

COOLING SYSTEM

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GENERAL INFORMATION

COOLING SYSTEM

Throughout this group, references may be made to a particular vehicle by letter or number designation. A chart showing the breakdown of these designations is included in the Introduction Section at the front of this service manual.

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, hoses, clamps, air condition condenser, transmission oil lines and charge air cooler.

- When Engine is cold: Thermostat is closed, cooling system has no flow through the radiator. The coolant bypass flows through the engine and heater core.

- When Engine is warm: Thermostat is open, coolant flow through radiator and heater core.

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 engine equipped vehicles are shown in (Fig. 1). The 2.5L engine coolant routing is shown in (Fig. 2).

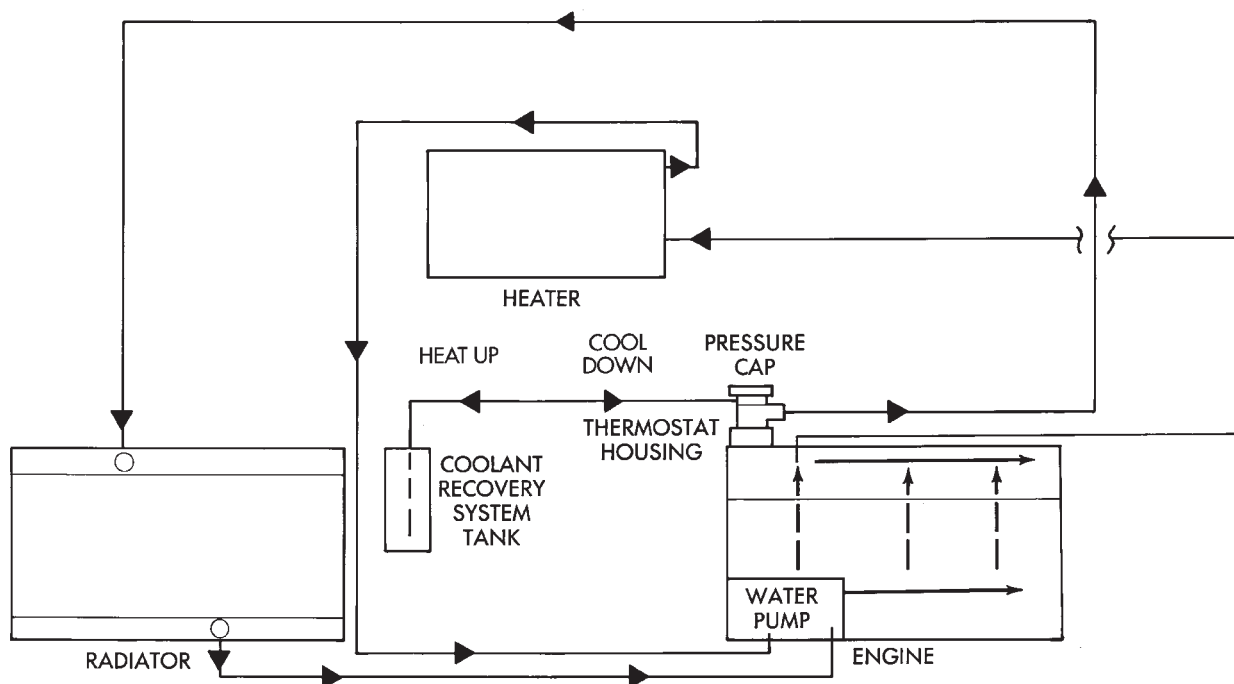
WATER PIPES—2.5L

The 2.5L engine use metal piping beyond the lower radiator hose to route coolant to the suction side of water pump, located in the V of the cylinder banks.

The pipes are also 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. 3).

ACCESSORY DRIVE BELTS

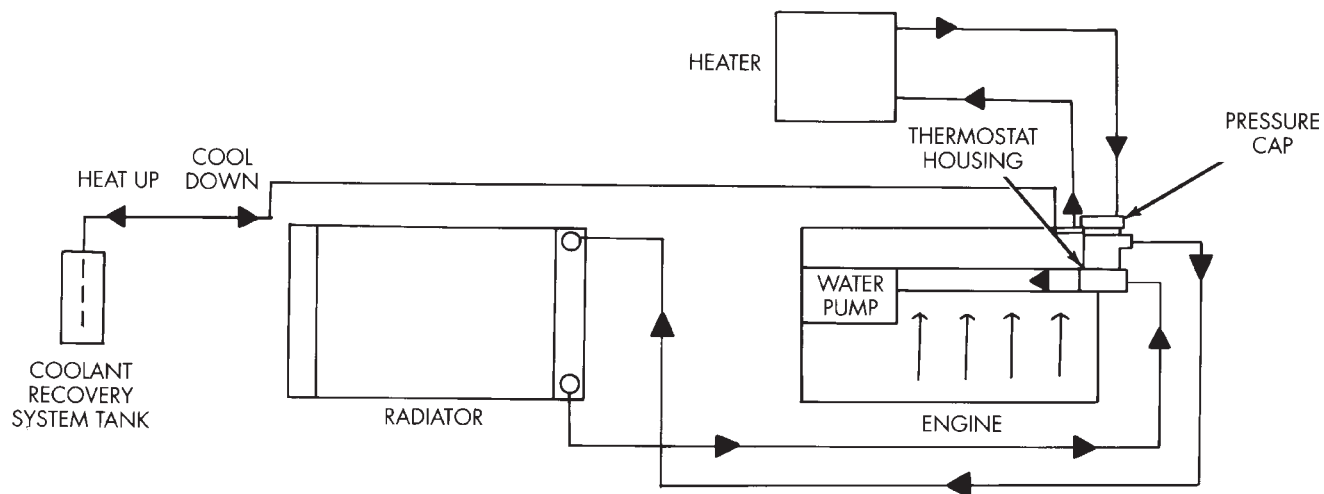
The engine is equipped with 2 drive belts. One belt drives the power steering pump, the other drives the generator and air conditioning. (Fig. 4)



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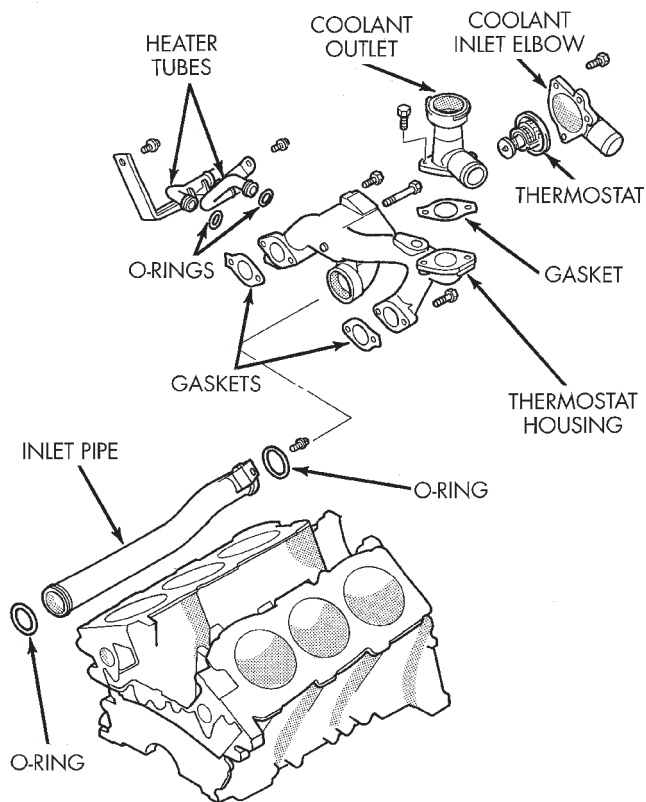
Fig. 1 Cooling System Operation—2.4L Engine

GENERAL INFORMATION (Continued)



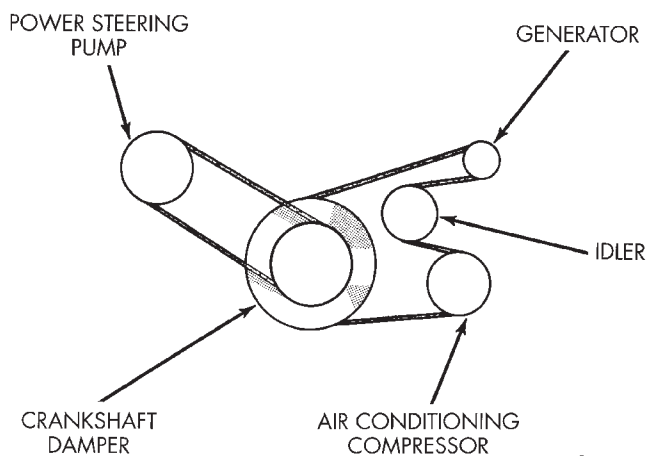
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Fig. 2 Cooling System Operation—2.5L Engine



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Fig. 3 Engine Inlet Coolant Pipes—2.5L Engine



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Fig. 4 Drive Belts—All Engines

GENERAL INFORMATION (Continued)

COOLANT RECOVERY SYSTEM (CRS)

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 (Fig. 5).

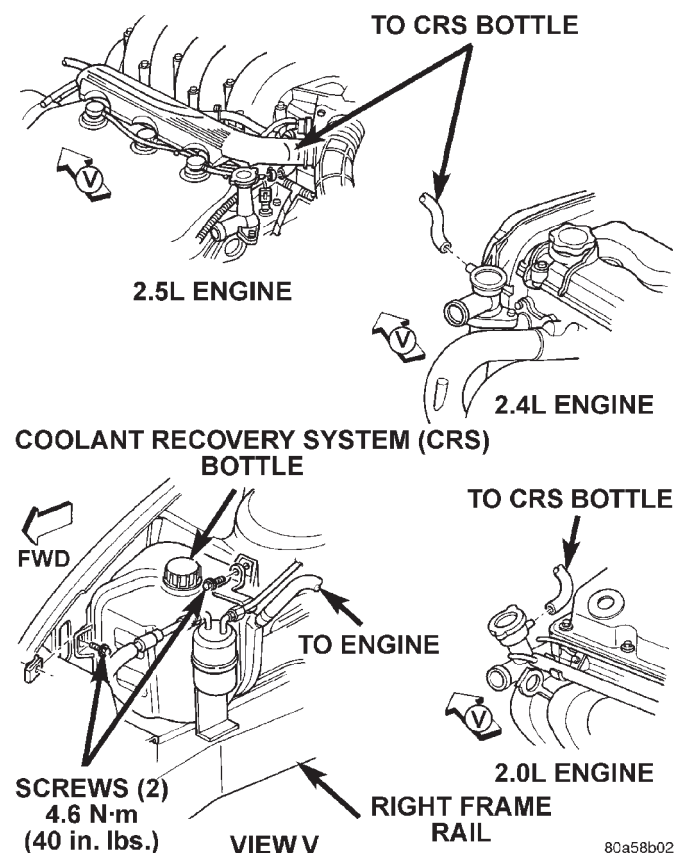


Fig. 5 Coolant Recovery System

See Coolant Level Check Service, Deaeration and Pressure Cap sections for operation and service. Vehicles equipped with the electric monitor system use a level sensor in the CRS tank, see Group 8E Electrical for service.

ENGINE THERMOSTATS

The 2.4L engine thermostat is located on the front of the engine (radiator side) in the thermostat housing/engine outlet connector (Fig. 6). The thermostat has a air bleed located in the flange and a O-ring with a locating dimple incorporate on it. There is a relief in the cylinder head for locating the air bleed.

The 2.5L engine thermostat is located in a thermostat housing, located below the throttle body. This

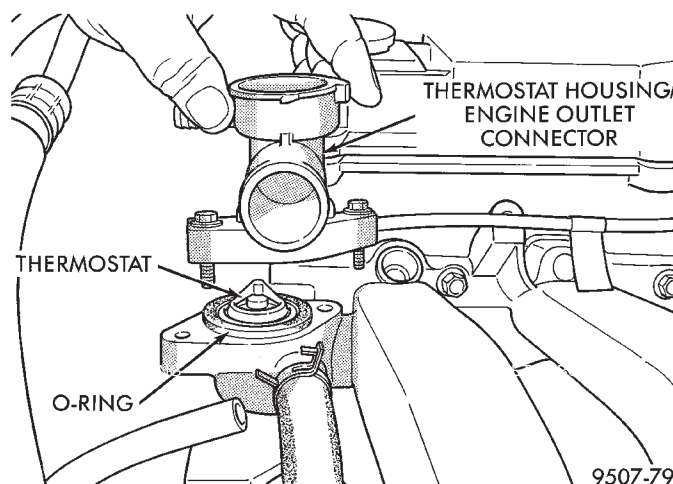


Fig. 6 Thermostat and Engine Outlet Connector—2.4L Engine

thermostat has an air bleed valve, located in the thermostat flange (Fig. 7).

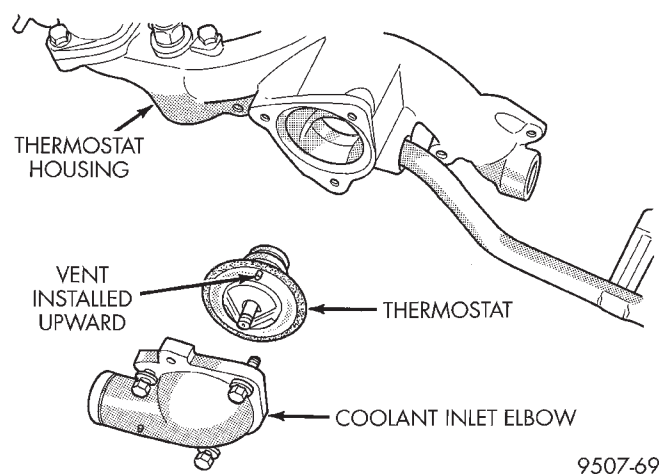


Fig. 7 Thermostat, Housing and Inlet Elbow—2.5L Engine

WATER PUMP

The water pump body is made of aluminum with a steel impeller. The water pump is bolted to the front of the block, and driven by the timing belt. The water pump is the heart of the cooling system, pumping the coolant through the engine block, cylinder head, heater core, and radiator.

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

WATER PUMP—2.5L ENGINE

The 2.5L pump bolts directly to the engine block, using a gasket for pump to block sealing (Fig. 8). The pump is serviced as a unit.

GENERAL INFORMATION (Continued)

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

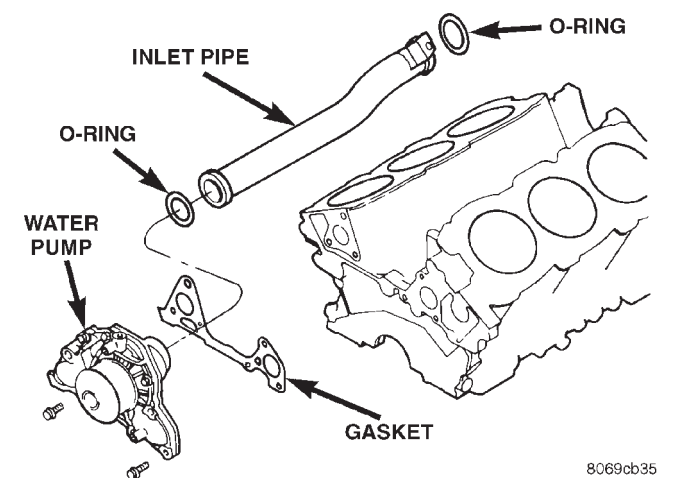


Fig. 8 Water Pump—2.5L Engine

WATER PUMP INLET TUBE—2.4L ENGINE

The inlet tube connects the water pump to the radiator and heater core. This tube is sealed by a O-ring and held in place by fasteners to the block.

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. Then carry this heat to the radiator where the tube/fin assemblies of these components can give off the heat to the air.

COOLANT REPLACEMENT

Refer to Group 0, Lubrication and Maintenance for schedule.

COOLING SYSTEM PRESSURE CAP

The cooling system is equipped with a pressure cap that releases pressure at some point within a range of 97-124 kPa (14-18 psi) (Fig. 9).

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

There is a vent valve in the center of the cap that allows a small coolant flow to the CRS tank. **If the valve is stuck shut, the radiator hoses will collapse on cool-down. Clean the vent valve (Fig. 9) to ensure proper sealing when boiling point is reached.**

There is a gasket in the cap that seals to the top of the filler neck so that vacuum is maintained to draw coolant back into the system from the coolant reserve system tank.

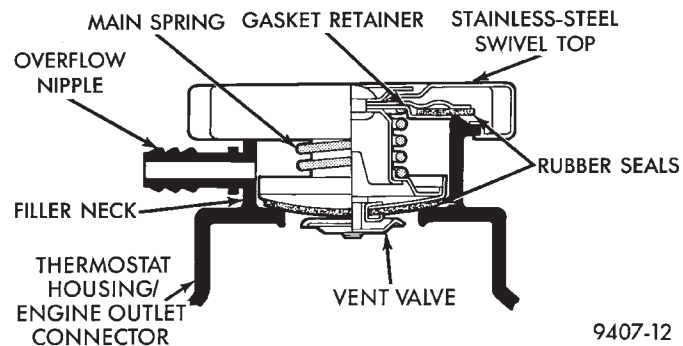


Fig. 9 Cooling System Pressure Cap to Filler Neck

RADIATOR

The radiators are cross flow types (horizontal tubes) with design features that provide greater strength as well as sufficient heat transfer capabilities to keep the engine satisfactorily cooled (Fig. 10).

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

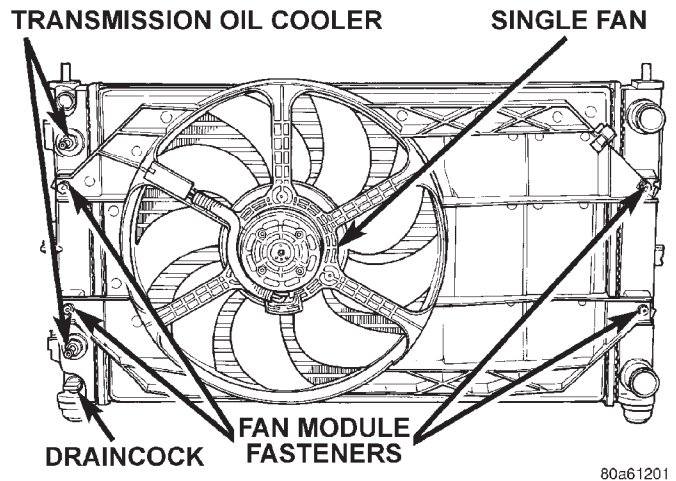


Fig. 10 Radiator Module—JX

COOLING SYSTEM FAN

The radiator has a single cooling fan, with a two speed motor (Fig. 10). The fan is controlled by the Powertrain Control Module (PCM) which energizes the fan relay.

AUTOMATIC TRANSMISSION OIL COOLER—2.4L

Oil coolers are internal oil to coolant type, mounted in the radiator left tank (Fig. 10). 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. Tighten Oil Cooler Hose Clamps to 2 N·m (18 in. lbs.).

GENERAL INFORMATION (Continued)

AUXILIARY TRANSMISSION OIL COOLER—2.5L

Models equipped with 2.5L engine, have an auxiliary transmission oil cooler added in series with the internal oil cooler in the radiator. The auxiliary cooler is a external oil to air type mounted in front of the cooling module (Fig. 11).

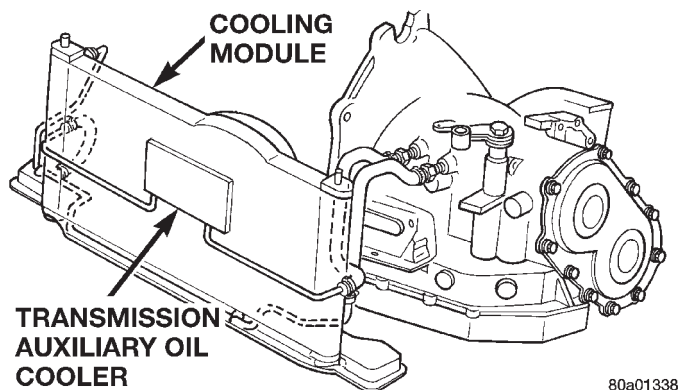


Fig. 11 Auxiliary Transmission Oil Cooler—2.5L Engine

ENGINE BLOCK HEATER

On all models an engine block heater is available as an optional accessory. The heater, operated by ordinary house current (110 Volt A.C.) through a power cord and connector behind the radiator grille. Refer to Description and Operation in this section for more information.

DESCRIPTION AND OPERATION**THERMOSTAT**

The engine cooling thermostats are 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 radiator, fan, and ambient temperature, not the thermostat.

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

COOLANT PERFORMANCE

Performance is measurable. For heat transfer pure water absorbs 1 btu 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 ethylene glycol (.7 btu) can cause an engine to run hot, cause detonation, and will freeze at -22°C (-8°F).
- 50/50 Ethylene Glycol and Distilled 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, coolant sensor and heater are all designed for 50/50 ethylene glycol.

Where required, a 56 percent glycol and 44 percent water mixture will provide a freeze point of -46°C (-50°F).

NOTE: Richer mixtures cannot be measured with field equipment and can lead to problems associated with 100 percent glycol. If there is doubt that the coolant mixture is too rich for field equipment to measure, put a sample in a clean container. Add exactly the same amount of water and retest. If the coolant in the vehicle is 100% antifreeze, the diluted sample will read 50%. If the coolant in the vehicle was 70% antifreeze and 30% water, the diluted sample will read as 35%, etc.

SELECTION AND ADDITIVES

The use of aluminum cylinder heads, intake manifolds, and water pumps requires special corrosion protection. Mopar Antifreeze or their equivalent are 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 suspected water supply in cooling system. A 50/50 ethylene glycol and distilled water mix is recommended.

COOLING SYSTEM PRESSURE CAP

The cooling system is equipped with a pressure cap that releases built up 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

DESCRIPTION AND OPERATION (Continued)

connecting hose. **If valve is stuck shut, the radiator hoses will be collapsed on cool down. Clean the vent valve (Fig. 12) 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.

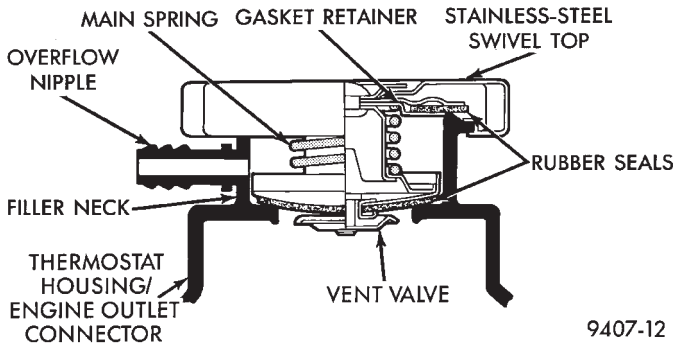


Fig. 12 Cooling System Pressure Cap

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 TO ESCAPE THROUGH THE OVERFLOW TUBE AND WHEN THE SYSTEM STOPS PUSHING OUT COOLANT AND STEAM AND THE PRESSURE DROPS CONTINUE SERVICE.

WARNING: CONSTANT TENSION HOSE CLAMPS ARE USED ON MOST COOLING SYSTEM HOSES. WHEN REMOVING OR INSTALLING, USE ONLY TOOLS DESIGNED FOR SERVICING THIS TYPE OF CLAM. ALWAYS WEAR SAFETY GLASSES WHEN SERVICING CONSTANT TENSION CLAMPS.

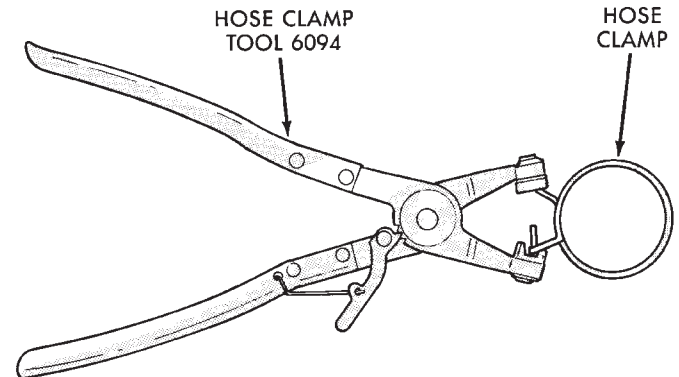
CAUTION: A number or letter is stamped into the tongue of constant tension clamps. If replacement is necessary, use only a original equipment clamp with matching number or letter.

The hose clamps are removed by using Special Tool 6094 or equivalent constant tension clamp pliers (Fig. 13) to compress 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.



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Fig. 13 Hose Clamp Tool

ENGINE BLOCK HEATER

The heater, operated by ordinary house current (110 Volt A.C.) through a power cord and connector behind the radiator grille, 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. 14). **The power cord must be secured in its retainer clips, and not positioned so it could contact linkages or exhaust manifolds and become damaged. For removal procedures, refer to Removal and Installation in this section.**

WATER PUMP—2.4L ENGINE

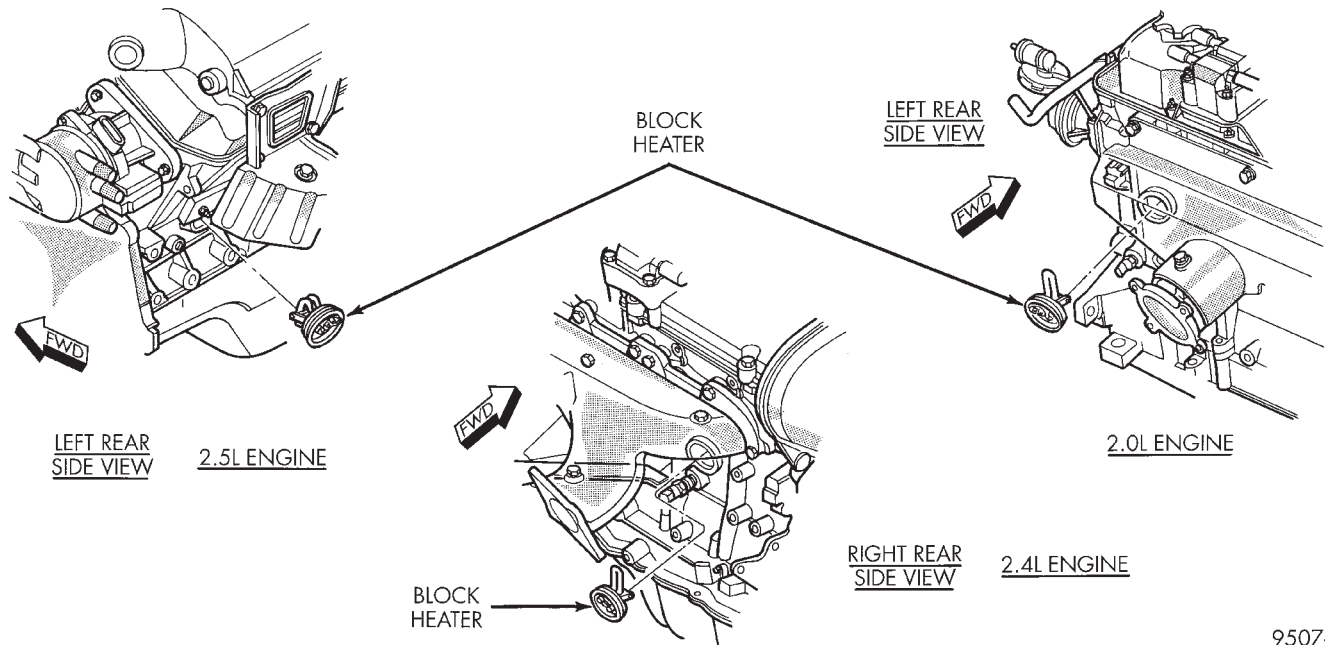
The water has a diecast aluminum body and housing with a stamped steel impeller. The water pump bolts directly to the block (Fig. 15). Cylinder block to water pump sealing is provided by a rubber O-ring. The water pump is driven by the timing belt. Refer to Group 9, Engine section for component removal to access the water pump.

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

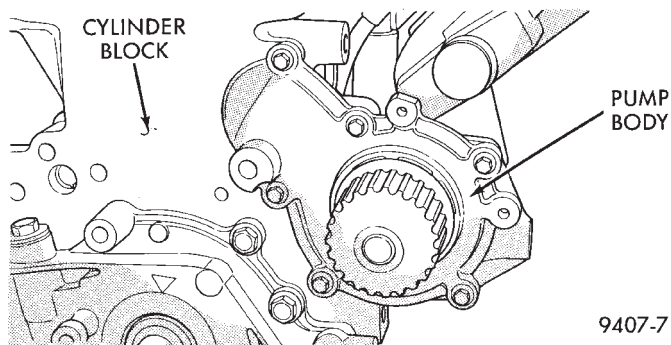
WATER PUMP—2.5L ENGINE

The water pump has a aluminum body with a steel impeller. A gasket is used to seal the pump to the cylinder block. The water pump inlet is located at the rear of the pump, a inlet tube located between the cylinder heads connects the water pump with the thermostat housing (Fig. 16). The water pump is

DESCRIPTION AND OPERATION (Continued)



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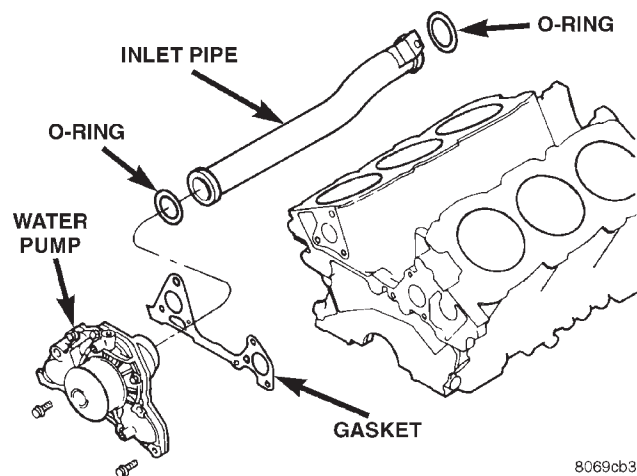
Fig. 14 Engine Block Heater

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Fig. 15 Water Pump

driven by the timing belt. Refer to group 9, Engines for timing belt removal.

NOTE: The water pump can be replaced with out discharging the air conditioning system.



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Fig. 16 Water Pump and Inlet Tube

DIAGNOSIS AND TESTING**COOLING SYSTEM DIAGNOSIS**

CONDITION	POSSIBLE CAUSE	CORRECTION
TEMPERATURE GAUGE READS LOW	1. Has a Diagnostic Trouble Code (DTC) number 17 been set indicating a stuck open engine thermostat? 2. Is the temperature gauge (if equipped) connected to the temperature gauge coolant sensor on the engine? 3. Is the temperature gauge (if equipped) operating OK? 4. Coolant level low during cold ambient temperature, accompanied by poor heater performance.	1. Refer to On Board Diagnostic in Group 25. Replace thermostat if necessary. if the (DTC) number 17 has not been set, the problem may be with the temperature gauge. 2. Check the connector at the engine coolant sensor. Refer to Group 8E. Repair as necessary. 3. Check Gauge operation. Refer to Group 8E. Repair as necessary. 4. Check coolant level in the coolant overflow/reserve tank and the radiator. Inspect the system for leaks. Repair as necessary. Refer to WARNINGS outlined in this section before removing pressure cap.
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 overflow/reserve tank 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.	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 Group 8E. Repair as necessary. 3. Check warning lamp operation. Refer to Group 8E. Repair as necessary. 4. Check for coolant leaks and repair as necessary. Refer to checking cooling system for leaks in this group. 5. Tighten cap. 6. (a) Check condition of cap and cap seals. Refer to Radiator cap Inspection. Replace cap if necessary. 6. (b) Check condition of filler neck. If neck is bent or damaged, replace neck.

DIAGNOSIS AND TESTING (Continued)

ENGINE THERMOSTAT TESTING

COOLING SYSTEM DIAGNOSIS CONT.

CONDITION	POSSIBLE CAUSES	CORRECTION
TEMPERATURE GAUGE READS HIGH OR ENGINE COOLANT WARNING LAMP ILLUMINATES. COOLANT MAY OR MAY NOT BE LOST FROM SYSTEM.	7. Coolant level low in radiator but not in coolant overflow/reserve tank. This means the radiator is not drawing coolant from the coolant overflow/reserve tank 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 can not be formed. 8. Freeze point of coolant not correct. Mixture may be too rich. 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 is being used causing reduced air flow. 15. Thermostat partially or completely shut. This is more prevalent on high mileage vehicles. 16. Electric cooling fan not operating properly. 17. Cylinder head gasket leaking. 18. Heater core leaking.	7. (a) Check condition of radiator cap and cap seals. Replace cap if necessary. (b) Check condition of filler neck. If neck is damaged, replace filler neck. (c) Check condition of hoses from filler neck to coolant tank. It should be tight at both ends without any kinks or tears. Replace hose if necessary. (d) Check coolant overflow/reserve tank and tank hoses for blockage. Repair as necessary. 8. Check coolant. Refer to coolant section in this group. Adjust glycol to water ratio as required. 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 insects or debris. 11. Replace or re-core radiator. 12. Refer to Fuel and Ignition System group for diagnosis. Also refer to the appropriate Powertrain Diagnosis Procedures manual for operation of the DRB scan tool. 13. Inspect brake system and repair as necessary. Refer to Group 5, Brakes for diagnosis. 14. Remove bug screen. 15. Check thermostat operation and replace as necessary. Refer to thermostats in this group. 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 group 9, Engines. 18. Check heater core for leaks. Refer to Group 24, Heating and Air Conditioning. Repair as necessary.

DIAGNOSIS AND TESTING (Continued)

COOLING SYSTEM DIAGNOSIS CONT.

CONDITION	POSSIBLE CAUSES	CORRECTION
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 defective or shorted. Also, corroded or loose wiring in this circuit. 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 causing thermostat to open late. 8. Water pump impeller loose on shaft. 9. Loose accessory drive belt (water pump slipping). 10. Air leak on the suction side of water pump allows air to build up in cooling system causing thermostat to open late.	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 outlined in this section. 2. A normal condition. No correction is necessary. 3. Check operation of gauge and repair if necessary. Refer to Group 8E, Instrument Panel And Gauges. 4. A normal condition. No correction is necessary. Gauge reading should return to normal range after a few minutes of engine operation. 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 this group. 7. (a) Check for cylinder head gasket leaks with a commercially available Block Leak Tester. 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 Pumps in this group. 9. Refer to Engine Accessory Drive Belts in this group. Check and correct as necessary. 10. Locate leak and repair as necessary.
PRESSURE CAP IS BLOWING OFF STEAM AND/OR COOLANT TO COOLANT TANK. TEMPERATURE GAUGE READING MAY BE ABOVE NORMAL BUT NOT HIGH. COOLANT LEVEL MAY BE HIGH IN COOLANT RESERVE/OVERFLOW TANK	1. Pressure relief valve in radiator cap is defective.	1. Check condition of radiator cap and cap seals. Refer to Radiator Caps in this group. Replace cap as necessary.

DIAGNOSIS AND TESTING (Continued)

COOLING SYSTEM DIAGNOSIS CONT.

CONDITION	POSSIBLE CAUSES	CORRECTION
COOLANT LOSS TO THE GROUND WITHOUT PRESSURE CAP BLOWOFF, GAUGE IS READING HIGH OR HOT	1. Coolant leaks in radiator, cooling system hoses, water pump or engine.	1. Pressure test and repair as necessary. Refer to Testing Cooling System For Leaks in this group.
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. Mixture is too high or too lean.	1. Check reason for overheating and repair as necessary. 2. Check the freeze point of the coolant. Refer to Coolant in the group for test procedure. Adjust the glycol to water ratio as required.
HOSE OR HOSES COLLAPSE WHEN ENGINE IS COOLING	1. Vacuum created in cooling system on engine cool-down is not being relieved through coolant reserve/overflow system.	1. (a) Radiator cap relief valve stuck. Refer to Radiator Cap in this group. Replace if necessary. (b) Hose between coolant reserve/overflow tank and radiator is kinked. Repair as necessary. (c) Vent at coolant reserve/overflow tank is plugged. Clean vent and repair as necessary. (d) Reserve/overflow tank is internally blocked or plugged. Check for blockage and repair as necessary.
ELECTRIC RADIATOR FAN RUNS 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 RUN. GAUGE READING HIGH OR NOT	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 blades loose. 2. Fan blades striking a surrounding object. 3. Air obstructions at radiator or air conditioning condenser. 4. Electric fan motor defective.	1. Replace fan blade assembly. Refer to Cooling System Fans in this group. 2. Locate point of fan blade contact and repair as necessary. 3. Remove obstructions and/or clean debris or insects from radiator or A/C condenser. 4. Refer to procedure outlined in this section.

DIAGNOSIS AND TESTING (Continued)

COOLING SYSTEM DIAGNOSIS CONT.

CONDITION	POSSIBLE CAUSES	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 Group 7, Cooling.
INADEQUATE HEATER PERFORMANCE.	1. Has a diagnostic trouble code (DTC) number 17 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 accessory drive belt may be slipping causing poor water pump operation.	1. Refer to On-Board Diagnostic in Group 25, and replace thermostat if necessary. 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 group. Repair as necessary. If slipping belt is detected, refer to accessory drive belts in this group. Repair as necessary.
HEAT ODOR	6. Various heat shields are used at certain drive line components. One or more of these shields may be missing.	6. Locate missing shields and replace or repair as necessary.

DIAGNOSIS AND TESTING (Continued)

COOLING SYSTEM DIAGNOSIS CONT.

CONDITION	POSSIBLE CAUSES	CORRECTION
HEAT ODOR - CONT.	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.	2. Refer to the previous Temperature Gauge Reads High in these Diagnosis Charts. Repair as necessary. 3. Refer to Cooling System Fan in this group for diagnosis. Repair as necessary. 4. Clean undercoating as necessary. 5. Refer to On-Board Diagnostics in Group 25. DTC's may also be checked using the DRB scan tool. Refer to the proper Powertrain Diagnostics Procedures manual for checking the thermostat using the DRB scan tool. Replace thermostat if necessary.
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) number 17 been set?	1. Refer to On-Board Diagnostics in Group 25. DTC's may also be checked using the DRB scan tool. Refer to the proper Powertrain Diagnostics Procedures manual for checking the thermostat using the DRB scan tool. Replace thermostat if necessary.
STEAM IS COMING FROM FRONT OF VEHICLE NEAR GRILL AREA WHEN WEATHER IS WET, ENGINE IS WARMED UP AND 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 contacts 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 in the group for test procedure. Adjust the glycol to water ratio as required.
COOLANT LEVEL CHANGES IN COOLANT RESERVE/OVERFLOW TANK. TEMPERATURE GAUGE IS IN NORMAL RANGE	1. Level changes are to be expected as coolant volume fluctuates with engine temperature. If the level in the tank 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.

DIAGNOSIS AND TESTING (Continued)

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

The 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, code 17 will be set. Do not change a thermostat for lack of heater performance or temperature gage position, unless code 17 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 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:

(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

The radiator has a single cooling fan, with a two speed motor (Fig. 17). The fan is controlled by the Powertrain Control Module (PCM) which energizes the fan relay. Fan operation is accomplished three ways:

- When air conditioning system pressure reaches 210 psi, fan will operate.
- Coolant temperature reaches 215° F, fan will operate.
- Models equipped with automatic transmission, a fluid thermister may have some influences on fan operation.
- Refer to tables below for fan operation.

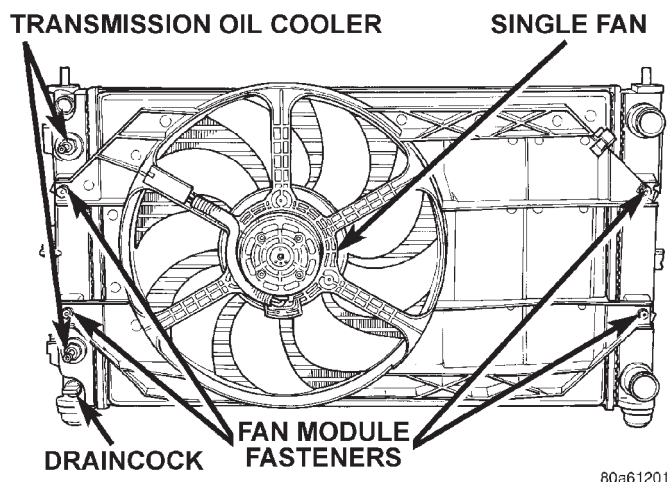
RADIATOR FAN OPERATION—2.4L ENGINE

Radiator Fan Control			A/C Pressure	
A/C Off	Low	High		
Fan On:	102°C (215°F)	107°C (225°F)		
Fan Off:	96°C (205°F)	96°C (205°F)		
A/C On	Low	High	Low	High
Fan On:	102°C (215°F)	107°C (225°F)	1,448 Kpa (210 psi)	1,718 Kpa (249 psi)
Fan Off:	96°C (205°F)	96°C (205°F)	1,207 Kpa (175 Psi)	1,585 Kpa (229 Psi)
EATX Fluid Temperature			Low Speed	High Speed
Fan On:			118°C (244°F)	122°C (252°F)
Fan Off:			116°C (240°F)	118°C (244°F)

RADIATOR FAN OPERATION—2.5L ENGINE

Radiator Fan Control			A/C Pressure	
A/C Off	Low	High		
Fan On:	102°C (215°F)	107°C (224°F)		
Fan Off:	96°C (205°F)	103°C (217°F)		
A/C On	Low	High	Low	High
Fan On:	102°C (215°F)	107°C (224°F)	1,448 Kpa (210 psi)	1,718 Kpa (249 psi)
Fan Off:	96°C (205°F)	101°C (213°F)	1,207 Kpa (175 psi)	1,585 Kpa (229 psi)
EATX Fluid Temperature			Low Speed	High Speed
Fan On:			118°C (244°F)	122°C (252°F)
Fan Off:			116°C (240°F)	118°C (244°F)

DIAGNOSIS AND TESTING (Continued)



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Fig. 17 Cooling Fan—JX

ELECTRIC FAN MOTOR TEST

Refer to Powertrain Diagnostic Manual for procedure.

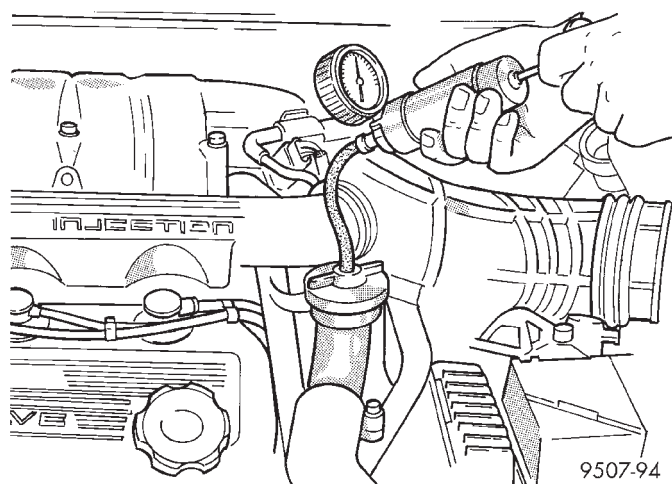
For wiring diagrams of the fan motor systems refer to 8W Wiring Diagrams.

TESTING SYSTEM FOR LEAKS

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. 18) 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.



9507-94

Fig. 18 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. Re-attach the tester. If the

needle on the dial fluctuates it indicates a combustion leak, usually a head gasket leak.

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

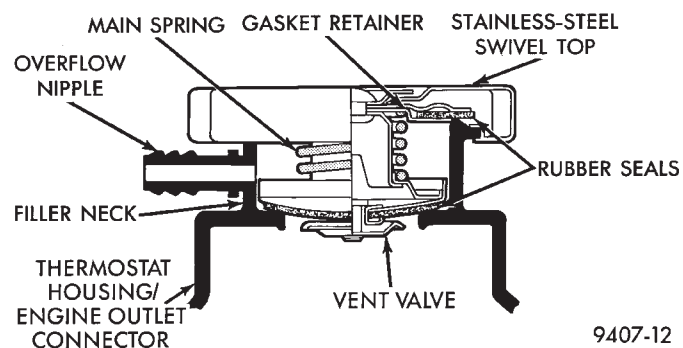
If the needle on the dial does not fluctuate, race the engine a few times. If an abnormal amount of coolant or steam is emitted from the tail pipe, it may indicate a faulty head gasket, cracked engine block or cylinder head.

There may be internal leaks which can be determined by removing the oil dip-stick. 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.

PRESSURE 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. 19). Attach the radiator pressure tester to the **filler neck 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.



9407-12

Fig. 19 Cooling System Pressure Cap to 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

DIAGNOSIS AND TESTING (Continued)

- 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.

PRESSURE TESTING 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. 20). 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 on the 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

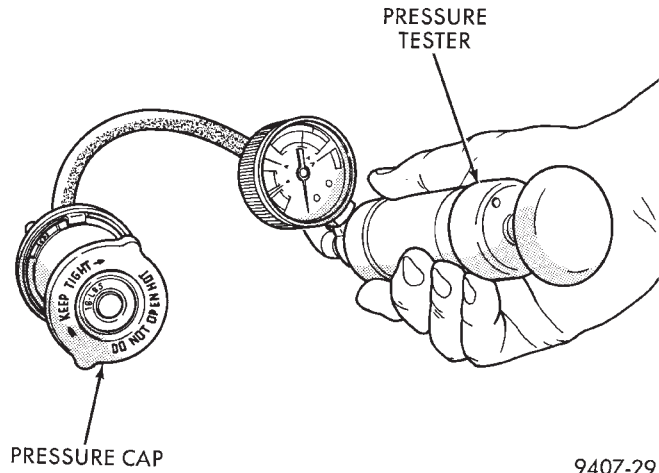


Fig. 20 Pressure Testing Radiator Cap

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.

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 the temperature gauge could rise slowly to about 1/2 gauge travel. The fan will come on and the gauge could drop to about 1/3 gauge travel, this is normal.

DIAGNOSIS AND TESTING (Continued)

ACCESSORY DRIVE BELTS

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

Condition	Possible Cause	Correction
INSUFFICIENT ACCESSORY OUTPUT DUE TO BELT SLIPPAGE	(a) Belt too loose. (b) Belt excessively glazed or worn	(a) Adjust belt tension. (b) Replace and tighten as specified.
BELT SQUEAL WHEN ACCELERATING ENGINE	(a) Belts too loose. (b) Belts glazed.	(a) Adjust belt tension (b) Replace belts.
BELT CHIRP AT IDLE	(a) Belts too loose. (b) Dirt and paint imbedded in belt. (c) Non-uniform belt. (d) Misaligned pulleys. (e) Non-uniform groove or eccentric pulley.	(a) Adjust belt tension. (b) Replace belt. (c) Replace belt. (d) Align accessories (e) Replace pulley.
BELT ROLLED OVER IN GROOVE OR BELT JUMPS OFF	(a) Broken cord in belt. (b) Belt too loose, or too tight. (c) Misaligned pulleys. (d) Non-uniform grooves or eccentric pulley.	(a) Replace belt. (b) Adjust belt tension. (c) Align accessories. (d) Replace pulley.

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

ROUTINE COOLANT LEVEL CHECK

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. Simply observe, with the engine idling and warmed up to normal operating temperature, that the level of the coolant in the reserve tank is between the minimum and maximum marks.

ADDING ADDITIONAL COOLANT

NOTE: The radiator cap should not be removed.

When additional coolant is needed, it should be added to the coolant reserve tank. Use only 50/50 concentration of ethylene glycol type antifreeze and water

SERVICING COOLANT LEVEL

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 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 ADD mark there is a 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.

DRAINING COOLING SYSTEM

NOTE: Drain, flush, and fill the cooling system at the mileage or time intervals specified in the Maintenance Schedule in this Group. If the solution is dirty or 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 from your vehicle. Check governmental regulations for disposal of used engine coolant.

SERVICE PROCEDURES (Continued)

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. 21). The coolant reserve tank should empty first, then remove radiator pressure cap. (if not, see Testing Cooling System for leaks).

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.

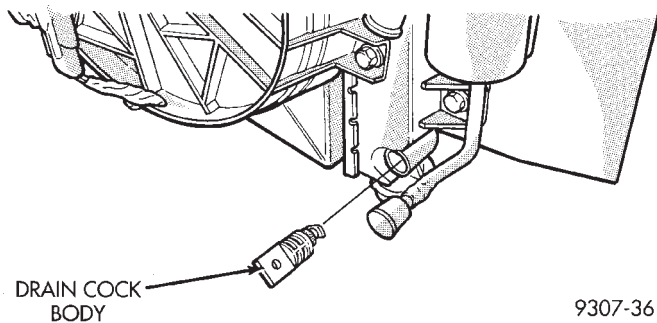


Fig. 21 Draincock—Typical

REFILLING COOLING SYSTEM

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

Fill system using antifreeze described in Coolant section. Fill 50 percent of capacity with 100 percent glycol. Then complete filling system with water. The thermostats in the these engines allow air flow to 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 reserve system to at least the FULL HOT mark with 50/50 solution. It may be necessary to add coolant to the reserve tank to maintain coolant level between the FULL HOT and ADD mark after three or four warm-up, cool down cycles and trapped air has been removed.

REMOVAL AND INSTALLATION

WATER PUMP—2.4L ENGINE

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 of this section.

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

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

(5) Remove power steering pump bracket bolts and set pump and bracket assembly aside. Power steering lines do not need to be disconnected.

(6) Remove right engine mount bracket.

(7) Remove timing belt. Refer to Timing Belt Removal in Group 9 for procedure.

(8) Remove inner timing belt cover.

(9) Remove water pump attaching screws to engine (Fig. 22).

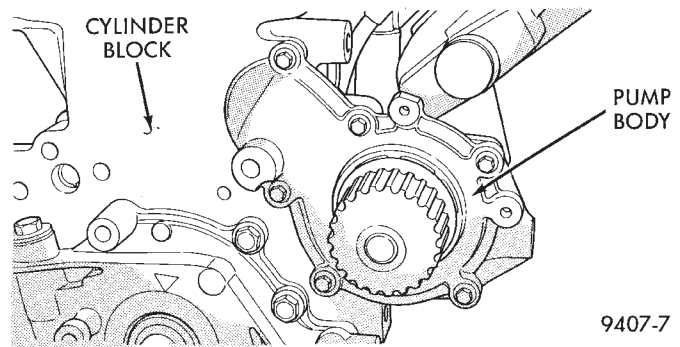


Fig. 22 Water Pump

INSTALLATION

(1) Install new O-ring gasket in water pump body O-ring groove (Fig. 23).

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.

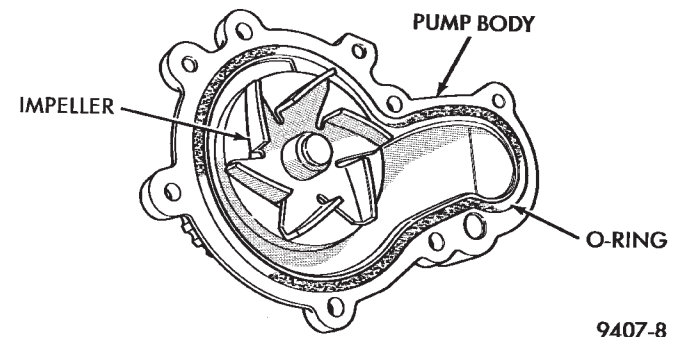


Fig. 23 Water Pump Body

(2) Assemble pump body to block and tighten screws to 12 N·m (105 in. lbs.) (Fig. 22). Pressurize cooling system to 15 psi with pressure tester and check water pump shaft seal and O-ring for leaks.

REMOVAL AND INSTALLATION (Continued)

- (3) Rotate pump by hand to check for freedom of movement.
- (4) Install inner timing belt cover.
- (5) Install timing belt. Refer to Timing Belt Installation in Group 9 and Reassemble engine.
- (6) Install right engine mount bracket and engine mount. Refer to Group 9 for procedure.
- (7) Fill cooling system. Refer to Filling Cooling System for procedure outlined in this group.
- (8) Install power steering pump and accessory drive belts, Refer to Accessory Drive Belts, in this Group.

WATER PUMP—2.5L ENGINE

REMOVAL

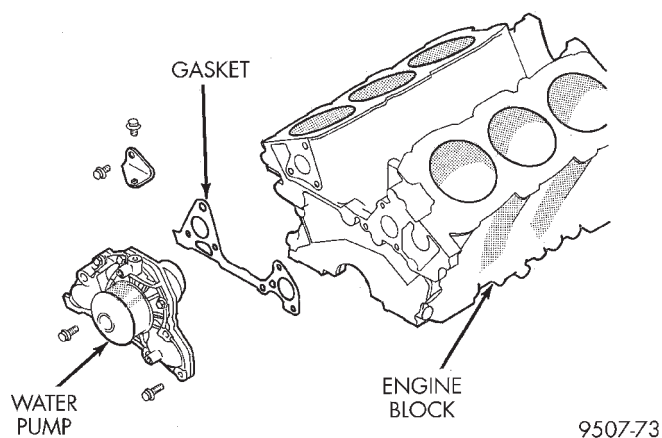


Fig. 24 Water Pump—2.5L Engine

- (1) Drain cooling system. Refer to Draining Cooling System in this group.
- (2) Remove mounting bolts.
- (3) Separate pump from water inlet pipe (Fig. 25) and remove pump (Fig. 24).

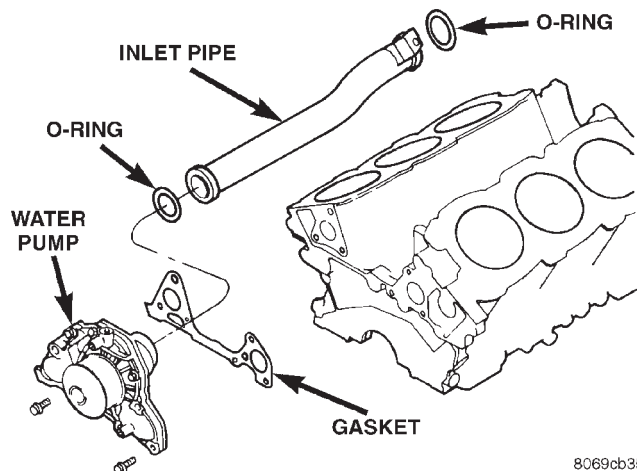


Fig. 25 Water Pump Inlet Tube

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. 26). Wet the O-ring with water to facilitate assembly.

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

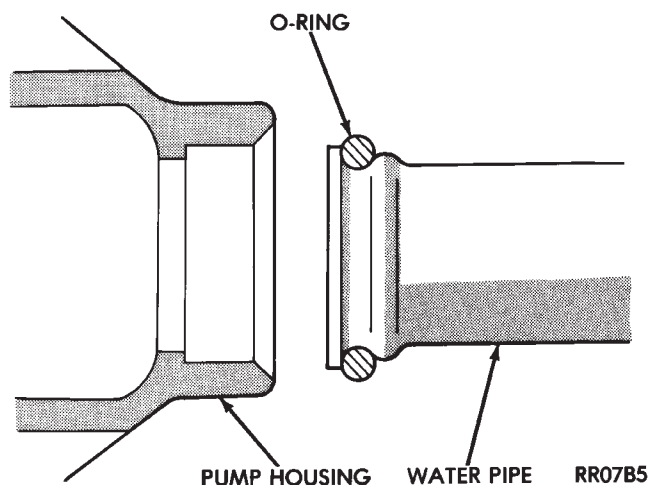


Fig. 26 Water Pipe O-Ring

- (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 Group 9, Engine and install timing belt. Reassemble engine.
- (6) Fill cooling system. See Refilling Cooling System.
- (7) Install accessory drive belts. Refer to Accessory Drive Belts, in this Group for procedure.

WATER PUMP INLET TUBE—2.4L

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. 27).
- (4) Remove the 2 fasteners from that hold the inlet tube to the block.
- (5) Rotate tube while removing the tube from the engine block (Fig. 28).

INSTALLATION

- (1) Inspect the O-ring for damage before installing the tube into the cylinder block (Fig. 28).
- (2) Lube O-ring with coolant and install into the cylinder block opening.

REMOVAL AND INSTALLATION (Continued)

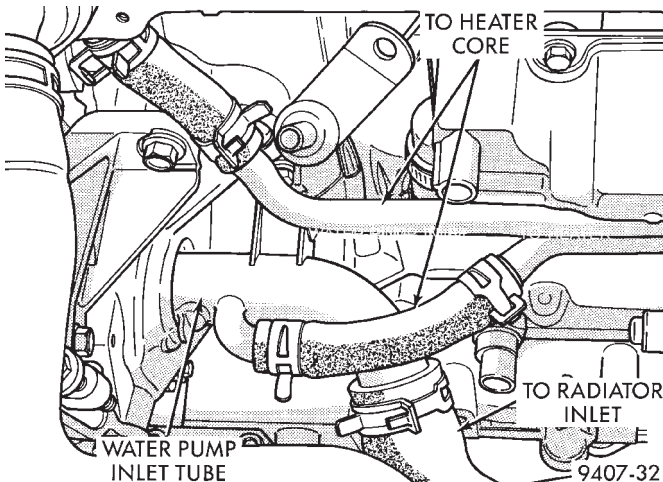


Fig. 27 Water Pump Inlet Tube Hose Connections

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

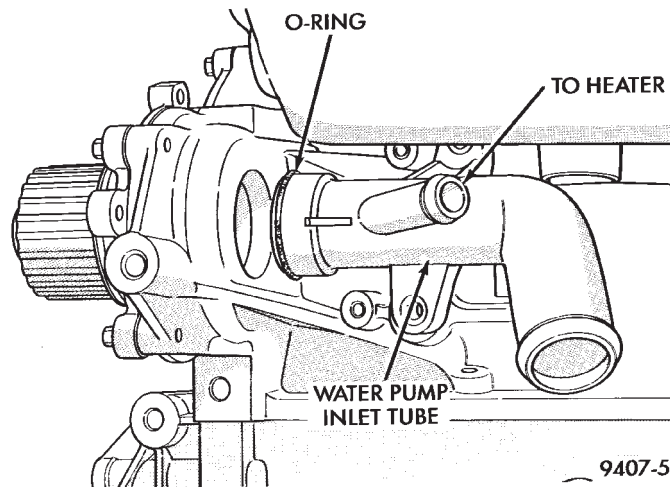


Fig. 28 Water Pump Inlet Tube—Service

- (4) Connect lower radiator hose and heater hose to inlet tube (Fig. 27).
- (5) Install upper radiator hose.
- (6) Fill cooling system. Refer to procedure outlined in this section.

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. 29).
- (3) Remove thermostat, discard gasket and clean both gasket sealing surfaces.

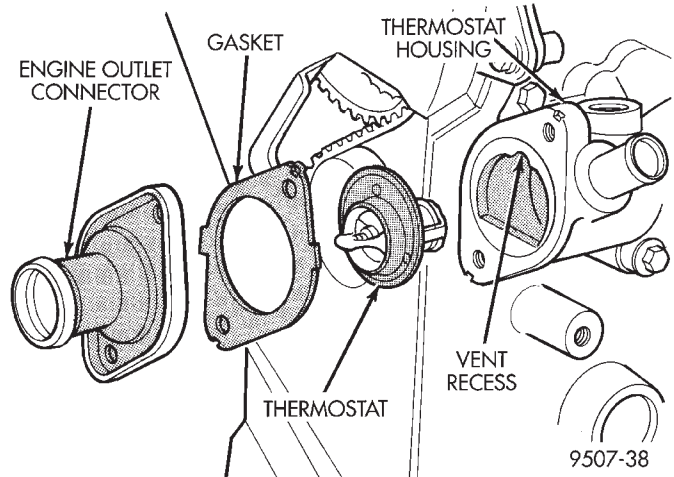


Fig. 29 Thermostat, Housing, and Outlet Connector—2.4L Engine

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. 29).
- (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. 29). Tighten bolts to 28 N·m (250 in. lbs.).
- (4) Refill the cooling system to the proper level. Refer to Refilling Cooling System outlined in this section for procedure

THERMOSTAT—2.5L

REMOVAL

- (1) Drain cooling system to the thermostat level or below.
- (2) Remove inlet hose and bolts from coolant elbow. Remove elbow. (Fig. 30).
- (3) Remove thermostat assembly, and clean sealing surfaces.

INSTALLATION

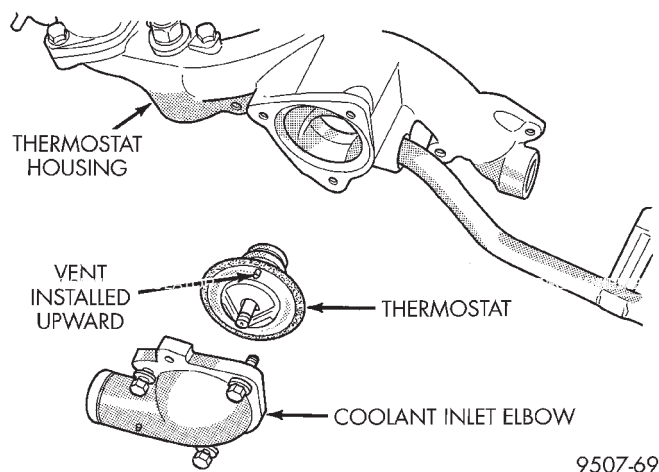
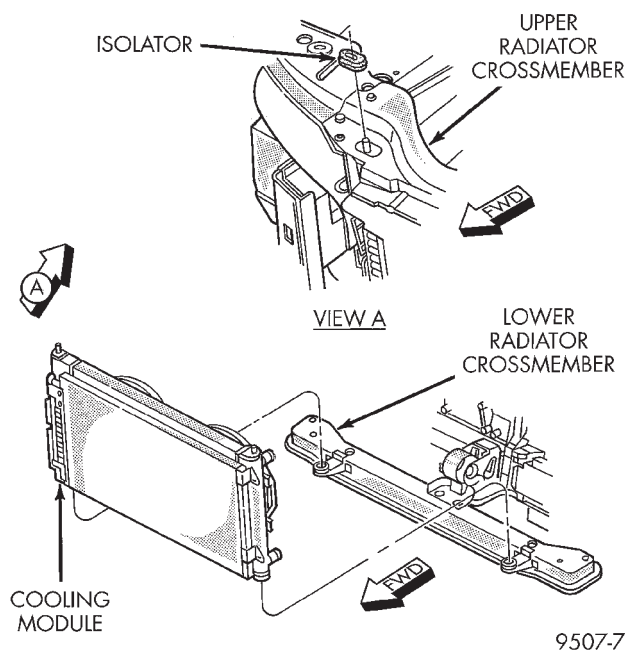
- (1) Install thermostat into the recess in the thermostat housing. Install inlet elbow and tighten the bolts to 12 N·m (133 in. lbs.) (Fig. 30).
- (2) Fill cooling system. Refer to Refilling System outlined in this section.

RADIATOR

REMOVAL

- (1) Disconnect negative cable from auxiliary jumper terminal. Remove air inlet resonator. Refer to Group 14, Fuel System for procedure.

REMOVAL AND INSTALLATION (Continued)

**Fig. 30** Thermostat, Housing and Inlet Elbow**Fig. 31** Cooling Module Mounting

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 upper radiator crossmember (Fig. 31). Refer to Group 23, Body for procedure.

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

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

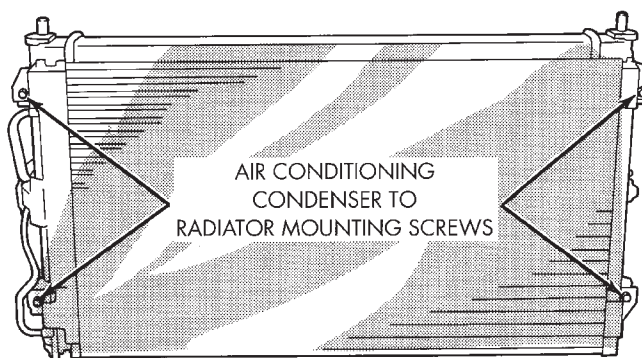
(5) Disconnect automatic transmission hoses from cooler and plug off.

(6) Disconnect the fan wiring connector.

(7) 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.

(8) Remove the air conditioning condenser attaching screws located at the front of the radiator (Fig. 32), if equipped. It is not necessary to discharge the air conditioning system to remove radiator.



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Fig. 32 A/C Condenser to Radiator Mounting Screws

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

(4) Connect lower radiator hose and clamp. Connect automatic transmission hoses; tighten hose clamps to 2.5 N·m (22 in. lbs.).

(5) Connect fan motor electrical connection.

(6) 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.

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

REMOVAL AND INSTALLATION (Continued)

(8) Connect negative cable from auxiliary jumper terminal.

(9) Fill cooling system with coolant. Refer to Refilling Cooling System in this group.

(10) 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 drain cock stem counterclockwise to unscrew the stem. When the stem is unscrewed to the end of the threads, pull the stem (Fig. 33) 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.

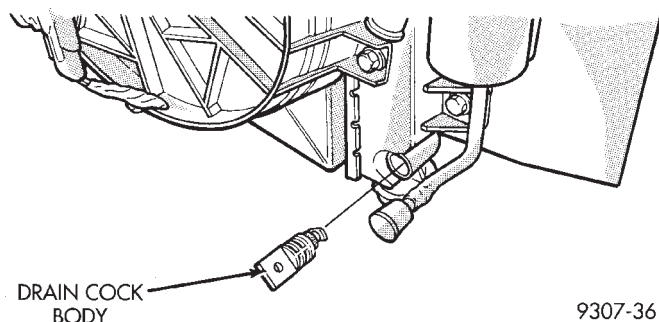


Fig. 33 Draincock—Typical

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.

RADIATOR FAN, MOTOR AND SHROUD

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. 34).** Do not permit the fan blades to touch the bench.

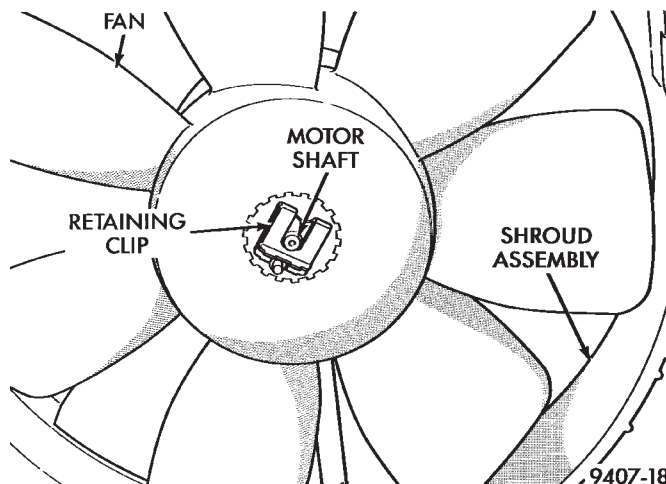
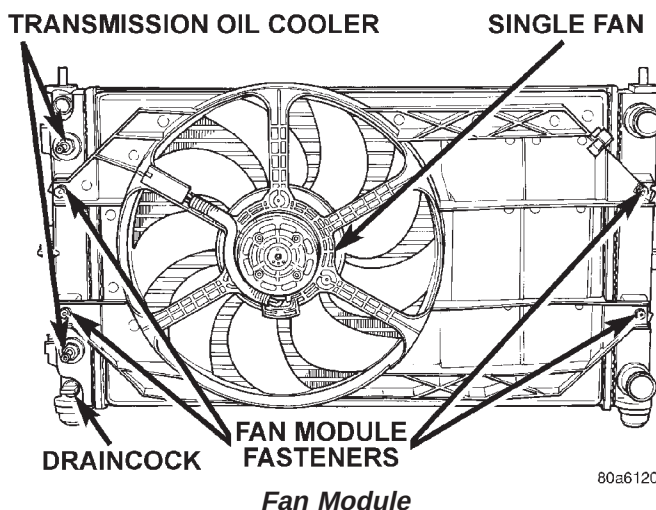


Fig. 34 Radiator Fan—Removal

(2) To install fan on motor shaft, slide the fan over shaft. Support motor and shaft as above 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. For removal and installation procedures, refer to Radiator Section.

FAN MOTOR SERVICE

(1) Remove the motor fasteners from support. Remove motor from support.

(2) Reverse the above procedure for Installation. Tighten fan motor fasteners to 5 N·m (45 in. lbs.).

INSTALLATION

(1) Install assembly to radiator. Torque shroud to radiator fasteners to 7.5 N·m (65 in. lbs.).

(2) Connect fan motor lead. **For wiring diagrams of fan motor systems Refer to 8W Wiring Diagrams .**

REMOVAL AND INSTALLATION (Continued)

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

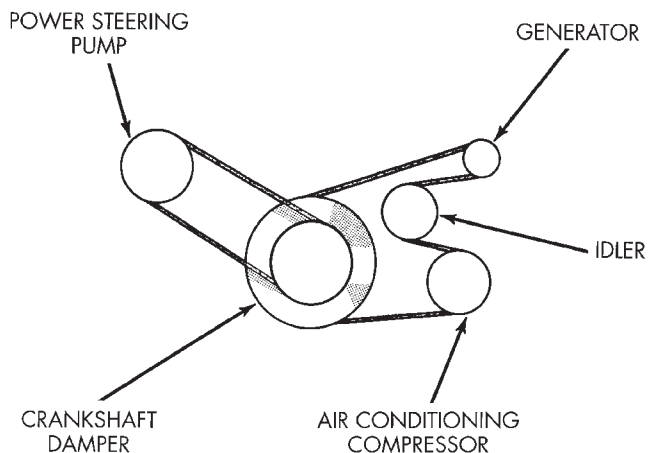
(1) Thoroughly clean core hole and heater seat (Fig. 35).

(2) Insert heater assembly with electrical connector position at the top of the core hole.

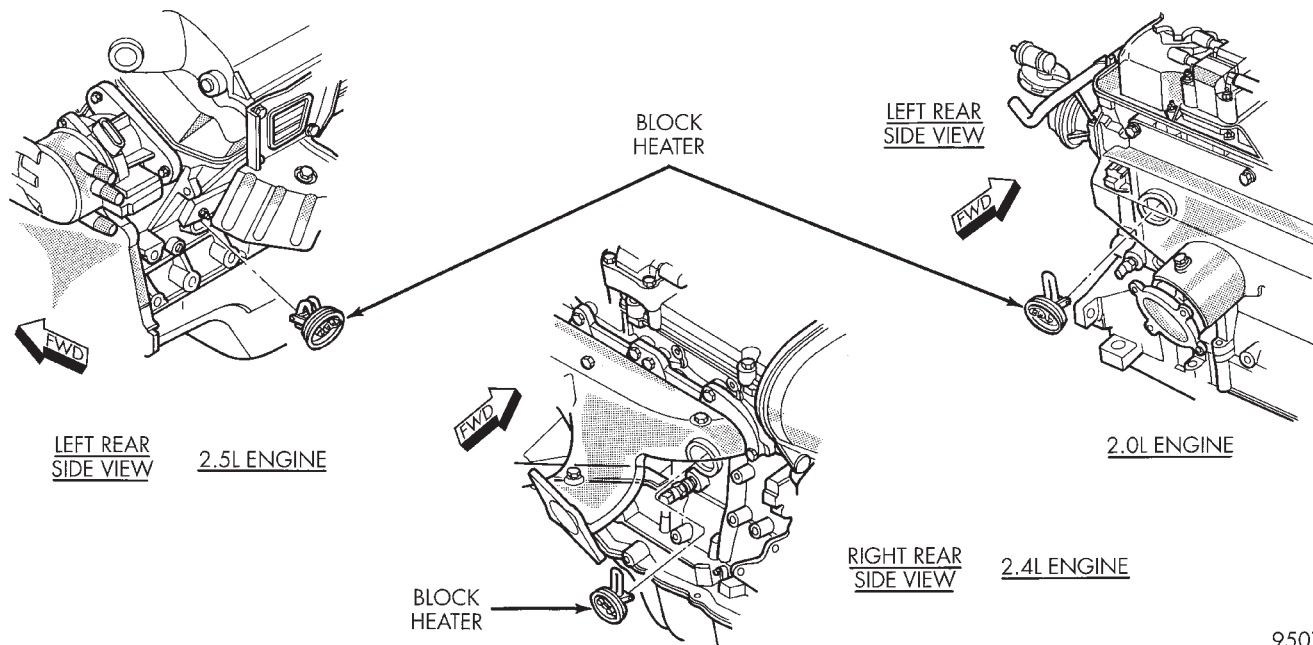
(3) With heater seated, tighten center screw securely to assure a positive seal.

(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.

GENERATOR, POWER STEERING PUMP AND AIR CONDITIONING COMPRESSOR DRIVE BELT—2.4L ENGINE**AIR CONDITIONING COMPRESSOR AND GENERATOR BELT**

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Accessory Drive Belt System—All Engines

9507-76

Fig. 35 Engine Block Heaters

REMOVAL AND INSTALLATION (Continued)

(1) Loosen T-Bolt locking nut A and pivot bolt B to remove and install Poly V belt and/or adjust belt tension (Fig. 36).

(2) Tighten adjusting bolt to adjust belt tension to specification shown in belt tension chart (Fig. 40).

(3) Tighten T-Bolt locking nut A and pivot bolt B to 54 N·m (40 ft. lbs.) (Fig. 36).

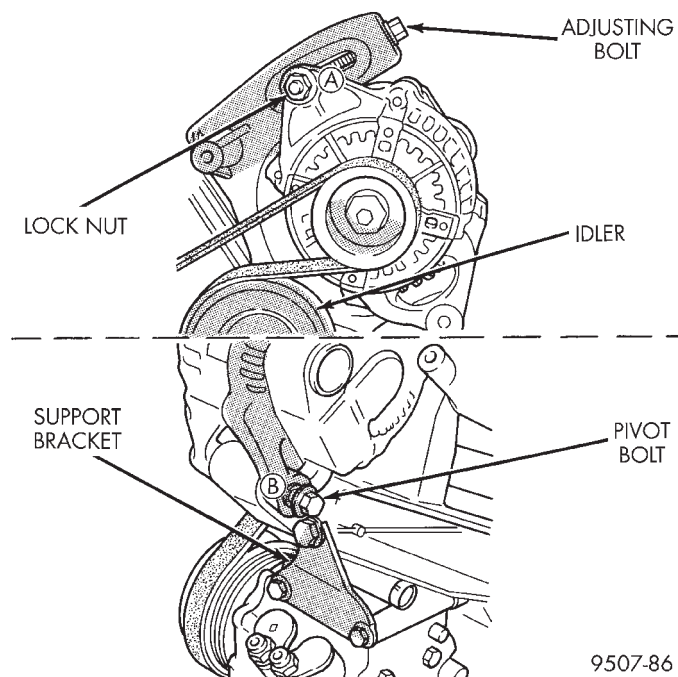


Fig. 36 Air Conditioning Compressor and Generator Belt Adjustment

POWER STEERING PUMP BELT

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

(2) From under the vehicle loosen locking bolts D and E (Fig. 37).

(3) Install the belt. Adjust belt tension with 1/2 in. breaker bar installed in adjusting bracket. See tension specification in chart (Fig. 40).

(4) Tighten locking bolt D to 54 N·m (40 ft. lbs.) (Fig. 37).

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

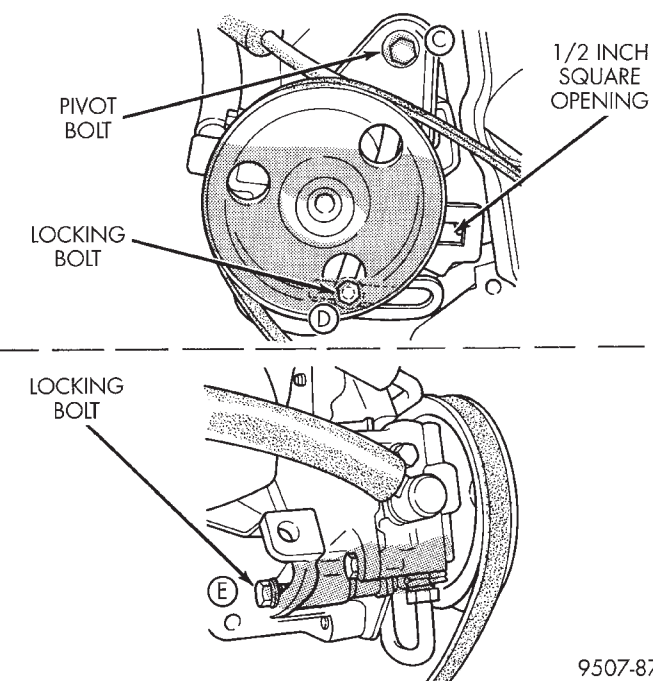


Fig. 37 Power Steering Belt Adjustment

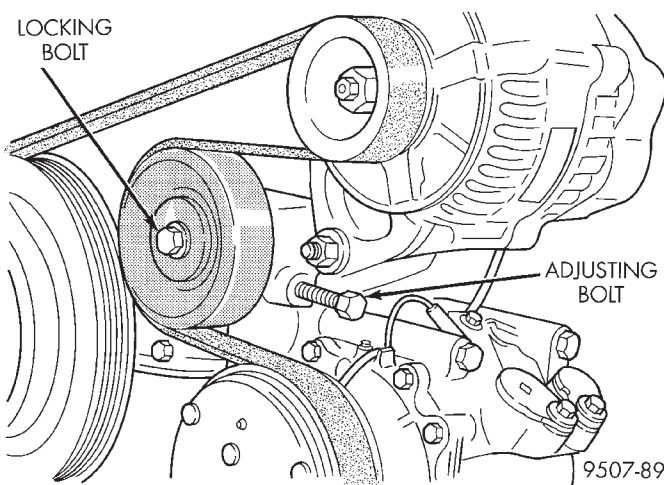


Fig. 38 Air Conditioning Compressor and Generator Belt Idler

ACCESSORY DRIVE BELT—2.5L ENGINE

AIR CONDITIONING BELT AND GENERATOR BELT

To remove and install the air conditioning compressor and generator drive belt, first loosen the idler pulley lock bolt, then turn the adjusting screw to increase or decrease the idler pulley tension (Fig. 38).

To adjust the air conditioning and generator drive belt, loosen the idler pulley bolt (Fig. 38) and adjust belt tension by turning adjusting screw (Fig. 38). Tighten pulley bolt to 54 N·m (40 ft. lbs.) after adjustment.

REMOVAL AND INSTALLATION (Continued)

POWER STEERING PUMP BELT

(1) From the top of the vehicle loosen pivot bolt (Fig. 39).

(2) From under the vehicle loosen the locking bolts F and G (Fig. 39).

(3) Install the belt. Adjust belt tension with 1/2 in. breaker bar installed in adjusting bracket (Fig. 39). See tension specification in chart (Fig. 40).

(4) Tighten locking bolt G to 28 N·m (250 in. lbs.) (Fig. 39).

(5) Tighten locking bolt F and the pivot bolt to 54 N·m (40 ft. lbs.).

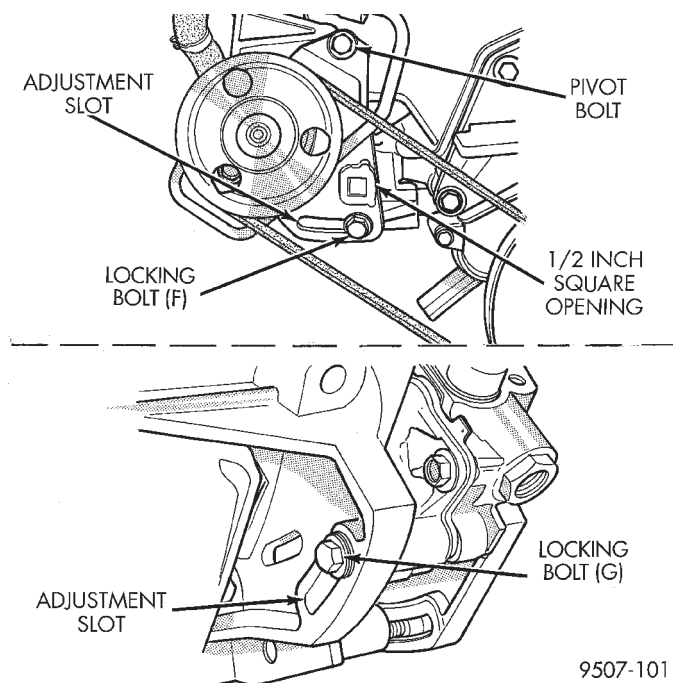


Fig. 39 Power Steering Belt Adjustment

ACCESSORY DRIVE BELT		GAUGE
2.0/2.4L ENGINE		
AIR CONDITIONING COMPRESSOR/ GENERATOR	NEW	150 LB.
	USED	80 LB.
POWER STEERING PUMP	NEW	130 LB.
	USED	80 LB.
2/5L ENGINE		
AIR CONDITIONING COMPRESSOR/ GENERATOR	NEW	150 LB.
	USED	80 LB.
POWER STEERING PUMP	NEW	130 LB.
	USED	80 LB.

Fig. 40 Belt Tension Chart

CLEANING AND INSPECTION

WATER PUMP—2.4L ENGINE

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

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

WATER PUMP—2.5L ENGINE

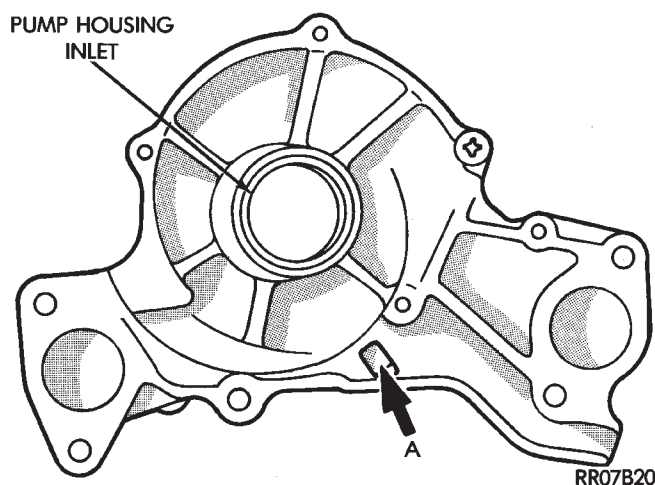


Fig. 41 Water Pump Inspection

Replace the water pump if it has any of the following defects:

- Damage or cracks on the pump body.
- Coolant leaks, if the shaft seal is leaking, evident by traces of coolant leaks from vent hole A in (Fig. 41).
- Impeller rubs inside of pump.
- Excessively loose or rough turning bearing.

ACCESSORY DRIVE BELT INSPECTION

Belt replacement under any or all of the following conditions is required, excessive wear, frayed cords or severe glazing.

Poly-V-Belt system with back drive pulley may develop minor cracks across the ribbed side (due to reverse bending). These minor cracks are considered normal and acceptable. Cracks parallel are not (Fig. 42).

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

CLEANING AND INSPECTION (Continued)

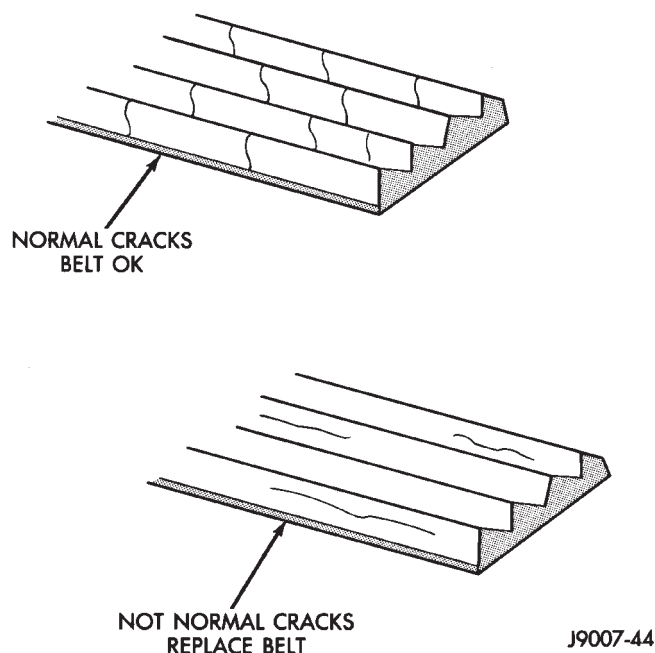


Fig. 42 Drive Belt Wear Pattern

COOLING SYSTEM CAP

Hold the cap in your hand, **right side up** (Fig. 43). 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.**

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

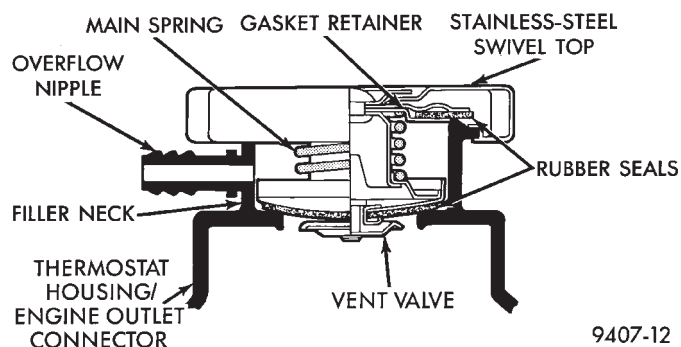


Fig. 43 Cooling System Pressure Cap

CLEANING COOLING SYSTEM

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

RADIATOR FLUSHING

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.

ENGINE FLUSHING

Drain radiator (see: **Draining Cooling System**) and remove hoses from radiator. Remove engine thermostat and reinstall thermostat housing. A gasket may be needed to seal the housing to cylinder head because the seal is part of thermostat. 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. Install thermostat and fill cooling system. Refer to **Refilling Cooling System**) for procedure.

REVERSE FLUSHING

Reverse flushing of the cooling system is the forcing of water through the cooling system, using air pressure in a direction opposite to that of the normal flow of water. This is only necessary with dirty systems and evidence of partial plugging.

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

BELT TENSION GAUGE METHOD

For conventional belts and Poly-V belts, use belt tensioning Special Tool Kit C-4162 to obtain proper belt tension.

Adjust the belt tension for a **New** or **Used** belt as prescribed in the Belt Tension Chart (Fig. 44).

ACCESSORY DRIVE BELT		GAUGE
2.0/2.4L ENGINE		
AIR CONDITIONING COMPRESSOR/ GENERATOR	NEW	150 LB.
	USED	80 LB.
POWER STEERING PUMP	NEW	130 LB.
	USED	80 LB.
2.5L ENGINE		
AIR CONDITIONING COMPRESSOR/ GENERATOR	NEW	150 LB.
	USED	80 LB.
POWER STEERING PUMP	NEW	130 LB.
	USED	80 LB.

Fig. 44 Belt Tension Chart

SPECIFICATIONS

COOLING SYSTEM CAPACITY

ENGINE	2.4L	2.5L
LITERS	8.5*	10.0*
U.S. QUARTS	9.0*	10.5*
* CAPACITY, Includes Heater and Coolant Recovery System		

TORQUE

DESCRIPTION TORQUE

A/C Condenser to Radiator

Fasteners 5 N·m (45 in. lbs.)

Thermostat Housing 2.0/2.4L

Bolts 12.5 N·m (110 in. lbs.)

Thermostat Housing 2.5L

Bolts 19 N·m (168 in. lbs.)

Water Pump Mounting 2.0/2.4L

Bolts 12 N·m (105 in. lbs.)

Water Pump Mounting 2.5L

Bolts 24 N·m (205 in. lbs.)

Water Pump Inlet Tube to Block

Bolts 12 N·m (105 in. lbs.)

Water Pump Inlet Pipe to Cylinder Head 2.5L

Fasteners 14 N·m (123 in. lbs.)

Fan Module to Radiator

Fasteners 7 N·m (65 in. lbs.)

Fan Motor to Shroud

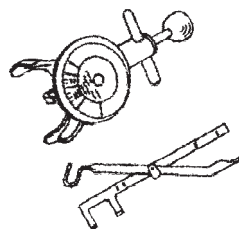
Fasteners 5 N·m (45 in. lbs.)

Transmission Oil Cooler Hose

Clamps 2 N·m (18 in. lbs.)

SPECIAL TOOLS

COOLING



Accessory Drive Belt Tension Gauge C-4162