COOLING

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COOLING

DESCRIPTION - ENGINE COOLING SYSTEM

The engine cooling system consists of a cooling module, pressure cap, coolant bottle, thermostat (inlet type), coolant, plumbing, and a water pump to circulate the coolant (Fig. 1). The engine cooling module consist of a radiator, electric radiator fan motors, shroud, internal transmission oil cooler, internal engine oil cooler (if equipped), air conditioning condenser, and a auxiliary transmission oil cooler (if equipped).

OPERATION - ENGINE COOLING SYSTEM

CAUTION: The cooling system is designed to function with a 50/50 mixture of Mopar® Antifreeze/Coolant, 5 Year/100,000 Mile Formula (MS-9769) or equivalent, and distilled water. Higher concentrations may result in poor cooling performance and premature water pump seal failure. This antifreeze/coolant may not be mixed or substituted with any other type.

- When Engine is cold: Thermostat is closed, cooling system has no flow through the radiator. The coolant flows through the engine, heater core, coolant bottle and an internal engine by-pass.
- When Engine is warm: Thermostat is open, coolant flows through the radiator, heater core, coolant bottle and by-pass.

The cooling systems primary purpose is to maintain engine temperature in a range that will provide satisfactory engine performance and emission levels under all expected driving conditions. It also provides hot coolant for heater, and cooling for automatic transmission fluid. It does this by transferring heat from engine metal to coolant, moving this heated coolant to the radiator, and then transferring this heat to the ambient air.

The coolant flow circuit is shown in (Fig. 1).

COOLING (Continued)

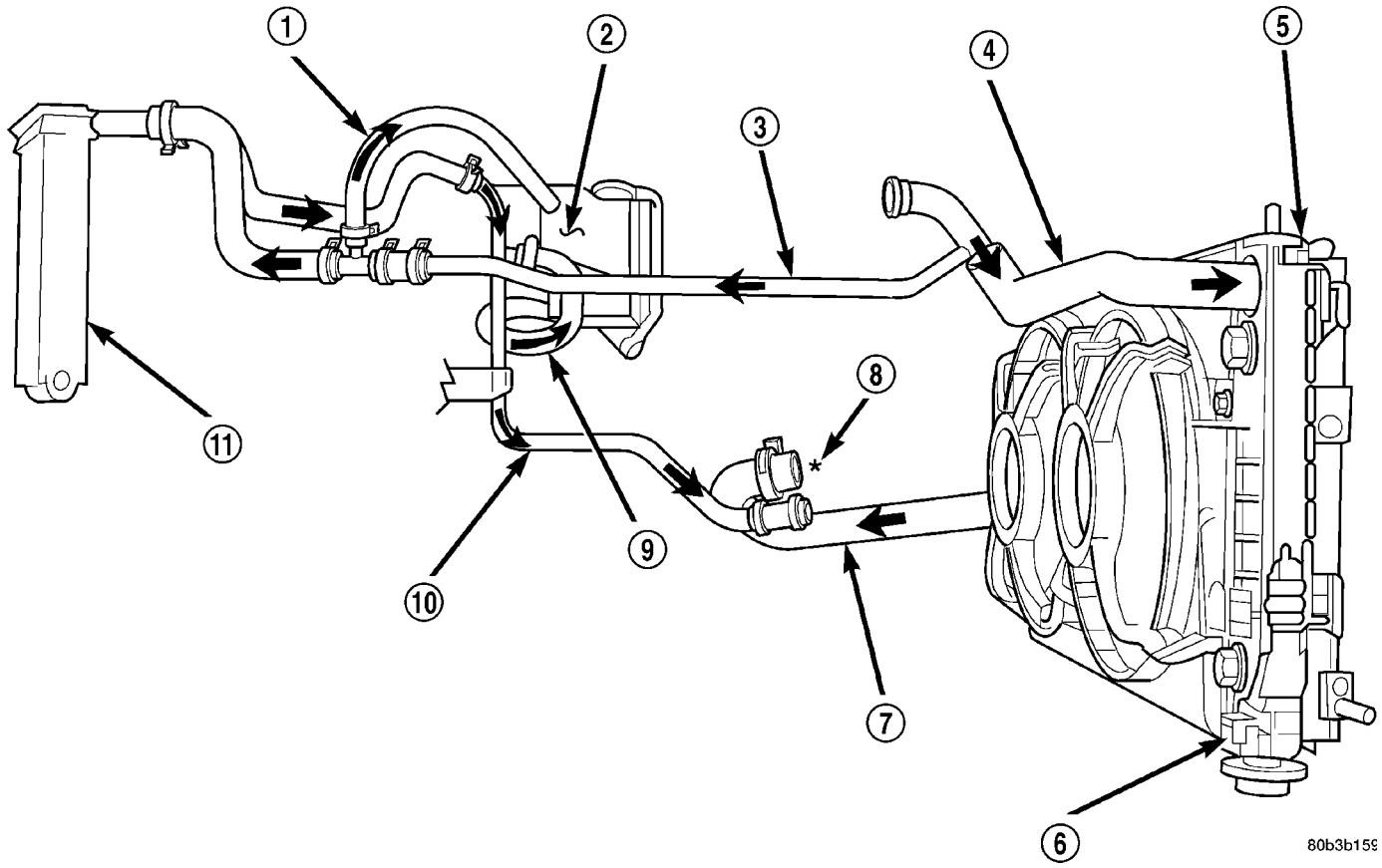

Fig. 1 COOLING SYSTEM FLOW

1 - BOTTLE SUPPLY HOSE
2 - PRESSURE BOTTLE
3 - HEATER SUPPLY TUBE
4 - RADIATOR UPPER INLET HOSE
5 - RADIATOR
6 - DRAIN COCK
7 - RADIATOR LOWER OUTLET HOSE
8 - THERMOSTAT LOCATION
9 - BOTTLE RETURN
10 - HEATER RETURN TUBE
11 - HEATER CORE

COOLING (Continued)

DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING - COOLING SYSTEM

CONDITION	POSSIBLE CAUSES	CORRECTION
TEMPERATURE GAUGE READING IS INCONSISTENT (FLUCTUATES, CYCLES OR IS ERRATIC).	1. During cold weather operation with the heater blower in the high position, the gauge reading may drop slightly. Fluctuation is also influenced by loads, outside temperature, and cycling of the air conditioning system.	1. A normal condition. No correction is necessary.
	2. Temperature gauge or engine sending unit sensor defective or shorted. Also, corroded or loose wiring in this circuit.	2. Check operation of gauge and repair if necessary. Refer to INSTRUMENT PANEL AND SYSTEMS.
	3. Gauge reading rises when vehicle is brought to a stop after heavy use (engine still running).	3. A normal condition. No correction is necessary. Gauge reading should return to normal range after vehicle is driven.
	4. Gauge reading high after restarting a warmed-up (hot) engine.	4. A normal condition. No correction is necessary. The gauge should return to normal range after a few minutes of engine operation.
	5. Coolant level low (air will build up in the cooling system causing the thermostat to open late).	5. Check and correct coolant leaks. Refer to Testing Cooling System for Leaks in this section.
	6. Cylinder head gasket leaking allowing exhaust gas to enter cooling system causing thermostat to open late.	6. (a) Check for cylinder head gasket leaks with a commercially available block leak tester. Repair as necessary. (b) Check for coolant in engine oil. Inspect for white steam emitting from exhaust system. Repair as necessary.
	7. Water pump impeller loose on shaft.	7. Check water pump and replace as necessary. Refer to Water Pump Removal in this section.
	8. Air leak on the suction side of water pump allows air to build up in cooling system causing thermostat to open late.	8. Locate leak and repair as necessary.
PRESSURE CAP IS BLOWING OFF STEAM AND/OR COOLANT. TEMPERATURE GAUGE READING MAY BE ABOVE NORMAL BUT NOT HIGH. COOLANT LEVEL MAY BE HIGH IN COOLANT RESERVE/OVERFLOW TANK.	1. Pressure relief valve in radiator cap is defective, or was not properly seated.	1. Check condition of radiator cap and cap seal. Refer to Pressure Cap in this group. Replace cap as necessary.
	2. Incorrect cap was installed.	2. Replace cap as necessary.
	3. Incorrect coolant mixture.	3. Make sure a 50% by volume mixture of coolant is used.
	4. System overfilled.	4. Ensure cold coolant level is between MIN and MAX marks on coolant bottle.

COOLING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
COOLANT LOSS TO THE GROUND WITHOUT PRESSURE CAP BLOWOFF. GAUGE IS READING HIGH OR HOT.	1. Coolant leaks in radiator, cooling system hoses, water pump or engine.	1. Pressure test and repair as necessary. (Refer to 7 - COOLING - DIAGNOSIS AND TESTING - COOLING SYSTEM LEAK TESTING)
DETONATION OR PRE-IGNITION (NOT CAUSED BY IGNITION SYSTEM) GAUGE MAY NOT BE READING HIGH.	1. Engine overheating. 2. Freeze point of coolant not correct. Mixture too concentrated or too diluted. 3. Wrong cooling system pressure cap.	1. Check reason for overheating and repair as necessary. 2. Check freeze point of the coolant. (Refer to 7 - COOLING/ENGINE/ COOLANT - DIAGNOSIS AND TESTING) Adjust the ethylene glycol to water ratio as required. 3. Install correct pressure cap.
HOSE(S) COLLAPSE AS ENGINE COOLS DOWN.	1. Vacuum created in cooling system on engine cool-down is not being relieved through coolant bottle system.	1. (a) Pressure cap relief valve stuck. (Refer to 7 - COOLING/ENGINE/ RADIATOR PRESSURE CAP - INSPECTION) Replace as necessary. (b) Hose between the pressure and overflow container is plugged. Clean vent and repair as necessary. (c) Vent at coolant reserve/overflow container is plugged. Clean vent and repair as necessary. (d) Reserve/overflow container is internally blocked. Clean and repair as necessary
ELECTRIC RADIATOR FAN RUNS ALL THE TIME.	1. Fan relay, Powertrain Control Module (PCM) or engine coolant temperature sensor possibly defective. 2. Check for low coolant level. 3. A/C pressure transducer defective.	1. (Refer to Appropriate Diagnostic Information) Repair as necessary. 2. Repair as necessary. 3. (Refer to Appropriate Diagnostic Information) Repair as necessary.
NOISY RADIATOR FAN.	1. Fan blade loose. 2. Fan blade striking a surrounding object. 3. Air obstructions at radiator or A/C condenser. 4. Electric fan motor defective.	1. Replace radiator fan assembly. (Refer to 7 - COOLING/ENGINE/ RADIATOR FAN - REMOVAL) 2. Locate point of fan blade contact and repair/replace as necessary. 3. Remove obstructions and/or clean debris. 4. Replace radiator fan assembly. (Refer to 7 - COOLING/ENGINE/ RADIATOR FAN - REMOVAL)

COOLING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
INADEQUATE AIR CONDITIONER PERFORMANCE (COOLING SYSTEM SUSPECTED).	1. Radiator and/or A/C condenser is restricted, obstructed or dirty (insects, leaves, etc.).	1. Remove restriction and/or clean as necessary.
	2. Electrical radiator fan not operating when A/C is operated.	2. (Refer to Appropriate Diagnostic Information) Repair as necessary.
	3. Engine is overheating (heat may be transferred from radiator to A/C condenser. High underhood temperatures due to engine overheating may also transfer heat to A/C components.	3. Correct overheating condition.
	4. All models are equipped with air seals at the radiator and/or A/C condenser. If these seals are missing or damaged, not enough air flow will be pulled through the radiator and A/C condenser.	4. Check for missing or damaged air seals and repair as necessary.
INADEQUATE HEATER PERFORMANCE.	1. Has a diagnostic trouble code (DTC) been set?	1. (Refer to Appropriate Diagnostic Information) Repair as necessary.
	2. Low Coolant level.	2. (Refer to 7 - COOLING - DIAGNOSIS AND TESTING) Repair as necessary.
	3. Air Trapped in heater core.	3. Improper coolant fill procedure. (Refer to 7 - COOLING - STANDARD PROCEDURE)
	4. Obstructions in heater hose fitting at engine or at heater core.	4. Remove heater hoses at both ends and check for obstructions. Repair as necessary.
	5. Heater hose kinked or obstructed.	5. Locate kinked or obstructed area. Repair as necessary.
	6. Thermostat possibly stuck open.	6. (Refer to 7 - COOLING/ENGINE/ ENGINE COOLANT THERMOSTAT - DIAGNOSIS AND TESTING)
	7. Water pump is not pumping coolant to heater core. When the engine is fully warmed up, both heater hoses should be hot to the touch. If only one of the hoses is hot, the water pump may not be operating correctly.	7. (Refer to 7 - COOLING/ENGINE/ WATER PUMP - DIAGNOSIS AND TESTING)
HEAT ODOR	1. Various heat shields are used at certain driveline components. One or more of these shields may be missing.	1. Locate missing shields and replace or repair as necessary.
	2. Is the temperature gauge reading above the normal range?	2. Refer to Temperature Gauge Reads High in these Diagnosis Charts.

COOLING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
	3. Radiator fan operating incorrectly. 4. Has undercoating been applied to any unnecessary component? 5. Engine may be running rich, causing the catalytic converter to overheat	3. (Refer to 7 - COOLING/ENGINE/ RADIATOR FAN - DIAGNOSIS AND TESTING) Repair as necessary. 4. Clean undercoating as necessary. 5. (Refer to Appropriate Diagnostic Information)
POOR DRIVEABILITY (THERMOSTAT POSSIBLY STUCK OPEN). GAUGE MAY BE READING LOW.	1. For proper driveability, clean vehicle emissions and prevention of buildup of engine oil sludge, the thermostat must be operating properly. Has a diagnostic trouble code been set?	1. (Refer to Appropriate Diagnostic Information) Replace thermostat if necessary
STEAM IS COMING FROM FRONT OF VEHICLE NEAR GRILL AREA WHEN WEATHER IS WET, ENGINE WARMED UP AND RUNNING WITH VEHICLE STATIONARY, OR JUST SHUT OFF. TEMPERATURE GAUGE IS NORMAL.	1. During wet weather, moisture (snow, ice, rain, or condensation) on the radiator will evaporate when the thermostat opens. The thermostat opening allows heated coolant into the radiator. When the moisture contacts the hot radiator, steam may be emitted. this usually occurs in cold weather with no fan or air flow to blow it away.	1. Occasional steam emitting from this area is normal. No repair is necessary.
COOLANT COLOR	1. Coolant color is not necessarily an indication of adequate corrosion or temperature protection. Do not rely on coolant color for determining condition of coolant.	1. Check the freeze point of the coolant. (Refer to 7 - COOLING/ ENGINE/COOLANT - DIAGNOSIS AND TESTING) Adjust the ethylene glycol-to-water ratio as necessary and service according to maintenance schedule. (Refer to LUBRICATION & MAINTENANCE/MAINTENANCE SCHEDULES - DESCRIPTION)
COOLANT LEVEL CHANGES IN COOLANT BOTTLE. TEMPERATURE GAUGE IS IN NORMAL RANGE.	1. Level changes are to be expected as coolant volume fluctuates with engine temperature. The coolant level will also drop as the system removes air from a recent filling.	1. A normal condition. No repair is necessary.

DIAGNOSIS AND TESTING - COOLING SYSTEM LEAK

With engine not running, wipe the coolant bottle neck sealing seat clean.

Attach a radiator pressure tester to the coolant bottle, as shown in (Fig. 2) and apply 104 kPa (15 psi) pressure. If the pressure drops more than 2 psi in 2 minutes inspect all points for external leaks.

All hoses, radiator and heater, should be moved while at 15 psi since some leaks occur while driving due to engine rock, etc.

If the cooling system will not pressurize easily and there is no coolant leaks, the cooling system is only partially filled. (Refer to 7 - COOLING - STANDARD PROCEDURE - COOLING SYSTEM FILL)

If there are no external leaks after the gauge dial shows a drop in pressure, detach the tester. Start engine and run the engine to normal operating tem-

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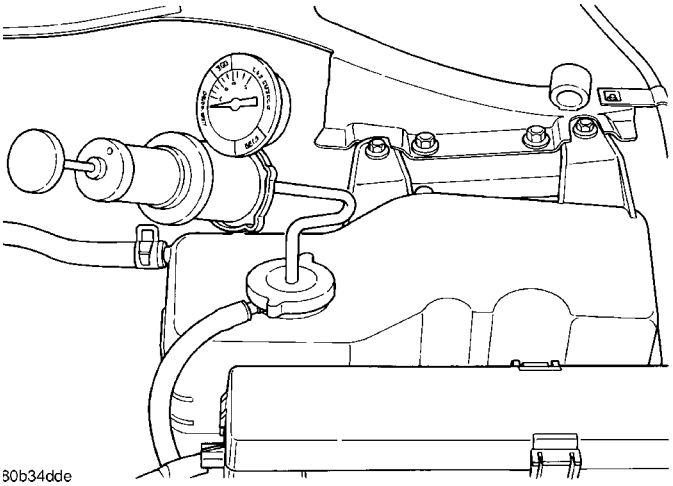


Fig. 2 PRESSURE TESTING COOLING SYSTEM

perature in order to open the thermostat and allow the coolant to expand. Reattach the tester. If the needle on the dial fluctuates it indicates a combustion leak, usually a head gasket leak.

WARNING: WITH TOOL IN PLACE PRESSURE BUILDS UP FAST. ANY EXCESSIVE AMOUNT OF PRESSURE BUILT UP BY CONTINUOUS ENGINE OPERATION MUST BE RELEASED TO A SAFE PRESSURE POINT. NEVER PERMIT PRESSURE TO EXCEED 138 kPa (20 psi).

If the needle on the dial does not fluctuate, race the engine a few times. If an abnormal amount of coolant or steam is emitted from the tail pipe, it may indicate a faulty head gasket, cracked engine block or cylinder head.

There may be internal leaks which can be determined by removing the oil dipstick. If water globules appear intermixed with the oil it will indicate an internal leak in the engine. If there is an internal leak, the engine must be disassembled for repair.

DIAGNOSIS AND TESTING - COOLING SYSTEM AERATION

Low coolant level in a cross flow radiator will equalize in both tanks with engine off. With engine at running and at operating temperature, the high pressure inlet tank runs full and the low pressure outlet tank drops. If this level drops below the top of the transmission oil cooler, aeration will occur drawing air into the water pump resulting in the following:

- High reading shown on the temperature gauge.
- Loss of coolant flow through the heater core.
- Corrosion in the cooling system.
- Transmission oil will become hotter.
- Water pump seal may run dry, increasing the risk of premature seal failure.
- Combustion gas leaks into the coolant can also cause the above problems.

DIAGNOSIS AND TESTING - COOLING SYSTEM DEAERATION

As air is removed from the cooling system, it gathers in the coolant bottle. This pressure is released into the atmosphere through the pressure valve located in the pressure cap when pressure reaches 96 - 124 kPa (14 - 18 psi). This air is replaced with coolant from the coolant bottle, when the system is allowed to cool.

NOTE: Deaeration does not occur at engine idle—higher engine speeds are required. Normal driving will deaerate cooling system.

To effectively deaerate the system, multiple thermal cycles of the system may be required.

STANDARD PROCEDURE

STANDARD PROCEDURE - COOLANT LEVEL CHECK

NOTE: Do not remove coolant bottle pressure cap for routine coolant level inspections.

The coolant bottle provides a quick visual method for determining the coolant level without removing the pressure cap. With the engine cold, the level of the coolant in the coolant bottle (Fig. 3) should be between the MIN and MAX lines on the bottle.

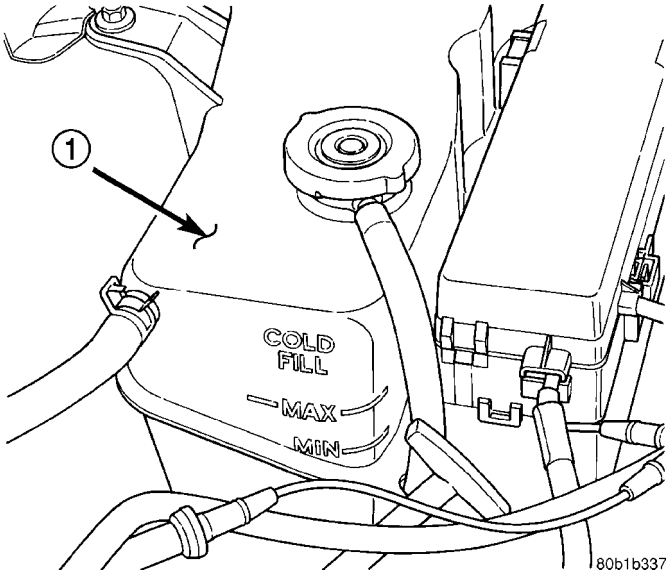


Fig. 3 COOLANT BOTTLE COLD FILL LEVEL

1 - COOLANT PRESSURE BOTTLE

COOLING (Continued)

STANDARD PROCEDURE - COOLING SYSTEM DRAINING

When servicing the cooling system, it is essential that coolant does not drip on the drive belts or pulleys. If necessary, shield the belts with shop towels before working on the cooling system. If coolant contacts the belts or pulleys, flush both with clean water.

WARNING: DO NOT REMOVE HOSE CLAMPS OR HOSES, CYLINDER BLOCK DRAIN PLUGS, COOLANT BOTTLE CAP, OR OPEN THE RADIATOR DRAINCOCK, WHEN THE SYSTEM IS HOT AND UNDER PRESSURE BECAUSE SERIOUS BURNS FROM THE COOLANT CAN OCCUR.

The radiator draincock that is located at the lower right side of radiator (Fig. 4). The draincock stem is closed in the horizontal position, pointing to 3:00 o'clock. Draining takes place through the cooling module's lower right side insulator. **Do Not Use pliers to open draincock.**

CAUTION: Do not pull outward on the draincock flange while opening. Damage to the draincock body and O-ring seal may occur

(1) To open the draincock to the minimum drain position, turn the draincock stem countercolockwise to the 12:00 o'clock position. For the maximum drain position, turn draincock stem counterclockwise 180 degrees to the 9:00 o'clock position.

(2) Remove coolant pressure bottle cap and open the bleed valve.

(3) Remove the cylinder block drain plug(s) located below each exhaust manifold.

Most service drains are about 80 percent of capacity because not all coolant is drained from system. For capacity specifications, (Refer to LUBRICATION & MAINTENANCE - SPECIFICATIONS - FLUID CAPACITIES)

CAUTION: The cooling system normally operates at 97-124 kPa (14-18 psi) pressure. Exceeding this pressure may damage the radiator or hoses.

STANDARD PROCEDURE - COOLING SYSTEM FILLING

WARNING: MAKE SURE ENGINE COOLING SYSTEM IS COOL BEFORE REMOVING PRESSURE CAP OR ANY HOSE. SEVERE PERSONAL INJURY MAY RESULT FROM ESCAPING HOT COOLANT. THE COOLING SYSTEM IS PRESSURIZED WHEN HOT.

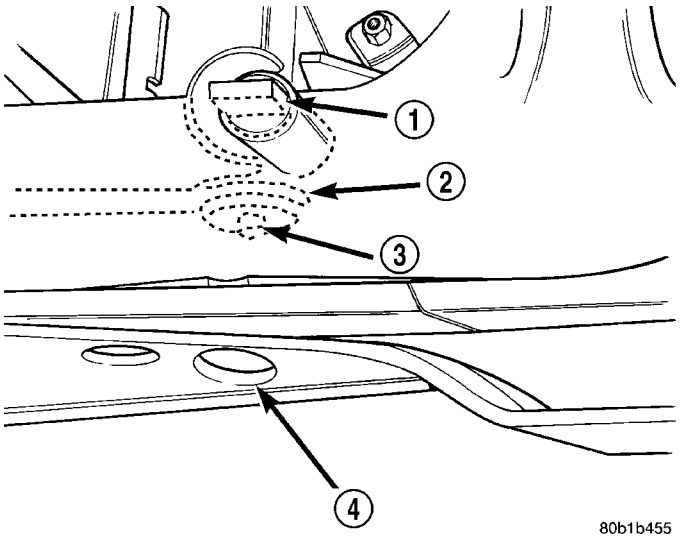


Fig. 4 RADIATOR DRAINCOCK LOCATION

1 - DRAINCOCK STEM
2 - INSULATOR
3 - DRAIN
4 - DRAIN HOLE

CAUTION: Do not use well water, or suspect water supply in cooling system. Use only a 50/50 mixture of the specified ethylene glycol type antifreeze/coolant and distilled water. (Refer to LUBRICATION & MAINTENANCE/FLUID TYPES - DESCRIPTION).

NOTE: COOLING SYSTEM FILL PROCEDURE IS CRITICAL TO OVERALL COOLING SYSTEM PERFORMANCE.

(1) Close radiator draincock by turning the stem clockwise to the 3:00 o'clock position. **Hand tighten only.**

(2) Install engine block drain plugs, if removed.

WARNING: WHEN INSTALLING DRAIN HOSE TO AIR BLEED VALVE, ROUTE HOSE AWAY FROM ACCESSORY DRIVE BELTS, ACCESSORY DRIVE PULLEYS, AND ELECTRIC COOLING FAN MOTORS.

(3) Attach one end of a 6.35 mm (0.250 in.) ID clear hose that is approximately 1200 mm (48 in.) long, to the bleed valve.

- **Bleed Valve Location (2.7L):** Located on the water outlet connector at the front of engine (Fig. 5).
- **Bleed Valve Location (3.5L):** Located on the lower intake manifold, left of center and below the upper intake plenum (Fig. 5).

(4) Route hose away from the accessory drive belt, drive pulleys and electric cooling fan. Place the other end of hose into a clean container. The hose will prevent coolant from contacting the accessory drive belt when bleeding the system during the refilling operation (Fig. 5).

COOLING (Continued)

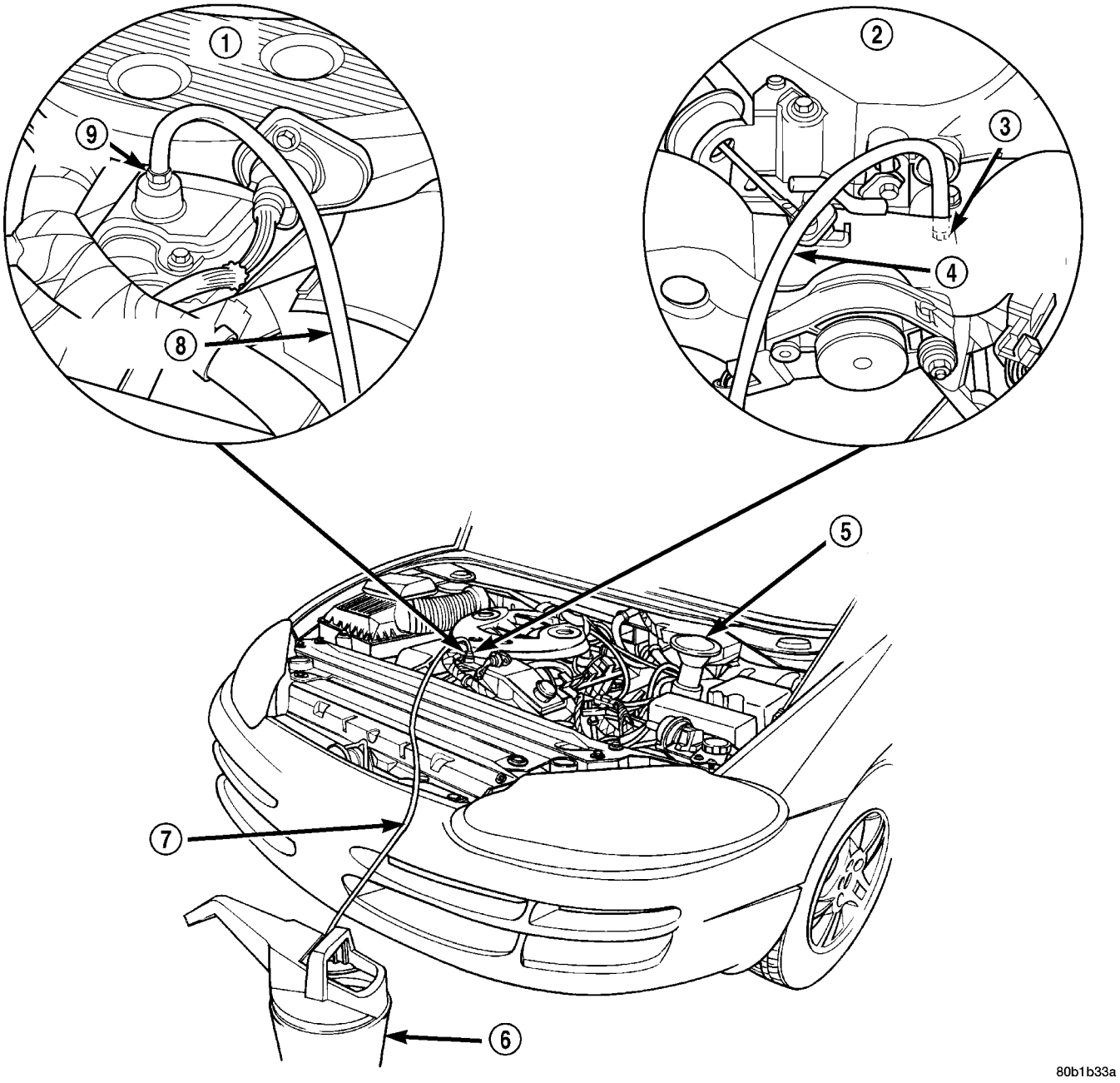


Fig. 5 COOLING SYSTEM BLEEDING

1 - 2.7L ENGINE
2 - 3.5L ENGINE
3 - BLEED VALVE
4 - TO COOLANT CONTAINER
5 - SPECIAL TOOL 8195
6 - COOLANT CONTAINER
7 - HOSE
8 - TO COOLANT CONTAINER
9 - BLEED VALVE

COOLING (Continued)

NOTE: IT IS IMPERATIVE THAT THE COOLING SYSTEM AIR BLEED VALVE BE OPENED BEFORE ANY COOLANT IS ADDED TO THE COOLING SYSTEM. FAILURE TO OPEN THE BLEED VALVE FIRST WILL RESULT IN AN INCOMPLETE FILL OF THE SYSTEM.

(5) Open the cooling system bleed valve (Fig. 5).

(6) Attach Special Tool 8195, Filling Aid Funnel to pressure bottle filler neck (Fig. 6).

(7) Use the supplied clip to pinch overflow hose that connects between the two chambers of the coolant bottle (Fig. 6).

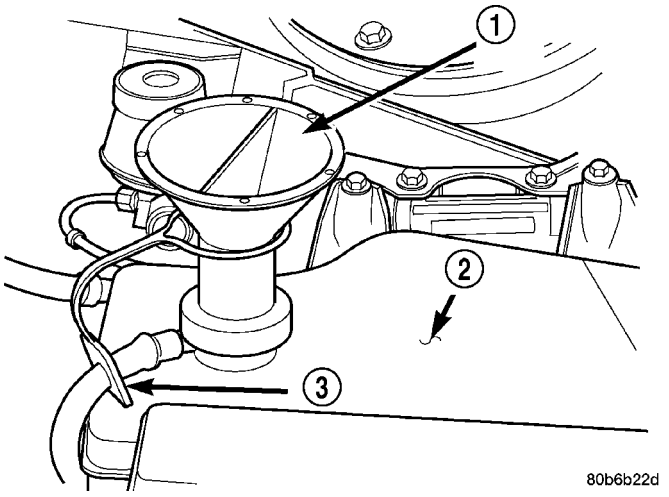


Fig. 6 SPECIAL TOOL 8195

1 - SPECIAL TOOL 8195
2 - PRESSURE BOTTLE
3 - PINCH OVERFLOW HOSE

CAUTION: Do not mix coolants. If coolant is used other than specified, a reduction in corrosion protection will occur.

(8) Pour a 50/50 mix of Mopar® Antifreeze/Coolant, 5 Year/100,000 Mile Formula and distilled water into the larger section of Filling Aid Funnel (the smaller section of funnel is to allow air to escape). For system capacity, (Refer to LUBRICATION & MAINTENANCE - SPECIFICATIONS - FLUID CAPACITIES).

(9) Slowly fill the cooling system until a steady stream of coolant flows from the hose attached to the bleed valve (Fig. 5).

(10) Close the bleed valve and continue filling system to the top of the Filling Funnel.

(11) Remove clip from overflow hose (Fig. 6).

(12) Allow the coolant in Filling Funnel to drain into overflow chamber of the pressure bottle.

(13) Remove Special Tool 8195, Filling Aid Funnel. Install cap on coolant pressure bottle.

(14) Remove hose from bleed valve.

(15) Start engine and run until it reaches operating temperature.

NOTE: The engine cooling system will push any remaining air into the coolant bottle within about an hour of normal driving. As a result, a drop in coolant level in the pressure bottle may occur. If the engine cooling system overheats and pushes coolant into the overflow side of the coolant bottle, this coolant will be sucked back into the cooling system ONLY IF THE PRESSURE CAP IS LEFT ON THE BOTTLE. Removing the pressure cap breaks the vacuum path between the two bottle sections and the coolant will not return to cooling system.

(16) Shut off engine allow it to cool down. This permits coolant to be drawn into the pressure chamber.

(17) With engine COLD, observe coolant level in pressure chamber. Coolant level should be within MIN and MAX marks. Adjust coolant level as necessary.

NOTE: The coolant bottle has two chambers. Coolant will normally only be in the inboard (smaller) of the two. The outboard chamber is only to recover coolant in the event of an overheat or after a recent service fill. The outboard chamber should normally be empty. If there is coolant in the overflow side of the coolant bottle (after several warm/cold cycles of the engine) and coolant level is within MIN and MAX marks, disconnect the end of the overflow hose at the fill neck and lower it into a clean container. Allow coolant to drain into the container until emptied. Reconnect overflow hose to fill neck.

COOLING (Continued)

STANDARD PROCEDURE - ADDING ADDITIONAL COOLANT

CAUTION: Do not use well water, or suspect water supply in cooling system. Use only a 50/50 mixture of the specified ethylene glycol type antifreeze/coolant and distilled water. (Refer to LUBRICATION & MAINTENANCE/FLUID TYPES - DESCRIPTION).

When additional coolant is needed, it should be added to the coolant pressure bottle.

For coolant service schedules (Refer to LUBRICATION & MAINTENANCE/MAINTENANCE SCHEDULES - DESCRIPTION).

WARNING: DO NOT OPEN COOLING SYSTEM WHEN HOT AND UNDER PRESSURE BECAUSE PERSONAL INJURY AND SERIOUS BURNS FROM COOLANT CAN OCCUR. ALLOW ENGINE TO COOL BEFORE SERVICING COOLING SYSTEM.

(1) Try squeezing the radiator upper hose to determine if the system is still pressurized.

(2) Place a shop towel over the pressure cap and turn to the first stop. Wait to see if any pressure is released. When no pressure is released, press down on the cap and turn to the second stop. Remove cap (Fig. 7).

NOTE: If the coolant pressure bottle is completely empty, (Refer to 7 - COOLING - STANDARD PROCEDURE - COOLING SYSTEM FILLING).

(3) If there is some coolant in coolant pressure bottle, slowly fill coolant pressure bottle.

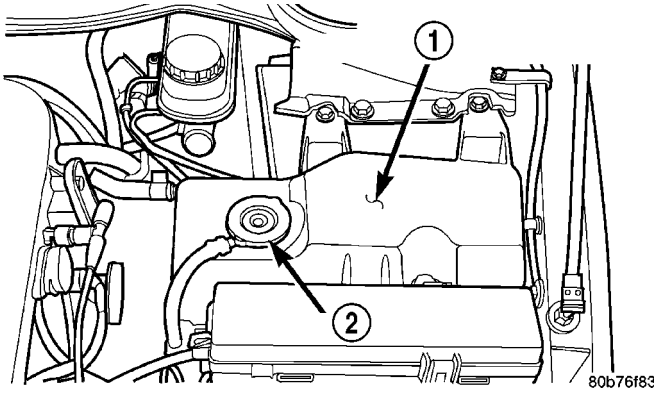


Fig. 7 COOLANT BOTTLE LOCATION

1 - COOLANT RECOVERY PRESSURE BOTTLE
2 - PRESSURE CAP

SPECIFICATIONS

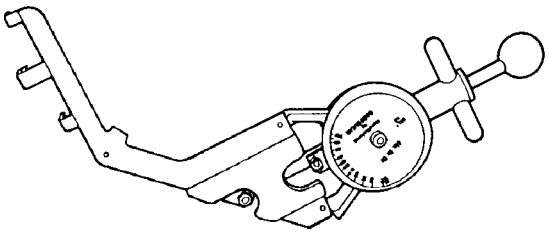
TORQUE

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
A/C Condenser to Radiator - Bolts	5	—	45
A/C Belt Tensioner & Pulley (2.7L) - Bolts	28	—	250
A/C Belt Tensioner Pulley (3.5L) - Nut	54	40	—
Engine Block Heater	12	—	105
Cooling System Bleed Valve - (2.7L)	12	—	110
Cooling System Bleed Valve - (3.5L)	8	—	70
Condenser Inlet Tube Bracket Screw	5	—	45
Engine Oil Cooler - Lines to Engine	30	—	260
Engine Oil Cooler - Lines to Radiator	18	—	160
Engine Coolant Sensor	28	20	—
Radiator Fan to Radiator - Screws	5	—	45
Generator/Power Steering Belt Tensioner Pulley - Nut	54	40	—
Thermostat Housing	12	—	105
Transmission Oil Cooler - Hose Clamps	3	—	28
Transmission Oil Cooler - Flare Nuts at Trans	30	—	260
Water Pump - Bolts	12	—	105
Water Outlet Connector - Bolts	12	—	105

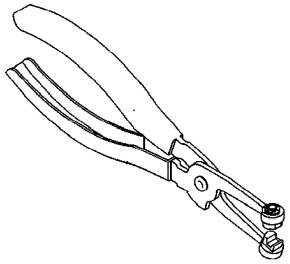
COOLING (Continued)

SPECIAL TOOLS

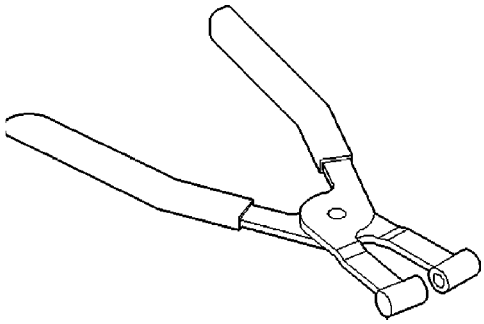
COOLING



Belt Tension Gauge 7198

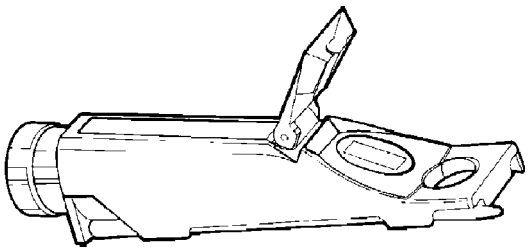


Hose Clamp Pliers 8495

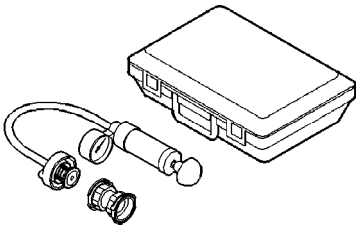


Hose Clamp Pliers 6094

Filling Aid Funnel 8195



Coolant Refractometer 8286



Cooling System Tester 7700

ACCESSORY DRIVE

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ACCESSORY DRIVE

DESCRIPTION

The accessory drive system on 2.7L and 3.5L engines utilizes two different belts. A conventional V-belt drives the air conditioning compressor on 3.5L engines, a Poly-V belt on the 2.7L engine. A Poly-V belt drives the generator and power steering pump on all engines.

OPERATION

The accessory drive belts provide the link between the engine crankshaft and the engine driven accessories.

DIAGNOSIS AND TESTING - ACCESSORY DRIVE BELT

CONDITION	POSSIBLE CAUSE	CORRECTION
INSUFFICIENT ACCESSORY OUTPUT DUE TO BELT SLIPPAGE	1. Belt too loose.	1. Adjust belt tension.
	2. Belt excessively glazed or worn.	2. Replace and tighten as specified.
BELT SQUEAL WHEN ACCELERATING ENGINE	1. Belts too loose.	1. Adjust belt tension.
	2. Belts glazed.	2. Replace belts.
BELT CHIRP AT IDLE	1. Belts too loose.	1. Adjust belt tension.
	2. Foreign material imbedded in belt.	2. Replace belt.
	3. Non-uniform belt.	3. Replace belt.
	4. Misaligned pulley(s).	4. Align accessories.
	5. Non-uniform groove or eccentric pulley.	5. Replace pulley(s).
BELT ROLLED OVER IN GROOVE OR BELT JUMPS OFF	1. Broken cord in belt.	1. Replace belt.
	2. Belt too loose, or too tight.	2. Adjust belt tension.
	3. Misaligned pulleys.	3. Align accessories.
	4. Non-uniform grooves or eccentric pulley.	4. Replace pulley(s).

DRIVE BELTS - 2.7L

REMOVAL

GENERATOR/POWER STEERING BELT

(1) Loosen tensioner pulley locking nut (Fig. 1).
(2) Loosen belt adjusting bolt (Fig. 1).
(3) Remove generator/power steering belt.

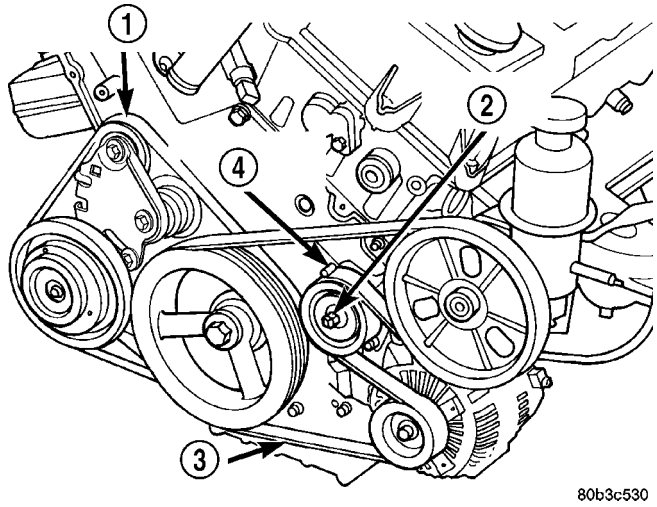

Fig. 1 ACCESSORY DRIVE BELTS

1 - A/C DRIVE BELT
2 - LOCKING NUT
3 - GENERATOR/POWER STEERING DRIVE BELT
4 - ADJUSTING BOLT

AIR CONDITIONING BELT

NOTE: The A/C drive belt self tensioner is NOT a dynamic tensioner. After adjustment the tensioner bracket bolts are tightened. The torsion spring is no longer responsible for tensioning the A/C belt. The torsion spring is only used for initial belt tensioning.

(1) Remove generator/power steering belt to gain access to A/C belt. Refer to GENERATOR/POWER STEERING BELT for procedure.
(2) Loosen **BUT DO NOT REMOVE** tensioner locking bolt and pivot bolt (Fig. 2).
(3) Insert 1/2" drive breaker bar into square opening on belt tensioner. Rotate tensioner counterclockwise until belt can be removed from pulleys (Fig. 2).
(4) Slowly rotate tensioner clockwise to relieve spring load.

CLEANING

Clean all foreign debris from belt pulley grooves. The belt pulleys must be free of oil, grease, and coolants before installing the drive belt.

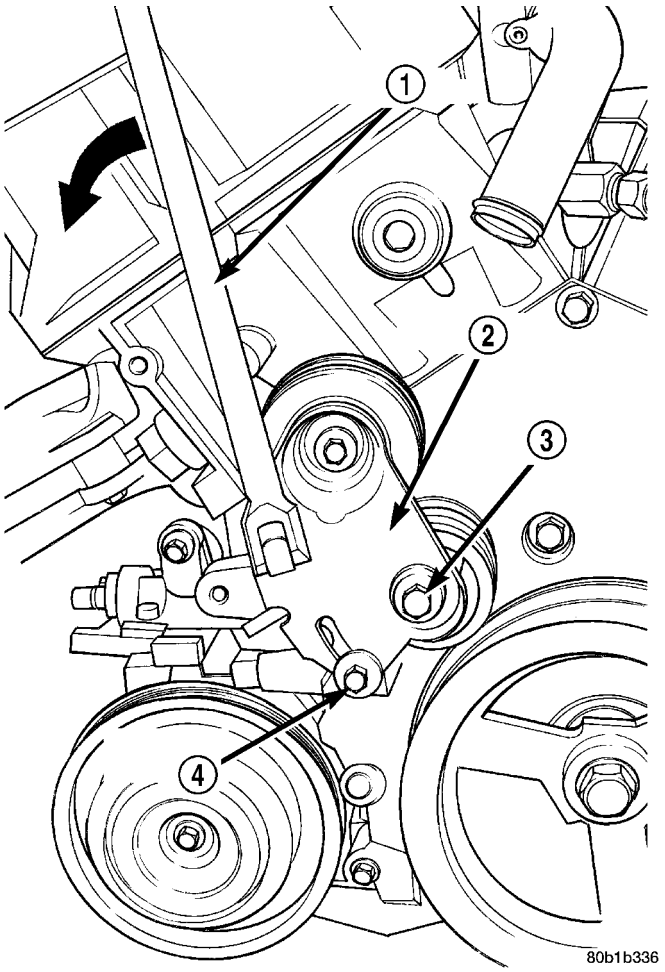

Fig. 2 AIR CONDITIONING DRIVE BELT

1 - 1/2" DRIVE BREAKER BAR
2 - TENSIONER
3 - PIVOT BOLT
4 - LOCKING BOLT

INSPECTION

Belt replacement under any or all of the following conditions is required:

- Excessive wear
- Frayed cords
- Severe glazing

Poly-V Belt system may develop minor cracks across the ribbed side (due to reverse bending). These minor cracks are considered normal and acceptable. Parallel cracks are not (Fig. 3).

NOTE: Do not use any type of belt dressing or restorer on Poly-V Belts.

DRIVE BELTS - 2.7L (Continued)

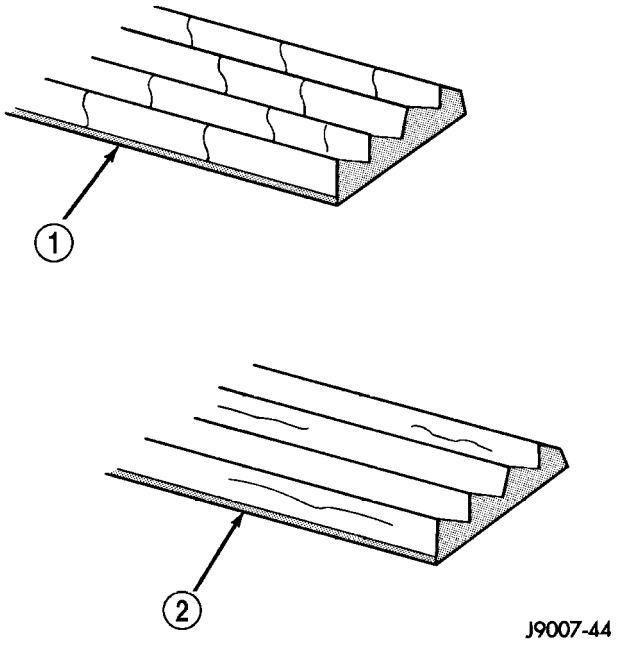

Fig. 3 Drive Belt Wear Pattern

1 - NORMAL CRACKS - BELT OK
2 - NOT NORMAL CRACKS - REPLACE BELT

INSTALLATION

AIR CONDITIONING BELT - NEW

WARNING: DO NOT REMOVE A/C BELT TENSIONER LOCKING BOLT WITHOUT FIRST HOLDING THE TENSIONER WITH A 1/2" DRIVE BREAKER BAR, AS PERSONAL INJURY COULD RESULT.

NOTE: Verify that torsion spring position is in the new belt position before installing a NEW belt (Fig. 4). If torsion spring is not in the new belt position, follow steps 1–7 to change the tensioner spring from the USED belt position to the NEW belt position.

(1) Insert a 1/2" drive breaker bar into the square opening on the tensioner. Hold counterclockwise pressure on tensioner while removing the locking bolt (Fig. 2).

(2) Carefully release spring load of the torsion spring on the tensioner.

(3) Remove pivot bolt, tensioner, and spring from front timing cover.

(4) Insert spring arm into the NEW belt position on the tensioner (Fig. 4).

(5) Install torsion spring, tensioner, and pivot bolt.

(6) Install pivot bolt. Tighten only finger tight, at this time.

(7) Using a 1/2" drive breaker bar, apply counterclockwise pressure until locking bolt can be installed.

(8) Install the NEW belt by rotating the tensioner counterclockwise until the NEW belt can be installed on pulleys. See (Fig. 5) for belt routing.

(9) Release tensioner and remove breaker bar. Belt is automatically adjusted with the tensioner's torsion spring.

(10) Tighten tensioner locking bolt and pivot bolt to 28 N·m (250 in. lbs.) (Fig. 2).

(11) Install generator/power steering belt. Refer to GENERATOR/POWER STEERING BELT INSTALLATION for procedure.

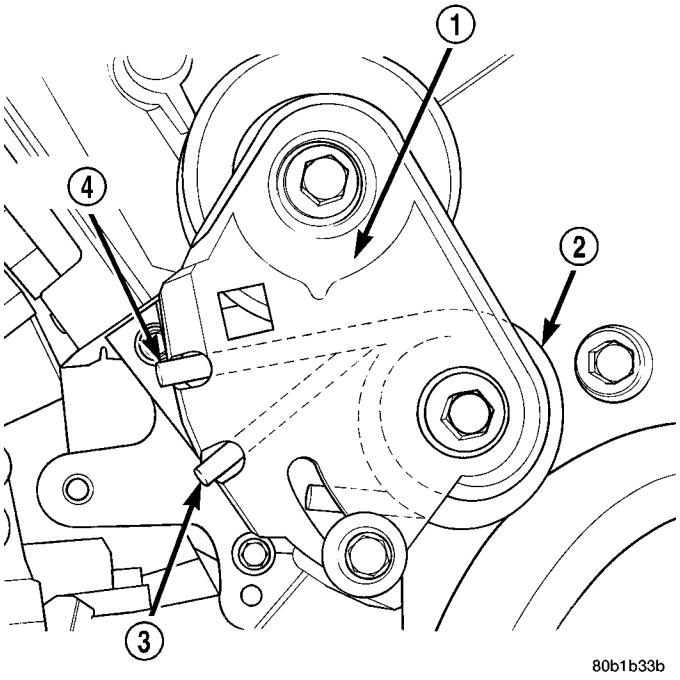

Fig. 4 Air Conditioning Belt Tensioner Spring Position

1 - TENSIONER
2 - TORSION SPRING
3 - NEW BELT POSITION
4 - USED BELT POSITION

AIR CONDITIONING BELT - USED

NOTE: A "used belt" is considered having more than 500 miles of service use.

NOTE: Perform steps 1–7 to change the tensioner spring from the NEW belt position, to the USED belt position.

(1) Insert a 1/2" drive breaker bar into the square opening on tensioner. Hold counterclockwise pressure on tensioner, while removing tensioner locking bolt (Fig. 2).

(2) Carefully release the tension of spring on tensioner.

DRIVE BELTS - 2.7L (Continued)

(3) Remove pivot bolt, tensioner, and spring from front cover.

(4) Insert spring into the USED belt position on tensioner bracket (Fig. 4).

(5) Install spring, tensioner bracket, and pivot bolt.

(6) Install pivot bolt. Tighten only finger tight, at this time.

(7) Using a 1/2" drive breaker bar, apply counterclockwise pressure until locking bolt can be installed.

(8) Install the USED belt by rotating tensioner counterclockwise until belt can be installed on pulleys. See (Fig. 5) for belt routing.

(9) Release tensioner and remove breaker bar. Belt is automatically adjusted with the tensioner's torsion spring.

(10) Tighten tensioner locking bolt and pivot bolt to 28 N·m (250 in. lbs.) (Fig. 2).

(11) Install generator/power steering belt. Refer to GENERATOR/POWER STEERING BELT INSTALLATION for procedure.

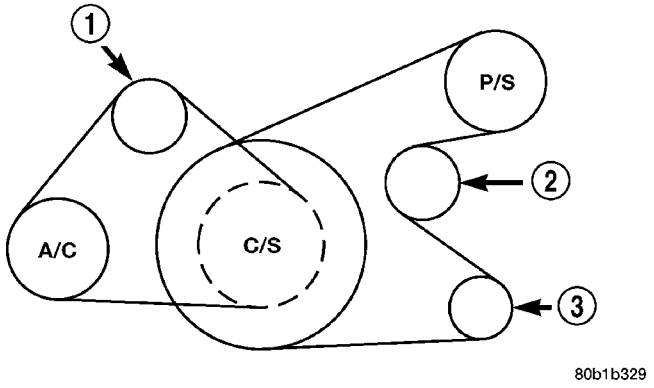

Fig. 5 BELT ROUTING - 2.7L

1 - IDLER
2 - IDLER
3 - GENERATOR

GENERATOR/POWER STEERING BELT INSTALLATION

(1) Install generator/power steering belt on pulleys.

(2) Tighten belt adjusting bolt to proper belt tension (Fig. 1). (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - ADJUSTMENTS)

(3) Tighten tensioner locking nut (Fig. 1).

ADJUSTMENTS - BELT TENSION

Use belt tension gauge, Special Tool 7198 for conventional V-belts and Poly-V belts. For Special Tool identification, (Refer to 7 - COOLING - SPECIAL TOOLS).

Adjust the belt tension for **NEW** or **USED** belt tension applications. Refer to BELT TENSION CHART—2.7/3.5L ENGINES.

BELT TENSION CHART—2.7/3.5L ENGINES

POLY-V BELT	GAUGE
Generator/Power Steering Belt (all engines)	New Belt: 836 ±44 N (190 ±10 lbs.)
	Used Belt: 534 N (120 lbs.)
V-BELT	GAUGE
Air Conditioning Belt (3.5L only)	New Belt: 667 ±44 N (160 ±10 lbs.)
	Used Belt: 534 N (120 lbs.)

DRIVE BELTS - 3.5L

REMOVAL

GENERATOR/POWER STEERING BELT

The Poly-V generator/power steering belt has an adjustable tensioner pulley located on the front timing belt cover.

(1) Loosen tensioner pulley locking nut.

(2) Raise vehicle on hoist.

(3) Remove the two (2) push clips attaching lower air shield to engine cradle. Remove air shield.

(4) Loosen tensioner adjusting bolt until the belt can be removed.

AIR CONDITIONING BELT

(1) Remove generator/power steering drive belt to gain access to the air conditioning drive belt. Refer to GENERATOR/POWER STEERING BELT for procedure.

(2) To remove air conditioning drive belt, first loosen the tensioner pulley lock nut, then loosen the adjusting screw to the tensioner pulley assembly until the belt can be removed (Fig. 6).

CLEANING

Clean all foreign debris from belt pulley grooves. The belt pulleys must be free of oil, grease, and coolants before installing the drive belt.

INSPECTION

Belt replacement under any or all of the following conditions is required:

- Excessive wear
- Frayed cords
- Severe glazing

Poly-V Belt system may develop minor cracks across the ribbed side (due to reverse bending). These minor cracks are considered normal and acceptable. Parallel cracks are not (Fig. 7).

DRIVE BELTS - 3.5L (Continued)

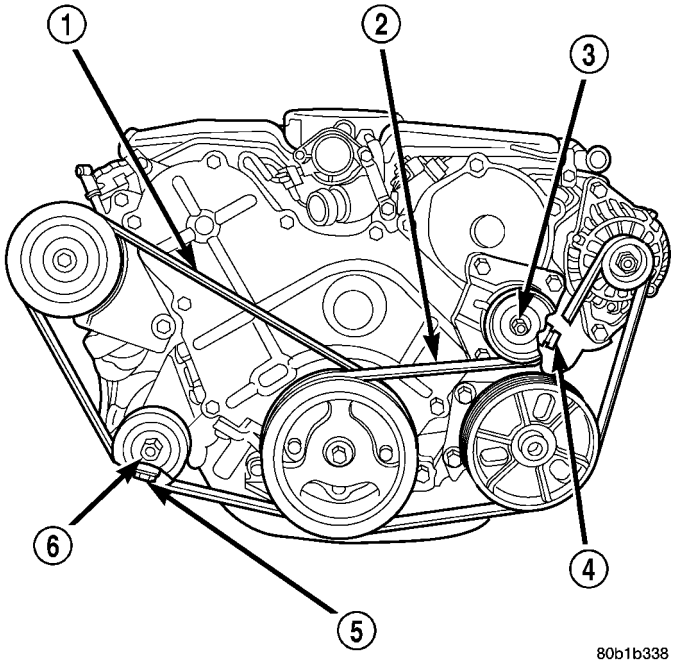

Fig. 6 ACCESSORY DRIVE BELTS

1 - V-BELT
2 - POLY-V BELT
3 - LOCKING NUT
4 - ADJUSTING BOLT
5 - ADJUSTING BOLT
6 - LOCKING NUT

NOTE: Do not use any type of belt dressing or restorer on Poly-V Belts.

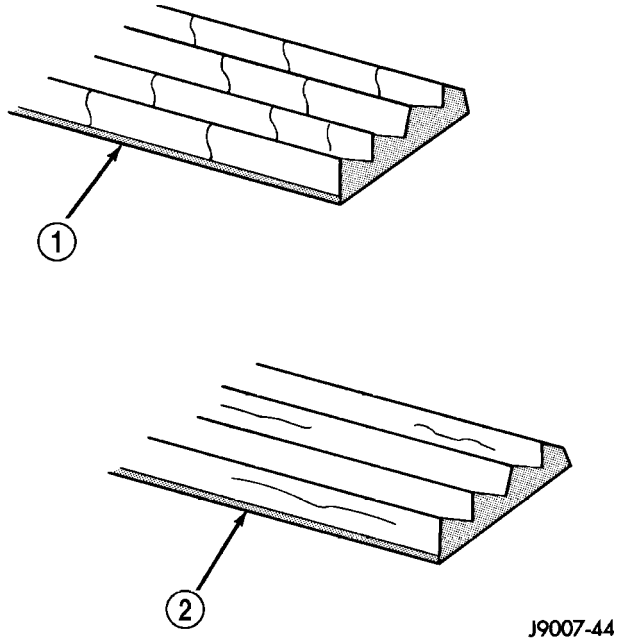

Fig. 7 Drive Belt Wear Pattern

1 - NORMAL CRACKS - BELT OK
2 - NOT NORMAL CRACKS - REPLACE BELT

INSTALLATION

NOTE: Use Special Tool 7198, Belt Tension Gauge to obtain proper tension on accessory drive belts. For Special Tool identification, (Refer to 7 - COOLING - SPECIAL TOOLS). For accessory drive belt tension specifications, (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - ADJUSTMENTS).

AIR CONDITIONING BELT

(1) Install air conditioning belt over drive pulleys. Tighten the tensioner adjusting bolt (Fig. 6) until the belt is at specified tension using a Belt Tension Gauge (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - ADJUSTMENTS). Tighten tensioner pulley locking nut to 54 N·m (40 ft. lbs.) (Fig. 6).

(2) Install generator/power steering drive belt and adjust to specified tension. Refer to GENERATOR/POWER STEERING BELT for procedure.

GENERATOR/POWER STEERING BELT

The Poly-V generator/power steering belt has an adjustable tensioner pulley located on the front timing belt cover.

(1) Install generator/power steering belt.

(2) Tighten adjusting bolt until the specified tension is obtained (Fig. 6) (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - ADJUSTMENTS).

(3) Install lower air shield and attaching push clips.

(4) Lower vehicle.

(5) Tighten tensioner pulley locking nut to 54 N·m (40 ft. lbs.) (Fig. 6).

ADJUSTMENTS - BELT TENSION

Use belt tension gauge, Special Tool 7198 for conventional V-belts and Poly-V belts. For Special Tool identification, (Refer to 7 - COOLING - SPECIAL TOOLS).

Adjust the belt tension for **NEW** or **USED** belt tension applications. Refer to BELT TENSION CHART—2.7/3.5L ENGINES.

BELT TENSION CHART—2.7/3.5L ENGINES

POLY-V BELT	GAUGE
Generator/Power Steering Belt (all engines)	New Belt: 836 ±44 N (190 ±10 lbs.)
	Used Belt: 534 N (120 lbs.)
V-BELT	GAUGE
Air Conditioning Belt (3.5L only)	New Belt: 667 ±44 N (160 ±10 lbs.)
	Used Belt: 534 N (120 lbs.)

ENGINE

TABLE OF CONTENTS

ENGINE

CLEANING

Drain cooling system and refill with clean water. Refer to drain and fill procedures in this section. Run engine with radiator cap installed until upper radiator hose is hot. Stop engine and drain water from system. If water is dirty; fill, run, and drain system again, until water runs clear. Refill cooling system with a 50/50 mixture of the recommended ethylene glycol and distilled water (Refer to LUBRICATION & MAINTENANCE/FLUID TYPES - DESCRIPTION).

ENGINE (Continued)

INSPECTION

After performing a cleaning/flush procedure, inspect all hoses, clamps and connections for deterioration and leaks. Inspect radiator and heater core for leaks.

COOLANT

DESCRIPTION - ENGINE COOLANT

WARNING: ANTIFREEZE IS AN ETHYLENE GLYCOL BASE COOLANT AND IS HARMFUL IF SWALLOWED OR INHALED. IF SWALLOWED, DRINK TWO GLASSES OF WATER AND INDUCE VOMITING. IF INHALED, MOVE TO FRESH AIR AREA. SEEK MEDICAL ATTENTION IMMEDIATELY. DO NOT STORE IN OPEN OR UNMARKED CONTAINERS. WASH SKIN AND CLOTHING THOROUGHLY AFTER COMING IN CONTACT WITH ETHYLENE GLYCOL. KEEP OUT OF REACH OF CHILDREN. DISPOSE OF GLYCOL BASE COOLANT PROPERLY, CONTACT YOUR DEALER OR GOVERNMENT AGENCY FOR LOCATION OF COLLECTION CENTER IN YOUR AREA. DO NOT OPEN A COOLING SYSTEM WHEN THE ENGINE IS AT OPERATING TEMPERATURE OR HOT UNDER PRESSURE, PERSONAL INJURY CAN RESULT. AVOID RADIATOR COOLING FAN WHEN ENGINE COMPARTMENT RELATED SERVICE IS PERFORMED, PERSONAL INJURY CAN RESULT.

CAUTION: Use of Propylene Glycol based coolants is not recommended, as they provide less freeze protection and less boiling protection.

The cooling system is designed around the coolant. The coolant must accept heat from engine metal, in the cylinder head area near the exhaust valves and engine block. Then coolant carries the heat to the radiator where the tube/fin radiator can transfer the heat to the air.

The use of aluminum cylinder blocks, cylinder heads, and water pumps requires special corrosion protection. Mopar® Antifreeze/Coolant, 5 Year/100,000 Mile Formula (MS-9769), or the equivalent ethylene glycol base coolant with hybrid organic corrosion inhibitors (called HOAT, for Hybrid Organic Additive Technology) is recommended. This coolant offers the best engine cooling without corrosion when mixed with 50% Ethylene Glycol and 50% distilled water to obtain a freeze point of -37°C (-35°F). If it loses color or becomes contaminated, drain, flush, and replace with fresh properly mixed coolant solution.

The green coolant **MUST NOT BE MIXED** with the orange or magenta coolants. When replacing coolant the complete system flush must be performed before using the replacement coolant.

CAUTION: Mopar® Antifreeze/Coolant, 5 Year/100,000 Mile Formula (MS-9769) may not be mixed with any other type of antifreeze. Doing so will reduce the corrosion protection and may result in premature water pump seal failure. If non-HOAT coolant is introduced into the cooling system in an emergency, it should be replaced with the specified coolant as soon as possible.

DIAGNOSIS AND TESTING - COOLANT CONCENTRATION TESTING

Coolant concentration should be checked when any additional coolant was added to system or after a coolant drain, flush and refill. The coolant mixture offers optimum engine cooling and protection against corrosion when mixed to a freeze point of -37°C (-34°F) to -46°C (-50°F). The use of a hydrometer or a refractometer can be used to test coolant concentration.

A hydrometer will test the amount of glycol in a mixture by measuring the specific gravity of the mixture. The higher the concentration of ethylene glycol, the larger the number of balls that will float, and higher the freeze protection (up to a maximum of 60% by volume glycol).

A refractometer (Special Tool 8286)(Refer to 7 - COOLING - SPECIAL TOOLS) will test the amount of glycol in a coolant mixture by measuring the amount a beam of light bends as it passes through the fluid.

Some coolant manufactures use other types of glycols into their coolant formulations. Propylene glycol is the most common new coolant. However, propylene glycol based coolants do not provide the same freezing protection and corrosion protection and is not recommended.

CAUTION: Do not mix types of coolant—corrosion protection will be severely reduced.

STANDARD PROCEDURE - COOLANT SERVICE

For engine coolant recommended service schedule, (Refer to LUBRICATION & MAINTENANCE/MAINTENANCE SCHEDULES - DESCRIPTION).

COOLANT OUTLET CONNECTOR - 2.7L

REMOVAL

WARNING: DO NOT REMOVE PRESSURE CAP WITH THE SYSTEM HOT AND UNDER PRESSURE BECAUSE SERIOUS BURNS FROM COOLANT CAN OCCUR.

(1) Drain cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
(2) Remove upper intake manifold (Refer to 9 - ENGINE/MANIFOLDS/INTAKE MANIFOLD - REMOVAL).
(3) Remove screws attaching heater tube to outlet connector.
(4) Disengage tube from outlet connector only enough for connector removal.
(5) Remove bolts attaching water outlet connector (Fig. 1).
(6) Remove outlet connector.

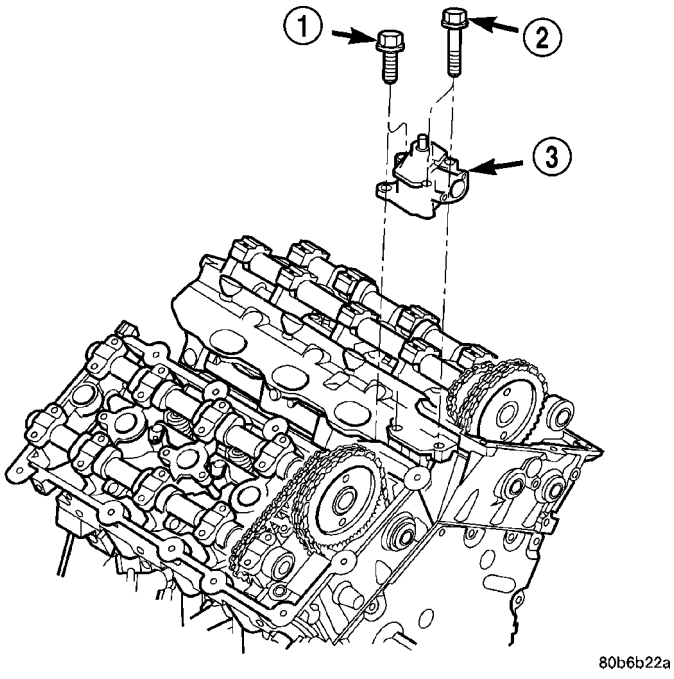

Fig. 1 Coolant Outlet Connector - 2.7L

1 - BOLT (2)
2 - BOLT (2)
3 - COOLANT OUTLET CONNECTOR

INSTALLATION

(1) Clean sealing surfaces. Inspect gaskets for tears and cuts. Replace as necessary.
(2) Install outlet connector and tighten bolts to 12 N·m (105 in. lbs.) (Fig. 1).
(3) Inspect and replace heater supply tube O-ring as necessary.
(4) Lubricate O-ring and insert heater tube assembly into outlet connector. Tighten screws to 3 N·m (30 in. lbs.).
(5) Install upper intake manifold (Refer to 9 - ENGINE/MANIFOLDS/INTAKE MANIFOLD - INSTALLATION).
(6) Fill cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).

COOLANT RECOVERY PRESSURE CONTAINER

DESCRIPTION

The coolant bottle consists of a pressure chamber and a overflow chamber (Fig. 2) that is mounted in the engine compartment (Fig. 3). The overflow hose connects the pressure chamber to the overflow chamber.

NOTE: Coolant will normally be in the pressure chamber side of the coolant bottle. The overflow chamber should normally be empty

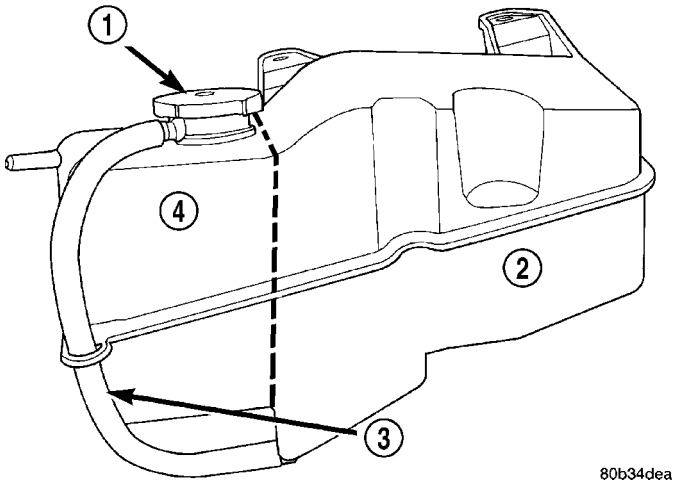

Fig. 2 COOLANT PRESSURE/RECOVERY BOTTLE

1 - PRESSURE CAP
2 - OVERFLOW CHAMBER
3 - OVERFLOW HOSE
4 - PRESSURE CHAMBER

OPERATION

The pressure chamber keeps the coolant free of trapped air, provides a volume for expansion and contraction, and provides a convenient and safe method for checking and adjusting coolant level at atmospheric pressure. It also provides some reserve coolant to cover minor leaks, evaporation or boiling losses. The overflow chamber allows coolant recovery in case of an overheat.

COOLANT RECOVERY PRESSURE CONTAINER (Continued)

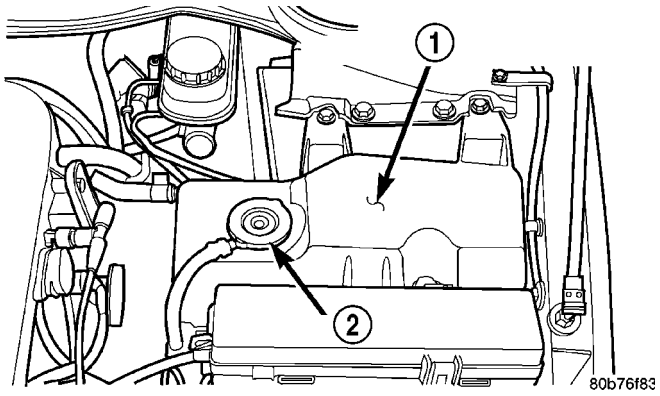

Fig. 3 COOLANT BOTTLE LOCATION

1 - COOLANT RECOVERY PRESSURE BOTTLE
2 - PRESSURE CAP

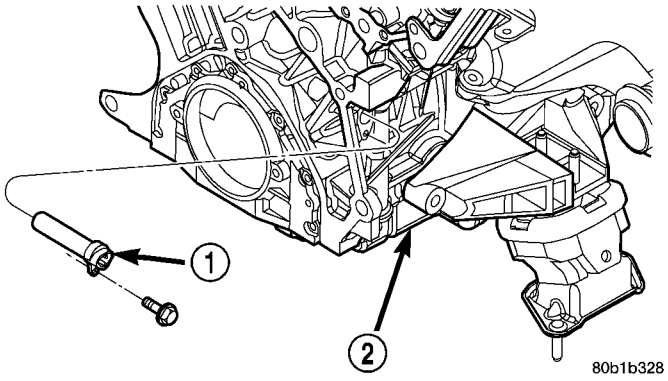

Fig. 4 ENGINE BLOCK HEATER

1 - BLOCK HEATER
2 - ENGINE — RIGHT SIDE

ENGINE BLOCK HEATER

DESCRIPTION

The engine block heater is mounted in the cylinder block, near the right rear corner (Fig. 4). The block heater is a dry cylinder type design and is powered by 110 volt AC. **The power cord must be secured in its retainer clips, and not positioned so it could contact linkages or exhaust manifolds and become damaged.**

OPERATION

When power is applied (110 volt AC) to the block heater, the heating element transfers heat through the aluminum engine block and into the coolant without directly penetrating the cooling system.

DIAGNOSIS AND TESTING - ENGINE BLOCK HEATER

If unit does not operate, trouble can be in either the power cord or the heater element. Test power cord for continuity with a 110-volt voltmeter or 110-volt test light; test heater element continuity with an ohmmeter or 12-volt test light.

REMOVAL

(1) Raise vehicle on hoist.
(2) Detach power cord plug from heater (Fig. 4).
(3) Remove block heater attaching screw located below heater terminals.
(4) Remove block heater from cylinder block.

INSTALLATION

(1) Thoroughly clean cylinder block heater cavity.
(2) Insert heater assembly into block such that mounting hole is located below heater terminals.
(3) Install mounting screw and tighten to 12 N·m (105 in. lbs.).
(4) Attach power cord to heater.

CAUTION: To prevent damage, the power cord must be secured in its retainer clips, and not positioned so it could contact linkages or exhaust manifolds.

(5) Lower vehicle.

ENGINE COOLANT TEMPERATURE SENSOR

DESCRIPTION

The engine coolant temperature sensor threads into the coolant system (Fig. 5) or (Fig. 6).

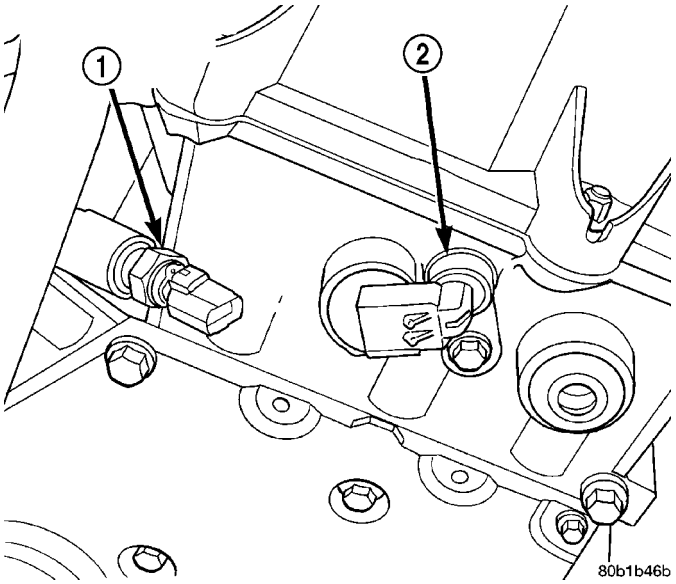

Fig. 5 ENGINE COOLANT TEMPERATURE SENSOR - 2.7L

1 - ENGINE COOLANT TEMPERATURE SENSOR
2 - CAMSHAFT POSITION SENSOR

ENGINE COOLANT TEMPERATURE SENSOR (Continued)

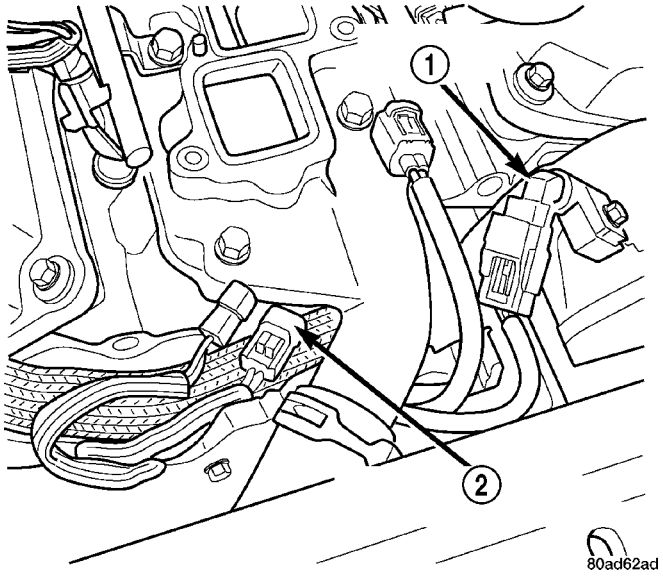

Fig. 6 ENGINE COOLANT TEMPERATURE SENSOR - 3.5L

1 - CAMSHAFT POSITION SENSOR
2 - ENGINE COOLANT TEMPERATURE SENSOR

OPERATION

The sensor provides an input to the Powertrain Control Module (PCM). As coolant temperature varies, the sensor resistance changes, resulting in a different input voltage to the PCM.

When the engine is cold, the PCM will demand slightly richer air-fuel mixtures and higher idle speeds until normal operating temperatures are reached.

The engine coolant sensor input also determines operation of the low and high speed cooling fans.

REMOVAL

(1) Disconnect negative cable from remote jumper terminal.

(2) With the engine cold, disconnect coolant sensor electrical connector (Fig. 5) or (Fig. 6).

(3) Remove sensor.

INSTALLATION

(1) Install engine coolant temperature sensor (Fig. 5) or (Fig. 6). Tighten sensor to 28 N·m (20 ft. lbs.) torque.

(2) Attach electrical connector to sensor.

(3) Connect negative cable to remote jumper terminal.

ENGINE COOLANT THERMOSTAT

DESCRIPTION

The thermostat on the 2.7L and 3.5L engines are located on the lower left side of engine, near the front (Fig. 7) and (Fig. 8). The thermostat on both engines are on the inlet side of the water pump. The thermostats have an air bleed located in the thermostat flange. The air bleed allows internal trapped air during cooling system filling to be released.

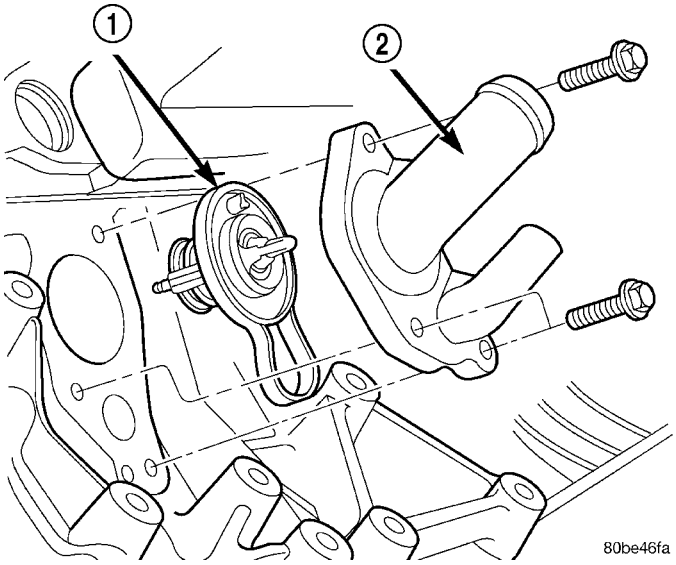

Fig. 7 THERMOSTAT AND HOUSING - 2.7L

1 - THERMOSTAT AND GASKET
2 - THERMOSTAT HOUSING/COOLANT INLET

OPERATION

The engine cooling thermostat is a wax pellet driven, reverse poppet type. The thermostat is located in the inlet side of the engine to provide fast warm up and to optimize a consistent temperature in the engine. The thermostat is designed to prevent leakage through it and to guarantee a minimum engine operating temperature of 82°C (180°F). They also automatically reach wide open at a temperature of approximately 95°C (203°F) so they do not restrict flow to the radiator as temperature of the coolant rises in hot weather to around 104°C (220°F). Above 102°C (215°F) the coolant temperature is controlled by the radiator, fan, and ambient temperature, not the thermostat.

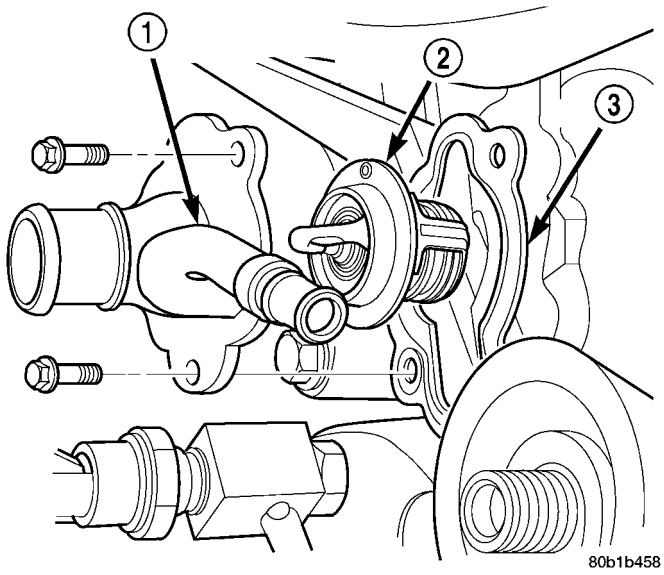

Fig. 8 THERMOSTAT AND HOUSING - 3.5L

1 - THERMOSTAT HOUSING/COOLANT INLET
2 - THERMOSTAT
3 - GASKET

DIAGNOSIS AND TESTING - ENGINE COOLANT THERMOSTAT

The thermostat is operated by a wax filled container (pellet) which is sealed so that when heated to a predetermined temperature, the wax expands enough to overcome the closing spring and water pump pressure, which forces the valve to open. Coolant leakage into the pellet will cause a thermostat to fail open. Do not attempt to free up a thermostat with a screwdriver.

The open too soon type failure mode is included in the on-board diagnosis. The check engine light will not be lit by an open too soon condition. If it has failed open, a DTC diagnostic trouble code will be set. Do not change a thermostat for lack of heat by gauge or heater performance, unless a code is present, (Refer to 7 - COOLING - DIAGNOSIS AND TESTING) for other probable causes. Failing shut is the normal long term mode of failure, and normally, only on high mileage vehicles. The temperature gauge will indicate this condition.

ENGINE COOLANT THERMOSTAT - 2.7L

REMOVAL

(1) Disconnect negative cable from remote jumper terminal.

WARNING: DO NOT REMOVE PRESSURE CAP WITH THE SYSTEM HOT AND UNDER PRESSURE BECAUSE SERIOUS BURNS FROM COOLANT CAN OCCUR.

(2) Drain cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
(3) Remove the engine oil dipstick and tube. To prevent coolant from entering engine, cover the dipstick tube opening in crankcase with a suitable plug.
(4) Raise vehicle on hoist.
(5) Support the engine and remove the left engine mount (Refer to 9 - ENGINE/ENGINE MOUNTING/ LEFT MOUNT - REMOVAL).
(6) Remove generator support strut.
(7) Disconnect generator electrical connector.
(8) Remove the transaxle dipstick tube bracket attaching bolt.
(9) Remove the lower heater hose tube bracket bolt.
(10) Remove the lower heater hose from thermostat housing.
(11) Remove radiator lower hose from thermostat housing.
(12) Remove thermostat housing bolts (Fig. 9).
(13) Remove thermostat and housing.

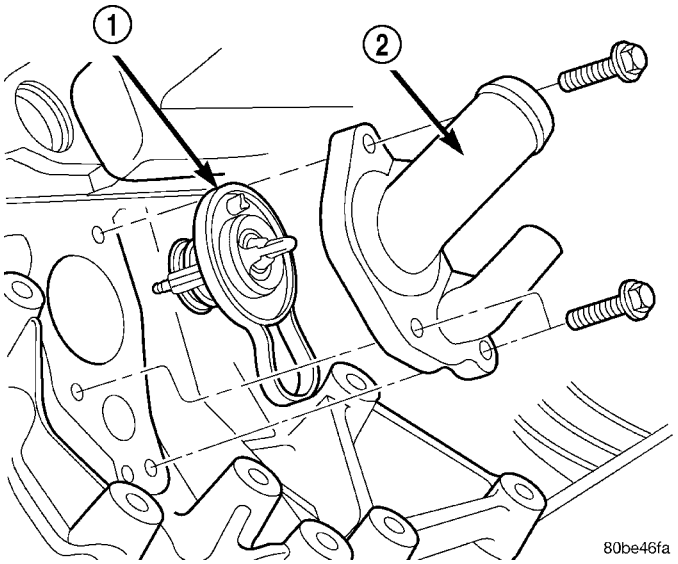

Fig. 9 Thermostat and Housing - 2.7L

1 - THERMOSTAT AND GASKET
2 - THERMOSTAT HOUSING/COOLANT INLET

ENGINE COOLANT THERMOSTAT - 2.7L (Continued)

INSTALLATION

(1) Clean gasket sealing surfaces.

NOTE: Install thermostat with the bleed valve located at the 12 o'clock position.

(2) Install thermostat and gasket into the thermostat housing.
(3) Install thermostat and housing to cylinder block. Tighten attaching bolts to 12 N·m (105 in. lbs.) (Fig. 9).
(4) Connect the heater return and radiator lower hoses to the thermostat housing. Install hose clamps.
(5) Install the heater hose tube bracket bolt.
(6) Install the transaxle dipstick tube bracket attaching bolt.
(7) Install the generator support strut.
(8) Connect the generator electrical connector.
(9) Install the left engine mount (Refer to 9 - ENGINE/ENGINE MOUNTING/LEFT MOUNT - INSTALLATION).
(10) Lower vehicle.
(11) Inspect and replace dipstick O-ring as necessary. Install the engine oil dipstick and tube.
(12) Refill cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
(13) Connect negative cable to remote jumper terminal.

ENGINE COOLANT THERMOSTAT - 3.5L

REMOVAL

WARNING: DO NOT REMOVE PRESSURE CAP WITH THE SYSTEM HOT AND UNDER PRESSURE BECAUSE SERIOUS BURNS FROM COOLANT CAN OCCUR.

(1) Disconnect negative cable from remote jumper terminal.
(2) Drain cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
(3) Raise vehicle on hoist.
(4) Disconnect electrical connectors from engine oil and power steering pressure switches.
(5) Disconnect radiator and heater hoses from thermostat housing.
(6) Remove thermostat housing bolts (Fig. 10).
(7) Remove housing, thermostat, and gasket.

NOTE: The OEM thermostat is staked in place at the factory. To ensure proper seating of replacement thermostat, carefully remove the bulged metal from the thermostat housing using a suitable hand held grinder. It is not necessary to restake the replacement thermostat into the thermostat housing.

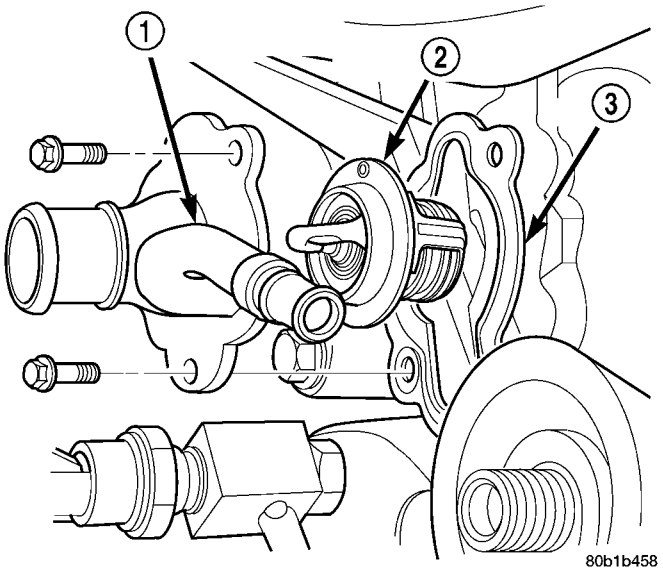

Fig. 10 Thermostat and Housing - 3.5L

1 - THERMOSTAT HOUSING/COOLANT INLET
2 - THERMOSTAT
3 - GASKET

INSTALLATION

NOTE: The OEM thermostat is staked in place at the factory. To ensure proper seating of replacement thermostat, carefully remove the bulged metal from the thermostat housing using a suitable hand held grinder. It is not necessary to restake the replacement thermostat into the thermostat housing.

(1) Clean gasket sealing surfaces.
(2) Install thermostat and gasket into thermostat housing. For ease of installation, install bolts in housing for thermostat and gasket retention.
(3) Install thermostat and housing to cylinder block (Fig. 10). Tighten bolts to 12 N·m (105 in. lbs.).
(4) Connect heater and radiator hoses and install hose clamps.
(5) Connect electrical connectors to engine oil and power steering pressure switches.
(6) Lower vehicle and connect negative cable to remote jumper terminal.
(7) Refill cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
(8) Connect negative cable to remote jumper terminal.

HEATER SUPPLY TUBE - 2.7L

REMOVAL

WARNING: DO NOT REMOVE PRESSURE CAP WITH THE SYSTEM HOT AND UNDER PRESSURE BECAUSE SERIOUS BURNS FROM COOLANT CAN OCCUR.

(1) Drain cooling system. (Refer to 7 - COOLING - STANDARD PROCEDURE)
(2) Remove radiator upper crossmember. (Refer to 23 - BODY/EXTERIOR/GRILLE OPENING REINFORCEMENT - REMOVAL)
(3) Remove radiator upper hose at tube.
(4) Remove heater hose from heater tube at rear of engine.
(5) Disconnect heater tube from retaining clip at rear of engine.
(6) Disconnect electrical connector from coolant temperature sensor.
(7) Remove screws attaching heater tube to outlet connector (Fig. 11).
(8) Disengage heater tube from outlet connector (Fig. 11). To remove heater tube, move forward until the tube clears cylinder heads.

INSTALLATION

(1) Inspect heater tube O-ring. Replace as necessary.
(2) Lubricate O-ring with a silicone type grease such as Mopar® Dielectric Grease.
(3) Install the heater tube by inserting tube in-between cylinder heads. Insert tube into water outlet housing (Fig. 11).
(4) Attach heater tube to the retaining clip at rear of engine.
(5) Install attaching screws and tighten to 3 N·m (30 in. lbs.).
(6) Install radiator upper and heater hoses to heater tube.
(7) Connect electrical connector to coolant temperature sensor.
(8) Install radiator upper crossmember. (Refer to 23 - BODY/EXTERIOR/GRILLE OPENING REINFORCEMENT - INSTALLATION)
(9) Fill cooling system. (Refer to 7 - COOLING - STANDARD PROCEDURE)

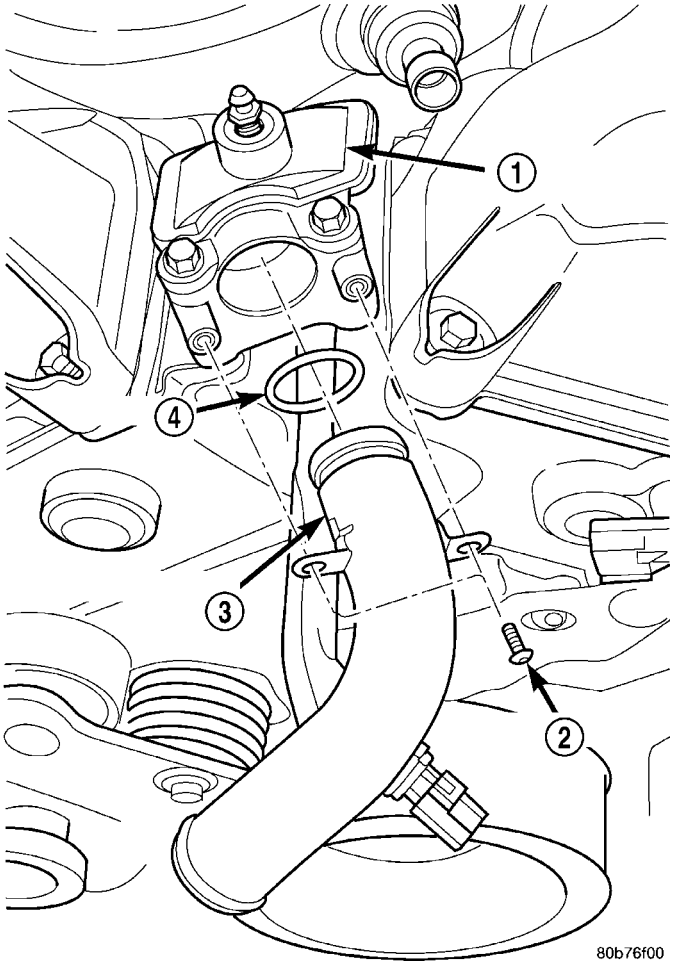

Fig. 11 Heater Supply Tube - Removal/Installation

1 - OUTLET CONNECTOR
2 - SCREW (2)
3 - HEATER TUBE
4 - O-RING

HEATER SUPPLY TUBE - 3.5L

REMOVAL

WARNING: DO NOT REMOVE PRESSURE CAP WITH SYSTEM HOT AND UNDER PRESSURE BECAUSE SERIOUS BURNS FROM COOLANT CAN OCCUR.

(1) Drain cooling system. (Refer to 7 - COOLING - STANDARD PROCEDURE)
(2) Remove upper and lower intake manifold. (Refer to 9 - ENGINE/MANIFOLDS/INTAKE MANIFOLD - REMOVAL)
(3) Position lower intake manifold upside down on bench and remove the tube retaining bolt (Fig. 12).
(4) Remove tube from manifold and discard O-ring.

HEATER SUPPLY TUBE - 3.5L (Continued)

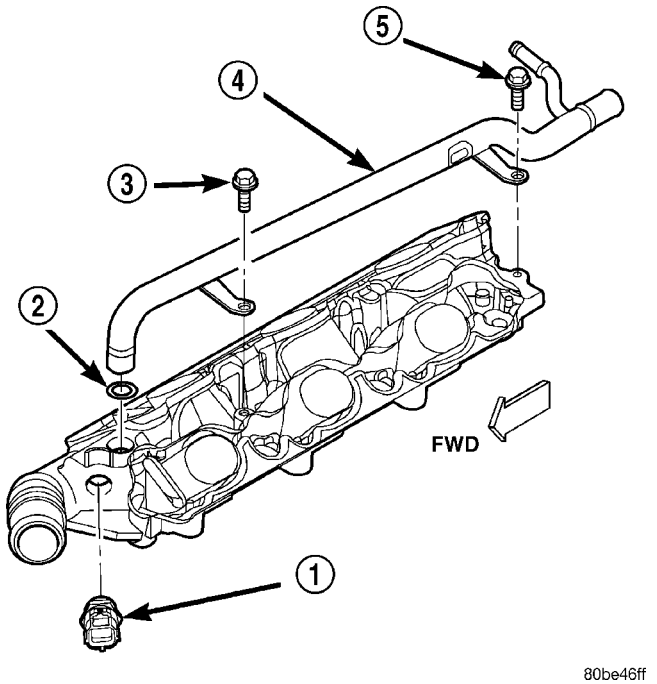

Fig. 12 Heater Supply Tube - 3.2/3.5L

1 - COOLANT TEMPERATURE SENSOR
2 - O-RING
3 - BOLT
4 - HEATER SUPPLY TUBE
5 - BOLT

INSTALLATION

(1) Clean heater tube sealing surfaces.

(2) Inspect heater tube O-ring. Replace as necessary.

(3) Lubricate O-ring with a silicone type grease such as Mopar® Dielectric Grease.

(4) Install O-ring on heater tube (Fig. 12).

(5) Install heater tube on manifold.

(6) Install retaining bolts and tighten to 12 N·m (105 in. lbs.) (Fig. 12).

(7) Install lower and upper intake manifolds. (Refer to 9 - ENGINE/MANIFOLDS/INTAKE MANIFOLD - INSTALLATION)

(8) Refill cooling system. (Refer to 7 - COOLING - STANDARD PROCEDURE)

HOSE CLAMPS

DESCRIPTION

The cooling system utilizes both worm drive and spring type hose clamps. If a spring type clamp replacement is necessary, replace with the original Mopar® equipment spring type clamp. To identify size of spring hose clamps, the size in millimeters has been stamped on each clamp (Fig. 13). Refer to HOSE CLAMP USAGE CHART for proper size and location of hose clamps.

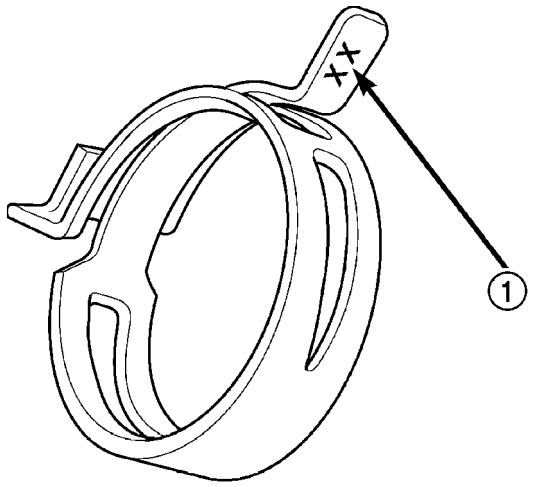

Fig. 13 Spring Clamp Size Location

1 - SPRING CLAMP SIZE LOCATION

HOSE CLAMP USAGE CHART

SPRING CLAMP LOCATION		2.7L	3.5L
Upper Radiator Hose	@ engine	39 mm	47 mm
	@ radiator	39 mm	39 mm
Lower Radiator Hose	@ engine	40 mm	39 mm
	@ radiator	39 mm	39 mm
Heater Hoses	3/4″	27 mm	27 mm
	3/8″	17 mm	17 mm

OPERATION

The worm type hose clamp uses a specified torque value to maintain proper tension on a hose connection.

The spring type hose clamp applies constant tension on a hose connection. To remove a spring type hose clamp, use Special Tool 6094 or equivalent, constant tension clamp pliers (Fig. 14) to compress the hose clamp.

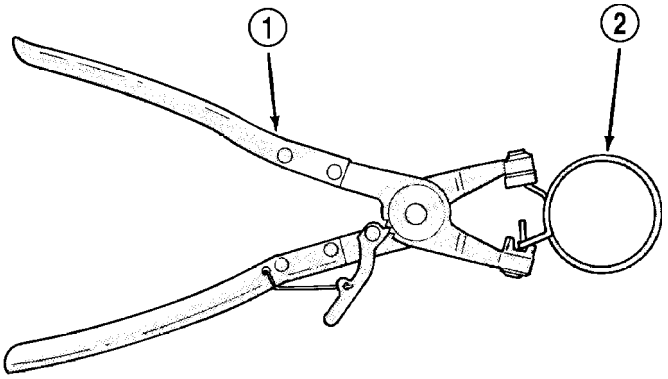

Fig. 14 HOSE CLAMP TOOL

1 - HOSE CLAMP TOOL 6094
2 - HOSE CLAMP

RADIATOR

REMOVAL

NOTE: It is not necessary to discharge air conditioning system when removing the radiator.

(1) Disconnect negative cable from remote jumper terminal.

WARNING: DO NOT REMOVE THE CYLINDER BLOCK PLUG OR THE RADIATOR DRAINCOCK WITH THE SYSTEM HOT AND UNDER PRESSURE BECAUSE SERIOUS BURNS FROM COOLANT CAN OCCUR.

(2) Drain cooling system. (Refer to 7 - COOLING - STANDARD PROCEDURE)
(3) Remove radiator upper crossmember. (Refer to 23 - BODY/EXTERIOR/GRILLE OPENING REINFORCEMENT - REMOVAL)
(4) Remove upper and lower coolant hoses from the radiator.
(5) Disconnect transmission hoses from cooler and plug (Fig. 15).
(6) Disconnect engine oil cooler lines (if equipped) (Fig. 15).

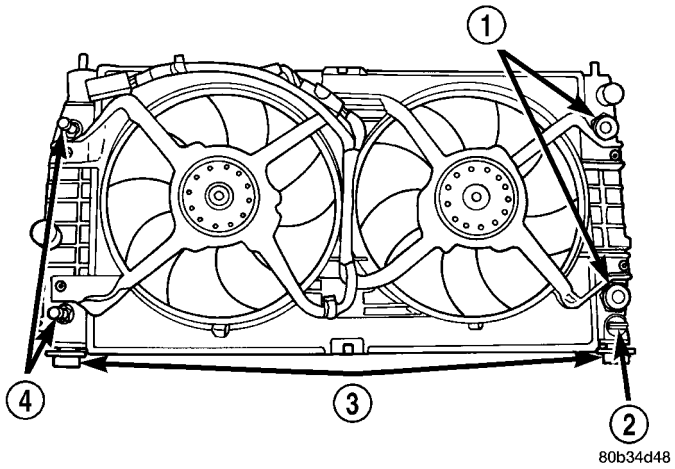

Fig. 15 RADIATOR

1 - ENGINE OIL COOLER FITTINGS (IF EQUIPPED)
2 - DRAINCOCK
3 - LOWER MOUNTING ISOLATORS
4 - TRANSMISSION COOLER LINE NIPPLES

(7) Disconnect the radiator fan electrical connector (Fig. 16).
(8) Remove radiator fan (Fig. 16).

CAUTION: Avoid bending the condenser inlet tube. Care should be taken not to damage radiator or condenser cooling fins or water tubes during removal.

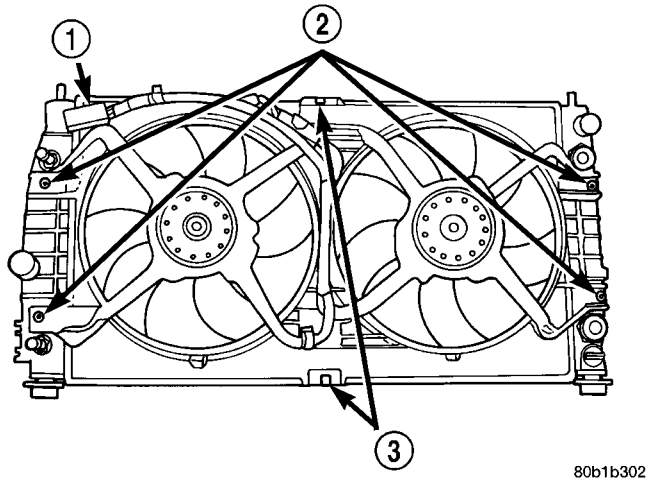

Fig. 16 RADIATOR FAN

1 - ELECTRICAL CONNECTOR
2 - FASTENERS
3 - CLIPS

(9) Remove the air conditioning condenser attaching screws located at the front of the radiator (Fig. 17) or (Fig. 18).
(10) Remove fastener attaching transmission cooler line bracket to left side of radiator (Fig. 17) or (Fig. 18).

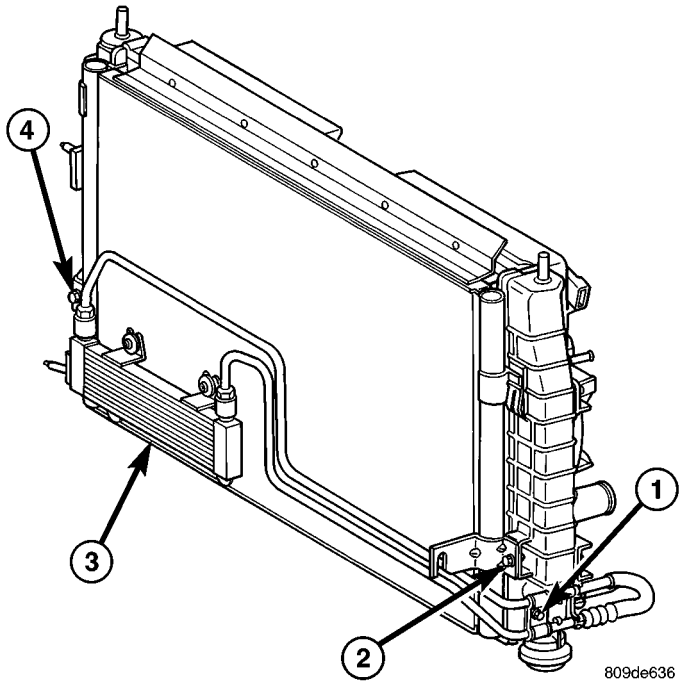

Fig. 17 A/C CONDENSER TO RADIATOR - 3.5L & 2.7L w/AUTO STICK

1 - TRANS COOLER LINE BRACKET SCREW
2 - SCREW - CONDENSER TO RADIATOR
3 - TRANS COOLER
4 - SCREW - CONDENSER TO RADIATOR

RADIATOR (Continued)

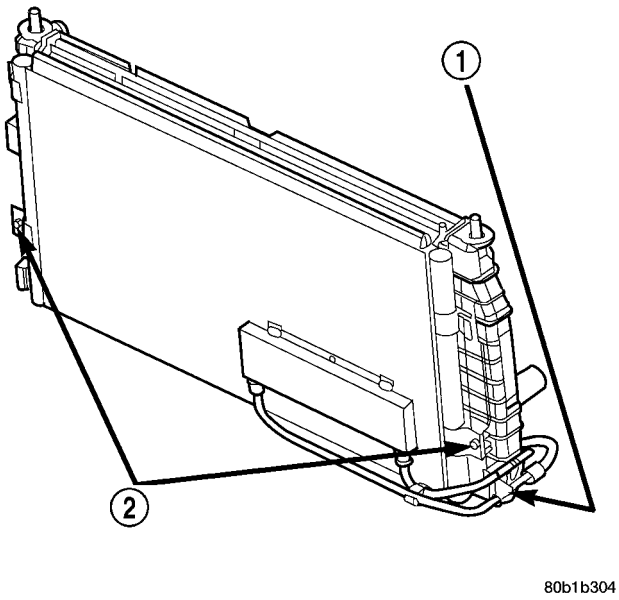

Fig. 18 A/C CONDENSER TO RADIATOR - 2.7L w/o AUTO STICK

1 - TRANSMISSION OIL COOLER LINE MOUNTING BRACKET
2 - A/C CONDENSER TO RADIATOR MOUNTING SCREWS

(11) Lift condenser upward enough to disengage upper mounting clips. Allow condenser to rest on lower radiator crossmember. It is not necessary to discharge the air conditioning system.

(12) Radiator can now be lifted from engine compartment. **Care should be taken not to damage radiator cooling fins or water tubes during removal.**

CLEANING

Clean radiator fins are necessary for good heat transfer. The radiator and air conditioning fins should be cleaned when an accumulation of debris has occurred. With the engine cold, apply cold water and compressed air to the back (engine side) of the radiator to flush the radiator and/or A/C condenser of debris.

INSPECTION

Inspect the radiator tanks for cracks, broken or missing fittings also inspect the joint where the tanks seam up to the radiator core for signs of leakage and/or deteriorating seals.

Inspect radiator core for corroded, bent or missing cooling fins. Inspect the core for bent or damaged cooling tubes.

INSTALLATION

(1) Position radiator into engine compartment. Seat the radiator assembly lower rubber isolators into the mounting holes in radiator lower support (Fig. 15).

(2) Attach air conditioning condenser to mounting clips on radiator. Install mounting screws and tighten to 5 N·m (45 in. lbs.) (Fig. 17) or (Fig. 18).

(3) Install the radiator lower hose and clamp.

(4) Install the transmission cooler line bracket and attaching fastener (Fig. 17) or (Fig. 18). Connect automatic transmission hoses and torque hose clamps to 3 N·m (28 in. lbs.).

(5) Install the radiator fan. (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - INSTALLATION)

(6) Connect radiator fan motor electrical connector.

(7) Connect engine oil cooler lines (if equipped). Torque lines to 18 N·m (160 in. lbs.).

(8) Install the radiator upper hose. Align hose so it does not interfere with the accessory drive belt or engine. Position hose clamp so it will not interfere with the hood.

(9) Install the radiator upper support crossmember. (Refer to 23 - BODY/EXTERIOR/GRILLE OPENING REINFORCEMENT - INSTALLATION)

(10) Connect negative cable to remote jumper terminal.

(11) Fill cooling system with coolant. (Refer to 7 - COOLING - STANDARD PROCEDURE)

(12) Operate engine until it reaches normal operating temperature. Check cooling system and automatic transmission for correct fluid levels.

RADIATOR DRAINCOCK

REMOVAL

WARNING: DO NOT REMOVE THE CYLINDER BLOCK PLUG OR THE RADIATOR DRAINCOCK WITH THE SYSTEM HOT AND UNDER PRESSURE BECAUSE SERIOUS BURNS FROM COOLANT CAN OCCUR.

CAUTION: Use of pliers on draincock is not recommended. Damage may occur to part. Draincock should not be removed unless leakage is observed.

(1) Drain the cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).

(2) Turn the draincock stem counterclockwise 180 degrees to the 9:00 o'clock position.

(3) With the stem at the 9:00 o'clock position, pull the draincock assembly from the radiator tank (Fig. 19).

INSTALLATION

(1) Inspect the draincock body and O-ring for damage. Replace as necessary.

RADIATOR DRAINCOCK (Continued)

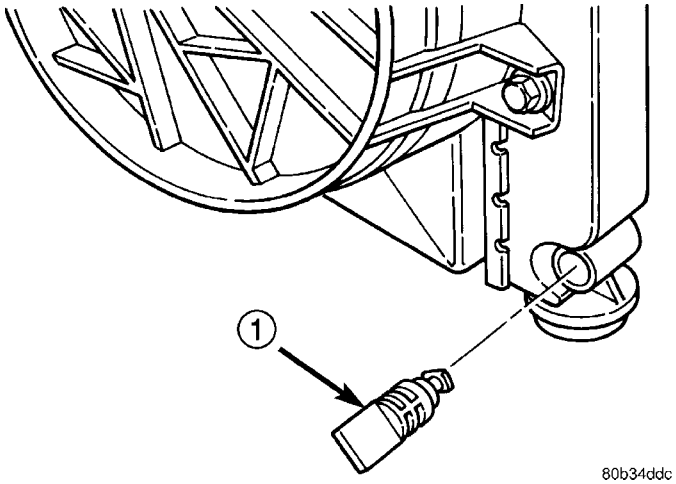

Fig. 19 DRAINCOCK

1 - DRAINCOCK ASSEMBLY

(2) Position the draincock assembly horizontally to the tank opening with the manufactures identification mark facing down.

(3) Push the draincock assembly into the tank opening while rotating clockwise until it snaps into place.

(4) Close the draincock stem by turning clockwise until it stops at the horizontal position.

(5) Fill the cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).

PRESSURE CAP

DESCRIPTION

The cooling system cap is located on the coolant pressure bottle. The cap construction includes; stainless steel swivel top, rubber seals and retainer, main spring, and a spring loaded valve (Fig. 20).

OPERATION

The pressure cap allows the cooling system to operate at higher than atmospheric pressure which raises the coolant boiling point, thus allowing increased radiator cooling capacity. The pressure cap releases pressure at some point within a range of 110 kPa ± 14 kPa (16 psi ± 2 psi) (Fig. 20).

A spring-loaded vent valve in the center of the cap allows the system to pressurize and depressurize without creating a vacuum. If the valve is stuck open, coolant will escape to the overflow hose. There is also a gasket in the cap to seal to the top of the filler neck.

CAUTION: Use only the pressure cap specified for this vehicle. Use of other pressure caps can lead to coolant loss and overheating.

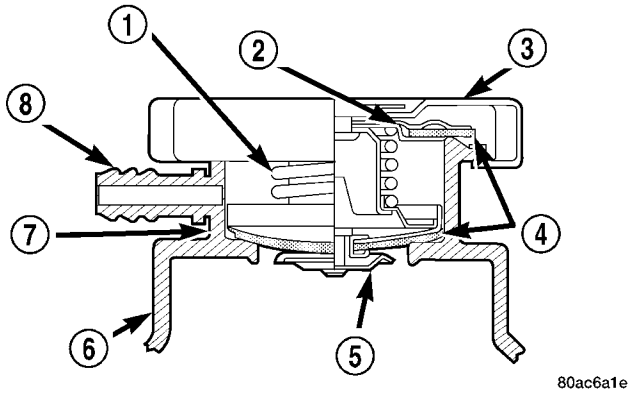

Fig. 20 PRESSURE CAP

1 - MAIN SPRING
2 - GASKET RETAINER
3 - STAINLESS STEEL SWIVEL TOP
4 - RUBBER SEALS
5 - SPRING LOADED VALVE
6 - COOLANT PRESSURE BOTTLE
7 - FILLER NECK
8 - OVERFLOW NIPPLE

INSPECTION

WARNING: IF VEHICLE HAS BEEN RUN RECENTLY, WAIT 15 MINUTES BEFORE REMOVING CAP. THEN PLACE A SHOP TOWEL OVER THE CAP AND WITHOUT PUSHING DOWN ROTATE IT COUNTERCLOCKWISE TO THE FIRST STOP. ALLOW FLUIDS TO ESCAPE THROUGH THE OVERFLOW TUBE AND WHEN THE SYSTEM STOPS PUSHING OUT COOLANT AND STEAM AND PRESSURE DROPS, REMOVE THE CAP COMPLETELY. SQUEEZING THE RADIATOR INLET HOSE WITH A SHOP TOWEL (TO CHECK PRESSURE) BEFORE AND AFTER TURNING TO THE FIRST STOP IS RECOMMENDED.

WARNING: THE WARNING WORDS DO NOT OPEN HOT ON THE COOLANT BOTTLE PRESSURE CAP IS A SAFETY PRECAUTION. WHEN HOT, PRESSURE BUILDS UP IN COOLING SYSTEM. TO PREVENT SCALDING OR INJURY, THE COOLANT BOTTLE PRESSURE CAP SHOULD NOT BE REMOVED WHILE THE SYSTEM IS HOT AND/OR UNDER PRESSURE.

The pressure cap upper gasket (seal) pressure relief can be checked by removing cap. Attach a suitable Cooling System Tester such as Tool 7700 to the cap and pump air into the cap. Pressure cap upper gasket should relieve at 124 kPa (18 psi) and hold pressure at 110 kPa (16 psi) minimum.

Remove the pressure tester and hold the cap in hand, **right side up** (Fig. 21). The vent valve at the bottom of the cap should not open. If the rubber gas-

PRESSURE CAP (Continued)

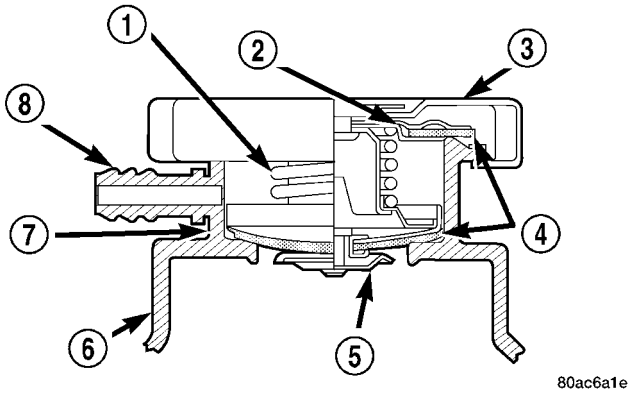

Fig. 21 PRESSURE CAP

1 - MAIN SPRING
2 - GASKET RETAINER
3 - STAINLESS STEEL SWIVEL TOP
4 - RUBBER SEALS
5 - SPRING LOADED VALVE
6 - COOLANT PRESSURE BOTTLE
7 - FILLER NECK
8 - OVERFLOW NIPPLE

ket has swollen and prevents the valve from closing, replace the cap.

Hold the cap in hand **upside down.** If any light can be seen between vent valve and rubber gasket, replace cap.

There is no need to remove the pressure cap at any time **except** for the following purposes:

- Checking and adjust antifreeze freeze point.
- Refilling system with new coolant.
- Conducting service procedures.
- Checking for vacuum leaks.

RADIATOR FAN

DESCRIPTION

The radiator fan assembly includes two electric motors, a motor support, and a one piece shroud. The assembly is fastened to the radiator by screws with square nuts and retaining clips (Fig. 22).

OPERATION

The cooling system fans will operate at two speeds and are simultaneously activated. The dual fan system improves engine cooling and air conditioning performance in hot weather and severe driving conditions, while reducing fan noise and power consumption.

The cooling fans will operate based on inputs to the Powertrain Control Module (PCM). When fan operation is determined necessary, the PCM provides a ground to the fan relay control circuit.

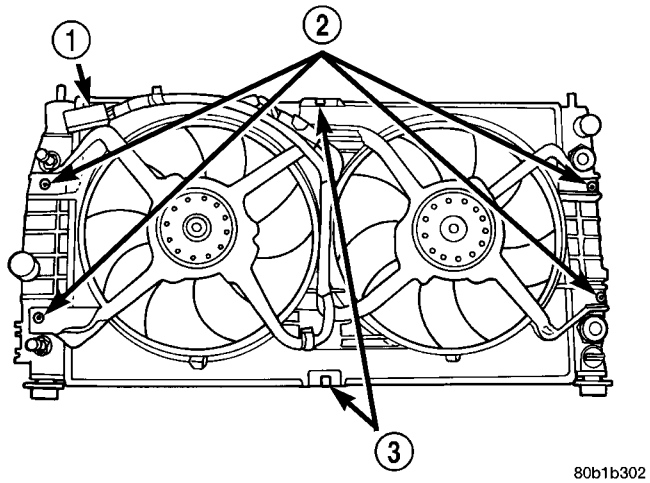

Fig. 22 RADIATOR FAN

1 - ELECTRICAL CONNECTOR
2 - FASTENERS
3 - CLIPS

The inputs provided to the PCM that influence fan operation are:

- Coolant Temperature Sensor
- Intake Air Temperature Sensor
- Output Speed Sensor
- Transmission Oil Temperature Sensor
- A/C Pressure Transducer

For more information (Refer to 7 - COOLING/ENGINE/RADIATOR FAN RELAY - OPERATION).

DIAGNOSIS AND TESTING - RADIATOR FAN CONTROL

Radiator fan control can be accomplished five ways. A pressure transducer on the air conditioning compressor discharge line sends a signal to the Powertrain Control Module (PCM) which will activate both fans if necessary. In addition to this control, the fans are turned on based on coolant temperature sensor, intake air temperature sensor, output speed sensor, and transmission oil temperature sensor output to the PCM. The PCM switches the fans on through the fan relays.

The PCM provides fan control for the following conditions:

- Regardless of coolant temperature the fan will not run during cranking until the engine starts.
- Fans will run in accordance with the specifications listed in the following operation charts.

For additional circuit and diagnostic information (Refer to Appropriate Wiring and Diagnostic Information).

RADIATOR FAN (Continued)

RADIATOR FAN OPERATION - 2.7L ENGINE

ENGINE COOLANT TEMPERATURE							INTAKE (CHARGE) TEMPERATURE	
	A/C Off		A/C On		Engine @ Idle < 13 Km/h (8 MPH) Vehicle Speed		Vehicle Speed < 45 Km/h (28 MPH)**	
Fan Speed	Low	High	Low	High	Low	High	Low	High
Fan On:	106°C (223°F)	110°C (230°F)	105°C (221°F)	110°C (230°F)	104°C (219°F) - After 1st Fan Cycle	110°C (230°F)	65°C (149°F) if coolant<93°C (199°F) 61°C (142°F) if coolant >105°C (221°F)	After Low Fan On for 8 minutes.
Fan Off:	102°C (216°F)	107°C (225°F)	102°C (216°F)	106°C (223°F)	Fan on time = 4 minutes*	105°C (221°F)	64°C (147°F) if coolant<92°C (197°F 60°C (140°F) if coolant>104°C (219°F	Fan on time = 4 minutes*
*Minimum fan on time = 90 seconds								
**Note: If low fan is on for 8 minutes, fan turns on high speed for 4 minutes, then goes back to low speed.								

	A/C PRESSURE		TRANSMISSION OIL TEMPERATURE	
Fan Speed	Low	High	Low	High
Fan On:	1,448 Kpa (210 psi)	1,717 Kpa (249 psi)	109°C (228°F)	111°C (232°F)
Fan Off:	1,207 Kpa (175 psi)	1,503 Kpa (218 psi)	104°C (220°F)	109°C (228°F)

RADIATOR FAN (Continued)

RADIATOR FAN OPERATION - 3.5L ENGINE

ENGINE COOLANT TEMPERATURE					INTAKE (CHARGE) AIR TEMPERATURE	
	A/C Off/On		Engine @ Idle < 13 Km/h (8 MPH) Vehicle Speed		Vehicle Speed < 45 Km/h (28 MPH)	
Fan Speed	Low	High	Low	High	Low	High
Fan On:	102°C (216°F)	110°C (230°F)	99°C (210°F) - After 2nd Fan Cycle	110°C (230°F)	71°C (159°F) if coolant<93°C (199°F) 66°C (150°F) if coolant>99°C (210°F)	72°C (162°F)
Fan Off:	99°C (210°F)	105°C (221°F)	Fan on time = 4 minutes*	105°C (221°F)	Fan on time = 8 minutes*	Fan on time = 4 minutes*
*Minimum fan on time = 90 seconds						
	A/C PRESSURE			TRANSMISSION OIL TEMPERATURE		
Fan Speed	Low		High	Low	High	
Fan On:	1,448 Kpa (210 psi)		1,717 Kpa (249 psi)	102°C (216°F)	109°C (228°F)	
Fan Off:	1,207 Kpa (175 psi)		1,510 Kpa (219 psi)	98°C (208°F)	107°C (224°F)	

REMOVAL

(1) Remove radiator upper crossmember (Refer to 23 - BODY/EXTERIOR/GRILLE OPENING REINFORCEMENT - REMOVAL).

(2) Disconnect radiator fan motor electrical connector.

(3) Partially drain cooling system below the level of the upper radiator hose.

(4) Disconnect upper radiator hose from radiator.

(5) Remove radiator fan attaching fasteners and upper clip (Fig. 23).

(6) Remove radiator fan by lifting upward to clear radiator.

INSTALLATION

(1) Install radiator fan.

(2) Install upper clip and fasteners (Fig. 23).

(3) Connect upper radiator hose to radiator.

(4) Connect fan motor electrical connector (Fig. 23).

(5) Install radiator upper crossmember (Refer to 23 - BODY/EXTERIOR/GRILLE OPENING REINFORCEMENT - INSTALLATION).

(6) Fill cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE - COOLING SYSTEM FILLING).

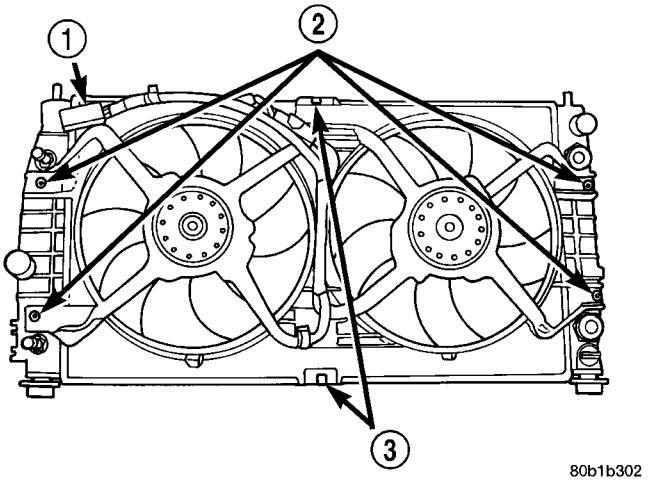

Fig. 23 RADIATOR FAN

1 - ELECTRICAL CONNECTOR
2 - FASTENERS
3 - CLIPS

RADIATOR FAN RELAY

DESCRIPTION

The HI/LO and HI radiator fan relays are located in the Power Distribution Center (PDC) near the coolant recovery pressure container (Fig. 24). A decal on the inside of the PDC covers shows the location of each relay and fuse contained in the PDC. It is an ISO relay.

RADIATOR FAN RELAY (Continued)

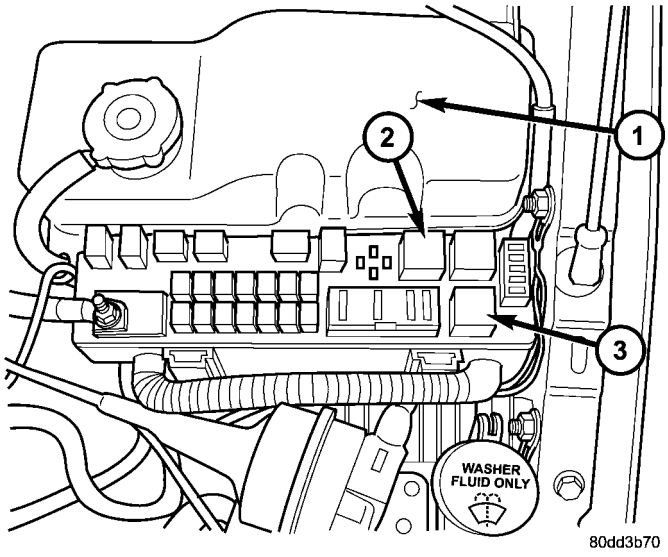

Fig. 24 Radiator Fan Relays (HI/LO & HI)

1 - COOLANT RECOVERY PRESSURE CONTAINER
2 - RADIATOR FAN HI/LO RELAY
3 - RADIATOR FAN HI RELAY

All vehicles (except 2.7L base) are also equipped with No. 1 and No. 2 radiator fan relays that are mounted to the radiator fan motor shroud (Fig. 25).

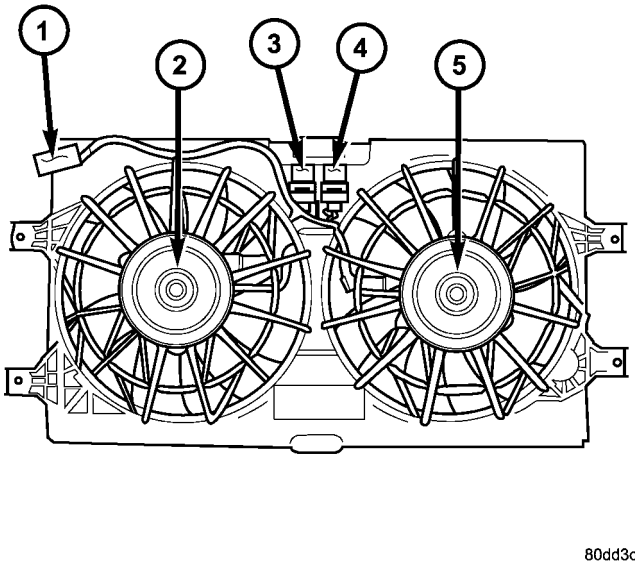

Fig. 25 Radiator Fan Relays - No. 1 & No. 2 (Except 2.7L Base)

1 - ELECTRICAL CONNECTOR
2 - RADIATOR FAN MOTOR NO. 2
3 - RADIATOR FAN RELAY NO. 2
4 - RADIATOR FAN RELAY NO. 1
5 - RADIATOR FAN MOTOR NO. 1

OPERATION

2.7L BASE

The cooling system uses two fans. Both fans operate at two different speeds, low and high. Depending on engine coolant temperature and A/C system high side pressure, the fans operate at either low or high speed. The PCM controls radiator fan speed by grounding the coil side of either the HI/LO fan relay or the HI fan relay. The ignition switch supplies voltage to the coil sides of the relay. When the PCM grounds the coil side of the relay, the contacts close and the battery supplies power to the fans. Refer to WIRING DIAGRAMS.

EXCEPT 2.7L BASE

The cooling system uses two fans. Both fans operate at two different speeds, low and high. Depending on engine coolant temperature and A/C system high side pressure, the fans operate at either low or high speed. The PCM controls radiator fan speed by grounding the coil side of either the HI/LO fan relay or the HI fan relay. Low speed radiator fan function is achieved by running both fan motors in a series circuit. High speed radiator fan function is achieved by running both fan motors in a parallel circuit. Refer to WIRING DIAGRAMS.

WATER PUMP

DIAGNOSIS AND TESTING - WATER PUMP

A quick test to determine water pump operation is to check for proper heater system performance (Refer to 24 - HEATING & AIR CONDITIONING - DIAGNOSIS AND TESTING). A defective pump will not circulate heated coolant through the heater hoses. For additional diagnosis, (Refer to 7 - COOLING - DIAGNOSIS AND TESTING). For water pump inspection, (Refer to 7 - COOLING/ENGINE/WATER PUMP - INSPECTION).

WATER PUMP - 2.7L

DESCRIPTION

The 2.7L pump has a die cast aluminum housing and a plastic swept vane impeller. It bolts directly to the cylinder block, behind the timing chain cover (Fig. 26). The water pump is driven by the back side of the engine primary timing chain.

REMOVAL

The water pump on all models can be replaced without discharging the air conditioning system.

WATER PUMP - 2.7L (Continued)

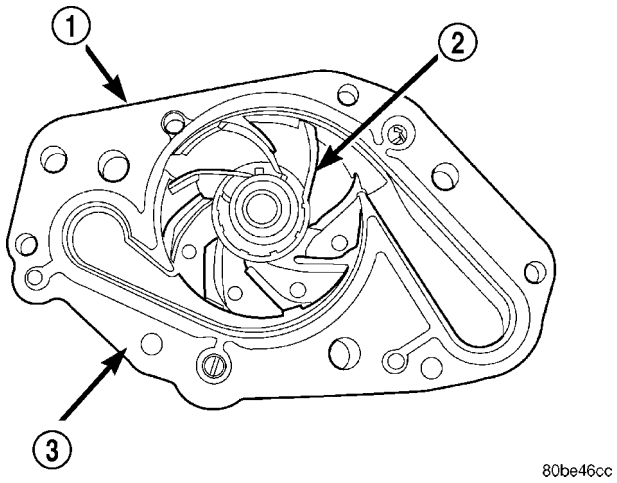

Fig. 26 WATER PUMP - 2.7L ENGINE

1 - WATER PUMP BODY
2 - IMPELLER
3 - GASKET

NOTE: It is normal for the water pump to weep a small amount of coolant from the primary weep hole (black stain at weep passage). Do not replace the water pump if this condition exists. Replace the water pump if a heavy deposit or a steady flow of engine coolant is evident from the primary weep passage (Fig. 28) and (Fig. 29). This indicates a shaft seal failure and pump must be replaced. Coolant may leak from the secondary weep passage and fill the valley of the engine (Fig. 28) and (Fig. 30). If this condition is found, clean the primary weep passage of debris. Be sure to perform a thorough analysis before replacing water pump.

WARNING: DO NOT REMOVE PRESSURE CAP WITH THE SYSTEM HOT AND PRESSURIZED. SERIOUS BURNS FROM COOLANT CAN RESULT.

(1) Drain cooling system. (Refer to 7 - COOLING - STANDARD PROCEDURE)

(2) Remove radiator upper crossmember. (Refer to 23 - BODY/EXTERIOR/GRILLE OPENING REINFORCEMENT - REMOVAL)

(3) Remove radiator fan. (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - REMOVAL)

(4) Remove accessory drive belts. (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL)

NOTE: The water pump is driven by the primary timing chain.

(5) Remove the timing chain and all chain guides-(Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).

(6) Remove bolts attaching water pump to block (Fig. 27).

(7) Remove water pump and gasket.

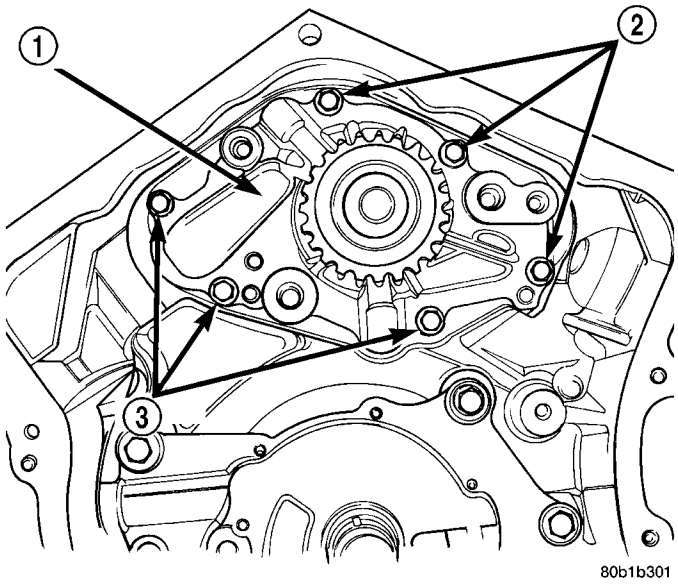

Fig. 27 WATER PUMP - 2.7L

1 - WATER PUMP
2 - BOLTS
3 - BOLTS

INSPECTION - 2.7L

Inspect and replace the water pump if it has any of the following defects:

(1) Damage or cracks on the pump body.

(2) Coolant leaks: If the shaft seal is leaking, this will be evident by traces of thick deposits of dried glycol running down from the pump primary weep passage (Fig. 28) and (Fig. 29). A thin black stain below the pump primary weep hole/passage is considered normal operation.

(3) Coolant leaks: If the pump primary weep passage is plugged, coolant may come from the secondary weep passage and collect in the valley of the engine. The coolant will eventually run out the back side of the engine (Fig. 28) and (Fig. 30). Leakage from the secondary weep passage may give false indications that core plug(s) may be leaking on the back side of the engine block. If this condition is found, clean the primary weep passage of debris.

(4) Impeller rubs inside of cylinder block.

(5) Excessively loose or rough turning bearing.

WATER PUMP - 2.7L (Continued)

NOTE: It is normal for the water pump to weep a small amount of coolant from the primary weep hole (black stain at weep passage). Do not replace the water pump if this condition exists. Replace the water pump if a heavy deposit or a steady flow of engine coolant is evident from the primary weep passage (Fig. 28) and (Fig. 29). This indicates a shaft seal failure and pump must be replaced. Coolant may leak from the secondary weep passage and fill the valley of the engine (Fig. 28) and (Fig. 30). If this condition is found, clean the primary weep passage of debris. Be sure to perform a thorough analysis before replacing water pump.

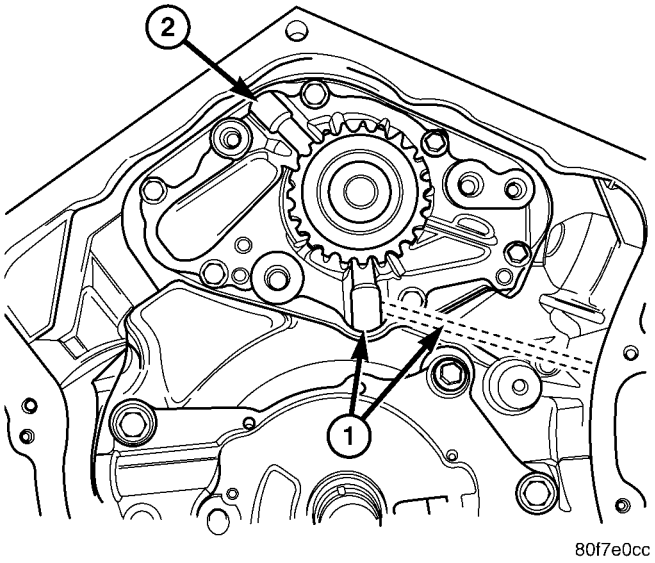

Fig. 28 Water Pump Weep Passages - 2.7L

1 - PRIMARY WEEP PASSAGE
2 - SECONDARY WEEP PASSAGE

INSTALLATION

(1) Clean all sealing surfaces.

(2) Install water pump and gasket. Tighten mounting bolts to 12 N·m (105 in. lbs.).

(3) Install timing chain guides and timing chain (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION).

(4) Install the timing chain cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).

(5) Install the crankshaft damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - INSTALLATION).

(6) Install the accessory drive belts. (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION)

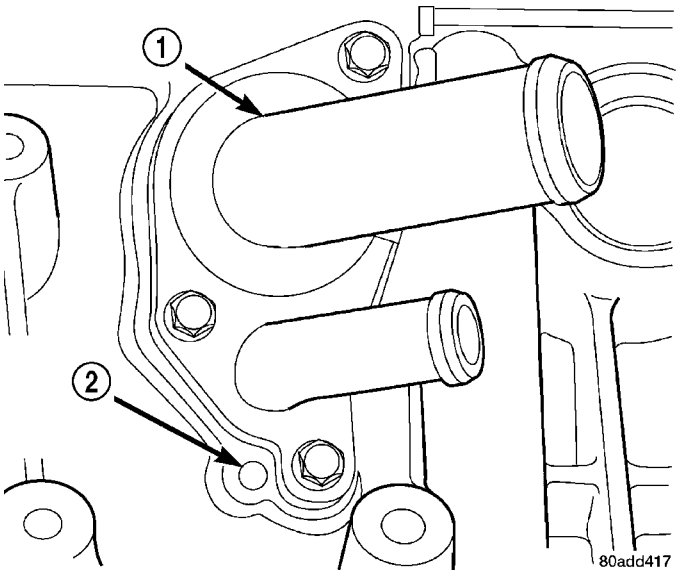

Fig. 29 Primary Water Pump Weep Passage - 2.7L

1 - THERMOSTAT HOUSING/COOLANT INLET
2 - WATER PUMP WEEP PASSAGE

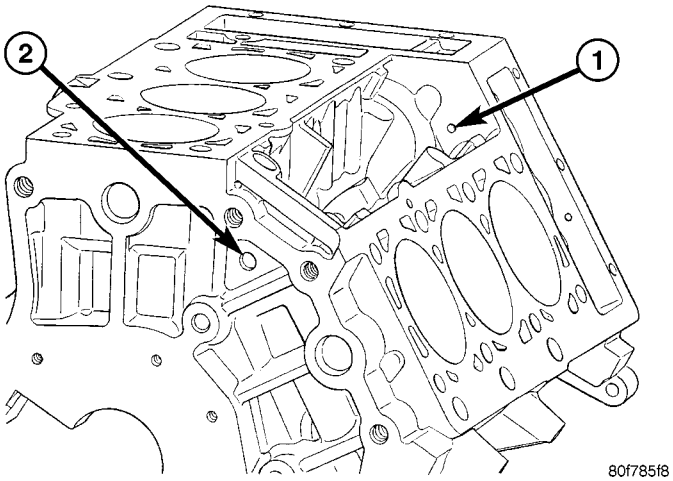

Fig. 30 Secondary Water Pump Weep Passage - 2.7L

1 - WEEP PASSAGE TO VALLEY OF BLOCK
2 - HOLE IN REAR OF BLOCK

(7) Install the radiator fan (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - INSTALLATION) and

(8) Install the radiator upper crossmember (Refer to 23 - BODY/EXTERIOR/GRILLE OPENING REINFORCEMENT - INSTALLATION).

(9) Fill cooling system. (Refer to 7 - COOLING - STANDARD PROCEDURE)

WATER PUMP - 3.5L

DESCRIPTION

The 3.5L water pump has a die cast aluminum housing and a plastic swept vane impeller. It bolts directly to the right rear timing belt cover using an O-ring for sealing (Fig. 32). The water pump is driven by the engine timing belt.

REMOVAL

The water pump on all models can be replaced without discharging the air conditioning system.

WARNING: DO NOT REMOVE PRESSURE CAP WITH THE SYSTEM HOT AND UNDER PRESSURE BECAUSE SERIOUS BURNS FROM COOLANT CAN OCCUR.

NOTE: It is normal for the water pump to weep a small amount of coolant from the weep hole (black stain on water pump body). Do not replace the water pump if this condition exists. Replace the water pump if a heavy deposit or a steady flow of engine coolant is evident on water pump body from the weep hole (shaft seal failure). Be sure to perform a thorough analysis before replacing water pump.

(1) Drain cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).

(2) Remove accessory drive belts (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).

NOTE: The water pump is driven by the timing belt.

(3) Remove engine timing belt (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT AND SPROCKETS - REMOVAL).

(4) Remove water pump mounting bolts (Fig. 31). Note position of longer bolt for proper re-installation.

(5) Remove water pump body from engine (Fig. 31).

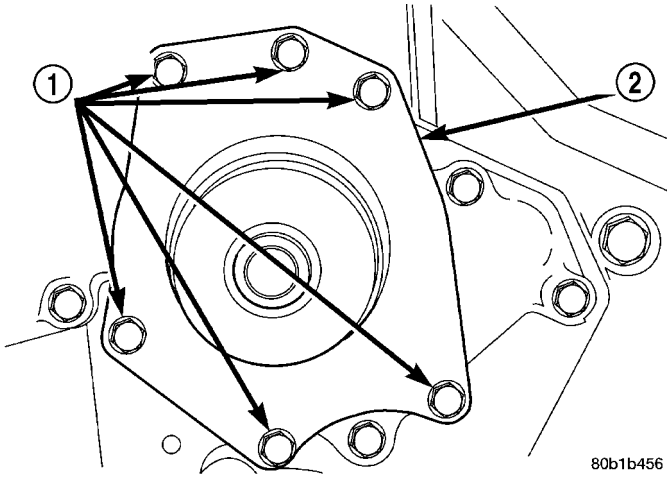

Fig. 31 WATER PUMP - 3.5L ENGINE

1 - SCREWS
2 - WATER PUMP BODY

INSPECTION

Inspect and replace the water pump if it has any of the following defects:

(1) Damage or cracks on the pump body.

(2) Coolant leaks; if the seal is leaking, this will be evident by traces of thick deposits of dried glycol running down the pump body and components below. A thin black stain below pump weep hole/passage is considered normal operation.

(3) Impeller rubs inside of the rear timing belt cover.

(4) Excessively loose or rough turning bearing.

NOTE: It is normal for the water pump to weep a small amount of coolant from the weep hole (black stain on water pump body). Do not replace the water pump if this condition exists. Replace the water pump if a heavy deposit or a steady flow of engine coolant is evident on water pump body. This indicates a shaft seal failure and pump must be replaced. Be sure to perform a thorough analysis before replacing water pump.

WATER PUMP - 3.5L (Continued)

INSTALLATION

(1) Clean all O-ring surfaces on pump and cover.

(2) Apply Mopar® Dielectric Grease or the equivalent silicone grease to the O-ring to facilitate assembly. Install new O-ring on water pump (Fig. 32).

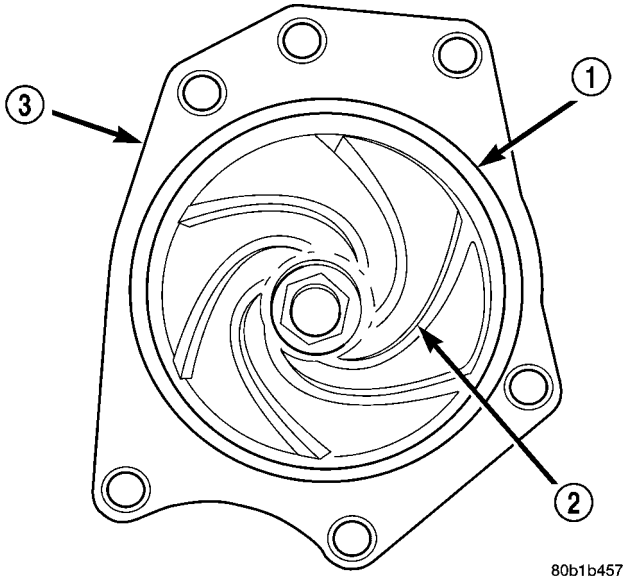

Fig. 32 WATER PUMP - 3.5L

1 - O-RING
2 - IMPELLER
3 - WATER PUMP BODY

(3) Position water pump to engine.

(4) Install mounting bolts and tighten to 12 N·m (105 in. lbs.).

(5) Install timing belt (Refer to 9 - ENGINE/ VALVE TIMING/TIMING BELT AND SPROCKETS - INSTALLATION).

(6) Install accessory drive belts (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

(7) Fill cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).

TRANSMISSION

TABLE OF CONTENTS

TRANSMISSION OIL COOLER

DESCRIPTION

The transmission oil cooler circuit consists of a series connected internal cooler mounted inside the left radiator tank and an external oil cooler mounted to the front of the air conditioning condenser (Fig. 1).

OPERATION

Transmission oil is supplied to the internal (in-tank) transmission cooler (Fig. 1). The oil is then routed to the external cooler mounted to the front side of the A/C condenser. Oil is then returned to the transmission from the external oil cooler (Fig. 1).

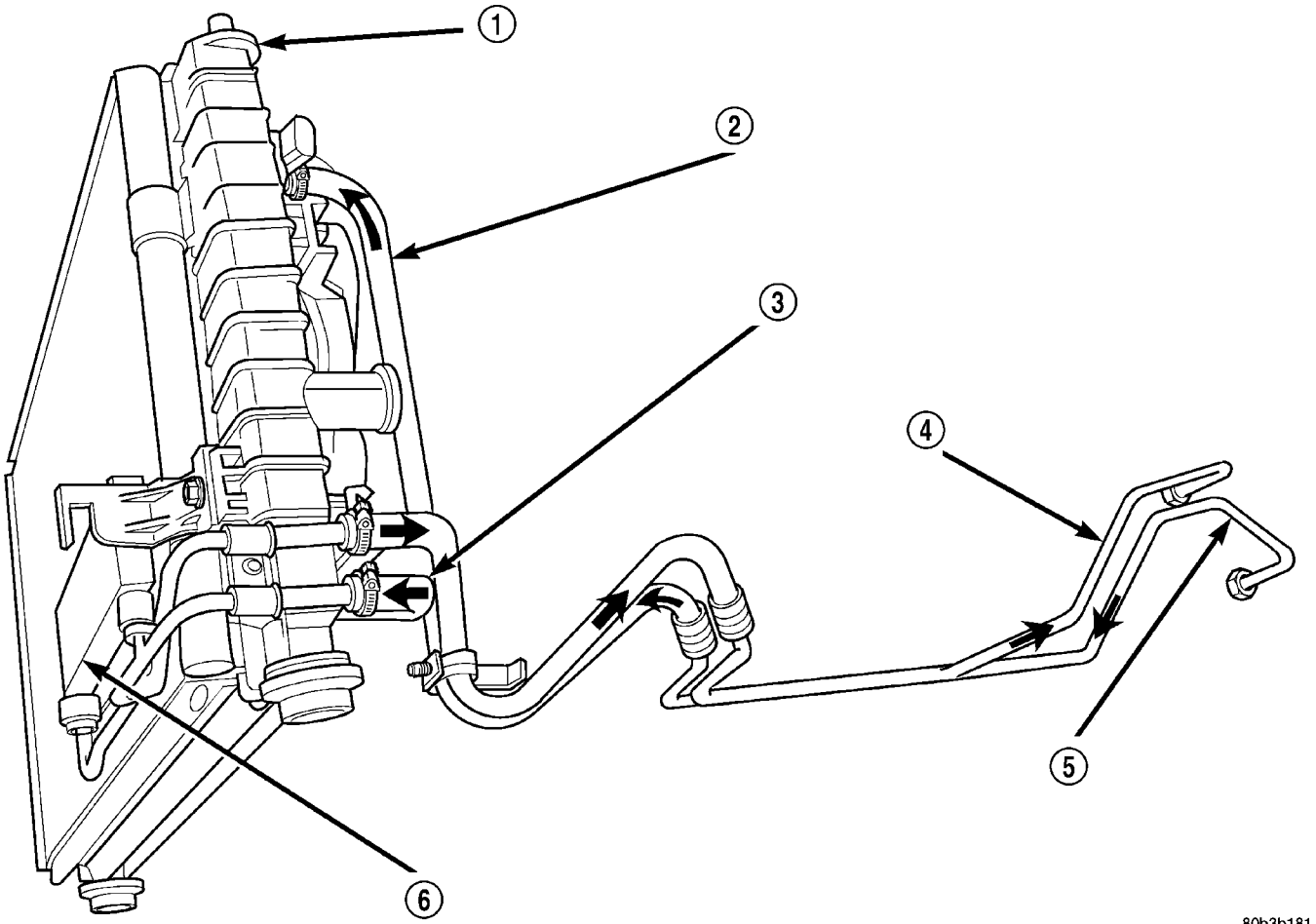

Fig. 1 TRANSMISSION OIL COOLER

1 - RADIATOR
2 - TRANSMISSION OIL COOLER SUPPLY LINE TO IN-TANK COOLER
3 - FROM IN-TANK COOLER TO EXTERNAL OIL COOLER
4 - TRANSMISSION OIL RETURN LINE
5 - TRANSMISSION OIL SUPPLY LINE TO IN-TANK OIL COOLER
6 - EXTERNAL TRANSMISSION OIL COOLER

TRANSMISSION OIL COOLER (Continued)

REMOVAL

The in-tank transmission oil cooler is serviced with the radiator (Refer to 7 - COOLING/ENGINE/RADIATOR - REMOVAL).

For removal of external trans cooler perform the following procedures:

(1) Disconnect negative cable from remote jumper terminal.

(2) Remove the radiator upper support (Refer to 23 - BODY/EXTERIOR/GRILLE OPENING REINFORCEMENT - REMOVAL).

(3) Raise vehicle on hoist.

(4) Remove right and left front wheels.

(5) Remove front fascia (Refer to 13 - FRAMES & BUMPERS/BUMPERS/FRONT FASCIA - REMOVAL).

(6) Disconnect the hoses connecting to the external cooler.

(7) Remove the radiator side air shields.

(8) Remove the screw attaching the cooler line support bracket and remove the bracket.

(9) Cut-off the cooler to condenser attaching straps (Fig. 2).

(10) Remove the transmission oil cooler and lines (Fig. 2).

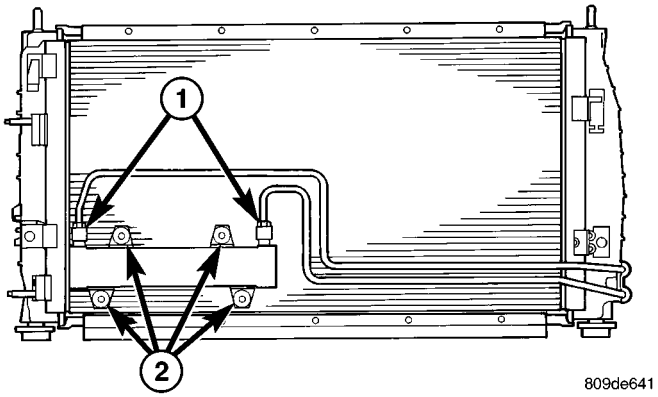

Fig. 2 TRANSMISSION OIL COOLER

1 - COOLER LINE FITTINGS - 19 N·m (170 in. lbs.)
2 - COOLER RETAINING STRAPS

CLEANING

Check the external cooler for debris on the cooling fin surfaces. Clean as necessary.

INSPECTION

Inspect all hoses, tubes, clamps and connections for leaks, cracks, or damage. Replace as necessary. Use only approved transmission oil cooler hoses that are molded to fit the space available.

Inspect external coolers for leaks, loose mounts, or damage. Replace as necessary.

INSTALLATION

For in-tank transmission oil cooler installation (Refer to 7 - COOLING/ENGINE/RADIATOR - INSTALLATION).

For external trans oil cooler installation, perform the following procedures:

(1) Remove the bolts attaching the A/C condenser to the radiator (Fig. 3).

(2) Lift A/C condenser up to disengage from upper retainers on radiator.

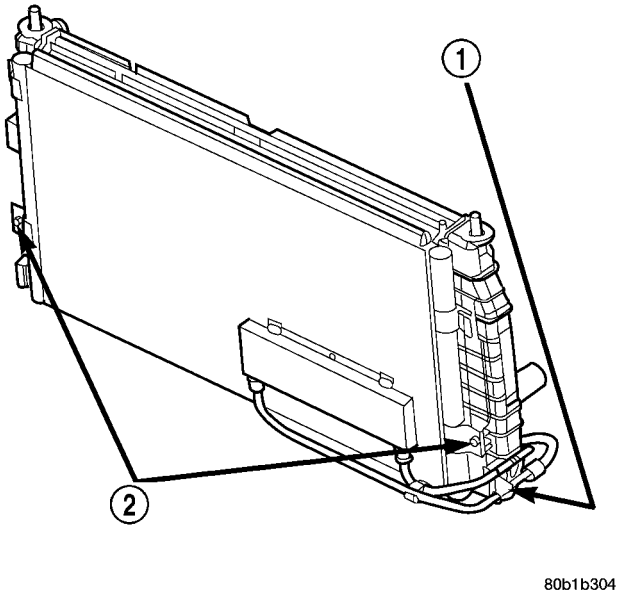

Fig. 3 A/C CONDENSER TO RADIATOR

1 - TRANSMISSION OIL COOLER LINE MOUNTING BRACKET
2 - A/C CONDENSER TO RADIATOR MOUNTING SCREWS

TRANSMISSION OIL COOLER (Continued)

(3) Reposition the A/C condenser to allow access to condenser rear surface.

(4) Remove the previously cut-off cooler retaining straps.

(5) Position and install the new retaining straps in the same locations on the condenser.

(6) Reposition A/C condenser on the radiator upper retainers.

(7) Install the A/C condenser mounting bolts and tighten to 5 N·m (45 in. lbs.) (Fig. 3).

(8) Install the foam pads on the retaining straps

(9) Position the transmission oil cooler on A/C condenser by guiding the retaining straps through the cooler mounting holes (Fig. 2).

(10) Position the external cooler lines to the side of radiator. Install support bracket and screw (Fig. 4).

(11) Install the retaining strap locks and tighten to secure the cooler to the condenser. Trim off the excess strap material.

(12) Connect the cooler hoses to cooler lines and tighten hose clamps to 3 N·m (28 in. lbs.).

(13) Install radiator side air shields.

(14) Install the front fascia (Refer to 13 - FRAMES & BUMPERS/BUMPERS/FRONT FASCIA - INSTALLATION).

(15) Install the front wheels

(16) Install the radiator upper support (Refer to 23 - BODY/EXTERIOR/GRILLE OPENING REINFORCEMENT - INSTALLATION).

(17) Connect negative cable cable to remote jumper terminal.

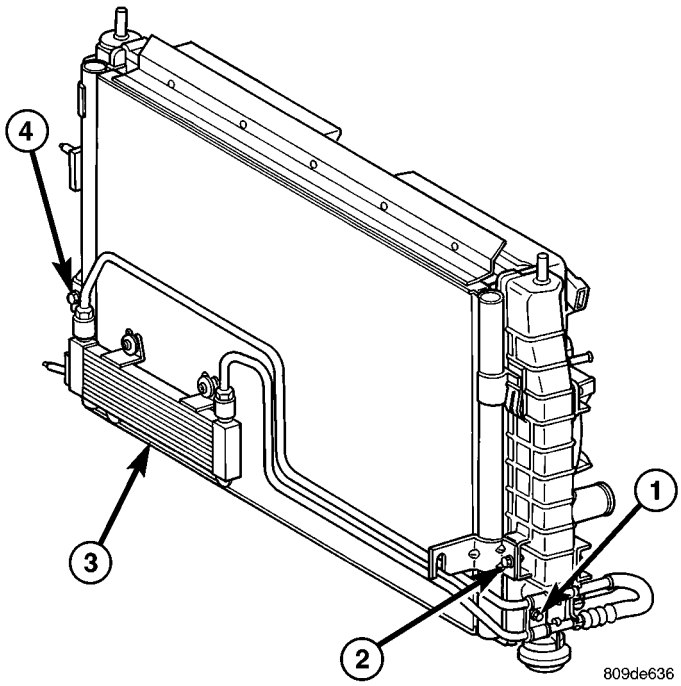

Fig. 4 A/C CONDENSER TO RADIATOR

1 - TRANS COOLER LINE BRACKET SCREW
2 - SCREW - CONDENSER TO RADIATOR
3 - TRANS COOLER
4 - SCREW - CONDENSER TO RADIATOR

(18) Start engine and check transmission oil level. Adjust level as necessary.

TRANSMISSION OIL COOLER LINES

REMOVAL

(1) Loosen hose clamps at radiator connections and remove cooler hoses (Fig. 5).
(2) Remove lines from transmission.
(3) Remove lines from supports.

INSPECTION

Inspect all cooler lines and clamps. Replace as necessary.

INSTALLATION

(1) Position cooler lines and connect to transmission. Torque flare nuts at transmission to 30 N·m (260 in. lbs.).
(2) Connect cooler lines to supports.
(3) Connect cooler hoses to radiator (Fig. 5). Tighten hose clamps to 3 N·m (28 in. lbs.).
(4) Start engine and check transmission fluid level. Adjust as necessary.

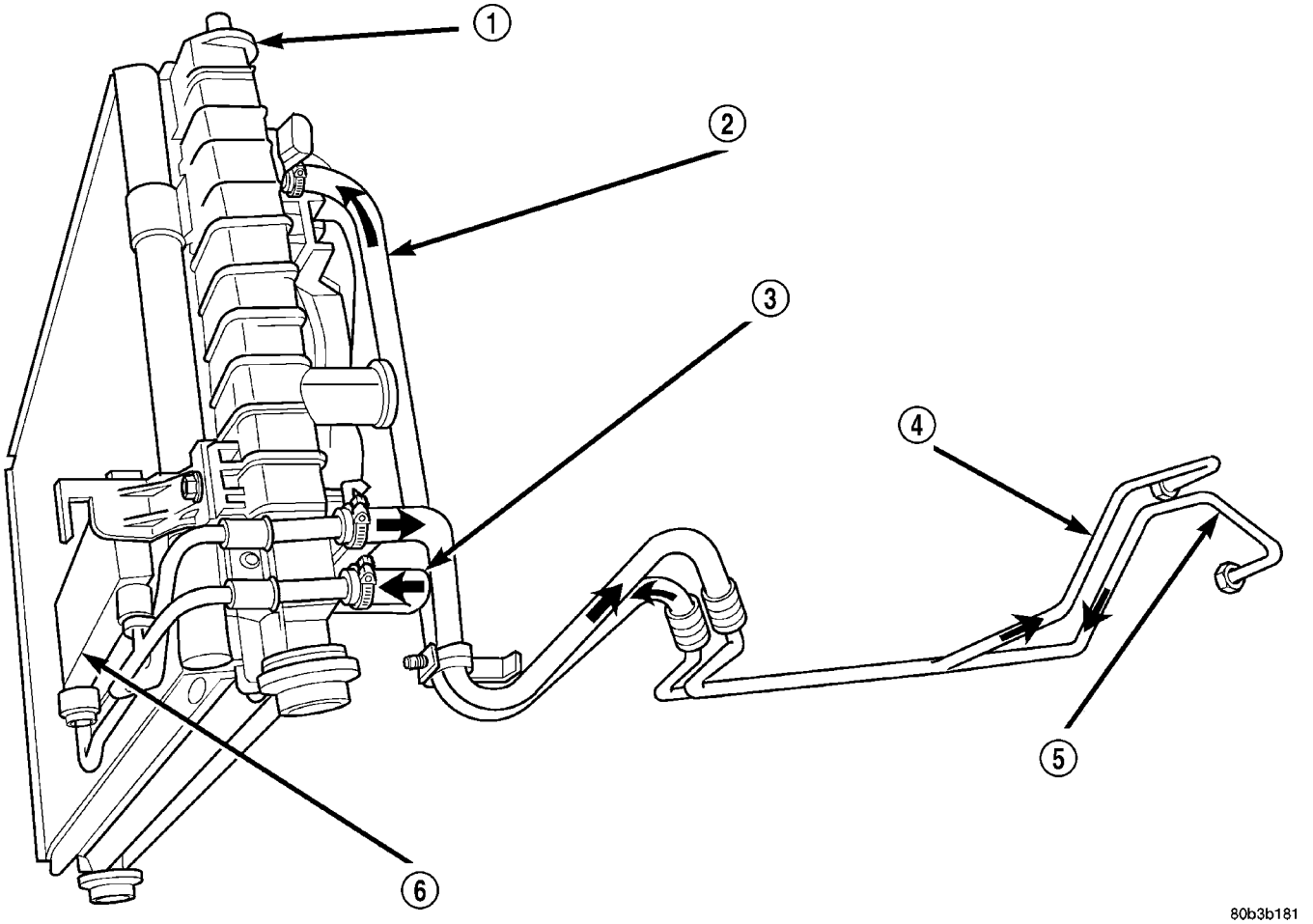

Fig. 5 TRANSMISSION OIL COOLER

1 - RADIATOR
2 - TRANSMISSION OIL COOLER SUPPLY LINE TO IN-TANK COOLER
3 - FROM IN-TANK COOLER TO EXTERNAL OIL COOLER
4 - TRANSMISSION OIL RETURN LINE
5 - TRANSMISSION OIL SUPPLY LINE TO IN-TANK OIL COOLER
6 - EXTERNAL TRANSMISSION OIL COOLER