

COOLING

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COOLING

DESCRIPTION

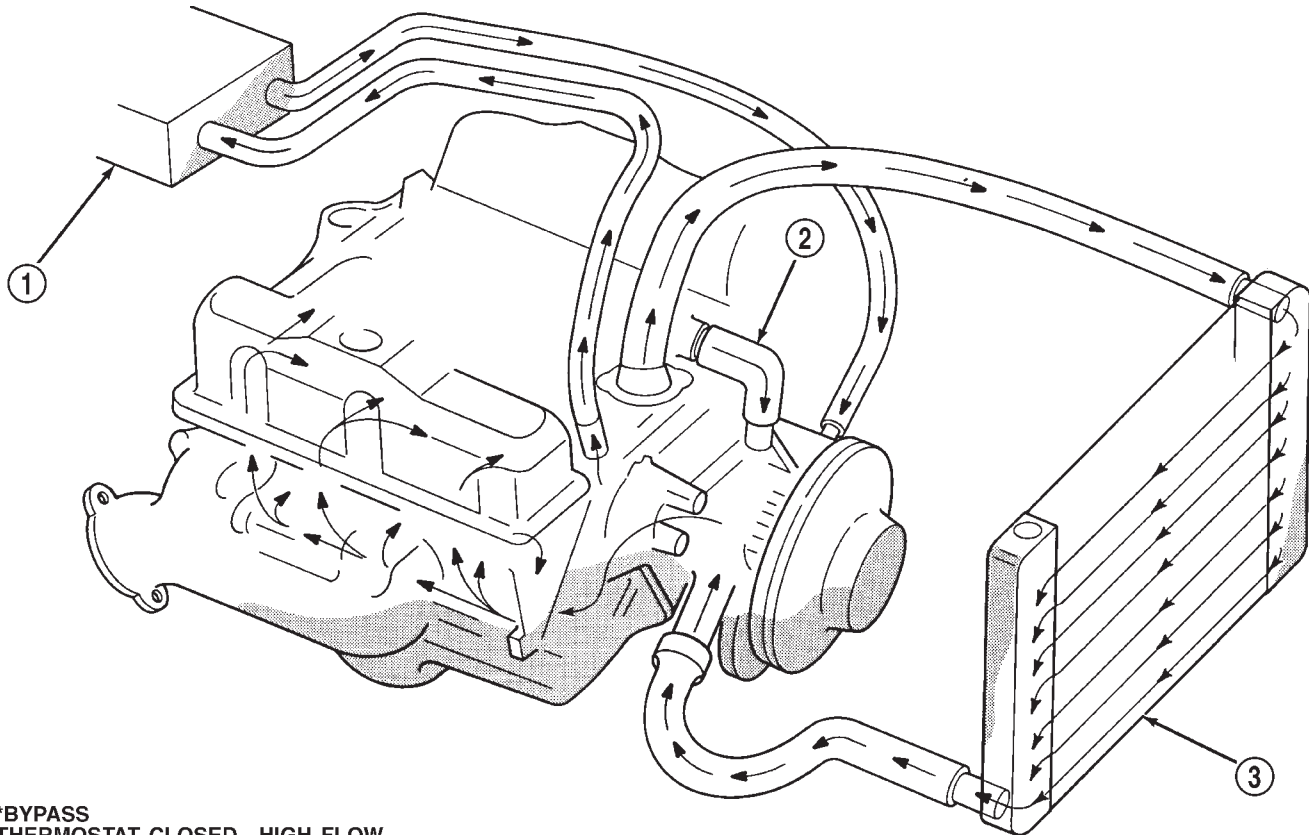
DESCRIPTION - COOLING SYSTEM FLOW - 5.9L ENGINE

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.

An optional factory installed maximum duty cooling package is available on most models. This package will provide additional cooling capacity for vehicles used under extreme conditions such as trailer towing in high ambient temperatures (Fig. 1).

COOLING (Continued)



*BYPASS
THERMOSTAT CLOSED—HIGH FLOW
THERMOSTAT OPEN—LOW FLOW

J9407-1

Fig. 1 Engine Cooling System Flow

- 1 - HEATER
2 - BYPASS*

3 - CROSSFLOW RADIATOR

DESCRIPTION—COOLING SYSTEM FLOW - 5.9L DIESEL

The diesel engine cooling system consists of (Fig. 2):

- Cross-flow radiator
- Belt driven water pump
- Belt driven mechanical cooling fan
- Thermal viscous fan drive
- Fan shroud
- Radiator pressure cap
- Vertically mounted thermostat
- Coolant reserve/recovery system
- Transmission oil cooler
- Coolant

Coolant flow circuits for the 5.9L diesel engine are shown in (Fig. 3).

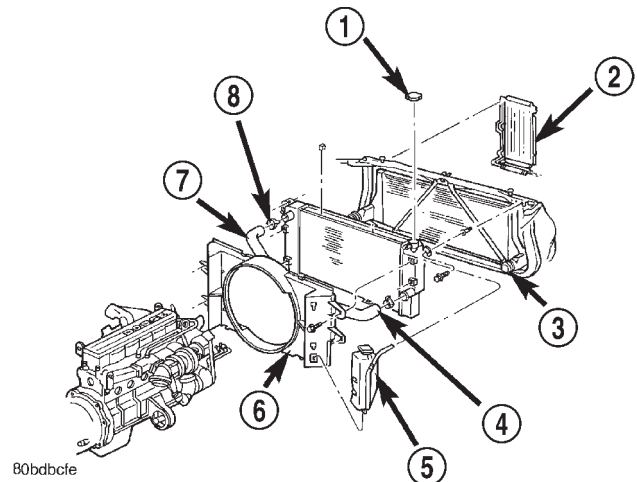
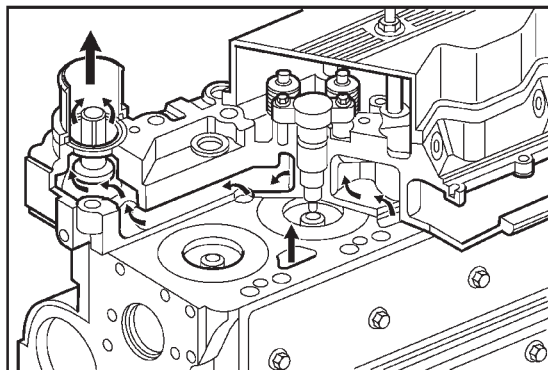


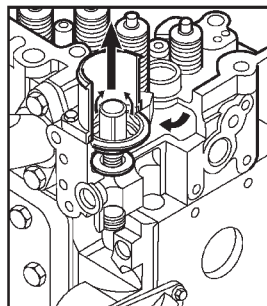
Fig. 2 Cooling System Components 5.9L Diesel Engine

- 1 - RADIATOR CAP
2 - AUXILIARY TRANSMISSION OIL COOLER
3 - CHARGE AIR COOLER
4 - RADIATOR LOWER HOSE
5 - OVERFLOW/RESERVOIR BOTTLE
6 - FAN SHROUD
7 - RADIATOR UPPER HOSE
8 - CONSTANT TENSION CLAMP

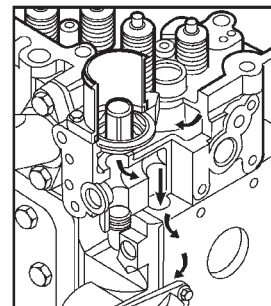
COOLING (Continued)



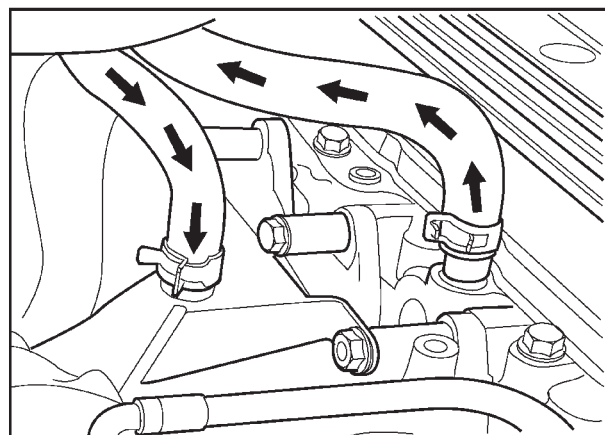
**COOLANT FLOW THROUGH
CYLINDER HEAD**



**THERMOSTAT OPEN
BYPASS CLOSED**



**THERMOSTAT CLOSED
BYPASS OPEN**



HEATER CORE SUPPLY AND RETURN HOSES

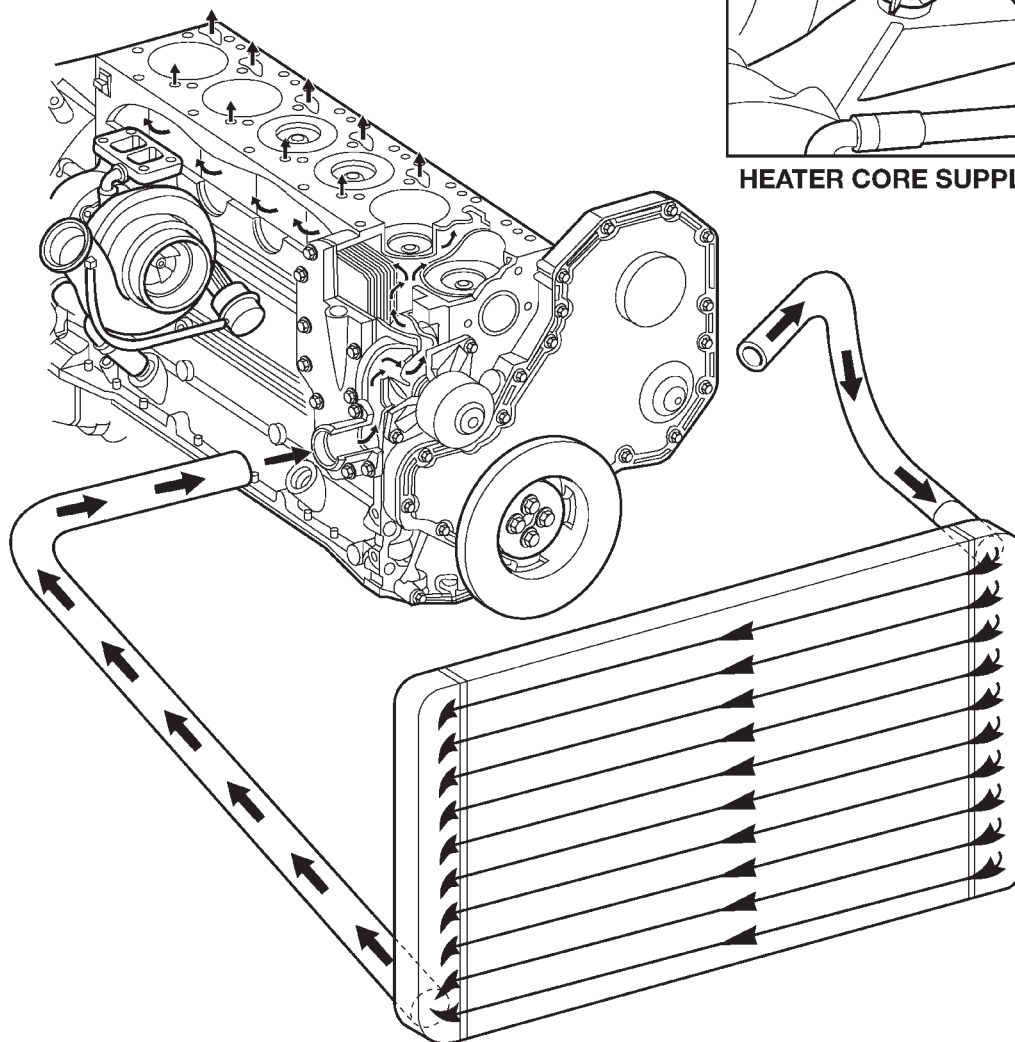


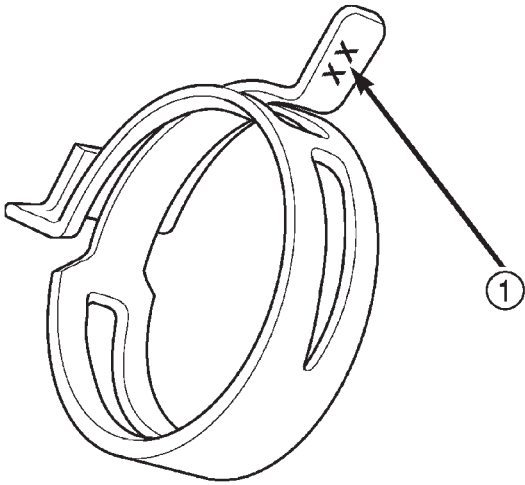
Fig. 3 Cooling System Circulation—Diesel Engine

COOLING (Continued)

DESCRIPTION—HOSE CLAMPS

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

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



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Fig. 4 Spring Clamp Size Location

1 - SPRING CLAMP SIZE LOCATION

OPERATION**OPERATION—HOSE CLAMPS**

The worm type hose clamp uses a specified torque value to maintain proper tension on a hose connection.

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

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.

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.

An optional factory installed maximum duty cooling package is available on most models. This pack-

age will provide additional cooling capacity for vehicles used under extreme conditions such as trailer towing in high ambient temperatures.

DIAGNOSIS AND TESTING**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 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.

TRAILER TOWING:

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

AIR CONDITIONING; ADD-ON OR AFTER MARKET:

A maximum cooling package should have been ordered with vehicle if add-on or after market A/C is installed. If not, maximum cooling system components should be installed for model involved per manufacturer's specifications.

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 refill- ing (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 7 - COOLING - DIAGNOSIS AND TESTING)

COOLING (Continued)

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 - 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. 5).

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.

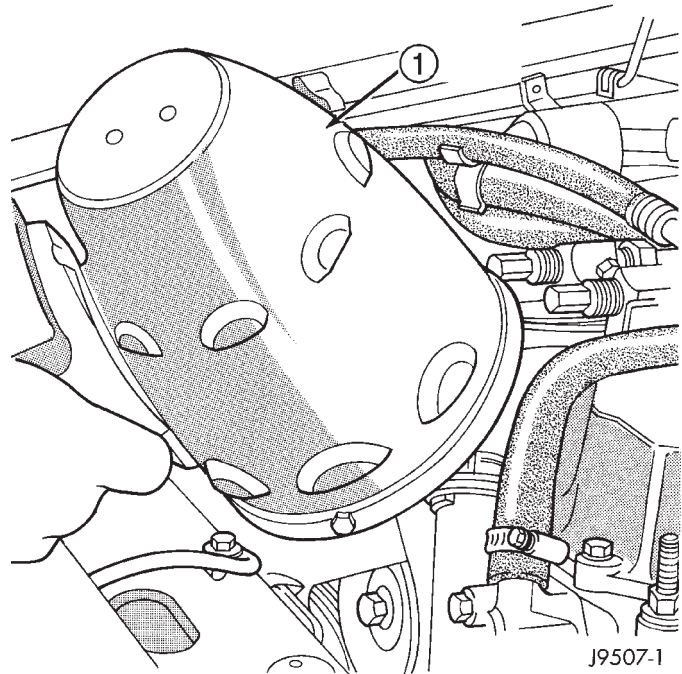


Fig. 5 Leak Detection Using Black Light—Typical

1 - TYPICAL BLACK LIGHT TOOL

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

Carefully remove radiator pressure cap from filler neck 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, dirt and solder residue. 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. 6).

Operate tester pump to apply 103.4 kPa (15 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,

COOLING (Continued)

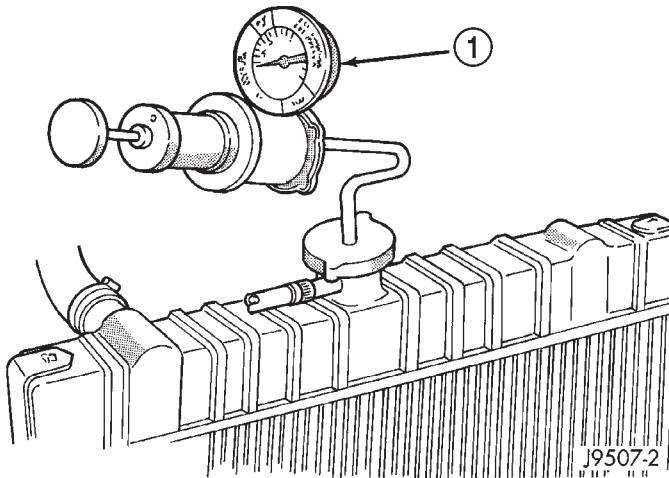


Fig. 6 Pressure Testing Cooling System—Typical

1 - TYPICAL COOLING SYSTEM PRESSURE TESTER

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 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 110 KPA (20 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 DRAIN-COCK 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 drain-cock 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 GAS ENGINE*COOLING SYSTEM DIAGNOSIS—GASOLINE ENGINE*

CONDITION	POSSIBLE CAUSES	CORRECTION
TEMPERATURE GAUGE READS LOW	1. Has a Diagnostic Trouble Code (DTC) been set indicating a stuck open thermostat? 2. Is the temperature sending unit connected? 3. Is the temperature gauge operating OK? 4. Coolant level low in cold ambient temperatures accompanied with poor heater performance. 5. Improper operation of internal heater doors or heater controls.	1. (Refer to 25 - EMISSIONS CONTROL - DESCRIPTION) for On-Board Diagnostics and DTC information. Replace thermostat if necessary. 2. Check the temperature sensor connector. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - SCHEMATIC - ELECTRICAL) Repair connector if necessary. 3. Check gauge operation. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER/ENGINE TEMPERATURE GAUGE - DESCRIPTION). Repair as necessary. 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 CAUTIONS associated with removing the radiator cap. 5. Inspect heater and repair as necessary. (Refer to 24 - HEATING & AIR CONDITIONING - DIAGNOSIS AND TESTING) for procedures.

COOLING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
TEMPERATURE GAUGE READS HIGH OR THE COOLANT WARNING LAMP ILLUMINATES. COOLANT MAY OR MAY NOT BE LOST OR LEAKING FROM THE 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. 2. Is the temperature gauge reading correctly? 3. Is the temperature warning illuminating unnecessarily? 4. Coolant low in coolant reserve/overflow tank and radiator? 5. Pressure cap not installed tightly. If cap is loose, boiling point of coolant will be lowered. Also refer to the following Step 6. 6. Poor seals at the radiator cap. 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	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. Refer to Possible Causes (2-20). 2. Check gauge. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - SCHEMATIC - ELECTRICAL). Repair as necessary. 3. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - SCHEMATIC - ELECTRICAL). 4. Check for coolant leaks and repair as necessary. (Refer to 7 - COOLING - DIAGNOSIS AND TESTING). 5. Tighten cap 6. (a) Check condition of cap and cap seals. Refer to Radiator Cap. Replace cap if necessary. (b) Check condition of radiator filler neck. If neck is bent or damaged, replace radiator. 7. (a) Check condition of radiator cap and cap seals. Refer to Radiator Cap in this Group. Replace cap if necessary. (b) Check condition of radiator filler neck. If neck is bent or 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 coolant reserve/overflow tank and tanks hoses for blockage. Repair as necessary.

COOLING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
	8. Incorrect coolant concentration	8. Check coolant. (Refer to LUBRICATION & MAINTENANCE/ FLUID TYPES - DESCRIPTION).
	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 area of obstruction and repair as necessary.
	10. Radiator or A/C condenser fins are dirty or clogged.	10. Remove insects and debris. (Refer to 7 - COOLING - STANDARD PROCEDURE).
	11. Radiator core is corroded or plugged.	11. Have radiator re-cored or replaced.
	12. Aftermarket A/C installed without proper radiator.	12. Install proper radiator.
	13. Fuel or ignition system problems.	13. Refer to 14 - Fuel System or 8 - Electrical for diagnosis and testing procedures.
	14. Dragging brakes.	14. Check and correct as necessary. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING) for correct procedures.
	15. Bug screen or cardboard is being used, reducing airflow.	15. Remove bug screen or cardboard.
	16. Thermostat partially or completely shut.	16. Check thermostat operation and replace as necessary. (Refer to 7 - COOLING/ENGINE/ENGINE COOLANT THERMOSTAT - REMOVAL).
	17. Viscous fan drive not operating properly.	17. Check fan drive operation and replace as necessary. (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - REMOVAL).
	18. Cylinder head gasket leaking.	18. Check for cylinder head gasket leaks. (Refer to 7 - COOLING - DIAGNOSIS AND TESTING).
	19. Heater core leaking.	19. Check heater core for leaks. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - DIAGNOSIS AND TESTING). Repair as necessary.

COOLING (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. 2. Temperature gauge or engine mounted gauge sensor defective or shorted. Also, corroded or loose wiring in this circuit. 3. Gauge reading rises when vehicle is brought to a stop after heavy use (engine still running) 4. Gauge reading high after re-starting a warmed up (hot) engine. 5. Coolant level low in radiator (air will build up in the cooling system causing the thermostat to open late). 6. Cylinder head gasket leaking allowing exhaust gas to enter cooling system causing a thermostat to open late. 7. Water pump impeller loose on shaft. 8. Loose accessory drive belt. (water pump slipping) 9. Air leak on the suction side of the water pump allows air to build up in cooling system causing thermostat to open late.	1. A normal condition. No correction is necessary. 2. Check operation of gauge and repair if necessary. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING). 3. A normal condition. No correction is necessary. Gauge should return to normal range after vehicle is driven. 4. A normal condition. No correction is necessary. The gauge should return to normal range after a few minutes of engine operation. 5. Check and correct coolant leaks. (Refer to 7 - COOLING - DIAGNOSIS AND TESTING). 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. Check water pump and replace as necessary. (Refer to 7 - COOLING/ENGINE/WATER PUMP - REMOVAL). 8. (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - DIAGNOSIS AND TESTING). Check and correct as necessary. 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 7 - COOLING/ENGINE/RADIATOR PRESSURE CAP - DIAGNOSIS AND TESTING). Replace cap as necessary.

COOLING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
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. 2. Freeze point of coolant not correct. Mixture is too rich or too lean.	1. Check reason for overheating and repair as necessary. 2. Check coolant concentration. (Refer to LUBRICATION & MAINTENANCE/FLUID TYPES - DESCRIPTION).
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. 2. Fan blades striking a surrounding object. 3. Air obstructions at radiator or air conditioning condenser. 4. Thermal viscous fan drive has defective bearing. 5. A certain amount of fan noise may be evident on models equipped with a thermal viscous fan drive. Some of this noise is normal.	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/FAN DRIVE VISCOUS CLUTCH - REMOVAL). 5. (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - DESCRIPTION) for an explanation of normal fan noise.

COOLING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
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 - REMOVAL). If a slipping belt is detected, (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - DIAGNOSIS AND TESTING). If heater core obstruction is detected, (Refer to 24 - HEATING & AIR CONDITIONING/ PLUMBING/HEATER CORE - REMOVAL).
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, 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 LUBRICATION & MAINTENANCE/FLUID TYPES - DESCRIPTION). 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.

COOLING (Continued)

DIAGNOSIS AND TESTING - COOLING SYSTEM DIESEL ENGINE*COOLING SYSTEM DIAGNOSIS—DIESEL ENGINE*

CONDITION	POSSIBLE CAUSES	CORRECTION
TEMPERATURE GAUGE READS LOW	1. Vehicle is equipped with a heavy duty cooling system. 2. Temperature gauge not connected 3. Temperature gauge connected but not operating. 4. Coolant level low.	1. None. System operating normally. 2. Connect gauge. 3. Check gauge. Refer (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING) 4. Fill cooling system. (Refer to 7 - COOLING - STANDARD PROCEDURE)
TEMPERATURE GAUGE READS HIGH. COOLANT MAY OR MAY NOT BE LEAKING FROM SYSTEM	1. Vehicle overloaded, high ambient (outside) temperatures with A/C turned on, stop and go driving or prolonged operation at idle speeds. 2. Temperature gauge not functioning correctly. 3. Air trapped in cooling 4. Radiator cap faulty. 5. Plugged A/C or radiator cooling fins. 6. Coolant mixture incorrect. 7. Thermostat stuck shut. 8. Bug screen or winter front being used. 9. Viscous fan drive not operating properly. 10. Cylinder head gasket leaking. 11. Heater core leaking. 12. cooling system hoses leaking.	1. Temporary condition, repair not required. Notify customer of vehicle operation instructions located in Owners Manual. 2. Check gauge. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING) 3. Drain cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE) and refill (Refer to 7 - COOLING - STANDARD PROCEDURE) 4. Replace radiator cap. 5. Clean all debris away from A/C and radiator cooling fins. 6. Drain cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE) refill with correct mixture (Refer to 7 - COOLING - STANDARD PROCEDURE). 7. Replace thermostat. 8. Remove bug screen or winter front. 9. Check viscous fan (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - DIAGNOSIS AND TESTING) 10. Check for leaking head gaskets (Refer to 7 - COOLING - DIAGNOSIS AND TESTING). 11. Replace heater core. 12. Tighten clamps or Replace hoses.

COOLING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
	13. Brakes dragging.	13. Check brakes. (Refer to 5 - BRAKES/HYDRAULIC/ MECHANICAL - DIAGNOSIS AND TESTING)
TEMPERATURE GAUGE READING INCONSISTENT (ERRATIC, CYCLES OR FLUCTUATES)	1. Heavy duty cooling system, extream cold ambient (outside) temperature or heater blower motor in high position. 2. Temperature gauge or gauge sensor defective. 3. Temporary heavy usage or load. 4. Air traped in cooling system. 5. Water pump 6. Air leak on suction side of water pump.	1. None. System operating normaly. 2. Check gauge. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING) 3. None. Normal condition. 4. Fill cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE). 5. Replace water pump. 6. Check for leak. (Refer to 7 - COOLING - DIAGNOSIS AND TESTING)
RADIATOR CAP LEAKING STEAM AND /OR COOLANT INTO RESERVOIR BOTTLE. (TEMPERATURE GAUGE MAY READ HIGH)	1. Radiator cap defective. 2. Radiator neck surface damaged.	1. Replace radiator cap. 2. Replace radiator.
HOSE OR HOSES COLLAPSE WHEN ENGINE IS COOLING.	1. Vacuum created in cooling system on engine cool-down is not being relieved through coolant reservior/overflow system.	1. Replace radiator cap, check vent hose between radiator and reservoir bottle for blockage also check reservoir bottle vent for blockage.
NOISY FAN	1. Fan blade(s) loose, damaged. 2. Thermal viscous fan drive. 3. Fan blades striking surrounding objects. 4. Thermal viscous fan drive bearing. 5. Obstructed air flow through radiator.	1. Replace fan blade assembly. 2. None. Normal condition. 3. Locate contact point and repair as necessary. 4. Replace viscous fan drive assembly. 5. Remove obstruction.
INADEQUATE AIR CONDITIONER PERFORMANCE (COOLING SYSTEM SUSPECTED)	1. Radiator and/or A/C condenser air flow obstructed.	1. Remove obstruction and/or clean.

COOLING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
	2. Thermal viscous fan drive not working.	2. Check fan drive. (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - DIAGNOSIS AND TESTING)
	3. Air seals around radiator damaged or missing.	3. Inspect air seals, repair or replace as necessary.
INADEQUATE HEATER PERFORMANCE. GAUGE MAY OR MAY NOT READ LOW.	1. Heavy duty cooling system, and cooler ambient temperatures.	1. None. Normal condition.
	2. Obstruction in heater hoses.	2. Remove hoses, remove obstruction.
	3. Water pump damaged.	3. Replace water pump.
HEAT ODOR	1. Damaged or missing drive line heat shields.	1. Repair or replace damaged or missing heat shields.
	2. Thermal viscous fan drive damaged.	2. Check thermal viscous fan drive. (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - DIAGNOSIS AND TESTING)

STANDARD PROCEDURE

STANDARD PROCEDURE - DRAINING COOLING SYSTEM 5.9L/8.0L ENGINES

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

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

- (1) Remove radiator pressure cap.
- (2) Loosen radiator petcock.
- (3) Remove cylinder block drain plugs. Refer to (Fig. 7).

STANDARD PROCEDURE—DRAINING COOLING SYSTEM 5.9L DIESEL ENGINE

WARNING: DO NOT REMOVE THE CYLINDER BLOCK DRAIN PLUGS OR LOOSEN THE RADIATOR DRAIN PLUG 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.

- (1) Start the engine and place the heater control temperature selector in the Full-On position. Vacuum is needed to actuate the heater controls.

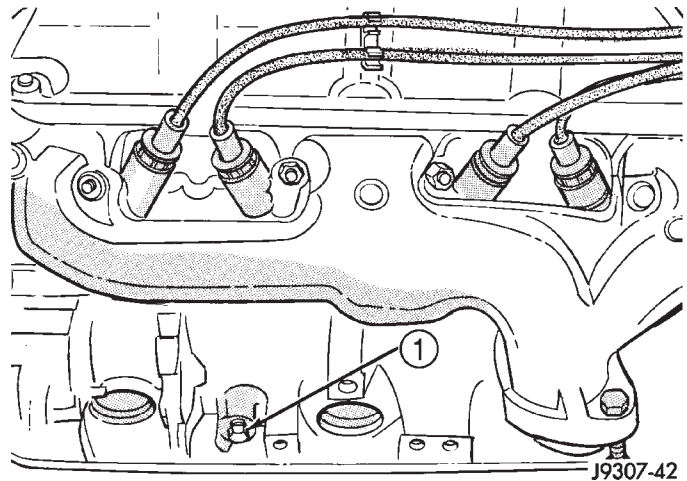


Fig. 7 Cylinder Block Drain Plug - 5.9L Engines

1 - BLOCK DRAIN PLUG

- (2) Turn the ignition off.

(3) Do not remove radiator cap when draining coolant from reserve/overflow tank. Open radiator drain plug and when tank is empty, remove radiator cap. If the coolant reserve/overflow tank does not drain, (Refer to 7 - COOLING - DIAGNOSIS AND TESTING). The coolant need not be removed from tank unless the system is being refilled with fresh mixture.

- (4) Remove radiator pressure cap.

COOLING (Continued)

STANDARD PROCEDURE - REFILLING COOLING SYSTEM 5.9L/8.0L ENGINES

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

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

Clean cooling system prior to refilling. (Refer to 7 - COOLING - STANDARD PROCEDURE).

(1) Install cylinder block drain plugs. Coat the threads with Mopar® Thread Sealant with Teflon.

(2) Close radiator petcock.

(3) Fill cooling system with a 50/50 mixture of water and antifreeze.

(4) Fill coolant reserve/overflow tank to FULL mark on indicator stick.

(5) Start and operate engine until thermostat opens (upper radiator hose warm to touch).

(6) If necessary, add a 50/50 water and antifreeze mixture to the coolant reserve/overflow tank. This is done to maintain coolant level between the FULL and ADD marks. The level in the reserve/overflow tank may drop below the ADD mark after three or four warm-up and cool-down cycles.

STANDARD PROCEDURE—REFILLING COOLING SYSTEM 5.9L DIESEL ENGINE

Clean cooling system prior to refilling (Refer to 7 - COOLING - STANDARD PROCEDURE).

(1) Close radiator drain plug.

CAUTION: Due to the use of the one-way check valve, the engine must not be operating when refilling the cooling system.

NOTE: The diesel engine is equipped with a one-way check valve (jiggle pin). The check valve is used as a servicing feature and will vent air when the system is being filled. Water pressure (or flow) will hold the valve closed.

(2) Fill the cooling system with a 50/50 mixture of water and antifreeze.

(3) Fill coolant reserve/overflow tank to the FULL mark.

(4) Start and operate engine until thermostat opens. Upper radiator hose should be warm to touch.

(5) If necessary, add 50/50 water and antifreeze mixture to the coolant reserve/overflow tank to maintain coolant level. This level should be between the ADD and FULL marks. The level in the reserve/overflow tank may drop below the ADD mark after three or four warm-up and cool-down cycles.

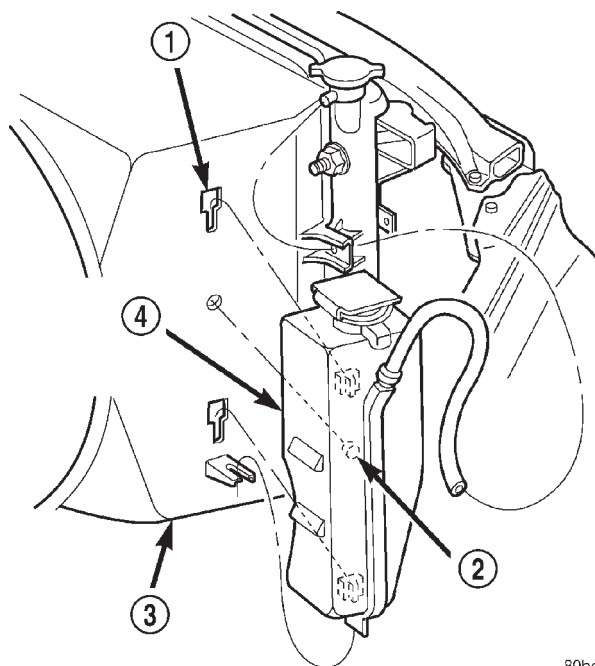
STANDARD PROCEDURE - ADDING ADDITIONAL COOLANT

The use of aluminum cylinder blocks, cylinder heads and water pumps requires special corrosion protection. Only Mopar® Antifreeze/Coolant, 5 Year/100,000 Mile Formula (glycol base coolant with corrosion inhibitors called HOAT, for Hybrid Organic Additive Technology) is recommended. This coolant offers the best engine cooling without corrosion when mixed with 50% distilled water to obtain a freeze point of -37°C (-35°F). If it loses color or becomes contaminated, drain, flush, and replace with fresh properly mixed coolant solution.

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

STANDARD PROCEDURE—COOLANT LEVEL CHECK

NOTE: Do not remove radiator cap for routine coolant level inspections. The coolant level can be checked at coolant recovery bottle.



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Fig. 8 COOLANT RESERVE/OVERFLOW TANK—ALL EXCEPT 8.0L V-10 ENGINE

- 1 - T-SLOTS
- 2 - ALIGNMENT PIN
- 3 - FAN SHROUD
- 4 - COOLANT RESERVE/OVERFLOW TANK

COOLING (Continued)

The coolant reserve/overflow system provides a quick method for determining coolant level without removing radiator pressure cap. With engine not running, open the coolant recovery bottle cap and remove coolant level indicator dipstick to observe coolant level in coolant recovery bottle. The coolant level should be between ADD and FULL marks. If the coolant level is at or below the ADD mark, fill the recovery bottle with a 50/50 mixture of antifreeze and water ONE QUART AT A TIME. Repeat this procedure until the coolant level is at the FULL mark (Fig. 8).

STANDARD PROCEDURE - COOLING SYSTEM CLEANING/REVERSE FLUSHING

CLEANING

Drain cooling system and refill with water. Run engine with radiator cap installed until upper radiator hose is hot. Stop engine and drain water from system. If water is dirty, fill system with water, run engine and drain system. Repeat until water drains clean.

REVERSE FLUSHING

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

REVERSE FLUSHING RADIATOR

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

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

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

REVERSE FLUSHING ENGINE

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

CAUTION: On vehicles equipped with a heater water control valve, be sure heater control valve is closed (heat off). This will prevent coolant flow with scale and other deposits from entering heater core.

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

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

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 flushing operation.

CAUTION: Follow manufacturers instructions when using these products.

STANDARD PROCEDURE - COOLANT SELECTION - ADDITIVES

The use of aluminum cylinder blocks, cylinder heads and water pumps requires special corrosion protection. Only Mopar® Antifreeze/Coolant, 5 Year/100,000 Mile Formula (glycol base coolant with corrosion inhibitors called HOAT, for Hybrid Organic Additive Technology) is recommended. This coolant offers the best engine cooling without corrosion when mixed with 50% distilled water to obtain a freeze point of -37°C (-35°F). If it loses color or becomes contaminated, drain, flush, and replace with fresh properly mixed coolant solution.

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

COOLING (Continued)

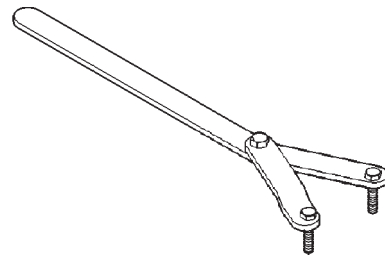
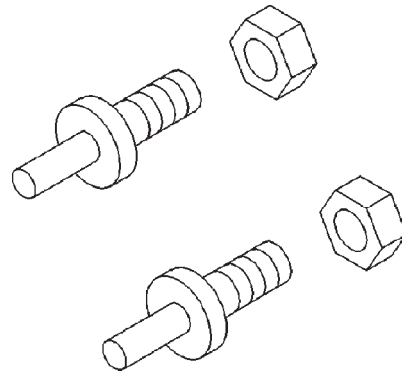
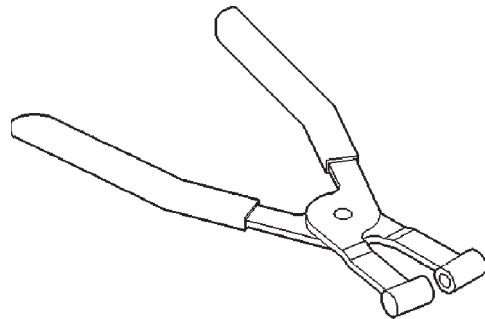
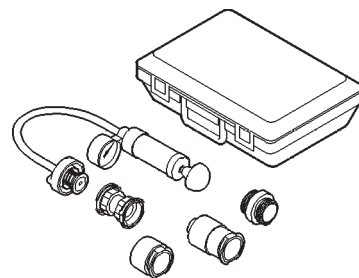
SPECIFICATIONS

TORQUE

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs
Belt Tensioner Pulley 5.9L Engine-Bolt	61	45	—
Belt Tensioner Pulley 8.0L Engine— Bolt	88	65	—
Belt Tensioner to Mounting Bracket— Bolt 5.9L Engine	67	50	—
Belt Tensioner to Mounting Bracket— Bolt 8.0L Engine	41	30	—
Block Heater—Screw Gas Engines	2	—	17
Block Heater—Hex Diesel Engine	43	32	—
Fan Shroud to Radiator Mounting— Bolts	6	—	50
Heater Hose Fitting at Water Pump—(8.0L)	16	—	142
Idler Pulley Mounting—Bolts Gas Engines	61	45	—
Radiator Mounting—Bolts	11	—	95
Thermal Viscous Fan to Hub—(Diesel)	57	42	—
Thermostat Housing—Bolts 5.9L	23	—	200
Thermostat Housing—Bolts 8.0L	25	—	220
Thermostat Housing—Bolts Diesel	24	—	212
Water Pump Mounting—Bolts Gas Engines	40	30	—
Water Pump Mounting—Bolts Diesel	24	—	212

SPECIAL TOOLS

COOLING

**SPANNER WRENCH 6958****Adapter Pins 8346****Pliers 6094****Pressure Tester 7700-A**

ACCESSORY DRIVE

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BELT TENSIONERS - 5.9L

DESCRIPTION

Correct drive belt tension is required to ensure optimum performance of the belt driven engine accessories. If specified tension is not maintained, belt slippage may cause; engine overheating, lack of power steering assist, loss of air conditioning capacity, reduced generator output rate, and greatly reduced belt life.

It is not necessary to adjust belt tension on the 5.9L engines. These engines are equipped with an automatic belt tensioner (Fig. 1). The tensioner maintains correct belt tension at all times. Due to use of this belt tensioner, do not attempt to use a belt tension gauge on 5.9L engines.

OPERATION

The automatic belt tensioner maintains belt tension by using internal spring pressure, a pivoting arm and pulley to press against the drive belt.

REMOVAL

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

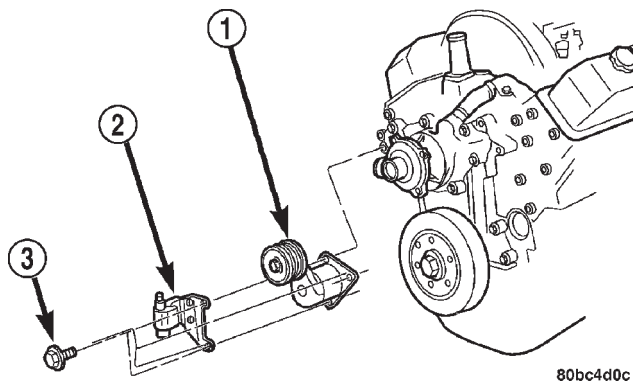


Fig. 1 Automatic Belt Tensioner - 5.9L Engines

- 1 - AUTOMATIC TENSIONER
- 2 - COIL AND BRACKET
- 3 - SCREW AND WASHER

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

(2) Disconnect wiring and secondary cable from ignition coil.

(3) Remove ignition coil from coil mounting bracket (two bolts). Do not remove coil mounting bracket from cylinder head.

BELT TENSIONERS - 5.9L (Continued)

(4) Remove tensioner assembly from mounting bracket (one nut) (Fig. 2).

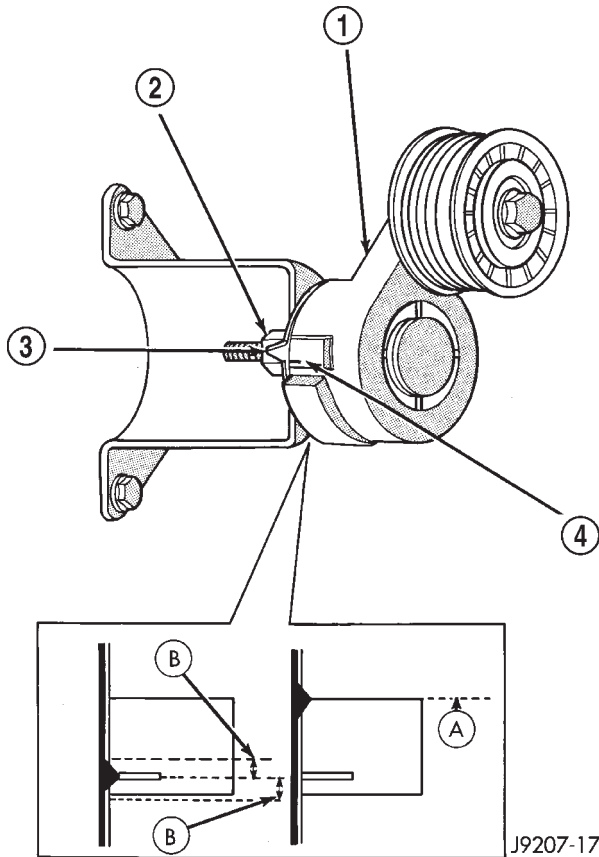


Fig. 2 Tensioner Indexing Marks and Mounting Nut

- 1 - TENSIONER ASSEMBLY
- 2 - TENSIONER MOUNTING NUT
- 3 - INDEXING ARROW
- 4 - INDEXING MARK

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

INSTALLATION

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

(2) Install tensioner assembly to mounting bracket. An indexing tab is located on back of tensioner. Align this tab to slot in mounting bracket. Tighten nut to 67 N·m (50 ft. lbs.) torque.

(3) Connect all wiring to ignition coil.

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

(4) Install coil to coil bracket. If nuts and bolts are used to secure coil to coil bracket, tighten to 11 N·m (100 in. lbs.) torque. If coil mounting bracket has been tapped for coil mounting bolts, tighten bolts to 5 N·m (50 in. lbs.) torque.

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

(6) Check belt indexing marks (Fig. 2).

BELT TENSIONERS - 8.0L

DESCRIPTION

CAUTION: Do not attempt to check belt tension with a belt tension gauge on vehicles equipped with an automatic belt tensioner.

Drive belts on 8.0L engines are equipped with a spring loaded automatic belt tensioner (Fig. 3) This belt tensioner will be used with all belt configurations, such as with or without power steering or air conditioning.

The tensioner is equipped with an indexing arrow (Fig. 4) on back of tensioner and an indexing mark on tensioner housing.

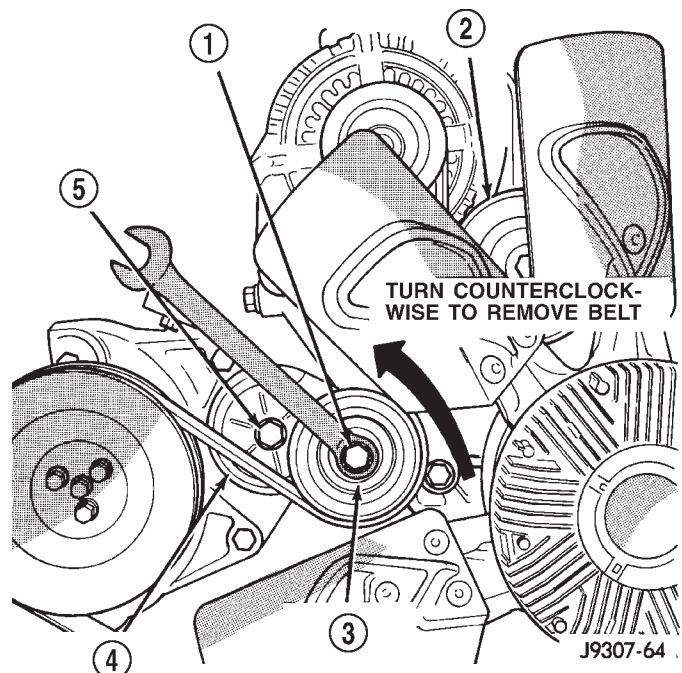
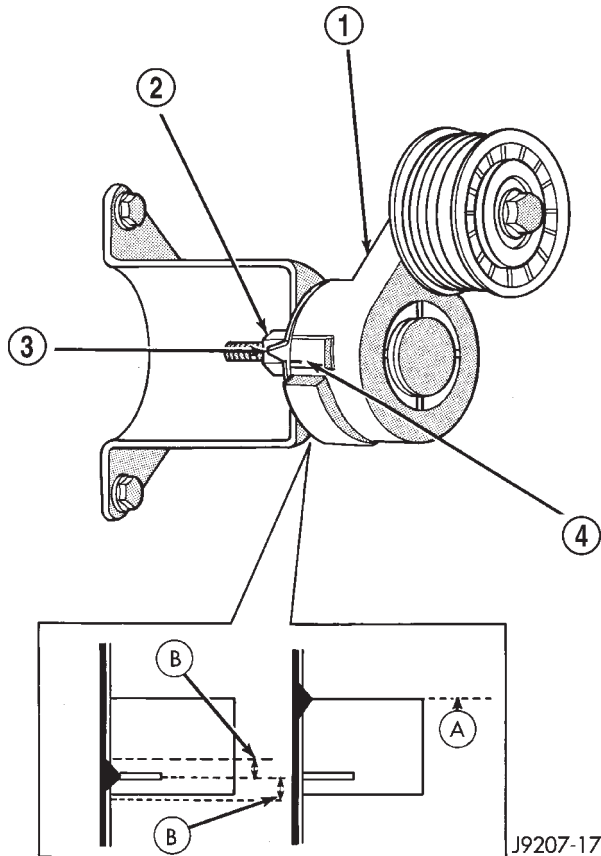


Fig. 3 Belt Tensioner—8.0L V-10 Engines

- 1 - PULLEY BOLT
- 2 - IDLER PULLEY
- 3 - TENSIONER PULLEY
- 4 - TENSIONER
- 5 - TENSIONER MOUNTING BOLT

BELT TENSIONERS - 8.0L (Continued)

**Fig. 4 Indexing Marks—8.0L Engines Typical**

- 1 - TENSIONER ASSEMBLY
- 2 - TENSIONER MOUNTING NUT
- 3 - INDEXING ARROW
- 4 - INDEXING MARK

OPERATION

WARNING: THE AUTOMATIC BELT TENSIONER ASSEMBLY IS SPRING LOADED. DO NOT ATTEMPT TO DISASSEMBLE THE TENSIONER ASSEMBLY.

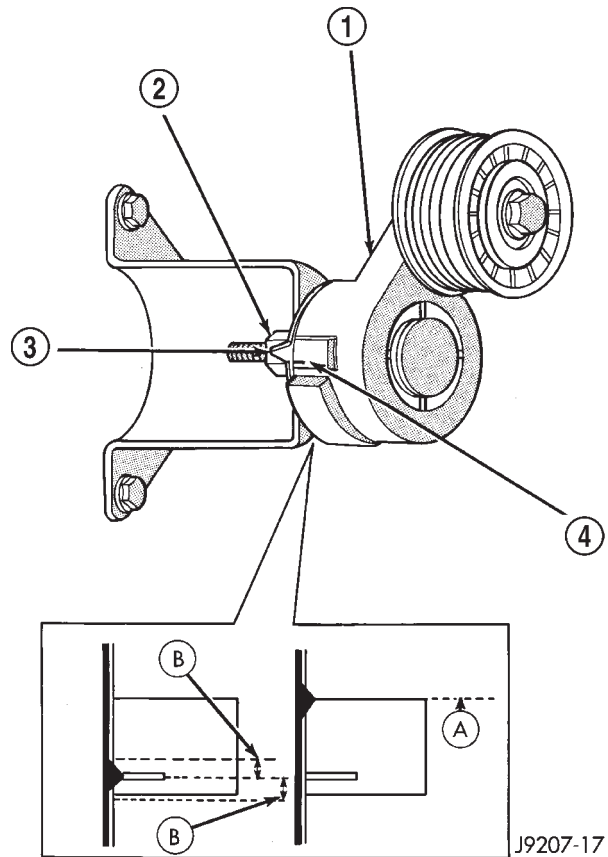
The automatic belt tensioner maintains correct belt tension using a coiled spring within the tensioner housing. The spring applies pressure to the tensioner arm pressing the arm into the belt, tensioning the belt.

If a new belt is being installed, the arrow must be within approximately 3 mm (1/8 in.) of indexing mark (point B-) (Fig. 5). Belt is considered new if it has been used 15 minutes or less. If this 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.

A used belt should be replaced if tensioner indexing arrow has moved to point-A (Fig. 5). Tensioner travel stops at point-A.

**Fig. 5 Indexing Marks—8.0L Engines Typical**

- 1 - TENSIONER ASSEMBLY
- 2 - TENSIONER MOUNTING NUT
- 3 - INDEXING ARROW
- 4 - INDEXING MARK

REMOVAL

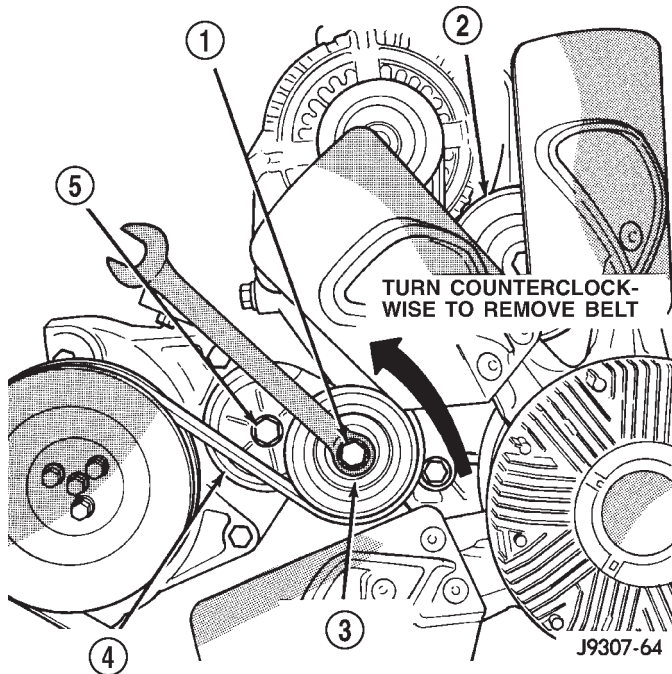
WARNING: BECAUSE OF HIGH SPRING PRESSURE, DO NOT ATTEMPT TO DISASSEMBLE AUTOMATIC TENSIONER. UNIT IS SERVICED AS AN ASSEMBLY (EXCEPT FOR PULLEY).

CAUTION: If the pulley is to be removed from the tensioner, its mounting bolt has left-hand threads.

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

(2) Remove tensioner mounting bolt (Fig. 6) and remove tensioner.

BELT TENSIONERS - 8.0L (Continued)

**Fig. 6 Belt Tensioner**

- 1 - PULLEY BOLT
- 2 - IDLER PULLEY
- 3 - TENSIONER PULLEY
- 4 - TENSIONER
- 5 - TENSIONER MOUNTING BOLT

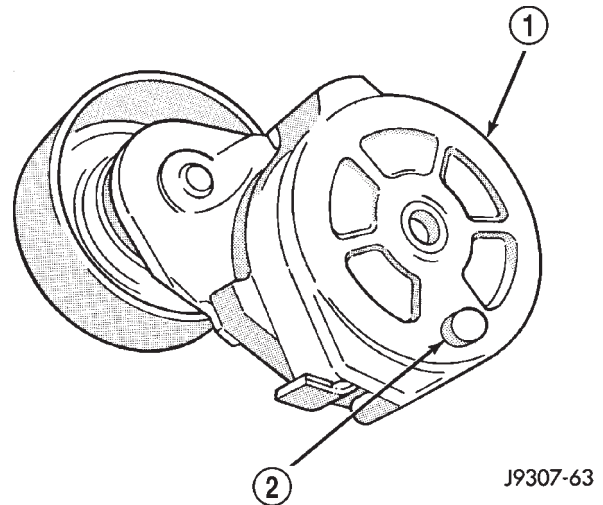
INSTALLATION

CAUTION: If the pulley is to be removed from the tensioner, its mounting bolt has left-hand threads.

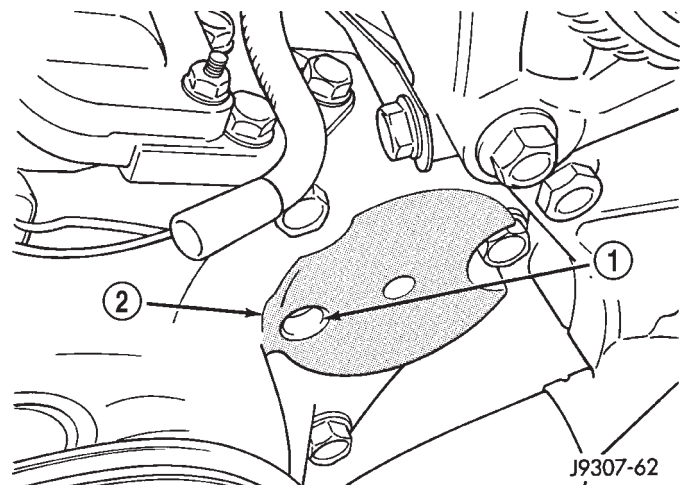
(1) Install pulley and pulley bolt to tensioner. Tighten bolt to 88 N·m (65 ft. lbs.) torque.

(2) Install tensioner assembly to mounting bracket. A dowel pin is located on back of tensioner (Fig. 7). Align this to dowel hole (Fig. 8) in tensioner mounting bracket. Tighten bolt to 41 N·m (30 ft. lbs.) torque.

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

**Fig. 7 Tensioner Dowel Pin**

- 1 - BELT TENSIONER
- 2 - DOWEL PIN

**Fig. 8 Tensioner Dowel Hole**

- 1 - DOWEL PIN HOLE
- 2 - TENSIONER MOUNTING BRACKET

BELT TENSIONERS - 5.9L DIESEL

DESCRIPTION

Drive belts on all engines are equipped with a spring loaded automatic belt tensioner (Fig. 9). This tensioner maintains constant belt tension at all times and requires no maintenance or adjustment.

CAUTION: Do not attempt to check belt tension with a belt tension gauge on vehicles equipped with an automatic belt tensioner.

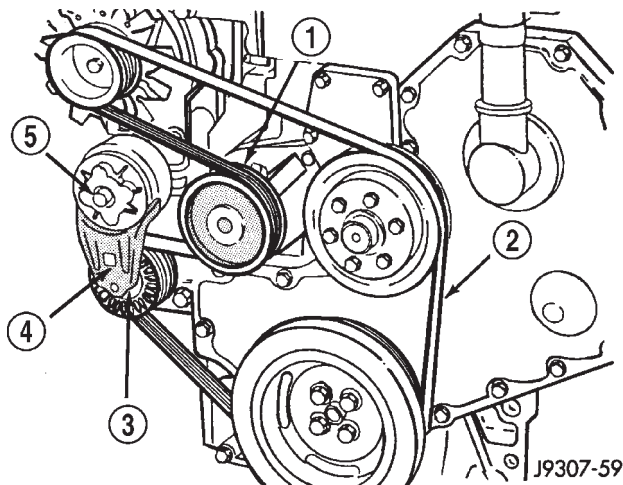


Fig. 9 Belt

- 1 - WATER PUMP
- 2 - ACCESSORY DRIVE BELT
- 3 - AUTOMATIC BELT TENSIONER
- 4 - 3/8" SQUARE BOLT
- 5 - MOUNT. BOLT

OPERATION

WARNING: THE AUTOMATIC BELT TENSIONER ASSEMBLY IS SPRING LOADED. DO NOT ATTEMPT TO DISASSEMBLE THE TENSIONER ASSEMBLY.

The automatic belt tensioner maintains correct belt tension using a coiled spring within the tensioner housing. The spring applies pressure to the tensioner arm pressing the arm into the belt, tensioning the belt.

If a new belt is being installed, the arrow must be within approximately 3 mm (1/8 in.) of indexing mark. Belt is considered new if it has been used 15 minutes or less. If this 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.

REMOVAL

WARNING: BECAUSE OF HIGH SPRING PRESSURE, DO NOT ATTEMPT TO DISASSEMBLE AUTOMATIC TENSIONER. UNIT IS SERVICED AS AN ASSEMBLY.

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

(2) Remove tensioner mounting bolt (Fig. 10) and remove tensioner.

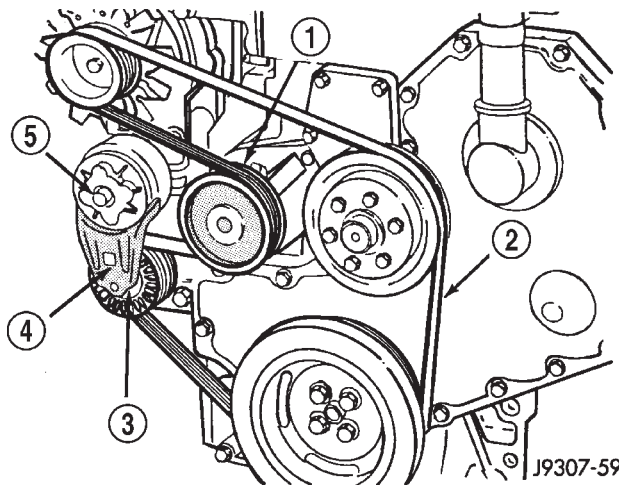


Fig. 10 Automatic Belt Tensioner Diesel Engine—Typical

- 1 - WATER PUMP
- 2 - ACCESSORY DRIVE BELT
- 3 - AUTOMATIC BELT TENSIONER
- 4 - 3/8" SQUARE BOLT
- 5 - MOUNT. BOLT

INSTALLATION

(1) Install tensioner assembly to mounting bracket. A dowel is located on back of tensioner. Align this dowel to hole in tensioner mounting bracket. Tighten bolt to 41 N·m (30 ft. lbs.) torque.

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

DRIVE BELTS - 5.9L

DIAGNOSIS AND TESTING - ACCESSORY DRIVE BELT

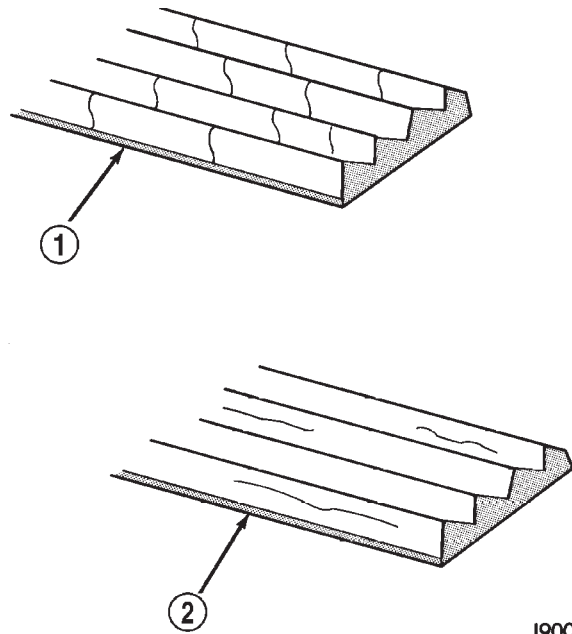
VISUAL DIAGNOSIS

When diagnosing serpentine accessory drive belts, small cracks that run across the ribbed surface of the belt from rib to rib (Fig. 11), are considered normal. These are not a reason to replace the belt. However, cracks running along a rib (not across) are **not** normal. Any belt with cracks running along a rib must be replaced (Fig. 11). Also replace the belt if it has excessive wear, frayed cords or severe glazing.

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

NOISE DIAGNOSIS

Noises generated by the accessory drive belt are most noticeable at idle. Before replacing a belt to resolve a noise condition, inspect all of the accessory drive pulleys for alignment, glazing, or excessive end play.



J9007-44

Fig. 11 Belt Wear Patterns

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

ACCESSORY 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. 2. Installation damage	1. Remove foreign objects from pulley grooves. Replace belt. 2. Replace belt
RIB OR BELT WEAR	1. Pulley misaligned 2. Abrasive environment 3. Rusted pulley(s) 4. Sharp or jagged pulley groove tips 5. Belt rubber deteriorated	1. Align pulley(s) 2. Clean pulley(s). Replace belt if necessary 3. Clean rust from pulley(s) 4. Replace pulley. Inspect belt. 5. Replace belt
BELT SLIPS	1. Belt slipping because of insufficient tension 2. Belt or pulley exposed to substance that has reduced friction (belt dressing, oil, ethylene glycol) 3. Driven component bearing failure (seizure) 4. Belt glazed or hardened from heat and excessive slippage	1. Inspect/Replace tensioner if necessary 2. Replace belt and clean pulleys 3. Replace faulty component or bearing 4. Replace belt.

DRIVE BELTS - 5.9L (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
LONGITUDAL BELT CRACKING	1. Belt has mistracked from pulley groove 2. Pulley groove tip has worn away rubber to tensile member	1. Replace belt 2. Replace belt
"GROOVE JUMPING" (Belt does not maintain correct position on pulley)	1. Incorrect belt tension 2. Pulley(s) not within design tolerance 3. Foreign object(s) in grooves 4. Pulley misalignment 5. Belt cordline is broken	1. Inspect/Replace tensioner if necessary 2. Replace pulley(s) 3. Remove foreign objects from grooves 4. Align component 5. Replace belt
BELT BROKEN (Note: Identify and correct problem before new belt is installed)	1. Incorrect belt tension 2. Tensile member damaged during belt installation 3. Severe misalignment 4. Bracket, pulley, or bearing failure	1. Replace Inspect/Replace tensioner if necessary 2. Replace belt 3. Align pulley(s) 4. Replace defective component and belt
NOISE (Objectionable squeal, squeak, or rumble is heard or felt while drive belt is in operation)	1. Incorrect belt tension 2. Bearing noise 3. Belt misalignment 4. Belt to pulley mismatch 5. Driven component induced vibration	1. Inspect/Replace tensioner if necessary 2. Locate and repair 3. Align belt/pulley(s) 4. Install correct belt 5. Locate defective driven component and repair
TENSION SHEETING FABRIC FAILURE (Woven fabric on outside, circumference of belt has cracked or separated from body of belt)	1. Tension sheeting contacting stationary object 2. Excessive heat causing woven fabric to age 3. Tension sheeting splice has fractured	1. Correct rubbing condition 2. Replace belt 3. Replace belt
CORD EDGE FAILURE (Tensile member exposed at edges of belt or separated from belt body)	1. Incorrect belt tension 2. Belt contacting stationary object 3. Pulley(s) out of tolerance 4. Insufficient adhesion between tensile member and rubber matrix	1. Inspect/Replace tensioner if necessary 2. Replace belt 3. Replace pulley 4. Replace belt

DRIVE BELTS - 5.9L (Continued)

REMOVAL

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.

CAUTION: Do not attempt to check belt tension with a belt tension gauge on vehicles equipped with an automatic belt tensioner. Refer to Automatic Belt Tensioner in this group.

Drive belts on these engines are equipped with a spring loaded automatic belt tensioner (Fig. 12). This belt tensioner will be used on all belt configurations, such as with or without power steering or air conditioning. For more information, (Refer to 7 - COOLING/ACCESSORY DRIVE/BELT TENSIONERS - DESCRIPTION).

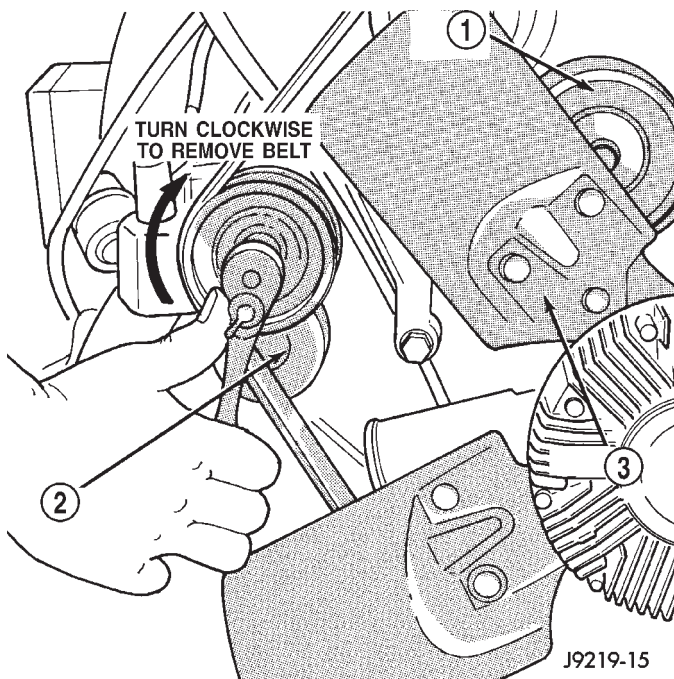


Fig. 12 Belt Tensioner - 5.9L Gas Engines

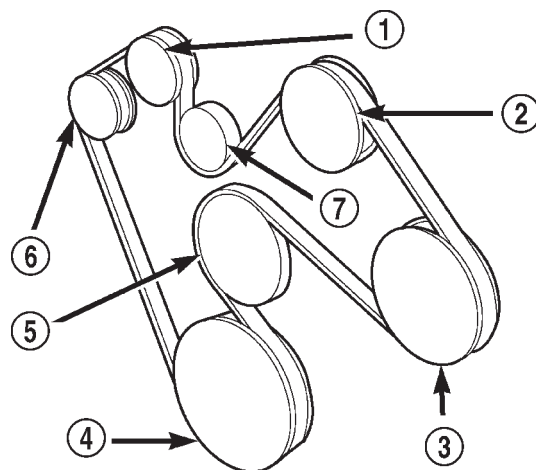
- 1 - IDLER PULLEY
- 2 - TENSIONER
- 3 - FAN BLADE

- (1) Attach a socket/wrench to pulley mounting bolt of automatic tensioner (Fig. 12).
- (2) Rotate tensioner assembly clockwise (as viewed from front) until tension has been relieved from belt.
- (3) Remove belt from idler pulley first.
- (4) Remove belt from vehicle.

INSTALLATION

CAUTION: When installing the accessory drive belt, the belt must be routed correctly. If not, engine may overheat due to water pump rotating in wrong direction. Refer to (Fig. 13) (Fig. 14) for correct engine belt routing. The correct belt with correct length must be used.

- (1) Position drive belt over all pulleys **except** idler pulley. This pulley is located between generator and A/C compressor.
- (2) Attach a socket/wrench to pulley mounting bolt of automatic tensioner (Fig. 12).
- (3) Rotate socket/wrench clockwise. Place belt over idler pulley. Let tensioner rotate back into place. Remove wrench. Be sure belt is properly seated on all pulleys.
- (4) Check belt indexing marks.

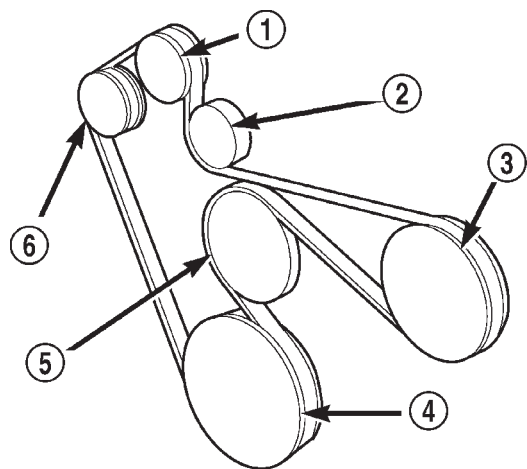


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Fig. 13 Belt Routing - 5.9L Engines with A/C

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

DRIVE BELTS - 5.9L (Continued)



80bdbd05

Fig. 14 Belt Routing - 5.9L Engines Without A/C

- 1 - GENERATOR PULLEY
- 2 - IDLER PULLEY
- 3 - POWER STEERING PULLEY
- 4 - CRANKSHAFT PULLEY
- 5 - WATER PUMP PULLEY
- 6 - TENSIONER PULLEY

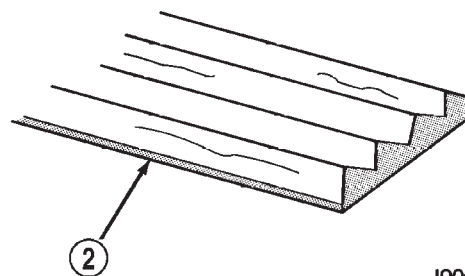
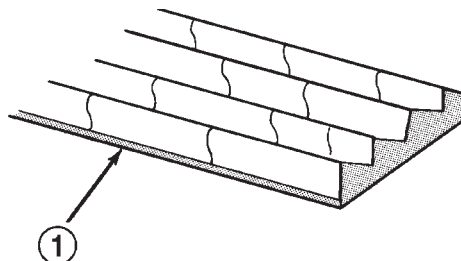
DRIVE BELTS - 8.0L

DIAGNOSIS AND TESTING—ACCESSORY DRIVE BELT**VISUAL DIAGNOSIS**

When diagnosing serpentine accessory drive belts, small cracks that run across the ribbed surface of the belt from rib to rib (Fig. 15), are considered normal. These are not a reason to replace the belt. However, cracks running along a rib (not across) are **not** normal. Any belt with cracks running along a rib must

be replaced (Fig. 15). Also replace the belt if it has excessive wear, frayed cords or severe glazing.

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



J9007-44

Fig. 15 Belt Wear Patterns

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

NOISE DIAGNOSIS

Noises generated by the accessory drive belt are most noticeable at idle. Before replacing a belt to resolve a noise condition, inspect all of the accessory drive pulleys for alignment, glazing, or excessive end play.

DRIVE BELTS - 8.0L (Continued)

ACCESSORY 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. 2. Installation damage	1. Remove foreign objects from pulley grooves. Replace belt. 2. Replace belt
RIB OR BELT WEAR	1. Pulley misaligned 2. Abrasive environment 3. Rusted pulley(s) 4. Sharp or jagged pulley groove tips 5. Belt rubber deteriorated	1. Align pulley(s) 2. Clean pulley(s). Replace belt if necessary 3. Clean rust from pulley(s) 4. Replace pulley. Inspect belt. 5. Replace belt
BELT SLIPS	1. Belt slipping because of insufficient tension 2. Belt or pulley exposed to substance that has reduced friction (belt dressing, oil, ethylene glycol) 3. Driven component bearing failure (seizure) 4. Belt glazed or hardened from heat and excessive slippage	1. Inspect/Replace tensioner if necessary 2. Replace belt and clean pulleys 3. Replace faulty component or bearing 4. Replace belt.
LONGITUDAL BELT CRACKING	1. Belt has mistracked from pulley groove 2. Pulley groove tip has worn away rubber to tensile member	1. Replace belt 2. Replace belt
"GROOVE JUMPING" (Belt does not maintain correct position on pulley)	1. Incorrect belt tension 2. Pulley(s) not within design tolerance 3. Foreign object(s) in grooves 4. Pulley misalignment 5. Belt cordline is broken	1. Inspect/Replace tensioner if necessary 2. Replace pulley(s) 3. Remove foreign objects from grooves 4. Align component 5. Replace belt
BELT BROKEN (Note: Identify and correct problem before new belt is installed)	1. Incorrect belt tension 2. Tensile member damaged during belt installation 3. Severe misalignment 4. Bracket, pulley, or bearing failure	1. Replace Inspect/Replace tensioner if necessary 2. Replace belt 3. Align pulley(s) 4. Replace defective component and belt

DRIVE BELTS - 8.0L (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
NOISE (Objectional squeal, spueak, or rumble is heard or felt while drive belt is in operation)	1. Incorrect belt tension 2. Bearing noise 3. Belt misalignment 4. Belt to pulley mismatch 5. Driven component induced vibration	1. Inspect/Replace tensioner if necessary 2. Locate and repair 3. Align belt/pulley(s) 4. Install correct belt 5. Locate defective driven component and repair
TENSION SHEETING FABRIC FAILURE (Woven fabric on outside, circumference of belt has cracked or separated from body of belt)	1. Tension sheeting contacting stationary object 2. Excessive heat causing woven fabric to age 3. Tension sheeting splice has fractured	1. Correct rubbing condition 2. Replace belt 3. Replace belt
CORD EDGE FAILURE (Tensile member exposed at edges of belt or separated from belt body)	1. Incorrect belt tension 2. Belt contacting stationary object 3. Pulley(s) out of tolerance 4. Insufficient adhesion between tensile member and rubber matrix	1. Inspect/Replace tensioner if necessary 2. Replace belt 3. Replace pulley 4. Replace belt

REMOVAL

Drive belts are equipped with a spring loaded automatic belt tensioner (Fig. 16). This belt tensioner will be used on all belt configurations, such as with or without power steering or air conditioning. For more information, refer to Automatic Belt Tensioner, proceeding in this group.

(1) Attach a socket/wrench to pulley mounting bolt of automatic tensioner (Fig. 16). The threads on the pulley mounting bolt are left- hand.

(2) Relax the tension from the belt by rotating the tensioner counterclockwise (as viewed from front) (Fig. 16). When all belt tension has been relaxed, remove belt from tensioner pulley first and other pulleys last.

INSTALLATION

CAUTION: When installing the accessory drive belt, the belt must be routed correctly. If not, engine may overheat due to water pump rotating in wrong direction. Refer to (Fig. 17) (Fig. 18) for correct engine belt routing. The correct belt with correct length must be used.

CAUTION: If the pulley is to be removed from the tensioner, its mounting bolt has left-hand threads.

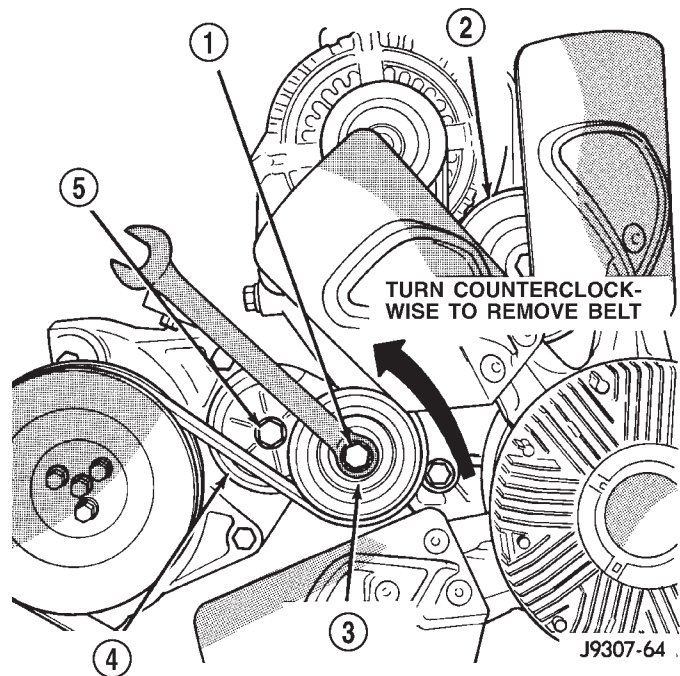


Fig. 16 Belt Tensioner

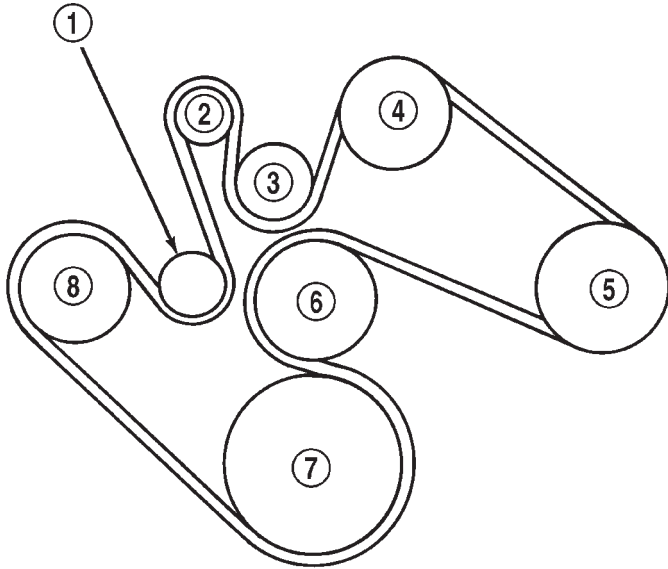
- 1 - PULLEY BOLT
- 2 - IDLER PULLEY
- 3 - TENSIONER PULLEY
- 4 - TENSIONER
- 5 - TENSIONER MOUNTING BOLT

DRIVE BELTS - 8.0L (Continued)

(1) Position drive belt over all pulleys **except** tensioner pulley.

(2) Attach a socket/wrench to pulley mounting bolt of automatic tensioner (Fig. 16).

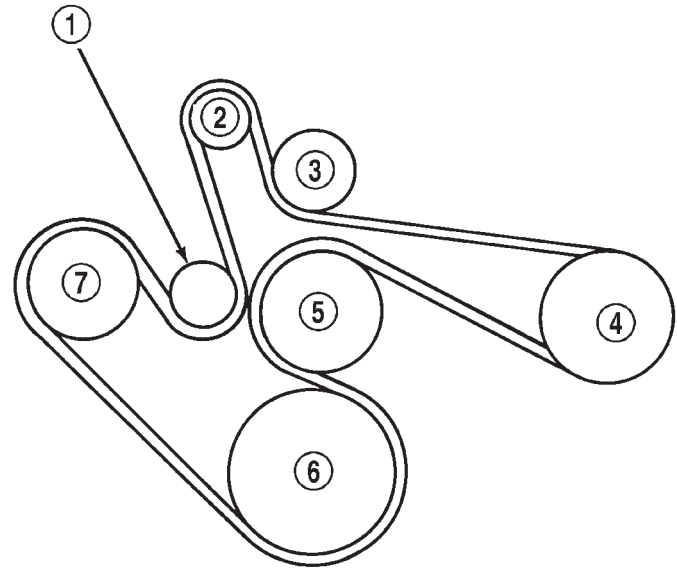
(3) Rotate socket/wrench counterclockwise. Install belt over tensioner pulley. Let tensioner rotate back into place. Remove wrench. Be sure belt is properly seated on all pulleys.



J9307-55

Fig. 17 Belt Routing—With A/C

- 1 - AUTOMATIC TENSIONER
- 2 - GENERATOR PULLEY
- 3 - IDLER PULLEY
- 4 - A/C COMPRESSOR PUMP PULLEY
- 5 - POWER STEERING PUMP PULLEY
- 6 - WATER PUMP AND FAN PULLEY
- 7 - CRANKSHAFT PULLEY
- 8 - AIR PUMP (A.I.R.) PULLEY



J9307-56

Fig. 18 Belt Routing—Without A/C

- 1 - AUTOMATIC TENSIONER
- 2 - GENERATOR PULLEY
- 3 - IDLER PULLEY
- 4 - POWER STEERING PUMP PULLEY
- 5 - WATER PUMP AND FAN PULLEY
- 6 - CRANKSHAFT PULLEY
- 7 - AIR PUMP (A.I.R.) PULLEY

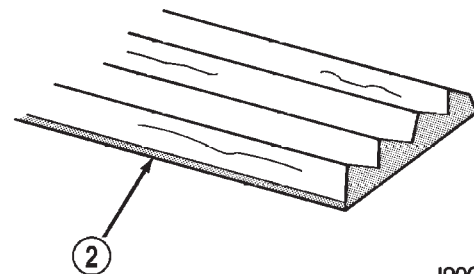
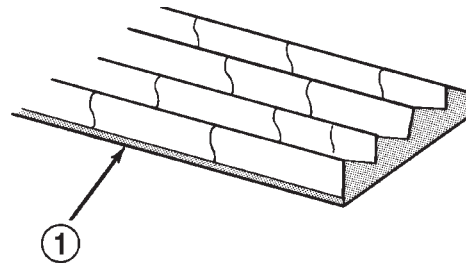
DRIVE BELTS - 5.9L DIESEL

DIAGNOSIS AND TESTING—ACCESSORY DRIVE BELT

VISUAL DIAGNOSIS

When diagnosing serpentine accessory drive belts, small cracks that run across the ribbed surface of the belt from rib to rib (Fig. 19), are considered normal. These are not a reason to replace the 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 the belt if it has excessive wear, frayed cords or severe glazing.

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



J9007-44

Fig. 19 Belt Wear Patterns

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

DRIVE BELTS - 5.9L DIESEL (Continued)

NOISE DIAGNOSIS

Noises generated by the accessory drive belt are most noticeable at idle. Before replacing a belt to

resolve a noise condition, inspect all of the accessory drive pulleys for alignment, glazing, or excessive end play.

ACCESSORY 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. 2. Installation damage	1. Remove foreign objects from pulley grooves. Replace belt. 2. Replace belt
RIB OR BELT WEAR	1. Pulley misaligned 2. Abrasive environment 3. Rusted pulley(s) 4. Sharp or jagged pulley groove tips 5. Belt rubber deteriorated	1. Align pulley(s) 2. Clean pulley(s). Replace belt if necessary 3. Clean rust from pulley(s) 4. Replace pulley. Inspect belt. 5. Replace belt
BELT SLIPS	1. Belt slipping because of insufficient tension 2. Belt or pulley exposed to substance that has reduced friction (belt dressing, oil, ethylene glycol) 3. Driven component bearing failure (seizure) 4. Belt glazed or hardened from heat and excessive slippage	1. Inspect/Replace tensioner if necessary 2. Replace belt and clean pulleys 3. Replace faulty component or bearing 4. Replace belt.
LONGITUDAL BELT CRACKING	1. Belt has mistracked from pulley groove 2. Pulley groove tip has worn away rubber to tensile member	1. Replace belt 2. Replace belt
"GROOVE JUMPING" (Belt does not maintain correct position on pulley)	1. Incorrect belt tension 2. Pulley(s) not within design tolerance 3. Foreign object(s) in grooves 4. Pulley misalignment 5. Belt cordline is broken	1. Inspect/Replace tensioner if necessary 2. Replace pulley(s) 3. Remove foreign objects from grooves 4. Align component 5. Replace belt

DRIVE BELTS - 5.9L DIESEL (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
BELT BROKEN (Note: Identify and correct problem before new belt is installed)	1. Incorrect belt tension 2. Tensile member damaged during belt installation 3. Severe misalignment 4. Bracket, pulley, or bearing failure	1. Replace Inspect/Replace tensioner if necessary 2. Replace belt 3. Align pulley(s) 4. Replace defective component and belt
NOISE (Objectional squeal, spueak, or rumble is heard or felt while drive belt is in operation)	1. Incorrect belt tension 2. Bearing noise 3. Belt misalignment 4. Belt to pulley mismatch 5. Driven component induced vibration	1. Inspect/Replace tensioner if necessary 2. Locate and repair 3. Align belt/pulley(s) 4. Install correct belt 5. Locate defective driven component and repair
TENSION SHEETING FABRIC FAILURE (Woven fabric on outside, circumference of belt has cracked or separated from body of belt)	1. Tension sheeting contacting stationary object 2. Excessive heat causing woven fabric to age 3. Tension sheeting splice has fractured	1. Correct rubbing condition 2. Replace belt 3. Replace belt
CORD EDGE FAILURE (Tensile member exposed at edges of belt or separated from belt body)	1. Incorrect belt tension 2. Belt contacting stationary object 3. Pulley(s) out of tolerance 4. Insufficient adhesion between tensile member and rubber matrix	1. Inspect/Replace tensioner if necessary 2. Replace belt 3. Replace pulley 4. Replace belt

REMOVAL

CAUTION: Do not attempt to check belt tension with a belt tension gauge on vehicles equipped with an automatic belt tensioner. Refer to Automatic Belt Tensioner in this group.

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 on diesel engines are equipped with a spring loaded automatic belt tensioner (Fig. 20). (Fig. 20) displays the tensioner for vehicles without air conditioning.

This belt tensioner will be used on all belt configurations, such as with or without air conditioning. For more information, (Refer to 7 - COOLING/ACCESSORY DRIVE/BELT TENSIONERS - DESCRIPTION).

(1) A 3/8 inch square hole is provided in the automatic belt tensioner (Fig. 20). Attach a 3/8 inch drive-long handle ratchet to this hole.

(2) Rotate ratchet and tensioner assembly counter-clockwise (as viewed from front) until tension has been relieved from belt.

(3) Remove belt from water pump pulley first.

(4) Remove belt from vehicle.

INSTALLATION

CAUTION: When installing the accessory drive belt, the belt must be routed correctly. If not, engine may overheat due to water pump rotating in wrong direction. Refer to (Fig. 21) (Fig. 22) for correct engine belt routing. The correct belt with correct length must be used.

(1) Position drive belt over all pulleys **except** water pump pulley.

(2) Attach a 3/8 inch ratchet to tensioner.

DRIVE BELTS - 5.9L DIESEL (Continued)

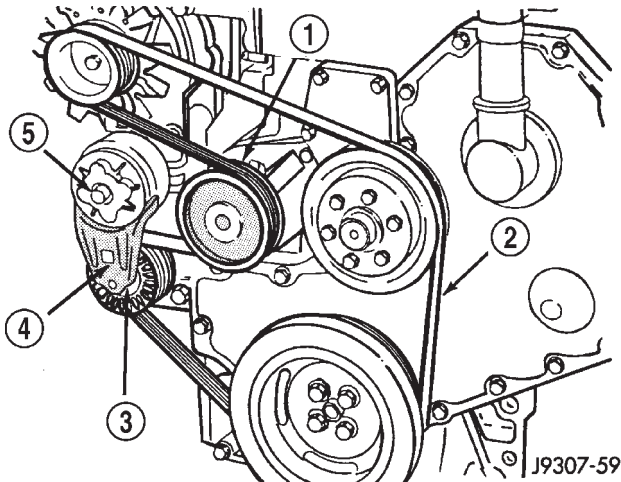


Fig. 20 Belt Tensioner—5.9L Diesel—Typical (non-A/C shown)

- 1 - WATER PUMP
- 2 - ACCESSORY DRIVE BELT
- 3 - AUTOMATIC BELT TENSIONER
- 4 - 3/8" SQUARE BOLT
- 5 - MOUNT. BOLT

(3) Rotate ratchet and belt tensioner counterclockwise. Place belt over water pump pulley. Let tensioner rotate back into place. Remove ratchet. Be sure belt is properly seated on all pulleys.

*POWER STEERING PUMP IS NOT BELT DRIVEN

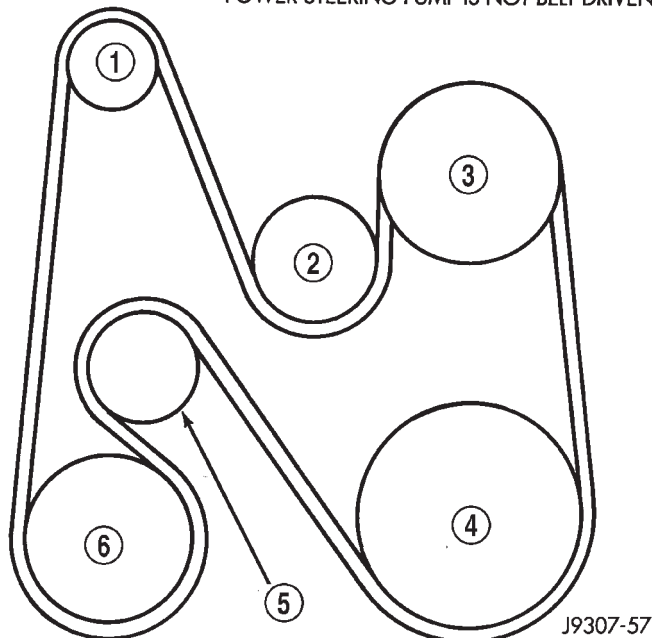


Fig. 21 Belt Routing—5.9L Diesel Engine—With A/C

- 1 - GENERATOR PULLEY
- 2 - WATER PUMP PULLEY
- 3 - FAN PULLEY
- 4 - CRANKSHAFT PULLEY
- 5 - AUTOMATIC TENSIONER
- 6 - A/C COMPRESSOR PUMP PULLEY

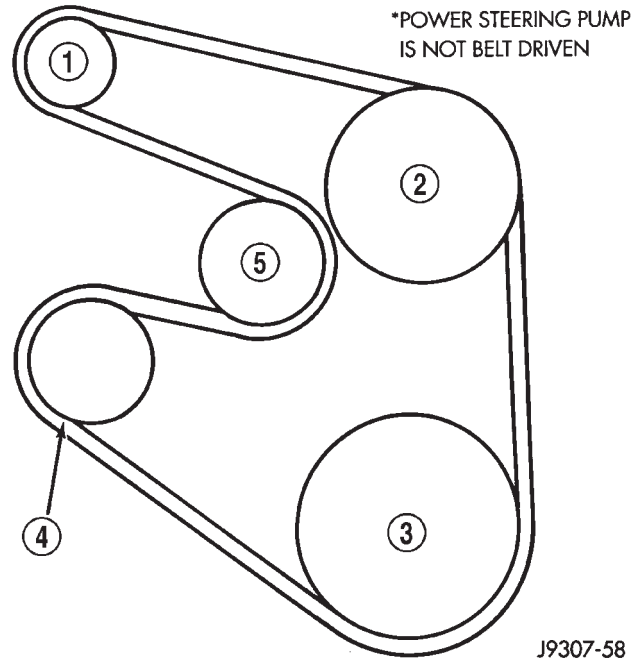


Fig. 22 Belt Routing—5.9L Diesel Engine—Without A/C

- 1 - GENERATOR PULLEY
- 2 - FAN PULLEY
- 3 - CRANKSHAFT PULLEY
- 4 - AUTOMATIC TENSIONER
- 5 - WATER PUMP PULLEY

VACUUM PUMP - 5.9L DIESEL

DESCRIPTION

The vacuum pump and the power steering pump are combined into a single assembly on diesel engine models (Fig. 23). Both pumps are operated by a drive gear attached to the vacuum pump shaft. The shaft gear is driven by the camshaft gear.

The vacuum pump is a constant displacement, vane-type pump. Vacuum is generated by four vanes mounted in the pump rotor. The rotor is located in the pump housing and is pressed onto the pump shaft.

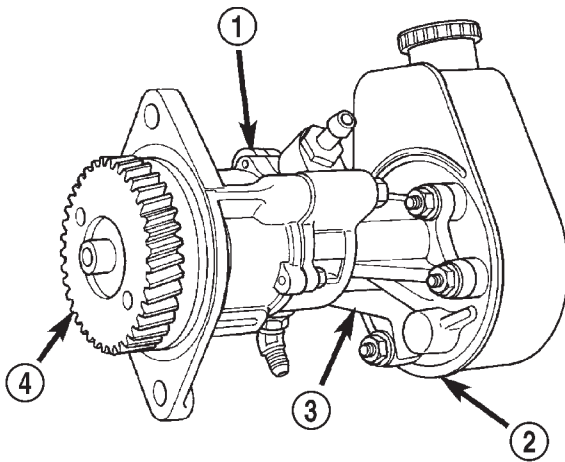
The vacuum and steering pumps are operated by a single drive gear pressed onto the vacuum pump shaft. The drive gear is operated by the engine camshaft gear.

The vacuum and power steering pump shafts are connected by a coupling. Each pump shaft has an adapter with drive lugs that engage in the coupling.

The vacuum pump rotating components are lubricated by engine oil. Lubricating oil is supplied to the pump through an oil line at the underside of the pump housing.

VACUUM PUMP - 5.9L DIESEL (Continued)

The complete assembly must be removed in order to service either pump. However, the power steering pump can be removed and serviced separately when necessary.



80a611d3

Fig. 23 Diesel Vacuum & Power Steering Pump Assembly

- 1 - VACUUM PUMP
- 2 - POWER STEERING PUMP
- 3 - PUMP ADAPTER
- 4 - DRIVE GEAR

The vacuum pump is not a serviceable component. If diagnosis indicates a pump malfunction, the pump must be replaced as an assembly. Do not disassemble or attempt to repair the pump.

The combined vacuum and steering pump assembly must be removed for access to either pump. However, the vacuum pump can be removed without having to disassemble the power steering pump.

If the power steering pump requires service, simply remove the assembly and separate the two pumps. Refer to the pump removal and installation procedures in this section.

OPERATION

Vacuum pump output is transmitted to the HEVAC, speed control, systems through a supply hose. The hose is connected to an outlet port on the pump housing and uses an in-line check valve to retain system vacuum when vehicle is not running.

Pump output ranges from a minimum of 8.5 to 25 inches vacuum.

The pump rotor and vanes are rotated by the pump drive gear. The drive gear is operated by the camshaft gear.

DIAGNOSIS AND TESTING—VACUUM PUMP OUTPUT

The vacuum pump supplies necessary vacuum to components in the following systems:

- HEVAC system
- Speed Control System

A quick check to determine if the vacuum pump is the cause of the problem in any of these systems is to road test the vehicle and verify that all of these systems are functioning properly. If only one of these has a vacuum related failure, then it is likely the vacuum pump is not the cause.

A standard vacuum gauge can be used to check pump output when necessary. Simply disconnect the pump supply hose and connect a vacuum gauge to the outlet port for testing purposes. With the engine running, vacuum output should be a minimum of 25 inches, depending on engine speed.

DIAGNOSING LOW VACUUM OUTPUT CONDITION

If the vacuum pump is suspected of low vacuum output, check the pump and vacuum harnesses as follows:

- (1) Visually inspect the vacuum harness for obvious failures (i.e. disconnected, cracks, breaks etc.)
- (2) Disconnect the vacuum supply hose at the vacuum pump check valve. Connect vacuum gauge to this valve and run engine at various throttle openings. Output should be a minimum 25 inches of vacuum. If vacuum is consistently below 25 inches, the vacuum pump should be replaced. If output is within specified limits, the vacuum harness should be suspected as the cause.
- (3) Disconnect and isolate the vacuum supply harness. Cap off open ends and apply roughly 15 inches of vacuum to the harness. If the vacuum gauge does not hold its reading, then there is an open in the harness and it should be repaired or replaced.
- (4) If the vacuum loss is still not detected at this point, then the pump and harness are not the cause of the low vacuum condition. Apply vacuum to the related components of the vacuum supply system (i.e. valves, servos, solenoids, etc.) to find the source of the vacuum loss.

REMOVAL

- (1) Disconnect battery negative cables.
- (2) Position drain pan under power steering pump.
- (3) Disconnect vacuum and steering pump hoses.
- (4) Disconnect lubricating oil feed line from fitting at underside of vacuum pump (Fig. 24).
- (5) Remove lower bolt that attaches pump assembly to engine block (Fig. 25).

VACUUM PUMP - 5.9L DIESEL (Continued)

(6) Remove bottom, inboard nut that attaches adapter to steering pump. This nut secures a small bracket to engine block. Nut and bracket must be removed before pump assembly can be removed from block.

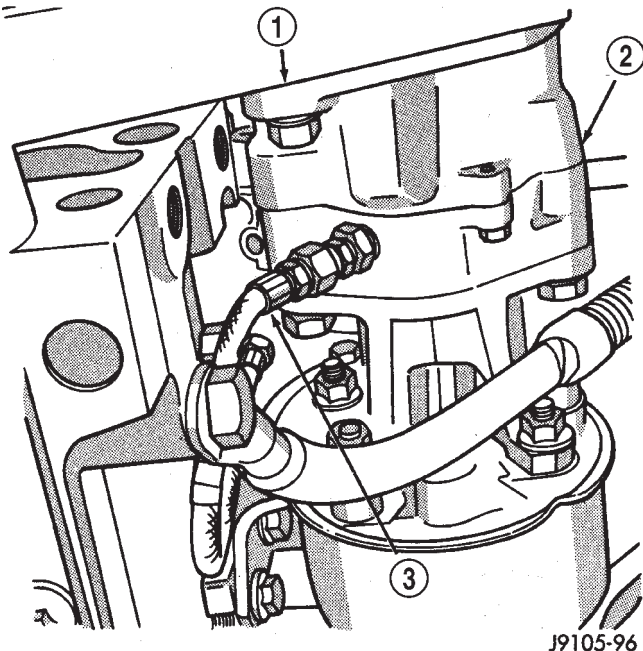


Fig. 24 Vacuum Pump Oil Feed Line

- 1 - ENGINE BLOCK
- 2 - VACUUM PUMP
- 3 - VACUUM PUMP OIL FEED LINE

(7) Remove upper bolt that attaches pump assembly to engine block (Fig. 26).

(8) Remove pump assembly from vehicle.

NOTE: The vacuum pump and adapter are serviced as an assembly and must not be separated.

(9) Remove the remaining three power steering pump to adapter mounting nuts (Fig. 27).

(10) Gently, remove the steering pump from the adapter. Use caution not to damage the oil seal in the adapter body (Fig. 28).

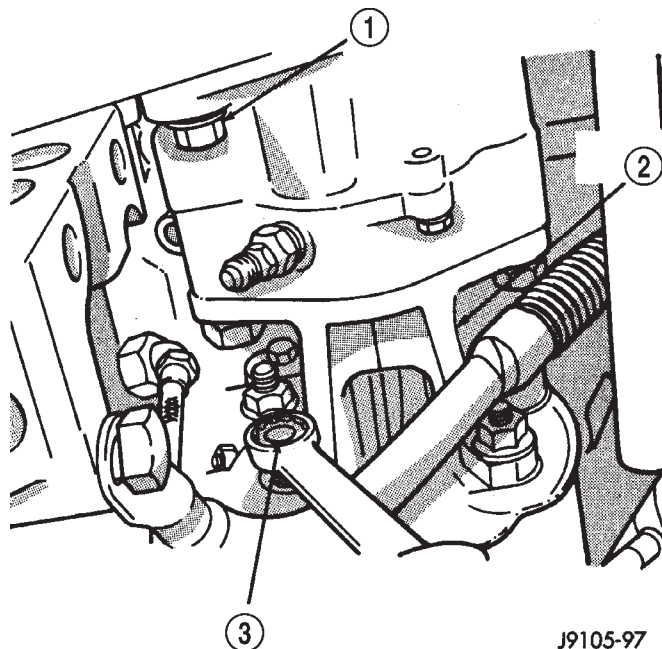


Fig. 25 Vacuum Pump Mounting

- 1 - PUMP ASSEMBLY LOWER MOUNTING BOLT
- 2 - ADAPTER BRACKET
- 3 - BOTTOM—INBOARD ADAPTER BRACKET NUT

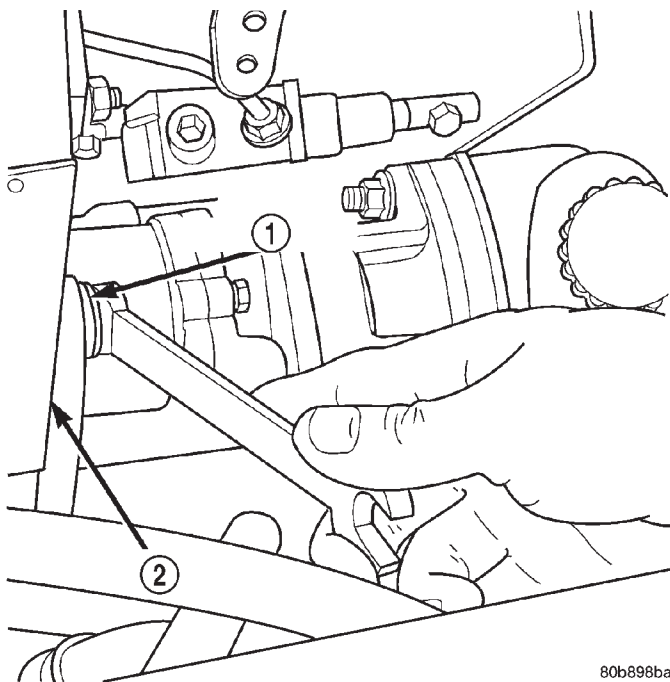
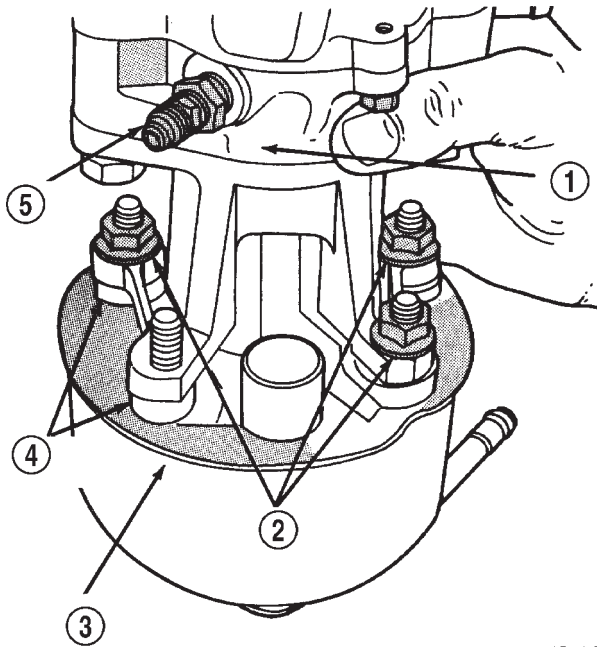


Fig. 26 Pump Assembly Upper Mounting Bolt

- 1 - PUMP UPPER BOLT
- 2 - DRIVE COVER

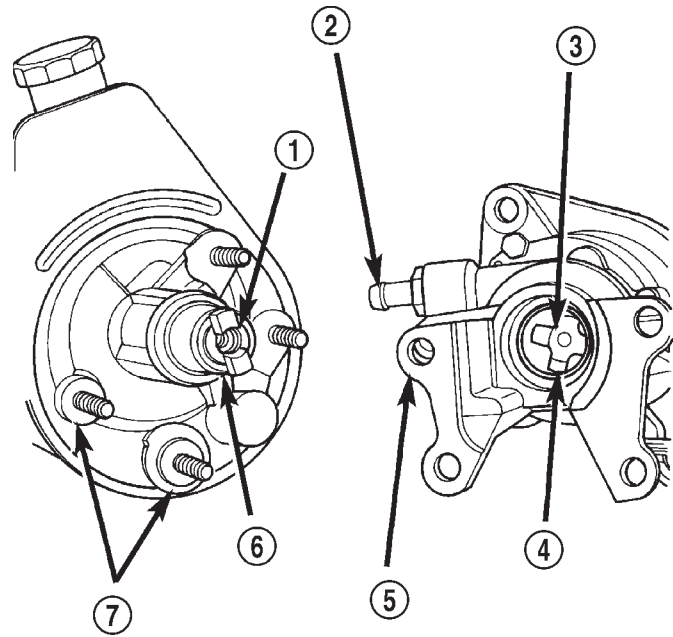
VACUUM PUMP - 5.9L DIESEL (Continued)



J9119-78

Fig. 27 Adapter to Power Steering Pump Nuts

- 1 - VACUUM PUMP
- 2 - ATTACHING NUTS
- 3 - STEERING PUMP
- 4 - PUMP SPACERS
- 5 - OIL FEED FITTING



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Fig. 28 Steering Pump, Vacuum Pump and Adapter

- 1 - PUMP SHAFT
- 2 - VACUUM FITTING
- 3 - VACUUM PUMP DRIVE
- 4 - OIL SEAL
- 5 - MOUNTING BRACKET
- 6 - DRIVE DOG
- 7 - PUMP SPACERS

INSTALLATION

NOTE: Make sure the two pump spacers are present before assembling power steering pump to adapter.

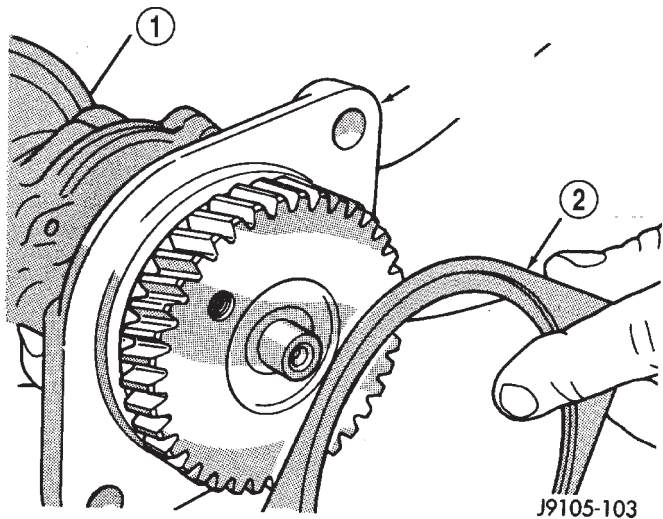
(1) Aline the steering pump drive dog with the slot in the vacuum pump drive assembly, slide the steering pump into place on the adapter. **Use care not to damage the oil seal in the adapter body.**

(2) Install the three steering pump to adapter nuts, do not install the lower inboard mounting nut at this time. Tighten nuts to 24 N·m (18 ft. lbs.).

(3) Position new gasket on vacuum pump mounting flange (Fig. 29). Use Mopar® Perfect Seal, or silicone adhesive/sealer to hold gasket in place.

(4) Insert pump assembly upper attaching bolt in mounting flange and gasket. Use sealer or grease to hold bolt in place if necessary.

(5) Position pump assembly on engine and install upper bolt (Fig. 30). Tighten upper bolt only enough to hold assembly in place at this time.

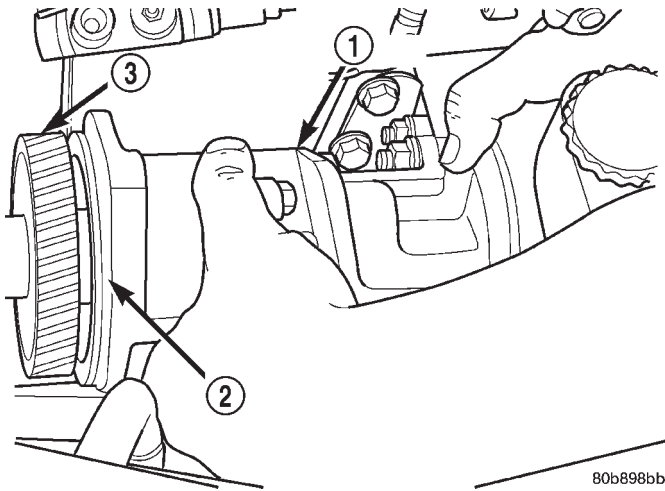


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Fig. 29 Pump Mounting Flange Gasket

- 1 - PUMP MOUNTING FLANGE
- 2 - PUMP GASKET (APPLY SEALER TO BOTH SIDES)

VACUUM PUMP - 5.9L DIESEL (Continued)

**Fig. 30 Installing Pump Assembly On Engine**

- 1 - PUMP ASSEMBLY
- 2 - PUMP GASKET
- 3 - DRIVE GEAR

(6) Working from under vehicle, install pump assembly lower attaching bolt. Then tighten upper and lower bolt to 77 N·m (57 ft. lbs.).

(7) Position bracket on steering pump inboard stud. Then install remaining adapter attaching nut on stud. Tighten nut to 24 N·m (18 ft. lbs.).

(8) Connect oil feed line to vacuum pump connector and tighten line fitting.

(9) Connect steering pump pressure and return lines to pump. Tighten pressure line fitting to 30 N·m (22 ft. lbs.).

(10) Connect vacuum hose to vacuum pump.

(11) Connect battery cables, if removed.

(12) Fill power steering pump reservoir and Purge air from steering pump lines (Refer to 19 - STEERING/PUMP - STANDARD PROCEDURE).

ENGINE

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COOLANT

DESCRIPTION - ENGINE COOLANT

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.

COOLANT (Continued)

OPERATION

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 RECOVERY CONTAINER - 3.9L/5.2L/5.9L/ 5.9L DIESEL

DESCRIPTION

The coolant reserve/overflow tank is mounted to the side of the fan shroud (Fig. 1), and is made of high temperature plastic.

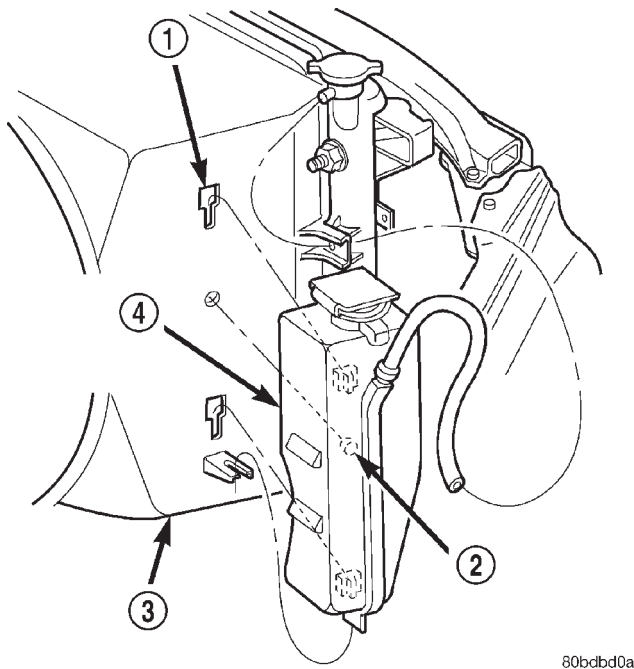


Fig. 1 Coolant Reserve/Overflow Tank

- 1 - T-SLOTS
- 2 - ALIGNMENT PIN
- 3 - FAN SHROUD
- 4 - COOLANT RESERVE/OVERFLOW TANK

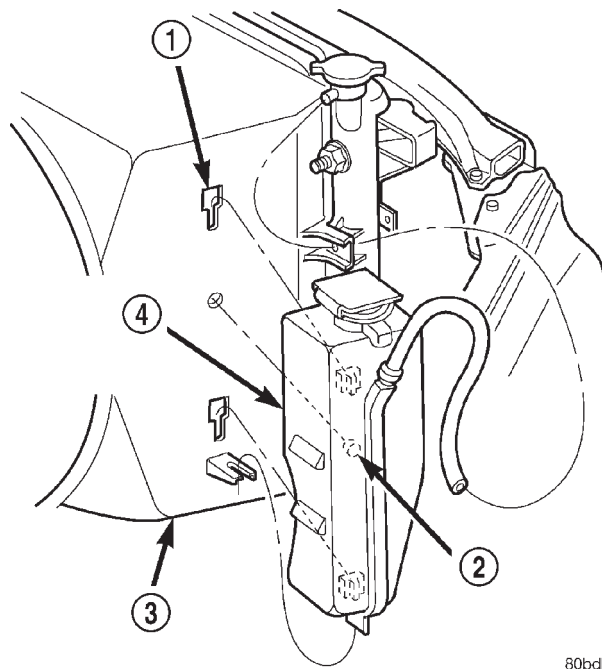
OPERATION

The coolant reserve/overflow system works in conjunction with the radiator pressure cap. It utilizes thermal expansion and contraction of coolant to keep coolant free of trapped air. It provides a volume for expansion and contraction of coolant. It also provides a convenient and safe method for checking coolant level and adjusting level at atmospheric pressure. This is done without removing the radiator pressure cap. The system also provides 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.

REMOVAL

- (1) Remove overflow hose from radiator.
- (2) Unsnap the coolant reserve/overflow tank from fan shroud. Lift straight up. The fan shroud is equipped with T-shaped slots (Fig. 2) to attach the tank. An alignment pin is located on the side of tank.



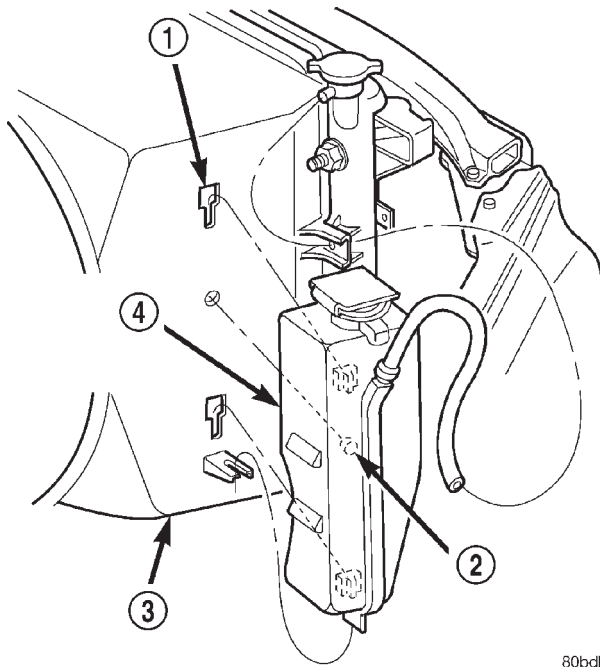
**Fig. 2 COOLANT RESERVE/OVERFLOW TANK—ALL
EXCEPT 8.0L V-10 ENGINE**

- 1 - T-SLOTS
- 2 - ALIGNMENT PIN
- 3 - FAN SHROUD
- 4 - COOLANT RESERVE/OVERFLOW TANK

COOLANT RECOVERY CONTAINER - 3.9L/5.2L/5.9L/5.9L DIESEL (Continued)

INSTALLATION

- (1) Snap the tank into the two T-slots and the alignment pin on fan shroud (Fig. 3).
- (2) Connect overflow hose to radiator.



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Fig. 3 COOLANT RESERVE/OVERFLOW TANK—ALL EXCEPT 8.0L V-10 ENGINE

- 1 - T-SLOTS
- 2 - ALIGNMENT PIN
- 3 - FAN SHROUD
- 4 - COOLANT RESERVE/OVERFLOW TANK

COOLANT RECOVERY CONTAINER - 8.0L

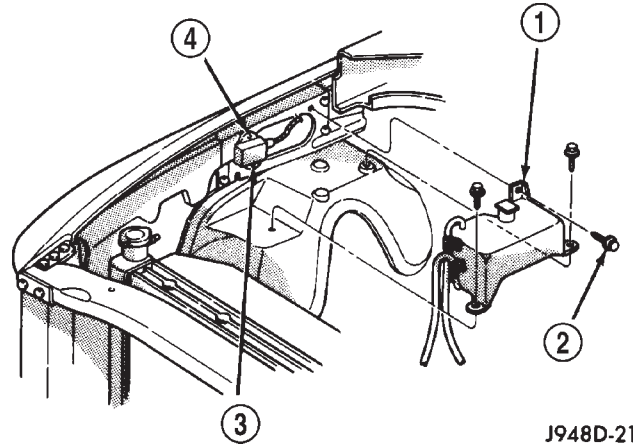
DESCRIPTION

On the 8.0L V-10 engine the tank is mounted to right inner fender (Fig. 4), and is made of high temperature plastic.

OPERATION

The coolant reserve/overflow system works in conjunction with the radiator pressure cap. It utilizes thermal expansion and contraction of coolant to keep coolant free of trapped air. It provides a volume for expansion and contraction of coolant. It also provides a convenient and safe method for checking coolant level and adjusting level at atmospheric pressure. This is done without removing the radiator pressure cap. The system also provides 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. Cool-



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Fig. 4 Coolant Reserve/Overflow Tank—8.0L V-10 Engine

- 1 - COOLANT RESERVE/OVERFLOW TANK
- 2 - TANK MOUNTING BOLTS (3)
- 3 - ICM MOUNTING BOLTS (2)
- 4 - IGNITION CONTROL MODULE (ICM)

ant will then be drawn from the coolant tank and returned to a proper level in the radiator.

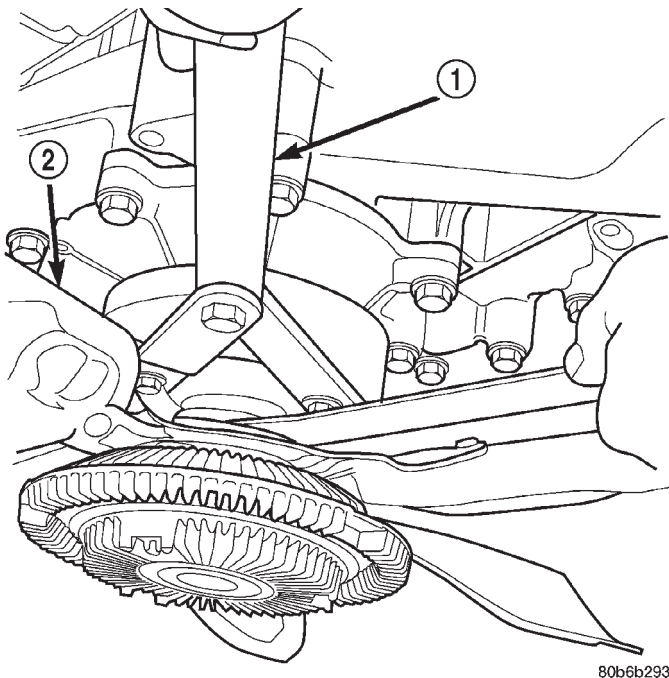
RADIATOR FAN - 5.9L/8.0L

REMOVAL

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.

- (1) Disconnect negative battery cable from battery.
- (2) Remove throttle cable at top of fan shroud.
- (3) All Except 8.0L V-10 Engine: Unsnap coolant reserve/overflow tank from fan shroud and lay aside. The tank is held to shroud with T-shaped slots. Do not disconnect hose or drain coolant from tank.
- (4) The thermal viscous fan drive/fan blade assembly is attached (threaded) to water pump hub shaft (Fig. 6). Remove fan blade/viscous fan drive assembly from water pump by turning mounting nut counter-clockwise as viewed from front. Threads on viscous fan drive are **RIGHT-HAND**. A Snap-On 36 MM Fan Wrench (number SP346 from Snap-On Cummins Diesel Tool Set number 2017DSP), Special Tool 6958 Spanner Wrench and Adapter Pins 8346 should be used to prevent pulley from rotating (Fig. 5).

RADIATOR FAN - 5.9L/8.0L (Continued)

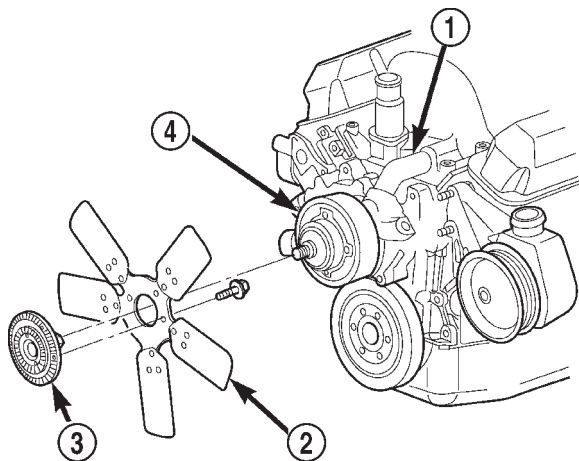


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Fig. 5 Using Special Tool 6958 Spanner Wrench

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

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



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Fig. 6 Fan Blade/Viscous Fan Drive - Gas Engines - Typical

- 1 - WATER PUMP BYPASS HOSE
2 - FAN BLADE ASSEMBLY
3 - VISCOUS FAN DRIVE
4 - WATER PUMP AND PULLEY

(6) Do not unbolt fan blade assembly (Fig. 6) from viscous fan drive at this time.

(7) Remove four fan shroud-to-radiator mounting bolts.

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

(9) 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 spring tension.

(10) Remove four bolts securing fan blade assembly to viscous fan drive (Fig. 6).

CAUTION: Some 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.

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) Install fan blade assembly to viscous fan drive. Tighten bolts (Fig. 6) 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) Install fan shroud.

RADIATOR FAN - 5.9L/8.0L (Continued)

(4) Install fan blade/viscous fan drive assembly to water pump shaft (Fig. 6).

(5) Except 8.0L V-10 Engine: Install coolant reserve/overflow tank to fan shroud. Snaps into position.

(6) Install throttle cable to fan shroud.

(7) Connect negative battery cable.

NOTE:

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.

RADIATOR FAN - 5.9L DIESEL

REMOVAL

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.

- (1) Disconnect the battery negative cables.
- (2) Remove the fan shroud mounting bolts. Position fan shroud towards engine.

CAUTION: Do not remove the fan pulley bolts. This pulley is under spring tension.

(3) The thermal viscous fan drive/fan blade assembly is attached (threaded) to the fan hub shaft (Fig. 7). Remove the fan blade/fan drive assembly from fan pulley by turning the mounting nut clockwise (as viewed from front). Threads on the viscous fan drive are **LEFT-HAND**. A Snap-On 36 MM Fan Wrench (number SP346 from Snap-On Cummins Diesel Tool Set number 2017DSP) can be used. Place a bar or screwdriver between the fan pulley bolts to prevent pulley from rotating.

(4) Remove the fan shroud and the fan blade/viscous drive as an assembly from vehicle.

(5) Remove fan blade-to-viscous fan drive mounting bolts.

(6) Inspect the fan for cracks, loose rivets, loose or bent fan blades.

CAUTION: Some engines equipped with serpentine drive belts have reverse rotating fans and viscous fan drives. They are marked with the word

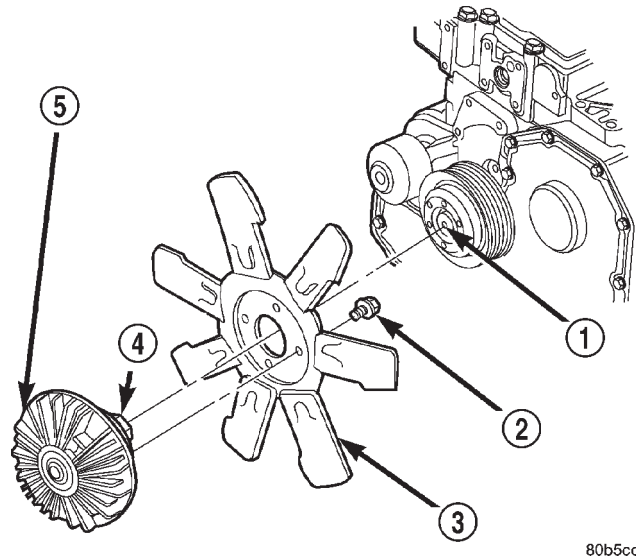


Fig. 7 Fan Blade/Viscous Fan Drive

- 1 - THREADED SHAFT
- 2 - BOLT (4)
- 3 - FAN BLADE
- 4 - THREADED NUT
- 5 - VISCOUS FAN DRIVE

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REVERSE to designate their usage. Installation of the wrong fan or viscous fan drive can result in engine overheating.

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.

RADIATOR FAN - 5.9L DIESEL (Continued)

INSTALLATION

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

(2) Position the fan shroud and fan blade/viscous fan drive to the vehicle as an assembly.

(3) Install viscous fan drive assembly on fan hub shaft (Fig. 7). Tighten mounting nut to 57 N·m (42 ft. lbs.) torque.

(4) Install fan shroud bolts into position and tighten the mounting bolts to 6 N·m (50 in. lbs.) torque.

(5) Connect the battery negative cables.

NOTE:

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.

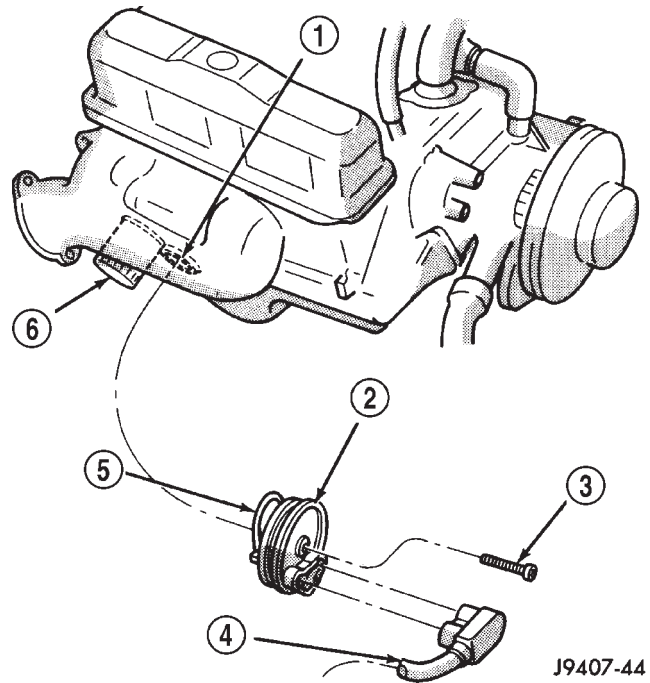


Fig. 8 Engine Block Heater

- 1 - FREEZE PLUG HOLE
- 2 - BLOCK HEATER
- 3 - SCREW
- 4 - POWER CORD (120V AC)
- 5 - HEATING COIL
- 6 - OIL FILTER

ENGINE BLOCK HEATER - 5.9L

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.

An optional engine block heater is available on all models. The heater is equipped with a power cord. 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. The cord is attached to an engine compartment component with tie-straps.

The 5.9L gas powered engine has the block heater located on the right side of engine next to the oil filter (Fig. 8).

OPERATION

The heater warms the engine coolant providing easier engine starting and faster warm-up in low temperatures. Connecting the power cord to a grounded 110-120 volt AC electrical outlet with a grounded three wire extension cord provides the electricity needed to heat the element..

REMOVAL

- (1) Disconnect battery negative cable.
- (2) Drain coolant (Refer to 7 - COOLING - STANDARD PROCEDURE).

(3) Remove power cord from heater by unplugging (Fig. 9).

(4) Loosen (but do not completely remove) the screw at center of block heater (Fig. 9).

(5) Remove block heater by carefully prying from side-to-side. Note direction of heating element coil (up or down). Element coil must be installed correctly to prevent damage.

INSTALLATION

(1) Clean and inspect the block heater hole.

(2) Install new O-ring seal(s) to heater in gasoline engines.

(3) Insert block heater into cylinder block.

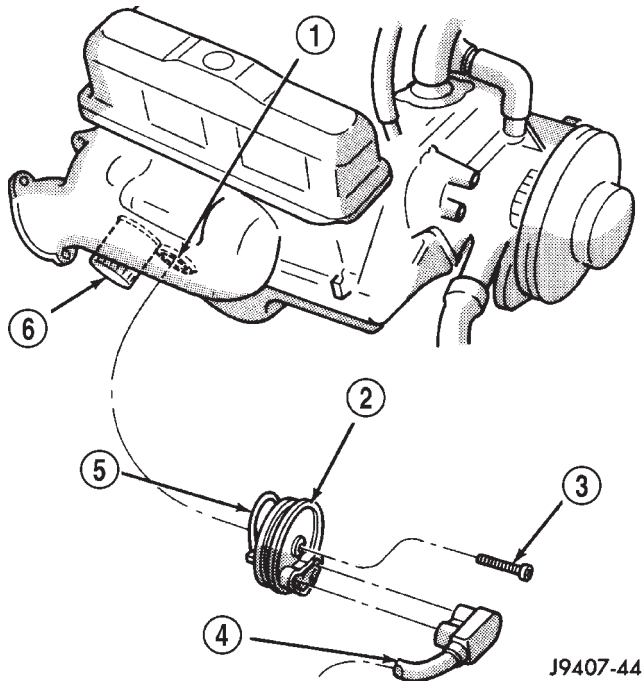
(4) With heater fully seated, tighten center screw to 2 N·m (17 in. lbs.).

(5) Fill cooling system with recommended coolant. (Refer to 7 - COOLING - STANDARD PROCEDURE).

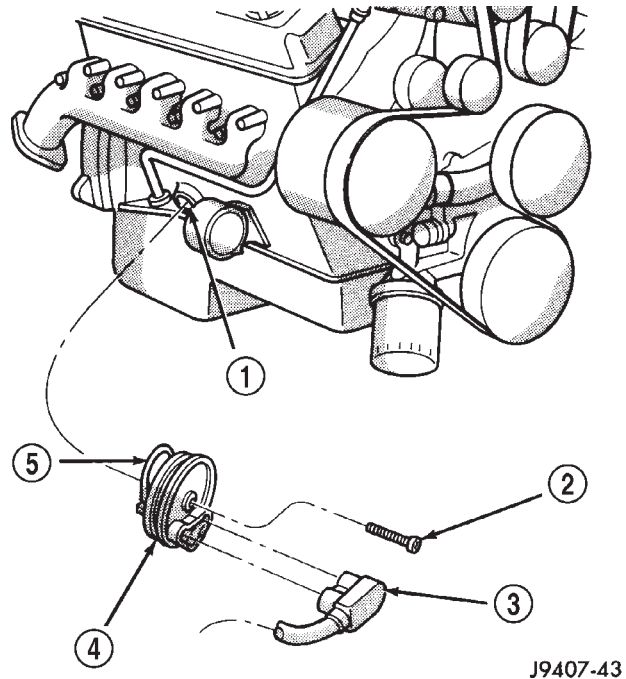
(6) Start and warm the engine.

(7) Check block heater for leaks.

ENGINE BLOCK HEATER - 5.9L (Continued)

**Fig. 9 Engine Block Heater**

- 1 - FREEZE PLUG HOLE
- 2 - BLOCK HEATER
- 3 - SCREW
- 4 - POWER CORD (120V AC)
- 5 - HEATING COIL
- 6 - OIL FILTER

**Fig. 10 Engine Block Heater—8.0L V-10 Engine**

- 1 - FREEZE PLUG HOLE
- 2 - SCREW
- 3 - POWER CORD (120V AC)
- 4 - BLOCK HEATER
- 5 - HEATING COIL

ENGINE BLOCK HEATER - 8.0L

DESCRIPTION

An optional engine block heater is available on all models. The heater is equipped with a power cord. 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. The cord is attached to an engine compartment component with tie-straps.

The 8.0L V-10 engine has the block heater located on the right side of engine next to the engine oil dipstick tube (Fig. 10).

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.

OPERATION

The heater warms the engine coolant providing easier engine starting and faster warm-up in low temperatures. Connecting the power cord to a

grounded 110-120 volt AC electrical outlet with a grounded three wire extension cord provides the electricity needed to heat the element..

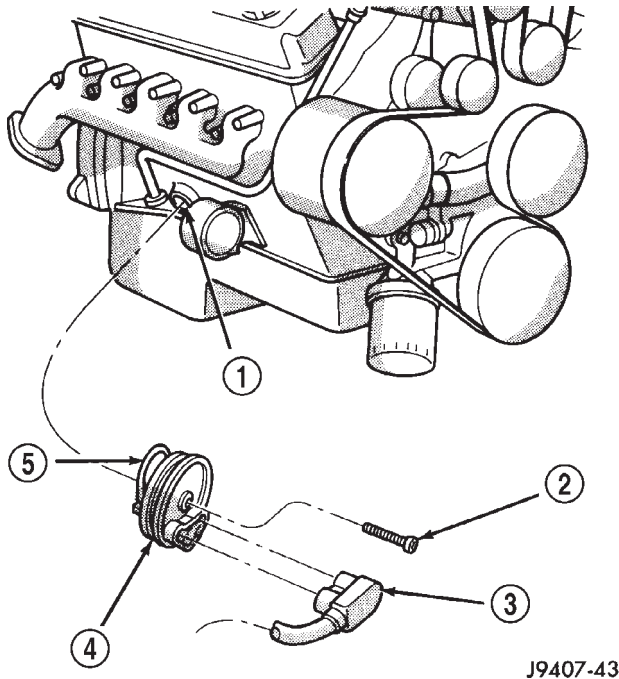
REMOVAL

- (1) Disconnect battery negative cable.
- (2) Drain coolant from radiator and cylinder block (Refer to 7 - COOLING - STANDARD PROCEDURE).
- (3) Remove power cord from heater by unplugging (Fig. 11).
- (4) Loosen (but do not completely remove) the screw at center of block heater (Fig. 11).
- (5) Remove block heater by carefully prying from side-to-side. Note direction of heating element coil (up or down). Element coil must be installed correctly to prevent damage.

INSTALLATION

- (1) Clean and inspect the block heater hole.
- (2) Install new O-ring seal(s) to heater in gasoline engines.
- (3) Insert block heater into cylinder block.
- (4) With heater fully seated, tighten center screw to 2 N·m (17 in. lbs.).

ENGINE BLOCK HEATER - 8.0L (Continued)

**Fig. 11 Block Heater—8.0L V-10 Engine**

- 1 - FREEZE PLUG HOLE
- 2 - SCREW
- 3 - POWER CORD (120V AC)
- 4 - BLOCK HEATER
- 5 - HEATING COIL

(5) Fill cooling system with recommended coolant (Refer to 7 - COOLING - STANDARD PROCEDURE).

- (6) Start and warm the engine.
- (7) Check block heater for leaks.

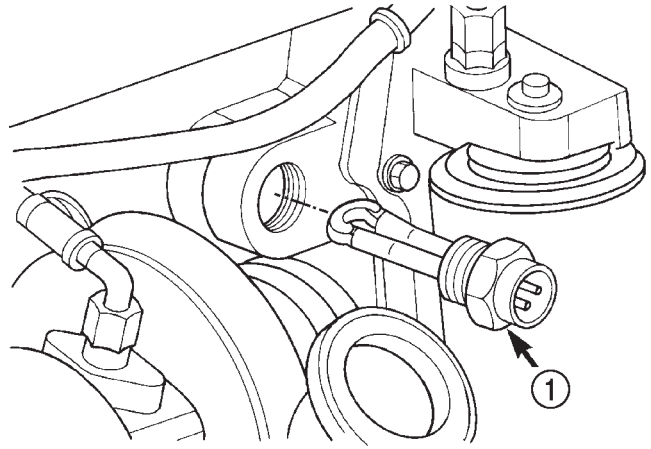
ENGINE BLOCK HEATER - 5.9L DIESEL

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.

An optional engine block heater is available on all models. The heater is equipped with a power cord. The heater is mounted in a threaded hole of the engine cylinder block with the heating element immersed in engine coolant. The cord is attached to an engine compartment component with tie-straps.

The 5.9L diesel engine has the block heater located on the right side of the engine below the exhaust manifold next to the oil cooler (Fig. 12).



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Fig. 12 Engine Block Heater—5.9L Diesel Engine

1 - BLOCK HEATER

OPERATION

The heater warms the engine coolant providing easier engine starting and faster warm-up in low temperatures. Connecting the power cord to a grounded 110-120 volt AC electrical outlet with a grounded three wire extension cord provides the electricity needed to heat the element..

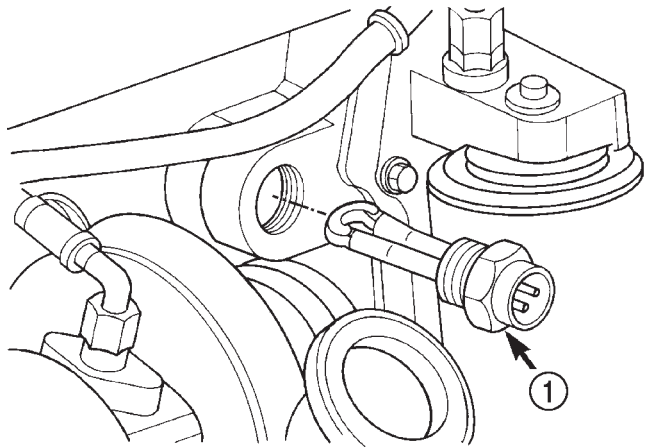
REMOVAL

- (1) Disconnect the battery negative cables.
- (2) Drain coolant from radiator and cylinder block (Refer to 7 - COOLING - STANDARD PROCEDURE).
- (3) Unscrew the power cord retaining cap and disconnect cord from heater element.
- (4) Using a suitable size socket, loosen and remove the block heater element (Fig. 13).

INSTALLATION

- (1) Clean and inspect the threads in the cylinder block.
- (2) Coat heater element threads with Mopar® Thread Sealer with Teflon.
- (3) Screw block heater into cylinder block and tighten to 43 N·m (32 ft. lbs.).
- (4) Connect block heater cord and tighten retaining cap.
- (5) Fill cooling system with recommended coolant (Refer to 7 - COOLING - STANDARD PROCEDURE).
- (6) Start and warm the engine.
- (7) Check block heater for leaks.

ENGINE BLOCK HEATER - 5.9L DIESEL (Continued)



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Fig. 13 Block Heater—Diesel Engine

1 - BLOCK HEATER

ENGINE COOLANT TEMP SENSOR - 5.9L

DESCRIPTION

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

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

WARNING: HOT, PRESSURIZED COOLANT CAN CAUSE INJURY BY SCALDING. COOLING SYSTEM MUST BE PARTIALLY DRAINED BEFORE REMOVING THE COOLANT TEMPERATURE SENSOR. REFER TO GROUP 7, COOLING.

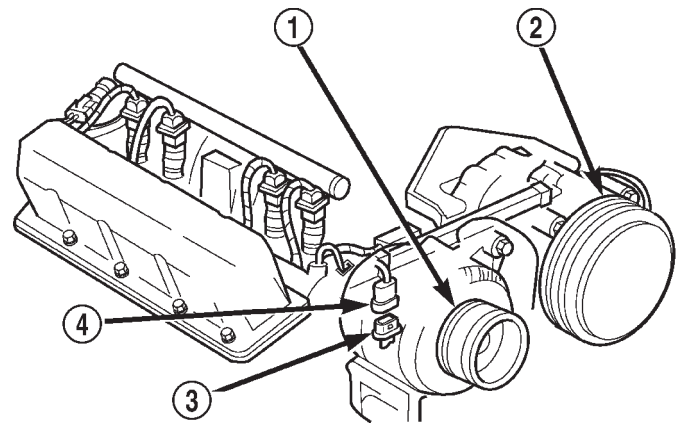
(1) Partially drain cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).

(2) Remove air cleaner assembly.

(3) Disconnect electrical connector from sensor (Fig. 14).

(4) **Engines with air conditioning:** When removing the connector from sensor, do not pull directly on wiring harness. Fabricate an L-shaped hook tool from a coat hanger (approximately eight inches long). Place the hook part of tool under the connector for removal. The connector is snapped onto the sensor. It is not equipped with a lock type tab.

(5) Remove sensor from intake manifold.



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Fig. 14 Engine Coolant Temperature

1 - GENERATOR

2 - A/C COMPRESSOR

3 - ENGINE COOLANT TEMPERATURE SENSOR

4 - ELEC. CONN.

INSTALLATION

(1) Install sensor.

(2) Tighten to 6–8 N·m (55–75 in. lbs.) torque.

(3) Connect electrical connector to sensor. The sensor connector is symmetrical (not indexed). It can be installed to the sensor in either direction.

(4) Install air cleaner assembly.

(5) Refill cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).

ENGINE COOLANT THERMOSTAT - 5.9L

DESCRIPTION

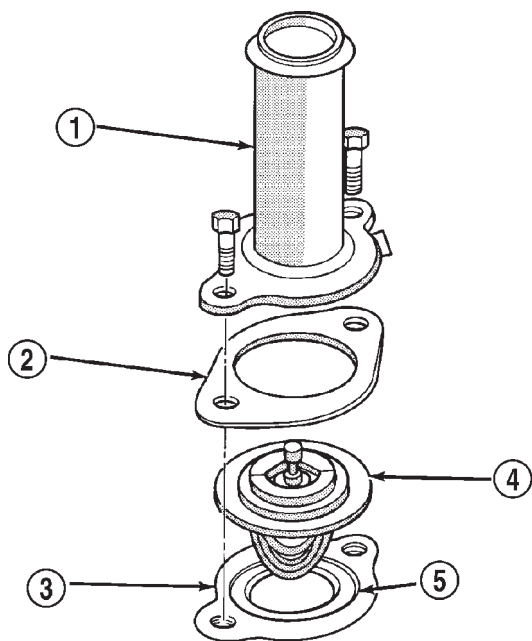
CAUTION: Do not operate an engine without a thermostat, except for servicing or testing.

The thermostat on the 5.9L gas powered engine is located beneath the thermostat housing at the front of the intake manifold (Fig. 15).

The thermostat is a wax pellet driven, reverse poppet choke type.

Coolant leakage into the pellet container will cause the thermostat to fail in the open position. Thermostats very rarely stick. Do not attempt to free a thermostat with a prying device.

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 longer engine warmup time, unreliable warmup performance, increased exhaust emissions and crankcase condensation that can result in sludge formation.



J9207-14

Fig. 15 Thermostat - 5.9L Gas Powered Engines

- 1 - THERMOSTAT HOUSING
- 2 - GASKET
- 3 - INTAKE MANIFOLD
- 4 - THERMOSTAT
- 5 - MACHINED GROOVE

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 **gasoline powered 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) in the PCM memory. Do not change a thermostat for lack of heat as indicated by the instrument panel gauge or by poor heater performance unless a DTC is present. Refer to the Diagnosis section of this group for other probable causes. For other DTC numbers, (Refer to 25 - EMISSIONS CONTROL - DESCRIPTION).

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

REMOVAL

WARNING: DO NOT LOOSEN RADIATOR DRAIN-CKOCK 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.

Factory installed thermostat housings on 3.9L, 5.2L and 5.9L engines are installed on a gasket with an anti-stick coating. This will aid in gasket removal and clean-up.

(1) Disconnect negative battery cable at battery.

(2) Drain cooling system until coolant level is below thermostat (Refer to 7 - COOLING - STANDARD PROCEDURE).

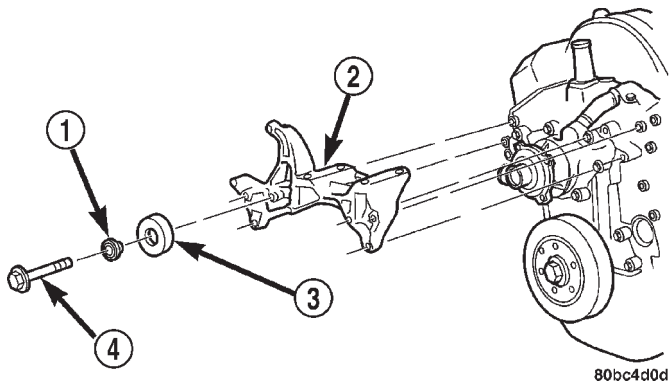
(3) Air Conditioned vehicles: Remove support bracket (generator mounting bracket-to-intake manifold) located near rear of generator (Fig. 16).

NOTE: On air conditioning equipped vehicles, the generator must be partially removed.

(4) Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL) (Fig. 17).

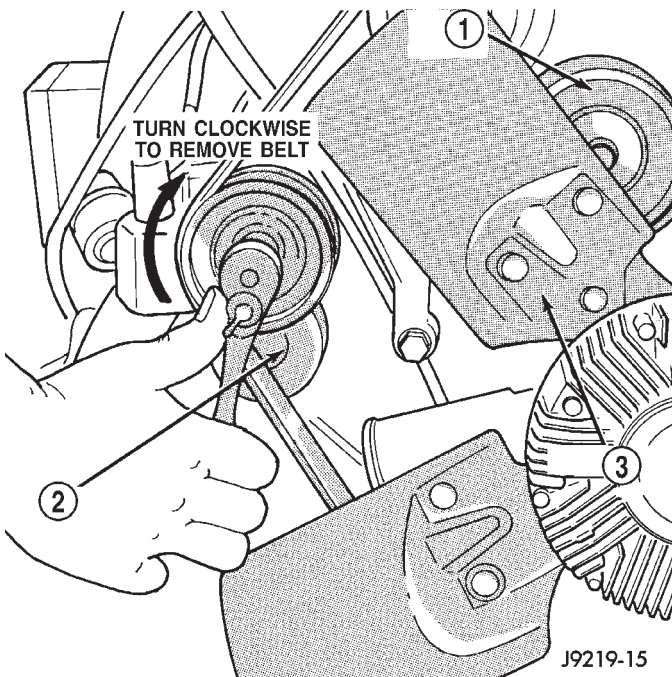
(5) Remove two generator mounting bolts. Do not remove any wiring at generator. If equipped with 4WD, unplug 4WD indicator lamp wiring harness (located near rear of generator).

ENGINE COOLANT THERMOSTAT - 5.9L (Continued)

**Fig. 16 Generator Support Bracket—5.9L Engine**

- 1 - IDLER PULLEY BUSHING
- 2 - A/C AND/OR GENERATOR MOUNTING BRACKET
- 3 - IDLER PULLEY
- 4 - SCREW AND WASHER

(6) Remove generator. Position generator to gain access for thermostat gasket removal.

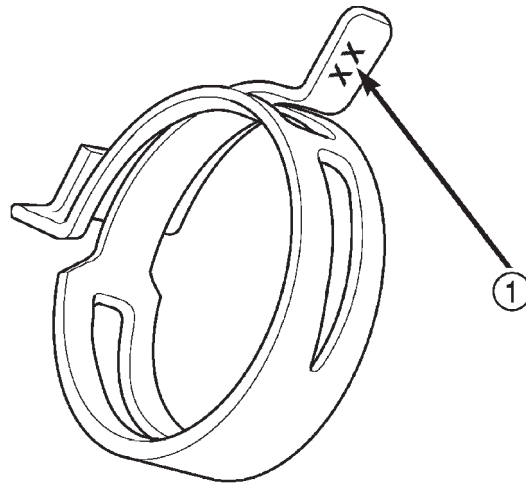
**Fig. 17 Automatic Belt Tensioner—5.9L Engines**

- 1 - IDLER PULLEY
- 2 - TENSIONER
- 3 - FAN BLADE

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 (Fig. 18). If replacement is necessary, use only an original equipment clamp with matching number or letter.



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Fig. 18 SPRING CLAMP SIZE LOCATION

- 1 - SPRING CLAMP SIZE LOCATION

(7) Remove radiator upper hose clamp and upper hose at thermostat housing.

(8) Position wiring harness (behind thermostat housing) to gain access to thermostat housing.

(9) Remove thermostat housing mounting bolts, thermostat housing, gasket and thermostat (Fig. 19). Discard old gasket.

INSTALLATION

(1) Clean mating areas of intake manifold and thermostat housing.

(2) Install thermostat (spring side down) into recessed machined groove on intake manifold (Fig. 19).

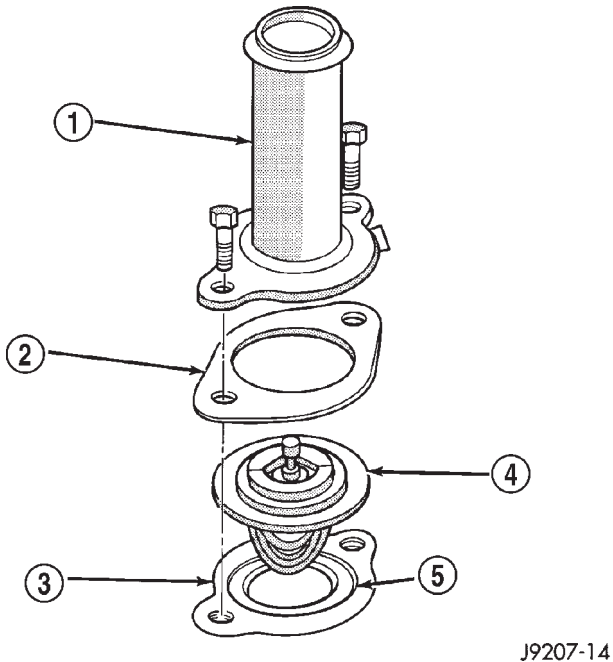
(3) Install gasket on intake manifold and over thermostat (Fig. 19).

(4) Position thermostat housing to intake manifold. Note the word **FRONT** stamped on housing (Fig. 20). For adequate clearance, this **must** be placed towards front of vehicle. The housing is slightly angled forward after installation to intake manifold.

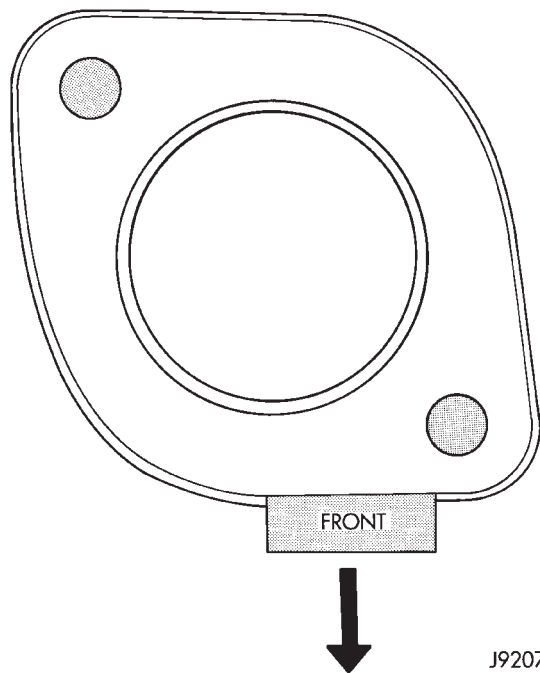
(5) Install two housing-to-intake manifold bolts. Tighten bolts to 23 N·m (200 in. lbs.) torque.

(6) Install radiator upper hose to thermostat housing.

ENGINE COOLANT THERMOSTAT - 5.9L (Continued)

**Fig. 19 Thermostat—5.9L Engines**

- 1 - THERMOSTAT HOUSING
- 2 - GASKET
- 3 - INTAKE MANIFOLD
- 4 - THERMOSTAT
- 5 - MACHINED GROOVE

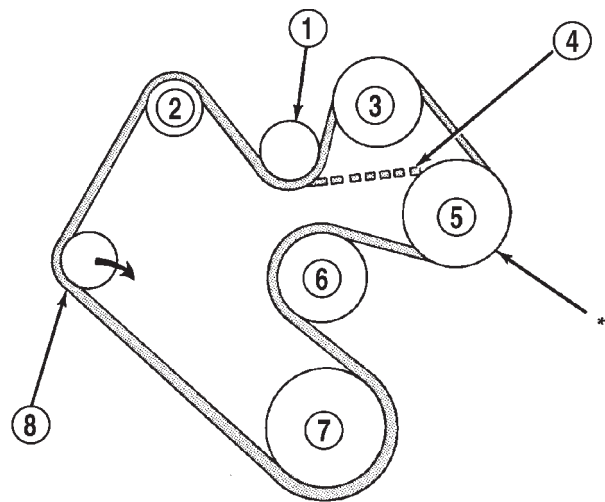
**Fig. 20 Thermostat Position—5.9L Engines**

CAUTION: When installing the serpentine accessory drive belt, the belt must be routed correctly. If not, engine may overheat due to water pump rotating in wrong direction. Refer to (Fig. 21) for correct 3.9L, 5.2L and 5.9L engine belt routing. The correct belt with correct length must be used.

(7) Air Conditioned vehicles; Install generator. Tighten bolts to 41 N·m (30 ft. lbs.).

(8) Install support bracket (generator mounting bracket-to-intake manifold) (Fig. 16). Tighten bolts to 54 N·m (40 ft. lbs.) torque.

(9) Install accessory drive belt (Fig. 17)(Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).



*IF VEHICLE IS NOT EQUIPPED WITH POWER STEERING, THIS WILL BE AN IDLER PULLEY.

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Fig. 21 Belt Routing—5.9L Engines

- 1 - IDLER PULLEY
- 2 - GENERATOR PULLEY
- 3 - A/C COMPRESSOR PULLEY
- 4 - IF W/OUT A/C
- 5 - POWER STEERING PUMP PULLEY
- 6 - WATER PUMP PULLEY
- 7 - CRANKSHAFT PULLEY
- 8 - AUTOMATIC TENSIONER

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

(11) Connect battery negative cable.

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

ENGINE COOLANT THERMOSTAT - 8.0L

DESCRIPTION

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

The thermostat on all gas powered engines is located beneath the thermostat housing at the front of the intake manifold (Fig. 22).

The thermostat is a moveable sleeve type.

Coolant leakage into the pellet container will cause the thermostat to fail in the open position. Thermostats very rarely stick. Do not attempt to free a thermostat with a prying device.

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 longer engine warmup time, unreliable warmup performance, increased exhaust emissions and crankcase condensation that 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

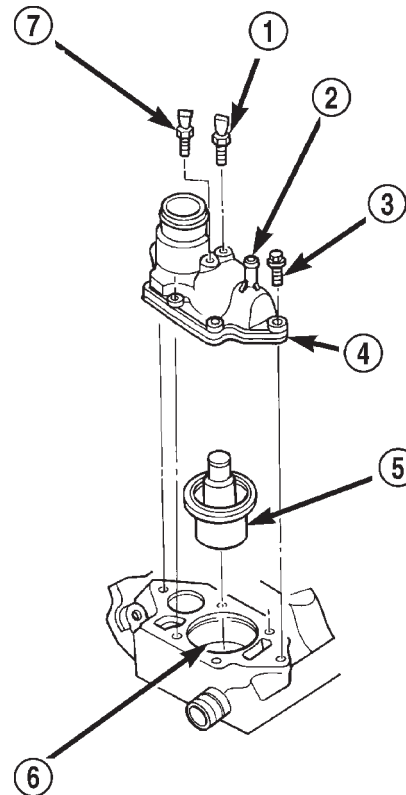
ON-BOARD DIAGNOSTICS

All **gasoline powered 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) in the PCM memory. Do not change a thermostat for lack of heat as indicated by the instrument panel gauge or by poor heater performance unless a DTC is present. Refer to the Diagnosis section of this group for other probable causes. For other DTC numbers, (Refer to 25 - EMISSIONS CONTROL - DESCRIPTION).

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

REMOVAL

WARNING: DO NOT LOOSEN THE RADIATOR DRAINCOCK WITH THE SYSTEM HOT AND PRES-



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Fig. 22 Thermostat—8.0L V-10 Engine

- 1 - COOLANT TEMP. SENSOR (FOR PCM)
- 2 - HEATER SUPPLY FITTING
- 3 - BOLTS (6)
- 4 - HOUSING WITH INTEGRAL SEAL
- 5 - THERMOSTAT
- 6 - RUBBER LIP SEAL
- 7 - TEMP. GAUGE SENDING UNIT

SURIZED. SERIOUS BURNS FROM THE COOLANT CAN OCCUR.

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

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

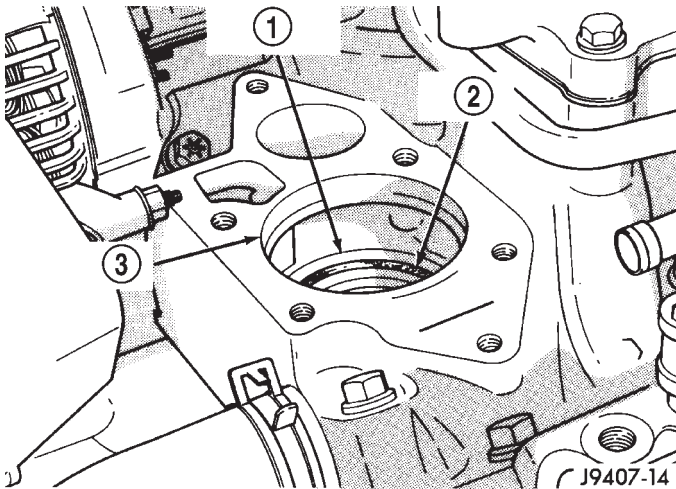
A rubber lip-type seal with a metal shoulder is pressed into the intake manifold beneath the thermostat (Fig. 23).

(1) Disconnect negative battery cable at battery.

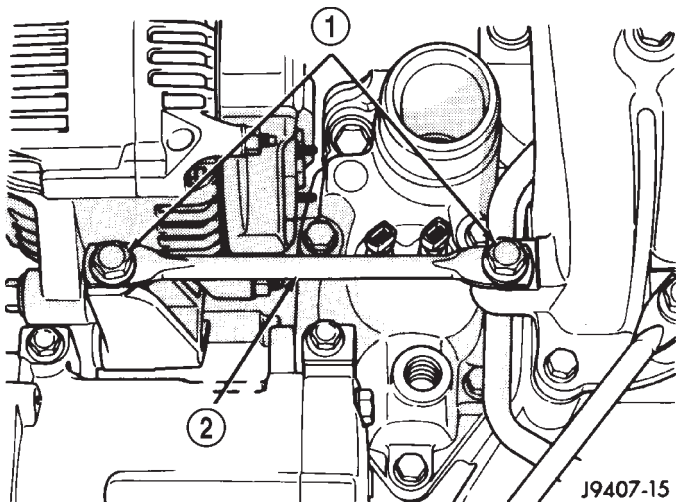
(2) Drain cooling system until coolant level is below thermostat (Refer to 7 - COOLING - STANDARD PROCEDURE).

(3) Remove the two support rod mounting bolts and remove support rod (intake manifold-to-generator mount) (Fig. 24).

ENGINE COOLANT THERMOSTAT - 8.0L (Continued)

**Fig. 23 Thermostat Seal—8.0L V-10 Engine**

- 1 - METAL SEAL SHOULDER
- 2 - RUBBER LIP SEAL
- 3 - THERMOSTAT OPENING

**Fig. 24 Support Rod—8.0L V-10 Engine**

- 1 - BOLTS
- 2 - SUPPORT ROD

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.

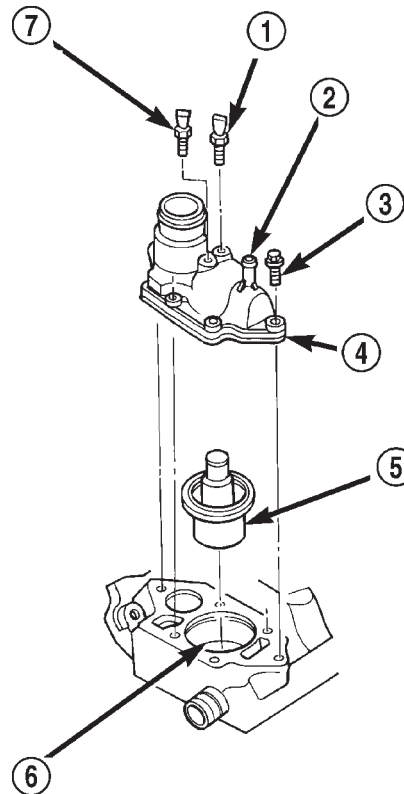
CAUTION: A number or letter is stamped into the tongue of constant tension clamps. If replacement

is necessary, use only an original equipment clamp with a matching number or letter.

(4) Remove upper radiator hose clamp. Remove upper radiator hose at thermostat housing.

(5) Disconnect the wiring connectors at both of the sensors located on thermostat housing.

(6) Remove six thermostat housing mounting bolts, thermostat housing and thermostat.

**Fig. 25 Thermostat—8.0L V-10 Engine**

- 1 - COOLANT TEMP. SENSOR (FOR PCM)
- 2 - HEATER SUPPLY FITTING
- 3 - BOLTS (6)
- 4 - HOUSING WITH INTEGRAL SEAL
- 5 - THERMOSTAT
- 6 - RUBBER LIP SEAL
- 7 - TEMP. GAUGE SENDING UNIT

INSTALLATION

(1) Clean mating areas of intake manifold and thermostat housing.

(2) Check the condition (for tears or cracks) of the rubber thermostat seal located in the intake manifold (Fig. 23) (Fig. 25). The thermostat should fit snugly into the rubber seal.

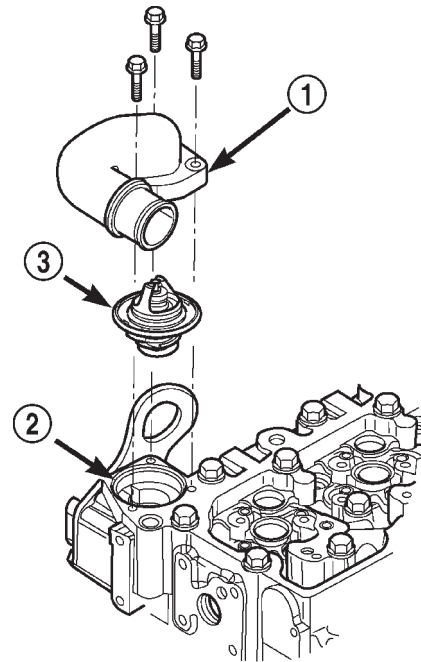
(3) If seal replacement is necessary, coat the outer (metal) portion of the seal with Mopar® Gasket Maker. Install the seal into the manifold using Special Seal Tool number C-3995-A with handle tool number C-4171.

ENGINE COOLANT THERMOSTAT - 8.0L (Continued)

- (4) Install thermostat into recessed machined groove on intake manifold (Fig. 25).
- (5) Install thermostat housing (Fig. 25).
- (6) Install housing-to-intake manifold bolts. Tighten bolts to 25 N·m (220 in. lbs.) torque.

CAUTION: Housing bolts should be tightened evenly to prevent damage to housing and to prevent leaks.

- (7) Connect the wiring to both sensors.
- (8) Install the upper radiator hose and hose clamp to thermostat housing.
- (9) Install support rod.
- (10) Fill cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
- (11) Connect negative battery cable to battery.
- (12) Start and warm engine. Check for leaks.



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Fig. 26 Thermostat—5.9L Diesel—Typical

- 1 - WATER OUTLET CONNECTOR
- 2 - THERMOSTAT HOUSING
- 3 - THERMOSTAT

ENGINE COOLANT THERMOSTAT - 5.9L DIESEL

DESCRIPTION

CAUTION: Do not operate an engine without a thermostat, except for servicing or testing. An engine with the thermostat removed will operate in the radiator bypass mode, causing an overheat condition.

The thermostat of the 5.9L diesel engine is located in the front of the cylinder head, underneath the water outlet connector (Fig. 26).

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 longer engine warmup time, unreliable warmup performance, increased exhaust emissions and crankcase condensation that 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

The cooling system used with the diesel engine provides the extra coolant capacity and extra cooling protection needed for higher GVWR (Gross Vehicle Weight Rating) and GCWR (Gross Combined Weight Rating) vehicles.

This system capacity will not effect warm up or cold weather operating characteristics if the thermo-

stat is operating properly. This is because coolant will be held in the engine until it reaches the thermostat "set" temperature.

Diesel engines, due to their inherent efficiency are slower to warm up than gasoline powered engines, and will operate at lower temperatures when the vehicle is unloaded. Because of this, lower temperature gauge readings for diesel versus gasoline engines may, at times be normal.

Typically, complaints of low engine coolant temperature are observed as low heater output when combined with cool or cold outside temperatures.

To help promote faster engine warm-up, the electric engine block heater must be used with cool or cold outside temperatures. This will help keep the engine coolant warm when the vehicle is parked. Use the block heater if the outside temperature is below 4°C (40°F). **Do not use the block heater if the outside temperature is above 4°C (40°F).**

A "Cold Weather Cover" is available from the parts department through the Mopar Accessories product line. This accessory cover is designed to block airflow entering the radiator and engine compartment to promote faster engine warm-up. It attaches to the front of the vehicle at the grill opening. **The cover is to be used with cool or cold temperatures only. If used with high outside temperatures, serious engine damage could result.** Refer to the literature supplied with the cover for additional information.

ENGINE COOLANT THERMOSTAT - 5.9L DIESEL (Continued)

(1) To determine if the thermostat is defective, it must be removed from the vehicle (Refer to 7 - COOLING/ENGINE/ENGINE COOLANT THERMOSTAT - REMOVAL).

(2) After the thermostat has been removed, examine the thermostat and inside of thermostat housing for contaminants. If contaminants are found, the thermostat may already be in a "stuck open" position. Flush the cooling system before replacing thermostat (Refer to 7 - COOLING - STANDARD PROCEDURE).

(3) Place the thermostat into a container filled with water.

(4) Place the container on a hot plate or other suitable heating device.

(5) Place a commercially available radiator thermometer into the water.

(6) Apply heat to the water while observing the thermostat and thermometer.

(7) When the water temperature reaches 83°C (181°F) the thermostat should start to open (valve will start to move). If the valve starts to move before this temperature is reached, it is opening too early. Replace thermostat. The thermostat should be fully open (valve will stop moving) at 95°C (203°F). If the valve is still moving when the water temperature reaches 203°, it is opening too late. Replace thermostat. If the valve refuses to move at any time, replace thermostat.

REMOVAL

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

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

(1) Disconnect the battery negative cables.

(2) Drain cooling system until coolant level is below thermostat (Refer to 7 - COOLING - STANDARD PROCEDURE).

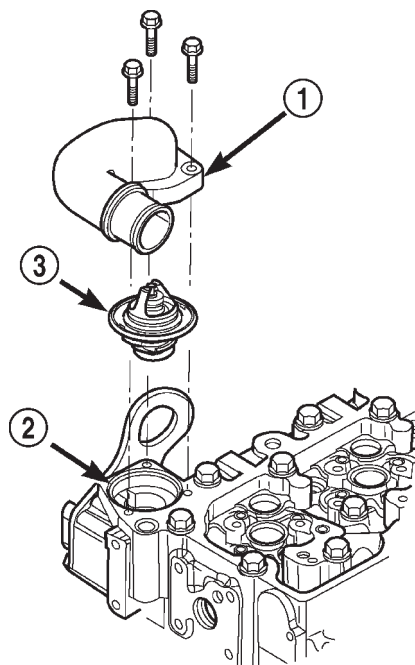
WARNING: CONSTANT TENSION HOSE CLAMPS ARE USED ON MOST COOLING SYSTEM HOSES. WHEN REMOVING OR INSTALLING, USE ONLY TOOLS DESIGNED FOR SERVICING THIS TYPE OF CLAMP, SUCH AS SPECIAL CLAMP TOOL (NUMBER 6094). SNAP-ON CLAMP TOOL (NUMBER HPC-20) MAY BE USED FOR LARGER CLAMPS. ALWAYS WEAR SAFETY GLASSES WHEN 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 a matching number or letter.

(3) Remove radiator hose clamp and hose from thermostat housing.

(4) Remove the three (3) water outlet-to-cylinder head bolts and remove the water outlet connector (Fig. 27).

(5) Clean the mating surfaces of the water outlet connector and clean the thermostat seat groove at the top of the thermostat housing (Fig. 27).



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Fig. 27 Thermostat Removal/Installation

- 1 - WATER OUTLET CONNECTOR
- 2 - THERMOSTAT HOUSING
- 3 - THERMOSTAT

INSTALLATION

(1) Install the thermostat into the groove in the top of the thermostat housing (Fig. 27).

(2) Install the water outlet connector and bolts. Tighten the bolts to 24 N·m (18 ft. lbs.) torque.

(3) Install the radiator upper hose and clamp.

(4) Fill the cooling system with coolant (Refer to 7 - COOLING - STANDARD PROCEDURE).

(5) Connect the battery negative cables.

(6) Start the engine and check for coolant leaks. Run engine to check for proper thermostat operation.

FAN DRIVE VISCOUS CLUTCH - 5.9L/8.0L

DESCRIPTION

The thermal viscous fan drive (Fig. 28) 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.

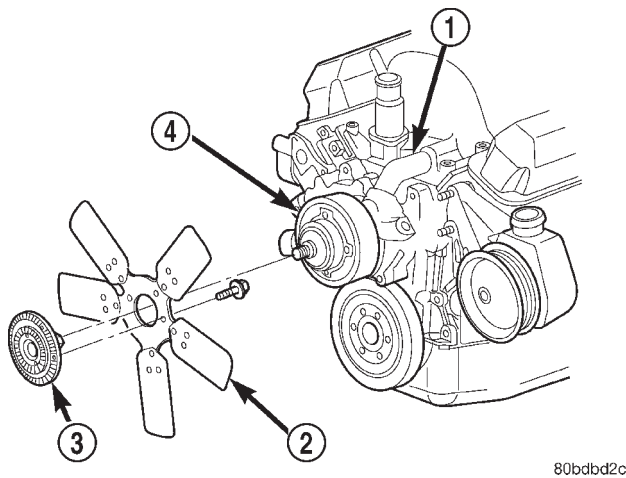


Fig. 28 Viscous Fan

- 1 - WATER PUMP BYPASS HOSE
- 2 - FAN BLADE ASSEMBLY
- 3 - VISCOUS FAN DRIVE
- 4 - WATER PUMP AND PULLEY

OPERATION

A thermostatic bimetallic spring coil is located on the front face of the viscous fan drive unit (a typical viscous unit is shown in (Fig. 29). 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.

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.

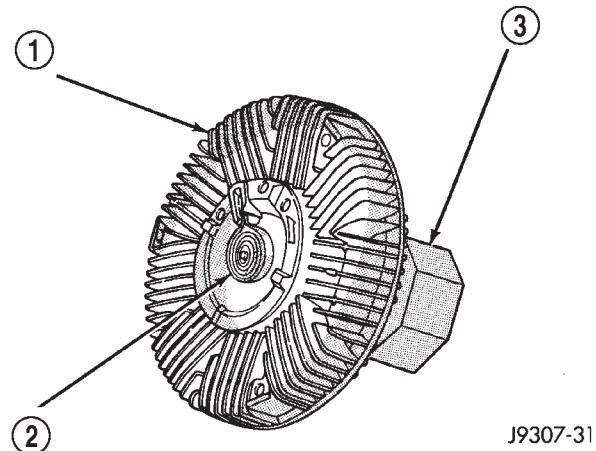


Fig. 29 Viscous Fan Drive—Typical

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

DIAGNOSIS AND TESTING - VISCOUS FAN DRIVE

NOISE

NOTE: It is normal for fan noise to be louder (roaring) when:

- The underhood temperature is above the engagement point for the viscous drive coupling. This may occur when ambient (outside air temperature) is very high.
- Engine loads and temperatures are high such as when towing a trailer.
- Cool silicone fluid within the fan drive unit is being redistributed back to its normal disengaged (warm) position. This can occur during the first 15 seconds to one minute after engine start-up on a cold engine.

LEAKS

Viscous fan drive operation is not affected by small oil stains near the drive bearing. If leakage appears excessive, replace the fan drive unit.

VISCOUS 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.

FAN DRIVE VISCOUS CLUTCH - 5.9L/8.0L (Continued)

(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. The timing light is to be used as a strobe light. This step cannot be used on the diesel engine.

(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 88° C (190° F). Fan drive **engagement** should start to occur at/between:

- 5.9L gas engines — 79° C (175° F)
 - 8.0L engine — 88° to 96° C (190° to 205° F)
 - 5.9L diesel engine — 71° to 82° C (160° to 179° 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 (non-diesel only).

(7) When viscous drive engagement is verified, remove the plastic sheet. Fan drive **disengagement** should start to occur at between 57° to 79° C (135° to 175° F). A definite **decrease** of fan flow noise (roaring) should be noticed. If not, replace the defective viscous fan drive unit.

CAUTION: Some 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.

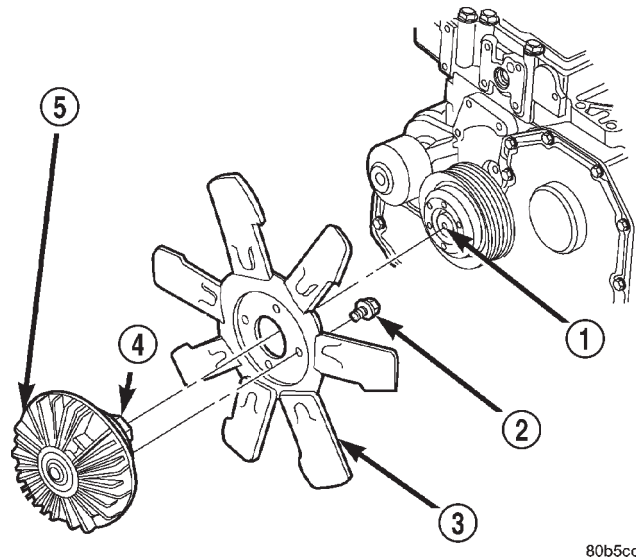
CAUTION: If the viscous fan drive is replaced because of mechanical damage, the cooling fan blades should also be inspected. Inspect for fatigue cracks, loose blades, or loose rivets that could have resulted from excessive vibration. Replace fan blade assembly if any of these conditions are

found. Also inspect water pump bearing and shaft assembly for any related damage due to a viscous fan drive malfunction.

FAN DRIVE VISCOUS CLUTCH - 5.9L DIESEL

DESCRIPTION

The thermal viscous fan drive (Fig. 30) 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.



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Fig. 30 Viscous Fan

- 1 - THREADED SHAFT
- 2 - BOLT (4)
- 3 - FAN BLADE
- 4 - THREADED NUT
- 5 - VISCOUS FAN DRIVE

OPERATION

A thermostatic bimetallic spring coil is located on the front face of the viscous fan drive unit (a typical viscous unit is shown in (Fig. 31). 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.

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

FAN DRIVE VISCOUS CLUTCH - 5.9L DIESEL (Continued)

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.

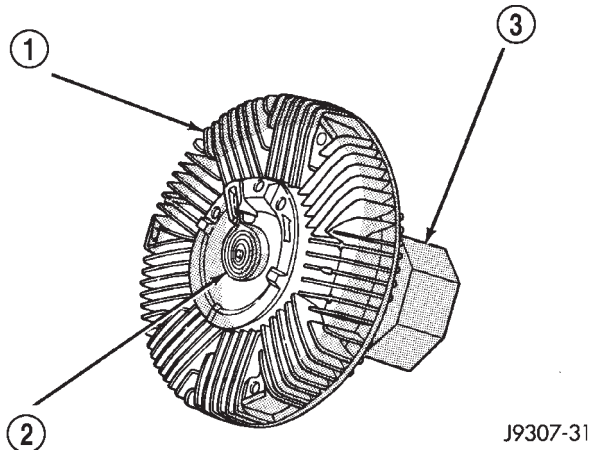


Fig. 31 Viscous Fan Drive—Typical

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

DIAGNOSIS AND TESTING - VISCOUS FAN DRIVE

NOISE

NOTE: It is normal for fan noise to be louder (roaring) when:

- The underhood temperature is above the engagement point for the viscous drive coupling. This may occur when ambient (outside air temperature) is very high.
- Engine loads and temperatures are high such as when towing a trailer.
- Cool silicone fluid within the fan drive unit is being redistributed back to its normal disengaged (warm) position. This can occur during the first 15 seconds to one minute after engine start-up on a cold engine.

LEAKS

Viscous fan drive operation is not affected by small oil stains near the drive bearing. If leakage appears excessive, replace the fan drive unit.

VISCOUS 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. The timing light is to be used as a strobe light. This step cannot be used on the diesel engine.

(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 88° C (190° F). Fan drive **engagement** should start to occur at/between:

- 5.9L gas engines — 79° C (175° F)
- 8.0L engine — 88° to 96° C (190° to 205° F)
- 5.9L diesel engine — 71° to 82° C (160° to 179° 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 (non-diesel only).

(7) When viscous drive engagement is verified, remove the plastic sheet. Fan drive **disengagement** should start to occur at between 57° to 79° C (135° to 175° F). A definite **decrease** of fan flow noise (roaring) should be noticed. If not, replace the defective viscous fan drive unit.

FAN DRIVE VISCOUS CLUTCH - 5.9L DIESEL (Continued)

CAUTION: Some 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.

RADIATOR - 5.9L

DESCRIPTION

The radiator is a aluminum cross-flow design with horizontal tubes through the radiator core and vertical plastic side tanks (Fig. 32).

This radiator contains an internal transmission oil cooler only on the V-10 gas engine and the 5.9L diesel engine combinations.

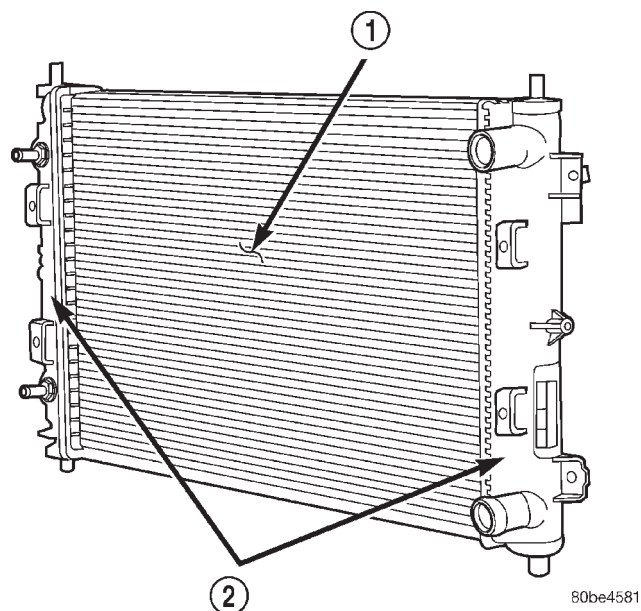


Fig. 32 Cross Flow Radiator—Typical

1 - COOLING TUBES

2 - TANKS

OPERATION

The radiator supplies sufficient heat transfer using the cooling fins interlaced between the horizontal tubes in the radiator core to cool the engine.

DIAGNOSIS AND TESTING—RADIATOR COOLANT FLOW

Use the following procedure to determine if coolant is flowing through the cooling system.

(1) Idle engine until operating temperature is reached. If the upper radiator hose is warm to the touch, the thermostat is opening and coolant is flowing to the radiator.

WARNING: HOT, PRESSURIZED COOLANT CAN CAUSE INJURY BY SCALDING. USING A RAG TO COVER THE RADIATOR PRESSURE CAP, OPEN RADIATOR CAP SLOWLY TO THE FIRST STOP. THIS WILL ALLOW ANY BUILT-UP PRESSURE TO VENT TO THE RESERVE/OVERFLOW TANK. AFTER PRESSURE BUILD-UP HAS BEEN RELEASED, REMOVE CAP FROM FILLER NECK.

(2) Drain a small amount of coolant from the radiator until the ends of the radiator tubes are visible through the filler neck. Idle the engine at normal operating temperature. If coolant is flowing past the exposed tubes, the coolant is circulating.

REMOVAL

(1) Disconnect battery negative cables.

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.

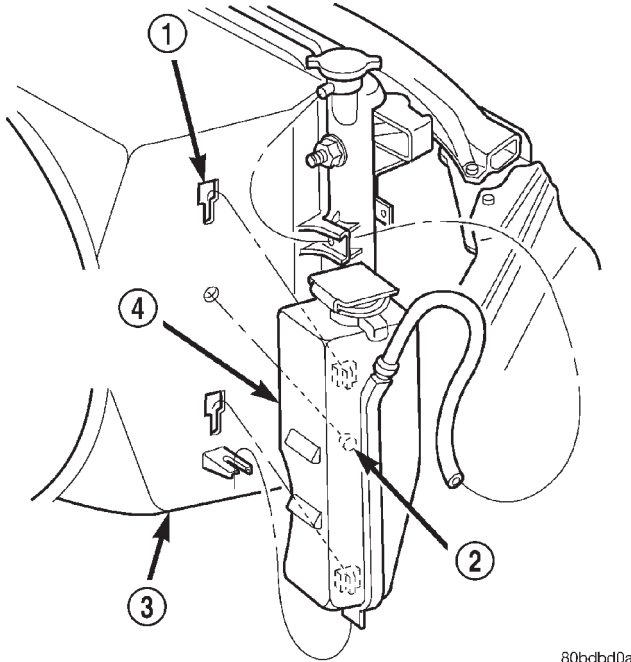
(2) Drain the cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).

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 a matching number or letter.

RADIATOR - 5.9L (Continued)

- (3) Remove hose clamps and hoses from radiator.
- (4) Remove coolant reserve/overflow tank hose from radiator filler neck nipple.
- (5) Remove the coolant reserve/overflow tank from the fan shroud (pull straight up). The tank slips into T-slots on the fan shroud (Fig. 33).

**Fig. 33 Coolant Recovery Bottle**

- 1 - T-SLOTS
- 2 - ALIGNMENT PIN
- 3 - FAN SHROUD
- 4 - COOLANT RESERVE/OVERFLOW TANK

(6) Disconnect electrical connectors at windshield washer reservoir tank and remove tank.

(7) Remove the four fan shroud mounting bolts (Fig. 34). Position shroud rearward over the fan blades towards engine.

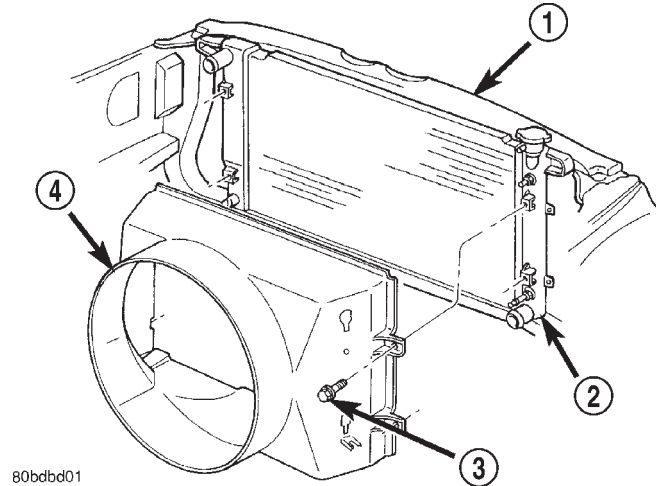
(8) Remove the plastic clips retaining the rubber shields to the sides of radiator. Position rubber shields to the side.

(9) Remove the two radiator upper mounting bolts (Fig. 35).

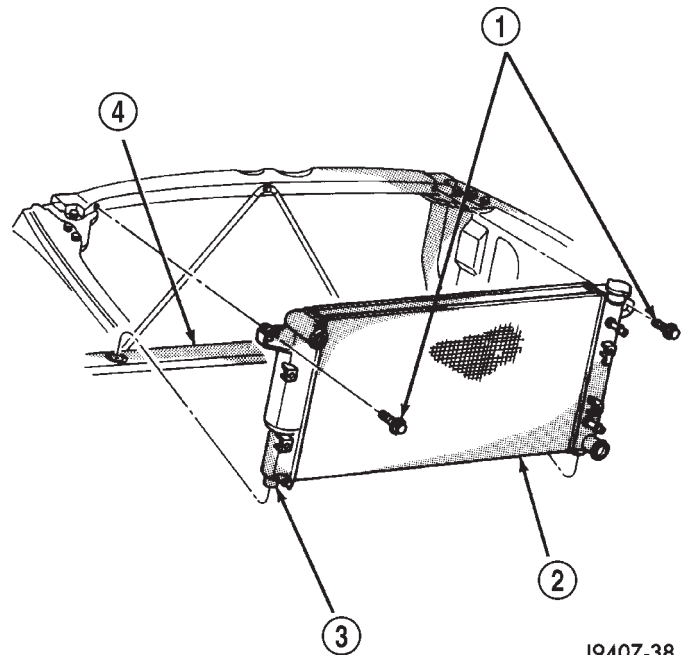
(10) Lift radiator straight up and out of engine compartment. The bottom of the radiator is equipped with two alignment dowels that fit into holes in the lower radiator support panel (Fig. 35). Rubber biscuits (insulators) are installed to these dowels. Take care not to damage cooling fins or tubes on the radiator and air conditioning condenser when removing.

CLEANING

Clean radiator fins are necessary for good heat transfer. The radiator and air conditioning fins should be cleaned when an accumulation of debris

**Fig. 34 Fan Shroud Mounting - 5.9L Engines**

- 1 - RADIATOR SUPPORT
- 2 - RADIATOR
- 3 - BOLTS (4)
- 4 - FAN SHROUD

**Fig. 35 Typical Radiator Mounting**

- 1 - MOUNTING BOLTS
- 2 - RADIATOR
- 3 - ALIGNMENT DOWELS (2)
- 4 - RADIATOR SUPPORT

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

RADIATOR - 5.9L (Continued)

INSPECTION

Inspect the radiator side tanks for cracks, broken or missing fittings also inspect the joint where the tanks seam up to the radiator core for signs of leakage and/or deteriorating seals.

Inspect radiator core for corroded, bent or missing cooling fins. Inspect the core for bent or damaged cooling tubes.

INSTALLATION

(1) Position fan shroud over the fan blades rearward towards engine.

(2) Install rubber insulators to alignment dowels at lower part of radiator.

(3) Lower the radiator into position while guiding the two alignment dowels into lower radiator support. Different alignment holes are provided in the lower radiator support for each engine application.

(4) Install two upper radiator mounting bolts. Tighten bolts to 11 N·m (95 in. lbs.) torque.

(5) Position the rubber shields to the sides of radiator. Install the plastic clips retaining the rubber shields to the sides of radiator.

(6) Connect both radiator hoses and install hose clamps.

(7) Install windshield washer reservoir tank.

(8) Position fan shroud to flanges on sides of radiator. Install fan shroud mounting bolts (Fig. 34). Tighten bolts to 6 N·m (50 in. lbs.) torque.

(9) Install coolant reserve/overflow tank hose to radiator filler neck nipple.

(10) Install coolant reserve/overflow tank to fan shroud (fits into T-slots on shroud).

(11) Install battery negative cables.

(12) Position heater controls to **full heat** position.

(13) Fill cooling system with coolant (Refer to 7 - COOLING - STANDARD PROCEDURE).

(14) Operate engine until it reaches normal temperature. Check cooling system fluid levels.

RADIATOR - 8.0L

DESCRIPTION

The radiator is a aluminum cross-flow design with horizontal tubes through the radiator core and vertical plastic side tanks (Fig. 36).

This radiator contains an internal transmission oil cooler only on the V-10 gas engine and the 5.9L diesel engine combinations.

OPERATION

The radiator supplies sufficient heat transfer using the cooling fins interlaced between the horizontal tubes in the radiator core to cool the engine.

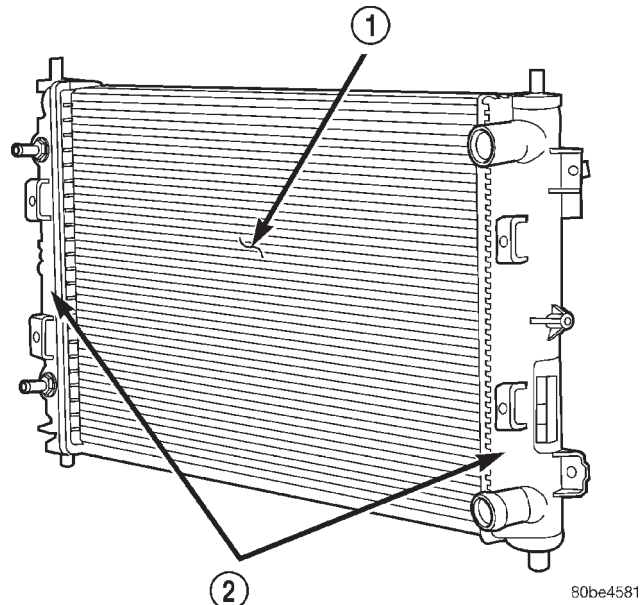


Fig. 36 Cross Flow Radiator—Typical

- 1 - COOLING TUBES
2 - TANKS

DIAGNOSIS AND TESTING—RADIATOR COOLANT FLOW

Use the following procedure to determine if coolant is flowing through the cooling system.

(1) Idle engine until operating temperature is reached. If the upper radiator hose is warm to the touch, the thermostat is opening and coolant is flowing to the radiator.

WARNING: HOT, PRESSURIZED COOLANT CAN CAUSE INJURY BY SCALDING. USING A RAG TO COVER THE RADIATOR PRESSURE CAP, OPEN RADIATOR CAP SLOWLY TO THE FIRST STOP. THIS WILL ALLOW ANY BUILT-UP PRESSURE TO VENT TO THE RESERVE/OVERFLOW TANK. AFTER PRESSURE BUILD-UP HAS BEEN RELEASED, REMOVE CAP FROM FILLER NECK.

(2) Drain a small amount of coolant from the radiator until the ends of the radiator tubes are visible through the filler neck. Idle the engine at normal operating temperature. If coolant is flowing past the exposed tubes, the coolant is circulating.

REMOVAL

(1) Disconnect battery negative cables.

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.

RADIATOR - 8.0L (Continued)

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

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 a matching number or letter.

(3) Remove hose clamps and hoses from radiator.

(4) Remove coolant reserve/overflow tank hose from radiator filler neck nipple.

(5) The coolant recovery/reservoir does not require removal. Disconnect the overflow hose from the radiator.

(6) Disconnect electrical connectors at windshield washer reservoir tank and remove tank.

(7) Remove the four fan shroud mounting bolts (Fig. 37). Position shroud rearward over the fan blades towards engine.

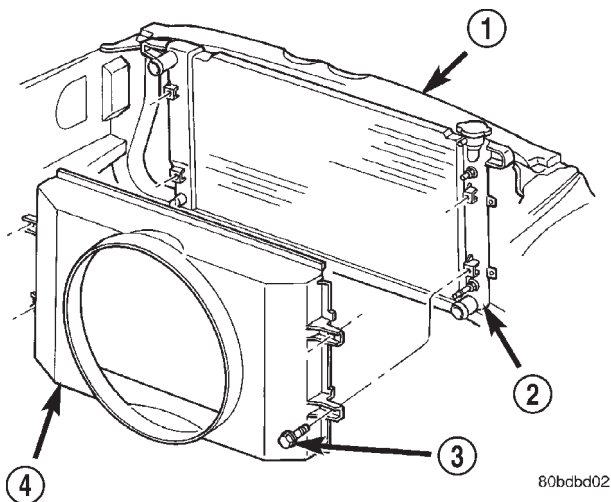
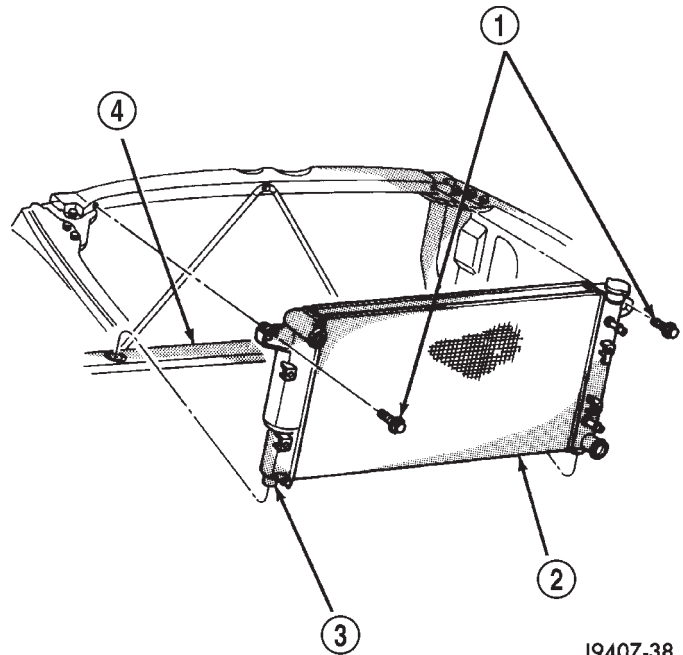


Fig. 37 Fan Shroud Mounting—8.0L Engine

- 1 - RADIATOR SUPPORT
- 2 - RADIATOR
- 3 - BOLTS (4)
- 4 - FAN SHROUD

(8) Remove the two radiator upper mounting bolts (Fig. 38).

(9) Lift radiator straight up and out of engine compartment. The bottom of the radiator is equipped



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Fig. 38 Typical Radiator Mounting

- 1 - MOUNTING BOLTS
- 2 - RADIATOR
- 3 - ALIGNMENT DOWELS (2)
- 4 - RADIATOR SUPPORT

with two alignment dowels that fit into holes in the lower radiator support panel (Fig. 38). Rubber biscuits (insulators) are installed to these dowels. Take care not to damage cooling fins or tubes on the radiator and air conditioning condenser when removing.

CLEANING

Clean radiator fins are necessary for good heat transfer. The radiator and air conditioning fins should be cleaned when an accumulation of debris has occurred. With the engine cold, apply cold water and compressed air to the back (engine side) of the radiator to flush the radiator and/or A/C condenser of debris.

INSPECTION

Inspect the radiator side tanks for cracks, broken or missing fittings also inspect the joint where the tanks seam up to the radiator core for signs of leakage and/or deteriorating seals.

Inspect radiator core for corroded, bent or missing cooling fins. Inspect the core for bent or damaged cooling tubes.

INSTALLATION

(1) Position fan shroud over the fan blades rearward towards engine.

RADIATOR - 8.0L (Continued)

(2) Install rubber insulators to alignment dowels at lower part of radiator.

(3) Lower the radiator into position while guiding the two alignment dowels into lower radiator support. Different alignment holes are provided in the lower radiator support for each engine application.

(4) Install two upper radiator mounting bolts. Tighten bolts to 11 N·m (95 in. lbs.) torque.

(5) Connect both radiator hoses and install hose clamps.

(6) Install windshield washer reservoir tank.

(7) Position fan shroud to flanges on sides of radiator. Install fan shroud mounting bolts (Fig. 37). Tighten bolts to 6 N·m (50 in. lbs.) torque.

(8) Install coolant reserve/overflow tank hose to radiator filler neck nipple.

(9) Connect the overflow hose to the radiator.

(10) Install battery negative cables.

(11) Position heater controls to **full heat** position.

(12) Fill cooling system with coolant (Refer to 7 - COOLING - STANDARD PROCEDURE).

(13) Operate engine until it reaches normal temperature. Check cooling system fluid levels.

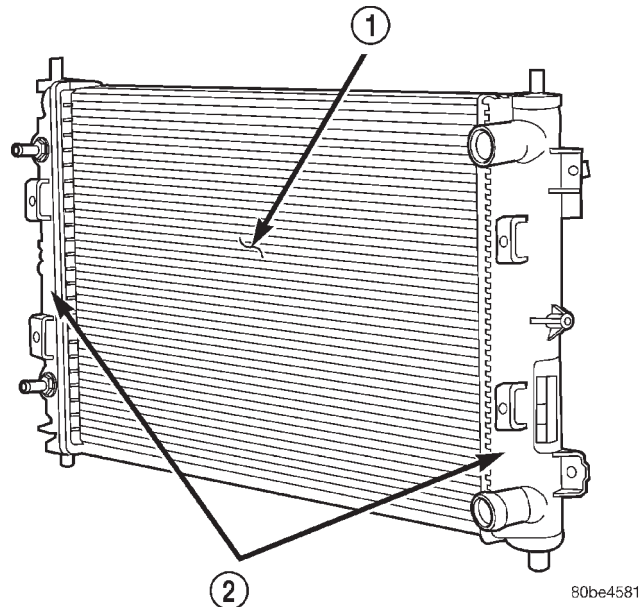


Fig. 39 Cross Flow Radiator—Typical

1 - COOLING TUBES

2 - TANKS

RADIATOR - 5.9L DIESEL

DESCRIPTION

The radiator is a aluminum cross-flow design with horizontal tubes through the radiator core and vertical plastic side tanks (Fig. 39).

This radiator contains an internal transmission oil cooler only on the V-10 gas engine and the 5.9L diesel engine combinations.

OPERATION

The radiator supplies sufficient heat transfer using the cooling fins interlaced between the horizontal tubes in the radiator core to cool the engine.

DIAGNOSIS AND TESTING—RADIATOR COOLANT FLOW

Use the following procedure to determine if coolant is flowing through the cooling system.

(1) Idle engine until operating temperature is reached. If the upper radiator hose is warm to the touch, the thermostat is opening and coolant is flowing to the radiator.

WARNING: HOT, PRESSURIZED COOLANT CAN CAUSE INJURY BY SCALDING. USING A RAG TO COVER THE RADIATOR PRESSURE CAP, OPEN RADIATOR CAP SLOWLY TO THE FIRST STOP. THIS WILL ALLOW ANY BUILT-UP PRESSURE TO VENT TO THE RESERVE/OVERFLOW TANK. AFTER PRES-

SURE BUILD-UP HAS BEEN RELEASED, REMOVE CAP FROM FILLER NECK.

(2) Drain a small amount of coolant from the radiator until the ends of the radiator tubes are visible through the filler neck. Idle the engine at normal operating temperature. If coolant is flowing past the exposed tubes, the coolant is circulating.

REMOVAL

(1) Disconnect both battery negative cables. Remove the nuts retaining the positive cable to the top of radiator. Position positive battery cable to rear of vehicle.

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.

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

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.

RADIATOR - 5.9L DIESEL (Continued)

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 a matching number or letter.

(3) Remove hose clamps and hoses from radiator.

(4) Remove coolant reserve/overflow tank hose from radiator filler neck nipple.

(5) Remove the coolant reserve/overflow tank from the fan shroud (pull straight up). The tank slips into T-slots on the fan shroud (Fig. 40). The tank recovery/reservoir does not require removal. Disconnect the overflow hose from the radiator.

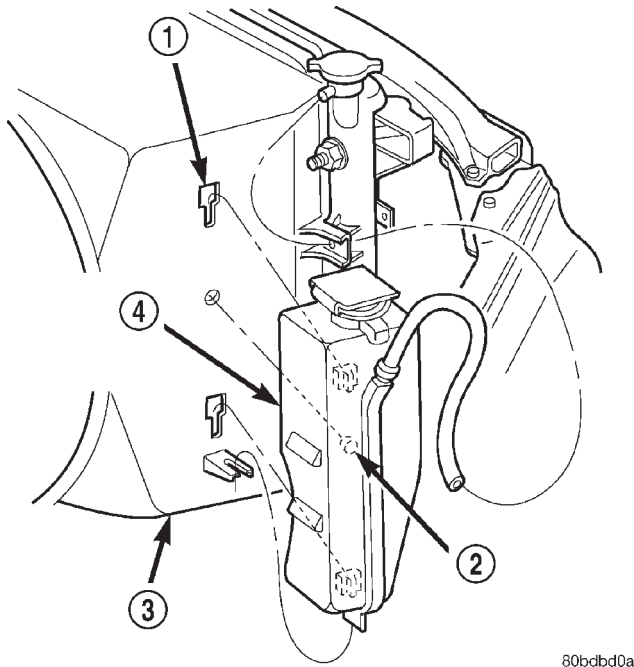


Fig. 40 Coolant Recovery Bottle—Typical

- 1 - T-SLOTS
- 2 - ALIGNMENT PIN
- 3 - FAN SHROUD
- 4 - COOLANT RESERVE/OVERFLOW TANK

(6) Disconnect electrical connectors at windshield washer reservoir tank and remove tank.

(7) Remove the two metal clips retaining the upper part of fan shroud to the top of radiator.

(8) Remove the four fan shroud mounting bolts (Fig. 41). Position shroud rearward over the fan blades towards engine.

(9) Remove the two radiator upper mounting bolts (Fig. 42).

(10) Lift radiator straight up and out of engine compartment. The bottom of the radiator is equipped with two alignment dowels that fit into holes in the lower radiator support panel (Fig. 42). Rubber biscuits (insulators) are installed to these dowels. Take care not to damage cooling fins or tubes on the radiator and air conditioning condenser when removing.

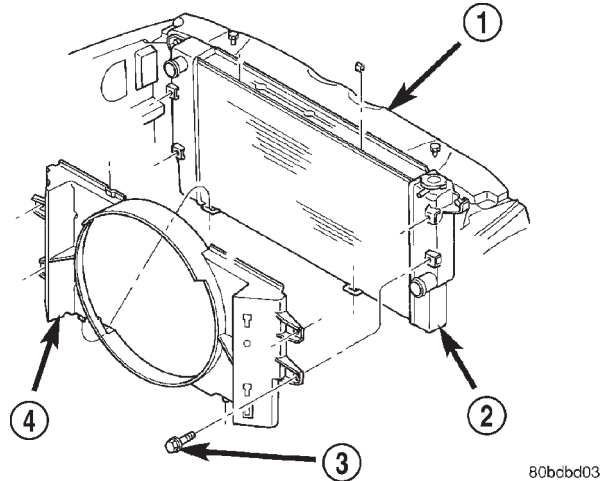


Fig. 41 Fan Shroud Mounting—5.9L Diesel Engine

- 1 - RADIATOR SUPPORT
- 2 - RADIATOR
- 3 - BOLTS (4)
- 4 - FAN SHROUD

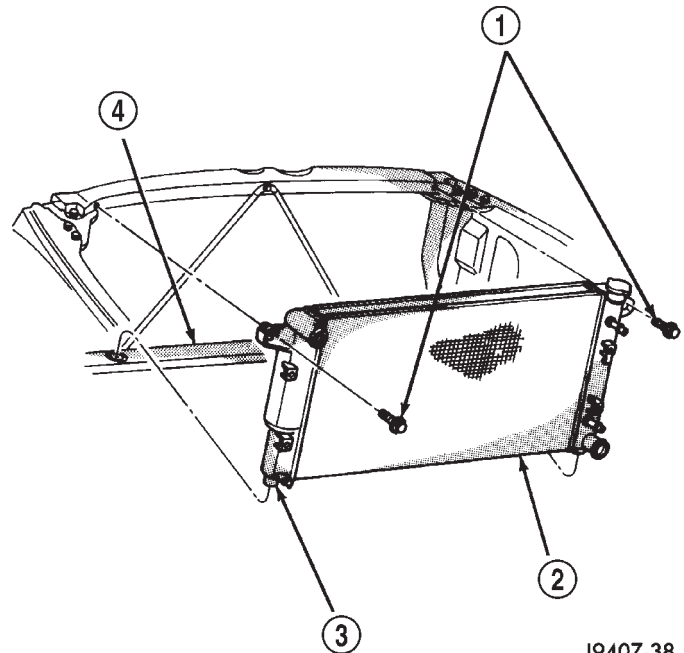


Fig. 42 Typical Radiator Mounting

- 1 - MOUNTING BOLTS
- 2 - RADIATOR
- 3 - ALIGNMENT DOWELS (2)
- 4 - RADIATOR SUPPORT

RADIATOR - 5.9L DIESEL (Continued)

CLEANING

Clean radiator fins are necessary for good heat transfer. The radiator and air conditioning fins should be cleaned when an accumulation of debris has occurred. With the engine cold, apply cold water and compressed air to the back (engine side) of the radiator to flush the radiator and/or A/C condenser of debris.

INSPECTION

Inspect the radiator side tanks for cracks, broken or missing fittings also inspect the joint where the tanks seam up to the radiator core for signs of leakage and/or deteriorating seals.

Inspect radiator core for corroded, bent or missing cooling fins. Inspect the core for bent or damaged cooling tubes.

INSTALLATION

(1) Position fan shroud over the fan blades rearward towards engine.

(2) Install rubber insulators to alignment dowels at lower part of radiator.

(3) Lower the radiator into position while guiding the two alignment dowels into lower radiator support. Different alignment holes are provided in the lower radiator support for each engine application.

(4) Install two upper radiator mounting bolts. Tighten bolts to 11 N·m (95 in. lbs.) torque.

(5) Connect both radiator hoses and install hose clamps.

(6) Connect transmission cooler lines to radiator tank. Inspect quick connect fittings for debris and install until an audible "click" is heard. Pull apart to verify connection.

(7) Install windshield washer reservoir tank.

(8) Position fan shroud to flanges on sides of radiator. Install fan shroud mounting bolts (Fig. 41). Tighten bolts to 6 N·m (50 in. lbs.) torque.

(9) Install metal clips to top of fan shroud.

(10) Install coolant reserve/overflow tank hose to radiator filler neck nipple.

(11) Install coolant reserve/overflow tank to fan shroud (fits into T-slots on shroud).

(12) Install battery negative cables.

(13) Install positive battery cable to top of radiator. Tighten radiator-to-battery cable mounting nuts.

(14) Position heater controls to **full heat** position.

(15) Fill cooling system with coolant (Refer to 7 - COOLING - STANDARD PROCEDURE).

(16) Operate engine until it reaches normal temperature. Check cooling system and automatic transmission (if equipped) fluid levels.

RADIATOR PRESSURE CAP

DESCRIPTION

Radiators are equipped with a pressure cap, which releases pressure at some point within a range of 97-124 kPa (14-18 psi). The pressure relief point (in pounds) is engraved on top of 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.

A rubber gasket seals radiator filler neck to prevent leakage. This is done to keep system under pressure. It also maintains vacuum during coolant cool-down allowing coolant to return from reserve/overflow tank.

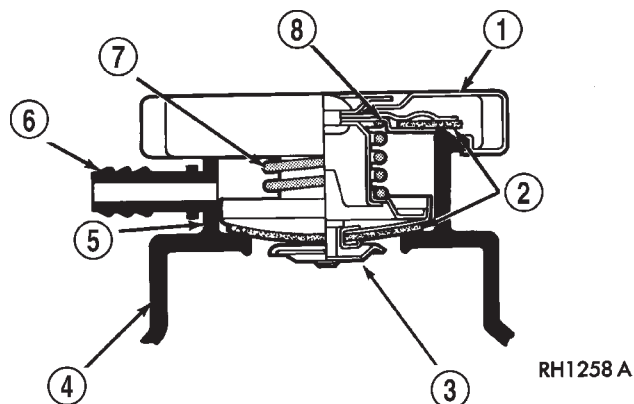


Fig. 43 Radiator Pressure Cap and Filler Neck—Typical

- 1 - STAINLESS-STEEL SWIVEL TOP
- 2 - RUBBER SEALS
- 3 - VENT VALVE
- 4 - RADIATOR TANK
- 5 - FILLER NECK
- 6 - OVERFLOW NIPPLE
- 7 - MAIN SPRING
- 8 - GASKET RETAINER

OPERATION

The cap (Fig. 43) contains a spring-loaded pressure relief valve that opens when system pressure reaches release range of 97-124 kPa (14-18 psi).

A vent valve in the center of cap allows a small coolant flow through cap when coolant is below boiling temperature. The valve is completely closed when boiling point is reached. As the coolant cools, it contracts and creates a vacuum in the cooling system. This causes the vacuum valve to open and coolant in the reserve/overflow tank to be drawn through its connecting hose into radiator. If the vacuum valve is stuck shut, the radiator hoses will collapse on cool-down. Clean the vent valve (Fig. 43).

RADIATOR PRESSURE CAP (Continued)

DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING—RADIATOR CAP-TO-FILLER NECK SEAL

The pressure cap upper gasket (seal) pressure relief can be tested by removing overflow hose from radiator filler neck nipple. Attach hose of pressure tester tool 7700 (or equivalent) to nipple. It will be necessary to disconnect hose from its adapter for filler neck. Pump air into radiator. The pressure cap upper gasket should relieve at 69-124 kPa (10-18 psi) and hold pressure at a minimum of 55 kPa (8 psi).

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

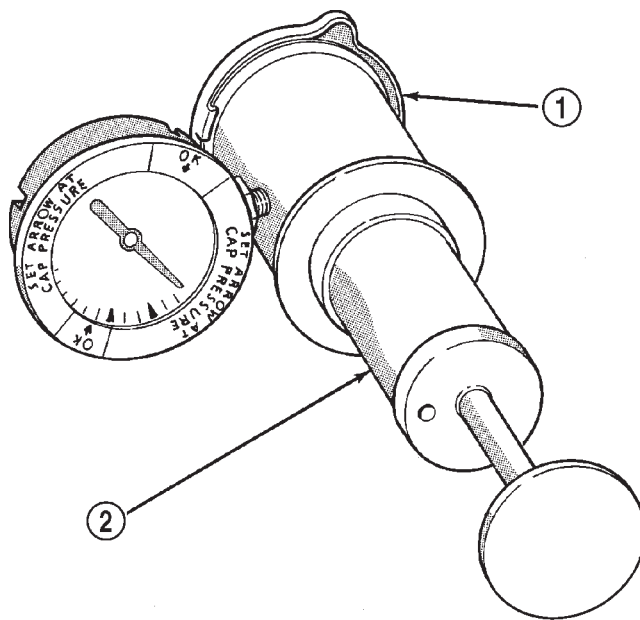
Do not remove radiator cap at any time **except** for the following purposes:

- Check and adjust antifreeze freeze point
- Refill system with new antifreeze
- Conducting service procedures
- Checking for vacuum 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 CAP AND WITHOUT PUSHING CAP DOWN, ROTATE IT COUNTER-CLOCKWISE TO FIRST STOP. ALLOW FLUID TO ESCAPE THROUGH THE COOLANT RESERVE/OVERFLOW HOSE INTO 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.

DIAGNOSIS AND TESTING—RADIATOR CAP

Remove cap from radiator. Be sure that sealing surfaces are clean. Moisten rubber gasket with water and install cap on pressure tester 7700 or an equivalent (Fig. 44).



J9507-3

Fig. 44 Pressure Testing Radiator Cap—Typical Tester

- 1 - PRESSURE CAP
2 - TYPICAL COOLING SYSTEM PRESSURE TESTER

NOTE: 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.

Operate tester pump to bring pressure to 104 kPa (15 psi) on gauge. If pressure cap fails to hold pressure of at least 97 kPa (14 psi) replace cap.

The pressure cap may test properly while positioned on tool 7700 (or equivalent). It may not hold pressure or vacuum when installed on radiator. If so, inspect radiator filler neck and cap's top gasket for damage. Also inspect for dirt or distortion that may prevent cap from sealing properly.

CLEANING

Clean radiator pressure cap using a mild soap and water mixture. **DO NOT** use any chemicals stronger than mild soap, damage to the seal can occur.

RADIATOR PRESSURE CAP (Continued)

INSPECTION

Hold cap at eye level, right side up. The vent valve (Fig. 45) at bottom of cap should open. If rubber gasket has swollen and prevents vent valve from opening, replace cap.

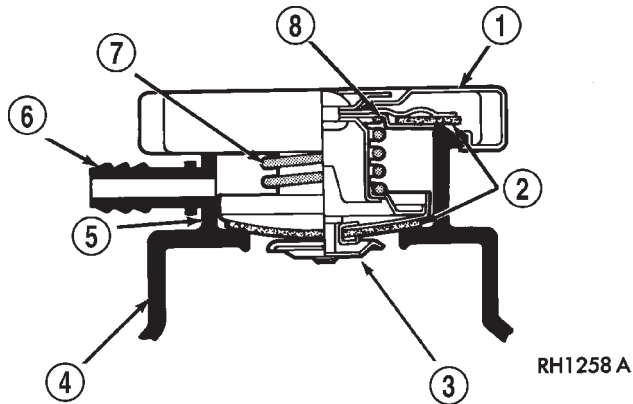


Fig. 45 Radiator Pressure Cap

- 1 - STAINLESS-STEEL SWIVEL TOP
- 2 - RUBBER SEALS
- 3 - VENT VALVE
- 4 - RADIATOR TANK
- 5 - FILLER NECK
- 6 - OVERFLOW NIPPLE
- 7 - MAIN SPRING
- 8 - GASKET RETAINER

Hold cap at eye level, upside down. If any light can be seen between vent valve and rubber gasket, replace cap. **Do not use a replacement cap that has a spring to hold vent shut.** A replacement cap must be the type designed for a coolant reserve/overflow system with a completely sealed diaphragm spring and a rubber gasket. This gasket is used to seal to radiator filler neck top surface. Use of proper cap will allow coolant return to radiator.

WATER PUMP - 5.9L

DESCRIPTION

The water pump is located on the engine front cover, and has an integral pulley attached (Fig. 46).

The water pump impeller is pressed onto the rear of a shaft that rotates in a bearing pressed into the water pump body. The body has a small hole for ventilation. The water pump seals are lubricated by antifreeze in the coolant mixture. Additional lubrication is not necessary.

OPERATION

A centrifugal water pump circulates coolant through the water jackets, passages, intake manifold, radiator core, cooling system hoses and heater core,

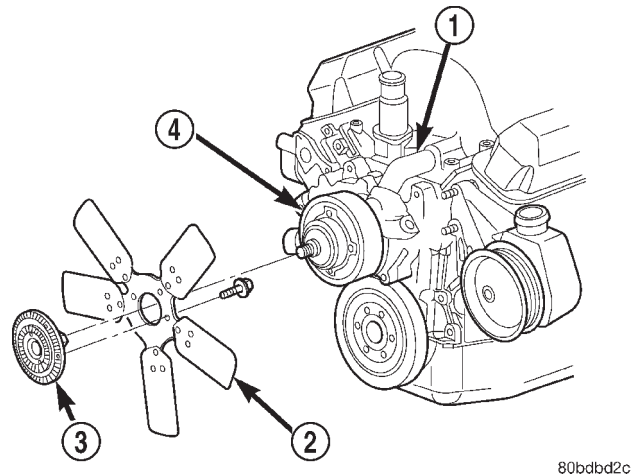


Fig. 46 Water Pump Location—Typical

- 1 - WATER PUMP BYPASS HOSE
- 2 - FAN BLADE ASSEMBLY
- 3 - VISCOUS FAN DRIVE
- 4 - WATER PUMP AND PULLEY

this coolant absorbs the heat generated when the engine is running. The pump is driven by the engine crankshaft via a drive belt.

DIAGNOSIS AND TESTING—WATER PUMP

A quick test to determine if pump is working is to check if heater warms properly. A defective water pump will not be able to circulate heated coolant through the long heater hose to the heater core.

REMOVAL

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

The water pump on all gas powered engines is bolted directly to the engine timing chain case/cover.

On the 5.9L gas powered engine, 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 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - DIAGNOSIS AND TESTING).

(1) Disconnect negative cable from battery.

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

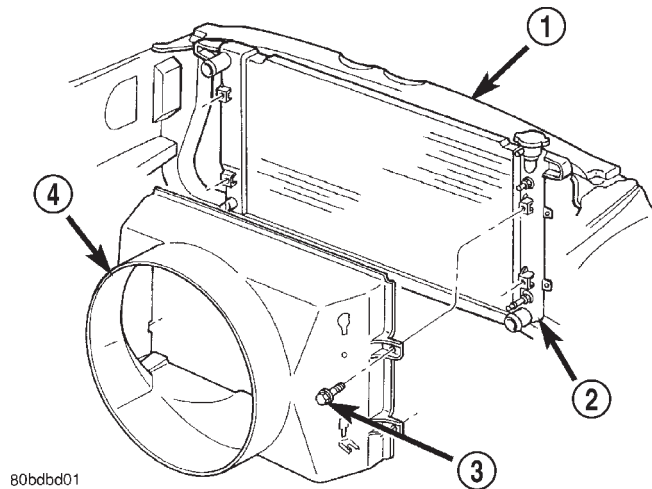
Do not waste reusable coolant. If solution is clean, drain coolant into a clean container for reuse.

WATER PUMP - 5.9L (Continued)

(3) Remove windshield washer reservoir tank from radiator fan shroud.

(4) Disconnect the coolant reserve/overflow tank-to-radiator hose at the tank.

(5) Remove the four fan shroud mounting bolts at the radiator (Fig. 47). Do not attempt to remove shroud from vehicle at this time.



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Fig. 47 Typical Fan Shroud Mounting

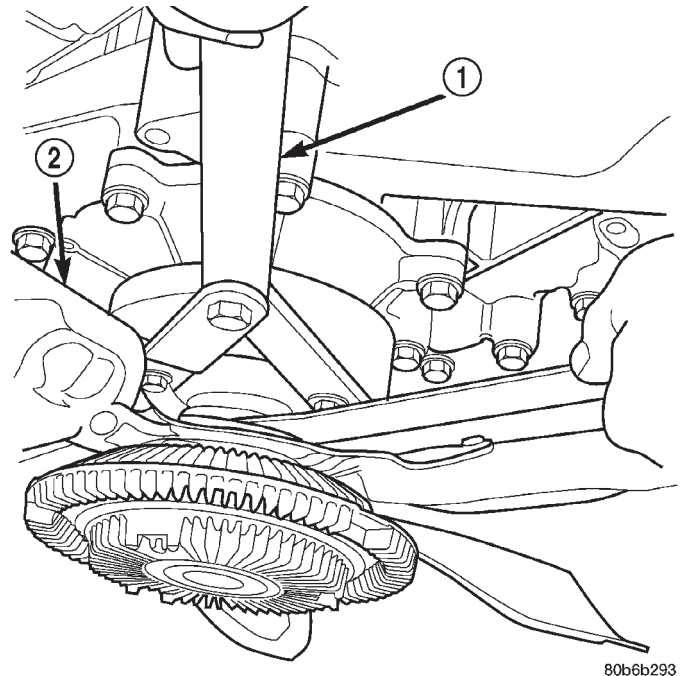
- 1 - RADIATOR SUPPORT
- 2 - RADIATOR
- 3 - BOLTS (4)
- 4 - FAN SHROUD

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 a matching number or letter.

(6) Remove upper radiator hose at radiator.

(7) The thermal viscous fan drive is attached (threaded) to the water pump hub shaft (Fig. 49). Remove the fan/fan drive assembly from water pump by turning the mounting nut counterclockwise (as viewed from front). Threads on the fan drive are **RIGHT-HAND**. A Snap-On 36 MM Fan Wrench (number SP346 from Snap-On Cummins Diesel Tool Set number 2017DSP) can be used with Special Tool 6958 Spanner Wrench and Adapter Pins 8346 (Fig. 48) to prevent the pulley from rotating.



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Fig. 48 Using Special Tool 6958 Spanner Wrench and Adapter Pins 8346

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

(8) If water pump is being replaced, do not unbolt fan blade assembly (Fig. 49) from the thermal control fan drive.

(9) Remove fan blade/fan drive and fan shroud as an assembly from vehicle.

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

(11) Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL) (Fig. 50).

(12) Remove the lower radiator hose and heater hose from water pump.

(13) Loosen heater hose coolant return tube mounting bolt (Fig. 51) and remove tube from water pump. Discard the old tube O-ring.

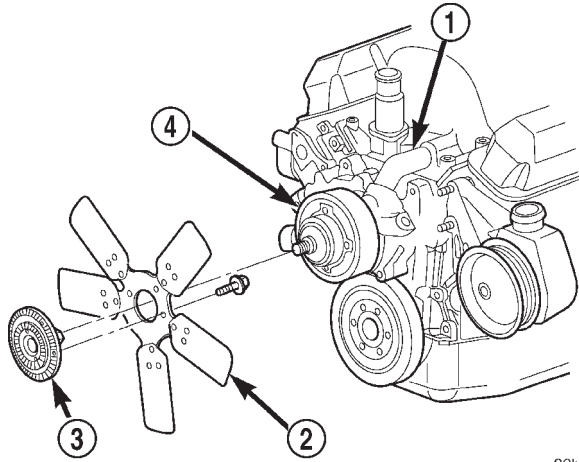
(14) Remove the seven water pump mounting bolts (Fig. 52).

(15) Loosen the clamp at the water pump end of bypass hose (Fig. 49). Slip the bypass hose from the water pump while removing pump from vehicle. Do not remove the clamp from the bypass hose.

(16) Discard old gasket.

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

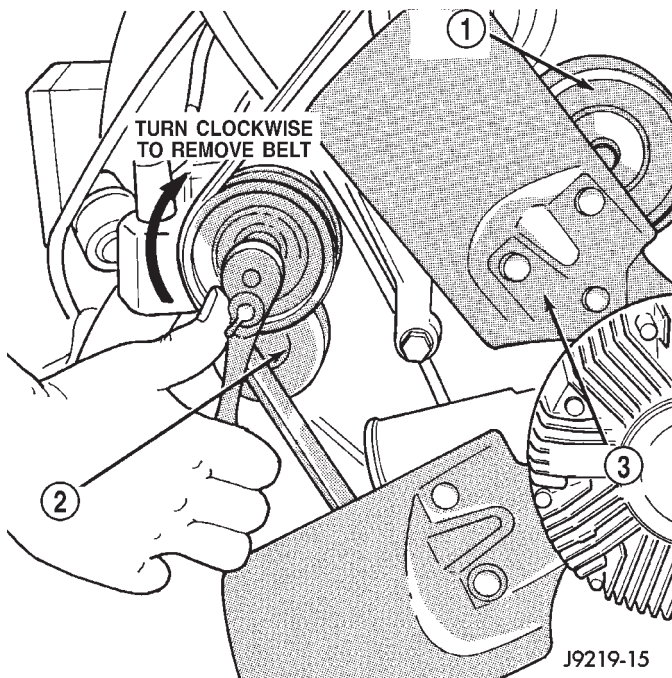
WATER PUMP - 5.9L (Continued)



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Fig. 49 Fan Blade and Viscous Fan Drive - Typical

- 1 - WATER PUMP BYPASS HOSE
- 2 - FAN BLADE ASSEMBLY
- 3 - VISCOUS FAN DRIVE
- 4 - WATER PUMP AND PULLEY



J9219-15

Fig. 50 Belt Tensioner 5.9L V-8 Engine

- 1 - IDLER PULLEY
- 2 - TENSIONER
- 3 - FAN BLADE

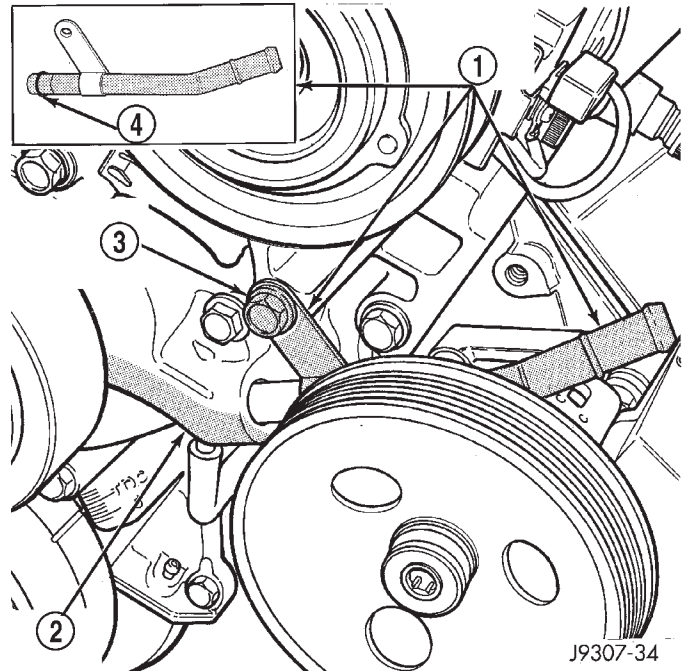
CLEANING

Clean gasket mating surfaces as necessary.

INSPECTION

Visually inspect the water pump and replace if it has any of the following conditions:

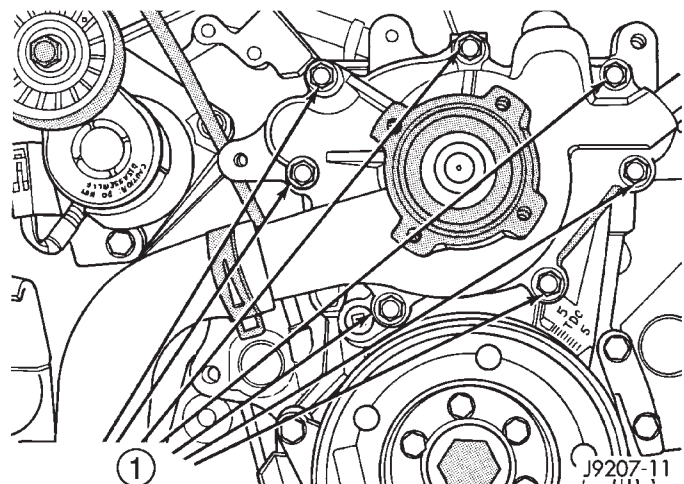
- The body is cracked or damaged



J9307-34

Fig. 51 Coolant Return Tube 5.9L V-8 Engine

- 1 - COOLANT RETURN TUBE
- 2 - WATER PUMP
- 3 - TUBE MOUNTING BOLT
- 4 - O-RING



J9207-11

Fig. 52 Water Pump Bolts - 5.9L V-8 Gas Engine - Typical

- 1 - WATER PUMP MOUNTING BOLTS

• Water leaks from the shaft seal. This is evident by traces of coolant below the vent hole

• Loose or rough turning bearing. Also inspect thermal fan drive

• Impeller rubbing the pump body

INSTALLATION

- (1) Clean gasket mating surfaces.

WATER PUMP - 5.9L (Continued)

(2) Using a new gasket, install water pump to engine as follows: Guide water pump nipple into bypass hose as pump is being installed. Install water pump bolts (Fig. 52). Tighten water pump mounting bolts to 40 N·m (30 ft. lbs.) torque.

(3) Position bypass hose clamp to bypass hose.

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

(5) Install a new o-ring to the heater hose coolant return tube (Fig. 51). Coat the new o-ring with anti-freeze before installation.

(6) Install coolant return tube and its mounting bolt to engine (Fig. 51). Be sure the slot in tube bracket is bottomed to mounting bolt. This will properly position return tube.

(7) Connect radiator lower hose to water pump.

(8) Connect heater hose and hose clamp to coolant return tube.

(9) Install drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION) (Fig. 50).

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

(11) Install fan shroud.

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

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

(14) Connect negative battery cable.

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

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 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - DIAGNOSIS AND TESTING).

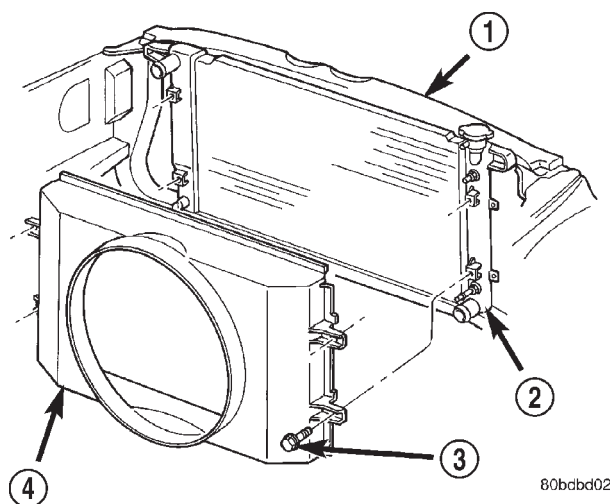
(1) Disconnect negative battery cable from battery.

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

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

(3) Remove windshield washer reservoir tank from radiator fan shroud.

(4) Remove the four fan shroud mounting bolts at the radiator (Fig. 53). Do not attempt to remove shroud from vehicle at this time.



80bcbd02

Fig. 53 Typical Fan Shroud Mounting

- 1 - RADIATOR SUPPORT
- 2 - RADIATOR
- 3 - BOLTS (4)
- 4 - FAN SHROUD

WATER PUMP - 8.0L

DIAGNOSIS AND TESTING—WATER PUMP

A quick test to determine if pump is working is to check if heater warms properly. A defective water pump will not be able to circulate heated coolant through the long heater hose to the heater core.

REMOVAL**NOTE:**

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

The water pump on all gas powered engines is bolted directly to the engine timing chain case/cover.

On the 8.0L V-10 engine, a rubber o-ring (instead of 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

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 a matching number or letter.

(5) Remove radiator upper hose at radiator.

(6) The thermal viscous fan drive is attached (threaded) to the water pump hub shaft (Fig. 55).

WATER PUMP - 8.0L (Continued)

Remove the fan/fan drive assembly from water pump by turning the mounting nut counterclockwise (as viewed from front). Threads on the fan drive are **RIGHT-HAND**. A Snap-On 36 MM Fan Wrench (number SP346 from Snap-On Cummins Diesel Tool Set number 2017DSP) can be used with Special Tool 6958 Spanner Wrench and Adapter Pins 8346 (Fig. 54) to prevent the pulley from rotating.

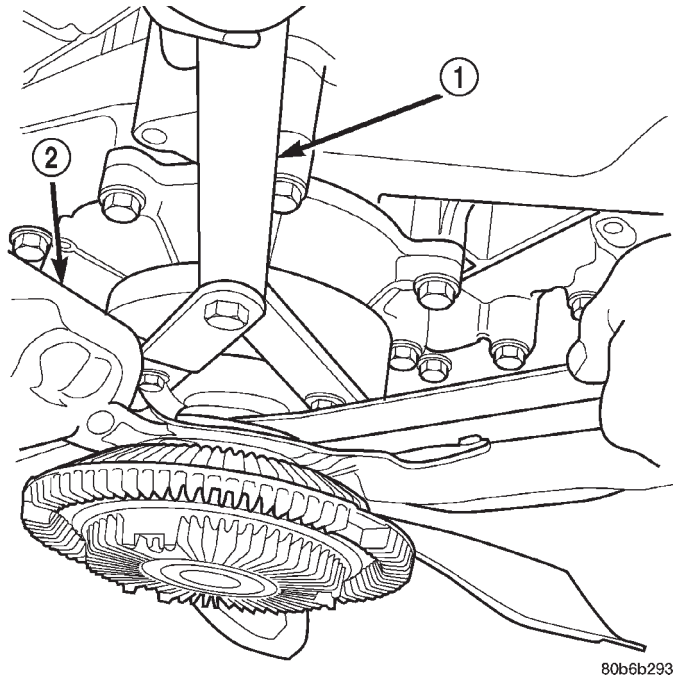


Fig. 54 Using Special Tool 6958 Spanner Wrench and Adapter Pins 8346

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

(7) If water pump is being replaced, do not unbolt fan blade assembly (Fig. 55) from the thermal control fan drive.

(8) Remove fan blade/fan drive and fan shroud as an assembly from vehicle.

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

(9) Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL) (Fig. 56).

(10) Remove the radiator lower hose at water pump.

(11) Remove heater hose at water pump fitting.

(12) Remove the seven water pump mounting bolts (Fig. 57).

(13) Loosen the clamp at the water pump end of bypass hose. Slip the bypass hose from the water

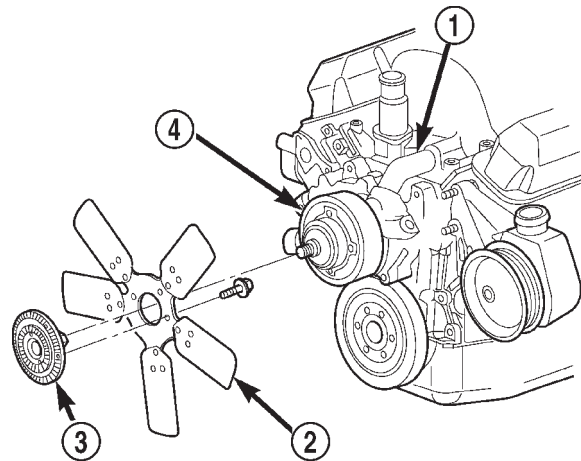


Fig. 55 Fan Blade and Viscous Fan Drive—Typical

- 1 - WATER PUMP BYPASS HOSE
- 2 - FAN BLADE ASSEMBLY
- 3 - VISCOUS FAN DRIVE
- 4 - WATER PUMP AND PULLEY

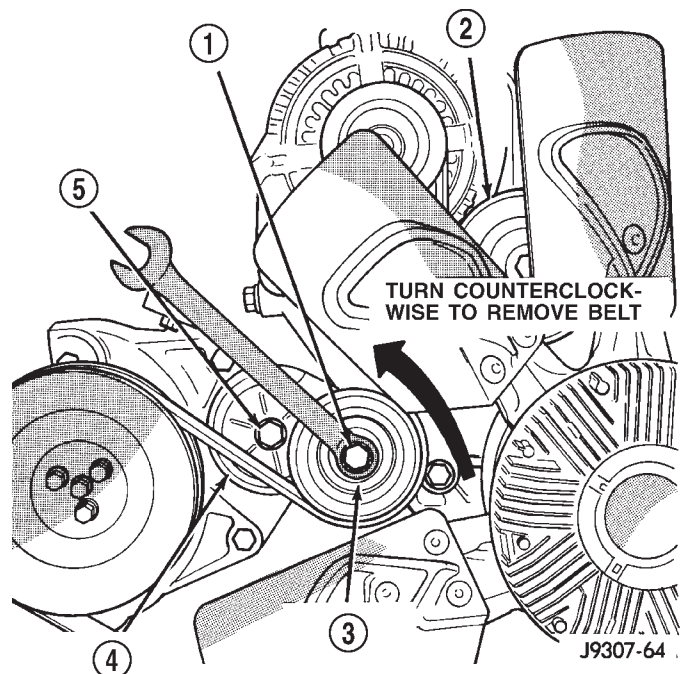


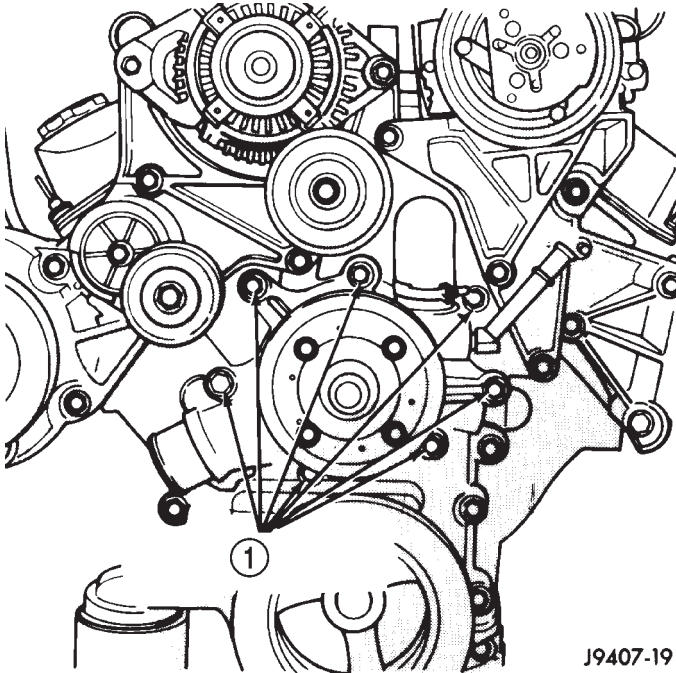
Fig. 56 Belt Tensioner—8.0L V-10 Engine

- 1 - PULLEY BOLT
- 2 - IDLER PULLEY
- 3 - TENSIONER PULLEY
- 4 - TENSIONER
- 5 - TENSIONER MOUNTING BOLT

pump while removing pump from vehicle. Do not remove the clamp from the bypass hose.

(14) Discard the water pump-to-timing chain/case cover o-ring seal (Fig. 58).

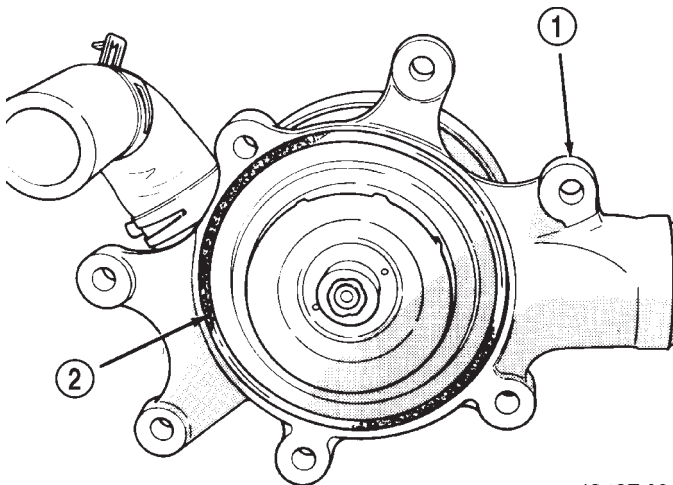
WATER PUMP - 8.0L (Continued)



J9407-19

Fig. 57 Water Pump Bolts—8.0L V-10—Typical

1 - WATER PUMP MOUNTING BOLTS (7)



J9407-18

Fig. 58 Water Pump O-Ring Seal—8.0L V-101 - WATER PUMP
2 - O-RING SEAL

(15) Remove the heater hose fitting from water pump if pump replacement is necessary. Note position (direction) of fitting before removal. Fitting must be re-installed to same position.

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

CLEANING

Clean gasket mating surfaces as necessary.

INSPECTION

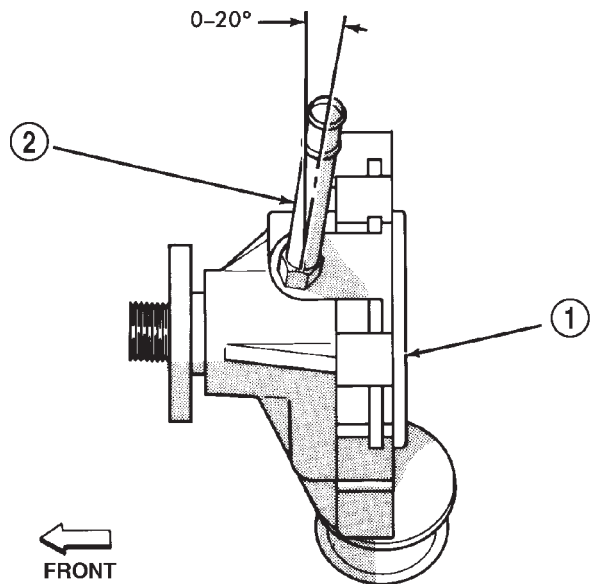
Visually inspect the water pump and replace if it has any of the following conditions:

- The body is cracked or damaged
- Water leaks from the shaft seal. This is evident by traces of coolant below the vent hole
- Loose or rough turning bearing. Also inspect thermal fan drive
- Impeller rubbing the pump body

INSTALLATION

(1) If water pump is being replaced, install the heater hose fitting to the pump. Tighten fitting to 16 N·m (144 in. lbs.) torque. After fitting has been torqued, position fitting as shown in (Fig. 59). When positioning fitting, do not back off (rotate counter-clockwise). Use a sealant on the fitting such as Mopar® Thread Sealant With Teflon. Refer to the directions on the package.

CAUTION: This heater hose fitting must be installed to pump before pump is installed to engine.



J9407-17

Fig. 59 Heater Hose Fitting Position—8.0L V-101 - HEATER HOSE FITTING
2 - WATER PUMP

(2) Clean the o-ring mating surfaces at rear of water pump and front of timing chain/case cover.

(3) Apply a small amount of petroleum jelly to o-ring (Fig. 58). This will help retain o-ring to water pump.

WATER PUMP - 8.0L (Continued)

(4) Install water pump to engine as follows: Guide water pump fitting into bypass hose as pump is being installed. Install water pump bolts (Fig. 57). Tighten water pump mounting bolts to 40 N·m (30 ft. lbs.) torque.

(5) Position bypass hose clamp to bypass hose.

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

(7) Connect radiator lower hose to water pump.

(8) Connect heater hose and hose clamp to heater hose fitting.

(9) Install drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION) (Fig. 56).

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

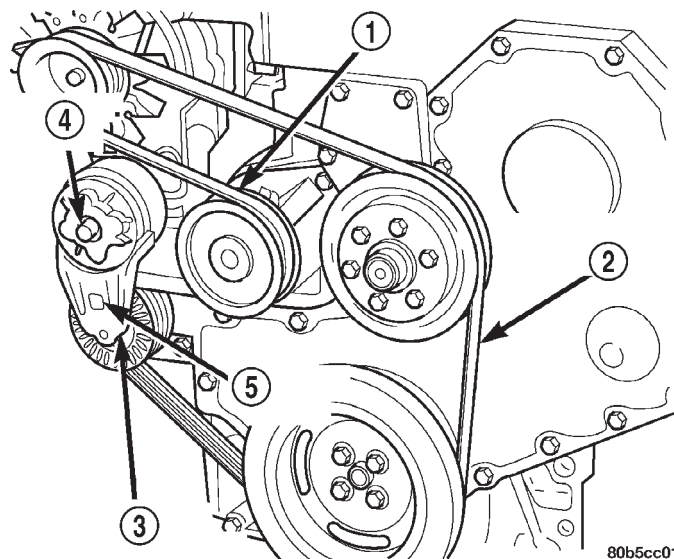
(11) Install fan shroud to radiator. Tighten bolts to 6 N·m (50 in. lbs.) torque.

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

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

(14) Connect negative battery cable.

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



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Fig. 60 Water Pump—5.9L Diesel—Typical (non-A/C shown)

- 1 - WATER PUMP
- 2 - ACCESSORY DRIVE BELT
- 3 - AUTOMATIC BELT TENSIONER
- 4 - MOUNT BOLT
- 5 - 3/8" SQUARE HOLE

WATER PUMP - 5.9L DIESEL

DESCRIPTION

The water pump is mounted to the engine front cover between the automatic belt tensioner and the fan drive pulley (Fig. 60).

The water pump impeller is pressed onto the rear of a shaft that rotates in a bearing pressed into the water pump body. The body has a small hole for ventilation. The water pump seals are lubricated by antifreeze in the coolant mixture. Additional lubrication is not necessary.

OPERATION

The diesel engine water pump draws coolant from radiator outlet and circulates it through engine, heater core and back to radiator inlet. The crankshaft pulley drives the water pump with a serpentine drive belt (Fig. 60).

DIAGNOSIS AND TESTING—WATER PUMP

A quick test to determine if pump is working is to check if heater warms properly. A defective water pump will not be able to circulate heated coolant through the long heater hose to the heater core.

REMOVAL

(1) Disconnect battery negative cables.

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

(3) Remove the bolt retaining the wiring harness near the top of water pump. Position wire harness to the side.

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

(5) Remove water pump mounting bolts (Fig. 61).

(6) Clean water pump sealing surface on cylinder block.

CLEANING

Clean gasket mating surfaces as necessary.

INSPECTION

Visually inspect the water pump and replace if it has any of the following conditions:

- The body is cracked or damaged
- Water leaks from the shaft seal. This is evident by traces of coolant below the vent hole
- Loose or rough turning bearing. Also inspect thermal fan drive
- Impeller rubbing the pump body

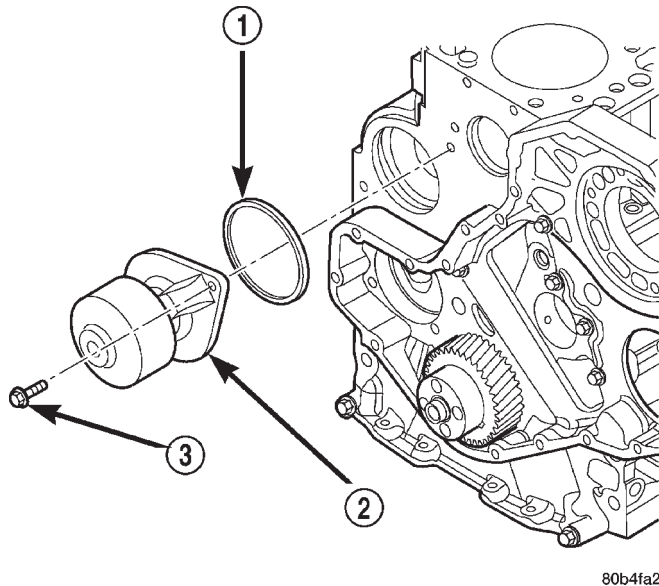
INSTALLATION

(1) Install new O-ring seal in groove on water pump (Fig. 62).

(2) Install water pump. Tighten mounting bolts to 24 N·m (18 ft. lbs.) torque.

(3) Install accessory drive belt. Refer to procedure in this group.

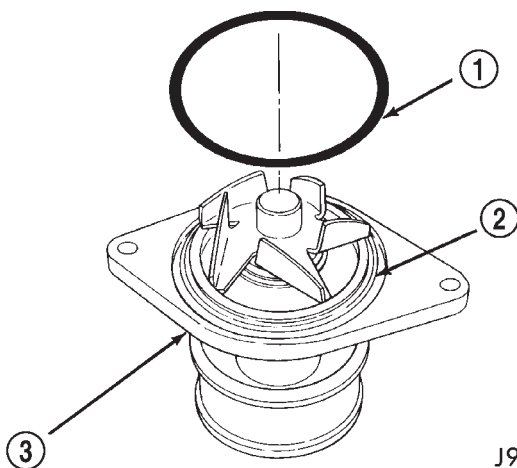
WATER PUMP - 5.9L DIESEL (Continued)



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Fig. 61 Water Pump Removal/Installation

- 1 - O-RING SEAL (SQUARE)
- 2 - WATER PUMP
- 3 - BOLT (2)



J9107-6

Fig. 62 Pump O-ring Seal

- 1 - O-RING SEAL
- 2 - GROOVE
- 3 - WATER PUMP

(4) Install the bolt retaining the wiring harness near top of water pump.

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

(6) Connect both battery cables.

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

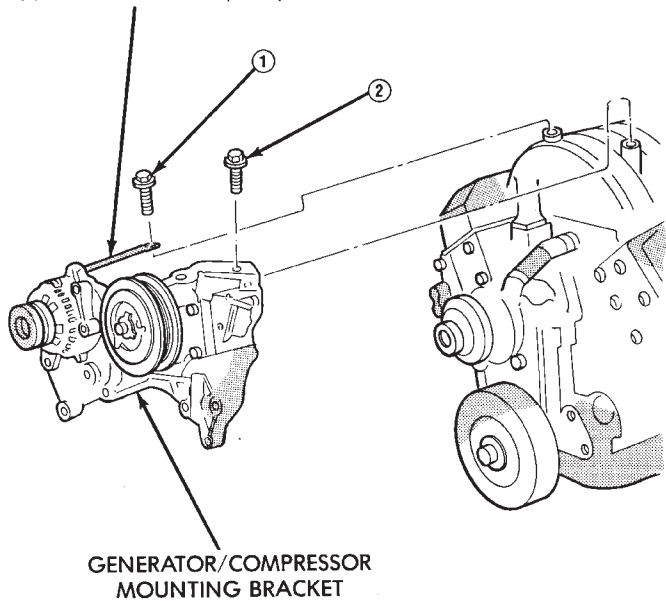
WATER PUMP INLET TUBE - 5.9L

REMOVAL

REMOVAL - WATER PUMP BYPASS HOSE WITH AIR CONDITIONING

If equipped with A/C, the generator and A/C compressor along with their common mounting bracket (Fig. 63) must be partially removed. Removing the generator or A/C compressor from their mounting bracket is not necessary. Also, discharging the A/C system is not necessary. **Do not** remove any refrigerant lines from A/C compressor.

SUPPORT BRACKET (ROD)



J9307-66

Fig. 63 Generator - A/C Compressor Mounting Bracket - Typical

WARNING: THE A/C SYSTEM IS UNDER PRESSURE EVEN WITH THE ENGINE OFF. REFER TO REFRIGERANT WARNINGS IN 24 - HEATING AND AIR CONDITIONING.

WATER PUMP INLET TUBE - 5.9L (Continued)

- (1) Disconnect negative battery cable from battery.
- (2) Partially drain cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE). Do not waste reusable coolant. If the solution is clean, drain the coolant into a clean container for reuse.
- (3) Remove upper radiator hose clamp at radiator. A special clamp tool must be used to remove the constant tension clamps. Remove hose at radiator.
- (4) Disconnect throttle cable from clip at radiator fan shroud.
- (5) Unplug wiring harness from A/C compressor.
- (6) Remove the air cleaner assembly.
- (7) Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
- (8) **5.9L V-8 LDC-Gas:** The drive belt idler pulley must be removed to gain access to one of the A/C compressor/generator bracket mounting bolts. Remove the idler pulley bolt and remove idler pulley (Fig. 64).

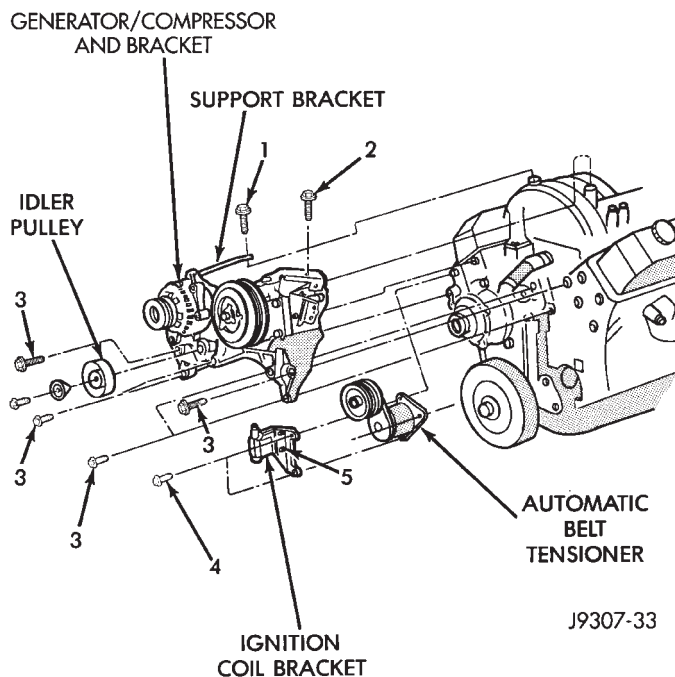


Fig. 64 Idler Pulley - 5.9L V-8 LDC-Gas Engine

- (9) **5.9L HDC-Gas:** The automatic belt tensioner/pulley assembly must be removed to gain access to one of the A/C compressor/generator bracket mounting bolts. Remove the tensioner mounting bolt (Fig. 65) and remove tensioner.

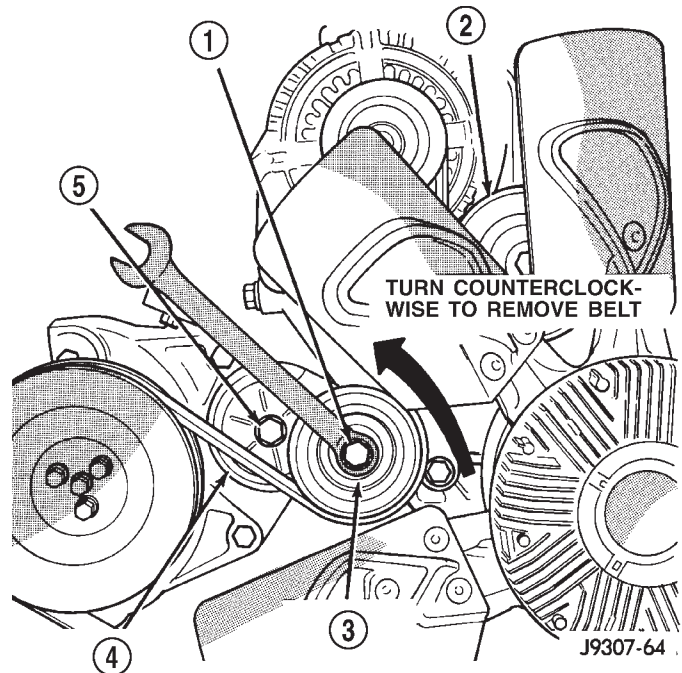


Fig. 65 Belt Tensioner - 5.9L HDC-Gas Engine

- 1 - PULLEY BOLT
- 2 - IDLER PULLEY
- 3 - TENSIONER PULLEY
- 4 - TENSIONER
- 5 - TENSIONER MOUNTING BOLT

- (10) Remove the engine oil dipstick tube mounting bolt at the side of the A/C-generator mounting bracket.

- (11) Disconnect throttle body control cables.

- (12) Remove heater hose coolant return tube mounting bolt (Fig. 66) (Fig. 67) and remove tube from engine. Discard the old tube O-ring.

- (13) Remove bracket-to-intake manifold bolts (number 1 and 2 (Fig. 63).

- (14) Remove remaining bracket-to-engine bolts (Fig. 68) (Fig. 69).

WATER PUMP INLET TUBE - 5.9L (Continued)

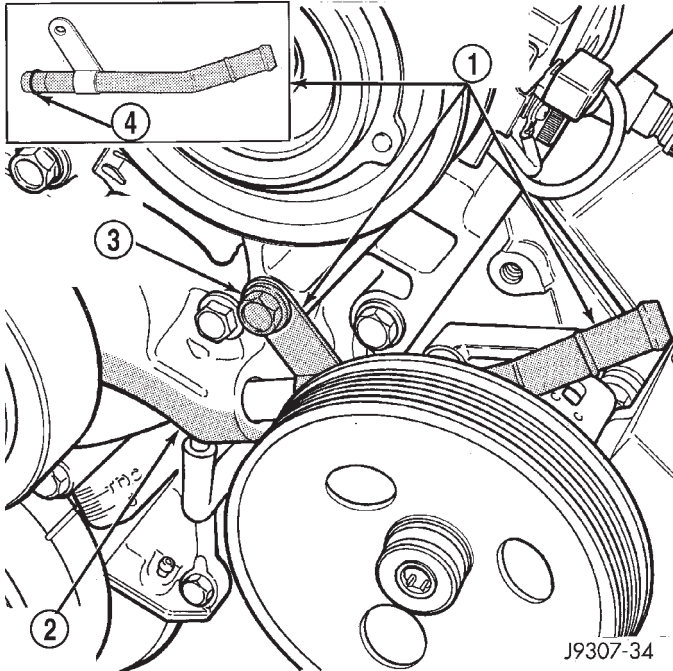


Fig. 66 Coolant Return

- 1 - COOLANT RETURN TUBE
- 2 - WATER PUMP
- 3 - TUBE MOUNTING BOLT
- 4 - O-RING

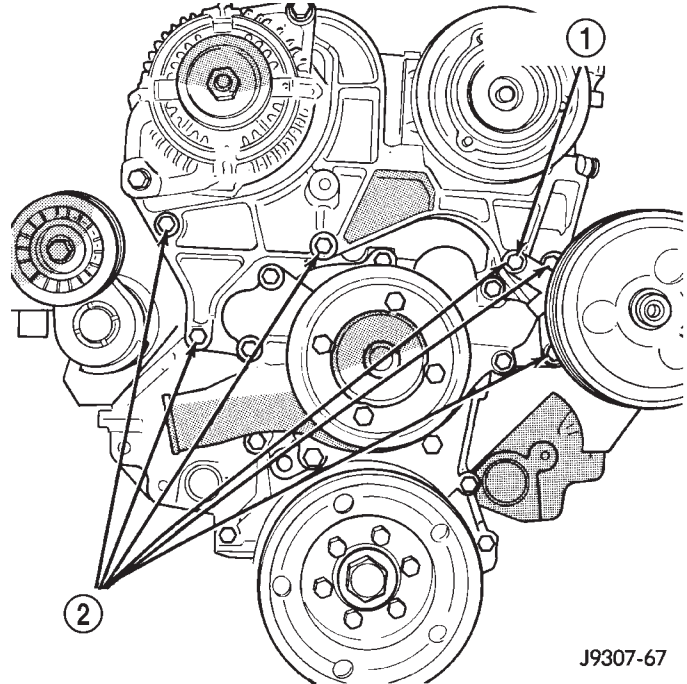


Fig. 68 Bracket Bolts - 5.9L V-8 LDC-Gas

- 1 - COOLANT TUBE MOUNTING BOLT
- 2 - BRACKET MOUNTING BOLTS

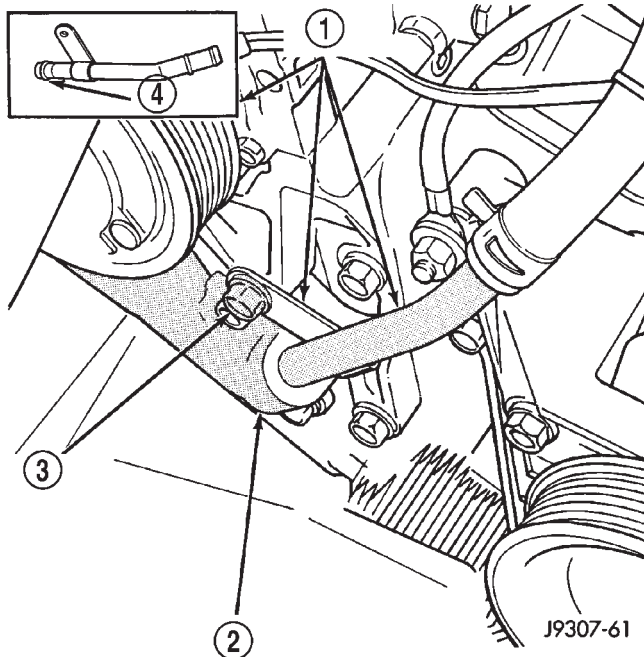


Fig. 67 Coolant Return Tube - 5.9L HDC-Gas Engine

- 1 - COOLANT RETURN TUBE
- 2 - WATER PUMP
- 3 - TUBE MOUNTING BOLT
- 4 - O-RING

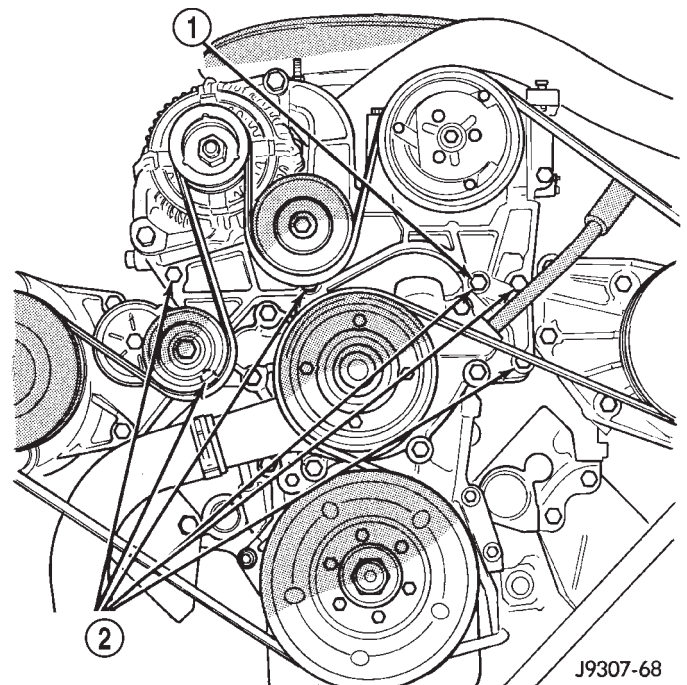


Fig. 69 Bracket Bolts - 5.9L HDC-Gas Engine

- 1 - COOLANT TUBE MOUNTING BOLT
- 2 - BRACKET MOUNTING BOLTS

WATER PUMP INLET TUBE - 5.9L (Continued)

(15) Lift and position generator and A/C compressor (along with their common mounting bracket) to gain access to bypass hose. A block of wood may be used to hold assembly in position.

(16) Loosen and position both hose clamps to the center of bypass hose. A special clamp tool must be used to remove the constant tension clamps. Remove hose from vehicle.

REMOVAL - WATER PUMP BYPASS HOSE WITHOUT AIR CONDITIONING

A water pump bypass hose (Fig. 70) is used between the intake manifold and water pump on all gas powered engines. To test for leaks, (Refer to 7 - COOLING - DIAGNOSIS AND TESTING).

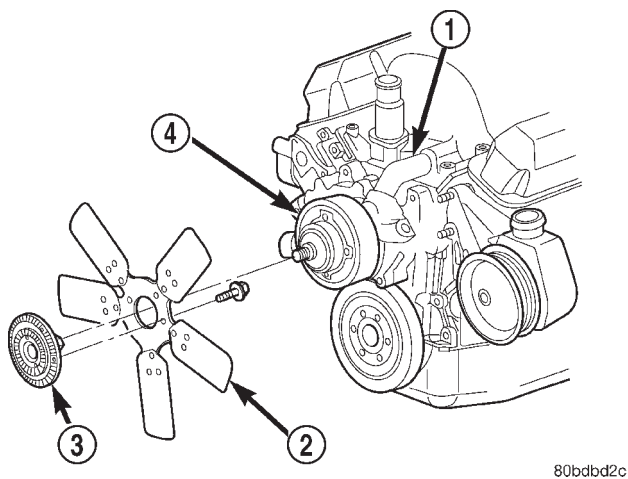


Fig. 70 Water Pump Bypass Hose - Typical

- 1 - WATER PUMP BYPASS HOSE
- 2 - FAN BLADE ASSEMBLY
- 3 - VISCOUS FAN DRIVE
- 4 - WATER PUMP AND PULLEY

(1) Partially drain cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE). 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). 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 a matching number or letter.

(2) Loosen both bypass hose clamps and position to the center of hose.

(3) Remove hose from vehicle.

INSTALLATION

INSTALLATION - WATER PUMP BYPASS HOSE WITH AIR CONDITIONING

(1) Position bypass hose clamps to the center of hose.

(2) Install bypass hose to engine.

(3) Secure both hose clamps.

(4) Install generator-A/C mounting bracket assembly to engine. Tighten bolt number 1 (Fig. 63) to 41 N·m (30 ft. lbs.) torque. Tighten bolt number 2 (Fig. 63) to 28 N·m (20 ft. lbs.) torque. Tighten bracket mounting bolts (Fig. 68) (Fig. 69) to 40 N·m (30 ft. lbs.) torque.

(5) Install a new O-ring to the heater hose coolant return tube (Fig. 66) (Fig. 67). Coat the new O-ring with antifreeze before installation.

(6) Install coolant return tube and its mounting bolt to engine (Fig. 66) (Fig. 67).

(7) Connect throttle body control cables.

(8) Install oil dipstick mounting bolt.

(9) **/5.9L V-8 LDC-Gas Engine:** Install idler pulley. Tighten bolt to 41 N·m (30 ft. lbs.) torque.

WATER PUMP INLET TUBE - 5.9L (Continued)

(10) **5.9L HDC-Gas:** Install automatic belt tensioner assembly to mounting bracket. A dowel pin is located on back of tensioner (Fig. 71). Align this to dowel hole (Fig. 72) in tensioner mounting bracket. Tighten bolt to 41 N·m (30 ft. lbs.) torque.

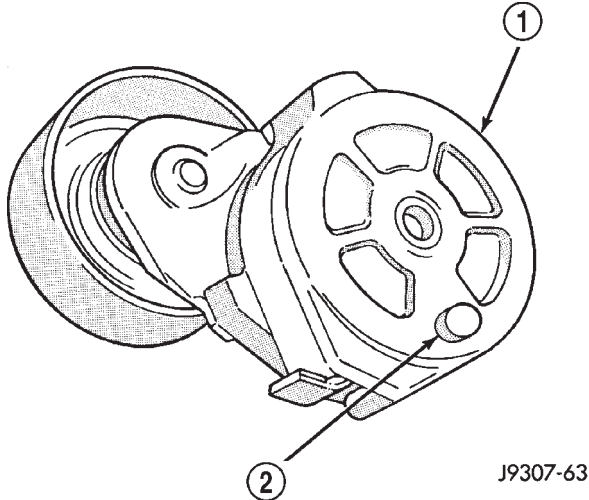


Fig. 71 Tensioner Dowel Pin - 5.9L HDC-Gas Engine

- 1 - BELT TENSIONER
2 - DOWEL PIN

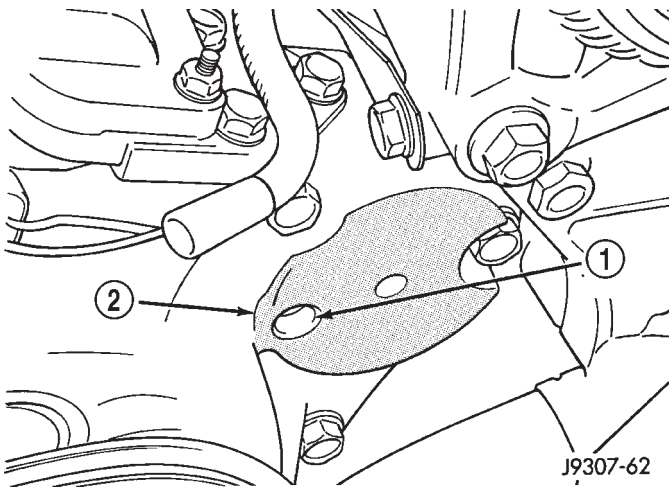


Fig. 72 Tensioner Mounting

- 1 - DOWEL PIN HOLE
2 - TENSIONER MOUNTING BRACKET

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

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 (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION). The correct belt with the correct length must be used.

- (12) Install air cleaner assembly.
(13) Install upper radiator hose to radiator.
(14) Connect throttle cable to clip at radiator fan shroud.
(15) Connect wiring harness to A/C compressor.
(16) Fill cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
(17) Start and warm the engine. Check for leaks.

INSTALLATION - WATER PUMP BYPASS HOSE WITHOUT AIR CONDITIONING

- (1) Position bypass hose clamps to the center of hose.
(2) Install bypass hose to engine.
(3) Secure both hose clamps.
(4) Fill cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
(5) Start and warm the engine. Check for leaks.

TRANSMISSION

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TRANS COOLER - 5.9L

DESCRIPTION

An air-to-oil transmission oil cooler is standard on all engine packages. the cooler is located between the radiator and air conditioning condenser (Fig. 1).

OPERATION

The transmission oil is routed through the cooler where heat is removed from the transmission oil before returning to the transmission. The cooler has an internal thermostat that controls fluid flow through the cooler. When the transmission fluid is cold (less than operating temperature) the fluid is routed through the cooler bypass. when the transmission fluid reaches operating temperatures and above, the thermostat closes off the bypass allowing fluid flow through the cooler. The thermostat MUST be

removed from the cooler before the cooler can be flushed. The thermostat is serviceable.

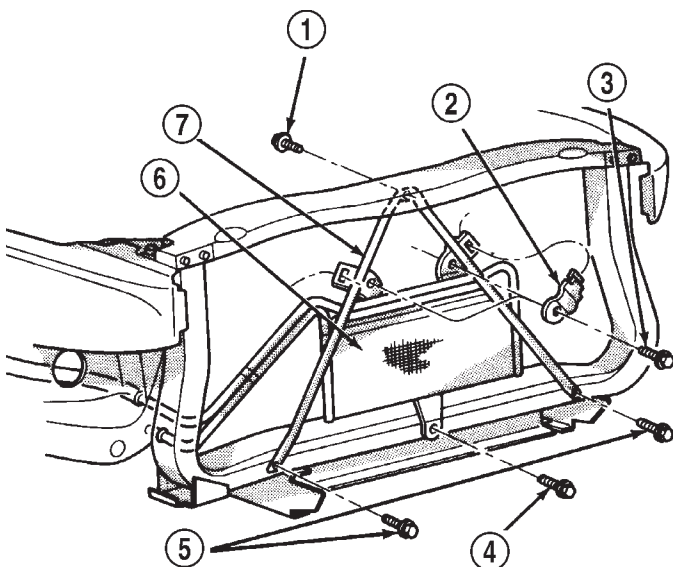
STANDARD PROCEDURE

STANDARD PROCEDURE - FLUSHING
COOLERS AND TUBES - WITH RADIATOR
IN-TANK TRANSMISSION OIL COOLER

When a transmission failure has contaminated the fluid, the oil cooler(s) must be flushed. The torque converter must also be replaced. This will insure that metal particles or sludged oil are not later transferred back into the reconditioned (or replaced) transmission.

The only recommended procedure for flushing coolers and lines is to use Tool 6906-B Cooler Flusher.

TRANS COOLER - 5.9L (Continued)



J9407-40

Fig. 1 Automatic Transmission Oil

- 1 - UPPER RADIATOR SUPPORT BRACKET BOLT
- 2 - MOUNTING STRAPS (2)
- 3 - TRANS. OIL COOLER UPPER MOUNTING BOLT (2)
- 4 - TRANS. OIL COOLER LOWER MOUNTING BOLT (2)
- 5 - LOWER RADIATOR SUPPORT BRACKET BOLT (2)
- 6 - TRANSMISSION OIL COOLER
- 7 - RADIATOR SUPPORT BRACKET

WARNING:

WEAR PROTECTIVE EYEWEAR THAT MEETS THE REQUIREMENTS OF OSHA AND ANSI Z87.1-1968. WEAR STANDARD INDUSTRIAL RUBBER GLOVES. KEEP LIGHTED CIGARETTES, SPARKS, FLAMES, AND OTHER IGNITION SOURCES AWAY FROM THE AREA TO PREVENT THE IGNITION OF COMBUSTIBLE LIQUIDS AND GASES. KEEP A CLASS (B) FIRE EXTINGUISHER IN THE AREA WHERE THE FLUSHER WILL BE USED.

KEEP THE AREA WELL VENTILATED.

DO NOT LET FLUSHING SOLVENT COME IN CONTACT WITH YOUR EYES OR SKIN: IF EYE CONTAMINATION OCCURS, FLUSH EYES WITH WATER FOR 15 TO 20 SECONDS. REMOVE CONTAMINATED CLOTHING AND WASH AFFECTED SKIN WITH SOAP AND WATER. SEEK MEDICAL ATTENTION.

(1) Remove cover plate filler plug on Tool 6906-B. Fill reservoir 1/2 to 3/4 full of fresh flushing solution. Flushing solvents are petroleum based solutions generally used to clean automatic transmission components. **DO NOT** use solvents containing acids, water, gasoline, or any other corrosive liquids.

(2) Reinstall filler plug on Tool 6906-B.

(3) Verify pump power switch is turned OFF. Connect red alligator clip to positive (+) battery post. Connect black (-) alligator clip to a good ground.

(4) Disconnect the cooler lines at the transmission.

NOTE: When flushing transmission cooler and lines, ALWAYS reverse flush.

NOTE: The converter drainback valve must be removed and an appropriate replacement hose installed to bridge the space between the transmission cooler line and the cooler fitting. Failure to remove the drainback valve will prevent reverse flushing the system. A suitable replacement hose can be found in the adapter kit supplied with the flushing tool.

(5) Connect the BLUE pressure line to the OUT-LET (From) cooler line.

(6) Connect the CLEAR return line to the INLET (To) cooler line

(7) Turn pump ON for two to three minutes to flush cooler(s) and lines.

(8) Turn pump OFF.

(9) Disconnect CLEAR suction line from reservoir at cover plate. Disconnect CLEAR return line at cover plate, and place it in a drain pan.

(10) Turn pump ON for 30 seconds to purge flushing solution from cooler and lines. Turn pump OFF.

(11) Place CLEAR suction line into a one quart container of Mopar® ATF +4, type 9602, Automatic Transmission Fluid.

(12) Turn pump ON until all transmission fluid is removed from the one quart container and lines. This purges any residual cleaning solvent from the transmission cooler and lines. Turn pump OFF.

(13) Disconnect alligator clips from battery. Reconnect flusher lines to cover plate, and remove flushing adapters from cooler lines.

STANDARD PROCEDURE - FLUSHING COOLERS AND TUBES - WITHOUT RADIATOR IN-TANK TRANSMISSION OIL COOLER

When a transmission failure has contaminated the fluid, the oil cooler(s) must be flushed. The torque converter must also be replaced. This will insure that metal particles or sludged oil are not later transferred back into the reconditioned (or replaced) transmission.

(1) Remove cover plate filler plug on Tool 6906B. Fill reservoir 1/2 to 3/4 full of fresh flushing solution. Flushing solvents are petroleum based solutions generally used to clean automatic transmission components. **DO NOT** use solvents containing acids, water, gasoline, or any other corrosive liquids.

TRANS COOLER - 5.9L (Continued)

- (2) Reinstall filler plug on Tool 6906B.
- (3) Verify pump power switch is turned OFF. Connect red alligator clip to positive (+) battery post. Connect black (-) alligator clip to a good ground.
- (4) Disconnect the cooler lines at the transmission.

NOTE: When flushing transmission cooler and lines, ALWAYS reverse flush.

NOTE: The converter drainback valve must be removed and an appropriate replacement hose installed to bridge the space between the transmission cooler line and the cooler fitting. Failure to remove the drainback valve will prevent reverse flushing the system. A suitable replacement hose can be found in the adapter kit supplied with the flushing tool.

- (5) Connect the BLUE pressure line to the OUTLET (From) cooler line.
- (6) Connect the CLEAR return line to the INLET (To) cooler line
- (7) Remove the transmission oil cooler from the vehicle. (Refer to 7 - COOLING/TRANSMISSION/TRANS COOLER - REMOVAL)
- (8) Remove the transmission oil cooler thermostat. (Refer to 7 - COOLING/TRANSMISSION/TRANS COOLER - DISASSEMBLY)
- (9) Re-install the thermostat cover onto the oil cooler and install the snap-ring.
- (10) Re-connect the oil cooler to the transmission cooler lines.
- (11) Turn pump ON for two to three minutes to flush cooler(s) and lines.

NOTE: This flushes the bypass circuit of the cooler only.

- (12) Turn pump OFF.
- (13) Remove the thermostat cover from the oil cooler.
- (14) Install Special Tool Cooler Plug 8414 into the transmission oil cooler.
- (15) Re-install the thermostat cover onto the oil cooler and install the snap-ring.
- (16) Turn pump ON for two to three minutes to flush cooler(s) and lines.

NOTE: This flushes the main oil cooler core passages only.

- (17) Turn pump OFF.
- (18) Remove the thermostat cover from the oil cooler.
- (19) Remove Special Tool Cooler Plug 8414 from the transmission oil cooler.

- (20) Install a new thermostat spring, thermostat, cover, and snap-ring into the transmission oil cooler. (Refer to 7 - COOLING/TRANSMISSION/TRANS COOLER - ASSEMBLY)

- (21) Install the transmission oil cooler onto the vehicle. (Refer to 7 - COOLING/TRANSMISSION/TRANS COOLER - INSTALLATION)

- (22) Disconnect CLEAR suction line from reservoir at cover plate. Disconnect CLEAR return line at cover plate, and place it in a drain pan.

- (23) Turn pump ON for 30 seconds to purge flushing solution from cooler and lines. Turn pump OFF.

- (24) Place CLEAR suction line into a one quart container of Mopar® ATF +4, type 9602, Automatic Transmission fluid.

- (25) Turn pump ON until all transmission fluid is removed from the one quart container and lines. This purges any residual cleaning solvent from the transmission cooler and lines. Turn pump OFF.

- (26) Disconnect alligator clips from battery. Reconnect flusher lines to cover plate, and remove flushing adapters from cooler lines.

REMOVAL

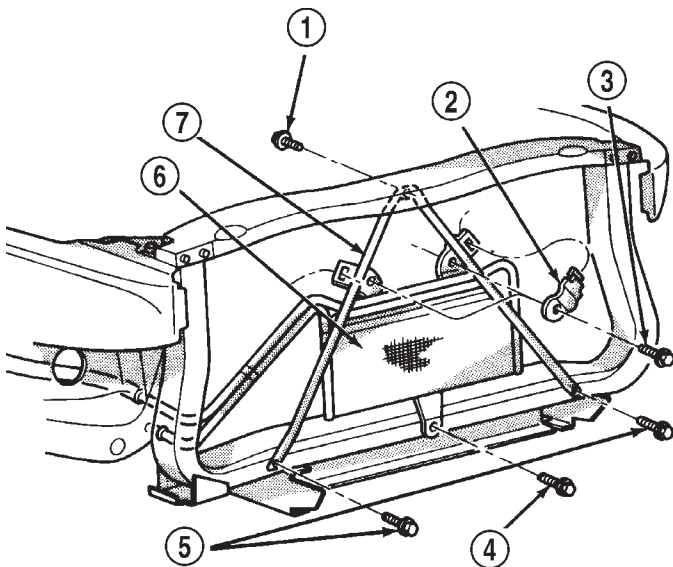
- (1) Disconnect battery negative cable.
- (2) Place a drain pan under the oil cooler lines.
- (3) Disconnect the transmission oil cooler line quick-connect fitting at the cooler outlet using the quick connect release tool 6935. Loosen clamp from inlet connection and slide hose off of nipple. Plug cooler lines to prevent oil leakage.
- (4) Remove the oil cooler lower mounting bolt (oil cooler-to-vehicle body) (Fig. 2).
- (5) Remove three bolts (radiator support bracket-to-body). Remove this A-shaped support bracket and the transmission oil cooler as an assembly from the vehicle. Take care not to damage the radiator core or A/C condenser fins with the cooling lines when removing.
- (6) Remove oil cooler from A-shaped support bracket by removing two upper mounting strap bolts and mounting straps at support bracket (Fig. 2).
- (7) Remove oil cooler from the A-shaped radiator support bracket.

DISASSEMBLY

NOTE: The transmission oil cooler uses an internal thermostat to control transmission oil flow through the cooler. This thermostat is servicable.

- (1) Remove the transmission oil cooler (Refer to 7 - COOLING/TRANSMISSION/TRANS COOLER - REMOVAL).
- (2) Remove the snap ring retaining the thermostat end plug (Fig. 3).

TRANS COOLER - 5.9L (Continued)

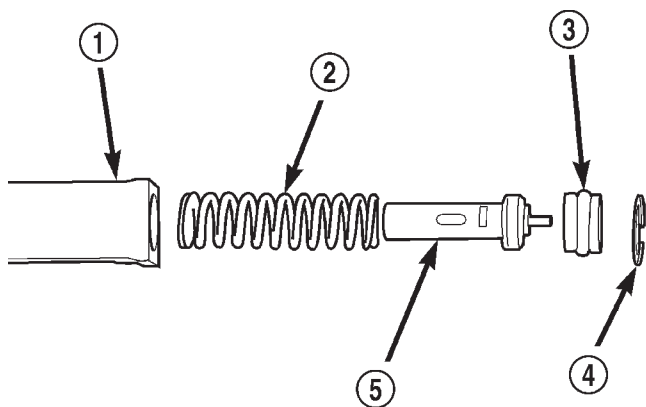


J9407-40

Fig. 2 Transmission Oil Cooler - 5.9L Engine

- 1 - UPPER RADIATOR SUPPORT BRACKET BOLT
- 2 - MOUNTING STRAPS (2)
- 3 - TRANS. OIL COOLER UPPER MOUNTING BOLT (2)
- 4 - TRANS. OIL COOLER LOWER MOUNTING BOLT (2)
- 5 - LOWER RADIATOR SUPPORT BRACKET BOLT (2)
- 6 - TRANSMISSION OIL COOLER
- 7 - RADIATOR SUPPORT BRACKET

(3) Remove the end plug, thermostat and spring from transmission oil cooler (Fig. 3).



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Fig. 3 Transmission Oil Cooler Thermostat Removal/Installation

- 1 - THERMOSTAT HOUSING
- 2 - SPRING
- 3 - END PLUG
- 4 - SNAP RING
- 5 - THERMOSTAT

ASSEMBLY

(1) Thoroughly clean the thermostat bore on the transmission oil cooler.

(2) Install new spring, thermostat, end plug and snap ring.

(3) Install transmission oil cooler (Refer to 7 - COOLING/TRANSMISSION/TRANS COOLER - INSTALLATION).

INSTALLATION

(1) Install the oil cooler assembly to the A-shaped radiator support bracket using the two upper mounting bolts and mounting straps. Install the bolts but do not tighten at this time.

(2) Install the radiator support bracket and oil cooler (as an assembly) to the vehicle.

(3) Install the two lower radiator A-shaped support bracket bolts. Do not tighten bolts at this time.

(4) Slide and position the oil cooler on the A-shaped bracket until its lower mounting hole lines up with the bolt hole on the vehicle body. Tighten the oil cooler mounting strap bolts to 6 N·m (50 in. lbs.) torque.

(5) Install the upper radiator A-shaped support bracket bolt. Tighten all three radiator support bracket mounting bolts to 11 N·m (95 in. lbs.) torque.

(6) Inspect quick connect fitting for debris and install the quick-connect fitting on the cooler outler tube until an audible "click" is heard. Pull apart to verify connection.

(7) Connect battery negative cable.

(8) Start the engine and check all fittings for leaks.

(9) Check the fluid level in the automatic transmission (Refer to 21 - TRANSMISSION/TRANS-AXLE/AUTOMATIC - 42RE/FLUID - STANDARD PROCEDURE), (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 44RE/FLUID - STANDARD PROCEDURE) or (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 46RE/FLUID - STANDARD PROCEDURE).

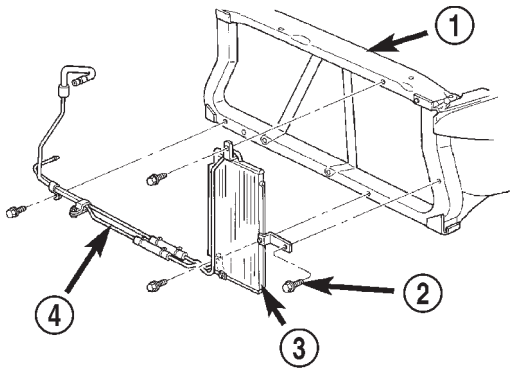
TRANS COOLER - 8.0L**DESCRIPTION**

The air-to-oil cooler is located in front of and to the left side of the radiator (Fig. 4). This cooler is supplied as standard equipment on all models equipped with an automatic transmission.

OPERATION

The transmission oil is routed through the cooler where the cooler removes heat from the transmission fluid, before returning to the transmission.

TRANS COOLER - 8.0L (Continued)



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Fig. 4 Automatic Transmission Oil Cooler—8.0L Engine

- 1 - RADIATOR SUPPORT
- 2 - OIL COOLER MOUNTING BOLTS
- 3 - TRANSMISSION OIL COOLER
- 4 - TRANSMISSION OIL COOLER LINES

STANDARD PROCEDURE

STANDARD PROCEDURE - FLUSHING COOLERS AND TUBES - WITH RADIATOR IN-TANK TRANSMISSION OIL COOLER

When a transmission failure has contaminated the fluid, the oil cooler(s) must be flushed. The torque converter must also be replaced. This will insure that metal particles or sludged oil are not later transferred back into the reconditioned (or replaced) transmission.

The only recommended procedure for flushing coolers and lines is to use Tool 6906-B Cooler Flusher.

WARNING:

WEAR PROTECTIVE EYEWEAR THAT MEETS THE REQUIREMENTS OF OSHA AND ANSI Z87.1-1968. WEAR STANDARD INDUSTRIAL RUBBER GLOVES. KEEP LIGHTED CIGARETTES, SPARKS, FLAMES, AND OTHER IGNITION SOURCES AWAY FROM THE AREA TO PREVENT THE IGNITION OF COMBUSTIBLE LIQUIDS AND GASES. KEEP A CLASS (B) FIRE EXTINGUISHER IN THE AREA WHERE THE FLUSHER WILL BE USED.

KEEP THE AREA WELL VENTILATED.

DO NOT LET FLUSHING SOLVENT COME IN CONTACT WITH YOUR EYES OR SKIN: IF EYE CONTAMINATION OCCURS, FLUSH EYES WITH WATER FOR 15 TO 20 SECONDS. REMOVE CONTAMINATED CLOTHING AND WASH AFFECTED SKIN WITH SOAP AND WATER. SEEK MEDICAL ATTENTION.

(1) Remove cover plate filler plug on Tool 6906-B. Fill reservoir 1/2 to 3/4 full of fresh flushing solution. Flushing solvents are petroleum based solutions generally used to clean automatic transmission compo-

nents. **DO NOT** use solvents containing acids, water, gasoline, or any other corrosive liquids.

(2) Reinstall filler plug on Tool 6906-B.

(3) Verify pump power switch is turned OFF. Connect red alligator clip to positive (+) battery post. Connect black (-) alligator clip to a good ground.

(4) Disconnect the cooler lines at the transmission.

NOTE: When flushing transmission cooler and lines, ALWAYS reverse flush.

NOTE: The converter drainback valve must be removed and an appropriate replacement hose installed to bridge the space between the transmission cooler line and the cooler fitting. Failure to remove the drainback valve will prevent reverse flushing the system. A suitable replacement hose can be found in the adapter kit supplied with the flushing tool.

(5) Connect the BLUE pressure line to the OUT-LET (From) cooler line.

(6) Connect the CLEAR return line to the INLET (To) cooler line

(7) Turn pump ON for two to three minutes to flush cooler(s) and lines.

(8) Turn pump OFF.

(9) Disconnect CLEAR suction line from reservoir at cover plate. Disconnect CLEAR return line at cover plate, and place it in a drain pan.

(10) Turn pump ON for 30 seconds to purge flushing solution from cooler and lines. Turn pump OFF.

(11) Place CLEAR suction line into a one quart container of Mopar® ATF +4, type 9602, Automatic Transmission Fluid.

(12) Turn pump ON until all transmission fluid is removed from the one quart container and lines. This purges any residual cleaning solvent from the transmission cooler and lines. Turn pump OFF.

(13) Disconnect alligator clips from battery. Reconnect flusher lines to cover plate, and remove flushing adapters from cooler lines.

STANDARD PROCEDURE - FLUSHING COOLERS AND TUBES - WITHOUT RADIATOR IN-TANK TRANSMISSION OIL COOLER

When a transmission failure has contaminated the fluid, the oil cooler(s) must be flushed. The torque converter must also be replaced. This will insure that metal particles or sludged oil are not later transferred back into the reconditioned (or replaced) transmission.

(1) Remove cover plate filler plug on Tool 6906B. Fill reservoir 1/2 to 3/4 full of fresh flushing solution. Flushing solvents are petroleum based solutions gen-

TRANS COOLER - 8.0L (Continued)

erally used to clean automatic transmission components. **DO NOT** use solvents containing acids, water, gasoline, or any other corrosive liquids.

- (2) Reinstall filler plug on Tool 6906B.
- (3) Verify pump power switch is turned OFF. Connect red alligator clip to positive (+) battery post. Connect black (-) alligator clip to a good ground.
- (4) Disconnect the cooler lines at the transmission.

NOTE: When flushing transmission cooler and lines, ALWAYS reverse flush.

NOTE: The converter drainback valve must be removed and an appropriate replacement hose installed to bridge the space between the transmission cooler line and the cooler fitting. Failure to remove the drainback valve will prevent reverse flushing the system. A suitable replacement hose can be found in the adapter kit supplied with the flushing tool.

- (5) Connect the BLUE pressure line to the OUTLET (From) cooler line.
- (6) Connect the CLEAR return line to the INLET (To) cooler line
- (7) Remove the transmission oil cooler from the vehicle. (Refer to 7 - COOLING/TRANSMISSION/TRANS COOLER - REMOVAL)
- (8) Remove the transmission oil cooler thermostat. (Refer to 7 - COOLING/TRANSMISSION/TRANS COOLER - DISASSEMBLY)
- (9) Re-install the thermostat cover onto the oil cooler and install the snap-ring.
- (10) Re-connect the oil cooler to the transmission cooler lines.
- (11) Turn pump ON for two to three minutes to flush cooler(s) and lines.

NOTE: This flushes the bypass circuit of the cooler only.

- (12) Turn pump OFF.
- (13) Remove the thermostat cover from the oil cooler.
- (14) Install Special Tool Cooler Plug 8414 into the transmission oil cooler.
- (15) Re-install the thermostat cover onto the oil cooler and install the snap-ring.
- (16) Turn pump ON for two to three minutes to flush cooler(s) and lines.

NOTE: This flushes the main oil cooler core passages only.

- (17) Turn pump OFF.
- (18) Remove the thermostat cover from the oil cooler.

(19) Remove Special Tool Cooler Plug 8414 from the transmission oil cooler.

(20) Install a new thermostat spring, thermostat, cover, and snap-ring into the transmission oil cooler. (Refer to 7 - COOLING/TRANSMISSION/TRANS COOLER - ASSEMBLY)

(21) Install the transmission oil cooler onto the vehicle. (Refer to 7 - COOLING/TRANSMISSION/TRANS COOLER - INSTALLATION)

(22) Disconnect CLEAR suction line from reservoir at cover plate. Disconnect CLEAR return line at cover plate, and place it in a drain pan.

(23) Turn pump ON for 30 seconds to purge flushing solution from cooler and lines. Turn pump OFF.

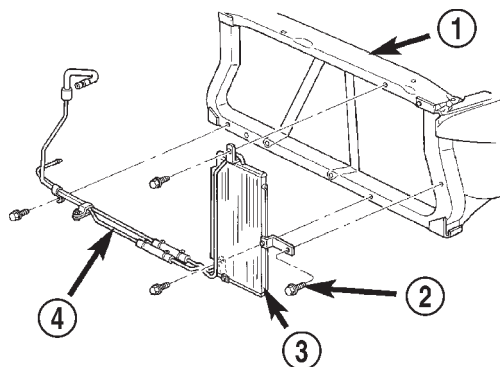
(24) Place CLEAR suction line into a one quart container of Mopar® ATF +4, type 9602, Automatic Transmission fluid.

(25) Turn pump ON until all transmission fluid is removed from the one quart container and lines. This purges any residual cleaning solvent from the transmission cooler and lines. Turn pump OFF.

(26) Disconnect alligator clips from battery. Reconnect flusher lines to cover plate, and remove flushing adapters from cooler lines.

REMOVAL

- (1) Place a drain pan under the oil cooler lines.
- (2) Disconnect the two transmission lines from the oil cooler by loosening the two worm gear clamps and pulling the rubber hoses off of the oil cooler tubes (Fig. 5). Plug all oil cooler lines to prevent oil leakage.
- (3) Remove three oil cooler-to-radiator support mounting bolts (Fig. 5).
- (4) Remove the oil cooler and line assembly from the vehicle.



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Fig. 5 Transmission Oil Cooler—8.0L Engine

- 1 - RADIATOR SUPPORT
- 2 - OIL COOLER MOUNTING BOLTS
- 3 - TRANSMISSION OIL COOLER
- 4 - TRANSMISSION OIL COOLER LINES

TRANS COOLER - 8.0L (Continued)

INSTALLATION

(1) Install the oil cooler and cooler line assembly to the vehicle.

(2) Install three mounting bolts and tighten to 6 N·m (50 in. lbs.) torque.

(3) Connect the transmission cooling lines to the oil cooler by pushing the rubber hoses onto the oil cooler tubes. Tighten the worm gear clamps to 2 N·m (18 in. lbs.)

(4) Start the engine and check all fittings for leaks.

(5) Check the fluid level in the automatic transmission (Refer to 21 - TRANSMISSION/TRANS-AXLE/AUTOMATIC - 47RE/FLUID - STANDARD PROCEDURE).

TRANS COOLER - 5.9L DIESEL

DESCRIPTION

All diesel models equipped with an automatic transmission are equipped with both a main water-to-oil cooler and a separate air-to-oil cooler. Both coolers are supplied as standard equipment on diesel engine powered models when equipped with an automatic transmission.

The main water-to-oil transmission oil cooler is mounted to a bracket on the turbocharger side of the engine (Fig. 6).

The air-to-oil cooler is located in front of and to the left side of the radiator (Fig. 7).

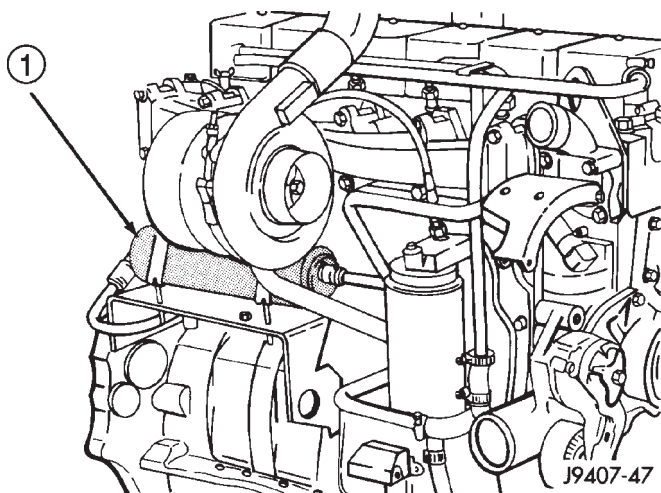
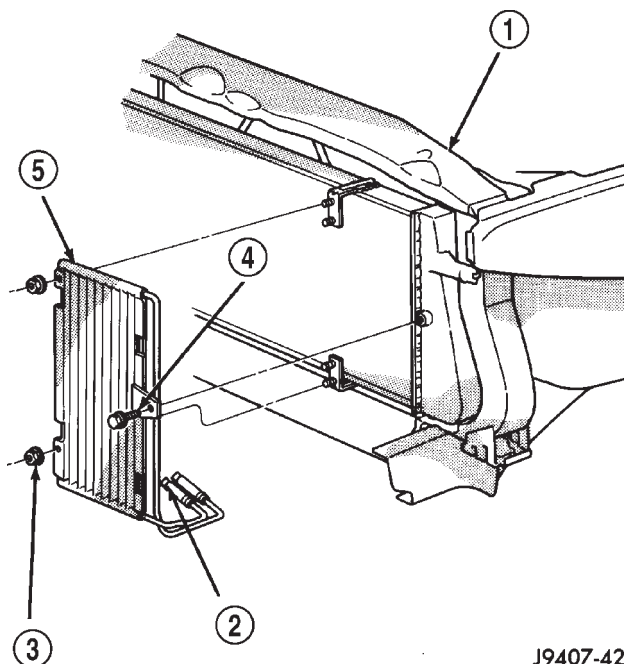


Fig. 6 Transmission Water-To-Oil Cooler—Diesel Engine—Typical

1 - TRANSMISSION WATER-TO-OIL COOLER



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Fig. 7 Auxiliary Transmission Oil Cooler—Diesel Engine

- 1 - CHARGE AIR COOLER (INTERCOOLER)
- 2 - QUICK-CONNECT FITTINGS (2)
- 3 - MOUNTING NUTS (2)
- 4 - MOUNTING BOLT
- 5 - TRANSMISSION OIL COOLER

OPERATION

The transmission oil is routed through the main cooler first, then the auxiliary cooler where additional heat is removed from the transmission oil before returning to the transmission.

STANDARD PROCEDURE

STANDARD PROCEDURE - FLUSHING COOLERS AND TUBES - WITH RADIATOR IN-TANK TRANSMISSION OIL COOLER

When a transmission failure has contaminated the fluid, the oil cooler(s) must be flushed. The torque converter must also be replaced. This will insure that metal particles or sludged oil are not later transferred back into the reconditioned (or replaced) transmission.

The only recommended procedure for flushing coolers and lines is to use Tool 6906-B Cooler Flusher.

TRANS COOLER - 5.9L DIESEL (Continued)

WARNING:

WEAR PROTECTIVE EYEWEAR THAT MEETS THE REQUIREMENTS OF OSHA AND ANSI Z87.1-1968. WEAR STANDARD INDUSTRIAL RUBBER GLOVES. KEEP LIGHTED CIGARETTES, SPARKS, FLAMES, AND OTHER IGNITION SOURCES AWAY FROM THE AREA TO PREVENT THE IGNITION OF COMBUSTIBLE LIQUIDS AND GASES. KEEP A CLASS (B) FIRE EXTINGUISHER IN THE AREA WHERE THE FLUSHER WILL BE USED.

KEEP THE AREA WELL VENTILATED.

DO NOT LET FLUSHING SOLVENT COME IN CONTACT WITH YOUR EYES OR SKIN: IF EYE CONTAMINATION OCCURS, FLUSH EYES WITH WATER FOR 15 TO 20 SECONDS. REMOVE CONTAMINATED CLOTHING AND WASH AFFECTED SKIN WITH SOAP AND WATER. SEEK MEDICAL ATTENTION.

(1) Remove cover plate filler plug on Tool 6906-B. Fill reservoir 1/2 to 3/4 full of fresh flushing solution. Flushing solvents are petroleum based solutions generally used to clean automatic transmission components. **DO NOT** use solvents containing acids, water, gasoline, or any other corrosive liquids.

(2) Reinstall filler plug on Tool 6906-B.

(3) Verify pump power switch is turned OFF. Connect red alligator clip to positive (+) battery post. Connect black (-) alligator clip to a good ground.

(4) Disconnect the cooler lines at the transmission.

NOTE: When flushing transmission cooler and lines, ALWAYS reverse flush.

NOTE: The converter drainback valve must be removed and an appropriate replacement hose installed to bridge the space between the transmission cooler line and the cooler fitting. Failure to remove the drainback valve will prevent reverse flushing the system. A suitable replacement hose can be found in the adapter kit supplied with the flushing tool.

(5) Connect the BLUE pressure line to the OUTLET (From) cooler line.

(6) Connect the CLEAR return line to the INLET (To) cooler line

(7) Turn pump ON for two to three minutes to flush cooler(s) and lines.

(8) Turn pump OFF.

(9) Disconnect CLEAR suction line from reservoir at cover plate. Disconnect CLEAR return line at cover plate, and place it in a drain pan.

(10) Turn pump ON for 30 seconds to purge flushing solution from cooler and lines. Turn pump OFF.

(11) Place CLEAR suction line into a one quart container of Mopar® ATF +4, type 9602, Automatic Transmission Fluid.

(12) Turn pump ON until all transmission fluid is removed from the one quart container and lines. This purges any residual cleaning solvent from the transmission cooler and lines. Turn pump OFF.

(13) Disconnect alligator clips from battery. Reconnect flusher lines to cover plate, and remove flushing adapters from cooler lines.

STANDARD PROCEDURE - FLUSHING COOLERS AND TUBES - WITHOUT RADIATOR IN-TANK TRANSMISSION OIL COOLER

When a transmission failure has contaminated the fluid, the oil cooler(s) must be flushed. The torque converter must also be replaced. This will insure that metal particles or sludged oil are not later transferred back into the reconditioned (or replaced) transmission.

(1) Remove cover plate filler plug on Tool 6906B. Fill reservoir 1/2 to 3/4 full of fresh flushing solution. Flushing solvents are petroleum based solutions generally used to clean automatic transmission components. **DO NOT** use solvents containing acids, water, gasoline, or any other corrosive liquids.

(2) Reinstall filler plug on Tool 6906B.

(3) Verify pump power switch is turned OFF. Connect red alligator clip to positive (+) battery post. Connect black (-) alligator clip to a good ground.

(4) Disconnect the cooler lines at the transmission.

NOTE: When flushing transmission cooler and lines, ALWAYS reverse flush.

NOTE: The converter drainback valve must be removed and an appropriate replacement hose installed to bridge the space between the transmission cooler line and the cooler fitting. Failure to remove the drainback valve will prevent reverse flushing the system. A suitable replacement hose can be found in the adapter kit supplied with the flushing tool.

(5) Connect the BLUE pressure line to the OUTLET (From) cooler line.

(6) Connect the CLEAR return line to the INLET (To) cooler line

(7) Remove the transmission oil cooler from the vehicle. (Refer to 7 - COOLING/TRANSMISSION/TRANS COOLER - REMOVAL)

(8) Remove the transmission oil cooler thermostat. (Refer to 7 - COOLING/TRANSMISSION/TRANS COOLER - DISASSEMBLY)

TRANS COOLER - 5.9L DIESEL (Continued)

(9) Re-install the thermostat cover onto the oil cooler and install the snap-ring.

(10) Re-connect the oil cooler to the transmission cooler lines.

(11) Turn pump ON for two to three minutes to flush cooler(s) and lines.

NOTE: This flushes the bypass circuit of the cooler only.

(12) Turn pump OFF.

(13) Remove the thermostat cover from the oil cooler.

(14) Install Special Tool Cooler Plug 8414 into the transmission oil cooler.

(15) Re-install the thermostat cover onto the oil cooler and install the snap-ring.

(16) Turn pump ON for two to three minutes to flush cooler(s) and lines.

NOTE: This flushes the main oil cooler core passages only.

(17) Turn pump OFF.

(18) Remove the thermostat cover from the oil cooler.

(19) Remove Special Tool Cooler Plug 8414 from the transmission oil cooler.

(20) Install a new thermostat spring, thermostat, cover, and snap-ring into the transmission oil cooler. (Refer to 7 - COOLING/TRANSMISSION/TRANS COOLER - ASSEMBLY)

(21) Install the transmission oil cooler onto the vehicle. (Refer to 7 - COOLING/TRANSMISSION/TRANS COOLER - INSTALLATION)

(22) Disconnect CLEAR suction line from reservoir at cover plate. Disconnect CLEAR return line at cover plate, and place it in a drain pan.

(23) Turn pump ON for 30 seconds to purge flushing solution from cooler and lines. Turn pump OFF.

(24) Place CLEAR suction line into a one quart container of Mopar® ATF +4, type 9602, Automatic Transmission fluid.

(25) Turn pump ON until all transmission fluid is removed from the one quart container and lines. This purges any residual cleaning solvent from the transmission cooler and lines. Turn pump OFF.

(26) Disconnect alligator clips from battery. Reconnect flusher lines to cover plate, and remove flushing adapters from cooler lines.

REMOVAL

REMOVAL—AIR TO OIL COOLER

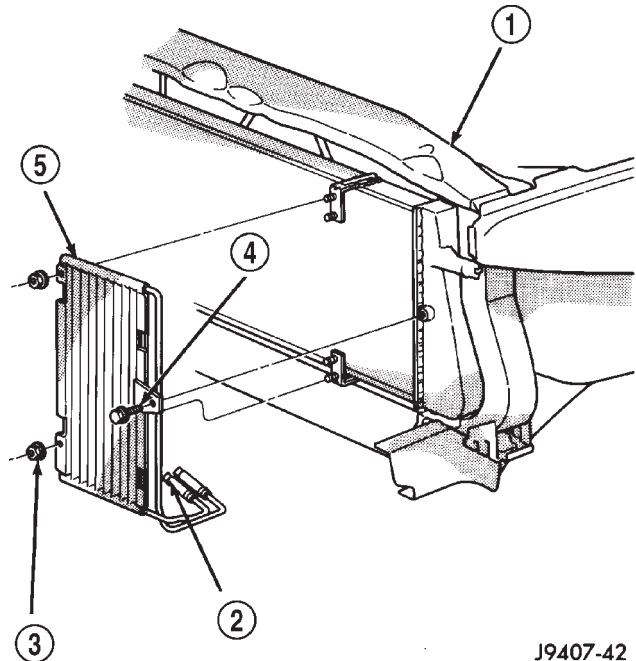
(1) Remove front bumper.

(2) Place a drain pan under the oil cooler.

(3) Raise the vehicle.

(4) Disconnect the oil cooler quick-connect fittings from the transmission lines.

(5) Remove the charge air cooler-to-oil cooler bolt (Fig. 8).



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Fig. 8 Auxiliary Transmission Oil Cooler—Diesel Engine

1 - CHARGE AIR COOLER (INTERCOOLER)

2 - QUICK-CONNECT FITTINGS (2)

3 - MOUNTING NUTS (2)

4 - MOUNTING BOLT

5 - TRANSMISSION OIL COOLER

(6) Remove two mounting nuts.

(7) Remove the oil cooler and line assembly towards the front of vehicle. Cooler must be rotated and tilted into position while removing.

REMOVAL—WATER TO OIL COOLER

CAUTION: If a leak should occur in the water-to-oil cooler mounted to the side of the engine block, engine coolant may become mixed with transmission fluid. Transmission fluid may also enter engine cooling system. Both cooling system and transmission should be drained and inspected in case of oil cooler leakage.

TRANS COOLER - 5.9L DIESEL (Continued)

- (1) Disconnect both battery negative cables.
- (2) Remove air cleaner assembly and air cleaner intake hoses.
- (3) Drain cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
- (4) Disconnect coolant lines from cooler.
- (5) Disconnect transmission oil lines from cooler. Plug cooler lines to prevent oil leakage.
- (6) Remove oil cooler mounting straps (Fig. 9).
- (7) Lift oil cooler off of mounting bracket.
- (8) If replacing cooler, make sure to transfer converter drain back valve to new cooler.

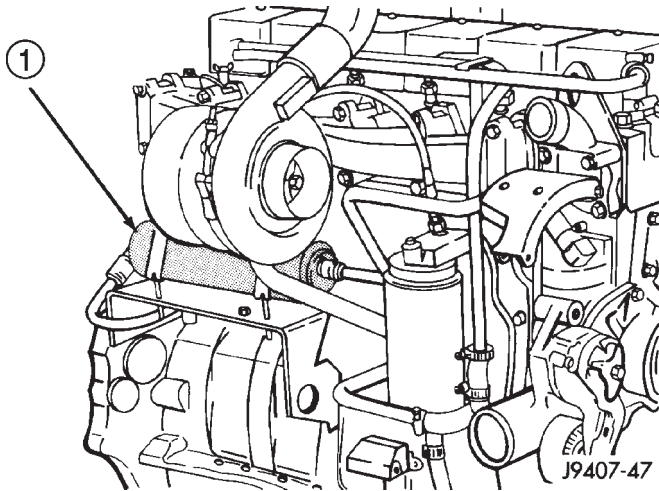


Fig. 9 Transmission Water-To- Oil Cooler—Diesel

1 - TRANSMISSION WATER-TO-OIL COOLER

INSTALLATION

INSTALLATION—AIR TO OIL COOLER

- (1) Carefully position the oil cooler assembly to the vehicle.
- (2) Install two nuts and one bolt. Tighten to 11 N·m (95 in. lbs.) torque.
- (3) Connect the quick-connect fittings to the transmission cooler lines.
- (4) Install front bumper.
- (5) Start the engine and check all fittings for leaks.
- (6) Check the fluid level in the automatic transmission (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 47RE/FLUID - STANDARD PROCEDURE).

INSTALLATION

- (1) Position oil cooler on bracket.
- (2) Install mounting straps.
- (3) Connect transmission oil lines to cooler.
- (4) Connect coolant hoses to cooler.
- (5) Connect battery negative cables.
- (6) Fill cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
- (7) Check transmission oil level and fill as necessary (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 47RE/FLUID - STANDARD PROCEDURE).
- (8) Install air cleaner assembly and air cleaner intake hoses.

