COOLING SYSTEM

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GENERAL INFORMATION

ACCESSORY DRIVE BELTS

The accessory drive system utilizes two different style of drive belts. The conventional V-belt and the Poly-V belt are used to drive the generator, air conditioning compressor, power steering pump and water pump. Satisfactory performance of these belts depends on belt condition and proper belt tension. Belt tensioning should be performed with the aid of a Burroughs gauge Special Tool C-4162. Because of space limitations in the engine compartment, the use of the gauge may be restricted. Raise the vehicle on a hoist and then remove the splash shield to gain access to the drive belts.

GENERAL INFORMATION (Continued)

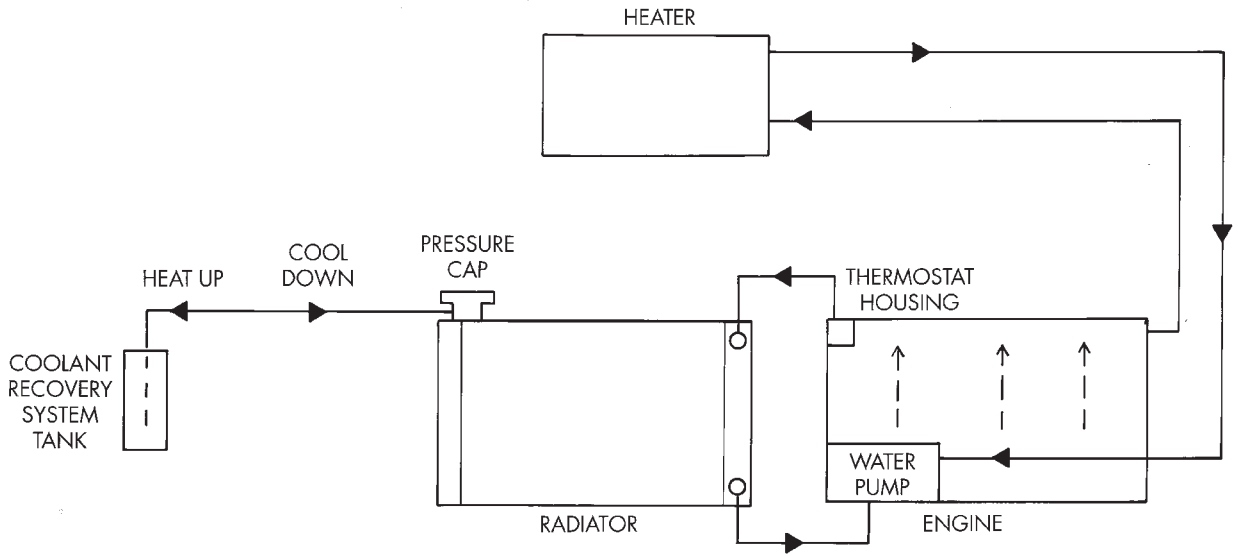

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Fig. 1 Cooling System Operation 2.4L and 3.3/3.8L Engines

COOLING SYSTEM

The cooling system has a radiator, coolant, electric fan motor, shroud, pressure cap, thermostat, coolant reserve system, transmission oil cooler, a water pump to circulate the coolant, hoses, and clamps to complete the circuit.

- When Engine is cold: thermostat is closed, cooling system has no flow through the radiator. The coolant bypass flows through the engine only.
- When Engine is warm: thermostat is open, cooling system has bypass flow and coolant flow through radiator.

Its 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 water (coolant) for heater performance and cooling for automatic transmission oil. 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.

Coolant flow circuits for 2.4L and 3.3/3.8L engines are shown in (Fig. 1), and 3.0L engine coolant routing is shown in (Fig. 2)

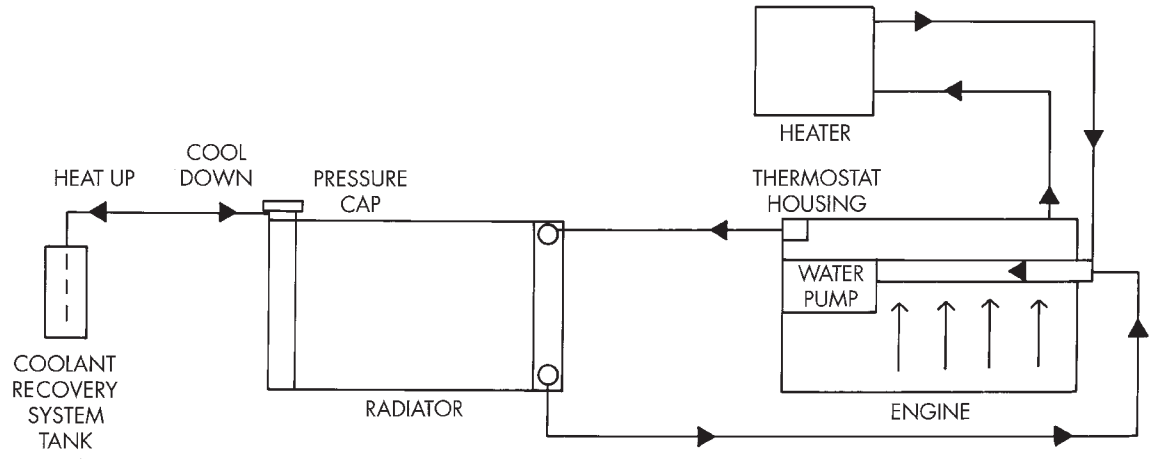

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Fig. 2 Cooling System Operation 3.0L Engine

GENERAL INFORMATION (Continued)

COOLANT RECOVERY SYSTEM (CRS)

This system works with the radiator pressure cap to use thermal expansion and contraction of the coolant to keep the coolant free of trapped air. Provides a convenient and safe method for checking coolant level and adjusting level at atmospheric pressure without removing the radiator pressure cap. It also provides some reserve coolant to cover deaeration and evaporation or boiling losses. All vehicles are equipped with this system and take various shapes and forms. (Fig. 3) shows a typical system in the typical location.

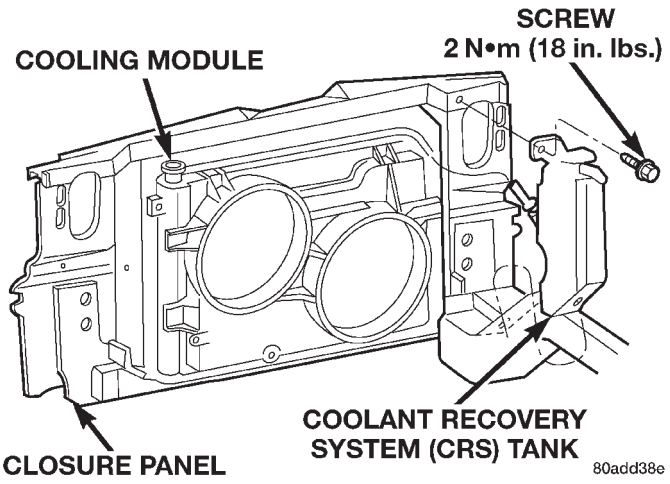

Fig. 3 Coolant Recovery System

See Coolant Level Service, and Deaeration, and Pressure Cap sections for operation and service.

AUTOMATIC TRANSMISSION OIL COOLER—2.4L

Oil cooler is internal oil to coolant type, mounted in the radiator left tank (Fig. 4). Rubber oil lines feed the oil cooler and the automatic transmission. Use only approved transmission oil cooler hose. Since these are molded to fit space available, molded hoses are recommended.

ENGINE THERMOSTAT

The engine cooling thermostats are a wax pellet driven, reverse poppet choke type. They are designed to provide the fastest warm up possible by preventing leakage through them and to guarantee a minimum engine operating temperature of 88 to 93°C (192 to 199°F). They also automatically reach wide open 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 this temperature the coolant temperature is controlled by the fan, the radiator, and the ambient temperature, not the thermostat.

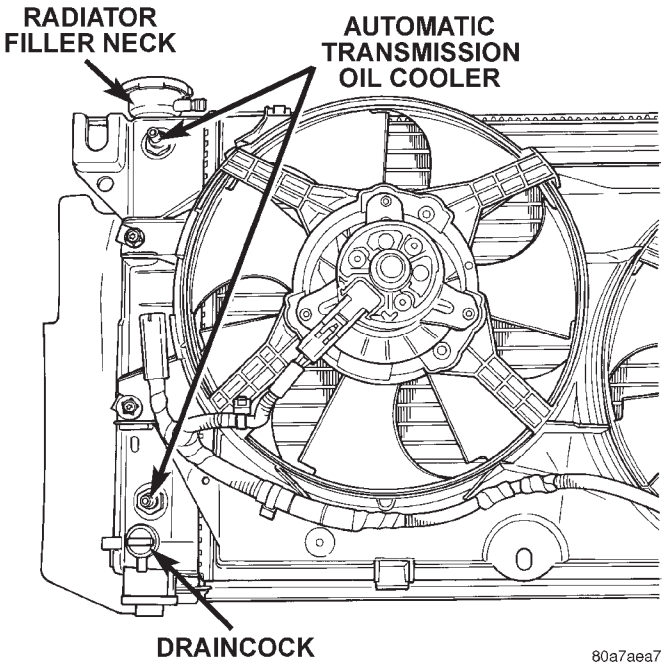

Fig. 4 Automatic Transmission Oil Cooler

WATER PUMPS

A quick test to tell whether the pump is working is to see if the heater warms properly. A defective pump can not circulate heated coolant through the long heater hose. **The water pump on all models can be replaced without discharging the air conditioning system.**

COOLANT

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. Coolant then carries this heat to the radiator, where the tube/fin assemblies of these components can give it up to the air.

The use of aluminum cylinder heads, intake manifolds, and water pumps requires special corrosion protection. Mopar® Antifreeze or the equivalent is recommended for best engine cooling without corrosion, when mixed only to a freeze point of -37°C (-35°F) to -59°C (-50°F). If it loses color or becomes contaminated, drain, flush, and replace with fresh properly mixed solution.

CAUTION: Do not use well water, or suspect water supply in cooling system. A 50/50 ethylene glycol and distilled water mix is recommended.

RADIATOR

The radiators are cross-flow types (horizontal tubes) with design features that provide greater strength along with sufficient heat transfer capabili-

GENERAL INFORMATION (Continued)

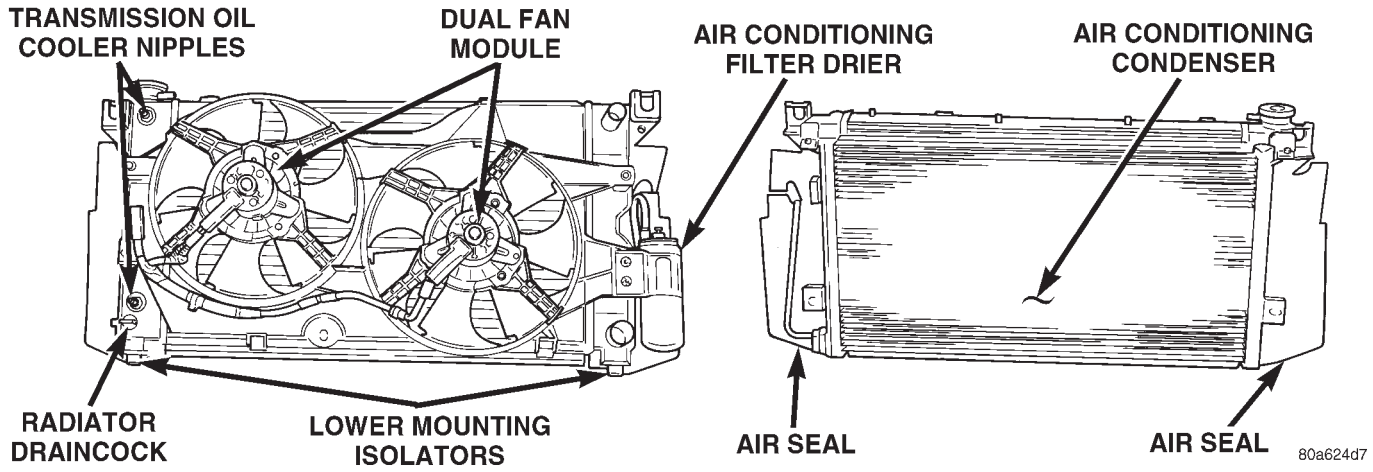

Fig. 5 Cooling Module—2.4L

ties to keep the engine satisfactorily cooled (Fig. 5), (Fig. 6), (Fig. 7) and (Fig. 8).

CAUTION: Plastic tanks, while stronger then brass are subject to damage by impact, such as wrenches etc., or by excessive torque on hose clamps.

If the plastic tank is damaged, replace the radiator.

RADIATOR PRESSURE CAP

The radiator is equipped with a pressure cap that releases excessive cooling system pressure; maintaining a range of 97-124 kPa (14-18 psi).

The cooling system will operate at higher than atmospheric pressure. The higher pressure raises the coolant boiling point thus, allowing increased radiator cooling capacity.

There is also a vent valve in the center of the cap. This valve also opens when coolant is cooling and contracting allowing coolant to return to radiator from coolant reserve system tank by vacuum through connecting hose. **If valve is stuck shut, or the coolant recovery hose is pinched, the radiator hoses will be collapsed on cool down. Clean the vent valve (Fig. 9) and inspect coolant recovery hose routing, to ensure proper sealing when boiling point is reached.**

The gasket in the cap seals the filler neck, so that vacuum can be maintained, allowing coolant to be drawn back into the radiator from the reserve tank.

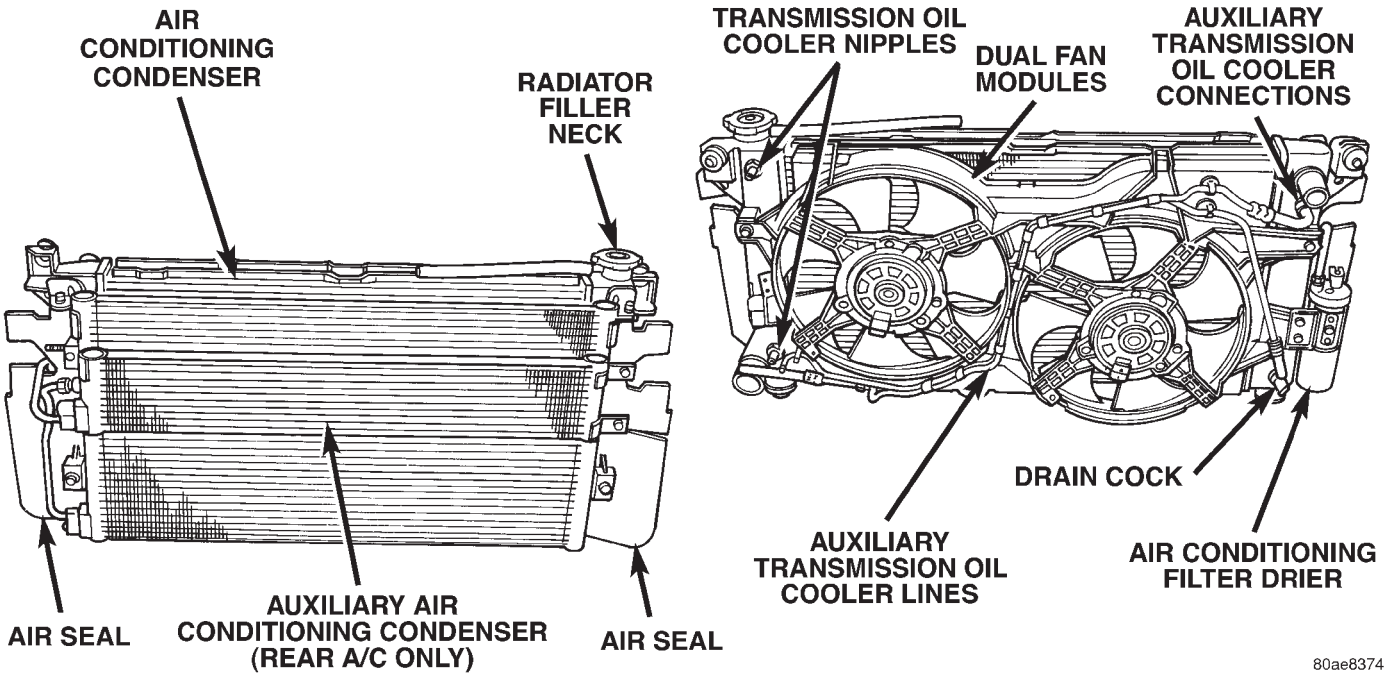

Fig. 6 Cooling Module—Trailer Tow (With Rear A/C)

GENERAL INFORMATION (Continued)

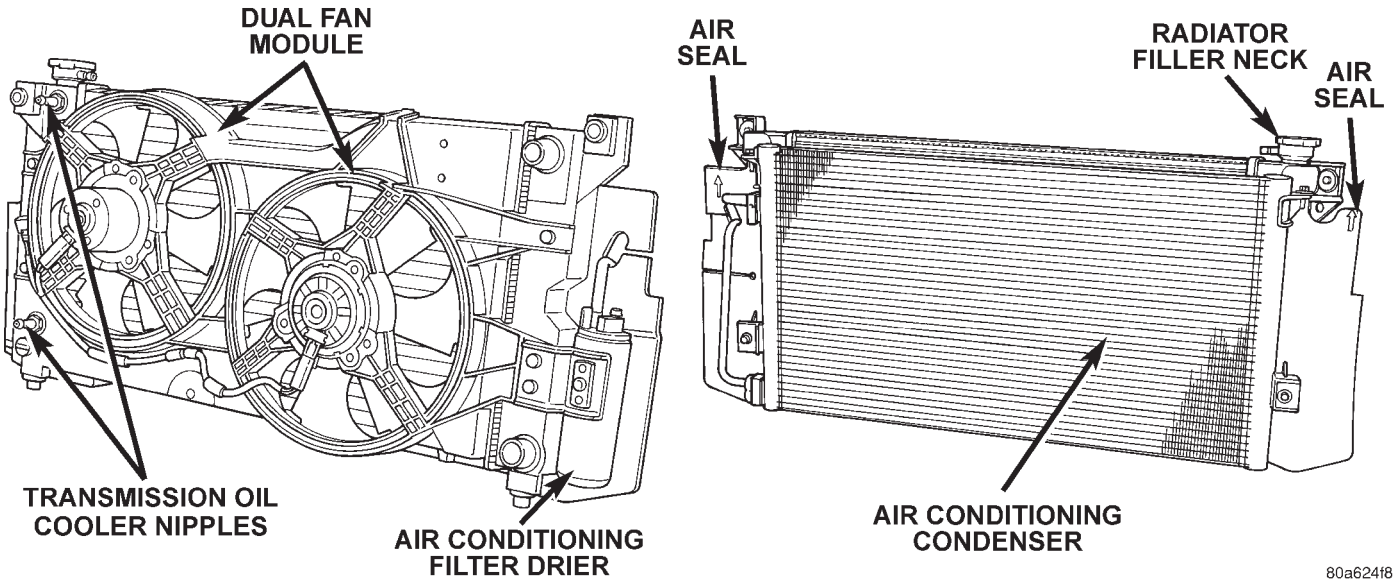

Fig. 7 Cooling Module—3.0L (Front A/C Only)

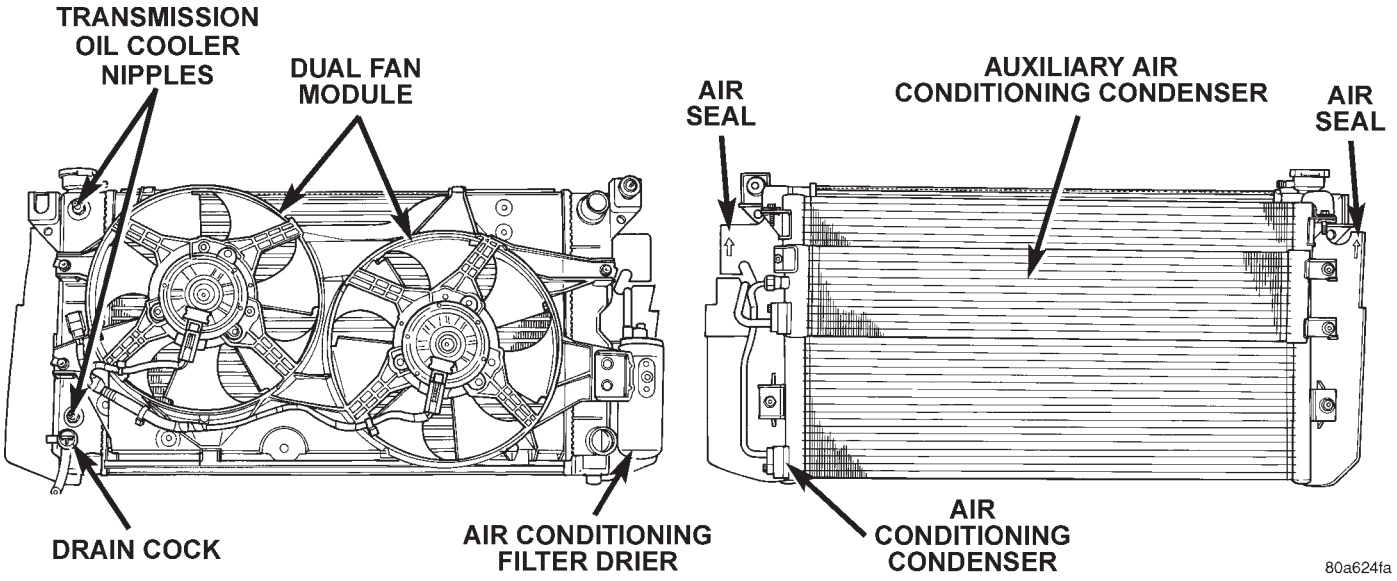

Fig. 8 Cooling Module—3.0/3.3/3.8L (With Rear A/C)

If the gasket is dirty or damaged, a vacuum may not be achieved, resulting is loss of coolant and eventual overheating due to low coolant level in radiator and engine.

ENGINE BLOCK HEATER

The engine block heater is available as an optional accessory on all models. The heater is operated by ordinary house current (110 Volt A.C.) through a power cord located behind the radiator grille. This provides easier engine starting and faster warm-up when vehicle is operated in areas having extremely low temperatures. The heater is mounted in a core hole (in place of a core hole plug) in the engine block, with the heating element immersed in coolant.

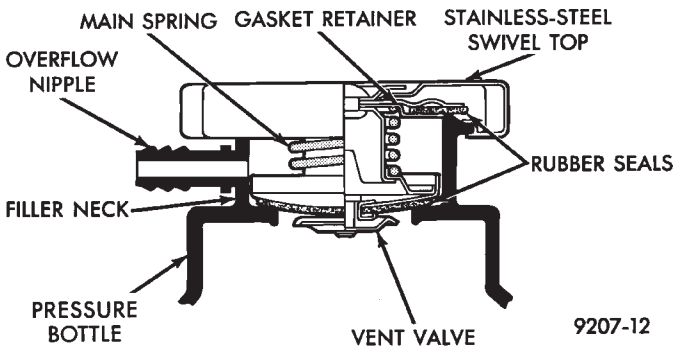

Fig. 9 Radiator Pressure Cap Filler Neck

DESCRIPTION AND OPERATION

WATER PIPES—3.0L ENGINE

The 3.0L engine uses metal piping beyond the lower radiator hose to route (suction) coolant to the water pump, which is located in the V of the cylinder banks (Fig. 10).

These pipes are provided with inlet nipples for thermostat bypass and heater return coolant hoses, and brackets for rigid engine attachment. The pipes employ O-rings for sealing at their interconnection and to the water pump (Fig. 10).

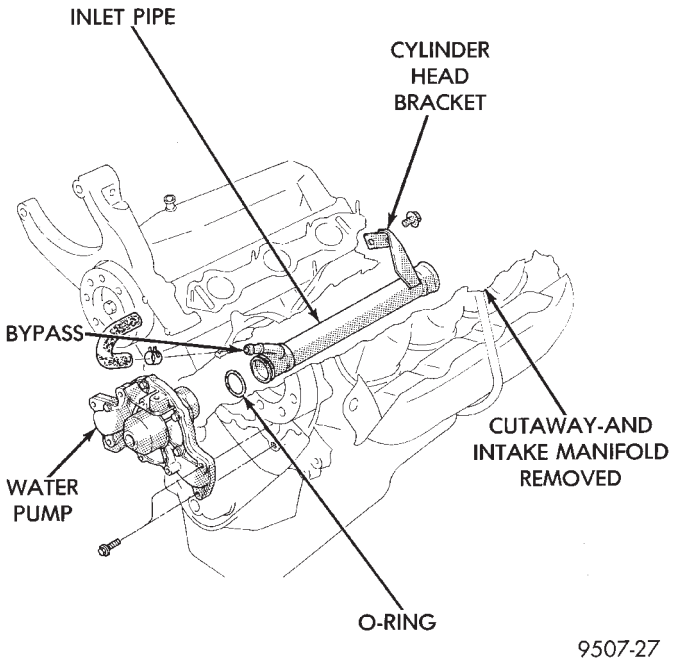

Fig. 10 Engine Inlet Coolant Pipes 3.0L Engine

COOLANT PERFORMANCE

Performance is measurable. For heat transfer pure water excels (Formula = 1 btu per minute for each degree of temperature rise for each pound of water). This formula is altered when necessary additives to control boiling, freezing, and corrosion are added as follows:

- Pure Water (1 btu) boils at 100°C (212°F) and freezes at 0°C (32°F)
- 100 percent Glycol (.7 btu) can cause a hot engine and detonation and will lower the freeze point to -22°C (-8°F).
- 50/50 Glycol and Water (.82 btu) is the recommended combination that provides a freeze point of -37°C (-35°F). The radiator, water pump, engine water jacket, radiator pressure cap, thermostat, temperature gauge, sending unit and heater are all designed for 50/50 glycol.

CAUTION: Do not use well water, or suspect water supply in cooling system. A 50/50 ethylene glycol and distilled water mix is recommended.

Where required, a 56 percent glycol and 44 percent water mixture will provide a freeze point of -59°C (-50°F).

CAUTION: Richer mixtures cannot be measured with field equipment. This can lead to problems associated with 100 percent glycol.

RADIATOR HOSES AND CLAMPS

WARNING: IF VEHICLE HAS BEEN RUN RECENTLY, WAIT 15 MINUTES BEFORE WORKING ON VEHICLE. RELIEVE PRESSURE BY PLACING A SHOP TOWEL OVER THE CAP AND WITHOUT PUSHING DOWN ROTATE IT COUNTERCLOCKWISE TO THE FIRST STOP. ALLOW FLUIDS AND STEAM TO ESCAPE THROUGH THE OVERFLOW TUBE. THIS WILL RELIEVE SYSTEM PRESSURE

The hoses are removed by using constant tension clamp pliers to compress the hose clamp.

A hardened, cracked, swollen or restricted hose should be replaced. Do not damage radiator inlet and outlet when loosening hoses.

Radiator hoses should be routed without any kinks and indexed as designed. The use of molded hoses is recommended.

Spring type hose clamps are used in all applications. If replacement is necessary replace with the original MOPAR® equipment spring type clamp.

WATER PUMP—2.4L ENGINE

The water pump has a diecast aluminum body and housing with a stamped steel impeller. The water pump bolts directly to the block. Cylinder block to water pump sealing is provided by a rubber O-ring. The water pump is driven by the timing belt. Refer to Timing Belt in Group 9, Engine for component removal providing access to water pump.

WATER PUMP—3.0L ENGINE

The pump bolts directly to the engine block, using a gasket for pump to block sealing (Fig. 11). The pump is serviced as a unit.

The water pump is driven by the timing belt. See Timing Belt in Group 9, Engine for component removal providing access to water pump.

DESCRIPTION AND OPERATION (Continued)

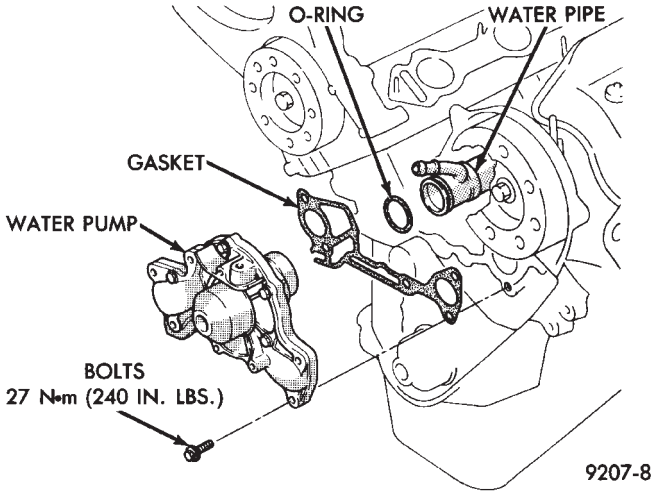

Fig. 11 Water Pump—3.0L Engine

WATER PUMP—3.3/3.8L ENGINES

The pump has a die cast aluminum body and a stamped steel impeller. It bolts directly to the chain case cover, using an O-ring for sealing. It is driven by the back surface of the Poly-V Drive Belt.

DIAGNOSIS AND TESTING

ACCESSORY DRIVE BELT

CONDITION	POSSIBLE CAUSES	CORRECTIONS
INSUFFICIENT ACCESSORY OUTPUT DUE TO BELT SLIPPAGE	1. Belt too loose 2. Belt excessively glazed or worn	1. Adjust belt tension (4 cyl. engine). Replace belt (6 cyl. engine) 2. Replace and tighten as specified
BELT SQUEAL WHEN ACCELERATING ENGINE	1. Belts too loose 2. Belt glazed	1. Adjust belt tension (4 cyl. engine). Replace belt (6 cyl. engine) 2. Replace belts
BELT SQUEAK AT IDLE	1. Belts too loose 2. Dirt or paint imbedded in belt 3. Non-uniform belt 4. Misaligned pulleys 5. Non-uniform groove or eccentric pulley	1. Adjust belt tension (4 cyl. engine). Replace belt (6 cyl. engine) 2. Replace belt 3. Replace belt 4. Align accessories 5. Replace pulley
BELT ROLLED OVER IN GROOVE OR BELT JUMPS OFF	1. Broken cord in belt 2. Belt too loose, or too tight 3. Misaligned pulleys 4. Non-uniform groove or eccentric pulley	1. Replace belt 2. Adjust belt tension (4 cyl. engine). Replace belt (6 cyl. engine) 3. Align accessories 4. Replace pulley

DIAGNOSIS AND TESTING (Continued)

COOLING SYSTEM DIAGNOSIS

Establish what "driving" conditions caused this complaint. Abnormal loads on the cooling system, such as the following may be the problem:

1. Prolonged Idle, Very High Ambient Temperature, Slight Tail Wind at Idle, Slow Traffic, Traffic Jams, High Speed, Steep Grades:
Driving techniques that avoid overheating are:
(a) Idle with A/C off when temperature gauge is at end of normal range.
(b) Do not increase engine speed for more air flow and coolant flow because the electric motor fan systems are not responsive to engine RPM. The added cooling from higher coolant flow rate is more than offset by increased heat rejection (engine heat added to coolant).

2. Trailer Towing:
Consult owner's manual—Trailer Towing. Do not exceed limits.

3. Air Conditioning: Add-on or After Market:
If add-on or after market A/C is involved maximum cooling components should be installed for the model involved per manufacturer's specifications.
Further diagnostic checks should not be required.

4. Recent Service or Accident Repair:
Determine if any recent service has been performed on the vehicle that may affect the cooling system such as engine adjustment (wrong timing), loose or slipping water pump belt, brakes (possibly dragging), changed parts (possibly wrong), recored radiator or cooling system refilling (possibly under-filled or trapped air).
If investigation reveals none of the above as cause for overheating complaint refer to the following symptoms chart.

Symptom	Action
Blinking Engine Warning Light Or High Gauge Indication—Without Coolant Loss	Normal with temporary operation with heavy load, towing a light trailer, high outdoor temperatures, and/or on a steep grade.
Coolant Loss	Improper refilling procedures can result in trapped air in the system. As the cooling system operates the pressure cap and coolant recovery system will deaerate the cooling system. A low coolant level will result in the Coolant Reserve Tank. Add coolant. If condition persists see System Diagnosis.
Fan Never Runs	Refer to Powertrain Diagnostic Manual for test procedure.
Fan Always Runs	Normal with A/C compressor clutch engaged. Otherwise consult Electrical Group 8.
Hot Car (Not Engine) **Heat Damage** **Hot Carpet, Seat, Trunk** **Hot Catalytic Converter** **Smoke, Burnt Odor**	Check heat shielding, exhaust system, emission controls, ignition timing and fuel/air ratio misfiring.
Hot Engine **Crackling Sounds** **Hot Smell** **Severe Local Hot Spots**	A moderate amount of sound of heating metal can be expected with any vehicle. However, a crackling sound from the thermostat housing, a hot smell and/or severe local hot spots on an engine can indicate blocked coolant passages. Inspect for plugged water passages, bad casting, core sand and plugging, a cracked block or head, or a blown head gasket. Usually accompanied with coolant loss.
Coolant Color	Coolant color is not necessarily an indication of adequate temperature or corrosion protection.
Coolant Recovery Bottle **—Level Changes**	Level changes are to be expected as coolant volume changes with engine temperature. If the level in the bottle is between the Maximum and Minimum marks at normal engine operating temperature, the level should return to within that range after operation at elevated temperatures.
—Coolant NOT Returning	Coolant will not return to the radiator if the radiator cap vent valve does not function, if an air leak destroys vacuum, or if the overflow passage is blocked or restricted. Inspect all portions of the overflow passage, pressure cap, filler neck nipple, hose, and passageways within the bottle for vacuum leak only. Coolant return failure will be evident by a low level in the radiator. Bottle level should increase during heat-up.

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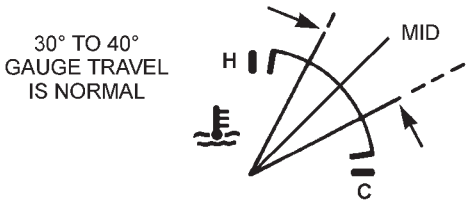
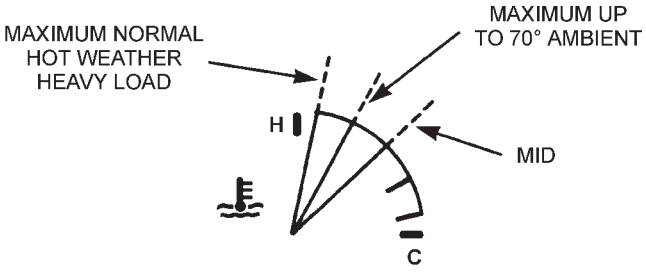
DIAGNOSIS AND TESTING (Continued)

CONDITION–AND CHECKS	DIAGNOSIS
MAGNETIC 90° GAUGE READS LOW	
	
	Fig. 1–Normal Gauge Travel
(1) Verify gauge, (Fig. 1) is temperature really low?	(1) See Electrical, Group 8 and check temperature sending unit. Repair/Replace gauge.
(2) Is code 17 set in diagnostics?	(2) Yes—Thermostat, No—Other
(3) Does it read cold?	(3) Wiring disconnect wrong sending unit used, sending unit for HOT lite, not gauge.
(4) Coolant level low in cold ambient. (Also poor heater performance)	(4) Check radiator and CRS for level—inspect for leaks.
(5) Coolant level O.K.	(5) Check heater controls, doors—see Group 24, Heaters and Air Conditioning.
GAUGE READS HIGH–Without Pressure Cap Blow off without Coolant or Steam from CRS Tank and to Ground	
	Fig. 2—Gauge Reading—Hot Weather—Heavy Load
(1) Is it really reading high?	(1) See Figure 2.
(2) If at "H" without other signs of boiling.	(2) Look for Grounded gauge, sending unit or wire. See Group 8, Electrical.
(3) Coolant level low in Radiator and CRS.	(3) a—Fill full remembering to vent air. b—Inspect for leaks, repair. c—Assure Pressure Cap was shut tight and seals at top and bottom of neck are functioning properly.
(4) Coolant level low in Radiator but not in CRS.	(4) a—Fill full remembering to vent air. b—Inspect for leaks and repair. c—Inspect for leaks in CRS to radiator connection. d—Inspect CRS hose for kinks. e—Assure cap seals at top and bottom.

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DIAGNOSIS AND TESTING (Continued)

CONDITION–AND CHECKS	DIAGNOSIS
(5) Check freeze point.	(5) a—Adjust to 50/50 Glycol and water. b—If no reading or below –59°C (–50°F), mixture is too rich clean system before refilling.
(6) Assure Coolant Flow.	(6) a—Look for flow through filler neck with some coolant removed and thermostat open. b—Repair water pump if necessary. See Water Pump Section.
(7) Other possible causes.	(7) a—**High Speed Only** —Radiator or Condenser air side plugged —Radiator core tubes plugged —Add on A/C without proper radiator —Engine out of tune (specifications) —Brakes dragging —Bug screen —Trailer towing or hill climbing b—**High and Low Speed** —Thermostat failed partially shut particularly if ambient temperature is below 21°C (70°F) and vehicle has high mileage. —Condenser or radiator air side plugged. —Add on A/C. c—**Low Speed—NOT high speed** —Fan not operating. —Check Diagnostics. —Check Fan Motor by wiring to battery, when disconnected from harness. —Check, Group 8, Electrical
Temperatue Gauge Reads Hot with Pressure Cap Blowoff and Steam and coolant to CRS and to Ground	
(1) Coolant Level Low in Radiator and CRS	(1) a—Fill Cooling System Full and Vent Air. b—Inspect for Leaks—repair. c—Assure Pressure cap was shut and seals. d—If low in radiator but not in CRS, also check connection to filler neck and pressure cap sealing. e—Inspect for CRS hose kinks.
(2) Check Coolant Freeze point.	(2) Adjust to 50/50 Glycol and water. –37°C (–35°F.)
(3) Assure Coolant flow.	(3) a—Look for flow through radiator filler neck with coolant lowered and thermostat open. b—When accompanied with "metal cracking sound"—consider core sand and/or bad head casting.
(4) Thermostat failed shut.	(4) Especially in cold to medium ambient temperatures.
(5) Head Gasket Leak.	(5) Use block leak checker.

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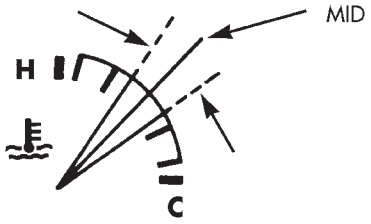
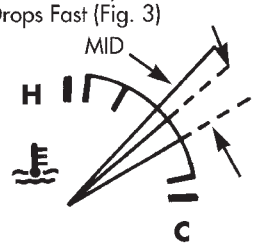
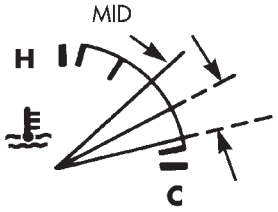
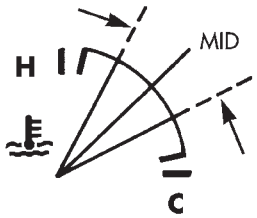
DIAGNOSIS AND TESTING (Continued)

CONDITION—AND CHECKS	DIAGNOSIS
Temperature Gauge Is Inconsistent Cycles—Erratic	 **Fig. 3—Normal Reaction to Fan Cycle**
(1) Is cycle normal?	(1) a—Normal Fan Cycle Due to Temperature. Raises Slowly—Drops Fast (Fig. 3)  **Fig. 4—Gauge Reaction to Thermostat** b—Normal Thermostat Cycle (Fig. 4)  **Fig. 5—Gauge Reaction—Winter, Idle, Heater On** c—Normal cycle at idle in winter with Heater on high. (Heater Heat Transfer exceeds engine Heat Rejection) drops lower with time. Sometimes noticed in winter between Drive and Idle (Fig. 5)  **Fig. 6—Gauge Reaction—Stop after Heavy Use** d—Hot water normal build up at stop after heavy use (Fig. 6)
(2) Is coolant level low in radiator (Low level can trap air in system which can put thermostat pellet in air and it opens late).	(2) Fill system, vent air and inspect for leaks.

DIAGNOSIS AND TESTING (Continued)

CONDITION—AND CHECKS	DIAGNOSIS
(3) Is there a head gasket leak that puts exhaust gas in system? (This acts like trapped air with same effect as 2 above.)	(3) a—Test with block leak checker and replace if necessary. b—Coolant in engine oil. c—White steam coming out of exhaust.
(4) Water pump impeller loose on shaft, slips sometimes.	(4) Replace.
(5) Air lead on suction side of water pump entraining air; see 2 above.	(5) Find leak and repair.
Warning Light Glows All the Time (No Gauge)	
(1) Check temperature sending unit. The sending unit for a light is a switch and has a screwdriver slot in the electrode that is used for calibration. The gauge sending units do NOT have a screwdriver slot.	(1) It is probably a sending unit for a gauge, NOT for a light.
Pressure Cap Blow-Off, With Steam to CRS and Coolant to Ground Without High Reading. Temperature Gauge Above Normal.	
(1) Check pressure cap relief pressure.	(1) Replace if lower than 14 psi.
Coolant Loss to Ground Without Pressure Cap Blow-Off	
(1) Leaks.	(1) a—Pressure test system while shaking hoses. b—Water pump seal. See "water pump," this Group.
Coolant Loss Past Pressure Cap Top Seal—Glycol Seen on Filler Neck	
(1) With normal gauge reading.	(1) a—Cap not on tight. b—Top seal leaking. c—Cap diaphragm "oil canned." d—Filler neck damaged. e—Rubber seal out of position.
(2) With high gauge reading or low gauge reading on new vehicle.	(2) a—CRS hose kinked. b—CRS tank and plastic tube plugged. c—Pressure cap rubber seal out of position.
Detonation or Pre-Ignition When Nothing to Cause It in Engine or Ignition	
(1) Check freeze point of coolant. If tester does not register reading or the reading is below −59°C (−50°F), be aware that 100% glycol makes engine metal run hotter even without a hot gauge reading.	(1) a—Adjust coolant to 50/50 glycol and water −37°C (−35°F). b—If 100% glycol has been found in the system, clean and flush the system before replacing with 50/50 glycol and water.
Hoses Observed Collapsing on Cool-Down	
(1) Check pressure cap vent valve.	(1) a—Must be free to move. Gasket swell can prevent valve from opening. b—Replace cap.
(2) Check CRS hose for kinking or plugging.	(2) Repair as required.
(3) Inside of cap plugged with stop leak pellet, green silica gel, or fiberglass.	(3) Clean cap.
Fan Runs All the Time	
(1) Check for relay.	(1) See Group 8, Electrical.
Fan Noisy	
(1) Check for loose fan. (2) Check for fan clearance to adjacent parts. (3) Check for loose mount fasteners. (4) Check for bent fan blades. (5) Check for fan blades spinning on hub. (6) Check for air obstructions on radiator or condenser.	(1) Repair as necessary.
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DIAGNOSIS AND TESTING (Continued)

CONDITION - AND CHECKS	DIAGNOSIS
Inadequate Air Conditioning Performance - Cooling System Suspected	
(1) Check for plugged air side of condenser and radiator front and rear.	(1) Wash out with low-velocity water.
(2) Assure fan runs whenever A/C head pressure exceeds 1724 kPa (250 psi).	(2) Repair as necessary.
(3) Check for missing air seals-recirculating air path.	
(4) Assure correct cooling system parts.	
Battery Dead - Suspect Fan Current Draw as Cause	
(1) With a good, fully charged battery.	(1) a - Assure fan control is operating properly. (1) b - See charging system in Electrical, Group 8B.
Hot Smell - Suspect Cooling System	
(1) Was temperature gauge high?	(1) a - Yes, See ″Gauge Reads High″ (1) b - No. See 2, 3, 4, and 5.
(2) Heat shields all in place?	(2) a - Yes, See 3, 4, and 5. (2) b - Repair or replace heat shields.
(3) Fan control operating properly?	(3) a - Yes, See 4 and 5. (3) b - No, See Radiator Fan Control this section.
(4) Heat exchanger air side plugged?	(4) Clean as required.
(5) Engine missing or running rich?	(5) Repair as required.
Poor Driveability - Suspect Failed Open Thermostat.	
(1) Check diagnostics - is code 17 set? (Engine too cold for too long)	(1) If yes, change thermostat.
Poor Heater Performance - Suspect Failed Open Thermostat	
(1) Does gauge read low?	(1) See 3
(2) Check coolant level.	(2) See 3
(3) Check diagnostics - is code 17 set? (Engine too cold for too long)	(3) If yes, change thermostat. If no, check heater bypass valve, which should be closed except in Max A/C or off mode; if not, see Heater and Air Conditioning Group, 24.
Steaming, Observe Water Vapor Through Grill or Head Gap at Standstill at Idle - In Wet Weather	
(1) This is normal. It is moisture, snow, or water on the outside of the radiator that evaporates when the thermostat opens to put hot coolant into the radiator. This usually occurs in cold weather with no fan or air flow to blow it away.	(1) Normal condition - no service required.

DIAGNOSIS AND TESTING (Continued)

RADIATOR COOLANT FLOW TEST

To determine whether coolant is flowing through the cooling system, use the following procedure:

(1) If engine is cold, idle engine until normal operating temperature is reached. Then feel the upper radiator hose. If it is hot, coolant is circulating.

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

(2) Remove radiator pressure cap when engine is cold, idle engine until thermostat opens, you should observe coolant flow while looking down the filler neck. Once flow is detected install radiator pressure cap.

RADIATOR FAN CONTROL

Fan control is accomplished two ways. A pressure transducer on the compressor discharge line sends a signal to the Powertrain Control Module (PCM) which will activate the fan. In addition to this control, the fan is turned on by the temperature of the coolant which is sensed by the coolant temperature sensor which sends the message to the PCM. The fan will not run during cranking until the engine starts no matter what the coolant temperature is.

CAUTION: The solid state fan relay is attached to the left frame rail near the lower radiator support. The relay bracket, and fastener are used to dissipate heat from the relay. Ensure the relay is properly attached to prevent the following:

- Intermittent engine overheating.
- Relay “thermal” shutdown, or relay damage.

ELECTRIC FAN MOTOR TEST

Refer to Powertrain Diagnostic Manual for procedure.

TESTING COOLING SYSTEM FOR LEAKS

With engine not running, wipe the radiator filler neck sealing seat clean. The radiator should be full.

Attach the Radiator Pressure Tool to the radiator, as shown in (Fig. 12) 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 radiator and heater hoses should be shaken while at 104 kPa (15 psi), since some leaks occur only while driving due to engine movement.

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

RADIATOR FAN OPERATION

Radiator Fan Control			A/C Pressure	
Fan Operation	Low Fan Speed 30%	High Fan Speed 100%	Low Fan Speed 30%	High Fan Speed 100%
On:	104°C (220°F)	110°C (230°F) Fan Speed Duty-Cycles (Ramps-up) from 31% to 99%	1,724 Kpa (250 psi)	2,068 Kpa (300 psi)Fan Speed Duty-Cycles (Ramps-up) from 31% to 99%
Off:	101°C (214°F)	Fan Speed Duty-Cycles (Ramps-down) from 99% to 31%	1,710 Kpa (248 psi)	Fan Speed Duty-Cycles (Ramps-down) from 99% to 31%

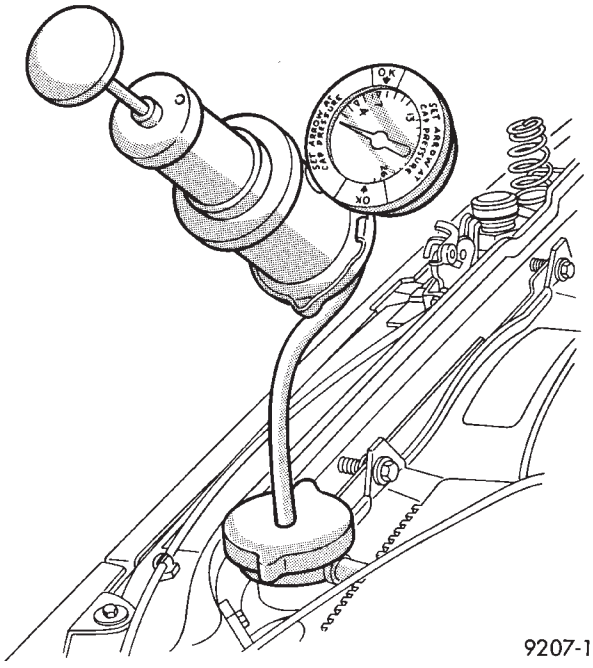


Fig. 12 Pressure Testing Cooling System

DIAGNOSIS AND TESTING (Continued)

WARNING: WITH TOOL IN PLACE, PRESSURE WILL BUILD UP FAST. EXCESSIVE 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 emits from the tail pipe, it may indicate a coolant leak caused by a faulty head gasket, cracked engine block, or cracked cylinder head.

There may be internal leaks that 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.

RADIATOR CAP TO FILLER NECK SEAL PRESSURE RELIEF CHECK

The pressure cap upper gasket (seal) pressure relief can be checked by removing the overflow hose at the radiator filler neck nipple (Fig. 13). Attach the Radiator Pressure Tool to the filler neck nipple and pump air into the radiator. Pressure cap upper gasket should relieve at 69-124 kPa (10-18 psi) and hold pressure at 55 kPa (8 psi) minimum.

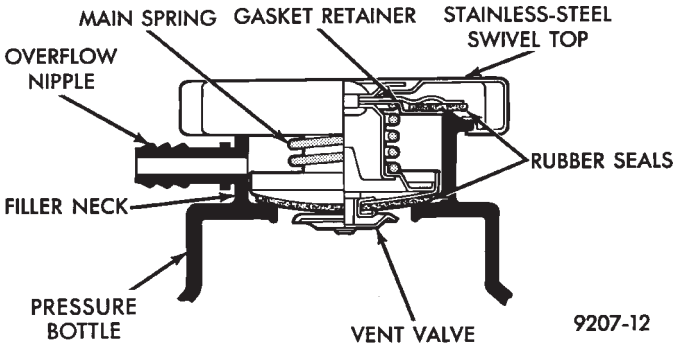


Fig. 13 Radiator Pressure Cap Filler Neck

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

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

(1) Check and adjust coolant freeze point. By adding or subtracting coolant through CRS bottle.
(2) Refill system with new coolant.
(3) Conducting service procedures.
(4) Checking for vacuum leaks.

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 COUNTERCLOCKWISE TO THE FIRST STOP. ALLOW FLUIDS TO ESCAPE THROUGH THE OVERFLOW TUBE AND WHEN THE SYSTEM STOPS PUSHING COOLANT AND STEAM INTO THE CRS TANK AND PRESSURE DROPS PUSH DOWN AND 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.

PRESSURE TESTING RADIATOR CAP

Dip the pressure cap in water, clean any deposits off the vent valve or its seat and apply cap to end of Radiator Pressure Tool. Working the plunger, bring the pressure to 104 kPa (15 psi) on the gauge. If the pressure cap fails to hold pressure of at least 97 kPa (14 psi) replace cap. See **CAUTION**.

If the pressure cap tests properly while positioned on Radiator Pressure Tool (Fig. 14), but will not hold pressure or vacuum when positioned on the radiator. Inspect the radiator filler neck and cap top gasket for irregularities that may prevent the cap from sealing properly.

CAUTION: Radiator Pressure Tool is very sensitive to small air leaks that will not cause cooling system problems. A pressure cap that does not have a history of coolant loss should not be replaced just because it leaks slowly when tested with this tool. Add water to the tool. Turn tool upside down and recheck pressure cap to confirm that cap is bad.

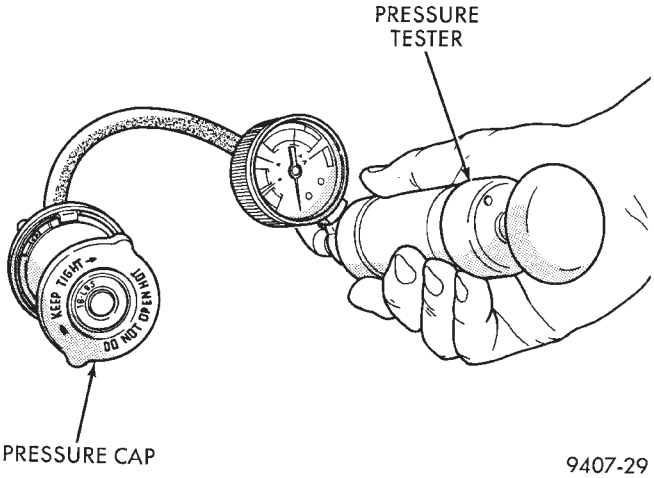


Fig. 14 Pressure Testing Radiator Cap

LOW COOLANT LEVEL AERATION

Low coolant level in a cross flow radiator will equalize in both tanks with engine off. With engine

DIAGNOSIS AND TESTING (Continued)

at running operating temperature the high pressure inlet tank runs full and the low pressure outlet tank drops:

- Transmission oil will become hotter.
- High reading shown on the temperature gauge.
- Air in the coolant can cause loss of flow through the heater.
- Exhaust gas leaks into the coolant also can cause the same problems.

DEAERATION

Air can only be removed from the system by gathering under the pressure cap. On the next heat up it will be pushed past the pressure cap into the CRS tank by thermal expansion of the coolant. It then escapes to the atmosphere in the CRS tank and is replaced with solid coolant on cool down.

TEMPERATURE GAUGE INDICATION

At idle with Air Conditioning off the temperature gauge will rise slowly to about 5/8 gauge travel, the fan will come on and the gauge will quickly drop to about 1/2 gauge travel. This is normal.

SERVICE PROCEDURES

COOLANT LEVEL CHECK—ROUTINE

Do not remove radiator cap for routine coolant level inspections.

The coolant reserve system provides a quick visual method for determining the coolant level without removing the radiator cap. **With the engine cold and not running,** simply observe the level of the coolant in the reserve tank (Fig. 3). The coolant level should be between the minimum and maximum marks.

COOLANT—ADDING ADDITIONAL

The radiator cap should not be removed. When additional coolant is needed to maintain this level, it should be added to the coolant reserve tank. Use only 50/50 mix of ethylene glycol type antifreeze and water.

CAUTION: Do not use well water, or suspect water supply in cooling system. A 50/50 ethylene glycol and distilled water mix is recommended.

COOLANT LEVEL SERVICE

The cooling system is closed and designed to maintain coolant level to the top of the radiator.

When servicing requires a coolant level check in the radiator, the engine must be **off** and **not** under pressure. Drain several ounces of coolant from the radiator draincock while observing the Coolant Recovery System (CRS) Tank. Coolant level in the CRS tank should drop slightly. Then remove the radiator cap. The radiator should be full to the top. If not, and the coolant level in the CRS tank is at the MIN mark there is an air leak in the CRS system. Check hose or hose connections to the CRS tank, radiator filler neck or the pressure cap seal to the radiator filler neck for leaks.

COOLING SYSTEM—DRAINING

Without removing radiator pressure cap and with system not under pressure, shut engine off and open draincock. The coolant reserve tank should empty first, then remove radiator pressure cap. (if not, see Testing Cooling System for leaks). To vent 2.4L engine remove the coolant temperature sensor located above water outlet housing (Fig. 15). The 3.0/3.3/3.8L engines have an air bleed vent on the thermostat.

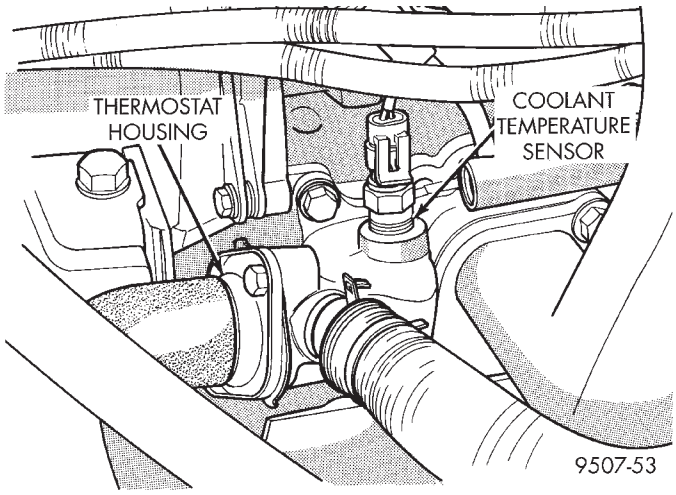


Fig. 15 Coolant Temperature Sensor—2.4L Engine Drain/Fill

Removal of a sensor is required because the thermostat does not have an air vent. Sensor removal allows an air bleed for coolant to drain from the engine block.

COOLING SYSTEM—REFILLING

First clean system to remove old coolant, see Cooling System Cleaning.

Fill the system, using the correct antifreeze as described in the Coolant Section. Fill the system to 50 percent of its capacity with 100 percent glycol. Then complete filling system with water. The 2.4L engine requires venting by removal of the coolant sensor on top of the water outlet connector (Fig. 15). When coolant reaches this hole:

- Install coolant sensor and tighten to 7 N·m (60 in. lbs.) for 2.4L Engines.

SERVICE PROCEDURES (Continued)

Continue filling system until full, this provides better heater performance. **Be careful not to spill coolant on drive belts or the generator.**

Fill coolant reserve system to at least the MAX mark with 50/50 solution. It may be necessary to add coolant to the reserve tank after three or four warm up/cool down cycles to maintain coolant level between the MAX and MIN mark. This will allow trapped air to be removed from the system.

REMOVAL AND INSTALLATION

WATER PUMP—2.4L ENGINE

REMOVAL

(1) Disconnect negative cable from battery.

(2) Raise vehicle on a hoist. Remove right inner splash shield.

(3) Remove accessory drive belts. Refer to Accessory Drive Belt service in this section.

(4) Drain cooling system. Refer to Cooling System Draining in this section.

(5) Support engine from the bottom and remove right engine mount.

(6) Remove right engine mount bracket.

(7) Remove timing belt. Refer to Group 9, Engine for procedure.

(8) Remove timing belt idler pulley.

(9) Hold camshaft sprocket with Special tool C-4687 and adaptor C-4687-1 while removing bolt. Remove both cam sprockets.

(10) Remove rear timing belt cover.

(11) Remove water pump attaching screws to engine (Fig. 16).

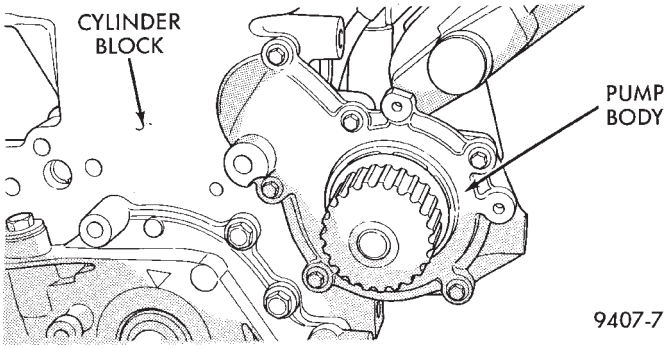


Fig. 16 Water Pump—2.4L Engine

INSTALLATION

(1) Install new O-ring gasket in water pump body O-ring groove (Fig. 17).

CAUTION: Make sure O-ring is properly seated in water pump groove before tightening screws. An improperly located O-ring may cause damage to the O-ring and cause a coolant leak.

(2) Assemble pump body to block and tighten screws to 12 N·m (105 in. lbs.) (Fig. 16). Pressurize cooling system to 15 psi with pressure tester and check water pump shaft seal and O-ring for leaks.

(3) Rotate pump by hand to check for freedom of movement.

(4) Install rear timing belt cover.

(5) Install camshaft sprockets and torque bolts to 101 N·m (75 ft. lbs.).

(6) Install timing belt idler pulley and torque mounting bolt to 61 N·m (45 ft. lbs.).

(7) Install timing belt. Refer to Group 9, Engine, 2.4L Timing Belt.

(8) Install right engine mount bracket and engine mount. Refer to Group 9 for procedure.

(9) Fill cooling system. See **Cooling System Filling.**

(10) Install accessory drive belts, Refer to Accessory Drive Belts, in this section.

(11) Lower vehicle and connect battery cable.

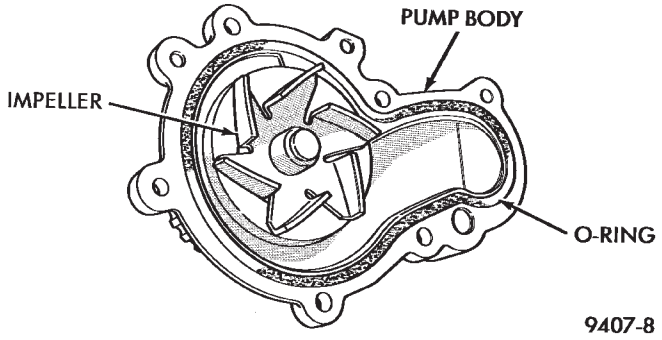


Fig. 17 Water Pump Body

WATER PUMP INLET TUBE—2.4L ENGINE

REMOVAL

(1) Drain cooling system. Refer to procedure outlined in this section.

(2) Remove upper radiator hose to access the hose connections at the inlet tube.

(3) Remove lower radiator hose and heater hose from the inlet tube (Fig. 18).

(4) Remove the 2 fasteners that hold the inlet tube to the block.

(5) Rotate tube while removing the tube from the engine block (Fig. 19).

INSTALLATION

(1) Inspect the O-ring for damage before installing the tube into the cylinder block (Fig. 19).

(2) Lube O-ring with coolant and install into the cylinder block opening.

(3) Install 2 fasteners and tighten to 12 N·m (105 in. lbs.).

(4) Connect lower radiator hose and heater hose to inlet tube (Fig. 18).

REMOVAL AND INSTALLATION (Continued)

(5) Install upper radiator hose.

(6) Fill cooling system. Refer to procedure outlined in this section.

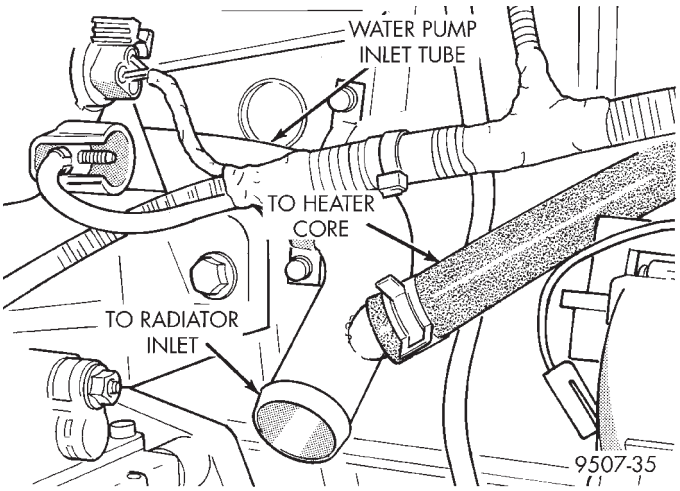


Fig. 18 Water Pump Inlet Tube Hose Connections

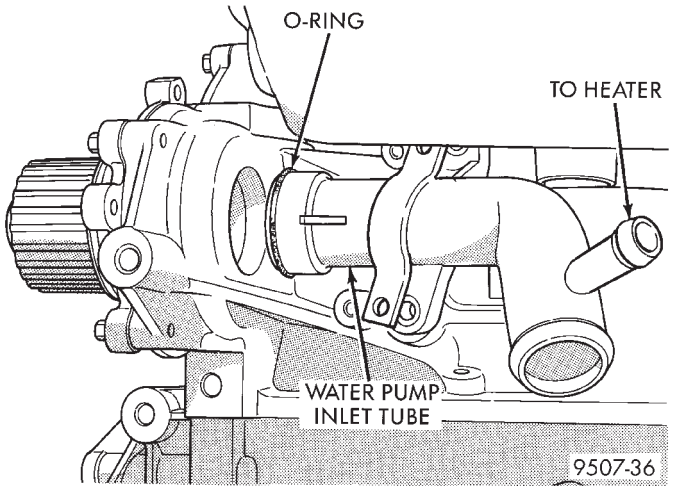


Fig. 19 Water Pump Inlet Tube —Service

WATER PUMP—3.0L ENGINE

REMOVAL

(1) Drain cooling system. Refer to Draining Cooling System in this group.

(2) To gain access to water pump refer to Group 9, Engine for Timing Belt Removal.

(3) Remove mounting bolts.

(4) Separate pump from water inlet pipe (Fig. 20) and (Fig. 21) and remove.

INSPECTION

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, evident by traces of coolant leaks from vent hole **A** in (Fig. 21).

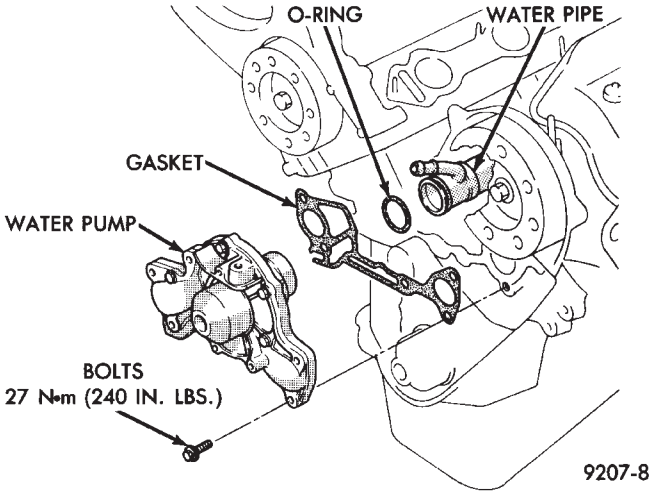


Fig. 20 Water Pump—3.0L Engine

(3) Impeller rubs the inside of pump.

(4) Loose or rough turning bearing.

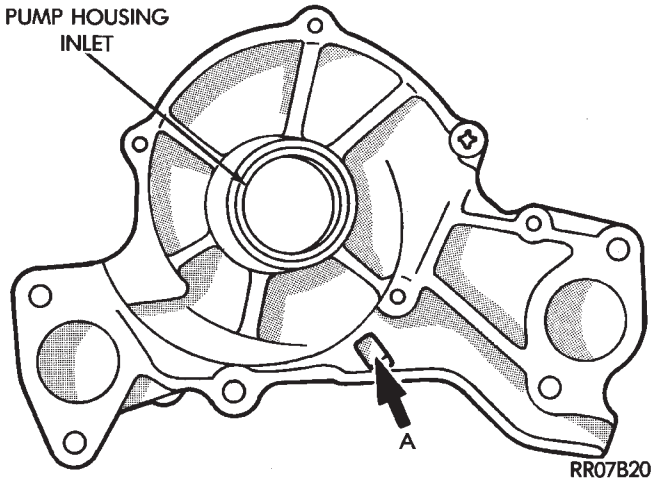


Fig. 21 Water Pump Inspection

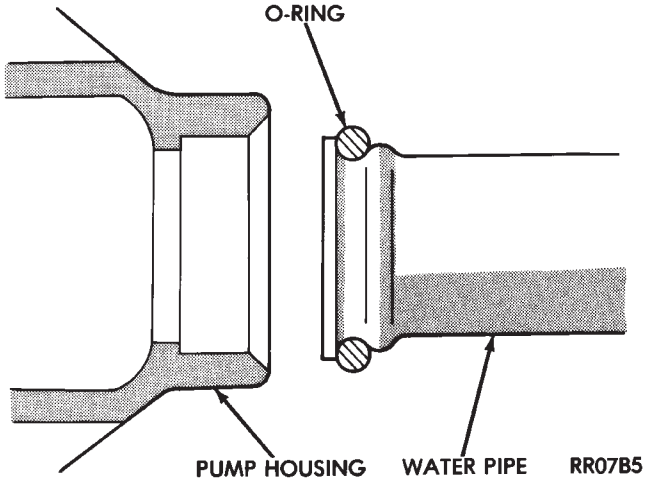


Fig. 22 Water Pipe O-Ring

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

(1) Clean all gasket and O-ring surfaces on pump and water pipe inlet tube.

(2) Install new O-ring on water inlet pipe (Fig. 22). Wet the O-ring (with water) to ease assembly.

CAUTION: Keep the O-ring free of oil or grease.

(3) Install new gasket on water pump and install pump inlet opening over water pipe, press assembly to cause water pipe insertion into pump housing.

(4) Install pump to block mounting bolts and tighten to 27 N·m (20 ft. lbs.).

(5) See Timing Belt in Engine, Group 9 and install timing belt. Reassemble engine.

(6) Fill cooling system. See Refilling Cooling System.

WATER PUMP—3.3/3.8L ENGINES

REMOVAL

(1) Drain Cooling System. Refer to Draining Cooling System in this group.

(2) Remove Poly-V Drive Belt.

(3) Remove right front lower fender shield.

(4) Remove pump pulley bolts and remove pulley.

(5) Remove pump mounting screws (Fig. 23). Remove water pump.

(6) Remove and discard O-ring seal.

(7) Clean O-ring groove and O-ring surfaces on pump and chain case cover. Take care not to scratch or gouge sealing surface.

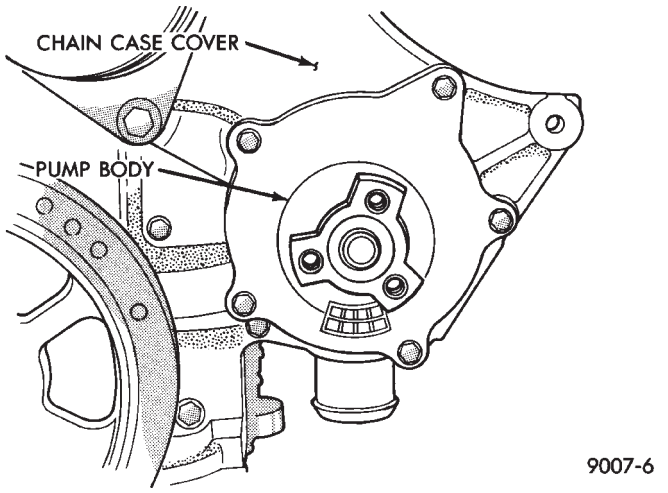


Fig. 23 Water Pump —3.3/3.8L Engines

INSTALLATION

(1) Install new O-ring into groove (Fig. 24).

(2) Install pump to chain case cover. Torque screws to 12 N·m (105 in. lbs.)

(3) Rotate pump by hand to check for freedom of movement.

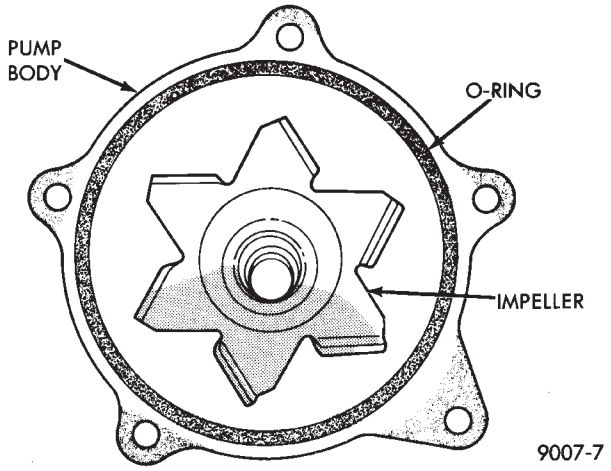


Fig. 24 Water Pump Body

(4) Position pulley on pump. Install screws and torque to 30 N·m (250 in. lbs.).

(5) Install drive belt. See Accessory Drive Belts in this group.

(6) Install right front lower fender shield.

(7) Refill Cooling System. See Refilling Cooling System.

THERMOSTAT—2.4L ENGINE

REMOVAL

(1) Drain cooling system down below the thermostat level. Refer to Draining Cooling System in this group.

(2) Remove thermostat housing bolts and housing (Fig. 25).

(3) Remove thermostat, discard gasket and clean both gasket sealing surfaces.

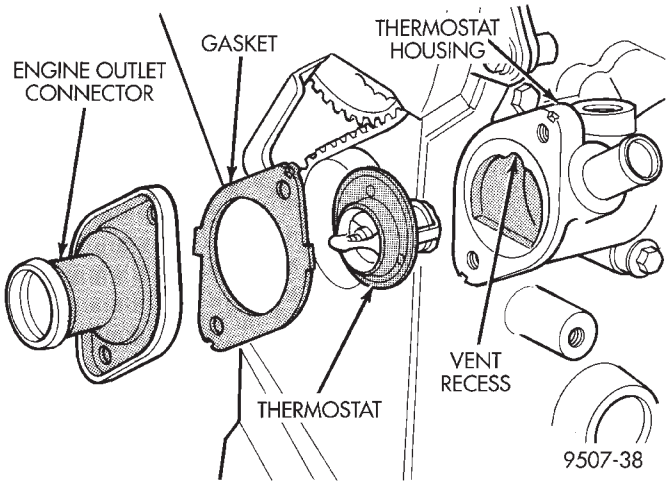


Fig. 25 Thermostat, Housing, and Outlet Connector—2.4L Engine

REMOVAL AND INSTALLATION (Continued)

INSTALLATION—2.4L ENGINE

(1) Place a new gasket (dipped in clean water) on the engine outlet connector surface. Center the thermostat in thermostat housing (Fig. 25).

(2) Place the engine outlet connector and gasket over the thermostat, making sure thermostat is seated in the thermostat housing.

(3) Bolt outlet connector to thermostat housing (Fig. 25). Tighten bolts to 28 N·m (250 in. lbs.).

(4) Refill the cooling system to the proper level. Refer to Cooling System Refilling outlined in this section for procedure

THERMOSTAT—3.0L ENGINE

REMOVAL

(1) Drain cooling system down below the thermostat level. Refer to Draining Cooling System in this group.

(2) Remove thermostat housing bolts and housing (Fig. 26).

(3) Remove thermostat, discard gasket and clean both gasket sealing surfaces.

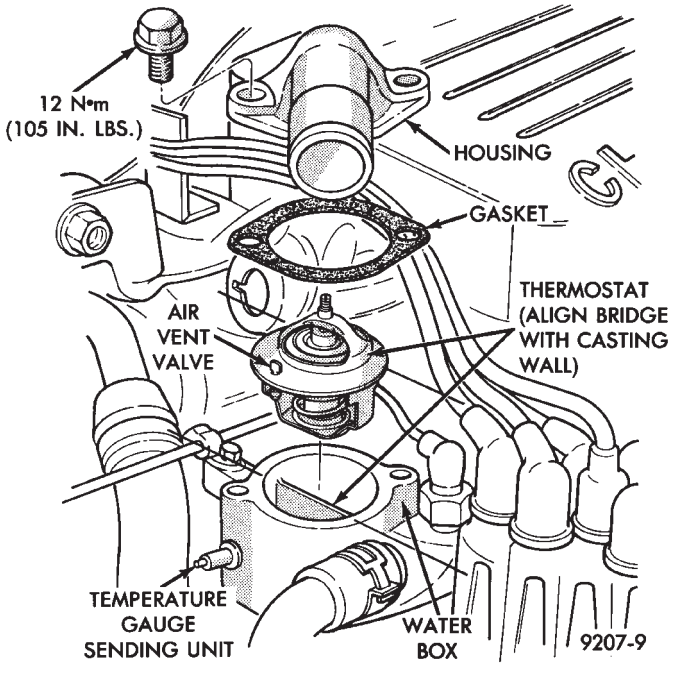


Fig. 26 Thermostat, Housing, and Water Box—3.0L Engine

INSTALLATION—3.0L ENGINE

(1) Center thermostat in water box pocket. Check that the flange is seated correctly in the countersunk portion of the intake manifold water box (Fig. 26) and (Fig. 27).

(2) Install new gasket on water box.

(3) Install housing over gasket and thermostat and tighten bolts to 12 N·m (105 in. lbs.).

(4) Refill the cooling system to the proper level. Refer to Cooling System Refilling outlined in this section for procedure.

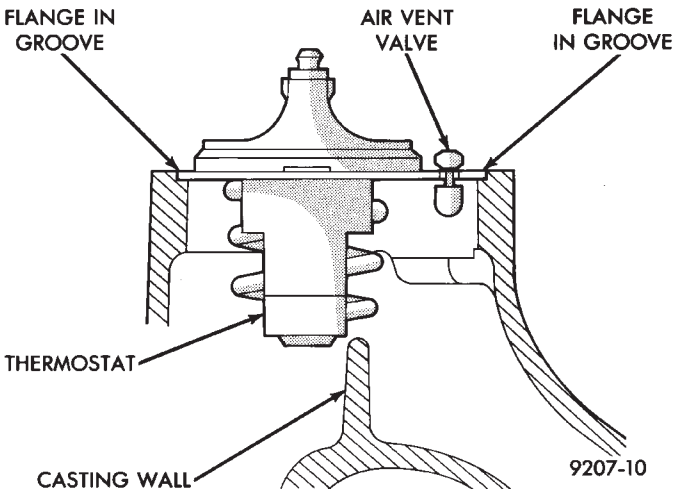


Fig. 27 Thermostat Installed—3.0L Engine

THERMOSTAT—3.3/3.8L ENGINES

REMOVAL

(1) Drain cooling system down below the thermostat level. Refer to Cooling System Draining in this section.

(2) Remove thermostat housing bolts and housing (Fig. 28).

(3) Remove thermostat, discard gasket and clean both gasket sealing surfaces.

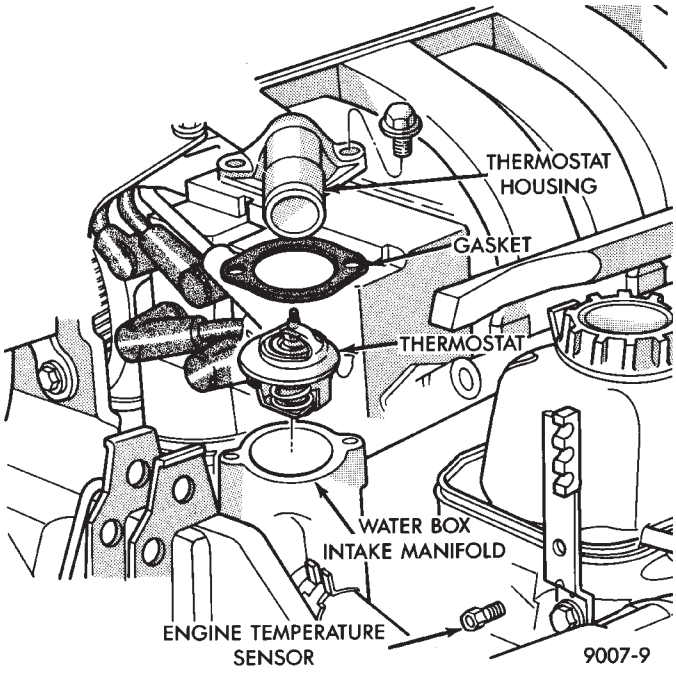


Fig. 28 Thermostat, Housing, and Water Box—3.3/3.8L Engines

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

(1) Place a new gasket (dipped in water) on the thermostat housing surface, center thermostat into opening in the intake manifold water box.

(2) Place housing and gasket over the thermostat, making sure thermostat is in the recess provided (Fig. 28).

(3) Bolt housing to intake manifold, tighten bolts to 28 N·m (250 in. lbs.).

(4) Refill the cooling system to the proper level. Refer to Cooling System Refilling outlined in this section for procedure.

RADIATOR

REMOVAL

(1) Disconnect negative cable from battery.

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 Draining Cooling System of this section.

(3) Remove air intake resonator.

(4) Remove coolant reserve system tank to filler neck tube hose.

(5) Disconnect fans from the connector located on the left side of the fan module.

(6) Remove the Coolant Recovery System (CRS) tank retaining screw from the upper radiator closure panel crossmember.

(7) Disconnect the upper radiator mounting screws from the crossmember. Disconnect the engine block heater wire if equipped.

(8) Remove the upper radiator closure panel crossmember. Refer to Group 23 Body for procedure.

(9) Remove air cleaner assembly.

(10) Disconnect automatic transmission oil cooler lines at radiator and plug.

(11) Disconnect inlet and outlet hoses from the radiator. Remove the lower hose clip from the fan module.

(12) Remove A/C condenser fasteners and separate the condenser from the radiator (Fig. 29). Verify the condenser is supported in position.

(13) Remove A/C filter/dryer mounting bracket, 2 bolts to the fan module, and 2 nuts to the filter/dryer.

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

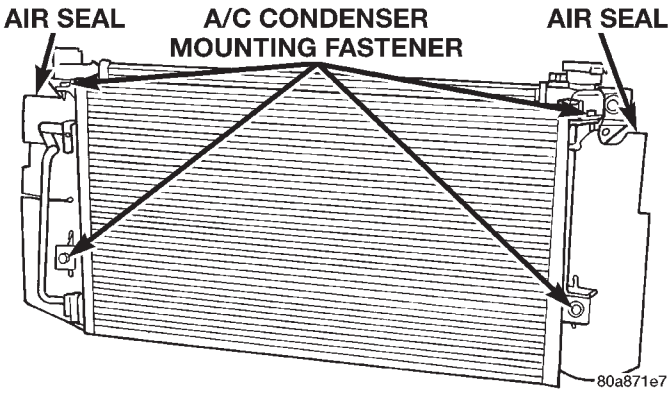


Fig. 29 Air Conditioning Condenser Mounting Fasteners

INSTALLATION

(1) **Be sure the air seals are in position before radiator is installed.** Slide radiator down into position behind closure panel. Seat the radiator with the rubber isolators into the mounting holes provided, with a 10 lbs. force.

(2) Install A/C filter/dryer and mounting bracket onto fan module.

(3) Install Air Conditioning Condenser onto the radiator (Fig. 29).

(4) Unplug and connect automatic transmission oil cooler lines to radiator.

(5) Install inlet and outlet radiator hoses (including coolant reserve hose) and connect the fan motor electrical connection.

(6) Install air cleaner assembly.

(7) Install the upper radiator closure panel crossmember. Refer to Group 23 Body for procedure.

(8) Install the upper radiator mounting screws. Tighten radiator mounting bolts to 12 N·m (105 in. lbs.). Connect the engine block heater wire if equipped.

(9) Install the Coolant Recovery System (CRS) tank retaining screw to the upper radiator closure panel crossmember.

(10) Install air intake resonator.

(11) Fill cooling system. Refer to Cooling System Filling in this section.

(12) Connect negative cable to battery.

RADIATOR DRAINCOCK

REMOVAL

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

(1) Turn the draincock stem counterclockwise to unscrew the stem. When the stem is unscrewed to

REMOVAL AND INSTALLATION (Continued)

the end of the threads turn back 1/8 turn and, pull the stem (Fig. 30) from the radiator tank.

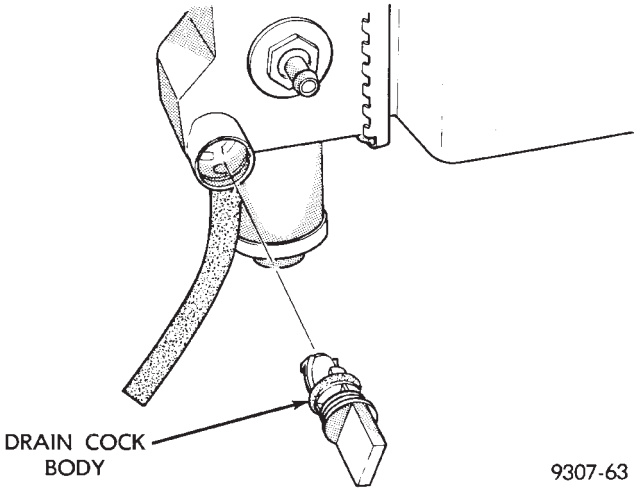


Fig. 30 Draincock Disassembled

INSTALLATION

(1) Push the draincock assembly body into the tank opening until it snaps into place.

(2) Tighten the draincock stem by turning clockwise until it stops.

FAN MODULE

REMOVAL

There are no repairs to be made to the fan or shroud assembly. If the fan is warped, cracked, or otherwise damaged, it must be replaced as a assembly (Fig. 31).

(1) Raise the vehicle on hoist.

(2) Remove the radiator outlet hose from hose retaining clip and remove clip from shroud.

(3) Remove lower auxiliary transmission cooler lines from retaining clips on the fan module shroud, if equipped.

(4) Lower the vehicle. Remove the air intake resonator from the throttle body and air cleaner assembly.

(5) Disconnect the fans electrical connector located on the left side of the fan module.

(6) Remove the Coolant Recovery System (CRS) attaching screw from the upper crossmember.

(7) Remove upper grill to crossmember valence panel.

(8) Disconnect the upper radiator mounts from the crossmember. Remove the upper crossmember. Refer to Group 23 Body for procedure.

(9) Remove the air cleaner assembly.

(10) Remove fan module retaining fasteners (Fig. 31).

(11) Remove upper auxiliary transmission cooler lines from retaining clips on the fan module shroud, if equipped.

(12) Disconnect and plug the transmission line from the radiator fitting on the lower left side.

(13) Raise vehicle on the hoist and remove the filter/drier, fan module and radiator mounting bolts located on the lower right of the module.

(14) Lower the vehicle on hoist and remove the upper fan module to radiator retaining clips.

(15) Remove the fan module from the vehicle.

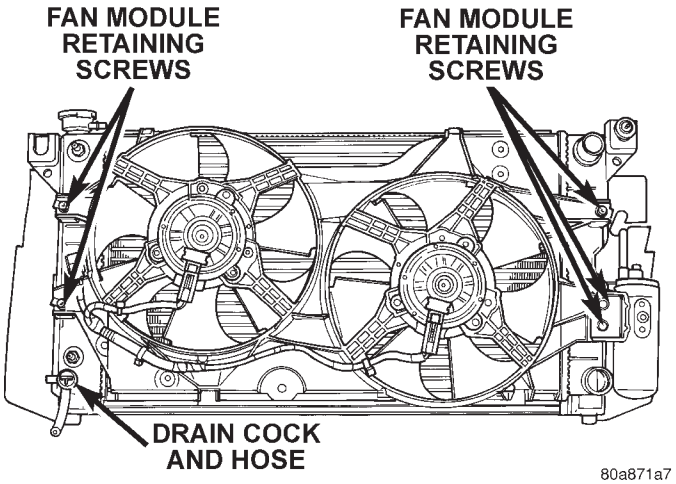


Fig. 31 Fan Module

INSTALLATION

(1) Install fan module assembly into attaching clips on the radiator.

(2) Install the upper fan module to radiator retaining clips.

(3) Raise vehicle on the hoist and install the filter/drier, fan module and radiator mounting fasteners located on the lower right of the module.

(4) Lower the vehicle. Connect the transmission line to the radiator fitting on the lower left side.

(5) Install the upper auxiliary transmission cooler lines to the retaining clips on the fan module shroud, if equipped.

(6) Install fan module retaining fasteners (Fig. 31). Tighten to 12 N·m (105 in. lbs.).

(7) Install the air cleaner assembly.

(8) Install the crossmember. Refer to Group 23 Body for procedure. Connect the upper radiator mounts to the crossmember. Tighten fasteners to 12 N·m (105 in. lbs.).

(9) Install the Coolant Recovery System (CRS) attaching screw to the upper crossmember. Tighten to 2 N·m (18 in. lbs.).

(10) Install upper grill to crossmember valence panel.

(11) Connect the fans to the connector located on the left side of the fan module.

(12) Install the air intake resonator to the throttle body and air cleaner assembly.

REMOVAL AND INSTALLATION (Continued)

(13) Raise the vehicle. Install the lower auxiliary transmission cooler lines to the retaining clips on the fan module shroud, if equipped.

(14) Install outlet hose retainer clip to the shroud. Install the radiator outlet hose to the retaining clip.

(15) Lower the vehicle.

ENGINE BLOCK HEATER

REMOVAL

(1) Drain coolant from radiator and cylinder block. Refer to Cooling System Drain, Clean, Flush and Refill of this section for procedure.

(2) Remove power cord plug from heater.

(3) Loosen screw in center of heater. Remove heater assembly.

INSTALLATION

(1) Thoroughly clean core hole and heater seat.

(2) Insert heater assembly with element loop positioned **upward.**

(3) With heater seated, tighten center screw securely to assure a positive seal.

(4) Fill cooling system with coolant to the proper level, vent air, and inspect for leaks. Pressurize system with Radiator Pressure Tool before looking for leaks.

(5) Install power cord plug to heater.

ACCESSORY DRIVE BELTS—2.4L

REMOVAL/INSTALLATION-ADJUST

GENERATOR AND AIR CONDITIONING

(1) Loosen lower generator pivot bolt and upper locking nut, then loosen adjusting bolt (Fig. 32) to remove belt tension.

CAUTION: Belt damage may occur if the following procedure is not performed.

(2) Tighten lock nut to 21 N·m (180 in. lbs.) and torque generator pivot bolt to 54 N·m (40 ft. lbs.). To assure proper alignment of generator assembly. Adjust belt tension by tightening the adjusting bolt until proper belt tension is obtained. Refer to tension specification in Belt Tension Chart.

(3) Torque lock nut to 54 N·m (40 ft. lbs.).

POWER STEERING PUMP

(1) From on top of the vehicle loosen locking nuts D and F (Fig. 33).

(2) From under the vehicle loosen the pivot bolt E. Loosen adjusting bolt G until belt can be removed.

(3) After installing a new belt, adjust belt tension by tightening the adjusting bolt until the proper tension obtained. Refer to tension specification in Belt Tension Chart.

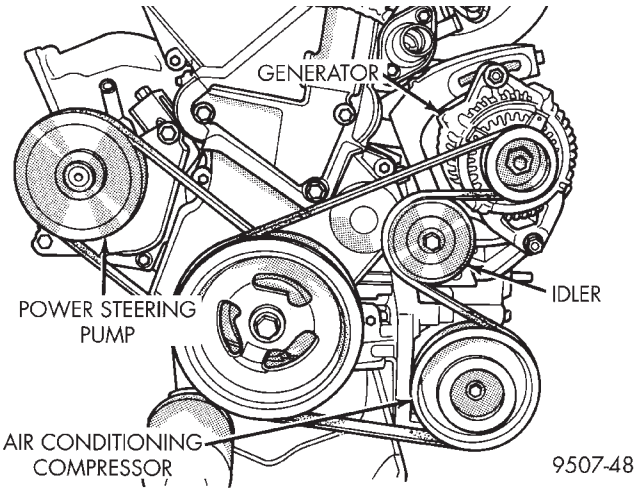


Fig. 32 Air Conditioning Compressor/Generator Belts—2.4L

(4) Tighten locking nuts D and F to 54 N·m (40 ft. lbs.).

(5) Tighten pivot bolt E to 54 N·m (40 ft. lbs.)

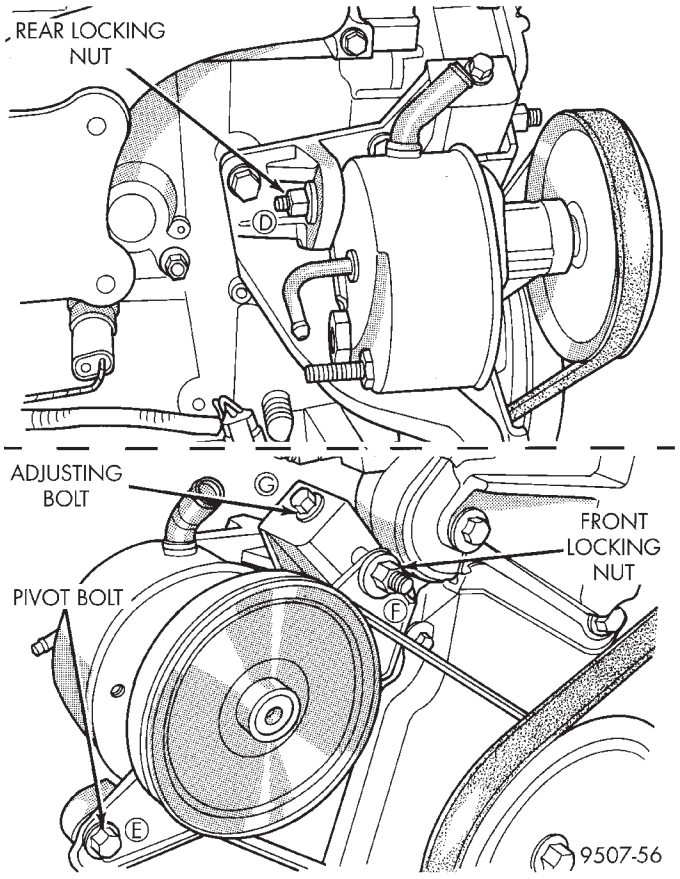


Fig. 33 Power Steering Pump Adjustment

REMOVAL AND INSTALLATION (Continued)

ACCESSORY DRIVE BELTS—3.0L

GENERATOR/POWER STEERING PUMP BELT

REMOVAL/INSTALLATION

The Poly-V generator/power steering pump belt is provided with a dynamic tensioner (Fig. 34) to maintain proper belt tension. To remove or install this belt, apply force in a clockwise direction to the tensioner pulley bolt (Fig. 34).

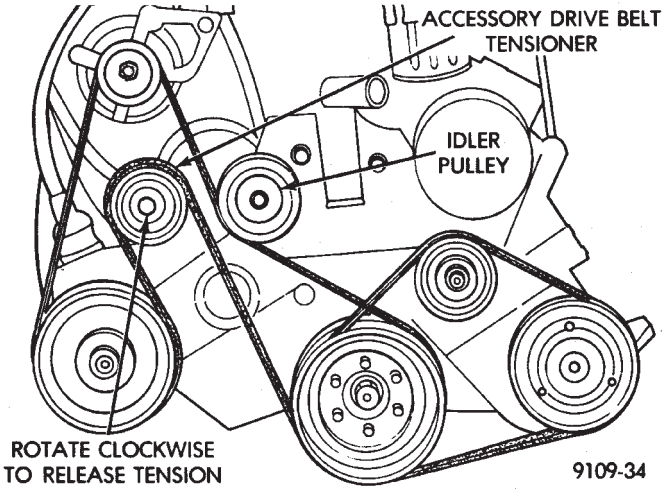


Fig. 34 Release Belt Tensioner—3.0L

AIR CONDITIONING BELT

REMOVAL

To remove the air conditioning compressor drive belt, first loosen the idler pulley lock nut, then turn the adjusting screw to lower the idler pulley (Fig. 35).

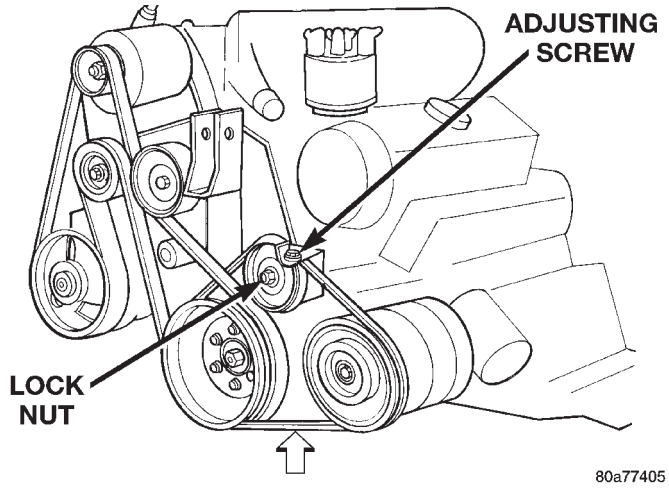


Fig. 35 Air Conditioning Drive Belt—3.0L Engine

INSTALLATION/ADJUSTMENT

To adjust the air conditioning drive belt, loosen the idler pulley lock nut (Fig. 35) and adjust belt tension by tightening adjusting screw. Refer to Proper Belt Tension and Belt Tension Chart in this Section for procedure. Tighten pulley lock nut to 54 N·m (40 ft. lbs.) after adjustment.

ACCESSORY DRIVE BELT—3.3/3.8L

REMOVE/INSTALL

GENERATOR, POWER STEERING PUMP, AIR CONDITIONING COMPRESSOR AND WATER PUMP DRIVE BELT

The Poly-V Drive belt is provided with a dynamic tensioner (Fig. 36) to maintain proper belt tension. To remove or install this belt.

(1) Raise vehicle on hoist.

(2) Remove right front splash shield.

(3) Release tension by rotating the tensioner clockwise (Fig. 36).

(4) Reverse above procedure to install.

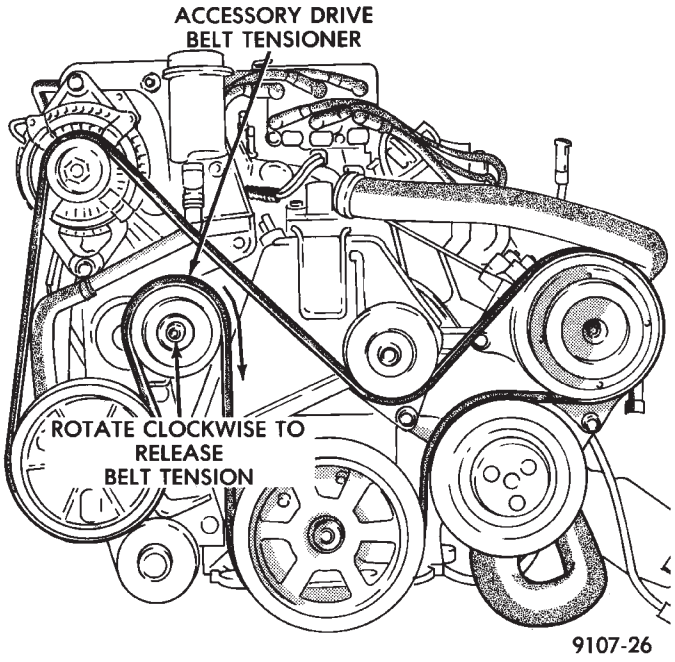


Fig. 36 Accessory Drive Belt—3.3/3.8L Engines

CLEANING AND INSPECTION

WATER PUMP

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 greenish-brown dried glycol running down the pump body and components below. A thin black stain below pump weep hole is considered normal operation.

(3) Impeller rubs inside of chain case cover 3.3/3.8L or cylinder block 2.4L engines.

(4) Excessively loose or rough turning bearing.

CLEANING AND INSPECTION (Continued)

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 green/brown 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.

ACCESSORY DRIVE BELT

When inspecting serpentine drive belts, small cracks that run across the ribbed surface of the belt from rib to rib (Fig. 37), are considered normal. these are not reasons to replace the belt. However, cracks running along the rib (not across) are not normal. Any belt with cracks running along the rib must be replaced (Fig. 37). Also replace the belt if it has excessive wear, frayed cords or severe glazing.

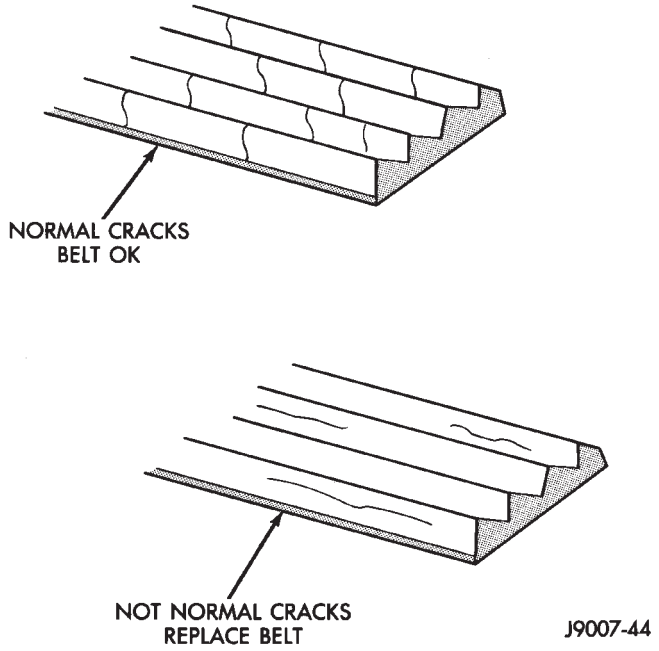


Fig. 37 Serpentine Drive Belt Wear Patterns

RADIATOR PRESSURE CAP

INSPECTION

Hold the cap in hand, **right side up**. The vent valve at the bottom of the cap should open. If the rubber gasket has swollen and prevents the valve from opening, replace the cap.

Hold the cleaned cap in hand **upside down.** If any light shows between vent valve and rubber gasket, replace cap. **Do not use a replacement cap that has a spring to hold the vent shut.**

Replacement cap must be of the type designed for coolant reserve system with a completely sealed diaphragm spring, and rubber gasket to seal to filler neck top surface. This design assures coolant return to radiator.

COOLING SYSTEM CLEANING

Drain cooling system (see: **Cooling System Draining**) and refill with clean water (see: **Cooling System Refilling**). 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.

REVERSE FLUSHING THE RADIATOR

Drain cooling system and remove radiator hoses from engine. Install suitable flushing gun in radiator lower hose. Fill radiator with clean water and turn on air in short blasts.

CAUTION: Internal radiator pressure must not exceed 138 kPa (20 psi) as damage to radiator may result. Continue this procedure until water runs clear.

REVERSE FLUSHING THE ENGINE

Drain radiator (see: **Draining Cooling System**) and remove hoses from radiator. Remove engine thermostat and reinstall thermostat housing. Install suitable flushing gun to thermostat housing hose. Turn on water, and when engine is filled, turn on air, but no higher than 138 kPa (20 psi) in short blasts. Allow engine to fill between blasts of air. Continue this procedure until water runs clean. Reinstall thermostat using a new housing gasket. Fill cooling system (See **Refilling**).

CHEMICAL CLEANING

One type of corrosion encountered with aluminum cylinder heads is aluminum hydroxide deposits. Corrosion products are carried to the radiator and deposited when cooled off. They appear as dark grey when wet and white when dry. This corrosion can be removed with a two part cleaner (oxalic acid and neutralizer) available in auto parts outlets. Follow manufacturers directions for use.

ADJUSTMENTS

PROPER BELT TENSION

Satisfactory performance of the belt driven accessories depends on proper belt tension. Belt tensioning should be performed with the aid of a Burroughs gauge Special Tool C-4162. Because of space limitations in the engine compartment, the use of the gauge may be restricted. Raise the vehicle on a hoist

ADJUSTMENTS (Continued)

and the remove the splash shield to gain access to the drive belts.

BELT TENSION GAUGE METHOD

Use belt tensioning Special Tool Kit C-4162 for:

CAUTION: The Burroughs gauge for the Poly-V belt is not to be used on the V-belt. These gauges are not interchangeable.

- For conventional V-belts affix the Burroughs gauge (Special Tool C-4162) to the belt. Adjust the belt tension for New or Used belt as prescribed in the Belt Tension Chart.
- For a Poly-V belt affix the Poly-V Burroughs gauge to the belt and then apply specified tension to the belt as prescribed in the Belt Tension Chart

Adjust belt tension for a **New** or **Used** belt as prescribed in the Belt Tension Chart.

BELT TENSION CHART

ACCESSORY DRIVE BELT	GAUGE
2.4L ENGINE	
A/C COMPRESSOR / GENERATOR	NEW 190 LB.
	USED 115 LB.
POWER STEERING	NEW 140 LB.
	USED 90 LB.
3.0L ENGINE	
A/C COMPRESSOR	NEW 150 LB.
	USED 80 LB.
GENERATOR / POWER STEERING	DYNAMIC TENSIONER
3.3/3.8L ENGINES	
A/C COMPRESSOR	DYNAMIC TENSIONER
GENERATOR / WATER PUMP / POWER STEERING	DYNAMIC TENSIONER

SPECIFICATIONS

COOLING SYSTEM CAPACITY

Engine	Standard Duty		Trailer Tow or Heavy Duty	
	Front Heater	Rear Heater	Front Heater	Rear Heater
2.4L	10.6 liters* (11.23 qts.)*	N/A	N/A	N/A
3.0L	12.3 liters* (13.0 qts.)*	N/A	N/A	15.0 liters* (15.9 qts.)*
3.3/3.8L	12.5 liters* (13.23 qts.)*	15.26 liters* (16.13 qts.)*	12.5 liters* (13.23 qts.)*	15.26 liters* (16.13 qts)*

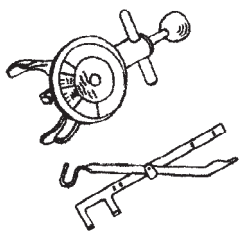
*Includes Heater and Coolant Recovery Tank Filled to Max Level.

TORQUE CHART

DESCRIPTION	TORQUE
Thermostat Housing	
Bolts—2.4L & 3.3/3.8L	28 N·m (250 in. lbs.)
Bolts—3.0L	12 N·m (105 in. lbs.)
Water Pump Mounting	
Bolts—2.4L & 3.3/3.8L	12 N·m (250 in. lbs.)
Bolts—3.0L	27 N·m (240 in. lbs.)
Water Pump Inlet Tube	
Bolts—2.4L	12 N·m (250 in. lbs.)
Bolts—3.0L	11 N·m (94 in. lbs.)
Water Pump Pulley	
Bolts—3.3/3.8L	28 N·m (250 in. lbs.)
Transaxle Oil Cooler Hose	
Clamps—All Engines	2 N·m (18 in. lbs.)
Radiator Mounting Upper Bracket	
Nut—All Engines	12 N·m (105 in. lbs.)

SPECIAL TOOLS

COOLING



Belt Tension Gauge C-4162