Use wheel bearing grease to hold thrust washer in place.

3) Drive connector gear onto end of axle using a plastic hammer. Install snap ring. Ensure snap ring seats properly in groove. Ensure axle tube and carrier case sealing surfaces are clean. Install springs on shift shaft/fork. Insert shift shaft/fork into groove in differential sleeve. Install shift shaft/fork assembly into tube assembly at same time sleeve is installed onto connector gear.

4) Apply a bead of Sealant (GM 1052942 or Loctite 518) to axle tube sealing surface. Assemble axle tube to carrier case. Install and tighten axle tube-to-carrier bolts to specification. See TORQUE SPECIFICATIONS. Inspect shift mechanism operation.

FRONT AXLE ASSEMBLY

Disassembly

1) Remove axle carrier. See FRONT AXLE ASSEMBLY under REMOVAL & INSTALLATION. Remove right axle tube and inner axle shaft assembly. See RIGHT AXLE TUBE & INNER AXLE SHAFT under REMOVAL & INSTALLATION.

2) Remove shift shaft/fork assembly consisting of sleeve, springs and seals. See Fig. 5. Remove thrust washer and output shaft from right side of carrier assembly. Remove right output shaft bearing using Bearing Remover (J-34011). Remove washer from right side of carrier assembly.

3) Remove left output flange from carrier assembly by prying on one side with a screwdriver while simultaneously tapping outward on other side with a soft-faced hammer. Remove deflector from output flange. Remove 6 cover-to-carrier bolts securing left side cover. Tap cover to loosen and remove. Pry out left output flange seal with a screwdriver.

4) Remove 10 bolts holding carrier halves together. Insert screwdriver in slots provided (one next to fill plug, one 180 degrees from fill plug) and pry carrier halves apart. See Fig. 12.

5) Remove differential assembly from carrier. See Fig. 5. Remove both side bearing adjusting sleeve lock tabs. Using Side Bearing Adjusting Wrench (J-33792), rotate adjusting sleeve and push side bearings out of bores. Remove side bearings from adjusting sleeve using Bearing Remover (J-21551).

6) Using Pinion Flange Remover Set (J-8614-01), hold pinion flange stationary and remove pinion nut. See Fig. 4. Mount left half of carrier in Holding Fixture (J-33837-1). Use bolts supplied with remover set to install carrier on fixture. See Fig. 7. Remove pinion flange and deflector.

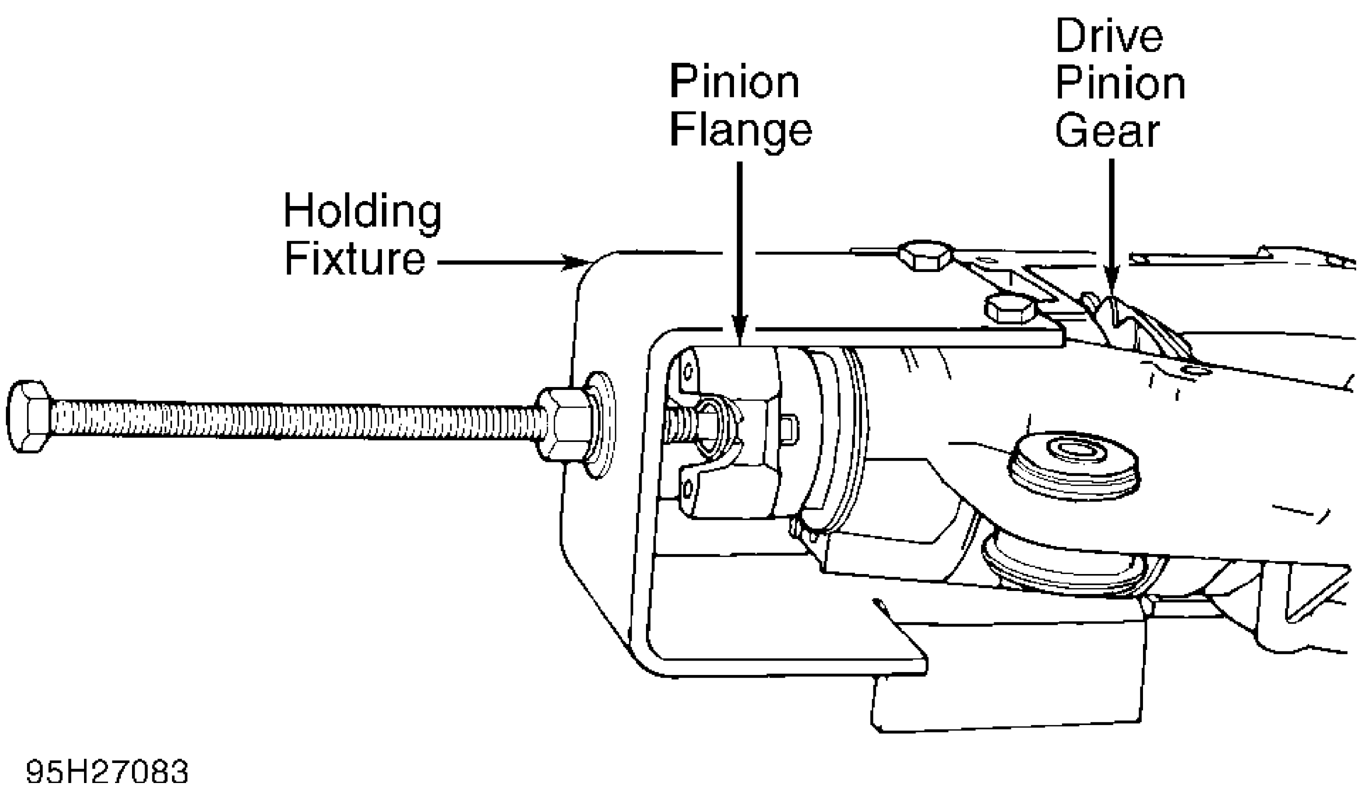


Fig. 7: Installing Pinion Holding Fixture Tool
Courtesy of General Motors Corp.

7) Remove pinion with attached shim, inner bearing and spacer as an assembly. Remove collapsible spacer from pinion. Using

Differential Side/Pinion Bearing Remover (J-22912-01), press inner bearing from pinion. Remove shim(s) from pinion, keeping shims in order.

8) Install Bearing Race Remover (J-33837-6) on Holding Fixture (J-33837-1) and remove outer pinion bearing, race and pinion seal. Remove inner pinion bearing race by pushing it out of carrier with bearing race remover installed on Pinion Bearing Remover/Installer Set (J-33837). See Fig. 8.

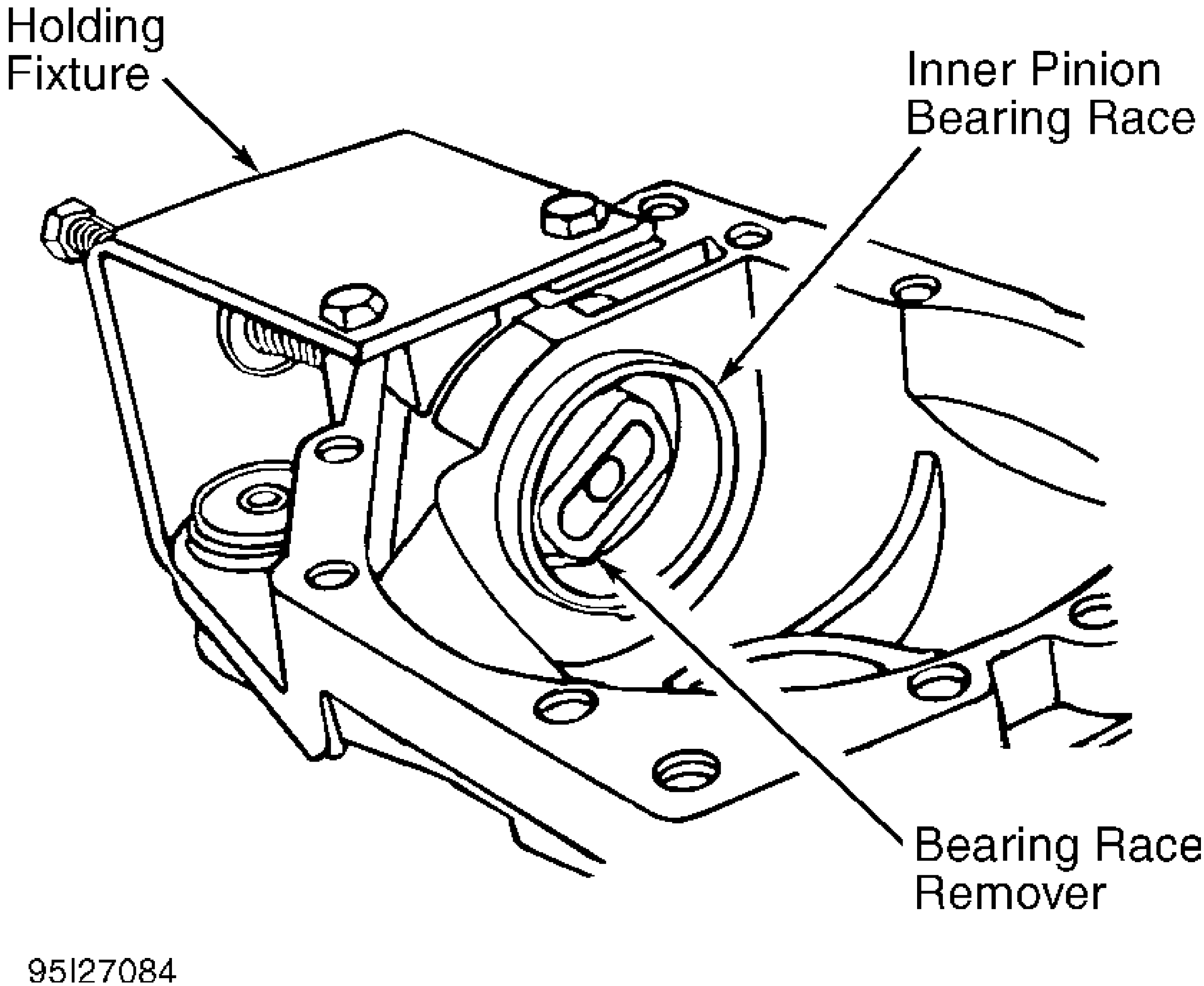


Fig. 8: Removing Inner Pinion Bearing Race
Courtesy of General Motors Corp.

9) Using Differential Side/Pinion Bearing Remover (J-22912-01), remove side bearings from differential case assembly. Remove ring gear bolts. Ring gear uses left-hand thread bolts. Using a brass drift, drive ring gear from differential case. DO NOT pry ring gear from differential case or damage to ring gear and differential case will occur.

10) Remove bolt from differential pinion gear shaft. Remove pinion gear shaft. Roll pinion gears and thrust washers out of differential case. Remove side gears and thrust washers, marking side

gears and differential case left and right for reassembly reference. Upper and lower carrier mounting bushings should be replaced using Bushing Remover (J-33791).

Cleaning & Inspection

Clean all parts in cleaning solvent. Inspect all parts for excessive wear. Replace as required.

Reassembly

1) Install pinion bearing races using Holding Fixture (J-33837-1) and Bearing Race Installer (J-33837-4) until races are seated in carrier. See Fig. 9. Lubricate inner and outer bearings, then set pinion depth. See DRIVE PINION DEPTH under ADJUSTMENTS.

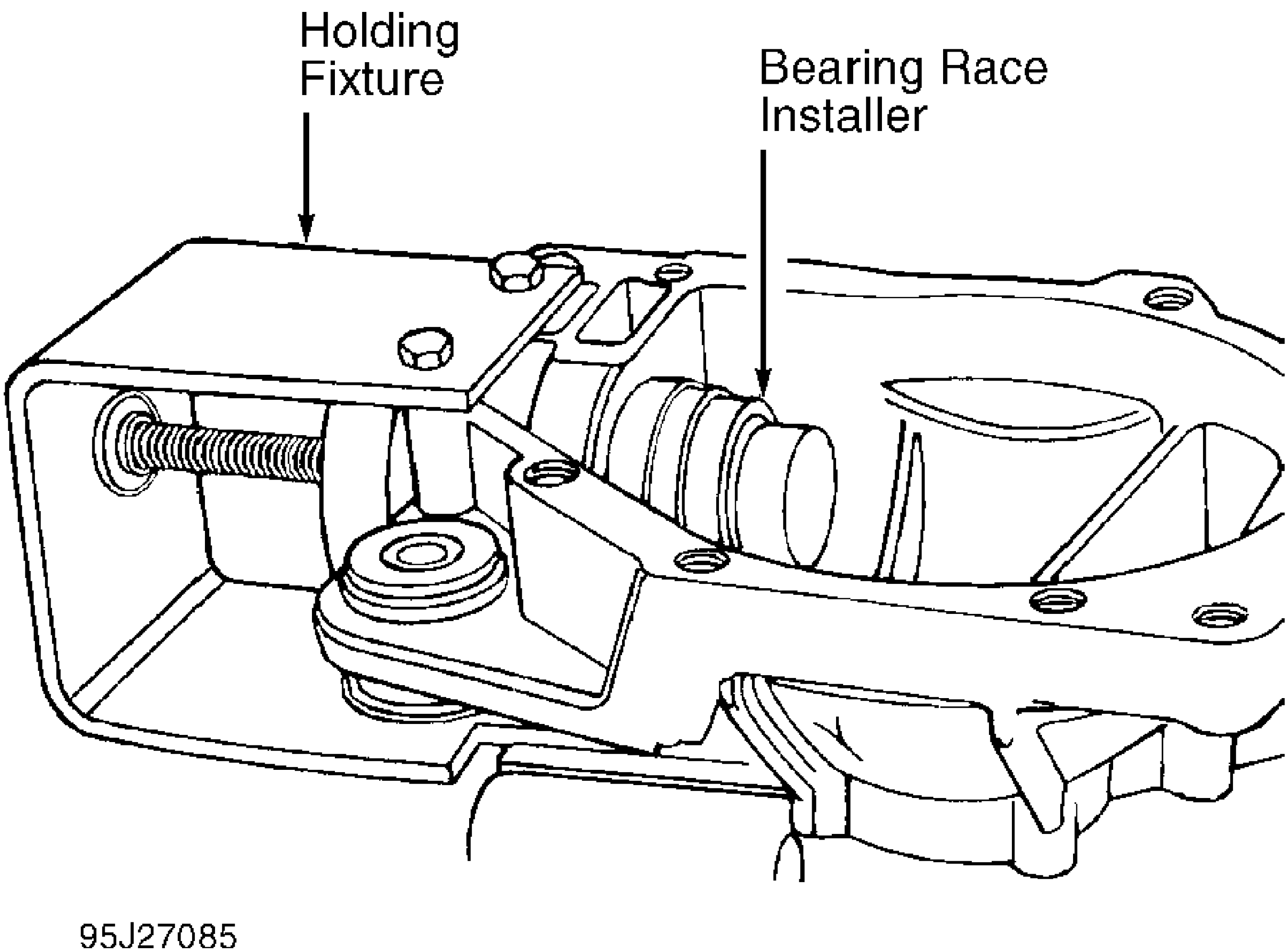


Fig. 9: Installing Inner Pinion Bearing Race
Courtesy of General Motors Corp.

2) Install appropriately sized shim onto pinion. Shim size was previously determined during pinion depth adjustment. Using Pinion Bearing Installer (J-33785), install inner pinion bearing onto pinion. Install NEW collapsible spacer onto pinion shaft. Lubricate outer pinion bearing, and install bearing and pinion seal into carrier case using Seal Installer (J-33782). Insert pinion, with attached inner bearing and collapsible spacer, into carrier case.

3) Install deflector and pinion flange. Apply GM PST sealant to area where pinion threads meet pinion flange. Install pinion washer

and nut. Install same flange holder previously used to remove pinion flange. Hold flange while slowly tightening nut and checking pinion flange until no end play is present. DO NOT tighten nut any further.

4) Rotate pinion several times to ensure bearings have been seated. Recheck end play. Set final pinion preload to 15-25 INCH lbs. (1.7-2.8 N.m) by tightening pinion nut in small increments, rotating pinion between increments. Each increment increases preload by several INCH lbs.

5) If preload specification is exceeded, remove pinion and install NEW collapsible spacer. Once preload has been obtained, rotate pinion several times to ensure bearings have seated and recheck preload.

6) Install side gears and thrust washers into differential case. If old side gears are being reinstalled, ensure they are placed in their original locations as marked during disassembly.

7) Position one pinion gear between side gears and rotate gears until pinion gear is directly opposite opening in case. Place remaining pinion gear between side gears. Ensure holes in both pinion gears line up. Rotate pinion gears toward opening just enough to allow installation of thrust washers.

8) Install differential pinion gear shaft. Install pinion gear shaft bolt. Install ring gear onto differential assembly. Tighten NEW bolts alternately in progressive steps to 60 ft. lbs. (81 N.m). Ring gear uses left-hand thread bolts.

9) Press side bearings onto differential assembly using Side Bearing Installer (J-33790). Press bearings onto sleeves using Bearing Installer (J-33788).

10) Using same side bearing adjusting wrench used during disassembly, install sleeves into carrier case. Install side bearing races into carrier using Race Installer (J-23423-A). Place differential assembly into left carrier case half. Turn left sleeve inward until backlash is felt between ring and pinion.

11) Remove carrier case from holding fixture, and attach carrier halves together using 4 bolts. If halves DO NOT make complete contact, back out right sleeve. Install carrier case bolts and tighten to 35 ft. lbs. (47 N.m). Set ring gear backlash adjustment to specification. See RING GEAR BACKLASH under ADJUSTMENTS.

12) Install both side bearing adjusting sleeve lock tabs over left and right sleeves. Remove 4 bolts holding axle carrier halves together and separate carrier halves. Apply Sealant (GM 1052942 or Loctite 518) to one carrier housing surface.

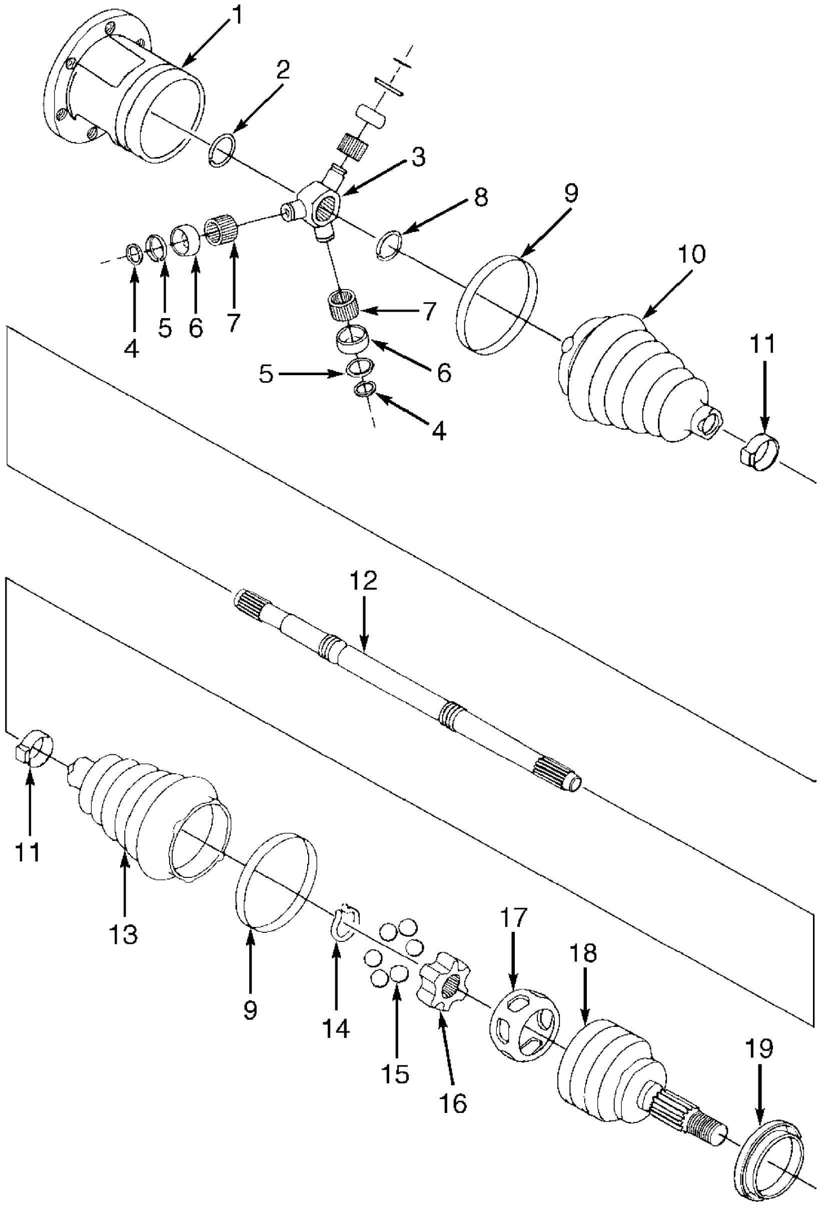
13) Reconnect axle carrier housing halves. Install 10 attaching bolts and tighten to specification. See TORQUE SPECIFICATIONS. Install/drive seal into left side cover. Apply Sealant (GM 1052942 or Loctite 518) to left side cover. Install 6 cover-to-carrier bolts securing left side cover and tighten to specification. See TORQUE SPECIFICATIONS.

14) Install deflector onto left output shaft and insert shaft into left side of carrier. Drive shaft into place with a soft-faced (brass or plastic) hammer. Install NEW pilot bearing into right output shaft using Pilot Bearing Installer (J-33842). Install washer onto right output shaft, and insert right output shaft into right side of carrier.

15) Install right axle tube and inner axle shaft assembly. See RIGHT AXLE TUBE & INNER AXLE SHAFT under REMOVAL & INSTALLATION. To complete reassembly, reverse disassembly procedure.

LEFT DRIVE AXLE SHAFT

NOTE: Use illustration for exploded view of left drive axle shaft. See Fig. 10.



1. Tripot Housing
2. Retainer Ring
3. Spider
4. Needle Retainer Ring
5. Needle Retainer
6. Tripot Ball
7. Needle Roller
8. Spacer Ring
9. Boot Ring
10. Dust Boot
11. Boot Ring
12. Axle Shaft
13. Dust Boot
14. Race Retainer Ring
15. Ball
16. Inner Race
17. Cage
18. Outer Race
19. Deflector Ring

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Fig. 10: Exploded View Of Left Axle Shaft
Courtesy of General Motors Corp.

ADJUSTMENTS

DRIVE PINION DEPTH

1) Lubricate inner and outer pinion bearings liberally with gear oil. Hold pinion bearings in position and install Pinion Shim Setting Gauge (J-33838). Install Dial Indicator (J-29763) onto gauge. See Fig. 11.

2) With gauge installed, preload inner and outer pinion bearings to 9-14 INCH lbs. (1.0-1.6 N.m) by tightening shim setting gauge mounting bolt while holding end of gauge shaft with a wrench. Rotate shaft several times to ensure bearings have seated. Recheck preload.

3) Push dial indicator downward until needle rotates about 3/4 turn clockwise. Tighten dial indicator in this position. Set button of pinion shim setting gauge on differential bearing bore. See Fig. 11.

NOTE: 4WD front axle drive pinion gears are nominal or zero, and are not marked on pinion head surface. Shim thickness will equal dial indicator gauge reading.

4) Rotate gauge slowly back and forth until dial indicator reads lowest point of bore. Set dial indicator to zero. Repeat rocking action of gauge to verify zero setting.

5) After satisfactory zero setting is obtained and verified, move gauge button out of differential side bearing bore. Record dial indicator reading. Use a shim that is exactly the same size as this indicator reading.

6) Remove dial indicator and gauge from carrier. Position correct shim on drive pinion. Install drive pinion bearing. Continue at step 2) of REASSEMBLY under FRONT AXLE ASSEMBLY under OVERHAUL.

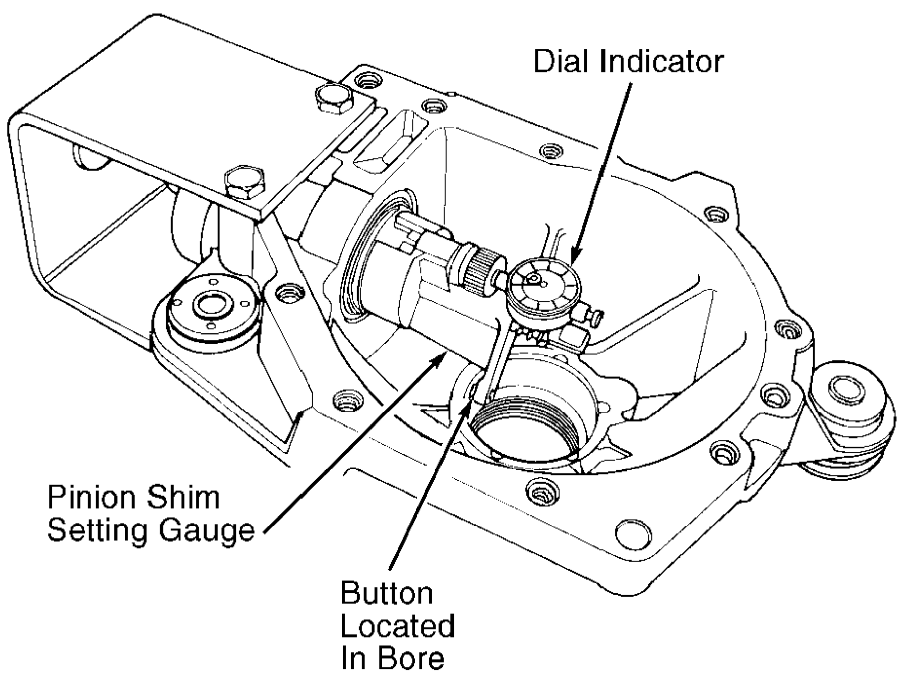

Fig. 11: Pinion Shim Setting Gauge & Dial Indicator Installation & Measurement
Courtesy of General Motors Corp.

RING GEAR BACKLASH

1) Use Side Bearing Adjusting Wrench (J-33792) and torque wrench to tighten right adjusting sleeve until no backlash is present. This torque measurement should be about 100 ft. lbs. (136 N.m).

2) Using Side Bearing Adjusting Wrench (J-33792), tighten left adjusting sleeve until no backlash is present. This torque measurement should be about 100 ft. lbs. (136 N.m).

3) Mark location of adjusting sleeves in relation to carrier halves so notches can be counted when turned. See Fig. 12. Turn right sleeve OUT 2 notches using side bearing adjusting wrench. Turn left sleeve IN one notch. Rotate pinion several times to seat bearings.

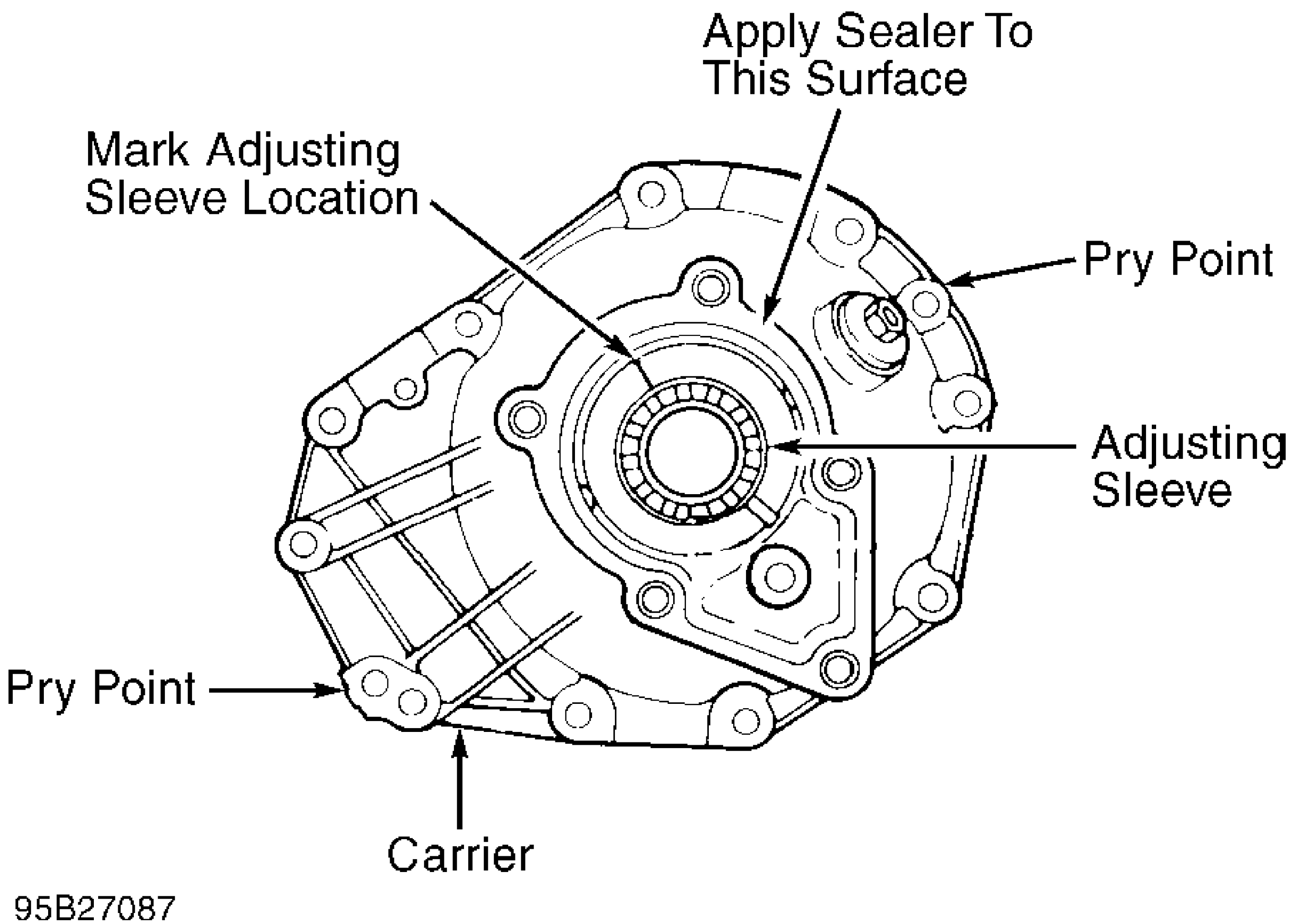

Fig. 12: Marking Adjusting Sleeve Location
Courtesy of General Motors Corp.

4) Mount base clamp of Dial Indicator Set (J-8001) so gauge plunger button contact outer edge of pinion flange. Ensure plunger is at right angle to flange. See Fig. 13. Move pinion flange through its free play travel while holding differential carrier and ring gear stationary. Record dial indicator reading. Divide dial indicator reading by 2 to obtain backlash reading.

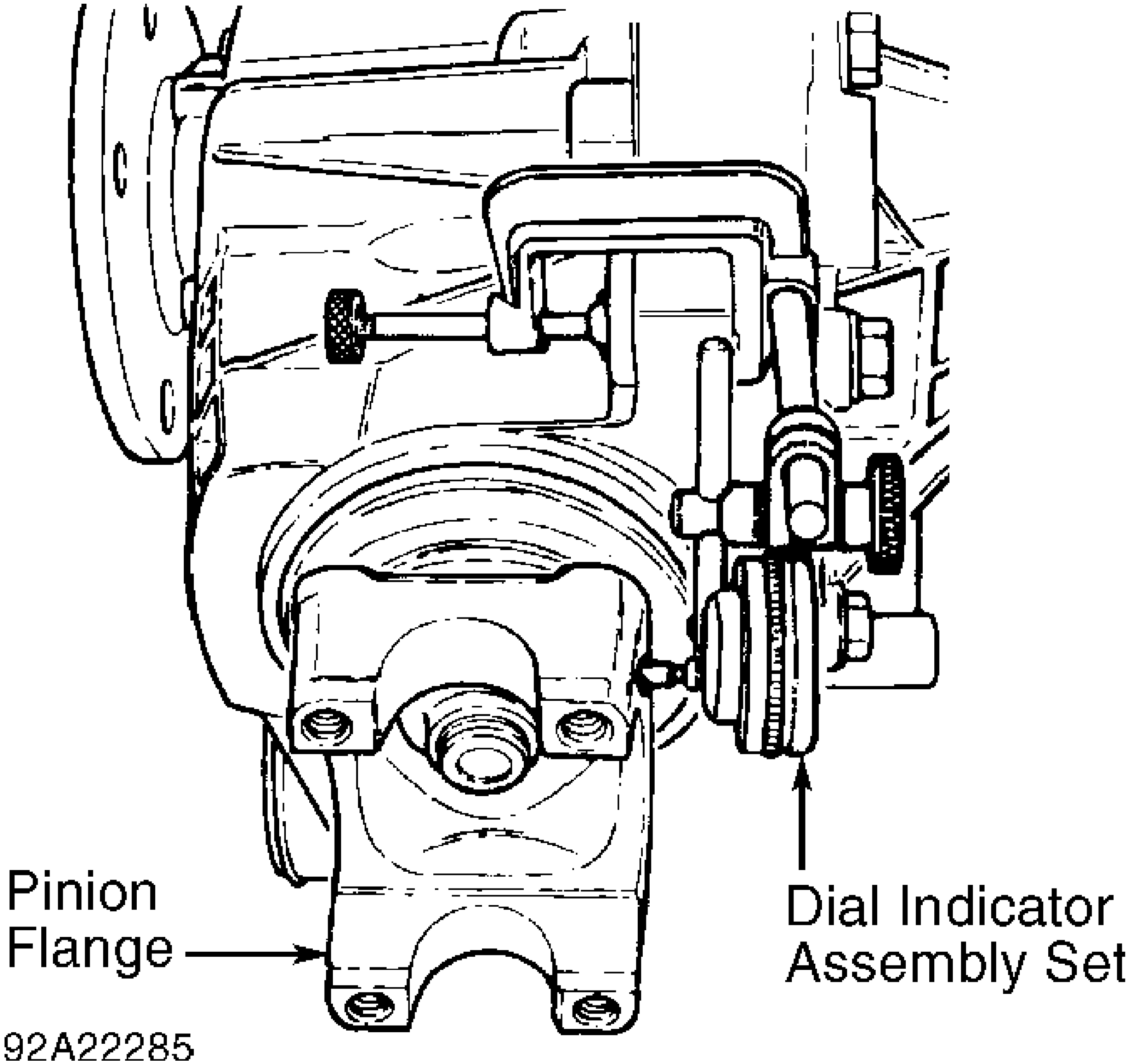

Fig. 13: Measuring Backlash At Pinion Flange
Courtesy of General Motors Corp.

5) Gear backlash at pinion flange should be .003-.010" (.08-.25 mm), with a preferred measurement of .005-.007" (.13-.18 mm). If backlash is not within specification, equally turn adjusting sleeves as necessary.

6) To increase backlash, turn left sleeve in and turn right sleeve out an equal amount. To decrease backlash, turn right sleeve in and turn left sleeve out an equal amount. Turning sleeve one notch will change backlash about .003" (.08 mm). DO NOT install sleeve locks yet.

7) When backlash is within specification, perform gear tooth contact pattern check. See GEAR TOOTH CONTACT PATTERNS article in GENERAL INFORMATION. When pattern is satisfactory, continue at step

12) of REASSEMBLY under FRONT AXLE ASSEMBLY under OVERHAUL.

AXLE ASSEMBLY SPECIFICATIONS

AXLE ASSEMBLY SPECIFICATIONS

Application	In. (mm)
Ring Gear Backlash	
Preferred	.005-.007 (.13-.18 mm)
Allowed	.003-.010 (.08-.25)
Ring Gear Runout (Maximum)	.002 (.05)
	INCH Lbs. (N.m)
Pinion Bearing Preload	15-25 (1.7-2.8)

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Axle Assembly Mounting (Bushing) Bolts	66 (90)
Axle Assembly Mounting (Bushing) Nuts	55 (75)
Axle Hub Nut	181 (245)
Ball Joint Nut (Upper)	83 (113)
Cable Switch Housing Bolts	35 (48)
Carrier Case Bolts	35 (47)
Drain & Fill Plugs	24 (33)
Drive Axle/Stub Shaft-To-Output Flange Bolts	59 (80)
Front Drive Shaft Bolts	59 (80)
Idler Arm-To-Steering Relay Rod Nut	60 (82)
Left Output Shaft Cover Bolts	18 (25)
Pitman Arm-To-Steering Relay Rod Nut	35 (47)
Right Axle Tube-To-Carrier Bolts	35 (48)
Right Axle Tube-To-Frame Bolts	55 (75)
Ring Gear Bolts (1)	59 (80)
Shock Absorber Lower Mounting Bolt	54 (73)
Skid Plate Bolts	20 (27)
Stabilizer Bar Bushing Bracket-To-Frame Bolts	30 (40)
Stabilizer Bar-To-Lower Control Arm Bolts	24 (33)
Tie Rod Nut	35 (47)
Wheel Lug Nuts	96 (130)
	INCH Lbs. (N.m)
Adjusting Sleeve Lock Bolt	71 (8)
Shift Cable Coupling Nut	89 (10)

(1) - Always use NEW bolts. Bolts are left-hand thread.

1996-97 DRIVE AXLES
General Motors 7 5/8", 8 1/2", 8 5/8" & 9 1/2" Ring Gears

Astro, Blazer, Bravada, C/K Series Pickup, Commercial Van, Express, Jimmy, Motorhome, Sierra, Sonoma, Suburban, S/T Series Pickup, Tahoe, Van, Yukon

MODEL IDENTIFICATION

Vehicle model can be identified by fifth character of Vehicle Identification Number (VIN), stamped on metal pad on top of left end of instrument panel, near windshield. See MODEL IDENTIFICATION table.

MODEL IDENTIFICATION

Series (1)	Model
"C"	2WD Pickup, Sierra, Suburban, Tahoe & Yukon
"G"	(2) RWD Van
"K"	4WD Pickup, Sierra, Suburban, Tahoe & Yukon
"L"	AWD Astro & Safari
"M"	2WD Astro & Safari
"S"	2WD Blazer, Jimmy, Pickup & Sonoma
"T"	4WD Blazer, Jimmy, Pickup & Sonoma
"T"	AWD Bravada

(1) - Fifth character of VIN.
(2) - Includes Express, Rally Van and Savana.

DESCRIPTION

NOTE: 8 1/2" ring gear differential is also used as front drive axle on K2 models. K2 models may also be equipped with a Dana front drive axle. See DRIVE AXLE - 7 5/8", 8.5", 8 5/8" & 9.5" in DRIVE AXLES.

NOTE: Some models are equipped with a locking differential. For testing and overhaul procedures, see DIFFERENTIALS - EATON LOCKING article.

Drive axle assembly is hypoid gear type with integral carrier housing. This type assembly is used on Light-Duty emission vehicles with semi-floating axles. Differential side bearing preload adjustment and drive pinion depth adjustment are made by using shims. Pinion bearing preload is made with a collapsible spacer.

A removable differential cover permits inspection and minor servicing of differential without removing axle assembly from vehicle. Service procedures are same for all assemblies, except for torque specifications and special tool numbers.

AXLE RATIO & IDENTIFICATION

Rear axle identification is stamped on forward side of axle tube. The first 3 digits indicate rear axle ratio, the next digit indicates axle assembly build source code and the next 3 digits indicate the day built.

LUBRICATION

Fill differential with 80W or 80W-90 GL-5 gear lubricant to within 1/4" (6 mm) below edge of filler hole. On models with limited-slip or locking differential, add 4 ozs (.12 L) of limited slip additive.

TROUBLE SHOOTING

See TROUBLE SHOOTING - BASIC PROCEDURES article in GENERAL INFORMATION.

REMOVAL & INSTALLATION

AXLE SHAFT & BEARING

Removal

1) Raise vehicle and support. Remove rear wheels and brake drums. Place drain pan below differential cover. Loosen, but DO NOT remove, differential cover bolts. Break cover loose. Allow lubricant to drain. Remove differential cover. Remove differential pinion shaft lock bolt.

2) On non-locking differential assemblies, remove differential pinion shaft. Push outer flanged end of axle shaft toward center of vehicle. Remove "C" lock from axle shaft groove and from counterbore recess in side gear. Remove axle shaft from axle housing.

3) On locking differential assemblies (with thrust block and clutch packs), move pinion shaft part way out. Rotate differential case to lock pinion shaft against carrier housing. See Fig. 1.

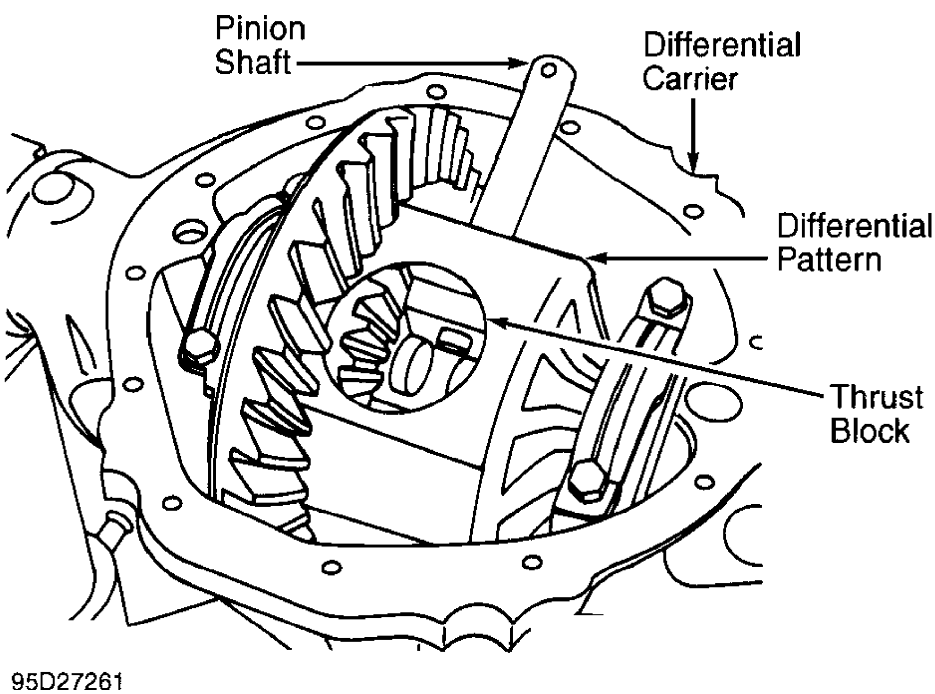

Fig. 1: Removing Axle From Locking Differential Assembly
Courtesy of General Motors Corp.

4) Using screwdriver, rotate "C" lock until its open end faces thrust block and "C" lock is aligned with thrust block sides.

See Fig. 2. Push axle shaft inward. Remove "C" lock from thrust block and axle shaft groove. Remove axle shaft from axle housing. See Fig. 2.

CAUTION: DO NOT hammer on axle shaft flange.

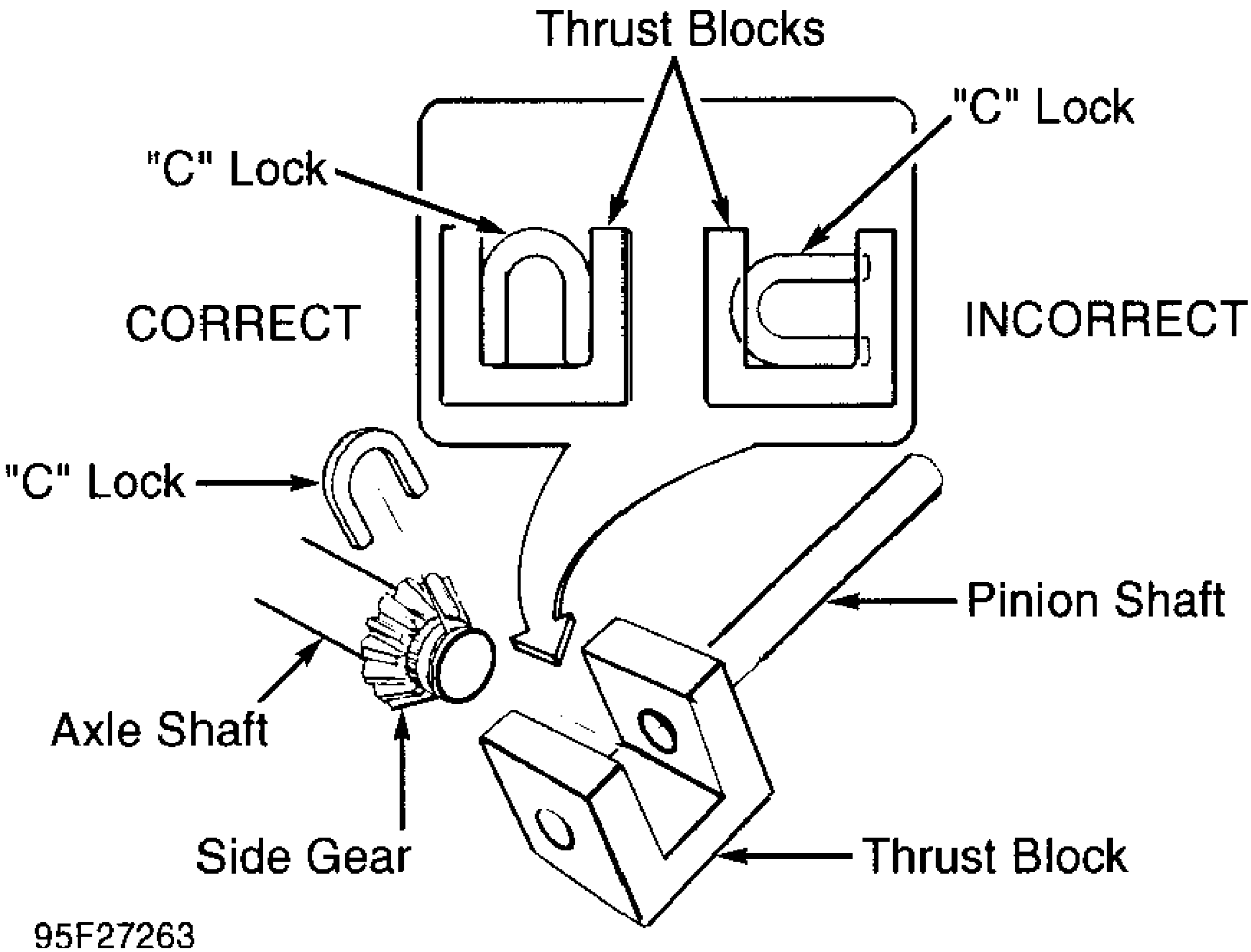

Fig. 2: Removing "C" Lock From Locking Differential
Courtesy of General Motors Corp.

5) On all assemblies, insert Axle Bearing & Seal Remover (J-22813-01) into axle housing behind bearing. Attach Slide Hammer (J-2619) and Adapter (J-2619-10) to bearing remover. Remove axle bearing and axle seal. See Fig. 3.

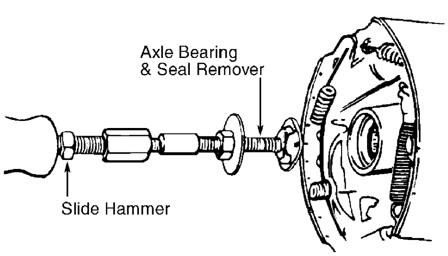

Fig. 3: Removing Axle Bearing & Seal
Courtesy of General Motors Corp.

Installation

1) Using Bearing Installer (J-8092), install axle shaft bearing into housing until bearing installer bottoms against housing shoulder.

2) Using Seal Installer (J-23771), install axle shaft seal into housing. Install axle shaft and "C" lock. Pull axle shaft outward to seat "C" lock.

3) Install pinion shaft and pinion shaft lock bolt. Tighten lock bolt to specification. See TORQUE SPECIFICATIONS. To complete installation, reverse removal procedure.

PINION FLANGE & OIL SEAL

NOTE: If replacing pinion and ring gear, discard original pinion flange after removal. Replacement pinion, ring gear and pinion flange are balanced as an assembly.

Removal

1) Raise and support vehicle. Remove drive shaft. Using an INCH-lb. torque wrench, rotate pinion several revolutions. Stop and start rotation several times. Note and record pinion bearing preload.

2) Match mark pinion-to-nut and nut-to-pinion flange for reassembly purposes. Count and record number of exposed threads on pinion.

3) Hold pinion flange with Pinion Flange Holder/Remover (J-8614-01 or J-8614-1). See Fig. 4. Remove nut. Install Pinion Flange Remover (J-8614-1, -2 and -3) through pinion flange holder and remover. Remove pinion flange from pinion. Pry pinion seal from housing.

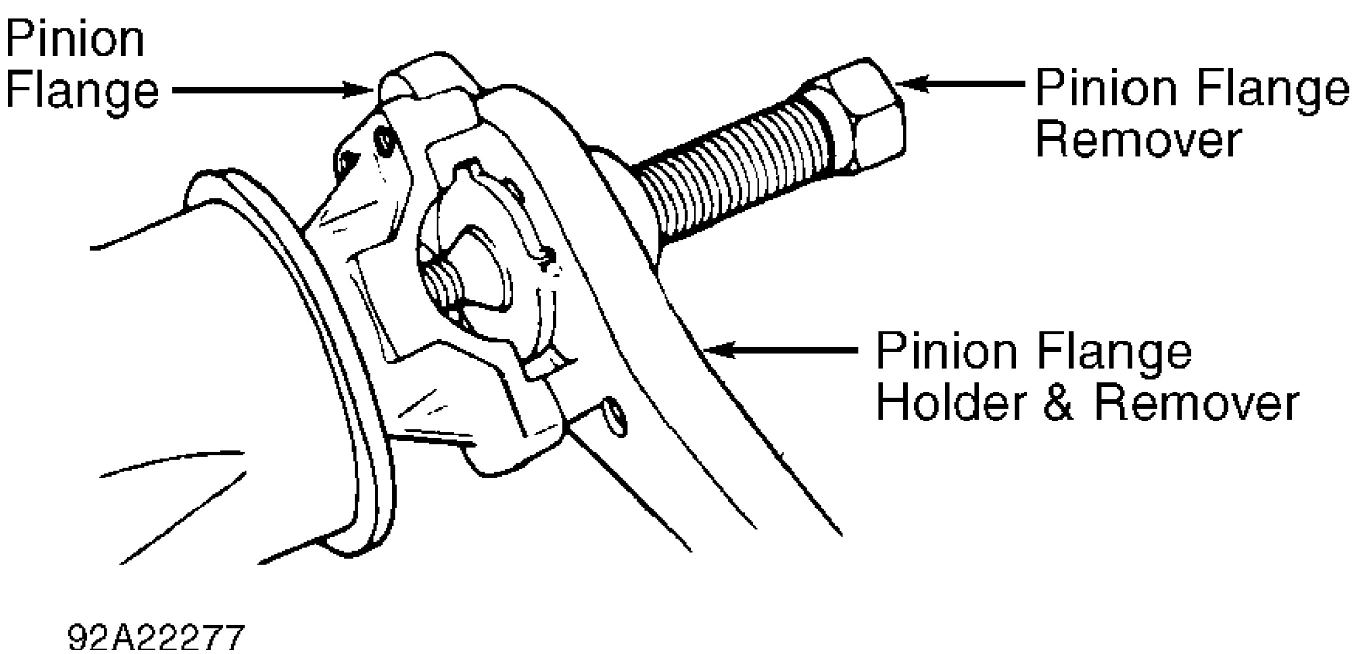

Fig. 4: Removing Pinion Flange
Courtesy of General Motors Corp.

Installation

1) Inspect pinion flange oil seal surface and drive splines. Replace pinion flange if damaged. Lubricate inside diameter of seal. Place pinion seal in housing bore.

2) Using Seal Installer (J-23911 for 7 5/8"; J-22388 for 8

1/2", 8 5/8" and 9 1/2"), install pinion seal.

3) Install a non-hardening sealer to pinion splines or internal splines of pinion flange. Align pinion flange marks with marks on pinion. Install pinion flange.

CAUTION: DO NOT hammer flange onto pinion shaft to install. Ring gear and pinion will be damaged.

4) Install washer and nut to pinion. Tighten nut snug, taking note of scribe marks and number of exposed threads. Measure pinion preload. Using pinion flange holder and remover, tighten nut in small increments. Tighten pinion nut until original preload plus 3-5 INCH lbs. (.3-.6 N.m) is obtained.

5) If preload exceeds amount specified in step 4), remove pinion flange and replace collapsible sleeve. Tighten pinion nut until original preload is obtained. Install drive shaft. Add lubricant as needed.

REAR HUB & CARRIER ASSEMBLY

Removal & Installation

1) Raise vehicle. Allow rear hub and carrier assembly to hang free. Drain lubricant. Remove rear wheels and brake drums. Remove parking brake cable. Disconnect drive shaft and brake lines. Disconnect vent hose from assembly. Support assembly. Disconnect height sensing, ABS sensor and brake proportional valve linkage (if equipped).

2) Disconnect shock absorbers at assembly. Remove stabilizer shaft (if equipped). Remove "U" bolt nuts, washers, spacers and spring plates. Lower and remove assembly from vehicle.

3) To install assembly, reverse removal procedure. Bleed brake system. Adjust height sensing and brake proportional valve linkage (if equipped).

OVERHAUL

DIFFERENTIAL ASSEMBLY

NOTE: Check and record ring gear backlash and pinion bearing preload before disassembly.

Disassembly

1) Remove axle shafts. See AXLE SHAFT & BEARING under REMOVAL & INSTALLATION. Roll out differential pinions and thrust washers. Mark pinions and thrust washers (left and right). Remove side gears and thrust washers. Mark side gears and thrust washers (left and right).

2) Mark differential case side bearing caps and housing. Loosen bearing cap bolts. Remove caps, mark shims, spacers, and side bearing races. Using pry bar, pry against housing at window of differential case and remove case.

CAUTION: Differential case side bearings are preloaded. Differential case will fall free after being pried past a certain point.

3) Place any loose shims with appropriate left and right bearing races. Using Differential Side Bearing Puller/Remover (J-22888) and Adapter (J-8107-2 for 7 5/8"; J-8107-4 for 8 1/2" and 8 5/8"; J-8107-3 for9 1/2"), remove differential case side bearings. DO NOT pull on bearing cage, pull on bearing cone.

4) Ring gear bolts have left-hand threads. Remove ring gear bolts. Tap ring gear off carrier using a soft drift and hammer. Using an INCH-lb. torque wrench and proper socket, check torque required to

rotate drive pinion. If no preload reading is obtained, check for looseness of pinion assembly, bearings or weak collapsible sleeve.

5) Remove pinion flange. See PINION FLANGE & OIL SEAL under REMOVAL & INSTALLATION. Install pinion nut back onto pinion. Install rear differential cover using 2 bolts to keep pinion from falling out. Tap end of pinion (using soft drift and hammer) to remove pinion from front bearing.

CAUTION: Use care not to damage pinion bearings when removing pinion from differential housing.

6) Remove differential cover and pinion assembly. Remove pinion oil seal and front bearing from housing. Remove collapsible spacer from pinion. Remove inner bearing from pinion using a press and Bearing Remover Clamp (J-25320 for 7 5/8"; J-8612-B for 8 1/2" and 8 5/8";J-22912-01 for 9 1/2"). Press bearing from pinion, and remove shim.

7) Remove pinion bearing races from axle housing using hammer and punch. Inspect bearings and bearing races. Replace as required. Discard and replace pinion oil seal, pinion nut and collapsible spacer.

Cleaning & Inspection

Clean all parts. Inspect all small gears, thrust washers, bearings and races for chipping, cracks, brinelling or wear. Inspect axle shaft splines, ring gear and pinion teeth. Inspect pinion shaft for cracks or excessive wear. Inspect pinion flange oil seal surface, drive splines, flange ears and bearing contact surface. Replace components as required.

Reassembly

1) If installing NEW ring gear and pinion, and/or pinion bearings, see DRIVE PINION DEPTH and SIDE BEARING PRELOAD under ADJUSTMENTS. After installing original pinion shims onto pinion, install inner pinion bearing onto pinion using Bearing Installer (J-5590). Drive bearing onto pinion until bearing is tightly seated against pinion shims.

2) Install a NEW collapsible spacer onto pinion. Lubricate pinion bearings. Install pinion into axle housing. Install outer bearing onto pinion using Bearing Installer (J-5590). Hold pinion in position from inside housing while driving bearing onto pinion. To install pinion oil seal and pinion flange, see PINION FLANGE & OIL SEAL under REMOVAL & INSTALLATION.

3) Install ring gear squarely onto differential case. Tighten ring gear bolts evenly and alternately to specification. Ring gear bolts are left-hand thread. See TORQUE SPECIFICATIONS.

4) Lubricate pinion gears and side gears with gear oil. Install left and right gears and thrust washers into case as marked in disassembly. Install one pinion gear onto side gears and rotate gears until pinion gear is exactly opposite. Place second pinion gear onto side gears so that pinion gear holes are exactly opposite each other.

5) Verify pinion shaft fits through both pinion gears for alignment purposes. Install pinion gear thrust washers. Hold pinion gears in position and carefully remove pinion shaft. Rotate side gears to position pinion gears in alignment with differential case holes. Install pinion shaft and pinion shaft lock bolt. Temporarily snug tighten lock bolt.

6) If side bearings were removed, install side bearings to differential case using Press or Bearing Installer (J-25299). Using Bearing Installer (J-25299), first install Adapter (J-8107-2) to opposite bearing end of differential case to protect case surface. Drive bearing onto case using hammer, Bearing Installer (J-25299) and Adapter (J-8092). Repeat for opposite side.

7) Lubricate side bearings and install races. Install differential case into carrier housing. Install spacer between each bearing race and housing with chamfered edge of spacer against housing. Install right bearing cap and loosely tighten bolts so that differential case is free to move but will not fall out of housing. To complete installation, see SIDE BEARING PRELOAD under ADJUSTMENTS.

ADJUSTMENTS

DRIVE PINION DEPTH

1) Drive pinion rear bearing shim thickness must be determined whenever a NEW axle housing, ring gear and pinion, or pinion bearings is installed. Shim pack thickness is determined by using Pinion Setting Gauge Set (J-21777). See Fig. 5.

2) Install pinion bearing races into housing (if previously removed). Install lubricated rear pinion bearing through rear of housing. Position Gauging Plate (J-23597-11 for 7 5/8"; J-21777-29 for 8 1/2" and 8 5/8"; J-21777-85 for 9 1/2") to rear pinion bearing. Install stud bolt and washer through gauging plate and rear pinion bearing, pointing stud bolt toward front pinion bearing position. See Fig. 5.

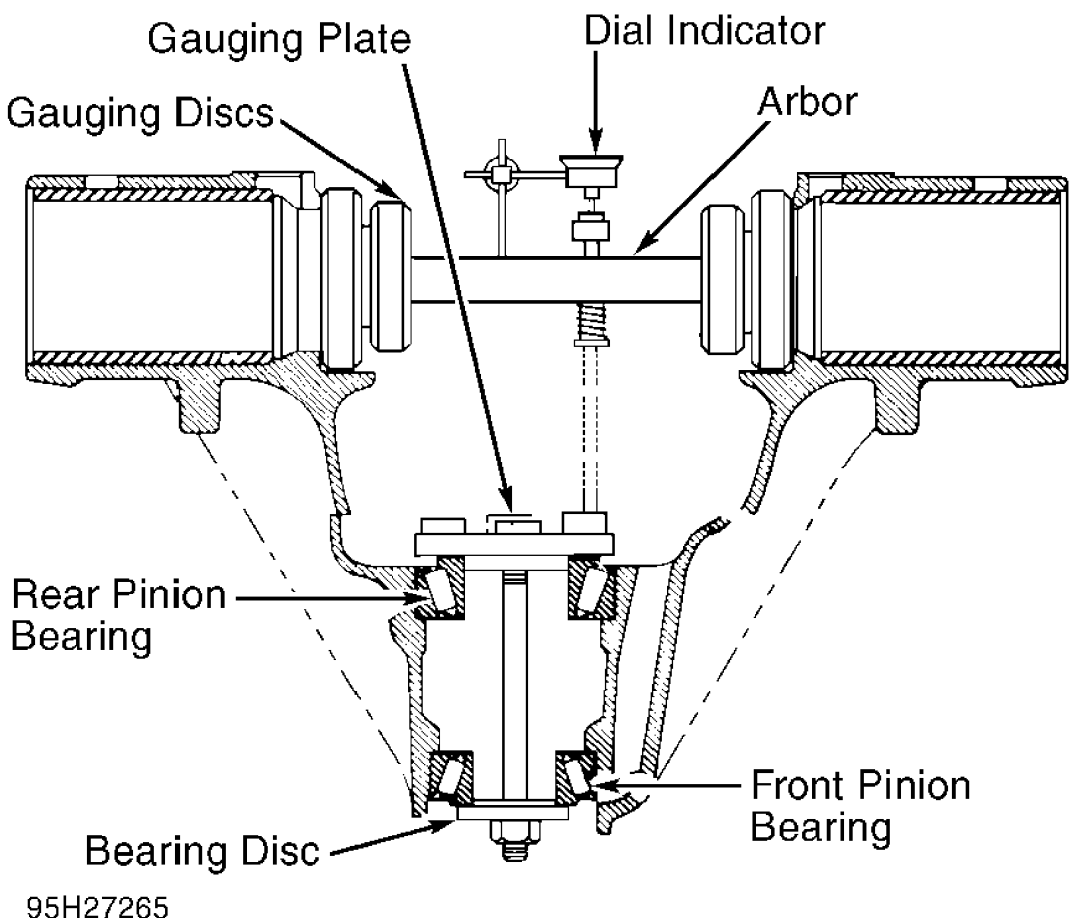

Fig. 5: Cross-Sectional View Of Pinion Setting Gauge Set
Courtesy of General Motors Corp.

3) Install lubricated front pinion bearing into race. Install Bearing Disc (J-21777-42) to outside of front pinion bearing. Install

and tighten stud bolt hex nut until snug. Rotate gauge plate and bearings to ensure proper seating, while snugging hex nut. Hold stud bolt head stationary with a wrench. Using INCH-lb. torque wrench, tighten hex nut in small increments until 20 INCH lbs. (2.2 N.m) of torque is required to rotate gauge plate and bearings. See Fig. 5.

4) Mount side bearing Gauging Discs (J-21777-45 for 7 5/8", 8 1/2" and 8 5/8"; J-21777-86 for 9 1/2") on ends of arbor. Place arbor into carrier side bearing recesses making sure gauging discs are properly seated. Install side bearing caps and bolts. Snug tighten bolts to avoid arbor movement.

5) Position dial indicator on mounting post of arbor with contact button resting on top surface of plunger. Set dial indicator to zero. Push indicator down on indicator shaft until needle rotates 3-4 revolutions to right, and then tighten in this position.

6) Place plunger onto gauging area of pinion gauge plate. Rock plunger rod slowly back and forth across gauging area until dial indicator reads greatest deflection.

7) At point of greatest deflection, set indicator to zero. Repeat rocking action several times to verify setting. Once zero reading is obtained, rotate gauge shaft to remove plunger from gauging area.

8) Dial indicator will now read required pinion shim thickness for nominal pinion setting. Record this reading. Check drive pinion for painted or stamped markings on pinion stems, or for a stamped code number on small end of pinion gear.

9) If marking is a plus (+), add that many thousandths of an inch to recorded indicator reading. If marking is a minus (-), subtract that many thousandths of an inch from indicator reading. This measurement will then be required thickness of rear pinion bearing shim pack.

NOTE: If no markings are found on pinion, use dial indicator reading as shim thickness.

10) Remove bearing caps and all gauging tools from housing. Place selected shim pack on pinion gear. Using a press, install lubricated pinion bearing onto pinion shaft.

11) Install a NEW collapsible spacer over pinion gear shaft. Install pinion assembly into position from rear of housing. While holding pinion in position, carefully drive front pinion bearing onto pinion gear shaft until a few threads are exposed.

12) Install pinion seal, pinion flange, washer and nut. Ensure pinion flange alignment mark is properly aligned with pinion shaft end mark. Using Companion Flange Holder/Remover (J-8614-01), tighten pinion self-locking nut until all end play is removed. Rotate pinion several times to seat bearings. Check preload using an INCH-lb. torque wrench.

13) Continue tightening nut and checking preload until specified preload is obtained. See AXLE ASSEMBLY SPECIFICATIONS. DO NOT back off nut to lessen preload.

14) If preload is exceeded, install a NEW collapsible spacer and retighten self-locking nut until proper preload is obtained.

SIDE BEARING PRELOAD

NOTE: Adjust drive pinion depth prior to performing side bearing preload adjustment.

7 5/8", 8 1/2" & 8 5/8" Ring Gears

1) Side bearing preload and backlash adjustment are adjusted by varying thickness of both left and right side bearing shims. Side bearings must be previously installed to differential case. Lubricate side bearings and install races.

2) Place differential case assembly into position in housing. Position ring gear tightly against pinion so backlash is .000-.001" (0-.025 mm). Hold assembly in place by hand temporarily. Install Bearing Strap(J-22799-6) to left side bearing race.

3) Install Side Bearing Backlash Gauge (J-22779) between left side bearing race and carrier housing. See Fig. 6. While moving gauge up and down, tighten gauge adjusting nut until a slight drag is felt. Tighten lock bolt on side of gauge, and leave gauge in position.

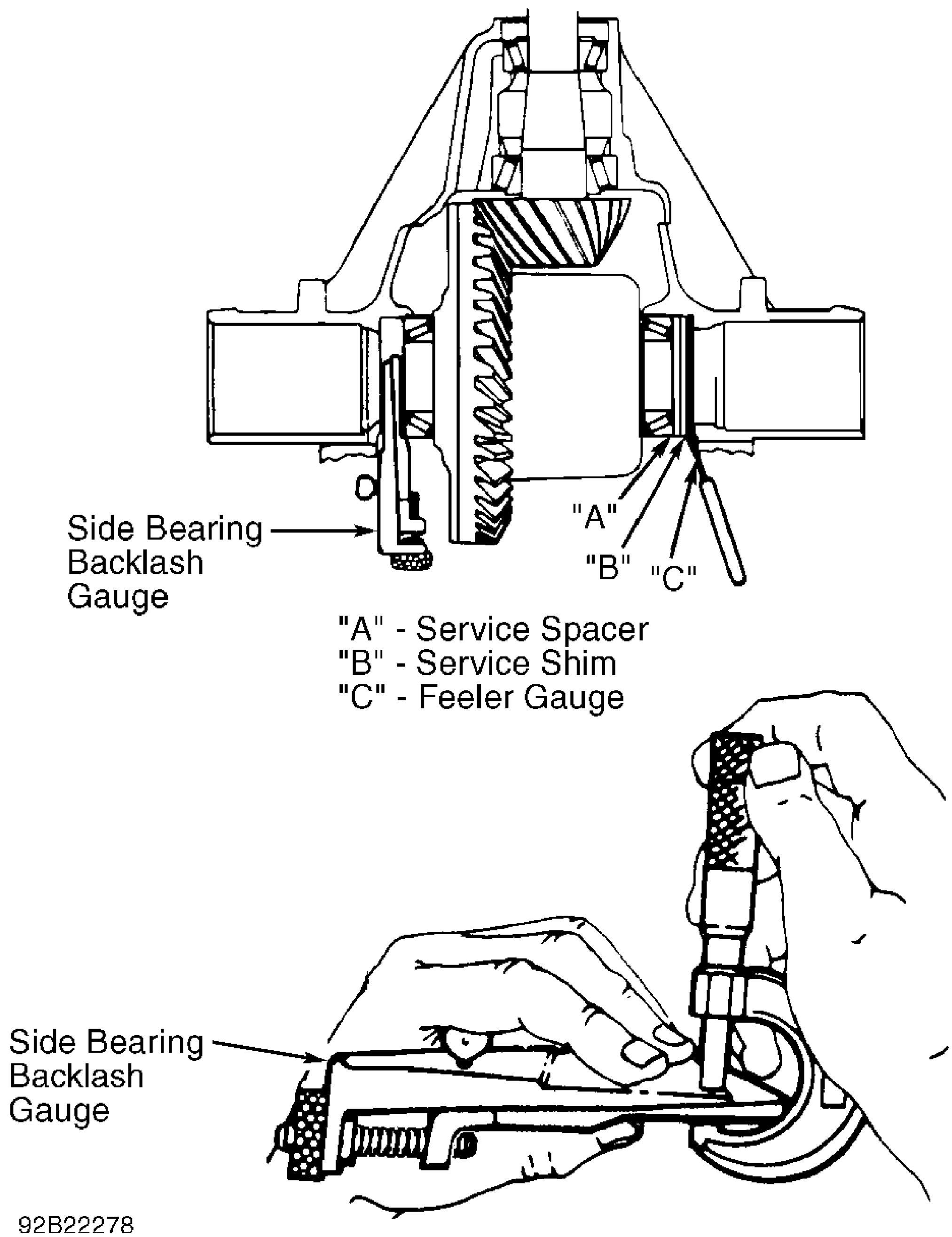

Fig. 6: Installing Side Bearing Backlash Gauge (J-22779)
Courtesy of General Motors Corp.

4) Install service adjustment spacer and shim between right bearing race and carrier housing. Determine bearing preload by

inserting feeler gauges between carrier and shim. The point just before feeler gauge drag begins is the correct feeler gauge thickness. This is the zero setting without preload.

5) Remove gauge from left side. Using a micrometer, measure gauge in 3 places and average readings. Record measurements.

6) Add together measurements of right side shim, spacer and feeler gauge. Subtract .010" (.25 mm) from ring gear (left) side measurement and add .010" (.25 mm) to opposite (right) side measurement. This allows for initial backlash adjustment.

7) To obtain correct preload, add .004" (.10 mm) to both measurements. Total measurement is correct shim pack thickness for each side. See following example:

* Ring Gear Side (Left) Shim Pack
* .250" (Gauging Tool Measurement)
* -.010" (Backlash Adjustment)
* +.004" (Bearing Preload)
* =.244" (Ring Gear Side Shim Pack)
* Opposite Ring Gear Side (Right) Shim Pack
* .265" (Combined Measurement Total)
* +.010" (Backlash Adjustment)
* +.004" (Bearing Preload)
* =.279" (Opposite Ring Gear Side Shim Pack)

NOTE: If shim is not chamfered enough and scrapes spacer when it is installed, file or grind chamfer before installation.

8) Install ring gear side shim first, and wedge opposite side shim between bearing cup and spacer. Install shim so chamfered side is against spacer. If necessary, partially remove differential case to install right side shim. If necessary, carefully tap shim into place with a soft-faced hammer. Tighten bearing cap bolts to specification. See TORQUE SPECIFICATIONS. Check backlash. See BACKLASH & FINAL ASSEMBLY.

9 1/2" Ring Gear

1) Differential side bearing preload is adjusted by adjusting nut in right differential bearing bore and by adjusting shims in left bearing bore. Bore and bearing cap provide mating threads for preload adjusting nut.

2) Install bearing races to differential bearings. Install differential case into axle housing assembly and temporarily hold in position by hand. Install bearing shims so chamfered side is against spacer.

3) Push differential case away from pinion and install adjusting nut. Tighten right side preload adjusting nut using Spanner Wrench(J-24429). Turn pinion to seat differential case bearings.

4) Back off adjusting nut slightly. Install bearing caps and snug tighten bolts. Turn adjusting nut until nut contacts shim. Note nut position and tighten nut 3 additional slots.

5) Tighten bearing cap bolts to specification. Install adjusting nut lock bolt and tighten to specification. See TORQUE SPECIFICATIONS. Check backlash adjustment. See BACKLASH & FINAL ASSEMBLY.

BACKLASH & FINAL ASSEMBLY

1) Rotate pinion and differential case several times to seat bearings. Using a dial indicator mounted to axle housing, check ring gear backlash at 4 different teeth locations around ring gear. Install indicator in line with gear rotation and perpendicular to tooth angle.

2) Ensure pinion flange is locked in position or held rigid while taking each backlash reading. Four backlash readings should not

vary more than .002" (.05 mm).

3) Total backlash reading should be .005-.009" (.13-.23 mm). If backlash is incorrect, adjust side bearing shims as necessary. After backlash adjustment is completed, perform gear tooth contact pattern check. See GEAR TOOTH CONTACT PATTERNS article in GENERAL INFORMATION.

4) If pattern is incorrect, adjust pinion or ring gear as required. Install axle shafts, "C" locks, pinion shaft and lock bolt. Install rear housing cover and add gear oil. See Fig. 7.

NOTE: DO NOT change total shim pack thickness for each side bearing. If a shim is removed from one side, add same thickness shim to other side.

AXLE ASSEMBLY SPECIFICATIONS

AXLE ASSEMBLY SPECIFICATIONS

Application	In. (mm)
Ring Gear Backlash	.005-.009 (.13-.23)
Side Bearing Preload	
7 5/8", 8 1/2" & 8 5/8"	.008 (.20)
9 1/2"	Zero plus 3 Slots
	INCH Lbs. (N.m)
Pinion Bearing Preload (1)	
7 5/8" Ring Gear	
New Bearings	24-32 (2.7-3.6)
Used Bearings	8-12 (1.0-1.4)
8 1/2", 8 5/8" & 9 1/2" Ring Gear	
New Bearings	20-25 (2.3-2.8)
Used Bearings	10-15 (1.1-1.7)

(1) - Preload measurement is torque needed to turn pinion in housing without differential case and ring gear installed.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Differential Bearing	
Adjusting Nut Lock Bolt (9 1/2" Ring Gear)	22 (30)
Differential Cover Bolts	20 (27)
Drive Shaft-To-Pinion Flange Bolts	
Except C3500 Heavy Duty	15 (20)
C3500 Heavy Duty	27 (36)
"S" & "T" Series	
2.2L	15 (20)
4.3L	33 (45)
Pinion Shaft Lock Bolt	27 (36)
Ring Gear-To-Differential Case Bolt (1)	
7 5/8" Ring Gear	90 (120)
8 1/2" & 8 5/8" Ring Gear	90 (120)
9 1/2" Ring Gear	105 (145)
Side Bearing Cap Bolt	
8 1/2" & 8 5/8" Ring Gear	60 (81)
9 1/2" Ring Gear	60 (81)

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Side Bearing Preload Adjusting Nut Lock Bolt
  9 1/2" Ring Gear  ..............................  22 (30)
Spring "U" Bolts ("S" & "T" Series)
  Inner Nuts  ....................................  41 (56)
  Outer Nuts  ....................................  48 (65)

(1) - Left-hand thread. Use NEW bolts.
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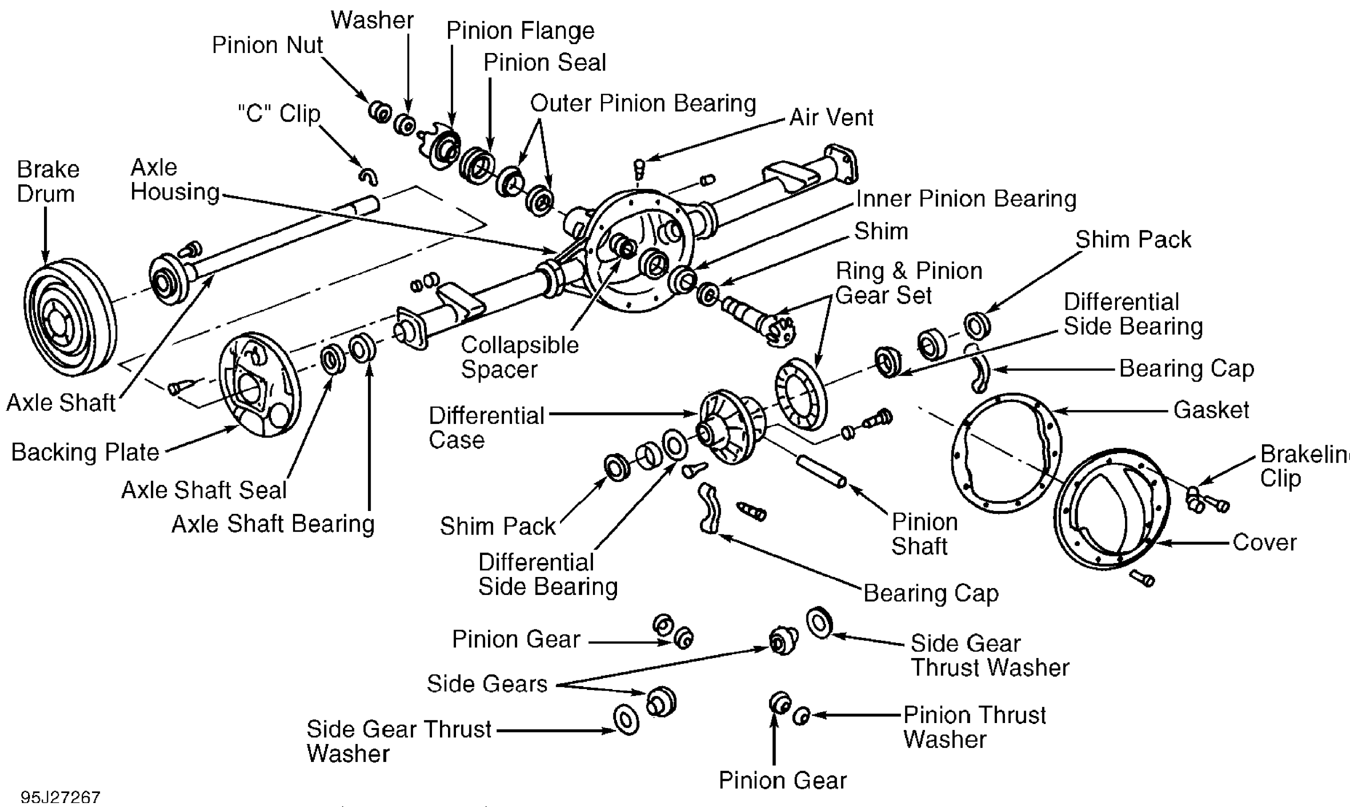


Fig. 7: Axle Assembly (8 1/2" & 8 5/8" Shown; Others Similar)
Courtesy of General Motors Corp.

DRIVE BELT ROUTING

1997 Chevrolet Blazer

1996-97 ENGINE COOLING
General Motors Corp. Specifications - Trucks

All Models

SPECIFICATIONS

CAUTION: When battery is disconnected, vehicle computer and memory systems may lose memory data. Driveability problems may exist until computer systems have completed a relearn cycle. See COMPUTER RELEARN PROCEDURES article in the GENERAL INFORMATION before disconnecting battery.

BELT ADJUSTMENT

BELT ADJUSTMENT

Application	(1) Lbs. (kg)
All Models	(1)

(1) - Serpentine belt tension is maintained automatically by a spring-tensioned idler pulley. No adjustment is necessary.

SERPENTINE DRIVE BELT ROUTING & ALIGNMENT

NOTE: For serpentine belt routing, see underhood label or Figs. 1-12.

NOTE: Diagram for 3.4L not available from manufacturer at time of publication.

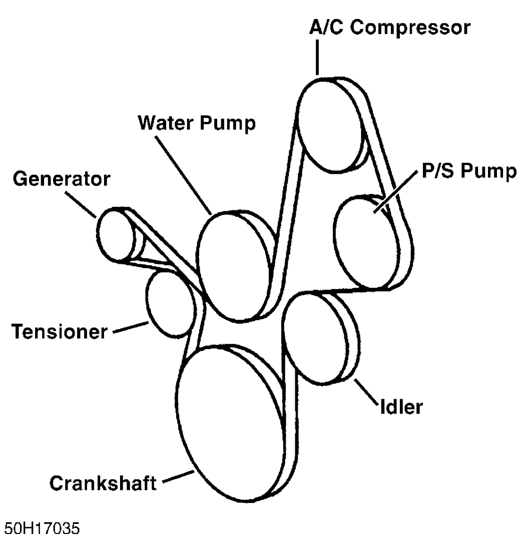


Fig. 1: Drive Belt Routing - 2.2L (With A/C & P/S)
Courtesy of General Motors Corp.

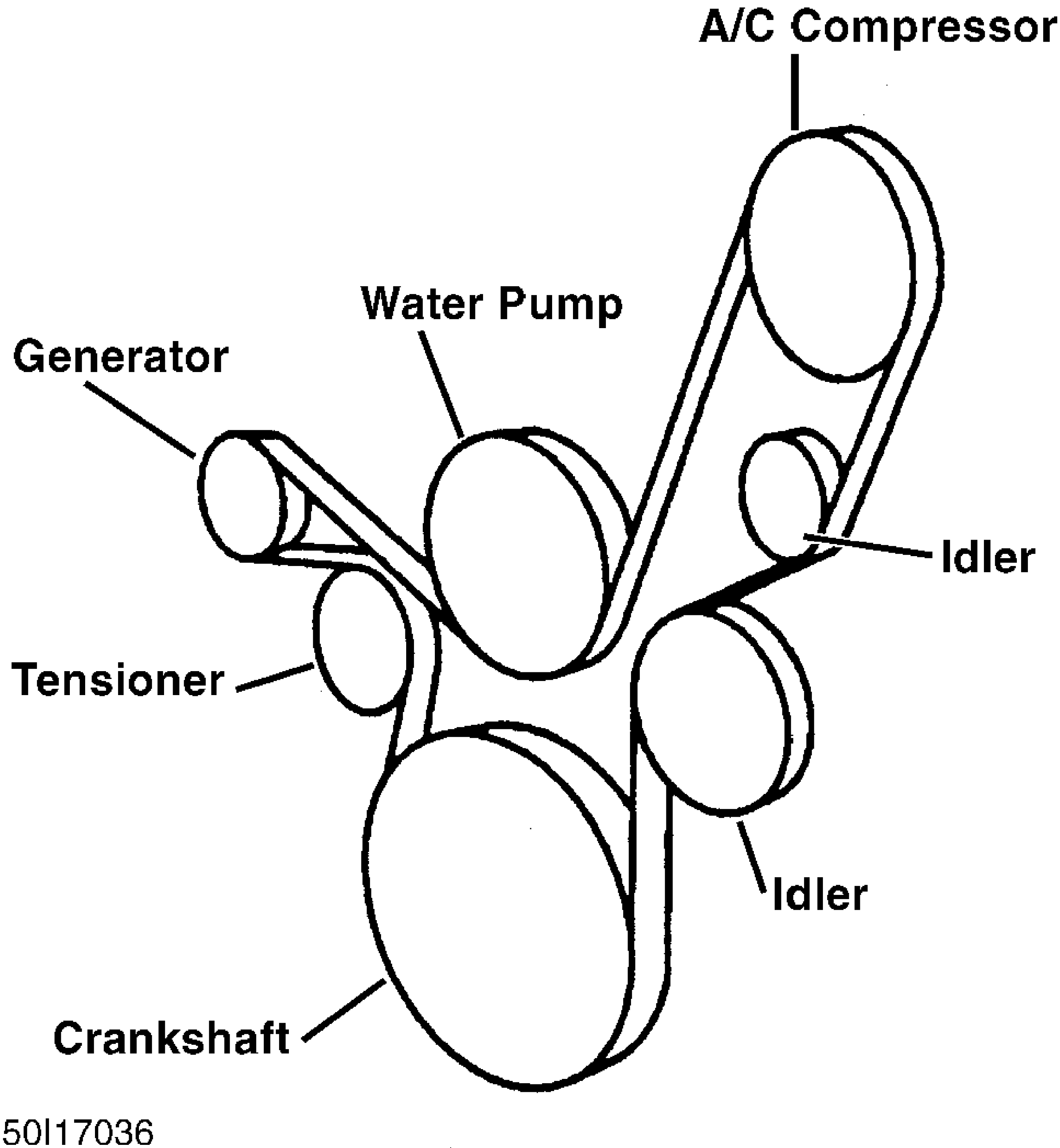


Fig. 2: Drive Belt Routing - 2.2L (With A/C & Manual Steering)
Courtesy of General Motors Corp.

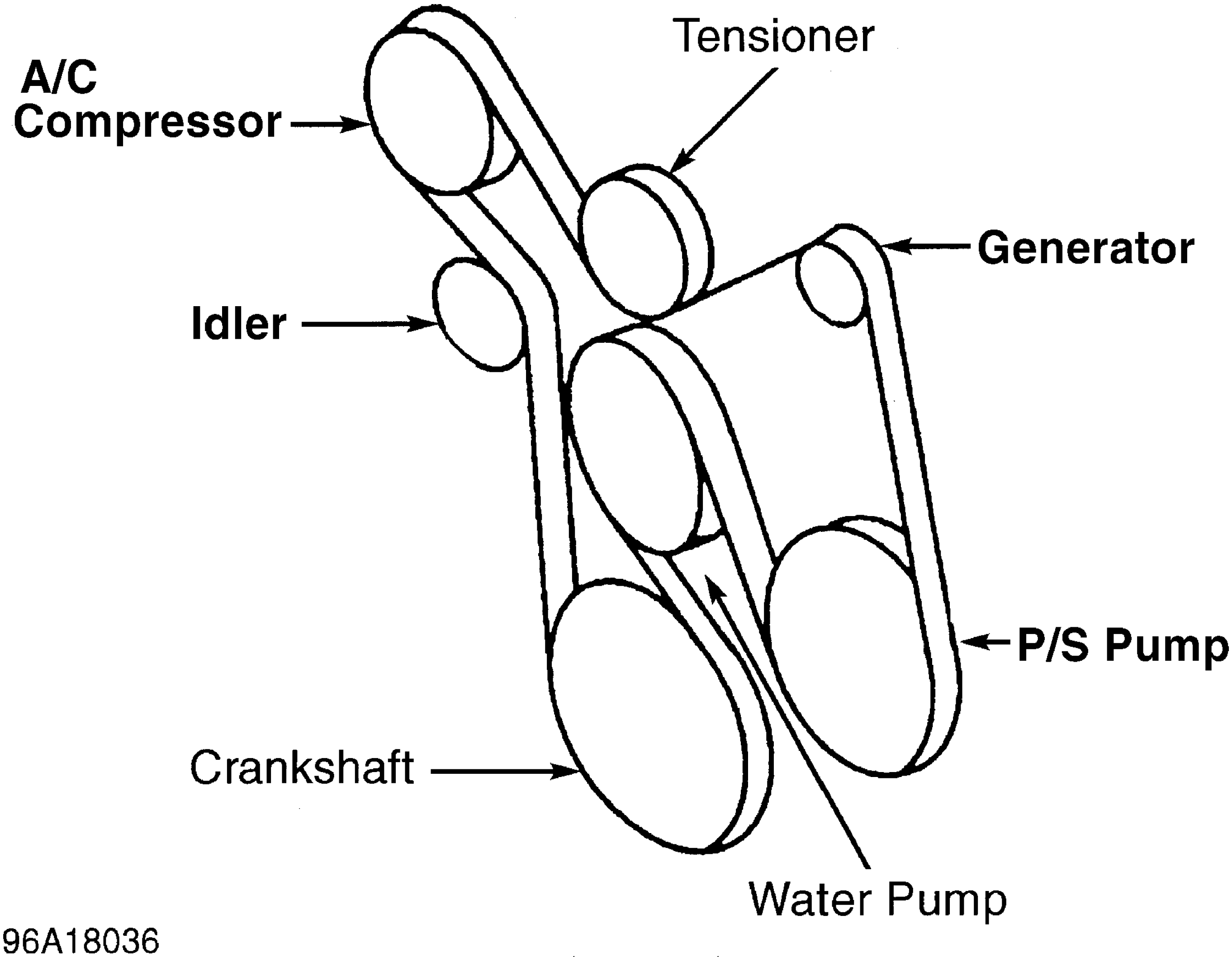
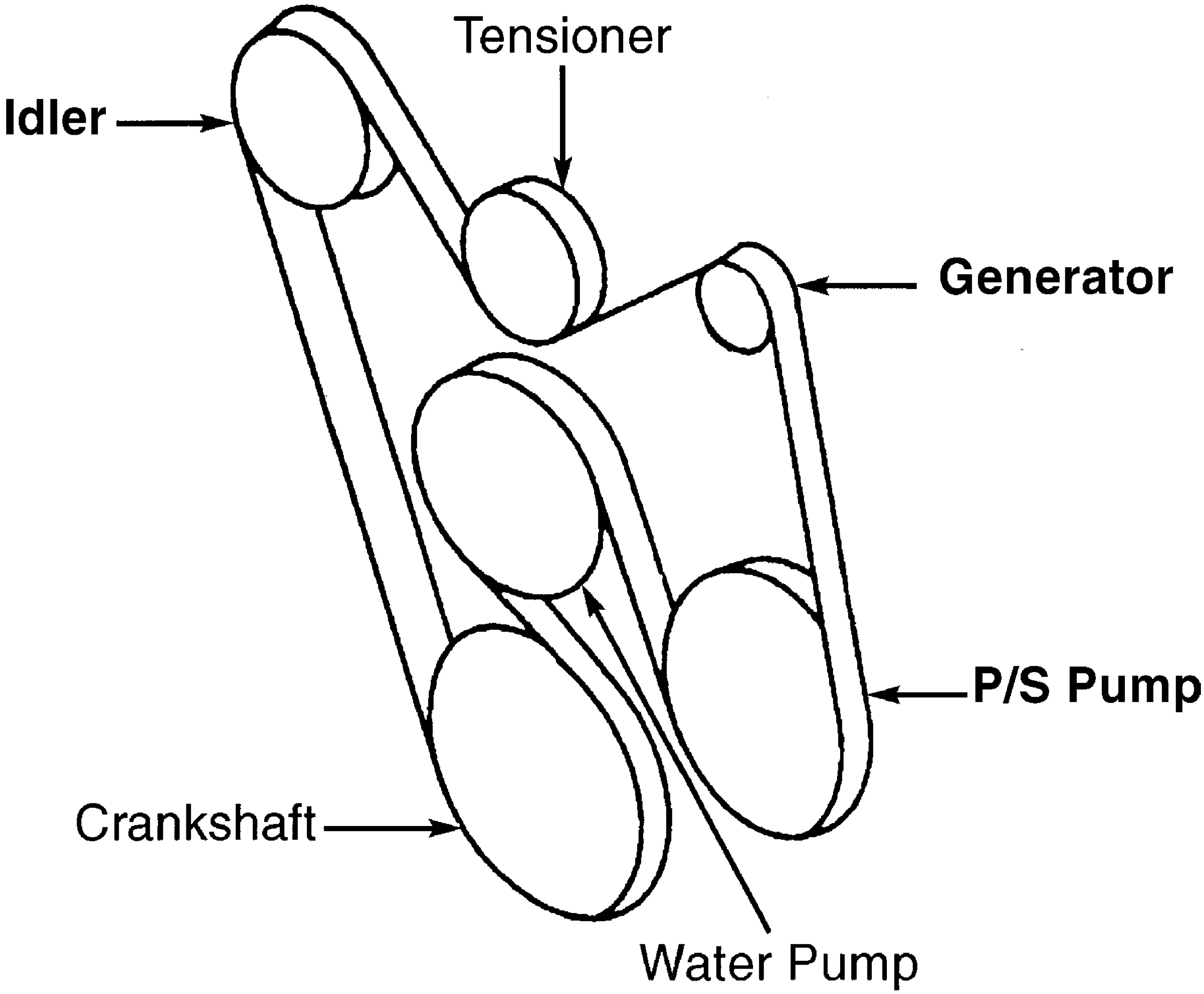


Fig. 3: Drive Belt Routing - 2.2L (Without A/C, With P/S)
Courtesy of General Motors Corp.



96C18038
Fig. 4: Drive Belt Routing - 2.2L (Without A/C, With Manual Steering)
Courtesy of General Motors Corp.

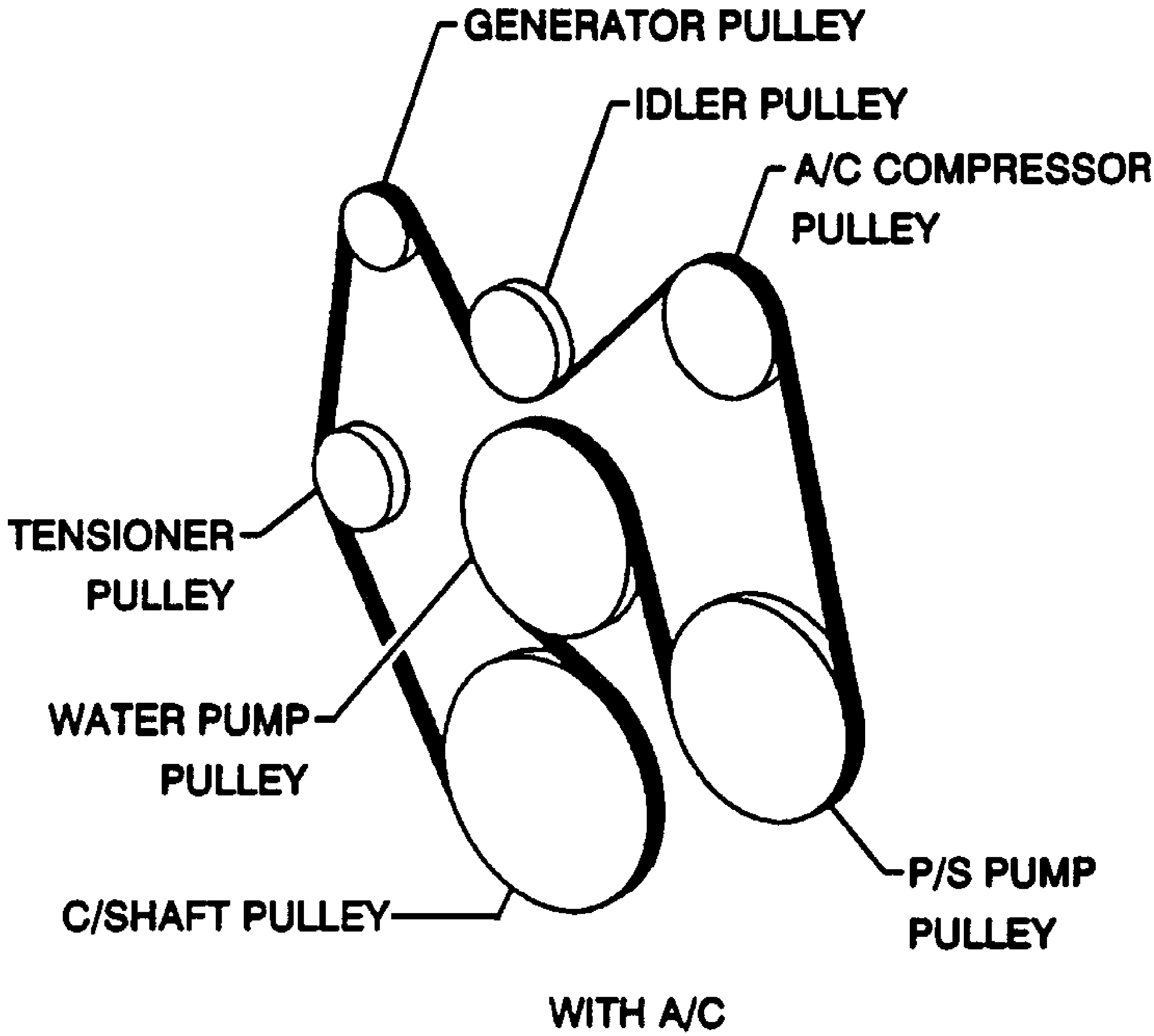


Fig. 5: Drive Belt Routing - 4.3L, 5.0L & 5.7L (With A/C)
Courtesy of General Motors Corp.

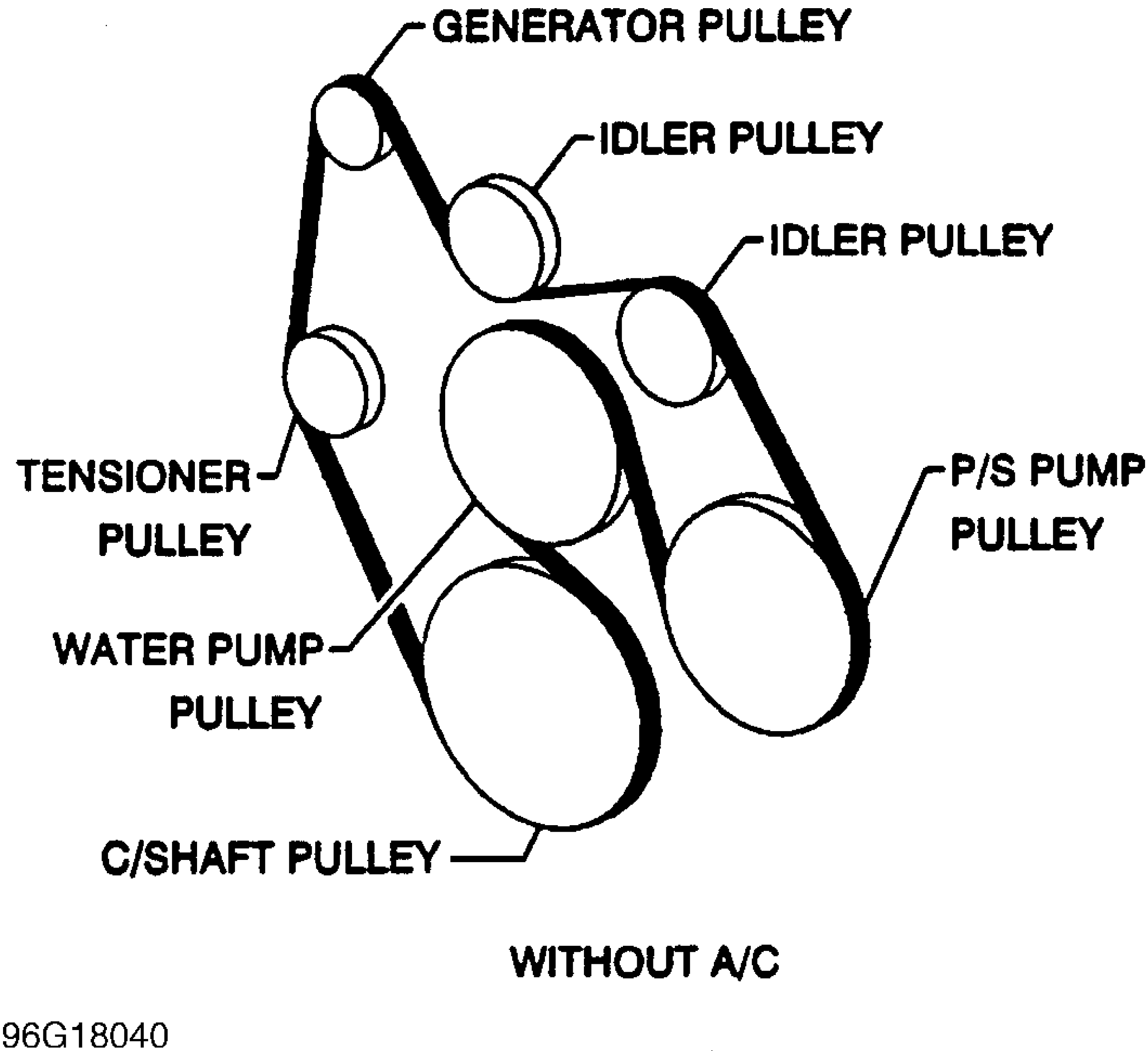


Fig. 6: Drive Belt Routing - 4.3L, 5.0L & 5.7L (Without A/C)
Courtesy of General Motors Corp.

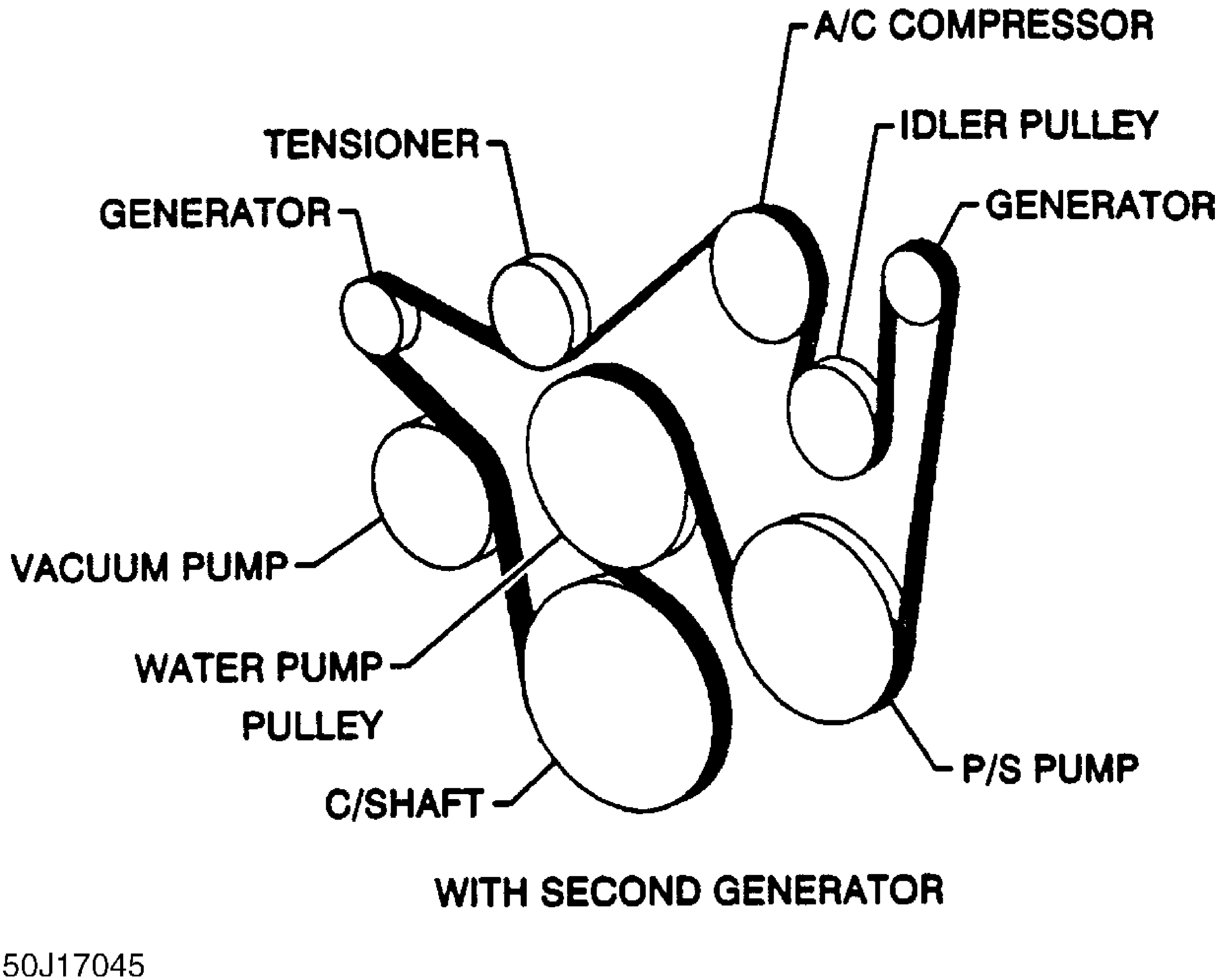


Fig. 7: Drive Belt Routing - 6.5L Diesel (With Second Generator)
Courtesy of General Motors Corp.

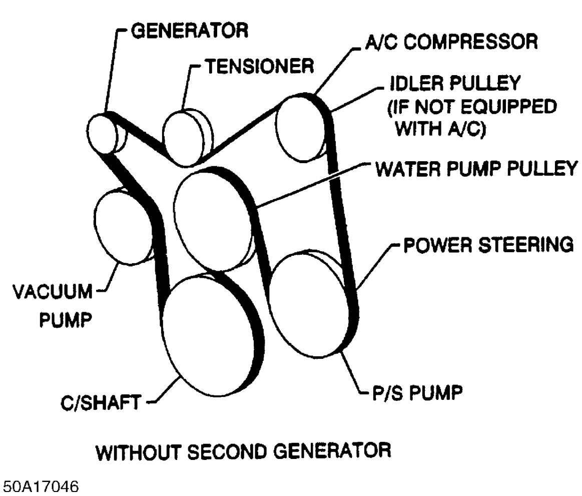


Fig. 8: Drive Belt Routing - 6.5L Diesel (Without Second Generator)
Courtesy of General Motors Corp.

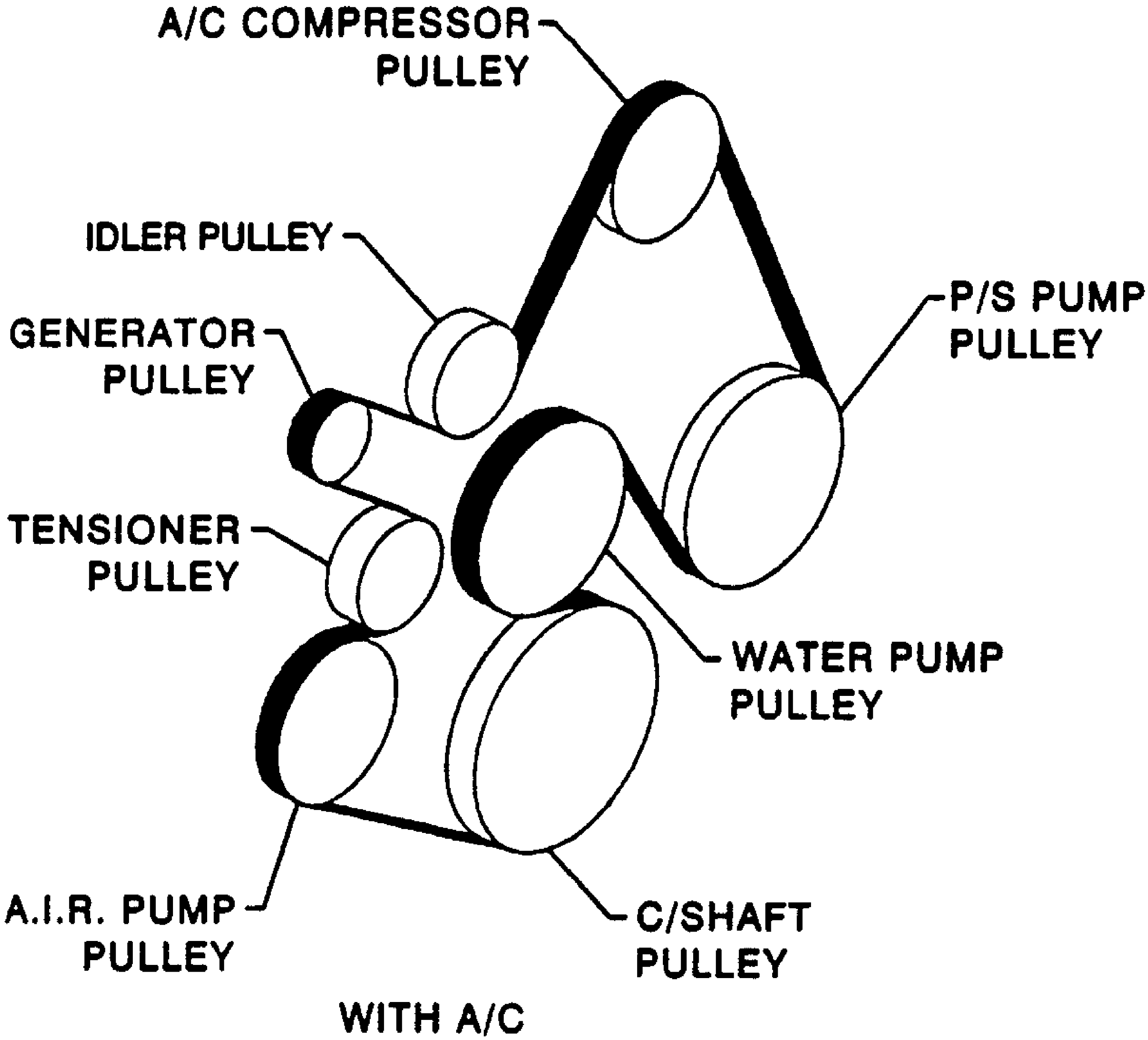


Fig. 9: Drive Belt Routing - 7.4L (With A/C & Secondary Air Injection)
Courtesy of General Motors Corp.

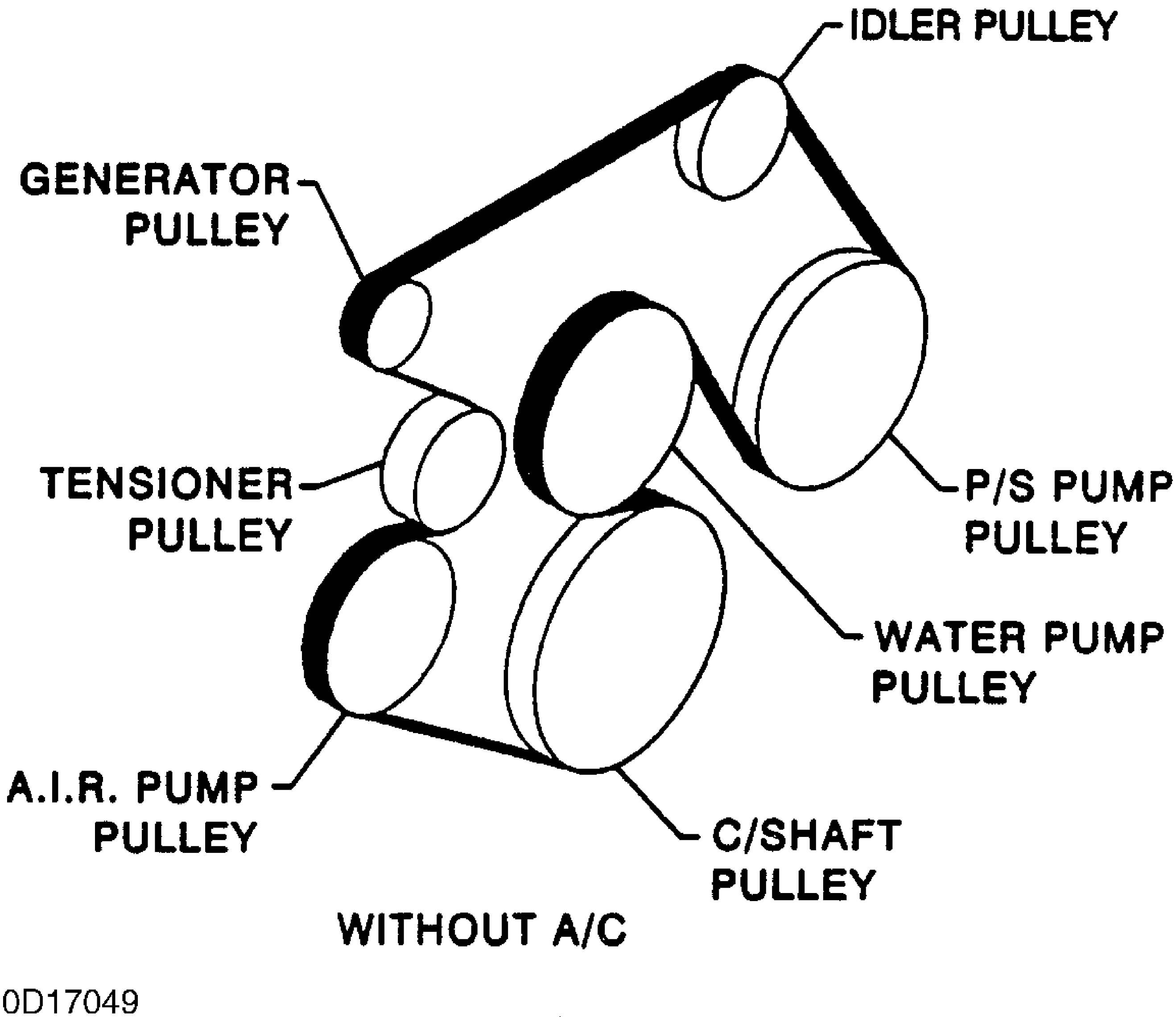


Fig. 10: Drive Belt Routing - 7.4L (Without A/C, With Secondary Air Injection)
Courtesy of General Motors Corp.

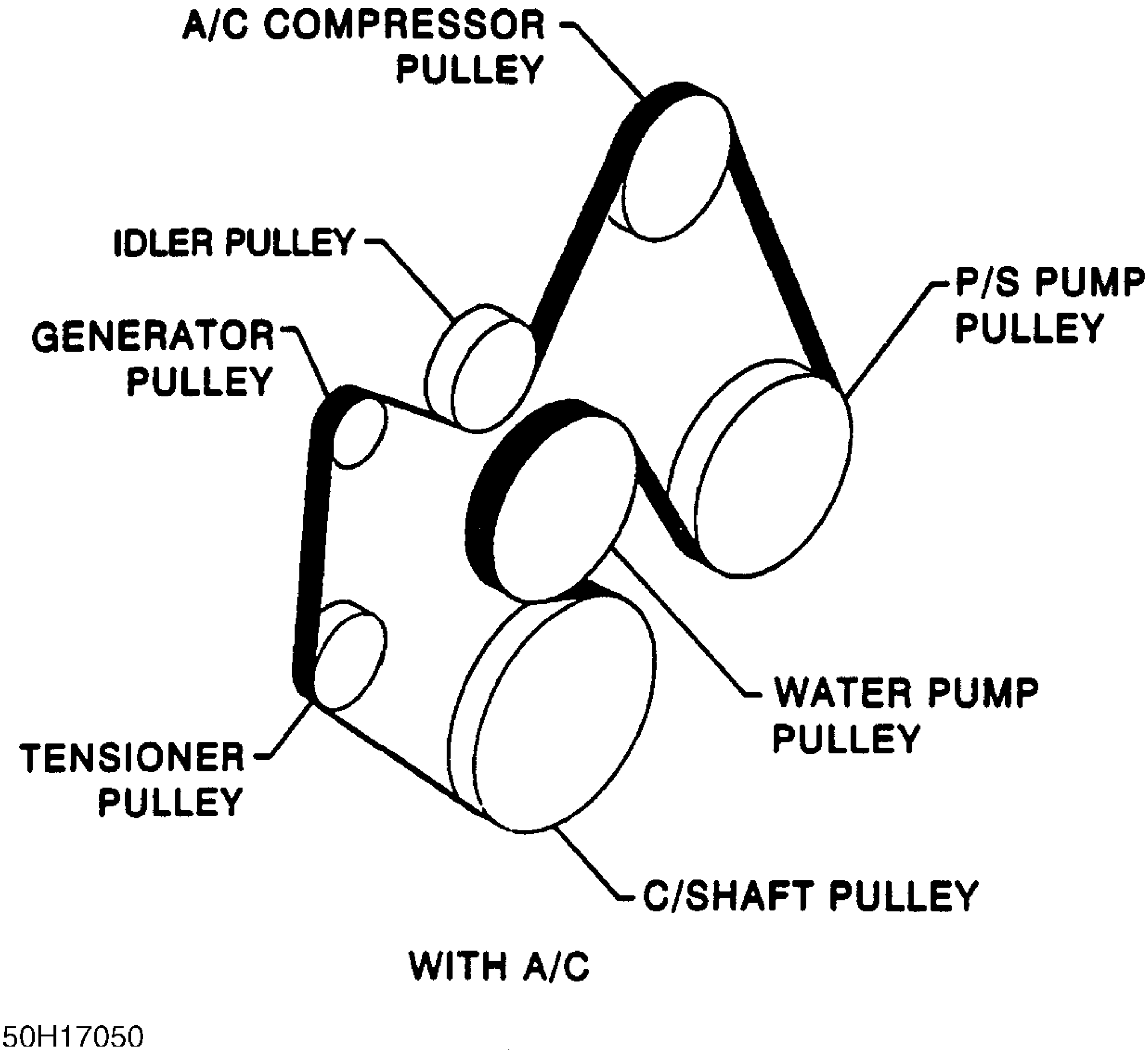


Fig. 11: Drive Belt Routing - 7.4L (With A/C, Without Secondary Air Injection)
Courtesy of General Motors Corp.

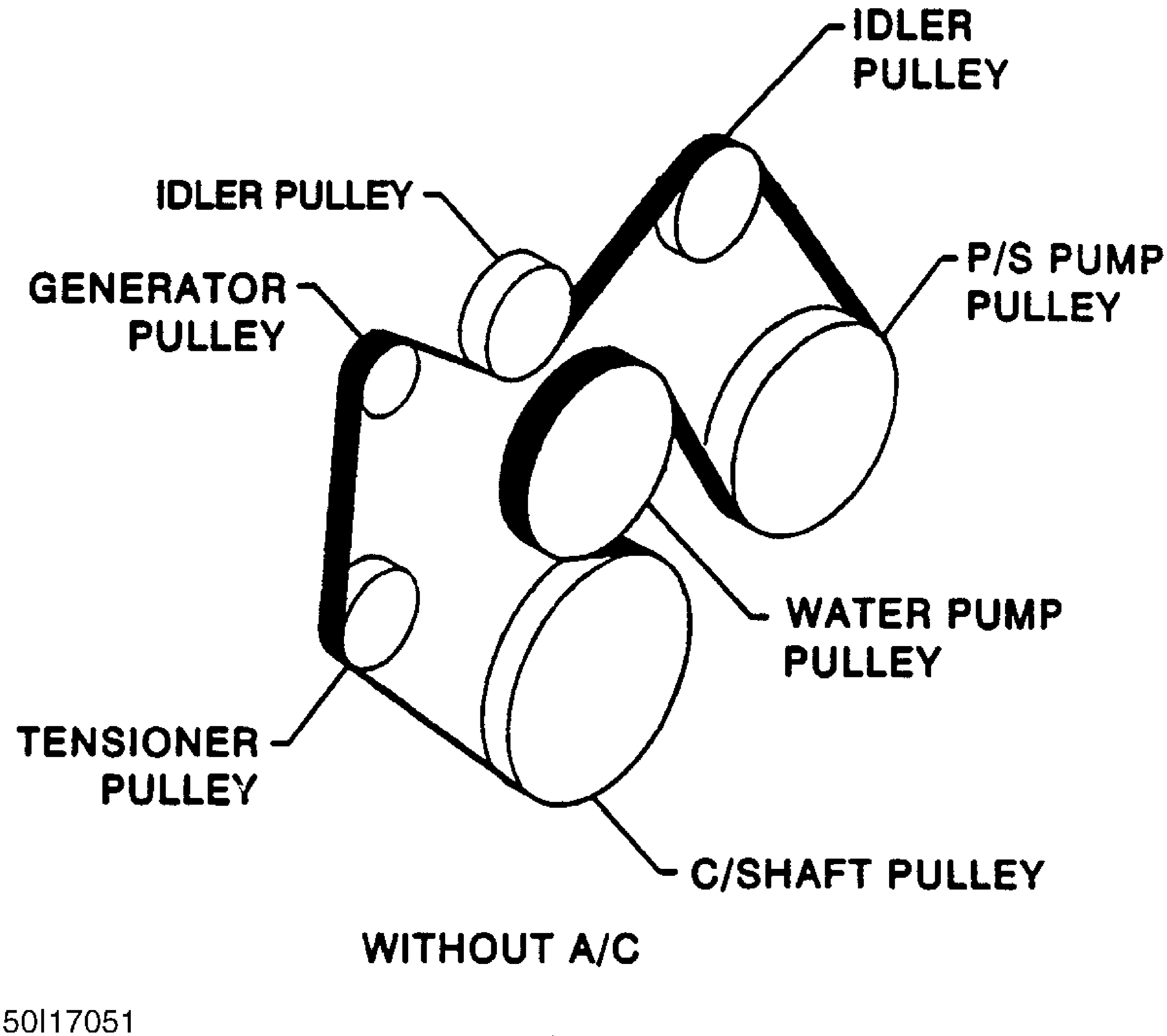


Fig. 12: Drive Belt Routing - 7.4L (Without A/C, Without Secondary Air Injection)
Courtesy of General Motors Corp.

DRIVE SHAFT & UNIVERSAL JOINTS

1996-97 Drive Axles - Drive Shafts & Universal Joints

Astro, Blazer, C/K Series Pickup, Commercial Van, Express,
Motorhome, Sonoma, S/T Series Pickup, Suburban, Tahoe,
GMC C/K Series Pickup, Jimmy, Motorhome, Safari, Savana,
Sierra, Suburban, Van, Yukon,
Bravada

MODEL IDENTIFICATION

Vehicle model can be identified by fifth character of Vehicle Identification Number (VIN), stamped on metal pad on top of left end of instrument panel, near windshield. See MODEL IDENTIFICATION table.

MODEL IDENTIFICATION

Series (1)	Model
"C"	2WD Pickup, Sierra, Suburban, Tahoe & Yukon
"G"	(2) RWD Van
"K"	4WD Pickup, Sierra, Suburban, Tahoe & Yukon
"L"	AWD Astro & Safari
"M"	2WD Astro & Safari
"P"	Commercial Van & Motorhome
"S"	2WD Blazer, Jimmy, Pickup & Sonoma
"T"	4WD Blazer, Jimmy, Pickup & Sonoma
"T"	AWD Bravada

(1) - Fifth character of VIN.
(2) - Includes Express, Rally Van and Savana.

DESCRIPTION

CONSTANT VELOCITY JOINTS

Constant Velocity (CV) joints are used on AWD "L" and 4WD "K" and "T" Series vehicles. These joints are located at axle end of drive shaft. A cage contains 6 balls inside CV joint. See appropriate DRIVE AXLE article.

DRIVE SHAFTS

Drive shafts may have one shaft, 2 shafts with a center bearing, or 3 shafts with slip joints. Three shafts are used on 4WD vehicles. Location of slip joints vary with model application. See Fig. 1.

UNIVERSAL JOINTS

Universal joints compensate for the effects of vehicle loading and axle windup present during acceleration. When operated within designed angle variations, a universal joint will operate effectively. When the design angle is changed or exceeded, operational life of joint will decrease.

On a driveline with a designed deep angle, a double cardan joint is used in place of a simple universal joint. A double cardan joint is composed of 2 universal joints, coupled by a yoke and phased for constant velocity. A ball socket between the 2 universal joints serves as a centering device. See Fig. 2. This causes each of the 2 units to operate through half of the complete angle between drive shaft and differential carrier.

Needle roller bearings are used in universal joints. Needles are held in place on the trunnions by round bearing cups. Bearing cups are held in the yokes either by snap rings or injected plastic retainers.

INSPECTION

If abnormal vibration or driveline noise is present, check these sources of possible vibration before overhauling driveline:

Drive Shaft

Check drive shaft for damage or dents. Check for undercoating adhering to shaft. If present, clean shaft thoroughly.

Universal Joints

Check for foreign material stuck in joints. Check for loose bolts, worn bearings and rust showing lack of grease.

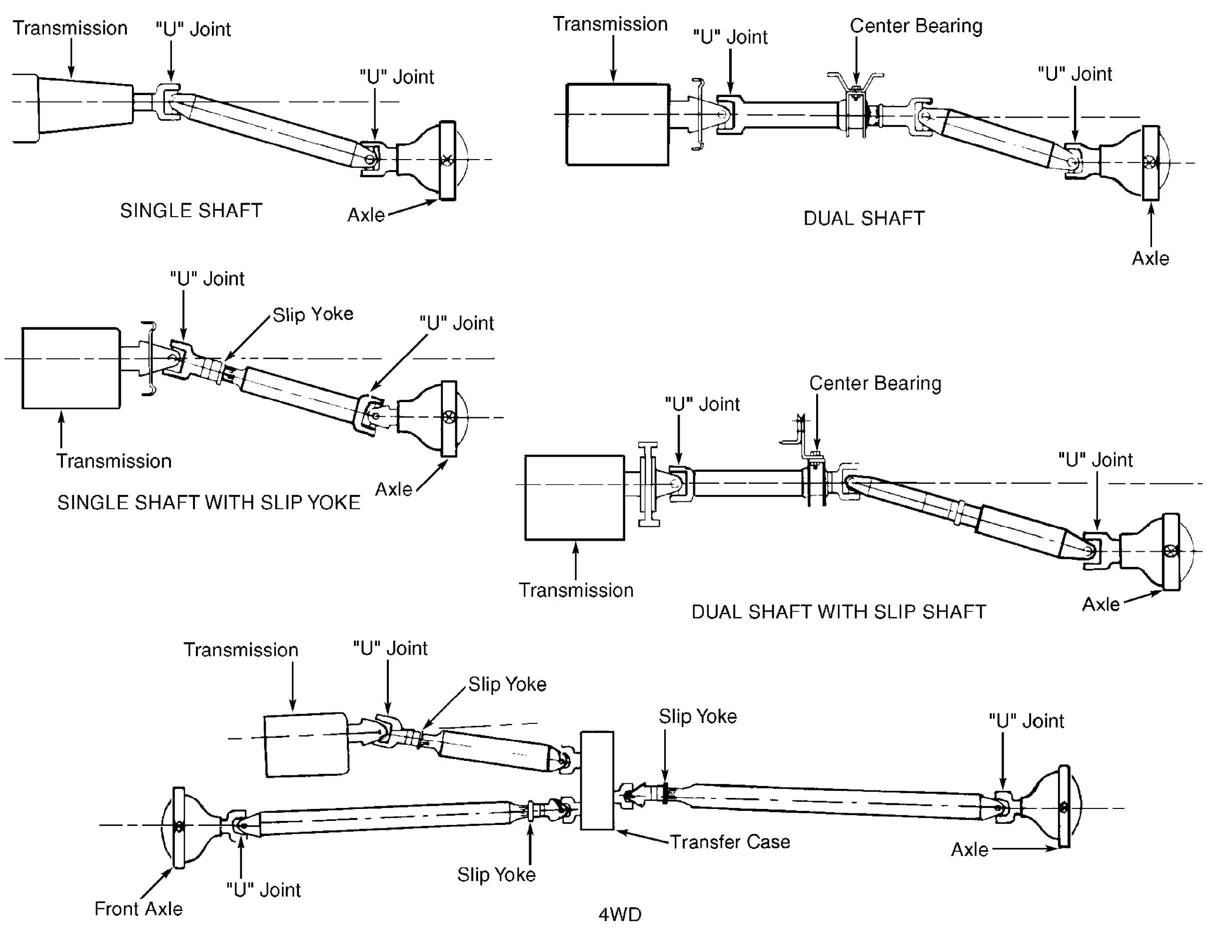


Fig. 1: Identifying Commonly Used Drive Shaft Combinations

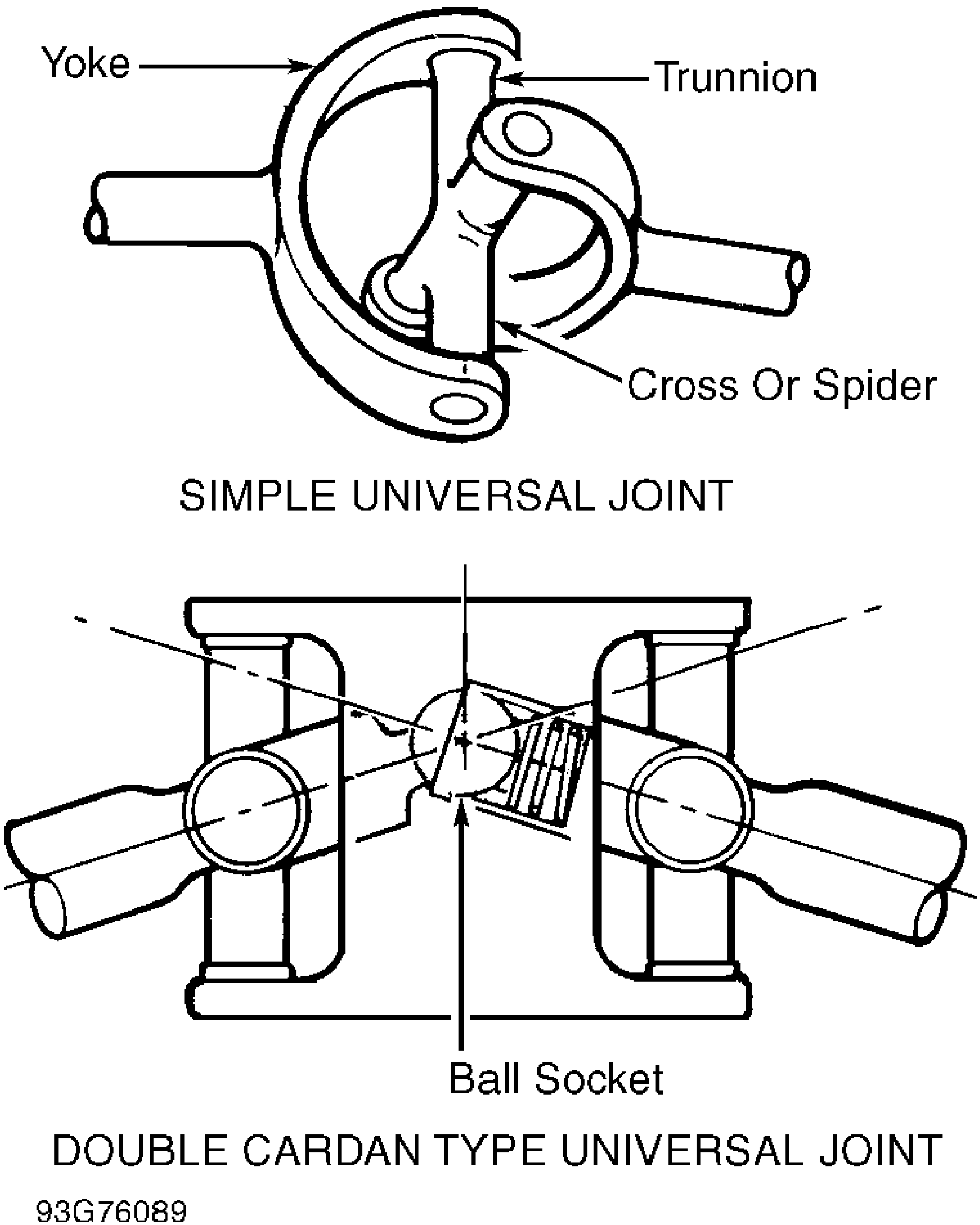


Fig. 2: Identifying Simple Universal Joint & Double Cardan Joint
Courtesy of General Motors Corp.

Center Bearing

Tighten drive shaft center bearing mounting bolts. If bearing insulator is deteriorated or oil-soaked, replace it.

Engine & Transmission Mounts

Tighten mounting bolts. Replace deteriorated mounts.

Tires & Wheels

Check tire inflation and wheel balance. Check for foreign objects in tread, damaged tread, mismatched tread patterns or incorrect tire size.

ADJUSTMENTS

DRIVE SHAFT PHASING

1-Piece Shafts

Ensure flange on each end of drive shaft is in same plane. Check for arrows on slip joint and drive shaft to aid in alignment. If flanges are not in same plane, disassemble universal joint and align. See Fig. 3.

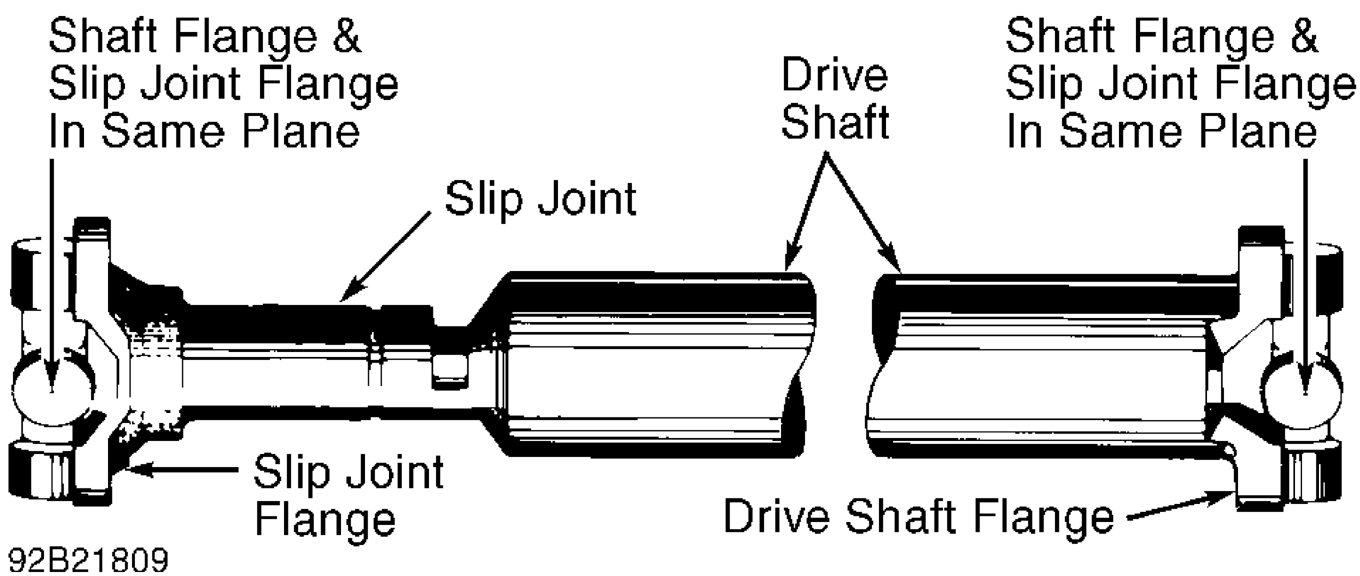


Fig. 3: Phase Alignment Of 1-Piece Drive Shaft

2-Piece Or 3-Piece Shafts

1) Rotate transmission until yoke ears are on a horizontal plane. If drive shaft is correctly installed, center line of yoke ears at each end of individual shafts will be parallel. If flanges are not in same plane, remove drive shaft. Install drive shaft with yokes aligned to a horizontal plane. See Fig. 4.

2) On models with 2-piece shafts, rotate transmission yoke until trunnion is in horizontal plane. Install front drive shaft with "U" joint trunnion in vertical plane. Connect bearing support to crossmember.

3) Ensure that front face of bearing support is perpendicular (90 degrees) to centerline of drive shaft. Install rear drive shaft with "U" joint trunnion of slip joint in vertical plane.

4) Set differential pinion yoke trunnion in vertical plane. Connect rear drive shaft to pinion yoke. If 2-piece shaft is correctly installed, centerline of trunnions at each end of individual shafts will be parallel. See Fig. 4.

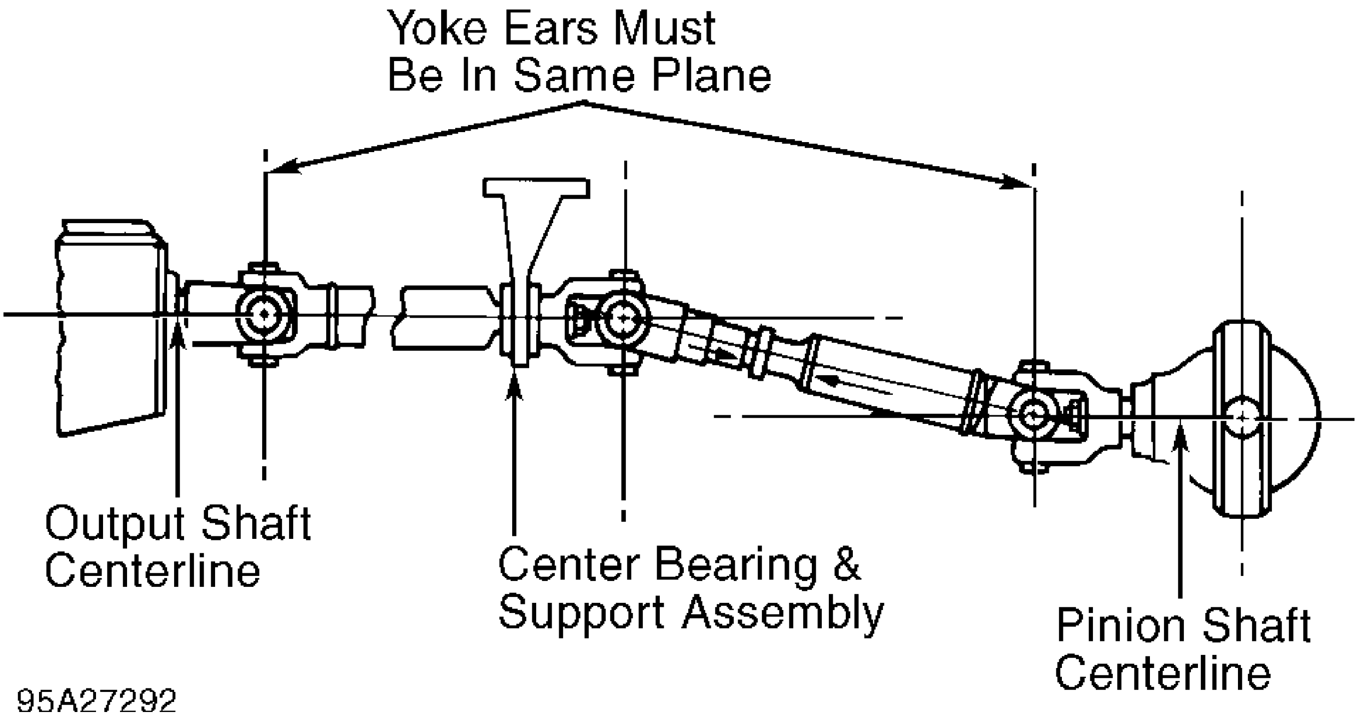


Fig. 4: Phase Alignment Of 2-Piece Drive Shaft (3-Piece Shaft Is Similar)

DRIVE SHAFT BALANCING

Adjustment

1) Drive shaft imbalance may often be cured by disconnecting shaft and rotating it 180 degrees in relation to other components. Test by raising rear wheels off ground, and turning shaft with engine.

NOTE: DO NOT run engine without ram airflow across radiator for prolonged periods, as overheating of engine or transmission may occur.

2) On most models, balance testing may be done by marking shaft in 4 positions, 90 degrees apart. Place marks about 6" (152 mm) forward of weld, at rear end of shaft. Number marks 1, 2, 3 and 4.

3) Place screw-type hose clamp so clamp head is in No. 1 position, and rotate shaft with engine. If there is little or no change, move clamp head to No. 2 position, and repeat test.

4) Continue procedure until vibration is at lowest level. If no difference is noted with clamp head moved to all 4 positions, vibrations may not be drive shaft imbalance.

5) If vibration is lessened but not completely gone, place 2 clamps at that point, and run test again. Combined weight of clamps in one position may increase vibration. If so, rotate clamps 1/2" apart, above and below best position, and repeat test.

6) Continue to rotate clamps as necessary, until vibration is at lowest point. If vibration level is still unacceptable, leave rear clamp(s) in position and repeat procedure at front end of drive shaft. If vibration can be eliminated or reduced to acceptable levels using this test procedure, send drive shaft to balance shop for permanent balancing.

FLANGE ALIGNMENT & RUNOUT

Adjustment

1) All flanges must be perpendicular in both vertical and horizontal planes to engine crankshaft. Only exception is "broken back" type driveline, which has flanges that are not perpendicular in vertical plane. See Fig. 5.

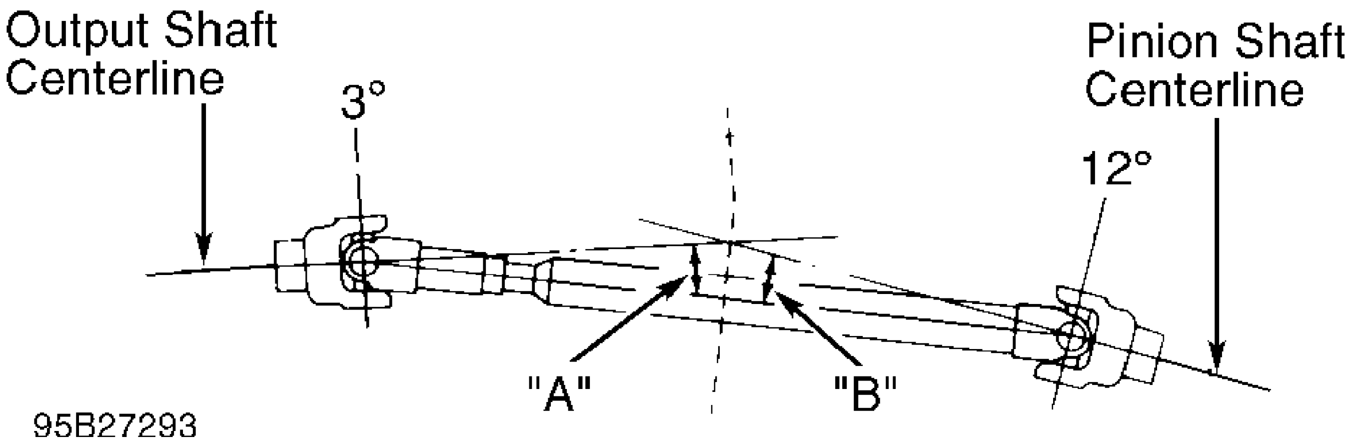


Fig. 5: "Broken Back" Type Drive Shaft Alignment (Typical)

2) With non-parallel or "broken back" type installation, working angles of universal joints of a given drive shaft should be equal. Angle "A" = angle "B".

3) This is calculated as follows: angle of output shaft centerline is subtracted from angle of drive shaft. Difference should equal angle of drive shaft subtracted from pinion shaft angle.

4) Parallel type joints maintain constant velocity between output shaft and pinion shaft. Vibration is minimized and component life maximized when universal joints are parallel.

5) Using dial indicator, measure runout of transmission flange, center bearing flange and pinion flange. If runout exceeds .003-.005" (.08-.13 mm), replace flange.

6) If dial indicator cannot be used, push rod with snug fit through flange bearing bore. See if it aligns with opposite flange bore. If not, replace flange. See Fig. 6.

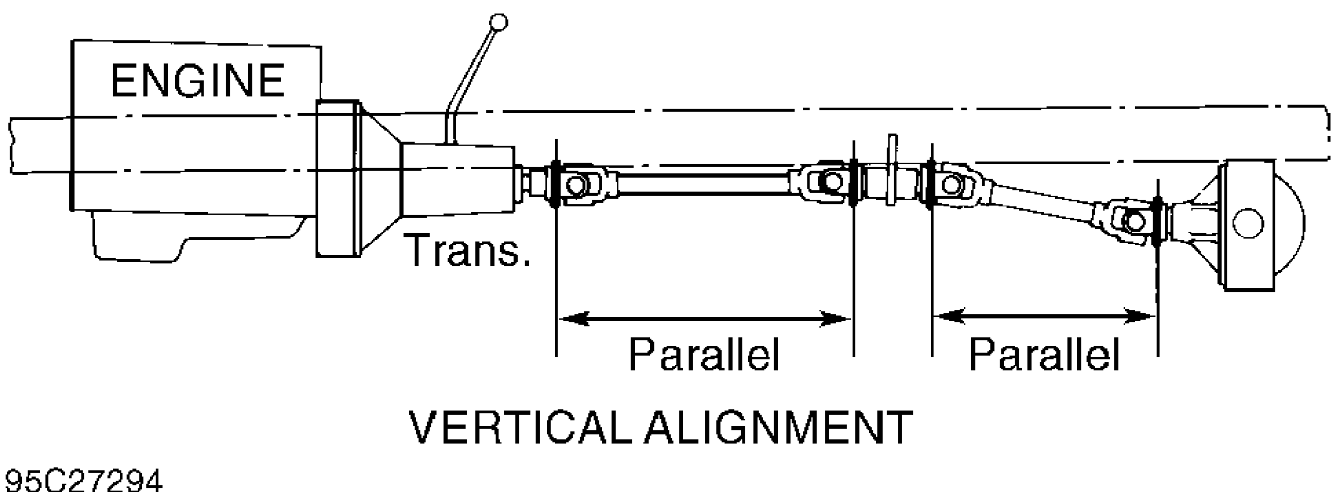


Fig. 6: Vertical Alignment Of Drive Shaft

7) Rotate transmission flange until it is vertical, measuring from side. Check center bearing and pinion flanges. They cannot be more than one degree off vertical. See DRIVE SHAFT PHASING.

8) Rotate transmission flange until it is vertical, measured from side. Measure angle from end and record it. Check all other flanges for same angle. They must be within 1/2 degree of each other. Adjust as required.

9) If difficulty is encountered when making these adjustments, horizontal alignment should be checked. Even though vertical alignment is correct, horizontal alignment can be badly out of adjustment. This is often found after major component replacement or repair of serious accident damage. See Fig. 7.

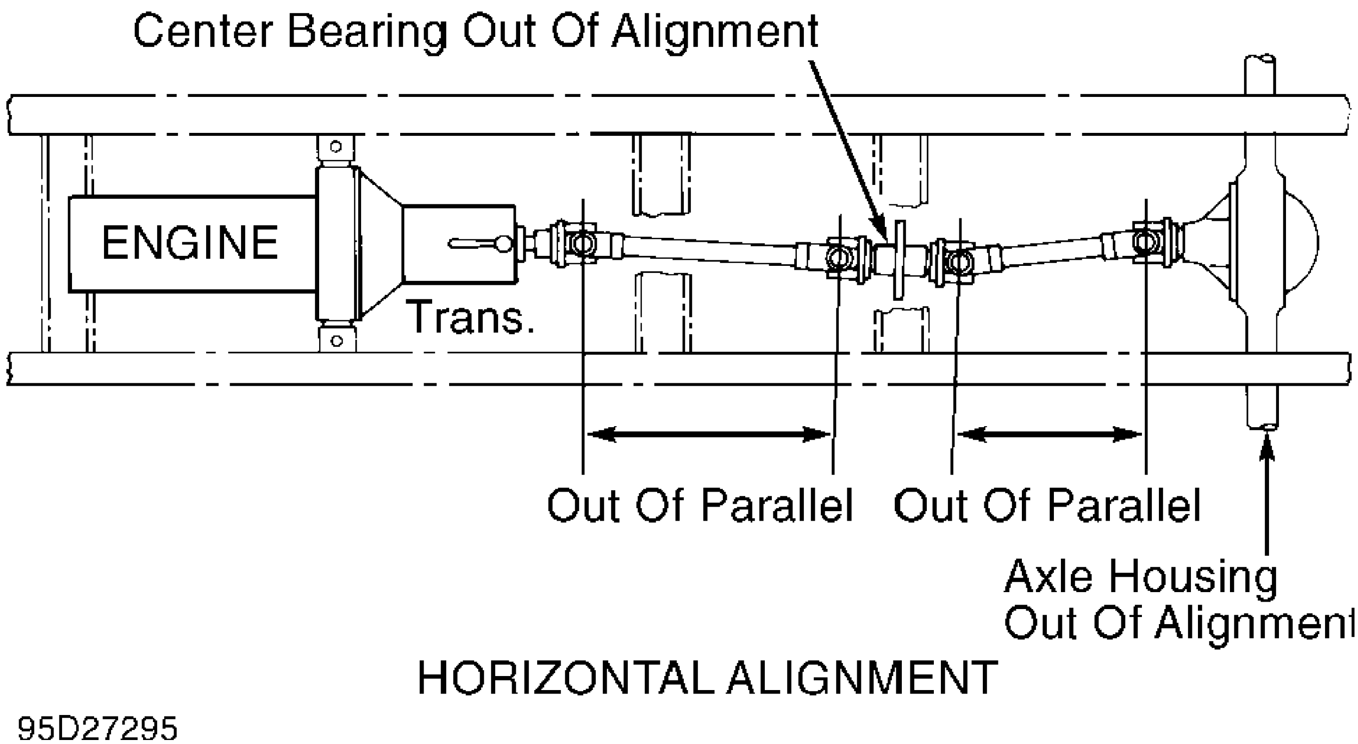


Fig. 7: Horizontal Alignment Of Drive Shaft

10) To make horizontal alignment checks, set up straightedges. See Fig. 8. Set transmission output flange horizontal and clamp straightedge to flange in a horizontal plane. Repeat procedure with drive pinion flange. Ensure that flanges are horizontal by checking angle of straightedge with spirit level.

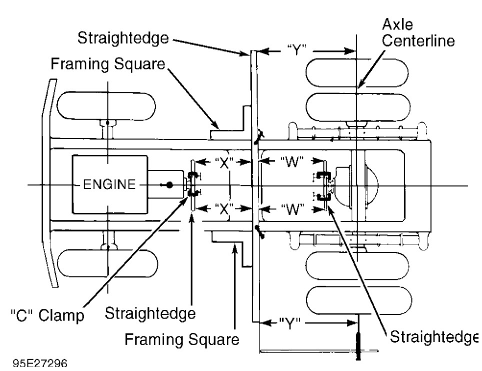


Fig. 8: Checking Horizontal Alignment

11) Using straightedge that is 12" (305 mm) longer than width of rear wheel track at 90 degrees, clamp to frame side rails. Use large framing squares to align straightedge with side rails.

12) Measure distance "X" at each side. If both measurements are not within 1/16" (1.6 mm) of each other, transmission flange is horizontally misaligned. See Fig. 8.

13) Measure distance "Y" (edge of straightedge to axle shaft centerline) at each side. If 2 dimensions are not within 1/8" (3.2 mm) of each other, axle housing is misaligned.

14) Measure distance "W" at each side. If both measurements are not within 1/16" (1.6 mm) of each other, pinion flange is horizontally misaligned.

DRIVE SHAFT RUNOUT

Raise vehicle so rear wheels can spin. Attach dial indicator to smooth place on vehicle underbody. A magnetic base dial gauge is recommended. DO NOT attach dial indicator base at a weld. With transmission in Neutral, hand rotate axle pinion flange or transmission and take required dial indicator readings on drive shaft. See DRIVE SHAFT RUNOUT (IN.) table.

1-Piece Drive Shafts

If runout exceeds specifications, rotate drive shaft 180 degrees at pinion flange and install. Check runout again.

2-Piece Drive Shafts

Measure rear drive shaft runout. Reference mark position of rear drive shaft yoke to pinion flange. Remove rear drive shaft and measure front drive shaft runout, both on tube and at tapered hole on splined end. If runout exceeds specifications, rotate rear drive shaft 180 degrees at pinion flange and install. Check runout again.

3-Piece Drive Shafts

Check each shaft at its center and at both ends, approximately 3" (76 mm) from weld. If problem is found, disconnect each shaft, one at a time, and measure remaining shafts until problem shaft is found. Rotate shaft connected to problem shaft 180 degrees and install. Check runout again. If necessary, repeat procedure in an attempt to bring runout to specifications. If runout is still not within specifications, replace appropriate drive shaft. If runout still exceeds specifications, check for bent pinion.

DRIVE SHAFT RUNOUT (IN.)

Application	Front Check	Center Check	Rear Check
1-Piece			
Astro & Safari	.024	.024	.024
"C" & "K" Series			
Exc. Aluminum Graphite	.040	.050	.055
Aluminum Graphite	.040	.....	.040
"G" & "P" Series	.040	.050	.055
"S" & "T" Series	.024	.024	.024
2-Piece			
"C" & "K" Series			
Front			
With Slip Yoke	.025	.....	(1) .004
With Fixed Yoke	.040	.....	(1) .007
Rear	(2) .030	.040	.040
"G" Series	.030	.030	.035
"P" Series			
Front	.020	.....	(3) .008
Rear	(2) (4) .030	.030	.035
3-Piece			

"C" & "K" Series			
Pickup	.025	.040	.040
Suburban	.015	.010	.015
"P" Series	.015	.010	.015

(1) - Measured on ground surface near spine, with drive shaft removed.
(2) - Measured with rear shaft connected to front shaft. Runout of front drive shaft must be within specification.
(3) - Measured at tapered hole in end of splined shaft, with rear drive shaft removed.
(4) - Measured with front drive shaft disconnected. Runout of front drive shaft must be within specification.

UNIVERSAL JOINT MAINTENANCE

Lubrication

1) Whenever drive shaft is removed or slip yoke sticks in extension housing seal, clean yoke with solvent. Lubricate inside diameter of seal with synthetic oil seal lubricant and outside diameter of seal with transmission fluid.

2) Ball socket on double cardan joint requires periodic lubrication through provided fitting. Special Lubricant (1050679) is recommended by manufacturer. If lubrication fitting cannot be seen from beneath vehicle, double cardan joint may be lubricated from above using Adapter (J-25512-2) attached to end of a flex hose. See Fig. 9.

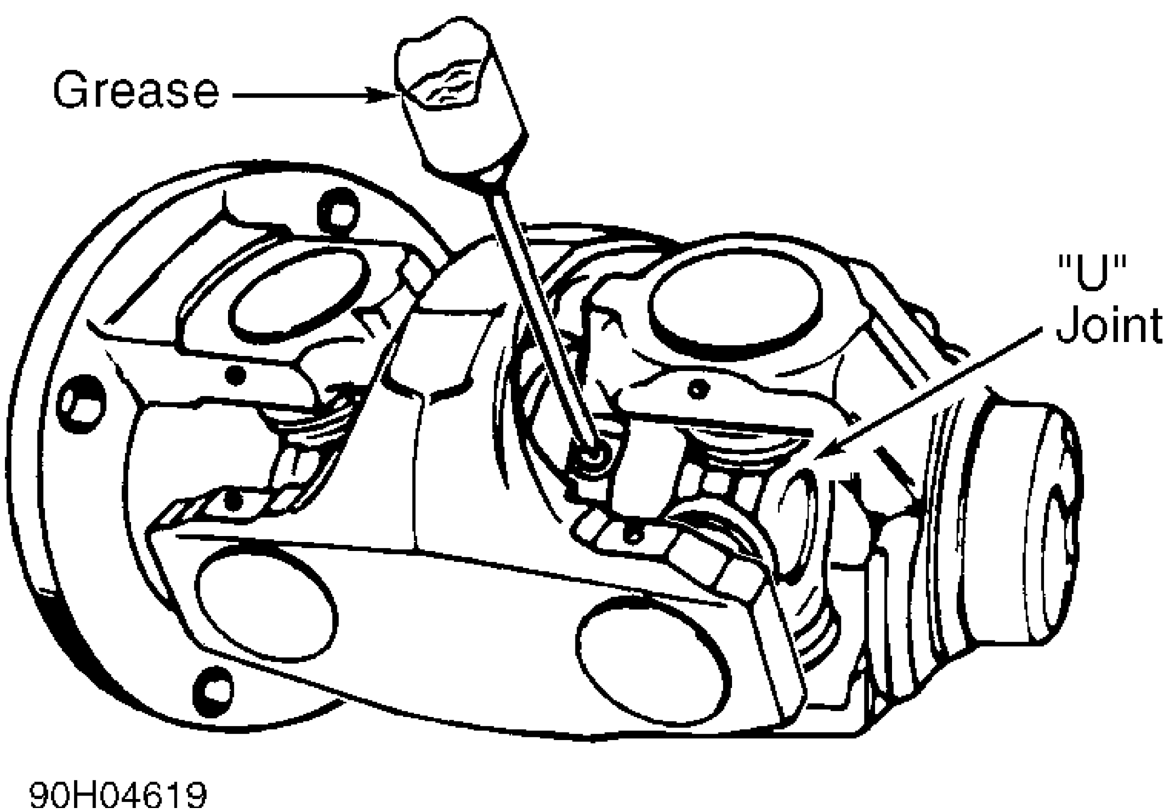


Fig. 9: Lubricating Ball Socket Of Double Cardan Joint
Courtesy of General Motors Corp.

OVERHAUL

NOTE: DO NOT disassemble universal joints unless external leakage or damage has occurred.

Before disassembly, scribe alignment marks on yoke and shaft for reassembly. If joints are rusted or corroded, apply penetrating oil before pressing out bearing cups or trunnion pin.

CROSS SHAFT & ROLLER TYPE UNIVERSAL JOINTS

Snap rings or injected plastic retainers may be used to retain bearing cups. Joints with snap rings may be disassembled and reassembled using same cross shaft and bearings. Joints with nylon retainers are disassembled by breaking nylon retainers; install NEW nylon retainers after service, or replace joints with joints that use snap rings.

Removal & Disassembly

1) Disconnect yoke or flange attaching bolts and remove drive shaft from vehicle. DO NOT use a pry bar to hold drive shaft while loosening bolts, or damage to bearing seals may result. Scribe marks on yoke and shaft for reassembly reference.

2) Remove retaining strap (if equipped). Remove bushing retainers/snap rings from yoke. Press out bearing cups. Remove last bearing cup by pressing on end of cross shaft.

3) Remove cross shaft assembly from yoke. DO NOT remove seal retainers from cross shaft. Cross shaft and retainers are serviced as an assembly.

Reassembly & Installation

1) Coat roller bearings with lubricant. Fill bearing cups with grease. Place cross assembly in drive shaft yoke. Place bearing cups in position.

2) Press both bearing cups into yoke until retainers/snap rings can be installed. Ensure cross stays aligned in center of bearing cups while pressing into place. Install retainers/snap rings. Repeat procedure for remaining bearing caps. Install strap (if equipped). Install drive shaft in vehicle. Ensure scribed marks on yoke and shaft are aligned.

DOUBLE CARDAN TYPE UNIVERSAL JOINTS

Removal & Disassembly

1) Disconnect yoke and flange attaching bolts. Remove drive shaft from vehicle. Index mark joint, yoke flange and cross shafts for reassembly. See Fig. 10.

2) Pry out all snap rings and press bearing out far enough to allow bearing cup end to be clamped in vise. Tap on yoke until free of bearing cup.

3) Repeat procedure for remaining bearings. Remove remaining parts from center yoke assembly.

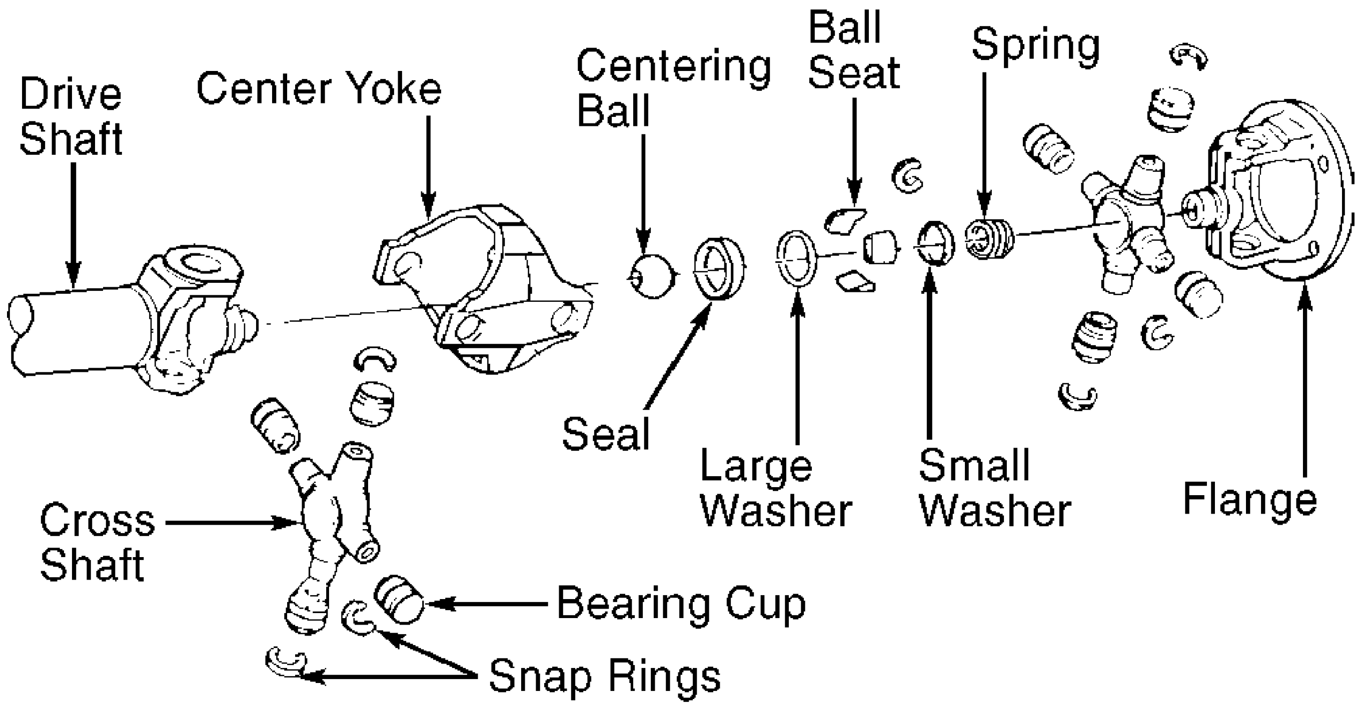


Fig. 10: Exploded View Of Double Cardan Type Universal Joint
Courtesy of General Motors Corp.

Reassembly

1) Pack all bearings with Lubricant (1050679). Assemble center yoke components in reverse order of disassembly.

2) Using arbor press or vise, press 2 opposing bearing cups into position at same time until all bearing cups are installed. Ensure cross shafts and yokes remain aligned during this process.

3) Check for free movement of joint. If bind exists, seat bearings by sharply rapping yokes with brass hammer. DO NOT hammer directly on bearings.

Installation

1) Before installing drive shaft, clean yoke and inspect machined surface for scratches, nicks or burrs.

2) Provide support for drive shaft during installation to prevent damage to universal joints. Position front end of shaft and align marks made during removal.

3) Install and attach 2 clamps to pinion yoke. Install 4 screws and lock washer assemblies on CV joint at transfer case. Use press bar to prevent assembly from rotating while attaching screw assemblies.

* DRIVETRAIN SYSTEMS UNIFORM INSPECTION GUIDELINES *

1997 Chevrolet Blazer

GENERAL INFORMATION
Drivetrain/Transmission Motorist Assurance Program
Standards For Automotive Repair

All Makes and Models

INTRODUCTION TO MOTORIST ASSURANCE PROGRAM (MAP)

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INTRODUCTION TO MOTORIST ASSURANCE PROGRAM (MAP)

OVERVIEW OF MOTORIST ASSURANCE PROGRAM

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

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

These Standards of Service require that an inspection of the vehicle's (problem) system be made and the results communicated to the customer according to industry standards. Given that the industry did not have such standards, the Motorist Assurance Program successfully promulgated industry inspection communication standards in 1994-95 for the following systems: Exhaust, Brakes, ABS, Steering and Suspension, Engine Maintenance and Performance, HVAC, and Electrical Systems. Further, revisions to all of these inspection were recently published. Further, revisions to all of these inspection communication standards are continually republished. In addition to these, standards for Drive Train and Transmissions have recently been promulgated. Participating shops utilize these Uniform Inspection & Communication Standards as part of the inspection process and for communicating their findings to their customers.

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

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

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

1444 I Street, NW Suite 700
Washington, DC 20005
Phone (202) 712-9042 Fax (202) 216-9646
January 1999

MAP UNIFORM INSPECTION GENERAL GUIDELINES

OVERVIEW OF SERVICE REQUIREMENTS & SUGGESTIONS

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

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

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

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

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

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

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

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

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

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

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

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

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

Reasons to Require Repair or Replacement

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

NOTE: When a repair is required, the shop must refuse partial service to the system in question, if the repair creates or continues an unsafe condition.

Reasons to Suggest Repair or Replacement

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

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

DRIVE/POWER TRAIN ASSEMBLIES

SERVICE PROCEDURES REQUIRED AND SUGGESTED FOR PROPER VEHICLE OPERATION

NOTE: Whenever transmission or drivetrain service is performed that affects the suspension alignment, for example, removing the engine cradle, it is required that the alignment be checked and corrected if necessary.

AUTOMATIC TRANSMISSION/TRANSAXLE ASSEMBLIES

AUTOMATIC TRANSMISSION/TRANSAXLE ASSEMBLY INSPECTION

Condition	Code	Procedure
Any internal component failure that requires removal of the assembly from the vehicle for service. (1)	A	(2) Require repair or replacement of the automatic transmission/transaxle assembly.

(1) - It is Required that the torque converter and all other failure related components be inspected for cause and condition.
(2) - For components not requiring removal of the assembly, refer to the component listing in this document.

DIFFERENTIAL AND FINAL DRIVE ASSEMBLIES

NOTE: Does not include half shafts.

DIFFERENTIAL AND FINAL DRIVE ASSEMBLY INSPECTION

Condition	Code	Procedure
Any internal component failure that requires removal of the assembly from the vehicle for service. (1)	A	Require repair or replacement of the differential assembly.

(1) - For components not requiring removal of the assembly, refer to the component listing in this document.

MANUAL TRANSMISSION/TRANSAXLE ASSEMBLIES

MANUAL TRANSMISSION/TRANSAXLE ASSEMBLY INSPECTION

Condition	Code	Procedure
Any internal component failure that requires removal of the assembly from the vehicle for service. (1)	A	Require repair or replacement of the manual transmission/transaxle assembly.

(1) - For components not requiring removal of the assembly,

refer to the component listing in this document.

TRANSFER CASE ASSEMBLIES

TRANSFER CASE ASSEMBLY INSPECTION

Condition	Code	Procedure
Any internal component failure that requires removal of the assembly from the vehicle for service. (1)	A	Require repair or replacement of the transfer case differential assembly.

(1) - For components not requiring removal of the assembly, refer to the component listing in this document.

DRIVE TRAIN/COMPONENTS

The conditions listed for the components included in this section assume that the problem has been isolated to the specific component through proper testing.

ACTUATORS (ELECTRICAL)

ACTUATOR (ELECTRICAL) INSPECTION

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

		replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	1	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.

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

ACTUATORS (VACUUM)

ACTUATOR (VACUUM) INSPECTION

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

Linkage missing	C	Require replacement.
Linkage noisy	2	Suggest repair or replacement.
Missing	C	Require replacement.
Noisy	2	Suggest repair or replacement.
Out of adjustment	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.

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

AXLES

AXLE INSPECTION

Condition	Code	Procedure
Bent	A	Require replacement.
Broken	A	Require replacement.
End play exceeds specifications	B	Require repair or replacement.
Flange bent	A	Require replacement.
Flange threads stripped	A	Require repair or replacement.
Twisted	A	Require replacement.
Worn, affecting performance	A	Require replacement.

BEARINGS AND RACES

NOTE: When replacing or repacking bearings, grease seal replacement is required. You are not required to replace these components in axle sets. Determine the need to replace based upon the individual component conditions that follow.

BEARING AND RACE INSPECTION

Condition	Code	Procedure
Bearing end-play exceeds specifications	B	Require adjustment of bearing, if possible. If proper adjustment cannot be obtained, require replacement of bearing assembly.
Bearing rollers, balls or races are worn, pitted, or		

feel rough when rotated as an assembly	B	Require replacement of bearing assembly.

BELL CRANKS

BELL CRANK INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Bent	A	Require repair or replacement.
Broken	A	Require repair or replacement.
Cracked	A	Require repair or replacement.
Missing	C	Require replacement.
Worn, affecting performance	A	Require repair or replacement.

BELL HOUSINGS

See HOUSINGS (BELL, CASE, TAIL (EXTENSION) AND AUXILIARY).

BUSHINGS (EXTERNAL)

BUSHING (EXTERNAL) INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require repair or replacement of bent part if available; otherwise, replace bushing.
Attaching hardware broken	A	Require replacement of broken part if available; otherwise, replace bushing.
Attaching hardware corroded, affecting structural integrity	A	Require replacement of corroded part if available; otherwise, replace bushing.
Attaching hardware incorrect	A	Require replacement of incorrect part if available; otherwise, replace bushing.
Attaching hardware loose	A	Require repair or replacement of loose part if available; otherwise, replace bushing.
Attaching hardware missing	C	Require replacement of missing part if available; otherwise, replace bushing.

Attaching hardware threads damaged	A	... Require repair or replacement of part with damaged threads if available; otherwise, replace bushing.
Attaching hardware threads stripped (threads missing)	A	..... Require replacement of part with stripped threads if available; otherwise, replace bushing.
Binding	A	.. Require repair or replacement.
Contaminated	1	.... Suggest replacement.
Deteriorated, affecting performance	A	.. Require repair or replacement.
Distorted, affecting performance	A	.. Require repair or replacement.
Missing	A	.... Require replacement.
Noisy	2	.... (1) Further inspection required.
Rubber separating from internal metal sleeve on bonded bushing	A	.... Require replacement.
Seized	A	.... Require replacement.
Shifted (out of position)	B	.. Require repair or replacement.
Split	A	.... Require replacement.
Surface cracking (weather-checked)	..	.... No service suggested or required.
Worn, affecting performance	A	.. Require repair or replacement.
Worn close to the end of its useful life	1	.... Suggest replacement.

(1) - If noise isolated to bushing, suggest repair or replacement.

CAUTION: Use only approved lubricant on rubber bushings. Petroleum-based lubricants may damage rubber bushings.

CABLES (SPEEDOMETER)

CABLE (SPEEDOMETER) INSPECTION

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

required.

Bracket broken, affecting performance	A	Require replacement.
Bracket broken, not affecting performance	..	No service suggested or required.
Bracket corroded, affecting performance	A	Require repair or replacement.
Bracket corroded, not affecting performance	2	Suggest repair or replacement.
Bracket cracked, affecting performance	A	Require repair or replacement.
Bracket cracked, not affecting performance	1	Suggest repair or replacement.
Bracket loose, affecting performance	A	Require repair or replacement.
Bracket loose, not affecting performance	1	Suggest repair or replacement.
Bracket missing	C	Require replacement.
Broken	A	Require replacement.
Cracked	A	Require repair or replacement.
Disconnected	A	Require repair or replacement.
Kinked	A	Require repair or replacement.
Melted	A	(1) Require repair or replacement.
Missing	C	Require replacement.
Noisy	2	Suggest repair or replacement.
Routed incorrectly	2	Suggest repair.
Seized	A	Require repair or replacement.

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

CABLES (TV, DETENT AND SHIFT)

CABLE (TV, DETENT AND SHIFT) INSPECTION

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

Bracket corroded, not affecting performance	2	Suggest repair or replacement.
Bracket cracked, affecting performance	A	Require repair or replacement.
Bracket cracked, not affecting performance	1	Suggest repair or replacement.
Bracket loose, affecting performance	A	Require repair or replacement.
Bracket loose, not affecting performance	1	Suggest repair or replacement.
Bracket missing	C	Require replacement.
Broken	A	Require replacement.
Cracked	A	Require repair or replacement.
Disconnected	A	Require repair or replacement.
Frayed	A	Require replacement.
Kinked	A	Require repair or replacement.
Melted	A	(1) Require repair or replacement.
Missing	C	Require replacement.
Noisy	2	Suggest repair or replacement.
Out of adjustment	B	(2) Require repair or replacement.
Routed incorrectly	2	Suggest repair.
Seized	A	Require repair or replacement.
Self-adjuster inoperative	A	Require repair or replacement of self-adjuster.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Cable replacement is required if it cannot be adjusted within specifications.

CARRIER BEARINGS

See INTERMEDIATE SHAFT SUPPORT BEARINGS.

CLUTCH CABLES AND CABLE HOUSINGS

CLUTCH CABLE AND CABLE HOUSING INSPECTION

Condition	Code	Procedure
Broken	A	Require replacement.
Cable bent	A	Require replacement.
Cable binding	A	Require repair or replacement.
Cable mounting loose	B	Require repair or replacement.
Cable out of adjustment	B	Require repair or replacement.
Frayed	B	Require replacement.
Housing heat-damaged	1	Suggest replacement.
Missing	C	Require replacement.
Noisy	2	Suggest repair or replacement.
Seized	A	Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Worn, affecting performance	A	Require replacement.

CLUTCH DISCS (MANUAL TRANSMISSION)

CLUTCH DISC (MANUAL TRANSMISSION) INSPECTION

Condition	Code	Procedure
Backing plate cracked	A	Require replacement.
Broken	A	Require replacement.
Contaminated with oil	A	Require replacement.
Damper cushion broken	A	Require replacement.
Damper cushion collapsed	A	Require replacement.
Damper spring collapsed	A	Require replacement.
Damper spring missing	C	(1) Require replacement.
Friction material cracked through	B	Require replacement.
Friction material flaking or chunking	B	Require replacement.
Friction material surface cracking	B	No service suggested or required.
Grooved	B	No service suggested or required unless the pressure plate or flywheel is being resurfaced or replaced. In this case, replacement of clutch disc is required.
Ridged	B	No service suggested or required unless the pressure plate or flywheel is being resurfaced or replaced. In this case, replacement of clutch disc is required.
Splines worn, affecting performance	A	Require replacement.
Warped	A	Require replacement.
Wear exceeds specifications (where applicable)	B	Require replacement.
Worn close to the end of its useful life	1	Suggest replacement.
Worn, affecting performance	A	Require replacement.

(1) - Not all clutch discs have springs in all spring chambers on the disc.

CLUTCH FORKS

CLUTCH FORK INSPECTION

Condition	Code	Procedure
Bent	B	Require replacement.
Broken	A	Require repair or replacement.
Cracked	B	Require repair or replacement.
Worn close to the end of its useful life	1	Suggest replacement.
Worn, affecting performance	A	Require replacement.

CLUTCH LINKAGES (MECHANICAL)

See LINKAGES (EXTERNAL).

CLUTCH MASTER CYLINDERS

CLUTCH MASTER CYLINDER INSPECTION

Condition	Code	Procedure
Cover gasket distorted ..	A	.... Require replacement of cover gasket.
Cover gasket gummy	A	.... Require replacement of cover gasket.
Cylinder leaking fluid from rear of bore	A	.. Require repair or replacement.
Cylinder leaking fluid internally	A	.... Require replacement.
Dust boot missing	C	..... Require replacement of dust boot.
Dust boot punctured	A	..... Require replacement of dust boot.
Dust boot torn	A	..... Require replacement of dust boot.
Fluid level incorrect ...	B	. Require fluid level adjustment.
Housing damaged, affecting performance	A	.. Require repair or replacement.
Master cylinder has residue in reservoir (make parallel w/brakes when they are done)	2	.... (1) Further inspection required.
Threads damaged	A	...... Require repair replacement
Threads stripped (threads missing)	A	.... Require replacement.

(1) - DO NOT replace master cylinder unless it exhibits conditions listed for replacement. You may suggest fluid change according to OEM service intervals.

CLUTCH PEDALS

CLUTCH PEDAL INSPECTION

Condition	Code	Procedure
Bent, affecting performance	A	.. Require repair or replacement.
Broken	A	.. Require repair or replacement.
Pedal pad missing	C	.... Require replacement of pedal pad.
Pivot bushings worn, affecting performance ..	A	.... Require replacement of pivot bushings.

CLUTCH PIVOTS

CLUTCH PIVOT INSPECTION

Condition	Code	Procedure
Bent	A	Require replacement.
Broken	A	Require repair or replacement.
Cracked	A	Require repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Worn close to the end of its useful life	1	Suggest replacement.
Worn, affecting performance	A	Require replacement.

CLUTCH PRESSURE PLATES

See PRESSURE PLATES.

CLUTCH RELEASE BEARINGS

CLUTCH RELEASE BEARING INSPECTION

Condition	Code	Procedure
Collar broken	A	Require replacement.
Cracked	A	Require replacement.
Rough when rotated as an assembly	B	Require replacement.
Seized	A	Require replacement.
Wear exceeds specifications	B	Require replacement.
Worn close to the end of its useful life	1	Suggest replacement.
Worn, affecting performance	A	Require replacement.

CLUTCH SLAVE CYLINDERS (CONCENTRIC)

CLUTCH SLAVE CYLINDER (CONCENTRIC) INSPECTION

Condition	Code	Procedure
Bearing rough when rotated as an assembly	B	Require replacement.
Bearing seized	A	Require replacement.
Bleeder pipe leaks	A	Require repair or replacement.
Carrier assembly worn, affecting performance	A	Require replacement.
Collar broken	A	Require replacement.
Cracked	A	Require replacement.
Housing leaks	A	Require replacement.
Inoperative	A	Require replacement.
Release binding	A	Require replacement.
Spring broken	A	Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Worn, affecting performance	A	Require replacement.

CLUTCH SLAVE CYLINDERS (CONVENTIONAL OR EXTERNAL)

CLUTCH SLAVE CYLINDER (CONVENTIONAL OR EXTERNAL) INSPECTION

Condition	Code	Procedure
Binding	A	Require repair or replacement.
Bleeder port damaged (not repairable)	A	(1) Require replacement.
Bleeder port damaged (repairable)	A	(1) Require repair.
Bleeder screw broken off in slave cylinder	A	(1) Require replacement.
Bleeder screw seized	A	(2) Require replacement.
Bore corroded (pitted)	B	Require replacement.
Bore grooved	A	Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

(1) - Only required if the hydraulic system must be opened.
(2) - Seized is defined as a bleeder screw that cannot be removed after a practical attempt at removing it has been made.

COMPANION FLANGES

See YOKES AND SLIP YOKES.

CONNECTORS

See WIRING HARNESSES AND CONNECTORS.

COOLER BYPASS VALVES

COOLER BYPASS VALVE INSPECTION

Condition	Code	Procedure
Inoperative	A	Require replacement.
Installed incorrectly	A	Require repair.
Leaking	A	Require repair or replacement.
Restricted	A	Require repair or replacement.

COOLER LINES

COOLER LINE INSPECTION

Condition	Code	Procedure
Abrasion damage, affecting structural integrity	A	Require repair or replacement.
Abrasion damage, not affecting structural integrity	..	No service suggested or required.
Application incorrect	B	Require replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.

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		

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 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)

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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.

ELECTRICAL COMPONENT LOCATOR - 4.3L V6 VINS [W,X]

1997 Chevrolet Blazer

1997 ELECTRICAL COMPONENT LOCATION
General Motors Electrical Component Location

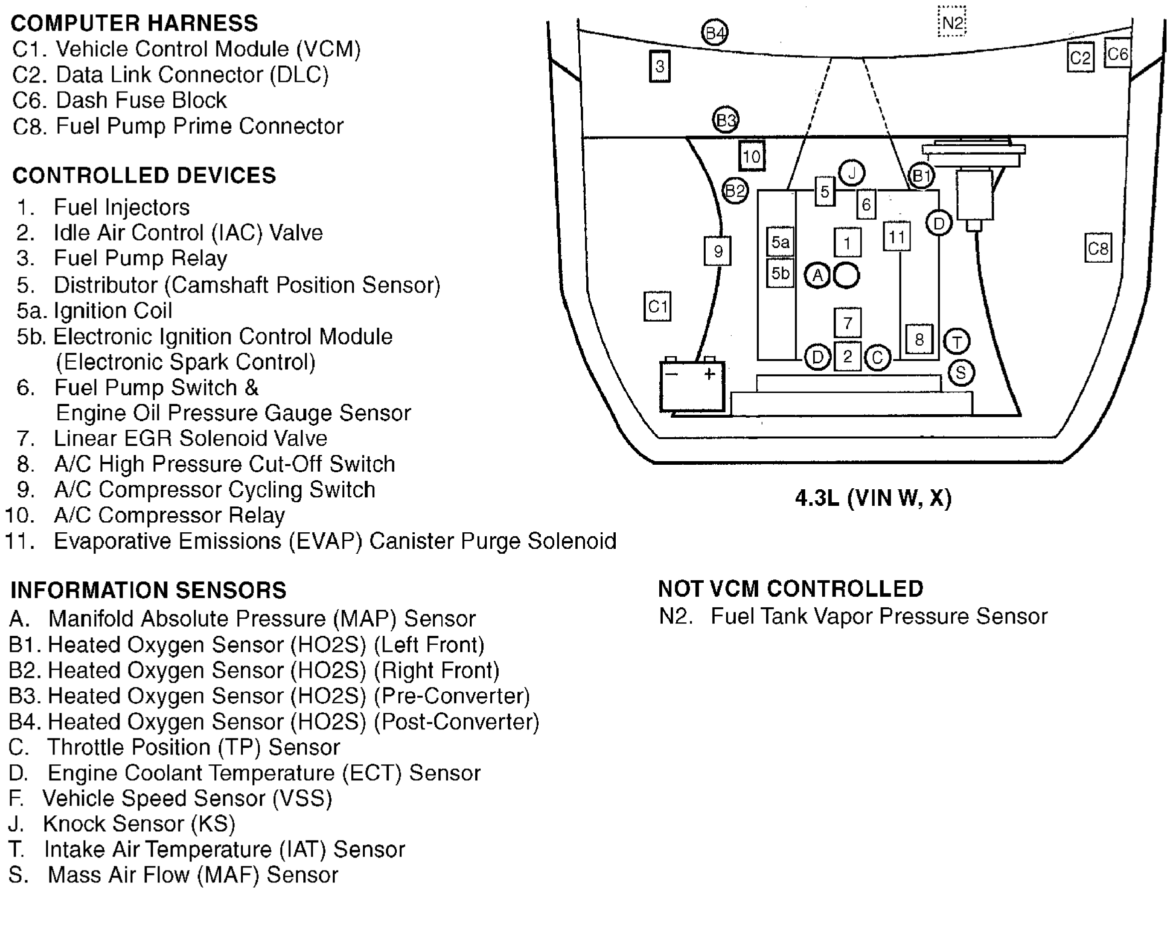
Chevrolet; Blazer, S10 Pickup
GMC; Jimmy, Sonoma
Oldsmobile; Bravada

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.

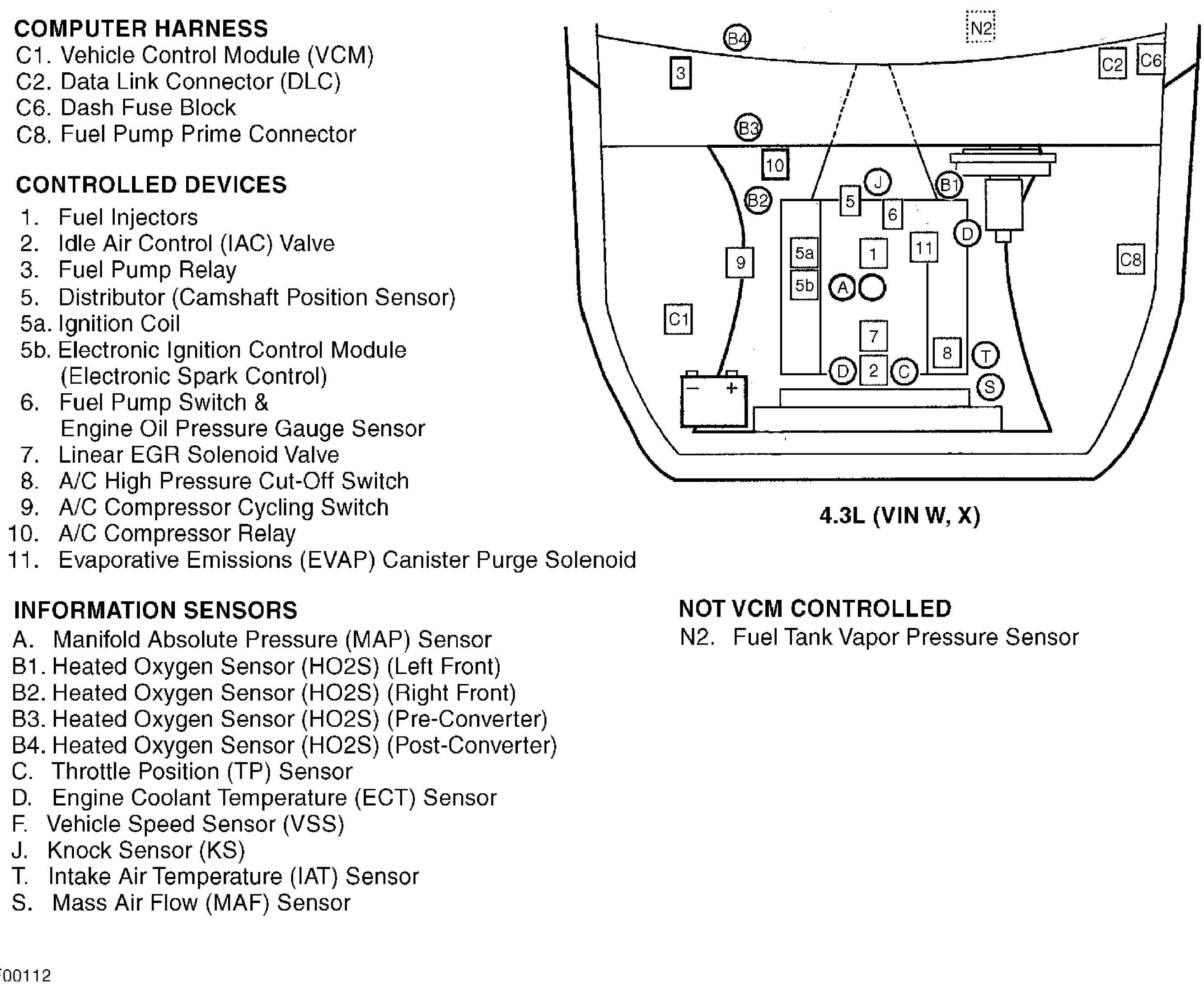
BUZZERS, RELAYS & TIMERS

Component	Component Location



A/C Compressor Relay	On center rear of engine compartment.
Blower Motor Relay	On center rear of engine compartment.

Daytime Running Lamps (DRL) Relay	Behind glove box, on relay center.
Door Lock Relay	Behind right side of dash, above blower plenum.
Fog Lamp Relay	Behind glove box, on relay center.

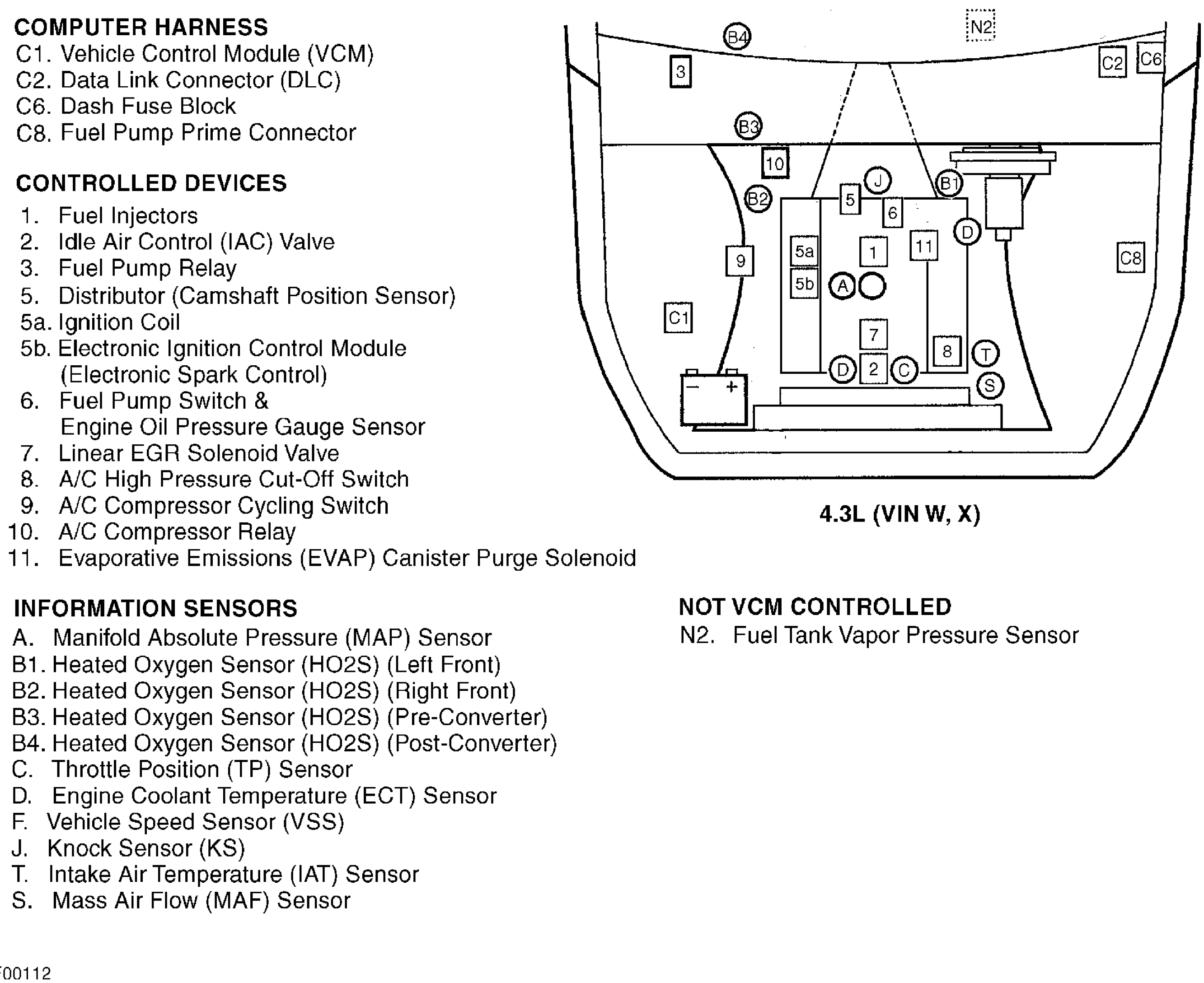


Fuel Pump Relay	Behind glove box, on relay center.
Hazard Flasher	In power distribution center.
Horn Relay	Behind glove box, on relay center.
Map/Dome Lamp Relay	Behind dash, right of steering column.
Starter Relay	Center rear of engine compartment.

Turn Signal Lamp Flasher	In power distribution center.

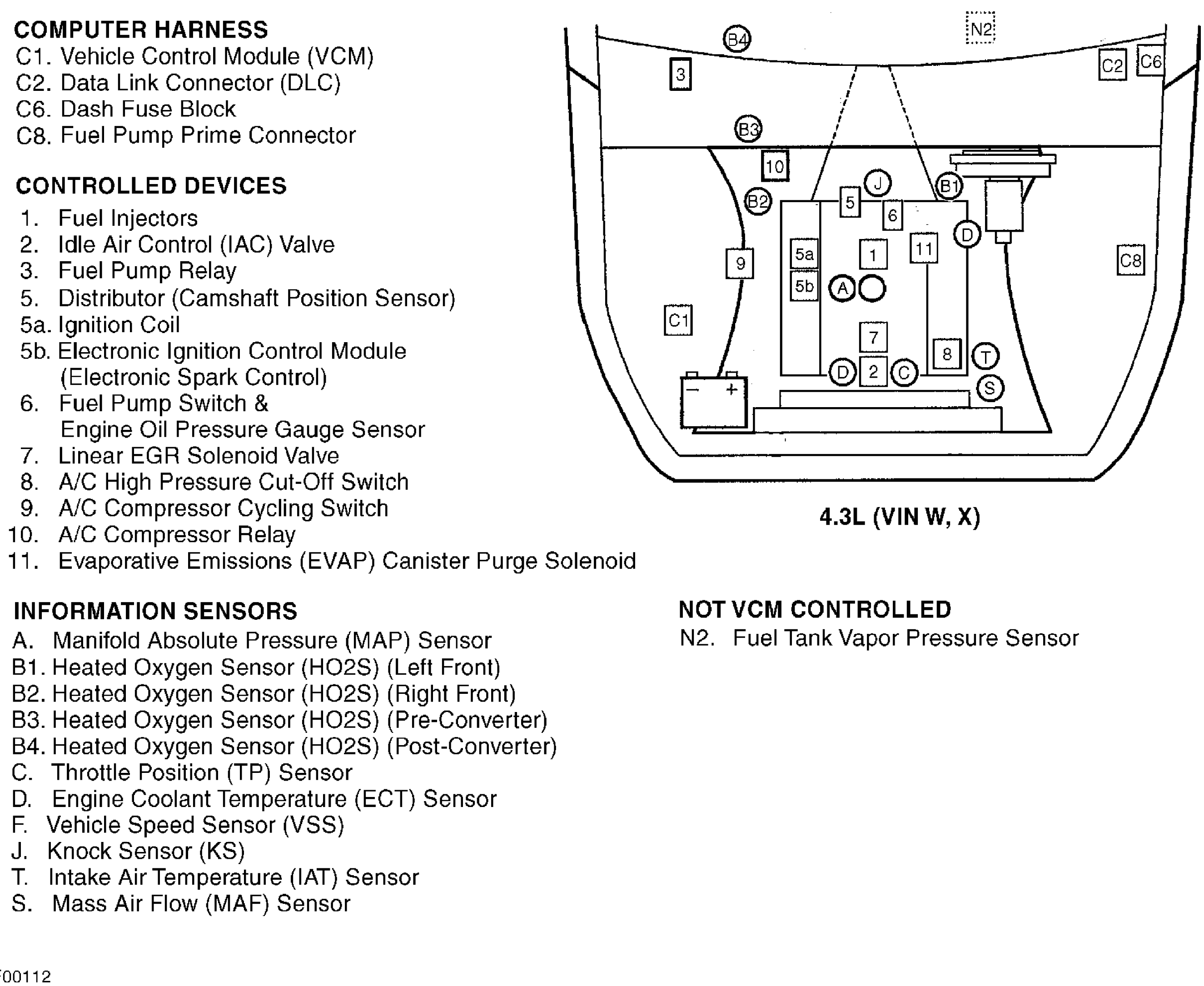
CIRCUIT PROTECTION DEVICES

Component	Component Location
Battery Junction Block	On left rear of engine compartment.
Diode, A/C Compressor Clutch	At A/C compressor.
Dash Fuse Block	On left side of dash.
Power Distribution Center	Below left side of dash.
Relay Center	Behind glove box.



CONTROL UNITS

Component	Component Location
Alarm Module	In power distribution center.
Chime Module	In power distribution center.
Cruise Control Module	On left side of firewall.
Daytime Running Lamps (DRL) Module	Behind dash, above steering column.
Inflatable Restraint Diagnostic Energy Reserve Module	Behind right kick panel.

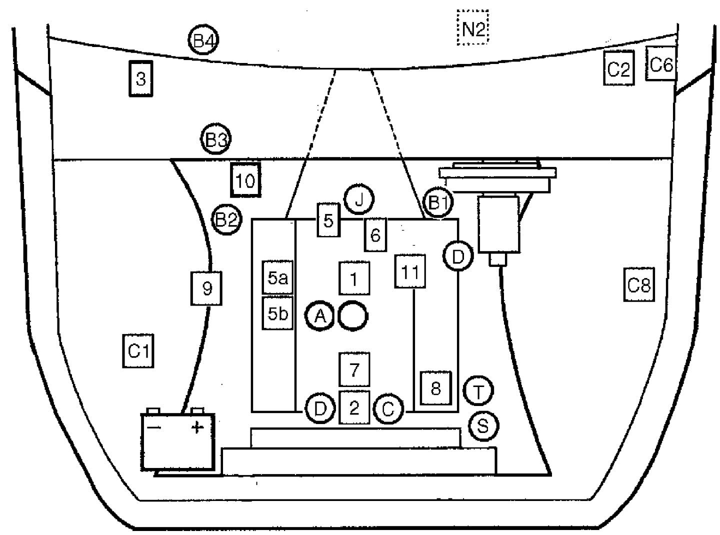


Electronic Ignition Control Module (Electronic Spark Control)	On top right side of engine.
Fuel Level Buffer Module	Under glove box.

Heater and A/C Controller	Under center of dash.
Interior Lamp Control Module	Behind left side of dash.
Remote Keyless Entry Module	Behind lower left side of dash, near park brake.
Sun Roof Express Module	Part of sun roof assembly.
Transfer Case Control Module	Behind center of dash.

COMPUTER HARNESS
C1. Vehicle Control Module (VCM)
C2. Data Link Connector (DLC)
C6. Dash Fuse Block
C8. Fuel Pump Prime Connector

CONTROLLED DEVICES
1. Fuel Injectors
2. Idle Air Control (IAC) Valve
3. Fuel Pump Relay
5. Distributor (Camshaft Position Sensor)
5a. Ignition Coil
5b. Electronic Ignition Control Module (Electronic Spark Control)
6. Fuel Pump Switch & Engine Oil Pressure Gauge Sensor
7. Linear EGR Solenoid Valve
8. A/C High Pressure Cut-Off Switch
9. A/C Compressor Cycling Switch
10. A/C Compressor Relay
11. Evaporative Emissions (EVAP) Canister Purge Solenoid



4.3L (VIN W, X)

INFORMATION SENSORS
A. Manifold Absolute Pressure (MAP) Sensor
B1. Heated Oxygen Sensor (HO2S) (Left Front)
B2. Heated Oxygen Sensor (HO2S) (Right Front)
B3. Heated Oxygen Sensor (HO2S) (Pre-Converter)
B4. Heated Oxygen Sensor (HO2S) (Post-Converter)
C. Throttle Position (TP) Sensor
D. Engine Coolant Temperature (ECT) Sensor
F. Vehicle Speed Sensor (VSS)
J. Knock Sensor (KS)
T. Intake Air Temperature (IAT) Sensor
S. Mass Air Flow (MAF) Sensor

NOT VCM CONTROLLED
N2. Fuel Tank Vapor Pressure Sensor

97F00112

Vehicle Control Module (VCM)	On right front of engine compartment.
Windshield Wiper Pulse Control Module	On center of firewall.

MOTORS

Component	Component Location

Blower Motor	On right rear of engine compartment.
Power Door Lock Motors (4)	In bottom rear of each door.
Power Seat Motors (3)	Under each front seat.
Power Window Motors (4)	In each door.
Liftgate Lock Actuator	In endgate, below glass.
Mode Door Vacuum Actuator (Lower)	On left side of air distributor module.
Mode Door Vacuum Actuator (Upper) distributor module.	On right side of air
Washer Pump Motor (Front)	In washer fluid reservoir, on left front of engine compartment.
Washer Pump Motor (Rear)	In washer fluid reservoir, on left front of engine compartment.
Wiper Motor (Front)	Part of windshield wiper pulse control module.
Wiper Motor (Rear)	On top center of rear endgate.

SENDING UNITS & SENSORS

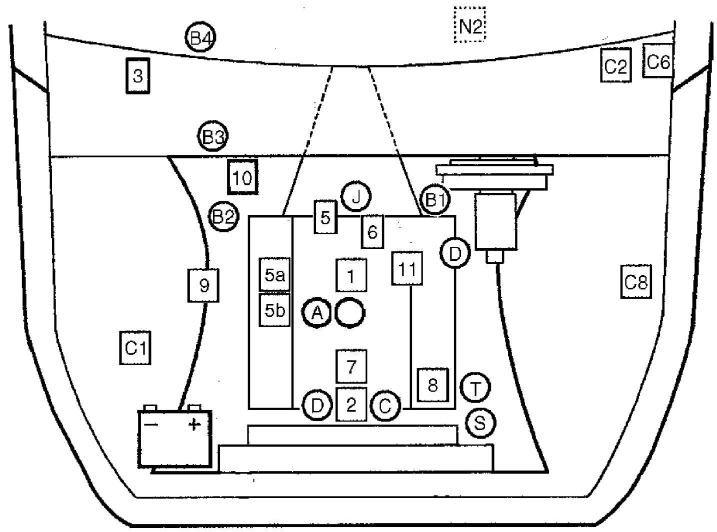
Component	Component Location
ABS Wheel Speed Sensors (2)	Inside of respective front wheel.
Arming Sensor (2WD)	Inside left frame rail.
Arming Sensor (4WD)	On second crossmember, near left frame rail.
Ambient Air Temperature Sensor	In front center of vehicle, near hood latch.

COMPUTER HARNESS

C1. Vehicle Control Module (VCM)
C2. Data Link Connector (DLC)
C6. Dash Fuse Block
C8. Fuel Pump Prime Connector

CONTROLLED DEVICES

1. Fuel Injectors
2. Idle Air Control (IAC) Valve
3. Fuel Pump Relay
5. Distributor (Camshaft Position Sensor)
5a. Ignition Coil
5b. Electronic Ignition Control Module (Electronic Spark Control)
6. Fuel Pump Switch & Engine Oil Pressure Gauge Sensor
7. Linear EGR Solenoid Valve
8. A/C High Pressure Cut-Off Switch
9. A/C Compressor Cycling Switch
10. A/C Compressor Relay
11. Evaporative Emissions (EVAP) Canister Purge Solenoid



4.3L (VIN W, X)

INFORMATION SENSORS

A. Manifold Absolute Pressure (MAP) Sensor
B1. Heated Oxygen Sensor (HO2S) (Left Front)
B2. Heated Oxygen Sensor (HO2S) (Right Front)
B3. Heated Oxygen Sensor (HO2S) (Pre-Converter)
B4. Heated Oxygen Sensor (HO2S) (Post-Converter)
C. Throttle Position (TP) Sensor
D. Engine Coolant Temperature (ECT) Sensor
F. Vehicle Speed Sensor (VSS)
J. Knock Sensor (KS)
T. Intake Air Temperature (IAT) Sensor
S. Mass Air Flow (MAF) Sensor

NOT VCM CONTROLLED

N2. Fuel Tank Vapor Pressure Sensor

97F00112

Camshaft Position Sensor	In distributor.
Crankshaft Position Sensor	On front of engine, near crankshaft pulley.
Discriminating Sensors (2)	On frame rail on respective sides of engine compartment.
Engine Coolant Temperature Gauge Sensor	On lower left side of engine.

COMPUTER HARNESS

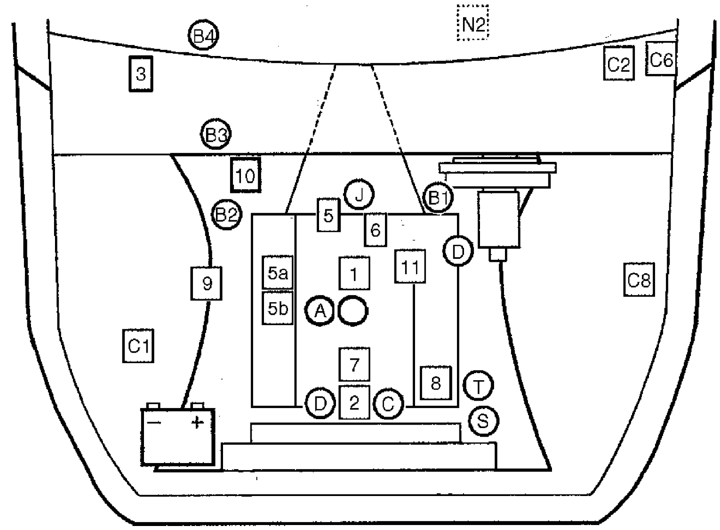
C1. Vehicle Control Module (VCM)
C2. Data Link Connector (DLC)
C6. Dash Fuse Block
C8. Fuel Pump Prime Connector

CONTROLLED DEVICES

1. Fuel Injectors
2. Idle Air Control (IAC) Valve
3. Fuel Pump Relay
5. Distributor (Camshaft Position Sensor)
5a. Ignition Coil
5b. Electronic Ignition Control Module (Electronic Spark Control)
6. Fuel Pump Switch & Engine Oil Pressure Gauge Sensor
7. Linear EGR Solenoid Valve
8. A/C High Pressure Cut-Off Switch
9. A/C Compressor Cycling Switch
10. A/C Compressor Relay
11. Evaporative Emissions (EVAP) Canister Purge Solenoid

INFORMATION SENSORS

A. Manifold Absolute Pressure (MAP) Sensor
B1. Heated Oxygen Sensor (HO2S) (Left Front)
B2. Heated Oxygen Sensor (HO2S) (Right Front)
B3. Heated Oxygen Sensor (HO2S) (Pre-Converter)
B4. Heated Oxygen Sensor (HO2S) (Post-Converter)
C. Throttle Position (TP) Sensor
D. Engine Coolant Temperature (ECT) Sensor
F. Vehicle Speed Sensor (VSS)
J. Knock Sensor (KS)
T. Intake Air Temperature (IAT) Sensor
S. Mass Air Flow (MAF) Sensor



4.3L (VIN W, X)

NOT VCM CONTROLLED

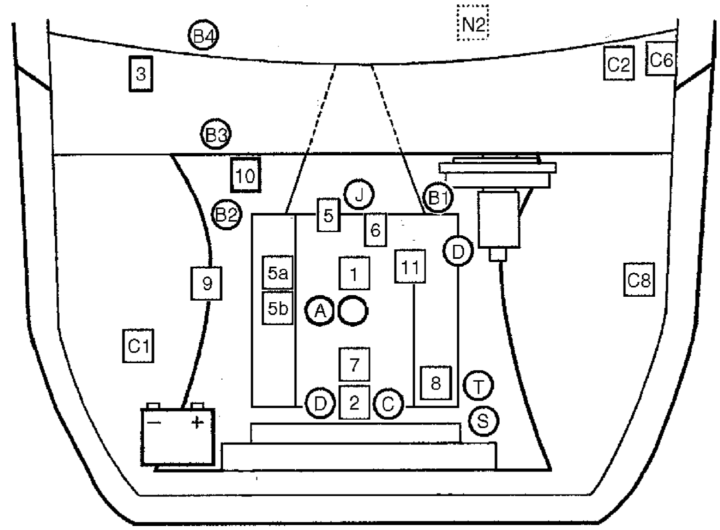
N2. Fuel Tank Vapor Pressure Sensor

97F00112

Engine Coolant Temperature (ECT) Sensor	In lower left side of engine.
Fuel Level Sensor (w/Fuel Pump)	On top of fuel tank.

COMPUTER HARNESS
C1. Vehicle Control Module (VCM)
C2. Data Link Connector (DLC)
C6. Dash Fuse Block
C8. Fuel Pump Prime Connector

CONTROLLED DEVICES
1. Fuel Injectors
2. Idle Air Control (IAC) Valve
3. Fuel Pump Relay
5. Distributor (Camshaft Position Sensor)
5a. Ignition Coil
5b. Electronic Ignition Control Module (Electronic Spark Control)
6. Fuel Pump Switch & Engine Oil Pressure Gauge Sensor
7. Linear EGR Solenoid Valve
8. A/C High Pressure Cut-Off Switch
9. A/C Compressor Cycling Switch
10. A/C Compressor Relay
11. Evaporative Emissions (EVAP) Canister Purge Solenoid



4.3L (VIN W, X)

INFORMATION SENSORS
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B1. Heated Oxygen Sensor (HO2S) (Left Front)
B2. Heated Oxygen Sensor (HO2S) (Right Front)
B3. Heated Oxygen Sensor (HO2S) (Pre-Converter)
B4. Heated Oxygen Sensor (HO2S) (Post-Converter)
C. Throttle Position (TP) Sensor
D. Engine Coolant Temperature (ECT) Sensor
F. Vehicle Speed Sensor (VSS)
J. Knock Sensor (KS)
T. Intake Air Temperature (IAT) Sensor
S. Mass Air Flow (MAF) Sensor

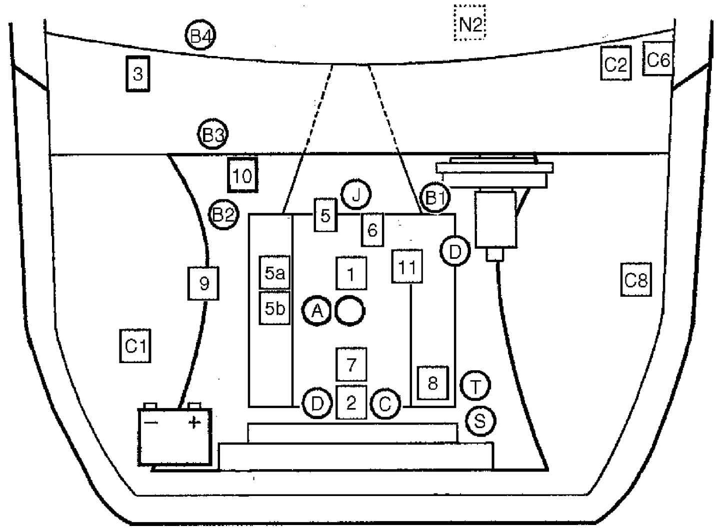
NOT VCM CONTROLLED
N2. Fuel Tank Vapor Pressure Sensor

97F00112

Fuel Pump Switch and Engine Oil Pressure Gauge Sensor	On top rear of engine, near distributor.
Fuel Pump Sender	In top of fuel tank.

COMPUTER HARNESS
C1. Vehicle Control Module (VCM)
C2. Data Link Connector (DLC)
C6. Dash Fuse Block
C8. Fuel Pump Prime Connector

CONTROLLED DEVICES
1. Fuel Injectors
2. Idle Air Control (IAC) Valve
3. Fuel Pump Relay
5. Distributor (Camshaft Position Sensor)
5a. Ignition Coil
5b. Electronic Ignition Control Module (Electronic Spark Control)
6. Fuel Pump Switch & Engine Oil Pressure Gauge Sensor
7. Linear EGR Solenoid Valve
8. A/C High Pressure Cut-Off Switch
9. A/C Compressor Cycling Switch
10. A/C Compressor Relay
11. Evaporative Emissions (EVAP) Canister Purge Solenoid



4.3L (VIN W, X)

INFORMATION SENSORS
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B4. Heated Oxygen Sensor (HO2S) (Post-Converter)
C. Throttle Position (TP) Sensor
D. Engine Coolant Temperature (ECT) Sensor
F. Vehicle Speed Sensor (VSS)
J. Knock Sensor (KS)
T. Intake Air Temperature (IAT) Sensor
S. Mass Air Flow (MAF) Sensor

NOT VCM CONTROLLED
N2. Fuel Tank Vapor Pressure Sensor

97F00112

Fuel Tank Vapor Pressure Sensor   Top of fuel tank.

COMPUTER HARNESS
C1. Vehicle Control Module (VCM)
C2. Data Link Connector (DLC)
C6. Dash Fuse Block
C8. Fuel Pump Prime Connector

CONTROLLED DEVICES
1. Fuel Injectors
2. Idle Air Control (IAC) Valve
3. Fuel Pump Relay
5. Distributor (Camshaft Position Sensor)
5a. Ignition Coil
5b. Electronic Ignition Control Module (Electronic Spark Control)
6. Fuel Pump Switch & Engine Oil Pressure Gauge Sensor
7. Linear EGR Solenoid Valve
8. A/C High Pressure Cut-Off Switch
9. A/C Compressor Cycling Switch
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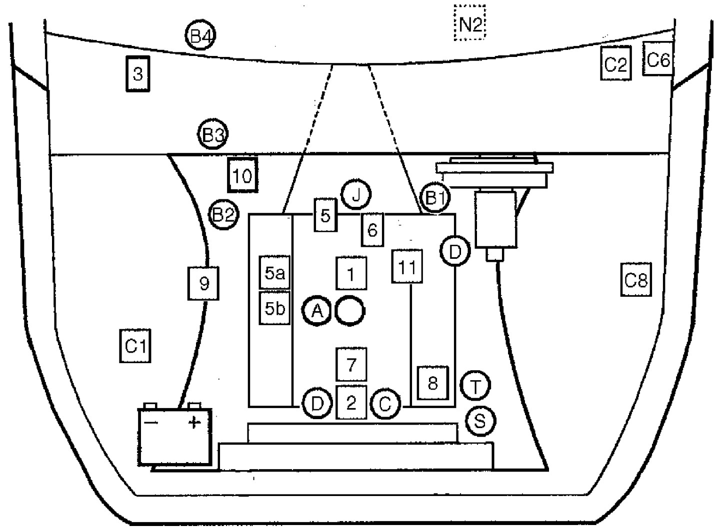
11. Evaporative Emissions (EVAP) Canister Purge Solenoid



4.3L (VIN W, X)

INFORMATION SENSORS
A. Manifold Absolute Pressure (MAP) Sensor
B1. Heated Oxygen Sensor (HO2S) (Left Front)
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B3. Heated Oxygen Sensor (HO2S) (Pre-Converter)
B4. Heated Oxygen Sensor (HO2S) (Post-Converter)
C. Throttle Position (TP) Sensor
D. Engine Coolant Temperature (ECT) Sensor
F. Vehicle Speed Sensor (VSS)
J. Knock Sensor (KS)
T. Intake Air Temperature (IAT) Sensor
S. Mass Air Flow (MAF) Sensor

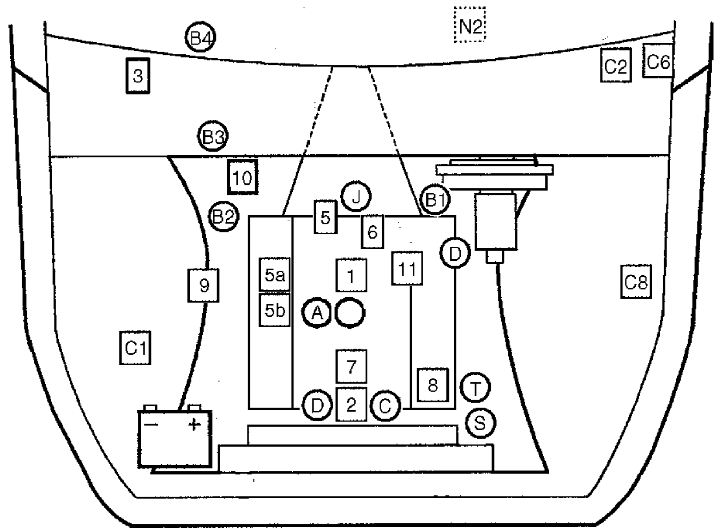
NOT VCM CONTROLLED
N2. Fuel Tank Vapor Pressure Sensor

97F00112

Heated Oxygen Sensor (HO2S) (Left Front)	In left exhaust manifold.

COMPUTER HARNESS
C1. Vehicle Control Module (VCM)
C2. Data Link Connector (DLC)
C6. Dash Fuse Block
C8. Fuel Pump Prime Connector

CONTROLLED DEVICES
1. Fuel Injectors
2. Idle Air Control (IAC) Valve
3. Fuel Pump Relay
5. Distributor (Camshaft Position Sensor)
5a. Ignition Coil
5b. Electronic Ignition Control Module (Electronic Spark Control)
6. Fuel Pump Switch & Engine Oil Pressure Gauge Sensor
7. Linear EGR Solenoid Valve
8. A/C High Pressure Cut-Off Switch
9. A/C Compressor Cycling Switch
10. A/C Compressor Relay
11. Evaporative Emissions (EVAP) Canister Purge Solenoid



4.3L (VIN W, X)

INFORMATION SENSORS
A. Manifold Absolute Pressure (MAP) Sensor
B1. Heated Oxygen Sensor (HO2S) (Left Front)
B2. Heated Oxygen Sensor (HO2S) (Right Front)
B3. Heated Oxygen Sensor (HO2S) (Pre-Converter)
B4. Heated Oxygen Sensor (HO2S) (Post-Converter)
C. Throttle Position (TP) Sensor
D. Engine Coolant Temperature (ECT) Sensor
F. Vehicle Speed Sensor (VSS)
J. Knock Sensor (KS)
T. Intake Air Temperature (IAT) Sensor
S. Mass Air Flow (MAF) Sensor

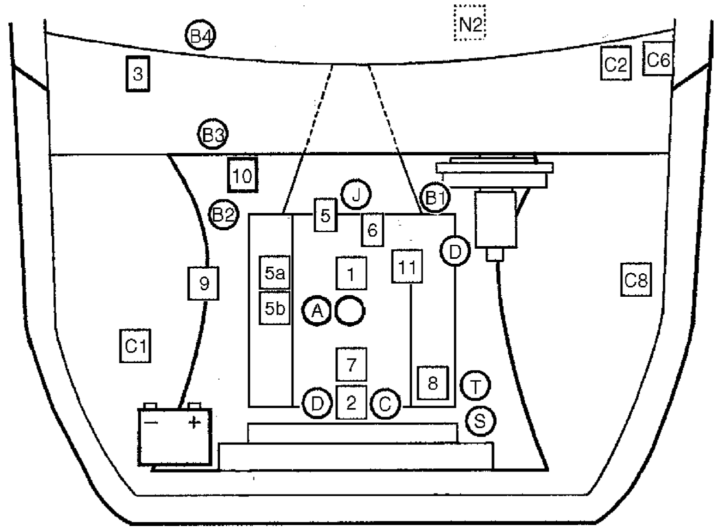
NOT VCM CONTROLLED
N2. Fuel Tank Vapor Pressure Sensor

97F00112

Heated Oxygen Sensor (HO2S) (Pre-Converter)	In exhaust system, before catalytic converter.

COMPUTER HARNESS
C1. Vehicle Control Module (VCM)
C2. Data Link Connector (DLC)
C6. Dash Fuse Block
C8. Fuel Pump Prime Connector

CONTROLLED DEVICES
1. Fuel Injectors
2. Idle Air Control (IAC) Valve
3. Fuel Pump Relay
5. Distributor (Camshaft Position Sensor)
5a. Ignition Coil
5b. Electronic Ignition Control Module (Electronic Spark Control)
6. Fuel Pump Switch & Engine Oil Pressure Gauge Sensor
7. Linear EGR Solenoid Valve
8. A/C High Pressure Cut-Off Switch
9. A/C Compressor Cycling Switch
10. A/C Compressor Relay
11. Evaporative Emissions (EVAP) Canister Purge Solenoid



4.3L (VIN W, X)

INFORMATION SENSORS
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B2. Heated Oxygen Sensor (HO2S) (Right Front)
B3. Heated Oxygen Sensor (HO2S) (Pre-Converter)
B4. Heated Oxygen Sensor (HO2S) (Post-Converter)
C. Throttle Position (TP) Sensor
D. Engine Coolant Temperature (ECT) Sensor
F. Vehicle Speed Sensor (VSS)
J. Knock Sensor (KS)
T. Intake Air Temperature (IAT) Sensor
S. Mass Air Flow (MAF) Sensor

NOT VCM CONTROLLED
N2. Fuel Tank Vapor Pressure Sensor

97F00112

Heated Oxygen Sensor (HO2S) (Post-Converter)	In exhaust system, after catalytic converter.

COMPUTER HARNESS
C1. Vehicle Control Module (VCM)
C2. Data Link Connector (DLC)
C6. Dash Fuse Block
C8. Fuel Pump Prime Connector

CONTROLLED DEVICES
1. Fuel Injectors
2. Idle Air Control (IAC) Valve
3. Fuel Pump Relay
5. Distributor (Camshaft Position Sensor)
5a. Ignition Coil
5b. Electronic Ignition Control Module (Electronic Spark Control)
6. Fuel Pump Switch & Engine Oil Pressure Gauge Sensor
7. Linear EGR Solenoid Valve
8. A/C High Pressure Cut-Off Switch
9. A/C Compressor Cycling Switch
10. A/C Compressor Relay
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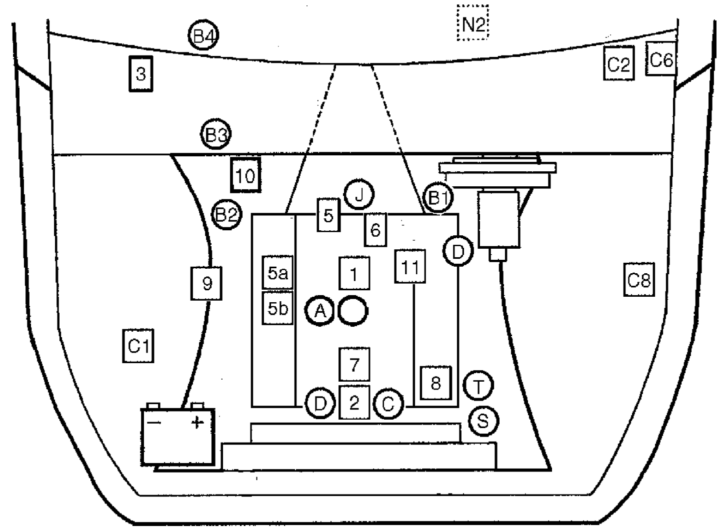

4.3L (VIN W, X)

INFORMATION SENSORS
A. Manifold Absolute Pressure (MAP) Sensor
B1. Heated Oxygen Sensor (HO2S) (Left Front)
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B4. Heated Oxygen Sensor (HO2S) (Post-Converter)
C. Throttle Position (TP) Sensor
D. Engine Coolant Temperature (ECT) Sensor
F. Vehicle Speed Sensor (VSS)
J. Knock Sensor (KS)
T. Intake Air Temperature (IAT) Sensor
S. Mass Air Flow (MAF) Sensor

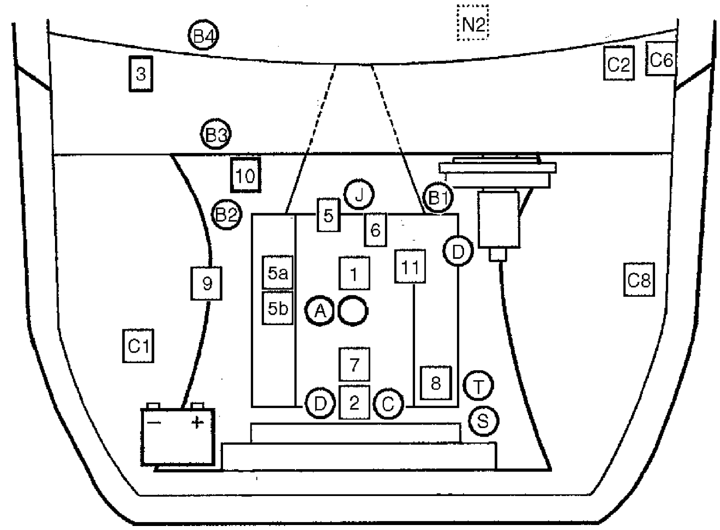
NOT VCM CONTROLLED
N2. Fuel Tank Vapor Pressure Sensor

97F00112

Heated Oxygen Sensor (HO2S) (Right Front) In right exhaust manifold.

COMPUTER HARNESS
C1. Vehicle Control Module (VCM)
C2. Data Link Connector (DLC)
C6. Dash Fuse Block
C8. Fuel Pump Prime Connector

CONTROLLED DEVICES
1. Fuel Injectors
2. Idle Air Control (IAC) Valve
3. Fuel Pump Relay
5. Distributor (Camshaft Position Sensor)
5a. Ignition Coil
5b. Electronic Ignition Control Module (Electronic Spark Control)
6. Fuel Pump Switch & Engine Oil Pressure Gauge Sensor
7. Linear EGR Solenoid Valve
8. A/C High Pressure Cut-Off Switch
9. A/C Compressor Cycling Switch
10. A/C Compressor Relay
11. Evaporative Emissions (EVAP) Canister Purge Solenoid



4.3L (VIN W, X)

INFORMATION SENSORS
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B4. Heated Oxygen Sensor (HO2S) (Post-Converter)
C. Throttle Position (TP) Sensor
D. Engine Coolant Temperature (ECT) Sensor
F. Vehicle Speed Sensor (VSS)
J. Knock Sensor (KS)
T. Intake Air Temperature (IAT) Sensor
S. Mass Air Flow (MAF) Sensor

NOT VCM CONTROLLED
N2. Fuel Tank Vapor Pressure Sensor

97F00112

Intake Air Temperature (IAT) Sensor	In fresh air intake duct.

COMPUTER HARNESS
C1. Vehicle Control Module (VCM)
C2. Data Link Connector (DLC)
C6. Dash Fuse Block
C8. Fuel Pump Prime Connector

CONTROLLED DEVICES
1. Fuel Injectors
2. Idle Air Control (IAC) Valve
3. Fuel Pump Relay
5. Distributor (Camshaft Position Sensor)
5a. Ignition Coil
5b. Electronic Ignition Control Module (Electronic Spark Control)
6. Fuel Pump Switch & Engine Oil Pressure Gauge Sensor
7. Linear EGR Solenoid Valve
8. A/C High Pressure Cut-Off Switch
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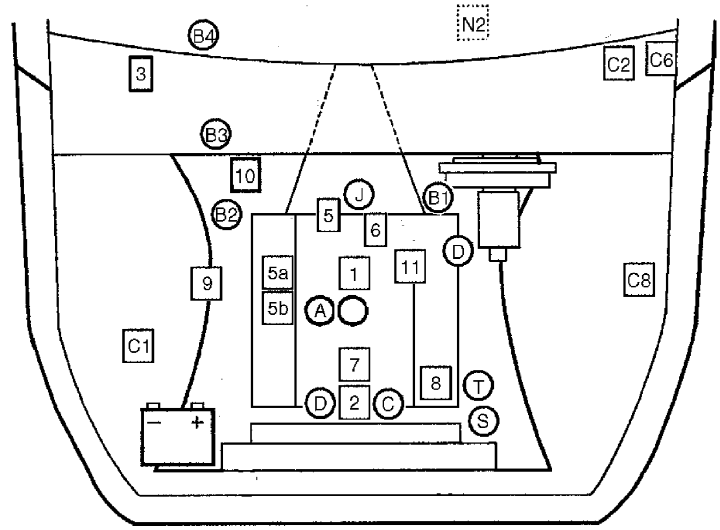

4.3L (VIN W, X)

INFORMATION SENSORS
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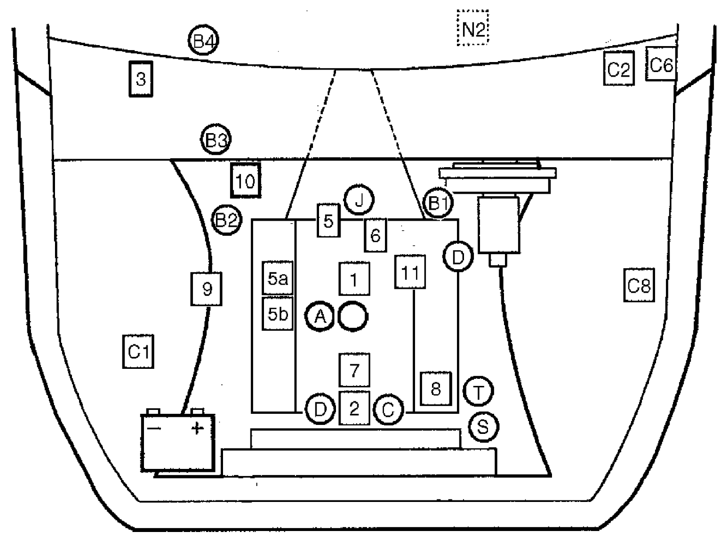
B4. Heated Oxygen Sensor (HO2S) (Post-Converter)
C. Throttle Position (TP) Sensor
D. Engine Coolant Temperature (ECT) Sensor
F. Vehicle Speed Sensor (VSS)
J. Knock Sensor (KS)
T. Intake Air Temperature (IAT) Sensor
S. Mass Air Flow (MAF) Sensor

NOT VCM CONTROLLED
N2. Fuel Tank Vapor Pressure Sensor

97F00112

Knock Sensor (KS) On top center of engine.

COMPUTER HARNESS
C1. Vehicle Control Module (VCM)
C2. Data Link Connector (DLC)
C6. Dash Fuse Block
C8. Fuel Pump Prime Connector



4.3L (VIN W, X)

CONTROLLED DEVICES
1. Fuel Injectors
2. Idle Air Control (IAC) Valve
3. Fuel Pump Relay
5. Distributor (Camshaft Position Sensor)
5a. Ignition Coil
5b. Electronic Ignition Control Module (Electronic Spark Control)
6. Fuel Pump Switch & Engine Oil Pressure Gauge Sensor
7. Linear EGR Solenoid Valve
8. A/C High Pressure Cut-Off Switch
9. A/C Compressor Cycling Switch
10. A/C Compressor Relay
11. Evaporative Emissions (EVAP) Canister Purge Solenoid

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C. Throttle Position (TP) Sensor
D. Engine Coolant Temperature (ECT) Sensor
F. Vehicle Speed Sensor (VSS)
J. Knock Sensor (KS)
T. Intake Air Temperature (IAT) Sensor
S. Mass Air Flow (MAF) Sensor

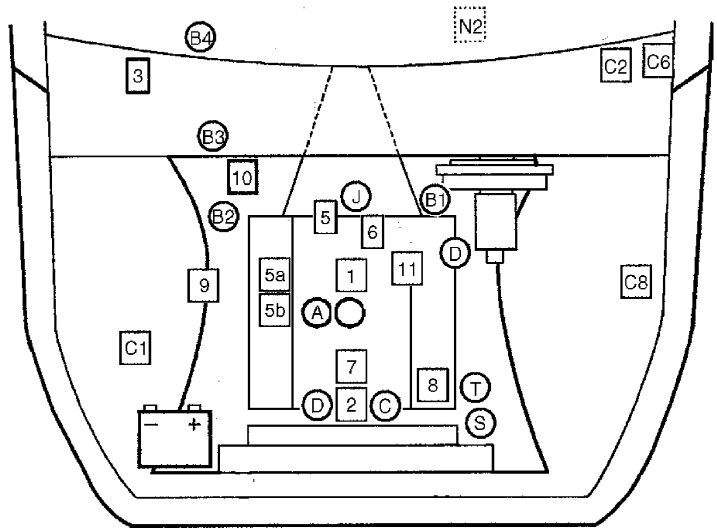
NOT VCM CONTROLLED
N2. Fuel Tank Vapor Pressure Sensor

97F00112

Manifold Absolute Pressure (MAP) Sensor	On top center of engine.

COMPUTER HARNESS
C1. Vehicle Control Module (VCM)
C2. Data Link Connector (DLC)
C6. Dash Fuse Block
C8. Fuel Pump Prime Connector

CONTROLLED DEVICES
1. Fuel Injectors
2. Idle Air Control (IAC) Valve
3. Fuel Pump Relay
5. Distributor (Camshaft Position Sensor)
5a. Ignition Coil
5b. Electronic Ignition Control Module (Electronic Spark Control)
6. Fuel Pump Switch & Engine Oil Pressure Gauge Sensor
7. Linear EGR Solenoid Valve
8. A/C High Pressure Cut-Off Switch
9. A/C Compressor Cycling Switch
10. A/C Compressor Relay
11. Evaporative Emissions (EVAP) Canister Purge Solenoid



4.3L (VIN W, X)

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B4. Heated Oxygen Sensor (HO2S) (Post-Converter)
C. Throttle Position (TP) Sensor
D. Engine Coolant Temperature (ECT) Sensor
F. Vehicle Speed Sensor (VSS)
J. Knock Sensor (KS)
T. Intake Air Temperature (IAT) Sensor
S. Mass Air Flow (MAF) Sensor

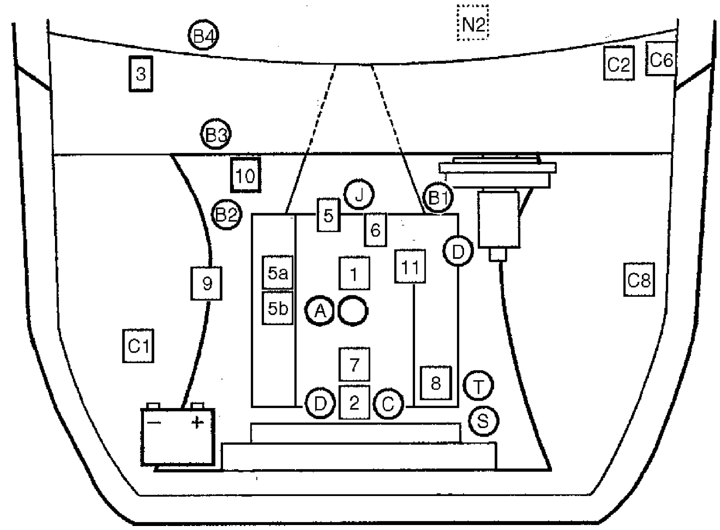
NOT VCM CONTROLLED
N2. Fuel Tank Vapor Pressure Sensor

97F00112

Mass Air Flow (MAF) Sensor On air intake assembly.

COMPUTER HARNESS
C1. Vehicle Control Module (VCM)
C2. Data Link Connector (DLC)
C6. Dash Fuse Block
C8. Fuel Pump Prime Connector

CONTROLLED DEVICES
1. Fuel Injectors
2. Idle Air Control (IAC) Valve
3. Fuel Pump Relay
5. Distributor (Camshaft Position Sensor)
5a. Ignition Coil
5b. Electronic Ignition Control Module (Electronic Spark Control)
6. Fuel Pump Switch & Engine Oil Pressure Gauge Sensor
7. Linear EGR Solenoid Valve
8. A/C High Pressure Cut-Off Switch
9. A/C Compressor Cycling Switch
10. A/C Compressor Relay
11. Evaporative Emissions (EVAP) Canister Purge Solenoid



4.3L (VIN W, X)

INFORMATION SENSORS
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B3. Heated Oxygen Sensor (HO2S) (Pre-Converter)
B4. Heated Oxygen Sensor (HO2S) (Post-Converter)
C. Throttle Position (TP) Sensor
D. Engine Coolant Temperature (ECT) Sensor
F. Vehicle Speed Sensor (VSS)
J. Knock Sensor (KS)
T. Intake Air Temperature (IAT) Sensor
S. Mass Air Flow (MAF) Sensor

NOT VCM CONTROLLED
N2. Fuel Tank Vapor Pressure Sensor

97F00112

Throttle Position (TP) Sensor On throttle body assembly.

COMPUTER HARNESS
C1. Vehicle Control Module (VCM)
C2. Data Link Connector (DLC)
C6. Dash Fuse Block
C8. Fuel Pump Prime Connector

CONTROLLED DEVICES
1. Fuel Injectors
2. Idle Air Control (IAC) Valve
3. Fuel Pump Relay
5. Distributor (Camshaft Position Sensor)
5a. Ignition Coil
5b. Electronic Ignition Control Module (Electronic Spark Control)
6. Fuel Pump Switch & Engine Oil Pressure Gauge Sensor
7. Linear EGR Solenoid Valve
8. A/C High Pressure Cut-Off Switch
9. A/C Compressor Cycling Switch
10. A/C Compressor Relay
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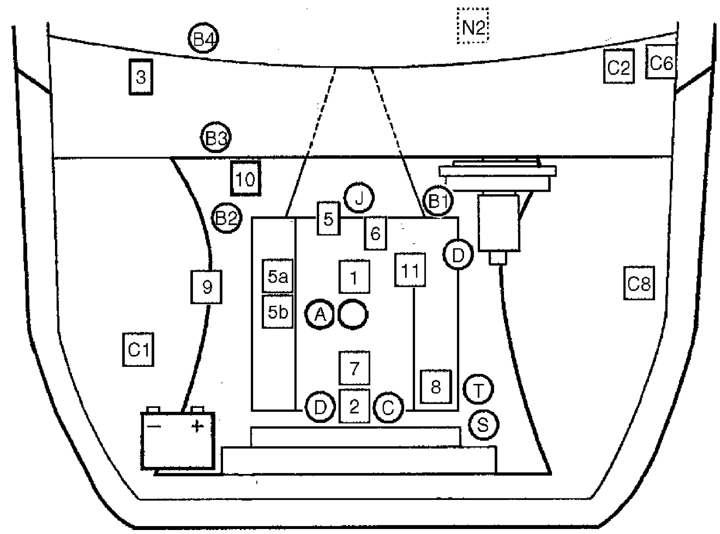

4.3L (VIN W, X)

NOT VCM CONTROLLED
N2. Fuel Tank Vapor Pressure Sensor

97F00112

Vehicle Speed Sensor (VSS)	On left rear of transmission or transfer case.

SOLENOIDS & SOLENOID VALVES

Component	Component Location
1-2 Shift Solenoid Valve	Inside transmission.
2-3 Shift Solenoid Valve	Inside transmission.
3-2 Shift Solenoid Valve	Inside transmission.
Air Inlet Valve Actuator	On blower plenum, near right kick panel.
Air Temperature Valve Electric Actuator	On top of blower plenum.
Brake Pressure Modulator Valve (BPMV)	In left rear of engine compartment.

Brake Transmission Shift Interlock Solenoid (Bravada)	On center floor, near shift lever.
Brake Transmission Shift Interlock Solenoid (except Bravada)	On steering column, near shift lever.

COMPUTER HARNESS

C1. Vehicle Control Module (VCM)
C2. Data Link Connector (DLC)
C6. Dash Fuse Block
C8. Fuel Pump Prime Connector

CONTROLLED DEVICES

1. Fuel Injectors
2. Idle Air Control (IAC) Valve
3. Fuel Pump Relay
5. Distributor (Camshaft Position Sensor)
5a. Ignition Coil
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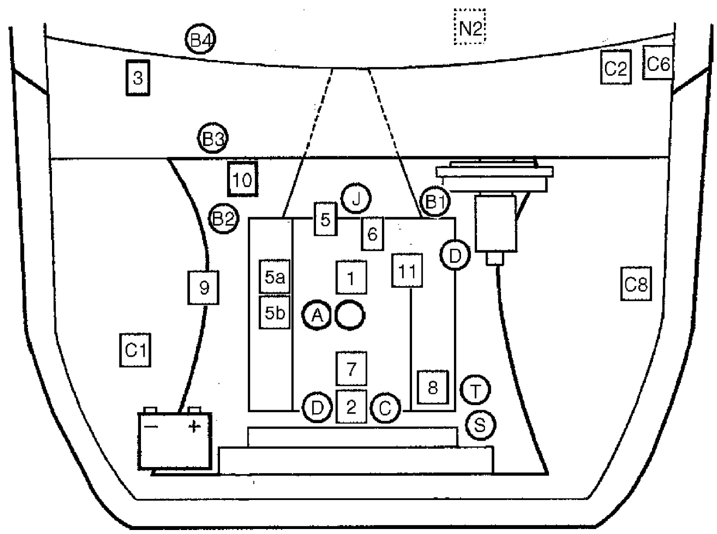

4.3L (VIN W, X)

INFORMATION SENSORS

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D. Engine Coolant Temperature (ECT) Sensor
F. Vehicle Speed Sensor (VSS)
J. Knock Sensor (KS)
T. Intake Air Temperature (IAT) Sensor
S. Mass Air Flow (MAF) Sensor

NOT VCM CONTROLLED

N2. Fuel Tank Vapor Pressure Sensor

97F00112

Evaporative Emissions (EVAP) Canister Purge Solenoid	On top right rear of engine.

COMPUTER HARNESS
C1. Vehicle Control Module (VCM)
C2. Data Link Connector (DLC)
C6. Dash Fuse Block
C8. Fuel Pump Prime Connector

CONTROLLED DEVICES
1. Fuel Injectors
2. Idle Air Control (IAC) Valve
3. Fuel Pump Relay
5. Distributor (Camshaft Position Sensor)
5a. Ignition Coil
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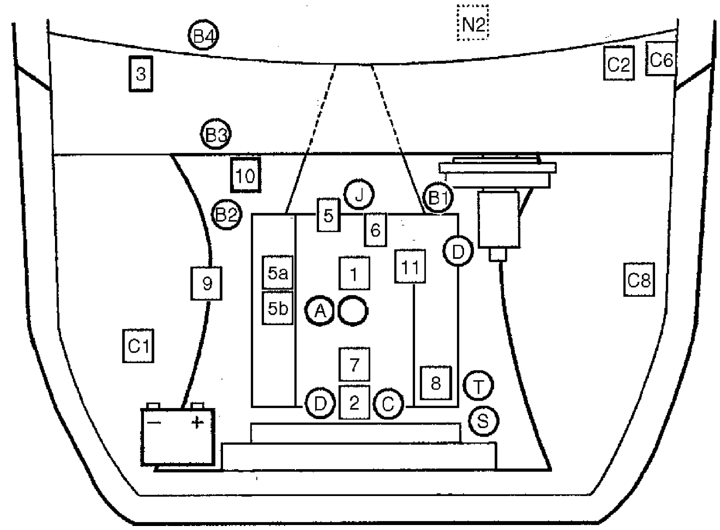

4.3L (VIN W, X)

INFORMATION SENSORS
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D. Engine Coolant Temperature (ECT) Sensor
F. Vehicle Speed Sensor (VSS)
J. Knock Sensor (KS)
T. Intake Air Temperature (IAT) Sensor
S. Mass Air Flow (MAF) Sensor

NOT VCM CONTROLLED
N2. Fuel Tank Vapor Pressure Sensor

97F00112

Idle Air Control (IAC) Valve On throttle body assembly.

COMPUTER HARNESS
C1. Vehicle Control Module (VCM)
C2. Data Link Connector (DLC)
C6. Dash Fuse Block
C8. Fuel Pump Prime Connector

CONTROLLED DEVICES
1. Fuel Injectors
2. Idle Air Control (IAC) Valve
3. Fuel Pump Relay
5. Distributor (Camshaft Position Sensor)
5a. Ignition Coil
5b. Electronic Ignition Control Module (Electronic Spark Control)
6. Fuel Pump Switch & Engine Oil Pressure Gauge Sensor
7. Linear EGR Solenoid Valve
8. A/C High Pressure Cut-Off Switch
9. A/C Compressor Cycling Switch
10. A/C Compressor Relay
11. Evaporative Emissions (EVAP) Canister Purge Solenoid

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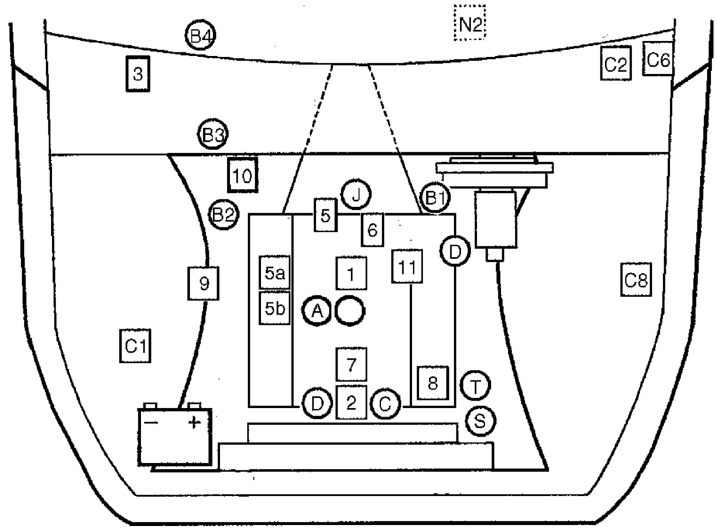

4.3L (VIN W, X)

NOT VCM CONTROLLED
N2. Fuel Tank Vapor Pressure Sensor

97F00112

Linear EGR Solenoid Valve	On top front of engine.
Pressure Control Solenoid Valve	Inside automatic transmission.
Torque Converter Clutch Pulse Width Modulation Solenoid Valve	Inside automatic transmission.
Window Release Solenoid (Rear)	In center of tailgate.

SWITCHES

Component	Component Location

COMPUTER HARNESS
C1. Vehicle Control Module (VCM)
C2. Data Link Connector (DLC)
C6. Dash Fuse Block
C8. Fuel Pump Prime Connector

CONTROLLED DEVICES
1. Fuel Injectors
2. Idle Air Control (IAC) Valve
3. Fuel Pump Relay
5. Distributor (Camshaft Position Sensor)
5a. Ignition Coil
5b. Electronic Ignition Control Module (Electronic Spark Control)
6. Fuel Pump Switch & Engine Oil Pressure Gauge Sensor
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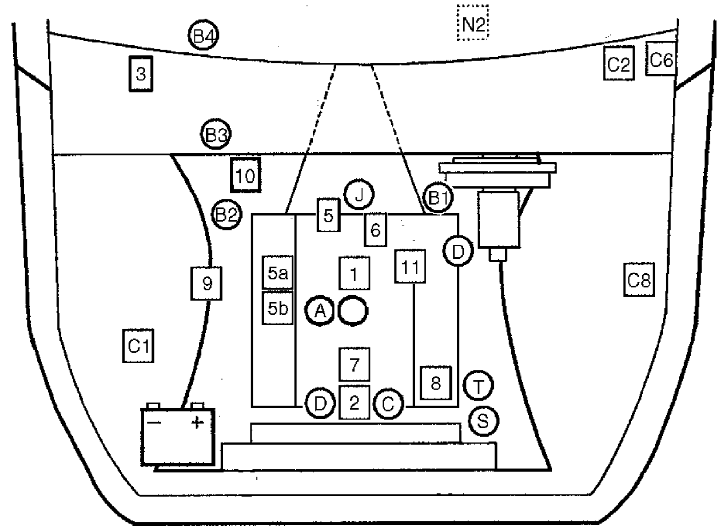

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S. Mass Air Flow (MAF) Sensor

NOT VCM CONTROLLED
N2. Fuel Tank Vapor Pressure Sensor

97F00112

A/C Compressor Cycling Switch	On right rear of engine compartment, near accumulator.

COMPUTER HARNESS
C1. Vehicle Control Module (VCM)
C2. Data Link Connector (DLC)
C6. Dash Fuse Block
C8. Fuel Pump Prime Connector

CONTROLLED DEVICES
1. Fuel Injectors
2. Idle Air Control (IAC) Valve
3. Fuel Pump Relay
5. Distributor (Camshaft Position Sensor)
5a. Ignition Coil
5b. Electronic Ignition Control Module
(Electronic Spark Control)
6. Fuel Pump Switch &
Engine Oil Pressure Gauge Sensor
7. Linear EGR Solenoid Valve
8. A/C High Pressure Cut-Off Switch
9. A/C Compressor Cycling Switch
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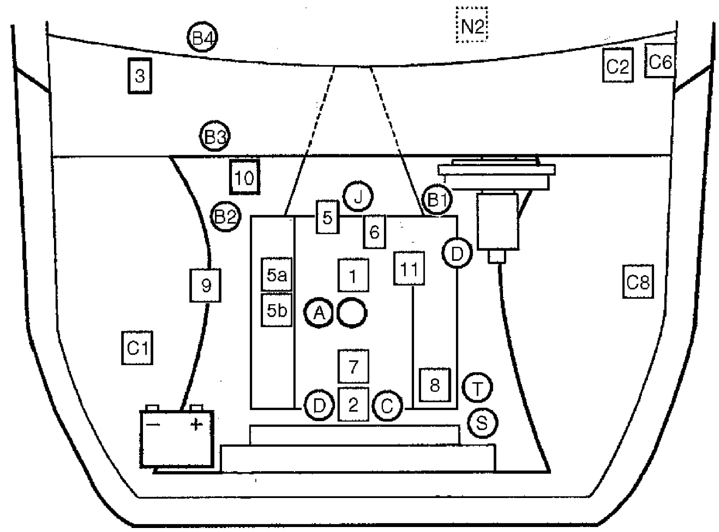

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T. Intake Air Temperature (IAT) Sensor
S. Mass Air Flow (MAF) Sensor

NOT VCM CONTROLLED
N2. Fuel Tank Vapor Pressure Sensor

97F00112

A/C High Pressure Cut-Off Switch	On rear of A/C compressor.
Automatic Transmission Fluid Pressure Manual Valve Position Switch	Inside transmission.
Back-Up Lamp Switch	On left side of transmission.
Brake Pressure Warning Switch	On left side of engine compartment, part of BPMV.
Clutch Pedal Position and Cruise Control Shutoff Switch	On clutch pedal support bracket.
Front Axle Switch	On front axle, right of differential.
Park Brake Warning Switch	On base of park brake assembly.
Park/Neutral Position (PNP) Switch	On left side of transmission.

Safety Belt Retractor Switch	Under driver's seat.
TCC Brake and Cruise Control Release Switch	On brake pedal support bracket.
Transmission Range (TR) Switch	On left side of transmission.
Wiper Cutout Switch (Rear)	Inside endgate.

MISCELLANEOUS

Component	Component Location
Auxiliary Power Outlet (2)	On center of dash.
Blower Motor Resistor	On right rear of engine compartment, on blower module.

COMPUTER HARNESS
C1. Vehicle Control Module (VCM)
C2. Data Link Connector (DLC)
C6. Dash Fuse Block
C8. Fuel Pump Prime Connector

CONTROLLED DEVICES
1. Fuel Injectors
2. Idle Air Control (IAC) Valve
3. Fuel Pump Relay
5. Distributor (Camshaft Position Sensor)
5a. Ignition Coil
5b. Electronic Ignition Control Module (Electronic Spark Control)
6. Fuel Pump Switch & Engine Oil Pressure Gauge Sensor
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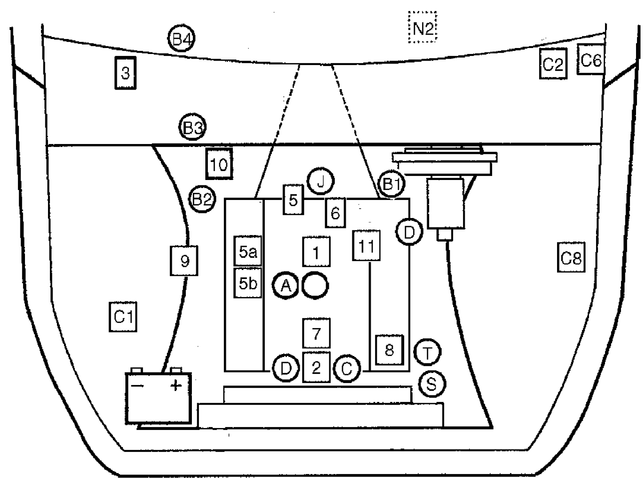

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D. Engine Coolant Temperature (ECT) Sensor
F. Vehicle Speed Sensor (VSS)
J. Knock Sensor (KS)
T. Intake Air Temperature (IAT) Sensor
S. Mass Air Flow (MAF) Sensor

NOT VCM CONTROLLED
N2. Fuel Tank Vapor Pressure Sensor

97F00112

Data Link Connector (DLC)	Under left side of dash.

COMPUTER HARNESS
C1. Vehicle Control Module (VCM)
C2. Data Link Connector (DLC)
C6. Dash Fuse Block
C8. Fuel Pump Prime Connector

CONTROLLED DEVICES
1. Fuel Injectors
2. Idle Air Control (IAC) Valve
3. Fuel Pump Relay
5. Distributor (Camshaft Position Sensor)
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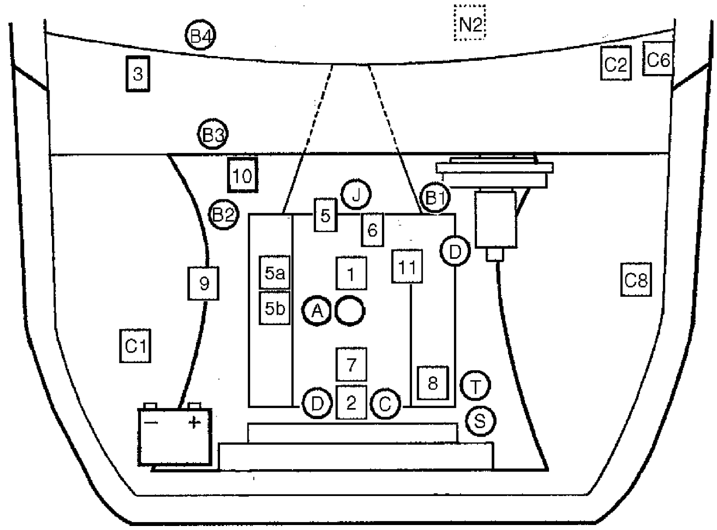

4.3L (VIN W, X)

NOT VCM CONTROLLED
N2. Fuel Tank Vapor Pressure Sensor

97F00112

Distributor	Top rear of engine.
Diode Module	Behind dash, above steering column.

COMPUTER HARNESS
C1. Vehicle Control Module (VCM)
C2. Data Link Connector (DLC)
C6. Dash Fuse Block
C8. Fuel Pump Prime Connector

CONTROLLED DEVICES
1. Fuel Injectors
2. Idle Air Control (IAC) Valve
3. Fuel Pump Relay
5. Distributor (Camshaft Position Sensor)
5a. Ignition Coil
5b. Electronic Ignition Control Module (Electronic Spark Control)
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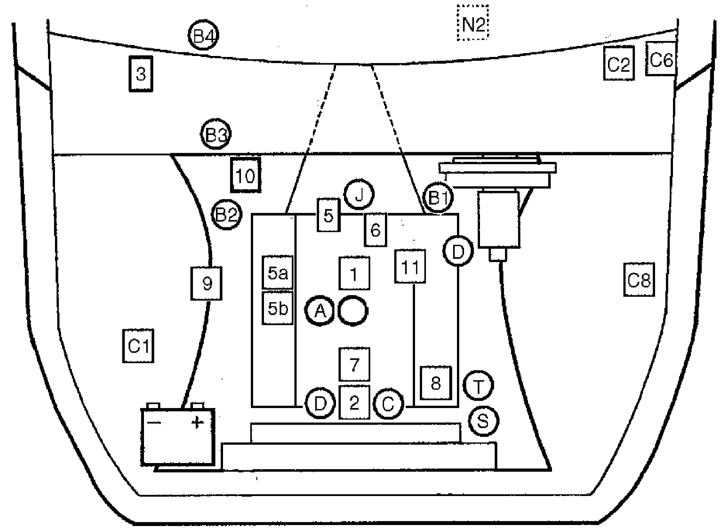

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F. Vehicle Speed Sensor (VSS)
J. Knock Sensor (KS)
T. Intake Air Temperature (IAT) Sensor
S. Mass Air Flow (MAF) Sensor

NOT VCM CONTROLLED
N2. Fuel Tank Vapor Pressure Sensor

97F00112

Fuel Injectors	On top of engine, at intake ports.

COMPUTER HARNESS
C1. Vehicle Control Module (VCM)
C2. Data Link Connector (DLC)
C6. Dash Fuse Block
C8. Fuel Pump Prime Connector

CONTROLLED DEVICES
1. Fuel Injectors
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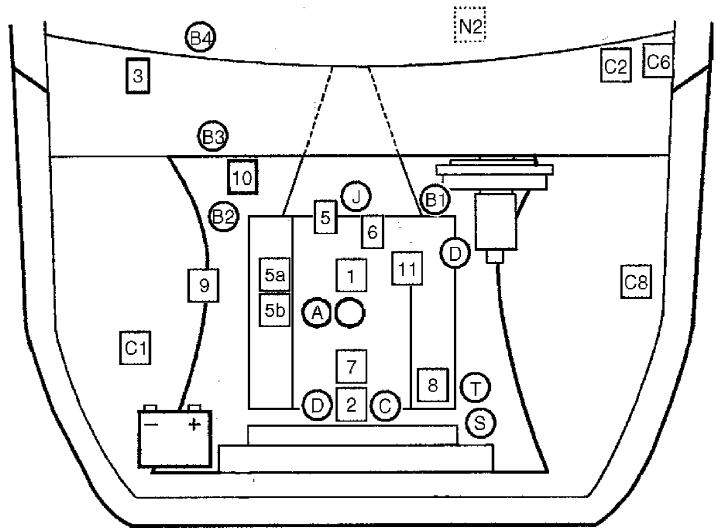

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S. Mass Air Flow (MAF) Sensor

NOT VCM CONTROLLED
N2. Fuel Tank Vapor Pressure Sensor

97F00112

Fuel Pump Prime Connector   On left rear side of engine compartment.

COMPUTER HARNESS
C1. Vehicle Control Module (VCM)
C2. Data Link Connector (DLC)
C6. Dash Fuse Block
C8. Fuel Pump Prime Connector

CONTROLLED DEVICES
1. Fuel Injectors
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3. Fuel Pump Relay
5. Distributor (Camshaft Position Sensor)
5a. Ignition Coil
5b. Electronic Ignition Control Module (Electronic Spark Control)
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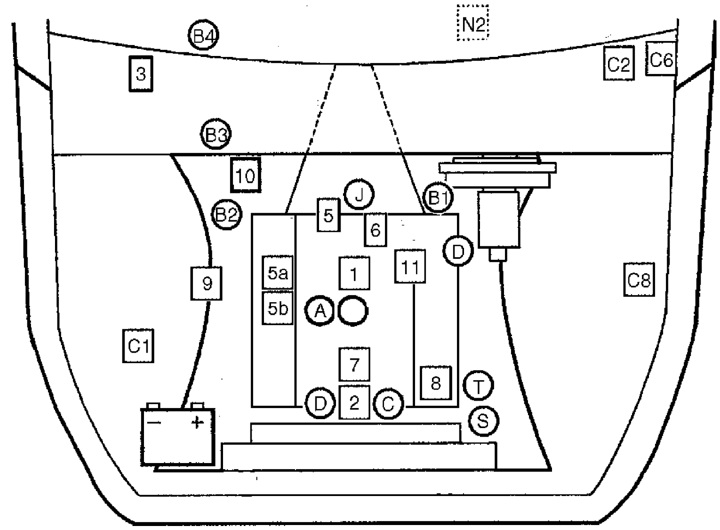

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S. Mass Air Flow (MAF) Sensor

NOT VCM CONTROLLED
N2. Fuel Tank Vapor Pressure Sensor

97F00112

Ignition Coil	On top right side of engine.
Resistor, A/C Request Voltage Drop	In dash harness, near relay center.
Transfer Case Connector (Electric Shift 4WD)	On left side of transfer case.

* ELECTRICAL SYSTEM UNIFORM INSPECTION GUIDELINES *

1997 Chevrolet Blazer

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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KEYLESS ENTRY KEYPADS AND TRANSMITTERS
KEYLESS ENTRY TRANSMITTERS
LEDS
LENSES
MICROPHONES
MIRRORS (ELECTROCHROMATIC AND HEATED)
MOTORS
NEUTRAL SAFETY SWITCHES
ODOMETERS
ODOMETERS, SPEEDOMETERS AND TACHOMETERS (CABLE-DRIVEN)
PULLEYS
RECEIVERS, AMPLIFIERS, EQUALIZERS AND SUB-WOOFER VOLUME CONTROLS
RELAY BOXES
RELAYS
SEALED BEAMS
SEAT HEATERS
SECURITY ALARM SENSORS
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SPEEDOMETERS
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SWITCHES
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TAPE PLAYERS AND CD PLAYERS
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TRANSCEIVERS
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VACUUM ACCUMULATORS (RESERVOIRS)
VACUUM RESERVOIRS
VOLTAGE REGULATORS
WASHER FLUID LEVEL SENDERS
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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.

Condition	Code	Procedure
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.

TRANSCEIVERS

TRANSCEIVER 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.

Condition	Code	Procedure
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

1997 Chevrolet Blazer

GENERAL INFORMATION
Electrostatic Discharge (ESD) Warning - Basic Information

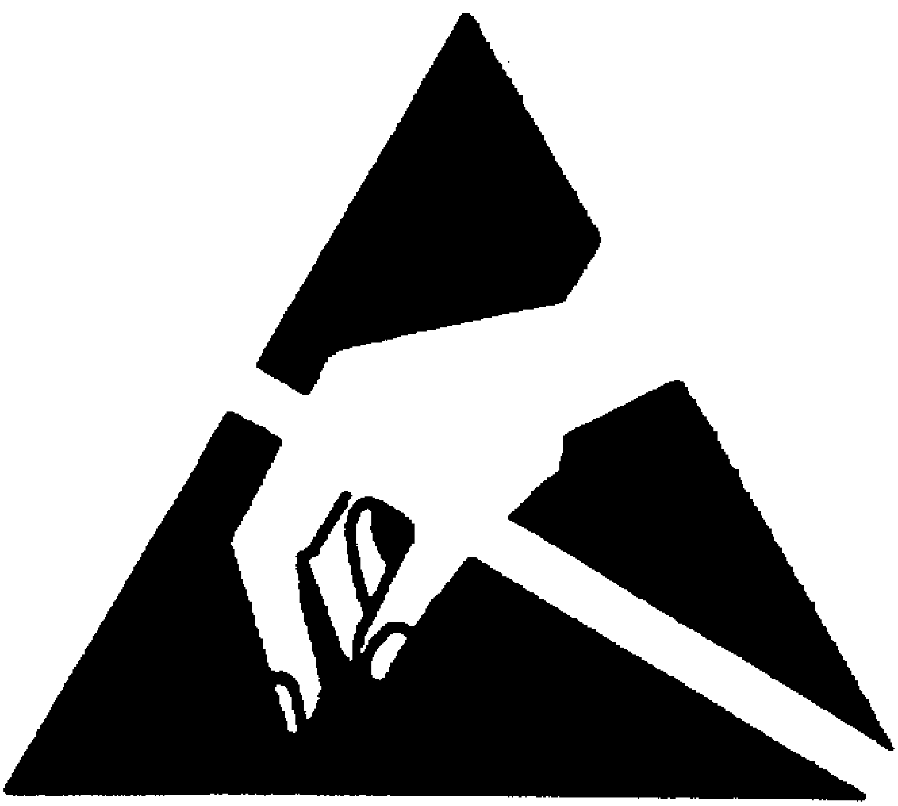
All Makes amd Models

* PLEASE READ THIS FIRST *

NOTE: This article is intended for general information purposes only.

INTRODUCTION

All Electrostatic Discharge (ESD) sensitive components contain solid state circuits (transistors, diodes, semiconductors) that may become damaged when contacted with an electrostatic charge. The following information applies to all ESD sensitive devices. The ESD symbol shown in Fig. 1 may be used on schematics to indicate which components are ESD sensitive. See Fig. 1. Although different manufactures may display different symbols to represent ESD sensitive devices, the handling and measuring precautions and procedures are the same.



50I12680

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.

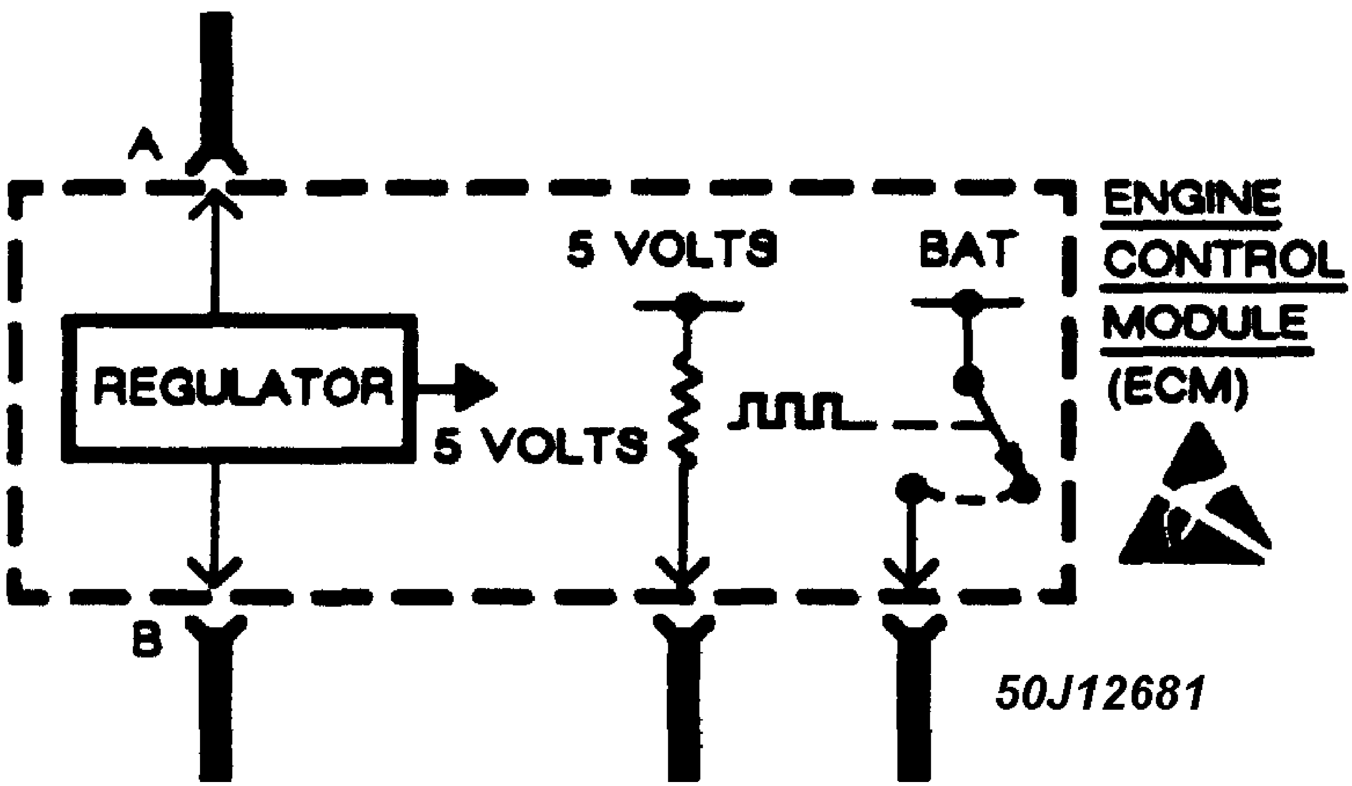


Fig. 2: Sample Schematic Showing Typical ESD Sensitive Device

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.

1997 ENGINE PERFORMANCE
General Motors Corp. - Emission Applications

All Models Trucks & Vans

EMISSION APPLICATIONS

EMISSION APPLICATIONS TABLE

Engine & Fuel System	Emission Control Systems & Devices
Light Duty Emissions (1)	
2.2L (151") 4-Cyl. SFI	
Major Control Systems/Devices	PCV, ACL, (2) EVAP, TWC, FR, EGR, SPK, HO2S, O2S, CEC, MIL
Components/Other Related Devices	EVAP-VC, EVAP-TPCV, EGR-CS, SPK-EST
3.4L (208") V6 SFI	
Major Control Systems/Devices	PCV, ACL, (2) EVAP, TWC+OC, FR, EGR, SPK, (3) HO2S, CEC, MIL
Components/Other Related Devices	EVAP-VC, EVAP-CPCS, EVAP-TPCV, SPK-EST, SPK-ESC
4.3L (262") V6 CSI	
Major Control Systems/Devices	PCV, (2) EVAP, TWC, FR, (4) EGR, SPK, (5) HO2S, CEC, MIL
Components/Other Related Devices	(6) EVAP-CPCS, SPK-ESC, SPK-EST
5.0L (305") V8 CSI	
Major Control Systems/Devices	PCV, ACL, (2) EVAP, (3) TWC, FR, (4) EGR, SPK, (5) HO2S, CEC, MIL
Components/Other Related Devices	EVAP-CPCS, EGR-EVRV, SPK-EST, SPK-ESC
5.7L (350") V8 CSI	
Major Control Systems/Devices	PCV, ACL, (2) EVAP, (3) TWC, FR, (4) EGR, SPK, (5) HO2S, CEC, MIL
Components/Other Related Devices	EVAP-CPCS, EGR-EVRV, SPK-EST, SPK-ESC
6.5L (396") V8 Diesel (Turbo)	
Major Control Systems/Devices	PCV, EGR, CEC, STS, MIL
Components/Other Related Devices	CD-REGVLV, EGR-CS, EGR-EVRV
6.5L (396") V8 Diesel	
Major Control Systems/Devices	PCV, EGR, CEC, STS, MIL
Components/Other Related Devices	CD-REGVLV, EGR-CS, EGR-EVRV
7.4L (454") V8 CSI	
Major Control Systems/Devices	PCV, ACL, (2) EVAP, OC, FR, EGR, SPK, (6) AP, (5) HO2S, CEC, MIL
Components/Other Related Devices	EVAP-CPCS, SPK-EST, SPK-ESC
Heavy Duty Emissions (7)	
4.3L (262") V6 CSI	
Major Control Systems/Devices	PCV, ACL, (2) EVAP, OC, FR, (4) EGR, SPK, (5) HO2S, CEC, MIL
Components/Other Related Devices	EVAP-CPCS, EGR-CS, SPK-EST
5.7L (350") V8 CSI	
Major Control Systems/Devices	PCV, ACL, (2) EVAP, (3) OC, FR, EGR, SPK, (5) HO2S, CEC, MIL
Components/Other Related Devices	EVAP-CPCS, EGR-CS, SPK-EST

6.5L (396") V8 Diesel (Turbo)	
Major Control Systems/Devices	PCV, EGR, CEC, STS, MIL
Components/Other Related Devices	CD-REGVLV, EGR-CS, EGR-EVRV
6.5L (396") V8 Diesel	
Major Control Systems/Devices	PCV, EGR, CEC, STS, MIL
Components/Other Related Devices	CD-REGVLV, EGR-CS, EGR-EVRV
7.4L (454") V8 CSI	
Major Control Systems/Devices	PCV, ACL, (2) EVAP, (3) OC, FR, EGR, SPK, (3) HO2S, CEC, MIL
Components/Other Related Devices	EVAP-CPCS, SPK-EST

(1) - Vehicles up to 8500 GVW.
(2) - Vapor canister type.
(3) - Equipped with 2.
(4) - Linear EGR Valve.
(5) - Equipped with 4.
(6) - California only.
(7) - Vehicles over 8500 GVW.

ABBREVIATION DEFINITIONS

ABBREVIATION DEFINITIONS TABLE

Abbreviation	Definition
ACL	Air Cleaner (Thermostatic Air Cleaner)
AP	Air Pump Injection System
CD-REGVLV	Crankcase Depression Regulator Valve
CEC	Computerized Engine Controls
CSI	Central Sequential Injection
EGR	Exhaust Gas Recirculation
EGR-CS	EGR Control Solenoid
EGR-EVRV	EGR Electronic Vacuum Regulator Valve
EVAP	Evaporative Emission Control
EVAP-CPCS	EVAP Canister Purge Control Solenoid
EVAP-TPCV	EVAP Tank Pressure Control Valve
EVAP-VC	EVAP Vapor Canister
FR	Fill Pipe Restrictor
MIL	Malfunction Indicator Light
OC	Oxidation Catalytic Converter
HO2S	Heated Oxygen Sensor
O2S	Oxygen Sensor
PCV	Positive Crankcase Ventilation
SFI	Sequential Multiport Fuel Injection
SPK	Spark Controls
SPK-ESC	SPK Electronic Spark Control
SPK-EST	SPK Electronic Spark Timing
STS	Service Throttle Soon Light
TWC	Three-Way Catalytic Converter
TWC + OC	Three Way + Oxidation Catalytic Converter

ENGINE COOLING FAN

1997 Chevrolet Blazer

1997 ENGINE COOLING
General Motors Corp. - Electric Cooling Fan

All Truck/Van Models

MODEL IDENTIFICATION

MODEL IDENTIFICATION TABLE

Series (1)	Model
"C"	2WD Pickup, Sierra, Suburban, Tahoe & Yukon
"K"	4WD Pickup, Sierra, Suburban, Tahoe & Yukon
"L"	AWD Astro & Safari
"M"	2WD Astro & Safari
"P"	Commercial Van/Motorhome
"S"	2WD Blazer, Jimmy, Pickup & Sonoma
"T"	4WD Blazer, Jimmy, Pickup & Sonoma
"T"	AWD Bravada
"U"	Silhouette, Trans Sport & Venture

(1) - Vehicle series is fifth character of VIN.

DESCRIPTION

All FWD and some RWD vehicles use an electric cooling fan. The electric cooling fan is used for radiator and A/C condenser cooling. Cooling fan operates when A/C is on and when engine coolant temperature exceeds a specific value. One or more cooling fan relays may be used.

TROUBLE SHOOTING

PRELIMINARY INFORMATION

This article contains only the text required to test electric cooling fans. Other diagnostic information may be referenced while performing electric cooling fan diagnosis. See appropriate G - TESTS W/CODES article in ENGINE PERFORMANCE section for complete information on engine control systems.

Some truck models are equipped with an auxiliary electric cooling fan. The auxiliary electric cooling fan is not controlled by Powertrain Control Module (PCM).

Trouble shoot cooling fan using appropriate diagnostic information provided. For cooling fan relay location, see COOLING FAN RELAY LOCATION table.

COOLING FAN RELAY LOCATION TABLE

Application	Location
"C" & "K" Series	(1) In Engine Compartment Fuse/Relay Block, Near Anti-Lock Brake Control Module
"P" Series	
Diesel	Under Battery Junction Block, On Engine Bulkhead Relay Bracket
Gasoline	At Main Support Bracket,

"U" Series	Behind Steering Column Inside Electrical Center, At Right Front Of Engine Compartment

(1) - See Fig. 1.

To help save diagnostic time, ALWAYS check for blown fuses or fusible links before proceeding with any testing. If fuses are blown, locate and repair short circuit before replacing fuses. Ensure all related relay and wire harness connections are clean and tight. Repair as necessary. See WIRING DIAGRAMS for component, terminal and wire color identification.

WARNING: Vehicles may be equipped with a PCM/VCM using an Electronically Erasable Programmable Read Only Memory (EEPROM). When replacing PCM/VCM, the new PCM/VCM must be programmed.

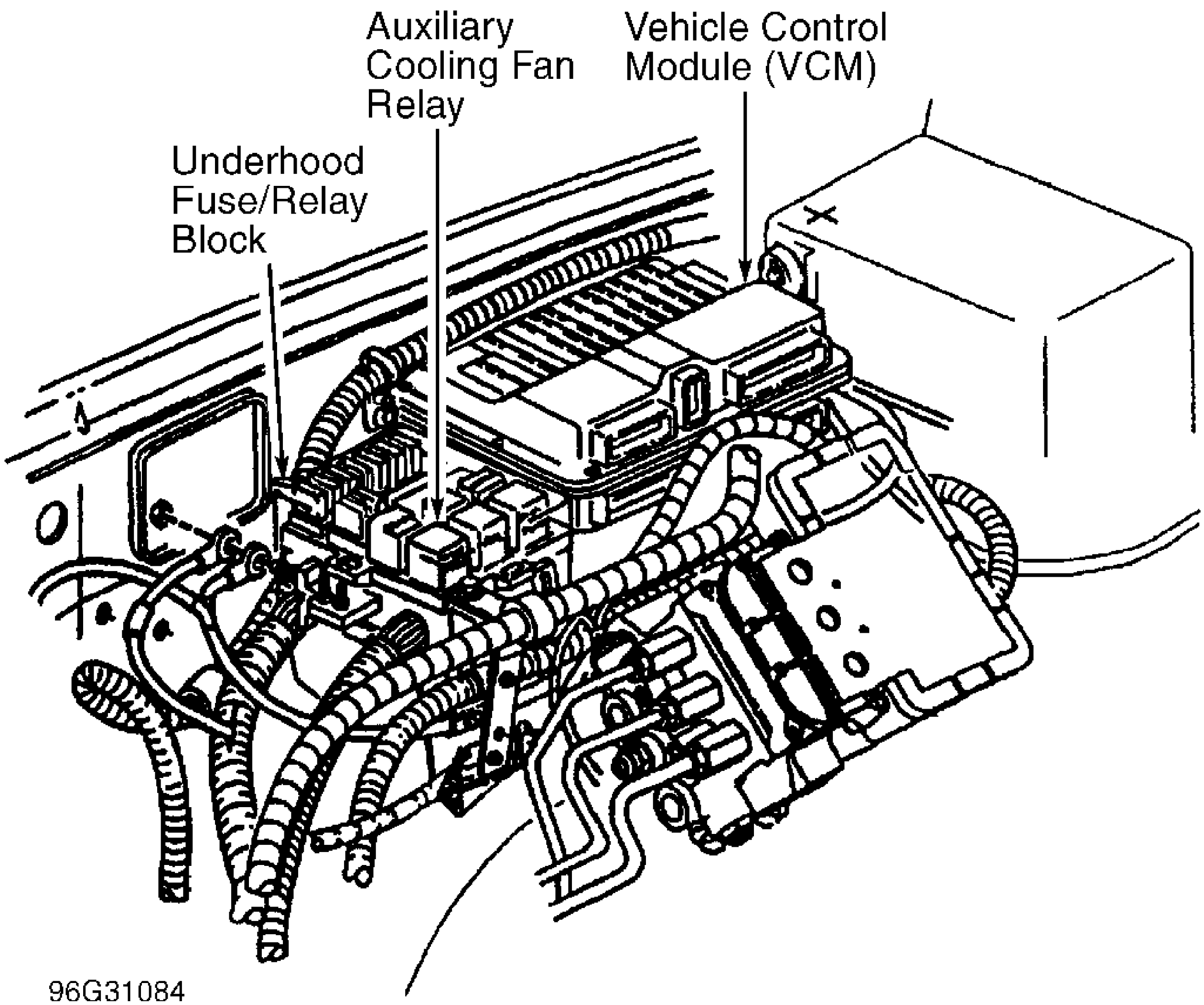


Fig. 1: Auxiliary Cooling Fan Relay Location ("C" & "K" Series)
Courtesy of General Motors Corp.

SCAN TOOL

A variety of information is transmitted through Data Link Connector (DLC). This data is transmitted at a high frequency which requires the use of Tech 1 Scan Tool (94-00101A), appropriate cartridge kit and vehicle interface module kit. Other types of scan tools are available and may function and provide adequate information for diagnostic work. Always refer to scan tool manufacturer's instructions.

ELECTRIC COOLING FAN CIRCUIT DIAGNOSIS

3.4L ("U" SERIES)

NOTE: Cooling fan circuit utilizes 3 cooling fan relays. Relays directly controlling fan motors are 4-pin type and are referred to as No. 1 and No. 2. Relay determining cooling fan motor low speed or high speed operation is referred to as 5-pin relay in this test. See WIRING DIAGRAMS.

Description

Power for cooling fan motors is supplied through COOL FAN 1 Maxi-fuse (30-amp) and COOL FAN 2 Maxi-fuse (30-amp) in underhood electrical center. Cooling fan relays are energized when current flows from Maxi-fuses through relay coils, then to ground through Powertrain Control Module (PCM). No. 1 cooling fan relay control circuit is grounded for low speed operation. Both fan control circuits and all 3 relays are grounded for high speed fan operation.

During low speed cooling fan operation, PCM supplies a ground path for No. 1 cooling fan relay. As a result, relay contacts close, allowing current to flow from COOL FAN 1 Maxi-fuse through relay coil to cooling fan No. 1 (left side). During low speed cooling fan operation, ground path for cooling fan No. 1 is through cooling fan relay (5-pin) and cooling fan motor No. 2 (right side). This results in a series circuit with both fans operating at low speed.

During high speed cooling fan operation, PCM supplies 2 ground paths for all 3 cooling fan relays. As a result, relay contacts close in all relays, allowing both cooling fan motors to operate at high speed. Both cooling fans are supplied current from both COOL FAN Maxi-fuses. Each cooling fan motor has a separate ground path when operating in high speed mode.

Cooling Fan Circuit Diagnosis

1) If Powertrain On-Board Diagnostic (OBD) System Check has not been performed, see appropriate G - TESTS W/CODES article in ENGINE PERFORMANCE section. If OBD SYSTEM CHECK has been performed, go to next step.

2) Check for PCM Diagnostic Trouble Codes (DTCs). If any DTCs are present, perform testing for applicable DTC. Repair all DTCs that are set before proceeding with testing. See appropriate G - TESTS W/CODES article in ENGINE PERFORMANCE section. If no DTCs are present, go to next step.

3) Ensure engine coolant temperature is less than 212°F (100°C). Turn A/C off. Turn ignition on. If cooling fans go off, go to next step. If cooling fans do not go off, go to step 32).

4) Using scan tool, select RELAY CONTROL function. Command low speed fans on. If cooling fans operate at low speed, go to next step. If cooling fans do not operate as specified, go to step 8).

5) Command high speed fans on. Wait 6 seconds. If cooling fans operate at high speed, go to next step. If cooling fans do not operate as specified, go to step 58).

NOTE: Ensure ambient temperature is greater than 48°F (9°C) before proceeding.

6) Exit scan tool OUTPUT TESTS. Start engine. Turn A/C on. If cooling fans come on, go to DIAGNOSTIC AIDS. If cooling fans do not come on, go to next step.

7) Using scan tool, view A/C REQUEST display. If YES is displayed, go to step 77). If YES is not displayed, go to appropriate A/C CLUTCH CIRCUIT DIAGNOSIS TEST in A/C COMPRESSOR CLUTCH CONTROLS article.

8) If either cooling fan is running, go to next step. If neither cooling fan runs, go to step 16).

9) If cooling fan No. 1 runs, go to next step. If cooling fan No. 1 does not run, go to step 14).

10) Turn ignition off. Disconnect cooling fan No. 2 harness connector. Turn ignition on. Using scan tool, select RELAY CONTROL function. Command low speed fans on. If cooling fan No. 1 runs, go to next step. If cooling fan No. 1 does not run, go to step 80).

11) Remove cooling fan relay (5-pin) from underhood electrical center. If cooling fan No. 1 runs, go to next step. If cooling fan No. 1 does not run, go to step 13).

12) Locate and repair short to ground in circuit No. 532 (Gray wire). After repairs, go to step 81).

13) Check circuit No. 409, and/or circuit No. 473 for a short to ground. Repair as necessary and go to step 81). If no problem was found, go to step 70).

14) Turn ignition off. Disconnect cooling fan No. 1 harness connector. Turn ignition on. Using scan tool, select RELAY CONTROL function. Command low speed fans on. If cooling fan No. 2 runs, go to next step. If cooling fan No. 2 does not run, go to step 71).

15) Replace cooling fan No. 1 diode. After replacing cooling fan diode, go to step 81).

16) Turn ignition on. Remove No. 1 cooling fan relay from underhood electrical center. Using a test light connected to ground, probe No. 1 cooling fan relay cavity No. 87. If test light illuminates, go to step 18). If test light does not illuminate, go to next step.

17) Check for blown Maxi-fuse that supplies power to No. 1 cooling fan relay. If fuse is blown, locate and repair short circuit. Possible causes for short circuit are:

* Seized cooling fan motors.
* Shorted cooling fan motor windings.
* Short to ground in circuit No. 504.
* Short to ground in power feed circuit between fuse and No. 1 cooling fan relay.

If fuse is not blown, check for an open in power feed circuit between fuse and No. 1 cooling fan relay. Repair as necessary. After repairs, go to step 81).

18) Using a test light connected to ground, probe No. 1 cooling fan relay cavity No. 86. If test light illuminates, go to step 20). If test light does not illuminate, go to next step.

19) Check for blown Maxi-fuse that supplies power to No. 1 cooling fan relay. If fuse is blown, locate and repair short circuit. Possible causes for short circuit are:

* Seized cooling fan motors.
* Shorted cooling fan motor windings.
* Short to ground in circuit No. 504.
* Shorted relay coil in cooling fan relay.
* Short to ground in power feed circuit between fuse and No. 1 cooling fan relay.

If fuse is not blown, check for an open in power feed circuit between fuse and No. 1 cooling fan relay. Repair as necessary. After repairs, go to step 81).

20) Turn ignition off. Disconnect both cooling fan harness connectors. Using fused jumper wires, jumper terminals "A" and "B" together at both harness connectors. Turn ignition on. Connect a test light between No. 1 cooling fan relay cavities No. 30 and 87. If test light illuminates, go to next step. If test light does not illuminate, go to step 27).

21) Connect a test light between No. 1 cooling fan relay cavities No. 85 and 86. Turn ignition on. Using scan tool, select RELAY CONTROL function. Command low speed fans on. If test light illuminates, go to next step. If test light does not illuminate, go to step 25).

22) Turn ignition off. Remove jumper wires and reconnect cooling fan harness connectors. Connect a fused jumper wire between No. 1 cooling fan relay cavities No. 30 and 87. Turn ignition on. If both cooling fans run, go to next step. If not, go to step 24).

23) Check for poor connections at No. 1 cooling fan relay in underhood electrical center. Repair as necessary. After repairs, go to step 81). If no problem was found, go to step 37).

24) Check for poor connections at both cooling fan motors. Repair as necessary. After repairs, go to step 81). If no problem was found, go to step 63).

25) Turn ignition off. Disconnect PCM harness connector C1. Install a fused jumper wire between No. 1 cooling fan relay cavities No. 85 and 86. Turn ignition on. Using a test light connected to ground, probe PCM harness connector C1, terminal No. 32 (Dark Green wire). If test light illuminates, go to step 77). If test light does not illuminate, go to next step.

26) Locate and repair open in circuit No. 335 (Dark Green wire) between No. 1 cooling fan relay and PCM harness connector C1, terminal No. 32. After repairs, go to step 81).

27) Turn ignition off. Remove jumper wires and reconnect cooling fan harness connectors. Connect a fused jumper wire between No. 1 cooling fan relay cavities No. 30 and 87. Remove cooling fan relay (5-pin) from underhood electrical center. Using a test light connected to ground, probe cooling fan relay (5-pin) cavity No. 30. If test light illuminates, go to next step. If test light does not illuminate, go to step 31).

28) Connect a test light between cooling fan relay (5-pin) cavities No. 30 and 87A. If test light illuminates, go to step 30). If test light does not illuminate, go to next step.

29) Check for open in circuit No. 409 between cooling fan relay (5-pin) cavity No. 87A and harness connector terminal "B" at cooling fan motor No. 2. Repair as necessary. After repairs, go to step 81). If no problem was found, go to step 57).

30) Check for poor connections at cooling fan relay (5-pin) cavitiesNo. 30 and 87A in underhood electrical center. Repair as necessary. After repairs, go to step 81). If no problem was found, go to step 76).

31) Check for an open in circuit No. 504 between No. 1 cooling fan relay cavity No. 30 and harness connector terminal "B" at cooling fan motor No. 1. Repair as necessary. After repairs, go to step 81). If no problem was found, go to step 56).

32) Using scan tool, view A/C REQUEST. If YES is displayed, go to appropriate A/C CLUTCH CIRCUIT DIAGNOSIS TEST in A/C COMPRESSOR CLUTCH CONTROLS article. If YES is not displayed, go to next step.

33) If both cooling fans are operating at low speed, go to next step. If both cooling fans do not operate at low speed, go to step 40).

34) Remove No. 1 cooling fan relay from underhood electrical center. If both cooling fans run, go to next step. If both cooling

fans do not run, go to step 36).

35) Locate and repair short to power in circuit No. 504 (White wire). After repairs, go to step 81).

36) Using a test light connected to battery positive, probe No. 1 cooling fan relay cavity No. 85. If test light illuminates, go to step 38). If test light does not illuminate, go to next step.

37) Replace No. 1 cooling fan relay. After replacing cooling fan relay, go to step 81).

38) Turn ignition off. Disconnect PCM harness connector C1. Using a test light connected to battery positive, probe No. 1 cooling fan relay cavity No. 85. If test light come on, go to next step. If test light does not illuminate, go to step 77).

39) Locate and repair short to ground in circuit No. 335 (Dark Green wire) between No. 1 cooling fan relay and PCM harness connector C1, terminal No. 32. After repairs, go to step 81).

40) If both cooling fans operate at high speed, go to next step. If both cooling fans do not operate at high speed, go to step 42).

41) Using scan tool, view A/C PRESSURE on display. If reading is less than 1.2 volts, go to step 77). If reading is 1.2 volts or greater, go tostep 44).

42) Turn ignition off. Disconnect PCM harness connector C1. Turn ignition on. If cooling fan No. 2 operates at high speed, go to next step. If cooling fan No. 2 does not operate at high speed, go to step 77).

43) Check for a short to ground in circuit No. 473 to cooling fan relay (5-pin) and relay No. 2 control circuit (Dark Blue wire). Repair as necessary. After repairs, go to step 81). If no problem was found, go to step 52).

44) Turn ignition off. Disconnect A/C pressure sensor harness connector. Turn ignition on. Using scan tool, view A/C PRESSURE on display. If reading is near zero volts, go to step 46). If reading is not as specified, go to next step.

45) Using a voltmeter, check voltage between A/C pressure sensor signal and ground circuits. If reading is near zero volts, go to step 77). If reading is not as specified, go to step 51).

46) Using a test light connected to battery positive, probe A/C pressure sensor ground circuit. If test light illuminates, go to next step. If test light does not illuminate, go to step 49).

47) Using a voltmeter, check voltage between A/C pressure sensor 5-volt reference and sensor ground. If reading is near 5 volts, go to next step. If reading is not as specified, go to step 50).

48) Replace A/C pressure sensor. After replacing pressure sensor, go to step 81).

49) Locate and repair open or short to power in A/C pressure sensor ground circuit. After repairs, go to step 81).

50) Locate and repair open or short to ground in A/C pressure sensor 5-volt reference circuit. After repairs, go to step 81).

51) Locate and repair short to power in A/C pressure sensor signal circuit. After repairs, go to step 81).

52) Remove No. 2 cooling fan relay from underhood electrical center. If cooling fan No. 2 operates at high speed, go to next step. If cooling fan No. 2 does not operate at high speed, go to step 70).

53) Remove cooling fan relay (5-pin) from underhood electrical center. If cooling fan No. 2 operates at high speed, go to next step. If cooling fan No. 2 does not operate at high speed, go to step 55).

54) Locate and repair short to power in circuit No. 409 (Light Blue wire) between No. 2 cooling fan relay and cooling fan motor No. 2. After repairs, go to step 81).

55) Locate and repair short to power in circuit No. 532 (Dark Blue wire) between cooling fan relay (5-pin) and cooling fan motor No. 1. After repairs, go to step 81).

56) Check for an open in circuit No. 532 (Dark Blue wire) between cooling fan relay (5-pin) cavity No. 30 and terminal "A" of cooling fan motor No. 1 harness connector. Repair as necessary. After repairs, go to step 81). If no problem was found, go to step 79).

57) Check for an open in circuit No. 1050 (Black wire) between cooling fan motor No. 2 harness connector terminal "A" and ground. Repair as necessary. After repairs, go to step 81). If no problem was found, go to step 80).

58) Turn ignition on. Remove No. 2 cooling fan relay from underhood electrical center. Connect a test light between No. 2 cooling fan relay cavity No. 86 and battery positive. Using scan tool, select RELAY CONTROL function. Command high speed fans on. Wait 6 seconds. If test light illuminates, go to step 61). If test light does not illuminate, go to next step.

59) Remove cooling fan relay (5-pin) from underhood electrical center. Connect a test light between cooling fan relay (5-pin) cavity No. 86 and battery positive. Using scan tool, select RELAY CONTROL function. Command high speed fans on. Wait 6 seconds. If test light illuminates, go to step 78). If test light does not illuminate, go to next step.

60) Turn ignition off. Disconnect PCM harness connector C1. Check circuit No. 473 (Dark Blue wire) for an open or short to power. Repair as necessary. After repairs, go to step 81). If no problem is found, go to step 77).

61) Turn ignition off. Reinstall No. 2 cooling fan relay. Disconnect both cooling fan motor harness connectors. Turn ignition on. Using scan tool, select RELAY CONTROL function. Command high speed fans on. Wait 6 seconds. Using a test light connected to ground, probe terminal "B" of cooling fan motor No. 2 harness connector. If test light illuminates, go to next step. If test light does not illuminate, go to step 64).

62) Using a test light connected to battery positive, probe terminal "A" of cooling fan motor No. 1 harness connector. If test light illuminates, go to next step. If test light does not illuminate, go to step 71).

63) Check for a seized cooling fan motor or open motor winding. Replace appropriate cooling fan motor. After replacing motor, go to step 81).

64) Turn ignition off. Remove No. 2 cooling fan relay from underhood electrical center. Turn ignition on. Using a test light connected to ground, probe No. 2 cooling fan relay cavity No. 85. If test light illuminates, go to step 66). If test light does not illuminate, go to next step.

65) Locate and repair open in battery voltage circuit to No. 2 cooling fan relay. Check for blown Maxi-fuse (30-amp). Repair short to ground if blown. Replace fuse. After replacing fuse, go to step 81).

66) Using a test light connected to ground, probe No. 2 cooling fan relay cavity No. 30. If test light illuminates, go to step 68). If test light does not illuminate, go to next step.

67) Locate and repair open in battery voltage circuit to No. 2 cooling fan relay cavity No. 30. After repairs, go to step 81).

68) Check for open in circuit No. 409 (Light Blue wire) between cooling fan motor No. 2 harness connector terminal "B" and No. 2 cooling fan relay cavity No. 87. Repair as necessary. After repairs, go to step 81). If no problem was found, go to next step.

69) Check for poor connections at No. 2 cooling fan relay in underhood electrical center. Repair as necessary. After repairs, go to step 81). If no problem was found, go to next step.

70) Replace No. 2 cooling fan relay. After replacing cooling fan relay, go to step 81).

71) Turn ignition off. Remove cooling fan relay (5-pin) from underhood electrical center. Turn ignition on. Using a test light

connected to ground, probe cooling fan relay (5-pin) cavity No. 85. If test light illuminates, go to step 73). If test light does not illuminate, go to next step.

72) Locate and repair open in battery voltage circuit to cooling fan relay (5-pin) cavity No. 85. After repairs, go to step 81).

73) Using a test light connected to battery positive, probe cooling fan relay (5-pin) cavity No. 87. If test light illuminates, go to step 75). If test light does not illuminate, go to next step.

74) Locate and repair open in circuit No. 1050 (Black wire) between cooling fan relay (5-pin) cavity No. 87 and ground. After repairs, go to step 81).

75) Check for poor connections at cooling fan relay (5-pin) in underhood electrical center. Repair as necessary. After repairs, go to step 81). If no problem was found, go to step 76).

76) Replace cooling fan relay (5-pin). After replacing cooling fan relay, go to step 81).

77) Replace PCM. After replacing PCM, go to step 81).

78) Repair open in circuit No. 473 (Dark Blue wire) between PCM harness connector C1, terminal No. 31 and cooling fan relays (5-pin and No. 2) cavity No. 86. After repairs, go to step 81).

79) Replace cooling fan motor No. 1. After replacing cooling fan motor, go to step 81).

80) Replace cooling fan motor No. 2. After replacing motor, go to next step.

81) Ensure coolant temperature is less than 212°F (100°C). Turn A/C off. Start engine and let idle. If cooling fans are running, go to step 32). If cooling fans are not running, go to next step.

82) Using scan tool, select RELAY CONTROL function. Command low speed fans on. If both cooling fans operate at low speed, go to next step. If both cooling fans do not operate at low speed, go to step 8).

83) Command high speed cooling fans on. Wait 6 seconds. If both cooling fans operate at high speed, system is okay at this time. If both cooling fans do not operate at high speed, go to step 58).

Diagnostic Aids

Check for poor connections at PCM, cooling fan relays and cooling fan motors. Inspect harness connectors for damaged, corroded or backed-out terminal pins. Inspect related wiring harnesses for damage or improper routing.

4.3L, 5.0L, 5.7L & 7.4L ("C" & "K" SERIES)

Description

Auxiliary cooling fan is controlled by VCM based on various inputs. Battery voltage is supplied to the auxiliary cooling fan relay. If ignition voltage is supplied to auxiliary fan relay (coil side). VCM controls cooling fan by relay by providing a ground path.

NOTE: Check VCM Diagnostic Trouble Codes (DTCs) that may affect system. If any DTCs are present, perform testing for applicable DTC. Some DTCs may cause auxiliary cooling fan to stay on at all times. Repair all DTCs that are set before proceeding with testing. See appropriate ENGINE PERFORMANCE article.

Cooling Fan Circuit Diagnosis

1) Perform Powertrain On-Board Diagnostic (OBD) Sytem Check. See appropriate G - TESTS W/CODES article in ENGINE PERFORMANCE section. After performing OBM system check, go to next step.

2) Turn ignition on. Using scan tool, check if any Diagnostic Trouble Codes (DTCs) are present. If DTCs are present, perform testing

for applicable DTC. See appropriate G - TESTS W/CODES article in ENGINE PERFORMANCE section. If no DTCs are present, go to next step.

3) Ensure engine coolant temperature is less than 212°F (100°C) when diagnosing cooling fan system. Turn ignition on, with engine off. If cooling fan is off, go to next step. If cooling fan is on, go to step 5).

4) Using scan tool, command cooling fan relay on, then off. If cooling fan turns on and off with each command, system is okay. See DIAGNOSTIC AIDS. If cooling fan does not turn on and off with each command, go to step 6).

5) Disconnect cooling fan relay. If cooling fan stops, go to step 10). If cooling fan does not stop, go to step 16).

6) Turn ignition off. Disconnect cooling fan relay. Turn ignition on. Using a test light connected to ground, probe battery feed circuits at relay harness connector terminals. If test light illuminates on both circuits, go to next step. If not, go to step 19).

7) Connect test light between battery feed circuit and auxiliary fan relay circuit at relay harness connector. Using scan tool, command fan on and then off. If test light turn on and off with each command, go to next step. If not, go to step 11).

8) Turn ignition off. Reconnect cooling fan relay. Disconnect VCM harness connector containing the relay control circuit. Turn ignition on. Using DVOM on 10-amp. scale, check current draw on relay control circuit from VCM harness connector to ground. If current draw is less than 0.75 amp within 2 minutes, go to step 22). If not, go to step 11).

9) Disconnect cooling fan harness connector. Connect test light across cooling fan harness connector terminals. If test light illuminates, go to step 16). If test light does not illuminate, go to next step.

10) Turn ignition off. Disconnect VCM harness connector. Using DVOM, check resistance between ground and cooling fan relay control circuit at VCM harness connector. If resistance is infinite, go to step 24). If not, go to step 20).

11) Connect a fused jumper wire between battery feed circuit and circuit leading to cooling fan motor. If cooling fan operates, go to next step. If not, go to step 15).

12) Turn ignition off. Reconnect cooling fan relay. Disconect VCM harness connector containing the fan relay control circuit. Turn ignition on. Connect a fused jumper wire to ground and probe fan relay control circuit terminal at VCM harness connector. If relay operates, go to step 14). If not, go to next step.

13) Check connections at cooling fan relay connector. Repair as necessary. If connections are okay, go to next step.

14) Check connections at VCM harness connector. Repair as necessary. If connections are okay, go to step 21).

15) Check connections at cooling fan harness connector. Repair as necessary. If connections are okay, go to step 17).

16) Repair short to voltage in power feed circuit between cooling fan relay and fan motor.

17) Check for open in power feed circuit between cooling fan relay and cooling fan motor. Repair as necessary. If circuit is okay, go to next step.

18) Check for open in cooling fan motor ground circuit. Repair as necessary. If circuit is okay, go to step 23).

19) Repair open in battery feed circuit that did not illuminate test light.

20) Check for short to ground in relay control circuit. Repair as necessary. If circuit is okay, go to step 22).

21) Check for open in cooling fan relay control circuit. Repair as necessary. If circuit is okay, go to next step.

22) Replace auxiliary cooling fan relay. If cooling fan still does not operate, go to step 24).

23) Replace auxiliary cooling fan motor.

24) Replace VCM. Program replacement VCM using required equipment.

Diagnostic Aids

Whenever owner complains of an overheating problem, determine if complaint was due to an actual boilover, or TEMP light or gauge indicated overheating. Whenever gauge or light indicates overheating, but no boilover is detected, gauge or light circuit should be checked. Gauge accuracy can also be checked by comparing engine coolant temperature sensor reading with gauge reading.

If engine is actually overheating, and gauge indicates overheating, but cooling fan is not coming on, ECT sensor has probably shifted out of calibration and should be replaced. Whenever engine is overheating, and cooling fan is on, cooling system should be checked.

6.5L - VIN F DIESEL ("P" SERIES W/O AUX FAN CONTROL SWITCH)

Description

With ignition switch in ON position, ENG 1 fuse (20-amp) located in instrument panel fuse block, supplies voltage to coil side of auxiliary cooling fan relay. During A/C compressor operation, A/C high pressure switch closes. This supplies a ground path for cooling fan relay. As a result, relay contacts close, allowing current to flow to cooling fan motor through relay, resulting in auxiliary cooling fan motor operation.

NOTE: A fully charged A/C system is required for proper auxiliary cooling fan operation.

Cooling Fan Circuit Diagnosis

1) If cooling fan does not run, go to next step. If cooling fan runs continuously, go to step 10).

2) Turn ignition off. Remove cooling fan relay. Turn ignition on. Using a test light connected to ground, probe cooling fan relay harness connector terminal No. 30. If test light illuminates, go to next step. If test light does not illuminate, locate and repair open in Red wire between fusible link at battery junction block and cooling fan relay.

3) Using a fused jumper wire, jumper cooling fan relay harness connector terminals No. 30 and 87. If cooling fan motor does not run, go to next step. If cooling fan motor runs, go to step 6).

4) Disconnect cooling fan motor harness connector. Using a test light connected to ground, probe cooling fan motor harness connector terminal "A". If test light illuminates, go to next step. If test light does not illuminate, Locate and repair open in Red wire between cooling fan relay and cooling fan motor.

5) Turn ignition off. Using an ohmmeter, check resistance between cooling fan motor harness connector terminal "B" and ground. If resistance is greater than 5 ohms, locate and repair open or poor connection between cooling fan motor and ground. If resistance is not as specified, replace cooling fan motor.

6) Turn ignition on. Using a test light connected to ground, probe cooling fan relay harness connector terminal No. 85. If test light illuminates, go to next step. If test light does not illuminate, locate and repair open in Pink wire between ENG 1 fuse and cooling fan relay.

7) Turn ignition off. Disconnect A/C high pressure switch. Using an ohmmeter, check resistance between A/C high pressure switch harness connector terminal "A" and cooling fan relay harness connector terminal No. 86. If resistance is less than 5 ohms, go to next step. If resistance is not less than 5 ohms, locate and repair open in Dark Green wire between cooling fan relay and A/C high pressure switch.

8) Check resistance between A/C high pressure switch harness connector terminal "B" and ground. If resistance is less than 5 ohms, go to next step. If resistance is not less than 5 ohms, locate and repair open in Black wire between A/C high pressure switch and splice.

9) Reconnect cooling fan relay. Turn ignition on. Using a fused jumper wire, jumper A/C high pressure switch harness connector terminal "A" to ground. If cooling fan motor runs, replace A/C high pressure switch. If cooling fan motor does not run, replace cooling fan relay.

10) Turn ignition on. Disconnect cooling fan relay from harness connector. If cooling fan motor stops, go to next step. If cooling fan motor continues to operate, locate and repair short to power between cooling fan relay and cooling fan motor.

11) Turn ignition off. Disconnect A/C high pressure switch harness connector. Using an ohmmeter, check resistance between A/C high pressure switch harness connector terminal "A" and ground. If resistance is greater than 5 ohms, go to next step. If not, locate and repair short to ground in Dark Green wire between cooling fan relay and A/C high pressure switch.

12) Reconnect A/C high pressure switch harness connector. Turn ignition on. Using a test light connected to ground, probe cooling fan relay harness connector terminal No. 86. If test light illuminates, replace A/C high pressure switch. If test light does not illuminate, replace cooling fan relay.

6.5L - VIN F DIESEL ("P" SERIES W/AUX FAN CONTROL SWITCH) & 7.4L - VIN J DIESEL ("P" SERIES W/O AUX FAN CONTROL SWITCH)

Description

On models not equipped with Vehicle Control Module (VCM), ENG 1 fuse (20-amp) located in instrument panel fuse block supplies voltage to coil side of auxiliary cooling fan relay with ignition switch in ON position. A ground path for cooling fan relay is supplied by A/C high pressure switch, or auxiliary fan control switch (if equipped). On models equipped with VCM, a ground path for fan control relay is supplied by VCM. As a result, relay contacts close, allowing current to flow to cooling fan motor through relay, resulting in auxiliary cooling fan motor operation.

NOTE: A fully charged A/C system is required for proper auxiliary cooling fan operation.

Cooling Fan Circuit Diagnosis

1) If cooling fan does not operate, or does not operate properly, go to next step. If cooling fan runs continuously with ignition off, go to step 12). If cooling fan runs continuously with ignition on, go to step 13).

2) If cooling fan motor never operates, go to next step. If cooling fan motor does not operate with high coolant temperature, go to step 9). If cooling fan motor does not operate with A/C on, go to step 10).

3) Turn ignition off. Disconnect fan control relay harness connector. Turn ignition on. Using a test light connected to ground, probe fan control relay harness connector terminal No. 30. If test light illuminates, go to next step. If test light does not illuminate, locate and repair open in Red wire between fan control relay and splice near fusible link.

4) Using a fused jumper wire, jumper fan control relay harness connector terminals No. 30 and 87 together. If cooling fan motor runs, go to next step. If cooling fan motor does not run, go to step 6).

5) Disconnect jumper wire. Using a test light connected to ground, probe fan control relay harness connector terminal No. 85. If

test light illuminates, go to step 8). If test light does not illuminate, locate and repair open in Pink wire between ENG 1 fuse and fan control relay.

6) With jumper wire still in place, disconnect cooling fan motor harness connector. Using a test light connected to ground, probe cooling fan motor harness connector terminal "B". If test light illuminates, go to next step. If test light does not illuminate, locate and repair open in Red wire between fan control relay and cooling fan motor.

7) Using a test light connected to battery positive, probe cooling fan motor harness connector terminal "A". If test light illuminates, replace cooling fan motor. If test light does not illuminate, locate and repair open in Black wire between cooling fan motor and ground.

8) Reconnect fan control relay. Using a voltmeter, check voltage (backprobe) between fan control relay harness connector terminal No. 86 and ground. If reading is less than 10 volts, replace fan control relay. If reading is 10 volts or greater, locate and repair open in Dark Green wire between fan control relay and splice.

9) Disconnect auxiliary fan control switch harness connector. Turn ignition on. Using a voltmeter, check voltage between auxiliary fan control switch harness connector terminal "A" and ground. If reading is less than 10 volts, locate and repair open in Dark Green wire between auxiliary fan control switch and splice. If reading is 10 volts or greater, replace auxiliary fan control switch.

10) Disconnect A/C high pressure switch harness connector. Using a voltmeter, check voltage between auxiliary fan control switch harness connector terminal "B" and ground. If reading is 10 volts or greater, go to next step. If reading is less than 10 volts, locate and repair open in Dark Green wire between A/C high pressure fan switch and splice.

11) Using a test light connected to battery positive, probe A/C high pressure switch harness connector terminal "A". If test light illuminates, replace A/C high pressure fan switch. If test light does not illuminate, locate and repair open in Black wire between A/C high pressure switch harness connector terminal "A" and splice.

12) With ignition on, disconnect fan control relay harness connector. If cooling fan motor stops, replace fan control relay. If cooling fan motor continues to run, locate and repair short to power in Red wire between fan control relay and cooling fan motor.

13) Turn ignition off. Disconnect fan control relay harness connector. Using a test light connected to battery positive, probe cooling fan relay harness connector terminal No. 86. If test light illuminates, go to next step. If test light does not illuminate, replace fan control relay.

14) With test light still connected, disconnect auxiliary fan control switch harness connector. If test light remains on, go to next step. If test light does not remain on, replace auxiliary fan control switch.

15) With test light still connected, disconnect A/C high pressure fan switch harness connector. If test light remains on, locate and repair short to ground in Dark Green wire between fan control relay and either A/C high pressure fan switch or auxiliary fan control switch.

WIRING DIAGRAMS

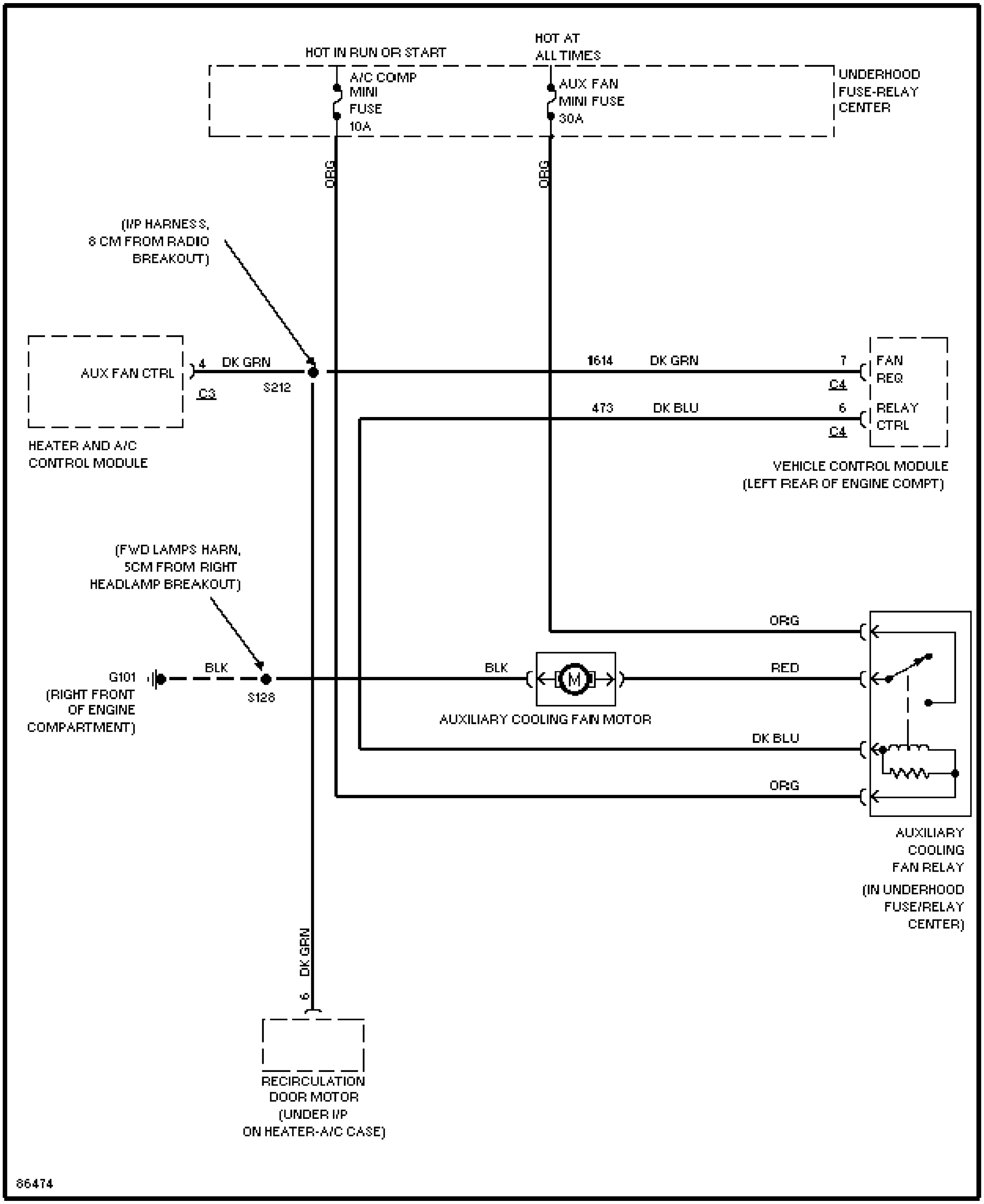


Fig. 2: Cooling Fan System Wiring Diagram ("C" & "K" Series)

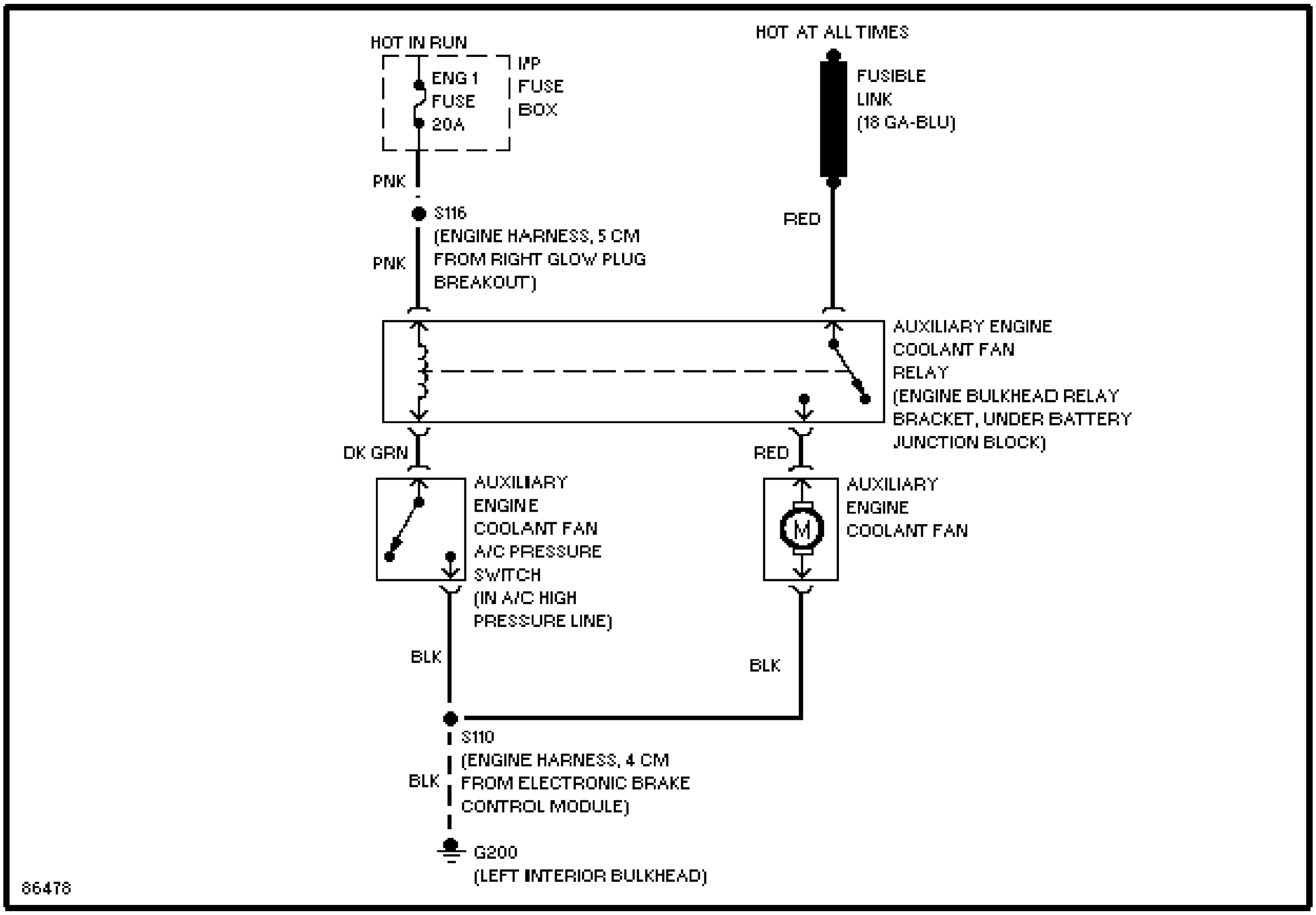


Fig. 3: Cooling Fan System Wiring Diagram ("P" Series - 6.5L VIN Y Diesel Engine)

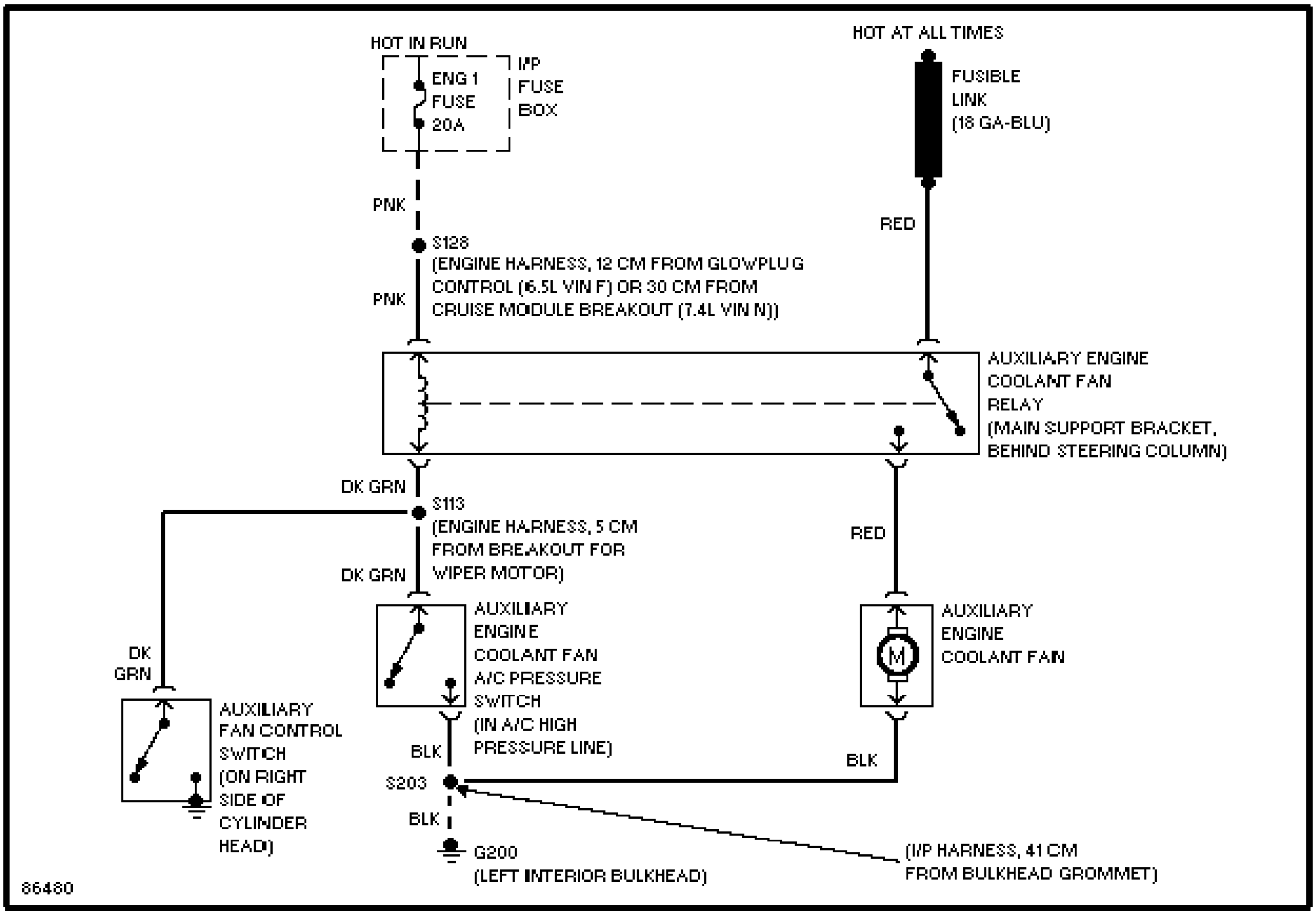


Fig. 4: Cooling Fan System Wiring Diagram ("P" Series 6.5L VIN F Diesel Engine - & 7.4L VIN N Engine)

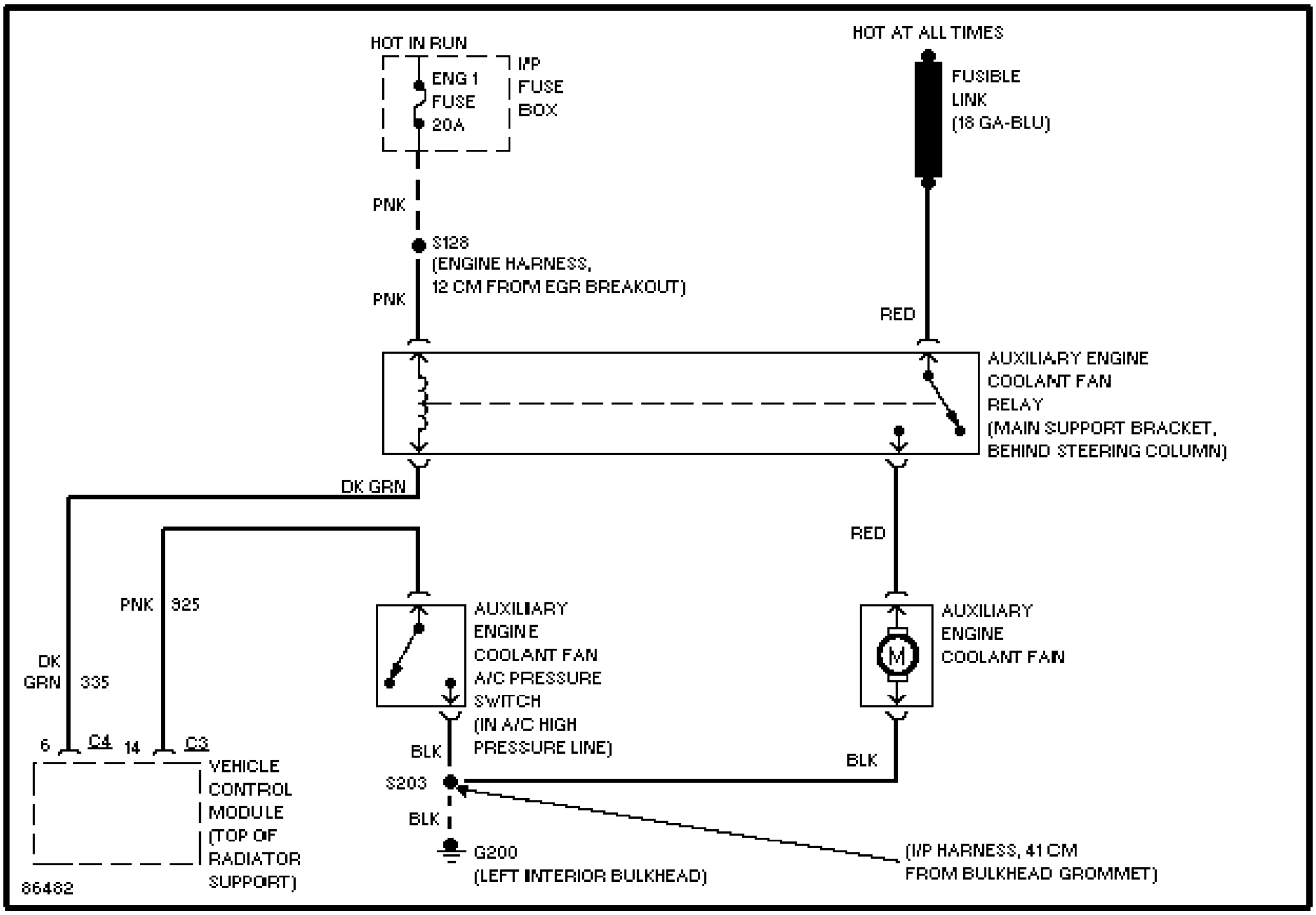


Fig. 5: Cooling Fan System Wiring Diagram ("P" Series - 7.4L VIN J Engine)

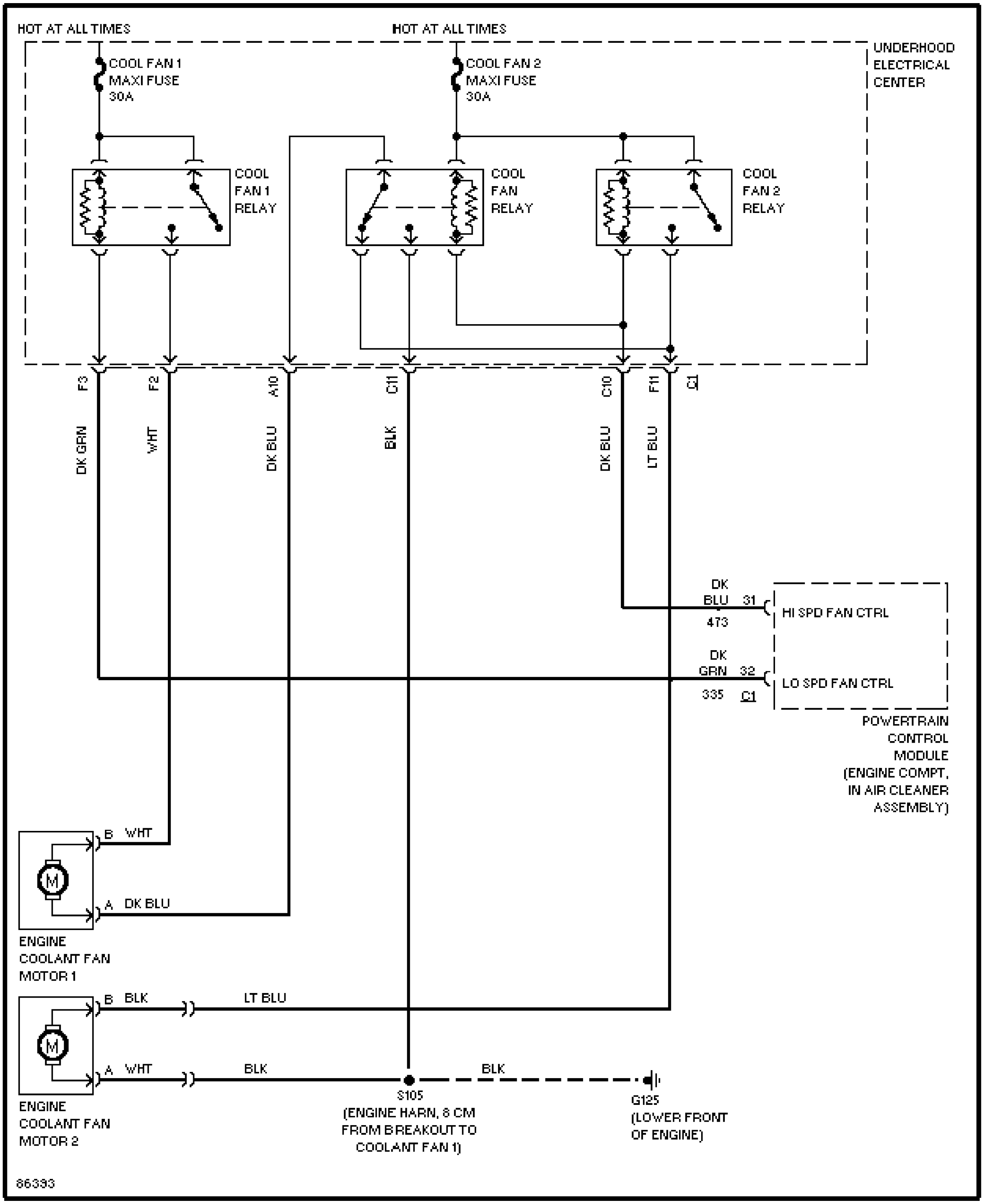


Fig. 6: Cooling Fan System Wiring Diagram ("U" Series)

ENGINE OVERHAUL PROCEDURES - GENERAL INFORMATION

1997 Chevrolet Blazer

Engine Overhaul Procedures - General Information
ALL PISTON ENGINES

* PLEASE READ THIS FIRST *

Examples used in this article are general in nature and do not necessarily relate to a specific engine or system. Illustrations and procedures have been chosen to guide mechanic through engine overhaul process. Descriptions of processes of cleaning, inspection, assembly and machine shop practice are included.

Always refer to appropriate engine overhaul article in the ENGINES section for complete overhaul procedures and specifications for the vehicle being repaired.

ENGINE IDENTIFICATION

The engine may be identified from its Vehicle Identification Number (VIN) stamped on a metal tab. Metal tab may be located in different locations depending on manufacturer. Engine identification number or serial number is located on cylinder block. Location varies with manufacturer.

INSPECTION PROCEDURES

* PLEASE READ THIS FIRST *

NOTE: Always refer to appropriate engine overhaul article in the ENGINES section for complete overhaul procedures and specifications for the vehicle being repaired.

GENERAL

Engine components must be inspected to meet manufacturer's specifications and tolerances during overhaul. Proper dimensions and tolerances must be met to obtain proper performance and maximum engine life.

Micrometers, depth gauges and dial indicator are used for checking tolerances during engine overhaul. Magnaflux, Magnaglo, dye-check, ultrasonic and x-ray inspection procedures are used for parts inspection.

MAGNETIC PARTICLE INSPECTION

Magnaflux & Magnaglo

Magnaflux is an inspection technique used to locate material flaws and stress cracks. The part in question is subjected to a strong magnetic field. The entire part, or a localized area, can be magnetized. The part is coated with either a wet or dry material that contains fine magnetic particles.

Cracks which are outlined by the particles cause an interruption in the magnetic field. The dry powder method of Magnaflux can be used in normal light. A crack will appear as an obvious bright line.

Fluorescent liquid is used in conjunction with a blacklight in a second Magnaflux system called Magnaglo. This type of inspection demands a darkened room. The crack will appear as a glowing line in this process. Both systems require complete demagnetizing upon completion of the inspection. Magnetic particle inspection applies to ferrous materials only.

PENETRANT INSPECTION

Zyglo

The Zyglo process coats the material with a fluorescent dye penetrant. The part is often warmed to expand cracks that will be penetrated by the dye. When the coated part is subjected to inspection with a blacklight, a crack will glow brightly. Developing solution is often used to enhance results. Parts made of any material, such as aluminum cylinder heads or plastics, may be tested using this process.

Dye Check

Penetrating dye is sprayed on the previously cleaned component. Dye is left on component for 5-45 minutes, depending upon material density. Component is then wiped clean and sprayed with a developing solution. Surface cracks will show up as a bright line.

ULTRASONIC INSPECTION

If an expensive part is suspected of internal cracking, Ultrasonic testing is used. Sound waves are used for component inspection.

X-RAY INSPECTION

This form of inspection is used on highly stressed components. X-ray inspection maybe used to detect internal and external flaws in any material.

PRESSURE TESTING

Cylinder heads can be tested for cracks using a pressure tester. Pressure testing is performed by plugging all but one of the holes in the head and injecting air or water into the open passage. Leaks are indicated by the appearance of wet or damp areas when using water. When air is used, it is necessary to spray the head surface with a soap solution. Bubbles will indicate a leak. Cylinder head may also be submerged in water heated to specified temperature to check for cracks created during heat expansion.

CLEANING PROCEDURES

* PLEASE READ THIS FIRST *

NOTE: Always refer to appropriate engine overhaul article in the ENGINES section for complete overhaul procedures and specifications for the vehicle being repaired.

GENERAL

All components of an engine do not have the same cleaning requirements. Physical methods include bead blasting and manual removal. Chemical methods include solvent blast, solvent tank, hot tank, cold tank and steam cleaning of components.

BEAD BLASTING

Manual removal of deposits may be required prior to bead blasting, followed by some other cleaning method. Carbon, paint and rust may be removed using bead blasting method. Components must be free of oil and grease prior to bead blasting. Beads will stick to grease or oil soaked areas causing area not to be cleaned.

Use air pressure to remove all trapped residual beads from components after cleaning. After cleaning internal engine parts made of aluminum, wash thoroughly with hot soapy water. Component must be thoroughly cleaned as glass beads will enter engine oil resulting in bearing damage.

CHEMICAL CLEANING

Solvent tank is used for cleaning oily residue from components. Solvent blasting sprays solvent through a siphon gun using compressed air.

The hot tank, using heated caustic solvents, is used for cleaning ferrous materials only. DO NOT clean aluminum parts such as cylinder heads, bearings or other soft metals using the hot tank. After cleaning, flush parts with hot water.

A non-ferrous part will be ruined and caustic solution will be diluted if placed in the hot tank. Always use eye protection and gloves when using the hot tank.

Use of a cold tank is for cleaning of aluminum cylinder heads, carburetors and other soft metals. A less caustic and unheated solution is used. Parts may be lift in the tank for several hours without damage. After cleaning, flush parts with hot water.

Steam cleaning, with boiling hot water sprayed at high pressure, is recommended as the final cleaning process when using either hot or cold tank cleaning.

COMPONENT CLEANING

* PLEASE READ THIS FIRST *

NOTE: Always refer to appropriate engine overhaul article in the ENGINES section for complete overhaul procedures and specifications for the vehicle being repaired.

SHEET METAL PARTS

Examples of sheet metal parts are the rocker covers, front and side covers, oil pan and bellhousing dust cover. Glass bead blasting or hot tank may be used for cleaning.

Ensure all mating surfaces are flat. Deformed surfaces should be straightened. Check all sheet metal parts for cracks and dents.

INTAKE & EXHAUST MANIFOLDS

Using solvent cleaning or bead blasting, clean manifolds for inspection. If the intake manifold has an exhaust crossover, all carbon deposits must be removed. Inspect manifolds for cracks, burned or eroded areas, corrosion and damage to fasteners.

Exhaust heat and products of combustion cause threads of fasteners to corrode. Replace studs and bolts as necessary. On "V" type intake manifolds, the sheet metal oil shield must be removed for proper cleaning and inspection. Ensure that all manifold parting surfaces are flat and free of burrs.

CYLINDER HEAD REPLACEMENT

* PLEASE READ THIS FIRST *

NOTE: Always refer to appropriate engine overhaul article in the ENGINES section for complete overhaul procedures and specifications for the vehicle being repaired.

REMOVAL

Remove intake and exhaust manifolds and valve cover. Cylinder head and camshaft carrier bolts (if equipped), should be removed only when the engine is cold. On many aluminum cylinder heads, removal while hot will cause cylinder head warpage. Mark rocker arm or overhead cam components for location.

Remove rocker arm components or overhead cam components. Components must be installed in original location. Individual design rocker arms may utilize shafts, ball-type pedestal mounts or no rocker arms. For all design types, wire components together and identify according to the corresponding valve. Remove cylinder head bolts. Note length and location. Some applications require cylinder head bolts be removed in proper sequence to prevent cylinder head damage. See Fig. 1. Remove cylinder head.

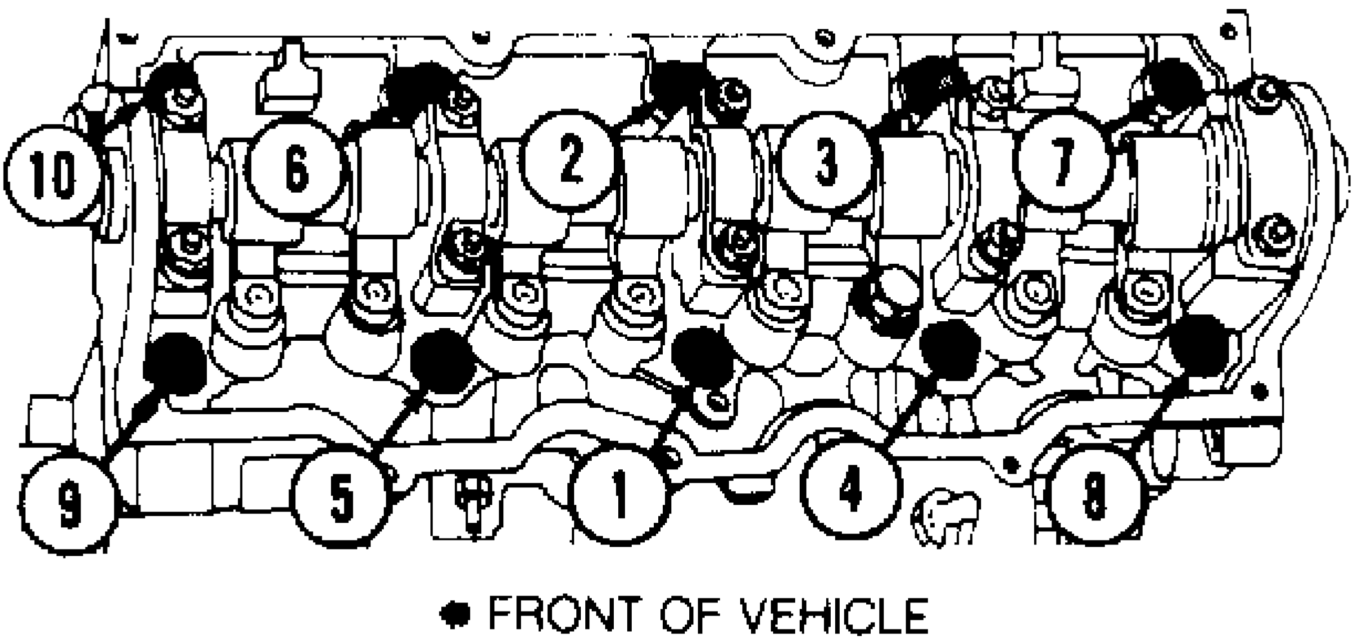


Fig. 1: Typical Cylinder Head Tightening or Loosening Sequence
This Graphic For General Information Only

INSTALLATION

Ensure all surfaces and head bolts are clean. Check that head bolt holes of cylinder block are clean and dry to prevent block damage when bolts are tightened. Clean threads with tap to ensure accurate bolt torque.

Install head gasket on cylinder block. Some manufacturer's may recommend sealant be applied to head gasket prior to installation. Note that all holes are aligned. Some gasket applications may be marked so certain area faces upward. Install cylinder head using care not to damage head gasket. Ensure cylinder head is fully seated on cylinder block.

Some applications require head bolts be coated with sealant prior to installation. This is done if head bolts are exposed to water passages. Some applications require head bolts be coated with light coat of engine oil.

Install head bolts. Head bolts should be tightened in proper steps and sequence to specification. See Fig. 1. Install remaining components. Tighten all bolts to specification. Adjust valves if required. See VALVE ADJUSTMENT in this article.

NOTE: Some manufacturers require that head bolts be retightened after specified amount of operation. This must be done to prevent head gasket failure.

VALVE ADJUSTMENT

Engine specifications will indicate valve train clearance and temperature at which adjustment is to be made on most models. In most cases, adjustment will be made with a cold engine. In some cases, both a cold and a hot clearance will be given for maintenance convenience.

On some models, adjustment is not required. Rocker arms are tightened to specification and valve lash is automatically set. On some models with push rod actuated valve train, adjustment is made at push rod end of rocker arm while other models do not require adjustment.

Clearance will be checked between tip of rocker arm and tip of valve stem in proper sequence using a feeler gauge. Adjustment is made by rotating adjusting screw until proper clearance is obtained. Lock nut is then tightened. Engine will be rotated to obtain all valve adjustments to manufacturer's specifications.

Some models require hydraulic lifter to be bled down and clearance measured. Different length push rods can be used to obtain proper clearance. Clearance will be checked between tip of rocker arm and tip of valve stem in proper sequence using a feeler gauge.

On overhead cam engines designed without rocker arms actuate valves directly on a cam follower. A hardened, removable disc is installed between the cam lobe and lifter. Clearance will be checked between cam heel and adjusting disc in proper sequence using a feeler gauge. Engine will be rotated to obtain all valve adjustments.

On overhead cam engines designed with rocker arms, adjustment is made at push rod end of rocker arm. Ensure that the valve to be adjusted is riding on the heel of the cam on all engines. Clearance will be checked between tip of rocker arm and tip of valve stem in proper sequence using a feeler gauge. Adjustment is made by rotating adjusting screw until proper clearance is obtained. Lock nut is then tightened. Engine will be rotated to obtain all valve adjustments to manufacturer's specifications.

CYLINDER HEAD OVERHAUL

* PLEASE READ THIS FIRST *

NOTE: Always refer to appropriate engine overhaul article in the ENGINES section for complete overhaul procedures and specifications for the vehicle being repaired.

DISASSEMBLY

Mark valves for location. Using valve spring compressor, compress valve springs. Remove valve locks. Carefully release spring compressor. Remove retainer or rotator, valve spring, spring seat and valve. See Fig. 2.

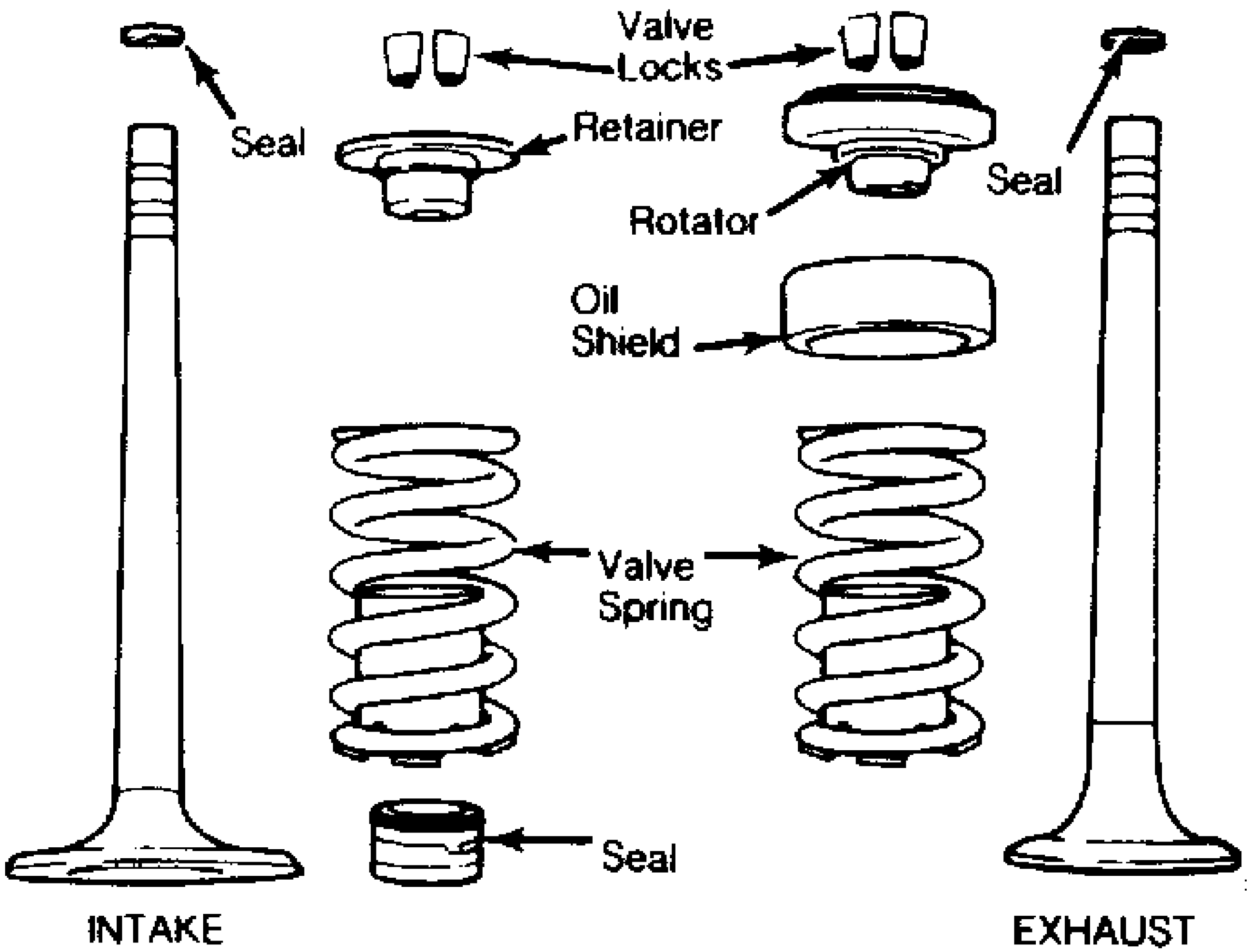


Fig. 2: Exploded View of Intake & Exhaust Valve Assemblies - Typical
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CLEANING & INSPECTION

Clean cylinder head and valve components using approved cleaning methods. Inspect cylinder head for cracks, damage or warped gasket surface. Place straightedge across gasket surface. Determine clearance at center of straightedge. Measure across both diagonals, longitudinal centerline and across the head at several points. See Fig. 3.

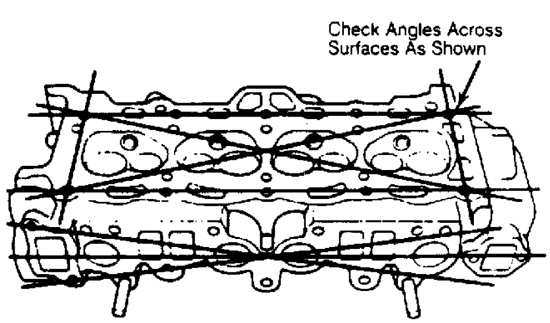

Fig. 3: Checking Cylinder Head for Warpage - Typical
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On cast cylinder heads, if warpage exceeds .003" (.08 mm) in a 6" span, or .006" (.15 mm) over total length, cylinder head must be resurfaced. On most aluminum cylinder heads, if warpage exceeds .002" (.05 mm) in any area, cylinder head must be resurfaced. Warpage specification may vary with manufacturer.

Cylinder head thickness should be measured to determine amount of material which can be removed before replacement is required. Cylinder head thickness must not be less than manufacturer's specifications.

If cylinder head required resurfacing, it may not align properly with intake manifold. On "V" type engines, misalignment is corrected by machining intake manifold surface that contacts cylinder head. Cylinder head may be machined on surface that contacts intake manifold.

Using oil stone, remove burrs or scratches from all sealing surfaces.

VALVE SPRINGS

Inspect valve springs for corroded or pitted valve spring surfaces which may lead to breakage. Polished spring ends caused by a rotating spring, indicates that spring surge has occurred. Replace springs showing evidence of these conditions.

Inspect valve springs for squareness using a 90 degree straightedge. See Fig. 4. Replace valve spring if out-of-square exceeds manufacturer's specification.

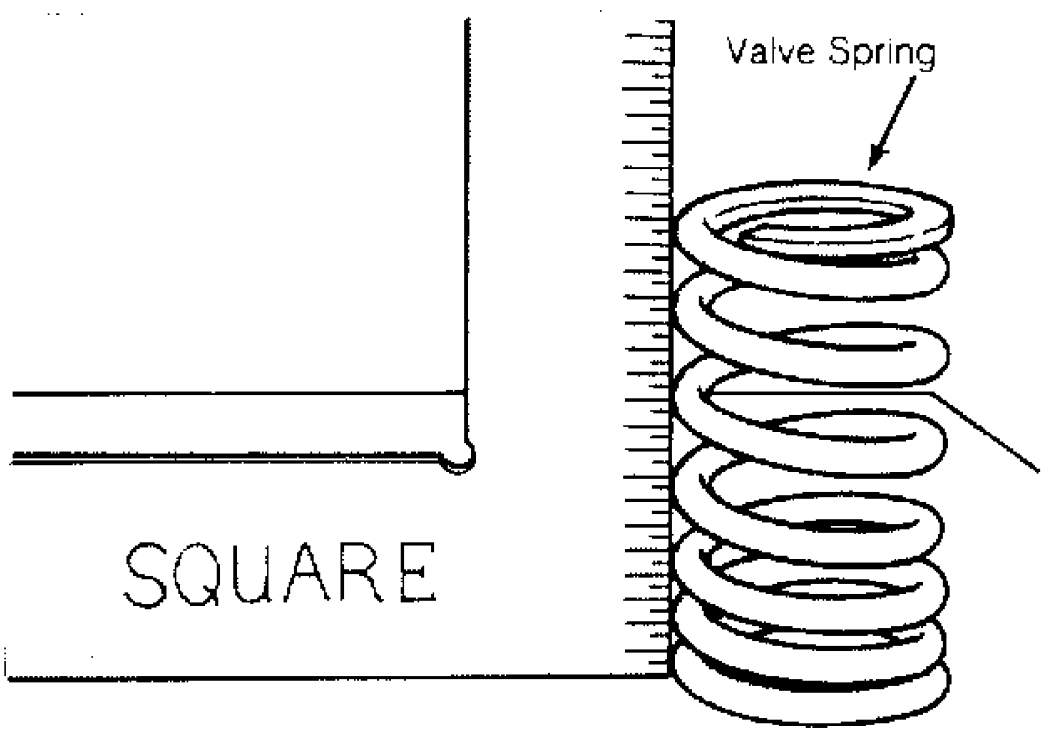

Fig. 4: Checking Valve Spring Squareness - Typical
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Using vernier caliper, measure free length of all valve springs. Replace springs if not within specification. Using valve spring tester, test valve spring pressure at installed and compressed heights. See Fig. 5.

Usually compressed height is installed height minus valve lift. Replace valve spring if not within specification. It is recommended to replace all valve springs when overhauling cylinder head.

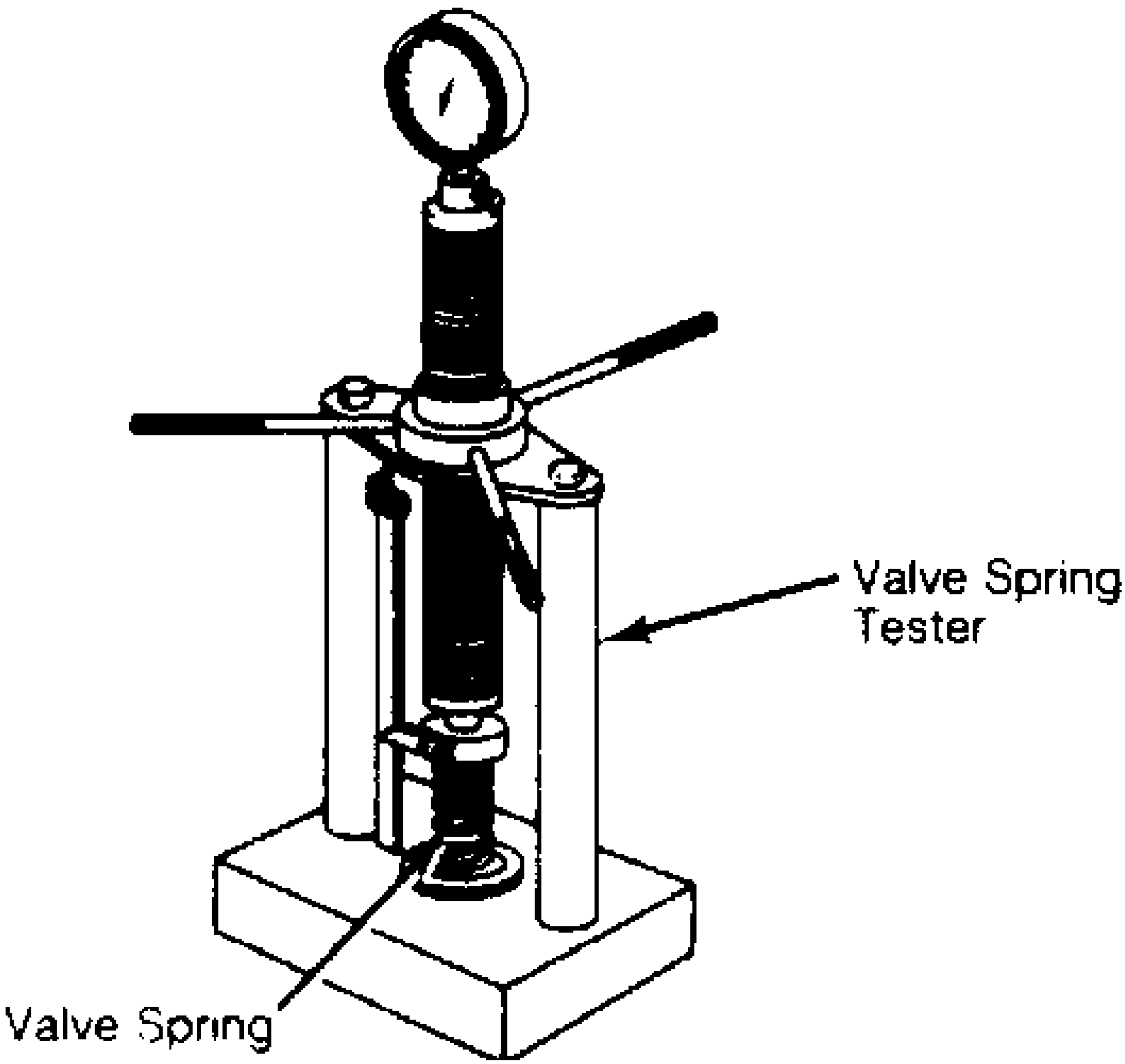

Fig. 5: Checking Valve Spring Pressure - Typical
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VALVE GUIDE

Measuring Valve Guide Clearance

Check valve stem-to-guide clearance. Ensure valve stem diameter is within specifications. Install valve in valve guide. Install dial indicator assembly on cylinder head with tip resting against valve stem just above valve guide. See Fig. 6.

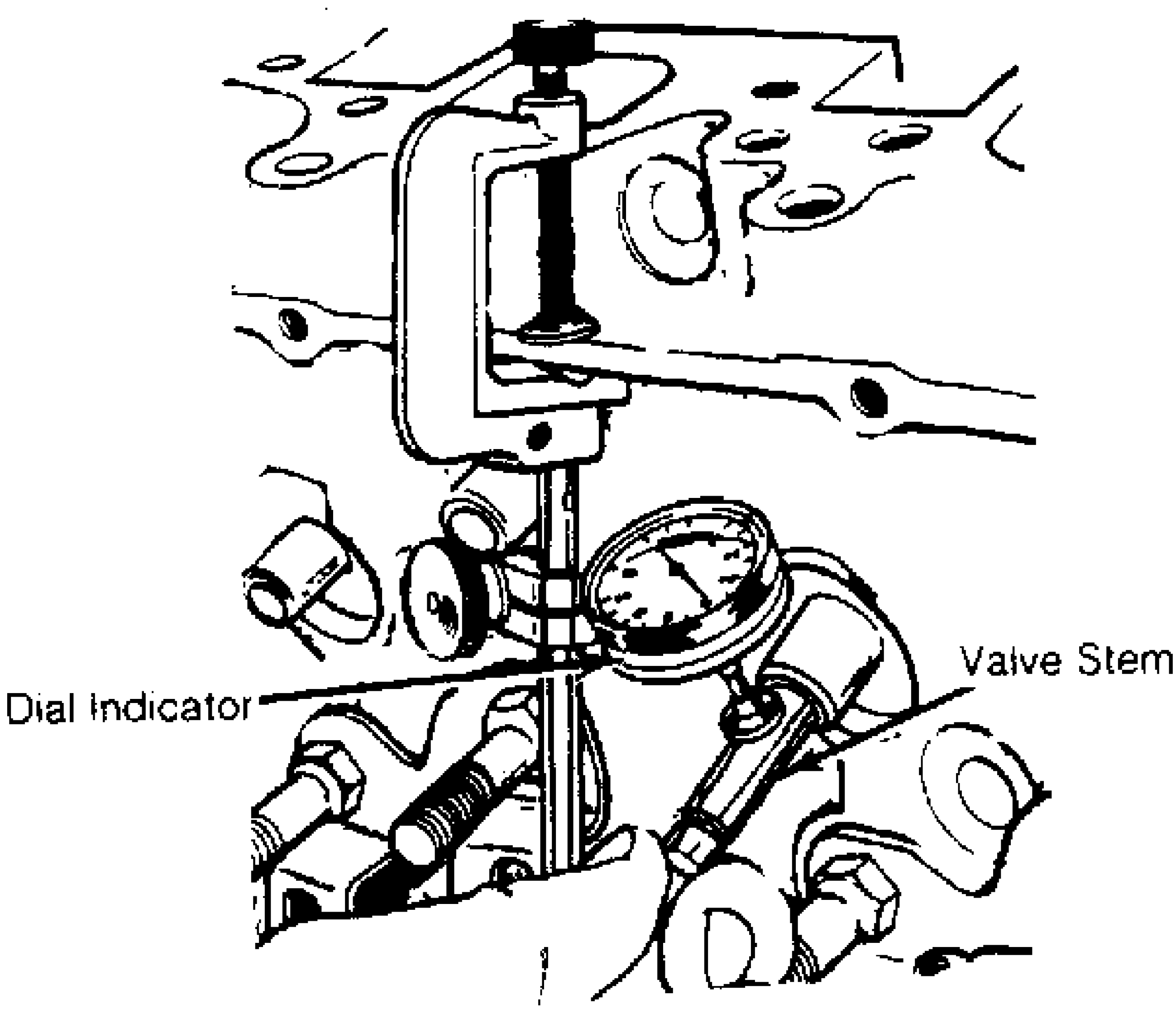

Fig. 6: Measuring Valve Stem-to-Guide Clearance - Typical
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Lower valve approximately 1/16" below valve seat. Push valve stem against valve guide as far as possible. Adjust dial indicator to zero. Push valve stem in opposite direction and note reading. Clearance must be within specification.

If valve guide clearance exceeds specification, valves with oversize stems may be used or valve guide must be replaced. On some applications, a false guide is installed, then reamed to proper specification. Valve guide reamer set is used to ream valve guide to obtain proper clearance for new valve.

Reaming Valve Guide

Select proper reamer for valve stem. Reamer must be of proper length to provide clean cut through entire length of valve guide. Install reamer in valve guide and rotate to cut valve guide. See Fig. 7.

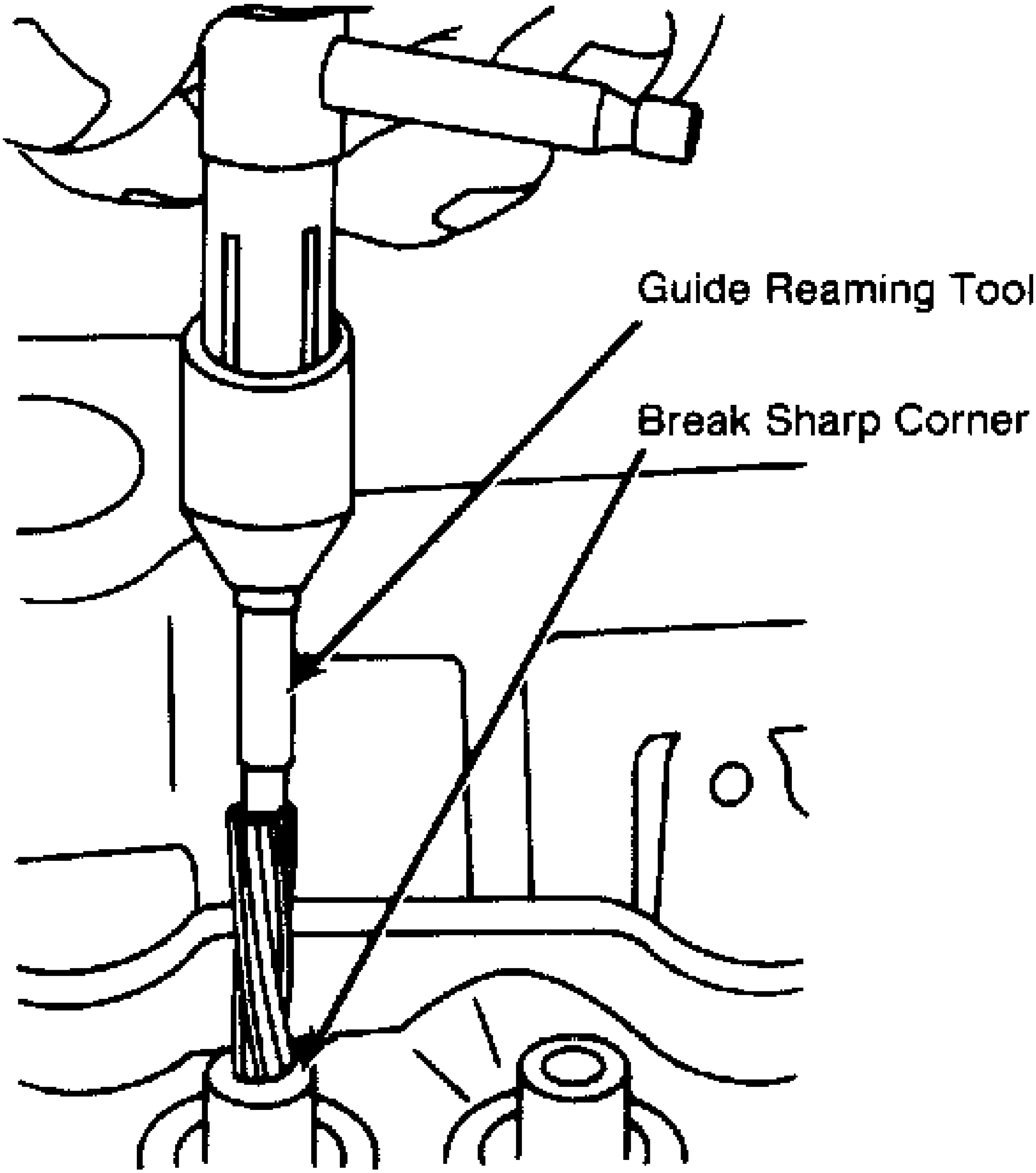

Fig. 7: Reaming Valve Guides - Typical
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Replacing Valve Guide

Replace valve guide if clearance exceeds specification. Valve guides are either pressed, hammered or shrunk in place, depending upon cylinder head design and type of metal used.

Remove valve guide from cylinder head by pressing or tapping on a stepped drift. See Fig. 8. Once valve guide is installed, distance from cylinder head to top of valve guide must be checked. This distance must be within specification.

Aluminum heads are often heated before installing valve guide. Guide is sometimes chilled in dry ice before installation. Combination of a heated head and chilled guide insures a tight guide fit upon assembly. The new guide must be reamed to specification.

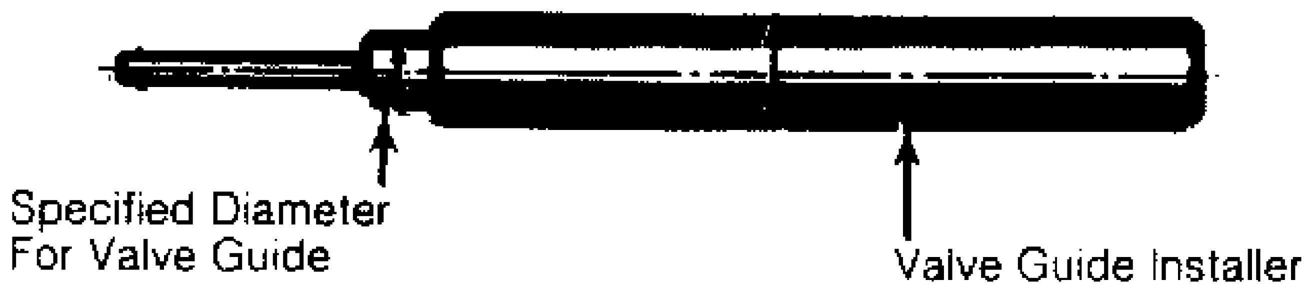

Fig. 8: Typical Valve Guide Remover & Installer
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VALVES & VALVE SEATS

Valve Grinding

Valve stem O.D. should be measured in several areas to indicate amount of wear. Replace valve if not within specification. Valve margin area should be measured to ensure that valve can be grounded. See Fig. 9.

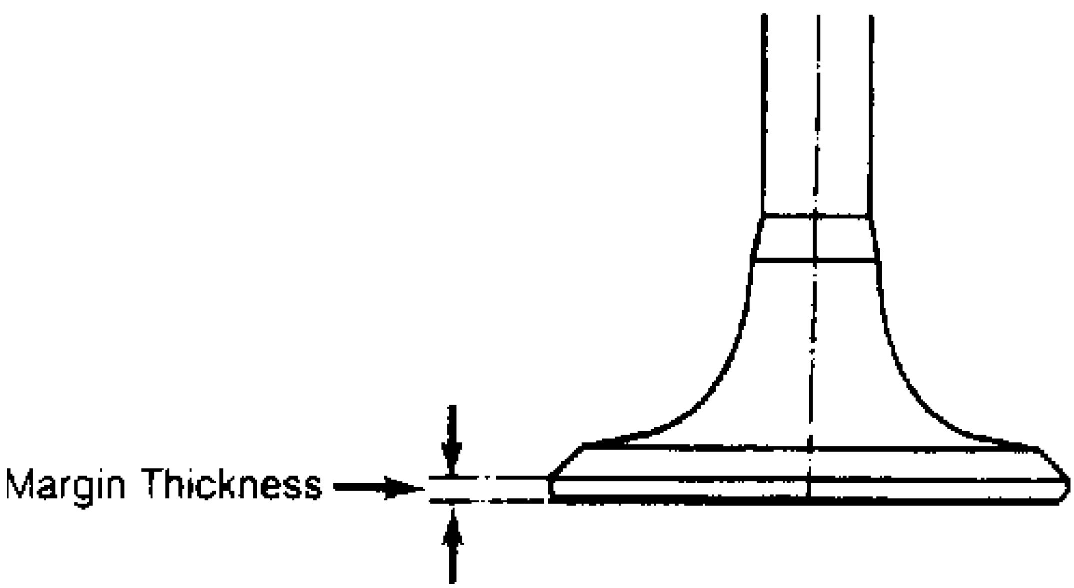

Fig. 9: Measuring Valve Head Margin - Typical
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If valve margin is less than specification, this will burn the valves. Valve must be replaced. Due to minimum margin dimensions during manufacture, some new type valves cannot be reground.

Resurface valve on proper angle specification using valve grinding machine. Follow manufacturer's instructions for valve grinding machine. Specifications may indicate a different valve face angle than seat angle.

Measure valve margin after grinding. Replace valve if not within specification. Valve stem tip can be refinished using valve grinding machine.

Valve Lapping

During valve lapping of recent designed valves, be sure to follow manufacturers recommendations. Surface hardening and materials used with some valves do not permit lapping. Lapping process will remove excessive amounts of the hardened surface.

Valve lapping is done to ensure adequate sealing between valve face and seat. Use either a hand drill or lapping stick with suction cup attached.

Moisten and attach suction cup to valve. Lubricate valve stem and guide. Apply a thin coat of fine valve grinding compound between valve and seat. Rotate lapping tool between the palms or with hand drill.

Lift valve upward off the seat and change position often. This is done to prevent grooving of valve seat. Lap valve until a smooth polished seat is obtained. Thoroughly clean grinding compound from components. Valve to valve seat concentricity should be checked. See VALVE SEAT CONCENTRICITY.

CAUTION: Valve guides must be in good condition and free of carbon deposits prior to valve seat grinding. Some engines contain an induction hardened valve seat. Excessive material removal will damage valve seats.

Valve Seat Grinding

Select coarse stone of correct size and angle for seat to be ground. Ensure stone is true and has a smooth surface. Select correct size pilot for valve guide dimension. Install pilot in valve guide. Lightly lubricate pilot shaft. Install stone on pilot. Move stone off and on the seat approximately 2 times per second during grinding operation.

Select a fine stone to finish grinding operation. Grinding stones with 30 and 60 degree angles are used to center and narrow the valve seat as required. See Fig. 10.

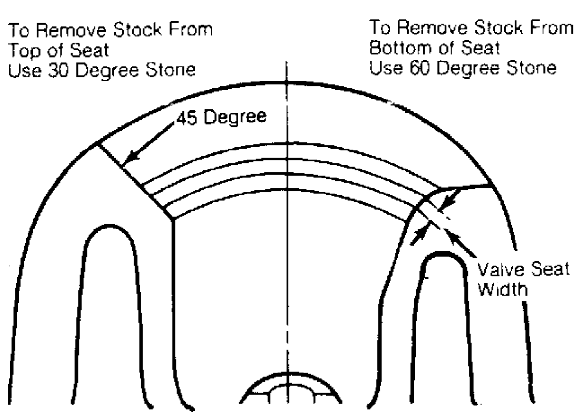

Fig. 10: Adjusting Valve Seat Width - Typical
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Valve Seat Replacement

Replacement of valve seat inserts is done by cutting out the old insert and machining an oversize insert bore. Replacement oversize insert is usually chilled and the cylinder head is sometimes warmed. Valve seat is pressed into the head. This operation requires specialized machine shop equipment.

Valve Seat Concentricity

Using dial gauge, install gauge pilot in valve guide. Position gauge arm on the valve seat. Adjust dial indicator to zero. Rotate arm 360 degrees and note reading. Runout should not exceed specification.

To check valve-to-valve seat concentricity, coat valve face lightly with Prussian Blue dye. Install valve and rotate it on valve seat. If pattern is even and entire seat is coated at valve contact point, valve is concentric with the seat.

REASSEMBLY

Valve Stem Installed Height

Valve stem installed height must be checked when new valves are installed or when valves or valve seats have been ground. Install valve in valve guide. Measure distance from tip of valve stem to spring seat. See Fig. 11. Distance must be within specifications.

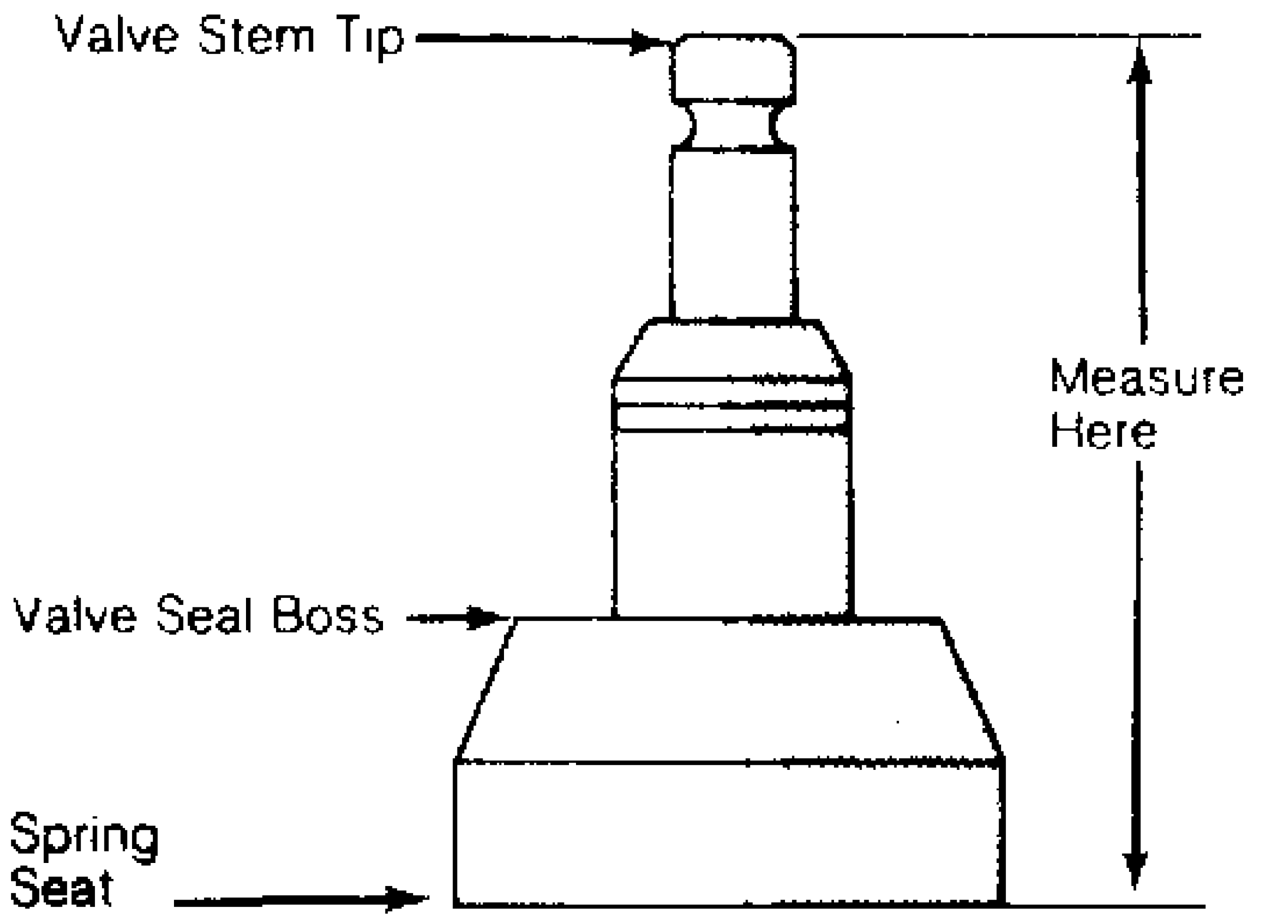

Fig. 11: Measuring Valve Stem Installed Height - Typical
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Remove valve and grind valve stem tip if height exceeds specification. Valve tips are surface hardened. DO NOT remove more than .010" (.25 mm) from tip. Chamfer sharp edge of reground valve tip. Recheck valve stem installed height.

VALVE STEM OIL SEALS

Valve stem oil seals must be installed on valve stem. See Fig. 2. Seals are needed due to pressure differential at the ends of valve guides. Atmospheric pressure above intake guide, combined with manifold vacuum below guide, causes oil to be drawn into the cylinder.

Exhaust guides also have pressure differential created by exhaust gas flowing past the guide, creating a low pressure area. This low pressure area draws oil into the exhaust system.

Replacement (On Vehicle)

Mark rocker arm or overhead cam components for location. Remove rocker arm components or overhead cam components. Components must be installed in original location. Remove spark plugs. Valve stem oil seals may be replaced by holding valves against seats using air pressure.

Air pressure must be installed in cylinder using an adapter for spark plug hole. An adapter can be constructed by welding air hose connection to spark plug body with porcelain removed.

Install adapter in spark plug hole. Apply a minimum of 140 psi (9.8 kg/cm^2) to adapter. Air pressure should hold valve closed. If air pressure does not hold valve closed, check for damaged or bent valve. Cylinder head must be removed for service.

Using valve spring compressor, compress valve springs. Remove valve locks. Carefully release spring compressor. Remove retainer or rotator and valve spring. Remove valve stem oil seal.

If oversized valves have been installed, oversized oil seals must be used. Coat valve stem with engine oil. Install protective sleeve over end of valve stem. Install new oil seal over valve stem and seat on valve guide. Remove protective sleeve. Install spring seat, valve spring and retainer or rotator. Compress spring and install valve locks. Remove spring compressor. Ensure valve locks are fully seated.

Install rocker arms or overhead cam components. Tighten all bolts to specification. Adjust valves if required. Remove adapter. Install spark plugs, valve cover and gasket.

VALVE SPRING INSTALLED HEIGHT

Valve spring installed height should be checked during reassembly. Measure height from lower edge of valve spring to the upper edge. DO NOT include valve spring seat or retainer. Distance must be within specifications. If valves and/or seats have been ground, a valve spring shim may be required to correct spring height. See Fig. 12.

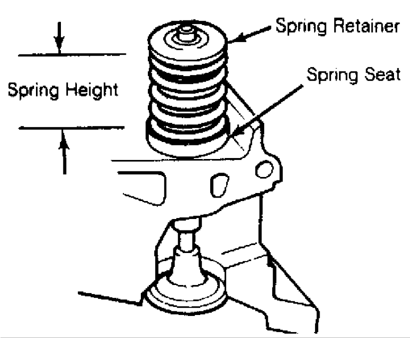

Fig. 12: Measuring Valve Spring Installed Height - Typical
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ROCKER ARMS & ASSEMBLIES

Rocker Studs

Rocker studs are either threaded or pressed in place. Threaded studs are removed by locking 2 nuts on the stud. Unscrew the stud by turning the jam nut. Coat the stud threads with Loctite and install. Tighten to specification.

Pressed in stud can be removed using a stud puller. Ream the stud bore to proper specification and press in a new oversize stud. Pressed in studs are often replaced by cutting threads in the stud bore to accept a threaded stud.

Rocker Arms & Shafts

Mark rocker arms for location. Remove rocker arm retaining bolts. Remove rocker arms. Inspect rocker arms, shafts, bushings and pivot balls (if equipped) for excessive wear. Inspect rocker arms for wear in valve stem contact area. Measure rocker arm bushing I.D. Replace bushings if excessively worn.

The rocker arm valve stem contact point can be reground, using special fixture for valve grinding machine. Remove minimum amount of material as possible. Ensure all oil passages are clear. Install rocker arms in original locations. Ensure rocker arm is properly seated in push rod. Tighten bolts to specification. Adjust valves if required. See VALVE ADJUSTMENT in this article.

Pushrods

Remove rocker arms. Mark push rods for location. Remove push rods. Push rods can be steel or aluminum, solid or hollow. Hollow pushrods must be internally cleaned to ensure oil passage to the rocker arms is cleaned. Check the pushrod for damage, such as loose ends on steel tipped aluminum types.

Check push rod for straightness. Roll push rod on a flat surface. Using feeler gauge, check clearance at center. Replace push rod if bent. The push rod can also be supported at each end and rotated. A dial indicator is used to detect bends in the push rod.

Lubricate ends of push rod and install push rod in original location. Ensure push rod is properly seated in lifter. Install rocker arm. Tighten bolts to specification. Adjust valves if required. See VALVE ADJUSTMENT in this article.

LIFTERS

Hydraulic Lifters

Before replacing a hydraulic lifter for noisy operation, ensure noise is not caused by worn rocker arms or valve tips. Hydraulic lifter assemblies must be installed in original locations. Remove the rocker arm assembly and push rod. Mark components for location. Some applications require intake manifold, or lifter cover removal. Remove lifter retainer plate (if used). To remove lifters, use a hydraulic lifter remover or magnet. Different type lifters are used. See Fig. 13.

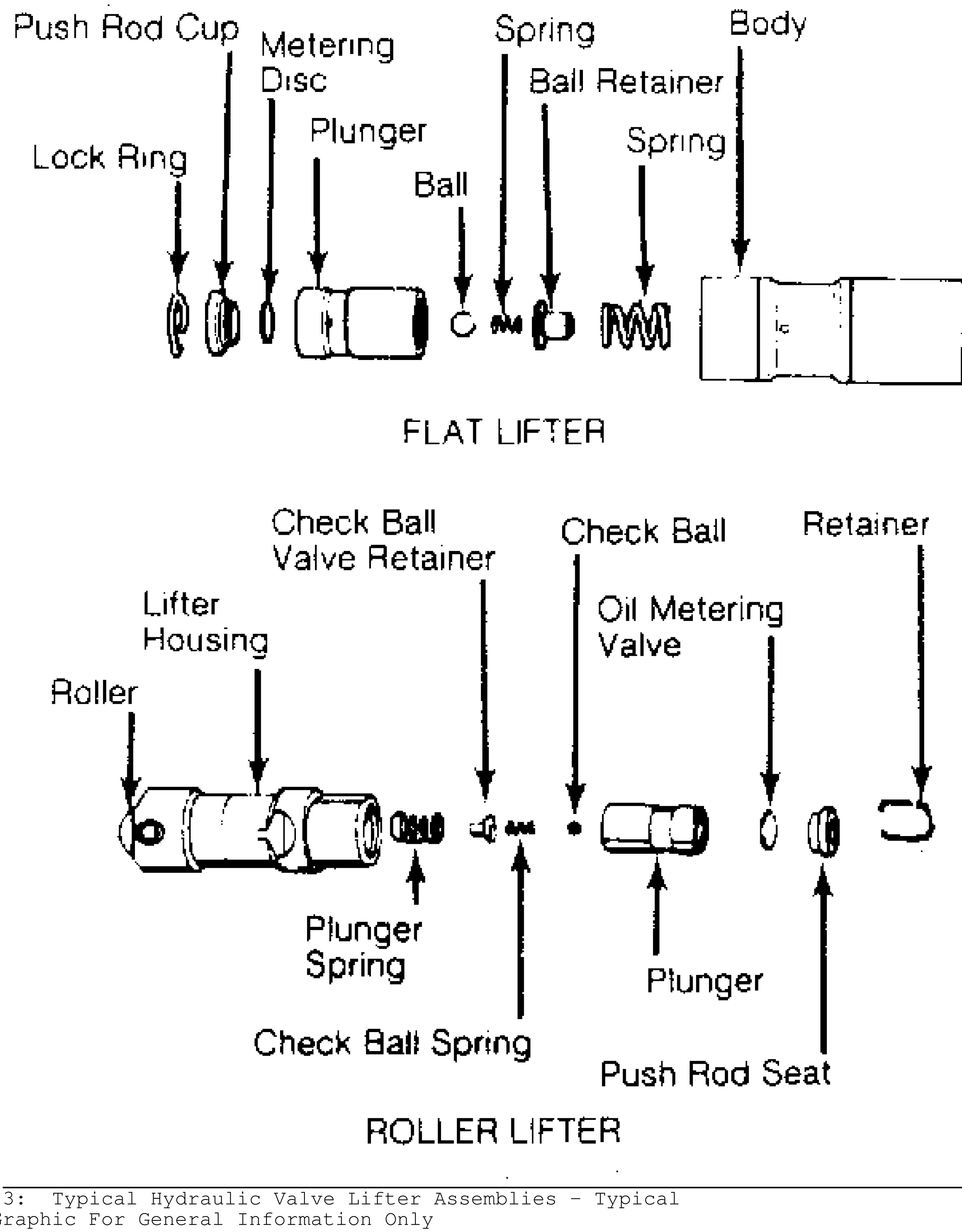

Fig. 13: Typical Hydraulic Valve Lifter Assemblies - Typical
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On sticking lifters, disassemble and clean lifter. DO NOT mix lifter components or positions. Parts are select-fitted and are not interchangeable. Inspect all components for wear. Note amount of wear in lifter body-to-camshaft contact area. Surface must have smooth and convex contact face. If wear is apparent, carefully inspect cam lobe.

Inspect push rod contact area and lifter body for scoring or signs of wear. If body is scored, inspect lifter bore for damage and lack of lubrication. On roller type lifters, inspect roller for flaking, pitting, loss of needle bearings and roughness during rotation.

Measure lifter body O.D. in several areas. Measure lifter bore I.D. of cylinder block. Some models offer oversized lifters. Replace lifter if damaged.

If lifter check valve is not operating, obstructions may be preventing it from closing or valve spring may be broken. Clean or replace components as necessary.

Check plunger operation. Plunger should drop to bottom of the body by its own weight when assembled dry. If plunger is not free, soak lifter in solvent to dissolve deposits.

Lifter leak-down test can be performed on lifter. Lifter must be filled with special test oil. New lifters contain special test oil. Using lifter leak-down tester, perform leak-down test following manufacturer's instructions. If leak-down time is not within specifications, replace lifter assembly.

Lifters should be soaked in clean engine oil several hours prior to installation. Coat lifter base, roller (if equipped) and lifter body with ample amount of Molykote or camshaft lubricant. See Fig. 13. Install lifter in original location. Install remaining components. Valve lash adjustment is not required on most hydraulic lifters. Preload of hydraulic lifter is automatic. Some models may require adjustment.

Mechanical Lifters

Lifter assemblies must be installed in original locations. Remove rocker arm assembly and push rod. Mark components for location. Some applications require intake manifold or lifter cover removal. Remove lifter retainer plate (if used). To remove lifters, use lifter remover or magnet.

Inspect push rod contact area and lifter body for scoring or signs of wear. If body is scored, inspect lifter bore for damage and lack of lubrication. Note amount of wear in lifter body-to-camshaft contact area. Surface must have smooth and convex contact face. If wear is apparent, carefully inspect cam lobe.

Coat lifter base, roller (if equipped) and lifter body with ample amount of Molykote or camshaft lubricant. Install lifter in original location. Install remaining components. Tighten bolts to specification. Adjust valves. See VALVE ADJUSTMENT in this article.

PISTONS, CONNECTING RODS & BEARINGS

* PLEASE READ THIS FIRST *

NOTE: Always refer to appropriate engine overhaul article in the ENGINES section for complete overhaul procedures and specifications for the vehicle being repaired.

RIDGE REMOVAL

Ridge in cylinder wall must be removed prior to piston removal. Failure to remove ridge prior to removing pistons will cause piston damage in piston ring locations.

With the piston at bottom dead center, place a rag in the bore to trap metal chips. Install ridge reamer in cylinder bore. Adjust ridge reamer using manufacturer's instructions. Remove ridge using ridge reamer. DO NOT remove an excessive amount of material. Ensure ridge is completely removed.

PISTON & CONNECTING ROD REMOVAL

Note top of piston. Some pistons may contain a notch, arrow or be marked "FRONT". Piston must be installed in proper direction to prevent damage with valve operation.

Check that connecting rod and cap are numbered for cylinder location and which side of cylinder block the number faces. Proper cap and connecting rod must be installed together. Connecting rod cap must be installed on connecting rod in proper direction to ensure bearing lock procedure. Mark connecting rod and cap if necessary. Pistons must be installed in original location.

Remove cap retaining nuts or bolts. Remove bearing cap. Install stud protectors on connecting rod bolts. This protects cylinder walls from scoring during removal. Ensure proper removal of ridge. Push piston and connecting rod from cylinder. Connecting rod boss can be tapped with a wooden dowel or hammer handle to aid in removal.

PISTON & CONNECTING ROD

Disassembly

Using ring expander, remove piston rings. Remove piston pin retaining rings (if equipped). On pressed type piston pins, special fixtures and procedures according to manufacturer must be used to remove piston pins. Follow manufacturer’s recommendations to avoid piston distortion or breakage.

Cleaning

Remove all carbon and varnish from piston. Pistons and connecting rods may be cleaned in cold type chemical tank. Using ring groove cleaner, clean all deposits from ring grooves. Ensure all deposits are cleaned from ring grooves to prevent ring breakage or sticking. DO NOT attempt to clean pistons using wire brush.

Inspection

Inspect pistons for nicks, scoring, cracks or damage in ring areas. Connecting rod should be checked for cracks using Magnaflux procedure. Piston diameter must be measured in manufacturers specified area.

Using telescopic gauge and micrometer, measure piston pin bore of piston in 2 areas, 90 degrees apart. This is done to check diameter and out-of-round.

Install proper bearing cap on connecting rod. Ensure bearing cap is installed in proper location. Tighten bolts or nuts to specification. Using inside micrometer, measure inside diameter in 2 areas, 90 degrees apart.

Connecting rod I.D. and out-of-round must be within specification. Measure piston pin bore I.D. and piston pin O.D. All components must be within specification. Subtract piston pin diameter from piston pin bore in piston and connecting rod to determine proper fit.

Connecting rod length must be measured from center of crankshaft journal inside diameter to center of piston pin bushing using proper caliper. Connecting rods must be the same length. Connecting rods should be checked on an alignment fixture for bent or twisted condition. Replace all components which are damaged or not within specification.

PISTON & CYLINDER BORE FIT

Ensure cylinder is checked for taper, out-of-round and properly honed prior to checking piston and cylinder bore fit. See CYLINDER BLOCK in this article. Using dial bore gauge, measure cylinder bore. Measure piston at right angle to piston pin in center of piston skirt area. Subtract piston diameter from cylinder bore diameter. The difference is piston-to-cylinder clearance. Clearance must be within specification. Mark piston for proper cylinder location.

ASSEMBLING PISTON & CONNECTING ROD

Install proper fitted piston on connecting rod for proper cylinder. Ensure piston marking on top of piston marked is in correspondence with connecting rod and cap number. See Fig. 14.

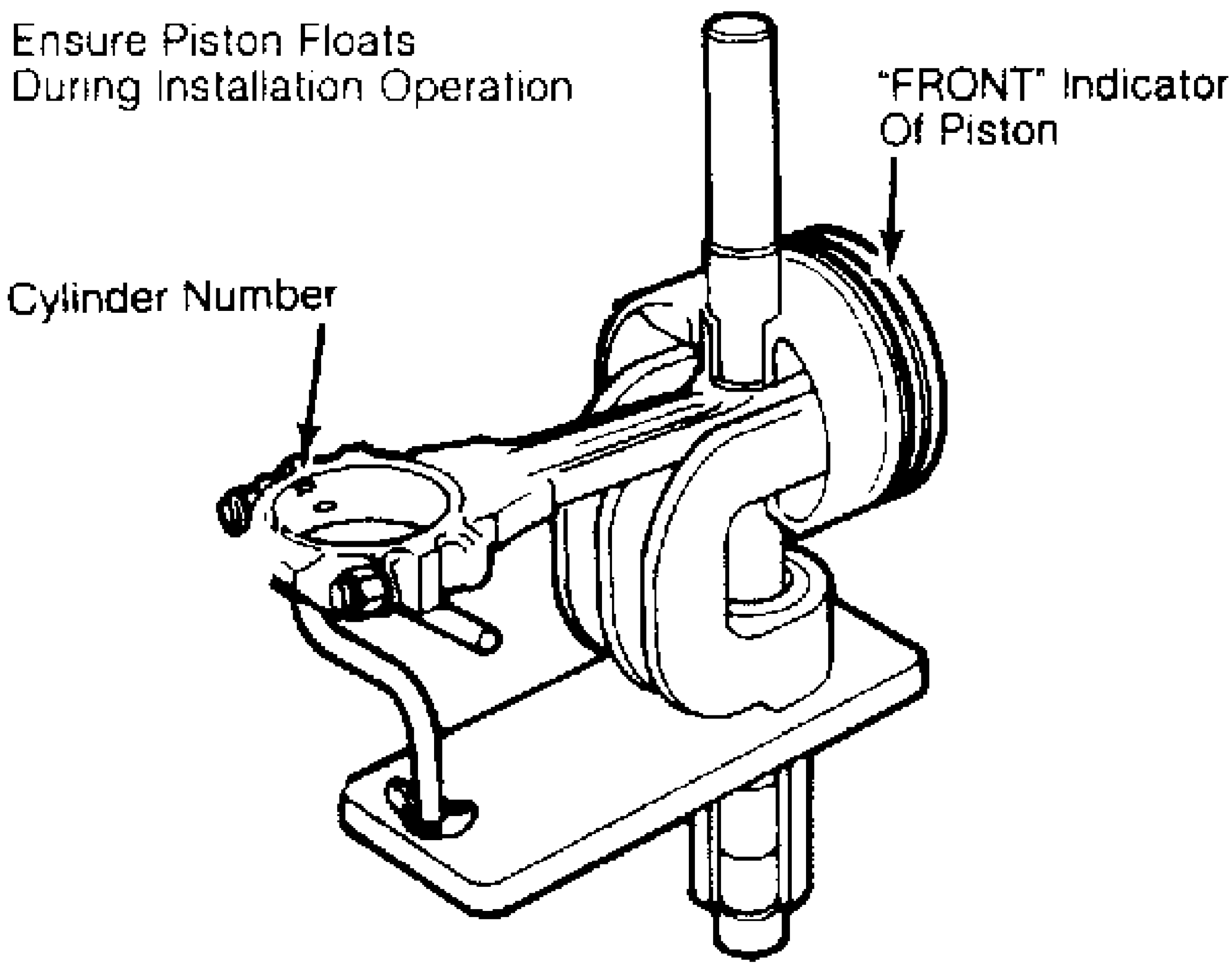

Fig. 14: Piston Pin Installation - Typical
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Lubricate piston pin and install in connecting rod. Ensure piston pin retainers are fully seated (if equipped). On pressed type piston pins, follow manufacturer's recommended procedure to avoid distortion or breakage.

CHECKING PISTON RING CLEARANCES

Piston rings must be checked for side clearance and end gap. To check end gap, install piston ring in cylinder which it is to be installed. Using an inverted piston, push ring to bottom of cylinder in smallest cylinder diameter.

Using feeler gauge, check ring end gap. See Fig. 15. Piston ring end gap must be within specification. Ring breakage will occur with insufficient ring end gap.

On some manufacturers, insufficient ring end gap may be corrected by using a fine file while other manufacturers recommend using another ring set. Mark rings for proper cylinder installation after checking end gap.

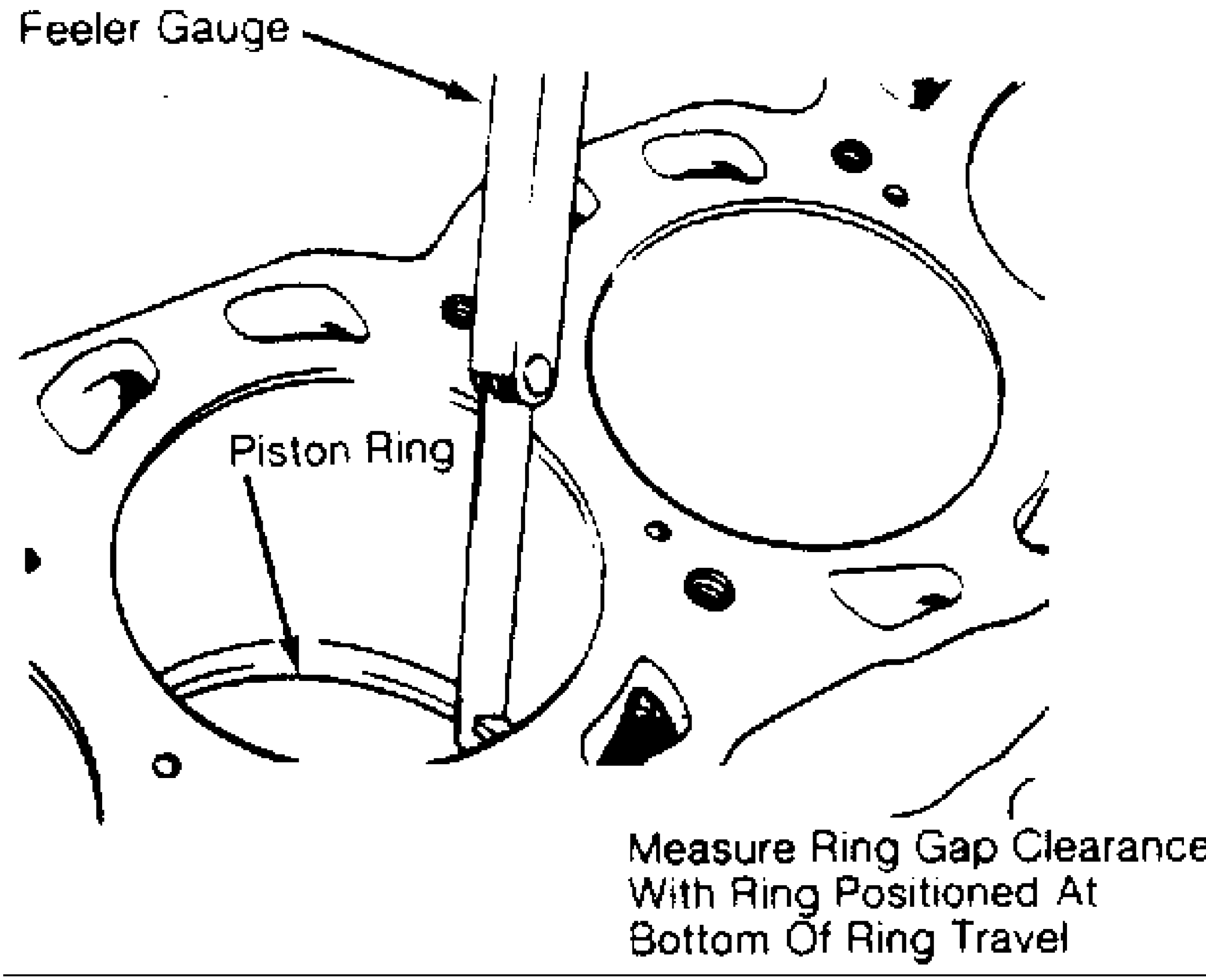

Fig. 15: Checking Piston Ring End Gap - Typical
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For checking side clearance, install rings on piston. Using feeler gauge, measure clearance between piston ring and piston ring land. Check side clearance in several areas around piston. Side clearance must be within specification.

If side clearance is excessive, piston ring grooves can be machined to accept oversized piston rings (if available). Normal practice is to replace piston.

PISTON & CONNECTING ROD INSTALLATION

Cylinders must be honed prior to piston installation. See CYLINDER HONING under CYLINDER BLOCK in this article.

Install upper connecting rod bearings. Lubricate upper bearings with engine oil. Install lower bearings in rod caps. Ensure bearing tabs are properly seated. Position piston ring gaps according to manufacturers recommendations. See Fig. 16. Lubricate pistons, rings and cylinder walls.

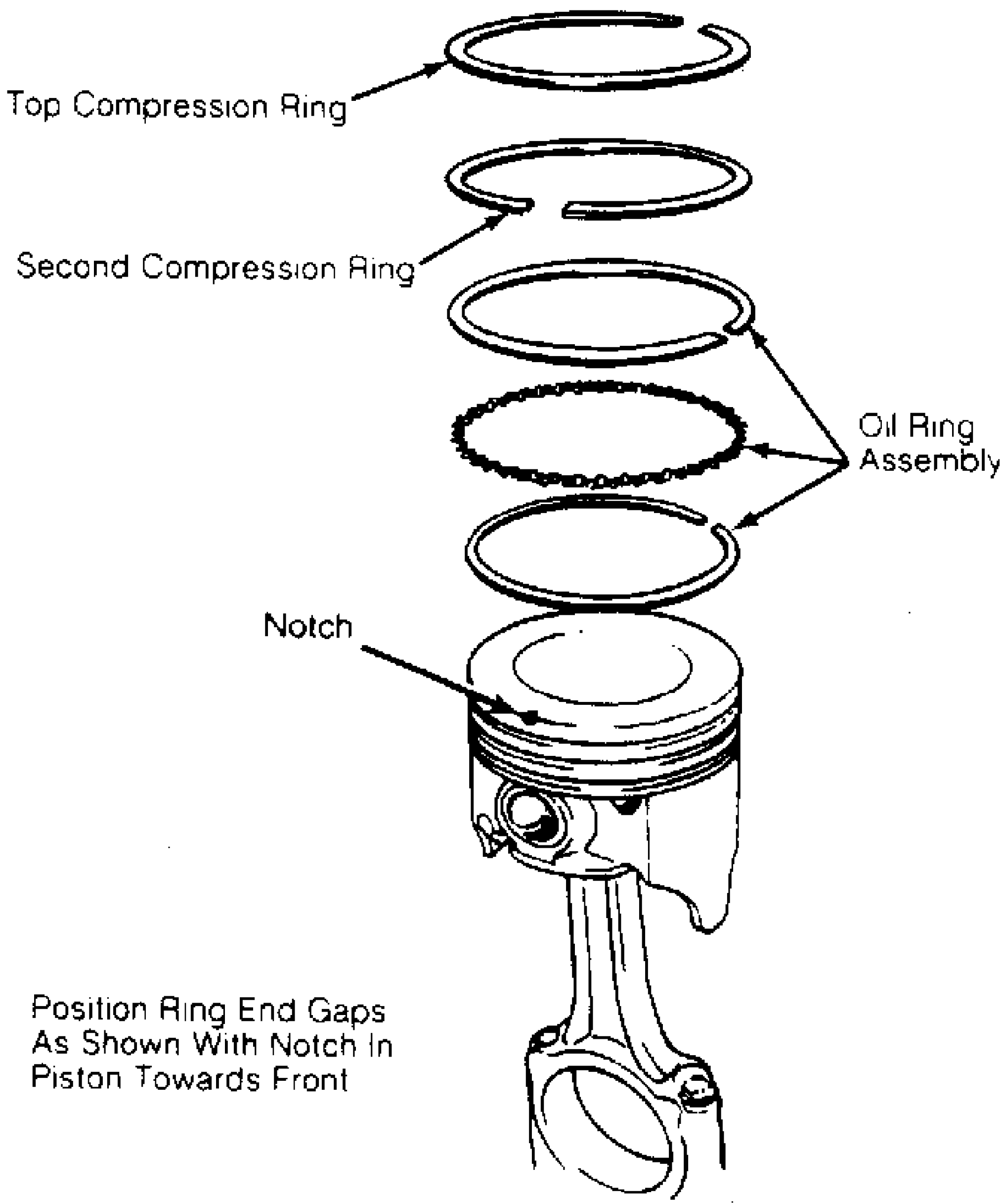

Fig. 16: Typical Piston Ring End Gap Positioning - Typical
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Install ring compressor. Use care not to rotate piston rings. Compress rings with ring compressor. Install plastic tubing protectors over connecting rod bolts. Install piston and connecting rod assembly. Ensure piston notch, arrow or "FRONT" mark is toward front of engine. See Fig. 17.

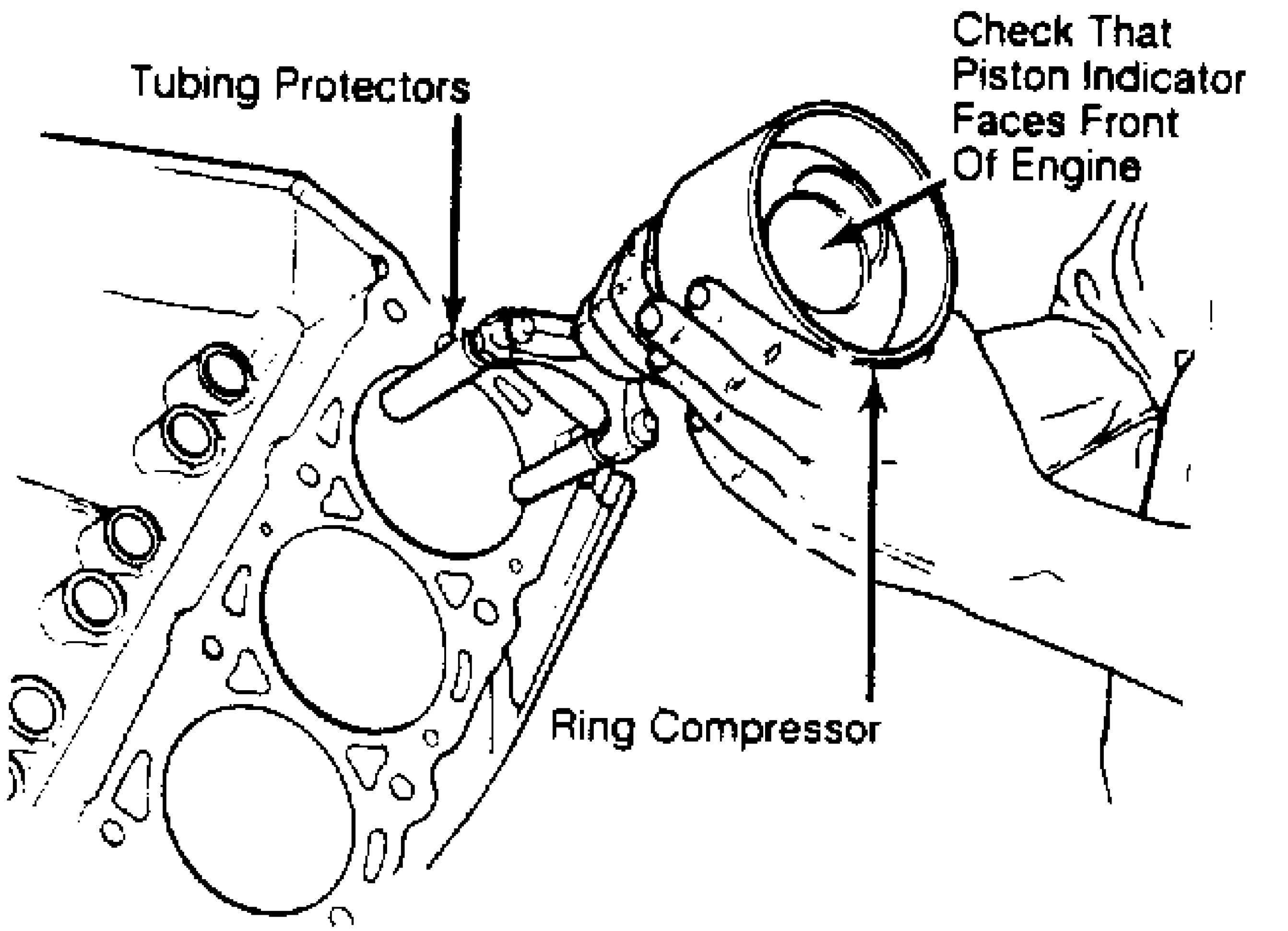

Fig. 17: Installing Piston & Connecting Rod Assembly - Typical
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Carefully tap piston into cylinder until rod bearing is seated on crankshaft journal. Remove protectors. Install rod cap and bearing. Lightly tighten connecting rod bolts. Repeat procedure 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.

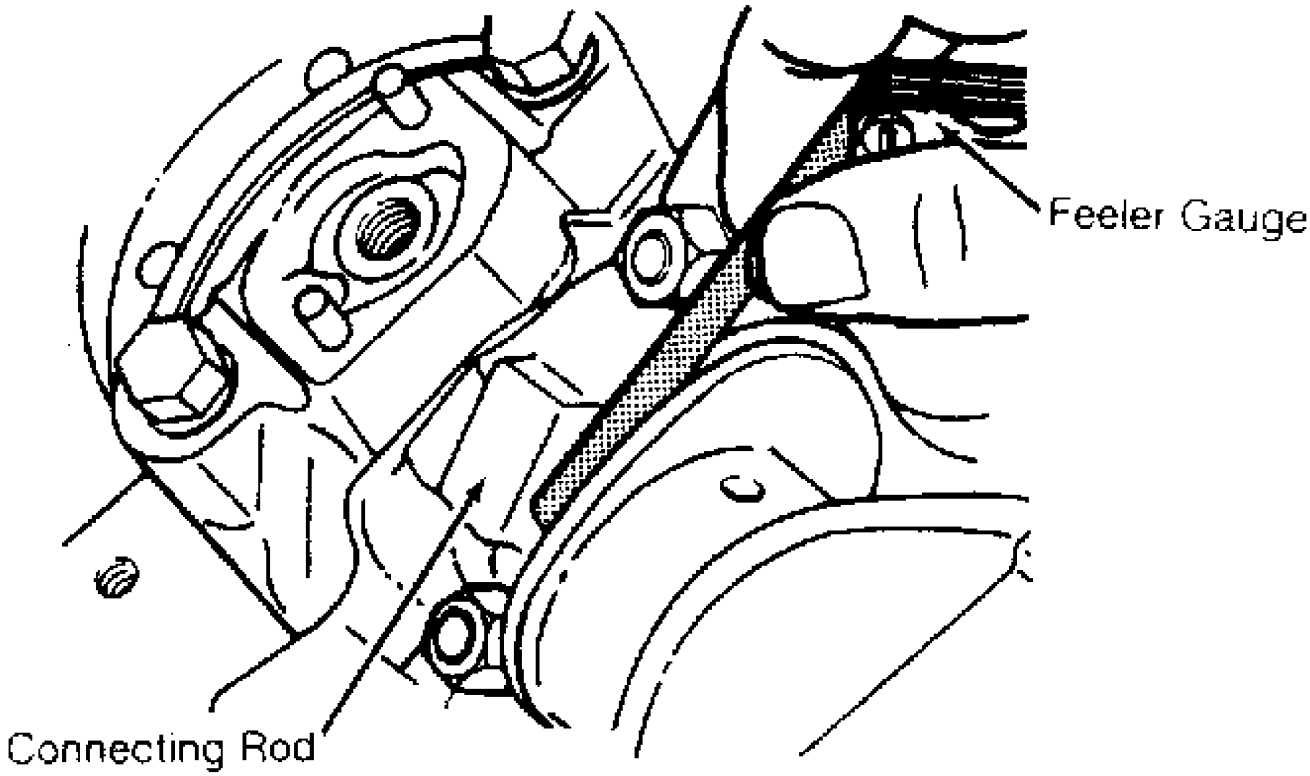

Fig. 18: Measuring Connecting Rod Side Clearance - Typical
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Check for improper bearing installation, wrong bearing cap or insufficient bearing clearance if side clearance is insufficient. Connecting rod may require machining to obtain proper clearance. 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.

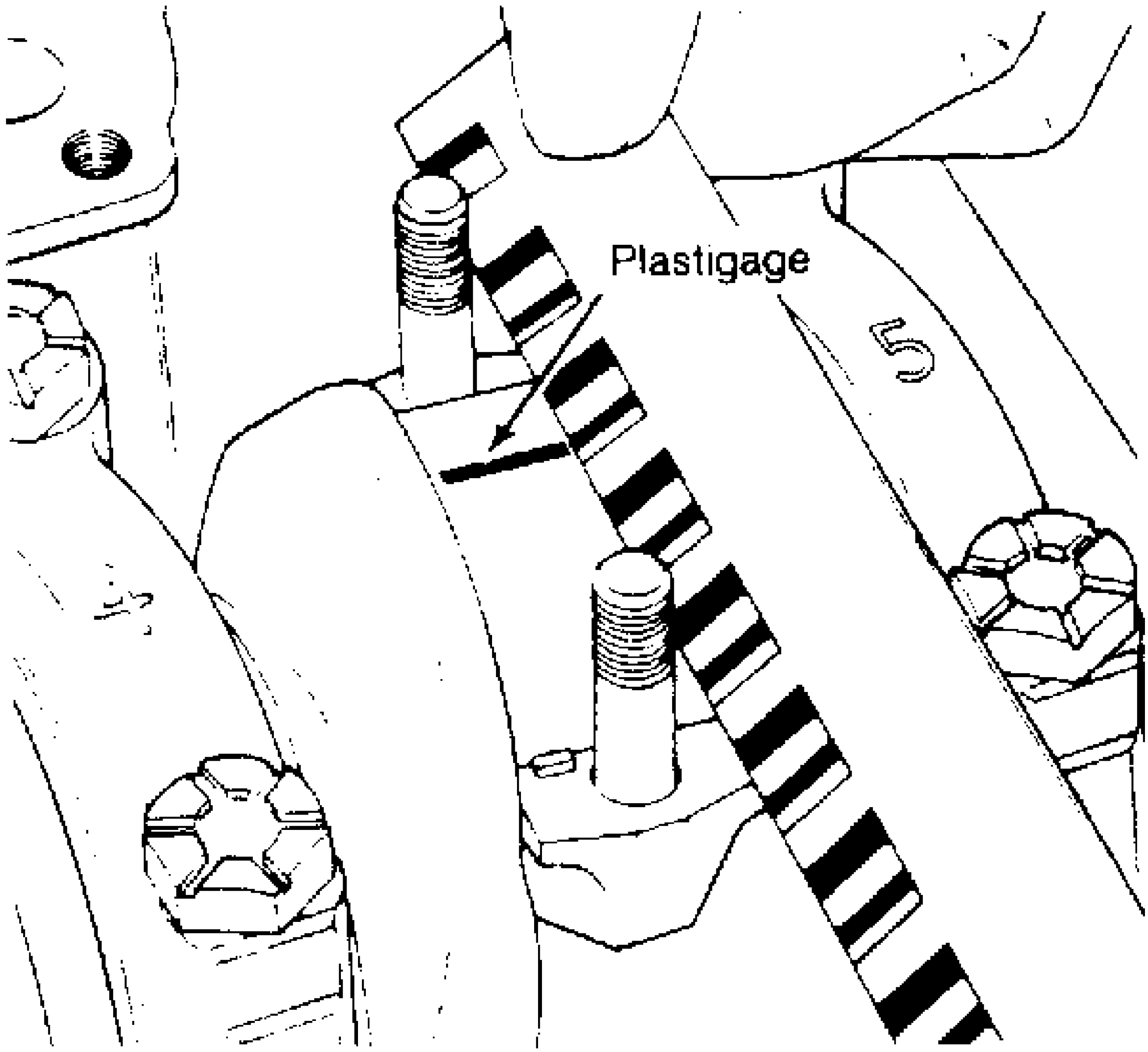

Fig. 19: Measuring Bearing Clearance - Typical
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Micrometer & Telescopic Gauge Method

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.

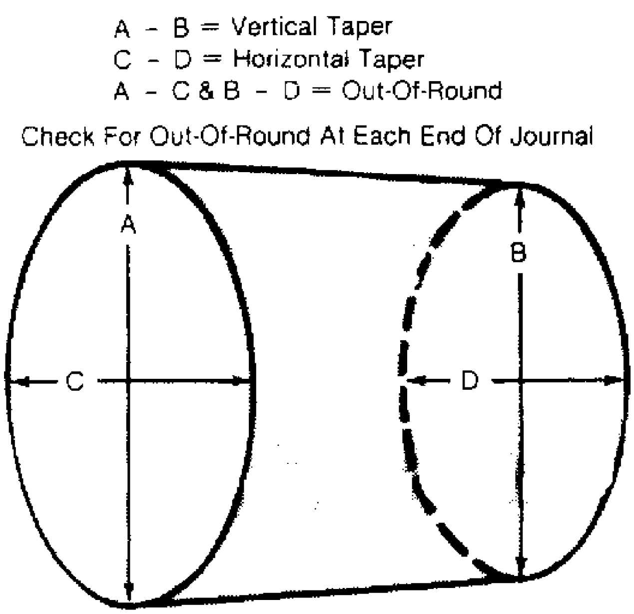

Fig. 20: Measuring Crankshaft Journal - Typical
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Crankshaft journal runout should be checked. Install crankshaft in "V" blocks or bench center. Position dial indicator

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.

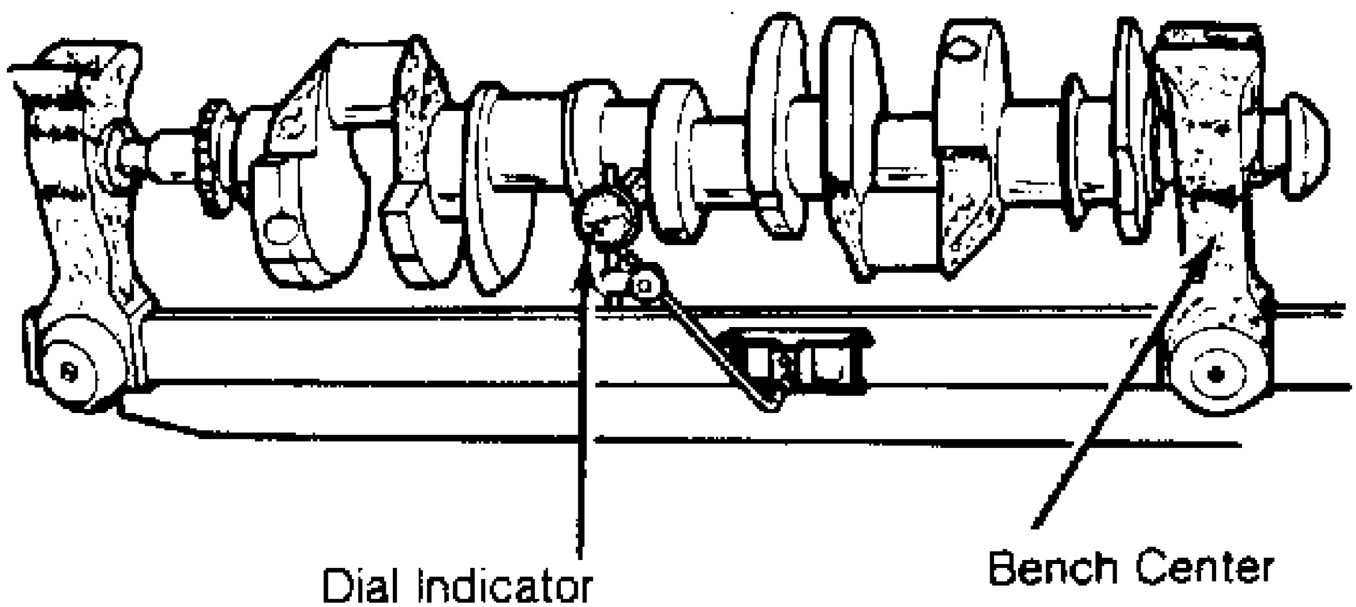

Fig. 21: Measuring Crankshaft Main Bearing Journal Runout - Typical
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INSTALLATION

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.

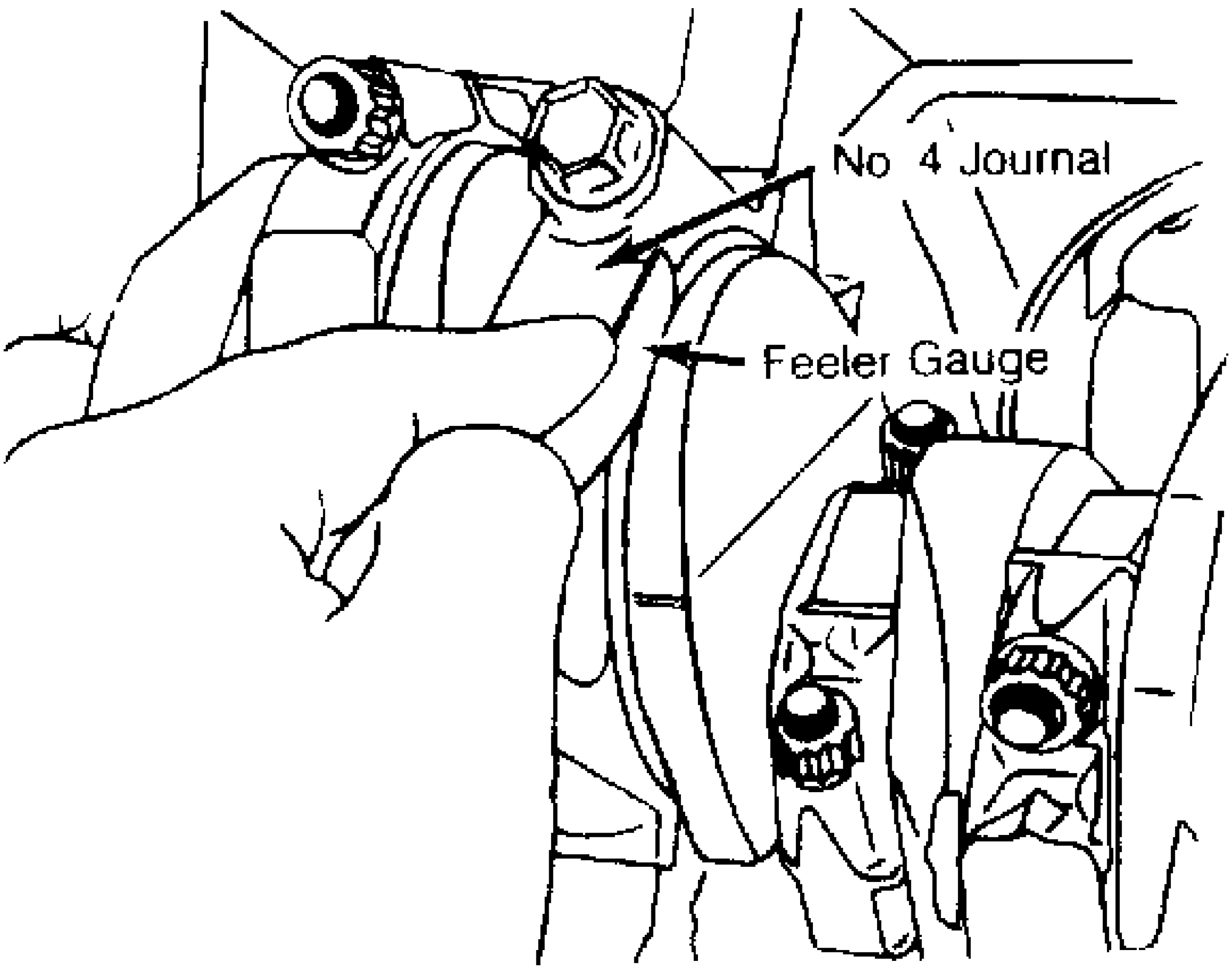

Fig. 22: Checking Crankshaft End Play - Typical
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Crankshaft end play must be within specification. If end play is not within specification, check for faulty thrust bearing installation or worn crankshaft. Some applications offer oversized thrust bearings.

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.

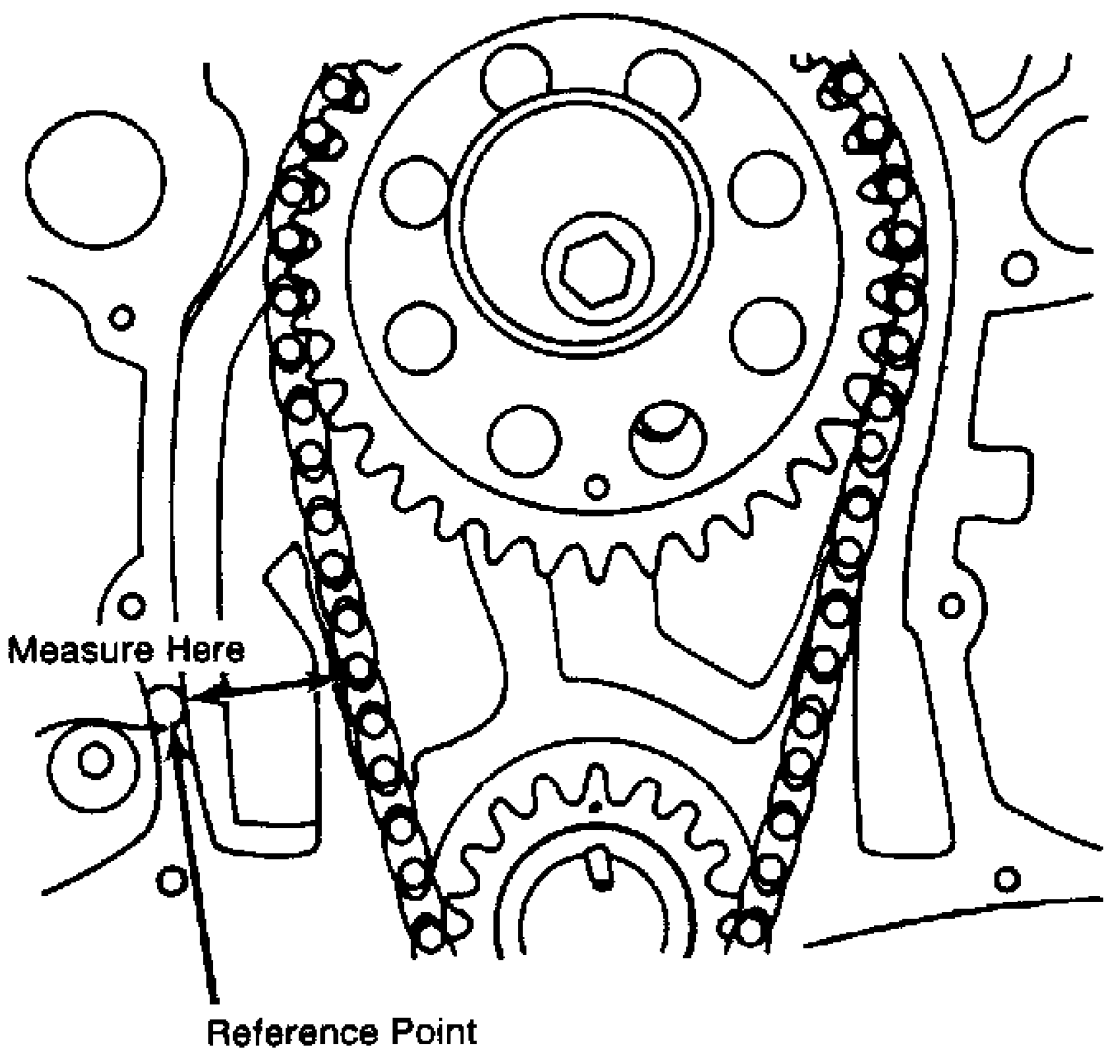

Fig. 23: Measuring Timing Chain Stretch - Typical
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Timing chains must be installed so that timing marks on camshaft gear and crankshaft gear are aligned according to manufacturer. See Fig. 24.

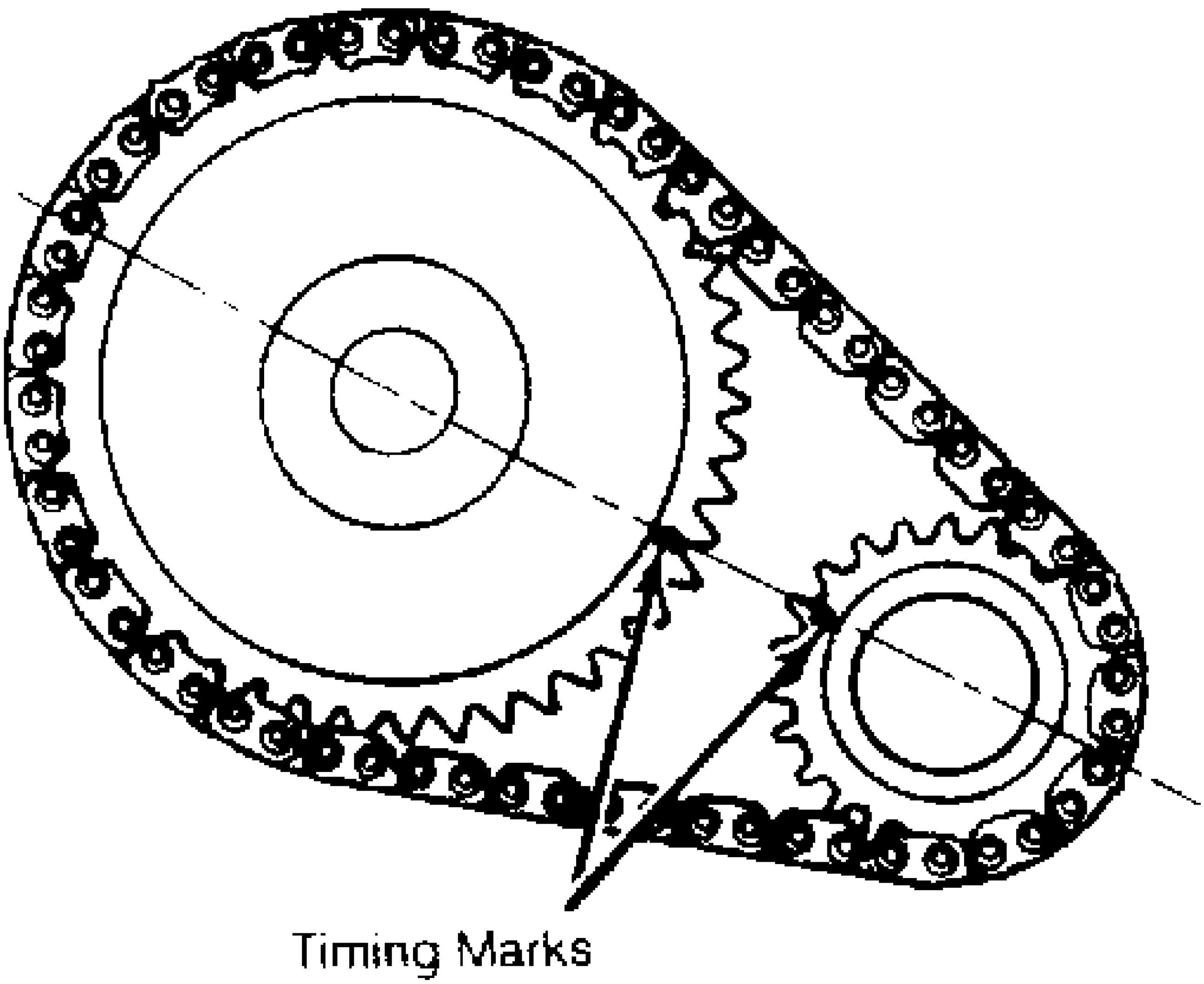

Fig. 24: Timing Gear Mark Alignment - Typical
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TIMING BELTS

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.

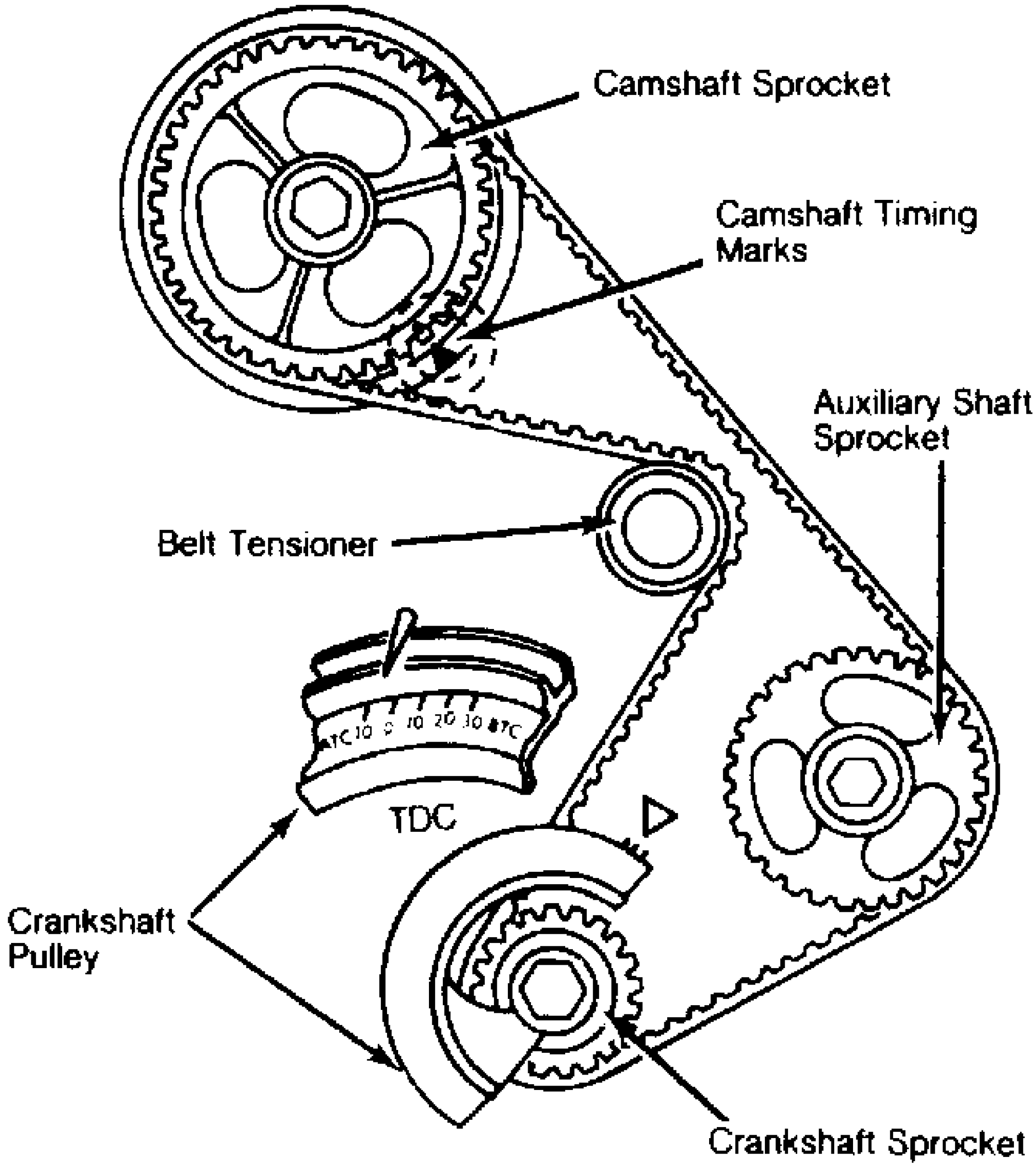

Fig. 25: Timing Belt Sprocket Alignment - Typical
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TENSION ADJUSTMENTS

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.

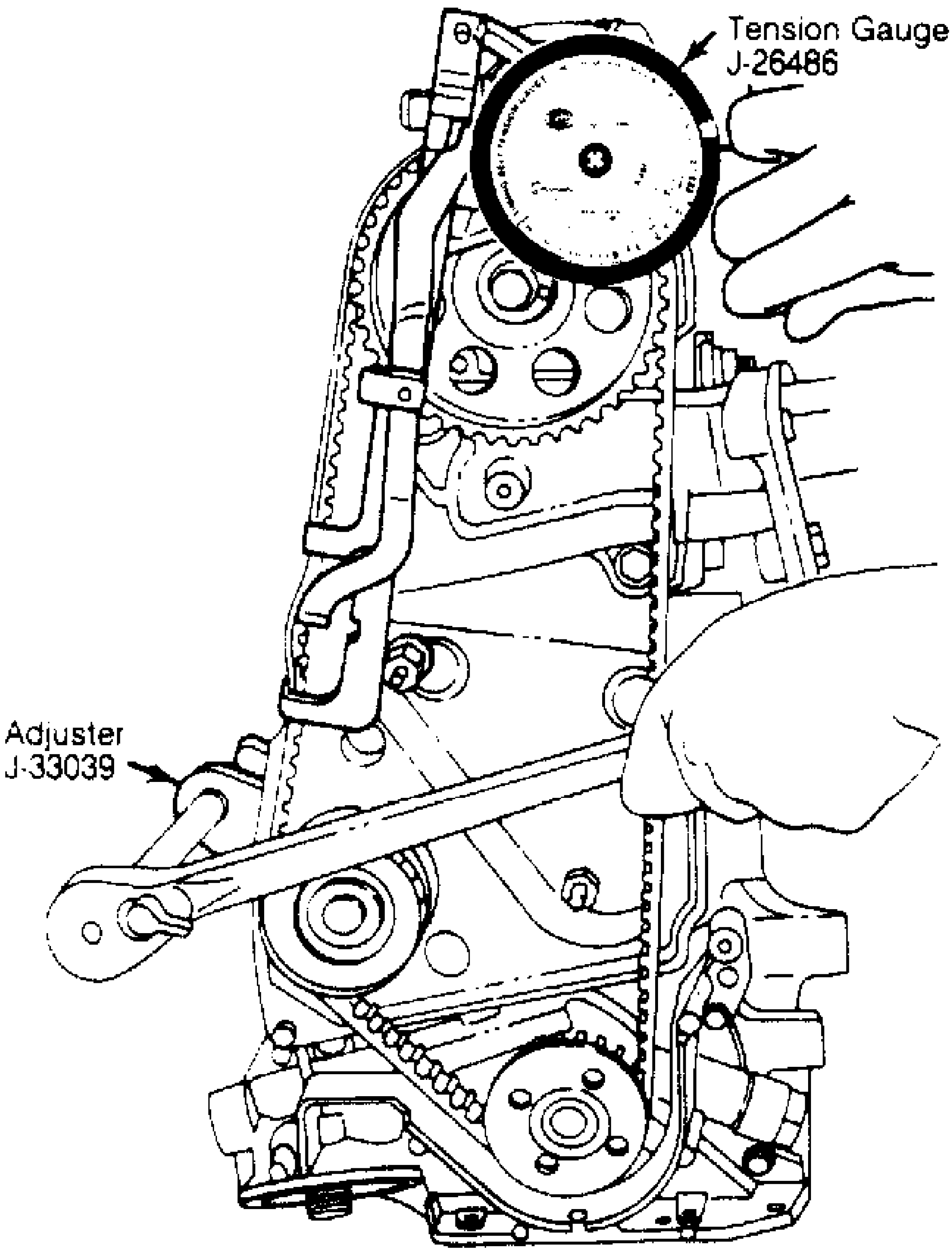

Fig. 26: Timing Belt Tension Adjustment - Typical
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TIMING GEARS

* 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.

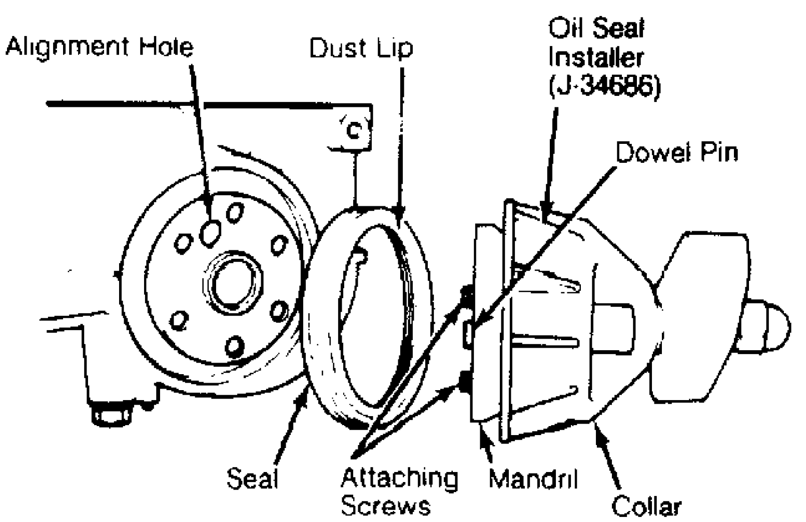

Fig. 27: Installing Typical One-Piece Oil Seal
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Rope Type Seal

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.

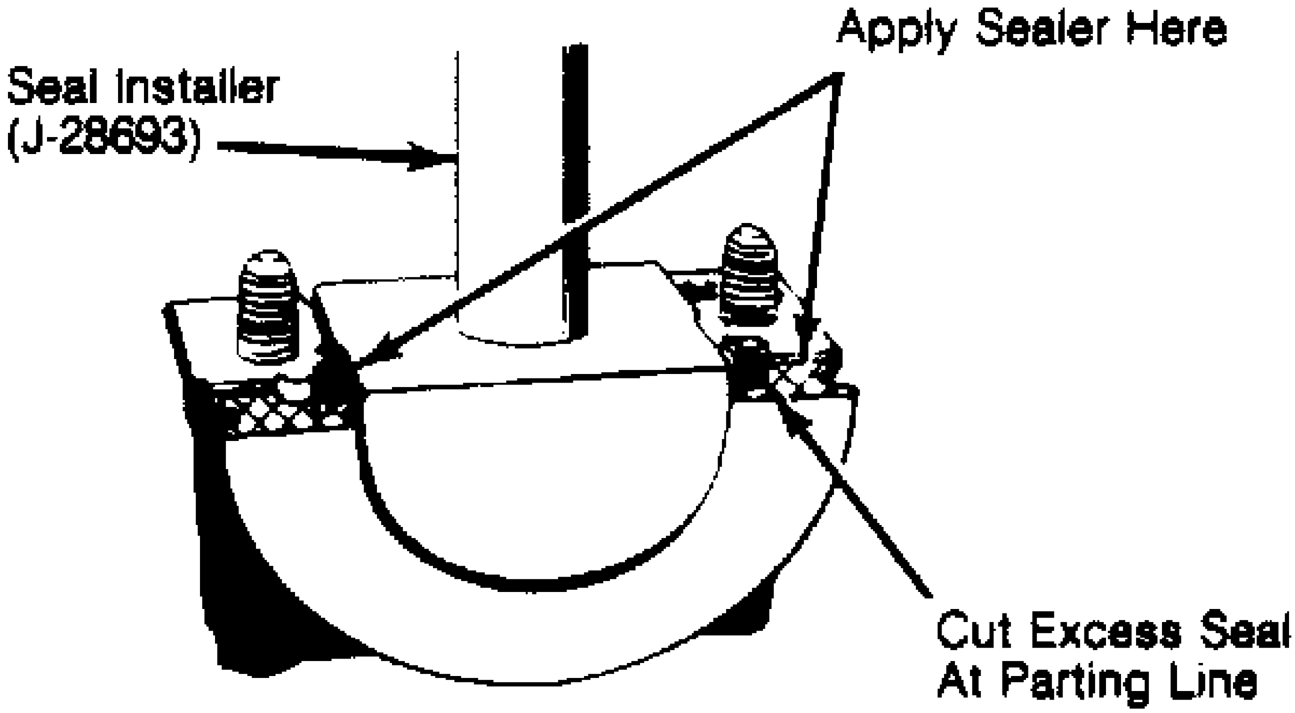

Fig. 28: Typical Rope Seal Installation
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Split-Rubber Type Seal

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.

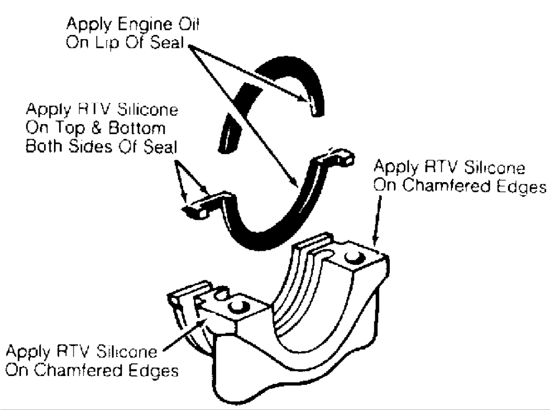

Fig. 29: Typical Split-Rubber Seal Installation
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OIL PUMP

* 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.

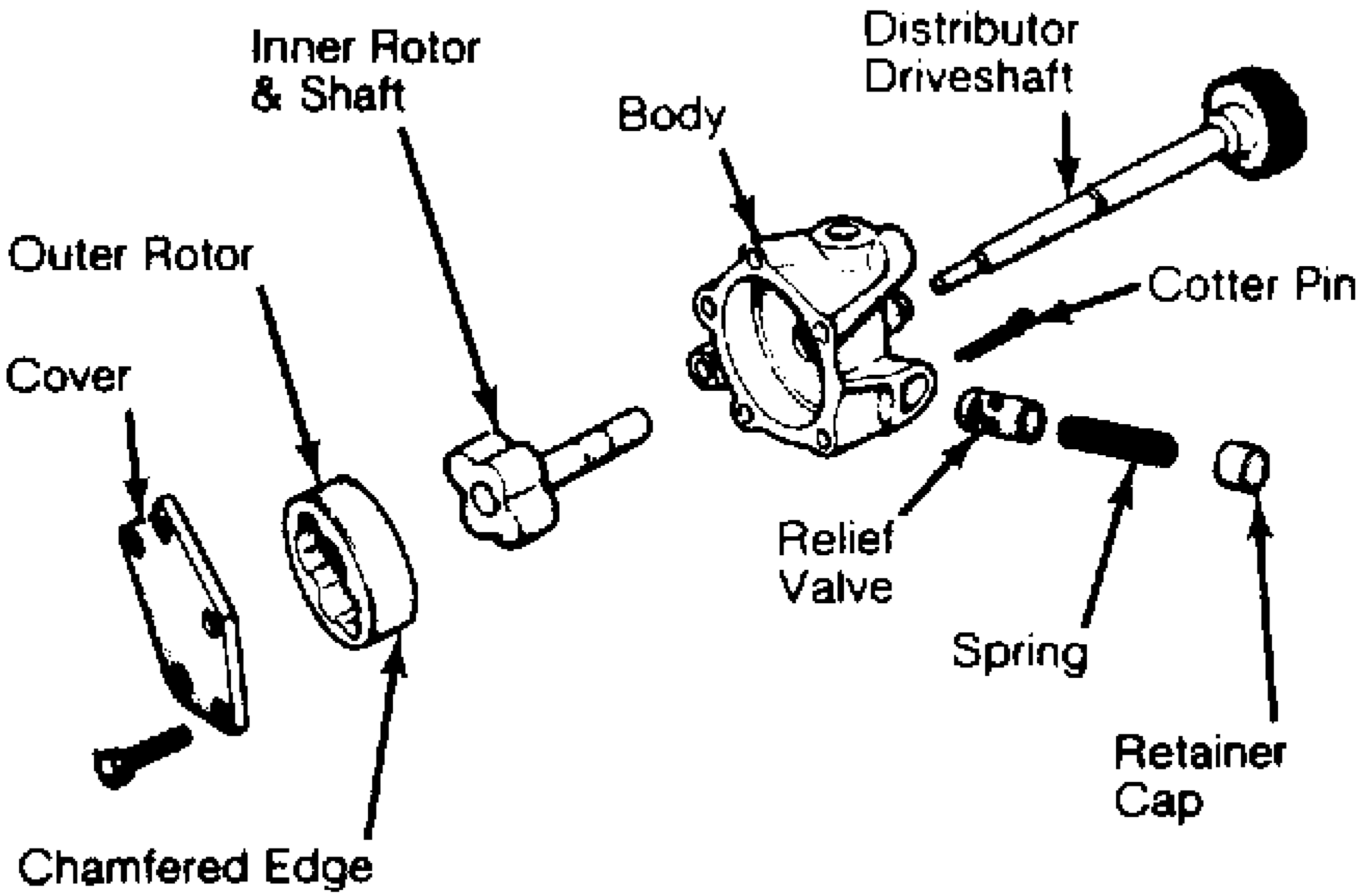

Fig. 30: Typical Rotor Type Oil Pump
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Measure outer rotor-to-body clearance. Replace pump assembly if clearance exceeds specification. Measure clearance between rotors. See Fig. 31. Replace shaft and both rotors if clearance exceeds specifications.

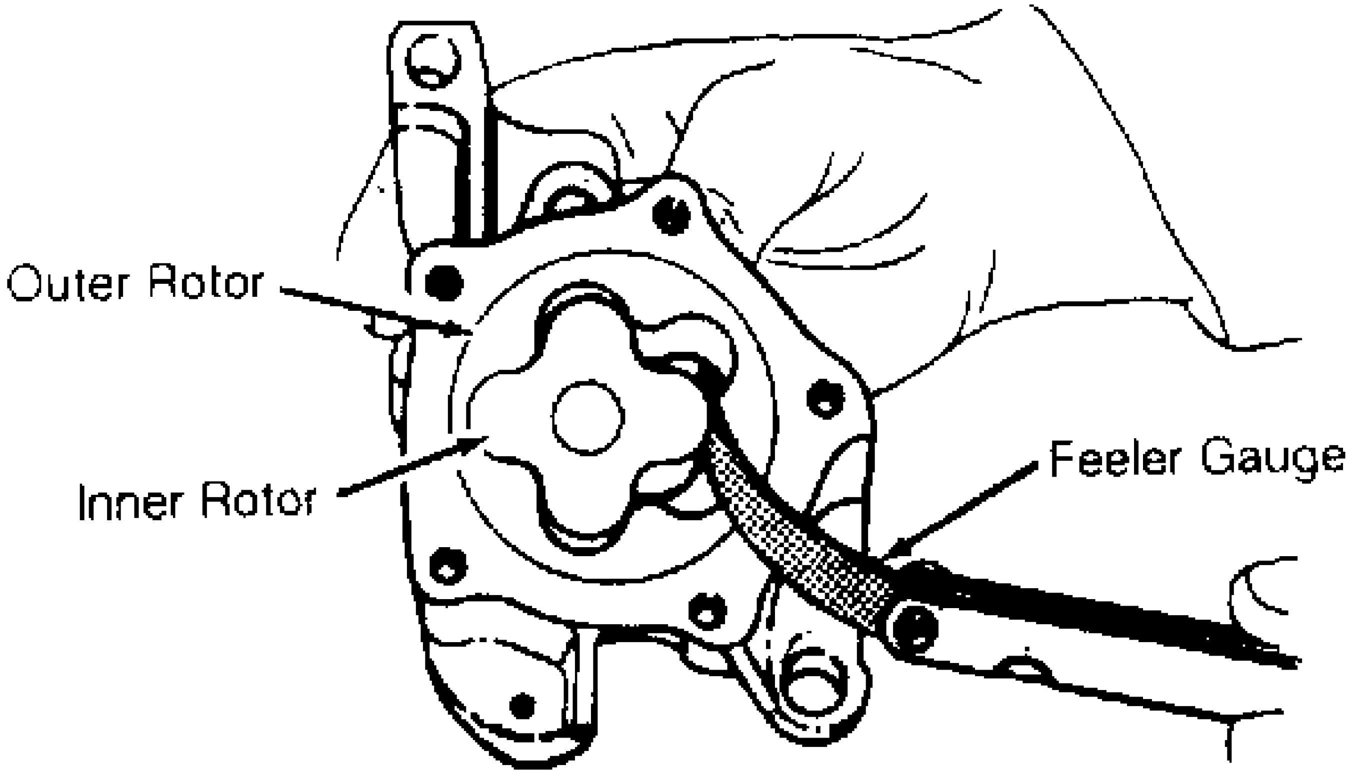

Fig. 31: Measuring Rotor Clearance - Typical
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Install rotors in pump body. Position straightedge across pump body. Using feeler gauge, measure clearance between rotors and straightedge. Pump cover wear is measured using a straightedge and feeler gauge. 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.

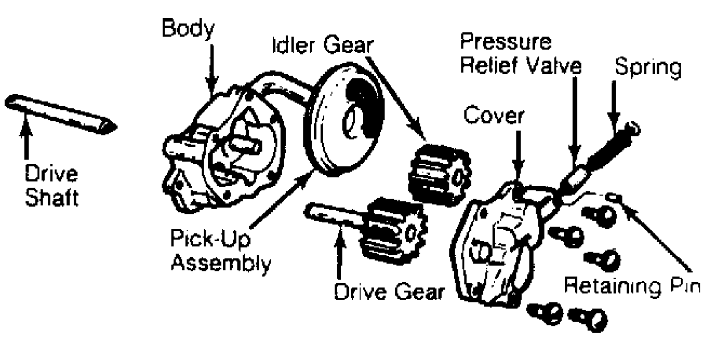

Fig. 32: Typical Gear Type Oil Pump
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Measure gear diameter and length. Measure gear housing cavity depth and diameter. See Fig. 33. Replace components if worn or damaged.

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.

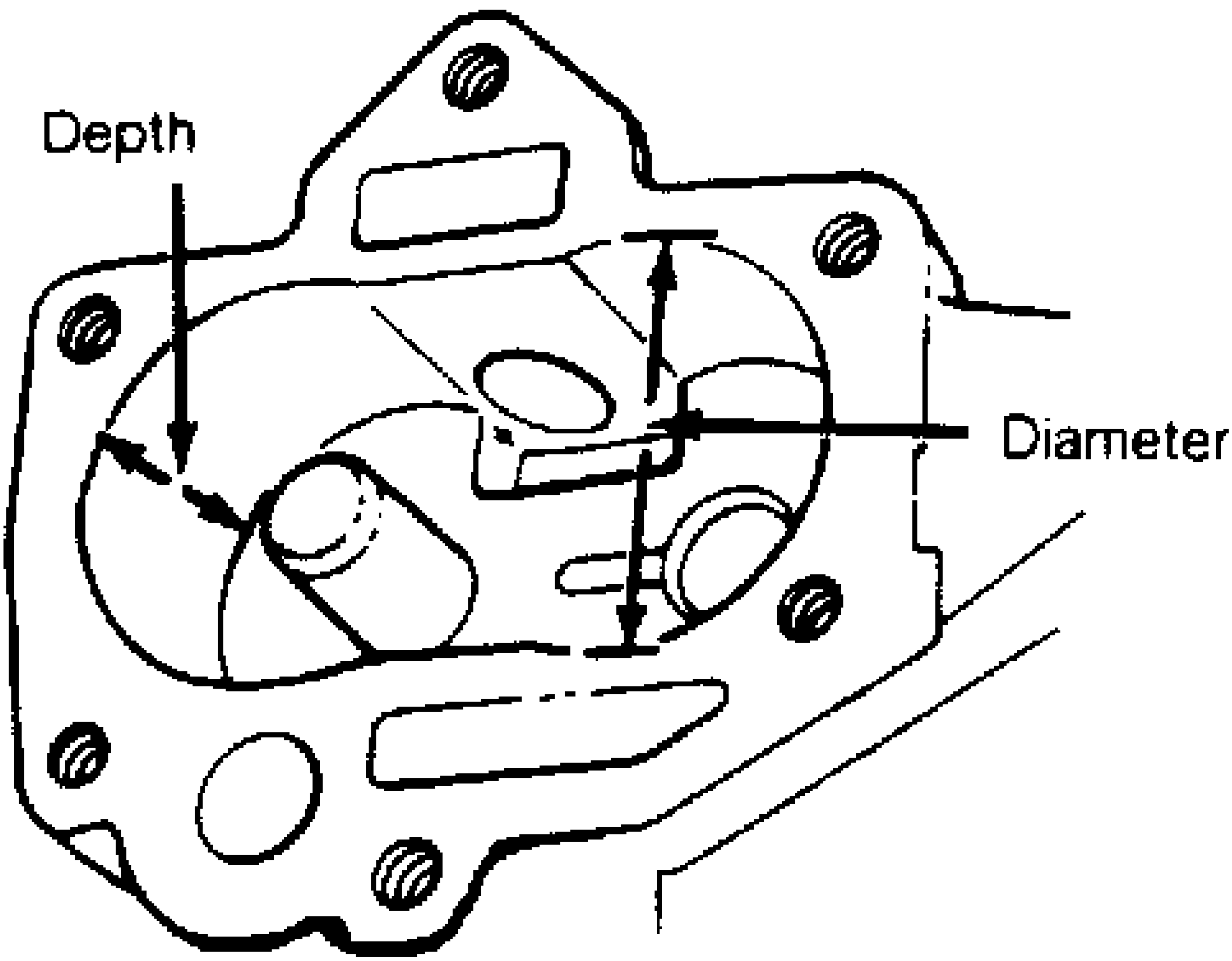

Fig. 33: Measuring Oil Pump Gear Cavity - Typical
This Graphic For General Information Only

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 *

1997 Chevrolet Blazer

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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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.

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

Condition	Code	Procedure
		of hardware.
Inoperative	A	(1) Require repair or replacement.
Leaking	A	Require replacement.
Melted, affecting performance	A	Require replacement.
Melted, not affecting performance	..	No service suggested or required.
Missing	C	Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require repair or replacement.

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

BAFFLES

See SHROUDS, BAFFLES AND DEFLECTORS.

BALLAST PRIMARY SUPPLY RESISTOR WIRES

See BALLAST RESISTORS AND PRIMARY SUPPLY RESISTOR WIRES.

BALLAST RESISTORS AND PRIMARY SUPPLY RESISTOR WIRES

BALLAST RESISTOR AND PRIMARY SUPPLY RESISTOR WIRE INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Conductor exposed	A	Require replacement.
Connector broken	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Inoperative	A	(2) Require replacement.
Insulation overheated	A	Require replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(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.

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 or driving operation to comply with all federal and local emissions standards. Adjustments are to be considered repairs.

CARBURETOR AND CHOKE INSPECTION

Condition	Code	Procedure
Air/fuel control incorrect	B	Require repair or replacement.
Application incorrect	B	Require repair or replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Components binding	A	Require repair or replacement.
Components damaged, affecting operation or performance	A	Require repair or replacement.
Components missing	C	Require replacement of components.
Contaminated	A	(1) Require repair or replacement. Further inspection required.
Controlling linkages binding	A	Require repair or replacement of linkage.
Leaking	A	Require repair or replacement.
Mechanical operation incorrect	B	Require repair or replacement.
Operating incorrectly	B	Require repair or replacement.

(1) - Some components may be serviceable; check for accepted cleaning procedure. Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.

CASTING CORE PLUGS AND EXPANSION PLUGS

CASTING CORE PLUG AND EXPANSION PLUG INSPECTION

Condition	Code	Procedure
Leaking	A	Require replacement.
Material type incorrect	2	Suggest replacement.

CHARGE AIR COOLERS "INTERCOOLERS" (CAC)

CHARGE AIR COOLER "INTERCOOLER" (CAC) INSPECTION

Condition	Code	Procedure
Air-to-air intercooler leaking, affecting boost performance	A	Require repair or replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware		

missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Leaking coolant	A	Require repair or replacement.
Missing	C	Require replacement.
Restricted, affecting performance	A	Require repair or replacement.

CHECK VALVES

See ASPIRATOR, CHECK AND DECEL VALVES.

CHOKES

See CARBURETORS AND CHOKES.

CLUTCH PEDAL POSITION SWITCHES

CLUTCH PEDAL POSITION SWITCH INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Inoperative	B	(2) Require repair or replacement. Further inspection required.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors		

exposed	B ..	Require repair or replacement.
Wire lead corroded	A ..	Require repair or replacement.
Wire lead open	A ..	Require repair or replacement.
Wire lead shorted	A ..	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

COLD START INJECTORS

See FUEL AND COLD START INJECTORS.

CONNECTORS

See WIRING HARNESSES AND CONNECTORS.

COOLANT

COOLANT INSPECTION

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

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

COOLANT RECOVERY TANKS

COOLANT RECOVERY TANK INSPECTION

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

Missing (if original equipment)	C	Require replacement.

COOLING FAN MOTOR MODULES

See COOLING FAN MOTOR RELAYS AND MODULES.

COOLING FAN MOTOR RELAYS AND MODULES

COOLING FAN MOTOR RELAY AND MODULE INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Housing cracked	2	Suggest repair or replacement.
Malfunctioning	A	(2) Require repair or replacement.
Missing	C	Require replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

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

COOLING FAN MOTOR RESISTORS

COOLING FAN MOTOR RESISTOR INSPECTION

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

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

COOLING FAN MOTOR SENSORS AND SWITCHES

COOLING FAN MOTOR SENSOR AND SWITCH INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or

		replacement.
Inoperative	B	(3) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

COOLING FAN MOTOR SWITCHES

See COOLING FAN MOTOR SENSORS AND SWITCHES.

COOLING FAN MOTORS

COOLING FAN MOTOR INSPECTION

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

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.

Condition	Code	Procedure
Terminal broken	A	.. Require repair or replacement.
Terminal burned, affecting performance	A	.... (1) Require repair or replacement.
Terminal burned, not affecting performance ..	2	.. Suggest repair or replacement.
Terminal corroded, affecting performance ..	A	.. Require repair or replacement.
Terminal corroded, not affecting performance ..	2	.. Suggest repair or replacement.
Terminal loose, affecting performance	B	.. Require repair or replacement.
Terminal loose, not affecting performance ..	1	.. Suggest repair or replacement.
Threads damaged	A	.. Require repair or replacement.
Threads stripped (threads missing)	A	.... Require replacement.
Wire lead conductors exposed	B	.. Require repair or replacement.
Wire lead corroded	A	.. Require repair or replacement.
Wire lead open	A	.. Require repair or replacement.
Wire lead shorted	A	.. Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

IGNITION BOOTS

See
IGNITION WIRES, BOOTS, COIL TOWERS AND TERMINALS (SECONDARY).

IGNITION COIL TOWERS

See
IGNITION WIRES, BOOTS, COIL TOWERS AND TERMINALS (SECONDARY).

IGNITION COILS

IGNITION COIL INSPECTION

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

		replacement.
Connector missing	C	Require replacement.
Corroded, affecting performance	A	Require replacement.
Corroded, not affecting performance	2	Suggest replacement.
Distorted	..	(2) No service suggested or required.
Inoperative	A	(3) Require replacement.
Oil leaking	A	Require replacement.
Out of specification	B	Require replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Distortion may be the result of overheating; coil should be tested.
(3) - Inoperative includes intermittent operation.

IGNITION CONTROL MODULES (ICM)

IGNITION CONTROL MODULE (ICM) INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Code set (if applicable)	A	(1) Further inspection required.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(2) Require repair or replacement.

Connector missing	A	.... Require repair.
Contaminated	A	.... (3) Require repair or replacement.
Leaking	A	.. Require repair or replacement.
Malfunctioning	A	.... (4) Require repair or replacement.
Missing	C	.... Require replacement.
Terminal broken	A	.. Require repair or replacement.
Terminal burned, affecting performance	A	.... (2) Require repair or replacement.
Terminal burned, not affecting performance ..	2	.. Suggest repair or replacement.
Terminal corroded, affecting performance ..	A	.. Require repair or replacement.
Terminal corroded, not affecting performance ..	2	.. Suggest repair or replacement.
Terminal loose, affecting performance	B	.. Require repair or replacement.
Terminal loose, not affecting performance ..	1	.. Suggest repair or replacement.
Threads damaged	A	.. Require repair or replacement.
Wire lead conductors exposed	B	.. Require repair or replacement.
Wire lead corroded	A	.. Require repair or replacement.
Wire lead open	A	.. Require repair or replacement.
Wire lead shorted	A	.. Require repair or replacement.

(1) - Refer to manufacturer's diagnostic trouble code procedure and require repair or replacement of affected component(s).
(2) - Determine cause and correct prior to repair or replacement of part.
(3) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(4) - Includes inoperative, intermittent operation, or failure to perform all functions.

IGNITION SWITCHES

See SWITCHES.

IGNITION TERMINALS

See
IGNITION WIRES, BOOTS, COIL TOWERS AND TERMINALS (SECONDARY).

IGNITION WIRES, BOOTS, COIL TOWERS AND TERMINALS (SECONDARY)

NOTE: You are not required to replace ignition wires in sets. However, you may suggest replacement of the entire secondary wire set for preventive maintenance.

IGNITION WIRE, BOOT, COIL TOWER AND TERMINAL (SECONDARY) INSPECTION

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

Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Carbon-tracked	A	Require replacement.
Corroded	1	Suggest repair or replacement.
Insulation leaking (shorted)	A	Require repair or replacement.
Metal heat shield bent	2	Suggest repair or replacement.
Missing	C	Require replacement.
Oil-soaked (spongy)	1	Suggest replacement.
Resistance incorrect	B	Require replacement.
Routed incorrectly	2	(1) Suggest repair.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(2) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.

(1) - If improper routing affects the performance of other systems, require repair. Proper routing, hardware, heatshields, etc., are intended to prevent premature failure of secondary ignition components.
(2) - Determine cause and correct prior to repair or replacement of part.

IN-TANK FUEL STRAINERS

IN-TANK FUEL STRAINER INSPECTION

Condition	Code	Procedure
Missing	C	Require replacement.
Restricted	A	Require repair or replacement.
Torn	A	Require replacement.

INERTIA FUEL SHUT-OFF SWITCHES

INERTIA FUEL SHUT-OFF SWITCH INSPECTION

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

		of hardware.
Connector broken	A	.. Require repair or replacement.
Connector melted	A	.... (1) Require repair or replacement.
Connector missing	C	.... Require replacement.
Contaminated	A	.... (2) Require replacement.
Inoperative	A	.... (3) Require repair or replacement.
Missing	C	.... Require replacement.
Terminal broken	A	.. Require repair or replacement.
Terminal burned, affecting performance	A	.... (1) Require repair or replacement.
Terminal burned, not affecting performance ..	2	.. Suggest repair or replacement.
Terminal corroded, affecting performance ..	A	.. Require repair or replacement.
Terminal corroded, not affecting performance ..	2	.. Suggest repair or replacement.
Terminal loose, affecting performance	B	.. Require repair or replacement.
Terminal loose, not affecting performance ..	1	.. Suggest repair or replacement.
Wire lead conductors exposed	B	.. Require repair or replacement.
Wire lead corroded	A	.. Require repair or replacement.
Wire lead open	A	.. Require repair or replacement.
Wire lead shorted	A	.. Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification.

INTAKE AIR TEMPERATURE SENSORS

INTAKE AIR TEMPERATURE SENSOR INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	.... Require replacement of hardware.
Attaching hardware threads damaged	A	... Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	... Require repair or replacement of hardware.
Connector broken	A	.. Require repair or replacement.
Connector (Weatherpack type) leaking	A	.. Require repair or replacement.
Connector melted	A	.... (1) Require repair or replacement.
Connector missing	C	.... Require replacement.
Contaminated	A	.... (2) Require repair or replacement.
Inoperative	B	.... (3) Require repair or

		replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Restricted, affecting performance	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

INTAKE MANIFOLDS

INTAKE MANIFOLD INSPECTION

Condition	Code	Procedure
Corroded, affecting sealability	A	Require repair or replacement.
Integrated air or fuel control components inoperative	A	(1) Require repair or replacement.
Internal air or fuel components damaged, affecting performance	A	Require repair or replacement of component.
Internal air or fuel components damaged, not affecting performance	..	No service suggested or required.
Internal air or fuel components missing	C	Require replacement of

		component.
Leaking	A	.. Require repair or replacement.
Out of specification	B	.... Require replacement.
Restricted	A	.. Require repair or replacement.
Threads damaged	A	.. Require repair or replacement.
Threads stripped (threads missing)	A	.. Require repair or replacement.
Warped	B	.. Require repair or replacement.

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

INTERCOOLERS

See CHARGE AIR COOLERS "INTERCOOLERS" (CAC).

KNOCK SENSORS

KNOCK SENSOR INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	.... Require replacement of hardware.
Attaching hardware threads damaged	A	... Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	... Require repair or replacement of hardware.
Connector broken	A	.. Require repair or replacement.
Connector (Weatherpack type) leaking	A	.. Require repair or replacement.
Connector melted	A	.... (1) Require repair or replacement.
Connector missing	C	.... Require replacement.
Inoperative	B	.... (2) Require repair or replacement. Further inspection required.
Leaking	A	.. Require repair or replacement.
Missing	C	.... Require replacement.
Resistance out of specification	B	.. Require repair or replacement.
Terminal broken	A	.. Require repair or replacement.
Terminal burned, affecting performance	A	.... (1) Require repair or replacement.
Terminal burned, not affecting performance ..	2	.. Suggest repair or replacement.
Terminal corroded, affecting performance ..	A	.. Require repair or replacement.
Terminal corroded, not affecting performance ..	2	.. Suggest repair or replacement.
Terminal loose, affecting performance	B	.. Require repair or replacement.
Terminal loose, not affecting performance ..	1	.. Suggest repair or replacement.
Threads damaged	A	.. Require repair or replacement.
Threads stripped (threads missing)	A	.... Require replacement.

Condition	Code	Procedure
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.

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

PCV VALVES

PCV VALVE INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Grommet broken	A	Require repair or replacement of grommet.
Grommet missing	C	Require replacement of grommet.
Grommet not functioning	A	Require repair or replacement of grommet.
Inoperative	A	(1) Require replacement.
Leaking	A	Require replacement.
Maintenance interval	3	Suggest replacement to comply with vehicle's OEM recommended service intervals.
Missing	C	Require replacement.
Restricted	A	Require replacement.

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

PICK-UP ASSEMBLIES (INCLUDES MAGNETIC, HALL EFFECT AND OPTICAL)

PICK-UP ASSEMBLY (MAGNETIC, HALL EFFECT AND OPTICAL) INSPECTION

Condition	Code	Procedure
Adjustment incorrect	B	Require repair.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Inoperative	B	(2) Require replacement.
Oil-soaked	A	Require replacement.

Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

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

POWER STEERING PRESSURE SENSORS

POWER STEERING PRESSURE SENSOR INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Inoperative	B	(3) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Restricted, affecting performance	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or

		replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

POWERTRAIN CONTROL MODULES (PCM) AND PROM

POWERTRAIN CONTROL MODULE (PCM) AND PROM INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Code set (if applicable)	A	(1) Further inspection required.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(2) Require repair or replacement.
Connector missing	A	Require repair.
Contaminated	A	(3) Require repair or replacement.
Leaking	A	Require repair or replacement.
Malfunctioning	A	(4) Require repair or replacement.
Missing	C	Require replacement.
Terminal broken	A	Require repair or replacement.

Terminal burned, affecting performance	A	(2) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Refer to manufacturer's diagnostic trouble code procedure and require repair or replacement of affected component(s).
(2) - Determine cause and correct prior to repair or replacement of part.
(3) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(4) - Includes inoperative, intermittent operation, failure to perform all functions, or out of OEM specification.

POWERTRAIN CONTROL PROM

See POWERTRAIN CONTROL MODULES (PCM) AND PROM.

PRESSURIZED EXPANSION TANK CAPS

See RADIATOR CAPS AND PRESSURIZED EXPANSION TANK CAPS.

RADIATOR CAPS AND PRESSURIZED EXPANSION TANK CAPS

RADIATOR CAP AND PRESSURIZED EXPANSION TANK CAP INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Coolant recovery check valve inoperative	A	(1) Require replacement.
Fails to maintain proper pressure	B	Require replacement.
Gasket missing	C	Require replacement of gasket.
Missing	C	Require replacement.
Seal missing	C	Require replacement of seal.

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

RADIATOR FAN BLADES

RADIATOR FAN BLADE INSPECTION

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

RADIATOR FAN CLUTCHES

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

RADIATOR FAN CLUTCH INSPECTION

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

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

RADIATORS

RADIATOR INSPECTION

Condition	Code	Procedure
Air flow restriction	A	Require repair.

Application incorrect ...	B	.... Require replacement.
Attaching hardware broken	A	... Require repair or replacement of hardware.
Attaching hardware missing	C	.... Require replacement of hardware.
Attaching hardware not functioning	A	.. Require repair or replacement of hardware.
Connection leaking	A	.. Require repair or replacement.
Corroded	1	.. Suggest repair or replacement.
Fins damaged, affecting performance	A	.. Require repair or replacement.
Fins damaged, not affecting performance ..	2	.. Suggest repair or replacement.
Internal oil cooler leaking	A	.. Require repair or replacement.
Internal restrictions, affecting performance ..	B	.. Require repair or replacement.
Internal restrictions, not affecting performance ..	2	.. Suggest repair or replacement.
Leaking	A	.. Require repair or replacement.
Threads damaged	A	.. Require repair or replacement.
Threads stripped (threads missing)	A	.. Require repair or replacement.
Tubes damaged, affecting performance	A	.. Require repair or replacement.
Tubes damaged, not affecting performance ..	..	.... No service suggested or required.

ROLL OVER VALVES

ROLL OVER VALVE INSPECTION

Condition	Code	Procedure
Inoperative	A	.... (1) Require replacement.
Leaking	A	.... Require replacement.
Missing	C	.... Require replacement.

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

SEALING COMPOUNDS

SEALING COMPOUND INSPECTION

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

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

SEALS

SEAL INSPECTION

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

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

SECONDARY AIR INJECTION SYSTEM MANAGEMENT DEVICES

SECONDARY AIR INJECTION SYSTEM MANAGEMENT DEVICE INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Inoperative	B	(3) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Restricted, affecting performance	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.

Wire lead open	.... A	..	Require repair or replacement.
Wire lead shorted	.... A	..	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

SENSORS AND ACTUATORS

NOTE: Conditions pertaining to the sensors and actuators listed in this section may be found under the name of the sensor or actuator.

SENSOR ABBREVIATION TABLE

Sensor	Abbreviation
Accelerator Pedal Position Sensor	APP
Air Conditioning Cycling Switch	AC
Air Conditioning Pressure Sensor	..
Air Fuel Ratio Sensor	..
Barometric Pressure Sensor	BARO
Camshaft Position Sensor	CMP
Clutch Pedal Position Switch	CPP
Cooling Fan Motor Sensors and Switches	..
Crankshaft Position Sensor	CKP
Electronic Transmission Feedback Devices	..
Engine Coolant Temperature Sensor	ECT
Evaporative Emission feedback devices	..
Exhaust Gas Recirculation feedback devices	..
Fan Control Sensor	FC
Intake Air Temperature Sensor	IAT
Knock Sensor	KS
Manifold Absolute Pressure Sensor	MAP
Mass Air Flow Sensor	MAF
O2 Sensor	O2S
Park Neutral Position Switch	PNP
Power Steering Pressure Sensor	PSP
Thermal Vacuum Valve	TVV
Throttle Position Sensor	TP Sensor
Throttle Position Switch	..
Transmission Range Switch	TR Switch
Vehicle Speed Sensor	VSS
Volume Air Flow Sensor	VAF

ACTUATOR ABBREVIATION TABLE

Actuator	Abbreviation
Air Injection Control Solenoid	..
Electronic Transmission control devices	..
Evaporative Emission Canister	EVAP
Purge Device	..
Exhaust Gas Recirculation Device	EGR
Fuel Injector	..
Idle Air Control	IAC

Idle Speed Control Actuator	ISC
Mix Control Solenoid	MC Solenoid
Secondary Air Injection System Management Device	AIR, PAIR
Vacuum Regulator Solenoid	..
Waste Gate Control Solenoid	..

SHROUDS, BAFFLES AND DEFLECTORS

SHROUD, BAFFLE AND DEFLECTOR INSPECTION

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

SPARK PLUGS

NOTE: You are not required to replace spark plugs in sets. However, you may suggest replacement of the other plugs for preventive maintenance.

SPARK PLUG INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Electrode eroded	1	Suggest replacement.
Fouled	A	(1) Require repair or replacement.
Gap incorrect	B	Require repair or replacement.
Insulation broken	A	Require replacement
Insulator cracked	A	Require replacement.
Leaking compression	A	Require repair or replacement.
Maintenance interval	3	Suggest replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads		

missing) .... A .... Require replacement.

(1) - Determine cause of fouling and suggest repair.

SPRING LOCKS

SPRING LOCK INSPECTION

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

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

SUPER CHARGERS

SUPER CHARGER INSPECTION

Condition	Code	Procedure
Attaching hardware damaged, affecting operation or performance	A ...	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Bearing noisy	A	Require replacement.
Bearing worn	A	Require replacement.
Boost pressure incorrect	A	(1) Require repair or replacement.
Clearance out of specification	B ..	Require repair or replacement.
Leaking	A ..	Require repair or replacement.
Noisy	2 ..	Suggest repair or replacement.
Threads damaged	A ..	Require repair or replacement.
Threads stripped (threads missing)	A ..	Require repair or replacement.

(1) - Boost pressure problems may be caused by other systems or components.

SWITCHES

SWITCH INSPECTION

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

		of hardware.
Binding, affecting performance	A	Require repair or replacement.
Binding, not affecting performance	2	Suggest repair or replacement.
Broken	A	Require repair or replacement.
Burned, affecting performance	A	(1) Require repair or replacement.
Burned, not affecting performance	2	(1) Suggest repair or replacement.
Cracked, affecting performance	A	Require repair or replacement.
Cracked, not affecting performance	1	Suggest repair or replacement.
Leaking	A	Require repair or replacement.
Malfunctioning	A	(2) Require repair or replacement.
Melted, affecting performance	A	(1) Require repair or replacement.
Melted, not affecting performance	2	(1) Suggest repair or replacement.
Missing	C	Require replacement.
Out of adjustment	B	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Won't return	A	Require repair or replacement.
Worn	1	Suggest replacement.

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

THERMAL VACUUM VALVES

THERMAL VACUUM VALVE INSPECTION

Condition	Code	Procedure
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or

		replacement.
Inoperative	B	.... (3) Require repair or replacement. Further inspection required.
Leaking	A	.. Require repair or replacement.
Missing	C	.... Require replacement.
Resistance out of specification	B	.. Require repair or replacement.
Restricted, affecting performance	A	.. Require repair or replacement.
Terminal broken	A	.. Require repair or replacement.
Terminal burned, affecting performance	A	.... (1) Require repair or replacement.
Terminal burned, not affecting performance ..	2	.. Suggest repair or replacement.
Terminal corroded, affecting performance ..	A	.. Require repair or replacement.
Terminal corroded, not affecting performance ..	2	.. Suggest repair or replacement.
Terminal loose, affecting performance	B	.. Require repair or replacement.
Terminal loose, not affecting performance ..	1	.. Suggest repair or replacement.
Threads damaged	A	.. Require repair or replacement.
Threads stripped (threads missing)	A	.... Require replacement.
Wire lead conductors exposed	B	.. Require repair or replacement.
Wire lead corroded	A	.. Require repair or replacement.
Wire lead open	A	.. Require repair or replacement.
Wire lead shorted	A	.. Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

THERMOSTATIC AIR DOOR ASSEMBLIES

THERMOSTATIC AIR DOOR ASSEMBLY INSPECTION

Condition	Code	Procedure
Attaching hardware damaged, affecting operation or performance	A	... Require repair or replacement of hardware.
Attaching hardware missing	C	.... Require replacement of hardware.
Binding	A	.. Require repair or replacement.
Leaking	A	.. Require repair or replacement.
Missing	C	.... Require replacement.
Seized	A	.. Require repair or replacement.

THERMOSTATS AND HOUSINGS

THERMOSTAT AND HOUSING INSPECTION

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

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

THROTTLE BODIES

THROTTLE BODY INSPECTION

Condition	Code	Procedure
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Leaking	A	Require repair or replacement.
Restricted	A	(3) Require repair.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.

Threads damaged	A ..	Require repair or replacement.
Threads stripped (threads missing)	A ..	Require repair or replacement.
Throttle shaft binding, affecting performance ..	A ..	Require repair or replacement.
Throttle shaft worn, affecting performance ..	A ..	Require repair or replacement.
Throttle shaft worn, not affecting performance ..	1 ..	Suggest repair or replacement.
Wire lead conductors exposed	B ..	Require repair or replacement.
Wire lead corroded	A ..	Require repair or replacement.
Wire lead open	A ..	Require repair or replacement.
Wire lead shorted	A ..	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Some components may be serviceable; check for accepted cleaning procedure.

THROTTLE CABLES

See THROTTLE LINKAGES AND CABLES.

THROTTLE LINKAGES AND CABLES

THROTTLE LINKAGE AND CABLE INSPECTION

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

Bracket loose, affecting performance	A	Require repair or replacement.
Bracket loose, not affecting performance	1	Suggest repair or replacement.
Bracket missing	C	Require replacement.
Broken	A	Require replacement.
Cracked	A	Require repair or replacement.
Disconnected	A	Require repair or replacement.
Kinked	A	Require repair or replacement.
Melted	A	Require repair or replacement.
Missing	C	Require replacement.
Noisy	2	Suggest repair or replacement.
Out of adjustment	B	(1) Require repair or replacement.
Routed incorrectly	2	Suggest repair.
Seized	A	Require repair or replacement.

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

THROTTLE POSITION SENSORS

THROTTLE POSITION SENSOR INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Inoperative	B	(3) Require repair or replacement. Further inspection required.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not		

affecting performance ..	1	.. Suggest repair or replacement.
Threads damaged	A	.. Require repair or replacement.
Threads stripped (threads missing)	A	.... Require replacement.
Wire lead conductors exposed	B	.. Require repair or replacement.
Wire lead corroded	A	.. Require repair or replacement.
Wire lead open	A	.. Require repair or replacement.
Wire lead shorted	A	.. Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

THROTTLE POSITION SWITCHES

THROTTLE POSITION SWITCH INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	.... Require replacement of hardware.
Attaching hardware threads damaged	A	... Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	.. Require repair or replacement of hardware.
Connector broken	A	.. Require repair or replacement.
Connector (Weatherpack type) leaking	A	.. Require repair or replacement.
Connector melted	A	.... (1) Require repair or replacement.
Connector missing	C	.... Require replacement.
Inoperative	B	.... (2) Require repair or replacement. Further inspection required.
Missing	C	.... Require replacement.
Resistance out of specification	B	.. Require repair or replacement.
Terminal broken	A	.. Require repair or replacement.
Terminal burned, affecting performance	A	.... (1) Require repair or replacement.
Terminal burned, not affecting performance ..	2	.. Suggest repair or replacement.
Terminal corroded, affecting performance ..	A	.. Require repair or replacement.
Terminal corroded, not affecting performance ..	2	.. Suggest repair or replacement.
Terminal loose, affecting performance	B	.. Require repair or replacement.
Terminal loose, not affecting performance ..	1	.. Suggest repair or replacement.
Threads damaged	A	.. Require repair or replacement.

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

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

TIMING BELT SPROCKETS

TIMING BELT SPROCKET INSPECTION

Condition	Code	Procedure
Alignment incorrect	B	Require repair.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Bent	A	Require replacement.
Cracked	A	Require replacement.
Key damaged	A	Require replacement.
Loose	A	Require repair or replacement.
Missing	C	Require replacement.
Pulley damaged, affecting belt life	A	Require replacement.
Sprocket damaged, affecting belt life	A	Require repair or replacement.
Sprocket loose	B	Require repair or replacement.
Sprocket-to-shaft alignment incorrect	B	Require repair or replacement.

TIMING BELTS

TIMING BELT INSPECTION

Condition	Code	Procedure
Adjustment incorrect	2	(1) Suggest adjustment.
Alignment incorrect	B	(2) Further inspection required.
Broken	A	Require replacement.
Cam timing out of specification	B	Require repair.
Cracked	1	Suggest replacement.
Fluid-soaked	1	Suggest replacement. Further inspection required.
Frayed	1	Suggest replacement.
Maintenance intervals	3	Suggest replacement to comply with vehicle OEM recommended

		service intervals.
Missing	C	(3) Require replacement.
Noisy	2	(4) Further inspection required. See note below.
Plies separated	A	Require replacement.
Tension out of specification	B	Require adjustment or replacement.
Teeth missing	A	Require replacement.

(1) - Inspect belt tensioners, pulleys, and cover.
(2) - Determine cause of incorrect alignment and require repair.
(3) - CAUTION: Internal engine damage may result from timing belt damage/failure.
(4) - Determine cause of noise and suggest repair.

TORQUE STRUTS

TORQUE STRUT INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Binding	A	Require replacement.
Body dented	A	(1) Further inspection required.
Body punctured	A	Require replacement.
Bushing deteriorated, affecting performance	A	Require replacement.
Bushing deteriorated, not affecting performance	..	No service suggested or required.
Bushings missing	C	Require replacement.
Bushings separated from mounting eye	1	Suggest replacement.
Damping (none)	A	Require replacement.
Leaking oil, enough for fluid to be running down the body	A	Require replacement.
Missing	C	Require replacement.
Noisy	2	(2) Further inspection required.
Piston rod bent	A	Require replacement.
Piston rod broken	A	Require replacement.
Seized	A	Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

(1) - Require replacement of units where dents restrict strut piston rod movement. If dents don't restrict movement, no service is suggested or required.
(2) - If noise is isolated to shock or strut, suggest replacement.

TRANSMISSION RANGE SWITCHES

TRANSMISSION RANGE SWITCH INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Inoperative	B	(3) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable;

check for accepted cleaning procedure.

TUBE CLAMPS

See HOSE AND TUBE COUPLERS, CONNECTORS AND CLAMPS.

TUBE CONNECTORS

See HOSE AND TUBE COUPLERS, CONNECTORS AND CLAMPS.

TUBE COUPLERS

See HOSE AND TUBE COUPLERS, CONNECTORS AND CLAMPS.

TUBES

See HOSES AND TUBES (FUEL LINES, RADIATOR, BY PASS, HEATER, RECOVERY TANK AND OIL COOLERS).

TURBO CHARGERS

TURBO CHARGER INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Boost pressure incorrect	A	(1) Require repair or replacement.
Leaking	A	Require repair or replacement.
Noisy	2	Suggest repair or replacement.
Oil seal (internal) leaking	A	Require repair or replacement.
Vibrates	A	Require repair or replacement.

(1) - Boost pressure problems may be caused by other systems or components.

VACUUM CONNECTIONS

See VACUUM HOSES, TUBES AND CONNECTIONS (NON-METALLIC).

VACUUM HOSES, TUBES AND CONNECTIONS (NON-METALLIC)

VACUUM HOSE, TUBE AND CONNECTION (NON-METALLIC) INSPECTION

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

Restricted	A	Require repair or replacement.
Surface cracks (dry-rotted)	1	Suggest replacement.

VACUUM REGULATOR SOLENOIDS

VACUUM REGULATOR SOLENOID INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Inoperative	B	(3) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Restricted, affecting performance	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

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

(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

VACUUM TUBES

See VACUUM HOSES, TUBES AND CONNECTIONS (NON-METALLIC).

VEHICLE SPEED SENSORS

VEHICLE SPEED SENSOR INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Inoperative	B	(3) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.

Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

VOLUME AIR FLOW SENSORS

VOLUME AIR FLOW SENSOR INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Inoperative	B	(3) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Restricted, affecting performance	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

WASTE GATE CONTROL SOLENOIDS

WASTE GATE CONTROL SOLENOID INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Inoperative	B	(3) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Restricted, affecting performance	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.

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

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

WASTE GATES AND BOOST CONTROL MECHANISMS

WASTE GATE AND BOOST CONTROL MECHANISM INSPECTION

Condition	Code	Procedure
Boost pressure incorrect	A	(1) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.

(1) - Incorrect boost pressure includes intermittent operation or out of OEM specification.

WATER PUMPS (ELECTRIC)

WATER PUMP (ELECTRIC) INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Inoperative	A	(2) Require replacement.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Noisy	2	Suggest replacement.
Rotation incorrect for application	B	Require repair or replacement.
Terminal broken	A	Require repair or replacement.

Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Vibration	1	Suggest replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

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

WATER PUMPS (NON-ELECTRIC)

WATER PUMP (NON-ELECTRIC) INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware corroded	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Corrosion (internal) is excessive, affecting performance	A	Require replacement.
Corrosion (internal) is excessive, not affecting performance	2	Suggest cooling system service.
Inoperative	A	(1) Require replacement.
Leaking	A	Require replacement.
Noisy	A	Require replacement.
Rotation incorrect for application	B	Require repair or replacement.
Shaft bent	A	Require replacement.

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

WIRING HARNESSES AND CONNECTORS

WIRING HARNESS AND CONNECTOR INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require repair or replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Insulation damaged, conductors exposed	A	Require repair or replacement.
Insulation damaged, conductors not exposed	1	Suggest replacement.
Open	A	Require repair or replacement.
Protective shield (conduit) melted	2	(1) Suggest repair or replacement.
Protective shield (conduit) missing	2	Suggest repair or replacement.
Resistance (voltage drop) out of specification	A	Require repair or replacement.
Routed incorrectly	B	Require repair.
Secured incorrectly	B	Require repair.
Shorted	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Voltage drop out of specification	A	Require repair or replacement.

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

1997 ENGINE PERFORMANCE
General Motors Corp. - Engine/VIN Identification

1997 Model Trucks & Vans

MODEL IDENTIFICATION

MODEL IDENTIFICATION TABLE

MODEL	BODY CODE (1)	(2) ENGINE	ENGINE ID	FUEL SYSTEM	IGNITION SYSTEM
Astro & Safari	M, L	4.3L (L35)	W	CSI (3)	Magnetic (4)
Blazer, Bravada, Jimmy, S10 Pickup, Sonoma	S, T	2.2L (LN2) (5)	4	SFI	Magnetic
		4.3L (L35)	W	CSI (3)	Magnetic (4)
		4.3L (LF6)	X	CSI (3)	Magnetic (4)
Commercial Van & Motorhome (P32/P42)	P	5.7L (L31)	R	CSI (3)	Magnetic
		6.5L (L57)	Y	Diesel	
		6.5L (L65)	F	Turbo Diesel	
		7.4L (L19)	N	TBI	Magnetic
		7.4L (L29)	J	CSI (3)	Magnetic
Van	G	4.3L (L35)	W	CSI (3)	Magnetic (4)
		5.0L (L30)	M	CSI (3)	Magnetic
		5.7L (L31)	R	CSI (3)	Magnetic
		6.5L (L65)	S	Turbo Diesel	
		7.4L (L29)	J	CSI (3)	Magnetic
Pickup	C, K	4.3L (L35)	W	CSI (3)	Magnetic (4)
		5.0L (L30)	M	CSI (3)	Magnetic
		5.7L (L31)	R	CSI (3)	Magnetic
		6.5L (L65)	F	Turbo Diesel	
		6.5L (L56)	S	Turbo Diesel	
		7.4L (L29)	J	CSI (3)	Magnetic
Silhouette,	U	3.4L (LA1)	E	SFI	Magnetic

Trans Sport & Venture					
Suburban	C, K	5.7L (L31)	R	CSI (3)	Magnetic
		6.5L (L65)	F	Turbo Diesel	
		7.4L (L29)	J	CSI (3)	Magnetic
Tahoe & Yukon	C, K	5.7L (L31)	R	CSI (3)	Magnetic
		6.5L (L56)	S	Turbo Diesel	

(1) - Series designation.
(2) - Engine code is stamped on engine block. See ENGINE CODE LOCATION.
(3) - Central Sequential Port Injection (CSI).
(4) - Uses Enhanced Electronic Ignition (OBD-II), utilizing a camshaft and crankshaft position sensor.
(5) - 2WD only.

VIN DEFINITION

1	G	C	F	C	3	4	J	8	V	Z	1	0	0	0	0	1
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 Division.
4 Indicates GVWR/Brake System.
5 Indicates Line/Chassis Type.
6 Indicates Series.
7 Indicates Body Type.
8 Indicates Engine Code.
9 Indicates Check Digit.
10 Indicates Model Year.
11 Indicates Assembly Plant.
12-17 Indicates Plant Sequence Number.

MODEL YEAR VIN CODE APPLICATION

MODEL YEAR VIN CODE APPLICATION TABLE

VIN Code	Model Year
S	1995
T	1996
V	1997

ENGINE CODE LOCATION

ENGINE CODE LOCATION TABLE (1)

Engine Code	Location
L19, L29, L30, L31,	On front of engine block, on right side above timing gear cover, OR on left side of engine block, on engine

L35 & LF6	-to-transmission mating flange.
L56, L57 & L65	On front of engine block, right side of timing gear housing casting, OR on top of engine block, near left cylinder head-to-engine block mating surface, at front, OR left side of engine block, on engine-to-transmission mating flange.
LA1	On left side of engine block, on engine-to-transmission mating flange.
LN2	On left side of engine block, under exhaust manifold, OR on left rear of engine, on bellhousing flange.
(1) - See ENGINE in MODEL IDENTIFICATION table for engine code prefix.	

END OF ARTICLE

* EXHAUST SYSTEM UNIFORM INSPECTION GUIDELINES *

1997 Chevrolet Blazer

GENERAL INFORMATION
Exhaust Systems Motorist Assurance Program
Standards For Automotive Repair

All Makes and Models

INTRODUCTION TO MOTORIST ASSURANCE PROGRAM (MAP)

CONTENTS

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.

GEAR TOOTH CONTACT PATTERNS

1997 Chevrolet Blazer

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.

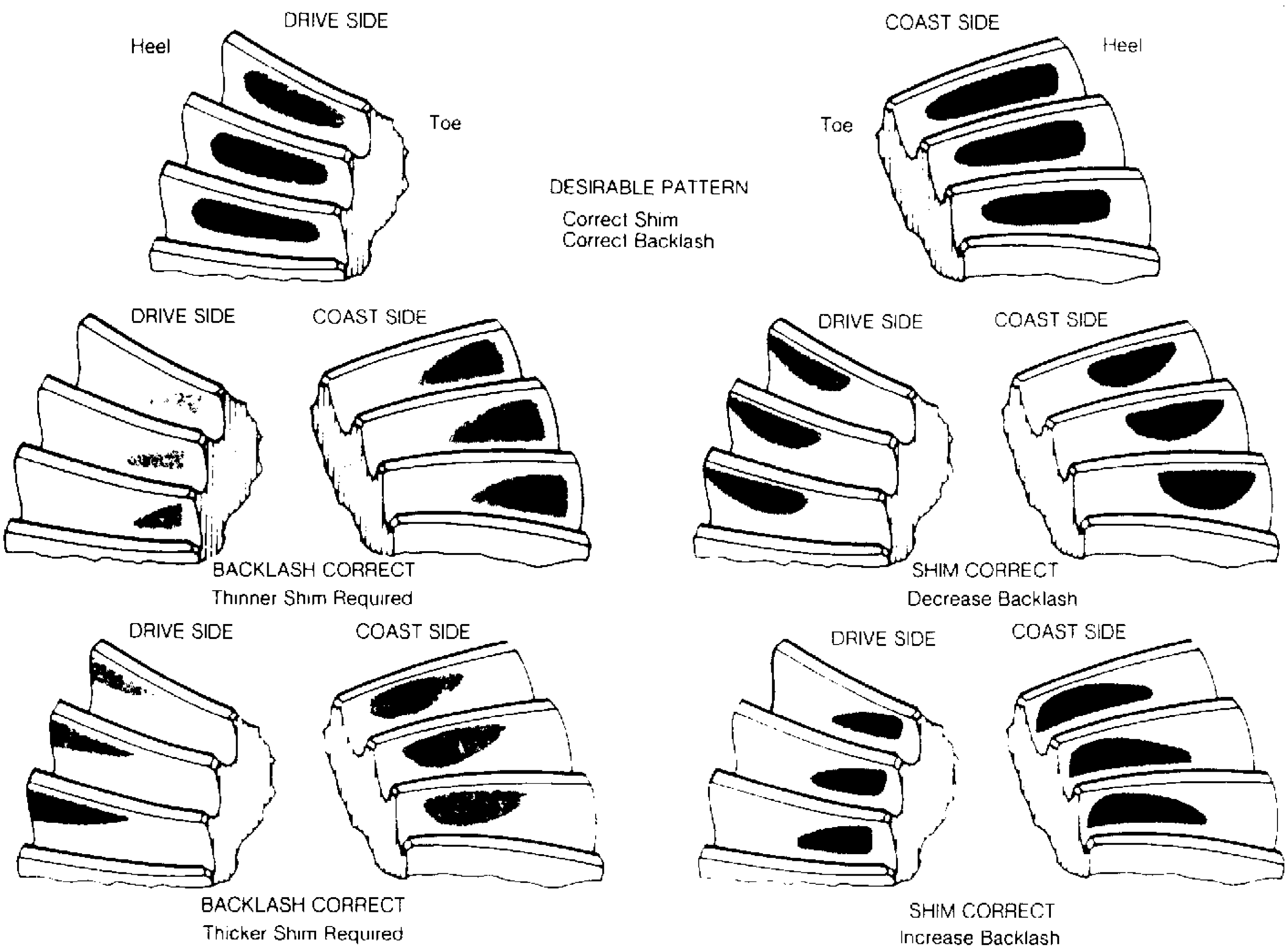


Fig. 1: Drive Axle Gear Tooth Patterns

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

1997 Chevrolet Blazer

GENERAL INFORMATION
General Cooling System Servicing

* PLEASE READ THIS FIRST *

The following article is for general information only. Information may not apply to all years, makes and models. See specific article in the ENGINE COOLING section.

DESCRIPTION

The basic liquid cooling system consists of a radiator, water pump, thermostat, electric or belt-driven cooling fan, pressure cap, heater, and various connecting hoses and cooling passages in the block and cylinder head.

MAINTENANCE

DRAINING

Remove radiator cap and open heater control valve to maximum heat position. Open drain cocks or remove plugs in bottom of radiator and engine block. In-line engines usually have one plug or drain cock, while "V" type engines will have 2, one in each bank of cylinders.

CLEANING

A good cleaning compound removes most rust and scale. Follow manufacturer's instructions in the use of cleaner. If considerable rust and scale has to be removed, cooling system should be flushed. Clean radiator air passages with compressed air.

FLUSHING

CAUTION: Some manufacturers use an aluminum and plastic radiator. Flushing solution must be compatible with aluminum.

Back Flushing

Back flushing is an effective means of removing cooling system rust and scale. The radiator, engine and heater core should be flushed separately.

Radiator

To flush radiator, connect flushing gun to water outlet of radiator and disconnect water inlet hose. To prevent flooding engine, use a hose connected to radiator inlet. Use air in short bursts to prevent damage to radiator. Continue flushing until water runs clear.

Engine

To flush engine, remove thermostat and replace housing. Connect flushing gun to water outlet of engine. Flush using short air bursts until water runs clean.

Heater Core

Flush heater core as described for radiator. Ensure heater control valve is set to maximum heat position before flushing heater.

REFILLING

To prevent air from being trapped in engine block, engine should be running when refilling cooling system. After system is full, continue running engine until thermostat is open, then recheck fill level. Do not overfill system.

TESTING

THERMOSTAT

1) Visually inspect thermostat for corrosion and proper sealing of valve and seat. If okay, suspend thermostat and thermometer in a 50/50 mixture of coolant and water. See Fig. 1. Do not allow thermostat or thermometer to touch bottom of container. Heat water until thermostat just begins to open.

2) Read temperature on thermometer. This is the initial opening temperature and should be within specification. Continue heating water until thermostat is fully open and note temperature. This is the fully opened temperature. If either reading is not to specification, replace thermostat.

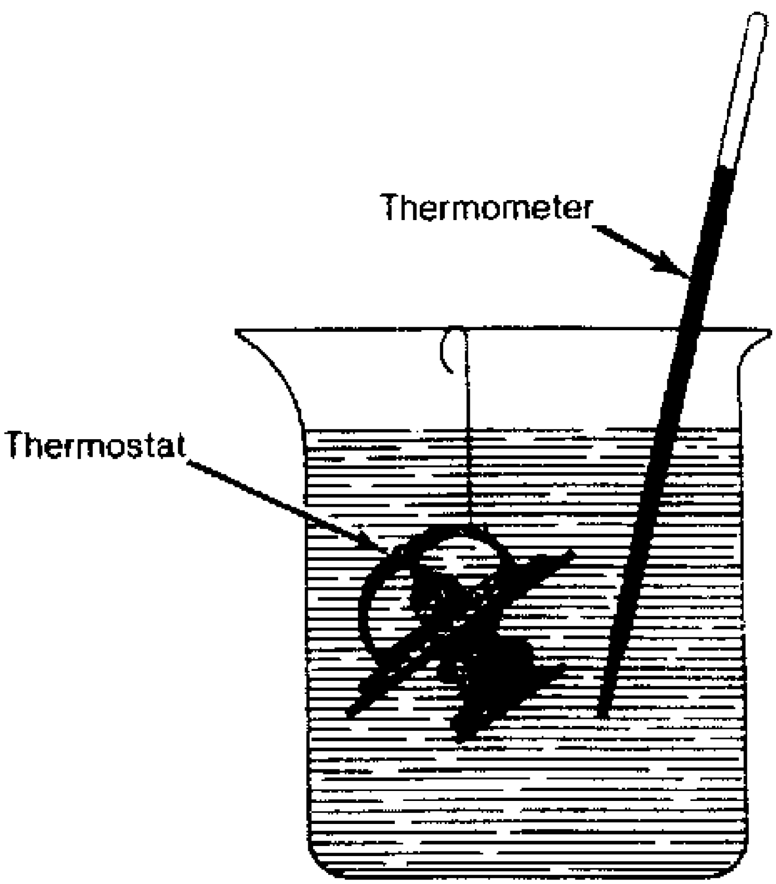


Fig. 1: Testing Thermostat in Anti-Freeze/Water Solution

PRESSURE TESTING

A pressure tester is used to check both radiator cap and complete cooling system. Test components as follows, following tool manufacturer's instructions.

Radiator Cap

Visually inspect radiator cap, then dip cap into water and connect to tester. Pump tester to bring pressure to upper limit of cap specification. If cap fails to hold pressure, replace cap.

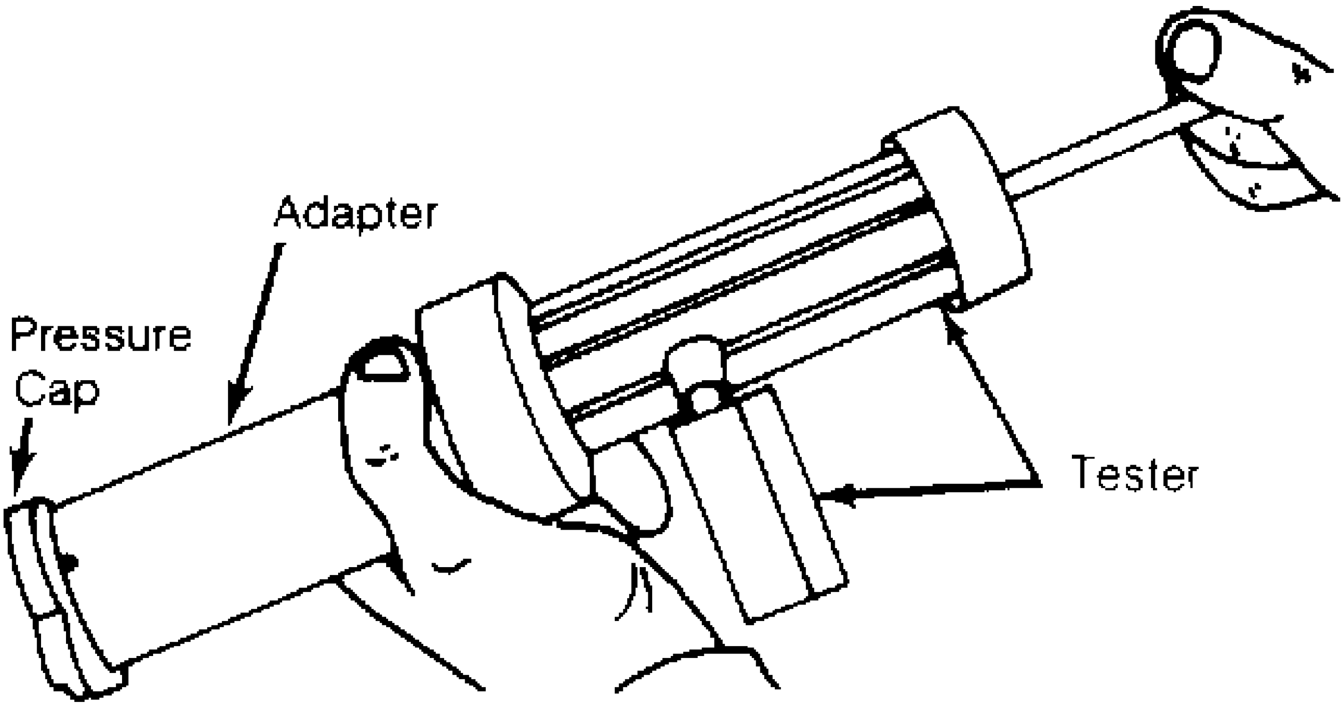


Fig. 2: Testing Radiator Pressure Cap

Cooling System

1) With engine off, wipe radiator filler neck seat clean. Fill radiator to correct level. Attach tester to radiator and pump until pressure is at upper level of radiator rating.

2) If pressure drops, inspect for external leaks. If no leaks are apparent, detach tester and run engine until normal operating temperature is reached. Reattach tester and observe. If pressure builds up immediately, a possible leak exists from a faulty head gasket or crack in head or block.

NOTE: Pressure may build up quickly. Release any excess pressure or cooling system damage may result.

3) If there is no immediate pressure build up, pump tester to within system pressure range (on radiator cap). Vibration of gauge pointer indicates compression or combustion leak into cooling system. Isolate leak by shorting each spark plug wire to cylinder block. Gauge pointer should stop or decrease vibration when leaking cylinder is shorted.

GENERATOR & REGULATOR

1997 ELECTRICAL
General Motors Corp. - Generators & Regulators

Chevrolet; Blazer, "S" & "T" Series Pickup
GMC; Jimmy & Sonoma
Oldsmobile; Bravada

DESCRIPTION

The CS130 (Charging System) generators have a high amperage output. The 130 designation is the outside diameter of the stator laminations, measured in millimeters. CS series generators include a delta stator, rectifier bridge, and rotor with slip rings and brushes. A built-in regulator incorporates fault detection circuitry. See Fig. 1. A conventional pulley and external fan are used to cool slip ring end frame, rectifier bridge and regulator.

Most CS series generators operate with 2 wire connections and a ground path through the mounting bracket. The first wire connection is the BAT (output) terminal. This terminal must be connected to the battery during operation. The second wire connection is through the charge indicator light or an external resistor to terminal "L" of the regulator. This connection provides initial excitation at start-up.

Three other regulator terminals, "P", "F/I" and "S", are provided for optional use. Terminal "P" is connected to the stator and may be connected to a tachometer. Terminal "F/I" provides an alternative method for turning on the generator without going through the charge indicator light or external resistor. Terminal "S" may be used to sense electrical system voltage at a remote point on the vehicle. If terminal "S" is not used, the regulator senses internal generator voltage.

Regulated voltage varies with temperature. System limits voltage by controlling rotor field current while field current is on. Regulator switches rotor field current on and off at a fixed frequency of 400 cycles per second to help control radio noise. By varying overall on/off time, correct average field current for proper system voltage control is obtained. At high speeds, with lower electrical loads, on-time may be 10 percent of off-time. At low speeds, with higher electrical loads, on-time may be 90 percent of off-time. See GENERATOR USAGE/AMP OUTPUT RATING table.

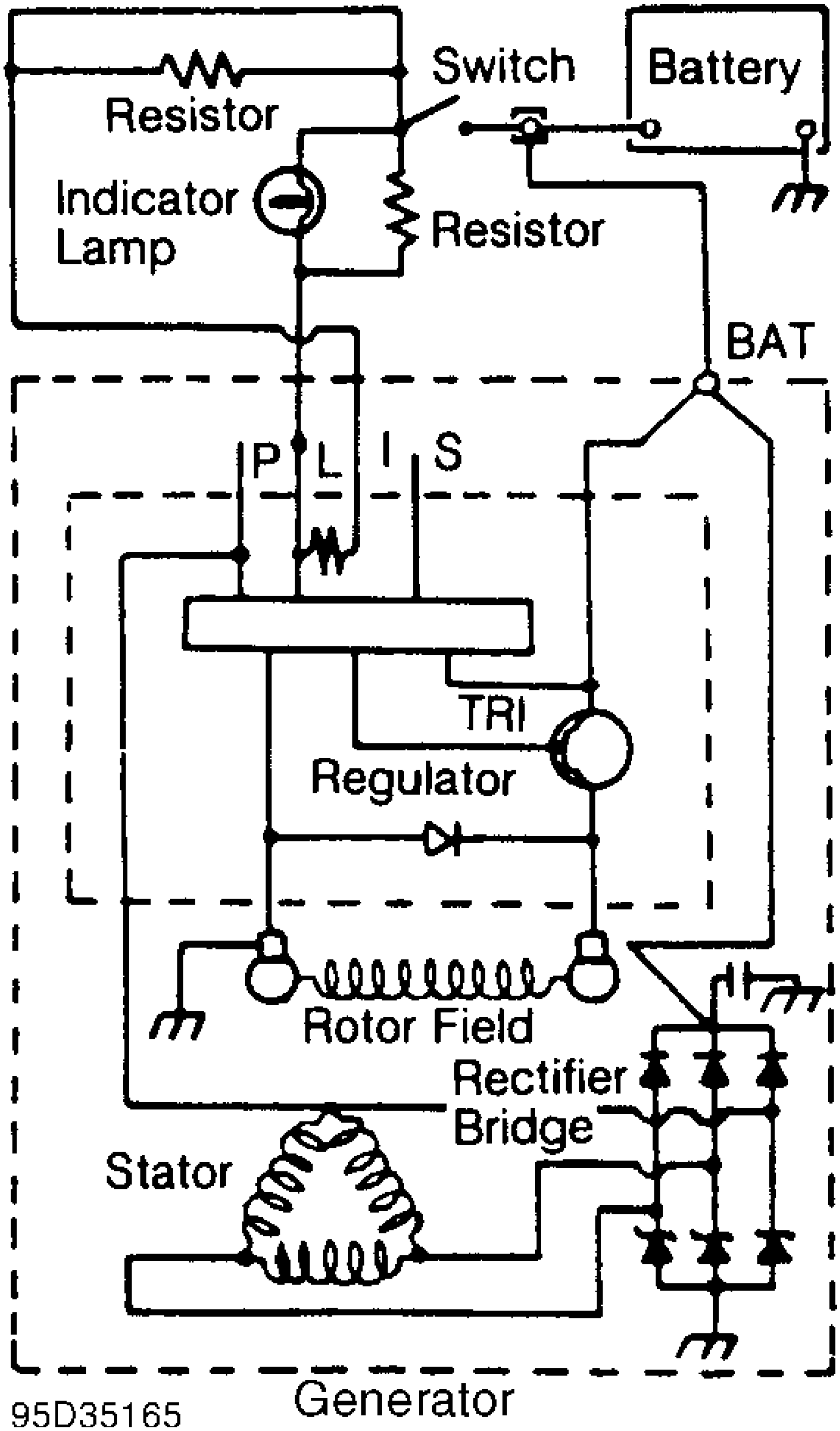


Fig. 1: Charging System Wiring Schematic CS130 Series
Courtesy of General Motors Corp.

GENERATOR USAGE/AMP OUTPUT RATING TABLE

Generator	Generator RPO Code	Rated AMP Output
CS130D	K60	100

ADJUSTMENTS

NOTE: No adjustment or maintenance is required on generator assembly. Regulator voltage is preset and no adjustment is possible. On all models drive belt tension is controlled by a belt tensioner.

TROUBLE SHOOTING

NOTE: See TROUBLE SHOOTING article in GENERAL INFORMATION.

ON-VEHICLE TESTING

NOTE: All generators are serviced by replacement only.

NOTE: Before making electrical checks, visually inspect all terminals for clean, tight connections. Check generator mounting bolts and drive belt tension. Ensure battery is in good condition prior to testing charging system.

CAUTION: When battery is disconnected, vehicle computer and memory systems may lose memory data. Driveability problems may exist until computer systems have completed a relearn cycle. See COMPUTER RELEARN PROCEDURES article in GENERAL INFORMATION before disconnecting battery.

CHARGE INDICATOR LIGHT

NOTE: Perform this test only if charge indicator light does not illuminate when ignition is turned on, or does not go out after engine is started.

CAUTION: DO NOT run engine with generator output terminal disconnected from battery.

1) Ensure battery is fully charged. Visually check generator belt and wiring. Turn ignition switch to ON position (engine not running). Charge indicator light should illuminate. If charge indicator light does not illuminate, go to next step. If charge indicator light illuminates, go to step 4).

2) Turn ignition off. Disconnect generator harness connector. Using a fused (5-amp) jumper wire, connect terminal "L" of generator harness connector to ground. Turn ignition on (engine not running). If charge indicator light illuminates, replace or repair generator.

3) If charge indicator light still does not illuminate, check for open in circuit between generator terminal "L" and ignition switch. Also check charge indicator light bulb. See WIRING DIAGRAM.

4) Start engine and run at 1500 RPM. Charge indicator light should go off. If charge indicator light remains illuminated, turn ignition off. Disconnect generator harness connector. If charge indicator light goes out, replace or repair generator. If charge indicator light remains illuminated, check for short to ground in generator terminal "L" circuit wiring harness.

UNDERCHARGED OR OVERCHARGED BATTERY

NOTE: Ensure battery is fully charged and in good condition before performing the following steps. If battery is not at (or near) a fully charged condition, service as necessary before proceeding.

1) Turn ignition and all accessories off. Using a voltmeter, measure and record battery voltage for use in step 4). Disconnect generator harness connector. Turn ignition switch to ON position (engine not running).

2) Connect negative lead of a voltmeter to a good engine ground. Connect positive voltmeter lead to terminal "L" of generator harness connector. On models with gauges, also connect positive voltmeter lead to terminal F/I of generator harness connector. See WIRING DIAGRAM.

3) Battery voltage should be present at terminal "L" or F/I (gauges only). If battery voltage is not present, repair open circuit between generator connector terminal and battery. If battery voltage is present, reconnect generator harness connector and go to next step.

4) Start engine and slowly increase speed to approximately 1500 RPM. Using a voltmeter, measure voltage between battery terminals. If voltage is greater than 16 volts, or less than voltage as measured in step 1), replace or repair generator. If voltage is less than 16 volts, or greater than voltage as measured in step 1), go to next step.

CAUTION: To prevent injury and/or damage to vehicle, disconnect negative battery cable before connecting or disconnecting a series type ammeter to generator.

CAUTION: Carbon pile testing is part of this procedure. To avoid battery explosion, turn carbon pile OFF before connecting to or disconnecting from vehicle battery.

5) Disconnect negative battery cable. Install ammeter to voltmeter. Connect voltmeter to generator output (BAT) terminal. Connect negative battery cable. With load off, connect carbon pile load tester across battery terminals. Run engine at approximately 1500 RPM, turn accessories on and load battery with carbon pile load until maximum generator output is reached. Adjust carbon pile to maintain 13 volts or more. Measure amp output.

6) If amp output is within 15 amps of rated output, generator is okay. If amp output is not within 15 amps of rated output, repair or replace generator. See GENERATOR USAGE/AMP OUTPUT RATING table.

BENCH TESTING

NOTE: Information not available from manufacturer at time of publication.

REMOVAL & INSTALLATION

WARNING: When battery is disconnected, vehicle computer and memory systems may lose memory data. Driveability problems may exist until computer systems have completed a relearn cycle. See COMPUTER RELEARN PROCEDURES article in GENERAL INFORMATION before disconnecting battery.

Removal & Installation

Disconnect negative battery cable. Remove drive belt. Remove nut retaining positive battery cable to generator BAT terminal. Disconnect generator electrical connector. Remove mounting bolts, nuts, braces and brackets. Remove other components as necessary. Remove generator. To install, reverse removal procedure.

OVERHAUL

NOTE: All generators are serviced by replacement only.

WIRING DIAGRAM

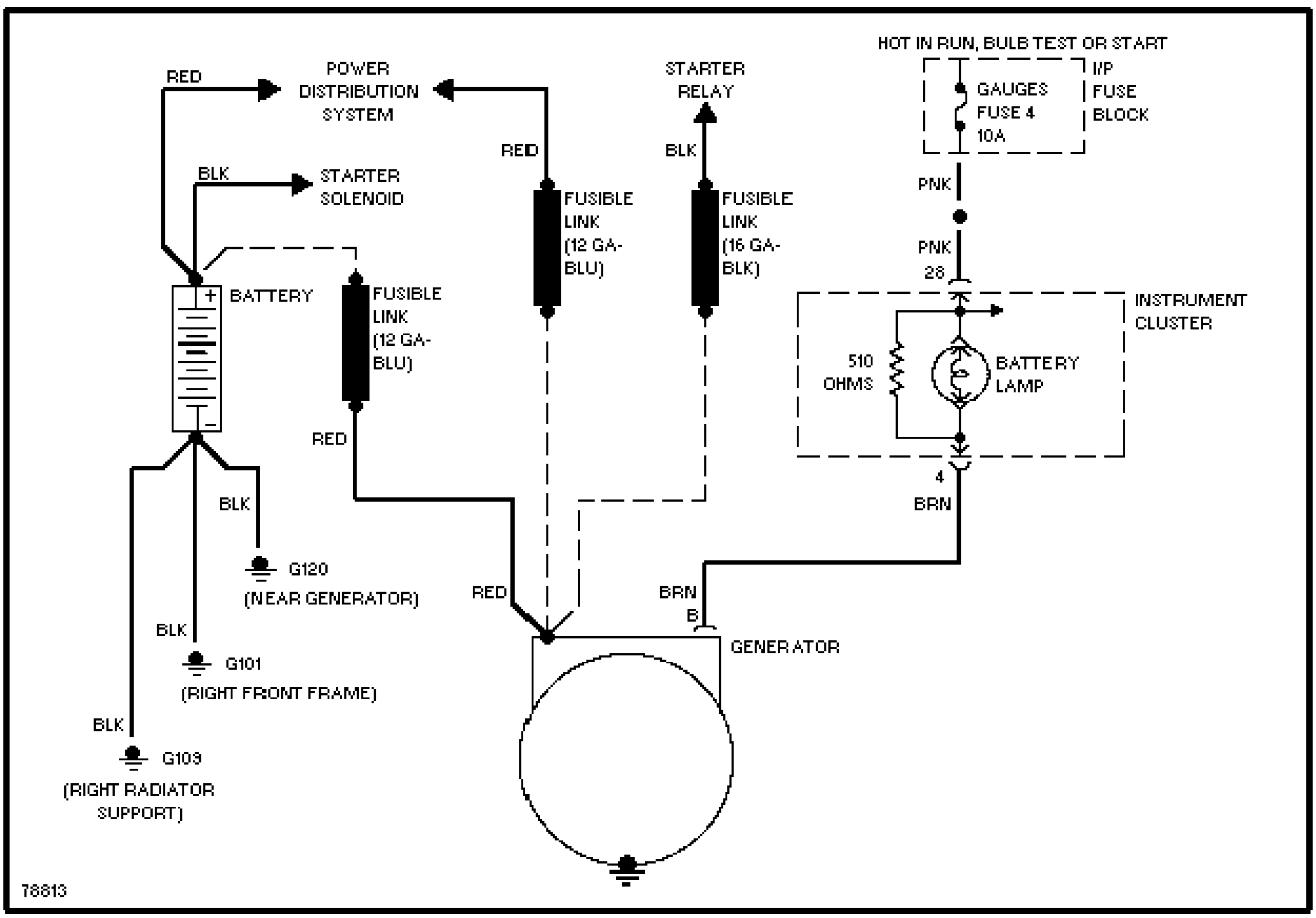


Fig. 2: Charging System Wiring Diagram

97V066000: GLAVAL CONVERSION VAN WHEELS - INSPECT

1997 Chevrolet Blazer

NHTSA RECALL BULLETIN

Model(s):	1995-97 Chevrolet Blazer
	1996-97 Dodge Ram Van B2500
	1996 Ford Club Wagon E150
	1996-97 Ford Pickup F150
	1996 Jeep Cherokee
Campaign No:	97V066000
Number of Affected Vehicles:	2121
Beginning Date of Manufacture:	1995 AUG
Ending Date of Manufacture:	1996 DEC

VEHICLE DESCRIPTION:

Glaval Conversion Vans and Pickup Trucks.

DESCRIPTION OF DEFECT:

The retainer clips were not removed from the rear brake drum wheel stud bolts prior to the installation of a custom wheel.

CONSEQUENCE OF DEFECT:

The wheel can appear to be or can actually go out of balance and could crack in the lug nut area increasing the risk of a vehicle crash.

CORRECTIVE ACTION:

Dealers will inspect the wheels and remove the retainer clips if still in place and also inspect wheels for cracks (including the front wheels, if the tires have been rotated). If the wheels are cracked in the lug nut area, the wheels will be replaced.

OWNER NOTIFICATION:

Owner notification is expected to begin during May 1997.

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 Glaval at 1-800-348-3708. 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.

HEATER SYSTEM TROUBLE SHOOTING

1997 Chevrolet Blazer

1997 A/C-HEATER SYSTEMS
General Motors Corp. - Heater System Trouble Shooting

Chevrolet; Blazer, S10 Pickup
GMC; Jimmy, Sonoma
Oldsmobile; Bravada

* PLEASE READ THIS FIRST *

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

TROUBLE SHOOTING

FUNCTIONAL TEST

NOTE: Perform this check if sent here from INSUFFICIENT HEAT DIAGNOSIS chart.

1) Idle engine for about 20 minutes until warm or until thermostat opens. Ensure coolant temperature is about 194°F (90°C). Select vent mode. Move temperature lever to coldest temperature setting. Select high blower speed. Air should exit instrument panel outlets and should be about the same temperature as outside air. Air should not exit floor outlets, defroster nozzles, or side window defogger outlets.

2) Select heater mode. Move temperature lever to hottest temperature setting. Most air should exit floor outlets, with remaining air exiting defroster and window defogger outlets and should be hot. Air should not exit instrument panel outlets.

3) Select defrost mode. Most air should exit defroster and defogger outlets, with a low volume of air exiting floor outlets. Move temperature lever to coldest setting. Air temperature should decrease to about the same temperature as outside air.

4) Slowly turn blower motor speed control knob toward OFF position, stopping briefly at each intermediate position to check force of airflow exiting instrument panel center outlets to hear blower noise. Airflow and blower noise should decrease noticeably at each intermediate position.

HEATER OUTPUT TEMPERATURE CHECK

NOTE: Perform this check if sent here from INSUFFICIENT HEAT DIAGNOSIS chart.

1) Remove radiator cap when engine is sufficiently cool. Select heater (floor) mode, high temperature setting and high blower speed. Idle engine until coolant can be seen flowing in radiator. Install radiator cap.

2) When engine is warm, after about 20 minutes, drive vehicle at 30 MPH (48 km/h). Measure ambient air temperature and floor outlet air temperature using accurate thermometers. If floor outlet air temperature exceeds minimum specification, heater output temperature is considered sufficient. See HEATER OUTPUT MINIMUM TEMPERATURE SPECIFICATIONS table.

HEATER OUTPUT MINIMUM TEMPERATURE SPECIFICATIONS TABLE

Ambient Air Temp. °F (°C)	Floor Outlet Temp. °F (°C)
0 (-18)	130 (54)
25 (-4)	139 (59)
50 (10)	147 (64)
75 (24)	155 (68)

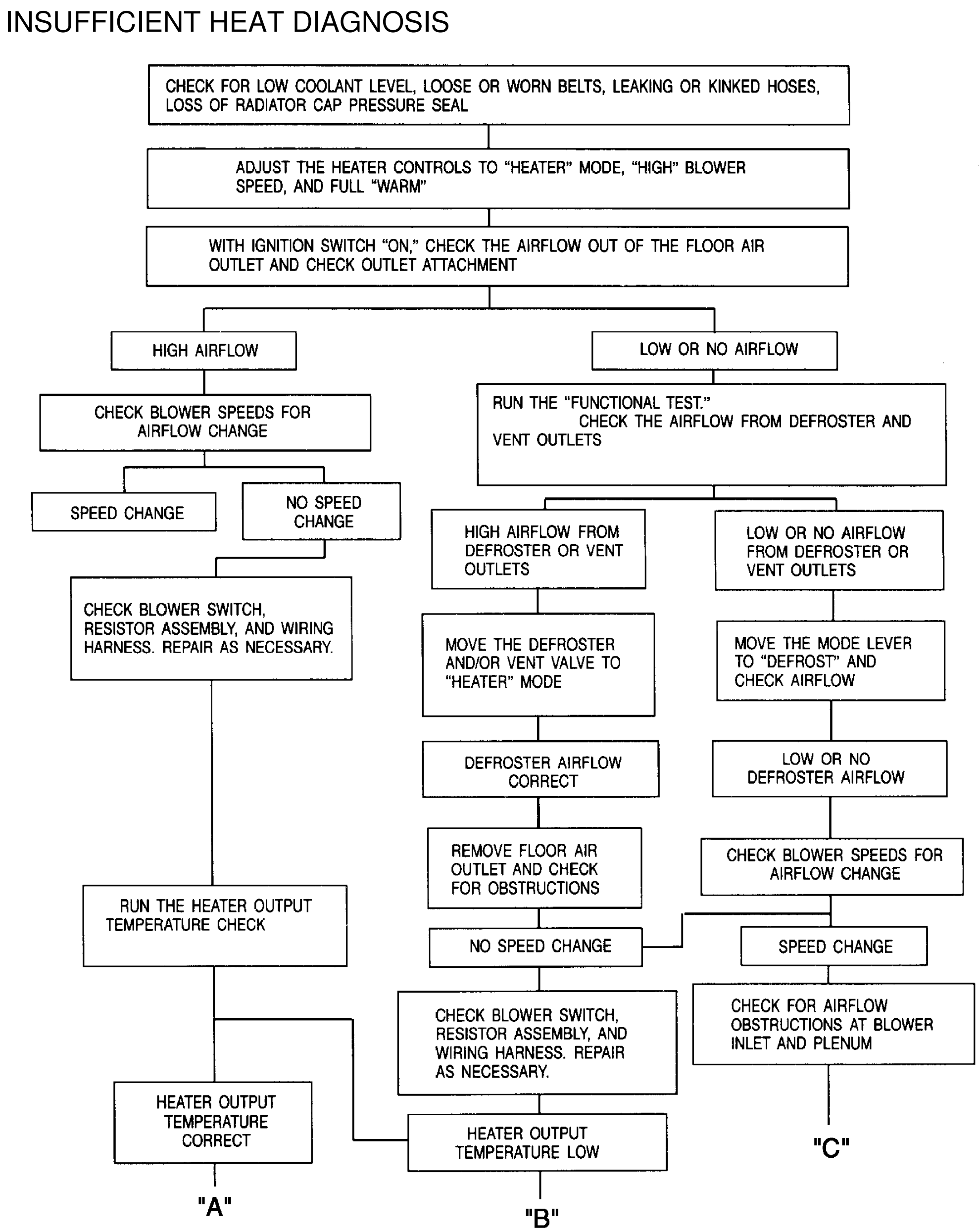


Fig. 1: Insufficient Heat Diagnosis - Flow Chart (1 Of 2)
Courtesy of General Motors Corp.

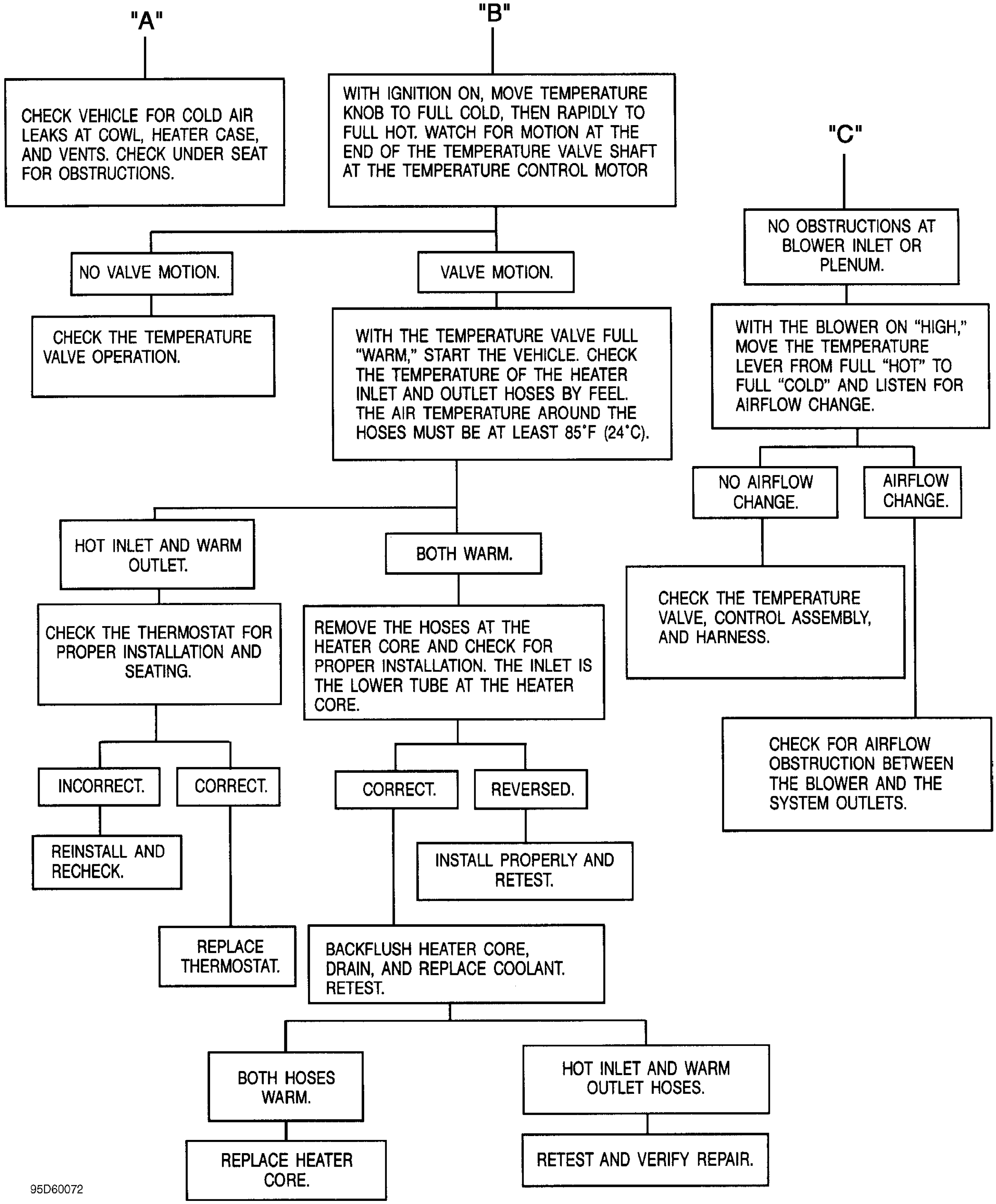


Fig. 2: Insufficient Heat Diagnosis - Flow Chart (2 Of 2)
Courtesy of General Motors Corp.

HEATER SYSTEM

1997 Chevrolet Blazer

1997 A/C-HEATER SYSTEMS
General Motors Corp. - Heater System

Chevrolet; Blazer, S10 Pickup
GMC; Jimmy, Sonoma
Oldsmobile; Bravada

DESCRIPTION

System blends heated outside air with cooler outside air to obtain desired temperature. Major components of the system are blower motor, air inlet assembly, heater air distributor assembly, and heater control panel.

Temperature control door is controlled by an actuator motor. Vacuum actuators control mode valves to regulate flow of air through heater unit.

OPERATION

AUXILIARY HEATER BLOWER SWITCH

A 3-speed blower switch (if equipped) is located on instrument panel, to right of steering column. When switch is in OFF position, auxiliary system does not operate.

BLOWER SPEED SWITCH

The blower speed switch selects low, medium-low, medium-high or high blower speed.

MODE SELECTOR

The mode selector directs discharge air to windshield, floor, or dash outputs, as desired by driver.

TEMPERATURE CONTROL SELECTOR

The temperature control lever or knob controls discharge air temperature in all mode positions. Full hot position provides maximum heat. Full cold position provides unheated air.

OPERATING MODES

NOTE: To identify heater vacuum selector valve operation, see Fig. 2.

VENT Mode
Air is directed to instrument panel outlets.

BI-LEV Mode
Air is directed to instrument panel and floor outlets. A slight amount of air is directed to defroster and side window defogger outlets.

HEAT Mode
Air is diverted to floor outlets to heat passenger compartment. A slight amount of air is directed to windshield and side window defogger outlets.

BLEND Mode

Air is divided between instrument panel and floor outlets, with a slight amount of air going to defroster outlets.

DEF Mode

Air is directed to windshield defroster outlets. A slight amount of air is diverted to floor outlets and side window defogger outlets.

ADJUSTMENTS

NOTE: Information on temperature control cable adjustment not available at time of publication

TROUBLE SHOOTING

NOTE: For Heater System trouble shooting information, see the HEATER SYSTEM TROUBLE SHOOTING article.
For front (and rear) blower motor trouble shooting information, see the A/C-HEATER SYSTEM - MANUAL article.

TEMPERATURE DOOR MALFUNCTIONING

1) Turn ignition on. Using DVOM, backprobe terminal "B" (Light Blue wire) of heater control module connector C2 to ground. Move temperature control knob from HOT setting to COLD setting, and then from COLD setting to HOT setting. If voltage varies between approximately 1-12 volts, go to step 3).

2) If voltage does not vary as indicated, check for poor connection at heater control module connector C2 (terminal "B") or short to ground/voltage in Light Blue wire. Also check for open Brown wire between heater control module connector C2 and fuse block. If connection and wires are okay, replace heater control module.

3) Using DVOM, backprobe temperature door motor terminal No. 10 (Brown wire) to ground. If battery voltage exists, go to next step. If voltage does not exist, repair open Brown wire between temperature door motor and fuse block.

4) Using DVOM, backprobe between temperature door motor terminal No. 7 (Black/White wire) and terminal No. 10 (Brown wire). If battery voltage exists, go to next step. If voltage does not exist, repair open Black/White wire.

5) Using DVOM, backprobe temperature door motor terminal No. 8 (Light Blue wire) to ground while moving temperature control knob. If voltage does not vary between approximately 1-12 volts, repair open Light Blue wire. If voltage varies between 1-12 volts, check for binding door or poor connections at temperature door motor. If okay, replace temperature door motor.

REMOVAL & INSTALLATION

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

ACTUATOR MOTOR

Removal & Installation

Actuator motor is located on top of heater case. Remove instrument panel. Unplug electrical connectors. Remove actuator motor. To install, reverse removal procedure.

BLOWER MOTOR

Removal & Installation

Disconnect negative battery cable. Remove vehicle control module (if equipped). Remove coolant reservoir. Remove cooling tube. Unplug connector. Remove blower motor. To install, reverse removal procedure.

CONTROL ASSEMBLY

Removal & Installation

Remove accessory trim plate. Remove heater control unit retaining screws. Remove heater control unit. Unplug vacuum connectors. Unplug electrical connectors. To install, reverse removal procedure.

HEATER CORE

CAUTION: Heater core can be damaged if too much force is applied to heater core pipes during hose removal.

Removal & Installation

Disconnect negative battery cable. Drain engine coolant. Disconnect heater hoses at core. See Fig. 1. Remove instrument panel. Remove rear case screws and rear case. Remove straps. Remove heater core. Remove seals. To install, reverse removal procedure. Fill cooling system. Start engine and check for leaks.

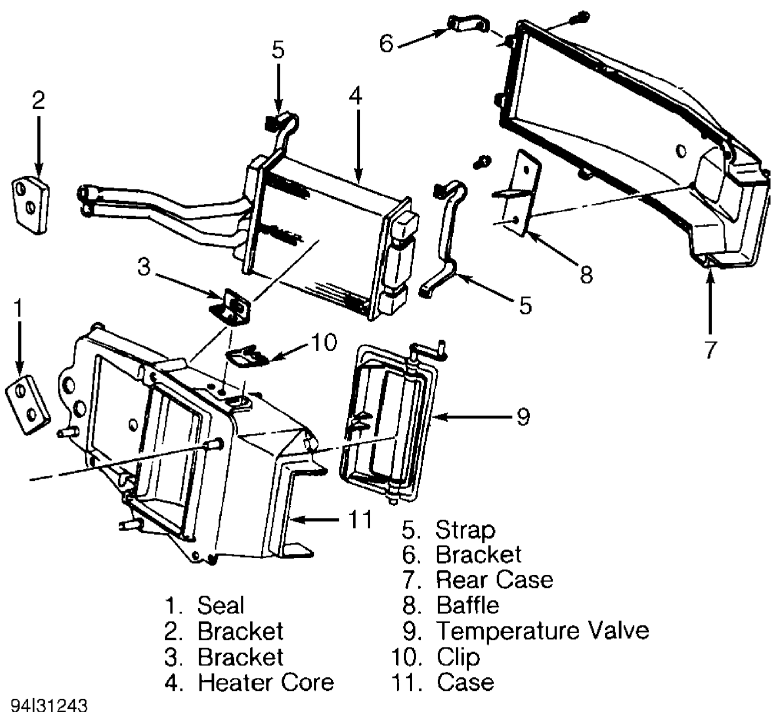


Fig. 1: Exploded View Of Heater System Components
Courtesy of General Motors Corp.

AUXILIARY HEATER COMPONENTS

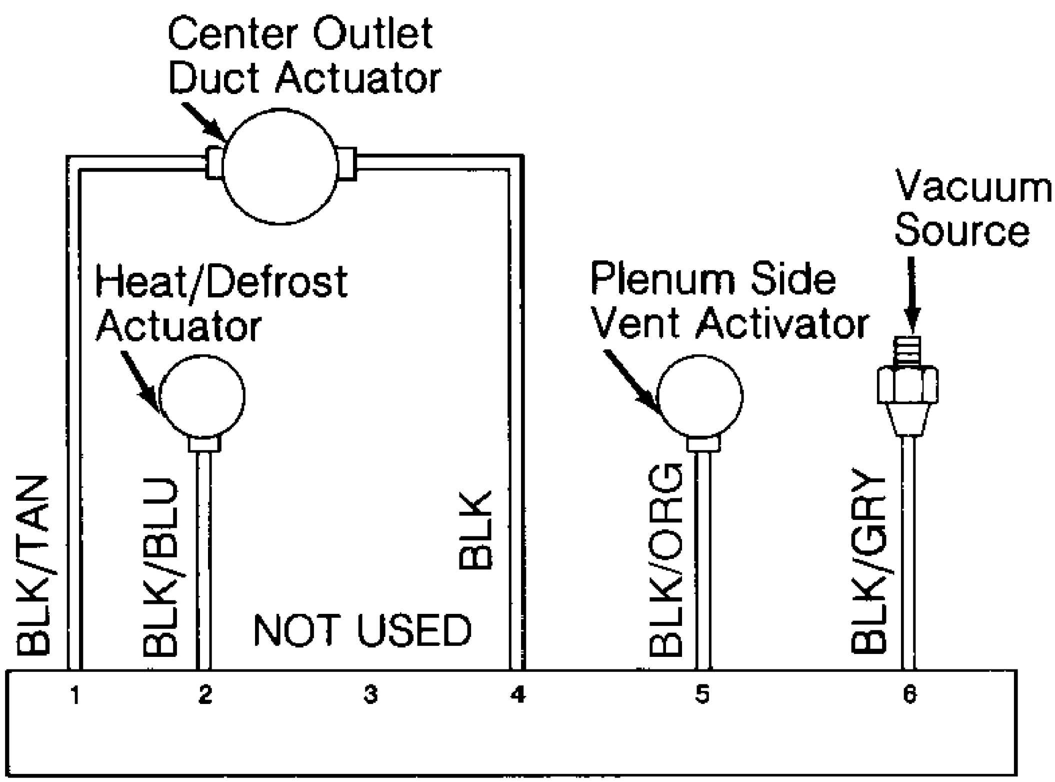
NOTE: Information not available at time of publication.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS TABLE

Application	INCH Lbs. (N.m)
Auxiliary Heater Bolts	13 (1.5)
Blower Motor Bolts	12 (1.4)
Heater Case Bolts	97 (11)

VACUUM DIAGRAM



A/C – HEATER VACUUM SELECTOR VALVE OPERATING CHART

CONNECTION	PORT	OFF	MAX	NORM	BI – LEV	VENT	HTR	BLEND	DEF
DEFROST	1	VENT	VAC	VAC	VENT	VAC	VENT	VENT	VAC
A/C	2	VENT	VAC	VAC	VAC	VAC	VENT	VENT	VENT
NOT USED	3	VENT	VENT	VENT	VENT	VENT	VENT	VENT	VENT
HEAT	4	VAC	VENT	VENT	VENT	VENT	VAC	VENT	VENT
RECIRC	5	VENT	VAC	VENT	VENT	VENT	VENT	VENT	VENT
SOURCE	6	VAC	VAC	VAC	VAC	VAC	VAC	VAC	VAC

95H17654

Fig. 2: Heater System Vacuum Diagram
Courtesy of General Motors Corp.

WIRING DIAGRAM

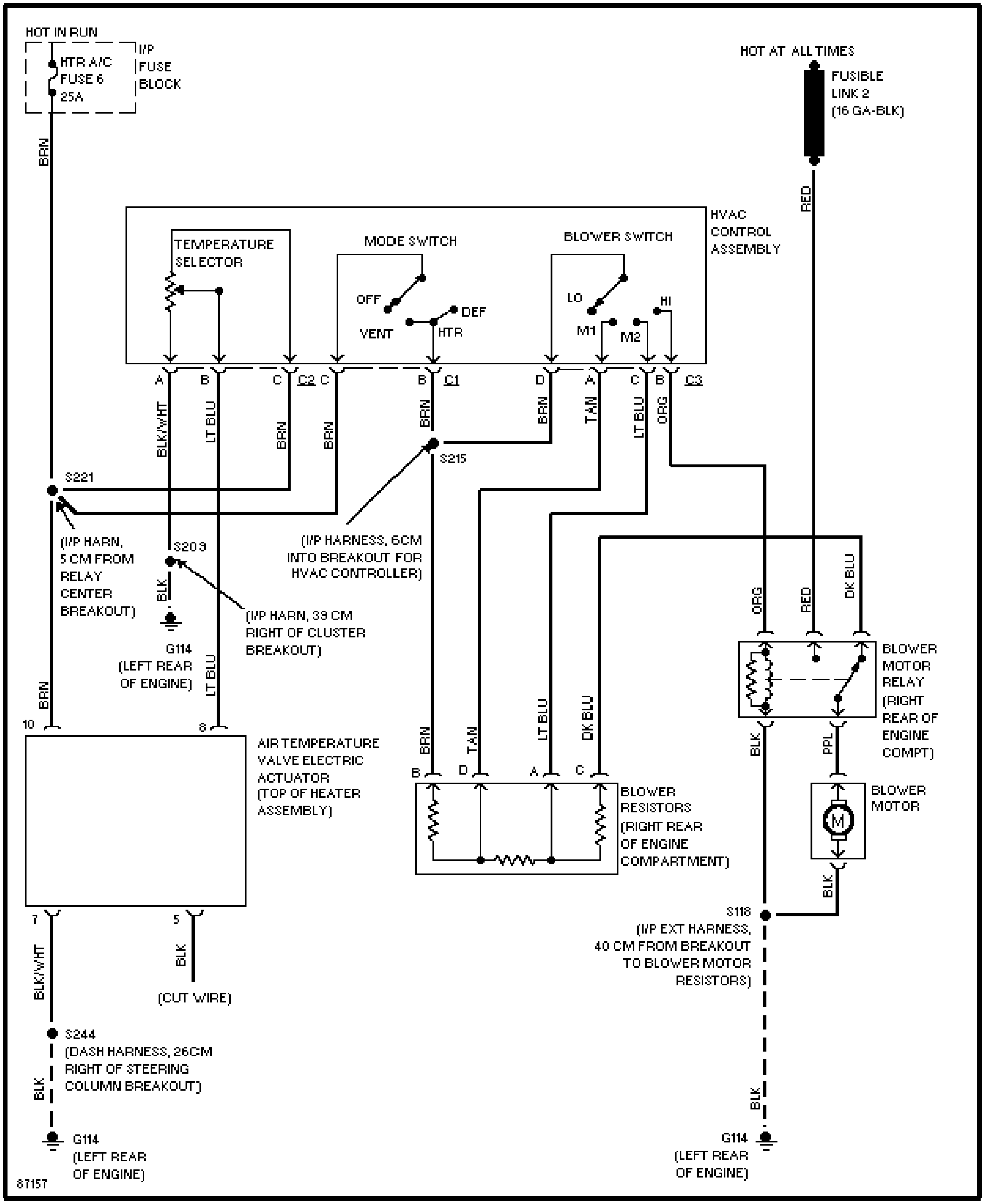


Fig. 3: Heater System Wiring Diagram

HOW TO USE SYSTEM WIRING DIAGRAMS

1997 Chevrolet Blazer

GENERAL INFORMATION
Using Wiring Diagrams

All Models

INTRODUCTION

This CD obtains wiring diagrams and technical service bulletins, containing wiring diagram changes from the domestic and import manufacturers. These are checked for accuracy and are all redrawn into a consistent format for easy use.

In the past, when cars were simpler, diagrams were simpler. All components were connected by wires and diagrams seldom exceeded 4 pages in length. Today, some wiring diagrams require more than 16 pages. It would be impractical to expect a service technician to trace a wire from page 1 across every page to page 16.

Removing some of the wiring maze reduces eyestrain and time wasted searching across several pages. Today the majority of these diagrams follow a much improved format, which permits space for internal switch details.

Wiring diagrams are drawn in a "top-down" format. The diagrams are drawn with the power source at the top of the diagram and the ground point at the bottom of the diagram. Components locations are identified on the wiring diagrams. Any wires that don't connect directly to a component are identified on the diagram to indicate where they go.

COLOR ABBREVIATIONS

COLOR ABBREVIATIONS TABLE

Color	Normal	Optional
Black	BLK	BK
Blue	BLU	BU
Brown	BRN	BN
Clear	CLR	CR
Dark Blue	DK BLU	DK BU
Dark Green	DK GRN	DK GN
Green	GRN	GN
Gray	GRY	GY
Light Blue	LT BLU	LT BU
Light Green	LT GRN	LT GN
Orange	ORG	OG
Pink	PNK	PK
Purple	PPL	PL
Red	RED	RD
Tan	TAN	TN
Violet	VIO	VI
White	WHT	WT
Yellow	YEL	YL

IDENTIFYING WIRING DIAGRAM ABBREVIATIONS

NOTE: Abbreviations used on these diagrams are normally self-explanatory. If necessary see ABBREVIATIONS article in GENERAL INFORMATION.

IDENTIFYING WIRING DIAGRAM SYMBOLS

NOTE: Standard wiring symbol are used in these diagrams. The illustration below will help clarify any symbols that are not easily understood at a glance. Most components are labeled "Motor", "Switch" or "Relay" in addition to being drawn with the standard symbol.

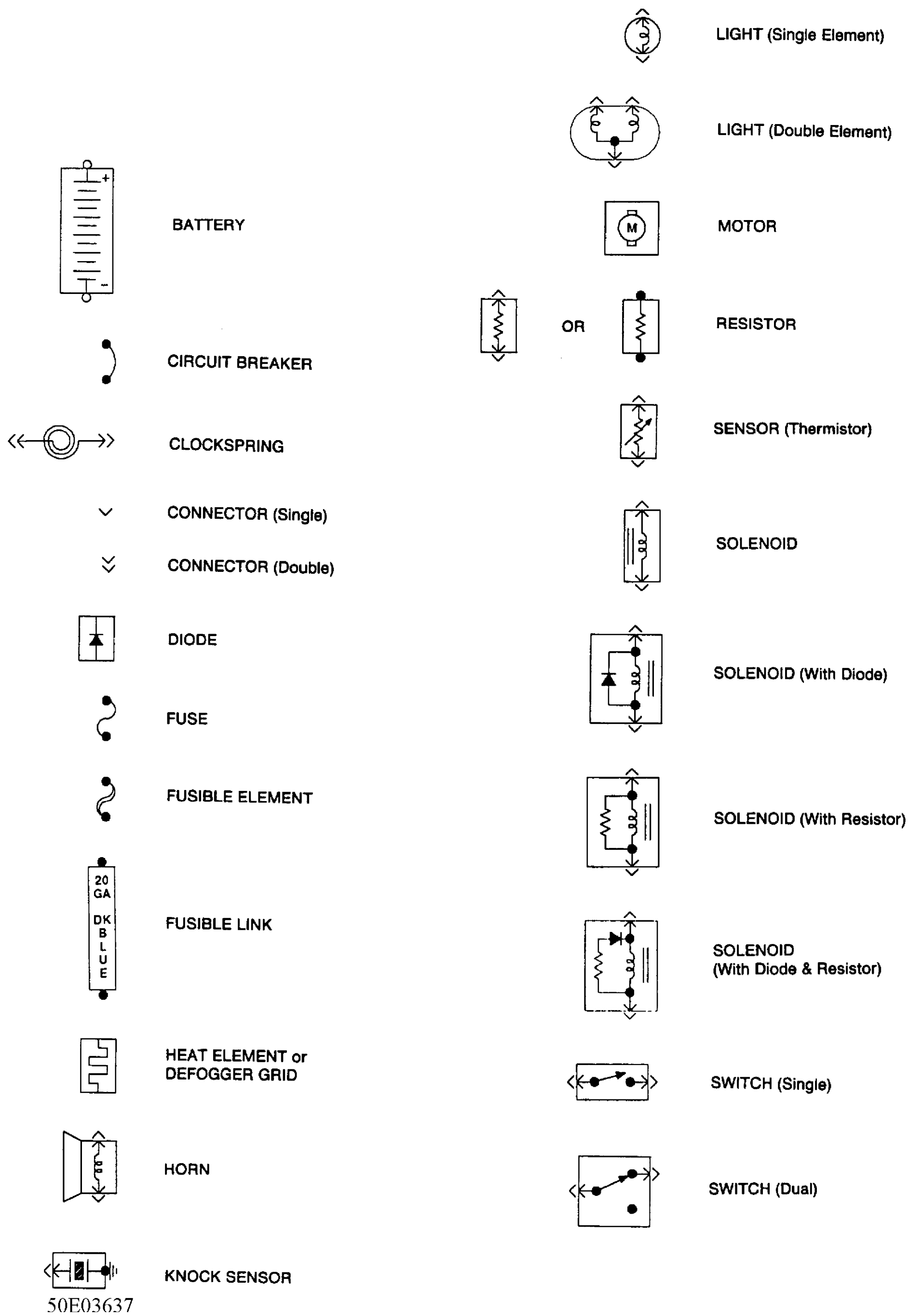


Fig. 1: Identifying Wiring Diagram Symbols

WIRING DIAGRAM COMPONENT LOCATIONS

When trying to locate a component in a wiring diagram and you don't know the specific system where it is located, use this handy component locator to find the system wiring diagram in which the component is located. Then, go to that system and locate the component within the wiring diagram.

For example, if you don't know the specific system in which the ignition switch is located, look up ignition switch in the wiring diagram component location tables and go to the appropriate wiring diagram(s) which contain either full or partial views of the ignition switch. The full view of the ignition switch is located in Power Distribution.

The first listing for the component will be the full or most complete view of the component. Additional listings will be partial views of the component. Not all components are used on all models.

All components will have a partial view in Ground Distribution and Power Distribution. Data Link Connectors show connecting circuits between modules. Alternate names for components may be listed in wiring diagram component locations tables.

WIRING DIAGRAM COMPONENT LOCATIONS TABLE

Component	Wiring Diagram
ABS Electronic Control Unit	Anti-Lock Brakes
	Data Link Connectors
ABS Hydraulic Unit	Anti-Lock Brakes
Acceleration Sensor	Anti-Lock Brakes
Accessory Delay Relay	Power Windows
A/C Compressor Clutch Relay	Engine Performance
A/C Sensor	Engine Performance
A/C Pressure Switch	Engine Performance
Adaptive Lamp Control Module	Exterior Lights
Air Bag(s)	Air Bag Restraint System
Air Bag Module	Air Bag Restraint System
Air Bag Sensor(s)	Air Bag Restraint System
Air Injection Pump Relay	Engine Performance
Air Temperature Sensor	Overhead Console
Alternator (Generator)	Generators & Regulators
Anti-Theft Control Module	Anti-Theft System
	Starters
Autolamp Control Relay	Headlight Systems
	Daytime Running Lights
Automatic Shutdown (ASD) Relay	Engine Performance
	Generators & Regulators
Autostick Switch	Engine Performance
Auxiliary Battery Relay	Generators & Regulators
Back-Up Lights	Back-Up Lights
	Exterior Lights
Barometric (BARO) Pressure Sensor	Engine Performance
Battery	Power Distribution
Battery Temperature Sensor	Engine Performance
Body Control Module	Body Control Computer
	Anti-Theft System
	Daytime Running Lights
	Engine Performance
	Headlight Systems
	Warning Systems
Boost Control Solenoid	Engine Performance
Boost Sensor	Engine Performance
Brake Fluid Level Switch	Analog Instrument Panels

INSTRUMENT PANEL

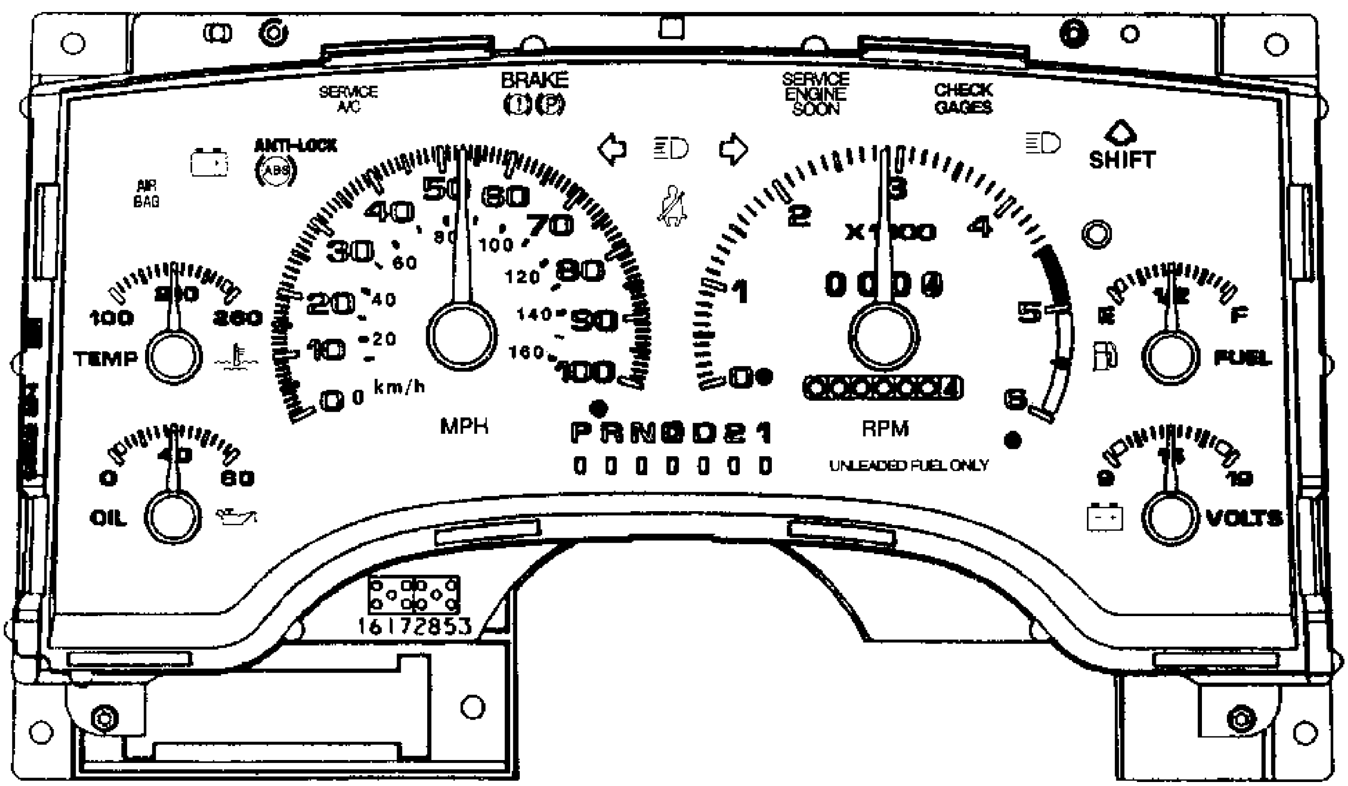
1997 Chevrolet Blazer

1997 ACCESSORIES/SAFETY EQUIP
General Motors Corp. - Analog Instrument Panels

Chevrolet; Blazer, "S" & "T" Series Pickup
GMC; Jimmy & Sonoma
Oldsmobile; Bravada

DESCRIPTION

Instrument cluster uses analog speedometer and gauges. See Fig. 1. Indicator lights, plugged into back of cluster, are serviceable, but no other components on cluster are serviceable. If any component on cluster is faulty, replace cluster.



97C28441

Fig. 1: Identifying Instrument Components
Courtesy of General Motors Corp.

WARNING: If BRAKE light is on, ensure brake hydraulic system is okay before driving vehicle.

BRAKE

When one or more of the following conditions exists, BRAKE light is grounded, turning on light:

* Parking brake switch is closed.
* Brake pressure differential switch is closed (detects loss of hydraulic pressure).
* BPMV detects problem in hydraulic part of ABS system. Light

also comes on for 2 seconds after ignition is turned on, and engine is off (BPMV turns on light for 2-second system check).

CHARGING SYSTEM

One side of battery symbol light bulb is connected to alternator field circuit, and other side to ignition power circuit. When ignition is turned on, bulb is grounded through field circuit. When engine is started, field output equalizes voltage across bulb, turning off light. If charging system output is insufficient, light comes on.

CHECK GAUGES

If coolant temperature is too high or oil pressure is too low, light comes on to alert driver of condition indicated by gauges. A CHECK GAUGES light driver (part of coolant temperature gauge) monitors signals from temperature gauge sending unit and oil pressure sending unit. If CHECK GAUGES light driver receives a signal from either sending unit, it grounds light.

COOLANT TEMPERATURE

See CHECK GAUGES.

OIL PRESSURE

See CHECK GAUGES.

SEAT BELT LIGHT

Seat belt warning light works in conjunction with a buzzer. If seat belt is not fastened when key is turned to run, buzzer will sound for 8 seconds and light will illuminate solid for 20 seconds and flash for 55 seconds. Buzzer will stop if belt is fastened during 8 second interval. If seat belt is fastened when key is turned to run, no buzzer will sound and light will illuminate solid for 75 seconds. If seat belt is unfastened during 8 second interval, buzzer will sound for remainder of 8 second interval.

SERVICE ENGINE SOON

If a problem occurs in engine control system, PCM/VCM grounds light. Light should come on when ignition is turned on, then go out when engine starts if no problems exist in engine control system.

SHIFT (M/T)

Light comes on to tell driver when to upshift for best fuel economy. PCM/VCM monitors engine speed, load and throttle position for light control. PCM/VCM grounds light if parameters are met.

AIR BAG PRECAUTIONS

Observe following precautions when working with vehicles equipped with Supplemental Inflatable Restraint (SIR) system:

* Before performing any instrument panel testing, diagnosis or repair, disable SIR system by disconnecting negative battery cable and Yellow 2-pin connector at base of

steering column.

* Wait 2 minutes before making SIR repairs. SIR system retains enough voltage to deploy air bag after power is disconnected.
* To prevent accidental air bag deployment, avoid SIR wiring harness when trouble shooting instrument panel components. All SIR wires are color-coded Yellow.

SPEEDOMETER & ODOMETER

Vehicle Speed Sensor (VSS) produces voltage pulses of frequency proportional to vehicle speed. This signal is processed by PCM/VCM to produce a voltage pulse signal to speedometer and odometer.

NOTE: Incorrect VSS calibrator calibration may adversely affect operation of ABS, engine control system and cruise control system.

TRIPMETER

Pressing button on cluster resets trip mileage to zero.

TESTING

CAUTION: When battery is disconnected, vehicle computer and memory systems may lose memory data. Driveability problems may exist until computer systems have completed a relearn cycle. See COMPUTER RELEARN PROCEDURES article in GENERAL INFORMATION before disconnecting battery.

CAUTION: Static electricity can destroy integrated circuits in instrument cluster and VSS calibrator. Before servicing these components, ground yourself and work area to discharge static electricity.

NOTE: Check GAUGES or IGN/GAU fuse in passenger compartment fuse block before testing. If all components in cluster are inoperative, check instrument cluster power and ground circuits. If power and ground circuits are okay, replace instrument cluster.

COOLANT TEMPERATURE GAUGE

Gauge Indicates Cold When Engine Is Hot

Disconnect temperature gauge sending unit connector. Connect jumper between ground and Dark Green wire terminal of sending unit connector. Turn ignition on. If gauge indicates hot, replace sending unit. If gauge does not indicate hot, check Dark Green wire between sending unit and cluster. If wire is okay, replace instrument cluster.

Gauge Indicates Hot When Engine Is Cold

Disconnect temperature gauge sending unit connector. Turn ignition on. If gauge indicates cold, replace sending unit. If gauge still indicates hot, check Dark Green wire between sending unit and cluster. If wire is okay, replace instrument cluster.

FUEL GAUGE

Gauge Stays At EMPTY

Disconnect fuel tank sending unit connector. Turn ignition on. If gauge indicates FULL, replace sending unit. If gauge indicates EMPTY, check for short to ground in Purple wire. If wire is okay, replace instrument cluster.

Gauge Stays At FULL

Disconnect fuel tank sending unit connector. Turn ignition on. Connect fused jumper wire between ground and Purple wire terminal of sending unit connector. If gauge indicates EMPTY, replace sending unit. If gauge indicates FULL, check Purple wire between sending unit and instrument cluster for an open circuit. If wire is okay, replace instrument cluster.

Gauge Is Inaccurate

1) Disconnect fuel tank sending unit connector. Connect Red lead of Instrument Panel Tester (J-33431) to Purple wire terminal of sending unit connector, and connect other Red lead to ground. Turn ignition on.

2) Set tester dial to zero ohms, then 90 ohms. If fuel gauge indicates EMPTY at zero ohms and FULL at 90 ohms, check sending unit ground. If ground is okay, replace sending unit. If fuel gauge does not indicate as specified, check Purple wire between sending unit and cluster. If wire is okay, fuel gauge.

INDICATOR LIGHTS

Brake Warning Light Inoperative

Disconnect instrument cluster connector. Set parking brake. Connect self-powered test light between instrument cluster connector Tan/White wire and ground. If test light comes on, check for poor connection at instrument cluster connector. If connection is okay, replace instrument cluster. If test light does not light, repair open circuit in Tan/White wire.

Ignition Switch Does Not Activate Brake Warning Light

1) Turn ignition on. Set parking brake. If brake warning light comes on, go to next step. If brake warning light does not come on, go to BRAKE WARNING LIGHT INOPERATIVE.

2) Release parking brake. Connect fused jumper wire between ground and Light Blue wire at 48-pin connector between ignition switch and parking brake warning switch. Turn ignition on. If brake warning light comes on, go to next step. If brake warning light does not come on, repair open circuit in Light Blue wire.

3) Connect fused jumper wire between Light Blue and Black wires at 48-pin connector. Turn ignition on. If brake warning light comes on, replace ignition switch. If brake warning light does not come on, repair open circuit in Black wire between 48-pin connector and ground.

Parking Brake Will Not Activate Brake Warning Light

1) Disconnect parking brake warning switch connector. Connect fused jumper wire between Light Blue wire at parking brake warning switch connector and ground. Turn ignition on. If brake warning light does not come on, go to next step. If brake warning light does come on, check for poor connection at parking brake warning switch. If connection is okay, replace parking brake warning switch.

2) Remove fused jumper wire. Connect fused jumper wire between instrument cluster connector Tan/White wire and ground. If brake warning light comes on, go to next step. If brake warning light does not come on, check for poor connection at instrument cluster connector. If connection is okay, replace instrument cluster.

3) Connect test light between diode module Light Blue wire and ground. If test light comes on, repair open circuit in Light Blue wire. If test light does not come on, repair open circuit in Tan/White wire between instrument cluster and diode module. If circuit is okay, replace diode module.

Brake Warning Light Remains On With Ignition On & Parking Brake Released

1) Disconnect parking brake warning switch connector. If brake warning light remains on, go to next step. If brake warning light does not remain on, replace parking brake warning switch.

2) Disconnect brake pressure warning switch connector (Brake Pressure Modulator Valve (BPMV) front connector). BPMV is located in engine compartment, on left inner fender panel and connector is on front side of BPMV. If brake pressure warning light remains on, go to next step. If brake pressure warning light does not remain on, replace brake pressure warning switch.

3) Disconnect 48-pin connector between ignition switch and parking brake warning switch. Check continuity between terminals B5 (Tan/White wire) and B2 (Black wire). If no continuity is present, reconnect connector and go to next step. If continuity is present, replace ignition switch.

4) Disconnect brake pressure modulator valve 10-pin connector. If brake warning light remains on, check Purple or Tan/White wires for a short to ground. If wires are okay, replace instrument cluster. If brake warning light does not remain on, diagnose brake system. See ANTI-LOCK BRAKE SYSTEM article in BRAKES section.

CHECK GAUGES Or Temperature Indicator Does Not Light With Ignition Switch In Run Or Start

Disconnect ignition switch connector. Connect fused jumper wire between Dark Green wire at ignition switch connector and ground. Turn ignition on. If temperature or CHECK GAUGES indicator lights, replace ignition switch. If temperature or CHECK GAUGES indicator does not light, repair open circuit in Dark Green wire between ignition switch connector and instrument cluster connector.

CHECK GAUGES Light Inoperative With High Coolant Temperature

Inspect CHECK GAUGES bulb and replace if faulty. If bulb is okay, replace instrument cluster.

CHECK GAUGES Light Inoperative With Low Oil Pressure

Inspect CHECK GAUGES bulb and replace if faulty. If bulb is okay, replace instrument cluster.

OIL PRESSURE GAUGE

NOTE: If procedure specifies replacing oil pressure sending unit, replace with revised sending unit. Some older version sending units may cause gauge to indicate oil pressure higher than actual pressure, or may cause gauge fluctuations. Check with manufacturer for latest part number.

Gauge Is Inaccurate

1) Disconnect oil pressure sending unit connector. Connect one Red wire lead of Instrument Panel Tester (J-33431) to Tan wire terminal of temperature sending unit connector, and connect other Red lead to ground. Turn ignition on.

2) Adjust tester dial to zero ohms, then 90 ohms. If gauge indicates LOW at zero ohms and HIGH at 90 ohms, replace sending unit. If gauge does not indicate as specified, check for open in Tan wire between sending unit and instrument cluster. If wire is okay, replace instrument cluster.

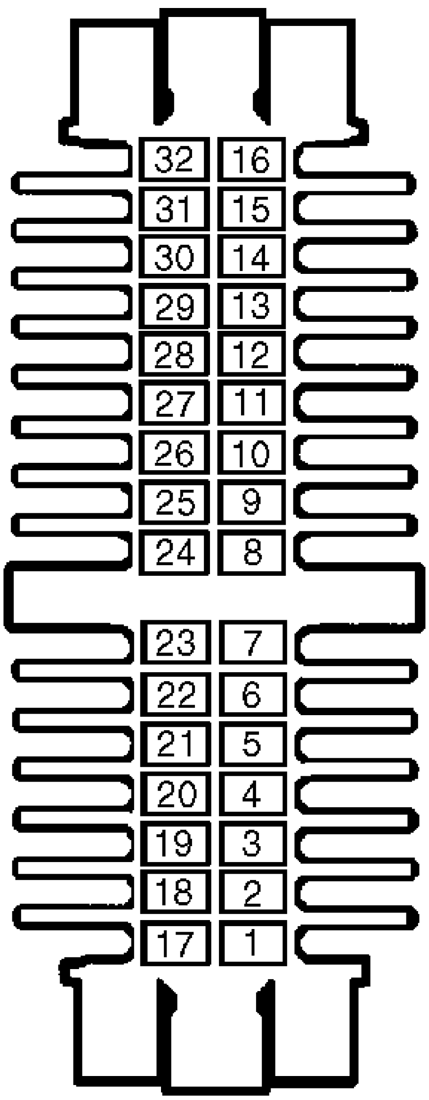
SPEEDOMETER & ODOMETER

NOTE: Speedometer and odometer testing for is not available from manufacturer.

TACHOMETER

Tachometer Inoperative

Connect Tech 1 scan tool to data link connector. Start engine. Read engine RPM from Tech 1 scan tool. If Tech 1 scan tool displays engine RPM, repair open or short to ground in White wire between ignition coil and instrument cluster terminal No. 8. See Fig. 2. If wire is okay, replace instrument cluster. If Tech 1 displays zero for engine RPM, repair open or short to ground in White wire. If wire is okay, replace ignition coil or Powertrain Control Module (PCM).



97J28315

Fig. 2: Instrument Cluster Connector
Courtesy of General Motors Corp.

VOLTMETER

Voltmeter Inaccurate

Turn ignition on. Check voltage across battery terminals. If battery voltage matches vehicle voltmeter, voltmeter is accurate. If battery voltage does not match vehicle voltmeter, check for open or high resistance in Pink or Black wires at instrument cluster. If wires are okay, replace instrument cluster.

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. See COMPUTER RELEARN PROCEDURES article in GENERAL INFORMATION before disconnecting battery.

CAUTION: Static electricity can destroy integrated circuits in instrument cluster and VSS calibrator. Before servicing these components, ground yourself and work area to discharge static electricity.

INSTRUMENT CLUSTER

Removal & Installation

Disconnect negative battery cable. Disable SIR system. See AIR BAG PRECAUTIONS. Remove sound insulation. Remove steering column cover nuts. Remove steering column cover. Remove instrument cluster bezel. Remove 4 cluster-to-instrument panel screws. Disconnect electrical connector. Remove cluster. See Fig. 3. To install, reverse removal procedure.

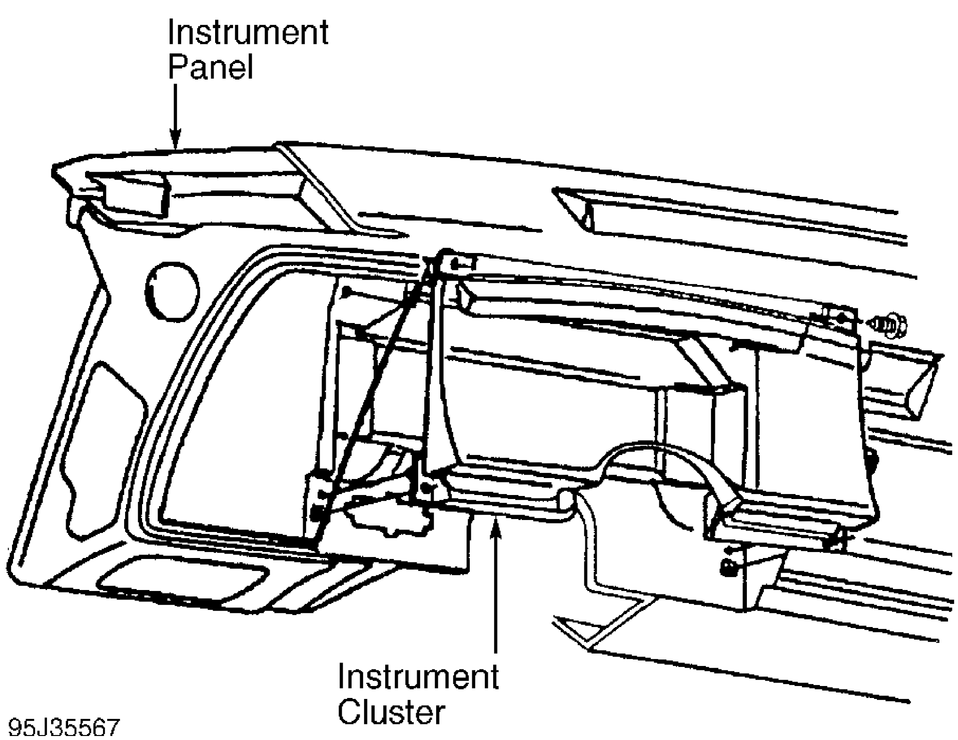


Fig. 3: Exploded View Of Instrument Cluster
Courtesy of General Motors Corp.

WIRING DIAGRAMS

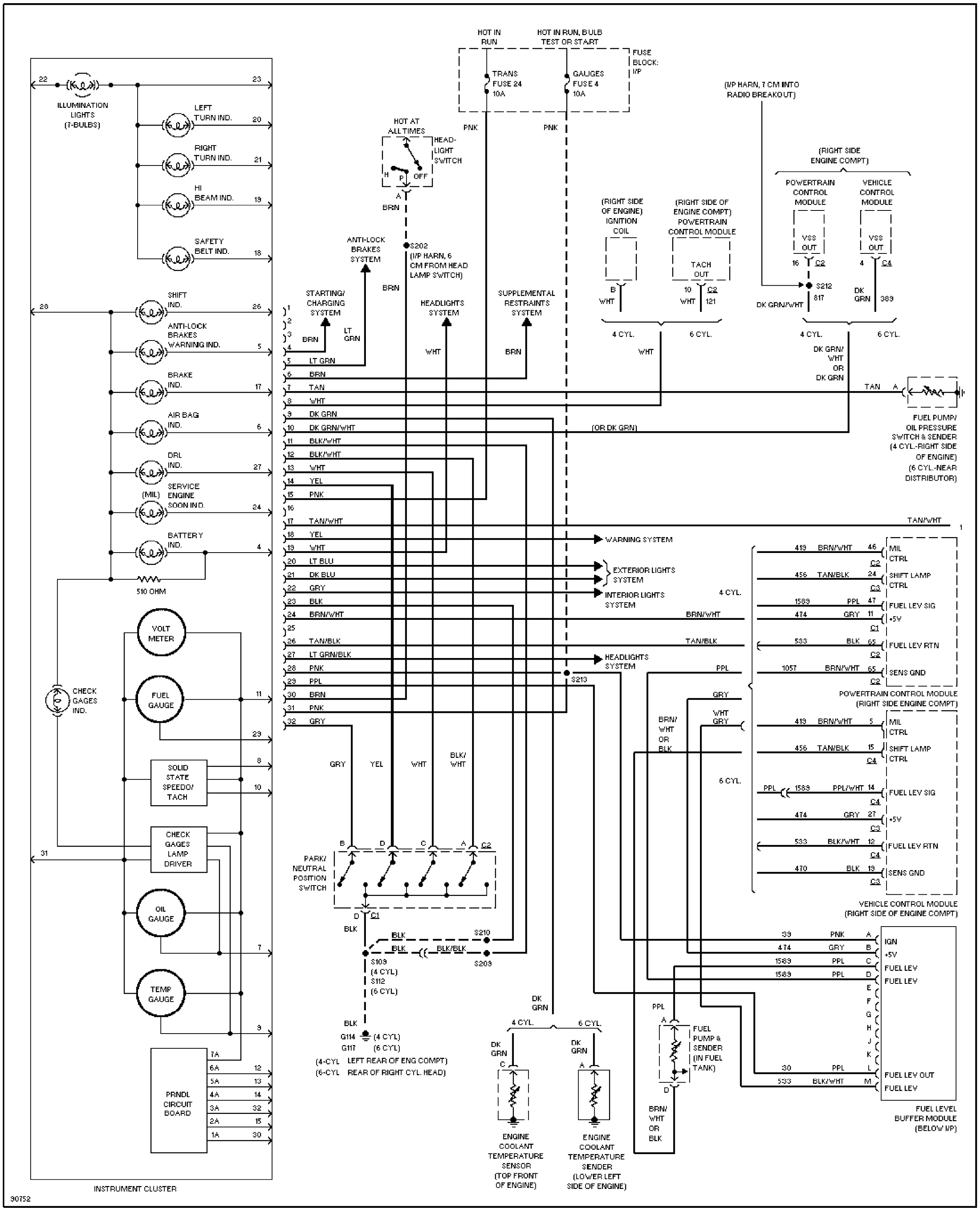


Fig. 4: Analog Instrument Panel Wiring Diagram (1 Of 2)

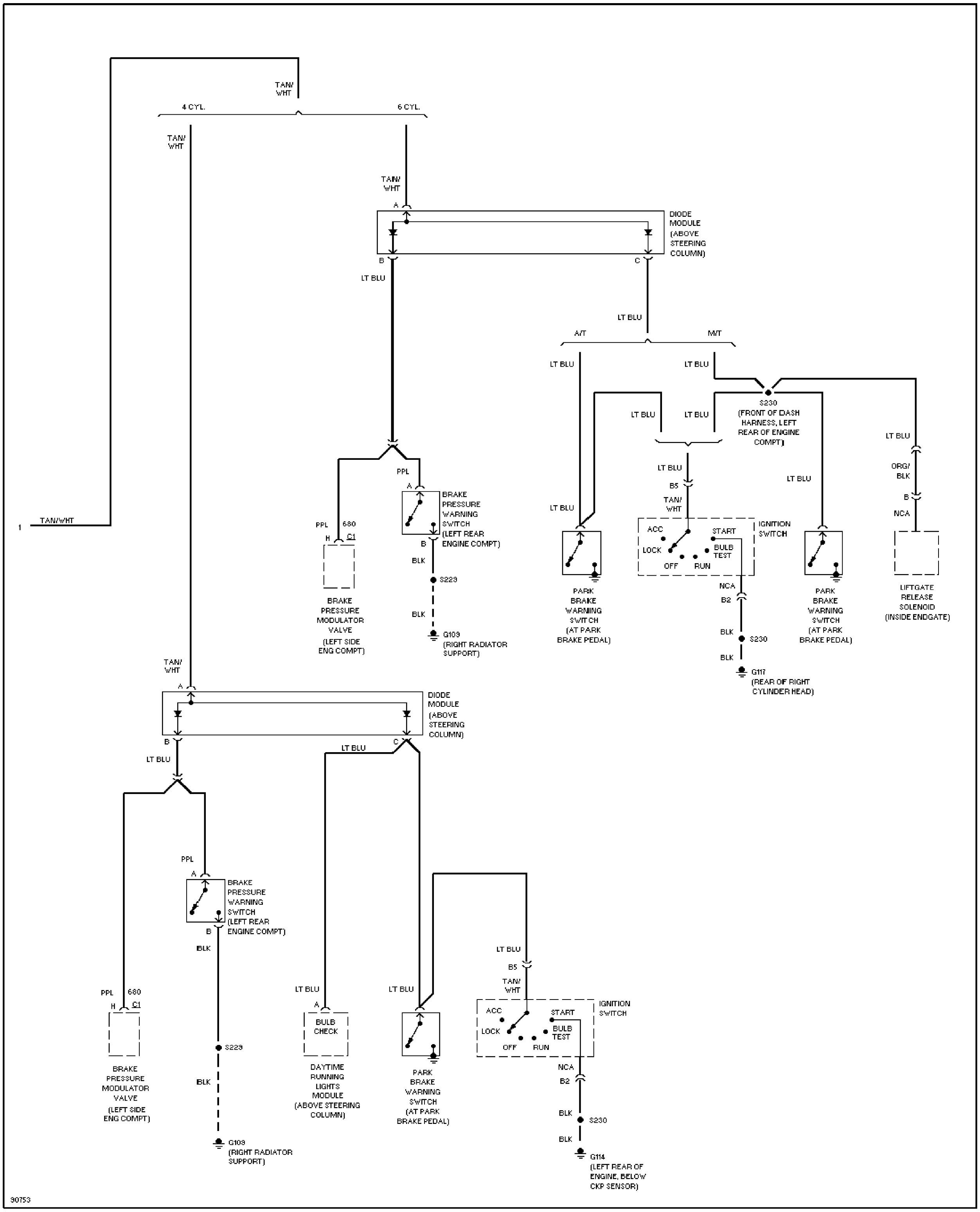


Fig. 5: Analog Instrument Panel Wiring Diagram (2 Of 2)

KEYLESS ENTRY SYSTEM - REMOTE

1997 Chevrolet Blazer

1997 ACCESSORIES & EQUIPMENT
General Motors Corp. - Remote Keyless Entry System

Chevrolet; Blazer & "S" & "T" Series Pickup
GMC; Jimmy & Sonoma
Oldsmobile; Bravada

DESCRIPTION

Remote keyless entry system is used to lock and unlock vehicle doors and release rear liftgate or liftgate window. A receiver control module, capable of recognizing 2 transmitters, is installed in instrument panel, behind and to the left of the radio. System also uses existing power door lock components.

OPERATION

When UNLOCK button is pressed on transmitter, signal is received by control module and unlocks driver's door only. When UNLOCK button is pressed a second time, within 1-5 seconds of the first press, remaining doors will unlock.

To lock doors, press DOOR button to lock all doors and liftgate at once. When button marked REAR 2X is depressed, rear door or liftgate unlocks. If REAR 2X button is depressed twice within 1-5 seconds, liftgate window is unlatched. Vehicle with manual transmissions must have parking brake applied for this feature to operate. Transmitter must be within 33 feet (10 m) to be received and decoded by receiver.

COMPONENT LOCATIONS

COMPONENT LOCATIONS TABLE

Component	Location
Data Link Connector	Lower Left Side Of Dash
Door Lock Relay	Behind Right Side Of Dash, Above Blower Plenum
Fuse Block	Left Side Of Dash
Remote Control Door Lock Receiver	Below Left Side Of Dash, Near Park Brake

PROGRAMMING PROCEDURES

TRANSMITTER REPROGRAMMING

Without Scan Tool

1) Ground terminal No. 4 (Black) to No. 8 (Black/White wire) of Data Link Connector (DLC) located under lower left side of instrument panel. Receiver will respond by locking and unlocking all doors and activating liftgate window release (if equipped) within 2 seconds. Press any button of first transmitter to be reprogrammed. Control module will respond by locking/unlocking all doors and activating liftgate window release (if equipped).

2) Press any button of second transmitter to be reprogrammed (if equipped). Control module will again respond by locking/unlocking

all doors and activating liftgate window release (if equipped). Remove ground from DLC terminals. Transmitter operation can be verified by locking and unlocking doors and automatically activating liftgate window release.

Without Scan Tool

1) With ignition switch in OFF position, hold down power unlock button on door panel. Turn ignition switch to ON position, then OFF. Turn ignition switch to ON position, then OFF a second time. Release power unlock button on door panel. Receiver will respond by locking and then unlocking all doors and unlatching rear window (utility vehicles only) to indicate programming mode.

2) Hold down LOCK and UNLOCK buttons on transmitter for 15 seconds. Receiver should respond by locking then unlocking all doors and unlatching rear window (utility vehicles only).

3) Repeat step 2) for each additional transmitter. All extra transmitters MUST be reprogrammed at this time. When a new transmitter is reprogrammed, old transmitters will be deactivated.

4) Turn ignition to ON position to exit transmitter mode.

RESYNCHRONIZATION

1) Resynchronization may be necessary due to security methods used by Remote Keyless Entry (RKE) system. Transmitters do not send the same signal twice. Receiver will not respond to a signal it has been sent previously preventing recording and playback of transmitter signal. Resynchronization will be necessary if and of the following occur:

* Transmitter battery is very weak.
* Transmitter battery is changed.
* Vehicle battery is very weak.
* Vehicle battery is replaced.
* Vehicle battery is disconnected.

To resynchronize transmitter to receiver, stand within 5 feet of vehicle and simultaneously depress and hold LOCK and UNLOCK buttons on transmitter for 7 seconds. Door locks should cycle to confirm resynchronization.

TROUBLE SHOOTING

Check GAUGES fuse No. 4 at instrument panel fuse block. Ensure all electrical connectors, circuits and grounds are good. Ensure power door locks system is operational. See POWER DOOR LOCKS article. Try second transmitter. If second transmitter operates system, replace battery in first transmitter. Ensure transmitter battery terminals are clean and making good contact.

TESTING

NOTE: To prevent damage, connector Test Adaptor Kit (J 35616-A) must be used whenever a diagnostic procedure requires checking or probing a terminal. To locate and identify terminals, see WIRING DIAGRAMS.

KEYLESS ENTRY SYSTEM INOPERATIVE

1) Operate power door locks using front door lock switches. If door locks operate normally, go to next step. If door locks do not operate normally, see POWER DOOR LOCKS article.

2) Disconnect remote control door lock receiver. Connect test light from ground to remote control door lock receiver connector Orange wire. If test light illuminates, go to next step. If test light does not illuminate, repair open in Orange wire between fuse block and remote control door lock receiver.

3) Connect test light from Black wire to Orange wire at remote control door lock receiver. If test light illuminates, go to next step. If test light does not illuminate, repair open in Black wire between remote control door lock receiver and ground.

4) Check remote control door lock receiver and connectors for poor terminal contact. If terminal contact is okay, program a known good transmitter. If transmitter programs correctly, replace suspect transmitter. If transmitter does not program correctly, replace remote keyless entry module. See PROGRAMMING PROCEDURES.

DRIVER'S DOOR LOCK OR UNLOCK FUNCTION INOPERATIVE, PASSENGER DOOR LOCKS OPERATE NORMALLY

1) Operate driver's door lock and unlock using left or right door lock switch. If system operates normally, go to next step. If system does not operate normally, go to step 3).

2) Program a known-good transmitter. See TRANSMITTER REPROGRAMMING. If transmitter programs normally, replace transmitter. If transmitter does not program normally, replace remote control door lock receiver.

3) Connect test light between ground and remote control door lock receiver Black, 16-pin connector terminal "B" (White wire). If test light illuminates, go to next step. If test light does not illuminate, check remote control door lock receiver Black, 16-pin connector for a poor connection. If okay, repair open circuit in White wire between remote control door lock receiver and splice S256.

4) Connect test light between ground and remote control door lock receiver connector terminal "R" (Light Blue wire). Press transmitter UNLOCK button. If test light flashes once, check for open circuit in Tan wire between remote control door lock receiver and driver side front door lock actuator. Also check for open circuit in Gray wire between driver side front door lock actuator and door lock relay. If okay, replace left front door lock actuator. If test light stays illuminated or does not illuminate at all, check for short to voltage in Tan wire between remote control door lock receiver and driver side front door lock actuator. If okay, replace remote control door lock receiver.

COURTESY LIGHTS DO NOT LIGHT WHEN UNLOCK FUNCTION IS OPERATED, BUT OPERATE NORMALLY WHEN ANY DOOR IS OPEN, DOOR LOCKS OPERATE NORMALLY

1) Disconnect remote control door lock receiver Black 16-pin connector. Connect test light between ground and remote control door lock receiver connector terminal "J" (Pink wire). If test light illuminates, go to next step. If test light does not illuminate, repair open circuit in Pink wire between fuse block and remote control door lock receiver.

2) Connect fused (20-amp) jumper wire between ground and remote control door lock receiver 16-pin connector terminal "S" (White wire). If courtesy lights illuminate, check remote control door lock receiver 16-pin connector for a poor connection. If connection is okay, replace remote control door lock receiver. If courtesy lights do not illuminate, repair open circuit in White wire between remote control door lock receiver and splice S279.

REAR LIFTGATE WINDOW RELEASE

NOTE: To prevent damage to terminal, connector Test Adaptor Kit (J 35616-A) must be used whenever a diagnostic procedure requires checking or probing a terminal. To locate and identify terminals, see WIRING DIAGRAMS.

1) Press rear endgate window release switch. If window releases, go to next step. If window does not release, see POWER REAR WINDOW/LIFTGATE RELEASE article.

2) Place transmission in Park (A/T) or set parking brake (M/T). Disconnect remote control door lock receiver 16-pin connector. Connect fused jumper wire between ground and remote control door lock receiver 16-pin connector terminal "L" (Black/White wire). If endgate window releases, replace remote control door lock receiver. If endgate window does not release, repair open circuit in Black/White wire between remote control door lock receiver and rear window release solenoid.

KEYLESS ENTRY RECEIVER/TRANSMITTER WILL NOT PROGRAM

Attempt to program system using a known-good transmitter. Retest system. If system operates correctly, replace transmitter. If system does not operate correctly, check Black/White wire between data link connector and remote control door lock receiver and Black wire between remote control door lock receiver and ground for an open circuit. If wires are okay, replace remote control door lock receiver.

REMOVAL & INSTALLATION

* PLEASE READ THIS FIRST *

CAUTION: When battery is disconnected, vehicle computer and memory systems may lose memory data. Driveability problems may exist until computer systems have completed a relearn cycle. See COMPUTER RELEARN PROCEDURES article in GENERAL INFORMATION section before disconnecting battery.

REMOTE CONTROL DOOR LOCK RECEIVER

Removal & Installation

Disconnect negative battery cable. Remove left side instrument panel sound insulator. Disconnect electrical connectors. Remove control module-to-instrument panel bolts. Remove control module. To install, reverse removal procedure. Reprogram transmitters. See TRANSMITTER REPROGRAMMING. Check system operation.

WIRING DIAGRAMS

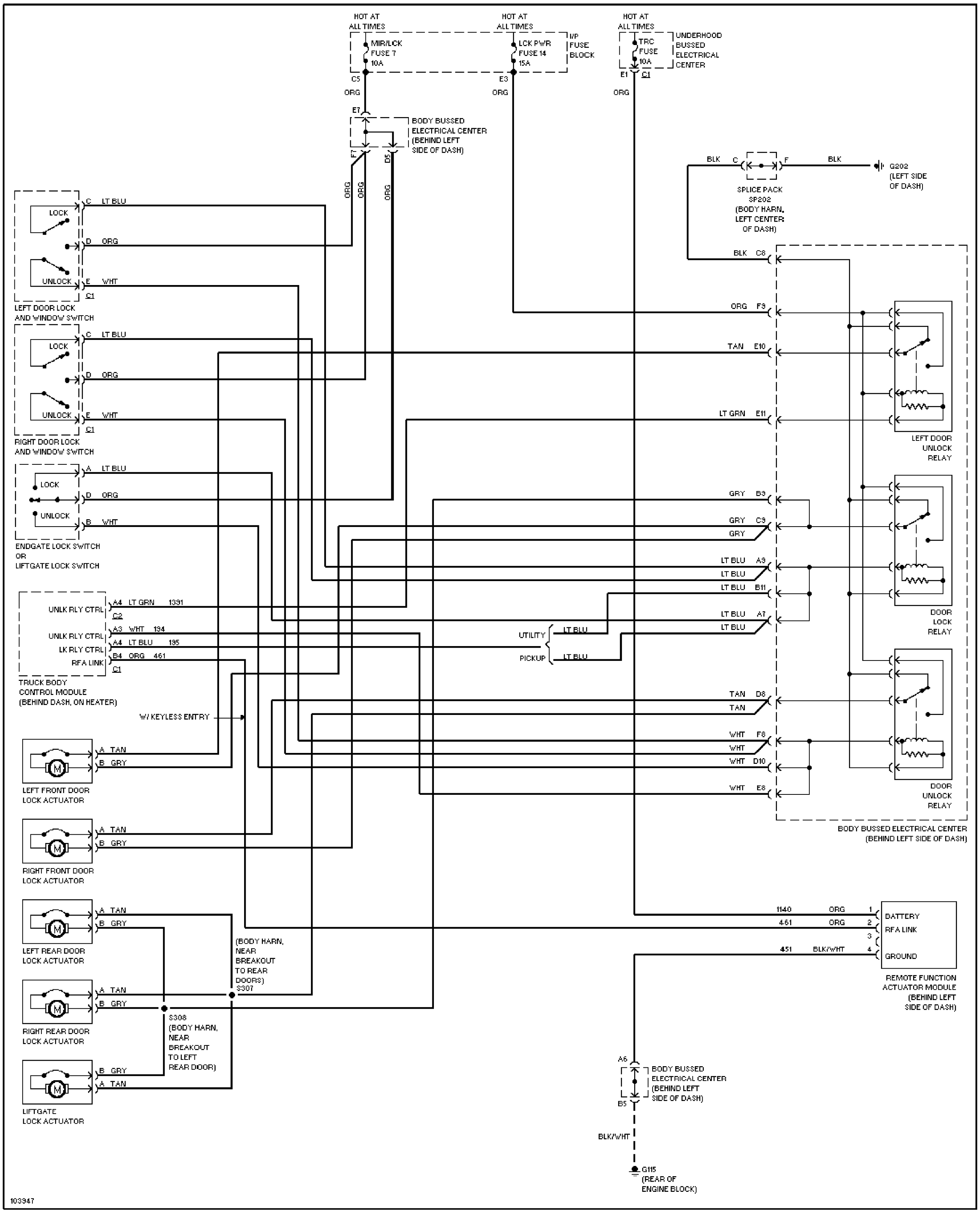


Fig. 1: Remote Keyless Entry System Wiring Diagram

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1997 ENGINE PERFORMANCE
General Motors Corp. - Wiring Diagrams

Chevrolet;  Blazer, S10 Pickup
GMC;  Jimmy, Sonoma
Oldsmobile;  Bravada
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WIRING DIAGRAMS

2.2L (2WD)

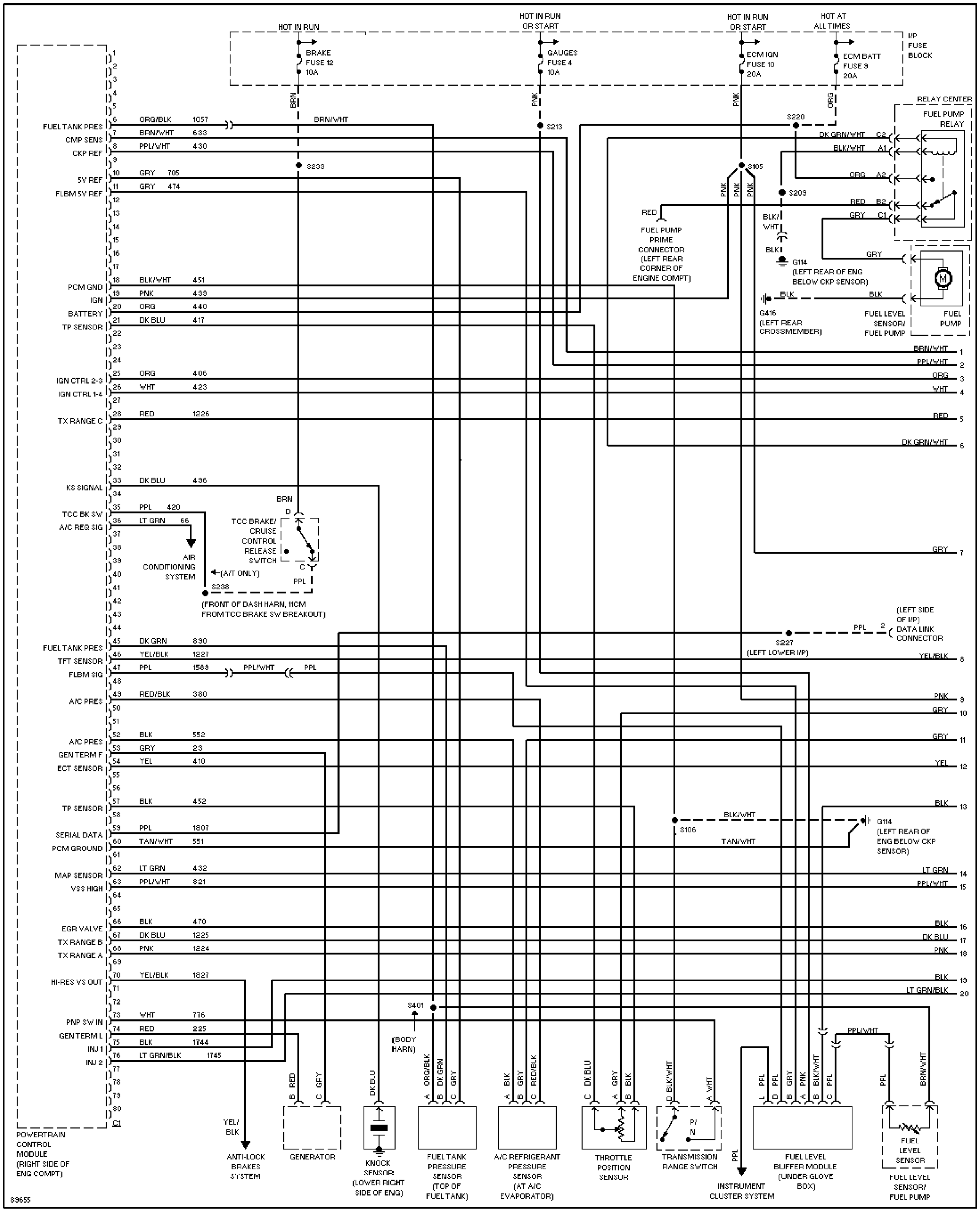


Fig. 1: PCM Wiring Diagram (2.2L - 1 Of 3)

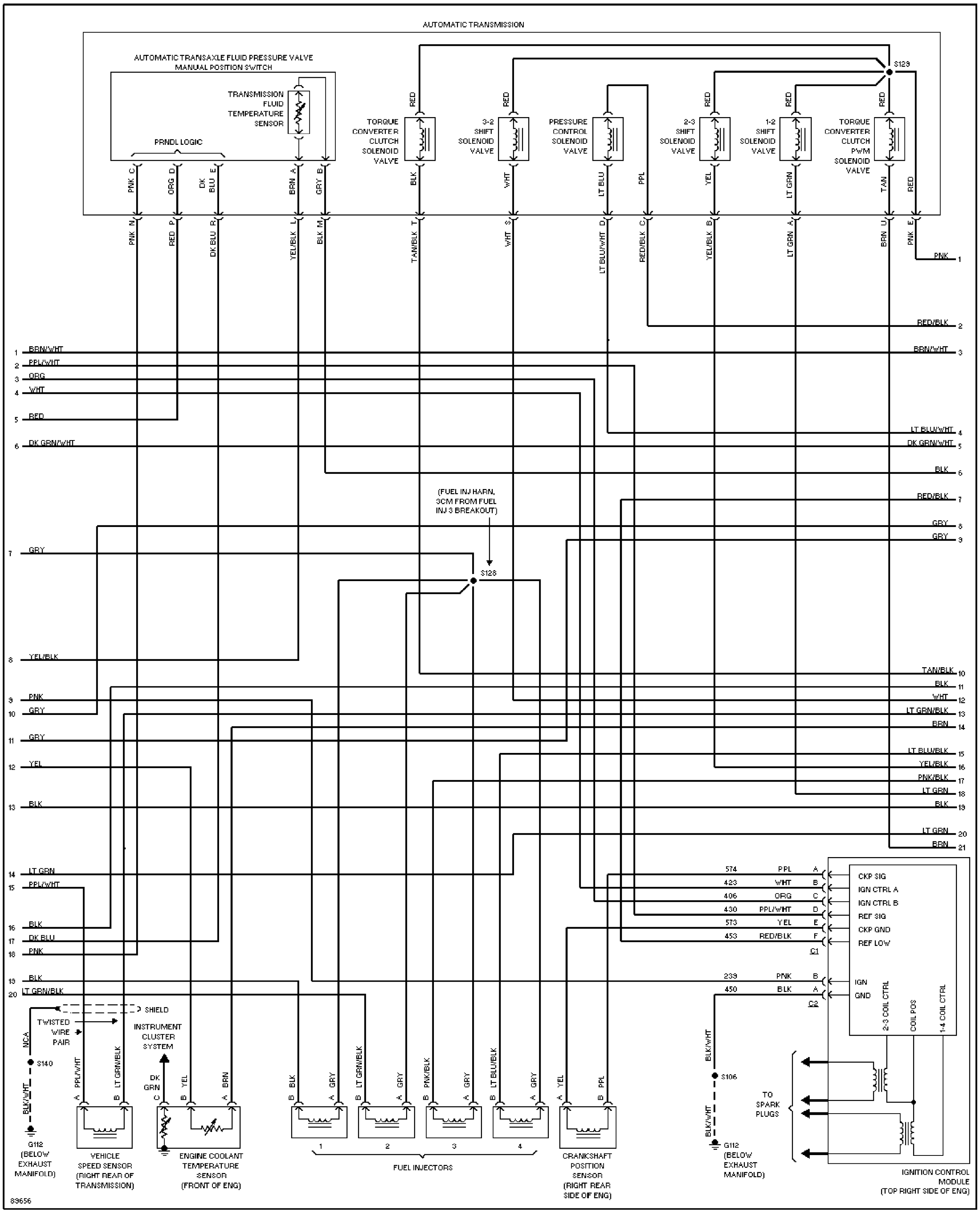


Fig. 2: PCM Wiring Diagram (2.2L - 2 Of 3)

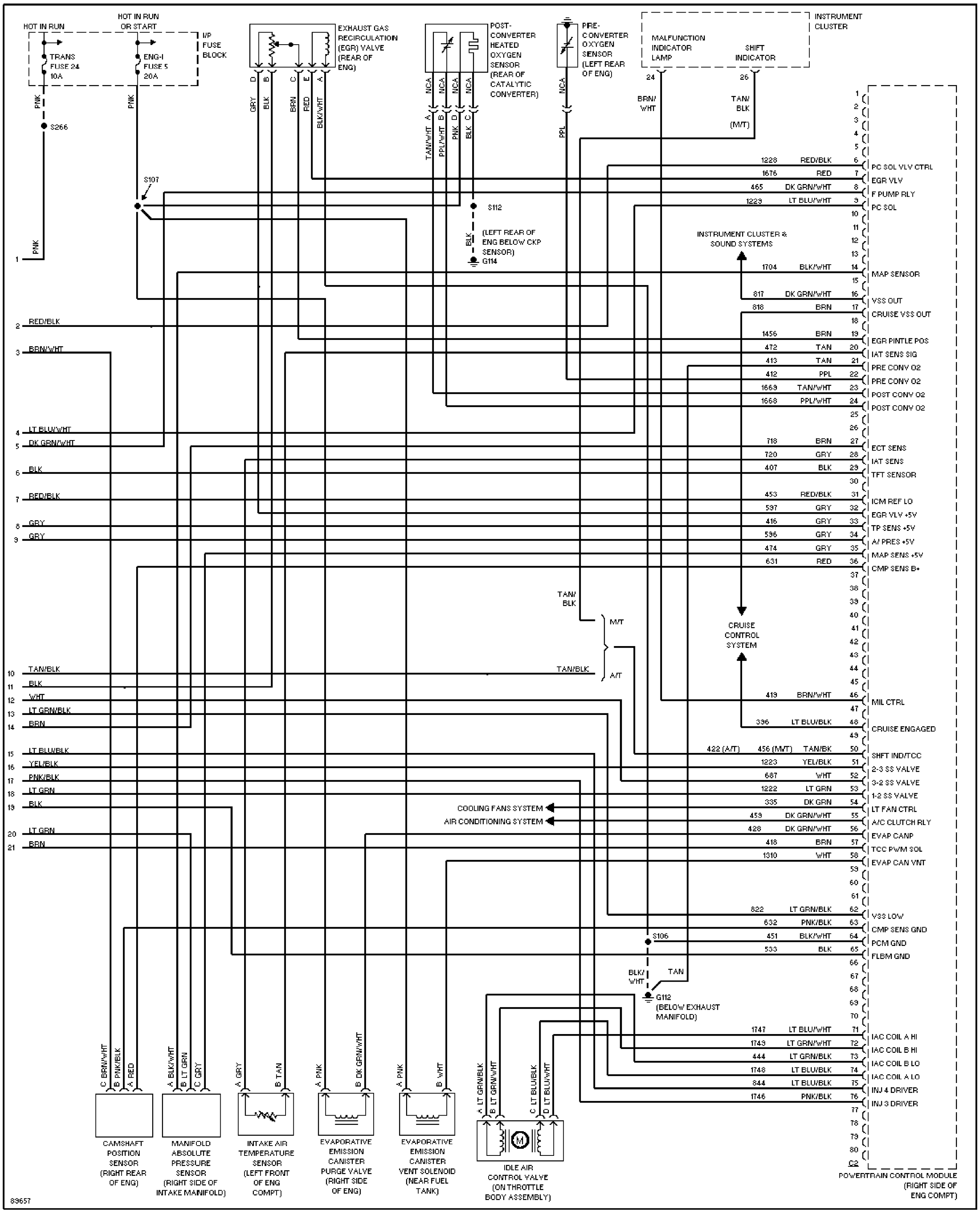


Fig. 3: PCM Wiring Diagram (2.2L - 3 Of 3)

4.3L

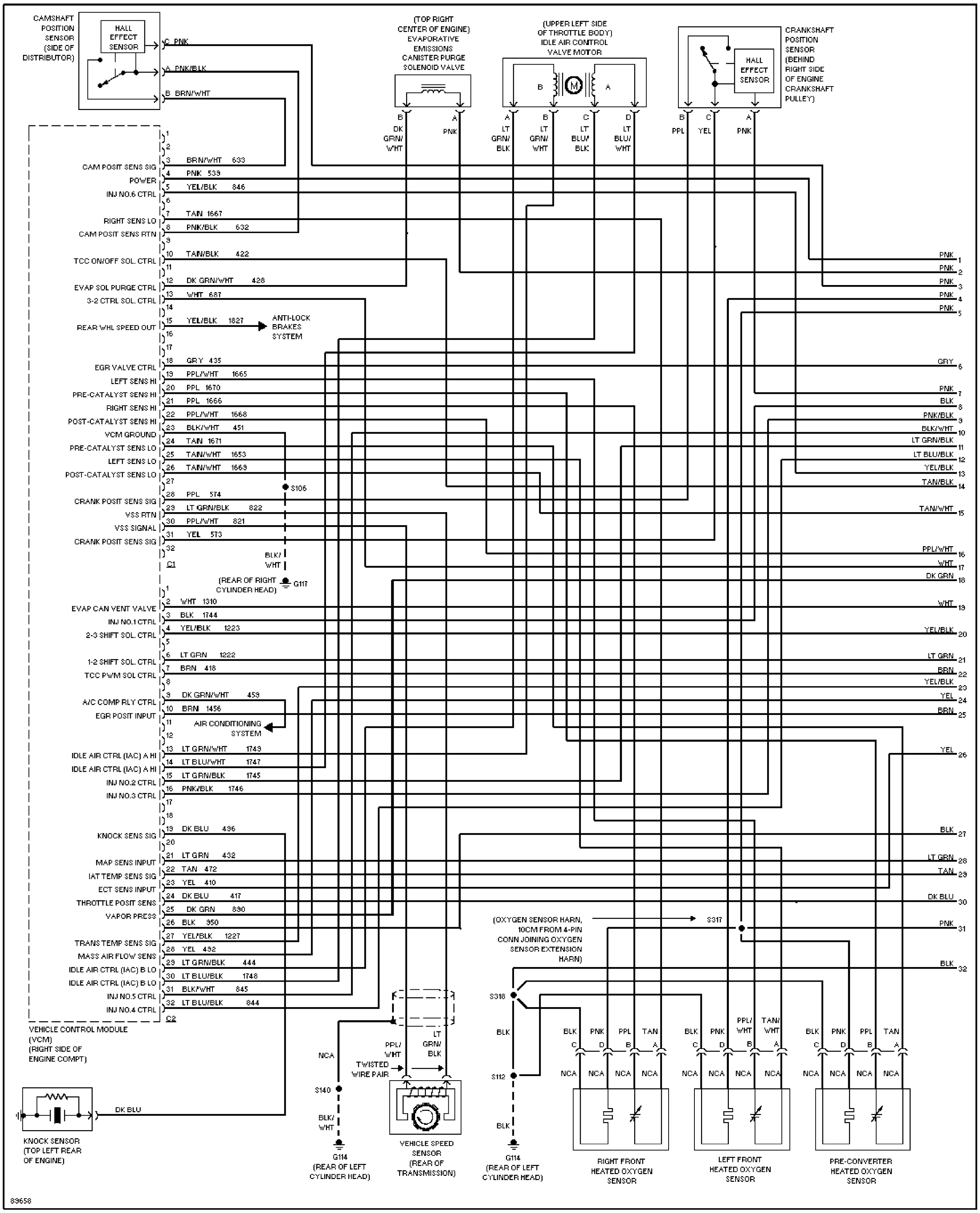


Fig. 4: VCM Wiring Diagram (4.3L - 1 Of 4)

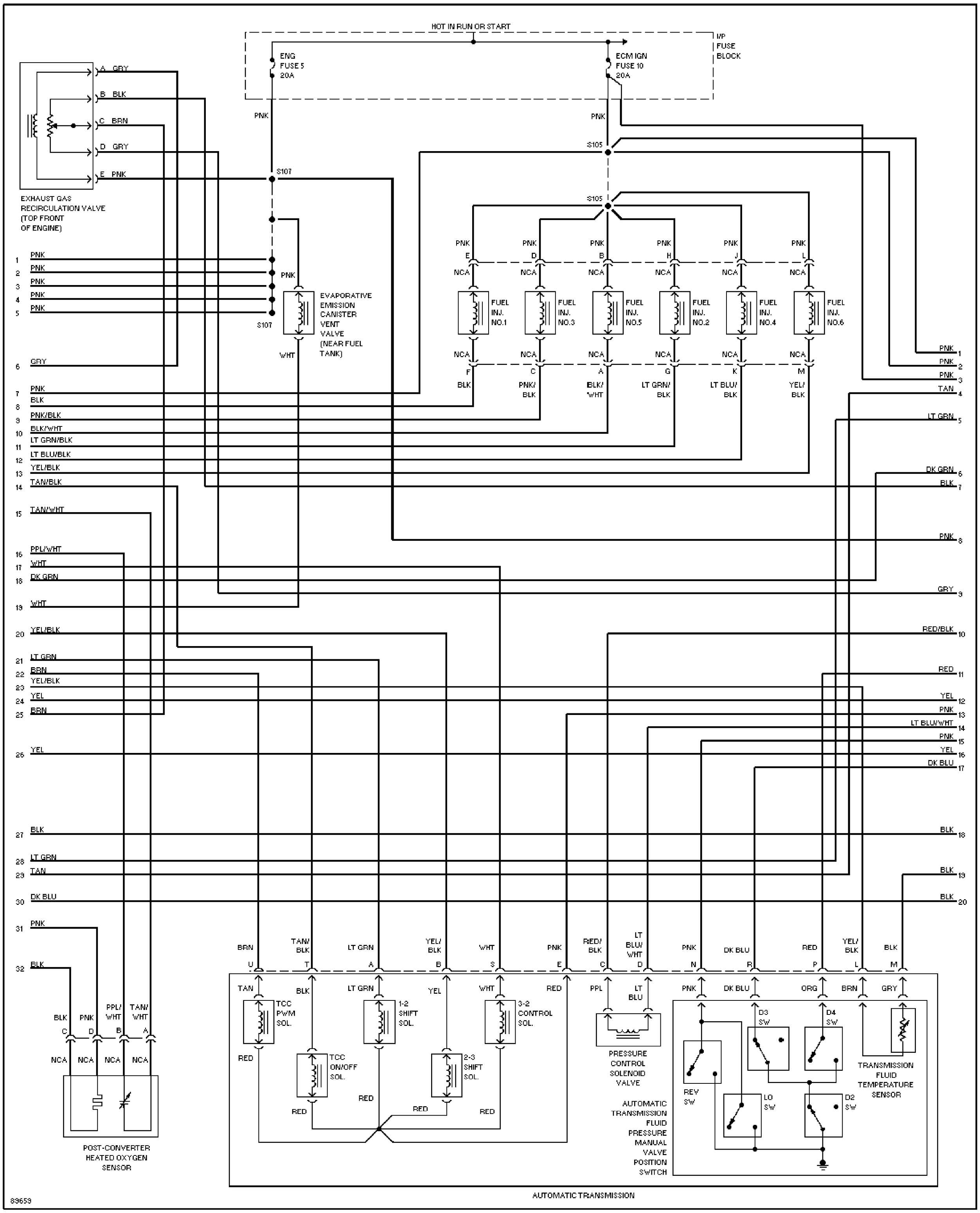


Fig. 5: VCM Wiring Diagram (4.3L - 2 Of 4)

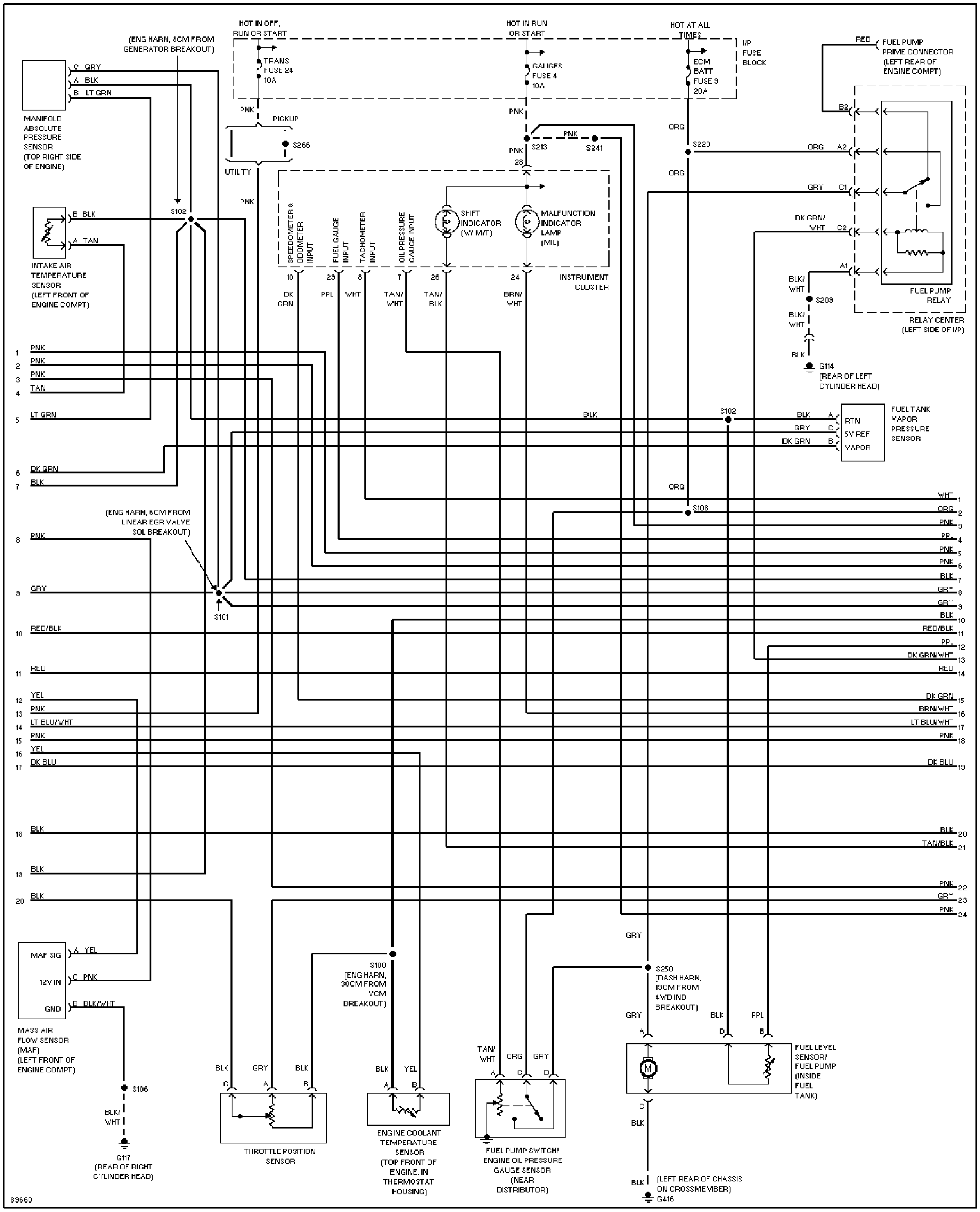


Fig. 6: VCM Wiring Diagram (4.3L - 3 Of 4)

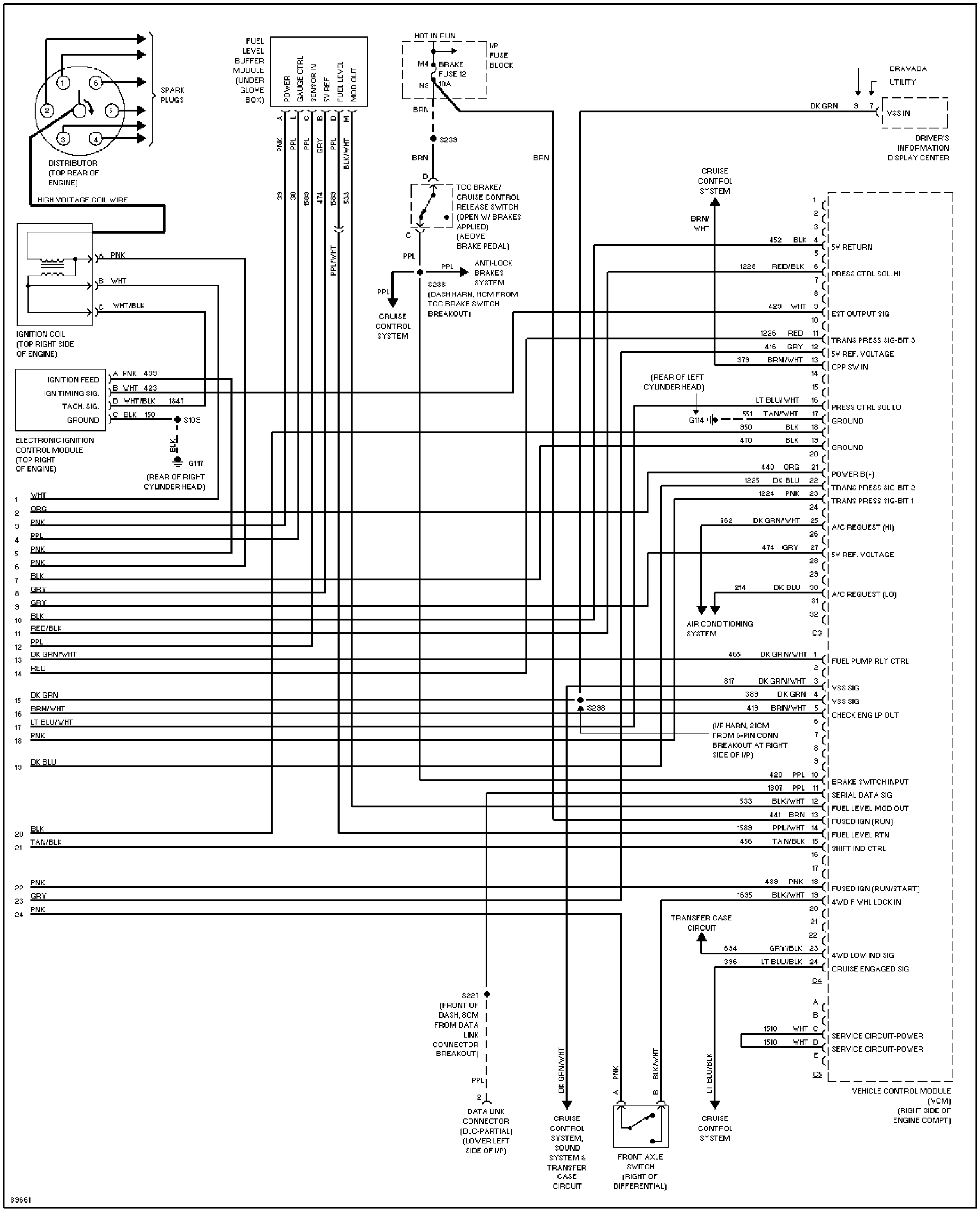


Fig. 7: VCM Wiring Diagram (4.3L - 4 Of 4)

MAINTENANCE INFORMATION

1997 Chevrolet Blazer

1997-99 MAINTENANCE
General Motors Corp. Maintenance Information

Chevrolet; Blazer
GMC; Jimmy
Envoy (1998-99)
Oldsmobile; Bravada

* PLEASE READ THIS FIRST *

NOTE: For scheduled maintenance intervals and the related fluid capacities, fluid specifications and labor times for major service intervals, see the appropriate SCHEDULED SERVICES article below. Warranty information and specifications for fluid capacities, lubrication specifications, wheel and tire size, and battery type are covered in this article.

Blazer & Jimmy

* SCHEDULED SERVICES - LONG TRIP/HIGHWAY
* SCHEDULED SERVICES - SHORT TRIP/CITY

Bravada & Envoy

* SCHEDULED SERVICES - LONG TRIP/HIGHWAY
* SCHEDULED SERVICES - SHORT TRIP/CITY

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.

SERVICE PARTS IDENTIFICATION LABEL

Label is located inside glove box door and has the vehicle's VIN, wheelbase, paint information, and a list of all production options and special equipment.

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)	1	G	C	B	S	1	4	Z	4	M	F	1	0	0	0	0	1
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17

1 - Nation Of Origin
  1 * United States
  4 * United States

2 - Manufacturer
  G * General Motors

3 - Make
  B * Chevrolet Incomplete
  C * Chevrolet Truck
  D * GMC Incomplete
  K * GMC MPV
  N * Chevrolet MPV
  T * GMC Truck
  H * Oldsmobile

4 - GVWR/Brake System
  B * 3001-4000/Hydraulic
  C * 4001-5000/Hydraulic
  D * 5001-6000/Hydraulic
  E * 6001-7000/Hydraulic
  F * 7001-8000/Hydraulic
  G * 8001-9000/Hydraulic

5 - Truck Line/Chassis Type
  S * Small Conventional Cab-2WD
  T * Small Conventional Cab-4WD

6 - Series
  1 * 1/2 Ton

7 - Body Type
  3 * 4-Door Utility
  4 * 2-Door Cab
  8 * 2-Door Utility
  9 * Extended Cab

8 - Engine Type
  W * 4.3L V6CPI
  X * 4.3L V6CPI
  4 * 2.2L L4MFI

9 - VIN Check Digit
     * 0 Through 9, Or X

10 - Vehicle Model Year
  V * 1997
  W * 1998
  X * 1999

11 - Assembly Plant Code
  K * Linden, NJ
  2 * Moraine, OH
  8 * Shreveport, LA

12-17 - Serial Number
     * Sequential Production Number

MAINTENANCE SERVICE INTERVAL DEFINITIONS

SEVERE & NORMAL SERVICE DEFINITIONS

Service is recommended at mileage intervals based on vehicle operation, emission classification, and Gross Vehicle Weight Rating (GVWR, VIN Position 4). Emission classification is identified by engine VIN code (except diesel-powered vehicles). Manufacturer's Schedules identify items to be serviced based on type of operation. Service schedules are based on the following primary operating conditions:

Normal Service/Long Trip/Highway

* No Severe Service Operating Conditions

Severe Service/Short Trip/City

NOTE: Use the Severe Service schedule if the vehicle to be serviced is operated under ANY (one or more) of these conditions:

* Most Trips Are Less Than 5 To 10 Miles (8 To 16 KM) This Is Particularly Important When Outside Temperatures Are Below Freezing
* Most Trips Include Extensive Idling (Such As Frequent Driving In Stop-And-Go Traffic)
* You Operate Your Vehicle In Dusty Areas Or Off-Road Frequently
* You Frequently Tow A Trailer
* If The Vehicle Is Used For Delivery Service, Police, Taxi Or Other Commercial Application

SERVICE POINT LOCATIONS

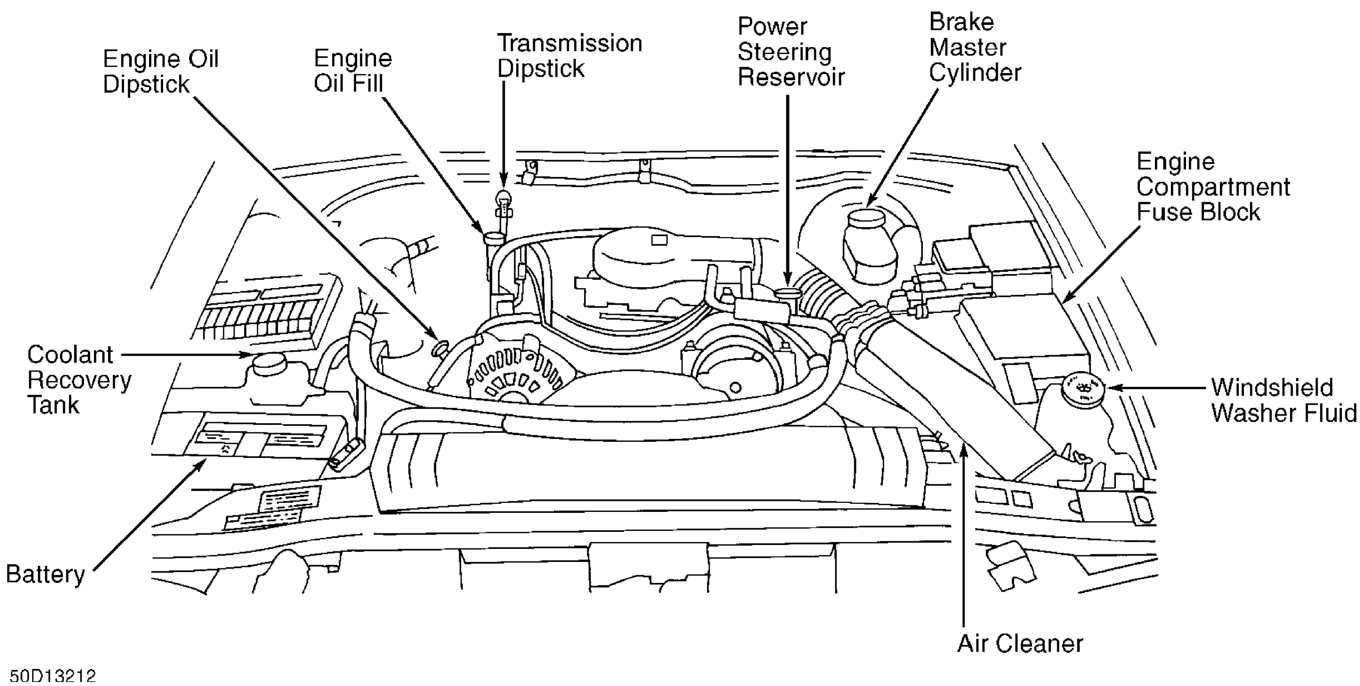
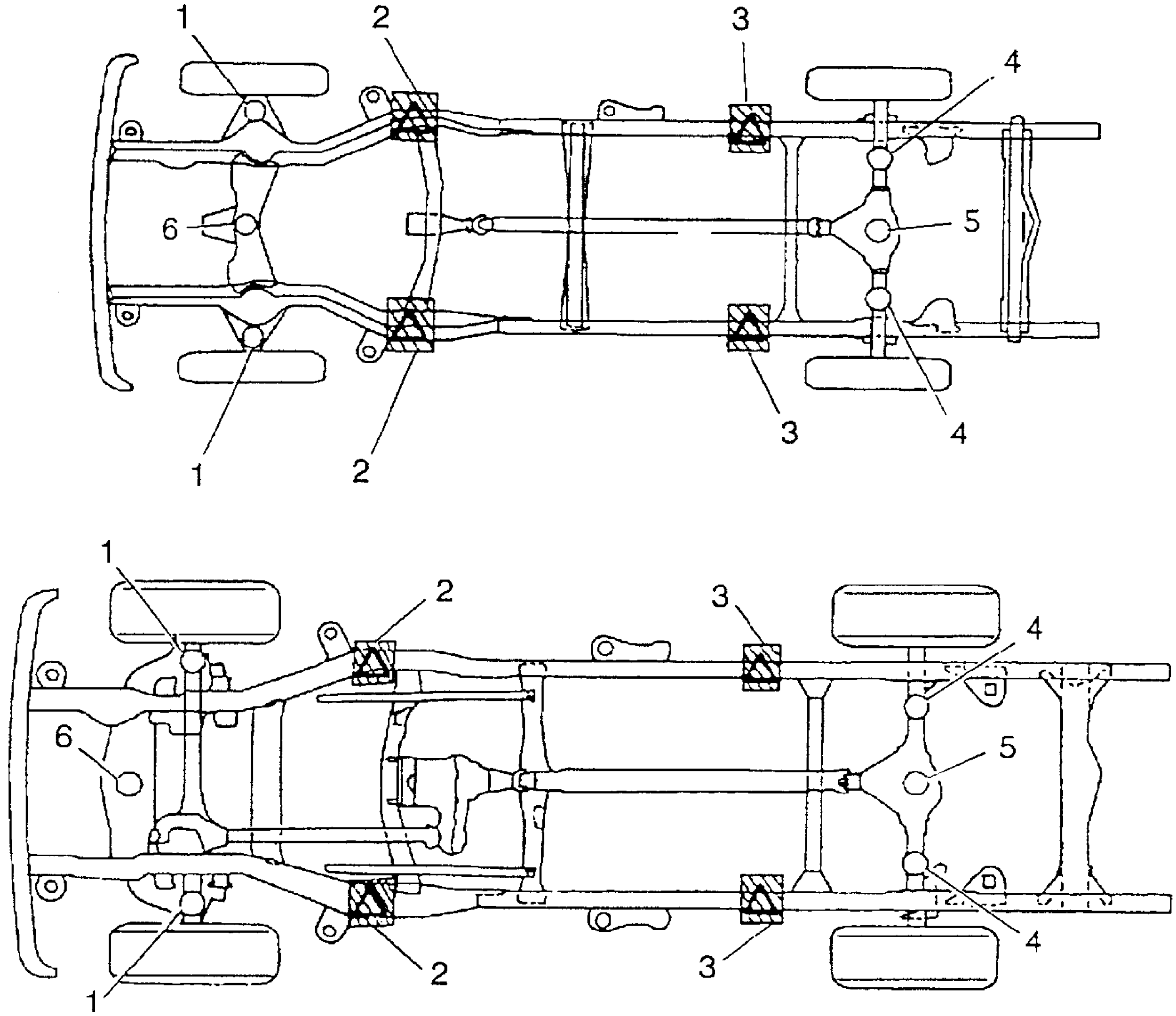


Fig. 1: Service Point Locations
Courtesy of General Motors Corp.



Legend

(1) Lower Control Arm; Inboard of the Lower Ball Joint
(2) Frame; at Second Crossmember
(3) Rear Spring; at Forward Spring Hanger
(4) Axle; Inboard of Shock Absorber Hanger
(5) Differential; at Center
(6) Front Suspension Crossmember; Center

△ Vehicle Jack or Floor Jack
○ Floor Jack
▨ Hoist

50E13213

Fig. 2: Lift Point Locations
Courtesy of General Motors Corp.

NOTE: For more information regarding jacking or hoisting the vehicle, refer to the JACKING & HOISTING article in the WHEEL ALIGNMENT section.

LUBRICATION SPECIFICATIONS

LUBRICATION SPECIFICATIONS TABLE

Material	Condition	Specification
Engine Oil (1)	Ambient Temperature Less Than 0°F (-18°C) To Over 100°F (38°C)	SAE 5W-30
	Ambient Temperature Above 0°F (-18°C) To Over 100°F (38°C)	SAE 10W-30
Engine Coolant	All	50/50 Mix of Distilled Water & DEX-COOL
Coolant Supplement Sealer	Complete Flush & Refill	GM Part No. 3634621 Or Equivalent
Brake Fluid	All	DOT 3
Clutch Fluid	All	DOT 3
Parking Brake Cable Guides Lubricant	All	Chassis Lubricant (GM Part No. 1052497)
Power Steering Fluid	All	GM Power Steering Fluid (GM Part No. 1052884)
Manual Transmission Fluid	All	Synchromesh Transmission Fluid (GM Part No. 12345349)
Automatic Transmission Fluid	All	DEXRON-III ATF
Key Lock Cylinders	All	Multi-Purpose Lubricant (GM Part No. 12346241)
Chassis Lubrication	All	Chassis Lubricant (GM Part No. 1052497) or Equivalent
Differential Front & Rear Axle	All	Axle Lubricant (GM Part No. 1052271) Or SAE 80W-90 GL-5 Gear Lubricant
Front Wheel Bearings	All	Wheel Bearing Lubricant (GM Part No. 1051344) Or Equivalent
Transfer Case	All	DEXRON-III ATF
Windshield Washer	All	GM Optikleen Washer Solvent

Solvent		(GM Part No. 1051515)
Transfer Case Shift Lever, Propeller Shaft Slip Splines & Universal Joints	All	Chassis Lubricant (GM Part NO. 1052497) Or Equivalent
Clutch Push-rod To Clutch Fork Joint	All	Chassis Lubricant (GM Part NO. 1052497) Or Equivalent
Constant Velocity Universal Joint	All	Chassis Lubricant (GM Part NO. 1052497) Or Equivalent
Hood Latch Assembly, Pivots, Spring Anchor & Release Pawl	All	Lubriplate Lubricant Aersol (GM Part No. 12346293) Or Equivalent
Tailgate Mounted Spare Tire Carrier (if equipped) Outer Tail-gate Handle Pivot Points & Hinges	All	Multi-Purpose Lubricant (GM Part No. 12346241)
Weatherstrip Conditioning	All	Dielectric Silicone Grease or Equivalent (GM Part No. 12345579)
Weatherstrip Squeaks	All	Multi-Purpose Lubricant (GM Part No. 12346241)
(1) - SAE 5W-30 preferred. Do not use 20W-50 or any other non-recommended grade.		

FLUID CAPACITIES

FLUID CAPACITIES TABLE

Item	Condition	Specification (1)
Engine Oil	Drained; With New Filter	4.5 Qts. (4.3L)
Differential Fluid	Front: Drained	2.6 Pts. (1.2L)
	Rear: Drained	4.0 Pts. (1.9L)
Engine Coolant	Automatic Transmission:Drained	11.7 Qts. (11.1L)
	Manual Transmission: Drained	11.9 Qts. (11.3L)

Transmission Fluid(4L60-E)	Drained	5.0 Qts. (4.7L)
R-134a Refrigerant	Drained	2.0 Lbs. (0.9 Kgs.)
Fuel Tank	Full Capacity	19.0 Gal. (72.1L)
(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.		

WHEEL & TIRE SPECIFICATIONS

TIRE REPLACEMENT

Wheel and tire information can be found on the Certification/Tire label attached to rear of driver's door or door pillar.

Replace tires with the same Tire Performance Criteria Specification number shown on the original tire's sidewall. If tires are replaced with those that do not have a TPC Specification number then replace tires that are the same size, load range, speed rating, and construction type.

WHEEL TIGHTENING

Tighten lug nuts to 95 ft. lbs. (130 N.m).

BATTERY SPECIFICATIONS

CAUTION: When battery is disconnected, vehicles equipped with computers may lose memory data. When battery power is restored, driveability problems may exist on some vehicles. These vehicles may require a relearn procedure. See COMPUTER RELEARN PROCEDURES article in the GENERAL INFORMATION section.

CAUTIONS & WARNINGS

SUPPLEMENTAL RESTRAINT SYSTEM (AIR BAG)

NOTE: See the AIR 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 ACCESSORIES/SAFETY EQUIPMENT.

Modification to the air bag system component or wiring can adversely affect system performance and possibly cause injury.

CAUTION: The Diagnostic Energy Reserve Module (DERM) can maintain enough voltage to cause a deployment of the inflator module for up to 10 minutes after the ignition switch is turned off and the battery is disconnected. Many of the service procedures require disconnection of the inflator module to avoid an accidental deployment.

CAUTION: Disconnect negative battery cable before servicing any air bag system, steering column or passenger side dash component. After any repair, turn ignition key to the ON position from passenger's side of vehicle in case of accidental air bag inflation

AIR CONDITIONING SERVICING

WARNING: Avoid breathing R-134a refrigerant and PAG lubricant vapors, exposure may irritate eyes, nose and throat. To remove R-134a from system use R-134a recycling equipment that meets SAE J2210 specifications. If accidental system discharge occurs, ventilate work area before resuming service.

WARNING: R-134a service equipment or vehicle A/C systems SHOULD NOT be pressure tested or leak tested with compressed air. Some mixtures of air/R134a have shown to be combustible at elevated pressures. These mixtures are dangerous and may cause fire and/or explosions. See AIR CONDITIONING SERVICE article in GENERAL INFORMATION section.

ANTI-LOCK BRAKE SYSTEM

CAUTION: 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.

AXLE LUBRICANTS

CAUTION: Axle lube quantities must be replaced if the axle has been submerged in water.

REPLACING BLOWN FUSES

CAUTION: 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 COMPUTER RELEARN PROCEDURES article in GENERAL INFORMATION section.

BRAKE PAD WEAR INDICATOR

Indicator will cause a squealing or scraping noise, warning that brake pads need replacement.

CATALYTIC CONVERTER

CAUTION: To prevent catalytic converter overheating, DO NOT allow engine to idle for more than 20 minutes.

COOLANT

CAUTION: All models have DEX-COOL engine coolant installed at the factory. DEX-COOL coolant is a silicate-free coolant that is orange in color.

NOTE: It should not be mixed with regular ethylene-glycol coolant.

To avoid possible damage to vehicle cooling system, visually check engine coolant color before adding and/or changing engine coolant. Vehicle should have an identification label placed under the hood stating what type coolant is installed.

WARNING: Do NOT add only plain water to the cooling system. Plain water, or some other liquid like alcohol, can boil before the proper coolant mix will. The vehicle's coolant warning system is set for the proper coolant mix only. With plain water or the wrong mix, the engine could get too hot, but the overheat warning may not appear. The engine could catch fire and passengers in the vehicle could be seriously injured.

Use a 50/50 mixture of distilled water and DEX-COOL engine coolant.

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.

FUEL SYSTEM SERVICE

WARNING: Relieve fuel system pressure prior to servicing any fuel system component.

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.

METHANOL GASOLINE

CAUTION: Fuel that is more than 5% methanol should not be used in this vehicle. It can corrode metal parts in the fuel system, and damage plastic and rubber parts. Even at 5% methanol or less, solvents and corrosion preventers must be used with this fuel to avoid these problems.

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.

WARRANTY INFORMATION

CAUTION: Due to the different warranties offered in various regions and the variety of after-market extended warranties available, please refer to the warranty package that came with the vehicle to verify all warranty options.

BUMPER-TO-BUMPER PLUS COVERAGE LIMITED WARRANTY

Everything is covered for 3 years or 36,000 miles, whichever occurs first. Also covered by this warranty are any repairs to vehicle which have proven defective during material and workmanship in normal use. Warranty repairs (parts and labor) will be made by the Dealer at no charge using new or remanufactured parts by the Dealer. This warranty is subject to a 100 deductible for each repair visit after the first year or 12,000 miles, whichever occurs first. Maintenance items are covered up to their first scheduled replacement interval only.

TIRE COVERAGE

The tires supplied with the vehicle are covered against defects in material or workmanship under the Bumper-To-Bumper coverage. Any tire replaced under the Bumper-To-Bumper coverage will continue to be covered for the remaining portion of the New Vehicle Limited Warranty.

CORROSION & RUST-THROUGH COVERAGE (ALL MODELS)

Body sheet metal panels are covered against for 3 years or 36,000 miles, whichever occurs first.

Covers any body-sheet metal panel that rusts through continues to be covered 6 years or 100,000 miles whichever occurs first.

NOTE: Cosmetic or surface corrosion (resulting from stone chips or scratches in the paint, for example) in not included in sheet metal coverage.

SUPPLEMENTAL INFLATABLE RESTRAINT COVERAGE (ALL MODELS)

Covers supplemental restraint system (if equipped) for 3 years, regardless of mileage.

EMISSIONS "DEFECT" & "PERFORMANCE" WARRANTIES (EXCEPT CALIFORNIA)

Defect Warranty ensures that vehicle meets applicable EPA regulations and that vehicle's emission control system is free from defects in materials and workmanship for a period of 2 years or 24,000 miles, whichever occurs first.

The Performance Warranty covers all costs of repairing or adjusting any components or parts as needed in order for the vehicle to pass a federally required state or local emissions test for a period of 2 years or 24,000 miles, whichever occurs first.

Other emission control parts related to these components are covered by the Performance Warranty, where applicable. If another part fails due to the failure of one of these components, both parts are covered. See customer's copy of warranty information for specific items covered.

If a catalytic converter or vehicle (powertrain) control module is found to be defective under either of these warranties, those parts are warranted for a period of 8 years or 80,000 miles, whichever occurs first.

EMISSION "PERFORMANCE" WARRANTY (CALIFORNIA)

If vehicle fails a Smog Check inspection, all necessary repairs and adjustments will be made by manufacturer to ensure that vehicle passes the inspection. Warranty begins at warranty start date and lasts for a period of 3 years or 50,000 miles, whichever occurs first.

EMISSION "DEFECT" WARRANTY (CALIFORNIA)

If any emission-related part on the vehicle is defective, the part will be repaired or replaced by manufacturer. Warranty begins at warranty start date and lasts for a period of 3 years or 50,000 miles, whichever occurs first.

Some emission-related parts are warranted for 7 years or 70,000 miles whichever occurs first, and will be repaired or replaced by manufacturer if found to be defective in material or workmanship. See customer's copy of warranty information for specific items covered.

TOWING

Towing is covered to the nearest dealer facility if the vehicle cannot be driven because of a warranted defect.

FUSES & CIRCUIT BREAKERS

FUSE PANEL LOCATIONS

The fuse block is located under the instrument panel to the left of the steering column. For 1998 vehicles there is also a fuse box located in the engine compartment on the driver's side.

INSTRUMENT PANEL FUSE IDENTIFICATION

Fuse & Circuit Breaker Identification - 1997

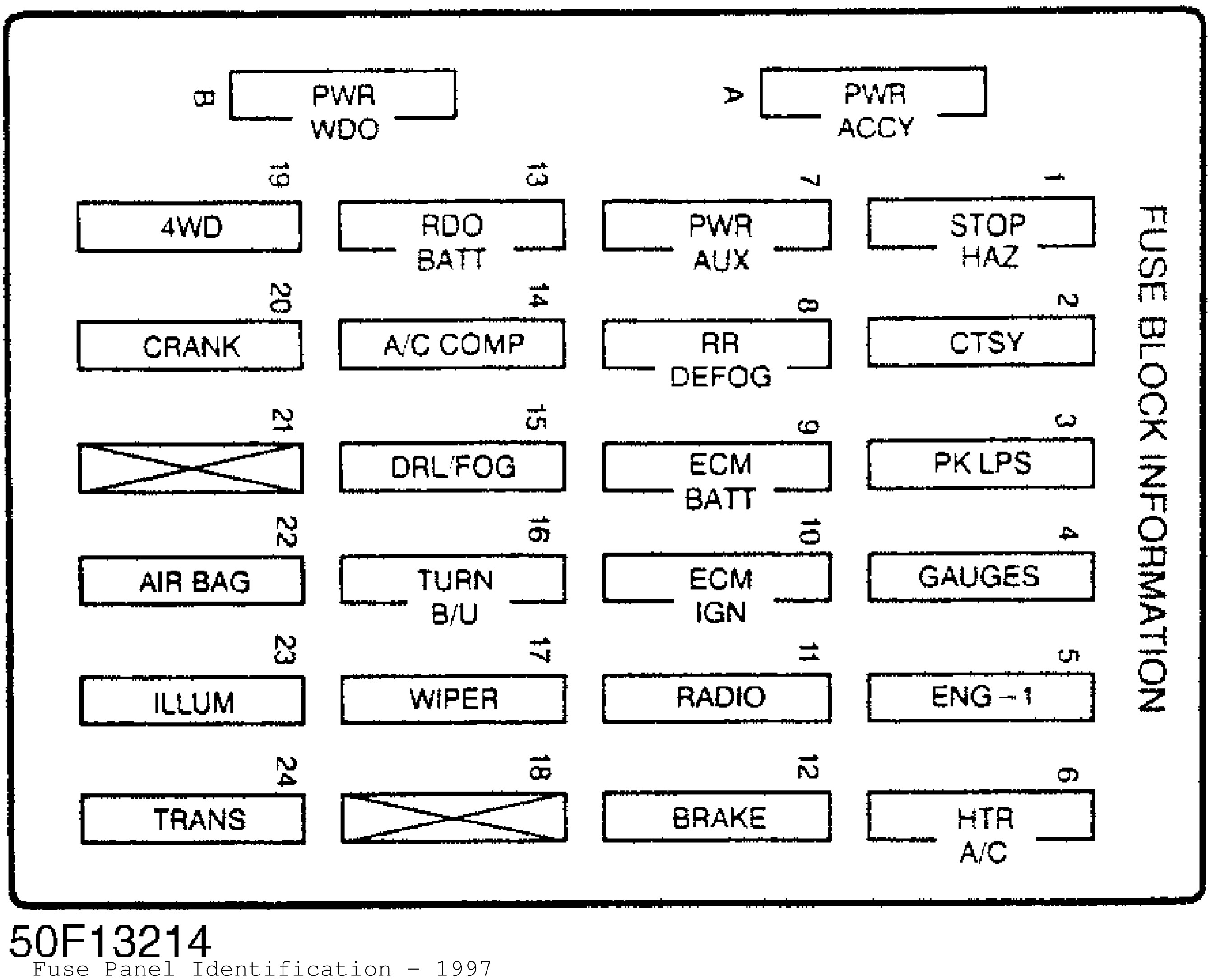
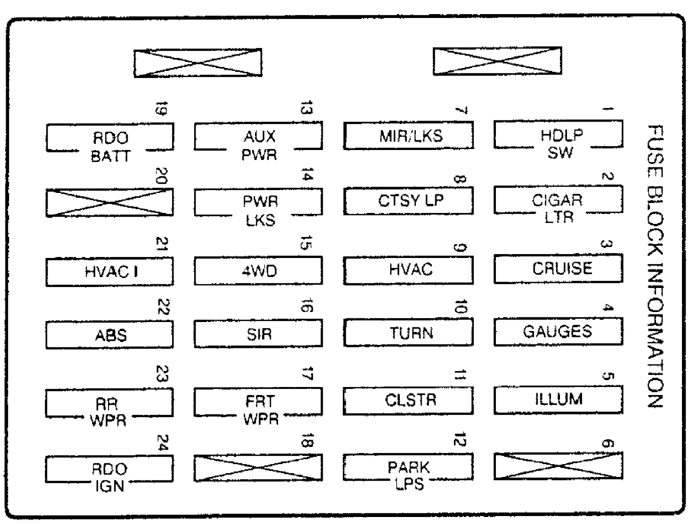


Fig. 3: Fuse Panel Identification - 1997
Courtesy of General Motors Corp.

- A - Power Door Locks, Power Seat, Power Seat Lumbar, Remote Keyless Entry
- B - Power Windows, Power Sunroof Module/Motor
- 1 - Stop Lamps, Hazard Lamps, Chime, Center High Mounted Stop Lamp Relay, Center High Mounted Stop Lamp
- 2 - Dome Lamps, Cargo Lamps, Visor Vanity Mirror, Cigarette Lighter Inside Rear View Mirror Lamp, Overhead Console Lamps, Power Outside Rear View Mirror, Lift Glass Release Motor, Illuminated Entry Module

3 - Parking Lights, License Plate Light, Electric Shift Transfer Case Module, Underhood Lamp, Rear Wiper, Fog Lamp Relay, Door Switch Lamp, Ashtray Lamp, Headlamp Switch
4 - A/C Compressor Relay, Cluster Chime Module, DRL Relay Coil, 4WD Indicator Light, DRL Module, Rear Defog Timer, Transfer Case Control Module Ignition, SIR Redundant Ignition, RKE Ignition, Fuel Sender Module
5 - Oxygen Sensor Heater, Exhaust Gas Recirculation, Cam Sensor, CANN. Purge, Canister Vent Solenoid, Mass Airflow Sensor, Cam Shaft Sensor
6 - Blower Motor, Temperature Door Motor, HI Blower Relay Coil
7 - Power Auxiliary Outlets, Assembly Line Diagnostic Link
8 - Rear Window Defog
9 - PCM/VCM Battery, Fuel Pump
10 - PCM/VCM Ignition, Injectors, Crank Sensor, Coil Driver Module
11 - Radio, Inside Rearview Mirror Map Lights, Rear Window Wiper/Washer, Driver Information Display Control Module
12 - ABS System, VCM IGN-3
13 - Clock, Radio Battery, CD Player
14 - A/C Compressor Battery Feed
15 - Daytime Running Lamps, Fog Lamps, Fog Lamp Relay
16 - Turn Signal & Back-Up Lights, Brake-Transmission Shift Interlock Solenoid
17 - Windshield Washers, Windshield Wiper Motor
18 - Not Used
19 - Electric Shift Transfer Case
20 - Crank Relay, Air Bag Module
21 - Not Used
22 - Air Bag Module
23 - Cluster Illumination, Radio Illumination, Heater Lamp, 4WD Illumination, Chime Module, Fog Lamp Illumination, Rear Wiper Switch Illumination, Rear Defogger Switch Illumination, Lift Glass Release Switch Illumination, Overhead Console Illumination
24 - PRNDL Power, 4L60E Automatic Transmission

Fuse & Circuit Breaker Identification - 1998



50G13215

Fig. 4: Fuse Panel Identification - 1998
Courtesy of General Motors Corp.

A - Not Used
B - Not Used

1 - Headlamp Switch, Body Control Module, Headlamp Relay
2 - Cigarette Lighter, Data Link Connector
3 - Cruise Control Module & Switch, Body Control Module, Heated Seats
4 - Gages, Body Control Module, Instrument Panel Cluster
5 - Interior Lights
6 - Not Used
7 - Power Outside Mirror, Power Lock Relay
8 - Courtesy Lamps, Battery Run-Down Protection
9 - HVAC Control Head (Manual)
10 - Turn Signal
11 - Cluster, Engine Control Module
12 - Parking Lamps, Power Window Switch, Body Control Module, Ashtray Lamp
13 - Auxiliary Power
14 - Power Locks Motor
15 - 4WD Switch, Engine Controls (VCM, PCM, Transmission)
16 - Supplemental Inflatable Restraint, SDM Module
17 - Front Wiper
18 - Not Used
19 - Radio Battery
20 - Not Used
21 - HVAC (Manual), (HVAC I (Automatic), HVAC Sensors (Automatic)
22 - Anti-Lock Brakes
23 - Rear Wiper
24 - Radio, Ignition

ENGINE COMPARTMENT FUSE IDENTIFICATION

Fuse & Circuit Breaker Identification - 1998

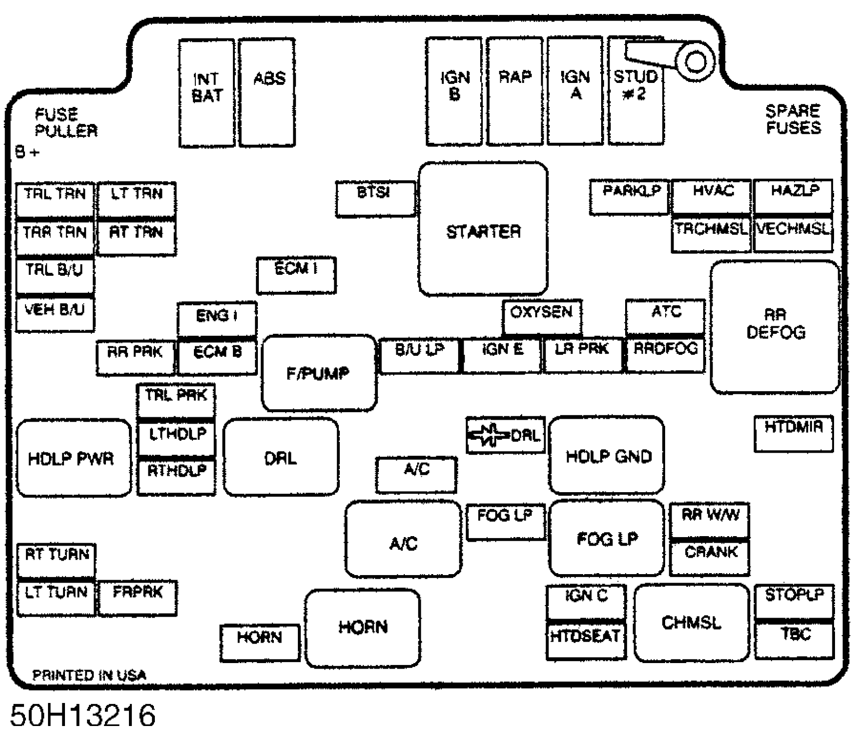


Fig. 5: Engine Compartment Fuse Identification - 1998
Courtesy of General Motors Corp.

TRL TRN - Trailer Left Turn
TRR TRN - Trailer Right Turn

TRL B/U - Trailer Back Up Lights
VEH B/U - Vehicle Back Up Lights
RT TURN - Right Turn Signal Front
LT TURN - Left Turn Signal Front
RT TURN - Right Turn Signal Rear
LT TURN - Left Turn Signal Rear
RR PRK - Right Rear Parking Lamps
TRL PRK - Trailer Parking Lamps
LT HDLP - Left Headlamp
RT HDLP - Right Headlamp
FR PRK - Front Parking Lamps
INT BAT - I/P Fuse Block Feed
ENG 1 - Engine Sensors/Solenoids, MAP, CAM, PURGE, VENT
ECM B - Engine Control Module, Fuel Pump, Module, Oil Pressure
ABS - Anti-Lock Brake System
ECM 1 - Engine Control Module Injectors
HORN - Horn
BTSI - Brake-Transmission Shift Interlock
B/U LP - Back-Up Lamps
A/C - Air Conditioning
RAP - Retained Accessory Power
O2 - Oxygen Sensor
IGN B - Column Feed, IGN 2,3,4
DRL - Daytime Running Lights
FOG LP - Fog Lamps
IGN A - Starting & Charging IGN 1
STUD #2 - Accessory Feeds, Electric Brake
PARKLP - Parking Lamps
LR PRK - Left Rear Parking Lamps
IGN C - Starter Solenoid, Fuel Pump, PRNDL
HTDSEAT - Heated Seat
ATC - Active Transfer Case
RRDFOG - Rear Defogger
HVAC - HVAC System
TRCHMSL - Trailer Center High Mount Stop Lamp
RR W/W - Rear Window Wiper
CRANK - Clutch Switch, NSBU Switch
HAZLP - Hazard Lamps
VECHMSL - Vehicle Center High Mount Stop Lamp
HTDMIR - Heated Mirror
STOPLP - Stop Lamps
TBC - Truck Body Computer

1997 ACCESSORIES/SAFETY EQUIP
General Motors Corp. - Power Mirrors

Chevrolet; Blazer, "S" & "T" Series Pickup
GMC; Jimmy & Sonoma
Oldsmobile; Bravada

DESCRIPTION & OPERATION

Power mirror assemblies contain 2 motors each. One motor positions the mirror up and down, and the other positions mirror right and left. Reversing polarity of motors will move power mirrors in opposite directions. The power mirror switch is located on the left door trim panel.

TROUBLE SHOOTING

Before proceeding with specific testing, check the following for proper operation:

* Check courtesy light and CTSY (15-amp or 20-amp) fuse for proper operation.
* Check power seat system operation. Ensure power accessory circuit breaker is okay.
* Check and ensure grounds are clean and tight.
* Check for broken or partially broken wire inside insulation, which could cause system malfunction, but prove good in a continuity/voltage check with system disconnected. These circuits may be intermittent or have high resistance when loaded, and if possible, should be checked by monitoring voltage drop with system operational (under load).
* Check for proper installation of aftermarket electronic equipment.

TESTING

BOTH POWER MIRRORS DO NOT OPERATE

1) Using test light, backprobe between power mirror switch connector terminal "H" (Orange wire) and ground. If test light illuminates, go to next step. If test light does not illuminate, repair open in Orange wire between power mirror switch and fuse block.

2) Backprobe between power mirror switch terminals "H" (Orange wire) and "A" (Black wire). If test light illuminates, check for poor connection at power mirror switch connector. If connection is okay, replace switch. If test light does not illuminate, repair poor connection or open in Black wire to power mirror switch.

LEFT POWER MIRROR DOES NOT OPERATE IN LEFT/RIGHT POSITIONS

1) Using test light, backprobe between power mirror switch terminals "D" (Yellow wire) and "B" (Light Blue wire). Move power mirror switch to left and right positions. If test light illuminates in both positions, go to next step. If test light does not illuminate in one or both positions, replace power mirror switch.

2) Backprobe between power mirror connector terminals "A" (Yellow wire) and "D" (Light Blue wire). Move power mirror switch to

left and right positions. If test light illuminates in both positions, replace power mirror. If test light does not illuminate in both positions, repair open in Yellow or Light Blue wire between power mirror switch connector and power mirror connector.

LEFT POWER MIRROR DOES NOT OPERATE IN UP/DOWN POSITIONS

1) Using test light, backprobe between power mirror switch terminals "D" (Yellow wire) and "E" (Light Green wire). Move power mirror switch to up and down positions. If test light illuminates in both positions, go to next step. If test light does not illuminate in one or both positions, replace power mirror switch.

2) Backprobe between power mirror connector terminals "C" (Yellow wire) and "B" (Light Green wire). Move power mirror switch to up and down positions. If test light illuminates in both positions, replace power mirror. If test light does not illuminate in both positions, repair open in Yellow or Light Green wire between power mirror switch connector and power mirror connector.

RIGHT POWER MIRROR DOES NOT OPERATE IN LEFT/RIGHT POSITIONS

1) Using test light, backprobe between power mirror switch terminals "D" (Yellow wire) and "F" (Purple/White wire). Move power mirror switch to left and right positions. If test light illuminates in both positions, go to next step. If test light does not illuminate in one or both positions, replace power mirror switch.

2) Backprobe between power mirror connector terminals "C" (Yellow wire) and "B" (Purple/White wire). Move power mirror switch to left and right positions. If test light illuminates, replace power mirror. If test light does not illuminate, repair open in Yellow or Purple/White wire between power mirror switch connector and power mirror connector.

RIGHT POWER MIRROR DOES NOT OPERATE IN UP/DOWN POSITIONS

1) Using test light, backprobe between power mirror switch terminals "D" (Yellow wire) and "C" (Gray wire). Move power mirror switch to up and down positions. If test light illuminates in both positions, go to next step. If test light does not illuminate in one or both positions, replace power mirror switch.

2) Backprobe between power mirror connector terminals "A" (Yellow wire) and "D" (Gray wire). Move power mirror switch to up and down positions. If test light illuminates, replace power mirror. If test light does not illuminate, repair open in Yellow or Gray wire between power mirror switch connector and power mirror connector.

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. See COMPUTER RELEARN PROCEDURES article in GENERAL INFORMATION before disconnecting battery.

POWER MIRROR ASSEMBLY

Removal & Installation

1) Disconnect negative battery cable. Remove door handle bezel screw. Prying at rear of bezel with lever in locked position, remove door handle bezel from trim panel.

2) If equipped with window regulator handle, insert Door Handle Remover (J-9886-01) between handle and bearing plate. Align

tool parallel with door handle, and push to disengage clip. Pull handle from door. Remove bearing plate.

3) On all models, use flat-blade tool to carefully remove power accessory switch panel. Pry off cover, and remove armrest screw. Remove door trim panel screws. Using Trim Panel Remover (J-38778), remove trim panel. Remove mirror access hole plugs. Remove power mirror mounting nuts. Disconnect electrical connector from power mirror. Remove power mirror assembly.

4) To install, reverse removal procedure. Tighten power mirror mounting screws to 53 INCH lbs. (6 N.m). Tighten handle bezel and door trim panel screws to 17 INCH lbs. (1.9 N.m).

POWER MIRROR GLASS

Removal & Installation

1) Place tape over mirror glass. Cover mirror face with a cloth, and break mirror lens. Wearing gloves, clean broken glass from inside mirror frame.

2) To install, remove adhesive backing from back of new mirror lens. Firmly press mirror lens into mirror housing.

WIRING DIAGRAMS

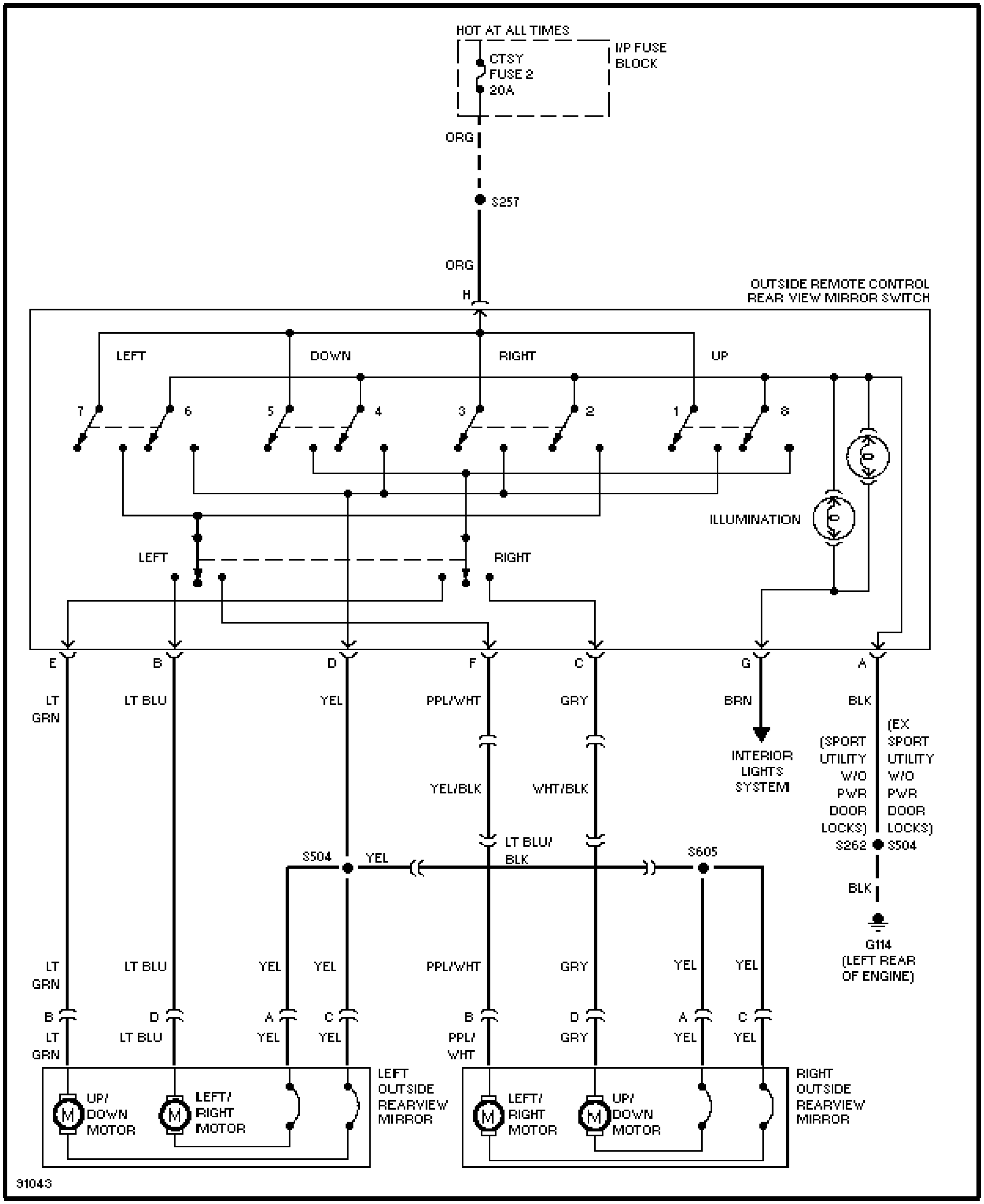


Fig. 1: Power Mirror System Wiring Diagram

PARASITIC LOAD EXPLANATION & TEST PROCEDURES

1997 Chevrolet Blazer

GENERAL INFORMATION
Parasitic Load Explanation & Test Procedures

* PLEASE READ THIS FIRST *

This article is provided for general information only. Not all procedures apply to all makes and models.

GENERAL INFORMATION

The term Parasitic Load refers to electrical devices that continue to use or draw current after the ignition switch is turned to OFF position. This small amount of continuous battery draw is expressed in milliamps (mA). On Ford Motor Co. and General Motors vehicles produced after 1980, a typical Parasitic Load should be no more than 50 milliamps (0.050 amps).

Vehicles produced since 1980 have memory devices that draw current with ignition off for as long as 20 minutes before shutting down the Parasitic Drain. When Parasitic Load exceeds normal specifications, the vehicle may exhibit dead battery and no-start condition.

Follow test procedure for checking Parasitic Loads to completion. A brief overview of a suggested test procedure is included along with some typical Parasitic Load specifications. Refer to the GENERAL MOTORS PARASITIC LOAD TABLE chart.

TESTING FOR PARASITIC LOAD

INTRODUCTION

CAUTION: Always turn ignition off when connecting or disconnecting battery cables, battery chargers or jumper cables. DO NOT turn test switch to OFF position (which causes current to run through ammeter or vehicle electrical system).

NOTE: Memory functions of various accessories must be reset after the battery is reconnected.

The battery circuit must be opened to connect test switch (shunt) and ammeter into the circuit. When a battery cable is removed, timer circuits within the vehicle computer are interrupted and immediately begin to discharge. If in doubt about the condition of the ammeter fuse, test it with an ohmmeter prior to beginning test. An open fuse will show the same reading (00.00) as no parasitic drain. Begin test sequence with the meter installed and on the 10-amp scale. Select lower scale to read parasitic draw.

TEST PROCEDURE USING TEST SWITCH

1) Turn ignition off. Remove negative battery terminal cable. Install Disconnect Tool (J-38758) test switch male end to negative battery cable. Turn test switch knob to OFF position (current through meter). Install negative battery cable to the female end of test switch.

2) Turn test switch knob to ON position (current through switch). Road test vehicle with vehicle accessories on (radio, air conditioner, etc.). After road test, turn ignition switch to LOCKED position and remove key. Connect ammeter terminals to test switch

terminals. See Fig. 1. Select 10-amp scale.

3) Turn off all electrical accessories. Turn off interior lights, underhood lamp, trunk light, illuminated entry, etc. To avoid damaging ammeter or obtaining a false meter reading, all accessories must be off before turning test switch knob to OFF position.

4) Turn test switch knob to OFF position to allow current to flow through ammeter. If meter reads wrong polarity, turn test switch to ON position and reverse leads. Turn test switch to OFF position. Observe current reading. If reading is less than 2 amps, turn test switch to ON position to keep electrical circuits powered-up.

5) Select low amp scale. Switch lead to the correct meter position. Turn test switch to OFF position and compare results to normal current draw. See the GENERAL MOTORS PARASITIC LOAD TABLE. If current draw is unusually high for the vehicle's overall electrical system, remove system fuses one at a time until current draw returns to normal.

6) Turn test switch to ON position each time door is opened or fuse is removed. Turn switch to OFF position to read current draw value through meter. When the cause of excessive current drain has been located and repaired, remove test switch and reconnect negative battery cable to the negative battery terminal.

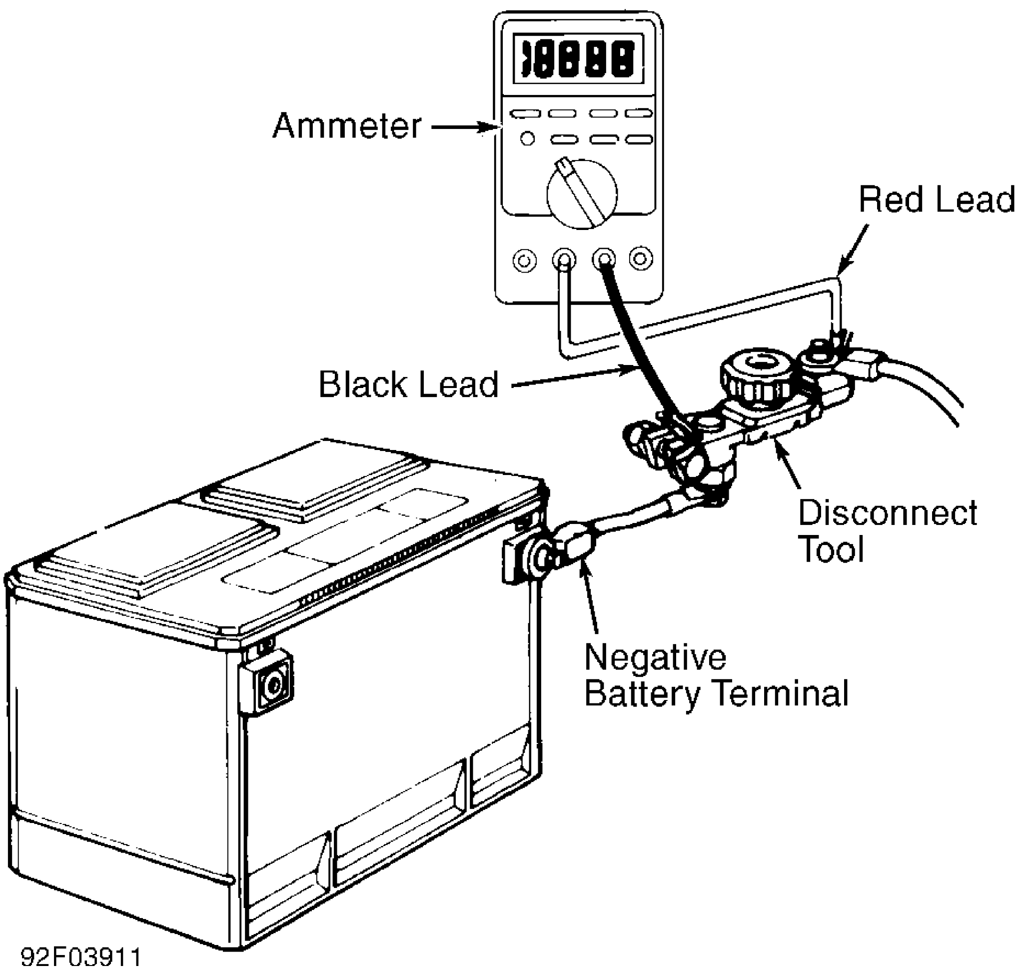


Fig. 1: Connecting Kent-Moore Disconnect Tool (J-38758)
Courtesy of General Motors Corp.

GENERAL MOTORS PARASITIC LOAD TABLE (MILLIAMPS)

Component	Normal Draw	Maximum Draw	Time-Out (Minutes)
Anti-Theft System	0.4	1.0	...
Auto Door Lock	1.0	1.0	...
Body Control Module	3.6	12.4	20
Central Processing System	1.6	2.7	20
Electronic Control Module	5.6	10.0	...
Electronic Level Control	2.0	3.3	20
Heated Windshield Module	0.3	0.4	...
HVAC Power Module	1.0	1.0	...
Illuminated Entry	1.0	1.0	1
Light Control Module	0.5	1.0	...
Oil Level Module	0.1	0.1	...
Multi-Function Chime	1.0	1.0	...
Pass Key Decoder Module	0.75	1.0	...
Power Control Module	5.0	7.0	...
Retained Accessory Power	3.8	3.8	...
Radio	7.0	8.0	15
Twilight Sentinel Module	1.0	1.0	...
Voltage Regulator	1.4	2.0	...

INTERMITTENT PARASITIC LOAD PROBLEMS

Intermittent parasitic lad can occur because of a memory device that does not power down with ignition off. With an intermittent parasitic load, battery draw can be greater than 1.0 amp. To find and intermittent problem requires that an ammeter and Disconnect Tool (J-38758) test switch be connected and left in the circuit. See Fig. 1. Road test vehicle. After road test, turn ignition off and remove key.

Monitor the milliamps scale for 15-20 minutes after ignition is turned off. This allows monitoring memory devices to determine if they time out and stop drawing memory current. The test switch is needed to protect ammeter when the vehicles is started.

DIODE CHECK & SOLENOID TEST (GENERAL MOTORS)

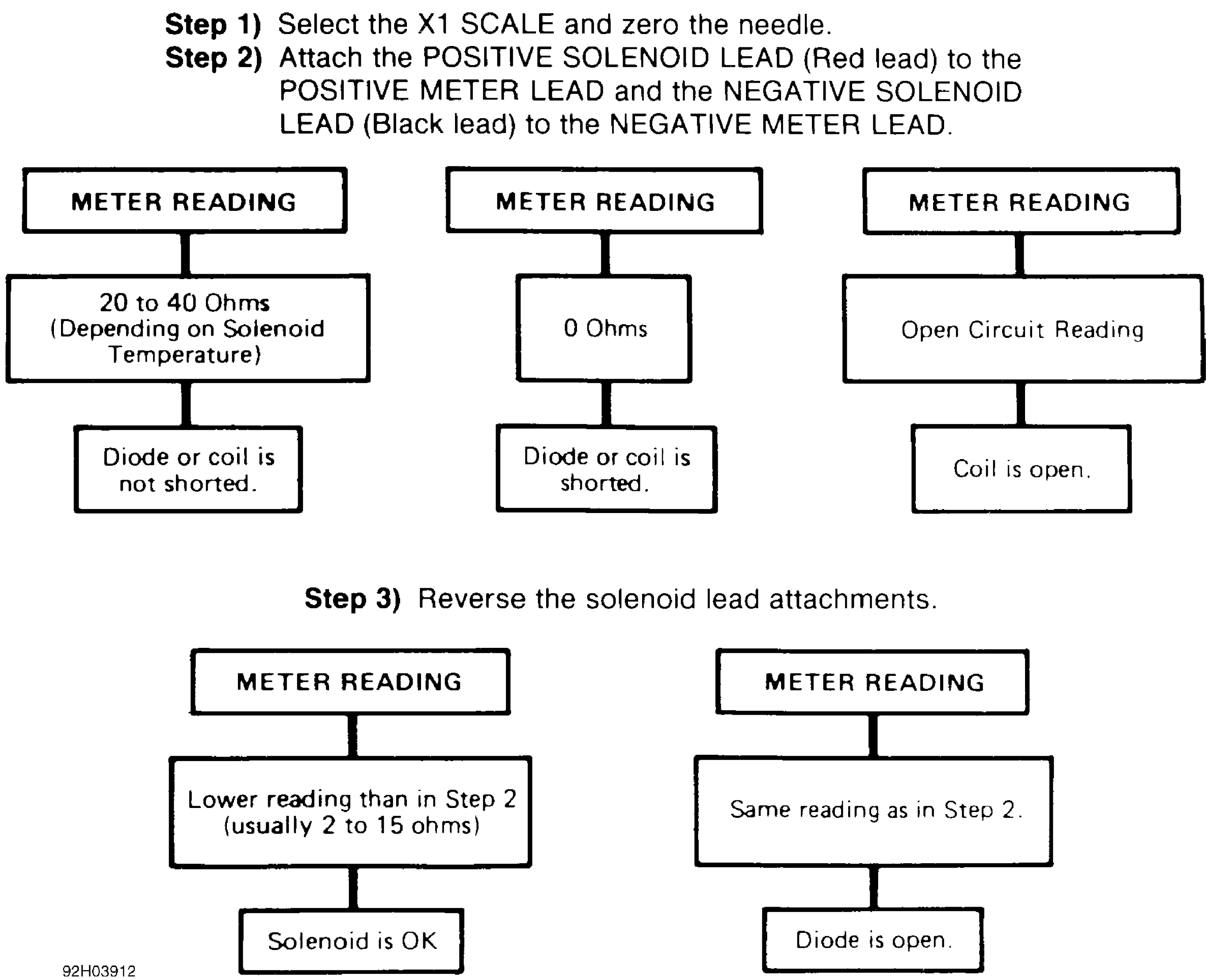


Fig. 2: Diode Check & Solenoid Test (General Motors)
Courtesy of General Motors Corp.

QUAD DRIVER TEST (GENERAL MOTORS)

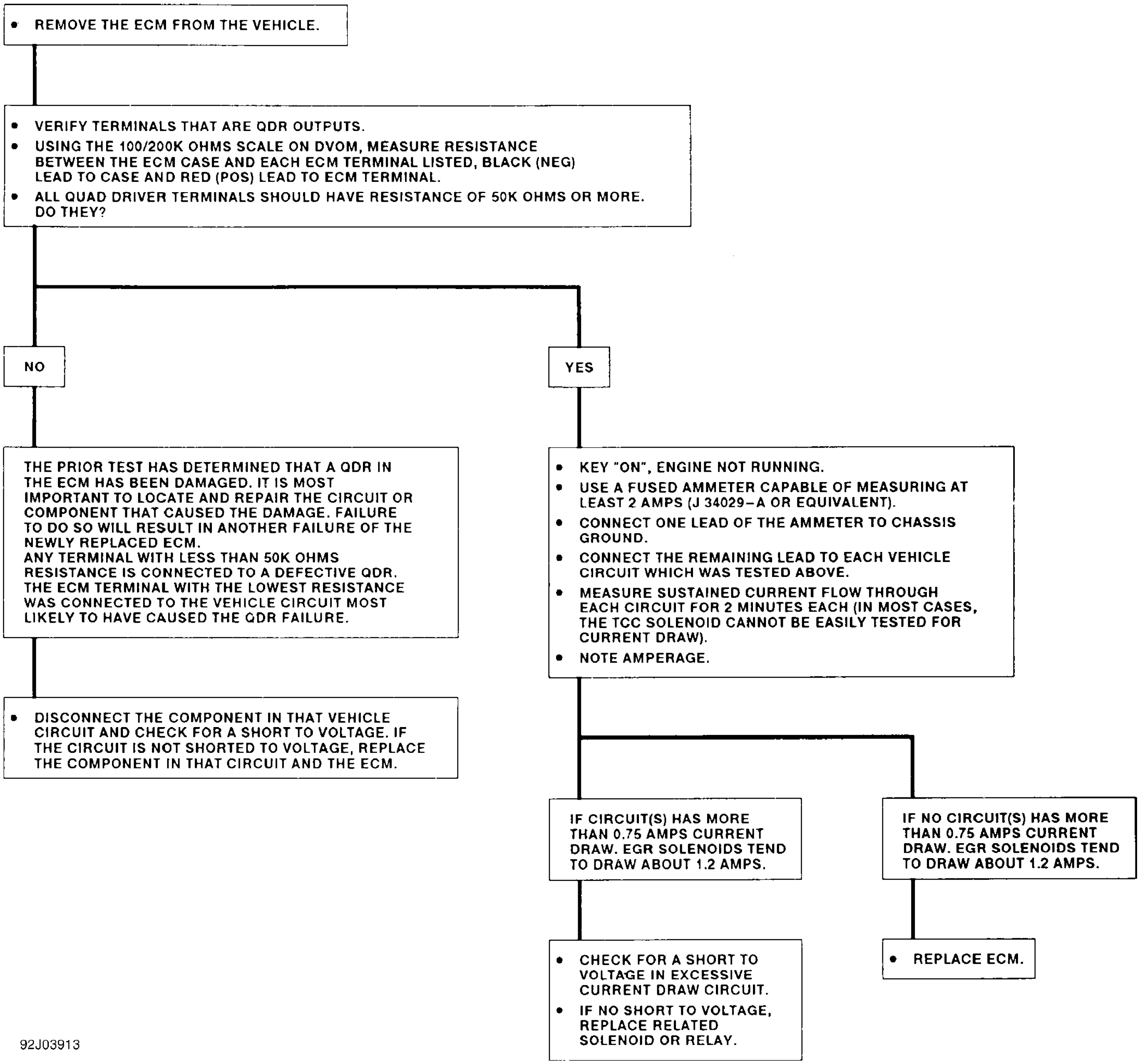


Fig. 3: Quad Driver Test (General Motors)
Courtesy of General Motors Corp.

PASSIVE RESTRAINT SYSTEM INSPECTION

1997 Chevrolet Blazer

GENERAL INFORMATION
Passive Restraint System Inspection - General Motors Corp.

* PLEASE READ THIS FIRST *

Follow all manufacturers servicing precautions when working with air bag systems. See SERVICE PRECAUTIONS in the appropriate AIR BAG RESTRAINT SYSTEM article in the ACCESSORIES/SAFETY EQUIPMENT section.

INTRODUCTION

When a vehicle equipped with passive restraint system has been involved in a collision, certain systems and components must be inspected and or replaced regardless of whether or not the air bag has deployed. Follow the manufacturer's guidelines provided in this article.

GENERAL MOTORS

AIR BAG APPLICATION - PASSENGER CARS (1988-98)

AIR BAG APPLICATION TABLE - GENERAL MOTORS PASSENGER CARS (1988-98)

Model	Year	(1) Location	Inspection Table
BUICK			
Century	1997-98	D/P	GM-14
	1993-96	DS	GM-2
LeSabre	1997-98	D/P	GM-16
	1994-96	D/P	GM-2
	1993	DS	GM-2
	1992	DS	GM-6
Park Avenue/ Ultra	1997-98	D/P	GM-19
	1994-96	D/P	GM-2
	1993	DS	GM-2
	1991-92	DS	GM-6
Reatta	1990-91	DS	GM-6
Regal	1997-98	D/P	GM-14
	1995-96	D/P	GM-4
	1994	DS	GM-2
Riviera	1996-98	D/P	GM-1
	1995	D/P	GM-2
	1990-93	DS	GM-6
Roadmaster	1995-96	D/P	GM-3
	1994	D/P	GM-2
	1993	DS	GM-2
	1991-92	DS	GM-6
Skylark	1998	D/P	GM-14
	1996-97	D/P	GM-1
	1994-95	DS	GM-2
CADILLAC			
Allante	1993	DS	GM-5
	1990-92	DS	GM-6
Catera	1997-98	D/P, SI	GM-17
Concours	1994-96	D/P	GM-2
DeVille	1994-96	D/P	GM-2

	1993	DS	GM-2
DeVille/Concours/ D'Elegance	1997-98	D/P, SI	GM-18
DeVille/Fleetwood	1992	DS	GM-2
	1989-91	DS	GM-6
Eldorado	1997-98	D/P	GM-18
	1993-96	D/P	GM-2
	1990-92	DS	GM-6
Fleetwood Brougham	1993-96	D/P	GM-2
Seville	1998	D/P, SI	GM-17
	1997	D/P	GM-18
	1993-96	D/P	GM-2
	1990-92	DS	GM-6
Sixty Special	1993	DS	GM-2
CHEVROLET			
Beretta	1993-96	DS	GM-2
	1991-92	DS	GM-5
Camaro	1997-98	D/P	GM-14
	1996	D/P	GM-1
	1993-95	D/P	GM-2
	1990-92	DS	GM-5
Caprice	1995-96	D/P	GM-3
	1994	D/P	GM-2
	1993	DS	GM-2
	1991-92	DS	GM-6
Cavalier	1998	D/P	GM-14
	1996-97	D/P	GM-1
	1995	D/P	GM-3
Corsica	1993-96	DS	GM-2
	1991-92	DS	GM-5
Corvette	1997-98	D/P	GM-14
	1994-96	D/P	GM-3
	1993	DS	GM-2
	1991-92	DS	GM-5
	1990	DS	GM-7
Impala SS	1995-96	D/P	GM-3
	1994	D/P	GM-2
Lumina	1997-98	D/P	GM-14
	1995-96	D/P	GM-4
Malibu	1997-98	D/P	GM-14
Metro	1998	D/P	GM-9
Monte Carlo	1997-98	D/P	GM-14
	1995-96	D/P	GM-4
Prizm	1998	D/P, SI	GM-17
GEO			
Metro	1995-97	D/P	GM-9
	1993	DS	GM-9
	1990-92	DS	GM-11
Prizm	1994-97	D/P	GM-10
	1993	DS	GM-10
Storm	1993	DS	GM-9
	1990-92	DS	GM-11
OLDSMOBILE			
Achieva	1998	D/P	GM-14
	1996-97	D/P	GM-1
	1994-95	DS	GM-2
Aurora	1996-98	D/P	GM-1
	1995	D/P	GM-2
Custom Cruiser	1991-92	DS	GM-6
Cutlass	1997-98	D/P	GM-14
Cutlass Ciera	1993-96	DS	GM-2
Cutlass Cruiser	1993-96	DS	GM-2

Cutlass Supreme	1997	D/P	GM-14
	1995-96	D/P	GM-4
	1994	DS	GM-2
Delta 88 Royale	1988-91	DS	GM-8
Eighty Eight/ Royale/LS	1997-98	D/P	GM-16
	1994-96	D/P	GM-2
	1993	DS	GM-2
	1992	DS	GM-6
	1988-91	DS	GM-8
Intrigue	1998	D/P	GM-14
LSS	1997-98	D/P	GM-16
	1996	D/P	GM-2
Ninety Eight Regency	1994-96	D/P	GM-2
	1993	DS	GM-2
	1991-92	DS	GM-6
	1989-90	DS	GM-8
Regency	1997-98	D/P	GM-16
Toronado	1990-92	DS	GM-6
PONTIAC			
Bonneville	1997-98	D/P	GM-16
	1994-96	D/P	GM-2
Bonneville SE/SSE	1992-93	DS	GM-2
Bonneville SSE/SSEi	1992-93	D/P	GM-2
Firebird	1997-98	D/P	GM-14
	1996	D/P	GM-1
	1993-95	D/P	GM-2
	1990-92	DS	GM-5
Grand Am	1998	D/P	GM-14
	1996-97	D/P	GM-1
	1994-95	DS	GM-2
Grand Prix	1997-98	D/P	GM-14
	1994-96	D/P	GM-4
Sunfire	1998	D/P	GM-14
	1996-97	D/P	GM-1
	1995	D/P	GM-3
SATURN			
Coupe	1995-98	D/P	GM-12
	1992-94	DS	GM-13
Sedan	1995-98	D/P	GM-12
	1992-94	DS	GM-13
Wagon	1995-98	D/P	GM-12
	1993-94	DS	GM-13

(1) - Location Definitions: D/P = Driver's & Passenger's Side, DS = Driver's Side Only, SI = Side Impact.

AIR BAG APPLICATION - LIGHT TRUCK & VAN (1988-98)

AIR BAG APPLICATION TABLE - GENERAL MOTORS LIGHT TRUCK & VAN (1988-98)

Model	Year	(1) Location	Inspection Table
CHEVROLET			
Astro	1997-98	D/P	GM-14
	1996	D/P	GM-1
	1993-95	DS	GM-2
Blazer	1998	D/P	GM-15
	1995-97	DS	GM-2

Chevy Van	1997-98	D/P	GM-16
	1996	D/P	GM-1
	1994-96	DS	GM-2
C/K Pickup	1997-98	D/P	GM-15
	1995-96	DS	GM-2
Express Van	1997-98	D/P	GM-16
	1996	D/P	GM-1
Lumina APV	1994-96	DS	GM-2
Sportvan	1994-96	DS	GM-2
Suburban	1997-98	D/P	GM-15
	1995-96	DS	GM-2
S10 Pickup	1998	D/P	GM-15
	1995-97	DS	GM-2
Tahoe	1997-98	D/P	GM-15
	1995-96	DS	GM-2
Tracker	1998	D/P	GM-9
Venture	1997-98	D/P	GM-14
GEO			
Tracker	1996-97	D/P	GM-9
GMC			
Jimmy	1998	D/P	GM-15
	1995-97	DS	GM-2
Rally/Vandura	1994-96	DS	GM-2
Safari	1997-98	D/P	GM-14
	1996	D/P	GM-1
	1993-95	DS	GM-2
Savana	1997-98	D/P	GM-16
	1996	D/P	GM-1
Sierra	1997-98	D/P	GM-15
	1995-96	DS	GM-2
Sonoma	1998	D/P	GM-15
	1995-97	DS	GM-2
Suburban	1997-98	D/P	GM-15
	1995-96	DS	GM-2
Yukon	1997-98	D/P	GM-15
	1995-96	DS	GM-2
OLDSMOBILE			
Bravada	1998	D/P	GM-15
	1996-97	DS	GM-2
Silhouette	1997-98	D/P	GM-14
	1994-96	DS	GM-2
PONTIAC			
Trans Sport	1997-98	D/P	GM-14
	1994-96	DS	GM-2

(1) - Location Definitions: D/P = Driver's & Passenger's Side, DS = Driver's Side Only, SI = Side Impact.

INSPECTION PROCEDURES

INSPECTION PROCEDURES TABLE - GM-1

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Forward Discriminating Sensor (1) * Sensing & Diagnostic Module (SDM) * Sensors In Area Of Accident Damage (2) * Instrument Panel Magnesium Beam (4)
Inspect & If Damaged, Replace	* Forward Discriminating Sensor (1) * Instrument Panel Braces (3)

Component (Even If Air Bag Did Not Deploy)	* Instrument Panel Magnesium Beam (4) * Instrument Panel Steering Column Reinforcement Plate * Knee Bolsters & Mounting Points (3) * Seat Belts & Mounting Points * Sensors In Area Of Accident Damage (Without Deployment) (2) * SIR Coil Assembly * Steering Column (3)
Comments	* Any sensor which the Sensing & Diagnostic Module (SDM) indicates as bad must be replaced. * If any components are damaged or bent, they must be replaced. * SRS wiring can be repaired following manufacturer's instructions. * On Chevrolet Express Van & GMC Savana only, check for excessive gaps between dash trim panels following manufacturer's instructions. If gaps are excessive, replace instrument panel magnesium beam.
(1) - Except Camaro, Firebird & 1996-97 Aurora & Riviera. (2) - 1996-97 Aurora & Riviera only. (3) - If damaged, also replace instrument panel magnesium beam on Chevrolet Express Van & GMC Savana only. (4) - Chevrolet Express Van & GMC Savana only.	

INSPECTION PROCEDURES TABLE - GM-2

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Sensors In Area Of Accident Damage
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Instrument Panel Braces * Instrument Panel Steering Column Reinforcement Plate * Knee Bolsters & Mounting Points * Seat Belts & Mounting Points * Sensors In Area Of Accident Damage (Without Deployment) * SIR Coil Assembly * Steering Column * Steering Wheel (1)
Comments	* Any sensor which the Diagnostic Energy Reserve Module (DERM) or Sensing & Diagnostic Module (SDM) indicates as bad must be replaced. * If any components are damaged or bent, they must be replaced. * SRS wiring can be repaired following manufacturer's instructions.
(1) - 1995 Aurora, Bonneville, Concours, DeVille, Eighty Eight, Eldorado, LeSabre, Ninety Eight, Park Avenue, Riviera, Seville & 1995-96 Fleetwood.	

INSPECTION PROCEDURES TABLE - GM-3

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * All Sensors
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Instrument Panel Braces * Instrument Panel Steering Column Reinforcement Plate * Knee Bolsters & Mounting Points * Seat Belts & Mounting Points * Sensors In Area Of Accident Damage (Without Deployment) * SIR Coil Assembly * Skid Plate/Skid Bar Assembly (1) * Steering Column * Steering Wheel (2)
Comments	* Any sensor which the Diagnostic Energy Reserve Module (DERM) indicates as bad must be replaced. * If any components are damaged or bent, they must be replaced. * SRS wiring can be repaired following manufacturer's instructions.
(1) - 1996 Corvette only. (2) - Cavalier, Corvette & Sunfire only.	

INSPECTION PROCEDURES TABLE - GM-4

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Anti-Theft Module (If Equipped)
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Anti-Theft Module Bracket (If Equipped) * Instrument Panel Braces * Instrument Panel Steering Column Reinforcement Plate * Knee Bolsters & Mounting Points * Seat Belts & Mounting Points * SIR Coil Assembly * Steering Column
Comments	* Any sensor which the Sensing & Diagnostic Module (SDM) indicates as bad must be replaced. * If any components are damaged or bent, they must be replaced. * SRS wiring can be repaired following manufacturer's instructions.

INSPECTION PROCEDURES TABLE - GM-5

Action	Component or System
Replace After Deployment	* Air Bag Module * Arming Sensor * Forward Discriminating Sensor * Passenger Compartment Discriminating

	Sensor (1)
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Diagnostic Energy Reserve Module (DERM) * Instrument Panel Braces * Instrument Panel Steering Column Reinforcement Plate * Knee Bolsters & Mounting Points * Seat Belts & Mounting Points * SIR Coil Assembly * Steering Column * Steering Wheel (2) * Wiring Harness
Comments	* If any components are damaged or bent, they must be replaced. * SRS wiring can be repaired following manufacturer's instructions.
(1) - Beretta & Corsica only. (2) - Corvette only.	

INSPECTION PROCEDURES TABLE - GM-6

Action	Component or System
Replace After Deployment	* Air Bag Module * Dual Sensor * Forward Discriminating Sensor
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Instrument Panel Braces * Instrument Panel Lower Trim (1) * Instrument Panel Steering Column Reinforcement Plate * Knee Bolsters & Mounting Points * Seat Belts & Mounting Points * SIR Coil Assembly * Steering Column * Wiring Harness
Comments	* If any components are damaged or bent, they must be replaced. * SRS wiring can be repaired following manufacturer's instructions.
(1) - LeSabre & Park Avenue only.	

INSPECTION PROCEDURES TABLE - GM-7

Action	Component or System
Replace After Deployment	* Air Bag Module * Diagnostic Energy Reserve Module (DERM) * Front Discrimination Sensors * SIR Coil Assembly
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Instrument Panel Braces * Instrument Panel Steering Column Reinforcement Plate * Knee Bolsters & Mounting Points * Seat Belts & Mounting Points * Steering Column

	* Steering Wheel * Wiring Harness
Comments	* If any components are damaged or bent, they must be replaced. * SRS wiring can be repaired following manufacturer's instructions.

INSPECTION PROCEDURES TABLE - GM-8

Action	Component or System
Replace After Deployment	* Air Bag Module * Arming Sensor * Passenger Compartment Sensor/Diagnostic Module (PCSDM) or SIR Control Module
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Knee Bolsters & Mounting Points * SIR Coil Assembly * Seat Belts & Mounting Points * Steering Column * Wiring Harness
Comments	* If any components are damaged or bent, they must be replaced. * SRS wiring can be repaired following manufacturer's instructions.

INSPECTION PROCEDURES TABLE - GM-9

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Sensing & Diagnostic Module (SDM) (1) * Sensors In Area Of Accident Damage (2)
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Instrument Panel Braces * Instrument Panel Steering Column Reinforcement Plate * Knee Bolsters & Mounting Points * Seat Belts & Mounting Points * Sensors In Area Of Accident Damage (Without Deployment) (2) * SIR Coil Assembly * Steering Column
Comments	* If any components are damaged or bent, they must be replaced. * SRS wiring can be repaired following manufacturer's instructions
(1) - 1996-98 Metro & Tracker only. (2) - 1995-98 Metro only.	

INSPECTION PROCEDURES TABLE - GM-10

Action	Component or System
Replace After	* Air Bag Module(s)

Deployment	* Center Sensor Assembly * Forward Sensors (1)
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Center Sensor Assembly (2) * Forward Sensors (1)(2) * Instrument Panel Steering Column Reinforcement Plate * Knee Bolster & Mounting Points * Seat Belts & Mounting Points * SIR Coil Assembly * Steering Column
Comments	* If any components are damaged or bent, they must be replaced. * SRS wiring can be repaired following manufacturer's instructions
(1) - Except 1996-97 Models. (2) - Without deployment only.	

INSPECTION PROCEDURES TABLE - GM-11

Action	Component or System
Replace After Deployment	* Air Bag Module * Arming Sensor * Forward Discriminating Sensor * Passenger Compartment Discriminating Sensor
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Instrument Panel Braces * Instrument Panel Steering Column Reinforcement Plate * Knee Bolster & Mounting Points * Seat Belts & Mounting Points * SIR Coil Assembly * Steering Column
Comments	* If any components are damaged or bent, they must be replaced. * SRS wiring can be repaired following manufacturer's instructions.

INSPECTION PROCEDURES TABLE - GM-12

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Sensing & Diagnostic Module (SDM) (1)
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Instrument Panel Mounting Attachments * Knee Bolster * Seat Belts & Mounting Points * Sensing & Diagnostic Module (SDM) * SIR Coil Assembly * Steering Column * Steering Column Foam Energy Absorber (1) * Steering Wheel
Comments	* If any components are damaged or bent, they must be replaced.

(1) - 1996-98 Models only.

INSPECTION PROCEDURES TABLE - GM-13

Action	Component or System
Replace After Deployment	* Air Bag Module * Sensors In Area Of Accident Damage
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Any Sensor Which DERM Indicates As Bad * Diagnostic Energy Reserve Module (DERM) * Instrument Panel Mounting Attachments * Knee Bolster * Resistor Module * Seat Belts & Mounting Points * Sensors In Area Of Accident Damage (Without Deployment) * SIR Coil Assembly * Steering Column * Steering Wheel
Comments	* If any components are damaged or bent, they must be replaced.

INSPECTION PROCEDURES TABLE - GM-14

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Sensing & Diagnostic Module (SDM) * Sensors In Area Of Accident Damage * Theft Deterrent Module (1)
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Instrument Panel Braces & Brackets * Instrument Panel Knee Bolsters * Seat Belts & Mounting Points * Sensors In Area Of Accident Damage (Without Deployment) * Steering Column * Steering Wheel Module Coil (SIR Coil)
Comments	* If any components are damaged or bent, they must be replaced.
(1) - Cutlass Supreme, Lumina & Monte Carlo only.	

INSPECTION PROCEDURES TABLE - GM-15

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Front End Discriminating Sensor * Sensing & Diagnostic Module (SDM) * Sensors In Area Of Accident Damage
Inspect & If Damaged, Replace Component (Even If Air	* Instrument Panel Braces & Brackets * Instrument Panel Knee Bolsters * Seat Belts & Mounting Points * Steering Column

Bag Did Not Deploy)	* Steering Wheel Module Coil (SIR Coil) * Sensors In Area Of Accident Damage (Without Deployment)
Comments	* If any components are damaged or bent, they must be replaced.

INSPECTION PROCEDURES TABLE - GM-16

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Sensing & Diagnostic Module (SDM) * Instrument Panel Magnesium Beam (3) * Sensors In Area Of Accident Damage
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Front End Discriminating Sensor * Instrument Panel Braces & Brackets (2) * Instrument Panel Knee Bolsters (2) * Instrument Panel Steering Column Reinforcement Plate (1) * Seat Belts & Mounting Points * Sensors In Area Of Accident Damage (Without Deployment) * Steering Column (2) * Steering Wheel Module Coil (SIR Coil)
Comments	* If any components are damaged or bent, they must be replaced. * On Chevrolet Express Van & GMC Savana only, check for excessive gaps between dash trim panels following manufacturer's instructions. If gaps are excessive, replace instrument panel magnesium beam.
(1) - Bonneville, Eighty Eight, LeSabre, LSS & Regency only. (2) - If damaged, also replace instrument panel magnesium beam on Chevrolet Express Van & GMC Savana only. (3) - Chevrolet Express Van & GMC Savana only.	

INSPECTION PROCEDURES TABLE - GM-17

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Sensing & Diagnostic Module (SDM) * Seat Belt Pretensioners (1)(4) * Sensors In Area Of Accident Damage * Side Impact Inflator Module(s) (2) * Side Impact Sensor & Mounting Bracket (2)
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Door Harness, Door Seal & Seat (2) * Instrument Panel Braces * Instrument Panel Cross Car Beam (3)(4) * Instrument Panel Steering Column Reinforcement Plate * Knee Bolsters & Mounting Points * Seats & Seat Mounting Points (4) * Seat Belts & Mounting Points * Seat Belt Pretensioners * Sensors In Area Of Accident Damage

	(Without Deployment) * Steering Column * Steering Wheel Module Coil (SIR Coil)
Comments	* If any components are damaged or bent, they must be replaced.
(1) - 1998 Catera & Seville only. (2) - On side of impact. (3) - 1998 Seville only. (4) - 1998 Prizm only.	

INSPECTION PROCEDURES TABLE - GM-18

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Door Assembly (2) * Door Trim Panel (2) * Instrument Panel Assembly (1) * Instrument Panel Upper Trim Panel * Sensors In Area Of Accident Damage * Side Impact Inflator Module(s) (2) * Side Impact Sensing Module (SISM) (2)
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Front End Discriminating Sensor * Instrument Panel Braces * Instrument Panel Knee Bolsters & Mounting Points * Instrument Panel Mounting Points & Brackets * Instrument Panel Steering Column Reinforcement Plate * Passenger Side Air Bag Module Mounting Points * Side Impact Inflator Module(s) Mounting Points * Side Impact Sensing Module(s) (SISM) Mounting Points * Seat Belts & Mounting Points * Sensing & Diagnostic Module (SDM) * Steering Column * Steering Wheel Module Coil (SIR Coil)
Comments	* If any components are damaged or bent, they must be replaced.
(1) - If passenger side air bag module mounting points are damaged. (2) - On side of impact.	

INSPECTION PROCEDURES TABLE - GM-19

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Instrument Panel Cross Car Beam (1) * Sensing & Diagnostic Module (SDM) (2) * Upper Instrument Panel
Inspect & If Damaged, Replace	* Instrument Panel Braces * Instrument Panel Cross Car Beam

Component (Even If Air Bag Did Not Deploy)	* Instrument Panel Knee Bolsters & Mounting Points * Instrument Panel Mounting Points & Brackets * Passenger Side Air Bag Module Mounting Points * Seat Belts & Mounting Points * Sensing & Diagnostic Module (SDM) * Steering Column * Steering Column Support Bracket * Steering Wheel Module Coil (SIR Coil)
Comments	* If any components are damaged or bent, they must be replaced.
(1) - If passenger side air bag module mounting points are damaged. (2) - If in area of accident damage.	

POWER WINDOWS

1997 Chevrolet Blazer

1997 ACCESSORIES/SAFETY EQUIP
General Motors Corp. - Power Windows

Chevrolet; Blazer, "S" & "T" Series Pickup
GMC; Jimmy & Sonoma
Oldsmobile; Bravada

DESCRIPTION & OPERATION

A permanent-magnet motor operates each power window. Each motor raises and lowers window when voltage is supplied. Motor direction depends on polarity of supply voltage. Switches control supply voltage polarity.

Master door lock/power window switch assembly controls all motors. Individual window switches are located on each door panel. Each motor is protected by a built-in circuit breaker. If a window switch is held too long with window obstructed or after window is fully up or down, circuit breaker opens circuit. Circuit breaker resets automatically as it cools.

TROUBLE SHOOTING

Before proceeding to TESTING, perform the following visual inspections:

* Check POWER WINDOW CIRCUIT BREAKER for damage. Replace if damaged.
* Check power window voltage supply fuse. If fuse is blown, service and repair source of overload. Replace fuse.
* Check for mechanical failures or binding linkage.
* If express down feature does not work, but window moves down with each switch depression, replace left window switch.
* Check for broken or partially broken wire inside insulation, which could cause system malfunction but prove good in a continuity/voltage check with system disconnected. These circuits may be intermittent or resistive when loaded. Check by monitoring voltage drop with system under load.
* Check for proper installation of aftermarket electronic equipment.

TESTING

CAUTION: When battery is disconnected, vehicle computer and memory systems may lose memory data. Driveability problems may exist until computer systems have completed a relearn cycle. See COMPUTER RELEARN PROCEDURES article in GENERAL INFORMATION before disconnecting battery.

NOTE: Before any testing is attempted, battery should be fully charged and all connections and pins cleaned and tightened to ensure proper continuity and ground.

NOTE: See appropriate wiring diagram under WIRING DIAGRAMS to assist in testing procedures.

2-DOOR

Windows Do Not Operate

1) Turn ignition switch to RUN position. Connect test light between ground and Yellow wire at left window switch 11-pin connector. If test light illuminates, go to next step. If test light does not illuminate, repair open in Yellow wire between left window switch and fuse block.

2) Connect test light between left window switch 11-pin connector Yellow and Black wires. If test light illuminates, check window switch for poor connection. If connection is okay, replace left window switch. If test light does not illuminate, repair open in Black wire between left window switch and ground.

Left Window Inoperative/Right Window Operates Okay

1) Turn ignition switch to RUN position. Connect test light between left window switch 8-pin connector Dark Blue and Brown wires. Observe test light and operate switch between UP and DOWN positions. If test light illuminates in both positions, go to next step. If test light does not illuminate in both positions, check left window switch for poor connection. If connection is okay, replace left window switch.

2) Connect test light between left window motor connector Dark Blue and Brown wires. Observe test light and operate switch between UP and DOWN positions. If test light illuminates in both positions, check left window motor connector for poor connection. If connection is okay, replace left window motor. If test light does not illuminate in both positions, repair open in Dark Blue or Brown wires between left window switch connector and left front window motor connector.

Right Window Inoperative From Individual Window Switch/Operates Okay From Left Window Switch

1) Turn ignition switch to RUN position. Connect test light between ground and Yellow wire at right window switch 11-pin connector. If test light illuminates, go to next step. If test light does not illuminate, repair open in Yellow wire between right window switch and fuse block.

2) Connect test light between right window switch 11-pin connector Dark Blue and Brown wires. Operate window between UP and DOWN positions. If test light illuminates in both positions, go to next step. If test light does not illuminate in both positions, check window switch for poor connection. If connection is okay, replace right window switch.

3) Connect test light between right window motor connector Dark Blue and Brown wires. Operate window switch between UP and DOWN positions. If test light illuminates in both positions, check right window motor for poor connection. If connection is okay, replace right window motor. If test light does not illuminate in both positions, repair open in Dark Blue or Brown wires between right window switch and right window motor.

Right Window Inoperative From Both Left & Right Switch/Left Window Operates Okay

1) Turn ignition switch to RUN position. Connect test light between right window motor connector Brown and Dark Blue wires. Operate window switch between UP and DOWN positions. If test light does not illuminate in both positions, go to next step. If test light illuminates in both positions, check right window motor for poor connection. If connection is okay, replace right window motor.

2) Connect test light between right window switch 11-pin connector Light Blue and Tan wires. Operate right window switch (at left window switch) between UP and DOWN positions. If test light illuminates in both directions, go to next step. If test light does

not illuminate in both directions, go to step 4).

3) Connect test light between right window switch 11-pin connector Dark Blue and Brown wires. Operate right window switch between UP and DOWN positions. If test light illuminates in both positions, repair open in Dark Blue or Brown wires between right window switch and right window motor. If test light does not illuminate in both positions, check right window switch for poor connection. If connection is okay, replace right window switch.

4) Connect test light between left window switch 8-pin connector Light Blue and Tan wires. Operate switch for inoperative window at left window switch. If test light illuminates in both positions, repair open in Light Blue or Tan wires between left window switch and right window switch. If test light does not illuminate in both positions, replace left window switch.

4-DOOR

All Windows Do Not Operate

1) Turn ignition switch to RUN position. Connect test light between ground and Yellow wire at left front window switch 11-pin connector. If test light illuminates, go to next step. If test light does not illuminate, repair open in Yellow wire.

2) Connect test light between left front window switch 11-pin connector Yellow and Black wires. If test light illuminates, check window switch for poor connection. If connection is okay, replace left front window switch. If test light does not illuminate, repair open in Black ground wire.

Left Front Window Inoperative/All Others Okay

1) Turn ignition switch to RUN position. Connect test light between left front window switch 8-pin connector Dark Blue and Brown wires. Operate switch between UP and DOWN positions. If test light illuminates in both directions, go to next step. If test light does not illuminate in both directions, check left front window switch for poor connection. If connection is okay, replace left front window switch.

2) Connect test light between left front window motor Dark Blue and Brown wires. Observe test light and operate switch between UP and DOWN positions. If test light illuminates in both positions, check left front window motor connector for poor connection. If connection is okay, replace motor. If test light does not illuminate in both positions, repair open in Dark Blue or Brown wire between left front window switch and left front window motor.

Right Front, Left Rear, Or Right Rear Window Inoperative From Individual Window Switch, But Operates Okay From Left Front Switch

1) Turn ignition switch to RUN position. Place window lock-out switch in OFF position. Connect test light between inoperative window switch connector Dark Blue wire (left rear and right rear), or Yellow wire (right front window switch) and ground. If test light illuminates, go to next step. If test light does not illuminate, repair open in Dark Blue or Yellow wires as necessary.

2) Connect test light between inoperative window switch connector Dark Blue and Brown wires. Operate window between UP and DOWN positions. If test light illuminates in both positions, go to next step. If test light does not illuminate in both positions, check inoperative window switch for poor connection. If connection is okay, replace inoperative window switch.

3) Connect test light between inoperative window motor connector Dark Blue and Brown wires. Operate window between UP and DOWN positions. If test light illuminates in both positions, check inoperative window motor for poor connection. If connection is okay,

replace inoperative window motor. If test light does not illuminate in both positions, repair open in Dark Blue or Brown wires between inoperative window switch and window motor.

One Window (Other Than Left Front) Is Inoperative From Left Front Window Switch & Individual Window Switch/All Other Windows Operate Okay

1) Turn ignition switch to RUN position. Connect test light between inoperative window motor connector terminals "A" (Brown wire) and "B" (Dark Blue wire). Operate window switch between UP and DOWN positions. If test light does not illuminate in both positions, go to next step. If test light illuminates in both positions, check inoperative window motor for poor connection. If connection is okay, replace window motor.

2) Connect test light between inoperative rear window switch connector terminals "A" (Dark Green or Light Green wire) and "D" (Purple wire), or between right front window switch connector terminals "J" (Light Blue wire) and "L" (Tan wire). Operate inoperative window switch (at left front switch) between UP and DOWN positions. If test light illuminates in both positions, go to next step. If test light does not illuminate in both positions, go to step 4).

3) Connect test light between right front inoperative window switch 11-pin connector terminals "G" (Dark Blue wire) and "K" (Brown wire), or between rear inoperative window switch connector terminals "F" (Brown wire) and "C" (Dark Blue wire). Operate inoperative window switch between UP and DOWN positions. If test light illuminates in both positions, repair open in Dark Blue or Brown wires between inoperative window switch and window motor. If test light does not illuminate in both positions, check inoperative window switch for poor connection. If connection is okay, replace inoperative window switch.

4) Connect test light between left front window switch connectors. For right front, connect test light between terminals "B" (Light Blue wire) and "D" (Tan wire) at 8-pin connector. For left rear, connect test light between terminals "A" (Dark Green wire) and "D" (Purple wire). For right rear, connect test light between terminals "A" (Light Green wire) and "D" (Purple wire). If test light illuminates in all positions, repair poor connection or open in appropriate wiring. If test light does not illuminate in all positions, replace left front window switch.

Lock-out Function Does Not Work But Windows Operate Okay

Turn ignition switch to RUN position. Put window lock-out switch in LOCK position. Using a test light, backprobe between lock-out switch connector terminal "B" (Dark Blue wire) and ground. If test light illuminates, replace lock-out switch. If test light does not illuminate, repair short to voltage in Dark Blue wire.

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. See COMPUTER RELEARN PROCEDURES article in GENERAL INFORMATION before disconnecting battery.

WINDOW MOTOR

Removal & Installation

1) Disconnect negative battery cable. Raise window to fully closed position. Secure glass to door frame using cloth-backed tape. Remove door garnish molding. Remove armrest mounting screws and

armrest.

2) Remove power window switch. See WINDOW SWITCH. Remove door trim panel retaining screws. Using Trim Panel Remover (J 38778) pry retainers from door frame, and remove door trim panel. Remove armrest bracket. Remove water protection shield. Disconnect electrical connectors from motor.

CAUTION: Sector gear must be locked into position. Regulator lift arm is under tension from counterbalance spring and could cause personal injury if sector gear is not locked in position.

3) Drill hole through regulator sector gear and backplate. Install bolt and nut, locking sector gear into position. Drill out window motor mounting rivets. Remove motor from window regulator. To install, reverse removal procedure. Use 3/16" (4.8 mm) rivets to install motor and regulator.

WINDOW SWITCH

Removal & Installation

Disconnect negative battery cable. Using flat-blade screwdriver, pry power window switch from door trim panel. Disconnect electrical connector and remove power window switch. To install, reverse removal procedure.

WIRING DIAGRAMS

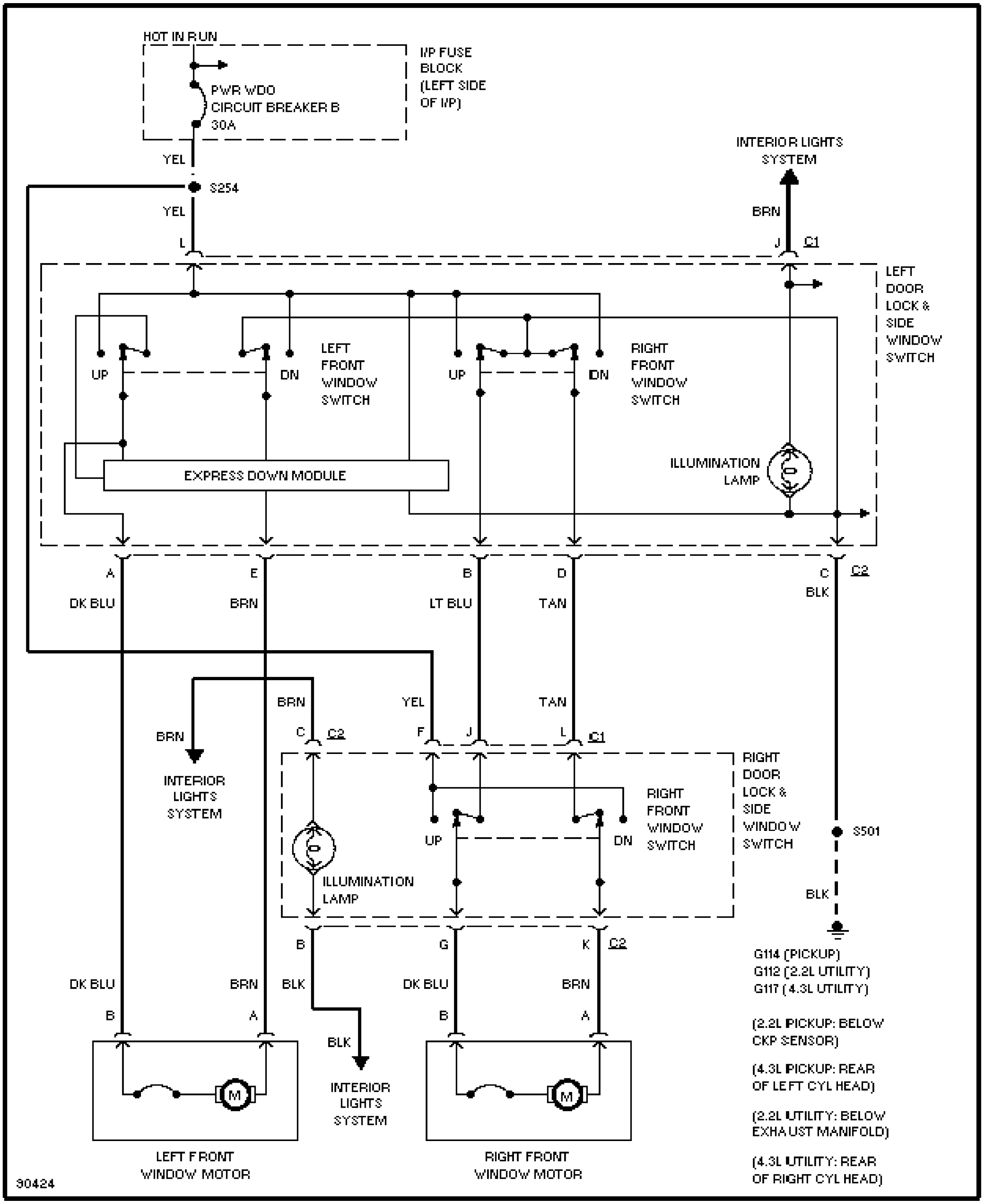


Fig. 1: Power Window System Wiring Diagram (2-Door)

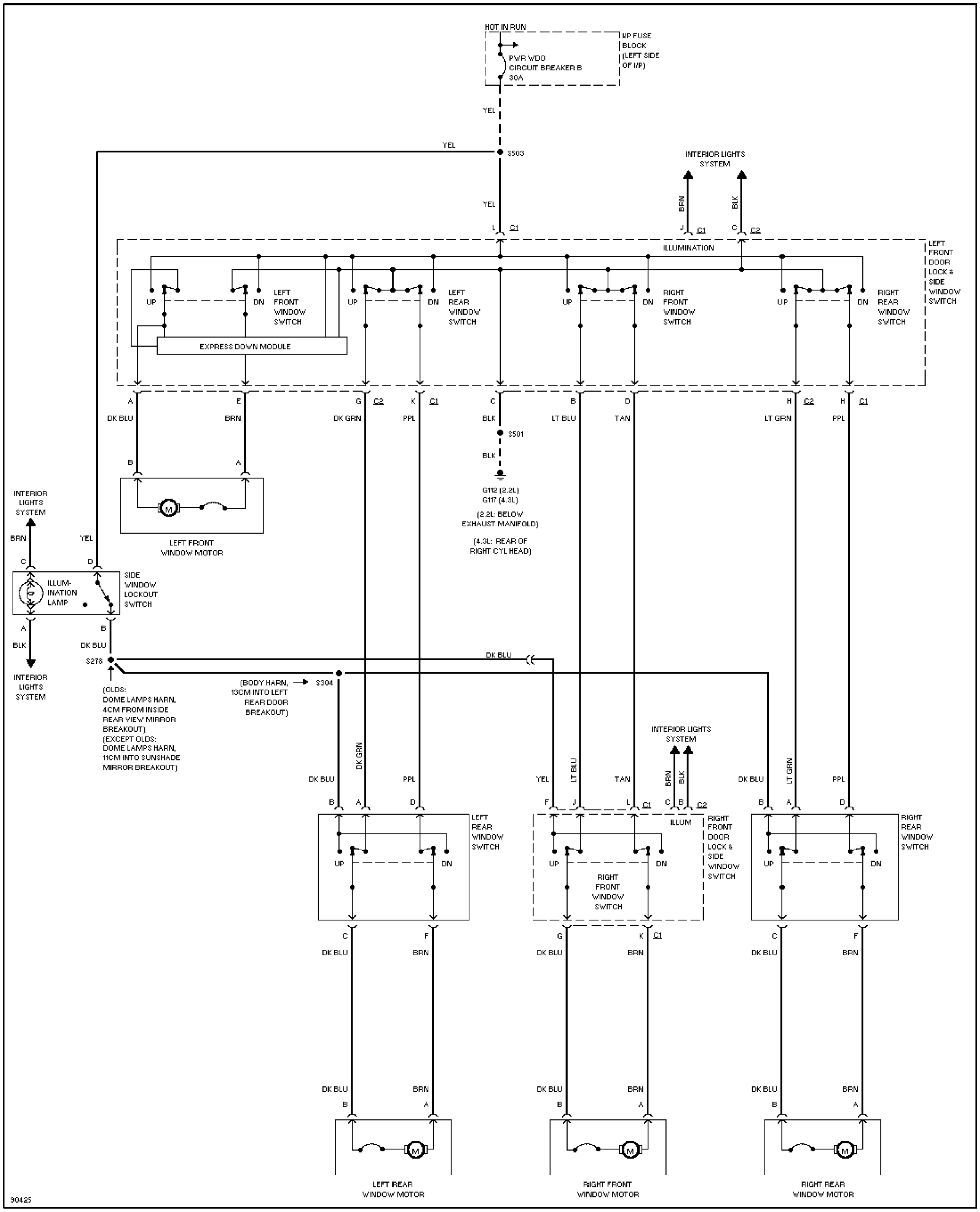


Fig. 2: Power Window System Wiring Diagram (4-Door)

N - REMOVE/INSTALL/OVERHAUL - 4.3L

1997 Chevrolet Blazer

1997 ENGINE PERFORMANCE
General Motors - Removal, Overhaul & Installation - 4.3L

Chevrolet; Blazer, S10 Pickup
GMC; Jimmy, Sonoma
Oldsmobile; Bravada

INTRODUCTION

This article contains removal, overhaul and installation procedures (when information was available at time of publication). If component removal and installation is primarily an unbolt and bolt-on procedure, only a torque specification may be furnished.

IGNITION SYSTEM

POWERTRAIN CONTROL MODULE (PCM)

CAUTION: All vehicles are equipped with either an Engine Control Module (ECM), Powertrain Control Module (PCM) or Vehicle Control Module (VCM) for engine control. Unless specifically stated, references to PCM also apply to ECM and VCM equipped vehicles. Some vehicles equipped with an electronically-controlled transmission also use a Transmission Control Module (TCM) for transmission control. Electronic components used in control systems are designed to carry very low voltages. As little as a 30-volt charge created by static electricity can cause a total or degrading failure in PCM or other electronic components containing integrated circuits. Before servicing PCM, technician must ground himself and work area to discharge static electricity.

CAUTION: DO NOT remove part from packaging until ready to install. Ground any static-proof package before opening. DO NOT touch electrical terminals of components unless properly grounded. DO NOT lay electrical components on car seat, carpeting or dashboard. Use electrostatic protection mat and ground strap whenever possible.

NOTE: Before replacing PCM, carefully inspect all wiring and control components. Failure to test for short circuits may result in repeated PCM failure due to shorts and Quad-Driver failure. To prevent internal damage to PCM, ensure ignition switch is in OFF position when connecting or disconnecting PCM connectors or any electrical components.

NOTE: When replacing defective PCM, remove knock sensor module from defective PCM. New PCM does not come equipped with knock sensor module. Install knock sensor module into new PCM.

Removal

Ensure ignition switch is in OFF position. Disconnect negative battery cable. Unplug electrical connectors from PCM. Remove PCM from vehicle. Remove access cover and remove knock sensor module from PCM.

Installation

Install knock sensor module in NEW PCM. Install access cover.

Install PCM into vehicle. Connect electrical connectors to PCM. Reconnect negative battery cable.

ELECTRICALLY ERASABLE PROGRAMMABLE READ-ONLY MEMORY (EEPROM)

EEPROM is a permanent memory that is part of PCM. EEPROM cannot be replaced. EEPROM contains program and calibration information that PCM uses to control powertrain. If PCM is replaced, ensure that NEW PCM software/calibration is correct and most recent version for vehicle. EEPROM must be programmed when new PCM is installed. Program EEPROM using latest software for that specific vehicle.

KNOCK SENSOR (KS) MODULE

Removal & Installation

1) KS module is located in PCM. Disconnect negative battery cable. Remove PCM from vehicle. See POWERTRAIN CONTROL MODULE (PCM). Position PCM with access cover up. Remove access cover from PCM.

2) Using thumb and forefinger, squeeze both ends of knock sensor module inward and pull module up from access hole. To install, reverse removal procedure. Ensure module latches into holder in PCM.

NOTE: If PCM is replaced, KS module must be transferred from original to replacement PCM.

DISTRIBUTOR

WARNING: Procedure A may be used for distributor installation if crankshaft has not been rotated from original position when distributor was removed. If intake manifold, cylinder head, crankshaft, camshaft, timing gear, or complete engine was removed or replaced, Procedure B must be followed. If DTC P1345 is present, distributor may be installed incorrectly, and must be reinstalled with Procedure B.

Removal

1) Ignition OFF. Remove spark plug and coil leads from distributor cap. Disconnect hall-effect switch connector from base of distributor. Remove distributor cap.

2) With a grease pencil, mark rotor position on distributor body, and label "#1". Remove distributor clamp hold-down bolt. Slowly remove distributor. Rotor will turn 42° counter-clockwise as distributor is removed. Mark new rotor position on distributor body with a grease pencil as "#2".

NOTE: If distributor is being replaced, transfer grease pencil marks from original distributor to new distributor.

Installation (Procedure A)

1) Align rotor to "#2" mark on distributor body. Guide distributor into place noting alignment of mounting hole in distributor hold down base with hole in intake manifold.

2) Rotor will rotate 42° clockwise as distributor is installed. If rotor does not align with "#1" mark, remove distributor and reinstall using INSTALLATION (PROCEDURE B). Remaining installation is reverse of removal.

NOTE: If DTC P1345 is present, distributor may be installed incorrectly, and must be reinstalled with Procedure B.

Installation (Procedure B)

1) Rotate engine until cylinder 1 is at TDC of compression

stroke. Align indent hole of distributor gear with white alignment line on lower part of distributor shaft housing. Rotor should point to distributor cap hold down hole nearest to flat side of distributor body.

2) Using a long screwdriver, align oil pump drive shaft with drive tab of distributor. Slowly install distributor, ensuring that spark plug towers are perpendicular to center line of engine.

3) When fully seated, rotor should be aligned with pointer cast into distributor body (pointer is marked with a "6" to indicate distributor is for 6-cylinder engine). If rotor is not aligned within a few degrees of pointer, remove distributor and return to step 1). Remaining installation is reverse of removal.

NOTE: If DTC P1345 is present, distributor may be installed incorrectly, and must be reinstalled with Procedure B.

CAMSHAFT POSITION (CMP) SENSOR

CMP sensor is located in the engine block adjacent to cam. See Fig. 1.

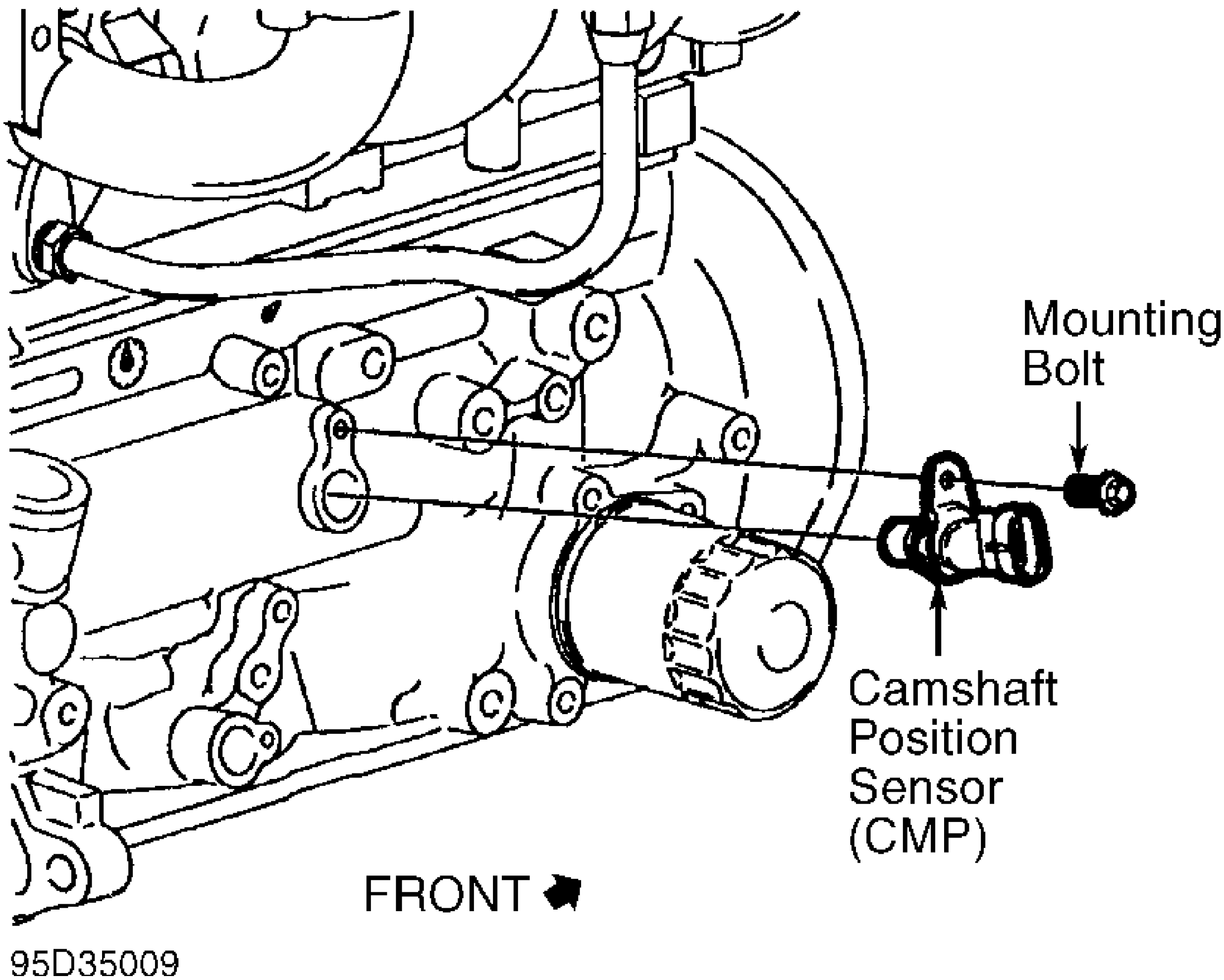


Fig. 1: Locating CMP Sensor In Engine Block
Courtesy of General Motors Corp.

CRANKSHAFT POSITION (CKP) SENSOR

CKP sensor is a magnetic sensor which protrudes into the block within about .050" (1.27 mm) from the crankshaft reluctor. See Fig. 2.

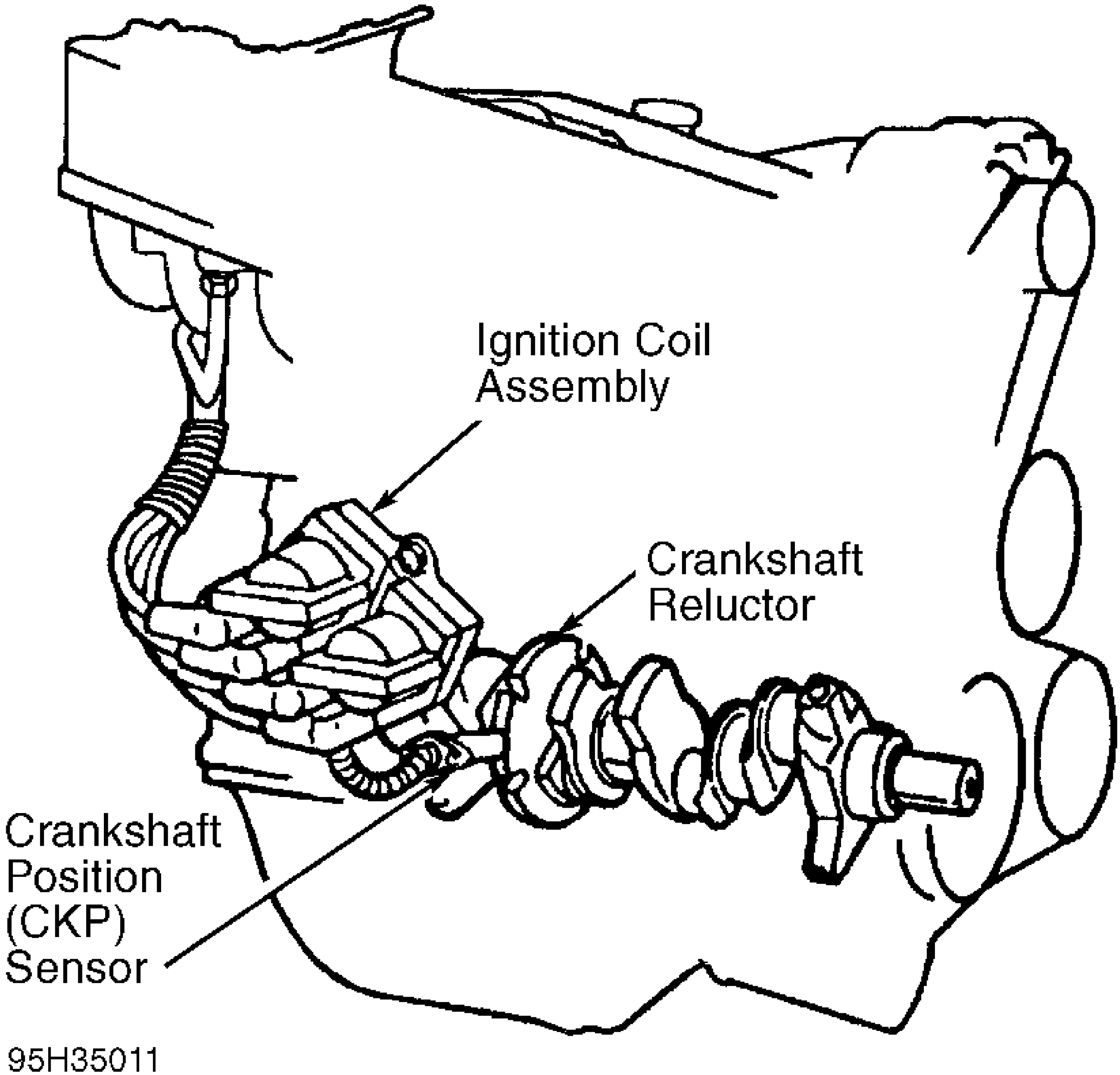


Fig. 2: Locating CKP Sensor At Side Of Engine Block
Courtesy of General Motors Corp.

KNOCK SENSOR (KS)

NOTE: Cooling system may need draining prior to removing knock sensor.

Removal & Installation

Knock sensor is located on side of engine block. See Fig. 3.

Disconnect negative battery cable. Disconnect wiring harness connector from knock sensor. Remove knock sensor. To install, reverse removal procedure. Install sealant to sensor threads prior to installation. Tighten knock sensor to 14 ft. lbs. (19 N.m).

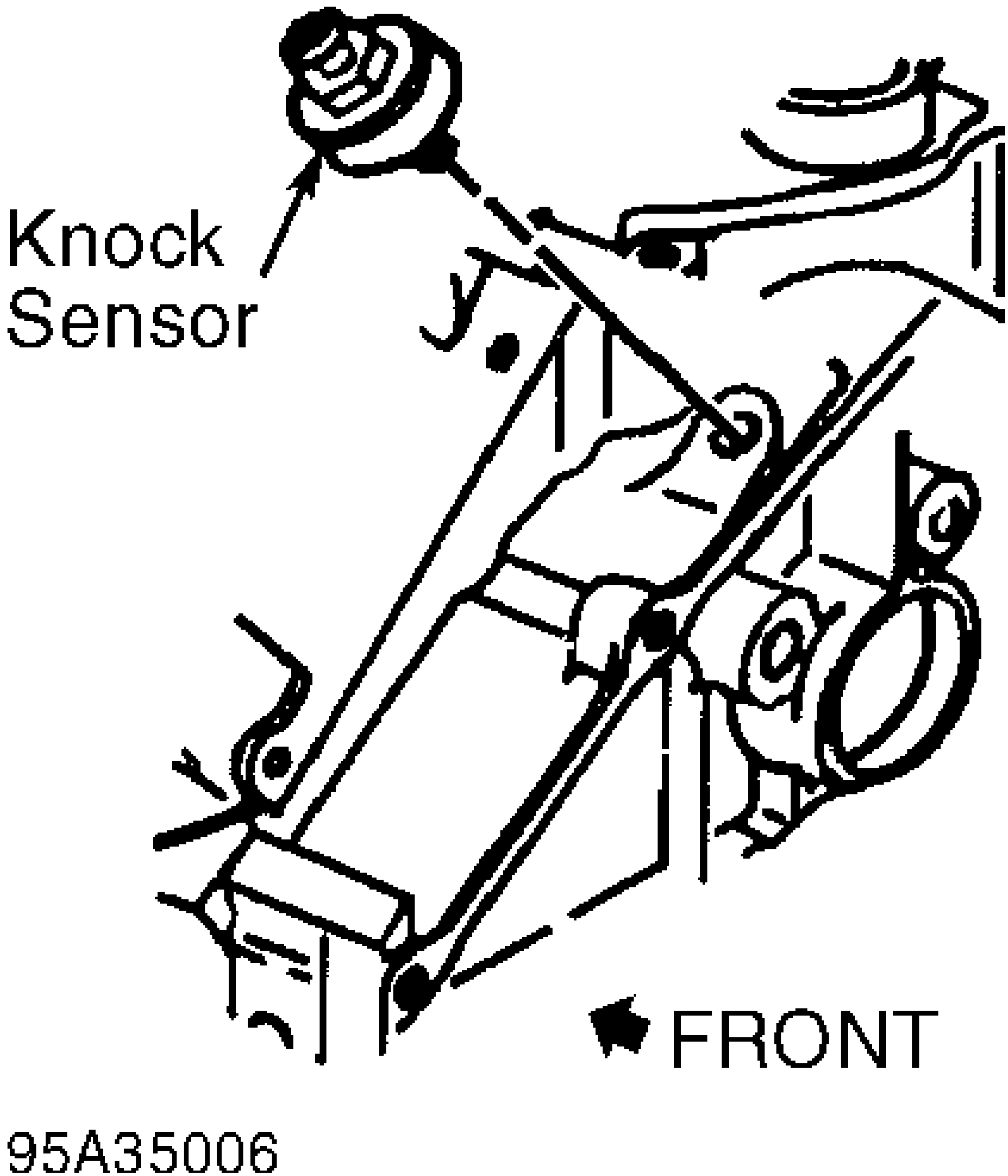


Fig. 3: Locating Knock Sensor
Courtesy of General Motors Corp.

FUEL METER BODY ASSEMBLY

Removal

1) Disconnect negative battery cable. Relieve fuel system pressure. Remove upper intake manifold assembly and throttle body. See UPPER INTAKE MANIFOLD ASSEMBLY (CSI). Disconnect fuel meter body electrical connector.

2) Remove fuel feed and return hoses from fuel pipes. Remove upper intake manifold assembly and throttle body. See UPPER INTAKE MANIFOLD ASSEMBLY (CSI).

NOTE: When disconnecting poppet nozzles, note installation sequence.

3) Squeeze poppet nozzle locking tabls together while lifting nozzle out of the casting socket. Remove fuel meter body from bracket by releasing lock tabs on bracket.

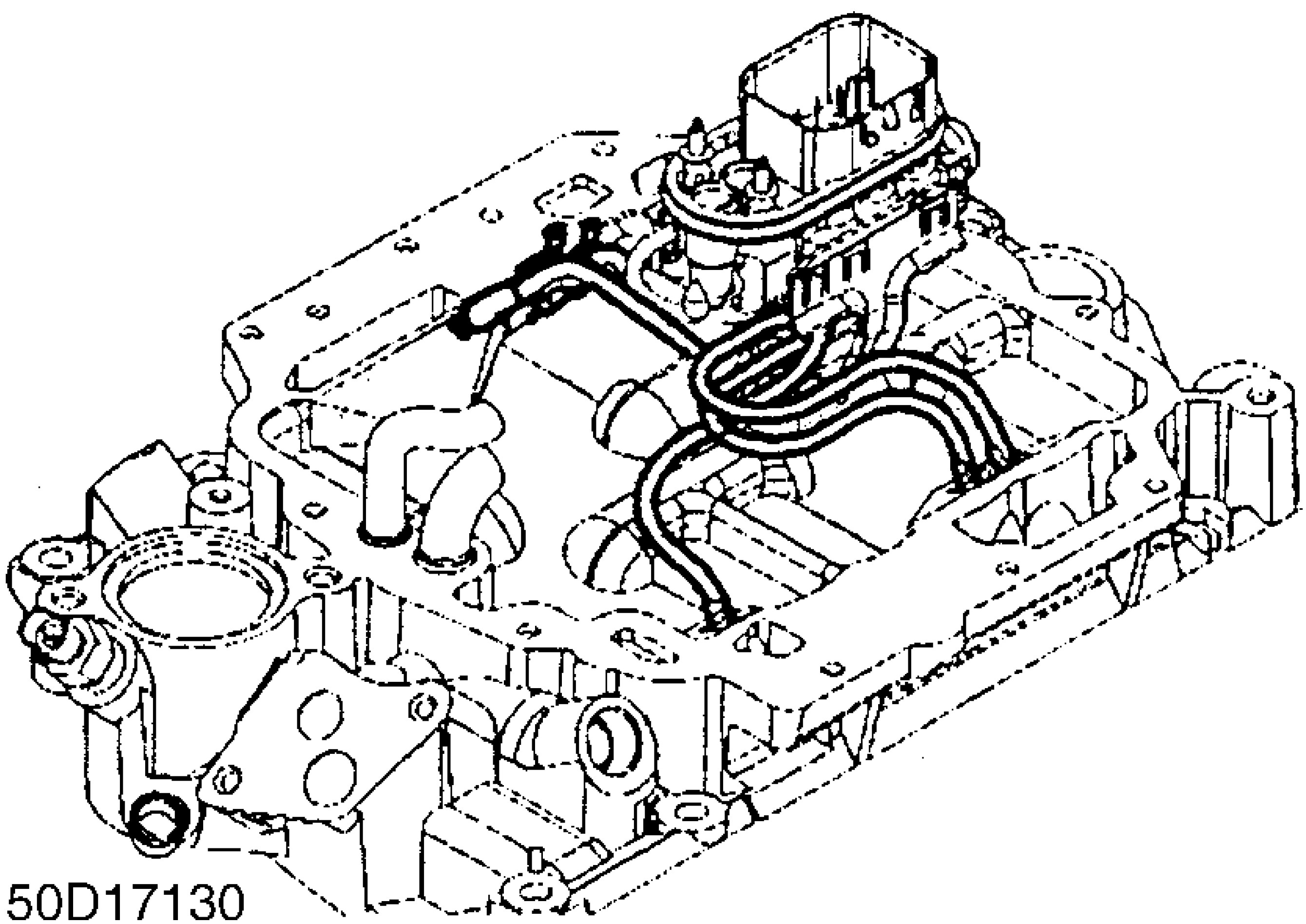


Fig. 4: Fuel Meter Body Assembly
Courtesy of General Motors Corp.

Installation

1) Install fuel meter body on intake manifold. Tighten fuel meter attachment bolts to 88 INCH lbs. (10 N.m).

CAUTION: To reduce risk of fire, ensure that poppet nozzles are firmly seated and locked in their sockets. Unlocked poppet nozzles can become loose which can result in fuel leaks.

Push fuel meter body into bracket. Ensure tabs are locked into place.

NOTE: Fuel meter body assemblies are numbered indicating nozzle order.

2) Push poppet nozzles into casting sockets. Inspect poppet nozzles to ensure they are firmly seated and locked. Install upper manifold electrical connector.

3) Install new O-rings on fuel feed and return pipes. Install fuel feed and return hoses on engine fuel pipes. Tighten fuel pipe nuts to 22 ft.lbs. (30 N.m). Connect negative battery cable. Turn ignition ON for 2 seconds. Ignition OFF for 10 seconds. Turn ignition ON. Check for fuel leaks.

4) Disconnect negative battery cable. Disconnect fuel pipes. Install upper manifold assembly. See UPPER INTAKE MANIFOLD ASSEMBLY (CSI). Install fuel filler cap. Connect fuel pipes. Connect negative battery cable.

FUEL SYSTEM PRESSURE RELIEF

1) Disconnect negative battery cable. Loosen fuel filler cap to relieve fuel tank pressure. Install Fuel Pressure Gauge (J-34730-1) to fuel pressure connection.

2) Wrap shop towel around pressure connection when installing fuel pressure gauge to absorb fuel leakage. Place gauge bleed hose into suitable container. Open bleed valve to bleed fuel pressure.

FUEL PUMP

NOTE: When installing sending unit, DO NOT fold or twist strainer. This will restrict fuel flow.

Removal & Installation

1) Relieve fuel system pressure. See FUEL SYSTEM PRESSURE RELIEF under FUEL SYSTEM. Disconnect negative battery cable. Raise vehicle and remove fuel tank. Using Sending Unit Remover (J-36608 or J-24187), remove sending unit and pump by turning cam lock counterclockwise.

2) Remove fuel pump from sending unit by pulling pump up into attaching hose while pulling outward from the bottom support. DO NOT damage rubber insulator or strainer. To install, reverse removal procedure.

IDLE AIR CONTROL (IAC) VALVE

Removal

Disconnect IAC valve harness connector. Remove IAC valve retaining screws and remove IAC valve from upper intake manifold assembly.

CAUTION: DO NOT manually extend or retract pintle if IAC valve has been in service. Damage to worm gear will result.

Installation

1) Inspect "O" ring for damage. Replace if necessary. If reusing IAC valve, DO NOT push or pull on pintle. Threads on worm gear will be damaged.

2) If replacing IAC valve, measure distance between tip of new IAC valve pintle and mounting flange. Distance should not exceed 1 1/8" (28 mm). If distance is more than specified, use finger pressure

to slowly retract pintle. Lubricate "O" ring with clean engine oil.

3) Apply thread locking compound (Loctite 262) to IAC valve retaining screw threads. Install IAC valve to throttle body. Tighten IAC valve retaining screws to 27 INCH lbs. (3 N.m). Connect IAC valve harness connector.

4) To reset IAC valve pintle position, turn ignition on for 5 seconds. Turn ignition off for 10 seconds. Start engine and check for proper idle operation. Repeat IAC valve resetting procedure if proper idle operation cannot be obtained.

5) Connect IAC valve harness connector and install air cleaner. Start engine and allow it to reach normal operating temperature. Drive vehicle. It may be necessary to reset idle speed. To reset, disconnect negative battery cable for 10 seconds and reconnect. Cycle ignition on with engine off for 5 seconds. Turn ignition off for 10 seconds and restart vehicle. Proper idle will be initialized.

THROTTLE BODY (CSI)

Removal & Installation

1) Disconnect negative battery cable. Remove air inlet duct fastener and duct. Disconnect IAC valve and TP sensor electrical connectors. Disconnect throttle and cruise control cables.

2) Remove accelerator cable bracket bolts and bracket. Remove wiring harness fastener nut and throttle body retaining studs. Remove throttle body assembly. Remove flange gasket and discard.

3) Clean gasket surface on intake manifold and throttle body. Install NEW flange gasket. Install throttle body. Install throttle body studs and wiring harness. Tighten throttle body studs to 18 ft. lbs. (24 N.m). To complete installation, reverse removal procedure. Ensure throttle and cruise control linkage does not hold throttle open.

UPPER INTAKE MANIFOLD ASSEMBLY (CSI)

Removal

1) Disconnect negative battery cable. Remove air inlet fastener and duct. Disconnect injector electrical connector. Relieve fuel pressure. See FUEL SYSTEM PRESSURE RELIEF under FUEL SYSTEM.

2) Disconnect throttle and cruise control cables from throttle lever cam and bracket. Disconnect power brake and crankcase ventilation valve vacuum hoses at upper manifold and valve cover. Disconnect electrical harness connectors from TP sensor, IAC valve and MAP sensor.

3) Disconnect No. 1 plug wire from distributor cap. Remove fuel pipe clip retaining bolt. Remove injector fuel inlet and outlet pipe retainer and nuts. Remove upper manifold assembly, attaching bolts and rear mounting nuts (position canister purge solenoid bracket to one side).

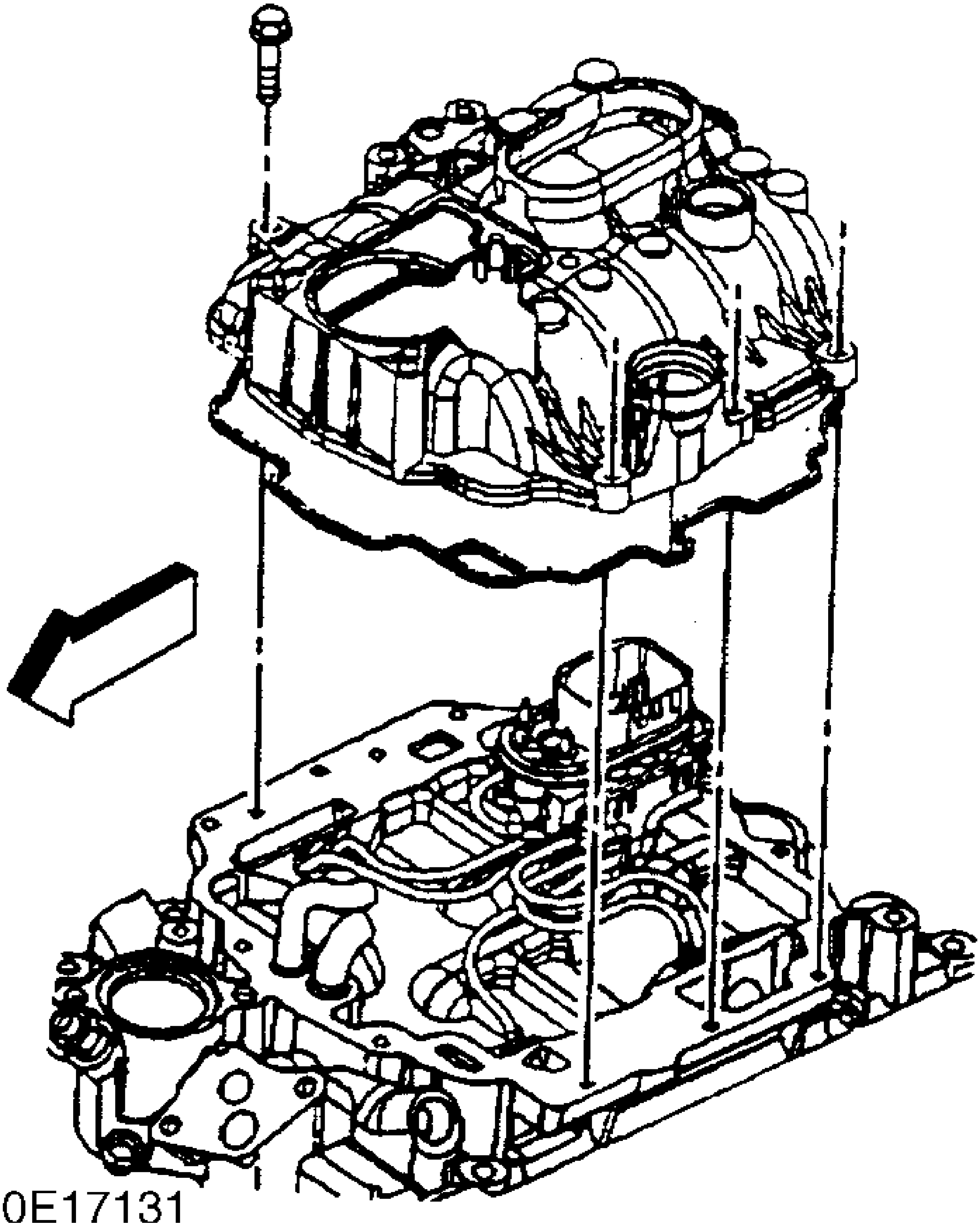


Fig. 5: Upper Intake Manifold Assembly
Courtesy of General Motors Corp.

Disassembly

1) When cleaning or replacing upper manifold assembly, remove

throttle cable bracket attaching bolts and bracket, throttle body assembly, MAP sensor, crankcase ventilation valve, purge solenoid and power brake booster vacuum pipe fitting.

CAUTION: DO NOT soak upper manifold assembly in an immersion type cleaner or any cleaner containing MEK.

2) Upper manifold assembly contains TP sensor, IAC valve and internal throttle shaft sealed ball bearings. These components MUST NOT be subjected to strong solvent or cleaner bath. Clean throttle bore and valve deposits with carburetor cleaner and a shop towel. Use care when cleaning gasket surfaces. Sharp tools may damage sealing surfaces.

Installation

To install, reverse removal procedure. Tighten upper manifold assembly mounting nuts to 18 ft. lbs. (24 N.m) using an alternating, diagonal pattern starting from the center.

THROTTLE POSITION (TP) SENSOR

Removal & Installation

1) Remove air cleaner assembly. Disconnect electrical connector from TP sensor. Remove attaching screws, lock washers, retainers, and TP sensor.

2) To install, reverse removal procedure. Adjust TP sensor to specification. See the D - ADJUSTMENTS - 4.3L article. When replacing a TP sensor, ensure correct part number is used. Use Loctite on TP sensor attaching screws.

OXYGEN SENSOR

CAUTION: Oxygen sensor is equipped with a permanent pigtail, which must be protected to prevent damage when removing sensor.

Removal

1) Oxygen sensor is mounted in the exhaust pipe, below exhaust manifold. Ensure sensor is free of contaminants. DO NOT use cleaning solvents of any type. Sensor may be difficult to remove when engine temperature is less than 120°F (48°C). Excessive removal force may damage threads in exhaust manifold or pipe.

2) Disconnect negative battery cable. Disconnect electrical connector from oxygen sensor. Carefully remove oxygen sensor from exhaust pipe.

CAUTION: Correct torque of oxygen sensor is critical to prevent crushing glass beads in graphite anti-seize compound. Crushing glass beads will cause sensor to seize in exhaust manifold. This may require replacement of exhaust manifold upon next removal.

Installation

1) Whenever oxygen sensor is removed, coat threads with anti-seize compound before reinstalling. New oxygen sensors already have this compound applied to threads.

2) Install oxygen sensor in exhaust pipe and tighten sensor to 30 ft. lbs. (41 N.m). Reconnect electrical connector to oxygen sensor. Reconnect negative battery cable.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS TABLE

Application	Ft. Lbs. (N.m)
Distributor Clamp Bolt	20 (27)
Fuel Line Nut	17 (23)
Fuel Tank Strap Nuts	33 (45)
Idle Air Control Valve (Threaded)	13 (18)
Oxygen Sensor	30 (41)
Throttle Body-To-Manifold Bolts	12 (16)
	INCH Lbs. (N.m)
Crankshaft Position Sensor Bolt	71 (8)
Idle Air Control Valve Screws (Flange Mounted)	27 (3)

97V096000: SAFETY BELTS

1997 Chevrolet Blazer

NHTSA RECALL BULLETIN

Model(s):	1994-97 Chevrolet S10
Campaign No:	97V096000
Number of Affected Vehicles:	475000

VEHICLE DESCRIPTION:

Extended cab pickup trucks equipped with 60/40 front bench seats and extended cab pickup trucks and 2-door utility vehicles equipped with manual locking recliner bucket seats.

DESCRIPTION OF DEFECT:

The outboard safety belt webbing on the driver's and/or passenger's seat can separate during a frontal impact.

CONSEQUENCE OF DEFECT:

If a separation occurred and there were secondary crash events or vehicle rollover, there would be no belt restraint of the occupant and increased injuries could occur.

CORRECTIVE ACTION:

Dealers will replace these safety belts.

OWNER NOTIFICATION:

Owner notification will begin during September 1997. 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 Chevrolet at 1-800-222-1020 or GMC at 1-800-462-8782. 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.

SCHEDULED SERVICES - LONG TRIP/HIGHWAY

1997 Chevrolet Blazer

1997-98 MAINTENANCE
General Motors Maintenance & Service Intervals
Long Trip/Highway

Chevrolet: Blazer
GMC Jimmy: "VORTEC" 4300 V6 VIN [W]

* READ THIS FIRST *

Before preforming maintenance on vehicle, ensure that all cautions and warnings have been observed to prevent vehicle damage or personal injury. See CAUTIONS & WARNINGS in MAINTENANCE INFORMATION article in this section.

Introduction

The frequency of scheduled inspection and maintenance services in this article are based on Long Trip/Highway vehicle usage ONLY. Long Trip/Highway vehicle usage is defined when none of the following conditions apply:

* Most Trips Are Less Than 5 To 10 Miles (8 To 16 KM) This Is Particularly Important When Outside Temperatures Are Below Freezing
* Most Trips Include Extensive Idling (Such As Frequent Driving In Stop-And-Go Traffic)
* You Operate Your Vehicle In Dusty Areas Or Off-Road Frequently
* You Frequently Tow A Trailer
* If The Vehicle Is Used For Delivery Service, Police, Taxi Or Other Commercial Application

If one or more of these conditions applies, this Long Trip/Highway service schedule article is insufficient. DO NOT USE. Instead, use the Short Trip/City service schedule: See SCHEDULED SERVICES - SHORT TRIP/CITY.

7,500 MILE (12,500 KM) LONG TRIP/HIGHWAY SERVICE

7,500 MILE (12,500 KM) LONG TRIP/HIGHWAY SERVICE

SERVICE		
Chassis Components (1)		
Rotate Tires		
INSPECT		
Rear/Front Axle Fluid		
REPLACE		
Engine Oil & Filter (1)		
(1) - Or every 12 months, whichever occurs first.		
LUBRICATION SPECIFICATIONS		
Material	Condition	Specification

Engine Oil (1)	Ambient Temperature Less Than 0°F (-18°C) To Over 100°F (38°C)	SAE 5W-30
	Ambient Temperature Above 0°F (-18°C) To Over 100°F (38°C)	SAE 10W-30
Chassis Lubrication	All	Chassis Lubricant (GM Part No. 1052497) or Equivalent
Differential Front & Rear Axle	All	Axle Lubricant (GM Part No. 1052271) Or SAE 80W-90 GL-5 Gear Lubricant
(1) - SAE 5W-30 preferred. Do not use 20W-50 or any other non-recommended grade.		

FLUID CAPACITIES		
Item	Condition	Specification (1)
Engine Oil	Drained; With New Filter	4.5 Qts. (4.3L)
Differential Fluid	Front: Drained	2.6 Pts. (1.2L)
	Rear: Drained	4.0 Pts. (1.9L)
(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.		

15,000 MILE (25,000 KM) LONG TRIP/HIGHWAY SERVICE

15,000 MILE (25,000 KM) LONG TRIP/HIGHWAY SERVICE

VERIFY	
	Last Major Service Was Performed.
SERVICE	
	Chassis Components (1)
	Rotate Tires
INSPECT	
	Rear/Front Axle Fluid
REPLACE	
	Engine Oil & Filter (1)
(1) - Or every 12 months, whichever occurs first.	

LUBRICATION SPECIFICATIONS		
Material	Condition	Specification

Engine Oil (1)	Ambient Temperature Less Than 0°F (-18°C) To Over 100°F (38°C)	SAE 5W-30
	Ambient Temperature Above 0°F (-18°C) To Over 100°F (38°C)	SAE 10W-30
Chassis Lubrication	All	Chassis Lubricant (GM Part No. 1052497) or Equivalent
Differential Front & Rear Axle	All	Axle Lubricant (GM Part No. 1052271) Or SAE 80W-90 GL-5 Gear Lubricant

(1) - SAE 5W-30 preferred. Do not use 20W-50 or any other non-recommended grade.

FLUID CAPACITIES

Item	Condition	Specification (1)
Engine Oil	Drained; With New Filter	4.5 Qts. (4.3L)
Differential Fluid	Front: Drained	2.6 Pts. (1.2L)
	Rear: Drained	4.0 Pts. (1.9L)

(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.

22,500 MILE (37,500 KM) LONG TRIP/HIGHWAY SERVICE

22,500 MILE (37,500 KM) LONG TRIP/HIGHWAY SERVICE

VERIFY	
	Last Major Service Was Performed.
SERVICE	
	Chassis Components (1)
	Rotate Tires
INSPECT	
	Rear/Front Axle Fluid
REPLACE	
	Engine Oil & Filter (1)

(1) - Or every 12 months, whichever occurs first.

LUBRICATION SPECIFICATIONS

Material	Condition	Specification
Engine Oil	Ambient Temperature Less Than	SAE 5W-30

(1)	0°F (-18°C) To Over 100°F (38°C)	
	Ambient Temperature Above 0°F (-18°C) To Over 100°F (38°C)	SAE 10W-30
Chassis Lubrication	All	Chassis Lubricant (GM Part No. 1052497) or Equivalent
Differential Front & Rear Axle	All	Axle Lubricant (GM Part No. 1052271) Or SAE 80W-90 GL-5 Gear Lubricant
(1) - SAE 5W-30 preferred. Do not use 20W-50 or any other non-recommended grade.		

FLUID CAPACITIES		
Item	Condition	Specification (1)
Engine Oil	Drained; With New Filter	4.5 Qts. (4.3L)
Differential Fluid	Front: Drained	2.6 Pts. (1.2L)
	Rear: Drained	4.0 Pts. (1.9L)
(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.		

30,000 MILE (50,000 KM) LONG TRIP/HIGHWAY SERVICE

30,000 MILE (50,000 KM) LONG TRIP/HIGHWAY SERVICE

VERIFY	
	Last Major Service Was Performed.
SERVICE	
	Chassis Components (1)
	Rotate Tires
	Front Wheel Bearings (2WD)
INSPECT	
	Rear/Front Axle Fluid
REPLACE	
	Engine Oil & Filter (1)
	Fuel Filter
	Air Cleaner Filter
(1) - Or every 12 months, whichever occurs first.	

LUBRICATION SPECIFICATIONS		
Material	Condition	Specification
Engine Oil (1)	Ambient Temperature Less Than 0°F (-18°C) To Over 100°F (38°C)	SAE 5W-30
	Ambient Temperature Above 0°F (-18°C) To Over 100°F (38°C)	SAE 10W-30
Chassis Lubrication	All	Chassis Lubricant (GM Part No. 1052497) or Equivalent
Differential Front & Rear Axle	All	Axle Lubricant (GM Part No. 1052271) Or SAE 80W-90 GL-5 Gear Lubricant
Front Wheel Bearings	All	Wheel Bearing Lubricant (GM Part No. 1051344) Or Equivalent
(1) - SAE 5W-30 preferred. Do not use 20W-50 or any other non-recommended grade.		

FLUID CAPACITIES		
Item	Condition	Specification (1)
Engine Oil	Drained; With New Filter	4.5 Qts. (4.3L)
Differential Fluid	Front: Drained	2.6 Pts. (1.2L)
	Rear: Drained	4.0 Pts. (1.9L)
(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.		

37,500 MILE (62,500 KM) LONG TRIP/HIGHWAY SERVICE

37,500 MILE (62,500 KM) LONG TRIP/HIGHWAY SERVICE

VERIFY	
	Last Major Service Was Performed.
SERVICE	
	Chassis Components (1)
	Rotate Tires
INSPECT	
	Rear/Front Axle Fluid
REPLACE	
	Engine Oil & Filter (1)

(1) - Or every 12 months, whichever occurs first.

LUBRICATION SPECIFICATIONS

Material	Condition	Specification
Engine Oil (1)	Ambient Temperature Less Than 0°F (-18°C) To Over 100°F (38°C)	SAE 5W-30
	Ambient Temperature Above 0°F (-18°C) To Over 100°F (38°C)	SAE 10W-30
Chassis Lubrication	All	Chassis Lubricant (GM Part No. 1052497) or Equivalent
Differential Front & Rear Axle	All	Axle Lubricant (GM Part No. 1052271) Or SAE 80W-90 GL-5 Gear Lubricant

(1) - SAE 5W-30 preferred. Do not use 20W-50 or any other non-recommended grade.

FLUID CAPACITIES

Item	Condition	Specification (1)
Engine Oil	Drained; With New Filter	4.5 Qts. (4.3L)
Differential Fluid	Front: Drained	2.6 Pts. (1.2L)
	Rear: Drained	4.0 Pts. (1.9L)

(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.

45,000 MILE (75,000 KM) LONG TRIP/HIGHWAY SERVICE

45,000 MILE (75,000 KM) LONG TRIP/HIGHWAY SERVICE

	VERIFY
	Last Major Service Was Performed.
	SERVICE
	Chassis Components (1)
	Rotate Tires
	INSPECT
	Rear/Front Axle Fluid
	REPLACE
	Engine Oil & Filter (1)

(1) - Or every 12 months, whichever occurs first.

LUBRICATION SPECIFICATIONS		
Material	Condition	Specification
Engine Oil (1)	Ambient Temperature Less Than 0°F (-18°C) To Over 100°F (38°C)	SAE 5W-30
	Ambient Temperature Above 0°F (-18°C) To Over 100°F (38°C)	SAE 10W-30
Chassis Lubrication	All	Chassis Lubricant (GM Part No. 1052497) or Equivalent
Differential Front & Rear Axle	All	Axle Lubricant (GM Part No. 1052271) Or SAE 80W-90 GL-5 Gear Lubricant
(1) - SAE 5W-30 preferred. Do not use 20W-50 or any other non-recommended grade.		

FLUID CAPACITIES		
Item	Condition	Specification (1)
Engine Oil	Drained; With New Filter	4.5 Qts. (4.3L)
Differential Fluid	Front: Drained	2.6 Pts. (1.2L)
	Rear: Drained	4.0 Pts. (1.9L)
(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.		

50,000 MILE (83,000 KM) LONG TRIP/HIGHWAY SERVICE

50,000 MILE (83,000 KM) LONG TRIP/HIGHWAY SERVICE

VERIFY	
	Last Major Service Was Performed.
REPLACE	
	Automatic Transmission Fluid & Filter (1)
(1) - Only perform if the vehicle is mainly driven under one or more of the following conditions: In heavy city traffic where the outside temperature regularly reaches 90°F (32°C) or higher, in hilly or mountainous terrain, when doing frequent trailer towing, or uses such as found in taxi, police or delivery service.	

LUBRICATION SPECIFICATIONS		
Material	Condition	Specification

Automatic Transmission Fluid	All	DEXRON-III ATF

52,500 MILE (87,500 KM) LONG TRIP/HIGHWAY SERVICE

52,500 MILE (87,500 KM) LONG TRIP/HIGHWAY SERVICE

VERIFY	
	Last Major Service Was Performed.
SERVICE	
	Chassis Components (1)
	Rotate Tires
INSPECT	
	Rear/Front Axle Fluid
REPLACE	
	Engine Oil & Filter (1)
(1) - Or every 12 months, whichever occurs first.	

LUBRICATION SPECIFICATIONS		
Material	Condition	Specification
Engine Oil (1)	Ambient Temperature Less Than 0°F (-18°C) To Over 100°F (38°C)	SAE 5W-30
	Ambient Temperature Above 0°F (-18°C) To Over 100°F (38°C)	SAE 10W-30
Chassis Lubrication	All	Chassis Lubricant (GM Part No. 1052497) or Equivalent
Differential Front & Rear Axle	All	Axle Lubricant (GM Part No. 1052271) Or SAE 80W-90 GL-5 Gear Lubricant
(1) - SAE 5W-30 preferred. Do not use 20W-50 or any other non-recommended grade.		

FLUID CAPACITIES		
Item	Condition	Specification (1)
Engine Oil	Drained; With New Filter	4.5 Qts. (4.3L)
Differential Fluid	Front: Drained	2.6 Pts. (1.2L)
	Rear: Drained	4.0 Pts. (1.9L)

(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.

60,000 MILE (100,000 KM) LONG TRIP/HIGHWAY SERVICE

60,000 MILE (100,000 KM) LONG TRIP/HIGHWAY SERVICE

VERIFY	
	Last Major Service Was Performed.
SERVICE	
	Chassis Components (1)
	Rotate Tires
	Front Wheel Bearings (2WD)
INSPECT	
	Engine Accessory Drive Belt
	Rear/Front Axle Fluid
	Fuel Tank, Cap & Lines
REPLACE	
	Engine Oil & Filter (1)
	Air Cleaner Filter
	Fuel Filter
(1) - Or every 12 months, whichever occurs first.	

LUBRICATION SPECIFICATIONS

Material	Condition	Specification
Engine Oil (1)	Ambient Temperature Less Than 0°F (-18°C) To Over 100°F (38°C)	SAE 5W-30
	Ambient Temperature Above 0°F (-18°C) To Over 100°F (38°C)	SAE 10W-30
Chassis Lubrication	All	Chassis Lubricant (GM Part No. 1052497) or Equivalent
Front Wheel Bearings	All	Wheel Bearing Lubricant (GM Part No. 1051344) Or Equivalent
Differential Front & Rear Axle	All	Axle Lubricant (GM Part No. 1052271) Or SAE 80W-90 GL-5 Gear Lubricant

(1) - SAE 5W-30 preferred. Do not use 20W-50 or any other non-recommended grade.

FLUID CAPACITIES		
Item	Condition	Specification (1)
Engine Oil	Drained; With New Filter	4.5 Qts. (4.3L)
Differential Fluid	Front: Drained	2.6 Pts. (1.2L)
	Rear: Drained	4.0 Pts. (1.9L)
(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.		

67,500 MILE (112,500 KM) LONG TRIP/HIGHWAY SERVICE

67,500 MILE (112,500 KM) LONG TRIP/HIGHWAY SERVICE

VERIFY	
	Last Major Service Was Performed.
SERVICE	
	Chassis Components (1)
	Rotate Tires
INSPECT	
	Rear/Front Axle Fluid
REPLACE	
	Engine Oil & Filter (1)
(1) - Or every 12 months, whichever occurs first.	

LUBRICATION SPECIFICATIONS		
Material	Condition	Specification
Engine Oil (1)	Ambient Temperature Less Than 0°F (-18°C) To Over 100°F (38°C)	SAE 5W-30
	Ambient Temperature Above 0°F (-18°C) To Over 100°F (38°C)	SAE 10W-30
Chassis Lubrication	All	Chassis Lubricant (GM Part No. 1052497) or Equivalent
Differential Front & Rear Axle	All	Axle Lubricant (GM Part No. 1052271) Or SAE 80W-90 GL-5 Gear Lubricant
(1) - SAE 5W-30 preferred. Do not use 20W-50 or any other non-		

recommended grade.		

FLUID CAPACITIES		
Item	Condition	Specification (1)
Engine Oil	Drained; With New Filter	4.5 Qts. (4.3L)
Differential Fluid	Front: Drained	2.6 Pts. (1.2L)
	Rear: Drained	4.0 Pts. (1.9L)
(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.		

75,000 MILE (125,000 KM) LONG TRIP/HIGHWAY SERVICE

75,000 MILE (125,000 KM) LONG TRIP/HIGHWAY SERVICE

VERIFY	
	Last Major Service Was Performed.
SERVICE	
	Chassis Components (1)
	Rotate Tires
INSPECT	
	Rear/Front Axle Fluid
REPLACE	
	Engine Oil & Filter (1)
(1) - Or every 12 months, whichever occurs first.	

LUBRICATION SPECIFICATIONS		
Material	Condition	Specification
Engine Oil (1)	Ambient Temperature Less Than 0°F (-18°C) To Over 100°F (38°C)	SAE 5W-30
	Ambient Temperature Above 0°F (-18°C) To Over 100°F (38°C)	SAE 10W-30
Chassis Lubrication	All	Chassis Lubricant (GM Part No. 1052497) or Equivalent
Differential Front & Rear Axle	All	Axle Lubricant (GM Part No. 1052271) Or SAE 80W-90 GL-5 Gear Lubricant
(1) - SAE 5W-30 preferred. Do not use 20W-50 or any other non-recommended grade.		

FLUID CAPACITIES		
Item	Condition	Specification (1)
Engine Oil	Drained; With New Filter	4.5 Qts. (4.3L)
Differential Fluid	Front: Drained	2.6 Pts. (1.2L)
	Rear: Drained	4.0 Pts. (1.9L)
(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.		

82,500 MILE (137,500 KM) LONG TRIP/HIGHWAY SERVICE

82,500 MILE (137,500 KM) LONG TRIP/HIGHWAY SERVICE

VERIFY	
	Last Major Service Was Performed.
SERVICE	
	Chassis Components (1)
	Rotate Tires
INSPECT	
	Rear/Front Axle Fluid
REPLACE	
	Engine Oil & Filter (1)
(1) - Or every 12 months, whichever occurs first.	

LUBRICATION SPECIFICATIONS		
Material	Condition	Specification
Engine Oil (1)	Ambient Temperature Less Than 0°F (-18°C) To Over 100°F (38°C)	SAE 5W-30
	Ambient Temperature Above 0°F (-18°C) To Over 100°F (38°C)	SAE 10W-30
Chassis Lubrication	All	Chassis Lubricant (GM Part No. 1052497) or Equivalent
Differential Front & Rear Axle	All	Axle Lubricant (GM Part No. 1052271) Or SAE 80W-90 GL-5 Gear Lubricant
(1) - SAE 5W-30 preferred. Do not use 20W-50 or any other non-recommended grade.		

FLUID CAPACITIES		
Item	Condition	Specification (1)
Engine Oil	Drained; With New Filter	4.5 Qts. (4.3L)
Differential Fluid	Front: Drained	2.6 Pts. (1.2L)
	Rear: Drained	4.0 Pts. (1.9L)
(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.		

90,000 MILE (150,000 KM) LONG TRIP/HIGHWAY SERVICE

90,000 MILE (150,000 KM) LONG TRIP/HIGHWAY SERVICE

VERIFY	
	Last Major Service Was Performed.
SERVICE	
	Chassis Components (1)
	Rotate Tires
	Front Wheel Bearings (2WD)
INSPECT	
	Rear/Front Axle Fluid
REPLACE	
	Engine Oil & Filter (1)
	Fuel Filter
	Air Cleaner Filter
(1) - Or every 12 months, whichever occurs first.	

LUBRICATION SPECIFICATIONS		
Material	Condition	Specification
Engine Oil (1)	Ambient Temperature Less Than 0°F (-18°C) To Over 100°F (38°C)	SAE 5W-30
	Ambient Temperature Above 0°F (-18°C) To Over 100°F (38°C)	SAE 10W-30
Chassis Lubrication	All	Chassis Lubricant (GM Part No. 1052497) or Equivalent
Differential Front & Rear Axle	All	Axle Lubricant (GM Part No. 1052271) Or SAE 80W-90 GL-5 Gear

		Lubricant
Front Wheel Bearings	All	Wheel Bearing Lubricant (GM Part No. 1051344) Or Equivalent
(1) - SAE 5W-30 preferred. Do not use 20W-50 or any other non-recommended grade.		

FLUID CAPACITIES		
Item	Condition	Specification (1)
Engine Oil	Drained; With New Filter	4.5 Qts. (4.3L)
Differential Fluid	Front: Drained	2.6 Pts. (1.2L)
	Rear: Drained	4.0 Pts. (1.9L)
(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.		

97,500 MILE (162,500 KM) LONG TRIP/HIGHWAY SERVICE

97,500 MILE (162,500 KM) LONG TRIP/HIGHWAY SERVICE

VERIFY	
	Last Major Service Was Performed.
SERVICE	
	Chassis Components (1)
	Rotate Tires
INSPECT	
	Rear/Front Axle Fluid
REPLACE	
	Engine Oil & Filter (1)
(1) - Or every 12 months, whichever occurs first.	

LUBRICATION SPECIFICATIONS		
Material	Condition	Specification
Engine Oil (1)	Ambient Temperature Less Than 0°F (-18°C) To Over 100°F (38°C)	SAE 5W-30
	Ambient Temperature Above 0°F (-18°C) To Over 100°F (38°C)	SAE 10W-30
Chassis Lubrication	All	Chassis Lubricant (GM Part No. 1052497) or Equivalent

Differential Front & Rear Axle	All	Axle Lubricant (GM Part No. 1052271) Or SAE 80W-90 GL-5 Gear Lubricant
(1) - SAE 5W-30 preferred. Do not use 20W-50 or any other non-recommended grade.		

FLUID CAPACITIES		
Item	Condition	Specification (1)
Engine Oil	Drained; With New Filter	4.5 Qts. (4.3L)
Differential Fluid	Front: Drained	2.6 Pts. (1.2L)
	Rear: Drained	4.0 Pts. (1.9L)
(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.		

100,000 MILE (166,000 KM) LONG TRIP/HIGHWAY SERVICE

100,000 MILE (166,000 KM) LONG TRIP/HIGHWAY SERVICE

VERIFY	
	Last Major Service Was Performed.
INSPECT	
	Spark Plug Wires
	Positive Crankcase Ventilation (PCV) Valve
REPLACE	
	Automatic Transmission Fluid & Filter (1)
	Spark Plugs
(1) - Only perform if the vehicle is mainly driven under one or more of the following conditions: In heavy city traffic where the outside temperature regularly reaches 90°F (32°C) or higher, in hilly or mountainous terrain, when doing frequent trailer towing, or uses such as found in taxi, police or delivery service.	

LUBRICATION SPECIFICATIONS		
Material	Condition	Specification
Automatic Transmission Fluid	All	DEXRON-III ATF

150,000 MILE (240,000 KM) LONG TRIP/HIGHWAY SERVICE

150,000 MILE (240,000 KM) LONG TRIP/HIGHWAY SERVICE

VERIFY	
	Last Major Service Was Performed
SERVICE	
	Cooling System (Drain, Flush & Refill) (1)
(1) - Or every 60 months since last service.	

LUBRICATION SPECIFICATIONS		
Material	Condition	Specification
Engine Coolant	All	50/50 Mix of Distilled Water & DEX-COOL
Coolant Supplement Sealer	Complete Flush & Refill	GM Part No. 3634621 Or Equivalent

FLUID CAPACITIES		
Item	Condition	Specification (1)
Engine Coolant	Automatic Transmission:Drained	11.7 Qts. (11.1L)
	Manual Transmission: Drained	11.9 Qts. (11.3L)
(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.		

LUBRICATION SPECIFICATIONS

LUBRICATION SPECIFICATIONS TABLE

Material	Condition	Specification
Engine Oil (1)	Ambient Temperature Less Than 0°F (-18°C) To Over 100°F (38°C)	SAE 5W-30
	Ambient Temperature Above 0°F (-18°C) To Over 100°F (38°C)	SAE 10W-30
Engine Coolant	All	50/50 Mix of Distilled Water & DEX-COOL
Coolant Supplement Sealer	Complete Flush & Refill	GM Part No. 3634621 Or Equivalent
Brake Fluid	All	DOT 3
Clutch Fluid	All	DOT 3
Parking Brake Cable Guides Lubricant	All	Chassis Lubricant (GM Part No. 1052497)
Power	All	GM Power Steering Fluid

Steering Fluid		(GM Part No. 1052884)
Manual Transmission Fluid	All	Synchromesh Transmission Fluid (GM Part No. 12345349)
Automatic Transmission Fluid	All	DEXRON-III ATF
Key Lock Cylinders	All	Multi-Purpose Lubricant (GM Part No. 12346241)
Chassis Lubrication	All	Chassis Lubricant (GM Part No. 1052497) or Equivalent
Differential Front & Rear Axle	All	Axle Lubricant (GM Part No. 1052271) Or SAE 80W-90 GL-5 Gear Lubricant
Front Wheel Bearings	All	Wheel Bearing Lubricant (GM Part No. 1051344) Or Equivalent
Transfer Case	All	DEXRON-III ATF
Windshield Washer Solvent	All	GM Optikleen Washer Solvent (GM Part No. 1051515)
Transfer Case Shift Lever, Propeller Shaft Slip Splines & Universal Joints	All	Chassis Lubricant (GM Part NO. 1052497) Or Equivalent
Clutch Push-rod To Clutch Fork Joint	All	Chassis Lubricant (GM Part NO. 1052497) Or Equivalent
Constant Velocity Universal Joint	All	Chassis Lubricant (GM Part NO. 1052497) Or Equivalent
Hood Latch Assembly, Pivots, Spring Anchor & Release Pawl	All	Lubriplate Lubricant Aersol (GM Part No. 12346293) Or Equivalent
Tailgate Mounted Spare Tire Carrier (if equipped) Outer Tail-gate Handle	All	Multi-Purpose Lubricant (GM Part No. 12346241)

Pivot Points & Hinges		
Weatherstrip Conditioning	All	Dielectric Silicone Grease or Equivalent (GM Part No. 12345579)
Weatherstrip Squeaks	All	Multi-Purpose Lubricant (GM Part No. 12346241)

(1) - SAE 5W-30 preferred. Do not use 20W-50 or any other non-recommended grade.

FLUID CAPACITIES

FLUID CAPACITIES TABLE

Item	Condition	Specification (1)
Engine Oil	Drained; With New Filter	4.5 Qts. (4.3L)
Differential Fluid	Front: Drained	2.6 Pts. (1.2L)
	Rear: Drained	4.0 Pts. (1.9L)
Engine Coolant	Automatic Transmission:Drained	11.7 Qts. (11.1L)
	Manual Transmission: Drained	11.9 Qts. (11.3L)
Transmission Fluid(4L60-E)	Drained	5.0 Qts. (4.7L)
R-134a Refrigerant	Drained	2.0 Lbs. (0.9 Kgs.)
Fuel Tank	Full Capacity	19.0 Gal. (72.1L)

(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.

SCHEDULED SERVICES - SHORT TRIP/CITY

1997 Chevrolet Blazer

1997-98 MAINTENANCE
General Motors Maintenance & Service Intervals
Short Trip/City

Chevrolet: Blazer
GMC: Jimmy "VORTEC" 4300 V6 VIN [W]

* READ THIS FIRST *

Before preforming maintenance on vehicle, ensure that all cautions and warnings have been observed to prevent vehicle damage or personal injury. See CAUTIONS & WARNINGS in MAINTENANCE INFORMATION article in this section.

Introduction

The frequency of scheduled inspection and maintenance services in this article are based on Short Trip/City vehicle usage ONLY. Short Trip/City vehicle usage is defined as any one of the following conditions:

* Most Trips Are Less Than 5 To 10 Miles (8 To 16 KM) This Is Particularly Important When Outside Temperatures Are Below Freezing
* Most Trips Include Extensive Idling (Such As Frequent Driving In Stop-And-Go Traffic)
* Most Trips Are Through Dusty Areas
* You Frequently Tow A Trailer Or Use A Carrier On Top Of Your Vehicle
* If The Vehicle Is Used For Delivery Service, Police, Taxi Or Other Commercial Application

If none of these conditions apply, this Short Trip/City service schedule article is excessive. DO NOT USE. Instead, use the Long Trip/Highway service schedule: See SCHEDULED SERVICES - LONG TRIP/HIGHWAY.

3,000 MILE (5,000 KM) SHORT TRIP/CITY SERVICE

3,000 MILE (5,000 KM) SHORT TRIP/CITY SERVICE

INSPECT		
Rear/Front Axle Fluid		
SERVICE		
Chassis Components (1)		
REPLACE		
Engine Oil & Filter (1)		
(1) - Or every 3 months, whichever occurs first.		
LUBRICATION SPECIFICATIONS		
Material	Condition	Specification
Engine Oil	Ambient Temperature Less Than	SAE 5W-30

(1)	0°F (-18°C) To Over 100°F (38°C)	
	Ambient Temperature Above 0°F (-18°C) To Over 100°F (38°C)	SAE 10W-30
Chassis Lubrication	All	Chassis Lubricant (GM Part No. 1052497) or Equivalent
Differential Front & Rear Axle	All	Axle Lubricant (GM Part No. 1052271) Or SAE 80W-90 GL-5 Gear Lubricant
(1) - SAE 5W-30 preferred. Do not use 20W-50 or any other non-recommended grade.		

FLUID CAPACITIES

Item	Condition	Specification (1)
Engine Oil	Drained; With New Filter	4.5 Qts. (4.3L)
Differential Fluid	Front: Drained	2.6 Pts. (1.2L)
	Rear: Drained	4.0 Pts. (1.9L)
(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.		

6,000 MILE (10,000 KM) SHORT TRIP/CITY SERVICE

6,000 MILE (10,000 KM) SHORT TRIP/CITY SERVICE

VERIFY	
	Last Major Service Was Performed.
SERVICE	
	Chassis Components (1)
	Rotate Tires
INSPECT	
	Rear/Front Axle Fluid
REPLACE	
	Engine Oil & Filter (1)
(1) - Or every 3 months, whichever occurs first.	

LUBRICATION SPECIFICATIONS

Material	Condition	Specification
Engine Oil (1)	Ambient Temperature Less Than 0°F (-18°C) To Over	SAE 5W-30

	100°F (38°C)	
	Ambient Temperature Above 0°F (-18°C) To Over 100°F (38°C)	SAE 10W-30
Chassis Lubrication	All	Chassis Lubricant (GM Part No. 1052497) or Equivalent
Differential Front & Rear Axle	All	Axle Lubricant (GM Part No. 1052271) Or SAE 80W-90 GL-5 Gear Lubricant
(1) - SAE 5W-30 preferred. Do not use 20W-50 or any other non-recommended grade.		

FLUID CAPACITIES		
Item	Condition	Specification (1)
Engine Oil	Drained; With New Filter	4.5 Qts. (4.3L)
Differential Fluid	Front: Drained	2.6 Pts. (1.2L)
	Rear: Drained	4.0 Pts. (1.9L)
(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.		

9,000 MILE (15,000 KM) SHORT TRIP/CITY SERVICE

9,000 MILE (15,000 KM) SHORT TRIP/CITY SERVICE

VERIFY	
	Last Major Service Was Performed.
SERVICE	
	Chassis Components (1)
INSPECT	
	Rear/Front Axle Fluid
REPLACE	
	Engine Oil & Filter (1)
(1) - Or every 3 months, whichever occurs first.	

LUBRICATION SPECIFICATIONS		
Material	Condition	Specification
Engine Oil (1)	Ambient Temperature Less Than 0°F (-18°C) To Over 100°F (38°C)	SAE 5W-30
	Ambient Temperature Above 0°F	SAE 10W-30

	(-18°C) To Over 100°F (38°C)	
Chassis Lubrication	All	Chassis Lubricant (GM Part No. 1052497) or Equivalent
Differential Front & Rear Axle	All	Axle Lubricant (GM Part No. 1052271) Or SAE 80W-90 GL-5 Gear Lubricant
(1) - SAE 5W-30 preferred. Do not use 20W-50 or any other non-recommended grade.		

FLUID CAPACITIES		
Item	Condition	Specification (1)
Engine Oil	Drained; With New Filter	4.5 Qts. (4.3L)
Differential Fluid	Front: Drained	2.6 Pts. (1.2L)
	Rear: Drained	4.0 Pts. (1.9L)
(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.		

12,000 MILE (20,000 KM) SHORT TRIP/CITY SERVICE

12,000 MILE (20,000 KM) SHORT TRIP/CITY SERVICE

VERIFY	
	Last Major Service Was Performed.
SERVICE	
	Chassis Components (1)
	Rotate Tires
INSPECT	
	Rear/Front Axle Fluid
REPLACE	
	Engine Oil & Filter (1)
(1) - Or every 3 months, whichever occurs first.	

LUBRICATION SPECIFICATIONS		
Material	Condition	Specification
Engine Oil (1)	Ambient Temperature Less Than 0°F (-18°C) To Over 100°F (38°C)	SAE 5W-30
	Ambient Temperature Above 0°F (-18°C) To Over 100°F (38°C)	SAE 10W-30

Chassis Lubrication	All	Chassis Lubricant (GM Part No. 1052497) or Equivalent
Differential Front & Rear Axle	All	Axle Lubricant (GM Part No. 1052271) Or SAE 80W-90 GL-5 Gear Lubricant
(1) - SAE 5W-30 preferred. Do not use 20W-50 or any other non-recommended grade.		

FLUID CAPACITIES		
Item	Condition	Specification (1)
Engine Oil	Drained; With New Filter	4.5 Qts. (4.3L)
Differential Fluid	Front: Drained	2.6 Pts. (1.2L)
	Rear: Drained	4.0 Pts. (1.9L)
(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.		

15,000 MILE (25,000 KM) SHORT TRIP/CITY SERVICE

15,000 MILE (25,000 KM) SHORT TRIP/CITY SERVICE

VERIFY	
	Last Major Service Was Performed.
SERVICE	
	Chassis Components (1)
	Front Wheel Bearings (2WD)
INSPECT	
	Air Cleaner Filter (2)
	Rear/Front Axle Fluid
REPLACE	
	Engine Oil & Filter (1)
(1) - Or every 3 months, whichever occurs first. (2) - Replacement should be considered if driving in dusty conditions.	

LUBRICATION SPECIFICATIONS		
Material	Condition	Specification
Engine Oil (1)	Ambient Temperature Less Than 0°F (-18°C) To Over 100°F (38°C)	SAE 5W-30

	Ambient Temperature Above 0°F (-18°C) To Over 100°F (38°C)	SAE 10W-30
Chassis Lubrication	All	Chassis Lubricant (GM Part No. 1052497) or Equivalent
Front Wheel Bearings	All	Wheel Bearing Lubricant (GM Part No. 1051344) Or Equivalent
Differential Front & Rear Axle	All	Axle Lubricant (GM Part No. 1052271) Or SAE 80W-90 GL-5 Gear Lubricant
(1) - SAE 5W-30 preferred. Do not use 20W-50 or any other non-recommended grade.		

FLUID CAPACITIES		
Item	Condition	Specification (1)
Engine Oil	Drained; With New Filter	4.5 Qts. (4.3L)
Differential Fluid	Front: Drained	2.6 Pts. (1.2L)
	Rear: Drained	4.0 Pts. (1.9L)
(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.		

18,000 MILE (30,000 KM) SHORT TRIP/CITY SERVICE

18,000 MILE (30,000 KM) SHORT TRIP/CITY SERVICE

VERIFY	
	Last Major Service Was Performed.
SERVICE	
	Chassis Components (1)
	Rotate Tires
INSPECT	
	Rear/Front Axle Fluid
REPLACE	
	Engine Oil & Filter (1)
(1) - Or every 3 months, whichever occurs first.	

LUBRICATION SPECIFICATIONS		
Material	Condition	Specification

Engine Oil (1)	Ambient Temperature Less Than 0°F (-18°C) To Over 100°F (38°C)	SAE 5W-30
	Ambient Temperature Above 0°F (-18°C) To Over 100°F (38°C)	SAE 10W-30
Chassis Lubrication	All	Chassis Lubricant (GM Part No. 1052497) or Equivalent
Differential Front & Rear Axle	All	Axle Lubricant (GM Part No. 1052271) Or SAE 80W-90 GL-5 Gear Lubricant
(1) - SAE 5W-30 preferred. Do not use 20W-50 or any other non-recommended grade.		

FLUID CAPACITIES		
Item	Condition	Specification (1)
Engine Oil	Drained; With New Filter	4.5 Qts. (4.3L)
Differential Fluid	Front: Drained	2.6 Pts. (1.2L)
	Rear: Drained	4.0 Pts. (1.9L)
(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.		

21,000 MILE (35,000 KM) SHORT TRIP/CITY SERVICE

21,000 MILE (35,000 KM) SHORT TRIP/CITY SERVICE

VERIFY	
	Last Major Service Was Performed.
SERVICE	
	Chassis Components (1)
INSPECT	
	Rear/Front Axle Fluid
REPLACE	
	Engine Oil & Filter (1)
(1) - Or every 3 months, whichever occurs first.	

LUBRICATION SPECIFICATIONS		
Material	Condition	Specification
Engine Oil (1)	Ambient Temperature Less Than 0°F (-18°C) To Over 100°F (38°C)	SAE 5W-30

	Ambient Temperature Above 0°F (-18°C) To Over 100°F (38°C)	SAE 10W-30
Chassis Lubrication	All	Chassis Lubricant (GM Part No. 1052497) or Equivalent
Differential Front & Rear Axle	All	Axle Lubricant (GM Part No. 1052271) Or SAE 80W-90 GL-5 Gear Lubricant
(1) - SAE 5W-30 preferred. Do not use 20W-50 or any other non-recommended grade.		

FLUID CAPACITIES		
Item	Condition	Specification (1)
Engine Oil	Drained; With New Filter	4.5 Qts. (4.3L)
Differential Fluid	Front: Drained	2.6 Pts. (1.2L)
	Rear: Drained	4.0 Pts. (1.9L)
(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.		

24,000 MILE (40,000 KM) SHORT TRIP/CITY SERVICE

24,000 MILE (40,000 KM) SHORT TRIP/CITY SERVICE

VERIFY	
	Last Major Service Was Performed.
SERVICE	
	Chassis Components (1)
	Rotate Tires
INSPECT	
	Rear/Front Axle Fluid
REPLACE	
	Engine Oil & Filter (1)
(1) - Or every 3 months, whichever occurs first.	

LUBRICATION SPECIFICATIONS		
Material	Condition	Specification
Engine Oil (1)	Ambient Temperature Less Than 0°F (-18°C) To Over 100°F (38°C)	SAE 5W-30

	Ambient Temperature Above 0°F (-18°C) To Over 100°F (38°C)	SAE 10W-30
Chassis Lubrication	All	Chassis Lubricant (GM Part No. 1052497) or Equivalent
Differential Front & Rear Axle	All	Axle Lubricant (GM Part No. 1052271) Or SAE 80W-90 GL-5 Gear Lubricant
(1) - SAE 5W-30 preferred. Do not use 20W-50 or any other non-recommended grade.		

FLUID CAPACITIES		
Item	Condition	Specification (1)
Engine Oil	Drained; With New Filter	4.5 Qts. (4.3L)
Differential Fluid	Front: Drained	2.6 Pts. (1.2L)
	Rear: Drained	4.0 Pts. (1.9L)
(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.		

27,000 MILE (45,000 KM) SHORT TRIP/CITY SERVICE

27,000 MILE (45,000 KM) SHORT TRIP/CITY SERVICE

VERIFY	
	Last Major Service Was Performed.
SERVICE	
	Chassis Components (1)
INSPECT	
	Rear/Front Axle Fluid
REPLACE	
	Engine Oil & Filter (1)
(1) - Or every 3 months, whichever occurs first.	

LUBRICATION SPECIFICATIONS		
Material	Condition	Specification
Engine Oil (1)	Ambient Temperature Less Than 0°F (-18°C) To Over 100°F (38°C)	SAE 5W-30
	Ambient Temperature Above 0°F (-18°C) To Over 100°F (38°C)	SAE 10W-30

Chassis Lubrication	All	Chassis Lubricant (GM Part No. 1052497) or Equivalent
Differential Front & Rear Axle	All	Axle Lubricant (GM Part No. 1052271) Or SAE 80W-90 GL-5 Gear Lubricant
(1) - SAE 5W-30 preferred. Do not use 20W-50 or any other non-recommended grade.		

FLUID CAPACITIES		
Item	Condition	Specification (1)
Engine Oil	Drained; With New Filter	4.5 Qts. (4.3L)
Differential Fluid	Front: Drained	2.6 Pts. (1.2L)
	Rear: Drained	4.0 Pts. (1.9L)
(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.		

30,000 MILE (50,000 KM) SHORT TRIP/CITY SERVICE

30,000 MILE (50,000 KM) SHORT TRIP/CITY SERVICE

VERIFY	
	Last Major Service Was Performed.
SERVICE	
	Chassis Components (1)
	Rotate Tires
	Front Wheel Bearings (2WD)
INSPECT	
	Rear/Front Axle Fluid
REPLACE	
	Engine Oil & Filter (1)
	Air Cleaner Filter
	Fuel Filter
(1) - Or every 3 months, whichever occurs first.	

LUBRICATION SPECIFICATIONS		
Material	Condition	Specification
Engine Oil (1)	Ambient Temperature Less Than 0°F (-18°C) To Over	SAE 5W-30

	100°F (38°C)	
	Ambient Temperature Above 0°F (-18°C) To Over 100°F (38°C)	SAE 10W-30
Chassis Lubrication	All	Chassis Lubricant (GM Part No. 1052497) or Equivalent
Front Wheel Bearings	All	Wheel Bearing Lubricant (GM Part No. 1051344) Or Equivalent
Differential Front & Rear Axle	All	Axle Lubricant (GM Part No. 1052271) Or SAE 80W-90 GL-5 Gear Lubricant
(1) - SAE 5W-30 preferred. Do not use 20W-50 or any other non-recommended grade.		

FLUID CAPACITIES		
Item	Condition	Specification (1)
Engine Oil	Drained; With New Filter	4.5 Qts. (4.3L)
Differential Fluid	Front: Drained	2.6 Pts. (1.2L)
	Rear: Drained	4.0 Pts. (1.9L)
(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.		

33,000 MILE (55,000 KM) SHORT TRIP/CITY SERVICE

33,000 MILE (55,000 KM) SHORT TRIP/CITY SERVICE

VERIFY	
	Last Major Service Was Performed.
SERVICE	
	Chassis Components (1)
INSPECT	
	Rear/Front Axle Fluid
REPLACE	
	Engine Oil & Filter (1)
(1) - Or every 3 months, whichever occurs first.	

LUBRICATION SPECIFICATIONS		
Material	Condition	Specification
Engine Oil	Ambient Temperature Less Than	SAE 5W-30

(1)	0°F (-18°C) To Over 100°F (38°C)	
	Ambient Temperature Above 0°F (-18°C) To Over 100°F (38°C)	SAE 10W-30
Chassis Lubrication	All	Chassis Lubricant (GM Part No. 1052497) or Equivalent
Differential Front & Rear Axle	All	Axle Lubricant (GM Part No. 1052271) Or SAE 80W-90 GL-5 Gear Lubricant
(1) - SAE 5W-30 preferred. Do not use 20W-50 or any other non-recommended grade.		

FLUID CAPACITIES		
Item	Condition	Specification (1)
Engine Oil	Drained; With New Filter	4.5 Qts. (4.3L)
Differential Fluid	Front: Drained	2.6 Pts. (1.2L)
	Rear: Drained	4.0 Pts. (1.9L)
(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.		

36,000 MILE (60,000 KM) SHORT TRIP/CITY SERVICE

36,000 MILE (60,000 KM) SHORT TRIP/CITY SERVICE

VERIFY	
	Last Major Service Was Performed.
SERVICE	
	Chassis Components (1)
	Rotate Tires
INSPECT	
	Rear/Front Axle Fluid
REPLACE	
	Engine Oil & Filter (1)
(1) - Or every 3 months, whichever occurs first.	

LUBRICATION SPECIFICATIONS		
Material	Condition	Specification
Engine Oil (1)	Ambient Temperature Less Than 0°F (-18°C) To Over	SAE 5W-30

	100°F (38°C)	
	Ambient Temperature Above 0°F (-18°C) To Over 100°F (38°C)	SAE 10W-30
Chassis Lubrication	All	Chassis Lubricant (GM Part No. 1052497) or Equivalent
Differential Front & Rear Axle	All	Axle Lubricant (GM Part No. 1052271) Or SAE 80W-90 GL-5 Gear Lubricant
(1) - SAE 5W-30 preferred. Do not use 20W-50 or any other non-recommended grade.		

FLUID CAPACITIES		
Item	Condition	Specification (1)
Engine Oil	Drained; With New Filter	4.5 Qts. (4.3L)
Differential Fluid	Front: Drained	2.6 Pts. (1.2L)
	Rear: Drained	4.0 Pts. (1.9L)
(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.		

39,000 MILE (65,000 KM) SHORT TRIP/CITY SERVICE

39,000 MILE (65,000 KM) SHORT TRIP/CITY SERVICE

VERIFY	
	Last Major Service Was Performed.
SERVICE	
	Chassis Components (1)
INSPECT	
	Rear/Front Axle Fluid
REPLACE	
	Engine Oil & Filter (1)
(1) - Or every 3 months, whichever occurs first.	

LUBRICATION SPECIFICATIONS		
Material	Condition	Specification
Engine Oil (1)	Ambient Temperature Less Than 0°F (-18°C) To Over 100°F (38°C)	SAE 5W-30
	Ambient Temperature Above 0°F	SAE 10W-30

	(-18°C) To Over 100°F (38°C)	
Chassis Lubrication	All	Chassis Lubricant (GM Part No. 1052497) or Equivalent
Differential Front & Rear Axle	All	Axle Lubricant (GM Part No. 1052271) Or SAE 80W-90 GL-5 Gear Lubricant
(1) - SAE 5W-30 preferred. Do not use 20W-50 or any other non-recommended grade.		

FLUID CAPACITIES		
Item	Condition	Specification (1)
Engine Oil	Drained; With New Filter	4.5 Qts. (4.3L)
Differential Fluid	Front: Drained	2.6 Pts. (1.2L)
	Rear: Drained	4.0 Pts. (1.9L)
(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.		

42,000 MILE (70,000 KM) SHORT TRIP/CITY SERVICE

42,000 MILE (70,000 KM) SHORT TRIP/CITY SERVICE

VERIFY	
	Last Major Service Was Performed.
SERVICE	
	Chassis Components (1)
	Rotate Tires
INSPECT	
	Rear/Front Axle Fluid
REPLACE	
	Engine Oil & Filter (1)
(1) - Or every 3 months, whichever occurs first.	

LUBRICATION SPECIFICATIONS		
Material	Condition	Specification
Engine Oil (1)	Ambient Temperature Less Than 0°F (-18°C) To Over 100°F (38°C)	SAE 5W-30
	Ambient Temperature Above 0°F (-18°C) To Over 100°F (38°C)	SAE 10W-30

Chassis Lubrication	All	Chassis Lubricant (GM Part No. 1052497) or Equivalent
Differential Front & Rear Axle	All	Axle Lubricant (GM Part No. 1052271) Or SAE 80W-90 GL-5 Gear Lubricant
(1) - SAE 5W-30 preferred. Do not use 20W-50 or any other non-recommended grade.		

FLUID CAPACITIES		
Item	Condition	Specification (1)
Engine Oil	Drained; With New Filter	4.5 Qts. (4.3L)
Differential Fluid	Front: Drained	2.6 Pts. (1.2L)
	Rear: Drained	4.0 Pts. (1.9L)
(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.		

45,000 MILE (75,000 KM) SHORT TRIP/CITY SERVICE

45,000 MILE (75,000 KM) SHORT TRIP/CITY SERVICE

VERIFY	
	Last Major Service Was Performed.
SERVICE	
	Chassis Components (1)
	Front Wheel Bearings (2WD)
INSPECT	
	Air Cleaner Filter (2)
	Rear/Front Axle Fluid
REPLACE	
	Engine Oil & Filter (1)
(1) - Or every 3 months, whichever occurs first. (2) - Replacement should be considered if driving in dusty conditions.	

LUBRICATION SPECIFICATIONS		
Material	Condition	Specification
Engine Oil (1)	Ambient Temperature Less Than 0°F (-18°C) To Over 100°F (38°C)	SAE 5W-30

	Ambient Temperature Above 0°F (-18°C) To Over 100°F (38°C)	SAE 10W-30
Chassis Lubrication	All	Chassis Lubricant (GM Part No. 1052497) or Equivalent
Front Wheel Bearings	All	Wheel Bearing Lubricant (GM Part No. 1051344) Or Equivalent
Differential Front & Rear Axle	All	Axle Lubricant (GM Part No. 1052271) Or SAE 80W-90 GL-5 Gear Lubricant
(1) - SAE 5W-30 preferred. Do not use 20W-50 or any other non-recommended grade.		

FLUID CAPACITIES

Item	Condition	Specification (1)
Engine Oil	Drained; With New Filter	4.5 Qts. (4.3L)
Differential Fluid	Front: Drained	2.6 Pts. (1.2L)
	Rear: Drained	4.0 Pts. (1.9L)
(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.		

48,000 MILE (80,000 KM) SHORT TRIP/CITY SERVICE

48,000 MILE (80,000 KM) SHORT TRIP/CITY SERVICE

VERIFY	
	Last Major Service Was Performed.
SERVICE	
	Chassis Components (1)
	Rotate Tires
INSPECT	
	Rear/Front Axle Fluid
REPLACE	
	Engine Oil & Filter (1)
(1) - Or every 3 months, whichever occurs first.	

LUBRICATION SPECIFICATIONS

Material	Condition	Specification

Engine Oil (1)	Ambient Temperature Less Than 0°F (-18°C) To Over 100°F (38°C)	SAE 5W-30
	Ambient Temperature Above 0°F (-18°C) To Over 100°F (38°C)	SAE 10W-30
Chassis Lubrication	All	Chassis Lubricant (GM Part No. 1052497) or Equivalent
Differential Front & Rear Axle	All	Axle Lubricant (GM Part No. 1052271) Or SAE 80W-90 GL-5 Gear Lubricant
(1) - SAE 5W-30 preferred. Do not use 20W-50 or any other non-recommended grade.		

FLUID CAPACITIES		
Item	Condition	Specification (1)
Engine Oil	Drained; With New Filter	4.5 Qts. (4.3L)
Differential Fluid	Front: Drained	2.6 Pts. (1.2L)
	Rear: Drained	4.0 Pts. (1.9L)
(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.		

50,000 MILE (83,000 KM) SHORT TRIP/CITY SERVICE

50,000 MILE (83,000 KM) SHORT TRIP/CITY SERVICE

VERIFY	
	Last Major Service Was Performed.
REPLACE	
	Automatic Transmission Fluid & Filter (1)
(1) - Only perform if the vehicle is mainly driven under one or more of the following conditions: In heavy city traffic where the outside temperature regularly reaches 90°F (32°C) or higher, in hilly or mountainous terrain, when doing frequent trailer towing, or uses such as found in taxi, police or delivery service.	

LUBRICATION SPECIFICATIONS		
Material	Condition	Specification
Automatic Transmission Fluid	All	DEXRON-III ATF

51,000 MILE (85,000 KM) SHORT TRIP/CITY SERVICE

51,000 MILE (85,000 KM) SHORT TRIP/CITY SERVICE

VERIFY		
	Last Major Service Was Performed.	
SERVICE		
	Chassis Components (1)	
INSPECT		
	Rear/Front Axle Fluid	
REPLACE		
	Engine Oil & Filter (1)	
(1) - Or every 3 months, whichever occurs first.		
LUBRICATION SPECIFICATIONS		
Material	Condition	Specification
Engine Oil (1)	Ambient Temperature Less Than 0°F (-18°C) To Over 100°F (38°C)	SAE 5W-30
	Ambient Temperature Above 0°F (-18°C) To Over 100°F (38°C)	SAE 10W-30
Chassis Lubrication	All	Chassis Lubricant (GM Part No. 1052497) or Equivalent
Differential Front & Rear Axle	All	Axle Lubricant (GM Part No. 1052271) Or SAE 80W-90 GL-5 Gear Lubricant
(1) - SAE 5W-30 preferred. Do not use 20W-50 or any other non-recommended grade.		
FLUID CAPACITIES		
Item	Condition	Specification (1)
Engine Oil	Drained; With New Filter	4.5 Qts. (4.3L)
Differential Fluid	Front: Drained	2.6 Pts. (1.2L)
	Rear: Drained	4.0 Pts. (1.9L)
(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.		

54,000 MILE (90,000 KM) SHORT TRIP/CITY SERVICE

54,000 MILE (90,000 KM) SHORT TRIP/CITY SERVICE

	VERIFY
	Last Major Service Was Performed.
	SERVICE
	Chassis Components (1)
	Rotate Tires
	INSPECT
	Rear/Front Axle Fluid
	REPLACE
	Engine Oil & Filter (1)
(1) - Or every 3 months, whichever occurs first.	

LUBRICATION SPECIFICATIONS

Material	Condition	Specification
Engine Oil (1)	Ambient Temperature Less Than 0°F (-18°C) To Over 100°F (38°C)	SAE 5W-30
	Ambient Temperature Above 0°F (-18°C) To Over 100°F (38°C)	SAE 10W-30
Chassis Lubrication	All	Chassis Lubricant (GM Part No. 1052497) or Equivalent
Differential Front & Rear Axle	All	Axle Lubricant (GM Part No. 1052271) Or SAE 80W-90 GL-5 Gear Lubricant

(1) - SAE 5W-30 preferred. Do not use 20W-50 or any other non-recommended grade.

FLUID CAPACITIES

Item	Condition	Specification (1)
Engine Oil	Drained; With New Filter	4.5 Qts. (4.3L)
Differential Fluid	Front: Drained	2.6 Pts. (1.2L)
	Rear: Drained	4.0 Pts. (1.9L)

(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.

57,000 MILE (95,000 KM) SHORT TRIP/CITY SERVICE

57,000 MILE (95,000 KM) SHORT TRIP/CITY SERVICE

	VERIFY

	Last Major Service Was Performed.
SERVICE	
	Chassis Components (1)
INSPECT	
	Rear/Front Axle Fluid
REPLACE	
	Engine Oil & Filter (1)
(1) - Or every 3 months, whichever occurs first.	

LUBRICATION SPECIFICATIONS

Material	Condition	Specification
Engine Oil (1)	Ambient Temperature Less Than 0°F (-18°C) To Over 100°F (38°C)	SAE 5W-30
	Ambient Temperature Above 0°F (-18°C) To Over 100°F (38°C)	SAE 10W-30
Chassis Lubrication	All	Chassis Lubricant (GM Part No. 1052497) or Equivalent
Differential Front & Rear Axle	All	Axle Lubricant (GM Part No. 1052271) Or SAE 80W-90 GL-5 Gear Lubricant

(1) - SAE 5W-30 preferred. Do not use 20W-50 or any other non-recommended grade.

FLUID CAPACITIES

Item	Condition	Specification (1)
Engine Oil	Drained; With New Filter	4.5 Qts. (4.3L)
Differential Fluid	Front: Drained	2.6 Pts. (1.2L)
	Rear: Drained	4.0 Pts. (1.9L)

(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.

60,000 MILE (100,000 KM) SHORT TRIP/CITY SERVICE

60,000 MILE (100,000 KM) SHORT TRIP/CITY SERVICE

VERIFY	
	Last Major Service Was Performed.

SERVICE	
	Chassis Components (1)
	Rotate Tires
	Front Wheel Bearings (2WD)
INSPECT	
	Engine Accessory Drive Belt
	Rear/Front Axle Fluid
	Fuel Tank, Cap & Lines
REPLACE	
	Engine Oil & Filter (1)
	Air Cleaner Filter
	Fuel Filter

(1) - Or every 3 months, whichever occurs first.

LUBRICATION SPECIFICATIONS

Material	Condition	Specification
Engine Oil (1)	Ambient Temperature Less Than 0°F (-18°C) To Over 100°F (38°C)	SAE 5W-30
	Ambient Temperature Above 0°F (-18°C) To Over 100°F (38°C)	SAE 10W-30
Chassis Lubrication	All	Chassis Lubricant (GM Part No. 1052497) or Equivalent
Front Wheel Bearings	All	Wheel Bearing Lubricant (GM Part No. 1051344) Or Equivalent
Differential Front & Rear Axle	All	Axle Lubricant (GM Part No. 1052271) Or SAE 80W-90 GL-5 Gear Lubricant

(1) - SAE 5W-30 preferred. Do not use 20W-50 or any other non-recommended grade.

FLUID CAPACITIES

Item	Condition	Specification (1)
Engine Oil	Drained; With New Filter	4.5 Qts. (4.3L)
Differential Fluid	Front: Drained	2.6 Pts. (1.2L)
	Rear: Drained	4.0 Pts. (1.9L)

(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.

63,000 MILE (105,000 KM) SHORT TRIP/CITY SERVICE

63,000 MILE (105,000 KM) SHORT TRIP/CITY SERVICE

VERIFY	
	Last Major Service Was Performed.
SERVICE	
	Chassis Components (1)
INSPECT	
	Rear/Front Axle Fluid
REPLACE	
	Engine Oil & Filter (1)
(1) - Or every 3 months, whichever occurs first.	

LUBRICATION SPECIFICATIONS

Material	Condition	Specification
Engine Oil (1)	Ambient Temperature Less Than 0°F (-18°C) To Over 100°F (38°C)	SAE 5W-30
	Ambient Temperature Above 0°F (-18°C) To Over 100°F (38°C)	SAE 10W-30
Chassis Lubrication	All	Chassis Lubricant (GM Part No. 1052497) or Equivalent
Differential Front & Rear Axle	All	Axle Lubricant (GM Part No. 1052271) Or SAE 80W-90 GL-5 Gear Lubricant
(1) - SAE 5W-30 preferred. Do not use 20W-50 or any other non-recommended grade.		

FLUID CAPACITIES

Item	Condition	Specification (1)
Engine Oil	Drained; With New Filter	4.5 Qts. (4.3L)
Differential Fluid	Front: Drained	2.6 Pts. (1.2L)
	Rear: Drained	4.0 Pts. (1.9L)
(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.		

66,000 MILE (110,000 KM) SHORT TRIP/CITY SERVICE

66,000 MILE (110,000 KM) SHORT TRIP/CITY SERVICE

VERIFY	
	Last Major Service Was Performed.
SERVICE	
	Chassis Components (1)
	Rotate Tires
INSPECT	
	Rear/Front Axle Fluid
REPLACE	
	Engine Oil & Filter (1)
(1) - Or every 3 months, whichever occurs first.	

LUBRICATION SPECIFICATIONS

Material	Condition	Specification
Engine Oil (1)	Ambient Temperature Less Than 0°F (-18°C) To Over 100°F (38°C)	SAE 5W-30
	Ambient Temperature Above 0°F (-18°C) To Over 100°F (38°C)	SAE 10W-30
Chassis Lubrication	All	Chassis Lubricant (GM Part No. 1052497) or Equivalent
Differential Front & Rear Axle	All	Axle Lubricant (GM Part No. 1052271) Or SAE 80W-90 GL-5 Gear Lubricant

(1) - SAE 5W-30 preferred. Do not use 20W-50 or any other non-recommended grade.

FLUID CAPACITIES

Item	Condition	Specification (1)
Engine Oil	Drained; With New Filter	4.5 Qts. (4.3L)
Differential Fluid	Front: Drained	2.6 Pts. (1.2L)
	Rear: Drained	4.0 Pts. (1.9L)

(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.

69,000 MILE (115,000 KM) SHORT TRIP/CITY SERVICE

69,000 MILE (115,000 KM) SHORT TRIP/CITY SERVICE

	VERIFY
	Last Major Service Was Performed.
	SERVICE
	Chassis Components (1)
	INSPECT
	Rear/Front Axle Fluid
	REPLACE
	Engine Oil & Filter (1)
(1) - Or every 3 months, whichever occurs first.	

LUBRICATION SPECIFICATIONS

Material	Condition	Specification
Engine Oil (1)	Ambient Temperature Less Than 0°F (-18°C) To Over 100°F (38°C)	SAE 5W-30
	Ambient Temperature Above 0°F (-18°C) To Over 100°F (38°C)	SAE 10W-30
Chassis Lubrication	All	Chassis Lubricant (GM Part No. 1052497) or Equivalent
Differential Front & Rear Axle	All	Axle Lubricant (GM Part No. 1052271) Or SAE 80W-90 GL-5 Gear Lubricant

(1) - SAE 5W-30 preferred. Do not use 20W-50 or any other non-recommended grade.

FLUID CAPACITIES

Item	Condition	Specification (1)
Engine Oil	Drained; With New Filter	4.5 Qts. (4.3L)
Differential Fluid	Front: Drained	2.6 Pts. (1.2L)
	Rear: Drained	4.0 Pts. (1.9L)

(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.

72,000 MILE (120,000 KM) SHORT TRIP/CITY SERVICE

72,000 MILE (120,000 KM) SHORT TRIP/CITY SERVICE

VERIFY	
	Last Major Service Was Performed.
SERVICE	
	Chassis Components (1)
	Rotate Tires
INSPECT	
	Rear/Front Axle Fluid
REPLACE	
	Engine Oil & Filter (1)

(1) - Or every 3 months, whichever occurs first.

LUBRICATION SPECIFICATIONS

Material	Condition	Specification
Engine Oil (1)	Ambient Temperature Less Than 0°F (-18°C) To Over 100°F (38°C)	SAE 5W-30
	Ambient Temperature Above 0°F (-18°C) To Over 100°F (38°C)	SAE 10W-30
Chassis Lubrication	All	Chassis Lubricant (GM Part No. 1052497) or Equivalent
Differential Front & Rear Axle	All	Axle Lubricant (GM Part No. 1052271) Or SAE 80W-90 GL-5 Gear Lubricant

(1) - SAE 5W-30 preferred. Do not use 20W-50 or any other non-recommended grade.

FLUID CAPACITIES

Item	Condition	Specification (1)
Engine Oil	Drained; With New Filter	4.5 Qts. (4.3L)
Differential Fluid	Front: Drained	2.6 Pts. (1.2L)
	Rear: Drained	4.0 Pts. (1.9L)

(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.

75,000 MILE (125,000 KM) SHORT TRIP/CITY SERVICE

75,000 MILE (125,000 KM) SHORT TRIP/CITY SERVICE

VERIFY
Last Major Service Was Performed.

SERVICE
Chassis Components (1)
Front Wheel Bearings (2WD)

INSPECT
Air Cleaner Filter (2)
Rear/Front Axle Fluid

REPLACE
Engine Oil & Filter (1)

(1) - Or every 3 months, whichever occurs first.
(2) - Replacement should be considered if driving in dusty conditions.

LUBRICATION SPECIFICATIONS

Material	Condition	Specification
Engine Oil (1)	Ambient Temperature Less Than 0°F (-18°C) To Over 100°F (38°C)	SAE 5W-30
	Ambient Temperature Above 0°F (-18°C) To Over 100°F (38°C)	SAE 10W-30
Chassis Lubrication	All	Chassis Lubricant (GM Part No. 1052497) or Equivalent
Front Wheel Bearings	All	Wheel Bearing Lubricant (GM Part No. 1051344) Or Equivalent
Differential Front & Rear Axle	All	Axle Lubricant (GM Part No. 1052271) Or SAE 80W-90 GL-5 Gear Lubricant

(1) - SAE 5W-30 preferred. Do not use 20W-50 or any other non-recommended grade.

FLUID CAPACITIES

Item	Condition	Specification (1)
Engine Oil	Drained; With New Filter	4.5 Qts. (4.3L)
Differential Fluid	Front: Drained	2.6 Pts. (1.2L)
	Rear: Drained	4.0 Pts. (1.9L)

(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.

78,000 MILE (130,000 KM) SHORT TRIP/CITY SERVICE

78,000 MILE (130,000 KM) SHORT TRIP/CITY SERVICE

VERIFY	
	Last Major Service Was Performed.
SERVICE	
	Chassis Components (1)
	Rotate Tires
INSPECT	
	Rear/Front Axle Fluid
REPLACE	
	Engine Oil & Filter (1)
(1) - Or every 3 months, whichever occurs first.	

LUBRICATION SPECIFICATIONS

Material	Condition	Specification
Engine Oil (1)	Ambient Temperature Less Than 0°F (-18°C) To Over 100°F (38°C)	SAE 5W-30
	Ambient Temperature Above 0°F (-18°C) To Over 100°F (38°C)	SAE 10W-30
Chassis Lubrication	All	Chassis Lubricant (GM Part No. 1052497) or Equivalent
Differential Front & Rear Axle	All	Axle Lubricant (GM Part No. 1052271) Or SAE 80W-90 GL-5 Gear Lubricant
(1) - SAE 5W-30 preferred. Do not use 20W-50 or any other non-recommended grade.		

FLUID CAPACITIES

Item	Condition	Specification (1)
Engine Oil	Drained; With New Filter	4.5 Qts. (4.3L)
Differential Fluid	Front: Drained	2.6 Pts. (1.2L)
	Rear: Drained	4.0 Pts. (1.9L)
(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.		

81,000 MILE (135,000 KM) SHORT TRIP/CITY SERVICE

81,000 MILE (135,000 KM) SHORT TRIP/CITY SERVICE

VERIFY	
	Last Major Service Was Performed.
SERVICE	
	Chassis Components (1)
INSPECT	
	Rear/Front Axle Fluid
REPLACE	
	Engine Oil & Filter (1)
(1) - Or every 3 months, whichever occurs first.	

LUBRICATION SPECIFICATIONS

Material	Condition	Specification
Engine Oil (1)	Ambient Temperature Less Than 0°F (-18°C) To Over 100°F (38°C)	SAE 5W-30
	Ambient Temperature Above 0°F (-18°C) To Over 100°F (38°C)	SAE 10W-30
Chassis Lubrication	All	Chassis Lubricant (GM Part No. 1052497) or Equivalent
Differential Front & Rear Axle	All	Axle Lubricant (GM Part No. 1052271) Or SAE 80W-90 GL-5 Gear Lubricant

(1) - SAE 5W-30 preferred. Do not use 20W-50 or any other non-recommended grade.

FLUID CAPACITIES

Item	Condition	Specification (1)
Engine Oil	Drained; With New Filter	4.5 Qts. (4.3L)
Differential Fluid	Front: Drained	2.6 Pts. (1.2L)
	Rear: Drained	4.0 Pts. (1.9L)

(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.

84,000 MILE (140,000 KM) SHORT TRIP/CITY SERVICE

84,000 MILE (140,000 KM) SHORT TRIP/CITY SERVICE

VERIFY	
	Last Major Service Was Performed.
SERVICE	
	Chassis Components (1)
	Rotate Tires
INSPECT	
	Rear/Front Axle Fluid
REPLACE	
	Engine Oil & Filter (1)
(1) - Or every 3 months, whichever occurs first.	

LUBRICATION SPECIFICATIONS

Material	Condition	Specification
Engine Oil (1)	Ambient Temperature Less Than 0°F (-18°C) To Over 100°F (38°C)	SAE 5W-30
	Ambient Temperature Above 0°F (-18°C) To Over 100°F (38°C)	SAE 10W-30
Chassis Lubrication	All	Chassis Lubricant (GM Part No. 1052497) or Equivalent
Differential Front & Rear Axle	All	Axle Lubricant (GM Part No. 1052271) Or SAE 80W-90 GL-5 Gear Lubricant

(1) - SAE 5W-30 preferred. Do not use 20W-50 or any other non-recommended grade.

FLUID CAPACITIES

Item	Condition	Specification (1)
Engine Oil	Drained; With New Filter	4.5 Qts. (4.3L)
Differential Fluid	Front: Drained	2.6 Pts. (1.2L)
	Rear: Drained	4.0 Pts. (1.9L)

(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.

87,000 MILE (145,000 KM) SHORT TRIP/CITY SERVICE

87,000 MILE (145,000 KM) SHORT TRIP/CITY SERVICE

VERIFY	
	Last Major Service Was Performed.
SERVICE	
	Chassis Components (1)
INSPECT	
	Rear/Front Axle Fluid
REPLACE	
	Engine Oil & Filter (1)
(1) - Or every 3 months, whichever occurs first.	

LUBRICATION SPECIFICATIONS

Material	Condition	Specification
Engine Oil (1)	Ambient Temperature Less Than 0°F (-18°C) To Over 100°F (38°C)	SAE 5W-30
	Ambient Temperature Above 0°F (-18°C) To Over 100°F (38°C)	SAE 10W-30
Chassis Lubrication	All	Chassis Lubricant (GM Part No. 1052497) or Equivalent
Differential Front & Rear Axle	All	Axle Lubricant (GM Part No. 1052271) Or SAE 80W-90 GL-5 Gear Lubricant
(1) - SAE 5W-30 preferred. Do not use 20W-50 or any other non-recommended grade.		

FLUID CAPACITIES

Item	Condition	Specification (1)
Engine Oil	Drained; With New Filter	4.5 Qts. (4.3L)
Differential Fluid	Front: Drained	2.6 Pts. (1.2L)
	Rear: Drained	4.0 Pts. (1.9L)
(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.		

90,000 MILE (150,000 KM) SHORT TRIP/CITY SERVICE

90,000 MILE (150,000 KM) SHORT TRIP/CITY SERVICE

VERIFY

	Last Major Service Was Performed.
SERVICE	
	Chassis Components (1)
	Rotate Tires
	Front Wheel Bearings (2WD)
INSPECT	
	Rear/Front Axle Fluid
REPLACE	
	Engine Oil & Filter (1)
	Air Cleaner Filter
	Fuel Filter

(1) - Or every 3 months, whichever occurs first.

LUBRICATION SPECIFICATIONS

Material	Condition	Specification
Engine Oil (1)	Ambient Temperature Less Than 0°F (-18°C) To Over 100°F (38°C)	SAE 5W-30
	Ambient Temperature Above 0°F (-18°C) To Over 100°F (38°C)	SAE 10W-30
Chassis Lubrication	All	Chassis Lubricant (GM Part No. 1052497) or Equivalent
Front Wheel Bearings	All	Wheel Bearing Lubricant (GM Part No. 1051344) Or Equivalent
Differential Front & Rear Axle	All	Axle Lubricant (GM Part No. 1052271) Or SAE 80W-90 GL-5 Gear Lubricant

(1) - SAE 5W-30 preferred. Do not use 20W-50 or any other non-recommended grade.

FLUID CAPACITIES

Item	Condition	Specification (1)
Engine Oil	Drained; With New Filter	4.5 Qts. (4.3L)
Differential Fluid	Front: Drained	2.6 Pts. (1.2L)
	Rear: Drained	4.0 Pts. (1.9L)

(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.

93,000 MILE (155,000 KM) SHORT TRIP/CITY SERVICE

93,000 MILE (155,000 KM) SHORT TRIP/CITY SERVICE

	VERIFY
	Last Major Service Was Performed.
	SERVICE
	Chassis Components (1)
	INSPECT
	Rear/Front Axle Fluid
	REPLACE
	Engine Oil & Filter (1)
(1) - Or every 3 months, whichever occurs first.	

LUBRICATION SPECIFICATIONS

Material	Condition	Specification
Engine Oil (1)	Ambient Temperature Less Than 0°F (-18°C) To Over 100°F (38°C)	SAE 5W-30
	Ambient Temperature Above 0°F (-18°C) To Over 100°F (38°C)	SAE 10W-30
Chassis Lubrication	All	Chassis Lubricant (GM Part No. 1052497) or Equivalent
Differential Front & Rear Axle	All	Axle Lubricant (GM Part No. 1052271) Or SAE 80W-90 GL-5 Gear Lubricant

(1) - SAE 5W-30 preferred. Do not use 20W-50 or any other non-recommended grade.

FLUID CAPACITIES

Item	Condition	Specification (1)
Engine Oil	Drained; With New Filter	4.5 Qts. (4.3L)
Differential Fluid	Front: Drained	2.6 Pts. (1.2L)
	Rear: Drained	4.0 Pts. (1.9L)

(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.

96,000 MILE (160,000 KM) SHORT TRIP/CITY SERVICE

96,000 MILE (160,000 KM) SHORT TRIP/CITY SERVICE

	VERIFY
	Last Major Service Was Performed.
	SERVICE
	Chassis Components (1)
	Rotate Tires
	INSPECT
	Rear/Front Axle Fluid
	REPLACE
	Engine Oil & Filter (1)
(1) - Or every 3 months, whichever occurs first.	

LUBRICATION SPECIFICATIONS

Material	Condition	Specification
Engine Oil (1)	Ambient Temperature Less Than 0°F (-18°C) To Over 100°F (38°C)	SAE 5W-30
	Ambient Temperature Above 0°F (-18°C) To Over 100°F (38°C)	SAE 10W-30
Chassis Lubrication	All	Chassis Lubricant (GM Part No. 1052497) or Equivalent
Differential Front & Rear Axle	All	Axle Lubricant (GM Part No. 1052271) Or SAE 80W-90 GL-5 Gear Lubricant

(1) - SAE 5W-30 preferred. Do not use 20W-50 or any other non-recommended grade.

FLUID CAPACITIES

Item	Condition	Specification (1)
Engine Oil	Drained; With New Filter	4.5 Qts. (4.3L)
Differential Fluid	Front: Drained	2.6 Pts. (1.2L)
	Rear: Drained	4.0 Pts. (1.9L)

(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.

99,000 MILE (165,000 KM) SHORT TRIP/CITY SERVICE

99,000 MILE (165,000 KM) SHORT TRIP/CITY SERVICE

	VERIFY
	Last Major Service Was Performed.
	SERVICE
	Chassis Components (1)
	INSPECT
	Rear/Front Axle Fluid
	REPLACE
	Engine Oil & Filter (1)
(1) - Or every 3 months, whichever occurs first.	

LUBRICATION SPECIFICATIONS

Material	Condition	Specification
Engine Oil (1)	Ambient Temperature Less Than 0°F (-18°C) To Over 100°F (38°C)	SAE 5W-30
	Ambient Temperature Above 0°F (-18°C) To Over 100°F (38°C)	SAE 10W-30
Chassis Lubrication	All	Chassis Lubricant (GM Part No. 1052497) or Equivalent
Differential Front & Rear Axle	All	Axle Lubricant (GM Part No. 1052271) Or SAE 80W-90 GL-5 Gear Lubricant

(1) - SAE 5W-30 preferred. Do not use 20W-50 or any other non-recommended grade.

FLUID CAPACITIES

Item	Condition	Specification (1)
Engine Oil	Drained; With New Filter	4.5 Qts. (4.3L)
Differential Fluid	Front: Drained	2.6 Pts. (1.2L)
	Rear: Drained	4.0 Pts. (1.9L)

(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.

100,000 MILE (166,000 KM) SHORT TRIP/CITY SERVICE

100,000 MILE (166,000 KM) SHORT TRIP/CITY SERVICE

VERIFY

	Last Major Service Was Performed.
INSPECT	
	Spark Plug Wires
	Positive Crankcase Ventilation (PCV) Valve
REPLACE	
	Automatic Transmission Fluid & Filter (1)
	Spark Plugs

(1) - Only perform if the vehicle is mainly driven under one or more of the following conditions: In heavy city traffic where the outside temperature regularly reaches 90°F (32°C) or higher, in hilly or mountainous terrain, when doing frequent trailer towing, or uses such as found in taxi, police or delivery service.

LUBRICATION SPECIFICATIONS

Material	Condition	Specification
Automatic Transmission Fluid	All	DEXRON-III ATF

150,000 MILE (240,000 KM) SHORT TRIP/CITY SERVICE

150,000 MILE (240,000 KM) SHORT TRIP/CITY SERVICE

VERIFY	
	Last Major Service Was Performed
SERVICE	
	Cooling System (Drain, Flush & Refill) (1)

(1) - Or every 60 months since last service.

LUBRICATION SPECIFICATIONS

Material	Condition	Specification
Engine Coolant	All	50/50 Mix of Distilled Water & DEX-COOL
Coolant Supplement Sealer	Complete Flush & Refill	GM Part No. 3634621 Or Equivalent

FLUID CAPACITIES

Item	Condition	Specification (1)
Engine Coolant	Automatic Transmission:Drained	11.7 Qts. (11.1L)

	Manual Transmission: Drained	11.9 Qts. (11.3L)
(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.		

LUBRICATION SPECIFICATIONS

LUBRICATION SPECIFICATIONS TABLE

Material	Condition	Specification
Engine Oil (1)	Ambient Temperature Less Than 0°F (-18°C) To Over 100°F (38°C)	SAE 5W-30
	Ambient Temperature Above 0°F (-18°C) To Over 100°F (38°C)	SAE 10W-30
Engine Coolant	All	50/50 Mix of Distilled Water & DEX-COOL
Coolant Supplement Sealer	Complete Flush & Refill	GM Part No. 3634621 Or Equivalent
Brake Fluid	All	DOT 3
Clutch Fluid	All	DOT 3
Parking Brake Cable Guides Lubricant	All	Chassis Lubricant (GM Part No. 1052497)
Power Steering Fluid	All	GM Power Steering Fluid (GM Part No. 1052884)
Manual Transmission Fluid	All	Synchromesh Transmission Fluid (GM Part No. 12345349)
Automatic Transmission Fluid	All	DEXRON-III ATF
Key Lock Cylinders	All	Multi-Purpose Lubricant (GM Part No. 12346241)
Chassis Lubrication	All	Chassis Lubricant (GM Part No. 1052497) or Equivalent
Differential Front & Rear Axle	All	Axle Lubricant (GM Part No. 1052271) Or SAE 80W-90 GL-5 Gear Lubricant
Front Wheel Bearings	All	Wheel Bearing Lubricant (GM Part No. 1051344) Or Equivalent

Transfer Case	All	DEXRON-III ATF
Windshield Washer Solvent	All	GM Optikleen Washer Solvent (GM Part No. 1051515)
Transfer Case Shift Lever, Propeller Shaft Slip Splines & Universal Joints	All	Chassis Lubricant (GM Part NO. 1052497) Or Equivalent
Clutch Push-rod To Clutch Fork Joint	All	Chassis Lubricant (GM Part NO. 1052497) Or Equivalent
Constant Velocity Universal Joint	All	Chassis Lubricant (GM Part NO. 1052497) Or Equivalent
Hood Latch Assembly, Pivots, Spring Anchor & Release Pawl	All	Lubriplate Lubricant Aersol (GM Part No. 12346293) Or Equivalent
Tailgate Mounted Spare Tire Carrier (if equipped) Outer Tail-gate Handle Pivot Points & Hinges	All	Multi-Purpose Lubricant (GM Part No. 12346241)
Weatherstrip Conditioning	All	Dielectric Silicone Grease or Equivalent (GM Part No. 12345579)
Weatherstrip Squeaks	All	Multi-Purpose Lubricant (GM Part No. 12346241)
(1) - SAE 5W-30 preferred. Do not use 20W-50 or any other non-recommended grade.		

FLUID CAPACITIES

FLUID CAPACITIES TABLE

Item	Condition	Specification (1)
Engine Oil	Drained; With New Filter	4.5 Qts. (4.3L)
Differential Fluid	Front: Drained	2.6 Pts. (1.2L)
	Rear: Drained	4.0 Pts. (1.9L)

Engine Coolant	Automatic Transmission:Drained	11.7 Qts. (11.1L)
	Manual Transmission: Drained	11.9 Qts. (11.3L)
Transmission Fluid(4L60-E)	Drained	5.0 Qts. (4.7L)
R-134a Refrigerant	Drained	2.0 Lbs. (0.9 Kgs.)
Fuel Tank	Full Capacity	19.0 Gal. (72.1L)
(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.		

97V096001: SEAT BELTS COULD SEPARATE - NEW BELTS

1997 Chevrolet Blazer

NHTSA RECALL BULLETIN

Model(s):	1994-97 Chevrolet S10 1994-97 GMC Sonoma 1996-97 Chevrolet Blazer
Campaign No:	97V096001
Number of Affected Vehicles:	586058
Beginning Date of Manufacture:	1993 JUL
Ending Date of Manufacture:	1994 JUL

VEHICLE DESCRIPTION:

Extended cab pickup trucks equipped with 60/40 front bench seats and extended cab pickup trucks and 2-door utility vehicles equipped with manual locking recliner bucket seats.

DESCRIPTION OF DEFECT:

The outboard safety belt webbing on the driver's and/or passenger's seat can separate during a frontal impact.

CONSEQUENCE OF DEFECT:

If a separation occurred and there were secondary crash events or vehicle rollover, there would be no belt restraint of the occupant and increased injuries could occur.

CORRECTIVE ACTION:

Dealers will replace these safety belts.

OWNER NOTIFICATION:

Owner notification will begin during September 1997.

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 Chevrolet at 1-800-222-1020 or GMC at 1-800-462-8782. 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.

SEATS - POWER

1997 Chevrolet Blazer

1997 ACCESSORIES/SAFETY EQUIP
General Motors Corp. - Power Seats

Chevrolet; Blazer, "S" & "T" Series Pickup
GMC; Jimmy, Sonoma
Oldsmobile; Bravada

DESCRIPTION & OPERATION

A 6-way power seat is used on driver's seat (all models) and passenger seat (some models). System consists of 3 reversible motors attached to a seat drive rail. Each motor contains a self-resetting circuit breaker. Power seat switch is located on left side of driver's seat, or on right side of passenger's seat. Drive cables connect motor to gearnuts, which turn jack screws and adjusters at each side of seat.

TROUBLE SHOOTING

Check power accessory circuit breaker. If motors operate but seat does not move, check for obstruction in seat drive rail or check for broken drive gear. If seat tilts forward and/or rearward but does not move up or down, replace power seat switch.

TESTING & DIAGNOSIS

POWER SEAT DOES NOT OPERATE IN ANY DIRECTION

1) Disconnect power seat switch connector. Connect test light between power seat switch harness terminal "B" (Orange wire) and ground. If test light illuminates, go to next step. If test light does not illuminate, repair open in Orange wire between power seat switch and fuse block.

2) Connect self-powered test light between seat switch assembly terminal "A" (Black wire) and ground. If test light illuminates, replace power seat switch. If test light does not illuminate, repair open in Black wire.

POWER SEAT DOES NOT TILT FORWARD

1) Disconnect power seat front height motor connector. Connect test light between front height motor harness terminals "A" (Dark Blue wire) and "B" (Dark Green wire). Operate front height switch. If test light does not illuminate, go to next step. If test light illuminates, check and repair any damaged wiring. If wiring is okay, replace front height motor.

2) Disconnect power seat switch connector. Connect self-powered test light between front height motor harness terminal "A" (Dark Blue wire) and power seat switch harness terminal "H" (Dark Blue wire). If test light illuminates, go to next step. If test light does not illuminate, repair open in Dark Blue wire between power seat switch and front height motor.

3) Connect self-powered test light between front height motor harness terminal "B" (Dark Green wire) and power seat switch harness terminal "G" (Dark Green wire). If test light illuminates, replace power seat switch. If test light does not illuminate, repair open in Dark Green wire between power seat switch and front height motor.

POWER SEAT DOES NOT TILT REARWARD

1) Disconnect power seat rear height motor connector. Connect test light between rear height motor harness terminals "A" (Yellow wire) and "B" (Light Blue wire). Operate rear height switch. If test light does not illuminate, go to next step. If test light illuminates, check and repair any damaged wiring. If wiring is okay, replace rear height motor.

2) Disconnect power seat switch connector. Connect self-powered test light between rear height motor harness terminal "A" (Yellow wire) and power seat switch harness terminal "A" (Yellow wire). If test light illuminates, go to next step. If test light does not illuminate, repair open in Yellow wire between power seat switch and rear height motor.

3) Connect self-powered test light between rear height motor harness terminal "B" (Light Blue wire) and power seat switch harness terminal "B" (Light Blue wire). If test light illuminates, replace power seat switch. If test light does not illuminate, repair open in Light Blue wire between power seat switch and rear height motor.

POWER SEAT DOES NOT MOVE FORWARD OR REARWARD

1) Disconnect power seat forward/rearward motor connector. Connect a test light between forward/rearward motor harness terminals "A" (Tan wire) and "B" (Light Green wire). Operate forward/rearward switch. If test light does not illuminate, go to next step. If test light illuminates, replace forward/rearward motor.

2) Disconnect power seat switch connector. Connect self-powered test light between forward/rearward motor harness terminal "A" (Tan wire) and power seat switch harness terminal "E" (Tan wire). If test light illuminates, go to next step. If test light does not illuminate, repair open in Tan wire between power seat switch and forward/rearward motor.

3) Connect self-powered test light between forward/rearward motor harness terminal "B" (Light Green wire) and power seat switch harness terminal "C" (Light Green wire). If test light illuminates, replace power seat switch. If test light does not illuminate, repair open in Light Green wire between power seat switch and forward/rearward motor.

POWER LUMBAR INOPERATIVE

1) Disconnect power lumbar support connector. Connect self-powered test light between ground and Black wire terminal at power lumbar support harness connector. If test light illuminates, go to next step. If test light does not illuminate, repair open in Black wire between power lumbar support and ground.

2) Connect test light between ground and Orange wire at power lumbar support harness connector. If test light illuminates, go to next step. If test light does not illuminate, repair open in Orange wire between power lumbar support and fuse block.

3) Disconnect lumbar support motor. Connect jumper wire between one end of motor and ground. Connect self-powered test light between other end of motor and ground. If test light illuminates, go to next step. If test light does not illuminate, replace lumbar support motor.

4) Reconnect power lumbar support connector. Connect test light between ground and Orange wire terminal at power lumbar support switch. If test light does not illuminate, go to next step.

5) Connect self-powered test light between ground and Black wire terminal at power lumbar switch. If test light illuminates, repair open in Orange wire between power lumbar support and lumbar support switch. If test light does not illuminate, replace power

lumbar switch.

REMOVAL & INSTALLATION

NOTE: Complete removal and installation procedures of components are not available from manufacturer.

Removal & Installation (Power Seat)

Disconnect negative battery cable. Remove seat adjuster trim cover screws. Remove seat adjuster trim covers. Disconnect power seat electrical connectors. Remove power seat assembly from vehicle. To install, reverse removal procedure. Tighten power seat adjuster-to-seat bolts and nuts to 33 ft. lbs. (45 N.m).

Removal & Installation (Adjuster Motor & Drive Cables)

1) Adjust seat to full upward front and rear position. Disconnect negative battery cable. Remove power seat from vehicle. See POWER SEAT. Noting location and routing of cables, squeeze ends of motor-to-adjuster cables to disconnect cables.

2) Disconnect electrical connector. Remove adjuster assembly bolts. Remove adjuster assembly from vehicle. Remove motor from adjuster assembly. To install, reverse removal procedure. Tighten power seat adjuster-to-seat bolts and nuts to 33 ft. lbs. (45 N.m).

Removal & Installation (Power Lumbar Switch)

Remove front seat. See POWER SEAT. Remove bolts, and remove seat track from seat bottom. Remove "J" strip from outboard side of seat bottom frame. Pull seat bottom cover back to expose power lumbar switch. Remove power lumbar switch. Disconnect electrical connector. To install, reverse removal procedure.

WIRING DIAGRAMS

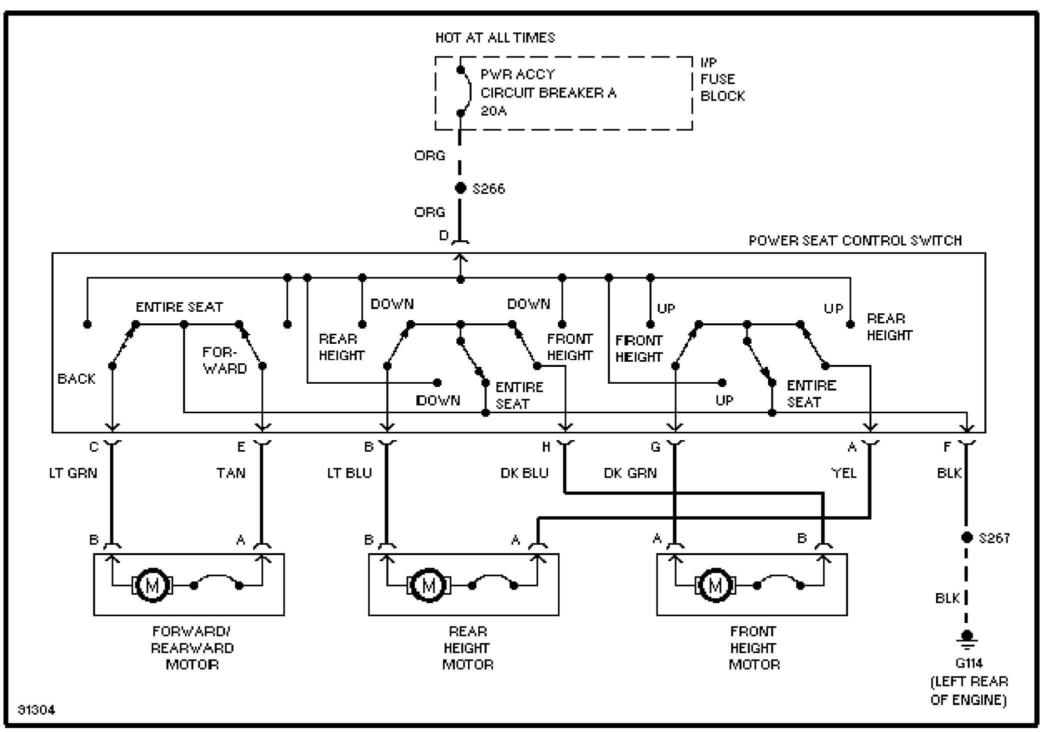


Fig. 1: Power Seats Wiring Diagram (Blazer, Bravada & Jimmy)

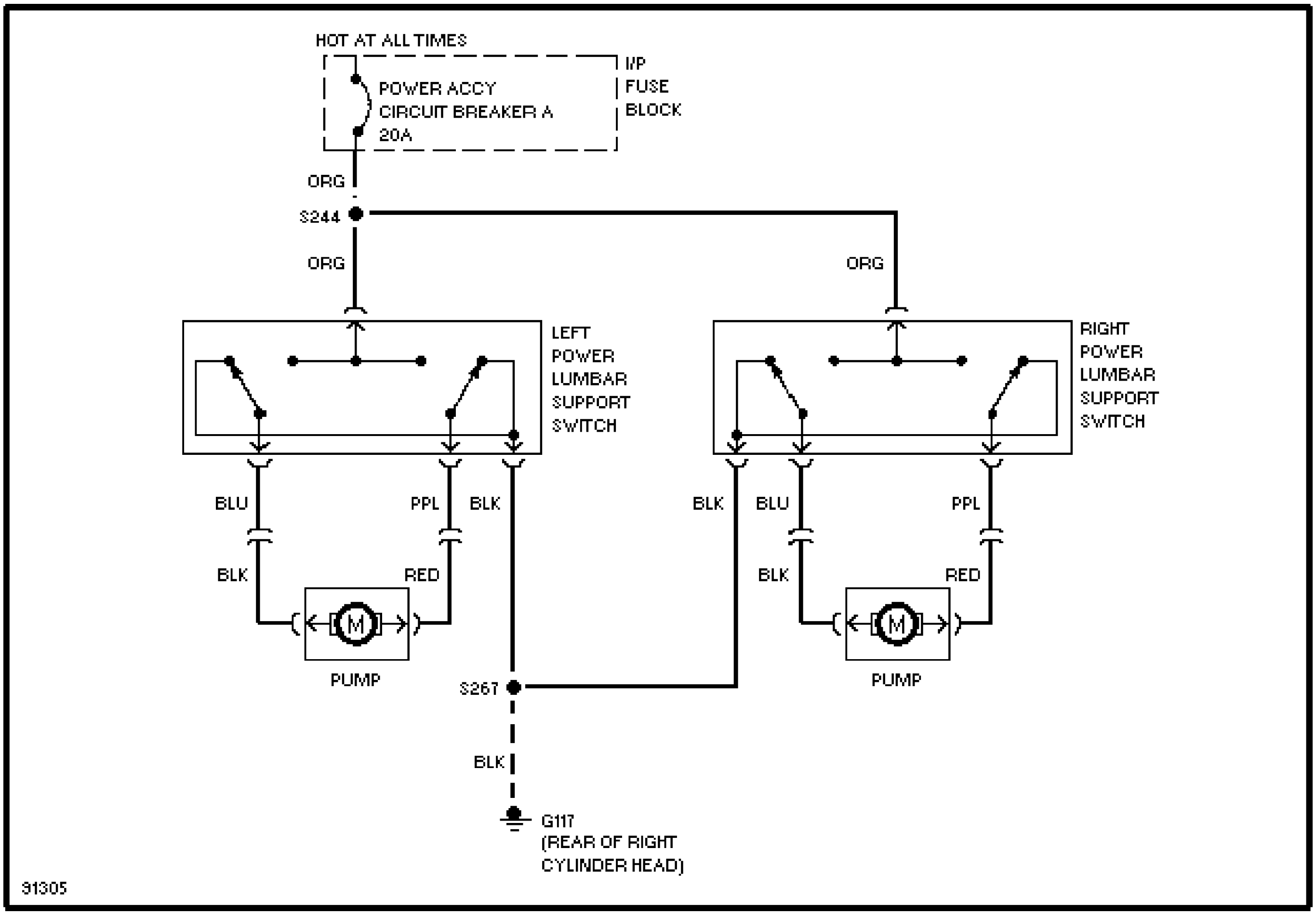


Fig. 2: Power Lumbar Seats Wiring Diagram (Blazer, Bravada & Jimmy)

1997 ENGINE PERFORMANCE
General Motors Corp. - Sensor Operating Range Charts - 4.3L

Chevrolet; Blazer, S10 Pickup
GMC; Jimmy, Sonoma
Oldsmobile; Bravada

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 will cause driveability problems.

NOTE: Perform all voltage tests with a Digital Volt-Ohmmeter (DVOM) with a minimum 10-megohm input impedance, unless stated otherwise in testing procedures.

ECT (1), DFT (2) & IAT (3) SENSOR RESISTANCE VALUES TABLE (4)

°F (°C)	Ohms
266 (130)	70
212 (100)	177
194 (90)	241
176 (80)	332
158 (70)	467
140 (60)	667
122 (50)	973
113 (45)	1188
104 (40)	1459
95 (35)	1802
86 (30)	2238
77 (25)	2796
68 (20)	3520
59 (15)	4450
50 (10)	5670
41 (5)	7280
32 (0)	9420
23 (- 5)	12,300
14 (- 10)	16,180
5 (- 15)	21,450
- 4 (- 20)	28,680
- 22 (- 30)	52,700
- 40 (- 40)	100,700

(1) - Engine Coolant Temperature (ECT) sensor.
(2) - Diesel Fuel Temperature (DFT) sensor.
(3) - Intake Air Temperature (IAT) sensor.
(4) - Measure resistance across sensor terminals.

MAP SENSOR VOLTAGE RANGE TABLE (1)

Throttle Position	Volts
At Idle	1.0-1.5
Wide Open Throttle	4.0-4.6

(1) - Measured at sensor, or as seen on scan tester. Ensure sensor output changes instantly when intake manifold

vacuum is applied and released.

OXYGEN SENSOR VOLTAGE TEST TABLE (1)

Condition	Volts
Lean	.1
Rich	.9

(1) - Measure voltage between oxygen sensor ground and signal terminals at PCM.

THROTTLE POSITION (TP) SENSOR VOLTAGE RANGE TABLE (1)

Throttle Position	Volts
At Idle	.6
Wide Open Throttle	4.8

(1) - Measured at sensor, or as seen on scan tester.

SHIFT INTERLOCK SYSTEM

1997 Chevrolet Blazer

1997-98 AUTOMATIC TRANSMISSIONS
Shift Interlock Systems

Chevrolet; S10, Blazer
GMC; Envoy, Sonoma, Jimmy
Oldsmobile; Bravada

DESCRIPTION

Transmission shift interlock system prevents driver from moving gearshift lever from Park unless ignition switch is in RUN position. On models equipped with shift interlock solenoid, gearshift lever cannot be moved from Park without simultaneously depressing brake pedal with ignition switch in RUN position. Shift interlock solenoid is located near steering column or center console.

OPERATION

Models equipped with park lock cable, gearshift lever is locked in Park when ignition switch is in LOCK position. When ignition switch is turned to RUN position, gearshift lever is allowed movement to desired position. Ignition key cannot be removed until gearshift lever is returned to Park.

Models equipped with shift interlock solenoid, gearshift lever cannot be moved from Park without simultaneously depressing brake pedal with ignition switch in RUN position. When pressure is applied to brake pedal, solenoid is actuated to release gearshift lever. Brake light switch completes or interrupts circuit to mechanically lock or unlock gearshift lever in Park by energizing or de-energizing solenoid, depending upon application. See WIRING DIAGRAMS.

TROUBLE SHOOTING

* PLEASE READ THIS FIRST *

NOTE: Individual component testing procedures are not available from manufacturer. To identify model specific components within shift interlock system, component location, wire color and wire terminal identification, see WIRING DIAGRAMS.

VISUAL INSPECTION

Diagnosis of shift interlock system should begin with a general visual inspection. Each model is similar in function, but may be equipped with a variety of components depending upon application. Before beginning any diagnosis, refer to appropriate wiring diagram to become familiar with the type of system being diagnosed and for use as a guide to pinpoint areas of concern. See WIRING DIAGRAMS.

Once familiar with system being diagnosed, check operation of the following:

* With ignition switch in LOCK position, gearshift lever should be locked in Park.
* With gearshift lever in Park, ignition switch should be allowed movement from LOCK position to any desired position and back to LOCK position. Ignition key should be removable while in LOCK position.

* With ignition switch in RUN position, gearshift lever should be allowed movement from Park. Models equipped with shift interlock solenoid require that brake pedal be depressed for this operation.
* With ignition switch in RUN position and gearshift lever in any position other than Park, ignition key is non-removable. Ignition key is removable only when gearshift lever is returned to Park.

If shift interlock system operates as specified, system is functioning properly at this time. If system does not operate as specified, inspect mechanical functions of the following:

* Ignition switch.
* Gearshift lever assembly.
* External shift cable/linkage.
* Internal transmission shift linkage.

Adjust or repair as necessary. See ADJUSTMENTS. If no mechanical problems are found, inspect all electrical components while referring to appropriate wiring diagram as a guide. See WIRING DIAGRAMS. Ensure all electrical harness connections are tight and free of corrosion. Check for misrouted wires and damaged components. Ensure fuses are good and appropriate circuits are properly grounded.

ADJUSTMENTS

* PLEASE READ THIS FIRST *

WARNING: When battery is disconnected, vehicle computer and memory systems may lose memory data. Driveability problems may exist until computer systems have completed a relearn cycle. See COMPUTER RELEARN PROCEDURES article in GENERAL INFORMATION section before disconnecting battery.

* COMPUTER RELEARN PROCEDURES (1997)
* COMPUTER RELEARN PROCEDURES (1998)

ACTUATOR

Actuator is located on steering column. See Fig. 1. Move actuator rod to adjuster block side for leverage. See Fig. 2. Press on adjuster block to compress internal adjuster spring and engage adjuster teeth. Slide adjuster block as far away from solenoid as possible. Reposition actuator rod to solenoid side. Rod will be visible in hole in actuator block.

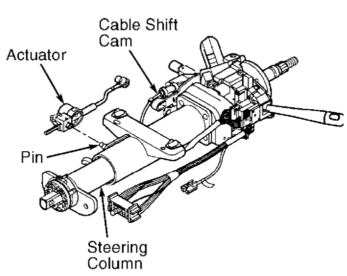


Fig. 1: Locating Shift Interlock Assembly (Typical)
Courtesy of General Motors Corp.

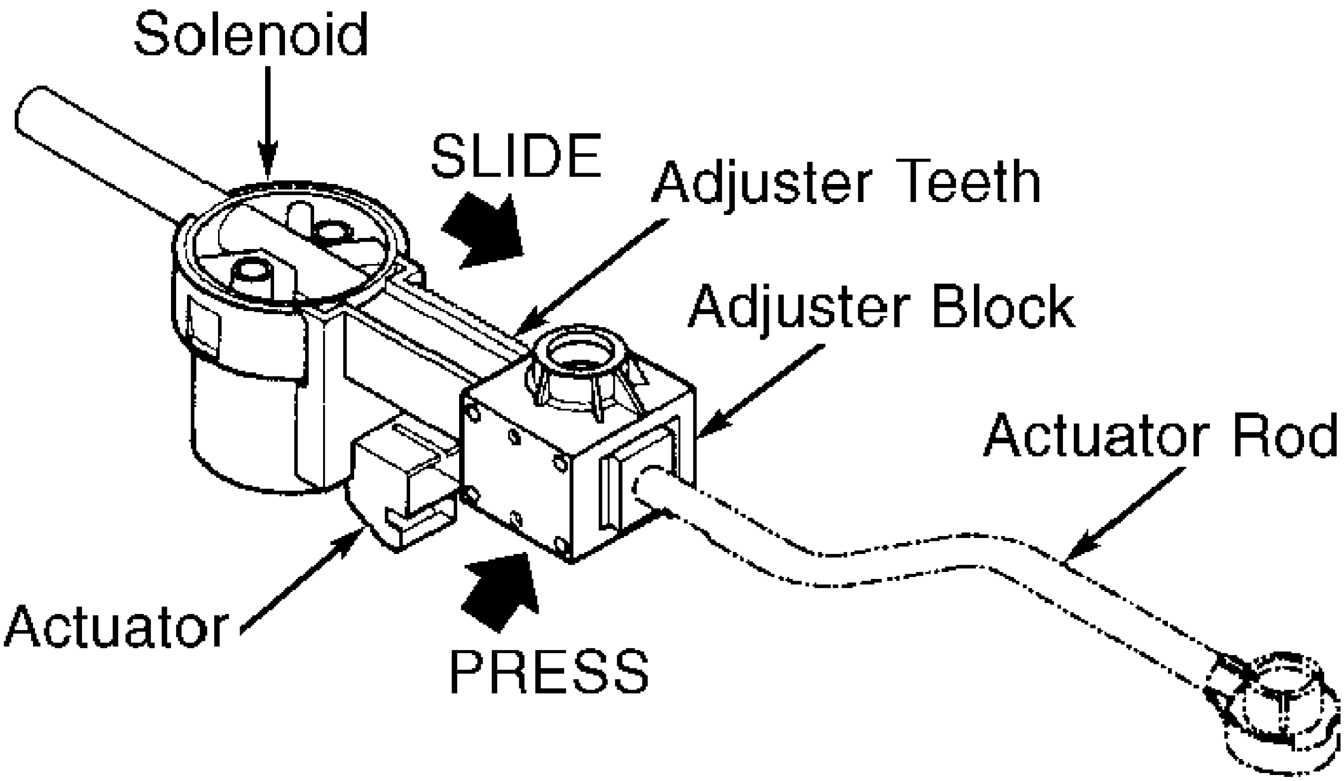


Fig. 2: Adjusting Shift Interlock Actuator (Typical)
Courtesy of General Motors Corp.

PARK LOCK CABLE

1) Lift cable lock button. Move gearshift lever to Park. Snap cable connector into shifter base. Ensure ignition key is in RUN position.

2) Snap cable housing into ignition switch inhibitor. Turn ignition key to LOCK position. Snap cable end onto park lock lever pin. Remove slack from cable connector. Snap cable connector lock button down.

WIRING DIAGRAMS

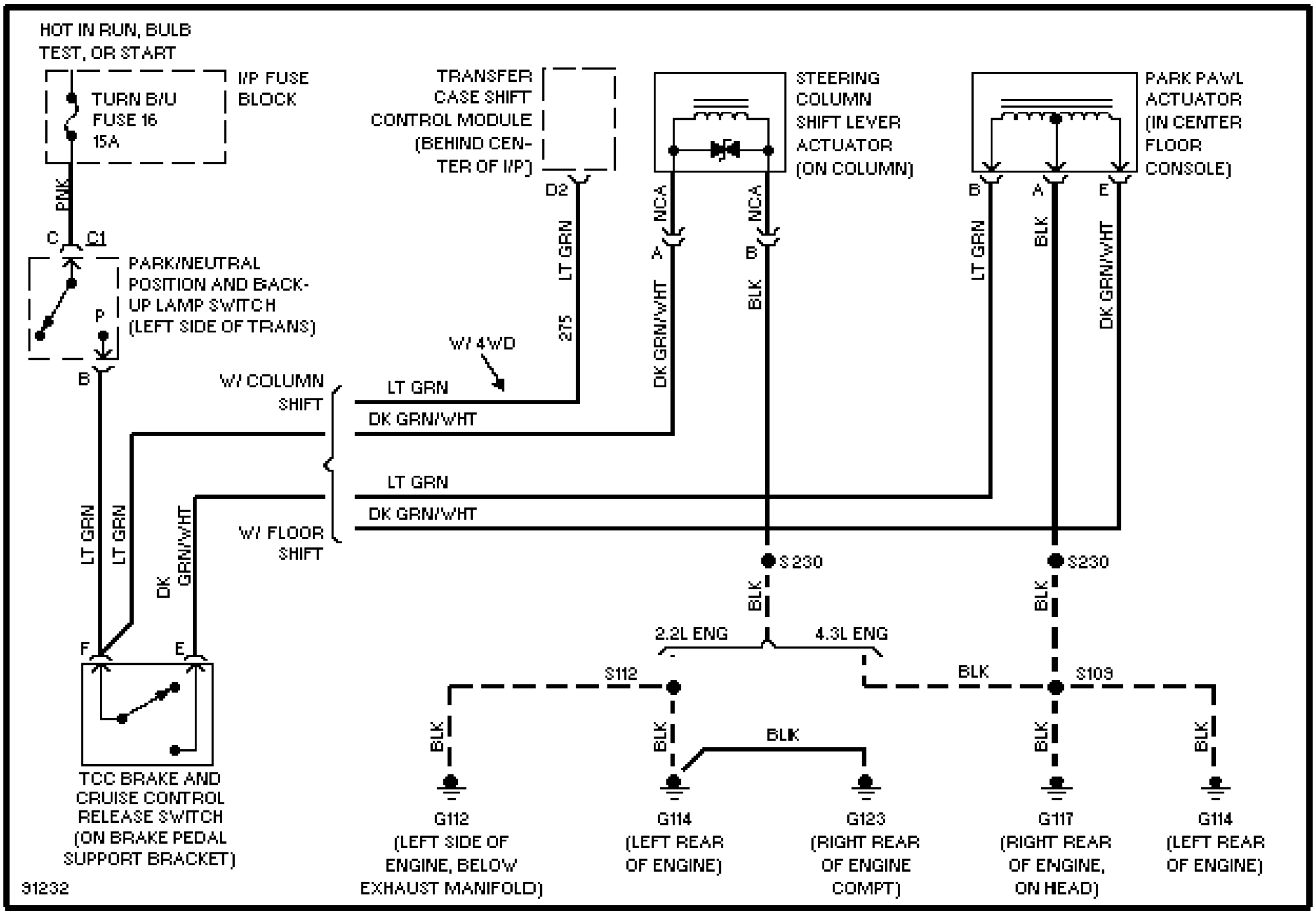


Fig. 3: Wiring Diagram (1997)

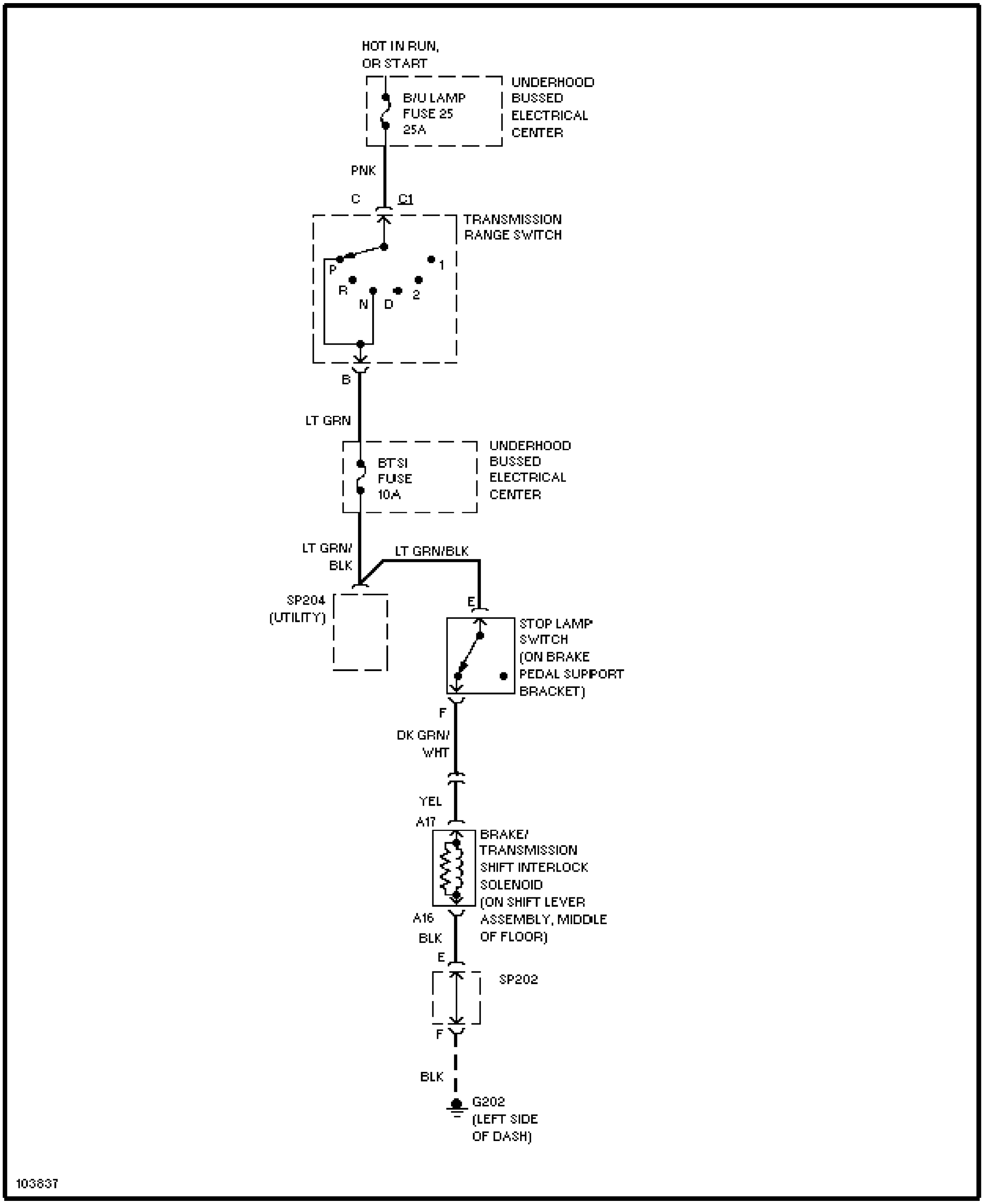


Fig. 4: Wiring Diagram (With Column Shift) (1998)

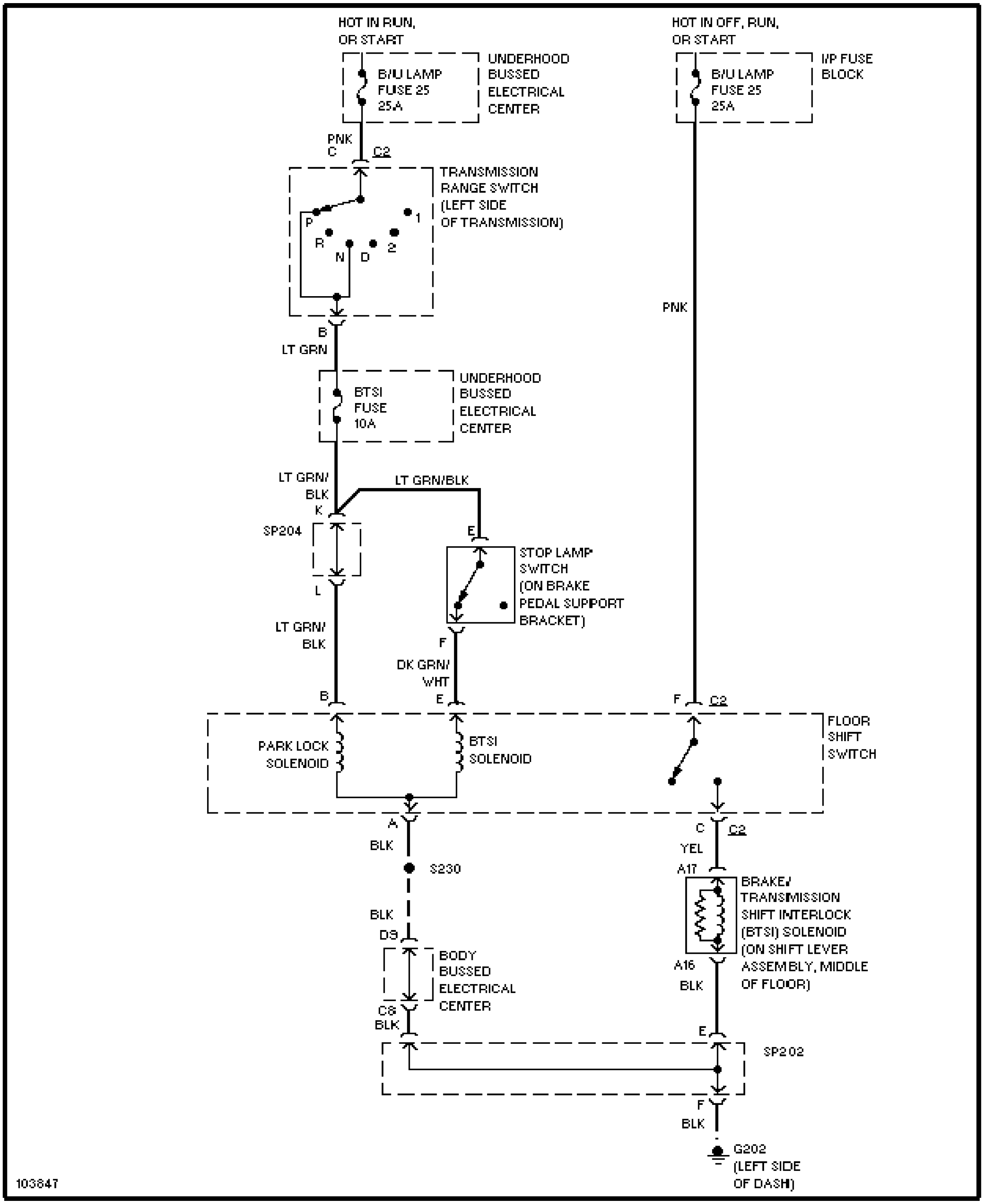


Fig. 5: Wiring Diagram (With Console Shift) (1998)

C - SPECIFICATIONS - 4.3L

1997 Chevrolet Blazer

1997 ENGINE PERFORMANCE
General Motors. - Service & Adjustment Specifications - 4.3L

Chevrolet; Blazer, S10 Pickup
GMC; Jimmy, Sonoma
Oldsmobile; Bravada

INTRODUCTION

Use this article to quickly find specifications related to servicing and on-vehicle adjustments. This article may be used for quick reference when you are familiar with proper adjustment procedures and only need a specification.

CAPACITIES

BATTERY SPECIFICATIONS TABLE

Cold Crank Amps @ 0°F (-18°C)	Reserve Capacity (Minutes)
525	90
690	90

FLUID CAPACITIES TABLE

Application	(1) Quantity - Qts. (L)
Crankcase	(2) 4.5 (4.3)
Cooling System (Includes Heater)	
With A/T	11.7 (11.1)
With M/T	11.9 (11.3)
Automatic Transmission (Dexron-III) (3)	
4L60-E	5.0 (4.7)
Manual Transmission	
NVG 3500	(4) 2.2 (2.0)
NVG 4500	(5) 4.0 (3.8)

(1) - Fluid capacities listed are approximate. Always fill to FULL mark.
(2) - Includes oil filter capacity.
(3) - Drain and refill capacity only. Does not include torque converter.
(4) - Synchromesh Transmission Fluid (GM 12345349).
(5) - Castrol Syntorq LT transmission fluid.

QUICK-SERVICE

SERVICE INTERVALS & SPECIFICATIONS

REPLACEMENT INTERVALS TABLE

Component	Interval (Miles)
Accessory Drive Belt	60,000
Air Cleaner	(1)

Engine Coolant	150,000
Fuel Filter	30,000
Oil & Filter	7500
Spark Plugs	100,000

(1) - No scheduled replacement interval available at time of publication. Check and replace as necessary.

BELT TENSION

BELT ADJUSTMENT TABLE

Application	Tension - Lbs. (kg)
All Models	(1)

(1) - Serpentine belt tension is maintained automatically by spring-tensioned idler pulley. Adjustment not necessary.

MECHANICAL CHECKS

ENGINE COMPRESSION

COMPRESSION RATIO TABLE

Application	Compression Ratio
4.3L (VIN W & X)	9.2:1

VALVE CLEARANCE

NOTE: All models are equipped with hydraulic lifters. Adjustments are not required.

IGNITION SYSTEM

IGNITION COIL

PICK-UP COIL RESISTANCE TABLE

Application	Ohms
All Models	500-1500

HIGH TENSION WIRE RESISTANCE

HIGH TENSION WIRE RESISTANCE TABLE

Application	Ohms
All Models	30,000 Maximum

SPARK PLUGS

SPARK PLUG TYPE TABLE

Application	Part No.
4.3L (VIN W & X)	AC 41-932

SPARK PLUG SPECIFICATIONS TABLE

Application	Gap In. (mm)	Torque Ft. Lbs. (N.m)
4.3L (VIN W & X)	.060 (1.52)	15 (20)

FIRING ORDER

NOTE: For firing order, see illustration. See Fig. 1.

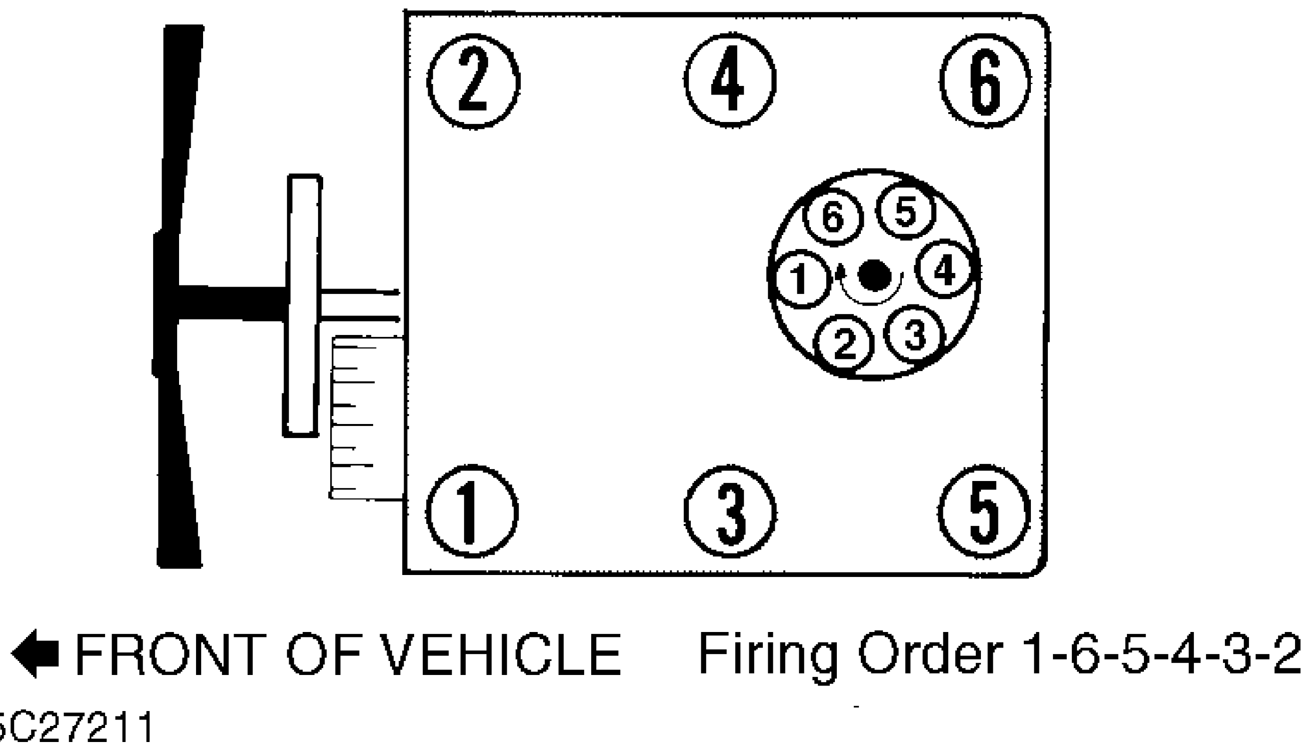


Fig. 1: Firing Order

IGNITION TIMING

NOTE: Ignition timing is controlled by control module and is not adjustable.

FUEL SYSTEM

FUEL PUMP

NOTE: Fuel pump performance is a measurement of fuel pressure and volume availability, not regulated fuel pressure.

FUEL PUMP PERFORMANCE TABLE

Application	psi (kg/cm^2)
4.3L (VIN W & X)	60-66 (4.2-4.6)

INJECTOR RESISTANCE

INJECTOR RESISTANCE SPECIFICATIONS TABLE (1)

Application	Ohms
All	11.8-12.6

(1) - Injector resistance specification is at 50-95°F (10-35°C).

IDLE SPEED & MIXTURE

NOTE: Idle mixture on fuel injected models is controlled by control module and is not adjustable. Controlled idle speed and IAC count can be checked using scan tool. See CONTROLLED IDLE SPEED & IAC COUNT table. For controlled idle speed adjustment procedures, see the D - ADJUSTMENTS - 4.3L article.

CONTROLLED IDLE SPEED & IAC COUNT TABLE

Application	Idle RPM	(1) IAC Counts
Under 8500 GVW		
Auto. Trans. (2)	565-615	50-30
Man. Trans. (3)	525-575	50-30
Over 8500 GVW		
Auto. Trans. (2)	625-675	50-30
Man. Trans. (3)	675-725	50-30

(1) - Add 2 counts for engines with less than 500 miles.
(2) - Automatic transmission in Drive.
(3) - Manual transmission in Neutral. Tech 1 scan tool will display "RDL" with transmission in Neutral.

THROTTLE POSITION (TP) SENSOR

TP sensor output voltage should be .85 volt or less at idle (closed throttle) and is not adjustable.

1997 ELECTRICAL
General Motors Corp. - Starters

Chevrolet; Blazer, "S" & "T" Pickup
GMC; Jimmy & Sonoma
Oldsmobile; Bravada

DESCRIPTION

When the ignition switch is turned to the START position, the Delco-Remy starter solenoid windings are energized. This causes the solenoid plunger to move the shift lever, which engages the pinion with the engine flywheel ring gear. The movement of the plunger also closes the main solenoid contacts, applying battery voltage to the starter motor. See Fig. 1.

When the engine starts, the pinion will overrun, protecting the armature from excessive speed and the flywheel from damage. When the ignition switch is released, the plunger return spring disengages the pinion.

On starters with the SD designation, used on gasoline engines only, the pinion is driven directly by the armature shaft. Wound field coils energize pole pieces that are arranged around the armature.

Starters with the PG designation, used on diesel or large displacement gasoline engines, have a pinion that is driven by a gear reduction system. These starters are easily identified by 3 Torx bolts that retain the solenoid. The PG starter should not be disassembled and is serviceable only by complete replacement.

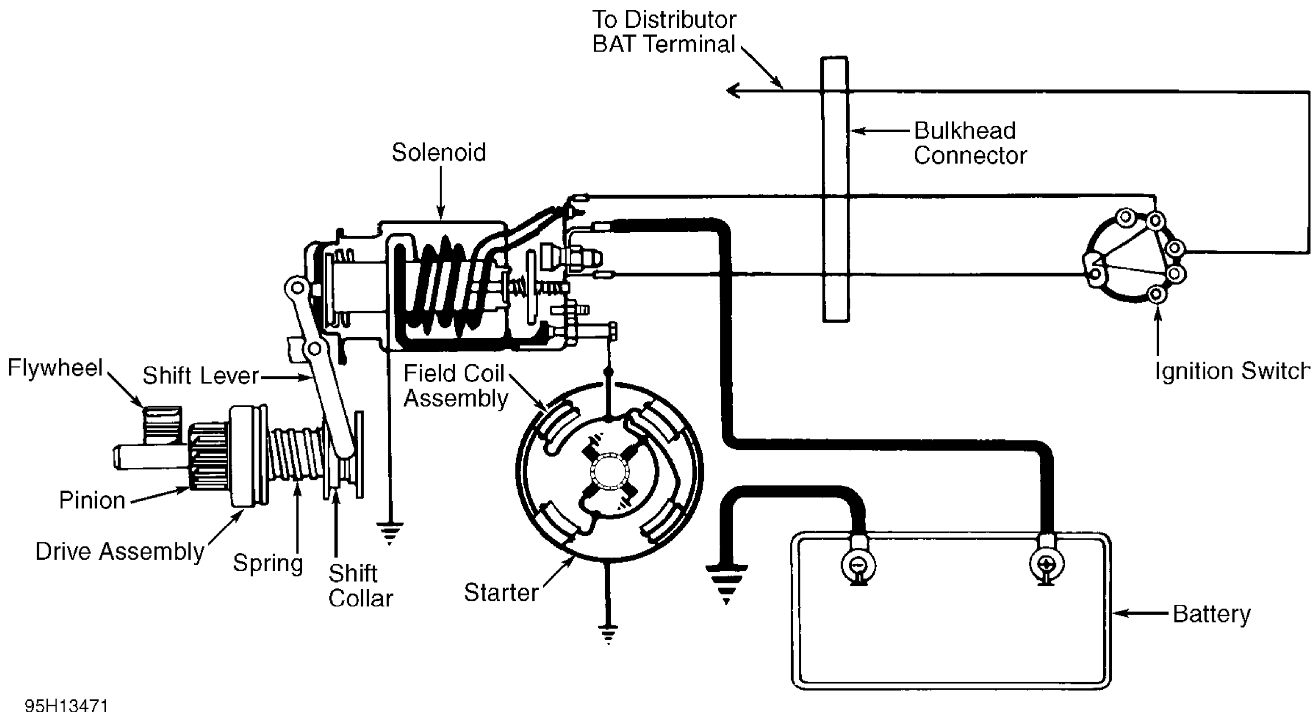


Fig. 1: Typical Cranking Circuit
Courtesy of General Motors Corp.

COMPONENT LOCATIONS

COMPONENT LOCATIONS

Component	Location
Battery Junction Block	Left Rear Of Engine Compartment
Clutch Pedal Position & Cruise Control Shutoff Switch	On Clutch Pedal Support Bracket
Instrument Panel Fuse Block	Left Side Of Instrument Panel
Transmission Range Switch	Left Side Of Automatic Transmission
Starter Relay	Center Rear Of Engine Compartment
Transfer Case Shift Control Module	Behind Center Of Instrument Panel

TROUBLE SHOOTING

NOTE: For information not covered in this article, see TROUBLE SHOOTING - BASIC PROCEDURES article in GENERAL INFORMATION.

TROUBLE SHOOTING HINTS

Note condition of SECURITY indicator light. If indicator stays on or flashes continuously troubleshoot anti-theft system. Check starter solenoid terminals and battery grounds. Check for proper installation of aftermarket electronic equipment. Perform self-diagnostic system test, to be certain no trouble codes are stored in PCM memory which may lead to misdiagnosis. See appropriate G - TESTS W/CODES article in ENGINE PERFORMANCE section. Refer to menu below.

* For 2.2L engines, see G - TESTS W/CODES - 2.2L
* For 4.3L engines, see G - TESTS W/CODES - 4.3L

Check Black fusible link located at generator, Blue fusible link located at battery and Black fusible link located at battery junction block. Check 10-amp CRANK No. 20 fuse, located in instrument panel fuse block. See COMPONENT LOCATIONS table.

STARTER NOISE

CAUTION: Never operate starter for periods of more than 15 seconds. Excessive cranking can cause starter to overheat. Allow starter to cool for at least 2 minutes after each time operated.

NOTE: Check flywheel ring gear for damage.

1) A high-pitched whine, heard while cranking (before engine starts), indicates excessive distance between starter pinion and flywheel. If high-pitched whine is heard after engine starts and key is released, distance between starter pinion and flywheel is too small. Locate high spot on flywheel before checking pinion-to-flywheel clearance. Pinion-to-flywheel clearance should be .020" (0.5 mm). See Fig. 2.

2) If loud, siren-like "whoop" sound is heard after the engine starts, drive assembly is likely defective. If "rumble", "growl" or "knock" is present as starter is coasting to a stop after starting engine, starter armature is bent or unbalanced.

3) If diagnosis indicates pinion should be closer to flywheel, ensure proper starter motor was installed. During initial starter motor installation, shim(s) are not used. If shim(s) are present, remove as necessary.

4) If diagnosis indicates starter should be moved away from flywheel, add shims as necessary. If using .039" (1.0 mm) long shims, do not exceed 2 shims. If using .015" (.38 mm) long shims, do not exceed 3 shims. If condition is not corrected, and pinion-to-flywheel clearance has been reached, short shims may be added to outer side of starter motor bolt using .015" (.38 mm) shims. For starter removal, see STARTER under REMOVAL & INSTALLATION.

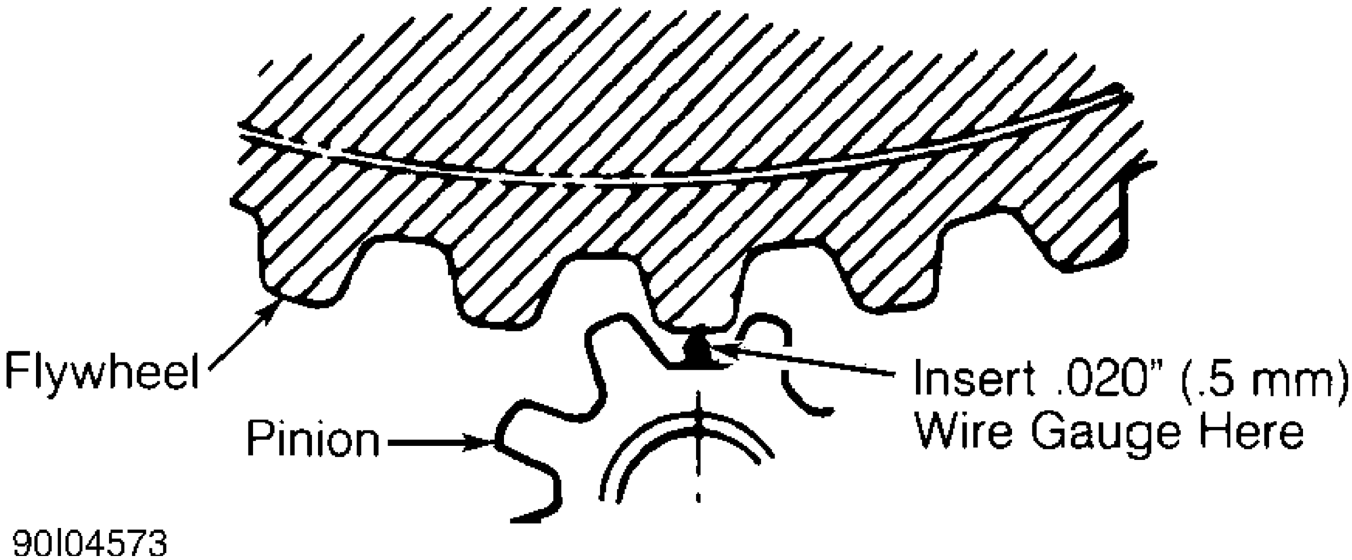


Fig. 2: Measuring Pinion-To-Flywheel Clearance
Courtesy of General Motors Corp.

ON-VEHICLE TESTING

WARNING: Vehicles are equipped with air bag supplemental restraint system. Before attempting ANY repairs involving steering column, instrument panel or related components, see SERVICE PRECAUTIONS and DISABLING & ACTIVATING AIR BAG SYSTEM in appropriate AIR BAG RESTRAINT SYSTEM article.

NOTE: The following tests assume that engine and battery are operating normally and are at operating temperatures, battery is charged, there are no engine problems that would cause a no-start condition, and no diagnostic trouble codes are present.

SLOW OR NO CRANK ONLY AFTER EXTENDED PERIODS OF VEHICLE NON-USE

There may be a parasitic load on electrical system. See PARASITIC LOAD EXPLANATION & TEST PROCEDURES article in GENERAL INFORMATION section.

ENGINE DOES NOT CRANK, STARTER SOLENOID DOES NOT CLICK

1) Place gear selector in Park (A/T) or depress clutch pedal (M/T). Place ignition switch to START position. Using a DVOM, measure voltage between starter solenoid connector terminal "S" (Purple wire)

and engine ground. If voltage is 9.6 volts or greater, go to next step. If voltage is lower than 9.6 volts, clean starter motor mounting blots, starter motor and mounting surface, and repeat test. If starter still does not engage, replace starter.

2) Remove starter relay from underhood fuse-relay center. See COMPONENT LOCATIONS table. Connect a test light, between starter relay connector terminal No. 30 and ground. If test light illuminates, check for an open in Purple wire between starter relay connector terminal No. 87 and starter solenoid terminal "S". If test light does not illuminate, check for open in Red wire along with Black fusible link between starter relay connector terminal No. 30 and generator. Also check for an open in Red wire along with Blue fusible link between battery positive terminal and generator.

3) Connect a fused jumper between starter relay terminals No. 85 and 86. Place gear selector in Park (A/T) or depress clutch pedal (M/T). Connect test light between starter relay connector terminal No. 86 and ground. Turn ignition switch to START position. If test light does not illuminate, go to next step. If test light illuminates check for an open in Black wire between starter relay connector terminal No. 86 and engine ground(s). See WIRING DIAGRAMS. If Black wire is okay replace, starter relay.

4) If vehicle is equipped with automatic transmission, go to next step. If vehicle is equipped with manual transmission, go to step 12)

5) Place gear selector in Park (A/T) or depress clutch pedal (M/T). Turn ignition switch to START position. Connect a test light between transmission range switch connector C1 terminal "G" (Yellow wire) and ground. If test light does not illuminate go to next step. If test light illuminates, check for an open in Yellow wire between transmission range switch connector C1 terminal "G" and starter relay connector terminal No. 85.

6) Turn ignition switch to START position. Connect a test light between transmission range switch connector C1 terminal "E" (Purple wire) and ground. If test light does not illuminate, go to next step. If test light illuminates, adjust or replace transmission switch.

7) Locate in line 7-pin Medium Gray C103 connector, located at left rear of engine compartment above brake booster. Disconnect 7-pin Medium Gray connector C103. Turn ignition switch to START position. Connect test light between female side of connector C103 terminal "A" (Purple wire) and ground. Turn ignition switch to START position. If test light does not illuminate, go to next step. If test light illuminates, check for an open in Purple wire between male side of connector C103 terminal "A" and transmission range switch connector C1 terminal "E".

8) Locate in line 56-pin Black C203 connector, located behind right side of instrument panel. Disconnect 56-pin Black connector C203. Turn ignition switch to START position. Connect test light between female side of connector C203 terminal A8 (Purple wire) and ground. Turn ignition switch to START position. If test light does not illuminate, go to next step. If test light illuminates, check for an open in Purple wire between male side of connector C203 terminal A8, female side of connector C103 terminal "A" and inflatable restraint diagnostic energy reserve module connector terminal B10.

9) Turn ignition switch to START position. Connect a test light between instrument panel fuse block connector terminal E1 (Purple wire) and ground. If test light does not illuminates, go to next step. If test light illuminates, check for an open in Purple wire between instrument panel fuse block connector terminal E1 and female side of connector C203 terminal A8. If wire is okay. replace 10-amp CRANK fuse No. 20.

10) Locate Black 48-pin connector C211, located at steering column harness. Backprobe Black 48-pin connector C211 terminal D1

(Yellow wire). See Fig. 3. Turn ignition switch to START position. Connect a test light between connector C211 terminal D1 (Yellow wire) and ground. If test light does not illuminate, go to next step. If test light illuminates, check for an open in Yellow wire between male side of connector C211 terminal D1 and instrument panel fuse block connector terminal D2.

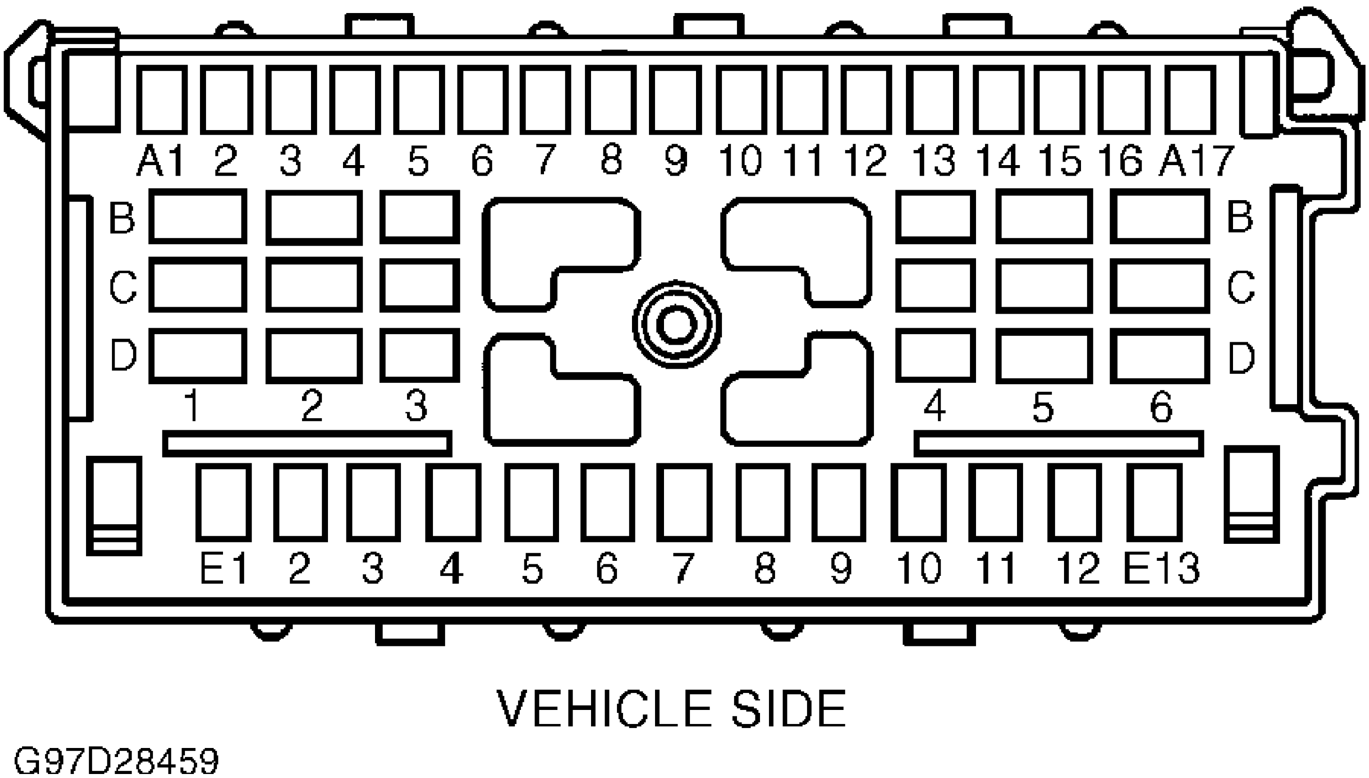


Fig. 3: Identifying Black 48-pin C211 Connector ("S" & "T" Series)
Courtesy of General Motors Corp.

11) Disconnect Black 48-pin connector C211. Turn ignition switch to START position. Connect test light between male side of connector C211 terminal D5 (Red wire) and ground. If test light does not illuminate, check for an open in Red wire between battery junction block Black fusible link and male side of connector C211 terminal D5. If Red wire is okay, replace battery junction block Black fusible link. If test light illuminates, replace ignition switch.

12) Locate Black 15-pin connector C102, located in at left rear of engine compartment above brake booster. Backprobe Black 15-pin connector C102 terminal "D" (Purple/White wire). See Fig. 4. Depress clutch pedal. Turn ignition switch to START position. Connect test light between connector C102 terminal "D" (Purple/White wire) and ground. If test light does not illuminate, go to next step. If test light illuminates, check for an open in Purple/White wire between male side of connector C102 terminal "D" and starter relay connector terminal No. 85.

13) Turn ignition switch to START position. Depress clutch pedal. Connect test light between clutch pedal position and cruise control shutoff switch connector terminal "C" (Purple/White wire) and ground. If test light does not illuminate, go to next step. If test light illuminates, check for an open in Purple/White wire between clutch pedal position and cruise control shutoff switch connector terminal "C", inflatable restrain shift control module connector terminal D16 and female side of connector C102 terminal "D".

14) Turn ignition switch to START position. Connect test light between clutch pedal position and cruise control shutoff switch connector terminal "A" (Purple wire) and ground. If test light does not illuminate, go to next step. If test light illuminates, replace clutch pedal position and cruise control shutoff switch.

15) Locate 56-pin Black C203 connector, located behind right side of instrument panel. Disconnect 56-pin Black connector C203. See Fig. 5. Turn ignition switch to START position. Connect test light betw een female side of connector C203 terminal A8 (Purple wire) and ground. If test light does not illuminate, go to step 9). If test light illuminates, check for an open in Purple wire between male side of connector C203 terminal A8, clutch pedal position and cruise control shutoff switch connector terminal "A" and transfer case shift control module D16.

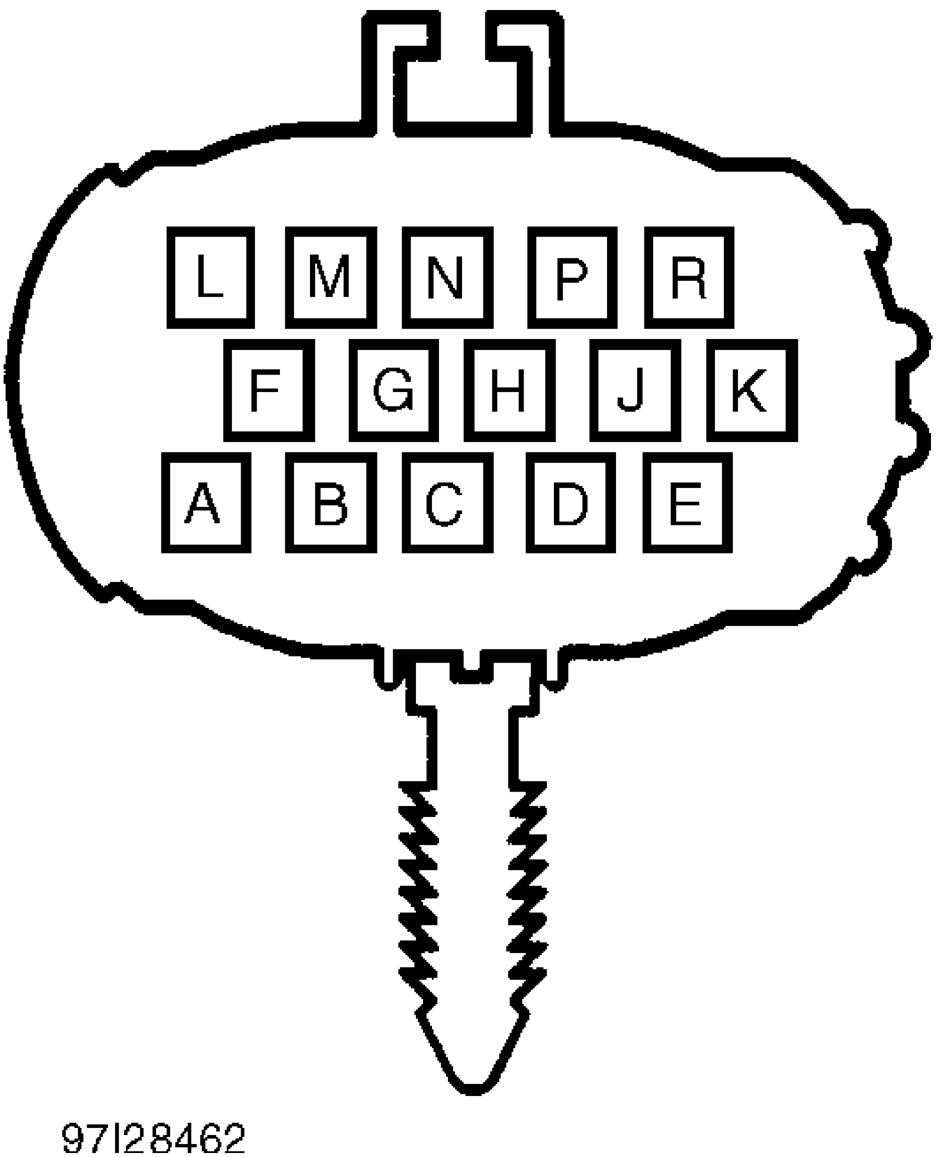


Fig. 4: Identifying Black 15-pin Connector C102 ("S" & "T" Series - M/T Only)
Courtesy of General Motors Corp.

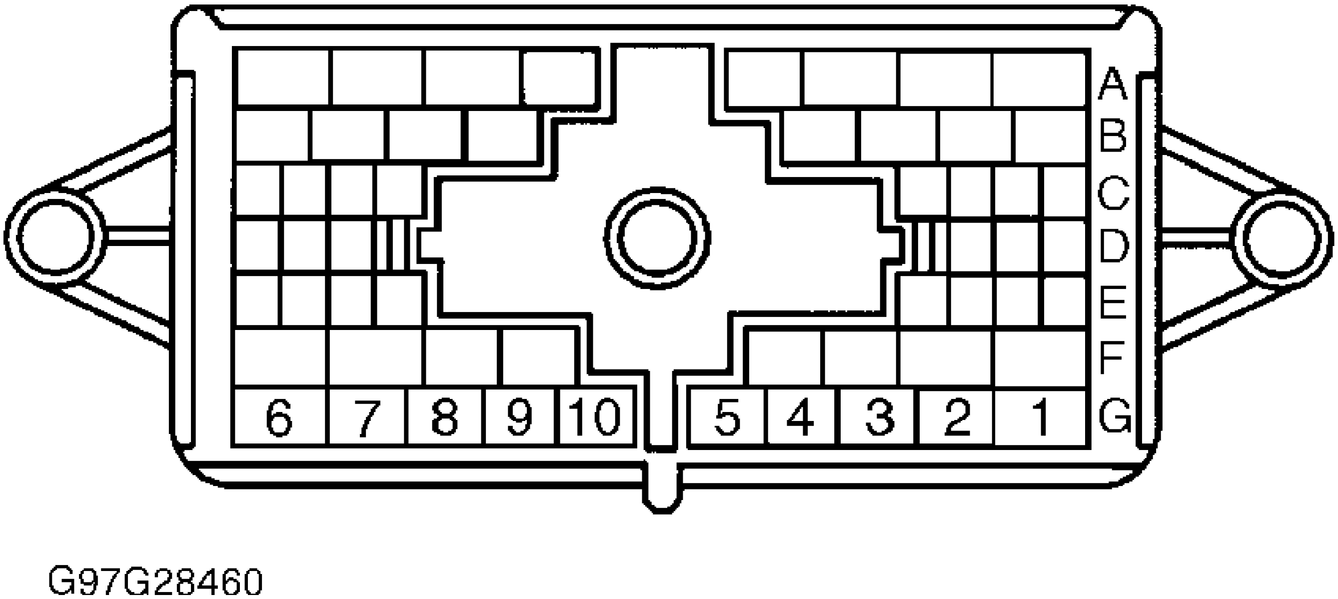


Fig. 5: Identifying 56-pin Black C203 Connector ("S" & "T" Series)
Courtesy of General Motors Corp.

SOLENOID CLICKS, ENGINE DOES NOT CRANK

1) Remove 20-amp ECM IGN fuse No. 10 from instrument panel fuse block. Turn ignition switch to START position and hold for 15 seconds. Using a DVOM, measure voltage between battery negative and positive terminals. If voltage is more than 9,5 volts, go to next step. If voltage is less 9.5 volts or less, perform battery load test. If battery is okay, go to next step. If battery fails load test, replace battery and recheck symptom.

2) Turn ignition switch to START position. Using a DVOM, measure voltage between generator terminal (Red wire) and engine ground. If voltage is more than .5 volts, replace Black wire between generator and starter relay connector terminal No. 30 including Black fusible link, and recheck symptom. If voltage is .5 volts or less, go to next step.

3) Turn ignition switch to START position. Using a DVOM, measure voltage between generator terminal (Red wire) and battery negative terminal. If voltage is more than .5 volts, replace negative battery cable. If voltage is .5 volts or less, go to next step.

4) Turn ignition switch to START position. Using a DVOM, measure voltage between battery positive terminal and ground. If voltage is more than .5 volts, replace positive battery cable. If voltage is .5 volts or less, clean starter motor mounting blots, starter motor and mounting surface, and repeat test. IF starter still does not engage, replace starter and recheck symptom.

BENCH TESTING

PRELIMINARY TESTS

NOTE: On PG260 starter motor, starter is serviced as an assembly. If test values do not meet specifications, replace starter and solenoid as an assembly.

Remove starter from vehicle. See STARTER under REMOVAL & INSTALLATION. Check starter for damage such as broken or stripped electrical terminals, broken or cracked drive end housing, etc.. If no obvious damage is found, perform starter no-load test and pinion clearance check before disassembling starter motor.

SOLENOID WINDINGS TESTS

NOTE: To prevent overheating, DO NOT allow solenoid pull-in current to flow for more than 15 seconds.

NOTE: Current flow will decrease as windings heat up.

Hold-In Windings Test

1) If solenoid is not removed from starter motor assembly, disconnect field lead from terminal "M" on solenoid and insulate field lead from solenoid motor terminal. Connect an ammeter and switch in series with 12-volt battery and starter solenoid terminal "S" as illustrated. See Fig. 6. Connect a voltmeter between solenoid terminal "S" and ground. Connect a carbon pile across battery.

2) Turn switch on and quickly adjust carbon pile load until voltage reads as specified. See PULL-IN WINDINGS SPECIFICATIONS table. Check ammeter reading. Turn off carbon pile and open switch. At 10 volts reading should be 10-20 amps. If amperage reading is not as specified, replace starter solenoid.

Pull-In Windings Test

Connect test equipment as in hold-in windings test. See HOLD-IN WINDINGS TEST. See Fig. 6. Ground starter solenoid terminal "M". Turn switch on and quickly adjust carbon pile load until voltage reads as specified. Check ammeter reading. Turn off carbon pile and open switch. At 10 volts reading should be 60-85 amps. If ammeter reading is not as specified, replace starter solenoid.

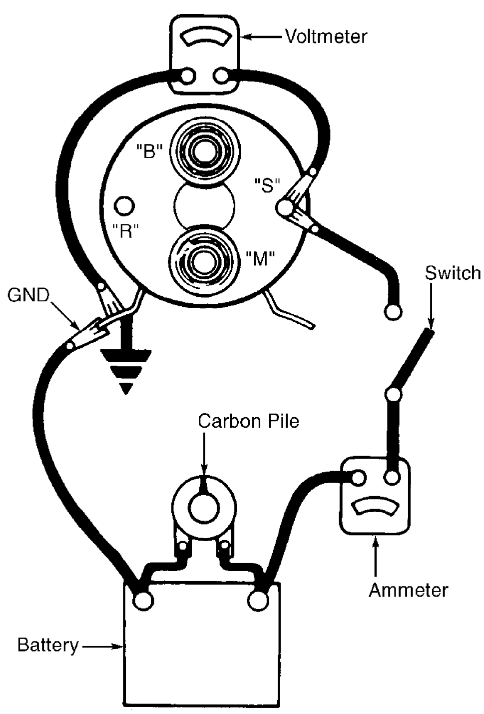


Fig. 6: Solenoid Winding Test Connections
Courtesy of General Motors Corp.

STARTER NO-LOAD TEST

CAUTION: DO NOT apply more voltage than specified. Excessive voltage may cause armature to throw windings due to excessive speed.

1) Secure starter in vise. Turn carbon pile off and open switch. Connect test equipment to starter as illustrated. See Fig. 7. Turn switch on and adjust carbon pile until voltage reads as specified. See STARTER NO-LOAD TEST SPECIFICATIONS table. Check ammeter reading and pinion speed on RPM indicator. Turn off carbon pile and open switch. Compare RPM and amperage readings with specifications. See STARTER NO-LOAD TEST SPECIFICATIONS table.

2) If amperage and RPM readings are as specified, starter motor is okay. If test indicates low free speed and/or high current draw, unit may have tight, dirty or worn bearings or bushings, shorted or grounded armature, or a grounded field.

3) High current draw with pinion moving into cranking position but no pinion rotation indicates a direct ground in field, or frozen bearings or bushings. No pinion movement and a normal current reading indicates plunger is unable to move into solenoid or drive is unable to move on armature shaft. No pinion movement and very low or no current draw indicates an open or ground in solenoid windings.

4) Pinion moving into cranking position but not turning and very low current draw indicates an open in field circuit or armature windings, or no current flow between solenoid battery and motor field terminals while motor is engaged. Connect a jumper wire between solenoid battery and motor field terminal "M". If motor now turns at specified RPM, replace solenoid.

5) Low no-load and low current draw indicates high internal resistance due to poor brush lead connections; a dirty commutator; an open in armature windings; broken, worn or weak brush springs; or worn, damaged or dirty brushes. High no-load speed and high current draw indicates shorted field coils or shorted armature windings. If starter vibrates or is noisy, armature may be rubbing against inside of frame and field.

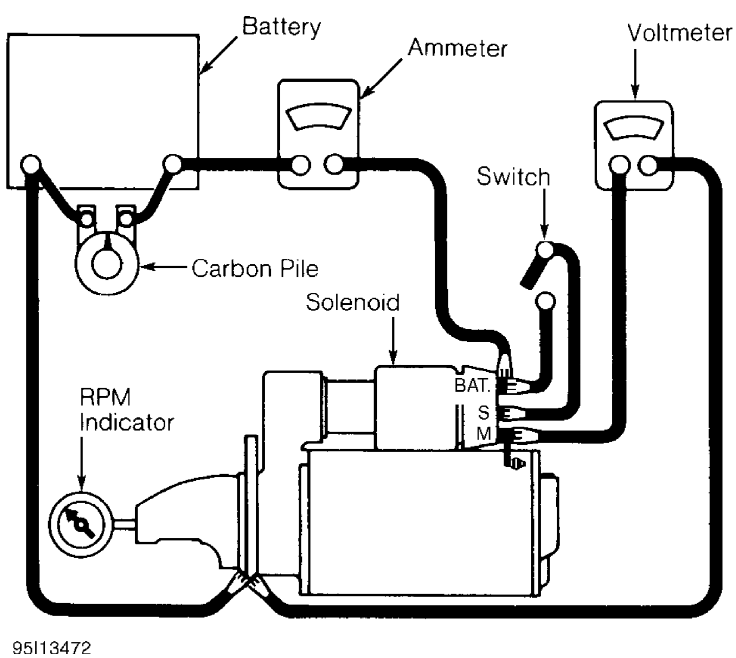


Fig. 7: Starter No-Load Test Connections
Courtesy of General Motors Corp.

STARTER NO-LOAD TEST SPECIFICATIONS

Application	Starter RPM	(1) Amps
2.2L		
SD205	52-76	6,000-12,900
4.3L		
PG260	(1) 50-62	8,500-10,700

(1) - At 10 volts.

PULL-IN WINDINGS SPECIFICATIONS

Application	Starter Motor	Amps
2.2L	SD205	(1) 60-85
4.3L	PG260	(2) 30-50

(1) - At 10 volts.
(2) - At 11.5 volts.

ARMATURE TEST

NOTE: Any ball bearings that are removed from armature must be replaced with new bearings.

1) Inspect solder joints between armature windings and commutator bars. If any have come loose, replace armature. If commutator is rough or damaged, replace armature. DO NOT turn commutator in lathe or undercut spaces between bars. If commutator is dirty, clean with 400 grit emery cloth and blow away any copper dust.

2) Using growler, check armature for shorts. Hold a flat steel strip on armature parallel to armature core or shaft. Rotate armature in growler. Steel strip will vibrate on area of short circuit.

3) Using self-powered test light, place one lead on armature shaft and other lead on commutator. Test light should not illuminate. If test light illuminates, armature is shorted or grounded and must be replaced.

4) If no-load test indicated armature may be rubbing against inside of frame and field assembly, inspect outside of armature for signs of rubbing. If armature is scored only on one side of laminations, armature shaft may be bent and armature should be replaced. If scoring is all around armature laminations, check frame and field assembly for an out-of-position pole or for a foreign object lodged inside. Repair or replace frame and field assembly.

CAUTION: Some starters have a molded-type commutator. DO NOT undercut insulation as it may cause serious damage to commutator.

FIELD COIL OPEN TEST

Remove armature from frame and field assembly. Using self-powered test light, place one lead on field lead connection and other lead on one insulated brush. See Fig. 8. Test light should illuminate. If test light does not illuminate, field coil is open. Repair or replace field and frame assembly. Repeat test for each insulated brush.

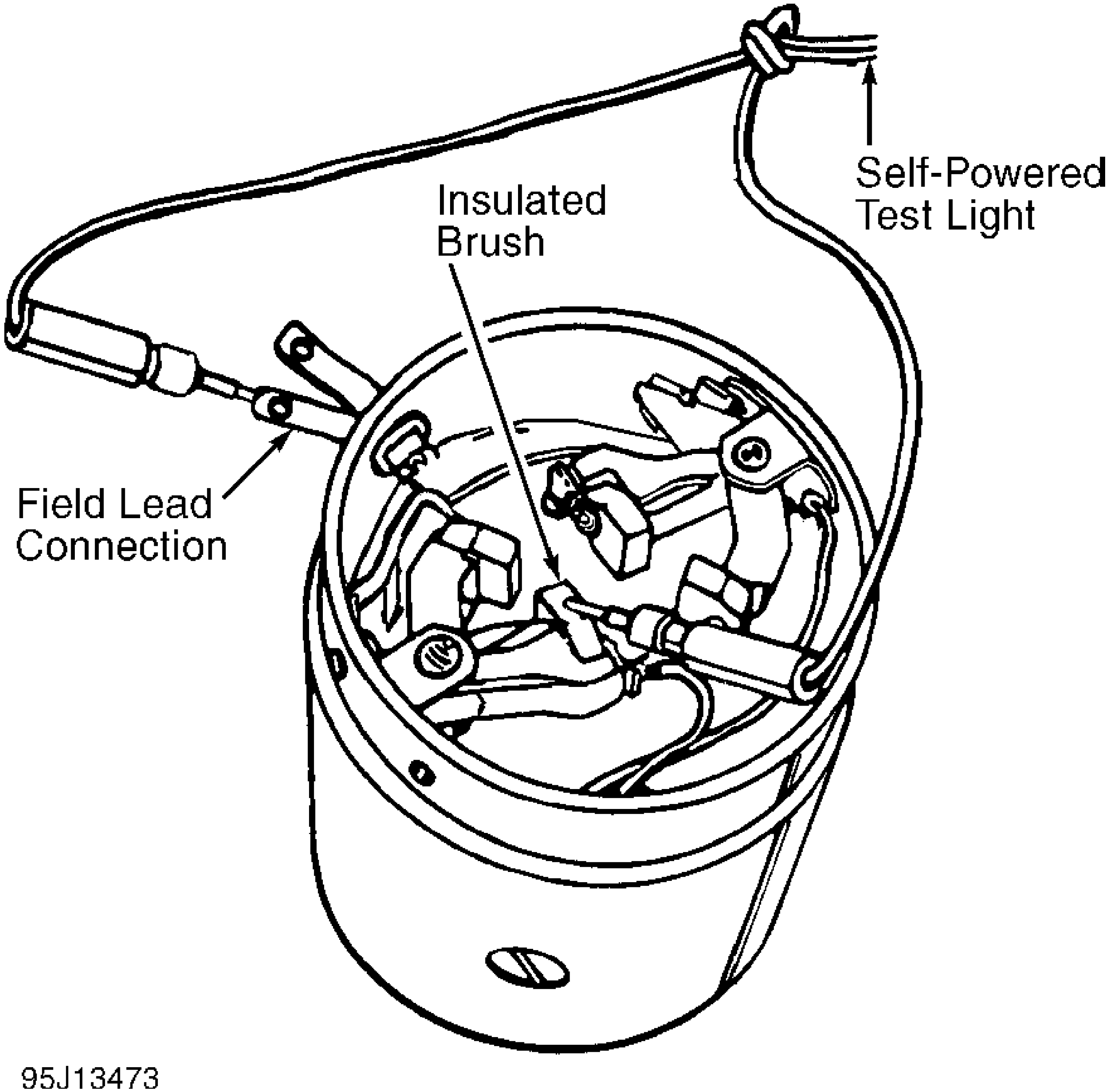


Fig. 8: Testing Field Coil For Open
Courtesy of General Motors Corp.

FIELD COIL GROUND TEST

Remove armature from field and frame assembly. On starters with shunt lead, separate field and shunt lead connections during test. Ensure field lead connection is NOT touching ground during test. Using self-powered test light, place one lead on grounded brush holder and other lead on one insulated brush. See Fig. 9. Test light should not illuminate. If test light illuminates, field coil is grounded. Repair or replace field and frame assembly. Repeat test for each insulated brush.

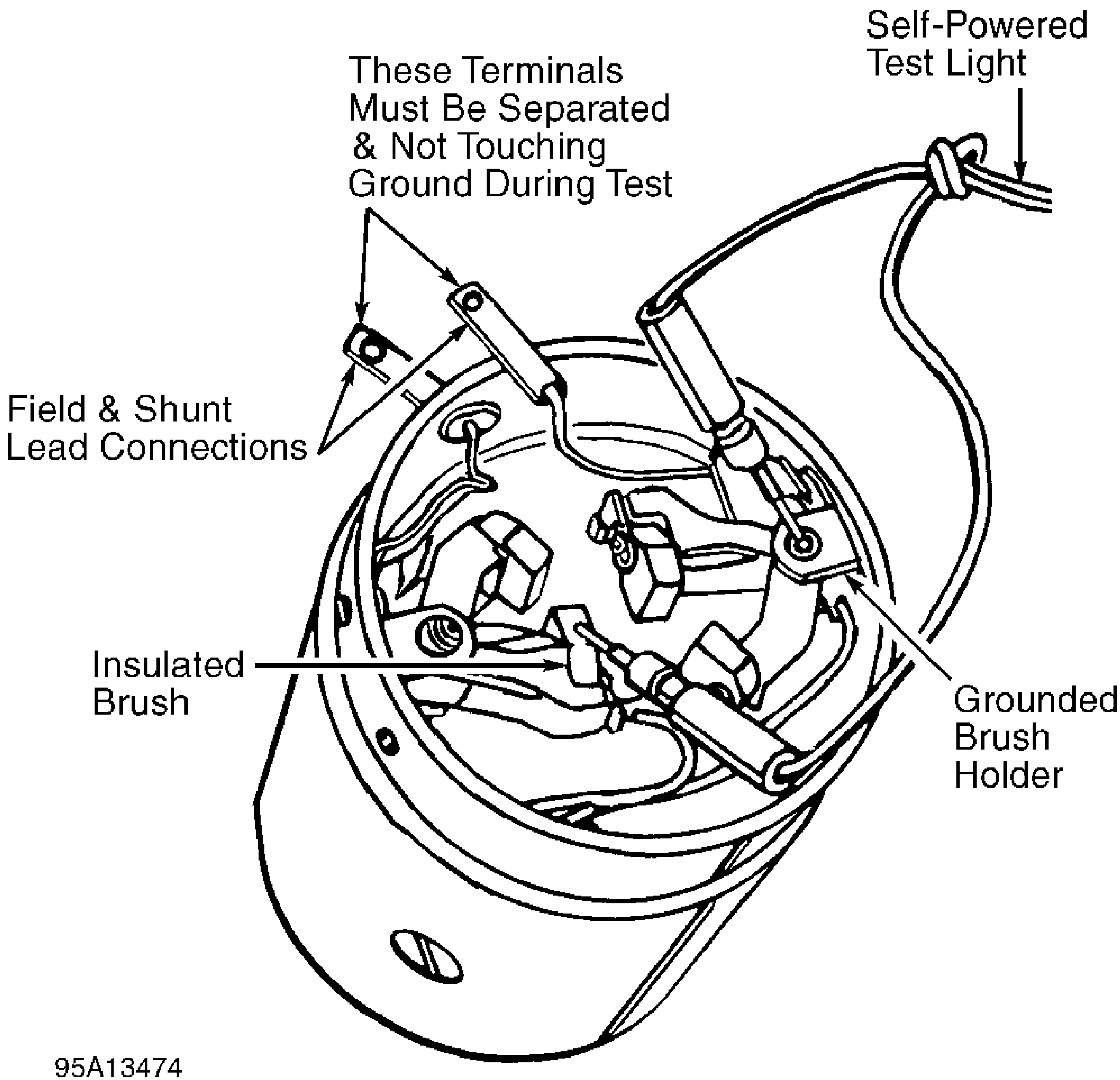


Fig. 9: Testing Field Coil For Ground
Courtesy of General Motors Corp.

BRUSHES, SPRINGS & HOLDERS CHECK

If any brushes are damaged (oil-soaked or pitted) or worn more than 90 percent, replace, frame and fields. If brushes are not damaged and still have more than 50 percent of brush material left, use a soft cloth to clean contact face of brushes. Check brush spring tension and replace springs if weak, discolored or distorted. Ensure brush holders are clean and brushes are not binding in holders. Ensure full surface of brush contacts commutator for proper performance.

COMMUTATOR END FRAME & BEARING

Replace armature assembly is commutator outer diameter is less than 1.378" (36 mm) or if undercut depth is less than .008" (.2 mm). Do not undercut insulation. Ensure commutator end bearing has not spun in frame. If bearing has spun, replace frame and bearing. Do not lubricate bearing. If bearing is dry or damaged, replace bearing. Install new bearing no deeper then .080 in (2.1 mm).

DRIVE END HOUSING & BEARING

Ensure drive end bearing has not spun in housing. If bearing has spun, replace housing and bearing. Do not lubricate bearing. If bearing is dry or damaged, replace bearing. Install new bearing no deeper then .010 in (.4 mm).

DRIVE ASSEMBLY CHECK

1) Check pinion teeth for chips, cracks or excessive wear. If pinion teeth are damaged, replace drive assembly. Also check flywheel for damage. Check drive assembly for slipping before disassembly from armature. With drive assembly attached to armature, cover armature with shop towels and secure in a vise.

2) Using a 12-point socket and a torque wrench, turn pinion counterclockwise. Pinion should lock and withstand a torque of 50 ft. lbs. (68 N.m) without slipping. If pinion slips before 50 ft. lbs. (68 N.m) is reached, replace drive assembly.

3) Using a 12-point socket and a torque wrench, turn pinion clockwise. Pinion should turn freely in overrunning direction (clockwise) only. If pinion does not turn freely in clockwise direction, replace drive assembly.

PINION CLEARANCE CHECK

NOTE: Pinion clearance is not adjustable. If clearance is not within specification, disassemble and check starter motor for worn or damaged components.

1) Secure starter motor in vise with opening in housing accessible for measurement. Disconnect field lead at solenoid terminal "M" and insulate from solenoid field terminal "M". Connect battery negative terminal lead to starter frame. Connect 12 volts to starter solenoid terminal "S". Momentarily touch jumper lead from starter solenoid terminal "M" to starter frame, shifting pinion into cranking position.

2) Push pinion as far as possible away from retainer. Using a feeler gauge, ensure there is .010-.160" (.25-4.06 mm) clearance between pinion and retainer. See Fig. 10.

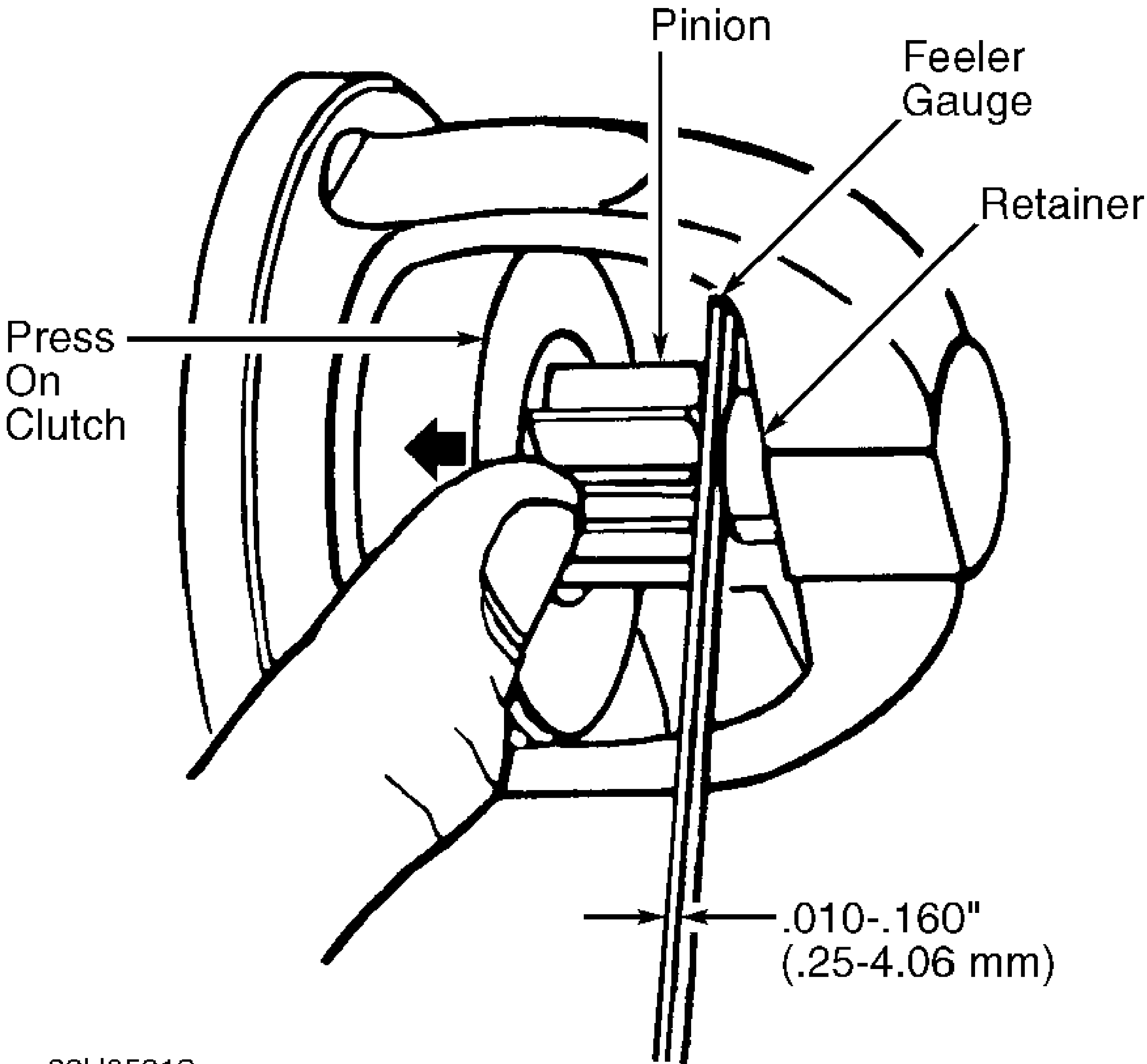


Fig. 10: Checking Pinion Clearance
Courtesy of General Motors Corp.

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. See COMPUTER RELEARN PROCEDURES article in GENERAL INFORMATION before disconnecting battery.

NOTE: Vehicles are designed for starter mounting without shims. A short shim or long shims may have been added to correct a noise or engagement condition. When installing starter any previously installed shims should be replaced in original location to ensure proper pinion to flywheel clearance.

STARTER

Removal

On all engines, disconnect negative battery cable. Raise and support vehicle.

On 2.2L engine, remove front exhaust pipe. Remove brace rod from front of engine to clutch housing. Remove starter heat shield. Remove starter solenoid terminal "S" nut and battery cable nut. Separate wiring from starter. Remove brush end bracket attaching bolt. Remove starter mounting bolts. Remove shims and note arrangement for reassembly. If necessary remove brush end bracket from starter.

On 4.3L engine, remove front exhaust pipe. Remove starter solenoid terminal "S" nut and battery cable nut. Separate wiring from starter. Remove starter mounting bolts. Remove shims and note arrangement for reassembly.

On 4.3L 4WD, disconnect engine mounts. Raise and support engine. Remove transmission mount and support transmission assembly. Remove starter mounting bolts. Remove shims and note arrangement for reassembly. Remove starter solenoid terminal "S" nut and battery cable nut. Separate wiring from starter.

On 4WD Utility, remove starter solenoid terminal "S" nut and battery cable nut. Separate wiring from starter. If equipped remove transfer case shield. Remove bolts and two brackets holding brake pipe to transmission crossmember. Remove transmission crossmember attaching bolts. Remove transmission mount bolts and support transmission assembly. Slide transmission crossmember out of way. Remove bracket that holds transmission fluid cooler lines to flywheel housing. Remove brace rod to flywheel housing and lower flywheel housing. Remove starter mounting bolts. Remove shims and note arrangement for reassembly.

Installation

To install, reverse removal procedure. Ensure shims are installed in original location. Tighten starter mounting bolts to specification. See TORQUE SPECIFICATIONS.

OVERHAUL

STARTER & SOLENOID

CAUTION: DO NOT clean starter in digressing tank or with grease dissolving solvents. This will remove lubricant from clutch mechanism, and damage insulation on armature and field coil.

NOTE: When reassembleing starter and solenoid, use grease (10477431) for lubrication. Use of other greases may cause starter failure.

NOTE: On PG260 starter motor, starter and solenoid are not overhauled and are replaced as a complete assembly.

Disassembly

1) Remove solenoid by turning 90 degrees pulling solenoid out of starter. If shaft needs to be drilled out, a new shaft and retaining ring will be needed for reassembly. Check starter drive for slippage before removing from armature shaft. Pinion stop color ring is not re-used. See Figs. 11 and 12.

Assembly

1) Apply a small amount of lubricant to armature shaft and to starter drive contact points. Use 2 sets of pliers to snap pinion stop collar over retainer ring. Lubricate solenoid core with grease. Apply grease evenly around inside edge or solenoid core. Apply thickly to first 1/2 (13 mm) inside edge of core. Plunger movement will distribute grease properly. Soak new drive end bushing in oil, before installation, for at least 30 minutes. To install, reverse removal procedure.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Start Mounting Bracket-To-Engine Bolts (2.2L)	
2WD Sonoma & "S" Series Pickup	33 (45)
Starter Mounting Bolts	
"S" Series Pickup	33 (45)
"S" & "T" Series Blazer	35 (47)
"T" Series Pickup	35 (47)
	In. Lbs. (N.m)
Solenoid To Starter Bolts & Screws	70 (7)
Solenoid Terminals Inner Nuts	71 (8)

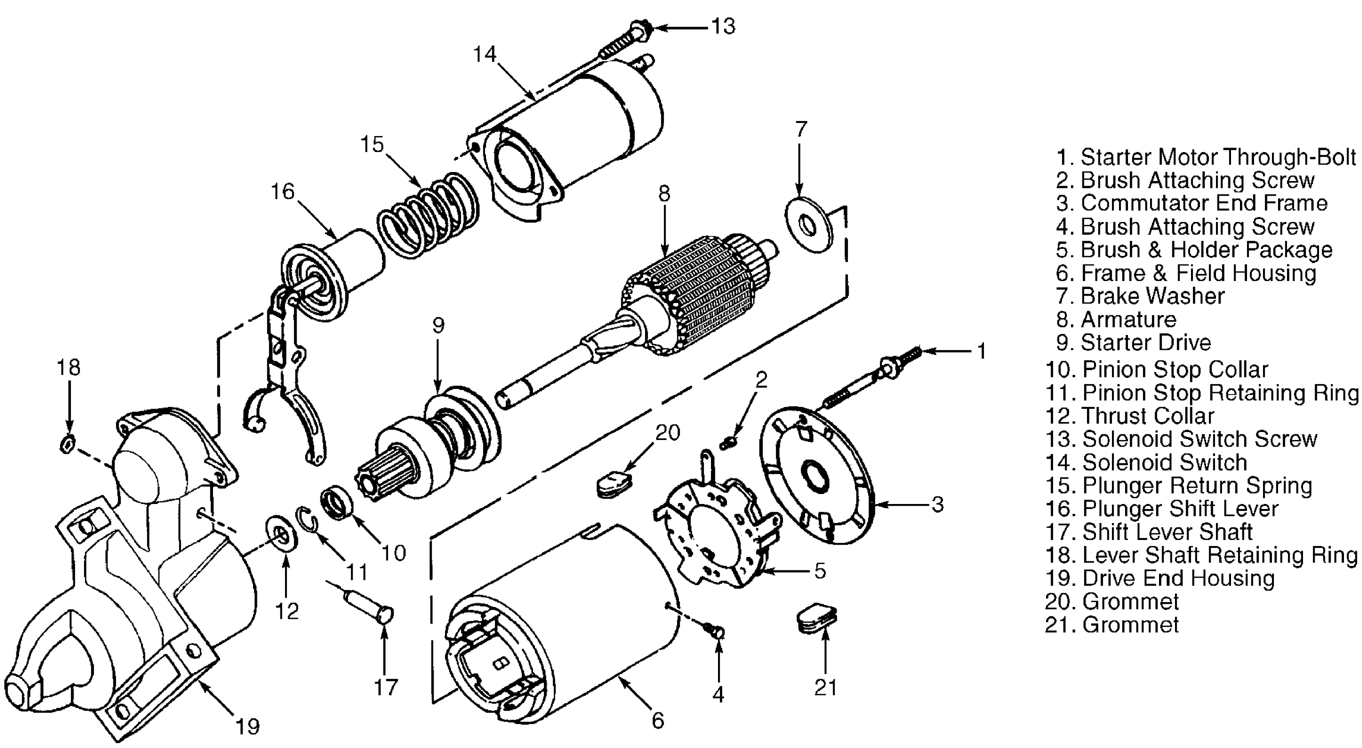
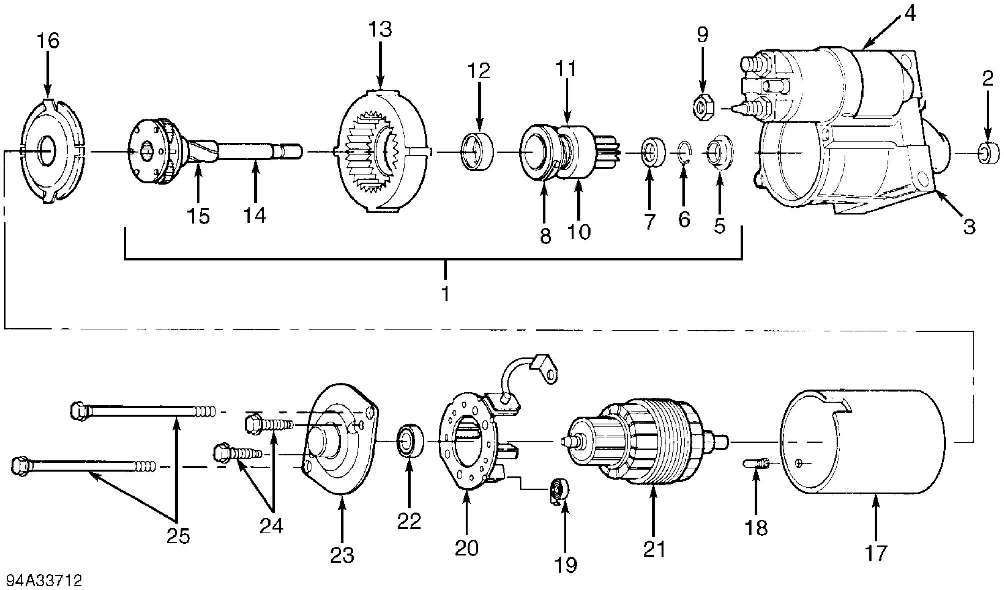


Fig. 11: Exploded View Of Delco-Remy Starter Motor (SD205 & SD255)
Courtesy of General Motors Corp.



1. Starter Drive & Shaft Assembly
2. Shaft Drive End Bearing
3. Starter Drive Housing
4. Solenoid Switch
5. Starter Drive Thrust Collar
6. Drive Stop Collar Retainer
7. Drive Stop Collar
8. Shift Collar Pin
9. Solenoid Switch Outer Nut
10. Starter Drive Clutch
11. Starter Drive Assembly
12. Bushing
13. Internal Tooth Gear
14. Shaft
15. Shaft & Gear Assembly
16. Planetary Gears Shield
17. Frame & Field
18. Starter Drain Tube
19. Brush Spring
20. Brush Holder Assembly
21. Armature
22. Commutator End Bearing
23. Commutator End Frame
24. Brush Holder Assembly Screw
25. Through-Bolt

Fig. 12: Exploded View Of Delco-Remy Starter Motor (PG250)
Courtesy of General Motors Corp.

WIRING DIAGRAMS

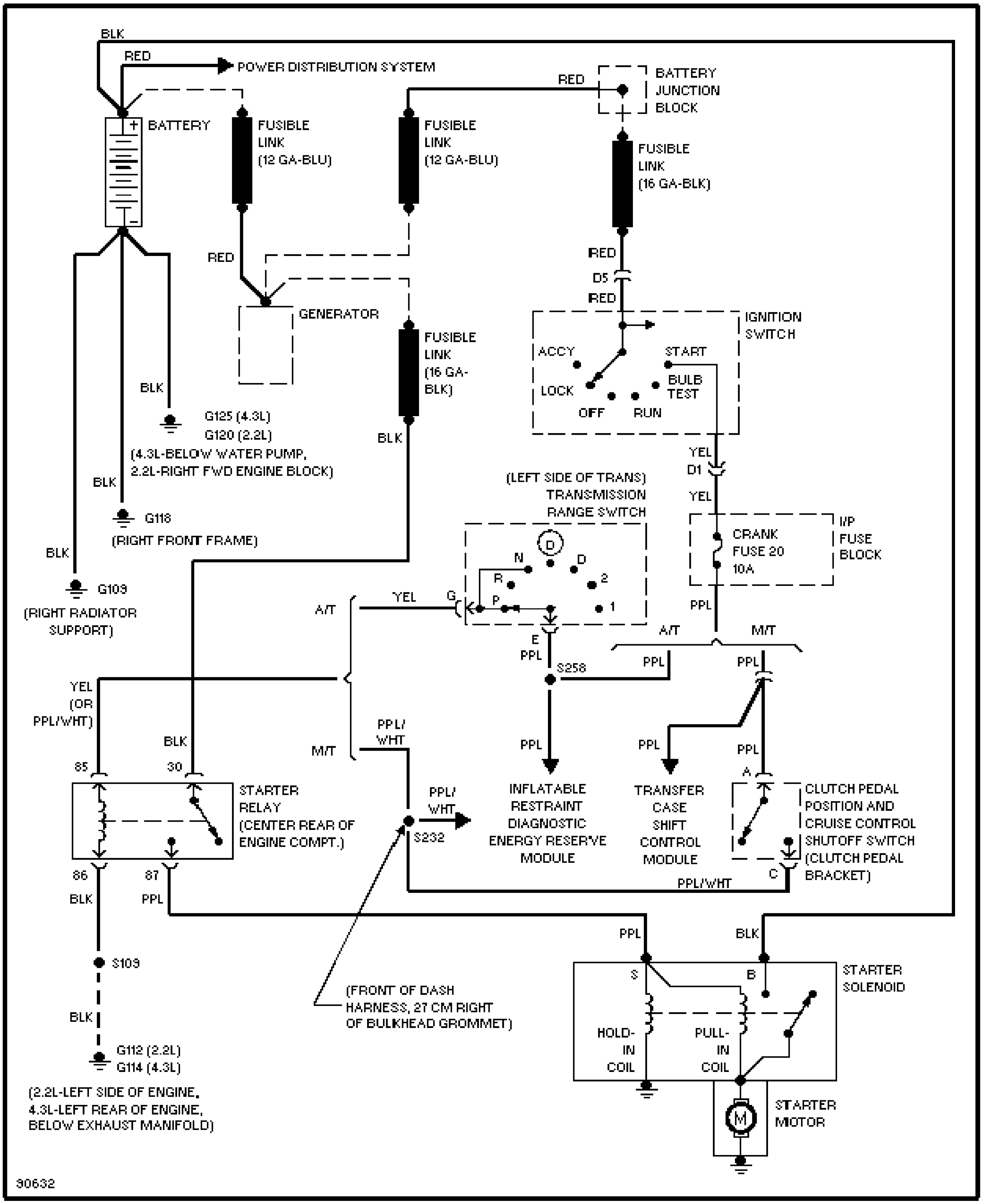


Fig. 13: Starting System Wiring Diagram (Blazer, Bravada, Jimmy, "S" & "T" Pickup, Sonoma)

STEERING COLUMN SWITCHES

1997 Chevrolet Blazer

1997 ACCESSORIES/SAFETY EQUIP
General Motors Corp. - Steering Column Switches

Chevrolet; Blazer, "S" & "T" Pickup
GMC; Jimmy & Sonoma
Oldsmobile; Bravada

DESCRIPTION

WARNING: Deactivate air bag system before performing any service operation. See AIR BAG RESTRAINT SYSTEM article. Do not apply electrical power to any component on steering column without first deactivating air bag system. Air bag may deploy.

Steering columns are designated as fixed-column or tilt-column, and as column-shift or floor-shift. Column-shift and floor-shift columns are basically the same except for shift lever and related components. Multifunction switch (located on left side of column) incorporates the wiper/washer and cruise control switches, and acts as a mechanical link to hazard and turn signal switches.

ADJUSTMENTS

PARK LOCK CABLE

Column Shift

Ensure gear shift lever is in Park. Turn lock cylinder to OFF-LOCK position and remove key. Using Park Lock Cable Pliers (J-41396), unlock adjuster ring on cable assembly. Pull on cable until park lock latch contacts gear shift lever. Release cable. Using park lock cable pliers, lock adjuster ring securely in place.

TESTING

NOTE: For cruise control switch testing, see CRUISE CONTROL SYSTEM article. For wiper/washer switch testing, see WIPER/WASHER SYSTEM article.

HORN SYSTEM

Horns Inoperative

1) Connect test light between ground and horn relay terminal C3 (Orange wire). Connect test light between ground and horn relay terminal C4 (Orange wire). If test light illuminates in both positions, go to next step. If test light does not illuminate in both positions, repair open in appropriate Orange wire between horn relay and instrument panel fuse block.

2) Connect test light between horn relay terminals C4 (Orange wire) and A3 (Black wire). Press horn button. If test light illuminates, go to next step. If test light does not illuminate, go to step 4).

3) Connect a fused jumper wire between horn relay terminals C4 (Orange wire) and A4 (Dark Green wire). If horns do not sound, go to step 5). If horns sound, replace horn relay.

4) Connect test light between horn relay terminal C3 (Orange wire) and horn slip ring connector. Press horn button. If test light does not illuminate, replace horn switch. If test light illuminates, repair open in Black wire between horn relay and horn switch.

5) Using DVOM, check for continuity between horn relay terminal A4 (Dark Green wire) and horn connector terminal "B" (Dark Green wire). If continuity exists, go to next step. If continuity does not exist, repair open in Dark Green wire between horn relay and horn.

6) Check for continuity between ground and each horn connector terminal "A" (Black wire). If continuity exists, replace both horns. If continuity does not exist, repair open in Black wire between horn and ground.

Horns Sound At All Times

1) Remove horn relay, located in relay center behind glove box. If horns stop sounding, go to next step. If horns do not stop sounding, repair short to voltage in Dark Green wire between horn relay and horn.

2) Connect test light between horn relay terminals C3 (Orange wire) and A3 (Black wire) at relay center. If test light illuminates, go to next step. If test light does not illuminate, replace horn relay.

3) Disconnect horn switch. If test light does not illuminate, replace horn switch. If test light illuminates, repair short to ground in Black wire between horn relay and horn switch.

One Horn Inoperative

1) Disconnect inoperative horn. Connect test light between ground and horn harness terminal "B" (Dark Green wire). Press horn button. If test light illuminates, go to next step. If test light does not illuminate, repair open in appropriate Dark Green wire between horn and horn relay.

2) Connect test light between inoperative horn harness connector terminals "B" (Dark Green wire) and "A" (Black wire). If test light does not illuminate, repair open in Black wire between horn and ground. If test light illuminates, check for poor connections at horn. If connections are okay, replace horn.

Fuse Blows When Horn Button Is Pressed

1) Replace CTSY fuse (20-amp) located in instrument panel fuse block. Disconnect horn connector terminal "B" (Dark Green wire) from both horns. Press horn button. If fuse is okay, go to next step. If fuse blows again, repair short to ground in Dark Green wire between horn relay and horns.

2) Reinstall right horn. Press horn button. If fuse blows, replace right horn. If fuse does not blow, replace left horn.

IGNITION SWITCH

Turn ignition off. Disconnect steering column switch 48-pin connector located on steering column. Using DVOM, check for continuity between specified terminals with ignition switch in specified position. See IGNITION SWITCH CONTINUITY TEST table. See Fig. 1. If continuity does not exist as indicated, repair as necessary.

IGNITION SWITCH CONTINUITY TEST TABLE

Switch Position	Continuity Between Terminals (Wire Color)
ACC	D2 (RED), D5 (RED) & D6 (BRN)
OFF	.....
RUN	D2 (RED), D5 (RED) & D6 (BRN);
	D2 (RED), D5 (RED) & C6 (ORG);
	D2 (RED), D5 (RED) & C5 (PNK);
	D2 (RED), D5 (RED) & C1 (PNK/WHT Or WHT)
START	D2 (RED), D5 (RED) & C5 (PNK);

D2 (RED), D5 (RED) & D1 (YEL)

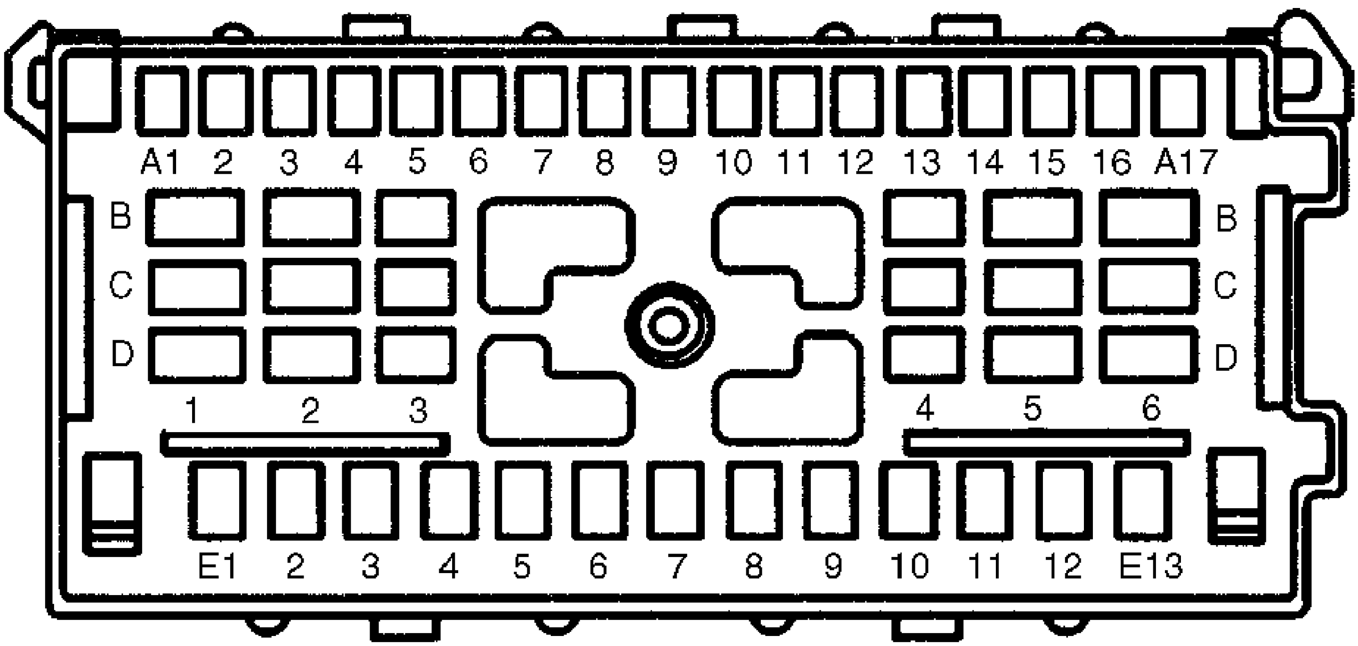


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Fig. 1: Identifying 48-Pin Connector Terminals
Courtesy of General Motors Corp.

TURN SIGNAL/HAZARD SWITCH

Turn ignition off. Disconnect steering column switch 48-pin connector located on steering column. Using DVOM, check for continuity between specified terminals with turn signal/hazard switch in specified position. See TURN SIGNAL/HAZARD SWITCH CONTINUITY TEST table. See Fig. 1. If continuity does not exist as indicated, repair as necessary.

TURN SIGNAL/HAZARD SWITCH CONTINUITY TEST TABLE

Switch Position	Continuity Between Terminals (Wire Color)
No Signals On	A1 (Not Used) & E6 (DK GRN); A1 (Not Used) & E7 (YEL)
Left Turn On	A2 (PNK) & A3 (LT BLU); E9 (PPL) & A7 (LT BLU); E9 (PPL) & E7 (YEL); E2 (LT BLU) & E6 (DK GRN); A1 (Not Used) & E6 (DK GRN)
Right Turn On	A2 (PNK) & A3 (LT BLU); E9 (PPL) & A6 (DK BLU); E9 (PPL) & E6 (DK GRN); E2 (LT BLU) & E7 (YEL); A1 (Not Used) & E7 (YEL)
Hazards On	E8 (BRN) & E1 (LT BLU); E9 (PPL) & E6 (DK GRN); E9 (PPL) & E7 (YEL); E9 (PPL) & A6 (DK BLU); E9 (PPL) & A7 (LT BLU)

REMOVAL & INSTALLATION

WARNING: Deactivate air bag system before performing any service operation. See AIR BAG RESTRAINT SYSTEM article. Do not apply electrical power to any component on steering column without first deactivating air bag system. Air bag may deploy.

CAUTION: When battery is disconnected, vehicle computer and memory systems may lose memory data. Driveability problems may exist until computer systems have completed a relearn cycle. See COMPUTER RELEARN PROCEDURES article in GENERAL INFORMATION before disconnecting battery.

NOTE: Use illustration for exploded view of upper section of steering column assembly. See Fig. 5 or 6. Before servicing steering column, place shift lever in Park, turn lock cylinder to OFF-LOCK position and remove key.

STEERING WHEEL

Removal & Installation

1) Turn ignition switch to OFF-LOCK position. Remove air bag module, if equipped. See AIR BAG RESTRAINT SYSTEM article. Remove horn pad, if equipped. Mark steering wheel hub in relation to slash mark on steering shaft for installation reference. Loosen steering wheel shaft nut, positioning it flush with end of shaft.

2) Using appropriate steering wheel puller, remove steering wheel. See STEERING WHEEL PULLER SPECIFICATIONS table. To install, reverse removal procedure. Tighten steering wheel nut to specification. See TORQUE SPECIFICATIONS.

STEERING WHEEL PULLER SPECIFICATIONS TABLE

Application	Tool (Part No.)
Blazer, Bravada, Jimmy, Sonoma, "S" & "T" Pickups	Puller (J-1859-A)

STEERING COLUMN

CAUTION: Ensure wheels of vehicle are in straight-ahead position and steering column is in LOCK position before disconnecting steering column or intermediate shaft from steering gear, or SIR coil will become uncentered. If weight of column is supported by only lower or upper support bracket, lower bearing adapter may be damaged.

CAUTION: When steering column is removed from vehicle, it is extremely susceptible to damage. DO NOT drop or lean on column. DO NOT hammer on ends of shaft, or plastic injections which maintain column rigidity could be loosened.

Removal

1) Disconnect negative battery cable. Remove air bag module, if equipped. See AIR BAG RESTRAINT SYSTEM article. Remove steering column trim panels. On column shift, disconnect transmission control cable. On all models, remove steering wheel. See STEERING WHEEL.

2) Remove electrical connectors. Remove nut and bolt from upper to lower shaft connection. Remove upper and lower steering

column support nuts. Remove steering column, rotating column to allow shift lever to clear instrument panel opening, if necessary.

Installation

To install, reverse removal procedure. Tighten upper and lower column mounting bolts to specification. Tighten upper intermediate steering shaft bolt and nut to specification. See TORQUE SPECIFICATIONS.

IGNITION & KEY ALARM SWITCH ASSEMBLY

Removal & Installation

1) Remove lock cylinder. See LOCK CYLINDER (FUNCTIONAL). Remove turn signal and multifunction switch. See TURN SIGNAL & MULTIFUNCTION SWITCH.

2) Using small screwdriver, gently pry retaining clip on key alarm. Rotate alarm switch 1/4 turn, and remove alarm switch. Remove 2 switch mounting screws. Remove ignition and key alarm switch assembly. See Fig. 2.

3) To install, reverse removal procedure. Tighten ignition and key alarm screws to specification. See TORQUE SPECIFICATIONS.

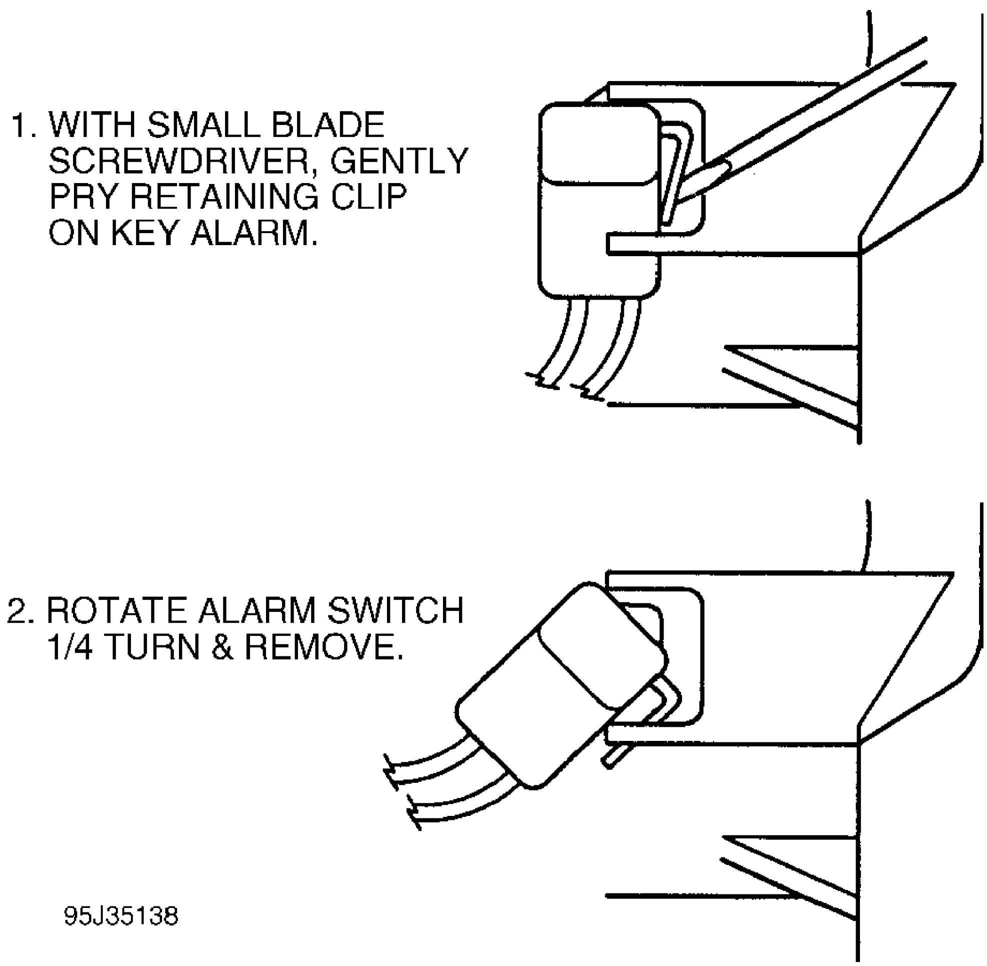


Fig. 2: Removing Ignition & Key Alarm Switch Assembly
Courtesy of General Motors Corp.

LOCK CYLINDER (FUNCTIONAL)

Removal & Installation

1) Remove steering column. See STEERING COLUMN. Using Modular Column Holding Fixture (J-41352), secure steering column. Remove tilt lever. Remove 2 lower shroud screws. Tilt lower shroud down and slide back to disengage locking tabs, then remove lower shroud. Remove upper shroud.

2) Hold key in START position. Using 1/16" Allen wrench, push on lock cylinder retaining pin. Release key to RUN position, and pull lock cylinder set from lock module assembly.

3) To install, insert key into lock cylinder and turn to RUN position. Ensure sector in lock module assembly is in RUN position. Insert lock cylinder into upper cover. Align locking and positioning tabs with slots in lock module assembly, and press lock cylinder into position. To complete installation, reverse removal procedure.

LOCK CYLINDER (NON-FUNCTIONAL)

Removal

1) Remove steering column. See STEERING COLUMN. Using Modular Column Holding Fixture (J-41352), secure steering column. Remove tilt lever. Remove 2 lower shroud screws. Tilt lower shroud down and slide back to disengage locking tabs, then remove lower shroud. Remove upper shroud.

2) Remove retaining ring. Remove SIR coil assembly. See AIR BAG RESTRAINT SYSTEM article. Remove wave washer. Using Lock Plate Compressor (J-23653-SIR), remove and discard retaining ring. Remove shaft lock shield assembly. Remove turn signal cancel cam.

3) On models with park lock cable, ensure lock cylinder is in OFF-LOCK position and gear shift is in Park. Insert small screwdriver into slot in lock module assembly, push against locking tab on end of cable, and remove park lock cable.

4) On all models, remove 3 screws, and remove lock module assembly with upper shroud. Remove backing plate from lock module assembly. Mark 2 sector gears at OFF-LOCK position for reassembly reference. See Fig. 3. Remove both sector gears.

5) Using an 1/8" burring tool, remove positioning tab on end of lock cylinder. See Fig. 4. Remove all burrs in and around lock module assembly and lock cylinder. From inside lock module assembly, push on locking tab and pull out lock cylinder. Clean debris from lock module assembly.

NOTE: Ensure 2 sector gears are properly aligned at OFF-LOCK position, or lock cylinder and ignition switch will be improperly timed.

Installation

1) Install sector gears and backing plate to lock module assembly, ensuring reference marks are aligned. Ensure sector in lock module assembly is in OFF-LOCK position. Insert key in lock cylinder, and turn key to OFF-LOCK position. Align locking and position tabs with slots in lock module assembly and press lock cylinder into position. Turn lock cylinder to ACC position, and check alignment of arrows on sector gears (arrows should be pointing at each other). Turn lock cylinder back to LOCK position.

2) To complete installation, reverse removal procedure. When installing turn signal canceling cam, lubricate lower brass surface with synthetic grease. Use new shaft lock retaining ring. Tighten all screws to specification. See TORQUE SPECIFICATIONS. Adjust park lock cable, if necessary. See PARK LOCK CABLE under ADJUSTMENTS.

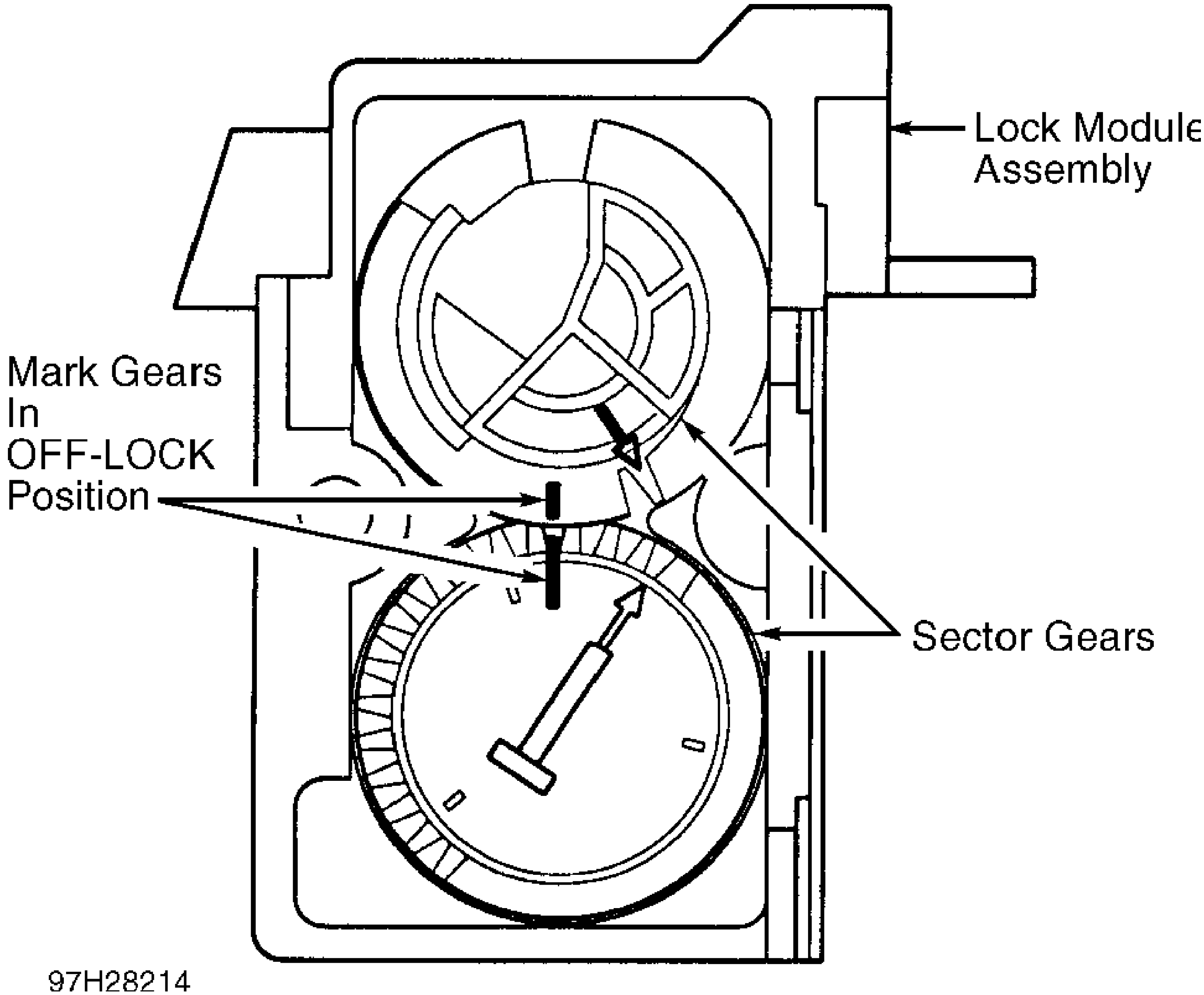


Fig. 3: Aligning Sector Gears
Courtesy of General Motors Corp.

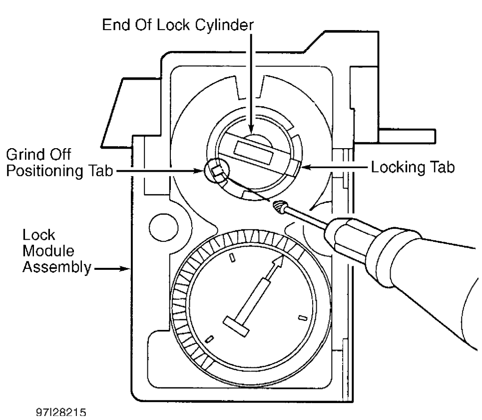


Fig. 4: Removing Lock Cylinder Positioning Tab
Courtesy of General Motors Corp.

TURN SIGNAL & MULTIFUNCTION SWITCH

Removal

1) Ensure lever is in center of OFF position. Disconnect negative battery cable. Disable air bag system. See AIR BAG RESTRAINT SYSTEM article. Remove steering wheel. See STEERING WHEEL. Remove knee bolster, if necessary.

2) Remove bolts/screws and lower column cover. Remove bolts/screws and upper column cover. Remove lock cylinder, if necessary. See LOCK CYLINDER (FUNCTIONAL). Remove wiring harness strap. Disconnect steering column electrical connector. Disconnect turn signal and multifunction switch Gray and Black connectors. Remove turn signal and multifunction switch from vehicle.

Installation

Install turn signal and multifunction switch. Using small, flat-blade screwdriver, compress electrical contact and move switch into position. Ensure electrical contact rests on cancel cam. See Fig. 5 or 6. Tighten turn signal and multifunction switch screws to spe cification. See TORQUE SPECIFICATIONS. To complete installation, reverse removal procedure.

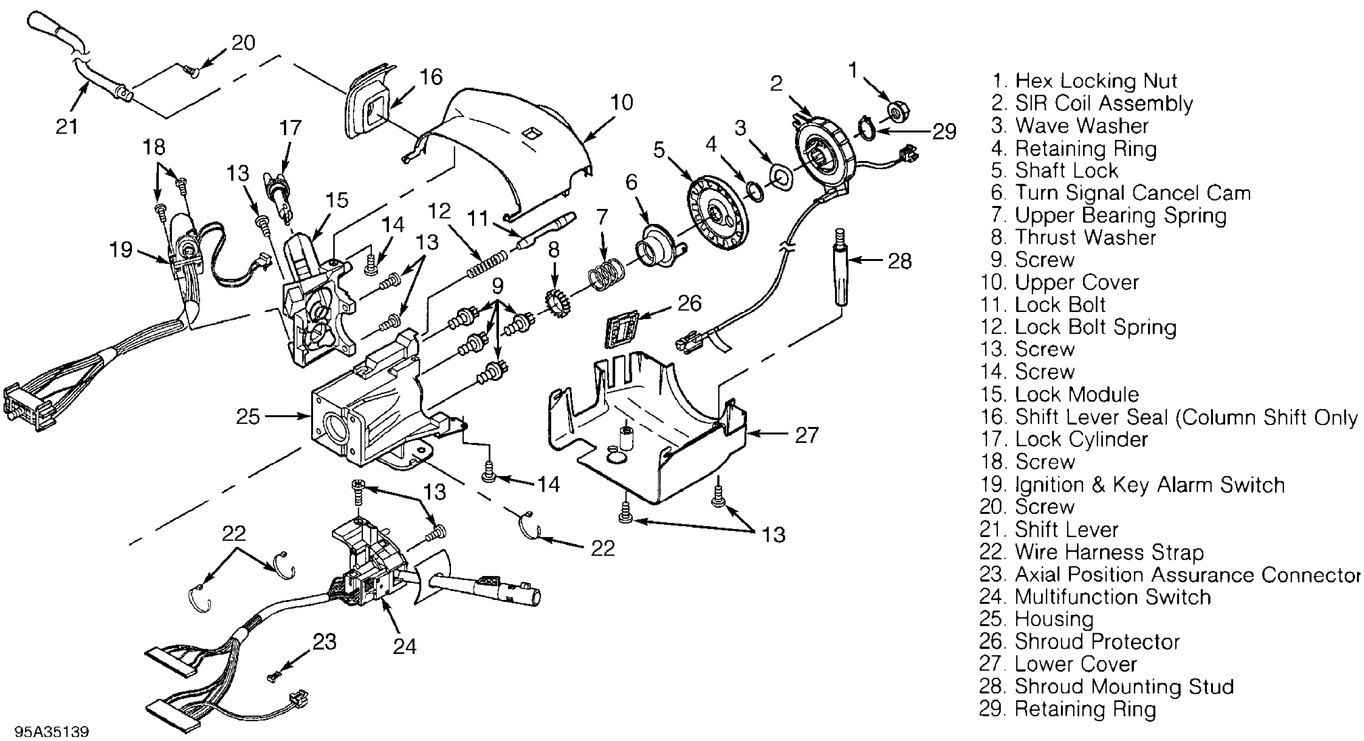
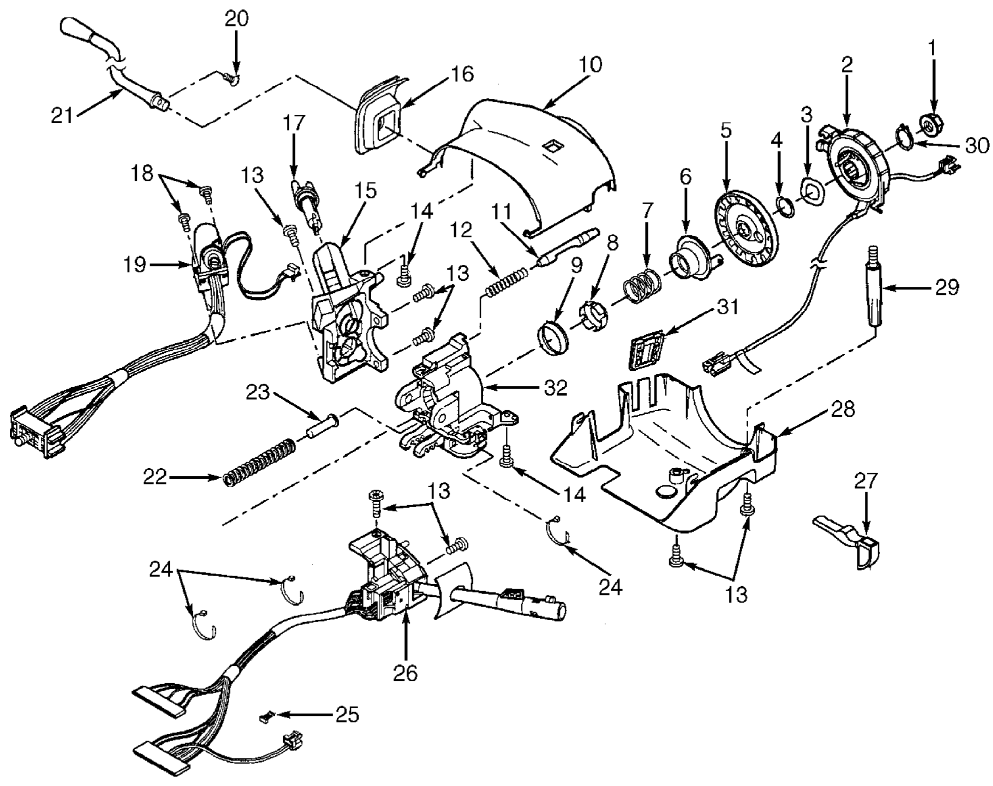


Fig. 5: Exploded View Of Upper Steering Column Assembly (Non-Tilt Column)
Courtesy of General Motors Corp.



1. Hex Locking Nut
2. SIR Coil Assembly
3. Wave Washer
4. Retaining Ring
5. Shaft Lock
6. Turn Signal Cancel Cam
7. Upper Bearing Spring
8. Inner Race Seat
9. Inner Race
10. Upper Cover
11. Lock Bolt
12. Lock Bolt Spring
13. Screw
14. Screw
15. Lock Module
16. Shift Lever Seal (Column Shift Only)
17. Lock Cylinder
18. Screw
19. Ignition & Key Alarm Switch
20. Screw
21. Shift Lever
22. Tilt Spring
23. Spring Guide
24. Wire Harness Strap
25. Axial Position Assurance Connector
26. Multifunction Switch
27. Tilt Lever
28. Lower Cover
29. Shroud Mounting Stud
30. Retaining Ring
31. Shroud Protector
32. Tilt Head Assembly

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Fig. 6: Exploded View Of Upper Steering Column Assembly (Tilt Column)
Courtesy of General Motors Corp.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS TABLE

Application	Ft. Lbs. (N.m)
Steering Column Upper & Lower Bolts/Screws	22 (30)
Steering Wheel Nut	30 (41)
Upper Intermediate Shaft Pinch Bolt	35 (47)
	INCH Lbs. (N.m)
Ignition & Key Alarm Screws	12 (1.4)
Intermediate Shaft Seal Screw	27 (3)
Lock Module Assembly Screws	53 (6)
Lower Shroud Screws	53 (6)
Steering Column Connector Screw	53 (6)
Turn Signal & Multifunction Switch Screws	53 (6)
Upper Shroud Screws	12 (1.4)

WIRING DIAGRAMS

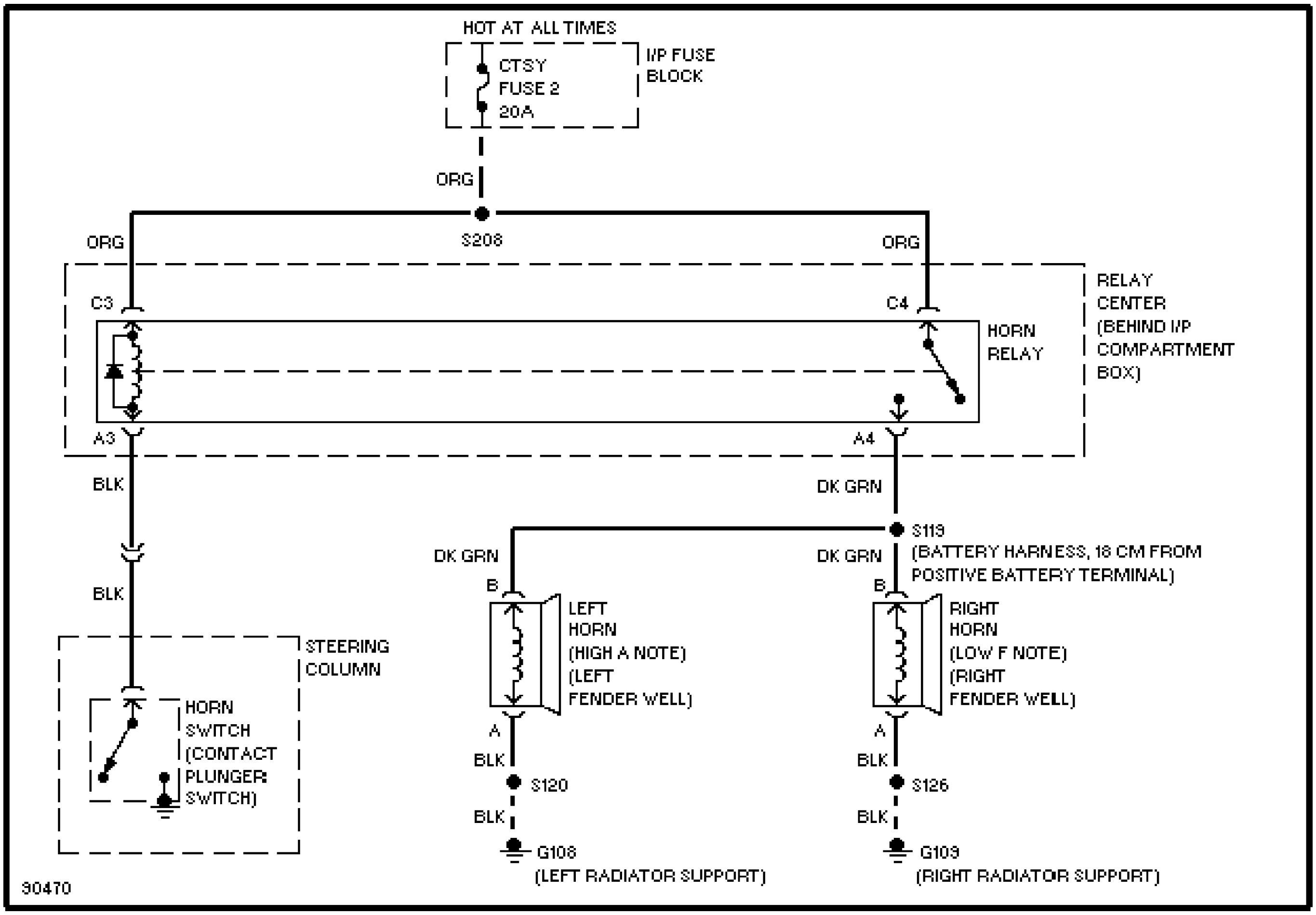


Fig. 7: Horn System Wiring Diagram

STEERING COLUMN

1997 Chevrolet Blazer

1997 STEERING
Steering Columns - General Motors Corp.

Chevrolet; "S" & "T" Series Blazer & Pickup
GMC; Jimmy, Sonoma
Oldsmobile; Bravada

DESCRIPTION

All models use a collapsible steering column with an integral ignition switch and locking device. Some models include tilt wheel, gear shift interlock device, and/or Supplemental Inflatable Restraint (SIR) system.

DISABLING & ACTIVATING AIR BAG SYSTEM

1) To disable air bag system, turn ignition switch to OFF position. Remove SIR fuse from fuse block. Disconnect Yellow SIR connector at base of steering column. On models equipped with passenger-side air bag, also disconnect Yellow connector under right side of instrument panel. INFLATABLE RESTRAINT indicator light will come on. This is normal.

2) Wait 10 minutes before working on vehicle. All connectors used on SIR system use Connector Position Assurance (CPA) clips to ensure connector retention.

3) To activate air bag system, turn ignition switch to OFF position. Connect Yellow 2-pin connector and CPA clip at base of steering column and/or under right side of instrument panel. Install SIR fuse. Turn ignition switch to RUN position. INFLATABLE RESTRAINT indicator light should go off. For more information, see AIR BAG RESTRAINT SYSTEM article in ACCESSORIES/SAFETY EQUIP section.

ADJUSTMENTS

PARK LOCK CABLE

Ensure gear shift lever is in Park. turn lock cylinder to PARK-LOCK position and remove key. Using Park Lock Cable Pliers (J-41396), unlock adjuster ring on cable assembly. Pull on cable until park lock latch contacts gear shift lever. Release cable. Using park lock cable pliers, lock adjuster ring securely in place.

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. See COMPUTER RELEARN PROCEDURES article in GENERAL INFORMATION before disconnecting battery.

NOTE: Use only specified screws. Using screws that are too long may prevent column from compressing upon impact.

STEERING WHEEL & HORN PAD

WARNING: Wait 10 minutes after disabling air bag system before servicing system. Servicing air bag system before 10 minutes may cause accidental air bag deployment and possible personal injury.

Removal (With Air Bag)

1) Disable air bag system. See DISABLING & ACTIVATING AIR BAG SYSTEM. Inflator module is located on steering wheel hub. Turn steering wheel 90 degrees to access rear shroud hole. Insert screwdriver and push leaf spring to release pin. Turn steering wheel 180 degrees to access remaining shroud holes. Repeat release procedure with screwdriver.

2) Partially remove inflator module from top. Disconnect steering wheel inflator module connector, CPA clip and horn contact from inflator. Remove inflator module.

3) Position steering wheel straight ahead. Remove snap ring and steering wheel retaining nut. Mark steering wheel and shaft for reassembly reference. Using Steering Wheel Puller (J-1859-03), remove steering wheel.

CAUTION: To prevent damage to canceling cam and switch assembly, turn signal switch must be in neutral position before steering wheel is installed.

Installation

1) Ensure turn signal switch is in neutral position. Install and align steering wheel. DO NOT misalign steering wheel. Install and tighten steering wheel retaining nut to 30 ft. lbs. (41 N.m). Install snap ring.

2) Install horn contact, steering wheel inflator module connector and CPA clip. Install inflator module to steering wheel. Press inflator module firmly until all latch pins are engaged.

3) To complete installation, reverse removal procedure. Check INFLATABLE RESTRAINT indicator light to ensure system is functioning properly. For more information, see AIR BAG RESTRAINT SYSTEM article in ACCESSORIES/SAFETY EQUIP section.

Removal (Without Air Bag)

Disconnect negative battery cable. Remove horn pad. Remove snap ring and steering wheel retaining nut. Disconnect horn lead assembly (if equipped). Mark steering wheel and shaft for reassembly reference. Using Steering Wheel Puller (J-1859-03), remove steering wheel.

CAUTION: To prevent damage to canceling cam and switch assembly, turn signal switch must be in neutral position before steering wheel is installed.

Installation

Before installing steering wheel, ensure turn signal switch is in neutral position. Install steering wheel onto steering shaft aligning marks made during removal. DO NOT misalign steering wheel rim more than .79" (20 mm) from centerline. Connect horn lead assembly (if equipped). Install and tighten steering wheel retaining nut to 30 ft. lbs. (41 N.m). Install snap ring and horn pad. Connect negative battery cable.

STEERING COLUMN

NOTE: Although columns are similar, some procedures do not apply to all steering columns.

Removal

1) Disconnect negative battery cable. Disconnect transmission shift linkage from column shift tube levers. Mark position of joint to

steering shaft. Remove upper intermediate shaft bolt and nut from steering shaft.

2) Remove steering column support bracket bolts and nuts. Remove support bracket. Remove steering column seal bolts and seal. Remove steering wheel. See STEERING WHEEL & HORN PAD. Disconnect electrical connectors at column harness.

3) Disconnect start/neutral switch and back-up light switch electrical connectors (if equipped). Disconnect transmission indicator cable (if equipped). On column shift models, rotate column so shift lever can clear dash opening. On all models, remove steering column assembly.

Installation

To install, reverse removal procedure. Tighten bolts and screws to specification. See TORQUE SPECIFICATIONS.

INTERMEDIATE SHAFT

Removal

Set front wheels in straight-ahead position. Mark joint-to-steering shaft position. Mark joint-to-steering gear worm shaft position. Remove intermediate shaft shield screw (if equipped). Remove shield (if equipped). Remove upper and lower intermediate shaft bolts and nut. Remove intermediate shaft.

Installation

To install, reverse removal procedure. Tighten bolts, nut and screw to specification. See TORQUE SPECIFICATIONS.

LOCK CYLINDER (FUNCTIONAL)

Removal & Installation

1) Remove steering column. See STEERING COLUMN. Using Modular Column Holding Fixture (J-41352), secure steering column. Remove tilt lever (if equipped). Remove 2 lower shroud screws. Tilt lower shroud down and slide back to disengage locking tabs, then remove lower shroud. Remove upper shroud.

2) Hold key in START position. Using 1/16" Allen wrench, push on lock cylinder retaining pin. Release key to RUN position, and pull lock cylinder set from lock module assembly.

3) To install, insert key into lock cylinder and turn to RUN position. Ensure sector in lock module is in RUN position. Insert lock cylinder into upper cover. Align locking and positioning tabs with slots in lock module assembly, and press lock cylinder into position. To complete installation, reverse removal procedure.

LOCK CYLINDER (NON-FUNCTIONAL)

Removal

1) Remove steering Column. See STEERING COLUMN. Using Modular Column Holding Fixture (J-41352), secure steering column. Remove tilt lever, if equipped. Remove 2 lower shroud screws. Tilt lower shroud down and slide back to disengage locking tabs, then remove lower shroud. Remove upper shroud.

2) Remove retaining ring. Remove SIR clockspring assembly. See AIR BAG RESTRAINT SYSTEM article in ACCESSORIES/SAFETY EQUIP section. Remove wave washer. Using Lock Plate Compressor (J-23563-SIR), remove and discard retaining ring. Remove shaft lock shield assembly. Remove turn signal cancelling cam.

3) On models with park lock cable, ensure lock cylinder is in OFF-LOCK position and gearshift is in Park. Insert small screwdriver into slot in lock module assembly, push against locking tab on end of cable and remove park lock cable.

4) On all models, remove 3 screws, and remove lock module assembly with upper shroud. Remove backing plate from lock module assembly. Mark 2 sector gears at PARK-LOCK position for installation reference. See Fig. 1. Remove both sector gears.

5) Using 1/8" burring tool, remove positioning tab on end of lock cylinder. See Fig. 2. Remove all burrs in and around lock module assembly and lock cylinder. From inside lock module assembly, push on locking tab and pull out lock cylinder. Clean debris from lock module assembly.

NOTE: Ensure 2 sector gears are properly aligned at OFF-LOCK position, or lock cylinder will be improperly timed.

Installation

1) Install sector gears and backing plate to lock module assembly, ensuring reference marks are aligned. Ensure sector gear in lock module is in OFF-LOCK position. Insert key in lock cylinder, and turn key to OFF-LOCK position. Align position and locking tabs with slots in lock module assembly and press lock cylinder into position. Turn lock cylinder to ACC position, and check alignment of arrows on sector gears (arrows should point toward each other). Turn lock cylinder back to OFF-LOCK position.

2) To complete installation, reverse removal procedure. When installing turn signal cancelling cam, lubricate lower brass surface with synthetic grease. Use NEW shaft lock retaining ring. Tighten all screws to specification. See TORQUE SPECIFICATIONS. Adjust park lock cable, if necessary. See PARK LOCK CABLE in ADJUSTMENTS.

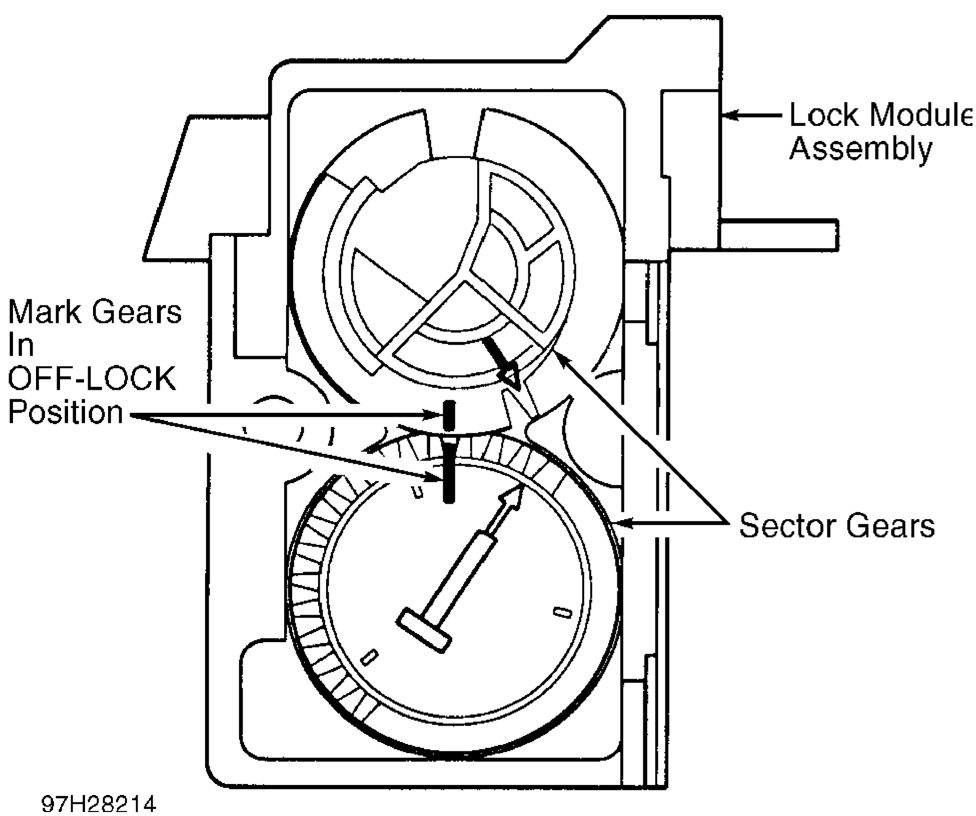


Fig. 1: Aligning Sector Gears
Courtesy of General Motors

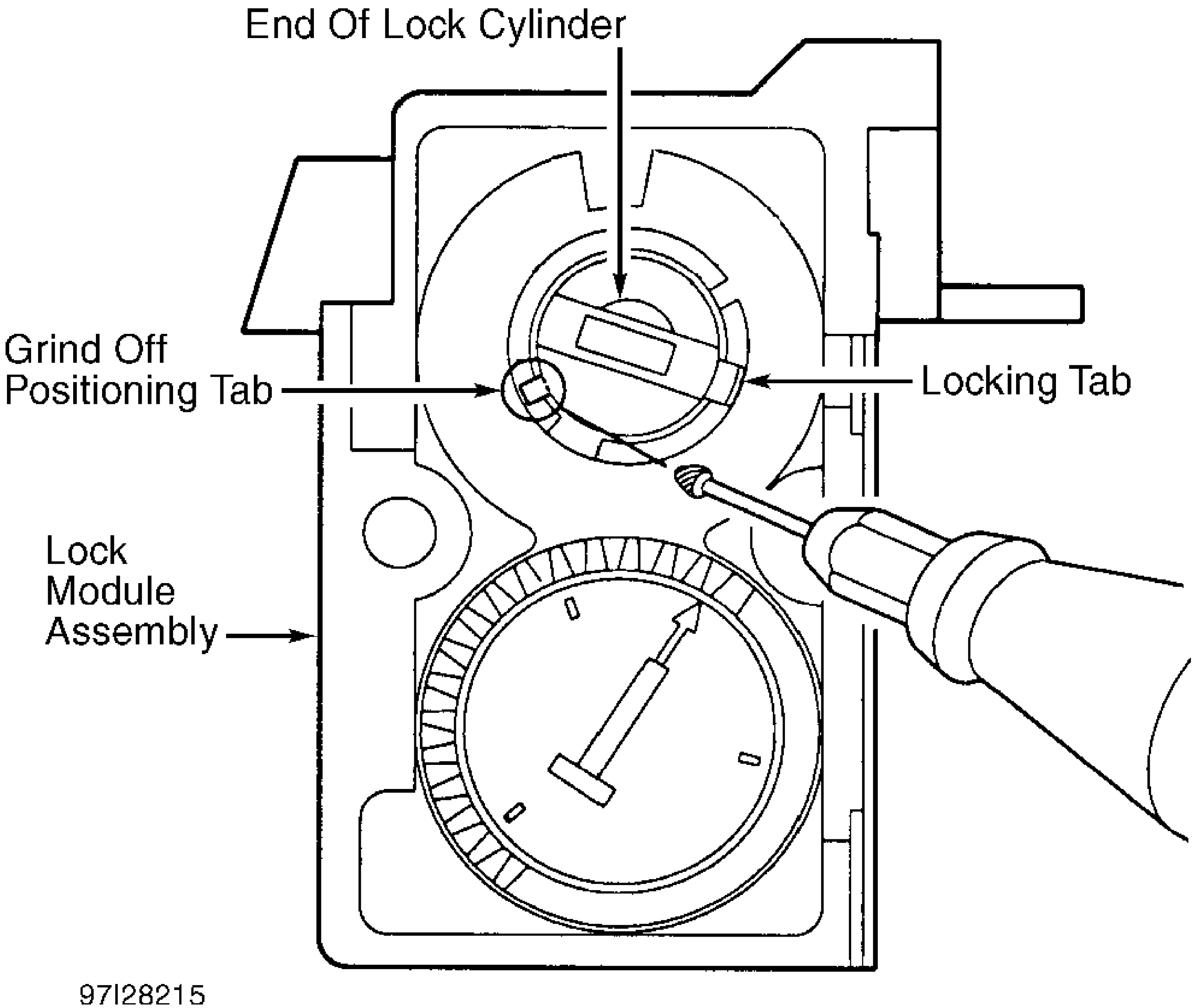


Fig. 2: Removing Lock Cylinder Positioning Tab
Courtesy of General Motors

TURN SIGNAL & MULTIFUNCTION SWITCH

Removal

1) Ensure lever is in center of OFF position. Disconnect negative battery cable. Disable air bag system (if equipped). See DISABLING & ACTIVATING AIR BAG SYSTEM. Remove steering wheel. See STEERING WHEEL & HORN PAD. Remove knee bolster, if necessary.

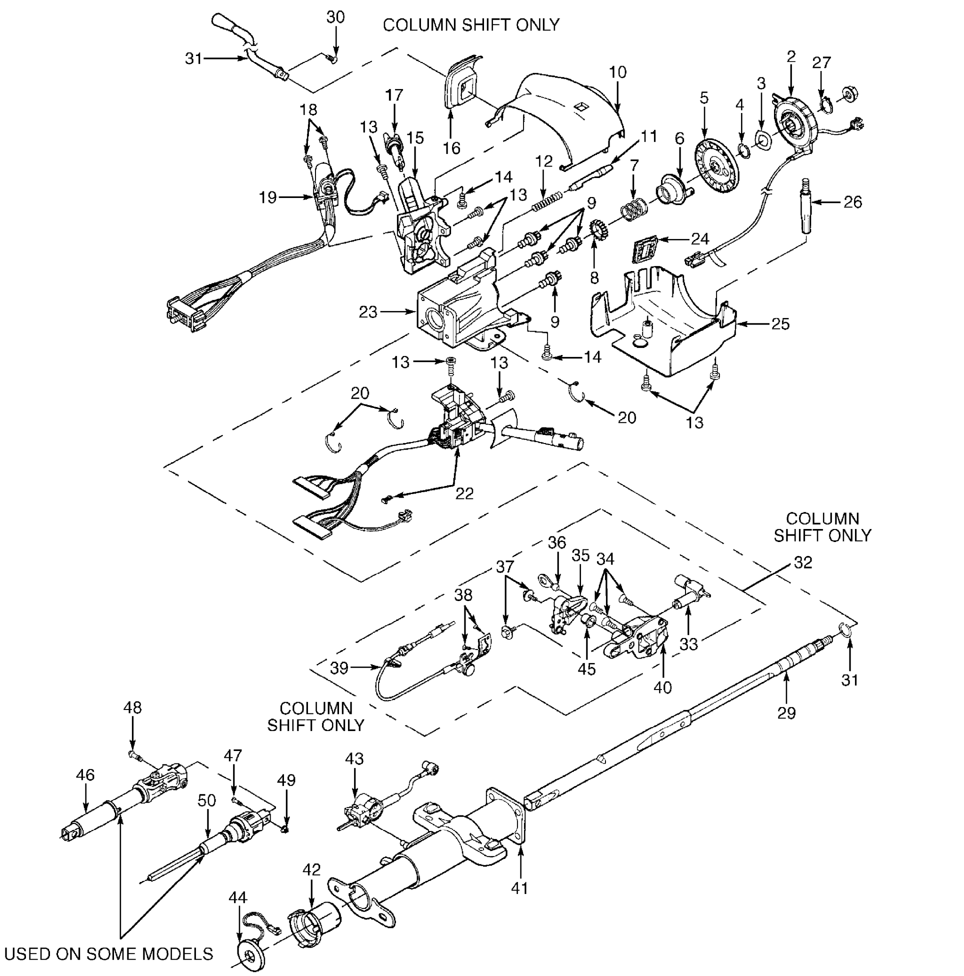
2) Remove bolts/screws and lower column cover. Remove bolts/screws and upper column cover. Remove lock cylinder, if necessary. See LOCK CYLINDER (FUNCTIONAL). Remove harness strap. Disconnect steering column electrical connector. Disconnect turn signal and multifunction switch Gray and Black connectors. Remove turn signal and multifunction switch.

Installation

Install turn signal and multifunction switch. Using small flat-blade screwdriver, compress electrical contact and move switch into position. Ensure electrical contact rests on cancelling cam. See Figs. 3-4. Tighten turn signal and multifunction switch screws to specification. See TORQUE SPECIFICATIONS. To complete installation, reverse removal procedure.

OVERHAUL

NOTE: Use illustrations for exploded view of steering columns. See Figs. 3-4.



1. Lock Nut
2. Air Bag Clockspring
3. Wave Washer
4. Retaining Ring
5. Shift Lock Shield
6. Cancelling Cam
7. Upper Bearing Spring
8. Thrust Washer
9. Torx Head Screw
10. Upper Shroud
11. Lock Bolt Assembly
12. Lock Bolt Spring
13. Self-Tapping Screw
14. Torx Head Screw
15. Lock Module
16. Shift Lever Seal
17. Lock Cylinder
18. Self-Tapping Screw
19. Ignition & Key Alarm Switch
20. Harness Strap
21. Axial Position Assurance Connector
22. Multifunction Switch
23. Steering Column Housing
24. Shroud Protector
25. Lower Shroud
26. Shroud Mounting Stud
27. Retaining Ring
28. Retaining Ring
29. Steering Shaft
30. Shift Lever Screw
31. Shift Lever
32. Shift Assembly (Column Shift Only)
33. Shift Lever Clevis
34. Screw
35. Cable Shift Cam
36. Ball & Actuator Assembly
37. Flange Head Bolt
38. Self-Tapping Screw
39. Park Lock Cable
40. Gear Shift Lever Support Bracket
41. Shift Column Jacket
42. Adapter & Bearing Assembly
43. Electrical (BTSI) Actuator
44. EVO Sensor
45. Cam Bushing
46. Yoke & Intermediate Steering Shaft
47. Locking Bolt
48. Pinch Bolt
49. Hex Nut
50. Coupler & Steering Shaft

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Fig. 3: Exploded View Of Non-Tilt Steering Column (Typical)
Courtesy of General Motors

1. Lock Nut
2. Air Bag Clockspring
3. Wave Washer
4. Retaining Ring
5. Shift Lock Shield
6. Cancelling Cam
7. Upper Bearing Spring
8. Upper Bearing Inner Race Seat
9. Inner Race
10. Upper Shroud
11. Lock Bolt Assembly
12. Lock Bolt Spring
13. Self-Tapping Screw
14. Torx Head Screw
15. Lock Module
16. Shift Lever Seal
17. Lock Cylinder
18. Self-Tapping Screw
19. Ignition & Key Alarm Switch
20. Tilt Spring
21. Spring Guide
22. Harness Strap
23. Axial Position Assurance Connector
24. Multifunction Switch
25. Tilt Head Assembly
26. Shroud Protector
27. Lower Shroud
28. Shroud Mounting Stud
29. Retaining Ring
30. Shift Lever Screw
31. Shift Lever
32. Tilt Lever Assembly
33. Upper Race & Shaft Assembly
34. Centering Sphere
35. Joint Preload Spring
36. Lower Steering Shaft Assembly
37. Linear Shift Assembly
38. Shift Lever Clevis
39. Screw
40. Cable Shift Cam
41. Ball & Actuator Assembly
42. Flange Head Bolt
43. Self-Tapping Screw
44. Park Lock Cable
45. Gear Shift Lever Support Bracket
46. Torx Head Screw
47. Pivot Pin
48. Steering Column Support
49. Shift Column Jacket
50. Adapter & Bearing Assembly
51. Electrical (BTSI) Actuator
52. EVO Sensor
53. Cam Bushing
54. Coupling & Steering Shaft Assembly
55. Yoke & Intermediate Steering Shaft
56. Locking Bolt
57. Pinch Bolt
58. Hex Nut

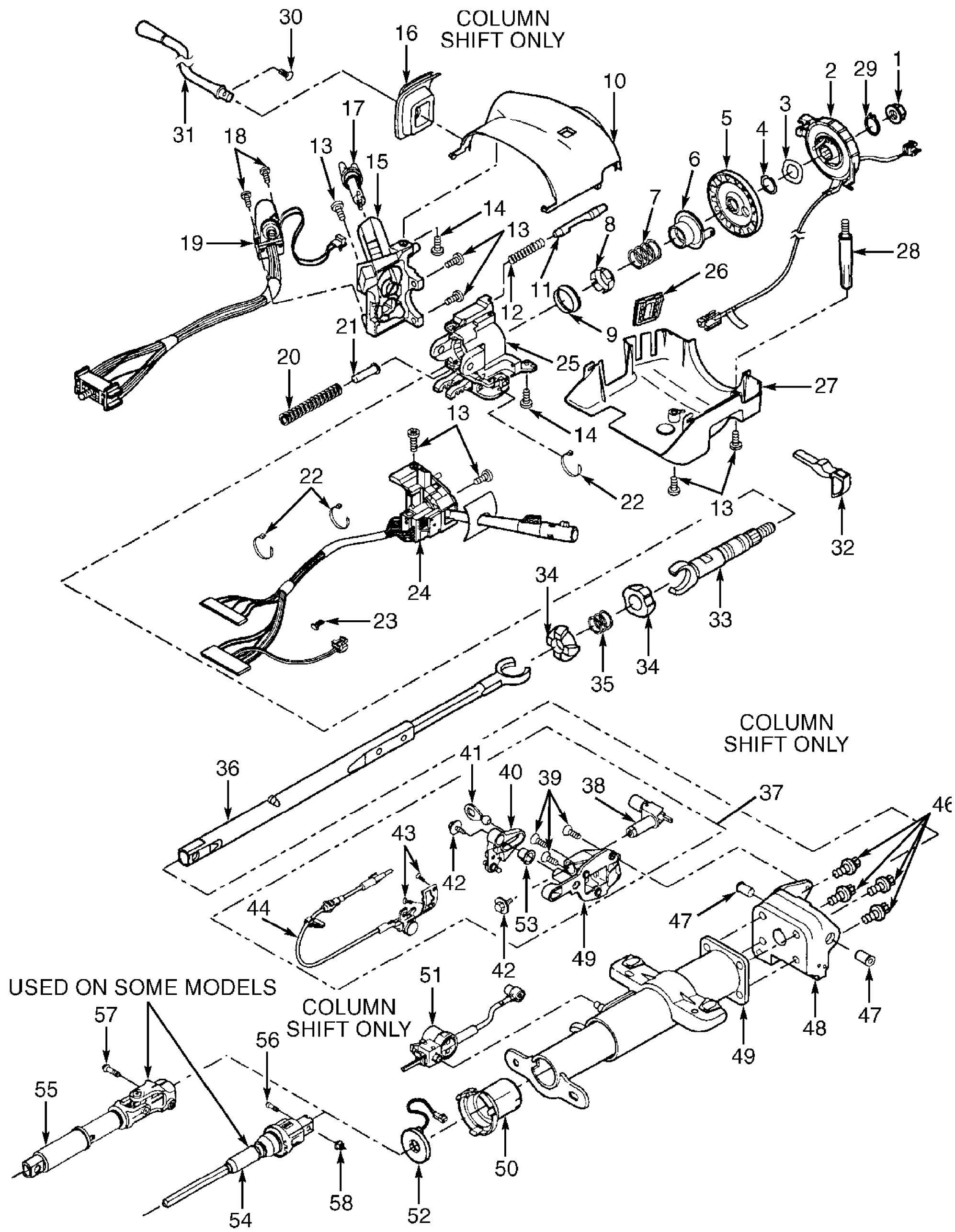

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Fig. 4: Exploded View Of Tilt Steering Column (Typical)
Courtesy of General Motors

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS TABLE

Application	Ft. Lbs. (N.m)
Lower Intermediate Shaft Bolt	25 (34)
Steering Column Support Bracket Bolts	22 (30)
Steering Wheel Retaining Nut	30 (41)
Upper Intermediate Shaft Bolt/Nut	45 (61)
	INCH Lbs. (N.m)
Column Shroud Screws	80 (9.0)
Dimmer Switch Screw	35 (4.0)
Ignition Switch Screw	35 (3.8)
Intermediate Shaft Shield Screw	53 (6.0)
Turn Signal Switch Screws	35 (3.8)

STEERING KNUCKLES - 4WD

1997 Chevrolet Blazer

1996-97 DRIVE AXLES
General Motors Corp. 4WD Steering Knuckles

Chevrolet; Astro, "T" Series Blazer, Sierra, Suburban, "K" & "T" Series Pickup
GMC; Jimmy, Safari, Sierra, Sonoma, Suburban, Tahoe, Yukon, "K" & "T" Series Pickup
Oldsmobile; Bravada

MODEL IDENTIFICATION

MODEL IDENTIFICATION

Series (1)	Model
"K"	Pickup, Sierra, Suburban, Tahoe & Yukon
"L" (2)	Astro & Safari
"T"	Blazer, Jimmy, Pickup & Sonoma
"T" (2)	Bravada

(1) - Fifth character of VIN.
(2) - All Wheel Drive (AWD).

ADJUSTMENTS

BALL JOINT TURNING EFFORT

NOTE: Front axle ball joint adjustment is only necessary when there is excessive play in steering, irregular wear on tire or persistent loosening of tie rod.

REMOVAL & INSTALLATION

STEERING KNUCKLE

Removal

1) Raise and support vehicle. Remove wheel and tire assembly. Install Axle Shaft Boot Seal Protector (J-28712) on axle shaft boot to protect boot during repair. Depress brake caliper piston, detach brake caliper and wire aside. Remove brake rotor.

2) Remove cotter pin and retainer (if equipped) from axle shaft nut. Remove nut and washer from axle shaft. Remove cotter pin and tie rod end nut. Separate tie rod end from steering knuckle. See Fig. 1.

3) Attach puller to hub. Tighten pressure screw, and force axle shaft from hub and bearing assembly. Remove hub and bearing assembly from steering knuckle. Remove splash shield. Support lower control arm using floor jack or jackstand.

CAUTION: Support lower control arm with floor jack or jackstand to maintain tension on torsion bar.

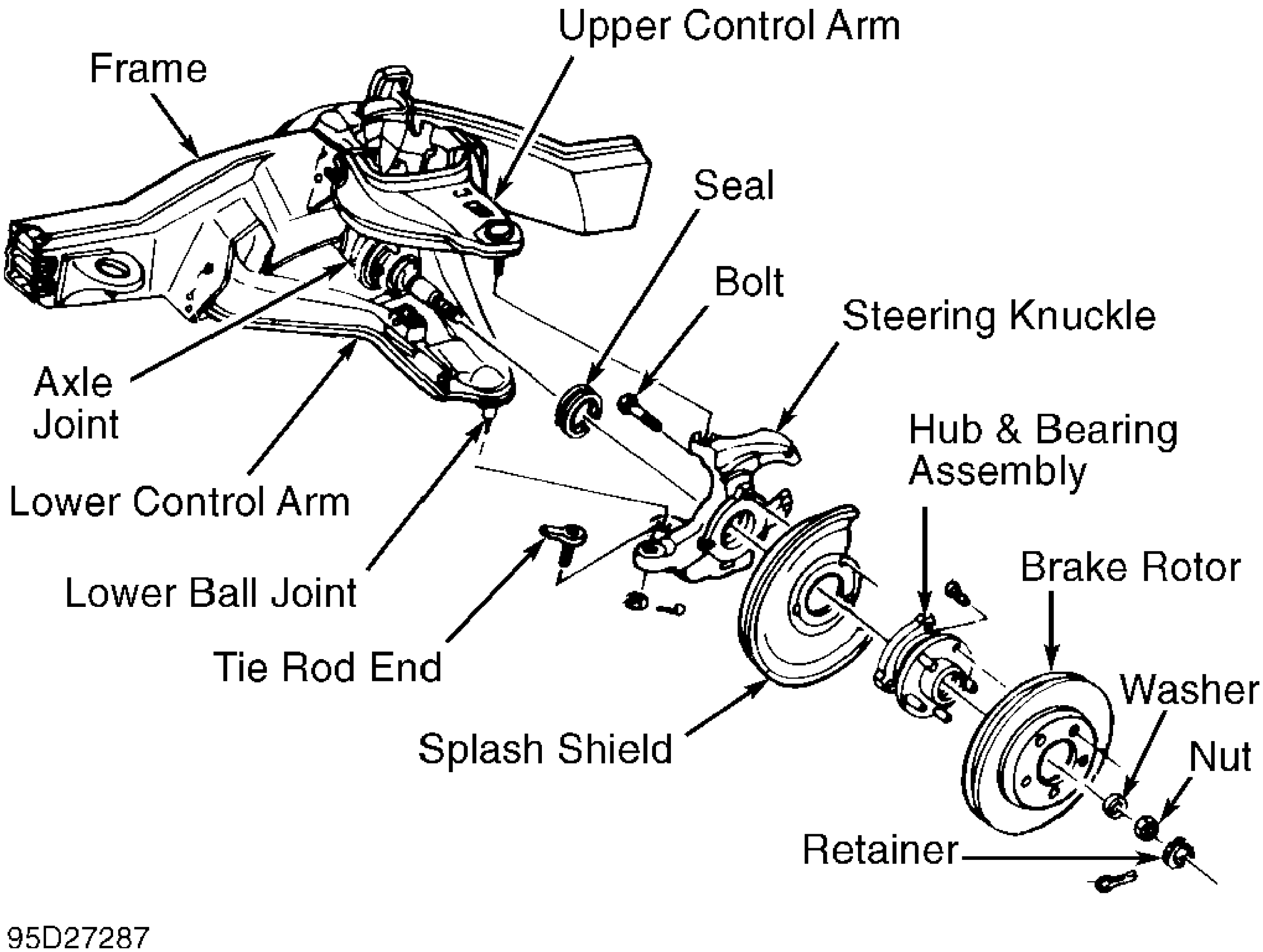

Fig. 1: Exploded View Of Hub & Steering Knuckle Assembly ("T" Series Shown; "K" & "L" Series Are Similar)
Courtesy of General Motors Corp.

4) Remove cotter pins from ball joint studs. On "T" Series, place Ball Joint Separator (J-34026) over upper or lower ball joint. See Fig. 2. Loosen ball joint nut. Back off until nut contacts ball joint separator. Continue backing off nut until nut forces ball stud out of steering knuckle.

5) On all other models, separate ball joint from steering knuckle using Ball Joint Separator (J-36607). On all models, remove steering knuckle from vehicle without damaging or moving axle shaft. Remove seal from steering knuckle.

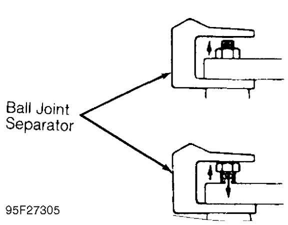

Fig. 2: Separating Ball Joint From Steering Knuckle ("T" Series)
Courtesy of General Motors Corp.

Installation

1) To install, reverse removal procedure. Install NEW seal into steering knuckle using Seal Installer (J-36605 for Astro and Safari; J-36606 for "K" Series; J-28574 for "T" Series).

2) On "T" Series, ensure spacer is installed on steering knuckle at upper ball joint stud hole. On all models, tighten bolts and nuts to specification. See TORQUE SPECIFICATIONS. If necessary, tighten tie rod and ball joint nuts to align cotter key hole. DO NOT loosen nuts for alignment. Remove boot protector from axle shaft.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Astro & Safari	
Axle Shaft Nut	173 (235)
Ball Joint Nut (Lower)	94 (128)
Ball Joint Nut (Upper)	66 (90)
Brake Caliper Bolt	37 (50)
Hub & Bearing Assembly Bolt	66 (90)
Splash Shield Bolt	12 (16)
Tie Rod Nut	37 (50)
Wheel Lug Nut	103 (140)
"K" Series	
Axle Shaft Nut	173 (235)
Ball Joint Nut (Lower)	94 (128)
Ball Joint Nut (Upper)	74 (100)
Brake Caliper Bolt	37 (50)
Hub & Bearing Assembly Bolt	133 (180)
Splash Shield Bolt	19 (26)
Tie Rod Nut	35 (48)
Wheel Lug Nut	
Dual Wheel (Heavy-Duty)	177 (240)
Dual Wheel	140 (190)
Single Wheel	118 (160)
"T" Series	
Axle Shaft Nut	181 (245)
Ball Joint Nut	70 (95)
Brake Caliper Bolt	37 (50)
Hub & Bearing Assembly Bolt	77 (105)
Tie Rod Nut	35 (47)
Wheel Lug Nut	96 (130)

1997 STEERING
Power Recirculating Ball - General Motors Corp.

Chevrolet; "S" & "T" Series Blazer & Pickup
GMC; Jimmy & Sonoma
Oldsmobile; Bravada

DESCRIPTION & OPERATION

Steering gear is a variable ratio, recirculating ball-type which acts as a rolling thread between worm shaft and rack piston. The worm shaft is supported at lower end by a thrust bearing with 2 races. It is supported at upper end by a bearing assembly in the adjuster plug. Control valves, located inside steering gear housing, direct power steering fluid to either side of rack piston. See Fig. 1.

Steering linkage connects steering gear to front wheels through pitman arm. Steering linkage consists of pitman arm, idler arm, relay rod and tie rods. See Figs. 2 and 3. Tie rod ends connect to relay rod by ball studs. Adjuster tubes between inner and outer tie rod ends are used to adjust toe. Some models have a shock absorber attached to relay rod.

Two different types of vane-type power steering pumps are used. The Model "P" pump is mounted inside reservoir. See Fig. 9. The Model "CB" pump is mounted below reservoir. See Fig. 11. On both models, vanes are driven by a rotor and move fluid from intake to pressure cavities of pump ring.

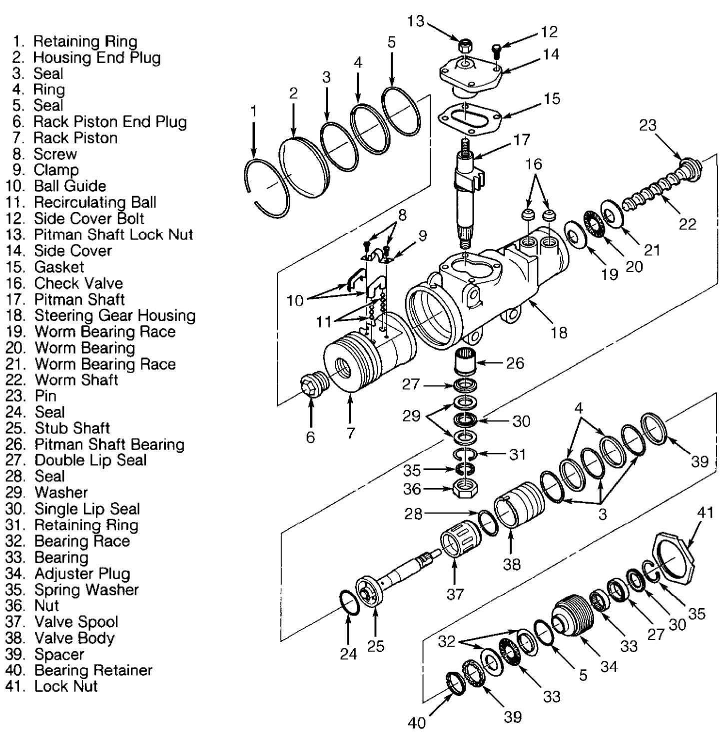

Fig. 1: Exploded View Of Power Steering Gear
Courtesy of General Motors Corp.

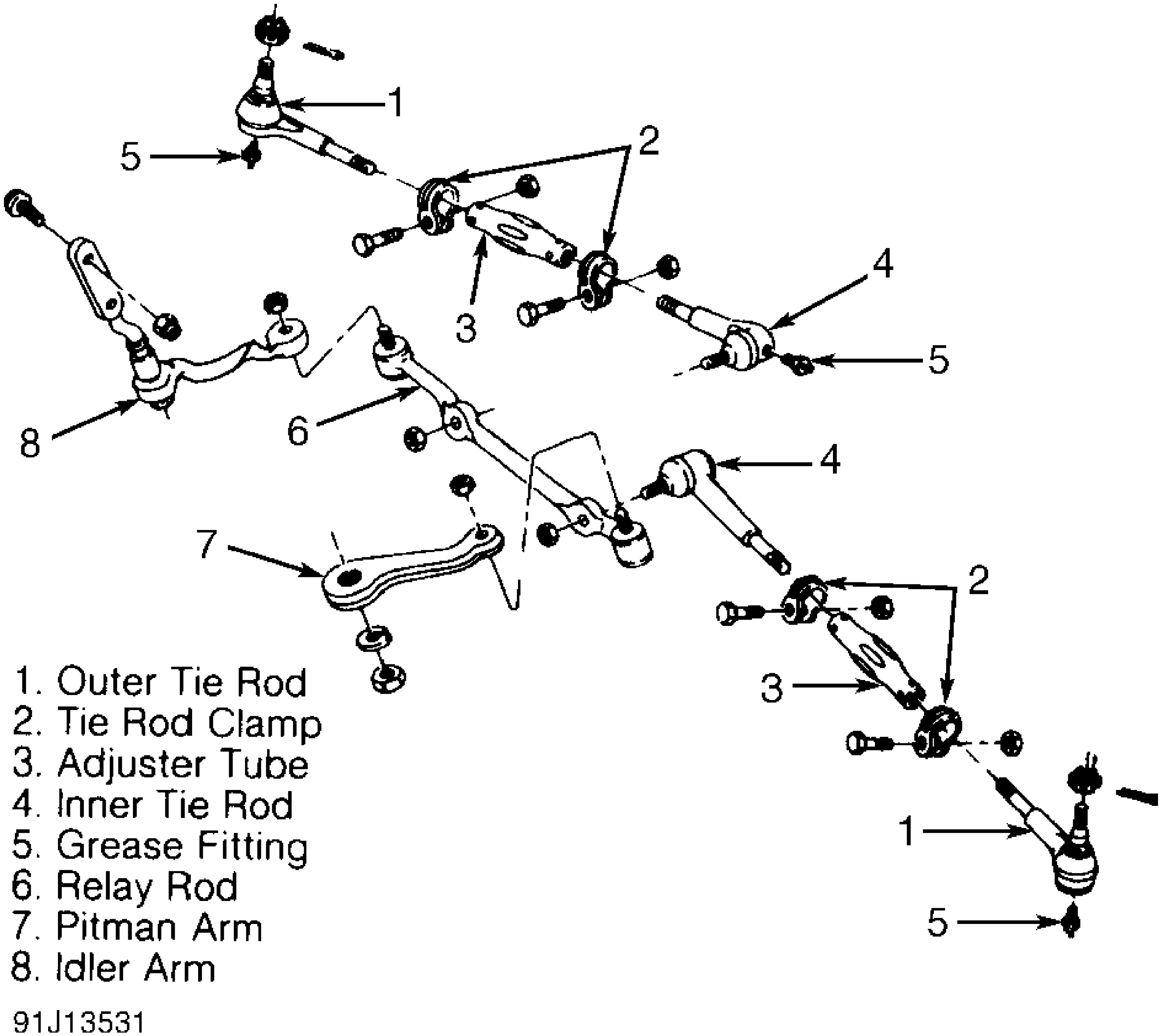

Fig. 2: Exploded View Of Steering Linkage (2WD)
Courtesy of General Motors Corp.

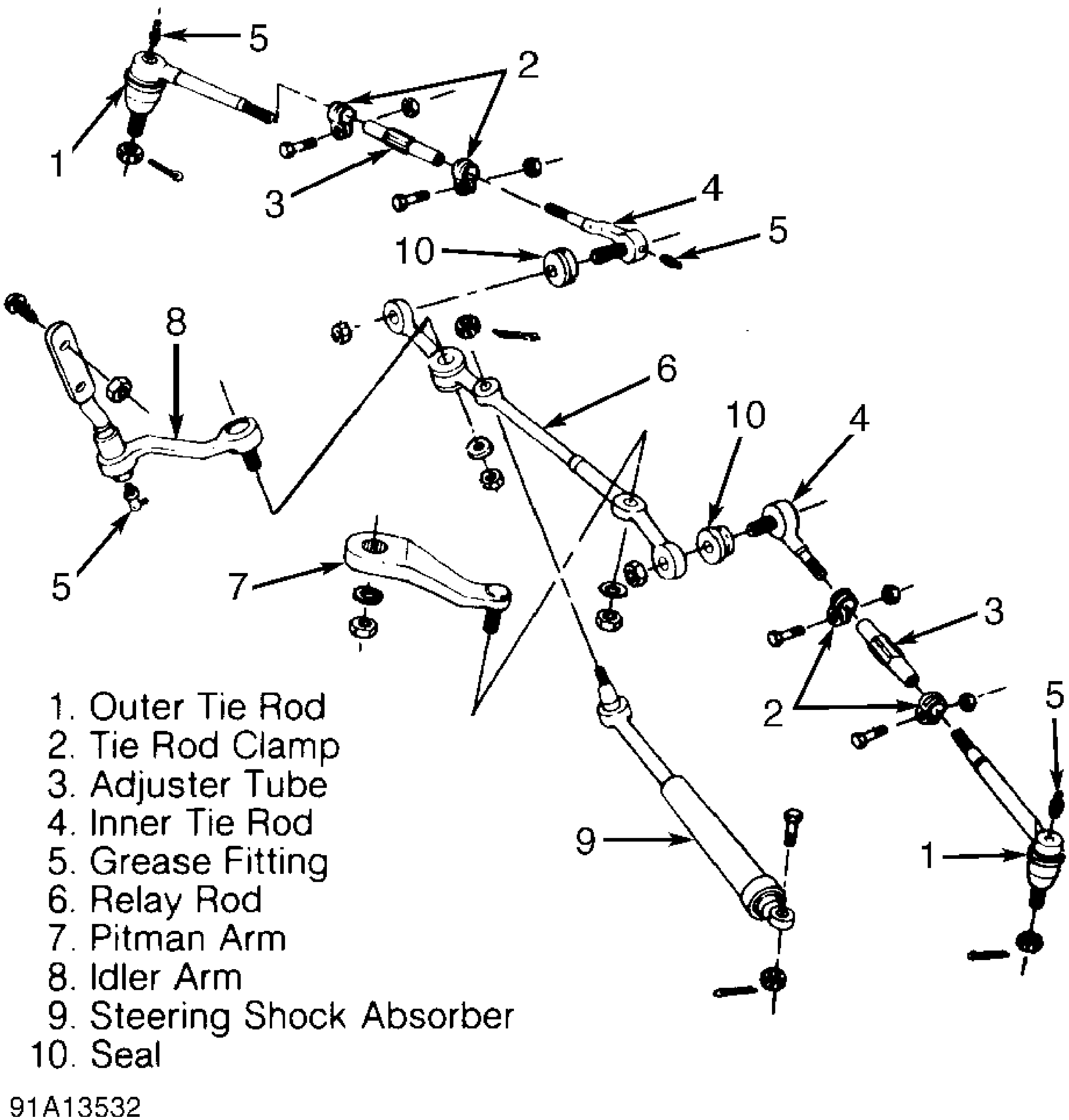

Fig. 3: Exploded View Of Steering Linkage (4WD)
Courtesy of General Motors Corp.

LUBRICATION

FLUID TYPE

Manufacturer recommends General Motors Power Steering Fluid (1050017) or an equivalent. Failure to use proper fluid will cause hose and seal damage.

FLUID LEVEL CHECK

To check fluid level, run engine until power steering fluid reaches normal operating temperature, about 170°F (77°C). Turn engine off. Remove fluid reservoir cap, and check level gauge. On models with remote reservoir, fluid level should be 1/2"-1" from top of reservoir with wheels turned fully left. Add fluid through fluid reservoir cap as necessary, and recheck fluid level. DO NOT overfill system.

HYDRAULIC SYSTEM BLEEDING

1) Fill reservoir to correct level. Allow fluid to settle for no less than 2 minutes. Start engine and run for 30-60 seconds, then turn off. Check fluid level and add fluid (as necessary). Repeat procedure until fluid level in reservoir remains constant.

2) Raise and support vehicle with both front wheels off ground. Start engine. Turn wheels right and left, lightly contacting stops. Check fluid level and add fluid (as necessary).

3) Lower vehicle. Turn wheels right and left, slowly from lock to lock. Turn off engine. Check fluid level and add fluid (as necessary). If fluid is foamy, allow vehicle to sit for a few minutes and repeat bleeding procedure.

ADJUSTMENTS

NOTE: Adjust worm bearing preload before performing over-center preload adjustment.

POWER STEERING PUMP BELT

BELT TENSION TABLE (1)

Application	New Belt	Used Belt
Serpentine Belt	(2)	(2)
"V" Belt	146	67

(1) - Tension in lbs. using V-belt tension gauge
(2) - Serpentine belts are equipped with self-tensioner; adjustment is not required.

WORM BEARING PRELOAD

1) Remove steering gear from vehicle and mount in vise before performing preload adjustments. See STEERING GEAR under REMOVAL & INSTALLATION. Remove worm bearing adjuster lock nut. See Fig. 1. Using spanner wrench, turn adjuster plug clockwise until plug is seated in housing. Torque should be about 20 ft. lbs. (27 N.m).

2) Index mark housing even with one hole in adjuster plug. See Fig. 4. Measure back 1/2" counterclockwise from first index mark. Mark housing with second index mark. Rotate adjuster plug back counterclockwise until hole in adjuster plug aligns with second index mark on housing. Install and tighten adjuster plug lock nut. Ensure adjuster plug remains in position.

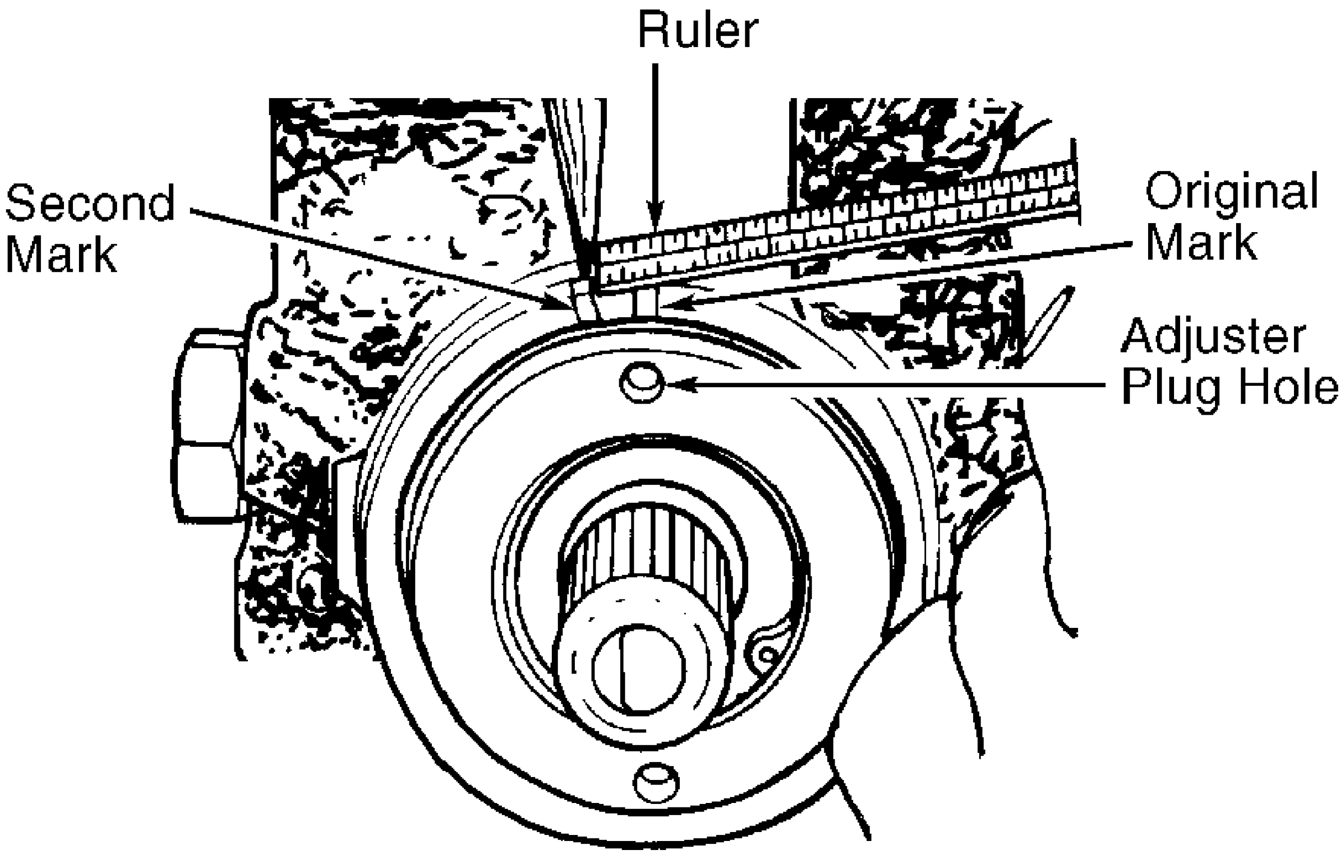

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Fig. 4: Measuring Worm Bearing Preload
Courtesy of General Motors Corp.

OVER-CENTER PRELOAD

1) With worm bearing preload adjusted, rotate stub shaft slowly from stop to stop while counting total number of turns. With stub shaft positioned at either stop, rotate stub shaft back 2/3 total number of turns counted. Stub shaft should be back to exact center position. Flat on stub shaft should be facing upward and parallel to side cover and master spline on pitman shaft should be aligned with adjuster screw.

2) Turn pitman shaft adjuster screw counterclockwise until extended, then back off one full turn. Place INCH-lb. torque wrench in vertical position on end of stub shaft. Measure gear over-center torque by rotating torque wrench attached to stub shaft in a 90 degree arc, 45 degrees on each side of center. See Fig. 5. Record highest degree of arc on each side of center. Record highest reading.

3) Turn adjuster screw in until torque required to rotate stub shaft is 6-10 INCH lbs. (.6-1.1 N.m) greater than reading in step 2). Continue adjustment until over-center reading is within specification. See LASH ADJUSTMENT PRELOAD table. Tighten adjuster screw lock nut when reading is obtained.

LASH ADJUSTMENT PRELOAD TABLE

Application	Over-Center INCH Lbs. (N.m)	(1) Total INCH Lbs. (N.m)

New Gears	6-10 (0.7-1.1)	18 (2.0)
Used Gears (2)	4-5 (.5-.6)	14 (1.6)

(1) - Total preload is sum of worm bearing and over-center preload.
(2) - In service for more than 400 miles.

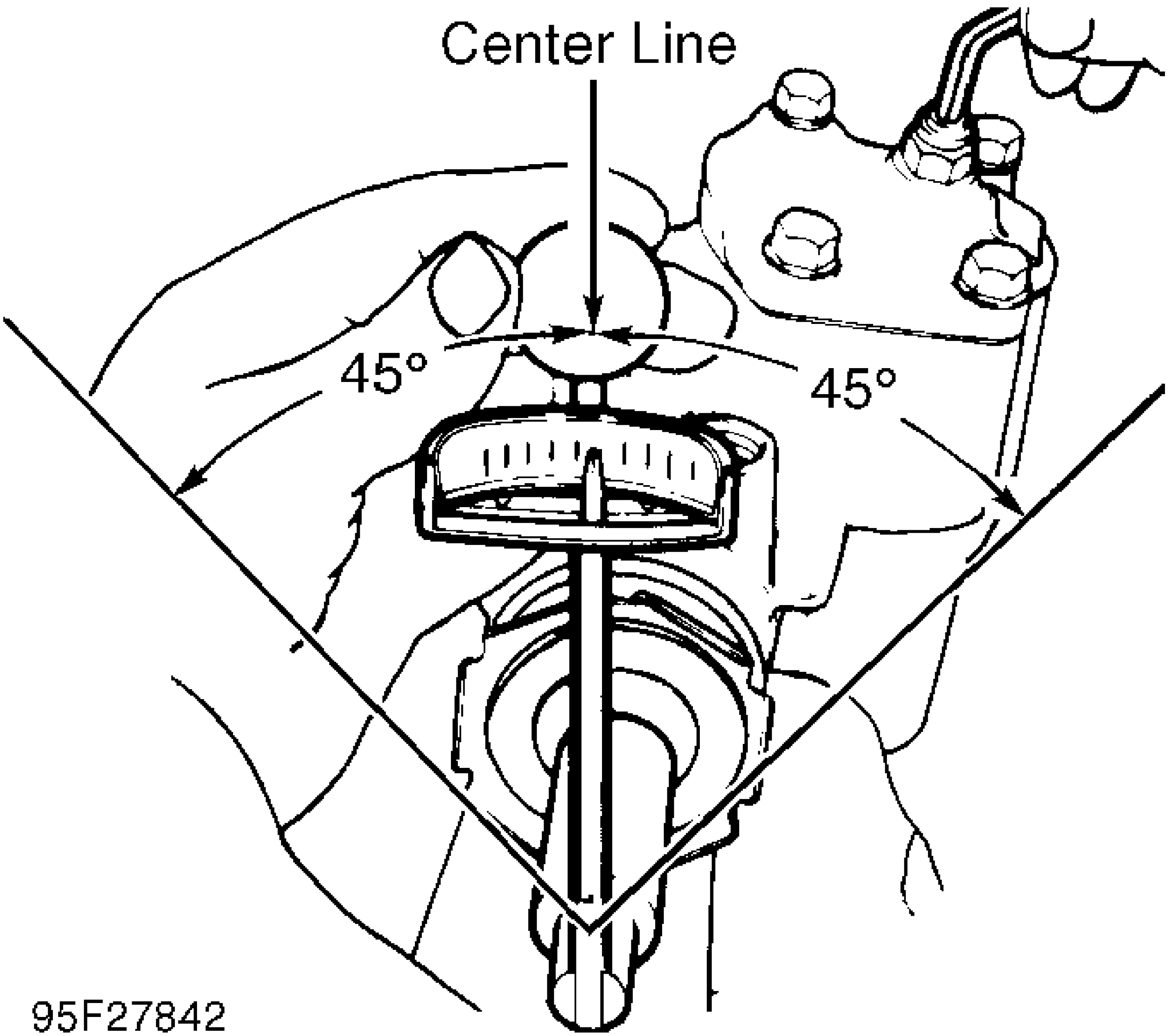


Fig. 5: Adjusting Over-Center Preload
Courtesy of General Motors Corp.

TROUBLE SHOOTING

NOTE: See TROUBLE SHOOTING - BASIC PROCEDURES article in GENERAL TROUBLE SHOOTING section.

TESTING

HYDRAULIC SYSTEM PRESSURE TEST

1) Ensure belt tension is correct. Disconnect high pressure line from power steering pump. Connect Power Steering Pressure Gauge (J-5176-D) hose to power steering pump fitting. Connect other hose from valve side of tester to steering gear inlet.

2) Open valve on pressure gauge. Check fluid level and add fluid as necessary. Check for possible leaks at pressure gauge connections. Bleed air from system. See HYDRAULIC SYSTEM BLEEDING under LUBRICATION. Run engine until fluid reaches normal operating temperature of 150-170°F (66-77°C). Check fluid level and add fluid as necessary.

3) Note pressure reading with valve open and engine idling. Pressure should be 80-125 psi (6-9 kg/cm^2). If pressure exceeds 200 psi (14 kg/cm^2), check hoses for restrictions and poppet valve for proper assembly.

CAUTION: To prevent pump damage, DO NOT hold gauge valve closed for more than 5 seconds.

4) Completely close and open valve 3 times. Record highest reading each time. Readings should be within specification. See PRESSURE TEST SPECIFICATIONS table.

5) If pressure readings are within specification and within 50 psi (4 kg/cm^2) of each other, pump is operating properly.

6) If readings are within specification but not within 50 psi (4 kg/cm^2) of each other, flow control valve in pump is sticking. Remove valve, but DO NOT disassemble it. Clean valve. Flush system if dirty.

7) If pressure is constant but more than 100 psi (7 kg/cm^2) below specification, clean or replace flow control valve in pump. If readings are still low, replace pump.

8) If pressure readings are as specified, turn steering wheel from stop to stop with valve open. Record highest pressure with wheels at both stops. If highest pressure is not equal to highest pressure recorded in step 2), steering gear is leaking internally. Repair or replace assembly.

9) Turn engine off. Remove tester. Reconnect pressure hose. Check fluid level. Bleed hydraulic system. See HYDRAULIC SYSTEM BLEEDING under LUBRICATION.

PRESSURE TEST SPECIFICATIONS TABLE

Idle Pressure psi (kg/cm^2)	Relief Pressure psi (kg/cm^2)
80-125 (6-9)	1100-1200 (77-84)

REMOVAL & INSTALLATION

STEERING GEAR

Removal

1) Center steering gear. Raise and support vehicle. Place drain pan under steering gear assembly. Disconnect return and feed lines from steering gear. Cap ends of lines and steering gear fittings. Remove flexible coupling-to-intermediate shaft retaining screw. Remove flexible coupling (if equipped). Remove shield from

intermediate shaft (if equipped).

2) Mark alignment of lower clamp to steering shaft. Remove lower clamp bolt from steering shaft. Mark relationship of pitman arm-to-pitman shaft. Remove pitman arm nut and spring washer. Remove pitman arm using Puller (J-6632-01) or Remover (J-29107). Remove steering gear mounting bolts and washers. Remove steering gear.

Installation

To install, reverse removal procedure. Ensure lower clamp bolt hole is aligned with groove in worm shaft (if equipped). Ensure pitman arm-to-pitman shaft reference marks are aligned. Tighten bolts and nuts to specification. See TORQUE SPECIFICATIONS. Fill reservoir (if necessary). Bleed air from system. See HYDRAULIC SYSTEM BLEEDING under LUBRICATION.

POWER STEERING PUMP

Removal

1) Place drain pan under steering pump assembly. Disconnect return and feed lines from steering pump. Cap ends of lines and steering pump fittings.

2) Unload power steering pump belt tensioner (if equipped). Remove power steering pump belt. Remove bracket mounting nuts, and remove bracket (if equipped). Using Pulley Remover (J-25034-B), remove pulley from pump shaft. Remove pump mounting bolts and remove pump.

Installation (All Models)

To install, reverse removal procedure. Use Pulley Installer (J-25033-B) to install pulley. Install pulley flush with end of pump shaft plus or minus .010" (.25 mm). Tighten bolts and nuts to specification. See TORQUE SPECIFICATIONS. Fill reservoir (if necessary). Bleed air from system. See HYDRAULIC SYSTEM BLEEDING under LUBRICATION.

INNER & OUTER TIE ROD ENDS

Removal

Raise and support vehicle. Remove cotter pins and outer tie rod end nuts. Remove inner tie rod end nuts. Using Wheel Stud and Tie Rod Remover (J-6627-A), remove outer tie rod ball studs from steering knuckle and inner tie rod ball studs from relay rod. On Commercial Van with I-Beam Axle, remove shock absorber from tie rod. On all models, loosen adjuster tube clamp bolts and clamps. Unscrew and remove tie rod ends from adjuster tube.

Installation

1) Lubricate tie rod end threads with chassis lubricant before installing. Install inner and outer tie rod ends to adjuster tube. Inner and outer tie rod end threads must be adjusted equally within 3 threads. Install adjuster clamps and clamp bolts. Ensure clamps are positioned between locating dimples on ends of adjuster tube.

2) Tie rod ends must rotate full travel and travel must be maintained during clamp tightening. Slot in adjuster tube and slot in clamp must be properly positioned.

3) Install inner tie rod ends to relay rod ensuring seal is on ball stud. Tighten Steering Linkage Installer (J-29193 or J-29194) to 40 ft. lbs. (54 N.m) to seat tapers. Install and tighten inner tie rod end-to-relay rod nuts. Install outer tie rod end to steering knuckle.

CAUTION: When installing outer tie rod end nut, tighten nut to align cotter pin hole. DO NOT tighten nut more than an additional

1/6 turn to align cotter pin hole. DO NOT back off nut to insert cotter pin.

4) Install and tighten outer tie rod end nut. Tighten bolts and nuts to specification. See TORQUE SPECIFICATIONS. Adjust toe-in. See WHEEL ALIGNMENT SPECIFICATIONS & PROCEDURES article in WHEEL ALIGNMENT section.

RELAY ROD

Removal

1) Raise and support vehicle. Remove inner tie rod end nuts. Remove inner tie rod ends from relay rod (if equipped). On models without inner tie rods, remove tie rod end-to-steering knuckle nuts. Separate tie rod ends from steering knuckle.

2) On all models, remove steering shock absorber nut from relay rod (if equipped). Using Steering Linkage Puller (J-24319-01), remove steering shock absorber from relay rod (if equipped). Remove connecting rod nut and remove connecting rod from relay rod (if equipped).

3) Remove relay rod end nuts from pitman arm and idler arm. Using Steering Linkage Puller (J-24319-01), remove pitman arm and idler arm from relay rod. Remove relay rod. See Figs. 2 and 3.

Installation

Reverse removal procedure. Ensure seals are on ball studs. Using Steering Linkage Installer (J-29193 or J-29194), seat all tapers to 40 ft. lbs. (54 N.m). Tighten nuts to specification. See TORQUE SPECIFICATIONS. Adjust toe-in. See WHEEL ALIGNMENT SPECIFICATIONS & PROCEDURES article in WHEEL ALIGNMENT section.

IDLER ARM

NOTE: Replace idler arm assembly if an up and down force of 25 ft. lbs. (110 N.m), applied at relay rod end of idler arm, produces a lash of more than 1/8" (3 mm) for a total of 1/4" (6 mm) in straight-ahead position. See Fig. 6.

Removal

Raise and support vehicle. Remove idler arm-to-frame nut and bolt. Remove idler arm nut and spring washer from relay rod. Using Steering Linkage Puller (J-24319-01), remove idler arm from relay rod. Remove idler arm. See Figs. 2 and 3.

Installation

To install, reverse removal procedure. Ensure seal is on ball stud. Using Steering Linkage Installer (J-29193 or J-29194), seat tapers to 40 ft. lbs. (54 N.m). Tighten nuts to specification. See TORQUE SPECIFICATIONS. Adjust toe-in. See WHEEL ALIGNMENT SPECIFICATIONS & PROCEDURES article in WHEEL ALIGNMENT section.

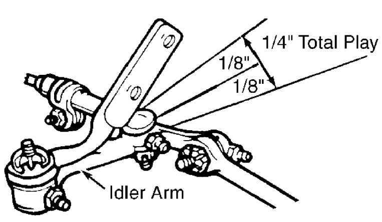


Fig. 6: Checking Idler Arm Play
Courtesy of General Motors Corp.

PITMAN ARM

Removal

1) Raise and support vehicle. Disconnect air induction assembly. Slide up intermediate shaft cover. Mark intermediate shaft for reassembly. Remove intermediate shaft. Disconnect oil filter lines at crossmember bracket. Remove splash shield.

2) Remove pitman arm nut and spring washer from relay rod. Using Steering Linkage Puller (J-24319-01), remove pitman arm from relay rod.

3) Remove lower steering gear bolts. LOOSEN upper steering gear bolt. Rotate steering gear for pitman arm clearance at crossmember, and support gear using block of wood.

4) Mark pitman arm-to-pitman shaft position. Remove pitman arm nut and spring washer from pitman shaft. Using Remover (J-6632-01) or Puller (J-29107), remove pitman arm from pitman shaft. See Figs. 2 and 3.

Installation

To install, reverse removal procedure. Ensure pitman arm-to-pitman shaft reference marks are aligned. Ensure seal is on ball stud. Using Steering Linkage Installer (J-29193 or J-29194), seat tapers to 40 ft. lbs. (54 N.m). Tighten nuts to specification. See TORQUE SPECIFICATIONS.

CONNECTING ROD

Removal

Raise and support vehicle. Remove connecting rod nuts from pitman arm and relay rod. Using Steering Linkage Puller (J-24319-01), remove connecting rod from pitman arm and relay rod.

Installation

To install, reverse removal procedure. Ensure seal is on ball stud. Using Steering Linkage Installer (J-29193 or J-29194), seat tapers to 40 ft. lbs. (54 N.m). Tighten nuts to specification. See TORQUE SPECIFICATIONS.

STEERING SHOCK ABSORBER

Removal

Remove steering shock absorber nut from relay rod. Using Steering Linkage Puller (J-24319-01), remove steering shock absorber from relay rod. Remove steering shock absorber-to-frame nut and bolt. Remove steering shock absorber.

Installation

Reverse removal procedure. Ensure seal is on ball stud. Using Steering Linkage Installer (J-29193 or J-29194), seat tapers to 40 ft. lbs. (54 N.m). Tighten nuts to specification. See TORQUE SPECIFICATIONS.

OVERHAUL

STEERING GEAR

Disassembly

1) Mount steering gear in vise, clamping onto one mounting tab. Pitman shaft should be in a vertical position. Insert punch through housing access hole to unseat retaining ring. Pry retaining ring out of groove in housing.

2) Rotate stub shaft counterclockwise to force housing end plug from housing. Remove seals and ring. Using Rack Piston Arbor (J-21552) and socket, remove rack piston end plug from rack piston.

3) Remove side cover bolts. Remove pitman shaft nut and spring washer from lower end of shaft retaining pitman arm. Remove pitman shaft and side cover assembly. Remove pitman shaft adjuster screw lock nut. Remove pitman shaft cover. Remove gasket from side cover.

4) Remove pitman shaft lower dust seal and rubber boot (if equipped). Using snap-ring pliers, remove pitman shaft lower retaining ring. Remove pitman shaft lower seals and washer. Using Pitman Shaft Bearing Puller (J-6278), remove pitman shaft bearing from housing.

5) Insert Rack Piston Arbor (J-21552) into end of rack piston assembly until arbor seats into end of worm shaft. Threaded arbor will keep recirculating balls from falling out of rack piston. Rotate stub shaft counterclockwise, forcing rack piston onto arbor. Remove rack piston and arbor assembly. Ensure arbor is fully inserted so recirculating balls will not fall out.

6) Remove adjuster plug lock nut. Using spanner wrench, remove adjuster plug. Remove valve body, stub shaft, worm shaft, seal, bearing races and worm bearing assembly from housing. If further disassembly is required, see appropriate component under OVERHAUL.

Inspection

Clean components using solvent, and blow dry. Avoid wiping valve components using cloth. Lint may cause binding of mechanism. DO NOT steam clean hydraulic parts.

Reassembly

1) Lubricate components with power steering fluid before reassembly. Install valve body, stub shaft and worm shaft assembly into housing.

2) Place seal protector over stub shaft. Install adjuster plug until it seats against valve body. Remove seal protector from housing. Loosely install adjuster plug lock nut. Insert rack piston (with arbor to retain recirculating balls) into housing. Align worm shaft and rack piston. Turn stub shaft clockwise to engage worm shaft. Maintain pressure on arbor until worm shaft is fully engaged. Remove arbor.

3) Install NEW pitman shaft side cover gasket. Thread pitman shaft side cover onto adjuster screw until it bottoms. Back off 1/2 turn. Install pitman shaft so center sector gear tooth meshes with center groove in rack piston. Install side cover bolts.

4) Install adjuster screw lock nut halfway onto pitman shaft. Install rack piston end plug in rack piston. Install housing end plug seals, ring, end plug and retainer ring. Adjust worm shaft bearing preload and over-center preload. See WORM BEARING PRELOAD and OVER-CENTER PRELOAD under ADJUSTMENTS.

ADJUSTER PLUG

Disassembly

Using snap-ring pliers, remove adjuster plug retaining ring. Remove adjuster plug washer and seal. Using screwdriver, pry up bearing retainer at raised area. Using Bearing Remover (J-8524-1) and Driver (J-7079-2), remove bearing from adjuster plug.

Inspection

Inspect bearings and races for scoring, pitting and wear. Inspect adjuster plug threads for damage.

Reassembly

Using Bearing Remover (J-8524-1) and Driver (J-7079-2), install bearing into adjuster plug. Install bearing retainer. Lubricate seal with power steering fluid. Install adjuster plug seal, washer and retaining ring.

NOTE: Retainer projections must not extend beyond washer when retaining ring is seated. Adjuster plug washer must be free to rotate.

WORM SHAFT, STUB SHAFT & VALVE BODY

Disassembly

1) Mark position of worm bearing races and bearing to worm shaft. Mark position of worm shaft notches to valve body. Remove worm shaft from valve body and stub shaft assembly. Remove stub shaft seal. Remove worm bearing races and bearing from worm shaft.

2) Lightly tap end of stub shaft against wood block until shaft cap is free of valve body. Pull stub shaft outward until drive pin hole is visible. See Fig. 7.

CAUTION: DO NOT pull shaft more than 1/4" (6 mm) or spool valve may become cocked in valve body.

3) Disengage drive pin. Remove stub shaft from valve body. Rotate and remove valve spool from valve body. If binding occurs, realign valves.

CAUTION: DO NOT force stub shaft or valve spool out of valve body.

4) Remove spool valve seal. Remove valve body rings and seals.

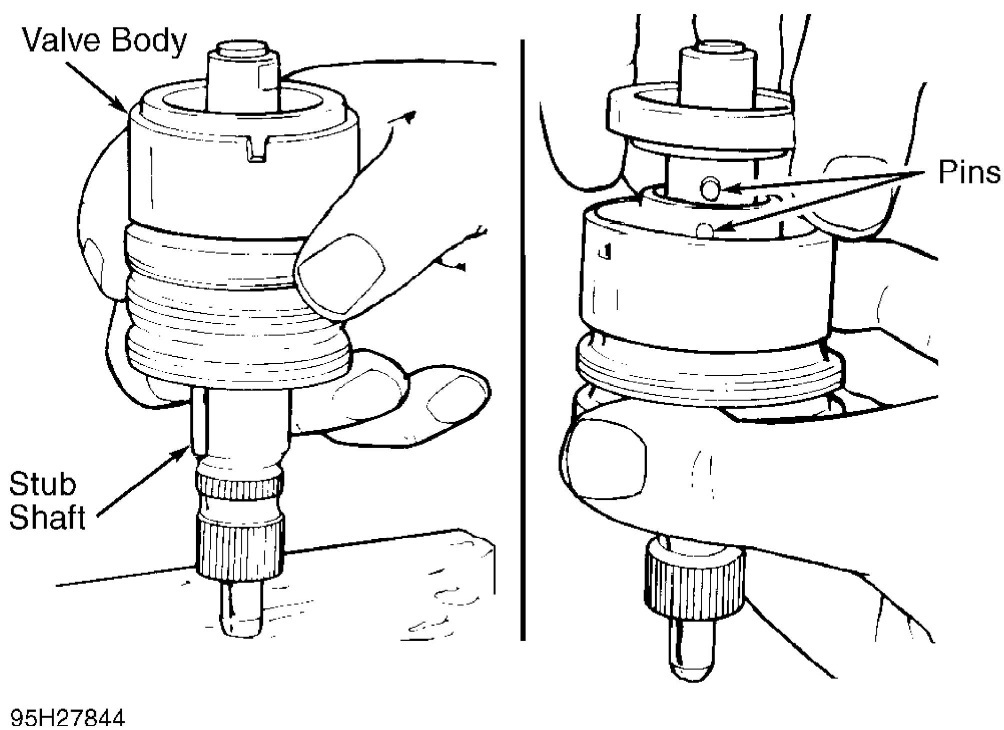


Fig. 7: Removing Stub Shaft From Valve Body
Courtesy of General Motors Corp.

Inspection

1) Clean components using solvent, and blow dry. Inspect stub

shaft for nicks and burrs. Remove nicks and burrs using crocus cloth if possible. Inspect shaft pin for wear and cracks.

2) Check valve spool fit in valve body. Remove nicks and burrs using crocus cloth if possible. Lubricate valve spool with power steering fluid. Rotate valve spool in valve body. If valve spool does not rotate freely, replace complete valve and stub shaft assembly.

3) Valve assembly is balanced during assembly. If replacing any components other than rings or seals, replace complete valve and stub shaft assembly.

Reassembly

1) Lubricate valve body components with power steering fluid. Install NEW rings and seals. Lubricate spool valve seals with power steering fluid and install on valve spool. Carefully insert valve spool into valve body.

2) Push valve spool through valve body until locating pin hole is visible at opposite end of valve body, and valve spool is flush with notched end of valve body. Install stub shaft into valve spool and valve body.

3) Align stub shaft locating pin with valve spool locating hole. Align notch in stub shaft cap with pin in valve body. Install stub shaft seal into valve body.

CAUTION: Before installing assembled valve body into gear housing, ensure valve body stub shaft locating pin is fully engaged in stub shaft cap notch. DO NOT allow stub shaft to disengage from valve body pin.

4) Install bearing and races on worm shaft, aligning marks made during disassembly. See Fig. 1. Install worm shaft onto valve body and stub shaft assembly, aligning notches made during disassembly.

RACK PISTON BALLS

Disassembly

Remove ball guide clamp screws and clamps. Remove ball guides. Remove all recirculating balls from rack piston. See Fig. 1.

Inspection

Clean components using solvent, and blow dry. Inspect rack piston grooves for scoring. Inspect ball bearings for damage. If any ball bearings are damaged, replace entire set. Check ball guides for cracks or dented ends. Inspect rack piston teeth for chips, cracks, dents and scoring. If rack piston is damaged, replace rack piston and worm shaft as an assembly.

Reassembly

1) Lubricate seals and ring with power steering fluid and carefully install onto rack piston. Install worm shaft into rack piston until worm shaft touches piston shoulder. While turning worm shaft counterclockwise, insert ball bearings into rack piston.

NOTE: Ensure light and dark colored balls are installed alternately; Black balls are .0005" (.013 mm) smaller than Silver balls.

2) Install 6 balls in ball guide, alternating ball colors. Bearings in guide must be in sequence with bearings in rack piston. Hold balls in place with chassis lubricant. Install return ball guide assembly into position.

3) Install clamp. Tighten clamp screws. See Fig. 8. Insert Rack Piston Arbor (J-21552) into rack piston until it contacts worm

shaft. Maintain pressure on arbor, and back worm shaft out of rack piston. DO NOT allow ball bearings to drop out.

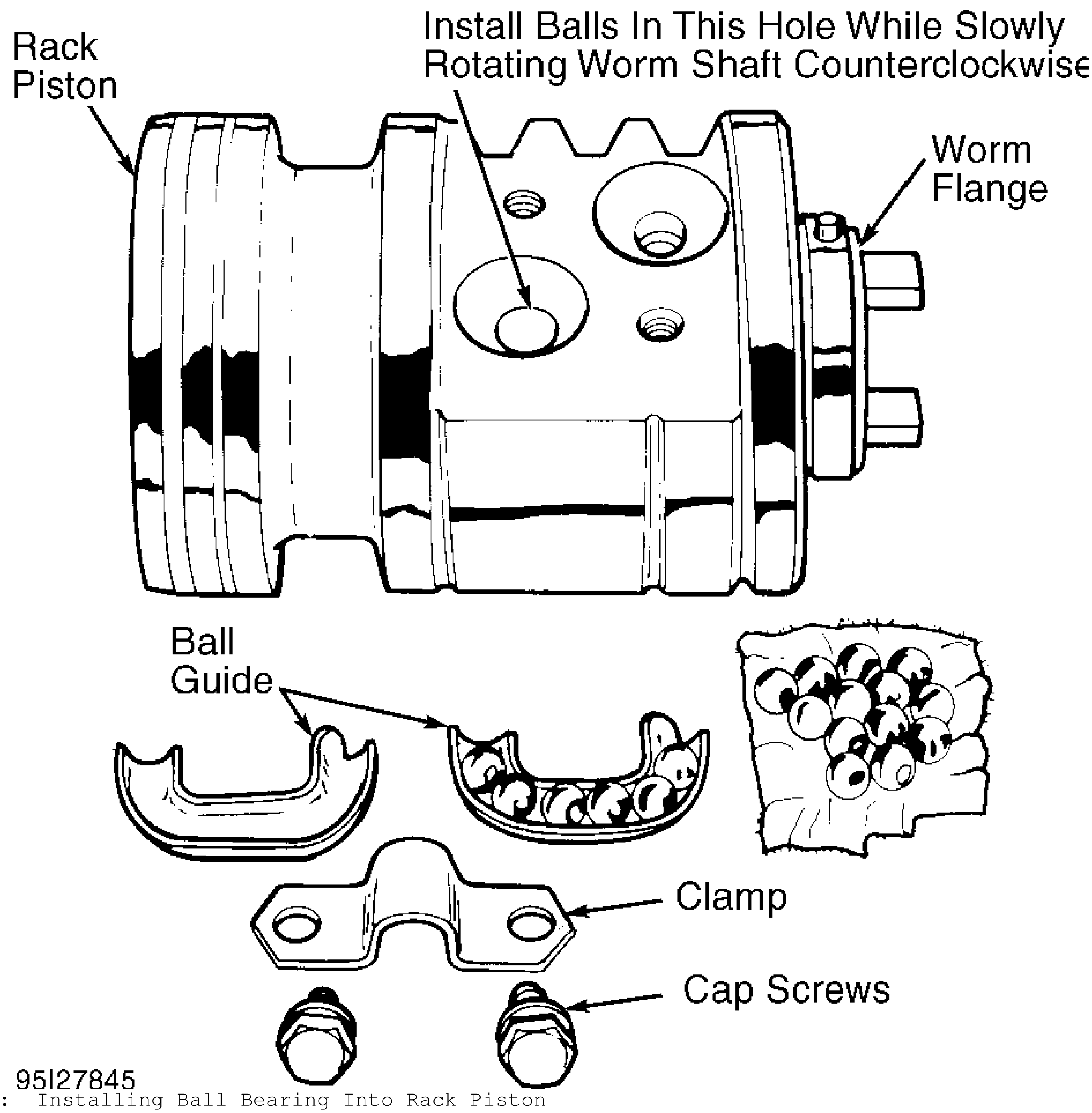


Fig. 8: Installing Ball Bearing Into Rack Piston
Courtesy of General Motors Corp.

POWER STEERING PUMP

Disassembly (Model "P")

1) Using Puller (J-29785-A), remove pulley from shaft if not previously removed. Remove union fitting and "O" ring. Remove reservoir retaining bolts. Remove reservoir and "O" rings from

housing.

2) Using punch and screwdriver, remove end plate retaining ring. Remove end plate and pressure plate spring. See Fig. 9. Remove "O" ring, flow control valve, and spring. Using soft-faced hammer, tap end of drive shaft to loosen pressure plate.

3) Remove pressure plate, pump ring, vanes, retaining ring, rotor, and thrust plate assembly from housing. Remove drive shaft. Pry drive shaft seal from housing. Remove dowel pins and seals.

Inspection

1) Clean all pump components with solvent and blow dry. Inspect flow control valve assembly for wear, scoring, burrs and other damage. Inspect seal bore for burrs, nicks and score marks.

2) Inspect machined surfaces of body for scratches or burrs. Check "O" ring mating surfaces. Inspect drive shaft for excessive wear.

3) Inspect pump ring for roughness. Check thrust plate and pressure plate for scoring and wear. Ensure vanes slide freely but fit snugly into slots. If vanes are loose in slots, replace rotor and/or vanes.

Reassembly

1) Lubricate all "O" rings, seals, pump ring, rotor and vanes with power steering fluid. Using socket, press NEW drive shaft seal into housing.

2) Install dowel pins and all "O" rings. Install drive shaft and thrust plate. Install pump rotor into housing with counterbore facing drive shaft side of steering pump.

3) Install NEW drive shaft retaining ring, ensuring ring is seated in groove. Install vanes with rounded edges toward pump ring. Install pump ring and pressure plate. Install "O" ring, flow control valve, and spring.

4) Install pressure plate spring, end plate, and retaining ring. Install seals and reservoir. Install union fitting, "O" ring, and reservoir retaining bolts.

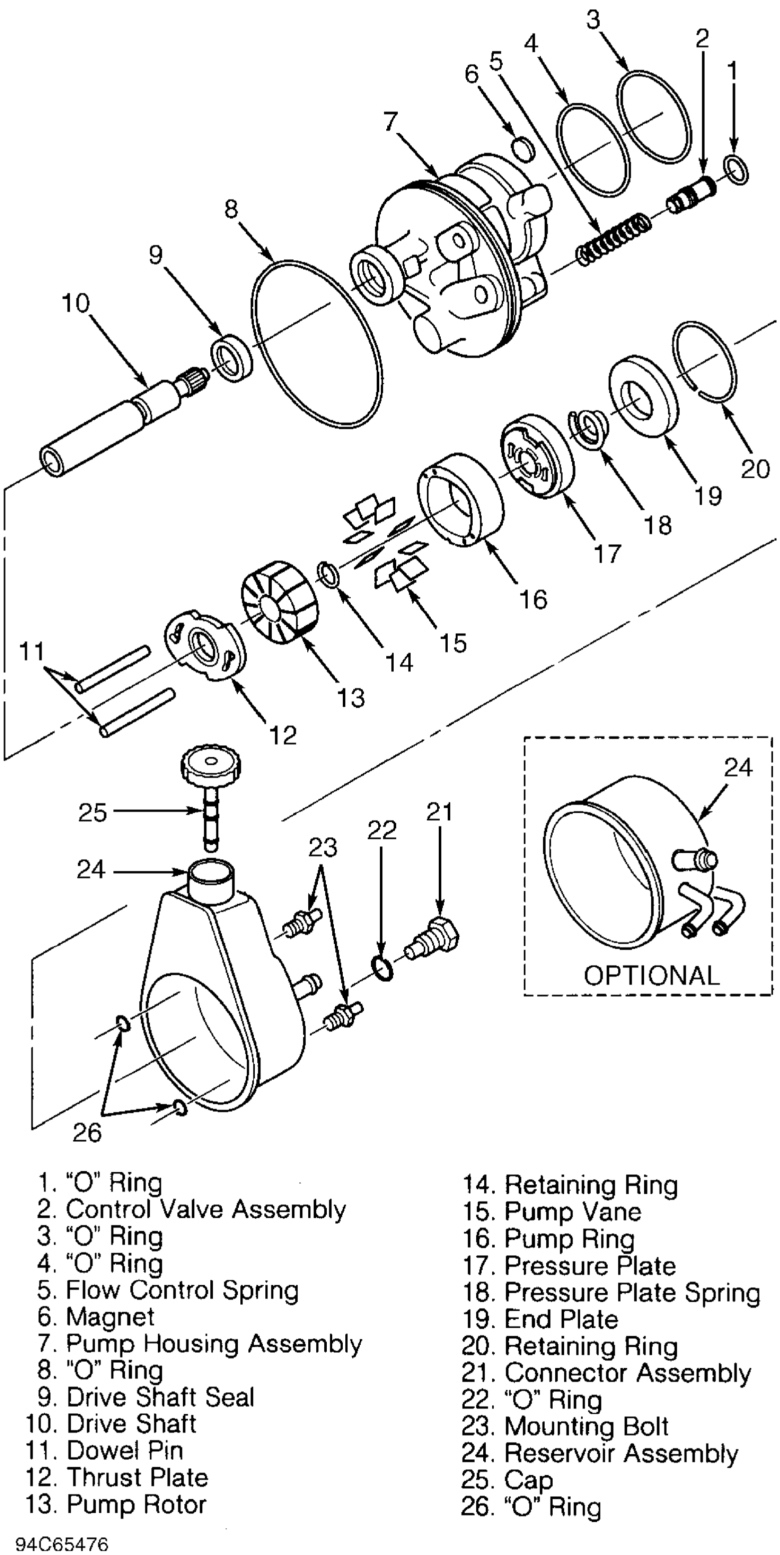


Fig. 9: Exploded View Of Power Steering Pump (Model "P")
Courtesy of General Motors Corp.

Disassembly (Model "CB")

1) Remove pump assembly from vehicle. Remove retaining clips

between reservoir and housing and remove reservoir from housing.

2) Remove union fitting and "O" ring. Remove control valve assembly and flow control spring.

3) Protect drive shaft with shim stock and using a small chisel, cut drive shaft seal and remove. Using small drift punch, remove end cover retaining ring. See Fig. 10.

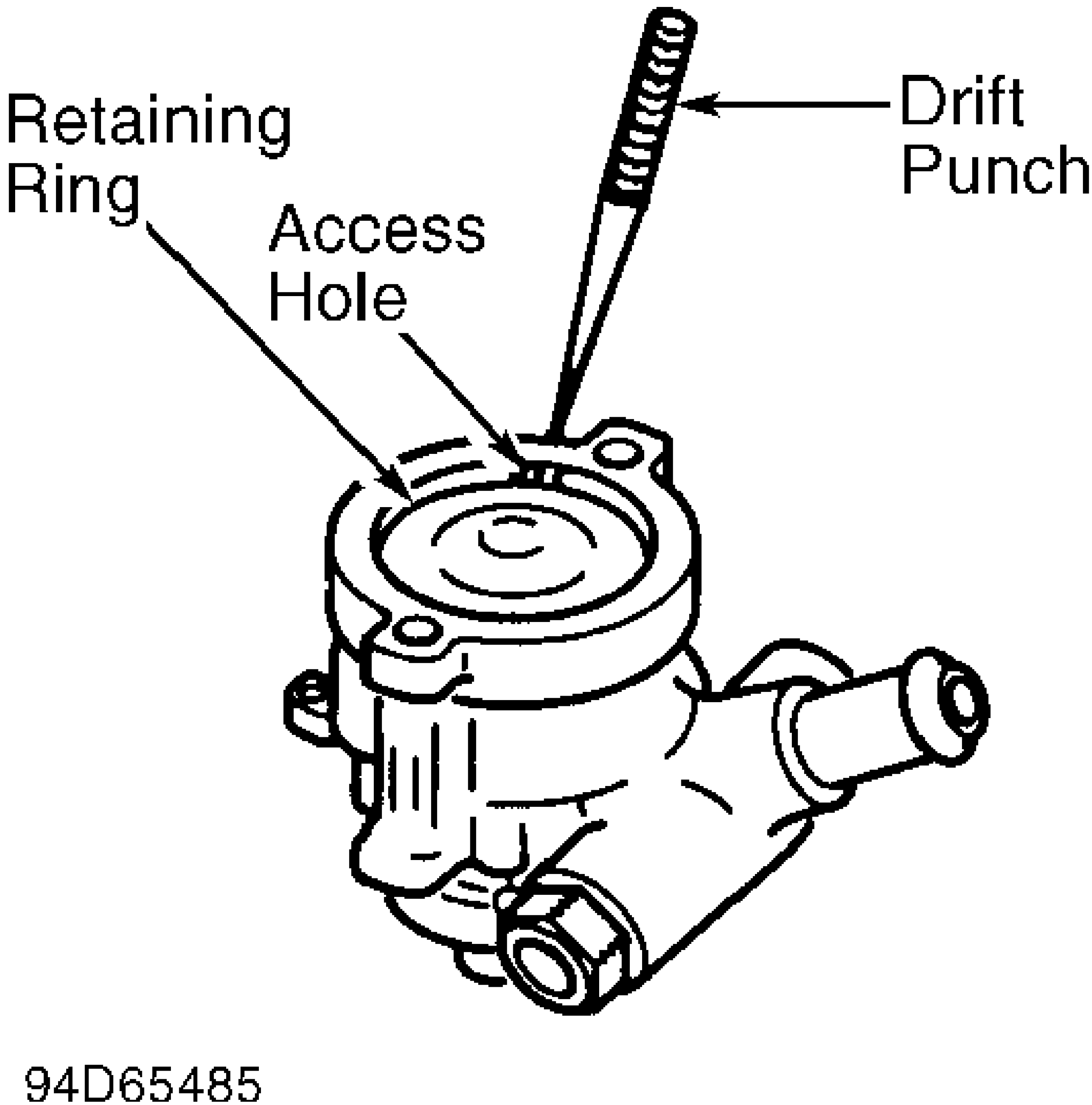
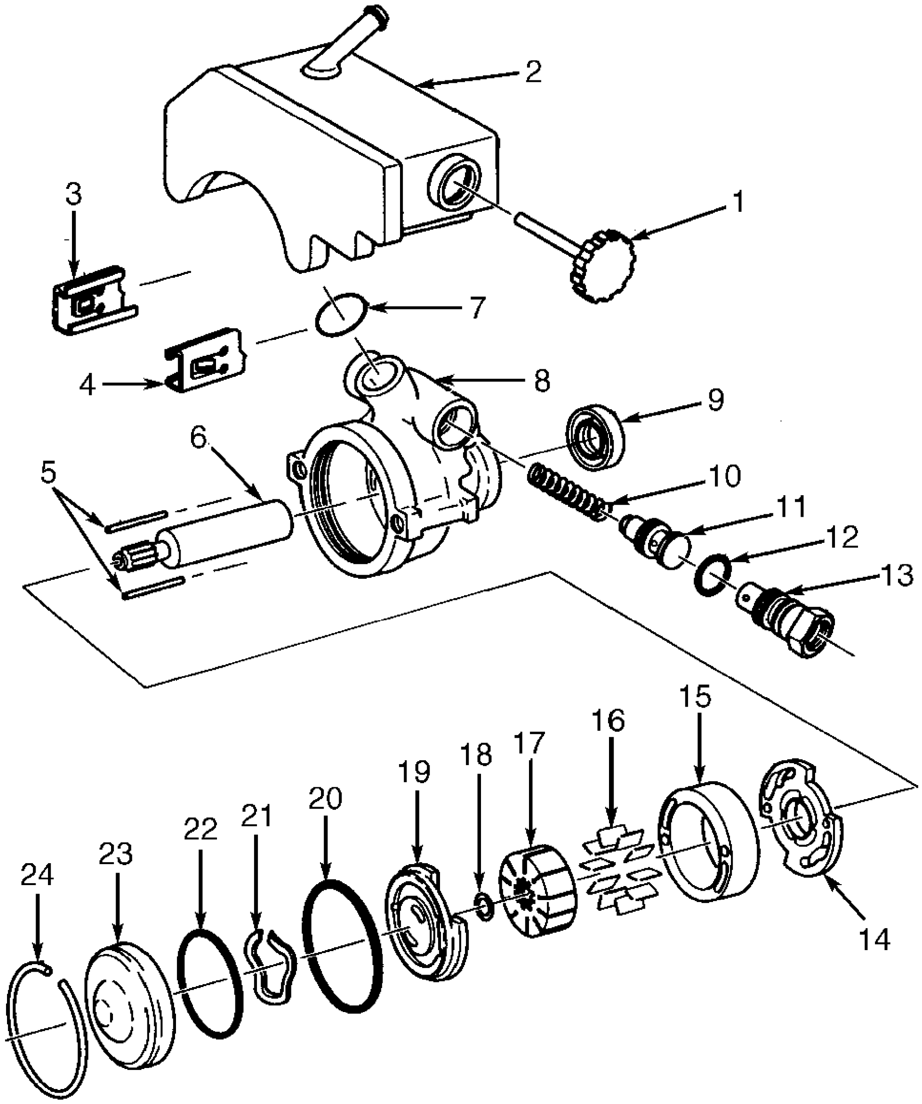


Fig. 10: Removing Retaining Ring (Pump Model "CB")
Courtesy of General Motors Corp.

4) Remove internal components of pump by gently pushing on drive shaft. See Fig. 11.



1. Cap
2. Reservoir Assembly
3. Retaining Clip
4. Retaining Clip
5. Dowel Pin
6. Drive Shaft
7. "O" Ring
8. Pump Housing
9. Drive Shaft Seal
10. Flow Control Spring
11. Control Valve Assembly
12. "O" Ring
13. Union
14. Thrust Plate
15. Pump Ring
16. Vane
17. Pump Rotor
18. Retaining Ring
19. Pressure Plate
20. "O" Ring
21. Pressure Plate Spring
22. "O" Ring
23. End Cover
24. Retaining Ring

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Fig. 11: Exploded View Of Power Steering Pump (Model "CB")
Courtesy of General Motors Corp.

5) Remove "O" ring from pump housing. Remove locating dowel pins. Remove drive shaft seal (if not already removed). Remove end

cover, pressure plate spring and "O" ring from pressure plate.

6) Remove pump ring and vanes from drive shaft subassembly. Remove retaining ring from drive shaft. Remove pump rotor and thrust plate from drive shaft.

Inspection

Clean all parts in power steering fluid and dry with compressed air. Inspect pressure plate, pump ring, vanes, thrust plate and drive shaft for scoring, pitting or chatter marks. Replace any damaged parts.

Reassembly

1) Lubricate NEW drive shaft seal with power steering fluid and drive seal into pump housing using Seal Driver (J-7728). See Fig. 12.

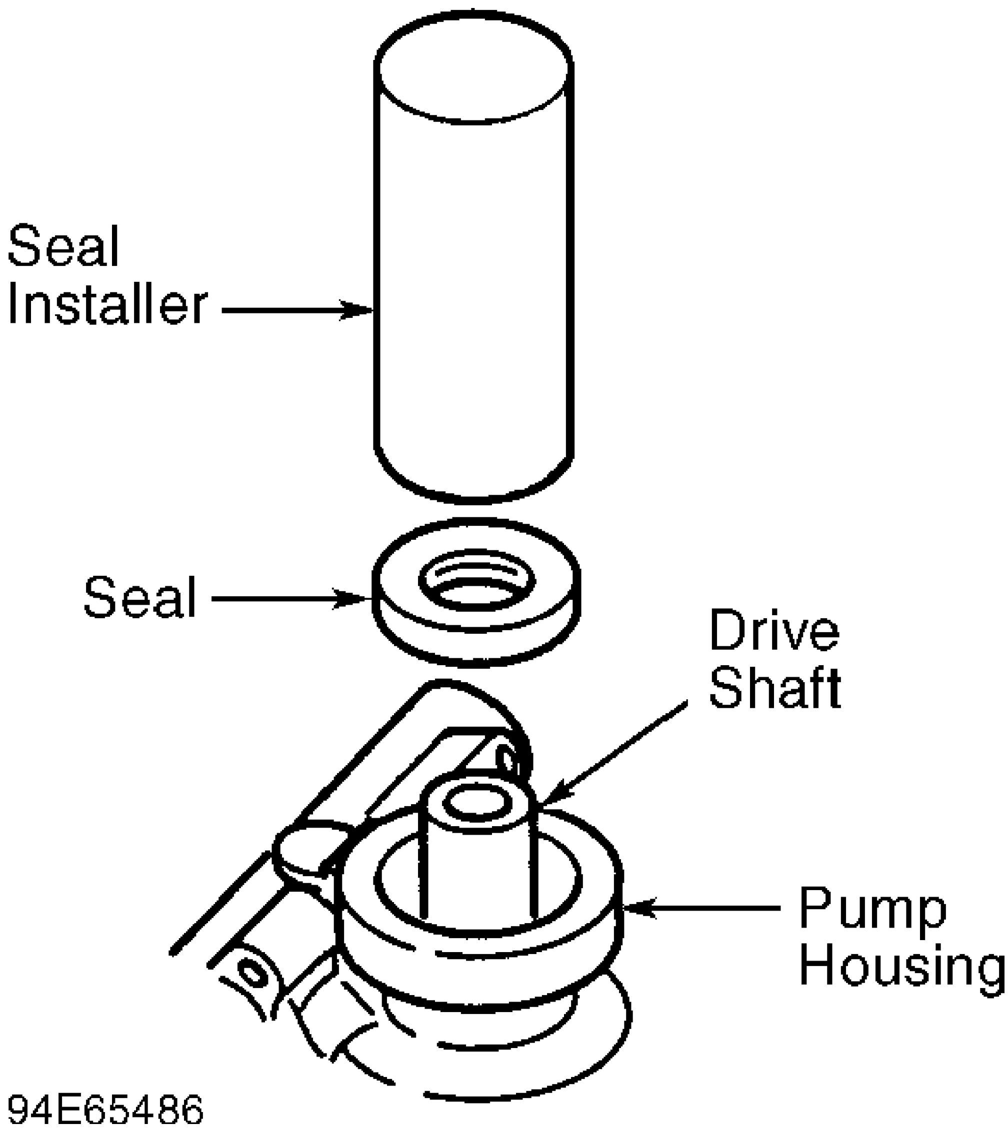

Fig. 12: Installing Drive Shaft Seal
Courtesy of General Motors Corp.

2) Install pump ring dowel pins into pump housing. Assemble thrust plate and pump rotor onto drive shaft. Fit NEW retaining ring

to shaft. See Fig. 13.

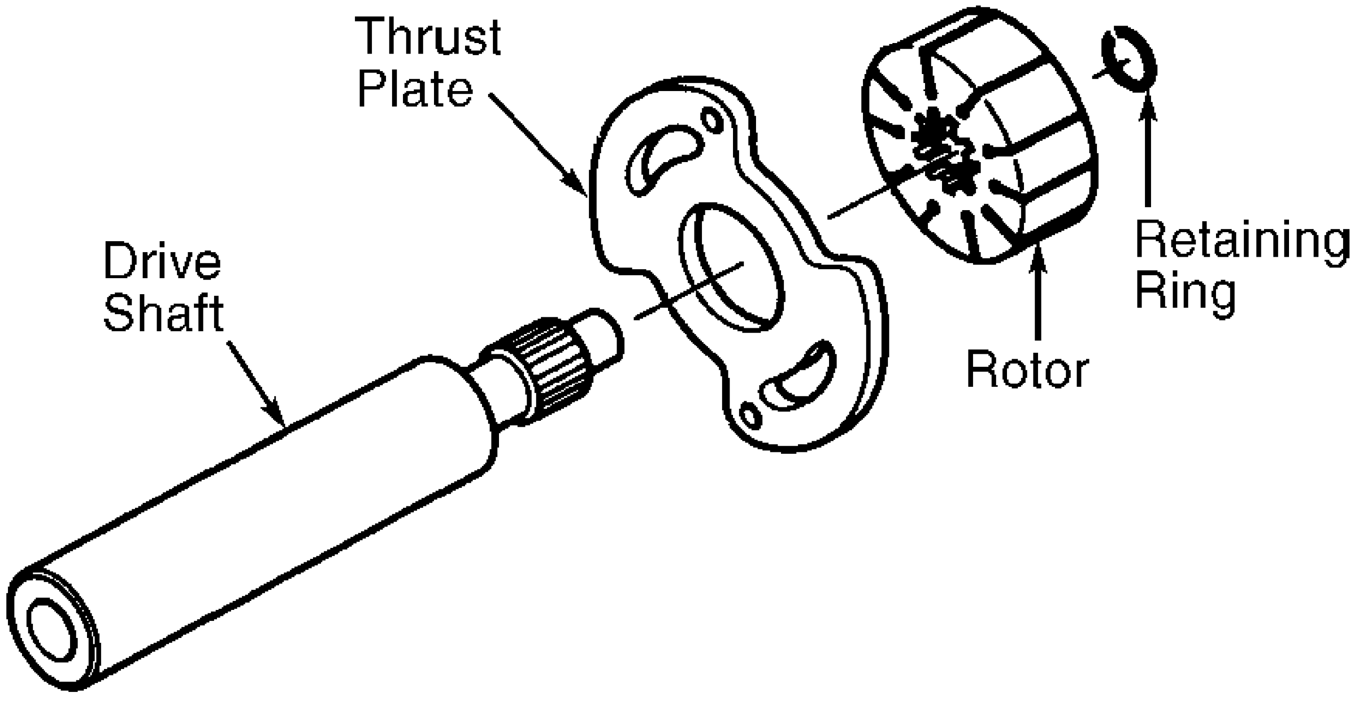

Fig. 13: Assembling Drive Shaft Subassembly
Courtesy of General Motors Corp.

3) Install drive shaft subassembly into pump housing. install vanes into pump rotor. With holes positioned correctly onto dowel pins, install pump ring into pump housing.

4) Lubricate NEW "O" ring with power steering fluid and install into pump body. Install pressure plate and pressure plate spring.

5) Lubricate NEW "O" ring with power steering fluid and install into end cover. Lubricate outer edge of end cover with power steering fluid. Press end cover into pump housing. When installing retaining ring into groove, ensure opening of ring is near access hole in pump housing. See Fig. 14.

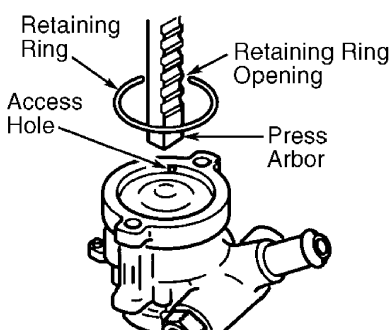

Fig. 14: Installing End Cover & Retaining Ring
Courtesy of General Motors Corp.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS TABLE

Application	Ft. Lbs. (N.m)
Adjuster Plug Lock Nut	78-81 (106-110)
Idler Arm Mounting Bolts	60 (81)
Idler Arm-To-Relay Rod Nut	
2WD	35 (47)
4WD	60 (81)
Intermediate Shaft-To-Stub Shaft Bolt	26 (35)
Pitman Arm-To-Relay Rod Nut	60 (81)
Pitman Shaft Adjuster Screw Lock Nut	20 (27)
Rack Piston End Plug	110 (149)
Shock Absorber-To-Frame Bolt	26 (35)
Shock Absorber-To-Relay Rod Nut	45-46 (61-62)
Side Cover Bolts	40 (54)
Steering Gear Mounting Bolts	55 (75)
Steering Pump Mounting Bolts	
2.2L	20 (27)
4.3L	36 (49)
Tie Rod Adjuster Clamp Nut	14 (19)
Tie Rod-To-Relay Rod Nut	35 (47)
Tie Rod-To-Steering Knuckle Nut	35 (47)
Union Fitting	55 (75)

* STEERING UNIFORM INSPECTION GUIDELINES *

1997 Chevrolet Blazer

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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TIE ROD ENDS (INNER AND OUTER)
TRACK BARS
TRAILING ARMS
WHEEL BEARINGS, RACES AND SEALS

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:

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.

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 HARNESSES

AIR RIDE SUSPENSION - WIRING HARNESS INSPECTION

Condition	Code	Procedure
Connector bent	A	Require repair or replacement.
Connector broken	A	Require repair or replacement.
Connector loose	A	Require repair or replacement.
Damaged (cut, burned, or chafed)	A	Require repair or replacement.
Excessive resistance	B	Require repair or replacement.
Fuse blown	A	Require replacement.
Fusible link blown	A	Require replacement.
Open	A	Require repair or replacement.
Poor ground	A	Require repair or replacement.
Routed incorrectly	B	Require rerouting according to vehicle manufacturer's specifications.
Shorted	A	Require repair or replacement.
Terminal bent	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal corroded	A	Require repair or replacement.
Terminal loose	A	Require repair or replacement.

BALL JOINTS

Before requiring or suggesting ball joint replacement, the approved OEM procedure must be used to measure ball joint wear. The measurement(s) obtained, along with the vehicle manufacturer's specifications, must be noted on the inspection report. Some states require that these measurements also appear on the invoice.

NOTE: The term "perceptible movement," defined as any visible movement in any direction, has been the industry standard for determining the need for replacement of follower ball joints. Some vehicle manufacturers are now publishing specifications for follower ball joints that were previously diagnosed by the "perceptible movement" standard. Before requiring or suggesting any parts be replaced based on "perceptible movement," consult your repair manual to determine if OEM specifications exist.

You are not required to replace ball joints in axle sets. However, when replacing a ball joint due to wear exceeding manufacturer's specification, you may suggest replacement of the other ball joint if its measurement shows it is close to the end of its useful life, for preventive maintenance.

BALL JOINT INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require repair or replacement of bent part if available; otherwise, replace ball joint.
Attaching hardware broken	A	Require replacement of broken part if available; otherwise, replace ball joint.
Attaching hardware corroded, affecting structural integrity	A	Require replacement of corroded part if available; otherwise, replace ball joint.
Attaching hardware incorrect	A	Require replacement of incorrect part if available; otherwise, replace ball joint.
Attaching hardware loose	A	Require repair or replacement of loose part if available; otherwise, replace ball joint.
Attaching hardware missing	C	Require replacement of missing part if available; otherwise, replace ball joint.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads if available; otherwise, replace ball joint.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads if available; otherwise, replace ball joint.
Binding	A	(1) Further inspection required.
Grease boot cracked	2	(2) Suggest replacement.
Grease boot missing	2	(3) Suggest replacement.
Grease boot torn	2	(4) Suggest replacement.
Grease fitting broken	A	Require replacement of grease fitting.
Grease fitting missing	C	Require replacement of grease fitting.
Grease fitting won't seal	A	Require replacement of grease fitting.
Greaseable ball joint will		

not take grease	2	(5) Suggest replacement of grease fitting.
Nut on ball joint loose	A	(6) Require repair or replacement.
Pre-load adjustment incorrect	B	Require repair or replacement.
Seized	A	Require replacement.
Stud bent	B	(7) Require replacement.
Stud broken	A	(7) Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	(7) Require replacement.
Wear exceeds manufacturer's specifications	B	Require replacement.

(1) - If greaseable, grease ball joint. If problem persists or joint is non-greaseable, require replacement.
(2) - Cracked grease boot will allow contaminants to enter the ball joint and will accelerate wear.
(3) - Lack of grease boot will allow contaminants to enter the ball joint and will accelerate wear.
(4) - Torn grease boot will allow contaminants to enter the ball joint and will accelerate wear.
(5) - If the greaseable ball joint still will not take grease after replacing the grease fitting, suggest replacement of ball joint.
(6) - Check for bent stud or damaged taper hole.
(7) - Check for damaged taper hole.

BUSHINGS

BUSHING INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require repair or replacement of bent part if available; otherwise, replace bushing.
Attaching hardware broken	A	Require replacement of broken part if available; otherwise, replace bushing.
Attaching hardware corroded, affecting structural integrity	A	Require replacement of corroded part if available; otherwise, replace bushing.
Attaching hardware incorrect	A	Require replacement of incorrect part if available; otherwise, replace bushing.
Attaching hardware loose	A	Require repair or replacement of loose part if available; otherwise, replace bushing.
Attaching hardware missing	C	Require replacement of missing part if available; otherwise, replace bushing.
Attaching hardware threads damaged	A	Require repair or replacement

of part with damaged threads if available; otherwise, replace bushing.

Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads if available; otherwise, replace bushing.
Binding	A	Require repair or replacement.
Deteriorated, affecting performance	A	Require repair or replacement.
Distorted, affecting performance	A	Require repair or replacement.
Leaking (fluid-filled type)	A	Require replacement.
Missing	C	Require replacement.
Noisy	2	(1) Further inspection required.
Rubber separating from internal metal sleeve on bonded bushing	A	Require replacement.
Seized	A	Require replacement.
Shifted (out of position)	B	Require repair or replacement.
Split	A	Require replacement.
Surface cracking (weather-checked)	..	No service suggested or required.

(1) - If noise isolated to bushing, suggest repair or replacement.

CAUTION: Use only approved lubricant on rubber bushings. Petroleum-based lubricants may damage rubber bushings.

CENTER LINKS

CENTER LINK INSPECTION

Condition	Code	Procedure
Attaching hardware incorrect	A	Require replacement of incorrect part, if available; otherwise, replace center link.
Attaching hardware loose	A	Require repair or replacement of loose part, if available; otherwise, replace center link.
Attaching hardware missing	C	Require replacement of missing part, if available; otherwise, replace center link.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads, if available; otherwise, replace center link.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads, if

		available; otherwise, replace center link.
Bent	B	Require replacement.
Binding	A	(1) Further inspection required.
Grease boot cracked	2	(2) Suggest replacement.
Grease boot missing	2	(3) Suggest replacement.
Grease boot torn	2	(4) Suggest replacement.
Grease fitting broken	A	Require replacement of grease fitting.
Grease fitting missing	C	Require replacement of grease fitting.
Grease fitting won't seal	A	Require replacement of grease fitting.
Grease seal missing	2	(3) Suggest replacement.
Grease seal torn	2	(4) Suggest replacement.
Looseness (perceptible horizontal movement)	1	(5) Suggest replacement.
Looseness that is excessive	B	(5)(6) Require replacement.
Seized	A	Require replacement.
Stud bent	B	(7) Require replacement.
Stud broken	A	(7) Require replacement.
Stud loose in taper hole	A	(7) Require repair or replacement.
Taper hole elongated	A	(8) Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	(7) Require replacement.
Wear exceeds manufacturer's specifications	B	Require replacement.

(1) - If greaseable, grease joint. If problem persists or joint is non-greaseable, require replacement.
(2) - Cracked grease boot will allow contaminants to enter the joint and will accelerate wear.
(3) - Lack of grease boot will allow contaminants to enter the joint and will accelerate wear.
(4) - Torn grease boot will allow contaminants to enter the joint and will accelerate wear.
(5) - If manufacturer's procedures for inspection exist, use those procedures; otherwise, use an approved inspection method such as the dry park check.

CAUTION: DO NOT use pliers or pry bar to check ball and socket movement. Use only moderate hand pressure.

(6) - Excessive looseness is defined as being significant enough to affect vehicle handling or structural integrity.
(7) - Check for damaged taper hole.
(8) - Check for damaged stud.

CONTROL ARM SHAFTS

CONTROL ARM SHAFT INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require replacement of broken

		part, if available; otherwise, replace shaft.
Attaching hardware loose	A	Require repair or replacement of loose part, if available; otherwise, replace shaft.
Attaching hardware missing	C	Require replacement of missing part, if available; otherwise, replace shaft.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads, if available; otherwise, replace shaft.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads, if available; otherwise, replace shaft.
Bent	B	Require replacement.
Shaft bushing surface undersized (worn)	B	Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

CONTROL ARMS

CONTROL ARM INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require repair or replacement of bent part, if available; otherwise, replace control arm.
Attaching hardware broken	A	Require replacement of broken part, if available; otherwise, replace control arm.
Attaching hardware corroded, affecting structural integrity	A	Require replacement of corroded part, if available; otherwise, replace control arm.
Attaching hardware incorrect	A	Require replacement of incorrect part, if available; otherwise, replace control arm.
Attaching hardware loose	A	Require repair or replacement of loose part, if available; otherwise, replace control arm.
Attaching hardware missing	C	Require replacement of missing part, if available; otherwise, replace control arm.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads,

		if available; otherwise, replace control arm.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads, if available; otherwise, replace control arm.
Bent	B	Require replacement.
Bushing hole oversized	B	Require replacement.
Ball joint hole oversized (loose interference or press fit)	B	(1) Further inspection required.
Corroded, affecting structural integrity	A	Require replacement.
Holes distorted	A	Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

(1) - If oversized ball joint is available, require replacement of ball joint. If oversized ball joint is not available, require replacement of control arm.

DRAG LINKS

DRAG LINK INSPECTION

Condition	Code	Procedure
Attaching hardware incorrect	A	Require replacement of incorrect part, if available; otherwise, replace drag link.
Attaching hardware loose	A	Require repair or replacement of loose part, if available; otherwise, replace drag link.
Attaching hardware missing	C	Require replacement of missing part, if available; otherwise, replace drag link.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads, if available; otherwise, replace drag link.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads, if available; otherwise, replace drag link.
Bent	B	Require replacement.
Binding	A	(1) Further inspection required.
Grease boot cracked	2	(2) Suggest replacement.
Grease boot missing	2	(3) Suggest replacement.
Grease boot torn	2	(4) Suggest replacement.
Grease fitting broken	A	Require replacement of grease fitting.

Grease fitting missing	C	Require replacement of grease fitting.
Grease fitting won’t seal	A	Require replacement of grease fitting.
Grease seal missing	2	(5) Suggest replacement.
Grease seal torn	2	(4) Suggest replacement.
Looseness (perceptible horizontal movement)	1	(6) Suggest replacement.
Looseness that is excessive	B	(6)(7) Require replacement.
Seized	A	Require replacement.
Stud bent	B	(8) Require replacement.
Stud broken	A	(8) Require replacement.
Stud loose in taper hole	A	(8) Require repair or replacement.
Taper hole elongated	A	(9) Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	(8) Require replacement.
Wear exceeds manufacturer’s specifications	B	Require replacement.

(1) - If greaseable, grease joint. If problem persists or joint is non-greaseable, require replacement.
(2) - Cracked grease boot will allow contaminants to enter the joint and will accelerate wear.
(3) - Lack of grease boot will allow contaminants to enter the joint and will accelerate wear.
(4) - Torn grease boot will allow contaminants to enter the joint and will accelerate wear.
(5) - Missing grease seal will allow contaminants to enter the joint and will accelerate wear.
(6) - If manufacturer’s procedures for inspection exist, use those procedures; otherwise, use an approved inspection method such as the dry park check.
CAUTION: DO NOT use pliers or pry bar to check ball and socket movement. Use only moderate hand pressure.
(7) - Excessive looseness is defined as being significant enough to affect vehicle handling or structural integrity.
(8) - Check for damaged taper hole.
(9) - Check for damaged stud.

ELECTRONIC RIDE CONTROL SHOCKS AND STRUTS

NOTE: This section covers the electronic damping control portion of the electronic shock or strut. For dampening portion of shock or strut conditions and procedures, refer to the SHOCK ABSORBERS, STRUT CARTRIDGES AND STRUT ASSEMBLIES section.

ELECTRONIC RIDE CONTROL SHOCK AND STRUT INSPECTION

Condition	Code	Procedure
Connector bent	A	Require repair or replacement.
Connector broken	A	Require repair or replacement.
Connector loose	A	Require repair or replacement.
Electronic valve control		

inoperative	2	(1) Suggest replacement.
Terminal bent	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal corroded	A	Require repair or replacement.
Terminal loose	A	Require repair or replacement.

(1) - It is acceptable to replace with a non-electronically controlled unit, where available.

IDLER ARMS

IDLER ARM INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require replacement of broken part, if available; otherwise, replace idler arm.
Attaching hardware incorrect	A	Require replacement of incorrect part, if available; otherwise, replace idler arm.
Attaching hardware loose	A	Require repair or replacement of loose part, if available; otherwise, replace idler arm.
Attaching hardware missing	C	Require replacement of missing part, if available; otherwise, replace idler arm.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads, if available; otherwise, replace idler arm.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads, if available; otherwise, replace idler arm.
Binding	A	(1) Further inspection required.
Grease boot cracked	2	(2) Suggest replacement.
Grease boot missing	2	(3) Suggest replacement.
Grease boot torn	2	(4) Suggest replacement.
Grease fitting broken	A	Require replacement of grease fitting.
Grease fitting missing	C	Require replacement of grease fitting.
Grease fitting won't seal	A	Require replacement of grease fitting.
Grease seal missing	2	(5) Suggest replacement.
Grease seal torn	2	(4) Suggest replacement.
Greaseable joint will not take grease	2	(1) Suggest replacement of grease fitting.
Looseness at frame bracket end	B	(6)(7) Require repair or replacement.

Looseness at link end (perceptible horizontal movement)	1	(8) Suggest replacement.
Looseness at link end that is excessive	B	(8)(9) Require replacement.
Mounted out of position (center link not parallel)	B	Require repositioning.
Nut on stud loose	A	(10) Require repair or replacement.
Seized	A	Require replacement.
Stud bent	B	(11) Require replacement.
Stud broken	A	(11) Require replacement.
Taper hole elongated	A	(12) Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	(11) Require replacement.
Wear exceeds manufacturer's specifications	B	Require replacement.

(1) - If greaseable, grease joint. If problem persists or joint is non-greaseable, require replacement.
(2) - Cracked grease boot will allow contaminants to enter joint and will accelerate wear.
(3) - Lack of grease boot will allow contaminants to enter joint and will accelerate wear.
(4) - Torn grease boot will allow contaminants to enter joint and will accelerate wear.
(5) - Missing grease seal will allow contaminants to enter joint and will accelerate wear.
(6) - If manufacturer's procedures and specifications exist, use those procedures and specifications; otherwise, use an approved inspection method such as the dry park check.
(7) - Looseness is defined as movement that creates excessive toe change.
(8) - If manufacturer's procedures for inspection exist, use those procedures; otherwise, use an approved inspection method such as the dry park check.
CAUTION: DO NOT use pliers or pry bar to check ball and socket movement. Use only moderate hand pressure.
(9) - Excessive looseness is defined as significant enough to affect vehicle handling or structural integrity.
(10) - Check for bent stud or damaged taper hole.
(11) - Check for damaged taper hole.
(12) - Check for damaged stud.

KING PINS

You are not required to replace king pins in axle sets. However, when replacing a king pin due to wear exceeding manufacturer's specifications, you may suggest replacement of the other king pin on the axle if its measurement shows it is close to the end of its useful life.

KING PIN INSPECTION

Condition	Code	Procedure
Bearing balls pitted	A	Require replacement.
Bearing balls worn	A	Require replacement.
Bearing races pitted	A	Require replacement.

Bearing races worn	A	Require replacement.
Bearing rollers pitted	A	Require replacement.
Bearing rollers worn	A	Require replacement.
Bearing seal bent	2	Suggest replacement of seal or bearing.
Bearing seal missing	2	Suggest replacement of seal or bearing.
Bearing seal torn	2	Suggest replacement of seal or bearing.
Binding	A	Require repair or replacement of affected parts.
End caps missing	C	Require replacement of missing part, if available; otherwise, replace king pin.
End play exceeds specifications	B	Require repair.
Grease fitting broken	A	Require replacement of grease fitting.
Grease fitting missing	C	Require replacement of grease fitting.
Grease fitting won't seal	A	Require replacement of grease fitting.
Locating pins missing	C	Require replacement of missing part, if available; otherwise, replace king pin.
Looseness exceeds manufacturer's specifications	B	Require replacement of worn parts.
Seized	A	Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Will not take grease	2	(1) Suggest replacement of grease fitting.

(1) - If king pin will not take grease after replacement of grease fitting, suggest replacement of king pin.

PITMAN ARMS

PITMAN ARM INSPECTION

Condition	Code	Procedure
Attaching hardware incorrect	A	Require replacement of incorrect part, if available; otherwise, replace pitman arm.
Attaching hardware loose	A	Require repair or replacement of loose part, if available; otherwise, replace pitman arm.
Attaching hardware missing	C	Require replacement of missing part, if available; otherwise, replace pitman arm.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads, if available; otherwise,

		replace pitman arm.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads, if available; otherwise, replace pitman arm.
Bent	B	Require replacement.
Binding	A	(1) Further inspection required.
Grease boot cracked	2	(2) Suggest replacement.
Grease boot missing	2	(3) Suggest replacement.
Grease boot torn	2	(4) Suggest replacement.
Grease fitting broken	A	Require replacement grease fitting.
Grease fitting missing	C	Require replacement of grease fitting.
Grease fitting won't seal	A	Require replacement of grease fitting.
Grease seal missing	2	(3) Suggest replacement of seal.
Grease seal torn	2	(4) Suggest replacement of seal.
Looseness (perceptible horizontal movement)	1	(5) Suggest replacement.
Looseness that is excessive	B	(5)(6) Require replacement.
Nut on stud loose	A	(7) Require repair or replacement.
Seized	A	Require replacement.
Splines damaged	A	Require repair or replacement.
Splines stripped (splines missing)	A	Require replacement.
Stud bent	B	(8) Require replacement.
Stud broken	A	(8) Require replacement.
Stud loose in taper hole	A	(8) Require repair or replacement.
Taper hole elongated	A	(9) Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	(8) Require replacement.

(1) - If greaseable, grease joint. If problem persists or joint is non-greaseable, require replacement.
(2) - Cracked grease boot will allow contaminants to enter joint and will accelerate wear.
(3) - Lack of grease boot will allow contaminants to enter joint and will accelerate wear.
(4) - Torn grease boot will allow contaminants to enter joint and will accelerate wear.
(5) - If manufacturer's procedures for inspection exist, use those procedures; otherwise, use an approved inspection method such as the dry park check.
CAUTION: DO NOT use pliers or pry bar to check ball and socket movement. Use only moderate hand pressure.
(6) - Excessive looseness is defined as being significant enough to affect vehicle handling or structural integrity.
(7) - Check for bent stud of damaged taper hole.
(8) - Check for damaged taper hole.
(9) - Check for damaged stud.

POWER STEERING HOSES

POWER STEERING HOSE INSPECTION

Condition	Code	Procedure
Blistered	B	Require replacement.
Blocked	A	Require repair or replacement.
Fitting threads damaged	A	Require repair or replacement.
Fitting threads stripped (threads missing)	A	Require replacement.
Inner fabric (webbing) cut	A	Require replacement.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Outer covering is cracked to the extent that the inner fabric of hose is visible	B	Require replacement.
Restricted	A	Require repair or replacement.

POWER STEERING (HYDRAULIC) PUMPS

If diagnosis has determined that complete disassembly is necessary to determine the extent of the system failure, the suggestion may be made to rebuild or replace the power steering pump. Repair or replacement of the following components may be required if performed as part of a power steering pump overhaul or rebuild service to meet a minimum rebuild standard.

POWER STEERING (HYDRAULIC) PUMP INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require repair or replacement of bent part.
Attaching hardware broken	A	Require replacement of broken part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Belt alignment incorrect	B	(1) Further inspection required.
Belt cracked	1	Suggest replacement.
Belt frayed	1	Suggest replacement.
Belt missing	C	Require replacement.
Belt noisy	2	(2) Further inspection required.
Belt plies separated	A	Require replacement.

Belt tension out of specification	B	Require adjustment or replacement.
Belt worn beyond adjustment range	B	Require replacement.
Belt worn so it contacts bottom of pulley	A	Require replacement.
Binding	A	Require repair or replacement.
Fluid at or beyond service interval	3	Suggest fluid change.
Fluid contaminated	B	(3) Require flushing and refilling of the system.
Fluid level incorrect	B	Require adjustment of fluid level.
Inadequate assist	A	(4) Further inspection required.
Leaking	A	Require repair or replacement.
Noise	2	(5) Further inspection required.
Pulley bent	A	Require repair or replacement of pulley.
Pulley missing	C	Require replacement of pulley.
Remote reservoir leaking	A	Require replacement of reservoir,
Reservoir cap broken	A	Require replacement of cap.
Reservoir cap missing	C	Require replacement of cap.
Seized	A	Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

(1) - Determine cause of incorrect alignment and require repair.
(2) - Determine cause of noise and suggest repair.
(3) - Determine and correct source of contamination. OEM specifications must be followed for fluid type.
(4) - If pump is source of inadequate assist, require repair or replacement.
(5) - If noise is isolated to pump, suggest repair or replacement.

RADIUS ARMS

RADIUS ARM INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require replacement of broken part.
Attaching hardware incorrect	A	Require replacement of incorrect part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.

Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Bent	B	Require replacement.
Corroded, affecting structural integrity	A	Require replacement.
Holes distorted	A	Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

RELAY RODS

RELAY ROD INSPECTION

Condition	Code	Procedure
Attaching hardware incorrect	A	Require replacement of incorrect part, if available; otherwise, replace relay rod.
Attaching hardware loose	A	Require repair or replacement of loose part, if available; otherwise, replace relay rod.
Attaching hardware missing	C	Require replacement of missing part, if available; otherwise, replace relay rod.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads, if available; otherwise, replace relay rod.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads, if available; otherwise, replace relay rod.
Bent	B	Require replacement.
Binding	A	(1) Further inspection required.
Grease boot cracked	2	(2) Suggest replacement.
Grease boot missing	2	(3) Suggest replacement.
Grease boot torn	2	(4) Suggest replacement.
Grease fitting broken	A	Require replacement grease fitting.
Grease fitting missing	C	Require replacement of grease fitting.
Grease fitting won’t seal	A	Require replacement of grease fitting.
Grease seal missing	2	(3) Suggest replacement.
Grease seal torn	2	(4) Suggest replacement.
Looseness (perceptible horizontal movement)	1	(5) Suggest replacement.
Looseness that is excessive	B	(5)(6) Require replacement.
Seized	A	Require replacement.
Stud bent	B	(7) Require replacement.

Stud loose in taper hole	A	(7) Require repair or replacement.
Taper hole elongated	A	(8) Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	(7) Require replacement.
Wear exceeds manufacturer's specifications	B	Require replacement.

(1) - If greaseable, grease joint. If problem persists or joint is non-greaseable, require replacement.
(2) - Cracked grease boot will allow contaminants to enter the joint and will accelerate wear.
(3) - Lack of grease boot will allow contaminants to enter the joint and will accelerate wear.
(4) - Torn grease boot will allow contaminants to enter the joint and will accelerate wear.
(5) - If manufacturer's procedures for inspection exist, use those procedures; otherwise, use an approved inspection method such as the dry park check.
CAUTION: DO NOT use pliers or pry bar to check ball and socket movement. Use only moderate hand pressure.
(6) - Excessive looseness is defined as being significant enough to affect vehicle handling or structural integrity.
(7) - Check for damaged taper hole.
(8) - Check for damaged stud.

SHOCK ABSORBERS, STRUT CARTRIDGES AND STRUT ASSEMBLIES

You are not required to replace shocks or struts in axle sets. However, when replacing a shock or strut due to the conditions that follow, you may suggest replacement of the other shock or strut on the same axle for improved performance and preventive maintenance.

* Part is close to the end of its useful life
* To extend tire life
* To balance ride and handling
* To improve stopping distance

When replacing steering and/or suspension components which may affect an alignment angle, you are required to check and adjust alignment as needed. Refer to the OEM specifications.

Under no circumstances should a technician bend struts or strut housings.

A vehicle's load-carrying and handling abilities are limited by its suspension, tires, brakes, and driveline. Installing coil over shocks or any other load assist device does not increase the vehicle's load capacity. See the vehicle owner's manual for more details.

NOTE: If vehicle is equipped with original equipment coil over shocks, apply the conditions for coil springs from the SPRINGS - COIL, LEAF AND TORSION BAR section of the STEERING AND SUSPENSION guidelines. If the vehicle is equipped with add-on coil over shocks, you may suggest replacing the shocks with standard shocks for any spring-related condition.

SHOCK ABSORBER, STRUT CARTRIDGE AND STRUT ASSEMBLY INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require repair or replacement of bent part, if available; otherwise, replace shock or strut.
Attaching hardware broken	A	Require replacement of broken part, if available; otherwise, replace shock or strut.
Attaching hardware corroded, affecting structural integrity	A	Require replacement of corroded part, if available; otherwise, replace shock or strut.
Attaching hardware incorrect	A	Require replacement of incorrect part, if available; otherwise, replace shock or strut.
Attaching hardware loose	A	Require repair or replacement of loose part, if available; otherwise, replace shock or strut.
Attaching hardware missing	C	Require replacement of missing part, if available; otherwise, replace shock or strut.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads, if available; otherwise, replace shock or strut.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads, if available; otherwise, replace shock or strut.
Binding	A	Require replacement.
Body dented	A	(1) Further inspection required.
Body punctured	A	Require replacement.
Brake hose bracket bent	B	Require repair or replacement.
Brake hose bracket missing	C	Require replacement.
Brake hose bracket threads damaged	A	Require repair or replacement.
Brake hose bracket threads stripped (threads missing)	C	Require replacement.
Compression bumper missing	C	Require replacement of compression bumper.
Compression bumper split	1	Suggest replacement of compression bumper.
Damping (none)	A	Require replacement.
Dust boot (bellows) split	2	(2) Suggest replacement of boot.

Dust boot (bellows) missing	2	(2) Suggest replacement of boot.
Dust boot (bellows) torn	2	(2) Suggest replacement of boot.
Dust shield broken	2	(2) Suggest replacement.
Dust shield missing	2	(2) Suggest replacement.
Gland nut (strut housing cap) is not removable using appropriate tool	A	(3) Require replacement of nut and/or housing.
Gland nut (strut housing cap) threads damaged	A	Require repair or replacement of nut.
Gland nut (strut housing cap) threads stripped (threads missing)	A	Require replacement of nut.
Housing dented	A	(1) Further inspection required.
Housing punctured	A	Require replacement.
Jounce bumper missing	C	Require replacement of jounce bumper.
Jounce bumper split	1	Suggest replacement of jounce bumper.
Leaking oil, enough for fluid to be running down the body	A	(4) Require replacement.
Noise	2	(5) Further inspection required.
Piston rod bent	A	Require replacement.
Piston rod broken	A	Require replacement.
Piston rod has surface defect	2	Suggest replacement.
Piston rod threads damaged	A	Require repair or replacement.
Piston rod threads stripped (threads missing)	A	Require replacement.
Seized	A	Require replacement.
Shock missing	C	Require replacement.
Strut housing bent	A	Require replacement.
Strut housing cap (gland nut) is not removable using appropriate tool	A	(3) Require replacement of nut and/or housing.
Strut housing cap (gland nut) threads damaged	A	Require repair or replacement of nut.
Strut housing cap (gland nut) threads stripped (threads missing)	A	Require replacement of nut.
Strut housing severely corroded, affecting structural integrity	A	Require replacement.
Strut housing threads damaged	A	Require repair or replacement.
Strut housing threads stripped (threads missing)	A	Require replacement.
Tire cupping	A	(6) Further inspection required.

(1) - Require replacement of units where dents restrict shock or strut piston rod movement. If dents don't restrict movement, no service is suggested or required. Especially critical on mono-tube shocks.
(2) - This condition can lead to damage of the piston rod, which, in turn, causes premature piston rod seal wear.
(3) - Only required if replacing cartridge.
(4) - CAUTION: If the strut cartridge has been replaced previously, the oil on the strut housing may be filler oil. The technician must identify the source of the oil.
(5) - If noise is isolated to shock or strut, suggest replacement.
(6) - Although shocks or struts may have contributed to tire cupping, an inspection is needed of the entire suspension system. If the shock or strut is found to be contributing to the tire cupping, require replacement.

SPINDLES

SPINDLE INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require replacement of broken part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Bent	B	Require replacement.
Broken	A	Require replacement.
Race seat area undersized	B	Require replacement.
Scored	A	Require repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

SPRINGS - COIL, LEAF AND TORSION BAR

When springs are replaced, it is suggested, but not required, that both springs on an axle be replaced to maintain equal height from side to side and to provide a balanced ride and proper handling.

When variable rate springs are installed in place of conventional coil springs, they must be installed in axle sets to ensure proper handling, uniform ride, and proper chassis height.

Erroneous height measurements may result from: improper tire inflation, non-standard tire or wheel size, and heavy load in vehicle or trunk.

SPRING (COIL, LEAF AND TORSION BAR) INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require repair or replacement of bent part.
Attaching hardware broken	A	Require replacement of broken part.
Attaching hardware corroded, affecting structural integrity	A	Require replacement of corroded part.
Attaching hardware incorrect	A	Require replacement of incorrect part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Broken (all springs except secondary leave(s) on multi-leaf springs)	A	Require replacement.
Coil clash	..	(1) Require ride height check.
Coil spring insulator deteriorated	2	Suggest replacement of insulator.
Coil spring insulator missing	2	Suggest replacement of insulator.
Coil spring insulator split	2	Suggest replacement of insulator.
Coil spring plastic coating deteriorated – rust present	A	(2) Refer to manufacturer's service requirements.
Composite spring damaged	..	(3) Further inspection required.
Cracked (all springs except composite leaf and secondary leave(s) on multi-leaf springs)	A	Require replacement.
Installed incorrectly	B	Require repair.
Leaf spring insulators missing	2	Suggest replacement of insulators.
Secondary leaf on multi-leaf spring broken	1	Suggest repair or replacement
Secondary leaf on multi-leaf spring cracked	1	Suggest repair or replacement
Torsion bar		

adjuster bent	A	(4) Require repair or replacement of adjuster.
Torsion bar adjuster seized	A	(4) Require repair or replacement of adjuster.
Torsion bar adjuster threads damaged	A	(4) Require repair or replacement of part with damaged threads.
Torsion bar adjuster threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Vehicle suspension height not within OEM specifications	B	Require adjustment or replacement.

(1) - If vehicle is within manufacturer's height specifications, no service is suggested or required.
(2) - Some manufacturers require replacement under these conditions.
(3) - Check vehicle ride height. If ride height is OK, no service is suggested or required.
(4) - Only required if ride height needs to be adjusted.

STEEL POWER STEERING LINES

CAUTION: When replacing steel power steering lines, be sure to use a replacement product that meets or exceeds OEM design specifications.

STEEL POWER STEERING LINE INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require repair or replacement of bent part.
Attaching hardware broken	A	Require replacement of broken part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Blocked	A	Require repair or replacement.
Fitting incorrect (such as compression fitting)	B	Require replacement.
Flare type incorrect	B	Required replacement.
Leaking	A	Require tightening or replacement.
Line type incorrect	B	Require replacement.

Restricted	A	Require replacement.
Routed incorrectly	B	Require routing correction.
Rust-pitted	1	Suggest replacement.
Rust pitted, affecting structural integrity	A	Require replacement.

STEERING ARMS

STEERING ARM INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require repair or replacement of bent part.
Attaching hardware broken	A	Require replacement of broken part.
Attaching hardware incorrect	A	Require replacement of incorrect part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Bent	B	Require replacement.
Broken	A	Require replacement.
Taper hole elongated	A	(1) Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

(1) - Check for damaged stud.

STEERING DAMPERS

The following procedures are only required if the vehicle was originally equipped from the factory with a steering damper. If the steering damper is an add-on unit, then the unit may be removed instead of repairing or replacing.

STEERING DAMPER INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require repair or replacement of bent part, if available; otherwise, replace steering damper.
Attaching hardware broken	A	Require replacement of broken part, if available; otherwise,

replace steering damper.
Attaching hardware
corroded, affecting
structural integrity ... A . Require replacement of corroded
part, if available; otherwise,
replace steering damper.
Attaching hardware
incorrect .... A .... Require replacement of
incorrect part, if available;
otherwise, replace steering
damper.
Attaching hardware
loose .... A ... Require repair or replacement
of loose part, if available;
otherwise, replace steering
damper.
Attaching hardware
missing .... C .. Require replacement of missing
part, if available; otherwise,
replace steering damper.
Attaching hardware
threads damaged .... A ... Require repair or replacement
of part with damaged threads,
if available; otherwise,
replace steering damper.
Attaching hardware
threads stripped
(threads missing) ...... A ..... Require replacement of part
with stripped threads, if
available; otherwise, replace
steering damper.
Binding .... A .... Require replacement.
Damper body dented ...... A .... (1) Further inspection
required.
Damper body punctured ... A .... Require replacement.
Damping (none) .... A .... Require replacement.
Dust boot (bellows)
missing .... 2 .... (2) Suggest replacement
of boot.
Dust boot (bellows)
split .... 2 .... (2) Suggest replacement
of boot.
Dust shield broken ...... 2 .... (2) Suggest replacement.
Dust shield missing ..... 2 .... (2) Suggest replacement.
Leaking oil, enough for
fluid to be running
down the body .... A .... Require replacement.
Loose .... A .. Require repair or replacement.
Missing .... C .... Require replacement.
Noise .... 2 .... (3) Further inspection
required.
Piston rod bent .... A .... Require replacement.
Piston rod broken .... A .... Require replacement.
Piston rod has surface
defect .... 2 .... Suggest replacement.
Piston rod threads
stripped (threads
missing) .... A .... Require replacement.
Piston rod threads
damaged .... A .. Require repair or replacement.
Seized .... A .... Require replacement.

(1) - Require replacement of units where dents restrict damper

piston rod movement. If dents don't restrict movement, no service is suggested or required. Especially critical on mono-tube dampers.

(2) - This condition can lead to damage of the piston rod, which, in turn, causes premature piston rod seal wear.

(3) - If noise is isolated to damper, suggest replacement.

STEERING GEARS (EXCEPT RACK AND PINION)

If diagnosis has determined that complete disassembly is necessary to determine the extent of the system failure, the suggestion may be made to rebuild or replace the power steering pump. Repair or replacement of the following components may be required, if performed as part of a power steering pump overhaul or rebuild service to meet a minimum rebuild standard.

STEERING GEAR (EXCEPT RACK AND PINION) INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require replacement of broken part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Binding	A	Require repair or replacement
Flex coupler binding	A	Require repair or replacement of coupler.
Flex coupler loose	A	Require repair or replacement of coupler.
Flex coupler missing parts	A	Require repair or replacement of coupler.
Flex coupler soft/spongy	A	Require replacement of coupler.
Flex coupler torn	A	Require replacement of coupler.
Fluid contaminated	B	(1) Require flushing and refilling of the system.
Gasket leaking	A	Require repair or replacement of gasket.
Housing leaking	A	Require replacement.
Hydraulic fittings leaking	A	Require repair or replacement of fittings.
Inadequate power assist	A	(2) Further inspection required. See note below.
Lash exceeds manufacturer's specifications	B	Require repair or replacement.
Seal leaking	A	Require repair or replacement

		of seal and/or mating part.
Splines damaged	A	... Require repair or replacement of splines.
Splines stripped	A	. Require replacement of splines.
Steering coupler shield cracked	2	.... Suggest replacement.
Steering coupler shield missing	C	.... Require replacement.
Threads damaged	A	... Require repair or replacement of part with damaged threads.
Threads stripped (threads missing)	A	..... Require replacement of part with stripped threads.
U-joint binding	A	... Require repair or replacement of joint.
U-joint loose	A	... Require repair or replacement of joint.
Unequal power assist	A	.. Require repair or replacement.

(1) - Determine and correct source of contamination. OEM specifications must be followed for fluid type.
(2) - If steering gear is source of inadequate assist, require repair or replacement.

STEERING GEARS - RACK AND PINION

If diagnosis has determined that complete disassembly is necessary to determine the extent of the system failure, the suggestion may be made to rebuild or replace the power steering pump. Repair or replacement of the following components may be required, if performed as part of a power steering pump overhaul or rebuild service to meet a minimum rebuild standard.

STEERING GEARS - RACK AND PINION INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	.... Require replacement of broken part.
Attaching hardware loose	A	.. Require repair or replacement of loose part.
Attaching hardware missing	C	.... Require replacement of missing part.
Attaching hardware threads damaged	A	.. Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	.... Require replacement of part with stripped threads.
Balance tube blocked	A	.. Require repair or replacement of balance tube.
Balance tube missing	C	.. Require replacement of balance tube.
Balance tube restricted .	A	... Require repair or replacement of balance tube.
Bellows boot clamp missing	C	... Require replacement of clamp.
Bellows boot cracked		

(not through) .... 2 .. Suggest replacement of bellows boot.
Bellows boot missing .... C .. Require replacement of bellows boot.
Bellows boot not sealing .... A ... Require repair or replacement of bellows boot.
Bellows boot torn .... A .. Require replacement of bellows boot.
Bellows boot twisted (from toe adjustment) .. B .... Require repair.
Fitting leaking .... A .. Require repair or replacement.
Fitting missing .... A . Require replacement of fitting.
Fitting threads damaged .... A ... Require repair or replacement of part with damaged threads.
Fitting threads stripped (threads missing) ...... A ..... Require replacement of part with stripped threads.
Flex coupler binding .... A ... Require repair or replacement of coupler.
Flex coupler loose ...... A ... Require repair or replacement of coupler.
Flex coupler missing parts .... A ... Require repair or replacement of coupler.
Flex coupler soft/spongy .... A . Require replacement of coupler.
Flex coupler torn .... A . Require replacement of coupler.
Fluid contaminated ...... B .... (1) Require flushing and refilling of the system.
Gasket leaking .... A .. Require repair or replacement.
Hard steering on cold start-up .... 1 .... (2) Suggest repair or replacement.
Housing cracked, affecting structural integrity .... B .... Require replacement.
Housing leaking .... A .... Require replacement.
Inadequate power assist . A .... (3) Further inspection required.
Lash exceeds manufacturer’s specifications .... B .. Require repair or replacement.
Seal leaking .... A .. Require repair or replacement.
Splines damaged .... A .. Require repair or replacement.
Splines stripped (splines missing) ...... A .... Require replacement.
Steel line blocked ...... A ... Require repair or replacement of line.
Steel line leaking ...... A ... Require repair or replacement of line.
Steel line missing ...... C .... Require replacement of line.
Steel line restricted ... A ... Require repair or replacement of line.
Steering coupler shield cracked .... 2 .... Suggest replacement.
Steering coupler shield missing .... C .... Require replacement.
Steering coupler shield torn .... 2 .... Suggest replacement.
Threads damaged .... A ... Require repair or replacement of part with damaged threads.

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		

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 (chunking),
 exposing cord  ..........  A  ............  Require replacement.
Tread missing pieces
(chunking), not
 exposing cord  ..........  1  ............  Suggest replacement.
Tread separations           A  ............  Require replacement.
Tube in tubeless tire       3  ....  (4) Suggest removal of tube.
Weather-checking  ........  ..  .........  No service required or
                                                        suggested.
Worn to tread wear
 indicators  .............  B  ............  Require replacement.
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(1) - Determine and correct cause of irregular tire wear.
(2) - If radials and bias or bias-belted ply tires are on the same vehicle, the radials must be on the rear axle, except for high-pressure temporary spares.
(3) - Excessive is defined as enough to contribute to performance problems. Match mounting may correct run-out. If not, require replacement of appropriate part. Refer to manufacturer's specifications.
(4) - Most manufacturers do not recommend tubes in tubeless tires. Inspect tire and wheel assembly to determine the reason for a tube in tubeless tire. Recommendation for repair or replacement should be based upon condition of tires and/or wheel listed in these guidelines.

VALVE STEMS

VALVE STEM INSPECTION

Condition	Code	Procedure
Bent	1	Suggest replacement.
Broken	A	Require replacement.
Cut, but not leaking	1	Suggest replacement.
Deteriorated (cracking, dry rot)	1	Suggest replacement.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped	A	Require replacement.
Valve cap missing	C	Require replacement of cap.
Weather-checking	1	Suggest replacement.
Won't take air	A	Require repair or replacement.

WHEEL ATTACHMENT HARDWARE

For conditions noted below, also check conditions of wheel stud holes.

CAUTION: Proper lug nut torque is essential. Follow recommended torque specifications and tightening sequence. DO NOT lubricate threads unless specified by the vehicle manufacturer.

WHEEL ATTACHMENT HARDWARE INSPECTION

Condition	Code	Procedure
Bent	A	Require replacement.
Broken	A	(1) Require replacement.

Loose	B	... Require repair or replacement of affected component.
Lug nut installed backward	B	.. Require repair or replacement.
Lug nut mating type incorrect	B	..... Require replacement of nut.
Lug nut mating surface dished	A	..... Require replacement of nut.
Lug nut rounded	A	. (2) Require replacement of nut.
Lug nut seized	A	. (2) Require replacement of nut.
Stud incorrect	B	.... Require replacement of stud.
Threads damaged	A	... Require repair or replacement of component with damaged threads.
Threads stripped	A	.... Require replacement of component with stripped threads.

(1) - Some manufacturers require replacement of all studs on that wheel if two or more studs or nuts on the same wheel are broken or missing.
(2) - Only required if removing wheel.

WHEELS (RIMS)

WARNING: Mounting a regular tire on a high-pressure compact spare wheel is not permitted. Attempting to mount a tire of one diameter on a wheel of a different diameter or flange type may result in serious injury or death. If the wheel identification stamp is not legible, or cannot be found, do not use the wheel until the size and type have been properly identified. Wheels of different diameter, offset, or width cannot be mixed on the same axle. Bead seat tapers cannot be interchanged.

WHEEL (RIM) INSPECTION

Condition	Code	Procedure
Bead leaking, caused by wheel	A	.... (1) Require repair or replacement.
Bent hub mounting surface	A	.... Require replacement.
Bent rim, causing vibration	2	.... (1) Suggest replacement.
Broken	A	.... Require replacement.
Cast wheel porous, causing a leak	A	.. Require repair or replacement.
Clip-on balance weight is incorrect type for rim flange	2	.... Suggest replacement.
Corrosion, affecting structural integrity ...	A	.... Require replacement.
Corrosion build-up on wheel mounting surface	A	.... Require repair.
Cracked	A	.... Require replacement.
Directional/asymmetrical wheels mounted incorrectly	B	.... Require remounting and/or repositioning.

Load capacity less than OEM specifications	B	Require replacement.
Offset mismatched on same axle	B	Require replacement.
Rivets leaking	A	Require replacement.
Run-out beyond OEM specs	B	Require replacement.
Stud holes elongated	A	(2) Require replacement.
Welded or brazed repair	2	Suggest replacement.
Welds leaking	A	Require replacement.
Wheel centering (pilot) hole incorrect	B	Require replacement.

(1) - CAUTION: DO NOT attempt to correct a bent rim.
(2) - Inspect wheel attaching hardware for damage.

SUN ROOF - POWER

1997 Chevrolet Blazer

1997-98 ACCESSORIES & EQUIPMENT
General Motors Corp. - Power Sun Roofs

Chevrolet; Blazer
GMC; Evnoy & Jimmy
Oldsmobile; Bravada

DESCRIPTION & OPERATION

Sun roof has 2 modes of operation, sliding open and closed in one mode and raising up to vent and lowering to close from vent position. Sun roof express module determines operating mode. Sun roof is operated using single two pole rocker switch mounted in overhead console which provide sun roof control express module with two grounded inputs. Major components of system are drive motor, control module, glass panel and rail and track assembly. System also uses manually operated sunshade to cover opening inside vehicle.

With sun roof in fully closed position, pressing sun roof switch to CLOSE/VENT OPEN (forward) will raise sun roof to vent position. Motor will run until switch is released or full VENT position is reached. From vent position, pressing switch to OPEN/VENT CLOSE (rearward) position will lower sun roof to closed position unless switch is released before full CLOSE position in reached. If sun roof switch OPEN/VENT CLOSE position is held or pressed again, sun roof will slide to open position in express mode. Motor will run until full open soft-stop position is reached. From any open position, pressing sun roof switch to CLOSE/VENT OPEN sun roof will slide to close position or stop where switch is released.

Sun roof position is sensed by express module from a position encoding system located in sun roof motor and drive assembly. Three limit switches, LS1, LS2 and LS3 provide grounded input to express module. Sun roof express module is equipped with a timer circuit which stops operation of sun roof motor after 8.4 seconds. When either open and down or close and vent control switch contact is closed, timer begins. Sun roof motor operates until both contacts are open or until 8.4 seconds have elapsed. Sun roof motor direction is determined by polarity of voltage applied to motor.

Sun roof motor is equipped with manual drive capability. Hex head wrench inserted at center of motor may be used to drive sun roof through entire range of travel. Sun roof uses mechanical stops at open and vent positions.

COMPONENT LOCATIONS

COMPONENT LOCATIONS TABLE

Component	Location
Body Bussed Electrical Center (BBEC) 1998 Models	Left Side Of Instrument Panel Near Instrument Panel Fuse Block
Instrument Panel Fuse Block 1997 Models	Left Side Of Instrument Panel
Sun Roof Express Module	Overhead Between Seats

SERVICING

DRAIN HOSES

Pour about 16 ozs. (.5L) of water slowly into drain channel. Check for water drainage from all 4 hoses. If water flow is restricted, blow out drain hose system with compressed air. If water leaks from headliner, lower headliner and ensure drain hoses are attached to drain tubes.

ADJUSTMENTS

GLASS PANEL VERTICAL HEIGHT

1) Fully open sunshade. Open sun roof half-way. Loosen screws on both sides to raise or lower glass panel.
2) Align front edge of glass panel to roof. Glass panel should be flush to 1/32" (0.1 mm) below roof surface. Tighten front screws.
3) Align rear edge of glass panel to roof. Glass panel should be flush to 1/32" (0.1 mm) above roof surface. Tighten rear screws. Reinstall screws and covers.

TROUBLE SHOOTING

TROUBLE SHOOTING HINTS

1) Before electrical diagnosis, ensure sun roof is not binding due to mechanical failure.
2) Ensure electrical connections and ground are clean and tight. Check for broken wire inside insulation which could cause system failure but prove good in continuity/voltage check.
3) Check for proper installation of aftermarket electronic equipment which may effect integrity of other systems.

SYSTEM CHECK

NOTE: If any abnormal conditions are observed, refer to appropriate symptom test.

1) Fully open sunshade. Ensure sun roof fully closed. Turn ignition switch to RUN position. Push and hold sun roof switch to CLOSE/VENT OPEN (forward) position. When sun roof reaches vent position and stops, release switch. Sun roof should raise to vent soft stop position is reached without noise or vibration. Elapsed time should be less than 8.4 seconds.
2) With sun roof in vent position, push sun roof switch to OPEN/VENT CLOSE (rearward) position. When sun roof reaches fully closed position, release switch. Sun roof should lower to fully closed position. Elapsed time should be less than 8.4 seconds.
3) With sun roof fully closed, push sun roof switch to OPEN/VENT CLOSE (rearward) position momentarily. Sun roof should slide to full open position without noise or vibration in express mode. Elapsed time should be less than 8.4 seconds.
4) With sun roof fully open, push sun roof switch to CLOSE/VENT OPEN (rearward) position. Release switch when sun roof reaches full closed position. Sun roof should slide forward without noise or vibration until sun roof switch is released or fully closed position is reached. Elapsed time is less than 8.4 seconds.

SYSTEM TESTS

* PLEASE READ THIS FIRST *

CAUTION: To prevent damage to terminals, Connector Test Adaptor Kit (J-35616-A) must be used whenever a diagnostic procedure requires checking or probing terminals. To locate and identify terminals, see WIRING DIAGRAMS.

SUN ROOF INOPERATIVE

1) Remove sun roof opening trim. Remove headliner. See HEADLINER under REMOVAL & INSTALLATION. Disconnect sun roof express module 4-pin connector C1. Turn ignition switch to RUN position. Connect test light between sun roof express module connector C1, terminal "C" (Yellow wire) and ground. If test light illuminates, go to step 9). If test light does not illuminate, go to next step.

2) Check power window operation. If power windows operate, go to step 8). If power windows do not operate, go to next step.

3) Remove power window circuit breaker "B" (30-amp), located in Instrument Panel Fuse Block (1997 models) or Body Bussed Electrical Center (1998 models). Using DVOM, check continuity of power window circuit breaker "B". If continuity exists, go to step 5). If continuity does not exist, go to next step.

4) Replace power window circuit breaker with known good circuit breaker. Connect sun roof express module connector C1. Install headliner and opening trim. Recheck system operation.

5) Connect self-powered test light between Instrument Panel Fuse Block connector sun roof circuit breaker Yellow wire terminal (1997 models) or Body Bussed Electrical Center connector terminal D3 (Dark Green wire, 1998 models) and ground.If test light illuminates, go to next step. If test light does not illuminate, go to step 7).

6) Repair short to ground in Yellow or Dark Green wire between Fuse Block or BBEC, sun roof express module and side window switches. See WIRING DIAGRAMS. Connect sun roof express module connector C1. Install headliner and opening trim. Recheck system operation.

7) Repair open in Yellow wire between Instrument Panel Fuse Block and connector and splice S255 (1997 models) or Dark Green wire between BBEC and connector C209 (1998 models). See WIRING DIAGRAMS. Connect sun roof express module connector C1. Install headliner and opening trim. Recheck system operation.

8) Repair open in Yellow wire between splice S255 and express module (1997 models) or Dark Green or Yellow wire between connector C209 and sun roof express module. See WIRING DIAGRAMS. Connect sun roof express module connector C1. Install headliner and opening trim. Recheck system operation.

9) Connect self powered test light between sun roof express module connector C1, terminal "A" (Black wire) and ground. If test light illuminates, go to step 11). If test light does not illuminate, go to next step.

10) Repair open in Black wire between sun roof express module and ground. See WIRING DIAGRAMS. Connect sun roof express module connector C1. Install headliner and opening trim. Recheck system operation.

11) Using DVOM, measure resistance between sun roof express module connector C1, terminals "D" (Blue wire) and "B" (Purple wire). If resistance is greater than 100 ohms, go to next step. If resistance is not greater than 100 ohms, go to step 17).

12) Disconnect in-line 2-pin connector C392. Connect self powered test light between sun roof express module connector C1, terminal "D" (Blue wire) and connector C392, terminal No. 2 (Blue wire). If test light illuminates, go to step 14). If test light does not illuminate, go to next step.

13) Repair open in Blue wire between sun roof express module

and in-line connector C392. See WIRING DIAGRAMS. Reconnect sun roof motor connector C392 and sun roof express module connector C1. Install headliner and sun roof opening trim. Recheck system operation.

14) Connect self powered test light between sun roof express module connector C1, terminal "B" (Purple wire) and in-line connector C392, terminal No. 1 (Purple wire). If test light illuminates, go to step 16). If test light does not illuminate, go to next step.

15) Repair open in Purple wire between sun roof express module and in-line connector C392. See WIRING DIAGRAMS. Reconnect in-line connector C392 and sun roof express module. Install headliner and sun roof opening trim. Recheck system operation.

16) Connect sun roof express module connector C1. Replace sun roof motor and drive assembly. Recheck system operation.

17) Disconnect sun roof express module 8-pin connector C2. Connect self powered test light between sun roof express module connector C2, terminal No. 5 (Orange wire) and ground. If test light illuminates, go to next step. If test light does not illuminate, go to step 20).

18) Disconnect in-line 3-pin connector C390. Connect self powered test light between sun roof express module connector C2, terminal No. 5 (Orange wire) and ground. If test light illuminates, go to next step. If test light does not illuminate, go to step 23).

19) Repair short to ground in Orange wire between sun roof express module and in-line connector C390. See WIRING DIAGRAMS. Connect in-line connector C390 and sun roof express module connector C2. Install headliner and sun roof opening trim. Recheck system operation.

20) Connect self powered test light between sun roof express module connector C2, terminal No. 2 (Brown wire). If test light illuminates, go to next step. If test light does not illuminate, go to step 23).

21) Disconnect in line 3-pin connector C390. Connect self powered test light between sun roof express module connector C2, terminal No. 2 (Brown wire) and ground. If test light illuminates, go to next step. If test light does not illuminate, go to step 23).

22) Repair short to ground in Brown wire between sun roof express module and connector C309. See WIRING DIAGRAMS. Connect in line connector C390 and sun roof express module connector C2. Install headliner and sun roof opening trim. Recheck system operation.

23) Connect self powered test light between in-line connector C390, terminals "C" (Brown wire) and "A" (White wire). If test light illuminates, go to step 28). If test light does not illuminate, go to next step.

24) Connect self powered test light between in-line connector C390, terminals "B" (Brown wire) and "A" (White wire). If test light illuminates, go to step 28). If test light does not illuminate, go to next step.

25) Connect self powered test light between sun roof express module connector C2, terminal No. 3 (White wire) and in-line connector C390, terminal "A" (White wire). If test light illuminates, go to step 27). If test light does not illuminate, go to next step.

26) Repair short to ground in White wire between sun roof express module and connector C390. See WIRING DIAGRAMS. Connect in line connector C390 and sun roof express module connector C2. Install headliner and sun roof opening trim. Recheck system operation.

27) Connect self powered test light between in-line connector C390, terminals "B" (Orange wire) and "A" (White wire). If test light illuminates, go to step 29). If test light does not illuminate, go to next step.

28) Replace overhead console. Connect in line connector C390 and sun roof express module connector C2. Install headliner and sun roof opening trim. Recheck system operation.

29) Using hex head wrench at sun roof motor, attempt to move

sun roof through entire range of travel. If sun roof moves through entire range of travel, go to step 28). If sun roof does not move through entire range of travel, go to next step.

30) Replace sun roof assembly. See SUN ROOF ASSEMBLY under REMOVAL & INSTALLATION.

SUN ROOF DOES NOT RAISE TO VENT POSITION

1) Remove sun roof opening trim. Remove headliner. See HEADLINER under REMOVAL & INSTALLATION. Disconnect sun roof express module 8-pin connector C2. Ensure sun roof in fully closed position. Connect self powered test light between sun roof express module connector C2, terminals No. 1 (Black/White wire) and No. 8 (White wire). If test light illuminates, go to step 5). If test light does not illuminate, go to next step.

2) Disconnect in-line 4-pin connector C391. Connect self powered test light between sun roof express module connector C2, terminal No. 8 (White wire) and in-line connector C391, terminal No. 3 (White wire). If test light illuminates, go to step 4). If test light does not illuminate, go to next step.

3) Repair open in White wire between sun roof express module and in-line connector C391. See WIRING DIAGRAMS. Connect in-line connector C391 and sun roof express module connector C2. Install headliner and sun roof opening trim. Recheck system operation.

4) Connect sun roof express module connector C2. Replace sun roof motor and drive assembly. See MOTOR under REMOVAL & INSTALLATION.

5) Replace sun roof express module. See EXPRESS MODULE under REMOVAL & INSTALLATION.

SUN ROOF DOES NOT MOVE TO VENT POSITION

1) Remove sun roof opening trim. Remove headliner. See HEADLINER under REMOVAL & INSTALLATION. Disconnect sun roof express module 8-pin connector C2. Connect self powered test light between sun roof express module connector C2, terminals No. 5 (Orange wire) and No. 3 (White wire). If test light illuminates, go to next step. If test light does not illuminate, go to step 5).

2) Disconnect in-line 3-pin connector C390. Connect self powered test light between sun roof express module connector C2, terminal No. 5 (Orange wire) and in-line connector C390, terminal "B" (Orange wire). If test light illuminates, go to step 4). If test light does not illuminate, go to next step.

3) Repair open in Orange wire between sun roof express module and in-line connector C390. See WIRING DIAGRAMS. Connect in-line connector C390 and sun roof express module connector C2. Install headliner and sun roof opening trim. Recheck system operation.

4) Replace overhead console. Connect in line connector C390 and sun roof express module connector C2. Install headliner and sun roof opening trim. Recheck system operation.

5) Disconnect sun roof express module connector 4-pin connector C1. Connect self powered test light between sun roof express module connector C1, terminal "B" (Purple wire) and ground. If test light illuminates, go to step 4). If test light does not illuminate, go to next step.

6) Check for short to ground in Purple wire between sun roof express module and sun roof motor and drive assembly. If short to ground exists, go to next step. If short to ground does not exist, go to step 8).

7) Repair short to ground in Purple wire between sun roof express module and sun roof motor and drive assembly. See WIRING DIAGRAMS. Connect sun roof express module connector C1. Install headliner and sun roof opening trim. Recheck system operation.

8) Connect sun roof express module connector C1. Replace sun

roof sun roof motor and drive assembly. See MOTOR under REMOVAL & INSTALLATION.

9) Replace sun roof express module. See EXPRESS MODULE under REMOVAL & INSTALLATION.

SUN ROOF DOES NOT STOP AT VENT POSITION

1) Remove sun roof opening trim. Remove headliner. See HEADLINER under REMOVAL & INSTALLATION. Disconnect sun roof express module 8-pin connector C2. Connect self powered test light between sun roof express module connector C2, terminal No. 8 (White wire) and ground. If test light illuminates, go to next step. If test light does not illuminate, go to step 5).

2) Disconnect in-line 4-pin connector C391. Connect self powered test light between sun roof express module connector C2, terminal No. 8 (White wire) and ground. If test light illuminates, go to next step. If test light does not illuminate, go to step 4).

3) Repair short to ground in White wire between in-line connector C391 and sun roof express module. See WIRING DIAGRAMS. Connect in-line connector C391 and sun roof express module connector C2. Install headliner and sun roof opening trim. Recheck system operation.

4) Connect sun roof express module connector C2. Replace sun roof sun roof motor and drive assembly. See MOTOR under REMOVAL & INSTALLATION.

5) Replace sun roof express module. See EXPRESS MODULE under REMOVAL & INSTALLATION.

SUN ROOF DOES NOT STOP AT OPEN POSITION

1) Remove sun roof opening trim. Remove headliner. See HEADLINER under REMOVAL & INSTALLATION. Disconnect sun roof express module 8-pin connector C2. Open sun roof to VENT position. Connect self powered test light between sun roof express module connector C2, terminals No. 1 (Black/White wire) and No. 7 (Red wire). If test light illuminates, go to step 5). If test light does not illuminate, go to next step.

2) Disconnect in-line 4-pin connector C391. Connect self powered test light between sun roof express module connector C2, terminal No. 7 (Red wire) and in-line connector C391, terminal No. 4 (Red wire). If test light illuminates, go to step 4). If test light does not illuminate, go to next step.

3) Repair short to ground in Red wire between in-line connector C391 and sun roof express module. See WIRING DIAGRAMS. Connect in-line connector C391 and sun roof express module connector C2. Install headliner and sun roof opening trim. Recheck system operation.

4) Connect sun roof express module connector C2. Replace sun roof sun roof motor and drive assembly. See MOTOR under REMOVAL & INSTALLATION.

5) Replace sun roof express module. See EXPRESS MODULE under REMOVAL & INSTALLATION.

SUN ROOF DOES NOT STOP AT FLUSH POSITION WHEN CLOSING FROM OPEN POSITION

1) Remove sun roof opening trim. Remove headliner. See HEADLINER under REMOVAL & INSTALLATION. Disconnect sun roof express module 8-pin connector C2. Connect self powered test light between sun roof express module connector C2, terminal No. 6 (Black wire) and ground. If test light illuminates, go to next step. If test light does not illuminate, go to step 5).

2) Disconnect in-line 4-pin connector C391. Connect self

powered test light between sun roof express module connector C2, terminal No. 6 (Black wire) and ground. If test light illuminates, go to next step. If test light does not illuminate, go to step 4).

3) Repair short to ground in Black wire between in-line connector C391 and sun roof express module. See WIRING DIAGRAMS. Connect in-line connector C391 and sun roof express module connector C2. Install headliner and sun roof opening trim. Recheck system operation.

4) Connect sun roof express module connector C2. Replace sun roof sun roof motor and drive assembly. See MOTOR under REMOVAL & INSTALLATION.

5) Replace sun roof express module. See EXPRESS MODULE under REMOVAL & INSTALLATION.

SUN ROOF DOES NOT LOWER TO FLUSH POSITION

1) Remove sun roof opening trim. Remove headliner. See HEADLINER under REMOVAL & INSTALLATION. Disconnect sun roof express module 8-pin connector C2. Connect self powered test light between sun roof express module connector C2, terminals No. 2 (Brown wire) and No. 3 (White wire). If test light illuminates, go to next step. If test light does not illuminate, go to step 5).

2) Disconnect in-line 3-pin connector C390. Connect self powered test light between sun roof express module connector C2, terminal No. 2 (Brown wire) and in-line connector C390, terminal "C" (Brown wire). If test light illuminates, go to step 4). If test light does not illuminate, go to next step.

3) Repair short to ground in Brown wire between in-line connector C390 and sun roof express module. See WIRING DIAGRAMS. Connect in-line connector C390 and sun roof express module connector C2. Install headliner and sun roof opening trim. Recheck system operation.

4) Replace overhead console. Connect in-line connector C390 and sun roof express module connector C2. Install headliner and sun roof opening trim. Recheck system operation.

5) Disconnect sun roof express module 4-pin connector C1. Connect self powered test light between sun roof express module connector C1, terminal "D" (Blue wire) and ground. If test light illuminates, go to next step. If test light does not illuminate, go to step 9).

6) Check for short to ground in Blue wire between sun roof express module and sun roof motor and drive assembly. If short to ground exists in Blue wire, go to next step. If short to ground does not exist, go to step 8).

7) Repair short to ground in Blue wire between sun roof express module connector C1 and sun roof motor and drive assembly. See WIRING DIAGRAMS. Connect sun roof express module connector C1. Install headliner and sun roof opening trim. Recheck system operation.

8) Connect sun roof express module connector C1. Replace sun roof sun roof motor and drive assembly. See MOTOR under REMOVAL & INSTALLATION.

9) Replace sun roof express module. See EXPRESS MODULE under REMOVAL & INSTALLATION.

SUN ROOF DOES NOT STOP AT FLUSH POSITION WHEN CLOSING FORM VENT POSITION

1) Remove sun roof opening trim. Remove headliner. See HEADLINER under REMOVAL & INSTALLATION. Disconnect sun roof express module 8-pin connector C2. Fully open sun roof. Connect self powered test light between sun roof express module connector C2, terminals No. 1 (Black/White wire) and No. 6 (Black wire). If test light illuminates, go to step 5). If test light does not illuminate, go to

next step.
2) Disconnect in-line 4-pin connector C391. Connect self powered test light between sun roof express module connector C2, terminal No. 6 (Black wire) and in-line connector C391, terminal No. 1 (Black wire). If test light illuminates, go to step 4). If test light does not illuminate, go to next step.
3) Repair short to ground in Black wire between in-line connector C391 and sun roof express module. See WIRING DIAGRAMS. Connect in-line connector C391 and sun roof express module connector C2. Install headliner and sun roof opening trim. Recheck system operation.
4) Connect sun roof express module connector C2. Replace sun roof sun roof motor and drive assembly. See MOTOR under REMOVAL & INSTALLATION.
5) Replace sun roof express module. See EXPRESS MODULE under REMOVAL & INSTALLATION.

SUN ROOF OPENS ONLY TO VENT

1) Remove sun roof opening trim. Remove headliner. See HEADLINER under REMOVAL & INSTALLATION. Disconnect sun roof express module 8-pin connector C2. Connect self powered test light between sun roof express module connector C2, terminals No. 7 (Red wire) and ground. If test light illuminates, go to next step. If test light does not illuminate, go to step 5).
2) Disconnect in-line 4-pin connector C391. Connect self powered test light between sun roof express module connector C2, terminal No. 7 (Red wire) and ground. If test light illuminates, go to next step. If test light does not illuminate, go to step 4).
3) Repair short to ground in Red wire between in-line connector C391 and sun roof express module. See WIRING DIAGRAMS. Connect in-line connector C391 and sun roof express module connector C2. Install headliner and sun roof opening trim. Recheck system operation.
4) Connect sun roof express module connector C2. Replace sun roof sun roof motor and drive assembly. See MOTOR under REMOVAL & INSTALLATION.
5) Replace sun roof express module. See EXPRESS MODULE under REMOVAL & INSTALLATION.

SUN ROOF MAKES UNUSUAL NOISES WHEN OPENING

1) Remove sun roof opening trim. Remove headliner. See HEADLINER under REMOVAL & INSTALLATION. Turn ignition switch to RUN position. Operate sun roof through complete range of travel. While sun roof is in motion, listen for unusual noises and check for unusual vibration at sun roof motor. Turn ignition switch to OFF position. If source of noise and vibration is in sun roof motor go to next step. If source of noise and vibration is not in sun roof motor, go to step 3).
2) Replace sun roof sun roof motor and drive assembly. See MOTOR under REMOVAL & INSTALLATION.
3) Replace sun roof assembly. See SUN ROOF ASSEMBLY under REMOVAL & INSTALLATION.

SUN ROOF OPENS ONLY PART WAY

1) Remove sun roof opening trim. Remove headliner. See HEADLINER under REMOVAL & INSTALLATION. Turn ignition switch to RUN position. Attempt to operate sun roof through complete range of travel. While sun roof is in motion, listen for unusual noises and check for unusual vibration at sun roof motor. Also observe for any indications of binding or other mechanical binding. Turn ignition switch to OFF position. If source of noise and vibration is in sun

roof motor go to next step. If source of noise and vibration is not in sun roof motor, go to step 3).

2) Replace sun roof sun roof motor and drive assembly. See MOTOR under REMOVAL & INSTALLATION.

3) Replace sun roof assembly. See SUN ROOF ASSEMBLY under REMOVAL & INSTALLATION.

REMOVAL & INSTALLATION

* PLEASE READ THIS FIRST *

WARNING: When battery is disconnected, vehicle computer and memory systems may lose memory data. Driveability problems may exist until computer systems have completed a relearn cycle. See COMPUTER RELEARN PROCEDURES article in GENERAL INFORMATION section before disconnecting battery.

CONTROL SWITCH

Removal & Installation

Remove sum roof console. Disconnect electrical connector. Remove sun roof switch from console. To install, reverse removal procedure.

MOTOR

Removal & Installation

Remove sun roof opening trim. Remove headliner. See HEADLINER . Remove sun roof console mounting bracket. Remove wiring harness retaining straps. Disconnect electrical connectors. Remove sun roof motor. DO NOT move sun roof mechanism while motor is not in place. To install, reverse removal procedure. Tighten screws to 31 INCH lbs (3.5 N.m). Recheck system operation.

EXPRESS MODULE

Removal & Installation

Remove sun roof opening trim. Remove headliner. See HEADLINER . Remove sun roof console mounting bracket. Remove wiring harness retaining straps. Remove sun roof control module by sliding to right to release from sun roof assembly. To install, reverse removal procedure.

HEADLINER

Removal & Installation

Remove overhead sun roof console. Remove dome light (if equipped) and let hang. Remove sun roof opening trim. Remove coat hooks and passenger assist handle. Remove sun visors and retainers. Remove windshield garnish moldings. Remove body lock pillar trim panels (four door models). Remove rear header garnish molding. Remove rear upper seat belt anchor bolts. Remove body side trim panels. Remove headliner from vehicle. To install, reverse removal procedure. Tighten rear seat belt anchor bolts to 52 ft.lbs. (70 N.m).

GLASS PANEL R & I

Removal & Installation

Open sunshade fully. Close glass panel. If sun roof glass panel is to be reinstalled, place reference marks for screw location for proper alignment at reinstallation. Remove screws from glass panel. remove glass panel. To install, reverse removal procedure. Tighten glass panel screws to 31 INCH lbs. (3.5 N.m). Adjust as necessary. See GLASS PANEL VERTICAL HEIGHT under ADJUSTMENTS.

SUN ROOF ASSEMBLY

Removal & Installation

Remove sun roof opening trim. Remove headliner. See HEADLINER . Disconnect drain hoses from sun roof assembly. Disconnect electrical connectors. Remove bolts retaining sun roof assembly to roof. Remove nuts retaining sun roof assembly brackets to roof. Remove sun roof assembly from vehicle. To install, reverse removal procedure. Tighten nuts and bolts to 80 INCH lbs. (9 N.m). Adjust glass vertical height as necessary. Check system operation.

SUNSHADE

Removal & Installation

Remove glass panel. See GLASS PANEL R & I. Slide sunshade forward. Flex center of sunshade downward while pulling up and forward on front center of sunshade. Pull sun shade forward until front tabs release from track slots. Flex center of sunshade downward and release rear tabs from track slots. To install, reverse removal procedure.

WIND DEFLECTOR

Removal & Installation

Open sun roof until wind deflector springs are exposed. Remove sun roof assembly. See SUN ROOF ASSEMBLY. Drill out rivets securing wind deflector springs to sun roof assembly. Remove deflector springs and wind deflector. To install, reverse removal procedure.

DRAIN HOSES

Removal & Installation (Front)

Remove sun roof opening trim. Remove headliner. See HEADLINER . Remove windshield garnish molding. Disconnect sun roof drain hose from sun roof assembly. Remove front drain hoses. Left front sun roof drain hose is taped to wiring harness. To install, reverse removal procedure.

Removal & Installation (Rear)

Remove sun roof opening trim. Remove headliner. See HEADLINER . Remove body side trim panels as necessary. Remove rear hose from sun roof assembly. Remove drain hose. To install, reverse removal procedure.

WIRING DIAGRAMS

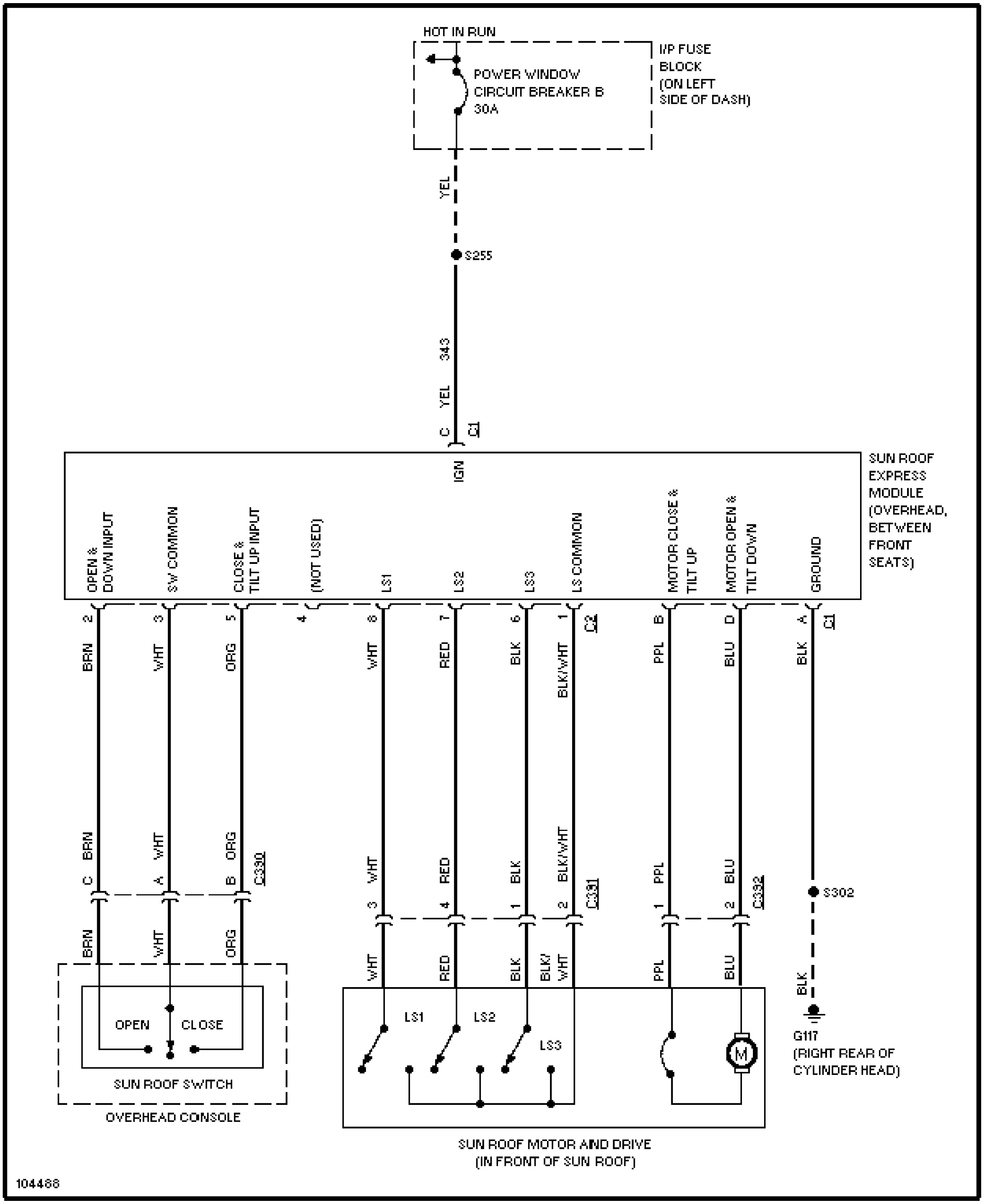

Fig. 1: Power Sun Roof System Wiring Diagram (1997)

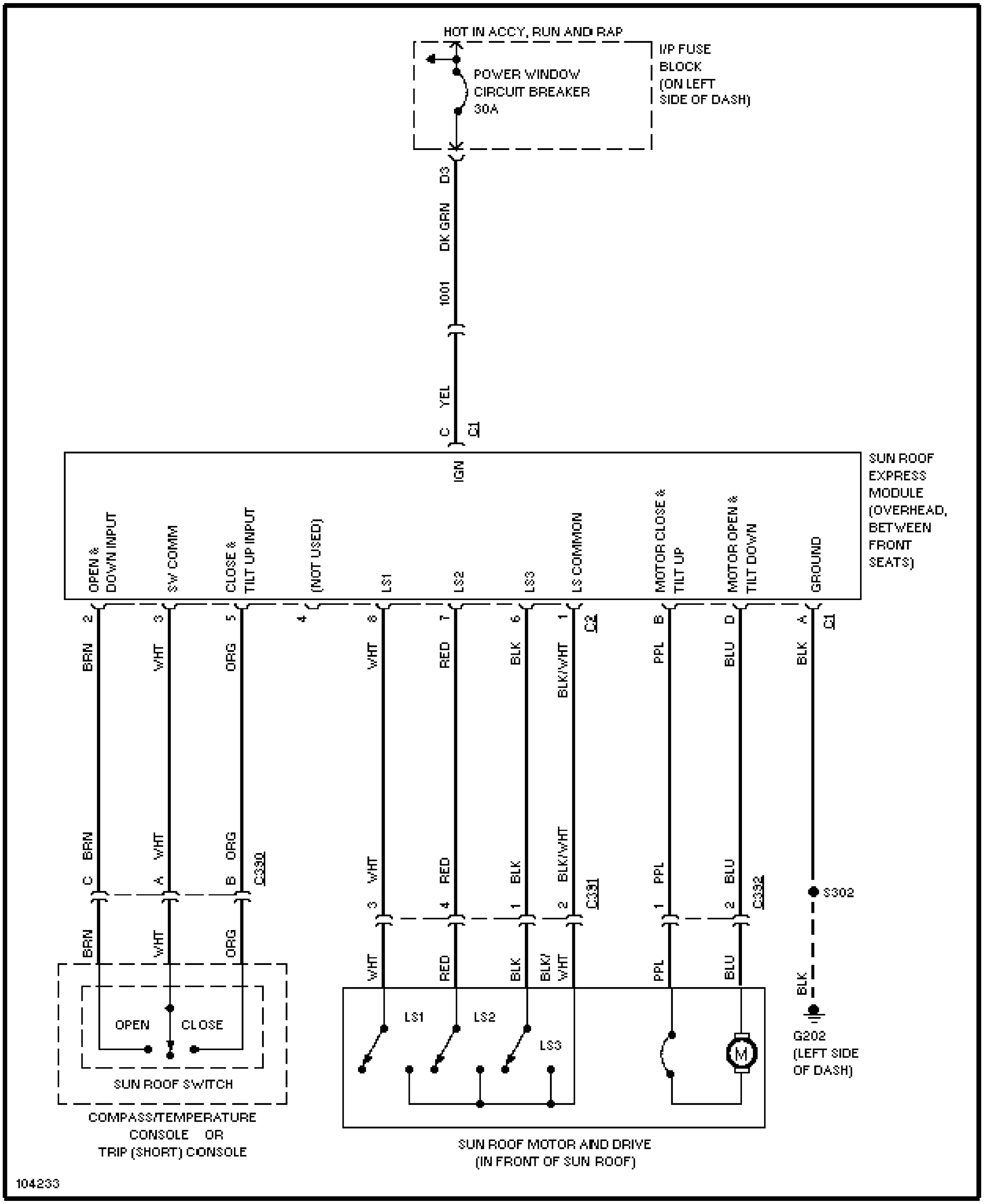

Fig. 2: Power Sun Roof System Wiring Diagram (1998)

1997 SUSPENSION
General Motors Corp. - Front 2WD Coil Spring

Chevrolet; "S" Series Blazer & Pickup
GMC; Jimmy & Sonoma

DESCRIPTION

Independent front suspension consists of upper and lower control arms with steering knuckle mounted between ball joints. See Fig. 1. Upper control arm is mounted on pivot shaft. Lower control arm is mounted directly to frame with pivot bolts.

Coil springs are mounted between lower control arm and a formed seat in suspension crossmember. Shock absorbers fit between lower control arm and frame. A stabilizer bar is mounted to frame side rails and connected to lower control arms.

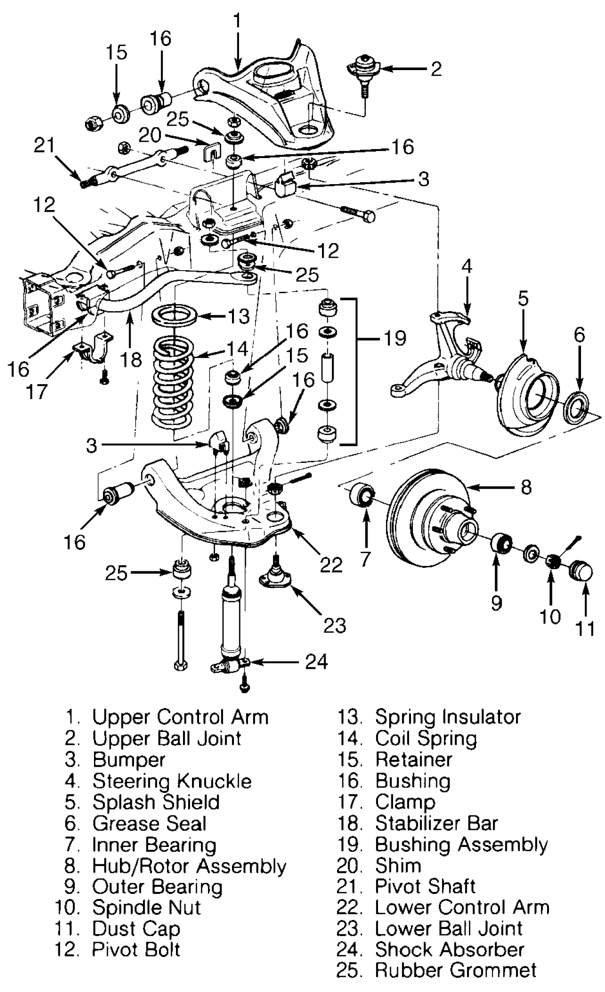

Fig. 1: Exploded View Of Front Suspension (Typical)
Courtesy of General Motors Corp.

ADJUSTMENTS & INSPECTION

WHEEL ALIGNMENT SPECIFICATIONS & PROCEDURES

NOTE: See WHEEL ALIGNMENT SPECIFICATIONS & PROCEDURES article in WHEEL ALIGNMENT section.

FRONT WHEEL BEARINGS

CAUTION: Never preload tapered roller bearings, or damage to bearings will result. Bearings are designed to have a slightly loose feel when properly adjusted.

1) Raise and support vehicle. Remove hub dust cap and cotter pin. Tighten spindle nut to 12 ft. lbs. (16 N.m) while turning wheel forward by hand. Back off nut until just loose.

2) Finger-tighten nut until snug. Loosen nut slightly until NEW cotter pin can be installed. DO NOT loosen nut more than 1/2 flat. Install cotter pin and measure hub end play. Hub end play (in and out movement) should be .001-.005" (.03-.13 mm). Install dust cap.

RIDING HEIGHT

NOTE: See WHEEL ALIGNMENT SPECIFICATIONS & PROCEDURES article in WHEEL ALIGNMENT section.

BALL JOINT CHECKING

NOTE: Ensure wheel bearings are properly adjusted before checking ball joints. Replace ball joint rubber grease seal if cut or damaged.

Upper Ball Joint

1) Raise and support vehicle with jackstand under lower control arm, near lower ball joint. Ensure upper control arm bumper does not contact frame. Place dial indicator against lower part of wheel rim. Push in on bottom of tire while pulling outward at top. Read dial indicator, then reverse push/pull procedure.

2) Lateral (horizontal) deflection should not exceed .125" (3.18 mm). If deflection is excessive, replace ball joint. With ball joint disconnected from steering knuckle, check to see if ball joint can be rotated by finger pressure. Replace if ball joint can be twisted.

Lower Ball Joint

1) Wear indicator is built into ball joint. Wear is indicated by position of the 1/2" diameter round boss that grease fitting is threaded into. A new ball joint has a boss projection of .050" (1.27 mm) beyond cover surface.

2) With vehicle weight on wheels, ensure wear indicator protrudes beyond surface of ball joint cover. Replace ball joint if wear indicator is recessed or even with housing.

REMOVAL & INSTALLATION

WHEEL HUB/ROTOR & BEARINGS

Removal

1) Raise and support vehicle. Remove wheel and tire assembly. Remove brake caliper, and wire aside. DO NOT allow brake caliper to hang by brakeline. Remove dust cap, cotter pin, spindle nut and washer. Carefully remove hub/rotor assembly to avoid damage to spindle

threads.

2) Remove outer bearing, inner grease seal and inner bearing. Clean bearings, and inspect bearings and races for damage. If races require removal from hub, drive old races from hub using hammer and Wheel Bearing Race Remover (J-29117-A).

Installation

1) To install, reverse removal procedure. Pack bearings with high-temperature bearing grease. Install NEW grease seal until seal is even with hub surface. Lubricate seal lip and hub cavity with wheel bearing grease.

2) Tighten bolts and nuts to specification. See TORQUE SPECIFICATIONS. Adjust wheel bearings. See FRONT WHEEL BEARINGS under ADJUSTMENTS & INSPECTION. Lower vehicle and check wheel alignment. See WHEEL ALIGNMENT SPECIFICATIONS & PROCEDURES article in WHEEL ALIGNMENT section.

SHOCK ABSORBERS

Removal

Raise and support vehicle. Remove wheel and tire assembly. Hold upper stem from turning while removing upper stem retaining nut, retainer and rubber grommet at top of shock absorber. Remove shock absorber-to-lower control arm bolts and nuts. Lower shock absorber from vehicle.

NOTE: Purging air from non-spiral groove shock is not required, as reservoir has gas-charged cell. Spiral groove shock has air-charged cell and air must be purged.

Inspection

1) On spiral groove shock, purge air from pressure chamber by mounting shock in vise (top end up) and fully extending unit. Reverse position (top end down) and fully collapse unit. Repeat procedure several times.

2) Bench check shock unit by mounting in vise with top end up (top end down on gas-charged shocks). DO NOT clamp vise on reservoir tube or mounting threads. Check rubber grommets for deterioration and replace as necessary.

3) Operate shock by hand at various rates of speed and note resistance. Rebound force is normally stronger than compression force. If resistance is not smooth and constant, replace shock.

Installation

To install, reverse removal procedure. Tighten bolts and nuts to specification. See TORQUE SPECIFICATIONS.

STABILIZER BAR

Removal

Raise and support vehicle. Remove wheel and tire assembly. Remove stabilizer bar-to-frame retaining bolts and clamps. See Fig. 1. Disconnect stabilizer bar from frame. Remove stabilizer bar-to-lower control arm retaining bolt, nut and washers. Disconnect stabilizer bar from lower control arm, and remove rubber grommets and bushing assembly. Remove stabilizer bar and bushings from vehicle. Check all rubber bushings for excessive wear, deterioration or damage. Replace as necessary.

Installation

To install, reverse removal procedure. Bushings should be installed with slit area toward front of vehicle. Apply rubber lubricant to bushings to aid in installation. Tighten bolts and nuts to specification. See TORQUE SPECIFICATIONS.

COIL SPRINGS

Removal

1) Raise and support vehicle with jackstand under frame, with control arms hanging free. Remove wheel and tire assembly. Remove shock absorber. See SHOCK ABSORBERS.

2) Install Spring Remover (J-23028-01) on floor jack. Position assembly under lower control arm so bushings seat in grooves of spring remover.

WARNING: Securely bolt Spring Remover (J-23028-01) to floor jack, and install safety chain through lower control arm and coil spring to prevent personal injury.

3) Remove stabilizer bar-to-lower control arm retaining bolt, nut and washers. Disconnect stabilizer bar from lower control arm, and remove rubber grommets and bushing assembly. Raise floor jack to release spring tension on lower control arm pivot bolts. Install safety chain around coil spring and through lower control arm.

4) Remove lower control arm pivot bolts and nuts (rear bolt and nut first). Carefully lower floor jack until all tension is released from coil spring. Remove safety chain and coil spring from vehicle.

CAUTION: DO NOT apply force on lower control arm and ball joint to remove coil spring. Coil spring can easily be removed by maneuvering spring.

Installation

1) Position coil spring onto lower control arm. Ensure spring insulator is in place. Raise control arm with spring remover and floor jack. Ensure coil spring is properly positioned, with end of lower spring coil covering one drain hole in lower control arm, and clear of or partially covering other drain hole.

NOTE: Coil spring must be positioned with tape at lowest position. Bottom of spring is coiled helical, and top is coiled flat with a gripper notch near end of spring coil.

2) Install lower control arm pivot bolts and nuts (front bolt and nut first). Pivot bolts must be installed with nuts toward rear of vehicle. To complete installation, reverse removal procedure. Tighten bolts and nuts to specification. See TORQUE SPECIFICATIONS. Lower vehicle and check wheel alignment. See WHEEL ALIGNMENT SPECIFICATIONS & PROCEDURES article in WHEEL ALIGNMENT section.

STEERING KNUCKLE

Removal

1) Raise and support vehicle with jackstand under frame, with control arms hanging free.

NOTE: DO NOT place jackstand under lower control arm. Spring tension is needed to break loose ball joint stud.

2) Remove wheel and tire assembly. Remove brake caliper, and wire aside. DO NOT allow brake caliper to hang by brakeline. Remove speed sensor (if equipped). Remove hub/rotor assembly. Remove splash shield. Remove cotter pin and nut from tie rod end. Use Tie Rod Remover (J-6627-A) to separate tie rod end from steering knuckle.

3) If replacing steering knuckle, carefully remove steering knuckle grease seal. Position floor jack under lower control arm between ball joint and spring seat. Raise floor jack until lower control arm is just supported.

CAUTION: Support lower control arm with floor jack during removal and installation of steering knuckle.

4) Remove cotter pins and nuts from upper and lower ball joints. Using Ball Joint Separator (J-23742), separate ball joint studs from steering knuckle. See Fig. 2. Raise upper control arm to disengage ball joint stud from steering knuckle. Remove steering knuckle.

Inspection

Inspect tapered holes in steering knuckle for out-of-round, deformation or damage. Inspect spindle for worn or damaged threads. Replace steering knuckle as necessary.

CAUTION: When installing upper and lower ball joint stud nuts, DO NOT loosen nut to install cotter pin.

Installation

1) To install, reverse removal procedure. Install NEW grease seal on steering knuckle (if removed). Tighten ball joint stud nuts to align cotter pin holes as necessary. Install tie rod end stud into steering knuckle.

2) Install Steering Linkage Installer (J-29193) or (J-29194). Tighten steering linkage installer to 40 ft. lbs. (54 N.m) to seat tie rod taper. Remove steering linkage installer and install tie rod end stud nut.

3) To complete installation, reverse removal procedure. Adjust wheel bearings. See FRONT WHEEL BEARINGS under ADJUSTMENTS & INSPECTION. Tighten bolts and nuts to specification. See TORQUE SPECIFICATIONS. Lower vehicle and check wheel alignment. See WHEEL ALIGNMENT SPECIFICATIONS & PROCEDURES article in WHEEL ALIGNMENT section.

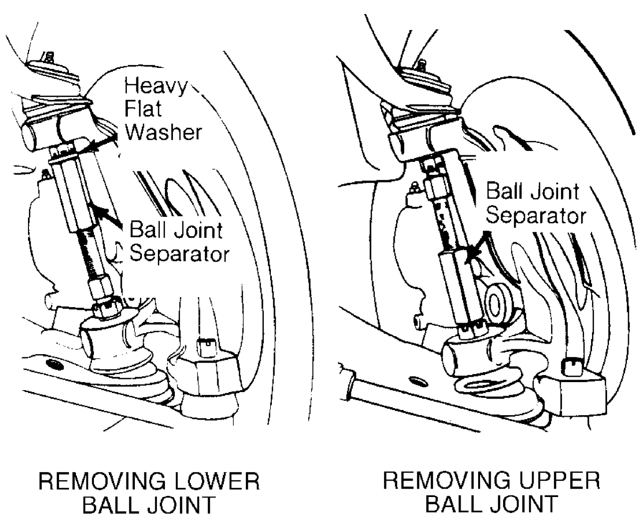

Fig. 2: Separating Upper & Lower Ball Joints From Steering Knuckle
Courtesy of General Motors Corp.

UPPER BALL JOINT

Removal

1) Raise and support vehicle with jackstand under lower control arm, between ball joint and spring seat. Jackstand must remain under lower control arm during upper ball joint servicing to maintain lower control arm and coil spring positioning.

2) Remove wheel and tire assembly. Remove brake caliper, and wire aside. DO NOT allow brake caliper to hang by brakeline. Remove nut securing speed sensor harness (if equipped). Remove grease fitting and cotter pin from upper ball joint stud. Remove upper ball joint stud nut.

3) Install Ball Joint Separator (J-23742) between upper and lower ball studs. See Fig. 2. Extend bolt on ball joint separator to loosen ball joint stud from steering knuckle. Remove ball joint separator. Separate ball joint from steering knuckle.

4) Using drill motor and 1/8" (3.18 mm) drill bit, drill 1/4" (6.35 mm) deep hole in ball joint retaining rivets. Using 1/2" (12.7 mm) drill bit, drill out rivet heads. Using a hammer and small punch, drive out rivets and remove upper ball joint from upper control arm.

CAUTION: When installing upper and lower ball joint stud nuts, DO NOT loosen nut to install cotter pin.

Installation

To install, reverse removal procedure. Use NEW nuts and bolts to install ball joint into upper control arm. Install grease fitting and lubricate NEW ball joint. Tighten bolts and nuts to specification. See TORQUE SPECIFICATIONS. Lower vehicle and check wheel alignment. See SPECIFICATIONS & PROCEDURES article in WHEEL ALIGNMENT.

LOWER BALL JOINT

Removal

1) Raise and support vehicle with jackstand under lower control arm between ball joint and spring seat. Jackstand must remain under lower control arm during lower ball joint servicing to maintain lower control arm and coil spring positioning.

2) Remove wheel and tire assembly. Remove brake caliper, and wire aside. DO NOT allow brake caliper to hang by brakeline. Remove grease fitting, rubber grease seal and cotter pin from lower ball joint stud. Remove lower ball joint stud nut.

3) Install Ball Joint Separator (J-23742) between upper and lower ball studs. See Fig. 2. Extend bolt on ball joint separator to loosen ball joint stud from steering knuckle. Remove ball joint separator. Separate ball joint from steering knuckle.

4) Place a wooden block between upper control arm and frame to keep steering knuckle assembly aside. Obtain "C" Clamp (J-9519-30) and Removers (J-9519-7 or J-9519-40 and J-9519-28) from Ball Joint Remover/Installer Set (J-9519-D), and assemble on lower control arm. See Fig. 3. Remove ball joint from lower control arm.

CAUTION: When installing upper and lower ball joint stud nuts, DO NOT loosen nut to install cotter pin.

Installation

1) Obtain "C" Clamp (J-9519-30) and Installer (J-9519-16) from ball joint remover/installer set, and assemble on lower control arm. See Fig. 3. Reverse removal procedure to install ball joint into lower control arm. Ensure bleed vent in rubber grease seal is facing inward. Install grease fitting and lubricate NEW ball joint.

2) To complete installation, reverse removal procedure. Tighten bolts and nuts to specification. See TORQUE SPECIFICATIONS. Lower vehicle and check wheel alignment. See
WHEEL ALIGNMENT SPECIFICATIONS & PROCEDURES article in WHEEL ALIGNMENT

section.

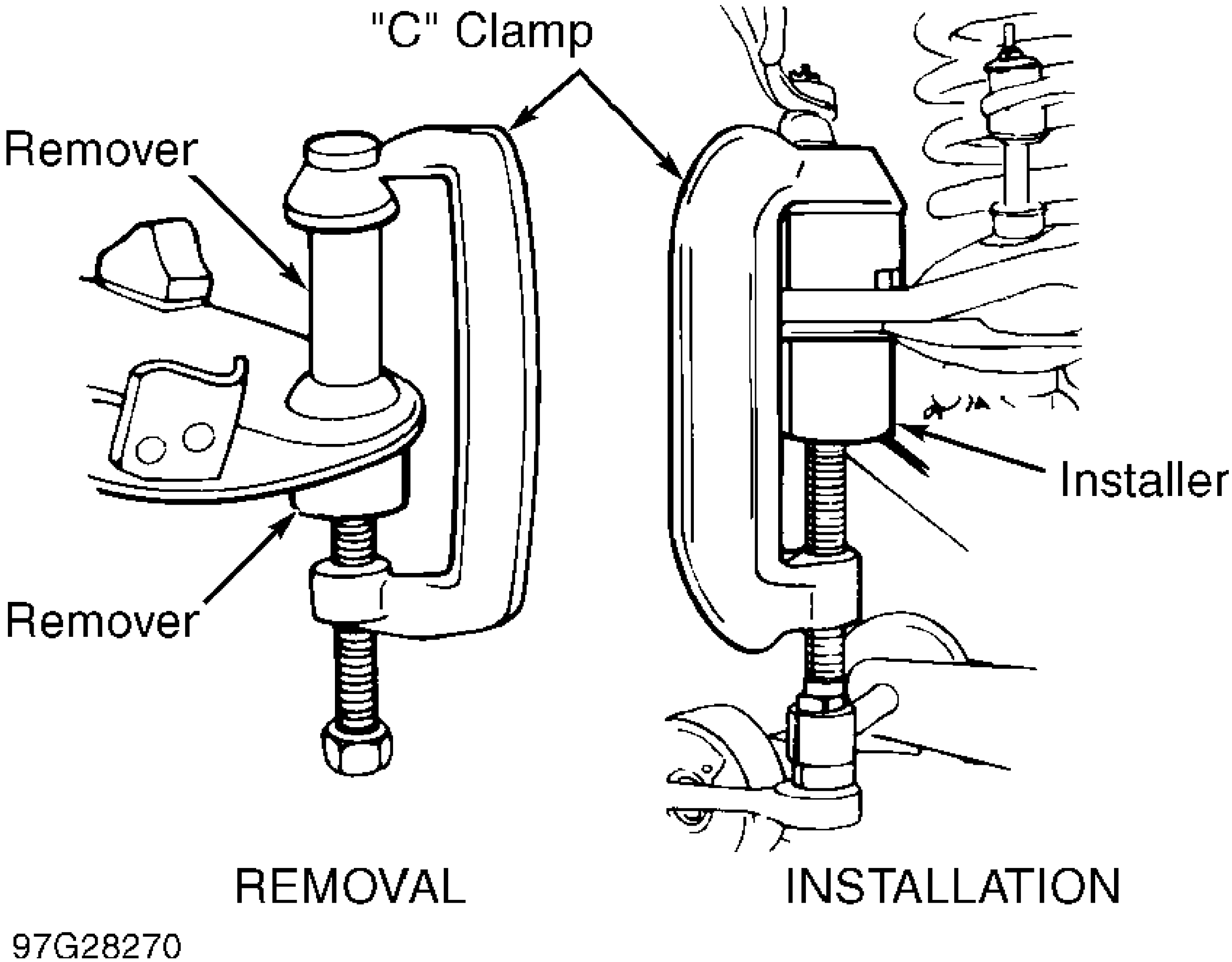

Fig. 3: Removing & Installing Lower Control Arm Ball Joint
Courtesy of General Motors Corp.

UPPER CONTROL ARM

Removal

1) Note location of alignment shims for reassembly. Remove upper control arm pivot shaft-to-frame nut and shim. See Fig. 1. Raise and support vehicle with jackstand under lower control arm, between ball joint and spring seat. Ensure jackstand remains under lower control arm during upper control arm servicing to maintain lower control arm and coil spring positioning.

2) Remove wheel and tire assembly. Remove grease fitting and cotter pin from upper ball joint stud. Remove upper ball joint stud nut. Install Ball Joint Separator (J-23742) between upper and lower ball studs. See Fig. 2. Extend bolt on ball joint separator to loosen ball joint stud from steering knuckle. Remove ball joint separator. Separate ball joint from steering knuckle. Lift upper control arm, and remove upper control arm pivot shaft-to-frame bolts. Remove upper control arm.

Installation

1) To install, reverse removal procedure.
2) Ensure holes in upper control arm shaft align with holes in frame. Ensure alignment shims are installed in original position.
3) Tighten bolts and nuts to specification. See TORQUE SPECIFICATIONS. Lower vehicle. Check wheel alignment. See WHEEL ALIGNMENT SPECIFICATIONS & PROCEDURES article in WHEEL ALIGNMENT section.

UPPER CONTROL ARM BUSHINGS

Pivot Shaft Bushing Replacement

1) Remove upper control arm from vehicle. See UPPER CONTROL ARM. Place upper control arm in soft-jawed vise. Remove nuts and retainers from ends of pivot shaft.
2) Using Bushing Remover/Installer (J-22269-1) and Receiver/Installer (J-21474-5), press bushing and pivot shaft from upper control arm. Repeat procedure for opposite bushing.
3) To install, place pivot shaft in upper control arm. Using Bushing Remover/Installer (J-22269-1) and small piece of pipe with the same outer diameter as bushing, press NEW bushing into upper control arm and onto pivot shaft.
4) Ensure each bushing is positioned .48-.52" (12.2-13.2 mm) from face of control arm to bushing outer sleeve. Repeat procedure for bushing on opposite end. Install nuts and retainers onto upper control arm pivot shaft ends.

LOWER CONTROL ARM

Removal

1) Raise and support vehicle with jackstand under frame, with control arms hanging free. Remove wheel and tire assembly. Remove coil spring. See COIL SPRINGS. Separate lower ball joint from steering knuckle. See LOWER BALL JOINT.
2) Separate lower control arm from steering knuckle and carefully maneuver out of opening in splash shield. Remove lower control arm-to-frame pivot bolts and nuts (rear bolt and nut first). Remove lower control from vehicle.

Installation

1) To install, reverse removal procedure. Use NEW nuts on lower control arm pivot bolts. Install lower control arm pivot bolts and nuts (front bolt and nut first). Ensure lower control arm pivot bolts are installed with bolt heads facing toward front of vehicle, and are tightened to specification with vehicle at riding height.
2) Tighten bolts and nuts to specification. See TORQUE SPECIFICATIONS. Lower vehicle and check wheel alignment. See WHEEL ALIGNMENT SPECIFICATIONS & PROCEDURES article in WHEEL ALIGNMENT section.

LOWER CONTROL ARM BUSHINGS

Front Bushing Replacement

1) Remove lower control arm from vehicle. See LOWER CONTROL ARM. Place lower control arm in soft-jawed vise. Using a blunt chisel, drive front bushing flare down even with rubber of bushing. Install appropriate lower control arm bushing service equipment. See CONTROL ARM BUSHING SERVICE EQUIPMENT table.
2) Tighten nut until front bushing is removed from lower control arm. To install front bushing, assemble appropriate control arm bushing service equipment. See Fig. 4.
3) Position NEW front bushing into lower control arm with lip side of bushing on outside of lower control arm. Tighten nut until bushing is fully seated into lower control arm. Flare front bushings

after installation. See Fig. 5. Turn nut on flaring die until bushing is flared about 45 degrees. Remove bushing flaring die and other service equipment.

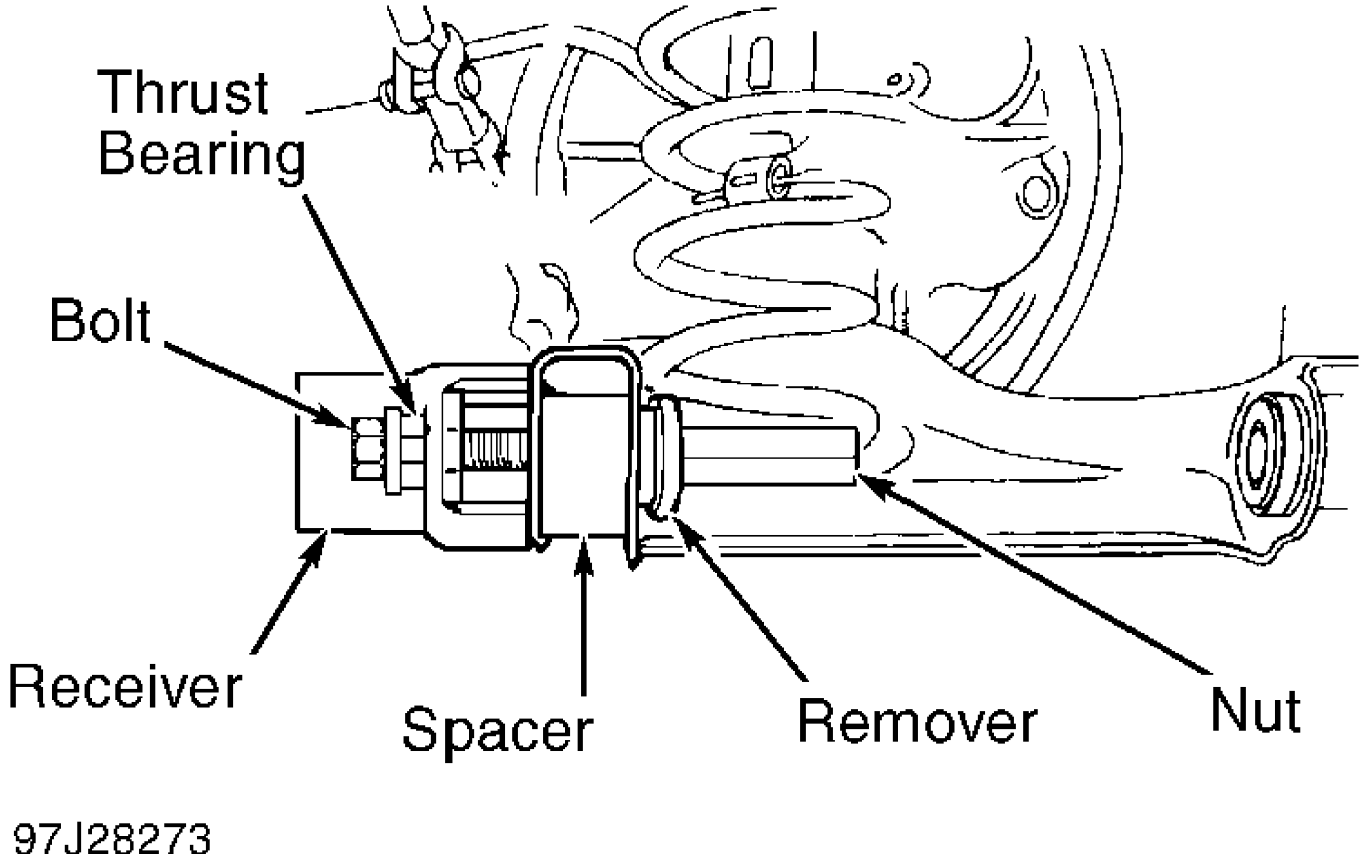

Fig. 4: Removing Lower Control Arm Front Bushing (Typical)
Courtesy of General Motors Corp.

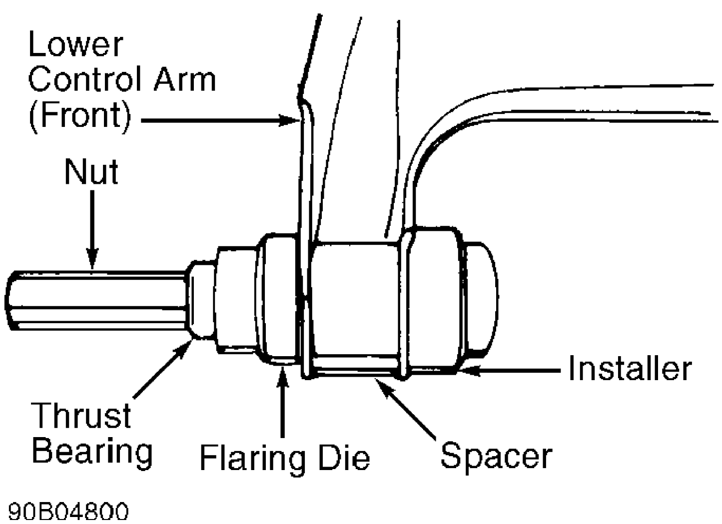

Fig. 5: Flaring Lower Control Arm Front Bushing
Courtesy of General Motors Corp.

CONTROL ARM BUSHING SERVICE EQUIPMENT TABLE

Application	Tool Number
Bolt & Thrust Washer	J-21474-3
Bushing Installer	J-21474-13
Nut	J-21474-4
Receiver/Installer	J-21474-5 Or J-21474-6

Rear Bushing Replacement

1) Remove lower control arm from vehicle. See LOWER CONTROL ARM. Place lower control arm in soft-jawed vise.

2) Install appropriate receiver, remover, spacer, nut and bolt as indicated. See Fig. 6. See CONTROL ARM BUSHING SERVICE EQUIPMENT table. Tighten nut until rear bushing is removed from lower control arm.

3) Assemble control arm bushing service set. Install nut, bolt, spacer and receiver. Position NEW rear bushing into lower control arm with lip side of bushing on outside of lower control arm. Tighten nut until bushing is fully seated into lower control arm.

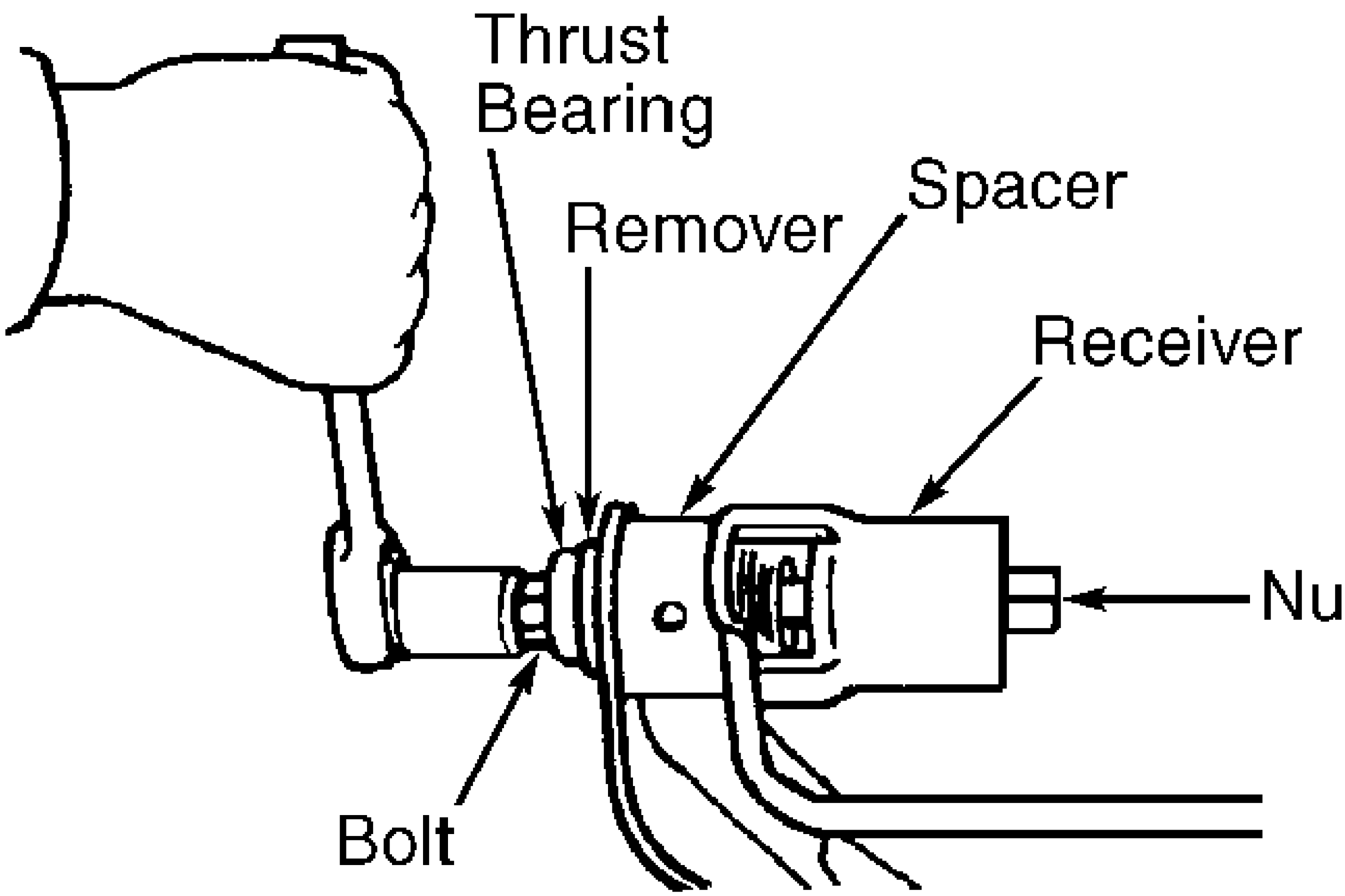

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Fig. 6: Removing Lower Control Arm Rear Bushing
Courtesy of General Motors Corp.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS TABLE

Application	Ft. Lbs. (N.m)
Ball Joint-To-Steering Knuckle Nut	
Lower	79 (107)
Upper	61 (83)
Lower Control Arm-To-Frame Pivot Bolt Nuts	
Front Bolt	(1) 85 (115)
Rear Bolt	(1) 72 (98)
Shock Absorber-To-Frame Nut	(2)
Shock Absorber-To-Lower Control Arm Bolts	22 (30)
Splash Shield Bolts	19 (26)
Stabilizer Bar To-Frame Bolts	13 (18)
Stabilizer Bar To-Lower Control Arm Nut	(3) 13 (18)
Tie Rod End-To-Steering Knuckle Nut	39 (53)
Upper Ball Joint-To-Control Arm Nuts	17 (23)
Upper Control Arm Pivot Shaft Nuts	85 (115)
Upper Control Arm Pivot Shaft-To-Frame Nuts	66 (89)
Wheel Lug Nut	95 (130)

(1) - Tighten with suspension loaded (weight of vehicle on wheels).
(2) - 97 INCH lbs. (11 N.m)
(3) - Obtain torque by running nut to unthreaded portion of bolt.

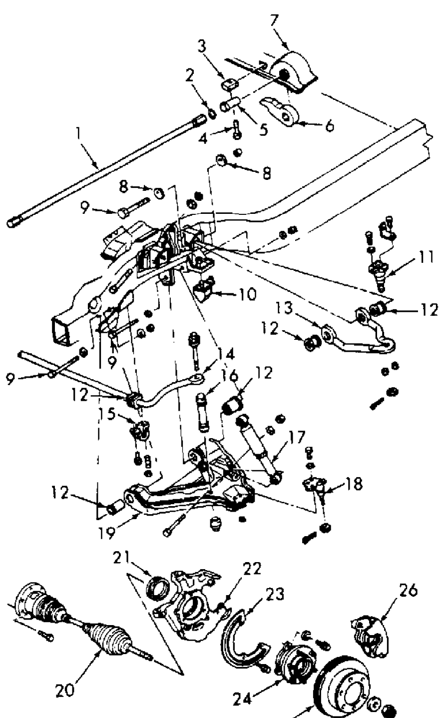
1997 SUSPENSION
General Motors - Front 4WD & AWD Torsion Bar

Chevrolet; "T" Series Blazer & Pickup
GMC; Jimmy & Sonoma
Oldsmobile; Bravada

DESCRIPTION

Independent front suspension consists of upper and lower control arms with steering knuckle mounted between ball joints. See Fig. 1. Shock absorbers fit between lower control arm and frame. A stabilizer bar is mounted to frame side rails and connected to lower control arms.

Torsion bars are used in place of coil springs. Front of torsion bar attaches to lower control arm. Rear of torsion bar attaches to adjustable arm at torsion bar support crossmember. Adjustments to trim height are made here.



1. Torsion Bar
2. Seal
3. Adjusting Nut
4. Adjusting Bolt
5. Anchor Adapter
6. Adjusting Arm
7. Support
8. Alignment Adjustment Cam
9. Pivot Bolt
10. Bumper
11. Upper Ball Joint
12. Bushing
13. Upper Control Arm
14. Stabilizer Bar
15. Clamp
16. Spacer
17. Shock Absorber
18. Lower Ball Joint
19. Lower Control Arm
20. Drive Axle
21. Grease Seal
22. Steering Knuckle
23. Splash Shield
24. Hub & Bearing Assembly
25. Rotor
26. Brake Caliper

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Fig. 1: Exploded View Of Front Suspension (Typical)
Courtesy of General Motors Corp.

ADJUSTMENTS & INSPECTION

WHEEL ALIGNMENT SPECIFICATIONS & PROCEDURES

NOTE: See WHEEL ALIGNMENT SPECIFICATIONS & PROCEDURES article in WHEEL ALIGNMENT section.

FRONT WHEEL BEARINGS

Front wheel bearings are sealed, pre-adjusted and require no maintenance unless wheel hub and bearing assembly is removed. See WHEEL HUB & BEARINGS under REMOVAL & INSTALLATION.

RIDING HEIGHT

NOTE: See WHEEL ALIGNMENT SPECIFICATIONS & PROCEDURES article in WHEEL ALIGNMENT section.

UPPER BALL JOINT CHECKING

NOTE: Replace ball joint rubber grease seal if cut or damaged.

1) Raise and support vehicle with jackstand under lower control arm, near lower ball joint. Ensure upper control arm bumper does not contact frame. Place dial indicator against lower part of wheel rim. Push in on bottom of tire while pulling outward at top. Read dial indicator, then reverse push/pull procedure.

2) If lateral (horizontal) deflection exceeds .125" (3.18 mm), replace ball joint. With ball joint disconnected from steering knuckle, try to rotate ball joint by finger pressure. If ball joint cannot be rotated, replace ball joint.

LOWER BALL JOINT CHECKING

NOTE: Replace ball joint rubber grease seal if cut or damaged.

Raise and support vehicle with jackstand under lower control arm, near lower ball joint. Place a dial indicator on spindle hub. Pry wheel between lower control arm and outer race to measure vertical movement. Note dial indicator reading. If reading exceeds .125" (3.18 mm), replace loose ball joint.

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. See COMPUTER RELEARN PROCEDURES article in GENERAL INFORMATION before disconnecting battery.

WHEEL HUB & BEARINGS

NOTE: Darkened areas on bearing assembly are caused by heat treatment process and DO NOT indicate a need for replacement.

Removal

1) Raise and support vehicle. Remove wheel and tire assembly. Install Axle Shaft Boot Seal Protector (J-28712) to drive axle shaft boot to protect drive axle during repair. Depress brake caliper piston, detach brake caliper and wire aside. Remove brake rotor. See

Fig. 1. Remove drive axle shaft nut cotter pin, retainer, drive axle shaft nut and washer. Pull hub and bearing assembly off drive axle shaft.

2) Inspect steering knuckle grease seal for cuts, distortion and wear. Inspect steering knuckle, hub and bearing for damage. Replace as necessary. If wheel hub stud must be replaced, use Wheel Stud Remover (J-6627-A).

Installation

1) To install NEW wheel hub stud, lubricate hub bore and install stud. Place 4 washers on stud and install stud nut with flat side to washers. Tighten stud nut to draw stud into hub bore. Remove nut and washers. Install hub and bearing assembly onto drive axle shaft.

2) To complete installation, reverse removal procedure. Tighten bolts and nuts to specification. See TORQUE SPECIFICATIONS. Depress brake pedal several times to extend caliper piston after installation.

STEERING KNUCKLE

Removal

1) Raise and support vehicle. Unload torsion bar tension. See Fig. 2. Count exact number of tool turns for reassembly reference. Slide, but DO NOT remove, torsion bar forward.

2) Remove wheel and tire assembly. Install Axle Shaft Boot Seal Protector (J-28712) to drive axle shaft boot to protect drive axle during repair. Depress brake caliper piston, detach brake caliper and wire aside. Remove brake rotor.

3) Remove drive axle shaft nut cotter pin, retainer, drive axle shaft nut and washer. Pull hub and bearing assembly off drive axle shaft. Remove splash shield. Remove cotter pin and tie rod end stud nut. Using Universal Steering Linkage Puller (J-24319-01), separate tie rod end from steering knuckle.

4) Remove upper and lower ball joint stud cotter pins. Place Ball Joint Separator (J-34026) over upper ball joint stud. Loosen ball joint stud nut. See Fig. 3. Back off nut until nut contacts tool. Continue backing off nut until nut forces ball stud out of steering knuckle. Remove spacer. Repeat procedure to separate lower ball joint from steering knuckle.

6) Remove steering knuckle from vehicle. Inspect steering knuckle grease seal for cuts, distortion and wear. Inspect steering knuckle, hub and bearing for damage. Replace as necessary.

Installation

1) Using hammer and Steering Knuckle Seal Installer (J-28574), install NEW steering knuckle grease seal into steering knuckle. Install spacer (if equipped). Install steering knuckle onto upper and lower ball joint studs.

CAUTION: When installing upper and lower ball joint stud nuts, tighten nut to align cotter pin hole. DO NOT tighten ball joint stud nuts more than an additional 1/6 turn to align cotter pin hole. Complete tightening of ball joint stud nuts with vehicle at proper riding height specification.

2) Install ball joint stud nuts and cotter pins. Install drive axle (if removed). Install tie rod end onto steering knuckle. Install tie rod end stud nut and cotter pin. Install splash shield. Install hub and bearing assembly onto drive axle shaft and into steering knuckle.

3) To complete installation, reverse removal procedure. Tighten bolts and nuts to specification. See TORQUE SPECIFICATIONS.

Lower vehicle. Check wheel alignment and adjust ride height. See WHEEL ALIGNMENT SPECIFICATIONS & PROCEDURES article in WHEEL ALIGNMENT section.

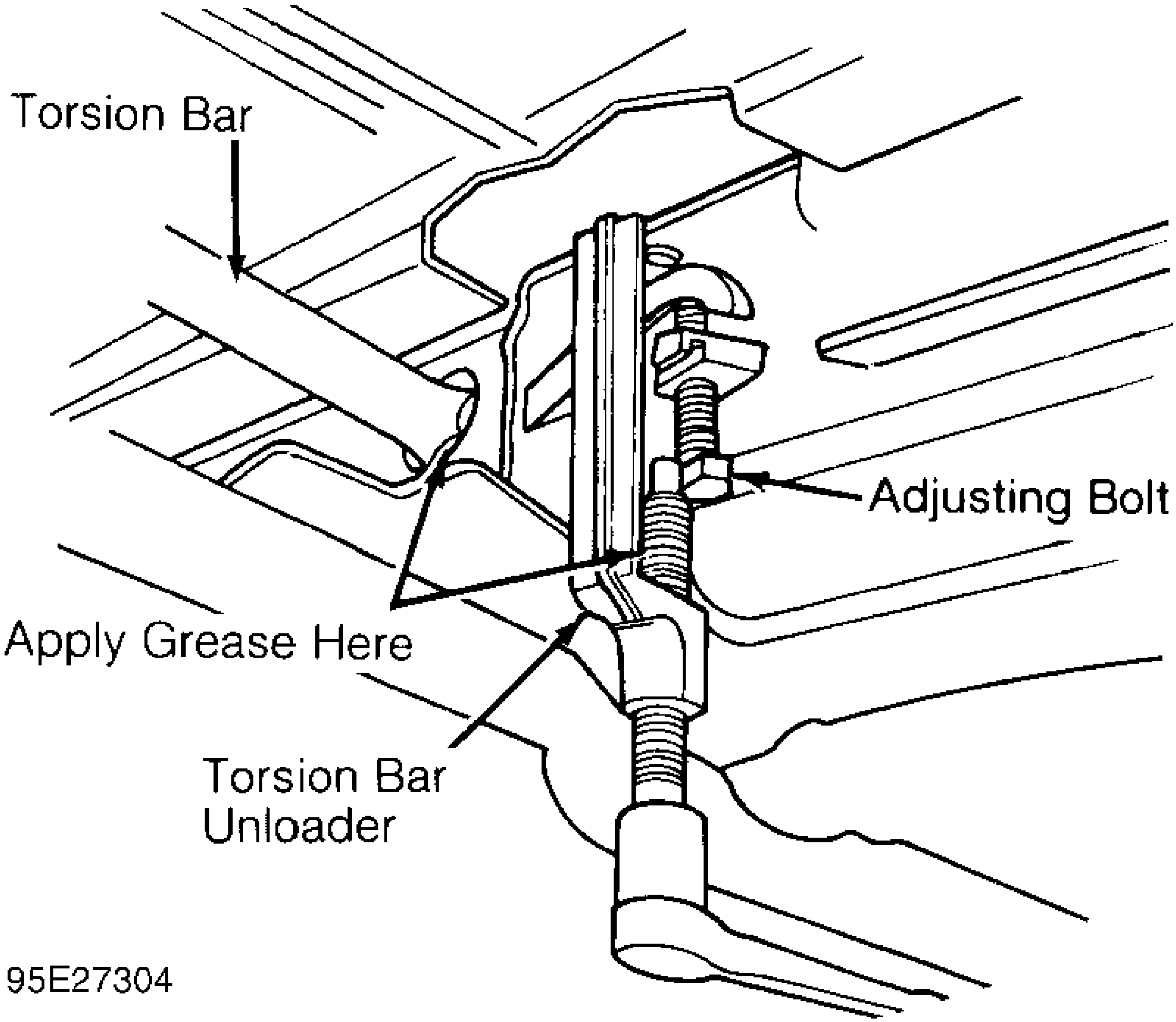

Fig. 2: Unloading Torsion Bar Tension
Courtesy of General Motors Corp.

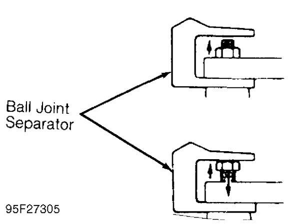

Fig. 3: Separating Ball Joint From Steering Knuckle
Courtesy of General Motors Corp.

SHOCK ABSORBERS

Removal

Raise and support vehicle. Remove wheel and tire assembly. Remove shock absorber retaining bolt and nut from lower control arm. Remove shock absorber retaining bolt and nut from frame. Remove shock absorber from vehicle.

NOTE: Purging air from non-spiral groove shock is not required, as reservoir has gas-charged cell. Spiral groove shock has air-charged cell and air must be purged.

Inspection

1) On spiral groove shock, purge air from pressure chamber by mounting shock in vise (top end up) and fully extending unit. Reverse position (top end down) and fully collapse unit. Repeat procedure several times.

2) Bench check shock unit by mounting in vise with top end up (top end down on gas-charged shocks). DO NOT clamp vise on reservoir tube or mounting threads. Check rubber grommets for deterioration and replace as needed.

3) Operate shock by hand at various rates of speed and note resistance. Rebound force is normally stronger than compression force. If resistance is not smooth and constant, replace shock.

Installation

To install, reverse removal procedure. Tighten bolts and nuts to specification. See TORQUE SPECIFICATIONS.

STABILIZER BAR

NOTE: Keep right and left side stabilizer bar components separate for installation in original locations.

Removal

Raise and support vehicle. Remove wheel and tire assembly. Remove fasteners and separate stabilizer bar from lower control arm. Remove stabilizer bar. Remove stabilizer bar bushings. Replace bushings if deformed or deteriorated. Replace stabilizer bar and clamps if excessive worn or damaged.

Installation

Unload torsion bar tension. See Fig. 2. Count exact number of tool turns for reassembly reference. To install, reverse removal procedure. Ensure split in bushing faces toward front of vehicle. Tighten bolts and nuts to specification. See TORQUE SPECIFICATIONS. Lower vehicle. Adjust ride height and check wheel alignment. See WHEEL ALIGNMENT SPECIFICATIONS & PROCEDURES article in WHEEL ALIGNMENT section.

UPPER BALL JOINT

Removal

1) Raise and support vehicle under lower control arms. Remove wheel and tire assembly. Remove upper ball joint stud nut and separate upper ball joint stud from steering knuckle using Ball Joint Separator (J-36607). Remove brakeline and brackets from upper control arm (if equipped).

2) Drill a 1/8" (3.18 mm) diameter by 1/4" (6.35 mm) deep hole in ball joint retaining rivets. Drill off rivet heads with a 1/2" (12.7 mm) drill bit. Drive out rivets with a hammer and small punch. Remove ball joint.

CAUTION: When installing upper ball joint stud nut, tighten nut to align cotter pin hole. DO NOT tighten ball joint stud nut more than an additional 1/6 turn to align cotter pin hole. Complete tightening of upper ball joint stud nut with vehicle at proper riding height specification.

Installation

To install, reverse removal procedure. Use NEW nuts and bolts to install ball joint to upper control arm. Lubricate NEW ball joint. Tighten bolts and nuts to specification. See TORQUE SPECIFICATIONS. Lower vehicle. Check ride height and adjust wheel alignment. See WHEEL ALIGNMENT SPECIFICATIONS & PROCEDURES article in WHEEL ALIGNMENT section.

LOWER BALL JOINT

Removal

1) Raise and support vehicle under lower control arms. Remove wheel. Remove steering knuckle. See STEERING KNUCKLE. Remove brakeline and brackets from lower control arm.

2) Drill a 1/8" (3.18 mm) diameter by 1/4" (6.35 mm) deep hole in ball joint retaining rivets. Drill off rivet heads with a 1/2" (12.7 mm) drill bit. Using a 5/16" (8 mm) drill bit, drill through 2/3 of the length of rivet shank. Drive out rivet with a 5/16" (8 mm) punch. Remove ball joint.

CAUTION: When installing lower ball joint stud nut, tighten nut to align cotter pin hole. DO NOT tighten ball joint stud nut more than an additional 1/6 turn to align cotter pin hole. Complete tightening of lower ball joint stud nut with vehicle at proper riding height specification.

Installation

To install, reverse removal procedure. Use NEW nuts and bolts to install ball joints to lower control arm. Lubricate NEW ball joint. Tighten bolts and nuts to specification. See TORQUE SPECIFICATIONS. Lower vehicle. Check wheel alignment and adjust ride height. See WHEEL ALIGNMENT SPECIFICATIONS & PROCEDURES article in WHEEL ALIGNMENT section.

UPPER CONTROL ARM

Removal

1) Raise and support vehicle under lower control arms. Remove wheel. Remove upper ball joint stud cotter pin. Place Ball Joint Separator (J-34026) over upper ball joint stud. Loosen ball joint stud nut. See Fig. 3. Back off nut until nut contacts tool. Continue backing off nut until nut forces ball stud out of steering knuckle. Remove spacer.

2) Mark alignment adjustment cams for reassembly reference. Remove upper control arm pivot bolts, cams/washers and nuts. Remove upper control arm from vehicle. See Fig. 4. Replace bushings and/or bumper as necessary.

Installation

1) If upper control arm bumper is deteriorated or damaged, install NEW bumper. Mount upper control arm on vehicle. Install pivot bolts, alignment adjustment cams and NEW pivot bolt nuts.

CAUTION: When installing upper ball joint stud nut, tighten nut to align cotter pin hole. DO NOT tighten ball joint stud nut more than an additional 1/6 turn to align cotter pin hole. Complete tightening of upper ball joint stud nut with vehicle at proper riding height specification.

2) Ensure pivot bolt heads are facing inward. Connect steering knuckle to upper ball joint studs. To complete installation, reverse removal procedure. Tighten bolts and nuts to specification. See TORQUE SPECIFICATIONS.

3) Lower vehicle. Check wheel alignment and adjust ride height. See WHEEL ALIGNMENT SPECIFICATIONS & PROCEDURES article in WHEEL ALIGNMENT section. Complete tightening of upper control arm pivot bolts and nuts with vehicle at proper riding height.

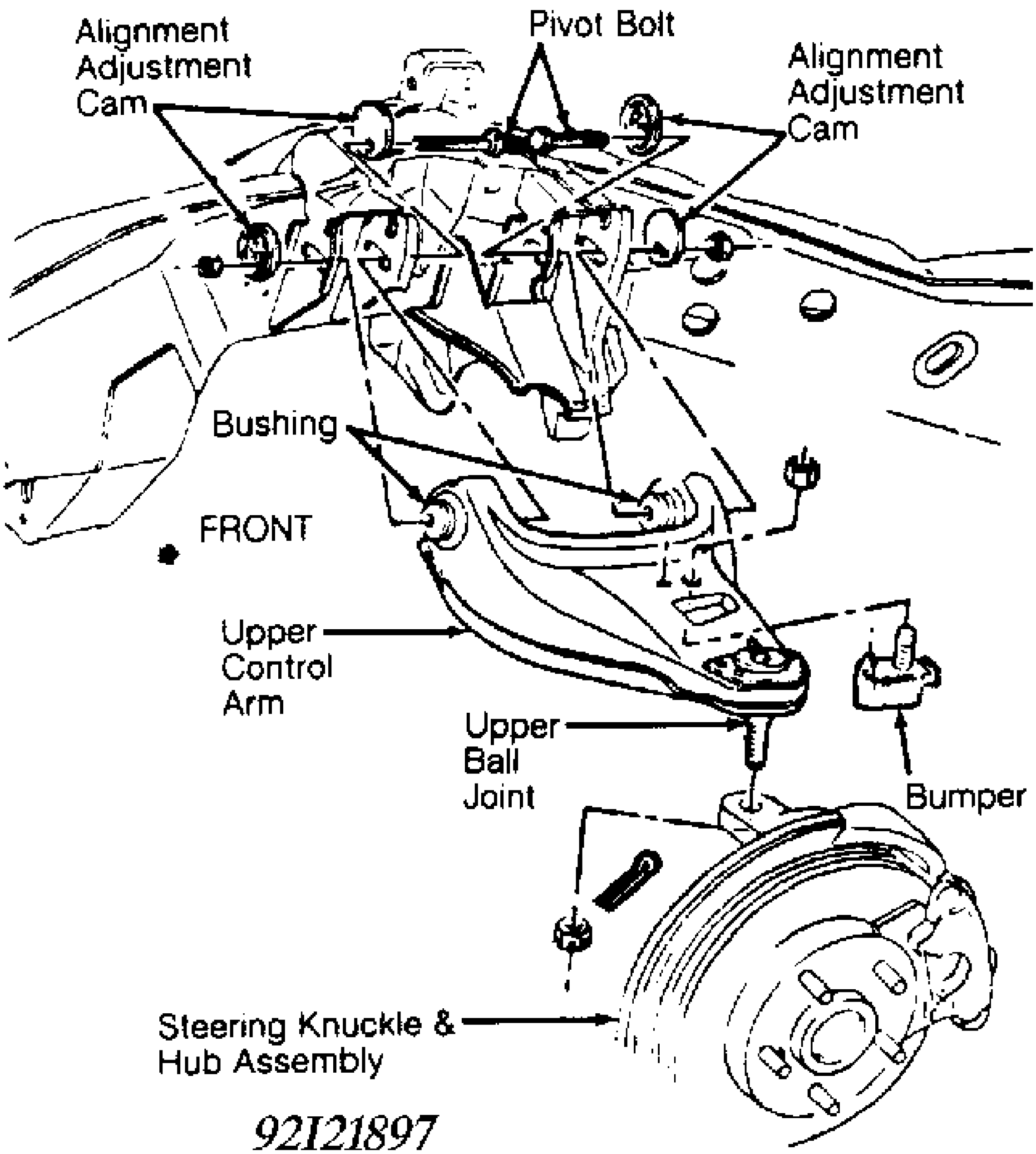

Fig. 4: Exploded View Of Upper Control Arm
Courtesy of General Motors Corp.

UPPER CONTROL ARM BUSHINGS

Bushing Replacement

1) Remove upper control arm from vehicle. See UPPER CONTROL ARM. Place upper control arm in soft-jawed vise.

2) Press bushings out of upper control arm using Nut (J-21474-18), Bolt (J-21474-19), washer, bearing and Control Arm Bushing Service Set (J-33793). See Fig. 5.

3) Install NEW bushings into upper control arm using Nut (J-21474-18), Bolt (J-21474-19), washer, bearing and Control Arm Bushing Service Set (J-33793). See Fig. 5.

4) Ensure bushings are properly seated in upper control arm. Install upper control arm. See UPPER CONTROL ARM.

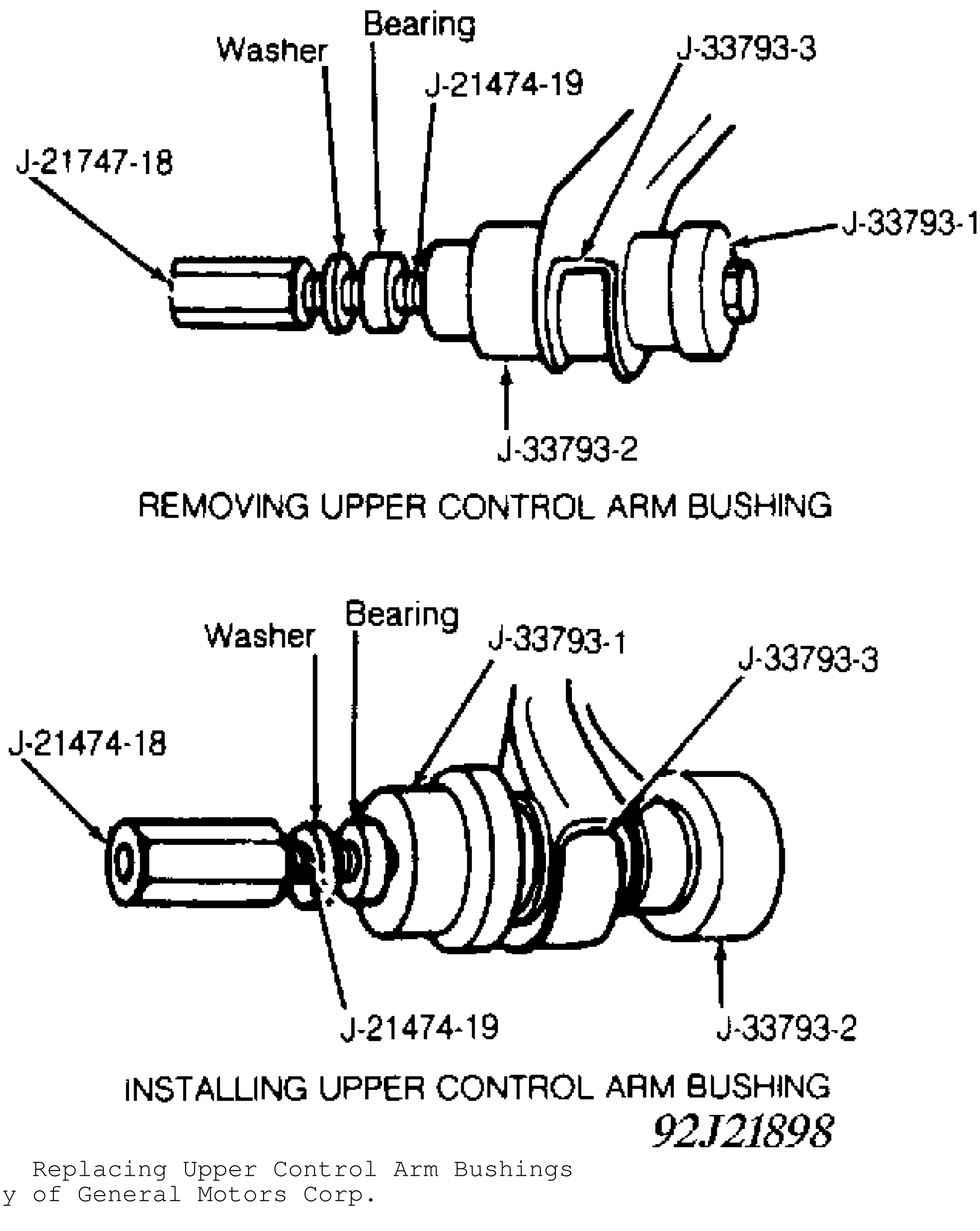

Fig. 5: Replacing Upper Control Arm Bushings
Courtesy of General Motors Corp.

LOWER CONTROL ARM

Removal

1) Raise and support vehicle. Unload torsion bar tension. See Fig. 2. Count exact number of tool turns for reassembly reference. Slide torsion bar forward to remove adjuster arm. Remove wheel and tire assembly.

2) Remove drive axle nut. Remove stabilizer bar from vehicle. See STABILIZER BAR. Remove shock absorber from vehicle. See SHOCK ABSORBERS. Separate lower ball joint from steering knuckle. See LOWER BALL JOINT.

3) Remove lower control arm pivot bolts, nuts and washers. Remove lower control arm from vehicle. See Fig. 1. Replace bushings and/or bumper as necessary.

Installation

1) To install, reverse removal procedure. Install front leg of lower control arm onto vehicle, then rear leg. Install lower control arm pivot bolts, washers and NEW nuts, with bolt heads facing rearward.

CAUTION: When installing upper ball joint stud nut, tighten nut to align cotter pin hole. DO NOT tighten ball joint stud nut more than an additional 1/6 turn to align cotter pin hole. Complete tightening of upper ball joint stud nut with vehicle at proper riding height specification.

2) Tighten bolts and nuts to specification. See TORQUE SPECIFICATIONS. Lower vehicle. Check wheel alignment and adjust ride height. See WHEEL ALIGNMENT SPECIFICATIONS & PROCEDURES article in WHEEL ALIGNMENT section. Complete tightening of lower control arm pivot bolts and nuts with vehicle at proper riding height specification.

LOWER CONTROL ARM BUSHINGS

Removal

Remove lower control arm. See LOWER CONTROL ARM. Place lower control arm in a soft-jawed vise. Press bushings out of lower control arm using a washer, bearing and Control Arm Bushing Service Set (J-21474). See Fig. 6.

Installation

To install, reverse removal procedure. Press in bushings until properly seated. Install lower control arm. See LOWER CONTROL ARM.

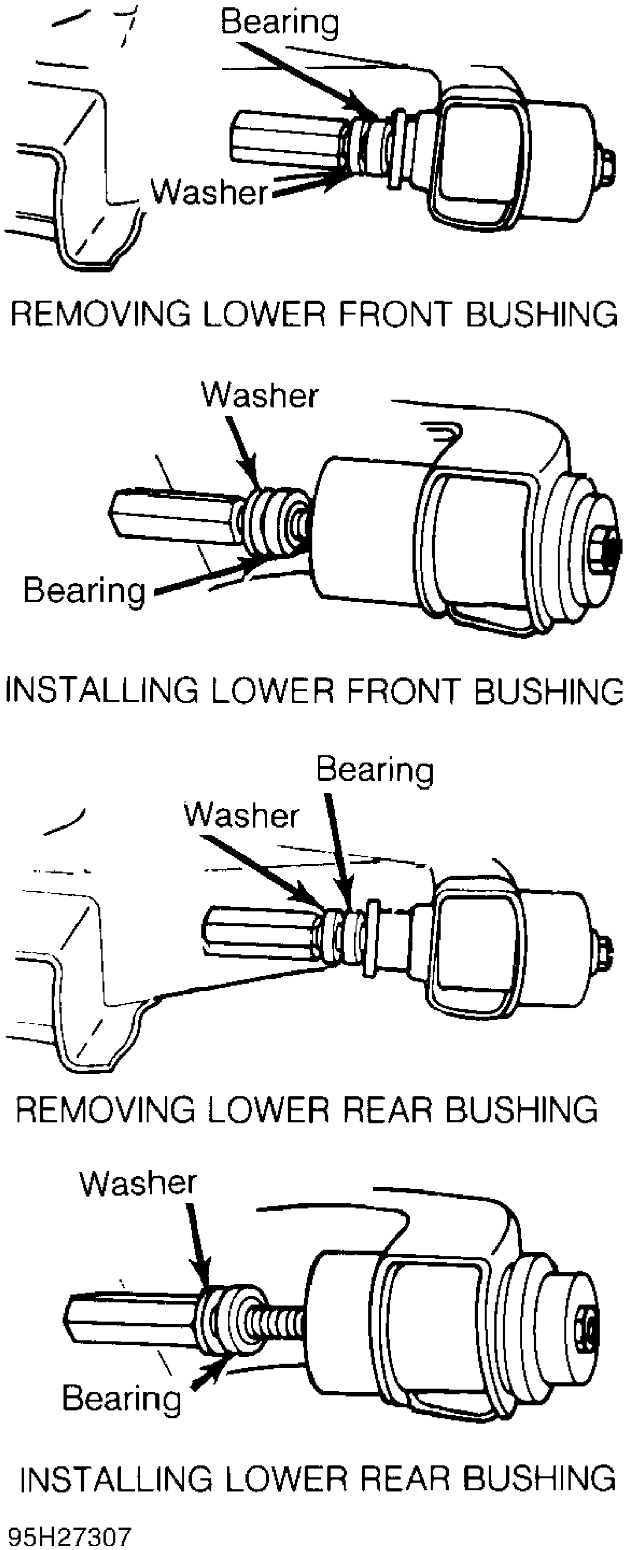

Fig. 6: Replacing Lower Control Arm Bushings
Courtesy of General Motors Corp.

TORSION BARS & SUPPORT

Removal

1) Raise and support vehicle. Remove wheel and tire assembly. Unload torsion bar tension. See Fig. 2. Mark adjusting bolt setting. Using Torsion Bar Unloading Tool (J-36202), increase tension on adjusting arm. Remove torsion bar adjusting bolt, counting number of turns for reassembly reference.

2) Remove torsion bar adjusting nut. Slowly relieve torsion bar tension. Remove unloading tool. Slide torsion bar forward. Remove torsion bar adjusting arm. Remove support mounting bolts, nuts and washers. Remove support retainer, spacer and rubber insulator. See Fig. 7.

3) Disconnect muffler flange from catalytic converter. Loosen rear exhaust hanger and lower rear exhaust. Remove torsion bar support. Slide torsion bar rearward and remove from lower control arm.

5) Inspect torsion bars, adjusting arms, retainers, rubber insulators and support for bend, cracks, deterioration or damage. Check adjusting bolt and nut for damage or stripped threads. Replace as necessary.

Installation

1) Install torsion bar rubber insulators, spacer and support retainer onto support. Install support assembly onto frame, slightly behind mounting holes. Install rear exhaust and rear exhaust hanger. Connect muffler flange to catalytic converter.

2) Install adjusting arm and seal onto torsion bar. Slide torsion bar into lower control arm in original position. Slide torsion bar support forward, engaging rear of torsion bar in support. Install support mounting bolts, nuts and washers. Tighten bolts and nuts to specification. See TORQUE SPECIFICATIONS.

3) Install adjusting bolt and nut on each torsion bar. Add tension to torsion bar with Torsion Bar Unloading Tool (J-36202). Ensure adjusting bolt is positioned to setting marked before removal. Release tension on unloading tool until tension is taken up by adjusting bolt. Remove unloading tool. Lower vehicle. Check wheel alignment and adjust ride height. See WHEEL ALIGNMENT SPECIFICATIONS & PROCEDURES article in WHEEL ALIGNMENT section.

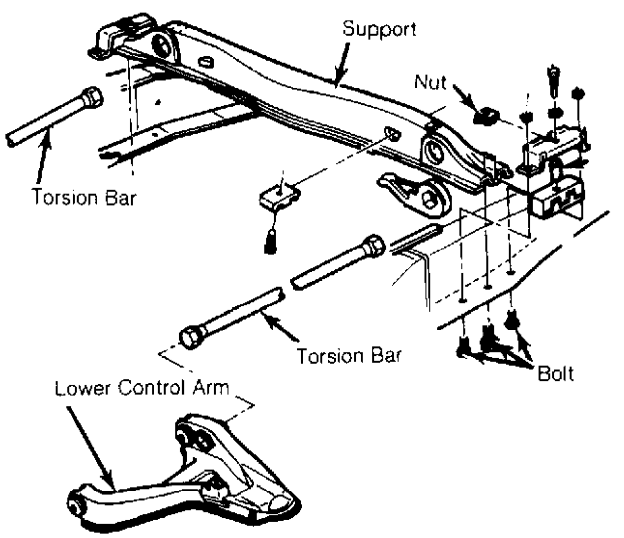

Fig. 7: Exploded View Of Torsion Bar & Support Assembly
Courtesy of General Motors Corp.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS TABLE

Application	Ft. Lbs. (N.m)
Ball Joint-To-Control Arm Nut (1)	17 (23)
Ball Joint-To-Steering Knuckle Nut (1) (2)	
Lower	79 (107)
Upper	61 (83)
Drive Axle Shaft Nut	181 (245)
Hub & Bearing/Shield-To-Steering Knuckle Bolt	77 (105)
Lower Control Arm-To-Frame Pivot Bolt (1) (5)	81 (110)
Lower Control Arm-To-Frame Pivot Bolt Nut (1) (3) (5)	81 (110)
Shock Absorber Nut (4)	54 (73)
Stabilizer Bar Clamp-To-Frame Bolt	26 (35)
Stabilizer Bar-To-Lower Control Arm Bolt	11 (15)
Tie Rod End-To-Steering Knuckle Nut	39 (53)
Torsion Bar Retainer-To-Support Link Nut	
Lower	50 (68)
Upper	33 (48)
Upper Control Arm-To-Frame Pivot Bolt Nut (1)	
Front	85 (115)
Rear	72 (98)
Wheel Lug Nut	95 (129)

(1) - Complete tightening of bolts and/or nuts with vehicle at proper riding height specification.
(2) - Tighten nut to align cotter pin hole. DO NOT tighten nut more than an additional 1/6 turn to align cotter pin hole.
(3) - Use NEW nuts during reassembly.
(4) - Install both bolts with nuts facing rear of vehicle.
(5) - Install upper/rear bolt with nut facing rear of vehicle. Install lower/front bolt with nut facing front of vehicle.

* SUSPENSION UNIFORM INSPECTION GUIDELINES *

1997 Chevrolet Blazer

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)

CONTENTS

TIE ROD ENDS (INNER AND OUTER)
TRACK BARS
TRAILING ARMS
WHEEL BEARINGS, RACES AND SEALS

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:

1444 I Street, NW Suite 700
Washington, DC 20005
Phone (202) 712-9042 Fax (202) 216-9646
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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		

Condition	Code	Procedure
threads damaged	A	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Dust boot missing	2	(1) Suggest replacement.
Dust boot split	2	(1) Suggest replacement.
Dust boot torn	2	(1) Suggest replacement.
Housing cracked	A	Require replacement.
Lead routing incorrect	B	Require rerouting according to vehicle manufacturer's specifications.
Loose	B	Require adjustment to vehicle manufacturer's specifications.
Missing	C	Require replacement.
Output signal incorrect	A	Require repair or replacement.
Wire lead damaged	A	Require repair or replacement.

(1) - This condition can lead to damage of the sliding magnet, which, in turn, causes premature sensor failure.

AIR RIDE SUSPENSION - MODULES

AIR RIDE SUSPENSION - MODULE INSPECTION

Condition	Code	Procedure
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Housing cracked	2	Suggest repair or replacement.
Inoperative	A	Require replacement.
Missing	C	Require replacement.

AIR RIDE SUSPENSION - RELAYS (COMPRESSOR)

AIR RIDE SUSPENSION - RELAY (COMPRESSOR) INSPECTION

Condition	Code	Procedure
Housing cracked	2	(1) Suggest replacement.
Intermittent	A	Require replacement.
Missing	C	Require replacement.
Output signal incorrect	A	Require replacement.

(1) - If moisture enters the relay, it can reduce life expectancy or impair function.

AIR RIDE SUSPENSION - SWITCHES (ON/OFF)

AIR RIDE SUSPENSION - SWITCH (ON/OFF) INSPECTION

Condition	Code	Procedure
Broken	A	Require replacement.
Missing	C	Require replacement.
Output signal incorrect	A	Require replacement.

AIR RIDE SUSPENSION - TORSION SPRINGS (COUNTER BALANCING)

AIR RIDE SUSPENSION - TORSION SPRING (COUNTER BALANCING) INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require repair or replacement of bent part.
Attaching hardware broken	A	Require replacement of broken part.
Attaching hardware incorrect	A	Require replacement of incorrect part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Broken	A	Require replacement.
Missing	C	Require replacement.

AIR RIDE SUSPENSION - TUBING

AIR RIDE SUSPENSION - TUBING INSPECTION

Condition	Code	Procedure
Attaching hardware incorrect	A	Require replacement of incorrect part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Blocked	A	Require repair or replacement.
Fitting incorrect	B	Require replacement.
Leaking	A	Require repair or replacement.
Line type incorrect	B	Require replacement.
Missing	C	Require replacement.
Restricted	A	Require repair or replacement.
Routed incorrectly	B	Require routing correction.

AIR RIDE SUSPENSION - WARNING LAMPS

AIR RIDE SUSPENSION - WARNING LAMP INSPECTION

Condition	Code	Procedure
Bulb burned out	A	Require replacement.
Warning light does not come on during bulb check	..	Further inspection required to determine cause.
Warning light flashes	..	Further inspection required to determine cause.
Warning light is intermittent	..	Further inspection required to determine cause.
Warning light stays on after initial bulb check	..	Further inspection required to determine cause.

AIR RIDE SUSPENSION - WIRING HARNESSES

AIR RIDE SUSPENSION - WIRING HARNESS INSPECTION

Condition	Code	Procedure
Connector bent	A	Require repair or replacement.
Connector broken	A	Require repair or replacement.
Connector loose	A	Require repair or replacement.
Damaged (cut, burned, or chafed)	A	Require repair or replacement.
Excessive resistance	B	Require repair or replacement.
Fuse blown	A	Require replacement.
Fusible link blown	A	Require replacement.
Open	A	Require repair or replacement.
Poor ground	A	Require repair or replacement.
Routed incorrectly	B	Require rerouting according to vehicle manufacturer's specifications.
Shorted	A	Require repair or replacement.
Terminal bent	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal corroded	A	Require repair or replacement.
Terminal loose	A	Require repair or replacement.

BALL JOINTS

Before requiring or suggesting ball joint replacement, the approved OEM procedure must be used to measure ball joint wear. The measurement(s) obtained, along with the vehicle manufacturer's specifications, must be noted on the inspection report. Some states require that these measurements also appear on the invoice.

NOTE: The term "perceptible movement," defined as any visible movement in any direction, has been the industry standard for determining the need for replacement of follower ball joints. Some vehicle manufacturers are now publishing specifications for follower ball joints that were previously diagnosed by the "perceptible movement" standard. Before requiring or suggesting any parts be replaced based on "perceptible movement," consult your repair manual to determine if OEM specifications exist.

You are not required to replace ball joints in axle sets. However, when replacing a ball joint due to wear exceeding manufacturer's specification, you may suggest replacement of the other ball joint if its measurement shows it is close to the end of its useful life, for preventive maintenance.

BALL JOINT INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require repair or replacement of bent part if available; otherwise, replace ball joint.
Attaching hardware broken	A	Require replacement of broken part if available; otherwise, replace ball joint.
Attaching hardware corroded, affecting structural integrity	A	Require replacement of corroded part if available; otherwise, replace ball joint.
Attaching hardware incorrect	A	Require replacement of incorrect part if available; otherwise, replace ball joint.
Attaching hardware loose	A	Require repair or replacement of loose part if available; otherwise, replace ball joint.
Attaching hardware missing	C	Require replacement of missing part if available; otherwise, replace ball joint.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads if available; otherwise, replace ball joint.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads if available; otherwise, replace ball joint.
Binding	A	(1) Further inspection required.
Grease boot cracked	2	(2) Suggest replacement.
Grease boot missing	2	(3) Suggest replacement.
Grease boot torn	2	(4) Suggest replacement.
Grease fitting broken	A	Require replacement of grease fitting.
Grease fitting missing	C	Require replacement of grease fitting.
Grease fitting won't seal	A	Require replacement of grease fitting.
Greaseable ball joint will		

not take grease	2	(5) Suggest replacement of grease fitting.
Nut on ball joint loose	A	(6) Require repair or replacement.
Pre-load adjustment incorrect	B	Require repair or replacement.
Seized	A	Require replacement.
Stud bent	B	(7) Require replacement.
Stud broken	A	(7) Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	(7) Require replacement.
Wear exceeds manufacturer's specifications	B	Require replacement.

(1) - If greaseable, grease ball joint. If problem persists or joint is non-greaseable, require replacement.
(2) - Cracked grease boot will allow contaminants to enter the ball joint and will accelerate wear.
(3) - Lack of grease boot will allow contaminants to enter the ball joint and will accelerate wear.
(4) - Torn grease boot will allow contaminants to enter the ball joint and will accelerate wear.
(5) - If the greaseable ball joint still will not take grease after replacing the grease fitting, suggest replacement of ball joint.
(6) - Check for bent stud or damaged taper hole.
(7) - Check for damaged taper hole.

BUSHINGS

BUSHING INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require repair or replacement of bent part if available; otherwise, replace bushing.
Attaching hardware broken	A	Require replacement of broken part if available; otherwise, replace bushing.
Attaching hardware corroded, affecting structural integrity	A	Require replacement of corroded part if available; otherwise, replace bushing.
Attaching hardware incorrect	A	Require replacement of incorrect part if available; otherwise, replace bushing.
Attaching hardware loose	A	Require repair or replacement of loose part if available; otherwise, replace bushing.
Attaching hardware missing	C	Require replacement of missing part if available; otherwise, replace bushing.
Attaching hardware threads damaged	A	Require repair or replacement

of part with damaged threads if available; otherwise, replace bushing.

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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.
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(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

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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
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		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,

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                                          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.
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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.

Condition	Code	Procedure
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Bent	B	Require replacement.
Corroded, affecting structural integrity	A	Require replacement.
Holes distorted	A	Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

RELAY RODS

RELAY ROD INSPECTION

Condition	Code	Procedure
Attaching hardware incorrect	A	Require replacement of incorrect part, if available; otherwise, replace relay rod.
Attaching hardware loose	A	Require repair or replacement of loose part, if available; otherwise, replace relay rod.
Attaching hardware missing	C	Require replacement of missing part, if available; otherwise, replace relay rod.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads, if available; otherwise, replace relay rod.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads, if available; otherwise, replace relay rod.
Bent	B	Require replacement.
Binding	A	(1) Further inspection required.
Grease boot cracked	2	(2) Suggest replacement.
Grease boot missing	2	(3) Suggest replacement.
Grease boot torn	2	(4) Suggest replacement.
Grease fitting broken	A	Require replacement grease fitting.
Grease fitting missing	C	Require replacement of grease fitting.
Grease fitting won’t seal	A	Require replacement of grease fitting.
Grease seal missing	2	(3) Suggest replacement.
Grease seal torn	2	(4) Suggest replacement.
Looseness (perceptible horizontal movement)	1	(5) Suggest replacement.
Looseness that is excessive	B	(5)(6) Require replacement.
Seized	A	Require replacement.
Stud bent	B	(7) Require replacement.

Stud loose in taper hole	A	.... (7) Require repair or replacement.
Taper hole elongated	A	.... (8) Require replacement.
Threads damaged	A	.. Require repair or replacement.
Threads stripped (threads missing)	A	.... (7) Require replacement.
Wear exceeds manufacturer's specifications	B	.... Require replacement.

(1) - If greaseable, grease joint. If problem persists or joint is non-greaseable, require replacement.
(2) - Cracked grease boot will allow contaminants to enter the joint and will accelerate wear.
(3) - Lack of grease boot will allow contaminants to enter the joint and will accelerate wear.
(4) - Torn grease boot will allow contaminants to enter the joint and will accelerate wear.
(5) - If manufacturer's procedures for inspection exist, use those procedures; otherwise, use an approved inspection method such as the dry park check.
CAUTION: DO NOT use pliers or pry bar to check ball and socket movement. Use only moderate hand pressure.
(6) - Excessive looseness is defined as being significant enough to affect vehicle handling or structural integrity.
(7) - Check for damaged taper hole.
(8) - Check for damaged stud.

SHOCK ABSORBERS, STRUT CARTRIDGES AND STRUT ASSEMBLIES

You are not required to replace shocks or struts in axle sets. However, when replacing a shock or strut due to the conditions that follow, you may suggest replacement of the other shock or strut on the same axle for improved performance and preventive maintenance.

* Part is close to the end of its useful life
* To extend tire life
* To balance ride and handling
* To improve stopping distance

When replacing steering and/or suspension components which may affect an alignment angle, you are required to check and adjust alignment as needed. Refer to the OEM specifications.

Under no circumstances should a technician bend struts or strut housings.

A vehicle's load-carrying and handling abilities are limited by its suspension, tires, brakes, and driveline. Installing coil over shocks or any other load assist device does not increase the vehicle's load capacity. See the vehicle owner's manual for more details.

NOTE: If vehicle is equipped with original equipment coil over shocks, apply the conditions for coil springs from the SPRINGS - COIL, LEAF AND TORSION BAR section of the STEERING AND SUSPENSION guidelines. If the vehicle is equipped with add-on coil over shocks, you may suggest replacing the shocks with standard shocks for any spring-related condition.

SHOCK ABSORBER, STRUT CARTRIDGE AND STRUT ASSEMBLY INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require repair or replacement of bent part, if available; otherwise, replace shock or strut.
Attaching hardware broken	A	Require replacement of broken part, if available; otherwise, replace shock or strut.
Attaching hardware corroded, affecting structural integrity	A	Require replacement of corroded part, if available; otherwise, replace shock or strut.
Attaching hardware incorrect	A	Require replacement of incorrect part, if available; otherwise, replace shock or strut.
Attaching hardware loose	A	Require repair or replacement of loose part, if available; otherwise, replace shock or strut.
Attaching hardware missing	C	Require replacement of missing part, if available; otherwise, replace shock or strut.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads, if available; otherwise, replace shock or strut.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads, if available; otherwise, replace shock or strut.
Binding	A	Require replacement.
Body dented	A	(1) Further inspection required.
Body punctured	A	Require replacement.
Brake hose bracket bent	B	Require repair or replacement.
Brake hose bracket missing	C	Require replacement.
Brake hose bracket threads damaged	A	Require repair or replacement.
Brake hose bracket threads stripped (threads missing)	C	Require replacement.
Compression bumper missing	C	Require replacement of compression bumper.
Compression bumper split	1	Suggest replacement of compression bumper.
Damping (none)	A	Require replacement.
Dust boot (bellows) split	2	(2) Suggest replacement of boot.

Dust boot (bellows) missing	2	(2) Suggest replacement of boot.
Dust boot (bellows) torn	2	(2) Suggest replacement of boot.
Dust shield broken	2	(2) Suggest replacement.
Dust shield missing	2	(2) Suggest replacement.
Gland nut (strut housing cap) is not removable using appropriate tool	A	(3) Require replacement of nut and/or housing.
Gland nut (strut housing cap) threads damaged	A	Require repair or replacement of nut.
Gland nut (strut housing cap) threads stripped (threads missing)	A	Require replacement of nut.
Housing dented	A	(1) Further inspection required.
Housing punctured	A	Require replacement.
Jounce bumper missing	C	Require replacement of jounce bumper.
Jounce bumper split	1	Suggest replacement of jounce bumper.
Leaking oil, enough for fluid to be running down the body	A	(4) Require replacement.
Noise	2	(5) Further inspection required.
Piston rod bent	A	Require replacement.
Piston rod broken	A	Require replacement.
Piston rod has surface defect	2	Suggest replacement.
Piston rod threads damaged	A	Require repair or replacement.
Piston rod threads stripped (threads missing)	A	Require replacement.
Seized	A	Require replacement.
Shock missing	C	Require replacement.
Strut housing bent	A	Require replacement.
Strut housing cap (gland nut) is not removable using appropriate tool	A	(3) Require replacement of nut and/or housing.
Strut housing cap (gland nut) threads damaged	A	Require repair or replacement of nut.
Strut housing cap (gland nut) threads stripped (threads missing)	A	Require replacement of nut.
Strut housing severely corroded, affecting structural integrity	A	Require replacement.
Strut housing threads damaged	A	Require repair or replacement.
Strut housing threads stripped (threads missing)	A	Require replacement.
Tire cupping	A	(6) Further inspection required.

(1) - Require replacement of units where dents restrict shock or strut piston rod movement. If dents don't restrict movement, no service is suggested or required. Especially critical on mono-tube shocks.
(2) - This condition can lead to damage of the piston rod, which, in turn, causes premature piston rod seal wear.
(3) - Only required if replacing cartridge.
(4) - CAUTION: If the strut cartridge has been replaced previously, the oil on the strut housing may be filler oil. The technician must identify the source of the oil.
(5) - If noise is isolated to shock or strut, suggest replacement.
(6) - Although shocks or struts may have contributed to tire cupping, an inspection is needed of the entire suspension system. If the shock or strut is found to be contributing to the tire cupping, require replacement.

SPINDLES

SPINDLE INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require replacement of broken part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Bent	B	Require replacement.
Broken	A	Require replacement.
Race seat area undersized	B	Require replacement.
Scored	A	Require repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

SPRINGS - COIL, LEAF AND TORSION BAR

When springs are replaced, it is suggested, but not required, that both springs on an axle be replaced to maintain equal height from side to side and to provide a balanced ride and proper handling.

When variable rate springs are installed in place of conventional coil springs, they must be installed in axle sets to ensure proper handling, uniform ride, and proper chassis height.

Erroneous height measurements may result from: improper tire inflation, non-standard tire or wheel size, and heavy load in vehicle or trunk.

SPRING (COIL, LEAF AND TORSION BAR) INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require repair or replacement of bent part.
Attaching hardware broken	A	Require replacement of broken part.
Attaching hardware corroded, affecting structural integrity	A	Require replacement of corroded part.
Attaching hardware incorrect	A	Require replacement of incorrect part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Broken (all springs except secondary leave(s) on multi-leaf springs)	A	Require replacement.
Coil clash	..	(1) Require ride height check.
Coil spring insulator deteriorated	2	Suggest replacement of insulator.
Coil spring insulator missing	2	Suggest replacement of insulator.
Coil spring insulator split	2	Suggest replacement of insulator.
Coil spring plastic coating deteriorated – rust present	A	(2) Refer to manufacturer's service requirements.
Composite spring damaged	..	(3) Further inspection required.
Cracked (all springs except composite leaf and secondary leave(s) on multi-leaf springs)	A	Require replacement.
Installed incorrectly	B	Require repair.
Leaf spring insulators missing	2	Suggest replacement of insulators.
Secondary leaf on multi-leaf spring broken	1	Suggest repair or replacement
Secondary leaf on multi-leaf spring cracked	1	Suggest repair or replacement
Torsion bar		

adjuster bent	A	(4) Require repair or replacement of adjuster.
Torsion bar adjuster seized	A	(4) Require repair or replacement of adjuster.
Torsion bar adjuster threads damaged	A	(4) Require repair or replacement of part with damaged threads.
Torsion bar adjuster threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Vehicle suspension height not within OEM specifications	B	Require adjustment or replacement.

(1) - If vehicle is within manufacturer's height specifications, no service is suggested or required.
(2) - Some manufacturers require replacement under these conditions.
(3) - Check vehicle ride height. If ride height is OK, no service is suggested or required.
(4) - Only required if ride height needs to be adjusted.

STEEL POWER STEERING LINES

CAUTION: When replacing steel power steering lines, be sure to use a replacement product that meets or exceeds OEM design specifications.

STEEL POWER STEERING LINE INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require repair or replacement of bent part.
Attaching hardware broken	A	Require replacement of broken part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Blocked	A	Require repair or replacement.
Fitting incorrect (such as compression fitting)	B	Require replacement.
Flare type incorrect	B	Required replacement.
Leaking	A	Require tightening or replacement.
Line type incorrect	B	Require replacement.

Restricted	A	Require replacement.
Routed incorrectly	B	Require routing correction.
Rust-pitted	1	Suggest replacement.
Rust pitted, affecting structural integrity	A	Require replacement.

STEERING ARMS

STEERING ARM INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require repair or replacement of bent part.
Attaching hardware broken	A	Require replacement of broken part.
Attaching hardware incorrect	A	Require replacement of incorrect part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Bent	B	Require replacement.
Broken	A	Require replacement.
Taper hole elongated	A	(1) Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

(1) - Check for damaged stud.

STEERING DAMPERS

The following procedures are only required if the vehicle was originally equipped from the factory with a steering damper. If the steering damper is an add-on unit, then the unit may be removed instead of repairing or replacing.

STEERING DAMPER INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require repair or replacement of bent part, if available; otherwise, replace steering damper.
Attaching hardware broken	A	Require replacement of broken part, if available; otherwise,

		replace steering damper.
Attaching hardware corroded, affecting structural integrity	A	Require replacement of corroded part, if available; otherwise, replace steering damper.
Attaching hardware incorrect	A	Require replacement of incorrect part, if available; otherwise, replace steering damper.
Attaching hardware loose	A	Require repair or replacement of loose part, if available; otherwise, replace steering damper.
Attaching hardware missing	C	Require replacement of missing part, if available; otherwise, replace steering damper.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads, if available; otherwise, replace steering damper.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads, if available; otherwise, replace steering damper.
Binding	A	Require replacement.
Damper body dented	A	(1) Further inspection required.
Damper body punctured	A	Require replacement.
Damping (none)	A	Require replacement.
Dust boot (bellows) missing	2	(2) Suggest replacement of boot.
Dust boot (bellows) split	2	(2) Suggest replacement of boot.
Dust shield broken	2	(2) Suggest replacement.
Dust shield missing	2	(2) Suggest replacement.
Leaking oil, enough for fluid to be running down the body	A	Require replacement.
Loose	A	Require repair or replacement.
Missing	C	Require replacement.
Noise	2	(3) Further inspection required.
Piston rod bent	A	Require replacement.
Piston rod broken	A	Require replacement.
Piston rod has surface defect	2	Suggest replacement.
Piston rod threads stripped (threads missing)	A	Require replacement.
Piston rod threads damaged	A	Require repair or replacement.
Seized	A	Require replacement.

(1) - Require replacement of units where dents restrict damper

piston rod movement. If dents don't restrict movement, no service is suggested or required. Especially critical on mono-tube dampers.
(2) - This condition can lead to damage of the piston rod, which, in turn, causes premature piston rod seal wear.
(3) - If noise is isolated to damper, suggest replacement.

STEERING GEARS (EXCEPT RACK AND PINION)

If diagnosis has determined that complete disassembly is necessary to determine the extent of the system failure, the suggestion may be made to rebuild or replace the power steering pump. Repair or replacement of the following components may be required, if performed as part of a power steering pump overhaul or rebuild service to meet a minimum rebuild standard.

STEERING GEAR (EXCEPT RACK AND PINION) INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require replacement of broken part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Binding	A	Require repair or replacement
Flex coupler binding	A	Require repair or replacement of coupler.
Flex coupler loose	A	Require repair or replacement of coupler.
Flex coupler missing parts	A	Require repair or replacement of coupler.
Flex coupler soft/spongy	A	Require replacement of coupler.
Flex coupler torn	A	Require replacement of coupler.
Fluid contaminated	B	(1) Require flushing and refilling of the system.
Gasket leaking	A	Require repair or replacement of gasket.
Housing leaking	A	Require replacement.
Hydraulic fittings leaking	A	Require repair or replacement of fittings.
Inadequate power assist	A	(2) Further inspection required. See note below.
Lash exceeds manufacturer's specifications	B	Require repair or replacement.
Seal leaking	A	Require repair or replacement

		of seal and/or mating part.
Splines damaged	A	Require repair or replacement of splines.
Splines stripped	A	Require replacement of splines.
Steering coupler shield cracked	2	Suggest replacement.
Steering coupler shield missing	C	Require replacement.
Threads damaged	A	Require repair or replacement of part with damaged threads.
Threads stripped (threads missing)	A	Require replacement of part with stripped threads.
U-joint binding	A	Require repair or replacement of joint.
U-joint loose	A	Require repair or replacement of joint.
Unequal power assist	A	Require repair or replacement.

(1) - Determine and correct source of contamination. OEM specifications must be followed for fluid type.
(2) - If steering gear is source of inadequate assist, require repair or replacement.

STEERING GEARS - RACK AND PINION

If diagnosis has determined that complete disassembly is necessary to determine the extent of the system failure, the suggestion may be made to rebuild or replace the power steering pump. Repair or replacement of the following components may be required, if performed as part of a power steering pump overhaul or rebuild service to meet a minimum rebuild standard.

STEERING GEARS - RACK AND PINION INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require replacement of broken part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Balance tube blocked	A	Require repair or replacement of balance tube.
Balance tube missing	C	Require replacement of balance tube.
Balance tube restricted	A	Require repair or replacement of balance tube.
Bellows boot clamp missing	C	Require replacement of clamp.
Bellows boot cracked		

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 (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		

(chunking), exposing cord	A	.... Require replacement.
Tread missing pieces (chunking), not exposing cord	1	.... Suggest replacement.
Tread separations	A	.... Require replacement.
Tube in tubeless tire	3	.... (4) Suggest removal of tube.
Weather-checking	..	.... No service required or suggested.
Worn to tread wear indicators	B	.... Require replacement.

(1) - Determine and correct cause of irregular tire wear.
(2) - If radials and bias or bias-belted ply tires are on the same vehicle, the radials must be on the rear axle, except for high-pressure temporary spares.
(3) - Excessive is defined as enough to contribute to performance problems. Match mounting may correct run-out. If not, require replacement of appropriate part. Refer to manufacturer's specifications.
(4) - Most manufacturers do not recommend tubes in tubeless tires. Inspect tire and wheel assembly to determine the reason for a tube in tubeless tire. Recommendation for repair or replacement should be based upon condition of tires and/or wheel listed in these guidelines.

VALVE STEMS

VALVE STEM INSPECTION

Condition	Code	Procedure
Bent	1	.... Suggest replacement.
Broken	A	.... Require replacement.
Cut, but not leaking	1	.... Suggest replacement.
Deteriorated (cracking, dry rot)	1	.... Suggest replacement.
Leaking	A	. Require repair or replacement.
Missing	C	.... Require replacement.
Threads damaged	A	. Require repair or replacement.
Threads stripped	A	.... Require replacement.
Valve cap missing	C	.... Require replacement of cap.
Weather-checking	1	.... Suggest replacement.
Won't take air	A	. Require repair or replacement.

WHEEL ATTACHMENT HARDWARE

For conditions noted below, also check conditions of wheel stud holes.

CAUTION: Proper lug nut torque is essential. Follow recommended torque specifications and tightening sequence. DO NOT lubricate threads unless specified by the vehicle manufacturer.

WHEEL ATTACHMENT HARDWARE INSPECTION

Condition	Code	Procedure
Bent	A	.... Require replacement.
Broken	A	.... (1) Require replacement.

Loose	B	Require repair or replacement of affected component.
Lug nut installed backward	B	Require repair or replacement.
Lug nut mating type incorrect	B	Require replacement of nut.
Lug nut mating surface dished	A	Require replacement of nut.
Lug nut rounded	A	(2) Require replacement of nut.
Lug nut seized	A	(2) Require replacement of nut.
Stud incorrect	B	Require replacement of stud.
Threads damaged	A	Require repair or replacement of component with damaged threads.
Threads stripped	A	Require replacement of component with stripped threads.

(1) - Some manufacturers require replacement of all studs on that wheel if two or more studs or nuts on the same wheel are broken or missing.
(2) - Only required if removing wheel.

WHEELS (RIMS)

WARNING: Mounting a regular tire on a high-pressure compact spare wheel is not permitted. Attempting to mount a tire of one diameter on a wheel of a different diameter or flange type may result in serious injury or death. If the wheel identification stamp is not legible, or cannot be found, do not use the wheel until the size and type have been properly identified. Wheels of different diameter, offset, or width cannot be mixed on the same axle. Bead seat tapers cannot be interchanged.

WHEEL (RIM) INSPECTION

Condition	Code	Procedure
Bead leaking, caused by wheel	A	(1) Require repair or replacement.
Bent hub mounting surface	A	Require replacement.
Bent rim, causing vibration	2	(1) Suggest replacement.
Broken	A	Require replacement.
Cast wheel porous, causing a leak	A	Require repair or replacement.
Clip-on balance weight is incorrect type for rim flange	2	Suggest replacement.
Corrosion, affecting structural integrity	A	Require replacement.
Corrosion build-up on wheel mounting surface	A	Require repair.
Cracked	A	Require replacement.
Directional/asymmetrical wheels mounted incorrectly	B	Require remounting and/or repositioning.

Load capacity less than OEM specifications	B	Require replacement.
Offset mismatched on same axle	B	Require replacement.
Rivets leaking	A	Require replacement.
Run-out beyond OEM specs	B	Require replacement.
Stud holes elongated	A	(2) Require replacement.
Welded or brazed repair	2	Suggest replacement.
Welds leaking	A	Require replacement.
Wheel centering (pilot) hole incorrect	B	Require replacement.

(1) - CAUTION: DO NOT attempt to correct a bent rim.
(2) - Inspect wheel attaching hardware for damage.

* SYMPTOM CHECK LIST *

1997 Chevrolet Blazer

SYMPTOM CHECK LIST WORKSHEETS

* PLEASE READ THIS FIRST *

NOTE: This article is intended for general information purposes only. It does not apply specifically to one make or model.

PURPOSE

Why Use the Symptom Check List Worksheets?

One of the most difficult and critical lines of communication is between the service customer and the technician. The clearer the technician understands the customer's concerns, the more likely the problem will be "fixed right the first time".

The Symptom Check List Worksheets in this article are designed to improve this communication. When used consistently, they can be helpful in reducing shop comebacks, increasing technician productivity, and producing satisfied customers. They also provide other benefits:

* Reduce "No Trouble Found" problems
* Increase customer involvement
* Customer perceive that "they really care and listen"
* Save time during peak write-up periods
* Reduce recontacting customers for additional information
* Improve night drop information
* Insure all the right questions are asked at write-up

Making the Worksheets a Part of Your Normal Routine

The following information contains ideas that may be helpful in forming habits that promote daily use of the Symptom Check Lists:

* HAVE THE SERVICE ADVISER FILL OUT THE FORM(S) WITH THE CUSTOMER WHENEVER POSSIBLE.
* Place them in your night drop for the customer to fill out, along with an instruction sheet to help them understand what to do.
* Hand out the worksheets to customers while they wait in line during the peak morning rush and ask them to fill it out. It will save time for all concerned and improve the quality of information received from the customer.
* Make sure it is attached to the hard copy when it goes to the technician.
* Place a copy with the final repair papers and review it with the customer at delivery.
* Put a new worksheet in the glovebox of all departing customers.
* Require that you personally see a copy of all worksheets filled out for shop comebacks.
* Hold a shop meeting to get employee buy-in and their ideas on how to make it effective in your shop.

There are many other ways to utilize the concept, but as with every other idea, successful implementation depends on employee involvement and buy-in.

SYMPTOM CHECK LIST WORKSHEETS

CONDENSED VERSION - ALL ON ONE PAGE

NOTE: Have the service adviser fill out this form with the customer whenever possible.

DRIVEABILITY WORKSHEET

(To Be Filled Out By Vehicle Owner)

Name: ____________________ **Date:** __________ **Make:** ____________

Model: ____________ **Year:** ____________ **Engine:** ____________ **Mileage:** __________

FAULT CHARACTERISTICS - SYMPTOMS - DESCRIPTION OF PROBLEM (Please Check All That Apply In All Categories)

Starting Problems	☐ Will Not Crank ☐ Cranks, But Won't Start ☐ Starts, But Takes A Long Time
Engine Quits/ Running Problems	**Quits:** ☐ Right After Starting ☐ When Put Into Gear ☐ Right After Vehicle Comes To A Stop ☐ During Steady Speed Driving ☐ While Idling ☐ During Acceleration ☐ When Parking
Poor Idling Conditions	**Idle Speed:** ☐ Is Too Slow At All Times ☐ Is Too Slow With A/C On ☐ Is Too Fast ☐ Is Rough Or Uneven ☐ Fluctuates Up and Down
Poor Running Conditions	☐ Runs Rough ☐ Lacks Power ☐ Hesitates Or Stumbles On Acceleration ☐ Bucks and Jerks ☐ Engine Knocks, Pings, Rattles ☐ Backfires ☐ Poor Fuel Economy ☐ Misfires or Cuts Out ☐ Surges and/or Chuggles ☐ Dieseling or Run-On ☐ Engine Light Always On ☐ Engine Light On Sometimes ☐ Fuel, Gas, or Sulfur Smell
Auto. Transmission Problems	☐ Improper Shifting (early/late) ☐ Changes Gear Randomly On Its Own ☐ Vehicle Does Not Move When In Gear
Poor Handling	☐ Pulls To One Side ☐ Hard Steering ☐ Vehicle Shakes and/or Vibrates While Moving
Noise Problems	**Explain:**
Odor Problems	**Explain:**
Problem Frequency	☐ Always ☐ Often ☐ Occasionally
Usually Occurs	☐ Morning ☐ Afternoon ☐ Anytime
Engine Temp.	☐ Cold ☐ Warm ☐ Hot
Vehicle Speed	☐ Low ☐ Cruising ☐ High
Driving Conditions During Occurrence	☐ Short - Less Than 2 Miles ☐ 2-10 Miles ☐ Long - More Than 10 Miles ☐ Stop & Go ☐ While Turning ☐ While Braking ☐ At Gear Engagement ☐ With A/C Operating ☐ With Headlights On ☐ During Acceleration ☐ During Deceleration ☐ Mostly Downhill ☐ Mostly Uphill ☐ Mostly Level ☐ Mostly Curvy ☐ Rough Road
Driving Habits	☐ Drive Hard Before Engine Is Warmed ☐ Allow Engine To Warm ☐ Mostly City Driving ☐ Highway ☐ Park Vehicle Inside ☐ Outside **Drive Per Day:** ☐ Less Than 10 Miles ☐ 10-50 ☐ More Than 50 **Fuel Octane:** ☐ 87 ☐ 89 ☐ 91 ☐ More Than 91 **Brand:** ____________ ☐ Gasohol ☐ Propane Conversion
Outside Weather	☐ Cold ☐ Warm ☐ Hot ☐ Wet/Rainy ☐ Fog ☐ Snow/Hail ☐ Dust/Dirt ☐ Dry ☐ Humid

Fig. 1: Entire Vehicle - Symptom Check List For Customer

FULL VERSION - ALL ON FOUR PAGES

NOTE: Have the service adviser fill out these forms with the customer whenever possible.

Dear Valued Customer:
Our goal is to fix your problem correctly and get you back on the road as soon as possible in the unlikely event you experience a problem with your vehicle. Help us identify the exact nature of the concern by taking a few moments to complete the appropriate section of this diagnostic worksheet. Thank you.

CUSTOMER NAME: ______ **PHONE NO.:** ______ **REPAIR ORDER NO.:** ______

DIAGNOSTIC WORKSHEET

DRIVEABILITY - ENGINE - AUTOMATIC TRANSMISSION

SYMPTOM (CHECK ALL THAT APPLY)

ENGINE

- ☐ "Service Engine Soon"/"Malfunction Indicator Light" on
- ☐ Hard start/no start (cranks OK)
- ☐ Won't crank
- ☐ Engine stalls
- ☐ Engine miss
- ☐ Miss while driving
- ☐ Hesitates, stumbles or sags
- ☐ Rough idle
- ☐ Idle is too high ☐ Idle is too low
- ☐ Poor power/performance
- ☐ Surge or chuggle, buck - jerk - skip
- ☐ Poor gas mileage ☐ Highway ☐ City
- ☐ Pings, detonates
- ☐ Suphur, rotten egg odor
- ☐ Backfires (popping noise) - underhood/tailpipe
- ☐ Exhaust smoke ☐ Increased oil consumption
- ☐ Runs on after key is turned off
- ☐ Speed fluctuates without moving accelerator
- ☐ Engine noise (explain): ______

(whine, rattle, groan, clunk, etc.)

- ☐ Other: ______

TRANSMISSION

- ☐ Does not shift properly ☐ Hard shift
- ☐ Will not shift ☐ Up ☐ Down
- ☐ Will not shift into overdrive
- ☐ Engine starts in other than "P" or "N"
- ☐ Noise (describe): ______

(whine, rattle, groan, clunk, buzz, etc.)

- ☐ Shifts into gear too early
- ☐ Overdrive doesn't work with speed control, but is otherwise OK
- ☐ Highway speed - shudder, surge, etc.
- ☐ Other: ______

EXPLAIN: ______

OPERATING CONDITIONS (CHECK ALL THAT APPLY)
HOW OFTEN DOES IT OCCUR? (Engine and/or Transmission)

- ☐ Always ☐ Few seconds ☐ Few minutes
- ☐ Few hours ☐ Few days ☐ Few weeks
- ☐ Few months ☐ Variable ☐ Only during event
- ☐ Every ______ to ____ miles ☐ Unknown
- ☐ Other (explain): ______
- ☐ Just started ☐ Getting better ☐ Getting worse
- ☐ Since new

WHEN DOES IT OCCUR? (Engine and/or Transmission)
When Engine Temperature is:

- ☐ Cold ☐ Warm ☐ Hot
- ☐ All the time ☐ Only during warmup

Weather Conditions:

- ☐ Very cold - below 0 degrees F ☐ Cold - 0 to 32 degrees F
- ☐ Cool - 32 to 60 degrees F ☐ Warm - 60 to 80 degrees F
- ☐ Hot - Above 80 degrees F ☐ Any environment
- ☐ Raining ☐ Dry ☐ Humid
- ☐ Snow/ice ☐ Wet roads ☐ Other (explain below)

Driving Conditions:

- ☐ Light throttle ☐ Medium throttle ☐ Hard throttle
- ☐ Starting ☐ At idle ☐ Decelerating
- ☐ Over bumps ☐ When shifting ☐ While turning
- ☐ Cruising steady at ______ MPH ☐ While braking
- ☐ Anytime ☐ Uphill ☐ Downhill
- ☐ Highway ☐ City/town ☐ Stop and go
- ☐ Between ______ MPH and ______ MPH
- ☐ Only with A/C or Defrost on

What Type of Fuel? **What Brand?** ______

- ☐ Regular UL ☐ Mid range UL ☐ Premium Unleaded
- ☐ Gasohol ☐ Ethanol ☐ Methanol
- ☐ Diesel #1 ☐ Diesel #2 ☐ Various brands

When Gear Selector is in:

- ☐ Park/Neutral ☐ Reverse ☐ Overdrive
- ☐ Drive/3 ☐ Drive/2 ☐ Drive/1

Between Gears:

- ☐ Park to R or D ☐ Rev/Drive ☐ First/Second
- ☐ Second/Third ☐ Third/Overdrive

50G15061

Fig. 2: Symptom Check List - Page 1

BRAKES - STEERING - SUSPENSION

SYMPTOM

- ☐ Vehicle pulls right - When ____________
- ☐ Vehicle pulls left - When ____________
- ☐ Steering wheel vibrates at ____ MPH
- ☐ Excessive play in steering
- ☐ Erratic steering when braking
- ☐ Poor steering wheel return after cornering
- ☐ Suspension bottoms out
- ☐ Leans or sways in corners
- ☐ Brake light on
- ☐ Traction control light on
- ☐ Uneven tire wear
- ☐ Sits uneven
- ☐ "Dog" tracks
- ☐ ABS light on
- ☐ Soft ride

Hard to steer

- ☐ Effort
- ☐ Wanders
- ☐ Steering wheel off center

Shimmy/vibration (check box below for location)

- ☐ Front
- ☐ Rear
- ☐ Don't know
- ☐ Seat
- ☐ Floor
- ☐ Other ____________

Brake pedal

- ☐ Noise
- ☐ Pulses
- ☐ Squeaks
- ☐ Hard
- ☐ Mushy
- ☐ Excessive travel

WHEN DOES IT OCCUR?

- ☐ Cold days
- ☐ Hot days
- ☐ Wet/rain
- ☐ All the time
- ☐ Intermittent
- ☐ Parking manuevers
- ☐ At road speed
- ☐ Accelerating
- ☐ Decelerating

EXPLAIN: ____________

SQUEAK - RATTLE - NOISE CONDITIONS

AREA OF NOISE

☐ Engine Compartment	☐ Left	☐ Right	☐ Center	☐ Don't know
☐ Front Suspension	☐ Left	☐ Right	☐ Center	☐ Don't know
☐ Rear Suspension	☐ Left	☐ Right	☐ Center	☐ Don't know
☐ Passenger Compartment	☐ Left	☐ Right	☐ Center	☐ Don't know
☐ Instrument Panel	☐ Left	☐ Right	☐ Center	☐ Don't know
☐ Doors	☐ Left	☐ Right	☐ Center	☐ Don't know
☐ Rear seat area	☐ Console	☐ Other ____________		

NOISE SOUNDS LIKE

- ☐ Knocks
- ☐ Hard metal
- ☐ Light metal
- ☐ Roars
- ☐ Ticking
- ☐ Whine
- ☐ Squeaks
- ☐ Rattles
- ☐ Scraping
- ☐ Other ____________

HOW OFTEN DOES IT OCCUR?

- ☐ Continuous
- ☐ Often
- ☐ Intermittent
- ☐ Just started
- ☐ Since new

WHEN DOES IT OCCUR?

- ☐ All the time
- ☐ Speed
- ☐ RPM
- ☐ Only moving
- ☐ On turns
- ☐ Braking
- ☐ Hard throttle
- ☐ Light throttle
- ☐ Decelerate
- ☐ Steady speed
- ☐ Idle in gear
- ☐ Idle out of gear
- ☐ Hot days
- ☐ Cold days
- ☐ Humid or rainy
- ☐ Temperature ____________
- ☐ Heavy bumps
- ☐ Light bumps
- ☐ Smooth pavement

EXPLAIN: ____________

CUSTOMER NAME: **PHONE NO.:** **REPAIR ORDER NO:**

SHOP USE ONLY:

VIN#: **MILES:** **TECHNICIAN:** **ADVISOR#:**

50H15062

Fig. 3: Symptom Check List - Page 2

AIR CONDITIONING - HEATER - VENTILATION

SYSTEM OR AREA AFFECTED

☐ Air conditioner ☐ Heater ☐ Defroster ☐ Vent ☐ Bi-Level ☐ Fan/blower
☐ Max A/C ☐ Automatic Temperature Control ☐ Mix/blend ☐ Economy ☐ All

SYMPTOM

☐ Does not work ☐ Blows wrong temperature air ☐ No air comes out of vents ☐ Rapid cycling
☐ Noisy (explain) ☐ Broken ☐ Odor ☐ Air comes from wrong outlets ☐ Blows fuse
☐ Leaks ☐ Insufficient heat or cool ☐ Other (explain below)

WHEN DOES IT OCCUR?

☐ All the time ☐ Hot ☐ Cold ☐ Intermittent ☐ Right after startup
☐ When change controls only ☐ Other (explain below) ☐ Fan blower speed High / Med / Low

EXPLAIN: ____

____

ELECTRICAL - RADIO - TAPE/CD PLAYER

SYMPTOM - MUSIC SYSTEM

☐ Does not work ☐ Noisy ☐ Static ☐ Won't load ☐ Won't eject ☐ Poor reception
☐ Controls do not work ☐ Blows fuse ☐ Other (explain below)

SYSTEM AFFECTED

☐ Radio only ☐ AM ☐ FM ☐ FM stereo ☐ Graphic equalizer
☐ Tape player ☐ CD player ☐ Whole system ☐ Steering wheel buttons ☐ Phone
☐ Speakers ☐ Front ☐ Rear ☐ Left ☐ Right
☐ Antenna ☐ Clock ☐ Radio or player controls ☐ Rear seat controls

ALL OTHER ELECTRICAL ITEMS OR ACCESSORIES
Please list the complaint accessory or item and check any applicable symptom(s) from the list that follows:

______________________ ☐ Inoperable ☐ Noisy ☐ No control ☐ Erratic
☐ Check light on or flashing ☐ Works improperly (explain below)
☐ Blows fuse ☐ Intermittent ☐ Related system affected (explain below)

______________________ ☐ Inoperable ☐ Noisy ☐ No control ☐ Erratic
☐ Check light on or flashing ☐ Works improperly (explain below)
☐ Blows fuse ☐ Intermittent ☐ Related system affected (explain below)

______________________ ☐ Inoperable ☐ Noisy ☐ No control ☐ Erratic
☐ Check light on or flashing ☐ Works improperly (explain below)
☐ 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#:**

50I15063

Fig. 4: Symptom Check List - Page 3

WATER LEAK - WINDNOISE

WATER LEAK
Leak Occurs When?

☐ Setting level ☐ Any time it rains ☐ While driving in the rain ☐ Car wash only
☐ Back lower than front (facing uphill) ☐ Front lower than back (facing downhill)

Location of Leak (where water appears):

☐ LF Door ☐ RF Door ☐ LR Door ☐ RR Door ☐ Windshield ☐ Rear window
☐ LF window ☐ RF window ☐ LR window ☐ RR window ☐ Side door ☐ Sunroof/T-Top
☐ Under instrument panel ☐ Rear door/rear hatch

WINDNOISE:
Location:

☐ LF Door ☐ RF Door ☐ LR Door ☐ RR Door ☐ Windshield ☐ Rear window
☐ LF window ☐ RF window ☐ LR window ☐ RR window ☐ Side door ☐ Sunroof/T-Top
☐ Under instrument panel ☐ Rear door/rear hatch

EXPLAIN: ____________________

MANUAL TRANSMISSION - CLUTCH

SYMPTOM - MANUAL GEAR SHIFT

☐ Hard to shift ☐ Doesn't shift
☐ Grinds going into _____ gear
☐ Noisy when in _____ gear or neutral _____
☐ Slips/pops out of gear
☐ Noise (describe): ____________________

☐ Upshift light stays on
☐ Upshift light doesn't light

WHEN DOES IT OCCUR?

☐ All the time ☐ Light load
☐ Heavy load

SYMPTOM - CLUTCH

☐ Hard to push ☐ Fail to release
☐ Noise when pressing pedal down (describe): ____________________

☐ Slips ☐ Chattering (grabbing)
☐ Odor present ☐ Pedal stays on the floor
☐ Squealing sound

WHEN DOES IT OCCUR?
When Engine Temperature is:

☐ Cold ☐ Hot
☐ Accelerating ☐ Decelerating

EXPLAIN: ____________________

COMMENTS:

____

CUSTOMER NAME: **PHONE NO.:** **REPAIR ORDER NO:**

SHOP USE ONLY:
VIN#: **MILES:** **TECHNICIAN:** **ADVISOR#:**

50J15064

Fig. 5: Symptom Check List - Page 4

INDIVIDUAL SYSTEM-BASED CHECK LISTS

NOTE: Have the service adviser fill out these forms with the customer whenever possible.

DRIVEABILITY - ENGINE - AUTOMATIC TRANSMISSION

SYMPTOM (CHECK ALL THAT APPLY)
ENGINE

- ☐ "Service Engine Soon"/Malfunction Indicator Light" on
- ☐ Hard start/no start (cranks OK)
- ☐ Won't crank
- ☐ Engine stalls
- ☐ Engine miss
- ☐ Miss while driving
- ☐ Hesitates, stumbles or sags
- ☐ Rough idle
- ☐ Idle is too high ☐ Idle is too low
- ☐ Poor power/performance
- ☐ Surge or chuggle, buck - jerk - skip
- ☐ Poor gas mileage ☐ Highway ☐ City
- ☐ Ping, detonates
- ☐ Sulphur/rotten egg odor
- ☐ Backfires (popping noise) - underhood/tailpipe
- ☐ Exhaust smoke ☐ Increased oil consumption
- ☐ Runs on after key is turned off
- ☐ Speed fluctuates without moving accelerator
- ☐ Engine noise (explain): ____________________

(whine, rattle, groan, clunk, etc.)

- ☐ Other: ____________________

TRANSMISSION

- ☐ Does not shift properly ☐ Hard shift
- ☐ Will not shift ☐ Up ☐ Down
- ☐ Will not shift into overdrive
- ☐ Engine starts in other than "P" or "N"
- ☐ Noise (describe): ____________________

(whine, rattle, groan, clunk, buzz, etc.)

- ☐ Shifts into next gear too early
- ☐ Overdrive doesn't work with speed control, but is otherwise OK
- ☐ Highway speed - shudder, surge, etc.
- ☐ Other: ____________________

EXPLAIN: ____________________

OPERATING CONDITIONS (CHECK ALL THAT APPLY)
HOW OFTEN DOES IT OCCUR? (Engine &/or Transmission)

- ☐ Always ☐ Few Seconds ☐ Few minutes
- ☐ Few hours ☐ Few days ☐ Few weeks
- ☐ Few months ☐ Variable ☐ Only during event
- ☐ Every ________ to ____ miles ☐ Unknown
- ☐ Other (explain): ____________________
- ☐ Just started ☐ Getting better ☐ Getting worse
- ☐ Since new

WHEN DOES IT OCCUR? (Engine and/or Transmission)
When Engine Temperature is:

- ☐ Cold ☐ Warm ☐ Hot
- ☐ All the time ☐ Only during warmup

Weather Conditions:

- ☐ Very cold - below 0°F ☐ Cold - 0 to 32°F
- ☐ Cool - 32 to 60°F ☐ Warm - 60 to 80°F
- ☐ Hot - above 80°F ☐ Any environment
- ☐ Raining ☐ Dry ☐ Humid
- ☐ Snow/Ice ☐ Wet roads
- ☐ Other (explain): ____________________

Driving Conditions:

- ☐ Light throttle ☐ Medium throttle ☐ Hard throttle
- ☐ Starting ☐ At idle ☐ Decelerating
- ☐ Over bumps ☐ When shifting ☐ While turning
- ☐ Cruising - steady at MPH ☐ While braking
- ☐ Anytime ☐ Uphill ☐ Downhill
- ☐ Highway ☐ City/town ☐ Stop and go
- ☐ Between ____ MPH and ____ MPH
- ☐ Only with A/C or Defrost on

What Type of Fuel? **What Brand?**

- ☐ Regular UL ☐ Midrange UL ☐ Premium UL
- ☐ Gasohol ☐ Ethanol ☐ Methanol
- ☐ Diesel #1 ☐ Diesel #2 ☐ Various brands

When Gear Selector is in:

- ☐ Park/Neutral ☐ Reverse ☐ Overdrive
- ☐ Drive/3 ☐ Drive/2 ☐ Drive/1

Between Gears:

- ☐ Park to R or D ☐ Reverse/Drive ☐ First/Second
- ☐ Second/Third ☐ Third/Overdrive

CUSTOMER NAME: **PHONE NO.:** **REPAIR ORDER NO:**

SHOP USE ONLY:

VIN#: **MILES:** **TECHNICIAN:** **ADVISOR#:**

50H15054

Fig. 6: Engine Driveability & Automatic Transmission

BRAKES - STEERING - SUSPENSION

SYMPTOM

☐ Vehicle pulls right - When ______________
☐ Vehicle pulls left - When ______________
☐ Steering wheel vibrates at ____ MPH
☐ Excessive play in steering
☐ Erratic steering when braking
☐ Poor steering wheel return after cornering
☐ Suspension bottoms out
☐ Leans or sways in corners
☐ Brake light on
☐ Traction control light on
☐ Uneven tire wear
☐ Sits uneven
☐ "Dog" tracks
☐ ABS light on
☐ Soft ride

Hard to steer

☐ Effort ☐ Wanders
☐ Steering wheel off center

Shimmy/vibration (check box below for location)

☐ Front ☐ Rear ☐ Don't know
☐ Seat ☐ Floor ☐ Other __________

Brake pedal

☐ Noise ☐ Pulses ☐ Squeaks ☐ Hard ☐ Mushy ☐ Excessive travel

WHEN DOES IT OCCUR?

☐ Cold days ☐ Hot days ☐ Wet/rain ☐ All the time ☐ Intermittent
☐ Parking manuevers ☐ At road speed ☐ Accelerating ☐ Decelerating

EXPLAIN: ____

CUSTOMER NAME: **PHONE NO.:** **REPAIR ORDER NO:**

SHOP USE ONLY:
VIN#: **MILES:** **TECHNICIAN:** **ADVISOR#:**

50C15059
Fig. 7: Brakes, Steering, & Suspension

AIR CONDITIONING - HEATER - VENTILATION

SYSTEM OR AREA AFFECTED

☐ Air conditioner ☐ Heater ☐ Defroster ☐ Vent ☐ Bi-Level ☐ Fan/blower
☐ Max A/C ☐ Automatic Temperature Control ☐ Mix/blend ☐ Economy ☐ All

SYMPTOM

☐ Does not work ☐ Blows wrong temperature air ☐ No air comes out of vents ☐ Rapid cycling
☐ Noisy (explain) ☐ Broken ☐ Odor ☐ Air comes from wrong outlets ☐ Blows fuse
☐ Leaks ☐ Insufficient heat or cool ☐ Other (explain below)

WHEN DOES IT OCCUR?

☐ All the time ☐ Hot ☐ Cold ☐ Intermittent ☐ Right after startup
☐ When change controls only ☐ Other (explain below) ☐ Fan blower speed High / Med / Low

EXPLAIN: ____

CUSTOMER NAME: **PHONE NO.:** **REPAIR ORDER NO:**

SHOP USE ONLY:
VIN#: **MILES:** **TECHNICIAN:** **ADVISOR#:**

50A15057
Fig. 8: Air Conditioning, Heater & Ventilation

ELECTRICAL - RADIO - TAPE/CD PLAYER

SYMPTOM - MUSIC SYSTEM

☐ Does not work ☐ Noisy ☐ Static ☐ Won't load ☐ Won't eject ☐ Poor reception
☐ Controls do not work ☐ Blows fuse ☐ Other (explain below)

SYSTEM AFFECTED

☐ Radio only ☐ AM ☐ FM ☐ FM stereo ☐ Graphic equalizer
☐ Tape player ☐ CD player ☐ Whole system ☐ Steering wheel buttons ☐ Phone
☐ Speakers ☐ Front ☐ Rear ☐ Left ☐ Right
☐ Antenna ☐ Clock ☐ Radio or player controls ☐ Rear seat controls

ALL OTHER ELECTRICAL ITEMS OR ACCESSORIES
Please list the complaint accessory or item and check any applicable symptom(s) from the list that follows:

______________________ ☐ Inoperable ☐ Noisy ☐ No control ☐ Erratic
☐ Check light on or flashing ☐ Works improperly (explain below)
☐ Blows fuse ☐ Intermittent ☐ Related system affected (explain below)

______________________ ☐ Inoperable ☐ Noisy ☐ No control ☐ Erratic
☐ Check light on or flashing ☐ Works improperly (explain below)
☐ Blows fuse ☐ Intermittent ☐ Related system affected (explain below)

______________________ ☐ Inoperable ☐ Noisy ☐ No control ☐ Erratic
☐ Check light on or flashing ☐ Works improperly (explain below)
☐ Blows fuse ☐ Intermittent ☐ Related system affected (explain below)

WHEN DOES IT OCCUR?

☐ All the time ☐ Hot ☐ Cold ☐ Just after starting - malfunctions for a while
☐ Intermittent ☐ After runs for ______ minutes ☐ Rough roads or bumps only
☐ Other (explain below)

EXPLAIN: ____

CUSTOMER NAME: **PHONE NO.:** **REPAIR ORDER NO:**

SHOP USE ONLY:
VIN#: **MILES:** **TECHNICIAN:** **ADVISOR#:**

50B15058

Fig. 9: Electrical, Radio & Tape/CD Player

MANUAL TRANSMISSION - CLUTCH

SYMPTOM - MANUAL GEAR SHIFT

- ☐ Hard to shift
- ☐ Doesn't shift
- ☐ Grinds going into_____ gear
- ☐ Noisy when in _______ gear or neutral _____
- ☐ Slips/pops out of gear
- ☐ Noise (describe): ____________________________
- ☐ Upshift light stays on
- ☐ Upshift light doesn't light

WHEN DOES IT OCCUR?

- ☐ All the time
- ☐ Light load
- ☐ Heavy load

SYMPTOM - CLUTCH

- ☐ Hard to push
- ☐ Fail to release
- ☐ Noise when pressing pedal down (describe): _________
- ☐ Slips
- ☐ Chattering (grabbing)
- ☐ Odor present
- ☐ Pedal stays on the floor
- ☐ Squealing sound

WHEN DOES IT OCCUR?
When Engine Temperature is:

- ☐ Cold
- ☐ Hot
- ☐ Accelerating
- ☐ Decelerating

EXPLAIN: ____

CUSTOMER NAME: **PHONE NO.:** **REPAIR ORDER NO:**

SHOP USE ONLY:
VIN#: **MILES:** **TECHNICIAN:** **ADVISOR#:**

50J15056

Fig. 10: Manual Transmission & Clutch

SQUEAK - RATTLE - NOISE CONDITIONS

AREA OF NOISE

☐ Engine Compartment	☐ Left	☐ Right	☐ Center	☐ Don't know
☐ Front Suspension	☐ Left	☐ Right	☐ Center	☐ Don't know
☐ Rear Suspension	☐ Left	☐ Right	☐ Center	☐ Don't know
☐ Passenger Compartment	☐ Left	☐ Right	☐ Center	☐ Don't know
☐ Instrument Panel	☐ Left	☐ Right	☐ Center	☐ Don't know
☐ Doors	☐ Left	☐ Right	☐ Center	☐ Don't know
☐ Rear seat area	☐ Console	☐ Other ____________		

NOISE SOUNDS LIKE

☐ Knocks	☐ Hard metal	☐ Light metal	☐ Roars	☐ Ticking	☐ Whine
☐ Squeaks	☐ Rattles	☐ Scraping	☐ Other ____________		

HOW OFTEN DOES IT OCCUR?

☐ Continuous ☐ Often ☐ Intermittent ☐ Just started ☐ Since new

WHEN DOES IT OCCUR?

☐ All the time	☐ Speed	☐ RPM	☐ Only moving	☐ On turns	☐ Braking
☐ Hard throttle	☐ Light throttle	☐ Decelerate	☐ Steady speed	☐ Idle in gear	☐ Idle out of gear
☐ Hot days	☐ Cold days	☐ Humid or rainy	☐ Temperature ________		
☐ Heavy bumps	☐ Light bumps	☐ Smooth pavement			

EXPLAIN: ____

____

____

____

CUSTOMER NAME: **PHONE NO.:** **REPAIR ORDER NO:**

SHOP USE ONLY:

VIN#: **MILES:** **TECHNICIAN:** **ADVISOR#:**

50F15060

Fig. 11: Squeak, Rattle, & Noise Conditions

WATER LEAK - WINDNOISE

WATER LEAK

Leak Occurs When?

☐ Setting level	☐ Any time it rains	☐ While driving in the rain	☐ Car wash only
☐ Back lower than front (facing uphill)		☐ Front lower than back (facing downhill)	

Location of Leak (where water appears):

☐ LF Door	☐ RF Door	☐ LR Door	☐ RR Door	☐ Windshield	☐ Rear window
☐ LF window	☐ RF window	☐ LR window	☐ RR window	☐ Side door	☐ Sunroof/T-Top
☐ Under instrument panel			☐ Rear door/rear hatch		

WINDNOISE:

Location:

☐ LF Door	☐ RF Door	☐ LR Door	☐ RR Door	☐ Windshield	☐ Rear window
☐ LF window	☐ RF window	☐ LR window	☐ RR window	☐ Side door	☐ Sunroof/T-Top
☐ Under instrument panel			☐ Rear door/rear hatch		

EXPLAIN: ____

____

____

CUSTOMER NAME: **PHONE NO.:** **REPAIR ORDER NO:**

SHOP USE ONLY:

VIN#: **MILES:** **TECHNICIAN:** **ADVISOR#:**

50I15055

Fig. 12: Water Leak & Wind Noise

I - SYSTEM/COMPONENT TESTS - 4.3L

1997 Chevrolet Blazer

1997 ENGINE PERFORMANCE
General Motors Corp. - System & Component Testing - 4.3L

Chevrolet; Blazer, S10 Pickup
GMC; Jimmy, Sonoma
Oldsmobile; Bravada

INTRODUCTION

Before testing separate components or systems, perform procedures in the F - BASIC TESTING - 4.3L article. Since many computer-controlled and monitored components set a trouble code if they malfunction, also perform procedures in the G - TESTS W/CODES - 4.3L article.

NOTE: Testing individual components does not isolate shorts or opens. Perform all voltage tests with a Digital Volt-Ohmmeter (DVOM) with a minimum 10-megohm input impedance, unless stated otherwise in test procedure. Use ohmmeter and refer to the L - WIRING DIAGRAMS article to isolate wiring harness shorts or opens.

The following table provides the location of commonly used diagnostic information.

GENERAL MOTORS REFERENCE TABLE

System Or Component	Diagnostic Information Location
Malfunction Indicator Light (MIL)	See ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK in F - BASIC TESTING - 4.3L article
DLC & MIL On Steady	See ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK in F - BASIC TESTING - 4.3L article
No Scan Tool Data	See ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK in F - BASIC TESTING - 4.3L article
No-Start Diagnosis	See appropriate NO-START - ENGINE CRANKS OKAY in F - BASIC TESTING - 4.3L article
Injector Circuit Diagnosis	See BASIC FUEL SYSTEM CHECKS in F - BASIC TESTING - 4.3L article
Fuel Pump Relay	See MODULES, MOTORS, RELAYS & SOLENOIDS
Fuel System Diagnosis	See appropriate BASIC FUEL SYSTEM CHECKS in F - BASIC TESTING - 4.3L article
Injector Balance Test	See FUEL SYSTEM
MAP Sensor	See ENGINE SENSORS & SWITCHES
Transmission Range Switch	See ENGINE SENSORS & SWITCHES
IAC Valve	See IDLE CONTROL SYSTEM under FUEL SYSTEM
Fuel Evaporation Control	See EMISSION SYSTEMS & SUB-SYSTEMS
Ignition Control Circuit	See IGNITION SYSTEM
Knock Sensor Check	See IGNITION SYSTEM
EGR System	See EMISSION SYSTEMS & SUB-SYSTEMS
Torque Converter Clutch	See MISCELLANEOUS PCM/VCM CONTROLS
Manual Transmission Shift Lights	See MISCELLANEOUS PCM/VCM CONTROLS
A/C Clutch Control	(1) See MISCELLANEOUS PCM/VCM CONTROLS
Electric Cooling Fan Control	(1) See MISCELLANEOUS PCM/VCM CONTROLS

(1) - Complete coverage in the A/C-HEATER SYSTEM article in the AIR CONDITIONING & HEAT section.

COMPUTERIZED ENGINE CONTROLS

CONTROL UNIT

NOTE: To perform the following ground and power tests, use appropriate wiring diagram in the L - WIRING DIAGRAMS article.

Ground Circuits

1) Using an ohmmeter, check for continuity to ground on PCM/VCM ground terminals. Resistance should be zero ohms. If not, repair open to ground.

2) Using a voltmeter, touch negative lead of voltmeter to a good ground. Touch positive lead of voltmeter to each ground terminal. With vehicle running, voltmeter should indicate less than one volt. If voltmeter reading is more than one volt, check for open, corrosion or loose connection on ground circuit.

Power Circuits

1) Using a voltmeter, check for battery voltage between PCM/VCM continuous power terminal(s) and ground. If battery voltage is not present, check for blown fuse or open fusible link. If okay, check for open in wire between PCM/VCM terminal and power source.

2) Turn ignition on. Using a voltmeter, check for battery voltage between PCM/VCM ignition power terminals and ground. If battery voltage is not present, check IGN fuse. If fuse is okay, check for an open in wire between battery and ignition switch, and between ignition switch and PCM/VCM terminal. If okay, check for a defective ignition switch.

3) Connect voltmeter between ground and PCM/VCM starter (crank) signal terminal. On vehicles with manual transmission/transaxle, depress clutch pedal. Turn ignition switch to START position. Battery voltage should be present ONLY when ignition switch is in START position.

4) If voltage is not present, check CRANK fuse or fusible link between ignition switch and PCM/VCM terminal. If fuse or fusible link is okay, check for an open in wire between ignition switch and PCM/VCM terminal, or check for a defective ignition switch.

ENGINE SENSORS & SWITCHES

A/C ON Switch/System Test

1) Turn ignition switch to RUN position. Move mode selector switch to any position other than OFF position. With A/C control assembly connected, measure voltage between mode selector switch Light Green wire and ground. For wiring schematics, see the L - WIRING DIAGRAMS article.

2) Battery voltage should be present. If battery voltage is present, mode selector switch is operating normally. If battery voltage is not present, check wire from mode selector switch to fuse for an open circuit. Also check A/C high and low pressure switches for open.

3) Check voltage between mode selector switch Dark Green/White wire or Light Green wire and ground. Voltage should not be present. If voltage is present, replace mode selector switch.

Brake Switch

Disconnect brake switch harness connector. Using an ohmmeter, check continuity between brake switch terminals. Continuity should be present. Depress brake pedal or activate brake switch, continuity should not be present.

Engine Coolant Temperature (ECT) Sensor

If a coolant sensor-related code is present, see the G - TESTS W/CODES - 4.3L article. An out-of-calibration sensor may not set a trouble code. Use following procedure to test sensor calibration. Disconnect ECT sensor connector. Measure resistance between sensor terminals. Resistance should be high when engine is cold and drop as engine warms. See ECT SENSOR RESISTANCE VALUES table.

ECT SENSOR RESISTANCE VALUES TABLE

Temperature °F (°C)	Resistance (Ohms)
212 (100)	177
158 (70)	467
100 (38)	1800
68 (20)	3520
23 (-5)	12,300
0 (-18)	25,000
-40 (-40)	100,700

NOTE: Intake Air Temperature (IAT) sensor is also referred to as Manifold Air Temperature (MAT) sensor.

Intake Air Temperature (IAT) Sensor

If an IAT sensor-related code is present, see the G - TESTS W/CODES - 4.3L article. An out-of-calibration sensor may not set a trouble code. Use following procedure to test calibration. Disconnect IAT sensor harness connector. Connect ohmmeter between sensor terminals. Sensor resistance should be as specified. See IAT SENSOR RESISTANCE table. With vehicle sitting overnight, IAT sensor and coolant sensor should have close to the same resistance reading.

IAT SENSOR RESISTANCE TABLE

Temperature °F (°C)	Resistance (Ohms)
212 (100)	185
158 (70)	450
100 (38)	1800
68 (20)	3400
40 (4)	7500
20 (-7)	13,500
0 (-18)	25,000
-40 (-40)	100,700

Knock Sensor

1) Disconnect knock sensor harness connector. Using an ohmmeter, measure knock sensor resistance between sensor terminal and engine block. Resistance should be 3300-4500 ohms. Connect voltmeter between sensor terminal and ground. Set voltmeter to 2-volt AC scale.

2) Start and idle engine. Tap on engine block near sensor. A signal should be indicated on voltmeter. If no signal is indicated, replace knock sensor. Also see TIMING CONTROL SYSTEMS under IGNITION SYSTEM and the G - TESTS W/CODES - 4.3L article.

Manifold Absolute Pressure (MAP) Sensor

1) MAP sensor circuit malfunction should set a related code in PCM/VCM memory. If a code is present, see the G - TESTS W/CODES - 4.3L article. An out-of-calibration sensor may not

set a trouble code. Use following procedure to test sensor calibration. If driveability problems exist, MAP sensor failure is suspected and no MAP code is present, disconnect MAP sensor connector. If driveability condition improves, check MAP vacuum hose for splits, kinks, proper routing and blockage. If no problems are found, replace MAP sensor.

2) With ignition on and engine off, check MAP sensor parameter using a scan tool connected to Data Link Connector (DLC). Voltage should be as specified in MAP SENSOR VOLTAGE RANGE table.

3) If MAP sensor voltage is as specified, go to next step. If voltage is not as specified, check 5-volt reference supply to sensor. Check harness integrity. If no problems are evident, replace MAP sensor.

4) Using a hand-held vacuum pump, apply 10 in. Hg to MAP sensor and note voltage change. Voltage should drop to about 1.0-2.5 volts less than specified in table. If voltage is not as specified or voltage reading does not immediately follow vacuum change, MAP sensor is faulty.

MAP SENSOR VOLTAGE RANGE TABLE

Altitude (Ft.)	Range (Volts)
Below 1000	3.8-5.5
1000-2000	3.6-5.3
2000-3000	3.5-5.1
3000-4000	3.3-5.0
4000-5000	3.2-4.8
5000-6000	3.0-4.6
6000-7000	2.9-4.5
7000-8000	2.8-4.3
8000-9000	2.6-4.2
9000-10,000	2.5-4.0

Oxygen Sensor (O2S)

1) Start engine and warm to operating temperature. Disconnect oxygen sensor. Connect DVOM between Purple wire of oxygen sensor and ground. Place DVOM on 2-volt scale.

2) Using another DVOM on 20-volt scale, connect DVOM in series between Purple wire from PCM/VCM and positive post of battery. This will simulate a rich condition, causing PCM/VCM to respond by leaning mixture. Reading on DVOM connected to oxygen sensor should decrease to less than .3 volt.

3) Move DVOM lead from positive battery post to negative battery post. This will simulate a lean condition, causing PCM/VCM to respond by richening mixture. Reading on DVOM connected to oxygen sensor should increase to greater than .8 volt. If reading does not change as specified, replace oxygen sensor.

4) If a second DVOM is not available, connect a jumper in Purple wire from PCM/VCM. Hold jumper in one hand and touch positive post of battery with other hand to simulate a rich condition. Touch negative post of battery to simulate a lean condition. For additional testing procedures, see the G - TESTS W/CODES - 4.3L article.

Oxygen Sensor Heating Element

On models with oxygen sensor heating elements, disconnect 3-wire connector at oxygen sensor. Measure resistance between White wire terminals on sensor side of connector. Resistance should be 3.5-14 ohms at 68°F (20°C). If resistance is not 3.5-14 ohms, replace oxygen sensor.

Throttle Position (TP) Sensor

1) Install jumper wires to enable connection of a DVOM in parallel between TP sensor harness connectors. Connect DVOM positive lead to Dark Blue wire terminal. Connect negative lead to Black wire terminal. See Fig. 1.

2) Turn ignition on, engine off. Slowly depress accelerator pedal. Signal voltage should gradually change from less than one volt at closed throttle to about 5.0 volts at wide open throttle position. If reading is not as specified, replace TP sensor.

3) TP sensor circuit malfunction should set a related trouble code. For further information, see the G - TESTS W/CODES - 4.3L article. Also see TP SENSOR ADJUSTMENT in the D - ADJUSTMENTS - 4.3L article.

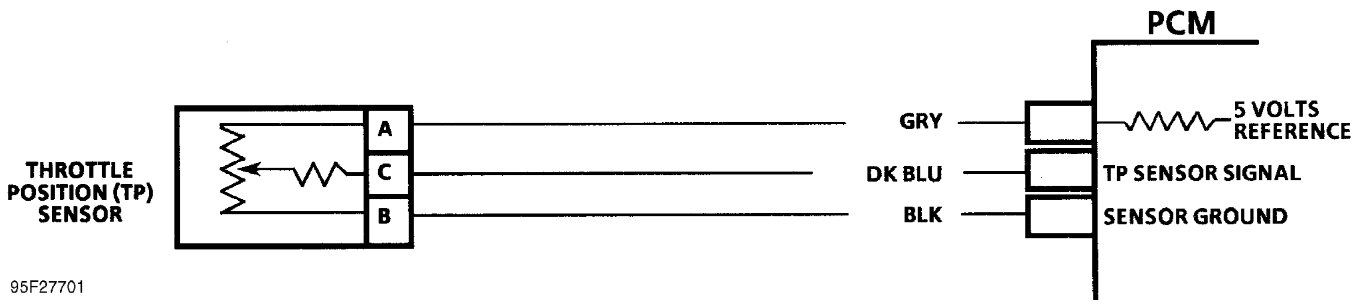


Fig. 1: Typical Throttle Position (TP) Sensor Circuit
Courtesy of General Motors Corp.

Transmission Range Switch

A problem in transmission range switch circuit will set related diagnostic trouble code. See the G - TESTS W/CODES - 4.3L article.

Vehicle Speed Sensor (PM Generator)

Disconnect vehicle speed sensor harness connector (located in transmission/transaxle). Place gear selector in Neutral. Raise vehicle drive wheels off the ground. Turn drive wheels by hand (more than 3 MPH). Measure AC signal voltage between sensor terminals. Voltage reading should vary from 0.1 to 0.5 volt AC as wheel is turned. If reading is not as specified, replace vehicle speed sensor. If a code is set, refer to the G - TESTS W/CODES - 4.3L article.

MODULES, MOTORS, RELAYS & SOLENOIDS

RELAYS

NOTE: To perform the following tests, use the L - WIRING DIAGRAMS article.

A/C Clutch Relay

See MISCELLANEOUS PCM/VCM CONTROLS.

Fuel Pump Relay

1) If a prolonged crank is required to start vehicle, fuel pump relay may be faulty. To verify, start engine. With engine running, disconnect oil pressure switch (fuel pump back-up circuit). If engine stalls, fuel pump relay is faulty. If vehicle continues to run, relay is okay. Check for other causes of prolonged crank.

2) To test fuel pump relay, disconnect fuel pump relay. Refer to COMPONENT LOCATIONS. Apply battery voltage and ground to fuel pump relay winding terminals (control and ground).

3) Using an ohmmeter, check continuity between fuel pump relay control and ground terminals. Continuity should exist. If

continuity does not exist, fuel pump relay is defective.

4) To by-pass fuel pump relay on vehicle (fuel pump not operating), turn ignition off. Disconnect fuel pump relay connector. Using a fused jumper wire, connect fuel pump test connector to positive side of battery. Fuel pump should run.

5) If fuel pump runs, check for faulty connections to relay or replace defective relay. To locate fuel pump test connector, refer to COMPONENT LOCATIONS.

SOLENOIDS

NOTE: All PCM/VCM-controlled solenoids should have at least 20 ohms of resistance (except fuel injectors).

Canister Purge Solenoid
See EMISSION SYSTEMS & SUB-SYSTEMS.

Idle Air Control (IAC) Valve
See IDLE CONTROL SYSTEM under FUEL SYSTEM.

Torque Converter Clutch (TCC) Solenoid
See MISCELLANEOUS PCM/VCM CONTROLS.

FUEL SYSTEM

FUEL DELIVERY

NOTE: For fuel system pressure testing, see the F - BASIC TESTING - 4.3L article.

Fuel Pressure Regulator (CSI)

Fuel pressure regulator is mechanically controlled by internal spring pressure. Regulator is adjusted at factory and is not serviceable. If fuel pressure is too low, check for restricted delivery line. Also, check fuel pump pressure and volume. If fuel pressure is too high, check for restricted fuel tank return line or fuel filter. If no faults are found and pressure is too high or too low, replace fuel pressure regulator.

Fuel Pump Oil Pressure Switch (Back-Up Circuit)

To test fuel pump oil pressure switch (fuel pump back-up circuit), start engine. With engine running, disconnect fuel pump relay. If engine stalls, fuel pump oil pressure switch is faulty. If vehicle continues to run, switch is okay.

Fuel Pump Relay
See FUEL PUMP RELAY under MODULES, MOTORS, RELAYS & SOLENOIDS
.

Fuel Pump Relay By-Pass Procedure

If fuel pump will not energize, relay may be by-passed to test fuel pump. Turn ignition off. Using a fused jumper wire, apply battery voltage to fuel pump test connector. Fuel pump should turn on. For fuel pump test connector location, refer to COMPONENT LOCATIONS.

FUEL CONTROL

NOTE: To check Central Sequential Port Injectors (CSI), see Central Sequential Port Injection Balance Test (CSI) and Injector Coil Test (CSI).

Oxygen Sensor (O2S)

See ENGINE SENSORS & SWITCHES.

NOTE: If injectors are dirty, they should be cleaned using approved injector cleaning procedure before performing fuel INJECTOR BALANCE TEST.

Central Sequential Port Injector Balance Test (CSI)

The injector balance test is used to pulse the injector for a precise amount of time, spraying a measured amount of fuel in the intake manifold. As each injector is pulsed, a drop in fuel rail pressure occurs. This pressure drop can be recorded and compared to other injectors. All injector should have the same pressure drop of 1.5 psi (.11 kg/cm^2).

NOTE: Allow engine to cool to avoid irregular readings due to "hot soak" fuel boiling. To prevent flooding, INJECTOR BALANCE TEST should not be repeated more than once without starting and running engine.

CAUTION: To avoid possible vehicle fire, wrap a shop towel around fitting to avoid fuel spillage.

1) Perform on-board diagnostics. Check for Diagnostic Trouble Code (DTC). If DTC(s) are present, diagnose DTC first. If DTC(s) are not present, go to next step.

2) Turn ignition off. Connect Fuel Pressure Gauge (J-39021-301) to pressure tap. Unplug injector harness connector. Connect Injector Switch Box (J-39021-210). Turn ignition on. Monitor fuel gauge. Fuel pressure should be 60-66 psi (4.2-4.6 kg/cm^2). If pressure is as specified, go to step 3). If pressure is not as specified, check fuel pump and fuel lines for restriction.

3) Run fuel pump for at least 2 seconds after ignition is turned on. Energize injectors one at a time. Note fuel pressure for each injector. Fuel pressure should drop about 1.5 psi (.11 kg/cm^2) on each injector. If fuel pressure drop is as specified, go to next step. If fuel pressure drop is not as specified, perform injector coil test. See INJECTOR COIL TEST (CSI).

4) Remove upper manifold assembly. Connect Poppet Nozzle Tester (J-34730-230). Connect a fused jumper wire (10-amp) to fuel pump test connector. Energize each injector one at a time, fuel should spray from each poppet nozzle tester. If fuel did not spray from an injector, go to next step.

5) Replace faulty injector and poppet nozzle assembly. After replacing injector and poppet nozzle assembly, go to next step.

6) Install Tech 1 scan tool. Select DTC, CLEAR INFO. Start engine. If engine starts and continues to run, go to next step. If engine does not start or starts and dies, repeat step 2).

7) Warm engine to normal operating temperature. Select DTC, FAILED THIS IGN. If additional DTC(s) are displayed, diagnose DTC. If DTC(s) are not present, go to next step.

8) Using scan tool, select CAPTURE INFO, REVIEW INFO. If additional DTC(s) are present, diagnose DTC. If DTC(s) are not present at this time, system is okay.

CAUTION: To avoid possible vehicle fire, wrap a shop towel around fitting to avoid fuel spillage.

Injector Coil Test (CSI)

1) Perform on-board diagnostic test. Diagnose any Diagnostic Trouble Code (DTC) present. If DTC is not present, go to next step.

2) Turn ignition off. Relieve fuel pressure. Connect Fuel Injector Tester (J-39021) to battery positive. Connect Injector Switch Box (J-39021-210). Set amperage on fuel injector tester to 0.5 amp.

Connect DVOM to fuel injector tester. Connect Tech 1 scan tool and monitor engine coolant temperature. If coolant temperature is 50-95°F (10-35°C), go to step 4). If coolant temperature is not as specified, go to next step.

3) Allow engine to warm or cool as necessary. If engine coolant temperature is now 50-95°F (10-35°C), go to next step.

4) Using fuel injector tester, press PUSH TO START TEST button and monitor DVOM reading. Perform this test to each injector. Voltage reading should be 5.44-7.53 volts. If voltage reading is as specified, go to next step. If voltage reading is not as specified, perform injector balance test. See CENTRAL SEQUENTIAL PORT INJECTOR BALANCE TEST (CSI).

5) Replace faulty injector nozzle and poppet assembly and then proceed to next step.

6) Using Tech 1 scan tool, select DTC, CLEAR INFO. Start engine. If engine starts and continues to run, go to next step. If engine does not start or starts and dies, repeat step 2).

7) Warm engine to normal operating temperature. Using scan tool, select DTC, FAILED THIS IGN. If DTC(s) are present, diagnose DTC(s). If DTC(s) are not present, go to next step.

8) Using scan tool, select CAPTURE INFO, REVIEW INFO. If additional DTC(s) are present, diagnose DTC(s). If DTC(s) are not present, system is okay.

IDLE CONTROL SYSTEM

Idle Air Control (IAC) Valve

1) Disconnect harness connector to motor. Check resistance across IAC coil terminals "A" to "B" and "C" to "D". See Fig. 2. Resistance should be 40-80 ohms. If okay, go to next step. If resistance is not as specified, replace IAC valve.

2) Check resistance between IAC terminals "B" to "C" and "A" to "D". Resistance should be infinite. If resistance is not as specified, replace IAC valve.

NOTE: Functional testing of Idle Air Control (IAC) valve requires a bidirectional scan tool capable of cycling PCM/VCM output devices or a special IAC Driver and Noid Light Set (222L or J-37027). Text in G - TESTS W/CODES - 4.3L article may refer to Tech 1 tester, General Motor's bidirectional scan tool.

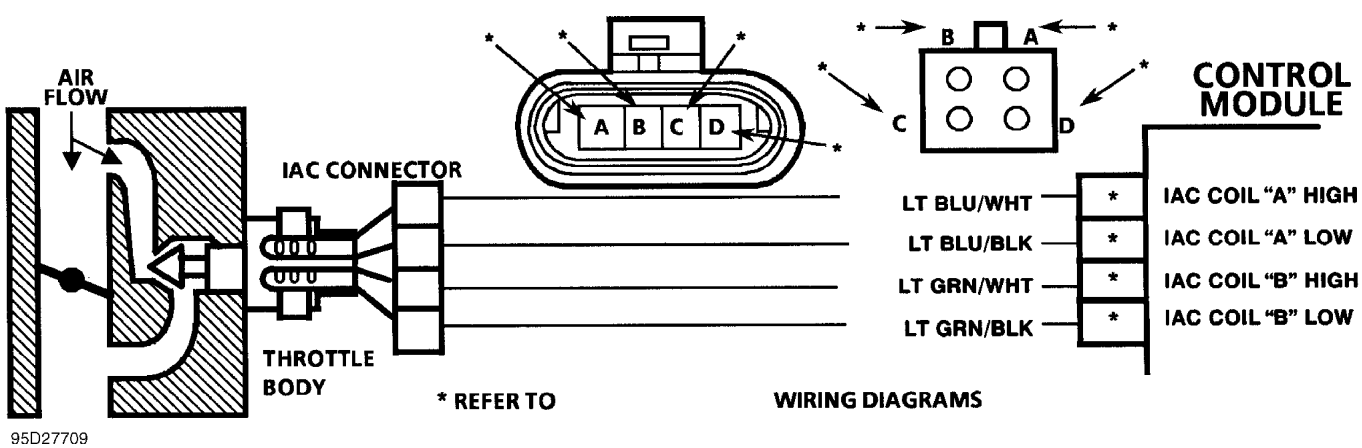


Fig. 2: Identifying IAC Valve Circuits (Typical)
Courtesy of General Motors Corp.

IGNITION SYSTEM

CIRCUIT DESCRIPTION

System includes a distributor, ignition coil, ignition control module, secondary wires, spark plugs, VCM and crank sensor. Ignition system is controlled by Vehicle Control Module (VCM). The VCM monitors the information from various engine sensors, computes the desired spark timing and controls the dwell and firing of the ignition coil via an (IC) line to the ignition control module.

ENHANCED IGNITION SYSTEM CHECK

NOTE: Before clearing DTCs, use scan tool Capture Info to save Freeze Frame and Failure Records for reference. Control module's data is deleted once Clear Info function is used.

1) Perform Powertrain On-Board Diagnostic (OBD) System Check.

2) Check spark plug wires for open circuits, cracks or improper seating of terminals at spark plugs, distributor and ignition coil before proceeding with test. Check spark at plug with J-26792 spark tester or equivalent while cranking. (If there is no spark on one wire, check a second wire). A few sparks then nothing is considered no spark. If adequate spark is present, go to HARD START diagnosis. If adequate spark is not present, go to step 3).

3) Remove coil wire from distributor cap. Insert J-26792 spark tester into the coil wire and clamp the tester onto a ground. Crank engine. If adequate spark is present, go to step 13). If adequate spark is not present, go to step 4).

4) Measure coil wire resistance using a DVOM. The resistance should be approximately 1000 ohms/inch. If resistance is within specified value, go to step 5). If resistance is not within specified value, go to step 32).

5) Disconnect ignition coil harness connector. Probe ignition coil connector terminal C with a test lamp connected to battery positive terminal. Crank engine. If test lamp is flashing while cranking engine, go to step 7). If test lamp is not flashing while cranking engine, go to step 6).

6) Turn OFF ignition. Probe ignition coil harness connector terminal C with a test lamp connected to battery positive terminal. If test lamp is illuminated, go to step 28). If not, go to step 9).

7) Probe ignition coil harness connector terminal B with a test lamp connected to battery positive. If test lamp is illuminated, go to step 29). If not, go to step 8).

8) Ignition ON, engine OFF. Measure terminal A voltage with a DVOM connected to a ground. If DVOM measures above 10V, go to step 21). If not, go to step 18).

9) Turn OFF ignition. Disconnect ignition control module harness connector. Check for an open circuit between ignition coil harness connector terminal C and ignition control module harness connector terminal D. If circuit is open, go to step 27). If circuit is not open, go to next step.

10) Disconnect ignition control module harness connector. Ignition ON, engine OFF. Measure voltage on terminal A at ignition control module harness connector with DVOM connected to ground. If DVOM measures above 10V, go to next step. If not, go to step 19).

11) Probe ignition control module hamess connector terminal C with a test lamp connected to battery positive terminal. If test lamp is illuminated, go to next step. If not, go to step 23).

12) Disconnect ignition control module harness connector. Probe ignition control module harness connector terminal B with DVOM set to AC scale connected to ground. Crank engine. Observe voltage while engine is being cranked. Voltage should be between 1-4 VAC. If voltage is as specified, go to step 20). If voltage is not as specified, go to step 15).

13) Remove distributor cap. Check cap for cracks, moisture, carbon tracks or physical damage. If any of these conditions are present, go to step 34). If cap is okay, go to next step.

14) Crank engine. Observe distributor rotor while engine is being cranked. If rotor did not turn, refer to appropriate N - REMOVE/INSTALL/OVERHAUL article. If rotor did turn, go to step 33).

15) Turn OFF ignition. Disconnect VCM C3 connector. Check ignition timing signal circuit for an open between the VCM C3 harness connector and ignition control module harness connector terminal B. If circuit is open, go to step 24). If circuit is okay, go to next step.

16) Probe ignition control (IC) circuit at VCM C3 connector with a test lamp connected to battery positive terminal. If test lamp is illuminated, go to step 25). If not, go to next step.

17) Ignition ON, engine OFF. Probe ignition control (IC) circuit at VCM C3 connector with a test lamp connected to ground. If test lamp is illuminated, go to step 26). If not, go to step 22).

18) Check for an open or shorted to ground ignition positive voltage circuit at terminal A of ignition coil. Repair as necessary. Go to step 37).

19) Check for an open or shorted to ground ignition positive voltage circuit at terminal A of the ignition control module. Repair as necessary. Go to step 37).

20) Check for poor ignition control module connection. If problem was found, go to step 30). If problem was not found, go to step 35).

21) Check for a poor coil connection. If problem was found, go to step 30). If problem was not found, go to step 31).

22) Check for a poor VCM connection. If problem was found, go to step 30). If problem was not found, go to step 36).

23) Repair open ignition control module ground circuit. Go to step 37).

24) Repair open IC circuit between VCM and ignition control module. Go to step 37).

25) Repair grounded IC circuit between VCM and ignition control module. Go to step 37).

26) Repair short to voltage in the IC circuit between the VCM and the ignition control module. Go to step 37).

27) Repair open in tachometer signal circuit between ignition coil and ignition control module. Go to step 37).

28) Repair short to ground in tachometer signal circuit between ignition coil and ignition control module. Go to step 37).

29) Repair short to ground in tachometer input circuit between ignition coil and instrument cluster. Go to step 37).

30) Repair circuit as necessary. Go to step 37).

31) Replace ignition coil. Refer to appropriate N - REMOVE/INSTALL/OVERHAUL article. Go to step 37).

32) Replace coil wire. Go to step 37).

33) Replace distributor rotor. Go to step 37).

34) Replace distributor cap. Go to step 37).

35) Replace ignition control module. Refer to appropriate N - REMOVE/INSTALL/OVERHAUL article. Go to step 37).

36) Replace VCM. Go to step 37).

37) Operate vehicle within conditions under which original symptom was noted. If system is not functioning properly, repeat testing from step 1).

Diagnostic Aids

NOTE: Numbers below refer to the step numbers in diagnostic test.

NOTE: Battery should be fully charged prior to any tests.

1) Perform the OBD system check before proceeding unless it

was already performed.
2) Checks for proper output from the enhanced ignition system. The spark tester requires a minimum of 25,000 volts to operate. This check can be used in case of an ignition miss, because the system may provicle enough voltage to run the engine but not enough to operate a spark plug under heavy load.
3) This test separates distributor cap, rotor and ignition wires from ignition coil in order to help identify a secondary ignition system problem.
5) This test checks ignition control module, connections, and wiring.
12) This test begins to determine if the VCM is providing a signal to the ignition control module. If the VCM is not providing a signal to the ignition control module, the problem exists between the ignition control module and the VCM.
14) This test checks for a basic engine mechanical problem.

TIMING CONTROL SYSTEMS

Ignition Control Circuit

An open or short to ground in Ignition Control (IC) or by-pass circuit will cause PCM/VCM to turn on Malfunction Indicator Light (MIL) and confirm fault by setting a related trouble code. Refer to the G - TESTS W/CODES - 4.3L article.

Knock Sensor Circuit (Models Using External Spark Controller Module)

1) An open or short circuit on IC module control wire to PCM/VCM will cause a loss of 12-volt IC module signal. This will cause PCM/VCM to fully retard ignition timing.
2) If a scan tool is available, connect tester to Data Link Connector (DLC). Using a metal object, tap on engine next to knock sensor and note knock parameter. Knock should be indicated on scan tool.
3) If a scan tool is not available, backprobe PCM/VCM knock sensor signal terminal with a DVOM. With engine idling, 8-12 volts should be present at this terminal. Using a metal object, tap on engine close to knock sensor. Voltage signal at PCM/VCM terminal should drop to zero volts, and return to original voltage when knock signal ceases.
4) If voltage signal does not respond as described, check knock sensor-to-module-signal. On vehicles equipped with automatic transmission, it may be necessary to place transmission in Drive for timing change to occur. See KNOCK SENSOR under ENGINE SENSORS & SWITCHES.

Knock Sensor Circuit (Models Using Knock Sensor With Internal Spark Controller Module)

1) An open or short circuit on knock sensor wire to PCM/VCM will set a related trouble code. A false detonation signal will not cause PCM/VCM to set a code.
2) If a scan tool is available, connect it to Data Link Connector (DLC). Tap on engine next to knock sensor and note "knock" parameter. Knock should be indicated on scan tool.
3) If a scan tool is not available, connect tachometer to engine. Start engine and hold RPM above idle. Using a metal object, tap on engine close to knock sensor. A noticeable decrease in engine RPM should occur. If no RPM decrease occurred, check knock sensor to PCM/VCM circuit.
4) On vehicles equipped with automatic transmission, it may be necessary to place transmission in Drive for timing change to occur. See KNOCK SENSOR under ENGINE SENSORS & SWITCHES.

EMISSION SYSTEMS & SUB-SYSTEMS

EXHAUST GAS RECIRCULATION

Linear EGR Valve (Digital Valve)

1) Install scan tool. Ensure transmission range switch is operating properly. See ENGINE SENSORS & SWITCHES. With engine at normal operating temperature, command EGR pintle position to zero percent. Increase engine speed to 2000 RPM. If scan tool reads actual EGR pintle position at greater than 3 percent, EGR valve is stuck open. Replace EGR valve.

2) If scan tool reads actual EGR pintle position at 3 percent or less, command a 25 percent position step increase (i.e. 0-25 percent, 25-50 percent, 50-75 percent, etc.). Observe MAP reading and actual EGR pintle position for 3 seconds. EGR should increase by about 25 percent position and MAP reading should also increase.

3) If actual EGR pintle position is stable and within 10 percent of desired EGR pintle position command after 2 seconds, go to next step. If actual EGR pintle position is not as specified, go to step 5).

4) MAP reading should have increased when EGR pintle responded. If MAP did not respond, check EGR passages and EGR valve for blockage. If MAP responded, set desired EGR pintle position to 100 percent. If EGR pintle position sets to 100 percent, EGR is okay. If not, replace EGR valve.

5) Turn engine off. Check EGR electrical circuit and connecting components. Turn ignition on, check for 5-volt reference voltage on harness connector terminal "D" (Gray wire). If 5-volt reference voltage is not present, check PCM/VCM. See CONTROL UNIT under COMPUTERIZED ENGINE CONTROLS. If circuits are okay, replace EGR valve.

FUEL EVAPORATION CONTROL

EVAP Control System

A problem in the EVAP control system will set a Diagnostic Trouble Code (DTC). See the G - TESTS W/CODES - 4.3L article.

POSITIVE CRANKCASE VENTILATION

Required Service

The PCV system may require service for obstructions if any of the following conditions exist:

* Rough Idle
* Stalling or Low Idle Speed
* Oil Leaks
* Oil in Air Cleaner
* Sludge in Engine

A leaking PCV valve or hose could cause:

* Rough Idle
* Stalling
* High Idle Speed

If engine idles roughly, check for clogged PCV valve and for plugged or broken PCV hoses BEFORE adjusting idle. Check for correct PCV valve application to ensure the correct valve is fitted. Replace PCV valve if required.

Checking PCV Valve Function

1) Remove PCV valve from rocker cover. Run engine at idle. Place thumb over open end of valve to check for vacuum. If there is no vacuum at valve, check for obstruction in manifold port, hoses or PCV valve. Repair or replace as necessary.

2) Turn engine off. Remove PCV valve. Shake valve and listen for rattle of check valve inside PCV valve. If a clear rattle is not heard, replace PCV valve.

3) Visually inspect valve for varnish or deposits that may make PCV valve sticky, restricted or incompletely seated. Replace if necessary.

4) Engine must be sealed for PCV system to function as designed. If leakage, sludging or dilution of oil is noted and PCV system is functioning properly, check engine for cause and repair as required to ensure PCV system will continue to function properly.

5) Since an engine operating without any crankcase ventilation can be damaged, it is important to replace PCV valve and air cleaner breather at regular intervals (at least every 30,000 miles). Check all hoses and clamps for failure or deterioration.

MISCELLANEOUS PCM/VCM CONTROLS

NOTE: Although not considered true engine performance-related systems, some controlled devices may affect driveability if they malfunction.

TRANSMISSION

NOTE: To perform the following tests, use appropriate wiring diagram in the L - WIRING DIAGRAMS article.

Torque Converter Clutch (TCC) Solenoid

Disconnect harness connector to TCC solenoid. Measure resistance between TCC solenoid terminals. Solenoid resistance should be 10-15 ohms at 68°F (20°C).

NOTE: Some solenoids have an internal pressure switch in series with solenoid winding and will not show continuity until transmission hydraulic pressure is applied.

Converter Lock-Up Signal At Transmission

1) Warm engine to operating temperature. Raise vehicle and support drive wheels. Support suspension where necessary to prevent damage to drive axles.

2) Disconnect converter clutch connector at transmission. Connect a test light across converter clutch harness terminals. Start engine and place transmission in Drive. Accelerate vehicle to 45 MPH and note test light.

3) If test light is not on, check solenoid power supply wire of harness for open or short to ground. Check ground circuit for open between harness connector and PCM/VCM. If harness is okay, see CONVERTER LOCK-UP SIGNAL FROM PCM/VCM.

Converter Lock-Up Signal From PCM/VCM

1) Warm engine to operating temperature. Raise vehicle and support drive wheels. Support suspension where necessary to prevent damage to drive axles.

2) Connect a test light to battery voltage. Touch TCC control driver terminal with test light. Accelerate vehicle to 45 MPH and note test light. If test light does not illuminate, problem is a faulty PCM/VCM connector or PCM/VCM.

Shift Light (Manual Transmission)

1) These tests assume a shift light problem exists. Use this procedure only if the light will not illuminate, or illuminates all the time.

2) Turn ignition on, with engine off. Note shift light. Shift light should not be on. If shift light is on, check for a short to ground between bulb and PCM/VCM or for bad PCM/VCM.

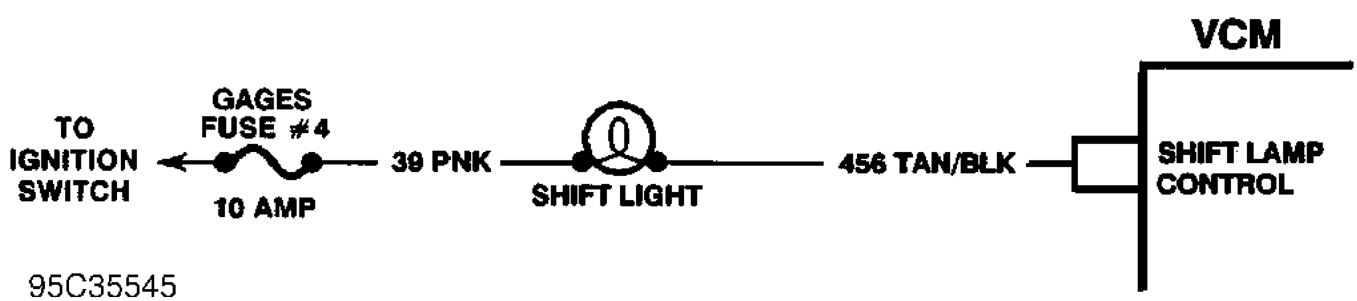
3) Turn ignition on, with engine off, ground test terminal No. 2 (Purple wire) of Data Link Connector (DLC). Malfunction Indicator Light (MIL) should flash and shift light should come on. If MIL illuminates, go to next step. If MIL does not flash, perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK in the F - BASIC TESTING - 4.3L article.

4) If shift light does not come on, ground Tan/Black light driver wire at PCM/VCM terminal using a jumper wire. For circuit identification, see SHIFT LIGHT CIRCUIT IDENTIFICATION table. See Fig. 3.

5) If shift light still does not come on, check for blown GAGES fuse, blown bulb or open circuit between fuse and PCM/VCM. If shift light illuminates when grounding PCM/VCM terminal with a jumper wire, problem is a bad PCM/VCM connection or bad PCM/VCM.

SHIFT LIGHT CIRCUIT IDENTIFICATION TABLE

Application	VCM Connector (Terminal No.)
4.3L	C4 (15)



95C35545
Fig. 3: Typical Shift Light Circuit
Courtesy of General Motors Corp.

PCM CONTROLLED WARNING LIGHTS & GAUGES

Warning Light Diagnosis

1) Perform On-Board Diagnostics (OBD) system check. See ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK in the F - BASIC TESTING - 4.3L article. After performing OBD system check, go to next step.

2) Check instrument cluster. See the INSTRUMENT PANEL article in the ACCESSORIES/SAFETY EQUIPMENT section. If instrument panel is okay, go to next step.

3) Turn ignition off. Disconnect PCM connector. Turn ignition on. Using a DVOM, check voltage between affected PCM output circuit at PCM harness connector terminal and ground. See the L - WIRING DIAGRAMS article. Battery voltage should be present. If battery voltage is present, go to next step. If battery voltage was not present, go to step 7).

4) Set DVOM to 10-amp scale. Check current between affected PCM output circuit and ground. Monitor reading for about 2 minutes. DVOM should read .05-1.50 amps. If reading is as specified, go to step 12). If reading is not as specified, go to next step.

5) Disconnect instrument cluster, leaving PCM connector

disconnected. Using DVOM, check voltage between affected PCM output circuit and ground. DVOM should read zero volts. If voltage reading is as specified, go to step 15). If voltage reading is not as specified, go to next step.

6) Locate and repair short to voltage in affected PCM output circuit. After repairs, go to step 17).

7) Check ignition feed fuse for instrument cluster indicator lights. If fuse is blown, go to next step. If fuse is okay, go to step 9).

8) Locate and repair short to ground in ignition feed circuit for instrument cluster indicator lights. Replace fuse and go to step 17).

9) Disconnect instrument cluster connector. Turn ignition on. Check voltage between ignition feed circuit for instrument cluster indicator lights and ground. Battery voltage should be present. If battery voltage is present, go to next step. If battery voltage was not present, go to step 14).

10) Check affected PCM output circuit for an open or shorted circuit to ground. If circuit is open or shorted, go to step 17). If circuit was okay, go to next step.

11) Check affected PCM output circuit and ignition feed circuit for poor connection at instrument cluster and at PCM. If problem is present, repair as necessary and then go to step 17). If problem was not found, go to step 15).

12) Turn ignition off. Reconnect PCM harness connector. Disconnect instrument cluster connector. Turn ignition on. Connect a test light between affected PCM output circuit and ignition feed circuit at instrument panel harness connector. Using a scan tool, perform OUTPUTS TEST function to cycle affected warning light on and off. If test light flashes on and off, check for shorted component or circuit in the output driver circuit. Check for faulty instrument cluster. If test light does not flash on and off, go to next step.

13) Check affected PCM output circuit for poor connection to PCM. Replace defective terminal and then go to step 17). If terminal is okay, go to step 16).

14) Repair open in ignition feed circuit to instrument cluster indicator lights. After repairs, go to step 17).

15) Replace instrument cluster and then go to step 17).

16) Replace PCM and then go to next step.

17) Using scan tool, operate affected warning light. If warning light does not operate properly, go to step 3).

Tachometer Control Circuit Diagnosis

1) Diagnose instrument cluster. See the INSTRUMENT PANEL article in the ACCESSORIES/SAFETY EQUIPMENT section. After diagnosis, go to next step.

2) Perform On-Board Diagnostic (OBD) system check. See ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK in the F - BASIC TESTING - 4.3L article. After performing OBD system check, go to next step.

3) Turn ignition off. Disconnect PCM connector. Turn ignition on. Using a DVOM, check voltage between tachometer control circuit at PCM harness connector terminal and ground. See the L - WIRING DIAGRAMS article. Battery voltage should be present. If battery voltage is present, go to next step. If battery voltage was not present, go to step 7).

4) Set DVOM to 10-amp scale. Check current between tachometer control circuit and ground. Monitor reading for about 2 minutes. DVOM should read .05-1.50 amps. If reading is not as specified, go to next step. If reading is as specified, go to step 12).

5) Disconnect instrument cluster, leaving PCM connector disconnected. Using DVOM, check voltage between tachometer control circuit and ground. DVOM should read zero volts. If voltage reading is as specified, go to step 15). If voltage reading is not as specified,

go to next step.

6) Locate and repair short to voltage in tachometer control circuit. After repairs, go to step 17).

7) Check ignition feed fuse for instrument cluster. If fuse is blown, go to next step. If fuse is okay, go to step 9).

8) Locate and repair short to ground in ignition feed circuit to instrument cluster. Replace fuse and go to step 17).

9) Disconnect instrument cluster connector. Turn ignition on. Check voltage between ignition feed circuit for instrument cluster and ground. Battery voltage should be present. If battery voltage was not present, go to step 14). If battery voltage is present, go to next step.

10) Check tachometer control circuit for an open or shorted circuit to ground. If circuit is open or shorted, go to step 17). If circuit was okay, go to next step.

11) Check tachometer control circuit and ignition feed circuit for poor connection at instrument cluster and at PCM. If problem is present, repair as necessary and then go to step 17). If problem was not found, go to step 15).

12) Turn ignition off. Reconnect PCM harness connector. Disconnect instrument cluster connector. Turn ignition on. Connect a test light between tachometer control circuit and ignition feed circuit at instrument panel harness connector. Using a scan tool, perform OUTPUTS TEST function to cycle tachometer control output light on and off. If test light flashes on and off, check for shorted component or circuit in the output driver circuit. Check for faulty instrument cluster. If test light does flash on and off, go to next step.

13) Check tachometer control circuit for poor connection to PCM. Replace defective terminal and then go to step 17). If terminal is okay, go to step 16).

14) Repair open in ignition feed circuit to instrument cluster. After repairs, go to step 17).

15) Replace instrument cluster and then go to step 17).

16) Replace PCM and then go to next step.

17) Start engine and observe tachometer. If tachometer does not operate properly, diagnose instrument cluster. See the INSTRUMENT PANEL article in the ACCESSORIES/SAFETY EQUIPMENT section.

A/C COMPRESSOR CLUTCH CONTROLS

The A/C compressor clutch relay is controlled by the PCM. The PCM improves idle quality by delaying A/C compressor clutch engagement until idle speed is increased, or disengages A/C compressor clutch when idle speed is too low. A/C compressor clutch is cycled by PCM. PCM smooths cycling of A/C compressor clutch by adding fuel the instant A/C compressor clutch is applied.

NOTE: See the L - WIRING DIAGRAMS article for component location, terminal and wire color identification.

RELAY LOCATION

A/C COMPRESSOR CLUTCH RELAY LOCATION TABLE

Application	Location
S/T Series	In Engine Compartment, On Bracket At Center Of Firewall

WARNING: Vehicles may be equipped with a PCM using an Electronically Erasable Programmable Read Only Memory (EEPROM). When replacing PCM, the new PCM must be programmed.

NOTE: To help save diagnostic time, ALWAYS check for blown fuses or fusible links before proceeding with any testing. If fuses are blown, locate and repair short circuit before replacing fuses. Ensure all related relay and wire harness connections are clean and tight. Repair as necessary.

A/C CLUTCH CIRCUIT DIAGNOSIS

Description

Vehicle Control Module (VCM) controls A/C clutch to improve idle quality and performance by delaying clutch engagement until idle speed is increased, releasing clutch when idle speed is too low, and smooths cycling of compressor by providing additional fuel the instant clutch is applied.

Turning on A/C supplies battery voltage through pressure switches to VCM. When VCM receives voltage on A/C request signal, A/C enable relay circuit is grounded. As a result, A/C compressor clutch engages.

Compressor Clutch Control Circuit Diagnosis

1) Before performing diagnosis, ensure A/C system is adequately charged. If system is not adequately charged, evacuate and recharge system. If system is adequately charged, go to next step.

2) Start engine and allow it to reach normal operating temperature. Turn A/C on, then off. If A/C clutch engages, then disengages within 20 seconds, diagnose A/C-heater system. If operation is not as specified, go to step 3).

3) Connect scan tool. Turn A/C on. Monitor A/C REQUEST data. If display reads YES, go to next step. If display does not read YES, go to step 8).

4) Disconnect A/C compressor clutch harness connector. Connect a test light between A/C clutch signal circuit (Dark Green wire) and ground circuit (Black wire) of A/C compressor clutch harness connector. If test light comes on, go to next step. If test light does not come on, go to step 12).

5) Check for a faulty A/C compressor clutch harness connector. Repair as necessary. Go to next step. If no problem is found, go to step 7).

6) Repair A/C compressor clutch harness connector. Go to step 27).

7) Replace A/C compressor clutch. Go to step 27).

8) Turn ignition off. Disconnect VCM connector C3. Turn ignition on. Using a test light connected to ground, probe A/C request signal circuit (Dark Green/White wire) at VCM harness connector C3. If test light comes on, go to next step. If test light does not come on, go to step 11).

9) Check for poor connection at VCM harness connector C3. If a problem is found, go to next step. If no problem is found, go to step 26).

10) Repair VCM harness connector C3. Go to step 27).

11) Repair open or short to ground in Dark Green/White wire to A/C pressure switch and/or A/C control switch. Go to step 27).

12) Using a test light connected to ground, probe A/C compressor clutch signal circuit (Dark Green wire) at A/C compressor clutch harness connector. If test light comes on, go to next step. If test light does not come on, go to step 14).

13) Repair open in A/C compressor clutch ground circuit (Black wire). Go to step 27).

14) Install scan tool. Turn ignition on, engine off. Using scan tool, command A/C relay on. If A/C relay clicks, go to step 23). If A/C relay does not click, go to next step.

15) Disconnect A/C relay. Using a test light connected to ground, probe A/C relay harness connector cavity No. 85 (Pink wire). If test light comes on, go to step 17). If test light does not come on, go to next step.

16) Repair open or short to ground in A/C relay ignition feed circuit (Pink wire). Go to step 27).

17) Connect a test light between A/C relay harness connector cavities No. 85 (Pink wire) and No. 86 (Dark Green/White wire). Using scan tool, command A/C relay on. If test light comes on, go to next step. If test light does not come on, go to step 19).

18) Replace A/C relay. Go to step 27).

19) Check for a faulty connection at VCM harness connector C3. If a problem is found, go to next step. If no problem is found, go to step 21).

20) Repair faulty connection at VCM connector C3. Go to step 27).

21) Check for an open Dark Green/White wire between A/C relay harness connector cavity No. 86 and VCM harness connector C3, terminal No. 9. If a problem is found, go to next step. If no problem is found, go to step 26).

22) Repair open in Dark Green/White wire between A/C relay harness connector cavity No. 86 and VCM connector C3, terminal No. 9. Go to step 27).

23) Remove A/C relay. Using a fused jumper wire, jumper A/C relay harness connector cavities No. 30 (Orange wire) and No. 87 (Dark Green wire) together. If A/C compressor clutch engages, go to next step. If A/C compressor clutch does not engage, go to step 25).

24) Replace A/C relay. Go to step 27).

25) Repair open or short to ground in A/C compressor clutch control circuit (Dark Green wire). Go to step 27).

26) Replace VCM. Go to next step.

27) Using scan tool, select DTC CLEAR INFO. Start engine and allow it to reach normal operating temperature. Select DTC SPECIFIC, then enter DTC number that was set. Operate vehicle within conditions that may have set this DTC. If DTC does not reset, go to next step. If DTC resets, go to step 2).

28) Using scan tool, select CAPTURE INFO, REVIEW INFO. If any DTCs are displayed that have not been diagnosed, perform diagnosis for applicable DTC. See the G - TESTS W/CODES - 4.3L article. If no DTCs are displayed, testing is complete.

COMPONENT LOCATIONS

COMPONENT LOCATIONS TABLE

Component	Location
A/C Compressor High Pressure Cut-Off Switch	On Rear Of A/C Compressor
A/C Compressor Relay	Center Rear Of Engine Compartment
A/C Cycling Switch	Right Rear Of Engine Near Accumulator
Camshaft Position (CMP) Sensor	In Distributor
Crankshaft Position (CKP) Sensor	Below Right Front Of Engine Near Harmonic Balancer
Cruise Control Module	Left Rear Of Engine Compartment On Cowl
Data Link Connector (DLC)	Lower Left Side Of Instrument Panel
Distributor	Top Rear Of Engine
EGR Valve	Top Rear Of Engine
Electronic Ignition Control Module	Top Right Side Of Engine
Engine Coolant Temperature (ECT) Sensor	Top Front Of Engine Between A/C Compressor & EGR Valve, On Thermostat Housing

EVAP Canister	Left Rear Of Vehicle, Near Fuel Tank
EVAP Canister Purge Solenoid	Top Right Center Of Engine
EVAP Canister Vent Valve	Crossmember At Fuel Tank
Fuel Injector	Top Center Of Engine
Fuel Level Sensor	Top Of Fuel Tank
Fuel Pump Prime Connector	Left Rear Side Of Engine Compartment
Fuel Pump Relay	In Relay Center Behind Glove Compartment
Fuel Tank Pressure Sensor	Top Of Fuel Tank
Idle Air Control (IAC) Valve	Top Left Side Of Engine
Ignition Coil	Top Right Side Of Engine
Intake Air Temperature (IAT) Sensor	Left Front Of Engine Compartment On Air Intake Duct
Knock Sensor	Top Rear Of Engine Above Transmission Bell Housing
Manifold Absolute Pressure (MAP) Sensor	Top Center Of Engine On Intake Manifold
Mass Airflow (MAF) Sensor	Left Front Of Engine Compartment In Air Intake Duct
Oxygen Sensor (O2S)	
Bank 1, Sensor No. 1	On Rear Of Left Exhaust Pipe At Left Side Of Transmission
Bank 2, Sensor No. 1	Right Rear Of Engine In Exhaust Pipe
Bank 1, Sensor No. 3	Rear Of Catalytic Converter
Relay Center	Behind Instrument Panel Glove Compartment
Throttle Position (TP) Sensor	Top Left Side Of Engine
Vehicle Control Module (VCM)	Right Side Of Engine Compartment
Vehicle Speed Sensor	
A/T With 2WD	Right Rear Of Transmission
A/T With 4WD	Left Rear Of Transfer Case
M/T With 2WD	Left Rear Of Transmission
M/T With 4WD	Left Rear Of Transfer Case

SYSTEM WIRING DIAGRAMS

1997 Chevrolet Blazer

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1997 System Wiring Diagrams
Chevrolet - Blazer
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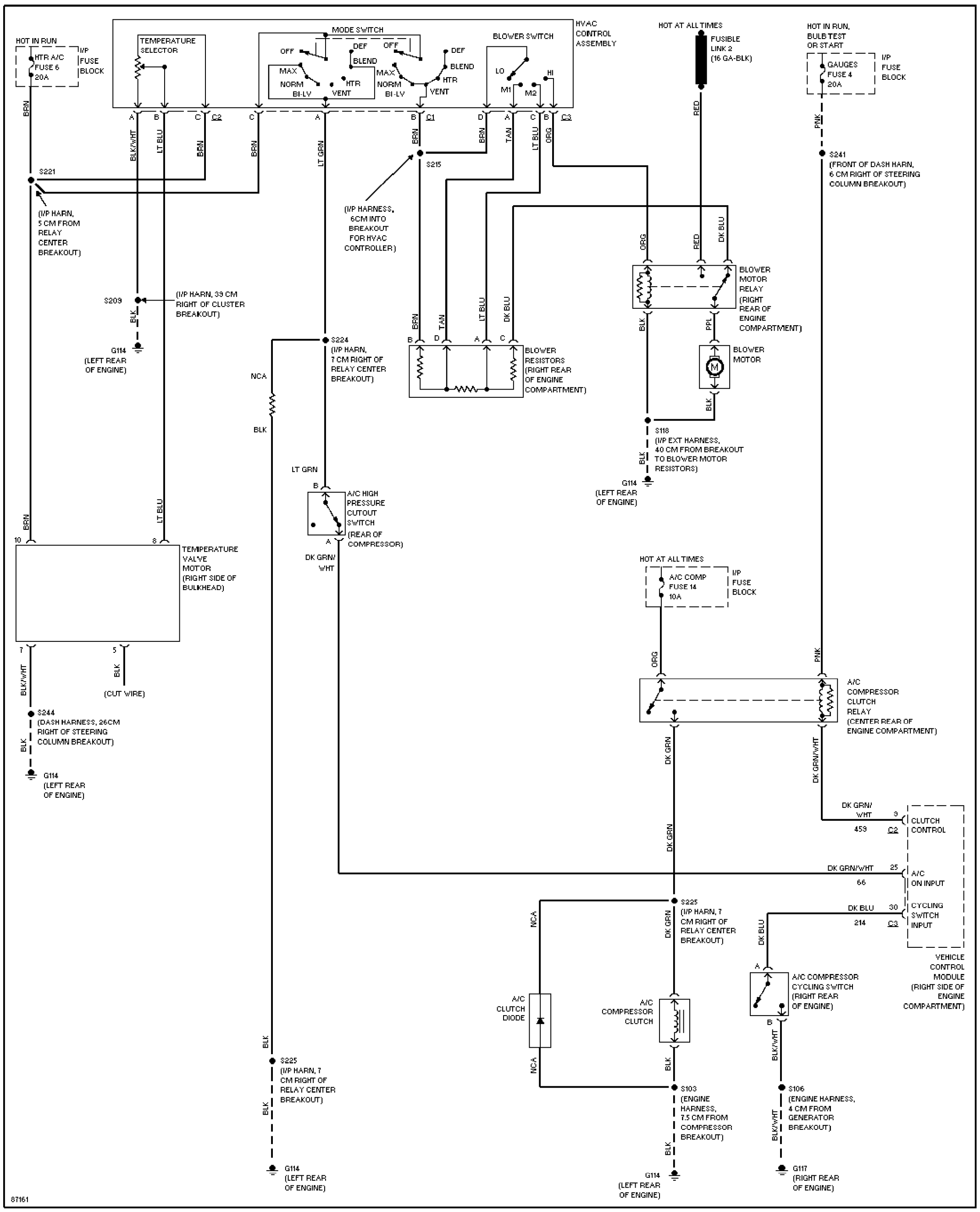
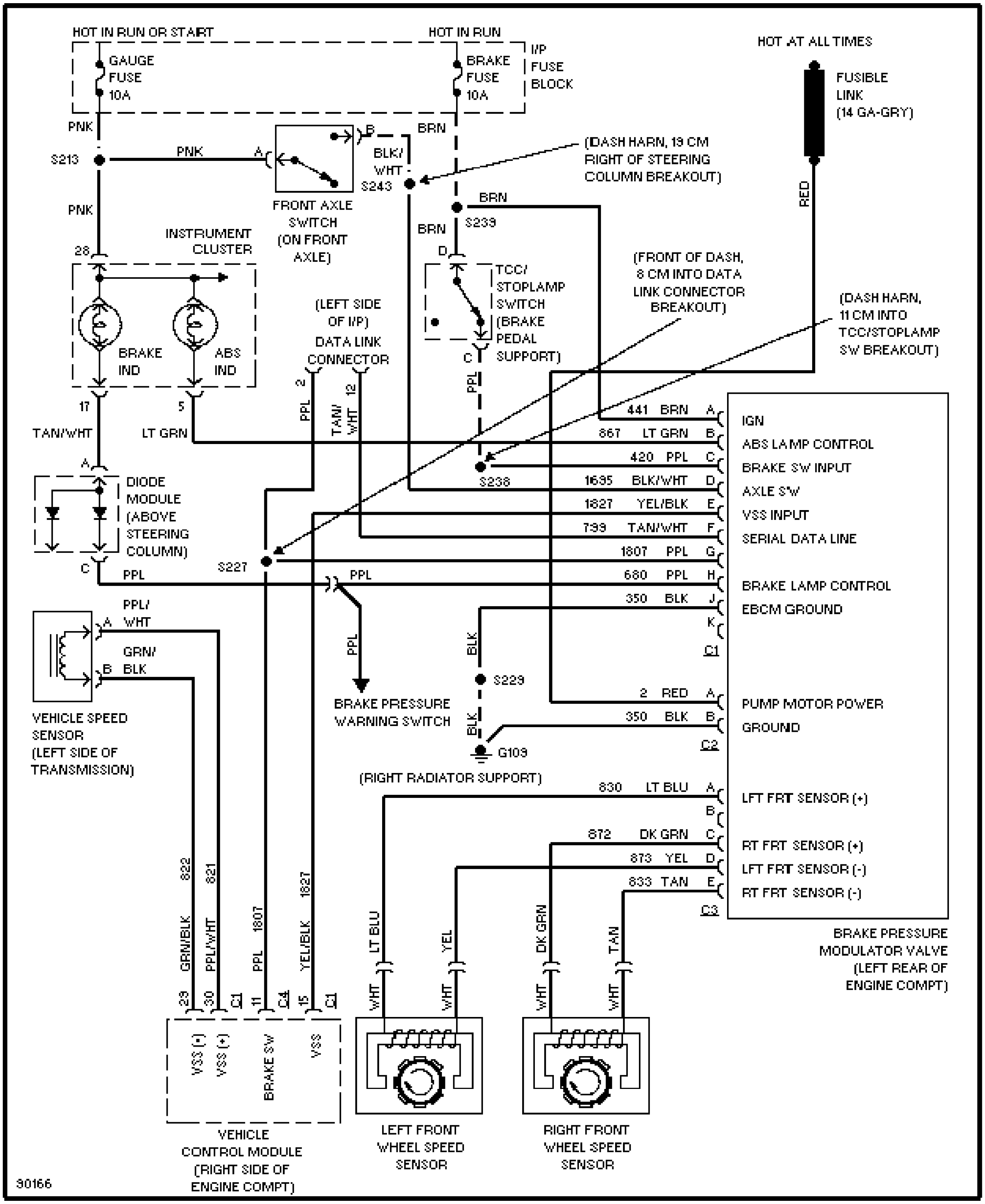
AIR CONDITIONING



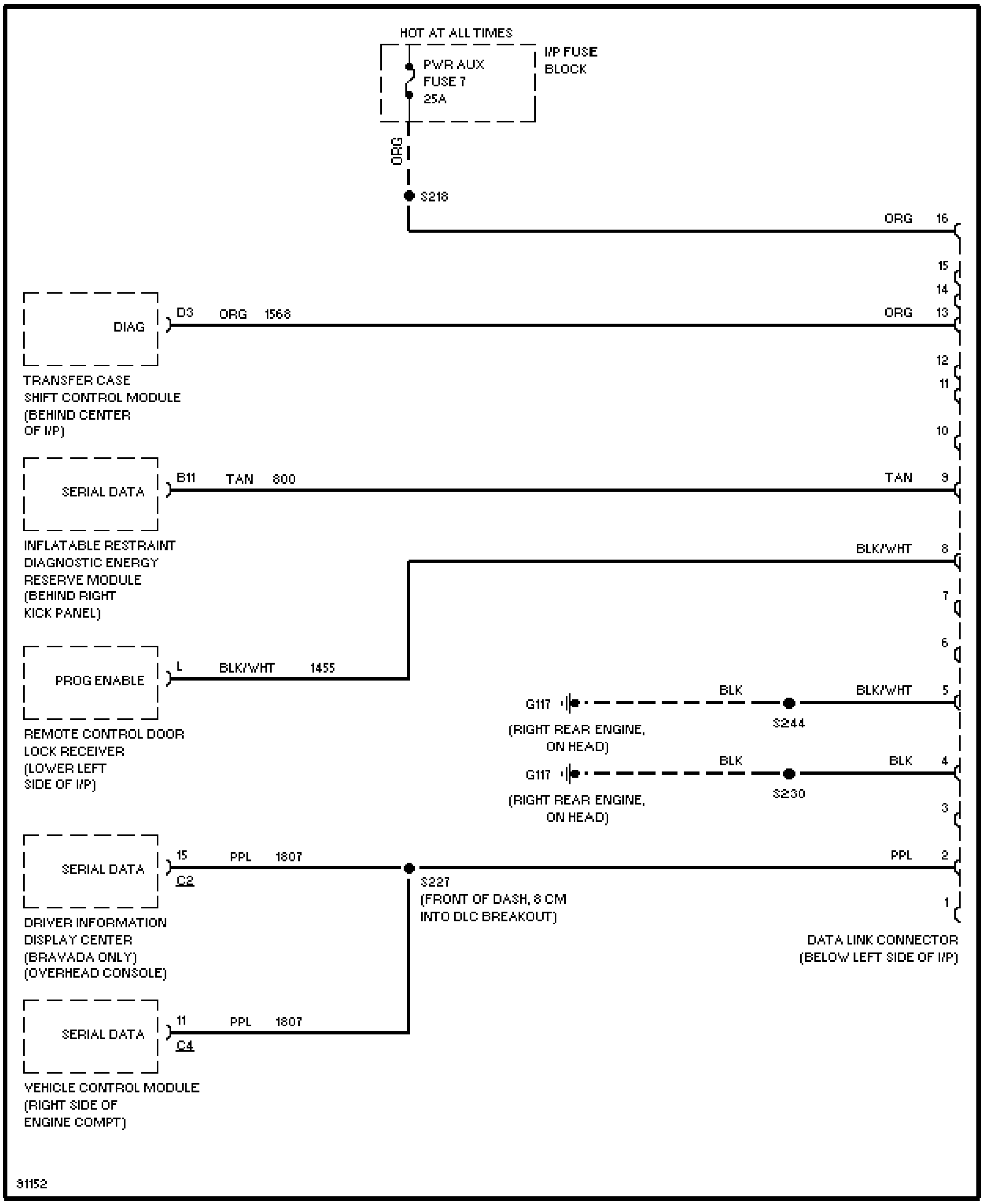
A/C Circuit

ANTI-LOCK BRAKES



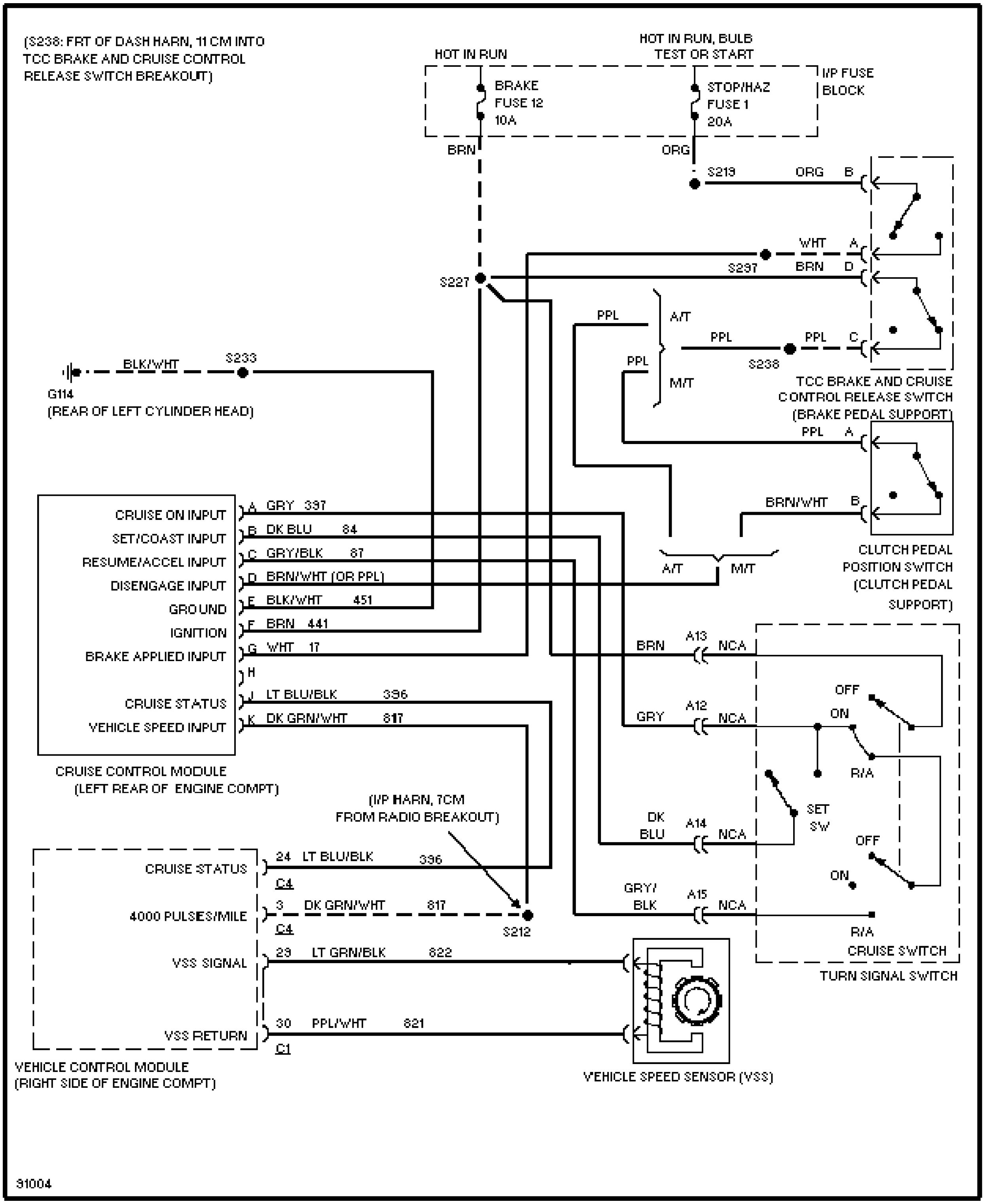
Anti-lock Brake Circuits

COMPUTER DATA LINES



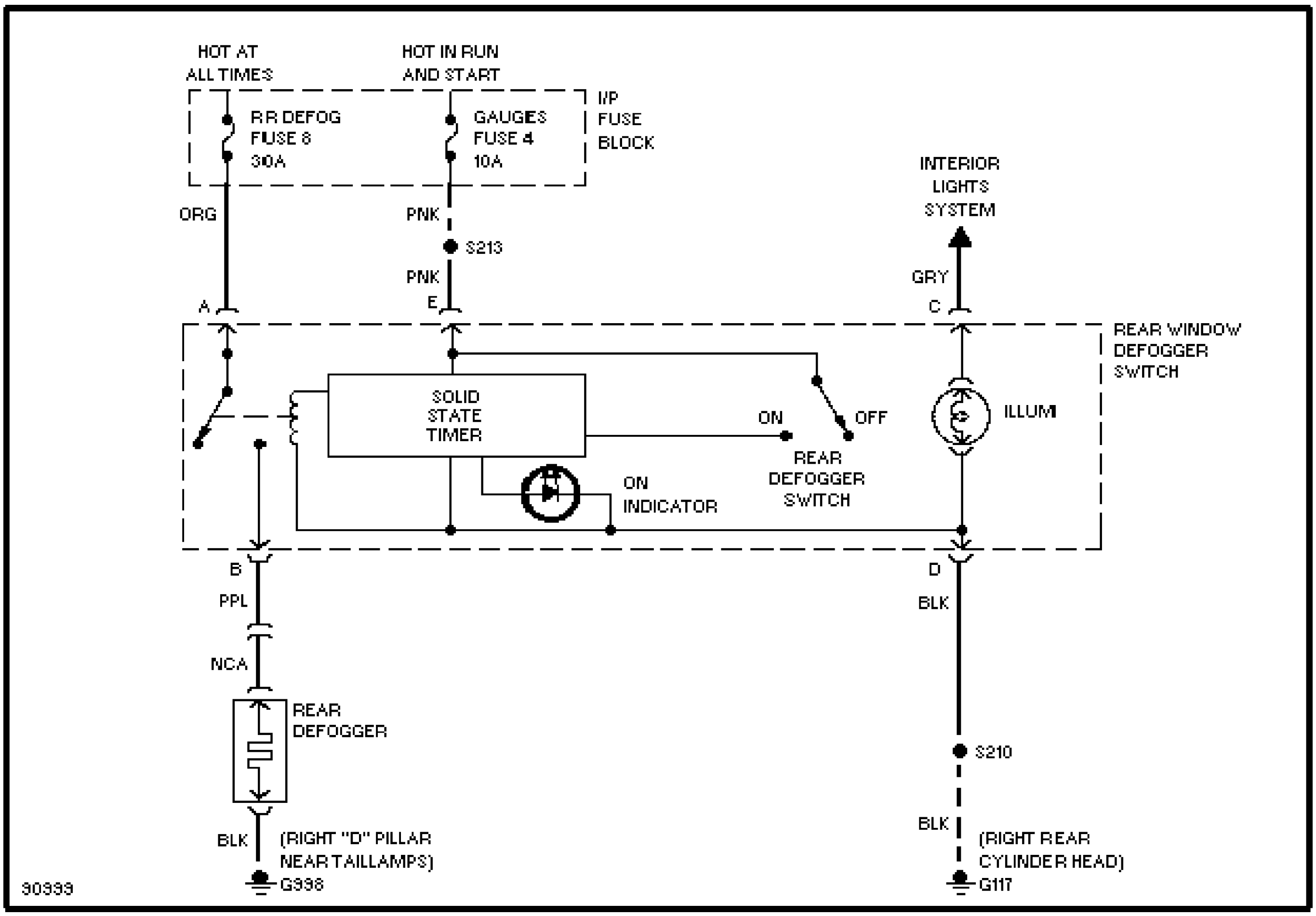
Computer Data Lines

CRUISE CONTROL



Cruise Control Circuit

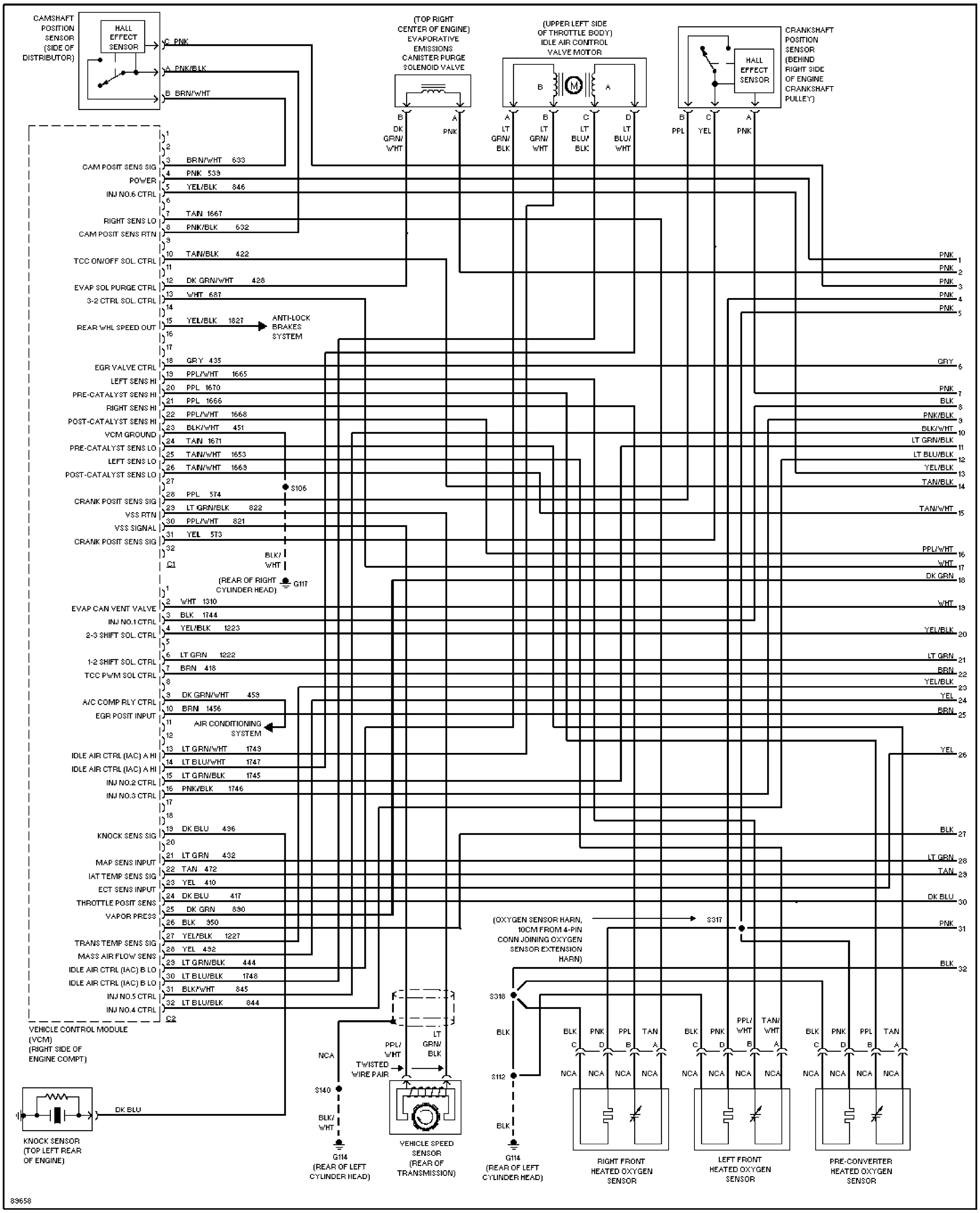
DEFOGGERS



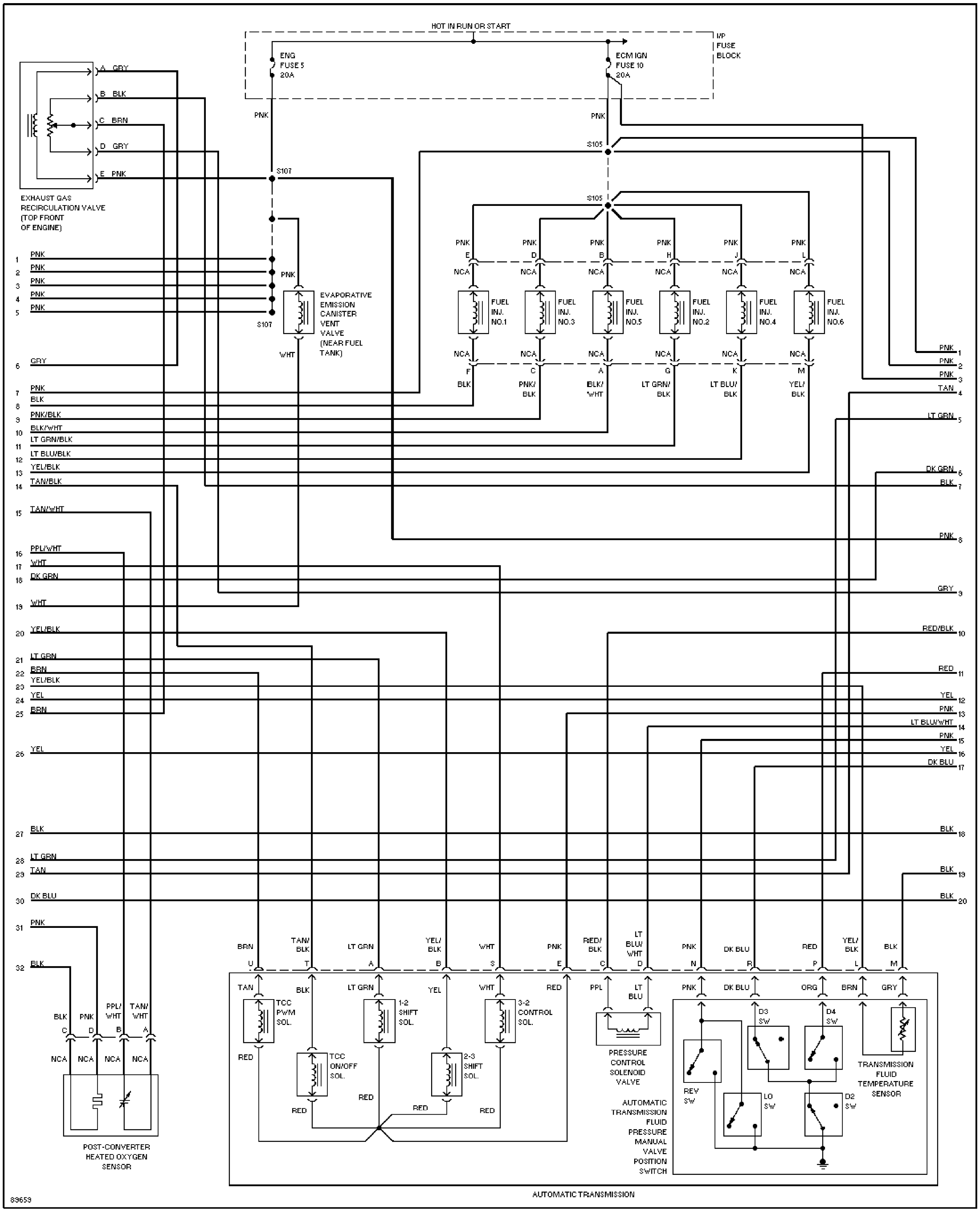
Defogger Circuit

ENGINE PERFORMANCE

4.3L



4.3L (VIN W), Engine Performance Circuits (1 of 4)



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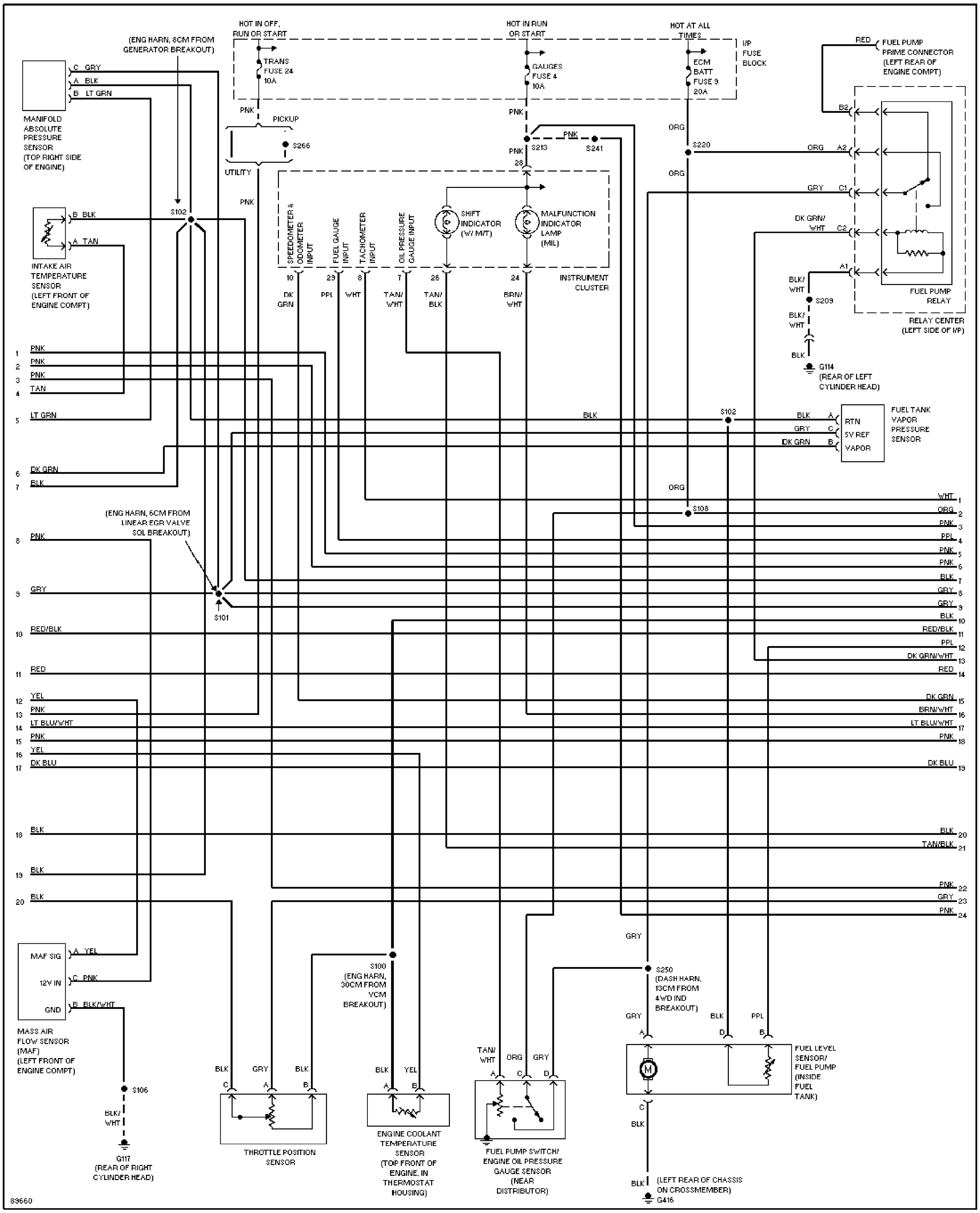

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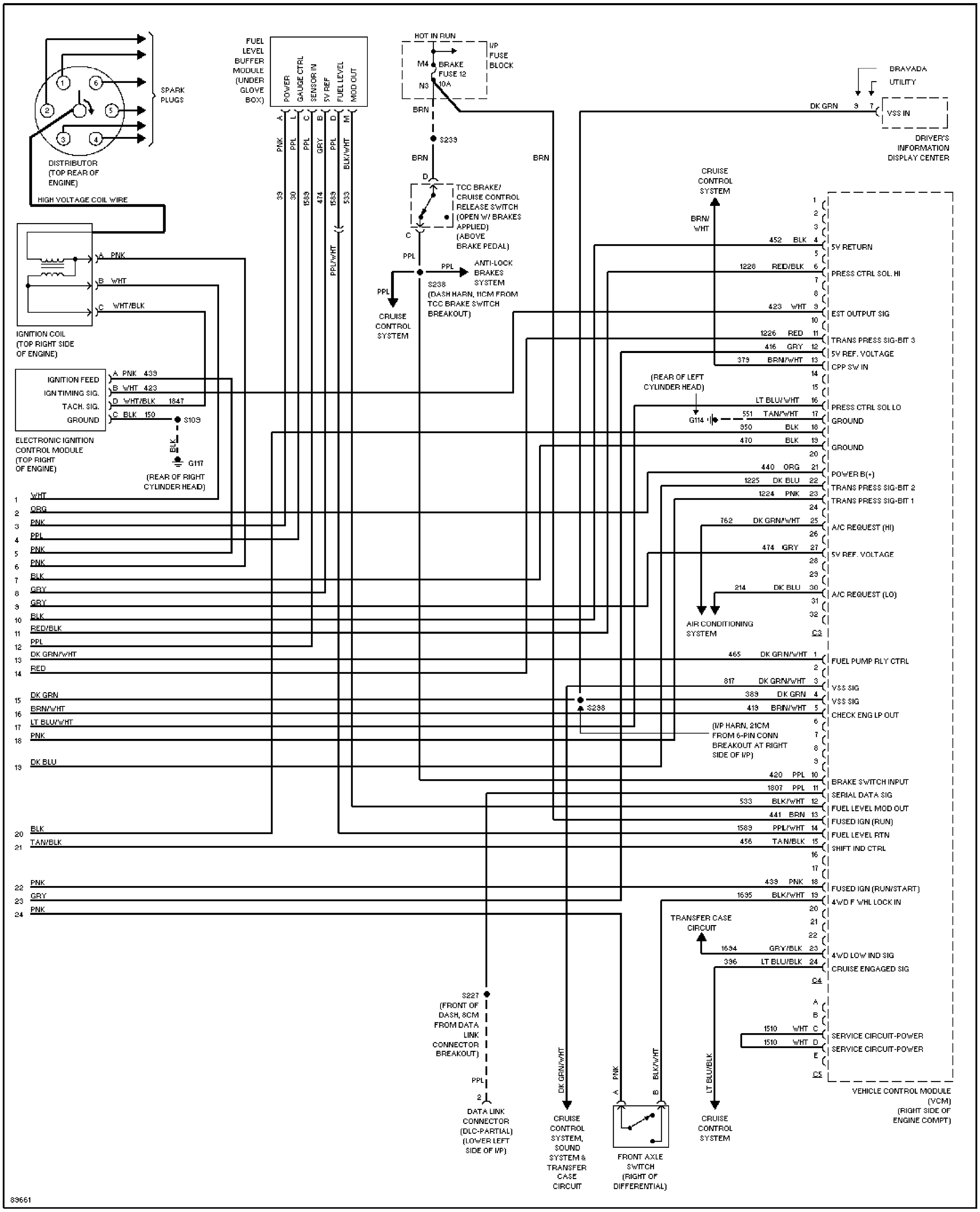
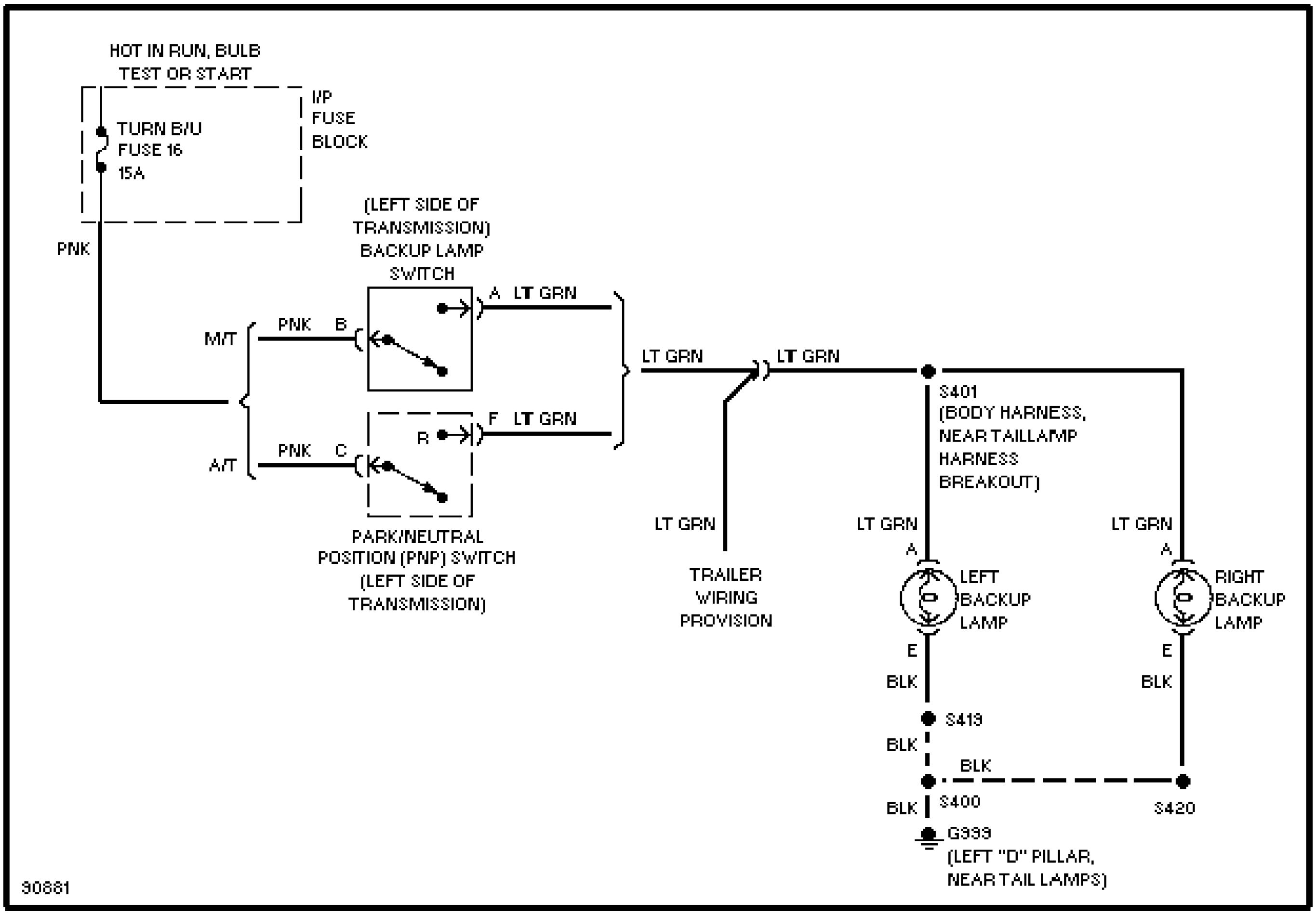
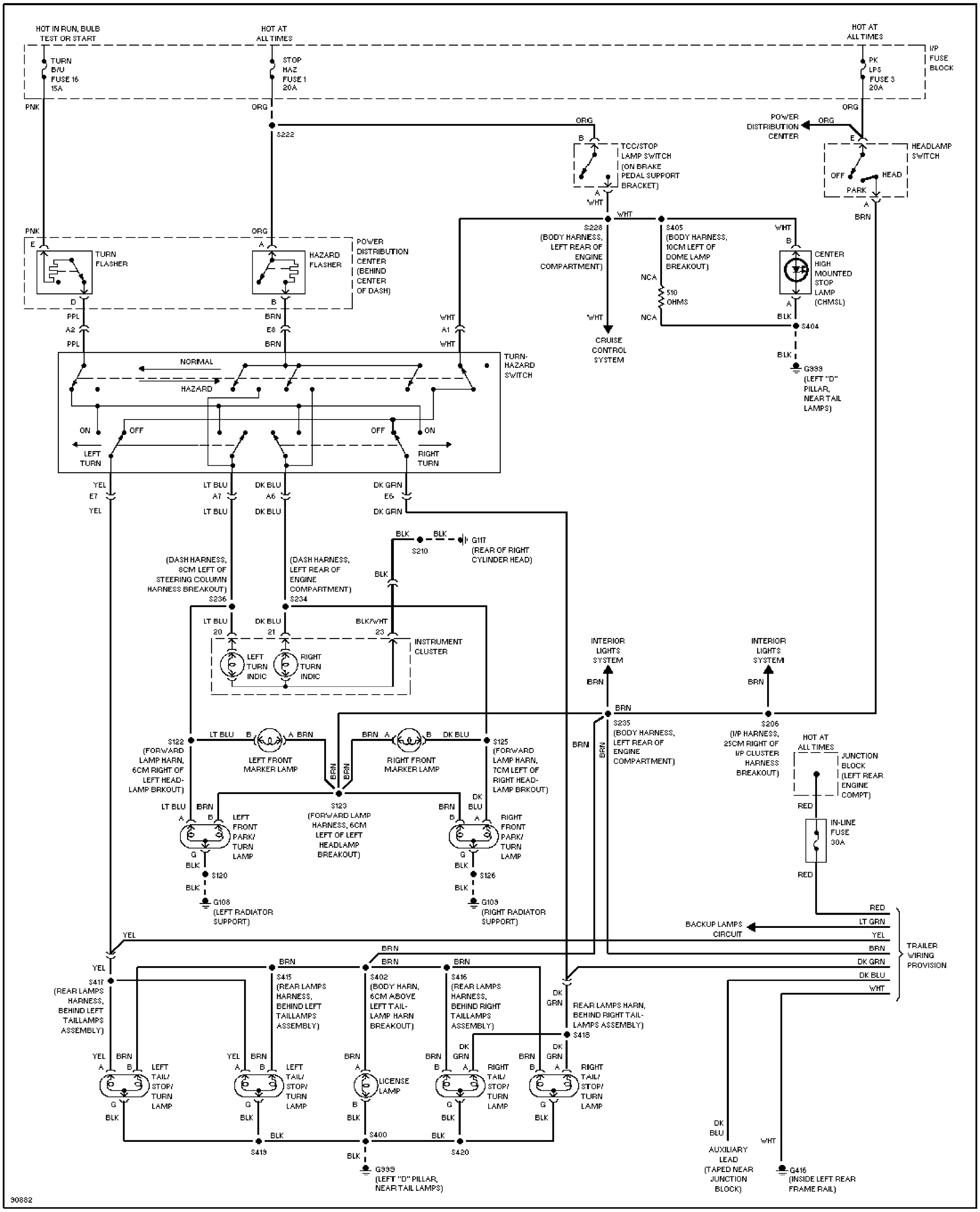


4.3L (VIN W), Engine Performance Circuits (4 of 4)

EXTERIOR LIGHTS

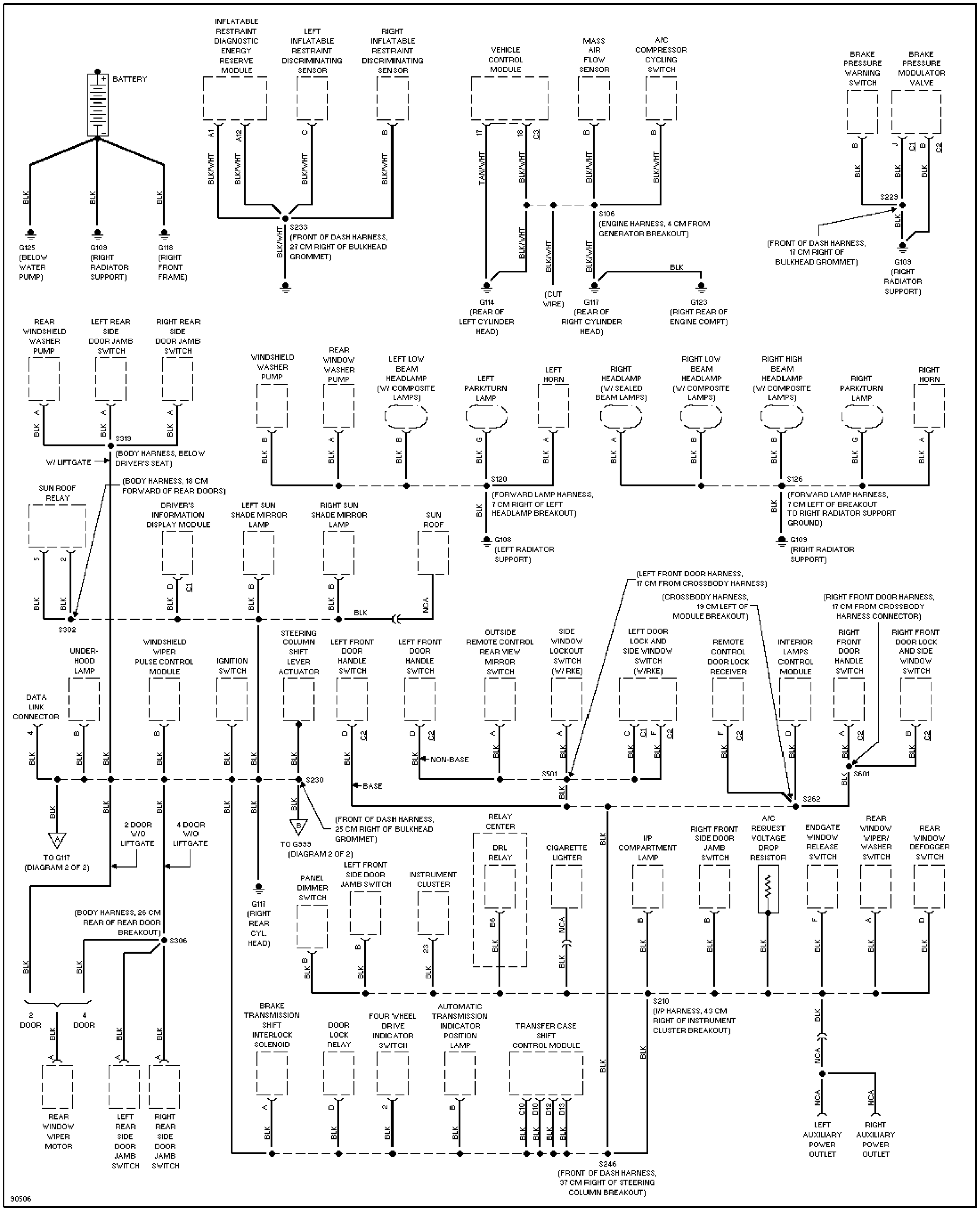


Back-up Lamps Circuit

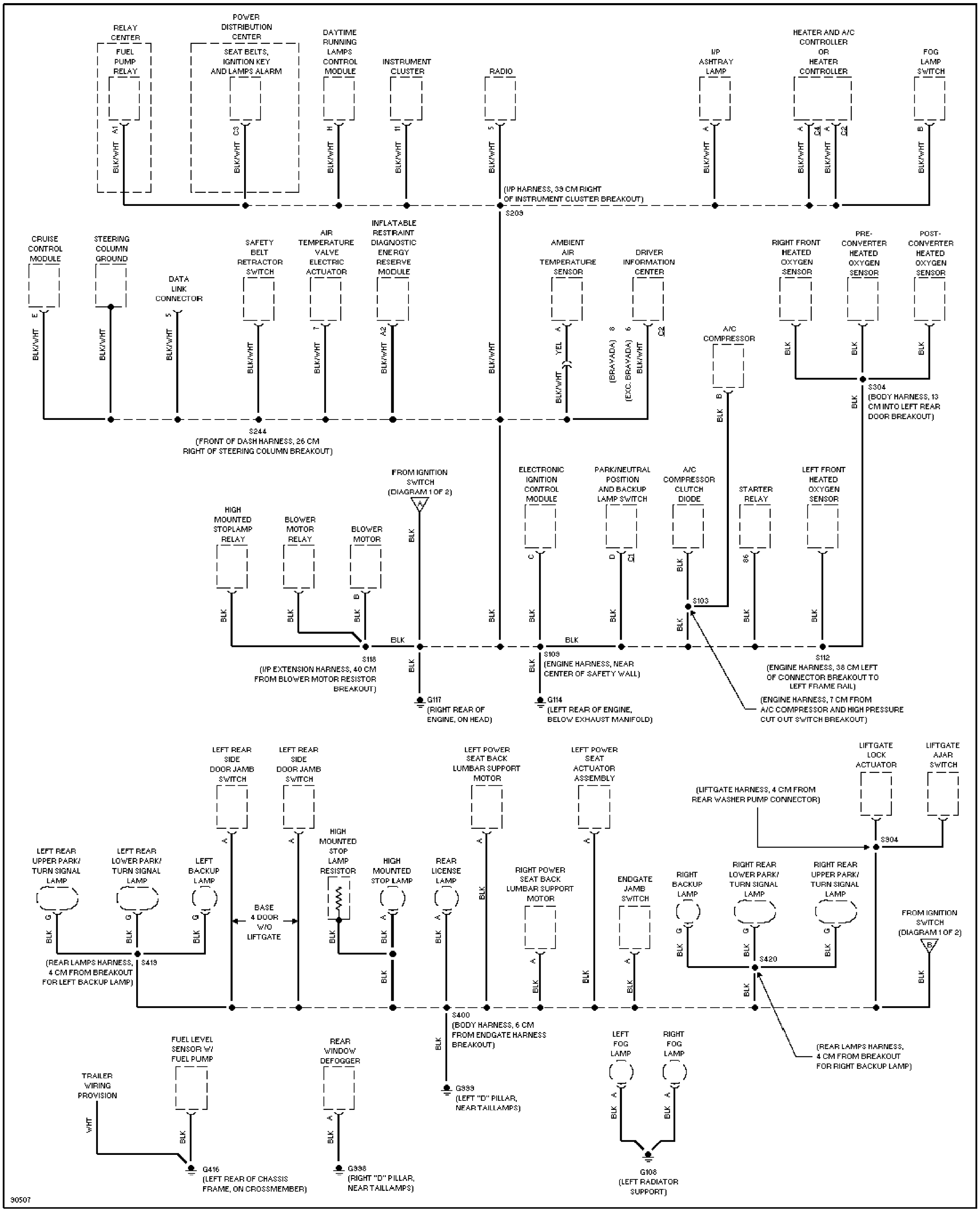


Exterior Lamps Circuit

GROUND DISTRIBUTION

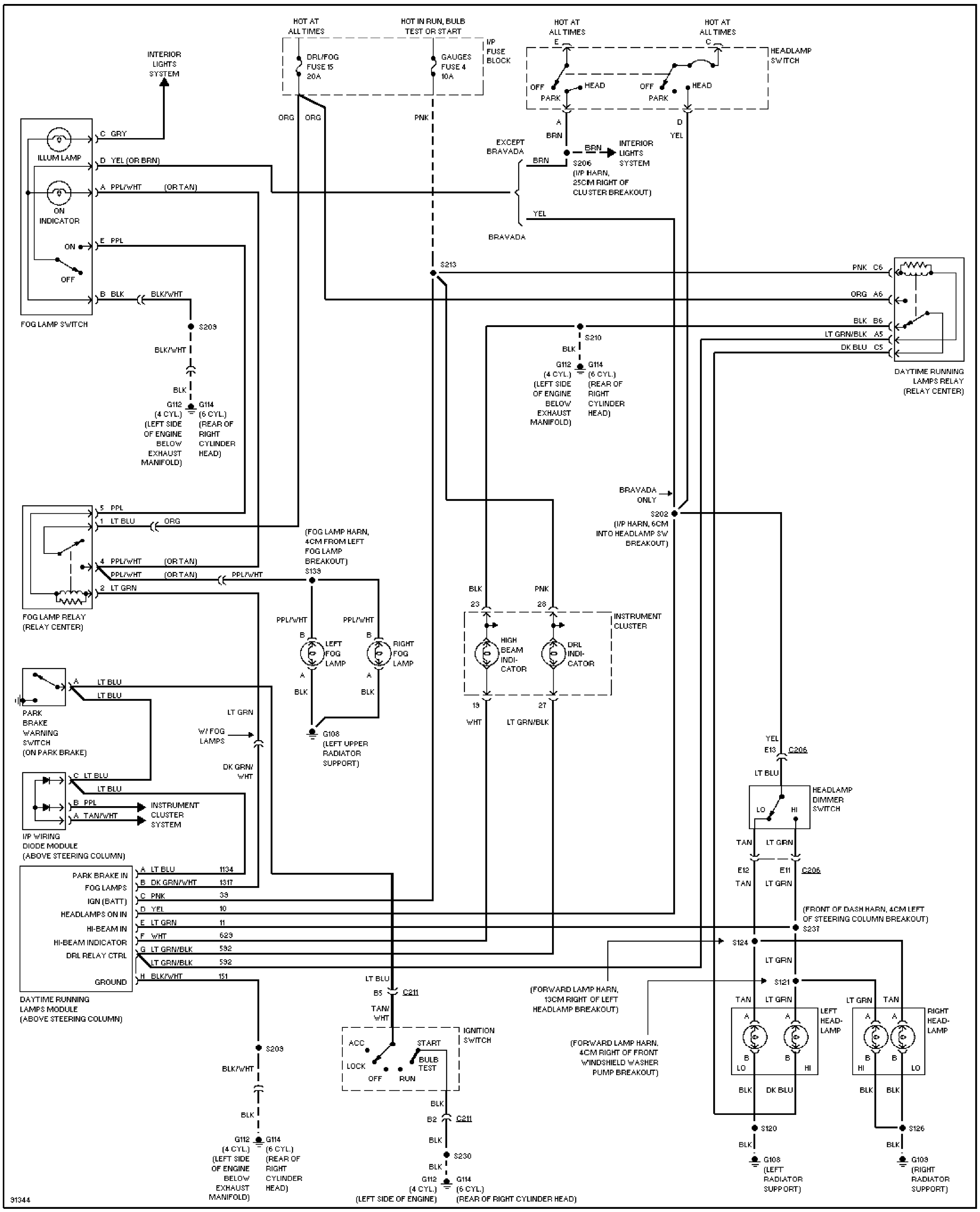


Ground Distribution Circuit (1 of 2)

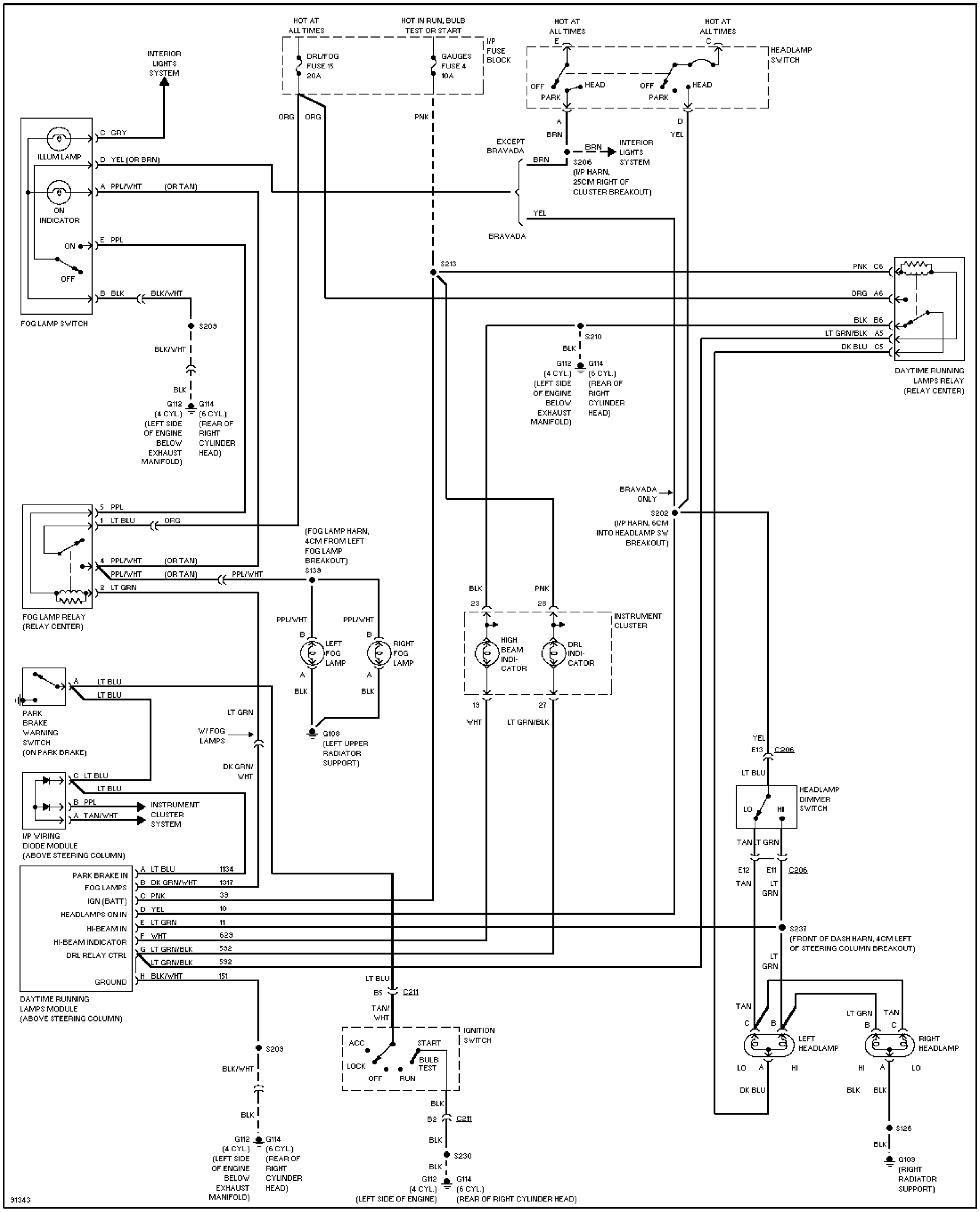


Ground Distribution Circuit (2 of 2)

HEADLIGHTS

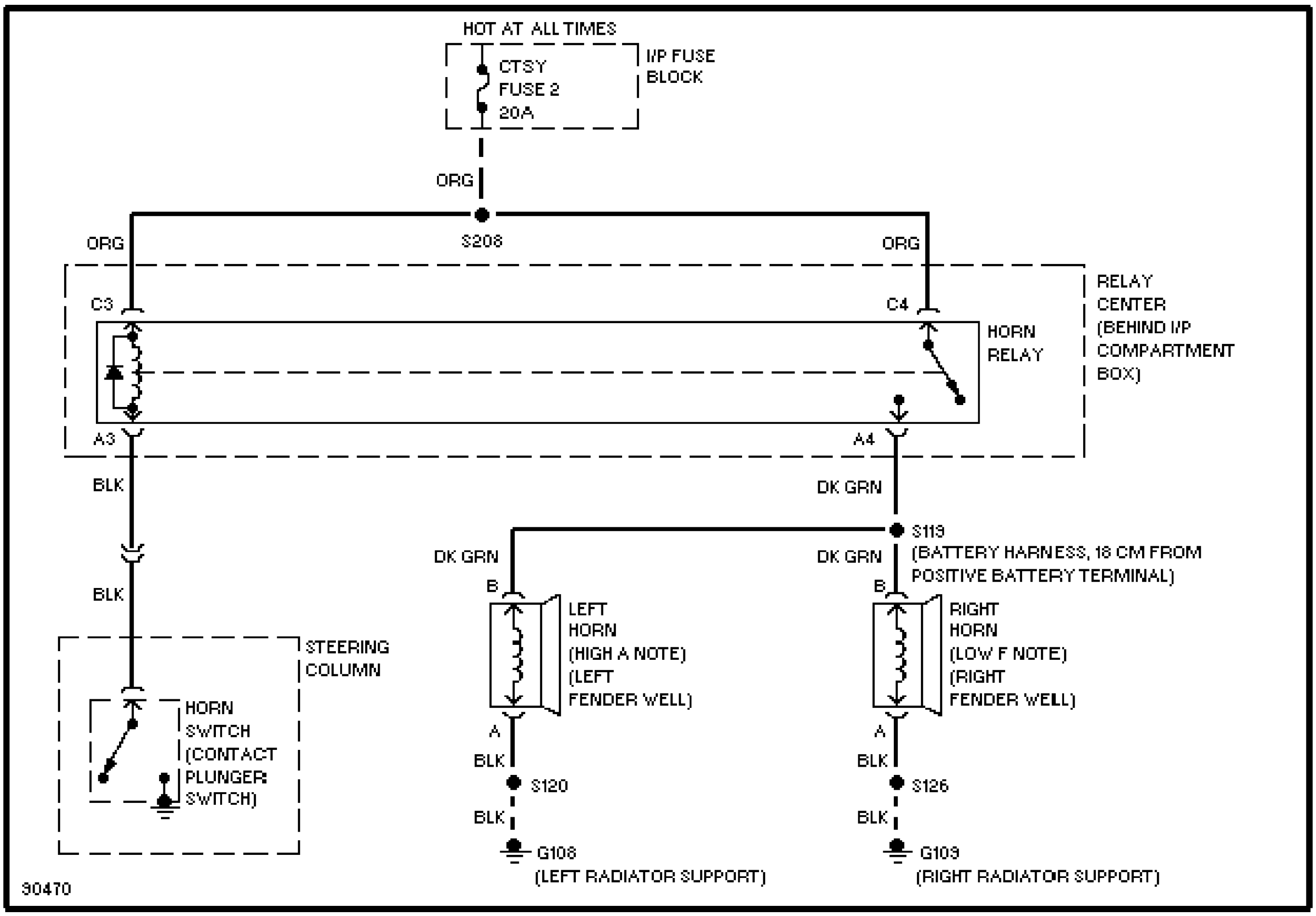


Headlight Circuit, W/ Composite Headlamps



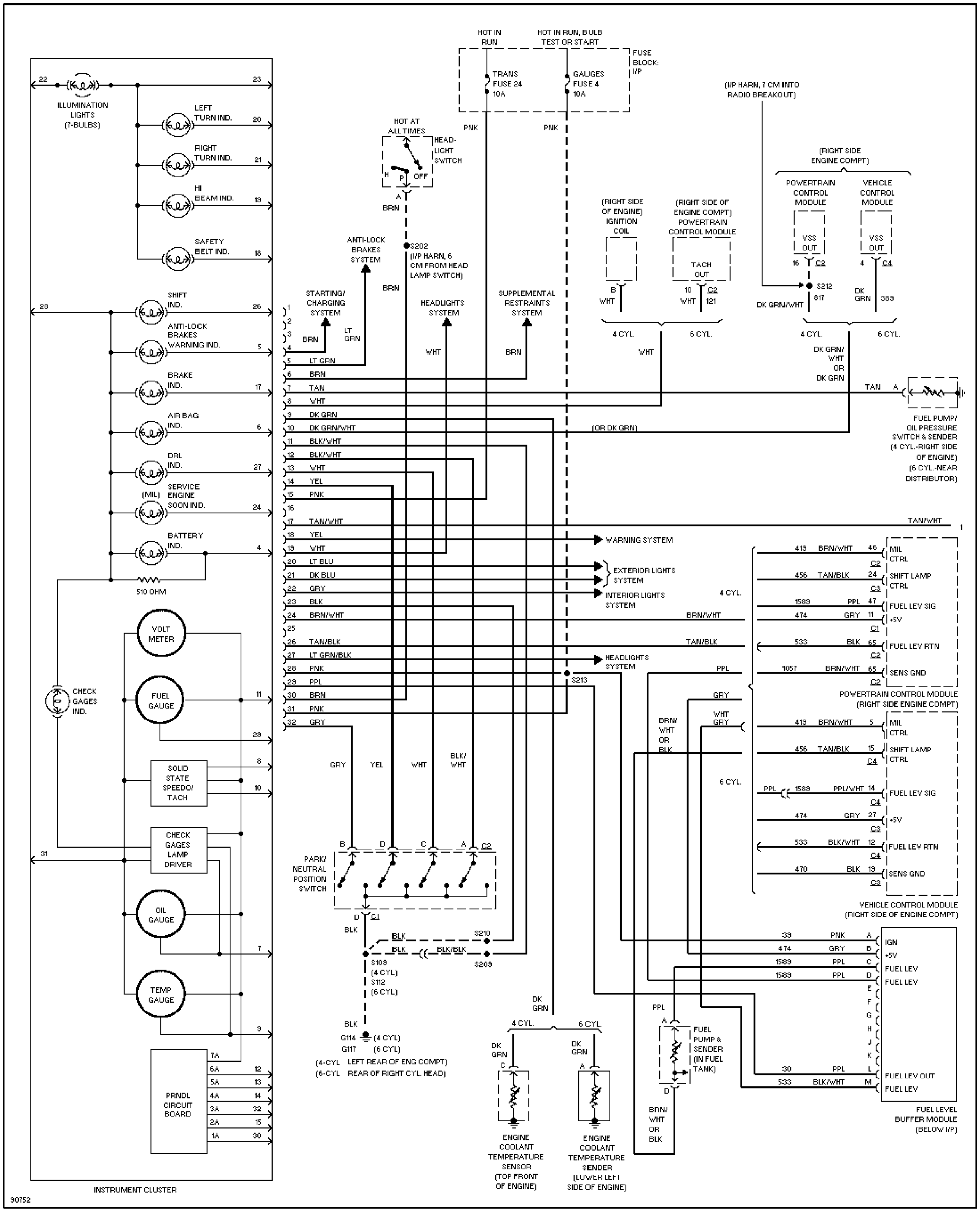
Headlight Circuit, W/ Sealed Beam Headlamps

HORN

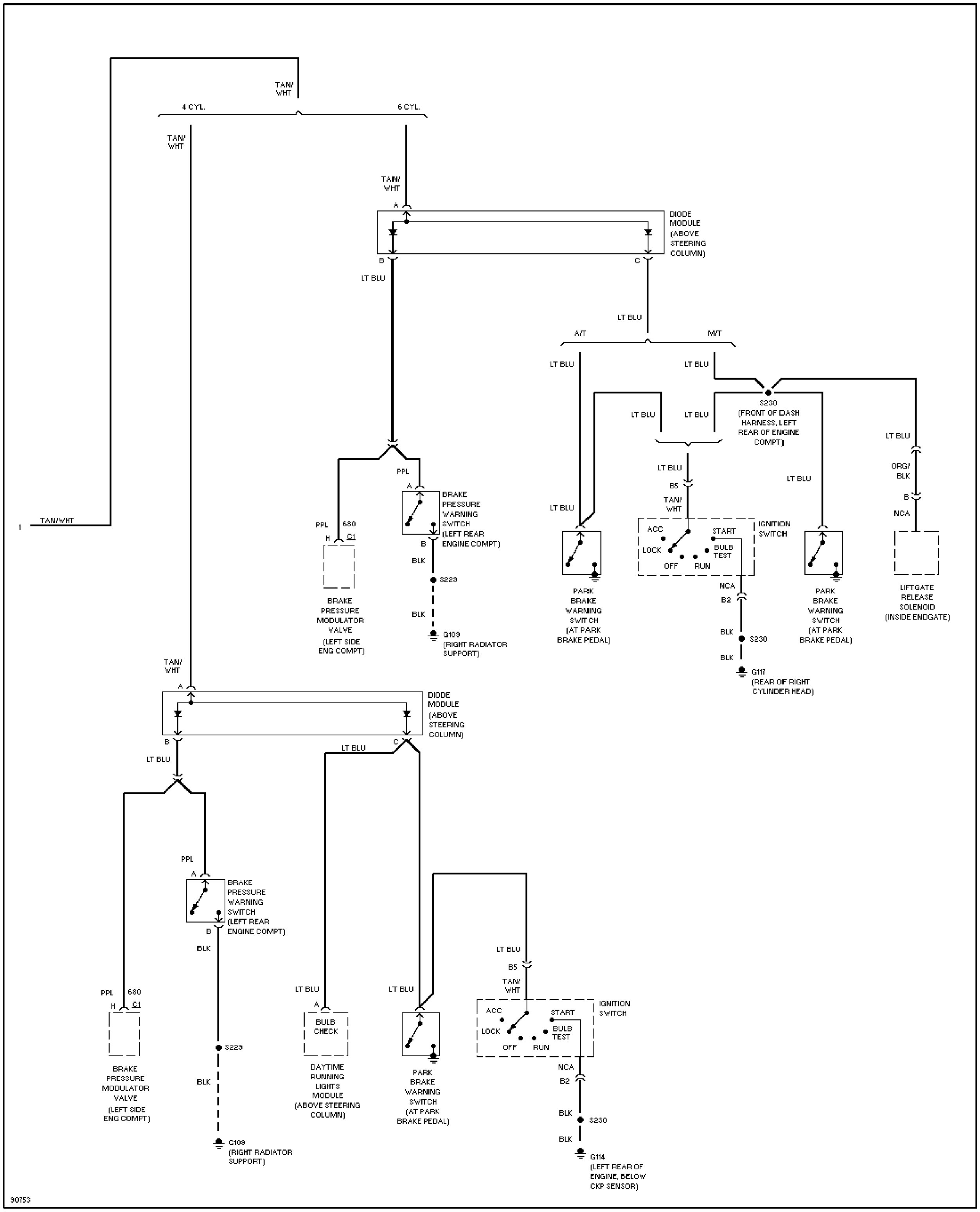


Horn Circuit

INSTRUMENT CLUSTER

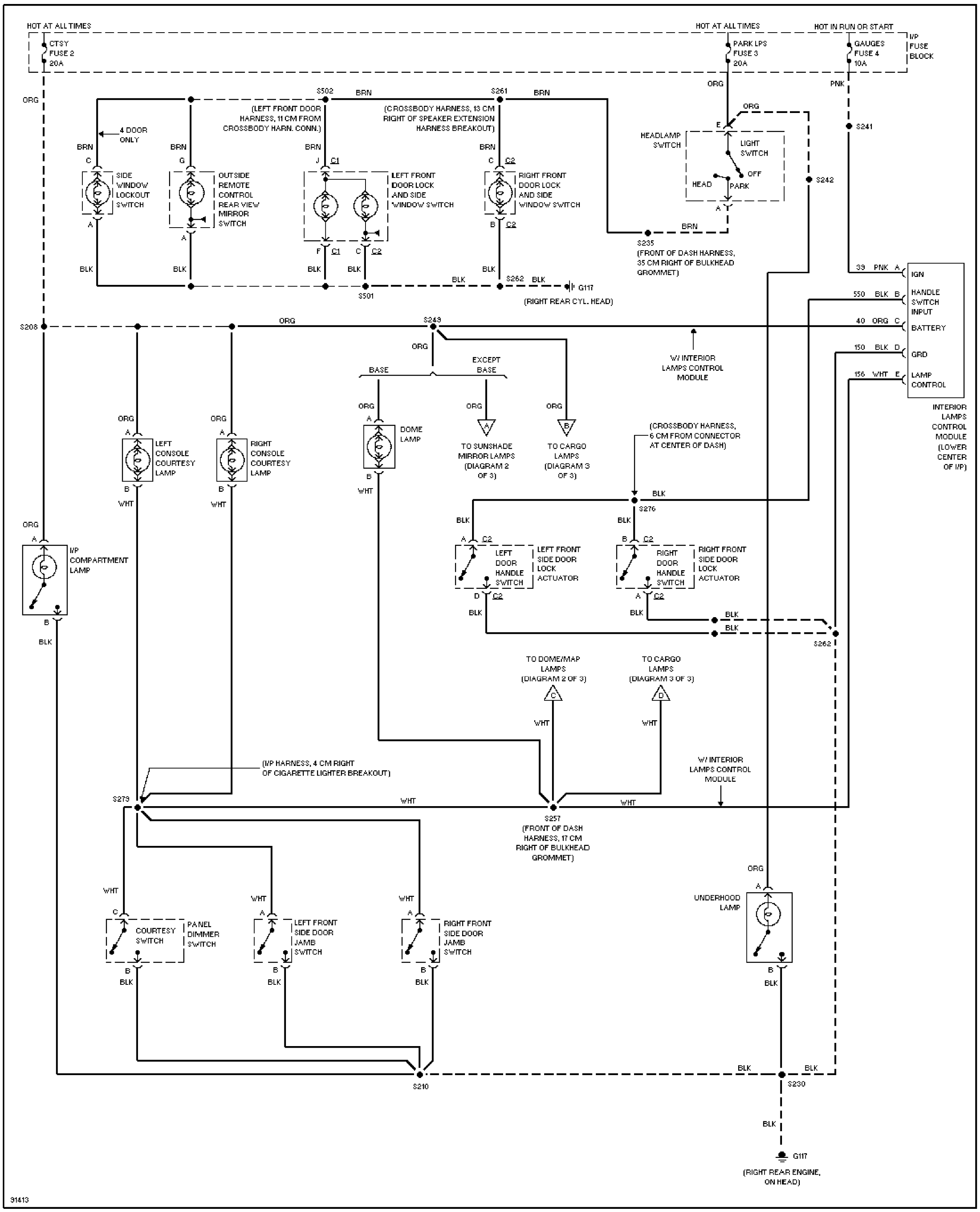


Instrument Cluster Circuit (1 of 2)

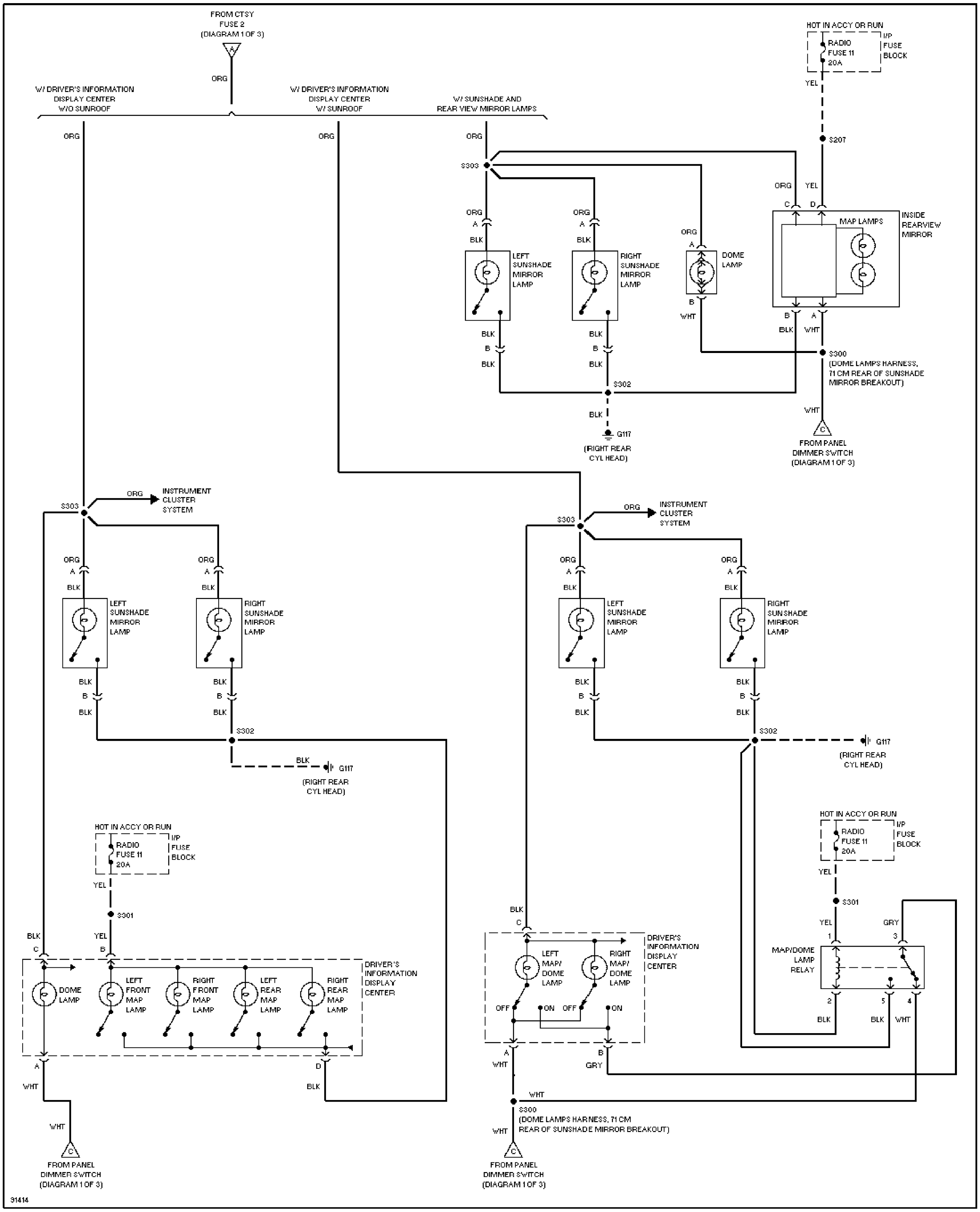


Instrument Cluster Circuit (2 of 2)

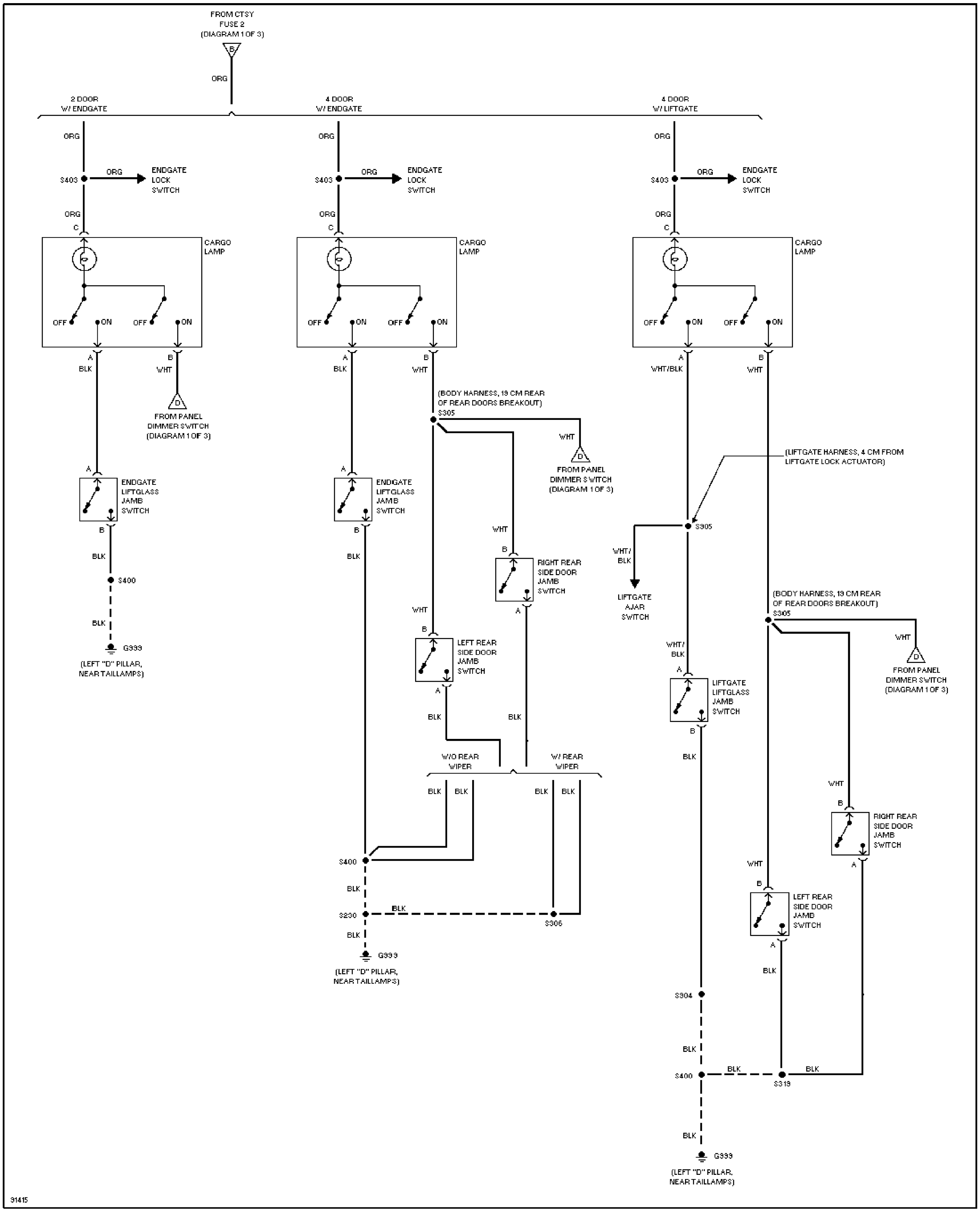
INTERIOR LIGHTS



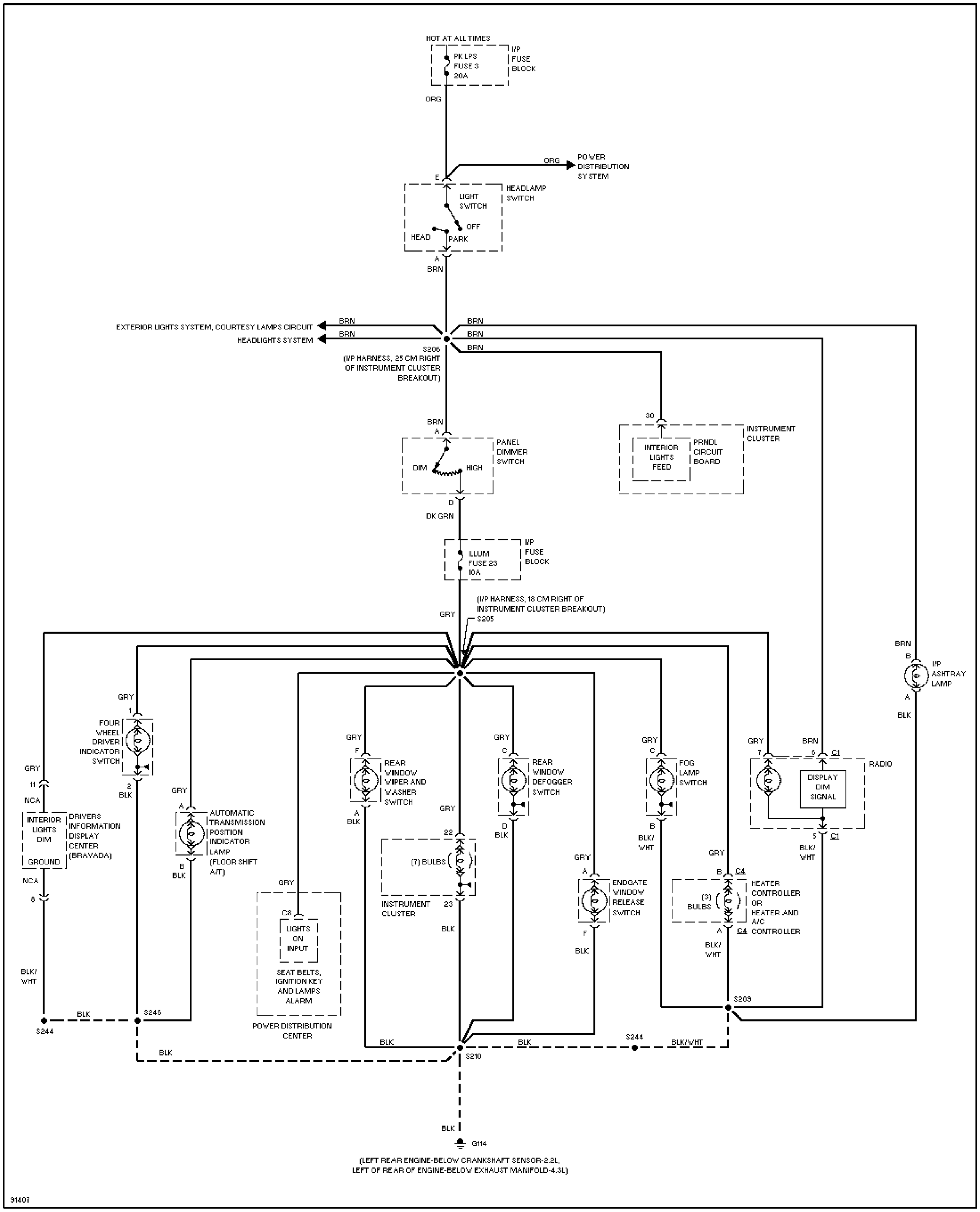
Courtesy Lamps Circuit (1 of 3)



Courtesy Lamps Circuit (2 of 3)

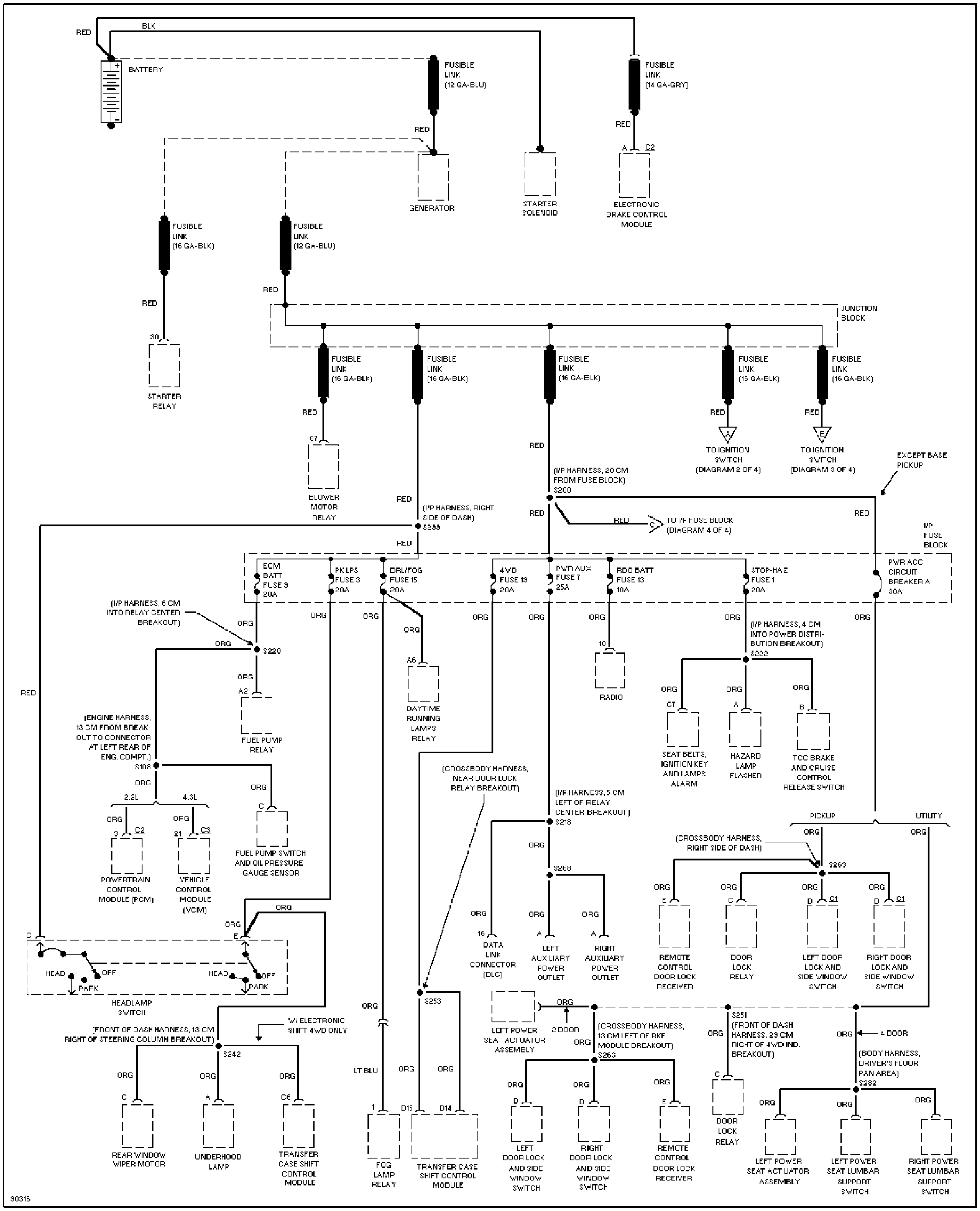


Courtesy Lamps Circuit (3 of 3)

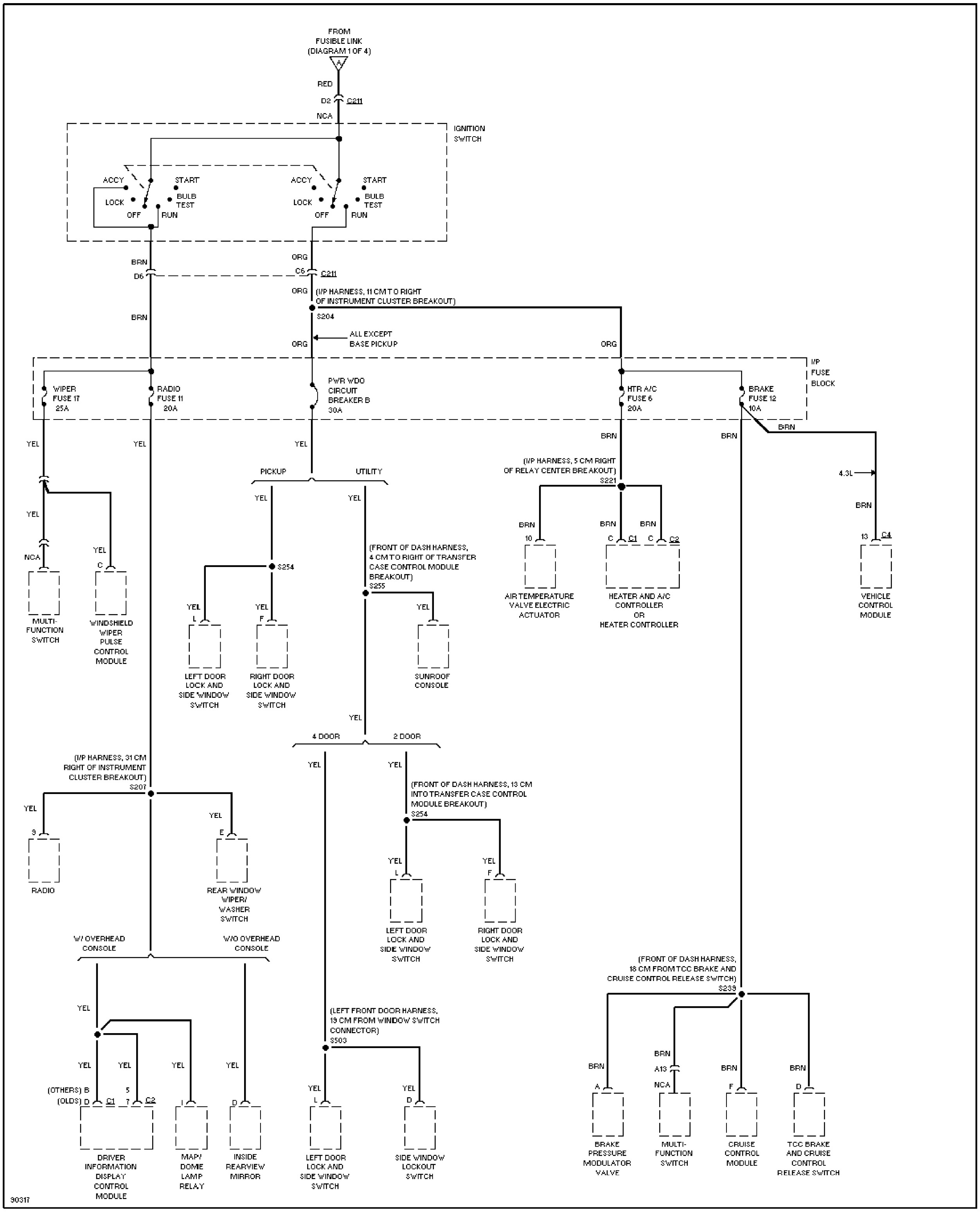


Instrument Illumination Circuit

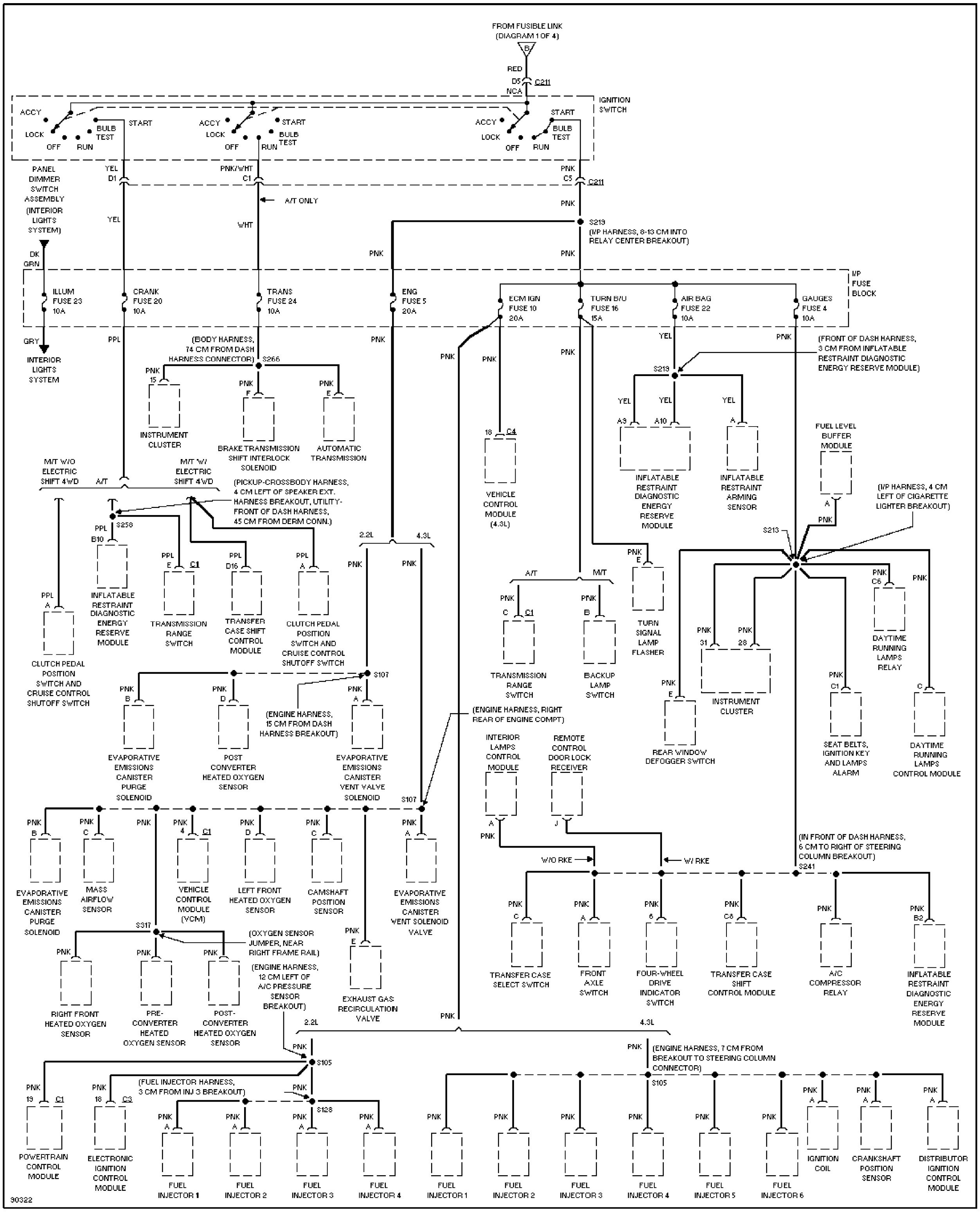
POWER DISTRIBUTION



Power Distribution Circuit (1 of 4)



Power Distribution Circuit (2 of 4)



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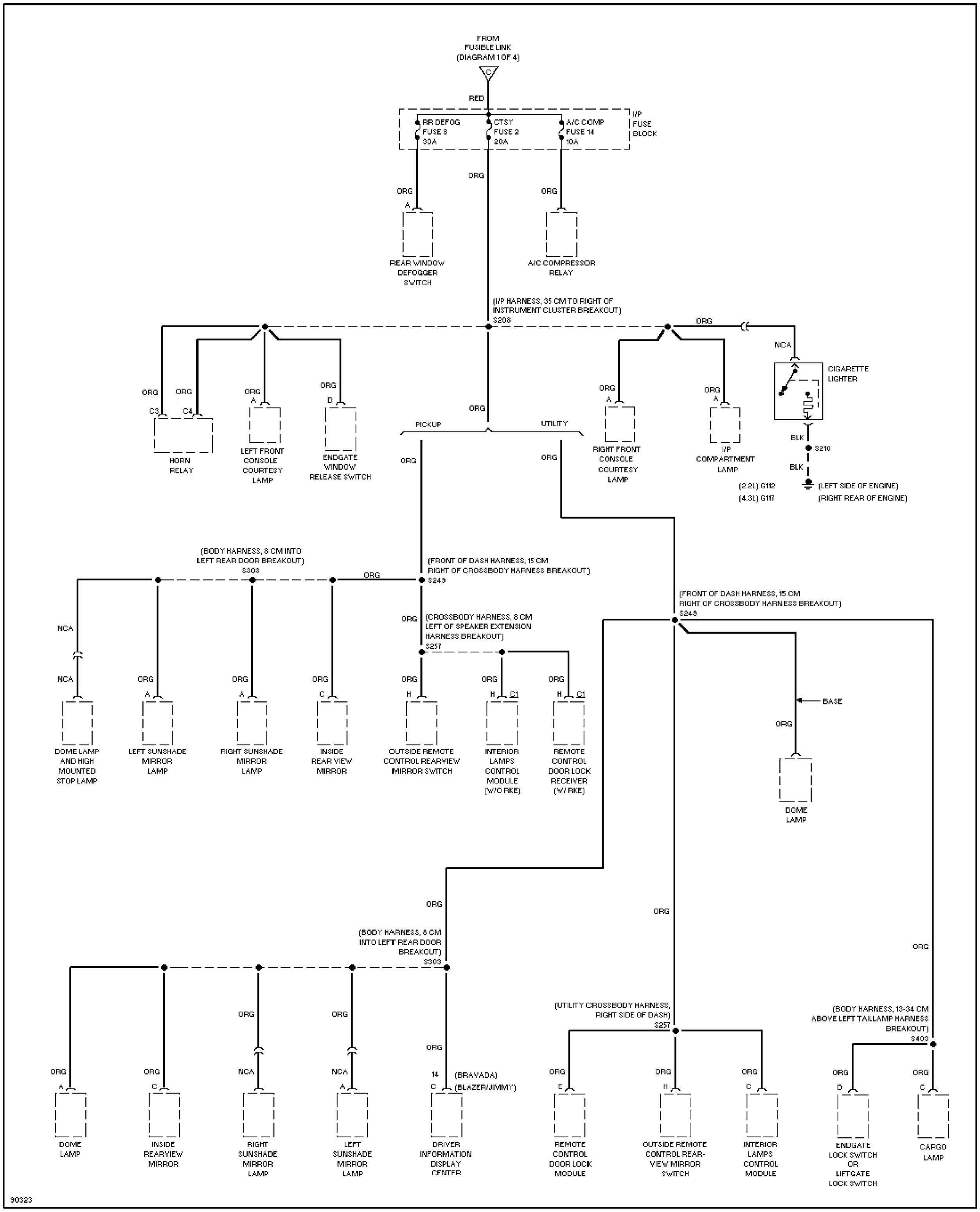
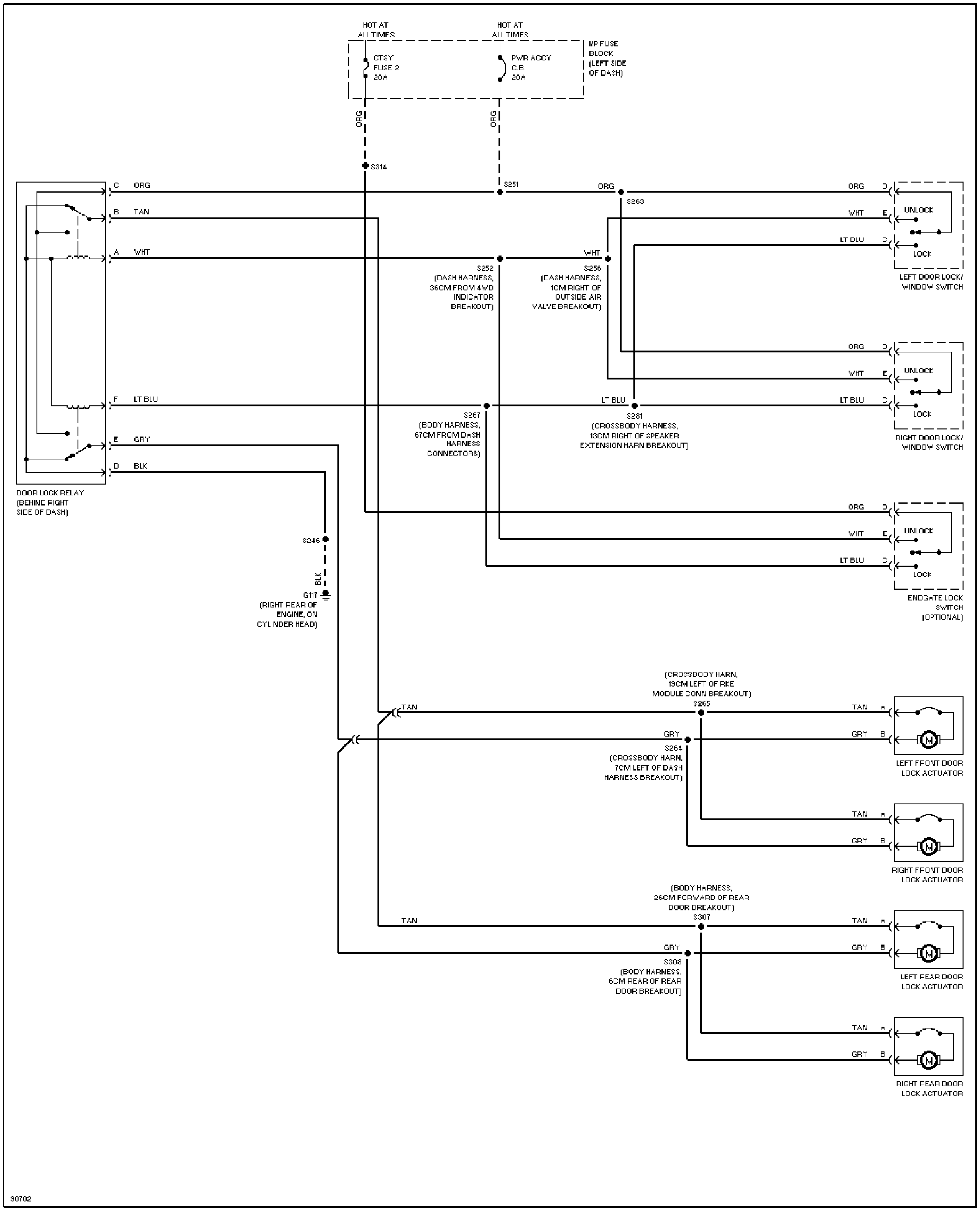
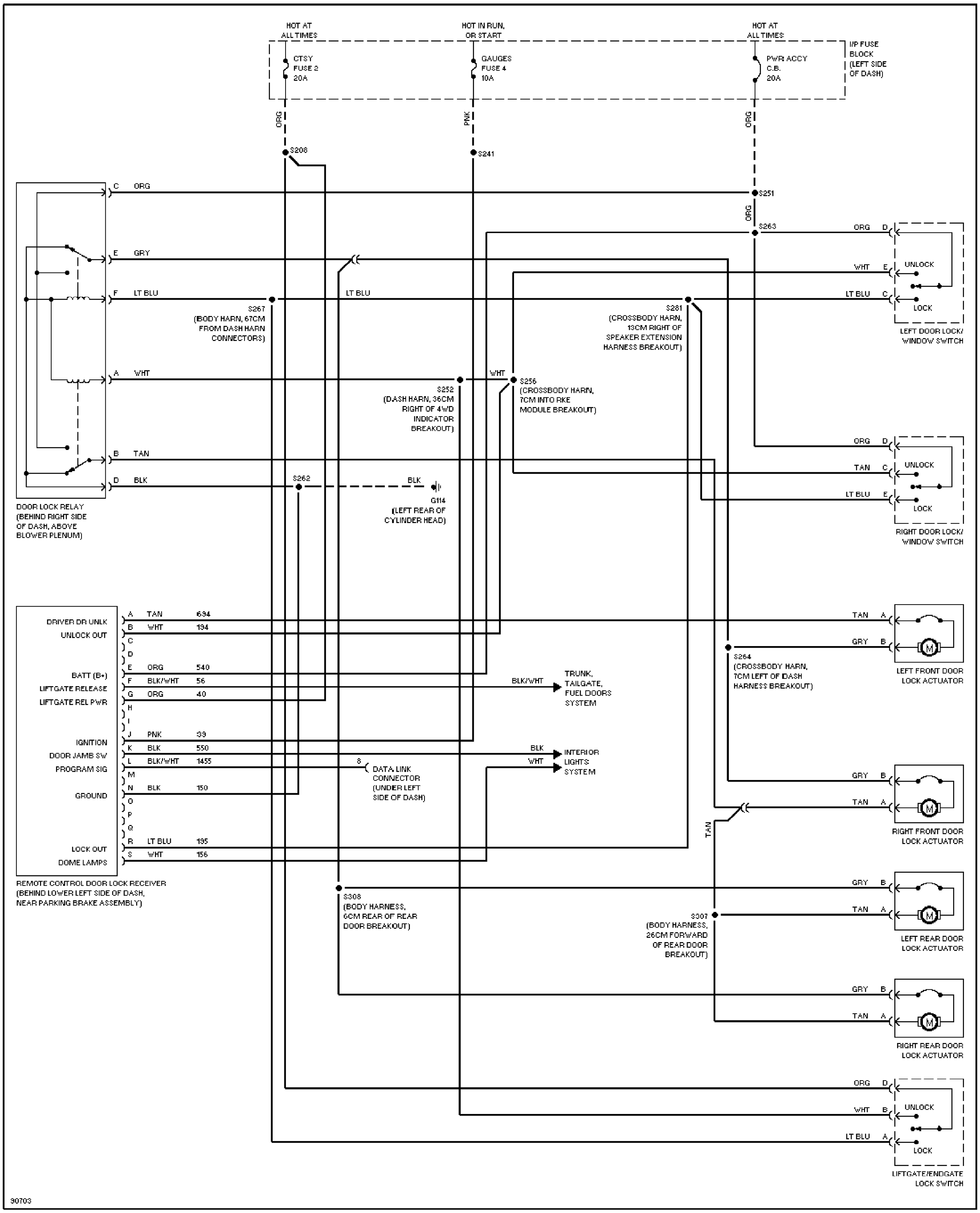


Power Distribution Circuit (4 of 4)

POWER DOOR LOCKS

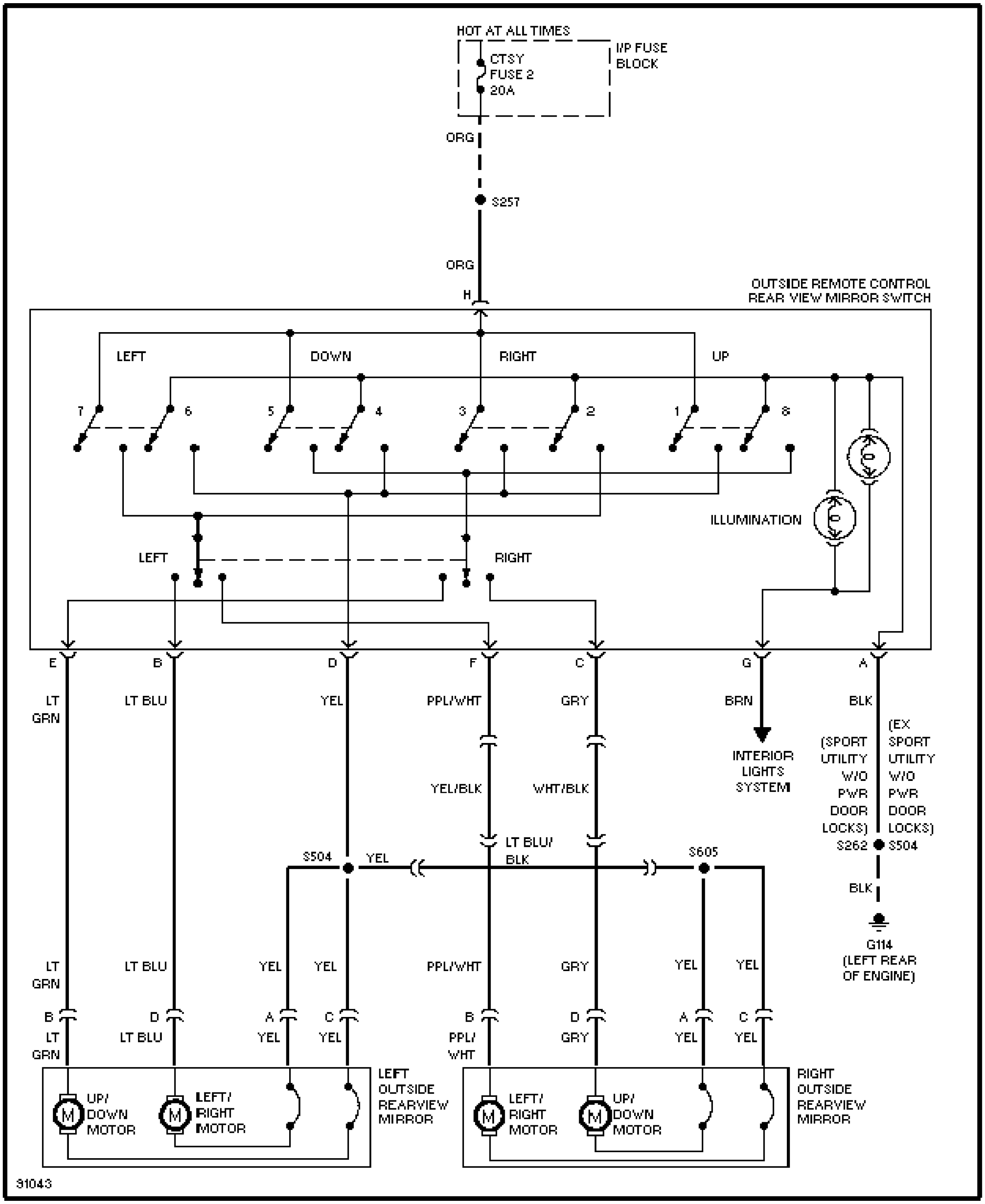


Door Lock Circuit



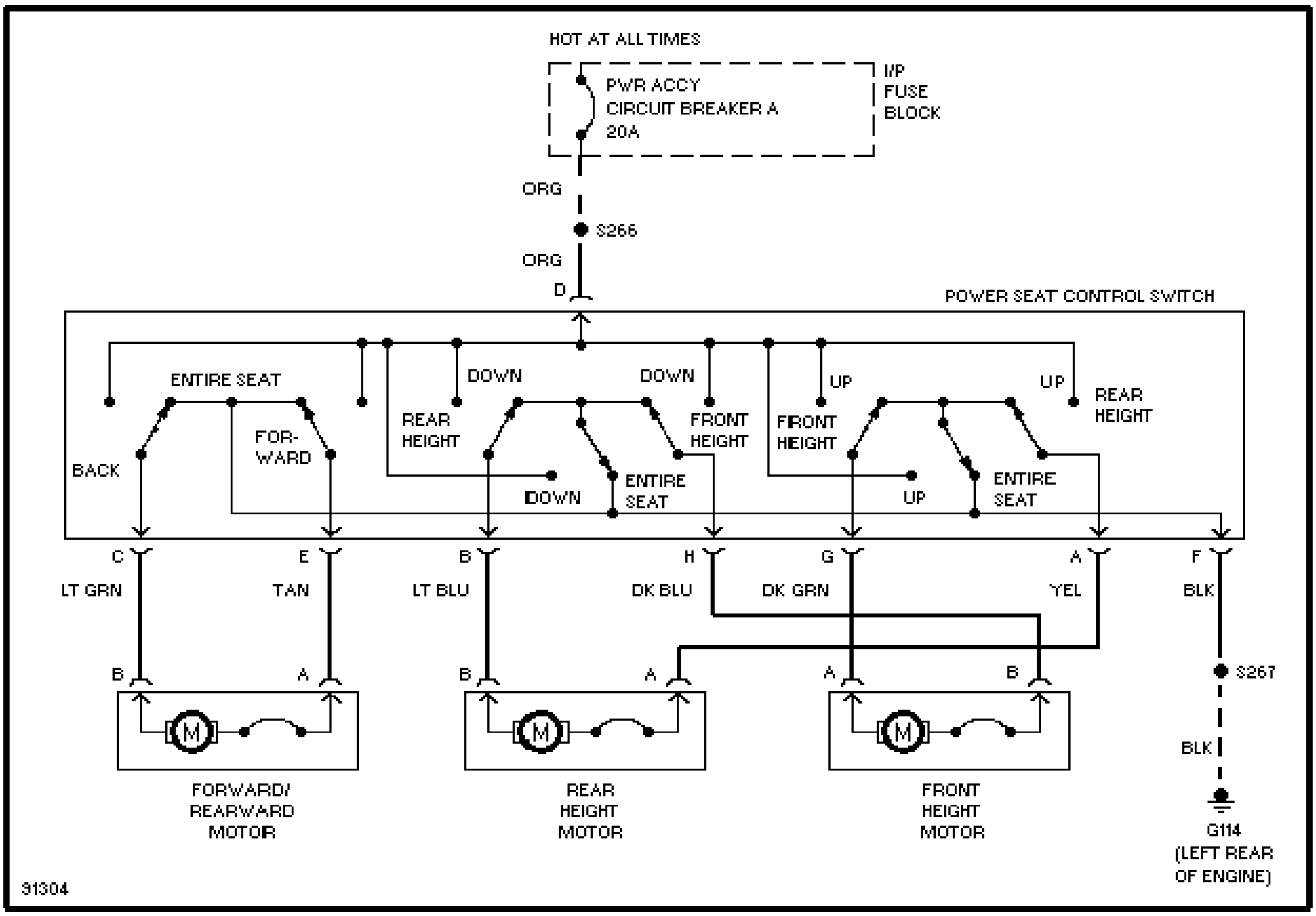
Keyless Entry Circuit

POWER MIRRORS

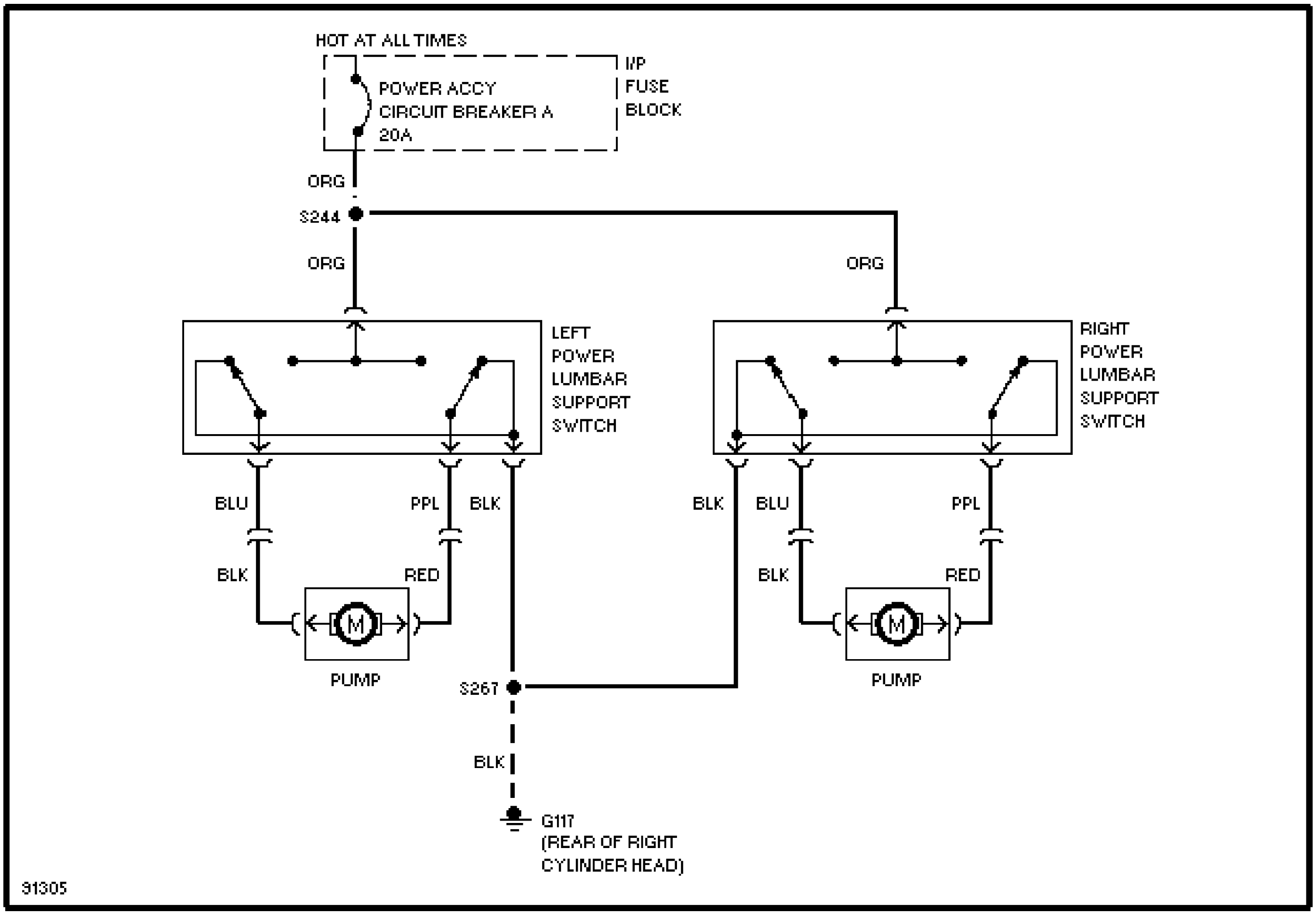


Power Mirror Circuit

POWER SEATS

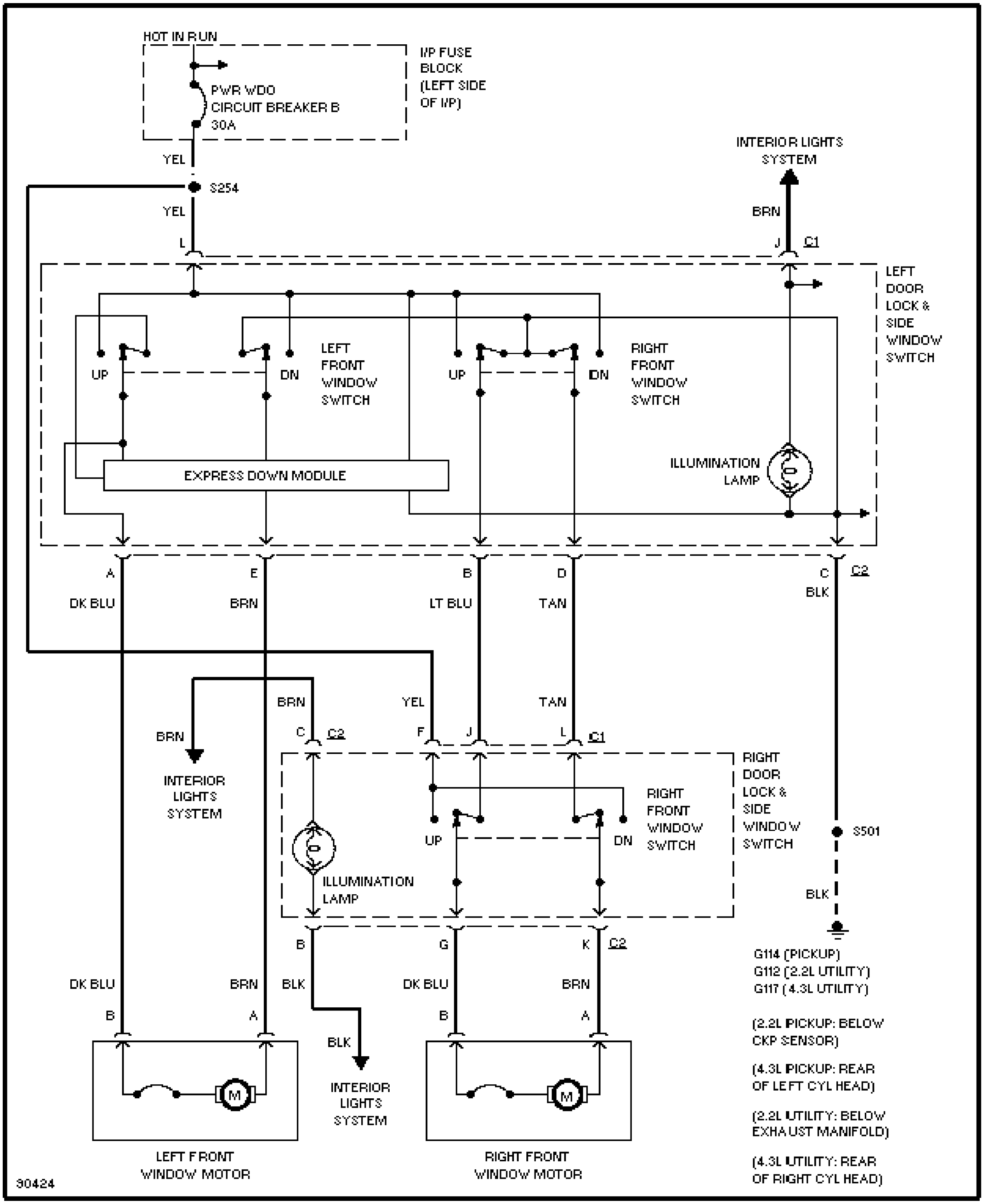


6-Way Power Seat Circuit

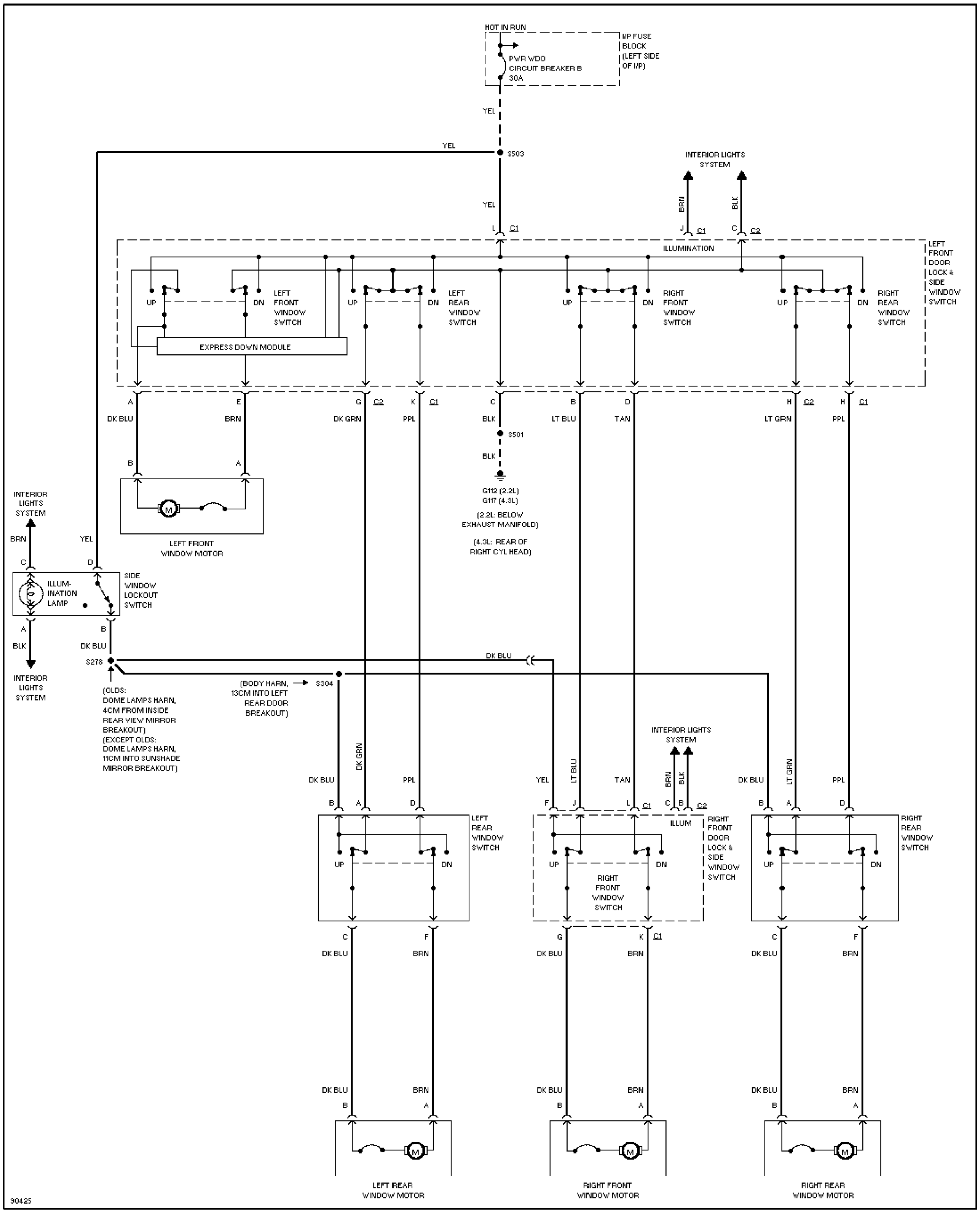


Lumbar Circuit

POWER WINDOWS

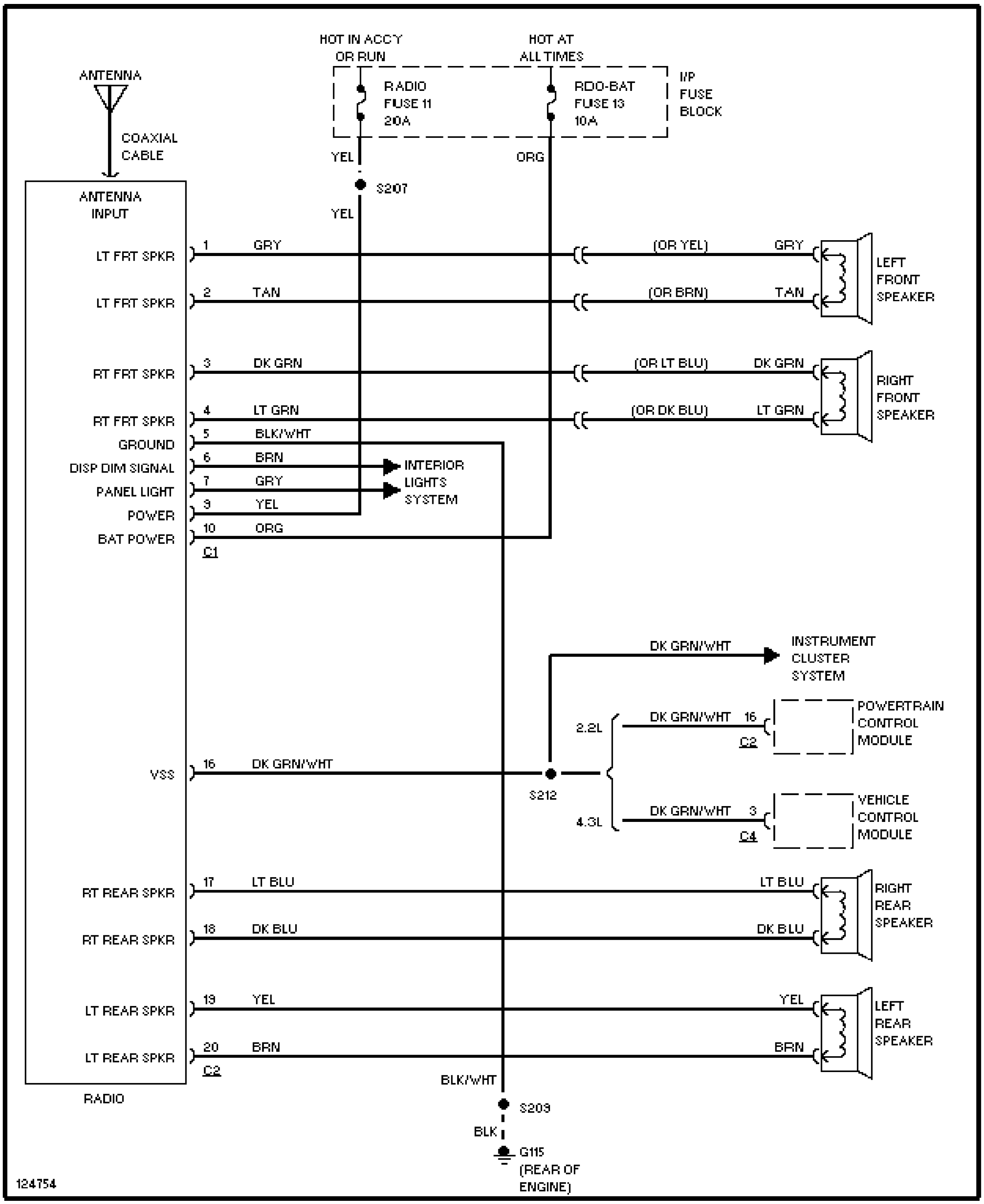


Power Window Circuit, 2 Door

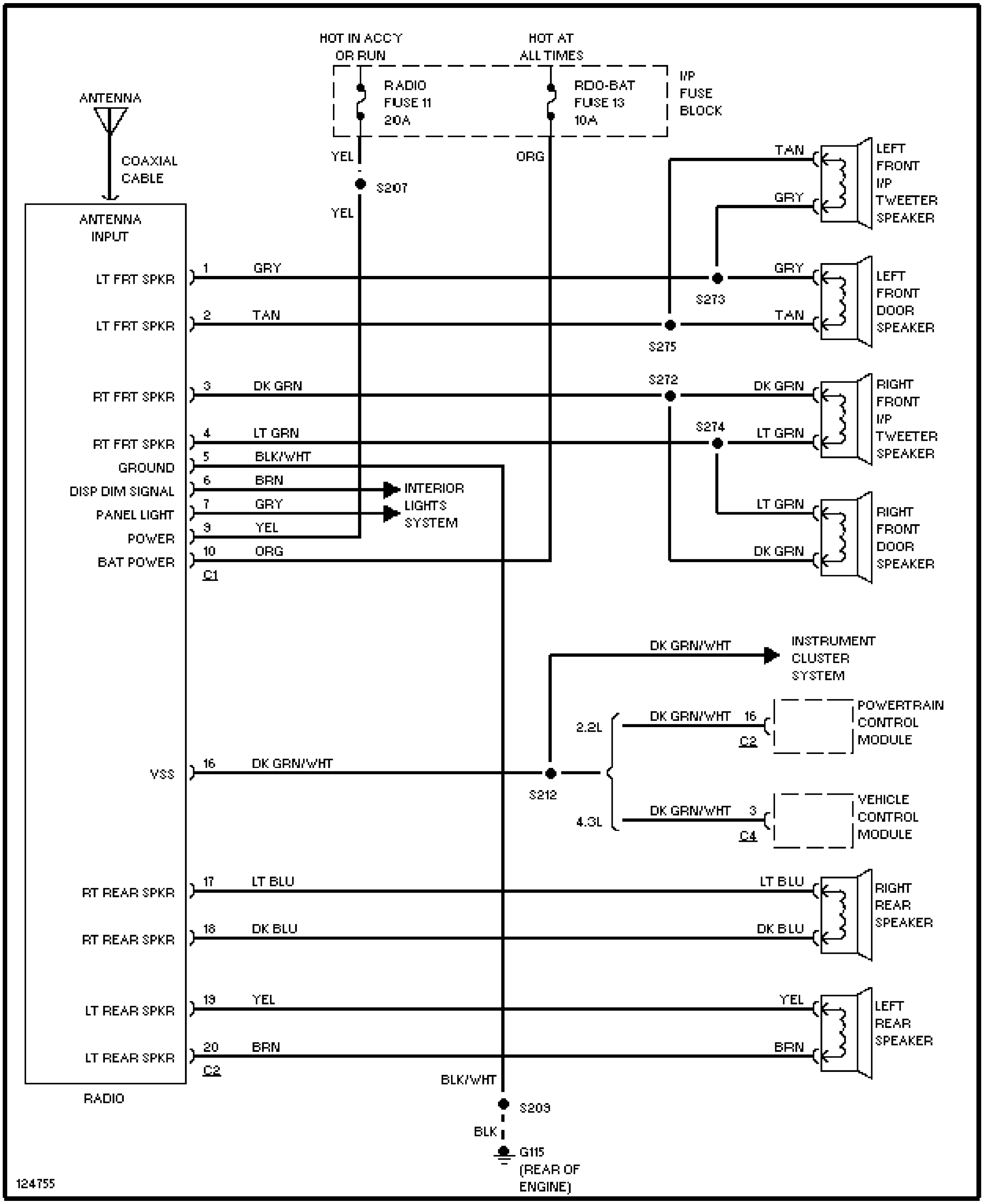


Power Window Circuit, 4 Door

RADIO

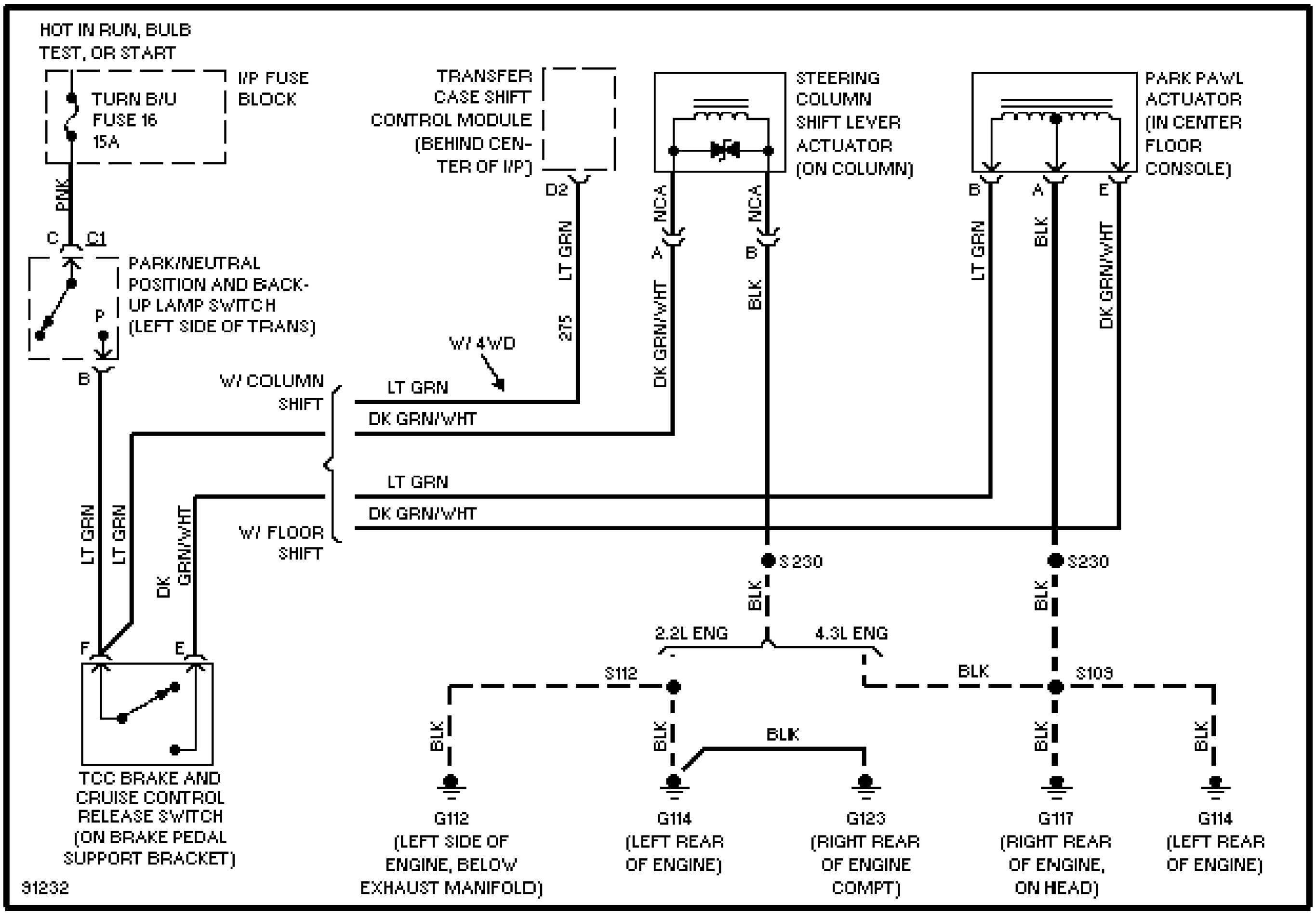


4-Speaker System Circuit



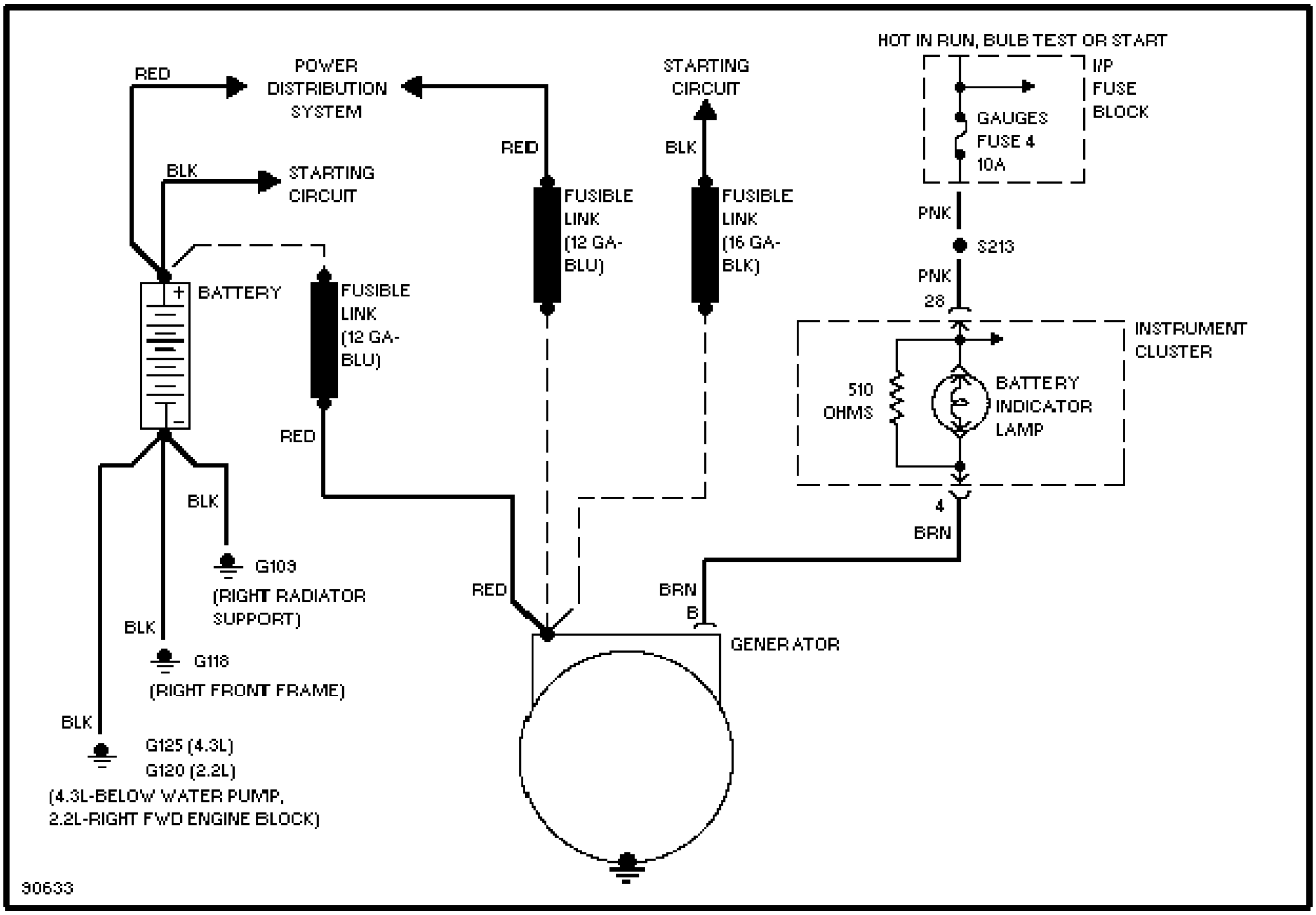
6-Speaker System Circuit

SHIFT INTERLOCKS

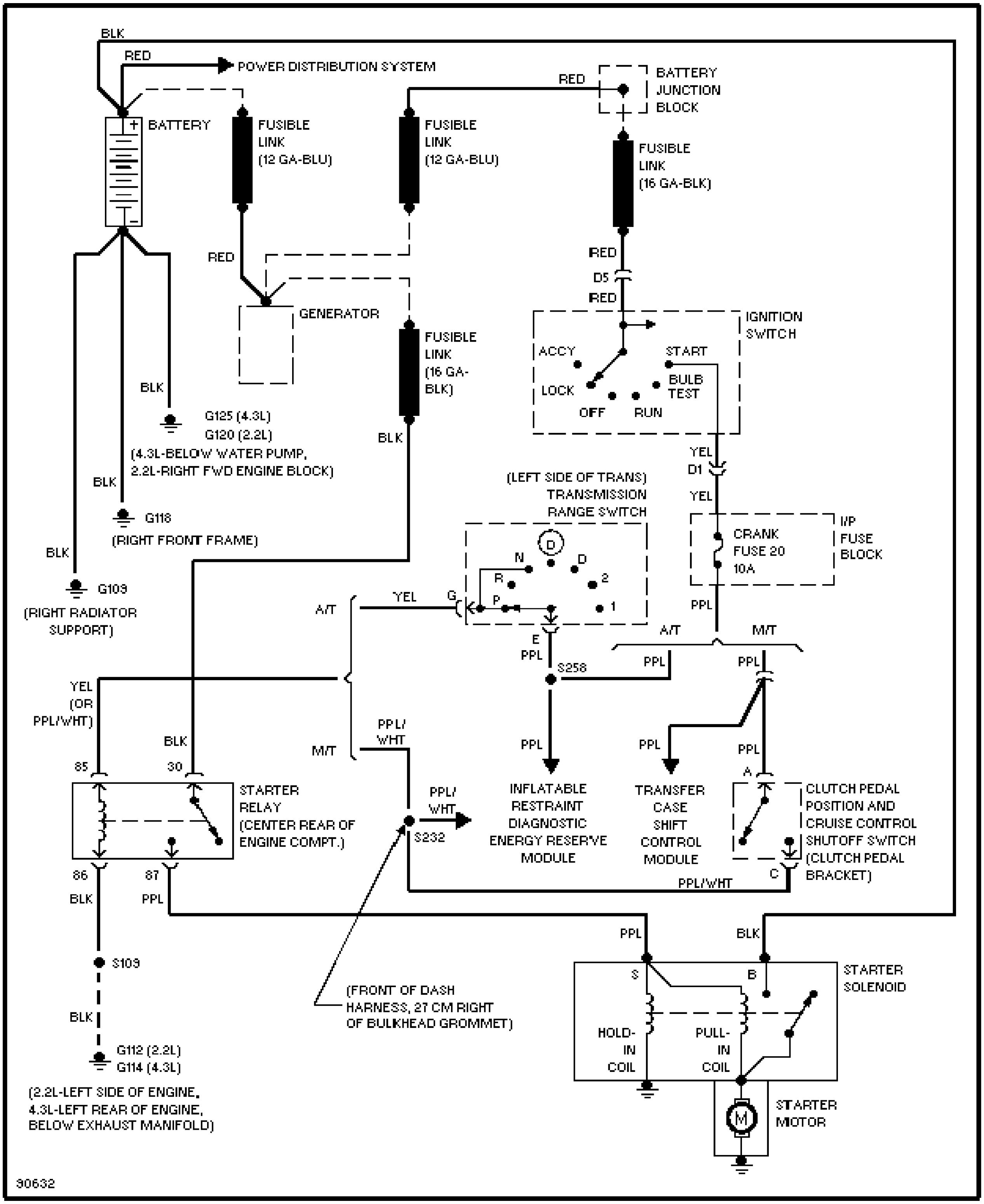


Shift Interlock Circuit

STARTING/CHARGING

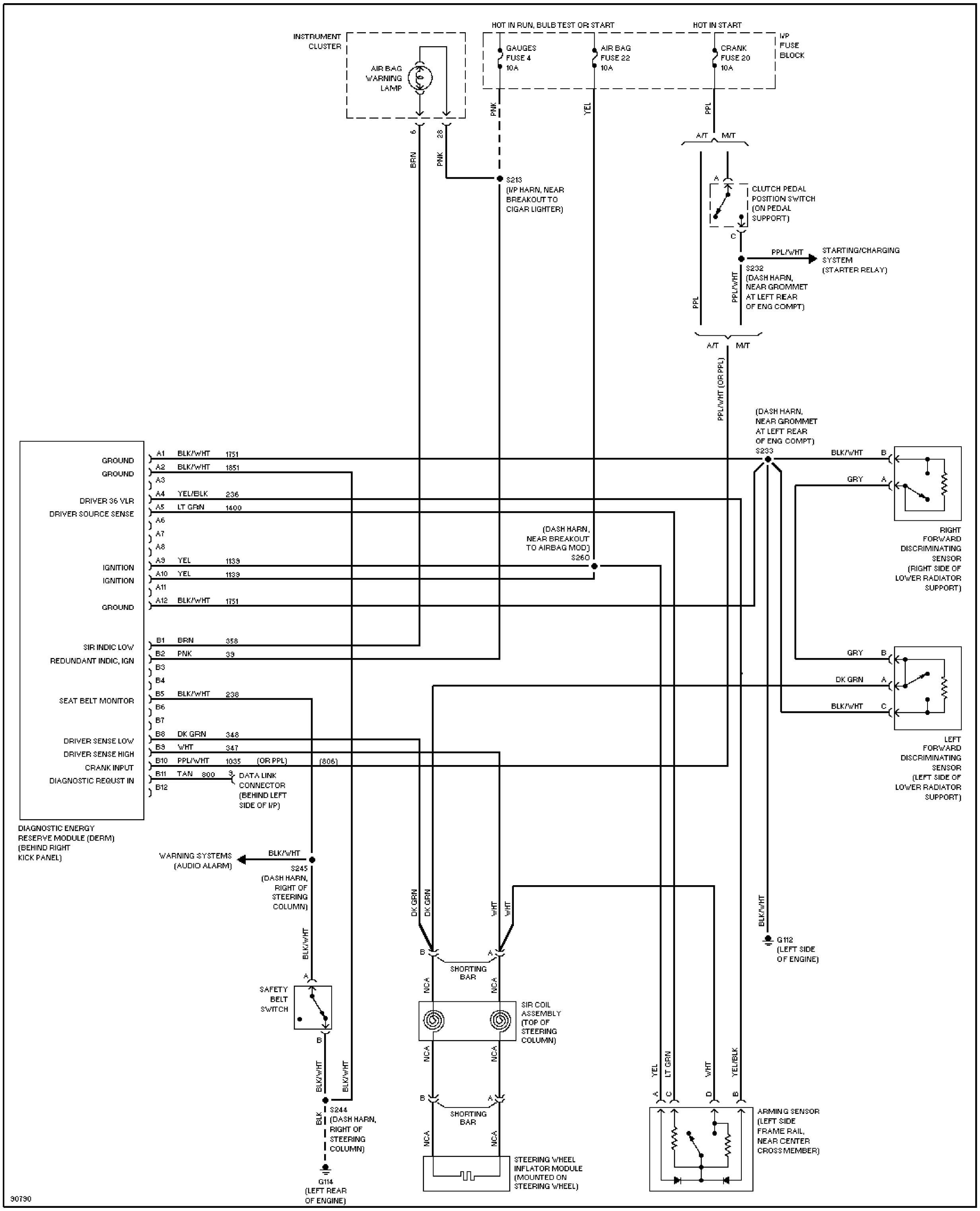


Charging Circuit



Starting Circuit

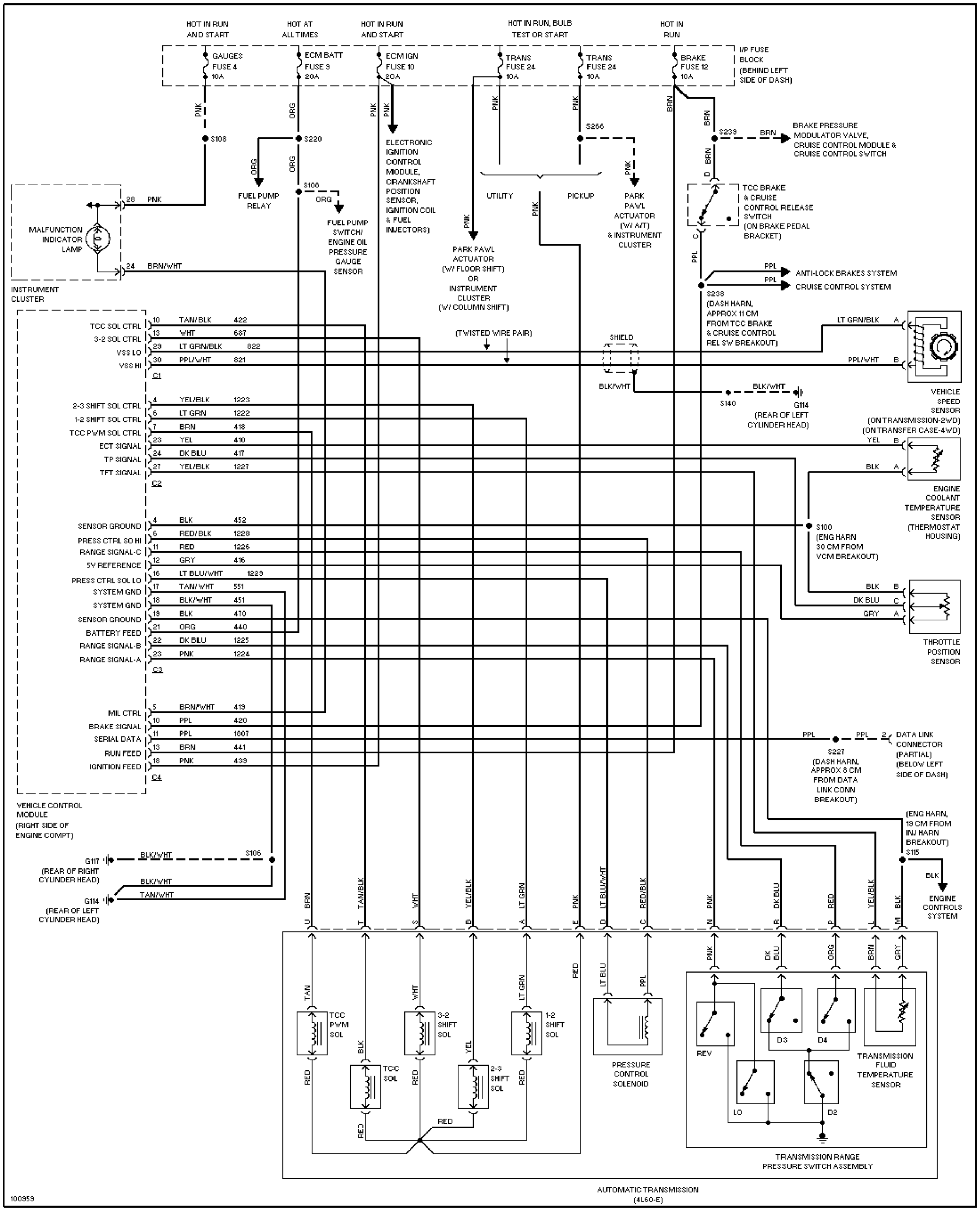
SUPPLEMENTAL RESTRAINTS



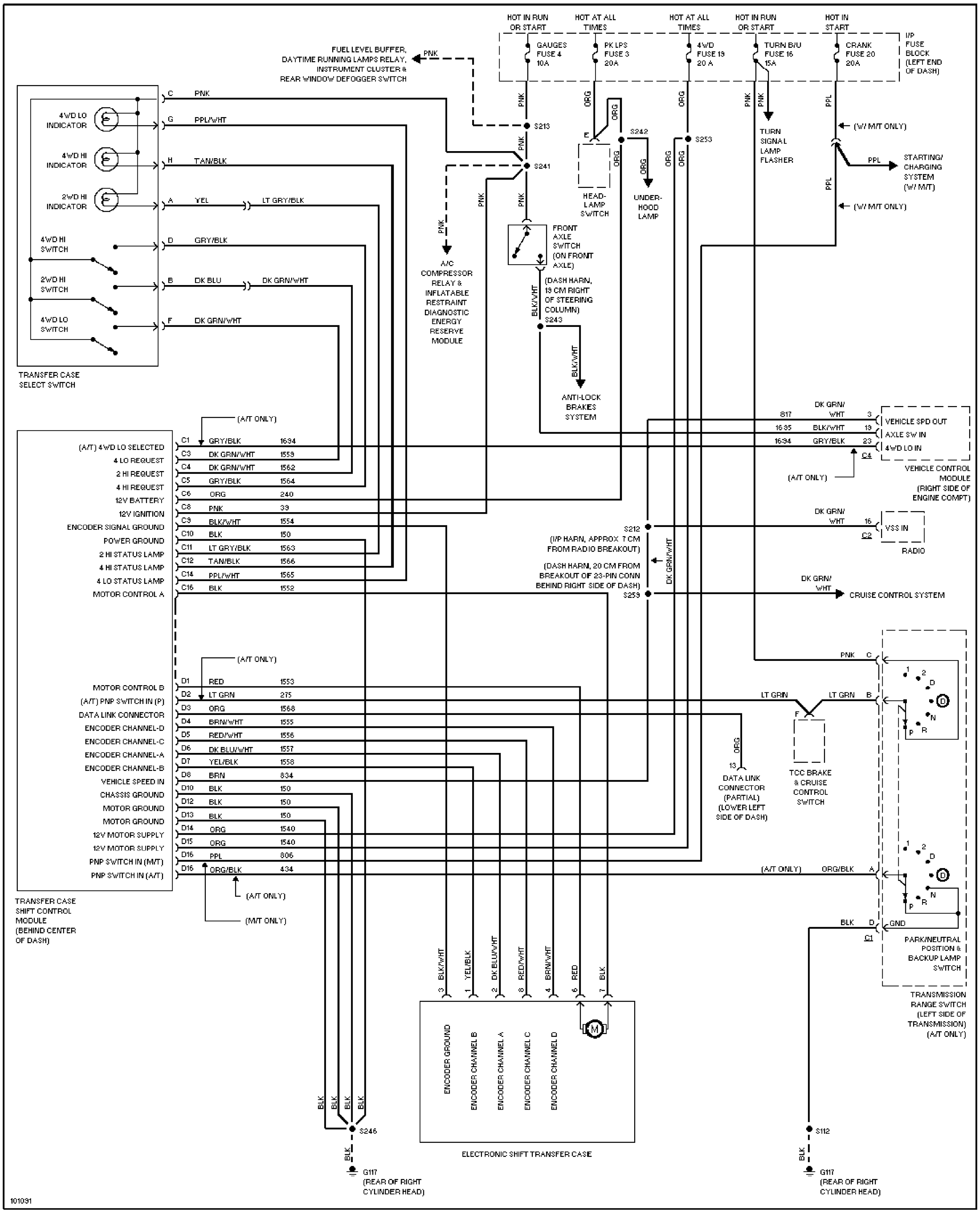
Supplemental Restraint Circuit

TRANSMISSION

4.3L

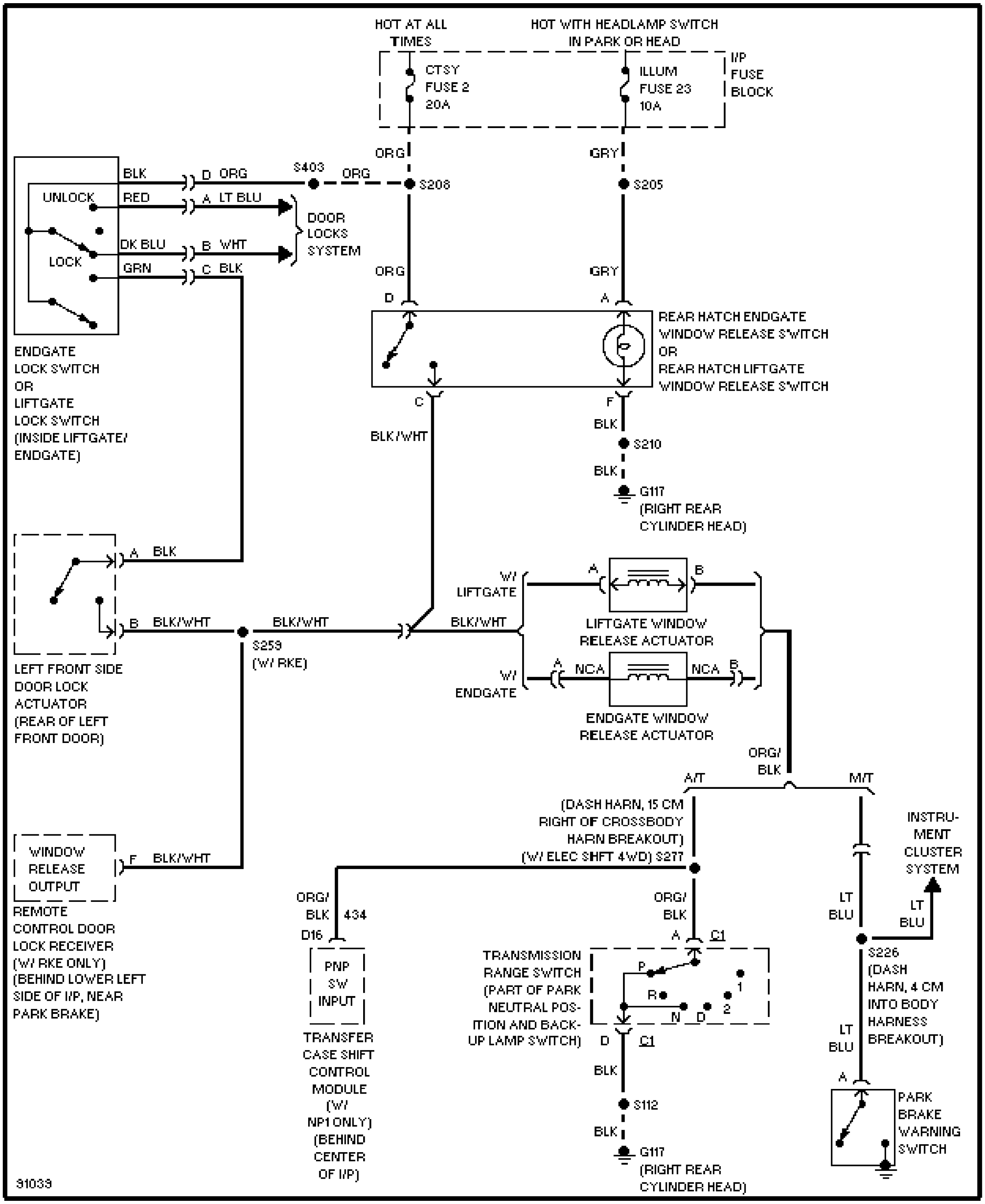


4.3L (VIN W), Transmission Circuit, 4L60-E



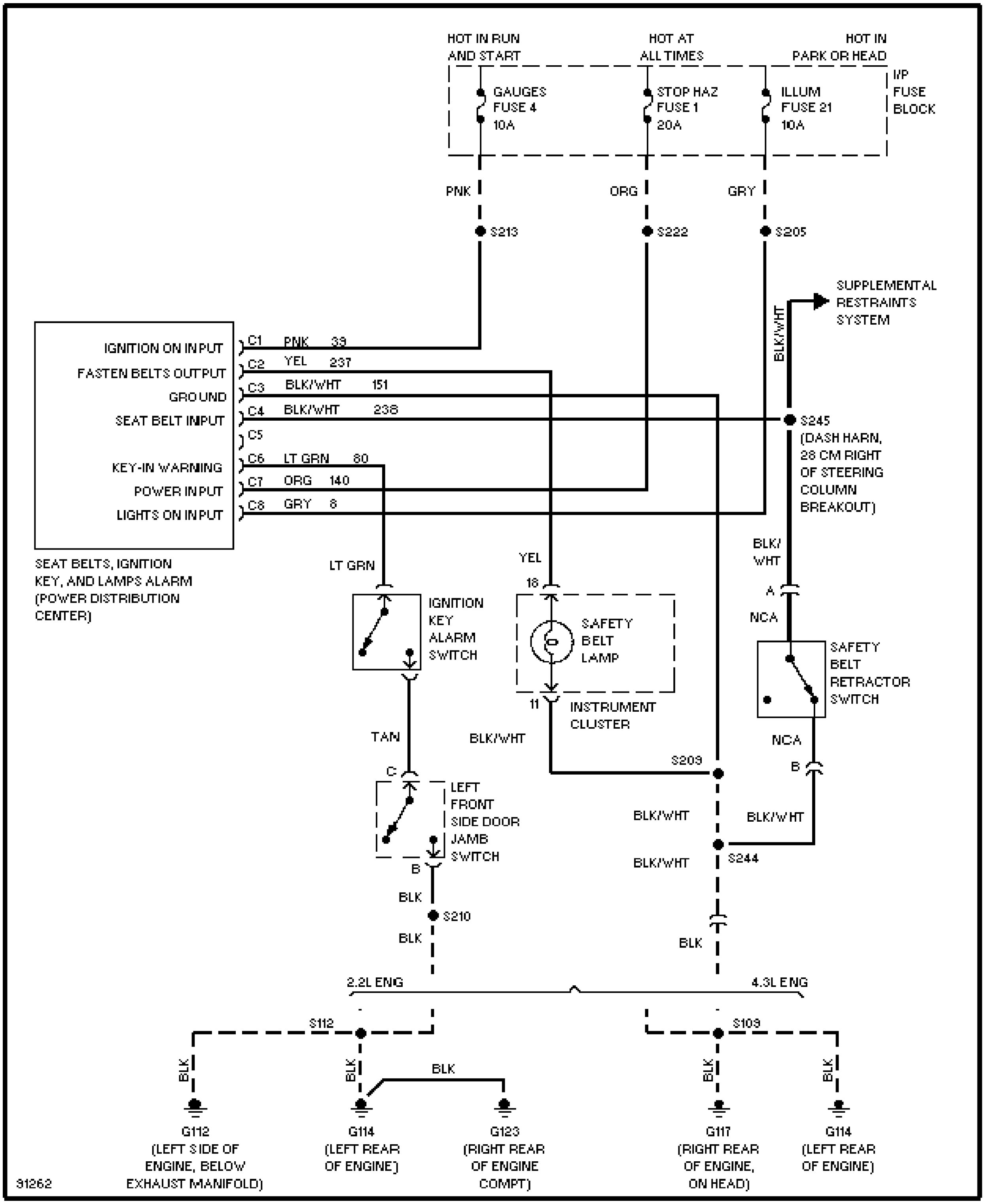
Electronic Transfer Case Circuit

TRUNK, TAILGATE, FUEL DOOR



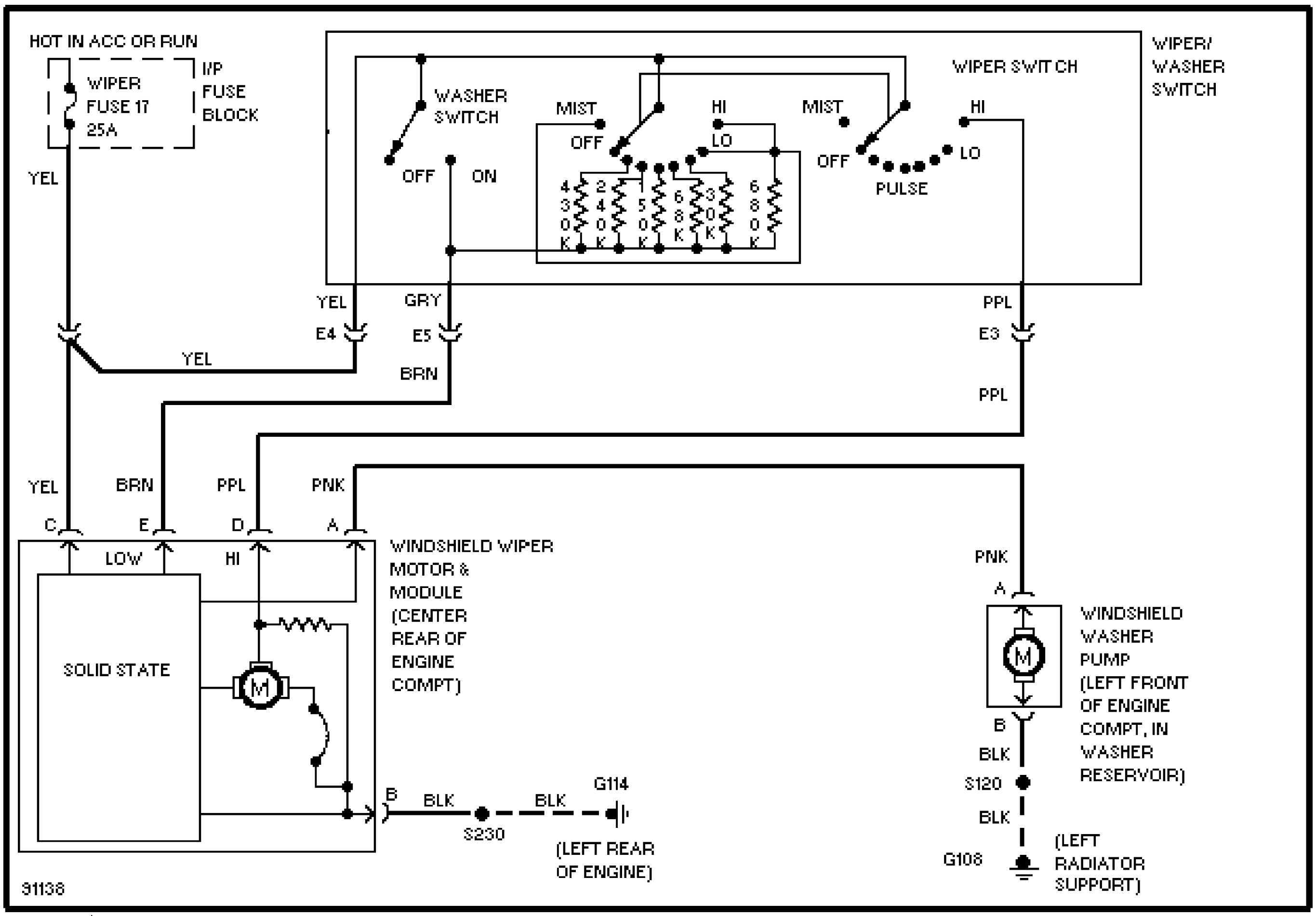
Rear Glass Release Circuit

WARNING SYSTEMS

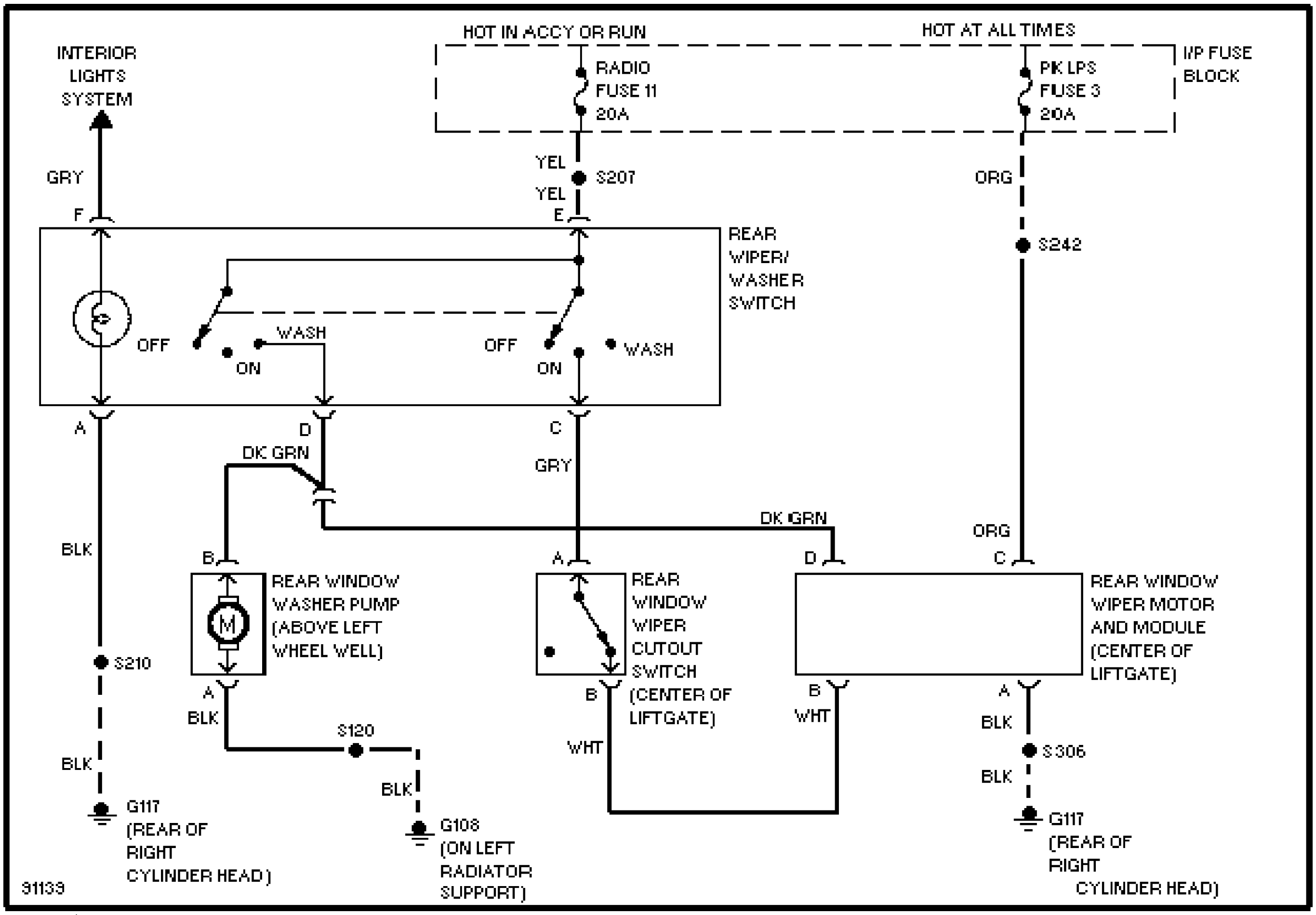


Warning System Circuits

WIPER/WASHER



Front Wiper/Washer Circuit



Rear Wiper/Washer Circuit

1997 ENGINE PERFORMANCE
General Motors - Self-Diagnostics - 4.3L

Chevrolet; Blazer, S10 Pickup
GMC; Jimmy, Sonoma
Oldsmobile; Bravada

INTRODUCTION

Most engine control problems are the result of mechanical breakdowns, poor electrical connections or damaged vacuum hoses. Before considering the computer system as a possible cause of problems, perform checks and inspections covered in the F - BASIC TESTING - 4.3L article. Failure to do so may result in lost diagnostic time.

If no faults found performing procedures in the F - BASIC TESTING - 4.3L article, proceed with DIAGNOSTIC PROCEDURE under SELF-DIAGNOSTIC SYSTEM. If no fault codes are present and driveability problems exist, proceed to the H - TESTS W/O CODES article for diagnosis by symptom (i.e., ROUGH IDLE, NO START, etc.). If only intermittent codes are present, see INTERMITTENTS in the H - TESTS W/O CODES article.

SELF-DIAGNOSTIC SYSTEM

* PLEASE READ THIS FIRST *

NOTE: For On-Board Diagnostic System Check see the F - BASIC TESTING - 4.3L article.

NOTE: Powertrain Control Module (PCM) may also be referred to as Vehicle Control Module (VCM) in some diagnostic text and illustrations. Terms may be used interchangeably.

PCM/VCM is equipped with a self-diagnostic system, which detects system failures or abnormalities. When a malfunction occurs, PCM/VCM will store a Diagnostic Trouble Code (DTC) and, in most cases, illuminate the Malfunction Indicator Light (MIL) located on instrument cluster. Malfunctions are recorded as hard failures or as intermittent failures.

There are 4 types of DTC category:

* Type "A" - Emissions related, turns on MIL the first time DTC sets.
* Type "B" - Emissions related, turns on MIL if fault is active for 2 consecutive driving cycles.
* Type "C" - Non-emissions related, does not turn on MIL, but will turn on SERVICE light.
* Type "D" - Non-emissions related, does not turn on MIL or SERVICE light.

Hard Failures

Most hard failures cause MIL to illuminate and remain on until malfunction is repaired. If MIL comes on and remains on (light may flash) during vehicle operation, cause of malfunction must be determined. See DIAGNOSTIC PROCEDURE.

If a sensor fails, PCM/VCM will use a substitute value in its calculations to continue engine operation. In this condition, vehicle is functional, but it will most likely display degraded driveability.

Intermittent Failures

Intermittent failures cause MIL to flicker or glow and go out about 10 seconds after intermittent fault goes away. Corresponding DTC, however, will be retained in PCM/VCM memory. If related fault does not reoccur within 50 engine starts, trouble code will be erased from control module memory. Intermittent failures may be caused by sensor, connector or wiring related problems. See INTERMITTENTS in the H - TESTS W/O CODES article.

NOTE: OBD II vehicles have options available in the scan tool DTC mode to display enhanced information available. However, to fully utilize information and procedures requires the use of a Tech 1 or 2 scan tool. See scan tool operator's manual for additional information.

The following are Tech 1 or 2 scan tool sub-menus in the DTC INFO and SPECIFIC DTC modes:

DTC INFO MODE

Used to search for a specific type of stored DTC information. There are 7 choices in this mode. Technician may be instructed to test DTC(s) in a certain manner. Follow the affected DTC test procedures. To get complete description of any status, hit ENTER key before pressing the desired F-key.

DTC STATUS

This selection will display any DTC(s) that have not run during the current ignition cycle or have reported a test failure during this ignition up to a maximum of 33 DTCs. DTC test which run and passed will cause that affected DTC to be removed from scan tool screen.

FAIL THIS IGN.

This selection will display all DTCs that have failed during the present ignition cycle.

HISTORY

This selection will display only DTC(s) that are stored in the control module's history memory. It will not type "B" DTCs. It will display all type "A" and type "B" DTCs that have the MIL illuminated and have failed within the last 40 warm-up cycles. It will also display type "C" DTCs that have failed within the 40 warm-up cycles.

LAST TEST FAIL

This selection will display only DTCs that have failed the last time the test ran. The last test may have ran during the previous ignition cycle, if a type "A" or "B" DTC is displayed. For type "C" DTCs, the last failure must have occurred during the current ignition cycle to be displayed as LAST TEST FAIL.

MIL REQUEST

This selection will display only DTCs that are requesting the MIL. Type "C" DTCs cannot be displayed using this option. This selection will report type "B" DTCs only after the MIL has been requested.

NOT RUN SCC

Not Run Since Code Clear option will display up to 33 DTCs that have not run since DTCs were last cleared. Since any displayed DTCs have not run, their condition (passing or failing) is unknown.

TEST FAIL SCC

Test Fail Since Code Clear selection will display all active and history DTCs that have reported a test failure since the last time DTCs were cleared. DTCs that last failed over 40 warm-up cycles before this option is selected will not be displayed.

FAILED SINCE CLEAR

This message indicates the DTC has failed at least once within the last 40 warm-up cycles since the last time DTCs were cleared.

NOT RUN SINCE CL.

Not Run Since Cleared message indicates that the selected diagnostic test has not run since the last time DTCs were cleared. Therefore, the diagnostic test status (passed or failed) is unknown. After DTCs are cleared, this message will continue to be displayed until the diagnostic test runs.

NOT RUN THIS IGN.

Not Run This Ignition message indicates the selected diagnostic test has not run this ignition cycle.

TEST RAN AND PASSED

This message indicates the selected diagnostic test has:

* Passed the last test.
* Ran and passed during this ignition cycle.
* Ran and passed since DTCs were last cleared.
* Test has not failed since DTCs were last cleared.

If this message is displayed, repair is done. If FAILED THIS IGN. message is displayed, repair is incomplete and further diagnosis is required.

DIAGNOSTIC PROCEDURE

Diagnosis of computerized engine control system should be performed in following order:

1) Ensure all engine systems not related to computer system are operating properly. DO NOT proceed with testing unless all other problems have been repaired. ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK must be performed before using specific DTC testing procedure. See the F - BASIC TESTING - 4.3L article.

2) If DTC(s) were displayed, determine whether codes are hard or intermittent trouble codes. Hard codes will cause MIL to illuminate continuously while engine is running. See HARD OR INTERMITTENT TROUBLE CODE DETERMINATION. For diagnosing hard codes, proceed to appropriate DTC test. For diagnosing intermittent codes, proceed to INTERMITTENTS in the H - TESTS W/O CODES article.

3) If no DTCs are present and a driveability problem exists, refer to SYMPTOMS in the H - TESTS W/O CODES article. Doing so will help identify proper system or component to check in the I - SYSTEM/COMPONENT TESTS article.

4) After necessary repairs are made, clear DTCs, verify vehicle will enter "closed loop" operation and ensure DTC does not reset.

READING TROUBLE CODES

NOTE: Use of Tech 1 or 2 scan tool is required to retrieve DTCs. Refer to user reference manuals supplied with scan tool.

TROUBLE CODE DEFINITIONS

TROUBLE CODE DEFINITION TABLE

Code No.	Circuit Affected
P0101	MAF System Performance
P0102	MAF Sensor Circuit Low Frequency
P0103	MAF Sensor Circuit High Frequency
P0106	MAP Sensor System Performance
P0107	MAP Sesnor Circuit Low Voltage
P0108	MAP Sensor Circuit High Voltage
P0112	IAT Sensor Circuit Low Voltage
P0113	IAT Sensor Circuit High Voltage
P0117	ECT Sensor Circuit Low Voltage
P0118	ECT Sensor Circuit High Voltage
P0121	TP Sensor System Performance
P0122	TP Sensor Circuit Low Voltage
P0123	TP Sensor Circuit High Voltage
P0125	ECT Excessive Time To Reach Closed Loop
P0131	HO2S Circuit Low Voltage-Bank 1, Sensor 1
P0132	HO2S Circuit High Voltage-Bank 1, Sensor 1
P0133	HO2S Slow Response-Bank 1, Sensor 1
P0134	HO2S Insufficient Activity-Bank 1, Sensor 1
P0135	HO2S Heater Circuit-Bank 1, Sensor 1
P0137	HO2S Circuit Low Voltage-Bank 1, Sensor 2
P0138	HO2S Circuit High Voltage Bank 1, Sensor 2
P0140	HO2S Insufficient Activity-Bank 1, Sensor 2
P0141	HO2S Heater Circuit-Bank 1, Sensor 2
P0143	HO2S Circuit Low Voltage-Bank 1, Sensor 3
P0144	HO2S Circuit High Voltage-Bank 1, Sensor 3
P0146	HO2S Insufficient Activity-Bank 1, Sensor 3
P0147	HO2S Heater Circuit-Bank 1, Sensor 3
P0151	HO2S Circuit Low Voltage-Bank 2, Sensor 1
P0152	HO2S Circuit High Voltage-Bank 2, Sensor 1
P0153	HO2S Slow Response-Bank 2, Sensor 1
P0154	HO2S Insufficient Activity-Bank 2, Sensor 1
P0155	HO2S Heater Circuit-Bank 2, Sensor 1
P0171	Fuel Trim System Lean-Bank 1
P0172	Fuel Trim System Rich-Bank 1
P0174	Fuel Trim System Lean-Bank 2
P0175	Fuel Trim System Rich-Bank 2
P0300	Engine Misfire Detected
P0301	Cyl. No. 1 Misfire Detected
P0302	Cyl. No. 2 Misfire Detected
P0303	Cyl. No. 3 Misfire Detected
P0304	Cyl. No. 4 Misfire Detected
P0305	Cyl. No. 5 Misfire Detected
P0306	Cyl. No. 6 Misfire Detected
P0327	Knock Sensor Low Voltage
P0336	CKP Sensor Circuit Performance
P0337	CKP Sensor Circuit Low Frequency
P0338	CKP Sensor Circuit High Frequency
P0339	CKP Sensor Circuit Intermittent
P0340	CKP Sensor Circuit
P0341	CMP Sensor Circuit Performance
P0401	EGR System Performance
P0420	TWC System Low Efficiency-Bank 1
P0461	Fuel Level Sensor Circuit Malfunction
P0462	Fuel Level Sensor Circuit Low Voltage
P0463	Fuel Level Sensor Circuit High Voltage
P0500	Vehicle Speed Sensor Circuit
P0506	Idle RPM Low (IAC Responding)
P0507	Idle RPM High (IAC Responding)

P0704	Clutch Switch Circuit
P1106	MAP Sensor Circuit Intermittentl High Voltage
P1107	MAP Sensor Circuit Intermittentl Low Voltage
P1111	IAT Sensor Circuit Intermittent High Voltage
P1112	IAT Sensor Circuit Intermittent Low Voltage
P1114	ECT Sensor Circuit Intermittent Low Voltage
P1115	ECT Sensor Circuit Intermittent High Voltage
P1121	TP Sensor Voltage Intermittentl High
P1122	TP Sensor Voltage Intermittentl Low
P1133	HO2S Insufficient Switching-Bank 1, Sensor 1
P1134	HO2S Transition Time Ratio-Bank 1, Sensor 1
P1153	HO2S Insufficient Switching-Bank 2, Sensor 1
P1154	HO2S Transition Time Ratio-Bank 2, Sensor 1
P1345	CKP/CMP Sesnor Correlation
P1351	IC Circuit High Voltage
P1361	IC Circuit Low Voltage
P1380	EBCM DTC Detected Rough Road Data Unusable
P1381	Misfire Detected-No EBCM/PCM/VCM Serial Data
P1441	EVAP System Flow During Non-Purge
P1508	IAC System-Low RPM
P1509	IAC System-High RPM

HARD OR INTERMITTENT TROUBLE CODE DETERMINATION

During any diagnostic procedure, determine if DTC(s) are hard failure codes or intermittent failure codes. Diagnostic procedures will not always help analyze intermittent codes. To determine hard codes and intermittent codes:

1) Enter diagnostic mode. Read and record all stored DTCs. Exit diagnostic mode, and clear DTCs. See CLEARING DIAGNOSTIC TROUBLE CODES (DTC).

2) Apply parking brake, and place transmission in Neutral or Park. Block drive wheels, and start engine. MIL should go out. Operate warm engine at specified RPM for 2 minutes and note MIL.

3) If MIL illuminates, enter diagnostic mode. Read and record DTCs. This will reveal hard failure codes. Oxygen sensor related codes may require a road test to reset hard failure after DTCs were cleared.

4) If MIL does not illuminate, all stored DTCs were intermittent failures, except as noted above.

NOTE: DTCs will be recorded at various operating times. Some codes require operation of that sensor or switch for 5 seconds; others require operation for 5 minutes or longer at normal operating temperature, vehicle speed and load. Therefore, some DTCs may not set in a service bay operational mode and may require road testing vehicle in order to duplicate conditions under which code will set.

CLEARING DIAGNOSTIC TROUBLE CODES (DTC)

To clear DTCs from memory, either to determine if malfunction will occur again or after making necessary repairs, disconnect power supply to ECM/PCM/VCM for at least 30 seconds or clear codes using a scan tool.

ECM/PCM/VCM LOCATION

On most models, ECM/PCM/VCM is located behind right or left side of dash, behind right or left kick panel, or on left or right side of engine compartment. For more precise location, see COMPONENT LOCATIONS in the I - SYSTEM/COMPONENT TESTS article.

DIAGNOSTIC MATERIALS

Diagnostic Aids

Diagnostic aids are additional tips used to help diagnose trouble codes when inspected circuit is okay. Diagnostic aids may help lead to a definitive solution to trouble code problem.

SPECIAL TOOLS (DIAGNOSTIC)

NOTE: A scan tool plugged into DLC is used to read DTCs and check voltages in system on serial data line. A scan tool is REQUIRED to retrieve vehicle information.

Computerized engine control system is most easily diagnosed using scan tool; however, other tools may aid in diagnosing problems. These tools are a tachometer, test light, ohmmeter, digital voltmeter with a 10-megohm input impedance (minimum), vacuum pump, vacuum gauge, fuel injector test lights and 6 jumper wires 6" long (one wire with female connectors at both ends, one wire with male connectors at both ends and 4 wires with male and female connectors at opposite ends). A test light, rather than a voltmeter, must be used when indicated by a diagnostic test. In addition, special jumper harnesses or testers may be required by manufacturer to facilitate diagnosis.

SCAN TOOL USAGE

NOTE: Before connecting scan tool to vehicle, diagnostic system should be checked to determine if system is operating properly and if information received will be accurate. This is done by performing ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK located in the F - BASIC TESTING - 4.3L article. If vehicle does not pass OBD system check, information received may be invalid.

Scan tool is a specialized tester which, when plugged into DLC, can be used to diagnose on-board computer control systems by providing instant access to circuit voltage information without need to crawl under dash or hood to backprobe sensors and connectors.

Scan tool cuts down diagnostic time dramatically by furnishing input data (voltage signals) which can be compared to specification parameters. See SCAN DATA. They may also furnish information on output device (solenoids and motors) status. However, status parameters only indicate output signals have been sent to devices by PCM/VCM; they do not indicate whether devices have responded properly to signal. Verify proper response at output device using a voltmeter or test light.

A problem may exist even if DTCs are not present. About 80 percent of driveability problems occur without DTCs. Sensors that are out of calibration will not set a DTC but will cause driveability problems.

Using a scan tool is the easiest method of checking sensor specifications and other data parameters. Scan tool is also useful in finding intermittent wiring problems by wiggling wiring harnesses and connections (key on, engine off) while observing data parameters. See SCAN DATA.

NOTE: If erroneous voltage signals are suspected, verify tester information using a digital voltmeter and wiring schematic. If non-existent codes are displayed, DO NOT use scan tool for diagnosis. Contact tester manufacturer for additional information.

SCAN DATA

NOTE: For scan data values, refer to scan tool manufacturer owner's manual or compare values with a known good component or vehicle.

SUMMARY

If no hard fault codes are present, driveability symptoms exist or intermittent DTC(s) exist, proceed to the H - TESTS W/O CODES article for diagnosis by symptom (i.e., ROUGH IDLE, NO START, etc.) or intermittent diagnostic procedures.

DIAGNOSTIC TROUBLE CODES

* PLEASE READ THIS FIRST *

NOTE: Before clearing DTCs, perform On-Board Diagnostic (OBD) System Check. See the F - BASIC TESTING - 4.3L article.
Record
FREEZE FRAME and FAILURE RECORDS for reference during testing. Data will be erased when DTCs are cleared. If PCM/VCM is replaced, NEW PCM/VCM must be programmed using special manufacturer's equipment.

DTC P0101 - MAF SENSOR SYSTEM PERFORMANCE

NOTE: For circuit reference, see L - WIRING DIAGRAMS article.

Circuit Description

Mass Airflow (MAF) sensor measures amount of air entering engine during a given time. VCM uses MAF sensor information for fuel delivery calculations. MAF sensor readings during acceleration are much higher than those during deceleration or idle.

VCM calculates what MAF sensor reading should be received from sensor under certain conditions using engine speed (RPM), throttle position, and altitude parameters. When these test conditions are met, VCM will compare its calculated MAF value to actual value received from sensor.

Conditions required to test for DTC are:

* Vehicle driven at a steady speed.
* No MAP or TP sensor DTCs are set.
* No EVAP system DTCs are set.
* EGR DTC P0401 not set.
* MAF sensor DTC P0102 or P0103 not set.

Diagnostic Procedures

1) Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the F - BASIC TESTING - 4.3L article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

2) Turn ignition on, with engine off. Using scan tool, read and record FAIL RECORD data. Operate vehicle within conditions noted in FAIL RECORD data. Using scan tool, read SPECIFIC DTC. If scan tool displays DTC P0101, go to next step. If DTC P0101 is not displayed, see DIAGNOSTIC AIDS.

3) Check for throttle body inlet screen blockage. Check for vacuum leaks at intake manifold, throttle body or EGR valve flange and pipes. Check for crankcase valve faulty, missing or incorrectly installed. Repair faulty conditions as necessary and go to step 17). If no faulty conditions exist, go to next step.

4) Turn ignition on, throttle closed. Using scan tool, read TP ANGLE value. If scan tool displays about zero percent, go to next step. If scan tool does not display zero percent, go to DTC P0121.

5) Turn ignition off. Disconnect MAF sensor harness connector. Turn ignition on, engine off. Using a DVOM, check voltage between MAF sensor harness connector signal circuit and chassis ground. If voltage is about 5 volts, go next step. If voltage is not as specified, go to step 7).

6) Connect a test light between MAF sensor harness connector ignition feed and ground circuits. If test light illuminates, go to step 10). If test light does not illuminate, go to step 9).

7) If voltage is less than 4.5 volts, go to step 11). If voltage is 4.5 volts or greater, go to next step.

8) Turn ignition off. Disconnect VCM connectors. Turn ignition on, engine off. Check voltage between VCM harness connector MAF signal circuit and chassis ground. If voltage reading is about zero volts, go to step 16). If voltage is not as specified, go to step 14),

9) Connect test light between MAF sensor harness connector ignition feed circuit and chassis ground. If test light illuminates, go to step 12). If test light does not illuminate, go to step 13).

10) Check for faulty connection at MAF sensor. Repair connection as necessary and go to step 17). If connection is okay, go to step 15).

11) Check MAF sensor signal circuit between VCM and MAF sensor for open or short to ground. Repair signal circuit as necessary and go to step 17). If signal circuit is okay, go to step 16).

12) Locate and repair open in the MAF sensor ground circuit. After repairs, go to step 17).

13) Locate and repair open MAF sensor ignition feed circuit. After repairs, go to step 17).

14) Locate and repair short to voltage in MAF sensor signal circuit. After repairs, go to step 17).

15) Replace MAF sensor. After replacing sensor, go to step 17).

16) Replace VCM. Program replacement VCM using required equipment. After replacement, go to next step.

17) Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0101. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

18) Using scan tool, read and record REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check for stuck or faulty Throttle Position (TP) sensor. Using scan tool, read TP ANGLE value with throttle closed. If value is not zero percent, check for and repair the following condition(s):

* Throttle plate sticking or excessive deposits on throttle plate or throttle bore.
* TP sensor signal circuit shorted to voltage.
* Faulty connection or high resistance in TP sensor ground circuit.

If none of the listed conditions exist and TP ANGLE value is not zero percent, replace TP sensor.

Check for faulty connections or damaged harness. Ensure harness is not routed too close to high-voltage wires, such as spark plug cables. If connections and harness appear okay, observe scan tool while moving all related harness and connectors. A change in scan tool display indicates fault location.

Check for plugged intake air duct or dirty air filter. A wide-open throttle acceleration from a stop should cause MAF reading on scan tool to increase from about 5-7 grams at idle to about 100 grams or greater at time of 1-2 shift. If not, check for restriction.

Check for a skewed MAP sensor, which can cause Barometric (BARO) pressure reading to be incorrectly calculated. This condition may also cause high Idle Air Control (IAC) counts. If IAC counts are high, replace MAP sensor.

Check for vacuum leaks at following locations:

* Air inlet duct between MAF sensor and throttle body.
* "O" rings at fuel meter body.
* Oil cap and dipstick tube.
* Purge solenoid.
* MAP sensor.
* Brake booster.
* Intake manifold, crankcase, throttle body and EGR gaskets.

DTC P0102 - MAF SENSOR CIRCUIT LOW FREQUENCY

NOTE: For circuit reference, see the L - WIRING DIAGRAMS article.

Circuit Description

Mass Airflow (MAF) sensor measures amount of air entering engine during a given time. VCM uses MAF sensor information for fuel delivery calculations. MAF sensor readings during acceleration are much higher than those during deceleration or idle.

VCM calculates what MAF sensor reading should be received from sensor under certain conditions using engine speed (RPM), throttle position, and altitude parameters. When these test conditions are met, VCM will compare its calculated MAF value to actual value received from sensor.

Condition required to set DTC:

* Engine running.
* Engine run time greater than .4 second.
* System voltage is at least 8 volts.
* Conditions must be present for a period of greater than zero seconds.

Diagnostic Procedures

1) Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the F - BASIC TESTING - 4.3L article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. After performing OBD system check, go to next step.

2) Start engine. With engine at idle, use scan tool to read MAF value. If MAF value is less than 2 grams per second, go to step 4). If value is 2 grams per second or greater, go to next step.

3) Turn engine off. Turn ignition on, engine off. Using scan tool, read and record FAIL RECORDS data. Operate vehicle within conditions noted in FAIL RECORD data. Using scan tool, read SPECIFIC DTC. If scan tool displays DTC P0102 FAILED THIS IGN, go to next step. If DTC P0102 FAILED THIS IGN is not displayed, see DIAGNOSTIC AIDS.

4) Check for MAF sensor inlet screen blockage. Check for vacuum leaks at intake manifold, throttle body or EGR valve flange and pipes. Check for crankcase valve faulty, missing or incorrectly installed. Repair faulty conditions as necessary. After repairs, go to step 14). If no faulty conditions exist, go to next step.

5) Turn ignition off. Disconnect MAF sensor harness connector. Turn ignition on, engine off. Using a DVOM, check voltage between MAF sensor harness connector signal circuit and chassis

ground. If voltage is about 5 volts, go next step. If voltage is not about 5 volts, go to step 9).

6) Connect a test light between MAF sensor harness connector ignition feed and ground circuits. If test light illuminates, go to step 8). If test light does not illuminate, go to next step.

7) Connect test light between MAF sensor harness connector ignition feed circuit and battery ground. If test light illuminates, go to step 10). If test light does not illuminate, go to step 11).

8) Check for faulty connection at MAF sensor. Repair connection as necessary. After repairs, go to step 14). If connection is okay, go to step 12).

9) Check MAF sensor signal circuit between VCM and MAF sensor for open or short. Repair signal circuit as necessary. After repairs, go to step 14). If signal circuit is okay, go to step 13).

10) Locate and repair open in the MAF sensor ground circuit. After repairs, go to step 14).

11) Locate and repair open MAF sensor ignition feed circuit. After repairs, go to step 14).

12) Replace MAF sensor. After replacing sensor, go to step 14).

13) Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to next step.

14) Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0102. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

15) Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check for faulty connections or damaged harness. Ensure harness is not routed too close to high-voltage wires, such as spark plug cables. If connections and harness appear okay, observe scan tool while moving all related harness and connectors. A change in scan tool display indicates fault location.

Check for vacuum leaks at following locations:

* Air inlet duct between MAF sensor and throttle body.
* "O" rings at fuel meter body.
* Oil cap and dipstick tube.
* Purge solenoid.
* MAP sensor.
* Brake booster.
* Intake manifold, crankcase, throttle body and EGR gaskets.

DTC P0103 - MAF SENSOR CIRCUIT HIGH FREQUENCY

NOTE: For circuit reference, see the L - WIRING DIAGRAMS article.

Circuit Description

Mass Airflow (MAF) sensor measures amount of air entering engine during a given time. VCM uses MAF sensor information for fuel delivery calculations. MAF sensor readings during acceleration are much higher than those during deceleration or idle.

VCM calculates what MAF sensor reading should be received from sensor under certain conditions using engine speed (RPM), throttle position, and altitude parameters. When these test conditions are met, VCM will compare its calculated MAF value to actual value received from sensor.

Conditions for setting DTC:

* Engine running.
* Engine run time is at least .4 second.
* System voltage is at least 8 volts.
* MAF sensor is at least 10400 Hz.
* Conditions must be present for a period greater than zero seconds.

Diagnostic Procedures

1) Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the F - BASIC TESTING - 4.3L article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

2) Start engine. With engine at idle, use scan tool to read MAF value. If MAF value is greater than 20 grams per second, go to step 4). If value is less than specified, go to next step.

3) Turn engine off. Turn ignition on, engine off. Using scan tool, read and record FAIL RECORDS data. Operate vehicle within conditions noted in FAIL RECORD data. Using scan tool, read SPECIFIC DTC. If scan tool displays DTC P0103 FAILED THIS IGN, go to next step. If scan tool does not display DTC P0103 FAILED THIS IGN, see DIAGNOSTIC AIDS.

4) Turn ignition off. Disconnect MAF sensor harness connector. Turn engine on and allow it to idle. Using scan tool, read MAF value. If value is about zero grams per second, go to next step. If value is not as specified, go to step 7).

5) Check for faulty connection at MAF sensor. Repair as necessary. After repairs, go to step 10). If connection is okay, go to next step.

6) Replace MAF sensor. After replacing sensor, go to step 10).

7) Ensure MAF sensor harness is not routed too close to high-voltage wires, such as spark plug cables, ignition coils or other high-voltage components. Reroute harness if necessary and go to step 10). If harness routing is okay, go to next step.

8) Check MAF sensor signal circuit connection at VCM. Repair as necessary. After repairs, go to step 10). If connection is okay, go to next step.

9) Replace VCM. Program replacement PCM using required equipment. After replacing VCM, go to next step.

10) Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0103. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

11) Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check for faulty connections or damaged harness. Ensure harness is not routed too close to high-voltage wires, such as spark plug cables. If connections and harness appear okay, observe scan tool while moving all related harness and connectors. A change in scan tool display indicates fault location. Check for vacuum leaks at following locations:

* Air inlet duct between MAF sensor and throttle body.
* "O" rings at fuel meter body.
* Oil cap and dipstick tube.
* Purge solenoid.
* MAP sensor.
* Brake booster.

* Intake manifold, crankcase, throttle body and EGR gaskets.

DTC P0106 - MAP SENSOR SYSTEM PERFORMANCE

NOTE: For circuit reference, see the L - WIRING DIAGRAMS article.

Circuit Description

Manifold Absolute Pressure (MAP) sensor responds to changes in intake manifold pressure (vacuum). A 5-volt reference is applied to sensor. A variable resistor moves in relation to manifold pressure and a voltage signal is returned to VCM through MAP signal circuit. Voltage signal varies from 1.0-1.5 volts at closed throttle (high vacuum) to 4.0-4.5 volts at wide open throttle (low vacuum). A change in throttle position and engine speed should precede change in MAP. If change does not occur, MAP malfunction is present. VCM utilizes MAP signal and throttle position to determine fuel delivery.

Conditions for setting DTC are:

* No TP sensor related DTCs.
* Engine running.
* Engine speed changes less than 100 RPM.
* TP angle changes less than 1.95 percent.
* EGR flow changes less than 10 percent.
* Idle air changes less than 100 counts.
* No change in brake switch status.
* No change in clutch status (M/T).
* No change in A/C status.
* No change in power steering switch status.
* Conditions have stabilized for a period of 0.5 second.

Diagnostic Procedures

1) Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the F - BASIC TESTING - 4.3L article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

2) Turn ignition on, engine off. Using scan tool, read MAP sensor voltage. Voltage should be 4.0-4.5 volts. If voltage varies 0.4 volt or greater from specification, go to next step. If voltage does not vary 0.4 volt or greater, go to step 6).

3) Disconnect and plug MAP sensor vacuum source. Connect a vacuum gauge to MAP sensor. Start engine. Using scan tool, read and record MAP sensor voltage. Observe and record MAP sensor voltage while applying 10 in. Hg If difference between first and second reading is 1.5 volts or greater, see DIAGNOSTIC AIDS. If difference is less than 1.5 volts, go to next step.

4) Check for faulty connection at MAF sensor. If faulty connection is found, go to next step. If connection is okay, go to step 6).

5) Repair connection as necessary. After repairs, go to step 7).

6) Replace MAP sensor. After replacing sensor, go to next step.

7) Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0106. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

8) Using scan tool, select Read and Record INFO in REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check MAP sensor vacuum source for leaks, restrictions or faulty connections.

DTC P0107 - MAP SENSOR CIRCUIT LOW VOLTAGE

NOTE: For circuit reference, see the L - WIRING DIAGRAMS article.

Circuit Description

Manifold Absolute Pressure (MAP) sensor measures changes in intake manifold pressure (vacuum). A low voltage signal, 1.0-1.5 volts, is sent to VCM on signal circuit at closed throttle (high vacuum). A high voltage signal, 4.0-4.5 volts is sent at wide open throttle (low vacuum).

Conditions required to set DTC are:

* No TP sensor related DTCs.
* Engine running.
* TP sensor is at least zero percent when engine speed is not greater than 1000 RPM.
* TP sensor is at least 10.1 percent when engine speed is greater than 1000 RPM.
* MAP voltage greater than 4.9 volts.

Diagnostic Procedures

1) Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the F - BASIC TESTING - 4.3L article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

2) Start and warm engine to normal operating temperature. Allow engine to idle. Using scan tool, read MAP sensor voltage. If voltage is less than 0.5 volt, go to next step. If voltage is not less than 0.5 volt, go to step 5).

3) Turn ignition off. Disconnect MAP sensor harness connector. Connect a jumper wire between MAP sensor harness connector 5-volt reference circuit and signal circuit. Turn ignition on. If voltage is greater than 4.7 volts, go to step 6). If voltage is not greater than 4.7 volts, go to next step.

4) Turn ignition off. Remove jumper wire. Connect a test light between MAP sensor harness connector signal circuit and battery voltage. Turn ignition on. If voltage is greater than 4.7 volts, go to step 9). If voltage is not greater than 4.7 volts, go to step 7).

5) DTC P0107 is intermittent. If any additional DTCs are set, diagnose affected DTCs. If no additional DTCs are set, see DIAGNOSTIC AIDS.

6) Check for faulty connection at MAP. If faulty connection is found, go to step 12). If connection is okay, go to step 11).

7) Check for open MAP sensor signal circuit. If open signal circuit is found, go to step 12). If no open signal circuit is found, go to next step.

8) Check MAP sensor signal circuit for short to ground. If short to ground in signal circuit is found, go to step 12). If no short to ground in signal circuit is found, go to step 13).

9) Check for open MAP sensor 5-volt reference circuit. If open 5-volt reference circuit is found, go to step 12). If no open 5-volt reference circuit is found, go to next step.

10) Check MAP sensor 5-volt reference circuit for short to ground. If short to ground in 5-volt reference circuit is found, go to step 12). If no short to ground in 5-volt reference circuit is found, go to step 13).

11) Replace MAP sensor. After replacing sensor, go to step 14).

12) Repair circuit as necessary. After repairs, go to step 14).

13) Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to next step.

14) Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0107. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

15) Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check MAP sensor signal and 5-volt reference circuits for intermittent open condition. With ignition on and engine off, MAP signal is equal to atmospheric pressure with signal voltage high. This information is used by VCM as an indication of altitude. Comparison of this reading with a known-good vehicle with same sensor is a way to check accuracy of suspect sensor. Reading should be within 0.4 volt. Disconnect sensor from bracket and twist sensor by hand to check for intermittents. Output changes greater than 0.1 volt indicate a faulty sensor connection.

DTC P0108 - MAP SENSOR CIRCUIT HIGH VOLTAGE

NOTE: For circuit reference, see the L - WIRING DIAGRAMS article.

Circuit Description

Manifold Absolute Pressure (MAP) sensor measures changes in intake manifold pressure (vacuum). A low voltage signal, 1.0-1.5 volts, is sent to VCM on signal circuit at closed throttle (high vacuum). A high voltage signal, 4.0-4.5 volts, is sent at wide open throttle (low vacuum).

Conditions for setting DTC:

* No TP sensor related DTCs are set.
* TP angle is not greater than 96.8 percent when engine speed is not greater than 1000 RPM.
* TP angle is not greater than 89.8 percent when engine speed is greater than 1000 RPM.
* MAP is greater than or equal to 4.9 volts.

Diagnostic Procedures

1) Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the F - BASIC TESTING - 4.3L article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

2) Correct any engine idle or vacuum problems before proceeding. Turn engine on and allow it to idle. Using scan tool, read MAP sensor voltage. If voltage is less than 4 volts, go to next step. If voltage is not less than 4 volts, go to step 4).

3) Turn ignition off. Disconnect MAP sensor harness connector. Turn ignition on. If voltage is less than one volt, go to step 5). If voltage is not less than one volt, go to step 9).

4) DTC P0108 is intermittent. If any additional DTCs are set, diagnose affected DTCs. If no additional DTCs are set, go to DIAGNOSTIC AIDS.

5) Using a DVOM connected to ground, probe 5-volt reference circuit at MAP sensor harness connector. If voltage reading is greater than 5.2 volts, go to step 10). If voltage reading is not greater than 5.2 volts, go to next step.

6) Using a test light connected battery voltage, probe MAP sensor ground circuit at MAP sensor harness connector. If test light illuminates, go to next step. If test light does not illuminate, go to step 14).

7) Check MAP sensor vacuum source for restriction. If

restriction is found, go to step 15). If no restriction is found, go to next step.

8) Replace MAP sensor. After replacing sensor, go to step 19).

9) Check for short to voltage in MAP sensor signal circuit. Repair as necessary. After repairs, go to step 15). If circuit is okay, go to step 18).

10) Turn ignition off. Disconnect VCM Gray harness connector. Turn ignition on. Using DVOM connected to ground, check voltage on 5-volt reference circuit at VCM harness connector. If voltage reading is greater than 5.2 volts, go to next step. If voltage reading is not greater than 5.2 volts, go to step 13).

11) Disconnect EGR harness connector. Check voltage on 5-volt reference circuit at VCM harness connector. If voltage reading is greater than 5.2 volts, go to next step. If voltage reading not greater than 5.2 volts, go to step 16).

12) Repair short to voltage on 5-volt reference circuit. After repairs, go to step 19).

13) Using DVOM connected to ground, check voltage on VCM harness connector terminal GR12. If voltage reading is greater than 5.2 volts, go to step 17). If voltage reading is not greater than 5.2 volts, go to step 18).

14) Repair sensor ground circuit. After repairs, go to step 19).

15) Repair as necessary. After repairs, go to step 19).

16) Replace EGR valve. After replacing EGR valve, go to step 19).

17) Repair short to ground on 5-volt reference circuit. After repairs, go to step 19).

18) Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to next step.

19) Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0108. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

20) Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check MAP sensor signal and 5-volt reference circuits for intermittent open condition. With ignition on and engine off, MAP signal is equal to atmospheric pressure with signal voltage high. This information is used by VCM as an indication of altitude. Comparison of this reading with a known-good vehicle with same sensor is a way to check accuracy of suspect sensor. Readings should be within 0.4 volt of each other.

Disconnect sensor from bracket and twist sensor by hand to check for intermittents. Output changes greater than 0.1 volt indicate a faulty sensor connection.

DTC P0112 - IAT SENSOR CIRCUIT LOW VOLTAGE

NOTE: For circuit reference, see the L - WIRING DIAGRAMS article.

Circuit Description

Intake Air Temperature (IAT) sensor is a thermistor that varies resistance based on temperature. As temperature of sensor increases, resistance decreases. High temperature will result in a low signal voltage. DTC will set when VCM sees an IAT sensor voltage of less than 0.82 volt for 10 seconds after engine runs for 100 seconds.

Conditions required to test for DTC are:

* Vehicle driven at 2 MPH or greater.
* No VSS DTCs are set.

Diagnostic Procedures

1) Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the F - BASIC TESTING - 4.3L article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

2) Turn engine on and allow it to idle. Using scan tool, read IAT sensor voltage. If voltage is less than 0.82 volt, go to next step. If voltage is not less than 0.82 volt, go to step 5).

3) Turn engine off. Turn ignition on. Disconnect IAT sensor harness connector. If voltage is greater than 4 volts, go to step 7). If voltage is not greater than 4 volts, go to next step.

4) Turn ignition off. Using DVOM, check resistance across IAT sensor harness connector. If resistance is infinite, go to step 8). If resistance is not infinite, go to step 6).

5) DTC P0112 is intermittent. If any additional DTCs are set, diagnose affected DTCs. If no additional DTCs are set, see DIAGNOSTIC AIDS.

6) Repair short to ground in IAT sensor signal circuit. After repairs, go to step 9).

7) Replace IAT sensor. After replacing sensor, go to step 9).

8) Replace VCM. Program replacement VCM using required equipment. After replacing and reprogramming VCM, go to next step.

9) Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0112. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

10) Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

If DTC P1112 is also set, problem is intermittent. Check for short to ground in IAT sensor harness connector signal circuit. Observe scan tool while moving all related harness and connectors. A change in scan tool display indicates fault location. See IAT TEMPERATURE-TO-RESISTANCE VALUES.

IAT TEMPERATURE-TO-RESISTANCE VALUES TABLE

Temperature °F (°C)	Ohms
212 (100)	177
194 (90)	241
158 (70)	467
122 (50)	973
104 (40)	1459
86 (30)	2238
68 (20)	3520
50 (10)	5670

DTC P0113 - IAT SENSOR CIRCUIT HIGH VOLTAGE

NOTE: For circuit reference, see the L - WIRING DIAGRAMS article.

Circuit Description

Intake Air Temperature (IAT) sensor is a thermistor that varies resistance based on temperature. As temperature of sensor increases, resistance decreases. Low temperature will result in a high signal voltage. DTC will set when VCM sees an IAT sensor voltage of greater than 5 volts.

Conditions required to set DTC are:

* No ECT sensor related DTCs.
* No VSS DTCs are set.
* No MAF sensor related DTCs.
* Vehicle speed is less than 2 MPH.
* MAF value is less than 250 grams per second.
* ECT is greater than 84.7°F (29.3°C).
* Engine run time is greater than 100 seconds.
* IAT voltage is greater than 4.9 volts.

Diagnostic Procedures

1) Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the F - BASIC TESTING - 4.3L article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

2) Start engine and allow to idle. Using scan tool, read IAT sensor voltage. If voltage is greater than 4.9 volts, go to next step. If voltage is not greater than 4.9 volts, go to step 6).

3) Turn engine off. Turn ignition on. Disconnect IAT sensor harness connector. Connect a jumper wire across IAT sensor harness connector. If voltage is less than 0.82 volt, go to step 7). If voltage is not less than 0.82 volt, go to next step.

4) Connect jumper wire between IAT sensor harness connector signal circuit and chassis ground. If voltage is less than 0.82 volt, go to step 8). If voltage is not less than 0.82 volt, go to next step.

5) If DTC P0123 is also set, go to DTC P0123. If DTC is not set, go to step 9).

6) DTC P0113 is intermittent. If any additional DTCs are set, diagnose affected DTCs. If no additional DTCs are set, see DIAGNOSTIC AIDS.

7) Inspect VCM and IAT sensor for proper connection. If a problem is found, go to step 10). If connections are okay, go to step 11).

8) Check IAT sensor harness connector ground circuit for open between VCM and IAT sensor. If open is found, go to step 10). If open is not found, go to step 12).

9) Check IAT sensor harness connector signal circuit for open between VCM and IAT sensor. If open is found, go to next step. If open is not found, go to step 12).

10) Repair circuit as necessary. After repairs, go to step 13).

11) Replace IAT sensor. After replacing sensor, go to step 13).

12) Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to next step.

13) Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0113. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

14) Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

If DTC P1112 is also set, problem is intermittent. Check for short to ground in IAT sensor harness connector signal circuit. Observe scan tool while moving all related harness and connectors. A change in scan tool display indicates fault location. Check for skewed IAT sensor. See the IAT TEMPERATURE-TO-RESISTANCE VALUES table.

DTC P0117 - ECT SENSOR CIRCUIT LOW VOLTAGE

NOTE: For circuit reference, see the L - WIRING DIAGRAMS article.

Circuit Description

Engine Coolant Temperature (ECT) sensor is a thermistor that varies resistance based on temperature. As temperature of sensor increases, resistance decreases. High temperature will result in a low signal voltage. DTC will set when VCM sees an ECT sensor voltage of less than 0.82 volt for 10 seconds after engine runs for 100 seconds.

Condition for setting DTC:

* Engine run time is greater than 5 seconds.
* Signal voltage is less than .25 volt for 5 seconds.

Diagnostic Procedures

1) Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the F - BASIC TESTING - 4.3L article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

2) Turn engine on and allow it to idle. Using scan tool, read ECT sensor voltage. If voltage is less than 0.82 volt, go to next step. If voltage is not less than 0.82 volt, go to step 5).

3)Turn engine off. Turn ignition on. Disconnect ECT sensor harness connector. If voltage is greater than 4 volts, go to step 7). If voltage is not greater than 4 volts, go to next step.

4) Turn ignition off. Using DVOM, check resistance across ECT sensor harness connector. If resistance is infinite, go to step 8). If resistance is not infinite, go to step 6).

5) DTC P0117 is intermittent. If any additional DTCs are set, diagnose affected DTCs. If no additional DTCs are set, see DIAGNOSTIC AIDS.

6) Repair short to ground in ECT sensor signal circuit. After repairs, go to step 9).

7) Replace ECT sensor. After replacing sensor, go to step 9).

8) Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to next step.

9) Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0117. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

10) Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check for short to ground in ECT sensor harness connector 5-volt reference circuit. Observe scan tool while moving all related harness and connectors. A change in scan tool display indicates fault location.

Check for skewed ECT sensor. See ECT TEMPERATURE-TO-RESISTANCE VALUES.

ECT TEMPERATURE-TO-RESISTANCE VALUES TABLE

Temperature °F (°C)	Ohms
212 (100)	177
194 (90)	241

158 (70)	467
122 (50)	973
104 (40)	1459
86 (30)	2238
68 (20)	3520
50 (10)	5670

DTC P0118 - ECT SENSOR CIRCUIT HIGH VOLTAGE

NOTE: For circuit reference, see the L - WIRING DIAGRAMS article.

Circuit Description

Engine Coolant Temperature (ECT) sensor is a thermistor that varies resistance based on temperature. As temperature of sensor increases, resistance decreases. Low temperature will result in a high signal voltage. DTC will set when VCM sees an ECT sensor voltage of greater than 5 volts.

Diagnostic Procedures

1) Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the F - BASIC TESTING - 4.3L article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

2) Start engine and allow it to idle. Using scan tool, read ECT sensor voltage. If voltage is greater than 4.9 volts, go to next step. If voltage is not greater than 4.9 volts, go to step 5).

3) Turn engine off. Turn ignition on. Disconnect ECT sensor harness connector. Connect a jumper wire across ECT sensor harness connector. If voltage is less than 0.82 volt, go to step 6). If voltage is not less than 0.82 volt, go to next step.

4) Connect jumper wire between ECT sensor harness connector signal circuit and chassis ground. If voltage is less than 0.82 volt, go to step 7). If voltage is not less than 0.82 volt, go to step 8).

5) DTC P0118 is intermittent. If any additional DTCs are set, diagnose affected DTCs. If no additional DTCs are set, go to DIAGNOSTIC AIDS.

6) Inspect VCM and ECT sensor for proper connection. If a problem is found, go to step 10). If connections are okay, go to step 11).

7) Check ECT sensor harness connector ground circuit for open between VCM and ECT sensor. If open is found, go to step 10). If open is not found, go to step 12).

8) If DTC P0123 is also set, go to DTC P0123. If DTC is not set, go to next step.

9) Check ECT sensor harness connector signal circuit for open between VCM and ECT sensor. If open is found, go to next step. If open is not found, go to step 12).

10) Repair circuit as necessary. After repairs, go to step 13).

11) Replace ECT sensor. After replacing sensor, go to step 13).

12) Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to next step.

13) Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0118. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

14) Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check for faulty connections or open in 5-volt reference and ground circuits. Check for skewed ECT sensor. See ECT TEMPERATURE-TO-RESISTANCE VALUES.

DTC P0121 - TP SENSOR SYSTEM PERFORMANCE

NOTE: For circuit reference, see the L - WIRING DIAGRAMS article.

Circuit Description

Throttle Position (TP) sensor measures amount of throttle opening. VCM uses TP sensor information for fuel delivery calculations. TP sensor readings during acceleration are much higher than those during deceleration or idle.

TP sensor signal is one of the most important inputs used by the VCM for fuel control and for most of the VCM control inputs.

Conditions required for setting DTC:

* No MAP related DTCs are present.
* No TP related DTCs are present.
* No IAT related DTCs are present.
* Engine is running.
* BARO is not at calculated default.
* Change in TP is less than 1.9 percent.

Diagnostic Procedures

1) Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the F - BASIC TESTING - 4.3L article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

2) Turn ignition on, engine off. Using scan tool, read TP ANGLE value. If value is greater than 2 percent, go to step 4). If value is not greater than 2 percent, go to next step.

3) Observe scan tool while moving throttle from closed to wide open, and closed again. If TP ANGLE value is greater than 2 percent, go to next step. If value is 2 percent or less, go to step 5).

4) Disconnect TP sensor harness connector. If TP ANGLE value is zero percent, go to step 6). If value is not zero percent, go to step 9).

5) DTC P0121 is intermittent. If any additional DTCs are set, diagnose affected DTCs. If no additional DTCs are set, go to DIAGNOSTIC AIDS.

6) Check for faulty connection at TP sensor. Repair connection as necessary. After repairs, go to next step. If connection is okay, go to step 8).

7) Repair circuit as necessary. After repairs, go to step 10).

8) Replace TP sensor. After replacing sensor, go to step 10).

9) Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to next step.

10) Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0121. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

11) Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check for and repair the following condition(s):

* Throttle plate sticking or excessive deposits on throttle plate or throttle bore.
* Check TP sensor harness connector terminals for damage.
* A steady throttle movement from a stop should cause TP ANGLE value reading on scan tool to increase smoothly as throttle is opened.

DTC P0122 - TP SENSOR CIRCUIT LOW VOLTAGE

NOTE: For circuit reference, see the L - WIRING DIAGRAMS article.

Circuit Description

Throttle Position (TP) sensor measures amount of throttle opening. VCM uses TP sensor information for fuel delivery calculations. TP sensor readings during acceleration are much higher than those during deceleration or idle.

Condition required for setting this DTC:

* Engine running.
* TP sensor voltage less than .25 volt.

Diagnostic Procedures

1) Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the F - BASIC TESTING - 4.3L article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

2) With throttle closed, use scan tool to read TP signal voltage. If voltage is less than 0.15 volt, go to next step. If voltage is not less than 0.15 volt, go to step 5).

3) Disconnect TP sensor harness connector. Connect a jumper wire between TP sensor harness connector sensor signal and 5-volt reference circuits. If voltage is greater than 4 volts, go to step 13). If voltage is not greater than 4 volts, go to next step.

4) Connect a test light between TP sensor harness connector signal circuit and battery voltage. If scan tool reading is greater than 4 volts, go to step 6). If scan tool reading is not greater than 4 volts, go to step 8).

5) DTC P0122 is intermittent. If any additional DTCs are set, diagnose affected DTCs. If no additional DTCs are set, see DIAGNOSTIC AIDS.

6) Check for open in TP sensor harness connector 5-volt reference circuit. If circuit is open, go to step 11). If circuit is okay, go to next step.

7) Check for short to ground in TP sensor harness connector 5-volt reference circuit. If circuit is shorted, go to step 11). If circuit is okay, go to step 10).

8) Check for open in TP sensor harness connector signal circuit. If circuit is open, go to step 11). If circuit is okay, go to next step.

9) Check for short to ground in TP sensor harness connector signal circuit. If circuit is shorted, go to step 11). If circuit is okay, go to next step.

10) Check for faulty connection at VCM. If faulty connection is found, go to next step. If connection is okay, go to step 13).

11) Repair circuit as necessary. After repairs, go to step 14).

12) Replace TP sensor. After replacing sensor, go to step 14).

13) Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to next step.

14) Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0122. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND

PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

15) Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check for and repair the following condition(s):

* Throttle plate sticking or excessive deposits on throttle plate or throttle bore.
* Check TP sensor harness connector 5-volt reference circuit for open or short to ground, and repair as necessary.
* TP signal voltage reading on scan tool should be less than 1.25 volt with throttle closed, and greater than 4.5 volts at wide open throttle.

DTC P0123 - TP SENSOR CIRCUIT HIGH VOLTAGE

NOTE: For circuit reference, see the L - WIRING DIAGRAMS article.

Circuit Description

Throttle Position (TP) sensor measures amount of throttle opening. VCM uses TP sensor information for fuel delivery calculations. TP sensor readings during acceleration are much higher than those during deceleration or idle.

Condition required for setting DTC:

* Engine running.
* TP sensor signal voltage is greater than 4.7 volts.

Diagnostic Procedures

1) Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the F - BASIC TESTING - 4.3L article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

2) With throttle closed, use scan tool to read TP signal voltage. If voltage is greater than 4.8 volts, go to next step. If voltage is not greater than 4.8 volts, go to step 4).

3) Turn ignition off. Disconnect TP sensor harness connector. Turn ignition on. Using scan tool check TP sensor voltage reading. If voltage reading is less than 0.2 volt, go to step 5). If voltage is not less than 0.2 volt, go to step 8).

4) DTC P0123 is intermittent. If no additional DTC(s) are present, see DIAGNOSTIC AIDS. If other DTC(s) are present, diagnose affected DTC(s).

5) Using DVOM connected to ground, probe 5-volt reference circuit at TP sensor harness connector. If voltage reading is greater than 5.2 volts, go to step 9). If voltage reading is not greater than 5.2 volts, go to next step.

6) Using a test light connected to battery voltage, probe TP sensor ground circuit at TP sensor harness connector. If test light illuminates, go to next step. If test light does not illuminate, go to step 13).

7) Replace TP sensor. After replacing sensor, go to step 18).

8) Check for short to voltage on TP sensor signal circuit. Repair as necessary. After repairs, go to step 14). If circuit is okay, go to step 17).

9) Turn ignition off. Disconnect VCM Gray harness connector. Turn ignition on. Using DVOM connected to ground, check voltage on the 5-volt reference circuit at the VCM harness connector. If voltage reading is greater than 5.2 volts, go to step 12). If voltage reading is not greater than 5.2 volts, go to next step.

10) Check voltage between ground and 5-volt reference circuit at VCM harness connector. If voltage reading is greater than 5.2

volts, go to next step. If voltage reading is not greater than 5.2 volts, go to step 17).

11) Disconnect EGR harness connector. Check voltage on 5-volt reference circuit at VCM harness connector. If voltage reading is greater than 5.2 volts, go to step 16). If voltage reading is not greater than 5.2 volts, go to step 15).

12) Repair short to voltage on the 5-volt reference circuit. After repairs, go to step 18).

13) Check for open in sensor ground circuit. If circuit is open, go to next step. If circuit is okay, go to step 17).

14) Repair as necessary. After repairs, go to step 18).

15) Replace EGR valve. After replacing EGR, go to step 18).

16) Repair short to voltage on 5-volt reference circuit. After repairs, go to step 18).

17) Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to next step.

18) Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0123. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

19) Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check for and repair the following condition(s):

* Throttle plate sticking or excessive deposits on throttle plate or throttle bore.
* Check TP sensor harness connector ground circuit for open, and signal circuit for short to ground.
* TP sensor signal voltage should be less than 1.25 volt with throttle closed, and greater than 4.5 volts at wide open throttle.

DTC P0125 - ECT EXCESSIVE TIME TO REACH CLOSED LOOP

NOTE: For circuit reference, see the L - WIRING DIAGRAMS article.

While engine is warming, VCM reads Engine Coolant Temperature (ECT) sensor to determine how long it takes coolant to reach temperature required for closed loop operation. VCM compares actual time required to a predetermined time.

Conditions required to set DTC are:

* Engine running.
* No ECT or IAT DTCs are set.
* Vehicle speed greater than one MPH.
* ECT and IAT greater than 15.8°F (-9°C).
* Start-up ECT is greater than 15.8°F (-9°C).

Diagnostic Procedures

1) Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the F - BASIC TESTING - 4.3L article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

2) Allow engine to cool completely. Turn ignition on. Using scan tool, compare ECT and IAT values. If values are close, go to next step. If values are not close, go to DTC P0117.

3) Check coolant level. If coolant level is low, diagnose cooling system. If coolant level is okay, go to next step.

4) While reading scan tool, start and warm engine to normal

operating temperature. If ECT value rises steadily to greater than 95°F (35°C) within 9 minutes, see DIAGNOSTIC AIDS. If ECT value does not rise as specified, go to next step.

5) Compare actual coolant temperature with scan tool ECT value. If temperatures are close, repair cooling system as necessary. If temperatures are not close, go to next step.

6) Replace ECT sensor. After replacing sensor, go to next step.

7) Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0125. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

8) Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Ensure thermostat is operating properly. Check for faulty connections or damaged harness. If connections and harness appear okay, observe scan tool while moving all related harness and connectors. A change in scan tool display indicates fault location.

Check for skewed ECT sensor. See ECT TEMPERATURE-TO-RESISTANCE VALUES.

DTC P0131 - HO2S CIRCUIT LOW VOLTAGE SENSOR 1

NOTE: For circuit reference, see the L - WIRING DIAGRAMS article.

Circuit Description

VCM provides about 0.45 volt reference to Heated Oxygen Sensor (HO2S). HO2S sensor signal voltage varies from about one volt when exhaust is rich to about 0.1 volt when exhaust is lean. VCM reads and stores sensor voltage information and evaluates the voltage samples to determine amount of time sensor voltage is out of range. If HO2S voltage is out of predetermined range, DTC will set.

Conditions required to test for DTC are:

* No ECT, IAT, MAF, MAP or TP sensor DTCs set.
* No EVAP system DTC set.
* No other DTC tests in progress.
* No device controls active.
* System voltage measures at least 9 volts.

Diagnostic Procedures

1) Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the F - BASIC TESTING - 4.3L article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

2) Start engine and allow it to reach operating temperature. Place gear selector in Park or Neutral, and apply parking brake. Increase engine speed to 1200 RPM. Using scan tool, read HO2S BANK 1, SENSOR 1 voltage. If voltage is less than 0.086 volt, go to next step. If voltage is not less than 0.086 volt, go to step 4).

3) Turn ignition off. Disconnect HO2S connector. Connect a jumper wire between HO2S harness connector ground circuit and chassis ground. Turn ignition on, engine off. If voltage is 0.35-0.55 volt, go to step 7). If voltage is not as specified, go to step 5).

4) DTC P0131 is intermittent. If any additional DTCs are set, diagnose affected DTCs. If no additional DTCs are set, see DIAGNOSTIC AIDS.

5) Check HO2S sensor harness connector signal circuit for short to ground. If short is found, go to next step. If circuit is

okay, go to step 8).

6) Repair circuit as necessary. After repairs, go to step 9).

7) See DIAGNOSTIC AIDS.

8) Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to next step.

9) Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0131. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

10) Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Using scan tool, observe LT FUEL TRIM values at different RPM. If conditions to set DTC 1031 exist, value should be about 158 or greater. Check for an intermittent short to ground in HO2S signal circuit. Never solder HO2S wires. Check for fuel contamination. Check for proper fuel pressure. Check for exhaust leaks.

DTC P0132 - HO2S CIRCUIT HIGH VOLTAGE BANK 1, SENSOR 1

NOTE: For circuit reference, see the L - WIRING DIAGRAMS article.

Circuit Description

VCM provides about 0.45 volt reference to Heated Oxygen Sensor (HO2S). HO2S sensor signal voltage varies from about one volt when exhaust is rich to about 0.1 volt when exhaust is lean. VCM reads and stores sensor voltage information and evaluates the voltage samples to determine amount of time sensor voltage is out of range. If HO2S voltage is out of predetermined range, DTC will set.

Conditions required to test for DTC are:

* No ECT, IAT, MAF, MAP or TP sensor DTCs set.
* No EVAP system DTC set.
* No other DTC tests in progress.
* No device controls active.
* System voltage measures at least 9 volts.

Diagnostic Procedures

1) Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the F - BASIC TESTING - 4.3L article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

2) Start engine and allow it to reach operating temperature. Place gear selector in Park or Neutral, and apply parking brake. Increase engine speed to 1200 RPM. Using scan tool, read HO2S BANK 1, SENSOR 1 voltage. If voltage is greater than 0.976 volt, go to next step. If voltage is not greater than 0.976 volt, go to step 4).

3) Turn ignition off. Disconnect HO2S connector. Connect a jumper wire between HO2S harness connector signal and ground circuits, and chassis ground. Turn ignition on, engine off. If voltage is less than 0.2 volt, go to step 5). If voltage is not less than 0.2 volt, go to step 6).

4) DTC P0132 is intermittent. If any additional DTCs are set, diagnose affected DTCs. If no additional DTCs are set, see DIAGNOSTIC AIDS.

5) See DIAGNOSTIC AIDS.

6) Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to next step.

7) Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool,

select DTC, SPECIFIC function and enter DTC P0132. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

8) Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check for proper fuel pressure. Check for proper fuel injector operation. Check EVAP canister for fuel saturation. Check for leaking fuel pressure regulator diaphragm. Check for proper TP sensor operation. Check HO2S for silicon contamination (powdery white deposit). Using scan tool, check HO2S voltage. Voltage should be greater than one volt. Check HO2S voltage with connector disconnected. If voltage goes from greater than one volt to about 0.45 volt, replace HO2S. Never solder HO2S wires.

DTC P0133 - HO2S SLOW RESPONSE BANK 1, SENSOR 1

NOTE: For circuit reference, see the L - WIRING DIAGRAMS article.

Circuit Description

VCM provides about 0.45 volt reference to Heated Oxygen Sensor (HO2S). HO2S sensor signal voltage varies from about one volt when exhaust is rich to about 0.1 volt when exhaust is lean. VCM reads and stores sensor voltage information and evaluates the voltage samples to determine amount of time sensor voltage is out of range. If HO2S voltage is out of predetermined range, DTC will set.

Conditions required to test for DTC are:

* No ECT, IAT, MAF, MAP or TP sensor DTCs set.
* No EVAP system DTC set.
* No other DTC tests in progress.
* No device controls are active.
* System voltage measures at least 9 volts.
* HO2S average transition time from lean-to-rich and rich-to -lean is greater than 100 milliseconds.

Diagnostic Procedures

1) Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the F - BASIC TESTING - 4.3L article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

2) If any other HO2S DTCs are set, diagnose affected DTCs. If no other HO2S DTCs are set, go to next step.

3) Using scan tool, read MAP sensor voltage, with engine idling. If voltage is greater than 4 volts, see DTC P0108. If voltage is not greater than 4 volts, go to next step.

4) Visually inspect exhaust system for leaks near HO2S. If leaks are found, go to step 8). If no leaks are found, go to next step.

5) Visually inspect HO2S for secure installation. If HO2S is not securely installed, go to step 8). If HO2S is securely installed, go to next step.

6) Ensure HO2S connector and harness are not contacting engine or exhaust system. If connector or harness are contacting engine or exhaust system, go to step 8). If connector and harness are okay, go to next step.

7) Check HO2S for silicon (powdery white) deposit, engine oil or coolant contamination. If contamination exists, go to step 9). If no contamination exists, see DIAGNOSTIC AIDS.

8) Repair as necessary. After repairs, go to step 11).

9) Repair source of contamination. After repairs, go to step

11).

10) Replace HO2S. After replacing sensor, go to next step.

11) Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0133. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

12) Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check HO2S Heater operation. Never solder HO2S wires.

DTC P0134 - HO2S INSUFFICIENT ACTIVITY BANK 1, SENSOR 1

NOTE: For circuit reference, see the L - WIRING DIAGRAMS article.

Circuit Description

VCM provides about 0.45 volt reference to Heated Oxygen Sensor (HO2S). HO2S sensor signal voltage varies from about one volt when exhaust is rich to about 0.1 volt when exhaust is lean. VCM reads and stores sensor voltage information and evaluates the voltage samples to determine amount of time sensor voltage is out of range. If HO2S voltage is out of predetermined range, DTC will set.

Conditions required to test for DTC are:

* No ECT, IAT, MAF, MAP or TP sensor DTCs set.
* No EVAP system DTC set.
* No other DTC tests in progress.
* No device controls active.
* System voltage measures at least 9 volts.
* Engine run time is at least 2 minutes.
* HO2S voltage is greater than .299 volts but less than .598 volts.

Diagnostic Procedures

1) Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the F - BASIC TESTING - 4.3L article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

2) Start engine and allow it to reach operating temperature. Place gear selector in Park or Neutral, and apply parking brake. Increase engine speed to greater than 1200 RPM for 2 minutes. Using scan tool, read LOOP MODE. If scan tool displays CLOSED LOOP, go to step 5). If scan tool does not display CLOSED LOOP, go to next step.

3) Turn ignition off. Disconnect HO2S connector. Connect a jumper wire between HO2S harness connector signal and ground circuits, and chassis ground. Turn ignition on, engine off. If voltage is less than 0.2 volt, go to step 7). If voltage is less than 0.2 volt, go to next step.

4) Remove jumper wire. Turn ignition off. Reconnect HO2S connector. Disconnect Blue VCM connector. Connect a test light between Blue VCM harness connector signal circuit and battery voltage. If test light illuminates, go to step 6). If test light does not illuminate, go to step 9).

5) DTC P0134 is intermittent. If any additional DTCs are set, diagnose affected DTCs. If no additional DTCs are set, see DIAGNOSTIC AIDS.

6) Check HO2S harness connector signal circuit for open. If open is found, go to step 11). If no open is found, go to step 8).

7) Check HO2S for faulty connection. If faulty connection is found, go to step 11). If connection is okay, go to step 10).

8) Check VCM for faulty connection. If faulty connection is found, go to step 11). If faulty connection is not found, go to step 12).

9) Repair open ground circuit. After repairs, go to step 13).

10) Replace HO2S. After replacing sensor, go to step 13).

11) Repair circuit as necessary. After repairs, go to step 13).

12) Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to next step.

13) Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0134. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

14) Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check for faulty connections or damaged harness. Check for faulty HO2S heater. Observe scan tool while moving all related harness and connectors. A change in scan tool display indicates fault location.

DTC P0135 - HO2S HEATER CIRCUIT BANK 1, SENSOR 1

NOTE: For circuit reference, see the L - WIRING DIAGRAMS article.

Circuit Description

VCM provides about 0.45 volt reference to Heated Oxygen Sensor (HO2S). HO2S sensor signal voltage varies from about one volt when exhaust is rich to about 0.1 volt when exhaust is lean. When ignition is turned on, battery voltage is supplied to HO2S heater to provide for faster sensor warm-up, thus allowing sensor to become active in a shorter period of time. VCM reads amount of time necessary for sensor to become active after start-up.

Conditions required to set DTC are:

* MAF less than 27 grams per second.
* Engine running greater than 2 seconds.
* ECT and IAT less than 89.6°F (32°C).
* Difference between ECT and IAT no greater than 41°F (5°C).
* Elapsed time HO2S bias voltage is greater than predetermined value.

Diagnostic Procedures

1) Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the F - BASIC TESTING - 4.3L article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

NOTE: If engine has been operating, allow engine to cool for about 1 hour before proceeding with tests.

2) Turn ignition off. Turn ignition, engine off. Using scan tool, read HO2S voltage. If voltage gradually decreases 0.15 volt, go to step 5). If voltage does not decrease as indicated, go to next step.

3) Disconnect HO2S harness connector. Connect a test light between chassis ground and ignition feed circuit at HO2S. If test light illuminates, go to next step. If test light does not illuminate, go to step 6).

4) Connect test light between ignition feed and heater ground

circuits at HO2S harness connector. If test light illuminates, go to step 7). If test light does not illuminate, go to step 8).

5) DTC P0135 is intermittent. If any additional DTCs are set, diagnose affected DTCs. If no additional DTCs are set, see DIAGNOSTIC AIDS.

6) Check HO2S (bank 1 sensor 1) fuse. If fuse is open, go to step 14. If fuse is okay, go to step 9).

7) Check HO2S for faulty connection. If faulty connection is found, go to step 12). If connection is okay, go to step 15).

8) Check HO2S for faulty connection. If faulty connection is found, go to step 12). If connection is okay, go to step 10).

9) Check HO2S for faulty connection. If faulty connection is found, go to step 12). If connection is okay, go to step 11).

10 Repair open HO2S ground circuit. After repairs, go to step 16).

11) Check for open HO2S harness connector ignition feed circuit. After repairs, go to step 13).

12) Repair faulty connection. After repairs, go to step 16).

13) Repair open HO2S ignition feed circuit. After repairs, go to step 16).

14) Repair short to ground in HO2S ignition feed circuit, replace fuse and go to step 16)

15) Replace HO2S. After replacing sensor, go to next step.

16) Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0135. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

17) Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check for faulty connections or damaged harness. Never solder HO2S wires.

DTC P0137 - HO2S CIRCUIT LOW VOLTAGE BANK 1, SENSOR 2

NOTE: For circuit reference, see the L - WIRING DIAGRAMS article.

Circuit Description

VCM provides about 0.45 volt reference to Heated Oxygen Sensor (HO2S). HO2S sensor signal voltage varies from about one volt when exhaust is rich to about 0.1 volt when exhaust is lean. VCM reads and stores sensor voltage information and evaluates the voltage samples to determine amount of time sensor voltage is out of range. If HO2S voltage is out of predetermined range, DTC will set.

Conditions required to test for DTC are:

* No ECT, IAT, MAF, MAP or TP sensor DTCs set.
* No EVAP system DTC set.
* No other DTC tests in progress.
* No device control active.
* System voltage measures at least 9 volts.

Diagnostic Procedures

1) Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the F - BASIC TESTING - 4.3L article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

2) Start engine and allow it to reach operating temperature. Place gear selector in Park or Neutral, and apply parking brake. Increase engine speed to 1200 RPM. Using scan tool, read HO2S BANK 2,

SENSOR 1 voltage. If voltage is less than 0.086 volt, go to next step. If voltage is not less than 0.086 volt, go to step 4).

3) Turn ignition off. Disconnect HO2S connector. Connect a jumper wire between HO2S harness connector ground circuit and chassis ground. Turn ignition on, engine off. If voltage is 0.35-0.55 volt, go to step 7). If voltage is not as specified, go to step 5).

4) DTC P0137 is intermittent. If any additional DTCs are set, diagnose affected DTCs. If no additional DTCs are set, see DIAGNOSTIC AIDS.

5) Check HO2S sensor harness connector signal circuit for short to ground. If short is found, go to next step. If circuit is okay, go to step 8).

6) Repair circuit as necessary. After repairs, go to step 9).

7) See DIAGNOSTIC AIDS.

8) Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to next step.

9) Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0137. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

10) Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Using scan tool, observe LT FUEL TRIM values at different RPM. If conditions to set DTC P0137 exist, value should be about 158 or greater. Check for an intermittent short to ground in HO2S signal circuit. Never solder HO2S wires. Check for fuel contamination. Check for proper fuel pressure. Check for exhaust leaks.

DTC P0138 - HO2S CIRCUIT HIGH VOLTAGE BANK 1, SENSOR 2

NOTE: For circuit reference, see the L - WIRING DIAGRAMS article.

Circuit Description

VCM provides about 0.45 volt reference to Heated Oxygen Sensor (HO2S). HO2S sensor signal voltage varies from about one volt when exhaust is rich to about 0.1 volt when exhaust is lean. VCM reads and stores sensor voltage information and evaluates the voltage samples to determine amount of time sensor voltage is out of range. If HO2S voltage is out of predetermined range, DTC will set.

Conditions required to test for DTC are:

* No ECT, IAT, MAF, MAP or TP sensor DTCs set.
* No EVAP system DTC set.
* No other DTC tests in progress.
* No device controls active.
* System voltage measures at least 9 volts.

Diagnostic Procedures

1) Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the F - BASIC TESTING - 4.3L article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

2) Start engine and allow it to reach operating temperature. Place gear selector in Park or Neutral, and apply parking brake. Increase engine speed to 1200 RPM. Using scan tool, read HO2S BANK 1, SENSOR 2 voltage. If voltage is greater than 976 mV, go to next step. If voltage is not greater 976 mV, go to step 4).

3) Turn ignition off. Disconnect HO2S connector. Connect a jumper wire between HO2S harness connector signal and ground circuits,

and chassis ground. Turn ignition on, engine off. If voltage is less than 0.2 volt, go to step 5). If voltage is not less than 0.2 volt, go to step 6).

4) DTC P0138 is intermittent. If any additional DTCs are set, diagnose affected DTCs. If no additional DTCs are set, see DIAGNOSTIC AIDS.

5) Go to DIAGNOSTIC AIDS.

6) Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to next step.

7) Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0138. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

8) Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check for proper fuel pressure. Check for proper fuel injector operation. Check EVAP canister for fuel saturation. Check for leaking fuel pressure regulator diaphragm. Check for proper TP sensor operation. Check HO2S for silicone contamination (powdery white deposit). Using scan tool, check HO2S voltage. Voltage should be greater than one volt. Check HO2S voltage with connector disconnected. If voltage goes from greater than one volt to about 0.45 volt, replace HO2S. Never solder HO2S wires.

DTC P0140 - HO2S INSUFFICIENT ACTIVITY BANK 1, SENSOR 2

NOTE: For circuit reference, see the L - WIRING DIAGRAMS article.

Circuit Description

VCM provides about 0.45 volt reference to Heated Oxygen Sensor (HO2S). HO2S sensor signal voltage varies from about one volt when exhaust is rich to about 0.1 volt when exhaust is lean. VCM reads and stores sensor voltage information and evaluates the voltage samples to determine amount of time sensor voltage is out of range. If HO2S voltage is out of predetermined range, DTC will set.

Conditions required to test for DTC are:

* No ECT, IAT, MAF, MAP or TP sensor DTCs set.
* No EVAP system DTC set.
* No other DTC tests in progress.
* No device controls active.
* System voltage measures at least 9 volts.
* Engine run time at least 2 minutes.
* HO2S voltage is greater than .299 volt, but less than .598 volt.

Diagnostic Procedures

1) Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the F - BASIC TESTING - 4.3L article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

2) Start engine and allow it to reach operating temperature. Place gear selector in Park or Neutral, and apply parking brake. Increase engine speed to greater than 1200 RPM for 2 minutes. Using scan tool, read LOOP MODE. If scan tool displays CLOSED LOOP, go to step 5). If scan tool does not display CLOSED LOOP, go to next step.

3) Turn ignition off. Disconnect HO2S connector. Connect a jumper wire between HO2S harness connector signal and ground circuits, and chassis ground. Turn ignition on, engine off. Read HO2S BANK 1

SENSOR GROUND voltage. If voltage is less than 0.2 volt, go to step 7). If voltage is 0.2 volt or greater, go to next step.

4) Remove jumper wire. Turn ignition off. Reconnect HO2S connector. Disconnect Blue VCM connector. Connect a test light between Blue VCM harness connector signal circuit and battery voltage. If test light illuminates, go to step 6). If test light does not illuminate, go to step 9).

5) DTC P0140 is intermittent. If any additional DTCs are set, diagnose affected DTCs. If no additional DTCs are set, see DIAGNOSTIC AIDS.

6) Check HO2S harness connector signal circuit for open. If open is found, go to step 11). If no open is found, go to step 8).

7) Check HO2S for faulty connection. If faulty connection is found, go to step 11). If connection is okay, go to step 10).

8) Check VCM for faulty connection. If faulty connection is found, go to step 11). If faulty connection is not found, go to step 12).

9) Repair open ground circuit. After repairs, go to step 13).

10) Replace HO2S. After replacing sensor, go to step 13).

11) Repair circuit as necessary. After repairs, go to step 13).

12) Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to next step.

13) Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0140. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

14) Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check for faulty connections or damaged harness. Check for faulty HO2S heater. Observe scan tool while moving all related harness and connectors. A change in scan tool display indicates fault location.

DTC P0141 - HO2S HEATER CIRCUIT BANK 1, SENSOR 2

NOTE: For circuit reference, see the L - WIRING DIAGRAMS article.

Circuit Description

VCM provides about 0.45 volt reference to Heated Oxygen Sensor (HO2S). HO2S sensor signal voltage varies from about one volt when exhaust is rich to about 0.1 volt when exhaust is lean. When ignition is turned on, battery voltage is supplied to HO2S heater to provide for faster sensor warm-up, thus allowing sensor to become active in a shorter period of time. VCM reads amount of time necessary for sensor to become active after start-up.

Conditions required to set DTC are:

* MAF less than 27 grams per second.
* Engine running greater than 2 seconds.
* ECT and IAT less than 89.6°F (32°C).
* Difference between ECT and IAT no greater than 41°F (5°C).
* Elapsed time HO2S bias voltage is greater than predetermined value.

Diagnostic Procedures

1) Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the F - BASIC TESTING - 4.3L article. Retrieve and record FREEZE FRAME

and/or FAIL RECORDS data for each DTC set. Go to next step.

NOTE: If engine has been operating, allow engine to cool for about one hour before proceeding with tests.

2) Turn ignition off. Turn ignition, engine off. Using scan tool, read HO2S BANK 1, SENSOR 2 voltage. If voltage gradually decreases 0.3 volt, go to step 5). If voltage does not decrease, go to next step.
3) Disconnect HO2S harness connector. Connect test light to chassis ground and probe ignition feed circuit at HO2S harness connector. If test light illuminates, go to next step. If test light does not illuminate, go to step 6).
4) Connect test light between ignition feed and heater ground circuits at HO2S harness connector. If test light illuminates, go to step 7). If test light does not illuminate, go to step 8).
5) DTC P0141 is intermittent. If any additional DTCs are set, diagnose affected DTCs. If no additional DTCs are set, see DIAGNOSTIC AIDS.
6) Check HO2S (bank 1 sensor 2) fuse. If fuse is open, go to step 14). If fuse is okay, go to step 9).
7) Check HO2S for faulty connection. If faulty connection is found, go to step 12). If connection is okay, go to step 15).
8) Check HO2S for faulty connection. If faulty connection is found, go to step 12). If connection is okay, go to step 10).
9) Check HO2S for faulty connection. If faulty connection is found, go to step 12). If connection is okay, go to step 11).
10) Repair open HO2S ground circuit. After repairs, go to step 16).
11) Check for open HO2S harness connector ignition feed circuit. After repairs, go to step 13).
12) Repair faulty connection. After repairs, go to step 16).
13) Repair open HO2S ignition feed circuit. After repairs, go to step 16).
14) Repair short to ground in HO2S ignition feed circuit. After repairs, go to step 16)
15) Replace HO2S. After replacing sensor, go to next step.
16) Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0141. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).
17) Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check for faulty connections or damaged harness. Never solder HO2S wires.

DTC P0143 - HO2S CIRCUIT LOW VOLTAGE BANK 1, SENSOR 3

NOTE: For circuit reference, see the L - WIRING DIAGRAMS article.

Circuit Description

VCM provides about 0.45 volt reference to Heated Oxygen Sensor (HO2S). HO2S sensor signal voltage varies from about one volt when exhaust is rich to about 0.1 volt when exhaust is lean. VCM reads and stores sensor voltage information and evaluates the voltage samples to determine amount of time sensor voltage is out of range. If HO2S voltage is out of predetermined range, DTC will set.

Conditions required to test for DTC are:

* No ECT, IAT, MAF, MAP or TP sensor DTCs set.
* No EVAP system DTC set.
* No other DTC tests in progress.
* No device controls active.
* System voltage measures at least 9 volts.

Diagnostic Procedures

1) Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the F - BASIC TESTING - 4.3L article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

2) Start engine and allow it to reach operating temperature. Place gear selector in Park or Neutral, and apply parking brake. Increase engine speed to 1200 RPM. Using scan tool, read HO2S BANK 1, SENSOR 3 voltage. If voltage is less than 0.26 volt, go to next step. If voltage is not less than 0.26 volt, go to step 4).

3) Turn ignition off. Disconnect HO2S connector. Connect a jumper wire between HO2S harness connector ground circuit and chassis ground. Turn ignition on, engine off. If voltage is 0.35-0.55 volt, see DIAGNOSTIC AIDS. If voltage is not as specified, go to step 5).

4) DTC P0143 is intermittent. If any additional DTCs are set, diagnose affected DTCs. If no additional DTCs are set, see DIAGNOSTIC AIDS.

5) Check HO2S sensor harness connector signal circuit for short to ground. If circuit is shorted, go to next step. If circuit is okay, go to step 7).

6) Repair circuit as necessary. After repairs, go to step 8).

7) Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to next step.

8) Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0143. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

9) Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Using scan tool, observe LT FUEL TRIM values at different RPM. If conditions to set DTC 1043 exist, value should be about 158 or greater. Check for an intermittent short to ground in HO2S signal circuit. Never solder HO2S wires. Check for fuel contamination. Check for proper fuel pressure. Check for exhaust leaks.

DTC P0144 - HO2S CIRCUIT HIGH VOLTAGE BANK 1, SENSOR 3

NOTE: For circuit reference, see the L - WIRING DIAGRAMS article.

Circuit Description

VCM provides about 0.45 volt reference to Heated Oxygen Sensor (HO2S). HO2S sensor signal voltage varies from about one volt when exhaust is rich to about 0.1 volt when exhaust is lean. VCM reads and stores sensor voltage information and evaluates the voltage samples to determine amount of time sensor voltage is out of range. If HO2S voltage is out of predetermined range, DTC will set.

Conditions required to test for DTC are:

* No ECT, IAT, MAF, MAP or TP sensor DTCs set.
* No EVAP system DTC set.
* No other DTC tests in progress.
* No device controls active.

* System voltage measures at least 9 volts.

Diagnostic Procedures

1) Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the F - BASIC TESTING - 4.3L article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

2) Start engine and allow it to reach operating temperature. Place gear selector in Park or Neutral, and apply parking brake. Increase engine speed to 1200 RPM. Using scan tool, read HO2S BANK 1, SENSOR 3 voltage. If voltage is greater than 0.976 volt, go to next step. If voltage is not greater than 0.976, go to step 4).

3) Turn ignition off. Disconnect HO2S connector. Connect a jumper wire between HO2S harness connector signal and ground circuits, and chassis ground. Turn ignition on, engine off. If voltage is less than 0.2 volt, see DIAGNOSTIC AIDS. If voltage is not less than 0.2 volt, go to step 5).

4) DTC P0144 is intermittent. If any additional DTCs are set, diagnose affected DTCs. If no additional DTCs are set, see DIAGNOSTIC AIDS.

5) Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to next step.

6) Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0144. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

7) Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check for proper fuel pressure. Check for proper fuel injector operation. Check EVAP canister for fuel saturation. Check for leaking fuel pressure regulator diaphragm. Check for proper TP sensor operation. Check HO2S for silicone contamination (powdery white deposit). Using scan tool, check HO2S voltage. Voltage should be greater than one volt. Check HO2S voltage with connector disconnected. If voltage goes from greater than one volt to about 0.45 volt, replace HO2S. Never solder HO2S wires.

DTC P0146 - HO2S INSUFFICIENT ACTIVITY BANK 1, SENSOR 3

NOTE: For circuit reference, see the L - WIRING DIAGRAMS article.

Circuit Description

VCM provides about 0.45 volt reference to Heated Oxygen Sensor (HO2S). HO2S sensor signal voltage varies from about one volt when exhaust is rich to about 0.1 volt when exhaust is lean. VCM reads and stores sensor voltage information and evaluates the voltage samples to determine amount of time sensor voltage is out of range. If HO2S voltage is out of predetermined range, DTC will set.

Conditions required to test for DTC are:

* No ECT, IAT, MAF, MAP or TP sensor DTCs set.
* No EVAP system DTC set.
* No other DTC tests in progress.
* No device controls active.
* System voltage measures at least 9 volts.
* HO2S voltage is greater than .351 volts, but less than .473 volts.

Diagnostic Procedures

1) Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the F - BASIC TESTING - 4.3L article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

2) If any other DTCs are set, diagnose affected DTC. If no other DTCs are set, go to next step.

3) Start engine and allow it idle. Using scan tool, read MAP sensor voltage. If voltage is greater than 4 volts, see DTC P0108. If voltage is not greater than 4 volts, go to next step.

4) Visually inspect exhaust system near HO2S (bank 1 sensor 1) for leaks. If leaks are found, go to step 8). If no leaks are found, go to next step.

5) Check if HO2S (bank 1 sensor 3) is installed securely. If HO2S is not installed securely, go to Step 8). If HO2S is installed securely, go to next step.

6) Ensure HO2S connector and harness are not contacting engine or exhaust system. If connector or harness are contacting engine or exhaust system, go to step 8). If connector and harness are okay, go to next step.

7) Check HO2S for silicone (powdery white) deposit, engine oil or coolant contamination. If contamination exists, go to step 9). If no contamination exists, see DIAGNOSTIC AIDS.

8) Repair as necessary. After repairs, go to step 11).

9) Repair source of contamination. After repairs, go to step 11).

10) Replace HO2S. After replacing sensor, go to next step.

11) Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0146. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

12) Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check HO2S Heater operation. Never solder HO2S wires.

DTC P0147 - HO2S HEATER CIRCUIT BANK 1, SENSOR 3

NOTE: For circuit reference, see the L - WIRING DIAGRAMS article.

Circuit Description

VCM provides about 0.45 volt reference to Heated Oxygen Sensor (HO2S). HO2S sensor signal voltage varies from about one volt when exhaust is rich to about 0.1 volt when exhaust is lean. When ignition is turned on, battery voltage is supplied to HO2S heater to provide for faster sensor warm-up, thus allowing sensor to become active in a shorter period of time. VCM reads amount of time necessary for sensor to become active after start-up.

Conditions required to set DTC are:

* MAF less than 27 grams per second.
* Engine running greater than 2 seconds.
* ECT and IAT less than 89.6°F (32°C).
* Difference between ECT and IAT no greater than 41°F (5°C).
* Elapsed time HO2S bias voltage is greater than predetermined value.

Diagnostic Procedures

1) Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the F - BASIC TESTING - 4.3L article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

NOTE: If engine has been operating, allow engine to cool for about one hour before proceeding with tests.

2) Turn ignition off. Turn ignition, engine off. Using scan tool, read HO2S voltage. If voltage gradually decreases 0.15 volt, go to step 5). If voltage does not decrease, go to next step.
3) Disconnect HO2S harness connector. Connect a test light between chassis ground and ignition feed circuit at HO2S. If test light illuminates, go to next step. If test light does not illuminate, go to step 6).
4) Connect test light between ignition feed and heater ground circuits at HO2S harness connector. If test light illuminates, go to step 7). If test light does not illuminate, go to step 8).
5) DTC P0147 is intermittent. If any additional DTCs are set, diagnose affected DTCs. If no additional DTCs are set, see DIAGNOSTIC AIDS.
6) Check HO2S (bank 1 sensor 3) fuse. If fuse is open, go to step 14). If fuse is okay, go to step 9).
7) Check HO2S for faulty connection. If faulty connection is found, go to step 12). If connection is okay, go to step 15).
8) Check HO2S for faulty connection. If faulty connection is found, go to step 12). If connection is okay, go to step 10).
9) Check HO2S for faulty connection. If faulty connection is found, go to step 12). If connection is okay, go to step 11).
10) Repair open HO2S ground circuit. After repairs, go to step 16).
11) Check for open HO2S harness connector ignition feed circuit. After repairs, go to step 13).
12) Repair faulty connection. After repairs, go to step 16).
13) Repair open HO2S ignition feed circuit. After repairs, go to step 16).
14) Repair short to ground in HO2S ignition feed circuit. After repairs, go to step 16)
15) Replace HO2S. After replacing sensor, go to next step.
16) Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0147. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).
17) Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check for faulty connections or damaged harness. Never solder HO2S wires.

DTC P0151 - HO2S CIRCUIT LOW VOLTAGE BANK 2, SENSOR 1

NOTE: For circuit reference, see the L - WIRING DIAGRAMS article.

Circuit Description

VCM provides about 0.45 volt reference to Heated Oxygen Sensor (HO2S). HO2S sensor signal voltage varies from about one volt when exhaust is rich to about 0.1 volt when exhaust is lean. VCM reads and stores sensor voltage information and evaluates the voltage samples to determine amount of time sensor voltage is out of range. If HO2S voltage is out of predetermined range, DTC will set.
Conditions for setting DTCs:

* No ECT, IAT, MAF, MAP or TP sensor DTCs set.

* No EVAP system DTC set.
* No other DTC tests in progress.
* No device controls active.
* System voltage measures at least 9 volts.

Diagnostic Procedures

1) Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the F - BASIC TESTING - 4.3L article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

2) Start engine and allow it to reach operating temperature. Place gear selector in Park or Neutral, and apply parking brake. Increase engine speed to 1200 RPM. Using scan tool, read HO2S BANK 2, SENSOR 1 voltage. If voltage is less than 0.086 volt, go to next step. If voltage is not less than 0.086 volt, go to step 4).

3) Turn ignition off. Disconnect HO2S connector. Connect a jumper wire between HO2S harness connector ground circuit and chassis ground. Turn ignition on, engine off. If voltage is 0.35-0.55 volt, go to Step 7). If voltage is not as specified, go to step 5).

4) DTC P0151 is intermittent. If any additional DTCs are set, diagnose affected DTCs. If no additional DTCs are set, see DIAGNOSTIC AIDS.

5) Check HO2S sensor harness connector signal circuit for short to ground. If circuit is shorted, go to next step. If circuit is okay, go to step 8).

6) Repair circuit as necessary. After repairs, go to step 9).

7) Go to DIAGNOSTIC AIDS.

8) Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to next step.

9) Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0151. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

10) Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Using scan tool, observe LT FUEL TRIM values at different RPM. If conditions to set DTC 1051 exist, value should be about 158 or more. Check for an intermittent short to ground in HO2S signal circuit. Never solder HO2S wires. Check for fuel contamination. Check for proper fuel pressure. Check for exhaust leaks.

DTC P0152 - HO2S CIRCUIT HIGH VOLTAGE BANK 2, SENSOR 1

NOTE: For circuit reference, see the L - WIRING DIAGRAMS article.

Circuit Description

VCM provides about 0.45 volt reference to Heated Oxygen Sensor (HO2S). HO2S sensor signal voltage varies from about one volt when exhaust is rich to about 0.1 volt when exhaust is lean. VCM reads and stores sensor voltage information and evaluates the voltage samples to determine amount of time sensor voltage is out of range. If HO2S voltage is out of predetermined range, DTC will set.

Conditions required to test for DTC are:

* No ECT, IAT, MAF, MAP or TP sensor DTCs set.
* No EVAP system DTC set.
* No other DTC tests in progress.
* No device controls active.
* System voltage measures at least 9 volts.

Diagnostic Procedures

1) Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the F - BASIC TESTING - 4.3L article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

2) Start engine and allow it to reach operating temperature. Place gear selector in Park or Neutral, and apply parking brake. Increase engine speed to 1200 RPM. Using scan tool, read HO2S BANK 2, SENSOR 1 voltage. If voltage is greater than 0.976 volt, go to next step. If voltage is not greater than 0.976 volt, go to step 4).

3) Turn ignition off. Disconnect HO2S connector. Connect a jumper wire between HO2S harness connector signal and ground circuits, and chassis ground. Turn ignition on, engine off. If voltage is less than 0.2 volt, go to step 5). If voltage is not less than 0.2 volt, go to step 6).

4) DTC P0152 is intermittent. If any additional DTCs are set, diagnose affected DTCs. If no additional DTCs are set, see DIAGNOSTIC AIDS.

5) Go to DIAGNOSTIC AIDS.

6) Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to next step.

7) Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0152. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

8) Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check for proper fuel pressure. Check for proper fuel injector operation. Check EVAP canister for fuel saturation. Check for leaking fuel pressure regulator diaphragm. Check for proper TP sensor operation. Check HO2S for silicone contamination (powdery white deposit). Using scan tool, check HO2S voltage. Voltage should be more than one volt. Check HO2S voltage with connector disconnected. If voltage goes from more than one volt to about 0.45 volt, replace HO2S. Never solder HO2S wires.

DTC P0153 - HO2S SLOW RESPONSE BANK 2, SENSOR 1

NOTE: For circuit reference, see the L - WIRING DIAGRAMS article.

Circuit Description

VCM provides about 0.45 volt reference to Heated Oxygen Sensor (HO2S). HO2S sensor signal voltage varies from about one volt when exhaust is rich to about 0.1 volt when exhaust is lean. VCM reads and stores sensor voltage information and evaluates the voltage samples to determine amount of time sensor voltage is out of range. If HO2S voltage is out of predetermined range, DTC will set.

Conditions required to test for DTC are:

* No ECT, IAT, MAF, MAP or TP sensor DTCs set.
* No EVAP system DTC set.
* No other DTC tests in progress.
* No device controls active.
* HO2S average transition tome from lean-to-rich or rich-to -lean is greater than 100 milliseconds.

Diagnostic Procedures

1) Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the

F - BASIC TESTING - 4.3L article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

2) If any other HO2S DTCs are set, diagnose affected DTCs. If no other HO2S DTCs are set, go to next step.

3) Using scan tool, read MAP sensor voltage, with engine idling. If voltage is greater than 4 volts, see DTC P0108. If voltage is not greater than 4 volts, go to next step.

4) Visually inspect exhaust system for leaks near HO2S. If leaks are found, go to step 8). If no leaks are found, go to next step.

5) Visually inspect HO2S for secure installation. If HO2S is not securely installed, go to step 8). If HO2S is securely installed, go to next step.

6) Ensure HO2S connector and harness are not contacting engine or exhaust system. If connector or harness are contacting engine or exhaust system, go to step 8). If connector and harness are okay, go to next step.

7) Check HO2S for silicone (powdery white) deposit, engine oil or coolant contamination. If contamination exists, go to step 9). If no contamination exists, see DIAGNOSTIC AIDS.

8) Repair as necessary. After repairs, go to step 11).

9) Repair source of contamination. After repairs, go to step 11).

10) Replace HO2S. After replacing sensor, go to next step.

11) Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0153. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

12) Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check HO2S Heater operation. Never solder HO2S wires.

DTC P0154 - HO2S INSUFFICIENT ACTIVITY BANK 2, SENSOR 1

NOTE: For circuit reference, see the L - WIRING DIAGRAMS article.

Circuit Description

VCM provides about 0.45 volt reference to Heated Oxygen Sensor (HO2S). HO2S sensor signal voltage varies from about one volt when exhaust is rich to about 0.1 volt when exhaust is lean. VCM reads and stores sensor voltage information and evaluates the voltage samples to determine amount of time sensor voltage is out of range. If HO2S voltage is out of predetermined range, DTC will set.

Conditions required to test for DTC are:

* No ECT, IAT, MAF, MAP or TP sensor DTCs set.
* No EGR and EVAP system DTC set.
* No other DTC tests in progress.
* No device controls active.
* Engine running at least 2 minutes.
* HO2S voltage is greater than 299 mV, but less than 598 mV.

Diagnostic Procedures

1) Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the F - BASIC TESTING - 4.3L article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

2) Start and warm engine to normal operating temperature. Place gear selector in Park or Neutral, and apply parking brake.

Increase engine speed to greater than 1200 RPM for 2 minutes. Using scan tool, read LOOP MODE. If scan tool displays CLOSED LOOP, go to step 5). If scan tool does not display CLOSED LOOP, go to next step.

3) Turn ignition off. Disconnect HO2S connector. Connect a jumper wire between HO2S harness connector signal and ground circuits, and chassis ground. Turn ignition on, engine off. If voltage is less than 0.2 volt, go to step 7). If voltage is not less than 0.2 volt, go to next step.

4) Remove jumper wire. Turn ignition off. Reconnect HO2S connector. Disconnect Blue VCM connector. Connect a test light between Blue VCM harness connector signal circuit and battery voltage. If test light illuminates, go to step 6). If test light does not illuminate, go to step 9).

5) DTC P0154 is intermittent. If any additional DTCs are set, diagnose affected DTCs. If no additional DTCs are set, go to DIAGNOSTIC AIDS.

6) Check HO2S harness connector signal circuit for open. If open is found, go to step 11). If no open is found, go to step 8).

7) Check HO2S for faulty connection. If faulty connection is found, go to step 11). If connection is okay, go to step 10).

8) Check VCM for faulty connection. If faulty connection is found, go to step 11). If faulty connection is not found, go to step 12).

9) Repair open ground circuit. After repairs, go to step 13).

10) Replace HO2S. After replacing sensor, go to step 13).

11) Repair circuit as necessary. After repairs, go to step 13).

12) Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to next step.

13) Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0154. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

14) Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check for faulty connections or damaged harness. Check for faulty HO2S heater. Observe scan tool while moving all related harness and connectors. A change in scan tool display indicates fault location.

DTC P0155 - HO2S HEATER CIRCUIT BANK 2, SENSOR 1

NOTE: For circuit reference, see the L - WIRING DIAGRAMS article.

Circuit Description

VCM provides about 0.45 volt reference to Heated Oxygen Sensor (HO2S). HO2S sensor signal voltage varies from about one volt when exhaust is rich to about 0.1 volt when exhaust is lean. When ignition is turned on, battery voltage is supplied to HO2S heater to provide for faster sensor warm-up, thus allowing sensor to become active in a shorter period of time. VCM reads amount of time necessary for sensor to become active after start-up.

Conditions required to set DTC are:

* MAF less than 27 grams per second.
* Engine running greater than 2 seconds.
* ECT and IAT less than 89.6°F (32°C).
* Difference between ECT and IAT not greater than 41°F (5°C).

* Elapsed time HO2S bias voltage is greater than predetermined value.

Diagnostic Procedures

1) Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the F - BASIC TESTING - 4.3L article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

NOTE: If engine has been operating, allow engine to cool for about one hour before proceeding with tests.

2) Turn ignition off. Turn ignition, engine off. Using scan tool, read HO2S voltage. If voltage gradually decreases 0.15 volt, go to step 5). If voltage does not decrease, go to next step.

3) Disconnect HO2S harness connector. Connect a test light between chassis ground and ignition feed circuit at HO2S. If test light illuminates, go to next step. If test light does not illuminate, go to step 6).

4) Connect test light between ignition feed and heater ground circuits at HO2S harness connector. If test light illuminates, go to step 7). If test light does not illuminate, go to step 8).

5) DTC P0155 is intermittent. If any additional DTCs are set, diagnose affected DTCs. If no additional DTCs are set, see DIAGNOSTIC AIDS.

6) Check HO2S (bank 2 sensor 1) fuse. If fuse is open, go to step 14). If fuse is okay, go to step 9).

7) Check HO2S for faulty connection. If faulty connection is found, go to step 12). If connection is okay, go to step 15).

8) Check HO2S for faulty connection. If faulty connection is found, go to step 12). If connection is okay, go to step 10).

9) Check HO2S for faulty connection. If faulty connection is found, go to step 12). If connection is okay, go to step 11).

10) Repair open HO2S ground circuit. After repairs, go to step 16).

11) Check for open HO2S harness connector ignition feed circuit. After repairs, go to step 13).

12) Repair faulty connection. After repairs, go to step 16).

13) Repair open HO2S ignition feed circuit. After repairs, go to step 16).

14) Repair short to ground in HO2S ignition feed circuit. After repairs, go to step 16)

15) Replace HO2S. After replacing sensor, go to next step.

16) Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0155. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

17) Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check for faulty connections or damaged harness. Never solder HO2S wires.

DTC P0171 - FUEL TRIM SYSTEM LEAN BANK 1

NOTE: For circuit reference, see the L - WIRING DIAGRAMS article.

Circuit Description

VCM reads HO2S signal voltage and adjusts fuel delivery based on this voltage. A change made to fuel delivery is indicated by Long

Term (LT) and Short Term (ST) FUEL TRIM values.

ST FUEL TRIM values change rapidly in response to HO2S signal voltages. These changes fine tune engine fueling. LT FUEL TRIM values changes in response to trends in ST fuel trim. LT fuel trim makes coarse adjustments to fueling in order to re-center and restore control to ST fuel trim. LT and ST fuel trim can be read by using a scan tool.

Ideal FUEL TRIM value is about 128. Fuel trim value greater than 128 indicates that VCM is adding fuel to compensate for a lean condition. Fuel trim less than 128 indicates that VCM is reducing amount of fuel to compensate for rich condition. DTC will set if VCM detects an excessively rich or lean condition.

Conditions required to test for DTC are:

* No IAC DTCs set at idle
* No ECT, EGR, HO2S, IAT, MAF, MAP, TP or VSS sensor DTCs set.
* No EVAP or voltage system DTCs set.
* No misfire DTCs set.
* TP position less than 69.9 percent.
* Engine speed 575-4500 RPM.
* BARO greater than 70 kPa.
* ECT greater than 32°F (0°C) but less than 210°F (99°C).
* MAP greater than 20 kPa but less than 99 kPa.
* IAT greater than 29°F (-20°C) but less than 158°F (70°C).
* Airflow greater than 3 gm/s. but less than 150 gm/s.
* Vehicle speed less than 85 MPH.
* Average short term trim is not greater than 115.

Diagnostic Procedures

1) Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the F - BASIC TESTING - 4.3L article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

2) Check exhaust system for corrosion, loose or missing hardware. Ensure HO2S is installed securely, and connector and harness are not contacting exhaust manifold or ignition wires. Check vacuum hoses for splits, kinks and proper routing. Check throttle body, intake manifold, and EGR valve for vacuum leaks. Check IAC, if high or unsteady idle condition exists. Check crankcase ventilation valve, spring and "O" ring for proper installation. Check for fuel contamination. Check for good VCM and sensor grounds. If any of these items isolate or require repair, go to step 8). If all items are okay, go to next step.

3) Cautiously connect a fuel pressure gauge to fuel rail. Turn ignition off for 10 seconds. Turn A/C off. Turn ignition on, engine off (fuel pump should run for about 2 seconds). Cycle ignition off and on until maximum pressure is obtained. Note fuel pressure while pump is running (pressure may vary slightly when pump stops). If pressure holds at 60-66 psi (4.2-4.6 kg/cm²), go to next step. If pressure is not as specified, go to step 11).

4) Start and idle engine. If fuel pressure drops 3-10 psi (0. 2-0.7 kg/cm²), go to next step. If fuel pressure does not drop as specified, go to step 11).

5) Perform INJECTOR BALANCE TEST under FUEL SYSTEM in the I - SYSTEM/COMPONENT TESTS article. If an injector problem is found, go to step 9). If injectors are okay, go to next step.

6) Perform EVAP CANISTER PURGE SOLENOID CHECK. See FUEL EVAPORATION CONTROL, under EMISSION SYSTEMS & SUB-SYSTEMS in the F - BASIC TESTING - 4.3L article. If a solenoid problem is found, go to next step. If solenoid is okay, go to DIAGNOSTIC AIDS.

7) Repair EVAP system. Operate vehicle in closed loop mode while using scan tool to read LT and ST FUEL TRIM values. LT FUEL TRIM value should decrease to less than 158, ST FUEL TRIM value should decrease to less than 180. If FUEL TRIM values are as specified, go to

step 10). If values are not as specified, see DIAGNOSTIC AIDS.

8) Repair items as necessary. Operate vehicle in closed loop mode while using scan tool to read LT and ST FUEL TRIM values. LT FUEL TRIM value should decrease to less than 158, ST FUEL TRIM value should decrease to less than 180. If FUEL TRIM values are as specified, go to step 10). If values are not as specified, go to step 3).

9) Replace fuel injector(s) as necessary. Operate vehicle in closed loop mode while using scan tool to read LT and ST FUEL TRIM values. LT FUEL TRIM value should decrease to less than 158, ST FUEL TRIM value should decrease to less than 180. If FUEL TRIM values are as specified, go to next step. If values are not as specified, go to step 6).

10) Lean condition does not exist. If driveability problem still exists, see the H - TESTS W/O CODES article.

11) See FUEL SYSTEM DIAGNOSIS under BASIC FUEL SYSTEM CHECKS in the F - BASIC TESTING - 4.3L article.

12) Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0171. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

13) Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

If problem cannot be isolated, attempt driving vehicle under various load conditions while using scan tool to read LT and ST FUEL TRIM values. This may help isolate condition which set DTC P0171. If condition to set DTC cannot be duplicated, problem could have been caused by a cylinder misfire. See DTC P0300.

DTC P0172 - FUEL TRIM SYSTEM RICH BANK 1

NOTE: For circuit reference, see the L - WIRING DIAGRAMS article.

Circuit Description

VCM reads HO2S signal voltage and adjusts fuel delivery based on this voltage. A change made to fuel delivery is indicated by Long Term (LT) and Short Term (ST) FUEL TRIM values.

ST FUEL TRIM values change rapidly in response to HO2S signal voltages. These changes fine tune engine fueling. LT FUEL TRIM values change in response to trends in ST fuel trim. LT fuel trim makes coarse adjustments to fueling in order to re-center and restore control to ST fuel trim. LT and ST fuel trim can be read by using a scan tool.

Ideal FUEL TRIM value is about 128. Fuel trim value greater than 128 indicates that VCM is adding fuel to compensate for a lean condition. Fuel trim less than 128 indicates that VCM is reducing amount of fuel to compensate for rich condition. DTC will set if VCM detects an excessively rich or lean condition.

Conditions required to test for DTC are:

* No IAC DTCs set (at idle)
* No ECT, EGR, HO2S, IAT, MAF, MAP, TP or VSS sensor DTCs set.
* No EVAP or voltage system DTCs set.
* No misfire DTCs set.
* Engine speed 575-4500 RPM.
* TP angle less than 70 percent.
* Engine speed is greater than 575 RPM but less than 4500 RPM.
* BARO is greater than 70 kPa.
* MAP greater than 20 kPa, but less 99 kPa.

* IAT greater than -4°F (-20°C), but less than 158°F (70°C).
* MAF greater than 3 gm/s. but less than 150 gm/s.
* Vehicle speed less than 85 MPH.
* Average short term fuel trim is not greater than 115.

Diagnostic Procedures

1) Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the F - BASIC TESTING - 4.3L article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

2) Check air intake duct for restrictions. Check for plugged air filter. Check IAC, if low or unsteady idle condition exists. Check throttle body for coking and IAC passages for blockage. Check fuel pressure regulator for proper operation. See FUEL SYSTEM DIAGNOSIS under BASIC FUEL SYSTEM CHECKS in the F - BASIC TESTING - 4.3L article. Check TP sensor for loose or missing mounting bolts. Using scan tool, read TP sensor voltage while slowly opening throttle from closed (0.20-0.74 volt) to wide open (4 volts). A steady throttle movement from a stop should cause TP sensor voltage to increase smoothly as throttle is opened. If any of these items isolate or require repair, go to step 7). If all items are okay, go to next step.

3) Connect a fuel pressure gauge to fuel rail. Turn ignition off for 10 seconds. Turn A/C off. Turn ignition on, engine off (fuel pump should run for about 2 seconds). Cycle ignition off and on until maximum pressure is obtained. Note fuel pressure while pump is running (pressure may vary slightly when pump stops). If pressure holds at 60-66 psi (4.2-4.6 kg/cm²), go to next step. If pressure is not as specified, go to step 10).

4) Perform INJECTOR BALANCE TEST under FUEL SYSTEM in the I - SYSTEM/COMPONENT TESTS article. If an injector problem is found, go to step 8). If injectors are okay, go to next step.

5) Check HO2S for silicon contamination (powdery white) deposit. If contamination is evident, go to step 11). If contamination is not evident, go to next step.

6) Operate vehicle in closed loop mode while using scan tool to read LT and ST FUEL TRIM values. If LT FUEL TRIM value increases to greater than 100 and ST FUEL TRIM value increases to greater than 94, go to step 9). If values are not as specified, go to DIAGNOSTIC AIDS.

7) Repair items as necessary. Operate vehicle in closed loop mode while using scan tool to read LT and ST FUEL TRIM values. LT FUEL TRIM value should increase to greater than 100, ST FUEL TRIM value should increase to greater than 94. If FUEL TRIM values are as specified, go to step 11). If values are not as specified, go to step 3).

8) Replace fuel injector(s) as necessary. Operate vehicle in closed loop mode while using scan tool to read LT and ST FUEL in closed loop mode while using scan tool to read LT and ST FUEL TRIM values. If LT value increases to greater than 100 and ST fuel value increases to greater than 94, go to step 11). If values are not as specified, go to step 5).

9) Rich condition does not exist. If driveability problem still exists, see the H - TESTS W/O CODES article.

10) See FUEL SYSTEM DIAGNOSIS under BASIC FUEL SYSTEM CHECKS in the F - BASIC TESTING - 4.3L article.

11) Replace HO2S (bank 2 sensor 1). After replacing sensor, go to next step.

12) Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0172. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

13) Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected

DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

If problem cannot be isolated, attempt driving vehicle under various load conditions while using scan tool to read LT and ST FUEL TRIM values. This may help isolate condition which set DTC P0172. If condition to set DTC cannot be duplicated, problem could have been caused by a cylinder misfire. See DTC P0300.

DTC P0174 - FUEL TRIM SYSTEM LEAN BANK 2

NOTE: For circuit reference, see the L - WIRING DIAGRAMS article.

Circuit Description

VCM reads HO2S signal voltage and adjusts fuel delivery based on this voltage. A change made to fuel delivery is indicated by Long Term (LT) and Short Term (ST) fuel trim values.

ST fuel trim values change rapidly in response to HO2S signal voltages. These changes fine tune engine fueling. LT fuel trim values changes in response to trends in ST fuel trim. LT fuel trim makes coarse adjustments to fueling in order to re-center and restore control to ST fuel trim. LT and ST fuel trim can be read by using a scan tool.

Ideal fuel trim value is about 128. Fuel trim value more than 128 indicates that VCM is adding fuel to compensate for a lean condition. Fuel trim less than 128 indicates that VCM is reducing amount of fuel to compensate for rich condition. DTC will set if VCM detects an excessively rich or lean condition.

Conditions required to test for DTC are:

* No IAC DTCs set at idle.
* No ECT, EGR, HO2S, IAT, MAF, MAP, TP or VSS sensor DTCs set.
* No EVAP or voltage system DTCs set.
* No misfire DTCs set.
* Engine speed 575-4500 RPM.
* BARO is greater than 70 kPa.
* ECT is greater than 140°F (60°C) but less than 210°F (99°C).
* MAP greater than 20 kPa, but less than 99 kPa.
* IAT greater than -4°F (-20°C), but less than 159°F (70°C).
* MAF us greater than 3 gm/s., but less than 150 gm/s.
* Vehicle speed less than 85 MPH.
* Average short term fuel trim is not greater than 115.

Diagnostic Procedures

1) Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the F - BASIC TESTING - 4.3L article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

2) Check exhaust system for corrosion, loose or missing hardware. Ensure HO2S is installed securely, and connector and harness are not contacting exhaust manifold or ignition wires. Check vacuum hoses for splits, kinks and proper routing. Check throttle body, intake manifold, and EGR valve for vacuum leaks. Check IAC, if high or unsteady idle condition exists. Check crankcase ventilation valve, spring and "O" ring for proper installation. Check for fuel contamination. Check for good VCM and sensor grounds. If any of these items isolate or require repair, go to step 8). If all items are okay, go to next step.

3) Cautiously connect a fuel pressure gauge to fuel rail. Turn ignition off for 10 seconds. Turn A/C off. Turn ignition on, engine off (fuel pump should run for about 2 seconds). Cycle ignition off and on until maximum pressure is obtained. Note fuel pressure while pump is running (pressure may vary slightly when pump stops). If pressure holds at 60-66 psi (4.2-4.6 kg/cm^2), go to next step. If

pressure is not as specified, go to step 11).

4) Start engine and allow it to idle. If pressure drops 3-10 psi (0.2-0.7 kg/cm²), go to next step. If pressure does not drop as specified, go to step 11).

5) Perform INJECTOR BALANCE TEST under FUEL SYSTEM in the I - SYSTEM/COMPONENT TESTS article. If an injector problem is found, go to step 9). If injectors are okay, go to next step.

6) Perform CANISTER PURGE SOLENOID CHECK under EMISSION SYSTEMS & SUB-SYSTEMS in the I - SYSTEM/COMPONENT TESTS article. If a solenoid problem is found, go to next step. If solenoid is okay, go to DIAGNOSTIC AIDS.

7) Repair EVAP system. Operate vehicle in closed loop mode while using scan tool to read LT and ST fuel trim values. LT fuel trim value should decrease to less than 158, ST fuel trim value should decrease to less than 180. If fuel trim values are as specified, go to step 10). If values are not as specified, go to DIAGNOSTIC AIDS.

8) Repair items as necessary. Operate vehicle in closed loop mode while using scan tool to read LT and ST fuel trim values. LT fuel trim value should decrease to less than 158, ST fuel trim value should decrease to less than 180. If fuel trim values are as specified, go to step 10). If values are not as specified, go to step 3).

9) Replace fuel injector(s) as necessary. Operate vehicle in closed loop mode while using scan tool to read LT and ST fuel trim values. LT fuel trim value should decrease to less than 158, ST fuel trim value should decrease to less than 180. If fuel trim values are as specified, go to next step. If values are not as specified, go to step 6).

10) Lean condition does not exist. If driveability problem still exists, see the H - TESTS W/O CODES article.

11) See FUEL SYSTEM DIAGNOSIS under BASIC FUEL SYSTEM CHECKS in the F - BASIC TESTING - 4.3L article.

12) Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0174. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

13) Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

If problem cannot be isolated, attempt driving vehicle under various load conditions while using scan tool to read LT and ST fuel trim values. This may help isolate condition which set DTC P0174. If condition to set DTC cannot be duplicated, problem could have been caused by a cylinder misfire. See DTC P0300.

DTC P0175 - FUEL TRIM SYSTEM RICH BANK 2

NOTE: For circuit reference, see the L - WIRING DIAGRAMS article.

Circuit Description

VCM reads HO2S signal voltage and adjusts fuel delivery based on this voltage. A change made to fuel delivery is indicated by Long Term (LT) and Short Term (ST) fuel trim values.

ST fuel trim values change rapidly in response to HO2S signal voltages. These changes fine tune engine fueling. LT fuel trim values changes in response to trends in ST fuel trim. LT fuel trim makes coarse adjustments to fueling in order to re-center and restore control to ST fuel trim. LT and ST fuel trim can be read by using a scan tool.

Ideal fuel trim value is about 128. Fuel trim value more than

128 indicates that VCM is adding fuel to compensate for a lean condition. Fuel trim less than 128 indicates that VCM is reducing amount of fuel to compensate for rich condition. DTC will set if VCM detects an excessively rich or lean condition.

Conditions required to test for DTC are:

* No IAC DTCs set at idle.
* No ECT, EGR, HO2S, IAT, MAF, MAP, TP or VSS sensor DTCs set.
* No EVAP or voltage system DTCs set.
* No misfire DTCs set.
* Engine speed 575-4500 RPM.
* ECT at normal operating temperature.
* Airflow 3-150 gm/s.
* Vehicle speed less than 85 MPH.
* BARO greater than 70 kPa.
* ECT greater than 140°F (60°C) but less than 212°F (100°C).
* MAP greater than 20 kPa but less than 99 kPa.
* IAT greater than -4°F (-20°C) but less than 158°F (70°C).
* MAF greater than 3 gm/s. but less than 150 gm/sec.
* Average short term fuel trim is not greater than 115.

Diagnostic Procedures

1) Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the F - BASIC TESTING - 4.3L article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

2) Check air intake duct for restrictions. Check for plugged air filter. Check IAC, if low or unsteady idle condition exists. Check throttle body for coking and IAC passages for blockage. Check fuel pressure regulator for proper operation. See FUEL SYSTEM DIAGNOSIS under BASIC FUEL SYSTEM CHECKS in the F - BASIC TESTING - 4.3L article. Check TP sensor for loose or missing mounting bolts. Using scan tool, read TP sensor voltage while slowly opening throttle from closed (0.20-0.74 volt) to wide open (4 volts). A steady throttle movement from a stop should cause TP sensor voltage to increase smoothly as throttle is opened. If any of these items isolate or require repair, go to step 8). If all items are okay, go to next step.

3) Cautiously connect a fuel pressure gauge to fuel rail. Turn ignition off for 10 seconds. Turn A/C off. Turn ignition on, engine off (fuel pump should run for about 2 seconds). Cycle ignition off and on until maximum pressure is obtained. Note fuel pressure while pump is running (pressure may vary slightly when pump stops). If pressure holds at 60-66 psi (4.2-4.6 kg/cm²), go to next step. If pressure is not as specified, go to step 11).

4) Perform INJECTOR BALANCE TEST under FUEL SYSTEM in the I - SYSTEM/COMPONENT TESTS article. If an injector problem is found, go to step 9). If injectors are okay, go to next step.

5) Check HO2S for silicone contamination (powdery white) deposit. If contamination is evident, go to step 12). If contamination is not evident, go to next step.

6) Perform CANISTER PURGE SOLENOID CHECK under EMISSION SYSTEMS & SUB-SYSTEMS in the I - SYSTEM/COMPONENT TESTS article. If a solenoid problem is found, go to next step. If solenoid is okay, go to DIAGNOSTIC AIDS.

7) Repair EVAP system. Operate vehicle in closed loop mode while using scan tool to read LT and ST fuel trim values. LT fuel trim value should increase to more than 100, ST fuel trim value should increase to more than 94. If fuel trim values are as specified, go to step 10). If values are not as specified, go to DIAGNOSTIC AIDS.

8) Repair items as necessary. Operate vehicle in closed loop mode while using scan tool to read LT and ST fuel trim values. LT fuel trim value should increase to more than 100, ST fuel trim value should increase to more than 94. If fuel trim values are as specified, go to step 10). If values are not as specified, go to step 3).

9) Replace fuel injector(s) as necessary. Operate vehicle in closed loop mode while using scan tool to read LT and ST fuel trim values. LT fuel trim value should increase to more than 100, ST fuel trim value should increase to more than 94. If fuel trim values are as specified, go to next step. If values are not as specified, go to step 5).

10) Rich condition does not exist. If driveability problem still exists, see the H - TESTS W/O CODES article.

11) See FUEL SYSTEM DIAGNOSIS under BASIC FUEL SYSTEM CHECKS in the F - BASIC TESTING - 4.3L article.

12) Replace HO2S (bank 2 sensor 1) and go to next step.

13) Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0175. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

14) Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

If problem cannot be isolated, attempt driving vehicle under various load conditions while using scan tool to read LT and ST fuel trim values. This may help isolate condition which set DTC P0175. If condition to set DTC cannot be duplicated, problem could have been caused by a cylinder misfire. See DTC P0300.

DTC P0300 - ENGINE MISFIRE DETECTED

NOTE: For circuit reference, see the L - WIRING DIAGRAMS article.

Circuit Description

Misfire is detected using Camshaft Position (CMP) and Crankshaft Position (CKP) sensors. When VCM senses CKP deceleration not associated with normal engine speed reduction, CMP is used to determine misfiring cylinder. VCM determines misfires on each cylinder and evaluates a random misfire and sets DTC.

Conditions required to test for DTC are:

* No IAC DTCs set.
* No CKP, MAF, TP or VSS sensor DTCs set.
* Rough road not detected.
* Engine speed 300-5600 RPM.
* ECT at normal operating temperature.
* System voltage 9-16 volts.
* Positive throttle position change is less than 2.9 percent for 100 msec.
* Negative throttle position change is less than 2.9 percent for 100 msec.
* A misfire is detected.

Diagnostic Procedures

1) Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the F - BASIC TESTING - 4.3L article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

2) Review FAILURE RECORDS data. If other DTCs are stored, diagnose affected DTCs. If no other DTCs are present, go to next step.

3) Start engine and allow it to idle. Using scan tool, read MAP sensor voltage. If voltage is greater than 4 volts, go to DTC P0108. If voltage is not greater than 4 volts, go to next step.

5) Turn ignition off, and then on. Duplicate conditions required to set DTC. Using scan tool, read DTC PRESENT THIS IGNITION

CYCLE. If scan tool displays DTC P0300, PRESENT THIS IGN, go to next step. If scan tool does not display DTC P0300, PRESENT THIS IGN, go to step 10).

6) Install a spark tester on No. 1 spark plug wire. Disconnect fuel injector harness at intake manifold. Crank engine and check for spark at tester. Repeat procedure for each spark plug wire. If spark was okay on all wires, go to next step. If spark was not okay, go to step 11).

7) Remove and check spark plugs for wear, excessive air gap, cracks or fouling. If spark plugs are okay, go to next step. If spark plugs are not okay, go to step 12).

8) Perform INJECTOR CIRCUIT TEST under FUEL SYSTEM DIAGNOSIS in the F - BASIC TESTING - 4.3L article. If fuel system is okay, go to next step. If not, go to step 13).

9) Diagnose and repair mechanical engine problem.

10) DTC P0300 is intermittent. See DIAGNOSTIC AIDS.

11) See IGNITION SYSTEM in the F - BASIC TESTING - 4.3L article.

12) Replace spark plug(s). After replacing spark plugs, go to step 14).

13) Repair as necessary. After repairs, go to next step.

14) Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0300. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

15) Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

A misfire could be caused by excessive vibration from sources other than engine. Check following items for possible cause of misfire: tire/wheel out of balance/round, uneven brake rotor or drum surface, or a rough road condition. Check plug wires for proper installation and operation. Check fuel level, condition and quality. If problem is intermittent, see the H - TESTS W/O CODES article.

DTC P0301 - CYLINDER NO. 1 MISFIRE DETECTED

NOTE: For circuit reference, see the L - WIRING DIAGRAMS article.

Circuit Description

Misfire is detected using Camshaft Position (CMP) and Crankshaft Position (CKP) sensors. When VCM senses CKP deceleration not associated with normal engine speed reduction, CMP is used to determine misfiring cylinder. VCM determines misfires on each cylinder and evaluates a random misfire and sets DTC.

Conditions for setting DTC are:

* No IAC DTCs set.
* No CKP, CMP, MAF, TP or VSS sensor DTCs set.
* ECT at least 19°F (-7°C).
* Fuel tank level is greater than 10 percent.
* Engine speed at least 600 RPM and less than 5600 RPM.
* System voltage at least 9 volts, but less than 14 volts.
* Positive throttle position change less than 4.9 percent for 100 msec.
* Negative throttle position change less than 2.9 percent for 100 msec.
* A misfire is detected.

Diagnostic Procedures

1) Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the F - BASIC TESTING - 4.3L article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

2) If any other DTCs are set, go to next step. If no other DTCs are set, go to step 4).

3) Diagnose affected DTC.

4) Start engine and allow it to idle. Using scan tool, read MAP sensor voltage. If voltage is greater than 4 volts, go to DTC P0108. If voltage is not greater than 4 volts, go to next step.

5) Turn ignition off, and then on. Duplicate conditions required to set DTC. Using scan tool, read DTC PRESENT THIS IGNITION CYCLE. If DTC P0301 sets, go to next step. If DTC does not set, go to step 10).

6) Install a spark tester on No. 1 spark plug wire. Disconnect fuel injector harness at intake manifold. Crank engine and check for spark at tester. Repeat procedure for each spark plug wire. If spark was okay on all wires, go to next step. If spark was not okay, go to step 11).

7) Remove and check spark plugs for wear, excessive air gap, cracks or fouling. If spark plugs are okay, go to next step. If spark plugs are not okay, go to step 12).

8) Perform INJECTOR CIRCUIT TEST under FUEL SYSTEM DIAGNOSIS in the F - BASIC TESTING - 4.3L article. If fuel system is okay, go to next step. If fuel system is not okay, go to step 13).

9) Diagnose and repair mechanical engine problem.

10) DTC P0301 is intermittent. Go to DIAGNOSTIC AIDS.

11) See IGNITION SYSTEM in the F - BASIC TESTING - 4.3L article.

12) Replace spark plug(s). After replacing spark plugs, go to step 14).

13) Repair as necessary. After repairs, go to next step.

14) Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0301. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

15) Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

A misfire could be caused by excessive vibration from sources other than engine. Check following items for possible cause of misfire: tire/wheel out of balance/round, uneven brake rotor or drum surface, or a rough road condition. Check plug wires for proper installation and operation. Check fuel level, condition and quality. If problem is intermittent, see the H - TESTS W/O CODES article.

DTC P0302 - CYLINDER NO. 2 MISFIRE DETECTED

NOTE: For circuit reference, see the L - WIRING DIAGRAMS article.

Circuit Description

Misfire is detected using Camshaft Position (CMP) and Crankshaft Position (CKP) sensors. When VCM senses CKP deceleration not associated with normal engine speed reduction, CMP is used to determine misfiring cylinder. VCM determines misfires on each cylinder and evaluates a random misfire and set DTC.

Conditions for setting DTC are:

* No IAC DTCs set.

* No CKP, CMP, MAF, TP or VSS sensor DTCs set.
* ECT at least 19°F (-7°C).
* Fuel tank level is greater than 10 percent.
* Engine speed at least 600 RPM and less than 5600 RPM.
* System voltage at least 9 volts, but less than 14 volts.
* Positive throttle position change less than 4.9 percent for 100 msec.
* Negative throttle position change less than 2.9 percent for 100 msec.
* A misfire is detected.

Diagnostic Procedures

1) Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the F - BASIC TESTING - 4.3L article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

2) If any other DTCs are set, diagnose affected DTCs. If no other DTCs are set, go to step 4).

3) Start engine and allow it to idle. Using scan tool, read MAP sensor voltage. If voltage is more than 4 volts, go to DTC P0108. If voltage is 4 volts or less, go to next step.

4) Turn ignition off, and then on. Duplicate conditions required to set DTC. Using scan tool, read DTC PRESENT THIS IGNITION CYCLE. If DTC P0302 sets, go to next step. If DTC does not set, go to step 9).

5) Install a spark tester on No. 2 spark plug wire. Disconnect fuel injector harness at intake manifold. Crank engine and check for spark at tester. Repeat procedure for each spark plug wire. If spark was okay on all wires, go to next step. If spark was not okay, go to step 10).

6) Remove and check spark plugs for wear, excessive air gap, cracks or fouling. If spark plugs are okay, go to next step. If spark plugs are not okay, go to step 11).

7) Perform cylinder compression test. See the F - BASIC TESTING - 4.3L article. If problem is found, repair as necessary. After repairs, go to step 13). If compression is okay, go to next step.

8) Perform INJECTOR CIRCUIT TEST under FUEL SYSTEM DIAGNOSIS in the F - BASIC TESTING - 4.3L article. If fuel system is okay, go to next step. If fuel system is not okay, go to step 12).

9) Misfire is currently not active. See DIAGNOSTIC AIDS.

10) See IGNITION SYSTEM in the F - BASIC TESTING - 4.3L article.

11) Replace spark plug(s). After replacing spark plug, go to step 13).

12) Repair as necessary. After repairs, go to next step.

13) Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0302. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

14) Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

A misfire could be caused by excessive vibration from sources other than engine. Check following items for possible cause of misfire: tire/wheel out of balance/round, uneven brake rotor or drum surface, or a rough road condition. Check plug wires for proper installation and operation. Check fuel level, condition and quality. If problem is intermittent, see the H - TESTS W/O CODES article.

DTC P0303 - CYLINDER NO. 3 MISFIRE DETECTED

NOTE: For circuit reference, see the L - WIRING DIAGRAMS article.

Circuit Description

Misfire is detected using Camshaft Position (CMP) and Crankshaft Position (CKP) sensors. When VCM senses CKP deceleration not associated with normal engine speed reduction, CMP is used to determine misfiring cylinder. VCM determines misfires on each cylinder and evaluates a random misfire and set DTC.

Conditions for setting DTC are:

* No CKP, CMP, IAC, MAF, TP or VSS sensor DTCs set.
* ECT at least 19°F (-7°C).
* Fuel tank level is greater than 10 percent.
* Engine speed at least 600 RPM and less than 5600 RPM.
* System voltage at least 9 volts, but less than 14 volts.
* Positive throttle position change less than 4.9 percent for 100 msec.
* Negative throttle position change less than 2.9 percent for 100 msec.
* A misfire is detected.

Diagnostic Procedures

1) Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the F - BASIC TESTING - 4.3L article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

2) If any other DTCs are set, diagnose affected DTCs. If no other DTCs are set, go to step 4).

3) Start engine and allow it to idle. Using scan tool, read MAP sensor voltage. If voltage is greater than 4 volts, go to DTC P0108. If voltage is not greater than 4 volts, go to next step.

4) Turn ignition off, and then on. Duplicate conditions required to set DTC. Using scan tool, read DTC PRESENT THIS IGNITION CYCLE. If DTC P0303 sets, go to next step. If DTC does not set, go to step 9).

5) Install a spark tester on No. 1 spark plug wire. Disconnect fuel injector harness at intake manifold. Crank engine and check for spark at tester. Repeat procedure for each spark plug wire. If spark was okay on all wires, go to next step. If spark was not okay, go to step 10).

6) Remove and check spark plugs for wear, excessive air gap, cracks or fouling. If spark plugs are okay, go to next step. If spark plugs are not okay, go to step 11).

7) Perform compression test. Repair as necessary. After repairs, go to step 13). If compression is okay, go to next step.

8) Diagnose fuel injector circuit. See the I - SYSTEM/COMPONENT TESTS article. If fuel system is okay, go to next step. If fuel system is not okay, go to step 12).

9) Misfire is currently not active. Ensure ignition wires are securely attached to spark plugs and distributor cap. Check for secondary ignition cross firing.

10) See IGNITION SYSTEM in the I - SYSTEM/COMPONENT TESTS article.

11) Replace spark plug(s). After replacing spark plus(s), go to step 13).

12) Repair as necessary. After repairs, go to next step.

13) Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0303. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

14) Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

DTC P0304 - CYLINDER NO. 4 MISFIRE DETECTED

NOTE: For circuit reference, see the L - WIRING DIAGRAMS article.

Circuit Description

Misfire is detected using Camshaft Position (CMP) and Crankshaft Position (CKP) sensors. When VCM senses CKP deceleration not associated with normal engine speed reduction, CMP is used to determine misfiring cylinder. VCM determines misfires on each cylinder and evaluates a random misfire and set DTC.

Conditions for setting DTC are:

* No IAC DTCs set.
* No CKP, CMP, MAF, TP or VSS sensor DTCs set.
* ECT at least 19°F (-7°C).
* Fuel tank level is greater than 10 percent.
* Engine speed at least 600 RPM and less than 5600 RPM.
* System voltage at least 9 volts, but less than 14 volts.
* Positive throttle position change less than 4.9 percent for 100 msec.
* Negative throttle position change less than 2.9 percent for 100 msec.
* A misfire is detected.

Diagnostic Procedures

1) Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the F - BASIC TESTING - 4.3L article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

2) If any other DTCs are set, diagnose affected DTCs. If no other DTCs are set, go to step 4).

3) Start engine and allow it to idle. Using scan tool, read MAP sensor voltage. If voltage is greater than 4 volts, go to DTC P0108. If voltage is not greater than 4 volts, go to next step.

4) Turn ignition off, and then on. Duplicate conditions required to set DTC. Using scan tool, read DTC PRESENT THIS IGNITION CYCLE. If DTC P0304 sets, go to next step. If DTC does not set, go to step 9).

5) Install a spark tester on No. 4 spark plug wire. Disconnect fuel injector harness at intake manifold. Crank engine and check for spark at tester. Repeat procedure for each spark plug wire. If spark was okay on all wires, go to next step. If spark was not okay, go to step 10).

6) Remove and check spark plugs for wear, excessive air gap, cracks or fouling. If spark plugs are okay, go to next step. If spark plugs are not okay, go to step 11).

7) Perform cylinder compression test. See the F - BASIC TESTING - 4.3L article. If problem is found, repair as necessary. After repairs, go to step 13). If compression is okay, go to next step.

8) Perform INJECTOR CIRCUIT TEST under FUEL SYSTEM DIAGNOSIS in the F - BASIC TESTING - 4.3L article. If fuel system is okay, go to next step. If fuel system is not okay, go to step 12).

9) Misfire is currently not active. See DIAGNOSTIC AIDS.

10) See IGNITION SYSTEM in the F - BASIC TESTING - 4.3L article.

11) Replace spark plug(s). After replacing spark plug(s), go to step 13).

12) Repair as necessary. After repairs, go to next step.

13) Using scan tool, select DTC, CLEAR INFO function. Start

engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0304. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

14) Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

A misfire could be caused by excessive vibration from sources other than engine. Check following items for possible cause of misfire: tire/wheel out of balance/round, uneven brake rotor or drum surface, or a rough road condition. Check plug wires for proper installation and operation. Check fuel level, condition and quality. If problem is intermittent, see the H - TESTS W/O CODES article.

DTC P0305 - CYLINDER NO. 5 MISFIRE DETECTED

NOTE: For circuit reference, see the L - WIRING DIAGRAMS article.

Circuit Description

Misfire is detected using Camshaft Position (CMP) and Crankshaft Position (CKP) sensors. When VCM senses CKP deceleration not associated with normal engine speed reduction, CMP is used to determine misfiring cylinder. VCM determines misfires on each cylinder and evaluates a random misfire and set DTC.

Conditions for setting DTC are:

* No IAC DTCs set.
* No CKP, CMP, MAF, TP or VSS sensor DTCs set.
* ECT at least 19°F (-7°C).
* Fuel tank level is greater than 10 percent.
* Engine speed at least 600 RPM and less than 5600 RPM.
* System voltage at least 9 volts, but less than 14 volts.
* Positive throttle position change less than 4.9 percent for 100 msec.
* Negative throttle position change less than 2.9 percent for 100 msec.
* A misfire is detected.

Diagnostic Procedures

1) Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the F - BASIC TESTING - 4.3L article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

2) If any other DTCs are set, diagnose affected DTCs. If no other DTCs are set, go to step 4).

3) Start engine and allow it to idle. Using scan tool, read MAP sensor voltage. If voltage is greater than 4 volts, go to DTC P0108. If voltage is not greater than 4 volts, go to next step.

4) Turn ignition off, then on. Duplicate conditions required to set DTC. Using scan tool, read DTC PRESENT THIS IGNITION CYCLE. If DTC P0305 sets, go to next step. If DTC does not set, go to step 9).

5) Install a spark tester on No. 5 spark plug wire. Disconnect fuel injector harness at intake manifold. Crank engine and check for spark at tester. Repeat procedure for each spark plug wire. If spark was okay on all wires, go to next step. If spark was not okay, go to step 10).

6) Remove and check spark plugs for wear, excessive air gap, cracks or fouling. If spark plugs are okay, go to next step. If spark plugs are not okay, go to step 11).

7) Perform cylinder compression test. See the F - BASIC TESTING - 4.3L article. If problem is found, repair as

necessary. After repairs, go to step 13). If compression is okay, go to next step.

8) Perform INJECTOR CIRCUIT TEST under FUEL SYSTEM DIAGNOSIS in the F - BASIC TESTING - 4.3L article. If fuel system is okay, go to next step. If fuel system is not okay, go to step 12).

9) Misfire is currently not active. See DIAGNOSTIC AIDS.

10) See IGNITION SYSTEM in the F - BASIC TESTING - 4.3L article.

11) Replace spark plug(s). After replacing spark plug(s), go to step 13).

12) Repair as necessary. After repairs, go to next step.

13) Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0305. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

14) Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

A misfire could be caused by excessive vibration from sources other than engine. Check following items for possible cause of misfire: tire/wheel out of balance/round, uneven brake rotor or drum surface, or a rough road condition. Check plug wires for proper installation and operation. Check fuel level, condition and quality. If problem is intermittent, see the H - TESTS W/O CODES article.

DTC P0306 - CYLINDER NO. 6 MISFIRE DETECTED

NOTE: For circuit reference, see the L - WIRING DIAGRAMS article.

Circuit Description

Misfire is detected using Camshaft Position (CMP) and Crankshaft Position (CKP) sensors. When VCM senses CKP deceleration not associated with normal engine speed reduction, CMP is used to determine misfiring cylinder. VCM determines misfires on each cylinder and evaluates a random misfire and set DTC.

Conditions for setting DTC are:

* No IAC DTCs set.
* No CKP, CMP, MAF, TP or VSS sensor DTCs set.
* ECT at least 19°F (-7°C).
* Fuel tank level is greater than 10 percent.
* Engine speed at least 600 RPM and less than 5600 RPM.
* System voltage at least 9 volts, but less than 14 volts.
* Positive throttle position change less than 4.9 percent for 100 msec.
* Negative throttle position change less than 2.9 percent for 100 msec.
* A misfire is detected.

Diagnostic Procedures

1) Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the F - BASIC TESTING - 4.3L article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

2) If any other DTCs are set, diagnose affected DTCs. If no other DTCs are set, go to step 4).

3) Start engine and allow it to idle. Using scan tool, read MAP sensor voltage. If voltage is greater than 4 volts, go to DTC P0108. If voltage is not greater than 4 volts, go to next step.

4) Turn ignition off, and then on. Duplicate conditions

required to set DTC. Using scan tool, read DTC PRESENT THIS IGNITION CYCLE. If DTC P0306 sets, go to next step. If DTC does not set, go to step 9).

5) Install a spark tester on No. 6 spark plug wire. Disconnect fuel injector harness at intake manifold. Crank engine and check for spark at tester. Repeat procedure for each spark plug wire. If spark was okay on all wires, go to next step. If spark was not okay, go to step 10).

6) Remove and check spark plugs for wear, excessive air gap, cracks or fouling. If spark plugs are okay, go to next step. If spark plugs are not okay, go to step 11).

7) Perform cylinder compression test. See the F - BASIC TESTING - 4.3L article. If problem is found, repair as necessary. After repairs, go to step 13). If compression is okay, go to next step.

8) Perform INJECTOR CIRCUIT TEST under FUEL SYSTEM DIAGNOSIS in the F - BASIC TESTING - 4.3L article. If fuel system is okay, go to next step. If fuel system is not okay, go to step 12).

9) Misfire is currently not active. See DIAGNOSTIC AIDS.

10) See IGNITION SYSTEM in the F - BASIC TESTING - 4.3L article.

11) Replace spark plug(s). After replacing spark plugs, go to step 13).

12) Repair as necessary. After repairs, go to next step.

13) Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0306. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

14) Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

A misfire could be caused by excessive vibration from sources other than engine. Check following items for possible cause of misfire: tire/wheel out of balance/round, uneven brake rotor or drum surface, or a rough road condition. Check plug sires for proper installation and operation. Check fuel level, condition and quality. If problem is intermittent, see the H - TESTS W/O CODES article.

DTC P0327 - KNOCK SENSOR LOW VOLTAGE

NOTE: For circuit reference, see the L - WIRING DIAGRAMS article.

Circuit Description

Knock Sensor (KS) is used to detect engine detonation (knock). If excessive knock is present, VCM will retard timing until knock goes away. When KS module in VCM determines that an abnormally high knock level exist, VCM will set DTC P0327.

Conditions for setting DTC are:

* Timing is retarded no more than zero degrees.
* System voltage is greater than 10 volts, but not greater than 17.1 volts.
* ECT greater than 140°F (60°C).
* Engine running at least 2 minutes.
* Engine speed is 500-900 RPM.
* Knock sensor noise less than 3 counts.

Diagnostic Procedures

1) Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the

F - BASIC TESTING - 4.3L article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

2) Operate vehicle within conditions required to set DTC. Using scan tool, select DTC, SPECIFIC function and enter DTC P0327. If scan tool displays DTC P0327 FAILED THIS IGN, go to step 4). If scan tool does not display DTC P0327 FAILED THIS IGN, go to next step.

3) Turn engine off. Turn ignition on, with engine off. Retrieve and record FAILED RECORDS data for DTC P0327. Operate vehicle within conditions required to set DTC. select DTC, SPECIFIC function and enter DTC P0327. If scan tool displays DTC P0327 FAILED THIS IGN, go to next step. If scan tool does not display DTC P0327 FAILED THIS IGN, see DIAGNOSTIC AIDS.

4) Disconnect knock sensor harness connector. Using a DVOM, check voltage between KS signal circuit and ground. Voltage reading should be about 5 volts. If voltage is not as specified, go to step 8). If voltage is as specified, go to next step.

5) Using DVOM, check resistance between knock sensor terminal and engine ground. Resistance should be about 100,000 ohms. If resistance is as specified, go to next step. If resistance is not as specified, go to step 12).

6) Turn ignition off. Connect DVOM between knock sensor terminal and engine ground. Tap on engine while observing DVOM. If any signal is present, go to next step. If signal is not present, go to step 9).

7) Check KS harness connector signal circuit for faulty terminal connection at KS. Repair as necessary and go to step 14). If terminal connections are okay, go to step 10).

8) Turn ignition off. Disconnect VCM harness connector. Turn ignition on and check KS signal circuit between VCM and KS harness connector for open, short to voltage or short to ground. Repair as necessary. After repairs, go to step 14). If circuit is okay, go to step 10).

9) Replace knock sensor. After replacing sensor, go to step 14).

10) Turn ignition off. Disconnect VCM harness connector. Check KS signal circuit for proper terminal connection at VCM. Repair or replace terminal as necessary. After repairs, go to step 14). If terminal is okay, go to next step.

11) Ensure KS module is fully seated and installed properly. If a problem is found, repair as necessary. After repairs, go to step 14). If no problem is found, go to next step.

12) Replace KS module. Operate vehicle within conditions required to set DTC. select DTC, SPECIFIC function and enter DTC P0327. If scan tool displays DTC P0327 FAILED THIS IGN, go to next step. If scan tool does not display DTC P0327 FAILED THIS IGN, go to step 14).

13) Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to next step.

14) Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0327. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

15) Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check for faulty connection at VCM. Check KS and VCM connectors for damage. Ensure KS harness is not routed too close to high-voltage wires, such as spark plug cables, ignition coils or other high-voltage components. Insure KS is installed properly and ensure torque is to specification. Torque specification is 14 ft. lbs. (19 N. m).

DTC P0336 - CRANKSHAFT POSITION SENSOR CIRCUIT PERFORMANCE

NOTE: For circuit reference, see the L - WIRING DIAGRAMS article.

Circuit Description

Crankshaft Position (CKP) sensor sends reference signal to VCM to indicate position of crankshaft and engine speed (RPM). VCM uses this information to determine ignition coil, fuel injector and ignition timing.

Conditions required to set DTC are:

* Engine cranking and VCM receives 4 or more camshaft signals without receiving CKP signal.
* CKP signal is missing for at least .5 second.

Diagnostic Procedures

1) Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the F - BASIC TESTING - 4.3L article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

2) If vehicle starts and runs, see DIAGNOSTIC AIDS. If vehicle does not start and run, go to next step.

3) Disconnect CKP sensor harness connector. Using test light, probe ignition feed circuit of CKP sensor connector (engine side) to ground. Turn ignition on, engine off. If test light illuminates, go to next step. If test light does not illuminate, go to step 6).

4) Connect test light between ignition feed circuit and sensor low circuit of CKP sensor connector. If test light illuminates, go to next step. If test light does not illuminate, go to step 7).

5) Turn ignition off. Install Gray jumpers from Connector Test Kit(J 35616-A) between engine harness connector and CKP sensor connector. Install DVOM set on duty cycle between CKP sensor 3X signal and low circuit terminals. Crank engine. If duty cycle is 40-60 percent, go to step 8). If duty cycle is not 40-60 percent, go to step 10).

6) Repair open or short to ground in CKP sensor ignition feed circuit. After repairs, go to step 13).

7) Check for open in sensor low circuit. If a problem was found, go to step 11). If a problem was not found, go to step 9).

8) With DVOM still connected between sensor 3X signal circuit and sensor low circuit, elect AC volt scale on DVOM. Crank engine. If voltage is greater than 10 volts, go to step 11). If voltage is not greater than 10 volts, go to next step.

9) Check for open in CKP sensor 3X signal and low circuits. If circuit is open, go to step 11). If circuit is okay, go to step 12).

10) Replace CKP sensor. Ensure CKP sensor mounting surface is clean and free of debris. After repairs, go to step 13).

11) Repair as necessary. After repairs, go to step 13).

12) Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to next step.

13) Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0336. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

14) Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check for faulty connections or damaged harness. Observe scan tool while moving all related harness and connectors. A change in scan tool display indicates fault location.

DTC P0337 - CRANKSHAFT POSITION SENSOR CIRCUIT LOW FREQUENCY

NOTE: For circuit reference, see the L - WIRING DIAGRAMS article.

Circuit Description

Crankshaft Position (CKP) sensor sends reference signal to VCM to indicate position of crankshaft and engine speed (RPM). VCM uses this information to determine ignition coil, fuel injector and ignition timing.

Conditions required for setting DTC are:

* Engine speed less than 4000 RPM.
* MAF at least 5 grams per second.
* Crank sensor duty cycle high reference to low reference ratio is less than .3125.

Diagnostic Procedures

1) Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the F - BASIC TESTING - 4.3L article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

2) Disconnect CKP sensor harness connector. Connect a test light between engine ground and signal circuit at CKP sensor. Turn ignition on, engine off. If test light illuminates, go to next step. If test light does not illuminate, go to step 8).

3) Turn ignition off. Connect test light between battery voltage and ground circuit at CKP sensor. If test light illuminates, go to next step. If test light does not illuminate, go to step 7).

4) Disconnect VCM Blue connector. Connect test light between battery voltage and ignition feed circuit at CKP sensor. If test light illuminates, go to step 10). If test light does not illuminate, go to next step.

5) Reconnect VCM Blue connector. Install Gray jumpers from Connector Tester Kit (J35616-A) between CKP sensor and CKP sensor harness connector. Start engine. Connect a DVOM (set to duty cycle) between CKP sensor signal and ground circuits. If duty cycle is less than 40 percent, go to step 11). If duty cycle is not less than 40 percent, go to next step.

6) Check for faulty connection at CKP sensor and go to step 12).

7) Check for open in CKP sensor ground circuit. If open is found, go to step 12). If circuit is okay, go to step 9).

8) Check for open or short to ground in CKP sensor signal circuit and go to step 12).

9) Check for faulty connection at VCM. If faulty connection is found, go to step 12). If connection is okay, go to step 13).

10) Repair short to ground in CKP sensor signal circuit. After repairs, go to step 14).

11) Replace CKP sensor. After replacing sensor, go to step 14).

12) Repair circuit as necessary. After repairs, go to step 14).

13) Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to next step.

14) Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0337. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED,

return to step 2).

15) Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check for faulty connections or damaged harness. Observe scan tool while moving all related harness and connectors. A change in scan tool display indicates fault location.

DTC P0338 - CRANKSHAFT POSITION SENSOR CIRCUIT HIGH FREQUENCY

NOTE: For circuit reference, see the L - WIRING DIAGRAMS article.

Circuit Description

Crankshaft Position (CKP) sensor sends reference signal to VCM to indicate position of crankshaft and engine speed (RPM). VCM uses this information to determine ignition coil, fuel injector and ignition timing.

Conditions foe setting DTC are:

* Engine speed less than 4000 RPM.
* MAF at least 5 grams per second.
* Crank sensor duty cycle high reference to low reference ratio is greater than .6875.

Diagnostic Procedures

1) Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the F - BASIC TESTING - 4.3L article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

2) If engine starts, go to step 4). If engine does not start, go to next step.

3) Using scan tool, clear DTCs. Crank engine for 10 seconds and read DTCs. If DTC P0338 resets, go to next step. If DTC does not reset, go to NO-START - ENGINE CRANKS OKAY in the F - BASIC TESTING - 4.3L article.

4) Start engine. Using scan tool, monitor engine speed (RPM). If RPM fluctuates up to twice desired RPM, go to step 14). If RPM does not fluctuate, go to next step.

5) Turn engine off. Turn ignition on, with engine off. Disconnect CKP sensor harness connector. Connect a test light between engine ground and signal circuit at CKP sensor. If test light illuminates, go to next step. If test light does not illuminate, go to step 8).

6) Connect test light between CKP sensor harness connector ground and signal circuits. If test light illuminates, go to next step. If test light does not illuminate, go to step 12).

7) Turn ignition off. Install Gray jumpers from Connector Tester Kit (J35616-A) between CKP sensor and CKP sensor harness connector. Using a DVOM, check voltage on CKP sensor harness connector signal circuit. If voltage is 2-3 volts, go to step 16). If voltage is not as specified, go to step 9).

8) Turn ignition off. Disconnect VCM Blue harness connector. Connect test light between battery voltage and ignition feed circuit at CKP sensor. If test light does not illuminate, go to step 15). If test light illuminates, go to step 11).

9) Check for open in CKP sensor ground circuit. If open is found, go to step 17). If circuit is okay, go to next step.

10) Check for short to ground in CKP sensor signal circuit. If short is found, go to step 17). If circuit is okay, go to step 13)

11) Repair short to ground in CKP sensor ignition feed circuit. After repairs, go to step 19).

12) Repair open CKP sensor ground circuit. After repairs, go

to step 19).

13) Check for faulty connection at CKP sensor. If faulty connection is found, go to step 17). If connection is okay, go to next step.

14) Replace CKP sensor. After replacing sensor, go to step 19).

15) Check for open in CKP sensor harness connector ignition feed circuit. If open is found, go to step 17). If circuit is okay, go to next step.

16) Check for faulty connection at VCM. If faulty connection is found, go to next step. If connection is okay, go to step 18).

17) Repair circuit as necessary. After repairs, go to step 19).

18) Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to next step.

19) Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0338. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

20) Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check for faulty connections or damaged harness. Observe scan tool while moving all related harness and connectors. A change in scan tool display indicates fault location.

DTC P0339 - CRANKSHAFT POSITION SENSOR CIRCUIT INTERMITTENT

Circuit Description

Crankshaft Position (CKP) sensor sends reference signal to VCM to indicate position of crankshaft and engine speed (RPM). VCM uses this information to determine ignition coil, fuel injector and ignition timing.

Conditions for setting DTC:

* MAF at least 5 grams per second.
* Change in calculated engine speed is at least 1000 RPM.
* Calculated engine speed equals zero RPM and 4 or more CMP cycles have occurred for a period of 2-3 seconds.

Diagnostic Procedures

1) Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the F - BASIC TESTING - 4.3L article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

2) If engine starts and runs, see DIAGNOSTIC AIDS. If engine does not start and run, go to next step.

3) Disconnect CKP sensor harness connector. Connect a test light between engine ground and ignition feed circuit at CKP sensor. Turn ignition on, engine off. If test light illuminates, go to next step. If test light does not illuminate, go to step 6).

4) Connect test light between CKP sensor harness connector ground and ignition feed circuits. If test light illuminates, go to next step. If test light does not illuminate, go to step 7).

5) Turn ignition off. Install Gray jumpers from Connector Tester Kit(J 35616-A) between CKP sensor and CKP sensor harness connector. Connect a DVOM (set to duty cycle) between CKP sensor signal and ground circuits. Crank engine. If duty cycle is 40-60 percent, go to step 8). If duty cycle is not as specified, go to step 10).

6) Repair open or short to ground in CKP sensor ignition feed circuit. After repairs, go to step 13).

7) Check CKP sensor harness ground circuit for an open. If open is found, go to step 11). If no open is found, go to step 9).

8) Select DVOM AC volt scale. Crank engine. If voltage is greater than 10 volts, go to step 11). If voltage is not greater than 10 volts, go to next step.

9) Check CKP sensor harness connector signal and ground circuits for an open. If an open is found, go to step 11). If no open is found, go to step 12).

10) Ensure CKP sensor mounting surface is clean and free of debris. Replace CKP sensor. After replacing sensor, go to step 13).

11) Repair as necessary. After repairs, go to step 13).

12) Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to next step.

13) Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0339. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

14) Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check for faulty connections or damaged harness. Observe scan tool while moving all related harness and connectors. A change in scan tool display indicates fault location. Inspect face of CKP sensor for metal shavings.

DTC P0340 - CAMSHAFT POSITION SENSOR CIRCUIT

NOTE: For circuit reference, see the L - WIRING DIAGRAMS article.

Circuit Description

Camshaft Position (CMP) sensor is used to indicate camshaft position so that VCM can determine which cylinder is misfiring if misfire is present. CMP sensor also checks for properly installed high voltage switch.

Conditions required to set DTC:

* Engine running.
* CMP sensor reference pulse is not seen once every 6 revolutions.

Diagnostic Procedures

1) Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the F - BASIC TESTING - 4.3L article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

2) Turn engine on and allow it to idle. Retrieve and record FREEZE FRAME and FAILED RECORDS data for DTC P0340. Continue to idle engine for one minute. Observe FREEZE FRAME, LAST TEST FAILED DTC. If DTC P0340 FAILED is not displayed, go to step 8). If DTC P0340 FAILED is displayed, turn engine off. Restart engine. If MIL remains on, go to next step. If MIL does not remain on, go to step 8).

3) Turn ignition on, with engine off. Disconnect CMP sensor harness connector. Connect a test light between engine ground and CKP sensor harness connector ignition feed circuit. If test light illuminates, go to next step. If test light does not illuminate, go to step 9).

4) Connect test light between CMP sensor harness connector ground and ignition feed circuits. If test light illuminates, go to

next step. If test light does not illuminate, go to step 11).

5) Ignition off. Install Gray jumpers from Connector Test Kit (J35616-A) between CMP sensor and CMP sensor harness connector. Using a DVOM, check voltage between on CMP sensor signal circuit. If voltage is 5-7 volts, go to step 15). If voltage is not 5-7 volts, go to next step.

6) Check CMP sensor harness connector signal circuit for open. If open is found, go to step 13). If open is not found, go to next step.

7) Check CMP sensor harness connector signal circuit for short to voltage. If short is found, go to step 13). If short is not found, go to step 12).

8) DTC P0340 is intermittent. If any additional DTCs are set, diagnose affected DTCs. If no additional DTCs are set, see DIAGNOSTIC AIDS.

9) Check for open in CMP sensor harness connector ignition feed circuit. If open is found, go to step 13). If open is not found, go to next step.

10) Repair short to ground in CMP sensor harness connector ignition feed circuit. After repairs, go to step 17).

11) Repair open in CMP sensor harness connector ground circuit. After repairs, go to step 17).

12) Check for faulty connection at CMP sensor. If faulty connection is found, go to next step. If connection is okay, go to step 14).

13) Repair circuit as necessary. After repairs, go to step 17).

14) Replace CMP sensor. After replacing sensor, go to step 17).

15) Check for faulty connection at VCM. If faulty connection is found, go to step 13). If connection is okay, go to next step.

16) Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to next step.

17) Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0340. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

18) Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check for faulty connections or damaged harness. Observe scan tool while moving all related harness and connectors. A change in scan tool display indicates fault location.

DTC P0341 - CAMSHAFT POSITION SENSOR CIRCUIT

NOTE: For circuit reference, see the L - WIRING DIAGRAMS article.

Circuit Description

DTC P0341 will set if cam pulses are not in proper ratio to crank pulses.

Conditions for setting DTC:

* Engine running.
* Cam sensor reference pulse is not detected at correct interval.

Diagnostic Procedures

1) Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the

F - BASIC TESTING - 4.3L article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

2) Check for intermittent short to voltage or Electromagnetic Interference (EMI) on CMP sensor wires such as wires run alongside spark plug wires or high power transistors (like mobile radios operating nearby). If problem is found, go to next step. If no problem is found, go to step 4).

3) Repair short to voltage or correct EMI interference. After repairs, go to next step.

4) Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0341. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

5) Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check for faulty connections or damaged harness. Observe scan tool while moving all related harness and connectors. A change in scan tool display indicates fault location.

DTC P0401 - EGR SYSTEM INSUFFICIENT FLOW

NOTE: For circuit reference, see the L - WIRING DIAGRAMS article.

Circuit Description

VCM test Exhaust Gas Recirculation (EGR) valve by momentarily commanding valve on while monitoring engine MAP. VCM will illuminate MIL and store DTC P0401 if expected increase is not seen under certain conditions during deceleration.

Conditions required to test for DTC are:

* No ECT, IAT, MAP, TP or VSS sensor DTCs set.
* No IAC, linear EGR (pintle position) or transmission DTCs set.
* Change in IAC less than 8 counts.
* ECT greater than 172°F (78°C).
* Vehicle speed greater than 27 MPH.
* BARO greater than 70 kPa.
* A/C clutch status unchanged.
* Transmission locked/unlocked status unchanged.
* No misfire DTC set.

Diagnostic Procedures

1) Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the F - BASIC TESTING - 4.3L article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

2) Start and warm engine to normal operating temperature. Run engine at greater than 1500 RPM. Using scan tool, command EGR duty cycle through 25, 50, 75 and 100 percent positions. If engine runs rough as EGR is cycled, go to step 5). If engine does not run rough, go to next step.

3) Turn engine off. Turn ignition on, engine off. Disconnect EGR valve harness connector. Connect a test light between EGR valve harness connector ignition feed and control circuits. If test light does not illuminate, go to next step. If test light illuminates, go to step 7).

4) Start engine. Using scan tool, select MISCELLANEOUS TESTS, EGR CONTROL. With test light still connected, command EGR duty cycle increase to 100 percent. If test light illuminates as EGR is cycled,

go to step 8). If test light does not illuminate, go to step 11).

5) Remove EGR valve and inspect valve and passages for damage. Inspect valve pintle to ensure it is not sticking partially open. If a problem is found, go to step 10). If no problem is found, go to next step.

6) See DIAGNOSTIC AIDS.

7) Check for short to ground in EGR valve control circuit. If short is found, go to step 14). If no short is found, go to step 15).

8) Check for restriction in EGR tube or passage. If restriction is found, go to step 10). If no restriction is found, go to next step.

9) Check for faulty electrical connection at EGR valve. If faulty connection is found, go to step 14). If connection is okay, go to next step.

10) Replace faulty EGR valve. After replacing EGR, go to step 16).

11) Check for an open in EGR control circuit. If an open is found, go to step 14). If an open is not found, go to next step.

12) Check for an open in EGR ignition feed circuit. If an open is found, go to step 14). If an open is not found, go to next step.

13) Check for faulty connection at VCM. If faulty connection is found, go to next step. If connection is okay, go to step 15).

14) Repair circuit as necessary. After repairs, go to step 16).

15) Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to next step.

16) Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0401. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

17) Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check for faulty connections or damaged harness. Inspect VCM harness connector EGR control circuit for backed-out terminal. Observe scan tool while moving all related harness and connectors. A change in scan tool display indicates fault location.

If EGR valve shows signs of excessive heat, check exhaust system for blockage or plugged catalytic converter. Ensure fuel injectors are functioning properly and check engine oil for fuel contamination.

DTC P0420 - TWC SYSTEM LOW EFFICIENCY BANK 1

NOTE: For circuit reference, see the L - WIRING DIAGRAMS article.

Circuit Description

Three-Way Catalyst (TWC) system is used to control emission. VCM uses signal from Heated Oxygen Sensor (HO2S) behind TWC read efficiency of TWC. VCM will set DTC P0420 if TWC oxygen storage capacity is less than a predetermined threshold.

Conditions for setting DTC:

* System in "closed-loop".
* Commanded air/fuel ratio is 14.7:1.
* Converter warm-up test passed.
* No ECT, HO2S, IAT, MAF, MAP, TP or VSS sensor DTCs set.
* No fuel trim or misfire DTCs set.

* ECT greater than 167°F (75°C).
* Vehicle in closed loop operation.
* Listed conditions met for at least 2 consecutive minutes.
* Engine load steady.
* Vehicle speed steady at 20-70 MPH.
* IAT at least 14.5°F (-9.75°C).
* MAF less than 50 grams per second.
* Throttle above idle.
* HO2S BANK 1, SENSOR 3 average value plus or minus 0.008 volts than HO2S BANK 1, SENSOR 2 value.

Diagnostic Procedures

1) Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the F - BASIC TESTING - 4.3L article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

2) Diagnose any other DTCs before proceeding. If no other DTCs are set, go to next step.

3) Check for and repair the following condition(s):

* Ensure TWC is an O.E. part.
* TWC for damage.
* Ensure no internal damaged catalyst rattle exists.
* Exhaust system for leaks, damage, loose or missing hardware.
* Ensure HO2S bank 1 sensor 3 is securely installed, and harness and connector are not damaged or contacting exhaust.

If any problem is found, go to step 9). If no problems are found, go to next step.

4) Check all VCM ground circuits. If problem is found, go to step 9). If no problem is found, go to next step.

5) Check all sensor ground circuits. If problem is found, to step 9). If no problem is found, go to next step.

6) Check HO2S bank 1 sensor 3 signal and ground circuits for intermittent opens. If problem is found, go to step 9). If no problem is found, go to next step.

7) Check HO2S bank 1 sensor 3 signal and ground circuits for intermittent short to ground. If problem is found, go to step 9). If no problem is found, go to next step.

8) Replace TWC. Check for possible engine misfire DTC or engine mechanical problem. After repairs, go to step 10.

9) Repair problem as necessary. After repairs, go to next step.

10) Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0420. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

11) Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Difficulty may be experienced in simulating conditions to set DTC, especially in urban areas.

DTC P0440 - EVAP SYSTEM

NOTE: For circuit reference, see the L - WIRING DIAGRAMS article.

Circuit Description

Evaporative (EVAP) emission system includes following components: fuel tank, EVAP vent solenoid, fuel tank pressure sensor, fuel pipes and hoses, vapor lines, fuel cap, EVAP emission canister, purge lines, and EVAP purge solenoid.

Conditions required to set DTC are:

* No ECT, HO2S, IAT, MAP, TP or VSS sensor DTCs set.
* DTC P0125 not active.
* No fuel level related DTCs set.
* Fuel tank level greater than 12.5 and 87.5 percent.
* System voltage is greater than 10 volts but not less than 17 volts.

Diagnostic Procedures

1) Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the F - BASIC TESTING - 4.3L article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

2) Turn ignition off. Remove fuel cap. Turn ignition on. Using scan tool, read FUEL TANK VACUUM. If scan tool displays zero in. H2O, go to next step. If scan tool does not display zero in. H2O, repair faulty fuel tank sensor circuit.

3) Zero pressure and vacuum gauges on EVAP Pressure/Purge Cart (J41413). Reinstall fuel cap. Read and Record FAIL RECORDS data for DTC P0440. Clear DTCs. Using scan tool, command EVAP vent solenoid ON (closed). Connect EVAP pressure/purge cart to EVAP service port. Using EVAP pressure/purge cart, attempt to pressurize EVAP system to 5 in. H2O. If specified pressure is achieved, go to next step. If specified pressure is not achieved, go to step 5).

4) Maintain EVAP system pressure at 5 in. H2O. Using scan tool, read FUEL TANK VACUUM. If scan tool displays 5 IN H2O, go to step 7). If scan tool does not display 5 IN H2O, go to step 6).

5) Disconnect fuel tank vapor and EVAP purge lines from EVAP canister. Plug fuel tank vapor line fitting at EVAP canister. Connect a hand-held vacuum pump to EVAP purge line fitting at EVAP canister. Ensure EVAP vent solenoid is still commanded ON (closed). Attempt to apply 5 in. Hg to EVAP canister. If vacuum is maintained as specified, go to step 10). If vacuum can not be maintained as specified, go to step 11).

6) Check EVAP purge line for restriction. If restriction is found, repair as necessary and go to step 15). If no restriction is found, repair faulty fuel tank sensor circuit.

7) Disconnect vacuum source line and plug vacuum source fitting at EVAP purge solenoid. Using scan tool, command EVAP vent solenoid ON (closed) and EVAP purge solenoid ON (100%). Using EVAP pressure/purge cart, pressurize EVAP system to 5 in. H2O. Observe pressure gauge on EVAP pressure/purge cart while removing plug from vacuum source fitting line at EVAP purge solenoid. If fuel tank vacuum decreases to zero in. H2O within 15 seconds, go to step 10). If vacuum does not decrease as specified, go to step 12).

8) Connect EVAP pressure/purge cart vacuum gauge to vacuum source line. Start engine. Run engine speed to greater than 2000 RPM while observing vacuum gauge. If vacuum is greater than 15 in. Hg, see DIAGNOSTIC AIDS. If vacuum is 15 in. Hg or less, go to step 13).

9) Check if vent hose is disconnected or damaged. Check EVAP canister for damage. If a problem is found, repair as necessary. After repairs, go to step 15). If no problem is found, go to step 14).

10) Check for missing or faulty fuel filler cap. Check for disconnected, leaking or damaged fuel tank vapor line or EVAP purge line. If a problem is found, repair as necessary. After repairs, go to step 15). If no problem is found, go to next step.

11). Using scan tool, command EVAP vent solenoid ON (closed). With EVAP pressure/purge cart connected to EVAP service port, continuously attempt to pressurize EVAP system by leaving EVAP pressure/purge cart control knob in PRESSURIZE position. Using Ultrasonic Leak Detector (J41413), locate and repair EVAP system leak.

It may be necessary to lower fuel tank to check connections at top of tank. Go to step 15).

12) Replace EVAP purge solenoid. After replacing purge solenoid, go to step 15).

13) Locate and repair cause of no source vacuum to EVAP purge solenoid. After repairs, go to step 15).

14) Replace EVAP vent solenoid. After replacing solenoid, go to next step.

15) Turn ignition on, engine off. Using scan tool, command EVAP vent solenoid ON (closed). Using EVAP pressure/purge cart pressurize EVAP system to 15 in. H2O. Monitor EVAP pressure/purge cart pressure gauge. Turn EVAP pressure/purge cart rotary switch to HOLD position. If pressure decreases to less than 10 in. H2O within 2 minutes, system is okay. If pressure does not decrease as specified, go to next step.

16) Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0440. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

17) Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check following items:

* For missing or damaged "O" rings at EVAP canister fuel vapor and purge line fittings.
* For cracks or punctures in EVAP canister.
* For damaged or disconnected source vacuum line, EVAP purge line, vent hose or fuel tank vapor line.
* For faulty connections at VCM. Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.
* For damaged harness. Inspect wiring harness to EVAP vent solenoid, EVAP purge solenoid, and fuel tank pressure sensor for intermittent open or short.

DTC P0442 - EVAP SYSTEM SMALL LEAK DETECTED

NOTE: For circuit reference, see the L - WIRING DIAGRAMS article.

Circuit Description

Evaporative (EVAP) emission system includes following components: fuel tank, EVAP vent solenoid, fuel tank pressure sensor, fuel pipes and hoses, vapor lines, fuel cap, EVAP emission canister, purge lines, and EVAP purge solenoid.

Conditions required to set DTC are:

* No ECT, HO2S, IAT, MAP, ODM, or TP sensor DTCs set.
* DTC P0125 not active.
* No fuel level DTCs.
* Fuel level is greater than 12.5 and 87.5 percent.
* Vacuum decay for a period of at least 15 seconds.
* Vacuum less than 7 in. H2O for less than 25 seconds.
* Vacuum greater than .1 in. H2O for longer than 35 seconds.

Diagnostic Procedures

1) Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the F - BASIC TESTING - 4.3L article. Retrieve and record FREEZE FRAME

and/or FAIL RECORDS data for each DTC set. Go to next step.

2) Turn ignition off. Remove fuel cap. Turn ignition on. Using scan tool, read FUEL TANK VACUUM. If scan tool displays zero in. H2O go to next step. If scan tool does not display zero in. H2O, repair faulty fuel tank sensor circuit.

3) Zero pressure and vacuum gauges on EVAP Pressure/Purge Cart (J41413). Reinstall fuel cap. Read and Record FAIL RECORDS data for DTC P0442. Clear DTCs. Using scan tool, command EVAP vent solenoid on (closed). Connect EVAP pressure/purge cart to EVAP service port. Using EVAP pressure/purge cart, pressurize EVAP system to 5 in. H2O. Using scan tool, read FUEL TANK VACUUM. If scan tool displays -5 in. H2O, go to next step. If scan tool does not display -5 in. H2O, repair faulty fuel tank sensor circuit.

4) Turn ignition on, engine off. Using scan tool, command EVAP vent solenoid on (closed). Using EVAP pressure/purge cart pressurize EVAP system to 15 in. H2O. Monitor EVAP pressure/purge cart pressure gauge. Turn EVAP pressure/purge cart rotary switch to HOLD position. If pressure decreases to less than 10 in. H2O within 2 minutes, go to next step. If pressure does not decrease as specified, see DIAGNOSTIC AIDS.

5) Disconnect fuel tank vapor and EVAP purge lines from EVAP canister. Plug fuel tank vapor line fitting at EVAP canister. Connect a hand vacuum pump to EVAP purge line fitting at EVAP canister. Ensure EVAP vent solenoid is still commanded ON (closed). Attempt to apply 5 in. Hg to EVAP canister. If vacuum is maintained as specified, go to step 8). If vacuum cannot be maintained as specified, go to next step.

6) Check if vent hose is disconnected or damaged. Check EVAP canister for damage. If a problem is found, repair as necessary. After repairs, go to step 10). If no problem is found, go to next step.

7) Replace EVAP vent solenoid. After replacing solenoid, go to step 10).

8) Check for missing or faulty fuel cap. Check for disconnected or leaking fuel tank vapor line. Check for disconnected or damaged EVAP purge line. If a problem is found, repair as necessary. After repairs, go to step 10. If no problem is found, go to next step.

9). Using scan tool, command EVAP vent solenoid on (closed). With EVAP pressure/purge cart connected to EVAP service port, attempt to pressurize EVAP system by leaving EVAP pressure/purge cart control knob in PRESSURIZE position. Using Ultrasonic Leak Detector (J41413), locate and repair EVAP system leak. It may be necessary to lower fuel tank to check connections at top of tank. After repairs, go to next step.

10) Turn ignition on, engine off. Using scan tool, command EVAP vent solenoid on (closed). Using EVAP pressure/purge cart pressurize EVAP system to 15 in. H2O. Monitor EVAP pressure/purge cart pressure gauge. Turn EVAP pressure/purge cart rotary switch to HOLD position. If pressure decreases to less than 10 in H2O within 2 minutes, return to step 2). If pressure does not decrease as specified, go to next step.

11) Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0442. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

12) Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check following items:

* For missing or damaged "O" rings at EVAP canister fuel vapor and purge line fittings.
* For cracks or punctures in EVAP canister.
* For damaged or disconnected source vacuum line, EVAP purge line, vacuum line, EVAP purge line, vent hose or fuel tank vapor line.
* For faulty connections at VCM. Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.
* For damaged harness. Inspect wiring harness to EVAP vent solenoid, EVAP purge solenoid, and fuel tank pressure sensor for intermittent open or short.

DTC P0446 - EVAP SYSTEM CANISTER VENT BLOCKED

NOTE: For circuit reference, see the L - WIRING DIAGRAMS article.

Circuit Description

Evaporative (EVAP) emission system includes following components: fuel tank, EVAP vent solenoid, fuel tank pressure sensor, fuel pipes and hoses, vapor lines, fuel cap, EVAP emission canister, purge lines, and EVAP purge solenoid.

Conditions for setting DTC are:

* No ECT, HO2S, IAT, MAP, ODM, or TP sensor DTCs set.
* DTC P0125 not active.
* No fuel level DTCs.
* Fuel tank level is greater than 12.5 and 87.5 percent.
* Excess vacuum present in EVAP system.

Diagnostic Procedures

1) Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the F - BASIC TESTING - 4.3L article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

2) Turn ignition on. Read and Record FAIL RECORDS data for DTC P0446. Clear DTCs. Turn ignition off. Remove fuel cap. Turn ignition on. Using scan tool, read FUEL TANK VACUUM. If scan tool displays zero in. H2O go to next step. If scan tool does not display zero in. H2O, repair faulty fuel tank sensor circuit.

3) Zero pressure and vacuum gauges on EVAP Pressure/Purge Cart (J41413). Reinstall fuel cap. Using scan tool, command EVAP vent solenoid ON (closed). Connect EVAP pressure/purge cart to EVAP service port. Using EVAP pressure/purge cart, pressurize EVAP system to 5 in. H2O. Using scan tool, read FUEL TANK VACUUM. If scan tool displays 5 in. H2O, go to next step. If scan tool does not display 5 in. H2O, repair faulty fuel tank sensor circuit.

4) Maintain EVAP system pressure at 5 in. H2O. Using scan tool, command EVAP vent solenoid OFF (open). Monitor EVAP pressure/purge cart pressure gauge. If pressure decreases to zero in H2O within 5 seconds, see DIAGNOSTIC AIDS. If pressure does not decrease as specified, go to next step.

5) Disconnect vent hose, marked "AIR", from EVAP canister. Switch EVAP pressure/purge cart rotary switch to PURGE. Warm engine to normal operating temperature. Monitor vacuum gauge while holding engine speed at 2500 RPM. If vacuum remains at less than 30 in. H2O, go to next step. If vacuum is not as specified, go to step 9).

6) Check if vent hose is between EVAP canister and EVAP solenoid is kinked, pinched or blocked. If a problem is found, repair as necessary. After repairs, go to step 9). If no problem is found, go to next step.

7) Replace EVAP vent solenoid. After replacing solenoid, go to step 9).

8) Replace EVAP canister. After replacing canister, go to next step.

9) Using scan tool, command EVAP vent solenoid ON (closed). With EVAP pressure/purge cart connected to EVAP service port, to pressurize EVAP system to 5 in. H2O. Switch EVAP pressure/purge cart rotary switch to HOLD. Using scan tool, command EVAP vent solenoid OFF (open). If pressure decreases to zero in H2O within 5 seconds, system is okay. If pressure does not decrease as specified, return to step 2).

Diagnostic Aids

Check following items:

* For missing or damaged "O" rings at EVAP canister fuel vapor and purge line fittings.
* For faulty connections at VCM. Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.
* For damaged harness. Inspect wiring harness to EVAP vent solenoid, EVAP purge solenoid, and fuel tank pressure sensor for intermittent open or short.

DTC P0461 - FUEL LEVEL SENSOR CIRCUIT MALFUNCTION

NOTE: For circuit reference, see the L - WIRING DIAGRAMS article.

Circuit Description

Fuel level sensor information is used by VCM to determine volume of fuel in fuel tank. Fuel level affects rate or change in air pressure in EVAP system.

Conditions required to set DTC are:

* Fuel tank level slosh test is completed
* Fuel tank main test is completed.
* Fuel tank level data valid.
* Fuel level signal has not changed for distance of 200 miles.

Diagnostic Procedures

1) Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the F - BASIC TESTING - 4.3L article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

2) Turn ignition off. Turn ignition on, with engine off. Using scan tool, compare fuel level on scan tool and vehicle fuel gauge. If fuel level are about the same, go to next step. If not, go to step 5).

3) Record vehicle fuel gauge reading. Turn ignition off. Disconnect Black VCM harness connector. Turn ignition on. If fuel gauge reading changed, go to next step. If fuel gauge reading did not change, go to step 5).

4) Turn ignition off. Locate fuel level sending unit harness connector forward of fuel tank. Disconnect fuel sending unit harness connector. Using jumper wire, jumper fuel level input to fuel level sensor ground. Turn ignition on. Check fuel gauge and scan tool reading. If both reads Empty (zero percent), go to next step. If not, go to step 6).

5) Check and repair circuit to fuel gauge sending unit.

6) Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to next step.

7) Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0461. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND

PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

8) Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

DTC P0462 - FUEL LEVEL SENSOR CIRCUIT LOW VOLTAGE

NOTE: For circuit reference, see the L - WIRING DIAGRAMS article.

Circuit Description

Fuel level sensor information is used by VCM to determine volume of fuel in fuel tank. Fuel level affects rate or change in air pressure in EVAP system.

Conditions required to set DTC are:

* Fuel tank level slosh test is completed
* Fuel tank main test is completed.
* Fuel tank level data valid.
* Fuel level signal is less than .39 volt for a period greater than 20 seconds.

Diagnostic Procedures

1) Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the F - BASIC TESTING - 4.3L article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

2) Turn ignition on, with engine off. Using scan tool, observe fuel level. If fuel level is 0-1 percent, go to step 4). If not, go to next step.

3) Diagnose vehicle's fuel level sender gauge module.

4) Using DVOM connected to ground, probe fuel level sensor input at fuel level sender gauge module. If voltage reading is less than .13 volt, go to next step. If voltage reading is not less than . 13 volt, go to step 6).

5) Check for open in fuel level sensor input circuit. Repair as necessary. After repairs, go to step 9). If circuit is okay, go to next step.

6) Using DVOM connected to ground, probe fuel level output at fuel level sender gauge module. If voltage reading is less than .13 volt, go to next step. If voltage reading is not less than .13 volt, go to step 8).

7) Check for open in fuel level output circuit. Repair as necessary. After repairs, go to step 10). If circuit is okay, go to next step.

8) Using DVOM connected to ground, probe fuel level module output at fuel level sender gauge module. If voltage reading is greater than 2.9 volts, go to step 11). If voltage reading is not greater than 2.9 volts, go to step 12).

9) Repair open in fuel level sensor input circuit. After repairs, go to step 13).

10) Repair open in fuel level output circuit. After repairs, go to step 13).

11) Repair short to voltage in fuel level module output circuit. After repairs, go to step 13).

12) Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to next step.

13) Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0462. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

14) Using scan tool, select CAPTURE INFO, REVIEW INFO

function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

DTC P0463 - FUEL LEVEL SENSOR CIRCUIT HIGH VOLTAGE

NOTE: For circuit reference, see the L - WIRING DIAGRAMS article.

Circuit Description

Fuel level sensor is an important input to VCM for enhanced evaporative system diagnostic. Fuel level is necessary for VCM to know volume of fuel in fuel tank. Fuel level affects rate of change in air pressure in EVAP system. Several enhanced evaporative system diagnostic sub-tests are dependent upon correct fuel level information. Diagnostic will not run when tank is greater than 85 percent or less than 15 percent full. Sensor signal will disable misfire when fuel levels are less than 15 percent.

Conditions for setting DTC:

* Fuel tank level slosh test is completed.
* Fuel tank level main test is completed.
* Fuel tank level data valid.
* Fuel level signal voltage is greater than 2.9 volts for a period longer than 20 seconds.

Diagnostic Procedures

1) Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the F - BASIC TESTING - 4.3L article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

2) Turn ignition on, with engine off. Using scan tool, observe fuel level. If fuel level is 99-100 percent, go to step 4). If not, go to next step.

3) Diagnose vehicle's fuel level sender gauge module.

4) Using DVOM connected to ground, probe fuel level sensor input at fuel level sender gauge module. If voltage reading is greater than 2.9 volts, go to next step. If voltage reading is not greater than 2.9 volts, go to step 6).

5) Check for short to voltage in fuel level sensor input circuit. Repair as necessary. After repairs, go to step 9). If circuit is okay, go to next step.

6) Using DVOM connected to ground, probe fuel level output (terminal "D") at fuel level buffer module. If voltage reading is greater than 2.9 volts, go to next step. If voltage reading is not greater than 2.9 volts, go to step 8).

7) Check for short to voltage in fuel level output circuit. Repair as necessary. After repairs, go to step 10). If circuit is okay, go to next step.

8) Check for open in fuel level buffer module sensor ground. Repair as necessary. After repairs, go to step 11). If circuit is okay, go to step 12).

9) Repair short to voltage in fuel level input circuit. After repairs, go to step 13).

10) Repair short to voltage in fuel level output circuit. After repairs, go to step 13).

11) Repair open in fuel level buffer module sensor ground. After repairs, go to step 13).

12) Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to next step.

13) Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0462. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

14) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

DTC P0500 - VEHICLE SPEED SENSOR CIRCUIT

NOTE: For circuit reference, see the L - WIRING DIAGRAMS article.

Circuit Description

Vehicle Speed Sensor (VSS) is a magnetic induction type. Gear teeth pressed on outside of output shaft induce an AC current in sensor as shaft rotates. Signal goes directly to VCM. VCM uses pulsed signal to calculate vehicle speed based on time between pulses.

Conditions required for setting DTC:

* No MAP DTCs set.
* Throttle angle less than 3.125 percent.
* ECT greater than 140°F (60°C).
* Engine speed 1400-4400 RPM.
* MAP less than 20 kPa.
* All conditions met for 5 seconds.

Diagnostic Procedures

1) Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the F - BASIC TESTING - 4.3L article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

2) Using scan tool, clear DTCs. Using Connector Test Adapter Kit (J35616) and a DVOM set to AC 200 volt scale, backprobe across VSS harness connector signal and ground circuits. Raise and support vehicle. Start engine and place transmission in gear. If voltage is constant, go to step 5). If voltage is not constant, go to next step.

3) If voltage varies, see DIAGNOSTIC AIDS. If voltage does not vary, go to next step.

4) If scan tool displays NO VOLTAGE, go to step 11). If scan tool does not display NO VOLTAGE, go to step12).

5) With vehicle still raised, disconnect VSS connector. With engine running, place transmission in gear. Using a DVOM on 200-volt AC scale, check voltage across signal and ground circuits at VSS. If voltage varies with RPM, go to step 7). If voltage does not vary, go to next step.

6) Replace VSS. After replacing sensor, go to step 12).

7) Check for faulty connection at VCM and VSS. If faulty connection is found, go to step 9). If connections are okay, go to next step.

8) Check for open or short in ground and signal circuits between VCM and VSS. If problem is found, go to step 10). If no problem is found, go to step 12).

9) Repair connection as necessary. After repairs, go to step 12).

10) Repair open or short as necessary. After repairs, go to step 12).

11) Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to next step.

12) Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0500. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

13) Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids
Ensure VCM is properly calibrated for vehicle speedometer.

DTC P0506 - IDLE SPEED LOW IDLE AIR CONTROL RESPONDING

NOTE: For circuit reference, see the L - WIRING DIAGRAMS article.

Circuit Description

VCM controls idle speed with an Idle Air Control (IAC) valve to a calculated RPM based on sensor inputs and actual engine RPM. VCM moves IAC valve in or out to vary amount of airflow into intake manifold and thus decrease or increase idle RPM.

VCM commands IAC in counts. A higher count, allows more air to by-pass throttle plate (higher idle).

Conditions required to test for DTC are:

* No ECT, MAP, TP or VSS sensor DTCs set.
* ECT greater than 122°F (50°C).
* IAT greater than -13°F (-25°C).
* BARO greater than 10.2 psi (0.72 kg/cm²) at less than 10,300 ft.
* Vehicle speed less than 2 MPH.
* Throttle angle at less than 1%.
* Engine running greater than 30 seconds.
* Conditions met for greater than 3 seconds.

Diagnostic Procedures

1) Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the F - BASIC TESTING - 4.3L article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

2) Using scan tool, read DTCs. If any other DTCs are set, diagnose affected DTCs. If no other DTCs are set, go to next step.

3) If DTC P0506 is active this ignition cycle, go to step 5). If DTC is not active this ignition cycle, go to next step.

4) DTC P0506 is intermittent. See DIAGNOSTIC AIDS.

5) Repair engine mechanical problem as necessary and go to next step.

6) Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0506. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

7) Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Ensure throttle stop screw has not been tampered with. Check for stuck IAC valve or throttle linkage. Reset IAC using scan tool MISC FUNCTIONS. Check if fuel system is running too rich or too lean. Inspect throttle body bore for foreign material.

DTC P0507 - IDLE SPEED HIGH IDLE AIR CONTROL RESPONDING

NOTE: For circuit reference, see the L - WIRING DIAGRAMS article.

Circuit Description

VCM controls idle speed with an Idle Air Control (IAC) valve to a calculated RPM based on sensor inputs and actual engine RPM. VCM moves IAC valve in or out to vary amount of airflow into intake manifold and thus decrease or increase idle RPM.

VCM commands IAC in counts. A higher count, allows more air

to by-pass throttle plate (higher idle).
Conditions required to test for DTC are:

* No ECT, MAP, TP or VS sensor DTCs set.
* ECT greater than 122°F (50°C).
* IAT greater than -13°F (-25°C).
* BARO greater than 70 kPa.
* Vehicle speed less than 2 MPH.
* System voltage greater than 10 volts, but less than 16 volts.
* Throttle at idle.
* Engine running longer than 30 seconds.
* Conditions met for more than 3 seconds.

Diagnostic Procedures

1) Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the F - BASIC TESTING - 4.3L article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

2) Using scan tool, read DTCs. If any other DTCs are set, diagnose affected DTCs. If no other DTCs are set, go to next step.

3) If DTC P0507 is active this ignition cycle, go to step 6). If DTC is not active this ignition cycle, go to next step.

4) DTC P0507 is intermittent. See DIAGNOSTIC AIDS.

5) Repair engine mechanical problem as necessary. After repairs, go to next step.

6) Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0507. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

7) Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Ensure throttle stop screw has not been tampered with. Check for stuck IAC valve or throttle linkage. Reset IAC using scan tool MISC FUNCTIONS. Check if fuel system is running too rich or too lean. Inspect throttle body bore for foreign material.

DTC P0704 - CLUTCH SWITCH CIRCUIT (WITH MANUAL TRANSMISSION)

NOTE: For circuit reference, see the L - WIRING DIAGRAMS article.

Circuit Description

DTC determines if transmission clutch switch has failed by looking for a clutch switch transition within a range from zero MPH to some higher speed.

DTC will set when the following conditions are present:

* No VSS DTCs are set.
* Vehicle speed is greater than 40 MPH.
* No clutch transition is detected.

Diagnostic Procedures

1) Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the F - BASIC TESTING - 4.3L article. After performing OBD system check, go to next step.

2) Turn ignition off. Install scan tool. Turn ignition on, with engine off. Using scan tool, display clutch switch parameter. Engage and disengage clutch several times. If scan tool display change indicates when clutch is engaged and disengaged, go to step 7). If scan tool display change does not indicate when clutch is engaged and

disengaged, go to next step.
3) Check if brake fuse is blown, go to step 8). If fuse is not blown, go to next step.
4) Turn ignition off. Disconnect clutch switch connector. Connect a jumper wire between ignition feed circuit and signal circuit of clutch switch connector. Turn ignition on, with engine off. Using scan tool, check if clutch switch is on. If scan tool indicates clutch switch is on, go to next step. If scan tool indicates clutch switch is off, go to step 6).
5) Remove jumper wire from clutch switch connector. Using scan tool, check if clutch switch is off. If scan tool indicates clutch switch is off, go to step 11). If scan tool indicates clutch switch is on, go to step 9).
6) Check for open in signal circuit. If a problem was found, go to step 12). If a problem was not found, go to step 10).
7) DTC is intermittent. See the H - TESTS W/O CODES article.
8) Check and repair conditions that caused fuse to blow. Replace fuse. After replacing fuse, go to step 14).
9) Check for short to battery in signal circuit. If a problem was found, go to step 12). If a problem was not found, go to step 13).
10) Check for poor connections at VCM. If a problem was found, go to step 12). If a problem was not found, go to step 13).
11) Replace clutch switch. After replacing switch, go to step 14).
12) Repair as necessary. After repairs, go to step 14).
13) Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to next step.
14) Using scan tool, select DTC, CLEAR INFO. Start and warm engine to normal operating temperature. Select DTC, SPECIFIC, then enter DTC P0704. Operate vehicle within the conditions for setting this DTC. If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, repeat step 2).
15) Using scan tool, select CAPTURE INFO, REVIEW INFO. If any undiagnosed DTC(s) are displayed, go to applicable DTC test.

DTC P1106 - MAP SENSOR CIRCUIT INTERMITTENT HIGH VOLTAGE

NOTE: For circuit reference, see the L - WIRING DIAGRAMS article.

Circuit Description

Manifold Absolute Pressure (MAP) sensor responds to changes in intake manifold pressure (vacuum). A 5-volt reference is applied to sensor. A variable resistor moves in relation to manifold pressure and a voltage signal is returned to VCM through MAP signal circuit. Voltage signal varies from 1.0-1.5 volts at closed throttle to 4.0-4.5 volts at wide open throttle (low vacuum). VCM utilizes MAP signal and throttle position to determine fuel delivery.

DTC will set when the following conditions are present:

* No TP sensor DTCs are set.
* Throttle position is not greater than 96.8 percent when engine speed is not greater than 1000 RPM.
* Throttle position is not greater than 89.8 percent when engine speed is greater than 1000 RPM.
* MAP greater than 4.9 volts.

Diagnostic Procedures

1) Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the F - BASIC TESTING - 4.3L article. After performing OBD system check, go to next step.
2) If engine idle is unstable, incorrect, or if manifold vacuum at idle is less than 15 in. Hg, repair as necessary. Install

scan tool. With engine idling, monitor MAP sensor voltage using scan tool. If MAP sensor voltage is greater than 4 volts, go to next step. If MAP sensor voltage is not greater than 4 volts, go to step 4).

3) Turn ignition off. Disconnect MAP sensor connector. Turn ignition on. Monitor MAP sensor voltage using scan tool. If MAP sensor voltage is less than one volt, go to step 5). If MAP sensor voltage is not less than one volt, go to step 9).

4) DTC is intermittent. If no additional DTCs are set, see DIAGNOSTIC AIDS. If any additional DTCs are set, go to applicable DTC test.

5) With DVOM to ground, probe 5-volt reference circuit at MAP sensor connector. If voltage is greater than 5.2 volts, go to step 10). If not, go to next step.

6) Using test light, probe MAP sensor connector ground circuit to battery voltage. If test light illuminates, go to step 7). If test light does not illuminate, go to step 14).

7) Check for restriction in MAP sensor vacuum source. If a problem was found, go to step 15). If a problem was not found, go to next step.

8) Replace MAP sensor. After replacing sensor, go to step 19).

9) Check for short to voltage in MAP signal circuit. If a problem was found, go to step 15). If a problem was not found, go to step 18).

10) Ignition off. Unplug VCM Gray connector. Ignition on. With DVOM to ground, check voltage on VCM connector MAP sensor 5-volt reference circuit terminal. If voltage is greater than 5.2 volts, go to next step. If not, go to step 13).

11) Unplug EGR electrical connector. Check voltage on VCM connector EGR sensor 5-volt reference circuit terminal. If voltage is greater than 5.2 volts, go to next step. If not, go to step 16).

12) Repair short to voltage on 5-volt reference circuit. After repairs, go to step 19).

13) With DVOM to ground, measure voltage on VCM connector TP sensor 5-volt reference circuit terminal. If voltage is greater than 5.2 volts, go to step 17). If not, go to step 18).

14) Repair MAP ground circuit. After repairs, go to step 19).

15) Repair as necessary. After repairs, go to step 19).

16) Replace EGR valve. After replacing EGR valve, go to step 19).

17) Repair short to voltage on the 5-volt reference circuit. After repairs, go to step 19).

18) Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to next step.

19) Using scan tool, select DTC, CLEAR INFO. Start and warm engine to normal operating temperature. Select DTC, SPECIFIC, then enter DTC P1106. Operate vehicle within the conditions for setting this DTC. If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, repeat step 2).

20) Using scan tool, select CAPTURE INFO, REVIEW INFO. If any undiagnosed DTC(s) are displayed, go to applicable DTC test.

Diagnostic Aids

An intermittent ground in MAP signal circuit or 5-volt reference circuit will result in DTC P1106 setting. With ignition on and engine off, manifold pressure is equal to atmospheric pressure with signal voltage high. VCM uses information as an indication of vehicle altitude.

To test accuracy of a suspect sensor, compare reading with a known-good vehicle. Reading should be 3.6-4.9 volts. If DTC is intermittent, see the H - TESTS W/O CODES article. To check for intermittent connection, disconnect sensor from bracket and twist sensor by hand. Output changes greater than .1 volt indicates a poor connection or connector. If okay, replace sensor. Ensure electrical connection remains securely connected. If sensor is removed from intake manifold, sensor-to-manifold seal must be replaced.

DTC P1107 - MAP SENSOR CIRCUIT INTERMITTENT LOW VOLTAGE

NOTE: For circuit reference, see the L - WIRING DIAGRAMS article.

Circuit Description

Manifold Absolute Pressure (MAP) sensor measures changes in intake manifold pressure (vacuum). A low voltage signal, 1.0-1.5 volts, is sent to VCM on 5-volt reference circuit at closed throttle (high vacuum). A high voltage signal, 4.0-4.5 volts is sent at wide open throttle (low vacuum).

Conditions required to set DTC are:

* Engine speed is 800 RPM or less with throttle closed, or more than 800 RPM with throttle slightly above idle.
* MAP sensor voltage less than 0.2 volt.
* No TP sensor DTCs are set.

Diagnostic Procedures

1) Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the F - BASIC TESTING - 4.3L article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

2) Turn engine on and allow it to idle. Using scan tool, read MAP sensor voltage. If voltage is less than 0.5 volt, go to next step. If voltage is not less than 0.5 volt, go to step 5).

3) Turn ignition off. Disconnect MAP sensor harness connector. Connect a jumper wire between MAP sensor harness connector 5-volt reference and signal circuits. Turn ignition on. If voltage is greater than 4.7 volts, go to step 6). If voltage is not greater than 4.7 volts, go to next step.

4) Turn ignition off. Disconnect jumper wire. Connect a test light between battery voltage and MAP sensor harness connector signal circuit. Turn ignition on. If voltage is greater than 4.7 volts, go to step 9). If voltage is not greater than 4.7 volts, go to step 7).

5) DTC P1107 is intermittent. If any additional DTCs are set, diagnose affected DTCs. If no additional DTCs are set, go to DIAGNOSTIC AIDS.

6) Check for faulty connection at MAP sensor. If faulty connection is found, go to step 12). If connection is okay, go to step 11).

7) Check for open MAP sensor signal circuit. If circuit is open, go to step 12). If circuit is okay, go to next step.

8) Check MAP sensor signal circuit for short to ground. If short is found, go to step 12). If circuit is okay, go to step 13).

9) Check for open in MAP sensor 5-volt reference circuit. If open is found, go to step 12). If circuit is okay, go to next step.

10) Check MAP sensor 5-volt reference circuit for short to ground. If short is found, go to step 12). If circuit is okay, go to step 13).

11) Replace faulty MAP sensor. After replacing sensor, go to step 14).

12) Repair circuit as necessary. After repairs, go to step 14).

13) Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to next step.

14) Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P1107. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND

PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

15) Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check MAP sensor signal and 5-volt reference circuits for intermittent open condition.

With ignition on and engine off, MAP signal is equal to atmospheric pressure with signal voltage high. This information is used by VCM as an indication of altitude. Comparison of this reading with a known-good vehicle with same sensor is a way to check accuracy of suspect sensor. Reading should be within 0.4 volt.

Disconnect sensor from bracket and twist sensor by hand to check for intermittents. Output changes greater than 0.1 volt indicate a faulty sensor connection.

DTC P1111 - IAT SENSOR CIRCUIT INTERMITTENT HIGH VOLTAGE

NOTE: For circuit reference, see the L - WIRING DIAGRAMS article.

Circuit Description

Intake Air Temperature (IAT) sensor is a thermistor. VCM applies and reads a 5-volt reference signal to sensor. When air is cold, sensor resistance is high and VCM will measure a high signal voltage. If air is warm, sensor resistance is low causing VCM to measure low voltage.

Conditions required to set DTC are:

* No ECT, VSS, MAF sensor DTCs not set.
* Vehicle speed less than 2 MPH.
* ECT greater than 183.2°F (84°C).
* IAT greater than -34.6°F (-37°C).
* Engine run time greater than 100 seconds.

Diagnostic Procedures

1) Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the F - BASIC TESTING - 4.3L article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

2) Turn engine on and allow it to idle. Using scan tool, read IAT sensor voltage. If voltage is greater than 4.9 volts, go to next step. If voltage is not greater than 4.9 volts, go to step 6).

3) Turn ignition off. Disconnect IAT sensor harness connector. Connect a jumper wire between IAT sensor harness connector 5-volt reference and ground circuits. Turn ignition on. If voltage is less than 0.82 volt, go to step 7). If voltage is not less than 0.82 volt, go to next step.

4) Connect jumper wire between IAT sensor harness connector signal circuit and engine ground. If voltage is less than 0.82 volt, go to step 8). If voltage is 0.82 volt or greater, go to next step.

5) If DTC P0123 is also set, go to DTC P0123 for diagnosis. If DTC is not set, go to step 9).

6) DTC P1111 is intermittent. If any additional DTCs are set, diagnose affected DTCs. If no additional DTCs are set, see DIAGNOSTIC AIDS.

7) Check for faulty connection at IAT sensor and at VCM. If faulty connection is found, go to step 10). If connections are okay, go to step 11).

8) Check for open IAT sensor ground circuit. If open is found, go to step 10). If circuit is okay, go to step 12).

9) Check for open IAT sensor signal circuit. If open is found, go to next step. If circuit is okay, go to step 12).

10) Repair circuit as necessary. After repairs, go to step 13).

11) Replace IAT sensor. After replacing sensor, go to step 13).

12) Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to next step.

13) Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P1111. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

14) Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check for faulty connections at IAT sensor and at VCM. Observe scan tool while moving all related harness and connectors. A change in scan tool display indicates fault location. Check for skewed IAT sensor. See IAT TEMPERATURE-TO-RESISTANCE VALUES table.

DTC P1112 - IAT SENSOR CIRCUIT INTERMITTENT LOW VOLTAGE

NOTE: For circuit reference, see the L - WIRING DIAGRAMS article.

Circuit Description

Intake Air Temperature (IAT) sensor is a thermistor. VCM applies and reads a 5-volt reference signal to sensor. When air is cold, sensor resistance is high and VCM will measure a high signal voltage. If air is warm, sensor resistance is low causing VCM to measure low voltage.

Conditions required to set DTC are:

* No VSS DTCs set.
* Vehicle speed at least 2 MPH.
* Engine running longer than 100 seconds.
* IAT sensor voltage less than 0.82 volt.

Diagnostic Procedures

1) Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the F - BASIC TESTING - 4.3L article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

2) Turn engine on and allow it to idle. Using scan tool, read IAT sensor voltage. If voltage is less than 0.82 volt, go to next step. If voltage is not less than 0.82 volt, go to step 5).

3)Turn engine off. Turn ignition on. Disconnect IAT sensor harness connector. If voltage is greater than 4 volts, go to step 7). If voltage is not greater than 4 volts, go to next step.

4) Turn ignition off. Using DVOM, check resistance across IAT sensor harness connector. If resistance is infinite, go to step 8). If resistance is not infinite, go to step 6).

5) DTC P1112 is intermittent. If any additional DTCs are set, diagnose affected DTCs. If no additional DTCs are set, see DIAGNOSTIC AIDS.

6) Repair short to ground in IAT sensor signal circuit. After repairs, go to step 9).

7) Replace IAT sensor. After replacing sensor, go to step 9).

8) Replace VCM. Replacement VCM requires special equipment for programming procedures. After replacing VCM, go to next step.

9) Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P1112. Operate vehicle

within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

10) Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check for faulty connections at IAT sensor and at VCM. Observe scan tool while moving all related harness and connectors. A change in scan tool display indicates fault location. Check for skewed IAT sensor. See IAT TEMPERATURE-TO-RESISTANCE VALUES.

DTC P1114 - ECT SENSOR CIRCUIT INTERMITTENT LOW VOLTAGE

NOTE: For circuit reference, see the L - WIRING DIAGRAMS article.

Circuit Description

Engine Coolant Temperature (ECT) sensor is a thermistor that varies resistance based on temperature. As temperature of sensor increases, resistance decreases. High temperature will result in a low signal voltage. DTC will set when VCM sees an ECT sensor voltage of less than 0.82 volt with engine running for 5 seconds.

Conditions for setting DTC:

* Engine run time greater than 5 seconds.
* ECT less than 0.25 volt (low resistance pull-up).
* ECT less than 0.25 volt (high resistance pull-up).

Diagnostic Procedures

1) Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the F - BASIC TESTING - 4.3L article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

2) Turn engine on and allow it to idle. Using scan tool, read ECT sensor voltage. If voltage is less than 0.82 volt, go to next step. If voltage is not less than 0.82 volt, go to step 5).

3) Turn engine off. Disconnect ECT sensor harness connector. Turn ignition on. If voltage is greater than 4 volts, go to step 7). If voltage is not greater than 4 volts, go to next step.

4) Turn ignition off. Using DVOM, check resistance across ECT sensor harness connector. If resistance is infinite, go to step 8). If resistance is not infinite, go to step 6).

5) DTC P1114 is intermittent. If any additional DTCs are set, diagnose affected DTCs. If no additional DTCs are set, see DIAGNOSTIC AIDS.

6) Repair short to ground in ECT sensor signal circuit. After repairs, go to step 9).

7) Replace ECT sensor. After replacing sensor, go to step 9).

8) Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to next step.

9) Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P1114. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

10) Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check for short to ground in ECT sensor harness connector 5-volt reference circuit. Observe scan tool while moving all related harness and connectors. A change in scan tool display indicates fault location.

Check for skewed ECT sensor. See ECT TEMPERATURE-TO-RESISTANCE VALUES.

DTC P1115 - ECT SENSOR CIRCUIT INTERMITTENT HIGH VOLTAGE

NOTE: For circuit reference, see the L - WIRING DIAGRAMS article.

Circuit Description

Engine Coolant Temperature (ECT) sensor is a thermistor or a variable resistor, that varies resistance based on temperature. As temperature of sensor increases, resistance decreases. Low temperature will result in a high signal voltage. DTC will set when VCM sees an ECT sensor voltage of greater than 5 volts.

Condition for setting DTC:

* Engine run time greater than 5 seconds.
* ECT greater than 4.9 volts.

Diagnostic Procedures

1) Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the F - BASIC TESTING - 4.3L article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

2) Turn engine on and allow it to idle. Using scan tool, read ECT sensor voltage. If voltage is greater than 4.9 volts, go to next step. If voltage is not greater than 4.9 volts, go to step 5).

3) Turn engine off. Turn ignition on. Disconnect ECT sensor harness connector. Connect a jumper wire across ECT sensor harness connector. If voltage is less than 0.82 volt, go to step 6). If voltage is not less than 0.82 volt, go to next step.

4) Connect jumper wire between ECT sensor harness connector signal circuit and chassis ground. If voltage is less than 0.82 volt, go to step 7). If voltage is not less than 0.82 volt, go to step 8).

5) DTC P1115 is intermittent. If any additional DTCs are set, diagnose affected DTCs. If no additional DTCs are set, go to DIAGNOSTIC AIDS.

6) Inspect VCM and ECT sensor for proper connection. If a problem is found, go to step 10). If connections are okay, go to step 11).

7) Check ECT sensor harness connector ground circuit for open between VCM and ECT sensor. If open is found, go to step 10). If open is not found, go to step 12).

8) If DTC P0123 is also set, go to DTC P0123. If DTC is not set, go to next step.

9) Check ECT sensor harness connector signal circuit for open between VCM and ECT sensor. If open is found, go to next step. If open is not found, go to step 12).

10) Repair circuit as necessary. After repairs, go to step 13).

11) Replace ECT sensor. After replacing sensor, go to step 13).

12) Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to next step.

13) Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P1115. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

14) Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check for faulty connections or open in 5-volt reference and ground circuits. Check for skewed ECT sensor. See ECT TEMPERATURE-TO-RESISTANCE VALUES.

DTC P1121 - TP SENSOR CIRCUIT INTERMITTENT HIGH VOLTAGE

NOTE: For circuit reference, see the L - WIRING DIAGRAMS article.

Circuit Description

Throttle Position (TP) sensor measures amount of throttle opening. VCM uses TP sensor information for fuel delivery calculations. TP sensor readings during acceleration are much higher than those during deceleration or idle.

Condition required to set DTC is:

* TP signal voltage is greater than 4.8 volts.
* MAP is less than 7.4 psi (0.51 kg/cm^2) for greater than 4 seconds with engine running.

Diagnostic Procedures

1) Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the F - BASIC TESTING - 4.3L article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

2) With throttle closed, use scan tool to read TP signal voltage. If voltage is greater than 4.8 volts, go to next step. If voltage is not greater than 4.8 volts, go to step 6).

3) Disconnect TP sensor harness connector. If voltage is less than 0.2 volt, go to next step. If voltage is not less than 0.2 volt, go to step 5).

4) Connect a test light between TP sensor harness connector ground circuit and battery voltage. If test light illuminates, go to step 7). If test light does not illuminate, go to step 9).

5) If DTC P0108 is also set, go to DTC P0108 for diagnosis. If DTC is not set, go to step 8).

6) DTC P1121 is intermittent. If any additional DTCs are set, diagnose affected DTCs. If no additional DTCs are set, see DIAGNOSTIC AIDS.

7) Check for faulty connection at TP sensor. If faulty connection is found, go to step 10). If connection is okay, go to step 11).

8) Check for short to voltage in TP sensor harness connector signal circuit. If short is found, go to step 10). If short is not found, go to step 12).

9) Check for open in TP sensor harness connector ground circuit. If circuit is open, go to next step.

10) Repair circuit as necessary. After repairs, go to step 13).

11) Replace TP sensor. After replacing sensor, go to step 13).

12) Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to next step.

13) Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P1121. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

14) Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check for and repair the following condition(s):

* Throttle plate sticking or excessive deposits on throttle plate or throttle bore.
* Check TP sensor harness connector ground circuit for open, and signal circuit for short to ground.
* TP sensor signal voltage should be less than 1.25 volt with throttle closed, and greater than 4.5 volts at wide open throttle.

DTC P1122 - TP SENSOR CIRCUIT INTERMITTENT LOW VOLTAGE

NOTE: For circuit reference, see the L - WIRING DIAGRAMS article.

Circuit Description

Throttle Position (TP) sensor measures amount of throttle opening. VCM uses TP sensor information for fuel delivery calculations. TP sensor readings during acceleration are much higher than those during deceleration or idle.

Condition for setting DTC:

* Engine running.
* TP sensor signal voltage less than .25 volt.

Diagnostic Procedures

1) Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the F - BASIC TESTING - 4.3L article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

2) With throttle closed, use scan tool to read TP signal voltage. If voltage is less than 0.15 volt, go to next step. If voltage is not less than 0.15 volt, go to step 5).

3) Disconnect TP sensor harness connector. Connect a jumper wire between TP sensor harness connector sensor signal and 5-volt reference circuits. If voltage is greater than 4 volts, go to step 13). If voltage is not greater than 4 volts, go to next step.

4) Connect a test light between TP sensor harness connector signal circuit and battery voltage. If voltage is greater than 4 volts, go to step 6). If voltage is not greater than 4 volts, go to step 8).

5) DTC P1122 is intermittent. If any additional DTCs are set, diagnose affected DTCs. If no additional DTCs are set, see DIAGNOSTIC AIDS.

6) Check for open in TP sensor harness connector 5-volt reference circuit. If open is found, go to step 11). If open is not found, go to next step.

7) Check for short to ground in TP sensor harness connector 5-volt reference circuit. If short is found, go to step 11). If short is not found, go to step 10).

8) Check for open in TP sensor harness connector signal circuit. If open is found, go to step 11). If open is not found, go to next step.

9) Check for short to ground in TP sensor harness connector signal circuit. If short is found, go to step 11). If short is not found, go to next step.

10) Check for faulty connection at VCM. If faulty connection is found, go to next step. If connection is okay, go to step 13).

11) Repair circuit as necessary. After repairs, go to step 14).

12) Replace TP sensor. After replacing sensor, go to step 14).

13) Replace VCM. Program replacement VCM using required equipment. After replacing PCM, go to next step.

14) Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P1122. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

15) Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check for and repair the following condition(s):

* Throttle plate sticking or excessive deposits on throttle plate or throttle bore.
* Check TP sensor harness connector 5-volt reference circuit for open or short to ground, and repair as necessary.
* TP signal voltage reading on scan tool should be less than 1.25 volt with throttle closed, and greater than 4.5 volts at wide open throttle.

DTC P1133 - HO2S INSUFFICIENT SWITCHING BANK 1, SENSOR 1

NOTE: For circuit reference, see the L - WIRING DIAGRAMS article.

Circuit Description

VCM provides about 0.45 volt reference to Heated Oxygen Sensor (HO2S). HO2S sensor signal voltage varies from about one volt when exhaust is rich to about 0.1 volt when exhaust is lean. VCM determines if HO2S is functioning properly by reading number of Lean/Rich (L/R) and Rich/Lean (R/L) switches.

Conditions required to set DTC are:

* No fuel trim DTCs set.
* L/R and R/L switches less than 30.
* No ECT, IAT, MAP, or TP sensor DTCs set.
* No EGR or EVAP DTCs set.
* DTC P0135 not set.
* Vehicle operating in closed loop mode.
* HO2S voltage 0.3-0.6 volt.
* TP angle value 10-20 percent.

Diagnostic Procedures

1) Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the F - BASIC TESTING - 4.3L article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

2) If any other DTCs are set, diagnose affected DTCs. If no other DTCs are set, go to next step.

3) Turn engine on and allow it to idle. Using scan tool, read MAP sensor voltage. If voltage is greater than 4 volts, go to DTC P0108. If voltage is not greater than 4 volts, go to next step.

4) Check air intake duct for improper installation, collapse, restriction, or missing or plugged air filter. Check throttle body and intake manifold for vacuum leaks. Check throttle body for damage to inlet or foreign objects blocking inlet, or for coking. Check exhaust system for corrosion, leaks, loose or missing hardware. Check HO2S for proper installation and for HO2S harness not contacting exhaust manifold. Check vacuum hoses for splits, kinks and proper connections. Check for fuel contamination. Check for good VCM and sensor grounds. If any of these items isolate or require repair, go to step next step. If all items are okay, go to step 6).

5) Repair or replace as necessary. After repairs, go to step 10).

6) Perform INJECTOR BALANCE TEST under FUEL SYSTEM in the I - SYSTEM/COMPONENT TESTS article. If an injector problem is found, go to step 9). If injectors are okay, go to next step.

7) Remove and inspect HO2S (bank 1, sensor 1) for contamination. If contamination is evident, go to next step. If contamination is not evident, see DIAGNOSTIC AIDS.

8) Replace HO2S. After replacing sensor, go to step 10).

9) Replace fuel injector(s). After replacing injector(s), go to next step.

10) Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P1133. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

11) Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check HO2S heater operation.

DTC P1134 - HO2S TRANSITION TIME RATIO BANK 1, SENSOR 1

NOTE: For circuit reference, see the L - WIRING DIAGRAMS article.

Circuit Description

VCM reads Heated Oxygen Sensor (HO2S) activity for 100 seconds. During this period, VCM counts the number of Lean/Rich (L/R) and Rich/Lean (R/L) switches.

With this information, an average time for all transitions can be determined. VCM then divides R/L average by L/R rich average to obtain a ratio. If HO2S ratio is not within range, DTC will set.

Conditions required to set DTC are:

* No fuel trim DTCs set.
* L/R and R/L switches less than 30 counts.
* No ECT, IAT, MAP, or TP sensor DTCs set.
* No EGR or EVAP DTCs set.
* DTC P0131, P0132, P0134 or P0135 not set.
* Vehicle operating in closed loop mode.
* HO2S voltage 0.3-0.6 volt.
* TP ANGLE value 10-20 percent.
* Average response time calculated for this ignition cycle.
* Ratio of HO2S (bank 1, sensor 1) L/R to R/L switches greater than 64 counts.
* Ratio of HO2S (bank 1, sensor 1) L/R to R/L switches greater than 48 counts.

Diagnostic Procedures

1) Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the F - BASIC TESTING - 4.3L article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

2) If any other DTCs are set, diagnose affected DTCs. If no other DTCs are set, go to next step.

3) Turn engine on and allow it to reach normal operating temperature. Set engine speed at 1200-2000 RPM for 2 minutes. Using scan tool, read HO2S BANK 1 SENSOR 1 voltage. If voltage rapidly switches from less than 0.3 volt to greater than 0.6 volt, go to next step. If voltage does not switch as specified, go to step 5).

4) With engine speed still at 1200-2000 RPM, read LOOP MODE. If scan tool displays CLOSED LOOP, see DIAGNOSTIC AIDS. If scan tool does not display CLOSED LOOP, go to step 8).

5) If voltage stays within 0.3-0.6 volt longer than it stays out of range, go to step 10). If voltage stays outside 0.3-0.6 volt longer than it stays within range, go to next step.

6) Check for faulty connection at VCM HO2S (bank 1, sensor 1) terminals. If faulty connection is found, go to step 10). If connection is okay, go to next step.

7) Check for faulty connection at HO2S (bank 1, sensor 2). If faulty connection is found, go to step 10). If connection is okay, go to next step.

8) Replace HO2S (bank 1, sensor 1) and go to step 11).

9) Check for HO2S contamination caused by leaded fuel, incorrect gasket sealer or over-rich operation. If problem is found, go to next step. If no problem is found, go to step 11).

10) Repair or replace as necessary. After repairs, go to next step.

11) Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P1134. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

12) Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Never solder HO2S wires.

DTC P1153 - HO2S INSUFFICIENT SWITCHING BANK 2, SENSOR 1

NOTE: For circuit reference, see the L - WIRING DIAGRAMS article.

Circuit Description

VCM provides about 0.45 volt reference to Heated Oxygen Sensor (HO2S). HO2S sensor signal voltage varies from about one volt when exhaust is rich to about 0.1 volt when exhaust is lean. VCM determines if HO2S is functioning properly by reading number of Lean/Rich (L/R) and Rich/Lean (R/L) switches.

Conditions required to set DTC are:

* No fuel trim DTCs set.
* L/R and R/L switches less than 30 counts.
* No ECT, IAT, MAP, or TP sensor DTCs set.
* No EGR or EVAP DTCs set.
* DTC P0155 not set.
* Vehicle operating in closed loop mode.
* HO2S voltage 0.3-0.6 volt.
* TP angle value 10-20 percent.

Diagnostic Procedures

1) Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the F - BASIC TESTING - 4.3L article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

2) If any other DTCs are set, diagnose affected DTCs. If no other DTCs are set, go to next step.

3) Turn engine on and allow it to reach normal operating temperature. Set engine speed at 1200-2000 RPM for 2 minutes. Using scan tool, read HO2S BANK 2 SENSOR 1 voltage. If voltage rapidly switches from less than 0.3 volt to more than 0.6 volt, go to next step. If voltage does not switch as specified, go to step 5).

4) With engine speed still at 1200-2000 RPM, read LOOP MODE. If scan tool displays CLOSED LOOP, see DIAGNOSTIC AIDS. If scan tool does not display CLOSED LOOP, go to step 8).

5) If voltage stays within 0.3-0.6 volt longer than it stays out of range, go to step 10). If voltage stays outside 0.3-0.6 volt longer than it stays within range, go to next step.

6) Check for faulty connection at VCM HO2S (bank 2, sensor 1) terminals. If faulty connection is found, go to step 10). If connection is okay, go to next step.

7) Check for faulty connection at HO2S (bank 2, sensor 1). If faulty connection is found, go to step 10). If connection is okay, go to next step.

8) Replace HO2S. After replacing sensor, go to step 11).

9) Check for HO2S contamination caused by leaded fuel, incorrect gasket sealer or over-rich operation. If problem is found, go to next step. If no problem is found, go to step 11).

10) Repair or replace as necessary. After repairs, go to next step.

11) Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P1153. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

12) Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Never solder HO2S wires.

DTC P1154 - HO2S TRANSITION TIME RATIO BANK 2, SENSOR 1

NOTE: For circuit reference, see the L - WIRING DIAGRAMS article.

Circuit Description

VCM reads Heated Oxygen Sensor (HO2S) activity for 100 seconds. During this period, VCM counts the number of Lean/Rich (L/R) and Rich/Lean (R/L) switches.

With this information, an average time for all transitions can be determined. VCM then divides R/L average by L/R rich average to obtain a ratio. If HO2S ratio is not within range, DTC will set.

Conditions required to set DTC are:

* No fuel trim DTCs set.
* L/R and R/L switches less than 30 counts.
* No ECT, IAT, MAP, or TP sensor DTCs set.
* No EGR or EVAP DTCs set.
* DTC P0155 not set.
* Vehicle operating in closed loop mode.
* HO2S voltage 0.3-0.6 volt.
* TP ANGLE value 10-20 percent.
* Average response time calculated for this ignition cycle.
* Ratio of HO2S (bank 2, sensor 1) L/R to R/L switches more than 64 counts.
* Ratio of HO2S (bank 2, sensor 1) L/R to R/L switches more than 48 counts.

Diagnostic Procedures

1) Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the F - BASIC TESTING - 4.3L article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

2) If any other DTCs are set, diagnose affected DTCs. If no other DTCs are set, go to next step.

3) Turn engine on and allow it reach normal operating temperature. Set engine speed at 1200-2000 RPM for 2 minutes. Using

scan tool, read HO2S BANK 2 SENSOR 1 voltage. If voltage rapidly switches from less than 0.3 volt to more than 0.6 volt, go to next step. If voltage does not switch as specified, go to step 5).

4) With engine speed still at 1200-2000 RPM, read LOOP MODE. If scan tool displays CLOSED LOOP, see DIAGNOSTIC AIDS. If scan tool does not display CLOSED LOOP, go to step 8).

5) If voltage stays within 0.3-0.6 volt longer than it stays out of range, go to step 10). If voltage stays outside 0.3-0.6 volt longer than it stays within range, go to next step.

6) Check for faulty connection at VCM HO2S (bank 2, sensor 1) terminal. If faulty connection is found, go to step 10). If connection is okay, go to next step.

7) Check for faulty connection at HO2S (bank 2, sensor 1). If faulty connection is found, go to step 10). If connection is okay, go to next step.

8) Replace HO2S (bank 2, sensor 1). After replacing HO2S sensor, go to step 11).

9) Check for HO2S contamination caused by leaded fuel, incorrect gasket sealer or over-rich operation. If problem is found, go to next step. If no problem is found, go to step 11).

10) Repair or replace as necessary. After repairs, go to next step.

11) Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P1154. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

12) Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Never solder HO2S wires.

DTC P1345 - CRANKSHAFT/CAMSHAFT POSITION SENSOR CORRELATION

NOTE: For circuit reference, see the L - WIRING DIAGRAMS article.

Circuit Description

If VCM sets DTC P1345, it has determined that distributor is installed incorrectly, or a mechanical malfunction in engine has occurred.

Condition required to set DTC is:

* With engine running, Camshaft Position (CMP) sensor pulse is not detected at correct time relative to Crankshaft Position (CKP) sensor pulse.

Diagnostic Procedures

1) Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the F - BASIC TESTING - 4.3L article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

2) Start engine. Using scan tool, read engine speed (RPM). If RPM fluctuates up to twice desired RPM, go to next step. If RPM does not fluctuate as specified, go to step 4).

3) Replace CKP sensor. After replacing sensor, go to step 6).

4) Check for proper distributor installation. If problem is found, go to next step. If no problem is found, go to step 6).

5) Repair as necessary. After repairs, go to next step.

6) Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P1345. Operate vehicle

within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

7) Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

DTC P1351 - IGNITION CONTROL CIRCUIT HIGH VOLTAGE

NOTE: For circuit reference, see the L - WIRING DIAGRAMS article.

Circuit Description

Crankshaft Position (CKP) sensor provides VCM with reference pulse input. VCM uses CKP input to determine ignition spark timing for each cylinder. Once VCM calculates ignition timing, it sends a signal to ignition coil module on Ignition Control (IC) circuit.

Conditions required to set DTC are:

* Engine speed less than 250 RPM.
* IC circuit voltage greater than 4.9 volts.

Diagnostic Procedures

1) Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the F - BASIC TESTING - 4.3L article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

2) Clear DTCs. Disconnect fuel injector connector. Crank engine 30 seconds. Read DTCs. If DTC P1351 sets, go to next step. If DTC does not set, see DIAGNOSTIC AIDS.

3) Turn ignition off. Reconnect fuel injector connector. Disconnect ignition coil module connector. Using voltmeter in AC scale, check voltage between engine ground and IC control circuit at ignition coil module, while cranking engine. If voltage is 1-4 volts, go to step 9). If voltage is not as specified, go to next step.

4) Turn ignition off. Disconnect VCM Gray connector. Check resistance of IC control circuit between VCM Gray harness connector and ignition coil module. If resistance is less than 10 ohms, go to step 6). If resistance is not less than 10 ohms, go to next step.

5) Repair open IC control circuit between VCM and ignition coil module and go to step 16).

6) Check for faulty connection at VCM. If faulty connection is found, go to next step. If connection is okay, go to step 8).

7) Repair faulty VCM connection. After repairs, go to step 16).

8) Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to step 16).

9) Turn ignition off. Connect a test light between battery voltage and ignition coil module harness connector ground circuit. If test light illuminates, go to step 11). If test light does not illuminate, go to next step.

10) Repair open ignition coil module ground circuit and go to step 16).

11) Turn ignition on. Connect test light between engine ground and ignition coil module harness connector ignition feed circuit, and then ignition coil module harness connector tachometer signal circuit. If test light illuminates on both circuits, go to step 13). If test light does not illuminate on both circuits, go to next step.

12) Repair faulty circuit. After repairs, go to step 16).

13) Check for faulty connection at ignition coil module. If faulty connection is found, go to step 15). If connection is okay, go to next step.

14) Replace ignition coil module. After replacing module, go to step 16).

15) Repair faulty connection. After repairs, go to next step.

16) Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P1351. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

17) Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check for faulty connections or damaged harness. If connections and harness appear okay, observe scan tool while moving all related harness and connectors. A change in scan tool display indicates fault location.

DTC P1361 - IGNITION CONTROL CIRCUIT NOT TOGGLING

NOTE: For circuit reference, see the L - WIRING DIAGRAMS article.

Circuit Description

Crankshaft Position (CKP) sensor provides VCM with reference pulse input. VCM uses CKP input to determine ignition spark timing for each cylinder. Once VCM calculates ignition timing, it sends a signal to ignition coil module on Ignition Control (IC) circuit.

Conditions required to set DTC are:

* EST enabled.
* Engine speed less than 250 RPM.
* EST voltage less than .40 volt.

Diagnostic Procedures

1) Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the F - BASIC TESTING - 4.3L article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

2) Clear DTCs. Disconnect fuel injector connector. Crank engine 15 seconds. Read DTCs. If DTC P1361 sets, go to next step. If DTC does not set, see DIAGNOSTIC AIDS.

3) Turn ignition off. Reconnect fuel injector connector. Disconnect ignition coil module connector. Using voltmeter in AC scale, check voltage between engine ground and IC control circuit at ignition coil module, while cranking engine. If voltage is 1-4 volts, go to step 9). If voltage is not as specified, go to next step.

4) Turn ignition off. Disconnect VCM Gray connector. Connect a test light between battery voltage and ignition coil module harness connector IC control circuit. If test light illuminates, go to next step. If test light does not illuminate, go to step 6).

5) Repair short to voltage in IC control circuit. After repairs, go to step 14).

6) Connect test light between engine ground and IC control circuit at VCM. If test light illuminates, go to next step. If test light does not illuminate, go to step 8).

7) Repair short to voltage in IC control circuit. After repairs, go to step 14).

8) Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to step 14).

9) Turn ignition off. Connect a test light between battery voltage and ignition coil module harness connector ground circuit. If test light illuminates, go to step 11). If test light does not illuminate, go to next step.

10) Repair open ignition coil module ground circuit. After repairs, go to step 14).

11) Check for faulty connection at ignition coil module. If faulty connection is found, go to step 13). If connection is okay, go to next step.

12) Replace ignition coil module. After replacing module, go to step 14).

13) Repair faulty connection. After repairs, go to next step.

14) Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P1361. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

15) Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check for faulty connections or damaged harness. If connections and harness appear okay, observe scan tool while moving all related harness and connectors. A change in scan tool display indicates fault location.

DTC P1380 - ELECTRONIC BRAKE CONTROL MODULE EBCM) DTC DETECTED ROUGH ROAD DATA UNUSABLE

NOTE: For circuit reference, see the L - WIRING DIAGRAMS article.

Circuit Description

This test determines if ABS system is capable of detecting a rough road situation.

Conditions for setting DTC:

* Vehicle speed at least 1 MPH.
* Engine speed less than 5800 RPM.
* Engine load not greater than 90 percent.
* DTC P0300 is set with MIL on.

Diagnostic Procedures

1) Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the F - BASIC TESTING - 4.3L article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

2) Disconnect VCM and Electronic Brake Control (EBCM) module connectors. Check for open in serial data circuit between EBCM and VCM. If open is found, go to next step. If open is not found, perform ABS system diagnosis. See the BRAKES SYSTEM - ANTI-LOCK article in the BRAKES section.

3) Repair as necessary. After repairs, go to next step.

4) Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P1380. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

5) Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check for faulty connections or damaged harness. If connections and harness appear okay, observe scan tool while moving all related harness and connectors. A change in scan tool display indicates fault location.

DTC P1381 - MISFIRE DETECTED NO EBCM/VCM SERIAL DATA

NOTE: For circuit reference, see the L - WIRING DIAGRAMS article.

Circuit Description

This test detects a serial data malfunction which could inhibit the transfer of the ABS rough road data to VCM.

Conditions for setting DTC:

* DTC P0300 is set with MIL on.
* EBCM not sending rough road data.

Diagnostic Procedures

1) Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the F - BASIC TESTING - 4.3L article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

2) Disconnect VCM and Electronic Brake Control (EBCM) module connectors. Check for open in serial data circuit between EBCM and VCM. If open is found, go to next step. If open is not found, perform ABS system diagnosis. See the BRAKES SYSTEM - ANTI-LOCK article in the BRAKES section.

3) Repair as necessary. After repairs, go to next step.

4) Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P1381. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

5) Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check for faulty connections or damaged harness. If connections and harness appear okay, observe scan tool while moving all related harness and connectors. A change in scan tool display indicates fault location.

DTC P1406 - EGR VALVE PINTLE POSITION CIRCUIT

NOTE: For circuit reference, see the L - WIRING DIAGRAMS article.

Circuit Description

VCM constantly reads EGR valve pintle position sensor to ensure valve is responding to commands from VCM.

Conditions required to set DTC are:

* EGR pintle position signal voltage out of normal range, or 10 percent greater or less than VCM commanded position.
* Ignition voltage greater than 9 volts.

Diagnostic Procedures

1) Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the F - BASIC TESTING - 4.3L article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

2) Turn ignition on. Using scan tool, read EGR PINTLE POS. If scan tool displays zero percent, go to next step. If scan tool does not display zero percent, go to step 8).

3) Using scan tool, select MISC TESTS and command EGR duty cycle through 25, 50, 75 and 100 percent positions. Compare scan tool display DESIRED EGR POSITION and ACTUAL EGR POS. If both readings are close, see DIAGNOSTIC AIDS. If readings are not close, go to next step.

4) Disconnect EGR valve harness connector. Connect a test light between EGR harness connector control and ignition feed circuits. Using scan tool, command EGR position to 100 percent. If test light illuminates, go to step 26). If test light does not illuminate, go to next step.

5) Connect test light between engine ground and EGR valve harness connector ignition feed circuit. If test light illuminates, go to next step. If test light does not illuminate, go to step 12).

6) Check for faulty connections at VCM harness and EGR valve harness connectors. Check for open circuits between VCM and EGR valve. If problem is found, go to next step. If no problem is found, go to step 8).

7) Repair faulty connection(s) or open circuit(s). After repairs, go to step 39).

8) Disconnect EGR valve harness connector. Using scan tool, read EGR PINTLE POS. If scan tool displays zero percent, go to step 16). If scan tool does not display zero percent, go to next step.

9) If DTC P0108 is also set, go to DTC P0108. If DTC is not set, go to next step.

10) Check for short to voltage in EGR pintle position circuit. If short is found, go to next step. If no short is found, go to step 12).

11) Repair short to voltage in EGR pintle position circuit. After repairs, go to step 39).

12) Check for blown fuse No. 4. If fuse is blown, go to next step. If fuse is okay, go to step 16).

13) Replace fuse No. 4. After repairs, go to next step.

14) Repair short to ground in EGR control circuit. After repairs, go to step 39).

15) Repair high circuit. After repairs, go to step 40).

16) Connect test light between battery voltage and EGR valve harness connector ground circuit. If test light illuminates, go to step 19). If test light does not illuminate, go to next step.

17) Check for open EGR valve ground circuit. If open is found, go to next step. If open is not found, go to step 19).

18) Repair open ground circuit. After repairs, go to step 40).

19) Connect test light between battery voltage and EGR valve harness connector low circuit. If test light illuminates, go to next step. If test light does not illuminate, go to step 23).

20) Disconnect VCM Blue harness connector. Using a test light connected to battery voltage, probe EGR harness connector terminal "A". If test light illuminates, go to next step. If test light does not illuminate, go to step 39).

21) Check for short to ground in EGR valve control low circuit. If short is found, go to next step. If no short is found, go to step 23).

22) Repair short to ground in EGR valve control low circuit. After repairs, go to step 40).

23) Check for faulty connection at EGR valve. If faulty connection is found, go to next step. If connection is okay, go to step 25).

24) Repair faulty connection at EGR harness connector. After repairs, go to step 40).

25) Replace EGR valve. After replacing EGR valve, go to step 40).

26) Using DVOM, check voltage between EGR valve harness connector ground and 5-volt reference circuits. If voltage reading is about 5 volts, go to step 31). If voltage reading is not about 5 volts, go to next step.

27) Using DVOM, check voltage between engine ground and VCM harness connector 5-volt reference circuit. If voltage is 5 volts, go to next step. If voltage is not 5 volts, go to step 29).

28) Check for faulty connection at VCM harness connector 5-volt reference circuit. If faulty connection is found, go to next step. If connection is okay, go to step 30).

29) Repair faulty connection at VCM harness connector 5-volt reference circuit. After repairs, go to step 40).

30) Repair open 5-volt reference circuit. After repairs, go to step 40).

31) Connect test light between battery voltage and EGR valve harness connector pintle position signal circuit. If test light illuminates, go to step 34). If test light does not illuminate, go to next step.

32) Check for short to ground in EGR pintle position signal circuit. If short is found, go to next step. If short is not found, go to step 34).

33) Repair short to ground in EGR pintle position signal circuit. After repairs, go to step 40).

34) Connect appropriate adapters from Connector Test Kit (J-35616) between EGR valve and EGR valve harness connector. Using DVOM, check voltage between engine ground and EGR valve pintle position signal circuit at EGR valve. Using scan tool, command EGR position to 100 percent. If voltage is 3.5-5.0 volts, go to next step. If voltage is not as specified, go to step 36).

35) Check for open in EGR pintle position circuit. Check for poor connection at EGR valve connector. If a problem is found, go to step 37). If no problem is found, go to next step.

36) Check for faulty connection at VCM harness connector pintle position signal circuit. If faulty connection is found, go to step 38). If connection is okay, go to step 39).

37) Repair open EGR pintle position signal circuit. After repairs, go to step 40).

38) Repair faulty connection. After repairs, go to step 40).

39) Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to next step.

40) Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P1406. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

41) Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check for faulty connections or damaged harness. If connections and harness appear okay, observe scan tool while moving all related harness and connectors. A change in scan tool display indicates fault location.

DTC P1441 - EVAP SYSTEM FLOW DURING NON-PURGE

NOTE: For circuit reference, see the L - WIRING DIAGRAMS article.

Circuit Description

Evaporative (EVAP) emissions canister purge is controlled by a solenoid valve which allows ported vacuum to purge canister when energized by VCM. A vacuum switch in purge line is used to detect when system is being purged. VCM supplies and reads a 12-volt reference to switch. If switch is open (purge detected) when commanded by VCM, DTC P1441 is set.

Conditions required to set DTC are:

* No HO2S, ECT, EGR, IAT, MAP, TP, VSS sensor DTCs set.

* DTC P0125 not active.
* Fuel tank greater than 12.5 percent but not greater than 87.5 percent.
* System voltage is greater than 10 volts but less than 17 volts.

Diagnostic Procedures

1) Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the F - BASIC TESTING - 4.3L article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

2) Turn ignition off. Remove fuel cap. Turn ignition on. Using scan tool, observe fuel tank pressure parameter. If fuel tank pressure is zero H2O, go to next step. If fuel tank pressure is not zero in. H2O, diagnose EVAP control system. See the I - SYSTEM/COMPONENT TESTS article.

3) Ensure gauges on Enhanced EVAP Pressure Purge Diagnostic Cart (J-41413) are zeroed. Replace fuel filler cap. Install diagnostic cart. Using scan tool, command EVAP vent on (closed). Pressurize EVAP system to 5 in. H2O using diagnostic cart. Observe fuel tank pressure on scan tool. If fuel tank pressure is 5 in. H2O, go to next step. If fuel tank pressure is not 5 in. H2O, go to step 5).

4) Maintain fuel tank pressure at 5 in. H2O. Observe fuel tank pressure parameter on scan tool. If fuel tank pressure is maintained at 5 in. H2O, go to next step. If fuel tank pressure is not maintained at 5 in. H2O, diagnose EVAP control system. See the I - SYSTEM/COMPONENT TESTS article.

5) Remove EVAP purge solenoid from intake manifold. Connect a hand-held vacuum pump to EVAP purge solenoid. Apply 15 in. Hg vacuum to solenoid. If solenoid holds vacuum, go to next step. If solenoid does not hold vacuum, go to step 7).

6) Check EVAP purge line for proper routing. Check for proper vacuum source to EVAP purge solenoid. Repair as necessary. After repairs, go to step 8). If no problems are found, see DIAGNOSTIC AIDS.

7) Replace EVAP purge solenoid. After repairs, go to step 9). Also, see DIAGNOSTIC AIDS.

8) Repair as necessary. After repairs, go to next step. Also, see DIAGNOSTIC AIDS.

9) Start engine. Remove fuel cap. Using scan tool, command EVAP vent valve on (closed) and EVAP purge solenoid off (zero percent). Replace fuel cap. Run engine at 2500 RPM. Monitor fuel tank pressure parameter on scan tool. If fuel tank pressure remains at zero in. H2O, system is okay. If fuel tank pressure does not remain at zero in H2O, repeat step 2).

Diagnostic Aids

Check vacuum hoses for damage. Check for faulty connections or damaged harness. If connections and harness appear okay, observe scan tool while moving all related harness and connectors. A change in scan tool display indicates fault location.

DTC P1508 - IAC SYSTEM LOW RPM

NOTE: For circuit reference, see the L - WIRING DIAGRAMS article.

Circuit Description

VCM controls idle speed with an Idle Air Control (IAC) valve to a calculated RPM based on sensor inputs and actual engine RPM. VCM moves IAC valve in or out to vary amount of airflow into intake manifold and thus decrease or increase idle RPM.

VCM commands IAC in counts. A higher count, allows more air to by-pass throttle plate (higher idle).

Conditions required to set DTC are:

* No ECT, MAP, TP or VSS sensor DTCs set.
* ECT greater than 122°F (50°C).
* IAT greater than -13°F (-25°C).
* BARO greater than 10.2 psi (0.72 kg/cm²) at less than 10,300 ft.
* Vehicle speed less than 2 MPH.
* Throttle at idle or less than 1%.
* Engine running longer than 30 seconds.
* Listed conditions met for more than 3 seconds.
* Change in calculated airflow greater than 2 counts.

Diagnostic Procedures

1) Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the F - BASIC TESTING - 4.3L article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

2) Turn ignition off. Connect IAC driver to IAC valve. Set parking brake, brake drive wheels and turn A/C off. Start engine and allow it to idle in Park (A/T) or Neutral (M/T). Using scan tool, read engine speed (RPM). Using IAC driver, extend and retract IAC valve. If engine RPM decreases and increases as IAC valve is cycled, go to next step. If engine RPM does not change, go to step 4).

3) If engine speed changes smoothly between 700-1500 RPM, go to step 5). If RPM does not change smoothly, go to next step.

4) Check IAC valve passage. If passage is not okay, clean passage and go to step 12). If passage is okay, replace IAC valve. Disconnect negative battery cable for 10 seconds, then reconnect cable. Turn ignition on, engine off for 5 seconds. Turn ignition off for at least 10 seconds and go to step 12).

5) Install IAC Node Light (J37027-A) in VCM harness. Cycle IAC driver and note lights. Both lights should cycle Green and Red, but not OFF as RPM changes from 700-1500 RPM. If lights flash as specified, go to step 8). If lights do not flash as specified, go to next step.

6) Check for faulty connector terminal contacts, open circuits, short to ground or voltage, faulty VCM connection. If problem is found, go to next step. If no problem is found, go to step 11).

7) Repair connection, terminal contact or circuit as necessary. After repairs, go to step 12).

8) Using other connector on IAC driver pigtail, check resistance across IAC valve coils. Check resistance of IAC coil "B" HI and LO circuits. Check resistance of coil "A" HI and LO circuits. If resistance on both coils is 40-80 ohms, go to next step. If resistance is not as specified on both coils, go to step 10).

9) Check resistance between coil "B" HI circuit and coil "A" LO circuit. Check resistance between coil "B" LO circuit and coil "A" HI circuit. Resistance should be infinite. If resistance is as specified between both coils, see DIAGNOSTIC AIDS. If resistance is not as specified, go to next step.

10) Replace IAC valve. Disconnect negative battery cable for 10 seconds, then reconnect cable. Turn ignition on, engine off for 5 seconds. Turn ignition off for at least 10 seconds. After repairs, go to step 12).

11) Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to next step.

12) Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P1508. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

13) Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected

DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check for stopped IAC valve, tampered throttle stop screw, and damaged throttle or linkage. Check for fuel system running too rich or too lean. Check throttle body bore for foreign material. Reset IAC using scan tool.

DTC P1509 - IAC SYSTEM HIGH RPM

NOTE: For circuit reference, see the L - WIRING DIAGRAMS article.

Circuit Description

VCM controls idle speed with an Idle Air Control (IAC) valve to a calculated RPM based on sensor inputs and actual engine RPM. VCM moves IAC valve in or out to vary amount of airflow into intake manifold and thus decrease or increase idle RPM.

VCM commands IAC in counts. A higher count, allows more air to by-pass throttle plate (higher idle).

Conditions required to set DTC are:

* No ECT, MAP, TP or VSS sensor DTCs set.
* ECT greater than 161.6°F (72°C).
* IAT greater than -13°F (-25°C).
* BARO greater than 10.2 psi (0.72 kg/cm²) at less than 10,300 ft.
* Vehicle speed less than 2 MPH.
* Throttle at idle.
* Engine running more than 30 seconds.
* Listed conditions met for more than 3 seconds.
* Change in calculated airflow more than 2 counts.

Diagnostic Procedures

1) Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the F - BASIC TESTING - 4.3L article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

2) Turn ignition off. Connect IAC driver to IAC valve. Set parking brake, brake drive wheels and turn A/C off. Start engine and allow it to idle in Park (A/T) or Neutral (M/T). Using scan tool, read engine speed (RPM). Using IAC driver, extend and retract IAC valve. If engine RPM decreases and increases as IAC valve is cycled, go to next step. If engine RPM does not change, go to step 4).

3) If engine speed changes smoothly between 700-1500 RPM, go to step 5). If RPM does not change smoothly, go to next step.

4) Check IAC valve passage. If passage is not okay, clean passage and go to step 12). If passage is okay, replace IAC valve. Disconnect negative battery cable for 10 seconds, then reconnect cable. Turn ignition on, engine off for 5 seconds. Turn ignition off for at least 10 seconds and go to step 12).

5) Install IAC Node Light (J37027-A) in VCM harness. Cycle IAC driver and note lights. Both lights should cycle Green and Red, but not OFF as RPM changes from 700-1500 RPM. If lights cycle as specified, go to step 8). If lights do not cycle as specified, go to next step.

6) Check for faulty connector terminal contacts, open circuits, short to ground or voltage, faulty VCM connection. If problem is found, go to next step. If no problem is found, go to step 11).

7) Repair connection, terminal contact or circuit as necessary. After repairs, go to step 12).

8) Using other connector on IAC driver pigtail, check resistance across IAC valve coils. Check resistance between IAC coil "B" ground and signal circuits. Check resistance across coil "A"

ground and signal circuits. If resistance on both coils is 40-80 ohms, go to next step. If resistance is not as specified on both coils, go to step 10).

9) Check resistance between coil "B" signal circuit and coil "A" ground circuit. Check resistance between coil "B" ground circuit and coil "A" signal circuit. Resistance should be infinite. If resistance is as specified between both coils, see DIAGNOSTIC AIDS. If resistance is not as specified, go to next step.

10) Replace IAC valve. Disconnect negative battery cable for 10 seconds, then reconnect cable. Turn ignition on, engine off for 5 seconds. Turn ignition off for at least 10 seconds. After repairs, go to step 12).

11) Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to next step.

12) Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P1509. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

13) Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check for stopped IAC valve, tampered throttle stop screw, and damaged throttle or linkage. Check for fuel system running too rich or too lean. Check throttle body bore for foreign material. Reset IAC using scan tool.

H - TESTS W/O CODES - 4.3L

1997 Chevrolet Blazer

1997 ENGINE PERFORMANCE
General Motors Corp. - Trouble Shooting - No Codes - 4.3L

Chevrolet; Blazer, S10 Pickup
GMC; Jimmy, Sonoma
Oldsmobile; Bravada

* PLEASE READ THIS FIRST *

NOTE: Models may use a Powertrain Control Module (PCM) or Vehicle Control Module (VCM). The term PCM will be used in this article to describe all control modules.

INTRODUCTION

Before diagnosing symptoms or intermittent faults, perform basic diagnostic procedures in the F - BASIC TESTING - 4.3L article and self-diagnostic steps in the G - TESTS W/CODES - 4.3L article. Use this article to diagnose driveability problems if a current trouble code is not present or if not equipped with a self-diagnostic system.

Symptom checks are intended to direct technician to malfunctioning component(s) for further diagnosis. A symptom should lead to a specific component or system test, or an adjustment specification. Use intermittent test procedures to locate driveability problems not occurring when vehicle is being tested.

NOTE: For specific testing, see I - SYSTEM/COMPONENT TESTS article. For specifications, see the D - ADJUSTMENTS - 4.3L article or C - SPECIFICATIONS - 4.3L article.

NOTE: SERVICE ENGINE SOON light, located on instrument cluster, is also referred to as the Malfunction Indicator Light (MIL).

PRELIMINARY CHECKS

* Verify the on-vehicle diagnostics are working by performing ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK in the F - BASIC TESTING - 4.3L article.
* Ensure PCM and MIL function properly.
* Ensure no trouble codes (except intermittent) are stored.
* Ensure fuel control system operates properly. See the F - BASIC TESTING - 4.3L article.
* Perform fuel system pressure test.
* Visually inspect all systems.

After all checks have been performed, verify customer complaint and locate correct symptom. Check items indicated under that symptom. Not all items listed under each symptom apply to all models and systems. These procedures normally recommend testing of specific system/component, such as EGR, TCC, etc. See the I - SYSTEM/COMPONENT TESTS article for test procedures.

SYMPTOMS

Before proceeding with any symptom diagnosis, perform all steps under PRELIMINARY CHECKS.

NOTE: If PCM displays data but engine fails to start, see NO-START DIAGNOSIS in the F - BASIC TESTING - 4.3L article.

SYMPTOM DIAGNOSIS

Symptom checks should not be used unless symptom occurs while vehicle is being tested. To reduce diagnostic time, ensure basic diagnostic procedures in the F - BASIC TESTING - 4.3L and self-diagnostic steps in the G - TESTS W/CODES - 4.3L articles were performed before diagnosing a symptom. Symptoms available for diagnosis include:

* Hard Start
* Stalls After Starting
* Hesitation, Sag Or Stumble
* Vehicle Surges Or Chuggles
* Lack Of Power Or Sluggish
* Engine Backfires
* Cuts Out, Misses
* Rough, Unstable Or Incorrect Idle
* Engine Will Not Idle
* Poor Fuel Economy
* Engine Dieseling/Run-On
* Detonation/Spark Knock
* Excessive Exhaust Emissions Or Odors

HARD START

Symptom Definition
Engine cranks okay, but does not start immediately. Engine eventually starts and may run okay or soon die.

Possible Causes & Corrections:

* Check for restricted exhaust system.
* Check ignition system for bare or shorted wires, incorrect pick-up coil resistance, loose ignition coil connections or moisture in distributor cap (if equipped).
* Using Spark Tester (J-26792), check for adequate spark output.
* Check ignition control circuit for short to ground.
* Remove spark plugs. Check for wet/fouled spark plugs, cracks in porcelain, improper gap, burned electrodes or heavy carbon deposits.
* Check for shorts by misting plug wires with water.
* Check fuel pump relay. Connect test light between fuel pump test terminal and ground. Turn ignition on. Test light should illuminate for 2 seconds. If test light does not illuminate, check fuel pump relay. See the I - SYSTEM/COMPONENT TESTS article. For location of fuel pump test connector, see the I - SYSTEM/COMPONENT TESTS article.
* Check for poor fuel quality or water-contaminated fuel.
* Check for correct fuel pressure at all speeds and engine RPMs.
* Check for a faulty in-tank fuel pump check valve (if equipped). A faulty check valve allows fuel in lines to drain back to tank after engine is stopped.
* Check EGR operation.
* Ensure ECT circuit or sensor resistance is not too high. See the K - SENSOR RANGE CHARTS article.
* Ensure TP sensor does not stick or bind. A sticking throttle shaft or binding linkage may cause a high TP sensor voltage (open throttle indication). PCM will not control idle if high

voltage is sensed.

* Check Idle Air Control (IAC) system. Check for foreign material in IAC bore.
* Ensure correct PROM is installed in vehicle. Check with dealer for latest application information.

STALLS AFTER STARTING

Symptom Definition

Engine starts okay but dies after brief idle, as soon as any load is placed on engine (such as turning on air conditioner or engaging transmission) or on initial drive-away.

Possible Causes & Corrections:

* Ensure Torque Converter Clutch (TCC) is not stuck on.
* Check brakelight switch operation.
* Check PCV valve for proper operation.
* Check for plugged or restricted fuel lines.
* If engine starts but then immediately stalls, open distributor by-pass circuit. If engine now starts and runs okay, replace distributor pick-up coil.
* Using Spark Tester (J-26792), check for a weak spark from ignition coil.
* Check Idle Air Control (IAC) system for proper operation.
* Unplug MAP sensor. PCM substitutes a default value for sensor signal. If stall condition is eliminated, replace MAP sensor.
* Check EGR system for proper operation.
* If stall occurs when air conditioner is turned on, check for air conditioner clutch signal to PCM terminal. Voltage at A/C terminal of PCM should be battery voltage when air conditioner compressor clutch is engaged. A high voltage surge due to a shorted compressor clutch diode could cause PCM shutdown.
* Check for an overcharged A/C system.

HESITATION, SAG OR STUMBLE

Symptom Definition

Momentary lack of response when accelerator is pushed down. Can occur at any vehicle speed. Usually occurs after a stop. If severe enough, may cause engine to stall.

Possible Causes & Corrections:

* Check for faulty spark plug wires. Check for fouled spark plugs.
* Check for open in ignition system ground circuit. Ensure initial ignition timing is correct.
* Ensure fuel pressure is correct in all speed ranges.
* Check for poor fuel quality or water-contaminated fuel.
* Ensure TP sensor does not stick or bind. Voltage should increase at a steady rate as throttle is moved toward wide open throttle.
* Check MAP sensor response and accuracy. See the I - SYSTEM/COMPONENT TESTS article.
* Check canister purge system for proper operation.
* Check EGR valve for proper operation.
* Ensure correct PROM is installed in PCM. Check dealer for latest application.
* Check charging system output. Repair if output is less than 9 volts or greater than 16 volts.

VEHICLE SURGES OR CHUGGLES

Symptom Definition

Engine power varies under steady throttle or cruise. Feels like vehicle speeds up and slows down even though accelerator pedal position remains constant.

Possible Causes & Corrections:

* Ensure park/neutral switch is properly adjusted.
* Check TCC for proper operation.
* Check for restricted exhaust system.
* Check for kinked or leaking vacuum lines.
* Ensure initial ignition timing is properly set.
* Using Spark Tester (J-26792), check for adequate spark output.
* Remove spark plugs, and check for wet/fouled spark plugs, cracks in porcelain, improper gap, burned electrodes or heavy carbon deposits. Check distributor cap, rotor and spark plug wires.
* Check ESC system for proper operation.
* Check in-line fuel filter. Replace if dirty or clogged.
* Check fuel for water contamination.
* Ensure fuel system pressure is correct at all engine speeds.
* If emission test shows excessive CO and HC emissions and vehicle emits odor, check all systems and components which could cause engine to run rich.
* If emission test shows excessive NOx emissions, check all systems and components which could cause engine to run lean or too hot.
* Check canister purge system for proper operation.
* Check for an intermittent EGR system problem.
* Check Oxygen Sensor (O2S) for lead or RTV sealant contamination. Such contamination causes a false high voltage signal to PCM, which responds by leaning air/fuel ratio.
* Check PCM grounds. Ensure they are clean, tight and properly located.
* Check charging system output. Repair if output is less than 9 volts or greater than 16 volts.
* Check A/C for excessive charge.

LACK OF POWER OR SLUGGISH

Symptom Definition

Engine delivers less power than expected. Little or no increase in speed when accelerator is applied.

Possible Causes & Corrections:

* Check exhaust system for restrictions, such as a damaged or collapsed pipe, muffler or catalytic converter. See EXHAUST SYSTEM BACKPRESSURE under MECHANICAL INSPECTION in the F - BASIC TESTING - 4.3L article.
* Check engine valve timing and compression.
* Check engine for a worn camshaft.
* Check TCC system for proper operation.
* Check transmission shift pattern and downshift operation.
* Using Spark Tester (J-26792), check for adequate spark output.
* Ensure correct initial ignition timing.
* Check ESC system for excessive retard.
* Check EST system for proper operation.
* Check air filter and fuel filter. Replace if necessary.

* Ensure fuel system pressure is correct at all engine speeds.
* Check for poor fuel quality or water-contaminated fuel.
* Check injector wires for short to ground at air cleaner.
* Check for spray from one injector on TBI unit. Malfunction may be present in injector assembly or in signal to injector assembly. Isolate malfunction by switching injector connectors. If problem remains with original injector, injector is defective. If malfunction moves with injector connector, problem is an improper signal in injector circuits.
* Check PCM grounds. Ensure they are clean, tight and properly located.
* Ensure EGR valve is not always open.
* Check charging system output. Repair if output is less than 9 volts or greater than 16 volts.
* Check A/C for proper operation.

ENGINE BACKFIRES

Symptom Definition

Fuel ignites within intake manifold or in exhaust system, making a loud popping noise.

Possible Causes & Corrections:

* Ensure EGR valve is not stuck open.
* Check engine for sticking or leaking valves.
* Check for proper valve timing.
* Check for engine vacuum leaks. Ensure engine is tuned to specifications.
* Using Spark Tester (J-26792), check available output voltage of ignition coil.
* Check for crossfire between spark plugs, distributor cap and spark plug wires.
* Check for an intermittent ignition system problem.
* Check for erratic spark timing or distributor reference (RPM) signal.
* Ensure initial ignition timing is properly set.
* Check for fuel or water in vacuum hose to MAP sensor. Also check for restricted hose.

CUTS OUT, MISSES

Symptom Definition

Cuts out, misses is defined as a steady pulsation or jerking following engine speed, usually more pronounced as engine load increases. Exhaust may have a steady spitting sound at idle or low speed. Perform visual inspection as described in F - BASIC TESTING - 4.3L article.

CAUTION: Grounding spark plug wire for extended periods may cause catalytic converter overheating.

Misfire Isolation

1) Start engine. Disconnect IAC motor. Using insulated pliers, remove one spark plug wire from a spark plug, and ground it against engine.

2) Note engine RPM as wire is grounded. Reconnect spark plug wire. Repeat procedure for all cylinders. Stop engine, and reconnect IAC motor.

3) If engine speed drops equally (within 50 RPM) on all cylinders, refer to ROUGH, UNSTABLE OR INCORRECT IDLE symptom. If there is no engine RPM drop or no excessive variation on one or more

cylinders, check spark or compression on respective cylinder(s).

Possible Causes & Corrections:

* Check for restricted exhaust system. See EXHAUST SYSTEM BACKPRESSURE under MECHANICAL INSPECTION in the F - BASIC TESTING - 4.3L article.
* Check for bent push rods, broken valve springs or worn camshaft lobes.
* Check ignition wires for short or faulty insulation.
* Check distributor cap (if equipped) for moisture, dust or cracks. Finely mist spark plug wires with water to check for shorts.
* Using Spark Tester (J-26792), check for adequate spark at spark plugs.
* Check ignition system for faulty grounds.
* Ensure EST wiring harness is not routed too close to ignition wiring. EST wiring harness routed too close to ignition wiring may cause induced voltage signals.
* Check ignition coil connections.
* Remove spark plugs, and check for incorrect heat range, wear, cracks, wetness, improper gap or heavy deposits.
* Check for poor quality or contaminated fuel.
* Check for improper fuel pressure.
* Ensure EGR valve is not stuck open.
* Check PCM for proper ground circuits.
* Ensure TP sensor does not stick or bind. TP sensor voltage should be less than 1.25 volts at idle.

ROUGH, UNSTABLE OR INCORRECT IDLE

Symptom Definition

Engine runs unevenly at idle. If bad enough, vehicle will shake. Idle RPM may vary. Engine idles at incorrect RPM.

Possible Causes & Corrections:

* Ensure throttle linkage and/or TP sensor do not stick or bind.
* Check park/neutral switch circuit. Ensure park/neutral switch is properly adjusted.
* Check exhaust system for restrictions, such as a damaged or collapsed pipe, muffler or catalytic converter. See EXHAUST SYSTEM BACKPRESSURE under MECHANICAL INSPECTION in the F - BASIC TESTING - 4.3L article.
* If rough idle occurs only when engine is hot, check PCV valve for proper operation. Check evaporative emission control system. Check for proper spark plug gap and engine compression.
* Ensure initial ignition timing is properly set.
* Disconnect MAP sensor. If condition is corrected, replace sensor.
* Check engine idle speed (both base and PCM idle).
* Check Idle Air Control (IAC) system. Check for foreign material in IAC bore.
* Check EGR system for proper operation.
* Check power steering pressure switch circuit.

ENGINE WILL NOT IDLE

Symptom Definition

Engine starts but will not run at idle. Engine runs if accelerator is held at part throttle.

Possible Causes & Corrections:

* Problem is most likely in Idle Air Control (IAC) system.
* Check EGR system.
* Check park/neutral switch.
* Disconnect MAP sensor. If condition is corrected, replace sensor.

POOR FUEL ECONOMY

Symptom Definition

Fuel economy, as measured by an actual road test, is noticeably lower than expected. Current fuel economy is noticeably lower than previous fuel economy.

Possible Causes & Corrections:

* Check for a clogged air filter.
* Check exhaust system for restrictions, such as a damaged or collapsed pipe, muffler or catalytic converter. See EXHAUST SYSTEM BACKPRESSURE under MECHANICAL INSPECTION in the F - BASIC TESTING - 4.3L article.
* Check engine compression.
* Check transmission shift pattern and downshift operation.
* Check TCC system for proper operation.
* Check for dragging brakes.
* Check cooling system thermostat for proper heat range and operation.
* Ensure initial ignition timing is properly set. Check EST and ESC for proper operation.
* Remove spark plugs, and check for wet/fouled spark plugs, cracks, improper gap, burned electrodes or heavy carbon deposits.
* Check for fuel pressure too high.
* Check for fuel pressure regulator leaking into intake manifold.
* Check ECT sensor for shift in calibration. See COOLANT TEMP RESISTANCE VALUES table in the K - SENSOR RANGE CHARTS article.
* Check Oxygen Sensor (O2S) for silicone or lead contamination.
* Ensure speedometer is properly calibrated.
* Ensure A/C is not always on.

ENGINE DIESELING/RUN-ON

Symptom Definition

Engine continues to run (but very rough) after ignition is turned off. If engine runs smoothly, check ignition switch.

Possible Causes & Corrections:

* Check engine for overheating.
* Check canister purge system staying on.
* Check for leaking injectors.
* Check IAC system.

DETONATION/SPARK KNOCK

Symptom Definition

A mild to severe ping, usually worse during acceleration. Engine makes sharp metallic knocks which change with degree of acceleration.

Possible Causes & Corrections:

* Check for low engine coolant and correct coolant solution.
* Check for obvious overheating problems.
* Check for loose water pump belt.
* Check for restricted airflow to radiator or restricted coolant flow.
* Check for faulty or incorrect thermostat.
* Check for incorrect basic engine parts such as camshaft, cylinder heads and pistons.
* Check for plugged PCV system.
* Check transmission range pressure switch assembly operation.
* Check transmission shift pattern and downshift operation.
* Check TCC system for proper operation.
* Check spark plugs for proper heat range and gap.
* Check knock sensor system operation.
* Ensure initial timing is correct.
* Remove carbon from engine with top engine cleaner.
* Check for incorrect fuel pressure.
* Check for poor fuel quality and proper octane rating. If scan tool readings are normal and no engine mechanical faults are present, fill fuel tank with a premium fuel with a minimum octane rating of 92. Re-evaluate vehicle performance.
* Check for spray from one injector on TBI unit. Malfunction may be present in injector assembly or in signal to injector assembly. Isolate malfunction by switching injector connectors. If problem remains with original injector, injector is defective. If malfunction moves with injector connector, problem is an improper signal in injector circuits.
* Check for a shifted ECT sensor. See DIAGNOSTICS AIDS in DTC 15 in the G - TESTS W/CODES - 4.3L article.
* If emission test shows excessive NOx emissions, check all systems and components which could cause engine to run lean or too hot.
* Check EGR valve for not working.
* Ensure correct PROM is installed in vehicle. Check dealer for latest application.

EXCESSIVE EXHAUST EMISSION (ODORS)

Symptom Definition

Vehicle fails emission test. Vehicle may also emit "rotten egg" smell (hydrogen sulfide) from exhaust pipe.

Possible Causes & Corrections:

* Check for lead contamination of catalytic converter. Check for removal/tampering at restrictor in fuel filler neck.
* Check for plugged PCV system.
* Check EGR valve for not working.
* If emission test shows excessive CO and HC emissions and vehicle emits odor, check all systems and components which could cause engine to run rich.
* If emission test shows excessive NOx emissions, check all systems and components which could cause engine to run lean or too hot.

INTERMITTENTS

INTERMITTENT PROBLEM DIAGNOSIS

Intermittent problem diagnosis requires duplication of circuit or component failure in order to identify problem. These procedures may lead to computer recording a trouble code which may help diagnosis.

If problem vehicle does not produce a trouble code, use a scan tool or DVOM to monitor voltage or resistance values while attempting to reproduce conditions which will create an intermittent problem. A change in status on scan tool or DVOM indicates a problem has been located.

When monitoring voltage, ensure ignition switch is in ON position or engine is running. When monitoring resistance (ohms), ensure ignition switch is in OFF position or negative battery cable is disconnected. A status change on scan tool or DVOM while performing TEST PROCEDURES indicates area of problem.

TEST PROCEDURES

Intermittent Simulation

Use following methods to reproduce conditions causing intermittent.

* Apply light vibration to components.
* Heat component.
* Wiggle or bend wiring harness.
* Spray component with water.
* Remove/apply vacuum supply source.

Monitor circuit/component voltage or resistance while attempting to simulate intermittent. If vehicle is running, monitor for trouble codes. Use test results to identify faulty component or circuit.

INTERMITTENT TROUBLE SHOOTING

Symptom Definition

Malfunction Indicator Light (MIL) comes on but does not stay on. A stored trouble code may or may not exist.

Possible Causes & Corrections

Use following procedures to determine possible causes of intermittent Malfunction Indicator Light (MIL) operation.

* Check for poor mating of one connector to another. Terminals may not be fully seated. Check for improperly formed or damaged terminals. Check wire-to-terminal connections.
* Check for poor connection from ignition coil to ground or arcing at spark plug wires or plugs.
* Check wire from Malfunction Indicator Light (MIL) to PCM for short to ground.
* Check wire from Data Link Connector (DLC) test terminal for intermittent short to ground.
* Check for poor connections in PCM ground terminals.
* Check for electrical system interference caused by defective relay, PCM-driven solenoid or switch, which may cause sharp electrical surge. This type of problem will normally occur when faulty component is operated.
* Check for aftermarket parts which may not have been produced to manufacturers' specifications. Solenoids without original -equipment diodes for circuit protection or voltage regulator using transistors instead of silicone-chip circuitry may cause voltage surges (up to 300 volts) in PCM wiring, causing temporary PCM shutdown. PCM shutdown is a normal response to system overvoltage (over 16 volts on most models). PCM

repowers when condition ceases to exist. A rapid shutdown and repower could cause a flickering Malfunction Indicator Light (MIL) with no codes set in memory.

* Check for improper installation of electrical accessories such as auxiliary lights or 2-way radios.
* Ensure EST wires are kept away from spark plug wires, distributor wires, distributor housing, ignition coil and generator. Ensure ground wire from PCM to distributor or ignition module is connected to a good ground.
* Check for intermittent short to ground on terminal "B" (diagnostic enable) of Data Link Connector (DLC) or in Malfunction Indicator Light (MIL) circuit.
* On vehicles not equipped with a driver information center, use scan tester to check for intermittent wiring problem. See SCAN TESTER USAGE in the G - TESTS W/CODES - 4.3L article.

1997 ENGINE PERFORMANCE
General Motors Corp. - Theory & Operation - 4.3L

Chevrolet; Blazer, S10 Pickup
GMC; Jimmy, Sonoma
Oldsmobile; Bravada

INTRODUCTION

This article covers basic description and operation of engine performance-related systems and components. Read this article before diagnosing vehicles or systems with which you are not completely familiar.

AIR INDUCTION SYSTEM

AIRFLOW SENSING

Speed Density

All engines are equipped with a Manifold Absolute Pressure (MAP) sensor, and use the speed density method to compute airflow rate. PCM uses manifold pressure to calculate the airflow rate. The MAP sensor responds to manifold vacuum changes due to engine load and speed changes. The PCM sends a voltage signal to the MAP sensor. Manifold pressure changes result in resistance changes in the MAP sensor.

By monitoring MAP sensor signal voltage, the PCM determines manifold pressure. If MAP sensor fails, the PCM supplies a fixed MAP sensor value, and uses the TP sensor to control fuel.

Some models also use an Intake Air Temperature (IAT) sensor. Sensor allows PCM to determine intake air temperature. PCM uses signal to delay EGR until intake air temperature reaches about 40°F (5°C). If intake air temperature becomes excessively high, PCM compensates by slightly retarding timing.

COMPUTERIZED ENGINE CONTROLS

The computerized engine control system monitors and controls a variety of engine/vehicle functions. The computerized engine control 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 Three-Way Catalytic (TWC) converter can control oxides of nitrogen (NOx), hydrocarbon (HC) and carbon monoxide (CO) emissions.

The computerized engine control system consists of engine PCM/VCM, input devices (sensor and switch input signals) and output signals.

POWERTRAIN CONTROL MODULE (PCM) & VEHICLE CONTROL MODULE (VCM)

NOTE: Models are equipped with a Powertrain Control Module (PCM) or a Vehicle Control Module (VCM). The difference between VCM and PCM is the PCM controls electronic transmission internals, cooling fan and cruise control system. The VCM provides control of the engine systems as well as the anti-lock brake system. Unless stated otherwise, references to PCM also apply to VCM-equipped vehicles.

For location of PCM/VCM, see COMPONENT LOCATIONS in the I - SYSTEM/COMPONENT TESTS article. The PCM/VCM consists of the Arithmetic Logic Unit (ALU), Central Processing Unit (CPU), power supply and system memories.

The PCM/VCM has a "learning" ability which allows it to make minor corrections for fuel system variations. If battery power is interrupted, a vehicle performance change may be noticed. PCM/VCM module corrects itself, and normal performance returns if vehicle is allowed to "relearn" optimum control conditions. "Relearning" occurs when vehicle is driven at normal operating temperature under part throttle, moderate acceleration and idle conditions.

Arithmetic Logic Unit (ALU)

This internal component of the PCM/VCM converts electrical signals received from various engine sensors into digital signals for use by the CPU.

Central Processing Unit (CPU)

CPU uses digital signals to perform all mathematical computations and logic functions necessary to deliver proper air/fuel mixture. CPU also calculates spark timing and idle speed. The CPU controls operation of emission control, "closed loop" fuel control and diagnostic system.

Power Supply

Power for PCM/VCM reference output signals (5 volts) and control devices (12 volts) is received from the battery through ignition circuit when ignition switch is in ON position. Keep-alive memory power is received directly from the battery.

Memories

PCM/VCM may use one or more of 5 types of memory:

* Calibration Package (CALPAC)
  Some models use a PROM and a CALPAC. CALPAC provides fuel delivery back-up so engine runs in case of PROM or PCM/VCM failure. Any time PCM/VCM is replaced, PROM and CALPAC must both be installed into replacement unit. If battery voltage is removed, CALPAC information is retained.
* Electronically Erasable Programmable Read Only Memory (EEPROM)
  Some models may use an EEPROM. This is the same as a PROM except it can be electronically reprogrammed by the manufacturer using special equipment.
* Memory Calibration (MEM-CAL)
  Some vehicles may use a PCM/VCM containing a MEM-CAL unit. This assembly contains functions of PROM and CALPAC. If power to PCM/VCM is removed, MEM-CAL information is retained. MEM-CAL also contains an internal Knock Sensor (KS) module on models equipped with a KS system.
* Programmable Read Only Memory (PROM)
  PROM is factory programmed engine calibration data which "tailors" PCM/VCM for specific transmission, engine, emission, vehicle weight and rear axle ratio application. The PROM can be removed from PCM/VCM. If battery voltage is removed, PROM information is retained.
* Random Access Memory (RAM)
  RAM is the scratch pad for the CPU. Data input, diagnostic codes and results of calculations are constantly updated and temporarily stored in RAM. If battery voltage is removed, all information stored in RAM is lost.
* Read Only Memory (ROM)

ROM is programmed information which only PCM/VCM can read. The ROM program cannot be changed. If battery voltage is removed, ROM information is retained.

NOTE: Components are grouped into 2 categories. The first category is INPUT DEVICES, consisting of components which control or produce voltage signals monitored by the control unit. The second category is OUTPUT SIGNALS, consisting of components controlled by the PCM/VCM.

INPUT DEVICES

Vehicles are equipped with different combinations of input devices. Not all devices are used on all models. To determine the input device usage on a specific model, see appropriate wiring diagram in the L - WIRING DIAGRAMS article. The available input signals include:

A/C On (A/C Request) Signal

The air conditioner "on" switch is mounted in instrument panel. This switch provides a simple "on"("A/C request") signal, which is monitored by PCM/VCM. The PCM/VCM uses this signal to determine control of the A/C clutch relay (if equipped) and to adjust idle speed when A/C compressor clutch is engaged. If this signal is not present on A/C equipped vehicles, vehicle may idle rough when A/C compressor cycles. To check function of the A/C switch, perform functional check of switch. See I - SYSTEM/COMPONENT TESTS article.

Battery Voltage

Battery voltage is monitored by PCM/VCM. If battery voltage swings low, a weak spark or improper fuel control may result. To compensate for low battery voltage, PCM/VCM may increase idle speed, advance ignition timing, increase ignition dwell or enrich the air/fuel mixture. If voltage swings high, PCM/VCM may set a charging system fault code and turn on Malfunction Indicator Light (MIL). If voltage signal swings excessively low (less than 9 volts) or excessively high (16 volts, most models), PCM/VCM shuts down for as long as condition exists. If condition is short-term, MIL flickers and vehicle may stumble. Vehicle stalls if condition persists.

Brake Switch Feedback

On models equipped with cruise control systems, PCM/VCM may monitor the brake switch circuit to determine when to engage and disengage cruise control. On vehicles equipped with a Torque Converter Clutch (TCC), one circuit of brake switch is in series with power supply for TCC solenoid located in automatic transmission.

Camshaft Position (CMP) Sensor

CMP sensor utilizes a Hall Effect sensor that serves a similar function as Crankshaft Position (CKP) sensor. CMP sensor is mounted inside distributor. CMP sensor creates a 1X signal and is used by PCM/VCM to identify which cylinder(s) are misfiring. The 1X signal will not affect driveability.

Cranking Signal

Cranking signal is a 12-volt signal monitored by the PCM. Signal is present when ignition switch is in the START position. The PCM/VCM uses signal to determine the need for starting enrichment. PCM/VCM also cancels diagnostics until engine is running and 12-volt signal is no longer present.

Crankshaft Position (CKP) Sensor

CKP sensor utilizes a pick-up coil type sensor mounted on bottom of timing cover. The CKP sensor monitors crankshaft position and sends signals to ignition control module. These signals provide PCM/VCM with a TDC position reference for each piston, as well as supplying an engine speed (RPM) signal. This allows PCM to fire appropriate ignition coil at the proper time, determine triggering of the fuel injectors, and to compute crankshaft position and RPM. CKP sensor signal is also used to detect a cylinder misfire by monitoring changes in crankshaft speed. For additional information, see IGNITION SYSTEM.

Digital Ratio Adapter Controller (DRAC)

DRAC compensates for various axle and tire ratios by monitoring the Vehicle Speed Sensor (VSS) signal and modifying it before passing it on to the PCM/VCM and speedometer. On models equipped with a DRAC, VSS buffer is an internal part of DRAC.

Engine Coolant Temperature (ECT) Sensor

The ECT sensor is a thermistor (temperature sensitive resistor) located in an engine coolant passage. The PCM/VCM supplies and monitors a 5-volt signal to ECT sensor. This monitored 5-volt signal is then modified by resistance of the ECT sensor. When coolant temperatures are low, ECT sensor resistance is high and the PCM/VCM sees a high monitored voltage signal. When coolant temperatures are high, ECT sensor resistance is low and the PCM/VCM sees a low monitored voltage. When fully warmed, ECT sensor should reflect a temperature of at least 185°F (85°C).

Coolant temperature input is used in the control of fuel delivery, ignition timing, idle speed, emission control devices and Torque Converter Clutch (TCC) application. An ECT sensor which is out of calibration will not set a Diagnostic Trouble Code (DTC), but can cause fuel delivery and driveability problems. An ECT sensor circuit problem should set a related DTC.

Exhaust Gas Recirculation (EGR) Pintle Position

This sensor is mounted inside linear EGR valve and informs PCM/VCM of EGR pintle movement. PCM/VCM uses this information to control EGR flow.

Fuel Pump Feedback

PCM/VCM monitors fuel pump circuit between fuel pump relay/oil pressure switch and fuel pump. This enables the PCM/VCM to determine if fuel pump is being energized by fuel pump relay or back-up oil pressure switch. A failure in this monitored circuit results in the setting of a related diagnostic trouble code in PCM/VCM memory.

Gear Switches

Gear switches are located inside automatic transmission. Switches may be normally open or closed, and change status depending upon internal hydraulic pressures. PCM/VCM uses high gear switch information in controlling emission components and engagement of Torque Converter Clutch (TCC).

Knock Sensor (KS)

The knock sensor is a piezoelectric device which detects abnormal engine vibrations (spark knock) in the engine. This vibration results in the production of a very low AC signal, which is sent from the knock sensor to the KS module (integral to PCM/VCM). The PCM/VCM then retards ignition timing until the engine knock ceases. Two knock sensors are used on some models.

A fault in the KS circuit may set a Diagnostic Trouble Code (DTC). See the G - TESTS W/CODES article. When a related DTC is not present and the KS system is the suspected cause of a driveability problem, perform functional check of KS system. See the I -

SYSTEM/COMPONENT TESTS article.

Manifold Absolute Pressure (MAP) Sensor

MAP sensor measures changes in manifold pressure. Changes in manifold pressure result from engine load and speed changes. The MAP sensor converts these changes in manifold pressure into a voltage output signal to PCM/VCM (1.5 volts at idle to about 4.5 volts at WOT). The PCM/VCM can monitor these signals and adjust air/fuel ratio and ignition timing under various operating conditions.

If MAP sensor fails, the PCM/VCM substitutes a fixed MAP value, and uses the TP sensor to control fuel delivery. A fault in the MAP circuit should set a related Diagnostic Trouble Code (DTC). If a related DTC is not present and MAP sensor is suspected of causing a driveability problem, perform functional check of MAP sensor. See the I - SYSTEM/COMPONENT TESTS article.

Intake Air Temperature (IAT) Sensor

IAT sensor is a thermistor (temperature sensitive resistor) mounted in the intake manifold. Low intake air temperature produces high internal sensor resistance, while high temperature causes low internal sensor resistance. The PCM/VCM supplies and monitors a 5-volt signal to sensor through a pull-down resistor in PCM/VCM.

IAT sensor, also known as a manifold air temperature sensor, allows PCM/VCM to determine intake air temperature. PCM/VCM uses signal to delay EGR until intake air temperature reaches about 40°F (5°C). If intake air temperature becomes excessively high, PCM/VCM compensates by slightly retarding ignition timing. After a vehicle has cooled overnight, IAT and ECT sensor signals (resistance and temperature) should be close to same reading. Failure in IAT sensor circuit should set a related diagnostic trouble code.

CAUTION: Measure O2S voltage with a Digital Volt-Ohmmeter (minimum 10-megohm impedance) only. Current drain of a conventional voltmeter could damage sensor.

Oxygen Sensor (O2S)

O2S is mounted in exhaust system and monitors oxygen content of exhaust gases. The oxygen content causes the Zirconia/Platinum-tipped O2S to produce 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 (about 1.0 volt) when a rich mixture is present. As PCM/VCM compensates for a lean or rich condition, this voltage signal constantly fluctuates between high and low, crossing a .45-volt reference voltage supplied by PCM/VCM on the O2S signal line. This is referred to as "cross counts".

The O2S does not function properly (produce voltage) until its temperature reaches 600°F (316°C). At temperatures less than the normal operating range of the sensor, vehicle functions in "open loop" mode, and PCM/VCM does not make air/fuel adjustments based upon O2S signals, but uses TP and MAP or MAF values to determine air/fuel ratio from a table built into memory. When PCM/VCM reads a voltage signal greater than .45 volt from the O2S, PCM/VCM begins to alter commands to injector to produce a leaner mixture.

Once vehicle has entered "closed loop" mode, a fault in the O2S circuit (cooled-down sensor or open or shorted O2S circuit) will return vehicle to "open loop" mode. A problem in the O2S circuit should set a related diagnostic trouble code.

On most engines, O2S uses an internal heating element. This type of sensor is referred to as a Heated Oxygen Sensor (HO2S). Heating element allows HO2S to warm more quickly, causing fuel system to enter "closed loop" mode sooner. Heating element also prevents fuel system from re-entering "open loop" mode, which would be a normal response to prolonged idling.

Park/Neutral Position (PNP) Switch

This switch is connected to transmission gear selector and signals PCM/VCM when transmission is in Park or Neutral. PCM/VCM uses this information for determining control of ignition timing, Torque Converter Clutch (TCC) and idle speed. To check function of PNP switch, perform functional check of switch. See the I - SYSTEM/COMPONENT TESTS article.

Transmission Fluid Pressure (TFP) Switch

The TFP is actually 5 pressure switches combined into a single unit mounted on transmission valve body. The PCM/VCM supplies battery voltage on 3 separate wires to TFP. By grounding one or more of the switches in various combinations, PCM/VCM detects what gear range the vehicle operator has selected.

Throttle Position (TP) Sensor

TP sensor is a variable mechanical resistor connected directly to throttle shaft linkage. TP sensor has 3 wires connected to it. One is connected to a 5-volt reference voltage supply from PCM/VCM, another is connected to PCM/VCM ground and third is a signal return which is monitored by PCM/VCM. Voltage signal from TP sensor varies from closed throttle (0.5-1.0 volt) to wide open throttle (4.5-5 volts). PCM/VCM uses this signal to determine control of fuel, idle speed, spark timing and Torque Converter Clutch (TCC). A problem in TP sensor circuit may set a related diagnostic trouble code.

Transmission Fluid Temperature (TFT) Sensor

TFT sensor is a thermistor (temperature sensitive resistor) mounted to the transmission valve body. The PCM/VCM supplies and monitors a 5-volt signal to TFT sensor. This monitored 5-volt signal is then modified by resistance of TFT sensor. When transmission fluid temperatures are low, TFT sensor resistance is high and PCM/VCM sees a high monitored voltage signal. When transmission fluid temperatures are high, TFT sensor resistance is low and PCM/VCM sees a low monitored voltage.

PCM/VCM uses TFT sensor input to control Torque Converter Clutch (TCC) application and shift quality. Sensor circuit problem should set a related diagnostic trouble code.

Vehicle Speed Sensor (VSS)

VSS is a Permanent Magnet (PM) generator mounted in transmission or transfer case. The VSS sends a pulsing signal to the PCM/VCM or Digital Ratio Adapter Controller (DRAC), which passes the signal on to the PCM/VCM. The PCM/VCM then converts this signal into Miles Per Hour (MPH) by monitoring the time interval between pulses. PCM/VCM uses this sensor input in controlling Torque Converter Clutch (TCC) engagement, shift speed, etc.

OUTPUT SIGNALS

NOTE: Models have different combinations of computer-controlled components. Not all listed components are used on every model. For theory and operation of components, refer to indicated system.

A/C Clutch Relay

See MISCELLANEOUS PCM/VCM CONTROLS.

Cruise Control Stepper Motor

See MISCELLANEOUS PCM/VCM CONTROLS.

Malfunction Indicator Light (MIL)
See SELF-DIAGNOSTIC SYSTEM.

EGR System
See EMISSION SYSTEMS

Electronic Ignition (EI)
See IGNITION SYSTEM

Fuel Injectors
See FUEL CONTROL under FUEL SYSTEM.

Fuel Pump & Fuel Pump Relay
See FUEL DELIVERY under FUEL SYSTEM.

Idle Air Control (IAC) Valve
See IDLE SPEED under FUEL SYSTEM.

Self-Diagnostics
See SELF-DIAGNOSTIC SYSTEM.

Serial Data
See SELF-DIAGNOSTIC SYSTEM.

Shift Solenoids
See MISCELLANEOUS PCM/VCM CONTROLS.

Torque Converter Clutch (TCC)
See MISCELLANEOUS PCM/VCM CONTROLS.

Transmission Shift Light (Manual Transmission)
See MISCELLANEOUS PCM/VCM CONTROLS.

FUEL SYSTEM

FUEL DELIVERY

Fuel Pump

An in-tank, electric fuel pump delivers fuel to injector(s) through an in-line fuel filter. The pump is designed to supply fuel pressure in excess of vehicle requirements. The pressure relief valve controls maximum fuel pump pressure.

On Central Sequential Port Injection (CSI) systems, pressure regulator is mounted to fuel metering body under upper intake manifold. Pressure regulator keeps fuel available to injector(s) at a constant pressure. Excess fuel is returned to fuel tank through pressure regulator return line.

When ignition switch is turned to ON position, PCM/VCM turns on electric fuel pump by energizing fuel pump relay. PCM/VCM keeps pump on if engine is running or cranking (PCM/VCM is receiving reference pulses from ignition module). If there are no reference pulses, PCM/VCM turns pump off within 2 seconds after ignition is turned on.

Most models also include a second control path through the oil pressure switch which will turn the fuel pump on after the switch detects oil pressure. Cranking time will be longer if fuel pump does not receive current until oil pressure switch contacts close.

Fuel Pressure Regulator

Fuel pressure regulator is a diaphragm-operated relief valve with injector pressure on one side and manifold pressure (vacuum) on the other. Pressure regulator maintains a pressure of 60-66 psi (4.2-

4.6 kg/cm²) under all operating conditions. Pressure regulator is a factory preset, nonadjustable, spring-loaded diaphragm attached to CSI assembly. Spring tension maintains a constant fuel pressure to injector regardless of engine load.

Fuel Pump Relay

When ignition switch is turned to ON position, PCM/VCM turns electric fuel pump on by energizing fuel pump relay. PCM/VCM keeps relay energized if engine is running or cranking (PCM/VCM is receiving reference pulses from ignition module). If there are no reference pulses, PCM/VCM turns pump off within 2-20 seconds after key on.

As a back-up system to fuel pump relay, the oil pressure switch also activates fuel pump. The oil pressure switch is normally open until oil pressure reaches about 4 psi (.28 kg/cm²). If fuel pump relay fails, the oil pressure switch closes when oil pressure is obtained and operates the fuel pump. Cranking time will be longer if fuel pump does not receive current until oil pressure switch contacts close. Oil pressure switch may be combined into a single unit with an oil pressure gauge sending unit or sensor.

PCM/VCM monitors fuel pump circuit between fuel pump relay/oil pressure switch and fuel pump, enabling PCM/VCM to determine if fuel pump is being energized by fuel pump relay or oil pressure switch. A failure in this monitored circuit results in the setting of a related diagnostic trouble code in PCM/VCM memory.

For more info on fuel pump activation, see the F - BASIC TESTING and the I - SYSTEM/COMPONENT TESTS articles.

FUEL CONTROL

The PCM/VCM, using input signals, determines adjustments to the air/fuel mixture to provide the optimum ratio for proper combustion under all operating conditions. Fuel control systems can operate in the "open loop" or "closed loop" mode.

Open Loop

When engine is cold and engine speed is greater than 400 RPM, PCM/VCM operates in "open loop" mode. In "open loop" mode, PCM/VCM calculates air/fuel ratio based upon coolant temperature and MAP or MAF sensor readings. Engine remains in "open loop" mode until O2S reaches operating temperature, coolant temperature reaches a preset temperature and a specific period of time has elapsed after engine starts.

Closed Loop

When O2S reaches operating temperature, coolant temperature reaches a preset temperature and a specific period of time has passed since engine start-up, PCM/VCM operates in "closed loop" mode. In "closed loop" mode, PCM/VCM controls air/fuel ratio based upon O2S signals (in addition to other input parameters) to maintain as close to a 14.7:1 air/fuel ratio as possible. If O2S cools off (due to excessive idling) or a fault occurs in O2S circuit, vehicle will re-enter "open loop" mode.

On most engines, O2S is equipped with an internal heating element. This type of sensor is known as a Heated Oxygen Sensor (HO2S). The heating element enables system to reach and maintain "closed loop" mode sooner, even during periods of extended idle.

Central Sequential Port Injection

CSI is a non-repairable injector assembly consisting of a fuel meter body, fuel pressure regulator, fuel injector and poppet nozzles with fuel tubes. CSI assembly is housed in the lower manifold assembly. Fuel pump and pressure regulator maintain fuel pressure at 60-66 psi (4.2-4.6 kg/cm²) under all operating conditions.

When injector is energized, pressurized fuel passes down fuel distribution tubes to poppet nozzles located at rear of intake valves. Fuel pressure forces poppet valves open, spraying fuel into cylinders when intake valves are open. As fuel pressure drops (due to all poppets opening or injector de-energizing), poppet nozzle spring pressure closes poppet nozzle until pressure again builds high enough to overcome poppet nozzle spring pressure. Excess fuel is returned to the fuel tank via the fuel return line.

Fuel System Operating Modes

Internal PCM/VCM calibration controls fuel delivery during starting, clear flood mode, deceleration and heavy acceleration.

* Starting
  During engine starts, PCM/VCM delivers one injector pulse for each distributor reference pulse received (synchronized mode). Injector pulse width is based upon coolant temperature and throttle position. PCM/VCM determines air/fuel ratio when throttle position is less than 80 percent open. Engine starting air/fuel ratio ranges from 0.8:1 at -40°F (-40°C) to 16.8:1 at 230°F (110°C). At lower coolant temperatures, injector pulse width is wider (richer air/fuel mixture ratio). When coolant temperature is high, injector pulse width becomes narrower (leaner air/fuel ratio).
* Clear Flood
  If engine is flooded, driver must depress accelerator pedal to Wide Open Throttle (WOT) position. At this position, PCM/VCM adjusts injector pulse width equal to an air/fuel ratio of 16.5:1. This air/fuel ratio is maintained as long as throttle remains in wide open position and engine speed is less than 600 RPM. If throttle position becomes less than 65 percent open and/or engine speed exceeds 600 RPM, PCM/VCM changes injector pulse width to that used during engine starting (based upon coolant temperature and manifold vacuum).
* Heavy Acceleration
  PCM/VCM provides fuel enrichment during heavy acceleration. Sudden opening of throttle valve causes rapid increase in MAP or MAF signal. Pulse width is directly related to MAP or MAF, throttle position and coolant temperature. Higher MAP or MAF and wider throttle angles give wider injector pulse width (richer mixture). During enrichment, injector pulses are not in proportion to distributor reference signals (non-synchronized). Any reduction in throttle angle cancels fuel enrichment.
* Deceleration
  During normal deceleration, fuel output is reduced. This reduction in available fuel serves to remove residual fuel from intake manifold. During sudden deceleration, when MAP or MAF, throttle position and engine speed are reduced to preset levels, fuel flow is cut off completely. This deceleration fuel cut-off overrides normal deceleration mode. During either deceleration mode, injector pulses are not in proportion to distributor reference signals.
* Battery Voltage Correction
  PCM/VCM compensates for low battery voltage by increasing injector pulse width and increasing idle RPM. PCM/VCM is able to perform these commands because of a built-in memory/ learning function.
* Fuel Cut-Off
  When ignition is turned off, injectors are de-energized to prevent dieseling. Injectors are not energized if RPM reference pulses are not received by the PCM/VCM, even with

ignition on. This prevents flooding before starting. Fuel cut-off also occurs at high engine RPM or excessive vehicle speed to prevent internal damage to engine. Some models may also cut off fuel injector signals during periods of sudden, closed throttle deceleration (when fuel is not needed).

IDLE SPEED

PCM/VCM controls engine idle speed depending upon engine operating conditions. PCM/VCM senses engine operating conditions and determines best idle speed.

Idle Air Control (IAC) Valve

The IAC valve controls engine idle speed to prevent stalling during engine load changes. The IAC valve is mounted on throttle body and controls the amount of air by-passed around the throttle plate. The IAC valve controls engine idle speed by moving its pintle in and out in steps referred to as "counts" (0 counts, fully seated; 255 counts, fully retracted). Counts can be measured by observing scan tool display while connected to the Data Link Connector (DLC).

If engine RPM is too low, pintle is retracted and more air is by-passed around the throttle plate to increase engine RPM. If engine RPM is too high, pintle is extended and less air is by-passed around the throttle plate to decrease engine RPM. Normal counts on an idling engine should be near 18. When engine is idling, PCM/VCM determines proper positioning of IAC valve based on battery voltage, coolant temperature, engine load and engine RPM.

If IAC valve is disconnected or reconnected with engine running, IAC loses its reference point and must be reset. On some models, IAC is reset by turning ignition on, then off. Other models require driving vehicle at normal operating temperature over 35 MPH with circuit properly connected. Problems in IAC circuit should set a related diagnostic trouble code.

The IAC valve affects only the idle system. If valve is stuck fully open, excessive airflow into the manifold creates a high idle speed. Valve stuck closed allows insufficient airflow, resulting in low idle speed. For calibration purposes, several different IAC valves are used. Ensure replacement valve is proper design.

IGNITION SYSTEM

Enhanced Ignition System

The enhanced ignition system consists of the VCM, distributor, ignition coil driver module, ignition coil and Camshaft Position (CMP) sensor. Ignition control and by-pass functions are controlled by the VCM.

* Camshaft Position (CMP) Sensor
  CMP sensor is similar to CKP sensor. CMP sensor provides one pulse (1X signal) per camshaft revolution. VCM uses this signal in conjunction with the crankshaft position to determine which cylinder(s) are misfiring.
* Crankshaft Position (CKP) Sensor
  CKP sensor is located in the front engine cover. Air gap between sensor and target wheel is preset and is not adjustable. Target wheel has 4 slots 60 degrees apart and is keyed to the crankshaft. Rotation of target wheel creates a change in the magnetic field of the sensor which results in an induced voltage pulse. One crankshaft revolution will result in 4 pulses (4X signal). Based on these pulses, VCM is able to determine crankshaft position and engine speed. VCM will then activate the fuel injector and provide spark to

distributor.

* Distributor
  Distributor assembly contains the Camshaft Position (CMP) sensor, cap, rotor and shaft. A Diagnostic Trouble Code (DTC) will set when distributor is installed a tooth off in relation to the camshaft. Distributor is not serviceable.
* Ignition Coil Driver Module
  Module is mounted next to coil. VCM signals the ignition coil driver to turn on primary current to the ignition coil by pulling the IC line high (4 volts). The ignition control driver turns the primary current on and off by applying and removing ground to primary winding. Module does not have a back-up function that would allow engine to run if IC signal is lost.

Ignition Timing Control

Ignition spark timing and ignition dwell time are entirely controlled by the PCM/VCM. The PCM/VCM monitors information from various engine sensors, computes the desired spark timing and dwell, and firing of the ignition coil via IC line to the coil driver.

EMISSION SYSTEMS

CATALYTIC CONVERTER

A Three-Way-Catalytic (TWC) converter is used to reduce exhaust emissions. This type of converter can reduce hydrocarbons (HC), carbon monoxide (CO) and oxides of nitrogen (NOx).

The upstream section of the converter contains a reducing/oxidizing bed to reduce NOx while oxidizing HC and CO. An air supply pipe from the air injection system injects air between the beds of the converter. Thus, the second converter bed oxidizes any remaining HC and CO to efficiently reduce exhaust emissions.

EXHAUST GAS RECIRCULATION (EGR)

The Exhaust Gas Recirculation (EGR) system is designed to reduce oxides of nitrogen (NOx) emissions by lowering combustion temperatures. A metered amount of exhaust gas is recirculated into the intake manifold and mixed with the air/fuel mixture. A linear EGR valve is used on all engines.

EGR valve includes electric motor to raise and lower EGR valve pintle and internal EGR valve pintle position sensor. EGR valve pintle is used to control EGR flow. PCM/VCM controls pintle based on engine temperature, engine RPM and EGR valve pintle position sensor inputs.

EVAPORATIVE EMISSION SYSTEM

All vehicles use carbon canister storage for evaporative fuel control. Evaporative emission control system stores gasoline fumes from fuel tank in a carbon canister. After engine is running, fumes are drawn into engine for burning during combustion process.

The basic components used in the evaporative emission system are an activated carbon canister (all models, open at top or bottom for fresh air intake), vacuum operated canister control valve (some Federal), or purge control solenoid (all other models). For specific component application and vacuum hose routing, see the M - VACUUM DIAGRAMS article.

Carbon Canister

Evaporative fumes from the fuel tank are vented through hose(s) into a canister containing activated carbon. Activated carbon absorbs and holds fuel vapors when engine is not operating. When engine is started and engine speed is greater than idle (purge at idle would cause too rich a mixture), engine vacuum draws fuel vapors from canister into engine. A vacuum canister purge valve or purge control solenoid regulates vapors through this purge line.

Carbon canisters are open in design. When engine is started, engine vacuum draws outside air into canister either through top or bottom, then through a filter in bottom of canister. This helps to purge vapors from the activated carbon.

Canister Purge Control Solenoid (CPCS)

CPCS allows fuel vapor to flow from carbon canister to the engine. Solenoid is normally closed and is pulse width-modulated by the PCM/VCM to precisely control vapor flow. PCM/VCM controls flow of fuel vapors based on coolant temperature. Above 113°F (45°C), purge control solenoid is open.Purge control solenoid is also opened if PCM/VCM detects extreme lean air/fuel mixture ratio conditions.

POSITIVE CRANKCASE VENTILATION (PCV)

The PCV system provides effective evacuation of crankcase vapors. Fresh air from the air filter housing is supplied to the crankcase, where it is mixed with blow-by gases and passed through the PCV valve and into the intake manifold. This mixture is then passed into the combustion chamber and burned.

The PCV valve provides primary control in this system by metering the flow (according to manifold vacuum) of the blow-by vapors. When manifold vacuum is high (at idle), the PCV restricts the flow to maintain a smooth idle.

Under conditions in which abnormal amounts of blow-by gases are produced (such as worn cylinders or rings), system is designed to allow excess gases to flow back through crankcase vent hose into air inlet.

Spring pressure holds PCV valve closed when engine is not running. This prevents hydrocarbon fumes from collecting in the intake manifold, a condition which could result in hard starting.

During engine operation, manifold vacuum pulls the valve closed against spring pressure. As vacuum decreases with increased engine load (ROM), spring pressure begins to overpower vacuum strength. This allows PCV valve to open proportional to engine load and evacuation requirements. Should the engine backfire, the PCV valve closes to prevent ignition of fumes in crankcase.

SELF-DIAGNOSTIC SYSTEM

The PCM/VCM is equipped with a self-diagnostic system which detects system failures or abnormalities. When a malfunction occurs, PCM/VCM will illuminate the Malfunction Indicator Light (MIL) located on instrument cluster. When a malfunction is detected and MIL is turned on, a corresponding Diagnostic Trouble Code (DTC) will be stored in PCM/VCM memory. Malfunctions are designated as either "emission related" or as "non-emission related", and are divided into 4 code types to identify type of fault. The 4 code types are defined as follows:

* Type "A"
  Emission related faults that illuminate MIL at first occurrence of a fail condition.
* Type "B"
  Emission related faults that illuminate MIL if a fault occurs in 2 consecutive ignition cycles.

* Type "C"
  Non-emission related faults that illuminate MIL only when fault is present. MIL will turn off 3 seconds after engine start if fault is no longer present, but a record of fault will remain stored in memory.
* Type "D"
  Non-emission related faults which do not illuminate MIL.

Emission related DTCs (type "A" or "B") cause MIL to illuminate and remain on until the malfunction is repaired. On models using digital display on dash to indicate DTCs, DTCs may be accompanied by a "current" or "history" indication for intermittent and hard failures. If MIL comes on and remains on during vehicle operation, cause of malfunction must be determined using appropriate diagnostic procedure for affected DTC located in the G - TESTS W/CODES article. If a sensor fails, PCM will use a substitute value in its calculations to continue engine operation. In this condition, vehicle is functional but loss of good driveability is likely.

Non-emission related DTCs (type "C") cause MIL to flicker or glow and go out about 10 seconds after the intermittent fault goes away. The corresponding DTC, however, will be retained in PCM/VCM memory. On models using digital display on dash to indicate DTCs, DTCs may be accompanied by a "current" or "history" indication for intermittent and hard failures. If related DTC does not reoccur within 50 engine restarts, related DTC will be erased from PCM/VCM memory. Intermittent failures may be caused by sensor, connector or wiring related problems. See the H - TESTS W/O CODES article.

MALFUNCTION INDICATOR LIGHT (MIL)

As a bulb and system check, MIL will illuminate when ignition switch is turned to ON position and engine is not running. When engine is started, MIL should go out. If MIL does not go out, a malfunction has been detected in the computerized engine control system or MIL circuit is faulty. MIL may be used on some models to display a stored Diagnostic Trouble Code (DTC). To access DTCs, see the G - TESTS W/CODES article.

SERIAL DATA

PCM/VCM has a serial data line. Serial data is a stream of electrical impulses which can be exchanged between control modules. Serial data can be interpreted using a special scan tool. Access serial data by connecting a scan tool to Data Link Connector (DLC). Update intervals and information contained within data stream vary with model application.

MISCELLANEOUS PCM/VCM CONTROLS

NOTE: Although not considered true engine performance-related systems, some devices may affect driveability if they malfunction.

A/C CLUTCH

On most models, PCM/VCM regulates operation of the A/C clutch through a relay. The PCM/VCM disengages the A/C compressor when compressor load on engine may cause driveability problems (i.e., during hot restart, idle, low speed steering maneuvers and wide open throttle operation) or if A/C refrigerant pressure drops to less than or rises to greater than normal operating levels.

Refrigerant pressure is sensed through the monitoring of high and low pressure switches or a pressure sensor which registers either high or low pressure levels. Hot restart is monitored through the coolant temperature sensor. For component application and related wiring, see the A/C-HEATER SYSTEM article.

A/C Pressure Switches

A/C high and low pressure switches may be used in the A/C compressor clutch or compressor clutch relay circuit. Switches are normally closed, completing the circuit which energizes the compressor clutch. When system refrigerant pressure increases beyond a certain point, high side switch opens, causing compressor clutch to disengage.

If system refrigerant level decreases (causing freon pressure to drop), low side pressure switch opens, preventing compressor damage by causing compressor clutch to disengage.

CRUISE CONTROL

On models equipped with cruise control, the system is operated by the PCM/VCM. PCM/VCM receives inputs from VSS, servo diaphragm position sensor, cruise control switch and brake release switch. Based on these inputs, PCM/VCM controls position of cruise control stepper motor. PCM/VCM prevents system engagement at speeds of less than 25 MPH. PCM/VCM is not serviceable; if defective, it must be replaced. A system fault is stored as a Diagnostic Trouble Code (DTC) in PCM/VCM memory.

TRANSMISSION

Torque Converter Clutch (TCC)

The transmission/transaxle TCC eliminates power loss of torque converter stage when vehicle is in a cruise condition, allowing driver the convenience of an automatic transmission while providing the fuel economy of a manual transmission. Fused battery ignition is supplied to TCC solenoid through a brake switch.

On some models, 2nd, 3rd and 4th gear hydraulic apply switches (located within transmission) may also be in series with solenoid power or ground circuit. On other models, switch status may only be monitored by PCM/VCM, without sharing power or ground with TCC solenoid. For wiring reference, see the TRANSMISSION SERVICING article.

The TCC engages when vehicle is moving faster than a pre-calibrated speed, engine is at normal operating temperature, throttle position sensor output is not changing (indicating a steady road speed) and transmission 3rd gear or high gear switch (if equipped) and brake switch are closed.

When vehicle speed is great enough (about 20-45 MPH as indicated by the vehicle speed sensor), PCM/VCM energizes TCC solenoid mounted in transmission, allowing torque converter to directly connect engine to the transmission. When operating conditions indicate transmission should operate as normal, TCC solenoid is de-energized, allowing transmission to return to normal automatic operation. Since power for the TCC solenoid is delivered through the brake switch, transmission also returns to normal automatic operation when brake pedal is depressed. To check function of TCC system, perform functional check of system. See MISCELLANEOUS PCM/VCM CONTROLS in the I - SYSTEM/COMPONENT TESTS article.

Electronic Transmission

On most vehicles, PCM/VCM controls transmission and other vehicle functions. PCM/VCM monitors a number of engine/vehicle functions and uses data to control shift solenoid "A", shift solenoid "B", TCC solenoid and the force motor. PCM/VCM also regulates TCC engagement, upshift pattern, downshift pattern and line pressure (shift quality).

* Shift Solenoid "A" (1st-2nd)
  Shift solenoid "A" is attached to the valve body and is a normally open exhaust valve. PCM/VCM activates solenoid by grounding it through an internal quad-driver. Solenoid "A" is on in 1st and 4th gears, but off in 2nd and 3rd. When on, solenoid redirects fluid to act on the shift valves.
* Shift Solenoid "B" (2nd-3rd)
  Shift solenoid "B" is attached to the valve body and is a normally open exhaust valve. PCM/VCM activates solenoid by grounding it through an internal quad-driver. Solenoid "B" is on in 3rd and 4th gears, but off in 1st and 2nd. When on, solenoid redirects fluid to act on the shift valves.
* Force Motor (Pressure Control Solenoid)
  Force motor is attached to valve body and controls line pressure by moving a pressure regulator valve against spring pressure. Force motor replaces throttle valve or vacuum modulator used on past transmissions. PCM/VCM varies line pressure based upon engine load. Engine load is calculated from various inputs, especially TP sensor. Line pressure is actually varied by changing amperage applied to force motor from zero (high pressure) to 1.1 amps (low pressure). Force motor is periodically pulsed to prevent fluid contamination or tarnish from causing pressure regulator valve to stick.

Shift Light

Shift light may be used on vehicles equipped with manual transmission. Light indicates best transmission shift point for maximum fuel economy. Power for light is supplied through GAUGES fuse. Light illuminates when PCM/VCM supplies a ground circuit for bulb. For wiring reference, see wiring schematic under MISCELLANEOUS PCM/VCM CONTROLS in the I - SYSTEM/COMPONENT TESTS article.

TRANSFER CASE - BORG-WARNER 44-72 (AWD)

1997 Chevrolet Blazer

1997 TRANSFER CASES
General Motors Corp. - Borg-Warner 44-72 (AWD)

Chevrolet; Astro & Blazer
GMC; Jimmy & Safari

* PLEASE READ THIS FIRST *

NOTE: The Borg-Warner 44-72 transfer case may also be known as AWD transfer case.

IDENTIFICATION

An aluminum identification tag is attached under a self-tapping case bolt at bottom of transfer case. This tag provides part number, serial number and build date.

DESCRIPTION

The Borg-Warner Model 44-72 transfer case is a full-time, chain-driven All-Wheel Drive (AWD) unit. The unit has either a 2 or 3-piece aluminum case with no external controls. Torque distribution is controlled by a viscous clutch which has alternating plates connected to front and rear output shafts. Torque is divided at a ratio of 1:3 to the front and 2:3 to the rear.

LUBRICATION

RECOMMENDED FLUID

Dexron III or equivalent should be used in Borg-Warner 44-72 transfer case.

ON-VEHICLE SERVICE

FRONT & REAR OUTPUT SHAFT OIL SEALS

NOTE: Front output shaft oil seal is replaceable on-vehicle.

Removal

Raise vehicle, and disconnect front and/or rear drive shaft. Remove front output shaft flange nut and steel flat washer. On all models, remove rubber sealing washer and front output flange. Pry out output shaft oil seals using screwdriver. DO NOT damage seal bore.

Installation

1) Lubricate seals with ATF. Install front oil seal. Install rear oil seal by aligning water drain hole in output shaft oil seal with drain groove in extension housing.

2) Install front or rear output shaft flange and rubber sealing washer. Install steel flat washer and flange nut. Tighten nut to specification. See TORQUE SPECIFICATIONS. Reconnect drive shafts, and check fluid level.

REMOVAL & INSTALLATION

TRANSFER CASE

Removal & Installation

1) Raise vehicle, and drain transfer case. Remove skid plate and heat shield. Remove front and rear drive shafts. Disconnect breather hose and electrical connections at transfer case.

2) Support transfer case with suitable jack. Remove transfer case support brace and adapter-to-transfer case bolts. Remove transfer case mount nuts and washers.

3) To install, reverse removal procedures. Ensure mating surfaces are clean, and install new gasket. Tighten bolts and nuts to specification. See TORQUE SPECIFICATIONS.

OVERHAUL

Disassembly

1) Remove front output flange nut. Remove steel flat washer, rubber sealing washer and output flange from front output shaft. Remove speed sensor bolt and speed sensor from extension housing. See Fig. 1.

2) Remove front cover bolts from rear case half, and remove front cover by prying case tabs apart. Remove front output shaft, drive chain and driven sprocket from rear case half. Remove input shaft from sun gear shaft.

3) Remove, as an assembly, sun gear shaft, sun gear shaft bearing, drive sprocket spacer, drive sprocket, viscous clutch and sun gear shaft thrust washer from planet carrier assembly. Remove planet carrier assembly and thrust washer from output shaft assembly.

4) Remove extension housing bolts and breather assembly from extension housing. Remove extension housing from rear case half. Remove output shaft snap ring from output shaft bearing.

5) Remove gear ring snap ring and output shaft assembly from gear ring. Remove front output shaft oil seal, input shaft oil seal, output shaft bearing snap ring and output shaft bearing from front cover. Remove rear output shaft oil seal from extension housing.

6) Press sun gear shaft bearing from sun gear shaft. Remove drive sprocket spacer, drive sprocket and viscous clutch from sun gear shaft.

7) Remove input shaft pilot bearing from output shaft assembly. Remove output shaft rear bearing from rear case half.

Cleaning & Inspection

Clean all parts with solvent and dry with compressed air. Replace all oil seals, "O" rings and snap rings. Check all parts for wear or damage. Replace all worn or damaged parts.

NOTE: Apply ATF to all parts before installing.

Reassembly

1) Install viscous clutch, drive sprocket, drive sprocket spacer and sun gear shaft bearing onto sun gear shaft. Install input shaft pilot bearing into output shaft assembly. Install output shaft assembly to gear ring, and install gear ring snap ring.

2) Install front output shaft bearing and bearing snap ring to front cover. Install rear output shaft bearing to rear case half.

3) Install output shaft assembly and gear ring through rear case half. Install output shaft bearing snap ring to output bearing. Apply an 1/8" bead of RTV silicone to rear case half extension housing sealing surface.

4) Install extension housing and bolts to rear case half. Tighten bolts to specification. Install speed sensor and speed sensor

bolt into extension housing. Tighten to specification. See TORQUE SPECIFICATIONS.

5) Align water drain hole in rear output shaft oil seal with drain groove in extension housing, and press seal into extension housing.

6) Using petroleum jelly, install planet carrier assembly thrust washer to output shaft assembly and align with input shaft pilot bearing. Install planet carrier assembly into gear ring. Install sun gear shaft thrust washer to planet carrier assembly.

7) Install sun gear shaft assembly into planet carrier assembly planet gears, and align viscous clutch teeth with gear ring spline. Install input shaft into input shaft pilot bearing, aligning input shaft with sun gear shaft thrust washer and planet carrier assembly thrust washer.

8) Install driven sprocket onto front output shaft, and install drive chain onto driven sprocket. Install drive chain over drive sprocket, and install front output shaft into output shaft rear bearing. Install front output shaft spacer and magnet.

9) Apply 1/8" bead of RTV silicone to rear case half front cover sealing surface. Install front cover and bolts to rear case. Tighten bolts to specification. See TORQUE SPECIFICATIONS.

10) Install front output shaft oil seal and input shaft oil seal. Install front output flange, rubber washer, steel flat washer and a new front output flange nut. Tighten flange nut to specification.

TORQUE SPECIFICATIONS

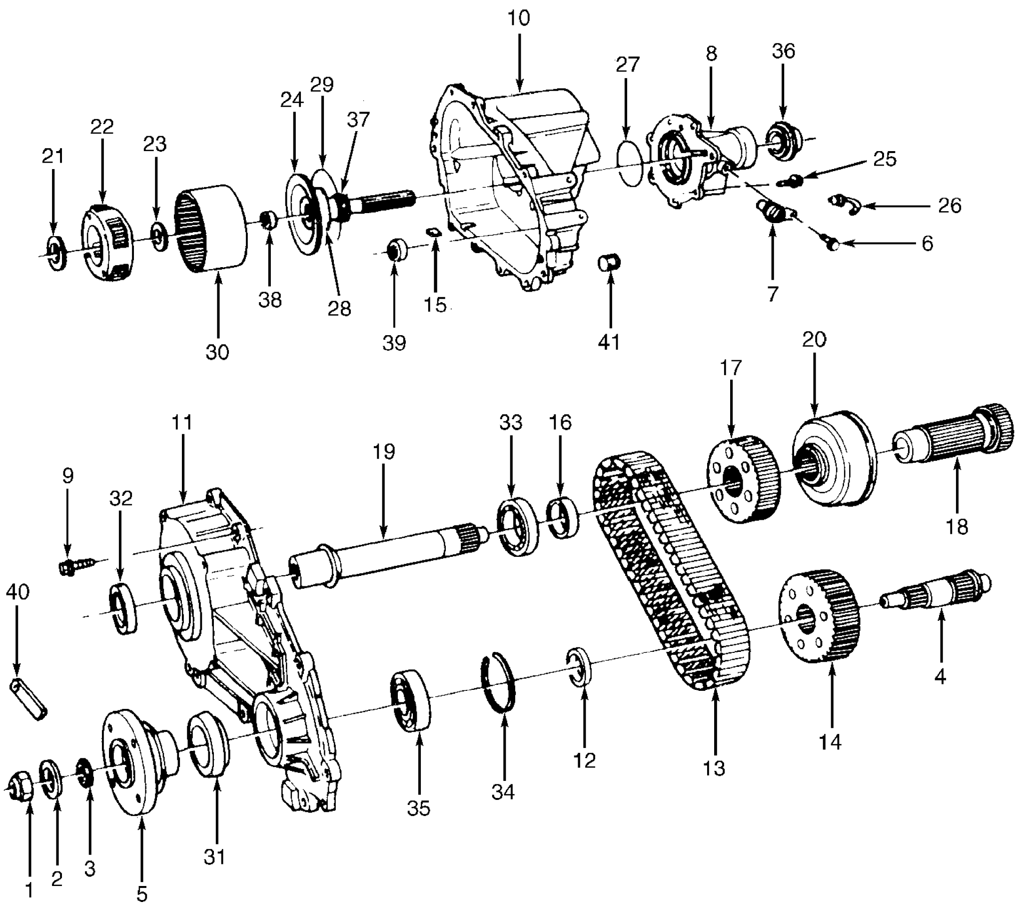
TORQUE SPECIFICATIONS TABLE (FORD MODELS)

Application	Ft. Lbs. (N.m)
Case Bolts	19-23 (26-31)
Case-To-Transmission Bolt	25-35 (34-48)
rain & Fill Plug	7-17 (10-23)
Drive Shaft Bolt	61-87 (83-118)
Mounting Strut Bolt	74-95 (100-130)
Rear Output Flange Nut	249-274 (338-372)
Skid Plate Bolt	16-21 (21-29)

TORQUE SPECIFICATIONS TABLE (GM MODELS)

Application	Ft. Lbs. (N.m)
Adapter-To-Transfer Case Half Bolts	30 (42)
Adapter-To-Transmission Bolts	38 (52)
Drain & Fill Plugs	18 (24)
Extension Housing Bolts	30 (42)
Front Cover Bolts	30 (42)
Front Output Shaft Flange Nut	80 (108)
Speed Sensor Bolt	12 (16)
Support Brace-To-Transfer Case Bolts	74 (100)
Transfer Case Mount Nuts	26 (35)

1. Front Output Flange Nut
2. Steel Flat Washer
3. Rubber Sealing Washer
4. Front Output Shaft
5. Front Output Flange
6. Speed Sensor Bolt
7. Speed Sensor
8. Extension Housing
9. Front Cover Bolts
10. Rear Case Half
11. Front Cover
12. Front Output Shaft Spacer
13. Drive Chain
14. Driven Sprocket
15. Magnet
16. Drive Sprocket Spacer
17. Drive Sprocket
18. Sun Gear Shaft
19. Input Shaft
20. Viscous Clutch
21. Sun Gear Shaft Thrust Washer
22. Planet Carrier Assembly
23. Planet Carrier Assembly Thrust Washer
24. Rear Output Shaft Assembly
25. Extension Housing Bolts
26. Breather Assembly
27. Front Output Shaft Bearing Snap Ring
28. Output Shaft Bearing
29. Gear Ring Snap Ring
30. Gear Ring
31. Front Output Shaft Oil Seal
32. Input Shaft Oil Seal
33. Sun Gear Shaft Bearing
34. Front Output Shaft Bearing Snap Ring
35. Front Output Shaft Bearing
36. Rear Output Shaft Oil Seal
37. Speedometer Tone Wheel
38. Input Shaft Pilot Bearing
39. Front Output Shaft Rear Bearing
40. Identification Tag
41. Drain/Fill Plug



92E13072

Fig. 1: Exploded View Of Borg-Warner 44-72 Transfer Case
Courtesy of Ford Motor Co.

TRANSFER CASE - NEW VENTURE 233 ELECTRONIC CONTROLS

1997 Chevrolet Blazer

1997 TRANSFER CASES
GM Corp. - NV 233 Electronic Controls - Selectable 4WD

Chevrolet; Blazer & "T" Series Pickups
GMC; Jimmy, Sonoma & "T" Series Pickups
Oldsmobile; Bravada

* PLEASE READ THIS FIRST *

NOTE: SELECTABLE 4WD electronic control system is also called ELECTRONIC SHIFT SYSTEM.

DESCRIPTION

New Venture 233, optional on "T" series trucks, is an electronic shift transfer case, with 3 modes of operation including 2HI, 4HI and 4LO. Floor-mounted shifter is eliminated, replaced by a switch on upper right side of instrument panel which is used to select operating range. Indicator lamps on switch show current mode of operation. When 4WD is selected, indicator lamp will turn on. Lamp will blink while front axle is engaging.

Shift select button displays transfer case mode and range, self-test, Diagnostic Trouble Codes (DTCs), and electronic shift mechanical engaging problems.

When transfer case is in 2HI, both 4HI and 4LO switch circuits are open and both lights are off. When 4WD button is pressed, 4WD indicator lamp turns on when front axle is engaged. Shifting of transfer case is performed by motor/encoder that receives signals from Transfer Case Control Module (TCCM). If correct input signals are received, TCCM will send drive voltages to motor/encoder which will position transfer case to proper shift position.

A range shift can only be made with automatic transmission in Neutral or with manual transmission clutch fully depressed. Shift occurs when vehicle speed is less than 3 MPH. If range shift to 4LO is selected when vehicle speed is more than 3 MPH, TCCM will default and position transfer case in 4HI.

OPERATION

TCCM receives input signals, processes signal information, develops output signals and sends output signal to control transfer case shifting. Input signals to TCCM are received from transfer case shift select buttons, neutral safety backup switch (on A/T), clutch safety switch (on M/T), vehicle speed sensor calibrator module, motor/encoder range and mode feedback signals, diagnostic enable signal, and front axle mechanical status signal.

To ensure electronic shift system is operating properly, TCCM continually performs diagnostic checks on itself and other parts of shift system whenever ignition switch is in RUN position.

COMPONENT LOCATIONS

Refer to COMPONENT LOCATIONS TABLE for list of key electronic system components and their location.

COMPONENT LOCATIONS TABLE

Component	Location
4WD Fuse	I/P Fuse Block
ATC Fuse	UBEC (1)
Body Bussed Electric Center (BBEC)	Near I/P Fuse Block
BTSI Fuse	UBEC (1)
CRANK Fuse	UBEC (1)
CTSY LAMP Fuse	I/P Fuse Block
Data Link Connector	Lower Left Of I/P
Front Axle Switch	Right Of Diff. On Front Axle
ILLUM Fuse	I/P Fuse Block
Speed Sensor	
Front	Top Left Of T/C
Rear	Top Right Of T/C
TCCM	Behind Center Of I/P
Transfer Case Select Switch	Upper Left Of Radio
UBEC	Over Left Fenderwall
VCM	Right Side Of Engine Compartment

(1) - Underhood Bussed Electrical Center.

SELF-DIAGNOSTIC SYSTEM

RETRIEVING DTCS

Diagnostic Trouble Codes (DTC) are displayed on 3 transfer case shift select buttons. When proper conditions are met, select buttons will blink to indicate DTC from "1" to "4".

1) Turn ignition off for at least 6 seconds. Locate DLC near right side of steering column. Install jumper wire between diagnostic pigtail (Orange wire at DLC, terminal No. 13) and ground.

2) Turn ignition to run position (engine off). Observe shift select buttons. If all shift select buttons blink once at same time then stop, no DTCs are stored. If only one code is stored, that code will blink repeatedly, with a 3 second delay between sequences. If more than one code is present, next code will flash after a 3 second delay, then sequence will repeat. Count number of blinks for each code. See Fig. 1.

3) Write down all DTCs. After retrieving DTCs clear TCCM memory and repeat procedure. See CLEARING DTCS. If DTCs return, perform appropriate DTC test. See DTC DEFINITIONS under SELF-DIAGNOSTIC SYSTEM.

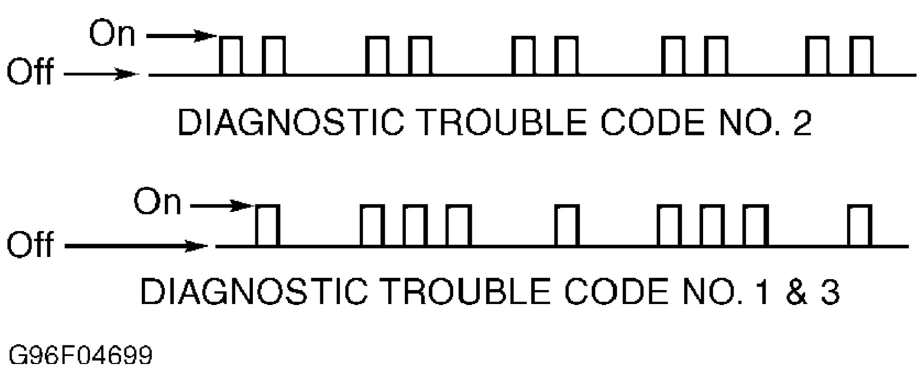


Fig. 1: Reading Diagnostic Trouble Code
Courtesy of General Motors Corp.

DTC DEFINITIONS

DTC "1"

When ignition switch is in run position, TCCM tests whether RAM standby power (maintained battery power) to TCCM was lost since ignition was last turned off. When power is interrupted to TCCM (pin No. 6), TCCM stores loss of RAM standby power and sets DTC "1". If DTC "1" is present, check circuit between TCCM and fuse block. Repair circuit as necessary. If circuit is okay, replace TCCM.

DTC "2"

During electronic shifting, TCCM checks motor/encoder for normal operation. If motor/encoder does not function properly, TCCM stores motor/encoder failure DTC "2". If DTC "2" is present, check circuits between TCCM and motor/encoder. If circuits are okay, replace motor/encoder. If circuits are repaired, perform FUNCTIONAL TEST.

DTC "3"

Each time electronic shift motor is turned on or off, TCCM tests whether motor functions properly. If motor does not function properly, TCCM stores motor circuit failure DTC "3". Shift select buttons will blink to alert driver of problem. If DTC "3" is present, check circuits between TCCM and electric shift motor. If circuits are okay, replace electric shift motor. If circuits are repaired, perform FUNCTIONAL TEST.

DTC "4"

Each time ignition is turned on, TCCM tests memory, program and internal system to ensure TCCM is operating properly. If fault is detected in TCCM, it stores a RAM/ROM memory failure DTC "4". If DTC "4" is present, replace TCCM.

CLEARING DTCS

NOTE: DTCs will not clear if 20-amp park lamp fuse No. 3 is not removed for at least 30 seconds.

Turn ignition off. Remove 20-amp park lamp fuse No. 3. Wait at least 40 seconds and reinstall fuse. Cycle ignition on and off 5 times. Now all DTCs will be cleared from TCCM memory.

TESTING

FUNCTIONAL TEST

1) Place transmission is Park position, turn ignition off and wait at least 6 seconds. Turn ignition to run position (engine off) and watch 3 shift select buttons. If all 3 buttons blink once, go to next step. If all 3 buttons do not blink once, see step 2) in FUNCTIONAL TEST FAILED.

2) During step 1), if one button stayed lit to indicate transfer case shift position, go to next step. If one button did not stay lit, see step 4) in FUNCTIONAL TEST FAILED.

3) Shift transfer case to 4HI, to 2HI, then back to 4HI. If transfer case mode shifts between 4HI and 2HI, go to next step. If transfer case mode does not shift between 4HI and 2HI, see step 5) in FUNCTIONAL TEST FAILED.

4) Apply parking brake. Place transmission in Park position (A/T) or in 1st gear (M/T). Turn ignition to run position (engine off). Place transfer case in 4HI position. Press 4LO shift select button. If 4LO shift select button blinks for 30 seconds then stops when 4HI button illuminates, go to next step. If button blinking does not respond as indicated, see step 7) in FUNCTIONAL TEST FAILED.

5) Place ignition in run position (engine off). Shift

transfer case to 4HI position and press 4LO shift select button while noting blinking. Place transmission in Neutral (A/T) or push clutch to floor (M/T). If 4LO shift select button stops blinking and stays lit when transmission is shifted as indicated, go to next step. If 4LO button does not respond as indicated, see
REDUCED OR NO MODE & RANGE SHIFT OPERATION test.

6) Press transfer case 2HI shift select button and shift transfer case to 2HI position. Place transmission in Park (A/T) or in 1st gear (M/T). Turn ignition off. Using a jumper wire, ground DLC pin No. 13. Turn ignition to run position (engine off). If all 3 shift select buttons blink once then stay off, test is complete, system is functioning normally. If all 3 shift select buttons do not respond as indicated, see step 8) in FUNCTIONAL TEST FAILED.

FUNCTIONAL TEST FAILED

1) If any of the 3 shift select buttons blinked once, go to next step. If any button did not blink once, see
ALL SHIFT SELECT BUTTONS DO NOT LIGHT test.

2) If one shift select button stayed lit to indicate transfer case shift position, go to next step. If one shift select button did not stay lit to indicate position, go to step 4).

3) If transfer case mode shifts between 4HI and 2HI, go to next step. If transfer case mode does not shift between 4HI and 2HI, go to step 5).

4) Turn ignition to run position (engine off). Place transmission in Neutral position. Push vehicle forward about 5 feet. If transfer case mode shifts between 4HI and 2HI, perform diagnosis of transfer case mechanical components. If transfer case mode does not shift between 4HI and 2HI, see
REDUCED OR NO MODE & RANGE SHIFT OPERATION test.

5) If more than one shift select button stays lit, see
MORE THAN ONE SHIFT SELECT BUTTON REMAINS LIT test. If more than one shift select button does not stay lit, go to next step.

6) Set parking brake. Place transmission in Park (A/T) or 1st gear(M/T). Turn ignition to run position (engine off). Press 4LO transfer case shift select button. If 4LO button blinks for 30 seconds, go to next step. If 4LO button does not blink for 30 seconds, to go step 8).

7) With ignition in run position (engine off), press 4LO shift select button and note blinking. Place transmission in Neutral (A/T) or depress clutch pedal (M/T). If 4LO shift select button stops blinking and stays lit when transmission is shifted as above, see PERFORM A DIAGNOSTIC ON TCCM. If 4LO shift select button does not react as indicated, see REDUCED OR NO MODE & RANGE SHIFT OPERATION test.

8) If transfer case range shifts to 4LO, see
ALL SHIFT SELECT BUTTONS REMAIN LIT test. If transfer case range does not shift to 4LO, see REDUCED OR NO MODE & RANGE SHIFT OPERATION test.

SYMPTOM TESTS

ALL SHIFT SELECT BUTTONS DO NOT LIGHT

1) If this diagnostic was referred from another test, go to next step. If diagnostic started here, see FUNCTIONAL TEST.

2) In instrument panel fuse block, check condition of 10-amp GAUGES fuse No. 4 and 20-amp PARK LAMP fuse No. 3 for open conditions. Also check 20-amp ATC fuse in Underhood Bussed Electrical Center (UBEC), if equipped. If one of these fuses is open, go to next step. If no fuses are open, see ALL SHIFT SELECT BUTTONS REMAIN LIT test.

3) Replace failed fuse(s). Turn ignition to run position

(engine off). Check operation of electronic shift system. Recheck fuse for open. If fuse failed again, go to next step. If fuse is okay, see FUNCTIONAL TEST7.

4) Turn ignition off. Check Orange wire circuit and Pink wire circuit for short to ground if fuse No. 3 or No. 4 was open. If either circuit is shorted to ground, go to next step. If either circuit is not shorted to ground, go to step 6).

5) With ignition off, repair grounded circuit noted in previous step. Replace open fuse, then go to FUNCTIONAL TEST.

6) Check pin "C" on back of shift select switch for battery voltage. If battery voltage is present, go to step 8). If battery voltage is not present, go to next step. See Fig. 2.

7) If there is an open in Orange wire circuit or Pink wire circuit between fuse and transfer case select switch connector, repair open. Check for loose electrical connections in circuit. When repair is complete, see FUNCTIONAL TEST.

8) Turn ignition to run position (engine off). Ensure shift select switch connector is properly connected. Depress all 3 shift select buttons while checking each of the following terminals for battery voltage: Check pin "B", pin "D" and pin "F". See Fig. 3. See WIRING DIAGRAMS. If battery voltage is present, go to next step. If battery voltage is not present, go to step 10).

9) Turn ignition off. Check for proper ground in Black wire circuit of TCCM connector. If wire is properly grounded, go to step 12). If wires are not properly grounded, go to step 11).

10) Ensure ignition is off. Replace shift select switch. After replacement, see FUNCTIONAL TEST.

11) If an open exists in Black wire circuit from TCCM connector to ground, repair open as necessary, then go to FUNCTIONAL TEST.

12) Check Orange wire terminal (pin C6) and Pink wire terminal at TCCM connector for battery voltage. See WIRING DIAGRAMS. If battery voltage is present at both pins, see PERFORM A DIAGNOSTIC ON TCCM. If battery voltage is not present at both pins, go to next step.

13) If battery voltage does not exist, an open exists in either circuit in previous step between fuse and TCCM connector. Repair open, then go to FUNCTIONAL TEST.

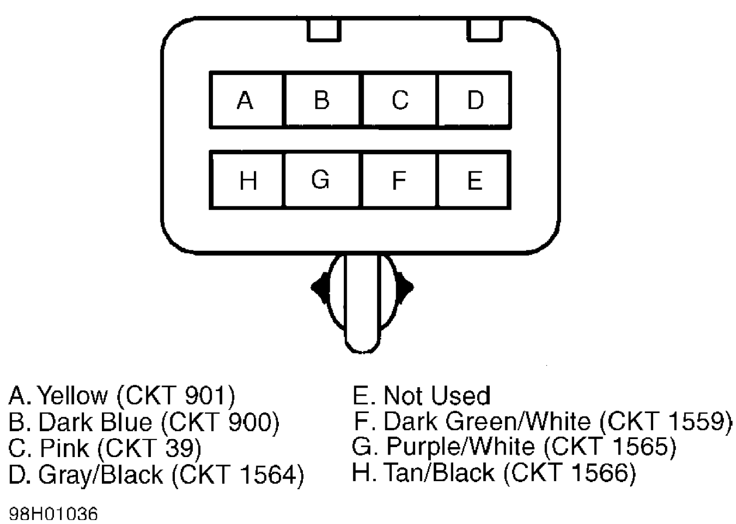


Fig. 2: Identifying Transfer Case Select Switch Connector Terminals
Courtesy of General Motors Corp.

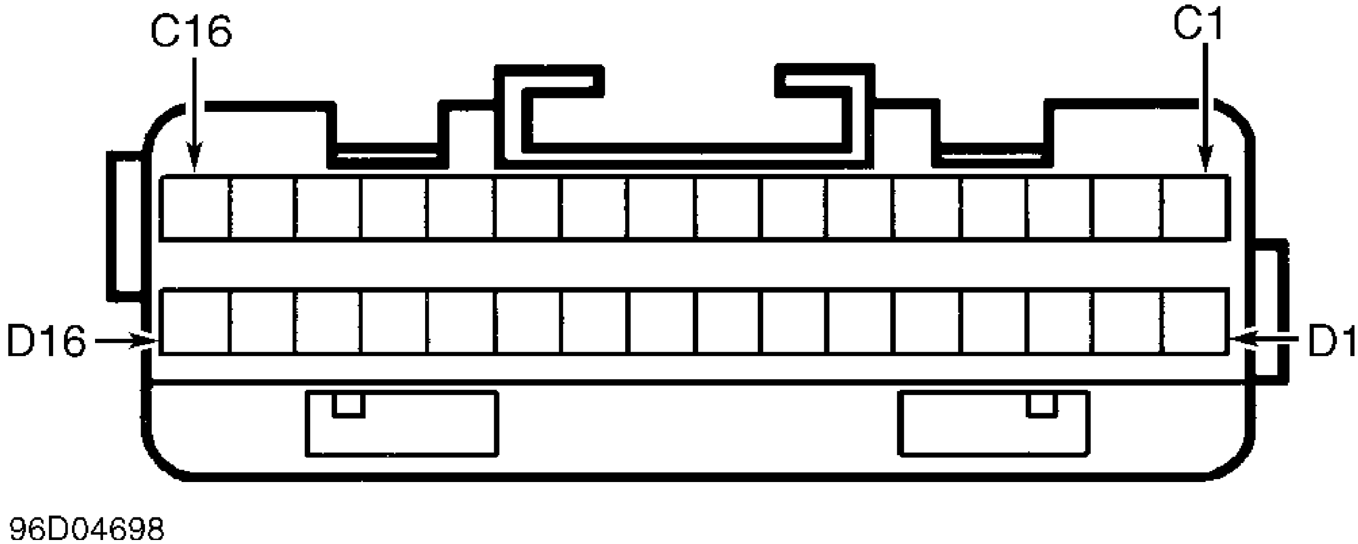


Fig. 3: Identifying TCCM Harness Connector Terminals (As Viewed From Back Of Connector)
Courtesy of General Motors Corp.

1 OR 2 SHIFT SELECT BUTTONS DO NOT LIGHT

1) If this diagnostic was referred from another test, go to next step. If diagnostic started here, perform FUNCTIONAL TEST, then go to next step.

2) Turn ignition off for at least 6 seconds, then turn ignition to run position (engine off). If mode and range shifts can now be made, go to next step. If mode and/or range shifts cannot be made, see REDUCED OR NO MODE & RANGE SHIFT OPERATION test.

3) If 2HI button will not light, check for open in Light Green/Black wire circuit between shift select switch and TCCM connector. If 4HI button will not light, check for open in Tan/Black wire circuit between shift select switch and TCCM connector. If 4LO button will not light, check for open in Purple/White wire circuit between shift select switch and TCCM connector. Repair open circuit(s) as found, then go to next step. If no open circuits are found, go to step 5).

4) If open circuit repairs were made successfully, see FUNCTIONAL TEST.

5) If 2HI button does not light, check for battery voltage at Light Green/Black wire terminal (pin C11) at TCCM connector. If 4HI button does not light, check for battery voltage at Tan/Black wire terminal (pin C12) at TCCM connector. If 4LO button does not light, check for battery voltage at Purple/White wire terminal (pin C14) at TCCM connector. If battery voltage exists at pin checked, go to step 7). If battery voltage does not exist at pin checked, go to next step.

6) If 2HI button will not light, check for open in Light Green/Black wire circuit between shift select switch and TCCM connector. If 4HI button will not light, check for open in Tan/Black wire circuit between shift select switch and TCCM connector. If 4LO button will not light, check for open in Purple/White wire circuit between shift select switch and TCCM connector. If open circuit(s) are found, go to next step. If no open circuits are found, go to step 8).

7) Turn ignition off. Repair open circuit(s). When repair is complete, see FUNCTIONAL TEST.

8) Turn ignition off. If 2HI button will not light, connect jumper wire from Light Green/Black wire terminal (pin C11) to ground. If 4HI button will not light, connect jumper wire from Tan/Black wire terminal (pin C12) to ground. If 4LO button will not light, connect

jumper wire from Purple/White wire terminal (pin C14) to ground. Turn ignition to run position (engine off). If shift select button lights for each grounded circuit, see PERFORM A DIAGNOSTIC ON TCCM test. If shift select button does not light when grounded, go to next step.

9) Replace shift select switch, then go to FUNCTIONAL TEST.

ALL SHIFT SELECT BUTTONS REMAIN LIT

1) If this diagnostic was referred from another test, go to next step. If diagnostic started here, perform FUNCTIONAL TEST, then go to next step.

2) Turn ignition off for at least 6 seconds, then turn ignition to run position (engine off). If mode and range shifts can now be made, go to next step. If mode and/or range shifts cannot be made, go to step 8).

3) If shift modes can be made from 2HI to 4HI to 2HI, go to next step. If shift modes cannot be made, go to step 7).

4) Turn ignition to run position (engine off). Check for battery voltage at Light Green/Black wire terminal (pin D2) on all models, at Purple or Orange/Black wire terminals (pins D16) at TCCM. See WIRING DIAGRAMS. If battery voltage is present at both pins, see PERFORM A DIAGNOSTIC ON TCCM. If battery voltage is not present, go to next step.

5) Turn ignition off. Check for open in Purple wire circuit, Orange/Black wire circuit and in Light Green/Black wire circuit between select switch and TCCM. If open was found, go to next step. If no open was found, see PERFORM A DIAGNOSTIC ON TCCM.

6) With ignition off, repair open circuit(s), then go to FUNCTIONAL TEST.

7) Turn ignition to run position (engine off). If 2HI cannot be selected, check for open in Dark Green/White wire circuit between TCCM (pin C4) and shift select switch. If 4HI cannot be selected, check for open in Gray/Black wire circuit between TCCM (pin C5) and shift select switch. If open is found, return to step 6). If no open is found, see PERFORM A DIAGNOSTIC ON TCCM.

8) Turn ignition to run position (engine off). Check for open in Red/White wire circuit between TCCM (pin D5) and motor/encoder. If an open is found, return to step 6). If no open is found, see PERFORM A DIAGNOSTIC ON TCCM.

MORE THAN ONE SHIFT SELECT BUTTON REMAINS LIT

1) If this diagnostic was referred from another test, go to next step. If diagnostic started here, perform FUNCTIONAL TEST, then go to next step.

2) If 2HI button remains lit, check for ground in Light Green/Black wire circuit between shift select switch and TCCM. If 4HI button remains lit, check for ground in Tan/Black wire circuit between shift select switch and TCCM. If 4LO button remains lit, check for ground in Purple/White wire circuit between shift select switch and TCCM. If circuit is grounded, go to next step. If circuit is not grounded, see PERFORM A DIAGNOSTIC ON TCCM.

3) Ensure ignition is off. Repair ground condition in appropriate wire circuit. Restore system, then go to FUNCTIONAL TEST.

NO SHIFT SELECT BUTTON REMAINS LIT

1) If this diagnostic was referred from another test, go to next step. If diagnostic started here, perform FUNCTIONAL TEST, then go to next step.

2) Check for open in Black/White wire circuit between motor/encoder and TCCM. If circuit is open, go to next step. If circuit is not open, see PERFORM A DIAGNOSTIC ON TCCM.

3) Ensure ignition is off. Repair open condition in Black/White wire circuit. Restore system, then go to FUNCTIONAL TEST.

REDUCED OR NO MODE & RANGE SHIFT OPERATION

1) If this diagnostic was referred from another test, go to next step. If diagnostic started here, perform FUNCTIONAL TEST, then go to next step.

2) Ensure harness connector and pins to motor/encoder are clean and not corroded and connector is properly installed. Check all circuits between motor/encoder and TCCM for grounded or open condition. Repair as necessary. If circuits are okay, see PERFORM A DIAGNOSTIC ON TCCM. If circuits were repaired, see FUNCTIONAL TEST.

PERFORM A DIAGNOSTIC ON TCCM

1) If this diagnostic was referred from another test, go to next step. If diagnostic started here, perform FUNCTIONAL TEST, then go to next step.

2) Retrieve DTCs. See RETRIEVING DTCS. Proceed as directed. If diagnosis is complete, see FUNCTIONAL TEST.

REMOVAL & INSTALLATION

MOTOR/ENCODER

Removal & Installation

Disconnect negative battery cable. Remove transfer case shield. Remove wiring harness connector from motor/encoder. Remove retaining bolts and remove motor/encoder. See Fig. 4. To install, reverse removal procedure, using NEW gasket. Align mating surface detents of motor/encoder and transfer case.

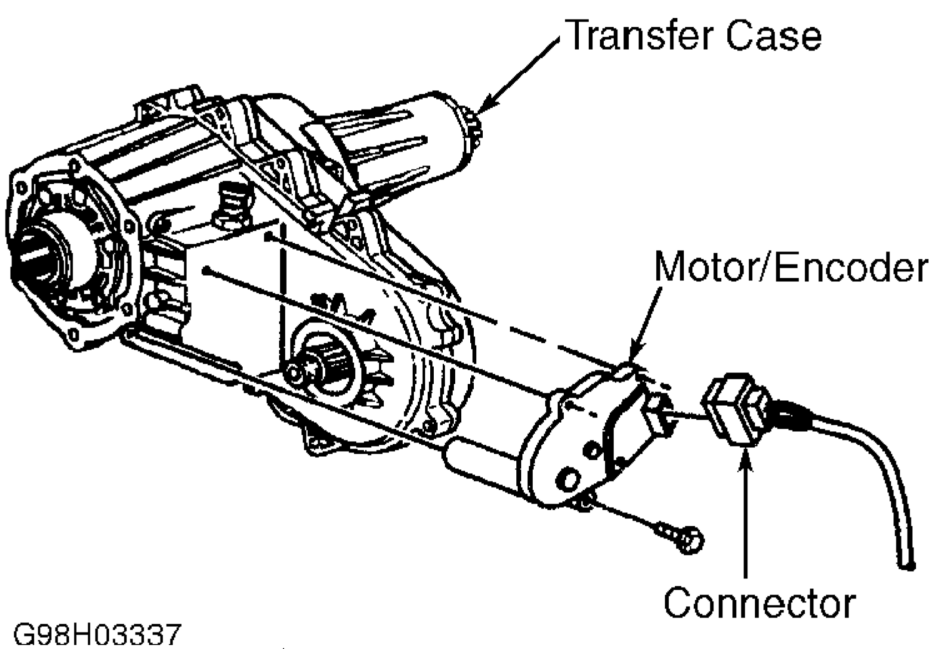


Fig. 4: Removing Motor/Encoder
Courtesy of General Motors Corp.

SHIFT SELECT SWITCH

Removal & Installation

Disconnect negative battery cable. Remove shift select switch from instrument panel by pulling tabs on rear of switch inward, then pulling switch straight out. Disconnect electrical connector. To install, reverse removal procedure.

TRANSFER CASE CONTROL MODULE

Removal & Installation

Disconnect negative battery cable. Remove lower instrument panel trim. Remove 2 screws holding control module to bracket (mounted on instrument panel reinforcement). Remove electrical connector and remove control module. To install, reverse removal procedure.

WIRING DIAGRAMS

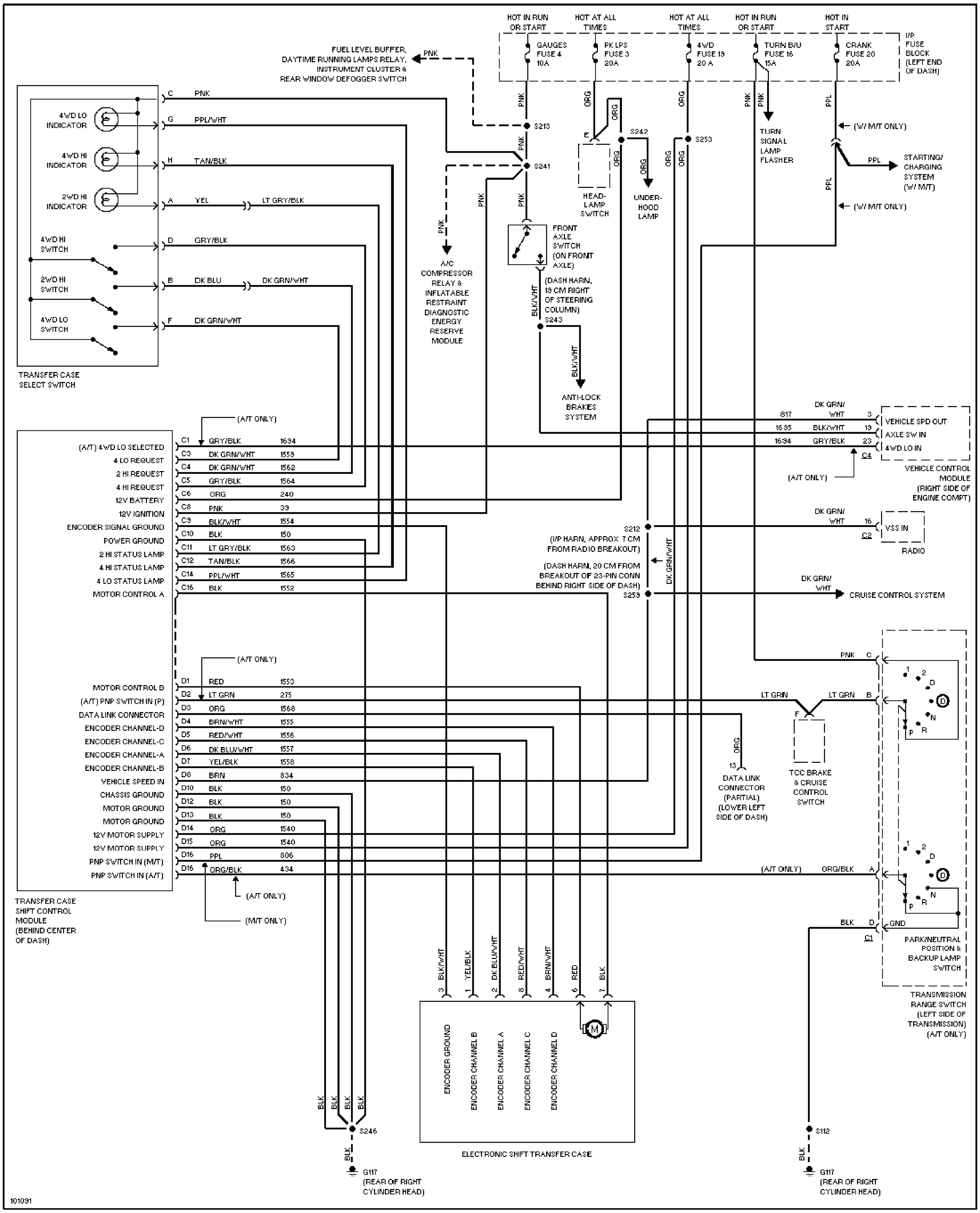


Fig. 5: Transfer Case Wiring Diagram (NV 233)

TRANSFER CASE OVERHAUL - NEW VENTURE 231

1997 Chevrolet Blazer

1997 TRANSFER CASES
General Motors Corp. - New Venture 231

Chevrolet; Blazer & S10
GMC; Jimmy & Sonoma

IDENTIFICATION

Transfer case can be identified by an I.D. tag, located on rear case. I.D. tag provides model number, serial number and low range ratio. Date of manufacture is the serial number (I.D. number). This information is necessary when ordering parts.

DESCRIPTION

Model 231 transfer case is a part time, chain-driven, 4-position unit with 2-piece aluminum case. Torque input in 4WD high and low range is undifferentiated. 2WD operation is achieved by a vacuum shift motor. Shift motor disconnects right front axle when 2WD is selected. Vacuum shift motor is controlled by a vacuum switch located on front of transfer case and actuated by shift sector.

ADJUSTMENTS

GEARSHIFT LINKAGE

Remove transfer case shift lever knob retainer. Remove shift lever knob. Remove floor console. Place shift lever in Neutral. Pry control cable end from shift lever. Loosen control cable lock nut. Check transfer case to ensure it is in Neutral. Ensure shift lever is in Neutral. Turn shift lever end of cable in or out as needed until it is aligned with shift lever. Install control cable on shift lever. Tighten control cable lock nut.

TESTING

VACUUM SWITCH

Shift to 2WD position. Locate vacuum switch on front of transfer case. Apply 15 in. Hg vacuum to "L". See Fig. 1. Vacuum should be present at "M". Connect a vacuum gauge to "N". Shift to 4WD position. Apply vacuum to "L". Vacuum should be present at "N". If switch fails any test, replace switch.

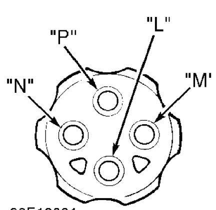


Fig. 1: Testing Vacuum Switch
Courtesy of Chrysler Corp.

TROUBLE SHOOTING

SYMPTOM DIAGNOSIS

Will Not Shift Or Difficult To Shift Into Gear

Vehicle speed too high; slow vehicle to 2-3 MPH to shift. Vehicle operated too long on dry paved surface; stop vehicle and place in Reverse or Neutral to relieve driveline torque. Ensure transfer case external linkage is not binding. Ensure correct fluid is used. Internal parts may be worn or damaged.

Noisy In All Gears

Check fluid level. Ensure correct fluid is used. If fluid is okay, locate possible internal mechanical problem.

Jumps Out Of Gear Or Noisy In 4WD

Transfer case not completely in gear; check shift linkage. Range fork damaged. Shift fork pads are worn or shift fork binding. Low range gear worn.

Fluid Leaking From Vent Or Seals

Transfer case overfilled. Vent plugged. Output shaft seals are damaged or not installed properly.

ON-VEHICLE SERVICE

FRONT OIL SEAL

Removal & Installation

1) Mark front drive shaft and flange for installation alignment reference. Remove front drive shaft. Remove flange. Discard washer and nut. Using a screwdriver, carefully remove oil seal. Ensure seal contact surface is clean.

2) Apply ATF to seal lip and flange seal surface. Install NEW oil seal. Install flange and NEW washer and nut. Tighten nut to specifications. See TORQUE SPECIFICATIONS. Install front drive shaft using alignment marks. Check transfer case fluid.

EXTENSION HOUSING OIL SEAL & BUSHING

Removal & Installation

1) Mark rear drive shaft and flange for installation alignment reference. Remove rear drive shaft. Tap extension housing in a clockwise direction and remove extension housing. DO NOT pry on extension housing. Using a screwdriver, remove oil seal from extension housing.

2) Using bushing driver, replace bushing in extension housing. Install NEW extension housing oil seal. Apply silicone sealant to extension housing mating surface. Install extension housing. To complete installation, reverse removal procedure.

REMOVAL & INSTALLATION

TRANSFER CASE

Removal

1) Shift transfer case into 4H position. Disconnect negative battery cable. Raise and support vehicle. Drain fluid.

2) Mark front and rear output shaft yokes and drive shafts for reassembly reference. Support transfer case with hydraulic jack and remove rear crossmember and skid plate, if equipped. Remove front and rear drive shafts.

3) Disconnect transfer case gearshift linkage, vent hose and all electrical and vacuum connections. Remove transfer case-to-transmission bolts. Remove transfer case from vehicle.

Installation

1) Clean all old gasket material from transmission and transfer case mating surfaces. Position NEW gasket on transfer case with orientation tab at upper left bolt hole.

2) Install transfer case, aligning splines of input shaft with transmission. Slide transfer case forward until seated against transmission. Install transfer case-to-transmission bolts and tighten to specification. See TORQUE SPECIFICATIONS. Install rear crossmember and skid plate.

3) Reconnect gearshift linkage, vent hose and all electrical and vacuum connections. Using reference marks made during removal, reinstall front and rear drive shafts. Refill transfer case. Adjust gearshift linkage. See ADJUSTMENTS. To complete installation, reverse removal procedure.

TRANSFER CASE DISASSEMBLY

1) Remove front companion yoke. See Fig. 2. Discard washer and nut. Shift transfer case to 4L and remove extension housing. Remove rear bearing snap ring. Using 2 screwdrivers under each tab, remove retainer housing. Remove rear case and oil pump as an assembly.

2) Remove oil pump pick-up screen and tube from rear case. Remove oil pump. Remove "O" ring from oil pump and discard. Do not separate oil pump halves. Pump must be replaced as an assembly if necessary.

3) Remove mode spring. Using a soft hammer, tap front output shaft upward and remove with drive chain as an assembly. Remove mainshaft, mode fork and shift rail as an assembly. Remove mode fork and shift rail from synchronizer sleeve.

4) Mark synchronizer sleeve position for reassembly reference. Remove synchronizer sleeve from mainshaft. Remove synchronizer hub snap ring. Remove synchronizer hub, stop ring and drive sprocket. Slide range fork pin out of sector.

5) Remove range fork and shift hub as an assembly. Remove range lever from sector shaft. Remove shift sector, bushing and "O" ring. Remove shift detent pin, spring and plug. Remove front bearing retainer. Remove input gear snap ring.

6) Press input and low range gear assembly from input gear bearing. Remove low range gear snap ring. Remove input gear retainer, thrust washers and input gear from low range gear.

7) Remove all oil seals. Remove magnet from front case. Remove front bearing snap ring. Using a plastic hammer, remove front bearing. Press input gear bearing from front case.

8) Using slide hammer and internal puller, remove input gear pilot bearing. Press bearings from drive sprocket. Using internal puller and slide hammer, remove output shaft rear bearing.

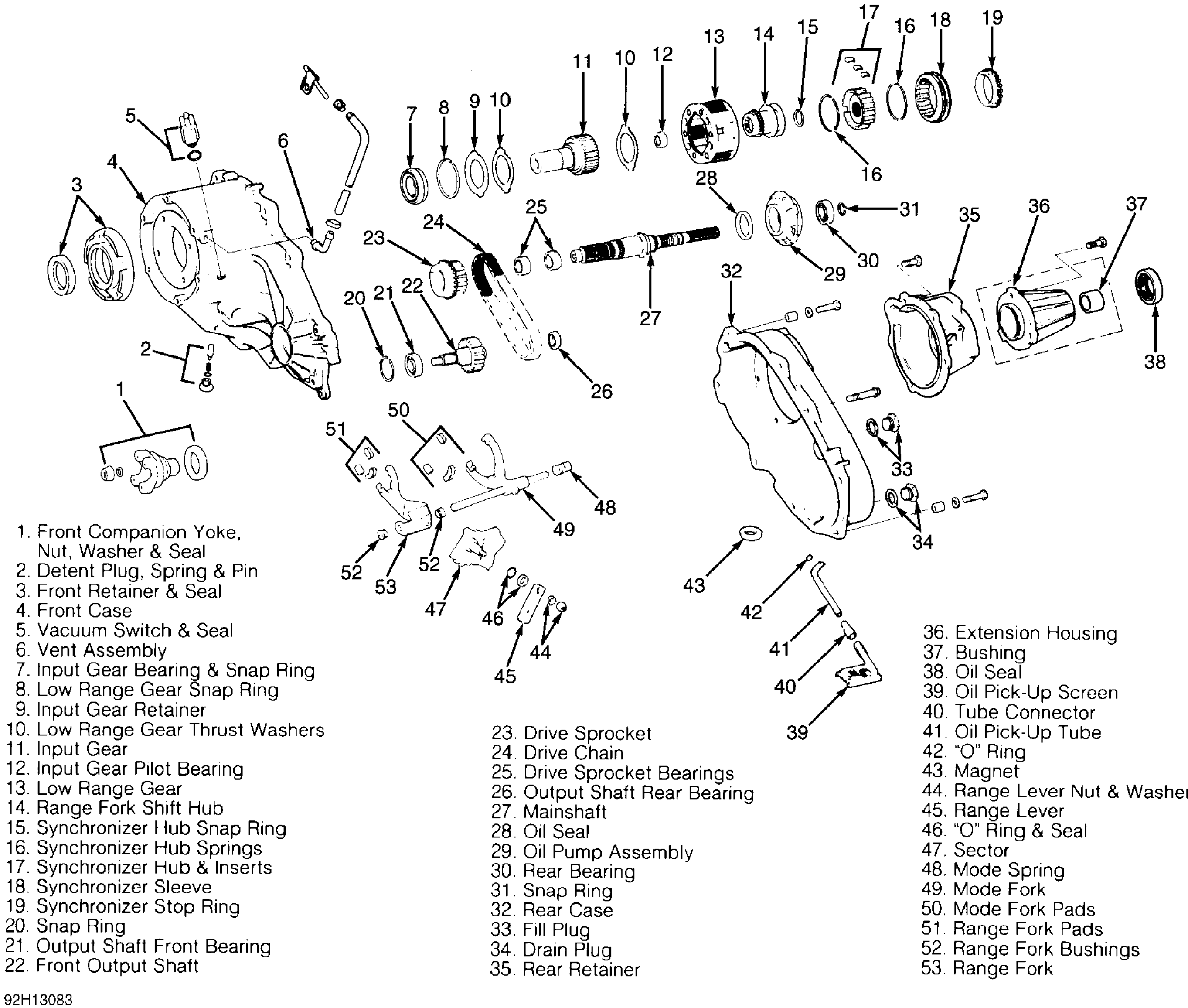


Fig. 2: Exploded View Of Model 231 Transfer Case
Courtesy of Chrysler Corp.

CLEANING & INSPECTION

Clean all parts with solvent. Dry with compressed air. Replace all oil seals, "O" rings and snap rings. Check all parts for wear or damage. Replace all worn or damaged parts. If low range annulus gear inside front case is damaged or worn, front case and gear must be replaced as an assembly. Replace oil pump as an assembly if any part is damaged or worn.

TRANSFER CASE REASSEMBLY

NOTE: When installing bearings, ensure bearing bores are aligned with oil feed holes.

1) Lubricate all parts with Dexron III before installing.

Install output shaft front bearing with NEW snap ring. Install output shaft oil seal in front case. Install snap ring on NEW input gear bearing. See Fig. 2.

2) Press input gear bearing so snap ring is seated against case. Using press, install NEW input gear pilot bearing. Assemble low range gear, input gear, thrust washers and retainer.

3) Install snap ring. Ensure snap ring is seated in low range gear groove. Start input gear shaft into bearing in front case. Press input shaft gear into bearing.

CAUTION: DO NOT press against end surfaces of gear. Failure to use proper size tool could lead to gear case or thrust washer damage.

4) Install input gear snap ring. Install oil seal in front bearing retainer. Apply a 1/8" bead of silicone sealant to retainer mating surface. Align oil channel in retainer with oil feed hole in case. Install retainer on case. Tighten bolts to specification.

5) Install sector shaft "O" ring and bushing. Install range sector in case. Install range lever and nut. Install detent, detent spring and plug. Tighten to specification. See TORQUE SPECIFICATIONS. Install NEW pads and fork rail bushings on range fork. Install range fork and shift hub.

6) Ensure range fork pin is engaged with range sector slot. Press front bearing in drive sprocket until bearing is flush with bore edge. Install rear bearing until bearing is flush with lower edge of chamfer in bearing bore.

7) Install inserts and spring in synchronizer hub. Install sprocket on mainshaft. Install synchronizer stop ring on mainshaft. Ensure stop ring is seated. Install synchronizer hub on mainshaft. Align and seat hub inserts on stop ring lugs. Install synchronizer hub snap ring.

8) Install synchronizer sleeve on hub. Ensure sleeve is positioned so beveled spline ends are facing stop ring. Ensure sleeve tooth is aligned (centered) over each synchronizer strut. Gear clash will occur if strut and sleeve teeth are misaligned. Install NEW pads on mode fork. Engage mode fork in synchronizer sleeve. Install mainshaft and fork assembly in case. Ensure mode fork shift rail is seated in both range fork bushings.

9) Install output shaft and drive chain assembly. Install mode spring on shift rail. Using bearing driver, install output shaft rear bearing. Lubricate bearing after installation. Install seal in oil pump feed housing. Install oil pump in housing. Tighten to specification.

10) Install oil pick-up tube "O" ring in oil pump. Prime oil pump by pouring ATF into pump through pick-up tube opening. Install oil pump and pick-up tube in case. Ensure oil screen is properly positioned. See Fig. 3. Install magnet in front case. Apply 1/8" bead of silicone sealer to front case. Install rear case. Tighten to specification. See TORQUE SPECIFICATIONS. Ensure mainshaft splines are engaged with oil pump inner gear and a washer is used on bolts at dowel locations.

11) Install rear bearings in retainer. Apply 1/8" bead of silicone sealer and install retainer to case. Install rear retainer snap ring. Install extension housing. Install front companion yoke. Install NEW gasket on vacuum switch. Install vacuum switch in case. Fill transfer case with Dexron III.

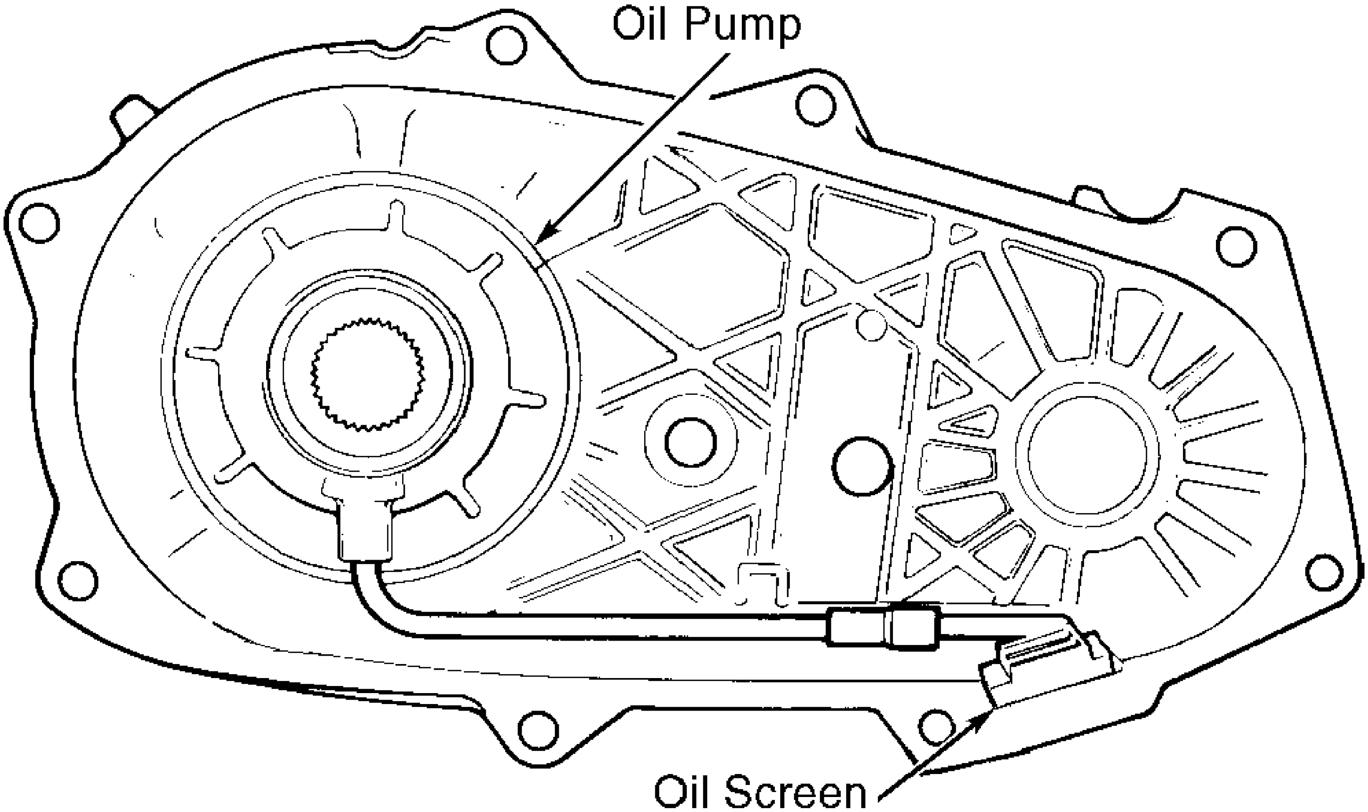


Fig. 3: Identifying Oil Pump Screen Position
Courtesy of Chrysler Corp.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS TABLE

Application	Ft. Lbs. (N.m)
Companion Flange Nut	80 (108)
Detent Plug	11 (15)
Drain & Fill Plug	30-40 (41-54)
Extension Housing Bolt	26-34 (35-46)
Front Bearing Retainer Bolt	14 (19)
Front Case-to-Rear Case Bolt	23 (31)
Range Lever Nut	20-25 (27-34)
Rear Bearing Retainer Bolt	20-25 (27-34)
Rear Crossmember	30 (41)
Shift Lever Lock Bolt	10 (14)
Shift Selector Lever Nut	20 (27)
Speed Sensor Bolt	23 (31)
Transfer Case-to-Transmission Nut	26 (35)
Vacuum Switch	17 (23)
	INCH Lbs. (N.m)
Control Cable Lock Nut	18 (2)

TRANSFER CASE OVERHAUL - NEW VENTURE 233

1997 Chevrolet Blazer

1997 TRANSFER CASES
General Motors Corp. - New Venture 233

Chevrolet; Blazer, "T" Series Pickup
GMC; Jimmy, Sonoma
Oldsmobile; AWD Bravada

IDENTIFICATION

Transfer case can be identified by an I.D. tag, located on rear case. See Fig. 1. I.D. tag provides model number, assembly number and low range ratio. This information is necessary when ordering parts.

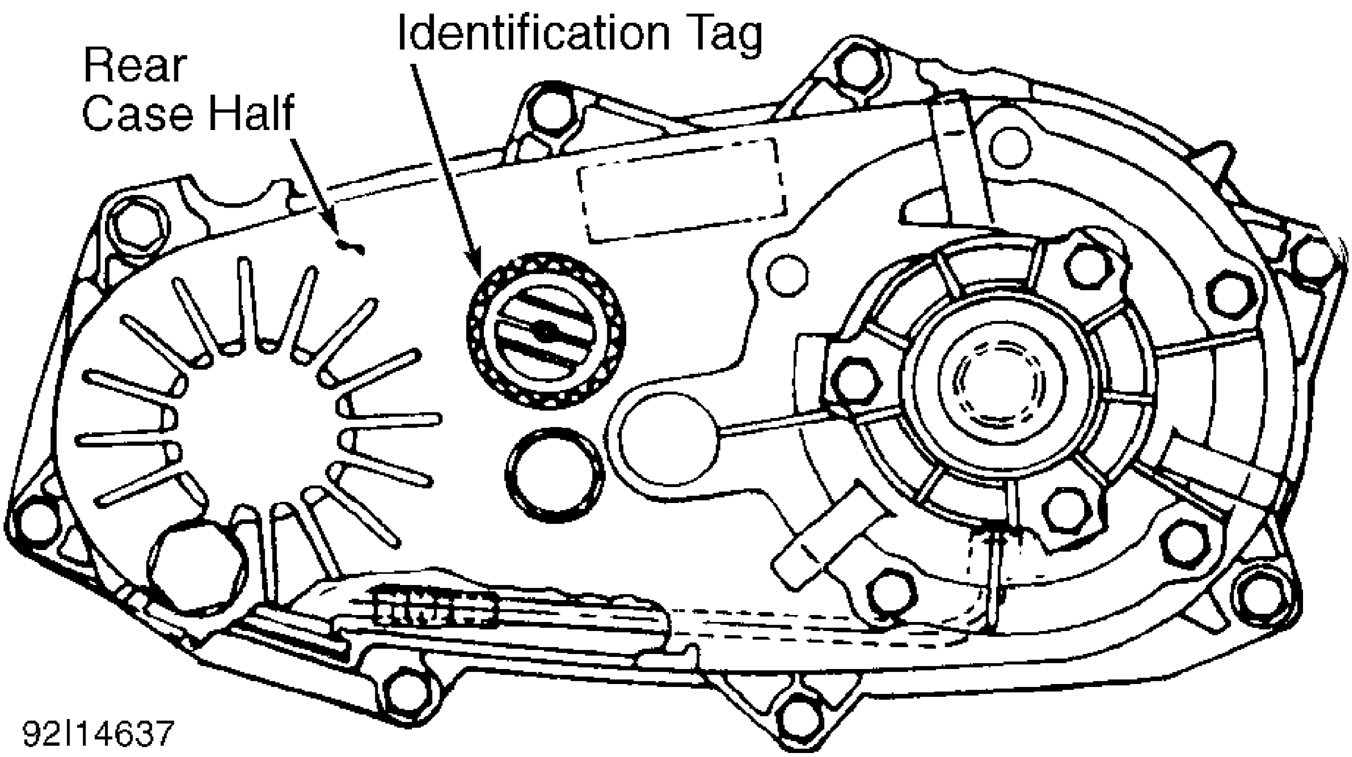


Fig. 1: Locating Identification Tag
Courtesy of General Motors Corp.

DESCRIPTION

Model 233 transfer case is a chain drive, 2-piece aluminum case, 3-position unit. Transfer case uses an electronic control system and a shift motor to shift the transfer case.

ADJUSTMENTS

GEARSHIFT LINKAGE

Model 233 uses a electronic control system and shift motor for transfer case shifting and is not equipped with transfer case gearshift linkage.

TESTING

ELECTRONIC SYSTEM

For testing of electronic system and components, see TRANSFER CASE DIAGNOSIS - NV 233 article in the POWERTRAIN section.

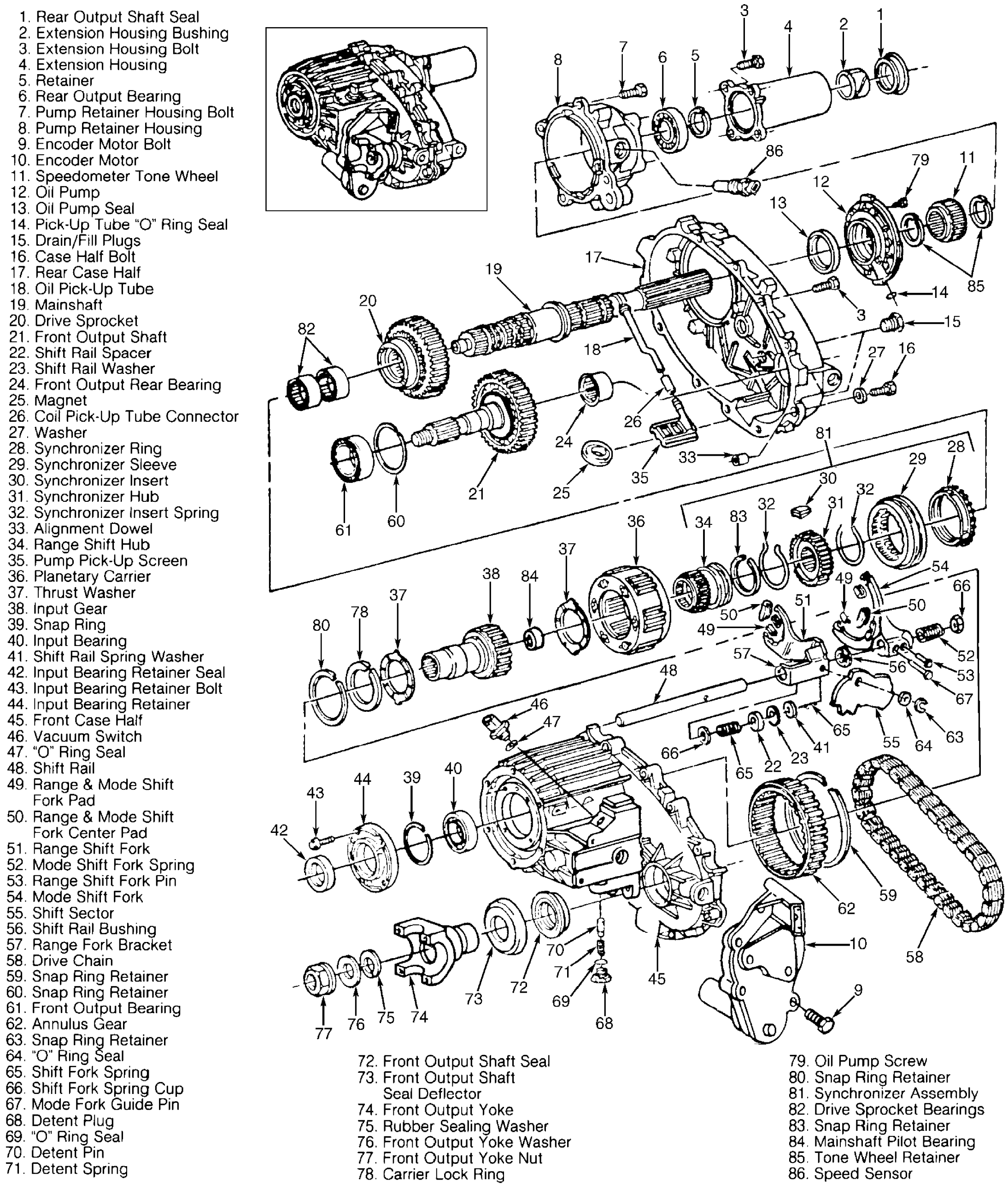


Fig. 2: Exploded View Of Model 233 Transfer Case
Courtesy of General Motors Corp.

TROUBLE SHOOTING

SYMPTOM DIAGNOSIS

Will Not Shift Or Difficult To Shift

Vehicle operated too long on dry paved surface. Stop vehicle. Place transmission in Reverse or Neutral to relieve drive line torque. Ensure correct fluid is used. Internal parts may be worn or damaged.

Noisy In All Gears

Check fluid level. Ensure correct fluid is used. If fluid is okay, locate possible internal mechanical problem.

Jumps Out Of Gear Or Noisy In 4WD

Transfer case internal shift mechanism faulty. Range fork damaged. Fork pads are worn. Shift fork binding. Low range gear worn.

Fluid Leaking From Vent Or Seals

Transfer case overfilled. Vent plugged. Output shaft seals are damaged or not installed properly.

ON-VEHICLE SERVICE

FRONT OIL SEAL

Removal

Mark front drive shaft and flange for alignment purposes. Remove front drive shaft. Remove flange. Discard washer and nut. Using a screwdriver, carefully remove oil seal. Ensure seal contact surface is clean.

Installation

Apply ATF to seal lip and yoke seal surface. Install oil seal and yoke with NEW washer and nut. Install front drive shaft using alignment marks. Check transfer case fluid.

EXTENSION HOUSING OIL SEAL & BUSHING

Removal

Mark rear drive shaft and flange for installation purposes. Remove rear drive shaft. Tap extension housing clockwise and remove extension housing. DO NOT pry on extension housing. Using a screwdriver, remove oil seal from extension housing.

Installation

Using bushing driver, replace bushing in extension housing. Install NEW extension housing oil seal. Apply silicone sealant to extension housing mating surface. Install extension housing. To complete installation, reverse removal procedure.

REMOVAL & INSTALLATION

TRANSFER CASE

WARNING: When battery is disconnected, vehicles equipped with computers may lose memory data. When battery power is restored, driveability problems may exist on some vehicles. These vehicles may require a relearn procedure. See COMPUTER RELEARN PROCEDURES article in the GENERAL INFORMATION section.

Removal

1) Shift transfer case into 4H and disconnect battery negative cable. Raise vehicle, remove skid plate and drain fluid.

2) Mark front and rear output shaft yokes to drive shafts for reassembly reference. Support transfer case and remove rear crossmember. Remove drive shafts.

3) Disconnect speedometer cable, electrical connections and vacuum (hoses) harness at transfer case. Remove transfer case attaching bolts. Remove transfer case from vehicle.

Installation

1) Clean all old gasket material from transmission and transfer case mating surfaces. Position NEW gasket on transfer case with orientation tab at upper left bolt hole.

2) Install transfer case, aligning splines of input shaft with transmission. Slide transfer case forward until seated against transmission. Install transfer case attaching bolts and tighten to specification. See TORQUE SPECIFICATIONS. Install rear crossmember.

3) Attach speedometer cable, electrical connections and vacuum harness at transfer case. Using reference marks made during removal, reinstall front and rear drive shafts. Refill transfer case. Install skid plate and lower vehicle. Connect negative battery cable. Road test vehicle.

TRANSFER CASE DISASSEMBLY

NOTE: See Fig. 2 for exploded view of transfer case.

1) Remove front output yoke. Discard lock nut. Remove shift motor, vacuum switch and speed sensor. Remove detent plug, spring and plunger from underside of case. Remove extension housing and rear output bearing retainer snap ring. Remove rear retainer housing bolts. Using 2 screwdrivers under each tab, remove pump retainer housing. Remove VSS rotor and snap ring from mainshaft. Remove case bolts (2 longer bolts go in doweled holes; mark all bolts for reinstallation position). Separate case halves by carefully prying only in molded slots. Remove oil pump assembly.

2) Remove pump pick-up tube, "O" ring and filter. See Fig. 3. Remove mode shift fork spring (positioned in middle of drive chain). Remove front output shaft seal and snap ring.

3) Remove mainshaft, drive chain, and driven sprocket as an assembly (mode fork and shift rail will be removed with this assembly).

4) Remove synchronizer-to-mainshaft snap ring. Remove drive sprocket. Remove range shift fork and range shift hub as an assembly. Rotate sector shaft to obtain clearance for range fork. Remove shift sector shaft snap ring and sector shaft assembly.

5) Remove input bearing retainer bolts, then remove retainer. Remove input gear snap ring. Use soft-face hammer to remove input and low range gear assembly. Remove input gear to low range gear assembly snap ring. Separate input gear from low range gear assembly. Remove input bearing. Remove needle bearings from input gear.

6) Remove front output bearing snap ring. Remove front output bearing. Remove oil seal from mainshaft extension housing, then remove input bearing retainer seal. Remove front output rear bearing. Remove mainshaft bearing from oil pump retainer. Remove magnet from front case.

7) Mark and disassemble main drive synchronizer stop rings from sleeve. Remove spring retainers from synchronizer hub. Separate synchronizer hub from synchronizer. Remove oil pump screws from oil pump.

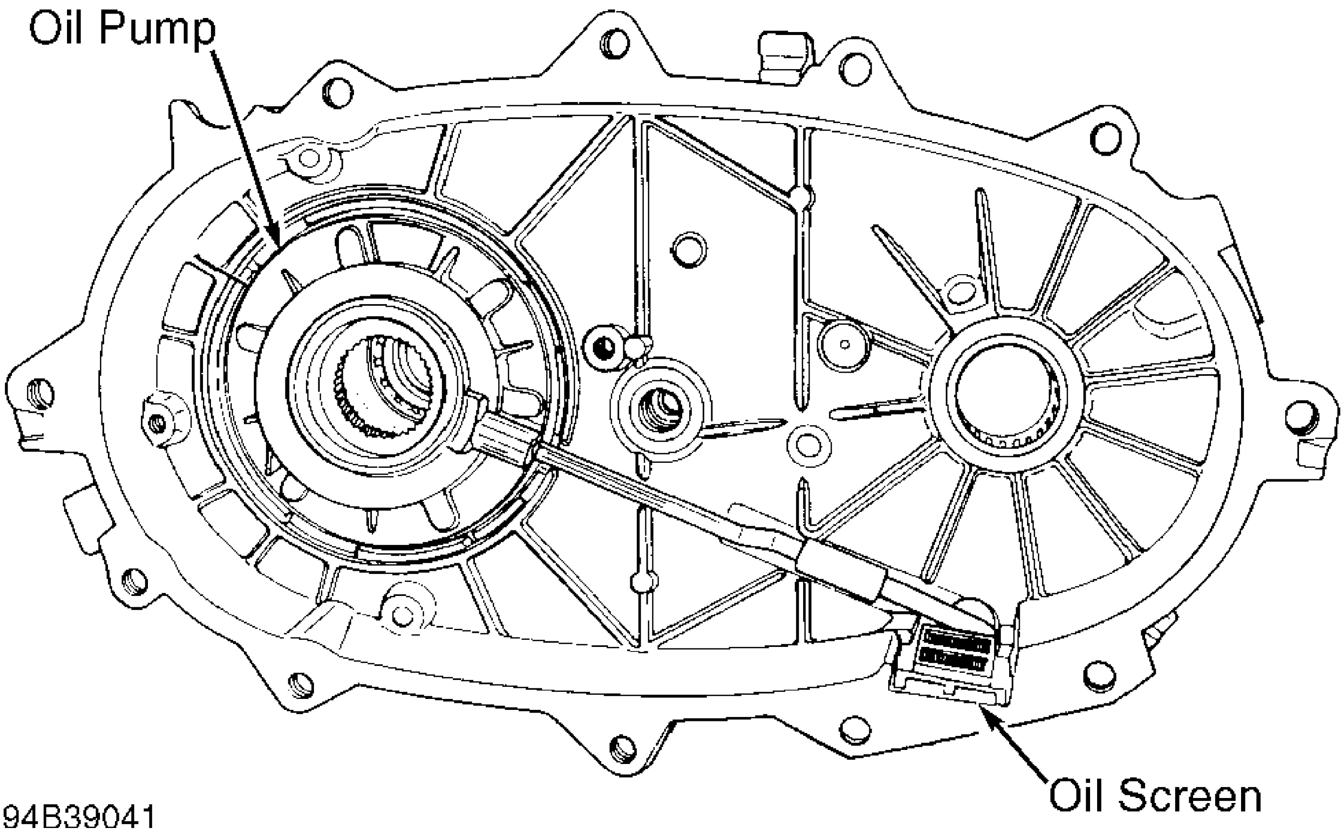


Fig. 3: Removing & Installing Oil Pump Oil Screen
Courtesy of General Motors Corp.

CLEANING & INSPECTION

Clean all parts with solvent. Dry all parts with compressed air, except bearings. Bearings must be wiped dry or allowed to air dry. Replace all oil seals, "O" rings and snap rings. Check all parts for wear or damage. Replace all worn or damaged parts. If annulus gear, inside front case, is damaged or worn, front case and gear must be replaced as an assembly. Replace oil pump as an assembly if any part is damaged or worn.

TRANSFER CASE REASSEMBLY

NOTE: See Fig. 2 for exploded view of transfer case. When installing bearings, ensure bearing bores are aligned with oil feed holes.

1) Lubricate all parts with Dexron-II ATF before installation. Install needle bearing into rear case half. Be sure bearing is flush with boss on case housing. Install front output shaft bearing with NEW snap ring. Install bearing into rear retainer housing.

2) Install input gear bearing. Install input gear assembly into planetary gear. Install input gear snap ring. Install input bearing. Install mainshaft extension housing seal. Lubricate seal lip with ATF fluid. Install input bearing seal into bearing retainer. Lubricate seal lip with ATF fluid.

3) Install magnet into front case half. Ensure synchronizer hub and sleeve mating marks are aligned, then install synchronizer hub

to sleeve. Install hub spring retainers and stop rings. Install synchronizer drive sprocket. Install synchronizer assembly and snap ring.

4) Use soft-face hammer to install input and low range gear assembly. Install input gear snap ring. Install input bearing retainer. Apply RTV sealant to bearing retainer mating surfaces. Apply thread-lock to bolts, then install retainer bolts and tighten evenly.

5)Install shift sector assembly and snap ring. Install range shift hub and fork (rotate sector to align range shift fork). Install drive chain, mainshaft and driven sprocket assembly. Install fork shift spring.

6) Install oil pump pickup tube and screen into rear case (use care not to damage "O" ring). Install oil pump onto pickup tube. Apply RTV sealant to case mating surface. Install rear case to front case (use care to avoid damage to oil pump. Apply thread-lock to case bolts. Install case bolts and tighten evenly.

7) Install mainshaft snap ring. Install VSS rotor and snap ring. Install rear retainer housing. Apply RTV sealant to rear retainer housing-to-rear case joint. Install pump retainer housing bolts. Install output bearing snap ring.

8) Apply RTV sealant to extension housing mating surface and install housing. Apply thread-lock to extension housing bolts and install bolts. Install detent plug, spring and plunger to bottom of case. Install vehicle speed sensor with new "O" ring. Install vacuum switch with new "O" ring. Install electronic shift motor and bolts. Install front output shaft seal. Lubricate seal lip with ATF fluid. Install front output shaft snap ring. Fill transfer case with Dexron-II ATF.

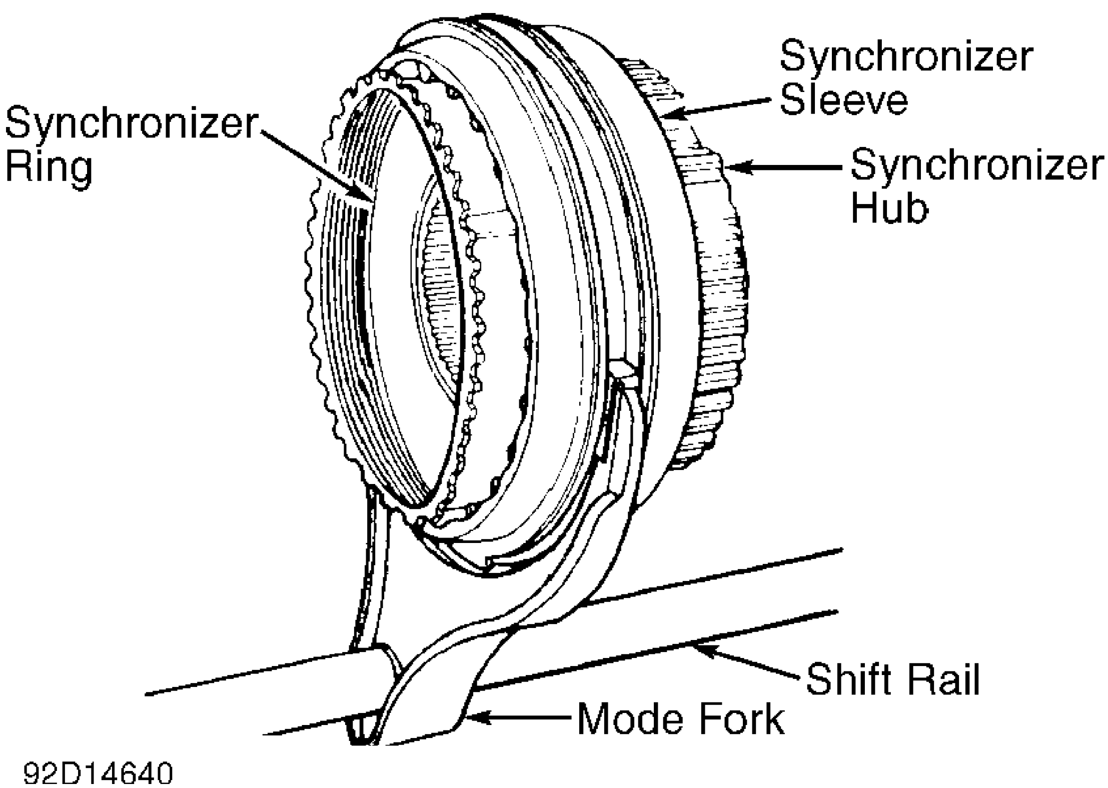


Fig. 4: Identifying Synchronizer Assembly Components
Courtesy of General Motors Corp.

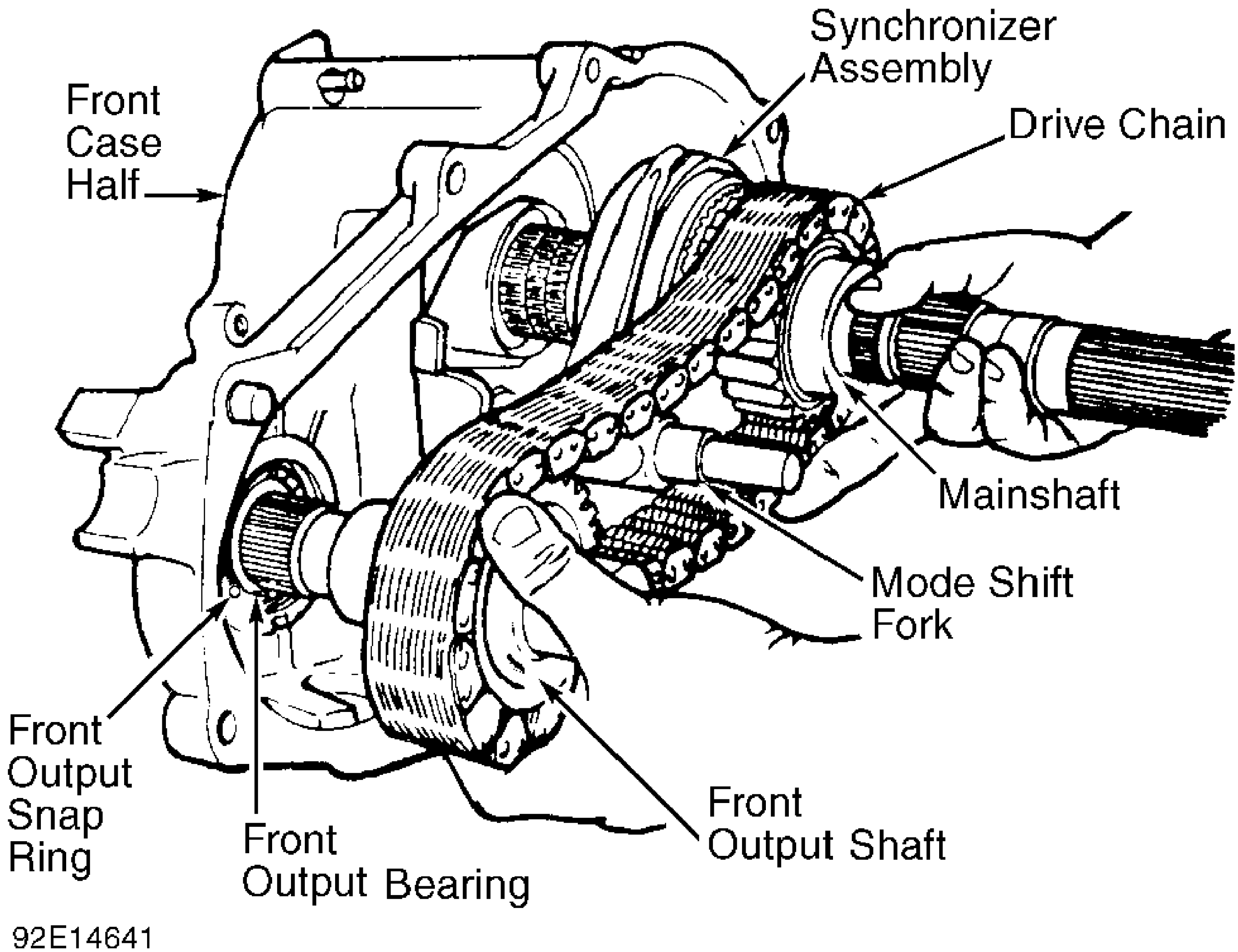


Fig. 5: Installing Output Shaft & Drive Chain Assembly
Courtesy of General Motors Corp.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS TABLE

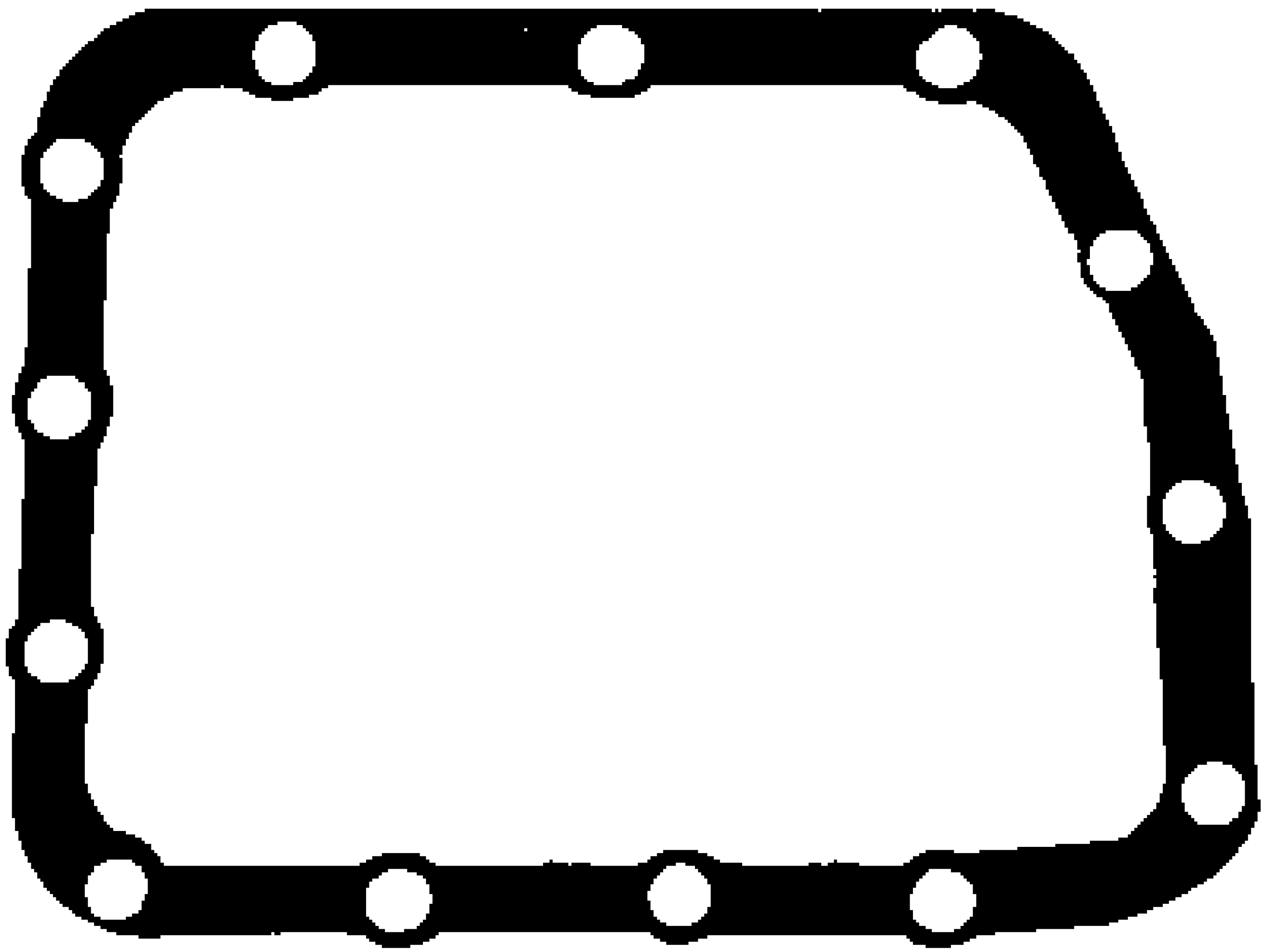
Application	Ft. Lbs. (N.m)
Detent Plug	11 (15)
Drain & Fill Plug	35 (47)
Extension Housing Bolt	23 (31)
Front & Rear Bearing Retainer Bolt	14 (19)
Front Case-To-Rear Case Bolts	23 (31)
Oil Pump Housing Screw	23 (31)
Output Yoke Nut	110 (152)
Range Lever Nut	23 (31)
Shift Motor Bolt	13 (18)
Transfer Case-To-Transmission Nuts	41 (55)
Vehicle Speed Sensor	23 (31)

1996-97 TRANSMISSION SERVICING
General Motors Corp. Oil Pan Gasket Identification

Passenger Cars, Light Trucks & Vans

OIL PAN GASKET IDENTIFICATION

SATURN MP6/MP7



94H32570

Fig. 1: Identifying Saturn MP6/MP7 Oil Pan Gasket

HYDRA-MATIC 3T40

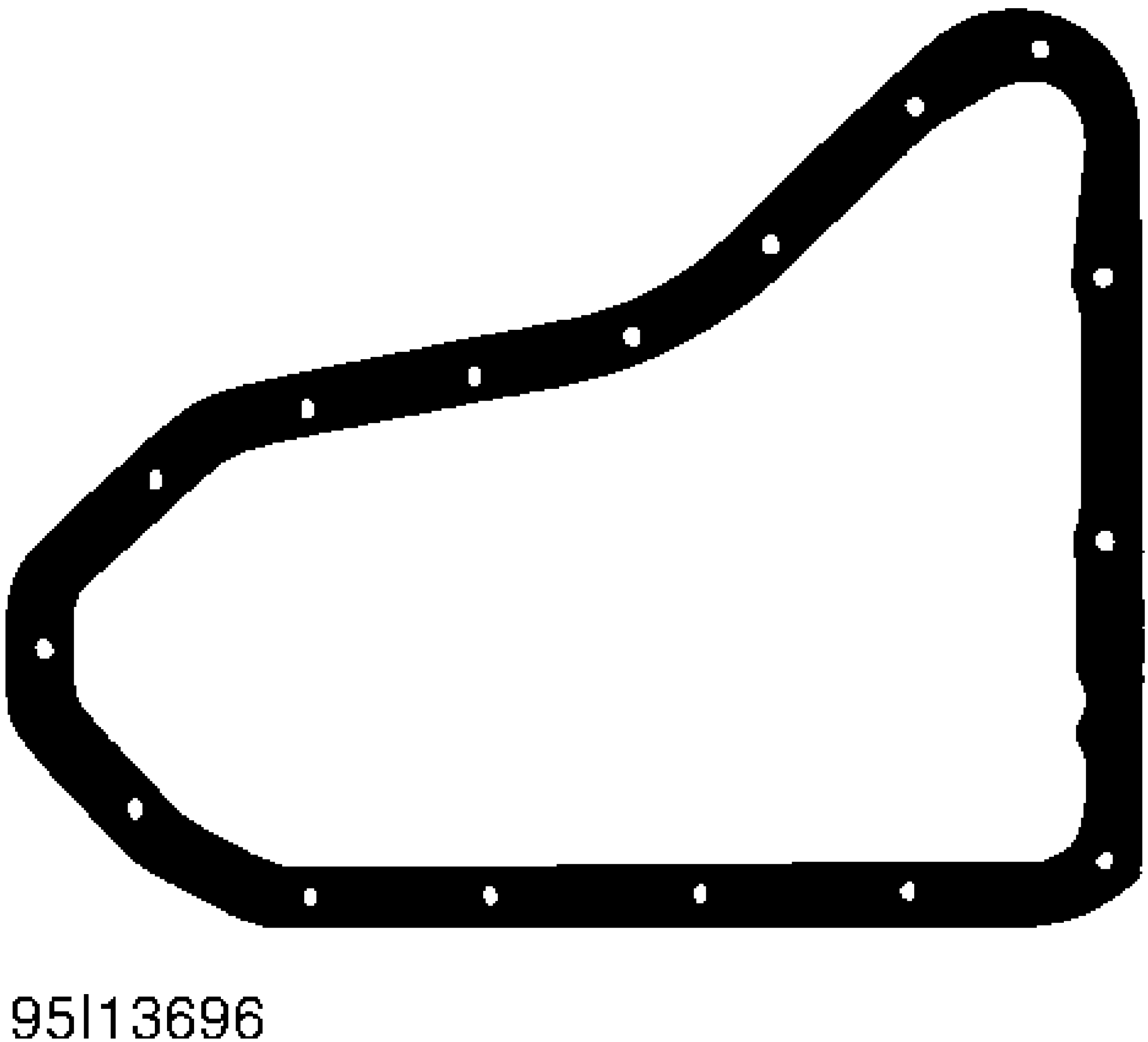


Fig. 2: Identifying Hydra-Matic 3T40 Oil Pan Gasket

HYDRA-MATIC 4L30-E

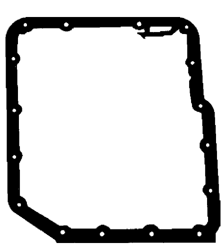


Fig. 3: Identifying Hydra-Matic 4L30-E Oil Pan Gasket

HYDRA-MATIC 4L60-E

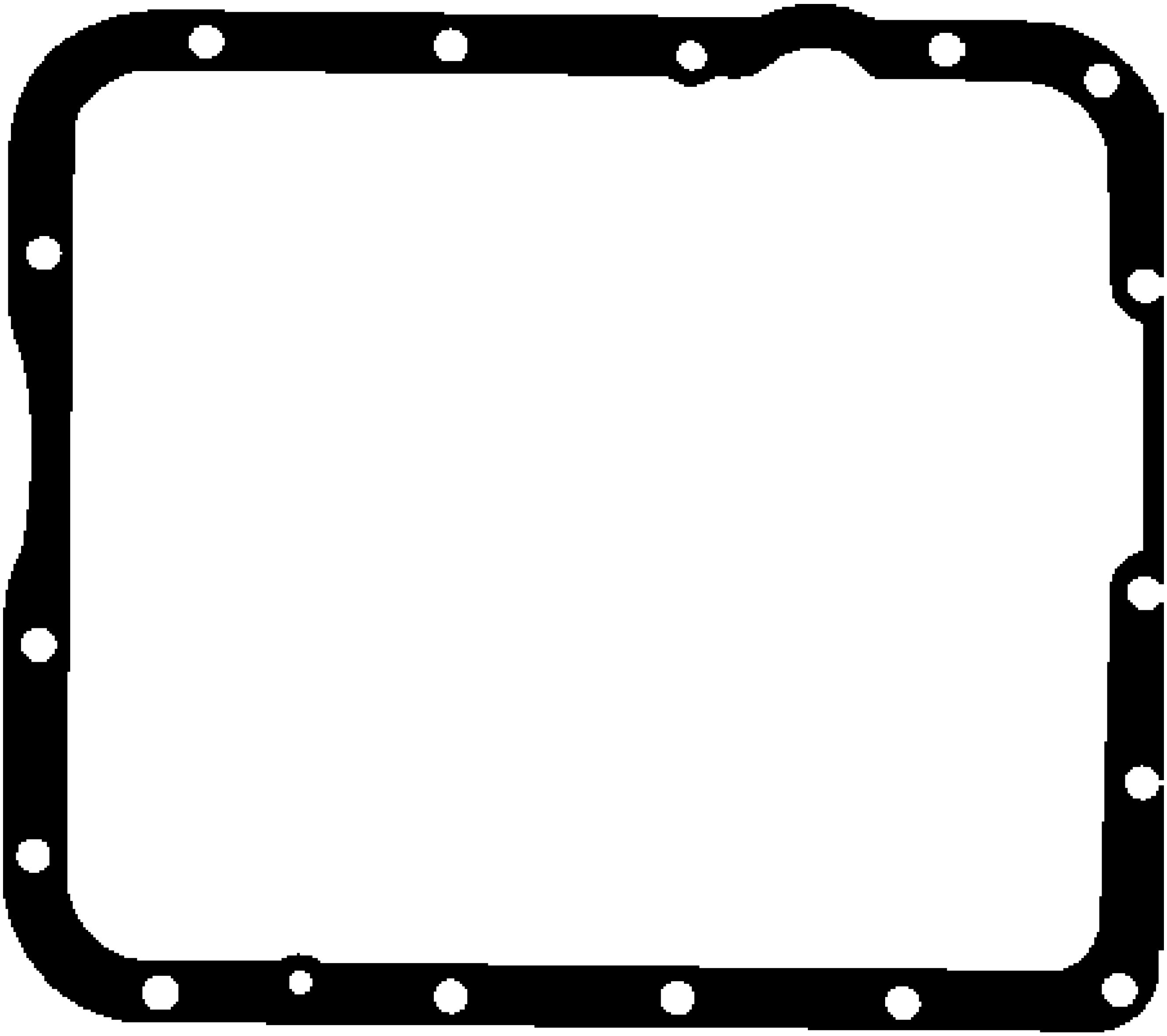


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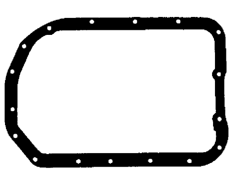
Fig. 4: Identifying Hydra-Matic 4L60-E Oil Pan Gasket

HYDRA-MATIC 4L80-E



91B13525

Fig. 5: Identifying Hydra-Matic 4L80-E Oil Pan Gasket

HYDRA-MATIC 4T40-E

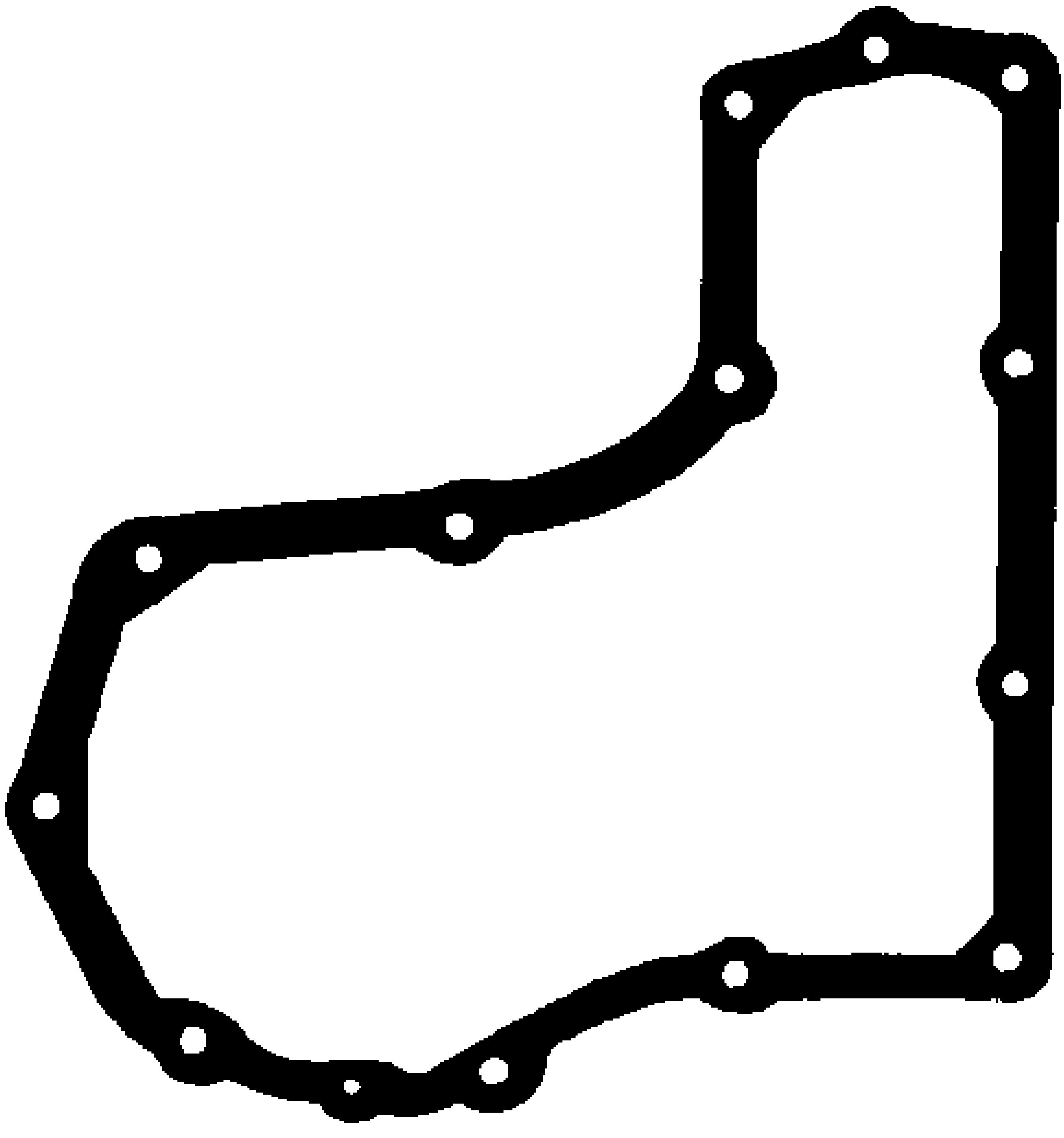


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Fig. 6: Identifying Hydra-Matic 4T40-E Oil Pan Gasket

HYDRA-MATIC 4T60-E & 4T65-E

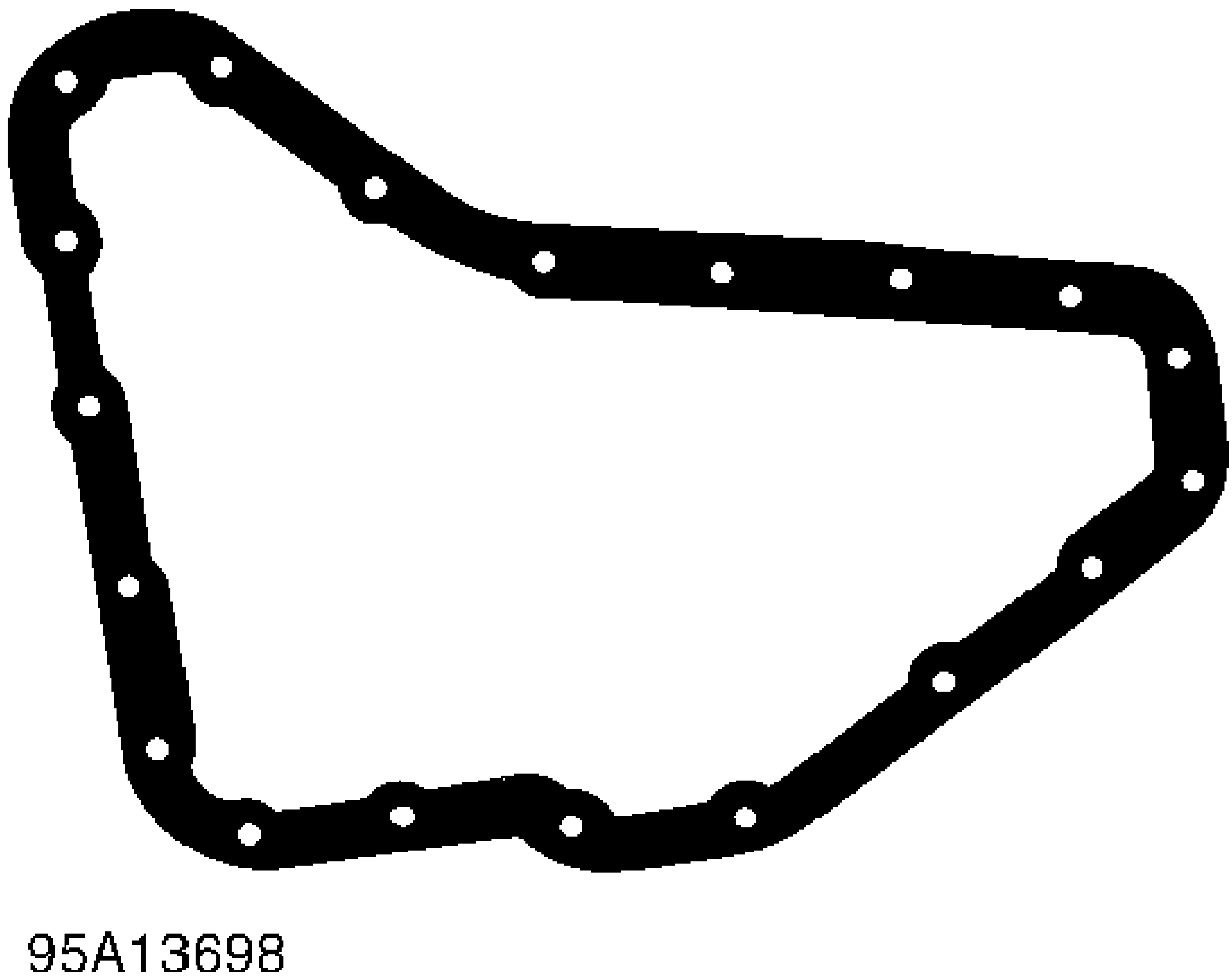

Fig. 7: Identifying Hydra-Matic 4T60-E & 4T65-E Oil Pan Gasket

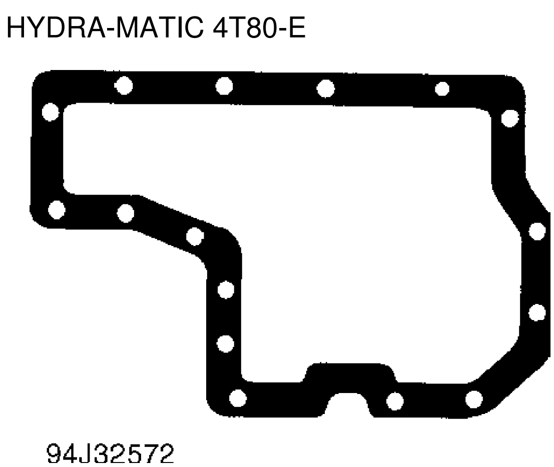

Fig. 8: Identifying Hydra-Matic 4T80-E Oil Pan Gasket

1997 AUTOMATIC TRANSMISSION REMOVAL
General Motors - 4L60-E (M30)

Chevrolet; S10, Blazer
GMC; Sonoma, Jimmy
Oldsmobile; Bravada

MODEL IDENTIFICATION

Vehicle model is identified by fifth character of Vehicle Identification Number (VIN). VIN is stamped on metal pad on top of left end of instrument panel, near windshield.

APPLICATION

TRANSMISSION IDENTIFICATION TABLE

Model	Transmission
S10, Sonoma, Blazer, Jimmy, Bravada	4L60-E (M30)

REMOVAL & INSTALLATION

CAUTION: When battery is disconnected, vehicle computer may lose memory data. Driveability problems may exist until computer systems have completed a relearn cycle. See the COMPUTER RELEARN PROCEDURES article in the GENERAL INFORMATION section before disconnecting battery.

Removal & Installation

1) Disconnect negative battery cable. Remove air cleaner. Disconnect shift cable from transmission. Raise and support vehicle. Drain transmission fluid. Disconnect shift linkage. Place reference marks on rear drive shaft and front drive shaft (if equipped) for installation reference. Remove drive shaft(s) from vehicle.

WARNING: ALWAYS relieve fuel pressure before disconnecting any fuel injection related component. DO NOT allow fuel to contact electrical components.

2) Relieve fuel pressure and remove fuel lines. Remove support bracket at catalytic converter. Support transmission with transmission jack. Remove transmission crossmember.

NOTE: DO NOT stretch or damage cables, wires or other component when lowering transmission.

3) Lower transmission enough to provide clearance for other components. Remove dipstick tube and seal. Cover opening in transmission. Remove speedometer harness and vacuum modulator line, if equipped. Remove electrical connectors from transmission. Remove cooler lines and cap all openings. Remove starter.

4) Remove transfer case shifter and position aside, if equipped. Remove transmission support braces. Note location of braces for installation. Remove converter housing cover. Place reference marks on flexplate and torque converter for installation reference. Remove torque converter-to-flexplate bolts.

NOTE: Support engine with jack or hoist before disconnecting transmission.

5) Remove transmission-to-engine mounting bolts. Note location of any brackets or clips and position aside. Slide transmission rearward, away from locating pins and install Converter Holding Strap (J-21366). Remove transmission from vehicle.

6) To install, reverse removal procedure. Torque converter must be against flexplate and rotate freely by hand. Ensure all reference marks align. Tighten bolts to specification. See TORQUE SPECIFICATIONS.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS TABLE

Application	Ft. Lbs. (N.m)
PNP Switch Mounting Bolt/Nut	21 (29)
Shift Lever-To-Manual Shaft Nut	21 (28)
	INCH Lbs. (N.m)
Oil Pan Retaining Bolts	97 (11.0)

TRANSMISSION SERVICING - A/T

1997 Chevrolet Blazer

1997 AUTOMATIC TRANSMISSION SERVICING
General Motors - 4L60-E (M30)

Chevrolet; S10, Blazer
GMC; Sonoma, Jimmy
Oldsmobile; Bravada

APPLICATION

TRANSMISSION IDENTIFICATION TABLE

Model	Transmission
S10, Sonoma, Blazer, Jimmy Bravada, Envoy	4L60-E (M30)

LUBRICATION

SERVICE INTERVALS

Transfer Case

Check transfer case lubricant at every oil change or every 12 months. Check more frequently under severe driving conditions.

Transmission

Check transmission fluid level at each engine oil change. Under normal driving conditions, change transmission fluid and filter every 50,000 miles. Under severe driving conditions, change transmission fluid and filter every 15,000 miles.

CHECKING FLUID LEVEL

NOTE: Transmission must be at normal operating temperature when checking fluid level. One pint of fluid will raise level from ADD 1 PT. or .5L to FULL mark on dipstick with transmission at normal temperature. DO NOT overfill.

Transmission

1) With vehicle parked on a level surface and engine at idle, move gearshift lever through all gear positions, ending in Park. Remove dipstick, wipe clean and check fluid level. Fluid level should be between ADD 1 PT. and FULL marks on dipstick.

2) If vehicle has been driven for an extended period of time at high speed, in city traffic or pulling a trailer, an accurate fluid level cannot immediately be determined. Allow transmission to cool for about 30 minutes after vehicle is parked, then recheck fluid level. Add appropriate fluid as needed. See RECOMMENDED FLUID.

Transfer Case

Remove transfer case fill plug. Check oil level. If level is not even with fill plug opening, add appropriate lubricant as necessary. See RECOMMENDED FLUID.

RECOMMENDED FLUID

Transmission

Dexron-III ATF.

Transfer Case
Dexron-III ATF.

FLUID CAPACITY

Transmission

The transmission refill capacities given below are approximate. Correct fluid level should always be determined by marks on dipstick, rather than by amount of fluid added. DO NOT overfill. See the TRANSMISSION REFILL CAPACITIES table and the TRANSFER CASE REFILL CAPACITIES table.

TRANSMISSION REFILL CAPACITIES TABLE

Application	Refill (Service) Qts. (L)	Dry Fill (Overhaul) Qts. (L)
4L60-E	5.0 (4.8)	11.0 (10.6)

TRANSFER CASE REFILL CAPACITIES TABLE

Application	Capacity Pts. (L)
NV 136	4.9 (2.3)
NV 231	3.8 (1.8)
NV 233	2.5 (1.2)
NV 241 & NV243	4.4 (2.1)
Borg-Warner 44-01 & 44-70	6.6 (3.1)
Borg-Warner 44-72	3.0 (1.4)

DRAINING & REFILLING

Transmission

1) Loosen transmission oil pan bolts. Pry pan loose and allow fluid to drain. Remove oil pan, gasket and filter or filter screen. Replace paper element filter (if equipped).

2) Clean filter screen (if equipped) and pan with solvent. Blow dry with compressed air. Install oil pan with NEW gasket. Add appropriate fluid to proper mark on dipstick. See RECOMMENDED FLUID. DO NOT overfill.

Transfer Case

Remove drain plug from transfer case. Remove fill plug for easier draining. With fluid drained, reinstall drain plug. Fill transfer case to bottom of filler plug opening with appropriate fluid. See RECOMMENDED FLUID.

ADJUSTMENTS

SHIFT CABLE/LINKAGE

1) Ensure shift cable is not restricted. Place gearshift lever in Neutral. Raise and support vehicle. Unlock locking tab securing shift cable to transmission bracket. Disconnect shift cable from transmission shift lever.

2) At transmission, place transmission shift lever in Neutral. Neutral position can be obtained by rotating transmission shift lever clockwise to stop, then counterclockwise 2 detents.

3) Pull cable end completely forward and release it.

Adjustment spring will position shift cable to its most rearward position. Reconnect shift cable to transmission shift lever. Press locking tab in to secure shift cable to transmission bracket.

PARK/NEUTRAL POSITION (PNP) SWITCH

NOTE: PNP switch may also be known as Transmission Range (TR) sensor.

1) Disconnect negative battery cable. Place gearshift lever in Neutral. Raise and support vehicle. Place transmission shift lever in Neutral. Neutral position can be obtained by rotating transmission shift lever fully forward (counterclockwise), then back 2 detents to Neutral position.

2) Disconnect PNP switch harness connector. Disconnect shift cable from transmission shift lever. Remove nut securing transmission shift lever to manual shaft and remove transmission shift lever.

3) Remove 2 PNP switch mounting bolts and PNP switch. Position PNP switch Adjusting Tool (J41364-A) on PNP switch. Ensure 2 lower tabs on tool align with 2 slots on PNP switch. Rotate tool until upper locator pin on tool aligns with slot on top of PNP switch. Leave tool on PNP switch. Ensure no burrs exist on transmission manual shaft.

4) Align PNP switch hub flats with manual shaft flats. Slide PNP switch on manual shaft until PNP switch mounting bracket contacts mounting bosses on transmission. Install 2 PNP switch mounting bolts and tighten to 21 ft. lbs. (28 N.m). Remove tool. Reconnect PNP switch harness connector.

CAUTION: Hold transmission shift lever while tightening nut to prevent internal transmission damage.

5) Install transmission shift lever and nut. Tighten nut to 21 ft. lbs. (28 N.m). Install shift cable. Lower vehicle. Reconnect negative battery cable. Ensure engine starts with transmission in Park and Neutral only. If further adjustment is necessary, loosen PNP switch bolts. Rotate switch slightly, tighten bolts and recheck for proper operation.

SHIFT INTERLOCK SYSTEM

NOTE: See SHIFT INTERLOCK SYSTEM article in AUTO TRANS DIAGNOSIS section.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS TABLE

Application	Ft. Lbs. (N.m)
PNP Switch Mounting Bolt/Nut	21 (29)
Shift Lever-To-Manual Shaft Nut	21 (28)
	INCH Lbs. (N.m)
Oil Pan Retaining Bolts	97 (11.0)

TRANSMISSION SERVICING - A/T

1997 Chevrolet Blazer

1996-97 AUTOMATIC TRANSMISSION SERVICING
General Motors Corp. Automatic Transmission

Chevrolet; Astro, Blazer, "C" & "K" Series Pickup, Commercial Van, Express, Lumina, Sonoma, "S" & "T" Series, Pickup, Suburban, Tahoe, Van, Venture
GMC; "C" & "K" Series Pickup, Jimmy, Safari, Savana, Sierra, "S" & "T" Series Pickup, Suburban, Yukon
Oldsmobile; Bravada, Silhouette
Pontiac; Trans Sport

MODEL IDENTIFICATION

MODEL IDENTIFICATION

Series (1)	Model
"C"	2WD Pickup, Sierra, Suburban, Tahoe & Yukon
"G"	(2) RWD Van
"K"	4WD Pickup, Sierra, Suburban, Tahoe & Yukon
"L"	AWD Astro & Safari
"M"	2WD Astro & Safari
"P"	Commercial Van/Motorhome
"S"	2WD Blazer, Jimmy, Pickup & Sonoma
"T"	4WD Blazer, Jimmy, Pickup & Sonoma, & AWD Bravada
"U"	Lumina Van, Silhouette, Trans Sport & Venture

(1) - Vehicle series is fifth character of VIN.
(2) - Includes Express and Savana.

APPLICATION

NOTE: For transmission/transaxle application, see TRANSMISSION OIL PAN GASKET ID - A/T article.

LUBRICATION

SERVICE INTERVALS

Transmission/Transaxle ("C" & "K" Series)

Check transmission/transaxle fluid level at each engine oil change. Under severe driving conditions or for vehicles over 8600 GVWR, change transmission fluid and filter every 50,000 miles. For other vehicles under normal driving conditions, fluid and filter do not require periodic changing.

Transmission/Transaxle ("T" Series Bravada Only)

Check transmission/transaxle fluid level at each engine oil change. Under normal driving conditions, fluid and filter do not require periodic changing. Under severe driving conditions, change transmission fluid and filter every 50,000 miles.

Transmission/Transaxle ("U" Series)

Check transmission/transaxle fluid level at each engine oil change. Under normal driving conditions, change transmission fluid and filter every 100,000 miles. Under severe driving conditions, change fluid and filter every 15,000 miles.

Transmission/Transaxle (All Other Models)

Check transmission/transaxle fluid level at each engine oil change. Under normal driving conditions, for vehicles over 8600 GVWR, change transmission fluid and filter every 24,000 miles. For vehicles under 8600 GVWR, change fluid and filter every 30,000 miles.

Under severe driving conditions, for vehicles over 8600 GVWR, change transmission fluid and filter every 12,000 miles. For vehicles under 8600 GVWR, change fluid and filter every 15,000 miles.

Transfer Case

Check transfer case lubricant at every oil change or every 12 months. Under severe conditions check more frequently.

CHECKING FLUID LEVEL

NOTE: Transmission/transaxle must be at normal operating temperature (180-200°F) when checking fluid level. One pint of fluid will raise level from ADD 1 PT. or .5L to FULL mark on dipstick with transmission/transaxle at normal temperature. DO NOT overfill.

Transmission/Transaxle

With vehicle parked on a level surface and engine at idle, move selector lever through all positions, ending in Park. Remove dipstick, wipe clean and check fluid level. Fluid level should be between ADD 1 PT. and FULL marks on dipstick. If vehicle has been driven for extended period of time at high speed, in city traffic or pulling a trailer, an accurate fluid level cannot be immediately determined. Allow transmission/transaxle to cool for about 30 minutes after vehicle is parked, then check fluid level.

Transfer Case

Remove fill plug. Check oil level. If level is not up to fill plug opening, add lubricant as necessary.

RECOMMENDED FLUID

Transmissions/transaxles and transfer cases use Dexron-III ATF.

FLUID CAPACITY

Transmission/Transaxle

The transmission/transaxle refill capacities given below are approximate. Correct fluid level should always be determined by marks on dipstick, rather than by amount of fluid added. DO NOT overfill transmission/transaxle. See appropriate REFILL CAPACITIES table.

TRANSMISSION/TRANSAXLE REFILL CAPACITIES

Application	Refill (Service) Qts. (L)	Dry Fill (Overhaul) Qts. (L)
3T40	4.0 (3.8)	7.0 (6.6)
4L60-E	5.0 (4.8)	11.0 (10.6)
4T60-E	6.0 (5.7)	8.0 (7.6)
4L80-E		
"C", "G" & "K" Series	7.7 (7.3)	13.5 (12.8)
"P" Series	5.0 (4.7)	11.5 (10.9)

TRANSFER CASE REFILL CAPACITIES

Application	Capacity
Models 231 & 233	2.5 Pts. (1.8L)
Model 241	5.2 Pts. (2.5L)
Model 243	2.5 Pts. (1.8L)
Model 4401	2.9 Pts. (1.4L)
Model 4470	6.6 Pts. (3.1L)
Model 4472	3.0 Pts. (1.5L)

DRAINING & REFILLING

Transmission/Transaxle

1) Loosen transmission/transaxle oil pan bolts. Pry pan loose and allow fluid to drain. Remove oil pan, gasket, and filter or filter screen. Replace paper element filter (if equipped).

2) Clean filter screen (if equipped) and pan with solvent, and blow dry with compressed air. Install oil pan with NEW gasket. Add fluid to proper mark on dipstick.

NOTE: On 4WD vehicles it may be necessary to remove the crossmember at the rear of the transmission to allow adequate clearance for transmission oil pan removal. Forcing the pan past the crossmember may damage the internal transmission wiring harness or solenoid connections.

Transfer Case

Remove drain plug from transfer case. Remove fill plug for easier draining. With fluid drained, reinstall drain plug. Fill transfer case to bottom of filler plug opening with appropriate fluid.

ADJUSTMENTS

THROTTLE VALVE (TV) CABLE

NOTE: The Hydra-Matic 4L60-E, 4T60-E and 4L80-E are electronically controlled transmissions/transaxles, and do not require adjustment.

3T40

Depress metal lock tab on adjuster and hold. Move slider back through fitting away from throttle body lever until slider stops at fitting. See Fig. 1. Release lock tab and open throttle body lever to full throttle stop. This automatically adjusts slider to correct setting.

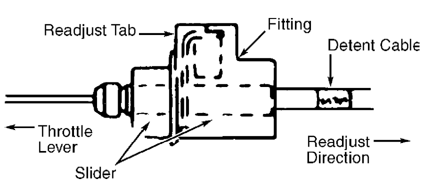

Fig. 1: Adjusting Throttle Valve (TV) Cable
Courtesy of General Motors Corp.

SHIFT LINKAGE

NOTE: Shift linkage adjustment information for "G", "S" and "T" series is not available from manufacturer.

"C", "K", "L" & "M" Series

1) Ensure shift cable is not restricted. Set transmission range selector lever to Neutral position. Raise and support vehicle. At transmission, set transmission shift lever to Neutral position. Turn shift lever clockwise to stop, then counterclockwise 2 detents. This is Neutral position.

2) Disconnect shift cable end from shift lever. Pull cable end completely forward and release it. Adjustment spring will position cable to its most rearward position. Reconnect shift cable end to shift lever.

"P" Series

1) Remove clevis pin retaining clip and clevis pin. Move shift lever arm at transmission fully forward and then pull back 2 detents to Neutral position.

2) Loosen jam nut and adjust cable end to align with shift lever arm at transmission. Tighten jam nut. Reinstall clevis pin and clip. Ensure engine starts in Park and Neutral only.

"U" Series

Place shift lever in Neutral. Neutral can be found by rotating transaxle select lever clockwise from Park to Reverse to Neutral. Push tab on cable adjuster to adjust cable in cable mounting bracket.

PARK/LOCK CONTROL CABLE

NOTE: Park/lock control cable adjustment information for all other models is not available from manufacturer.

"U" Series

1) Lift cable lock button. Move shift lever to Park. Snap cable connector into shifter base. Ensure ignition key is in RUN position.

2) Snap cable housing into ignition switch inhibitor. Turn key to LOCK position. Snap cable end onto park lock lever pin. Remove slack from cable connector. Snap cable connector lock button down.

PARK NEUTRAL POSITION (PNP) SWITCH

"C", "G", "K", "L", "M", "P", "S" & "T" Series (Transmission Mounted Switch)

1) Disconnect negative battery cable. Place transmission gear selector in Neutral position. Neutral position can be found by rotating gear lever clockwise from Park (full counterclockwise position) to Reverse, and then to Neutral.

2) Raise and support vehicle. Move shift lever arm at transmission fully forward and then pull back 2 detents to Neutral position. Loosen shift lever nut from shift shaft. Disconnect PNP switch wiring harness connector. Remove shift cable from shift lever arm. Remove shift lever nut and shift lever.

3) Remove 2 PNP switch bolts and PNP switch. Position PNP switch Adjusting Tool (J41364-A) on PNP switch. Ensure 2 lower tabs on tool align with 2 slots on PNP switch. Rotate tool until upper locator pin on tool aligns with slot on top of switch. Leave tool on PNP switch. Ensure no burrs exist on shift lever shaft.

4) Align PNP switch hub flats with manual shaft flats. Slide PNP switch on shift lever shaft until PNP switch mounting bracket contacts mounting bosses on transmission. Install 2 PNP switch bolts and tighten to 21 ft. lbs. (28 N.m). Remove tool. Reconnect PNP switch

wiring harness connector.

CAUTION: Hold shift lever while tightening nut to prevent internal transmission damage.

5) Install shift lever and nut. Tighten nut to 21 ft. lbs. (28 N.m). Install shift cable. Lower vehicle. Reconnect negative battery cable. Ensure vehicle does not start in any gear selector position except Park and Neutral. If further adjustment is necessary, loosen PNP switch bolts. Rotate switch slightly, tighten bolts and recheck for proper operation.

"U" Series (Transmission Mounted Switch)

1) Raise and support vehicle. Loosen switch mounting bolts. Align hole in switch lever with hole in switch assembly. Insert a gauge pin through switch holes to hold switch in Neutral position.

2) With selector lever on transmission in Neutral position, tighten switch mounting bolts and remove gauge pin. Lower vehicle. Ensure vehicle does not start in any gear selector position except "P" and "N".

OIL PAN GASKET IDENTIFICATION

NOTE: For oil pan gasket identification, see appropriate illustration in TRANSMISSION OIL PAN GASKET ID - A/T article.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Oil Pan Bolts	
3T40	8 (11)
4L60-E & 4L80-E	15 (20)
4T60-E	13 (18)
Park Neutral Position Switch ("U" Series)	
3T40	22 (30)
4T60-E	15 (20)
Shift Linkage Spring Washer Screw	
"C" & "K" Series	18 (24)
"L" & "M" Series	26 (35)

TRANSMISSION SERVICING - M/T

1997 Chevrolet Blazer

1996-97 MANUAL TRANSMISSION SERVICING
General Motors

"C/K" Series: Blazer, Jimmy, Pickup, Sierra, Suburban, Tahoe & Yukon;
"P" Series: Commercial Vans;
"S/T" Series: Blazer, Jimmy, Pickup & Sonoma

MODEL IDENTIFICATION

MODEL IDENTIFICATION - TRUCKS

Series (1)	Model
"C"	2WD Pickup, Sierra, Suburban, Tahoe & Yukon
"K"	4WD Pickup, Sierra, Suburban, Tahoe & Yukon
"P"	Commercial Van/Motorhome
"S"	2WD Blazer, Jimmy, Pickup & Sonoma
"T"	4WD Blazer, Jimmy, Pickup & Sonoma, & AWD Bravada

(1) - Vehicle series is fifth character of VIN.

APPLICATION

NOTE: For transmission/transaxle application, refer to TRANSMISSION OIL PAN GASKET ID - A/T article under TRANSMISSION SERVICING.

LUBRICATION

SERVICE INTERVALS

NOTE: There are 2 light truck emission control classifications: Light Duty and Heavy Duty. Light Duty refers to vehicles weighing up to 8600 lbs. (GVW); Heavy Duty refers to vehicles weighing over 8600 lbs. (GVW).

Transmission

On all Light Duty vehicles, check transmission fluid every 12 months or 7500 miles. On Heavy Duty vehicles, check fluid level every 12 months or 6000 miles. Periodic draining and refilling is not required.

Transfer Case

Check transfer case lubricant every oil change or 12 months. Under severe conditions, check it more frequently.

CHECKING FLUID LEVEL

Transmission

Check lubricant level at transmission filler plug hole. Lubricant should be level with bottom of filler hole.

Transfer Case

Remove filler plug. Check oil level. Lubricant should be level with bottom of filler hole.

RECOMMENDED FLUID

TRANSMISSION RECOMMENDED FLUID

Application	Fluid Type
T5 5-Speed (77-mm)	Dexron-III ATF
NV 1500 5-Speed (85-mm)	(1) GM Synchromesh Fluid (9985648)
NV 3500 5-Speed (85-mm)	GM Synchromesh Fluid (12345349)
NV 4500 5-Speed (109-mm)	GM GL-4 Trans. Fluid (12345871)

(1) - With 5 percent Friction Modifier (12380672)

TRANSFER CASE RECOMMENDED FLUID

Application	Fluid Type
Transfer Cases	Dexron-III ATF

FLUID CAPACITY

NOTE: Capacities listed in the following chart are approximations only. Correct fluid level should be determined by level at filler plug hole rather than by amount added.

TRANSMISSION REFILL CAPACITIES

Application	Pts. (L)
T5 5-Speed (77-mm)	4.8 (2.4)
NV 1500 5-Speed (85-mm)	5.7 (2.7)
NV 3500 5-Speed (85-mm)	4.2 (2.0)
NV 4500 5-Speed (109-mm)	8.4 (4.0)

TRANSFER CASE REFILL CAPACITIES

Application	Pts. (L)
Model 231 & 233	2.5 (1.2)
Model 241 & 243	4.6 (2.2)
Model 4401	2.9 (1.4)
Model 4470	6.6 (3.1)

ADJUSTMENTS

NOTE: Manual transmissions have no shift rods. Shift lever mounts directly to top of transmission and is not adjustable.

TROUBLE SHOOTING - BASIC PROCEDURES

1997 Chevrolet Blazer

GENERAL TROUBLE SHOOTING

* PLEASE READ THIS FIRST *

NOTE: This is GENERAL information. This article is not intended to be specific to any unique situation or individual vehicle configuration. The purpose of this Trouble Shooting information is to provide a list of common causes to problem symptoms. For model-specific Trouble Shooting, refer to SUBJECT, DIAGNOSTIC, or TESTING articles available in the section(s) you are accessing.

ACCESSORIES & ELECTRICAL

CHARGING SYSTEM TROUBLE SHOOTING

NOTE: This is GENERAL information. This article is not intended to be specific to any unique situation or individual vehicle configuration. The purpose of this Trouble Shooting information is to provide a list of common causes to problem symptoms. For model-specific Trouble Shooting, refer to SUBJECT, DIAGNOSTIC, or TESTING articles available in the section(s) you are accessing.

BASIC CHARGING SYSTEM TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
Vehicle Will Not Start	Dead battery	Check battery cells, alternator belt tension and alternator output
	Loose or corroded battery connections	Check all charging system connections
	Ignition circuit or switch malfunction	Check and replace as necessary
Alternator Light Stays On With Engine Running	Loose or worn alternator drive belt	Check alternator drive tension and condition, See Belt Adjustment in TUNE-UP article in the TUNE-UP section
	Loose alternator wiring connections	Check all charging system connections
	Short in alternator light wiring	See Indicator Warning Lights in STANDARD INSTRUMENTS in the ACCESSORIES & EQUIPMENT section
	Defective alternator stator or diodes	See Bench Tests in ALTERNATOR article
	Defective regulator	See Regulator Check in

		ALTERNATOR article
Alternator Light Stays Off With Ignition Switch ON	Blown fuse	See WIRING DIAGRAMS
	Defective alternator	See Testing in ALTERNATOR article
	Defective indicator light bulb or socket	See Indicator Warning Lights in STANDARD INSTRUMENTS in the ACCESSORIES & EQUIPMENT section
Alternator Light Stays OFF With Ignition Switch ON	Short in alternator wiring	See On-Vehicle Tests in ALTERNATOR article
	Defective rectifier bridge	See Bench Tests in ALTERNATOR article
Lights or Fuses Burn Out Frequently	Defective alternator wiring	See On-Vehicle Tests in ALTERNATOR article
	Defective regulator	See Regulator Check in ALTERNATOR article
	Defective battery	Check and replace as necessary
Ammeter Gauge Shows Discharge	Loose or worn drive belt	Check alternator drive belt tension and condition. See Belt Adjustment in TUNE-UP article in the TUNE-UP section
	Defective wiring	Check all wires and wire connections
	Defective alternator or regulator	See Bench Tests and On-Vehicle Tests in ALTERNATOR article
	Defective ammeter, or improper ammeter wiring connection	See Testing in STANDARD INSTRUMENTS in the ACCESSORIES & EQUIPMENT section
Noisy Alternator	Loose drive pulley	Tighten drive pulley attaching nut
	Loose mounting bolts	Tighten all alternator mounting bolts
	Worn or dirty bearings	See Bearing Replacement ALTERNATOR article

	Defective diodes or stator	See Bench Test in ALTERNATOR article
Battery Does Stay Charged	Loose or worn drive belt	Check alternator drive belt tension and condition. See Belt Adjustment in appropriate TUNE-UP article in the TUNE-UP section
	Loose or corroded battery connections	Check all charging system connections
	Loose alternator connections	Check all charging system connections
	Defective alternator or battery	See On-Vehicle Tests and Bench Tests in ALTERNATOR article
	Add-on electrical accessories exceeding alternator capacity	Install larger alternator
Battery Overcharged-Uses Too Much Water	Defective battery	Check alternator output and repair as necessary
	Defective alternator	See On-Vehicle Test and Bench Tests in ALTERNATOR article
	Excessive alternator voltage	Check alternator output and repair as necessary

IGNITION SYSTEM TROUBLE SHOOTING

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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.

OK

* To test secondary ignition system, modify a Spark Plug by attaching a ground wire to the body of the plug and

NOT OK

* Repair or replace damaged components as necessary

widening the gap to 1/4-3/8". Disconnect spark plug wire and insert test plug. Ground plug, crank engine, and check for spark.

GOOD SPARK

* If plug sparks, driveability problem is most likely NOT in the ignition system.

NO SPARK

* Remove coil wire from the distributor and attach the modified spark plug. Ground the plug and crank engine while checking for spark.

GOOD SPARK

* If plug has a good spark, the problem is in the plug wires, distributor cap, or rotor. Replace components as necessary.

NO SPARK

* Proceed to the IGNITION PRIMARY TROUBLE SHOOTING CHECK CHART below in this article.

Ignition Primary Trouble Shooting Chart

START: Visually inspect primary ignition wires for broken, frayed, split, or cut wires. Also check for loose, corroded, or disconnected connectors.

OK

* Check that battery voltage is at least 11.5 volts.

NOT OK

* Repair or replace damaged components as necessary.

NOT OK

* Replace or recharge the battery.

OK

* Check for battery voltage at the positive terminal of the coil.

OK

* Check air Gap of the Pick-Up coil in the distributor.

NOT OK

* Check resistance of ballast resistor (if used) for the correct resistance value.

OK

* Check Pick-Up coil for correct resistance value.

NOT OK

* Adjust or replace as necessary.

NOT OK

* Replace Pick-Up coil if not to specification.

OK

* Check control module for good ground connections.

OK

* If vehicle fails to run at this point, go to the appropriate article in the ENGINE PERFORMANCE section.

OK

* Check wires from the battery/ ignition switch to the coil. Also check the coil primary and secondary resistance.

NOT OK

* Replace ballast resistor if the measured resistance value is not within specification.

STARTER TROUBLE SHOOTING

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BASIC STARTER TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
Starter Fails to Operate	Dead battery or bad connections between starter and battery	Check battery charge and all wires and connections to starter
	Ignition switch faulty or misadjusted	Adjust or replace ignition switch
	Open circuit between starter switch ignition terminal on starter relay	Check and repair wires and connections as necessary
	Starter relay or starter defective	See Testing in STARTER article

	Open solenoid pull-in wire	See Testing in STARTER article
Starter Does Not Operate and Headlights Dim	Weak battery or dead cell	Charge or replace battery as necessary
	Loose or corroded battery connections	Check that battery connections are clean and tight
	Internal ground in starter windings	See Testing in STARTER article
	Grounded starter fields	See Testing in STARTERS
	Armature rubbing on pole shoes	See STARTER article
Starter Turns but Engine Does Not Rotate	Starter clutch slipping	See STARTER article
	Broken clutch housing	See STARTER article
	Pinion shaft rusted or dry	See STARTER article
	Engine basic timing incorrect	See Ignition Timing in TUNE-UP article
	Broken teeth on engine flywheel	Replace flywheel and check for starter pinion gear damage
Starter Will Not Crank Engine	Faulty overrunning clutch	See STARTER article
	Broken clutch housing	See STARTER article
	Broken flywheel teeth	Replace flywheel and check for starter pinion gear damage
	Armature shaft sheared or reduction gear teeth stripped	See STARTER article
	Weak battery	Charge or replace battery as necessary
	Faulty solenoid	See On-Vehicle Tests in STARTER article
	Poor grounds	Check all ground connections for tight and clean connections
	Ignition switch faulty or misadjusted	Adjust or replace ignition switch as necessary
Starter Cranks Engine Slowly	Battery weak or defective	Charge or replace battery as necessary

	Engine overheated	See ENGINE COOLING SYSTEM article
	Engine oil too heavy	Check that proper viscosity oil is used
	Poor battery-to-starter connections	Check that all between battery and starter are clean and tight
	Current draw too low or too high	See Bench Tests in STARTER article
	Bent armature, loose pole shoes screws or worn bearings	See STARTER article
	Burned solenoid contacts	Replace solenoid
	Faulty starter	Replace starter
Starter Engages Engine Only Momentarily	Engine timing too far advanced	See Ignition Timing in TUNE-UP article
	Overrunning clutch not engaging properly	Replace overrunning clutch. See STARTER article
	Broken starter clutch	See STARTER article
	Broken teeth on engine flywheel	Replace flywheel and check starter pinion gear for damage
	Weak drive assembly thrust spring	See STARTER article
	Weak hold-in coil	See Bench Tests in STARTER article
Starter Drive Will Not Engage	Defective point assembly	See Testing in STARTER article
	Poor point assembly ground	See Testing in STARTER article
	Defective pull-in coil	Replace starter solenoid
Starter Relay Does Not Close	Dead battery	Charge or replace battery as necessary
	Faulty wiring	Check all wiring and connections leading to relay
	Neutral safety switch faulty	Replace neutral safety switch
	Starter relay faulty	Replace starter relay

Starter Drive Will Not Disengage	Starter motor loose on mountings	Tighten starter attach bolts
	Worn drive end bushing	See STARTER article
	Damaged engine flywheel teeth	Replace flywheel and starter pinion gear for damage
	Drive yolk return spring broken or missing	Replace return spring
	Faulty ignition switch	Replace ignition switch
	Insufficient clearance between winding leads to solenoid terminal and main contact in solenoid	Replace starter solenoid
	Starter clutch not disengaging	Replace starter clutch
	Ignition starter switch contacts sticking	Replace ignition switch
Starter Relay Operates but Solenoid Does Not	Faulty solenoid switch, switch connections or	Check all wiring between relay and solenoid or replace relay or solenoid as necessary
	Broken lead or loose soldered connections	Repair wire or wire connections as necessary
Solenoid Plunger Vibrates When Switch is Engaged	Weak battery	Charge or replace battery as necessary
	Solenoid contacts corroded	Clean contacts or replace solenoid
	Faulty wiring	Check all wiring leading to solenoid
	Broken connections inside switch cover	Repair connections or replace solenoid
	Open hold-in wire	Replace solenoid
Low Current Draw	Worn brushes or weak	Replace brushes or brush springs as necessary
High Pitched Whine During Cranking Before Engine Fires but Engine Fires and Cranks Normally	Distance too great between starter pinion and flywheel	Align starter or check that correct starter and flywheel are being used
High Pitched Whine After Engine	Distance too small between starter pinion and flywheel	

Fires With Key released. Engine Fires and Cranks Normally	Flywheel runout contributes to the intermittent nature

AIR CONDITIONING & HEAT

AIR CONDITIONING TROUBLE SHOOTING

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BASIC AIR CONDITIONING TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE
Compressor Not Working	• Compressor clutch circuit open. • Compressor clutch coil inoperative. • Poor clutch ground connection. • Fan belts loose. • Thermostatic switch inoperative. • Thermostatic switch not adjusted. • Ambient temperature switch open. • Superheat fuse blown.
Excessive Noise or Vibration	• Missing or loose mounting bolts. • Bad idler pulley bearings. • Fan belts not tightened correctly. • Compressor clutch contacting body. • Excessive system pressure. • Compressor oil level low. • Damaged clutch bearings. • Damaged reed valves. • Damaged compressor.
Insufficient or No Cooling; Compressor Working	• Expansion valve inoperative. • Heater control valve stuck open. • Low system pressure. • Blocked condenser fins. • Blocked evaporator fins. • Vacuum system leak. • Vacuum motors inoperative. • Control cables improperly adjusted. • Restricted air inlet. • Mode doors binding. • Blower motor inoperative. • Temperature above system capacity.

HEATER SYSTEM TROUBLE SHOOTING

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BASIC HEATER SYSTEM TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE
Insufficient, Erratic, or No Heat	• Low Coolant Level • Incorrect thermostat. • Restricted coolant flow through heater core. • Heater hoses plugged. • Misadjusted control cable. • Sticking heater control valve. • Vacuum hose leaking. • Vacuum hose blocked. • Vacuum motors inoperative. • Blocked air inlet. • Inoperative heater blower motor. • Oil residue on heater core fins. • Dirt on heater core fins.
Too Much Heat	• Improperly adjusted cables. • Sticking heater control valve. • No vacuum to heater control valve. • Temperature door stuck open.
Air Flow Changes During Acceleration	• Vacuum system leak. • Bad check valve or reservoir.
Air From Defroster At All Times	• Vacuum system leak. • Improperly adjusted control cables. • Inoperative vacuum motor.
Blower Does Not Operate Correctly	• Blown fuse. • Blower motor windings open. • Resistors burned out. • Motor ground connection loose. • Wiring harness connections loose. • Blower motor switch inoperative. • Blower relay inoperative. • Fan binding or foreign object in housing. • Fan blades broken or bent.

BRAKES

BRAKE SYSTEM TROUBLE SHOOTING

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BRAKE SYSTEM TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
Brakes Pull Left or Right	Incorrect tire pressure	Inflate tires to proper pressure
	Front end out of alignment	See WHEEL ALIGNMENT
	Mismatched tires	Check tires sizes
	Restricted brake lines or hoses	Check hose routing
	Loose or malfunctioning caliper	See DISC BRAKES or BRAKE SYSTEM
	Bent shoe or oily linings	See DRUM BRAKES or BRAKE SYSTEM
	Malfunctioning rear brakes	See DRUM, DISC BRAKES or BRAKE SYSTEM
	Loose suspension parts	See SUSPENSION
Noises Without Brakes Applied	Front linings worn out	Replace linings
	Dust or oil on drums or rotors	See DRUM, DISC BRAKES or BRAKE SYSTEM
Noises With Brakes Applied	Insulator on outboard shoe damaged	See DISC BRAKES or BRAKE SYSTEM
	Incorrect pads or linings	Replace pads or linings
Brake Rough, Chatters or Pulsates	Excessive lateral runout	Check rotor runout
	Parallelism not to specifications	Reface or replace rotor
	Wheel bearings not adjusted	See SUSPENSION
	Rear drums out-of-round	Reface or replace drums
	Disc pad reversed, steel against rotor	Remove and reinstall pad
Excessive Pedal Effort	Malfunctioning power unit	See POWER BRAKES or BRAKE SYSTEM
	Partial system failure	Check fluid and pipes
	Worn disc pad or lining	Replace pad or lining
	Caliper piston stuck or	

	sluggish	See DISC BRAKES or BRAKE SYSTEM
	Master cylinder piston stuck	See MASTER CYLINDERS or BRAKE SYSTEM
	Brake fade due to incorrect pads for linings	Replace pads or linings
	Linings or pads glazed	Replace pads or linings
	Worn drums	Reface or replace drums
Excessive Pedal Travel	Partial brake system failure	Check fluid and pipes
	Insufficient fluid in master cylinder	See MASTER CYLINDERS or BRAKE SYSTEM
	Air trapped in system	See BRAKE BLEEDING or BRAKE SYSTEM
	Rear brakes not adjusted	See Adjustments in DRUM BRAKES or BRAKE SYSTEM
	Bent shoe or lining	See DRUM BRAKES or BRAKE SYSTEM
	Plugged master cylinder cap	See MASTER CYLINDERS or BRAKE SYSTEM
	Improper brake fluid	Replace brake fluid
Pedal Travel Decreasing	Compensating port plugged	See MASTER CYLINDERS or BRAKE SYSTEM
	Swollen cup in master cylinder	See MASTER CYLINDERS or BRAKE SYSTEM
	Master cylinder piston not returning	See MASTER CYLINDERS or BRAKE SYSTEM
	Weak shoe retracting springs	See DRUM BRAKES BRAKE SYSTEM
	Wheel cylinder piston sticking	See DRUM BRAKES or BRAKE SYSTEM
Dragging Brakes	Master cylinder pistons not returning	See MASTER CYLINDERS BRAKE SYSTEM
	Restricted brake lines or hoses	Check line routing
	Incorrect parking brake adjustment	See DRUM BRAKES BRAKE SYSTEM

	Parking Brake cables frozen	See DRUM BRAKES BRAKE SYSTEM
	Incorrect installation of inboard disc pad	Remove and replace correctly
	Power booster output rod too long	See POWER BRAKE UNITS BRAKE SYSTEM
	Brake pedal not returning freely	See DISC, DRUM BRAKES BRAKE SYSTEM
Brakes Grab or Uneven Braking Action	Malfunction of combination valve	See CONTROL VALVE or BRAKE SYSTEM
	Malfunction of power brake unit	See POWER BRAKE UNITS or BRAKE SYSTEM
	Binding brake pedal	See DISC, DRUM BRAKES or BRAKE SYSTEM
Pulsation or Roughness	Uneven pad wear caused by caliper	See DISC BRAKES or BRAKE SYSTEM
	Uneven rotor wear	See DISC BRAKES or BRAKE SYSTEM
	Drums out-of-round	Reface or replace drums

ENGINE MECHANICAL

COOLING SYSTEM TROUBLE SHOOTING

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COOLING SYSTEM TROUBLE SHOOTING

CONDITION	POSSIBLE CAUSE	CORRECTION
Overheating	Coolant Leak	Fill/Pressure Test System
	A/C Condenser Fins Clogged	Remove/Clean Condenser
	Radiator Fins Clogged	Remove/Clean Radiator
	Thermostat Stuck Closed	Replace Thermostat
	Clogged Cooling System Passages	Clean/Flush Cooling System

	Water Pump Malfunction	Replace Water Pump
	Fan Clutch Malfunction	Replace Fan Clutch
	Retarded Ignition Timing	Reset Ignition Timing
	Cooling Fan Malfunction	Test Cooling Fan/ Circuit
	Cooling Fan Motor Malfunction	Test Fan Motor
	Cooling Fan Relay Malfunction	Test Fan Relay
	Faulty Radiator Cap	Replace Radiator Cap
	Broken/Slipping Fan Belt	Replace Fan Belt
	Restricted Exhaust	Repair Exhaust System
Corrosion	Impurities In Coolant	Clean/Flush System
Coolant Leakage	Damaged hose	Replace Hose
	Leaky Water Pump	Replace Water Pump
	Damaged Radiator Seam	Replace/Repair Radiator
	Leaky Thermostat Cover	Replace Thermostat Cover
	Cylinder Head Problem	Check Head/Head Gasket
	Leaky Freeze Plugs	Replace Freeze Plugs
Recovery System Inoperative		
	Loose and/or Defective Radiator Cap	Replace Radiator Cap
	Overflow Tube Clogged and/or Leaking	Repair Tube
	Recovery Bottle Vent Restricted	Clean Vent
No Heater Core Flow		
	Collapsed Heater Hose	Replace Heater Hose
	Plugged Heater Core	Clean/Replace Heater Core
	Faulty Heater Valve	Replace Heater Valve

GASOLINE ENGINE - MECHANICAL TROUBLE SHOOTING

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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

High Oil Pressure	Improper grade of oil	Replace with proper oil
	Oil pressure relief valve stuck closed	Eliminate binding
	Oil pressure sender or gauge faulty	Replace sender or gauge
Noisy Main Bearings	Inadequate oil supply	Check oil delivery to main bearings
	Excessive main bearing clearance	Replace main bearings, See ENGINES
	Excessive crankshaft end play	Replace crankshaft, See ENGINES
	Loose flywheel or torque converter	Tighten attaching bolts
	Loose or damaged vibration damper	Tighten or replace vibration damper
	Crankshaft journals out-of-round	Re-grind crankshaft journals
	Excessive belt tension	Loosen belt tension
Noisy Connecting Rods	Excessive bearing clearance or missing bearing	Replace bearing, See ENGINES
	Crankshaft rod journal out-of-round	Re-grind crankshaft journal
	Misaligned connecting rod or cap	Remove rod or cap and realign
	Incorrectly tightened rod bolts	Remove and re-tighten rod bolts
Noisy Pistons and Rings	Excessive piston-to-bore clearance	Install larger pistons, See ENGINES
	Bore tapered or out-of-round	Rebore block
	Piston ring broken	Replace piston rings, See ENGINES
	Piston pin loose or seized	Replace piston pin, See ENGINES
	Connecting rods misaligned	Realign connecting rods
	Ring side clearance too loose or tight	Replace with larger or smaller rings
	Carbon build-up on piston	Remove carbon
Noisy Valve Train	Worn or bent push rods	Replace push rods, See ENGINES
	Worn rocker arms or bridged pivots	Replace push rods, See ENGINES
	Dirt or chips in valve lifters	Remove lifters and remove dirt/chips
	Excessive valve lifter leak-down	Replace valve lifters, See ENGINES
	Valve lifter face worn	Replace valve lifters, See ENGINES
	Broken or cocked valve springs	replace or reposition springs
	Too much valve stem-to-guide clearance	Replace valve guides, See ENGINES
	Valve bent	Replace valve, See ENGINES
	Loose rocker arms	Retighten rocker arms, See ENGINES
	Excessive valve seat run-out	Reface valve seats, See ENGINES

	Missing valve lock	Install new valve lock
	Excessively worn camshaft lobes	Replace camshaft, See ENGINES
	Plugged valve lifter oil holes	Eliminate restriction or replace lifter
	Faulty valve lifter check ball	Replace lifter check ball, See ENGINES
	Rocker arm nut installed upside down	Remove and reinstall correctly
	Valve lifter incorrect for engine	Remove and replace valve lifters
	Faulty push rod seat or lifter plunger	Replace plunger or push rod
Noisy Valves	Improper valve lash	Re-adjust valve lash, See ENGINES
	Worn or dirty valve lifters	Clean and/or replace lifters
	Worn valve guides	Replace valve guides, See ENGINES
	Excessive valve seat or face run-out	Reface seats or valve face
	Worn camshaft lobes	Replace camshaft, See ENGINES
	Loose rocker arm studs	Re-tighten rocker arm studs, See ENGINES
	Bent push rods	Replace push rods, See ENGINES
	Broken valve springs	Replace valve springs, See ENGINES
Burned,Sticking or Broken Valves	Weak valve springs or warped valves	Replace valves and/or springs, See ENGINES
	Improper lifter clearance	Re-adjust clearance or replace lifters
	Worn guides or improper guide clearance	Replace valve guides, See ENGINES
	Out-of-round valve seats or improper seat width	Re-grind valve seats
	Gum deposits on valve stems, seats or guides	Remove deposits
	Improper spark timing	Re-adjust spark timing
Broken Pistons/Rings	Undersize pistons	Replace with larger pistons, See ENGINES
	Wrong piston rings	Replace with correct rings, See ENGINES
	Out-of-round cylinder bore	Re-bore cylinder bore
	Improper connecting rod alignment	Remove and realign connecting rods
	Excessively worn ring grooves	Replace pistons, See ENGINES
	Improperly assembled piston pins	Re-assemble pin-to -piston, See ENGINES
	Insufficient ring gap clearance	Install new rings, See ENGINES
	Engine overheating	Check cooling system
	Incorrect ignition timing	Re-adjust ignition timing, See TUNE-UP
Excessive Exhaust Noise	Leaks at manifold to head, or to pipe	Replace manifold or pipe gasket
	Exhaust manifold	Replace exhaust

	cracked or broken	manifold, See ENGINES

ENGINE PERFORMANCE

CARBURETOR TROUBLE SHOOTING:

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BASIC COLD START SYMPTOMS TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
Engine Won't Start	Choke not closing	Check choke operation, see FUEL SYSTEMS
	Choke linkage bent	Check linkage, see FUEL SYSTEM
Engine Starts, Then Dies	Choke vacuum kick setting too wide	Check setting and adjust see, FUEL SYSTEMS
	Fast idle RPM too low	Reset RPM to specif- ication, see TUNE-UP
	Fast idle cam index incorrect	Reset fast idle cam index, see FUEL SYSTEMS
	Vacuum leak	Inspect vacuum system for leaks
	Low fuel pump outlet	Repair or replace pump, see FUEL SYSTEMS
	Low carburetor fuel level	Check float setting see FUEL SYSTEM
Engine Quits Under Load	Choke vacuum kick setting incorrect	Reset vacuum kick setting,see FUEL SYSTEMS
	Fast idle cam index incorrect	Reset fast idle cam index, see FUEL SYSTEM
	Incorrect hot fast idle speed RPM	Reset fast idle RPM, see TUNE-UP
Engine Starts, Runs Up,Then Idles, Slowly With Black Smoke	Choke vacuum kick set too narrow	Reset vacuum kick, see FUEL SYSTEMS
	Fast idle cam index	Reset fast idle cam

	incorrect	index, see FUEL SYSTEMS
	Hot fast idle RPM too low	Reset fast idle RPM, see TUNE-UP

BASIC HOT START SYMPTOMS TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
Engine Won't Start	Engine flooded	Allow fuel to evaporate

BASIC COLD ENGINE DRIVEABILITY SYMPTOMS TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
Engine Stalls in Gear	Choke vacuum kick setting incorrect	Reset choke vacuum kick, see FUEL SYSTEMS
	Fast idle RPM incorrect	Reset fast idle RPM, see TUNE-UP
	Fast idle cam index incorrect	Reset fast idle cam see FUEL SYSTEMS
Acceleration Sag or Stall	Defective choke control switch	Replace choke control switch
	Choke vacuum kick setting incorrect	Reset choke vacuum kick see, FUEL SYSTEMS
	Float level incorrect (too low)	Adjust float level, FUEL SYSTEMS
	Accelerator pump defective	Repair or replace pump see FUEL SYSTEMS
	Secondary throttles not closed	Inspect lockout adjustment,see FUEL SYSTEMS
Sag or Stall After Warmup	Defective choke control switch	Replace choke control switch, see FUEL SYSTEMS
	Defective accelerator pump	Replace pump, see FUEL SYSTEMS
	Float level incorrect (too low)	Adjust float level, see FUEL SYSTEMS
Backfiring & Black Smoke	Plugged heat crossover system	Remove restriction

BASIC WARM ENGINE DRIVEABILITY SYMPTOMS TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
Hesitation With Small Amount of Gas Pedal Movement	Vacuum leak	Inspect vacuum lines
	Accelerator pump weak or inoperable	Replace pump, see FUEL SYSTEMS
	Float level setting too low	Reset float level, see,FUEL SYSTEMS
	Metering rods sticking or binding	Inspect and/or replace rods, see FUEL SYSTEMS
	Carburetor idle or transfer system plugged	Inspect system and remove restriction
	Frozen or binding heated air inlet	Inspect heated air door for binding
Hesitation With Heavy Gas Pedal Movement	Defective accelerator pump	Replace pump, see FUEL SYSTEMS
	Metering rod carrier sticking or binding	Remove restriction
	Large vacuum leak	Inspect vacuum system and repair leak
	Float level setting too low	Reset float level, see FUEL SYSTEMS
	Defective fuel pump, lines or filter	Inspect pump, lines and filter
	Air door setting incorrect	Adjust air door setting, see FUEL

DIESEL ENGINE TROUBLE SHOOTING

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NOTE: Diesel engines mechanical diagnosis is the same as gasoline engines for items such as noisy valves, bearings, pistons, etc. The following trouble shooting covers only items pertaining to diesel engines.

BASIC DIESEL ENGINE TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
Engine Won't Crank	Bad battery connections or dead batteries	Check connections and/or replace

		batteries
	Bad starter connections or bad starter	Check connections and/or replace batteries
Engine Cranks Slowly, Won’t Start	Bad battery connections or dead batteries	Check connections and/or replace batteries
	Engine oil too heavy	Replace engine oil
Engine Cranks Normally, But Will Not Start	Glow plugs not functioning	Check glow plug system, see FUEL SYSTEMS
	Glow plug control not functioning	Check controller, see FUEL SYSTEMS
	Fuel not injected into cylinders	Check fuel injectors, see FUEL SYSTEMS
	No fuel to injection pump	Check fuel delivery system
	Fuel filter blocked	Replace fuel filter
	Fuel tank filter blocked	Replace fuel tank filter
	Fuel pump not operating	Check pump operation and/or replace pump
	Fuel return system blocked	Inspect system and remove restriction
	No voltage to fuel solenoid	Check solenoid and connections
	Incorrect or contaminated fuel	Replace fuel
	Incorrect injection pump timing	Re-adjust pump timing, see FUEL SYSTEMS
	Low compression	Check valves, pistons, rings, see ENGINES
	Injection pump malfunction	Inspect and/or replace injection pump
Engine Starts, Won’t Idle	Incorrect slow idle adjustment	Reset idle adjustment, see TUNE-UP
	Fast idle solenoid malfunctioning	Check solenoid and connections
	Fuel return system blocked	Check system and remove restrictions
	Glow plugs go off too soon	See glow plug diagnosis in FUEL SYSTEMS
	Injection pump timing incorrect	Reset pump timing, see FUEL SYSTEMS
	No fuel to injection pump	Check fuel delivery system
	Incorrect or contaminated fuel	Replace fuel
	Low compression	Check valves, piston, rings, see ENGINES
	Injection pump malfunction	Replace injection pump, see FUEL SYSTEMS
	Fuel solenoid closes in RUN position	Check solenoid and connections
Engines Starts/ Idles Rough W/out Smoke or Noise	Incorrect slow idle adjustment	Reset slow idle, see TUNE-UP
	Injection line fuel leaks	Check lines and connections
	Fuel return system blocked	Check lines and connections

	Air in fuel system	Bleed air from system
	Incorrect or contaminated fuel	Replace fuel
	Injector nozzle malfunction	Check nozzles, see FUEL SYSTEMS
Engines Starts and Idles Rough W/out Smoke or Noise, But Clears After Warm-Up	Injection pump timing incorrect	Reset pump timing, see FUEL SYSTEMS
	Engine not fully broken in	Put more miles on engine
	Air in system	Bleed air from system
	Injector nozzle malfunction	Check nozzles, see FUEL SYSTEMS
Engine Idles Correctly, Misfires Above Idle	Blocked fuel filter	Replace fuel filter
	Injection pump timing incorrect	Reset pump timing, see FUEL SYSTEMS
	Incorrect or contaminated fuel	Replace fuel
Engine Won't Return To Idle	Fast idle adjustment incorrect	Reset fast idle, see TUNE-UP
	Internal injection pump malfunction	Replace injection pump, see FUEL SYSTEMS
	External linkage binding	Check linkage and remove binding
Fuel Leaks On Ground	Loose or broken fuel line	Check lines and connections
	Internal injection pump seal leak	Replace injection pump, see FUEL SYSTEMS
Cylinder Knocking Noise	Injector nozzles sticking open	Test injectors, see FUEL SYSTEMS
	Very low nozzle opening pressure	Test injectors and/or replace
Loss of Engine Power	Restricted air intake	Remove restriction
	EGR valve malfunction	Replace EGR valve
	Blocked or damaged exhaust system	Remove restriction and/or replace components
	Blocked fuel tank filter	Replace filter
	Restricted fuel filter	Remove restriction and/or replace filter
	Block vent in gas cap	Remove restriction and/or replace cap
	Tank-to-injection pump fuel supply blocked	Check fuel lines and connections
	Blocked fuel return system	Remove restriction
	Incorrect or contaminated fuel	Replace fuel
	Blocked injector nozzles	Check nozzle for blockage, see FUEL SYSTEMS
	Low compression	Check valves, rings, pistons, see ENGINES
Loud Engine Noise With Black Smoke	Basic timing incorrect	Reset timing, see FUEL SYSTEMS
	EGR valve malfunction	Replace EGR valve
	Internal injection pump malfunction	Replace injection pump, see FUEL SYSTEMS

	Incorrect injector pump housing pressure	Check pressure, see FUEL SYSTEMS
Engine Overheating	Cooling system leaks	Check cooling system and repair leaks
	Belt slipping or damaged	Check tension and/or replace belt
	Thermostat stuck closed	Remove and replace thermostat, see ENGINE COOLING
	Head gasket leaking	Replace head gasket
Oil Light on at Idle	Low oil pump pressure	Check oil pump operation, see ENGINES
	Oil cooler or line restricted	Remove restriction and/or replace cooler
Engine Won't Shut Off	Injector pump fuel solenoid does not return fuel valve to OFF position	Remove and check solenoid and replace if needed
	VACUUM PUMP DIAGNOSIS	
Excessive Noise	Loose pump-to-drive assembly screws	Tighten screws
	Loose tube on pump assembly	Tighten tube
	Valves not functioning properly	Replace valves
Oil Leakage	Loose end plug	Tighten end plug
	Bad seal crimp	Remove and re-crimp seal

FUEL INJECTION TROUBLE SHOOTING

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BASIC FUEL INJECTION TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
Engine Won't Start (Cranks Normally)	Cold start valve inoperative	Test valve and circuit
	Poor connection;vacuum or wiring	Check vacuum and electrical connections
	Contaminated fuel	Test fuel for water or alcohol
	Defective fuel pump relay or circuit	Test relay and wiring
	Battery too low	Charge and test battery

	Low fuel pressure	Test pressure regulator and fuel pump, check for restricted lines and filters
	No distributor reference pulses	Repair ignition system as necessary
	Open coolant temperature sensor circuit	Test sensor and wiring
	Shorted W.O.T. switch in T.P.S.	Disconnect W.O.T. switch, engine should start
	Defective ECM	Replace ECM
	Fuel tank residual pressure valve leaks	Test for fuel pressure drop after shut down
Hard Starting	Disconnected hot air tube to air cleaner	Reconnect tube and test control valve
	Defective Idle Air Control (IAC) valve	Test valve operation and circuit
	Shorted, open or misadjusted T.P.S.	Test and adjust or replace T.P.S.
	EGR valve open	Test EGR valve and control circuit
	Poor Oxygen sensor signal	Test for shorted or circuit
	Incorrect mixture from PCV system	Test PCV for flow, check sealing of oil filter cap
Poor High Speed Operation	Low fuel pump volume	Faulty pump or restricted fuel lines or filters
	Poor MAP sensor signal	Test MAP sensor, vacuum hose and wiring
	Poor Oxygen sensor signal	Test for shorted or open sensor or circuit
	Open coolant temperature sensor circuit	Test sensor and wiring
	Faulty ignition operation	Check wires for cracks or poor connections, test secondary voltage with oscilloscope
	Contaminated fuel	Test fuel for water

		or alcohol
	Intermittent ECM ground	Test ECM ground connection for resistance
	Restricted air cleaner	Replace air cleaner
	Restricted exhaust system	Test for exhaust manifold back pressure
	Poor MAF sensor signal	Check leakage between sensor and manifold
	Poor VSS signal	If tester for ALCL hook-up is available check that VSS reading matches speedometer
Ping or Knock on Acceleration	Poor Knock sensor signal	Test for shorted or open sensor or circuit
	Poor Baro sensor signal	Test for shorted or open sensor or circuit
	Improper ignition timing	See VEHICLE EMISSION CONTROL LABEL (where applicable)
	Check for engine overheating problems	Low coolant, loose belts or electric cooling fan inoperative

NOTE: For additional electronic fuel injection trouble shooting information, see the appropriate article in the ENGINE PERFORMANCE section (not all vehicles have Computer Engine Control articles). Information is provided there for diagnosing fuel system problems on vehicles with electronic fuel injection.

IGNITION SYSTEM TROUBLE SHOOTING

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Ignition Secondary Trouble Shooting Chart

```
┌────────────────────────────────────────────────────────┐
│ START: Visually inspect Spark Plug Wires, Coil Wires,  │
│        Plug Wire Boots, Rotor, and Distributor Cap for │
│        signs of damage.                                │
```

OK

* To test secondary ignition system, modify a Spark Plug by attaching a ground wire to the body of the plug and widening the gap to 1/4-3/8". Disconnect spark plug wire and insert test plug. Ground plug, crank engine, and check for spark.

GOOD SPARK

* If plug sparks, driveability problem is most likely NOT in the ignition system.

NO SPARK

* Remove coil wire from the distributor and attach the modified spark plug. Ground the plug and crank engine while checking for spark.

GOOD SPARK

* If plug has a good spark, the problem is in the plug wires, distributor cap, or rotor. Replace components as necessary.

NO SPARK

* Proceed to the IGNITION PRIMARY TROUBLE SHOOTING CHECK CHART below in this article.

NOT OK

* Repair or replace damaged components as necessary

Ignition Primary Trouble Shooting Chart

START: Visually inspect primary ignition wires for broken, frayed, split, or cut wires. Also check for loose, corroded, or disconnected connectors.

OK

* Check that battery voltage is at least 11.5 volts.

NOT OK

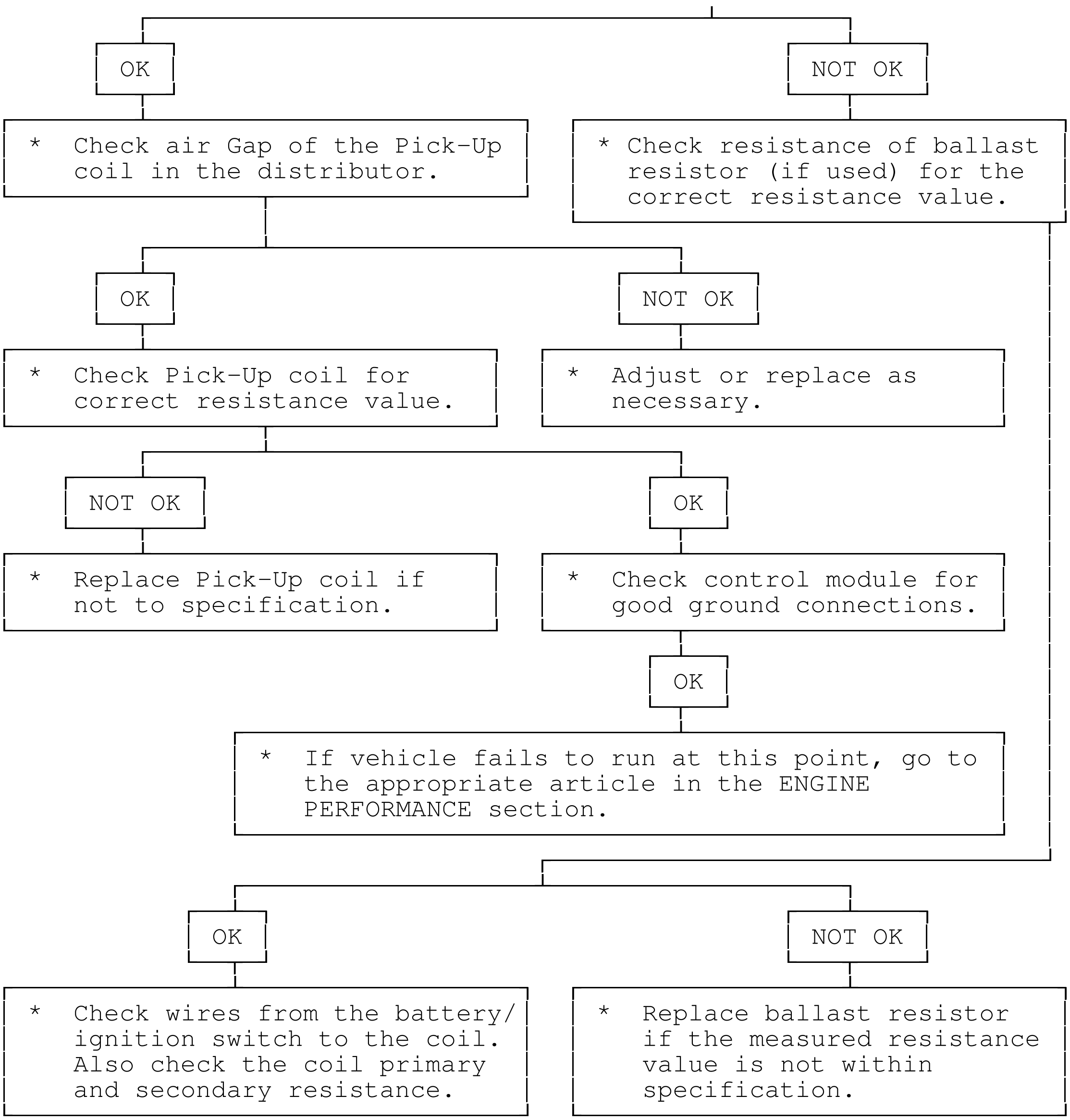
* Replace or recharge the battery.

OK

* Check for battery voltage at the positive terminal of the coil.

NOT OK

* Repair or replace damaged components as necessary.



STARTER TROUBLE SHOOTING

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BASIC STARTER TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
Starter Fails to Operate	Dead battery or bad connections between starter and battery	Check battery charge and all wires and connections to starter

	Ignition switch faulty or misadjusted	Adjust or replace ignition switch
	Open circuit between starter switch ignition terminal on starter relay	Check and repair wires and connections as necessary
	Starter relay or starter defective	See Testing in STARTER article
	Open solenoid pull-in wire	See Testing in STARTER article
Starter Does Not Operate and Headlights Dim	Weak battery or dead cell	Charge or replace battery as necessary
	Loose or corroded battery connections	Check that battery connections are clean and tight
	Internal ground in starter windings	See Testing in STARTER article
	Grounded starter fields	See Testing in STARTERS
	Armature rubbing on pole shoes	See STARTER article
Starter Turns but Engine Does Not Rotate	Starter clutch slipping	See STARTER article
	Broken clutch housing	See STARTER article
	Pinion shaft rusted or dry	See STARTER article
	Engine basic timing incorrect	See Ignition Timing in TUNE-UP article
	Broken teeth on engine flywheel	Replace flywheel and check for starter pinion gear damage
Starter Will Not Crank Engine	Faulty overrunning clutch	See STARTER article
	Broken clutch housing	See STARTER article
	Broken flywheel teeth	Replace flywheel and check for starter pinion gear damage
	Armature shaft sheared or reduction gear teeth stripped	See STARTER article
	Weak battery	Charge or replace battery as necessary
	Faulty solenoid	See On-Vehicle Tests in STARTER article
	Poor grounds	Check all ground

		connections for tight and clean connections
	Ignition switch faulty or misadjusted	Adjust or replace ignition switch as necessary
Starter Cranks Engine Slowly	Battery weak or defective	Charge or replace battery as necessary
	Engine overheated	See ENGINE COOLING SYSTEM article
	Engine oil too heavy	Check that proper viscosity oil is used
	Poor battery-to-starter connections	Check that all between battery and starter are clean and tight
	Current draw too low or too high	See Bench Tests in STARTER article
	Bent armature, loose pole shoes screws or worn bearings	See STARTER article
	Burned solenoid contacts	Replace solenoid
	Faulty starter	Replace starter
Starter Engages Engine Only Momentarily	Engine timing too far advanced	See Ignition Timing in TUNE-UP article
	Overrunning clutch not engaging properly	Replace overrunning clutch. See STARTER article
	Broken starter clutch	See STARTER article
	Broken teeth on engine flywheel	Replace flywheel and check starter pinion gear for damage
	Weak drive assembly thrust spring	See STARTER article
	Weak hold-in coil	See Bench Tests in STARTER article
Starter Drive Will Not Engage	Defective point assembly	See Testing in STARTER article
	Poor point assembly ground	See Testing in STARTER article
	Defective pull-in coil	Replace starter solenoid
Starter Relay	Dead battery	Charge or replace

Does Not Close		battery as necessary
	Faulty wiring	Check all wiring and connections leading to relay
	Neutral safety switch faulty	Replace neutral safety switch
	Starter relay faulty	Replace starter relay
Starter Drive Will Not Disengage	Starter motor loose on mountings	Tighten starter attach bolts
	Worn drive end bushing	See STARTER article
	Damaged engine flywheel teeth	Replace flywheel and starter pinion gear for damage
	Drive yolk return spring broken or missing	Replace return spring
	Faulty ignition switch	Replace ignition switch
	Insufficient clearance between winding leads to solenoid terminal and main contact in solenoid	Replace starter solenoid
	Starter clutch not disengaging	Replace starter clutch
	Ignition starter switch contacts sticking	Replace ignition switch
Starter Relay Operates but Solenoid Does Not	Faulty solenoid switch, switch connections or	Check all wiring between relay and solenoid or replace relay or solenoid as necessary
	Broken lead or loose soldered connections	Repair wire or wire connections as necessary
Solenoid Plunger Vibrates When Switch is Engaged	Weak battery	Charge or replace battery as necessary
	Solenoid contacts corroded	Clean contacts or replace solenoid
	Faulty wiring	Check all wiring leading to solenoid
	Broken connections inside switch cover	Repair connections or replace solenoid
	Open hold-in wire	Replace solenoid
Low Current Draw	Worn brushes or weak	Replace brushes or brush springs as necessary

High Pitched Whine During Cranking Before Engine Fires but Engine Fires and Cranks Normally	Distance too great between starter pinion and flywheel	Align starter or check that correct starter and flywheel are being used
High Pitched Whine After Engine Fires With Key released. Engine Fires and Cranks Normally	Distance too small between starter pinion and flywheel Flywheel runout contributes to the intermittent nature	

TUNE-UP TROUBLE SHOOTING - GAS ENGINE VEHICLES

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BASIC SPARK PLUG TROUBLE SHOOTING CHARTS

CONDITION	POSSIBLE CAUSE	CORRECTION
Normal Spark Plug Condition	Light Tan or Gray deposits	No Action
	Electrode not burned or fouled	No Action
	Gap tolerance not changed	No Action
Cold Fouling or Carbon Deposits	Overrich air/fuel mixture	Adjust air/fuel mixture, see ENGINE PERFORMANCE section
	Faulty choke	Replace choke assembly, see ENGINE PERFORMANCE section
	Clogged air filter	Clean and/or replace air filter
	Incorrect idle speed or dirty carburetor	Reset idle speed and/ or clean carburetor
	Faulty ignition wires	Replace ignition wiring
	Prolonged operation at idle	Shut engine off during long idle
	Sticking valves or worn valve guide seals	Check valve train
Wet Fouling or Oil Deposits	Worn rings and pistons	Install new rings and pistons

	Excessive cylinder wear	Rebore or replace block
	Excessive valve guide clearance	Worn or loose bearing
Gap Bridged	Deposits in combustion chamber becoming fused to electrode	Clean combustion chamber of deposits
Blistered Electrode	Engine overheating	Check cooling system
	Wrong type of fuel	Replace with correct fuel
	Loose spark plugs	Retighten spark plugs
	Over-advanced ignition timing	Reset ignition timing see ENGINE PERFORMANCE
Pre-Ignition or Melted Electrodes	Incorrect type of fuel	Replace with correct fuel
	Incorrect ignition timing	Reset ignition timing see ENGINE PERFORMANCE
	Burned valves	Replace valves
	Engine Overheating	Check cooling system
	Wrong type of spark plug, too hot	Replace with correct spark plug, see ENGINE PERFORMANCE
Chipped Insulators	Severe detonation	Check for over-advanced timing or combustion
	Improper gapping procedure	Re-gap spark plugs
Rust Colored Deposits	Additives in unleaded fuel	Try different fuel brand
Water In Combus-tion Chamber	Blown head gasket or cracked head	Repair or replace head or head gasket

NOTE: Before diagnosing an electronic ignition system, ensure that all wiring is connected properly between distributor, wiring connector and spark plugs. Ignition problem will show up either as: Engine Will Not Start or Engine Runs Rough.

BASIC ELECTRONIC IGNITION TROUBLE SHOOTING CHARTS

CONDITION	POSSIBLE CAUSE	CORRECTION
Engine Won't Start	Open circuit between distributor and bulkhead connector	Repair circuit
	Open circuit between bulkhead connector and	Repair circuit

	ignition switch	
	Open circuit between ignition switch and starter solenoid	Repair circuit
Engine Runs Rough	Fuel lines leaking or clogged	Tighten fitting, remove restriction
	Initial timing incorrect	Reset ignition timing see ENGINE PERFORMANCE
	Centrifugal advance malfunction	Repair distributor advance
	Defective spark plugs or wiring	Replace plugs or plug wiring
Component Failure	Spark arc-over on cap, rotor or coil	Replace cap, rotor or or coil
	Defective pick-up coil	Replace pick-up coil
	Defective ignition coil	Replace ignition coil
	Defective vacuum unit	Replace vacuum unit
	Defective control module	Replace control module

BASIC ELECTRONIC IGNITION TROUBLE SHOOTING CHARTS - USING OSCILLOSCOPE PATTERNS

CONDITION	POSSIBLE CAUSE	CORRECTION
Firing Voltage Lines are the Same, but Abnormally High	Retarded ignition timing	Reset ignition timing, see ENGINE PERFORMANCE section
	Fuel mixture too lean	Readjust carburetor, see ENGINE PERFORMANCE
	High resistance in coil wire	Replace coil wire
	Corrosion in coil tower terminal	Clean and/or replace coil
	Corrosion in distributor coil terminal	Clean and/or replace distributor cap
Firing Voltage Lines are the Same but Abnormally Low	Fuel mixture too rich	Readjust carburetor, see ENGINE PERFORMANCE
	Breaks in coil wire causing arcing	Replace coil wire
	Cracked coil tower causing arcing	Replace coil
	Low coil output	Replace coil
	Low engine compression	Determine cause and

		repair
One or More, But Not All Firing Voltage Lines are Higher Than Others	Carburetor idle mixture not balanced	Readjust carburetor, see ENGINE PERFORMANCE
	EGR valve stuck open	Clean and/or replace valve
	High resistance in spark plug wires	Replace spark plug wires
	Cracked or broken spark plug insulator	Replace spark plugs
	Intake vacuum leak	Repair leak
	Defective spark plugs	Replace spark plugs
	Corroded spark plug terminals	Replace spark plugs
One or More, But Not All Firing Voltage Lines Are Lower Than Others	Curb idle mixture not balanced	Readjust carburetor, see ENGINE PERFORMANCE
	Breaks in plug wires causing arcing	Replace plug wires
	Cracked coil tower causing arcing	Replace coil
	Low compression	Determine cause and repair
	Defective spark plugs	Replace spark plugs
	Corroded spark plugs	Replace spark plugs
Cylinders Not Firing	Cracked distributor cap terminals	Replace distributor cap
	Shorted spark plug wire	Determine cause and repair
	Mechanical problem in engine	Determine cause and repair
	Defective spark plugs	Replace spark plugs
	Spark plugs fouled	Replace spark plugs

BASIC DRIVEABILITY PROBLEMS TROUBLE SHOOTING TABLE

CONDITION	POSSIBLE CAUSE	CORRECTION
Hard Starting	Binding carburetor linkage	Eliminate binding
	Binding choke linkage	Eliminate binding
	Binding choke piston	Eliminate binding
	Restricted choke vacuum	Check vacuum lines for blockage

	Worn or dirty needle valve and seat	Clean carburetor, see ENGINE PERFORMANCE
	Float sticking	Readjust or replace float see the ENGINE PERFORMANCE section
	Incorrect choke adjustment	Reset choke adjustment see ENGINE PERFORMANCE
	Defective coil	Replace coil
	Improper spark plug gap	Regap spark plugs
	Incorrect ignition timing	Reset ignition timing see ENGINE PERFORMANCE
Detonation	Over-advanced ignition timing	Reset ignition timing see ENGINE PERFORMANCE
	Defective spark plugs	Replace spark plugs
	Fuel lines clogged	Clean fuel lines
	EGR system malfunction	Check and repair EGR system
	PCV system malfunction	Repair PCV system
	Vacuum leaks	Check and repair vacuum system
	Loose fan belts	Tighten or replace fan belts, see ENGINE PERFORMANCE
	Restricted airflow	Remove restriction
	Vacuum advance malfunction	Check distributor operation
Dieseling	Binding carburetor linkage	Eliminate binding
	Binding throttle linkage	Eliminate blinding
	Binding choke linkage or fast idle cam	Eliminate binding
	Defective idle solenoid	Replace idle solenoid see ENGINE PERFORMANCE
	Improper base idle speed	Reset idle speed, see see ENGINE PERFORMANCE
	Incorrect ignition timing	Reset ignition timing see ENGINE PERFORMANCE
	Incorrect idle mixture setting	Reset idle mixture, see ENGINE PERFORMANCE
Faulty Acceleration	Incorrect ignition timing	Reset ignition timing see ENGINE PERFORMANCE

	Engine cold and choke too lean	Adjust choke and allow engine to warm-up
	Defective spark plugs	Replace spark plugs
	Defective coil	Replace coil
Faulty Low Speed Operation	Clogged idle transfer slots	Clean idle transfer slots, see FUEL
	Restricted idle air bleeds and passages	Disassemble and clean carburetor, see FUEL
	Clogged air cleaner	Replace air filter
	Defective spark plugs	Replace spark plugs
	Defective ignition wires	Replace ignition wire see ENGINE PERFORMANCE
	Defective distributor cap	Replace distributor cap
Faulty High Speed Operation	Incorrect ignition timing	Reset ignition timing see ENGINE PERFORMANCE
	Defective distributor centrifugal advance	Replace advance mechanism
	Defective distributor vacuum advance	Replace advance unit
	Incorrect spark plugs or plug gap	Check gap and/or replace spark plugs
	Faulty choke operation	Check choke and repair as required
	Clogged vacuum passages	Remove restrictions
	Improper size or clogged main jet	Check jet size and clean, see FUEL
	Restricted air cleaner	Check filter and replace as necessary
	Defective distributor cap, rotor or coil	Replace cap, rotor or coil
Misfire at All Speeds	Defective spark plugs	Replace spark plugs
	Defective spark plug wires	Replace spark plug wires
	Defective distributor cap, rotor, or coil	Replace cap, rotor, or coil
	Cracked or broken vacuum hoses	Replace vacuum hoses

	Vacuum leaks	Repair vacuum leaks
	Fuel lines clogged	Remove restriction
Hesitation	Cracked or broken vacuum hoses	Replace vacuum hoses
	Vacuum leaks	Repair Vacuum leaks
	Binding carburetor linkage	Eliminate binding
	Binding throttle linkage	Eliminate binding
	Binding choke linkage or fast idle cam	Eliminate binding
	Improper float setting	Readjust float setting, see FUEL
	Cracked or broken ignition wires	Replace ignition wires
Rough idle, Missing or Stalling	Incorrect curb idle or fast idle speed	Reset idle speed, see see ENGINE PERFORMANCE
	Incorrect basic timing	Reset ignition timing see ENGINE PERFORMANCE
	Improper idle mixture adjustment	Reset idle mixture, see ENGINE PERFORMANCE
	Improper feedback system operation	Check feedback system see ENGINE PERFORMANCE
	Incorrect spark plug gap	Reset spark plug gap, see ENGINE PERFORMANCE
	Moisture in ignition components	Dry components
	Loose or broken ignition wires	Replace ignition wires
	Damaged distributor cap or or rotor	Replace distributor cap or rotor
	Faulty ignition coil	Replace ignition coil
	Fuel filter clogged or worn	Replace fuel filter
	Damaged idle mixture screw	Replace idle mixture screw, see FUEL
	Improper fast idle cam adjustment	Reset fast idle cam adjustment, see TUNE- see ENGINE PERFORMANCE
	Improper EGR valve operation	Replace EGR valve
	Faulty PCV valve air flow	Replace PCV valve
	Choke binding or improper choke setting	Reset choke or eliminate binding

	Vacuum leak	Repair vacuum leak
	Improper float bowl fuel level	Reset float adjustment, see FUEL
	Clogged air bleed or idle passages	Clean carburetor passages, see FUEL
	Clogged or worn air cleaner filter	Replace air filter
	Faulty choke vacuum diaphragm	Replace diaphragm, see ENGINE PERFORMANCE
	Exhaust manifold heat valve inoperative	Replace heat valve
	Improper distributor spark advance	Check distributor operation
	Leaking valves or valve components	Check and repair valvetrain
	Improper carburetor mounting	Remove and remount carburetor
	Excessive play in distributor shaft	Replace distributor
	Loose or corroded wiring connections	Repair or replace as required
Engine Surges	Improper PCV valve airflow	Replace PCV valve
	Vacuum leaks	Repair vacuum leaks
	Clogged air bleeds	Remove restriction
	EGR valve malfunction	Replace EGR valve
	Restricted air cleaner filter	Replace air filter
	Cracked or broken vacuum hoses	Replace vacuum hoses
	Cracked or broken ignition wires	Replace ignition wires
	Vacuum advance malfunction	Check unit and replace as necessary
	Defective or fouled spark plugs	Replace spark plugs
Ping or Spark Knock	Incorrect ignition timing	Reset ignition timing see ENGINE PERFORMANCE
	Distributor centrifugal or vacuum advance malfunction	Check operation and replace as necessary
	Carburetor setting too lean	Readjust mixture

		setting, see ENGINE PERFORMANCE
	Vacuum leak	Eliminate vacuum leak
	EGR valve malfunction	Replace EGR valve
Poor Gasoline Mileage	Cracked or broken vacuum hoses	Replace vacuum hoses
	Vacuum leaks	Repair vacuum leaks
	Defective ignition wires	Replace wires
	Incorrect choke setting	Readjust setting, see ENGINE PERFORMANCE
	Defective vacuum advance	Replace vacuum advance
	Defective spark plugs	Replace spark plugs
	Binding carburetor power piston	Eliminate binding
	Dirt in carburetor jets	Clean and/or replace jets
	Incorrect float adjustment	Readjust float setting, see FUEL
	Defective power valve	Replace power valve, see ENGINE PERFORMANCE
	Incorrect idle speed	Readjust idle speed
Engine Stalls	Improper float level	Readjust float level
	Leaking needle valve and seat	Replace needle valve and seat
	Vacuum leaks	Eliminate vacuum leaks

VACUUM PUMP - DIESEL TROUBLE SHOOTING

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NOTE: Diesel engines mechanical diagnosis is the same as gasoline engines for items such as noisy valves, bearings, pistons, etc. The following trouble shooting covers only items pertaining to diesel engines.

VACUUM PUMP (DIESEL) TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE	CORRECTION

Excessive Noise	Loose pump-to-drive assembly screws	Tighten screws
	Loose tube on pump assembly	Tighten tube
	Valves not functioning properly	Replace valves
Oil Leakage	Loose end plug	Tighten end plug
	Bad seal crimp	Remove and re-crimp seal

MANUAL TRANSMISSION

MANUAL TRANSMISSION TROUBLE SHOOTING

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MANUAL TRANSMISSION/TRANSAXLE TROUBLE SHOOTING

Condition	Possible Cause
Noisy In Forward Gears	.Low gear oil level, .Loose bell housing bolts, .Worn bearings or gears
Clunk On Deceleration (FWD Only)	.Loose engine mounts, .Worn inboard CV joints, .Worn differential pinion shaft, .Side gear hub counterbore in case worn oversize
Gear Clash When Shifting Forward Gears	.Clutch Out Of Adjustment, .Shift linkage damaged or out of adjustment, .Gears or synchronizers damaged, .Low gear oil level
Transmission Noisy When Moving (RWD Only) Quiet In Neutral With Clutch Engaged	.Worn rear outputshaft bearing
Gear Rattle	.Worn bearings, .Wrong gear oil, .Low gear oil, .Worn gears
Steady Ticking At Idle (Increases With RPM)	.Broken tooth on gear
Gear Clash When Shifting Forward Gears	.Worn or broken synchronizers
Loud Whine In Reverse	.Normal condition (1)

Noise When Stepping On Clutch	.Bad release bearing, .Worn pilot bearing
Ticking Or Screeching As Clutch Is Engaged	.Faulty release bearing, .Uneven pressure plate fingers
Click Or Snap When Clutch Is Engaged	.Worn clutch fork, .Worn or broken front bearing retainer
Transmission Shifts Hard	.Clutch not releasing, .Shift mechanism binding, .Clutch installed backwards
Will Not Shift Into One Gear, Shifts Into All Others	.Bent shift fork, .Worn detent balls
Locked Into Gear, Cannot Shift	.Clutch adjustment, .Worn detent balls
Transmission Jumps Out Of Gear	.Pilot bearing worn, .Bent shift fork, .Worn gear teeth or face .Excessive gear train end play .Worn synchronizers .Missing detent ball spring .Shift mechanism worn or out of adjustment .Engine or transmission mount bolts loose or out of adjustment .Transmission not aligned
Shift Lever Rattle	.Worn shift lever or detents .Worn shift forks .Worn synchronizers sleeve
Shift Lever Hops Under Acceleration	.Worn engine or transmission mounts

(1) - Most units use spur cut gears in reverse and are noisy

POWERTRAIN

CLUTCH TROUBLE SHOOTING

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BASIC CLUTCH TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
Chattering or Grabbing	Incorrect clutch adjustment	Adjust clutch
	Oil, grease or glaze on facings	Disassemble and clean or replace
	Loose "U" joint flange	See DRIVE AXLES article
	Worn input shaft spline	Replace input shaft
	Binding pressure plate	Replace pressure plate
	Binding release lever	See CLUTCH article
	Binding clutch disc hub	Replace clutch disc
	Unequal pressure plate contact	Replace worn/misaligned components
	Loose/bent clutch disc	Replace clutch disc
	Incorrect transmission alignment	Realign transmission
	Worn pressure plate, disc or flywheel	Replace damaged components
	Broken or weak pressure springs	Replace pressure plate
	Sticking clutch pedal	Lubricate clutch pedal & linkage
	Incorrect clutch disc facing	Replace clutch disc
	Engine loose in chassis	Tighten all mounting bolts
Failure to Release	Oil or grease on clutch facings	Clean or replace clutch clutch disc
	Incorrect release lever or pedal adjustment	See CLUTCH article
	Worn or broken clutch facings	Replace clutch disc
	Bent clutch disc or pressure plate	Replace damaged components
	Clutch disc hub binding on input shaft	Clean or replace clutch disc and/or input shaft
	Binding pilot bearing	Replace pilot bearing
	Sticking release bearing sleeve	Replace release bearing and/or sleeve
	Binding clutch cable	See CLUTCH article

	Defective clutch master	Replace master cylinder
	Defective clutch slave	Replace slave cylinder
	Air in hydraulic system	Bleed hydraulic system
Rattling	Weak or broken release lever spring	Replace spring and check alignment
	Damaged pressure plate	Replace pressure plate
	Broken clutch return spring	Replace return spring
	Worn splines on clutch disc or input shaft	Replace clutch disc and/or input shaft
	Worn clutch release bearing	Replace release bearing
	Dry or worn pilot bearing	Lubricate or replace pilot bearing
	Unequal release lever contact	Align or replace release lever
	Incorrect pedal free play	Adjust free play
	Warped or damaged clutch disc	Replace damaged components
Slipping	Pressure springs worn or	Release pressure plate
	Oily, greasy or worn facings	Clean or replace clutch disc
	Incorrect clutch alignment	Realign clutch assembly
	Warped clutch disc or pressure plate	Replace damaged components
	Binding release levers or clutch pedal	Lubricate and/or replace release components
Squeaking	Worn or damaged release	Replace release bearing
	Dry or worn pilot or release bearing	Lubricate or replace assembly
	Pilot bearing turning in crankshaft	Replace pilot bearing and/or crankshaft
	Worn input shaft bearing	Replace bearing and seal
	Incorrect transmission alignment	Realign transmission
	Dry release fork between pivot	Lubricate release fork and pivot
Heavy and/or Stiff Pedal	Sticking release bearing sleeve	Replace release bearing and/or sleeve

	Dry or binding clutch pedal hub	Lubricate and align components
	Floor mat interference with pedal	Lay mat flat in proper area
	Dry or binding ball/fork pivots	Lubricate and align components
	Faulty clutch cable	Replace clutch cable
Noisy Clutch Pedal	Faulty interlock switch	Replace interlock switch
	Self-adjuster ratchet noise	Lubricate or replace self-adjuster
	Speed control interlock switch	Lubricate or replace interlock switch
Clutch Pedal Sticks Down	Binding clutch cable	See CLUTCH article
	Springs weak in pressure plate	Replace pressure plate
	Binding in clutch linkage	Lubricate and free linkage
Noisy	Dry release bearing	Lubricate or replace release bearing
	Dry or worn pilot bearing	Lubricate or replace bearing
	Worn input shaft bearing	Replace bearing
Transmission Click	Weak springs in pressure plate	Replace pressure plate
	Release fork loose on ball stud	Replace release fork and/or ball stud
	Oil on clutch disc damper	Replace clutch disc
	Broken spring in slave cylinder	Replace slave cylinder

DRIVE AXLE - NOISE DIAGNOSIS

Unrelated Noises

Some driveline trouble symptoms are also common to the engine, transmission, wheel bearings, tires, and other parts of the vehicle. Ensure cause of trouble actually is in the drive axle before adjusting, repairing, or replacing any of its parts.

Non-Drive Axle Noises

A few conditions can sound just like drive axle noise and have to be considered in pre-diagnosis. The 4 most common noises are exhaust, tires, CV/universal joints and wheel trim rings.

In certain conditions, the pitch of the exhaust gases may sound like gear whine. At other times, it may be mistaken for a wheel bearing rumble.

Tires, especially radial and snow, can have a high-pitched tread whine or roar, similar to gear noise. Also, some non-standard tires with an unusual tread construction may emit a roar or whine.

Defective CV/universal joints may cause clicking noises or excessive driveline play that can be improperly diagnosed as drive axle problems.

Trim and moldings also can cause a whistling or whining noise. Ensure none of these components are causing the noise before disassembling the drive axle.

Gear Noise

A "howling" or "whining" noise from the ring and pinion gear can be caused by an improper gear pattern, gear damage, or improper bearing preload. It can occur at various speeds and driving conditions, or it can be continuous.

Before disassembling axle to diagnose and correct gear noise, make sure that tires, exhaust, and vehicle trim have been checked as possible causes.

Chuckle

This is a particular rattling noise that sounds like a stick against the spokes of a spinning bicycle wheel. It occurs while decelerating from 40 MPH and usually can be heard until vehicle comes to a complete stop. The frequency varies with the speed of the vehicle.

A chuckle that occurs on the driving phase is usually caused by excessive clearance due to differential gear wear, or by a damaged tooth on the coast side of the pinion or ring gear. Even a very small tooth nick or a ridge on the edge of a gear tooth is enough the cause the noise.

This condition can be corrected simply by cleaning the gear tooth nick or ridge with a small grinding wheel. If either gear is damaged or scored badly, the gear set must be replaced. If metal has broken loose, the carrier and housing must be cleaned to remove particles that could cause damage.

Knock

This is very similar to a chuckle, though it may be louder, and occur on acceleration or deceleration. Knock can be caused by a gear tooth that is damaged on the drive side of the ring and pinion gears. Ring gear bolts that are hitting the carrier casting can cause knock. Knock can also be due to excessive end play in the axle shafts.

Clunk

Clunk is a metallic noise heard when an automatic transmission is engaged in Reverse or Drive, or when throttle is applied or released. It is caused by backlash somewhere in the driveline, but not necessarily in the axle. To determine whether driveline clunk is caused by the axle, check the total axle backlash as follows:

1) Raise vehicle on a frame or twinpost hoist so that drive wheels are free. Clamp a bar between axle companion flange and a part of the frame or body so that flange cannot move.

2) On conventional drive axles, lock the left wheel to keep it from turning. On all models, turn the right wheel slowly until it is felt to be in Drive condition. Hold a chalk marker on side of tire about 12" from center of wheel. Turn wheel in the opposite direction until it is again felt to be in Drive condition.

3) Measure the length of the chalk mark, which is the total

axle backlash. If backlash is one inch or less, drive axle is not the source of clunk noise.

Bearing Whine

Bearing whine is a high-pitched sound similar to a whistle. It is usually caused by malfunctioning pinion bearings. Pinion bearings operate at drive shaft speed. Roller wheel bearings may whine in a similar manner if they run completely dry of lubricant. Bearing noise will occur at all driving speeds. This distinguishes it from gear whine, which usually comes and goes as speed changes.

Bearing Rumble

Bearing rumble sounds like marbles being tumbled. It is usually caused by a malfunctioning wheel bearing. The lower pitch is because the wheel bearing turns at only about 1/3 of drive shaft speed.

Chatter On Turns

This is a condition where the entire front or rear of vehicle vibrates when vehicle is moving. The vibration is plainly felt as well as heard. Extra differential thrust washers installed during axle repair can cause a condition of partial lock-up that creates this chatter.

Axle Shaft Noise

Axle shaft noise is similar to gear noise and pinion bearing whine. Axle shaft bearing noise will normally distinguish itself from gear noise by occurring in all driving modes (Drive, cruise, coast and float), and will persist with transmission in Neutral while vehicle is moving at problem speed.

If vehicle displays this noise condition, remove suspect axle shafts, replace wheel seals and install a new set of bearings. Re-evaluate vehicle for noise before removing any internal components.

Vibration

Vibration is a high-frequency trembling, shaking or grinding condition (felt or heard) that may be constant or variable in level and can occur during the total operating speed range of the vehicle.

The types of vibrations that can be felt in the vehicle can be divided into 3 main groups:

* Vibrations of various unbalanced rotating parts of the vehicle.
* Resonance vibrations of the body and frame structures caused by rotating of unbalanced parts.
* Tip-in moans of resonance vibrations from stressed engine or exhaust system mounts or driveline flexing modes.

DRIVE AXLE - RWD TROUBLE SHOOTING

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DRIVE AXLE (RWD) TROUBLE SHOOTING

CONDITION	POSSIBLE CAUSE	CORRECTION

Knocking or Clunking		
	Differential Side Gear Clearance	Check Clearance
	Worn Pinion Shaft	Replace Pinion Shaft
	Axle Shaft End Play	Check End Play
	Missing Gear Teeth	Check Differential/ Replace Gear
	Wrong Axle Backlash	Check Backlash
	Misaligned Driveline	Realign Driveline
Clinking During Engagement		
	Side Gear Clearance	Check Clearance
	Ring and Pinion Backlash	Check Backlash
	Worn/Loose Pinion Shaft	Replace Shaft/Bearing
	Bad "U" Joint	Replace "U" Joint
	Sticking Slip Yoke	Lube Slip Yoke
	Broken Rear Axle Mount	Replace Mount
	Loose Drive Shaft Flange	Check Flange
Click/Chatter On Turns		
	Differential Side Gear Clearance	Check Clearance
	Wrong Turn On Plates (1)	Replace Clutch Plates
	Wrong Differential Lubricant (1)	Change Lubricant
Knock Or Click	Flat Spot on Rear Wheel Bearing	Replace Wheel Bearing
Low Vibration At All Speeds		
	Faulty Wheel Bearing	Replace Wheel Bearing
	Faulty "U" Joint	Replace "U" Joint
	Faulty Drive Shaft	Balance Drive Shaft
	Faulty Companion Flange	Replace Flange
	Faulty Slip Yoke Flange	Replace Flange

(1) - Limited slip differential only.

FWD AXLE SHAFTS & CV JOINTS TROUBLE SHOOTING

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BASIC FWD AXLE SHAFTS & CV JOINTS TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE
Grease Leaks	CV boot torn or cracked
Clicking Noise on Cornering	Damaged outer CV
Clunk Noise on Acceleration	Damaged inner CV
Vibration or Shudder on Acceleration	Sticking, damaged or worn CV Misalignment or spring height

STEERING & SUSPENSION

MANUAL STEERING GEAR TROUBLE SHOOTING

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BASIC MANUAL STEERING GEAR TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
Rattle or Chucking Noise in Rack and Pinion	Rack and pinion mounting bracket loose	Tighten all mounting bolts
	Lack of/or incorrect lubricant	Correct as necessary
	Steering gear mounting bolts loose	Tighten all mounting bolts
Excessive Play	Front wheel bearing improperly adjusted	See FRONT SUSPENSION article
	Loose or worn steering linkage	See STEERING LINKAGE article
	Loose or worn steering gear shift	See MANUAL STEERING GEAR article
	Steering arm loose on gear shaft	See MANUAL STEERING GEAR article
	Steering gear housing bolts loose	Tighten all mounting bolts
	Steering gear adjustment too loose	See MANUAL STEERING GEAR article
	Steering arms loose on	Tighten and check

	knuckles	steering linkage
	Rack and pinion mounting loose	Tighten all mounting bolts
	Rack and pinion out of adjustment	See adjustment in STEERING article
	Tie rod end loose	Tighten and check steering linkage
	Excessive Pitman shaft-to-ball nut lash	Repair as necessary
Poor Returnability	Lack of lubricant in ball joint or linkage	Lubricate and service systems
	Binding in linkage or ball joints	See STEERING LINKAGE and SUSPENSION article
	Improper front end alignment	See WHEEL ALIGNMENT article
	Improper tire pressure	Inflate to proper pressure
	Tie rod binding	Inflate to proper pressure
	Shaft seal rubbing shaft	See STEERING COLUMN article
Excessive Vertical Motion	Improper tire pressure	Inflate to proper pressure
	Tires, wheels or rotors out of balance	Balance tires then check wheels and rotors
	Worn or faulty shock absorbers	Check and replace if necessary
	Loose tie rod ends or steering	Tighten or replace if necessary
	Loose or worn wheel bearings	See SUSPENSION article
Steering Pulls to One Side	Improper tire pressure	Inflate to proper pressure
	Front tires are different sizes	Rotate or replace if necessary
	Wheel bearings not adjusted properly	See FRONT SUSPENSION article
	Bent or broken suspension components	See FRONT SUSPENSION article
	Improper wheel alignment	See WHEEL ALIGNMENT article

	Brakes dragging	See BRAKES article
Instability	Low or uneven tire pressure	Inflate to proper pressure
	Loose or worn wheel bearings	See FRONT SUSPENSION article
	Loose or worn idler arm bushing	See FRONT SUSPENSION article
	Loose or worn strut bushings	See FRONT SUSPENSION article
	Incorrect front wheel alignment	See WHEEL ALIGNMENT article
	Steering gear not centered	See MANUAL STEERING GEARS article
	Springs or shock	Check and replace if necessary
	Improper cross shaft	See MANUAL STEERING GEARS article

POWER STEERING TROUBLE SHOOTING

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BASIC POWER STEERING TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
Rattle or Chucking Noise	Pressure hoses touching engine parts	Adjust to proper clearance
	Loose Pitman shaft	Adjust or replace if necessary
	Tie rods ends or Pitman arm loose	Tighten and check system
	Rack and pinion mounts loose	Tighten all mounting bolts
	Free play in worm and	See POWER STEERING GEAR article
	Loose sector shaft or thrust bearing adjustment	See POWER STEERING GEAR
	Free play in pot coupling	See STEERING COLUMN article

	Worn shaft serrations	See STEERING COLUMN article
Growl in Steering Pump	Excessive pressure in hoses	Restricted hoses, see POWER STEERING GEAR article
	Scored pressure plates	See POWER STEERING GEAR article
	Scored thrust plates or rotor	See POWER STEERING GEAR article
	Extreme wear of cam ring	See POWER STEERING GEAR article
Rattle in Steering Pump	Vanes not installed	See POWER STEERING PUMP article
	Vanes sticking in rotor	See POWER STEERING PUMP article
Swish noise in Pump	Defective flow control valve	See POWER STEERING PUMP article
Groan in Steering Pump	Air in fluid	See POWER STEERING PUMP article
	Poor pressure hose connection	Tighten and check, replace if necessary
Squawk When Turning	Damper "O" ring on valve spool cut	See POWER STEERING PUMP article
Moan or Whine in Pump	Pump shaft bearing scored	Replace bearing and fluid
	Air in fluid or fluid level low	See POWER STEERING PUMP article
	Hose or column grounded	Check and replace if necessary
	Cover "O" ring missing or damaged	See POWER STEERING PUMP article
	Valve cover baffle missing or damaged	See POWER STEERING PUMP article
	Interference of components in pump	See POWER STEERING PUMP article
	Loose or poor bracket alignment	Correct or replace if necessary
Hissing When Parking	Internal leakage in steering gear	Check valved assembly first
Chirp in Steering Pump	Loose or worn power steering belt	Adjust or replace if necessary
Buzzing When Not Steering	Noisy pump	See POWER STEERING PUMP article

	Free play in steering shaft bearing	See STEERING COLUMN article
	Bearing loose on shaft serrations	See STEERING COLUMN article
Clicking Noise in Pump	Pump slippers too long	See POWER STEERING PUMP article
	Broken slipper springs	See POWER STEERING PUMP article
	Excessive wear or nicked rotors	See POWER STEERING PUMP article
	Damaged cam contour	See POWER STEERING PUMP article
Poor Return of Wheel	Wheel rubbing against turn signal	See STEERING COLUMN SWITCHES article
	Flange rubbing steering gear adjuster	See STEERING COLUMN article
	Tight or frozen steering shaft bearing	See STEERING COLUMN article
	Steering gear out of adjustment	See POWER STEERING GEAR article
	Sticking or plugged spool valve	See POWER STEERING PUMP article
	Improper front end alignment	See WHEEL ALIGNMENT article
	Wheel bearings worn or loose	See FRONT SUSPENSION article
	Ties rods or ball joints binding	Check and replace if necessary
	Intermediate shaft joints binding	See STEERING COLUMN article
	Kinked pressure hoses	Correct or replace if necessary
	Loose housing head spanner nut	See POWER STEERING GEAR article
	Damaged valve lever	See POWER STEERING GEAR article
	Sector shaft adjusted too tight	See ADJUSTMENTS in POWER STEERING GEAR article
	Worm thrust bearing adjusted too tight	See ADJUSTMENTS in POWER STEERING GEAR article
	Reaction ring sticking in cylinder	See POWER STEERING GEAR article

	Reaction ring sticking in housing head	See POWER STEERING GEAR article
	Steering pump internal leakage	See POWER STEERING PUMP article
	Steering gear-to-column misalignment	See STEERING COLUMN article
	Lack of lubrication in linkage	Service front suspension
	Lack of lubrication in ball joints	Service front suspension
Increased Effort When Turning 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 to low	Adjust to correct setting
	Air in pump fluid system	See POWER STEERING PUMP article
	Pump output low	See POWER STEERING PUMP article
	Steering gear malfunctioning	See POWER STEERING GEAR article
Wheel Surges or Jerks	Low fluid level	Check and fill to proper level
	Loose fan belt	Adjust or replace if necessary
	Insufficient pump pressure	See POWER STEERING PUMP article
	Sticky flow control valve	See POWER STEERING PUMP article
	Linkage hitting oil pan at full turn	Replace bent components
Kick Back or Free Play	Air in pump fluid system	See POWER STEERING PUMP article
	Worn poppet valve in steering gear	See POWER STEERING PUMP article
	Excessive over center lash	See POWER STEERING GEAR article
	Thrust bearing out of adjustment	See POWER STEERING GEAR article

	Free play in pot coupling	See POWER STEERING PUMP article
	Steering gear coupling loose on shaft	See POWER STEERING PUMP article
	Steering disc mounting bolts loose	Tighten or replace if necessary
	Coupling loose on worm shaft	Tighten or replace if necessary
	Improper sector shaft adjustment	See POWER STEERING GEAR article
	Excessive worm piston side play	See POWER STEERING GEAR article
	Damaged valve lever	See POWER STEERING GEAR article
	Universal joint loose	Tighten or replace if necessary
	Defective rotary valve	See POWER STEERING GEAR article
No Power When Parking	Sticking flow control valve	See POWER STEERING PUMP article
	Insufficient pump pressure output	See POWER STEERING PUMP article
	Excessive internal pump leakage	See POWER STEERING PUMP article
	Excessive internal gear leakage	See POWER STEERING PUMP article
	Flange rubs against gear adjust plug	See STEERING COLUMN article
	Loose pump belt	Adjust or replace if necessary
	Low fluid level	Check and add proper amount of fluid
	Engine idle too low	Adjust to correct setting
	Steering gear-to-column misaligned	See STEERING COLUMN article
No Power, Left Turn	Left turn reaction seal "O" ring worn	See POWER STEERING GEAR article
	Left turn reaction seal damaged/missing	See POWER STEERING GEAR article
	Cylinder head "O" ring damaged	See POWER STEERING PUMP article

No Power, Right Turns	Column pot coupling bottomed	See STEERING COLUMN article
	Right turn reaction seal "O" ring worn	See POWER STEERING GEAR article
	Right turn reaction seal damaged	See POWER STEERING GEAR article
	Internal leakage through piston end plug	See POWER STEERING GEAR article
	Internal leakage through side plugs	See POWER STEERING GEAR article
Lack of Effort in Turning	Left and/or right reaction seal sticking in cylinder head	Replace, see POWER STEERING GEAR article
Wanders to One Side	Front end alignment incorrect	See WHEEL ALIGNMENT article
	Unbalanced steering gear valve	See POWER STEERING GEAR article
Low Pressure Due to Steering Pump	Flow control valve stuck or inoperative	See POWER STEERING PUMP article
	Pressure plate not flat against cam ring	See POWER STEERING PUMP article
	Extreme wear of cam ring	Replace and check adjustments
	Scored plate, thrust plate or rotor	See POWER STEERING PUMP article
	Vanes not installed properly	See POWER STEERING PUMP article
	Vanes sticking in rotor slots	See POWER STEERING PUMP article
	Cracked/broken thrust or pressure plate	See POWER STEERING PUMP article

STEERING COLUMN TROUBLE SHOOTING

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BASIC STEERING COLUMN TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
Noise in Steering	Coupling pulled apart	See STEERING COLUMNS article

	Column not correctly aligned	See STEERING COLUMNS article
	Broken lower joint	Replace joint
	Horn contact ring not	See STEERING COLUMN article
	Bearing not lubricated	See STEERING COLUMN article
	Shaft snap ring not properly seated	Reseat or replace snap ring
	Plastic spherical joint not lubricated	See STEERING COLUMN article
	Shroud or housing loose	Tighten holding screws
	Lock plate retaining ring not seated	See STEERING COLUMN article
	Loose sight shield	Tighten holding screws
High Steering Shaft Effort	Column assembly misaligned	See STEERING COLUMN article
	Improperly installed dust shield	Adjust or replace
	Tight steering universal joint	See STEERING COLUMN article
High Shift Effort	Column is out of alignment	See STEERING COLUMN article
	Improperly installed dust shield	Adjust or replace
	Seals or bearings not lubricated	See STEERING COLUMNS article
	Mounting bracket screws too long	Replace with new shorter screws
	Burrs on shift tube	Remove burrs or replace tube
	Lower bowl bearing assembled wrong	See STEERING COLUMN article
	Shift tube bent or broken	Replace as necessary
	Improper adjustment of shift levers	See STEERING COLUMN article
Improper Trans. Shifting	Sheared shift tube joint	Replace as necessary
	Sheared lower shaft lever	Replace as necessary
	Improper shift lever adjustment	See STEERING COLUMN article

	Improper gate plate adjustment	See STEERING COLUMN article
Excess Play in Column	Instrument panel bracket bolts loose	Tighten bolts and check bracket
	Broken weld nut on jacket	See STEERING COLUMN article
	Instrument bracket capsule sheared	See STEERING COLUMN article
	Column bracket/jacket bolts loose	Tighten bolts and check bracket
Steering Locks in Gear	Release lever mechanism	See STEERING COLUMN article

SUSPENSION TROUBLE SHOOTING

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BASIC SUSPENSION TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
Front End Noise	Loose or worn wheel	See Wheel Bearing Adjustment in SUSPENSION
	Worn shocks or shock mountings	Replace struts or strut mountings
	Worn struts or strut mountings	Replace struts or strut mountings
	Loose or worn lower control arm	See SUSPENSION
	Loose steering gear-to-frame bolts	See STEERING
	Worn control arm bushings	See SUSPENSION
	Ball joints not lubricated	Lubricate ball joints & see Ball Joint Checking in SUSPENSION
Front Wheel Shake, Shimmy, or Vibration	Tires or wheels out of balance	Check tire balance
	Incorrect wheel alignment	See WHEEL ALIGNMENT
	Drive shaft unbalanced	Check drive shaft balance

	Loose or worn wheel bearings	See WHEEL ALIGNMENT
	Loose or worn tie rod ends	See SUSPENSION
	Worn upper ball joints	See Ball Joint Checking in SUSPENSION
	Worn shock absorbers	Replace shock absorbers
	Worn strut bushings	Replace strut bushings
Car Pulls to One Side	Mismatched or uneven tires	Check tire condition
	Broken or sagging springs	See SUSPENSION
	Loose or worn strut bushings	See SUSPENSION
	Improper wheel alignment	See WHEEL ALIGNMENT
	Improper rear axle alignment	Check rear axle alignment
	Power steering gear unbalanced	See STEERING
	Front brakes dragging	See BRAKES
Abnormal Tire Wear	Unbalanced tires	Check tire balance & rotation
	Sagging or broken springs	See SUSPENSION
	Incorrect front end alignment	See WHEEL ALIGNMENT
	Faulty shock absorbers	Replace chock absorbers
Scuffed Tires	Toe-In incorrect	See WHEEL ALIGNMENT
	Suspension arm bent or twisted	See appropriate SUSPENSION article
Springs Bottom or Sag	Bent or broken springs	See SUSPENSION
	Leaking or worn shock absorbers	Replace shock absorbers
	Frame misalignment	Check frame for damage
Spring Noises	Loose "U" Bolts	See SUSPENSION
	Loose or worn bushings	See SUSPENSION
	Worn or missing interliners	See SUSPENSION
Shock Absorber Noise	Loose shock mountings	Check & tighten mountings
	Worn bushings	Replace bushings

	Air in system	Bleed air from system
	Undercoating on shocks	Remove undercoating
Car Leans or Sways on Corners	Loose stabilizer bar	See SUSPENSION
	Faulty shocks or mountings	Replace shocks or mountings
	Broken or sagging springs	See SUSPENSION
Shock Absorbers Leaking	Worn seals or reservoir tube crimped	See SUSPENSION
Broken Springs	Loose "U" bolts	See SUSPENSION
	Inoperative shock absorbers	Replace shock absorbers

WHEEL ALIGNMENT TROUBLE SHOOTING

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 WHEEL ALIGNMENT TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
Premature Tire Wear	Improper tire inflation	Check tire pressure
	Front alignment out of tolerance	See ALIGNMENT SPECS in WHEEL ALIGNMENT section
	Suspension components worn	See SUSPENSION section
	Steering system components worn	See STEERING section
	Improper standing height	See WHEEL ALIGNMENT
	Uneven or sagging springs	See SUSPENSION section
	Bent wheel	See WHEEL ALIGNMENT
	Improper torsion bar adjustment	See SUSPENSION section
	Loose or worn wheel bearings	See WHEEL BEARING ADJ. in SUSPENSION section
	Worn or defective shock	Replace shock absorbers
	Tires out of balance	Check tire balance
Pulls to One Side	Improper tire inflation	Check tire pressure
	Brake dragging	See BRAKE section

	Mismatched tires	See WHEEL ALIGNMENT
	Broken or sagging spring	See SUSPENSION section
	Broken torsion bar	See SUSPENSION section
	Power steering valve not centered	See STEERING section
	Front alignment out of tolerance	See WHEEL ALIGNMENT section
	Defective wheel bearing	See WHEEL BEARINGS in SUSPENSION section
	Uneven sway bar links	See SUSPENSION section
	Frame bent	Check for frame damage
	Steering system bushing worn	See STEERING section
Hard Steering	Idler arm bushing too tight	See STEERING LINKAGE in STEERING section
	Ball joint tight or seized	See SUSPENSION section
	Steering linkage too tight	See STEERING LINKAGE in STEERING section
	Power steering fluid low	Add proper amount of fluid
	Power steering drive belt loose	See STEERING section
	Power steering pump defective	See STEERING section
	Steering gear out of adjustment	See STEERING section
	Incorrect wheel alignment	See WHEEL ALIGNMENT
	Damaged steering gear	See STEERING section
	Damaged suspension	See SUSPENSION section
	Bent steering knuckle or supports	See SUSPENSION section
Vehicle "Wanders"	Strut rod or control arm bushing worn	See SUSPENSION section
	Loose or worn wheel bearings	See WHEEL BEARINGS in SUSPENSION section
	Improper tire inflation	Check tire pressure
	Stabilizer bar missing or defective	See SUSPENSION section

	Wheel alignment out of tolerance	See Adjustment in WHEEL ALIGNMENT section
	Broken spring	See SUSPENSION section
	Defective shock absorbers	Replace shock absorbers
	Worn steering & suspension components	See SUSPENSION section
Front End Shimmy	Tire out of balance/round	Check tire balance
	Excessive wheel runout	See WHEEL ALIGNMENT
	Insufficient or improper caster	See WHEEL ALIGNMENT section
	Worn suspension or steering components	See SUSPENSION section
	Defective shock absorbers	Replace shock absorber
	Wheel bearings worn or loose	See WHEEL BEARING ADJ. in SUSPENSION section
	Power steering reaction Bracket loose	See STEERING section
	Steering gear box (rack) mounting loose	See STEERING section
	Steering gear adjustment loose	See STEERING section
	Worn spherical joints	See SUSPENSION section
Toe-In Not Adjustable	Lower control arm bent	See SUSPENSION section
	Frame bent	Check frame for damage
Camber Not Adjustable	Control arm bent	See SUSPENSION section
	Frame bent	Check frame for damage
	Hub & bearing not seated properly	See SUSPENSION section

1997 ENGINE PERFORMANCE
General Motors Corp. - Vacuum Diagrams

Chevrolet; Blazer, S10 Pickup
GMC; Jimmy, Sonoma
Oldsmobile; Bravada

INTRODUCTION

This article contains underhood views or schematics of vacuum hose routing. Use these vacuum diagrams during the visual inspection of BASIC DIAGNOSTIC PROCEDURES. See the appropriate F - BASIC TESTING article. This will assist in identifying improperly routed vacuum hoses, which can cause driveability and/or computer-indicated malfunction.

F - BASIC TESTING - 2.2L
F - BASIC TESTING - 4.3L

EMISSION CONTROL DEVICE ABBREVIATIONS

EMISSION CONTROL DEVICE ABBREVIATION TABLE

Abbreviation	Emission Control Device
ACSRY	Accessory
CNSTR	Canister
CSI	Central Sequential Port Injection
EGR	Exhaust Gas Recirculation
EGR SOL	EGR Solenoid
EVAP	Evaporative
HVAC	Heating, Ventilation & A/C System
MAP	Manifold Air Pressure Sensor
PCV	Positive Crankcase Ventilation
REG	Regulator
SFI	Sequential Fuel Injection
SOL	Solenoid
VAC	Vacuum
VLV	Valve

VACUUM DIAGRAMS

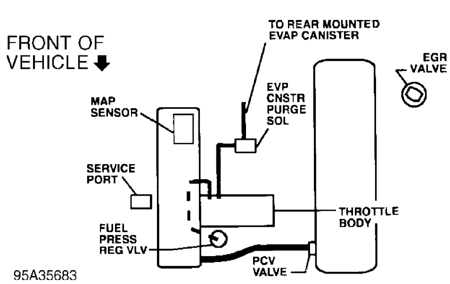


Fig. 1: 2.2L 2WD SFI
Courtesy of General Motors Corp.

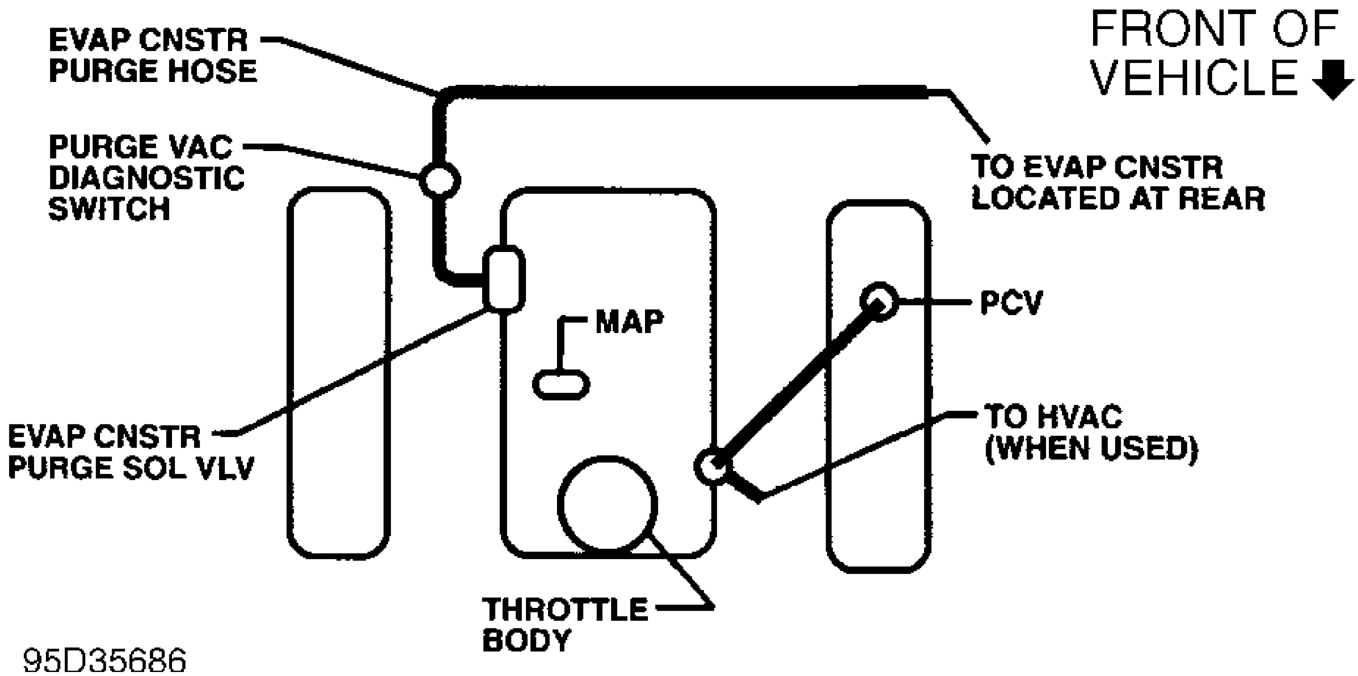


Fig. 2: 4.3L CSI
Courtesy of General Motors Corp.

WAVEFORMS - INJECTOR PATTERN TUTORIAL

1997 Chevrolet Blazer

GENERAL INFORMATION
Waveforms - Injector Pattern Tutorial

* PLEASE READ THIS FIRST *

NOTE: This article is intended for general information purposes only. This information may not apply to all makes and models.

PURPOSE OF THIS ARTICLE

Learning how to interpret injector drive patterns from a Lab Scope can be like learning ignition patterns all over again. This article exists to ease you into becoming a skilled injector pattern interpreter.

You will learn:

* How a DVOM and noid light fall short of a lab scope.
* The two types of injector driver circuits, voltage controlled & current controlled.
* The two ways injector circuits can be wired, constant ground/switched power & constant power/switched ground.
* The two different pattern types you can use to diagnose with, voltage & current.
* All the valuable details injector patterns can reveal.

SCOPE OF THIS ARTICLE

This is NOT a manufacturer specific article. All different types of systems are covered here, regardless of the specific year/make/model/engine.

The reason for such broad coverage is because there are only a few basic ways to operate a solenoid-type injector. By understanding the fundamental principles, you will understand all the major points of injector patterns you encounter. Of course there are minor differences in each specific system, but that is where a waveform library helps out.

If this is confusing, consider a secondary ignition pattern. Even though there are many different implementations, each still has a primary voltage turn-on, firing line, spark line, etc.

If specific waveforms are available in On Demand for the engine and vehicle you are working on, you will find them in the Engine Performance section under the Engine Performance category.

IS A LAB SCOPE NECESSARY?

INTRODUCTION

You probably have several tools at your disposal to diagnose injector circuits. But you might have questioned "Is a lab scope necessary to do a thorough job, or will a set of noid lights and a multifunction DVOM do just as well?"

In the following text, we are going to look at what noid lights and DVOMs do best, do not do very well, and when they can mislead you. As you might suspect, the lab scope, with its ability to look inside an active circuit, comes to the rescue by answering for the deficiencies of these other tools.

OVERVIEW OF NOID LIGHT

The noid light is an excellent "quick and dirty" tool. It can usually be hooked to a fuel injector harness fast and the flashing light is easy to understand. It is a dependable way to identify a no-pulse situation.

However, a noid light can be very deceptive in two cases:

* If the wrong one is used for the circuit being tested. Beware: Just because a connector on a noid light fits the harness does not mean it is the right one.
* If an injector driver is weak or a minor voltage drop is present.

Use the Right Noid Light

In the following text we will look at what can happen if the wrong noid light is used, why there are different types of noid lights (besides differences with connectors), how to identify the types of noid lights, and how to know the right type to use.

First, let's discuss what can happen if the incorrect type of noid light is used. You might see:

* A dimly flashing light when it should be normal.
* A normal flashing light when it should be dim.

A noid light will flash dim if used on a lower voltage circuit than it was designed for. A normally operating circuit would appear underpowered, which could be misinterpreted as the cause of a fuel starvation problem.

Here are the two circuit types that could cause this problem:

* Circuits with external injector resistors. Used predominately on some Asian & European systems, they are used to reduce the available voltage to an injector in order to limit the current flow. This lower voltage can cause a dim flash on a noid light designed for full voltage.
* Circuits with current controlled injector drivers (e.g. "Peak and Hold"). Basically, this type of driver allows a quick burst of voltage/current to flow and then throttles it back significantly for the remainder of the pulse width duration. If a noid light was designed for the other type of driver (voltage controlled, e.g. "Saturated"), it will appear dim because it is expecting full voltage/current to flow for the entire duration of the pulse width.

Let's move to the other situation where a noid light flashes normally when it should be dim. This could occur if a more sensitive noid light is used on a higher voltage/amperage circuit that was weakened enough to cause problems (but not outright broken). A circuit with an actual problem would thus appear normal.

Let's look at why. A noid light does not come close to consuming as much amperage as an injector solenoid. If there is a partial driver failure or a minor voltage drop in the injector circuit, there can be adequate amperage to fully operate the noid light BUT NOT ENOUGH TO OPERATE THE INJECTOR.

If this is not clear, picture a battery with a lot of corrosion on the terminals. Say there is enough corrosion that the starter motor will not operate; it only clicks. Now imagine turning on the headlights (with the ignition in the RUN position). You find they light normally and are fully bright. This is the same idea as noid light: There is a problem, but enough amp flow exists to operate the headlights ("noid light"), but not the starter motor ("injector").

How do you identify and avoid all these situations? By using the correct type of noid light. This requires that you understanding the types of injector circuits that your noid lights are designed for. There are three. They are:

* Systems with a voltage controlled injector driver. Another way to say it: The noid light is designed for a circuit with a "high" resistance injector (generally 12 ohms or above).
* Systems with a current controlled injector driver. Another way to say it: The noid light is designed for a circuit with a low resistance injector (generally less than 12 ohms) without an external injector resistor.
* Systems with a voltage controlled injector driver and an external injector resistor. Another way of saying it: The noid light is designed for a circuit with a low resistance injector (generally less than 12 ohms) and an external injector resistor.

NOTE: Some noid lights can meet both the second and third categories simultaneously.

If you are not sure which type of circuit your noid light is designed for, plug it into a known good car and check out the results. If it flashes normally during cranking, determine the circuit type by finding out injector resistance and if an external injector resistor is used. You now know enough to identify the type of injector circuit. Label the noid light appropriately.

Next time you need to use a noid light for diagnosis, determine what type of injector circuit you are dealing with and select the appropriate noid light.

Of course, if you suspect a no-pulse condition you could plug in any one whose connector fit without fear of misdiagnosis. This is because it is unimportant if the flashing light is dim or bright. It is only important that it flashes.

In any cases of doubt regarding the use of a noid light, a lab scope will overcome all inherent weaknesses.

OVERVIEW OF DVOM

A DVOM is typically used to check injector resistance and available voltage at the injector. Some techs also use it check injector on-time either with a built-in feature or by using the dwell/duty function.

There are situations where the DVOM performs these checks dependably, and other situations where it can deceive you. It is important to be aware of these strengths and weaknesses. We will cover the topics above in the following text.

Checking Injector Resistance

If a short in an injector coil winding is constant, an ohmmeter will accurately identify the lower resistance. The same is true with an open winding. Unfortunately, an intermittent short is an exception. A faulty injector with an intermittent short will show "good" if the ohmmeter cannot force the short to occur during testing.

Alcohol in fuel typically causes an intermittent short, happening only when the injector coil is hot and loaded by a current high enough to jump the air gap between two bare windings or to break down any oxides that may have formed between them.

When you measure resistance with an ohmmeter, you are only applying a small current of a few milliamps. This is nowhere near enough to load the coil sufficiently to detect most problems. As a result, most resistance checks identify intermittently shorted injectors as being normal.

There are two methods to get around this limitation. The first is to purchase an tool that checks injector coil windings under full load. The Kent-Moore J-39021 is such a tool, though there are others. The Kent-Moore costs around $240 at the time of this writing and works on many different manufacturer's systems.

The second method is to use a lab scope. Remember, a lab scope allows you to see the regular operation of a circuit in real time. If an injector is having an short or intermittent short, the lab scope will show it.

Checking Available Voltage At the Injector

Verifying a fuel injector has the proper voltage to operate correctly is good diagnostic technique. Finding an open circuit on the feed circuit like a broken wire or connector is an accurate check with a DVOM. Unfortunately, finding an intermittent or excessive resistance problem with a DVOM is unreliable.

Let's explore this drawback. Remember that a voltage drop due to excessive resistance will only occur when a circuit is operating? Since the injector circuit is only operating for a few milliseconds at a time, a DVOM will only see a potential fault for a few milliseconds. The remaining 90+% of the time the unloaded injector circuit will show normal battery voltage.

Since DVOMs update their display roughly two to five times a second, all measurements in between are averaged. Because a potential voltage drop is visible for such a small amount of time, it gets "averaged out", causing you to miss it.

Only a DVOM that has a "min-max" function that checks EVERY MILLISECOND will catch this fault consistently (if used in that mode). The Fluke 87 among others has this capability.

A "min-max" DVOM with a lower frequency of checking (100 millisecond) can miss the fault because it will probably check when the injector is not on. This is especially true with current controlled driver circuits. The Fluke 88, among others fall into this category.

Outside of using a Fluke 87 (or equivalent) in the 1 mS "min-max" mode, the only way to catch a voltage drop fault is with a lab scope. You will be able to see a voltage drop as it happens.

One final note. It is important to be aware that an injector circuit with a solenoid resistor will always show a voltage drop when the circuit is energized. This is somewhat obvious and normal; it is a designed-in voltage drop. What can be unexpected is what we already covered--a voltage drop disappears when the circuit is unloaded. The unloaded injector circuit will show normal battery voltage at the injector. Remember this and do not get confused.

Checking Injector On-Time With Built-In Function

Several DVOMs have a feature that allows them to measure injector on-time (mS pulse width). While they are accurate and fast to hookup, they have three limitations you should be aware of:

* They only work on voltage controlled injector drivers (e.g "Saturated Switch"), NOT on current controlled injector drivers (e.g. "Peak & Hold").
* A few unusual conditions can cause inaccurate readings.
* Varying engine speeds can result in inaccurate readings.

Regarding the first limitation, DVOMs need a well-defined injector pulse in order to determine when the injector turns ON and OFF. Voltage controlled drivers provide this because of their simple switch-like operation. They completely close the circuit for the entire duration of the pulse. This is easy for the DVOM to interpret.

The other type of driver, the current controlled type, start off well by completely closing the circuit (until the injector pintle opens), but then they throttle back the voltage/current for the duration of the pulse. The DVOM understands the beginning of the pulse but it cannot figure out the throttling action. In other words, it cannot distinguish the throttling from an open circuit (de-energized) condition.

Yet current controlled injectors will still yield a millisecond on-time reading on these DVOMs. You will find it is also always the same, regardless of the operating conditions. This is because it is only measuring the initial completely-closed circuit on-time, which always takes the same amount of time (to lift the injector pintle off its seat). So even though you get a reading, it is useless.

The second limitation is that a few erratic conditions can cause inaccurate readings. This is because of a DVOM's slow display rate; roughly two to five times a second. As we covered earlier, measurements in between display updates get averaged. So conditions like skipped injector pulses or intermittent long/short injector pulses tend to get "averaged out", which will cause you to miss important details.

The last limitation is that varying engine speeds can result in inaccurate readings. This is caused by the quickly shifting injector on-time as the engine load varies, or the RPM moves from a state of acceleration to stabilization, or similar situations. It too is caused by the averaging of all measurements in between DVOM display periods. You can avoid this by checking on-time when there are no RPM or load changes.

A lab scope allows you to overcome each one of these limitations.

Checking Injector On-Time With Dwell Or Duty

If no tool is available to directly measure injector millisecond on-time measurement, some techs use a simple DVOM dwell or duty cycle functions as a replacement.

While this is an approach of last resort, it does provide benefits. We will discuss the strengths and weaknesses in a moment, but first we will look at how a duty cycle meter and dwell meter work.

How A Duty Cycle Meter and Dwell Meter Work

All readings are obtained by comparing how long something has been OFF to how long it has been ON in a fixed time period. A dwell meter and duty cycle meter actually come up with the same answers using different scales. You can convert freely between them. See RELATIONSHIP BETWEEN DWELL & DUTY CYCLE READINGS TABLE.

The DVOM display updates roughly one time a second, although some DVOMs can be a little faster or slower. All measurements during this update period are tallied inside the DVOM as ON time or OFF time, and then the total ratio is displayed as either a percentage (duty cycle) or degrees (dwell meter).

For example, let's say a DVOM had an update rate of exactly 1 second (1000 milliseconds). Let's also say that it has been measuring/tallying an injector circuit that had been ON a total of 250 mS out of the 1000 mS. That is a ratio of one-quarter, which would be displayed as 25% duty cycle or 15° dwell (six-cylinder scale). Note that most duty cycle meters can reverse the readings by selecting the positive or negative slope to trigger on. If this reading were reversed, a duty cycle meter would display 75%.

Strengths of Dwell/Duty Meter

The obvious strength of a dwell/duty meter is that you can compare injector on-time against a known-good reading. This is the only practical way to use a dwell/duty meter, but requires you to have known-good values to compare against.

Another strength is that you can roughly convert injector mS on-time into dwell reading with some computations.

A final strength is that because the meter averages everything together it does not miss anything (though this is also a severe weakness that we will look at later). If an injector has a fault where it occasionally skips a pulse, the meter registers it and the reading changes accordingly.

Let's go back to figuring out dwell/duty readings by using injector on-time specification. This is not generally practical, but we will cover it for completeness. You NEED to know three things:

* Injector mS on-time specification.
* Engine RPM when specification is valid.
* How many times the injectors fire per crankshaft revolution.

The first two are self-explanatory. The last one may require some research into whether it is a bank-fire type that injects every 360° of crankshaft rotation, a bank-fire that injects every 720°, or an SFI that injects every 720°. Many manufacturers do not release this data so you may have to figure it out yourself with a frequency meter.

Here are the four complete steps to convert millisecond on-time:

1) Determine the injector pulse width and RPM it was obtained at. Let's say the specification is for one millisecond of on-time at a hot idle of 600 RPM.

2) Determine injector firing method for the complete 4 stroke cycle. Let's say this is a 360° bank-fired, meaning an injector fires each and every crankshaft revolution.

3) Determine how many times the injector will fire at the specified engine speed (600 RPM) in a fixed time period. We will use 100 milliseconds because it is easy to use.

Six hundred crankshaft Revolutions Per Minute (RPM) divided by 60 seconds equals 10 revolutions per second.

Multiplying 10 times .100 yields one; the crankshaft turns one time in 100 milliseconds. With exactly one crankshaft rotation in 100 milliseconds, we know that the injector fires exactly one time.

4) Determine the ratio of injector on-time vs. off-time in the fixed time period, then figure duty cycle and/or dwell. The injector fires one time for a total of one millisecond in any given 100 millisecond period.

One hundred minus one equals 99. We have a 99% duty cycle. If we wanted to know the dwell (on 6 cylinder scale), multiple 99% times .6; this equals 59.4° dwell.

Weaknesses of Dwell/Duty Meter

The weaknesses are significant. First, there is no one-to-one correspondence to actual mS on-time. No manufacturer releases dwell/duty data, and it is time-consuming to convert the mS on-time readings. Besides, there can be a large degree of error because the conversion forces you to assume that the injector(s) are always firing at the same rate for the same period of time. This can be a dangerous assumption.

Second, all level of detail is lost in the averaging process. This is the primary weakness. You cannot see the details you need to make a confident diagnosis.

Here is one example. Imagine a vehicle that has a faulty injector driver that occasionally skips an injector pulse. Every skipped pulse means that that cylinder does not fire, thus unburned O2 gets pushed into the exhaust and passes the O2 sensor. The O2 sensor indicates lean, so the computer fattens up the mixture to compensate for the supposed "lean" condition.

A connected dwell/duty meter would see the fattened pulse width but would also see the skipped pulses. It would tally both and likely come back with a reading that indicated the "pulse width" was within specification because the rich mixture and missing pulses offset each other.

This situation is not a far-fetched scenario. Some early GM

3800 engines were suffering from exactly this. The point is that a lack of detail could cause misdiagnosis.

As you might have guessed, a lab scope would not miss this.

RELATIONSHIP BETWEEN DWELL & DUTY CYCLE READINGS TABLE (1)

Dwell Meter (2)	Duty Cycle Meter
1°	1%
15°	25%
30°	50%
45°	75%
60°	100%

(1) - These are just some examples for your understanding. It is okay to fill in the gaps.
(2) - Dwell meter on the six-cylinder scale.

THE TWO TYPES OF INJECTOR DRIVERS

OVERVIEW

There are two types of transistor driver circuits used to operate electric fuel injectors: voltage controlled and current controlled. The voltage controlled type is sometimes called a "saturated switch" driver, while the current controlled type is sometimes known as a "peak and hold" driver.

The basic difference between the two is the total resistance of the injector circuit. Roughly speaking, if a particular leg in an injector circuit has total resistance of 12 or more ohms, a voltage control driver is used. If less than 12 ohms, a current control driver is used.

It is a question of what is going to do the job of limiting the current flow in the injector circuit; the inherent "high" resistance in the injector circuit, or the transistor driver. Without some form of control, the current flow through the injector would cause the solenoid coil to overheat and result in a damaged injector.

VOLTAGE CONTROLLED CIRCUIT ("SATURATED SWITCH")

The voltage controlled driver inside the computer operates much like a simple switch because it does not need to worry about limiting current flow. Recall, this driver typically requires injector circuits with a total leg resistance of 12 or more ohms.

The driver is either ON, closing/completing the circuit (eliminating the voltage-drop), or OFF, opening the circuit (causing a total voltage drop).

Some manufacturers call it a "saturated switch" driver. This is because when switched ON, the driver allows the magnetic field in the injector to build to saturation. This is the same "saturation" property that you are familiar with for an ignition coil.

There are two ways "high" resistance can be built into an injector circuit to limit current flow. One method uses an external solenoid resistor and a low resistance injector, while the other uses a high resistance injector without the solenoid resistor. See the left side of Fig. 1.

In terms of injection opening time, the external resistor voltage controlled circuit is somewhat faster than the voltage controlled high resistance injector circuit. The trend, however, seems to be moving toward use of this latter type of circuit due to its lower cost and reliability. The ECU can compensate for slower opening times by increasing injector pulse width accordingly.

NOTE: Never apply battery voltage directly across a low resistance injector. This will cause injector damage from solenoid coil overheating.

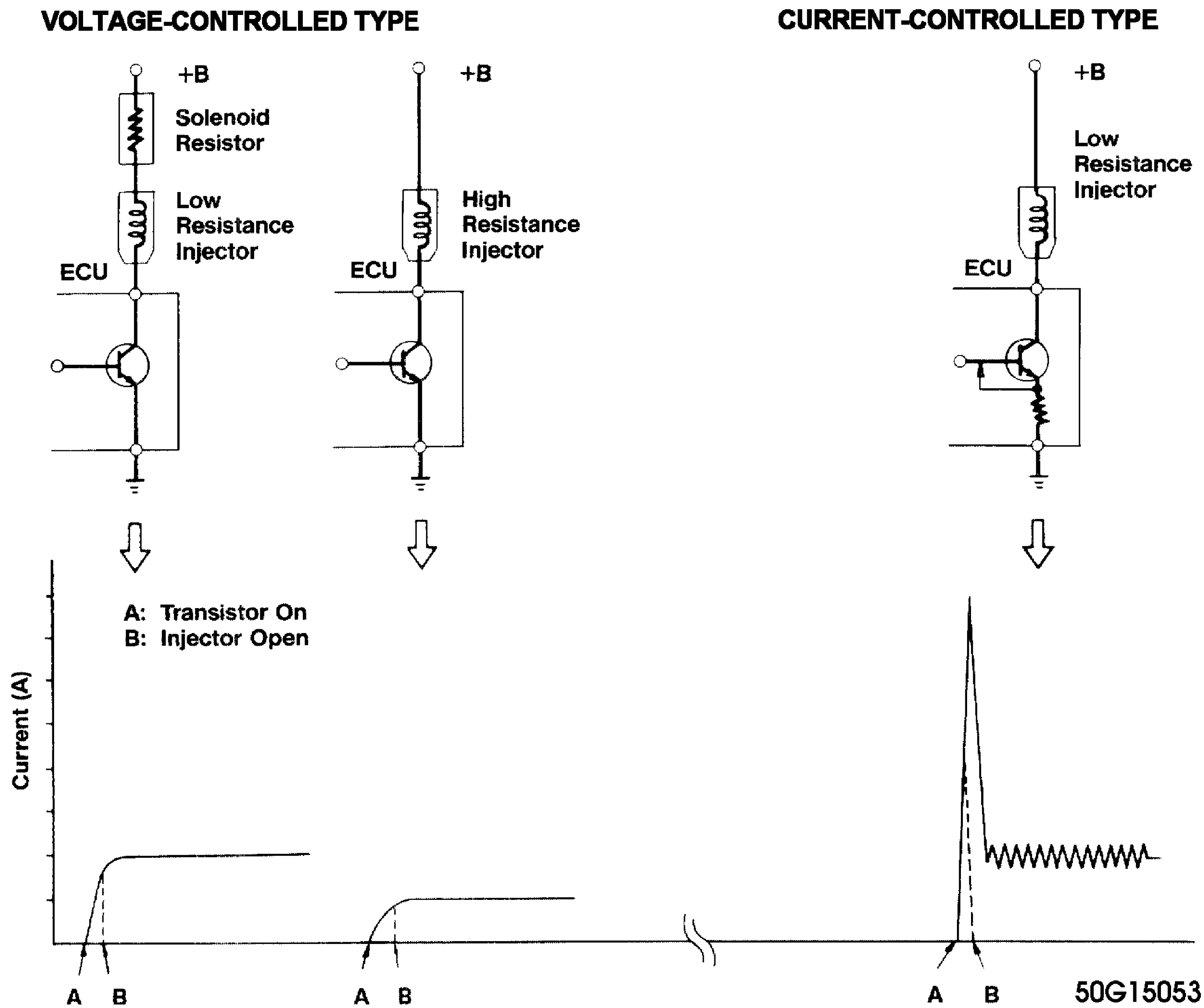


Fig. 1: Injector Driver Types - Current and Voltage

CURRENT CONTROLLED CIRCUIT ("PEAK & HOLD")

The current controlled driver inside the computer is more complex than a voltage controlled driver because as the name implies, it has to limit current flow in addition to its ON-OFF switching function. Recall, this driver typically requires injector circuits with a total leg resistance of less than 12 ohms.

Once the driver is turned ON, it will not limit current flow until enough time has passed for the injector pintle to open. This period is preset by the particular manufacturer/system based on the amount of current flow needed to open their injector. This is typically between two and six amps. Some manufacturers refer to this as the "peak" time, referring to the fact that current flow is allowed to "peak" (to open the injector).

Once the injector pintle is open, the amp flow is considerably reduced for the rest of the pulse duration to protect the injector from overheating. This is okay because very little amperage is needed to hold the injector open, typically in the area of one amp or less. Some manufacturers refer to this as the "hold" time, meaning that just enough current is allowed through the circuit to "hold" the already-open injector open.

There are a couple methods of reducing the current. The most common trims back the available voltage for the circuit, similar to turning down a light at home with a dimmer.

The other method involves repeatedly cycling the circuit ON-OFF. It does this so fast that the magnetic field never collapses and the pintle stays open, but the current is still significantly reduced. See the right side of Fig. 1 for an illustration.

The advantage to the current controlled driver circuit is the short time period from when the driver transistor goes ON to when the injector actually opens. This is a function of the speed with which current flow reaches its peak due to the low circuit resistance. Also, the injector closes faster when the driver turns OFF because of the lower holding current.

NOTE: Never apply battery voltage directly across a low resistance injector. This will cause injector damage from solenoid coil overheating.

THE TWO WAYS INJECTOR CIRCUITS ARE WIRED

Like other circuits, injector circuits can be wired in one of two fundamental directions. The first method is to steadily power the injectors and have the computer driver switch the ground side of the circuit. Conversely, the injectors can be steadily grounded while the driver switches the power side of the circuit.

There is no performance benefit to either method. Voltage controlled and current controlled drivers have been successfully implemented both ways.

However, 95% percent of the systems are wired so the driver controls the ground side of the circuit. Only a handful of systems use the drivers on the power side of the circuit. Some examples of the latter are the 1970's Cadillac EFI system, early Jeep 4.0 EFI (Renix system), and Chrysler 1984-87 TBI.

INTERPRETING INJECTOR WAVEFORMS

INTERPRETING A VOLTAGE CONTROLLED PATTERN

NOTE: Voltage controlled drivers are also known as "Saturated Switch" drivers. They typically require injector circuits with a total leg resistance of 12 ohms or more.

NOTE: This example is based on a constant power/switched ground circuit.

* See Fig. 2 for pattern that the following text describes.

Point "A" is where system voltage is supplied to the injector. A good hot run voltage is usually 13.5 or more volts. This point, commonly known as open circuit voltage, is critical because the injector will not get sufficient current saturation if there is a voltage shortfall. To obtain a good look at this precise point, you will need to shift your Lab Scope to five volts per division.

You will find that some systems have slight voltage fluctuations here. This can occur if the injector feed wire is also used to power up other cycling components, like the ignition coil(s). Slight voltage fluctuations are normal and are no reason for concern. Major voltage fluctuations are a different story, however. Major voltage shifts on the injector feed line will create injector performance problems. Look for excessive resistance problems in the feed circuit if you see big shifts and repair as necessary.

Note that circuits with external injector resistors will not be any different because the resistor does not affect open circuit voltage.

Point "B" is where the driver completes the circuit to ground. This point of the waveform should be a clean square point straight down with no rounded edges. It is during this period that current saturation of the injector windings is taking place and the driver is heavily stressed. Weak drivers will distort this vertical line.

Point "C" represents the voltage drop across the injector windings. Point "C" should come very close to the ground reference point, but not quite touch. This is because the driver has a small amount of inherent resistance. Any significant offset from ground is an indication of a resistance problem on the ground circuit that needs repaired. You might miss this fault if you do not use the negative battery post for your Lab Scope hook-up, so it is HIGHLY recommended that you use the battery as your hook-up.

The points between "B" and "D" represent the time in milliseconds that the injector is being energized or held open. This line at Point "C" should remain flat. Any distortion or upward bend indicates a ground problem, short problem, or a weak driver. Alert readers will catch that this is exactly opposite of the current controlled type drivers (explained in the next section), because they bend upwards at this point.

How come the difference? Because of the total circuit resistance. Voltage controlled driver circuits have a high resistance of 12+ ohms that slows the building of the magnetic field in the injector. Hence, no counter voltage is built up and the line remains flat.

On the other hand, the current controlled driver circuit has low resistance which allows for a rapid magnetic field build-up. This causes a slight inductive rise (created by the effects of counter voltage) and hence, the upward bend. You should not see that here with voltage controlled circuits.

Point "D" represents the electrical condition of the injector windings. The height of this voltage spike (inductive kick) is proportional to the number of windings and the current flow through them. The more current flow and greater number of windings, the more potential for a greater inductive kick. The opposite is also true. The less current flow or fewer windings means less inductive kick. Typically you should see a minimum 35 volts at the top of Point "D".

If you do see approximately 35 volts, it is because a zener diode is used with the driver to clamp the voltage. Make sure the beginning top of the spike is squared off, indicating the zener dumped the remainder of the spike. If it is not squared, that indicates the spike is not strong enough to make the zener fully dump, meaning the injector has a weak winding.

If a zener diode is not used in the computer, the spike from a good injector will be 60 or more volts.

Point "E" brings us to a very interesting section. As you can see, the voltage dissipates back to supply value after the peak of the inductive kick. Notice the slight hump? This is actually the mechanical injector pintle closing. Recall that moving an iron core through a magnetic field will create a voltage surge. The pintle is the iron core here.

This pintle hump at Point "E" should occur near the end of the downward slope, and not afterwards. If it does occur after the slope has ended and the voltage has stabilized, it is because the pintle is slightly sticking because of a faulty injector

If you see more than one hump it is because of a distorted pintle or seat. This faulty condition is known as "pintle float".

It is important to realize that it takes a good digital storage oscilloscope or analog lab scope to see this pintle hump clearly. Unfortunately, it cannot always be seen.

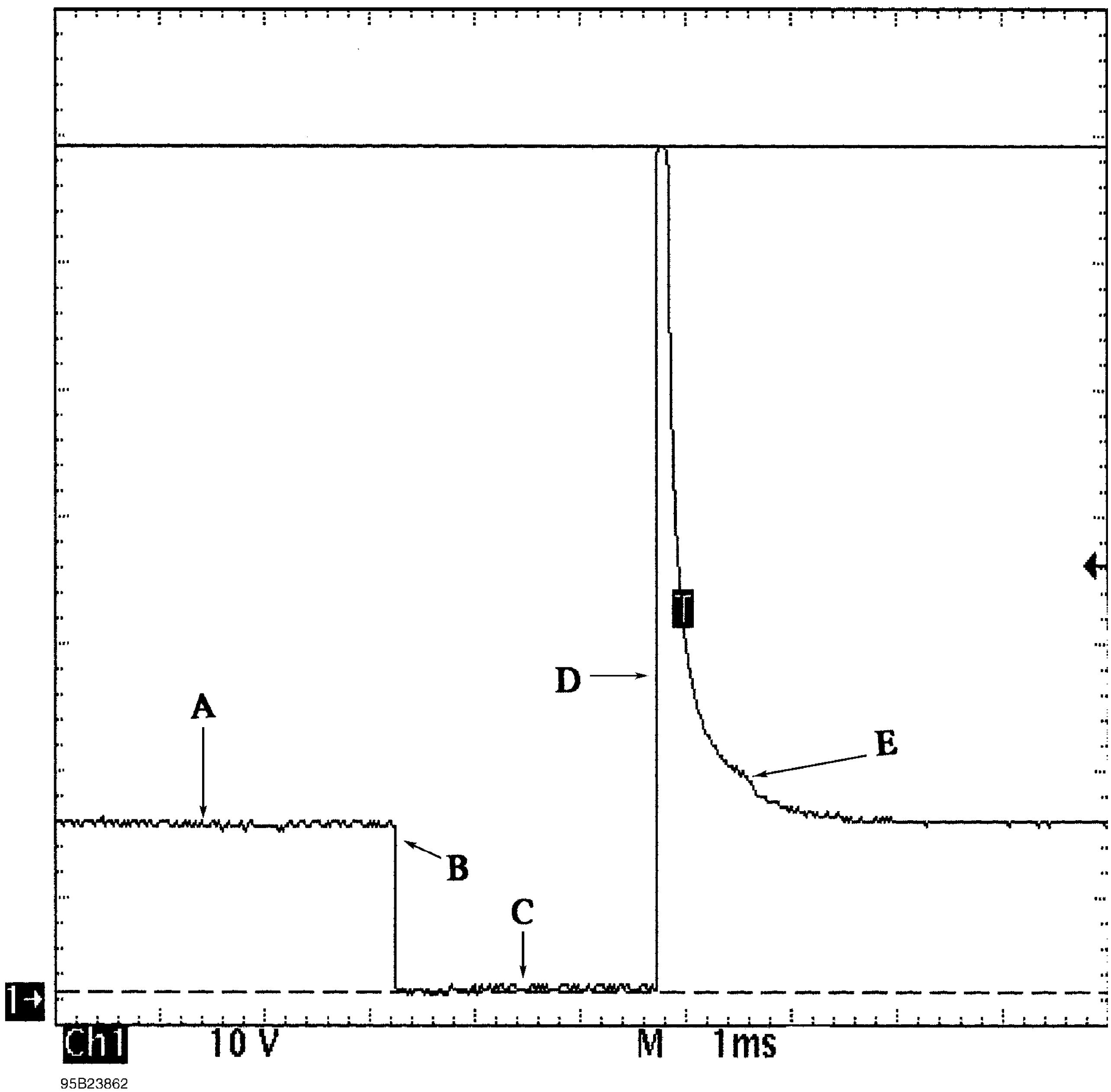


Fig. 2: Identifying Voltage Controlled Type Injector Pattern

INTERPRETING A CURRENT CONTROLLED PATTERN

NOTE: Current controlled drivers are also known as "Peak and Hold" drivers. They typically require injector circuits with a total leg resistance with less than 12 ohm.

NOTE: This example is based on a constant power/switched ground circuit.

* See Fig. 3 for pattern that the following text describes.

Point "A" is where system voltage is supplied to the injector. A good hot run voltage is usually 13.5 or more volts. This point, commonly known as open circuit voltage, is critical because the injector will not get sufficient current saturation if there is a voltage shortfall. To obtain a good look at this precise point, you will need to shift your Lab Scope to five volts per division.

You will find that some systems have slight voltage fluctuations here. This could occur if the injector feed wire is also used to power up other cycling components, like the ignition coil(s). Slight voltage fluctuations are normal and are no reason for concern. Major voltage fluctuations are a different story, however. Major voltage shifts on the injector feed line will create injector performance problems. Look for excessive resistance problems in the feed circuit if you see big shifts and repair as necessary.

Point "B" is where the driver completes the circuit to ground. This point of the waveform should be a clean square point straight down with no rounded edges. It is during this period that current saturation of the injector windings is taking place and the driver is heavily stressed. Weak drivers will distort this vertical line.

Point "C" represents the voltage drop across the injector windings. Point "C" should come very close to the ground reference point, but not quite touch. This is because the driver has a small amount of inherent resistance. Any significant offset from ground is an indication of a resistance problem on the ground circuit that needs repaired. You might miss this fault if you do not use the negative battery post for your Lab Scope hook-up, so it is HIGHLY recommended that you use the battery as your hook-up.

Right after Point "C", something interesting happens. Notice the trace starts a normal upward bend. This slight inductive rise is created by the effects of counter voltage and is normal. This is because the low circuit resistance allowed a fast build-up of the magnetic field, which in turn created the counter voltage.

Point "D" is the start of the current limiting, also known as the "Hold" time. Before this point, the driver had allowed the current to free-flow ("Peak") just to get the injector pintle open. By the time point "D" occurs, the injector pintle has already opened and the computer has just significantly throttled the current back. It does this by only allowing a few volts through to maintain the minimum current required to keep the pintle open.

The height of the voltage spike seen at the top of Point "D" represents the electrical condition of the injector windings. The height of this voltage spike (inductive kick) is proportional to the number of windings and the current flow through them. The more current flow and greater number of windings, the more potential for a greater inductive kick. The opposite is also true. The less current flow or fewer windings means less inductive kick. Typically you should see a minimum 35 volts.

If you see approximately 35 volts, it is because a zener diode is used with the driver to clamp the voltage. Make sure the beginning top of the spike is squared off, indicating the zener dumped the remainder of the spike. If it is not squared, that indicates the spike is not strong enough to make the zener fully dump, meaning there is a problem with a weak injector winding.

If a zener diode is not used in the computer, the spike from a good injector will be 60 or more volts.

At Point "E", notice that the trace is now just a few volts below system voltage and the injector is in the current limiting, or the "Hold" part of the pattern. This line will either remain flat and stable as shown here, or will cycle up and down rapidly. Both are normal methods to limit current flow. Any distortion may indicate shorted windings.

Point "F" is the actual turn-off point of the driver (and injector). To measure the millisecond on-time of the injector, measure between points "C" and "F". Note that we used cursors to do it for us; they are measuring a 2.56 mS on-time.

The top of Point "F" (second inductive kick) is created by the collapsing magnetic field caused by the final turn-off of the driver. This spike should be like the spike on top of point "D".

Point "G" shows a slight hump. This is actually the mechanical injector pintle closing. Recall that moving an iron core through a magnetic field will create a voltage surge. The pintle is the iron core here.

This pintle hump at Point "E" should occur near the end of the downward slope, and not afterwards. If it does occur after the slope has ended and the voltage has stabilized, it is because the pintle is slightly sticking. Some older Nissan TBI systems suffered from this.

If you see more than one hump it is because of a distorted pintle or seat. This faulty condition is known as "pintle float".

It is important to realize that it takes a good digital storage oscilloscope or analog lab scope to see this pintle hump clearly. Unfortunately, it cannot always be seen.

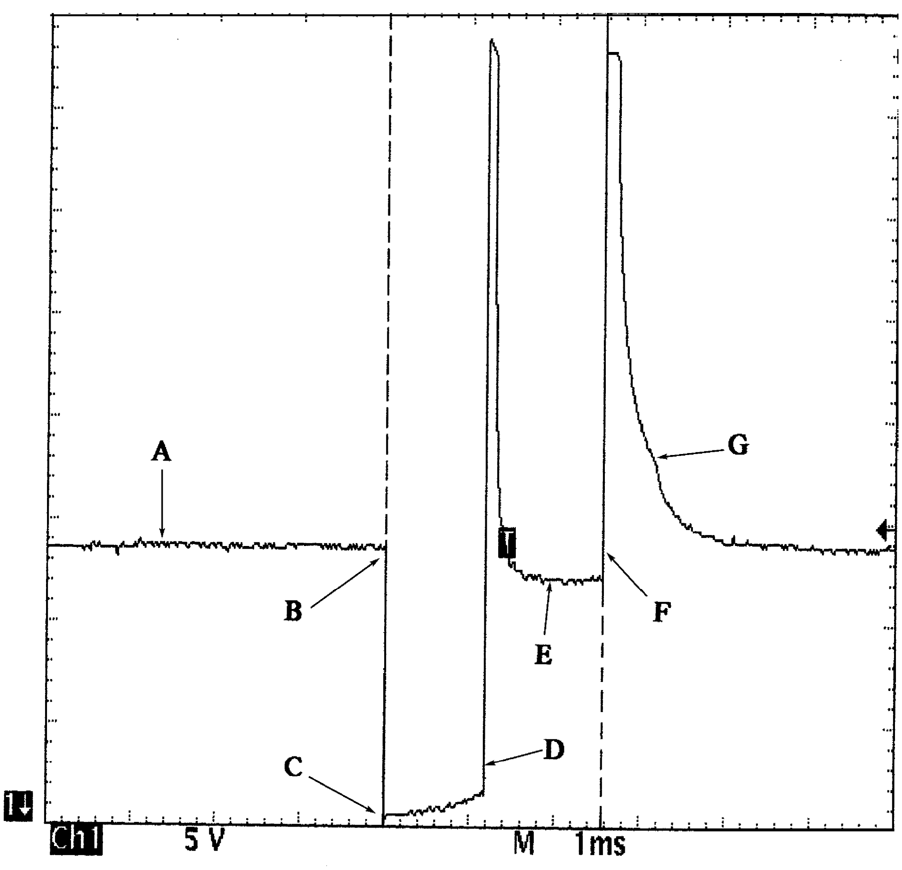


Fig. 3: Identifying Current Controlled Type Injector Pattern

CURRENT WAVEFORM SAMPLES

EXAMPLE #1 - VOLTAGE CONTROLLED DRIVER

The waveform pattern shown in Fig. 4 indicate a normal current waveform from a Ford 3.0L V6 VIN [U] engine. This voltage controlled type circuit pulses the injectors in groups of three injectors. Injectors No. 1, 3, and 5 are pulsed together and cylinders 2, 4, and 6 are pulsed together. The specification for an acceptable bank resistance is 4.4 ohms. Using Ohm’s Law and assuming a hot run voltage of 14 volts, we determine that the bank would draw a current of 3.2 amps.

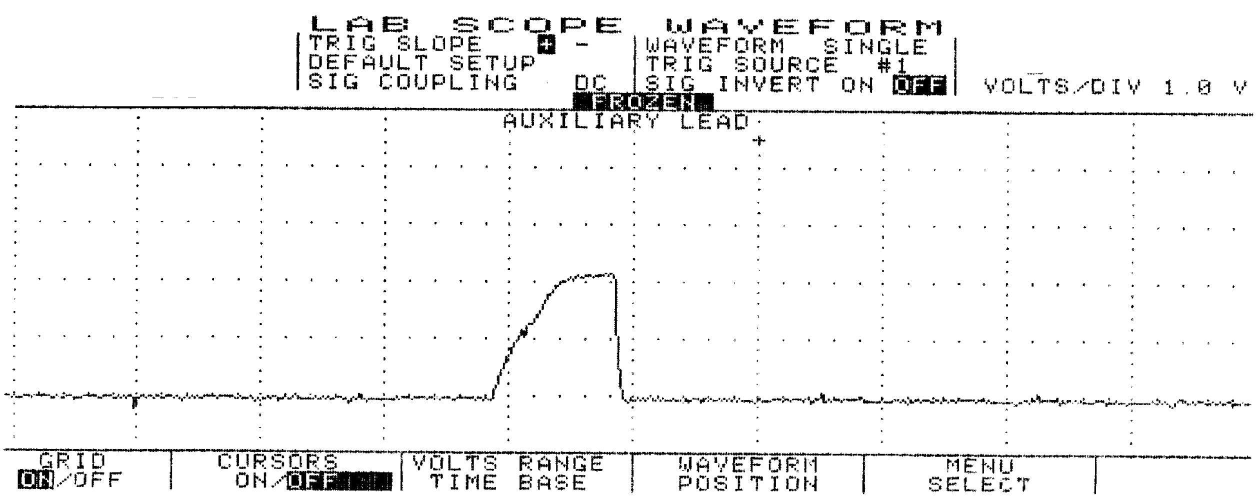
However this is not the case because as the injector windings become saturated, counter voltage is created which impedes the current flow. This, coupled with the inherent resistance of the driver’s transistor, impedes the current flow even more. So, what is a known good value for a dynamic current draw on a voltage controlled bank of injectors? The waveform pattern shown below indicates a good parallel injector current flow of 2 amps. See Fig. 4.

Note that if just one injector has a resistance problem and partially shorts, the entire parallel bank that it belongs to will draw more current. This can damage the injector driver.

The waveform pattern in Fig. 5 indicates this type of problem with too much current flow. This is on other bank of injectors of the same vehicle; the even side. Notice the Lab Scope is set on a one amp per division scale. As you can see, the current is at an unacceptable 2.5 amps.

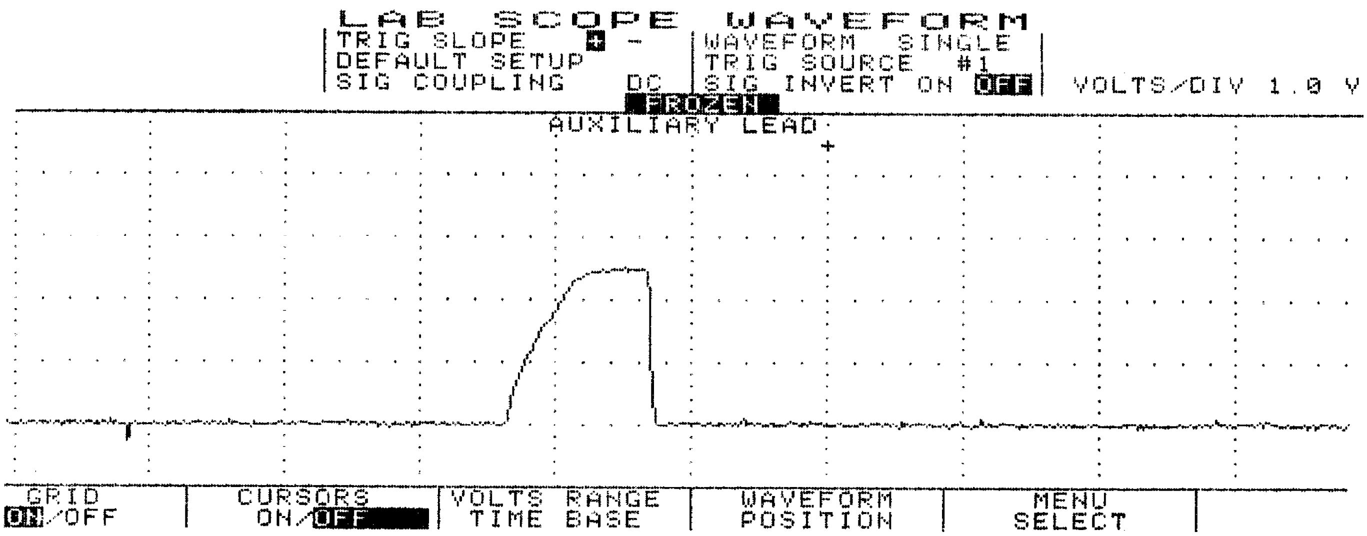
It is easy to find out which individual injector is at fault. All you need to do is inductively clamp onto each individual injector and compare them. To obtain a known-good value to compare against, we used the good bank to capture the waveform in Fig. 6. Notice that it limits current flow to 750 milliamps.

The waveform shown in Fig. 7 illustrates the problem injector we found. This waveform indicates an unacceptable current draw of just over one amp as compared to the 750 milliamp draw of the known-good injector. A subsequent check with a DVOM found 8.2 ohms, which is under the 12 ohm specification.



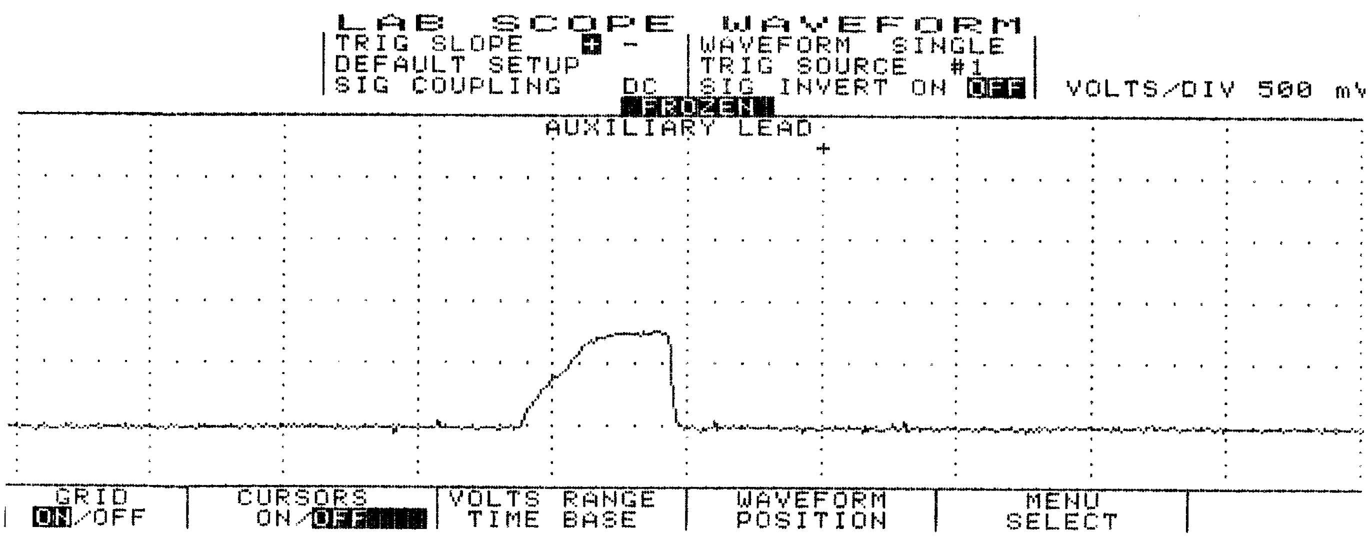
95D23864

Fig. 4: Injector Bank w/Normal Current Flow - Current Pattern



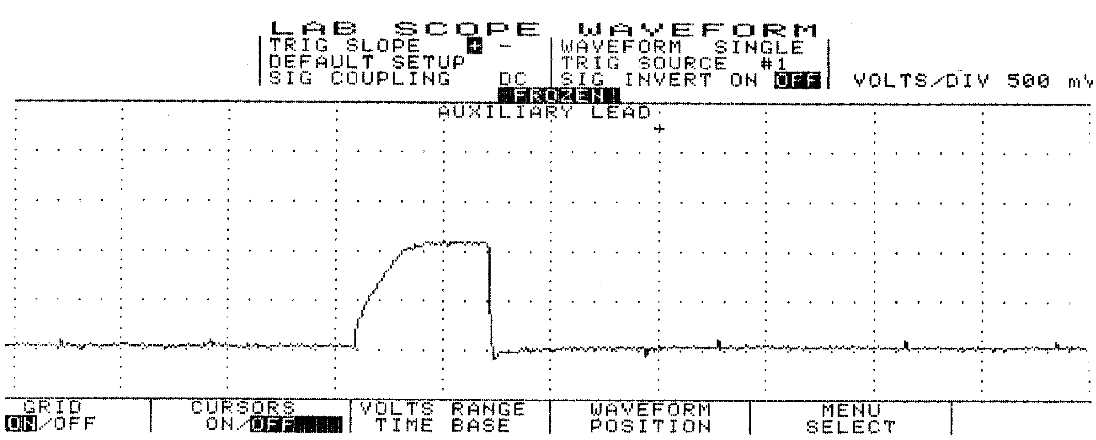
95E23865

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

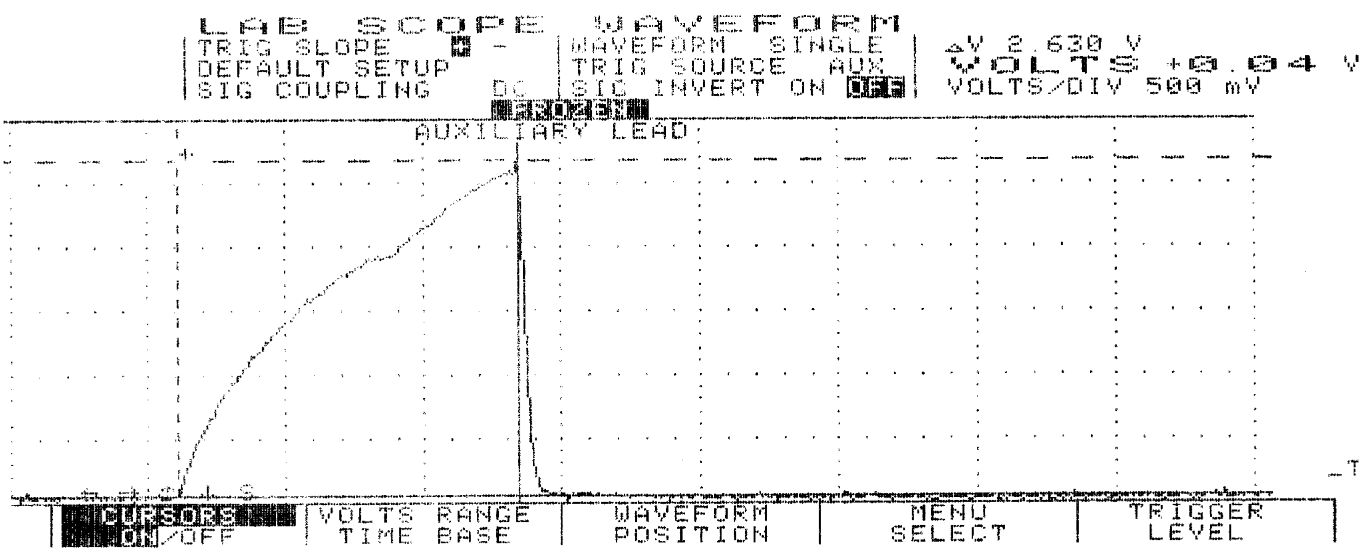
This time we will look at a GM 3.1L V6 VIN [T]. Fig. 8 shows the 1, 3, 5 (odd) injector bank with the current waveform indicating about a 2.6 amp draw at idle. This pattern, taken from a known good vehicle, correctly stays at or below the maximum 2.6 amps current range. Ideally, the current for each 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.

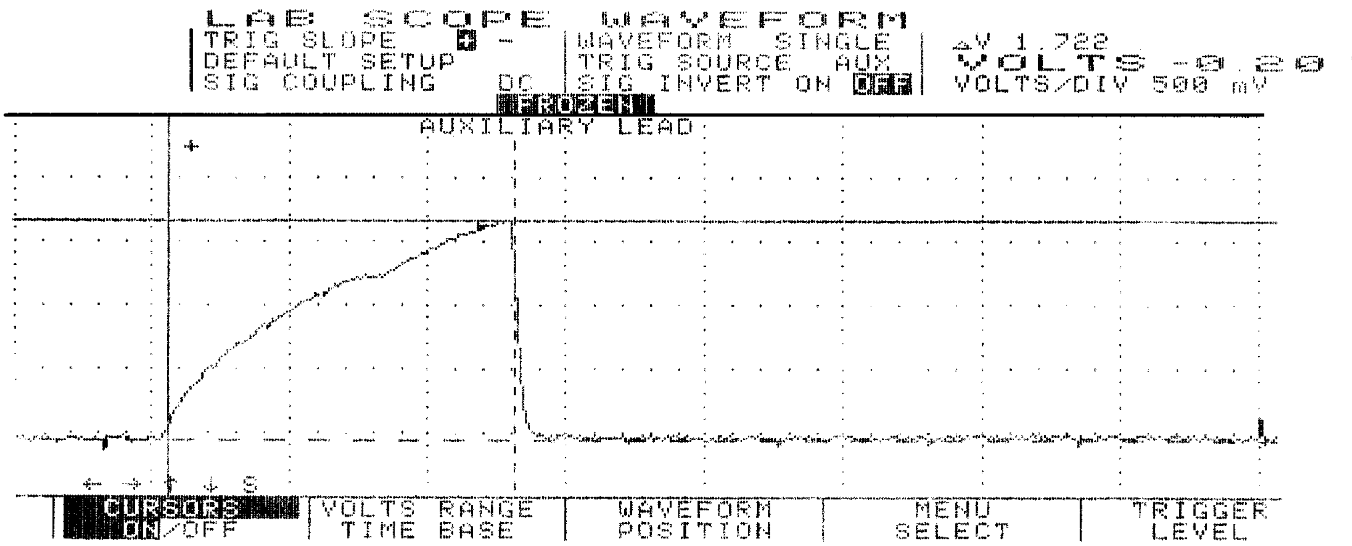
Now we are going to take a look at the even bank of injectors; injectors 2, 4, and 6. See Fig. 9. Notice this bank peaked at 1.7 amps at idle as compared to the 2.6 amps peak of the odd bank (Fig. 8). Current flow between even and odd injectors banks is not uniform, yet it is not causing a driveability 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

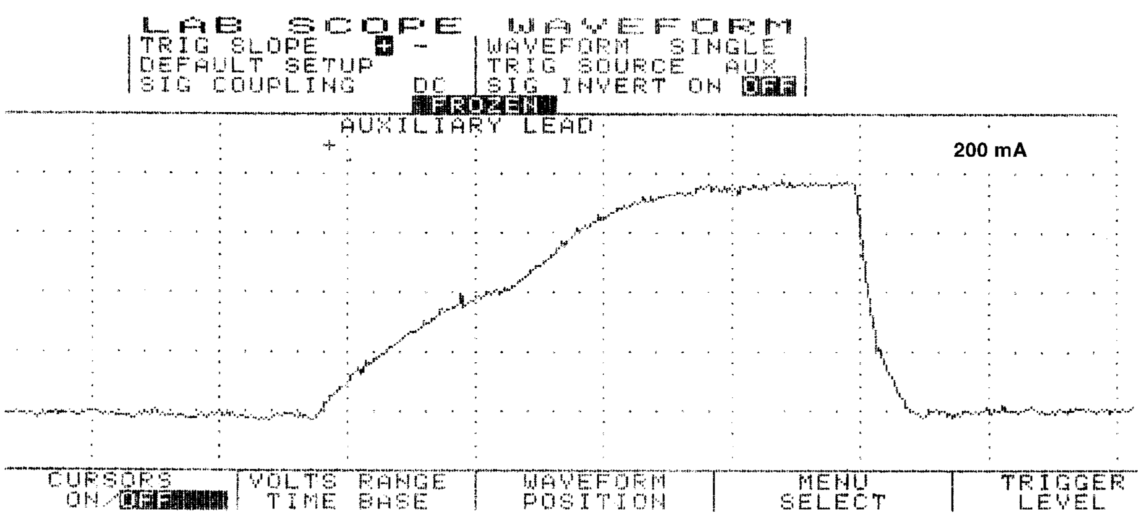
Fig. 9: Injector Even Bank w/Normal Current Flow - Current Pattern

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.

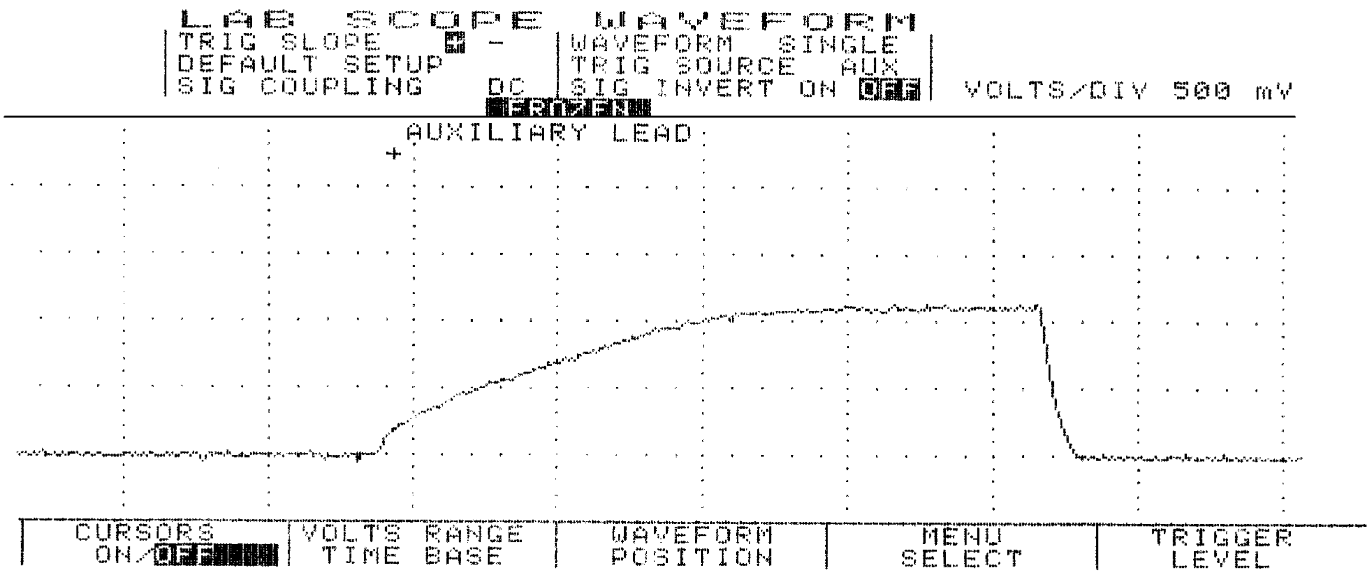
The next waveform pattern in Fig. 11 shows an abnormality with another injector. With the Lab Scope set on 500 milliamps per division, you can see that the current waveform indicates a 1200 milliamp draw. This is a faulty injector.

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

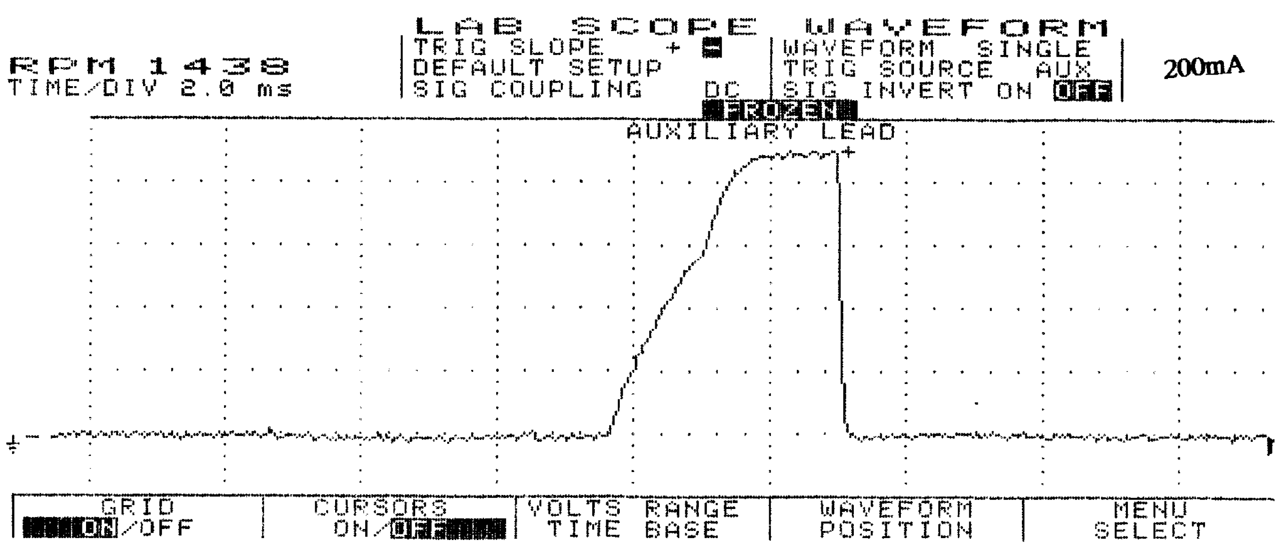


95H23876
Fig. 11: Single Injector w/Excessive Current Flow - Current Pattern

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.

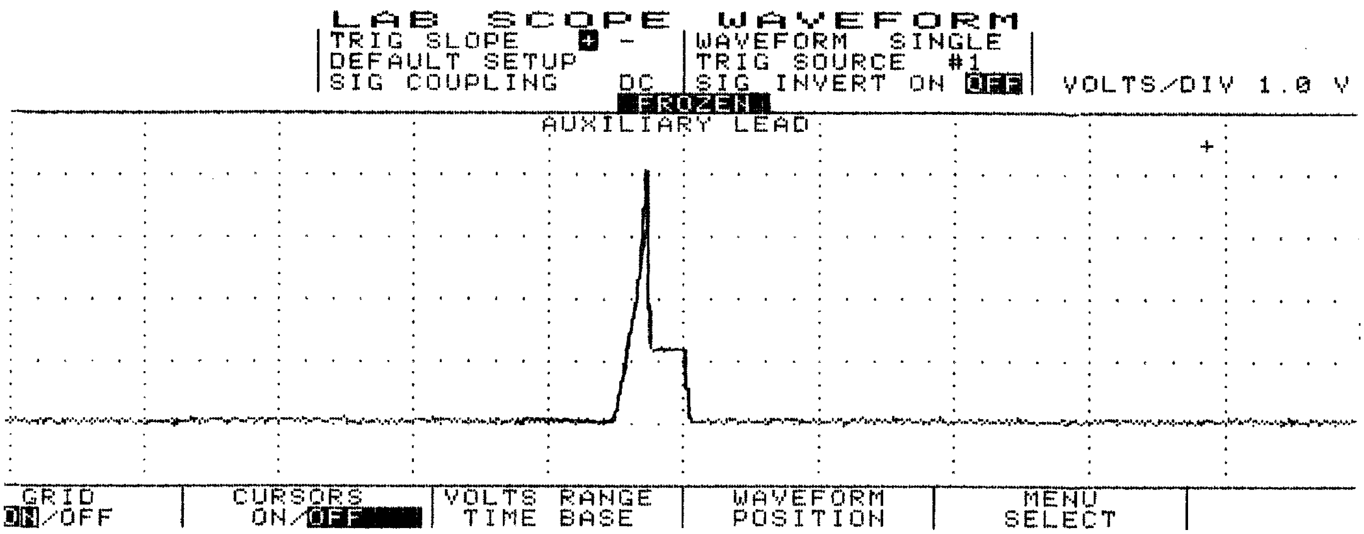


95D23872
Fig. 12: Single Injector w/Normal Current Flow - Current Pattern

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.

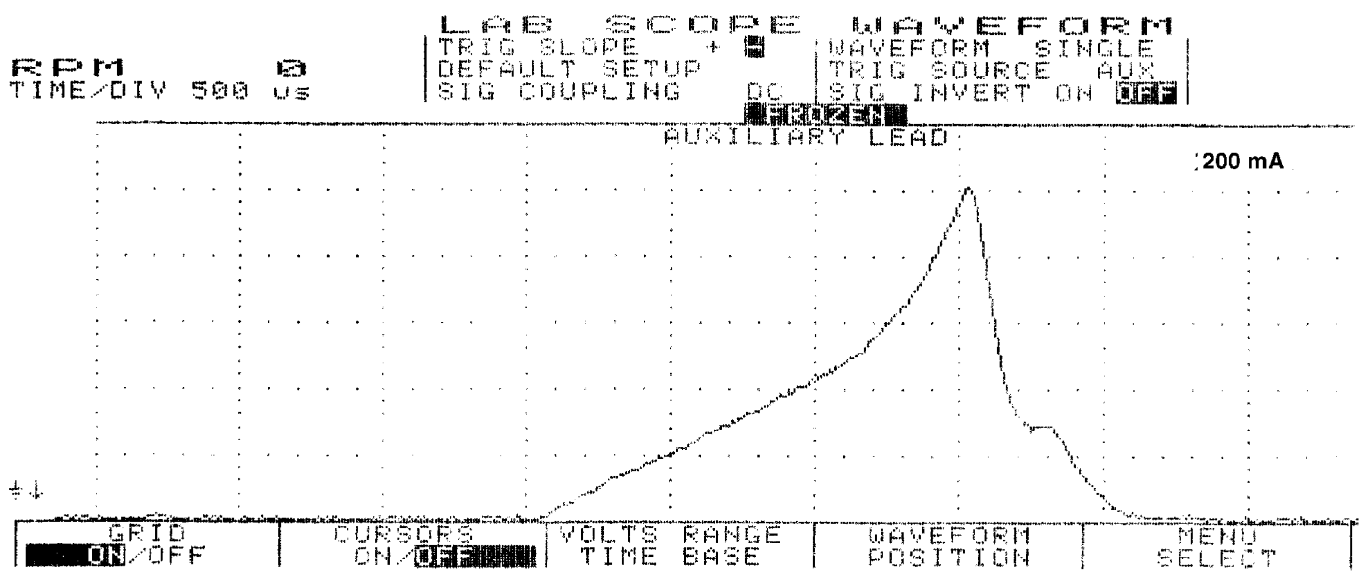


95H23868

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.



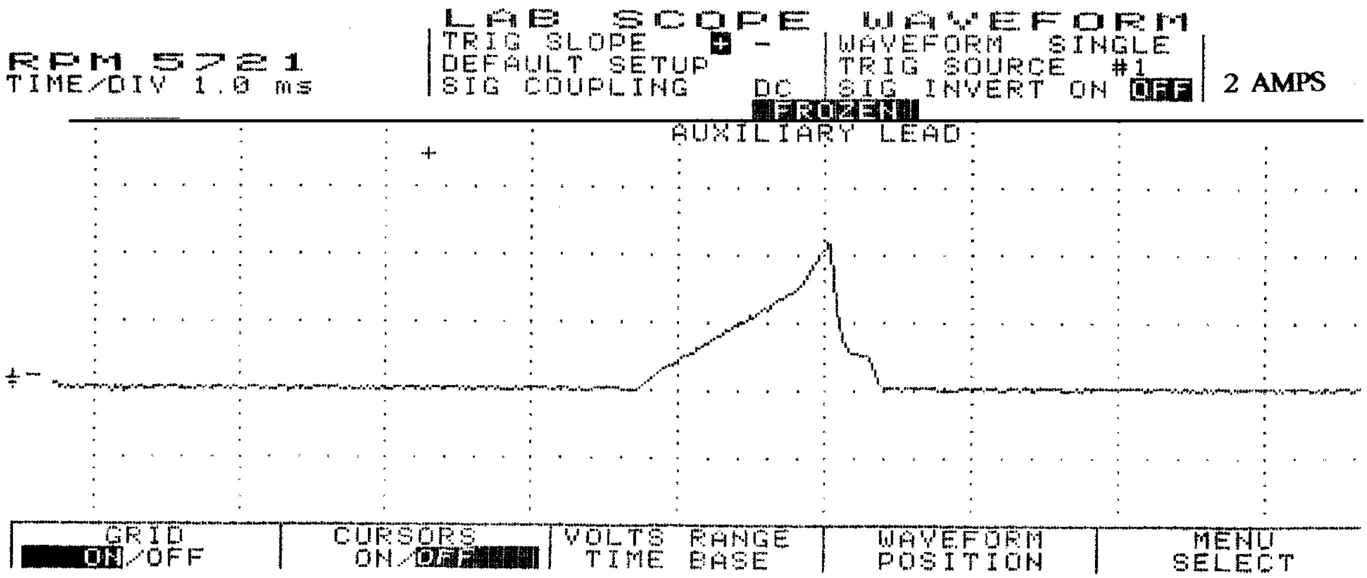
95I23869

Fig. 14: Single Injector w/Normal Current Flow - Current Pattern

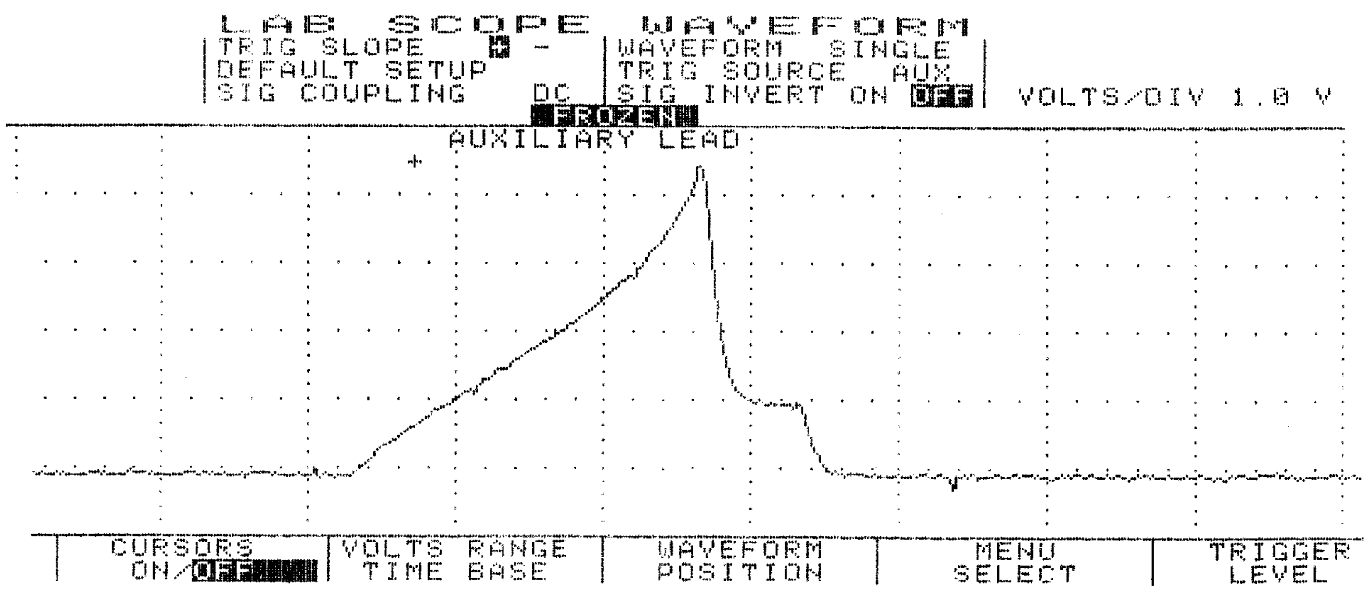
EXAMPLE #7 - CURRENT CONTROLLED DRIVER

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.

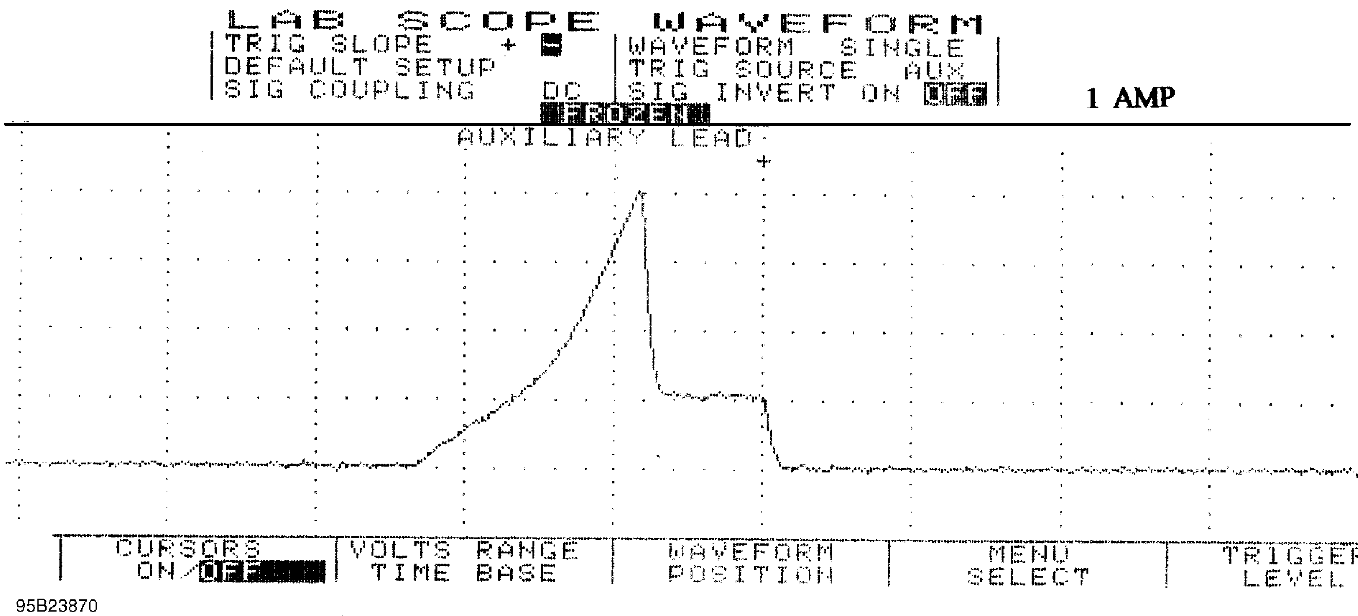
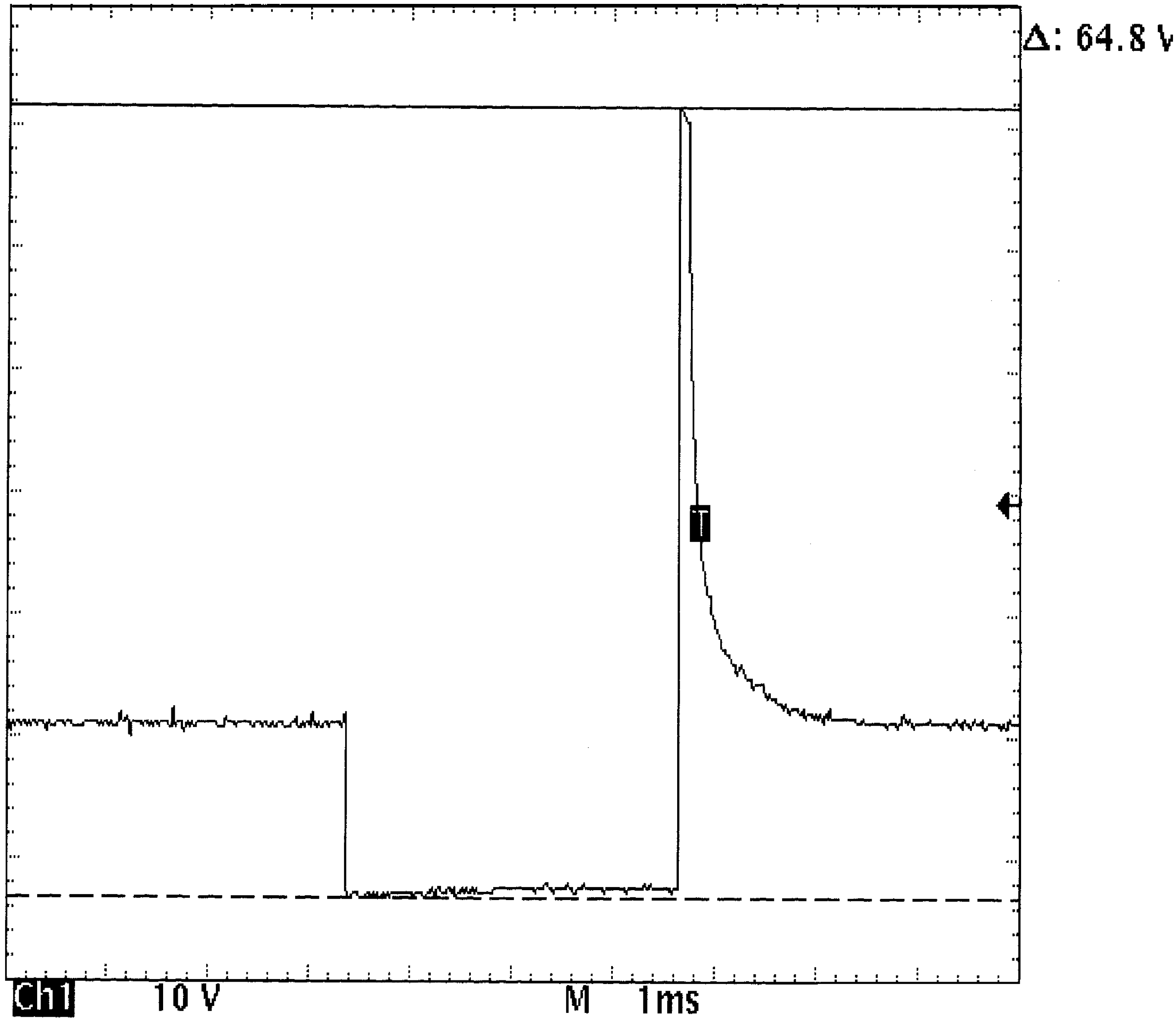


Fig. 17: Single Injector w/Normal Current Flow - Current Pattern

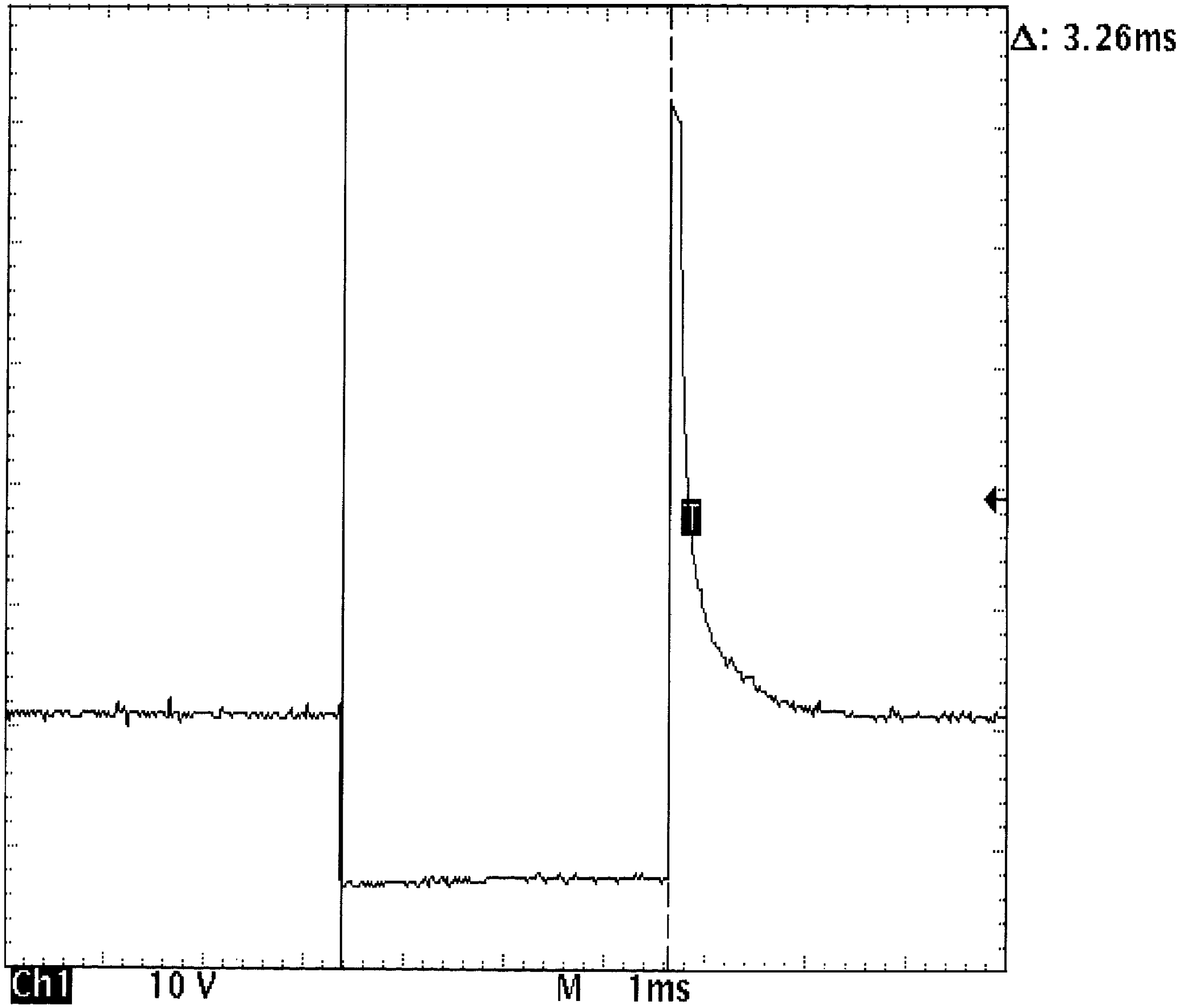
VOLTAGE WAVEFORM SAMPLES

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

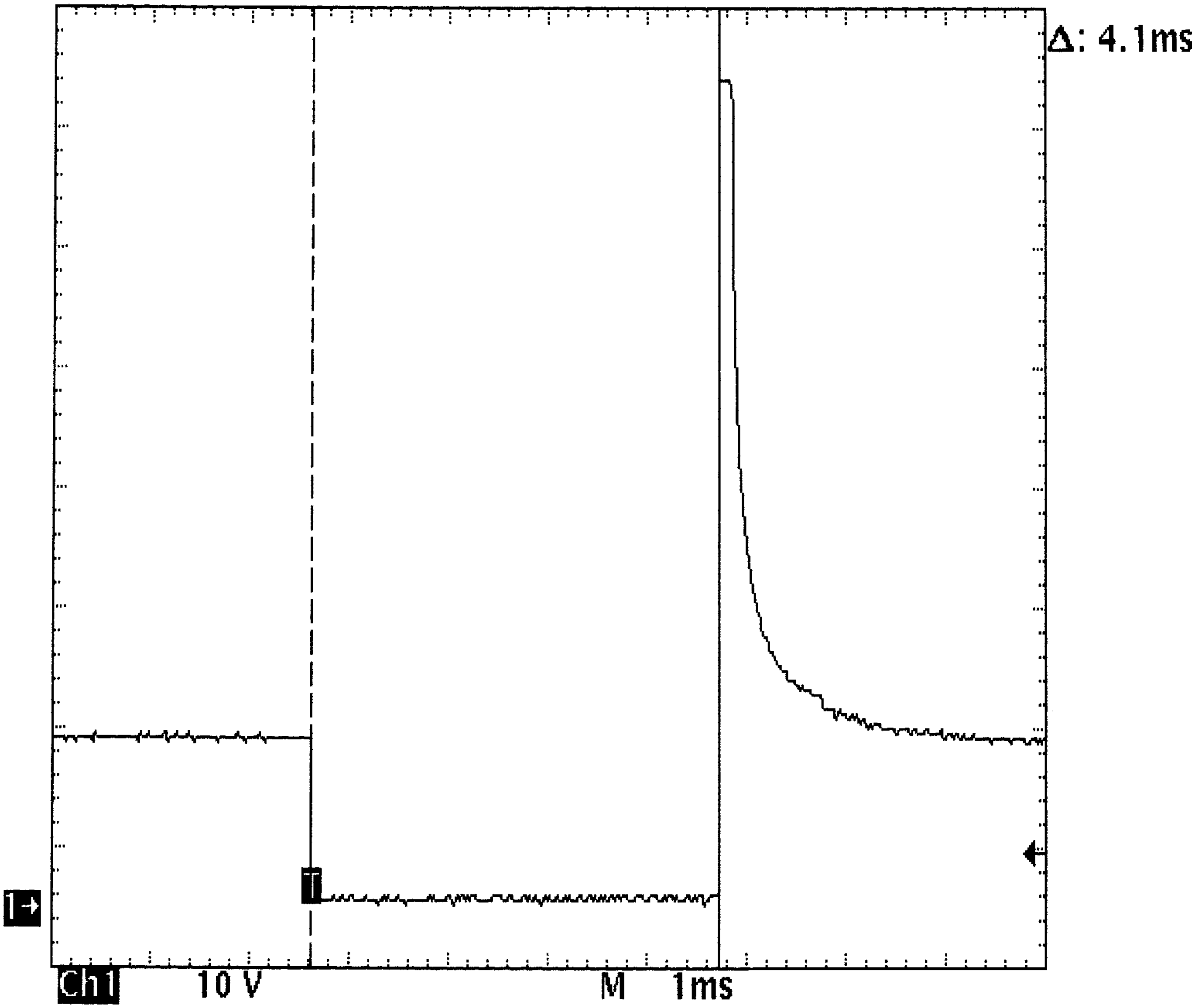


95F23858

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.



95I23851

Fig. 20: Injector Bank - Known Good - Voltage Pattern

EXAMPLE #3 - VOLTAGE CONTROLLED DRIVER

This known-good waveform pattern, Fig. 21, is from a GM 5.0L V8 TPI VIN [F]. It was taken during hot idle, closed loop and no load.

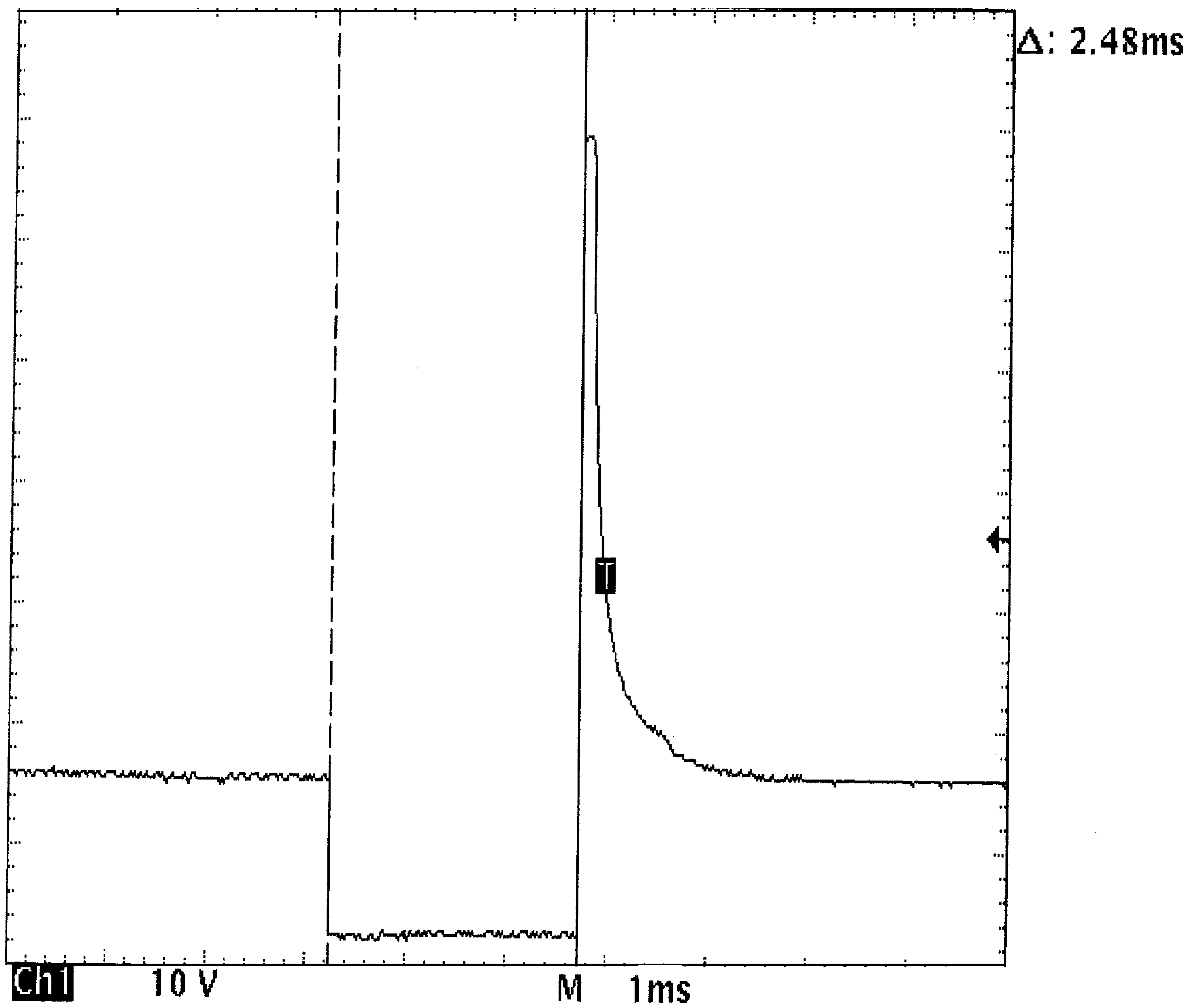
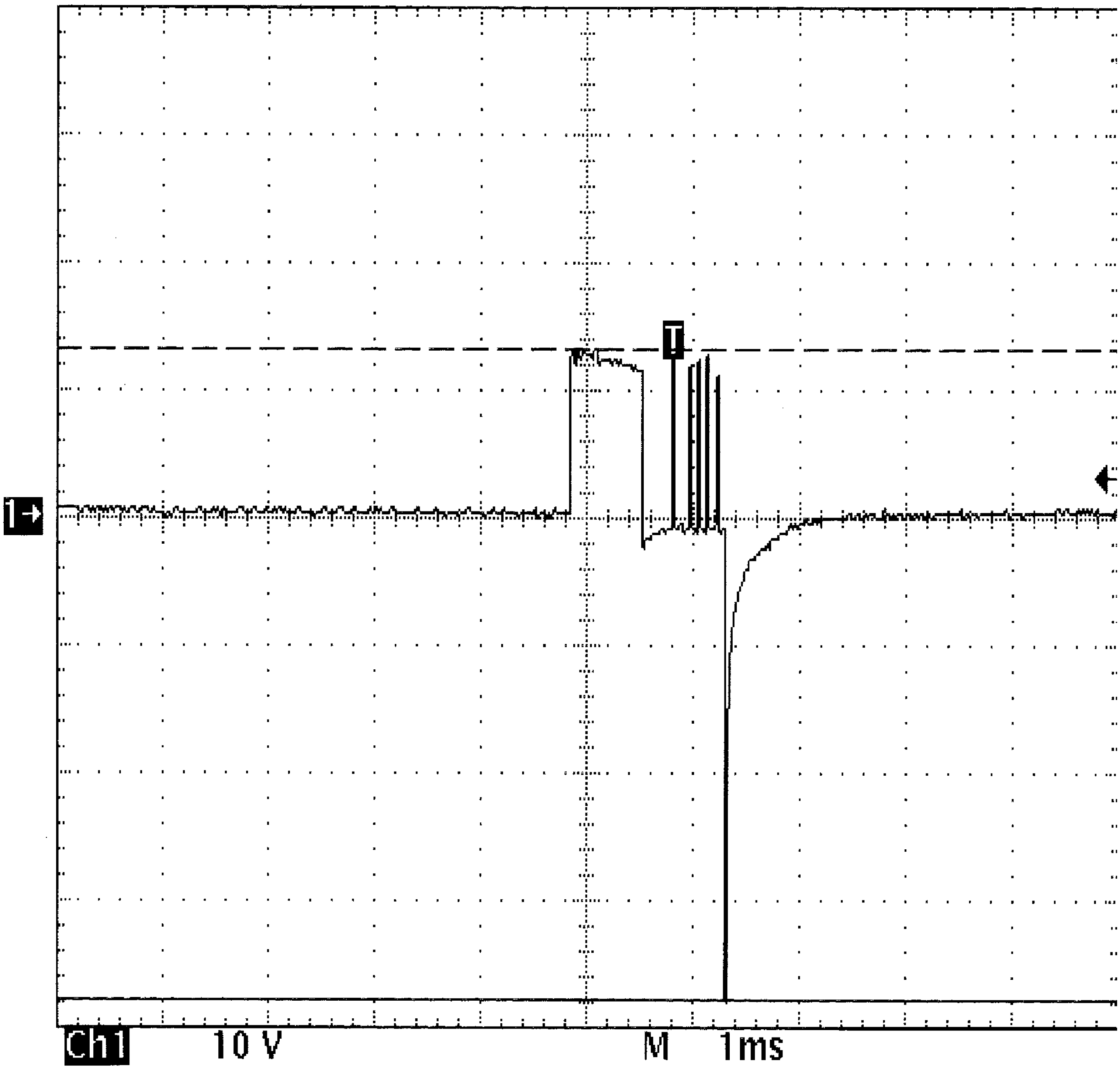


Fig. 21: Injector Bank - Known Good - Voltage Pattern

EXAMPLE #4 - CURRENT CONTROLLED DRIVER

From 1984 to 1987, Chrysler used this type injector drive on their TBI-equipped engines. See Fig. 22 for a known-good pattern. Instead of the ground side controlling the injector, Chrysler permanently grounds out the injector and switches the power feed side. Most systems do not work this way.

These injectors peak at 6 amps of current flow and hold at 1 amp.



95J23860
Fig. 22: Single Injector - Known Good - Voltage Pattern

EXAMPLE #5 - CURRENT CONTROLLED DRIVER

These two known-good waveform patterns are from a Chrysler 3.0L V6 VIN [3]. The first waveform, Fig. 23, is a dual trace pattern that illustrates how Chrysler uses the rising edge of the engine speed signal to trigger the injectors. The second waveform, Fig. 24, was taken during hot idle, closed loop, and no load.

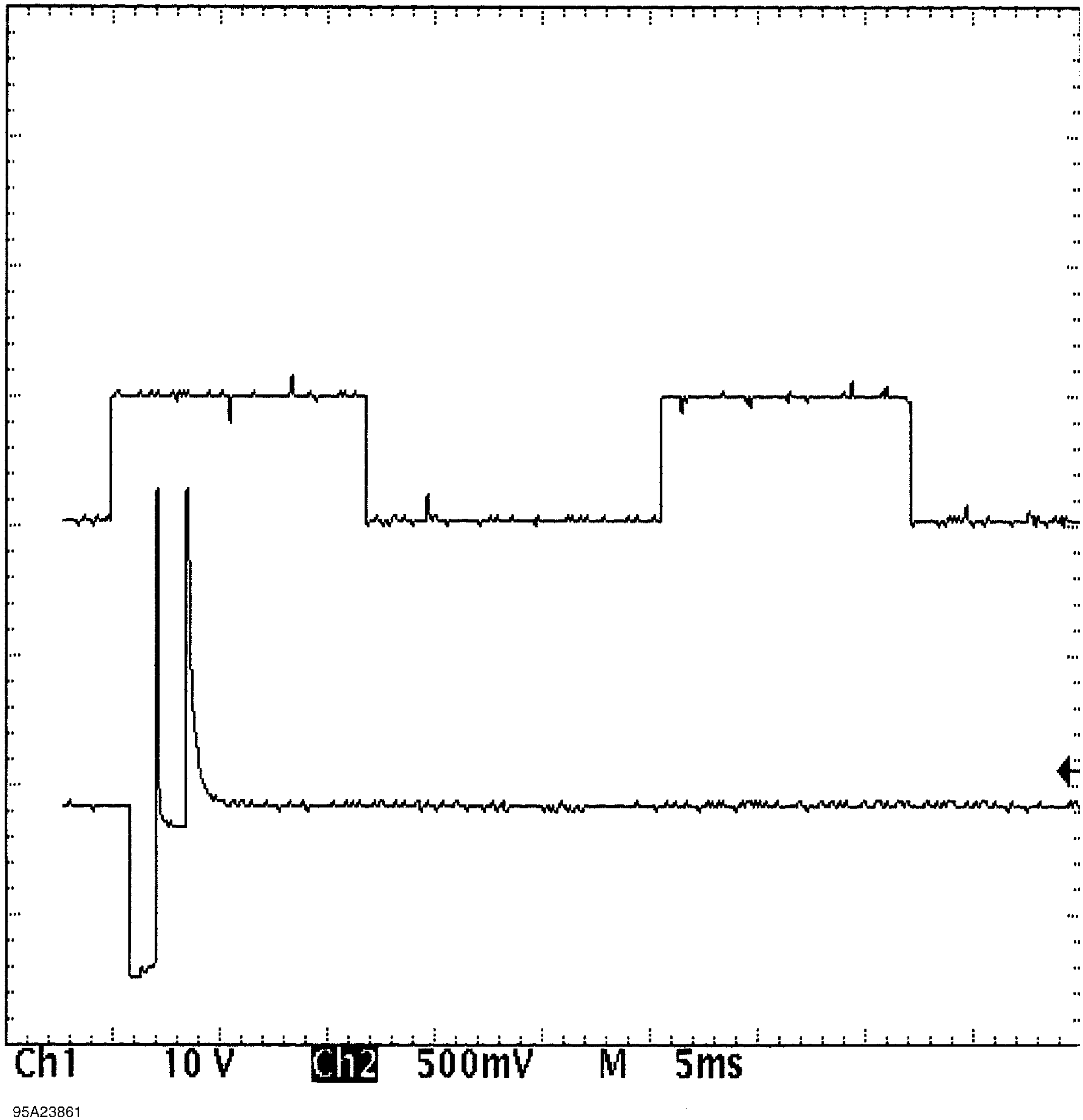
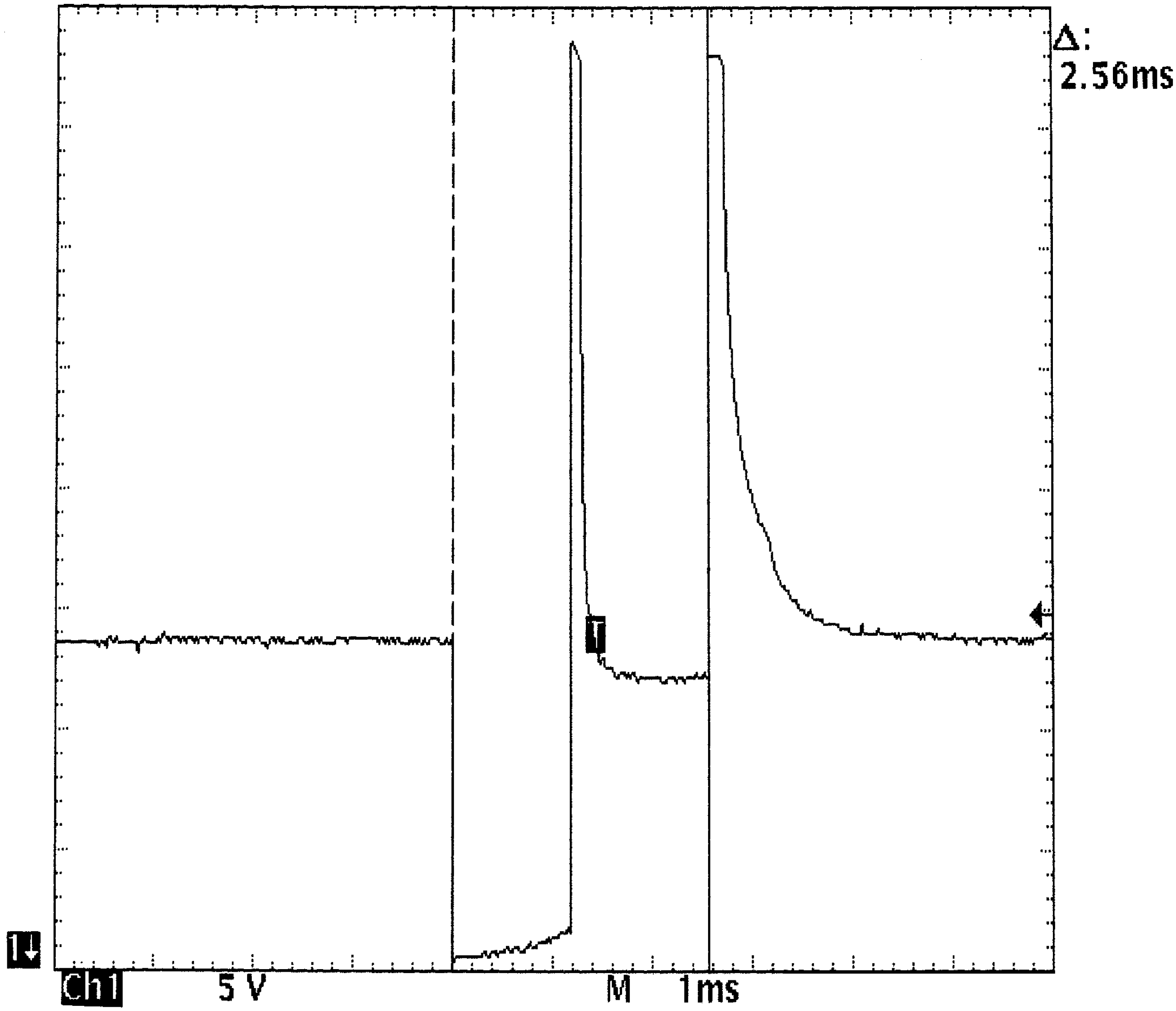


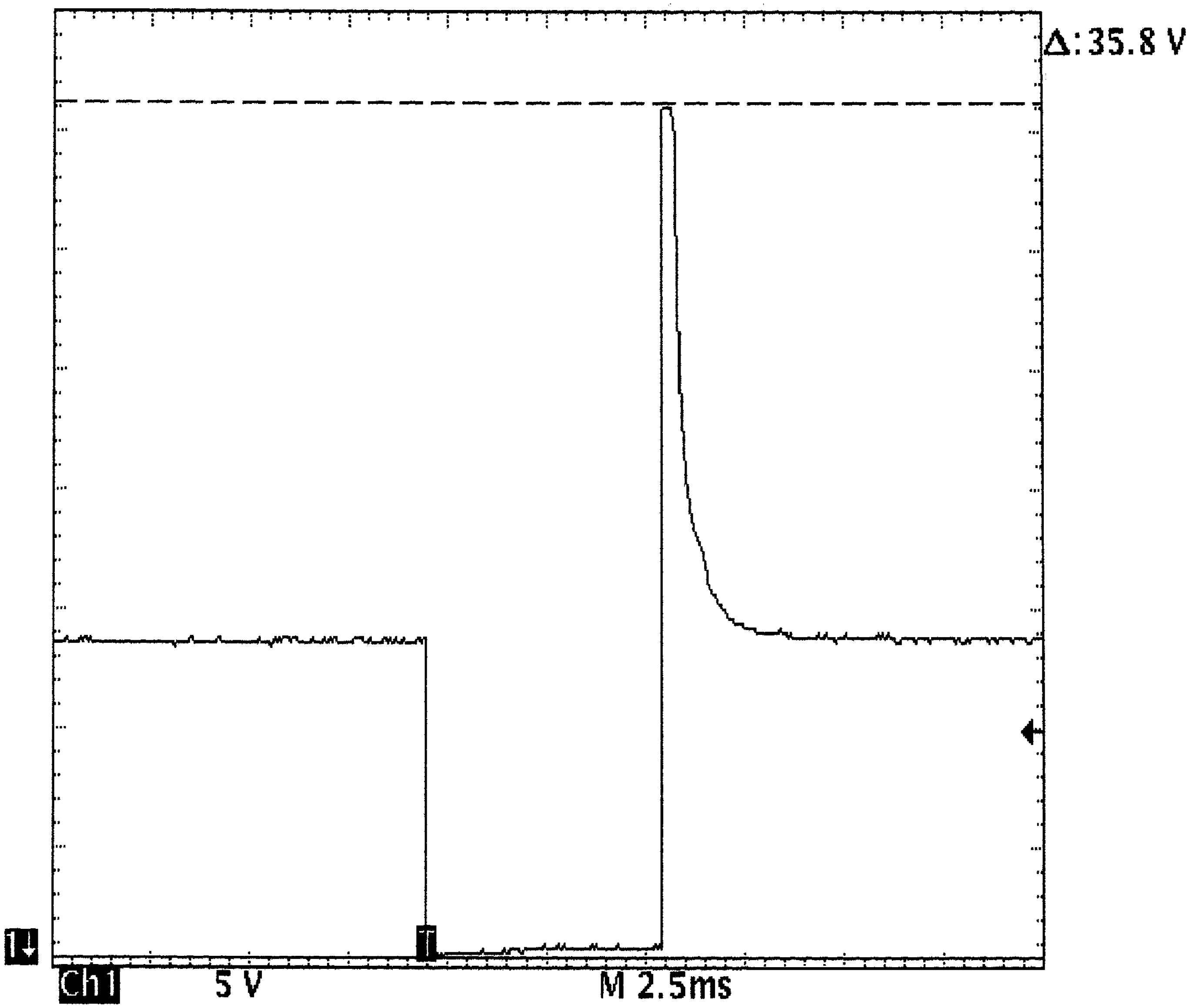
Fig. 23: Injector Bank - Known Good - Voltage Pattern



95B23854
Fig. 24: Injector Bank - Known Good - Voltage Pattern

EXAMPLE #6 - CURRENT CONTROLLED DRIVER

This known-good pattern from a Ford 3.0L V6 PFI VIN [U] illustrates that a zener diode inside the computer is used to clamp the injector’s inductive kick to 35-volts on this system. See Fig. 25.

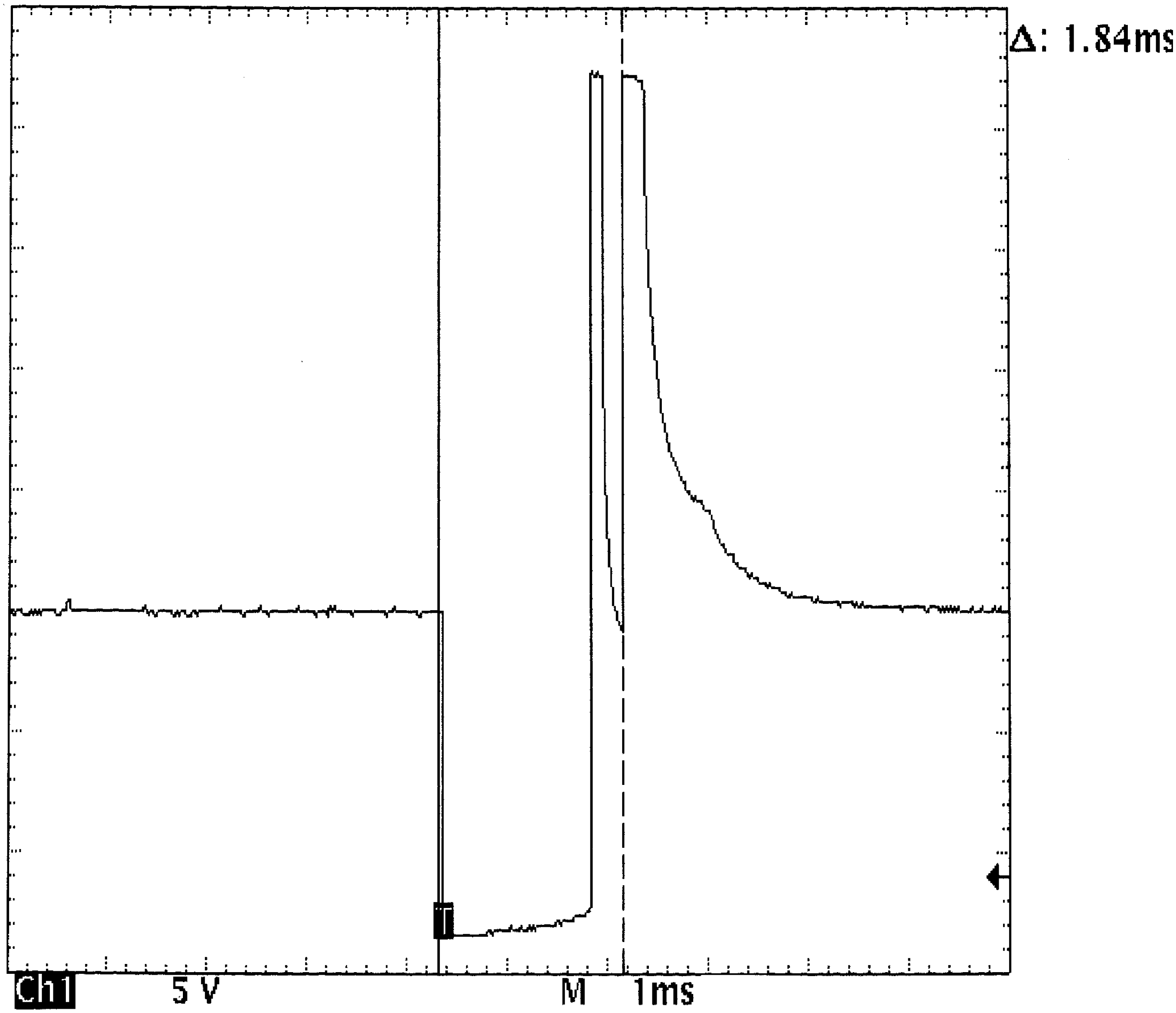


95J23852

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.

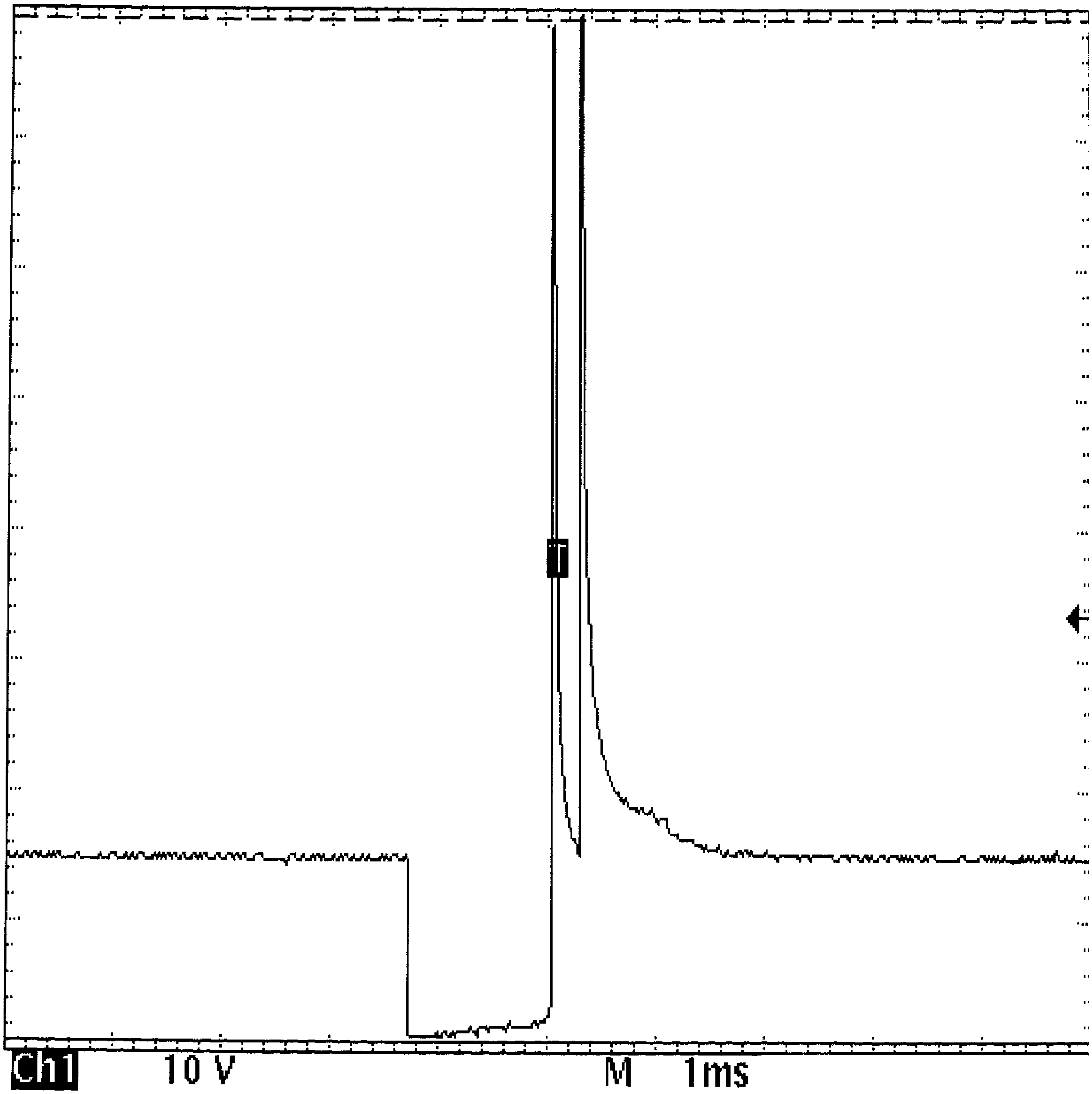


95D23856

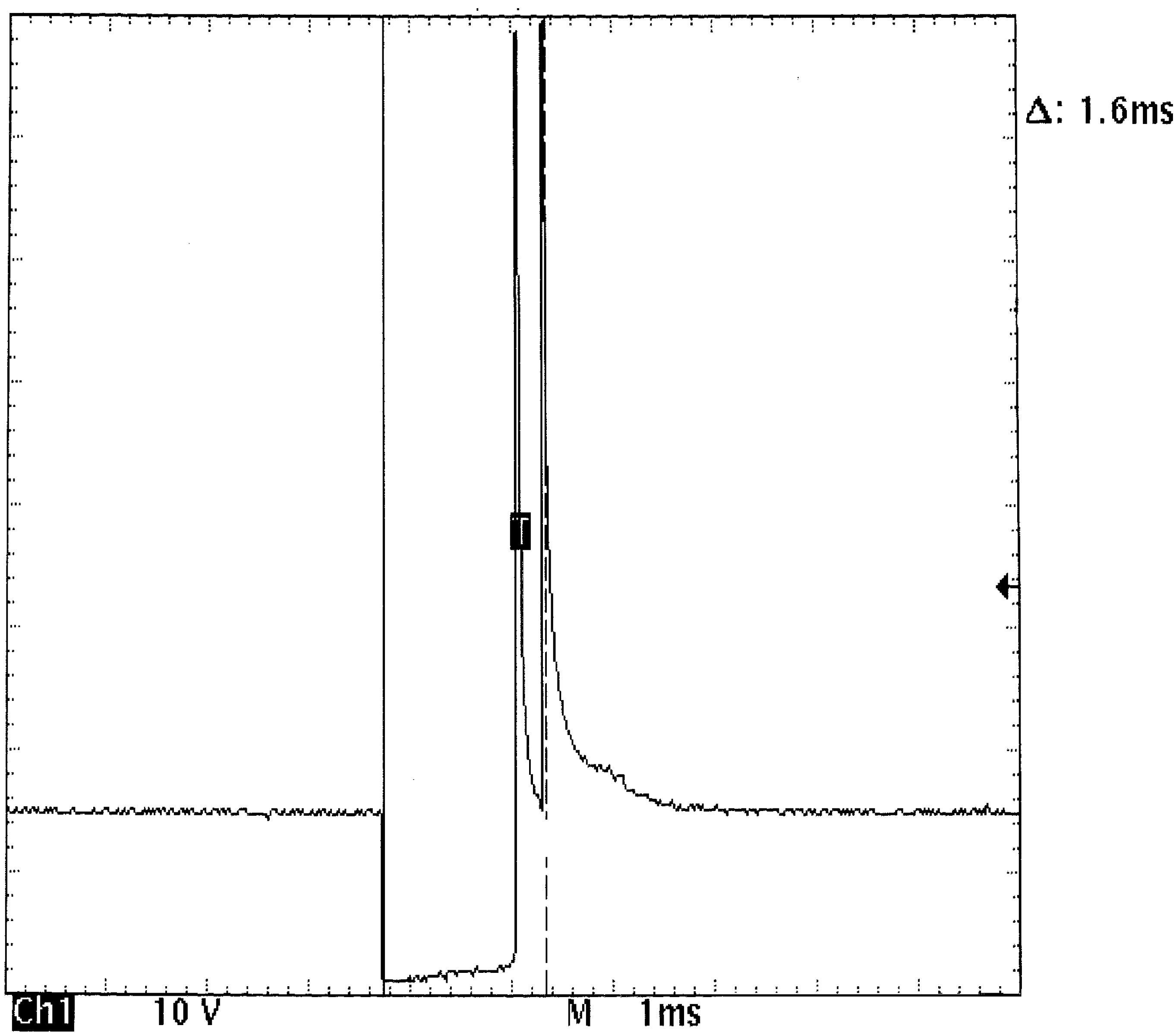
Fig. 26: Single Injector - Known Good - Voltage Pattern

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

1997 Chevrolet Blazer

1997 WHEEL ALIGNMENT
General Motors Corp. - Specifications & Procedures

Chevrolet; Blazer & S/T Series Pickup
GMC; Jimmy & Sonoma
Oldsmobile; Bravada

NOTE: Before 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.

JACKING & HOISTING

Put floor jack or vehicle hoist under vehicle at proper lifting points. See Fig. 1. If raising vehicle on a twin-post hoist, do not damage suspension components, rear axle cover, or steering linkage.

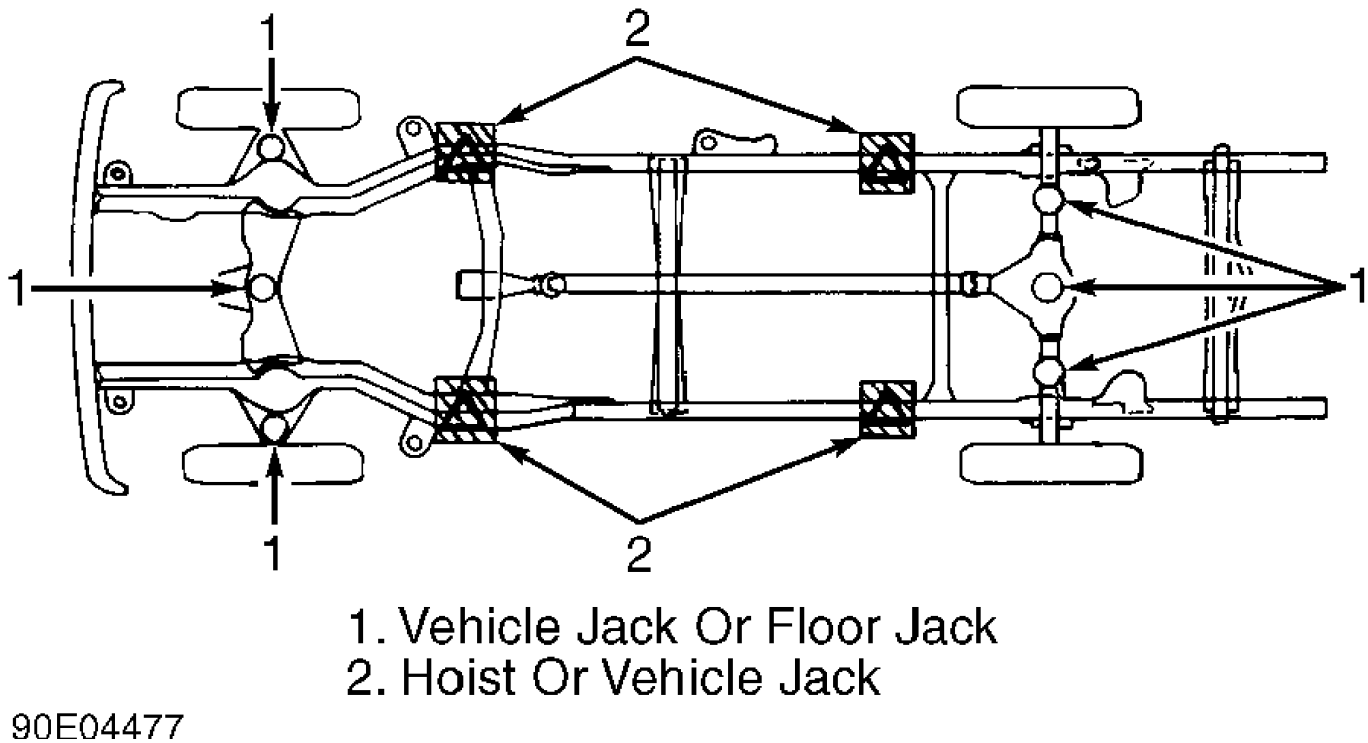


Fig. 1: Lifting Points
Courtesy of General Motors Corp.

RIDING HEIGHT

NOTE: Proper riding height is necessary for correct wheel alignment. Before measuring riding height, ensure tire inflation pressure is correct, cargo compartment is empty, and fuel tank is full.

Bounce vehicle several times to normalize suspension. Measure riding height. See Figs. 2 and 3. If riding height is not as specified, repair or replace suspension components as necessary. See RIDING HEIGHT SPECIFICATIONS table. If riding height is okay, align wheels. See WHEEL ALIGNMENT PROCEDURES.

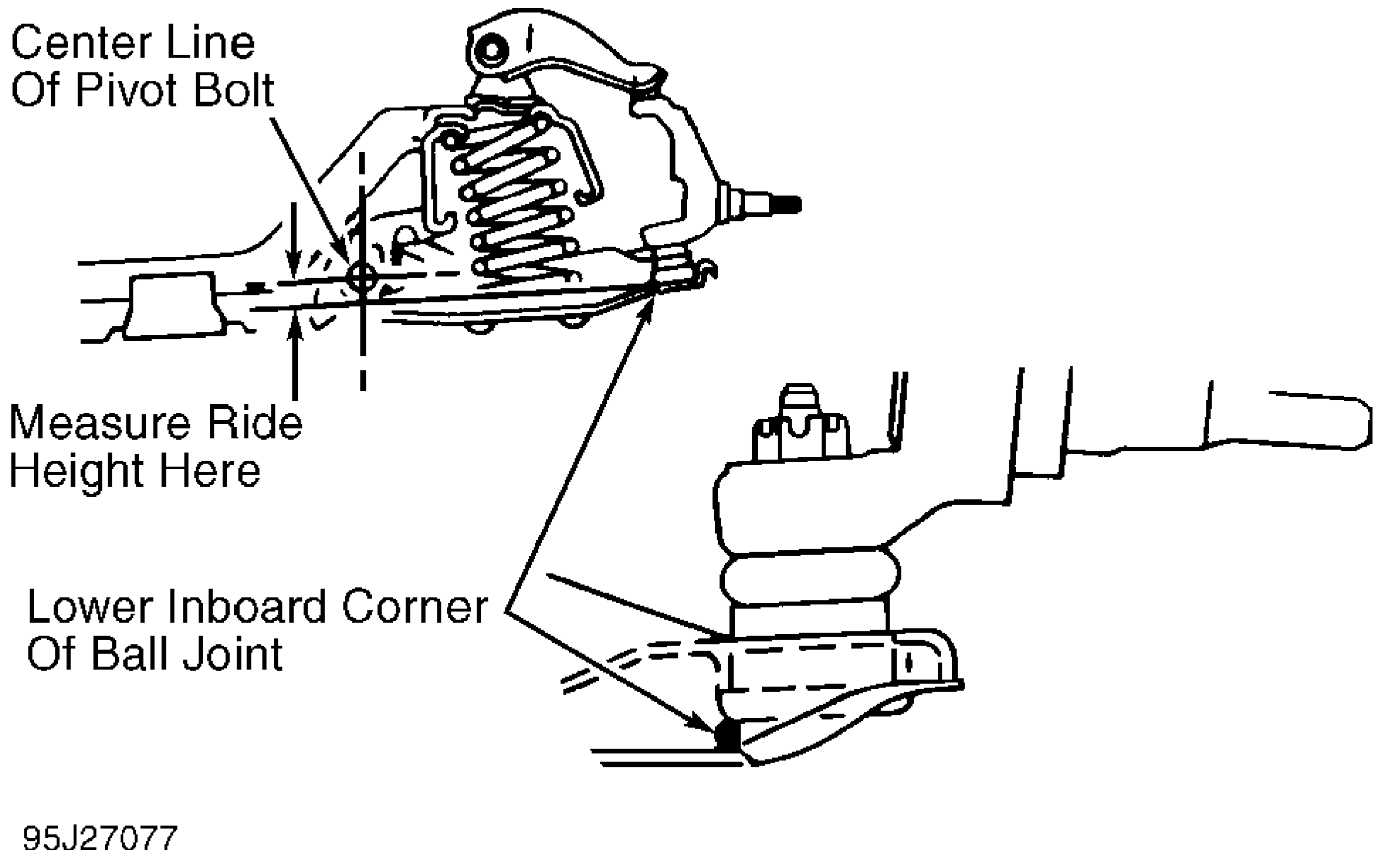


Fig. 2: Measuring Riding Height (2WD)
Courtesy of General Motors Corp.

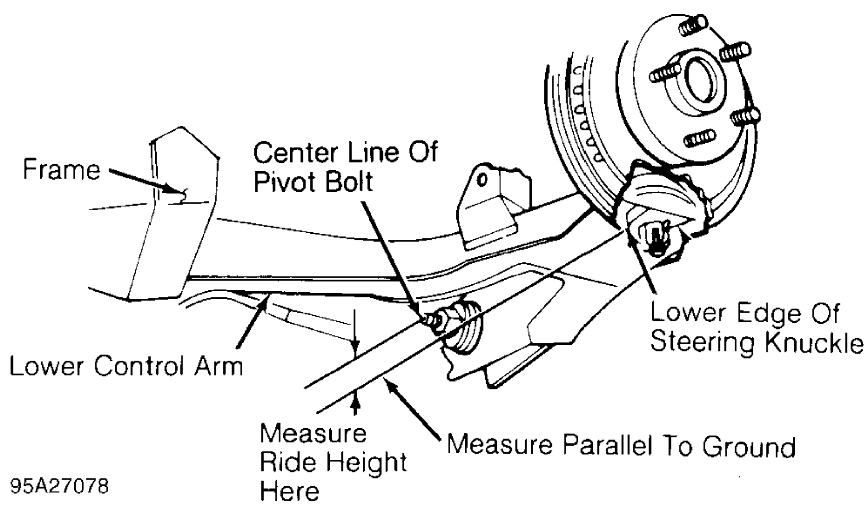


Fig. 3: Measuring Riding Height (4WD)
Courtesy of General Motors Corp.

RIDING HEIGHT SPECIFICATIONS TABLE

Application	In. (mm)
2WD	2.6-3.1 (67-79)
4WD	4.6-5.0 (116-128)

WHEEL ALIGNMENT PROCEDURES

PRE-ALIGNMENT CHECKS

Ensure steering wheel is centered and front wheels are in straight-ahead position (to correct, shorten one tie rod adjusting sleeve and lengthen the opposite sleeve in equal amounts). Ensure none of the following conditions exist:

* Incorrect vehicle riding height (see RIDING HEIGHT).
* Incorrect tire pressure, mismatched tires (differing size or type), excessive tire runout, unbalanced tire and wheel assemblies, loose wheel bearings, or loose wheel lug nuts.
* Loose or worn steering linkage/suspension components, or excessive play in steering gear box.

CAMBER & CASTER ADJUSTMENT

2WD

Loosen nuts securing upper control arm shaft to frame. See Fig. 4. Remove original shims from bolts, and add or remove shims until caster and camber are within specification. See WHEEL ALIGNMENT SPECIFICATIONS. Tighten nuts to specification. See TORQUE SPECIFICATIONS.

4WD

Loosen nut on end of each bolt securing upper control arm to frame brackets. See Fig. 5. Rotate bolts until camber and caster are within specification. See WHEEL ALIGNMENT SPECIFICATIONS. Tighten nuts to specification. See TORQUE SPECIFICATIONS.

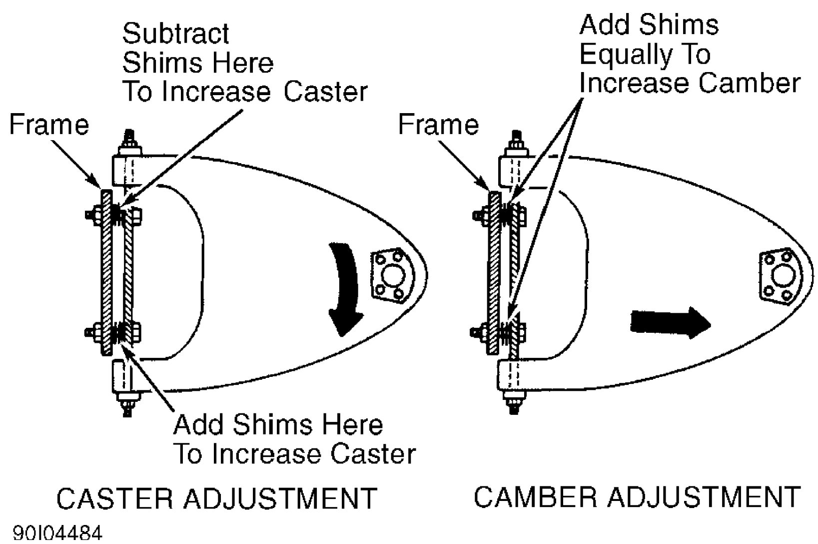


Fig. 4: Adjusting Caster & Camber (2WD)
Courtesy of General Motors Corp.

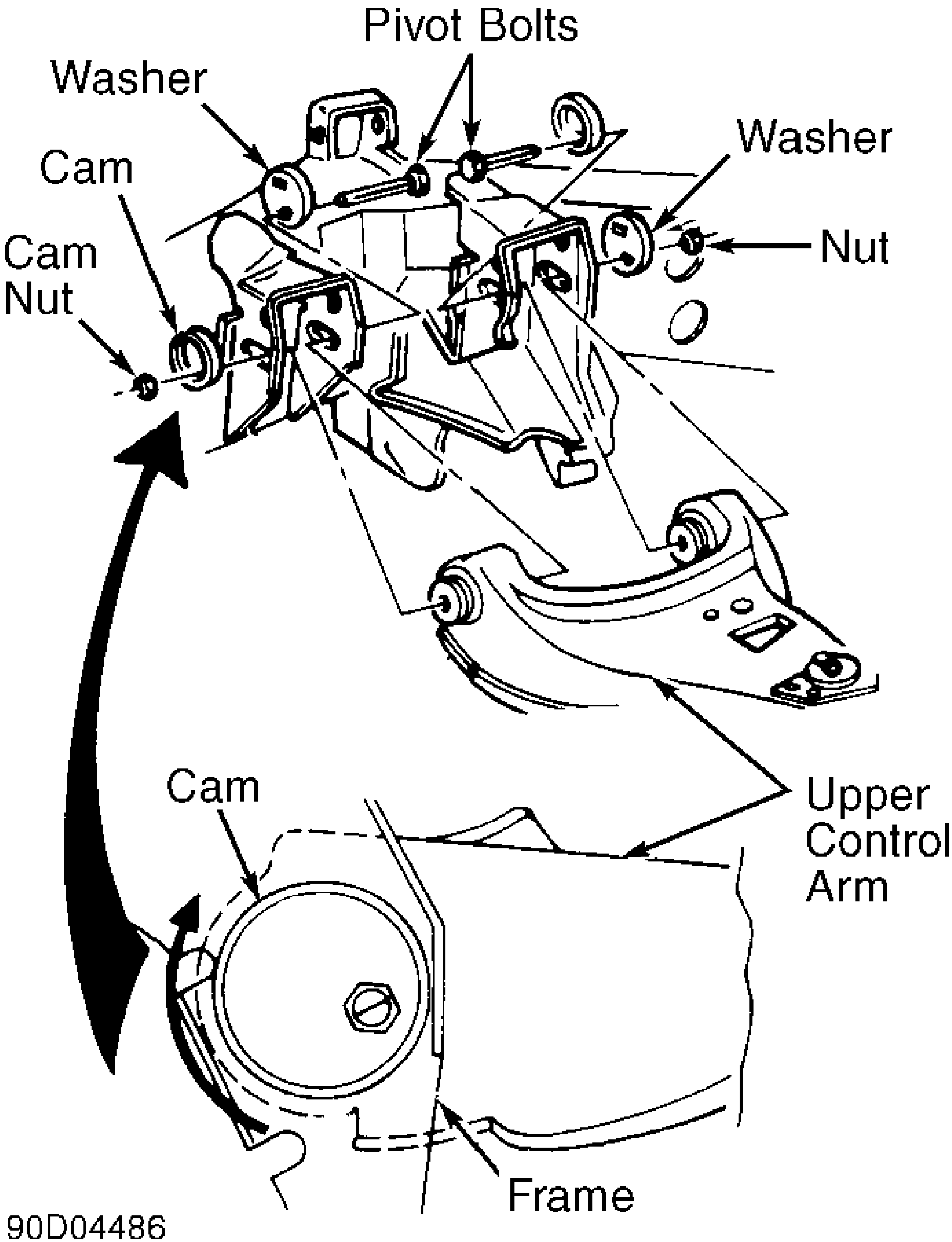


Fig. 5: Adjusting Caster & Camber (4WD)
Courtesy of General Motors Corp.

TOE-IN ADJUSTMENT

1) Center steering wheel and hold with steering wheel clamp. Loosen tie rod lock nuts or adjustment sleeve clamp bolts. Rotate inner tie rods or adjustment sleeves to align toe to specification. See WHEEL ALIGNMENT SPECIFICATIONS.

2) Ensure number of threads showing on each tie rod or inside each adjustment sleeve is nearly equal. Ensure tie rod ends are square before tightening lock nuts. Tighten tie rod lock nuts or adjustment sleeve clamp bolts to specification. See TORQUE SPECIFICATIONS.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS TABLE

Application	Ft. Lbs. (N.m)
Tie Rod Adjustment Sleeve Clamp Bolt	14 (19)
Upper Control Arm Nut	
2WD	55 (75)
4WD	85 (115)
Wheel Lug Nut	96 (130)

WHEEL ALIGNMENT SPECIFICATIONS

WHEEL ALIGNMENT SPECIFICATIONS TABLE

Application	Preferred	Range
Camber (1)	0	- 0.50 To 0.50
Caster		
Except Pickup (1)	3.00	2.50 To 3.50
Pickup (1)	2.00	1.50 To 2.50
Toe-In (1)	0.10	0 To 0.20
Toe-In (2)	0.50 (12.7)	0 To 0.10 (0 To 2.54)

(1) - Measurement in degrees.
(2) - Measurement in inches (mm).

WHEEL ALIGNMENT THEORY/OPERATION

1997 Chevrolet Blazer

GENERAL INFORMATION
Wheel Alignment Theory & Operation

ALL MODELS

* PLEASE READ THIS FIRST *

NOTE: This article is intended for general information purposes only. This information may not apply to all makes and models.

PRE-ALIGNMENT INSTRUCTIONS

GENERAL ALIGNMENT CHECKS

Before adjusting wheel alignment, check the following:

* Each axle uses tires of same construction and tread style, equal in tread wear and overall diameter. Verify that radial and axial runout is not excessive. Inflation should be at manufacturer's specifications.
* Steering linkage and suspension must not have excessive play. Check for wear in tie rod ends and ball joints. Springs must not be sagging. Control arm and strut rod bushings must not have excessive play. See Fig. 1.

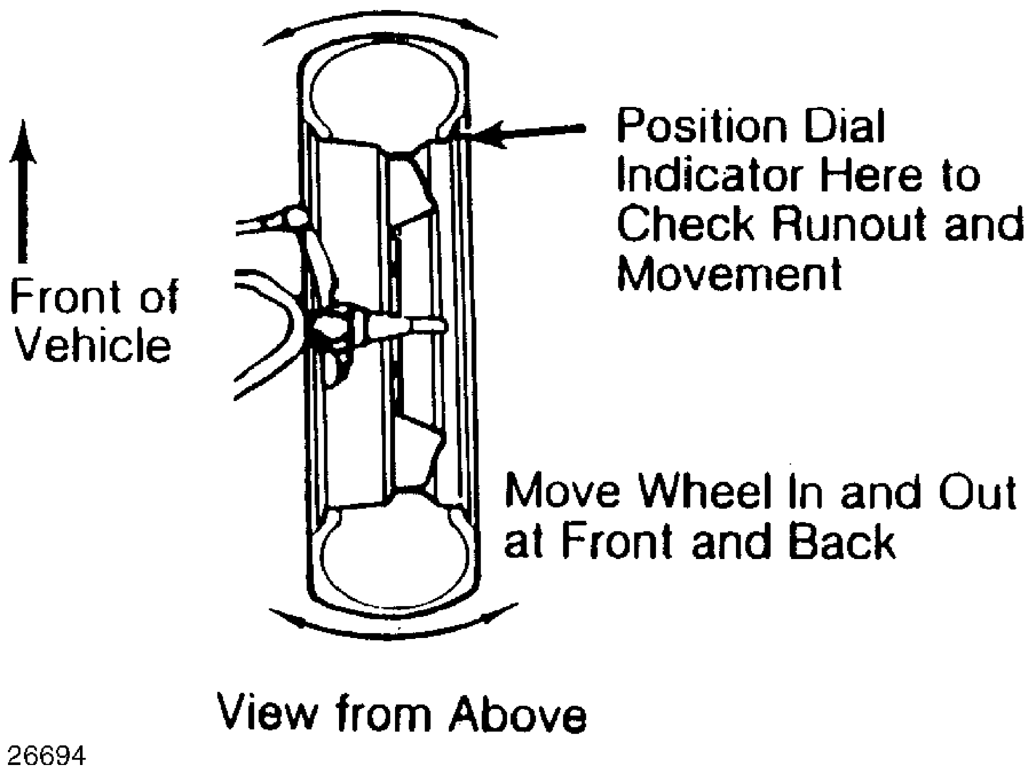


Fig. 1: Checking Steering Linkage

* Vehicle must be on level floor with full fuel tank, no passenger load, spare tire in place and no load in trunk. Bounce front and rear end of vehicle several times. Confirm

vehicle is at normal riding height.

* Steering wheel must be centered with wheels in straight ahead position. If required, shorten one tie rod adjusting sleeve and lengthen opposite sleeve (equal amount of turns). See Fig. 2.
* Wheel bearings should have the correct preload and lug nuts must be tightened to manufacturer's specifications. Adjust camber, caster and toe-in using this sequence. Follow instructions of the alignment equipment manufacturer.

CAUTION: Do not attempt to correct alignment by straightening parts. Damaged parts must be replaced.

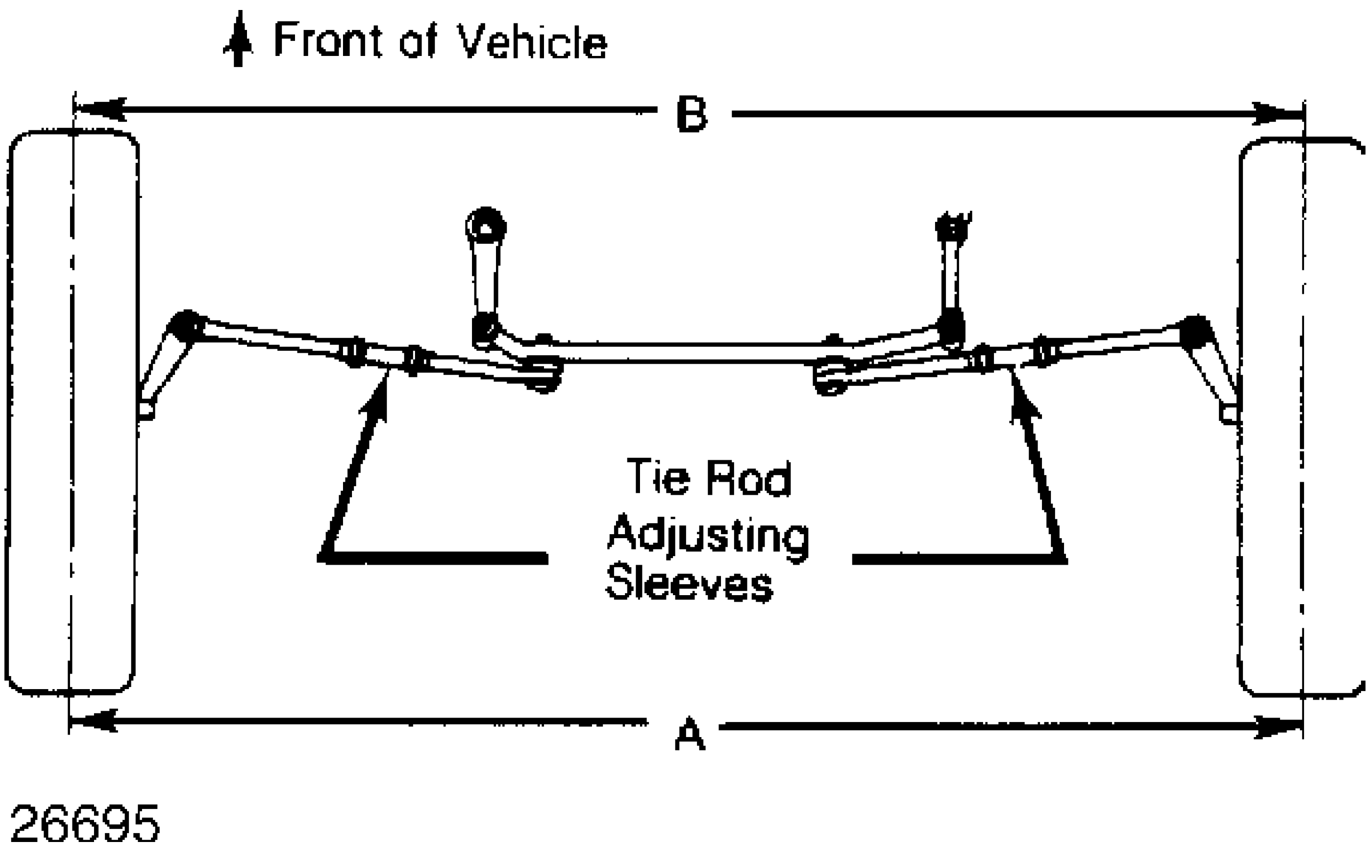


Fig. 2: Adjusting Tie Rod Sleeves (Top View)

CAMBER

1) Camber is the tilting of the wheel, outward at either top or bottom, as viewed from front of vehicle. See Fig. 3.

2) When wheels tilts outward at the top (from centerline of vehicle), camber is positive. When wheels tilt inward at top, camber is negative. Amount of tilt is measured in degrees from vertical.

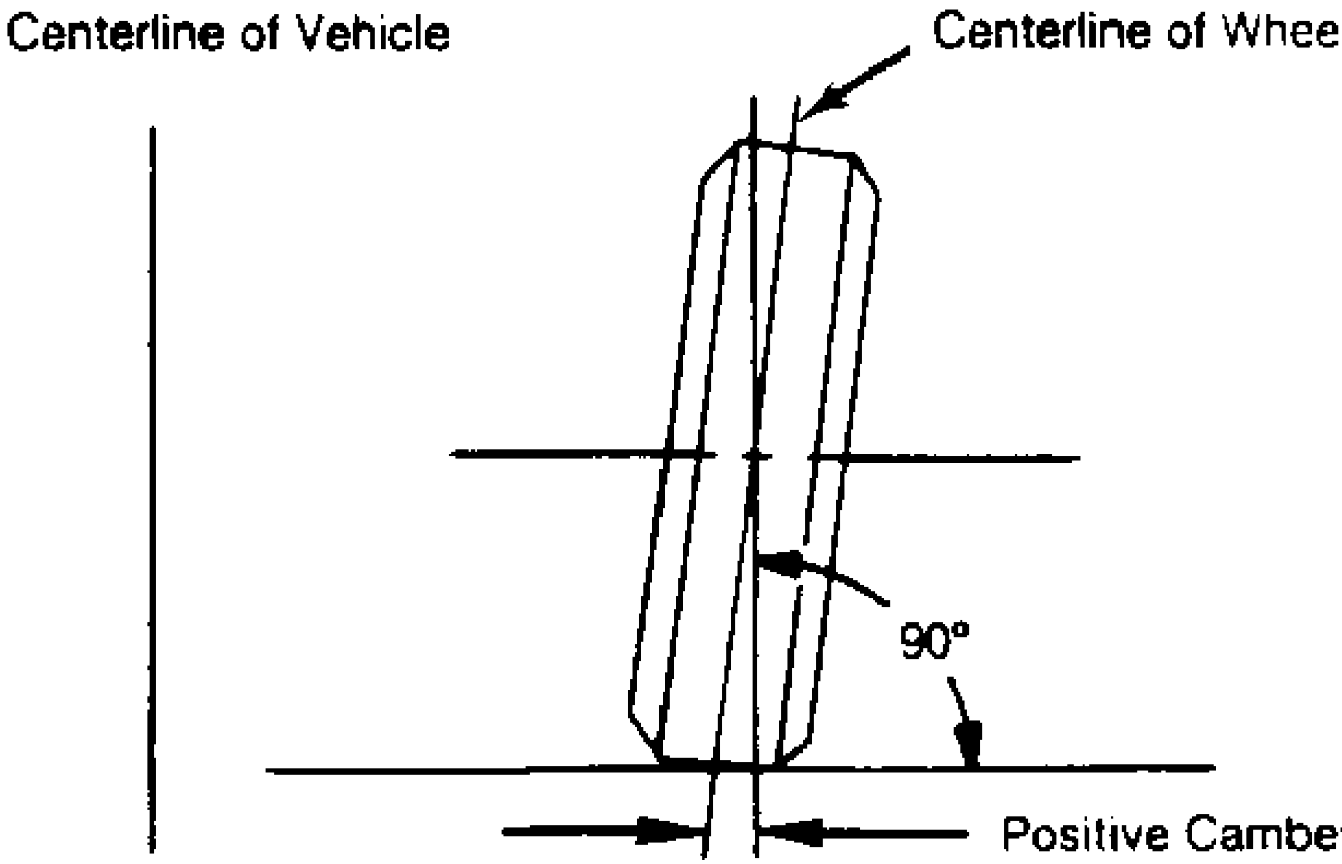


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Fig. 3: Determining Camber Angle

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.

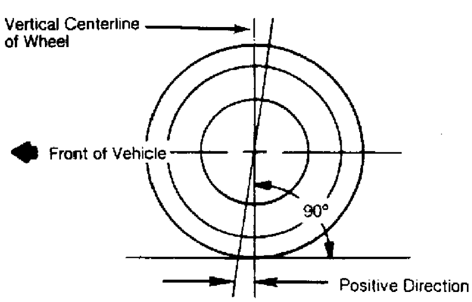

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Fig. 4: Determining Caster Angle

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.

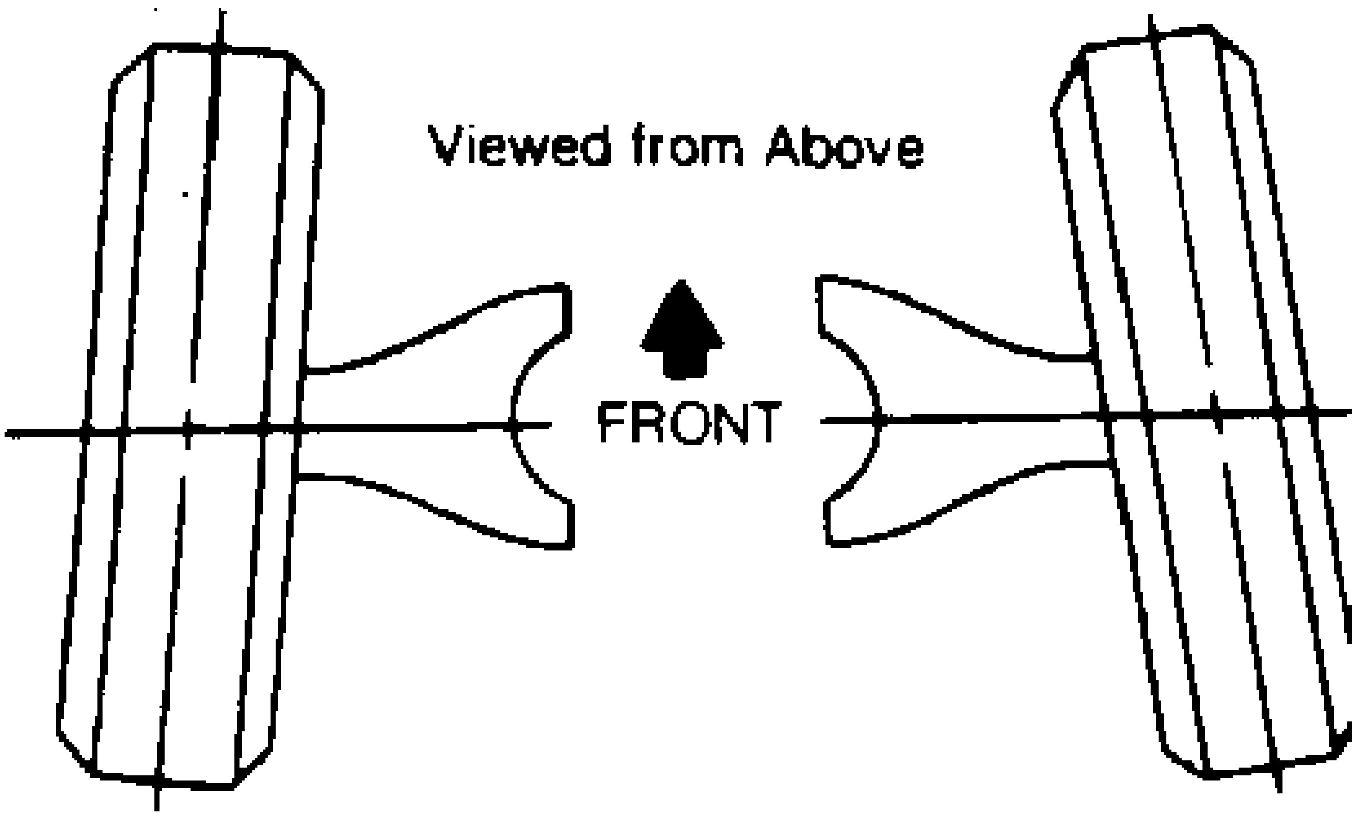

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Fig. 5: Wheel Toe-In (Dimension A Less Dimension B)

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.

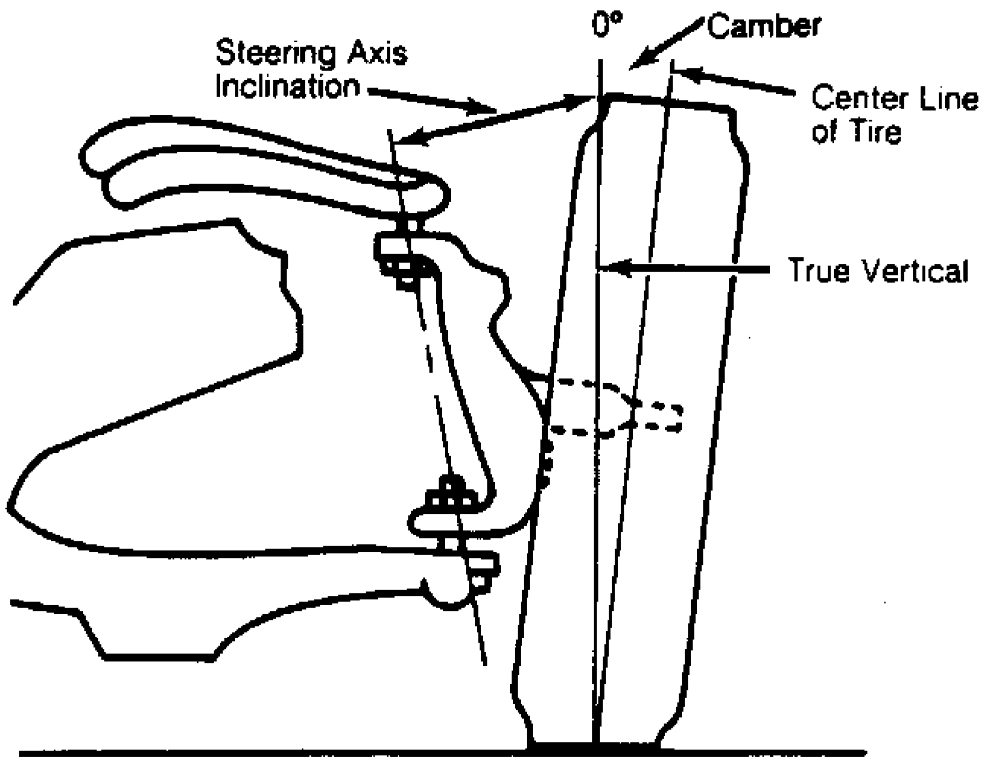

Fig. 6: Checking Steering Axis Inclination

1997 ACCESSORIES/SAFETY EQUIP
General Motors Corp. - Power Rear Window/Liftgate Release

Chevrolet; Blazer
GMC; Jimmy
Oldsmobile; Bravada

DESCRIPTION & OPERATION

Electric rear window release is used on all models. Some models are also equipped with an electronic locking feature. System consists of an instrument panel mounted switch, release solenoid in the liftgate, parking brake warning switch (M/T), Park/Neutral Position (PNP) switch (A/T) and necessary wiring. Circuit is powered by a fuse in the fuse block.

Rear window release and electronic door locking system consists of an instrument panel release switch, release solenoid in the liftgate, a liftgate lock/latch module, a liftgate strut switch, and latch solenoid.

TROUBLE SHOOTING

Check condition of CTSY fuse. If fuse is open, repair source of overload. Ensure all connections (ground and voltage) are clean and tight.

TESTING

REAR WINDOW RELEASE ACTUATOR INOPERATIVE

1) If vehicle has an Automatic Transmission (A/T), go to next step. If vehicle has a Manual Transmission (M/T), go to step 5).

2) Place transmission in Park. Remove endgate/liftgate trim panel. Disconnect window release solenoid. Check for continuity between window release solenoid connector terminal "B" (Black wire) and ground. If continuity exists, go to step 7). If continuity does not exist, go to next step.

3) Disconnect Transmission Range (TR) switch. Check for continuity between TR switch connector terminal "D" (Black wire) and ground. If continuity exists, go to next step. If continuity does not exist, locate and repair open in Black wire.

4) Connect a fused jumper wire between TR switch connector Orange/Black wire terminal and ground. Check for continuity to ground at window release solenoid. If continuity exists, replace TR switch. If continuity does not exist, locate and repair open in Orange/Black wire between window release solenoid and TR switch.

5) Set parking brake. Remove endgate/liftgate trim panel. Disconnect window release solenoid. Check for continuity to ground at window release solenoid connector terminal "B" (Orange/Black wire). If continuity exists, go to step 7). If continuity does not exist, go to next step.

6) Disconnect parking brake warning switch. Connect a fused jumper wire between parking brake switch connector Light/Blue wire terminal. Check for continuity to ground at window release solenoid connector terminal "B" (Orange/Black wire). If continuity exists, replace parking brake switch. If continuity does not exist, locate and repair open in Orange/Black wire or Light Blue wire between release solenoid and parking brake switch.

7) Using a test light connected to ground, check window release actuator connector Black/White wire terminal while depressing HATCH RELEASE switch on instrument panel. If test light illuminates, replace window release solenoid. If test light does not illuminate, go to next step.

8) Open left front side door. If interior lights illuminate, go to next step. If interior lights do not illuminate, repair fault with interior lighting.

9) Locate and repair open in Black/White wire between rear endgate/liftgate window release switch, front door lock actuator and endgate/liftgate window release solenoid. See appropriate WIRING DIAGRAM.

NEITHER ENDGATE LOCK SWITCH OR LIFTGATE RELEASE SWITCH ACTIVATES LIFTGATE RELEASE SOLENOID

1) Connect fused jumper wire between liftgate release solenoid connector (Orange/Black wire) and ground. If liftgate release solenoid does not activate, go to next step. If liftgate release solenoid does activate, go to step 3).

2) Disconnect liftgate release solenoid connector. Connect test light between liftgate release solenoid connector Black/White wire and ground. Press liftgate release switch. If test light comes on, replace liftgate release solenoid. If test light does not come on, repair open in Black/White wire.

3) If vehicle is equipped with Automatic Transmission (A/T), go to next step. If vehicle is equipped with Manual Transmission (M/T), go to step 6).

4) Place transmission in Park (A/T), or Neutral (M/T). Connect self-powered test light between park/neutral position switch connector C1 Orange/Black wire and ground. If test light does not come on, go to next step. If test light comes on, repair open circuit in Orange/Black wire.

5) Disconnect park/neutral position switch connector C1. Connect self-powered test light between park/neutral position switch connector C1 Black wire and ground. If test light comes on, replace park/neutral position switch. If test light does not come on, repair open circuit in Black wire.

6) Apply parking brake. Connect self-powered test light between parking brake warning switch connector Light Blue wire and ground. If test light comes on, repair open circuit in Light Blue or Orange/Black wires. If test light does not light, replace parking brake warning switch.

LIFTGATE RELEASE SWITCH DOES NOT ACTIVATE LIFTGATE RELEASE SOLENOID

1) Disconnect liftgate release switch connector. Connect test light between liftgate release switch Orange wire and ground. If test light comes on, go to next step. If test light does not come on, repair open circuit in Orange wire.

2) Momentarily connect fused jumper wire between liftgate release switch connector Orange and Black/White wires. If liftgate release solenoid activates, replace liftgate release switch. If liftgate release solenoid does not activate, repair open circuit in Black/White wire.

ENDGATE LOCK SWITCH DOES NOT ACTIVATE LIFTGATE RELEASE SOLENOID

1) Disconnect endgate lock switch connector. Connect test light between endgate lock switch connector Orange wire and ground. If test light comes on, go to next step. If test light does not come on,

repair open circuit in Orange wire.

2) Unlock left front door. Place Automatic Transmission (A/T) in Park or Neutral. For Manual Transmission (M/T), set parking brake. Momentarily connect fused jumper wire between endgate lock switch connector Orange and Black wires. If liftgate release solenoid does not activate, go to next step. If liftgate release solenoid activates, replace endgate lock switch.

3) Reconnect endgate lock switch connector. Disconnect driver's door lock key switch connector. Connect test light between driver's door lock key switch connector Black wire and ground. Press endgate lock switch. If test light comes on, go to next step. If test light does not come on, repair open circuit in Black wire.

4) Connect fused jumper wire between driver's door lock key switch connector Black/White and Black wires. Press endgate lock switch. If liftgate release solenoid activates, replace driver's door lock key switch. If liftgate release solenoid does not activate, repair open circuit in Black/White wire.

REMOTE KEYLESS ENTRY LIFTGATE RELEASE FUNCTION INOPERATIVE

(IF EQUIPPED)

1) Place Automatic Transmission (A/T) in Park or Neutral. For Manual Transmission (M/T), set parking brake. Disconnect remote keyless entry module connector C1 located behind lower left side of instrument panel, near parking brake. Connect test light between remote keyless entry module connector C1 terminal "B" (Black/White wire) and ground. Press liftgate release switch.

2) If test light comes on, see KEYLESS ENTRY SYSTEM - REMOTE article. If test light does not come on, repair open circuit in Black/White wire.

REMOVAL & INSTALLATION

NOTE: Removal and installation procedures are not available from manufacturer.

WIRING DIAGRAMS

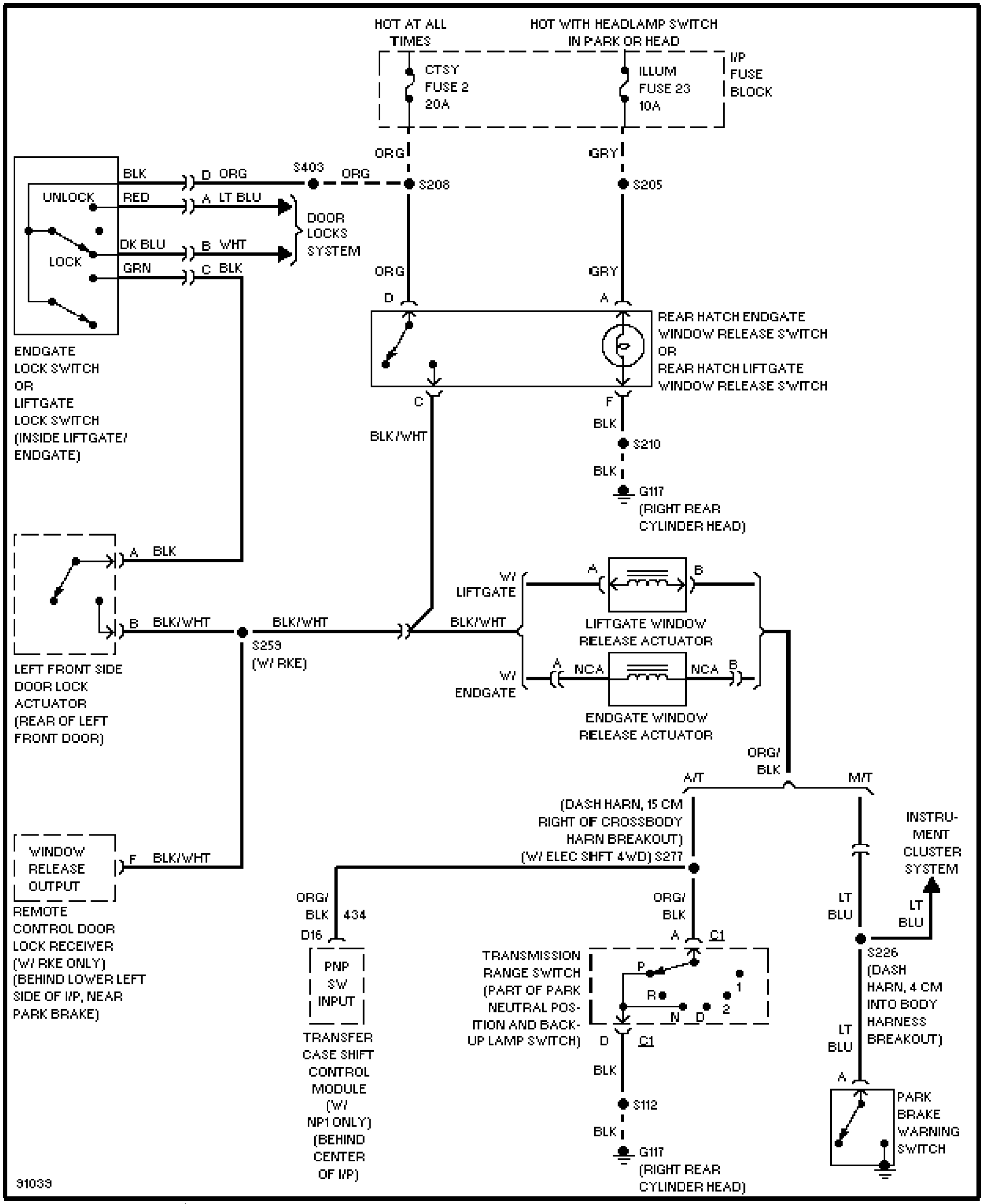

Fig. 1: Rear Window/Liftgate Release Wiring Diagram

WIPER/WASHER SYSTEM

1997 Chevrolet Blazer

1997 ACCESSORIES/SAFETY EQUIP
General Motors Corp. - Wiper/Washer Systems

Chevrolet; Blazer, "S" & "T" Series Pickup
GMC; Jimmy & Sonoma
Oldsmobile; Bravada

DESCRIPTION

FRONT

Wiper/washer system is a pulse delay system. System uses a permanent-magnet, positive-park, 2-speed wiper motor. System includes LOW, HIGH, DELAY and MIST modes. Variable resistor in wiper switch adjusts amount of current to a delay module attached to wiper motor. Delay module controls current to wiper motor.

REAR

System uses a positive-park, single-speed wiper motor. In addition to ON and OFF positions, switch on instrument panel has momentary WASH and WIPE positions. Washer pump is located in engine compartment, inside washer fluid reservoir.

TESTING

* PLEASE READ THIS FIRST *

WARNING: Vehicles are equipped with Supplemental Restraint System (SRS). Air bag system MUST be disabled before servicing ANY steering column component. Disabling system will prevent accidental air bag deployment, resulting in possible serious injury or property damage. See DISABLING & ACTIVATING AIR BAG SYSTEM in AIR BAG RESTRAINT SYSTEM article.

FRONT WIPER/WASHER

NOTE: Ensure WIPER fuse (No. 17) is okay before testing system.

Wipers Inoperative In All Modes

1) Turn ignition on and wiper switch to HIGH position. Using test light, backprobe between ground and terminal No. 4 of wiper switch connector. See Fig. 1. If light is on, go to next step. If light is not on, go to step 3).

2) Turn ignition off. Turn wiper switch to LO position. Turn ignition on. Connect jumper wire between wiper motor ground and chassis ground. If motor operates, repair ground circuit as necessary. If motor does not operate, replace wiper motor.

3) Check WIPER fuse (No. 17). If fuse is okay, repair open circuit in Yellow wire. If fuse is blown, replace as necessary. If fuse fails, repair short to ground in Yellow wire circuit. If no faults are found in circuit, replace wiper motor.

Wipers Run In Low Speed Only

Disconnect wiper motor harness connector. Using jumper wire, connect battery voltage to connector terminal No. "4". See Fig. 1. If motor does not operate, replace wiper motor. If motor operates, repair connector terminal No. "4" circuit as necessary. If no faults are found in circuit, replace wiper/washer switch.

Wipers Run In High Speed Only

Disconnect wiper motor harness connector. Using jumper wire, connect battery voltage to connector terminal No. "3". See Fig. 1. If motor does not operate, replace wiper motor. If motor operates, repair connector terminal No. "3" circuit as necessary. If no faults are found in circuit, replace wiper/washer switch.

Wipers Will Not Park

1) Disconnect wiper motor harness connector. Using jumper wire, connect battery voltage to connector terminal No. "1". See Fig. 1. Connect a second jumper wire between connector terminals No. "2" and "3". If wiper parks, go to next step. If wiper still does not park, replace circuit board. If wiper still will not park, replace motor.

2) Turn wiper switch to OFF position. Check for continuity between switch terminald No. "2" and "3". If continuity is present, repair open circuit between connector terminal No. "1" and fuse panel. If continuity is not present, repair open circuit between connector terminal No. "3" and switch. If fault is still present, replace wiper/washer switch.

Wipers Will Not Shut Off

Disconnect wiper motor harness connector. Using jumper wire, connect battery voltage to connector terminal No. "1". See Fig. 1. Connect a second jumper wire between connector terminals No. "2" and "3". If wiper parks, replace wiper/washer switch. If wiper still does not park, replace motor.

Washer Inoperative

1) Using test light, backprobe between ground and terminal No. 2 of wiper connector with WASH button pushed. See Fig. 1. If test light comes on, repair open circuit between connector terminal No. "2" and wiper motor. If test light does not come on, go to next step.

2) Remove washer pump. Connect test light between ground at wiper motor housing and positive terminal. If test light is on, replace motor. If test light is not on, replace circuit board and terminal assembly.

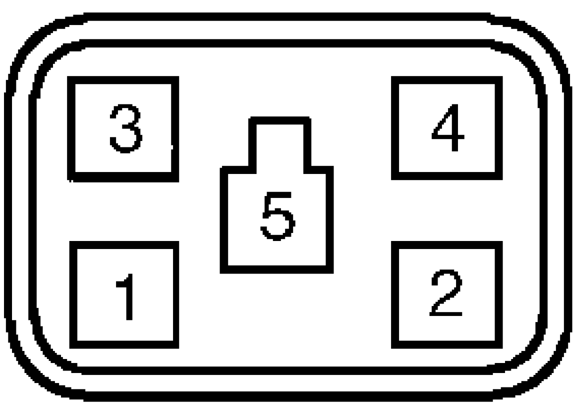

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Fig. 1: Identifying Wiper Motor Wiring Harness Connector Terminals
Courtesy of General Motors Corp.

REAR WIPER/WASHER

NOTE: Test information is not available from manufacturer. Ensure RADIO, ILLUM and PK LPS fuses are okay

REMOVAL & INSTALLATION

* PLEASE READ THIS FIRST *

WARNING: Vehicles are equipped with Supplemental Restraint System (SRS). Air bag system MUST be disabled before servicing ANY steering column component. Disabling system will prevent accidental air bag deployment, resulting in possible serious injury or property damage. See DISABLING & ACTIVATING AIR BAG SYSTEM in AIR BAG RESTRAINT SYSTEM article.

CAUTION: When battery is disconnected, vehicle computer and memory systems may lose memory data. Driveability problems may exist until computer systems have completed a relearn cycle. See COMPUTER RELEARN PROCEDURES article in GENERAL INFORMATION before disconnecting battery.

WIPER MOTOR

Removal (Front)

Disconnect negative battery cable. Remove wiper arms. Remove cowl vent grille and screen. Disconnect wiper motor electrical connector. Using Wiper Transmission Separator (J-39232), remove transmission from wiper motor drive link. See Fig. 2. Remove motor mounting screws. Remove motor.

Installation

To install, reverse removal procedure. Lubricate drive link socket with lithium grease. Install transmission to motor drive link using Wiper Transmission Installer (J-39529). Ensure transmission is assembled to drive link past second detent so that seal is compressed to a maximum height of 1" (25 mm).

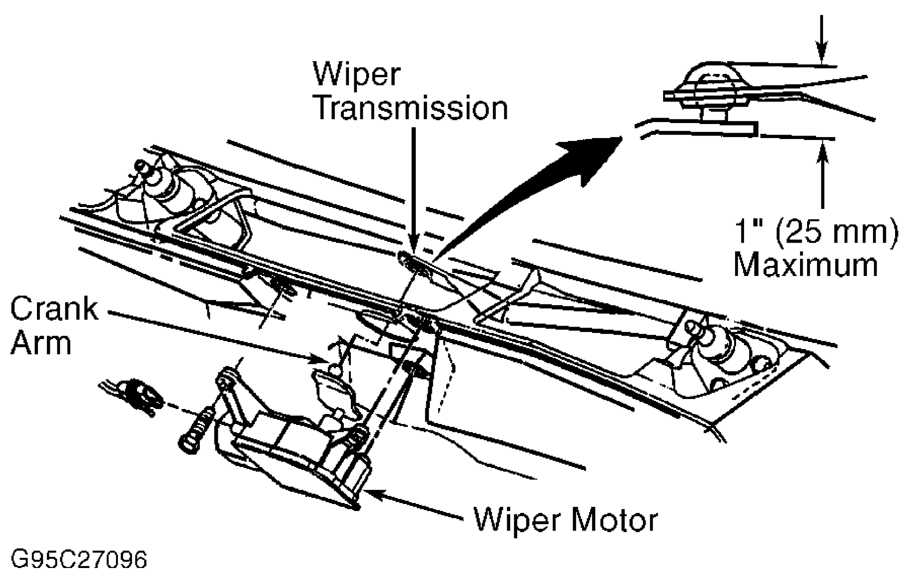

Fig. 2: Removing & Installing Front Wiper Motor
Courtesy of General Motors Corp.

Removal & Installation (Rear)

1) Disconnect negative battery cable. Disconnect washer hose

elbow. Remove wiper arm cap and nut. Remove wiper arm. Remove nut and spacer from motor shaft. See Fig. 3. Remove endgate interior panel. Disconnect wiper motor electrical connector.

2) Remove wiper motor mounting screws. Remove wiper motor. To install, reverse removal procedure. Tighten motor mounting screws to 57 INCH lbs. (6.5 N.m). Tighten motor shaft nut to 53 INCH lbs. (6 N.m). Tighten wiper arm nut to 17 ft. lbs. (23 N.m).

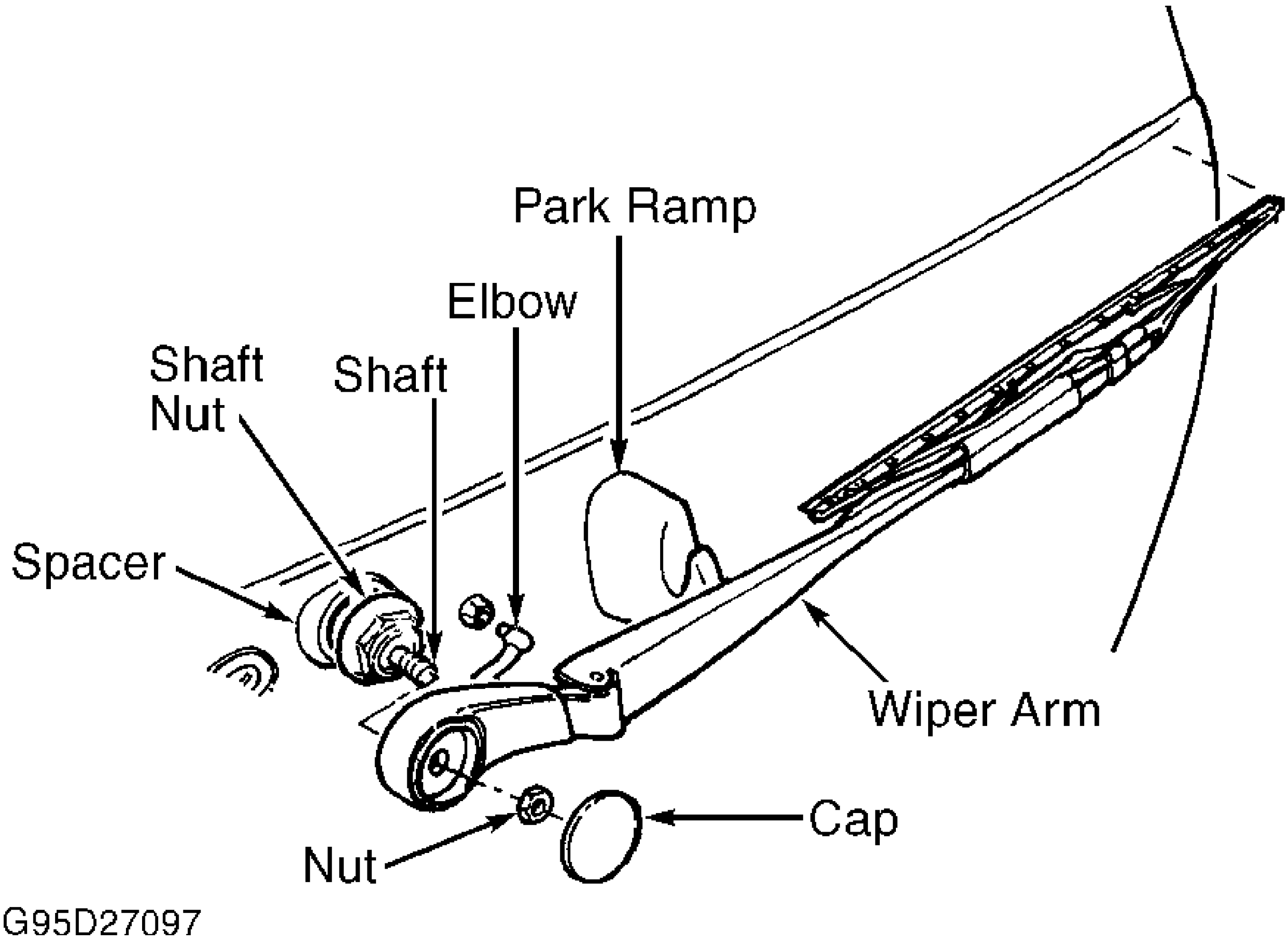

Fig. 3: Removing & Installing Rear Wiper Arm
Courtesy of General Motors Corp.

WIPER MOTOR CIRCUIT BOARD (FRONT)

Removal & Installation

Disconnect negative battery cable. Remove motor cover screws. Remove cover. Pull circuit board from motor. To install, reverse removal procedure. Tighten motor cover screws to 23 INCH lbs. (2.6 N.m).

WIPER SWITCH (FRONT)

Removal & Installation

1) Turn steering wheel to straight-ahead position. Disconnect negative battery cable. Remove inflator module. Remove horn contact wire from steering column.

2) Remove steering wheel nut. Using a puller, remove steering

wheel. DO NOT install puller bolts too far as damage to coil assembly can result.

3) Remove lower column cover screws. Pivot lower column cover down, slide back to release. Remove upper column cover. Remove multifunction switch assembly screws. Disconnect switch connector.

4) Remove switch assembly and wiring harness from column. To install, reverse removal procedure. Tighten steering wheel nut to 30 ft. lbs. (41 N.m).

WIPER SWITCH (REAR)

Removal & Installation

Disconnect negative battery cable. Remove wiper/washer switch from trim plate. Disconnect harness connector. To install, reverse removal procedure.

WIRING DIAGRAMS

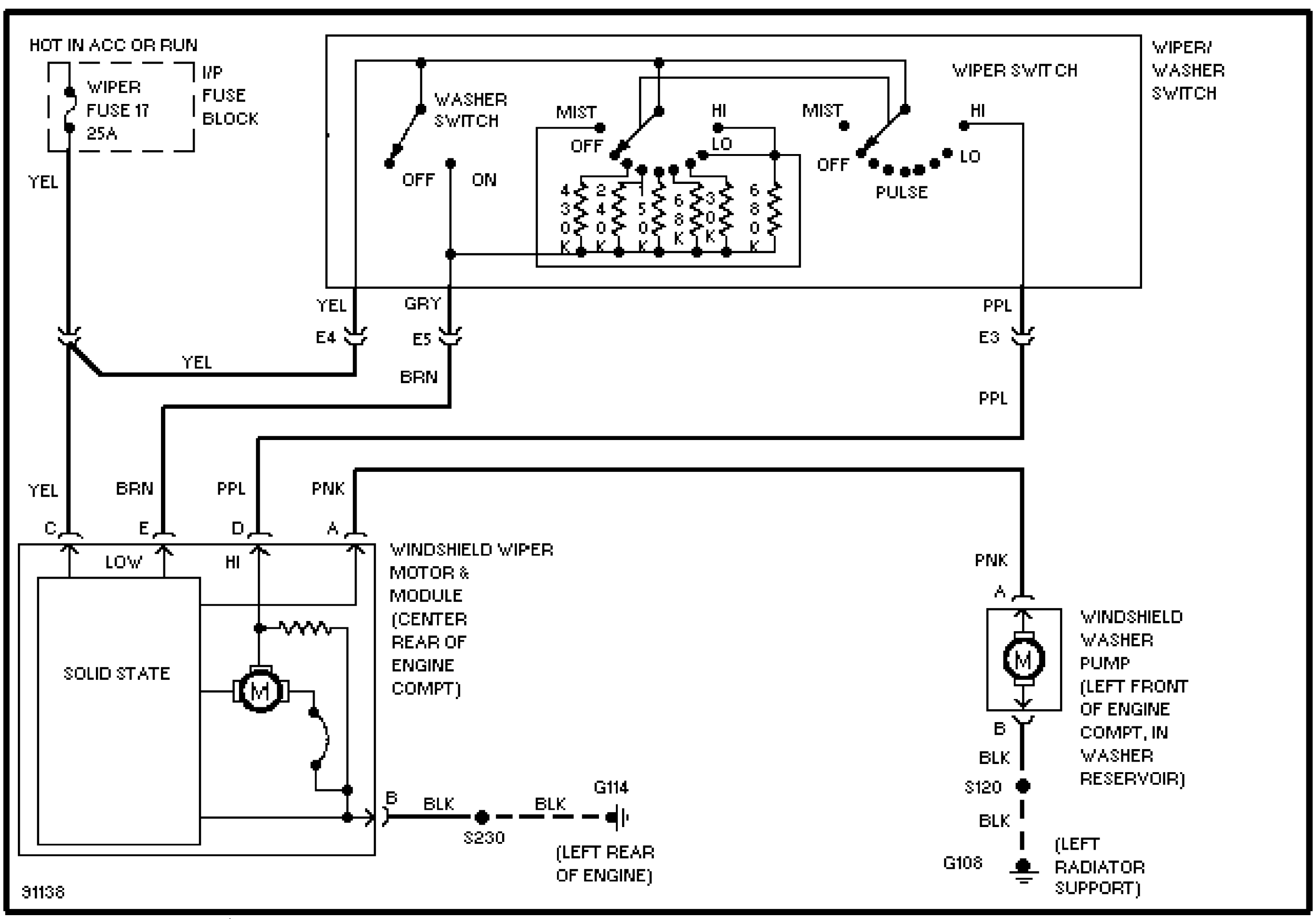

Fig. 4: Front Wiper/Washer System Wiring Diagram

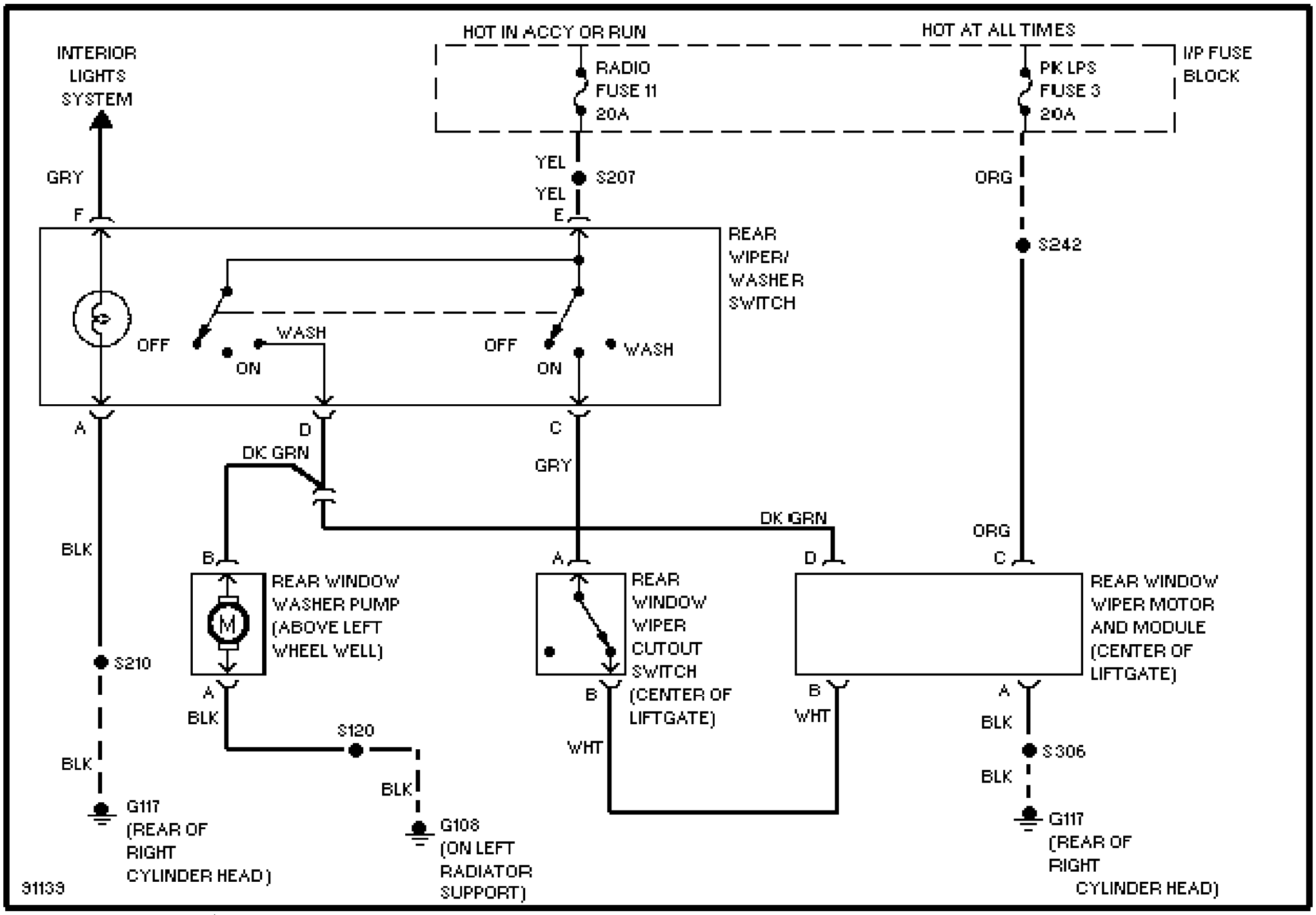

Fig. 5: Rear Wiper/Washer System Wiring Diagram (Blazer, Bravada & Jimmy)