# COOLING SYSTEM

TABLE OF CONTENTS


page

**DESCRIPTION AND OPERATION**
- COOLING SYSTEM . . . . . 2
- SYSTEM COOLANT ROUTING . . . . . 2
- WATER PUMP BYPASS—4.7L . . . . . 3
- AUTOMATIC TRANSMISSION OIL COOLER . . . . . 4
- COOLANT RESERVOIR / OVERFLOW SYSTEM . . . . . 4
- ENGINE BLOCK HEATER . . . . . 4
- RADIATOR . . . . . 4
- THERMOSTAT . . . . . 5
- RADIATOR PRESSURE CAP . . . . . 6
- COOLING SYSTEM HOSES AND HOSE CLAMPS . . . . . 7
- WATER PUMP . . . . . 7
- VISCOUS FAN DRIVE . . . . . 8

**DIAGNOSIS AND TESTING**
- ON-BOARD DIAGNOSTICS (OBD) . . . . . 9
- DRB SCAN TOOL . . . . . 10
- WATER PUMP TESTS . . . . . 10
- SERPENTINE DRIVE BELT DIAGNOSIS . . . . . 11
- THERMOSTAT . . . . . 11
- COOLING SYSTEM DIAGNOSIS . . . . . 13
- PRELIMINARY CHECKS . . . . . 13
- COOLING SYSTEM—TESTING FOR LEAKS . . . . 20
- RADIATOR COOLANT FLOW CHECK . . . . . 20
- VISCOUS FAN DRIVE . . . . . 21
- ELECTRIC COOLING FAN . . . . . 22
- RADIATOR CAP TO FILLER NECK SEAL—PRESSURE RELIEF CHECK . . . . . 22
- RADIATOR CAP—PRESSURE TESTING . . . . . 22
- DEAERATION . . . . . 23
- ENGINE BLOCK HEATER . . . . . 23
- LOW COOLANT LEVEL-AERATION . . . . . 23

page

**SERVICE PROCEDURES**
- COOLANT . . . . . 24
- COOLANT LEVEL—ROUTINE CHECK . . . . . 24
- COOLANT SELECTION AND ADDITIVES . . . . . 24
- COOLANT—ADDING ADDITIONAL . . . . . 24
- DRAINING AND FILLING COOLING SYSTEM . . . 25
- SERVICE COOLANT LEVEL . . . . . 25
- COOLING SYSTEM—REVERSE FLUSHING . . . . 26

**REMOVAL AND INSTALLATION**
- WATER PUMP—4.0L ENGINE . . . . . 27
- WATER PUMP 4.7L ENGINES . . . . . 29
- THERMOSTAT—4.0L ENGINE . . . . . 31
- THERMOSTAT— 4.7L ENGINE . . . . . 32
- RADIATOR FAN SHROUD . . . . . 33
- RADIATOR . . . . . 34
- WATER PUMP BYPASS HOSE—4.0L ENGINE . . 37
- ENGINE BLOCK HEATER . . . . . 38
- BELT REPLACEMENT/ADJUSTMENT . . . . . 39
- AUTOMATIC BELT TENSIONER . . . . . 41
- COOLING SYSTEM FAN 4.0L AND 4.7L ENGINES . . . . . 42
- VISCOUS FAN DRIVE . . . . . 43

**CLEANING AND INSPECTION**
- FAN BLADE . . . . . 43
- RADIATOR . . . . . 43
- RADIATOR PRESSURE CAP . . . . . 43
- WATER PUMP . . . . . 43
- COOLING SYSTEM HOSES . . . . . 44

**SPECIFICATIONS**
- COOLING SYSTEM CAPACITIES . . . . . 44
- DRIVE BELT TENSION . . . . . 44
- INFORMATION . . . . . 44
- TORQUE SPECIFICATIONS . . . . . 44

**SPECIAL TOOLS**
- COOLING . . . . . 45

# DESCRIPTION AND OPERATION

## COOLING SYSTEM

### DESCRIPTION

The cooling system consists of:

- A radiator
- Mechanical Cooling Fan
- Thermal viscous fan drive-Low disengaged
- Fan shroud
- Radiator pressure cap
- Thermostat
- Coolant reserve/overflow system
- Transmission oil cooler (if equipped with an automatic transmission)
- Coolant
- Water pump
- Hoses and hose clamps
- Accessory drive belt

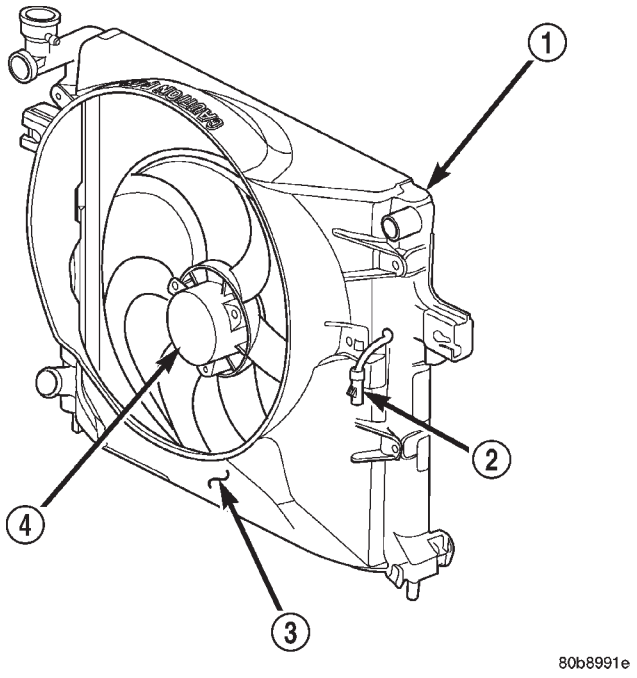



***Fig. 1 Cooling Module with Electric Fan— 4.0L and 4.7L***

1 – RADIATOR
2 – ELECTRIC COOLING FAN CONNECTOR
3 – FAN SHROUD
4 – ELECTRIC COOLING FAN

### OPERATION

The cooling system regulates engine operating temperature. It allows the engine to reach normal operating temperature as quickly as possible. It also maintains normal operating temperature and prevents overheating.

The cooling system also provides a means of heating the passenger compartment and cooling the automatic transmission fluid (if equipped). The cooling system is pressurized and uses a centrifugal water pump to circulate coolant throughout the system.

Vehicles equipped with the 4.7L engine receive a “max” cooling package which consists of a heavy duty radiator, a low disengaged fan viscous fan drive and an mechanical cooling fan. This package will provide additional cooling capacity for vehicles used under extreme conditions such as trailer towing in high ambient temperatures.

## SYSTEM COOLANT ROUTING

### DESCRIPTION

For cooling system routings refer to (Fig. 2) (Fig. 3).

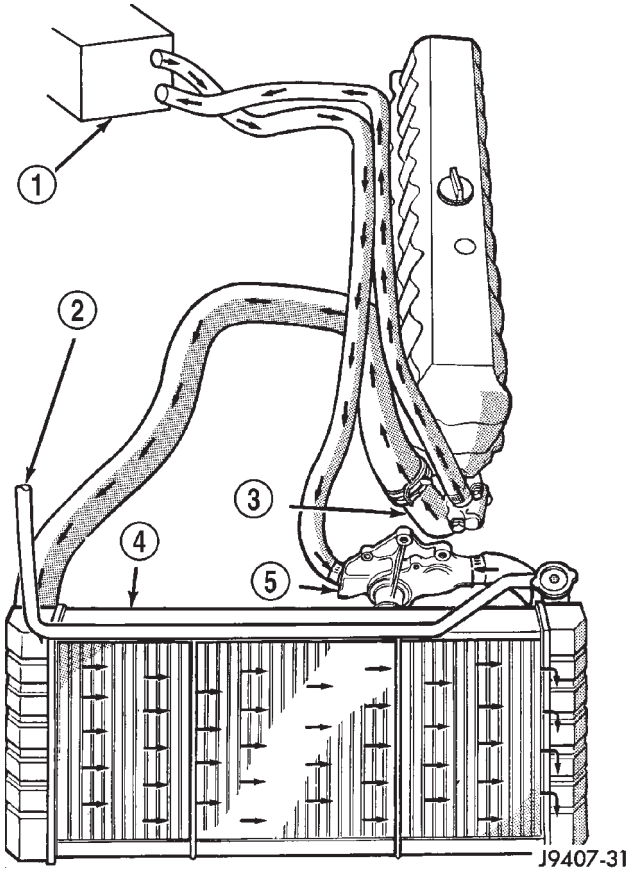



***Fig. 2 Engine Cooling System—4.0L Engine—Typical***

1 – HEATER CORE
2 – TO COOLANT RESERVE/OVERFLOW TANK
3 – THERMOSTAT HOUSING
4 – RADIATOR
5 – WATER PUMP

DESCRIPTION AND OPERATION (Continued)

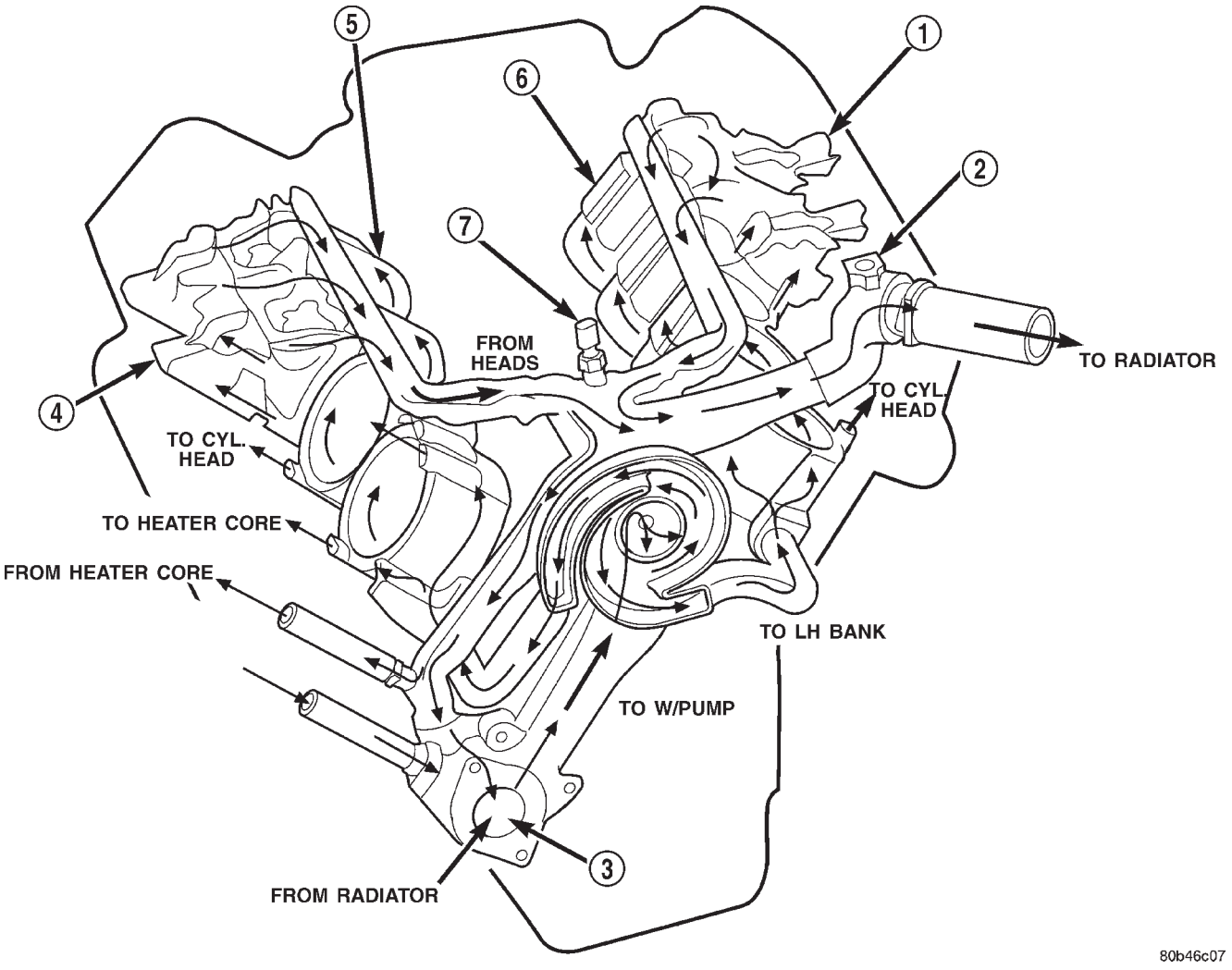



***Fig. 3 Engine Cooling System 4.7L Engine—Typical***

1 – LH CYL. HEAD
2 – BLEED
3 – THERMOSTAT LOCATION
4 – RH CYL. HEAD
5 – RH BANK CYL. BLOCK
6 – LH BANK CYL. BLOCK
7 – COOLANT TEMP. SENSOR

## WATER PUMP BYPASS—4.7L

### DESCRIPTION

The 4.7L engine uses an internal water/coolant bypass system. The design uses galleries in the timing chain cover to circulate coolant during engine warm-up preventing the coolant from flowing through the radiator. The thermostat uses a stub shaft located at the rear of the thermostat (Fig. 4) to control flow through the bypass gallery.

### OPERATION

When the thermostat is in the closed position the bypass gallery is not obstructed allowing 100% flow. When the thermostat is in the open position the stub shaft enters the bypass gallery obstructing bypass coolant flow by 50%. This design allows the coolant to reach operating temperature quickly when cold, while adding extra cooling during normal temperature operation.

DESCRIPTION AND OPERATION (Continued)

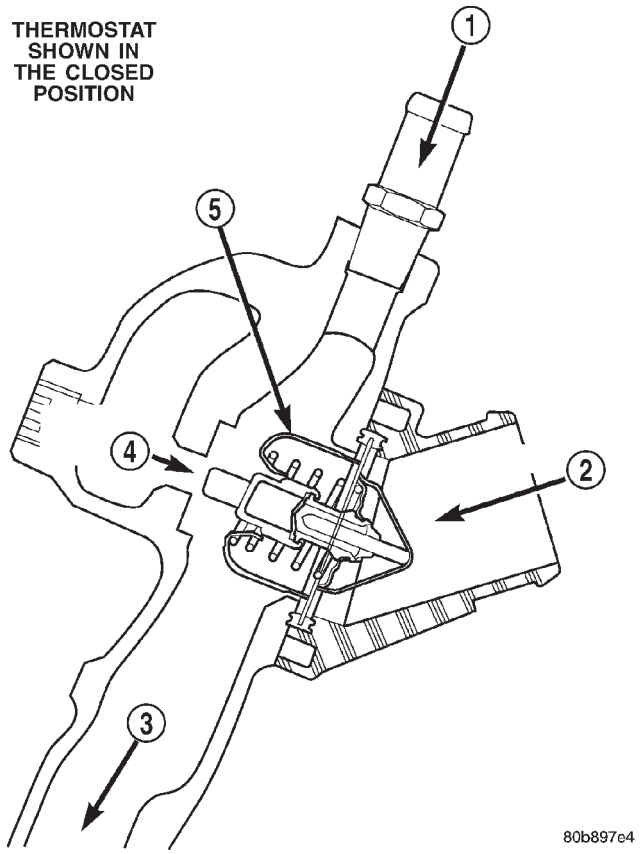



***Fig. 4 Water/Coolant Bypass Flow and Thermostat—4.7L Engine***

1 – FROM HEATER
2 – FROM RADIATOR
3 – TO WATER PUMP
4 – ENGINE BYPASS
5 – THERMOSTAT

## RADIATOR

### DESCRIPTION

All vehicles are equipped with a cross flow type radiator with plastic side tanks.

Plastic tanks, while stronger than brass, are subject to damage by impact, such as from tools or wrenches. Handle radiator with care.

## AUTOMATIC TRANSMISSION OIL COOLER

### DESCRIPTION

An internal high capacity/high efficiency cooler is used on all vehicles these coolers are an oil-to-coolant type which consists of plates mounted in the radiator outlet tank (Fig. 5). Because the internal oil cooler is so efficient, no auxiliary oil cooler is offered.

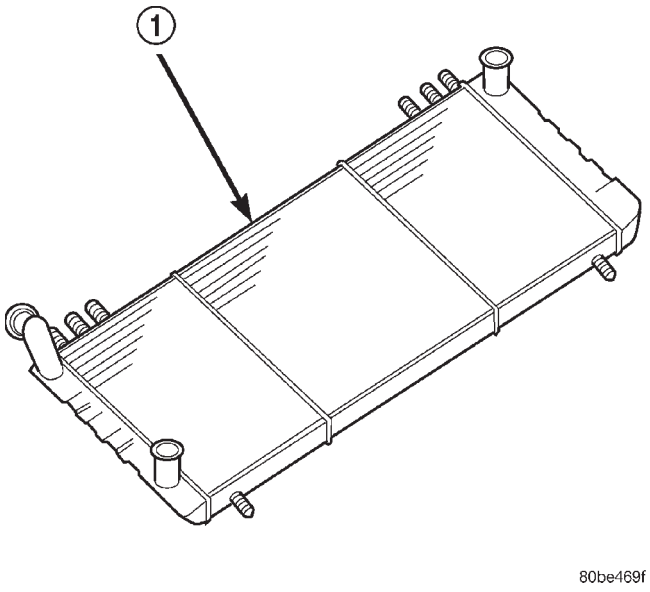



***Fig. 5 Cross Flow Radiator—Typical***

1 – RADIATOR

## COOLANT RESERVOIR / OVERFLOW SYSTEM

### DESCRIPTION

This system works along with the radiator pressure cap. This is done by using thermal expansion and contraction of the coolant to keep the coolant free of trapped air. It provides:

- A volume for coolant expansion and contraction.
- A convenient and safe method for checking/adjusting coolant level at atmospheric pressure. This is done without removing the radiator pressure cap.
- Some reserve coolant to the radiator to cover minor leaks and evaporation or boiling losses.

As the engine cools, a vacuum is formed in the cooling system of both the radiator and engine. Coolant will then be drawn from the coolant tank and returned to a proper level in the radiator.

The coolant reservoir/overflow system has a radiator mounted pressurized cap, an overflow tube and a plastic coolant reservoir/overflow tank (Fig. 6) mounted to the right inner fender.

## ENGINE BLOCK HEATER

### DESCRIPTION

**WARNING: DO NOT OPERATE ENGINE UNLESS BLOCK HEATER CORD HAS BEEN DISCONNECTED FROM POWER SOURCE AND SECURED IN PLACE. THE POWER CORD MUST BE SECURED IN ITS RETAINING CLIPS AND ROUTED AWAY FROM EXHAUST MANIFOLDS AND MOVING PARTS.**

DESCRIPTION AND OPERATION (Continued)

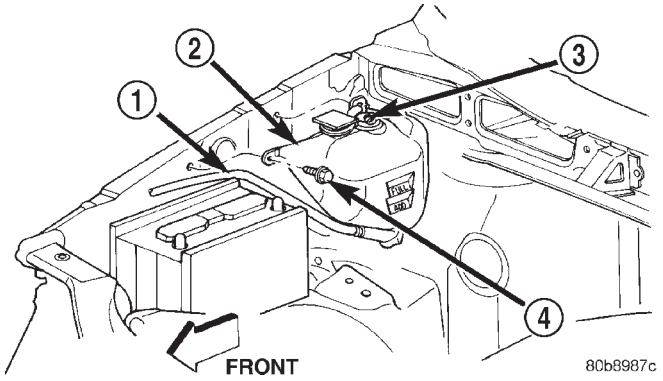



***Fig. 6 Coolant Reservoir / Overflow Tank***

1 – COOLANT OVERFLOW HOSE
2 – COOLANT RESERVOIR/OVERFLOW TANK
3 – COOLANT LEVEL SENSOR
4 – BOLT

An optional engine block heater (Fig. 7) (Fig. 8) is available with all models. The heater is equipped with a power cord. The cord is attached to an engine compartment component with tie-straps. The heater warms the engine providing easier engine starting and faster warm-up in low temperatures. The heater is mounted in a core hole of the engine cylinder block in place of a freeze plug with the heating element immersed in engine coolant.

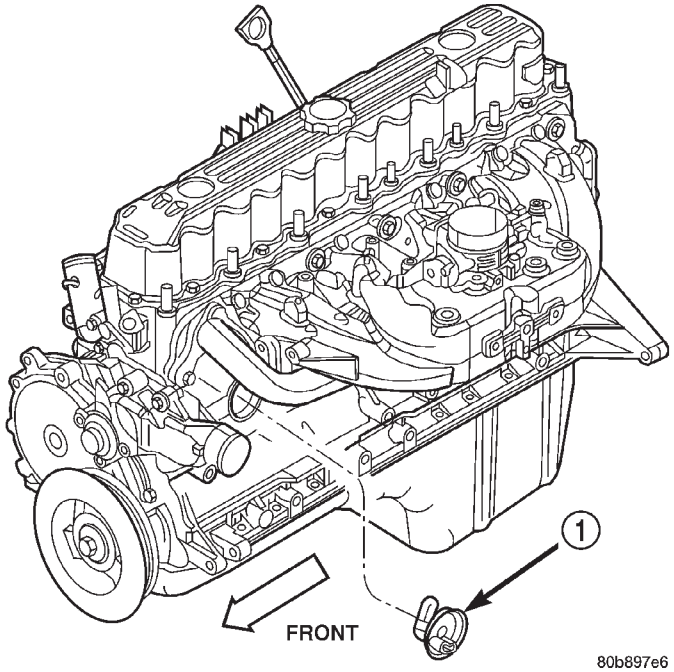



***Fig. 7 Block Heater—4.0L***

1 – ENGINE BLOCK HEATER

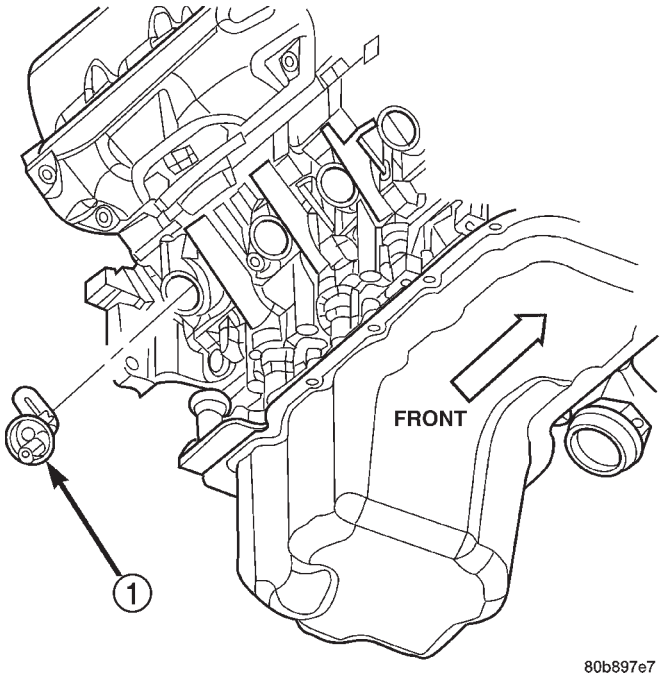



***Fig. 8 Block Heater—4.7L***

1 – ENGINE BLOCK HEATER

## OPERATION

Connecting the power cord to a grounded 110-120 volt AC electrical outlet with a grounded, three wire extension cord activates the heating element warming the engine coolant.

## THERMOSTAT

## DESCRIPTION

**CAUTION: Do not operate an engine without a thermostat, except for servicing or testing.**

A pellet-type thermostat controls the operating temperature of the engine by controlling the amount of coolant flow to the radiator. On all engines the thermostat is closed below 195°F (90°C). Above this temperature, coolant is allowed to flow to the radiator. This provides quick engine warm up and overall temperature control. On the 4.7L engine the thermostat is designed to block the flow of the coolant bypass journal by 50% instead of completely blocking the flow. This design controls coolant temperature more accurately (Fig. 9) (Fig. 10).

DESCRIPTION AND OPERATION (Continued)

The same thermostat is used for winter and summer seasons. An engine should not be operated without a thermostat, except for servicing or testing. Operating without a thermostat causes other problems. These are: longer engine warmup time, unreliable warmup performance, increased exhaust emissions and crankcase condensation. This condensation can result in sludge formation.

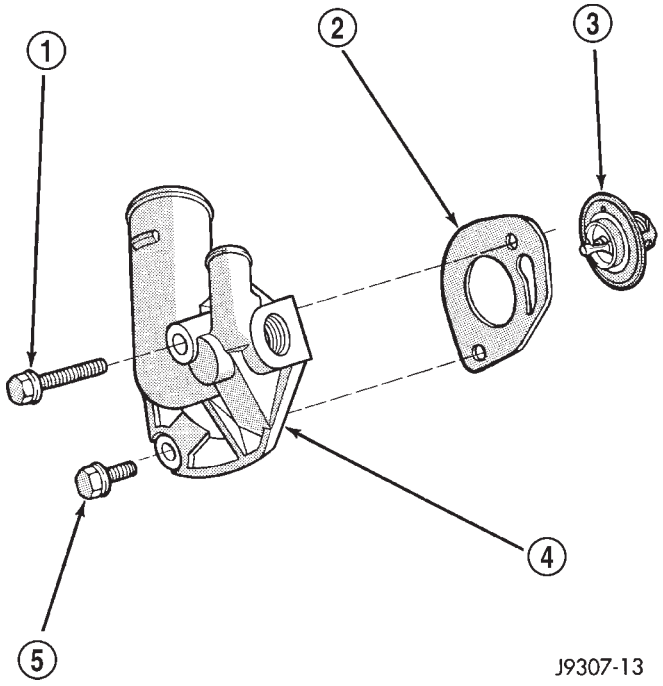



*Fig. 9 Thermostat and Housing—4.0L*

1 – LONG BOLT
2 – GASKET
3 – THERMOSTAT
4 – THERMOSTAT HOUSING
5 – SHORT BOLT

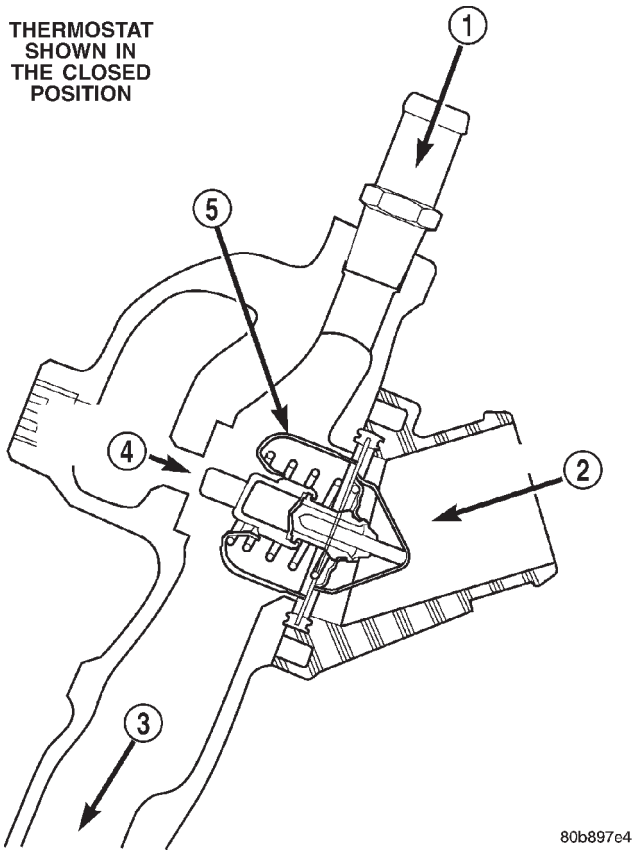



*Fig. 10 Thermostat Cross Section View 4.7L*

1 – FROM HEATER
2 – FROM RADIATOR
3 – TO WATER PUMP
4 – ENGINE BYPASS
5 – THERMOSTAT

## OPERATION

The wax pellet is located in a sealed container at the spring end of the thermostat. When heated, the pellet expands, overcoming closing spring tension and water pump pressure to force the valve to open.

# RADIATOR PRESSURE CAP

## DESCRIPTION

All radiators are equipped with a pressure cap. This cap releases pressure at some point within a range of 124-to-145 kPa (18-to-21 psi). The pressure relief point (in pounds) is engraved on top of the cap

The cooling system will operate at pressures slightly above atmospheric pressure. This results in a higher coolant boiling point allowing increased radiator cooling capacity. The cap contains a spring-loaded pressure relief valve. This valve opens when system pressure reaches the release range of 124-to-145 kPa (18-to-21 psi).

A rubber gasket seals the radiator filler neck. This is done to maintain vacuum during coolant cool-down and to prevent leakage when system is under pressure.

## OPERATION

A vent valve in the center of the cap will remain shut as long as the cooling system is pressurized. As the coolant cools, it contracts and creates a vacuum in cooling system. This causes the vacuum valve to open and coolant in reserve/overflow tank to be drawn through connecting hose into radiator. If the vacuum valve is stuck shut, or overflow hose is kinked, radiator hoses will collapse on cool-down.

DESCRIPTION AND OPERATION (Continued)

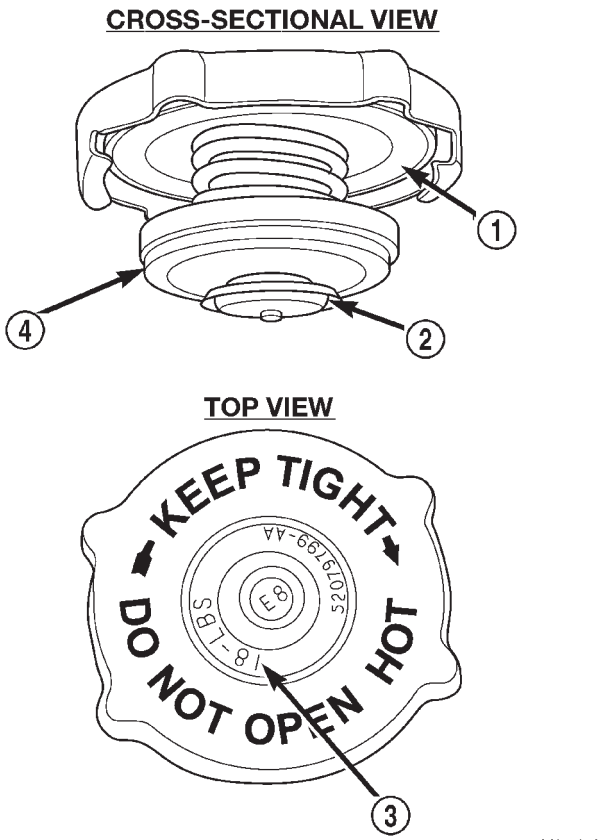



*Fig. 11 Radiator Pressure Cap—Typical*

1 – FILLER NECK SEAL
2 – VACUUM VENT VALVE
3 – PRESSURE RATING
4 – PRESSURE VALVE

## WATER PUMP

### DESCRIPTION

**CAUTION: All 4.0L 6-cylinder engines are equipped with a reverse (counterclockwise) rotating water pump and thermal viscous fan drive assembly. REVERSE is stamped or imprinted on the cover of the viscous fan drive and inner side of the fan. The letter R is stamped into the back of the water pump impeller. Engines from previous model years, depending upon application, may have been equipped with a forward (clockwise) rotating water pump. Installation of the wrong water pump or viscous fan drive will cause engine over heating.**

A centrifugal water pump circulates coolant through the water jackets, passages, intake manifold, radiator core, cooling system hoses and heater core. The pump is driven from the engine crankshaft by a single serpentine drive belt on all engines.

The water pump impeller is pressed onto the rear of a shaft that rotates in bearings pressed into the housing. The housing has two small holes to allow seepage to escape. The water pump seals are lubricated by the antifreeze in the coolant mixture. No additional lubrication is necessary.

**4.7L ENGINES:** Both heater hoses are connected to fittings on the timing chain front cover. The water pump is also mounted directly to the timing chain cover and is equipped with a non serviceable integral pulley (Fig. 13).

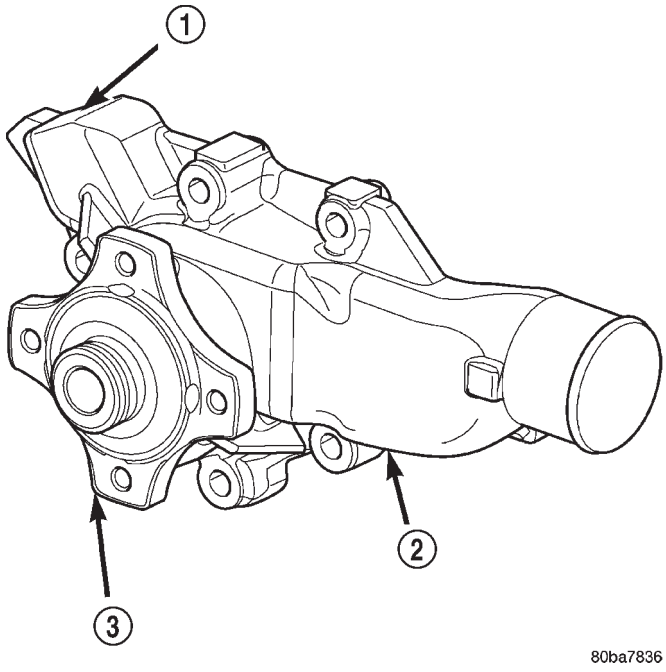



*Fig. 12 Water Pump—4.0L*

1 – HEATER HOSE FITTING BORE
2 – WATER PUMP
3 – WATER PUMP HUB

## COOLING SYSTEM HOSES AND HOSE CLAMPS

Rubber hoses route coolant to and from the radiator, intake manifold and heater core. The lower radiator hose is spring-reinforced to prevent collapse from water pump suction at moderate and high engine speeds.

**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, SUCH AS SPECIAL CLAMP TOOL (NUMBER 6094) (Fig. 14). SNAP-ON CLAMP TOOL (NUMBER HPC-20) MAY BE USED FOR LARGER CLAMPS. ALWAYS WEAR SAFETY GLASSES WHEN SERVICING CONSTANT TENSION CLAMPS.**

DESCRIPTION AND OPERATION (Continued)

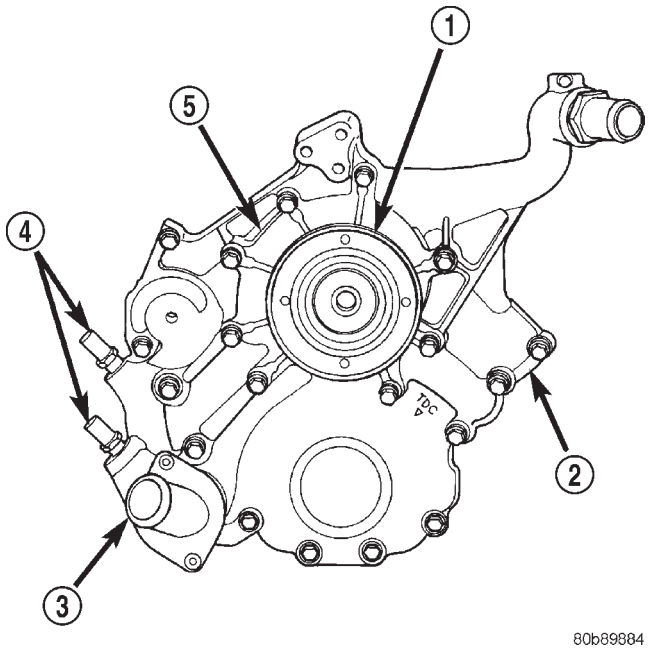



*Fig. 13 Water Pump and Timing Chain Cover—4.7L*

1 – INTEGRAL WATER PUMP PULLEY
2 – TIMING CHAIN COVER
3 – THERMOSTAT HOUSING
4 – HEATER HOSE FITTINGS
5 – WATER PUMP

**CAUTION: A number or letter is stamped into the tongue of constant tension clamps (Fig. 15). If replacement is necessary, use only an original equipment clamp with matching number or letter.**

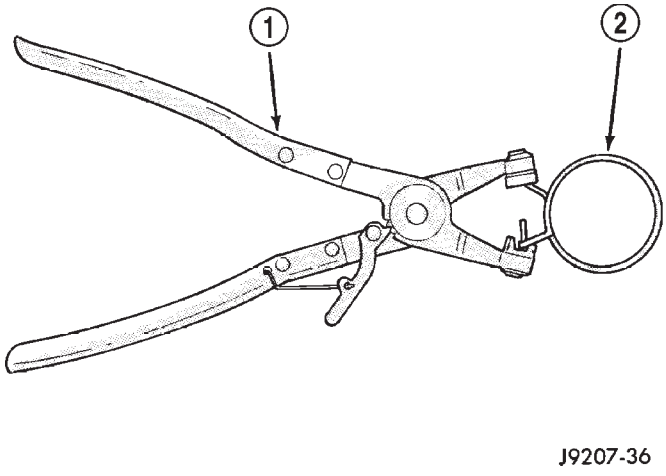



*Fig. 14 Hose Clamp Tool—Typical*

1 – HOSE CLAMP TOOL 6094
2 – HOSE CLAMP

Inspect the hoses at regular intervals. Replace hoses that are cracked, feel brittle when squeezed, or swell excessively when the system is pressurized.

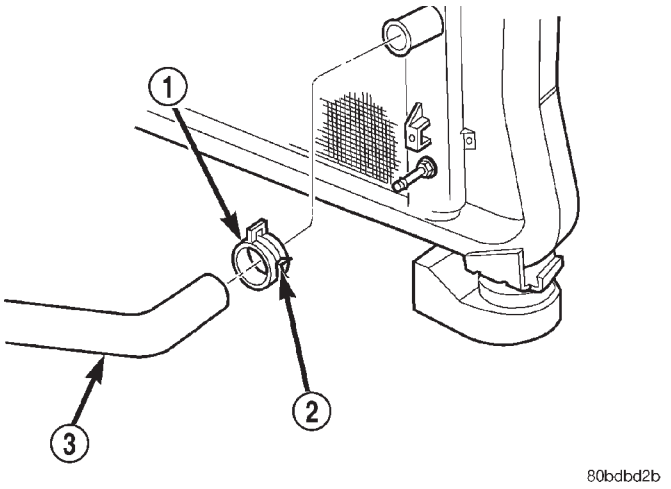



*Fig. 15 Clamp Number/Letter Location*

1 – CONSTANT TENSION HOSE CLAMP
2 – CLAMP NUMBER/LETTER LOCATION
3 – HOSE

For all vehicles: In areas where specific routing clamps are not provided, be sure that hoses are positioned with sufficient clearance. Check clearance from exhaust manifolds and pipe, fan blades, drive belts and sway bars. Improperly positioned hoses can be damaged, resulting in coolant loss and engine overheating.

When performing a hose inspection, inspect the radiator lower hose for proper position and condition of the internal spring.

## VISCOUS FAN DRIVE

### DESCRIPTION

**CAUTION: Engines equipped with serpentine drive belts have reverse rotating fans and viscous fan drives. They are marked with the word REVERSE to designate their usage. Installation of the wrong fan or viscous fan drive can result in engine overheating.**

**CAUTION: If the viscous fan drive is replaced because of mechanical damage, the cooling fan blades should also be inspected. Inspect for fatigue cracks, loose blades, or loose rivets that could have resulted from excessive vibration. Replace fan blade assembly if any of these conditions are found. Also inspect water pump bearing and shaft assembly for any related damage due to a viscous fan drive malfunction.**

DESCRIPTION AND OPERATION (Continued)

The thermal viscous fan drive (Fig. 16) is a silicone-fluid-filled coupling used to connect the fan blades to the water pump shaft. The coupling allows the fan to be driven in a normal manner. This is done at low engine speeds while limiting the top speed of the fan to a predetermined maximum level at higher engine speeds.

On all 4.7L an electrical cooling fan located in the fan shroud aids in low speed cooling, It is designed to augment the viscous fan, However, it does not replace the viscous fan.

On the 4.0L engines an electric fan is standard and the viscous fan is added on trailer tow packages only.

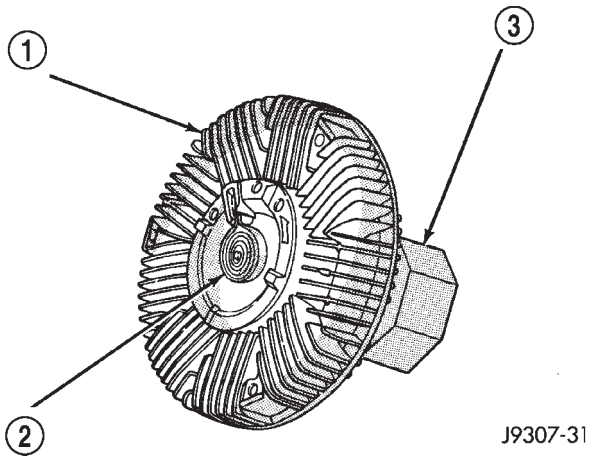



***Fig. 16 Viscous Fan Drive—4.0L and 4.7L Engines—Typical***

1 – VISCOUS FAN DRIVE
2 – THERMOSTATIC SPRING
3 – MOUNTING NUT TO WATER PUMP HUB

## OPERATION

A thermostatic bimetallic spring coil is located on the front face of the viscous fan drive unit (Fig. 16). This spring coil reacts to the temperature of the radiator discharge air. It engages the viscous fan drive for higher fan speed if the air temperature from the radiator rises above a certain point. Until additional engine cooling is necessary, **the fan will remain at a reduced rpm regardless of engine speed. Normally less than three hundred (300) rpm.**

Only when sufficient heat is present, will the viscous fan drive engage. This is when the air flowing through the radiator core causes a reaction to the bimetallic coil. It then increases fan speed to provide the necessary additional engine cooling.

Once the engine has cooled, the radiator discharge temperature will drop. The bimetallic coil again reacts and the fan speed is reduced to the previous disengaged speed.

# DIAGNOSIS AND TESTING

## ON-BOARD DIAGNOSTICS (OBD)

### FOR CERTAIN COOLING SYSTEM COMPONENTS

The powertrain control module (PCM) has been programmed to monitor certain cooling system components:

**NOTE: If the engine has remained cool for too long a period, such as with a stuck open thermostat, a Diagnostic Trouble Code (DTC) number 17 can be observed at the malfunction indicator lamp. This lamp is displayed on the instrument panel as the CHECK ENGINE lamp (Fig. 17).**

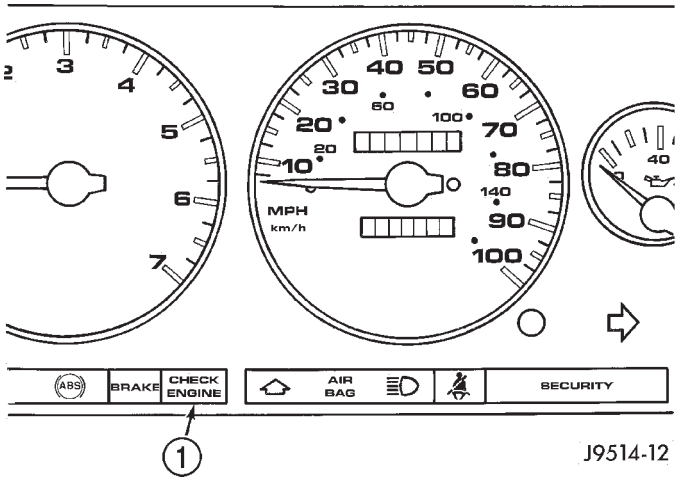



***Fig. 17 Check Engine Lamp Location***

1 – CHECK ENGINE LAMP

If the problem is sensed in a monitored circuit often enough to indicate an actual problem, a DTC is stored. The DTC will be stored in the PCM memory for eventual display to the service technician. If the problem is repaired or ceases to exist, the PCM cancels the DTC after 51 engine starts.

Certain criteria must be met for a DTC to be entered into PCM memory. The criteria may be a specific range of engine rpm, engine temperature and/or input voltage to the PCM.

A DTC indicates that the PCM has recognized an abnormal signal in a circuit or the system. A DTC may indicate the result of a failure, but never identify the failed component directly.

It is possible that a DTC for a monitored circuit may not be entered into memory even though a malfunction has occurred. Refer to On- Board Diagnostics (OBD) in Group 25, Emission Control Systems for additional information.

DIAGNOSIS AND TESTING (Continued)

## ACCESSING DIAGNOSTIC TROUBLE CODES

A stored Diagnostic Trouble Code (DTC) can be displayed by cycling the ignition key On-Off-On-Off-On within three seconds and observing the malfunction indicator lamp. This lamp is displayed on the instrument panel as the CHECK ENGINE lamp (Fig. 17).

They can also be displayed through the use of the Diagnostic Readout Box (DRB) scan tool. The DRB connects to the data link connector, left of the steering column above the brake pedal (Fig. 18). For operation of the DRB, refer to the appropriate Powertrain Diagnostic Procedures service manual.

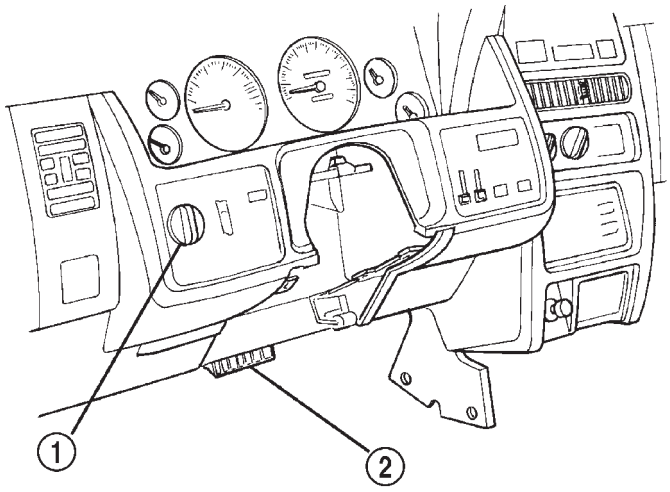



***Fig. 18 Data Link Connector Location***

1 – HEADLAMP SWITCH
2 – DATA LINK CONNECTOR (LEFT SIDE OF COLUMN ABOVE BRAKE PEDAL)

EXAMPLES:

- If the lamp (Fig. 17) flashes 1 time, pauses and flashes 2 more times, a flashing Diagnostic Trouble Code (DTC) number 12 is indicated. If this code is observed, it is indicating that the battery has been disconnected within the last 50 key-on cycles. It could also indicate that battery voltage has been disconnected to the PCM. In either case, other DTC's may have been erased.
- If the lamp flashes 1 time, pauses and flashes 7 more times, a flashing Diagnostic Trouble Code (DTC) number 17 is indicated.

After any stored DTC information has been observed, the display will end with a flashing DTC number 55. This will indicate the end of all stored information.

## ERASING TROUBLE CODES

After the problem has been repaired, use the DRB scan tool to erase a DTC. Refer to the appropriate Powertrain Diagnostic Procedures service manual for operation of the DRB scan tool.

## DRB SCAN TOOL

For operation of the DRB scan tool, refer to the appropriate Powertrain Diagnostic Procedures service manual.

## WATER PUMP TESTS

### LOOSE IMPELLER—4.0L and 4.7L

**NOTE: Due to the design of the 4.0L and 4.7L engine water pumps, testing the pump for a loose impeller must be done by verifying coolant flow in the radiator. To accomplish this refer to the following procedure.**

DO NOT WASTE reusable coolant. If solution is clean, drain coolant into a clean container for reuse.

(1) Drain coolant until the first row of cores is visible in the radiator.

(2) Leaving the radiator cap off, start the engine

(3) While looking into the radiator through the radiator fill neck, raise engine rpm to 2000 RPM. Observe the flow of coolant from the first row of cores.

(4) If there is no flow or very little flow visable, replace the water pump.

### INSPECTING FOR INLET RESTRICTIONS

Inadequate heater performance may be caused by a metal casting restriction in the heater hose inlet.

DO NOT WASTE reusable coolant. If solution is clean, drain the coolant into a clean container for reuse.

**WARNING: DO NOT LOOSEN THE RADIATOR DRAINCOCK WITH THE SYSTEM HOT AND UNDER PRESSURE. SERIOUS BURNS FROM THE COOLANT CAN OCCUR.**

(1) Drain sufficient coolant from the radiator to decrease the level below the heater hose inlet. On 4.7L engines this requires complete draining.

(2) Remove the heater hose.

(3) Inspect the inlet for metal casting flash or other restrictions.

**NOTE: On 4.0L engines remove the pump from the engine before removing restriction to prevent contamination of the coolant with debris. Refer to Water Pump Removal in this section. On 4.7L engine remove the fitting from the timing chain cover, If the restriction is in the timing chain cover, remove the timing chain cover. Refer to Timing Chain Cover in Group 9 Engine, for procedure.**

DIAGNOSIS AND TESTING (Continued)

## THERMOSTAT

### ON-BOARD DIAGNOSTICS

All models are equipped with On-Board Diagnostics for certain cooling system components. Refer to On-Board Diagnostics (OBD) in the Diagnosis section of this group for additional information. If the powertrain control module (PCM) detects low engine coolant temperature, it will record a Diagnostic Trouble Code (DTC). Refer to the Diagnosis section of this group for other probable causes. For other DTC numbers, refer to On-Board Diagnostics in Group 25, Emission Control Systems.

The DTC can also be accessed through the DRB scan tool. Refer to the appropriate Powertrain Diagnostic Procedures manual for diagnostic information and operation of the DRB scan tool.

### SERPENTINE DRIVE BELT DIAGNOSIS

When diagnosing serpentine drive belts, small cracks that run across ribbed surface of belt from rib to rib (Fig. 19), are considered normal. These are not a reason to replace belt. However, cracks running along a rib (not across) are **not** normal. Any belt with cracks running along a rib must be replaced (Fig. 19). Also replace belt if it has excessive wear, frayed cords or severe glazing.

Refer to the Serpentine Drive Belt Diagnosis charts for further belt diagnosis.

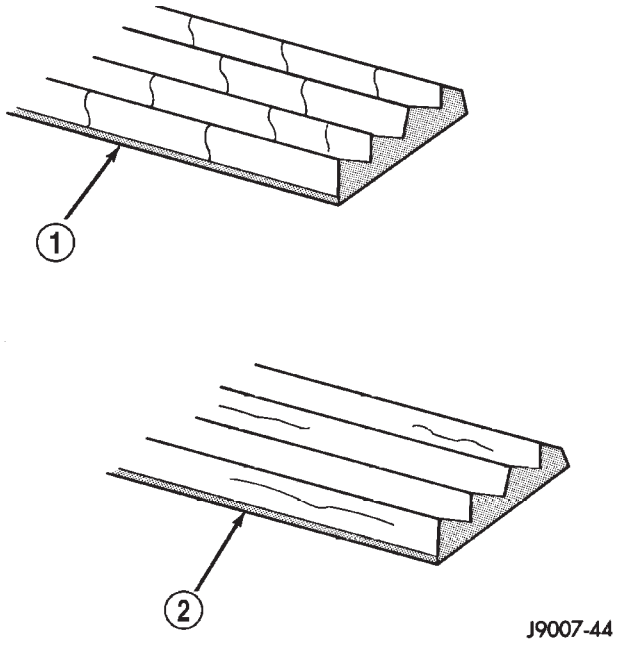



***Fig. 19 Serpentine Accessory Drive Belt Wear Patterns***

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

| SERPENTINE DRIVE BELT DIAGNOSIS | | |
|---|---|---|
| **CONDITION** | **POSSIBLE CAUSES** | **CORRECTION** |
| RIB CHUNKING (ONE OR MORE RIBS HAS SEPARATED FROM BELT BODY) | 1. Foreign objects imbedded in pulley grooves. | 1. Remove foreign objects from pulley grooves. Replace belt. |
| | 2. Installation damage. | 2. Replace belt. |
| RIB OR BELT WEAR | 1. Pulley(s) misaligned. | 1. Align pulley(s). |
| | 2. Abrasive environment. | 2. Clean pulley(s). Replace belt if necessary. |
| | 3. Rusted pulley(s). | 3. Clean rust from pulley(s). |
| | 4. Sharp or jagged pulley groove tips. | 4. Replace pulley. |
| | 5. Rubber deteriorated. | 5. Replace belt. |
| LONGITUDINAL BELT CRACKING (CRACKS BETWEEN TWO RIBS) | 1. Belt has mistracked from pulley groove. | 1. Replace belt. |
| | 2. Pulley groove tip has worn away rubber to tensile member. | 2. Replace belt. |

DIAGNOSIS AND TESTING (Continued)

| SERPENTINE DRIVE BELT DIAGNOSIS | | |
|---|---|---|
| **CONDITION** | **POSSIBLE CAUSES** | **CORRECTION** |
| BELT SLIPS | 1. Belt slipping because of insufficient tension. | 1. Replace automatic belt tensioner. |
| | 2. Belt routed incorrectly | 2. Verify belt routing. |
| | 3. Incorrect belt. | 3. Replace belt. |
| | 4. Belt or pulley subjected to substance (belt dressing, oil ethylene glycol) that has reduced friction. | 4. Replace belt and clean pulleys. |
| | 5. Driven component bearing failure. | 5. Replace faulty component bearing. |
| | 6. Belt glazed and hardened from heat and excessive slippage. | 6. Replace belt. |
| "GROOVE JUMPING" (BELT DOES NOT MAINTAIN CORRECT POSITION ON PULLEY) | 1. Belt tension either too high or too low. | 1. Replace automatic belt tensioner. |
| | 2. Belt routed incorrectly. | 2. Verify belt routing. |
| | 3. Incorrect belt. | 3. Replace belt. |
| | 4. Pulley(s) not within design tolerance. | 4. Replace pulley(s). |
| | 5. Foreign object(s) in grooves. | 5. Remove foreign objects from grooves. |
| | 6. Pulley misalignment. | 6. Check and replace. |
| | 7. Belt cord line is broken. | 7. Replace belt. |
| BELT BROKEN (NOTE: IDENTIFY AND CORRECT PROBLEM BEFORE NEW BELT IS INSTALLED) | 1. Excessive tension. | 1. Replace belt and automatic belt tensioner. |
| | 2. Incorrect belt. | 2. Replace belt. |
| | 3. Tensile member damaged during belt installation. | 3. Replace belt. |
| | 4. Severe misalignment. | 4. Check and replace. |
| | 5. Bracket, pulley, or bearing failure. | 5. Replace defective component and belt. |
| NOISE (OBJECTIONABLE SQUEAL, SQUEAK, OR RUMBLE IS HEARD OR FELT WHILE DRIVE BELT IS IN OPERATION) | 1. Belt slippage. | 1. Replace belt or automatic belt tensioner. |
| | 2. Bearing noise. | 2. Locate and repair. |
| | 3. Belt misalignment. | 3. Replace belt. |
| | 4. Belt-to-pulley mismatch. | 4. Install correct belt. |

DIAGNOSIS AND TESTING (Continued)

## PRELIMINARY CHECKS

### ENGINE COOLING SYSTEM OVERHEATING

Establish what driving conditions caused the complaint. Abnormal loads on the cooling system such as the following may be the cause.

(1) PROLONGED IDLE, VERY HIGH AMBIENT TEMPERATURE, SLIGHT TAIL WIND AT IDLE, SLOW TRAFFIC, TRAFFIC JAMS, HIGH SPEED, OR STEEP GRADES:

Driving techniques that avoid overheating are:

- Idle with A/C off when temperature gauge is at end of normal range.
- Increasing engine speed for more air flow is recommended.

(2) TRAILER TOWING:

Consult Trailer Towing section of owners manual. Do not exceed limits.

(3) RECENT SERVICE OR ACCIDENT REPAIR:

Determine if any recent service has been performed on vehicle that may effect cooling system. This may be:

- Engine adjustments (incorrect timing)
- Slipping engine accessory drive belt(s)
- Brakes (possibly dragging)
- Changed parts (incorrect water pump rotating in wrong direction)
- Reconditioned radiator or cooling system refilling (possibly under-filled or air trapped in system).
- Rubber and foam air seals not properly installed to radiator or A/C condenser after a repair.
- Upper and lower portions of radiator fan shroud not tightly connected. All air must flow through the radiator.
- Electric fan not functioning, (disconnected or damaged).

**NOTE: If investigation reveals none of the previous items as a cause for an engine overheating complaint, refer to Cooling System Diagnosis charts.**

These charts are to be used as a quick-reference only. Refer to the group text for information.

## COOLING SYSTEM DIAGNOSIS

*COOLING SYSTEM DIAGNOSIS CHART*

| CONDITION | POSSIBLE CAUSES | CORRECTION |
|---|---|---|
| TEMPERATURE GAUGE READS LOW | 1. Has a Diagnostic Trouble Code (DTC) been set indicating a stuck open engine thermostat. | 1. Refer to group 25, Emission Control Systems. Replace thermostat if necessary. If a Diagnostic Trouble Code (DTC) has not been set, the problem may be with the temperature gauge. |
| | 2. Temperature gauge (if equipped) disconnected from the temperature gauge coolant sensor on the engine | 2. Check the engine temperature sensor connector in the engine compartment. Refer to Group 8E. Repair as necessary. |
| | 3. Defective temperature gauge (if equipped) | 3. Check gauge operation. Refer to Group 8E. Repair as necessary. |
| | 4. Coolant level low in cold ambient temperatures accompanied with poor heater performance. | 4. Check coolant level in the coolant reserve/overflow tank and the radiator. Inspect system for leaks. Repair leaks as necessary. Refer to the Coolant section of the manual text for Warnings and precautions before removing the radiator cap. |
| | 5. Improper operation of internal heater doors or heater controls. | 5. Inspect heater and repair as necessary. Refer to Group 24, Heating and Air Conditioning for procedures. |
| | 6. Electric fan functioning when not required. | 6. Inspect electric fan for proper operation. Refer to Electric Cooling Fan in this section. Refer to Group 8W for electric cooling fan and relay circuit schematic data. |

DIAGNOSIS AND TESTING (Continued)

| CONDITION | POSSIBLE CAUSES | CORRECTION |
|---|---|---|
| TEMPERATURE GAUGE READS HIGH OR ENGINE COOLANT WARNING LAMP ILLUMINATES. COOLANT MAY OR MAY NOT BE LOST OR LEAKING FROM COOLING SYSTEM | 1. Trailer is being towed, a steep hill is being climbed, vehicle is operated in slow moving traffic, or engine is being idled with very high ambient (outside) temperatures and the air conditioning is on. Higher altitudes could aggravate these conditions. | 1. This may be a temporary condition and repair is not necessary. Turn off the air conditioning and attempt to 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 normal range, determine the cause for overheating and repair. Refer to POSSIBLE CAUSES (numbers 2 through 18). |
| | 2. Defective temperature gauge (if equipped) | 2. Check gauge. Refer to Group 8E. Repair as necessary. |
| | 3. Defective temperature warning lamp (if equipped) | 3. Check warning lamp operation. Refer to Group 8E. Repair as necessary. |
| | 4. Coolant low in coolant reserve/ overflow tank and radiator? | 4. Check for coolant leaks and repair as necessary. Refer to Testing Cooling System for Leaks in this group. |
| | 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. |
| | 6. Poor seals at radiator cap. | 6. (a) Check condition of cap and cap seals. Refer to Radiator Cap. Replace cap if necessary.<br>(b) Check condition of radiator filler neck. If neck is bent or damaged, replace radiator. |
| | 7. Coolant level low in radiator but not in coolant reserve/overflow tank. This means the radiator is not drawing coolant from the coolant reserve/ overflow tank as the engine cools. As the engine cools, a vacuum is formed in the cooling system of the engine and radiator. If radiator cap seals are defective, or cooling system has leaks, a vacuum can not be formed. | 7. (a) Check condition of radiator cap and cap seals. Refer to Radiator Cap in this group. Replace cap if necessary.<br>(b) Check condition of radiator filler neck. If neck is bent or damaged, replace radiator.<br>(c) Check the condition of the hose from the radiator to the coolant tank. It should fit tight at both ends without any kinks or tears. Replace hose if necessary.<br>(d) Check coolant reserve/overflow tank and tank hoses for blockage. Repair as necessary |
| | 8. Freeze point of antifreeze not correct. Mixture may be too rich. | 8. Check antifreeze. Refer to Coolant section of this group. Adjust antifreeze-to-water ratio as required. |

DIAGNOSIS AND TESTING (Continued)

| CONDITION | POSSIBLE CAUSES | CORRECTION |
|---|---|---|
| | 9. Coolant not flowing through system. | 9. Check for coolant flow at radiator filler neck with some coolant removed, engine warm and thermostat open. Coolant should be observed flowing through radiator. If flow is not observed, determine reason for lack of flow and repair as necessary. |
| | 10. Radiator or A/C condenser fins dirty or clogged. | 10. Clean insects or debris. Refer to Radiator Cleaning in this group. |
| | 11. Radiator core is corroded or plugged. | 11. Have radiator re-cored or replaced. |
| | 12. Fuel or ignition system problems. | 12. Refer to Fuel and Ignition System groups for diagnosis. Also refer to the appropriate Powertrain Diagnostic Procedures service manual for operation of the DRB scan tool. |
| | 13. Dragging brakes. | 13. Check and correct as necessary. Refer to Group 5, Brakes in the manual text. |
| | 14. Bug screen is being used reducing airflow. | 14. Remove bug screen. |
| | 15. Thermostat partially or completely shut. This is more prevalent of high mileage vehicles. | 15. Check thermostat operation and replace as necessary. Refer to Thermostats in this group. |
| | 16. Thermal viscous fan drive not operating properly. | 16. Check fan drive operation and replace if necessary. Refer to Viscous Fan Drive in this group. |
| | 17. Cylinder head gasket leaking. | 17. Check for cylinder head gasket leaks. Refer to Testing Cooling System for Leaks in this group. For repair, refer to Group 9, Engines. |
| | 18. Heater core leaking. | 18. Check heater core for leaks. Refer to Group 24, Heating and Air Conditioning. Repair as necessary. |
| | 19. Electric fan not functioning. | 19. Inspect electric fan for proper operation. Refer to Electric Cooling Fan in this section. Refer to Group 8W for electric cooling fan and relay circuit schematic data. |

DIAGNOSIS AND TESTING (Continued)

| CONDITION | POSSIBLE CAUSES | CORRECTION |
|---|---|---|
| TEMPERATURE GAUGE READING IS INCONSISTENT (FLUCTUATES, CYCLES OR IS ERRATIC) | 1. During cold weather operation, with the heater blower in the high position, the gauge reading may drop slightly. | 1. A normal condition. No correction is necessary. |
| | 2. Temperature gauge or engine mounted gauge sensor defective or shorted. Also, corroded or loose wiring in the circuit. | 2. Check operation of gauge and repair if necessary. Refer to Group 8E, Instrument Panel and Gauges. |
| | 3. Gauge reading rises when vehicle is brought to a stop after heavy use (engine still running). | 3. A normal condition. No correction is necessary. Gauge reading should return to normal range after vehicle is driven. |
| | 4. Gauge reading high after restarting a warmed-up (hot) engine. | 4. A normal condition. No correction is necessary. The gauge should return to normal range after a few minutes of engine operation. |
| | 5. Coolant level low in radiator (air will build up in the cooling system causing the thermostat to open late). | 5. Check and correct coolant leaks. Refer to Testing Cooling System for Leaks in this group. |
| | 6. Cylinder head gasket leaking allowing exhaust gas to enter cooling system causing thermostat to open late. | 6. (a) Check for cylinder head gasket leaks with a commercially available Block Leak Tester. Repair as necessary. (b) Check for coolant in the engine oil. Inspect for white steam emitting from exhaust system. Repair as necessary. |
| | 7. Water pump impeller loose on shaft. | 7. Check water pump and replace as necessary. Refer to Water Pumps in this group. |
| | 8. Loose accessory drive belt (water pump slipping). | 8. Refer to Engine Accessory Drive Belts in this group. Check and correct as necessary. |
| | 9. Air leak on the suction side of water pump allows air to build up in cooling system causing thermostat to open late. | 9. 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)

| 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.<br>2. Freeze point of antifreeze not correct. Mixture is too rich or too lean. | 1. Check reason for overheating and repair as necessary.<br>2. Check antifreeze. Refer to the Coolant section of this group. Adjust antifreeze-to-water ratio as required. |
| HOSE OR HOSES COLLAPSED 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.<br>(b) Hose between coolant reserve/ overflow tank and radiator is kinked. Repair as necessary.<br>(c) Vent at coolant reserve/overflow tank is plugged. Clean vent and repair as necessary.<br>(d) Reserve/overflow tank is interally blocked or plugged. Check for blockage and repair as necessary. |
| NOISY FAN | 1. Fan blades loose.<br>2. Fan blades striking a surrounding object.<br>3. Air obstructions at radiator or air conditioning condenser.<br>4. Thermal viscous fan drive has defective bearing.<br>5. A certain amount of fan noise (roaring) may be evident from the thermal viscous fan drive. Some of this noise is normal. | 1. Replace fan blade assembly. Refer to Cooling System Fans in this group.<br>2. Locate point of fan blade contact and repair as necessary.<br>3. Remove obstructions and/or clean debris or insects from radiator or A/C condenser.<br>4. Replace fan drive. Bearing is not serviceable. Refer to Viscous Fan Drive in this group.<br>5. Refer to Viscous Fan Drive in this group for an explanation of normal fan noise. |

DIAGNOSIS AND TESTING (Continued)

| CONDITION | POSSIBLE CAUSES | CORRECTION |
|---|---|---|
| INADEQUATE AIR CONDITIONER PERFORMANCE (COOLING SYSTEM SUSPECTED) | 1. Radiator and/or A/C condenser is restricted, obstructed or dirty (insects, leaves etc.) | 1. Remove restriction and/or clean as necessary. Refer to Radiator Cleaning in this group. |
| | 2. Electric fan not functioning. | 2. Inspect electric fan for proper operation. Refer to Electric Cooling Fan in this section. |
| | 3. Engine is overheating (heat may be transferred from radiator to A/C condenser. High underhood temperatures due to engine overheating may also transfer heat to A/C components). | 3. Correct overheating condition. Refer to text in Group 7, Cooling. |
| | 4. All models with are equipped with air seals at the radiator and/or A/C condenser. If these seals are missing or damaged, not enough air flow will be pulled through the radiator and A/C condenser. | 4. Check for missing or damaged air seals and repair as necessary. |
| INADEQUATE HEATER PERFORMANCE. THERMOSTAT FAILED IN OPEN POSITION | 1. Has a diagnostic trouble code (DTC) been set? | 1. Refer to group 25, Emission Control System and replace thermostat if necessary. |
| | 2. Coolant level low. | 2. Refer to Testing Cooling System for Leaks in the manual text. 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 water to heater core. When the engine is fully warmed up, both heater hoses should be hot to the touch. If only one of the hoses is hot, the water pump may not be operating correctly. The accessory drive belt may also be slipping causing poor water pump operation. | 5. Refer to Water Pumps in this group. Repair as necessary. If a slipping belt is detected, refer to Engine Accessory Drive Belts in this group. Repair as necessary. |

DIAGNOSIS AND TESTING (Continued)

| CONDITION | POSSIBLE CAUSES | CORRECTION |
|---|---|---|
| HEAT ODOR | 1. Various heat shields are used at certain drive line components. One or more of these shields may be missing. | 1. Locate missing shields and replace or repair as necessary. |
| | 2. Engine running hot | 2. Preform thermostat, water pump and fan test. Repair or replace as necessary. |
| | 3. Cooling fan malfunctioning. | 3. Refer to Cooling System Fan in this group for diagnosis. Repair as necessary |
| | 4. Undercoating or other contaminate applied to cooling or exhaust system. | 4. Clean as necessary. |
| | 5. Engine may be running rich causing the catalytic converter to overheat. | 5. Refer to the DRB scan tool and the appropriate Powertrain Diagnostic Procedures service manual. 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 group 25, Emission Control System. DTC's may also be checked using the DRB scan tool. Refer to the proper Powertrain Diagnostics Procedures service 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. Refer to Coolant in this group for antifreeze tests. Adjust antifreeze-to-water ratio as necessary. |
| 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)

## RADIATOR COOLANT FLOW CHECK

**NOTE: Due to the thermostat design used on the 4.7L engine this test only applies to the 4.0L engine.**

The following procedure will determine if coolant is flowing through the cooling system.

If engine is cold, idle engine until normal operating temperature is reached. Then feel the upper radiator hose. If hose is hot, the thermostat is open and water is circulating through cooling system.

## COOLING SYSTEM—TESTING FOR LEAKS

### ULTRAVIOLET LIGHT METHOD

All Jeep models have a leak detection additive added to the cooling system before they leave the factory. The additive is highly visible under ultraviolet light (black light). If the factory original coolant has been drained, pour one ounce of additive into the cooling system. The additive is available through the parts department. Place the heater control unit in HEAT position. Start and operate the engine until the radiator upper hose is warm to the touch. Aim the commercially available black light tool at the components to be checked. If leaks are present, the black light will cause the additive to glow a bright green color.

The black light can be used along with a pressure tester to determine if any external leaks exist (Fig. 20).

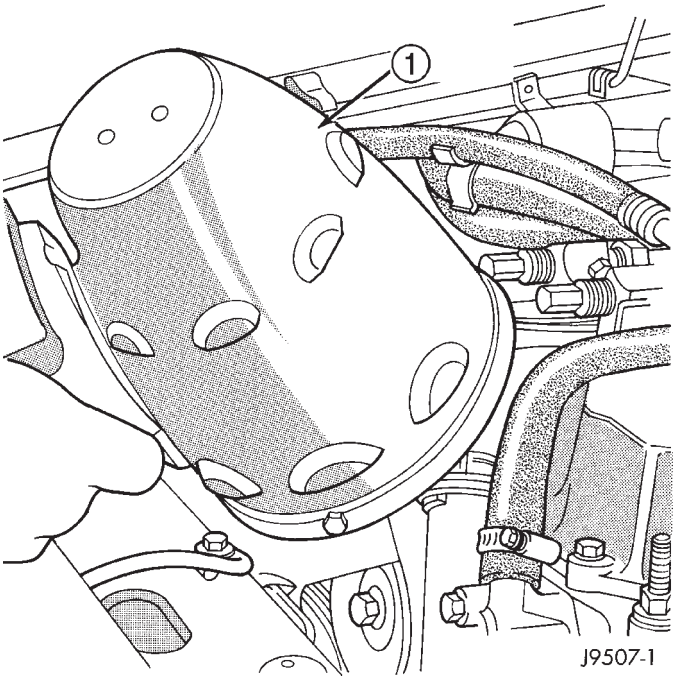



***Fig. 20 Leak Detection Using Black Light—Typical***
1 – TYPICAL BLACK LIGHT TOOL

### PRESSURE TESTER METHOD

The engine should be at the normal operating temperature. Recheck the system cold if the cause of coolant loss is not located during warm engine examination.

**WARNING: HOT, PRESSURIZED COOLANT CAN CAUSE INJURY BY SCALDING.**

Carefully remove the radiator pressure cap from the filler neck and check the coolant level. Push down on the cap to disengage it from the stop tabs. Wipe the inner part of the filler neck and examine the lower inside sealing seat for nicks, cracks, paint, dirt and solder residue. Inspect the reserve/overflow tank tube for internal obstructions. Insert a wire through the tube to be sure it is not obstructed.

Inspect the cams on the outside part of the filler neck. If the cams are damaged, seating of pressure cap valve and tester seal will be affected. Replace cap if cams are damaged.

Attach pressure tester 7700 (or equivalent) to the radiator filler neck (Fig. 21).

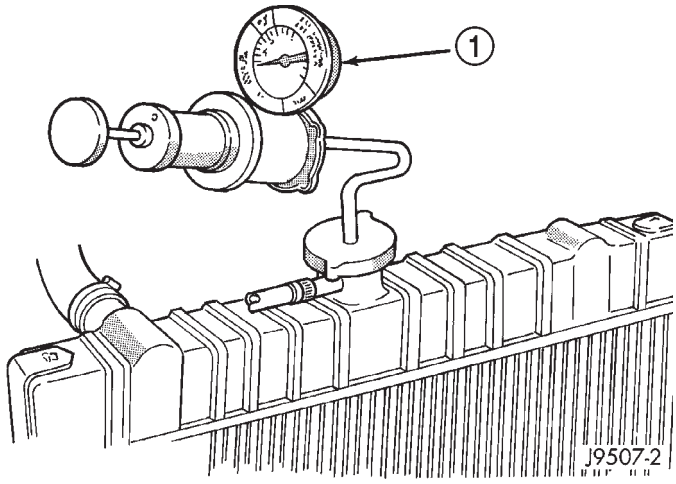



***Fig. 21 Pressurizing System—Typical***
1 – TYPICAL COOLING SYSTEM PRESSURE TESTER

Operate the tester pump to apply 124 kPa (18 psi) pressure to the system. If the hoses enlarge excessively or bulge while testing, replace as necessary. Observe the gauge pointer and determine the condition of the cooling system according to the following criteria:

- Holds Steady: If the pointer remains steady for two minutes, there are no serious coolant leaks in the system. However, there could be an internal leak that does not appear with normal system test pressure. Inspect for interior leakage or do the Internal Leakage Test. Do this if it is certain that coolant is being lost and no leaks can be detected.

DIAGNOSIS AND TESTING (Continued)

- Drops Slowly: Shows a small leak or seepage is occurring. Examine all connections for seepage or slight leakage with a flashlight. Inspect the radiator, hoses, gasket edges and heater. Seal any small leak holes with a Sealer Lubricant or equivalent. Repair leak holes and reinspect the system with pressure applied.
- Drops Quickly: Shows that a serious leakage is occurring. Examine the system for serious external leakage. If no leaks are visible, inspect for internal leakage.

### INTERNAL LEAKAGE INSPECTION

Remove the oil pan drain plug and drain a small amount of engine oil. Coolant, being heavier, will drain first, or operate engine to churn oil, then examine dipstick for water globules. Inspect the transmission dipstick for water globules. Inspect the transmission fluid cooler for leakage. Operate the engine without the pressure cap on the radiator until thermostat opens.

Attach a Pressure Tester to the filler neck. If pressure builds up quickly, a leak exists as result of a faulty cylinder head gasket or crack in the engine. Repair as necessary.

**WARNING: DO NOT ALLOW PRESSURE TO EXCEED 124 KPA (18 PSI). TURN THE ENGINE OFF. TO RELEASE THE PRESSURE, ROCK THE TESTER FROM SIDE TO SIDE. WHEN REMOVING THE TESTER, DO NOT TURN THE TESTER MORE THAN 1/2 TURN IF THE SYSTEM IS UNDER PRESSURE.**

If there is no immediate pressure increase, pump the Pressure Tester until the indicated pressure is within the system range. Vibration of the gauge pointer indicates compression or combustion leakage into the cooling system.

### COMBUSTION LEAKAGE TEST (WITHOUT PRESSURE TESTER)

DO NOT WASTE reusable coolant. If the solution is clean, drain the coolant into a clean container for reuse.

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

Drain sufficient coolant to allow for thermostat removal. Refer to Thermostat Replacement. Remove the accessory drive belt.

On 4.0L, Disconnect the radiator upper hose from the thermostat housing. Remove the housing and thermostat. Install the thermostat housing and hose.

On 4.7L, Disconnect the radiator lower hose from the thermostat housing. Remove the housing and thermostat. Install the thermostat housing and hose.

Add coolant to the radiator to bring the level to within 6.3 mm (1/4 in) of the top of the thermostat housing.

**CAUTION: Avoid overheating. Do not operate the engine for an excessive period of time. Open the draincock immediately after the test to eliminate boil over of coolant.**

Start the engine and accelerate rapidly three times (to approximately 3000 rpm) while observing the coolant. If internal engine combustion gases are leaking into the cooling system, bubbles will appear in the coolant. If bubbles do not appear, there is no internal combustion gas leakage.

## VISCOUS FAN DRIVE

### TESTING

If the fan assembly free-wheels without drag (the fan blades will revolve more than five turns when spun by hand), replace the fan drive. This spin test must be performed when the engine is cool.

For the following test, the cooling system must be in good condition. It also will ensure against excessively high coolant temperature.

**WARNING: BE SURE THAT THERE IS ADEQUATE FAN BLADE CLEARANCE BEFORE DRILLING.**

(1) Drill a 3.18-mm (1/8-in) diameter hole in the top center of the fan shroud.

(2) Obtain a dial thermometer with an 8 inch stem (or equivalent). It should have a range of -18° to 105°C (0° to 220° F). Insert thermometer through the hole in the shroud. Be sure that there is adequate clearance from the fan blades.

(3) Connect a tachometer and an engine ignition timing light (timing light is to be used as a strobe light).

(4) Block the air flow through the radiator. Secure a sheet of plastic in front of the radiator (or air conditioner condenser). Use tape at the top to secure the plastic and be sure that the air flow is blocked.

(5) Be sure that the air conditioner (if equipped) is turned off.

**WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING. DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.**

DIAGNOSIS AND TESTING (Continued)

(6) Start the engine and operate at 2400 rpm. Within ten minutes the air temperature (indicated on the dial thermometer) should be up to 93° C (200° F). Fan drive **engagement** should have started to occur at between 91° to 96° C (195° to 205° F). Engagement is distinguishable by a definite **increase** in fan flow noise (roaring). The timing light also will indicate an increase in the speed of the fan.

(7) When the air temperature reaches 93° C (200° F), remove the plastic sheet. Fan drive **disengagement** should have started to occur at between 62° to 85° C (145° to 185° F). A definite **decrease** of fan flow noise (roaring) should be noticed. If not, replace the defective viscous fan drive unit.

## ELECTRIC COOLING FAN

### ELECTRIC COOLING FAN AND RELAY DIAGNOSIS

**NOTE: Refer to Electrical Group 8W for electric cooling fan and relay circuit schematic.**

The powertrain control module (PCM) will enter a diagnostic trouble code (DTC) in memory if it detects a problem in the auxiliary cooling fan relay or circuit. Refer to Group 25, Emission Control Systems for correct DTC retrieval procedures.

If the electric cooling fan is inoperative, check the 15A fuse in the junction block and the 40A fuse in the Power Distribution Center (PDC) with a 12 volt test lamp or DVOM. Refer to the inside of the PDC cover for the exact location of the fuse. If fuses are o.k., refer to Group 8W for electric cooling fan and relay circuit schematic.

### RADIATOR CAP TO FILLER NECK SEAL—PRESSURE RELIEF CHECK

With radiator cap installed on filler neck, remove coolant reserve/overflow tank hose from nipple on filler neck. Connect a hand operated vacuum pump to nipple. Operate pump until a reading of 124 to 145 kPa (18 to 21 in. Hg) appears on gauge. If the reading stays steady, or drops slightly and then remains steady, the pressure valve seal is good. Replace radiator cap if reading does not hold.

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

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

- To check and adjust antifreeze freeze point.
- To refill system with new antifreeze.
- For conducting service procedures.
- When checking for leaks.

**WARNING: IF VEHICLE HAS BEEN RUN RECENTLY, WAIT AT LEAST 15 MINUTES BEFORE REMOVING RADIATOR CAP. WITH A RAG, SQUEEZE RADIATOR UPPER HOSE TO CHECK IF SYSTEM IS UNDER PRESSURE. PLACE A RAG OVER THE CAP AND WITHOUT PUSHING DOWN, ROTATE CAP COUNTER-CLOCKWISE TO THE FIRST STOP. ALLOW FLUID TO ESCAPE THROUGH OVERFLOW HOSE INTO COOLANT RESERVE/OVERFLOW TANK. SQUEEZE RADIATOR UPPER HOSE TO DETERMINE WHEN PRESSURE HAS BEEN RELEASED. WHEN COOLANT AND STEAM STOP BEING PUSHED INTO TANK AND SYSTEM PRESSURE DROPS, REMOVE RADIATOR CAP COMPLETELY.**

### RADIATOR CAP—PRESSURE TESTING

Remove cap from radiator. Be sure that sealing surfaces are clean. Moisten rubber gasket with water and install the cap on pressure tester (tool 7700 or an equivalent) (Fig. 22).

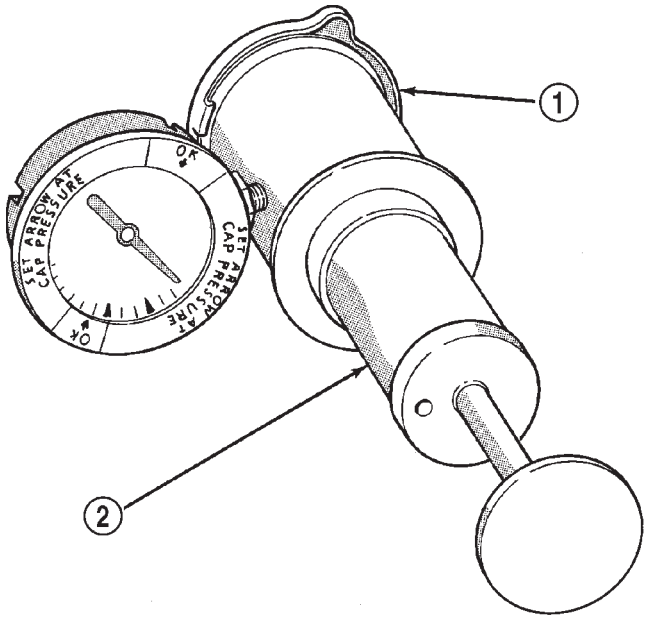



***Fig. 22 Pressure Testing Radiator Pressure Cap—Typical***

1 – PRESSURE CAP
2 – TYPICAL COOLING SYSTEM PRESSURE TESTER

Operate the tester pump and observe the gauge pointer at its highest point. The cap release pressure should be 124 to 145 kPa (18 to 21 psi). The cap is

DIAGNOSIS AND TESTING (Continued)

satisfactory when the pressure holds steady. It is also good if it holds pressure within the 124 to 145 kPa (18 to 21 psi) range for 30 seconds or more. If the pointer drops quickly, replace the cap.

**CAUTION: Radiator pressure testing tools are very sensitive to small air leaks, which 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 tool. Turn tool upside down and recheck pressure cap to confirm that cap needs replacement.**

## LOW COOLANT LEVEL-AERATION

If the coolant level in radiator drops below top of radiator core tubes, air will enter cooling system.

Low coolant level can cause thermostat pellet to be suspended in air instead of coolant. This will cause thermostat to open later, which in turn causes higher coolant temperature. Air trapped in cooling system also reduces amount of coolant circulating in heater core resulting in low heat output.

## DEAERATION

As the engine operates, any air trapped in cooling system gathers under the radiator cap. The next time the engine is operated, thermal expansion of coolant will push any trapped air past radiator cap into the coolant reserve/overflow tank. Here it escapes to the atmosphere into the tank. When the engine cools down the coolant, it will be drawn from the reserve/overflow tank into the radiator to replace any removed air.

## ENGINE BLOCK HEATER

If the unit does not operate (Fig. 23) (Fig. 24), 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 it's retainer clips and away from any components that may cause abrasion or damage, such as linkages, exhaust components, etc.**

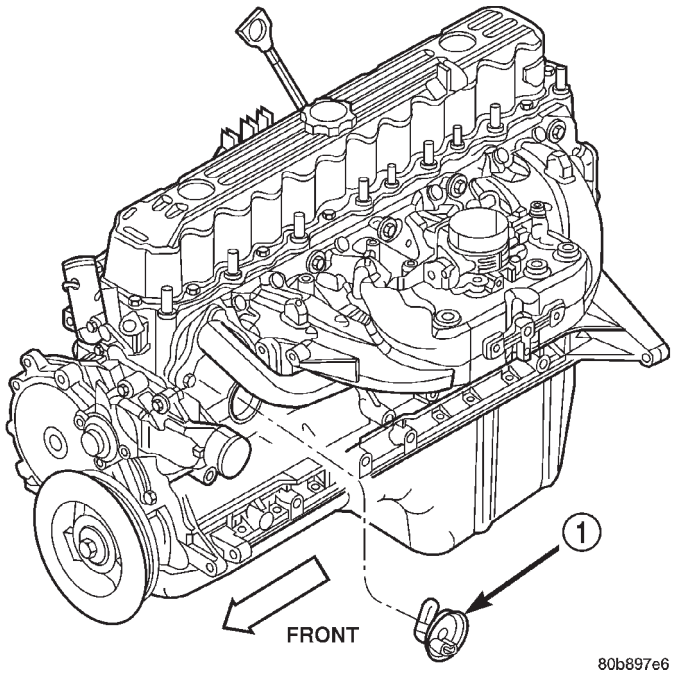



*Fig. 23 Engine Block Heater 4.0L Engine*

1 – ENGINE BLOCK HEATER

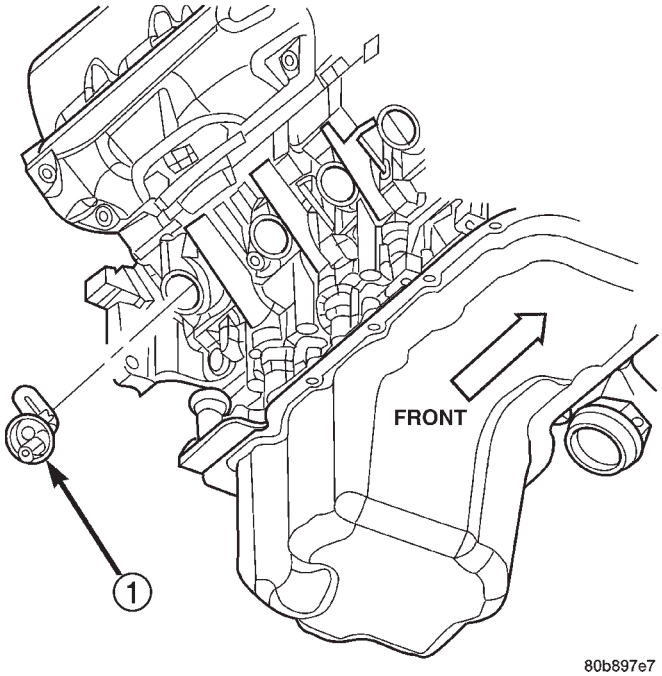



*Fig. 24 Engine Block Heater 4.7L Engine*

1 – ENGINE BLOCK HEATER

# SERVICE PROCEDURES

## COOLANT LEVEL—ROUTINE CHECK

**NOTE: Do not remove radiator cap for routine coolant level inspections. The coolant level can be checked at coolant reserve/overflow tank.**

The coolant reserve/overflow system provides a quick visual method for determining coolant level without removing radiator pressure cap. With engine idling and at normal operating temperature, observe coolant level in reserve/overflow tank. The coolant level should be between ADD and FULL marks.

## COOLANT

## DESCRIPTION

### ETHYLENE-GLYCOL MIXTURES

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

The required ethylene-glycol (antifreeze) and water mixture depends upon the climate and vehicle operating conditions. The recommended mixture of 50/50 ethylene-glycol and water will provide protection against freezing to -37 deg. C (-35 deg. F). The antifreeze concentration **must always** be a minimum of 44 percent, year-round in all climates. **If percentage is lower than 44 percent, engine parts may be eroded by cavitation, and cooling system components may be severely damaged by corrosion.** Maximum protection against freezing is provided with a 68 percent antifreeze concentration, which prevents freezing down to -67.7 deg. C (-90 deg. F). A higher percentage will freeze at a warmer temperature. Also, a higher percentage of antifreeze can cause the engine to overheat because the specific heat of antifreeze is lower than that of water.

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

### PROPYLENE-GLYCOL MIXTURES

It's overall effective temperature range is smaller than that of ethylene-glycol. The freeze point of 50/50 propylene-glycol and water is -32 deg. C (-26 deg. F). 5 deg. C higher than ethylene-glycol's freeze point. The boiling point (protection against summer boil-over) of propylene-glycol is 125 deg. C (257 deg. F ) at 96.5 kPa (14 psi), compared to 128 deg. C (263 deg. F) for ethylene-glycol. Use of propylene-glycol can result in boil-over or freeze-up on a cooling system designed for ethylene-glycol. Propylene glycol also has poorer heat transfer characteristics than ethylene glycol. This can increase cylinder head temperatures under certain conditions.

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

## OPERATION

### ETHYLENE-GLYCOL MIXTURES

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

## COOLANT SELECTION AND ADDITIVES

The presence of aluminum components in the cooling system requires strict corrosion protection. Maintain coolant at specified level with a mixture of ethylene-glycol based antifreeze and water. Daimler-Chrysler Corporation recommends Mopar Antifreeze or equivalent. If coolant becomes contaminated or looses color, drain and flush cooling system and fill with correctly mixed solution.

**CAUTION: Do not use coolant additives that are claimed to improve engine cooling.**

## COOLANT—ADDING ADDITIONAL

**Do not remove radiator cap to add coolant to system.** When adding coolant to maintain correct level, do so at coolant reserve/overflow tank. Use a 50/50 mixture of ethylene-glycol antifreeze and low mineral content water. Remove radiator cap only for testing or when refilling system after service. Removing cap unnecessarily can cause loss of coolant and allow air to enter system, which produces corrosion.

SERVICE PROCEDURES (Continued)

## SERVICE COOLANT LEVEL

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

**WARNING: DO NOT OPEN RADIATOR DRAINCOCK WITH ENGINE RUNNING OR WHILE ENGINE IS HOT AND COOLING SYSTEM IS UNDER PRESSURE.**

When vehicle servicing requires a coolant level check in radiator, drain several ounces of coolant from radiator drain cock. Do this while observing coolant reserve/overflow system tank. The coolant level in reserve/overflow tank should drop slightly. If not, inspect for a leak between radiator and coolant reserve/overflow system connection. Remove radiator cap. The coolant level should be to top of radiator. If not and if coolant level in reserve/overflow tank is at ADD mark, check for:

- An air leak in coolant reserve/overflow tank or its hose
- An air leak in radiator filler neck
- Leak in pressure cap seal to radiator filler neck

## DRAINING AND FILLING COOLING SYSTEM

### DRAINING COOLING SYSTEM

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

DO NOT WASTE reusable coolant. If the solution is clean, drain the coolant into a clean container for reuse.

### DRAINING ENTIRE SYSTEM

Use this procedure if the entire cooling system is to be drained, such as for engine removal.

(1) DO NOT remove radiator cap first. With engine cold, raise vehicle on a hoist and locate radiator draincock.

- 4.0L 6-cyl. Engine: Radiator draincock is located on the right/lower side of radiator facing to rear of vehicle.
- 4.7L V-8 Engines: Radiator draincock is located on the left/lower side of radiator facing to rear of vehicle.

(2) Attach one end of a hose to the draincock. Put the other end into a clean container. Open draincock and drain coolant from radiator. This will empty the coolant reserve/overflow tank. The coolant does not have to be removed from the tank unless the system is being refilled with a fresh mixture. When tank is empty, remove radiator cap and continue draining cooling system.

To drain the 4.0L 6-cylinder engine of coolant, remove the cylinder block drain plug located on the side of cylinder block (Fig. 25).

To drain the 4.7L V-8 engines of coolant, remove the cylinder block drain plugs located on the sides of cylinder block above the oil pan rail (Fig. 26).

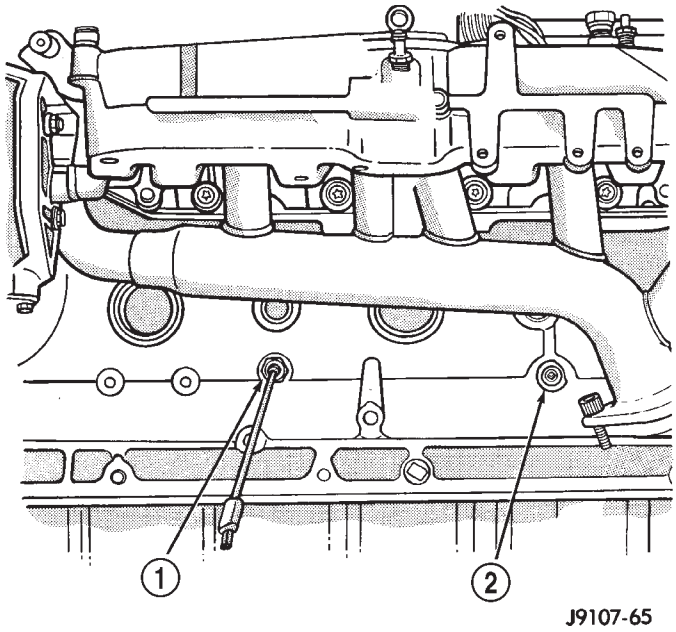



*Fig. 25 Drain Plug—4.0L Engine*

1 – COOLANT TEMPERATURE SENSOR
2 – BLOCK DRAIN PLUG

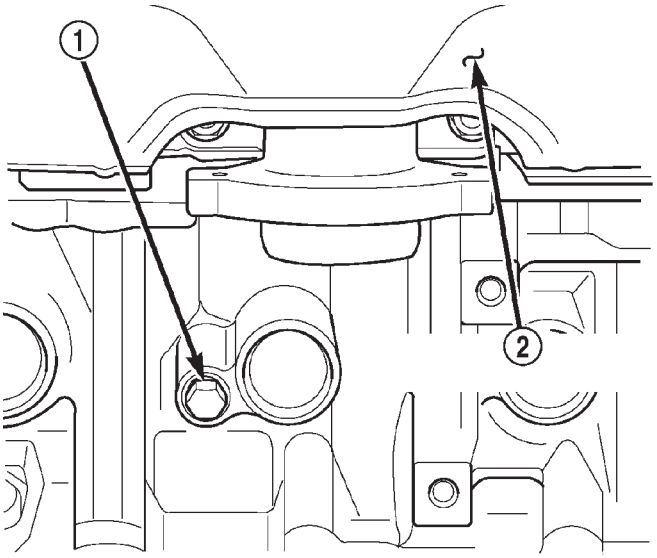



*Fig. 26 Drain Plug—4.7L Engine*

1 – CYLINDER BLOCK DRAIN PLUG
2 – EXHAUST MANIFOLD AND HEAT SHIELD

SERVICE PROCEDURES (Continued)

## PARTIAL DRAINING

Use this procedure if the coolant is to be partially drained, such as for engine thermostat removal.

(1) With engine cold, slowly remove the radiator cap. Raise vehicle on a hoist and locate radiator draincock.

- 4.0L Engine: Radiator draincock is located on the right/lower side of radiator facing to rear of vehicle.
- 4.7L Engines: Radiator draincock is located on the left/lower side of radiator facing to rear of vehicle.

(2) Attach one end of a hose to the draincock. Put the other end into a clean container.

(3) Open draincock and drain desired amount of coolant from radiator.

## REFILLING COOLING SYSTEM—4.0L ENGINE

(1) Tighten the radiator draincock and the cylinder block drain plug(s) (if removed).

(2) Fill system using a 50/50 mixture of ethylene-glycol antifreeze and low mineral content water. Fill radiator to top and install radiator cap. Add sufficient coolant to the reserve/overflow tank to raise level to FULL mark.

(3) With heater control unit in the HEAT position, operate engine with radiator cap in place.

(4) After engine has reached normal operating temperature, shut engine off and allow it to cool. When engine is cooling down, coolant will be drawn into the radiator from the reserve/overflow tank.

(5) Add coolant to reserve/overflow tank as necessary. **Only add coolant to the reserve/overflow tank when the engine is cold. Coolant level in a warm engine will be higher due to thermal expansion.** To purge the cooling system of all air, this heat up/cool down cycle (adding coolant to cold engine) must be performed three times. Add necessary coolant to raise tank level to the FULL mark after each cool down period.

## REFILLING COOLING SYSTEM—4.7L ENGINE

(1) Tighten the radiator draincock and the cylinder block drain plug(s) (if removed).

**CAUTION: Failure to purge air from the cooling system can result in an overheating condition and severe engine damage.**

(2) Remove the cooling system bleed plug from the radiator upper hose inlet housing. (Fig. 27) Fill system using a 50/50 mixture of ethylene-glycol antifreeze and low mineral content water, until coolant begains coming out of the cooling system bleed hole. Install the cooling system bleed plug. Fill radiator to top and install radiator cap. Add sufficient coolant to the reserve/overflow tank to raise level to FULL mark.

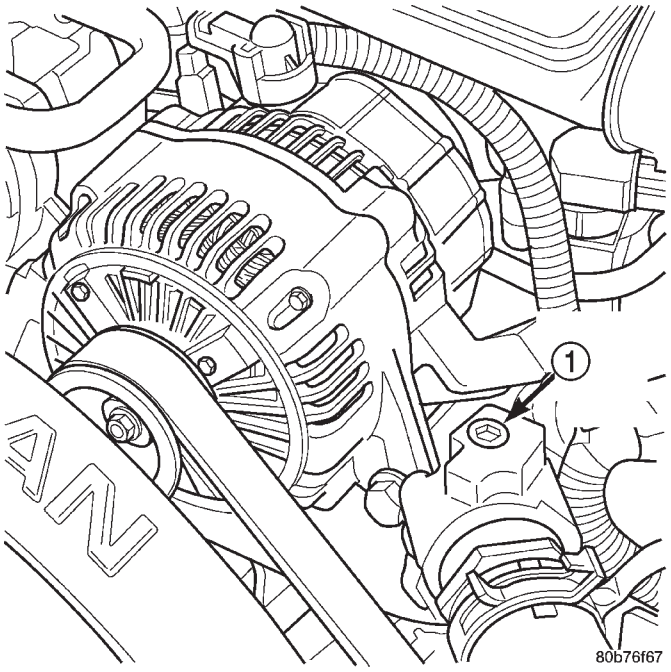



***Fig. 27 Cooling System Bleed Plug—4.7L***

1 – COOLING SYSTEM BLEED PLUG

(3) With heater control unit in the HEAT position, operate engine with radiator cap in place.

(4) After engine has reached normal operating temperature, shut engine off and allow it to cool. When engine is cooling down, coolant will be drawn into the radiator from the reserve/overflow tank.

(5) Add coolant to reserve/overflow tank as necessary. **Only add coolant to the reserve/overflow tank when the engine is cold. Coolant level in a warm engine will be higher due to thermal expansion.**

## COOLING SYSTEM—REVERSE FLUSHING

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

## CHEMICAL CLEANING

In some instances, use a radiator cleaner (Mopar Radiator Kleen or equivalent) before flushing. This will soften scale and other deposits and aid the flushing operation.

**CAUTION: Be sure instructions on the container are followed.**

SERVICE PROCEDURES (Continued)

### REVERSE FLUSHING

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

### REVERSE FLUSHING RADIATOR

Disconnect the radiator hoses from the radiator fittings. Attach a section of radiator hose to the radiator bottom outlet fitting and insert the flushing gun. Connect a water supply hose and air supply hose to the flushing gun.

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

Allow the radiator to fill with water. When radiator is filled, apply air in short blasts allowing radiator to refill between blasts. Continue this reverse flushing until clean water flows out through rear of radiator cooling tube passages. For more information, refer to operating instructions supplied with flushing equipment. Have radiator cleaned more extensively by a radiator repair shop.

### REVERSE FLUSHING ENGINE

Drain the cooling system. Remove the thermostat housing and thermostat. Install the thermostat housing. Disconnect the radiator upper hose from the radiator and attach the flushing gun to the hose. Disconnect the radiator lower hose from the water pump. Attach a lead away hose to the water pump inlet fitting.

Connect the water supply hose and air supply hose to the flushing gun. Allow the engine to fill with water. When the engine is filled, apply air in short blasts, allowing the system to fill between air blasts. Continue until clean water flows through the lead away hose. For more information, refer to operating instructions supplied with flushing equipment.

Remove the lead away hose, flushing gun, water supply hose and air supply hose. Remove the thermostat housing and install thermostat. Install the thermostat housing with a replacement gasket. Refer to Thermostat Replacement. Connect the radiator hoses. Refill the cooling system with the correct antifreeze/water mixture.

## REMOVAL AND INSTALLATION

### WATER PUMP—4.0L ENGINE

**CAUTION: If the water pump is replaced because of mechanical damage, the fan blades and viscous fan drive should also be inspected. These components could have been damaged due to excessive vibration.**

### REMOVAL

The water pump can be removed without discharging the air conditioning system (if equipped).

The water pump impeller is pressed on the rear of the pump shaft and bearing assembly. The water pump is serviced only as a complete assembly.

**NOTE: The water pump can be replaced without discharging the A/C system.**

**WARNING: DO NOT REMOVE THE BLOCK DRAIN PLUG(S) OR LOOSEN RADIATOR DRAINCOCK WITH THE SYSTEM HOT AND UNDER PRESSURE. SERIOUS BURNS FROM COOLANT CAN OCCUR.**

DO NOT WASTE reusable coolant. If the solution is clean, drain coolant into a clean container for reuse.

(1) Disconnect negative battery cable at battery.

(2) Drain the cooling system.

(3) The thermal viscous fan drive is attached (threaded) to the water pump hub shaft. Remove fan/viscous fan drive assembly from water pump by turning mounting nut counterclockwise as viewed from front. Threads on viscous fan drive are **RIGHT HAND** Do not attempt to remove fan/viscous fan drive assembly from vehicle at this time.

(4) If water pump is being replaced, do not unbolt fan blade assembly from thermal viscous fan drive.

(5) Remove fan shroud-to-radiator nuts (Fig. 28). Do not attempt to remove fan shroud at this time.

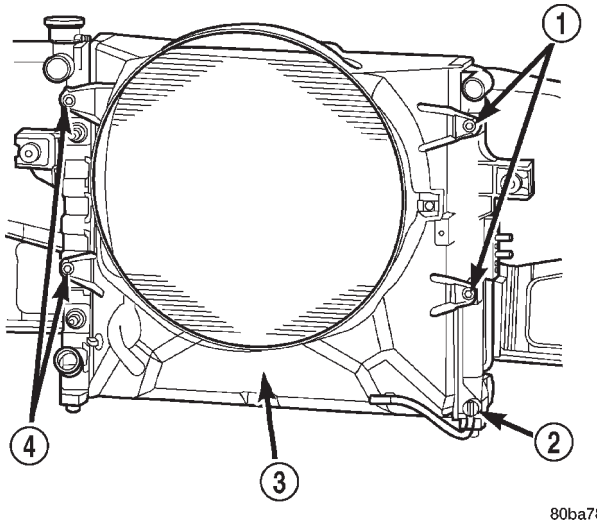



*Fig. 28 Fan Shroud Mounting*

1 – SHROUD FASTENERS
2 – DRAIN COCK
3 – RADIATOR FAN SHROUD
4 – SHROUD FASTENERS

REMOVAL AND INSTALLATION (Continued)

(6) Remove fan shroud and fan blade/viscous fan drive assembly from vehicle as a complete unit.

(7) After removing fan blade/viscous fan drive assembly, **do not** place thermal viscous fan drive in horizontal position. If stored horizontally, silicone fluid in viscous fan drive could drain into its bearing assembly and contaminate lubricant.

Loosen but do not remove the water pump pulley mounting bolts.

The drive belt is equipped with a spring loaded automatic belt tensioner. Relax tension from belt by rotating tensioner clockwise (as viewed from front) When all belt tension has been relaxed, remove accessory drive belt.

Remove the water pump pulley.

(8) Remove the idler pulley (located over the water pump).

**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, SUCH AS SPECIAL CLAMP TOOL (NUMBER 6094) (Fig. 29) SNAP-ON CLAMP TOOL (NUMBER HPC-20) MAY BE USED FOR LARGER CLAMPS. ALWAYS WEAR SAFETY GLASSES WHEN SERVICING CONSTANT TENSION CLAMPS.**

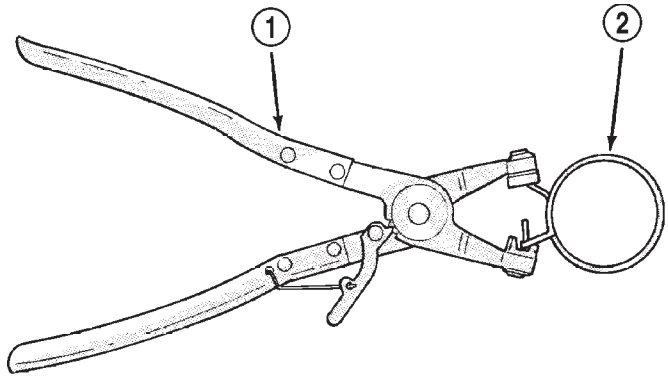



***Fig. 29 Hose Clamp Tool—Typical***

1 – HOSE CLAMP TOOL 6094
2 – HOSE CLAMP

**CAUTION: A number or letter is stamped into the tongue of constant tension clamps (Fig. 30). If replacement is necessary, use only an original equipment clamp with matching number or letter.**

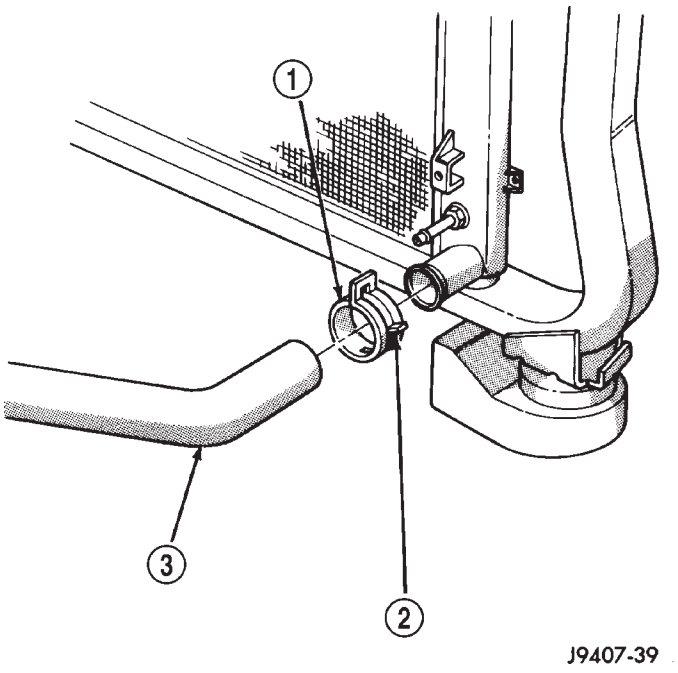



***Fig. 30 Clamp Number/Letter Location***

1 – TYPICAL CONSTANT TENSION HOSE CLAMP
2 – CLAMP NUMBER/LETTER LOCATION
3 – TYPICAL HOSE

(9) Remove lower radiator hose from water pump. Remove heater hose from water pump fitting.

(10) Remove the five pump mounting bolts (Fig. 31) and remove pump from vehicle. Discard old gasket. Note that one of the five bolts is longer than the other bolts.

(11) If pump is to be replaced, the heater hose fitting must be removed. Note position of fitting before removal.

## INSTALLATION

(1) If pump is being replaced, install the heater hose fitting to the pump. Use a sealant on the fitting such as Mopar™ Thread Sealant With Teflon. Refer to the directions on the package.

(2) Clean the gasket mating surfaces. If the original pump is used, remove any deposits or other foreign material. Inspect the cylinder block and water pump mating surfaces for erosion or damage from cavitation.

(3) Install the gasket and water pump. The silicone bead on the gasket should be facing the water pump. Also, the gasket is installed dry. Tighten mounting bolts to 30 N·m (22 ft. lbs.) torque. Rotate the shaft by hand to be sure it turns freely.

(4) Connect the radiator and heater hoses to the water pump.

(5) Position water pump pulley to water pump hub. Tighten bolts 28 N·m (250 in. lbs.).

Install the idler pulley. Tighten the bolt 47 N·m (35 ft. lbs.).

REMOVAL AND INSTALLATION (Continued)

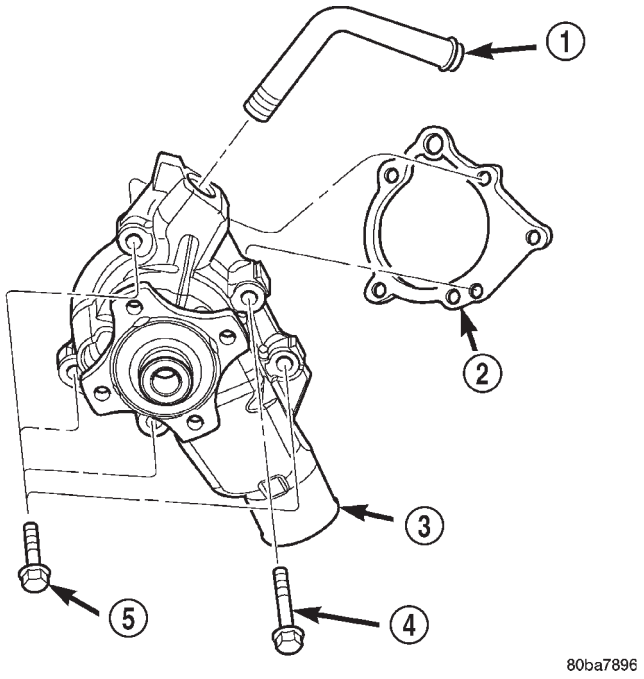



*Fig. 31 Water Pump Remove/Install—Typical*

1 – HEATER HOSE FITTING
2 – PUMP GASKET
3 – WATER PUMP
4 – LONG BOLT
5 – BOLTS (4) SHORT

**CAUTION: When installing the serpentine engine accessory drive belt, the belt MUST be routed correctly. If not, the engine may overheat due to the water pump rotating in the wrong direction. Refer to the Belt Removal and Installtion in this group for appropriate belt routing. You may also refer to the Belt Routing Label in the vehicle engine compartment.**

Install accessory drive belt.

(6) Install fan blade and viscous fan drive onto water pump.

(7) Fill cooling system with coolant and check for leaks. Refer to Refilling Cooling System in this group.

(8) Connect battery cable to battery.

(9) Start and warm the engine. Check for leaks.

## WATER PUMP 4.7L ENGINES

The water pump on 4.7L engines is bolted directly to the engine timing chain case/cover.

A gasket is used as a seal between the water pump and timing chain case/cover.

If water pump is replaced because of bearing/shaft damage, or leaking shaft seal, the mechanical cooling fan assembly should also be inspected. Inspect for fatigue cracks, loose blades, or loose rivets that could have resulted from excessive vibration. Replace fan if any of these conditions are found. Also check condition of the thermal viscous fan drive. Refer to Viscous Fan Drive in this group.

The water pump can be removed without discharging the air conditioning system (if equipped).

### REMOVAL

(1) Disconnect negative battery cable from battery.

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

Do not waste reusable coolant. If solution is clean, drain coolant into a clean container for reuse.

(3) The thermal viscous fan drive is attached (threaded) to the water pump hub shaft. Remove fan/viscous fan drive assembly from water pump by turning mounting nut counterclockwise as viewed from front. Threads on viscous fan drive are **RIGHT HAND.** Using special tool spanner wrench 6958 with adapter pins 8346 and a suitable fan wrench loosen the fan drive (Fig. 32). Do not attempt to remove fan/viscous fan drive assembly from vehicle at this time.

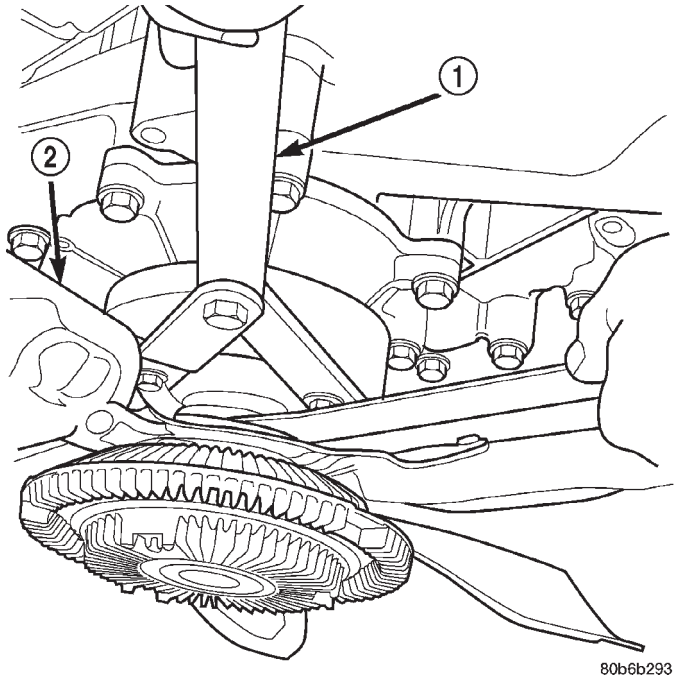



*Fig. 32 Viscous Fan and Fan Drive 4.7L*

1 – SPECIAL TOOL 6958 SPANNER WRENCH WITH ADAPTER PINS 8346
2 – FAN

REMOVAL AND INSTALLATION (Continued)

**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, SUCH AS SPECIAL CLAMP TOOL (NUMBER 6094). SNAP-ON CLAMP TOOL (NUMBER HPC-20) MAY BE USED FOR LARGER CLAMPS. 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 an original equipment clamp with matching number or letter.**

(4) If water pump is being replaced, do not unbolt fan blade assembly from thermal viscous fan drive.

(5) Remove two fan shroud-to-radiator nuts (Fig. 33). Do not attempt to remove fan shroud at this time.

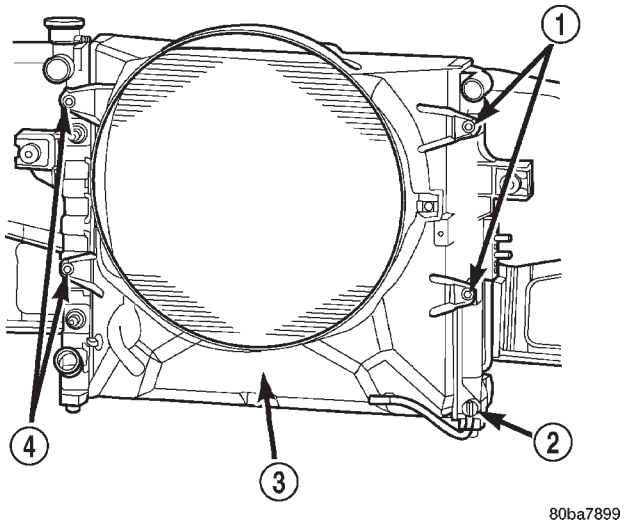



***Fig. 33 Fan Shroud Mounting Hardware***

1 – SHROUD FASTENERS
2 – DRAIN COCK
3 – RADIATOR FAN SHROUD
4 – SHROUD FASTENERS

(6) Remove fan shroud and fan blade/viscous fan drive assembly from vehicle as a complete unit.

(7) After removing fan blade/viscous fan drive assembly, **do not** place thermal viscous fan drive in horizontal position. If stored horizontally, silicone fluid in viscous fan drive could drain into its bearing assembly and contaminate lubricant.

(8) Remove accessory drive belt as follows: The drive belt is equipped with a spring loaded automatic belt tensioner. Relax tension from belt by rotating tensioner clockwise (as viewed from front) (Fig. 34). When all belt tension has been relaxed, remove accessory drive belt.

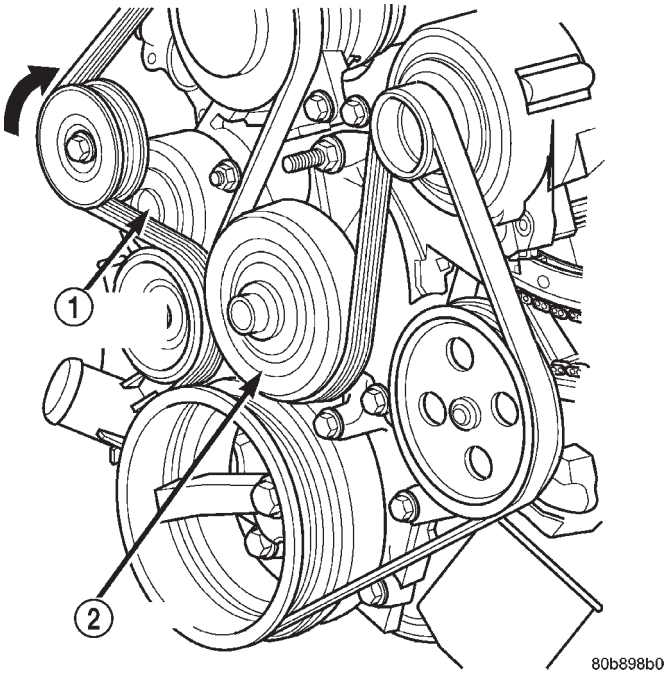



***Fig. 34 Automatic Belt Tensioner—4.7L***

1 – AUTOMATIC TENSIONER
2 – WATER PUMP PULLEY

(9) Remove lower radiator hose clamp and remove lower hose at water pump.

(10) Remove seven water pump mounting bolts and one stud bolt.

**CAUTION: Do not pry water pump at timing chain case/cover. The machined surfaces may be damaged resulting in leaks.**

(11) Remove water pump and gasket. Discard gasket.

## INSTALLATION

(1) Clean gasket mating surfaces.

(2) Using a new gasket, position water pump and install mounting bolts as shown. (Fig. 35). Tighten water pump mounting bolts to 54 N·m (40 ft. lbs.) torque.

(3) Spin water pump to be sure that pump impeller does not rub against timing chain case/cover.

(4) Connect radiator lower hose to water pump.

(5) Relax tension from belt tensioner (Fig. 34). Install drive belt.

REMOVAL AND INSTALLATION (Continued)

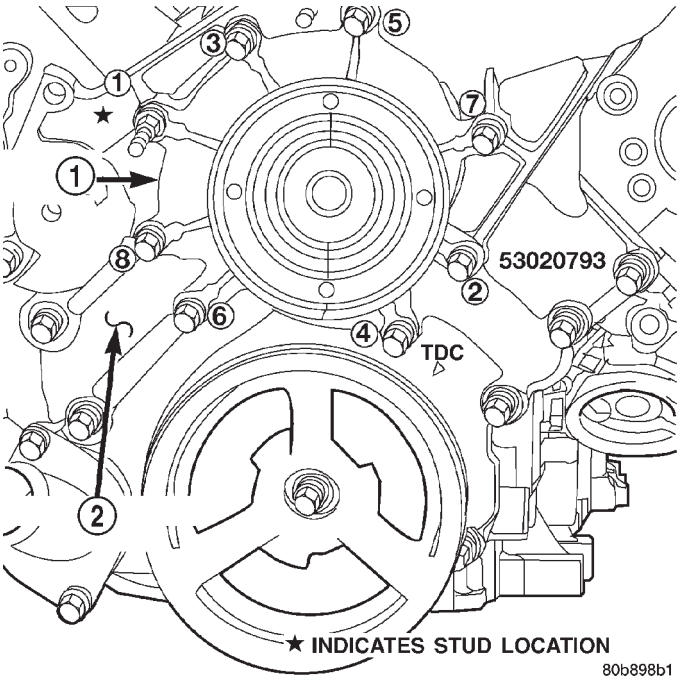



*Fig. 35 Water Pump Installation—4.7L*

1 – WATER PUMP
2 – TIMING CHAIN COVER

**CAUTION: When installing the serpentine accessory drive belt, belt must be routed correctly. If not, engine may overheat due to water pump rotating in wrong direction. Refer to (Fig. 36) for correct belt routing. Or, refer to the Belt Routing Label located in the engine compartment. The correct belt with correct length must be used.**

(6) Position fan shroud and fan blade/viscous fan drive assembly to vehicle as a complete unit.

(7) Be sure the upper and lower portions of the fan shroud are firmly connected. All air must flow through the radiator.

(8) Install two fan shroud-to-radiator nuts (Fig. 33).

(9) Be sure of at least 25 mm (1.0 inches) between tips of fan blades and fan shroud.

(10) Install fan blade/viscous fan drive assembly to water pump shaft.

(11) Fill cooling system. Refer to Refilling the Cooling System in this group.

(12) Connect negative battery cable.

(13) Start and warm the engine. Check for leaks.

## THERMOSTAT—4.0L ENGINE

### REMOVAL

**WARNING: DO NOT LOOSEN THE RADIATOR DRAINCOCK WITH THE SYSTEM HOT AND PRESSURIZED. SERIOUS BURNS FROM THE COOLANT CAN OCCUR.**

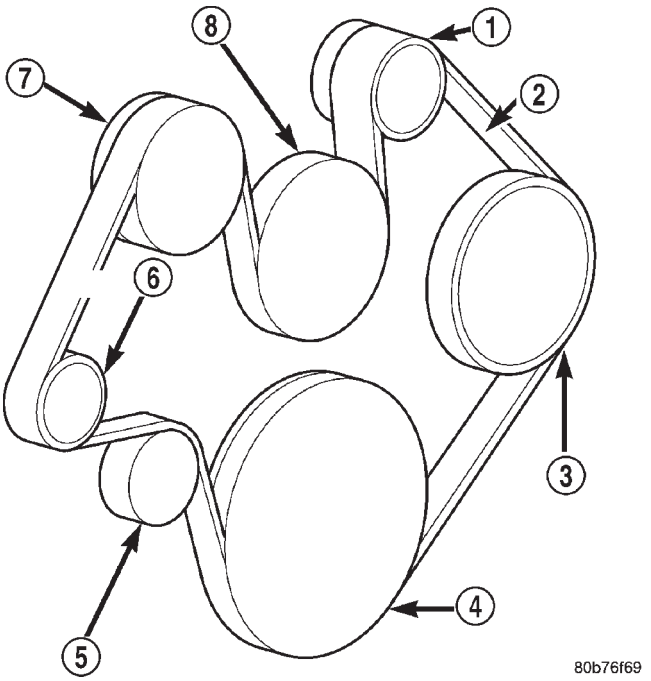



*Fig. 36 Belt Routing 4.7L*

1 – GENERATOR
2 – ACCESSORY DRIVE BELT
3 – POWER STEERING
4 – CRANKSHAFT
5 – IDLER
6 – TENSIONER
7 – A/C
8 – WATER PUMP

Do not waste reusable coolant. If the solution is clean, drain the coolant into a clean container for reuse.

(1) Drain the coolant from the radiator until the level is below the thermostat housing.

**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, SUCH AS SPECIAL CLAMP TOOL (NUMBER 6094) (Fig. 49). SNAP-ON CLAMP TOOL (NUMBER HPC-20) MAY BE USED FOR LARGER CLAMPS. 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 an original equipment clamp with matching number or letter.**

REMOVAL AND INSTALLATION (Continued)

(2) Remove radiator upper hose and heater hose at thermostat housing.

(3) Disconnect wiring connector at engine coolant temperature sensor.

(4) Remove thermostat housing mounting bolts, thermostat housing, gasket and thermostat (Fig. 37). Discard old gasket.

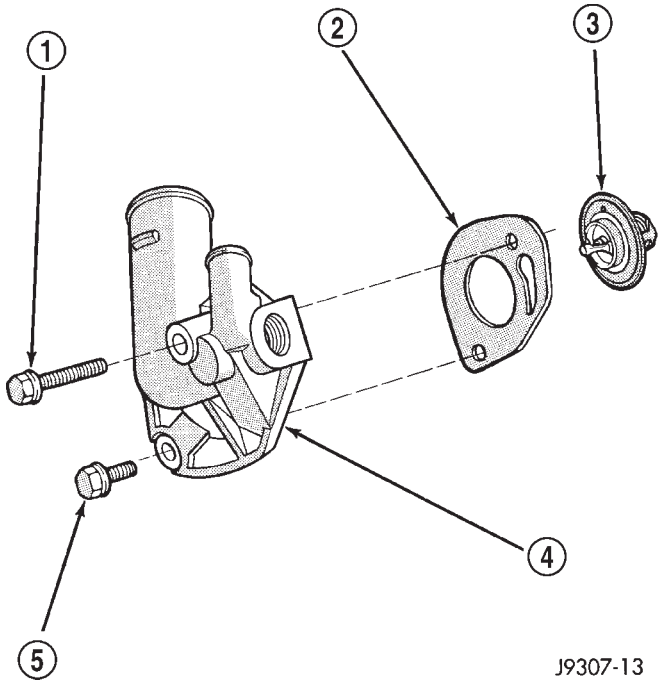



***Fig. 37 Thermostat Removal/Installation—4.0L Engine***

1 – LONG BOLT
2 – GASKET
3 – THERMOSTAT
4 – THERMOSTAT HOUSING
5 – SHORT BOLT

(5) Clean the gasket mating surfaces.

## INSTALLATION

(1) Install the replacement thermostat so that the pellet, which is encircled by a coil spring, faces the engine. All thermostats are marked on the outer flange to indicate the proper installed position.

(a) Observe the recess groove in the engine cylinder head (Fig. 38).

(b) Position thermostat in groove with arrow and air bleed hole on outer flange pointing up.

(2) Install replacement gasket and thermostat housing.

**CAUTION: Tightening the thermostat housing unevenly or with the thermostat out of its recess, may result in a cracked housing.**

(3) Tighten the housing bolts to 22 N·m (16 ft. lbs.) torque.

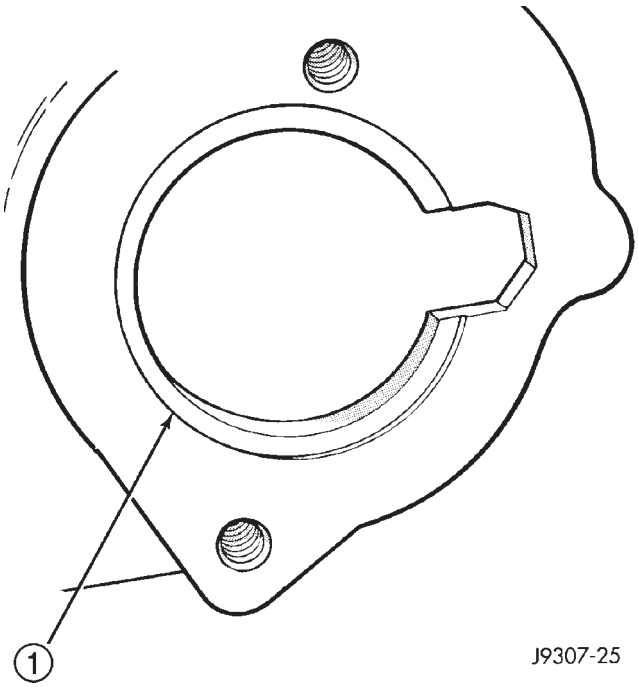



***Fig. 38 Thermostat Recess—4.0L Engine***

1 – GROOVE

(4) Install hoses to thermostat housing.

(5) Install electrical connector to coolant temperature sensor.

(6) Be sure that the radiator draincock is tightly closed. Fill the cooling system to the correct level with the required coolant mixture. Refer to Refilling Cooling System in this group.

(7) Start and warm the engine. Check for leaks.

# THERMOSTAT— 4.7L ENGINE

## REMOVAL

**WARNING: DO NOT LOOSEN RADIATOR DRAINCOCK WITH SYSTEM HOT AND PRESSURIZED. SERIOUS BURNS FROM COOLANT CAN OCCUR.**

Do not waste reusable coolant. If solution is clean, drain coolant into a clean container for reuse.

If thermostat is being replaced, be sure that replacement is specified thermostat for vehicle model and engine type.

(1) Disconnect negative battery cable at battery.

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

(3) Raise vehicle on hoist.

(4) Remove splash shield.

(5) Remove lower radiator hose clamp and lower radiator hose at thermostat housing.

(6) Remove thermostat housing mounting bolts, thermostat housing and thermostat (Fig. 39).

REMOVAL AND INSTALLATION (Continued)

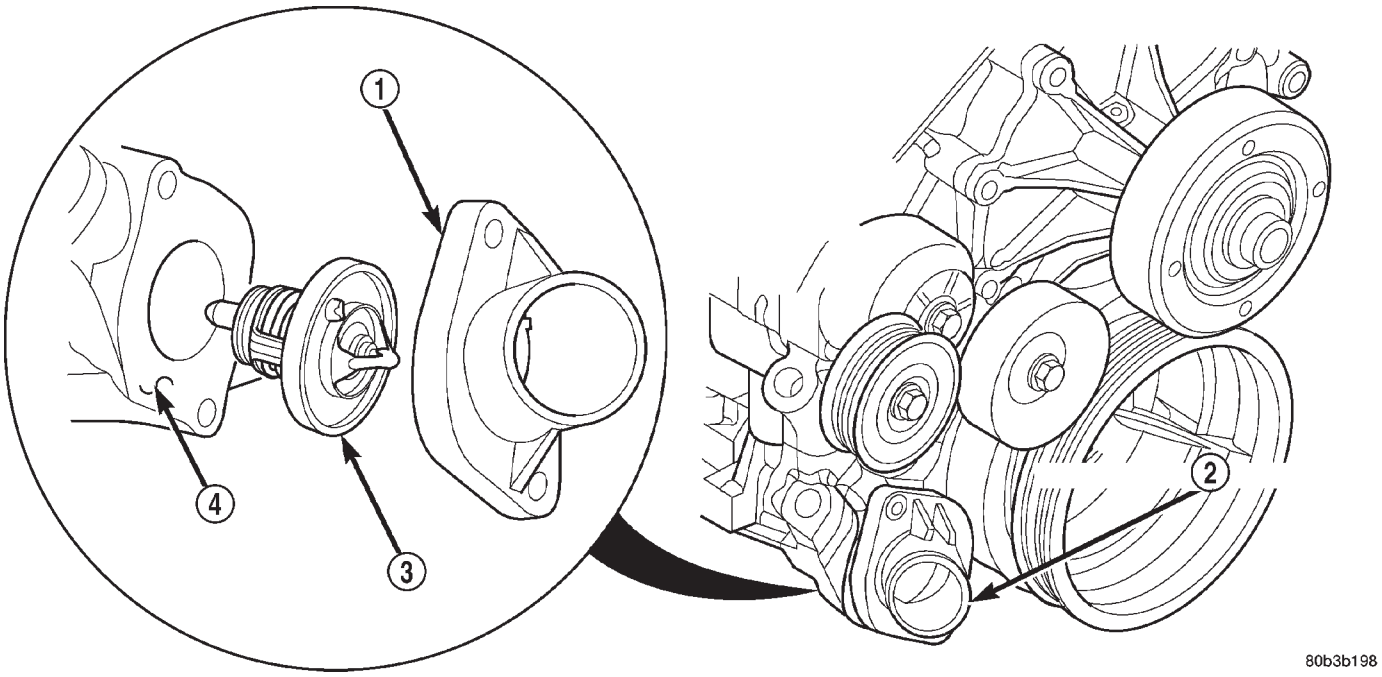



*Fig. 39 Thermostat and Thermostat Housing 4.7L*

1 – THERMOSTAT HOUSING
2 – THERMOSTAT LOCATION
3 – THERMOSTAT AND GASKET
4 – TIMING CHAIN COVER

### INSTALLATION

(1) Clean mating areas of timing chain cover and thermostat housing.

(2) Install thermostat (spring side down) into recessed machined groove on timing chain cover (Fig. 39).

(3) Position thermostat housing on timing chain cover.

(4) Install two housing-to-timing chain cover bolts. Tighten bolts to 13 N·m (115 in. lbs.) torque.

**CAUTION: Housing must be tightened evenly and thermostat must be centered into recessed groove in timimg chain cover. If not, it may result in a cracked housing, damaged timing chain cover threads or coolant leaks.**

(5) Install lower radiator hose on thermostat housing.

(6) Install splash shield.

(7) Lower vehicle.

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

(9) Connect negative battery cable to battery.

(10) Start and warm the engine. Check for leaks.

## RADIATOR FAN SHROUD

### REMOVAL

**NOTE: The fan can not be removed seperate from the shroud. Both fan and shroud must be removed together.**

(1) Using special tool 6958 Spanner Wrench and 8346 Adapters, remove the viscous fan from the water pump (Fig. 40).

(2) Gently lay fan into shroud.

(3) Disconnect the electrical connector for the electric fan, then disconnect connector from shroud

**NOTE: The lower left side mounting bolt can only be accessed from under vehicle.**

(4) Remove the mounting bolts form the shroud (Fig. 41).

(5) Remove the shroud and fan from vehicle.

### INSTALLATION

**NOTE: The fan can not be installed seperate from the shroud. Both fan and shroud must be installed together.**

REMOVAL AND INSTALLATION (Continued)

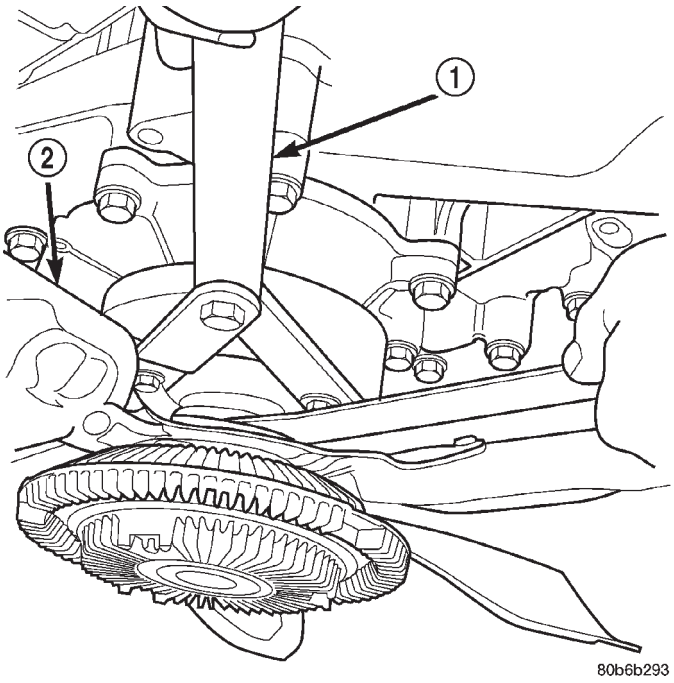



*Fig. 40 Viscous Fan 4.7L Engine*

1 – SPECIAL TOOL 6958 SPANNER WRENCH WITH ADAPTER PINS 8346
2 – FAN

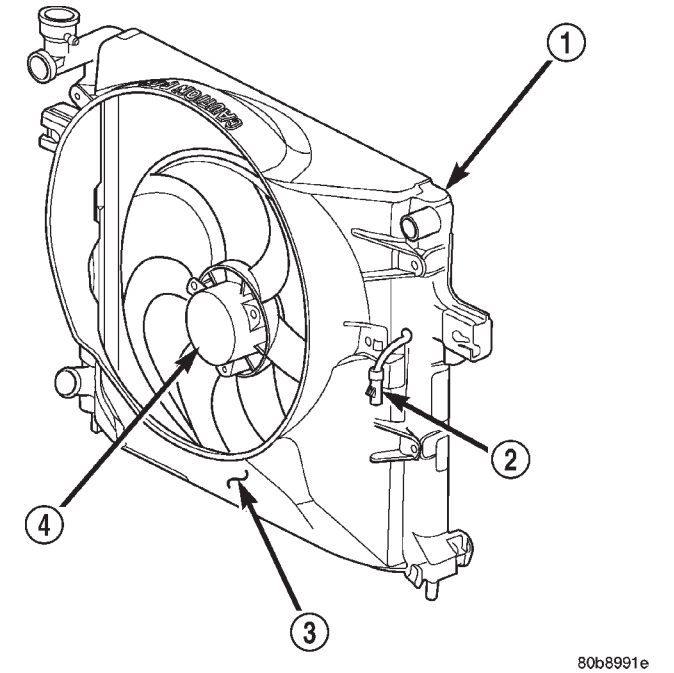



*Fig. 41 Fan Shroud and Electric Fan 4.7L Engine*

1 – RADIATOR
2 – ELECTRIC COOLING FAN CONNECTOR
3 – FAN SHROUD
4 – ELECTRIC COOLING FAN

(1) Carefully position the viscous fan into the shroud, then position the shroud and fan into the vehicle.

**NOTE: The lower left side mounting bolt can only be accessed from under vehicle.**

(2) Install the mounting bolts into the shroud
(3) Attach the electrical connector onto the shroud, then connect the connector to the electric fan connector.
(4) Install the viscous fan onto the water pump. Using special tool 6958 Spanner Wrench and 8346 Adapters, tighten the viscous fan onto the water pump (Fig. 40).

## RADIATOR

### REMOVAL

**WARNING: DO NOT REMOVE THE CYLINDER BLOCK DRAIN PLUGS OR LOOSEN THE RADIATOR DRAINCOCK WITH THE SYSTEM HOT AND UNDER PRESSURE. SERIOUS BURNS FROM COOLANT CAN OCCUR. REFER TO COOLING SYSTEM DRAINING IN THIS GROUP.**

Do not waste reusable coolant. If the solution is clean, drain the coolant into a clean container for reuse.

**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, SUCH AS SPECIAL CLAMP TOOL (NUMBER 6094) (Fig. 42). SNAP-ON CLAMP TOOL (NUMBER HPC-20) MAY BE USED FOR LARGER CLAMPS. ALWAYS WEAR SAFETY GLASSES WHEN SERVICING CONSTANT TENSION CLAMPS.**

**CAUTION: A number or letter is stamped into the tongue of constant tension clamps (Fig. 43). If replacement is necessary, use only an original equipment clamp with matching number or letter.**

**CAUTION: When removing the radiator or A/C condenser for any reason, note the location of all radiator-to-body and radiator-to-A/C condenser rubber air seals (Fig. 44). These are used at the top, bottom and sides of the radiator and A/C condenser. To prevent overheating, these seals must be installed to their original positions.**

(1) Disconnect the negative battery cable at battery.

REMOVAL AND INSTALLATION (Continued)

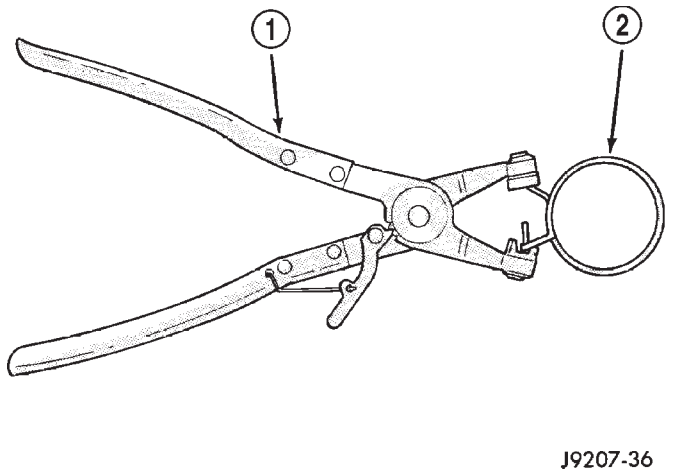



***Fig. 42 Hose Clamp Tool—Typical***

1 – HOSE CLAMP TOOL 6094
2 – HOSE CLAMP

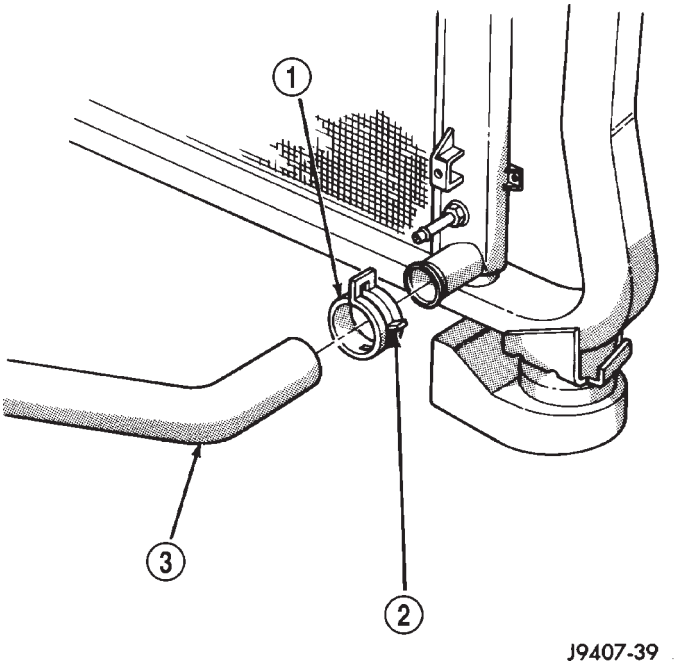



***Fig. 43 Clamp Number/Letter Location—Typical***

1 – TYPICAL CONSTANT TENSION HOSE CLAMP
2 – CLAMP NUMBER/LETTER LOCATION
3 – TYPICAL HOSE

**WARNING: DO NOT REMOVE THE CYLINDER BLOCK DRAIN PLUGS OR LOOSEN THE RADIATOR DRAINCOCK WITH THE SYSTEM HOT AND UNDER PRESSURE. SERIOUS BURNS FROM COOLANT CAN OCCUR. REFER TO COOLING SYSTEM DRAINING IN THIS GROUP.**

Do not waste reusable coolant. If the solution is clean, drain the coolant into a clean container for reuse.

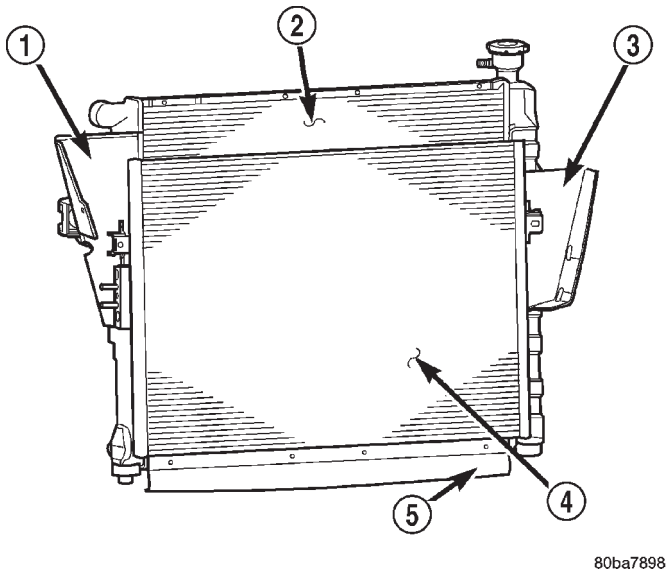



***Fig. 44 Air Seals—Typical***

1 – AIR DAM
2 – RADIATOR
3 – AIR DAM
4 – A/C CONDENSER
5 – AIR SEAL

**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, SUCH AS SPECIAL CLAMP TOOL (NUMBER 6094) (Fig. 42). SNAP-ON CLAMP TOOL (NUMBER HPC-20) MAY BE USED FOR LARGER CLAMPS. ALWAYS WEAR SAFETY GLASSES WHEN SERVICING CONSTANT TENSION CLAMPS.**

**CAUTION: A number or letter is stamped into the tongue of constant tension clamps (Fig. 43). If replacement is necessary, use only an original equipment clamp with matching number or letter.**

(2) Drain coolant from radiator. Refer to Draining Cooling System in this section.

**NOTE: The 4.0L engine does not require special tool 6958 spanner wrench or 8346 adapters to remove the fan drive from the water pump.**

(3) The thermal viscous fan drive is attached (threaded) to the water pump hub shaft. Remove fan/ viscous fan drive assembly from water pump by turning mounting nut counterclockwise as viewed from front. Threads on viscous fan drive are **RIGHT HAND.** Using spanner wrench 6958 with adapters 8346 (4.7L engines only) and a 36 MM Fan Wrench (Fig. 45) loosen the fan drive/ fan blade. Drive belt removal is not necessary for removal of fan drive.

REMOVAL AND INSTALLATION (Continued)

(4) Do not attempt to remove fan/viscous fan drive assembly from vehicle at this time.

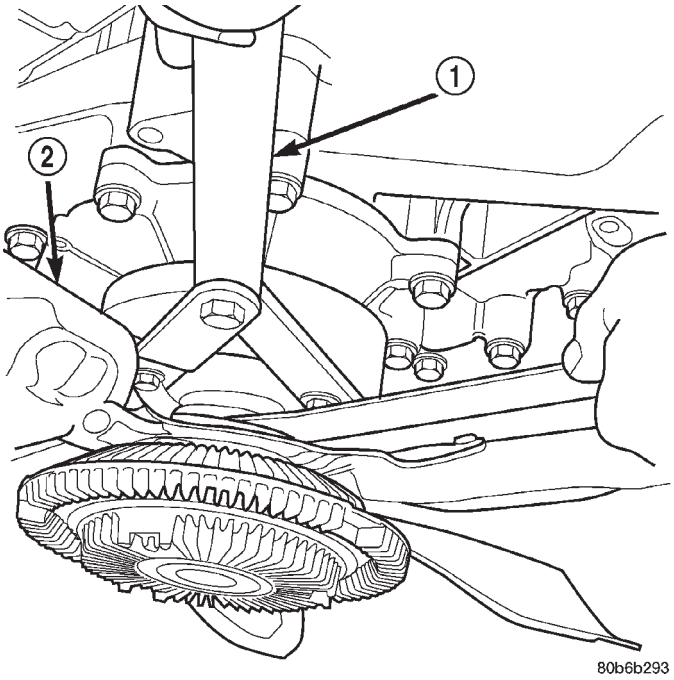



***Fig. 45 Viscous Fan Drive 4.7L Engine***

1 – SPECIAL TOOL 6958 SPANNER WRENCH WITH ADAPTER PINS 8346
2 – FAN

(5) Remove the front grill. Refer to Group 23 for procedure.

(6) Remove two radiator mounting bolts (Fig. 48) (Fig. 47).

(7) Disconnect both transmission cooler lines from radiator.

(8) Disconnect electric fan connector, then disconnect connector harness from shroud (all 4.7L engines and heavy cooling package 4.0L only) (Fig. 48) (Fig. 47).

(9) Disconnect the radiator upper and lower hoses (Fig. 48) (Fig. 47).

(10) Disconnect the overflow hose from radiator (Fig. 48) (Fig. 47).

(11) Remove the air inlet duct at the grill.

(12) The lower part of radiator is equipped with two alignment dowel pins (Fig. 46). They are located on the bottom of radiator tank and fit into rubber grommets. These rubber grommets are pressed into the radiator lower crossmember.

**WARNING: THE AIR CONDITIONING SYSTEM (IF EQUIPPED) IS UNDER A CONSTANT PRESSURE EVEN WITH THE ENGINE OFF. REFER TO REFRIGERANT WARNINGS IN GROUP 24, HEATING AND AIR CONDITIONING BEFORE HANDLING ANY AIR CONDITIONING COMPONENT.**

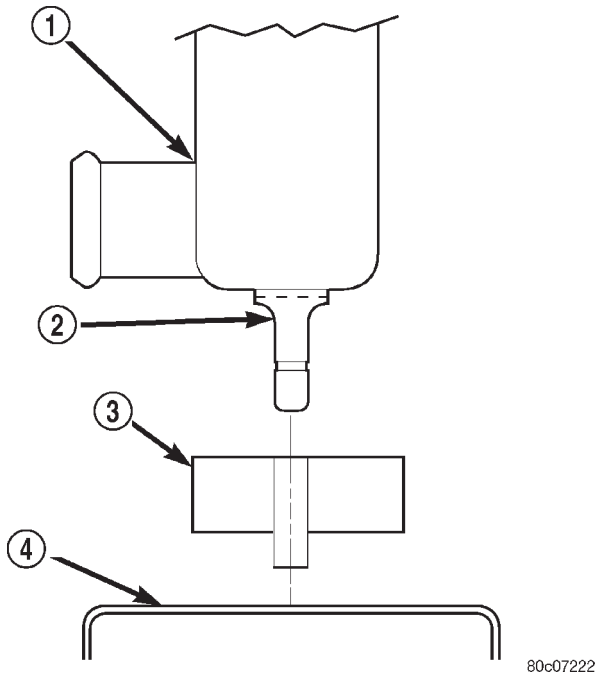



***Fig. 46 Radiator Alignment Dowels***

1 – RADIATOR
2 – ALIGNMENT DOWEL
3 – RADIATOR LOWER ISOLATOR
4 – RADIATOR LOWER CROSSMEMBER

(13) If equipped with an auxiliary automatic transmission oil cooler, use caution when removing radiator. The oil cooler lines are routed through a rubber air seal on the right side of radiator. Do not cut or tear this seal.

(14) Gently lift up and remove radiator from vehicle. Be careful not to scrape the radiator fins against any other component. Also be careful not to disturb the air conditioning condenser (if equipped) (Fig. 48).

## INSTALLATION

**CAUTION: Before installing the radiator or A/C condenser, be sure the radiator-to-body and radiator-to-A/C condenser rubber air seals (Fig. 44) are properly fastened to their original positions. These are used at the top, bottom and sides of the radiator and A/C condenser. To prevent overheating, these seals must be installed to their original positions.**

(1) Equipped with air conditioning: Gently lower the radiator into the vehicle. Guide the two radiator alignment dowels through the holes in the rubber air seals first and then through the A/C support brackets (Fig. 46). Continue to guide the alignment dowels into the rubber grommets located in lower radiator crossmember. The holes in the L-shaped brackets (located on bottom of A/C condenser) must be positioned between bottom of rubber air seals and top of rubber grommets.

REMOVAL AND INSTALLATION (Continued)

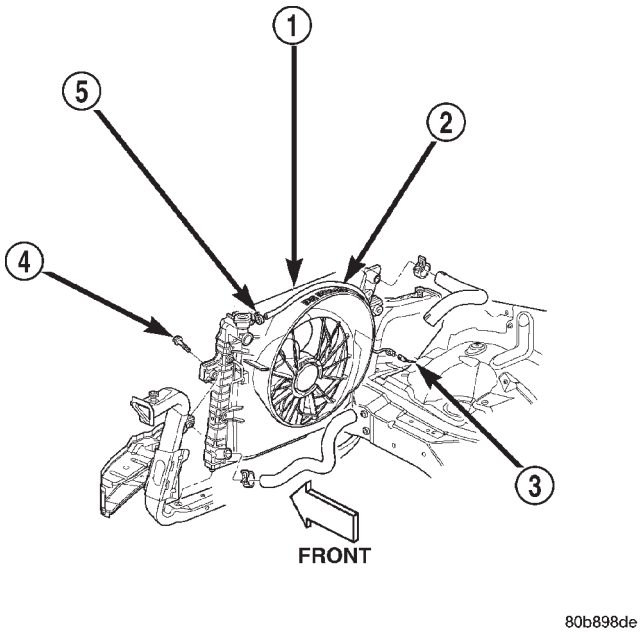



***Fig. 47 Radiator, Shroud and Electric Fan—4.0L Engine***

1 – RADIATOR/SHROUD/FAN ASSEMBLY
2 – OVER FLOW HOSE
3 – ELECTRIC FAN CONNECTOR
4 – RADIATOR MOUNTING BOLT(S)
5 – CLAMP

(2) Connect the radiator upper and lower hoses and hose clamps to radiator (Fig. 48).

**CAUTION: The tangs on the hose clamps must be positioned straight down.**

(3) Install coolant reserve/overflow tank hose at radiator (Fig. 48) (Fig. 47).
(4) Connect both transmission cooler lines at the radiator (Fig. 48) (Fig. 47).
(5) Install both radiator mounting bolts (Fig. 48) (Fig. 47).
(6) Install air inlet duct at grill.
(7) Attach electric fan harness to shroud, then connect harness to connector (all 4.7L engines and heavy cooling 4.0L only) (Fig. 48) (Fig. 47).
(8) Install the grill. Refer to group 23, Body.
(9) Install the fan/viscous fan drive assembly to the water pump.
(10) Rotate the fan blades (by hand) and check for interference at fan shroud.
(11) Be sure of at least 25 mm (1.0 inch) between tips of fan blades and fan shroud.
(12) Fill cooling system.
(13) Connect battery cable at battery.
(14) Start and warm engine. Check for leaks.

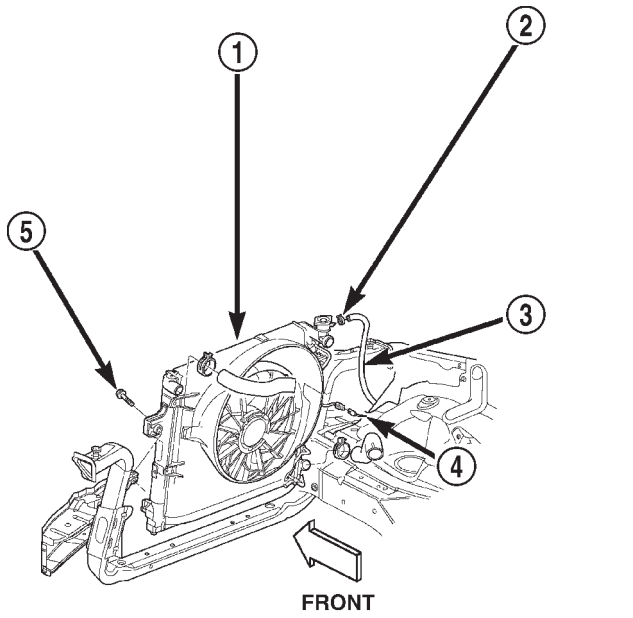



***Fig. 48 Radiator, Shroud and Electric Fan—4.7L Engine***

1 – RADIATOR/SHROUD/FAN ASSEMBLY
2 – CLAMP
3 – OVER FLOW HOSE
4 – ELECTRIC FAN CONNECTOR
5 – RADIATOR MOUNTING BOLT(S)

## WATER PUMP BYPASS HOSE—4.0L ENGINE

### REMOVAL

**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, SUCH AS SPECIAL CLAMP TOOL (NUMBER 6094) (Fig. 49). SNAP-ON CLAMP TOOL (NUMBER HPC-20) MAY BE USED FOR LARGER CLAMPS. ALWAYS WEAR SAFETY GLASSES WHEN SERVICING CONSTANT TENSION CLAMPS.**

**CAUTION: A number or letter is stamped into the tongue of constant tension clamps (Fig. 50). If replacement is necessary, use only an original equipment clamp with matching number or letter.**

(1) Partially drain cooling system. Refer to Draining Cooling System in this group.
(2) Do not waste reusable coolant. If solution is clean, drain coolant into a clean container for reuse.
(3) Loosen both bypass hose clamps (Fig. 49) and position to center of hose. Remove hose from vehicle.

REMOVAL AND INSTALLATION (Continued)

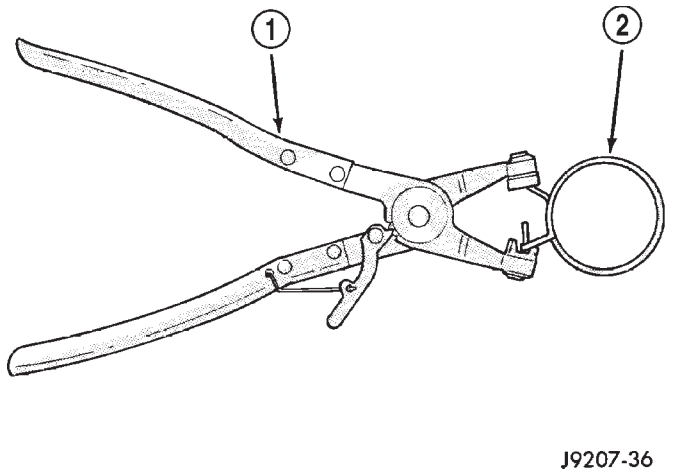



*Fig. 49 Hose Clamp Tool—Typical*

1 – HOSE CLAMP TOOL 6094
2 – HOSE CLAMP

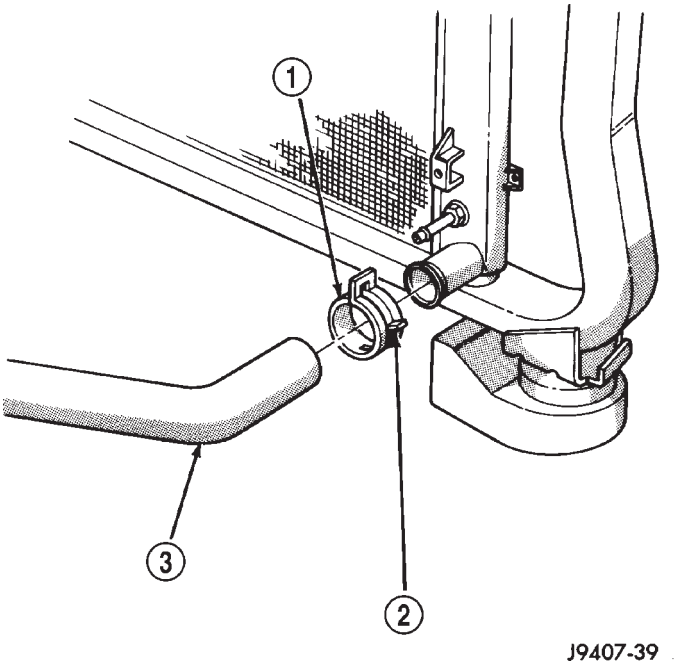



*Fig. 50 Clamp Number/Letter Location*

1 – TYPICAL CONSTANT TENSION HOSE CLAMP
2 – CLAMP NUMBER/LETTER LOCATION
3 – TYPICAL HOSE

## INSTALLATION

(1) Position bypass hose clamps (Fig. 49) to center of hose.
(2) Install bypass hose to engine.
(3) Secure both hose clamps (Fig. 49).
(4) Fill cooling system. Refer to Refilling the Cooling System in this group.
(5) Start and warm the engine. Check for leaks.

## ENGINE BLOCK HEATER

### REMOVAL

(1) Disconnect negative battery cable from battery.
(2) Drain coolant from radiator. Refer to Draining and Filling Cooling System in this section.
(3) Raise vehicle.
(4) Remove engine cylinder block drain plug(s) located on the sides of cylinder block above the oil pan rail (Fig. 51) (Fig. 52).

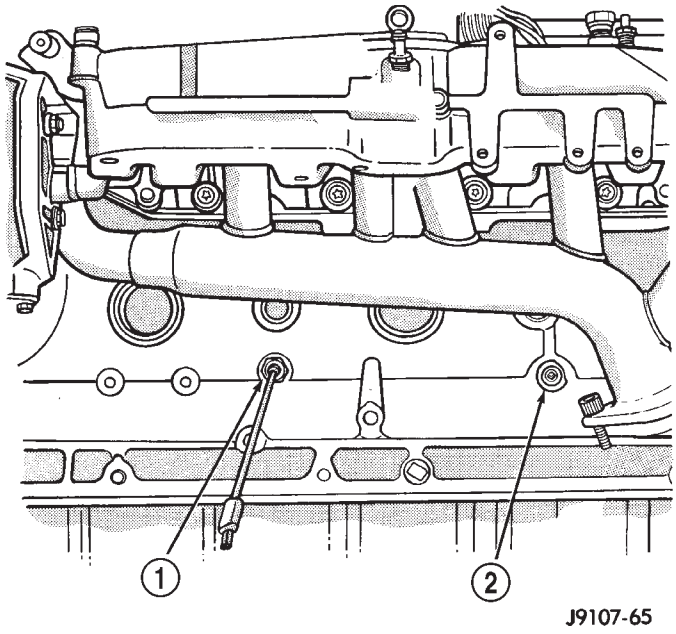



*Fig. 51 Drain Plug—4.0L Engine*

1 – COOLANT TEMPERATURE SENSOR
2 – BLOCK DRAIN PLUG

(5) Remove power cord from block heater.
(6) Loosen screw at center of block heater. Remove heater assembly (Fig. 53) (Fig. 54).

### INSTALLATION

(1) Thoroughly clean cylinder block core hole and block heater seat.
(2) Insert block heater assembly with element loop pointing at twelve o'clock (Fig. 53) (Fig. 54).
(3) With block heater fully seated, tighten center screw to 2 N·m (17 in. lbs.) torque.
(4) Fill cooling system with recommended coolant.
(5) Start and warm the engine. Check for leaks.

REMOVAL AND INSTALLATION (Continued)

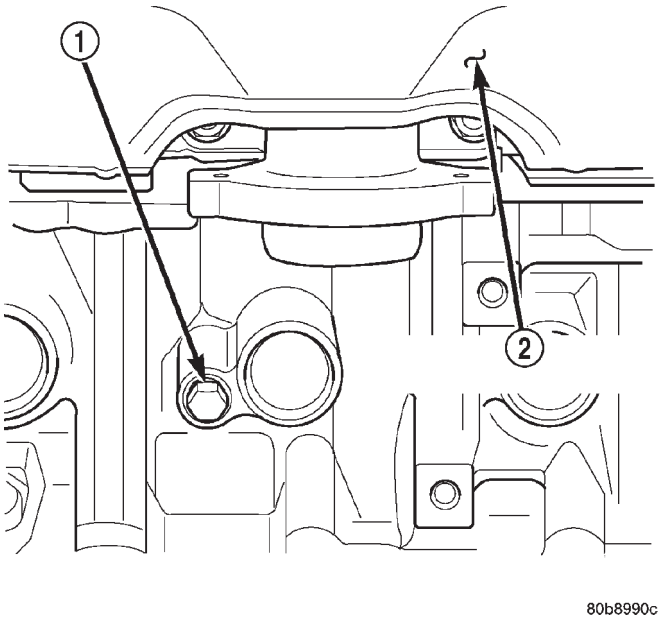



***Fig. 52 Drain Plug—4.7L Engine***

1 – CYLINDER BLOCK DRAIN PLUG
2 – EXHAUST MANIFOLD AND HEAT SHIELD

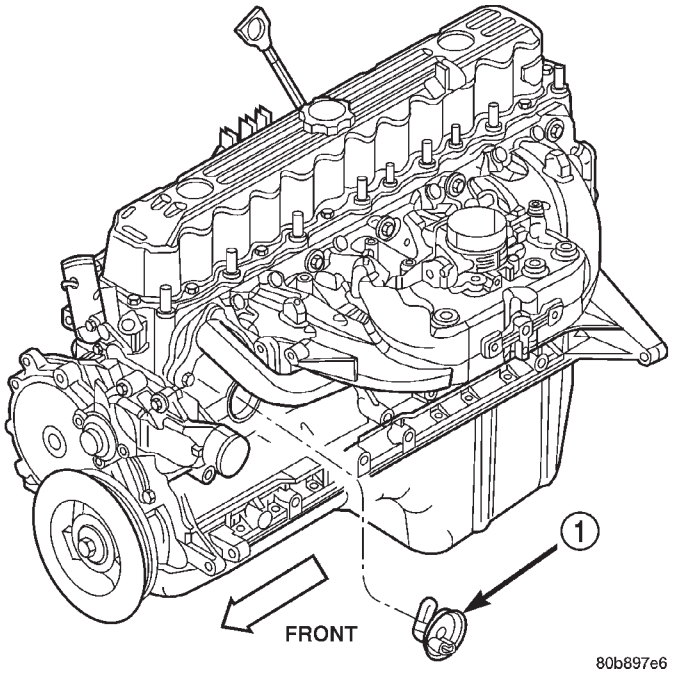



***Fig. 53 Engine Block Heater—4.0L***

1 – ENGINE BLOCK HEATER

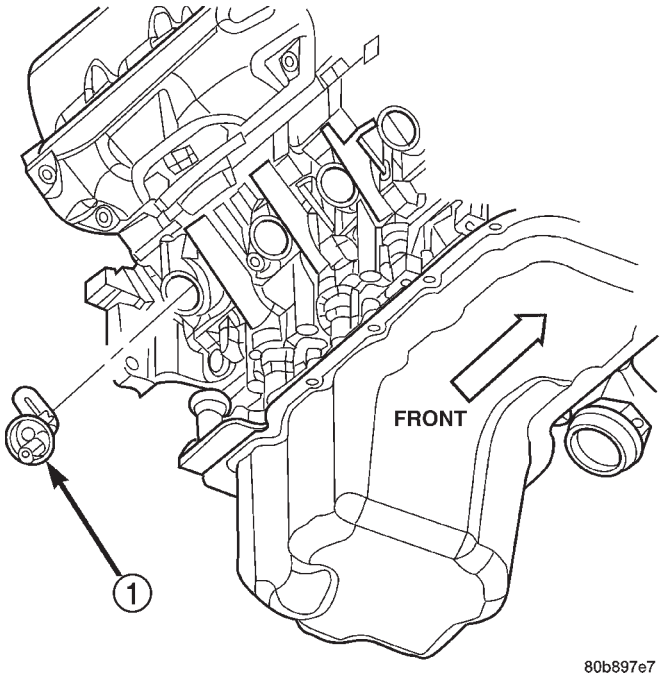



***Fig. 54 Engine Block Heater—4.7L***

1 – ENGINE BLOCK HEATER

## BELT REPLACEMENT/ADJUSTMENT

**NOTE: The belt routing schematics are published from the latest information available at the time of publication. If anything differs between these schematics and the Belt Routing Label, use the schematics on Belt Routing Label. This label is located in the engine compartment.**

### REMOVAL

**CAUTION: DO NOT LET TENSIONER ARM SNAP BACK TO THE FREEARM POSITION, SEVERE DAMAGE MAY OCCUR TO THE TENSIONER.**

Belt tension is not adjustable. Belt adjustment is maintained by an automatic ( spring load ) belt tensioner.

(1) Disconnect negative battery cable from battery.

(2) Rotate belt tensioner until it contacts its stop. Remove belt, then slowly rotate the tensioner into the freearm position. (Fig. 55) (Fig. 56).

### INSTALLATION

Belt tension is not adjustable. Belt adjustment is maintained by an automatic ( spring load ) belt tensioner.

(1) Check condition of all pulleys.

REMOVAL AND INSTALLATION (Continued)

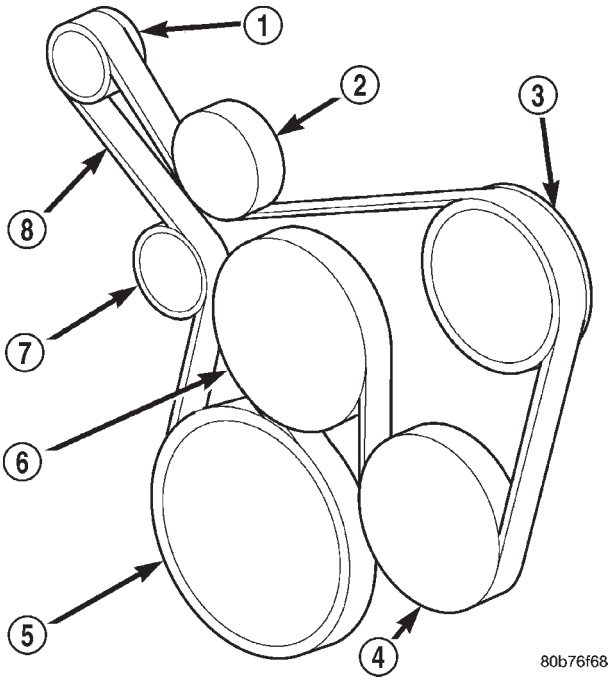



*Fig. 55 Belt Routing—4.0L*

1 – GENERATOR
2 – IDLER
3 – POWER STEERING
4 – A/C
5 – CRANKSHAFT
6 – WATER PUMP
7 – TENSIONER
8 – ACCESSORY DRIVE BELT

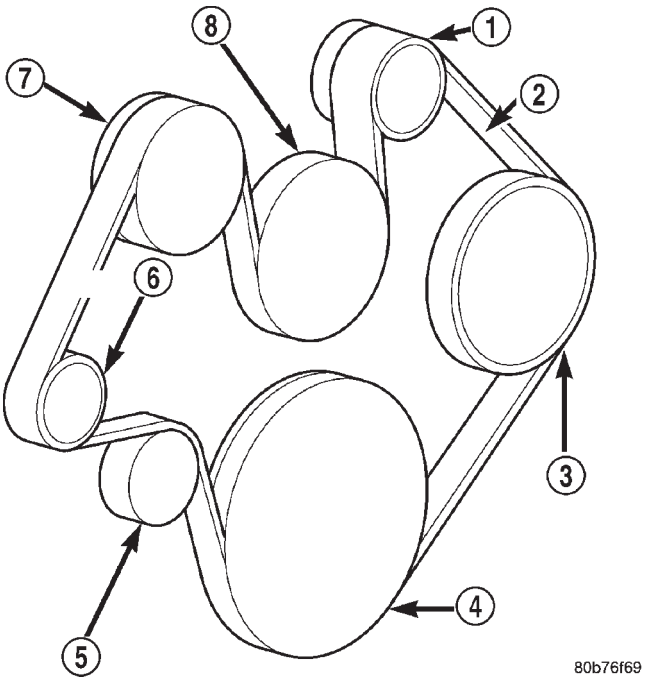



*Fig. 56 Belt Routing—4.7L*

1 – GENERATOR
2 – ACCESSORY DRIVE BELT
3 – POWER STEERING
4 – CRANKSHAFT
5 – IDLER
6 – TENSIONER
7 – A/C
8 – WATER PUMP

**CAUTION: When installing the serpentine accessory drive belt, the belt MUST be routed correctly. If not, the engine may overheat due to the water pump rotating in the wrong direction (Fig. 55) (Fig. 56).**

(2) Install new belt (Fig. 55) (Fig. 56). Route the belt around all pulleys except the idler pulley. Rotate the tensioner arm until it contacts its stop position. Route the belt around the idler and slowly let the tensioner rotate into the belt. Make sure the belt is seated onto all pulleys.

(3) With the drive belt installed, inspect the belt wear indicator (Fig. 57) (Fig. 58). On 4.7L Engines only, the gap between the tang and the housing stop (measurement A ) must not exceed 24 mm (.94 inches). On 4.0L Engines, the indicator mark must be between the minimum and maximum marks. If the measurement exceedes this specification replace the serpentine accessory drive belt.

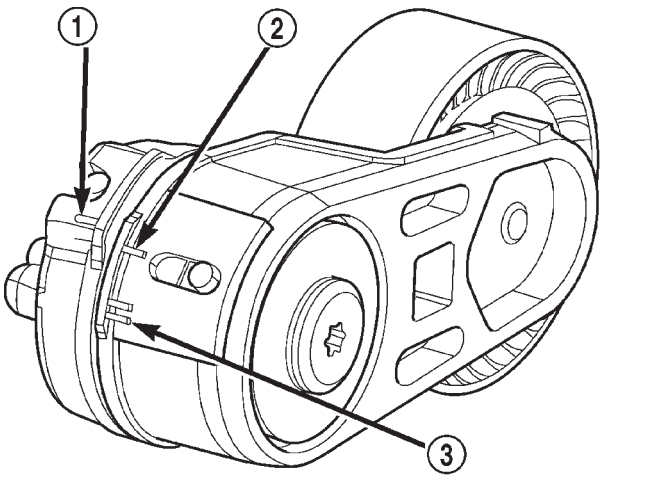



*Fig. 57 Accessory Drive Belt Wear Indicator—4.0L Engine*

1 – INDICATOR MARK
2 – MINIMUM TENSION MARK
3 – MAXIMUM TENSION MARK

REMOVAL AND INSTALLATION (Continued)

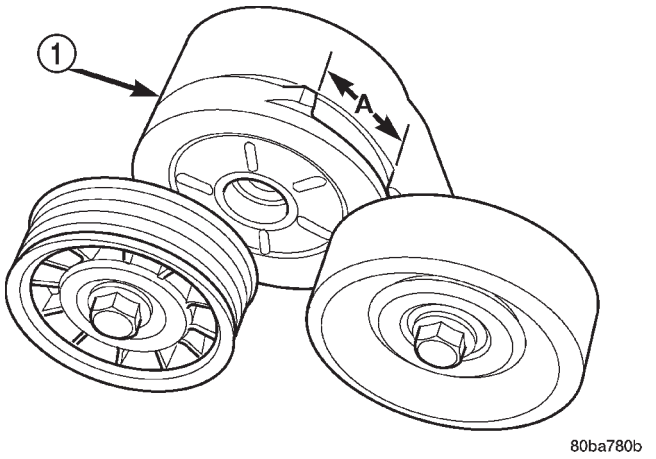



*Fig. 58 Accessory Drive Belt Wear Indicator—4.7L Engine*

1 – AUTOMATIC TENSIONER ASSEMBLY

## AUTOMATIC BELT TENSIONER

**On 4.7L engines, the tensioner is equipped with an indexing tang on back of tensioner and an indexing stop on tensioner housing. If a new belt is being installed, tang must be within approximately 24 mm (.94 inches) of indexing stop. Belt is considered new if it has been used 15 minutes or less.**

**On 4.0L engines, the tensioner arm has three marks. Upon installation of a new belt, the double line marks close to each other should be very close to the mark on the base. The belt should be replaced if the single line mark lines up with the mark on the base.**

If the above specification cannot be met, check for:

- The wrong belt being installed (incorrect length/ width)
- Worn bearings on an engine accessory (A/C compressor, power steering pump, water pump, idler pulley or generator)
- A pulley on an engine accessory being loose
- Misalignment of an engine accessory
- Belt incorrectly routed.

**NOTE: A used belt should be replaced if tensioner indexing arrow has moved to the minmum travel indicator. Tensioner travel stops at this point.**

### REMOVAL

(1) Remove accessory drive belt. Refer to Belt Replacement/Adjustment in this group.

(2) Remove tensioner assembly from mounting bracket (Fig. 59) (Fig. 60).

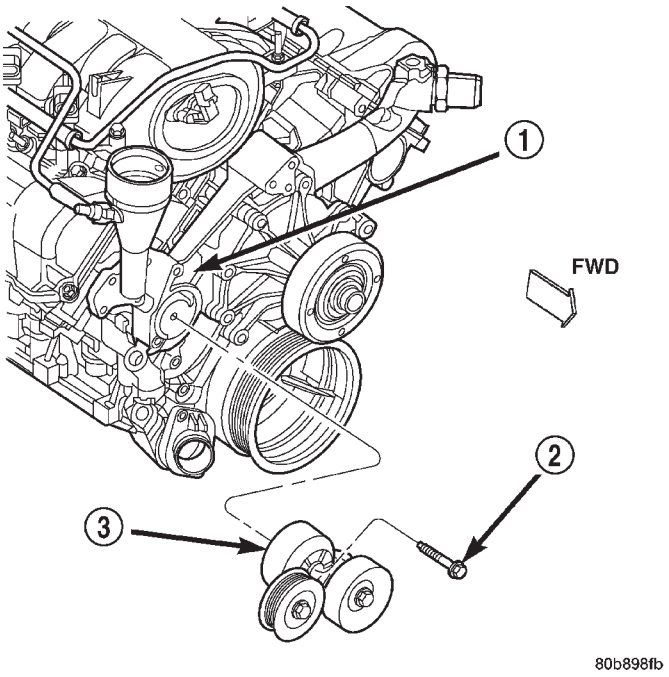



*Fig. 59 Automatic Belt Tensioner—4.7L Engine*

1 – TIMING CHAIN COVER
2 – BOLT TORQUE TO 41 N·m (30 FT LBS)
3 – AUTOMATIC BELT TENSIONER

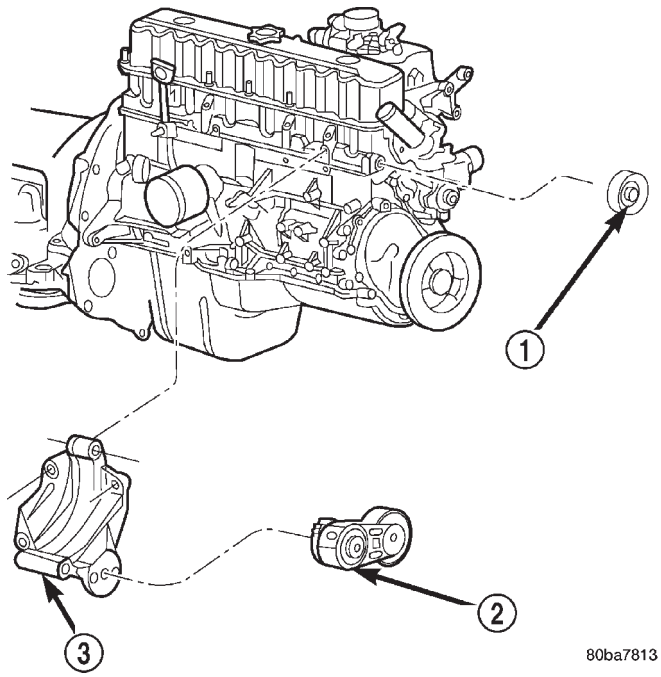



*Fig. 60 Automatic Belt Tensioner—4.0L Engine*

1 – IDLER PULLEY TIGHTEN TO 47 N·m (35 FT. LBS.)
2 – AUTOMATIC BELT TENSIONER
3 – GENERATOR MOUNTING BRACKET

REMOVAL AND INSTALLATION (Continued)

**WARNING: BECAUSE OF HIGH SPRING TENSION, DO NOT ATTEMPT TO DISASSEMBLE AUTOMATIC TENSIONER. UNIT IS SERVICED AS AN ASSEMBLY (EXCEPT FOR PULLEY ON 4.7L TENSIONER).**

(3) Remove pulley bolt. Remove pulley from tensioner (4.7L ONLY).

### INSTALLATION

(1) Install pulley and pulley bolt to tensioner. Tighten bolt to 61 N·m (45 ft. lbs.) torque (4.7L engine only).

(2) Install tensioner assembly to mounting bracket. (4.0L engine) align the two dowels on the tensioner with the mounting bracket and hand start the bolt. Tighten bolt to 28 N·m (250 in. lbs.). (4.7L engines) An indexing slot is located on back of tensioner. Align this slot to the head of the bolt on the front cover. Install the mounting bolt. Tighten bolt to 41 N·m (30 ft. lbs.).

**CAUTION: To prevent damage to coil case, coil mounting bolts must be torqued.**

(3) Install drive belt. Refer to Belt Removal/Installation in this group.

(4) Check belt indexing marks.

## COOLING SYSTEM FAN 4.0L AND 4.7L ENGINES

### VISCOUS FAN

#### REMOVAL

(1) Disconnect negative battery cable from battery.

**NOTE: The 4.0L engine does not require special tool 6958 spanner wrench or adapters 8346 to remove the fan drive.**

(2) The thermal viscous fan drive/fan blade assembly is attached (threaded) to water pump hub shaft (Fig. 61). Remove fan blade/viscous fan drive assembly from water pump by turning mounting nut counterclockwise as viewed from front. Threads on viscous fan drive are **RIGHT HAND.** Using spanner wrench 6958 with adapter pins 8346 (4.7L engine only) and a suitable fan wrench loosen the fan drive. (Fig. 62)

(3) Do not attempt to remove fan/viscous fan drive assembly from vehicle at this time.

(4) Do not unbolt fan blade assembly from viscous fan drive at this time.

(5) Remove fan shroud-to-upper crossmember nuts.

(6) Remove fan shroud and fan blade/viscous fan drive assembly as a complete unit from vehicle.

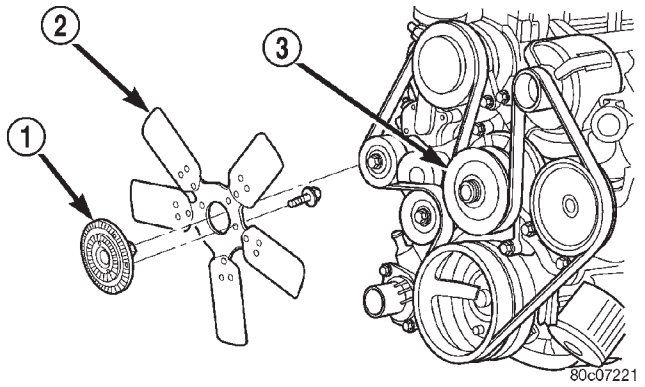



***Fig. 61 Fan Blade/Viscous Fan Drive—4.7L V-8 Engines***

1 – VISCOUS FAN DRIVE
2 – FAN BLADE
3 – WATER PUMP PULLEY

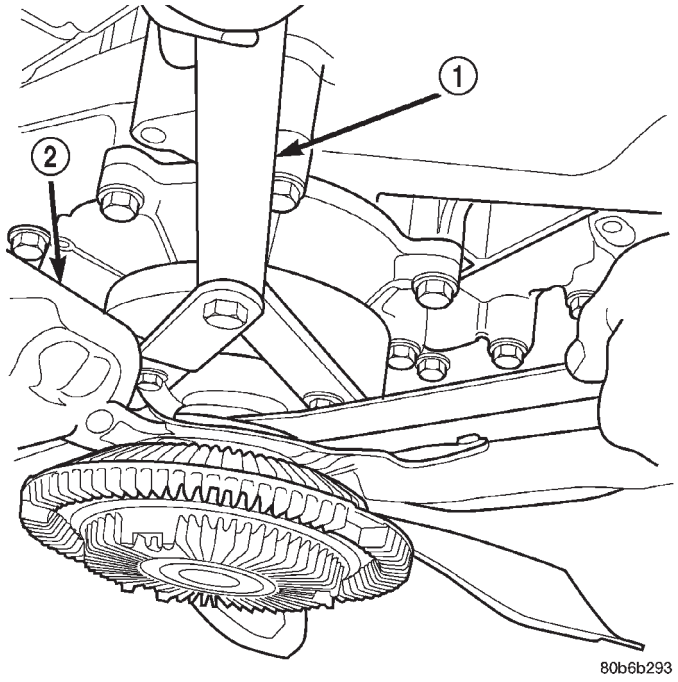



***Fig. 62 Fan Blade and Drive—Removal***

1 – SPECIAL TOOL 6958 SPANNER WRENCH WITH ADAPTER PINS 8346
2 – FAN

(7) After removing fan blade/viscous fan drive assembly, **do not** place viscous fan drive in horizontal position. If stored horizontally, silicone fluid in the viscous fan drive could drain into its bearing assembly and contaminate lubricant.

**CAUTION: Do not remove water pump pulley-to-water pump bolts. This pulley is under belt tension.**

(8) Remove four bolts securing fan blade assembly to viscous fan drive.

REMOVAL AND INSTALLATION (Continued)

#### INSTALLATION

(1) Install fan blade assembly to viscous fan drive. Tighten bolts to 23 N·m (17 ft. lbs.) torque.

(2) Position fan shroud and fan blade/viscous fan drive assembly to vehicle as a complete unit.

(3) Position fan shroud to radiator. Be sure the alignment tabs at the lower part of shroud are placed into the slots near lower part of radiator. Install and tighten the two fan shroud-to-upper crossmember mounting nuts.

Be sure of at least 25 mm (1.0 inches) between tips of fan blades and fan shroud.

(4) Install fan blade/viscous fan drive assembly to water pump shaft (Fig. 62).

(5) Connect negative battery cable.

### ELECTRIC FAN

The electric fan is only serviced as an assembly.

## VISCOUS FAN DRIVE

### REMOVAL/INSTALLATION

Refer to Cooling System Fan removal and installation procedures of the viscous fan drive unit procedures.

#### Viscous Fan Drive Fluid Pump Out Requirement:

After installing a **NEW** viscous fan drive, bring the engine speed up to approximately 2000 rpm and hold for approximately two minutes. This will ensure proper fluid distribution within the drive.

# CLEANING AND INSPECTION

## RADIATOR PRESSURE CAP

### CLEANING

Clean the radiator pressure cap using a mild soap and water only.

### INSPECTION

Visually inspect the pressure valve gasket on the cap. Replace cap if the gasket is swollen, torn or worn. Inspect the area around radiator filler neck for white deposits that indicate a leaking cap.

## RADIATOR

### CLEANING

Clean radiator fins With the engine cold, apply cold water and compressed air to the back (engine side) of the radiator to flush the radiator and/or A/C condenser of debris.

### INSPECTION

The radiator cooling fins should be checked for damage or deterioration. Inspect cooling fins to make sure they are not bent or crushed, these areas result in reduced heat exchange causing the cooling system to operate at higher temperatures. Inspect the plastic end tanks for cracks, damage or leaks.

Inspect the radiator neck for damage or distortion.

## WATER PUMP

### CLEANING

Clean the gasket mating surface. Use caution not to damage the gasket sealing surface.

### INSPECTION

Inspect the water pump assembly for cracks in the housing, Water leaks from shaft seal, Loose or rough turning bearing or Impeller rubbing either the pump body or timing chain case/cover.

## FAN BLADE

### CLEANING

Clean the fan blades using a mild soap and water. Do not use an abrasive to clean the blades.

### INSPECTION

**WARNING: DO NOT ATTEMPT TO BEND OR STRAIGHTEN FAN BLADES IF FAN IS NOT WITHIN SPECIFICATIONS.**

**CAUTION: If fan blade assembly is replaced because of mechanical damage, water pump and viscous fan drive should also be inspected. These components could have been damaged due to excessive vibration.**

(1) Remove fan blade assembly from viscous fan drive unit (four bolts).

(2) Lay fan on a flat surface with leading edge facing down. With tip of blade touching flat surface, replace fan if clearance between opposite blade and surface is greater than 2.0 mm (.090 inch). Rocking motion of opposite blades should not exceed 2.0 mm (.090 inch). Test all blades in this manner.

(3) Inspect fan assembly for cracks, bends, loose rivets or broken welds. Replace fan if any damage is found.

CLEANING AND INSPECTION (Continued)

## COOLING SYSTEM HOSES

### INSPECTION

Inspect the hoses at regular intervals. Replace hoses that are cracked, feel brittle when squeezed or swell excessively when the system is pressurized. The use of molded replacement hoses is recommended. When performing a hose inspection, inspect the radiator lower hose for proper position and condition of the spring.

# SPECIFICATIONS

## INFORMATION

The following specifications are published from the latest information available at the time of publication. **If anything differs between the specifications found on the Vehicle Emission Control Information (VECI) label and the following specifications, use specifications on VECI label.** The VECI label is located in the engine compartment. Refer to Group 25, Emission System for more information on the VECI label.

## COOLING SYSTEM CAPACITIES

| DESCRIPTION | SPECIFICATION |
|---|---|
| 4.0L (6 cyl. eng.) * | 14.1 L (15.0 quarts) |
| 4.7L (8 cyl. eng.) * | 13.7 L (14.0 quarts) |
| *** Includes coolant recovery bottle capacity = 1.9L (2.0 quarts)** | |

## DRIVE BELT TENSION

***4.0L (6 Cyl. eng.) 4.7L (V-8 eng.)***

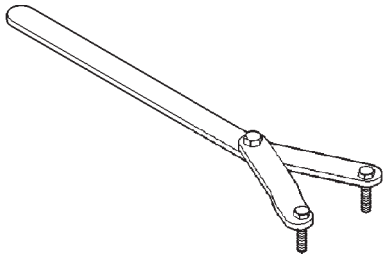
- Do not attempt to check belt tension with a tension gauge. System is equipped with an automatic tensioner. Refer to Automatic Belt Tensioner in Group 7, Cooling System.

## TORQUE SPECIFICATIONS

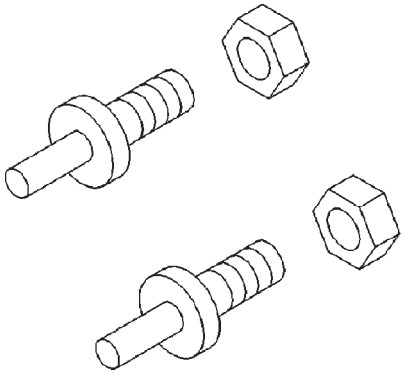
| DESCRIPTION | N·m | Ft. Lbs. | In. Lbs. |
|---|---|---|---|
| Automatic Belt Tensioner to Mounting Bracket—Bolt | | | |
| 4.0L | 28 | — | 250 |
| 4.7L | 41 | 30 | — |
| Automatic Belt Tensioner Pulley—Bolt | | | |
| (4.7L) | 61 | 45 | — |
| Block Heater—Bolt | | | |
| 4.0L | 4 | — | 32 |
| 4.7L | 2 | — | 17 |
| Fan Blade Assy. to Viscous Drive— | | | |
| Bolts 4.0L | 23 | — | 200 |
| Generator Mounting—Bolts 4.0L | 57 | 42 | — |
| Radiator Upper Isolator to | | | |
| Crossmember—Nuts | 3 | — | 20 |
| Radiator Upper Isolator to Radiator— | | | |
| Nuts | 4 | — | 36 |
| Radiator Brace—Bolts | 10 | — | 90 |
| Thermostat Housing—Bolts | | | |
| 4.0L | 22 | 16 | — |
| 4.7L | 13 | — | 115 |
| Transmission Auxiliary Oil Cooler— | | | |
| Bolts | 10 | — | 90 |
| Upper Radiator Crossmember to | | | |
| Body—Bolts | 10 | — | 90 |
| Water Pump—Bolts | | | |
| 4.0L | 23 | 17 | — |
| 4.7L | 54 | 40 | — |
| Water Pump Pulley to Water Pump— | | | |
| Bolts 4.0L | 28 | — | 250 |

## SPECIAL TOOLS

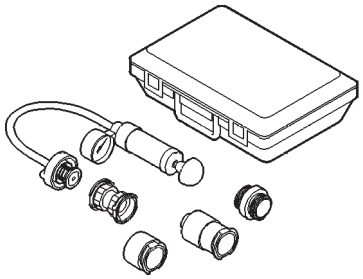
### COOLING



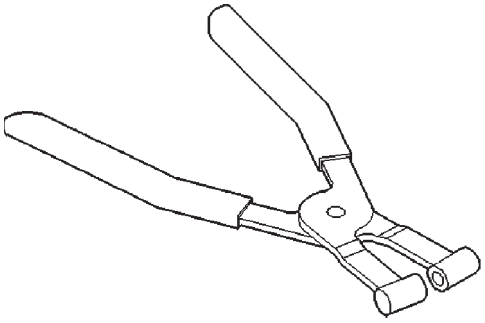
*Spanner Wrench 6958*



*Adapter Pins 8346*



*Pressure Tester 7700–A*



*Pliers 6094*