

COOLING SYSTEM

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DESCRIPTION AND OPERATION

COOLING SYSTEM

DESCRIPTION

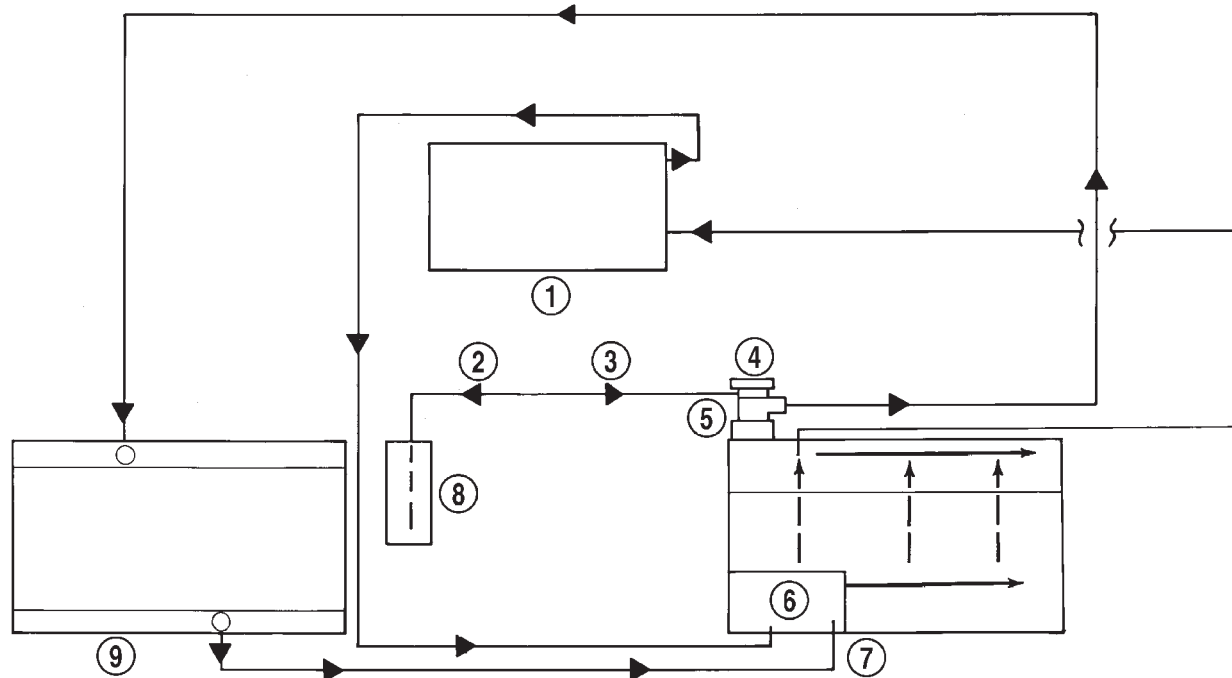
The cooling system consists of an engine cooling module, thermostat, coolant, a water pump to circulate the coolant. The engine cooling module may consist of a radiator, electric fan motor, shroud, radiator

pressure cap, coolant reserve system, transmission oil cooler and lines, hoses, clamps, and air conditioning condenser.

OPERATION

The primary purpose of a cooling system is to maintain engine temperature in a range that will provide satisfactory engine performance and emission levels under all expected driving conditions. It also

DESCRIPTION AND OPERATION (Continued)



9507-1

Fig. 1 Cooling System Operation—2.0L Engine

- | | |
|------------------------|----------------------------------|
| 1 - HEATER | 6 - WATER PUMP |
| 2 - HEAT UP | 7 - ENGINE |
| 3 - COOL DOWN | 8 - COOLANT RECOVERY SYSTEM TANK |
| 4 - PRESSURE CAP | 9 - RADIATOR |
| 5 - THERMOSTAT HOUSING | |

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.

The coolant flow circuits for 2.0L engine equipped vehicles are shown in (Fig. 1).

COOLANT

DESCRIPTION

ETHYLENE-GLYCOL MIXTURES

CAUTION: Richer antifreeze mixtures cannot be measured with normal field equipment and can cause problems associated with 100 percent ethylene-glycol.

The required ethylene-glycol (antifreeze) and water mixture depends upon the climate and vehicle operating conditions. The recommended mixture of 50/50 ethylene-glycol and water will provide protection against freezing to -37 deg. C (-35 deg. F). The antifreeze concentration **must always** be a minimum of 44 percent, year-round in all climates. **If percentage is lower than 44 percent, engine parts may be**

eroded by cavitation, and cooling system components may be severely damaged by corrosion. Maximum protection against freezing is provided with a 68 percent antifreeze concentration, which prevents freezing down to -67.7 deg. C (-90 deg. F). A higher percentage will freeze at a warmer temperature. Also, a higher percentage of antifreeze can cause the engine to overheat because the specific heat of antifreeze is lower than that of water.

Use of 100 percent ethylene-glycol will cause formation of additive deposits in the system, as the corrosion inhibitive additives in ethylene-glycol require the presence of water to dissolve. The deposits act as insulation, causing temperatures to rise to as high as 149 deg. C (300 deg. F). This temperature is hot enough to melt plastic and soften solder. The increased temperature can result in engine detonation. In addition, 100 percent ethylene-glycol freezes at 22 deg. C (-8 deg. F).

PROPYLENE-GLYCOL MIXTURES

It's overall effective temperature range is smaller than that of ethylene-glycol. The freeze point of 50/50 propylene-glycol and water is -32 deg. C (-26 deg. F). 5 deg. C higher than ethylene-glycol's freeze point. The boiling point (protection against summer boil-

DESCRIPTION AND OPERATION (Continued)

over) of propylene-glycol is 125 deg. C (257 deg. F) at 96.5 kPa (14 psi), compared to 128 deg. C (263 deg. F) for ethylene-glycol. Use of propylene-glycol can result in boil-over or freeze-up on a cooling system designed for ethylene-glycol. Propylene glycol also has poorer heat transfer characteristics than ethylene glycol. This can increase cylinder head temperatures under certain conditions.

Propylene-glycol/ethylene-glycol Mixtures can cause the destabilization of various corrosion inhibitors, causing damage to the various cooling system components. Also, once ethylene-glycol and propylene-glycol based coolants are mixed in the vehicle, conventional methods of determining freeze point will not be accurate. Both the refractive index and specific gravity differ between ethylene glycol and propylene glycol.

OPERATION

ETHYLENE-GLYCOL MIXTURES

Coolant flows through the engine block absorbing the heat from the engine, then flows to the radiator where the cooling fins in the radiator transfers the heat from the coolant to the atmosphere. During cold weather the ethylene-glycol coolant prevents water present in the cooling system from freezing within temperatures indicated by mixture ratio of coolant to water.

ENGINE THERMOSTAT—2.0L ENGINE

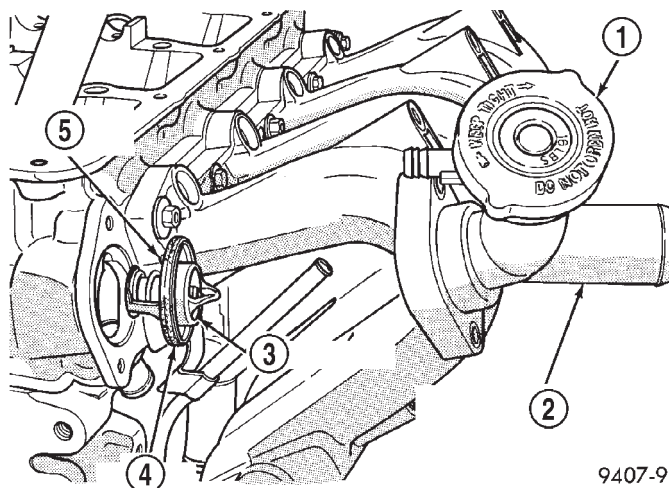
DESCRIPTION

The 2.0L engine thermostat is located on the front of the engine (radiator side) in the thermostat housing/engine outlet connector (Fig. 2). The thermostat has a air bleed vent located in the flange and a O-ring with a locating dimple incorporate on it. There is a relief in the housing for positioning the air bleed.

OPERATION

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

The thermostat is operated by a wax filled container (pellet) which is sealed. When heated coolant



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Fig. 2 Thermostat/Engine Outlet Connector—2.0L Engine

- 1 - PRESSURE CAP
- 2 - THERMOSTAT HOUSING/ENGINE OUTLET CONNECTOR
- 3 - THERMOSTAT
- 4 - O-RING
- 5 - VENT FACING UP

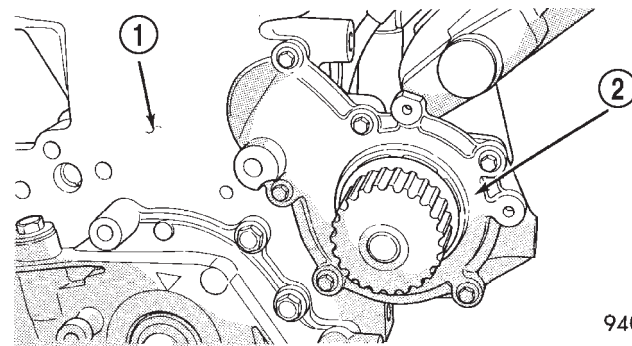
reaches a predetermined temperature, the wax expands enough to overcome the closing spring and water pump pressure, which forces the valve to open.

Coolant leakage into the wax pellet will cause a thermostat to fail open. Do not attempt to free-up a stuck open thermostat.

WATER PUMP—2.0L ENGINE

DESCRIPTION

The water pump has a diecast aluminum body and housing with a stamped steel impeller. The water pump bolts directly to the block (Fig. 3) and is driven by the timing belt. Cylinder block to water pump sealing is provided by a rubber O-ring.



9407-7

Fig. 3 Water Pump

- 1 - CYLINDER BLOCK
- 2 - PUMP BODY

DESCRIPTION AND OPERATION (Continued)

OPERATION

The water pump is the heart of the cooling system. The coolant is pumped through the engine block, cylinder head, heater core, and radiator.

COOLANT RECOVERY SYSTEM

DESCRIPTION

The coolant recovery system consist of a container and hose that is connected to the cooling system.

OPERATION

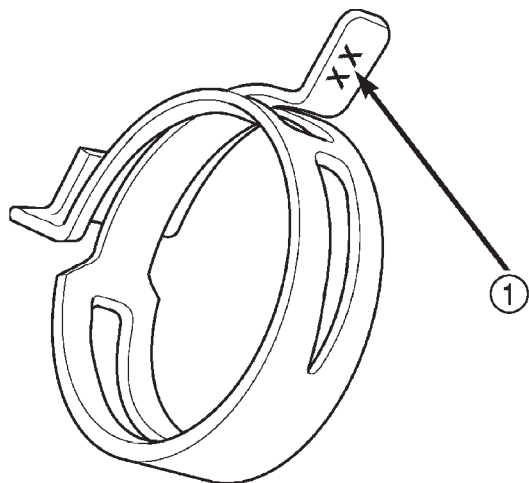
This system works in conjunction with the pressure cap to utilize thermal expansion and contraction of the coolant to keep the coolant free of trapped air. It provides a volume for expansion and contraction, provides a convenient and safe method for checking coolant level, and adjusting level at atmospheric pressure without removing the pressure cap. It also provides some reserve coolant to cover minor leaks and evaporation or boiling losses. All vehicles are equipped with this system.

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.

CAUTION: A number or letter is stamped into the tongue of constant tension clamps. If replacement is necessary, use only a original equipment clamp with matching number or letter (Fig. 4).



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Fig. 4 Spring Clamp Size Location

1 - SPRING CLAMP SIZE LOCATION

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, only use constant tension clamp pliers designed to compress the hose clamp.

ENGINE BLOCK HEATER

DESCRIPTION

The block heater is operated by ordinary house current (110 Volt A.C.) through a power cord and connector behind the radiator grille. 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.

CAUTION: 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

The block heater element is submerged in the cooling system's coolant. When electrical power (110 volt A.C.) is applied to the element, it creates heat. This heat is transferred to the engine coolant. This provides easier engine starting and faster warm-up when vehicle is operated in areas having extremely low temperatures.

RADIATOR

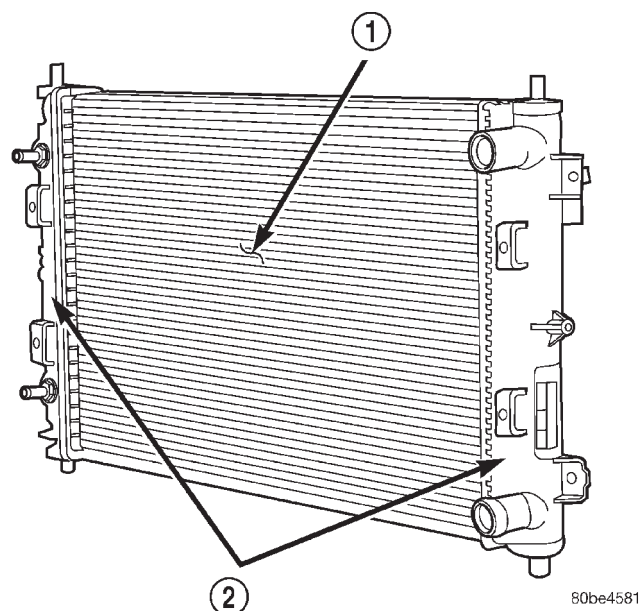
DESCRIPTION

The radiator is a cross flow type (horizontal tubes) with design features that provide greater strength as well as sufficient heat transfer capabilities to keep the engine coolant within operating temperatures. The radiator cooling tubes are made of aluminum and the side tanks are plastic (Fig. 5).

OPERATION

The radiator functions as a heat exchanger, using air flow across the exterior of the radiator tubes. This heat is then transferred from the coolant and into the passing air.

DESCRIPTION AND OPERATION (Continued)

**Fig. 5 Radiator**

- 1 – COOLING TUBES
2 – TANKS

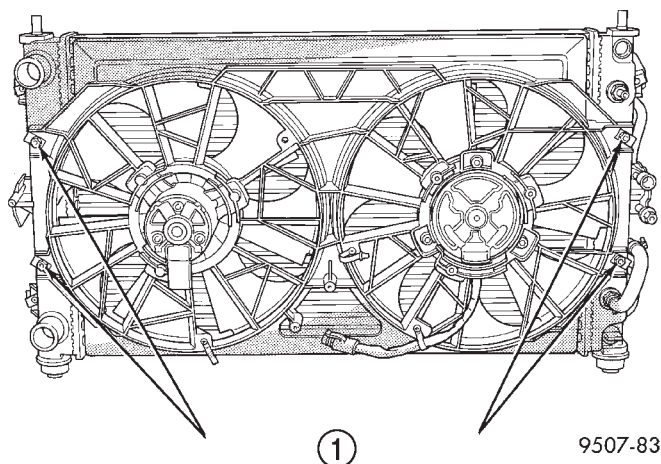
COOLING SYSTEM FANS

DESCRIPTION

All models use electric motor driven, two speed cooling system fans. The fan module includes a motor support and shroud. The module is fastened to the radiator by bolts (Fig. 6).

OPERATION

An electric motor drives the cooling fan to produce air flow across the radiator fins.

**Fig. 6 Fan Module**

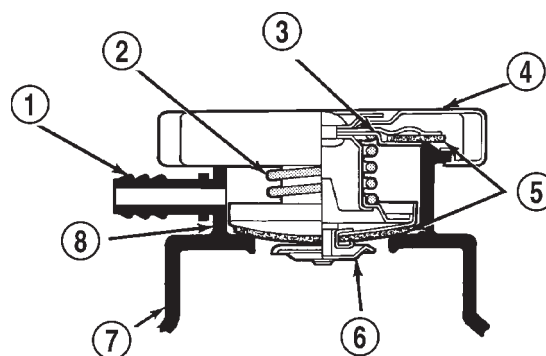
- 1 – FAN MODULE TO RADIATOR FASTENERS

COOLING SYSTEM PRESSURE CAP

DESCRIPTION

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

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, the radiator hoses will be collapsed on cool down. Clean the vent valve (Fig. 7) to ensure proper sealing when boiling point is reached.**

**Fig. 7 Cooling System Pressure Cap**

- 1 – OVERFLOW NIPPLE
2 – MAIN SPRING
3 – GASKET RETAINER
4 – STAINLESS-STEEL SWIVEL TOP
5 – RUBBER SEALS
6 – VENT VALVE
7 – THERMOSTAT HOUSING/ENGINE OUTLET CONNECTOR
8 – FILLER NECK

OPERATION

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

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.

TRANSMISSION OIL COOLER EXTERNAL—
2.0L ENGINE

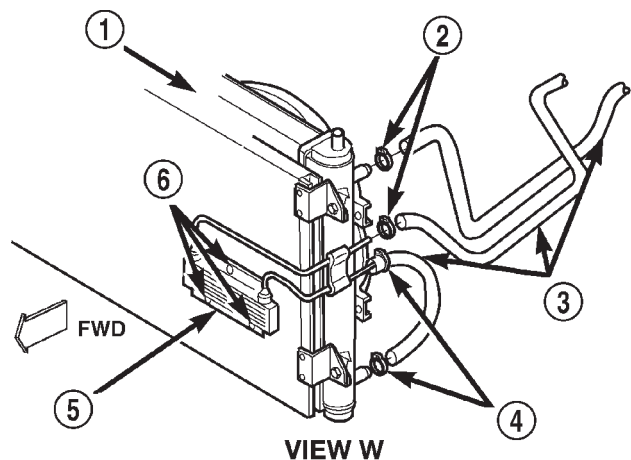
DESCRIPTION

An external oil-to-air type automatic transmission oil cooler is mounted ahead of the cooling module (Fig. 8). This style of cooler uses steel tubes and rubber oil lines to feed oil from the internal (in radiator tank) cooler to the external cooler and then to the automatic transmission.

DESCRIPTION AND OPERATION (Continued)

OPERATION

The oil flows from the internal (in radiator tank) to the external oil-to-air cooler. Heat is then transferred into the air.



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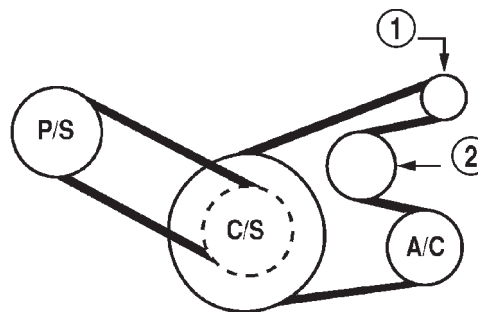
Fig. 8 Transmission Oil Cooler—2.0L Engine

- 1 – COOLING MODULE
- 2 – HOSE CLAMPS
- 3 – TRANSMISSION OIL COOLER HOSES
- 4 – HOSE CLAMPS
- 5 – EXTERNAL TRANSMISSION OIL COOLER
- 6 – RETAINING STRAPS

ACCESSORY DRIVE BELT

DESCRIPTION

The accessory drive consist of two Poly-V type belts (Fig. 9). One belt drives the power steering pump, the other drives the generator and air conditioning compressor. Both belts are manually tensioned.



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Fig. 9 Accessory Drive Belt System

- 1 – GEN.
- 2 – IDLER

OPERATION

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

DIAGNOSIS AND TESTING

COOLING SYSTEM DIAGNOSIS

CONDITION	POSSIBLE CAUSE	CORRECTION
TEMPERATURE GAUGE READS LOW	- Has a Diagnostic Trouble Code (DTC) been set indicating a stuck open engine thermostat? - Is the temperature gauge (if equipped) connected to the temperature gauge coolant sensor on the engine? - Is the temperature gauge (if equipped) operating OK? - Coolant level low during cold ambient temperature, accompanied by poor heater performance.	- Refer to On Board Diagnostic in EMISSION CONTROL SYSTEMS. Replace thermostat, if necessary. If a (DTC) has not been set, the problem may be with the temperature gauge. - Check the connector at the engine coolant sensor. Refer to INSTRUMENT PANEL AND SYSTEMS. Repair as necessary. - Check Gauge operation. Refer to INSTRUMENT PANEL AND SYSTEMS. Repair as necessary. - Check coolant level in the coolant recovery/reserve container and the radiator. Inspect the system for leaks. Repair as necessary. Refer to WARNINGS in this section before removing pressure cap.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSE	CORRECTION
TEMPERATURE GAUGE READS HIGH OR ENGINE COOLANT WARNING LAMP ILLUMINATES. COOLANT MAY OR MAY NOT BE LOST FROM SYSTEM.	1. Trailer being towed, a steep hill being climbed, vehicle being operated in slow moving traffic, or engine idling during high ambient (outside) temperatures with air conditioning on. High altitudes Could aggravate these conditions. 2. Is temperature gauge (if equipped) reading correctly? 3. Is temperature warning lamp (if equipped) illuminating unnecessarily? 4. Coolant low in recovery/reserve container and radiator? 5. Pressure cap not installed tightly. If cap is loose, boiling point of coolant will be lowered. Also refer to the following step 6. 6. Poor seals at radiator cap. 7. Coolant level low in radiator, but not in coolant recovery/reserve container. This indicates the radiator is not drawing coolant from the coolant recovery/reserve container as the engine cools. As the engine cools, a vacuum is formed inside the cooling system. If the radiator cap seals are defective, or the cooling system has a leak, a vacuum cannot be formed. 8. Freeze point of coolant not correct. Mixture ratio may be too rich.	1. This may be a temporary condition and repair is not necessary. Turn off the air conditioning and drive the vehicle without any of the previous conditions. Observe the temperature gauge the gauge should return to the normal range. If the gauge does not return to the normal range, determine the cause of the overheating and repair. Refer to POSSIBLE CAUSES in this section. 2. Check gauge. Refer to INSTRUMENT PANEL AND SYSTEMS. Repair as necessary. 3. Check warning lamp operation. Refer to INSTRUMENT PANEL AND SYSTEMS. Repair as necessary. 4. Check for coolant leaks and repair as necessary. Refer to Checking Cooling System for Leaks in this section. 5. Tighten cap. 6. (a) Check condition of cap and cap seals. Refer to Radiator cap Inspection. Replace cap if necessary. (b) Check condition of filler neck. If neck is bent or damaged, replace neck. 7. (a) Check condition of radiator cap and cap seals. Replace cap if necessary. (b) Check condition of filler neck. Replace if damaged. (c) Check condition of hose from filler neck to coolant container. It should be tight at both ends without any kinks or tears. Replace hose as necessary. (d) Check coolant recovery/reserve container and hose for blockage. Repair as necessary. 8. Check coolant concentration. Refer to Coolant Concentration Testing in this section. Adjust glycol-to-water ratio as required.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSE	CORRECTION
	9. Coolant not flowing through system. 10. Radiator or A/C condenser fins are dirty or clogged. 11. Radiator core is plugged or corroded. 12. Fuel or ignition system problems. 13. Dragging Brakes. 14 Bug screen or other aftermarket accessory is being used causing reduced air flow. 15. Thermostat partially or completely closed. 16. Electric cooling fan not operating properly. 17. Cylinder head gasket leaking. 18. Heater core leaking.	9. Check for coolant flow at filler neck with some coolant removed, engine warm, and thermostat open. Coolant should be observed flowing through filler neck. If flow is not observed, determine reason for lack of flow and repair as necessary. 10. Clean obstruction from fins. 11. Replace or re-core radiator. 12. Refer to Fuel and Ignition System groups for diagnosis. Also refer to the appropriate Powertrain Diagnostic Procedure manual. 13. Inspect brake system and repair as necessary. Refer to BRAKES for diagnosis. 14. Remove bug screen or accessory. 15. Check thermostat operation and replace as necessary. Refer to thermostat in this section for procedure. 16. Check electric fan operation and repair as necessary. 17. Check cylinder head gasket for leaks. Refer to testing cooling system for leaks. For repairs, refer to ENGINE. 18. Check heater core for leaks. Refer to HEATING AND AIR CONDITIONING and repair as necessary.
TEMPERATURE GAUGE READING IS INCONSISTENT (FLUCTUATES, CYCLES OR IS ERRATIC)	1. The gauge may cycle up and down. This is due to the cycling of the electric radiator fan. 2. During cold weather operation with the heater blower in the high position, the gauge reading may drop slightly. 3. Temperature gauge or engine mounted gauge sensor is defective or shorted.	1. A normal condition. No correction is necessary. If gauge cycling is going into the hot zone, check electric fan operation and repair as necessary. Refer to procedure in this section. 2. A normal condition. No correction is necessary. 3. Check operation of gauge and repair as necessary. Refer to INSTRUMENT PANEL AND SYSTEMS.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSE	CORRECTION
	4. Gauge reading rises when vehicle is brought to a stop after heavy use (engine still running). 5. Gauge reading high after restarting a warmed-up (hot) engine. 6. Coolant level low in radiator (air will build up in the cooling system causing the thermostat to open late). 7. Cylinder head gasket leaking allowing exhaust gas to enter cooling system. This will cause thermostat to open late. 8. Water pump impeller loose on shaft. 9. Loose drive belt (water pump slipping). 10. Air leak on the suction side of water pump allows air to build up in cooling system. This will cause the thermostat to open late.	4. A normal condition. No correction is necessary. The gauge should return to normal range after vehicle is driven. 5. A normal condition. No correction is necessary. The gauge should return to normal range after a few minutes of engine operation. 6. Check and correct coolant leaks. Refer to Testing Cooling System For Leaks in the section. 7. (a) Check for cylinder head gasket leaks using Tool C-3685-A Block Leak Tester or the equivalent. Repair as necessary. (b) Check for coolant in the engine oil. Inspect for white steam emitting from exhaust system. Repair as necessary. 8. Check water pump and replace as necessary. Refer to Water Pump in this section. 9. Check drive belt and correct as necessary. 10. Locate leak and repair as necessary.
PRESSURE CAP IS BLOWING OFF STEAM AND/OR COOLANT FLOWING INTO RECOVERY CONTAINER. TEMPERATURE GAUGE READING MAY BE ABOVE NORMAL, BUT NOT HIGH. COOLANT LEVEL MAY BE HIGH IN RECOVERY CONTAINER.	1. Pressure relief valve in radiator cap is defective.	1. Check condition of radiator cap and seals. Refer to Radiator Cap in this section. Replace as necessary.
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 Testing Cooling System For Leaks in this section.
DETONATION OR PRE-IGNITION (NOT CAUSED BY IGNITION SYSTEM). GAUGE MAY OR MAY NOT BE READING HIGH.	1. Engine overheating. 2. Freeze point of coolant not correct.	1. Check reason for overheating and repair as necessary. 2. Check the freeze point of the coolant. Refer to Coolant Concentration Testing in this section. Adjust glycol-to-water ratio as required.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSE	CORRECTION
HOSE OR HOSES COLLAPSE WHEN ENGINE IS COOLING	1. Vacuum created in cooling system on engine cool-down is not being relieved through coolant recovery/reserve container system.	1. (a) Radiator cap relief valve stuck. Refer to Radiator Cap in this section. Replace as necessary. (b) Hose between coolant recovery/reserve container and radiator is kinked. Repair as necessary. (c) Vent at coolant recovery/reserve container is plugged. Clean vent and repair as necessary. (d) Recovery/reserve container is internally blocked or plugged. Check for blockage and repair as necessary.
ELECTRIC RADIATOR FAN OPERATES ALL THE TIME.	1. Fan relay, powertrain control module (PCM) or engine coolant temperature sensor defective. 2. Check for low coolant level.	1. Refer to appropriate Powertrain Diagnostic Procedures manual for operation of the DRB scan tool. Repair as necessary. 2. Repair as necessary.
ELECTRIC RADIATOR FAN WILL NOT OPERATE. GAUGE READING HIGH OR HOT	1. Fan motor defective. 2. Fan relay, powertrain control module (PCM) or engine coolant temperature sensor defective. 3. Blown fuse in power distribution center (PDC).	1. Refer to appropriate Powertrain Diagnostic Procedures manual for operation of the DRB scan tool. Repair as necessary. 2. Refer to appropriate Powertrain Diagnostic Procedures manual for operation of the DRB scan tool. Repair as necessary. 3. Determine reason for blown fuse and repair as necessary.
NOISY 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 fan blade assembly. Refer to Cooling System Fan in this section. 2. Locate point of fan blade contact and repair as necessary. 3. Remove obstructions and/or clean debris from radiator and/or A/C condenser. 4. Refer to procedure in this section.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSE	CORRECTION
INADEQUATE AIR CONDITIONER PERFORMANCE (COOLING SYSTEM SUSPECTED)	1. Radiator and/or air conditioning condenser is restricted, obstructed or dirty. 2. Electric radiator fan not operating when A/C is on. 3. Engine is overheating (heat may be transferred from radiator to A/C condenser). High underhood temperature due to engine overheating may also transfer heat to A/C components.	1. Remove restriction and/or clean as necessary. 2. Refer to appropriate Powertrain Diagnostic Procedures manual for operation of the DRB scan tool. Repair as necessary. 3. Correct overheating condition. Refer to this section.
INADEQUATE HEATER PERFORMANCE.	1. Has a diagnostic trouble code (DTC) been set? 2. Coolant level low. 3. Obstructions in heater hose fittings at engine. 4. Heater hose kinked. 5. 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. The water pump drive belt may be slipping causing poor water pump operation.	1. Refer to On-Board Diagnostic in EMISSION CONTROL SYSTEMS. 2. Refer to testing cooling system for leaks in this section. Repair as necessary. 3. Remove heater hoses at both ends and check for obstructions. Repair as necessary. 4. Locate kinked area and repair as necessary. 5. Refer to water pump in this section. Repair as necessary.
HEAT ODOR	1. Various heat shields are used at certain driveline components. One or more of these shields may be missing. 2. Is temperature gauge reading above the normal range? 3. Is cooling fan operating correctly? 4. Has undercoating been applied to any unnecessary component. 5. Engine may be running rich causing the catalytic converter to overheat.	1. Locate missing shields and replace or repair as necessary. 2. Refer to the previous Temperature Gauge Reads High in these Diagnostic Charts. Repair as necessary. 3. Refer to Cooling System Fan in this section for diagnosis. Repair as necessary. 4. Clean undercoating as necessary. 5. Refer to appropriate Powertrain Diagnostic Procedures manual for operation of the DRB scan tool. Repair as necessary.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSE	CORRECTION
POOR DRIVEABILITY (THERMOSTAT POSSIBLY STUCK OPEN). GAUGE MAY BE READING LOW	1. For proper driveability, good vehicle emissions and for preventing build-up of engine oil sludge, the thermostat must be operating properly. Has a diagnostic trouble code (DTC) been set?	1. Refer to On-Board Diagnostics in EMISSION CONTROL SYSTEMS. DTC's may also be check using the DRB scan tool. Refer to the proper Powertrain Diagnostic Procedure manual for checking the thermostat if necessary.
STEAM IS COMING FROM FRONT OF VEHICLE NEAR GRILL AREA WHEN WEATHER IS WET, ENGINE IS WARMED UP, RUNNING, AND VEHICLE IS STATIONARY. TEMPERATURE GAUGE IS IN NORMAL RANGE.	1. During wet weather, moisture (snow, ice or rain condensation) on the radiator will evaporate when the thermostat opens. This opening allows heated water into the radiator. When the moisture contact the hot radiator, steam may be emitted. This usually occurs in cold weather with no fan or airflow 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 Coolant Concentration Testing in this section for procedure. Adjust the glycol-to-water ratio as required.
COOLANT LEVEL CHANGES IN COOLANT RECOVERY/RESERVE CONTAINER	1. Level changes are to be expected as coolant volume fluctuates with engine temperature. If the level in the container was between the FULL and ADD marks at normal engine operating temperature, the level should return to within that range after operation at elevated temperatures.	1. A normal condition. No repair is necessary.

THERMOSTAT

The thermostat is operated by a wax filled container (pellet) which is sealed. When heated coolant reaches a predetermined temperature the wax pellet 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 thermostat that opens 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 diagnostic trouble code (DTC) will be set. Do not change a thermostat for lack of heater performance or temperature gauge position, unless a DTC is present. See Diagnosis for other probable causes. Thermostat failing shut is the normal long term mode of failure, and normally, only on high mileage vehicles. The temperature gauge will

indicate this. Refer to Cooling System Diagnosis in this section.

WATER PUMP DIAGNOSIS

A quick flow test to tell whether or not the pump is working is to see if the heater warms properly. A defective pump will not be able to circulate heated coolant through the long heater hose.

Another flow test to help determine pump operation, remove radiator cap.

WARNING: DO NOT remove radiator cap if the cooling system is hot or under pressure.

COOLING SYSTEM FLOW CHECK

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

DIAGNOSIS AND TESTING (Continued)

(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 THE COOLING SYSTEM PRESSURE CAP WITH THE SYSTEM HOT AND UNDER PRESSURE BECAUSE SERIOUS BURNS FROM COOLANT CAN OCCUR.

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

RADIATOR FAN CONTROL

Fan control is accomplished three ways. The fan runs when the air conditioning pressure reaches a set psi see charts below. 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 Powertrain Control Module (PCM). The PCM turns on the fan through a fan relay. On models equipped with automatic transmission, a transmission fluid thermister may have some influences on fan operation. See Wiring Diagrams Manual for circuitry and diagnostics provided.

The Powertrain Control Module (PCM) provides fan control for the following conditions:

- The fan will not run during cranking until the engine starts no matter what the coolant temperature is.
- Fan will run when the air conditioning clutch is engaged, low pressure cutout switch is closed and once set compressor head pressure is reached. See charts.
- Fan will run according to the following information charts.

ELECTRIC FAN MOTOR TEST

Refer to Powertrain Diagnostic Manual for procedure.

For wiring diagrams of the fan motor systems refer to Group, 8W Wiring Diagrams.

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 -59°C (-50°F). The use of a hydrometer or a refractometer can be used to test coolant concentration.

RADIATOR FAN OPERATION—2.0L ENGINE

Radiator Fan Control			A/C Pressure	
A/C Off	Low	High		
Fan On:	104°C (220°F)	110°C (230°F)		
Fan Off:	99°C (210°F)	104°C (220°F)		
A/C On	Low	High	Low	High
Fan On:	99°C (210°F)	110°C (230°F)	1,466 Kpa (209 psi)	1,717 Kpa (249 psi)
Fan Off:	93°C (200°F)	104°C (220°F)	1,172 Kpa (170 psi)	1,579 Kpa (229 psi)
EATX Fluid Temperature			Low Speed	High Speed
Fan On:			116°C (240°F)	120°C (248°F)
Fan Off:			109°C (228°F)	116°C (240°F)

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 70% by volume glycol).

A refractometer 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 only recommended for limited usage. Refer to appropriate Technical Service Bulletin(s) regarding use of propylene glycol based coolants.

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

Because ethylene glycol and propylene glycol do not have the same specific gravities, the use of a hydrometer will be inaccurate. Therefore, a refractometer (Tool 8286) is recommended when testing either ethylene or propylene glycol coolants.

DIAGNOSIS AND TESTING (Continued)

COOLING SYSTEM LEAK TESTING

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

Attach a radiator pressure tester to the coolant filler neck, as shown in (Fig. 10) 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 104 kPa (15 psi) since some leaks occur while driving due to engine rock, etc.

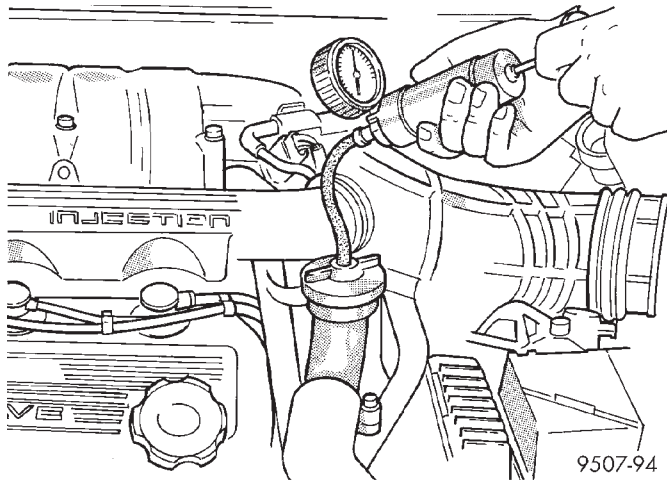


Fig. 10 Pressure Testing Cooling System—Typical

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 temperature 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 and is 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 tailpipe, 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.

COOLING SYSTEM PRESSURE RELIEF CHECK

The pressure cap upper gasket to filler neck seal can be checked by removing the overflow hose at the

radiator filler neck overflow nipple (Fig. 11). Attach the radiator pressure tester to the **filler neck overflow nipple**, and pump air into the system. The pressure cap upper gasket should relieve pressure at 69-124 kPa (10-18 psi), and hold pressure at 55 kPa (8 psi) minimum.

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

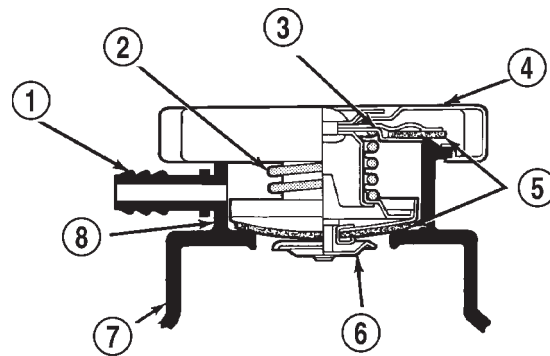


Fig. 11 Cooling System Pressure Cap to Filler Neck

- 1 – OVERFLOW NIPPLE
- 2 – MAIN SPRING
- 3 – GASKET RETAINER
- 4 – STAINLESS-STEEL SWIVEL TOP
- 5 – RUBBER SEALS
- 6 – VENT VALVE
- 7 – THERMOSTAT HOUSING/ENGINE OUTLET CONNECTOR
- 8 – FILLER NECK

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

- Check and adjust coolant freeze point
- Refill system with new coolant
- Conducting service procedures
- Checking for leaks

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

DIAGNOSIS AND TESTING (Continued)

COOLING SYSTEM PRESSURE CAP

Dip the pressure cap in water; clean off any deposits on the vent valve or its seat, and apply the cap to end of radiator pressure tester (Fig. 12). Working the plunger, increase 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 the cap.

CAUTION: The radiator pressure tester 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 the tool upside down, and recheck the pressure cap to confirm that the cap is faulty.

If the pressure cap tests properly while positioned the on radiator pressure tester, but will not hold pressure or vacuum when positioned on the filler neck, inspect the filler neck and cap top gasket for irregularities that may prevent the cap from sealing properly.

LOW COOLANT LEVEL AERATION

Low coolant level in a cross flow radiator will equalize in both tanks with engine off. With engine at running 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, air will be sucked into the water pump:

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

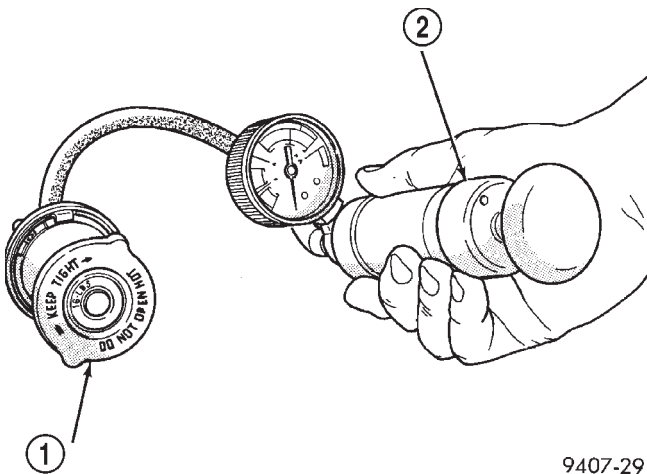


Fig. 12 Pressure Testing Radiator Cap

- 1 - PRESSURE CAP
- 2 - PRESSURE TESTER

COOLING SYSTEM 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 coolant recovery container by thermal expansion of the coolant. It then escapes to the atmosphere in the coolant recovery container and is replaced with coolant on cool down.

TRANSAXLE OIL COOLER FLOW CHECK

Refer to TRANSAXLE—Oil Cooler Flow Check for procedure.

ACCESSORY DRIVE BELT

Satisfactory performance of the belt driven accessories depends on belt condition and proper belt tension.

ACCESSORY DRIVE BELT DIAGNOSIS

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.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSE	CORRECTION
BELT CHIRP AT IDLE	1. Belts too loose. 2. Foreign material imbedded in belt. 3. Non-uniform belt. 4. Misaligned pulley(s). 5. Non-uniform groove or eccentric pulley.	1. Adjust belt tension. 2. Replace belt. 3. Replace belt. 4. Align accessories. 5. Replace pulley(s).
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 grooves or eccentric pulley.	1. Replace belt. 2. Adjust belt tension. 3. Align accessories. 4. Replace pulley(s).

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.

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. The level should be between the minimum and maximum marks.

COOLANT—ADDING ADDITIONAL

NOTE: The radiator cap should not be removed.

When additional coolant is needed, it should be added to the coolant recovery/reserve container (Fig. 13). Use only 50/50 concentration of ethylene glycol type antifreeze and water

COOLANT LEVEL SERVICING—2.0L ENGINE

NOTE: 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 drain cock while observing the Coolant

Recovery Container. Coolant level in the container should drop slightly. Then remove the radiator cap (Fig. 13). The radiator should be full to the top. If not, and the coolant level in the recovery container is at the ADD mark there is a air leak in the recovery system. Check hose or hose connections to the recovery container, radiator filler neck or the pressure cap seal to the radiator filler neck for leaks.

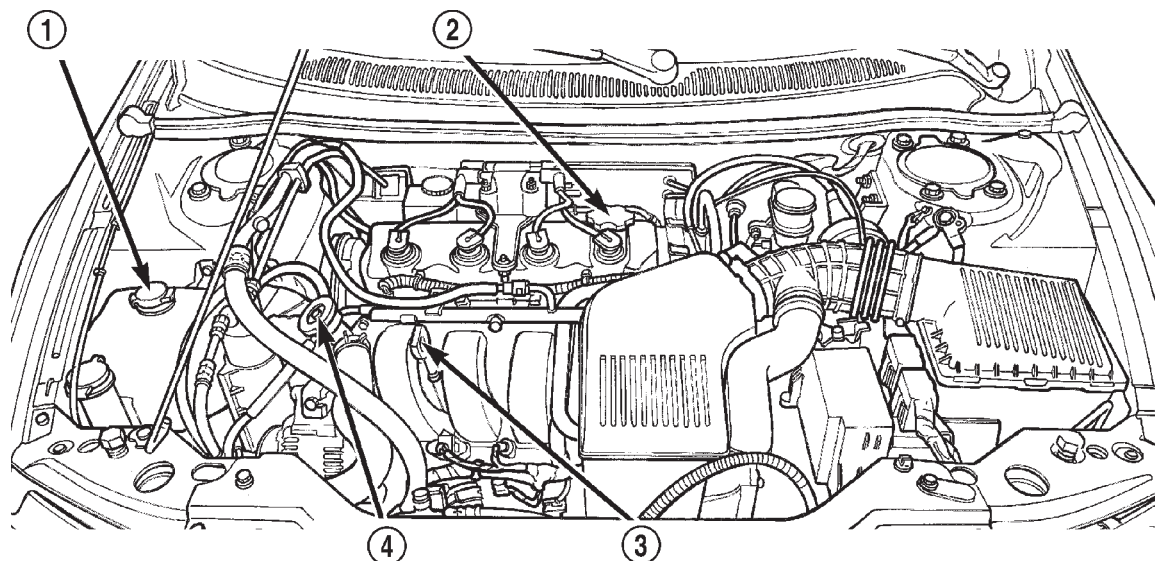
COOLING SYSTEM—DRAINING

NOTE: Drain, flush, and fill the cooling system at the mileage or time intervals specified in the Group 0, Lubrication and Maintenance. If the solution is dirty, rusty or contains a considerable amount of sediment, clean and flush with a reliable cooling system cleaner. Care should be taken in disposing of the used engine coolant. Check governmental regulations for disposal of used engine coolant.

WARNING: DO NOT REMOVE THE COOLING SYSTEM PRESSURE CAP OR OPEN THE RADIATOR DRAINCOCK, WHEN SYSTEM IS HOT AND UNDER PRESSURE BECAUSE SERIOUS BURNS FROM COOLANT CAN OCCUR.

To drain cooling system move temperature selector for heater to full heat with engine running (to provide vacuum for actuation). **Without removing radiator pressure cap and with system not under pressure**, Shut engine off and open draincock (Fig. 14). The coolant reserve tank should empty first, then remove radiator pressure cap. (if not, see Testing Cooling System for leaks).

SERVICE PROCEDURES (Continued)



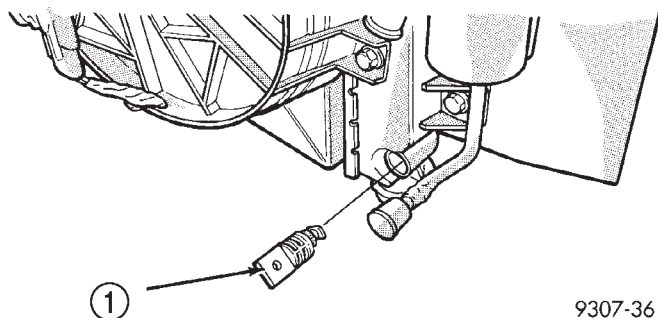
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Fig. 13 Coolant Recovery Container and Pressure Cap Locations—2.0L Engine

1 – COOLANT RECOVERY CONTAINER
2 – ENGINE OIL FILL

3 – ENGINE OIL DIPSTICK
4 – COOLANT PRESSURE CAP

NOTE: To open draincock on vehicle equipped with 2.5L engine, use a 3/8 inch drive extension 3" long, a 19mm socket with universal.



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Fig. 14 Draincock—Typical

1 – DRAIN COCK BODY

COOLING SYSTEM—REFILLING

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

Fill system with 50/50 glycol/water mix. Use anti-freeze described in Coolant section. The thermostat in the these engines allow air to flow through them.

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

Fill coolant recovery/reserve container to at least the FULL HOT mark with 50/50 glycol/water mix, (Fig. 13). It may be necessary to add coolant to the recovery/reserve container to maintain coolant level between the FULL HOT and ADD mark after three or four warm-up/cool down cycles and also, if any trapped air that has been removed from cooling system.

REMOVAL AND INSTALLATION**WATER PUMP—2.0L ENGINES****REMOVAL**

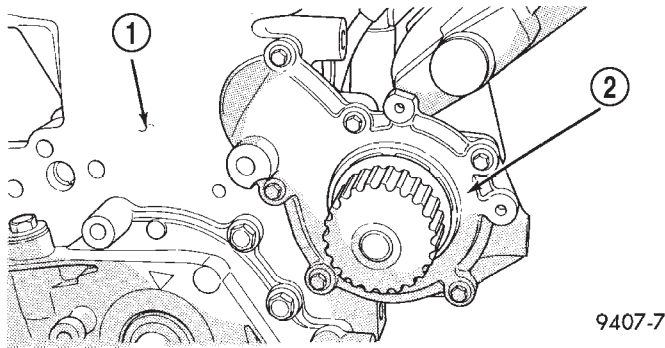
- (1) Raise vehicle on a hoist. Remove right inner splash shield.
- (2) Remove accessory drive belts and power steering pump. Refer to Accessory Drive Belt service in this section.
- (3) Drain cooling system. Refer to Cooling System Draining in this section.
- (4) Support engine from the bottom and remove right engine mount.
- (5) Remove right engine mount bracket.
- (6) Remove timing belt, camshaft sprockets, and rear timing belt cover. Refer to ENGINE for procedures.
- (7) Remove water pump attaching screws to engine (Fig. 15).

INSTALLATION

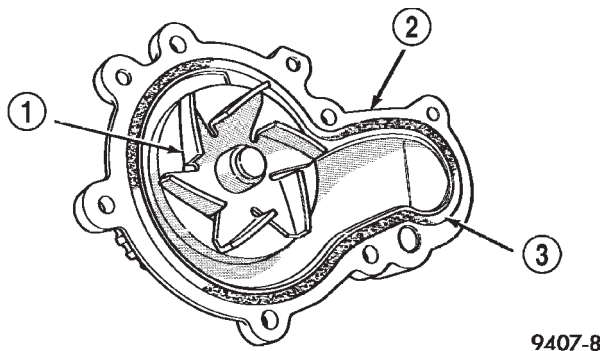
- (1) Install new O-ring gasket in water pump body O-ring groove (Fig. 16).

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.

REMOVAL AND INSTALLATION (Continued)

**Fig. 15 Water Pump**

- 1 - CYLINDER BLOCK
2 - PUMP BODY

**Fig. 16 Water Pump Body**

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

(2) Assemble pump body to block and tighten screws to 12 N·m (105 in. lbs.) (Fig. 15). 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, camshaft sprockets, and timing belt. Refer to ENGINE for procedures.

(5) Install right engine mount bracket and engine mount. Refer to ENGINE for procedure.

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

(7) Install power steering pump and accessory drive belts. Refer to Accessory Drive Belts, in this section.

WATER PUMP INLET TUBE—2.0/2.4L ENGINES

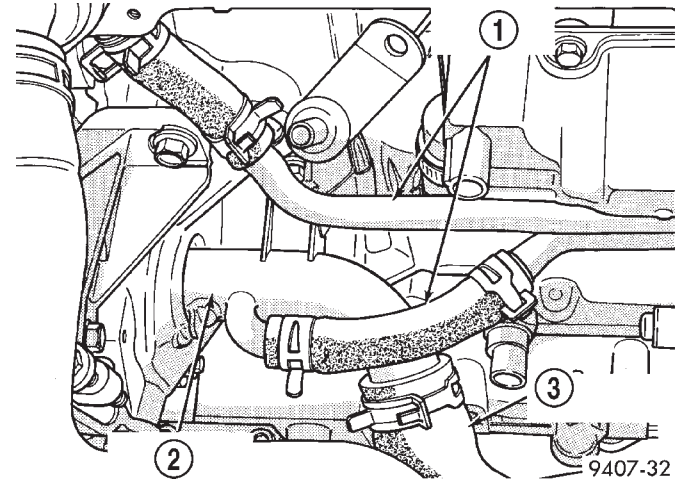
REMOVAL

(1) Drain cooling system. Refer to procedure 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. 17).

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

**Fig. 17 Water Pump Inlet Tube Hose Connections**

- 1 - TO HEATER CORE
2 - WATER PUMP INLET TUBE
3 - TO RADIATOR INLET

(5) Rotate inlet tube while removing from the engine block (Fig. 18).

INSTALLATION

(1) Inspect the O-ring for damage before installing the tube into the cylinder block (Fig. 18).

(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. 17).

(5) Install upper radiator hose.

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

THERMOSTAT—2.0L ENGINE

REMOVAL

(1) Drain cooling system to the thermostat level or below.

(2) Remove coolant recovery system (CRS) hose and thermostat/engine outlet connector bolts (Fig. 19).

(3) Remove thermostat assembly, and clean sealing surfaces.

REMOVAL AND INSTALLATION (Continued)

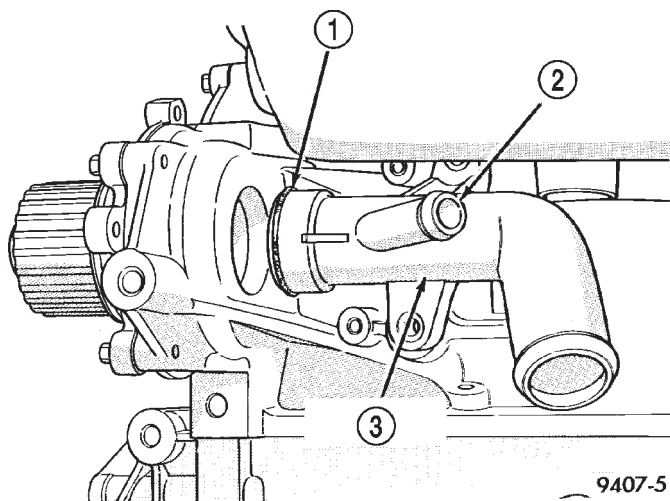


Fig. 18 Water Pump Inlet Tube—Service

- 1 - O-RING
- 2 - TO HEATER
- 3 - WATER PUMP INLET TUBE

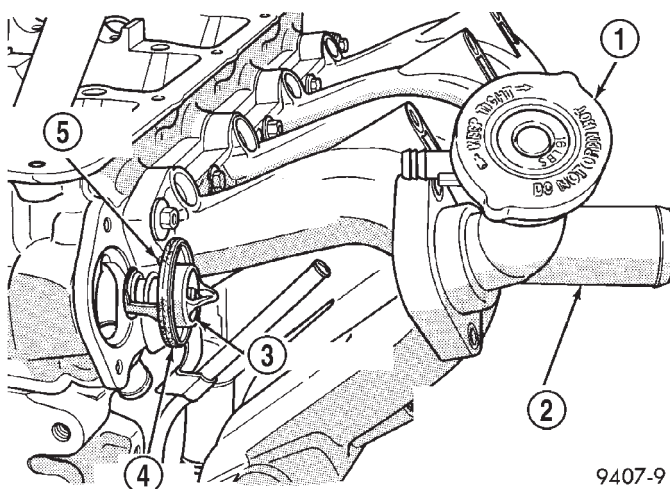


Fig. 19 Thermostat/Engine Outlet Connector—2.0L Engine

- 1 - PRESSURE CAP
- 2 - THERMOSTAT HOUSING/ENGINE OUTLET CONNECTOR
- 3 - THERMOSTAT
- 4 - O-RING
- 5 - VENT FACING UP

INSTALLATION

(1) Place the new thermostat assembly into the engine outlet connector. Align air bleed with notch on the cylinder head.

(2) Install engine outlet connector onto cylinder head and tighten bolts to 12.5 N·m (110 in. lbs.). Connect the coolant recovery system (CRS) hose.

(3) Fill cooling system. Refer to Cooling System Refilling in this section.

RADIATOR

REMOVAL

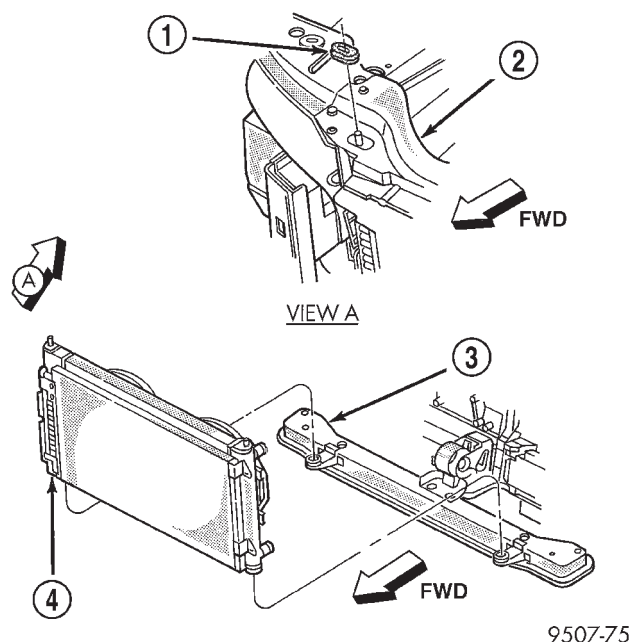


Fig. 20 Cooling Module Mounting

- 1 - ISOLATOR
- 2 - UPPER RADIATOR CROSSMEMBER
- 3 - LOWER RADIATOR CROSSMEMBER
- 4 - COOLING MODULE

(1) Disconnect negative cable from auxiliary jumper terminal.

(2) Remove air inlet resonator. Refer to Group 14, Fuel System for procedure.

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.

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

(4) Remove upper radiator crossmember (Fig. 20). Refer to Group 23, Body for procedure.

CAUTION: Plastic tanks, while stronger than brass are subject to damage by impact, such as wrenches.

(5) Remove hose clamps and hoses from the radiator.

(6) Disconnect the fan wiring connector.

(7) Remove fan module.

REMOVAL AND INSTALLATION (Continued)

(8) Disconnect automatic transmission hoses from cooler and plug off.

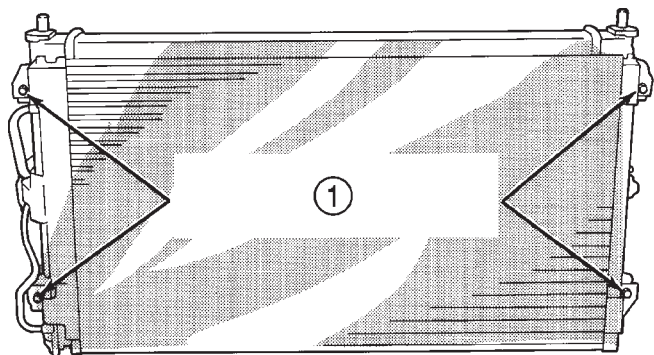
(9) Remove screw attaching support bracket for external transmission oil cooler lines to left side of radiator (if equipped).

(10) Disconnect the engine block heater wire, if equipped.

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

(11) Remove screw attaching support bracket for air conditioning lines from right side of radiator. Remove support bracket.

(12) Remove the air conditioning condenser attaching screws located at the front of the radiator (Fig. 21), if equipped. It is not necessary to discharge the air conditioning system to remove radiator.



9507-82

Fig. 21 A/C Condenser to Radiator Mounting Screws

1 – AIR CONDITIONING CONDENSER TO RADIATOR MOUNTING SCREWS

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

INSTALLATION

(1) Slide radiator and fan module down into position, seat the radiator assembly lower rubber isolators in the mount holes provided.

(2) Attach air conditioning condenser to radiator, if equipped. Tighten mounting screws to 5 N·m (45 in. lbs.).

(3) Install air conditioning line support bracket and attaching screw to right side of radiator.

(4) Connect engine block heater wire, if equipped.

(5) Connect lower radiator hose and clamp.

(6) Install external transmission oil cooler line support bracket and attaching screw to left side of radiator (if equipped).

(7) Connect automatic transmission hoses; tighten hose clamps to 2.5 N·m (22 in. lbs.).

(8) Install fan module.

(9) Connect fan motor electrical connection.

(10) Install upper radiator 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 liner.

(11) Install upper radiator crossmember. Refer to Group 23, Body for procedure.

(12) Connect negative cable to auxiliary jumper terminal.

(13) Fill cooling system with coolant. Refer to Cooling System Refilling in this section.

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

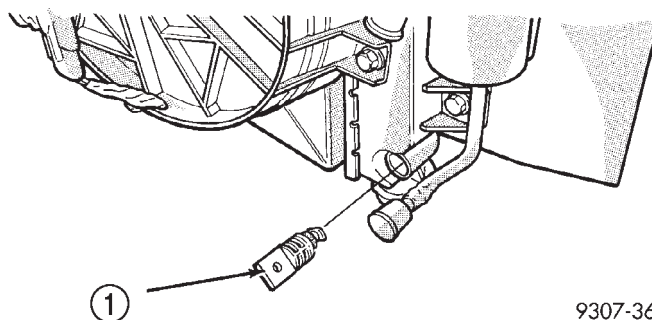
RADIATOR DRAINCOCK

REMOVAL

CAUTION: Plastic tanks, while stronger than brass are subject to damage by impact, such as wrenches.

(1) Turn the draincock stem counterclockwise to unscrew the stem. When the stem is unscrewed to the end of the threads, pull the stem (Fig. 22) from the radiator tank.

NOTE: To open draincock on vehicle equipped with 2.5L engine, use a 3/8 inch drive extension 3" long, a 19mm socket with universal.



9307-36

Fig. 22 Draincock—Typical

1 – DRAIN COCK BODY

INSTALLATION

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

(2) Tighten the draincock stem by turning clockwise to 2.0-2.7 N·m (18-25 in. lbs.) torque.

REMOVAL AND INSTALLATION (Continued)

RADIATOR FAN, MOTOR AND SHROUD

REMOVAL

- (1) Remove upper radiator crossmember. Refer to Group 23, Body for procedure.
- (2) Disconnect fan motor electrical connector.
- (3) Remove fasteners attaching fan module to radiator (Fig. 24).
- (4) Remove fan module.

FAN SERVICE

There are no repairs to be made to the fan. If the fan is warped, cracked, or otherwise damaged, it must be replaced with **only** the recommended part for adequate strength, performance and safety.

- (1) To remove fan from motor shaft, bench support the motor and motor shaft while removing the fan retaining clip, so that the shaft and motor will not be damaged by excessive force. **Surface burr removal may be required to remove fan from motor shaft (Fig. 23).** Do not permit the fan blades to touch the bench.

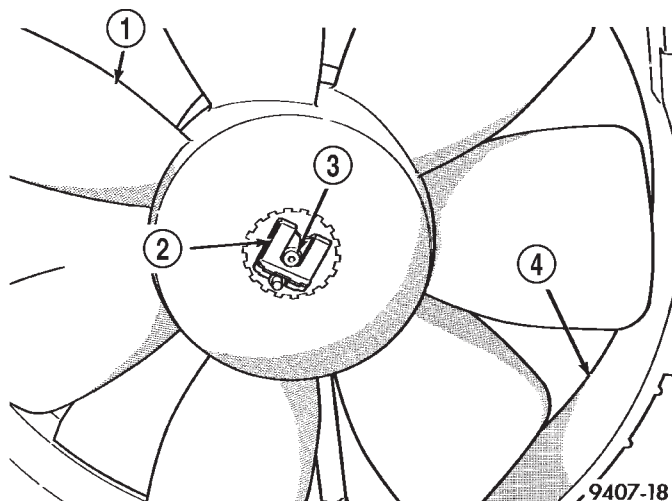


Fig. 23 Radiator Fan—Removal/Installation

- 1 – FAN
- 2 – RETAINING CLIP
- 3 – MOTOR SHAFT
- 4 – SHROUD ASSEMBLY

- (2) To install fan on motor shaft, slide the fan over the shaft. Support motor and shaft while installing fan retaining clip.

FAN SHROUD

All vehicles have fan shrouds to improve fan air flow efficiency.

The shroud supports the electric fan motor and fan.

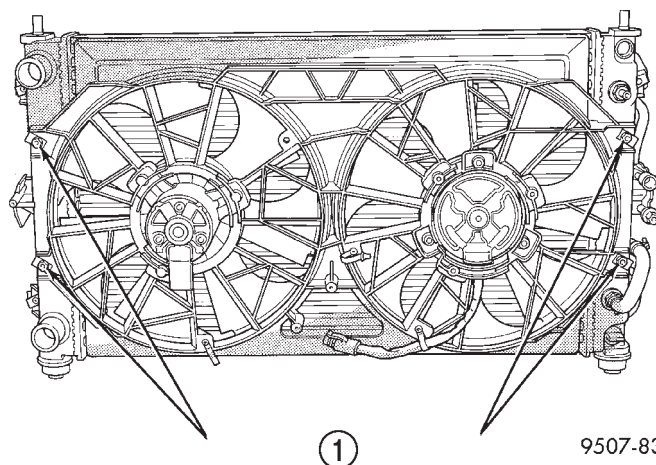


Fig. 24 Fan Module

- 1 – FAN MODULE TO RADIATOR FASTENERS

FAN MOTOR SERVICE

- (1) Remove the motor fasteners from support. Remove motor from support.
- (2) Reverse the above procedure for Installation. Tighten the short fan motor fasteners to 3 N·m (25 in. lbs.) and tighten the tall fan motor fasteners to 5 N·m (45 in. lbs.).

INSTALLATION

- (1) Install fan module to radiator. Tighten shroud to radiator fasteners to 7.5 N·m (65 in. lbs.) (Fig. 24).
- (2) Connect fan motor electrical connector. **For wiring diagrams of fan motor systems, refer to Group 8W, Wiring Diagrams.**
- (3) Install upper radiator crossmember. Refer to Group 23, Body for procedure.

TRANSMISSION OIL COOLER EXTERNAL—
2.0L ENGINE

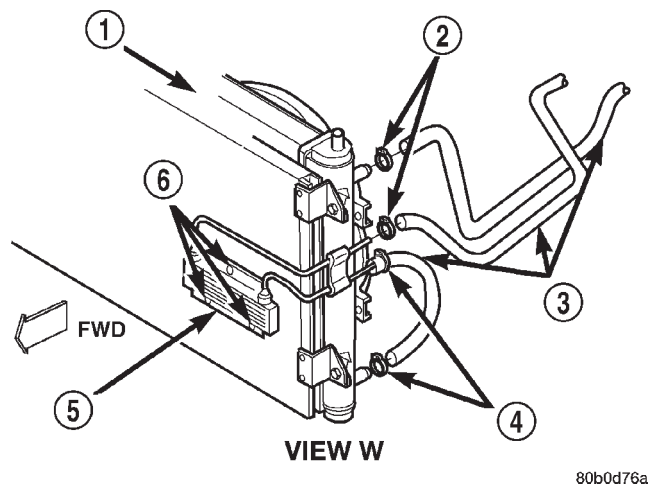
REMOVAL

- (1) Remove the upper radiator crossmember.
- (2) Remove the fan module. Refer to procedures in this section.
- (3) Loosen the cooler line bracket on the left side of radiator.
- (4) Disconnect cooler lines from cooler (Fig. 25).
- (5) Remove cooler (Fig. 25).

INSTALLATION

- (1) Install cooler (Fig. 25).
- (2) Connect cooler lines (Fig. 25).
- (3) Tighten cooler line support bracket.
- (4) Install cooling fan module.
- (5) Install upper radiator crossmember.
- (6) Check and adjust transmission oil level.

REMOVAL AND INSTALLATION (Continued)



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Fig. 25 Transmission Oil Cooler—2.0L Engine

- 1 - COOLING MODULE
- 2 - HOSE CLAMPS
- 3 - TRANSMISSION OIL COOLER HOSES
- 4 - HOSE CLAMPS
- 5 - EXTERNAL TRANSMISSION OIL COOLER
- 6 - RETAINING STRAPS

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) Detach 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 electrical connector position at the top of the core hole.

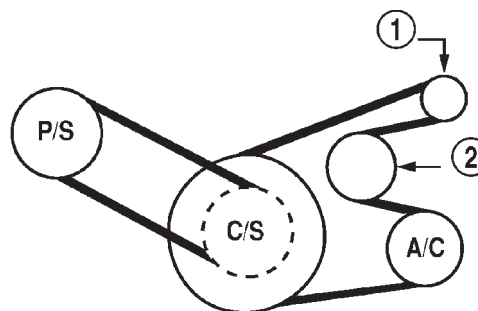
(3) With heater seated, tighten center screw securely to assure a positive seal.

(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.

The power cord must be secured in its retainer clips, and not positioned so it could contact linkages or exhaust manifolds and become damaged.

ACCESSORY DRIVE BELTS—2.0L ENGINE**AIR CONDITIONING COMPRESSOR AND GENERATOR BELT**

(1) Loosen T-Bolt locking nut (A) and pivot bolt (B) to remove and install the Poly-V belt and/or adjust belt tension (Fig. 26).



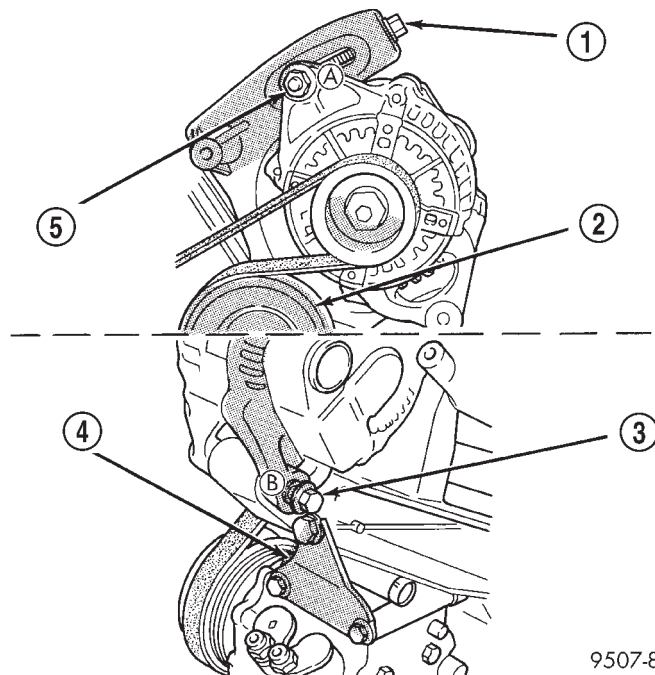
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Accessory Drive Belt System—2.0L Engines

- 1 - GEN.
- 2 - IDLER

(2) Tighten adjusting bolt to adjust belt tension to specification shown in Belt Tension Chart.

(3) Tighten T-Bolt locking nut (A) and pivot bolt (B) to 54 N·m (40 ft. lbs.) (Fig. 26).



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Fig. 26 Air Conditioning Compressor and Generator Belt Adjustment

- 1 - ADJUSTING BOLT
- 2 - IDLER
- 3 - PIVOT BOLT
- 4 - SUPPORT BRACKET
- 5 - LOCK NUT

POWER STEERING PUMP BELT

(1) From the top of the vehicle loosen pivot bolt (C).

REMOVAL AND INSTALLATION (Continued)

(2) From under the vehicle loosen locking bolts (D) and (E) (Fig. 27).

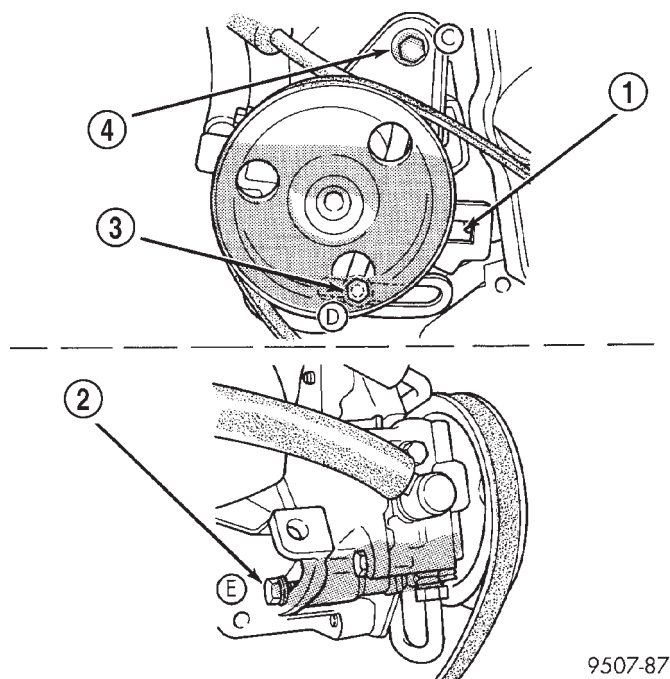


Fig. 27 Power Steering Belt Adjustment

- 1 - 1/2 INCH SQUARE OPENING
2 - LOCKING BOLT
3 - LOCKING BOLT
4 - PIVOT BOLT

(3) Install the belt. Adjust belt tension with 1/2 in. breaker bar installed in adjusting bracket. See Belt Tension Chart.

(4) Tighten locking bolt (D) to 54 N·m (40 ft. lbs.) (Fig. 27).

(5) Tighten locking bolt (E) to 28 N·m (250 in. lbs.).

(6) Tighten pivot bolt (C) to 54 N·m (40 ft. lbs.).

BELT TENSION CHART

ACCESSORY DRIVE BELTS	GAUGE
2.0L ENGINES	
Air Conditioning Compressor & Generator	New Belt: 667 N (150 lbs.)
	Used Belt: 356 N (80 lbs.)
Power Steering Pump	New Belt: 578 N (130 lbs.)
	Used Belt: 356 N (80 lbs.)

CLEANING AND INSPECTION

WATER PUMP—2.0L ENGINES

CLEANING

Clean gasket mating surfaces as necessary.

INSPECTION

Replace water pump body assembly if it has any of these defects:

- (1) Cracks or damage on the body.
- (2) Coolant leaks from the shaft seal, evident by coolant traces on the pump body.
- (3) Loose or rough turning bearing.
- (4) Impeller rubs either the pump body or the engine block.
- (5) Impeller loose or damaged.
- (6) Sprocket or sprocket flange loose or damaged.

ACCESSORY DRIVE BELT

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. These minor cracks are considered normal and acceptable. Cracks parallel are not (Fig. 28).

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

COOLING SYSTEM PRESSURE CAP

CLEANING

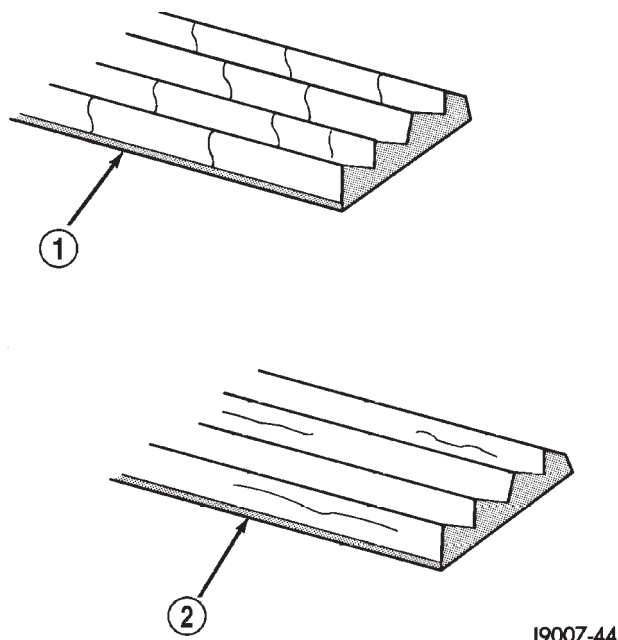
Use only a mild soap to clean the pressure cap.

INSPECTION

Hold the cap in your hand, **right side up** (Fig. 29). The vent valve at the bottom of the cap should open. If the rubber gasket has swollen, preventing the valve from opening, replace the cap.

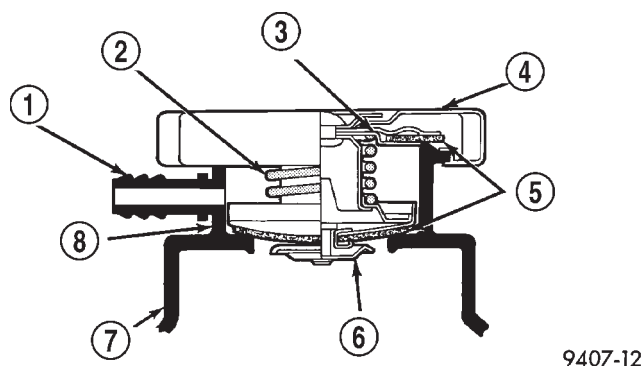
Hold the cleaned cap in your hand, **upside down**. If any light can be seen between vent valve and the rubber gasket, replace the cap. **Do not use a replacement cap that has a spring to hold the vent shut.**

CLEANING AND INSPECTION (Continued)

**Fig. 28 Drive Belt Wear Pattern**

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

A replacement cap must be of the type designed for coolant reserve systems. This design ensures coolant return to the radiator.

**Fig. 29 Cooling System Pressure Cap**

- 1 - OVERFLOW NIPPLE
2 - MAIN SPRING
3 - GASKET RETAINER
4 - STAINLESS-STEEL SWIVEL TOP
5 - RUBBER SEALS
6 - VENT VALVE
7 - THERMOSTAT HOUSING/ENGINE OUTLET CONNECTOR
8 - FILLER NECK

RADIATOR**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 side 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.

COOLING SYSTEM**CLEANING**

CAUTION: Internal radiator pressure must not exceed 138 kPa (20 psi) as damage to radiator may result.

Reverse flushing of cooling system is the forcing of water through the cooling system. This is done using air pressure in the opposite direction of normal coolant flow. It is usually only necessary with very dirty systems with evidence of partial plugging.

(1) Drain cooling system. Remove thermostat housing and thermostat. Install thermostat housing.

(2) Connect a suitable cooling system flusher and follow instructions supplied with flusher.

INSPECTION

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

TRANSAXLE OIL COOLER**CLEANING**

For cooler flushing procedure, refer to TRAN-SAXLE.

Clean debris from cooling fins on external (air-to-oil) cooler 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.

ADJUSTMENTS

BELT TENSION GAUGE METHOD

For conventional belts and Poly-V belts, use belt tensioning gauge Special Tool 7198 to obtain proper belt tension.

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

BELT TENSION CHART

ACCESSORY DRIVE BELTS	GAUGE
2.0L ENGINES	
Air Conditioning Compressor & Generator	New Belt: 667 N (150 lbs.)
	Used Belt: 356 N (80 lbs.)
Power Steering Pump	New Belt: 578 N (130 lbs.)
	Used Belt: 356 N (80 lbs.)

SPECIFICATIONS

COOLING SYSTEM CAPACITY

COOLING SYSTEM CAPACITY CHART

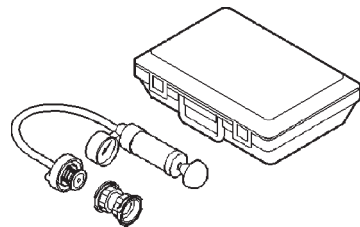
Engine	2.0L
COOLANT CAPACITY*	
Liters	8.0
U.S. Qts.	8.5

TORQUE

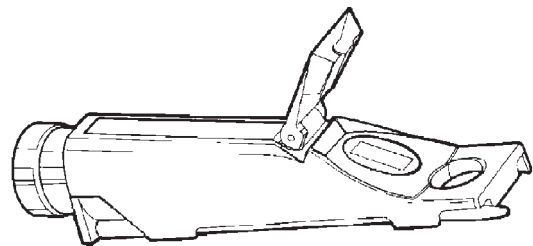
DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
A/C Condenser to Radiator—Fasteners	5	—	45
Thermostat Housing 2.0L—Bolts	12.5	—	110
Water Pump Mounting 2.0L—Bolts	12	—	105
Water Pump Inlet Tube to Block—Bolts	12	—	105
Fan Module to Radiator—Fasteners	7	—	65
Fan Motor to Shroud—Fasteners	5	—	45
Transmission Oil Cooler Hose—Clamps	2	—	18

SPECIAL TOOLS

COOLING SYSTEM



Cooling System Tester 7700



Coolant Refractometer 8286

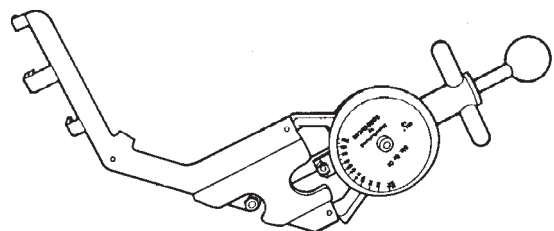


Fig. 30 Belt Tension Gauge 7198

