COOLING

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COOLING

DESCRIPTION

DESCRIPTION - COOLING SYSTEM 3.7L ENGINE

The cooling system consists of the following items:

- Electric cooling fan - Standard.
- Electric cooling fan and mechanical thermal viscous fan with low disengaged - Heavy duty cooling only
- Radiator
- Hot bottle pressure cap
- Thermostat
- Coolant reserve/overflow system
- Radiator in-tank transmission oil cooler (if equipped with an automatic transmission)
- Coolant
- Water pump
- Hoses and hose clamps

COOLING (Continued)

DESCRIPTION - COOLING SYSTEM ROUTING 3.7L ENGINE

For cooling system routing refer to (Fig. 1).

DESCRIPTION - HOSE CLAMPS

The cooling system utilizes spring type hose clamps. If a spring type clamp replacement is necessary, replace with the original Mopar® equipment spring type clamp.

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. 2). 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 a original equipment clamp with matching number or letter (Fig. 2).

OPERATION

OPERATION - COOLING SYSTEM

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.

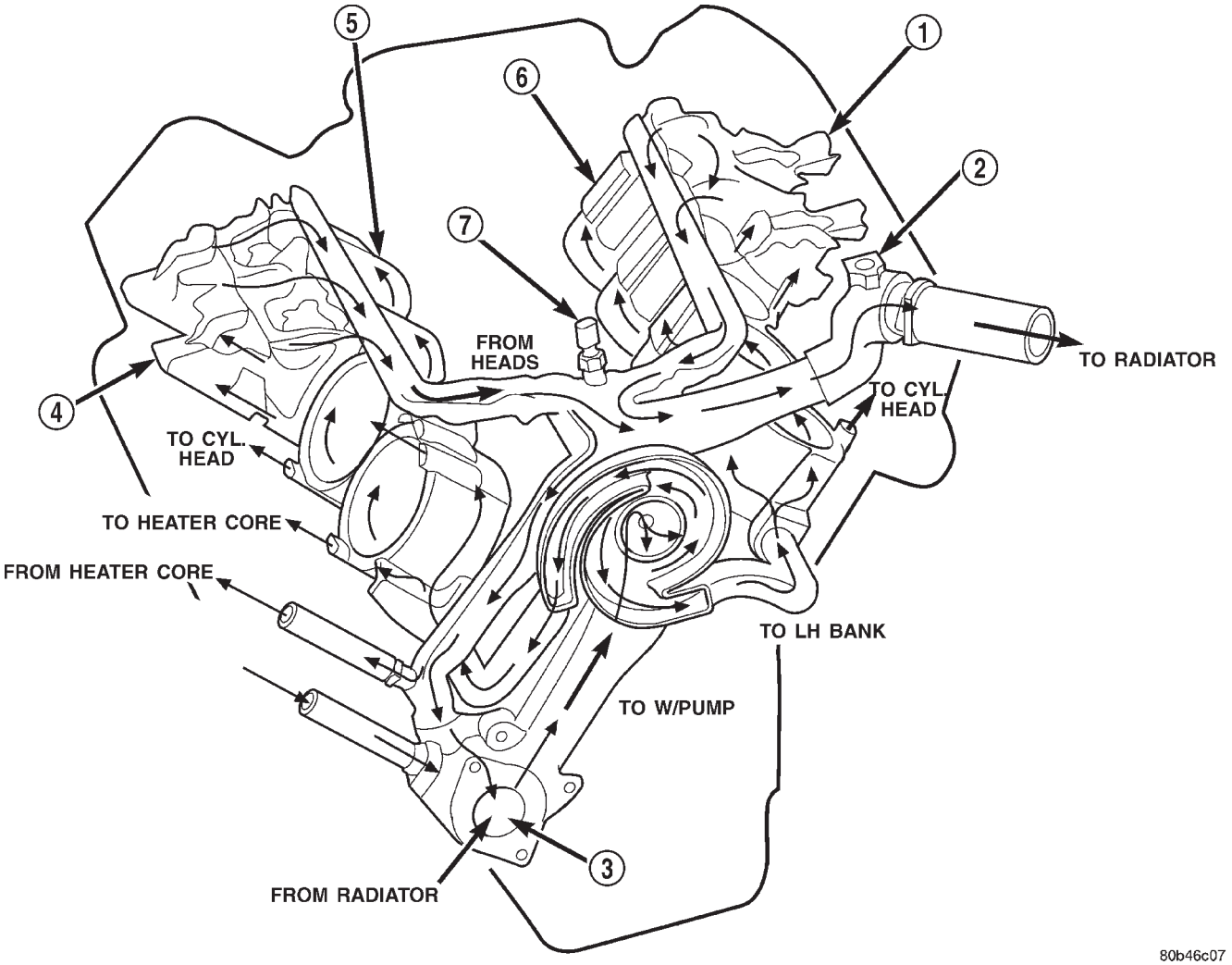


Fig. 1 Engine Cooling System 3.7L Engine

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

COOLING (Continued)

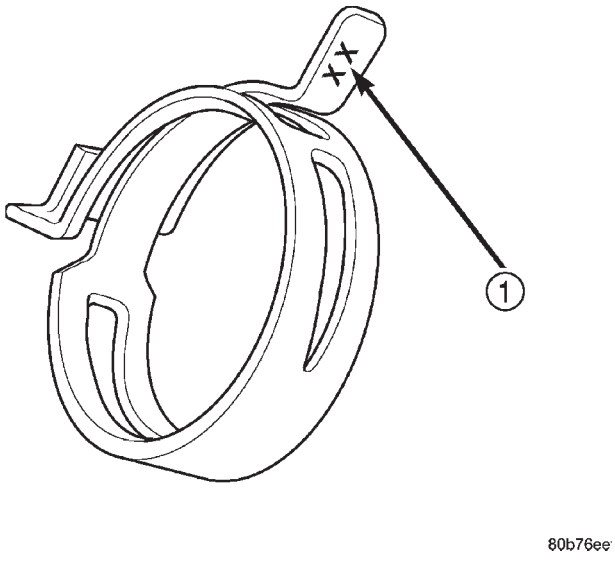


Fig. 2 Spring Clamp Size Location

1 - SPRING CLAMP SIZE LOCATION

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.

OPERATION - HOSE CLAMPS

The spring type hose clamp applies constant tension on a hose connection. To remove a spring type hose clamp, only use constant tension clamp pliers designed to compress the hose clamp.

DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING - ON-BOARD DIAGNOSTICS (OBD)

COOLING SYSTEM RELATED DIAGNOSTICS

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

- If the engine has remained cool for too long a period, such as with a stuck open thermostat, a Diagnostic Trouble Code (DTC) can be set.
- If an open or shorted condition has developed in the relay circuit controlling the electric radiator fan, a Diagnostic Trouble Code (DTC) can be set.

If the problem is sensed in a monitored circuit often enough to indicated an actual problem, a DTC is stored. The DTC will be stored in the PCM memory for eventual display to the service technician. (Refer to 25 - EMISSIONS CONTROL - DESCRIPTION).

ACCESSING DIAGNOSTIC TROUBLE CODES

To read DTC's and to obtain cooling system data, (Refer to 25 - EMISSIONS CONTROL - DESCRIPTION).

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 information for operation of the DRB scan tool.

DIAGNOSIS AND TESTING - 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:

- PROLONGED IDLE
- VERY HIGH AMBIENT TEMPERATURE
- SLIGHT TAIL WIND AT IDLE
- SLOW TRAFFIC
- TRAFFIC JAMS
- HIGH SPEED
- STEEP GRADES

Driving techniques that avoid overheating are:

- Idle with A/C off when temperature gauge is at end of normal range.

(1) TRAILER TOWING:

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

(2) 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, or pump rotating in wrong direction due to belt not correctly routed
- Reconditioned radiator or cooling system refilling (possibly under filled or air trapped in system).

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

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

COOLING (Continued)

DIAGNOSIS AND TESTING - COOLING SYSTEM LEAKS

ULTRAVIOLET LIGHT METHOD

A leak detection additive is available through the parts department that can be added to cooling system. The additive is highly visible under ultraviolet light (black light). Pour one ounce of additive into cooling system. Place heater control unit in HEAT position. Start and operate engine until radiator upper hose is warm to touch. Aim the commercially available black light tool at components to be checked. If leaks are present, black light will cause additive to glow a bright green color.

The black light can be used in conjunction with a pressure tester to determine if any external leaks exist (Fig. 3).

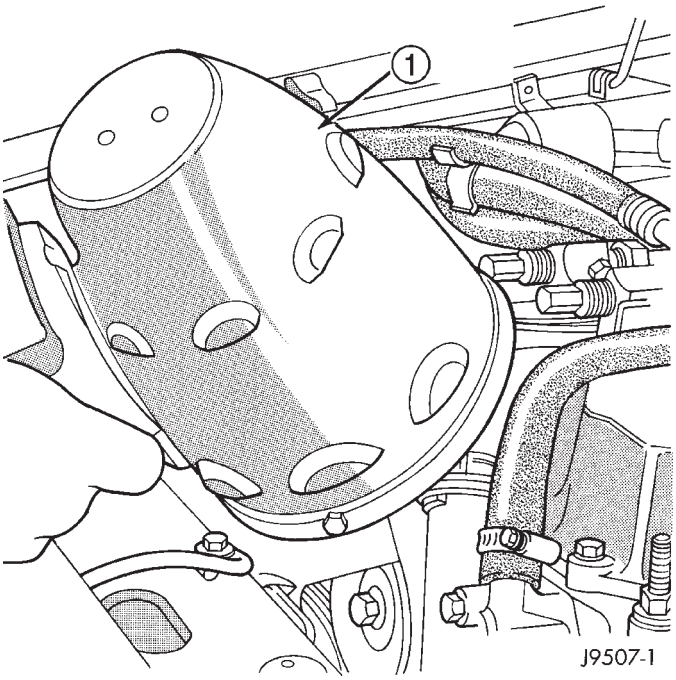


Fig. 3 Leak Detection Using Black Light - Typical

1 - TYPICAL BLACK LIGHT TOOL

PRESSURE TESTER METHOD

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

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

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

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

Attach pressure tester (7700 or an equivalent) to radiator filler neck (Fig. 4).

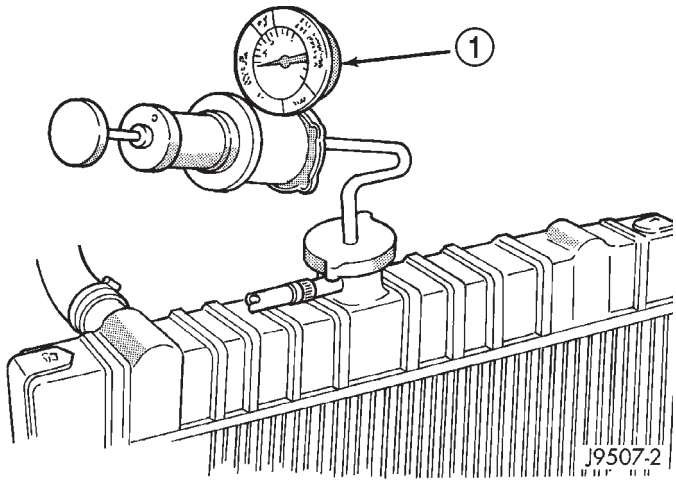


Fig. 4 Pressure Testing Cooling System - Typical

1 - TYPICAL COOLING SYSTEM PRESSURE TESTER

Operate tester pump to apply 110 kPa (16 psi) pressure to system. If hoses enlarge excessively or bulges while testing, replace as necessary. Observe gauge pointer and determine condition of cooling system according to following criteria:

Holds Steady: If pointer remains steady for two minutes, serious coolant leaks are not present in system. However, there could be an internal leak that does not appear with normal system test pressure. If it is certain that coolant is being lost and leaks cannot be detected, inspect for interior leakage or perform Internal Leakage Test.

Drops Slowly: Indicates a small leak or seepage is occurring. Examine all connections for seepage or slight leakage with a flashlight. Inspect radiator, hoses, gasket edges and heater. Seal small leak holes with a Sealer Lubricant (or equivalent). Repair leak holes and inspect system again with pressure applied.

Drops Quickly: Indicates that serious leakage is occurring. Examine system for external leakage. If leaks are not visible, inspect for internal leakage. Large radiator leak holes should be repaired by a reputable radiator repair shop.

INTERNAL LEAKAGE INSPECTION

Remove engine oil pan drain plug and drain a small amount of engine oil. If coolant is present in

COOLING (Continued)

the pan, it will drain first because it is heavier than oil. An alternative method is to operate engine for a short period to churn the oil. After this is done, remove engine dipstick and inspect for water globules. Also inspect transmission dipstick for water globules and transmission fluid cooler for leakage.

WARNING: WITH RADIATOR PRESSURE TESTER TOOL INSTALLED ON RADIATOR, DO NOT ALLOW PRESSURE TO EXCEED 124 KPA (18 PSI). PRESSURE WILL BUILD UP QUICKLY IF A COMBUSTION LEAK IS PRESENT. TO RELEASE PRESSURE, ROCK TESTER FROM SIDE TO SIDE. WHEN REMOVING TESTER, DO NOT TURN TESTER MORE THAN 1/2 TURN IF SYSTEM IS UNDER PRESSURE.

Operate engine without pressure cap on radiator until thermostat opens. Attach a Pressure Tester to filler neck. If pressure builds up quickly it indicates a combustion leak exists. This is usually the result of a cylinder head gasket leak or crack in engine. Repair as necessary.

If there is not an immediate pressure increase, pump the Pressure Tester. Do this until indicated pressure is within system range of 110 kPa (16 psi). Fluctuation of gauge pointer indicates compression or combustion leakage into cooling system.

Because the vehicle is equipped with a catalytic converter, **do not** remove spark plug cables or short out cylinders to isolate compression leak.

If the needle on dial of pressure tester does not fluctuate, race engine a few times to check for an abnormal amount of coolant or steam. This would be emitting from exhaust pipe. Coolant or steam from exhaust pipe may indicate a faulty cylinder head gasket, cracked engine cylinder block or cylinder head.

A convenient check for exhaust gas leakage into cooling system is provided by a commercially available Block Leak Check tool. Follow manufacturers instructions when using this product.

COMBUSTION LEAKAGE TEST - WITHOUT PRESSURE TESTER

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

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

Drain sufficient coolant to allow thermostat removal. (Refer to 7 - COOLING/ENGINE/ENGINE COOLANT THERMOSTAT - REMOVAL). Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).

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

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

Start engine and accelerate rapidly three times, to approximately 3000 rpm while observing coolant. If internal engine combustion gases are leaking into cooling system, bubbles will appear in coolant. If bubbles do not appear, internal combustion gas leakage is not present.

COOLING (Continued)

DIAGNOSIS AND TESTING - COOLING SYSTEM DIAGNOSIS CHART

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 thermostat?	1. Refer to (Refer to 25 - EMISSIONS CONTROL - DESCRIPTION) for On-Board Diagnostics and DTC information. Replace thermostat if necessary.
	2. Is the temperature sending unit connected?	2. Check the temperature sensor connector. (Refer to 7 - COOLING/ ENGINE/ENGINE COOLANT TEMP SENSOR - DESCRIPTION). Repair connector if necessary.
	3. Is the temperature gauge operating OK?	3. Check gauge operation. Repair as necessary.
	4. Coolant level low in cold ambient temperatures accompanied with poor heater performance.	4. Check coolant level in the coolant pressure botttle and the radiator. Inspect system for leaks. Repair leaks as necessary.
	5. Improper operation of internal heater doors or heater controls.	5. Inspect heater and repair as necessary. (Refer to 24 - HEATING & AIR CONDITIONING - DIAGNOSIS AND TESTING)
	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.
	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 the normal range, determine the cause for overheating and repair.
	2. Is the temperature gauge reading correctly?	2. Check gauge. (Refer to Group 8J - INSTRUMENT CLUSTER). Repair as necessary.
	3. Is the temperature warning illuminating unnecessarily?	3. Check warning lamp operation. (Refer to Group 8J - INSTRUMENT CLUSTER).Repair as necessary.
	4. Coolant low in coolant pressure bottle and radiator?	4. Check for coolant leaks and repair as necessary. (Refer to 7 - COOLING - DIAGNOSIS AND TESTING).

COOLING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
	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 the radiator cap.	6. (a) Check condition of cap and cap seals. (Refer to 7 - COOLING/ ENGINE/RADIATOR PRESSURE CAP - DIAGNOSIS AND TESTING). (b) Check condition of radiator filler neck. If neck is bent or damaged, replace radiator.
	7. Coolant not flowing through system.	7. (a) Check condition of pressure bottle cap and cap seals. (Refer to 7 - COOLING/ENGINE/RADIATOR PRESSURE CAP - DIAGNOSIS AND TESTING). (b) Check condition of radiator vent nipple. If neck is damaged, replace radiator. (c) Check 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. (d) Check pressure bottle/overflow tank and tanks hoses for blockage. Repair as necessary.
	8. Incorrect coolant concentration	8. Check coolant. (Refer to 7 - COOLING/ENGINE/COOLANT - DESCRIPTION) for correct coolant/water mixture ratio.
	9. Fan installed backwards on viscous drive.	9. Mount fan on drive correctly.
	10. Radiator or A/C condenser fins are dirty or clogged.	10. Remove insects and debris. (Refer to 7 - COOLING/ENGINE/ RADIATOR - CLEANING).
	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 /or IGNITION CONTROL for diagnosis.
	13. Dragging brakes.	13. Check and correct as necessary. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING) for correct procedures.
	14. Bug screen or cardboard is being used, reducing airflow.	14. Remove bug screen or cardboard.

COOLING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
	15. Thermostat partially or completely shut.	15. Check thermostat operation and replaces necessary. (Refer to 7 - COOLING/ENGINE/ENGINE COOLANT THERMOSTAT - DIAGNOSIS AND TESTING).
	16. Viscous fan drive not operating properly.	16. Check fan drive operation and replace as necessary. (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - DIAGNOSIS AND TESTING).
	17. Cylinder head gasket leaking.	17. Check for cylinder head gasket leaks. (Refer to 7 - COOLING - DIAGNOSIS AND TESTING). For repair, (Refer to 9 - ENGINE/ CYLINDER HEAD - REMOVAL).
	18. Heater core leaking.	18. Check heater core for leaks. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/ HEATER CORE - REMOVAL). 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.
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 this circuit.	2. Check operation of gauge and repair if necessary. Refer to Group 8J, Instrument cluster.
	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 should return to normal range after vehicle is driven.
	4. Gauge reading high after re-starting 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 cooling system (air will build up in the cooling system causing the thermostat to open late).	5. Check and correct coolant leaks. (Refer to 7 - COOLING - DIAGNOSIS AND TESTING).

COOLING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
	6. Cylinder head gasket leaking allowing exhaust gas to enter cooling system causing a thermostat to open late.	6. (a) Check for cylinder head gasket leaks. (Refer to 7 - COOLING - DIAGNOSIS AND TESTING). (b) Check for coolant in the engine oil. Inspect for white steam emitting from the exhaust system. Repair as necessary.
	7. Water pump impeller loose on shaft.	7. Check water pump and replace as necessary. (Refer to 7 - COOLING/ENGINE/WATER PUMP - DIAGNOSIS AND TESTING).
	8. Loose accessory drive belt. (water pump slipping)	8. (Refer to 7 - COOLING/ ACCESSORY DRIVE/DRIVE BELTS - DIAGNOSIS AND TESTING). Check and correct as necessary.
	9. Air leak on the suction side of the 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 pressure bottle cap is defective.	1. Check condition of radiator cap and cap seals. (Refer to 7 - COOLING/ENGINE/RADIATOR PRESSURE CAP - DIAGNOSIS AND TESTING). Replace cap as necessary.
COOLANT LOSS TO THE GROUND WITHOUT PRESSURE CAP BLOWOFF. GAUGE 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 7 - COOLING - DIAGNOSIS AND TESTING).
DETONATION OR PRE-IGNITION (NOT CAUSED BY IGNITION SYSTEM). GAUGE MAY OR MAY NOT BE READING HIGH	1. Engine overheating.	1. Check reason for overheating and repair as necessary.
	2. Freeze point of coolant not correct. Mixture is too rich or too lean.	2. Check coolant concentration. (Refer to 7 - COOLING/ENGINE/ COOLANT - DESCRIPTION) and adjust ratio as required.

COOLING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
HOSE OR HOSES COLLAPSE WHILE ENGINE IS RUNNING	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 7 - COOLING/ ENGINE/RADIATOR PRESSURE CAP - DIAGNOSIS AND TESTING). Replace if necessary (b) Hose between coolant reserve/overflow tank and radiator is kinked. Repair as necessary. (c) Vent at coolant reserve/overflow tank is plugged. Clean vent and repair as necessary. (d) Reserve/overflow tank is internally blocked or plugged. Check for blockage and repair as necessary.
NOISY VISCOUS FAN/DRIVE	1. Fan blades loose - 4.0L. 2. Fan blades striking a surrounding object. 3. Air obstructions at radiator or air conditioning condenser. 4. Thermal viscous fan drive has defective bearing - 4.0L	1. Replace fan blade assembly. (Refer to 7 - COOLING/ENGINE/ RADIATOR FAN - REMOVAL) 2. Locate point of fan blade contact and repair as necessary. 3. Remove obstructions and/or clean debris or insects from radiator or A/C condenser. 4. Replace fan drive. Bearing is not serviceable. (Refer to 7 - COOLING/ ENGINE/RADIATOR FAN - REMOVAL).
INADEQUATE HEATER PERFORMANCE. THERMOSTAT FAILED IN OPEN POSITION	1. Has a Diagnostic trouble Code (DTC) been set? 2. Coolant level low 3. Obstructions in heater hose/ fittings 4. Heater hose kinked 5. Water pump is not pumping water to/through the 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 or the heater core may be plugged. Accessory drive belt may be slipping causing poor water pump operation.	1. (Refer to 25 - EMISSIONS CONTROL - DESCRIPTION) for correct procedures and replace thermostat if necessary 2. (Refer to 7 - COOLING - DIAGNOSIS AND TESTING). 3. Remove heater hoses at both ends and check for obstructions 4. Locate kinked area and repair as necessary 5. (Refer to 7 - COOLING/ENGINE/ WATER PUMP - DIAGNOSIS AND TESTING). If a slipping belt is detected, (Refer to 7 - COOLING/ ACCESSORY DRIVE/DRIVE BELTS - REMOVAL). If heater core obstruction is detected, (Refer to 7 - COOLING - STANDARD PROCEDURE) for cooling system reverse flushing.

COOLING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
STEAM IS COMING FROM THE FRONT OF VEHICLE NEAR THE 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 or condensor, 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 7 - COOLING/ENGINE/ COOLANT - DESCRIPTION) for coolant concentration information. Adjust coolant mixture 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 operating temperature, the level should return to within that range after operation at elevated temperatures.	1. A normal condition. No repair is necessary.
FAN RUNS ALL THE TIME	1. Fan control sensors inoperative. 2. Fan control solenoid stuck ″on″. 3. Fan control solenoid harness damaged. 4. Transmission temperature too high. 5. Engine coolant temperature too high.	1. Check for DTC’s. Verify sensor readings. 2. Check fan operation speeds. Refer to fan speed operation table. 3. Check for DTC 1499. Repair as required. 4. Check for transmission over temp. DTC. 5. (a) Check coolant level. Correct level as required. (b) Thermostat stuck. Replace thermostat. (c) Water pump failed. Replace water pump. (d) Coolant flow restricted. Clean radiator. (e) Air flow over radiator obstructed.Remove obstruction.

COOLING (Continued)

STANDARD PROCEDURE

STANDARD PROCEDURE - DRAINING COOLING SYSTEM 3.7L ENGINE

WARNING: DO NOT REMOVE THE CYLINDER BLOCK DRAIN PLUGS (Fig. 5) OR LOOSEN THE RADIATOR DRAINCOCK WITH SYSTEM HOT AND UNDER PRESSURE. SERIOUS BURNS FROM COOLANT CAN OCCUR.

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

NOTE: 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.

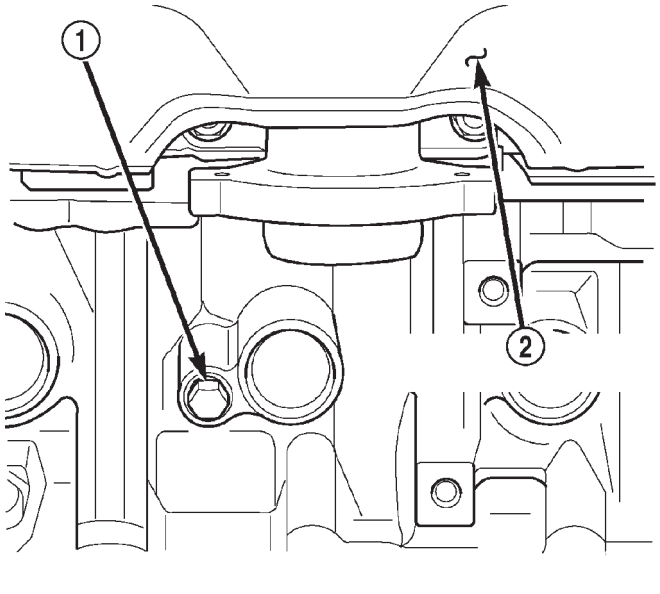


Fig. 5 Drain Plug - 3.7L Engine

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

STANDARD PROCEDURE - REFILLING COOLING SYSTEM 3.7L 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) .Fill system using a 50/50 mixture of ethyleneglycol antifreeze and low mineral content water.Fill pressure bottle to service line.and install cap.

NOTE: The engine cooling system will push any remaining air into the coolant bottle within about an hour of normal driving. As a result, a drop in coolant level in the pressure bottle may occur. If the engine cooling system overheats and pushes coolant into the overflow side of the coolant bottle, this coolant will be sucked back into the cooling system ONLY IF THE PRESSURE CAP IS LEFT ON THE BOTTLE. Removing the pressure cap breaks the vacuum path between the two bottle sections and the coolant will not return to cooling system.

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

(4) Add coolant to pressure bottle as necessary. **Only add coolant to the pressure bottle when the engine is cold. Coolant level in a warm engine will be higher due to thermal expansion.**

NOTE: The coolant bottle has two chambers. Coolant will normally only be in the outboard (larger) of the two. The inboard chamber is only to recover coolant in the event of an overheat or after a recent service fill. The inboard chamber should normally be empty. If there is coolant in the overflow side of the coolant bottle (after several warm/cold cycles of the engine) and coolant level is above cold full when cold, disconnect the end of the overflow hose at the fill neck and lower it into a clean container. Allow coolant to drain into the container until emptied. Reconnect overflow hose to fill neck.

STANDARD PROCEDURE - COOLING SYSTEM - REVERSE FLUSHING

CAUTION: The cooling system normally operates at 97-to-110 kPa (14-to -16 psi) pressure. Exceeding this pressure may damage the radiator or hoses.

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.

CHEMICAL CLEANING

If visual inspection indicates the formation of sludge or scaly deposits, use a radiator cleaner

COOLING (Continued)

(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.

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-110 kPa (14- to-16 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 (Refer to 7 - COOLING - STANDARD PROCEDURE). 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.

CAUTION: Be sure that the heater control valve is closed (heat off). This is done to prevent coolant flow with scale and other deposits from entering the heater core.

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 (Refer to 7 - COOLING/ENGINE/ENGINE COOLANT THERMOSTAT - REMOVAL). Install the thermostat and housing with a replacement gasket (Refer to 7 - COOLING/ENGINE/ENGINE COOLANT THERMOSTAT - INSTALLATION). Connect the radiator hoses. Refill the cooling system with the correct antifreeze/water mixture (Refer to 7 - COOLING - STANDARD PROCEDURE).

SPECIFICATIONS

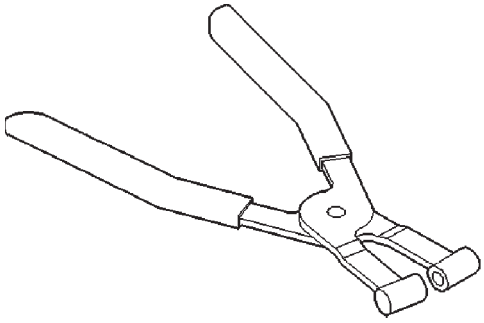
TORQUE

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Automatic Belt Tensioner to Mounting Bracket—Bolt			
2.4L	-	—	-
4.7L	41	30	—
Automatic Belt Tensioner Pulley—Bolt			
(3.7L)	61	45	—
Block Heater—Bolt			
2.4L	-	—	-
3.7L	2	—	17
Condenser to Radiator Bolts	8		70
Coolant Overflow Bottle to Plenum mounting bolts - 2.4L only	8.5		75
Coolant Pressure Bottle to Plenum mounting bolts -3.7L only	8.5		75
Electric Fan to Fan Shroud bolts	5.5		50
Fan Blade Assy. to Viscous Drive			
Bolts 3.7L	23	—	210
Fan Shroud to Radiator Mounting Bolts	8	—	70
Radiator Upper Isolator to Crossmember - Bolts	9.5	—	85
Thermostat Housing—Bolts			
2.4L	-	-	—
4.7L	13	—	115
Water Pump—Bolts			
2.4L	—	—	—
4.7L	54	40	—

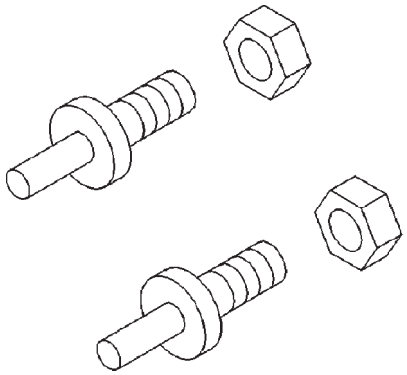
COOLING (Continued)

SPECIAL TOOLS

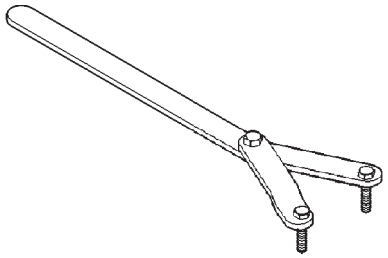
COOLING



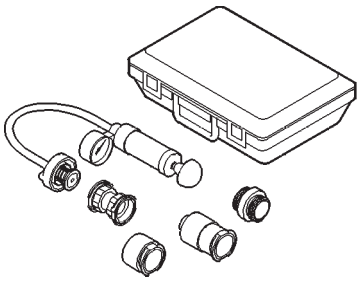
Pliers 6094



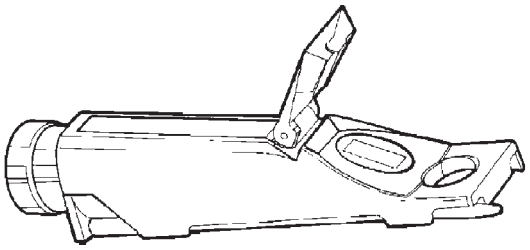
Adapter Pins 8346



Spanner Wrench 6958 with 8346 adapter pins



Pressure Tester 7700–A



Coolant Refractometer 8286

ACCESSORY DRIVE

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ACCESSORY DRIVE

DIAGNOSIS AND TESTING - SERPENTINE DRIVE BELT

When diagnosing serpentine drive belts, small cracks that run across ribbed surface of belt from rib to rib (Fig. 1), 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. 1). Also replace belt if it has excessive wear, frayed cords or severe glazing.

Refer to SERPENTINE DRIVE BELT DIAGNOSIS CHART for further belt diagnosis.

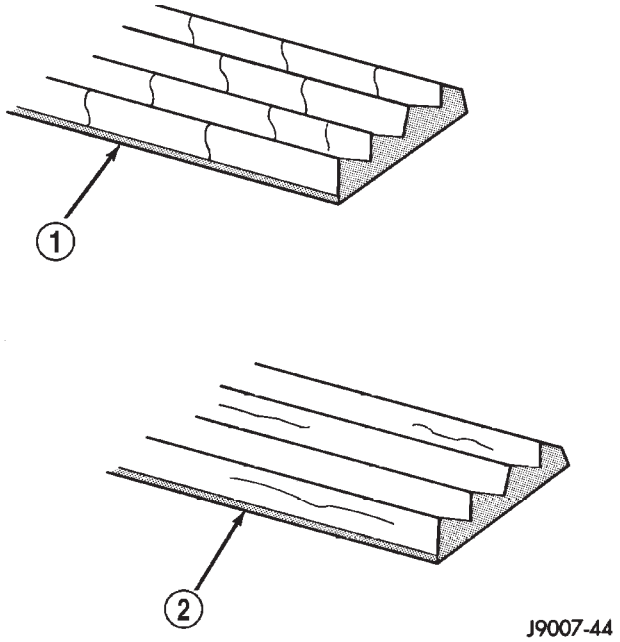

Fig. 1 Serpentine Accessory Drive Belt Wear Patterns

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

ACCESSORY DRIVE (Continued)

SERPENTINE DRIVE BELT DIAGNOSIS CHART

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.
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.

ACCESSORY DRIVE (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
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.

BELT TENSIONERS

REMOVAL - 3.7L ENGINE

(1) Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).

(2) Remove tensioner assembly from engine front cover (Fig. 2).

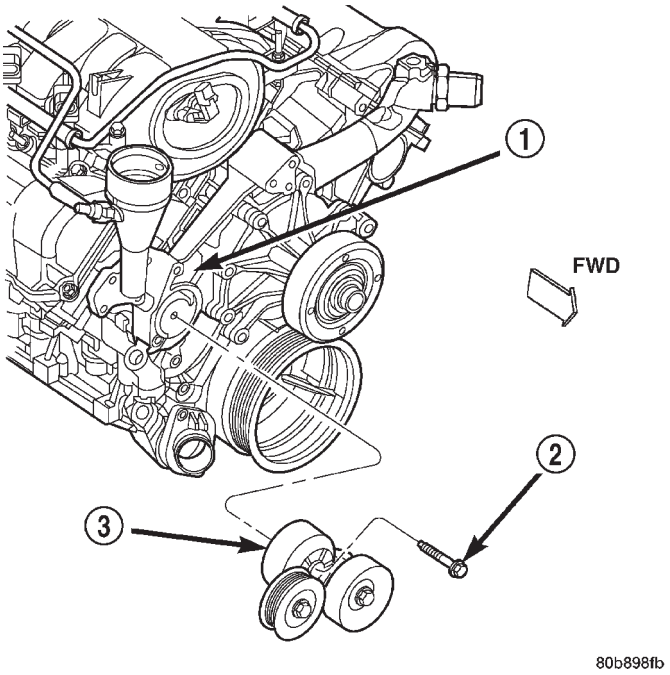

Fig. 2 Automatic Belt Tensioner

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

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

(3) Remove pulley bolt. Remove pulley from tensioner.

INSTALLATION - 3.7L ENGINE

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

(2) 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.).

(3) Install drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

(4) Check belt indexing marks (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

DRIVE BELTS - 3.7L

REMOVAL - 3.7L ENGINE

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.

DRIVE BELTS - 3.7L (Continued)

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. 3).

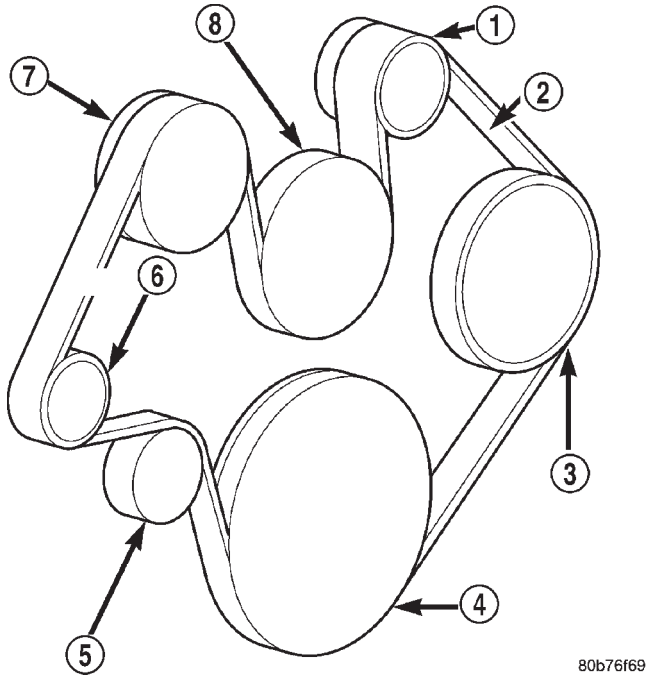

Fig. 3 Belt Routing - 3.7L

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

INSTALLATION - 3.7L ENGINE

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.

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

(1) Check condition of all pulleys.

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. 3).

(2) Install new belt (Fig. 3). 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. 4). On 3.7L Engines the gap between the tang and the housing stop (measurement A) must not exceed 24 mm (.94 inches).

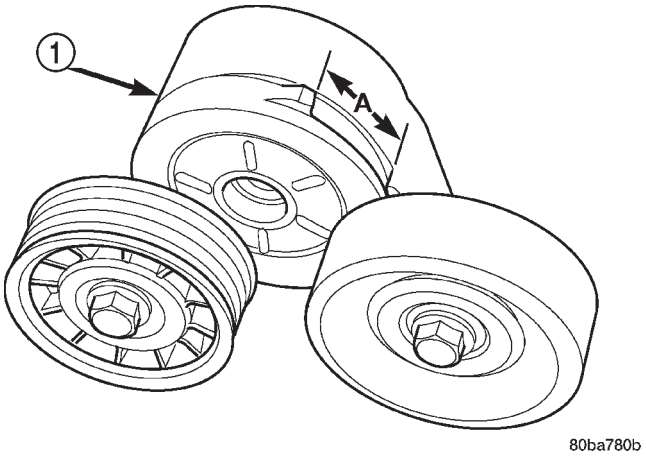

Fig. 4 Accessory Drive Belt Wear Indicator

1 - AUTOMATIC TENSIONER ASSEMBLY

ENGINE

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COOLANT RECOVERY PRESS CONTAINER

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, mounted to the right side of the cowl. It is mounted to the cowl with two nuts on top, and a slide bracket on the bottom.

OPERATION

The pressure chamber keeps the coolant free of trapped air, provides a volume for expansion and contraction, and provides a convenient and safe method for checking and adjusting coolant level at atmospheric pressure. It also provides some reserve coolant to cover minor leaks, evaporation or boiling losses. The overflow chamber allows coolant recovery in case of an overheat.

ENGINE COOLANT TEMPERATURE SENSOR

DESCRIPTION

The Engine Coolant Temperature (ECT) sensor is used to sense engine coolant temperature. The sensor protrudes into an engine water jacket.

ENGINE COOLANT TEMPERATURE SENSOR (Continued)

The ECT sensor is a two-wire Negative Thermal Coefficient (NTC) sensor. Meaning, as engine coolant temperature increases, resistance (voltage) in the sensor decreases. As temperature decreases, resistance (voltage) in the sensor increases.

OPERATION

At key-on, the Powertrain Control Module (PCM) sends out a regulated 5 volt signal to the ECT sensor. The PCM then monitors the signal as it passes through the ECT sensor to the sensor ground (sensor return).

When the engine is cold, the PCM will operate in Open Loop cycle. It will demand slightly richer air-fuel mixtures and higher idle speeds. This is done until normal operating temperatures are reached.

The PCM uses inputs from the ECT sensor for the following calculations:

- for engine coolant temperature gauge operation through CCD or PCI (J1850) communications
- Injector pulse-width
- Spark-advance curves
- ASD relay shut-down times
- Idle Air Control (IAC) motor key-on steps
- Pulse-width prime-shot during cranking
- O2 sensor closed loop times
- Purge solenoid on/off times
- EGR solenoid on/off times (if equipped)
- Leak Detection Pump operation (if equipped)
- Radiator fan relay on/off times (if equipped)
- Target idle speed

REMOVAL

2.4L

The Engine Coolant Temperature (ECT) sensor is installed into a water jacket at left front of cylinder head (Fig. 1).

WARNING: HOT, PRESSURIZED COOLANT CAN CAUSE INJURY BY SCALDING. COOLING SYSTEM MUST BE PARTIALLY DRAINED BEFORE REMOVING THE COOLANT TEMPERATURE SENSOR.

(1) Partially drain cooling system.
(2) Disconnect electrical connector from sensor.
(3) Remove sensor from cylinder head.

3.7L

The Engine Coolant Temperature (ECT) sensor is installed into a water jacket at front of intake manifold near rear of generator (Fig. 2).

WARNING: HOT, PRESSURIZED COOLANT CAN CAUSE INJURY BY SCALDING. COOLING SYSTEM MUST BE PARTIALLY DRAINED BEFORE REMOVING THE COOLANT TEMPERATURE SENSOR.

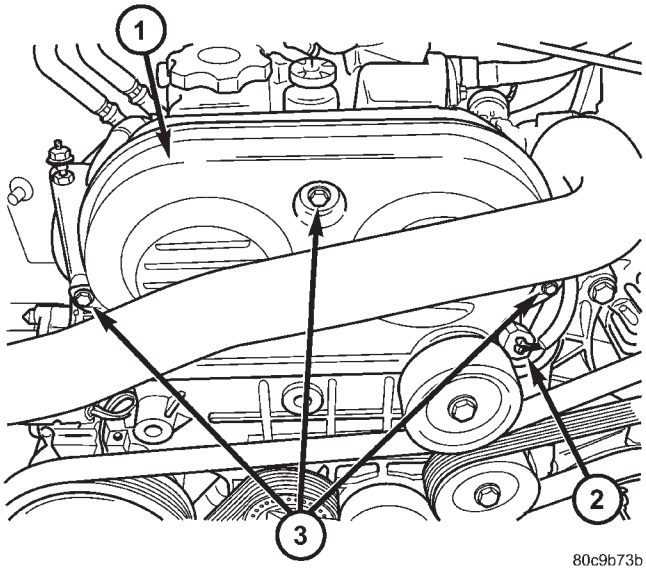

Fig. 1 ECT AND UPPER TIMING BELT COVER/ BOLTS-2.4L

1 - UPPER TIMING BELT COVER
2 - ELECTRICAL CONNECTOR (ECT)
3 - MOUNTING BOLTS (3)

(1) Partially drain cooling system.
(2) Disconnect electrical connector from sensor.
(3) Remove sensor from intake manifold.

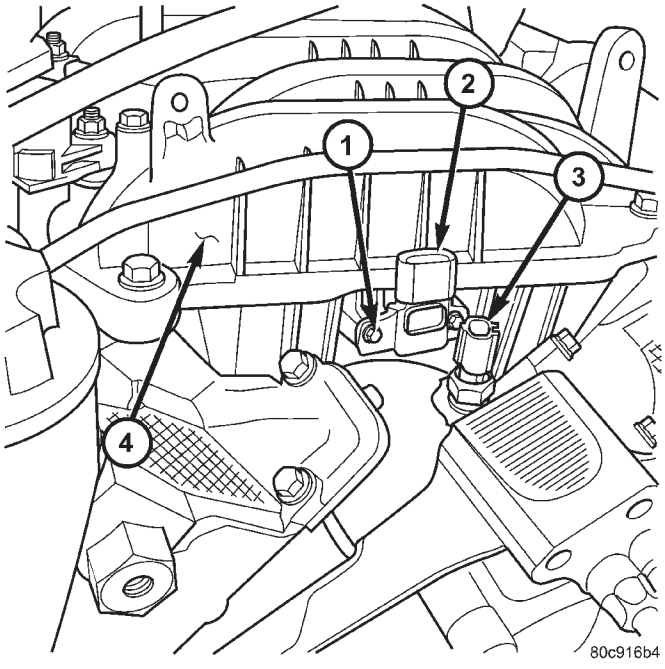

Fig. 2 MAP SENSOR / ECT SENSOR - 3.7L

1 - MOUNTING SCREWS
2 - MAP SENSOR
3 - ECT SENSOR

ENGINE COOLANT TEMPERATURE SENSOR (Continued)

INSTALLATION

(1) Apply thread sealant to sensor threads.
(2) Install sensor to engine.
(3) Tighten sensor to 11 N·m (8 ft. lbs.) torque.
(4) Replace any lost engine coolant.

ENGINE COOLANT THERMOSTAT

DESCRIPTION - 3.7L ENGINE

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 3.7L 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. 3).

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.

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.

DIAGNOSIS AND TESTING - THERMOSTAT

ON-BOARD DIAGNOSTICS

All models are equipped with On-Board Diagnostics for certain cooling system components.If the powertrain control module (PCM) detects low engine coolant temperature, it will record a Diagnostic Trouble Code (DTC). For other DTC numbers, (Refer to 25 - EMISSIONS CONTROL - DESCRIPTION).

The DTC can also be accessed through the DRB scan tool.

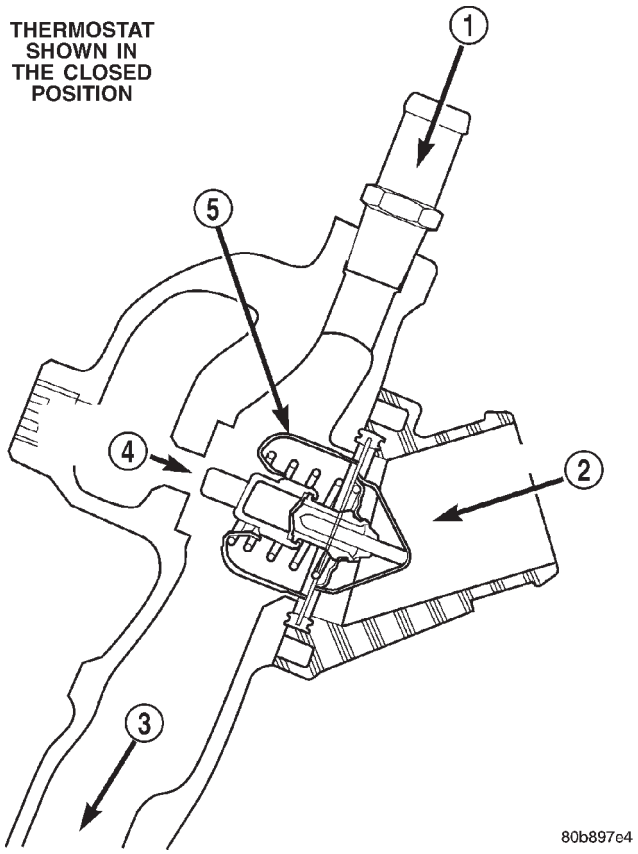

Fig. 3 Thermostat

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

REMOVAL - 3.7L ENGINE

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 7 - COOLING - STANDARD PROCEDURE).
(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. 4).

ENGINE COOLANT THERMOSTAT (Continued)

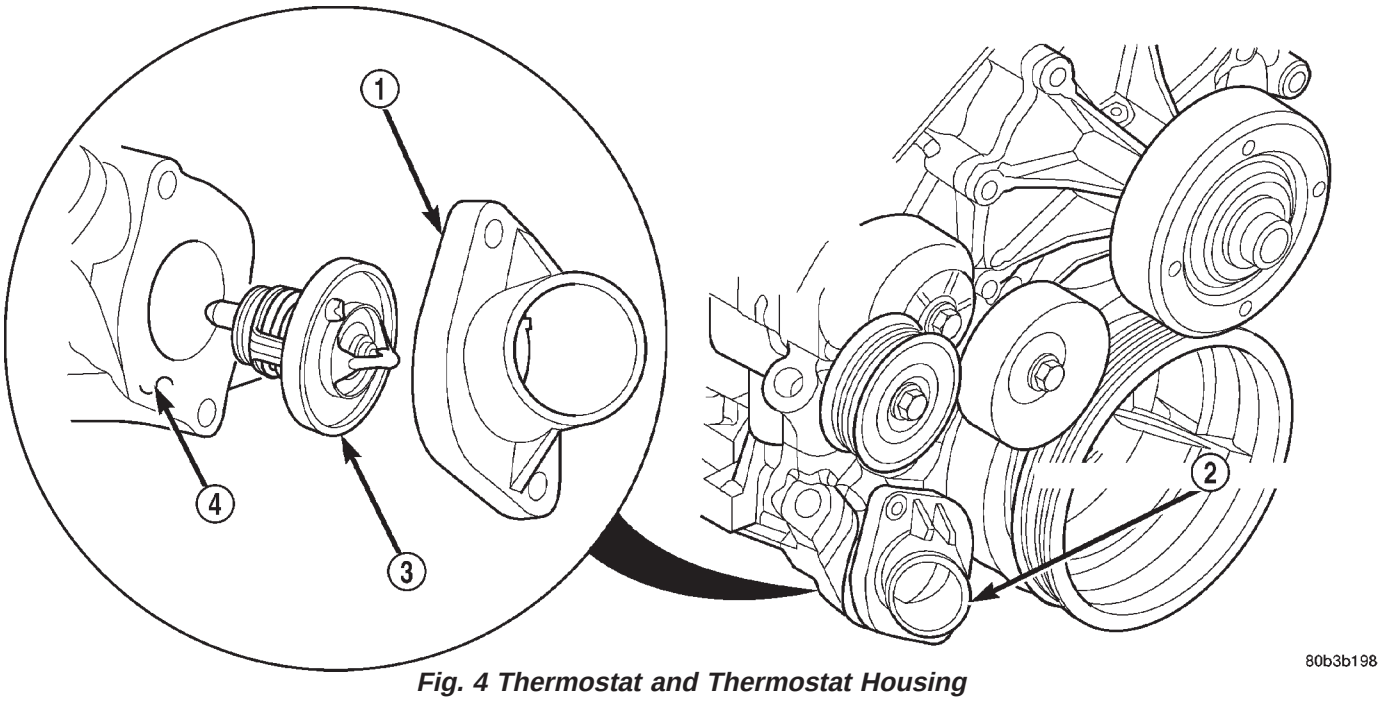

Fig. 4 Thermostat and Thermostat Housing

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

INSTALLATION - 3.7L ENGINE

(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. 4).

(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 7 - COOLING - STANDARD PROCEDURE).

(9) Connect negative battery cable to battery.

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

RADIATOR

DESCRIPTION

All vehicles are equipped with a cross flow type radiator with plastic side tanks (Fig. 5).

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

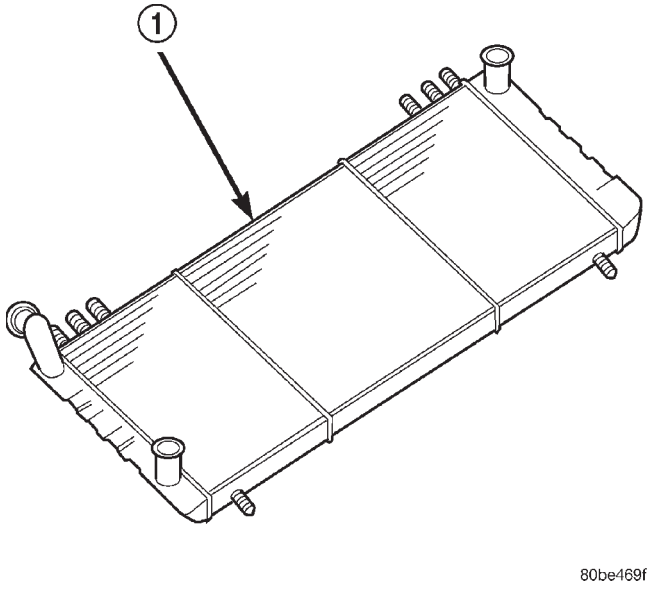

Fig. 5 Cross Flow Radiator - Typical

1 - RADIATOR

RADIATOR (Continued)

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.

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. 6). 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. 7). If replacement is necessary, use only an original equipment clamp with matching number or letter.

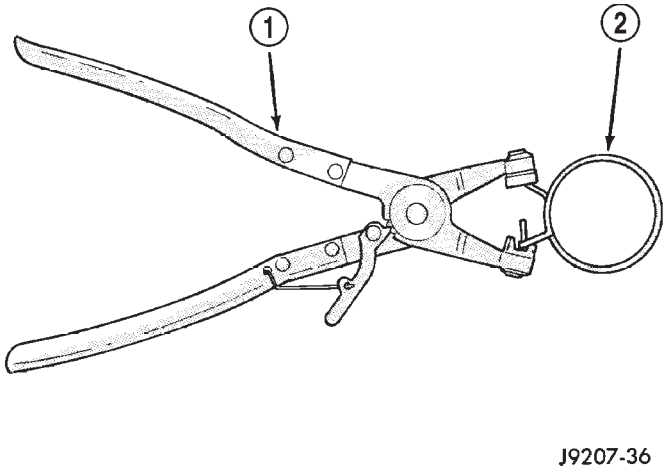

Fig. 6 Hose Clamp Tool - Typical

1 - HOSE CLAMP TOOL 6094
2 - HOSE CLAMP

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. 8). 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.

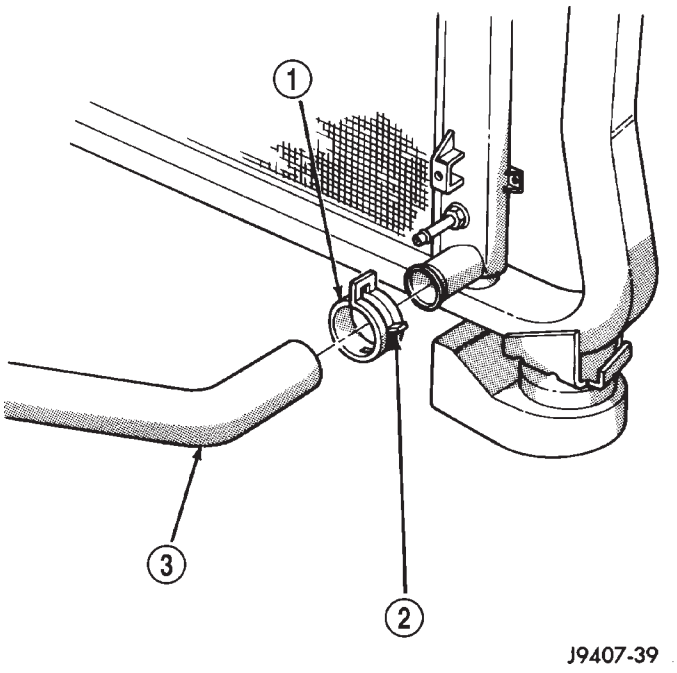

Fig. 7 Clamp Number/Letter Location - Typical

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

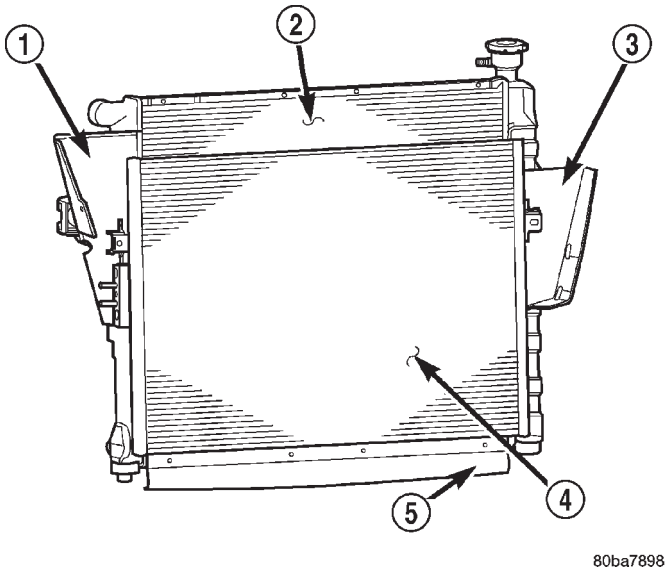

Fig. 8 Air Seals - Typical

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

(1) Disconnect the negative battery cable at battery.

(2) Drain coolant from radiator (Refer to 7 - COOLING - STANDARD PROCEDURE).

RADIATOR (Continued)

(3) Remove the front grill (Refer to 23 - BODY/EXTERIOR/GRILLE - REMOVAL).
(4) Remove the cooling fan from the engine, if equipped.
(5) Remove the two radiator mounting bolts.
(6) Disconnect both transmission cooler lines from radiator.
(7) Disconnect the connector for the electric fan.
(8) Disconnect the power steering cooler line from cooler.
(9) Disconnect the radiator upper and lower hoses.
(10) Disconnect the overflow hose from radiator.
(11) The lower part of radiator is equipped with two alignment dowel pins (Fig. 9). They are located on the bottom of radiator tank and fit into rubber grommets. These rubber grommets are pressed into the radiator lower crossmember.

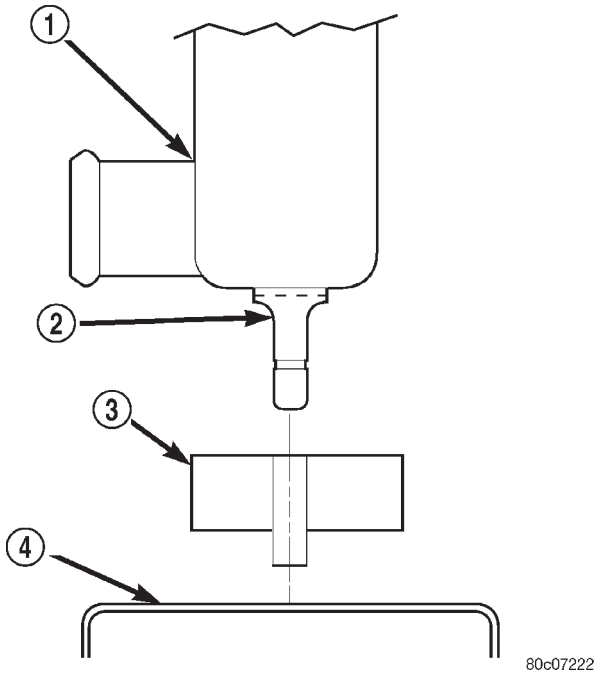

Fig. 9 Radiator Alignment Dowels - Typical

1 - RADIATOR
2 - ALIGNMENT DOWEL
3 - RADIATOR LOWER ISOLATOR
4 - 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, HEATING AND AIR CONDITIONING BEFORE HANDLING ANY AIR CONDITIONING COMPONENT.

NOTE: The radiator and radiator cooling fan can be removed as an assembly. It is not necessary to remove the cooling fan before removing or installing the radiator.

(12) 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).

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.

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 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) Gently lower the radiator and fan shroud into the vehicle. Guide the two radiator alignment dowels into the rubber grommets located in lower radiator crossmember.
(2) Connect the radiator upper and lower hoses and hose clamps to radiator.

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

(3) Install coolant reserve/overflow tank hose at radiator.
(4) Connect both transmission cooler lines at the radiator.
(5) Install both radiator mounting bolts.
(6) Reconnect the electric cooling fan.
(7) Install the grill (Refer to 23 - BODY/EXTERIOR/GRILLE - INSTALLATION).
(8) Reinstall the cooling fan to the engine.
(9) Rotate the fan blades (by hand) and check for interference at fan shroud.
(10) Refill cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
(11) Connect battery cable at battery.
(12) Start and warm engine. Check for leaks.

RADIATOR PRESSURE CAP

DESCRIPTION

The cooling system cap is located on the coolant pressure bottle. The cap construction includes; stainless steel swivel top, rubber seals and retainer, main spring, and a spring loaded valve (Fig. 10).

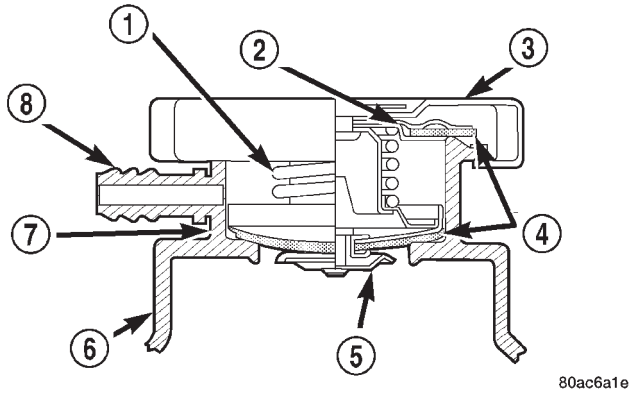

Fig. 10 PRESSURE CAP

1 - MAIN SPRING
2 - GASKET RETAINER
3 - STAINLESS STEEL SWIVEL TOP
4 - RUBBER SEALS
5 - SPRING LOADED VALVE
6 - COOLANT PRESSURE BOTTLE
7 - FILLER NECK
8 - OVERFLOW NIPPLE

OPERATION

The pressure cap allows the cooling system to operate at higher than atmospheric pressure which raises the coolant boiling point, thus allowing increased radiator cooling capacity. The pressure cap releases pressure at some point within a range of 110 kPa ± 14 kPa (16 psi ± 2 psi).

A spring-loaded vent valve in the center of the cap allows the system to pressurize and depressurize without creating a vacuum. If the valve is stuck open, coolant will escape to the overflow hose. There is also a gasket in the cap to seal to the top of the filler neck.

CAUTION: Use only the pressure cap specified for this vehicle. Use of other pressure caps can lead to coolant loss and overheating.

DIAGNOSIS AND TESTING - RADIATOR PRESSURE CAP

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. 11).

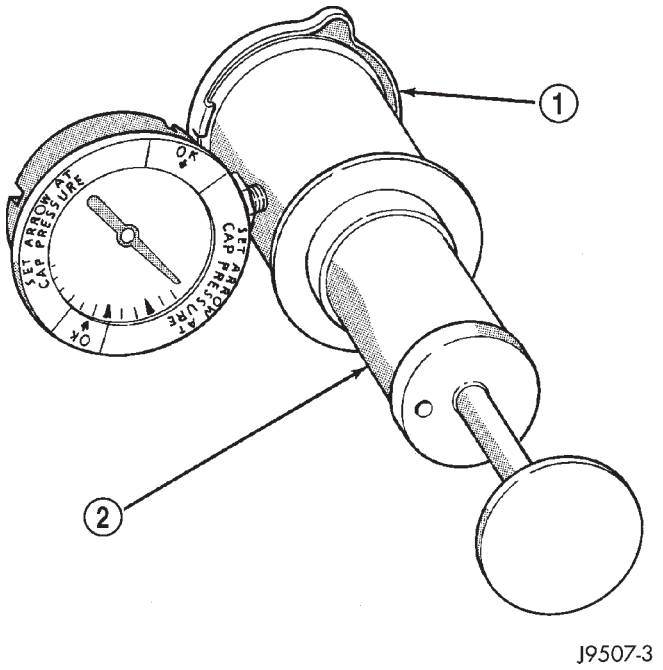

Fig. 11 Pressure Testing Radiator Pressure Cap - Typical

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 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.

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 FAN - ELECTRIC

DESCRIPTION

The fan (Fig. 12) is electrically controlled by the powertrain control module (PCM) through the fan control relay. This relay is located on the left wheel house in the engine compartment.

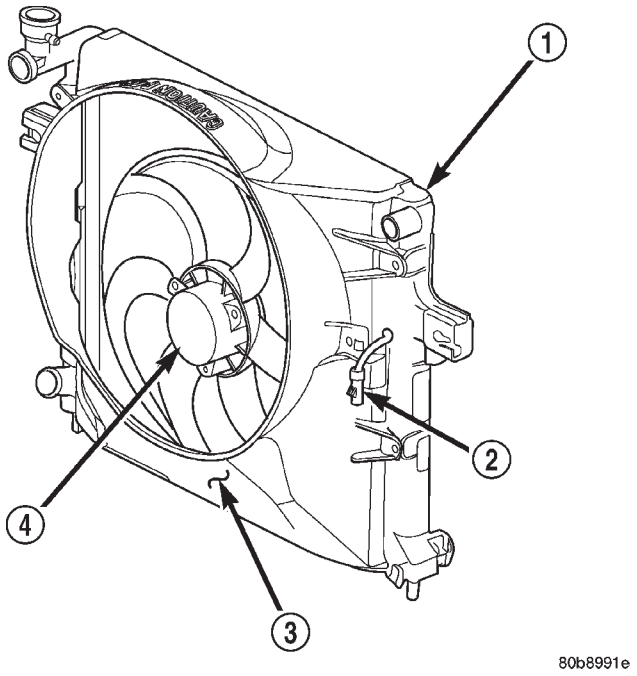

Fig. 12 Radiator Cooling Fan - Typical

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

OPERATION

The electric radiator cooling fan is controlled by the Powertrain Control Module (PCM) through the radiator cooling fan relay. The PCM regulates fan operation based on input from the engine coolant temperature sensor, battery temperature sensor,air conditioning select switch and vehicle speed.

The fan is not energized during engine cranking regardless of the electrical input from the temperature sensors and ,air conditioning switch. However, if engine operation conditions warrant fan engagement, the fan will run once engine starts.

On vehicles NOT equipped with AC: The relay is energized when the coolant temperature is above 80° C (176° F), or battery temperature sensor above – 12° C (10° F). It will then de-energize when coolant temperature drops below 82° C (180° F), or batter temperature sensor below – 9° C (16° F).

Vehicles Equipped with AC: In addition to using coolant temperature and battery temperature sensor to control cooling fan operation, the cooling fan will also be engaged when the ,air conditioning system is activated. The relay is also energized when, air conditioning is selected and coolant temperature is above 95° C (203° F), or , air conditioning is selected and battery temperature sensor is above 41° C (106° F). It will then de-energize when , air conditioning is selected and coolant temperature is below 92° C (198° F), or , air conditioning is selected and battery temperature is below 38° C (100° F).

REMOVAL

If the fan blade is bent, warped, cracked or damaged in any way, it must be replaced **only** with a replacement fan blade. **Do not attempt to repair a damaged fan blade.**

NOTE: For 3.7L Heavy Duty/Max Cool/Trailer Tow cooling package, the vicous fan cannot be removed seperate from the shroud. Both fan and shroud must be removed together.

(1) Disconnect battery negative cable.
(2) Using special tool 6958 spanner wrench and 8346 adapters, remove the vicous fan from the water pump (Fig. 13).

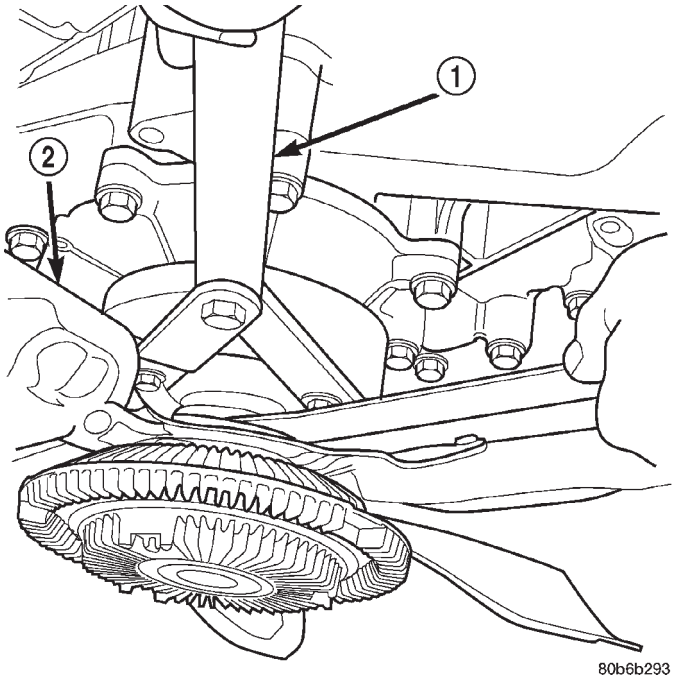

Fig. 13 Viscous Fan and Fan Drive 3.7L

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

(3) Gently lay fan into shroud.
(4) Disconnect the electrical connector for the electric fan, then disconnect connector from shroud.

RADIATOR FAN - ELECTRIC (Continued)

(5) Remove the two fan shroud mounting bolts connecting the fan shroud to the radiator (Fig. 14).

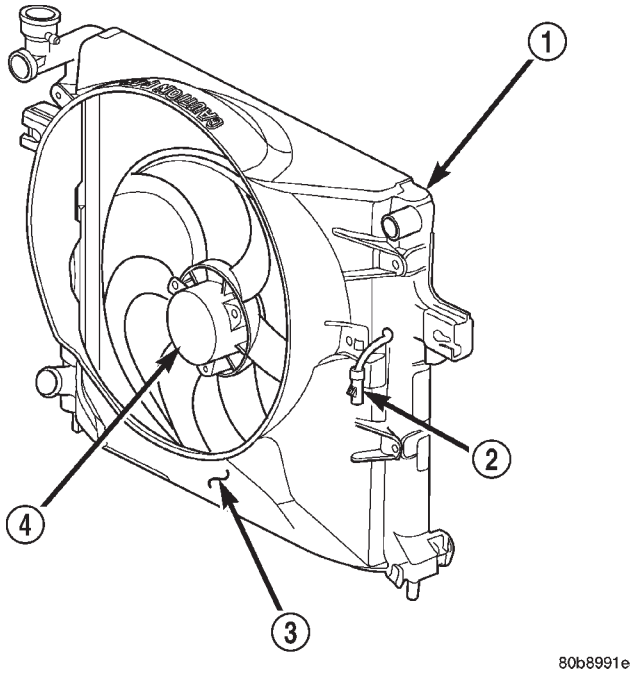

Fig. 14 Radiator Cooling Fan - Typical

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

(6) Remove the shroud and fan from the vehicle.

INSTALLATION

NOTE: For 3.7L Heavy Duty/Max Cool/Trailer Tow cooling package, the vicous fan cannot be installed seperate from the shroud. Both fan and shroud must be installed together.

(1) Gently lay vicous fan into shroud.
(2) Install fan shroud assembly into the vehicle. Tighten fan shroud to radiator bolts to (5.5 N·m (50 in. lbs.).
(3) Using special tool 6958 spanner wrench and 8346 adapters, install the vicous fan on the water pump.
(4) Connect fan motor wire connector to harness connector, and attach connector to shroud.
(5) Connect battery negative cable.
(6) Start engine and check fan operation.

RADIATOR - FAN - VISCOUS

DESCRIPTION

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.

The thermal viscous fan drive (Fig. 15) 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 the 3.7L engine, an electric fan is standard and the viscous fan is added on for trailer tow packages only.

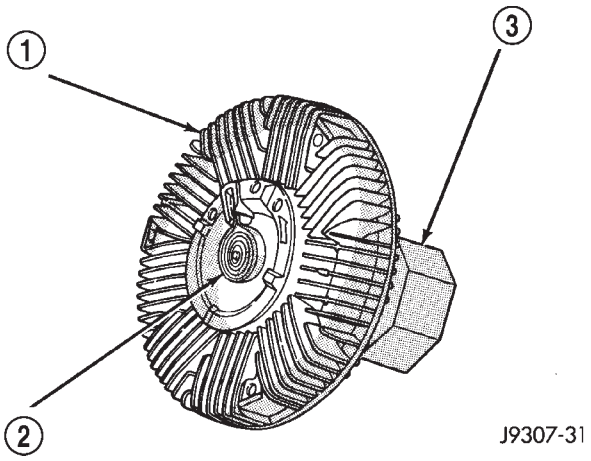

Fig. 15 Viscous Fan Drive - Typical

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. 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 - VISCOUS FAN DRIVE

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.

(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.

REMOVAL

(1) Disconnect negative battery cable from battery.

NOTE: The thermal viscous fan drive/fan blade assembly is attached (threaded) to water pump hub shaft.

(2) Remove fan blade/viscous fan drive assembly from water pump using special tool 6958 spanner wrench and 8346 adapters, by turning mounting nut counterclockwise as viewed from front (Fig. 16). Threads on viscous fan drive are **RIGHT HAND.**

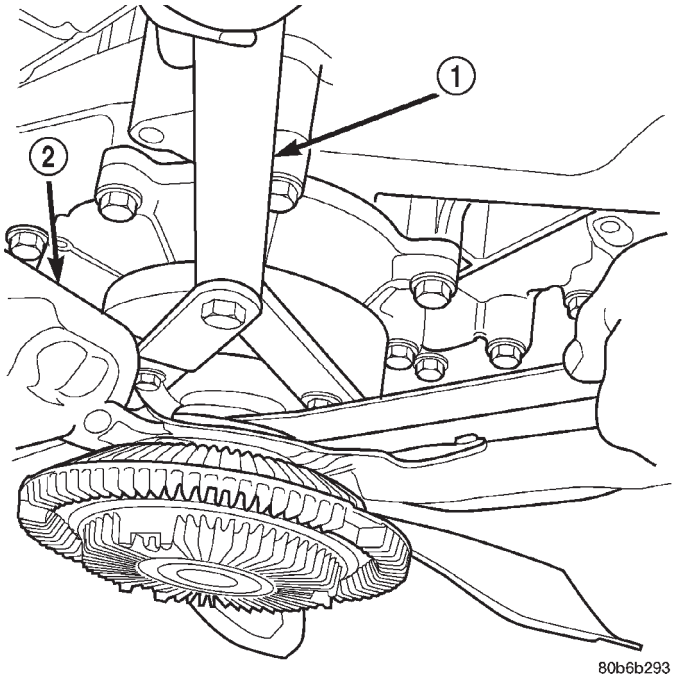

Fig. 16 Viscous Fan and Fan Drive 3.7L

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

(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 radiator bolts.

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

(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.

RADIATOR - FAN - VISCOUS (Continued)

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.

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.

INSTALLATION

(1) Assemble fan blade to viscous fan drive. Tighten mounting bolts to 27 N·m (20 ft. lbs.) torque.

NOTE: The vicous fan and fan shroud must be installed as an assembly.

(2) Gently lay vicous fan into fan shroud.

(3) Install the fan shroud to radiator mounting bolts, torque bolts to (5.5N·M or 50 in·lbs).

(4) Thread the fan and fan drive onto the water pump pulley, and tighten nut using special tool 6958 spanner wrench and 8346 adapters.

(5) Connect the electrical connector for the electric fan.

CAUTION: When installing a 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. (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL) for correct belt routing.

WATER PUMP

DESCRIPTION

DESCRIPTION - WATER PUMP

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.

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.

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. 17).

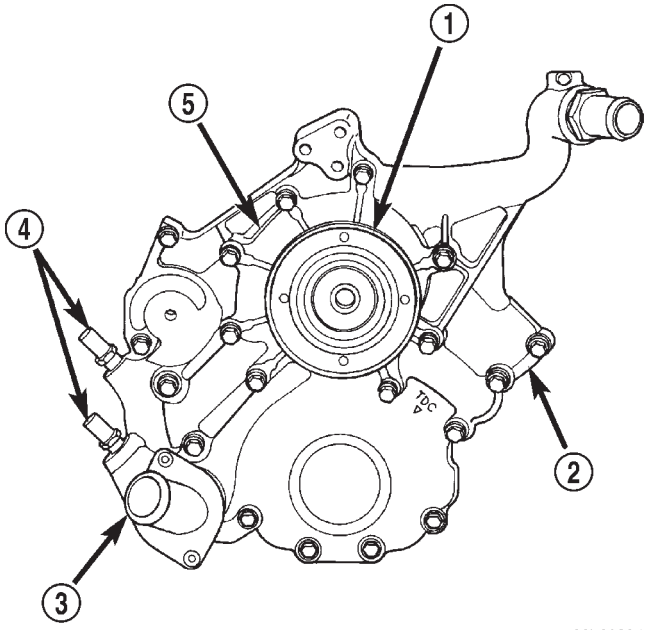

Fig. 17 Water Pump and Timing Chain Cover

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

DESCRIPTION

The 3.7L 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

WATER PUMP (Continued)

through the radiator. The thermostat uses a stub shaft located at the rear of the thermostat to control flow through the bypass gallery.

OPERATION - WATER PUMP

A centrifugal water pump circulates coolant through the water jackets, passages, intake manifold, radiator core, cooling system hoses and heater core, this coolant absorbs the heat generated when the engine is running. The pump is driven by the engine crankshaft via a drive belt.

REMOVAL

The water pump on 3.7L engines is bolted directly to the engine timing chain case cover.

(1) Disconnect negative battery cable from battery.

(2) Drain cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).

(3) Remove fan/viscous fan drive assembly from water pump (Fig. 18) (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - REMOVAL). Do not attempt to remove fan/viscous fan drive assembly from vehicle at this time.

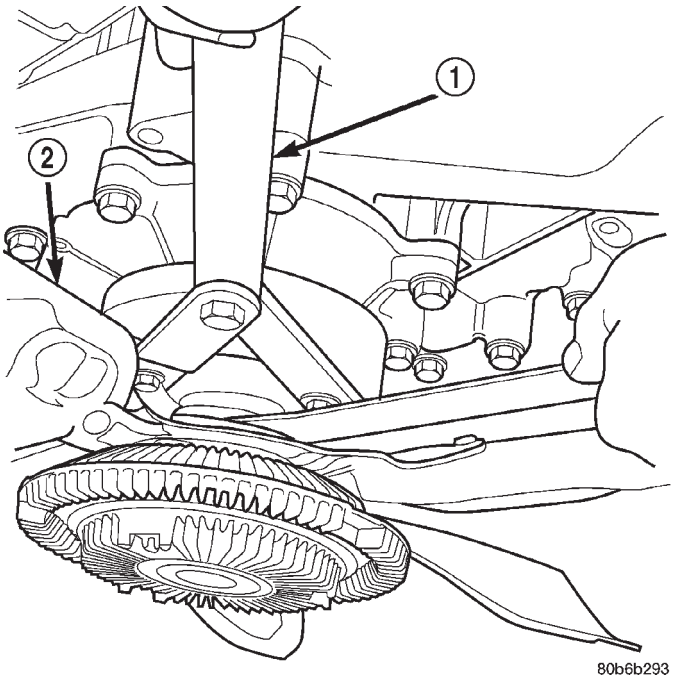

Fig. 18 Viscous Fan and Fan Drive 3.7L

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

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 screws, Disconnect the coolant overflow hose.

(6) Remove upper fan shroud and fan blade/viscous fan drive assembly from vehicle.

(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 (Fig. 19) (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).

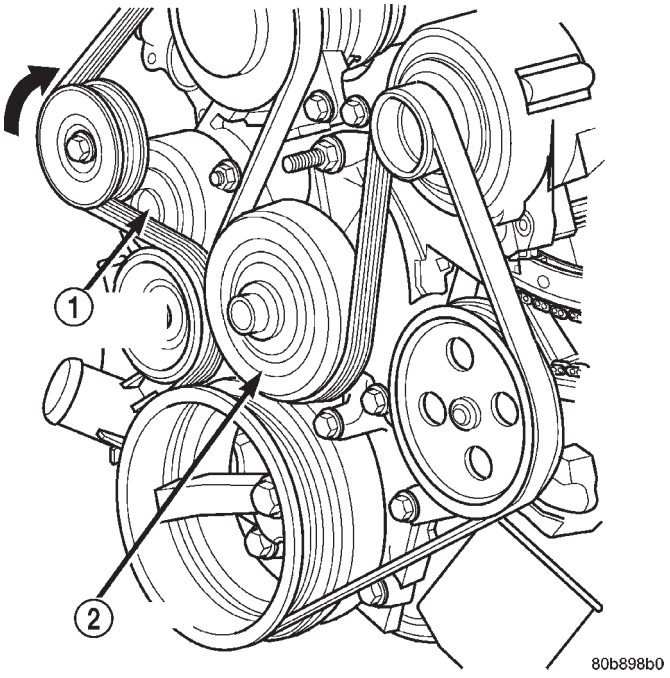

Fig. 19 Automatic Belt Tensioner—3.7L

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.

WATER PUMP (Continued)

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.

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.

INSTALLATION

The water pump on 3.7L engines is bolted directly to the engine timing chain case cover.

(1) Clean gasket mating surfaces.

(2) Using a new gasket, position water pump and install mounting bolts as shown. (Fig. 20). Tighten water pump mounting bolts to 54 N·m (40 ft. lbs.) torque.

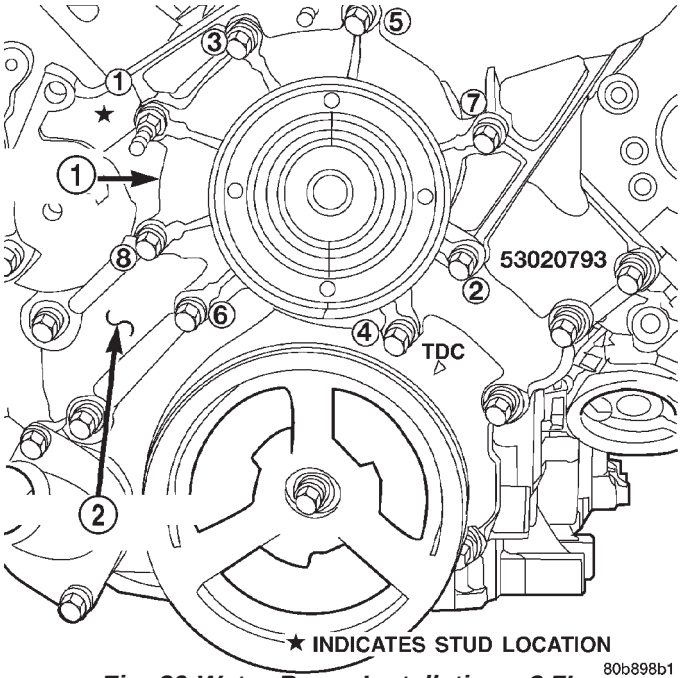

Fig. 20 Water Pump Installation—3.7L

1 - WATER PUMP
2 - TIMING CHAIN COVER

(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. Install drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/ DRIVE BELTS - INSTALLATION).

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. 21) 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.

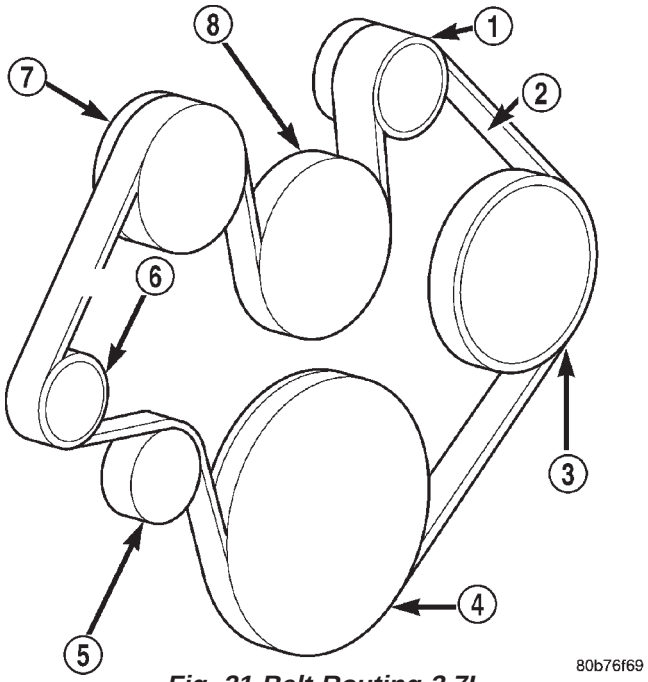

Fig. 21 Belt Routing 3.7L

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

(6) Position upper fan shroud and fan blade/viscous fan drive assembly.

(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 screws.

(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 (Refer to 7 - COOLING/ENGINE/ FAN DRIVE VISCOUS CLUTCH - INSTALLATION).

(11) Fill cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).

(12) Connect negative battery cable.

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

TRANSMISSION

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TRANS 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.Because the internal oil cooler is so efficient, no auxiliary oil cooler is offered. The cooler is not serviceable separately from the radiator.