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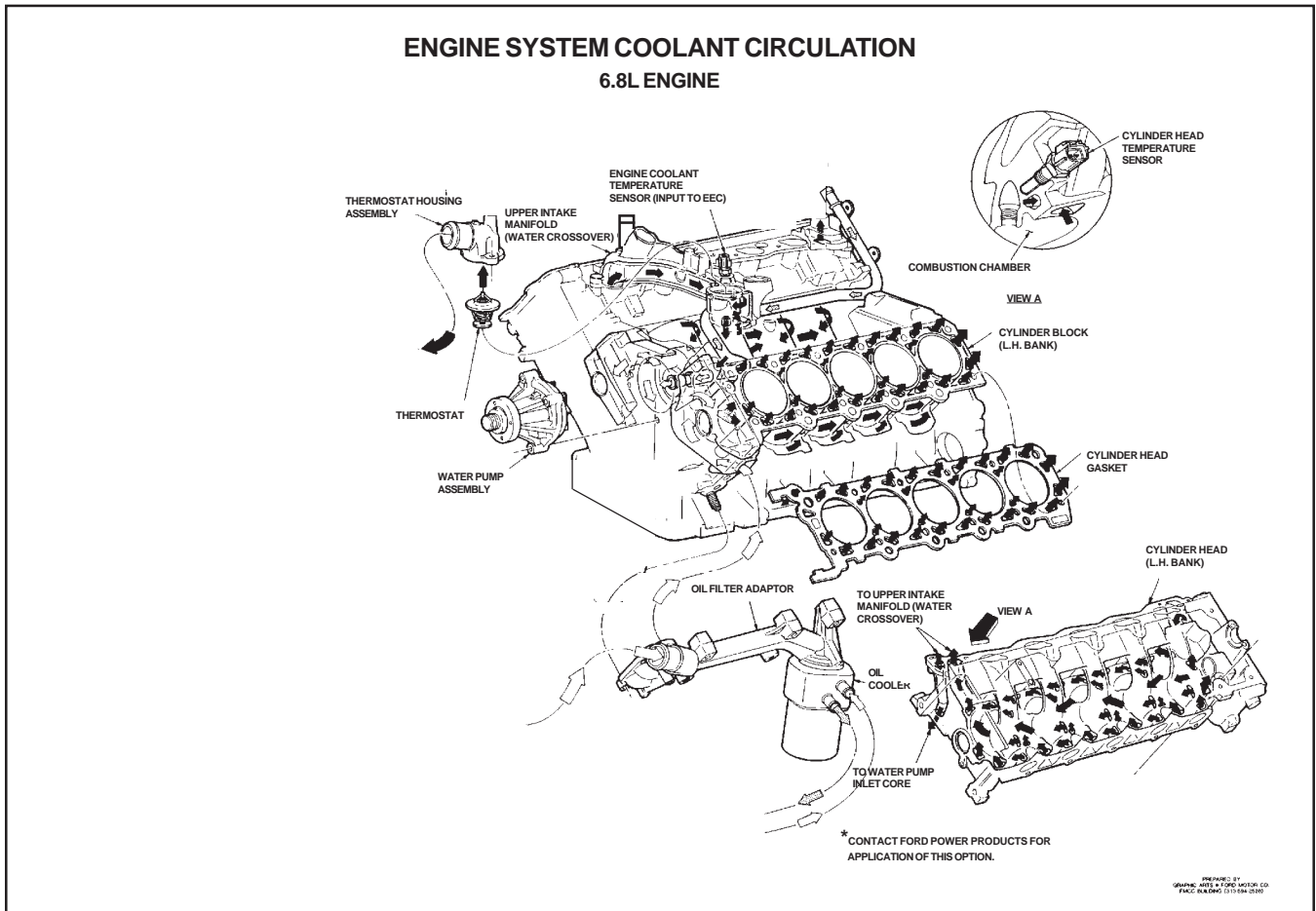
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GENERAL INFORMATION



Engine Cooling

Walter C. Avrea, the owner of patents 3,601,181 and RE27,965, has granted Ford Motor Company rights with respect to cooling systems covered by these patents.

The cooling system components are:

- Cylinder head temperature sensor (CHT sensor).
- Water thermostat and gasket assembly.
- Water pump assembly.

Coolant Flow is as follows:

- The water pump (8501) circulates the coolant.
- From the water pump to the engine block and the cylinder heads (6049) to the thermostat.
 - Thermostat closed, the coolant returns to the water pump through bypass hose.
 - Thermostat open, the coolant flows back to the radiator.
 - To the radiator for heat rejection then back to the lower radiator hose.
 - From the lower radiator hose (8286) to the water pump.



CAUTION: Alkaline brine solutions will cause serious engine cooling system damage.



CAUTION: Do not use. 100,000 mile, red in color antifreeze, it is not compatible with copper radiators.

Coolant:

- Use a 50/50 mix of Ethylene Glycol Permanent Antifreeze and water. This mixture is to be used year-round with temperatures above -30°F.

Recycled Coolant:

- Use recycled engine coolant produced by Ford approved processes. Not all coolant recycling processes produce coolant which meets Ford specification ESE-M97B44-A or WSS-M97B44-D, and use of such a coolant may harm engine and cooling system components.

Unsatisfactory Coolant Material:

- Alcohol-type antifreeze does not provide adequate water pump lubrication.
 - Has a lower boiling point.
 - Provides reduced antifreeze protection.

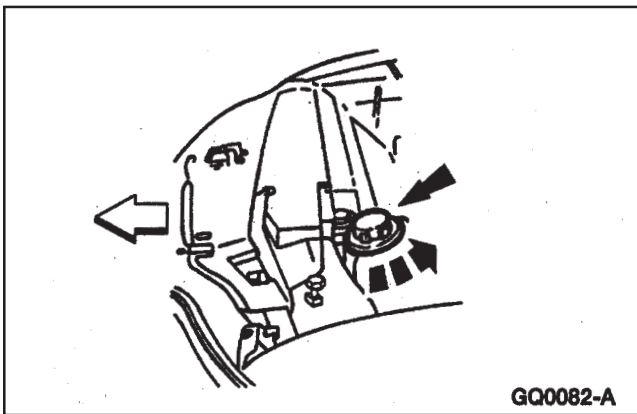
GENERAL SERVICE PROCEDURES


Cooling System Draining



WARNING: NEVER REMOVE THE PRESSURE RELIEF CAP WHILE THE ENGINE IS OPERATING OR WHEN THE COOLING SYSTEM IS HOT. MAY CAUSE PERSONAL INJURY OR DAMAGE TO COOLING SYSTEM OR ENGINE. TO AVOID HAVING SCALDING HOT COOLANT OR STEAM BLOW OUT OF THE DEGAS BOTTLE WHEN REMOVING THE PRESSURE RELIEF CAP, WAIT UNTIL THE ENGINE HAS COOLED DOWN TO AT LEAST 110°F.

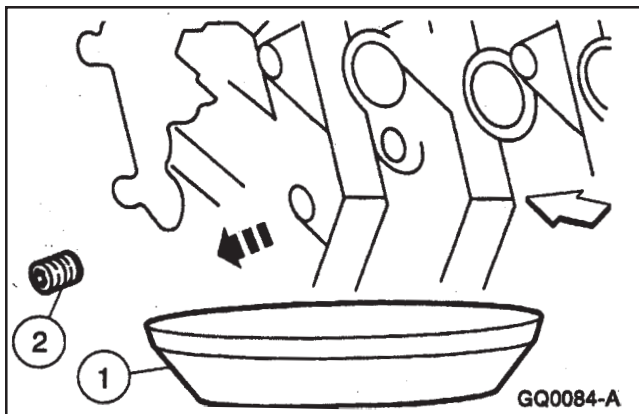
1. Wrap a thick cloth around the pressure relief cap and turn it slowly one-half turn counterclockwise. Stepping back while the pressure is released from the cooling system.
2. When you are sure all the pressure has been released, (still with a cloth) turn the pressure relief cap counterclockwise and remove.



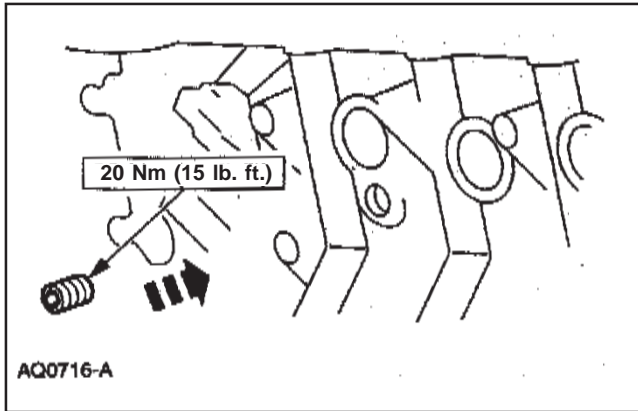
 **CAUTION:** The coolant must be recovered in a suitable, clean container for reuse. If the coolant is contaminated it must be recycled or disposed of properly.

NOTE: About 80% of coolant capacity can be recovered with the engine in the vehicle. Dirty, rusty or contaminated coolant requires replacement.

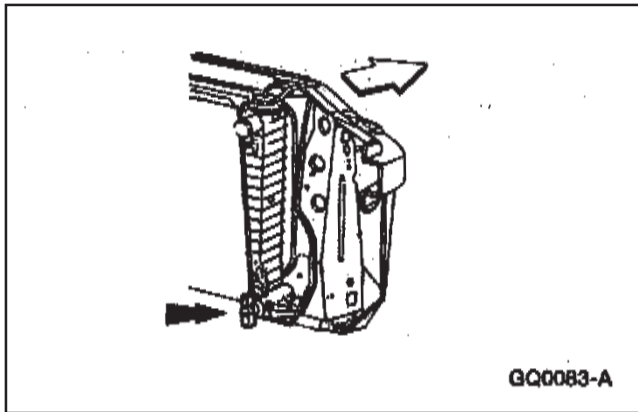
3. Place a suitable container below the radiator draincock (8115). If equipped, disconnect the coolant return hose at the fluid cooler.
4. Open the radiator draincock.



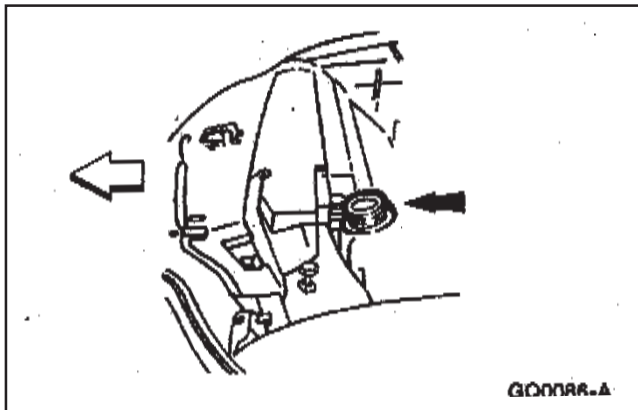
5. Remove the cylinder drain plug, if equipped, to drain the coolant from the cylinder block (6010).
 1. Place a drain pan below the cylinder block.
 2. Remove the drain plugs.



6. When the coolant is drained, make sure drain plugs are installed and tight.



7. Close the radiator draincock when finished.



Cooling System Filling

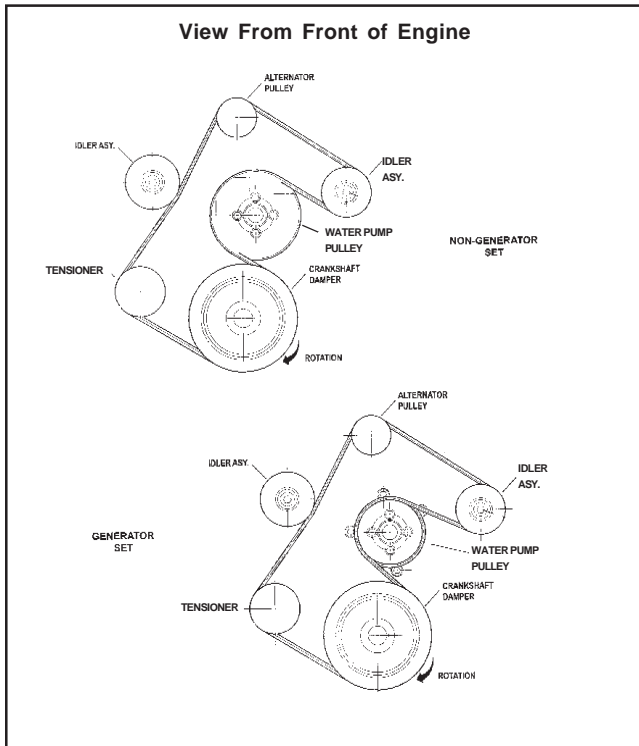
1. Add the proper engine coolant mixture to the degas bottle or radiator.
2. Move the temperature blend selector to the full warm position when equipped.
3. Run the engine until it reaches operating temperature.

4. Add the proper engine coolant mixture to the degas bottle or radiator until the coolant level is between the "COOLANT FILL LEVEL" marks.

NOTE: Systems without degas bottle fill radiator up to 1 inch below the filler neck.

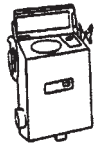
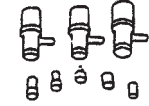
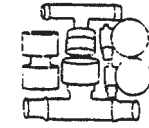
5. Turn off the engine and allow the cooling system to cool.
6. Repeat Steps 1 through 5 until the radiator level is OK.

Drive Belt Routing



Cooling System Flushing

Special Tool(s)

 <p>ST1166-A</p>	<p>Coolant System Drain/Flush/ Fill. 164-R3673</p>
 <p>ST1167-A</p>	<p>Flush Kit Hardware Package 164-R3658 or equivalent</p>
 <p>ST1168-A</p>	<p>Drain Kit 164-R3662 or equivalent</p>

Special Service Tools called for by the procedures can be obtained by calling:
1-800-ROTUNDA (1-800-768-8632).

REMOVAL AND INSTALLATION

Radiator Hose - Removal

Radiator hoses should be replaced whenever they become cracked, rotted or have a tendency to collapse.

Drain the radiator into appropriate container then loosen the clamps at each end of the hose to be removed. Slide the hose off the radiator connection and the engine water outlet connection (upper hose) or the water pump connection (lower hose).

Radiator Hose - Installation

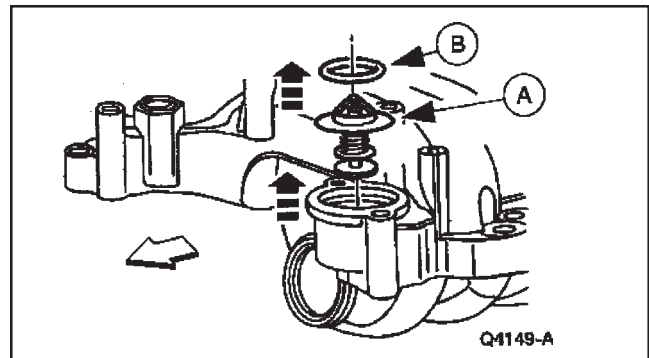
Position the clamps at least 1/8 inch from each end of the hose. Coat the connection areas with an approved water-resistant sealer and slide the hose on the connection. Make sure the clamps are beyond the bead and placed in the center of the clamping surface of the connections. Tighten the clamps. Fill the radiator with the recommended permanent antifreeze and water 50/50 mixture. Operate the engine for several minutes, then check the hoses and connections for leaks.

Thermostat - Removal



WARNING: AVOID INJURY FROM HOT COOLANT WHEN ENGINE IS HOT.

1. Partially drain the cooling system. For additional information, refer to Cooling System Draining, Filling and Flushing in this section.
2. Disconnect the upper radiator hose.
3. Remove the water outlet connection.
 - Remove the bolts.
 - Remove the water outlet connection.
4. Remove the (B) O-ring seal and the (A) water thermostat (8575).
 - Discard the (B) O-ring seal.

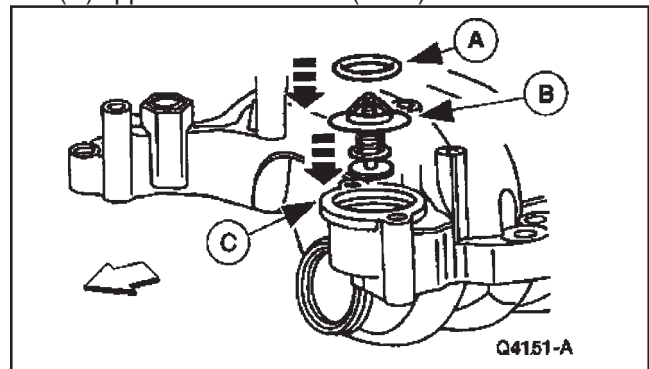


- (A) Thermostat (B) O-ring Seal

Thermostat - Installation

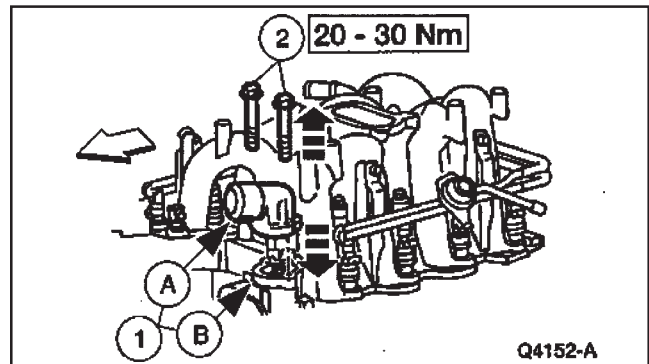
NOTE: Thermostat must be installed as illustrated.

1. Install the (B) water thermostat and use a new (A) O-ring seal to position the (B) water thermostat in the (C) upper intake manifold (9424).



- (A) O-ring Seal (B) Thermostat (C) Intake Manifold

2. Install the water outlet connection.
 1. Position the (A) water outlet connection on the (B) upper intake manifold.
 2. Install the bolts.

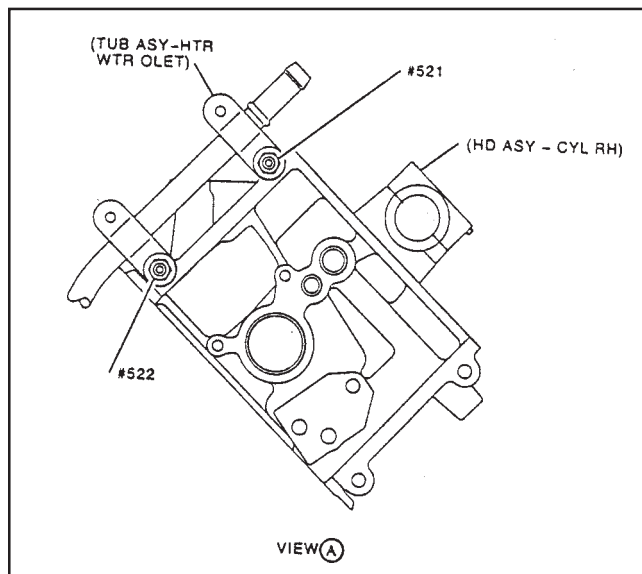


3. Connect the upper radiator hose.
4. Fill the cooling system. For additional information, refer to Cooling System Draining, Filling and Flushing in this section.

With or Without Dry Fuel Evaporator Plumbing

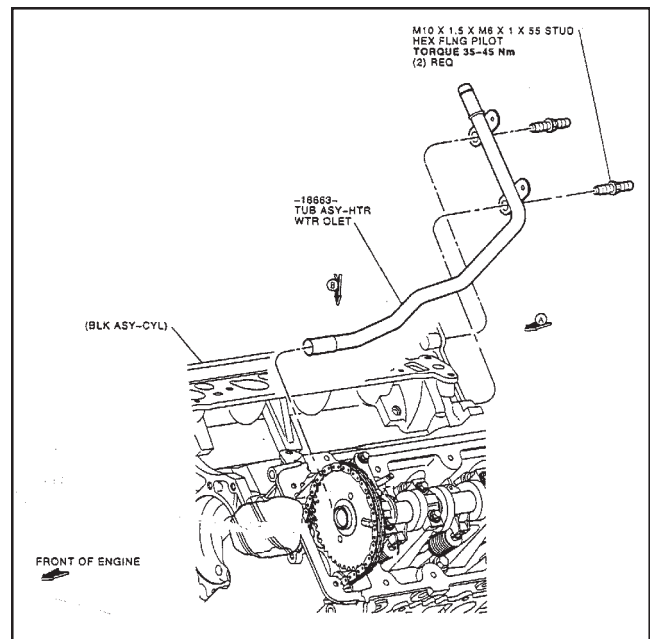
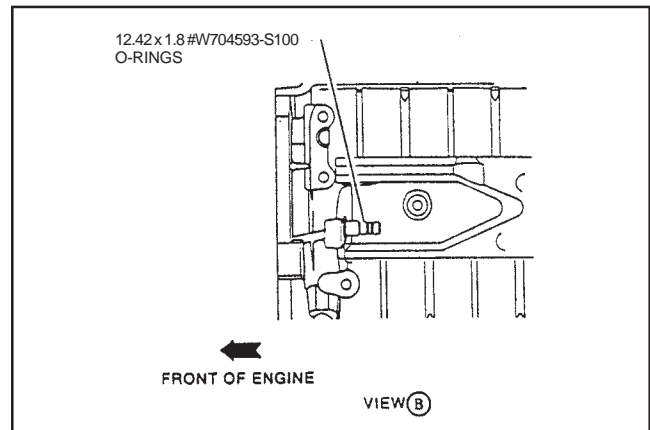
Removal of Heater Water Inlet Tube (18663)

1. Drain the cooling system.
2. Remove the upper and lower intake manifold together. Refer to Section 01 for details.
3. Remove the two studs securing the tube to the rear of the right side cylinder head and remove the tube.
4. Inspect the water pump tube assembly o-rings for damage.



Installation of Water Heater Return Tube Assembly with by-pass Hose

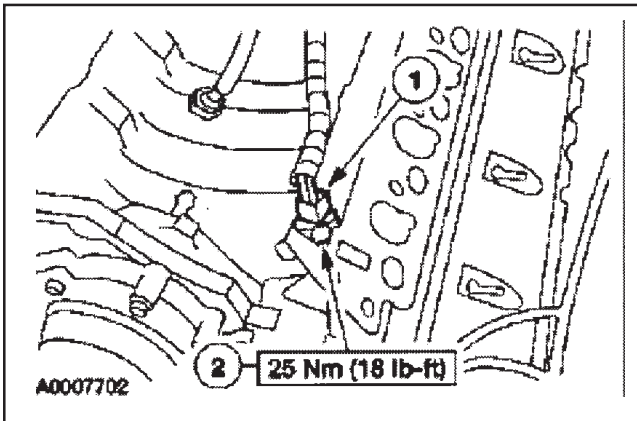
1. Lightly lubricate the o-rings prior to installing the water outlet tube.



2. Install the heater water outlet tube.
3. Install the water tube-mounting studs.
4. Install the lower and upper intake manifold. (Refer to Section 01.
5. Install rubber cap and clamp on outlet tube if not using LPG or cab heater.
6. Refill the cooling system.

Cylinder Head Temperature (CHT) Sensor - Replacement

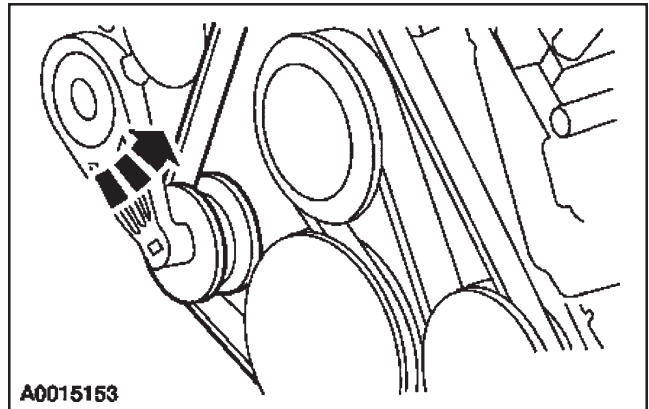
1. Remove the upper and lower intake manifold together. For additional information, refer to Section 01.
2. Remove the cylinder head temperature (CHT) sensor.
 1. Disconnect the electrical connector.
 2. Remove the CHT sensor.



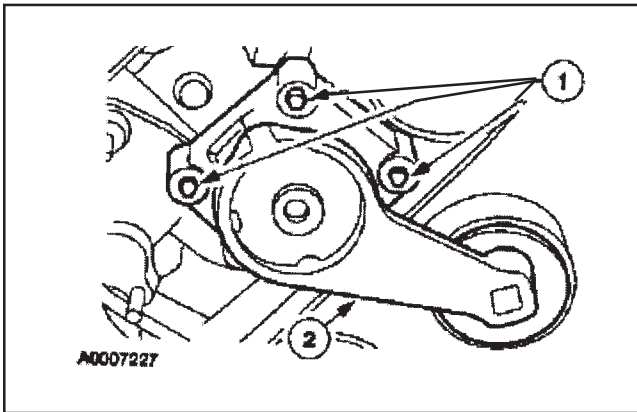
3. To install, reverse the removal procedure.

CAUTION: Do not over torque. May damage sensor.

Fan Drive Belt - Removal and Installation

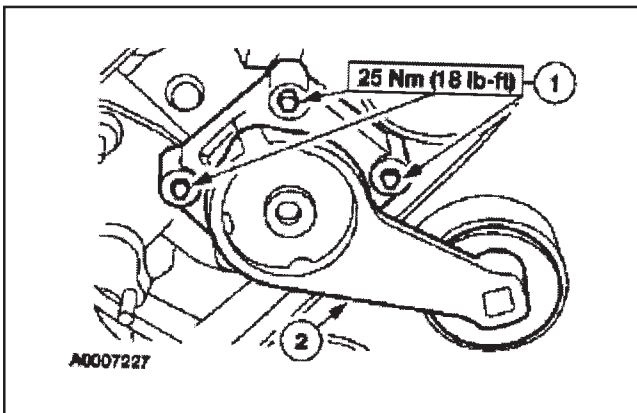


1. Rotate the drive belt tensioner counterclockwise and remove the drive belt.
2. **NOTE:** Refer to 05-9 for correct drive belt routing.
To install, reverse the removal procedure.



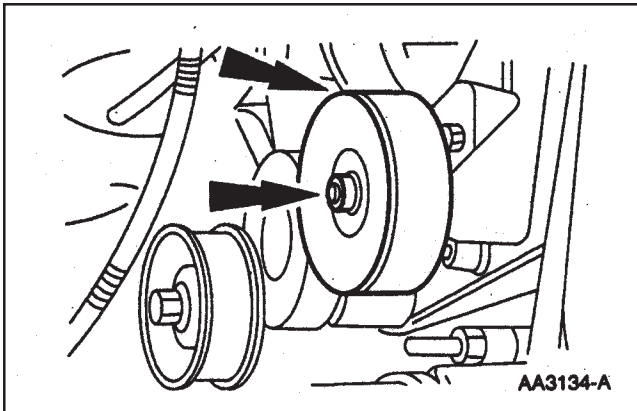
Belt Tensioner - Removal

1. Remove the drive belt (8620). For additional information, refer to Fan Drive Belt page 05-12.
2. Remove the belt tensioner.
 1. Remove the bolts.
 2. Remove the belt tensioner.



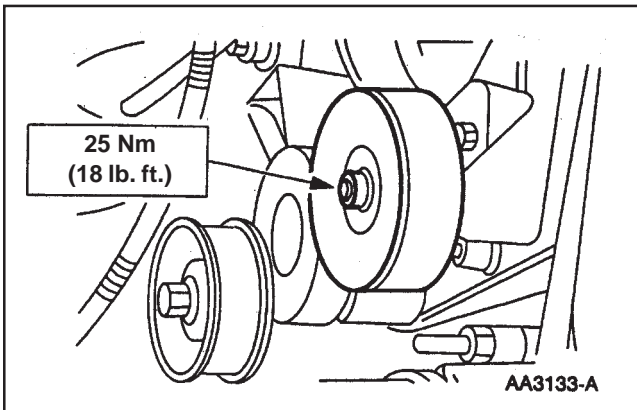
Belt Tensioner - Installation

1. To install, reverse the removal procedure.



Belt Idler Pulley - Removal

1. Remove the fan drive belt (8620) off of the belt idler pulley (8678). For additional information, refer to Fan Drive Belt page 05-12.
2. Remove the bolt and the belt idler pulley.



Belt Idler Pulley - Installation

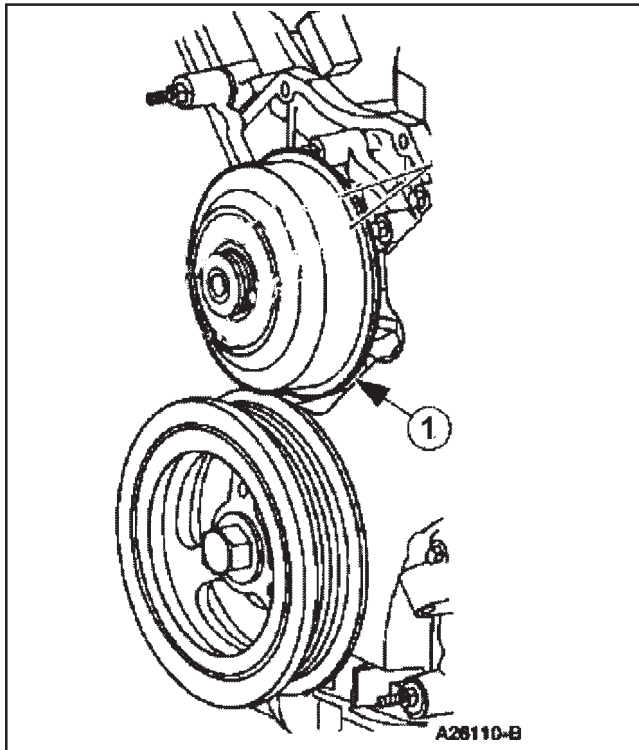
1. To install, reverse the removal procedure.

Water Pump - Removal

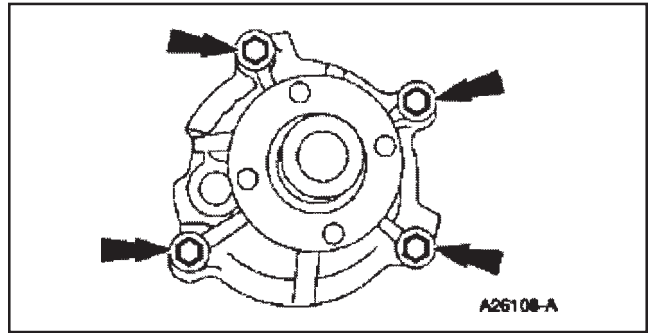
Material

Item	Specification
Motorcraft Premium Engine Coolant VC-4-A	ESE-M97B44-A

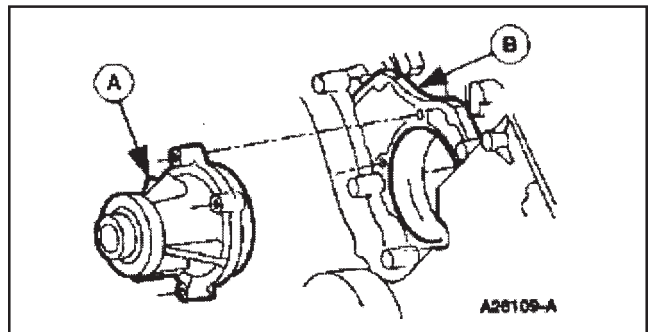
1. Drain the cooling system. For additional information, refer to Cooling System Draining, Filling and Flushing page 05-05.
2. Remove the engine cooling fan.
3. Remove the drive belt. For additional information, refer to Fan Drive Belt page 05-12.
4. Remove the water pump pulley (8509).
 - Remove the water pump pulley.



5. Remove the water pump bolts.



6. Remove the (A) water pump from the (B) cylinder block.
 - Clean and inspect the mating surfaces.

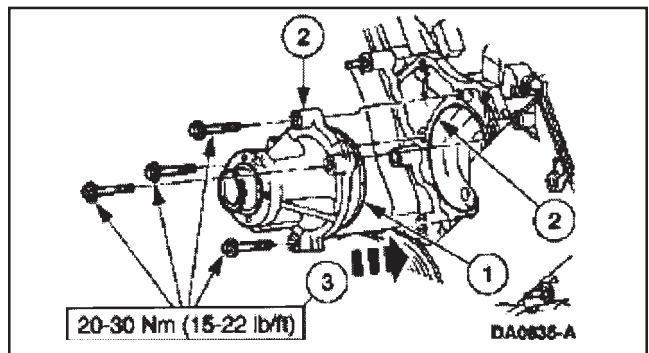


Water Pump - Installation

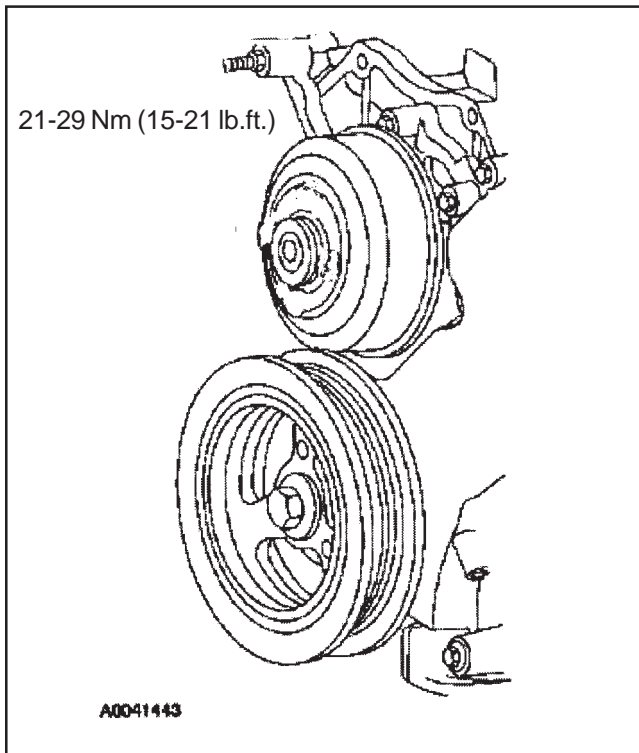
1. **CAUTION:** Cooling systems are recommended to be filled with Motorcraft Premium Engine Coolant VC-4-A meeting Ford specification ESE-M97B44-A (green color). Do not mix coolant types.

Install the water pump.

1. Lubricate the new O-ring seal using engine coolant and install the O-ring seal onto the water pump.
2. Position the water pump into the engine block and heater water outlet tube.
3. Install the bolts.



2. Position the pulley onto the water pump.



3. Install the fan spacer and fan.
4. Install the drive belt.
5. Refill the cooling system. For additional information, refer to Cooling System Draining, Filling and Flushing in this section.

DIAGNOSING AND TESTING

Refer to the following Diagnosis Chart for cooling system problems, their possible cause and recommended correction. Refer to the pertinent part for testing and repair.

The most frequent cooling system complaints are leakage and overheating. Either of these problems will soon render the vehicle inoperable.

Most vehicles use an ethylene glycol base antifreeze solution to which the manufacturers have added a dye color. The dye color makes the antifreeze solution an excellent leak detector. If this type of solution is not being used in the cooling system, a vegetable dye may be added to aid in locating external leakage.

NOTE: A small amount of antifreeze coming out the water pump weep hole may be normal.

CONDITION	POSSIBLE SOURCE	ACTION
<ul style="list-style-type: none"> • Loss of coolant. 	<ul style="list-style-type: none"> • Pressure cap and gasket. • Leakage. • Internal leakage. 	<ul style="list-style-type: none"> • Inspect, washer gasket and test. Replace only if cap will not hold pressure to specification • Pressure test system. • Inspect hose, hose connection, radiator, edges of cooling system gaskets, core plugs and drain plugs, water pump. Repair or replace as required. • Disassembly engine as necessary – check for: cracked intake manifold, blown head gaskets, warped head or block gasket surfaces, cracked cylinder head or cylinder block.
<ul style="list-style-type: none"> • Engine overheats. 	<ul style="list-style-type: none"> • Low coolant level. • Faulty drive belt tensioner. • Pressure cap. • Radiator obstruction. • Closed thermostat. • Fan. • Ignition. • Temp. gauge. • Engine. • Coolant mixture. 	<ul style="list-style-type: none"> • Fill as required. Check for coolant loss. • Replace belt or tensioner as required. • Test, replace if necessary. • Remove bugs, leaves, etc. • Test, replace if necessary. • Test, replace if necessary. • Check electrical circuits and repair as required. • Check water pump and block for blockage. • 1/2 water and 1/2 permanent antifreeze mixture.
<ul style="list-style-type: none"> • Engine fails to reach normal operating temperature. 	<ul style="list-style-type: none"> • Open thermostat. • Temperature gauge. 	<ul style="list-style-type: none"> • Test, replace if necessary. • Check electrical circuits and repair as required.

Visual Inspection

Check for leakage at:


1. All hoses and hose connections.
2. Radiator seams, radiator core, and radiator drain petcock.
3. All block core plugs and drain plugs.
4. Edges of all cooling system gaskets.
5. Water pump shaft and bushing.

Examine oil dipstick for evidence of coolant contaminated engine oil (white milky appearance).

NOTE: A small amount of antifreeze coming out the water pump weep hole may be normal.

Cooling System Visual Test

Special Tool(s)

 <p>ST1720-A</p>	<p>Battery/Anti-Freeze Tester 014-R1060 or equivalent</p>
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Special Service Tools called for by the procedures can be obtained by calling:
1-800-ROTUNDA (1-800-768-8632).



WARNING: NEVER REMOVE THE PRESSURE RELIEF CAP WHILE THE ENGINE IS OPERATING OR WHEN THE COOLING SYSTEM IS HOT. MAY CAUSE PERSONAL INJURY OR DAMAGE TO COOLING SYSTEM OR ENGINE. TO AVOID HAVING SCALDING HOT COOLANT OR STEAM BLOW OUT OF THE DEGAS BOTTLE WHEN REMOVING THE PRESSURE RELIEF CAP, WAIT UNTIL THE ENGINE HAS COOLED DOWN TO AT LEAST 110°F.

1. Wrap a thick cloth around the pressure relief cap and turn it slowly one-half turn counterclockwise. Stepping back while the pressure is released from the cooling system.
2. When you are sure all the pressure has been released, (still with a cloth) turn counterclockwise and remove the pressure relief cap.



CAUTION: If there is engine coolant in the engine oil the cause must be corrected and the oil changed or engine damage may occur.

NOTE: Check the engine coolant in the degas bottle and radiator (8005) when vehicle has been allowed to reach normal operating temperature. This will make sure sufficient engine coolant exchange has occurred.

3. Inspect the coolant in both the radiator and the degas bottle for coolant color:

- Clear, light green or blue indicates higher water content than required
- Dark brown indicates unauthorized stop leak may have been used. Use cooling system Stop Leak Powder E6AZ-19558-A or equivalent meeting Ford specification ESE-M99B170-A only.
- A light or reddish-brown color indicates rust in the cooling system. Flush the system and refill with the correct mixture of water and Premium Engine Coolant (green in color), E2FZ-19549-AA or equivalent meeting Ford specification ESE-M97B44-A.
- An iridescent sheen on top of the coolant indicates a trace of oil is entering the cooling system.
- A milky-brown color indicates that oil is entering the cooling system.
- The causes of the leak might be:
 - A blown head gasket (6051).
 - A cracked or warped cylinder head (6049).
 - A crack in the engine oil gallery and the cooling passageways.
- If engine coolant is present in the engine oil, the cause of the leak might be:
 - A blown head gasket.
 - A cracked or warped cylinder head.
 - A crack in the engine oil gallery and cooling passageways.

4. If the engine coolant appearance is good, test the engine coolant range with the battery and antifreeze tester:
 - Maximum ratio is 60/40.
 - Minimum ratio is 45/55.
5. Check the engine coolant system conditions:
 - If the engine cooling fluid is low, add specified coolant mixture only.
 - If the engine coolant fluid tests weak, add straight engine coolant until the readings are within acceptable levels.
 - If the engine coolant tests strong, remove some of the engine coolant and add water until readings are within acceptable levels.
6. Check for electrical charge in coolant. Using a DVOM, insert the (+) probe into coolant without touching radiator. Hold the (-) probe to radiator shell or a good ground and read the volts.:
 - Less than 1.5 volts is good.
 - If voltage is above 1.5 volts - drain, flush and replace coolant with a 50/50 mixture.

NOTE: Above 3 volts may indicate a bad head gasket.

Thermostat Test – Thermostat Removed



WARNING: USE CAUTION WORKING WITH HOT BOILING WATER AND WEAR APPROPRIATE PROTECTIVE GEAR. MAY CAUSE BODILY HARM.

Remove the thermostat and immerse it in boiling water. Replace the thermostat if it does not open at least 0.230" after one minute at 212°F.

If the problem being investigated is the inability of the cooling system to reach normal operating temperature, the thermostat should be checked for leakage. This may be done by holding the thermostat up to a lighted background. Leakage of light all around the thermostat valve (thermostat at room temperature) indicates that the thermostat is unacceptable and should be replaced. It is possible, on some thermostats, that a slight leakage of light at one or two locations on the perimeter of the valve may be detected. This should be considered normal.

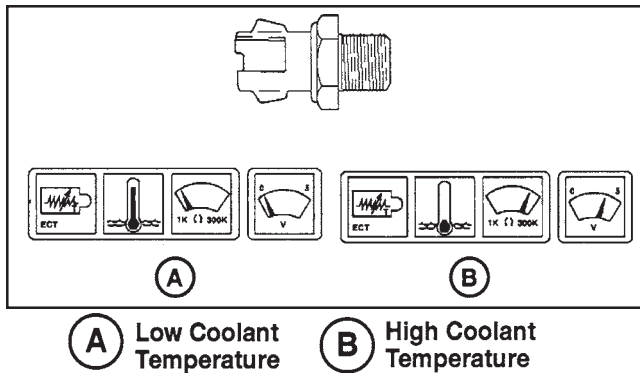
Radiator Leak Test, Removed From Vehicle



CAUTION: Never leak test an aluminum radiator in the same water that copper/brass radiators are tested in. Flux and caustic cleaners may be present in the cleaning tank and they will damage aluminum radiators.

1. Always install plugs in the oil cooler fittings before leak-testing or cleaning any radiator.
2. Clean the radiator before leak-testing to avoid contamination of the tank.
3. Leak-test the radiator in clean water with 138 kPa (20 psi) air pressure.

Engine Cylinder Head Temp. (CHT) Sensor



- Output is a variable voltage signal which typically ranges from 0.3 volt to 4.5 volts.
- At -40°F (CHT) resistance is approximately 925K ohms.
- At 77°F (CHT) resistance is approximately 30K ohms.
- At 248°F (CHT) resistance is approximately 1.2K ohms.

NOTE: Complete list of temperature sensor characteristics can be found on page 05-21 of this section.

Diagnostic Aids

The (CHT) sensor shares the same ground with other sensors. Check the ground circuit 359 (Gray) if other shared components.

NOTE: Refer to Section 08 for further diagnostics.

Inspect the harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connections. Inspect the wiring harness for damage. If the harness appears to be OK, back probe the CHT sensor connector with a digital voltmeter and observe the voltage while moving connectors and wiring harnesses related to the CHT sensor. A change in the voltmeter display will indicate the location of the fault.

Circuit Description

The engine cylinder head temperature (CHT) sensor is a thermistor which measures the temperature of the engine cylinder head. The ICM supplies a ground (circuit 359, Gray/Red) from the sensor and monitors voltage signal (circuit to 1102, Yellow/Lt. Green) to the sensor. When the engine coolant is cold, the sensor resistance is high and the ICM will monitor a high signal voltage at the CHT signal circuit. If the engine cylinder head is warm, the sensor resistance is lower, causing the ICM to monitor a lower voltage.

- Engine cylinder head temperature (CHT) sensor is a type of thermistor that converts engine temperature to an electrical voltage signal.
- The electrical resistance of the (CHT) sensor changes with temperature. As engine coolant temperature increases, the (CHT) resistance decreases.

WSG-1068 COOLING SYSTEM

CHT Sensor Data

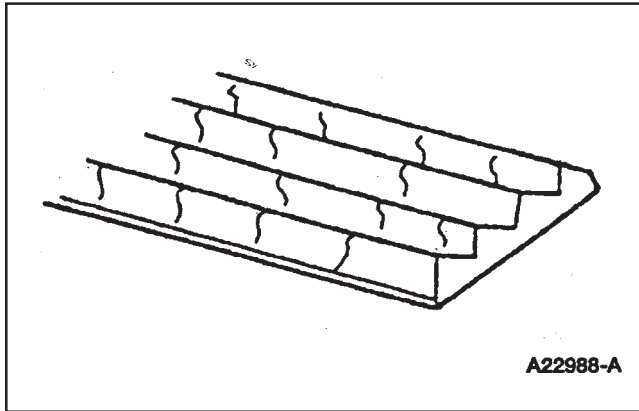
Temperature Sensor Characteristics

TEMPERATURE		NOM R, (OHMS)	NOM E _{OUT} (VOLTS)
(C)	(F)		
-40	-40	925,021	4.54
-35	-31	673,787	4.50
-30	-22	496,051	4.46
-25	-13	368,896	4.41
-20	-4	276,959	4.34
-15	5	209,816	4.25
-10	14	160,313	4.15
-5	23	123,485	4.02
0	32	95,851	3.88
5	41	74,914	3.71
10	50	58,987	3.52
15	59	46,774	3.32
20	68	37,340	3.09
25	77	30,000	2.86
30	86	24,253	2.62
35	95	19,716	2.39
40	104	16,113	2.15
45	113	13,236	1.93
50	122	10,926	1.72
55	131	9,061	1.52
60	140	7,548	1.34
65	149	6,332	1.18
70	158	5,335	1.04
75	167	4,515	.91
80	176	3,837	.79
85	185	3,274	.70
90	194	2,804	.61
95	203	2,411	.53
100	212	2,080	.47
105	221	1,801	.41
110	230	1,564	.36
115	239	1,363	.32
120	248	1,191	.28
125	257	1,044	.25
130	266	918	.22
135	275	809	.19
140	284	715	.17
145	293	633	.15
150	302	563	.14

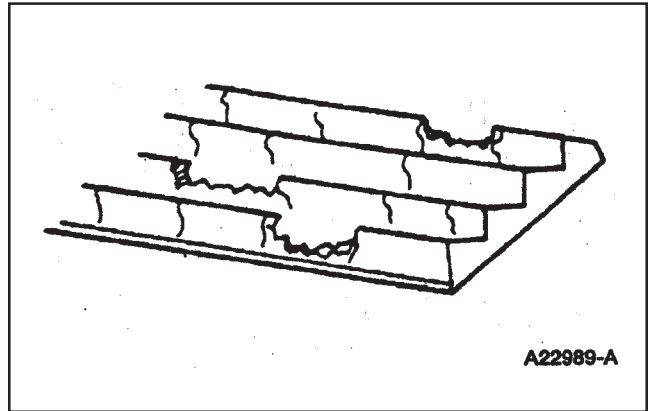
Voltage values calculated for VREF=5 volts (may vary 15% due to sensor and VREF variations).

V-Ribbed Serpentine Drive Belt

Cracks Across Ribs - Normal



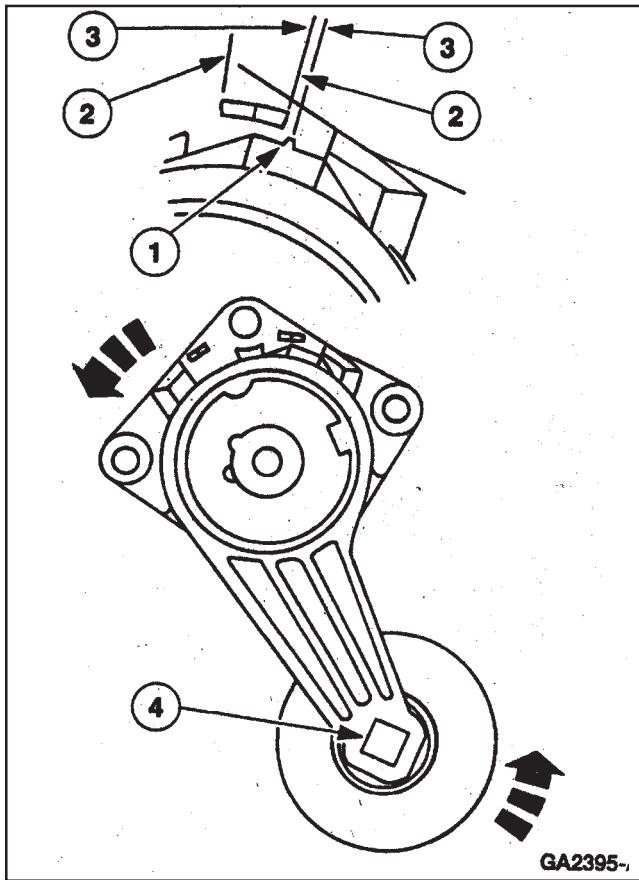
Chunks of Rib Missing - Replace Belt



Drive Belt Symptom Chart

Condition	Possible Source	Action
<ul style="list-style-type: none"> • Drive belt cracking • Drive belt chunking. 	<ul style="list-style-type: none"> • Worn out. • Overheated • Chemical or oil spilled on belt. 	<ul style="list-style-type: none"> • REPLACE the drive belt; Refer to Belt in this section.
<ul style="list-style-type: none"> • Drive belt noise or squeal. 	<ul style="list-style-type: none"> • Pulley misalignment. • Excessive pulley groove runout. • Damaged drive belt tensioner (6B209). • Fluid or contamination on the drive belt. 	<ul style="list-style-type: none"> • DETERMINE from which pulley the noise originates. CHECK that area with a straightedge and LOOK for for accessory pulley to be out of position in the fore/aft direction or at an angle to the straightedge. REPLACE the pulley or the component; • Replace belt tensioner. • CLEAN or REPLACE the drive belt; Refer to Fan Drive Belt this section.

Drive Tensioner/Belt Length Indicator



Item	Part Number	Description
1	-	Belt Length Indicator
2	-	Acceptable Belt Installation and Wear Range
3	-	Belt Replacement Range
4	-	Belt Tension Relief Point (Use 1/2 Inch Ratchet)

Automatic tensioners are calibrated at the factory to provide the correct amount of tension to the belt. Unless a spring within the tensioner assembly breaks or some other mechanical part of the tensioner fails, there is no need to check tensioners for proper tension.

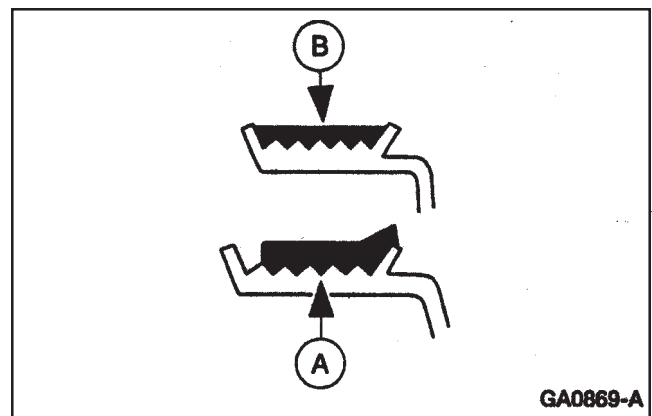
The only mechanical check that need be made, if you have any doubt about the tensioner function, would be to remove the belt in the area of the tensioner, to avoid belt contact, then using the proper tool, rotate the tensioner from its relaxed position through its full stroke and back to the relaxed position to assure that there is no "stick, grab, bind," and to assure that there is tension on the spring. It is a normal condition for the tensioner to be moving, under certain conditions, when the engine is

running. If the tensioner meets this criteria, it should be assumed to be a good tensioner.

Drive Belt Misalignment

CAUTION: Incorrect drive belt installation will cause excessive drive belt wear and may cause the drive belt to come off the drive pulleys.

Non-standard replacement drive belts may track differently or improperly. If a replacement drive belt tracks improperly, replace it with an original equipment drive belt to avoid performance failure or loss of belt.

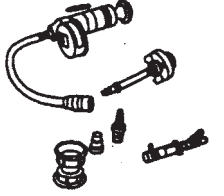



With the engine running, check drive belt tracking. If the **A** edge of the drive belt rides beyond the edge of the pulleys, noise and premature wear may occur. Make sure the **B** drive belt rides correctly on the pulley. If a drive belt tracking condition exists, proceed with the following:

Visually check the drive belt tensioner for damage, especially the mounting pad surface. If the drive belt tensioner is not installed correctly, the mounting surface pad will be out of position. This will result in a chirp or squeal noises.

- With the engine running, visually observe the grooves in the pulleys (not the pulley flanges or pulley front surfaces) for excessive wobble. Replace components as required.
- Check all accessories, mounting brackets and the drive belt tensioner for any interference that would prevent the component from mounting properly. Correct any interference condition and recheck belt tracking.
- Tighten all accessories, mounting brackets, and drive belt tensioner retaining hardware to specification. Recheck the drive belt tracking.

Special Tool(s)

 <p align="center">ST1474-A</p>	Radiator/Heater Core Pressure Tester 014-R1072 or equivalent
 <p align="center">ST1137-A</p>	Rotunda 73 Digital Multimeter 105-R0051 or equivalent

Special Service Tools called for by the procedures can be obtained by calling:
 1-800-ROTUNDA (1-800-768-8632).

Visual Inspection Chart

Mechanical	Electrical
<ul style="list-style-type: none"> • Leaks • Damaged hoses • Loose/damaged hose clamps • Damaged water thermostat gasket • Damaged head gaskets • Damaged intake manifold gasket • Damaged water pump • Damaged radiator • Damaged degas bottle • Damaged fan/fan clutch 	<ul style="list-style-type: none"> • Damaged engine coolant temperature sensor • Damaged wiring

Inspection and Verification

1. Verify the customer's concern by operating the engine to duplicate the condition.
2. Inspect to determine if any of the following mechanical or electrical concerns apply.
3. If the inspection reveals an obvious concern that can be readily identified, repair as necessary.
4. If the concern remains after the inspection, determine the symptom(s) and go to the Symptom Chart.

Symptom Chart


Condition	Possible Source	Action
<ul style="list-style-type: none"> • Loss of Coolant 	<ul style="list-style-type: none"> • Radiator. • Water pump seal. • Radiator hoses. • Heater hoses/tubes. • Heater core (if equipped). • Engine gaskets. • Degas bottle. 	<ul style="list-style-type: none"> • GO to Pinpoint Test A.
<ul style="list-style-type: none"> • The Engine Overheats 	<ul style="list-style-type: none"> • Water thermostat. • Water pump. • Internal engine coolant leak. • Radiator. • Cooling fan. • Pressure relief cap. 	<ul style="list-style-type: none"> • GO to Pinpoint Test B.
<ul style="list-style-type: none"> • The Engine Does Not Reach Normal Operating Temperature 	<ul style="list-style-type: none"> • Water thermostat. 	<ul style="list-style-type: none"> • GO to Pinpoint Test C.

PINPOINT TEST A: LOSS OF COOLANT

TEST CONDITIONS	TEST DETAILS/RESULTS/ACTIONS
1 CHECK THE ENGINE COOLANT LEVEL	
NOTE: Allow the engine to cool before checking the engine coolant level.	
	<p>1 Visually check the engine coolant level at the degas bottle (if equipped).</p> <ul style="list-style-type: none"> • Is the engine coolant level within specification? <p>▶ Yes GO to 2.</p> <p>▶ No REFILL the engine coolant as necessary. GO to 6.</p>
2 CHECK THE PRESSURE RELIEF CAP	
	<p>1 Perform the Pressure Relief Cap Test. For additional information, refer to Component Tests, Cap-Pressure Relief in this section.</p> <ul style="list-style-type: none"> • Is pressure relief cap OK? <p>▶ Yes GO to 3.</p> <p>▶ No INSTALL a new pressure relief cap. TEST the system for normal operation.</p>
3 CHECK THE ENGINE COOLANT FOR INTERNAL LEAK	
	<p>1 Inspect the engine coolant in degas bottle for signs of engine oil.</p> <ul style="list-style-type: none"> • Is oil evident in coolant? <p>▶ Yes If engine oil is evident, GO to Section 01.</p> <p>▶ No GO to 4.</p>

(Continued)


PINPOINT TEST A: LOSS OF COOLANT (Continued)

TEST CONDITIONS	TEST DETAILS/RESULTS/ACTIONS
<p>4 CHECK THE ENGINE BLOCK FOR COOLANT</p>	<p>1 Remove the oil level dipsticks (6750) from the engine.</p> <ul style="list-style-type: none"> • Is coolant evident in oil? <p>▶ Yes If coolant is in engine, GO to Section 01.</p> <p>▶ No GO to 5.</p>
<p>5 CHECK THE COOLANT RECOVERY SYSTEM</p>	<p>1  WARNING: NEVER REMOVE THE PRESSURE RELIEF CAP WHILE THE ENGINE IS OPERATING OR WHEN THE COOLING SYSTEM IS HOT. MAY CAUSE PERSONAL INJURY OR DAMAGE TO COOLING SYSTEM OR ENGINE. TO AVOID HAVING SCALDING HOT COOLANT OR STEAM BLOW OUT OF THE DEGAS BOTTLE WHEN REMOVING THE PRESSURE RELIEF CAP, WAIT UNTIL THE ENGINE HAS COOLED DOWN TO AT LEAST 110°F.</p> <p>2 Wrap a thick cloth around the pressure relief cap and turn it slowly one-half turn counterclockwise. Stepping back while the pressure is released from the cooling system.</p> <p>3 When you are sure all the pressure has been released, (still with a cloth) turn counterclockwise and remove the pressure relief cap.</p> <p>4 Inspect the pressure relief cap for foreign material between the sealing gasket and the diaphragm.</p> <ul style="list-style-type: none"> • Is the pressure relief cap OK? <p>▶ Yes GO to 6.</p> <p>▶ No CLEAN or INSTALL a new pressure relief cap. TEST the system for normal operation. GO to 1.</p>

PINPOINT TEST A: LOSS OF COOLANT (Continued)

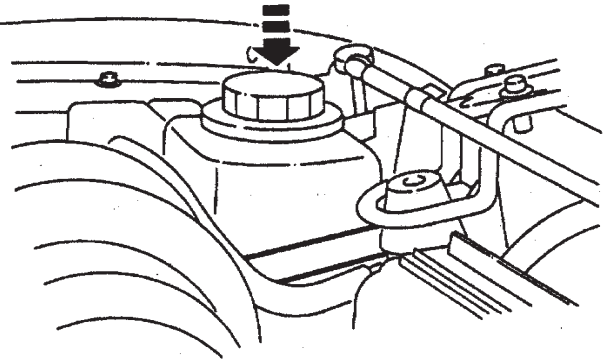
TEST CONDITIONS	TEST DETAILS/RESULTS/ACTIONS
6 CHECK THE DEGAS BOTTLE	<p>1 NOTE: The engine must be cool when coolant is added to the degas bottle.</p> <p>Add coolant to the degas bottle until fluid is between the coolant fill level marks.</p> <ul style="list-style-type: none"> • Does the degas bottle leak? <p>▶ Yes INSTALL a new degas bottle. TEST the system for normal operation.</p> <p>▶ No PERFORM the cooling system pressure test. For additional information, refer to Component Tests and Pressure Test in this section. REPAIR as necessary. TEST the system for normal operation.</p>

PINPOINT TEST B: THE ENGINE OVERHEATS

TEST CONDITIONS	TEST DETAILS/RESULTS/ACTIONS
1 CHECK THE ENGINE COOLANT LEVEL	
NOTE: If the engine is hot, allow the engine to cool before proceeding.	
	<p>1  WARNING: NEVER REMOVE THE PRESSURE RELIEF CAP WHILE THE ENGINE IS OPERATING OR WHEN THE COOLING SYSTEM IS HOT. MAY CAUSE PERSONAL INJURY OR DAMAGE TO COOLING SYSTEM OR ENGINE. TO AVOID HAVING SCALDING HOT COOLANT OR STEAM BLOW OUT OF THE DEGAS BOTTLE WHEN REMOVING THE PRESSURE RELIEF CAP, WAIT UNTIL THE ENGINE HAS COOLED DOWN TO AT LEAST 110°F.</p> <p>2 Wrap a thick cloth around the pressure relief cap and turn it slowly one-half turn counterclockwise. Stepping back while the pressure is released from the cooling system.</p> <p>3 When you are sure all the pressure has been released, (still with a cloth) turn counterclockwise and remove the pressure relief cap.</p> <p>4 Check the engine coolant level at the degas bottle.</p> <ul style="list-style-type: none"> • Is the engine coolant OK? <p>▶ Yes GO to 2.</p> <p>▶ No REFILL the engine coolant at the degas bottle. GO to Pinpoint Test A.</p>

(Continued)

PINPOINT TEST B: THE ENGINE OVERHEATS (Continued)

TEST CONDITIONS	TEST DETAILS/RESULTS/ACTIONS
<p>2 CHECK THE COOLANT CONDITION</p>	<p>1 Check the coolant for contaminants such as rust, corrosion, or discoloration.</p> <ul style="list-style-type: none"> • Is the coolant condition OK? <p>▶ Yes GO to 3.</p> <p>▶ No FLUSH the engine cooling system. For additional information, refer to Flushing – Engine and Radiator in this section. TEST the system for normal operation.</p>
<p>3 CHECK FOR AN AIRFLOW OBSTRUCTION</p>	<p>1 Inspect the radiator for obstructions such as leaves or dirt.</p> <ul style="list-style-type: none"> • Is there an obstruction? <p>▶ Yes REMOVE the obstruction. CLEAN the radiator. TEST the system for normal operation.</p> <p>▶ No GO to 4.</p>
<p>4 CHECK THE HEATER CORE (IF EQUIPPED) OPERATION AND/OR LPG EVAPORATOR</p>  <p style="text-align: right;">Q4194-B</p>	<p>1 Install the pressure relief cap.</p>

(Continued)

PINPOINT TEST B: THE ENGINE OVERHEATS (Continued)

TEST CONDITIONS	TEST DETAILS/RESULTS/ACTIONS
<p>4 CHECK THE LPG EVAPORATOR OPERATION (Continued)</p>	<p>2 As the engine starts to heat up, feel the inlet and outlet heater water hoses (18472). They should feel approximately the same after three or four minutes.</p> <ul style="list-style-type: none"> • Is the LPG evaporation hose approximately the same temperature as the inlet heater water hose? <p>▶ Yes GO to 5.</p> <p>▶ No TURN the engine off. REPAIR or INSTALL a new heater core or clear the LPG evaporation coolant passage way. TEST the system for normal operation.</p>
<p>5 CHECK THE WATER THERMOSTAT OPERATION</p>	<p>1 Start the engine and allow the engine to run for ten minutes.</p> <p>2 Feel the inlet and outlet heater water hoses and the underside of the upper radiator hose (8260).</p> <ul style="list-style-type: none"> • Are the upper radiator hose and the heater water hoses cold? <p>▶ Yes INSTALL a new water thermostat. TEST the system for normal operation.</p> <p>▶ No Go to 6.</p>
<p>6 CHECK THE COOLING FAN OPERATION</p>	<p>1 Perform the cooling fan component tests. For additional information, refer to the Component Tests in this section.</p> <ul style="list-style-type: none"> • Is the cooling fan operation OK? <p>▶ Yes GO to Section 01 for diagnosis and testing of the engine.</p> <p>▶ No INSTALL a new component determined to be faulty. For additional information, refer to Fan – Blade, and Shroud in this section. TEST the system for normal operation.</p>

(Continued)

PINPOINT TEST C: THE ENGINE DOES NOT REACH NORMAL OPERATING TEMPERATURE

TEST CONDITIONS	TEST DETAILS/RESULTS/ACTIONS
1 CHECK THE ENGINE TEMPERATURE	<p>1 Start the engine and allow the engine to idle for ten minutes.</p> <p>Feel the inlet and heater water hoses and the underside of the upper radiator hose.</p> <ul style="list-style-type: none">• Are the upper radiator hose and the heater water hoses cold? <p>▶ Yes INSTALL a new water thermostat.</p> <p>▶ No Test and diagnose the engine coolant temperature gauge.</p>

SPECIFICATIONS

General Specifications

Item	Specification
Drive Belt	6 Ribs
Capacity 4.2L ¹ (qts)	16.4 (17.3)
Coolant Mixture With Water	50% ²
Radiator Pressure Test	138 kPa (20 psi)
Water Pump Pulley Ratio	1.2
Water Thermostat Start To Open Temperature C (F)	83-87°C (181-188.6°F)
Water Thermostat Full Open Temperature C (F)	97.7-100°C (206-213°F)
Lubrication & Sealants	
Ford Premium Cooling System Flush F1AZ-19A503-A	ESR-M14P7-A
Pipe Sealant with Teflon® D8AZ-19554-A	WSK-M2G350-A2
Premium Long Life Grease XG-1-C	ESA-M1C75-B
Stop Leak Powder E6AZ-19558-A	ESE-M99B170

¹ Includes radiator coolant recovery reservoir fluid level between the "COOLANT FILL LEVEL" lines.

² Ford Premium Engine Coolant (green in color) ESE-M97B44-A or -B (Canada: Motorcraft CXC-10-B, Oregon: VC-5) Recycled Coolant or equivalent meeting Ford specification ESE-M97B44-A.

Torque Specifications

Description	Nm	Lb-Ft
Belt Idler Pulley Bolt	55	40
Drive Belt Tensioner Bolt	55	40

Description	Nm	Lb-Ft	Lb-In
Cylinder Head Temperature Sensor	9-11	–	80-95
Pulley to water pump	21-29	15-21	
Fan Assembly To Water Pump	55	41	–
Fan Shroud Bolts	9	–	80
Radiator Draincock	0.7-1.4	–	6-12
Radiator Support Bracket Bolts	30	22	–
Water Inlet and Outlet Connection Clamps	9	–	80
Water Pump Bolts	25	18	–
Water Outlet Tube Mounting Bolt	35-45	26-33	–

NOTE: Bolt information on installation page this section.