H1 HUMMER SERVICE MANUAL

COMMERCIAL HUMMER®

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TABLE OF CONTENTS

ABBREVIATIONS

ABS . . . . . Antilock Brake System
A/C . . . . . Air Conditioning
a.c . . . . . Alternating Current
AMP . . . . . Ampere
CO . . . . . Carbon Monoxide
C . . . . . Celsius (centigrade)
cm . . . . . Centimeter
CTIS . . . . . Central Tire Inflation System
CDR . . . . . Crankcase Depression Regulator
cm^3 . . . . . Cubic Centimeter
$in.^3$ . . . . . Cubic Inch
cyl . . . . . Cylinder
° . . . . . Degree (angle or temperature)
DTC . . . . . Diagnostic Trouble Code
dia . . . . . Diameter
d.c. . . . . Direct Current
EPA. . . . . Environmental Protection Agency
F . . . . . Fahrenheit
ft . . . . . Feet
ft/min . . . . . Feet Per Minute
fl oz . . . . . Fluid Ounce
gal . . . . . Gallon
g . . . . . Gram
GAWR . . . . . Gross Axle Weight Rating
GVW. . . . . Gross Vehicle Weight
GVWR . . . . . Gross Vehicle Weight Rating
hp . . . . . Horsepower
HVAC. . . . . Heat, Ventilation, and Air Conditioning
in . . . . . Inch
INC . . . . . Include
ID . . . . . Identification
I.D. . . . . Internal Diameter
kg . . . . . Kilograms
km . . . . . Kilometer
km/h . . . . . Kilometers Per Hour
kPa . . . . . Kilopascals
lh . . . . . Left Hand
L . . . . . Liter
max . . . . . Maximum
m . . . . . Meter
mpg . . . . . Miles Per Gallon
mph . . . . . Miles Per Hour
mm . . . . . Millimeter
min . . . . . Minimum
– . . . . . Minus
– . . . . . Negative
No . . . . . Number
Ohm . . . . . Ohms
oz . . . . . Ounce
O.D . . . . . Outside Diameter
P/N . . . . . Part Number
% . . . . . Percentage
pt . . . . . Pint
+ . . . . . Plus
+ . . . . . Positive
lb . . . . . Pound
lb-ft . . . . . Pound-feet
lb-in. . . . . Pound-inch
psi . . . . . Pounds Per Square Inch
qt . . . . . Quart
: . . . . . Ratio
ref. . . . . Reference
RPM . . . . . Revolutions Per Minute
rh . . . . . Right-Hand
cm^2 . . . . . Square Centimeters
in^2 . . . . . Square Inches
TT4 . . . . . Torque Trac 4
VIN . . . . . Vehicle Identification Number
V . . . . . Volts
W . . . . . Watts
UNC . . . . . Unified Coarse
UNF . . . . . Unified Fine

RECOMMENDED FUEL/FLUIDS/LUBRICANTS/ CAPACITIES

Recommended Fuel

Recommended fuel for 6.5L diesel engines is #2 diesel. Do not use any other type fuel.

Engine Oil

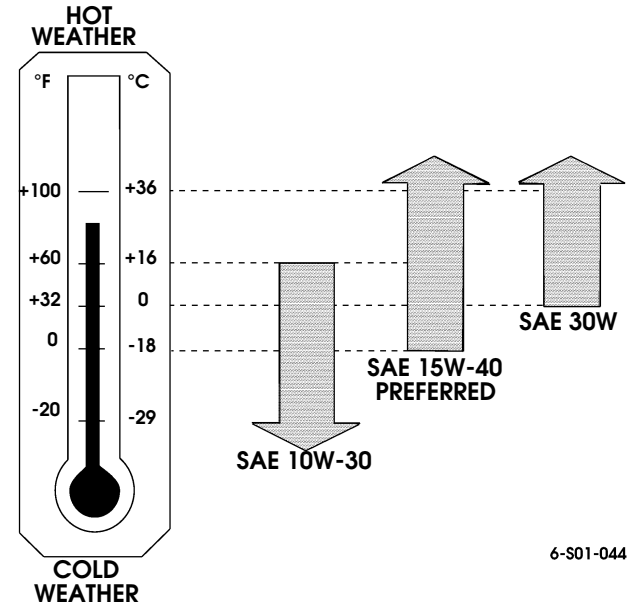

Figure 1-17: Oil Viscosity Chart

Diesel engine oil capacities are:

- 7.0 qts (6.6L) without filter change
- 8.0 qts (7.6L) with filter change
- 2.0 qts (1.9L) for engine oil cooler

Refer to Section 2 for more information regarding engine oil.

Engine Coolant

Recommended engine coolant is a mixture of ethylene glycol antifreeze and water.

Use a mixture containing 50% antifreeze and 50% water.

Radiator capacity is 7 qts (6.6L). System capacity is approximately 26 qts (25L).

Transmission/Transfer Case/Steering Gear and Pump Fluid

Recommended lubricant for the transmission, transfer case, and steering system is Dexron III automatic transmission fluid.

Approximate fluid capacities are:

- 1 qt (0.95L) for the steering gear and pump
- 3.5 qts (3.3L) for the transfer case
- 13.5 qts (12.8L) for the transmission, converter, and cooler
- 7.7 qts (7.3L) for the transmission (during fluid drain/refill)

Brake Fluid

Recommended brake fluid for all Hummer vehicles is DOT 3 brake fluid. Master cylinder approximate capacity is 1.64 pints (0.78L). Brake system approximate capacity is 3.1 pints (1.5L).

Front/Rear Axle and Geared Hub Lubricant

Recommended lubricant for axles and hubs is a heavy duty, multipurpose, API GL-5 gear lubricant, with viscosity ratings of 80W-90 or 75W-90.

The 80W-90 is an all purpose lubricant. The 75W-90 lubricant is suggested for use in areas where winter temperatures are consistently below freezing.

Steering Linkage and Suspension Lubricant

Recommended lubricant for steering and driveline components is an NLGI LB, or GC-LB grade multipurpose chassis grease. Use only those lubricants that display the NLGI certification symbol.

Body Lubrication

Door hinges, linkage parts, cables, and other body components can be lubricated with a number of different lubricants. Suggested lubricants and applications are:

- Window regulator mechanisms – spray white grease
- Window slides – silicone spray lube
- Door hinges – engine oil, ATF, or LPS brand spray lube
- Linkage/cables – LPS brand silicone spray lube
- Lock strikers – chassis grease, white grease, or LPS #3.
- Seat track – multipurpose chassis grease (NLGI-LB)
- Lock mechanisms –ATF, silicone spray lube, graphite lube

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Engine Diagnosis

PROBLEM	POTENTIAL CAUSE	CORRECTION
White Smoke	1. Low quality fuel.	1. Drain and refill tank with better quality fuel.
	2. Injection pump/engine timing is retarded.	2. Check and correct timing.
	3. Engine coolant entering combustion chamber through blown gasket, cracked head, loose/ damaged head bolts. May be accompanied by low coolant level and overheating.	3. Verify problem and repair as necessary. Replace cracked head, block, or head gasket.
	4. Low ambient temperatures (below freezing).	4. Normal condition caused primarily by water vapor. Not a concern unless it continues after warmup.
Black Smoke	1. Low grade diesel fuel.	1. Drain and refill tank.
	2. Overrich fuel mixture: • Drain/return lines restricted. • Injector(s) stuck open. • Engine speed or throttle sensor fault.	2. Test, diagnose and repair as required.
	3 Black smoke at wide open throttle.	3. Restriction in air intake system, no vacuum to wastegate actuator, damaged wastegate, or air leak at intake or exhaust manifold.
Gray Smoke	1. Long idle periods.	1. Try to avoid prolonged idling.
	2. Low grade fuel.	2. Add proper quality fuel. (not necessary to drain and refill tank).
	3. Fuel tank vent restricted.	3. Clear vent and line.
	4. Fuel return line restricted.	4. Clear restriction. Replace line if kinked or pinched.
	5. Engine problem (low compression excessive blowby, worn rings or valve stem seals).	5. Diagnose and repair as indicated.

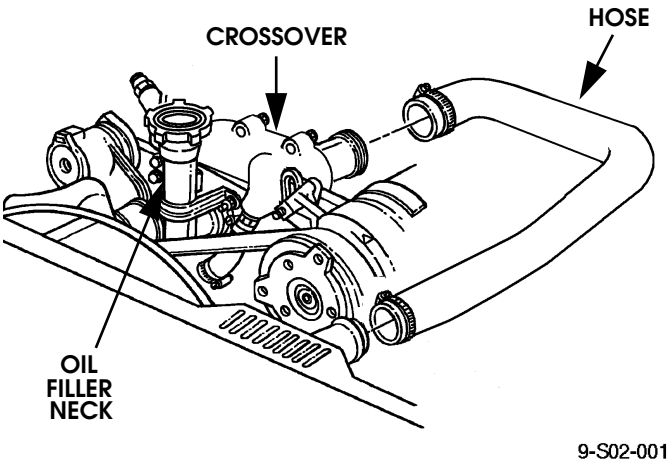


Figure 2-22: Upper Radiator Hose Connections

11. Remove fan and fan clutch.
12. Remove crankshaft pulley (Figure 2-14).
13. Remove torsional damper attaching bolt and washer (Figure 2-17).
14. Remove torsional damper with tool J–23523-F (Figure 2-18).
15. Remove drive keys from crankshaft. Replace keys if worn, chipped, or distorted.
16. Remove water pump and adapter plate as assembly (Figure 2-23).
17. Remove bolts that attach front cover to oil pan (Figure 2-24).
18. Rotate crankshaft by hand until timing marks on sprockets and gears are aligned and number one piston is at TDC.
19. Remove injection pump driven gear (Figure 2-24).
20. Remove baffle from front cover (Figure 2-24).
21. Remove nuts and washers attaching fuel injection pump to studs on front cover (Figure 2-24).

NOTE: There are timing marks on the front cover and injection pump. Note position of these marks for installation reference.

22. Remove bolts that attach front cover to engine block. Then break sealer bead with putty knife and remove cover.
23. Cover oil pan opening to prevent dirt entry.
24. Check timing chain deflection with dial indicator. Measure deflection mid-way between crankshaft and cam sprockets. Maximum allowable deflection is 0.810 in. (20.5 mm). Replace chain and sprockets if deflection is greater than specified.
25. Check camshaft end play with dial indicator. Maximum allowable end play is 0.012 in. (0.3 mm). Replace cam thrust plate and spacer if end play is greater than specified.

NOTE: Note position of timing marks on drive gear and crank and cam sprocket for installation reference.

26. Remove bolt and washer attaching injection pump drive gear to camshaft. Then remove gear (Figure 2-25).
27. Slide timing chain and sprockets off camshaft and crankshaft (Figure 2-25).
28. Remove drive keys from camshaft and crankshaft. Replace keys if chipped, cracked, or distorted. Minor burrs can be removed with a stone or fine tooth file.
29. Clean all old sealer off engine block, front cover, and water pump/adapter plate with scraper.

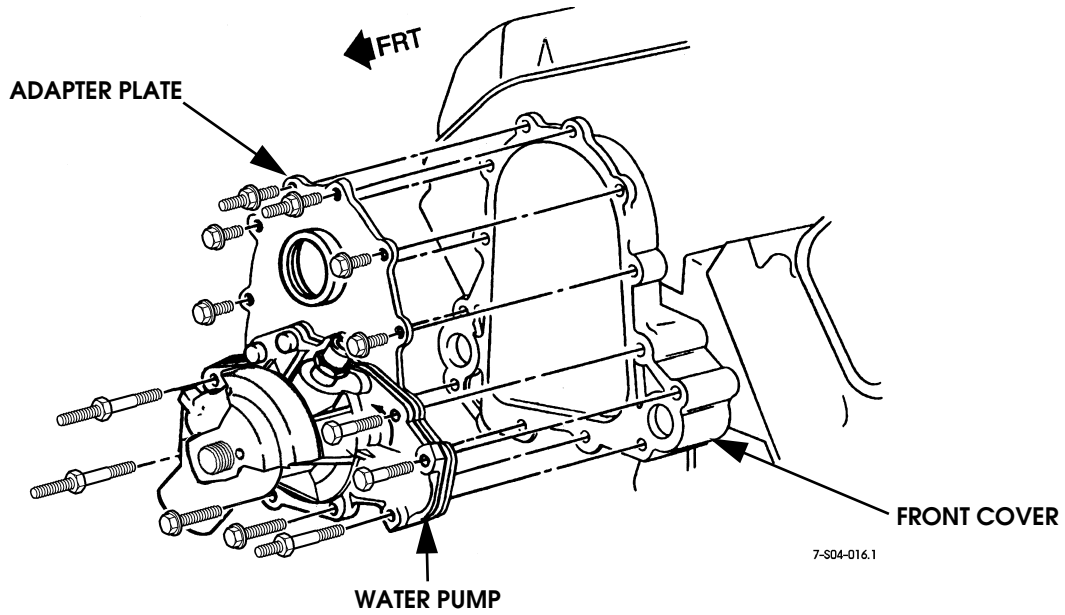


Figure 2-23: Water Pump and Adapter Plate Removal/Installation

Right Exhaust Manifold Rear Heat Shield Replacement

1. Remove console and engine access cover.
2. Detach rear heat shield from transmission fill tube clamp (Figure 2-39).
3. Remove rear heat shield.
4. Install rear heat shield.
5. Attach rear heat shield to transmission fill tube clamp.
6. Install engine access cover and console.

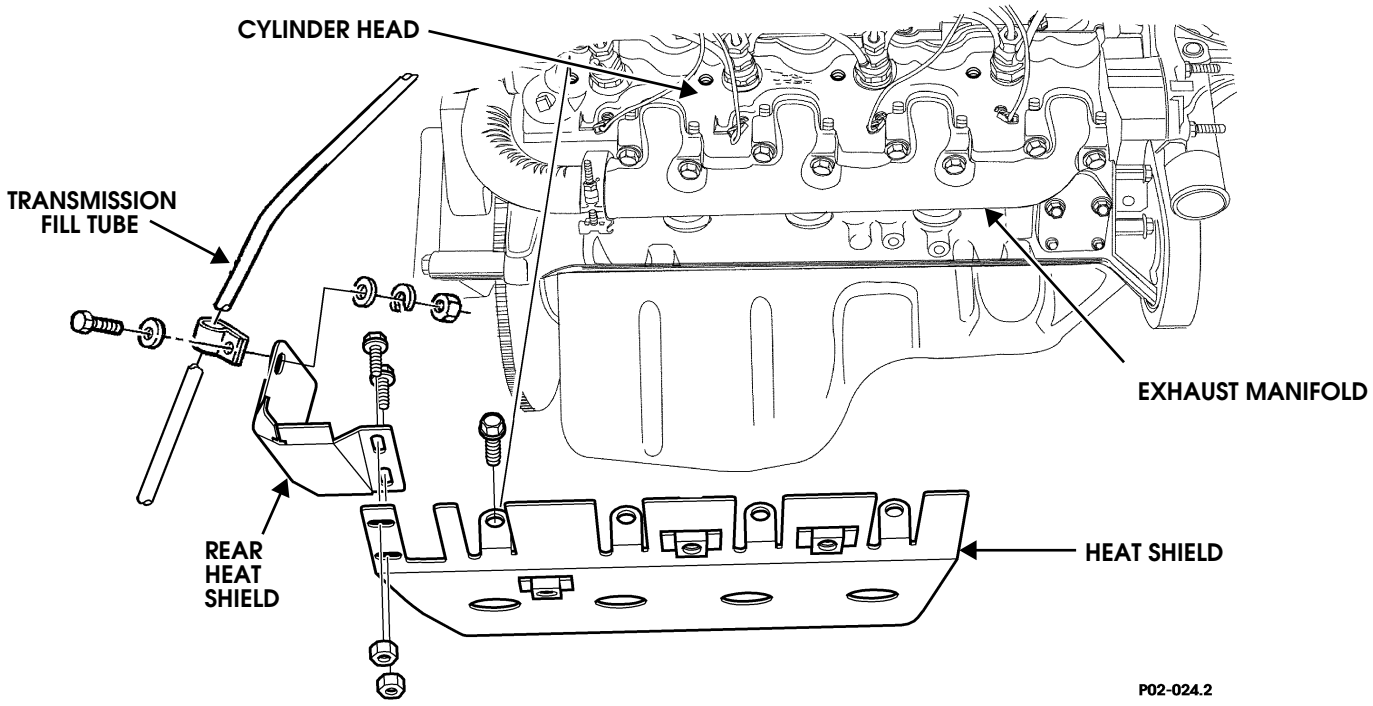


Figure 2-39: Right Rear Heat Shield

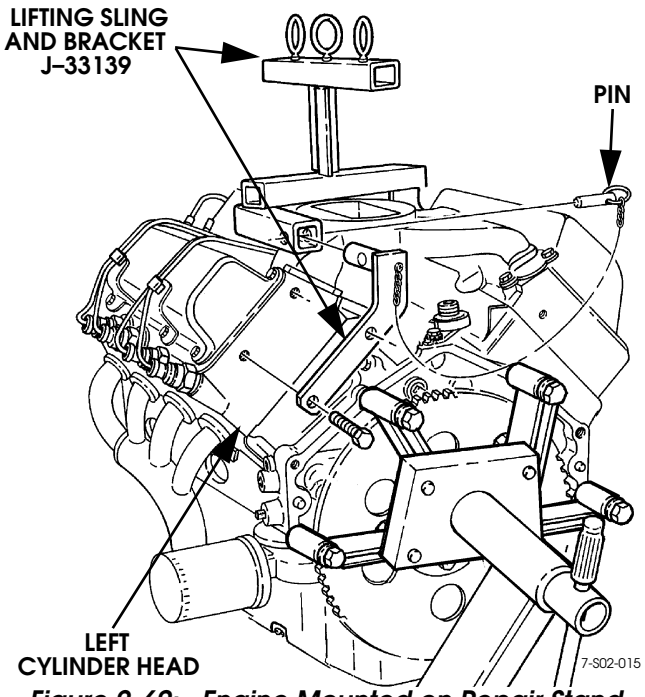


Figure 2-60: Engine Mounted on Repair Stand

ENGINE INSTALLATION

1. If new engine is being installed, transfer mounting brackets and insulators, generator, power steering pump, A/C compressor, drive plate (flywheel), turbocharger, and necessary mounting brackets, shields, damper pulleys, sensors and fittings, from old to new engine.
2. Attach lifting bracket to engine.
3. Attach hoist to lifting bracket. Raise engine and guide it into engine bay with aid of helper.
4. Align and seat engine on transmission. Be sure converter pilot hub is seated in crankshaft and that transmission is seated on engine block dowels. Install 2-3 transmission attaching bolts (finger tight) to hold engine and transmission in place.
5. Align and seat engine mounting bracket insulators on frame brackets. Be sure insulator studs are fully seated in frame brackets before proceeding.
6. Apply Loctite 242 to transmission, converter, and engine mount nuts/bolts. Then install and tighten nuts and bolts to following torque:
   - Converter bolts to 32 lb-ft (43 N•m)
   - Transmission bolts to 35 lb-ft (47 N•m)
   - Insulator stud nuts to 90 lb-ft (122 N•m)
7. Install converter housing access cover. Tighten cover attaching screws to 60 lb-in. (7 N•m) torque.
8. Connect engine oil cooler lines to fittings at rear of engine block.
9. Install turbocharger.
10. Install starter motor and shield with aid of helper. Tighten starter mounting bolts to 30-40 lb-ft (41-54 N•m) torque. Do not connect cable and solenoid wire to starter at this time.
11. Install exhaust pipe and heat shield, if removed and connect exhaust pipe to turbocharger. Tighten attaching nuts to 37 lb-ft (50 N•m) torque.
12. Install new oil filter.
13. Install intake manifolds and crossover.
14. Install/connect following:
    - Wire harness brackets and clamps
    - Injection pump, engine harness, sensor wires
    - Turbocharger actuator vacuum hose
    - Torbocharger heat shield
    - Transmission and engine dipstick tubes
    - AMG engine harness
15. Install fuel pump in clamp at driver side of engine bay.
16. Connect fuel lines to injection pump.
17. Install CDR valve and hose if removed.
18. Route hydraulic lines from power steering pump to hydroboost unit and connect lines. Be sure lines are clear of hot or rotating components and are not kinked at any spot.

Flywheel Removal

1. Remove six capscrews and flywheel from crankshaft (Figure 2-97).
2. Remove flywheel attaching bolts with impact wrench and suitable size socket.
3. Work flywheel off crankshaft flange with rocking motion.

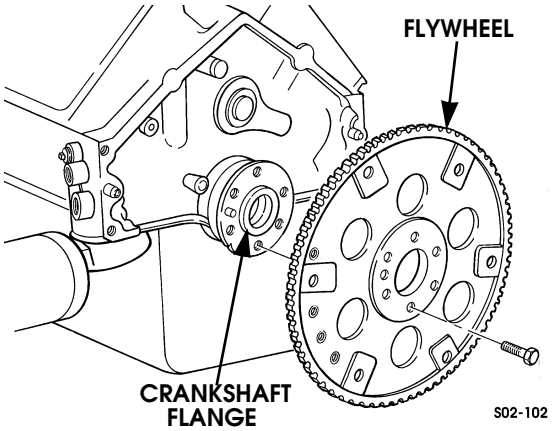


Figure 2-97: Flywheel Removal

Crankshaft and Main Bearings Removal

1. Inspect main bearing caps. Note if caps have factory I.D. markings on them. However, if caps do not have factory marks, it will be necessary to mark each cap with a center punch, or scriber. Main caps must be reinstalled in same location and direction, to maintain bore alignment for crankshaft journals (Figure 2-98).
2. Remove rear main oil seal.
3. Remove main bearing cap bolts. Discard bolts.
4. Tap main bearing caps with rawhide mallet to loosen. Then lift and remove caps. Keep them in order of removal (Figure 2-99).
5. Lift crankshaft out of bearing saddles in block. Place crankshaft on bench for cleaning and inspection.
6. Remove main bearing upper halves from block. Keep bearing halves for inspection and select fit reference.

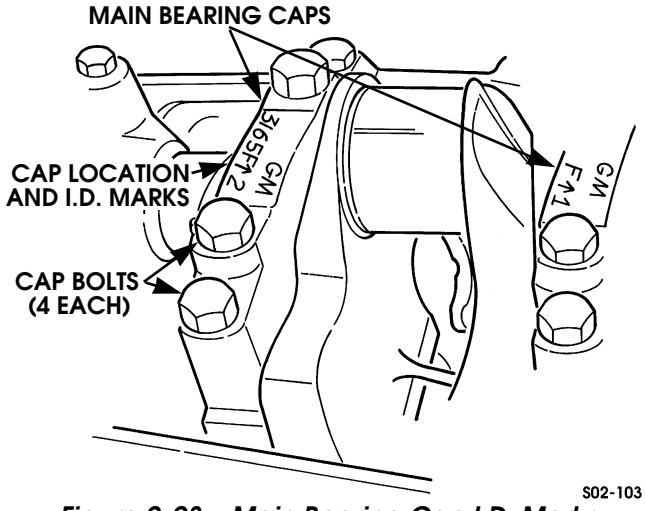


Figure 2-98: Main Bearing Cap I.D. Marks

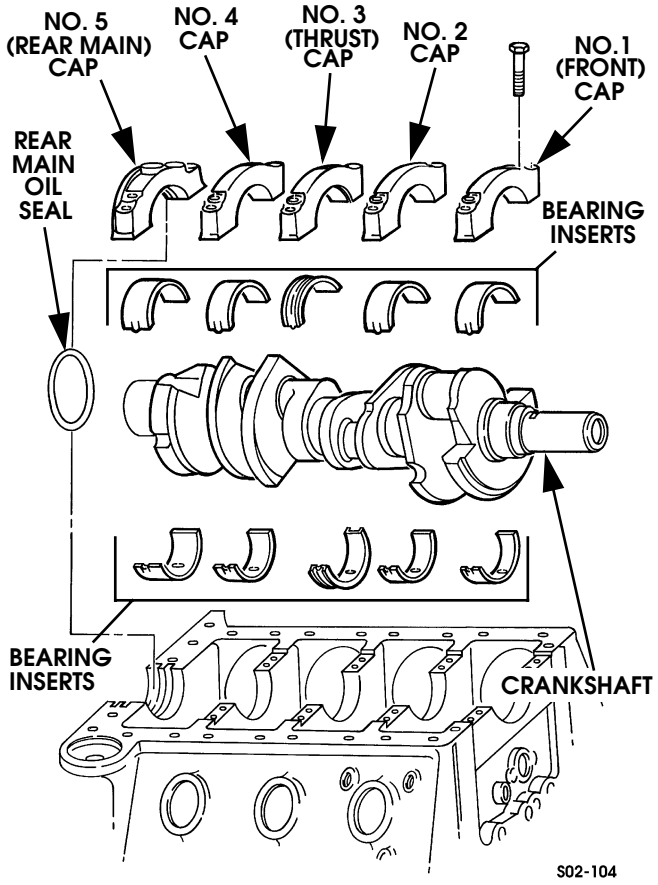


Figure 2-99: Crankshaft and Bearing Removal

CYLINDER BLOCK SERVICE

Cleaning

The block can be cleaned with standard parts cleaning equipment. However, if the crankcase and bores are heavily coated with varnish, gum, carbon, sludge, or rust deposits in the coolant passages, hot tanking will be necessary.

Clean out all oil galleys and water passages with wire brushes designed for this purpose.

WARNING: The cam bearings (Figure 2-100) must be replaced if the block is "hot tanked". The caustic solution used for this type of cleaning, will etch and weaken bearing surfaces. The expansion plugs and oil filter pressure regulating valve must also be removed before hot tank cleaning.

Coat the block with a light solvent after cleaning to prevent rust formation. Useful solvents are available from LPS Corp., Solder Seal, WD-40 and similar firms.

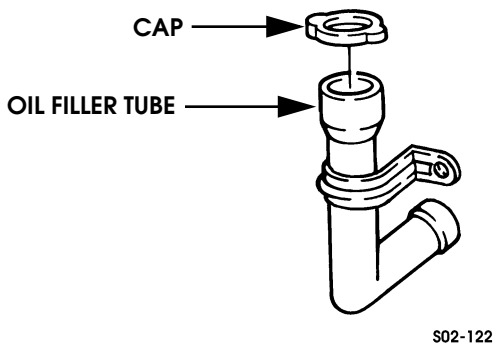


Figure 2-131: Oil Filler Tube and Cap

CYLINDER HEAD OVERHAUL

Disassembly

1. Remove glow plugs and injectors if not previously removed.
2. Remove temperature sender from left side head (Figure 2-132).

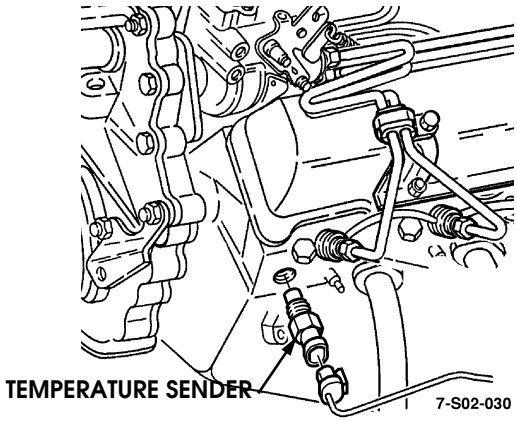


Figure 2-132: Temperature Sender Removal/ Installation

3. Clean valve faces with wire brush and measure amount valves are recessed in head with dial indicator. Intake valves should be recessed approximately 0.001 in. (0.034 mm) and exhaust valves approximately 0.002 in. (0.048 mm). Recessing means valve faces are positioned below cylinder head combustion chamber surface.
   - If valves extend or protrude above chamber surface, engine is equipped with wrong valves, or heads have been mismachined.
   - If valves are recessed to at least the stated values, continue with disassembly.
4. Remove valve assembly in sequence as follows:
   a. Compress valve spring with compressor tool J–8062 (Figure 2-133).
   b. Remove valve locks (Figure 2-134).
   c. Release and remove compressor tool.
   d. Remove valve retainer, shield and spring.
   e. Remove stem seal from valve and slide valve out of guide and head.
   f. Remove shim.
   g. On exhaust valve, also remove nylon stem and guide seal (Figure 2-134).
   h. Remove remaining valve assemblies in same manner.
   i. Keep valve parts together on workbench or use yardstick with drilled holes to keep valve assemblies separate.

NOTE: Do not intermix the valve parts as intake and exhaust valve are different. In addition, the exhaust valves have two stem seals and a rotator style spring retainer.

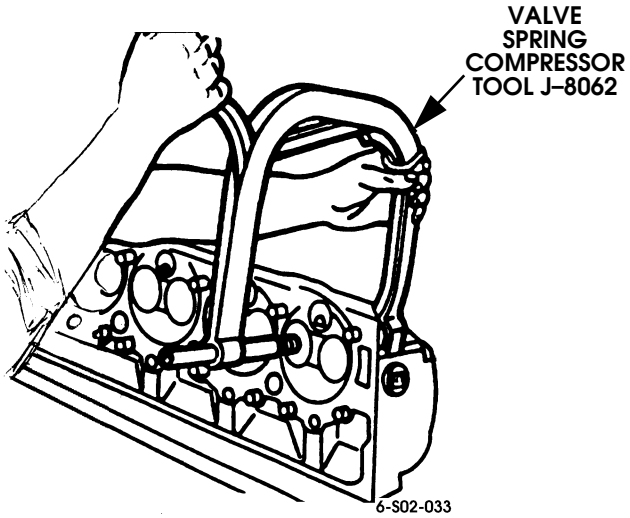


Figure 2-133: Compressing Valve Spring (to Remove Locks)

5. Mark position of pre-combustion chambers in each cylinder head (Figure 2-135). Ideally, chambers (if reused), should be installed in same location in head.
6. Remove prechambers from cylinder heads (Figure 2-135). Use a round pry tool to loosen and start each chamber out of seat in cylinder head.
7. Remove cover and gasket from right side head (Figure 2-136).

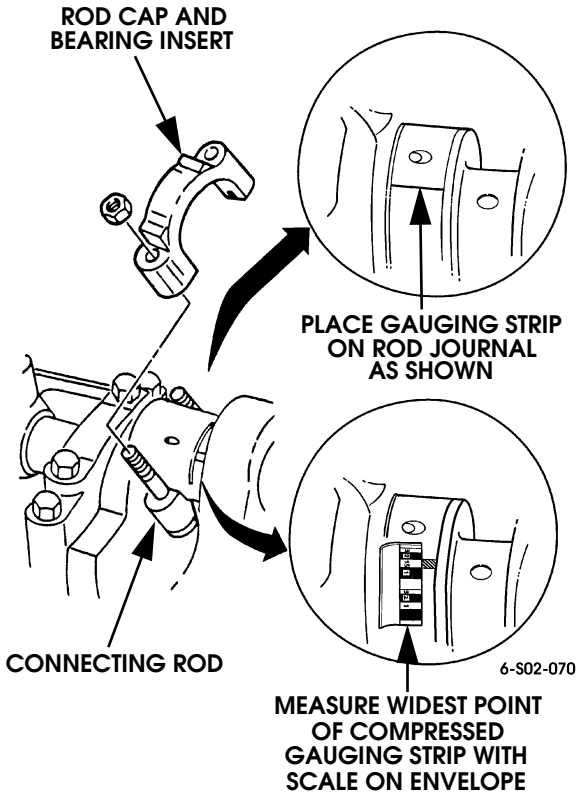


Figure 2-162: Measuring Connecting Rod Bearing Clearance with Plastic Gauging material

12. Check connecting rod side play with feeler gauge (Figure 2-163). Insert gauge between connecting rods on same journal. Clearance should be 0.007-0.025 in. (0.17-0.63 mm).

NOTE: If side clearance is incorrect, rod caps or rod and piston may be installed in wrong position.

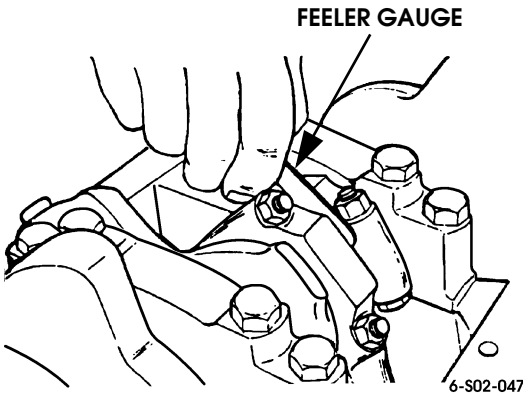


Figure 2-163: Checking Connecting Rod Side Clearance

OIL PUMP, OIL PAN, FLYWHEEL INSTALLATION

1. Pour 2-3 ounces engine oil into pump and rotate pump shaft to lubricate pump gears.
2. Install retainer and pump shaft in oil pump. Apply high temp bearing grease to upper end of shaft.
3. Install oil pump. Be sure pump is seated on rear main cap. Refer to *Oil Pump Drive Removal* in this section for more information.
4. Install pump mounting stud. Tighten stud to 59-74 lb-ft (80-100 N•m).
5. Seat pump pickup tube bracket on mounting stud. Tighten bracket nut to 35 lb-ft (47 N•m) torque. Tighten screw that secures bracket to pump pickup tube to 12 lb-ft (16 N•m) torque.
6. Apply silicone sealer, such as Permatex High Temp, Ultra Blue, or Ultra Black to surfaces of oil pan mounting flange surfaces (Figure 2-164).
7. Apply sealer to pan rear seal (Figure 2-164). Then press seal into place on oil pan. Coat seal ends with sealer as well.
8. Apply silicone sealer around two holes in right side panel rail on block (Figure 2-164).
9. Align and position oil pan on engine block pan rails. Tighten larger diameter bolts at rear of pan to 17 lb-ft (23 N•m) torque. Tighten remaining bolts/studs to 89 lb-in. (10 N•m) torque.

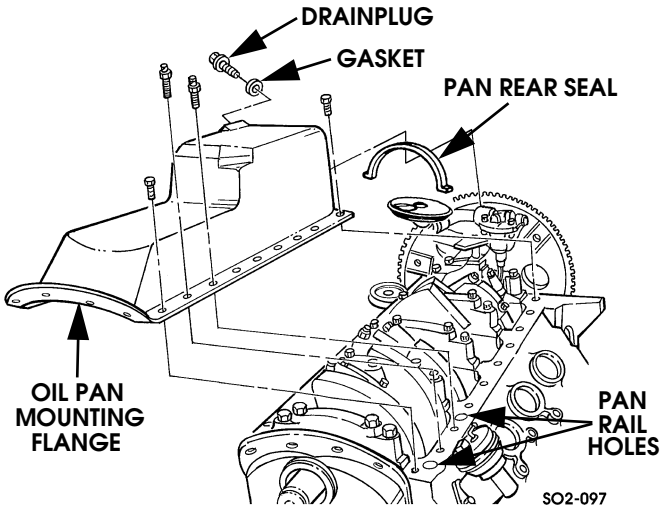


Figure 2-164: Oil Pan and Seal Installation

NOTE: Be sure pan rear seal was not displaced during pan installation.

10. Clean crankshaft flange and flywheel mounting surfaces.
11. Install flywheel on flange (Figure 2-165). Be sure converter bolt pads are facing out and away from engine.
12. Apply 1-2 drops Loctite 242 to new flywheel bolts (but only if new bolts do not have pre-applied thread locker). Then install and tighten bolts 65 lb-ft (88 N•m) torque.

ENGINE SPECIFICATIONS

General Data:

Displacement	6.5L/395 c.i.d.
Type	4 Cycle, Diesel, Liquid-Cooled
Bore	4.06 in. (103 mm)
Stroke	3.82 in. (97 mm)
Compression Ratio	20.2:1
Firing Order	1-8-7-2-6-5-4-3
Oil Pressure	6 psi (69 kPa) at idle (hot); 30 psi (552 kPa) at 2000 RPM

Cylinder Bore

Diameter (Refer to Service Piston and Bore Specifications)

- Out-of-Round (Maximum) . . . . . .0.0008 in. (0.02 mm)
- Taper (Thrust Side) (Maximum). . . .0.0008 in. (0.02 mm)

Piston to Bore Clearance[1]:

- Bores 1 through 6 . . 0.0037-0.0047 in. (0.094-0.120 mm)
- Bores 7 and 8. . . . . 0.004-0.005 in. (0.107-0.133 mm)

Piston Ring:

Groove Clearance:

- Top . . . . . Keystone Ring
- Second. . . . . .0.0015-0.0031 in. (0.039-0.079mm)
- Oil . . . . . 0.0016-0.0035 in. (0.040-0.090 mm)

End Gap[2]:

- Top . . . . . 0.010-0.020 in. (0.26-0.51 mm)
- Second. . . . . 0.029-0.039 in. (0.75-1.00 mm)
- Oil . . . . . 0.010-0.020 in. (0.25-0.51 mm)

Piston Pin:

Diameter	1.220-1.221 in. (30.9961-31.0039 mm)
Fit in Piston	0.00039-0.0006 in. (0.010-0.0153 mm)
Fit in Rod	0.0003-0.001 in. (0.0081-0.0309 mm)

Crankshaft:

- Journal Diameter
  (Refer to Main and Rod Journal Specification Charts)
- Journal Taper (Maximum). . . . . .0.0002 in. (0.005 mm)
- Journal Out-of-Round (Maximum) .0.0002 in. (0.005 mm)

Main Bearing Clearance

- No. 1, 2, 3, 4 . . . . . 0.0018-0.003 in. (0.045-0.083 mm)
- No. 5 . . . . . 0.002-0.0037 in. (0.055-0.093 mm)

Crankshaft End Play	0.0039-0.0098 in. (0.10-0.25 mm)
Rod Bearing Clearance (Select Fit)	0.0017-0.0039 in. (0.045-0.100 mm)
Rod Side Clearance	0.007-0.025 in. (0.17-0.63 mm)

Camshaft:

Lobe Lift ± 0.05

- Intake. . . . . .0.281 in. (7.133 mm)
- Exhaust . . . . . .0.281 in. (7.133 mm)
- Camshaft End Play . . . 0.002-0.012 in. (0.051-0.305 mm)

Journal Diameter (Refer to Camshaft Specifications Chart)

[1]NOTE: Add 0.0005 in. (0.013 mm) to cylinder bore diameters to determine proper bore size for cylinders no. 7 and no. 8.

[2]NOTE: Ring end gap specifications are for new bores; worn bores will generate larger ring end gaps.

Valve Train:

- Lifter Type . . . . . Hydraulic Roller
- Rocker Arm Ratio. 1.5:1
- Valve Lash (Intake and Exhaust) . . . . . Not Adjustable
- Valve Recess Depth:
  - Intake. . . . . .0.0013 in. (0.034 mm)
  - Exhaust . . . . . .0.0018 in. (0.048 mm)
- Face Angle (Intake and Exhaust) . . . . . .45°
- Seat Angle (Intake and Exhaust) . . . . . .46°
- Seat Runout (Intake and Exhaust) . . . . . .0.0019 in. (0.05 mm)
- Seat Width
  - Intake. . . . . 0.035-0.060 in. (0.89-1.53 mm)
  - Exhaust . . . . . 0.062-0.093 in. (1.57-2.36 mm)
- Stem Clearance
  - Intake. . . . . 0.001-0.0027 in. (0.026-0.069 mm)
  - Exhaust . . . . . 0.001-0.0027 in. (0.026-0.069 mm)
- Valve Spring Pressure
  - Closed . . . . . 80 lb at 1.81 in. (356 N @ 46.0 mm)
  - Open . . . . . 230 lb at 1.39 in. (1025 N @ 35.3 mm)
- Installed Height . . . . . 1.8 in. (46 mm)
- Timing Chain Free Play
  - New Chain. . . . . .0.500 in. (12.7 mm)
  - Used Chain . . . . . .0.800 in. (20.3 mm)

Fuel System Diagnosis—Diesel Engine

PROBLEM	POTENTIAL CAUSE	CORRECTION
No Start Condition (engine cranks but will not run)	1. Excessive amount of water or wax buildup in system.	1. Draw off sample at drain plug. Drain and flush system if necessary.
	2. Blown fuse.	2. Replace fuse. Check for shorts-grounds in affected circuit.
	3. No fuel to injection pump.	3. Test fuel-lift pump output. Replace pump if pressure is below 5.8 psi (40 kPa). Check lines and filter for restrictions if pump output is OK. Also test pump relay. Be sure pump relay is being energized when ignition switch is in crank or start position. Check fuel level in tanks
	4. No fuel to injectors.	4. Check shut off solenoid. Check fuel solenoid driver feed (terminal A) and ground (terminal C) circuits.
	5. Engine fault: • broken camshaft • damaged injection pump gears • timing chain or gear failure	5. Inspect and repair as needed.
	6. Fuel tank select valve problem.	6. Replace valve if it won't switch from main to auxiliary and back. NOTE: the valve will only operate if the fuel lift pump is energized!
	7. No inject signal from PCM.	7. Run scan tool test and replace failed sensor, harness wire, or connector.
	8. Injection pump failure.	8. Replace pump but only if failure is indicated by scan tool and pressure test.
	9. PCM ground or feed circuit fault (on ground or ignition voltage reference signal).	9. Confirm with scan tool. Use multimeter to locate fault.
	10. PCM fault.	10. Confirm with scan tool before replacement.
Engine Starts then Stalls	1. Air leak in fuel feed line.	1. Inspect lines and repair as needed. Bleed injectors afterward.
	2. Glow plug fault (cold ambient temperature).	2. Test and repair wiring, or replace failed glow plugs or relay/controller.
	3. Restriction in fuel tank vent or return lines.	3. Inspect and clear restriction. Replace cap vent, or lines as needed.
	4. Fuel-lift pump pressure below 2 psi (14 kPa) at injection pump, or 5.8 psi (40 kPa) at fuel pump outlet.	4. Replace pump but only if fuel lines to pump are not blocked, plugged, or restricted. Also be sure flow through 2-stage filter is not restricted as well.
	5. Idle rpm too low.	5. Adjust idle to required rpm.
	6. No injection signal to PCM (turbo diesel).	6. Test with scan tool and replace failed sensor or harness.

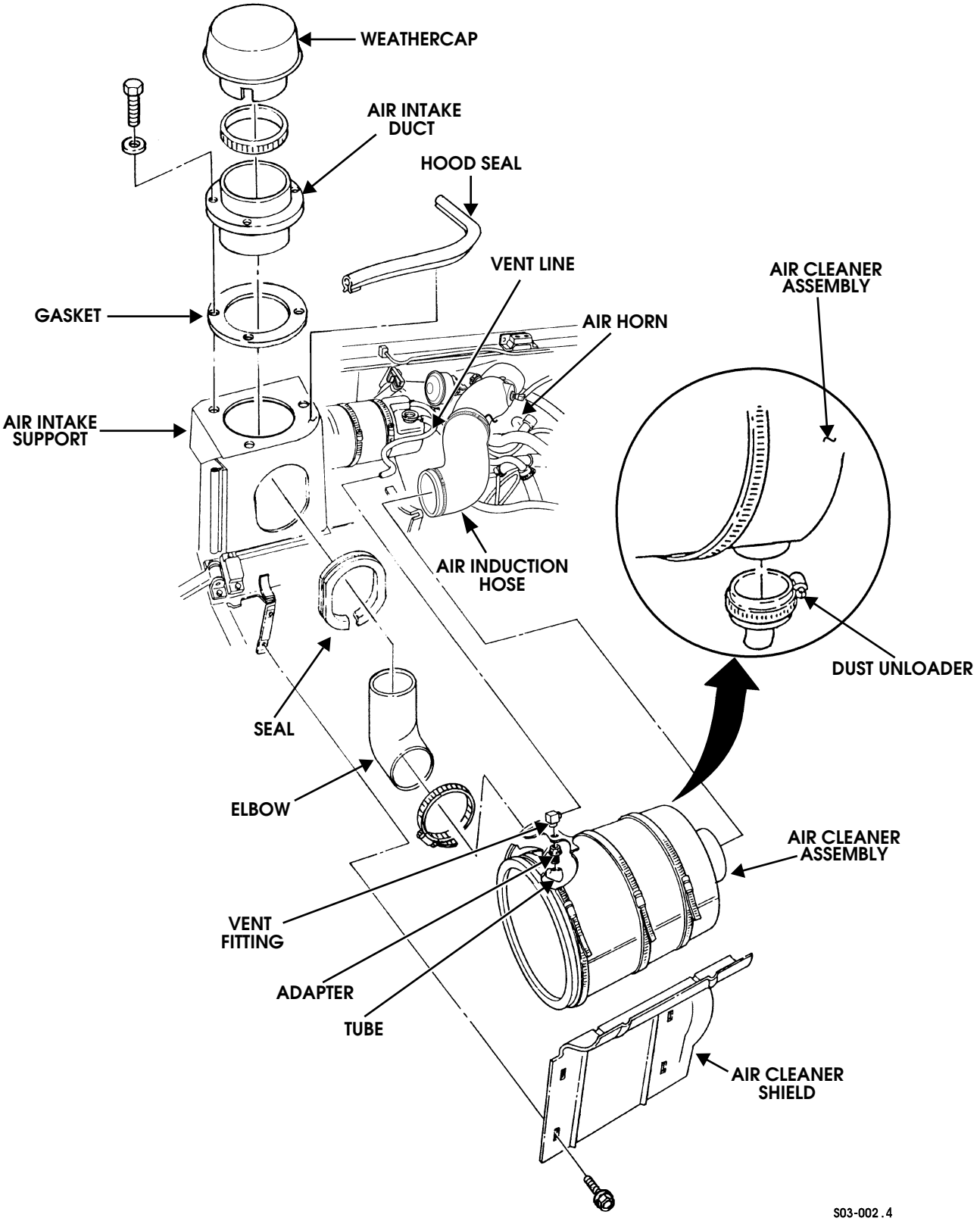


Figure 3-23: Air Cleaner Assembly and Dust Unloader

Fuel Filter Drain Hose and Valve Replacement

NOTE: To remove fuel filter drain valve only, perform steps 3 and 4.

Removal

1. Disconnect fuel filter drain hose from fuel filter (Figure 3-42).
2. Remove two tie straps and separate drain hose from transmission oil cooler lines.
3. Remove two tie straps and separate drain hose from transmission oil cooler lines.
4. Disconnect drain hose at drain valve.
5. Remove nut and drain valve from body

Installation

1. Install drain valve on body and tighten nut.
2. Connect drain hose to valve.
3. Connect drain hose to fuel filter.
4. Secure drain hose to transmission oil cooler lines with two tie straps.
5. Start engine and check for leaks.

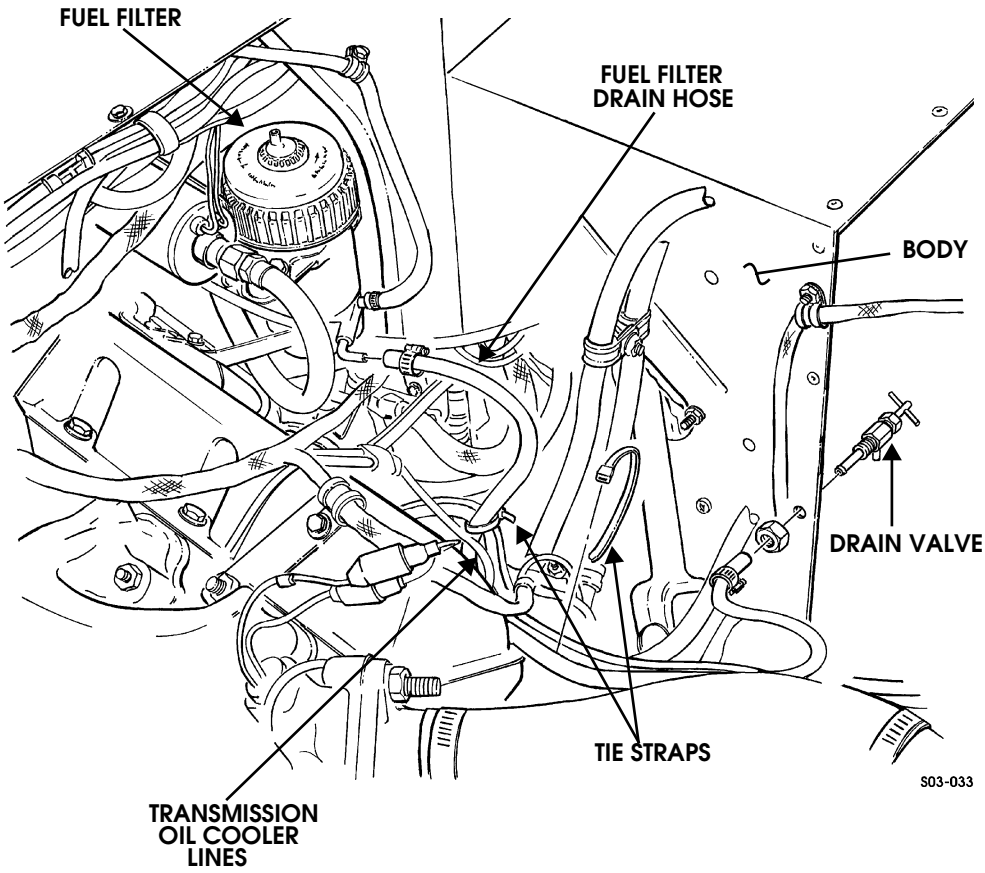


Figure 3-42: Fuel Filter Drain Hose And Valve Location

CROSSOVER PIPE REPLACEMENT

1. Remove console and engine cover.
2. Remove passenger side exhaust manifold rear heat shield.
3. Loosen transfer case exhaust pipe bracket U-bolt (Figure 3-62).
4. Disconnect crossover pipe at manifolds and at catalytic converter.
5. Position new crossover pipe on manifolds. Tighten flange bolts to 26 lb-ft. (35 N•m).
6. Connect crossover pipe to catalytic converter and tighten flange bolts to 26 lb-ft. (35 N•m).
7. Tighten exhaust bracket U-bolt nuts at transfer case to 26 lb-ft. (35 N•m).
8. Install heat shield.
9. Install engine cover and console.
10. Start and run engine. Verify that exhaust components are clear of body, frame, and driveline parts.

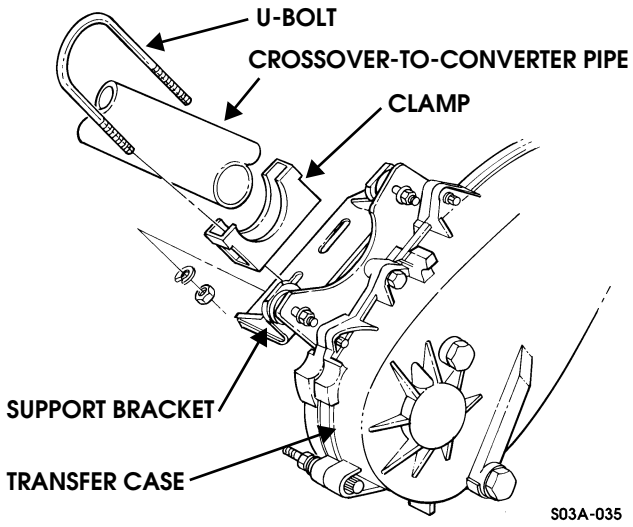


Figure 3-62: Transfer Case Exhaust Bracket Mounting

CATALYTIC CONVERTER REPLACEMENT

1. Loosen or remove necessary frame brackets and clamps that retain converter and pipe (Figures 3-61 and 3-62).
2. Remove bolts attaching converter to crossover or head pipe.
3. Remove flange bolts attaching converter to muffler and crossover or head pipe.
4. Remove U-bolt at transfer case bracket.
5. Remove converter.
6. Position new single or dual converter assembly in vehicle and loosely install flange bolts.
7. Connect necessary exhaust brackets and clamps to frame or body as required.
8. Tighten exhaust flange bolts to 26 lb-ft. (35 N•m).
9. Tighten frame bracket bolts.
10. Tighten transfer case exhaust bracket U-bolt nuts to 26 lb-ft. (35 N•m).

RADIATOR LOWER TUBE ASSEMBLY REPLACEMENT

Removal

1. Drain cooling system.
2. Remove drain valve from lower tube assembly (Figure 4-17).
3. Disconnect radiator lower tube assembly from frame bracket.
4. Loosen clamp and disconnect water pump inlet hose from lower tube assembly.
5. Loosen clamp and disconnect surge tank-to-lower radiator hose from lower tube assembly.
6. Loosen clamp and disconnect lower radiator hose from lower tube assembly.
7. Remove lower tube assembly.

Installation

1. Secure lower tube assembly to frame bracket with bolts, washers, and locknuts. Tighten locknuts to 6 lb-ft (8 N•m) (Figure 4-17).
2. Connect lower radiator hose to lower tube assembly and tighten clamp.
3. Connect surge tank-to-lower radiator hose to lower tube assembly and tighten clamp.
4. Connect water pump inlet hose to lower tube assembly and tighten clamp.
5. Apply sealant tape to threads of drain valve and screw drain valve into lower tube assembly.
6. Fill cooling system.

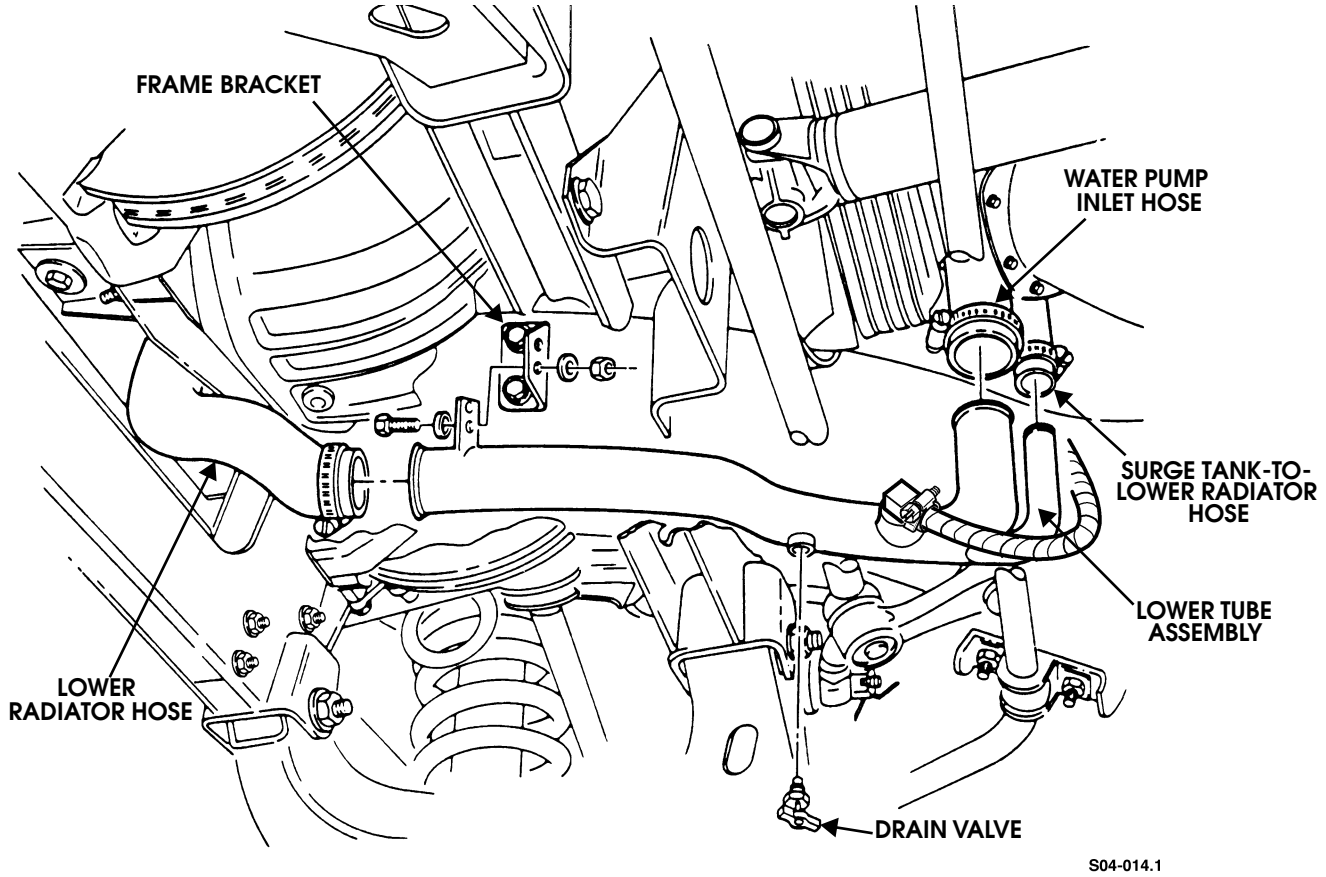


Figure 4-17: Radiator Lower Tube Assembly Location

AUTOMATIC TRANSMISSION INPUT (SHAFT) SPEED SENSOR AND OUTPUT (SHAFT) SPEED SENSOR (VEHICLE SPEED SENSOR)

The input and vehicle speed sensors are variable reluctance, magnetic pickup units (Figure 5-7). They consist of a permanent magnet surrounded by a wire coil. The sensors are mounted in the driver side of the transmission case and the top of the transfer case at the rear.

The vehicle speed sensor is positioned opposite the speedometer tone wheel in the rear of the transfer case. The input sensor is opposite the machined teeth on the forward clutch housing in the transmission (Figure 5-7). The tone wheel and gear teeth interrupt the sensor magnetic field as they rotate. This induces an AC current in each sensor coil. The vehicle sensor provides a voltage signal proportional to vehicle speed. The input sensor signal indicates transmission shaft/turbine speed. Both sensor signals are used by the PCM to determine shift speed, pattern, and converter clutch apply.

Sensor signals reaching the PCM are converted to a square wave form (Figure 5-7). The wave forms correspond to the teeth on the speedometer tone wheel and forward clutch. The increase in shaft speed will cause more teeth to interrupt the sensor magnetic field in a given time. This is reflected in an increase in the number of wave forms sent to the PCM. The wave forms are compared to a fixed signal voltage in the PCM to determine speeds.

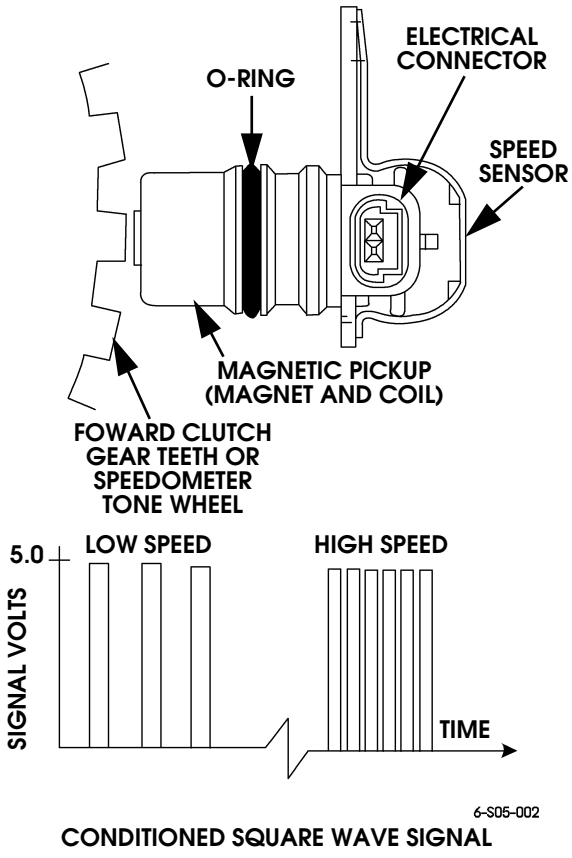


Figure 5-7: Transmission Speed Sensor Signal Form

TRANSMISSION FLUID TEMPERATURE SENSOR

The fluid temperature sensor is mounted on the internal transmission harness. Failure of the sensor constitutes wiring harness replacement. It is a temperature sensitive resistor more commonly known as a thermister (Figure 5-8). Low fluid temperature produces high resistance. The PCM controls torque converter clutch apply based on sensor input signals.

The PCM will not allow converter clutch apply when fluid temperature is below 68°F (20°C). At higher fluid temperatures, the PCM will apply or release the converter clutch as follows:

- Apply the clutch in second, third, fourth when fluid temperature exceeds 250°F (122°C).
- Release the clutch and prevent apply in any gear range when fluid temperature reaches or exceeds 300°F (150°C).
- Prevent converter clutch apply and set a-fault code when fluid temperature reaches 310°F (154°C).

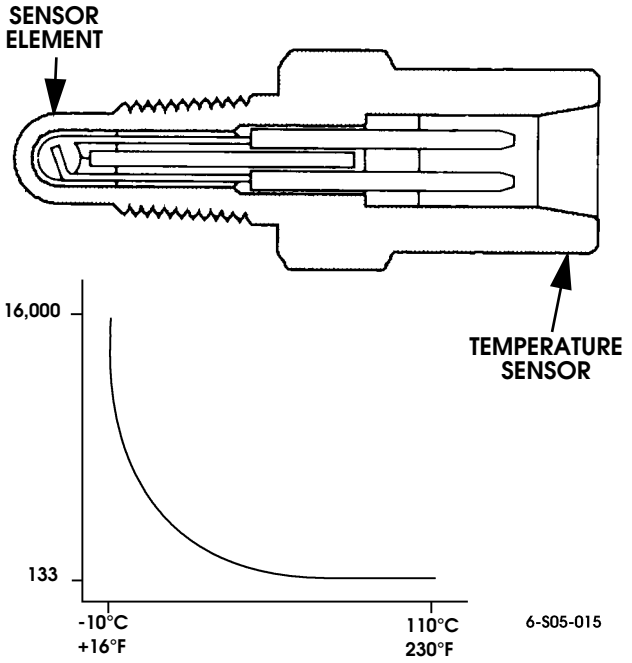


Figure 5-8: Temperature Sensor

Transmission Fluid Checking Procedure

Step	Action	Value(s)	Yes	No
16	Clear TRANS ADAPT. Is the proceedure complete?		Go to step 17	
17	Add new fluid. Is the proceedure complete?		Go to step 20	
18	Change the fluid and the filter. Is the procedure complete?		Go to step 10	
19	Clear TRANS ADAPT. Is the procedure complete?		Go to step 20	
20	Is the fluid level satisfactory? If not, correct as needed.		Go to step 21	
21	Perform the Functional Test Procedure. Is the functional test completed?		System is OK	

SCAN TOOL DIAGNOSIS

NOTE: The Tech 1 Scan Tool (Figure 5-20) checks function of the solenoids, sensors, and PCM. The scan tool connector is attached to the vehicle data link connector (Figure 5-21).The vehicle requires use of a VIM (Vehicle Interface Mod ule), part number 7000041.

The scan tool provides data on individual circuits, or on all the related electrical components in snap shot mode.

The PCM memory and circuits are interrogated by the scan tool. The tool reads diagnostic trouble codes (DTC) and displays fault and performance parameters.

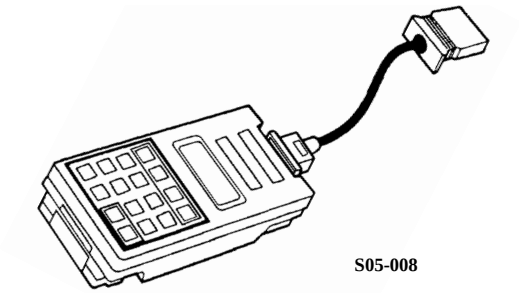


Figure 5-20: Tech 1 Scan Tool

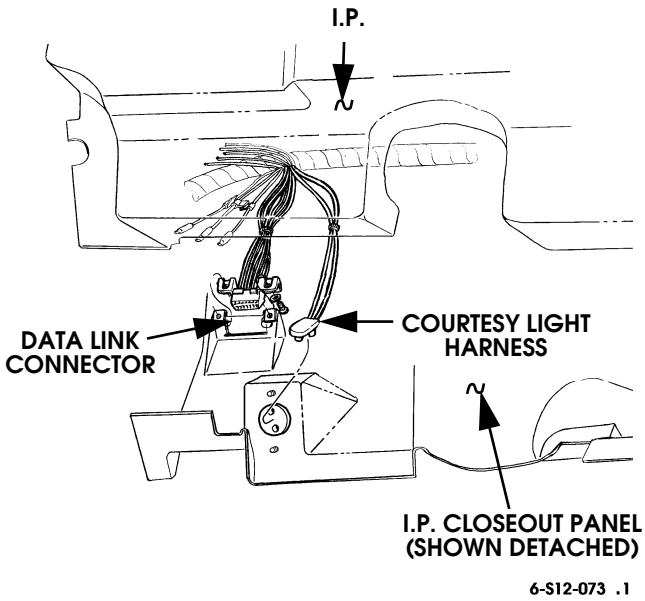


Figure 5-21: Data Link Connector

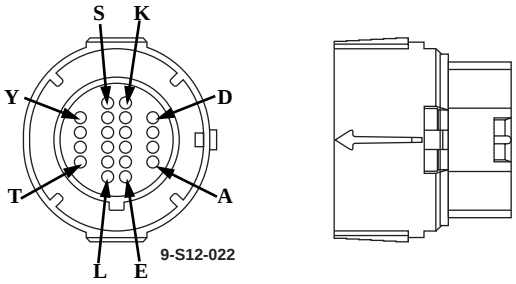
Transmission Warning Lamps

All Hummer vehicles are equipped with a malfunction indicator light (check engine) and a check throttle light. The purpose of the lights is to alert the driver when a transmission/engine, or electronic accelerator pedal circuit fault has occurred.

The warning lights are in circuit with the PCM, which controls light operation. The lights are illuminated for a few seconds at startup as part of a bulb check and circuit self test routine. The only other time illumination occurs, is when a system component or circuit fault occurs.

PIN	CKT	COLOR	CIRCUIT DESCRIPTION
45	327	YL	Water-in-fuel lamp activation
46	80	WH	Underhood lamp power
47	3	LB	Left front turn signal
48	914	PP	PCM class 2 communication line to DLC
49	644	YL	Tachometer signal
50	210	DG	Low washer fluid level lamp activation
51	195	YL	Headlight switch feed
52	603	DG	ABS lamp activation
53	719	BR	APP 1 ground
54	793	YL	Low coolant lamp activation
55	794	RD	Low air warning lamp activation
56	41	TN	Brake fluid level sensor feed
57	428	PK	CTIS buzzer activation
58	47	LG	Deflate solenoid activation
59	46	WH	CTIS compressor relay activation
60	725	GY	APP 3 Ground
61	767	BR	Compass mirror temperature signal
62	1	DB	Horn relay activation
63	91	TN	CTIS front inflate solenoid activation
64	37	RD	Batt feed to interior fuse box
65	12	OR	Headlamp high beam feed
66	13	TN	Headlamp low beam feed
67	38	RD	Headlamp switch feed
68	16	LG	Ignition supply to exterior fuse box fuses 2A, 2B, and 3B
69	175	LB	Power window relay feed
70	943	BR	Upper windshield washer pump activation
71	5	DG	Right rear turn signal
72	9	YL	Left rear turn signal
73	20	RD	Front park lamps
74	21	GY	Rear tail lamp feed
75	789	BR	Fuel selector valve control
76	941	TN	Lower windshield washer pump activation

20 WAY TRANSMISSION PASSTHROUGH LOCATION: TRANSMISSION, LEFT



C34 FEMALE

PIN	CKT	COLOR	CIRCUIT DESCRIPTION
A	237	LG	1-2 Shift Solenoid activation
B	315	YL	2-3 Shift Solenoid activation
C	264	RD	Pressure Control Solenoid high
D	265	LB	Pressure Control Solenoid low
E	351	PK	Transmission ignition feed
F			
G			
H			
J			
K			
L	923	BR	Transmission Fluid Temperature signal
M	359	BK	Transmission Fluid Temperature sensor ground
N	762	OR	Transmission fluid pressure manual vavle position switch range “A”
P	764	PP	Transmission fluid pressure manual valve position switch range “C”
R	763	DB	Transmission fluid pressure manual valve position switch range “B”
S	924	TN	Torque Converter Clutch solenoid activation
T			
W			
X			
Y			

Conditions For Setting The DTC

- No DTCs P1117 or P1118.
- No OSS sensor DTC P0502.
- No A/T ISS sensor. DTC P0716 or P0717.
- No A/T Component Slipping DTC P1870.
- The system voltage is 10.0 - 16.0 volts.
- The engine is running greater than 475 rpm for at least 30 seconds.
- The engine coolant temperature (ECT) is greater than 176° F (80° C).
- The TFT is -40 to +70° F (-40 to + 21 ° C) at start up.
- The ECT has changed at least 122° F (50 ° C) since start up.
- The vehicle speed is greater than 3 mph for at least 900 seconds (15 minutes).
- The TCC slip speed is greater than 60 rpm for at least 850 seconds (14 minutes)>
- DTC P0711 sets if all of the above conditions have been met and one of the following conditions exist:
  - Non TFT change: The TFT has not changed more than 4° F (2.25° C), in more than 80 seconds.
  - An unrealistic temperature change: The TFT has changed more than 68°F (20 ° C) 14 times in 7 seconds.

Action Taken When The DTC Sets

- The PCM uses a TFT default value of 280° F (140° C).
- The PCM freezes shift adapts.
- The PCM illuminates the Malfunction Indicator Lamp (MIL).

Conditions For Clearing The MIL/DTC

- For California Emissions only, the PCM turns off the MIL after three consecutive ignition cycles without a failure report.
- The DTC can be cleared using the scan tool. The DTC will be cleared when the vehicle has achieved 40 warm-up cycles without a failure reported.
- The PCM will cancel the DTC default actions when the fault no longer exists and the ignition is OFF long enough to power down the PCM.

Diagnostic Aids

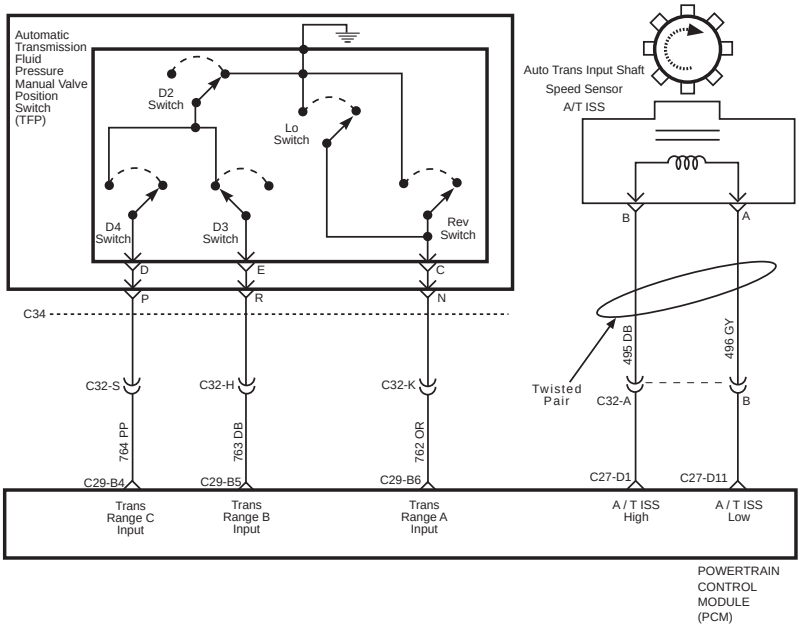
- When diagnosing for a possible intermittent short or open condition, wiggle the wiring harness while observing test equipment for a change.
- If any engine DTCs are present diagnose and clear these DTCs first. Then check to see if the transmission DTCs have reset.

Test Description

- The numbers below refer to the step numbers on the diagnostic chart.

2. This step tests for proper A/T fluid level and condition.
3. This step verifies that the vehicle sets DTC P0711.
5. The 12-volt test lamp is used as a fixed resistance.
6. Perform this step in order to ensure that the PCM monitors circuit 1227.
8. The TFT Sensor is part of the A/T Wiring Harness Assembly

DTC P0717 Input Speed Sensor Circuit - No Signal



9-S12-071

Circuit Description

The transmission input speed sensor consists of a permanent magnet surrounded by a coil of wire. An AC voltage is induced in the sensor by lugs on the rotating forward clutch. Signal voltage and frequency vary directly with forward clutch rotational speed.

This DTC detects a low Input Speed when the vehicle has high vehicle and engine speeds.

Conditions For Setting DTC

- No DTC P0722 or P0723.
- No switch assembly DTC P1810.
- Vehicle speed is greater than 20 MPH.
- Engine running for greater than 7 seconds.
- Transmission not in Park or Neutral.
- Input speed is less than 200 RPM for at least 2 second.

Action Taken When DTC Sets

- The PCM will default the transmission to maximum line pressure.
- The PCM will freeze shift adapts.
- The PCM will turn on the warning lamp.

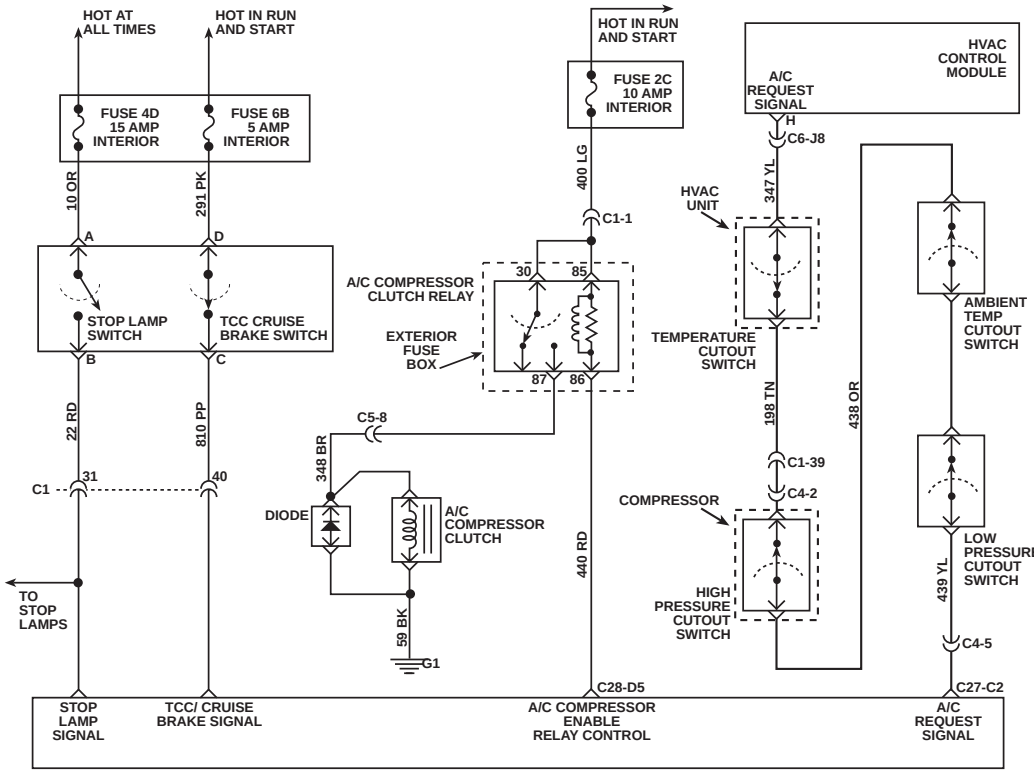
Conditions For Clearing DTC

- The PCM will turn the lamp off after three consecutive ignition cycles without a failure reported.
- The DTC can be cleared using the scan tool. The DTC will be cleared from history when the vehicle has achieved 40 warm-up cycles without reported failure.
- PCM will cancel DTC default actions when the fault no longer exists and ignition is cycled “Off” long enough to power down the PCM.

Diagnostic Aids

- Inspect wiring for poor electrical connections at the PCM and the 20-way connector Look for possible bent, backed out, deformed or damaged terminals. Also, check for chafed wire that could short to bare metal or other wiring. Inspect for broken wire inside the insulation.
- When diagnosing a possible intermittent short or open condition, move wiring while observing test equipment for a reading change.
- If any engine DTC(s) or TP Sensor codes are present diagnose and clear these DTC(s) first. Then check for transmission DTC(s) have reset.
- If any engine DTCs or TPS codes are present diagnose and clear these first. Then check to see if the transmission DTC(s) have reset.

DTC P0724 Brake Switch Circuit High Input



Circuit Description

The brake switch indicates brake pedal position. The normally-closed brake switch supplies a B+ signal on circuit 810 to the PCM. The signal voltage circuit is opened when the brakes are applied. The PCM uses this signal to deenergize the converter clutch solenoid when the brakes are applied.

This DTC detects a closed brake switch during decelerations.

Conditions For Setting DTC

- No DTC P0722, P0723.
- The PCM detects a closed brake switch/circuit (12 volts) for 2 seconds during decelerations and the following events occur seven consecutive times: vehicle speed is greater than 32 km/h (20 mph) for 6 seconds; then vehicle speed is between 8 and 32 km/h (5 and 20 mph) for 4 seconds; then vehicle speed is less than 8 km/h (5 mph).
- All conditions exist with 7 occurrences.

Action Taken When The DTC Sets

- PCM disregards the brake switch state if TPS is greater than 12% and vehicle speed is greater than 45 mph.
- The PCM will NOT illuminate the warning lamp.

Conditions For Clearing The DTC

- The DTC can be cleared using a scan tool. The DTC will be cleared when the vehicle has achieved 40 warm-up cycles without a failure reported.
- The PCM will cancel the DTC default actions when the fault no longer exists and the ignition is cycled “off” long enough to power down the PCM.

Diagnostic Aids

- Inspect the wiring for poor electrical connections at the PCM and brake switch. Look for bent, backed out, deformed or damaged terminals. Check for weak terminal tension as well. Also check for a chafed wire that could short to bare metal or other wiring. Inspect for a broken wire inside the insulation.
- When diagnosing for a possible intermittent short or open condition, move the wiring harness while observing test equipment for a change.
- Check customer driving habits and/or unusual traffic conditions (i.e. stop and go, expressway).
- Check brake switch for proper mounting and adjustment.
- If any engine DTCs or TPS codes are present diagnose and clear these DTCs first. Then check to see if the transmission DTCs have reset.

DTC P0748 Pressure Control Solenoid - Electrical

Step	Action	Value	Yes	No
1	1. Connect scan tool. 2. Turn the ignition switch to on. **NOTE: Important:** Before clearing DTC(s), use the scan tool to record "Failure Records" for reference, as data will be lost when the "Clear Info" function is used. 3. Record the DTC "Failure Records." 4. Start engine and shift into Park. 5. Using the transmission output control function on the scan tool, apply 0.1 amp through 1.0 amp while observing "PC Ref. Current" and "PC Act. Current." Is the "PC Act. Current" reading always within the indicated value?	0.16 amp	Go to Diagnostic Aids	Go to Step 2
2	1. Turn ignition off. 2. Disconnect transmission 20-way connector. 3. Install the 05743837 Jumper Harness on the transmission side of the 20-way connector. 4. Using the multimeter and Connector Test Adapter Kit, measure the resistance between terminals "C" and "D." Is the resistance within indicated values?	3-7 ohms	Go to Step 6	Go to Step 3
3	1. Remove transmission oil pan. 2. Disconnect wiring harness at PCS. 3. Measure resistance of PCS. Is resistance within indicated values?	3-7 ohms	Go to Step 5	Go to Step 4
4	Replace the PCS. Is the replacement complete?	—	Go to Step 8	—
5	Repair internal wiring harness for open. Is the repair complete?	—	Go to Step 8	—
6	Inspect/repair circuits 264 and 265 for short to ground or poor connections. Was a problem found?	—	Go to Step 8	Go to Step 7
7	Replace PCM. Is the replacement complete?	—	Go to Step 8	—
8	1. After the repair is complete, use the scan tool to select "DTC," then "Clear Info" function. 2. Select "Specific DTC" and enter DTC "P0748." 3. Ensure the following conditions are met: • The PCS duty cycle is not at its electrical high or low limit (short cleared).	—	—	Repair verified, exit DTC table.

DTC P0758 2-3 Shift Solenoid B Electrical (Cont'd)

Step	Action	Value	Yes	No
4	1. Turn ignition "Off". 2. Disconnect transmission 20-way connector (additional DTCs will set). 3. Connect 05743837 Jumper Harness to engine harness connector. 4. Stop engine, then turn the ignition switch to the "Run" position. 5. Connect test light from 05743837 Jumper Harness cavity "E" to ground. Is test light "on?"	—	Go to step 6.	Go to step 5.
5	Repair open or short to ground in ignition feed circuit to 2-3 shift solenoid valve. Was a problem found and corrected?	—	Go to step 15.	—
6	1. Install a test lamp between cavity E and cavity B of the jumper harness (0574837). 2. Using the transmission output control function on the scan tool, command the 2-3 shift solenoid valve "ON" and "OFF" three times. Does the test lamp illuminate when the shift solenoid is commanded "ON" and turn off when the shift solenoid is commanded "OFF"?	—	Go to step 9.	Go to step 7.
7	Inspect circuit 315 (YL) for an open or short to ground. Was an open or short to ground condition found?	—	Go to step 15.	Go to step 8.
8	Replace PCM. Is the replacement complete?	—	Go to step 16.	—
9	1. Turn ignition off. 2. Connect 05743837 Jumper Harness to transmission 20-way connector. 3. With aDVOM and Connector Test Adapter Kit, measure resistance between terminals "B" and "E." Is resistance within the indicated values?	19-31Ω	Go to step 11.	Go to step 10.
10	1. Disconnect the transmissions internal wiring harness from the 2-3 shift solenoid. 2. With a DVOM measure the resistance the 2-3 shift solenoid. Is resistance within indicated values?	19-31Ω	Go to step 13.	Go to step 14.
11	With a DVOM, measure resistance between terminals "B" to ground and "E" to ground. Are both readings greater than indicated value?	250KΩ	Go to Diagnostic Aids	Go to step 12.
12	1. Disconnect the transmission internal wiring harness from the 2-3 shift solenoid. 2. With a DVOM, measure the resistance from solenoid terminals to ground. Are both readings greater than indicated value?	250KΩ	Go to step 13.	Go to step 14
13	Replace the automatic transmission wiring harness assembly. Is the replacement complete?	—	Go to step 13.	—

DTC P1860 Torque Converter Clutch Pulse Width Modulation Solenoid Electrical

Step	Action	Value	Yes	No
1	Was the Powertrain On-Board Diagnostic (OBD) System Check performed?	—	Go to Step 2	Go to Powertrain OBD System Check
2	1. Install the scan tool (Tech 1). 2. With the engine OFF, turn the ignition switch to the RUN position. 3. Important: Before clearing the DTCs, use the scan tool in order to record the Freeze Frame and Failure Records for reference. The Clear Info function will erase the data 4. Record the DTC Freeze Frame and Failure Records. 5. If DTCs P0753, P0758, or P1860 are set, inspect the fuse. Is the fuse blown?	—	Go to Step 3	Go to Step 4
3	Inspect circuit 1020, the TCC PWM Sol. Valve and the internal wiring harness for a short to ground. Refer to Electrical Diagnosis, Section 8. Did you find and correct a problem?	—	Go to Step 17	—
4	1. Turn the ignition OFF. 2. Disconnect the transmission 20-way connector (additional DTCs may set). 3. Install the J–39775 Jumper Harness on the engine harness connector. 4. With the engine off, turn the ignition to the RUN position. 5. Connect a test lamp from the J–39775 Jumper Harness cavity E to ground. Is the test lamp ON?	—	Go to Step 6	Go to Step 5
5	Repair the open or high resistance located in ignition voltage feed circuit 1020 to the TCC PWM Sol. Valve. Refer to Electrical Diagnosis, Section 8. Is the repair complete?	—	Go to Step 17	—
6	1. Install the test lamp from cavities E to S of the J–39775 Jumper Harness. 2. Use the scan tool in order to command the TCC PWM Sol. Valve ON and OFF three times. Does the test lamp turn ON when you command the TCC PWM Sol. Valve ON, and does the lamp turn OFF when you command the TCC PWM Sol. Valve OFF?	—	Go to Step 8	—
7	Inspect and repair circuit 418 for an open or short to ground. Refer to Electrical Diagnosis, Section 8. Did you find a problem?	—	Go to Step 17	Go to Step 9
8	1. Install the J–39775 Jumper Harness on the transmission 20-way connector. 2. Measure the resistance between terminals E and S. Use the J–39200 DVOM and the J–35616-A Connector Test Adapter Kit (Both covered in *Electrical* Section 12). Is the resistance within the specified values?	10-15	Go to Step 11	Go to Step 10

Torque Converter Evaluation and Diagnosis

Replace the torque converter under any of the following conditions:

- External leaks appear in the hub weld area.
- The converter hub is scored or damaged.
- The converter pilot is broken, damaged, or fits poorly into the crankshaft.
- You discover steel particles after flushing the cooler and cooler lines.
- The pump is damaged, or you discover steel particles in the converter.
- The vehicle has TCC shudder and/or no TCC apply. Replace the torque converter only after all hydraulic and electrical diagnoses have been made. The converter clutch material may be glazed
- The converter has an imbalance which cannot be corrected. Refer to Flywheel/Torque Converter Vibration Test.
- The converter is contaminated with engine coolant which contains antifreeze.
- An internal failure occurs in the stator roller clutch.
- You notice excessive end play.
- Overheating produces heavy debris in the clutch.
- You discover steel particles or clutch lining material in the fluid filter or on the magnet, when not internal parts in the unit are worn or damaged. This condition indicates that lining material came from the converter.

Do Not Replace the Torque Converter

Do not replace the torque converter if you discover any of the following symptoms:

- The oil has an oder or the fluid is discolored, even though metal or clutch facing particles are not present.
- The threads in one or more of the converter bolt holes are damaged. Correct the condition with a new J-nut.
- Transmission failure did not display evidence of damaged or worn internal parts, steel particles or clutch plate lining material in the unit and inside the fluid filter.

Torque Converter Clutch Shudder

The key to diagnosing Torque Converter Clutch shudder is to note when it happens and under what conditions.

TCC shudder which is caused by the transmission should only occur during the apply or the release of the converter clutch. Shudder should never occur after the TCC plate is fully applied.

If the shudder occurs while the TCC is applying, the problem can be within the transmission or the torque converter. Something is causing one of the following conditions to occur:

- Something is not allowing the clutch to become fully engaged.
- Something is not allowing the clutch to release.
- The clutch is releasing and applying at the same time.

One of the following conditions may be causing the problem to occur:

- Leaking turbine shaft seals
- A restricted release orifice
- A distorted clutch or housing surface due to long converter bolts
- Defective friction material on the TCC plate

If Shudder Occurs After TCC has Applied

If shudder occurs after the TCC has applied, most of the time there is nothing wrong with the transmission!

As mentioned above, the TCC is not likely to slip after the TCC has been applied. Engine problems may go unnoticed under light throttle and load, but they may become noticeable after the TCC apply when going up a hill or accelerating. This is due to the mechanical coupling between the engine and the transmission.

Once TCC is applied, there is no torque converter assistance. Engine or driveline vibrations could be unnoticeable before TCC engagement.

Flywheel/Torque Converter Vibration Test

1. Start the engine.
2. With the engine at idle speed and the transmission in Park or Neutral, observe the vibration.
3. Turn the key off.

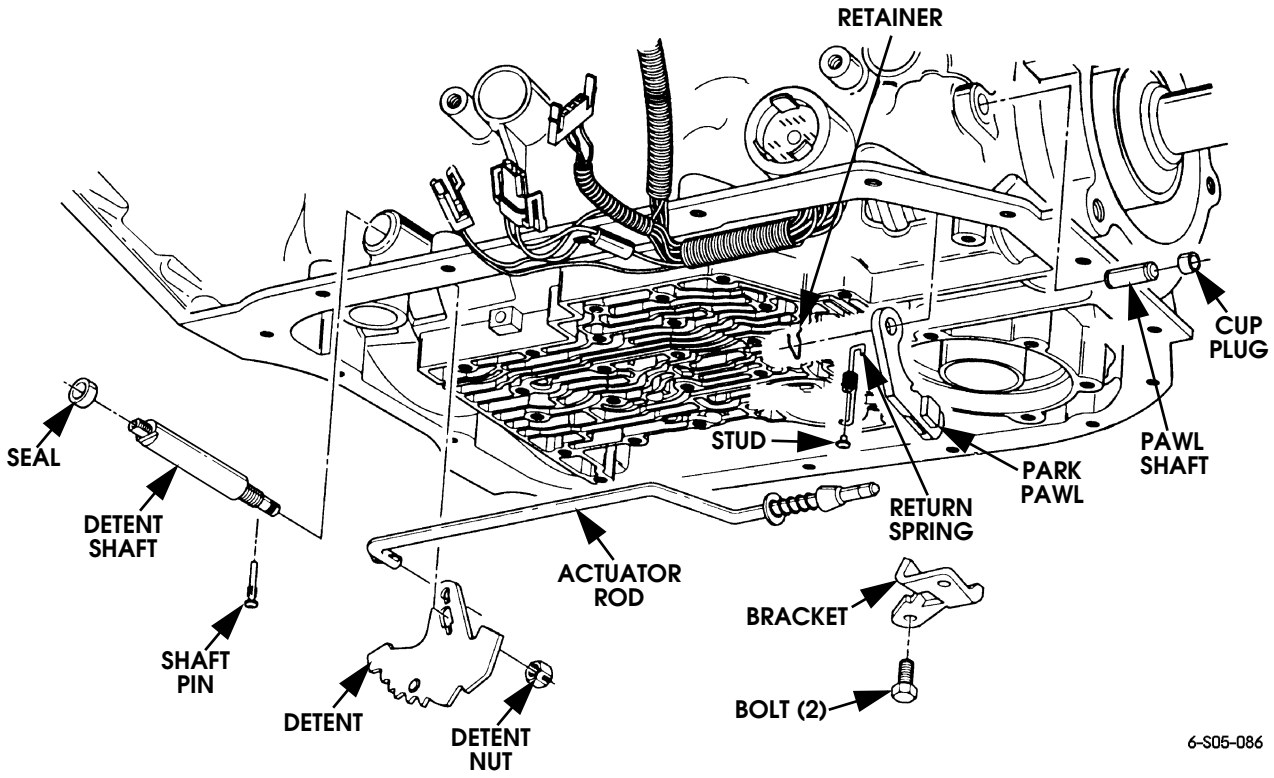


Figure 5-41: Park Lock Components

TRANSFER CASE OIL COOLER

The NP 242 used in Hummer vehicles is equipped with an internal oil cooler (Figure 5-67).

The cooler is mounted within the front case and secured by nuts and washers. O-rings are used to seal the cooler inlet/outlet tubes.

The cooler is interconnected to the transmission oil cooler circuit. However, transmission and transfer case oil are not intermixed. In operation, oil from the transmission cooler flows through the transfer case cooler. Heat from the transfer case oil is transmitted to the transmission oil which is then conveyed to the transmission cooler.

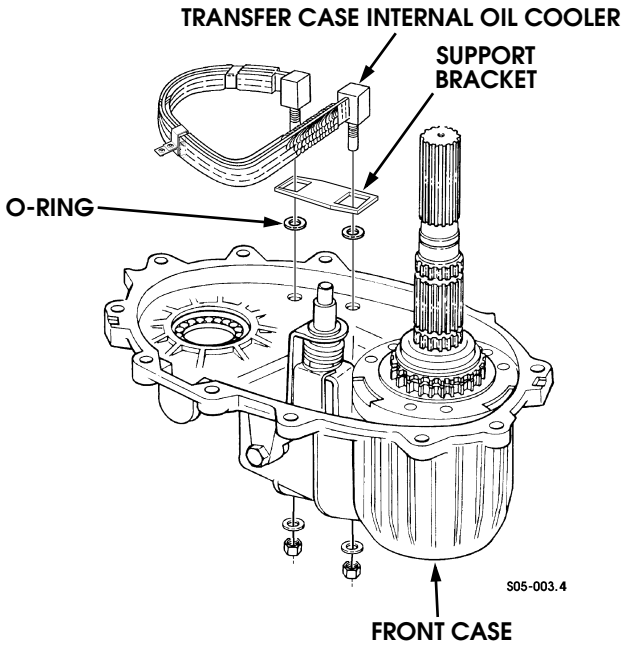


Figure 5-67: Oil Cooler Location

TRANSFER CASE IDENTIFICATION

An identification tag is attached to the rear case of each NP 242 transfer case (Figure 5-68). The tag provides the model number, assembly number, serial number, and low range ratio.

The serial number also represents the date of build. For example, a serial number of 10-10-99 would represent a build date of October 10, 1999.

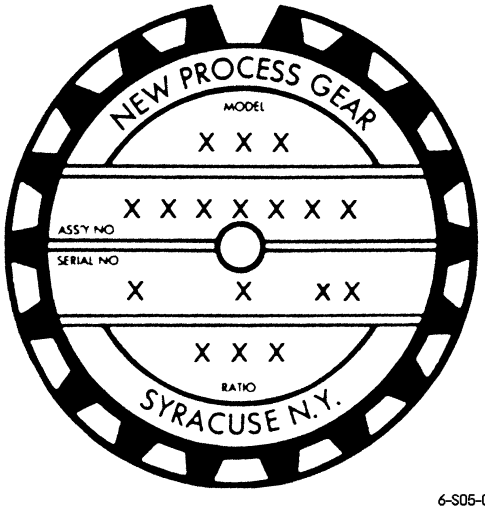


Figure 5-68: Transfer Case I.D. Tag Information

RECOMMENDED LUBRICANT

Dexron III is the recommended lubricant for the NP 242. Use it for topping off the fluid level and as replacement fluid for fluid changes, or after overhaul. Dexron IIE can also be used for topping off a low fluid level when Dexron III is not readily available.

Do not use friction modifiers or similar additives in the NP 242. Use recommended lubricants only.

Transfer Case Fluid Level

Correct transfer case fluid level is to the lower edge of the fill plug hole. Recommended fluid is Dexron III.

The vehicle must be on a level surface for an accurate fluid level check. If the vehicle is raised on a hoist to check fluid level, a drive-on style hoist is preferred. This type of hoist will keep the vehicle level.

The fill plug is just above the drain plug in the rear case. Tightening torque for the plug is 15-25 lb-ft (20-33 N•m).

23. Remove differential snap ring (Figure 5-101).
24. Remove differential from mainshaft (Figure 5-102).
25. Remove mainshaft needle roller bearings and spacers (Figure 5-103).

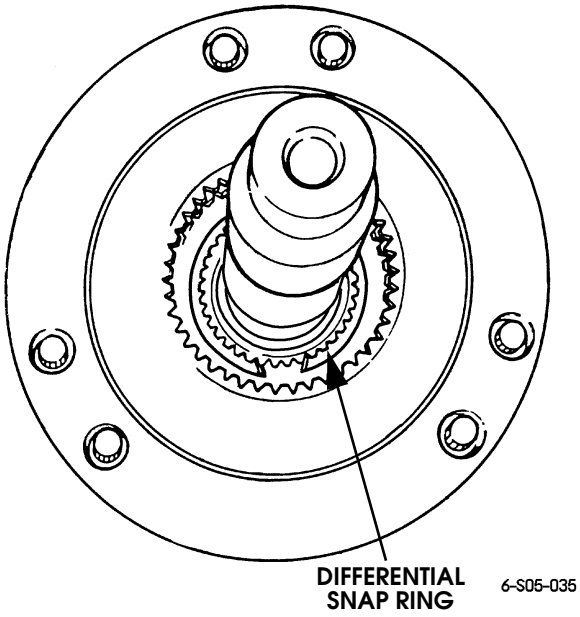


Figure 5-101: Differential Snap Ring Location

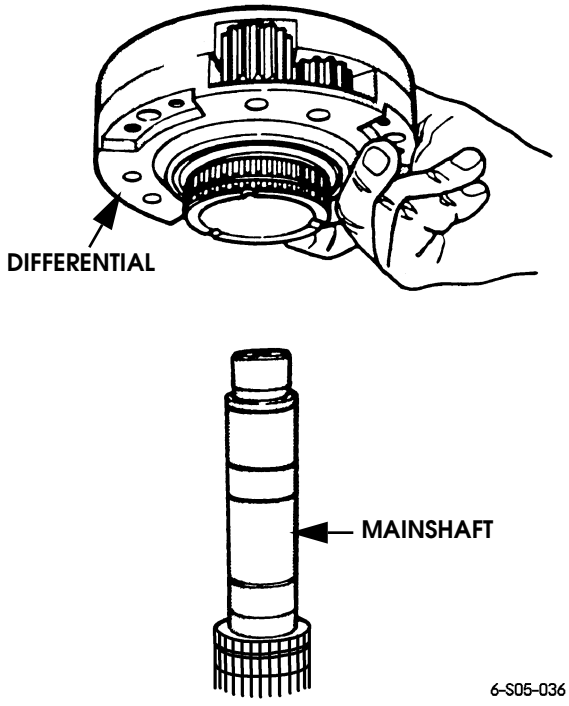


Figure 5-102: Differential Removal

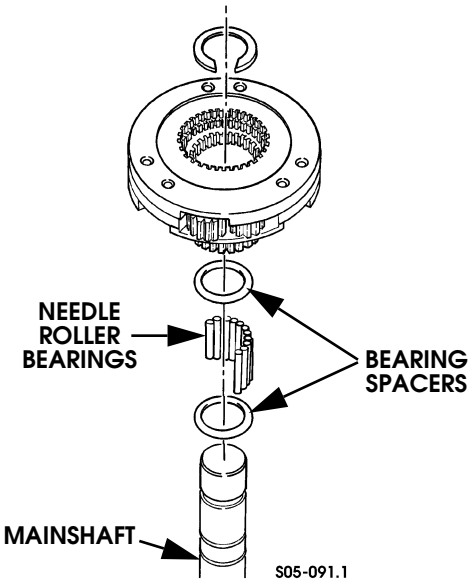


Figure 5-103: Mainshaft Bearing and Spacer Removal

26. Slide low range fork pin out of shift sector. Then remove low range fork and sleeve as assembly (Figure 5-104).
27. Remove shift sector.
28. Remove shift sector shaft bushing and O-ring (Figure 5-105).

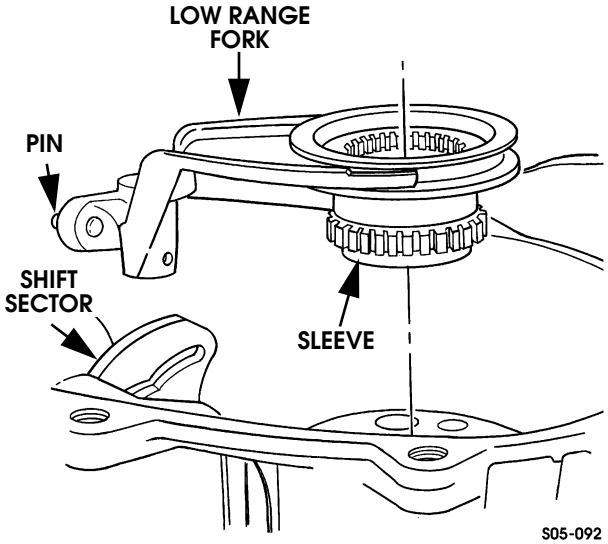


Figure 5-104: Range Fork and Sleeve Removal

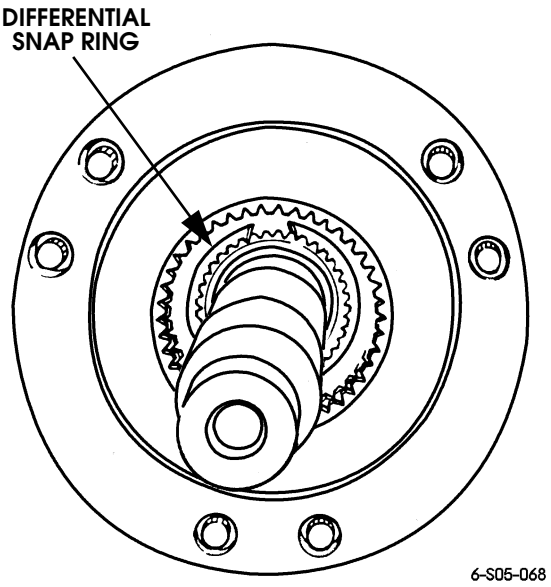


Figure 5-145: Differential Snap Ring Installation

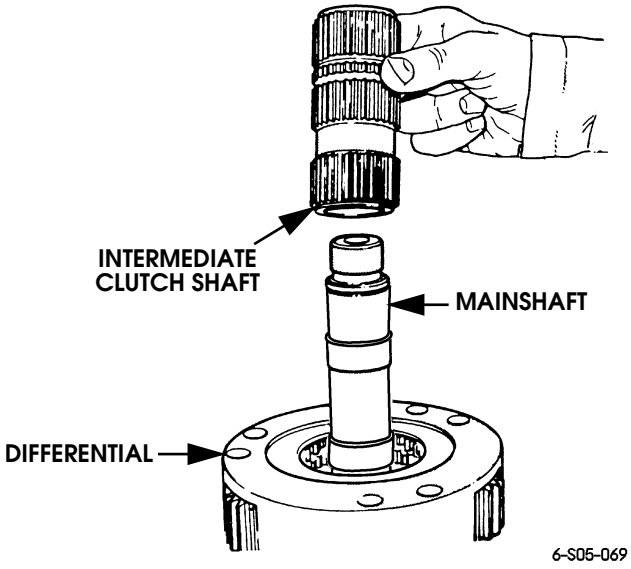


Figure 5-146: Intermediate Clutch Shaft Installation

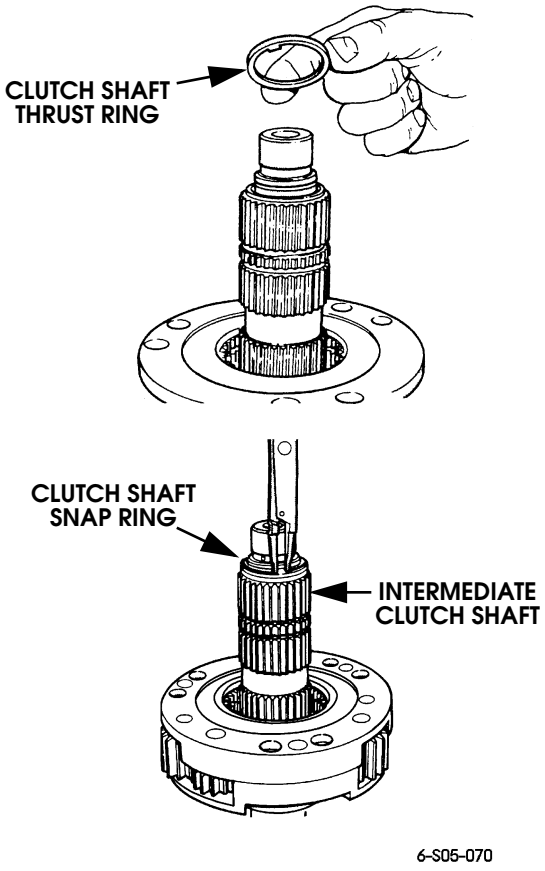


Figure 5-147: Intermediate Clutch Shaft Thrust Ring and Snap Ring Installation

18. Install shift rail. Install rail through mode fork, range fork, and into case bore and install lock pin (Figure 5-153).

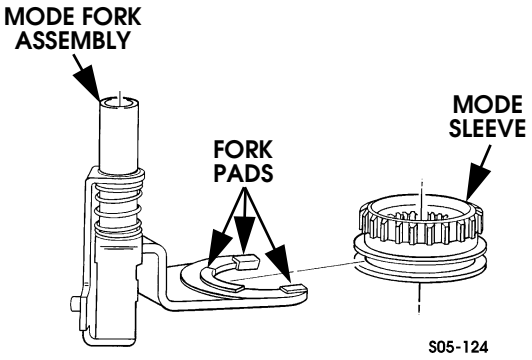


Figure 5-148: Installing Mode Sleeve in Mode Fork

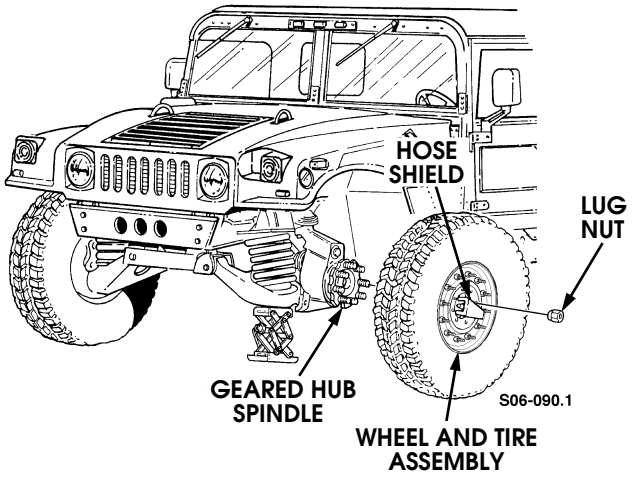


Figure 6-1: Wheel and Tire Assembly Replacement

Installation

NOTE: The Wrangler GS-A, 37 X 12.50R16.5 LT touring radial tire has an asymmetrical/directional tread design. The heavier, stiffer tread on the outside shoulder of the tire must face outward when being installed. Before installing on a wheel, inspect sidewall of tire and ensure SIDE FACING OUTWARDS imprint is facing outward (Figure 6-2).

NOTE: Install lug nuts with fingers to full engagement. If nuts resist finger tightening examine studs and nuts for damage and replace if damaged.

1. Position wheel on geared hub spindle according to marks on mounting studs and attach with lug nuts (Figure 6-1).

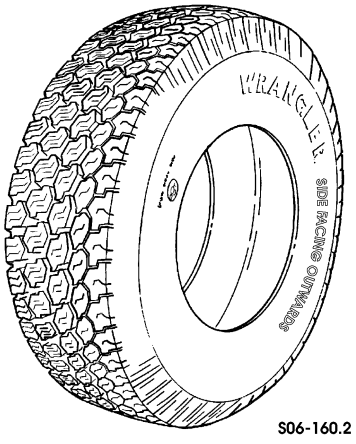


Figure 6-2: Side Facing Outwards Location

2. Remove support and lower corner of vehicle.
3. Two-piece wheel lugnut torque is 110 lb-ft (149 N•m). Use tightening sequence shown (Figure 6-3).

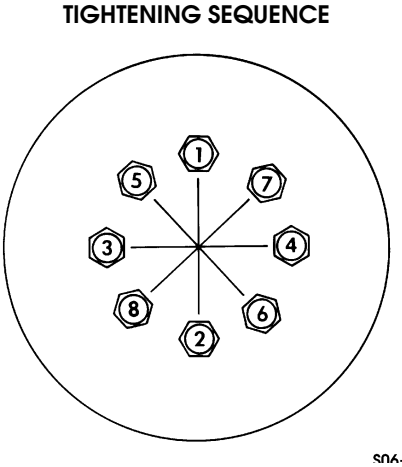


Figure 6-3: Lug Nut Tightening Sequence

CAUTION: *Do not allow pipe thread sealant into air system. Sealant will damage CTIS components and inhibit the CTIS operation.*

NOTE: Perform steps 4 and 5 for vehicles equipped with CTIS.

4. Install CTIS quick-connect valve and tube on spindle.
5. Install CTIS hose shield.

TIRE, TWO-PIECE WHEEL, AND RUNFLAT REPLACEMENT

WARNING: Do not use tire machine. Personal injury or damage to equipment may result.

CAUTION: *It is not recommended mixing one-piece wheel runflat assemblies and two-piece take-a-part runflat wheel assemblies on the same vehicle. Runflat profiles are different between the two types of wheel assemblies.*

CAUTION: *Do not mix two piece take-apart wheel components from previous model year vehicles with present production parts. Many features are not the same between the two wheel styles and will not fit together correctly. Present production wheel halves can be identified by a hole between two of the wheel half studs on both halves. These holes must be aligned when assembling the wheel halves.*

Removal and Disassembly

1. If the vehicle is equipped with a Central Tire Inflation System (CTIS), perform steps a through d:
   a. Release the quick disconnect fitting located in the center of the geared hub spindle on all four wheels.
   b. Remove the hose shield and lay aside.

Assembly

NOTE: If tires are to be replaced allow new tires to reach room temperature (above 60°) before mounting. This will make the tire more pliable and easier to work with.

CAUTION: *During assembly or disassembly, loose parts which are dropped inside the wheel/tire assembly must be removed. Failure to do so could result in damage to wheel/tire assembly.*

1. Apply one tube (approximately 11 ounces) of runflat gel lubricant to inside crown area of tire. Using clean brush, evenly spread gel lubricant 4 to 5 inches wide on inner crown area.

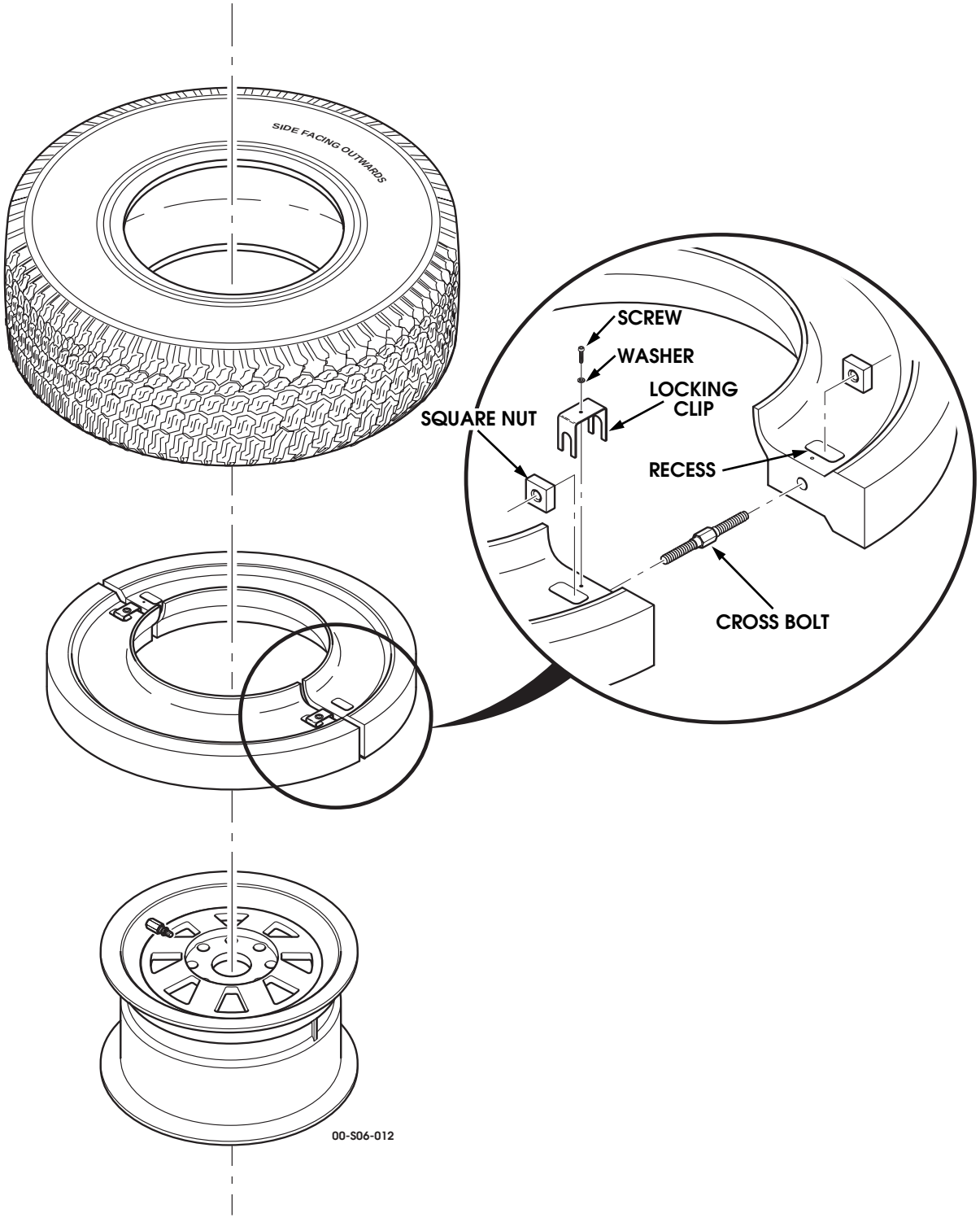


Figure 6-24: Runflat Installation

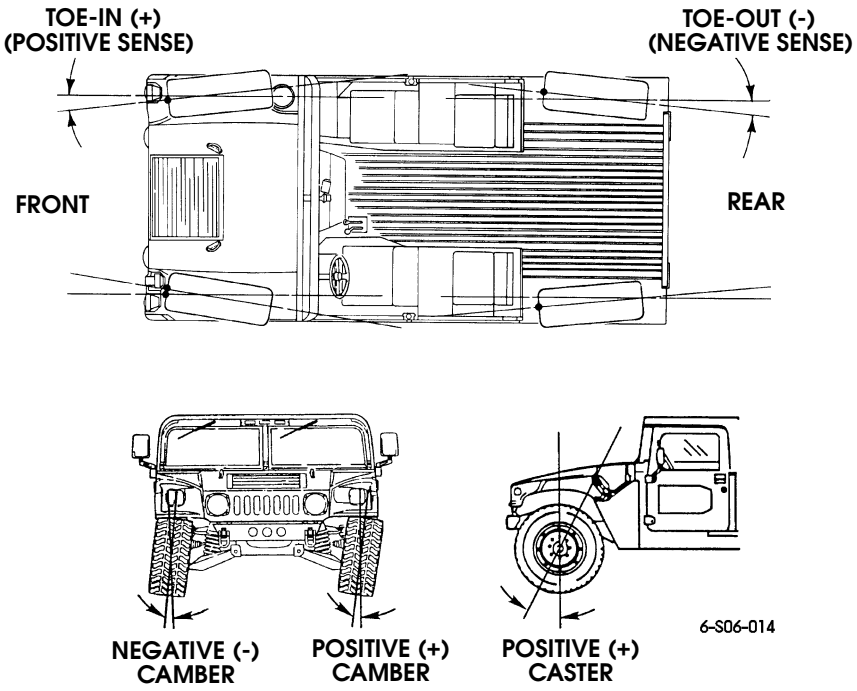


Figure 6-42: Wheel Alignment Information

WHEEL ALIGNMENT CORRECTION

Alignment adjustments should be performed one at a time and in sequence to avoid errors. Recommended adjustment sequence is:

a. caster
b. camber
c. front toe setting
d. rear toe setting
e. steering stops (See Section 8)

Leave the vehicle on the alignment rack for each of the adjustment procedures. This way, angle correction can be monitored continuously during actual adjustment.

Caster Adjustment

Caster adjustment applies to the front wheels only. It is controlled by turning the pivot bolts and eccentric washers on the upper control arm brackets (Figure 6-43). A positive caster angle is required on all Hummer vehicles.

Preferred caster angle is +2.5 to +3.5 degrees. Maximum allowable side-to-side variation is 0.5 degree.

1. Support the vehicle weight with the tires on the turntables.
2. Loosen upper control arm pivot bolt locknuts by holding the bolt head and turning the locknut to allow movement of the bolts (Figure 6-43).
3. Pry the upper control arm brackets open to allow freedom of movement of the control arm bushings. The edges of the control arm bushings are serrated and will be difficult to move if the brackets are not pried open.
4. Adjust caster angle by turning the eccentrics on the upper control arm brackets in opposite directions (Figure 6-43).
   - Preferred caster is +2.5 to +3.5 degrees and left-right variation must not exceed 0.5 degree.
   - Turning the front eccentric outward and the rear eccentric inward increases positive caster while turning the front eccentric inward and the rear outward decreases it.
   - Shims are available in 0.060 inch and 0.120 inch (1.5 and 3.0 mm) thicknesses for use behind the control arm mount brackets if the proper angles cannot be achieved with the use of the eccentrics alone. This would be an unusual situation and the vehicle should be inspected thoroughly for bent or worn parts before installing shims.
5. Tighten control arm pivot bolt nuts to 260 lb-ft (359 N•m) torque.
6. Verify correct caster angle at both front wheels. Be sure side-to-side caster variation does not exceed 0.5 degree.
7. Leave vehicle on rack for camber and toe adjustments.

INFLATE/DEFLATE AND TIRE SELECTOR SWITCHES

Removal

1. Remove CTIS instrument cluster panel.
2. Disconnect connector from inflate/deflate switch and tire selector switch (Figures 6-54 and 6-55).
3. Remove inflate/deflate and tire selector switches from CTIS instrument cluster and housing.

Cleaning and Inspection

Clean and inspect inflate/deflate and tire selector switches for damage. Replace defective parts.

Installation

1. Install inflate/deflate and tire selector switches in housing on CTIS instrument cluster (Figure 6-55).
2. Connect connector to switches.
3. Install CTIS instrument cluster panel.
4. Start engine and ensure switches operate properly.

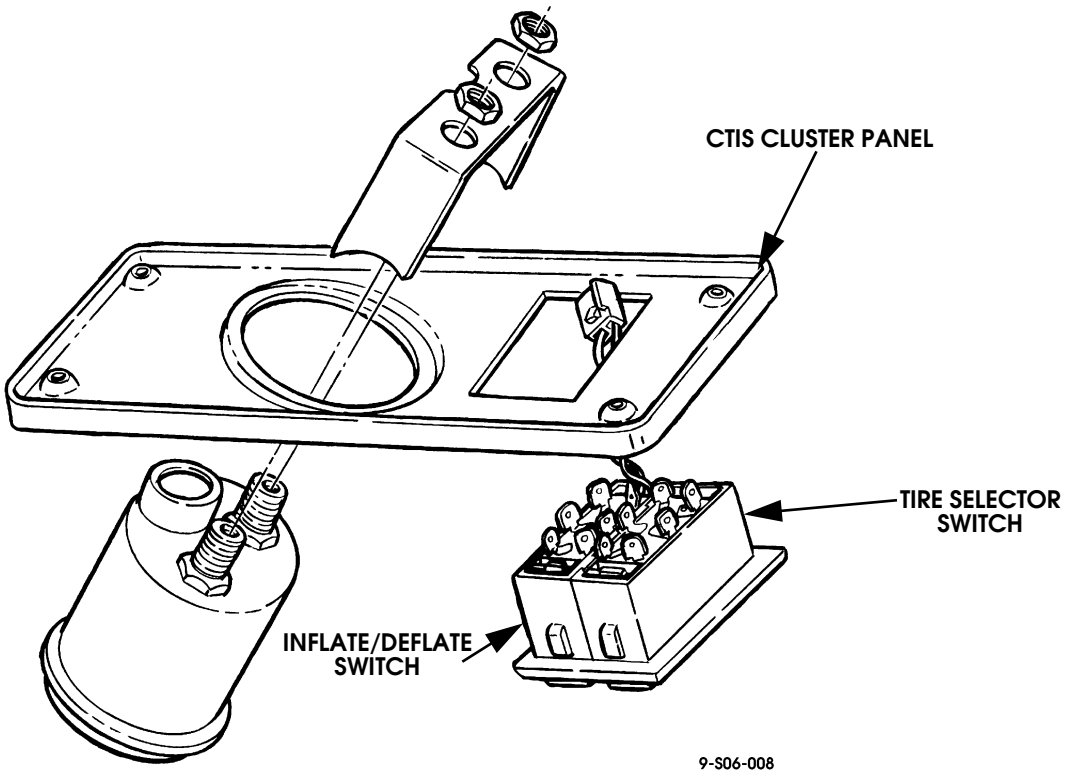


Figure 6-55: Inflate/Deflate Switch And Tire Selector Switch

FRONT CTI LINE REPLACEMENT

1. Disconnect line at front hub (Figure 6-69).
2. Loosen clamp on bracket attached to lower control arm, then move air line out of bracket (Figure 6-70).
3. Disconnect front air line at T-fitting secured to front crossmember.
4. Cut tie straps and remove front air line.
5. Tape ends of new line to prevent dirt entry. Then route line to front wheel and T-fittings.
6. Secure hose to fittings and in clamp on lower control arm bracket.
7. Install tie straps as needed.

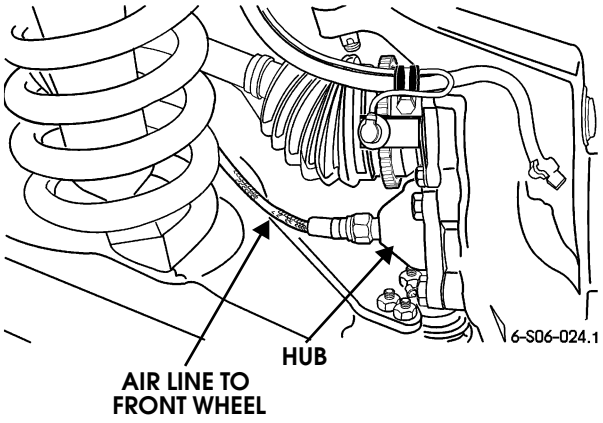


Figure 6-69: Line Connection to Hub

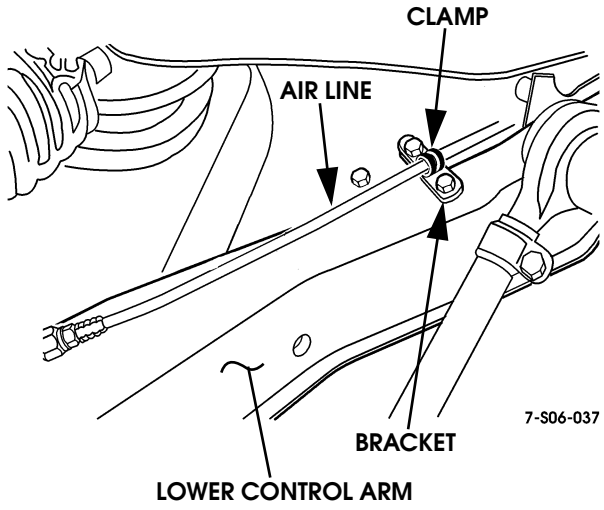


Figure 6-70: Line Bracket and Clamp Location

REAR CTI LINE REPLACEMENT

1. Disconnect line at rear wheel and at T-fitting (Figure 6-71).
2. Remove line from clamp on lower control arm and from rear hub.
3. If working on right rear line, remove clamp over crossmember to remove line (Figure 6-72).
4. Tape ends of new line to prevent dirt entry.
5. Connect line to T-fitting and rear hub.
6. Secure line in control arm clamp.
7. If working on right rear line, secure line to crossmember with clamp (Figure 6-72).

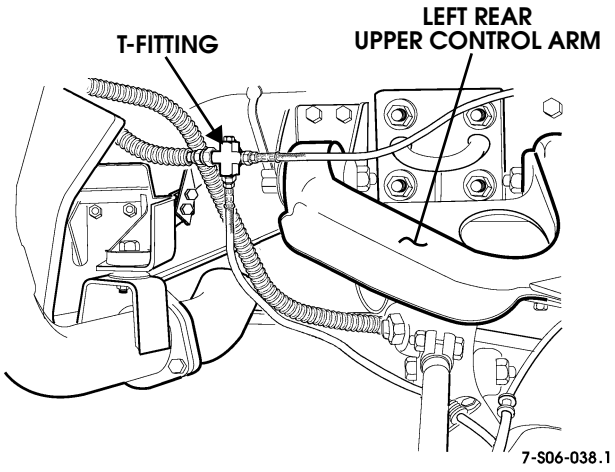


Figure 6-71: T-Fitting Location

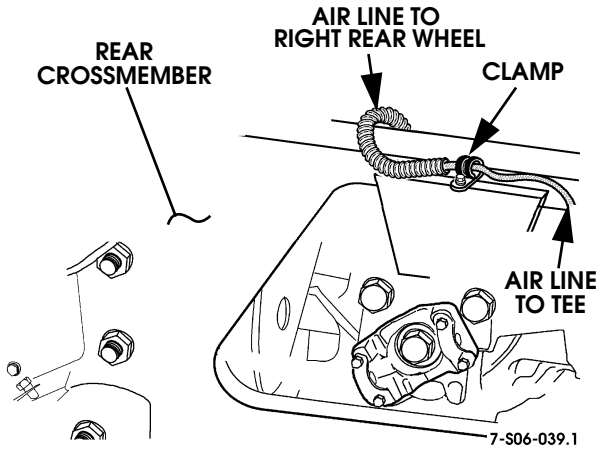


Figure 6-72: Right Rear Line Routing Over Rear Crossmember

Brake Chatter

On some new vehicles, roughness or a chatter sound from the brakes may be noticed during low speed brake application. The noise is a result of the lining edges of an unburnished brake pad rubbing against the rotor. Burnishing is a part of the vehicle break-in process which fully seats and conditions new brake pads. Although annoying, the brake noise is not detrimental to vehicle safety or performance, and will eventually be eliminated through normal brake use.

If chatter or roughness persists on a new vehicle, then chamfering of the brake pad lining edges can be performed. Chamfering of the brake pad is done by slightly grinding or filing the edge of the pad lining on a grinding wheel.

To complete the chamfering procedure:

1. Remove the eight service brake pads from the vehicle. Mark each pad for vehicle and caliper location.
2. Chamfer (grind or file) the brake pad lining edges. Ensure both brake pad lining edges are chamfered on each of the eight brake pads (Figure 7-2). Make sure pads are flat and even.
3. Install eight service brake pads at the original vehicle and caliper location.
4. Operate vehicle and check brakes for proper operation.

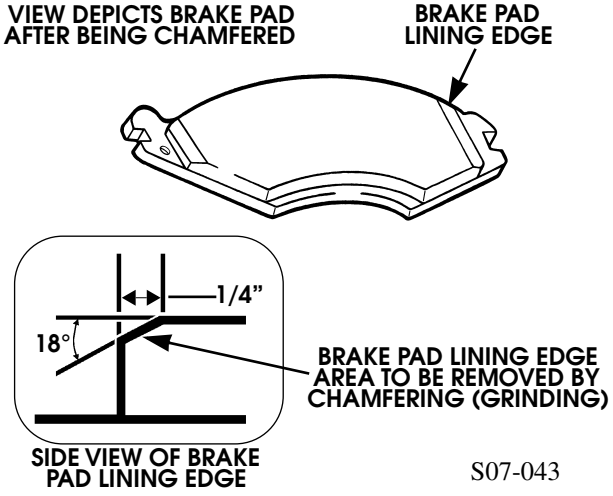


Figure 7-2: Chamfering Brake Pad

Booster or Pedal Pulsation

1. Check hydro-boost. Depress brake pedal several times, with engine off, to exhaust accumulator pressure. Depress brake pedal and start engine.
   a. Brake pedal should fall, then push back against operator's foot.
   b. Perform pressure test (Section 8).
   c. Replace hydro-boost if not operating properly.
2. Check halfshaft and rotor mounting for missing or loose capscrews. Replace inclined-cam washers, apply a thread locking compound and torque capscrews to 57 lb-ft (77 N•m).
3. Check brake rotor lateral run-out. Refinish any rotor not meeting specifications. Refer to *Checking Lateral Runout* in this section for more information.

Erratic Braking Action

1. Check for correct tire pressure.
2. Check brake pads for binding as a result of corrosion or dirt. Check brake pads for excessive wear. Minimum brake lining thickness is 1/8 in. (3.2 mm). Replace brake pads as sets (front or rear) if any pad does not meet specifications.
3. Check brake calipers for binding as a result of corrosion or dirt. Check for seized or binding brake caliper pistons. Repair any binding or seized caliper pistons. Check brake rotors for free movement. If rotors do not move freely, remove calipers and clean caliper guide pins (Figure 7-3).

NOTE: Calipers pins must be replaced in pairs. Caliper pins and bushing should be lubricated with an approved brake component lubricant.

4. Check for leaking caliper piston seals. Replace or rebuild any calipers with leaking seals.
5. Check rotor for glazing or scoring. Turn the rotor if glazed or scored. Do not exceed the minimum thickness shown on the inside of the rotor hat section. It is not recommended that rotors be turned when spotted or heat checked.
6. Check for damaged brake lines. Replace any damaged brake lines.
7. Check ABS operation. Check ABS warning lamp. Perform a 20 mph hard deceleration on a slippery surface (sand, gravel, snow, etc). If one or more wheels lock repair the ABS. Refer to ABS diagnostics in this secion.
8. Check toe adjustment. Adjust toe, if necessary. Refer to Section 5.

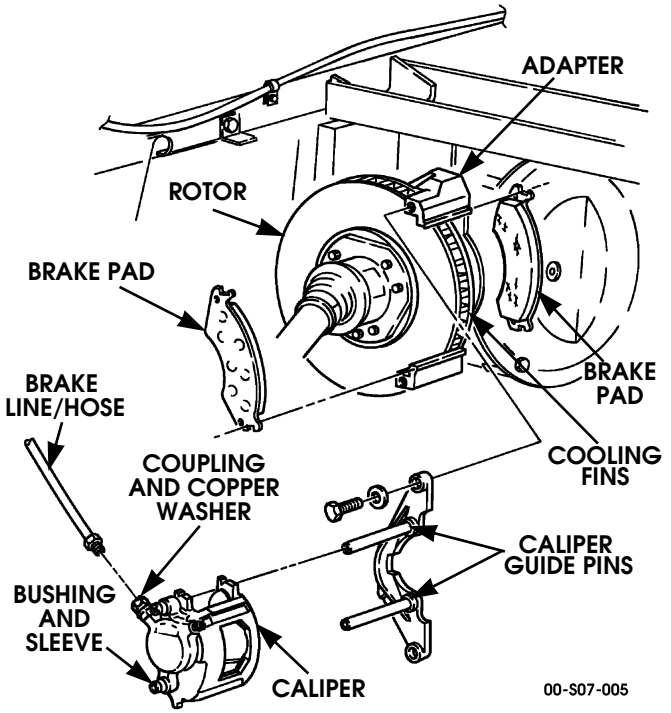


Figure 7-3: Brake Caliper and Brake Pads

REAR DUAL SERVICE/PARKING BRAKE PAD REPLACEMENT

Removal

1. Put transmission in PARK, chock wheels, and release parking brake.
2. Remove cotter pin, washer, and clevis pin securing parking brake cable to lever. Discard cotter pin (Figure 7-18).
3. Remove clip securing parking brake cable to caliper cable bracket and disconnect cable from caliper cable bracket. Discard clip.

CAUTION: *Caliper must be supported during removal to prevent damage to brake line.*

4. Remove two capscrews and washers securing yoke and caliper to adapter, and pull yoke and caliper away from rotor (Figure 7-19).

NOTE: Note positioning of brake pad surfaces for installation.

5. Remove two brake pads from adapter and rotor.

Cleaning and Inspection

NOTE: Clean all components, examine for wear or damage, and replace if necessary.

1. Clean mating surfaces of caliper and adapter and lightly lubricate adapter slides with brake component lubricant (Figure 7-19).

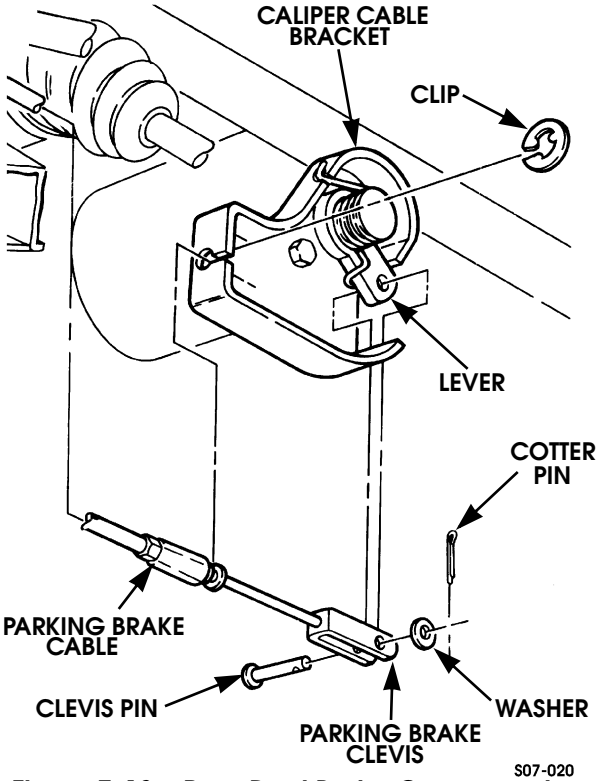


Figure 7-18: Rear Dual Brake Components

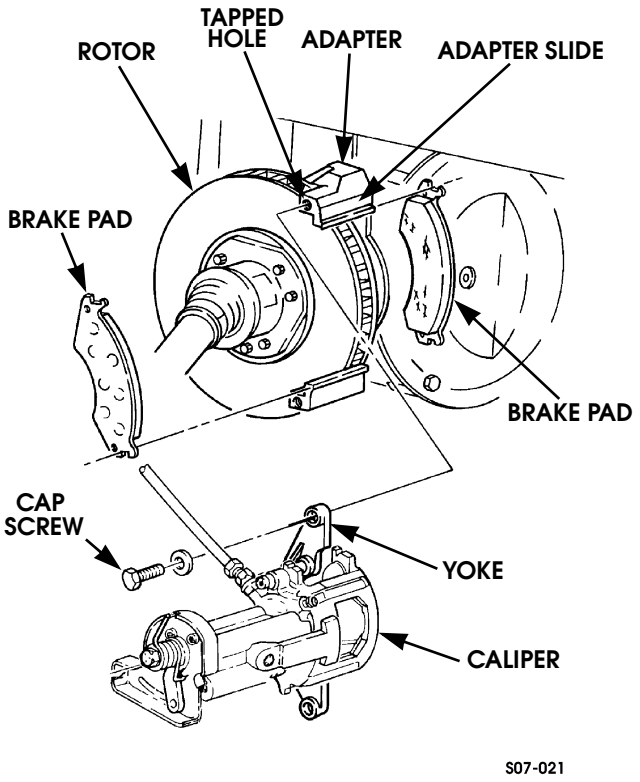


Figure 7-19: Rear Dual Brake Pad and Rotor

2. Inspect caliper and caliper piston face for pitting or damage (Figure 7-20).
3. Inspect piston dust boot and bushings for tears or deterioration.
4. Inspect caliper cable bracket for looseness, damage, and rotation.
5. Thoroughly clean and inspect rotor for heat checks, discoloration, pitting, or scoring (Figure 7-19).

CAUTION: *Ensure that grease and oil are not in contact with rotor and/or brake pad friction surface. Failure to do so will result in damage to equipment and poor performance.*

NOTE: Replace brake pads in sets only. If operation in wet and muddy conditions is expected, replace brake pads if brake lining thickness is less than 1/8 in. (3.2 mm).

6. Inspect brake pads for glazing, oil saturation, or wear. If glazed, oil saturated, or if brake lining thickness is less than 1/8 in. (3.2 mm), replace both pads and pads on opposite caliper.

6. Install thrust screw as follows:
   a. Align slot in thrust screw with centering pin.
   b. Insert thrust screw in caliper and seat it on centering pin and on ball bearings.
   c. Compress thrust screw retaining ring with fingers and install it in caliper bore below piston seal groove.

CAUTION: *Do not use metal tools to install the retaining ring. Metal tools will score or scratch the caliper bore.*

   d. Push assembly into bore as far as possible.
   e. Seat retaining ring using unassembled caliper piston. Lightly coat piston with DOT 3 brake fluid and insert it in bore. Then push piston sharply downward two or three times to seat retaining ring. Remove piston after ring is seated.
7. Install new O-ring on centering pin plug. Then position spacer on top of centering pin and install plug. Tighten plug securely with hex wrench or socket.
8. Install new caliper piston seal. Start square cut seal into groove at top of bore and work it into place with your fingers. Lubricate seal and bore with fresh DOT 3 brake fluid.
9. Assembly caliper piston as follows;
   a. Install cone clutch in piston.
   b. Lubricate bearing and race with DOT 3 brake fluid and install them on cone clutch. The open side of bearing goes toward race.
   c. Install wave washer (either side up).
   d. Install retaining ring with internal-type ring pliers. Flat side of ring goes toward wave washer.
10. Install caliper piston as follows:
   a. Install new dust boot on caliper piston.
   b. Lubricate caliper piston with fresh brake fluid. Then insert it through dust boot, into caliper bore, and onto thrust screw.
   c. Install parking brake lever on actuator shaft and rotate lever to extend thrust screw.
   d. Rotate piston onto thrust screw by hand, then with suitable size socket.
   e. Turn parking lever to normal (non-applied) position and complete piston installation as needed.
   f. Seat piston dust boot in groove at top of caliper bore. Use suitable size boot installer tool or flat punch.
11. Install new O-ring on piston retaining screw and install screw. Tighten screw securely.
12. Install parking brake lever retainer and bolt. Apply 1-2 drops Loctite to bolt threads before installation.
13. Install and seat parking brake lever return spring in cable housing slot.
14. Install bleed screw, if removed Apply anti-seize compound to screw threads beforehand.

Fault Code List
Ignition key "OFF" to test system (except where noted)

Fault Code	Problem Area	Test Pin Locations	Values	Check/Repair
6-6	Short circuit between two solenoid valve leads of **left rear inlet** solenoid valve.	21 and 4, 5, 6, 7, 22, 23, 24	5.0-7.5 Ω	Check electrical resistance of affected valves and wiring at ECU connector and at modulator assembly plug. Repair or replace wiring as necessary and replace modulator if short is internal. **Note: Fault code for both affected valves will be stored in memory.**
6-7	Short circuit between two solenoid valve leads of **left rear outlet** solenoid valve.	22 and 4, 5, 6, 7, 21, 23, 24	3.0-5.0 Ω	Check electrical resistance of affected valves and wiring at ECU connector and at modulator assembly plug. Repair or replace wiring as necessary and replace modulator if short is internal. **Note: Fault code for both affected valves will be stored in memory.**
6-8	Short circuit between solenoid valve and RCP relay 1.	11 and 4, 5, 6, 7, 21, 22, 23, 24	Open circuit	Check wiring harness at ECU connector to pump relay. Repair or replace as necessary.
6-9	Short circuit between solenoid valve and RCP relay 2.	12 and 4, 5, 6, 7, 21, 22, 23, 24	Open circuit	Check wiring harness at ECU connector to pump relay. Repair or replace as necessary.
6-12	**Right front** wheel speed signal missing.	17 and 34	Greater than 0.9 volts AC at one tire revolution per second.	Check for damaged tone wheel, incorrect sensor adjustment, excessive tone wheel runnout (> .041"), excessive geared hub input bearing play and tire size mismatch. Repair or replace as necessary.
6-13	**Left rear** wheel speed signal missing.	18 and 35	Greater than 0.9 volts AC at one tire revolution per second.	Check for damaged tone wheel, incorrect sensor adjustment, excessive tone wheel runnout (> .041"), excessive geared hub input bearing play and tire size mismatch. Repair or replace as necessary.
6-14	**Left front** wheel speed signal missing.	15 and 32	Greater than 0.9 volts AC at one tire revolution per second.	Check for damaged tone wheel, incorrect sensor adjustment, excessive tone wheel runnout (> .041"), excessive geared hub input bearing play and tire size mismatch. Repair or replace as necessary.
6-15	**Right rear** wheel speed signal missing.	16 and 33	Greater than 0.9 volts AC at one tire revolution per second.	Check for damaged tone wheel, incorrect sensor adjustment, excessive tone wheel runnout (> .041"), excessive geared hub input bearing play and tire size mismatch. Repair or replace as necessary.

Power Steering Fluid

Recommended fluid for the power steering system is Dexron III.

Power Steering Component Service

Most of the power steering pump components are not serviceable. The seals and the flow control valve, however, can be serviced. The pump can also be replaced as an assembly.

The steering gear can be removed and overhauled when required. Refer to the overhaul procedure in this section.

The fluid coolers and fluid lines are also replaced as assemblies when diagnosis indicates this is necessary.

Steering Linkage

The steering linkage consists of a steering (Pitman) arm, center link, idler arm, and left/right tie rods (Figure 8-3). The tie rods connect the center link to steering arms on the left and right side geared hubs. The idler arm stabilizes the center link and is attached to the vehicle frame. The steering arm connects the center link to the steering gear.

Steering Linkage Lubricant

Recommended lubricant for linkage lubrication points is NLGI-LB grade lubricating grease. Quality lubricants are available from suppliers such as Mobil, Kendall, and Valvoline.

STEERING (PITMAN) ARM REPLACEMENT

NOTE: Ensure front wheels are in straight-ahead position while steering arm is removed and installed.

Removal

1. Raise and support the front of the vehicle.
2. Remove the nut and lock washer from the steering gear shaft (Figure 8-2). Using puller J–42548, remove the pitman arm from the steering gear shaft.
3. Remove the cotter pin and slotted nut from the center link end of the pitman arm.
4. Using puller J–24319–B or equivalent, remove the pitman arm from the center link.
5. Loosen the idler arm to frame mount bolts to allow movement of the idler arm when the pitman arm is tightened to the center link.

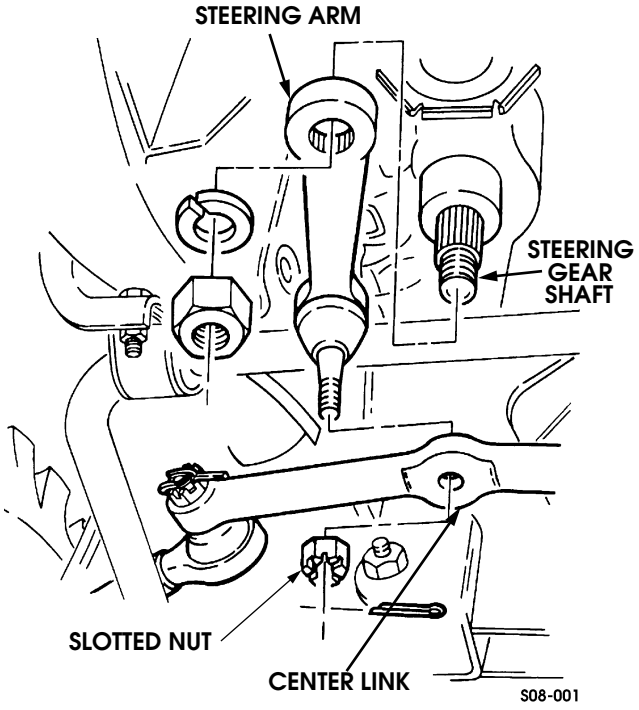


Figure 8-2: Steering (Pitman) Arm Removal

Installation

1. Secure the pitman arm to the steering gear shaft with the lock washer and nut. Tighten the nut to 185 lb-ft (251 N•m).
2. Secure the pitman arm to the center link with the slotted nut. Tighten the slotted nut to 80 lb-ft (108 N•m).
3. Install the cotter pin through the slotted nut. If necessary, tighten the slotted nut to align the holes for cotter pin insertion. DO NOT back off the slotted nut to align the holes.
4. Place the wheels in the straight ahead position and tighten the idler arm to frame bolts to 60 lb-ft (81 N•m).
5. Lubricate the pitman arm and lower the vehicle.

INTERMEDIATE STEERING SHAFT DUST BOOT REPLACEMENT

Removal

1. Remove close-out panel.
2. Remove three nuts, six washers, and three screws from dust boot (Figure 8-23).

NOTE: Before performing step 3, put scribe marks showing the position of the yoke relative to the splines.

3. Remove bolt on yoke and pull intermediate steering shaft from steering column.
4. Remove four locknuts, eight washers, four screws, spacer, and dust boot from cowl panel and intermediate steering shaft.

Installation

1. Secure spacer and dust boot to cowl panel with four screws, eight washers, and four locknuts. Tighten locknuts to 60 lb-ft (81 N•m) (Figure 8-23).
2. Insert intermediate steering shaft through dust boot. Align scribe marks and slide yoke onto steering column splines. Tighten locknut on yoke to 60 lb-ft (81 N•m).
3. Apply silicone spray or equivalent to end of steering shaft. Install three screws, six washers, and three nuts on dust boot.
4. Install close-out panel.

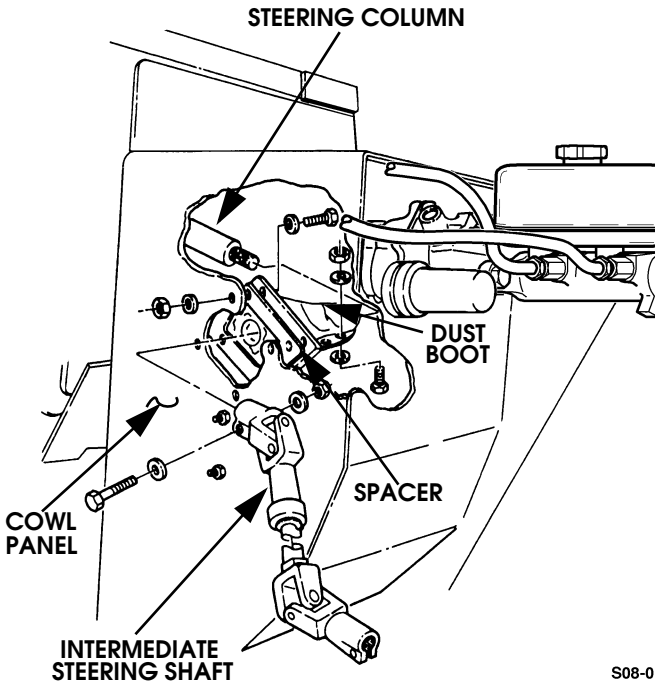


Figure 8-23: Intermediate Steering Shaft Dust Boot Replacement

Rack Piston Removal and Disassembly

1. Rotate stub shaft counterclockwise until rack piston is even with seal groove in open end of housing. Do not allow the rack piston to extend out of the housing. It only needs to be about 1/4 inch from the end.
2. Remove rack piston plug (Figure 8-39). Use a ratchet and socket extension to remove the plug as shown.

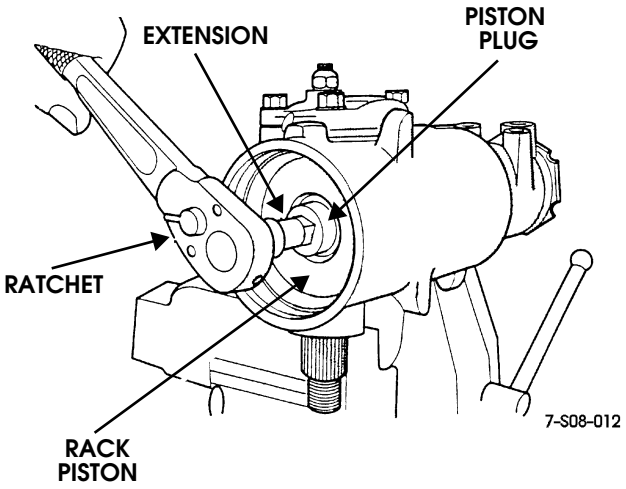


Figure 8-39: Rack Piston Plug Removal

3. Insert arbor tool J–21552 into rack piston (Figure 8-40).

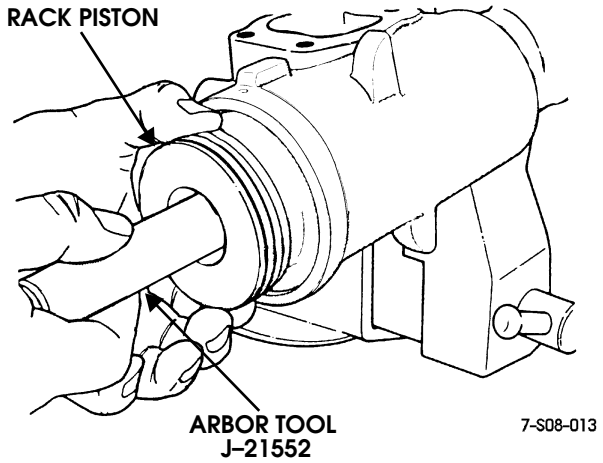


Figure 8-40: Rack Piston Removal

4. Hold arbor tool tightly in rack piston and turn stub shaft counterclockwise to push rack piston out of housing. Then remove rack piston, and arbor tool as assembly (Figure 8-40).
5. Remove wormshaft if it came out of stub shaft (Figure 8-41).

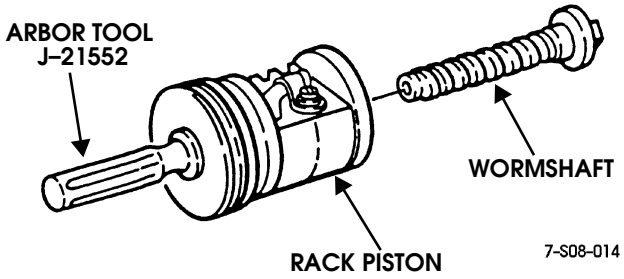


Figure 8-41: Wormshaft Removal

6. Remove thrust bearing and races from wormshaft.
7. Remove teflon seal rings and backup O-rings from rack piston (Figure 8-42).

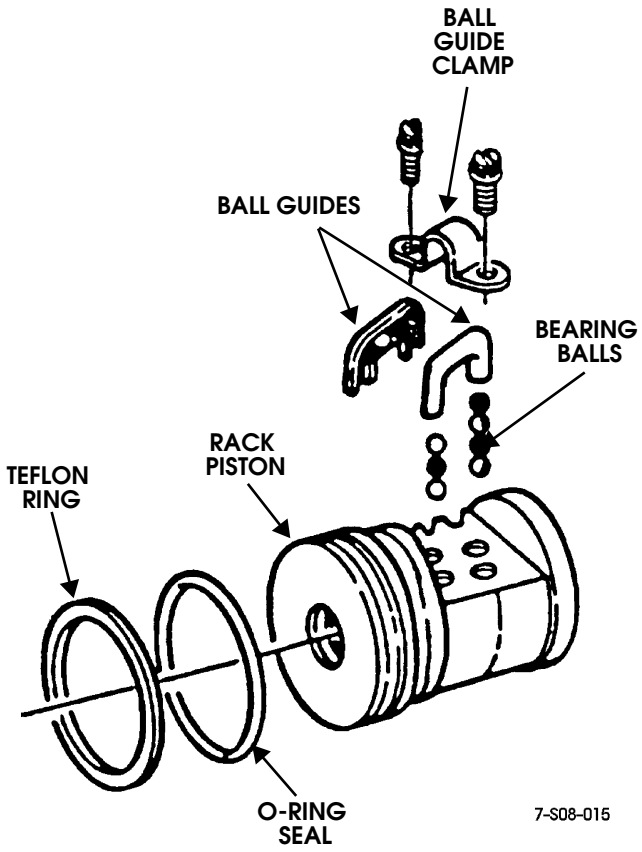


Figure 8-42: Rack Piston Components

8. Remove bolts attaching recirculating ball guide halves to rack piston, remove guides, and remove bearings from rack piston (Figure 8-41). A total of 24 bearings are used; 12 chrome and 12 black.

Pitman Shaft Overcenter Preload Torque Adjustment

1. Loosen locknut on pitman shaft adjuster screw.
2. Turn adjuster screw counterclockwise until fully extended. Then turn screw one full turn clockwise.
3. Rotate stub shaft from stop-to-stop and count number of turns. Then turn stub shaft back 1/2 number of turns. This will center rack piston and pitman shaft.
4. Verify that gear is centered. Flat on stub shaft should face upward and be parallel with side cover. In addition, master spline on pitman shaft should be parallel with adjuster screw (Figure 8-70). If gear is not centered, number of turns counted in step 3 may be incorrect, or pitman shaft sector teeth are not centered in rack piston. Make necessary corrections before proceeding.

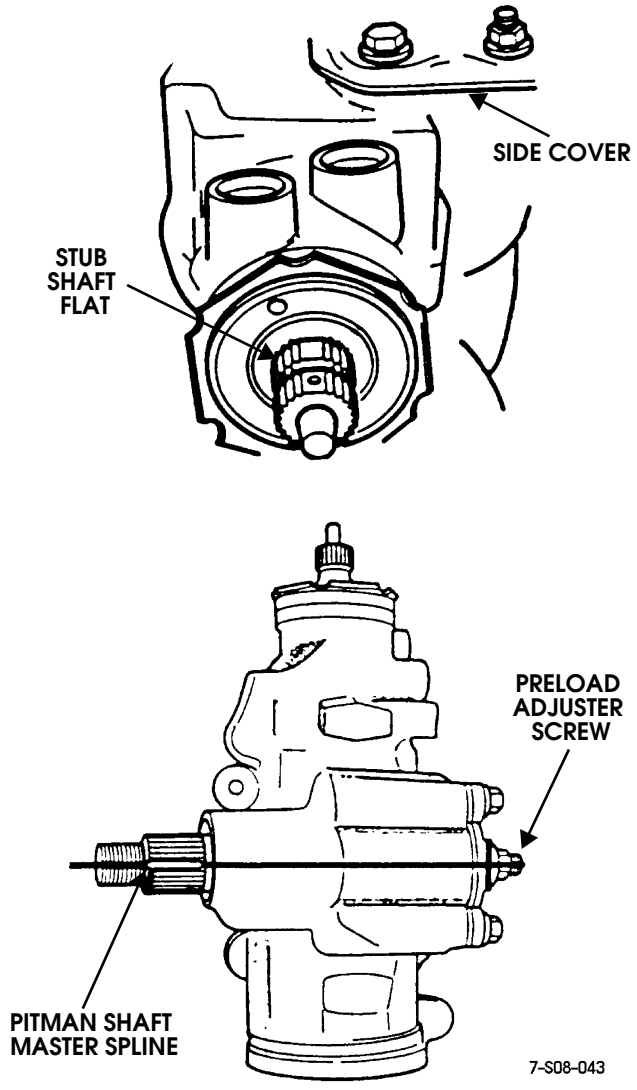


Figure 8-70: Verifying That Gear Is Centered

5. Measure wormshaft bearing preload as follows:
   - Position suitable size 12 point socket and inch pound torque wrench J–7754-C on stub shaft (Figure 8-71).
   - Slowly rotate torque wrench 45 degrees left and right of center. Note torque readings just before and on center in both directions. Correct preload torque is 6 to 15 lb-in (0.7 to 1.7 N•m).
   - If preload torque is within limits, continue with procedure as wormshaft bearing preload is correct.
   - If preload torque is not within limits, wormshaft bearing preload adjustment is incorrect, or wormshaft thrust bearing races were installed backwards. Correct fault before proceeding.

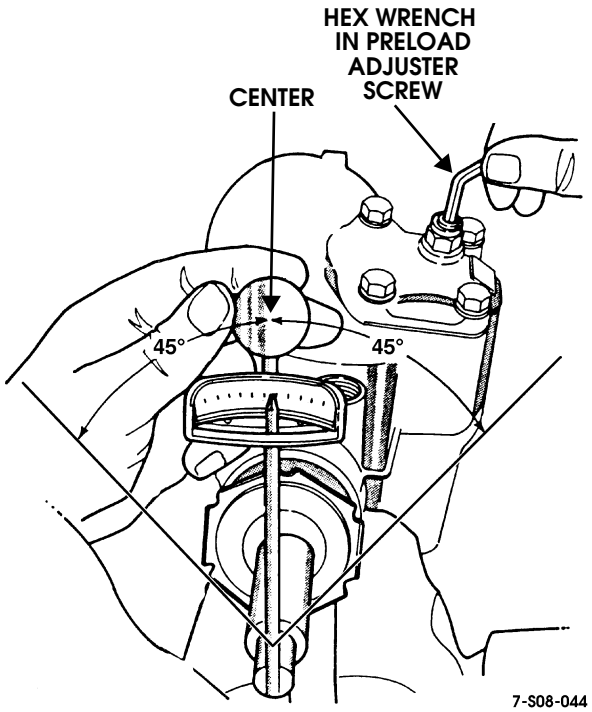


Figure 8-71: Checking /Adjusting Pitman Shaft Over-Center Preload

6. Adjust pitman shaft overcenter preload as follows:
   - Leave torque wrench in place on stub shaft.
   - Note wormshaft bearing preload measured in step 5. Then add additional 6-10 lb-in (0.7 to 1.1 N•m) to this figure for required overcenter preload.
   - Adjust overcenter preload by turning pitman shaft adjuster screw clockwise to increase preload, or counterclockwise to decrease preload.
7. Tighten adjuster screw locknut to 36 lb-ft (49 N•m) torque. Use hex wrench to prevent adjuster screw from turning while nut is tightened.
8. Verify that overcenter preload is still correct before installing gear in vehicle.

UPPER BALL JOINT REPLACEMENT

Removal

1. Remove wheel.
2. Raise and support lower control arm.
3. Disconnect the p-clamp securing the vent line and speed sensor lead to the upper control arm.
4. Remove cotter pin and slotted nut from upper ball joint (Figure 9-6).
5. Remove four locknuts, bolts, eight washers and upper ball joint from upper control arm.
6. Separate upper ball joint from geared hub using ball joint remover J–24319-B or equivalent. Remove ball joint.

Installation

1. Position upper ball joint on upper control arm, ensuring upper ball joint is placed above upper control arm (Figure 9-6).

NOTE: Check upper ball joint torque 15 minutes after initial installation. Adjust if necessary.

2. Install upper ball joint on upper control arm with four bolts, locknuts and eight washers. Tighten 3/8 fine thread locknuts to 30 lb-ft (41 N•m).

NOTE: Do not loosen slotted nut to install cotter pin.

3. Install upper ball joint on geared hub with slotted nut. Using crowfoot and adapter, tighten slotted nut to 65 lb-ft (88 N•m). Install cotter pin in slotted nut.
4. Install the p-clamp securing the vent line and speed sensor lead to the upper control arm.
5. Lubricate upper ball joint.
6. Install wheel.

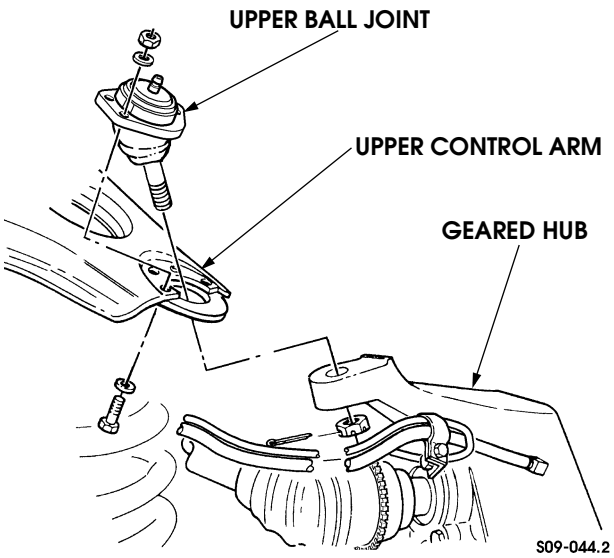


Figure 9-6: Upper Ball Joint Replacement

LOWER BALL JOINT WEAR CHECK

1. Support lower control arm with a jack or stand to unload lower ball joint.
2. Place prybar between lower arm at ball joint and geared hub and measure vertical play obtained by moving pry bar down (Figure 9-7). Maximum play should not exceed 1/8" (3.5 mm).
3. Replace ball joint if end play exceeds the limit.

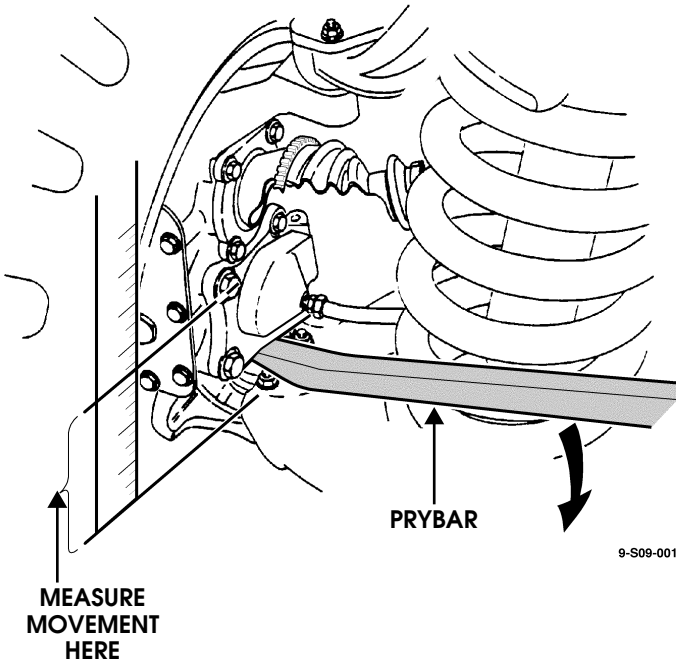


Figure 9-7: Lower Ball Joint Wear Check

incorrect, add or subtract shim gaskets and recheck end play.

8. Install driven gear and bearing spacer in geared hub (Figure 9-33).

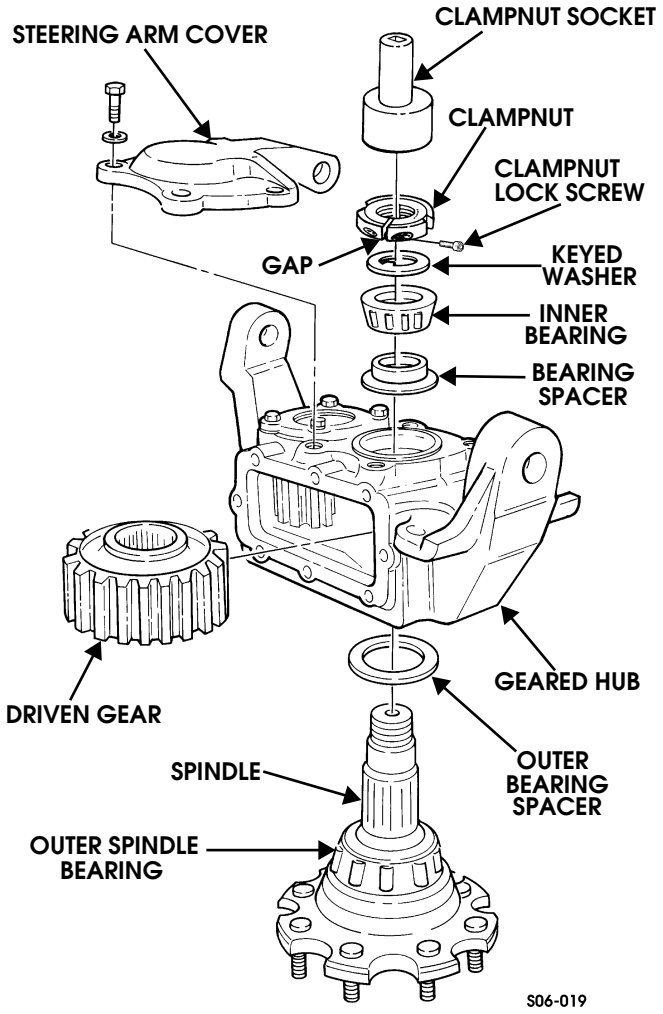


Figure 9-33: Geared Hub Driven Gear Installation

9. Install outer bearing spacer on spindle.
10. Lower geared hub onto spindle and align splines on driven gear with splines on spindle. Ensure outer spindle bearing seats in bearing cup.
11. Install inner bearing and keyed washer on spindle.

NOTE: After clampnut lock screw is installed into clampnut, clampnut must be completely installed on spindle within a ten minute limit.

12. Tighten clampnut lock screw three to five turns into clamp nut.

CAUTION: *Ensure clampnut is installed on spindle with boss (protruding side) facing inward toward bearing and large chamfer side with engraved part number facing away from bearing.*

13. Apply a thin coat of grease to boss (protruding side) of clampnut and install clampnut on spindle.

NOTE: If an excessive amount of torque (18-26 lb-in. (2-3 N•m)) is required to tighten clampnut lock screw to remove clampnut wobble, remove screw. Ensure threads of clampnut are clean and free of Loctite. Replace screw with a new one, or remove all previously applied Loctite from threads of old screw and apply fresh Loctite 272 to old screw threads prior to reinstallation. Use a hexagonhead socket with a calibrated torque wrench to tighten and check torque of screw.

14. Tighten clampnut lock screw until all clampnut wobble is removed and clamp nut can still be rotated by hand.
15. Using clampnut socket J–42545, tighten clamp nut to 40 lb-ft (54 N•m). Rotate spindle five revolutions both clockwise and counterclockwise to seat bearings.
16. Loosen and retighten clampnut to 25 lb-ft (34 N•m).

NOTE: Ensure clampnut does not move while clampnut lock screw is being tightened.

17. Using a hexagon-head socket and pre-set calibrated torque wrench, tighten clampnut lock screw to 90 lb-in. (10 N•m).
18. Mark a temporary line across end of spindle and clampnut.

NOTE: Using a feeler gauge, ensure a gap exists between clampnut gap surfaces. If no gap exists, remove and discard clampnut lock screw and clampnut. Acquire new screw and nut and repeat steps 12-18.

19. Using preset torque wrench, apply pressure to clamp nut in a counterclockwise direction until torque wrench clicks, indicating 90 lb-ft (122 N•m) of loosening torque was applied to clampnut.

NOTE: Clampnut should not move. To verify no movement occurred, check temporary mark across spindle and clampnut. If clampnut moves, remove and discard clampnut lock screw and clampnut. Repeat steps 12-19 with new screw and nut.

20. Paint or scribe a permanent line across end of spindle and clampnut.

NOTE: Immediately install steering arm cover after application of sealer.

21. Clean sealing surfaces on geared hub and steering arm cover. Apply anaerobic sealer to steering arm cover and secure steering arm cover to geared hub.

NOTE: Make sure bolts and holes are free of old Loctite.

22. Apply thread-locking compound to bolts. Secure steering arm cover to geared hub with four washers and bolts. Tighten bolts to 65 lb-ft (88 N•m).

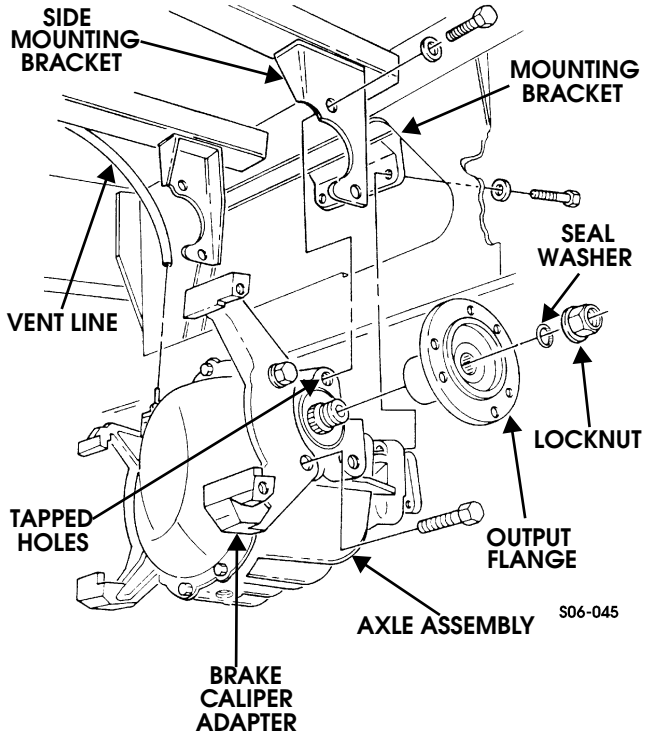


Figure 9-59: Rear Axle Assembly Installation

4. Raise axle assembly into place and connect vent line.
5. Apply thread-locking compound to axle assembly tapped holes. Install axle assembly on side mounting brackets with four washers and bolts.
6. Secure two output flanges and two seals to axle assembly with two locknuts. Tighten locknuts to 165-195 lb-ft (224-264 N•m).

NOTE: No washers required when securing front axle assembly to mounting bracket.

7. Apply thread-locking compound to bolts. Install two washers, bolts, and axle assembly to mounting bracket.
8. Tighten six bolts securing axle assembly to brackets to 110-139 lb-ft (149-188 N•m).
9. Install rear propeller shaft in transfer case (Figure 9-57).
10. Secure rear propeller shaft to pinion yoke with four bolts and two straps. Tighten bolts to 60 lb-ft (81 N•m) (Figure 9-57).
11. Install service brake rotors (Section 7).
12. Fill axle assembly to proper oil level (Section 1).
13. Install vent line to axle assembly.

AXLE ASSEMBLY REPAIR

Disassembly

1. Remove axle assembly.
2. Loosen locknut on output shaft assembly (Figure 9-60).

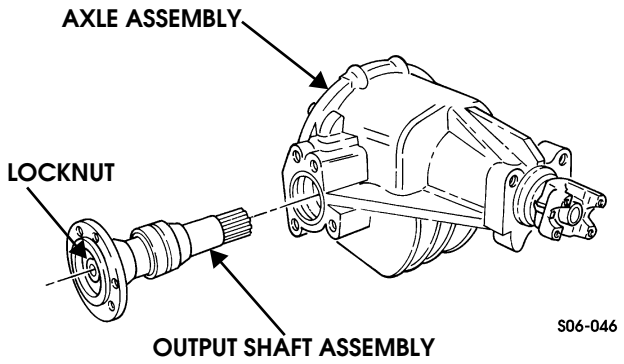


Figure 9-60: Output Shaft Assembly Removal

3. Using a slide hammer, remove output shaft assembly from axle assembly.
4. Remove locknut, seal washer, output flange and output shaft seal from output shaft. Discard seal washer, output shaft seal, and locknut (Figure 9-61).

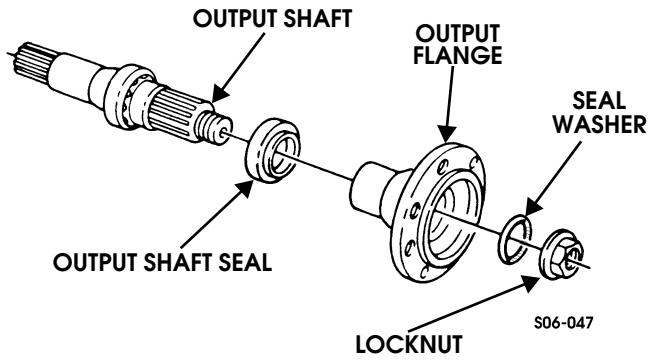


Figure 9-61: Output Shaft Assembly Breakdown

5. Repeat steps 2 through 4 for opposite side.
6. Secure two axle holding fixture adapters to housing with four bolts. Place housing in holding stand (Figure 9-62).

FRONT PROPELLER SHAFT AND U-JOINT SERVICE

Front Shaft Removal

1. Remove U-joint clamp bolts and straps. Then disconnect shaft yoke (Figure 9-104).

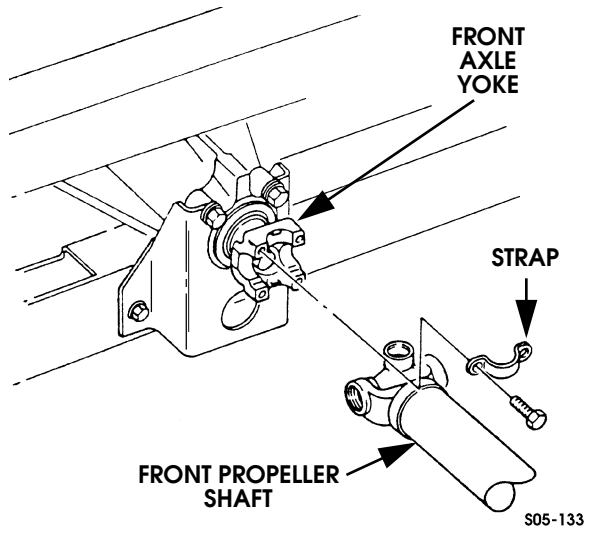


Figure 9-104: Front Propeller Shaft Attachment at Axle

2. Remove U-bolt nuts and disconnect front shaft from transfer case output yoke (Figure 9-105).

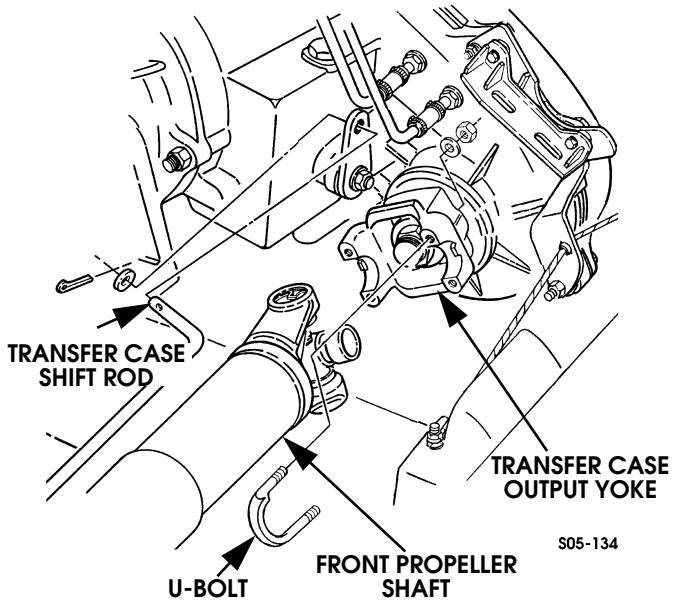


Figure 9-105: Front Propeller Shaft Attachment at Transfer Case

3. Disconnect transfer case shift rod at range lever.
4. Remove bolts attaching center bearing to engine mount (Figure 9-106).

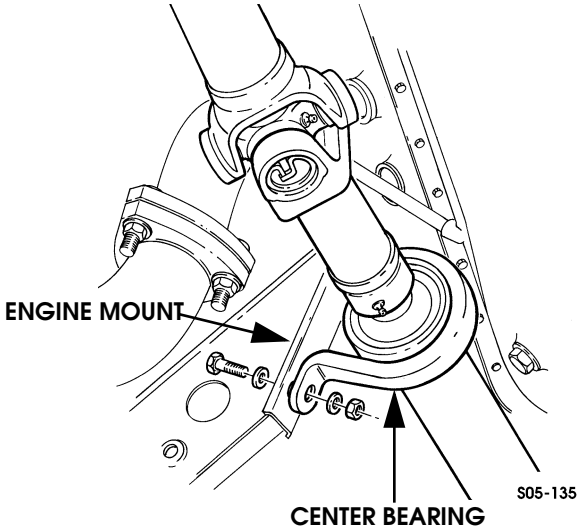


Figure 9-106: Center Bearing Attachment

5. Move front shaft forward, then rearward over top of transfer case and remove from vehicle.

FRONT PROPELLER SHAFT DISASSEMBLY AND OVERHAUL

1. Mark slip yokes for assembly alignment.
2. Mount shaft in vise and remove dust caps (Figure 9-107).
3. Pull slip yokes off propshaft and separate shaft halves.
4. Install standard bearing puller between center bearing and shield.
5. Mount assembly in shop press and press center bearing off shaft.
6. Remove shield from front propeller shaft.

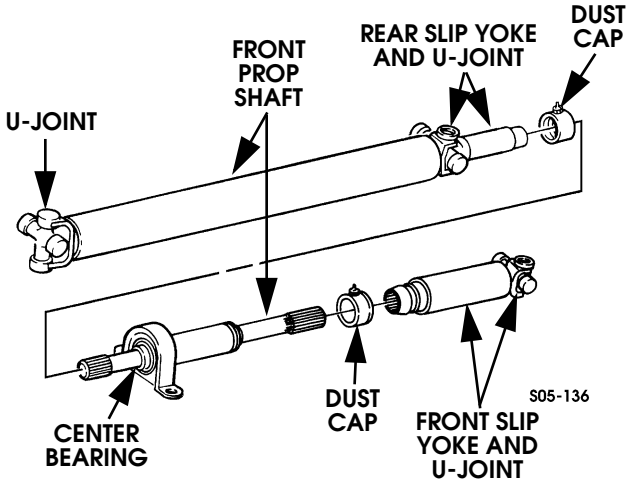


Figure 9-107: Front Propeller Shaft Assembly

REAR BUMPER REPLACEMENT

Removal

1. Remove swing-away spare tire carrier, if equipped (Section 6).
2. Remove rear license plate bracket (Section 10).
3. Remove trailer hitch, if equipped (Section 13).
4. Remove two locknuts, washers, bolts, and washers securing trailer harness to rear bumper (Figure 9-126).
5. Disconnect trailer harness from body harness, and pull trailer harness through hole in rear bumper.
6. Remove four locknuts, washers, bolts, and washers securing two tiedown brackets to rear bumper, two mounting brackets, and outer mounting brackets.
7. Remove eight bolts, washers, and rear bumper from two mounting brackets.

Installation

1. Install rear bumper on two mounting brackets and secure with eight washers and bolts. Do not tighten bolts (Figure 9-126).
2. Install two tiedown brackets on rear bumper, two mounting brackets, and outer mounting brackets, with four washers, bolts, washers, and locknuts. Do not tighten locknuts.
3. Tighten bolts installed in step 1 and locknuts installed in steps 2, 3, and 4 to 90 lb-ft (122 N•m).
4. Insert trailer harness through hole in rear bumper and connect trailer harness to body harness.
5. Secure trailer harness to rear bumper with two washers, bolts, washers, and locknuts.
6. Install trailer hitch, if removed.
7. Install rear license plate bracket.
8. Install swing-away spare tire carrier, if removed.

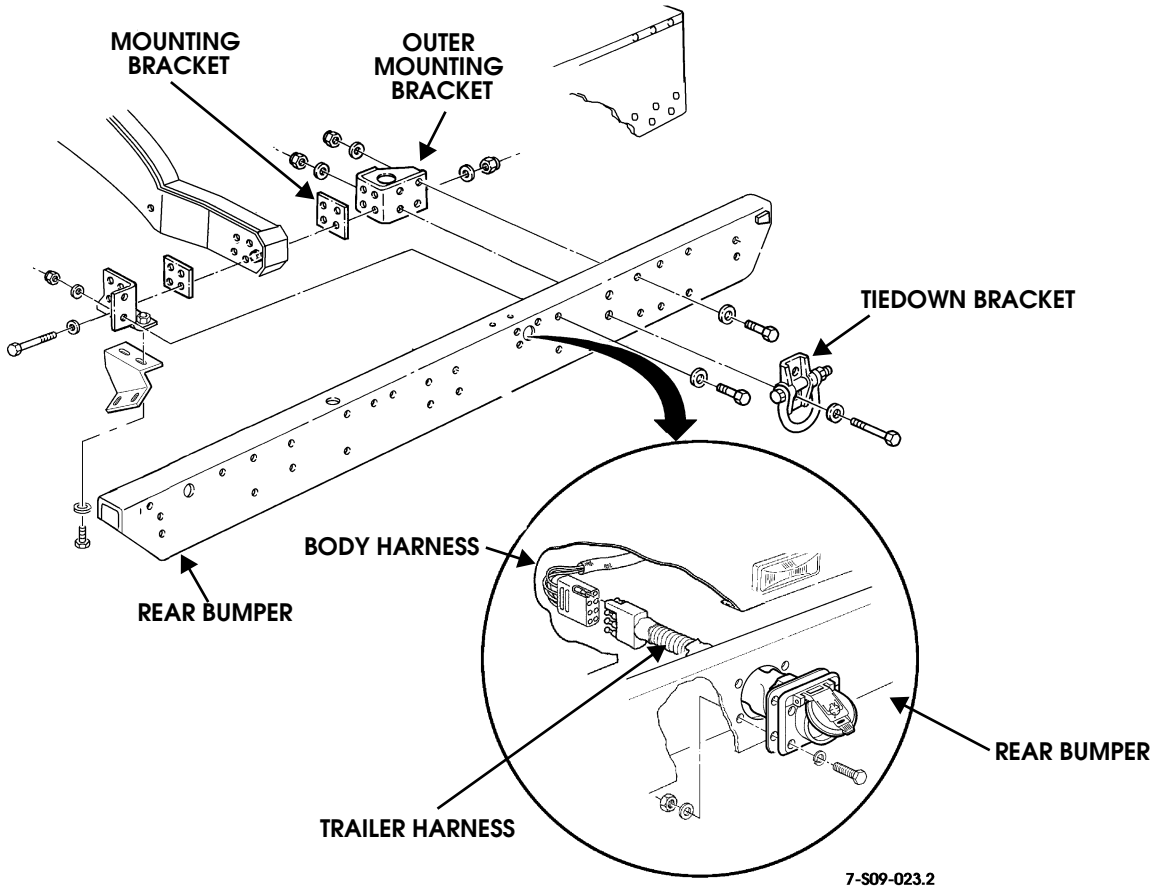


Figure 9-126: Rear Bumper Replacement

FRAME INSPECTION

General Information

The frame rails are constructed by arc-welding two "C" channels of preformed steel together to form a box cross section. The frame rails are internally reinforced at bolt hole locations by bushings or full cross-section spacers to prevent channels from collapsing from attaching load. The frame is made by bolting two non-identical frame rails to crossmembers. Crossmembers are held to stringent dimensional tolerances and therefore must be replaced if damaged.

INSPECTION

The visual inspection is the first and most critical step in forming a decision of whether to repair or replace a damaged frame component (Figure 9-151). Factors to consider when making a visual inspection are:

1. Twisted frame rails are not repairable and must be replaced.
2. Transverse tears or breaks extending across or into both upper or lower corners are not repairable by welding.
3. Short longitudinal cracks up to 6 inches (15.2 cm) or split welds can be repaired by heli-arc welding.

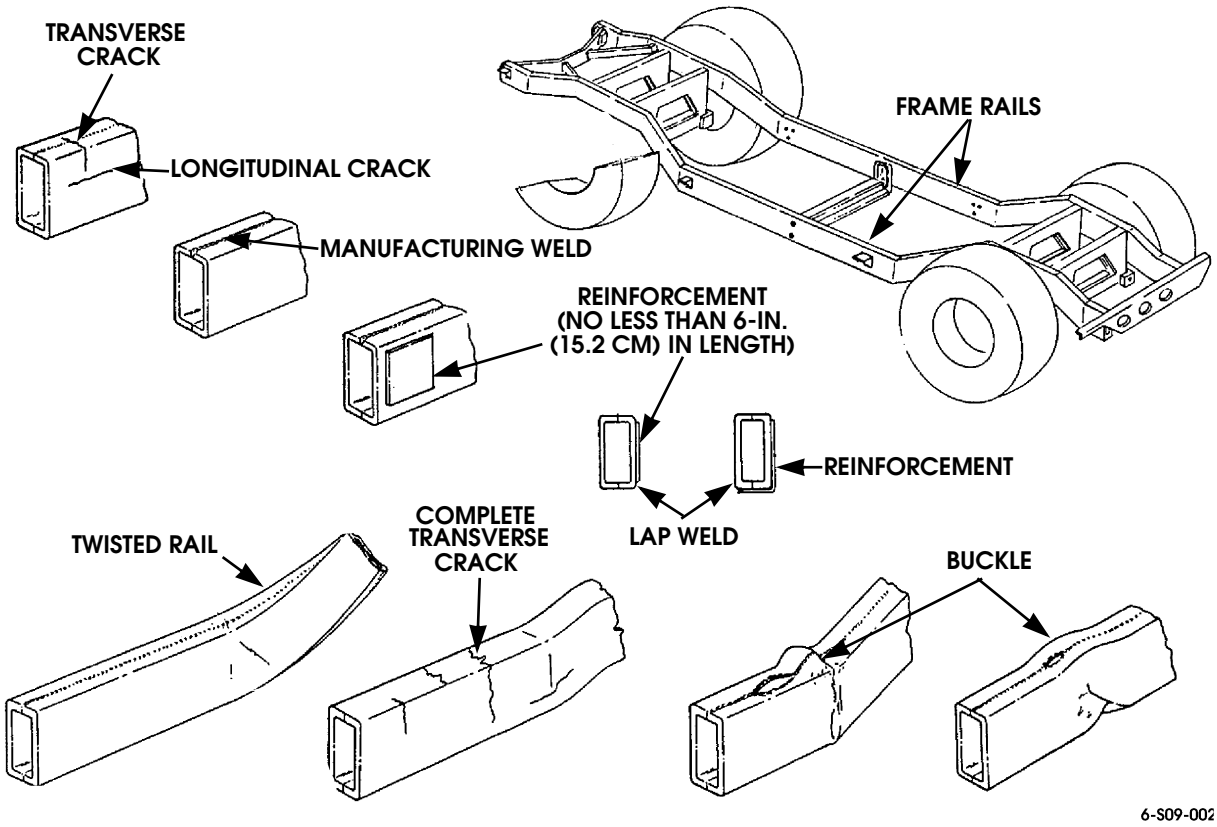


Figure 9-151: Frame Damage

17. With drum horizontal, install brake into drum.
18. Tighten brake retaining set screw to 18-22 ft-lb (24-30 N•m) torque.
19. Install two nylon thrust washers on drum.
20. Install drum assembly on gear train assembly. Rotate drum assembly as needed to engage driveshaft, brake, and output spline (Figure 9-176).

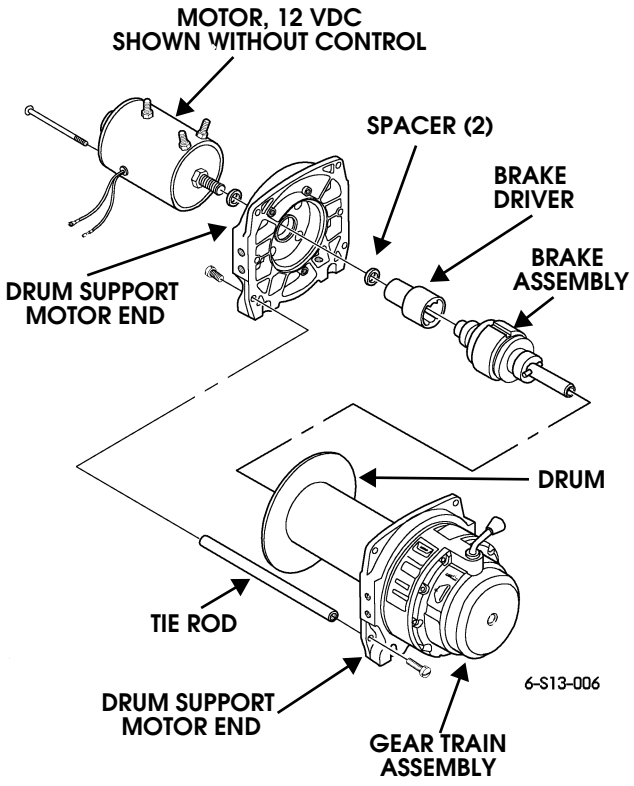


Figure 9-176: Drum Assembly and Gear Train Assembly

21. Install brake drive and spacer to motor shaft.
22. Install motor end drum support on drum assembly.
23. Install motor on motor end drum support, ensuring to engage brake drive with brake shaft end.
24. Install three tie rods between drum supports and secure with six bolts. Tighten bolts to 18 lb-ft (24 N•m).

NOTE: If motor or control have been pre-coated with sealing compound, remove compound from between motor case and control mounting gear contact area. Failure to do so may cause improper grounding of control.

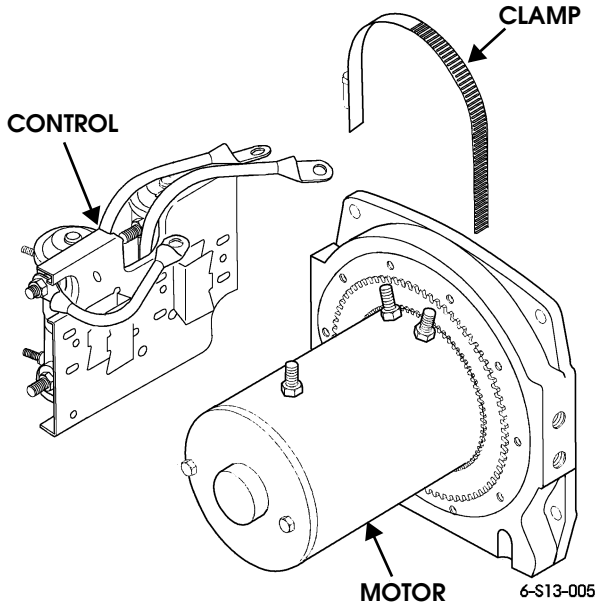


Figure 9-177: Control Unit and Motor

25. Connect three control leads to terminals and secure with nuts (Figure 9-178).
26. Secure control to motor with clamp.
27. Re-coat motor end of winch (including all leads and terminals) with PlastiDip Coating or equivalent waterproofing compound.
28. Install winch assembly and winch cable.

Winch Electric Thermal Switch/Brush Assembly Replacement

Removal

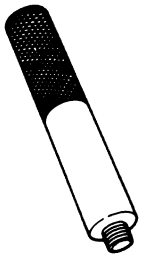
1. Remove winch and winch cable.

NOTE: Tag leads for assembly.

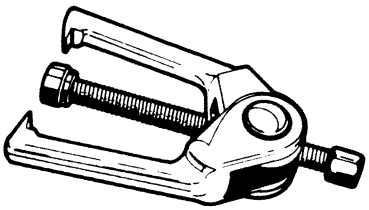
NOTE: It may be necessary to remove plastic coating from winch in order to perform steps 2 through 5.

2. Remove three nuts and control leads from motor (Figure 9-178).
3. Loosen clamp and remove control from motor (Figure 9-179).

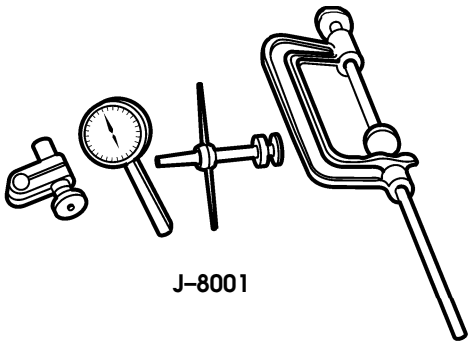
ESSENTIAL TOOLS



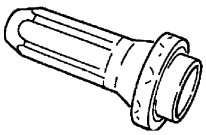
J–8092



J–24319-B

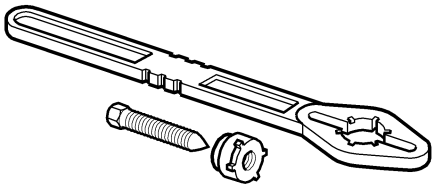


J–8001

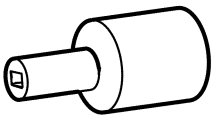


J–29162

J–44905



J–8614-O1



J–42545

7-S09-009.4

7-S09-009.5

TOOL	DESCRIPTION
J–8092	Universal Driver Handle
J–24319-B	Steering Linkage and Tie Rod Puller
J–8001	Dial Indicator
J–29162	Rear Retainer Seal Installer
J–44905	Input Seal Installer
J–8614-O1	Yoke Holding Tool (includes J–8614-5 bolt kit)
J–42545	Clampnut Socket
J–44906	Spindle Seal Installer (not shown)
J–38869	Seal Installer (not shown)
J–35910	Axle Boot Crimping Tool (not shown)
J–42546	1/4 in. Drive Torque Wrench (Preset) (not shown)
J–42547	3/8 in. Drive Torque Wrench (Preset) (not shown)
J–42591	Steering Cover Seal Installer (not shown)

Procure from Kent-Moore.

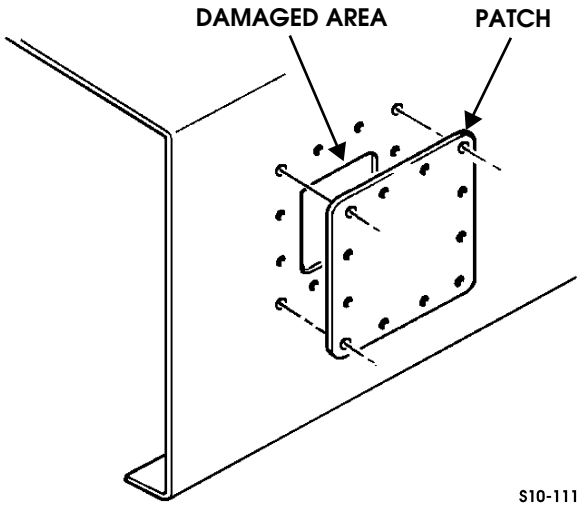


Figure 10-4: Patching

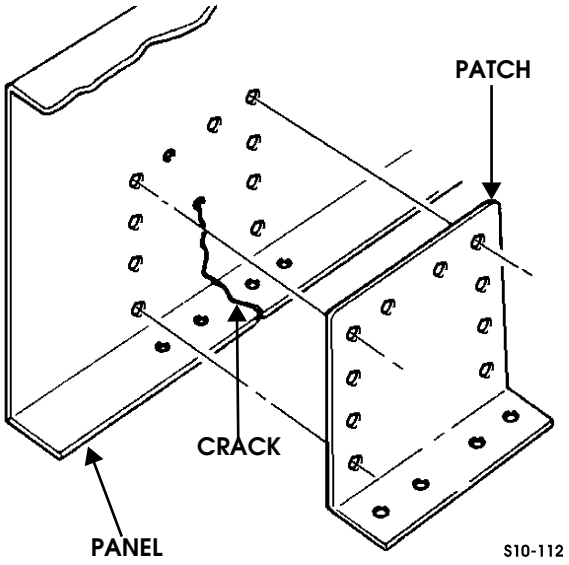


Figure 10-5: Patching Cracked Areas

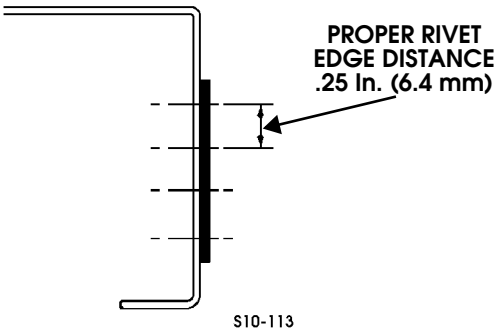


Figure 10-6: Proper Rivet Distance

Repair by Insertion

For damage that is large or more severe in nature than a crack or hole, it is often desirable to remove damaged area, insert a piece of material into removed area and reinforce with a doubler. This is termed repair by insertion. This method of repair is typically stronger and stiffer than an added patch (Figures 10-7 through 10-10).

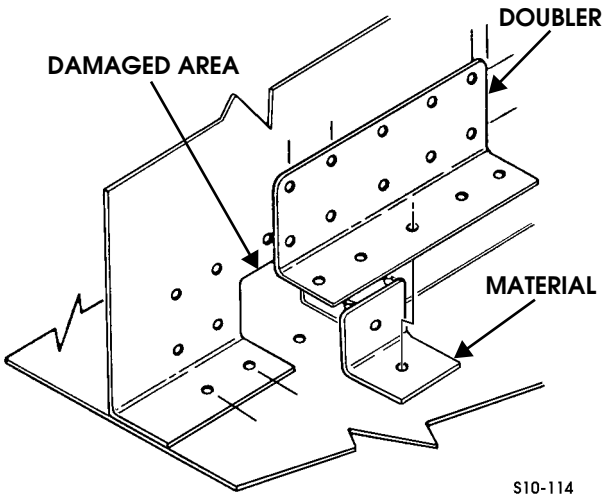


Figure 10-7: Reinforcing Damaged Area

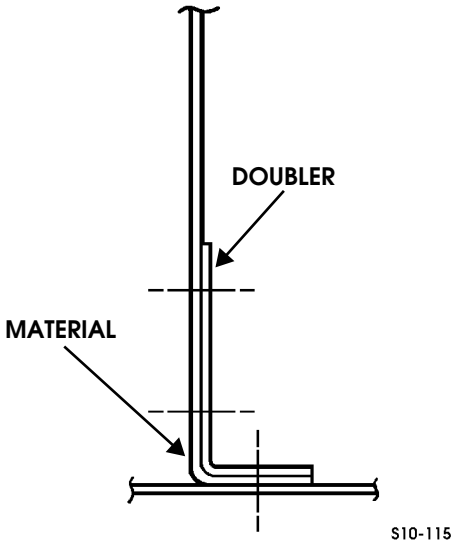


Figure 10-8: Doubler

SEAT BELT ASSEMBLY REPLACEMENT

NOTE: Replacement of the seat belt assembly is basically the same for all seat locations on all vehicle models. This procedure covers the left front seat belt on four-door hard top vehicles.

Removal

1. Remove seat.
2. Remove screw/washer assembly, seat buckle, and washer from body (Figure 10-30).
3. Remove inner kick panel enough to gain access to seat buckle electrical connector.
4. Disconnect seat buckle electrical connector from roof harness connector and pull seat buckle electrical connector through grommet in inner kick panel.

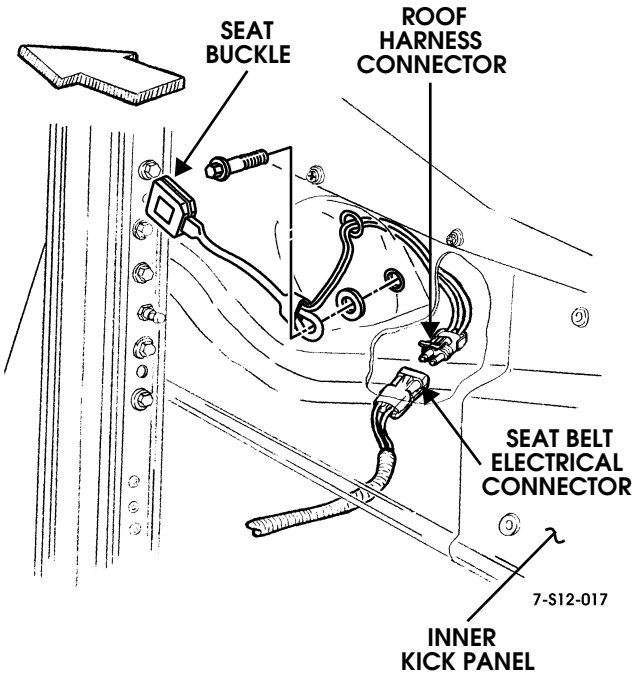


Figure 10-30: Seat Belt Electrical Connector Location

5. Remove screw/washer assembly, D-ring, webbing guide cover, and washer from B-pillar (Figure 10-31).

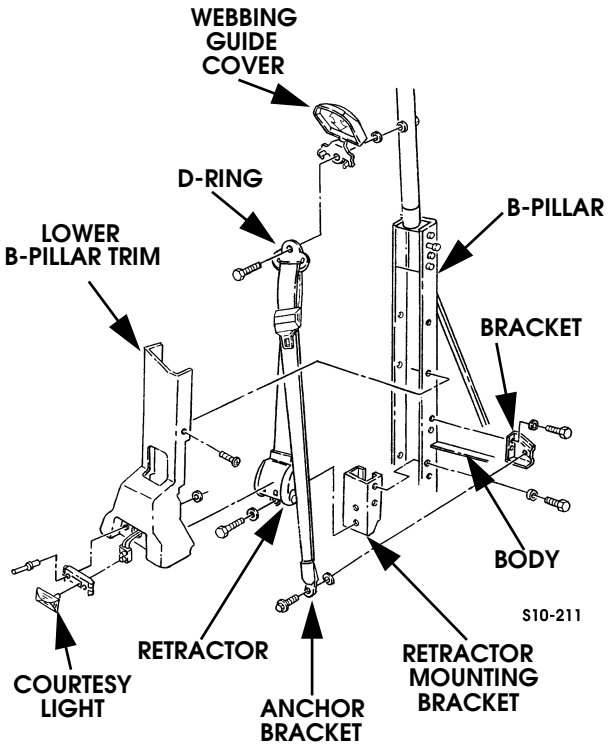


Figure 10-31: Seat Belt Assembly Breakdown

6. Remove screw/washer assembly, anchor bracket, and washer from bracket.

NOTE: Steps 8 and 9 are applicable to all vehicles except two-door vehicles with the enlarged cab.

7. Remove courtesy light lamp assembly, rivets, mounting bracket, and washers from lower B-pillar trim (Figure 10-31).
8. Disconnect body harness connector from courtesy light lamp assembly.
9. Remove screw/washer assemblies securing lower B-pillar trim to B-pillar.
10. Remove bolt, washer, and retractor from retractor mounting bracket. Remove seatbelt assembly from lower B-pillar trim.
11. Remove bolts, washers, and retractor mounting bracket from B-pillar.
12. Remove bolts, washers, and bracket from B-pillar and body.

Tunnel Carpet, Padding, and Hardboard Replacement

Removal

NOTE: Tunnel carpet, padding, and hardboard replacement is basically the same for all models. This task represents four-passenger model carpet replacement.

1. Remove inner kick panels.
2. Remove carpet from tunnel (Figure 10-54).
3. Remove padding from tunnel.
4. Remove panel fasteners and hardboard from tunnel.

Installation

1. Secure hardboard to tunnel with panel fasteners (Figure 10-54).
2. Install padding on tunnel.
3. Install carpet on tunnel.
4. Install inner kick panels.

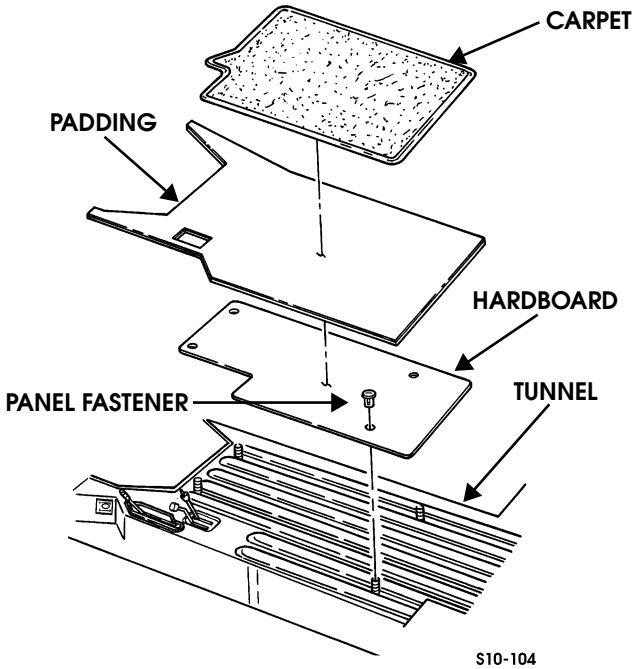


Figure 10-54: Carpet and Padding Installation

VISOR REPLACEMENT

Removal

NOTE: Visor replacement is the same for each side of the vehicle. This procedure covers the driver's side.

NOTE: If your vehicle has the lighted visor mirror, disconnect the visor mirror lead from the roof harness connector before removing the visor (Figure 10-57).

Remove screws, lockwashers, washers, and visor from body (Figure 10-57).

Installation

Secure visor mounting brackets to body with four screws, lockwashers, and washers (Figure 10-57).

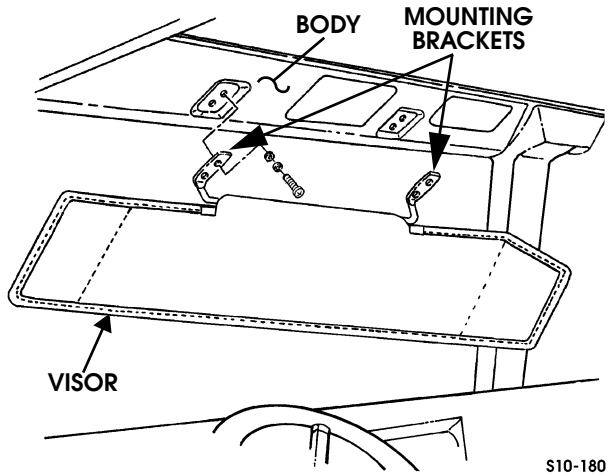


Figure 10-55: Visor Mounting

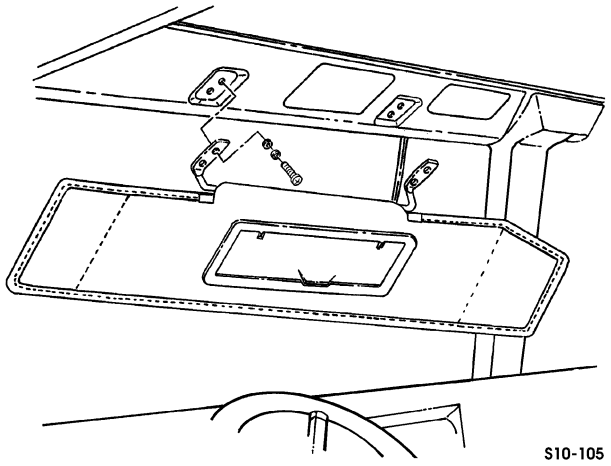


Figure 10-56: Visor With Lighted Mirror

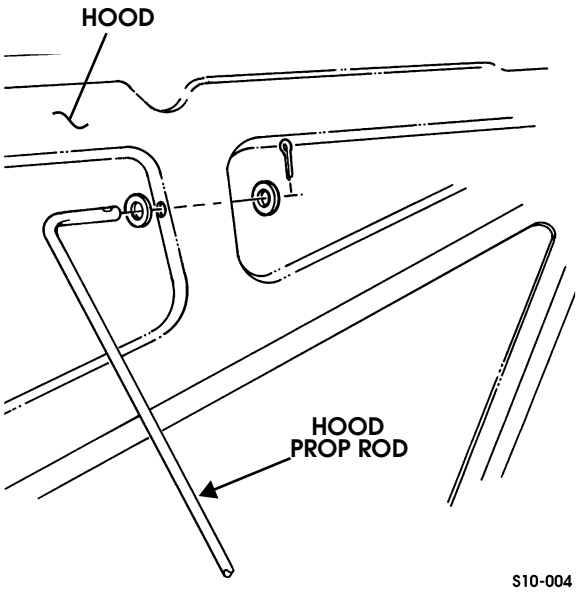


Figure 10-81: Hood Prop Rod Replacement

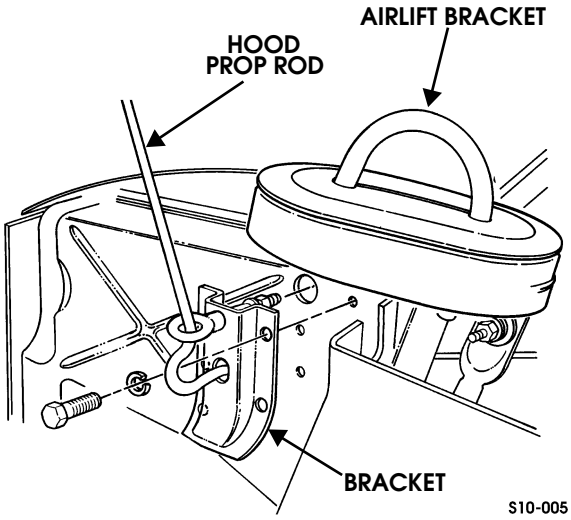


Figure 10-82: Hood Prop Rod and Bracket Replacement

Disassembly

1. Remove hood prop rod from eyebolt (Figure 10-83).
2. Remove locknut, washer, bushing, spring, snapring, bushing, washer, and eyebolt from bracket.

Cleaning and Inspection

NOTE: Clean all components, and examine for wear or damage. Replace if necessary.

Inspect two bushings and spring for cracks, wear, or distortion (Figure 10-83).

Assembly

1. Secure bushing to bracket with snapring (Figure 10-83).

NOTE: Length of spring with bracket assembled is 2-1/4 in. (5.7 cm).

2. Secure washer, eyebolt, spring, bushing, washer, and locknut to bracket.
3. Install hood prop rod into eyebolt.

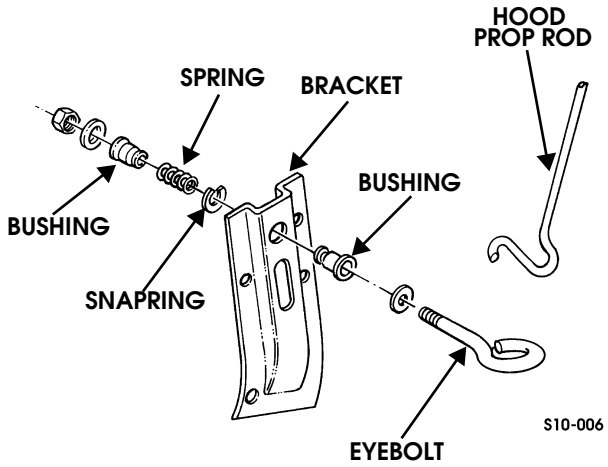


Figure 10-83: Hood Prop Rod and Bracket Assembly Breakdown

Installation

1. Secure hood prop rod and bracket to airlift bracket with four lockwashers and screws. Tighten screws to 6 lb-ft (8 N•m) (Figure 10-82).
2. Secure hood prop rod to hood with two washers and cotter pin (Figure 10-81).
3. Lower hood.

WINDSHIELD WASHER SYSTEM AND COMPONENTS

Reservoir and Pump Assembly Replacement

Removal

1. Drain reservoir.
2. Remove two screws and retaining bracket securing ABS ECU enclosure. Set aside ECU with enclosure.
3. Disconnect pump connector from reservoir and pump assembly (Figure 10-111).
4. Disconnect fluid level connector from fluid level sensor assembly.
5. Remove four bolts, lockwashers, and reservoir assembly from reservoir support assembly.
6. Disconnect windshield washer hose from reservoir and pump assembly.
7. Inspect wellnuts for damage. Replace if damaged.

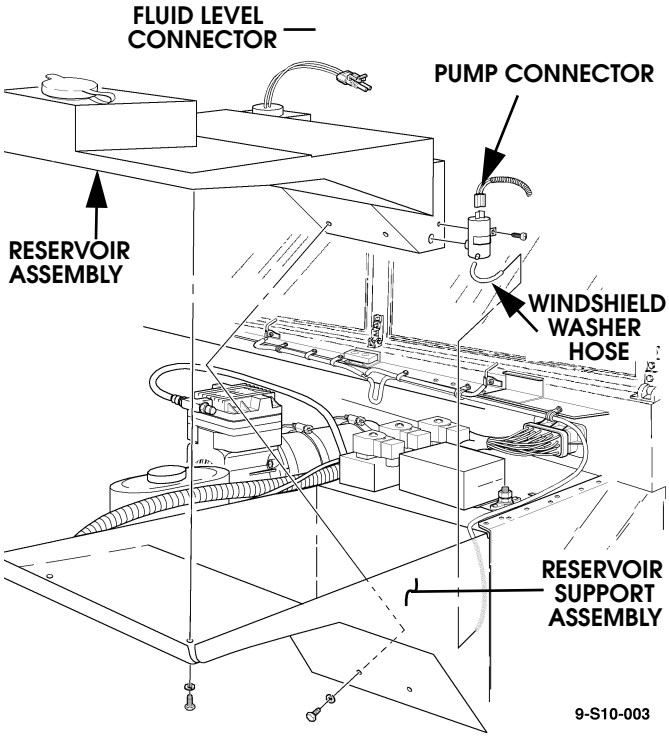


Figure 10-111: Windshield Washer Fluid Reservoir and Pump Replacement

Installation

1. Connect windshield washer hose to reservoir and pump assembly.
2. Secure reservoir assembly to reservoir support assembly with four lockwashers and bolts. Tighten bolts to 8 lb-ft (11 N•m) (Figure 10-111).
3. Connect fluid level connector to fluid level sensor assembly.
4. Connect pump connector to pump assembly.
5. Secure ABS ECU enclosure with retaining bracket and two screws.
6. Fill reservoir.

Windshield Washer Nozzle Replacement

Removal

1. Disconnect hose from nozzle (Figure 10-112).
2. Remove screw and nozzle from body.

Installation

1. Secure nozzle to body with screw.
2. Connect hose to nozzle.

Windshield Washer Hose Replacement

Removal

1. Remove two nuts, washers, screws, washers, and clamps securing hose to body (Figure 10-113).
2. Remove two screws and retaining bracket securing ABS ECU enclosure. Set aside ECU with enclosure.
3. Disconnect washer hose from pump and tee. Remove clamps from hose.
4. Disconnect two hoses from tee and nozzles and remove from clamps.

Installation

1. Slide two hoses through clamps and connect to tee and nozzles.
2. Slide hose through clamps and connect to tee and pump.
3. Secure hose to body with two clamps, washers, screws, washers, and nuts.
4. Secure ABS ECU enclosure with retaining bracket and two screws.

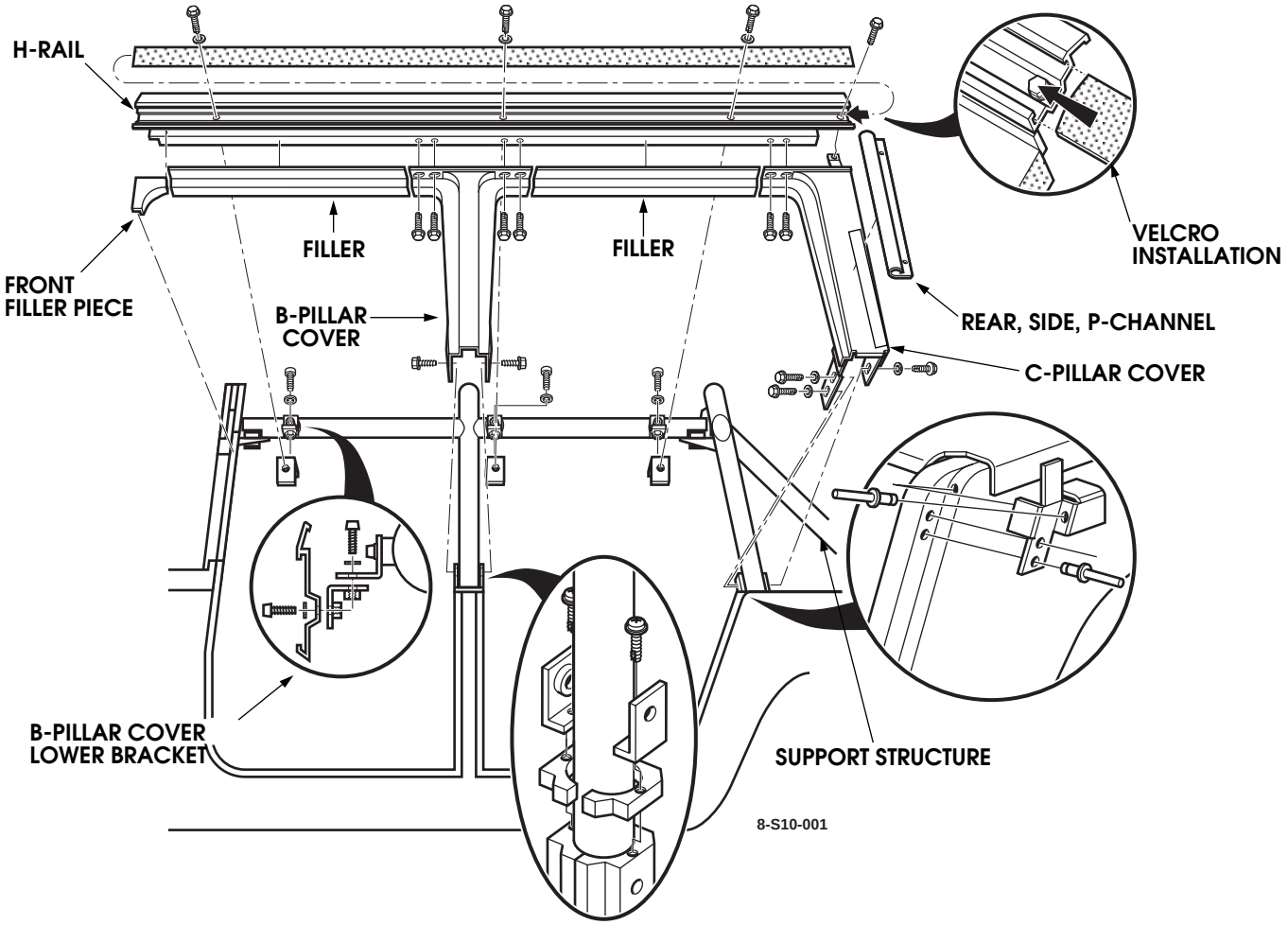


Figure 10-137: Rail and Support Structure Locations

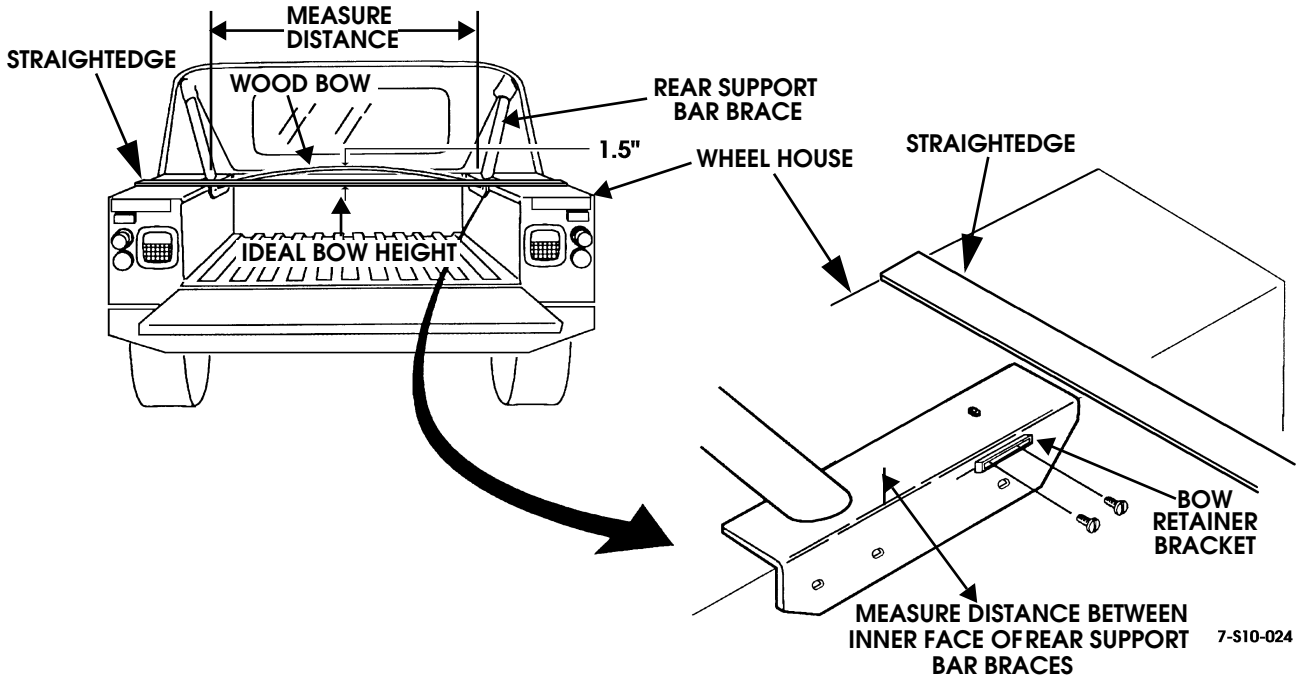


Figure 10-138: Bow Retainer Bracket Installation

Domelight/Cargo Light Replacement (Models 83, 84, 89, & 91)

Removal

1. Remove domelight lens (Figures 10-162 through 10-164).
2. Remove lamp from domelight.
3. Remove screws securing domelight to ground lead and connector.
4. Remove screw and domelight from roof bracket.

Installation

1. Secure domelight, connector, and ground lead to roof bracket with screws (Figures 10-162 through 10-164).
2. Install lamp in domelight.
3. Install domelight lens.

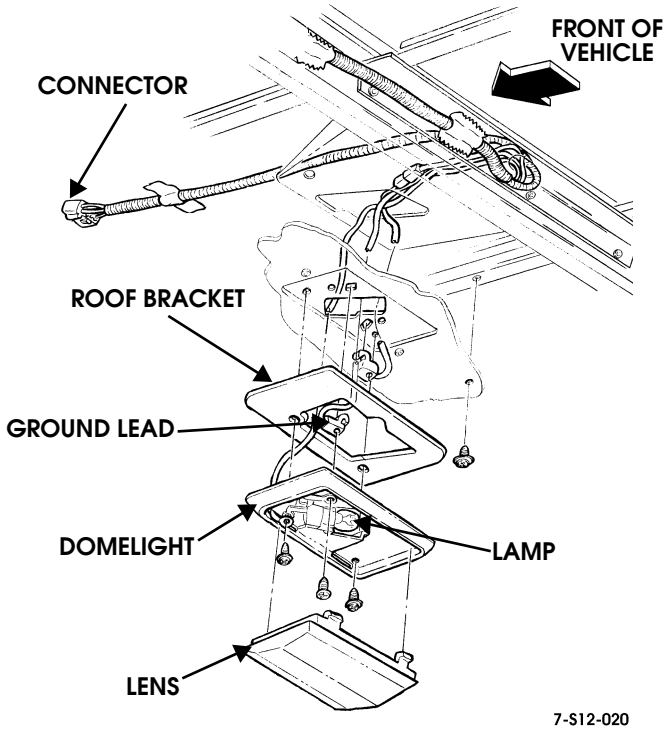


Figure 10-162: Standard Domelight Replacement

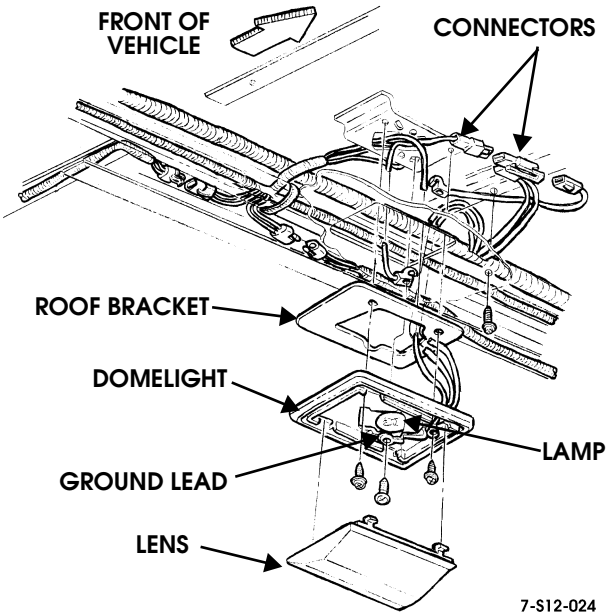


Figure 10-163: Rear Domelight (HMCS)

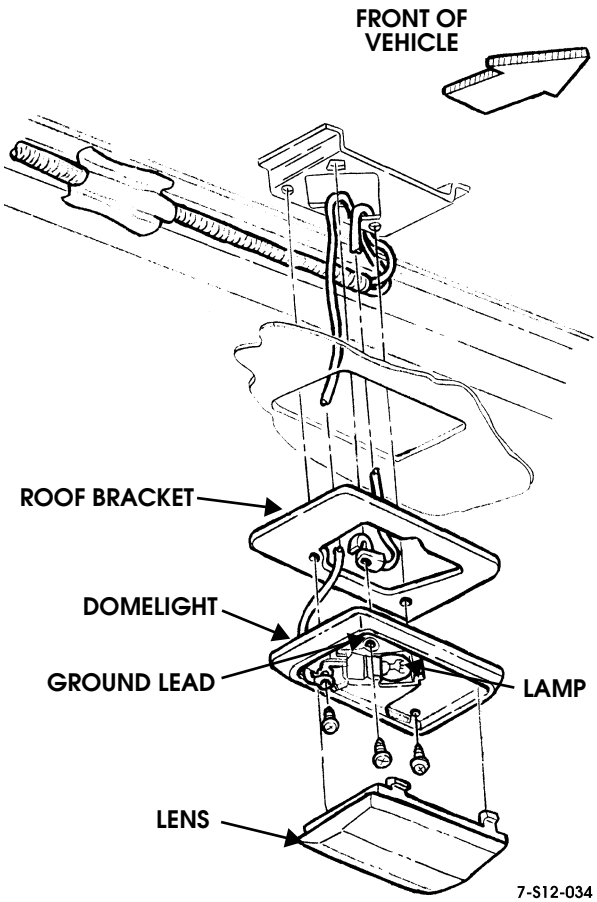


Figure 10-164: Cargo Light (HMCS)

SYSTEM PERFORMANCE CHECKS

Before performing any air conditioning repair, perform the following:

1. Check drivebelt for wear, damage, or loss of tension. Replace drivebelt as necessary.

1. Check compressor for secure mounting and proper alignment. Tighten loose hardware and align as necessary.
2. Visually inspect compressor, hoses and other accessible parts of system for damage or leaks. Look for patches of dirt, dust, and oil build-up. Refrigerant leaks usually involve compressor oil loss. This is especially applicable to clutch end of compressor.
3. Verify operation of climate control system by performing following:
   a. With the mode (air flow) control knob set to OFF, run engine to operating temperature (180°-240°F (82°-116°C)).
   b. Rotate temperature control knob clockwise until it stops at the warmest setting.
   c. Rotate mode control knob counterclockwise until it stops at the face setting.
   d. Turn fan control knob to any setting above LO and note direction and temperature of air flow.
   e. Verify that heated air is coming from instrument panel vents.
   f. Rotate mode control knob clockwise to the next setting, floor vents, and verify that heated air comes from appropriate vents.
   g. Continue checking the air flow positions, floor/defrost blend, and defrost.

NOTE: Any time the air flow control knob is placed in defrost or a defrost blend position (with an ambient temperature above 40°F), the compressor clutch engages to dehumidify the incoming air.

   h. Rotate the temperature control knob counterclockwise to its coldest extreme. Verify that cold air comes from the defrost vents. If the outside air temperature is 40°F or warmer, the refrigeration system will be responsible for cooling the air. If it is cooler than 40°F, the compressor will not cycle and the incoming air will simply be the outside air directed into the passenger compartment.
   i. Rotate the mode control knob counterclockwise until it stops at the Max A/C panel setting and verify that compressor clutch engages and air becomes colder. Turn the mode dial to the A/C setting. Verify that the air recirculation door closes, and the system brings in outside air.
   j. Check that blower motor delivers air at four different speeds. If not, perform electrical troubleshooting. Repair or replace blower motor, switch, relay, or blower motor resistor block.
   k. Check water control valve operation. Heater Shutoff Valve should open completely when temperature control knob is rotated clockwise.

Heating System Tests

In most cases, a low heat condition means an insufficient quantity of heated engine coolant is flowing through the heater core. Check as follows:

1. Check engine coolant level. If level is low, add coolant and inspect for leaks. If coolant level is correct, continue with tests.
2. Check pressure cap on surge tank for improper sealing with tester J–24460-01 or equivalent. If cap is OK, continue with tests. Replace cap if it fails to seal and recheck heater operation.
3. Set heater controls to highest heat setting.
4. Operate engine until coolant is at normal operating temperature (180-220° F or 82-113° C).
5. Check temperature of coolant flowing through heater core inlet and outlet hoses.
   - If both hoses feel hot and are about the same temperature, water control valve is OK and core is not restricted. Continue with test.
   - If both hoses are only warm (or even cool), engine is either not at operating temperature, or a water pump or thermostat problem has occurred.
   - If inlet hose is cool, or only slightly warm, water control valve or vacuum solenoid problem has occurred. Test as described in this section.
6. If heat output is still unsatisfactory but all else checks correctly, problem is with heat door in main unit, or in outlet ducts.

R-134a Pressure-to-Temperature Relationship Chart (with Engine OFF)

Psi	Temp (°F) R-134a	Psi	Temp (°F) R-134a	Psi	Temp (°F) R-134a	Psi	Temp (°F) R-134a
0	-14.7	25	29.3	70	69.6	200	130.1
1	-12.1	26	30.5	75	72.9	210	133.5
2	-9.6	27	31.7	80	76.1	220	136.7
3	-7.2	28	32.9	85	79.2	230	139.8
4	-4.9	29	34.0	90	82.2	240	142.9
5	-2.7	30	35.1	95	85.0	250	145.9
6	-0.6	32	37.4	100	87.8	260	148.8
7	1.4	34	39.5	105	90.5	270	151.6
8	3.4	36	41.6	110	93.1	280	154.3
9	5.3	38	43.6	115	95.6	290	157.0
10	7.1	40	45.6	120	98.0	300	159.6
11	8.9	42	47.4	125	100.4	310	162.2
12	10.6	44	49.2	130	102.7	320	164.7
13	12.3	46	51.0	135	104.9	330	167.2
14	13.9	48	52.8	140	107.1	340	169.6
15	15.4	50	54.5	145	109.3	350	171.9
16	17.0	52	56.4	150	111.4	360	174.2
17	18.5	54	57.8	155	113.3	370	176.5
18	19.9	56	59.3	160	115.4	380	178.7
19	21.4	58	60.8	165	117.4	390	180.7
20	22.8	60	62.4	170	119.3	400	183.1
21	24.1	62	63.9	175	121.2	-	-
22	25.5	64	65.4	180	123.0	-	-
23	26.8	66	66.8	185	124.8	-	-
24	28.0	68	68.2	190	126.6	-	-

DEFROST DUCT AND WINDSHIELD NOZZLES REPLACEMENT

Center Defrost Duct

Removal

1. Remove right side crash pad (Section 10).
2. Remove front console (Section 10).
3. Remove engine cover (Section 10).
4. Remove twelve screws, nuts, washers, and closeout panel from A-beam (Figure 11-24).
5. Remove eight screws, washers, and driver's and passenger's lower windshield retainers from A-beam.

NOTE: Plusnuts must be drilled out in order to remove ducts. New plusnuts are installed in the same holes.

6. Remove center defrost duct from A-beam.

Installation

1. Install center windshield defrost duct into A-beam (Figure 11-24). Align both ends with adjacent duct and insuring a leak-free overlap joint.

NOTE: Apply Silaprene Sealant 05593929 in a continuous bead around the new plusnuts making sure to cover both the edge of the plusnut and the vehicle body. This will provide better sealing.

2. Install new plusnuts into A-beam.
3. Install driver's and passenger's lower windshield retainers on A-beam with eight screws and washers.
4. Secure closeout panel to A-beam with twelve screws, plusnuts, and washers.
5. Install engine cover (Section 10).
6. Install front console (Section 10).
7. Check operation of windshield defrosters.
8. Install right side crash pad (Section 10).

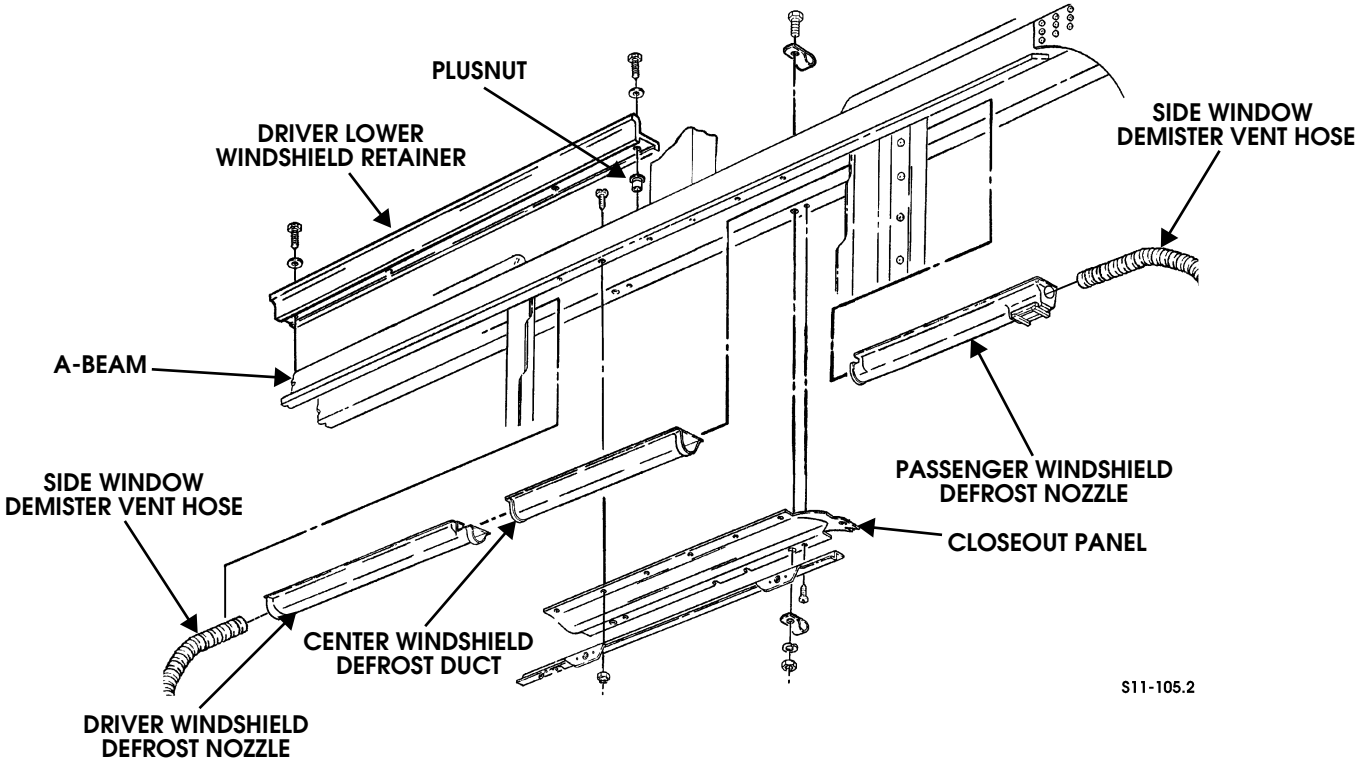


Figure 11-24: Windshield Defrost Ducts and Nozzles

Heater Core

The heater core is composed of copper and brass with numerous passages allowing heated engine coolant to pass through, transferring heat into the passing air from the blower motor. Coolant flow through the heater core is controlled by the water control valve in the engine compartment (Figure 11-58).

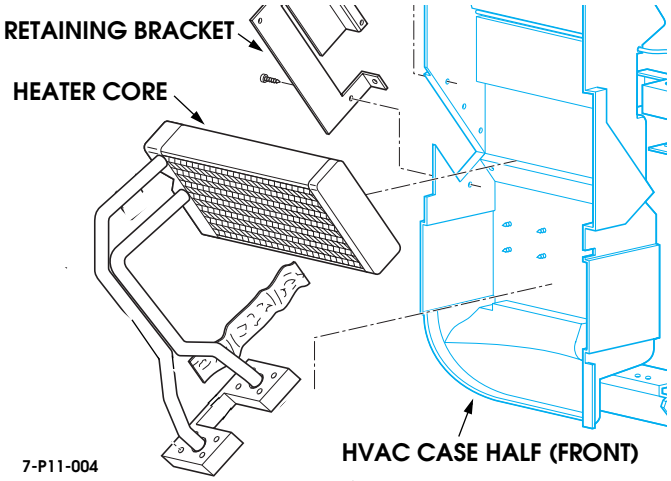


Figure 11-58: Heater Core

Evaporator

The evaporator is composed of a wide flat aluminum tube bent in a serpentine pattern. Fins extending out from the tube assist in transferring heat from the passing air into the refrigerant which is evaporating inside of the tubes (Figure 11-59).

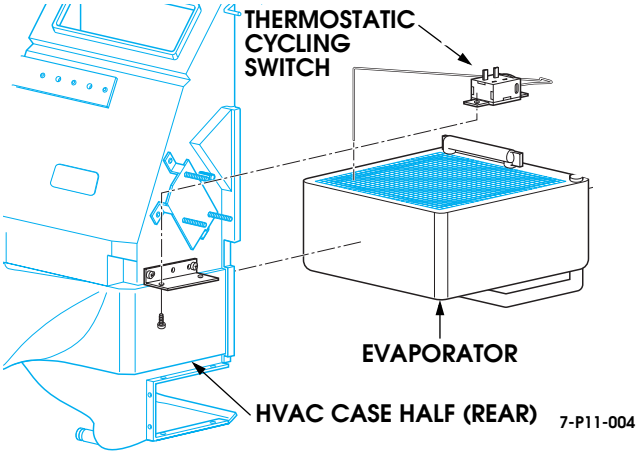


Figure 11-59: Evaporator

Thermostatic Cycling Switch

The thermostatic cycling switch is mounted on the side of the main HVAC unit (Figure 11-59). The thermostatic cycling switch is responsible for turning off the compressor clutch when evaporator temperature approaches freezing. Temperature is sensed by a capillary tube inserted in the fins of the evaporator. Should the evaporator reach freezing temperatures, moisture condensing on the fins of the evaporator will freeze and hinder air flow. The thermostatic cycling switch will interrupt current to the compressor clutch until the temperature rises to about 40° F.

Expansion Valve

The expansion valve controls the flow of refrigerant through the evaporator. Refrigerant must be metered to prevent the liquid refrigerant from flooding the evaporator. The expansion valve is exposed to both low and high pressures, and bases refrigerant flow on the pressure which is exiting the evaporator (Figure 11-60).

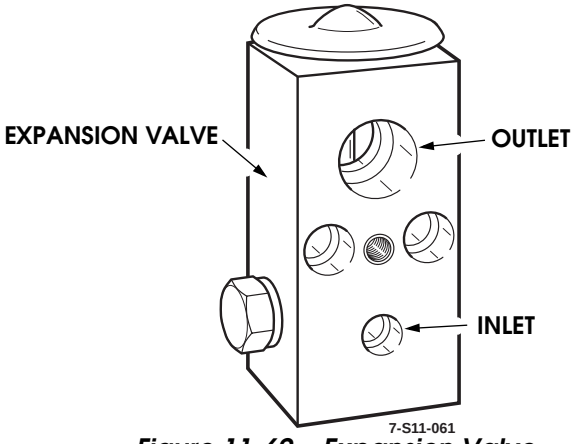


Figure 11-60: Expansion Valve

Blower Motor

The blower motor is a permanent magnet electric motor that drives a wheel type fan. The air enters the unit from the outside air intake, or from a door on the interior of the vehicle. The air is then forced through the evaporator and heater core.

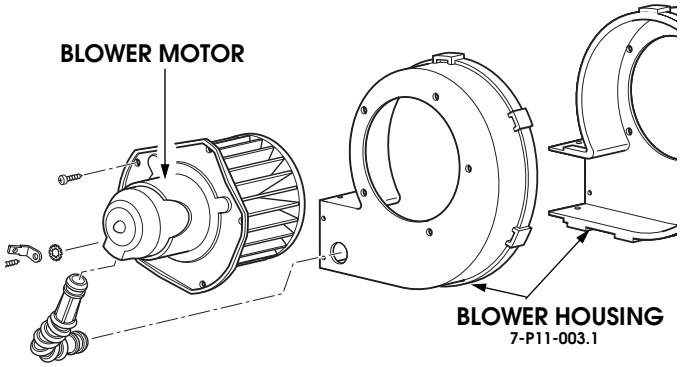


Figure 11-61: Blower Motor and Housing

Rear Defrost Button

The vehicle may be equipped with optional rear defrost. The rear defrost is comprised of an electrical grid which is bonded to the rear center glass. When the rear defrost button is pushed, a timed electric current is sent to the grid causing the temperature of the grid and glass to slowly rise, melting frost or evaporating exterior window fogging. The timer in the switch will shut off the current when an adequate amount of time has passed. This option is only available on the XLC2, and HMC4.

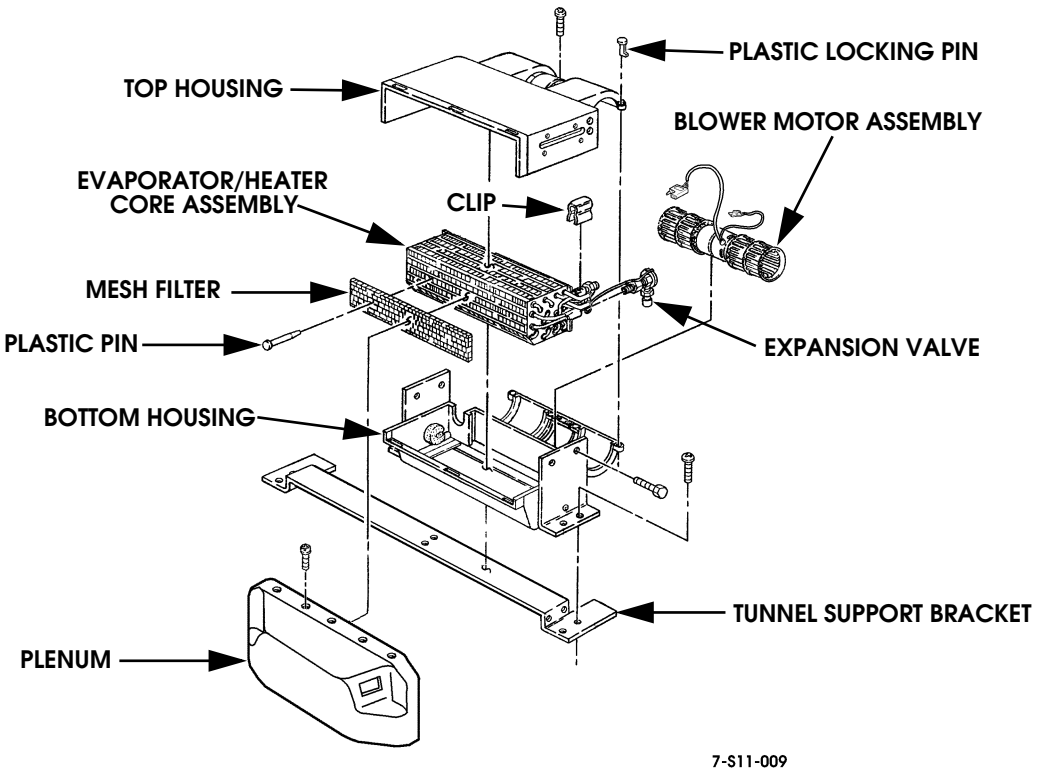


Figure 11-92: Auxiliary Air Conditioning Components

AUXILIARY EXPANSION VALVE REPLACEMENT

Removal

1. Discharge air conditioning system.
2. Remove rear console.
3. Remove prestite tape and bulb clamp.
4. Using two wrenches for equalized support, remove high-pressure hose from expansion valve. Remove O-ring from hose and discard O-ring (Figure 11-93).
5. Using two wrenches for equalized support, remove expansion valve from auxiliary unit. Remove and discard O-ring (Figure 11-86).

Installation

1. Install O-ring and expansion valve on auxiliary unit. Using two wrenches for equalized support, tighten to 15-20 lb-ft (20-27 N•m) (Figure 11-86).
2. Position O-ring onto high pressure hose and hand-thread hose fitting onto the expansion valve. Using two wrenches for equalized support, tighten to 11-13 lb-ft (15-17 N•m) (Figure 11-93).
3. Install prestite tape and bulb clamp.
4. Evacuate, charge, and leak test system.
5. Install rear console.
6. Start engine and check operation of auxiliary unit.

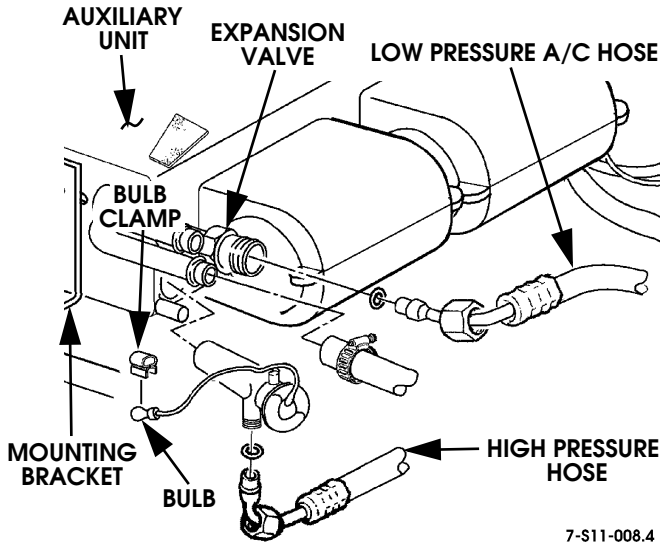


Figure 11-93: Expansion Valve Removal/Installation

FUSE/RELAY LOCATION AND IDENTIFICATION

Interior Fuse Box

The interior fuse box, is located under the instrument panel to the left of the steering column. The fuse box is divided into two mini-fuse junction blocks, relays, and a auxilliary power point.The mini-fuse blocks may be accessed without removing the main fuse box cover (Figure 12-17).

To access relays, the main fuse box cover must be removed. Before removing any of the fuse box access covers, refer to the illustrations and charts in this section for the location of specific fuses, relays, and circuit breakers. Doing this will enable you to go directly to the fuse or circuit breaker you want to inspect.

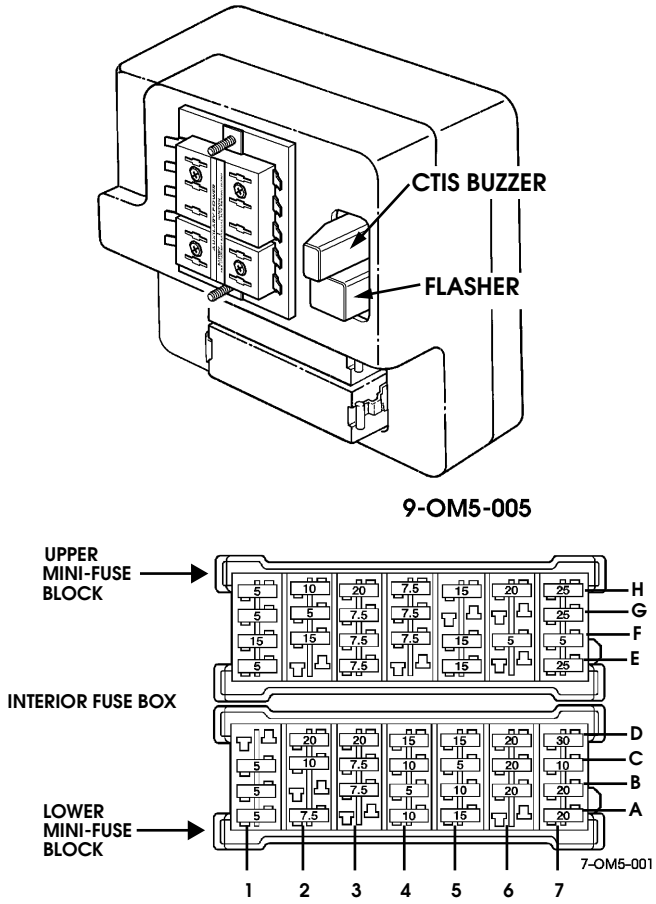


Figure 12-17: Interior Fuse Box and Mini Fuse Layout

Fuses and circuit breakers protect the vehicle's electrical system from damage caused by overloading. An overloaded circuit breaker will switch the circuit on again, causing intermittent operation. A blown fuse will permanently disable the circuit until the fuse is replaced.

Whenever a fuse blows or a circuit breaker opens a circuit, all electrical components using that circuit will not operate. Therefore, during diagnosis of any of these electrical components, check the appropriate fuses and circuit breakers for damage (Figure 12-20).

In Line Fuses

Some fuses are placed in-line with the components they are protecting, meaning they are not located in the fuse box but in the actual wire suppling current to the device. The only inline fuse used on the Hummer is in the power feed to the HVAC high blower relay. This fuse is located on the passenger side of the engine compartment inside a black plastic cover.

Auxiliary Power Point

An auxiliary power point is provided to ease installation of aftermarket electrical accessories. The power point is divided into 2 sections: Ignition and Battery. When a power supply is needed, a fuse must be installed into one of the empty slots, and a connection made to the adjacent terminal. The main supply circuits to both sections of the aux. power point are fused to 30 amps. Total amperage draw on either section should not exceed 30 amps.

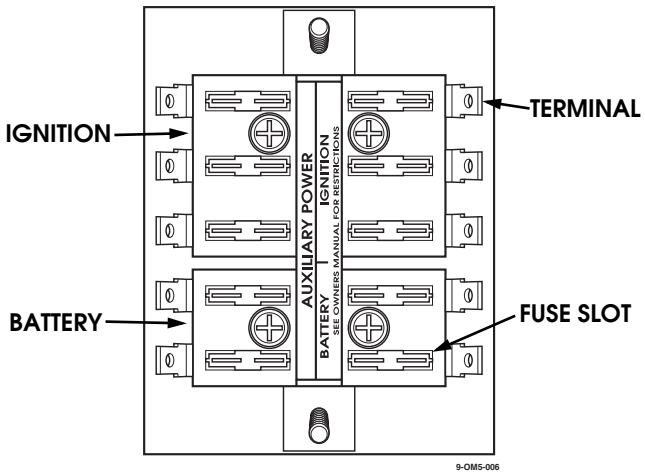


Figure 12-18: Auxiliary Power Point

ALTERNATOR

Removal

1. Disconnect battery negative cable.
2. Remove serpentine drivebelt from alternator pulley.
3. Loosen pivot bolt and remove front and rear alternator bolts (Figure 12-36).
4. Pull alternator away from engine. Remove nut and lockwasher and disconnect battery wires from battery alternator terminal (Figure 12-37).
5. Unlock and disconnect field wire (Figure 12-37).
6. Remove pivot bolt and alternator from engine.

Installation

1. Position alternator in bracket and install pivot bolt finger tight.
2. Connect battery wires to alternator. Secure with lockwasher and nut. Tighten nut to 62-80 lb-in (7-9 N•m).
3. Connect field wire to alternator.
4. Move alternator into alignment with lower bracket and install front and rear mounting bolts. Tighten bolts 18 lb-ft (25 N•m).
5. Tighten pivot bolt to 37 lb-ft. (50 N•m).
6. Install serpentine drivebelt on pulley and adjust belt.
7. Connect battery negative cable.

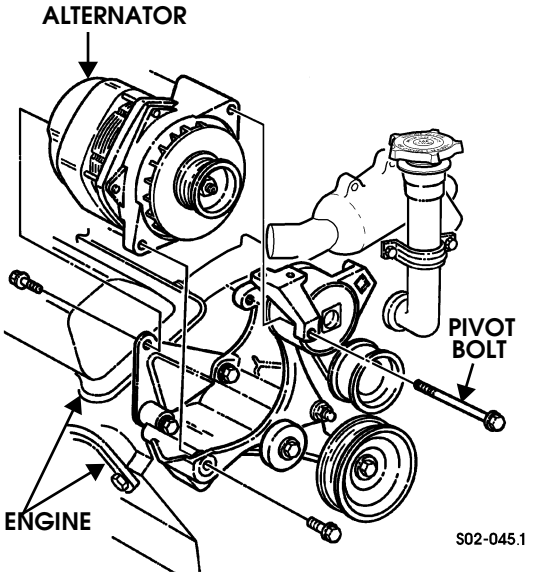


Figure 12-36: Alternator Mounting

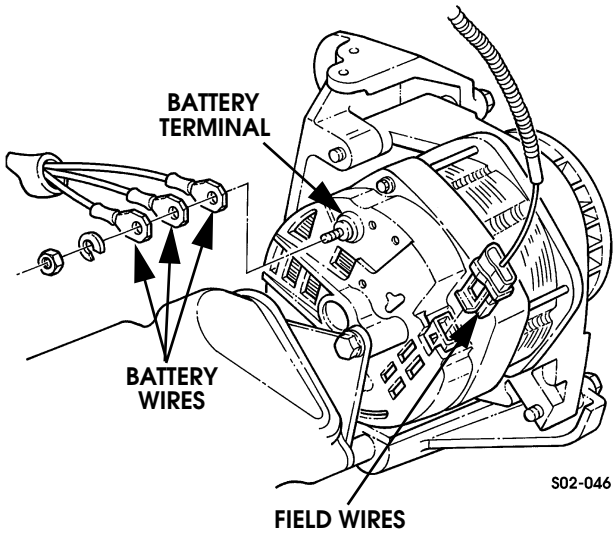


Figure 12-37: Alternator Connections

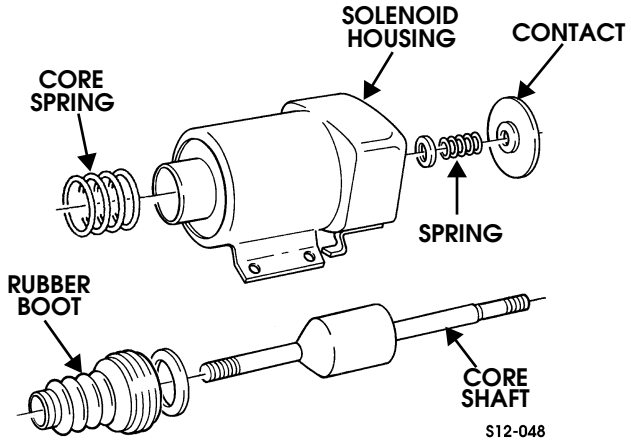


Figure 12-64: Solenoid Components

Starter Assembly

1. Assemble washer, rubber boot, spring retainer, spring, and spring retainer on core shaft and secure with snap ring (Figure 12-61).
2. Place core shaft assembly in solenoid housing.
3. Install washer, spring, contact, washer and locknut on core shaft.
4. Place gasket on cover and secure series winding lead to lug with screw and washer (Figure 12-61).
5. Install cover and gasket on solenoid housing and secure with four rubber washers and nut and lockwasher assemblies.
6. Install negative brushes and positive brushes in brush holders and retain with four springs (Figure 12-60).
7. Connect positive brush leads to field coil brackets with two screws.
8. Connect negative brush leads to frame with copper washers, screws, lockwashers, and nuts.
9. Cover negative lead screw heads with silicone adhesive sealant.
10. Apply chassis grease to armature shaft, shift lever studs, groove of clutch, and inside diameter of end plate (Figure 12-63).
11. Place washer, end plate, and gasket on armature shaft.
12. Place washer, clutch, and pinion stop on armature shaft and retain with snap ring. Position armature and shift lever in position shown for installation (Figure 12-59).
13. Install shift lever on clutch with shift lever studs engaged in clutch groove.
14. Start shift lever into pinion housing as armature is positioned in large bore of pinion housing. Then install screws through armature plate into pinion housing. Tighten screws to 40 lb-in. (5 N•m) (Figure 12-59).
15. Insert pin through pinion housing and shift lever. Then install two plugs in pinion housing (Figure 12-58).
16. Install O-ring and gasket in pinion housing (Figure 12-66).
17. Coat end plate-to-frame screws with adhesive sealant.

CAUTION: *As armature is inserted into frame assembly, carefully align brushes on commutator. Brushes chip and break easily.*

18. Align scribe marks on frame and pinion housing, and install armature and pinion housing in frame assembly. Install and tighten screws to 50 lb-in. (6 N•m).
19. Saturate felt wick with engine oil and install in end plate (Figure 12-65).

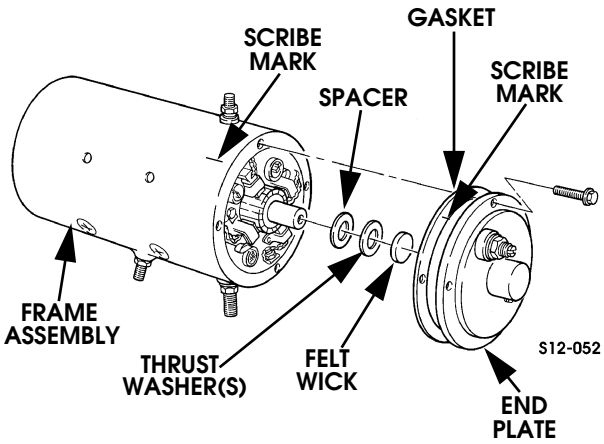


Figure 12-65: Starter End Plate Installation

20. Install spacer and thrust washers on armature shaft.
21. Align scribe marks on end plate and frame and install end plate. Tighten end plate screws to 25 lb-in. (3 N•m).
22. Coat threads of end plate screws with adhesive sealant.
23. Install end plate screws.
24. Check end play as described in following procedure.
25. Coat ribbed area of core shaft boot with lithium grease (Figure 12-67).
26. Align end of core shaft in hole in shift lever and install solenoid on frame. Tighten solenoid screws to 50 lb-in. (6 N•m).
27. Install core shaft nut. Tighten nut with socket, fabricated tool, and hex wrench (Figure 12-55)

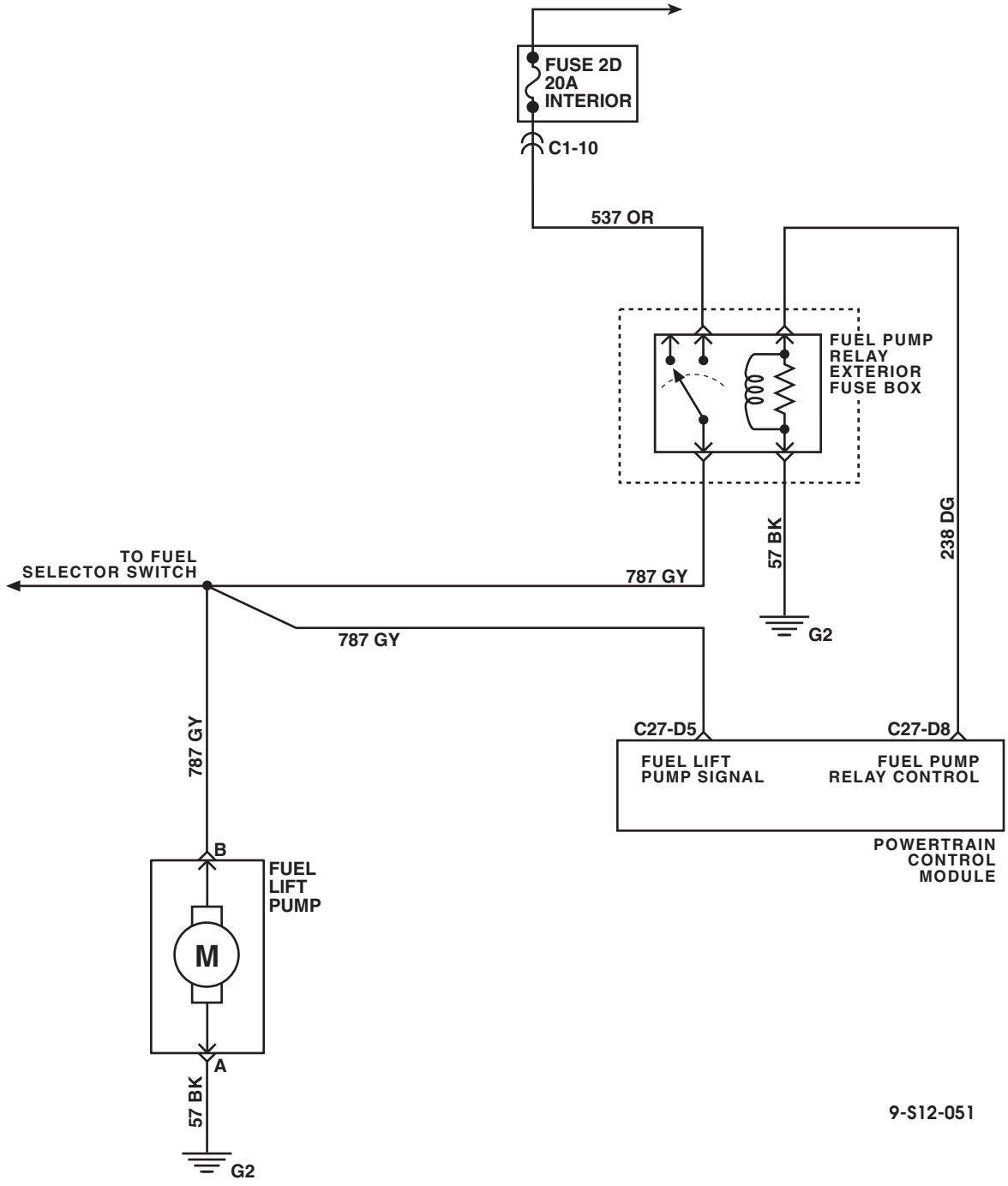


Figure 2-73: Fuel Lift Pump Schematic

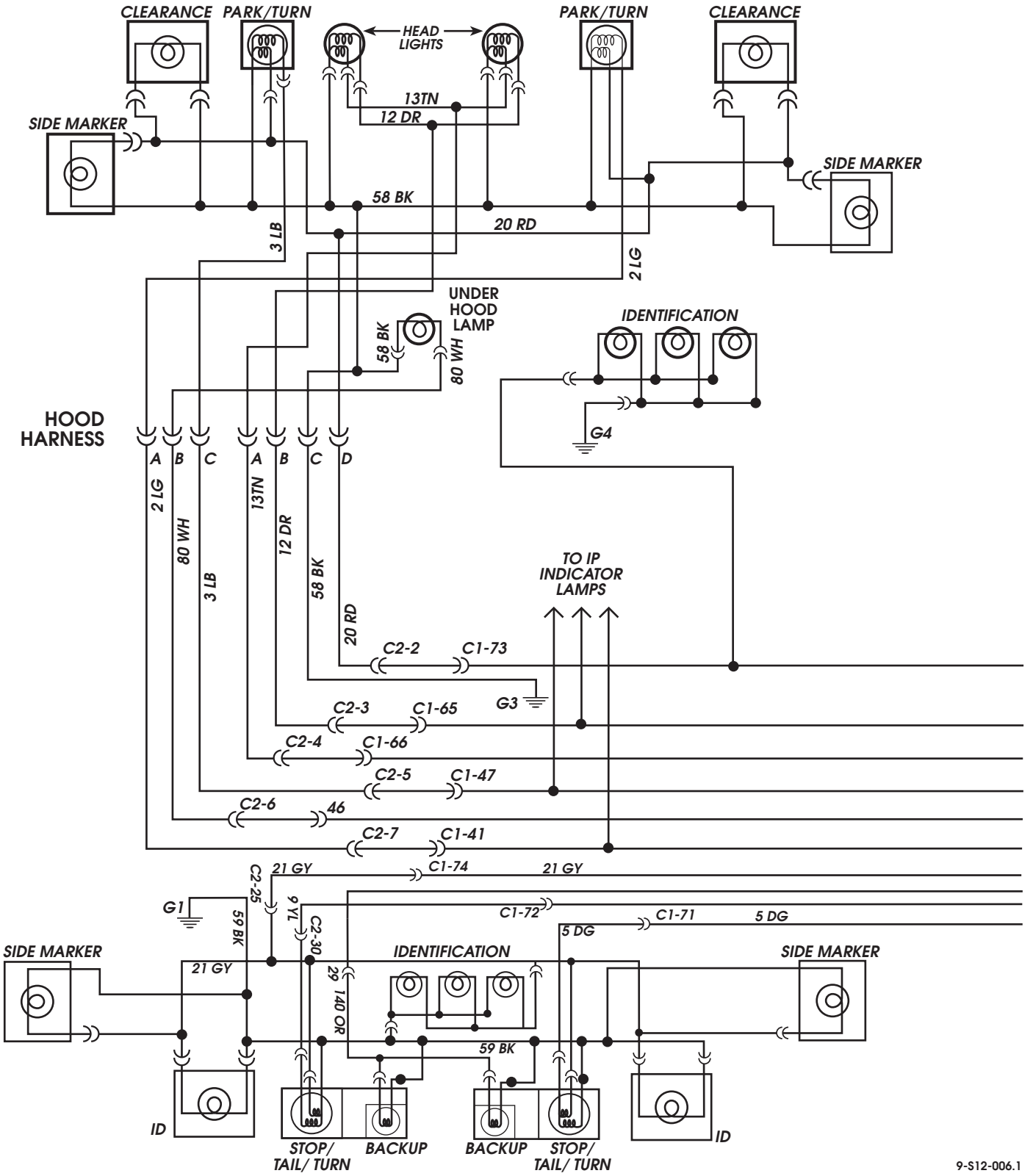


Figure 2-79: Lights Schematic (Sheet 1 of 2)

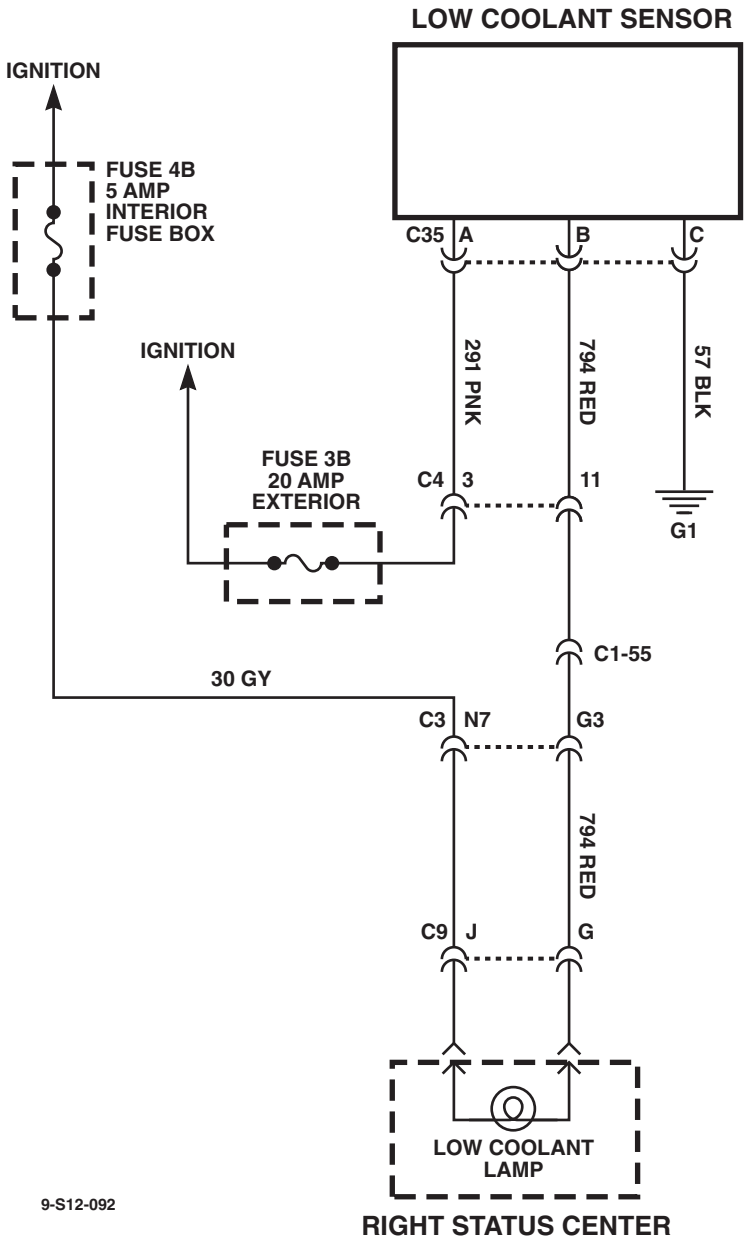


Figure 2-92: Low Coolant Sensor Schematic

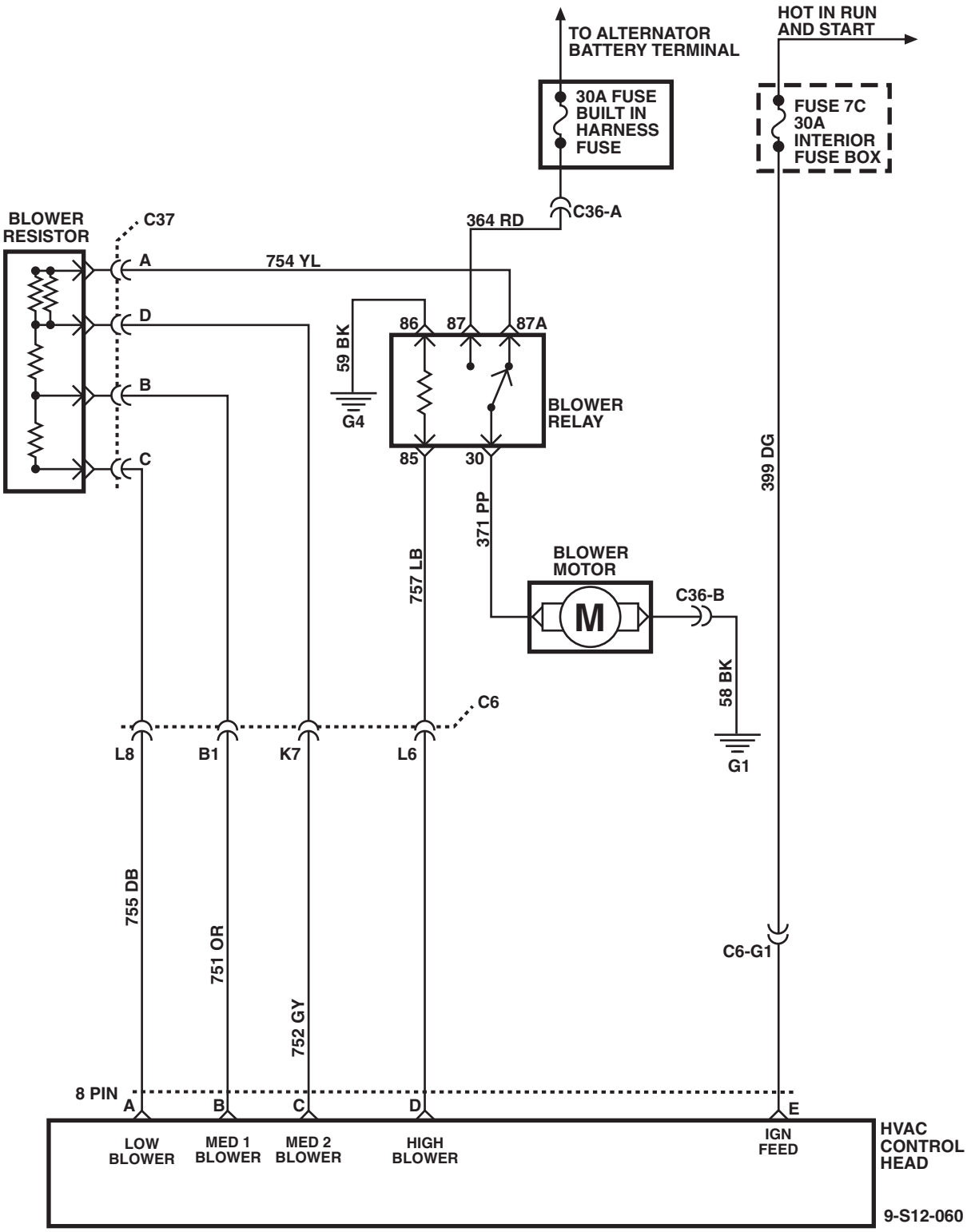


Figure 12-94: HVAC Blower Schematic

Both Heated Windshields Inoperative

Step	Action	Value(s)	Yes	No
1	Gain access to the heated windshield connections. Using a DVOM check the resistance to ground on the black wires at both windshields. Does the resistance meet the specified value?	<.2 Ω	Go to step 2.	Repair the open or bad connection in CKT 59 between the windshields and G4.
2	Remove the heated windshield switch from the bezel. Turn the ignition switch to the "RUN" position and turn the heated windshield switch to the "ON" position. Using a DVOM check the voltage drop between the brown wire (CKT 580) and the black wire (CKT 58). Is the specified voltage present?	12v	Repair the open or bad connection in CKT 580 between the heated windshield switch and the relays.	Go to step 3.
3	Using a DVOM measure the resistance to ground on the black wire (CKT 58) at the heated windshield switch. Does the resistance meet the specification?	<.2 Ω	Go to step 4.	Repair the open or bad connection in CKT 58 between the heated windshield switch and G4.
4	With the ignition in the "RUN" position and the heated windshield switch in the "ON" position. Use a DVOM to check for voltage at both tan wires (CKT 83) at the heated windshield switch. Is the specified voltage present?	12v	Replace the heated windshield switch.	Repair the open or bad connection in CKT 83 between the windshield switch and fuse 1C interior.

Rear Cargo Door Lock Module Replacement (HMCS Only).

Removal

1. Remove right rear seat.
2. Remove right rear seat belt ratchet assembly.
3. Remove right rear corner trim assembly (Figure 12-106).

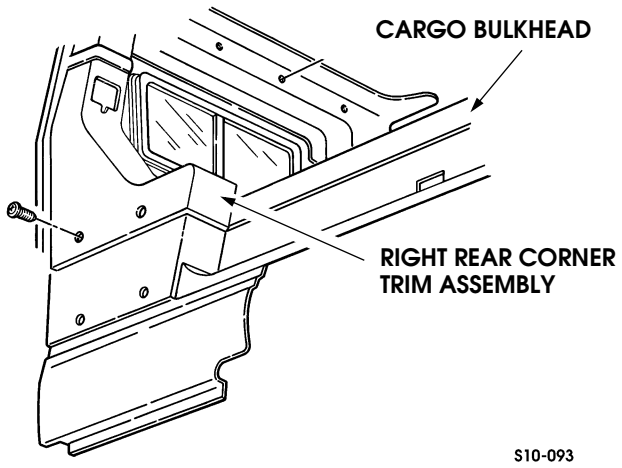


Figure 12-106: Removing Right Rear Trim Piece

4. Disconnect rear door lock harness jumper assembly from the rear door lock module.
5. Pull the module loose from the velcro attaching it to the body.

Installation

1. Apply new velcro strip to new rear door lock module
2. Affix new module to body and connect rear door lock harness jumper.
3. Verify operation of rear door locks.
4. Install right rear trim piece (Figure 12-106).
5. Apply loctite 242 to seat belt ratchet bolt.
6. Install seat belt ratchet bolt and torque to 35-40 ft-lbs (47-55 Nm).
7. Install right rear seat.

Rear Cargo Door Lock Harness Jumper Replacement

Removal

1. Remove right rear seat.
2. Remove right rear seat belt ratchet assembly.
3. Remove right rear corner trim assembly (Figure 12-106).
4. Disconnect harness from rear door lock module.
5. Remove slide out bulkhead.
6. Remove closeout panel from passenger side of rear cargo door frame.
7. Disconnect harness from door hinge contacts.
8. Pull the padding and carpet on the cargo area wall upward to expose the harness.
9. Remove remaining trim pieces behind right rear passenger seat.
10. Remove lower passenger side B-pillar trim.
11. Remove passenger side righthand kick panel.
12. Disconnect rear cargo door lock jumper.
13. Remove the harness from the vehicle.

Installation

1. Connect rear cargo door lock jumper harness to the connector at the B-Pillar.
2. Route harness along same locations to the rear cargo door lock module.
3. Connect the harness to the door lock module.
4. Route harness to the door hinge contacts and connect it.
5. Install passenger side cargo door frame closeout panel.
6. Reposition the cargo area padding.
7. Install trim pieces behind right rear passenger seat.
8. Install rear passenger righthand side kick panel.
9. Install passenger side lower B-pillar trim.
10. Install removable cargo area bulkhead.
11. Install passenger right rear seat.

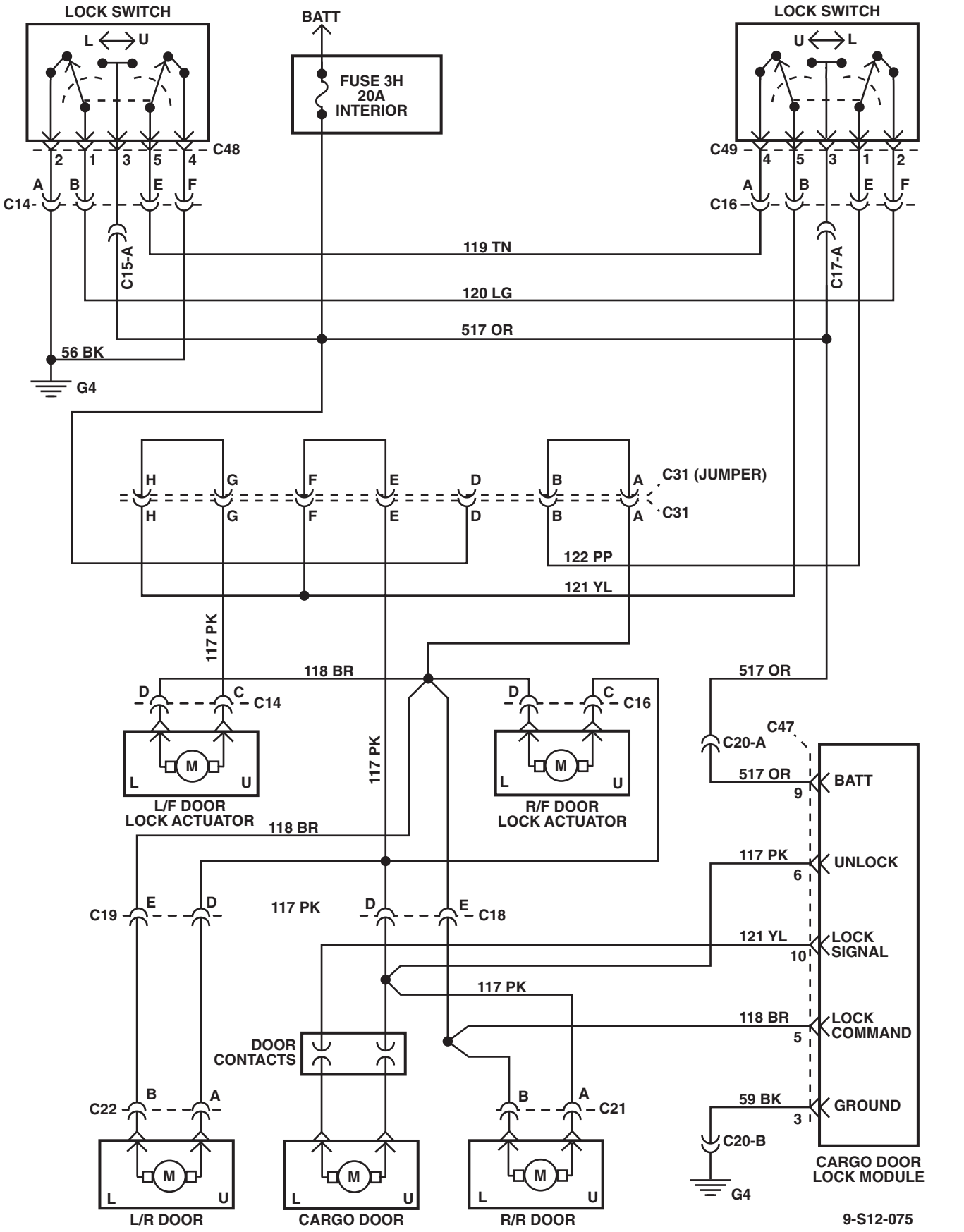


Figure 12-111: Power Locks HMCS W/O Remote Entry

7. Connect harness connector to power window regulator (Figure 2-123).
8. Connect harness connector to power door lock actuator.
9. Secure harness to door reinforcement with clamp and self-tapping screw.
10. Secure harness to door assembly with retainer.
11. Secure harness to door assembly with tie strap.
12. Install moisture barrier flap, vapor barrier, and door trim panel on door (Section 10).
13. Install power windows switch on door.
14. Install lower B-pillar trim and center kick panel (Section 10).
15. Connect battery ground cable (Section 12).
16. Check power windows and door locks for proper operation.
17. Remove nut and ground lead from ground stud.
18. Disconnect two window and lock harness connectors from door harness connectors (Figure 2-125).
19. Repeat step 10 for opposite side.
20. Remove B-pillar lower trim from both sides of the vehicle.
21. Disconnect lock and window harness connector from rear door harness connector (HMCS, HMC4, HMCO)
22. Repeat step 12 for opposite side (HMCS, HMC4, HMCO).
23. Disconnect vertical door lock jumper from window and door lock harness on the passenger side.(HMCS)
24. Remove tie straps securing harness to vehicle body harness and remove harness. Discard tie straps.

Installation

1. Route harness through instrument panel and along A- pillar to both sides of vehicle.
2. Connect harness connector to rear door harness connectors on both sides of vehicle (HMCS, HMC4, HMCO).
3. Connect vertical door lock jumper to window and door lock harness on the passenger side.(HMCS)
4. Connect two front lock and window harness connectors to door harness connectors on both sides of vehicle.
5. Install ground lead on ground stud with nut.
6. Connect two lock and window harness leads to vehicle body harness power leads.
7. Connect two power windows and door locks harness connectors to receiver harness connectors.
8. Secure harness to vehicle body harness with tie straps.
9. Install CTIS gauge panel
10. Install tachometer and clock harness into instrument panel
11. Install two gauge panels on instrument panel with eight screws (Section 12).
12. Install console cover (Section 10).
13. Install front outer kick panels (Section 10).
14. Install crash pad (Section 10).
15. Check power windows and door lock for proper operation

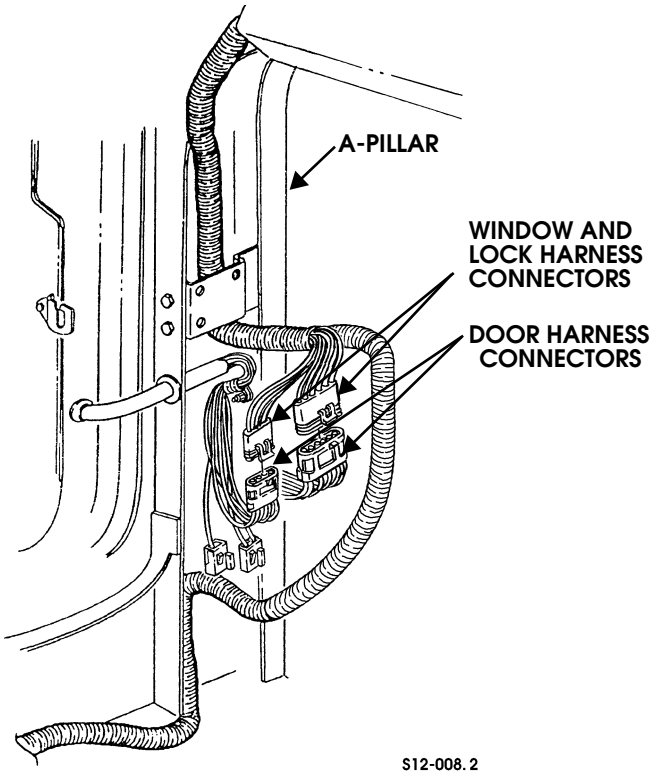


Figure 2-125: Door Harness Connectors

Cruise Control Inoperative VIN Z (Continued)

Step	Action	Value(s)	Yes	No
9	Using a DVOM set to measure voltage, place the ground lead on the IP ground point. Back probe cavity A11 in C29(CKT151) with the positive lead. With the ignition on and the cruise control switch on, is voltage present?	12v	Check for loose or poor connection at PCM if none are found replace the PCM.	Repair open, bad connection or short to ground in CKT151 between the PCM and cruise control arm.
10	Using a DVOM set to measure voltage, place the ground lead on the IP ground point. Back probe cavity D10 in C27(CKT153) with the positive lead. With the ignition on and the cruise control resume/accel button depressed, is voltage present?	12v	Check for loose or poor connection at PCM if none are found replace the PCM.	Repair open, bad connection or short to ground in CKT153 between the PCM and cruise control arm.
11	Using a DVOM set to measure voltage, place the ground lead on the IP ground point. Back probe cavity B11 in C29(CKT152) with the positive lead. With the ignition on and the cruise control set button depressed	12v	Check for loose or poor connection at PCM if none are found replace the PCM.	Repair open, bad connection or short to ground in CKT152 between the PCM and cruise control arm.
12	Using a DVOM set to measure voltage, place the ground lead on the IP ground point. Back probe cavity B10 in C29(CKT22) with the positive lead. Depress the brake switch. Is voltage present?	12v	go to step 13.	Check for open or short to ground/voltage in CKT 22, if none found replace brake switch.
13	Using a DVOM set to measure voltage, place the ground lead on the IP ground point. Back probe cavity B9 in C29(CKT810) with the positive lead. With the ignition on, is voltage present with the brake NOT applied, and disappear when the brake is depressed?	Brake OFF 12v Brake ON 0v	Check for loose or poor connection at PCM if none are found replace the PCM.	Check for open or short to ground/voltage in CKT 810, if none found replace brake switch.

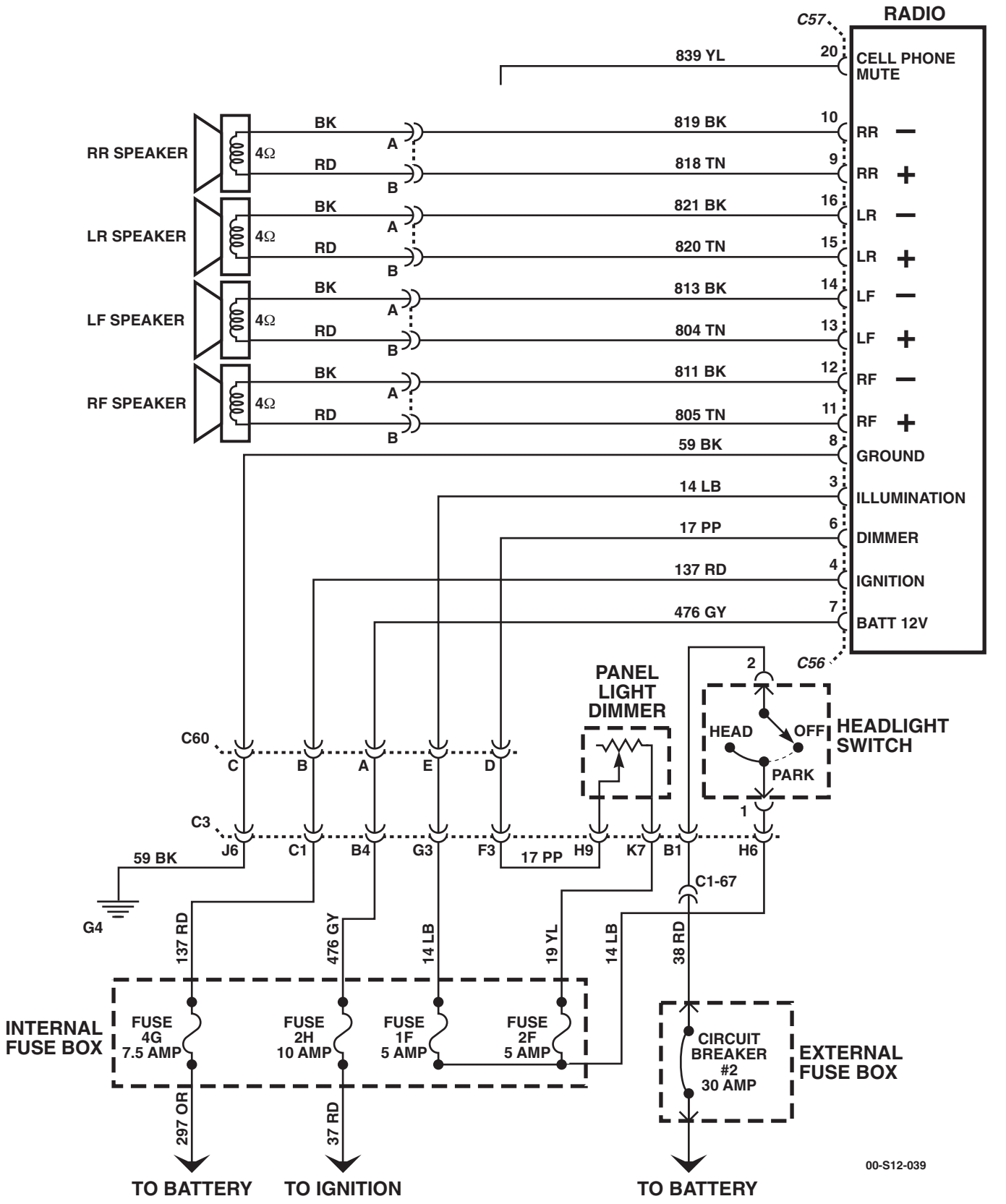
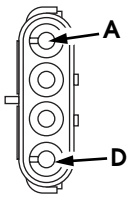


Figure 12-147: Standard Audio Harness Schematic Models 83, 84, 90 & 91.

PIN	CKT	COLOR	CIRCUIT DESCRIPTION
11	787	GY	Fuel pump + to selector valve
12	37	RD	Ignition relay feed
13	688	RD	Rear window defrost feed
14	723	YL	APP 3 5volt reference
15	724	DG	APP 3 signal
16	17	PP	+ FROM DIMMER MODULE
17	718	DB	APP 1 signal
18	353	YL	Speedometer signal
19	607	TN	ABS module diagnostic line
20	717	WH	APP 1 5volt reference
21	961	PP	TT4 lamp activation
22	720	TN	APP 2 5volt reference
23	640	OR	IGN+ CTIS warning circuits
24	92	GY	CTIS rear inflate solenoid activation
25	714	DB	Check throttle lamp activation
26	37	RD	Battery feed to interior accessories
27	338	DB	Wait lamp activation
28	658	BR	Check engine lamp activation
29	151	GY	Cruise control ON/OFF signal
30	31	TN	Oil pressure signal
31	22	RD	Brake switch signal – rest
32	721	LB	APP 2 sensor signal
33	580	BR	Not Used for 99 and 2000
34	606	OR	ABS diagnostic line
35	29	PK	Fuel gauge signal
36	39	DG	Engine temperature signal
37	153	LG	Cruise resume/accelerate signal
38	42	BR	Low brake fluid lamp activation
39	198	TN	A/C request
40	810	PP	TCC brake switch signal
41	2	LG	Right front turn signal
42	152	DB	Cruise set/coast signal
43	298	BR	Backup light switch feed
44	722	PP	APP 2 ground
45	327	YL	Water-in-fuel lamp activation
46	80	WH	Underhood lamp power

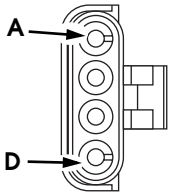
PIN	CKT	COLOR	DESCRIPTION
M6			
M7	83	TN	Ignition feed to heated windshield switch/timer
M8	580	BR	Heated windshield relay activation
M9			
N6			
N7	688	RD	Battery feed for rear defrost
N8			
N9	829	LG	Battery feed to radio
P6	170	PP	Battery feed to power window lockout switch
P7			
P8	313	DB	To right front power window master switch
P9	314	WH	To right front power window master switch
P10			

4 WAY RF DOOR RIGHT FRONT OUTSIDE KICK PANEL



9-S12-033

C17 MALE

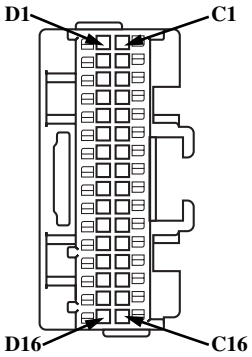


9-S12-034

C17 FEMALE

PIN	CKT	COLOR	DESCRIPTION
A	517	OR	Fused battery input to the passenger door lock switch
B	313	DB	Up/down signal to the power window motor
C	314	WH	Down/up signal to the power window motor
D	170	PP	Fused ignition input to the power window switch

32 WAY PCM-BLUE LOCATION: CENTER CONSOLE, PCM

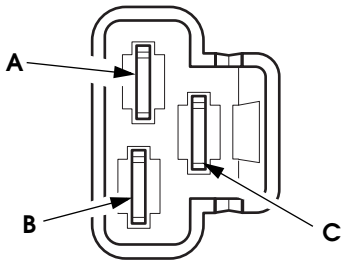


9-S12-042

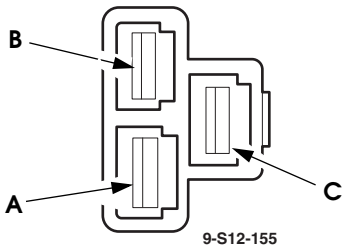
C28 MALE

PIN	CKT	COLOR	DESCRIPTION
C1			
C2	720	TN	APP (2) 5 volt ref.
C3	712	LG	Fuel inject signal
C4	237	LG	1-2 shift solenoid control
C5	924	TN	Torque converter clutch solenoid control
C6	315	YL	2-3 shift solenoid control
C7	338	DB	Wait to start lamp control
C8	914	PP	Class 2 communications (dlc)
C9			
C10			
C11	239	PK	Ignition / axle switch jumper
C12	239	PK	Ignition
C13	537	OR	Battery
C14	658	BR	Malfunction indicator lamp control
C15	701	DB	Engine shutoff solenoid control
C16			
D1			
D2			
D3			
D4			
D5	440	RD	Compressor clutch enable

3 WAY FRONT WIPER HARNESS NEAR MOTOR BEHIND A-PILLAR TRIM



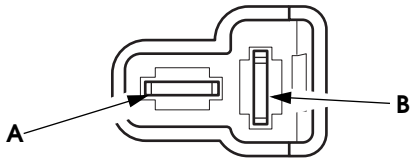
C 43 MALE



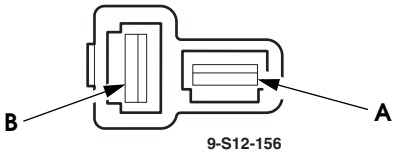
C 43 FEMALE

PIN	CKT	COLOR	DESCRIPTION
A	28	DB	Intermittent Power Supply
B	63	DG	Low Speed Power Supply
C	61	RD	High Speed Power Supply

2 WAY WIPER MOTOR CONNECTOR NEAR MOTOR BEHIND THE A-PILLAR TRIM



C 44 MALE



C 44 FEMALE

PIN	CKT	COLOR	DESCRIPTION
A	59	BR	Ground G4
B	65	BK	Intermittent Start Supply

INTERIOR MINI FUSE BLOCK 2 (UPPER)

Buss	Cavity	CKT. No.	Color & Ga.	Fuse
L1	1E	–	–	ES (5 AMP)
	2E	–	–	-1E-
	3E	–	–	–
	4E	–	–	-2E-
	5E	–	–	ET (7.5 AMP)
	6E	–	–	-3E-
	7E	–	–	–
	8E	–	–	-4E-
	9E	–	–	EW (15 AMP)
	10E	–	–	-5E-
	11E	–	–	–
	12E	–	–	-6E-
	13E	–	–	EY (25 AMP)
	14E	–	–	-7E-
	1F	14 D	16 LB	ES (5 AMP)
	2F	(BUSS L1)	–	-1F-
	3F	19 A	14 YL	ES (5 AMP)
	4F	14 B (BUSS L1)	14 LB	-2F-
	5F	20 A 20 B	14 RD 18 RD	ET (7.5 AMP)
	6F	(BUSS L1)	–	-3F-
	7F	21 A	14 GY	ET (7.5 AMP)
	8F	14 C (BUSS L1)	14 LB	-4F-
	9F	962 A	14 BR	EW (15 AMP)
	10F	14 A (BUSS L1)	12 LB	-5F-
L1A	11F	80 A	16 WH	ES (5 AMP)
	12F	14 B (BUSS L1A)	14 LB	-6F-
	13F	183 A	18 TN	ES (5 AMP)
	14F	(BUSS L1A)	–	-7F-
A1A	1G	640 D	16 OR	ES (5 AMP)
	2G	(BUSS A1A)	–	-1G-
	3G	296 A	16 DG	ES (5 AMP)
	4G	297 B (BUSS A1A)	14 OR	-2G-
A1	5G	71 A	12 WH	EZ (30 AMP)
	6G	297 B (BUSS A1)	14 OR	-3G-
	7G	137 A	16 RD	ET (7.5 AMP)
	8G	(BUSS A1)	–	-4G-
	9G	–	–	–
	10G	(BUSS A1)	–	-5G-
	11G	64 C	14 LG	EY (25 AMP)
	12G	(BUSS A1)	–	-6G-
	13G	65 B	14 YL	EY (25 AMP)
	14G	297 A (BUSS A1)	12 OR	-7G-
B1A	1H	554 A 554 B	18 GY 18 GY	ES (5 AMP)
	2H	(BUSS B1A)	–	1H
	3H	476 B 476 A	20 GY 16 GY	EU (10 AMP)
	4H	37 D (BUSS B1A)	14 RD	-2H-

11. Loosen set screw that retains brake.
12. Push brake through open end of drum and remove (Figure 13-8).
13. Remove driveshaft from gear train assembly (Figure 13-9).
14. Turn gear train assembly over with gear end drum support down. Remove ten hex-head screws and gear housing from gear end drum support.
15. Remove gasket from gear end drum support. Discard gasket (Figure 13-9).

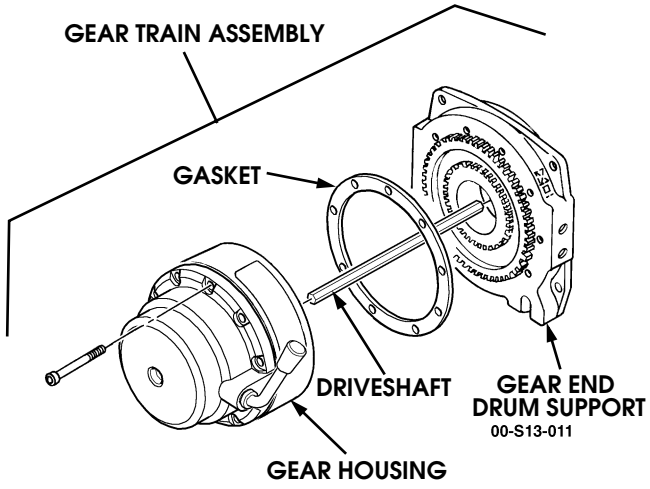


Figure 13-9: Gear Train Assembly

16. Remove detent spacer, spring, and detent ball from gear housing (Figure 13-10).

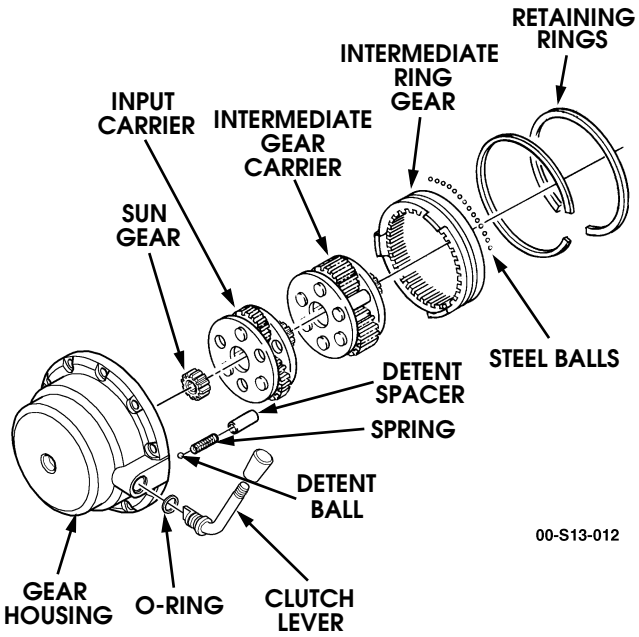


Figure 13-10: Gear Housing

17. Remove clutch lever and O-ring seal from gear housing. Discard O-ring seal.
18. Remove two retaining rings from gear housing (Figure 13-10).

NOTE: Intermediate ring gear comes out with 85 to 87 steel balls. Be sure to catch all 85 to 87 steel balls.

19. Remove intermediate ring gear and 85 to 87 steel balls from gear housing.
20. Remove input and intermediate gear carrier assembly from gear housing (Figure 13-10).
21. Remove and output gear carrier from output ring gear and gear end drum support (Figure 13-11)

.

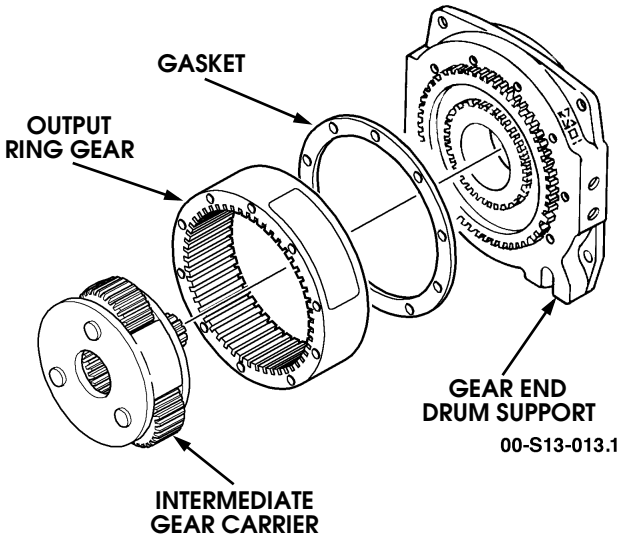


Figure 13-11: Gear Carriers

22. Remove output ring gear and gasket from gear end drum support.

Cleaning

CAUTION: *To avoid damage to equipment, do not clean brake assembly. Clean and inspect all winch components. Replace defective parts.*

Intermediate Shield Replacement

Removal

1. Remove six locknuts, washers, bolts, washers, and four rubber washers securing two transmission support brackets and intermediate shield to transmission mount crossmember. Remove support brackets. Discard locknuts (Figure 13-34).

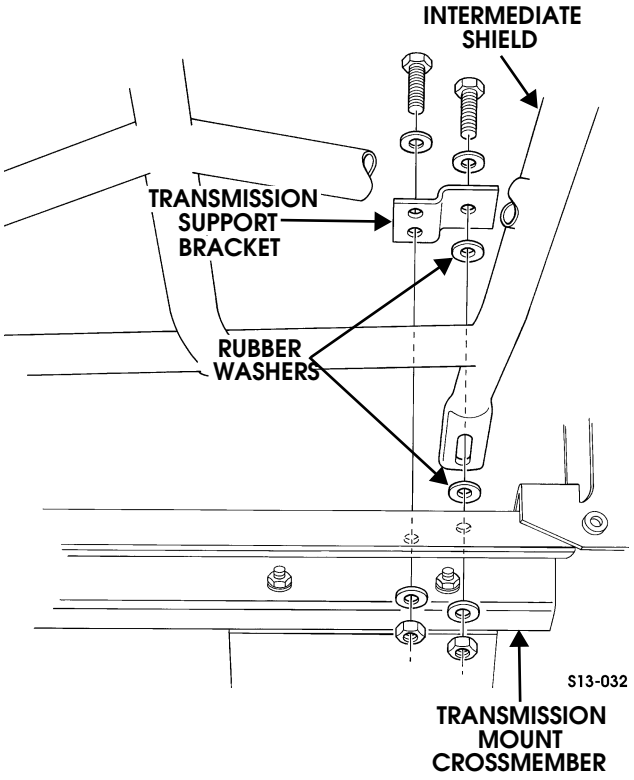


Figure 13-34: Intermediate Shield

2. Remove locknut, washer, capscrew, and washer securing left support bracket to engine mount bracket and frame rail. Discard locknut (Figure 13-35).
3. Remove four locknuts, washers, bolts, washers, and left support bracket from left mounting bracket. Discard locknuts.
4. Remove locknut, washer, capscrew, and washer securing right support bracket to frame rail. Discard locknut (Figure 13-36).
5. Remove four locknuts, washers, bolts, washers, and right support bracket from right mounting bracket. Discard locknuts.
6. Remove two locknuts, washers, bolts, washers, spacers, and intermediate shield from front crossmember and front shield. Discard locknuts (Figure 13-37).

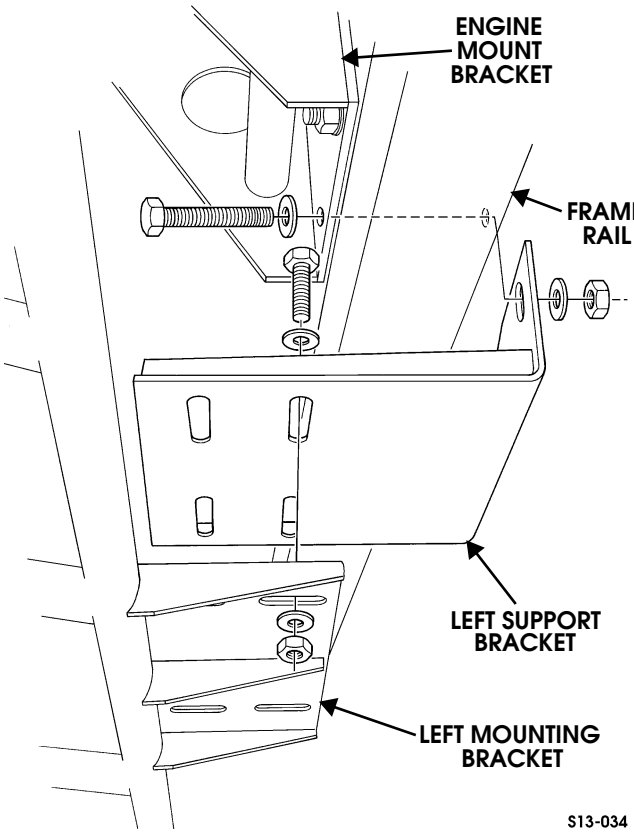


Figure 13-35: Left Support Bracket

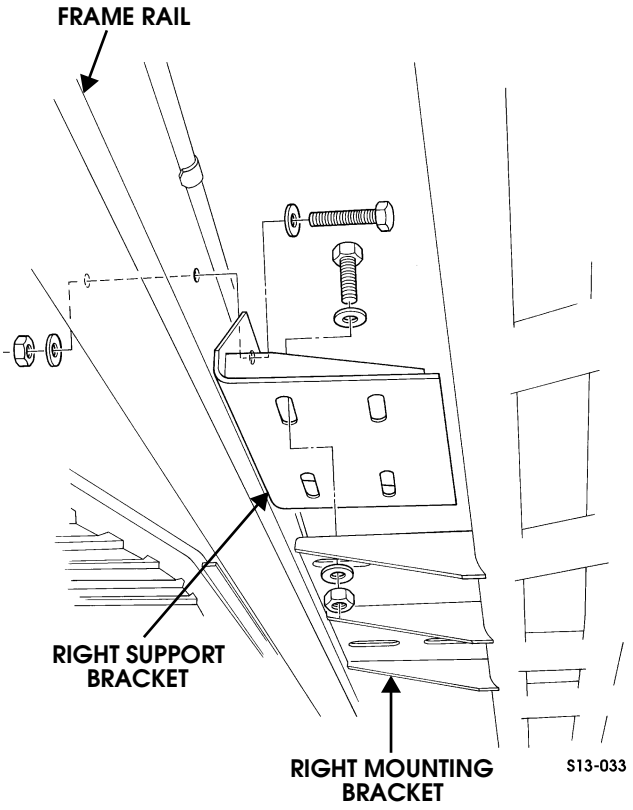


Figure 13-36: Right Support Bracket

Auxiliary Seat Frame Replacement

Removal

1. Remove auxiliary seat locking pins.
2. Remove auxiliary seat.
3. Remove four bolts, washers, and auxiliary seat frame from tunnel floor (Figure 13-61).

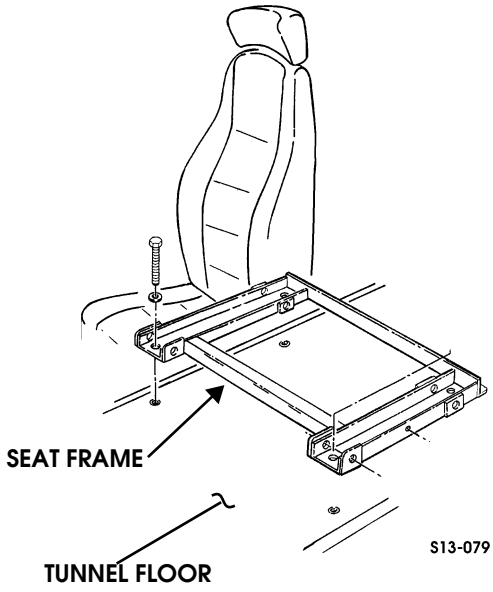


Figure 13-61: Auxiliary Seat Frame

Installation

1. Install auxiliary seat frame on tunnel floor with four washers and bolts (Figure 13-61). Torque bolts to 27-30 lb-ft (36-40 N•m).
2. Install auxiliary seat.
3. Attach auxiliary seat locking pins to seat frame.

Auxiliary Seat Locking Pin Replacement

Removal

NOTE: Left and right side locking pins are replaced the same. This procedure covers the left side only.

1. Remove two screws and locking pin cables from auxiliary seat frame (Figure 13-62).
2. Release and remove two locking pins from auxiliary seat frame and auxiliary seat.

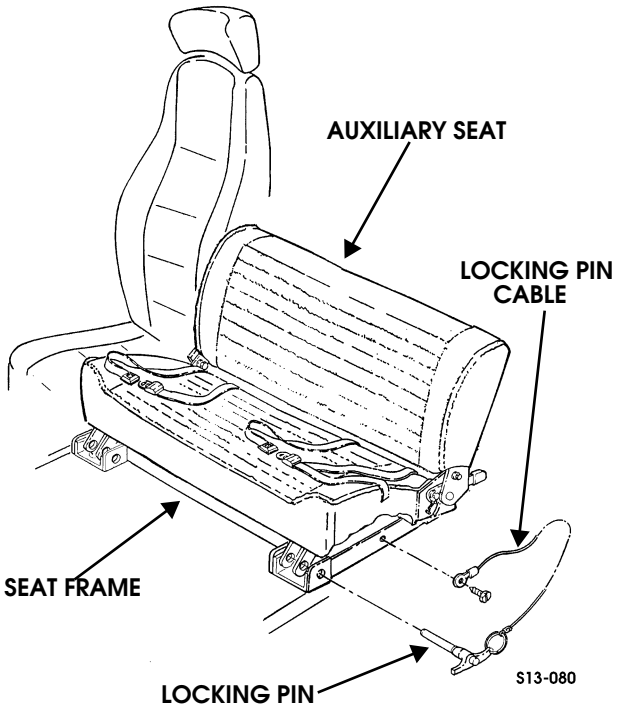


Figure 13-62: Auxiliary Seat Locking Pin

Installation

1. Install and fasten two locking pins on auxiliary seat frame and auxiliary seat (Figure 13-62).
2. Install two locking pin cables on auxiliary seat frame with two screws.

OFF-ROAD ACCESSORY KIT (MODEL 84)

Removal

1. Remove four bolts, locknuts, 8 retainer plates and gaskets securing the box to the wheelhouse (See Figure 13-79).
2. Lift the box off the wheelhouse and out of the vehicle.

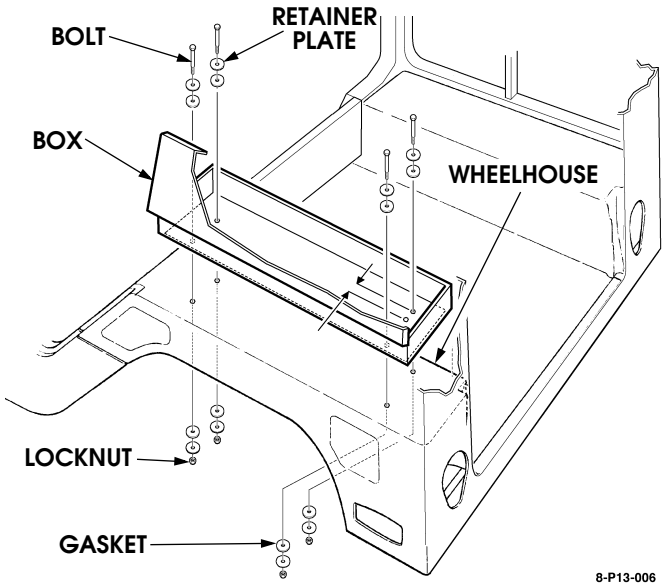


Figure 13-79: Off-Road Accessory Box Mounting

Installation

1. Position the tool box on the drivers side rear wheel house flush with the inside edge and centered front to rear making sure that the lid will open without contacting the side window or the upper trim panel.
2. Using the forward inboard and the two outboard holes in the bottom of the tool box as a template, mark the carpet and drill 1/4” holes through the carpet and the wheel house (See Figure 13-79).
3. Mount the tool box by installing three 1/4” bolts, retainer plates and Gaskets from the box side through the wheel house and three gaskets, retainer plates and locknuts on the wheel side.
4. Measure two inches inboard from the rear inboard mount hole in the bottom of the box and mark the box for drilling.
5. Drill a 1/4” hole at the marked position through the box, the carpet and the wheelhouse.
6. Install a 1/4” bolt, retainer plate and Gasket from the box side through the wheel house and a gasket, retainer plate and locknut on the wheel side. Torque all the fasteners to 12 lb ft.
7. Place the kit contents in the tool box and latch the lid before operating the vehicle.

CAUTION: *Box contents should not exceed 60 pounds.*

BEDLINER (MODELS 83, 85 AND 90)

Removal

1. Using a sharp knife or gasket scraper cut the edge trim adhesive between the vehicle and the edge trim all around the upper edge of the bedliner. Take care not to damage the edge trim so it can be reused.
2. Remove all the tiedowns in the bed area.
3. Remove the two plastic caps, screws and washers securing the top of the tailgate liner. Pull the tailgate liner off the tailgate.
4. If your vehicle is a soft top model, remove the bolts and nuts securing the “C” pillar rear support bars to the wheelhouse (See Figure 13-80). Remove the shims from between the support bar brackets.
5. Remove the bedliner.
6. Cut the edge trim off the tailgate.
7. Clean all the remaining adhesive off the bed and tailgate areas and the backside of the edge trim with an adhesive remover.

Installation

8. Place the bedliner into the vehicle. If your vehicle is a soft top model, perform the following steps:

- Slide the bedliner into the bed from the rear until the front of the bedliner is against the rear support bar brackets.
- Raise the rear of the bedliner.
- Make sure that both sides of the liner start sliding under the support bar brackets.
- Push the liner all the way forward until there is approximately 1/8" clearance between the rear floor edge of the liner and the vehicles “D” beam assembly (rear floor flange).

9. Align the tiedown holes in the liner with the holes in the vehicle. Install all the tiedowns loosely. Adjust the liner in the bed and torque the tiedowns to 27-30 lb-ft (36-40 N•m)
10. If your vehicle is a soft top model, use the holes in the “C” pillar rear support bar mount brackets as a template and drill 1/2" holes through the liner. Reinstall the previously removed shims between the liner and the support bar brackets, leaving out one shim on each side to make up for the thickness of the liner. Install the original bolts and nuts through the support bar mount brackets, the shims, the liner and the wheel houses, but do not tighten. Recheck the fit of the liner and torque the bolts to 31 lb-ft (42 N•m).
11. Use rubbing alcohol to clean the body along the top of the liner on the right and left sides. The edge trim will be installed in this area and the vehicle must be clean to insure proper adhesion.

POWERTRAIN OBD SYSTEM CHECK

Circuit Description

The On Board Diagnostic System Check is an organized approach to identifying a problem created by an electronic engine system fault. The OBD system check is the starting point for any driveability diagnosis. The OBD system check directs the service technician to the next step in diagnosing the complaint. Do not perform this check if no driveability complaint exists. Understanding the table correctly reduces the diagnostic time. Understanding the table correctly prevents the replacement of good parts.

Diagnostic Aids

Important: Do not clear the DTCs unless directed by a diagnostic procedure. Clearing the DTCs will also clear valuable freeze frame and failure records data.

Inspect all related wiring and connections including the connections at the PCM. These may cause and intermittent malfunction.

Check any circuitry that is suspected of causing an intermittent problem for the following conditions:

- Backed out terminals
- Improper mating
- broken locks
- Improperly formed or damaged terminals
- Poor terminal to wiring connections
- Physical damage to the wiring harness
- Corrosion
- Poor pin tension

Test Description

The numbers below refer to the step number in the diagnostic table.

1. When the ignition is turned on, the MIL will momentarily flash ON and OFF and then remain on until the engine is running if no Diagnostic Trouble Codes are stored.
2. The diagnostic tables in this section are designed for use with a properly functioning scan tool. Before beginning any other diagnostic procedures, correct the serial data communications. The Class II serial data will not transmit if the system voltage measures below 9v or above 16v.
3. Whenever multiple DTCs are stored, refer to the DTC tables in the following order:
    a. PCM Error DTCs
    b. System voltage DTCs
    c. Component level DTCs (DTCs that indicate a faulty part
    d. System level DTCs (DTCs that indicate a system fault).

5. By storing the Freeze Frame Data and the Failure records selection in the scan tool, an electronic copy of the freeze frame data and the failure records taken when the fault occurred is stored, which can be referred to later.
6. Checking the sensors for proper operation during warm up can be a crucial step in correctly diagnosing any driveability concern. Careful observation of these sensors during the engine warm up may reveal a slow responding sensor or a sensor that malfunctions only within a small portion of its range.

After the engine is at the normal operating temperature, a comparison of the actual control system data with the typical values is a quick way to determine if any parameter is not within limits. Keep in mind that a base engine problem may substantially alter sensor values.

Check the following sensors for proper operation:

- The Engine Coolant Temperature Sensor (ECT) for initial coolant temperature reading at ambient. Then observe the rise in the temperature while the engine is warming up.
- The Intake Air Temperature Sensor (IAT) for initial air temperature reading at ambient. Then observe the rise in the temperature while the engine is warming up.

Diagnostic Trouble Code (DTC) Identification (Contd)

DTC	Description	Type	Illuminate MIL
P0284	Cylinder Balance System Fault	D	No
P0335	CKP Sensor Circuit Performance	A	Yes
P0370	Timing Reference High Resolution	A	Yes
P0380	Glow Plug Circuit Performance	B	Yes
P0501	Vehicle Speed Sensor Circuit	D	No
P0567	Cruise Resume Circuit	D	No
P0568	Cruise Set Circuit	D	No
P0571	Cruise Brake Switch Circuit	D	No
P0601	PCM Memory	D	No
P0602	PCM Not Programmed	D	No
P0606	PCM Internal Communication Interrupted	A	Yes
P1125	APP System	C	No
P1214	Injection Pump Timing Offset	B	Yes
P1216	Fuel Solenoid Response Time Too Short	D	No
P1217	Fuel Solenoid Response Time Too Long	D	No
P1218	Injection Pump Calibration Circuit	B	Yes
P1621	EEPROM Write	B	Yes
P1627	A/D Performance	B	Yes
P1635	5 Volt Reference Low	D	No
P1641	Malfunction Indicator Lamp (MIL) Control Circuit	D	No
P1643	Write to Start Lamp Control Circuit	B	No
P1654	Service Throttle Soon (STS) Lamp Control Circuit	D	No
P1656	Wastegate Solenoid Control Circuit	B	Yes

DTC P0113 - Intake Air Temperature (IAT) Sensor Circuit High Voltage

Step	Action	Value(s)	Yes	No
1	**NOTE:** Before clearing DTC(s) use the Scan tool "Capture Info" to record Freeze Frame and Failure Record for reference, as data will be lost when "Clear Info" function is used. Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to OBD System Check
2	1. Scan tool connected. 2. Start the engine. 3. Monitor the IAT display on Scan Tool. Is the IAT display colder than or equal to the specified value?	-30°C (-22°F)	Go to Step 3	Go to Step 5
3	1. Turn the engine "OFF." 2. Turn the ignition "ON." 3. Disconnect the IAT sensor connector. 4. Jumper the IAT harness terminals together. Does the scan tool display IAT greater than or equal to the specified value?	151°C (303°F)	Go to Step 6	Go to Step 4
4	Jumper the IAT sensor signal circuit to a known good ground. Does the scan tool display an IAT greater than or equal to the specified value?	151°C (303°F)	Go to Step 7	Go to Step 8
5	DTC is intermittent. If no additional DTCs are stored, refer to "Diagnostic Aids." Are additional DTCs stored?	—	Go to the applicable DTC Table	Go to Diagnostic Aids
6	Inspect the sensor connector and PCM connector for a proper connection. Was a problem found?	—	Go to Step 9	Go to Step 10
7	Check the IAT sensor ground circuit for an open between the IAT sensor and the PCM. Was a problem found?	—	Go to Step 9	Go to Step 11
8	Check the IAT sensor signal circuit for an open between the IAT sensor and the PCM. Was a problem found?	—	Go to Step 9	Go to Step 11
9	Repair the circuit as necessary. Is the action complete?	—	Go to Step 12	—
10	Replace the faulty IAT sensor. Is the action complete?	—	Go to Step 12	—
11	Replace the faulty PCM. **NOTE:** If the PCM is faulty, the new PCM must be programmed. Go to PCM replacement and programming procedures. Is the action complete?	—	Go to Step 12	—
12	1. Using the Scan Tool, select "DTC," "Clear Info." 2. Start engine and idle at normal operating temperature. 3. Select "DTC," "Specific," then enter the DTC number which was set. 4. Operate vehicle within the conditions for setting this DTC as specified in the supporting text. Does the Scan Tool indicate that this diagnostic Ran and Passed?	—	Go to Step 13	—
13	Using the Scan Tool, select "Capture Info," "Review Info." Are any DTC's displayed that have not been diagnosed?	—	Go to the applicable DTC table	System OK

- A history DTC will clear after forty consecutive warm up cycles, if no failures are reported by this and any other emission related diagnostic.
- PCM battery voltage is interrupted.
- Using a scan tool.

Diagnostic Aids

- Using "Freeze Frame" and/or "Failure Records" data may aid in locating an intermittent condition. If the DTC cannot be duplicated, the information included in the "Freeze Frame" and/or "Failure Records" data can be useful in determining how many miles since the DTC set. The Fail Counter and Pass Counter can also be used to determine how many ignition cycles the diagnostic reported a pass and/or a fail. Operate the vehicle within the same freeze frame conditions (RPM, load, vehicle speed, temperature etc.). that were noted. This will isolate when the DTC failed.
- If other DTCs are set that share the same ground and/or 5.0 volt reference circuit, check for faulty connections and for faulty wiring.
- If the engine has been allowed to sit overnight, the engine coolant temperature and intake air temperature values should display within a few degrees of each other.
- If the engine coolant temperature exceeds 60˚C (140˚F), this indicates that the engine is capable of reaching the proper temperature, but not necessarily in the correct amount of time. This diagnostic table must be repeated on a cold engine, engine coolant and intake air temperature less than 50˚C (122˚F) and within 3˚C (5˚F) of each other. The time required to reach the temperature threshold must be measured. When starting a cold engine, measure the amount of time it takes the engine to reach the specified temperature. The engine should reach the specified temperature within 8 minutes. If the specified temperature is not reached within 7 minutes, check the following:

  Coolant level.

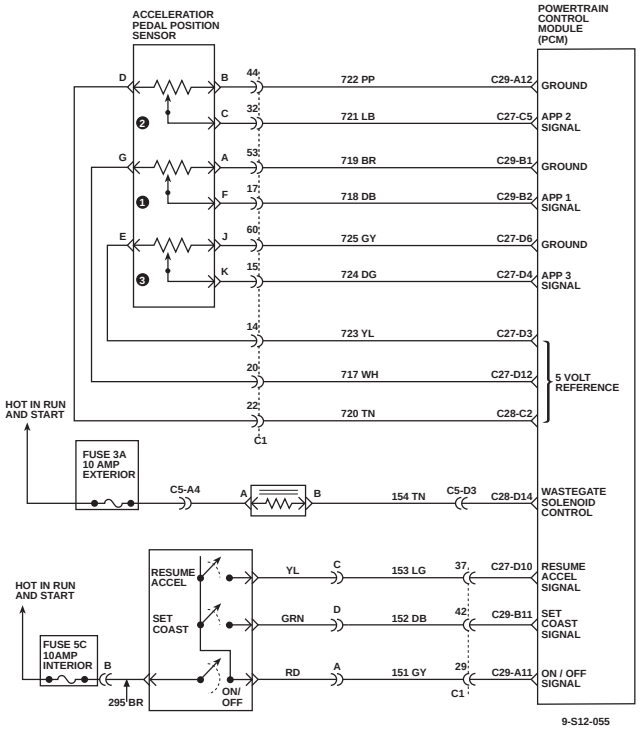
  Thermostat operation.

  Cooling fan.

Temperature VS Resistance.

˚C	˚F	OHMS
100	212	177
90	194	241
80	176	332
70	158	467
60	140	667
50	122	973
45	113	1188
40	104	1459
35	95	1802
30	86	2238
25	77	2796
20	68	3520
15	59	4450
10	50	5670
5	41	7280
0	32	9420
-5	23	12300
-10	14	16180
-15	5	21450
-20	-4	28680
-30	-22	52700
-40	-40	100700
Values are Approximate		

DTC P0221 Accelerator Pedal Position (APP) Sensor 2 Circuit Performance



Circuit Description

The Accelerator Pedal Position (APP) module provides a voltage signal that changes relative to accelerator position. There are three sensors located within the APP module that are scaled differently. This is a type C DTC.

Conditions for Setting the DTC

- Ignition voltage is greater than 6.4 volts.
- Engine speed greater than 300 rpm.
- The difference between APP 2 and APP 1 is greater than .23 volts (PCM compares pre-scaled voltage (internal to PCM)).
- The difference between APP 2 and APP 3 is greater than .50 volts (PCM compares pre-scaled voltage (internal to PCM)).
- No in range faults for APP 1 or APP 3 (PCM checks for high and low voltage faults).
- Conditions met for 2 seconds.

Action Taken When the DTC Sets

- The input from APP 2 sensor is ignored.
- A current and history DTC will set but it will not turn on the "Service Throttle Soon" lamp.
- The throttle will operate normally as long as there is only one malfunction present. If there are two APP malfunctions present, the PCM will then turn "ON" the "Service Throttle Soon" lamp and limit power. If a third APP malfunction is present, the "Service Throttle Soon" lamp will be "ON" and will only allow the engine to operate at idle.

Conditions for Clearing the MIL/DTC

- A History DTC will clear when forty consecutive warm-up cycles that the diagnostic does not fail (coolant temperature has risen 5°C (40°F) from start up coolant temperature and engine coolant temperature exceeds 71°C (160°F) that same ignition cycle).
- Use of a Scan Tool

Diagnostic Aids

A scan tool reads APP 2 position in volts and should read about 4.5 volts with throttle closed and ignition "ON" or at idle. Voltage should decrease at a steady rate as throttle is moved toward Wide Open Throttle (WOT). Also, 90% pedal travel is acceptable for correct APP operation. Refer to Section 2 for "Intermittents". Scan APP 2 sensor while depressing accelerator pedal with engine stopped and ignition "ON". Display should vary from about 4.5 volts when throttle was closed to about 1.5 volts when throttle is held at Wide Open Throttle (WOT) position.

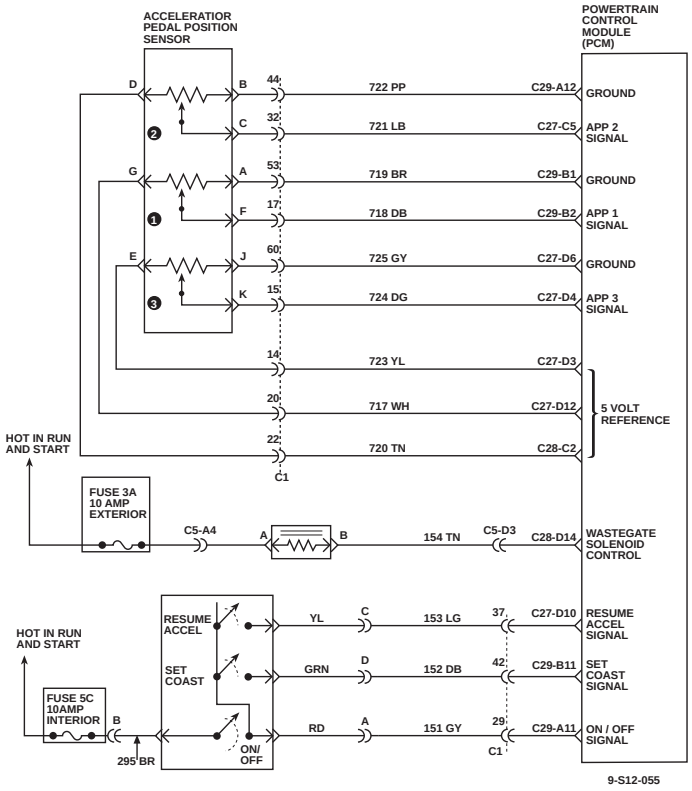
Test Description

Number(s) below refer to the number(s) on the diagnostic table.

4. This step determines if there is a good 5 volt reference.

5. This step will check for an open in the ground circuit.

DTC P0228 Accelerator Pedal Position (APP) Sensor 3 Circuit High Voltage



Circuit Description

The Accelerator Pedal Position (APP) module provides a voltage signal that changes relative to accelerator position. There are three sensors located within the APP module that are scaled differently. This is a type C DTC.

Conditions for Setting the DTC

- Voltage is greater than 4.75 volts on APP 3 sensor.
- Conditions met for 2 seconds.

Action Taken When the DTC Sets

- The input from APP 3 sensor is ignored.
- A current and history DTC will set but it will not turn on the "Service Throttle Soon" lamp. The throttle will operate normally as long as there is only one malfunction present. If two different APP sensors have a malfunction, the "Service Throttle Soon" lamp will light and the PCM will limit power. If three APP sensors have a malfunction present, the "Service Throttle Soon" lamp will light and the PCM will only allow the engine to operate at idle.

Conditions for Clearing the MIL/DTC

- A History DTC will clear when forty consecutive warm-up cycles that the diagnostic does not fail (coolant temperature has risen 5°C (40°F) from start up coolant temperature and engine coolant temperature exceeds 71°C (160°F) that same ignition cycle).
- Use of a Scan Tool

Diagnostic Aids

A scan tool reads APP 3 position in volts and should read about 4.0 volts with throttle closed and ignition "ON" or at idle. Voltage should decrease at a steady rate as throttle is moved toward Wide Open Throttle (WOT). Also, 90% pedal travel is acceptable for correct APP operation. Refer to Section 2 for "Intermittents". Scan APP 3 sensor while depressing accelerator pedal with engine stopped and ignition "ON". Display should vary from about 4.0 volts when throttle is closed to about 2.0 volts when throttle is held at Wide Open Throttle (WOT) position.

Test Description

Number(s) below refer to the number(s) on the diagnostic table.

2. This step determines if P0228 is a hard failure or an intermittent condition.

3. This step checks the PCM and wiring.

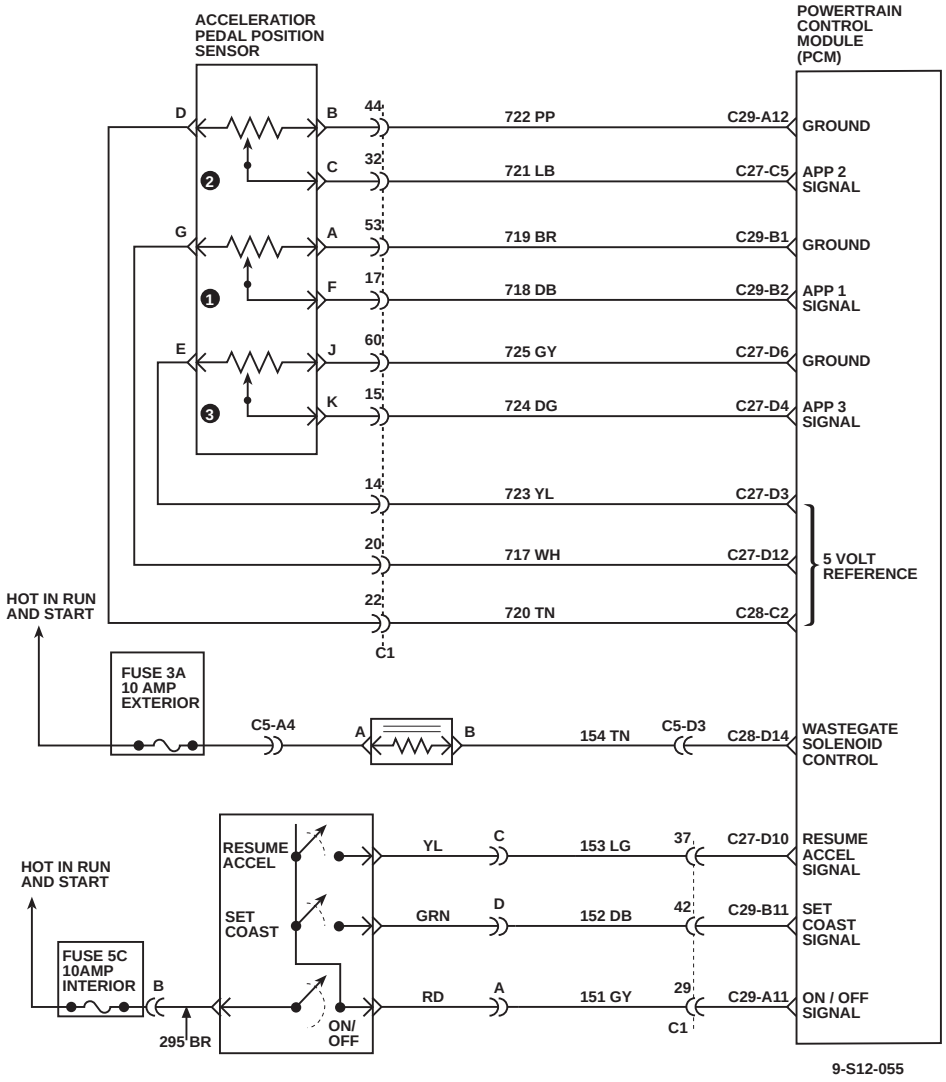
DTC P0251 - Injection Pump Cam System

Step	Action	Value(s)	Yes	No
16	1. Using the Scan Tool, select “DTC”, “Clear Info”. 2. Start engine and idle at normal operating temperature. 3. Select “DTC”, “Specific”, then enter the DTC number which was set. 4. Operate vehicle within the conditions for setting this DTC. Does the Scan Tool indicate that this diagnostic Ran and Passed?	—	Go to Step 17.	Go to Step 2.
17	Using the Scan Tool, select “Capture Info”, “Review Info”. Are any DTCs displayed that have not been diagnosed?	—	Go to DTC table	System OK.

DTC P0380 - Glow Plug Circuit Performance

Step	Action	Value	Yes	No
26	Repair the open or poor connections in the glow plug harness. Did you complete the repair?		Go to step 30.	
27	Repair the short to ground in the glow plug harness. Did you complete the repair?		Go to step 30.	
28	Replace the glow plug relay. Did you complete the repair?		Go to step 30.	
29	THE NEW PCM MUST BE PROGRAMMED.Replace the PCM. Did you complete the repair?		Go to step 30.	
30	Use a scan tool to clear the DTC's. Start the engine. Allow the engine to idle until the engine reaches normal operating temperature. Select the DTC and the specific DTC function. Enter the DTC number which was set. Operate the vehicle, with the Conditions for Setting this DTC, until the scan tool indicates the diagnostic Ran. Does the scan tool indicate the diagnostic Passed?		Go to step 31.	Go to step 2.
31	Does the scan tool display any addition undiagnosed DTC's?		Go to the applicable DTC table.	System OK.

DTC P1125 Accelerator Pedal Position (APP) System



Circuit Description

The Accelerator Pedal Position (APP) module provides a voltage signal that changes relative to accelerator position. There are three sensors located within the APP module that are scaled differently. This is a type C DTC.

Conditions for Setting the DTC

PCM has recognized an intermittent APP fault and there are no current APP faults stored.

Action Taken When the DTC Sets

Vehicle will operate at limited power.

Conditions for Clearing the MIL/DTC

- A History DTC will clear when forty consecutive warm-up cycles that the diagnostic does not fail (coolant temperature has risen 5°C (40°F) from start up coolant temperature and engine coolant temperature exceeds 71°C (160°F) that same ignition cycle).
- Use of a Scan Tool.

Diagnostic Aids

A DTC P1125 will set along with multiple APP DTCs. All other DTCs should be diagnosed first.

Test Description

Number(s) below refer to the number(s) on the diagnostic table.

1. This step determines if DTC P1125 is a hard failure or an intermittent condition.

DTC P1635 - PCM 5 Volt Reference Low

Step	Action	Value(s)	Yes	No
1	**Important:** Before clearing DTC(s) use the scan tool "Capture Info" to record freeze frame and failure records for reference, as data will be lost when "Clear Info" function is used. Was the *"On-Board Diagnostic (OBD) System Check"* performed?	—	Go to Step 2.	Go to *OBD System Check.*
2	1. Scan tool installed. 2. Crank engine for 15 seconds or start up. Does DTC reset?	—	Go to Step 3.	Go to Step 5.
3	1. Ignition ON, engine OFF> 2. Disconnect Boost/BARO sensor. 3. With J–39200 DVM, probe 5 volt reference circuit at harness connector. Is voltage less than the specified value?	4.0v	Go to Step 4.	Go to Step 6.
4	1. Disconnect PCM connector with the boost sensor 5 volt reference circuit. 2. With test light connected to B+, probe 5 volt reference circuit at PCM harness. Is test light ON?	—	Go to Step 7.	Go to Step 8.
5	DTC is intermittent. If no additional DTCs are stored, refer to "Diagnostic Aids". If additional DTCs are stored, refer to those charts(s) first. Are additional DTCs stored?	—	Go to applicable DTC table.	Go to *Diagnostic Aids*
6	Replace Boost/BARO sensor.	—	Go to Step 8.	—
7	Repair short to ground in 5 volt reference circuit. Is the action complete?	—	Go to Step 8.	—
8	Replace the faulty PCM. ***Notice:*** If the PCM is faulty, the new PCM must be programmed. Go to *PCM replacement and programming procedures.* Is the action complete?	—	Go to Step 9.	Go to Step 8.
9	1. Using the Scan Tool, select "DTC", "Clear Info". 2. Start engine and idle at normal operating temperature. 3. Select "DTC", "Specific", then enter the DTC number which was set. 4. Operate vehicle within the conditions for setting this DTC as specified in the supporting text. Does the Scan Tool indicate that this diagnostic Ran and Passed?	—	Go to Step 6.	Go to Step 2.
10	Using the Scan Tool, select "Capture Info", "Review Info". Are any DTCs displayed that have not been diagnosed?	—	Go to the applicable DTC table	System OK.

PIN	CKT	COLOR	DESCRIPTION
11	787	GY	Fuel pump + to selector valve
12	37	RD	Ignition relay feed
13	688	RD	Rear window defrost feed
14	723	YL	APP 3 5volt reference
15	724	DG	APP 3 signal
16	17	PP	+ From dimmer module
17	718	DB	APP 1 signal
18	353	YL	Speedometer signal
19	607	TN	ABS module diagnostic line
20	717	WH	APP 1 5volt reference
21	961	PP	TT4 lamp activation
22	720	TN	APP 2 5volt reference
23	640	OR	IGN+ CTIS warning circuits
24	92	GY	CTIS rear inflate solenoid activation
25	714	DB	Check throttle lamp activation
26	37	RD	Battery feed to interior accessories
27	338	DB	Wait lamp activation
28	658	BR	Check engine lamp activation
29	151	GY	Cruise control ON/OFF signal
30	31	TN	Oil pressure signal
31	22	RD	Brake switch signal – rest
32	721	LB	APP 2 sensor signal
33	580	BR	Not Used for 99
34	606	OR	ABS diagnostic line
35	29	PK	Fuel gauge signal
36	39	DG	Engine temperature signal
37	153	LG	Cruise resume/accelerate signal
38	42	BR	Low brake fluid lamp activation
39	198	TN	A/C request
40	810	PP	TCC brake switch signal
41	2	LG	Right front turn signal
42	152	DB	Cruise set/coast signal
43	298	BR	Backup light switch feed
44	722	PP	APP 2 ground
45	327	YL	Water-in-fuel lamp activation
46	80	WH	Underhood lamp power