COOLING SYSTEM

TABLE OF CONTENTS

DESCRIPTION AND OPERATION

COOLING SYSTEM

The cooling system consists of an engine cooling module, thermostat, coolant, and a water pump to circulate the coolant. The engine cooling module may consist of a radiator, electric fan motor, fan, shroud, coolant reserve system, transmission oil cooler, hoses, clamps, air conditioning condenser and transmission oil lines.

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

DESCRIPTION AND OPERATION (Continued)

Coolant flow circuit for the 2.0L engine is shown in (Fig. 1).

During any reassembly procedures all pipe fittings in water jacket, and water box require cleaning and application of thread sealant for entire length of threads.

COOLANT

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

Mopar® Antifreeze or the equivalent is recommended for optimum cooling performance and corrosion protection when mixed to a freeze point of -37° C (-35° F).

COOLANT REPLACEMENT

Refer to Group 0, Lubrication and Maintenance for schedule.

COOLANT PERFORMANCE

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

- Pure Water (1 btu) boils at 100°C (212°F) and freezes at 0°C (32°F).
- 100 Percent Glycol (.7 btu) can cause a hot engine and detonation and will raise the freeze point to 22°C (-8°F).
- 50/50 Glycol and Water (0.82 btu) is the recommended combination that provides a freeze point of -37°C (-35°F). The radiator, water pump, engine water jacket, radiator pressure cap, thermostat, temperature gauge, sending unit and heater are all designed for 50/50 glycol.

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

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

SELECTION AND ADDITIVES

The use of aluminum cylinder heads, intake manifolds, and water pumps requires special corrosion

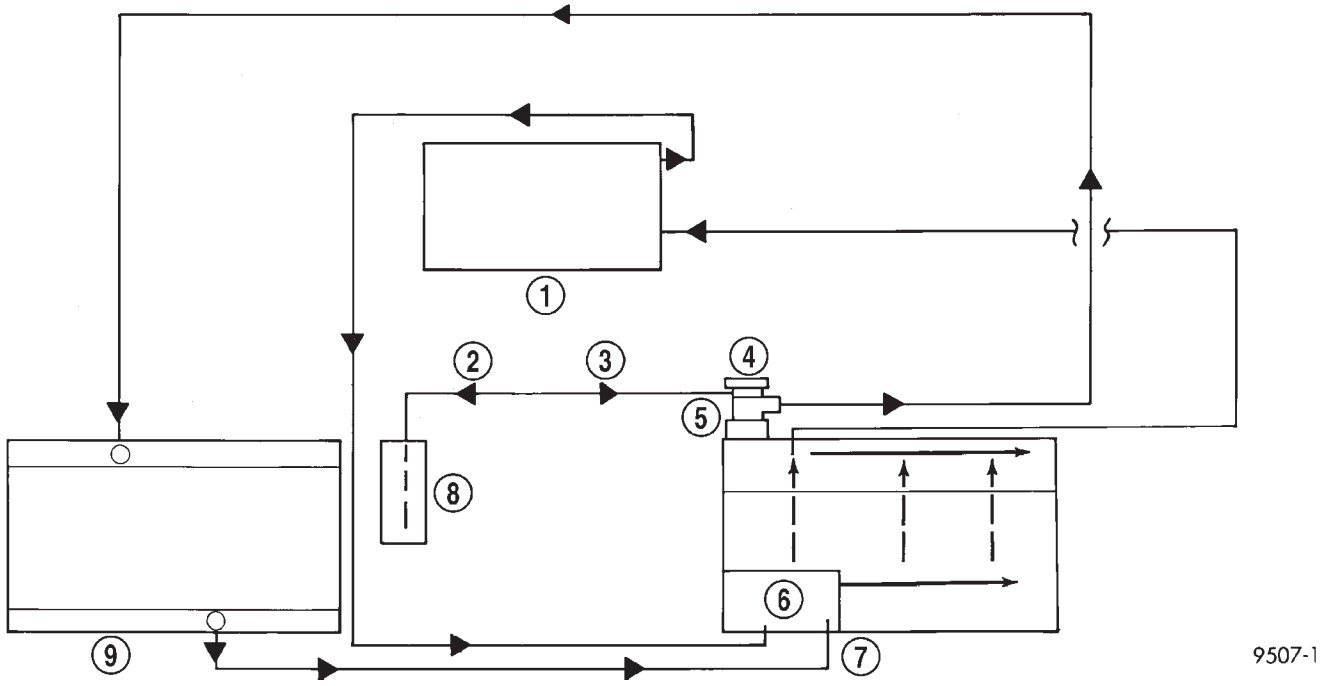


Fig. 1 Cooling System Operation

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

DESCRIPTION AND OPERATION (Continued)

protection. Mopar® Antifreeze or the equivalent is recommended for best engine cooling without corrosion. When mixed only to a freeze point of -37°C (-35°F) to -59°C (-50°F). If it looses color or becomes contaminated, drain, flush, and replace with fresh properly mixed solution.

COOLANT RECOVERY SYSTEM

This system works in conjunction with the radiator pressure cap to utilize thermal expansion and contraction of the coolant to keep the coolant free of trapped air. The system provides space for expansion and contraction. Also, the system provides a convenient and safe method for checking and adjusting the coolant level at atmospheric pressure without removing the pressure cap. It also provides some reserve coolant to compensate for minor leaks and evaporation or boiling losses. All vehicles are equipped with this system (Fig. 2).

Refer to Coolant Level Check, Deaeration, and Pressure Cap sections for operation and service.

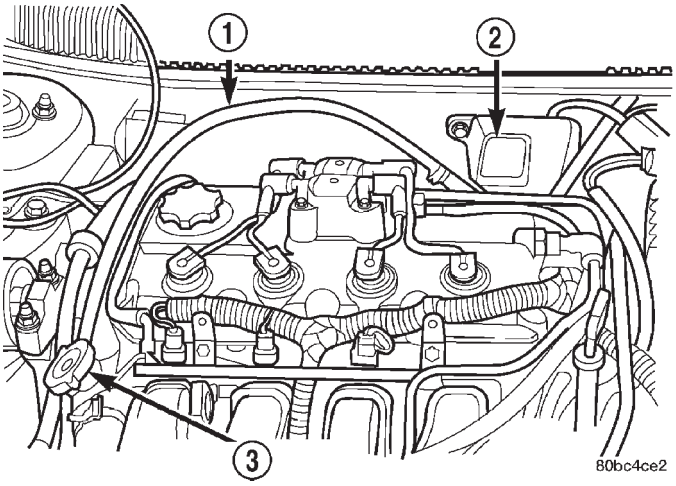


Fig. 2 Coolant Recovery System

1 – RECOVERY HOSE
2 – ENGINE COOLANT RECOVERY CONTAINER
3 – PRESSURE CAP

ENGINE THERMOSTAT

The engine thermostat is located on the front of the engine (radiator side) in the thermostat housing/engine outlet connector. The thermostat has an air bleed (vent) located in the flange and a O-ring for sealing incorporate on it. There is a relief in the thermostat housing/outlet connector for the O-ring.

The engine thermostat is a wax pellet driven, reverse poppet choke type. It 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). Also, the thermostat will automatically reach wide open, to accommodate unrestricted 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.

A thermostats 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. It does this by transferring heat from engine metal and automatic transmission oil cooler (if equipped) to coolant, moving this heated coolant to the heater core and radiator, and then transferring this heat to the ambient air.

RADIATOR

The radiator is a down-flow type (vertical 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 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.

The radiator has an aluminum core with plastic tanks. Although stronger than brass, plastic tanks are subject to damage by impact. Always handle radiator with care.

RADIATOR COOLING FAN MODULE

The radiator cooling fan is a single speed electric motor driven fan. The fan module includes an electric motor, fan blade, and a support shroud that is attached to the radiator (Fig. 3).

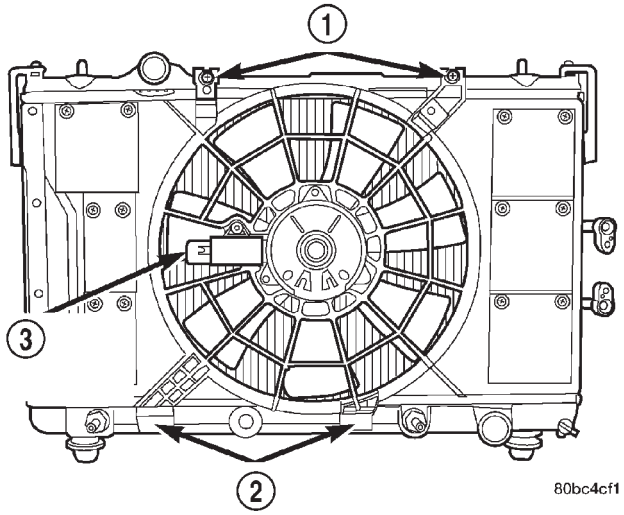


Fig. 3 Radiator Fan

1 – SCREWS
2 – LOWER MOUNTS
3 – FAN MOTOR ELECTRICAL CONNECTOR

DESCRIPTION AND OPERATION (Continued)

Radiator cooling fan control operation is accomplished two ways. The fan always runs when the air conditioning compressor clutch is engaged. 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 by grounding the relay's coil. The fan relay is located in the Power Distribution Center (PDC) (Fig. 4). Refer to the label beneath the PDC cover for location of fan relay.

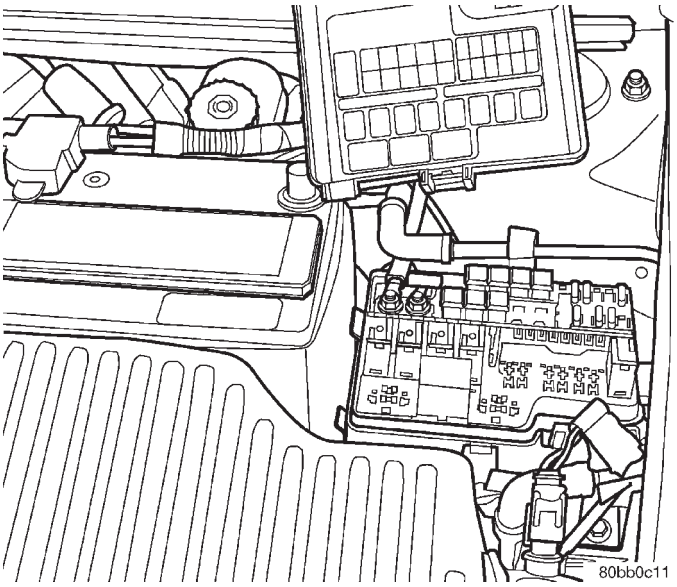


Fig. 4 Power Distribution Center (PDC)

The PCM will actuate the fan relay whenever the A/C clutch is engaged regardless of coolant temperature and vehicle speed. If the A/C clutch is not engaged, the PCM will actuate the fan relay when the coolant temperature reaches approximately (97° C) 207° F and turns off the fan relay when the coolant temperature drops to approximately (94°C) 201° F. The fan relay is also turned off when the vehicle speed is above approximately 100 Km/h (62 MPH). Refer to Group 8W, Wiring Diagrams for circuity provided.

If the cooling fan is inoperative or a Diagnostic Trouble Code (DTC) related to fan control has been set, refer to the appropriate Powertrain Diagnostic Manual for complete diagnostic procedures.

COOLING SYSTEM PRESSURE CAP

The cooling system pressure cap is located on the coolant outlet housing near the front of the cylinder head.

The cooling system will operate at higher than atmospheric pressure. The higher pressure raises the coolant boiling point, allowing increased radiator cooling capacity. The pressure cap will release cooling system pressure in a range of 97–124 kPa (14–18 psi).

RADIATOR COOLING FAN OPERATION CHART

Cooling Fan Control		
A/C Off		
Fan On:	97° C (207° F)	
Fan Off:	94° C (201° F)	Vehicle Speed > 100 Km/h (62 MPH)
A/C On		
Fan On—regardless of coolant temperature or vehicle speed.		

A vent valve located in the center of the cap allows a small amount of coolant flow from the coolant reserve system (CRS) tank. This valve is spring loaded in the closed position. However, it must be free to open during system cool-down. **If the valve is stuck shut, the radiator hoses will collapse on cool-down. Clean the vent valve (Fig. 5) to ensure proper sealing function.**

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 (CRS) tank.

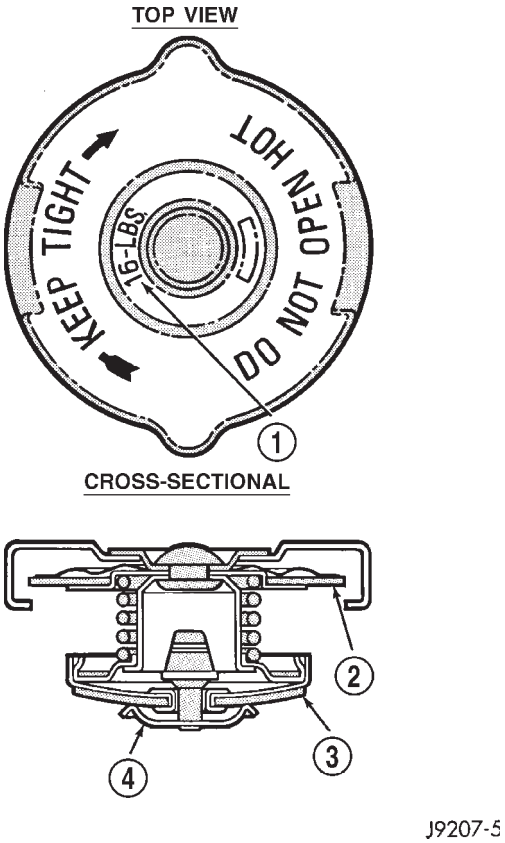


Fig. 5 Cooling System Pressure Cap

1 – PRESSURE RATING
2 – FILLER NECK SEAL
3 – PRESSURE VALVE
4 – VACUUM VENT VALVE (SHOWN IN SEALING POSITION)

DESCRIPTION AND OPERATION (Continued)

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 CLAMP. 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 (Fig. 6).

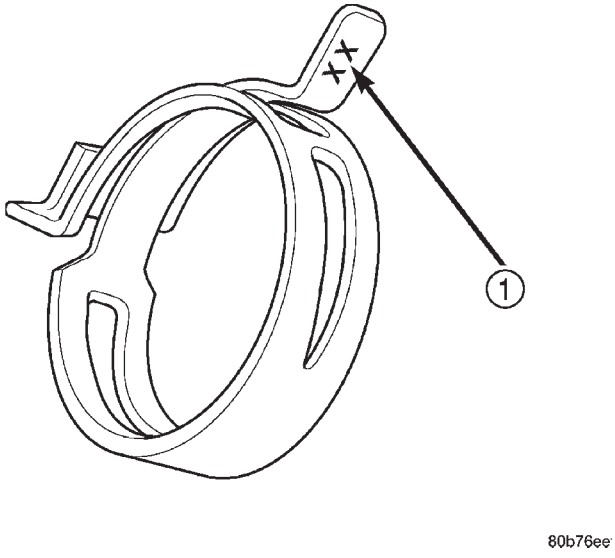


Fig. 6 Spring Clamp Size Location

1 – SPRING CLAMP SIZE LOCATION

The hose clamps are removed by using Special Tool 6094 or equivalent constant tension clamp pliers (Fig. 7) to compress the hose clamp.

A hardened, cracked, swollen or restricted hose should be replaced. Care should be taken not to damage radiator inlet and outlet when removing hoses.

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

Make sure hoses and connectors are clean and dry before installation. Do not lubricate hoses when installing.

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

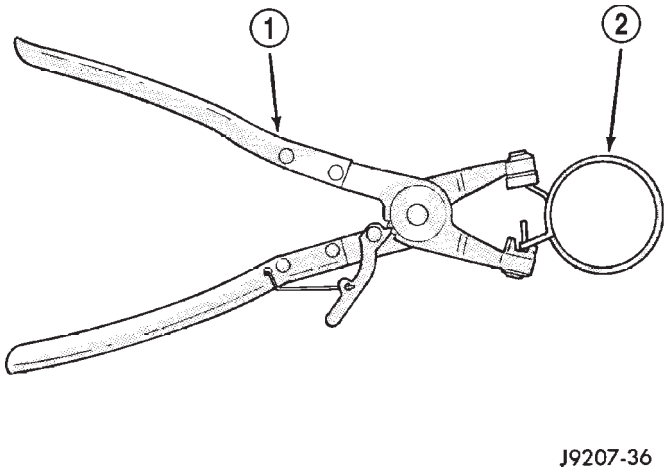


Fig. 7 Hose Clamp Tool

1 – HOSE CLAMP TOOL 6094
2 – HOSE CLAMP

WATER PUMP

The water pump has a diecast aluminum body and housing with a stamped steel impeller. The water pump bolts directly to the cylinder block and is driven by the timing belt (Fig. 8). Cylinder block to water pump sealing is provided by a rubber O-ring.

The water pump is the “heart” of the cooling system. It pumps 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.

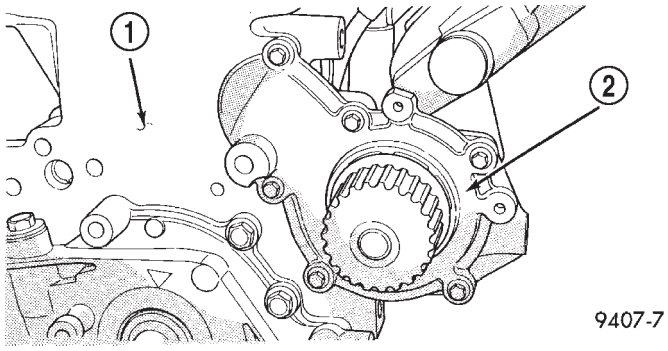


Fig. 8 Water Pump

1 – CYLINDER BLOCK
2 – PUMP BODY

DESCRIPTION AND OPERATION (Continued)

AUTOMATIC TRANSMISSION OIL COOLER

Oil coolers are internal oil to coolant type, mounted in the radiator lower tank (Fig. 9). 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.).

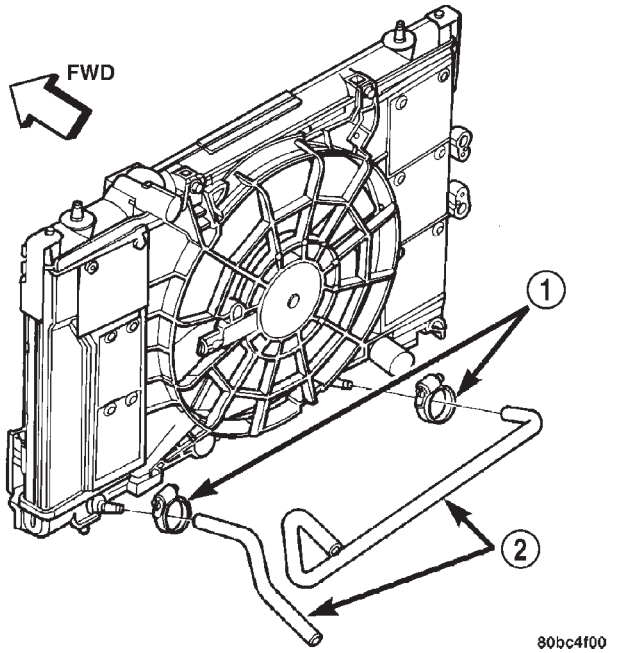


Fig. 9 Automatic Transmission Oil Cooler

1 – CLAMPS
2 – HOSES

ACCESSORY DRIVE BELTS

The accessory drive consist of two Poly-V type drive belts (Fig. 10). One belt drives the generator, the other drives the power steering pump and air conditioning compressor (if equipped). The power steering/air conditioning belt is tensioned by an automatically controlled belt tensioner. The generator belt is manually tensioned using an adjusting bolt and a locking nut.

ENGINE BLOCK HEATER

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. 11). The engine block heater is available as an optional accessory. The heater is operated by ordinary house current (110 Volt A. C.) through a power cord and connector behind the radiator grille.

When in operation, the engine block heater can provide easier engine starting and faster warm-up, when vehicle is operated in areas having extremely low temperatures.

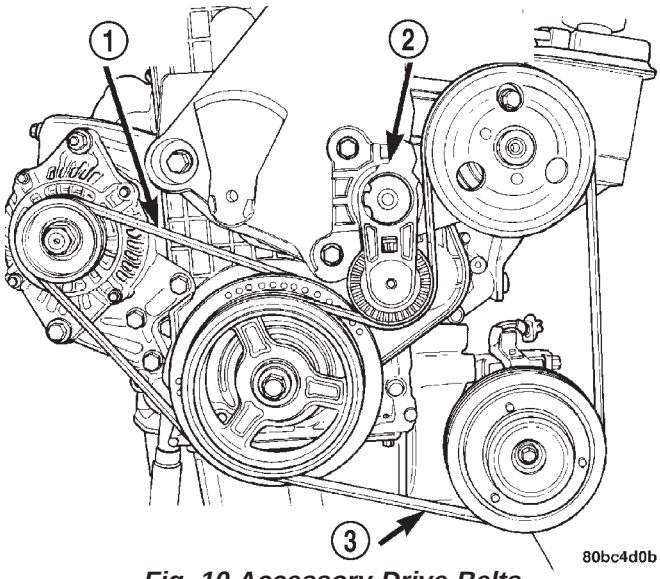


Fig. 10 Accessory Drive Belts

1 – GENERATOR BELT
2 – AUTOMATIC BELT TENSIONER
3 – POWER STEERING PUMP/A/C COMPRESSOR BELT

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.

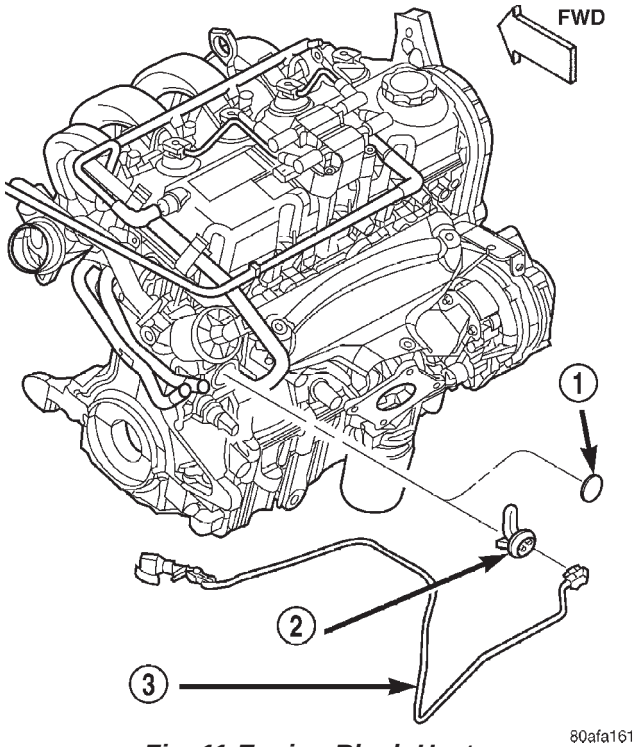


Fig. 11 Engine Block Heater

1 – CORE PLUG
2 – BLOCK HEATER
3 – POWER CORD

DIAGNOSIS AND TESTING

COOLING SYSTEM DIAGNOSIS

CONDITION	POSSIBLE CAUSE	CORRECTION
TEMPERATURE GAUGE READS LOW	1. Has a Diagnostic Trouble Code (DTC) been set indicating a stuck open engine thermostat?	1. Refer to On Board Diagnostic in Group 25. Replace thermostat, if necessary. If a (DTC) has not been set, the problem may be with the temperature gauge.
	2. Is the temperature gauge (if equipped) connected to the temperature gauge coolant sensor on the engine?	2. Check the connector at the engine coolant sensor. Refer to Group 8E. Repair as necessary.
	3. Is the temperature gauge (if equipped) operating OK?	3. Check Gauge operation. Refer to Group 8E. Repair as necessary.
	4. Coolant level low during cold ambient temperature, accompanied by poor heater performance.	4. 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.
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.	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. Is temperature gauge (if equipped) reading correctly?	2. Check gauge. Refer to Group 8E. Repair as necessary.
	3. Is temperature warning lamp (if equipped) illuminating unnecessarily?	3. Check warning lamp operation. Refer to Group 8E. Repair as necessary.
	4. Coolant low in recovery/reserve container and radiator?	4. Check for coolant leaks and repair as necessary. Refer to Checking Cooling System for Leaks in this section.
	5. Pressure cap not installed tightly. If cap is loose, boiling point of coolant will be lowered. Also refer to the following step 6.	5. Tighten 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. (CONT.)	6. Poor seals at radiator 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. 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.	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. Freeze point of coolant not correct. Mixture ratio may be too rich.	8. Check coolant concentration. Refer to Coolant Concentration Testing in this section. Adjust glycol-to-water ration as required.
	9. Coolant not flowing through system.	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. Radiator or A/C condenser fins are dirty or clogged.	10. Clean obstruction from fins.
	11. Radiator core is plugged or corroded.	11. Replace or re-core radiator.
	12. Fuel or ignition system problems.	12. Refer to Fuel and Ignition System groups for diagnosis. Also refer to the appropriate Powertrain Diagnostic Procedure manual.
	13. Dragging Brakes.	13. Inspect brake system and repair as necessary. Refer to Group 5, Brakes for diagnosis.
	14 Bug screen or other aftermarket accessory is being used causing reduced air flow.	14. Remove bug screen or accessory.
	15. Thermostat partially or completely closed. This is more prevalent on high mileage vehicles.	15. Check thermostat operation and replace as necessary. Refer to thermostat in this section for procedure.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSE	CORRECTION
	16. Electric cooling fan not operating properly.	16. Check electric fan operation and repair as necessary.
	17. Cylinder head gasket leaking.	17. Check cylinder head gasket for leaks. Refer to testing cooling system for leaks. For repairs, refer to Group 9, Engine.
	18. Heater core leaking.	18. Check heater core for leaks. Refer to Group 24, 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.	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. During cold weather operation with the heater blower in the high position, the gauge reading may drop slightly.	2. A normal condition. No correction is necessary.
	3, Temperature gauge or engine mounted gauge sensor is defective or shorted.	3. Check operation of gauge and repair as necessary. Refer to Group 8E, Instrument Panel and Gauges.
	4. Gauge reading rises when vehicle is brought to a stop after heavy use (engine still running).	4. A normal condition. No correction is necessary. The gauge should return to normal range after vehicle is driven.
	5. Gauge reading high after restarting a warmed-up (hot) engine.	5. A normal condition. No correction is necessary. The gauge should return to normal range after a few minutes of engine operation.
	6. Coolant level low in radiator (air will build up in the cooling system causing the thermostat to open late).	6. Check and correct coolant leaks. Refer to Testing Cooling System For Leaks in the section.
	7. Cylinder head gasket leaking allowing exhaust gas to enter cooling system. This will cause thermostat to open late.	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. Water pump impeller loose on shaft.	8. Check water pump and replace as necessary. Refer to Water Pump in this section.
	9. Loose drive belt (water pump slipping).	9. Check drive belt and correct as necessary.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSE	CORRECTION
	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.	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.
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.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSE	CORRECTION
ELECTRIC RADIATOR FAN WILL NOT OPERATE. GAUGE READING HIGH OR HOT	1. Fan motor defective.	1. Refer to appropriate Powertrain Diagnostic Procedures manual for operation of the DRB scan tool. Repair as necessary.
	2. Fan relay, powertrain control module (PCM) or engine coolant temperature sensor defective.	2. Refer to appropriate Powertrain Diagnostic Procedures manual for operation of the DRB scan tool. Repair as necessary.
	3. Blown fuse in power distribution center (PDC).	3. Determine reason for blown fuse and repair as necessary.
NOISY FAN	1. Fan blade loose.	1. Replace fan blade assembly. Refer to Cooling System Fan in this section.
	2. Fan blade striking a surrounding object.	2. Locate point of fan blade contact and repair as necessary.
	3. Air obstructions at radiator or A/C condenser.	3. Remove obstructions and/or clean debris from radiator and/or A/C condenser.
	4. Electric fan motor defective.	4. Refer to procedure in this section.
INADEQUATE AIR CONDITIONER PERFORMANCE (COOLING SYSTEM SUSPECTED)	1. Radiator and/or air conditioning condenser is restricted, obstructed or dirty.	1. Remove restriction and/or clean as necessary.
	2. Electric radiator fan not operating when A/C is on.	2. Refer to appropriate Powertrain Diagnostic Procedures manual for operation of the DRB scan tool. Repair as necessary.
	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.	3. Correct overheating condition. Refer to this section.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSE	CORRECTION
INADEQUATE HEATER PERFORMANCE.	1. Has a diagnostic trouble code (DTC) been set?	1. Refer to On-Board Diagnostic in Group 25, Emission Control Systems.
	2. Coolant level low.	2. Refer to testing cooling system for leaks in this section. Repair as necessary.
	3. Obstructions in heater hose fittings at engine.	3. Remove heater hoses at both ends and check for obstructions. Repair as necessary.
	4. Heater hose kinked.	4. Locate kinked area and repair as necessary.
	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.	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.	1. Locate missing shields and replace or repair as necessary.
	2. Is temperature gauge reading above the normal range?	2. Refer to the previous Temperature Gauge Reads High in these Diagnostic Charts. Repair as necessary.
	3. Is cooling fan operating correctly?	3. Refer to Cooling System Fan in this section for diagnosis. Repair as necessary.
	4. Has undercoating been applied to any unnecessary component.	4. Clean undercoating as necessary.
	5. Engine may be running rich causing the catalytic converter to overheat.	5. Refer to appropriate Powertrain Diagnostic Procedures manual for operation of the DRB scan tool. Repair as 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) been set?	1. Refer to On-Board Diagnostics in Group 25, 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.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSE	CORRECTION
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.

DIAGNOSIS AND TESTING (Continued)

ENGINE THERMOSTAT TESTING

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 Diagnosis in this section.

ACCESSORY DRIVE BELT DIAGNOSIS

CONDITION	POSSIBLE CAUSE	CORRECTION
BELT SLIPPAGE	1. Belt slipping because of insufficient tension.	1. Retension generator belt. Replace the power steering belt's automatic belt tensioner.
	2. Belt excessively glazed or hardened from heat and excessive slippage.	2. Replace belt.
	3. Incorrect belt.	3. Replace belt.
	4. Driven component bearing failure.	4. Replace faulty component.
	5. Belt or pulley subjected to substance (belt dressing, oil, ethylene glycol) that has reduced friction.	5. Replace belt and clean pulleys.
BELT NOISE (OBJECTIONABLE SQUEAL, SQUEAK, OR RUMBLE)	1. Belt slippage.	1. Retension generator belt, replace belt, or automatic belt tensioner.
	2. Foreign material imbedded in belt.	2. Replace belt.
	3. Non-uniform belt.	3. Replace belt.
	4. Misaligned pulley(s).	4. Align accessories.
	5. Non-uniform groove or eccentric pulley.	5. Replace pulley(s).
	6. Bearing noise.	6. Locate and repair.
BELT ROLLED OVER IN GROOVE OR BELT JUMPS OFF	1. Broken cord in belt.	1. Replace belt.
	2. Belt tension too loose, or too tight.	2. Retension generator belt. Replace the power steering belt's automatic belt tensioner.
	3. Misaligned pulleys.	3. Align accessories.
	4. Non-uniform grooves or eccentric pulley.	4. Replace pulley(s).
	5. Foreign object(s) in grooves.	5. Remove foreign objects in groove.

DIAGNOSIS AND TESTING (Continued)

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:

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

(1) Remove cooling system pressure cap.

(2) Remove a small amount of coolant from the system.

(3) Start the engine and warm up until thermostat opens.

(4) With the thermostat open and coolant level low, visually inspect for coolant flow. If flow is present, the water pump is pumping coolant through the system.

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.

ELECTRIC FAN MOTOR TEST

Refer to Powertrain Diagnostic Manual for procedure.

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.

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, Special Tool 8286 refractometer, is recommended when testing either ethylene or propylene glycol coolants.

TESTING COOLING SYSTEM FOR LEAKS

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

Attach a radiator pressure tester to the filler neck, as shown in (Fig. 12) and apply 104 kPa (15 psi) pressure. If the pressure drops more than 2 psi in 2 minutes, inspect the system for external leaks.

Move all hoses at the radiator and heater while system is pressurize at 15 psi, since some leaks occur due to engine rock while driving.

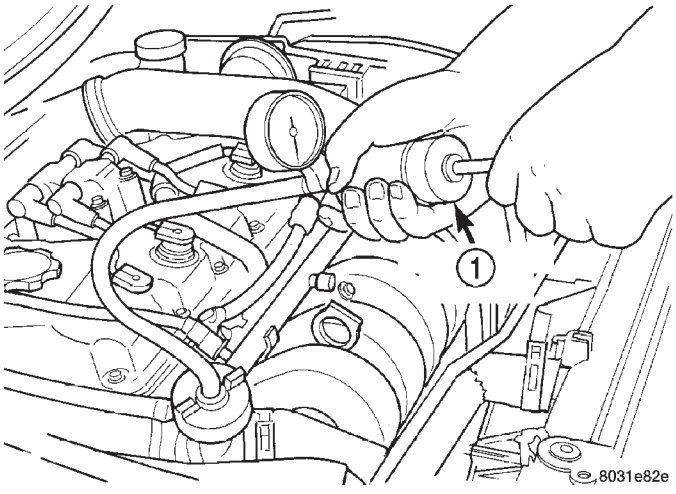


Fig. 12 Pressure Testing Cooling System—Typical

1 – PRESSURE TESTER

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

DIAGNOSIS AND TESTING (Continued)

the coolant to expand. Reattach the tester. If the needle on the dial fluctuates it indicates a combustion leak, usually a head gasket leak.

WARNING: WITH THE PRESSURE TESTER IN PLACE PRESSURE BUILDS UP QUICKLY. ANY EXCESSIVE PRESSURE BUILD-UP DUE TO 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 cracked 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 indicates 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. 13). 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.

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 COUNTERCLOCKWISE 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.

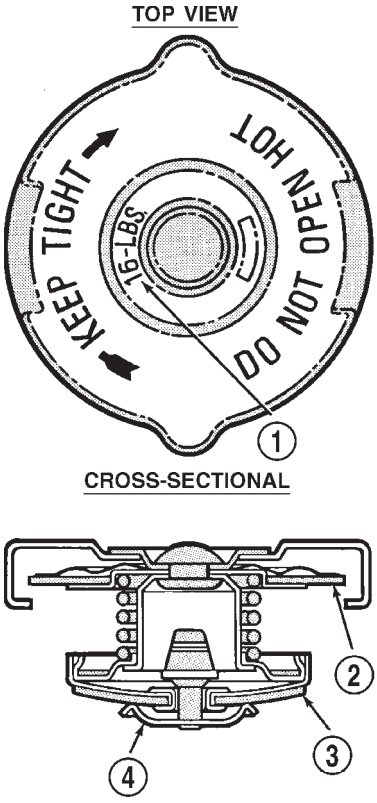


Fig. 13 Cooling System Pressure Cap

1 – PRESSURE RATING
2 – FILLER NECK SEAL
3 – PRESSURE VALVE
4 – VACUUM VENT VALVE (SHOWN IN SEALING POSITION)

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. 14). 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.

DIAGNOSIS AND TESTING (Continued)

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.

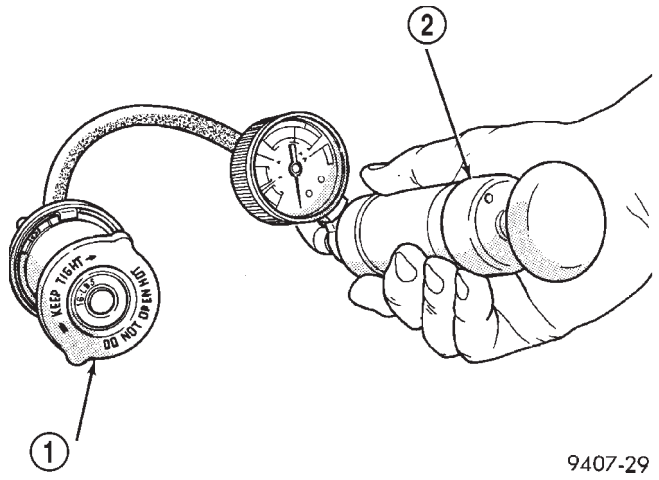


Fig. 14 Pressure Testing Radiator Cap

1 – PRESSURE CAP
2 – PRESSURE TESTER

LOW COOLANT LEVEL AERATION

- Will cause corrosion in the system.
- 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 above 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 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.

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.

ENGINE BLOCK HEATER

If heater unit does not operate (Fig. 15), possible causes can be either the power cord or the heater element. Test the power cord for continuity with a 110-volt voltmeter or 110-volt test light. Test heater element continuity with an ohmmeter or a 12-volt test light.

CAUTION: To prevent damage, the power cord must be secured in its retainer clips and away from any components that may cause abrasion or damage, such as linkages, exhaust components, etc.

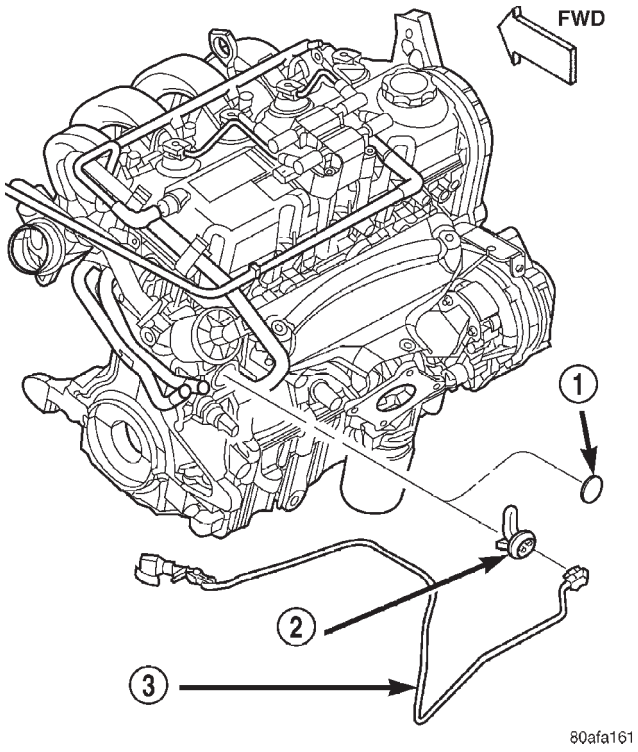


Fig. 15 Engine Block Heater

1 – CORE PLUG
2 – BLOCK HEATER
3 – POWER CORD

SERVICE PROCEDURES

COOLANT LEVEL CHECK—ROUTINE

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

The coolant recovery/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 recovery/reserve container (Fig. 16) is between the FULL HOT and ADD marks.

SERVICE PROCEDURES (Continued)

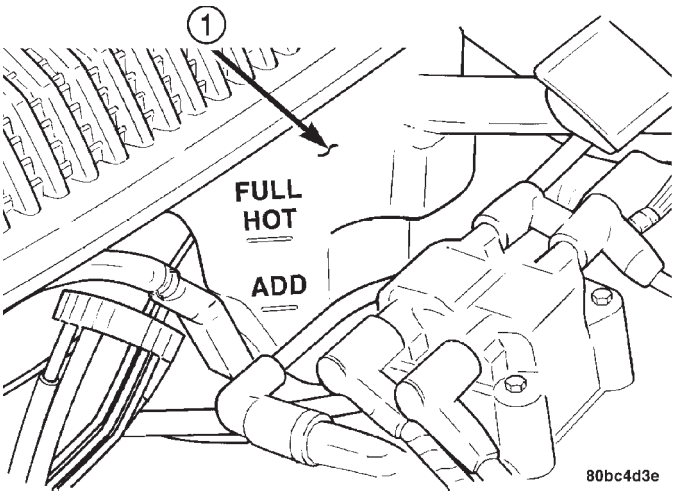


Fig. 16 Coolant Level

1 – COOLANT RECOVERY CONTAINER

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. 17). Use only 50/50 concentration of ethylene glycol type antifreeze and water

COOLANT LEVEL—SERVICING

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. 17). 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.

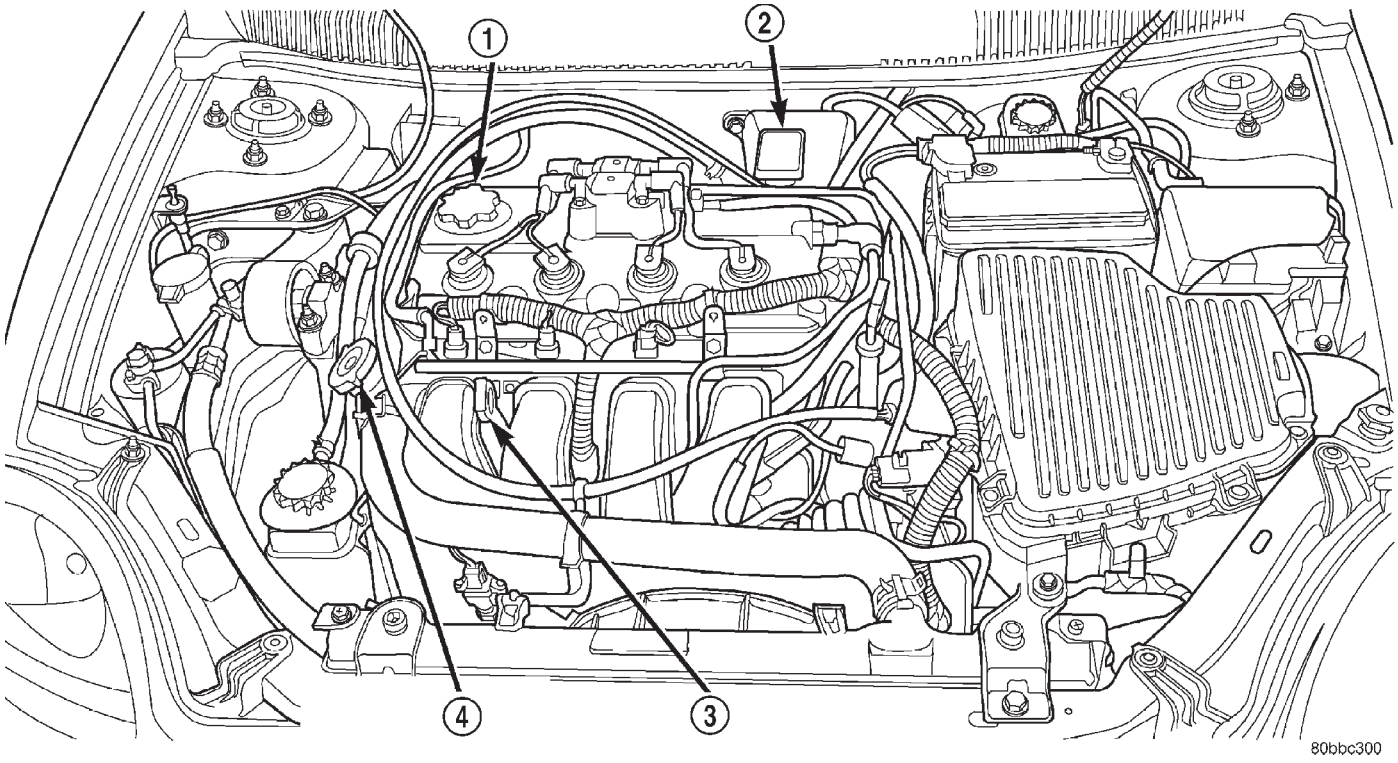


Fig. 17 Coolant Recovery Container and Pressure Cap Locations

1 – ENGINE OIL FILL
2 – ENGINE COOLANT RECOVERY CONTAINER
3 – ENGINE OIL DIPSTICK
4 – COOLING SYSTEM PRESSURE CAP

SERVICE PROCEDURES (Continued)

COOLING SYSTEM—DRAINING

NOTE: Drain, flush, and fill the cooling system at the mileage or time intervals specified in 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 from your vehicle. Check governmental regulations for disposal of used engine coolant.

Without removing radiator pressure cap and with system not under pressure:

(1) Shut engine off and turn draincock counterclockwise to open (Fig. 18).

(2) The coolant reserve tank should empty first, then remove the pressure cap. (if not, Refer to Testing Cooling System for leaks).

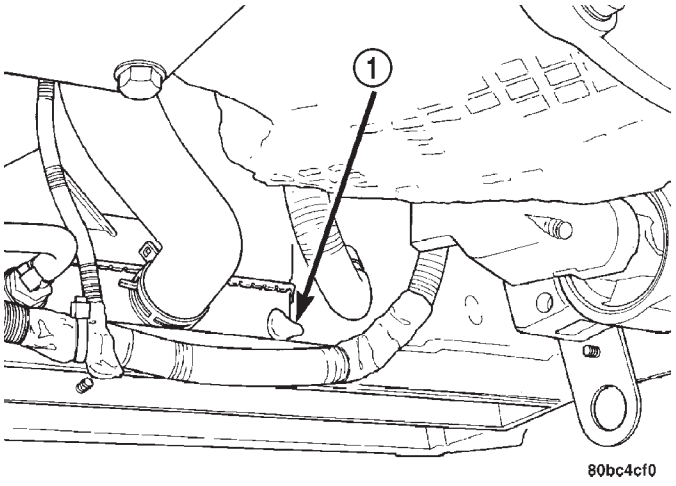


Fig. 18 Cooling System Drain Cock Location

1 – DRAIN COCK

COOLING SYSTEM—REFILLING

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

Fill system with 50/50 glycol/water mix. Use antifreeze described in Coolant section.

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/recovery system to at least the FULL HOT mark with 50/50 solution. It may be necessary to add coolant to the reserve/recovery container after three or four warm-up/cool down cycles to maintain coolant level between the FULL HOT and ADD marks; if any trapped air was removed from the system.

REMOVAL AND INSTALLATION

WATER PUMP

REMOVAL

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

(2) Remove accessory drive belts. Refer to procedure in this section.

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

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

(5) Remove upper and lower torque isolator struts.

(6) Support engine from the bottom and remove right engine mount attaching bolt.

(7) Remove right engine mount bracket.

(8) Remove timing belt and timing belt tensioner. Refer to Group 9, Engine for procedures.

(9) Remove camshaft sprocket and rear timing belt cover. Refer to Group 9, Engine for procedures.

(10) Remove water pump attaching screws to engine and remove pump (Fig. 19).

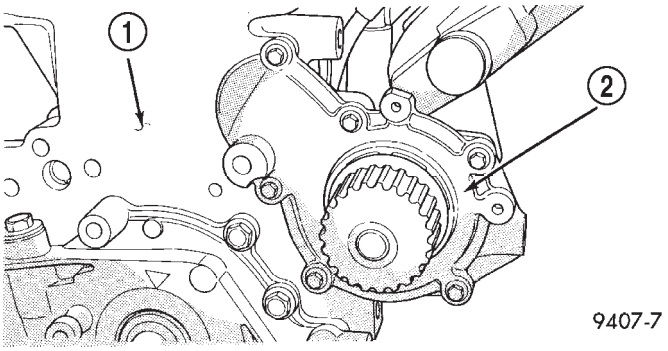


Fig. 19 Water Pump

1 – CYLINDER BLOCK
2 – PUMP BODY

INSTALLATION

(1) Apply Mopar® Dielectric Grease to O-ring before installation.

(2) Install new O-ring gasket in water pump body O-ring groove (Fig. 20).

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

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

REMOVAL AND INSTALLATION (Continued)

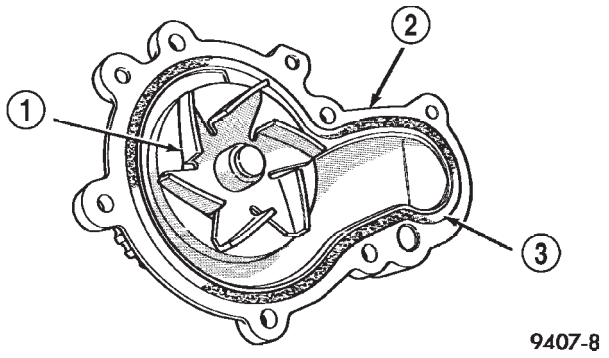


Fig. 20 Water Pump Body

1 – IMPELLER
2 – PUMP BODY
3 – O-RING

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

(5) Install rear timing belt cover and camshaft sprocket.

(6) Install timing belt tensioner and timing belt. Refer to Group 9, Engine for procedure.

(7) Install right engine mount bracket. Refer to Group 9, Engine for procedure.

(8) Install upper and lower torque isolator struts. Refer to Group 9, Engine for procedure.

(9) Fill cooling system. Refer to procedures in this section.

(10) Install accessory drive belts. Refer to procedure in this section.

(11) Perform camshaft and crankshaft timing relearn procedure as follows:

- Connect the DRB scan tool to the data link (diagnostic) connector. This connector is located in the passenger compartment; at the lower edge of instrument panel; near the steering column.
- Turn the ignition switch on and access the “miscellaneous” screen.
- Select “re-learn cam/crank” option and follow directions on DRB screen.

WATER PUMP INLET TUBE

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

REMOVAL

CAUTION: Do not use any sharp tools to remove hoses from inlet tube. This may cause the tube to leak.

(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 intake manifold. Refer to Group 9, Engine for procedure.

(4) Remove lower radiator hose and heater hose from the inlet tube.

(5) Remove lower intake manifold support bracket.

(6) Remove the inlet tube to the block fasteners.

(7) Rotate tube while removing the tube from the engine block (Fig. 21).

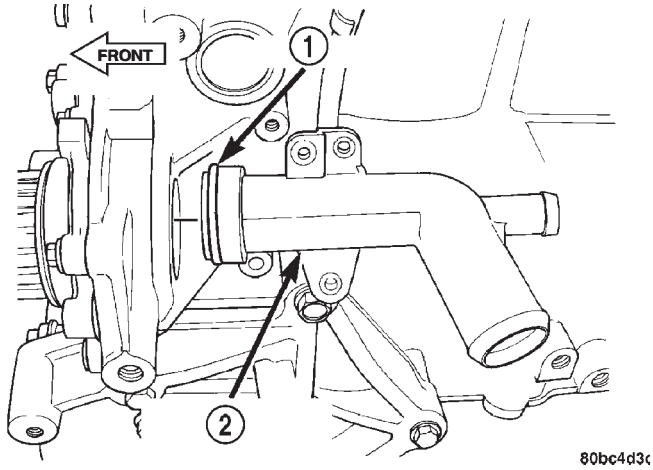


Fig. 21 Water Pump Inlet Tube

1 – O-RING
2 – WATER PUMP INLET TUBE

INSTALLATION

(1) Inspect the O-ring for damage before installing the tube into the cylinder block (Fig. 21). Replace O-ring as necessary.

(2) Lubricate O-ring with Mopar® Dielectric Grease and install inlet tube into the cylinder block opening.

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

(4) Install intake manifold lower support bracket fasteners and tighten to 12 N·m (105 in. lbs.).

(5) Connect lower radiator hose and heater hose to inlet tube.

(6) Install intake manifold. Refer to Group 9, Engine for procedure.

(7) Install upper radiator hose.

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

(9) Pressure system to 104 kPa (15 psi) to check for leaks.

ENGINE THERMOSTAT

REMOVAL

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

(2) Remove coolant recovery/reserve system hose and upper radiator hose.

REMOVAL AND INSTALLATION (Continued)

(3) Remove thermostat/engine outlet connector bolts (Fig. 22).

(4) Remove thermostat and O-ring assembly.

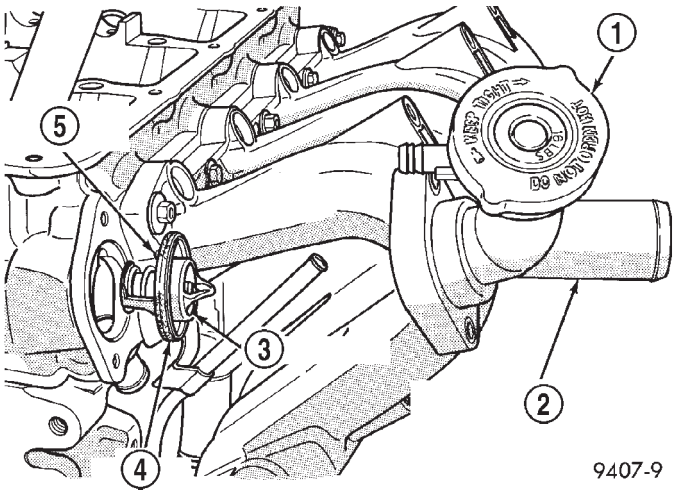


Fig. 22 Thermostat/Engine Outlet Connector

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

INSTALLATION

(1) Clean all sealing surfaces.

(2) Place the new thermostat assembly into the thermostat housing/outlet connector. Align vent with notch in cylinder head.

(3) Install thermostat housing/outlet connector onto cylinder head and tighten bolts to 12.5 N·m (110 in. lbs.).

(4) Install upper radiator hose.

(5) Connect the coolant recovery/reserve system hose.

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

RADIATOR

REMOVAL

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

(1) Disconnect negative cable from battery.

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

(3) Remove upper radiator hose from the radiator.

(4) Disconnect and cap automatic transmission hoses, if equipped.

(5) Disconnect cooling fan motor electrical connector.

(6) Remove cooling fan module retaining screws, located on the top of the shroud (Fig. 23). Lift shroud up and out of bottom shroud attachment clips separating shroud from radiator.

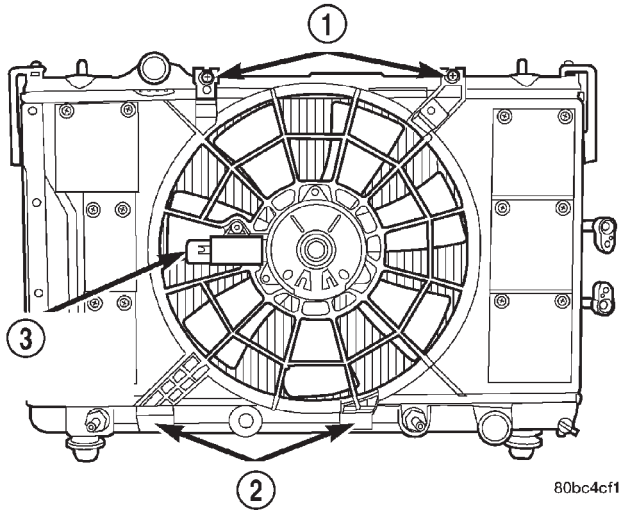


Fig. 23 Fan Module Mounting

1 – SCREWS
2 – LOWER MOUNTS
3 – FAN MOTOR ELECTRICAL CONNECTOR

(7) Remove the lower radiator hose.

(8) Remove upper radiator isolator bracket mounting screws (Fig. 24). Disconnect the engine block heater wire, if equipped.

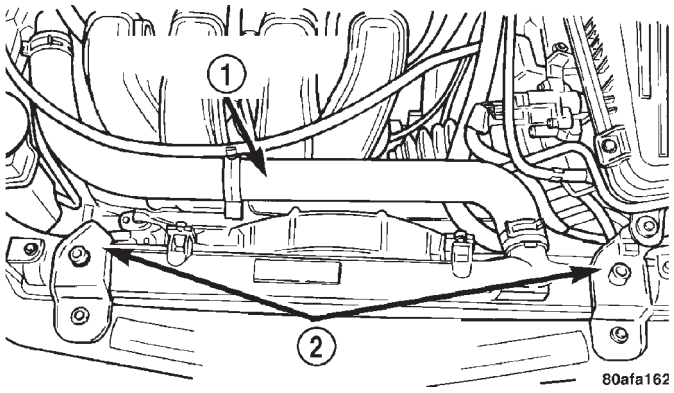


Fig. 24 Radiator Mounting

1 – UPPER RADIATOR HOSE
2 – UPPER RADIATOR MOUNTS

(9) Remove the air conditioning condenser attaching screws located at the front of the radiator, if equipped (Fig. 25), then lean condenser forward.

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

REMOVAL AND INSTALLATION (Continued)

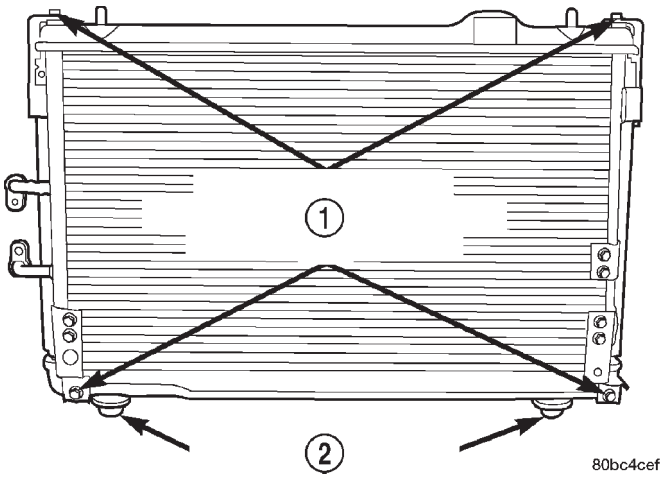


Fig. 25 A/C Condenser to Radiator Mounting Screws

1 – AIR CONDITIONING CONDENSER TO RADIATOR MOUNTING SCREWS
2 – LOWER ISOLATOR MOUNTS

(10) 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 down into position behind radiator support (yoke).

(2) Attach air conditioning condenser to radiator, if equipped (Fig. 25), with four mounting screws. Tighten screws to 5.4 N·m (50 in. lbs.). Then seat the radiator assembly lower rubber isolators into the mounting holes provided in the lower crossmember.

(3) Install and tighten radiator isolator mounting bracket screws to 10 N·m (90 in. lbs.) (Fig. 24). The radiator should have clearance to move up, approximately 5–8 mm (0.20–0.31 in.) after assembled.

(4) Install lower radiator hose. Align the hose and position the clamp so it will not interfere with engine components.

(5) Connect automatic transmission hoses, if equipped. Tighten hose clamps to 2 N·m (18 in. lbs.).

(6) Slide fan module down into clip(s) on lower radiator flange (Fig. 23). Install retaining screws and tighten to 7.5 N·m (65 in. lbs.).

(7) Connect the cooling fan motor electrical connector.

(8) Install upper radiator hose. Align the hose and position the clamp so they will not interfere with the engine or the hood.

(9) Connect negative cable to battery.

(10) Fill cooling system with coolant. Refer to procedure in this section.

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

RADIATOR DRAINCOCK

REMOVAL

(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. 26) from the radiator tank.

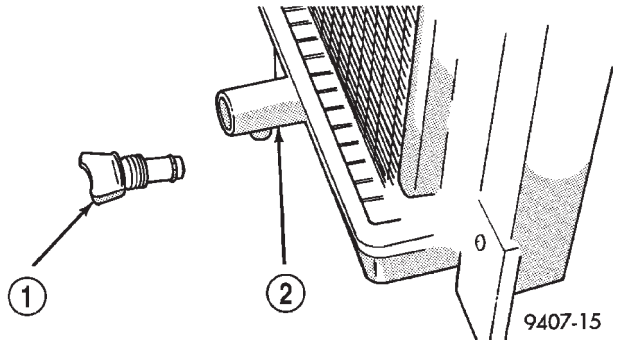


Fig. 26 Draincock

1 – DRAIN COCK BODY
2 – DRAIN COCK HOUSING

INSTALLATION

(1) Push the draincock assembly body into the tank opening.

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

COOLING FAN MODULE

All models use a single speed electric motor driven cooling system fan. The fan module includes a motor, fan blade, and support shroud. The module is fastened to the radiator by screws.

REMOVAL

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

(1) Disconnect negative cable from battery.

(2) Drain cooling system below upper radiator hose level. Refer to procedure in this section.

(3) Remove upper radiator hose from radiator (Fig. 27).

(4) Disconnect fan module electrical connector.

(5) Remove fan module screws from radiator (Fig. 28).

(6) Lift fan shroud up and out of lower shroud attachment clips.

(7) Refer to Disassembly and Assembly in this section for fan module sub-component service procedures.

REMOVAL AND INSTALLATION (Continued)

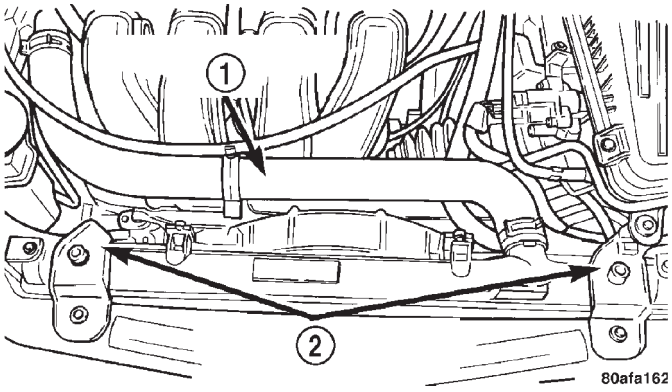


Fig. 27 Upper Radiator Hose

1 – UPPER RADIATOR HOSE
2 – UPPER RADIATOR MOUNTS

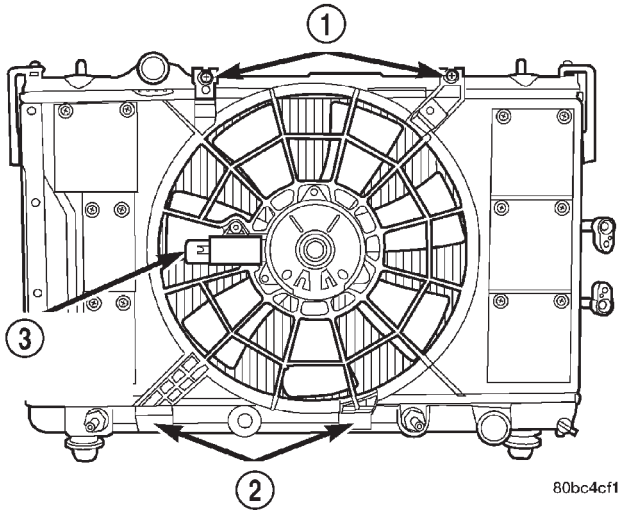


Fig. 28 Fan Module—Removal/Installation

1 – SCREWS
2 – LOWER MOUNTS
3 – FAN MOTOR ELECTRICAL CONNECTOR

INSTALLATION

(1) Install the fan module into the clips on the lower radiator tank.

(2) Install the fan module retaining screws and tighten to 7.5 N·m (65 in. lbs.).

(3) Connect fan module electrical connector. **For wiring diagrams of fan motor systems, refer to Group 8W, Wiring Diagrams**.

(4) Install the upper radiator hose to radiator (Fig. 27). Align hose and position clamp so it will not interfere with the engine or the hood.

(5) Connect negative cable to battery.

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

COOLANT RECOVERY CONTAINER

REMOVAL

(1) Disconnect recovery hose from water outlet connector/thermostat housing (Fig. 29).

(2) Remove container attaching fasteners (Fig. 30).

(3) Remove coolant recovery container.

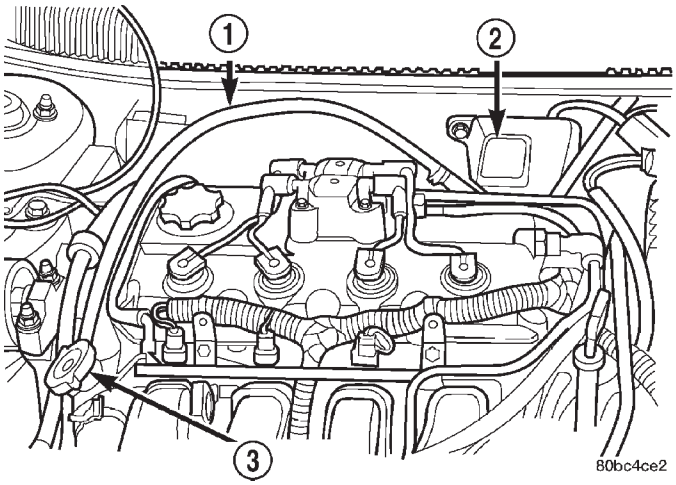


Fig. 29 Recovery Container Hose

1 – RECOVERY HOSE
2 – ENGINE COOLANT RECOVERY CONTAINER
3 – PRESSURE CAP

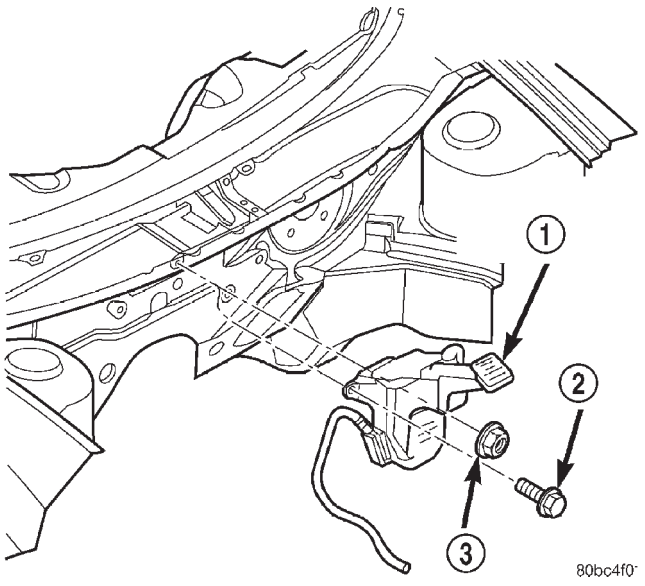


Fig. 30 Coolant Recovery Container

1 – COOLANT RECOVERY CONTAINER
2 – SCREW
3 – NUT

INSTALLATION

(1) Install coolant recovery container and tighten fasteners to 4 N·m (35 in. lbs.) (Fig. 30).

REMOVAL AND INSTALLATION (Continued)

(2) Connect recovery hose to water outlet connector/thermostat housing (Fig. 29).

(3) Fill container to proper level. Refer to Cooling System Refilling in this section.

ENGINE BLOCK HEATER

REMOVAL

(1) Drain coolant from radiator and cylinder block. Refer to Cooling System Draining in this section for procedure.

(2) Detach power cord plug from heater (Fig. 31).

(3) Loosen screw in center of heater. Remove heater assembly (Fig. 31).

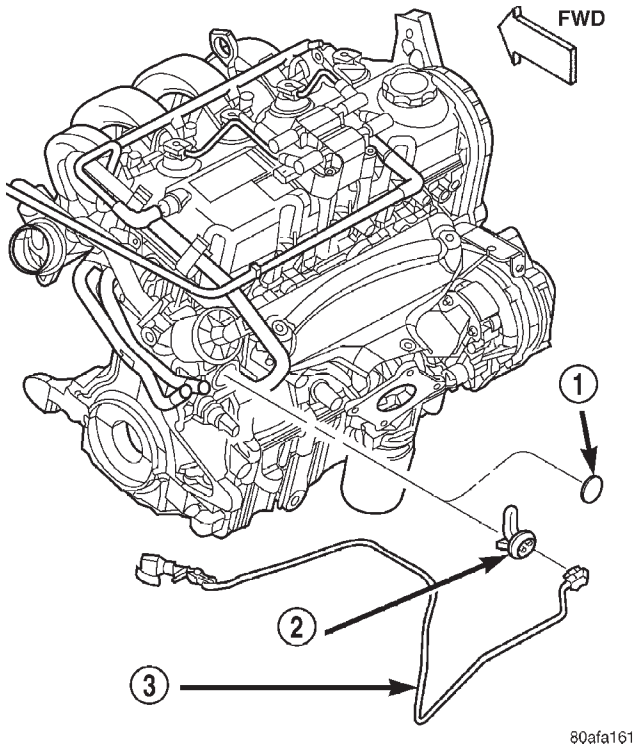


Fig. 31 Engine Block Heater

1 – CORE PLUG
2 – BLOCK HEATER
3 – POWER CORD

INSTALLATION

(1) Thoroughly clean core hole and heater seat.

(2) Insert heater assembly with element loop positioned **upward (Fig. 31)**.

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

(4) Connect power cord to block heater (Fig. 31).

(5) Fill cooling system with coolant to the proper level, vent air, and inspect for leaks.

ACCESSORY DRIVE BELTS

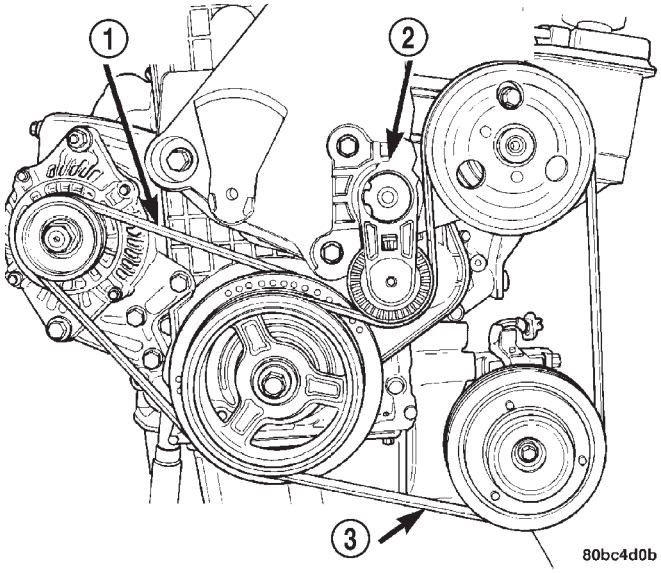


Fig. 32 Accessory Drive Belts

1 – GENERATOR BELT
2 – AUTOMATIC BELT TENSIONER
3 – POWER STEERING PUMP/A/C COMPRESSOR BELT

POWER STEERING PUMP AND AIR CONDITIONING COMPRESSOR BELT

REMOVAL

(1) Using a 17 mm wrench, rotate belt tensioner clockwise (Fig. 33) until belt can be removed from power steering pump pulley. Gently, release spring tension on tensioner.

(2) Remove belt (Fig. 34).

INSTALLATION

(1) Install belt (Fig. 34) over all pulleys except for the power steering pump pulley.

(2) Using a 17 mm wrench, rotate belt tensioner clockwise (Fig. 33) until belt can be installed onto power steering pulley. Release spring tension onto belt.

NOTE: When installing drive belt onto pulleys, make sure that belt is properly routed and all V-grooves make proper contact with pulley grooves.

(3) After belt is installed, inspect belt length indicator marks (Fig. 35). The indicator mark should be within the minimum belt length and maximum belt length marks. On a new belt, the indicator mark should align approximately with the nominal belt length mark.

REMOVAL AND INSTALLATION (Continued)

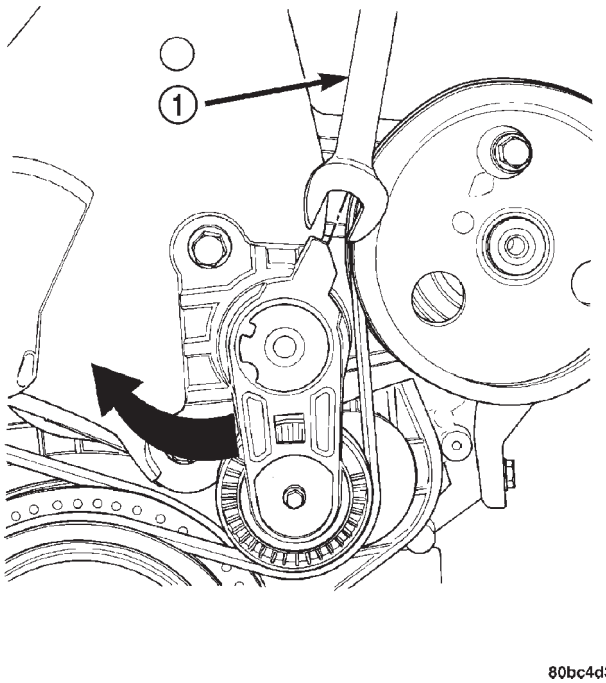


Fig. 33 Accessory Belt—Removing

1 – 17mm WRENCH

GENERATOR BELT

REMOVAL

(1) Remove power steering pump/air conditioning compressor drive belt.

(2) Loosen pivot bolt, then locking nut and adjusting bolt (Fig. 36).

(3) Remove generator belt.

NOTE: When installing drive belt onto pulleys, make sure that belt is properly routed and all V-grooves make proper contact with pulley grooves.

INSTALLATION

(1) Install belt and/or adjust belt tension by tightening adjusting bolt. Adjust belt to specification shown in Belt Tension Chart.

NOTE: Due to space limitations, the use of a belt tension gauge is limited. Therefore, measure the belt deflection at the center span of the generator belt. Refer to Belt Tension Chart for specifications.

(2) Tighten pivot bolt to 54 N·m (40 ft. lbs.) and locking nut to 54 N·m (40 ft. lbs.) (Fig. 36).

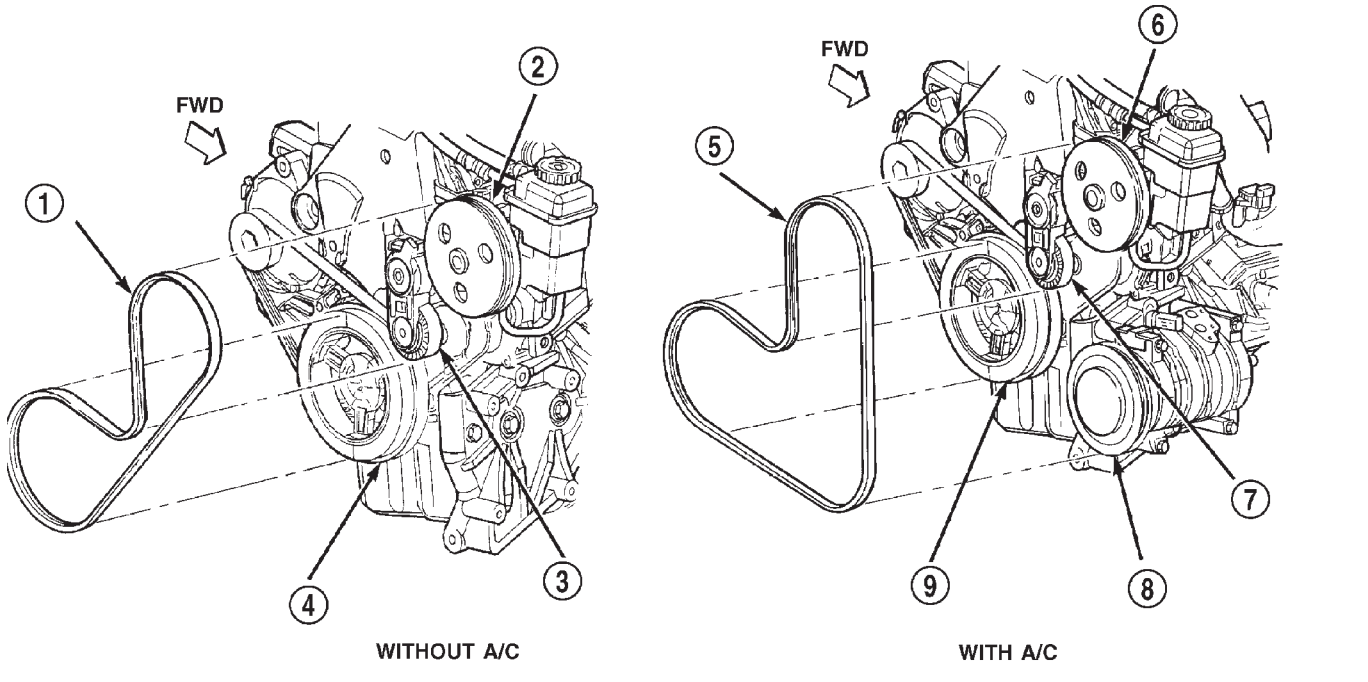


Fig. 34 Power Steering/Air Conditioning Belt

1 – BELT
2 – P/S PULLEY
3 – TENSIONER PULLEY
4 – CRANKSHAFT PULLEY
5 – BELT
6 – P/S PULLEY
7 – TENSIONER PULLEY
8 – A/C PULLEY
9 – CRANKSHAFT PULLEY

REMOVAL AND INSTALLATION (Continued)

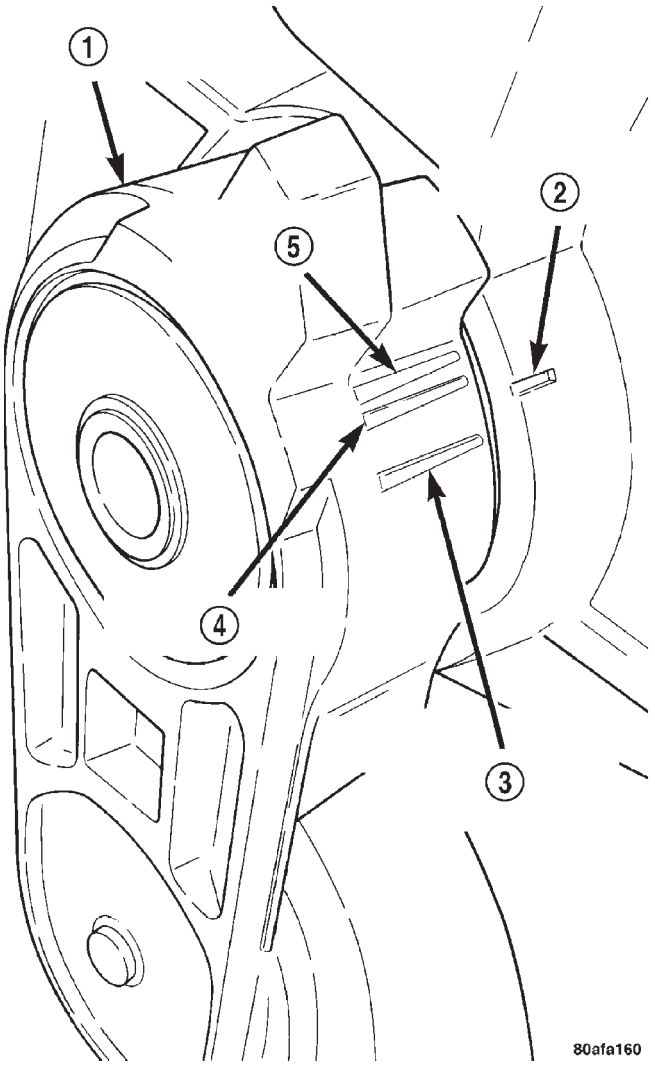


Fig. 35 Belt Length Indicator Marks

1 – AUTOMATIC BELT TENSIONER
2 – BELT LENGTH INDICATOR
3 – MAXIMUM BELT LENGTH
4 – NOMINAL BELT LENGTH
5 – MINIMUM BELT LENGTH

(3) Install power steering pump and A/C compressor drive belt.

AUTOMATIC BELT TENSIONER & PULLEY

The automatic belt tensioner (Fig. 37) maintains proper tension on the power steering and air conditioning belt. The tensioner is serviced with the engine mount bracket assembly. The tensioner pulley can be serviced.

NOTE: Slight axial movement of the tensioner arm is normal. Tensioner arm should move freely and maintain 50–70 lb. tension on belt.

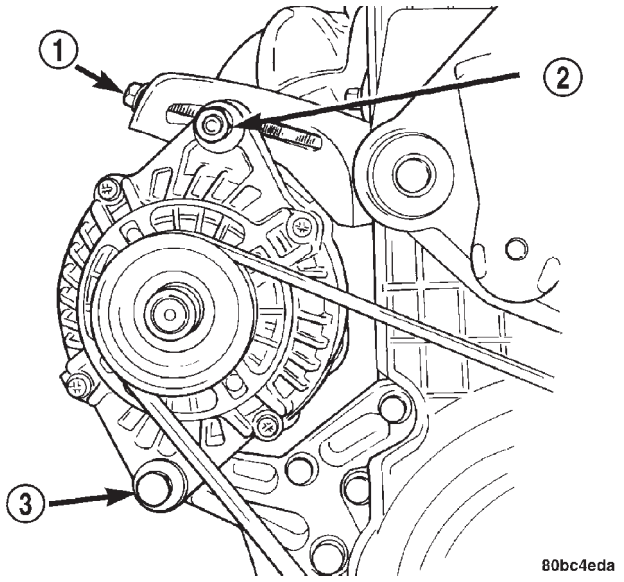


Fig. 36 Generator Belt Adjustment

1 – ADJUSTING BOLT
2 – LOCKING NUT
3 – PIVOT BOLT

BELT TENSION CHART

Accessory Drive Belt	Belt Tension	Belt Deflection at Center Span*
Power Steering Pump and A/C Compressor	Dynamic Tensioner	
Generator	New 135 lb. Used 100 lb.	4.5 mm (0.18 in.) 5.5 mm (0.22 in.)
* Belt deflection is measured at the center of the belt span with 4.5 kg (10 lb.) force.		

REMOVAL

(1) Remove engine mount bracket assembly. Refer to Group 9, Engine for procedure.
(2) Remove tensioner pulley mounting bolt.
(3) Remove pulley.

INSTALLATION

(1) Install tensioner pulley and bolt. Tighten bolt to 27 N·m (20 ft. lbs.).
(2) Install engine mount bracket assembly. Refer to Group 9, Engine for procedure.

DISASSEMBLY AND ASSEMBLY

COOLING FAN MODULE

The cooling fan module consist of the following three components: fan, fan motor, and shroud.

DISASSEMBLY AND ASSEMBLY (Continued)

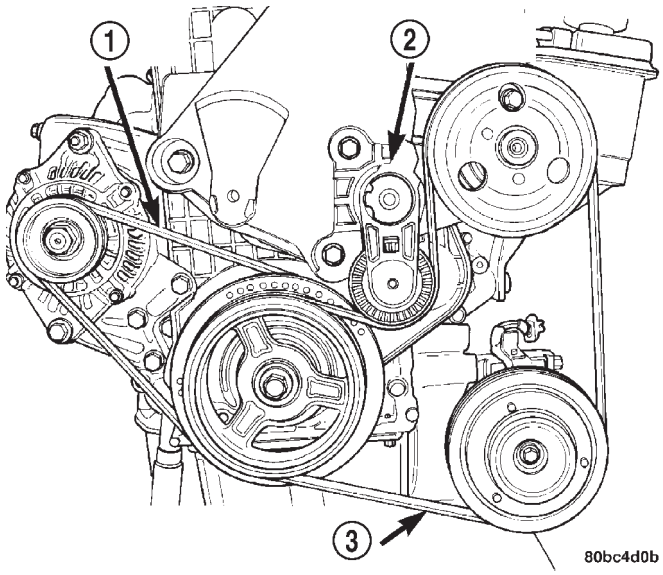


Fig. 37 Automatic Belt Tensioner

1 – GENERATOR BELT
2 – AUTOMATIC BELT TENSIONER
3 – POWER STEERING PUMP/A/C COMPRESSOR BELT

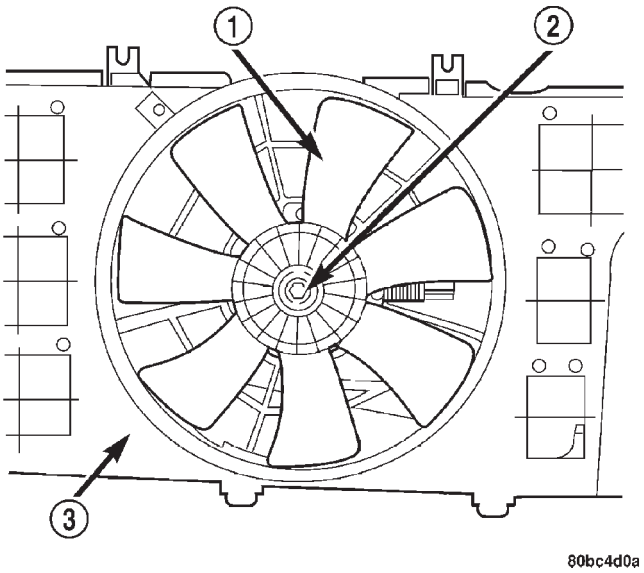


Fig. 38 Fan—Removal and Installation

1 – FAN
2 – NUT
3 – SHROUD ASSEMBLY

FAN

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

REMOVAL

(1) Remove cooling fan module. Refer to procedure in this section.
(2) Remove fan hub retaining nut (Fig. 38).
(3) Remove fan from motor shaft.

INSTALLATION

(1) Install fan on motor shaft.
(2) Install fan retaining nut and tighten to 3.8 N·m (34 in. lbs.) (Fig. 38).
(3) Install cooling fan module. Refer to procedure in this section.

FAN MOTOR

REMOVAL

(1) Remove cooling fan module. Refer to procedure in this section.
(2) Remove fan from motor shaft.
(3) Remove screw attaching the in-rush current suppressor (Fig. 39).
(4) Remove screws attaching motor to shroud (Fig. 39).
(5) Remove fan motor.

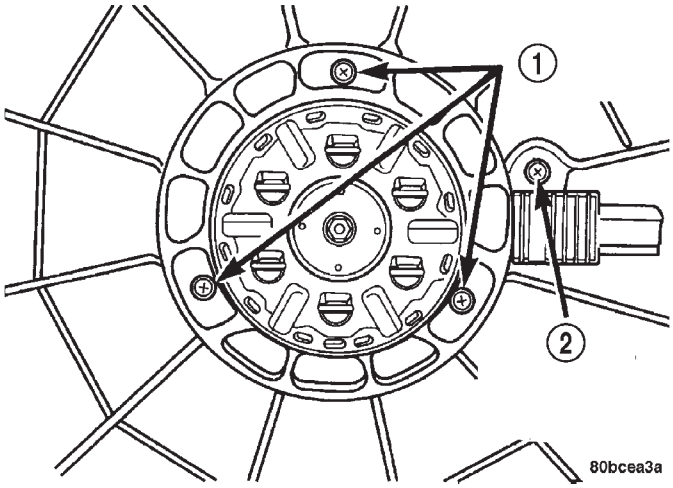


Fig. 39 Fan Motor—Removal and Installation

1 – FAN MOTOR SCREWS
2 – IN RUSH CURRENT SUPPRESSOR SCREW

INSTALLATION

(1) Install fan motor on shroud and tighten screws to 3.8 N·m (34 in. lbs.) (Fig. 39).
(2) Install screw attaching the in-rush current suppressor and tighten to 2.6 N·m (23 in. lbs.) (Fig. 39).
(3) Install fan on motor shaft.
(4) Install cooling fan module. Refer to procedure in this section.

DISASSEMBLY AND ASSEMBLY (Continued)

SHROUD

REMOVAL

(1) Remove cooling fan module. Refer to procedure in this section.

(2) Remove fan and fan motor as previously described.

INSTALLATION

(1) Install fan motor and fan as previously described.

(2) Install cooling fan module. Refer to procedure in this section.

CLEANING AND INSPECTION

WATER PUMP

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 INSPECTION

Belt replacement under any or all of the following conditions is required, excessive wear, frayed cords or 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. 40).

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

COOLING SYSTEM CAP

Hold the cap in your hand, **right side up** (Fig. 41). The vent valve at the bottom of the cap should open with a slight pull. If the rubber gasket has swollen, preventing the valve from opening, replace the cap.

If any light can be seen between vent valve and the rubber gasket, replace the cap. **Use only 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 system pressurization.

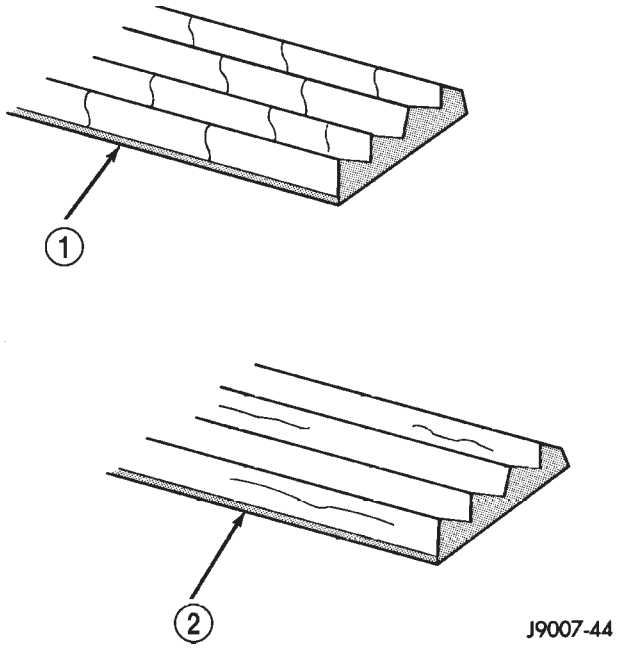


Fig. 40 Drive Belt Wear Pattern

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

COOLING SYSTEM CLEANING

(1) Drain cooling system. Refer to Cooling System Draining in this section for procedure.

(2) Refill with clean water. Refer to Cooling System Refilling in this section for procedure.

(3) Run engine with radiator cap installed until upper radiator hose is hot.

(4) Stop engine and drain water from system. If water is dirty, fill, run and drain the system again until water runs clear.

RADIATOR FLUSHING

(1) Drain cooling system. Refer to Cooling System Draining in this section for procedure.

(2) Remove radiator hoses from engine.

(3) Install suitable flushing gun in radiator lower hose.

(4) 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

(1) Drain radiator. Refer to Cooling System Draining in this section for procedure.

(2) Remove hoses from radiator.

CLEANING AND INSPECTION (Continued)

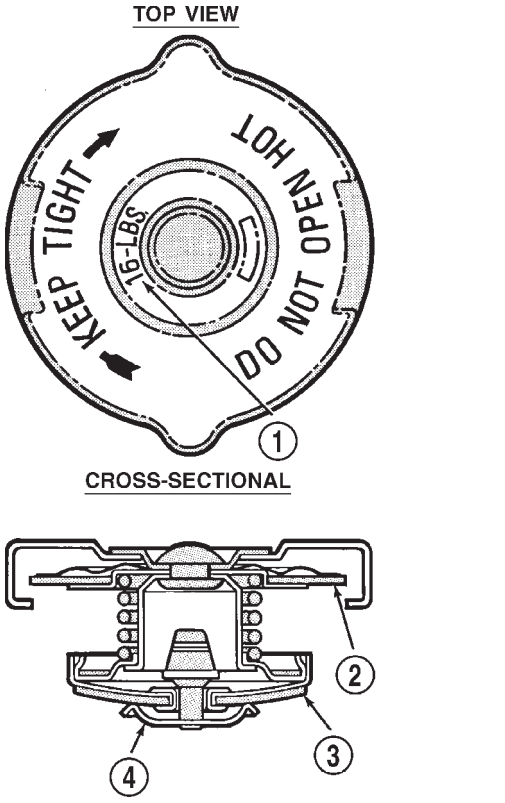


Fig. 41 Cooling System Pressure Cap

1 – PRESSURE RATING
2 – FILLER NECK SEAL
3 – PRESSURE VALVE
4 – VACUUM VENT VALVE (SHOWN IN SEALING POSITION)

(3) 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.

(4) 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.

(5) Install thermostat and fill cooling system. Refer to Cooling System Refilling in this section 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

For belt tension adjustment procedure, refer to Accessory Drive Belt Removal and Installation procedure.

SPECIFICATIONS

COOLING SYSTEM CAPACITY

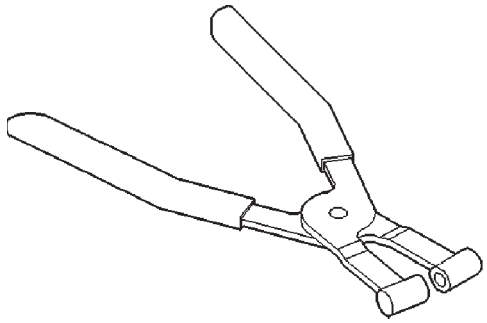
6.2 Liters (6.5 qts.)
CAPACITY, Includes Heater and Coolant Reserve System

TORQUE SPECIFICATIONS

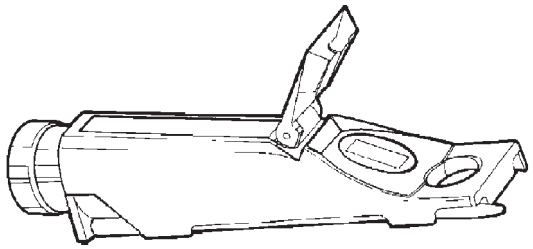
DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
A/C Condenser to Radiator—Screws	5.4	—	50
Automatic Belt Tensioner Pulley—Bolt	27	20	—
Coolant Recovery Container—Nut/Screw	4	—	35
Fan Module to Radiator—Screws	7.2	—	65
Fan Motor to Shroud—Screws	3.8	—	34
Fan Blade to Motor Shaft—Nut	3.8	—	34
In Rush Current Supressor—Screw	2.6	—	23
Generator Mounting—Pivot Bolt	54	40	—
Generator Mounting—Locking Nut	54	40	—
Radiator (Cooling Module) to Body—Screws	10	—	90
Thermostat Housing/Water Outlet Connector—Screws	12	—	105
Transmission Hose—Clamps	2	—	18
Water Pump to Engine Block—Bolts	12	—	105
Water Pump Inlet Tube to Engine Block—Bolts	12	—	105

SPECIAL TOOLS

COOLING



Hose Clamp Pliers 6094



Coolant Refractometer 8286