

# **SERVICE MANUAL**

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## **SERVICE MANUAL SECTION**

### **CF 500, CF 600 Cooling System**

**Truck Model: CF 500**

**Truck Model: CF 600**

**Unit Code: 12THU**

**Unit Code: 12UWR**

**Unit Code: 12890**

**S12015**

**04/29/2005**

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S12015

Read all safety instructions in the "Safety Information" section of this manual before doing any procedures.

Follow all warnings, cautions, and notes.

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## Safety Information

**NOTE:** Read the following before starting the service procedure.

The information contained in this International Service Manual Section was current at the time of printing and is subject to change without notice or liability.

You must follow your company safety procedures when you service or repair equipment. Be sure to understand all of the procedures and instructions before you begin work on the unit.

International uses the following types of notations to give warning of possible safety problems and to give information that will prevent damage to the equipment being serviced or repaired.



**WARNING:** A warning indicates procedures that must be followed exactly. Personal injury or possible death can occur if the procedure is not followed.

**CAUTION:** A caution indicates procedures that must be followed exactly. If the procedure is not followed, damage to equipment or components can occur.

**NOTE:** A note indicates an operation, procedure or instruction that is important for correct service.

Some procedures require the use of special tools for safe and correct service. Failure to use these special tools when required can cause injury to service personnel or damage to vehicle components.

This service manual section is intended for use by professional technicians, NOT a “do-it-yourselfer.” It is written to inform these technicians of conditions that may occur on some vehicles, or to provide information that could assist in the proper service of a vehicle. Properly trained technicians have the equipment, tools, safety instructions, and know-how to do a job properly and safely. If a condition is described, DO NOT assume that the service section applies to your vehicle. See your International Truck Dealer for information on whether this service section applies to your vehicle.

## Cooling System

### Specifications

**Table 1 General Specifications**

Item	Specification
<b>Cooling System Capacity</b>	
4.5L	—
<b>Cooling System Pressure Test Specifications</b>	
Radiator test pressure	103 kPa (15 psi)
<b>Radiator Cap Pressure Test Specifications</b>	
Pressure relief opening pressure	103 kPa (15 psi)
<b>Thermostat Opening Temperatures</b>	
Starts to open — 4.5L	87°-91°C (189°-196°F)
Fully open — 4.5L	104°C (219°F)

**Table 2 Torque Specifications**

Description	Nm	lb-ft.	lb-in.
Fan blade-to-fan clutch mounting bolts	17	13	—
Fan shroud-to-radiator nuts	6	—	53
Coolant pump pulley bolts	36	26	—
Fan clutch hub to coolant pump	133	98	—
Coolant pump mounting	23	17	—
Charge-air-cooler (CAC) duct clamps	12	9	—
Radiator strut rod bolts (M12)	107	79	—
Thermostat housing stud bolts	22	16	—
Block heater	41	30	—
CAC nuts	31	23	—
A/C condenser nuts	31	23	—

**Description and Operation****Cooling System**

**CAUTION:** Always fill the cooling system with the same type of coolant that is present in the system. Do not mix coolant types.

The cooling system components are the:

- Block heater
- Fan blade
- Fan clutch
- Fan shroud
- Radiator
- Coolant reservoir
- Pressure relief cap
- Coolant pump
- Coolant thermostat
- Upper radiator hose
- Lower radiator hose
- Coolant reservoir supply hose

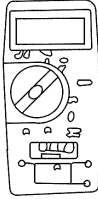

Engine coolant provides freeze protection, boil protection, cooling efficiency and corrosion protection to the engine and cooling components. In order to obtain these protections, the engine coolant must be maintained at the correct concentration and fluid level in the coolant reservoir.

When adding engine coolant, use a 50/50 mixture of engine coolant and distilled water.

To maintain the integrity of the coolant and the cooling system:

- Do not add alcohol, methanol, brine or any engine coolants mixed with alcohol or methanol antifreeze. These can cause engine damage from overheating or freezing.
- Do not mix with recycled coolant. Use of such coolants may harm the engine and cooling system components. Do not mix coolant types.

**Diagnosis and Testing****Table 3 Special Tools**

 <p>ST1137-A</p>	<p>Digital Multimeter ZTSE4357</p>
	<p>EZ-Tech III</p>

**Inspection and Verification**

**WARNING:** Do not unscrew the coolant pressure relief cap while the engine is operating or hot. The cooling system is under pressure; steam and hot liquid can come out forcefully when the cap is loosened slightly. Failure to follow these instructions may result in personal injury.

**CAUTION:** Check the coolant level, engine oil and transmission fluid. Top off the coolant if needed. If there is engine coolant in the engine oil or transmission fluid, the cause must be corrected and oil/fluid changed or major component damage can occur.

**CAUTION:** Always fill the cooling system with the same coolant that is present in the system. Do not mix coolant types.

1. Verify the customer concern by operating the engine to duplicate the condition.
2. Inspect to determine if any of the following mechanical or electrical concerns apply.

**Table 4 Visual Inspection Chart**

Mechanical	Electrical
<ul style="list-style-type: none"> <li>• Leaks</li> <li>• Damaged hoses</li> <li>• Loose/ damaged hose clamps</li> <li>• Damaged coolant gasket</li> <li>• Damaged head gaskets</li> <li>• Damaged coolant pump</li> <li>• Damaged radiator</li> <li>• Damaged coolant reservoir</li> <li>• Damaged heater core</li> <li>• Restricted airflow through the radiator cooling fins</li> <li>• Damaged fan/fan clutch</li> <li>• Damaged fan shroud</li> <li>• Charge air cooler fins obstructed</li> </ul>	<ul style="list-style-type: none"> <li>• Damaged engine coolant temperature sensor</li> <li>• Damaged wiring</li> </ul>

3. If the inspection reveals an obvious concern that can be readily identified, repair it as necessary.
4. Inspect the coolant condition.
  - If the engine coolant appearance is acceptable, test the engine coolant freezing point range. The freezing point should be in the range -46°C to -23°C (-50°F to -10°F). If the vehicle is driven in cold climates lower than -37°C (-34°F), it may be necessary to increase the coolant concentration to get adequate freeze protection.
    - Maximum coolant concentration is 60/40.
    - Minimum coolant concentration is 40/60.

- Adjust coolant range and level if necessary:
    - If coolant is low, add specified coolant mixture only.
    - If the engine coolant tests too 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 distilled water until the readings are within acceptable levels.
5. If the concern remains after the inspection, determine the symptom(s). GO to Symptom Chart.

**Table 5 Engine Control Module (ECM) Diagnostic Trouble Code**

DTC	Description	Source	Action
316	Engine coolant temperature unable to reach commanded set point	ECM	GO to Pinpoint Test C.
321	Engine coolant temperature above warning level	ECM	GO to Pinpoint Test B.
322	Engine coolant temperature above critical level	ECM	GO to Pinpoint Test B.
325	Power reduced — matched to cooling system performance	ECM	GO to Pinpoint Test B.



## Symptom Chart

Table 6 Symptom Chart

Condition	Possible Sources	Action
Loss of coolant	<ul style="list-style-type: none"> <li>• Radiator</li> <li>• Pressure relief cap</li> <li>• Coolant pump seal</li> <li>• Radiator hoses or clamps</li> <li>• Heater hoses</li> <li>• Heater core</li> <li>• Engine gaskets</li> <li>• Coolant reservoir</li> </ul>	GO to Pinpoint Test A.
The engine overheats	<ul style="list-style-type: none"> <li>• Coolant thermostat</li> <li>• Coolant pump</li> <li>• Internal engine coolant leak</li> <li>• Radiator</li> <li>• Cooling fan</li> <li>• Fan clutch</li> <li>• Pressure relief cap</li> <li>• Insufficient water or coolant in coolant mixture.</li> <li>• Fan belt</li> <li>• Restricted airflow</li> <li>• Low coolant level</li> </ul>	GO to Pinpoint Test B.
The engine does not reach normal operating temperature	Coolant thermostat	GO to Pinpoint Test C.
The block heater does not operate correctly	<p>A. Block heater power cable</p> <p>B. Block heater</p>	<p>A. CHECK the resistance of all 3 circuits in the power cable. If any circuit measures greater than 5 ohms, INSTALL a new power cable.</p> <p>B. CHECK the resistance of the block heater. If it does not measure between 12.5 and 17.0 ohms, INSTALL a new block heater.</p>

## Pinpoint Tests

Table 7 PINPOINT TEST A: LOSS OF COOLANT



Test Step	Result / Action to Take
<b>A1 CHECK THE ENGINE COOLANT LEVEL</b>  <b>NOTE:</b> Allow the engine to cool before checking the engine coolant level. <ul style="list-style-type: none"> <li>Key in OFF position.</li> </ul> <div style="border: 1px solid black; padding: 5px; margin: 10px 0;">  <b>WARNING:</b> Do not unscrew the coolant pressure relief cap while the engine is operating or hot. The cooling system is under pressure; steam and hot liquid can release forcefully when the cap is loosened slightly. Failure to follow these instructions may result in personal injury.         </div> <ul style="list-style-type: none"> <li>Visually check the engine coolant level at the coolant reservoir.</li> </ul> <b>Is the engine coolant level within specification?</b>	<b>Yes</b>  GO to A2.  <b>No</b>  REFILL the engine coolant as necessary. GO to A2.
<b>A2 CHECK THE COOLANT RESERVOIR PRESSURE RELIEF CAP</b>  <div style="border: 1px solid black; padding: 5px; margin: 10px 0;">  <b>WARNING:</b> Do not unscrew the coolant pressure relief cap while the engine is operating or hot. The cooling system is under pressure; steam and hot liquid can release forcefully when the cap is loosened slightly. Failure to follow these instructions may result in personal injury.         </div> <ul style="list-style-type: none"> <li>Inspect the pressure relief cap for foreign material between the sealing gasket and the diaphragm.</li> </ul> <b>Is the pressure relief cap OK?</b>	<b>Yes</b>  GO to A3.  <b>No</b>  CLEAN or INSTALL a new pressure relief cap. TEST the system for normal operation. GO to A3.

Table 7 PINPOINT TEST A: LOSS OF COOLANT (cont.)


Test Step	Result / Action to Take
<b>A3 CHECK THE ENGINE COOLANT FOR AN INTERNAL LEAK</b> <ul style="list-style-type: none"> <li>Key in OFF position.</li> </ul> <div style="border: 1px solid black; padding: 10px; margin: 10px 0;">  <b>WARNING:</b> Do not unscrew the coolant pressure relief cap while the engine is operating or hot. The cooling system is under pressure; steam and hot liquid can release forcefully when the cap is loosened slightly. Failure to follow these instructions may result in personal injury.         </div> <ul style="list-style-type: none"> <li>Inspect the engine coolant in the coolant reservoir for signs of transmission fluid or engine oil.</li> </ul> <b>Is oil or transmission fluid evident in the coolant?</b>	<b>Yes</b> If engine oil is evident, GO to EGES-305, Engine Diagnostics Manual. If transmission fluid is evident, REPAIR or INSTALL a new radiator as necessary.
<b>A4 CHECK THE ENGINE AND THE TRANSMISSION FOR COOLANT</b> <ul style="list-style-type: none"> <li>Remove the oil level and transmission fluid level indicators.</li> </ul> <b>Is coolant evident in the oil/fluid?</b>	<b>Yes</b> If coolant is in the engine, GO to EGES-305, Engine Diagnostics Manual. If coolant is in the transmission, INSTALL a new radiator.
<b>A5 PRESSURE TEST THE ENGINE COOLING SYSTEM</b> <ul style="list-style-type: none"> <li>Pressure test the engine cooling system.</li> </ul> <b>Does the engine cooling system leak?</b>	<b>Yes</b> REPAIR or INSTALL new components. TEST the system for normal operation.
	<b>No</b> The cooling system is operational. GO to Symptom Chart.

Table 8 PINPOINT TEST B: THE ENGINE OVERHEATS


Test Step	Result / Action to Take
<b>B1 CHECK THE ENGINE COOLANT LEVEL</b>  <b>NOTE:</b> If the engine is hot, allow the engine to cool before proceeding. <ul style="list-style-type: none"> <li>Key in OFF position.</li> </ul> <div style="border: 1px solid black; padding: 5px; margin: 10px 0;">  <b>WARNING:</b> Do not unscrew the coolant pressure relief cap while the engine is operating or hot. The cooling system is under pressure; steam and hot liquid can release forcefully when the cap is loosened slightly. Failure to follow these instructions may result in personal injury.         </div> <ul style="list-style-type: none"> <li>Allow the engine to cool.</li> <li>Check the engine coolant level at the coolant reservoir.</li> </ul> <b>Is the engine coolant OK?</b>	<b>Yes</b>  GO to B2.  <b>No</b>  REFILL the engine coolant at the coolant reservoir. GO to Pinpoint Test A.
<b>B2 CHECK THE COOLANT CONDITION</b>  <ul style="list-style-type: none"> <li>Check the coolant for contaminants such as rust, corrosion or discoloration.</li> </ul> <b>Is the coolant condition OK?</b>	<b>Yes</b>  GO to B3.  <b>No</b>  FLUSH the engine cooling system. TEST the system for normal operation.
<b>B3 CHECK FOR AN AIRFLOW OBSTRUCTION</b>  <ul style="list-style-type: none"> <li>Inspect the A/C condenser core, radiator and the charge-air-cooler, for obstructions such as leaves or dirt.</li> </ul> <b>Is there an obstruction?</b>	<b>Yes</b>  REMOVE the obstruction. CLEAN the A/C condenser core, charge-air-cooler and radiator. TEST the system for normal operation.  <b>No</b>  GO to B4.

Table 8 PINPOINT TEST B: THE ENGINE OVERHEATS (cont.)

Test Step	Result / Action to Take
<b>B4 CHECK THE COOLANT THERMOSTAT OPERATION</b> <ul style="list-style-type: none"> <li>Key in START position.</li> <li>Drive for 20 minutes in 2nd gear to open the thermostat.</li> <li>Feel the inlet heater hose and the underside of the upper radiator hose.</li> </ul> <b>Are the upper radiator hose and the inlet heater hoses cold?</b>	<b>Yes</b> INSTALL a new coolant thermostat. TEST the system for normal operation.  <b>No</b> GO to B5.
<b>B5 CHECK THE COOLING FAN OPERATION</b> <ul style="list-style-type: none"> <li>Key in OFF position.</li> <li>Carry out the cooling fan component tests. Refer to Fan Clutch Test in this section.</li> </ul> <b>Is the cooling fan operation OK?</b>	<b>Yes</b> REFER to EGES-305, Engine Diagnostics Manual for diagnosis and testing of the engine.  <b>No</b> INSTALL new fan components as necessary. TEST the system for normal operation.

Table 9 PINPOINT TEST C: THE ENGINE DOES NOT REACH NORMAL OPERATING TEMPERATURE

Test Step	Result / Action to Take
<b>C1 CHECK THE ENGINE TEMPERATURE</b> <ul style="list-style-type: none"> <li>Key in START position.</li> <li>Drive for 20 minutes in 2nd gear to open the thermostat.</li> <li>Feel the inlet heater hose and the underside of the upper radiator hose.</li> </ul> <b>Are the upper radiator hose and the inlet heater hose cold?</b>	<b>Yes</b> INSTALL a new coolant thermostat. TEST the system for normal operation.  <b>No</b> REFER to Instrument Cluster in S08307 for diagnosis and testing of the engine coolant temperature gauge.

**Component Tests — Thermostat — Coolant**

A new coolant thermostat should be installed only after the following electrical and mechanical tests have been carried out.

**Component Tests — Thermostat, Electrical Test**

**CAUTION:** Always vent the exhaust to the outside when carrying out this test.

**NOTE:** The electrical thermostat test is most accurate if carried out indoors at less than 37.8°C (100°F) ambient air. This test may be carried out with the engine warm or cold.

1. Check the engine coolant level. Fill as needed.
2. A diagnostic tool may be used to monitor the engine coolant temperature (ECT).

**NOTE:** Running this test with the vehicle in gear or with the A/C compressor clutch engaged (running) will cause incorrect diagnosis.

3. Place the transmission in PARK (P) or NEUTRAL (N).

- Start the engine and allow the engine to idle throughout this test. Allow the engine to run for 2 minutes, then record the engine coolant temperature (ECT) voltage. Record the ECT sensor voltage every 60 seconds. When the ECT sensor voltage trend changes direction or only changes slightly (0.03 volt or less) from the previous reading, record this as the thermostat opening voltage. Use the voltage and corresponding coolant temperature chart listed below.

Table 10

Coolant Temperature °C (°F)	ECT (Volts)
22 (71)	3.00
43 (109)	2.01
71 (159)	1.01
82 (180)	0.75
91 (195)	0.59
97 (206)	0.50
105 (221)	0.40

- If the thermostat opening voltage is greater than 0.75 volts which corresponds to a coolant temperature of less than 82°C (180°F), install a new coolant thermostat.
- If the thermostat opening voltage is less than 0.75 volts which corresponds to a temperature of greater than 82°C (180°F), the coolant thermostat is good, a new thermostat should not be installed. GO to Symptom Chart for further instructions.

#### Component Tests — Thermostat, Mechanical Test

- Remove the coolant thermostat.
- Check the coolant thermostat for seating. Hold the coolant thermostat up to a lighted background. Leakage of light around the thermostat valve at room temperature indicates that a new coolant thermostat should be installed. Some coolant thermostats have a small leakage notch at one

location on the perimeter of the thermostat valve, which is considered normal.

- Immerse the coolant thermostat in a boiling antifreeze and water mixture.
- See the General Specifications chart for coolant thermostat opening temperatures.

#### Component Tests — Radiator Leak Test, Removed From the 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.

**NOTE:** Always install plugs in the oil cooler fittings before leak-testing or cleaning any radiator.

**NOTE:** Clean the radiator before leak-testing to avoid contamination of the tank.

- Leak test the radiator in clean water with 138 kPa (20 psi) air pressure.

#### Fan Inspection

Inspect the fan blade for cracks or missing blades.

#### Component Tests — Fan Clutch Test

- Inspect the fan clutch for excessive wobble or free play at the mounting shaft.
- Run the engine at 2,000 rpm for 5 minutes to disengage the fan clutch. Shut off the engine and spin the fan blade by hand. A light resistance should be felt. No resistance or very high resistance indicates an unserviceable fan clutch.
- If any of the above conditions exists, install a new fan clutch. For additional information, refer to Cooling Fan in this section.

**General Procedures****Cooling System Draining, Filling and Bleeding****Draining**

**WARNING:** Never remove the pressure relief cap while the engine is operating or when the cooling system is hot. Failure to follow these instructions can result in damage to the cooling system or engine or result in personal injury. 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, then wrap a thick cloth around the pressure relief cap and turn it slowly. Step back while the pressure is released from the cooling system. When certain all the pressure has been released, (still with a cloth) turn and remove the pressure relief cap. Failure to follow these instructions can result in personal injury.

**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 correctly and the system filled with new coolant.

**CAUTION:** Always fill the cooling system with the same type of coolant that was drained from the system. Do not mix coolant types.

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

1. Place a suitable container below the radiator draincock. If equipped disconnect the coolant return hose at the fluid cooler.
2. Remove the pressure relief cap from the coolant reservoir.

3. Open the radiator draincock. Remove the cylinder drain plug, if equipped, to drain the coolant from the cylinder block.

**Filling and Bleeding**

**CAUTION:** Engine coolant provides freeze protection, boil protection, cooling efficiency and corrosion protection to the engine and cooling components. In order to obtain these protections, the engine coolant must be maintained at the correct concentration and fluid level in the coolant reservoir.

When adding engine coolant, use a 50/50 mixture of engine coolant and distilled water.

To maintain the integrity of the coolant and the cooling system:

- Add the same type of coolant that was drained from the system. Do not mix coolant types.
- Do not add alcohol, methanol, brine or any engine coolants mixed with alcohol or methanol antifreeze. These can cause engine damage from overheating or freezing.

1. Fill the engine cooling system via the coolant reservoir until coolant level is between the coolant fill level marks.
2. Run the engine until it reaches operating temperature at 2,000 rpm for 5 minutes.
3. Turn off the engine and allow the cooling system to cool.
4. Add the correct engine coolant mixture to the coolant reservoir until the coolant level is between the "COOLANT FILL LEVEL" marks.


**CAUTION:** If the air discharge remains cool and the engine coolant temperature gauge does not move, the engine coolant level is low in the engine and must be filled. Stop the engine, allow to cool and fill the cooling system as described.

5. Start the engine and allow to idle until normal operating temperature is reached. Hot air should discharge from the A/C vents with the climate control setting to full heat. The engine coolant temperature gauge should maintain a stabilized reading in the middle of the NORMAL range and the upper radiator hose should feel hot to the touch.
6. Repeat Steps 3-5 until the level is OK.

**CAUTION:** Always fill the cooling system with the same type of coolant that was drained from the system. Do not mix coolant types.

7. Fill the cooling system. For additional information, refer to Cooling System Draining, Filling and Bleeding in this section.

### Coolant System Flushing


 **WARNING:** Do not unscrew the coolant pressure relief cap while the engine is operating or hot. The cooling system is under pressure; steam and hot liquid can come out forcefully when the cap is loosened slightly. Failure to follow these instructions may result in personal injury.

1. Once pressure is released, remove the pressure relief cap.  
  
Drain the cooling system. For additional information, refer to Cooling System Draining, Filling and Bleeding in this section.
2. Remove the coolant thermostat.
3. Install the coolant hose connection without the coolant thermostat.

**NOTE:** Refer to the cooling system flusher manufacturer's operating instructions for specific vehicle hook-up.

4. Use an appropriate cooling system flusher to flush the engine and radiator.
5. Install the coolant thermostat. For additional information, refer to Thermostat in this section.
6. Backflush the heater core if necessary. For additional information, refer to Heater Core Backflushing in this section.

### Heater Core Backflushing

 **WARNING:** Never remove the pressure relief cap while the engine is operating or when the cooling system is hot. Failure to follow these instructions can result in damage to the cooling system or engine or personal injury. 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, then wrap a thick cloth around the pressure relief cap and turn it slowly. Step back while the pressure is released from the cooling system. When you are sure all the pressure has been released, (still with a cloth) turn and remove the pressure relief cap.

1. Once pressure is released, remove the pressure relief cap.
2. Clamp off the heater hoses.

**NOTE:** Refer to the cooling system flusher manufacturer's operating instructions for specific vehicle hook-up.

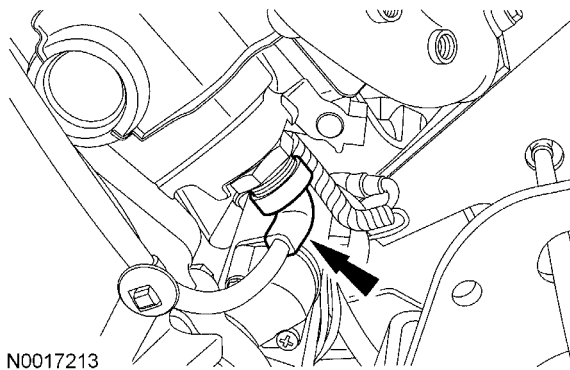
3. Use an appropriate cooling system flusher to backflush the heater core.
4. Remove the clamps from the heater hoses.



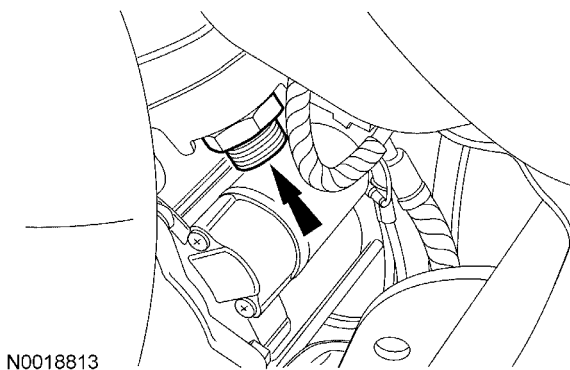
**Removal and Installation****Block Heater**

**CAUTION:** Always fill the cooling system with the same type of coolant that was drained from the system. Do not mix coolant types.

1. Drain the cooling system. For additional information, refer to Cooling System Draining, Filling and Bleeding in this section.
2. Disconnect the block heater electrical connector.



3. Remove the block heater and discard the O-ring seal.
  - To install, tighten to 41 Nm (30 lb-ft).
  - Install a new O-ring seal.



4. To install, reverse the removal procedure.

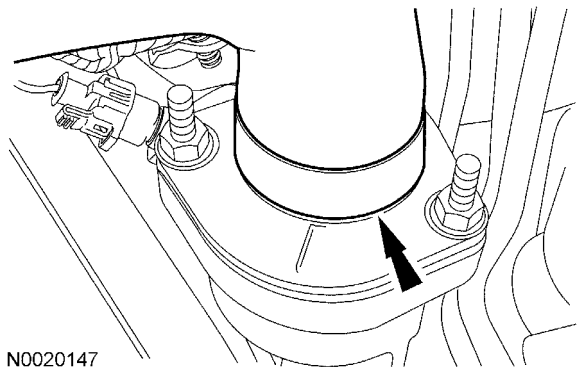
**Thermostat**

**CAUTION:** Always fill the cooling system with the same type of coolant that was drained from the system. Do not mix coolant types.

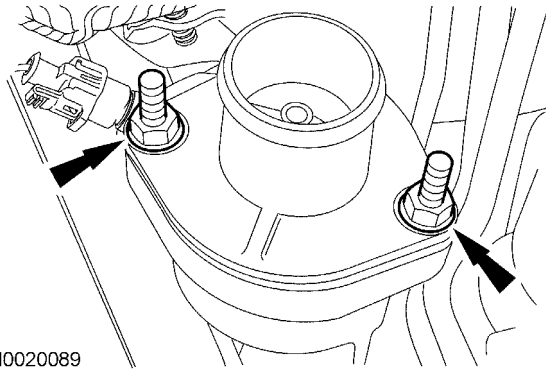
1. Drain the cooling system. For additional information, refer to Cooling System Draining, Filling and Bleeding in this section.

**CAUTION:** Use care when removing the radiator hose band clamp or damage to the radiator hose can occur.

2. Carefully remove the clamp and disconnect the upper radiator hose.



3. Remove the 2 stud bolts and the thermostat assembly.
  - Remove and discard the O-ring seal.
  - To install, tighten to 22 Nm (16 lb-ft).

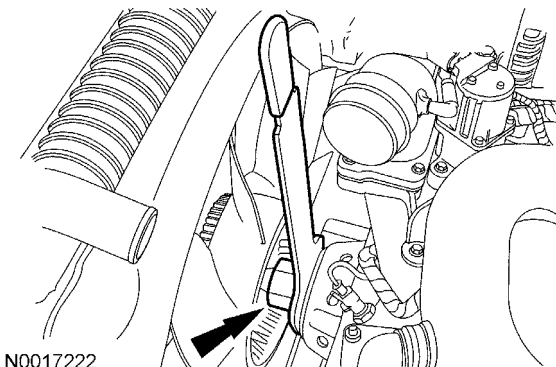


4. To install, reverse the removal procedure.
  - Install a new O-ring seal on the thermostat assembly.

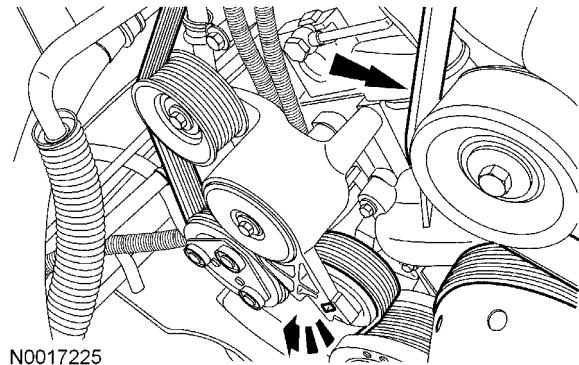
### Coolant Pump

**CAUTION:** Always fill the cooling system with the same type of coolant that was drained from the system. Do not mix coolant types.

1. Drain the cooling system. For additional information, refer to Cooling System Draining, Filling and Bleeding in this section.
2. Remove the cooling fan.
  - To install, tighten to 133 Nm (98 lb-ft).

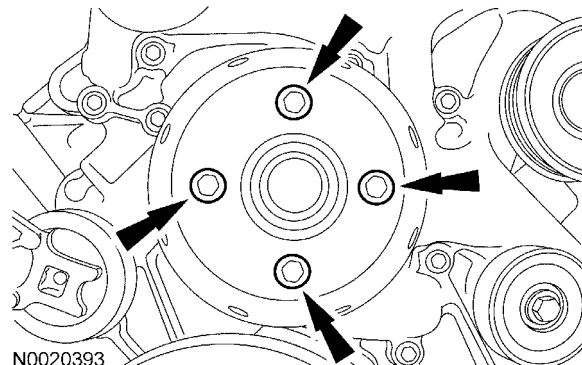


3. Rotate the accessory drive belt tensioner clockwise and remove the drive belt.

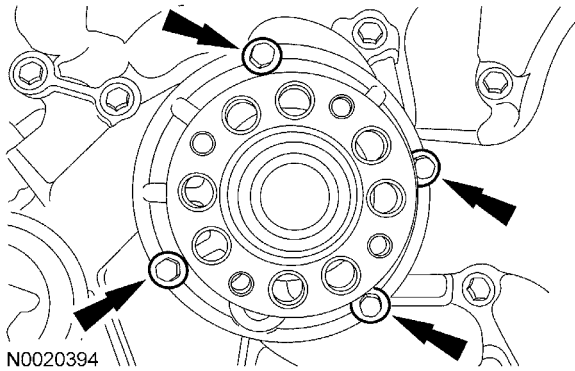


**NOTE:** Using a suitable tool, use a hole in the coolant pump pulley to prevent the pulley from turning.

4. Remove the bolts and the coolant pump pulley.
  - To install, tighten to 36 Nm (26 lb-ft).

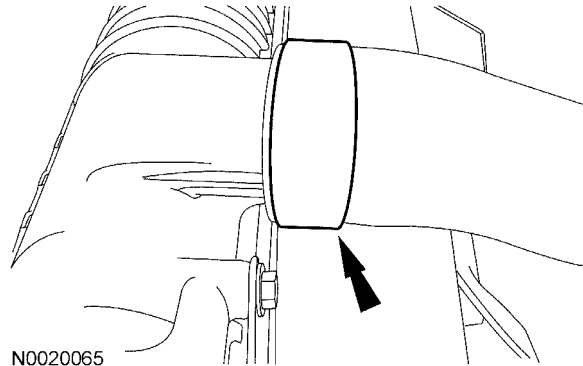


5. Remove the bolts, the coolant pump and discard the O-ring seal.
  - Inspect the mating surfaces. Clean the sealing surfaces with metal surface prep.
  - Install a new O-ring seal. Lubricate the O-ring seal with petroleum jelly prior to installation.
  - To install, tighten to 23 Nm (17 lb-ft).



**CAUTION:** Use care when removing the radiator hose band clamps or damage to the radiator hoses can occur.

3. Carefully remove the clamp and disconnect the upper radiator hose.

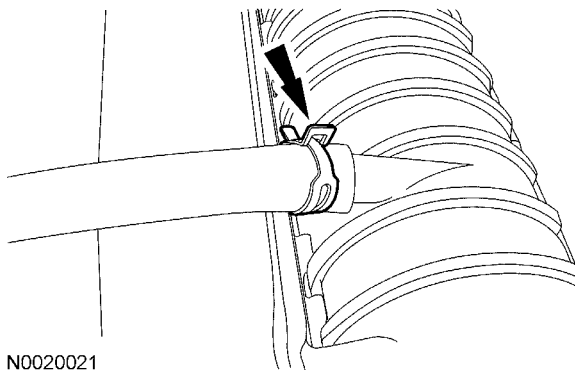


6. To install, reverse the removal procedure.

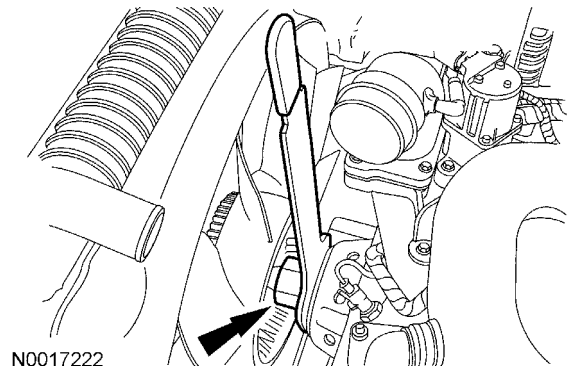
### Cooling Fan Shroud

**CAUTION:** Always fill the cooling system with the same type of coolant that was drained from the system. Do not mix coolant types.

1. Drain the cooling system. For additional information, refer to Cooling System Draining, Filling and Bleeding in this section.
2. Disconnect the radiator vent hose.

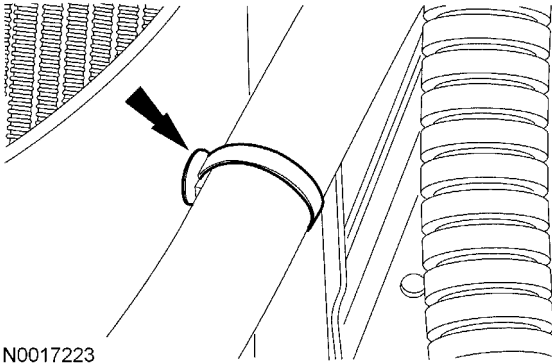


4. Remove the cooling fan.
  - To install, tighten to 133 Nm (98 lb-ft).

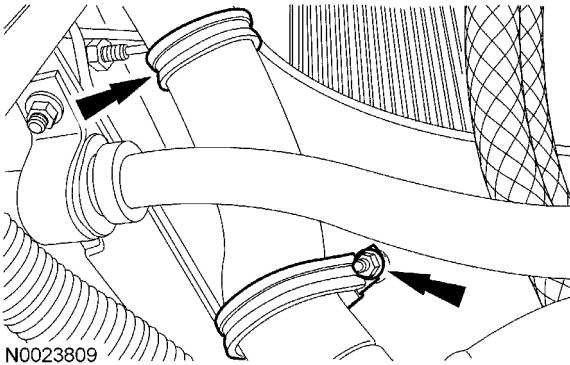


**NOTE:** Engine fill hose shown, transmission cooler hoses similar.

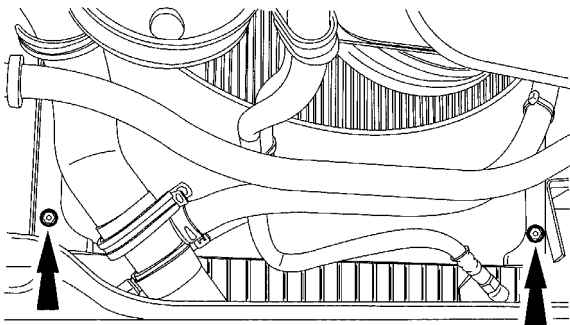
5. Disconnect the engine fill hose and transmission cooler hoses push pin retainers from the shroud.



6. Remove the retaining nuts and disconnect the lower radiator hose.

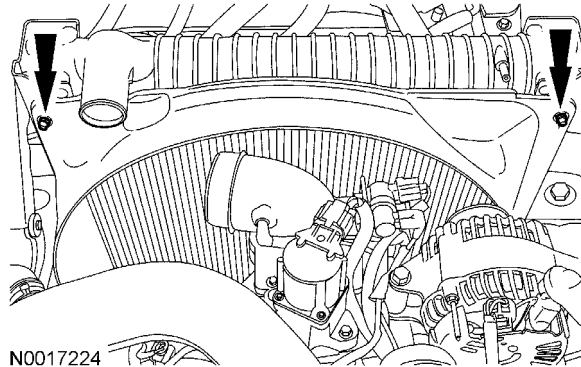


7. Remove the lower shroud retaining nuts.  
• To install, tighten to 6 Nm (53 lb-in).



**NOTE:** It is necessary to rotate the shroud to remove it from the vehicle.

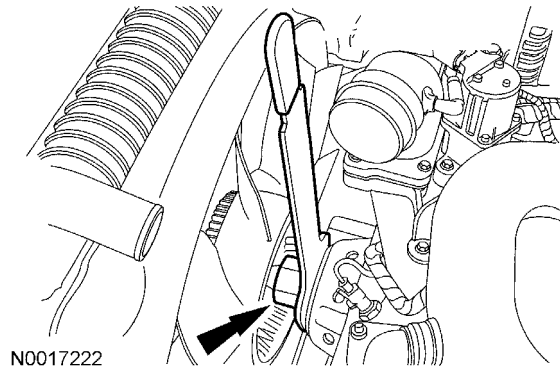
8. Remove the retaining nuts and the shroud.  
• To install, tighten to 6 Nm (53 lb-in).



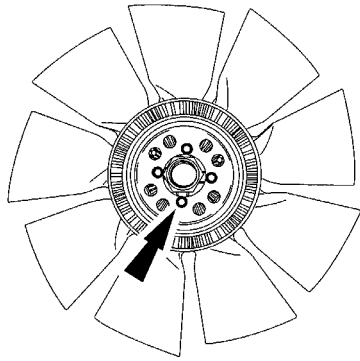
9. To install, reverse the removal procedure.  
• Install a new upper radiator hose clamp.  
• Fill and bleed the cooling system.

### Cooling Fan

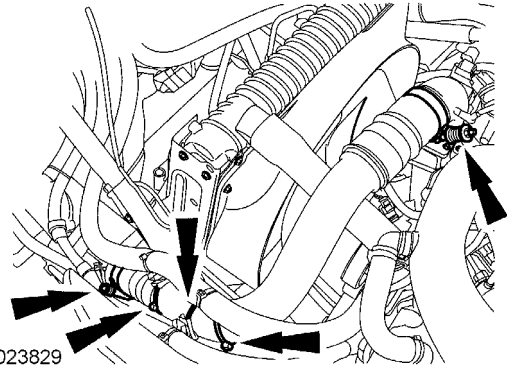
1. Remove the cooling fan and clutch.  
• To install, tighten to 133 Nm (98 lb-ft).



2. If necessary, remove the bolts and separate the cooling fan and the clutch.  
• To install, tighten to 17 Nm (13 lb-ft).



N0020187



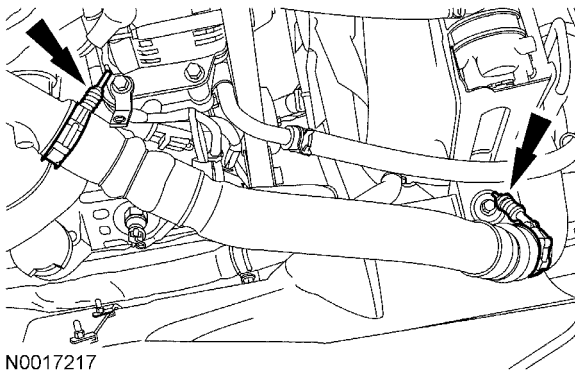
N0023829

3. To install, reverse the removal procedure.

### Radiator

**CAUTION:** Always fill the cooling system with the same type of coolant that was drained from the system. Do not mix coolant types.

1. Drain the cooling system. For additional information, refer to Cooling System Draining, Filling and Bleeding in this section.
2. Loosen the clamps and disconnect the charge-air-cooler (CAC) duct.
  - To install, tighten to 12 Nm (9 lb-ft).

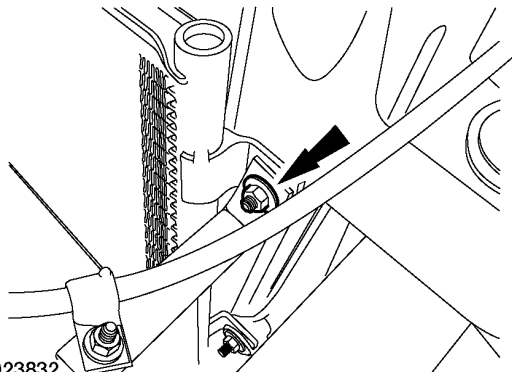


N0017217

3. Remove the tie straps. Loosen the clamps and disconnect the CAC duct.
  - To install, tighten to 12 Nm (9 lb-ft).

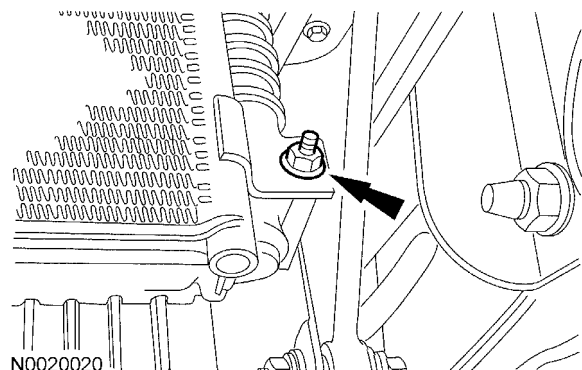
**NOTE:** LH shown, RH similar.

4. Remove the retaining nuts and position the heater hoses aside.
  - To install, tighten to 31 Nm (23 lb-ft).



N0023832

5. Remove the lower retaining nuts and position the A/C condenser aside.
  - To install, tighten to 31 Nm (23 lb-ft).



N0020020

S12015

Read all safety instructions in the "Safety Information" section of this manual before doing any procedures.

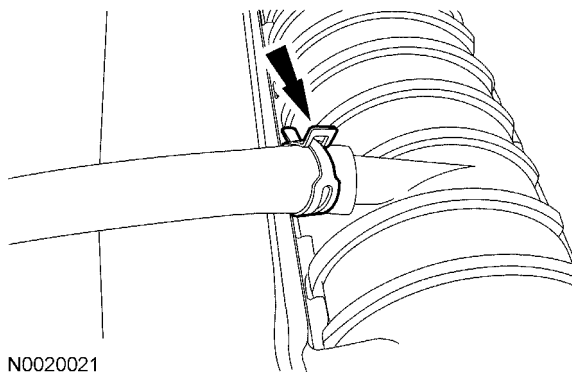
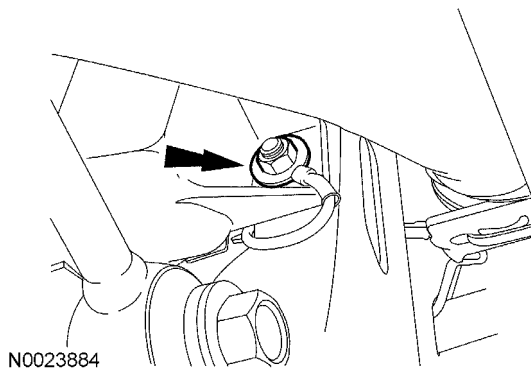
Follow all warnings, cautions, and notes.

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**NOTE:** LH shown, RH similar.

6. Remove the lower retaining nuts and ground wire.

- To install, tighten to 31 Nm (23 lb-ft).

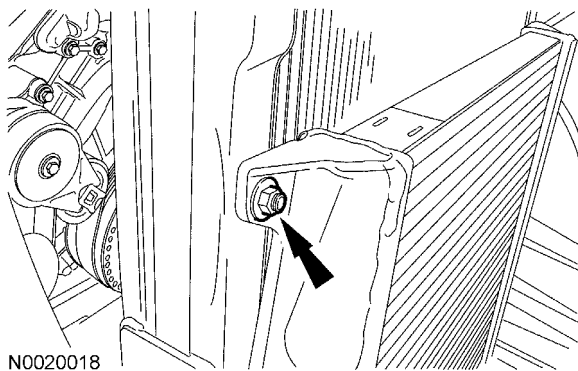


**CAUTION:** Use care when removing the radiator hose band clamps or damage to the radiator hoses can occur.

**NOTE:** RH shown, LH similar.

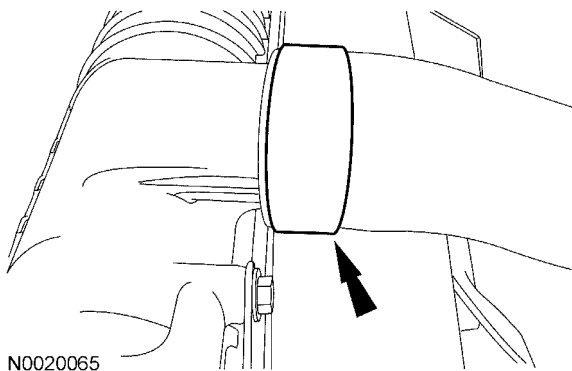
7. Remove the upper retaining nuts and the CAC.

- To install, tighten to 31 Nm (23 lb-ft).



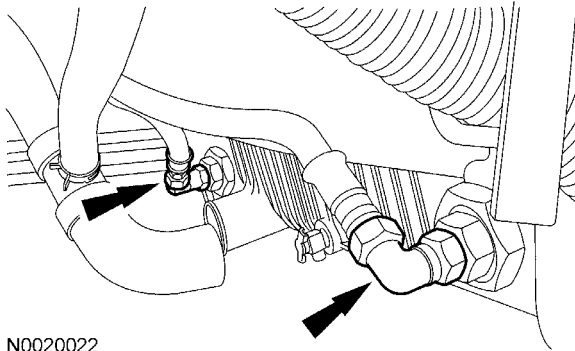
**NOTE:** Upper hose shown, lower hose similar.

9. Carefully remove the clamps and disconnect the radiator hoses.



8. Disconnect the radiator vent hose.

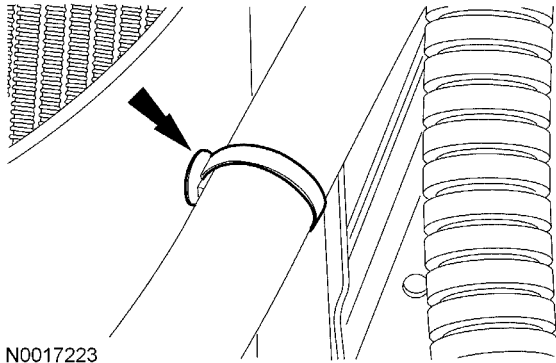
10. Disconnect the transmission cooling hoses.



N0020022

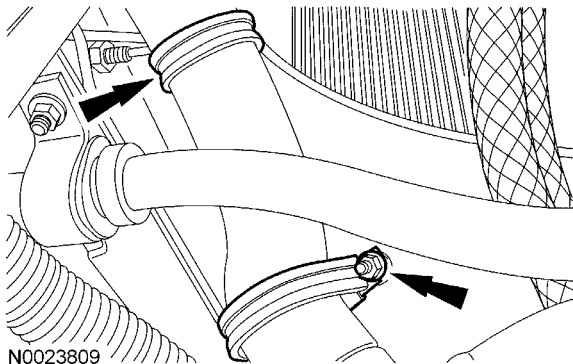
**NOTE:** Engine fill hose shown, transmission cooler hoses similar.

11. Disconnect the engine fill hose and transmission cooler hoses push pin retainers from the shroud.



N0017223

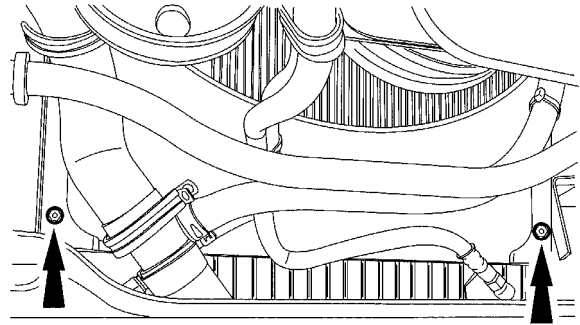
12. Remove the retaining nuts and disconnect the lower radiator hose.



N0023809

13. Remove the lower shroud retaining nuts.

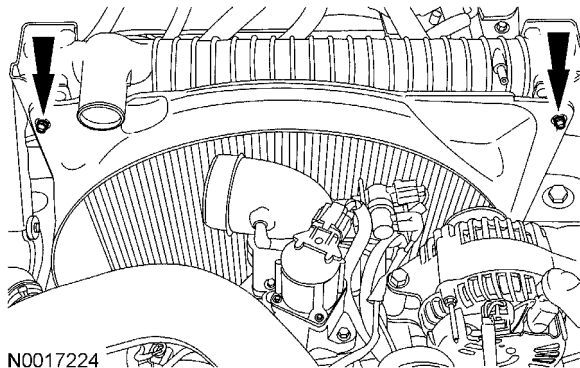
- To install, tighten to 6 Nm (53 lb-in).



N0023810

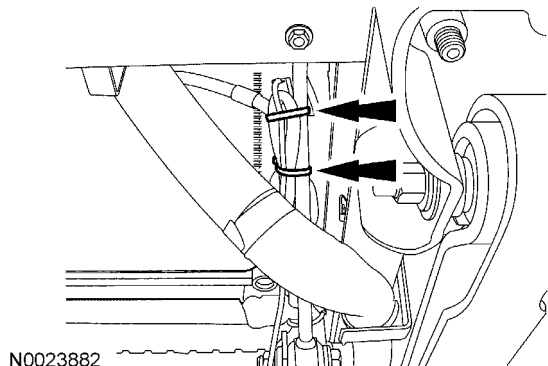
14. Remove the retaining nuts and position the shroud toward the engine.

- To install, tighten to 6 Nm (53 lb-in).



N0017224

15. Remove the tie straps and disconnect the wiring connector.

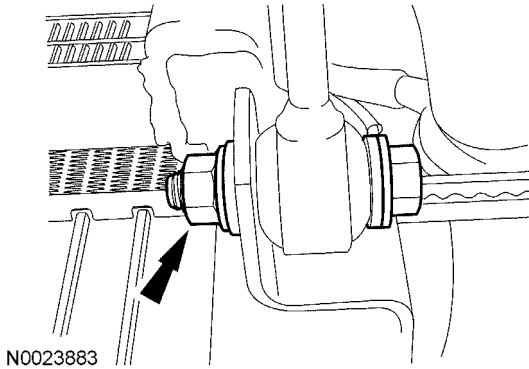


N0023882

**NOTE:** LH shown, RH similar.

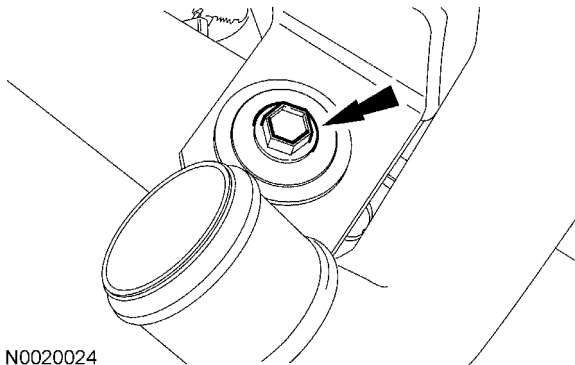
16. Remove the nuts, bolts and washers from the 2 radiator support rods.

- To install, tighten to 107 Nm (79 lb-ft).



17. Remove the mounting bolts and the radiator.

- To install, tighten to 107 Nm (79 lb-ft).



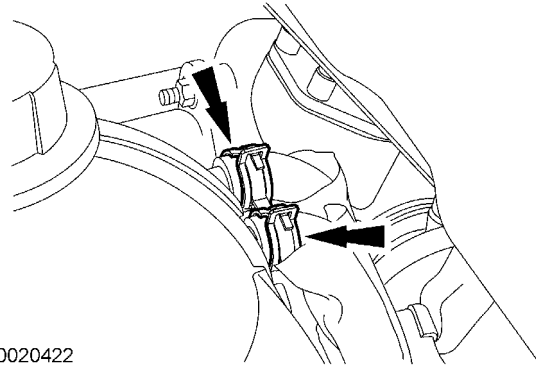
18. To install, reverse the removal procedure.

- Transfer the fittings as needed.
- Install new radiator hose clamps as needed.
- Fill and bleed the cooling system.
- Check and top off the transmission fluid level.

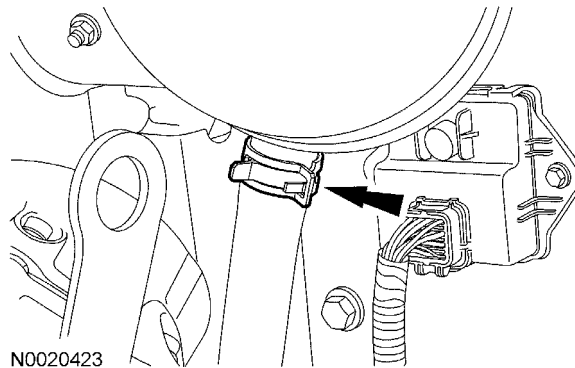
### Coolant Reservoir

**CAUTION:** Always fill the cooling system with the same type of coolant that was drained from the system. Do not mix coolant types.

1. Drain the cooling system. For additional information, refer to Cooling System Draining, Filling and Bleeding in this section.
2. Disconnect the radiator and engine hoses from the coolant reservoir.

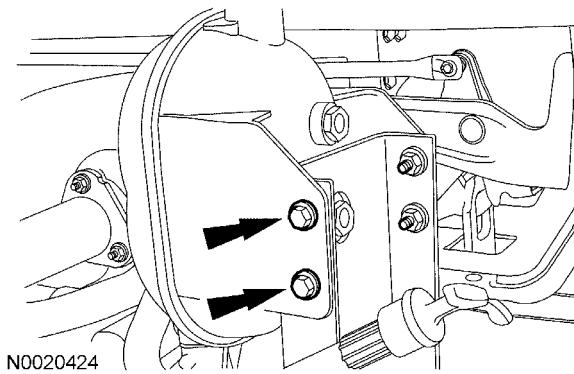


3. Disconnect the engine fill hose.



4. Remove the 4 bolts and the coolant reservoir.





5. To install, reverse the removal procedure.