
5 COOLING SYSTEM

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5.1 COOLANT PRE-HEATER

5.1.1 Coolant Pre-Heater Removal

Remove the coolant pre-heater as follows:

⚠ CAUTION:

To avoid injury from the expulsion of hot coolant, never remove the cooling system pressure cap while the engine is at operating temperature. Remove the cap slowly to relieve pressure. Wear adequate protective clothing (face shield or safety goggles, rubber gloves, apron, and boots).

1. Drain the coolant from the radiator. See Figure 5-1. Cooling system capacity is listed in Table 5-1.

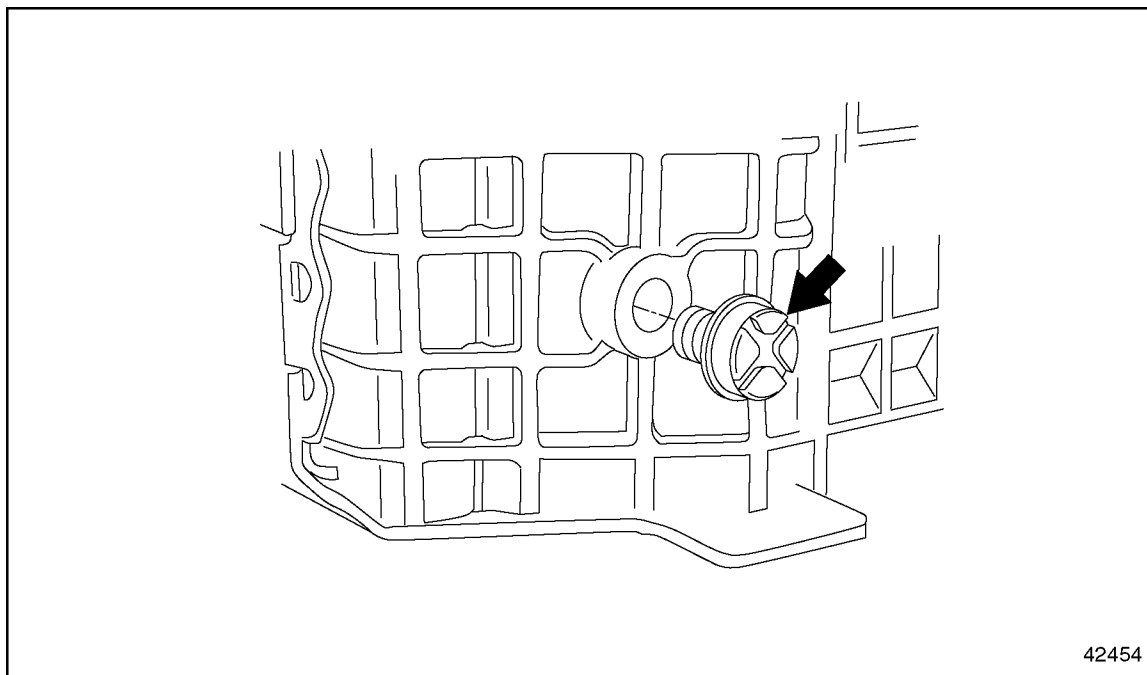


Figure 5-1 Coolant Drain Plug

Description	4-Cylinder L (qt)	6-Cylinder L (qt)
Total capacity	19 (20)	23 (24)
Antifreeze quantity at 50%	9.5 (10.0)	11.5 (12.0)
Antifreeze quantity at 55%	10.5 (11.1)	12.7 (13.4)

Table 5-1 Cooling System Capacity

⚠ CAUTION:

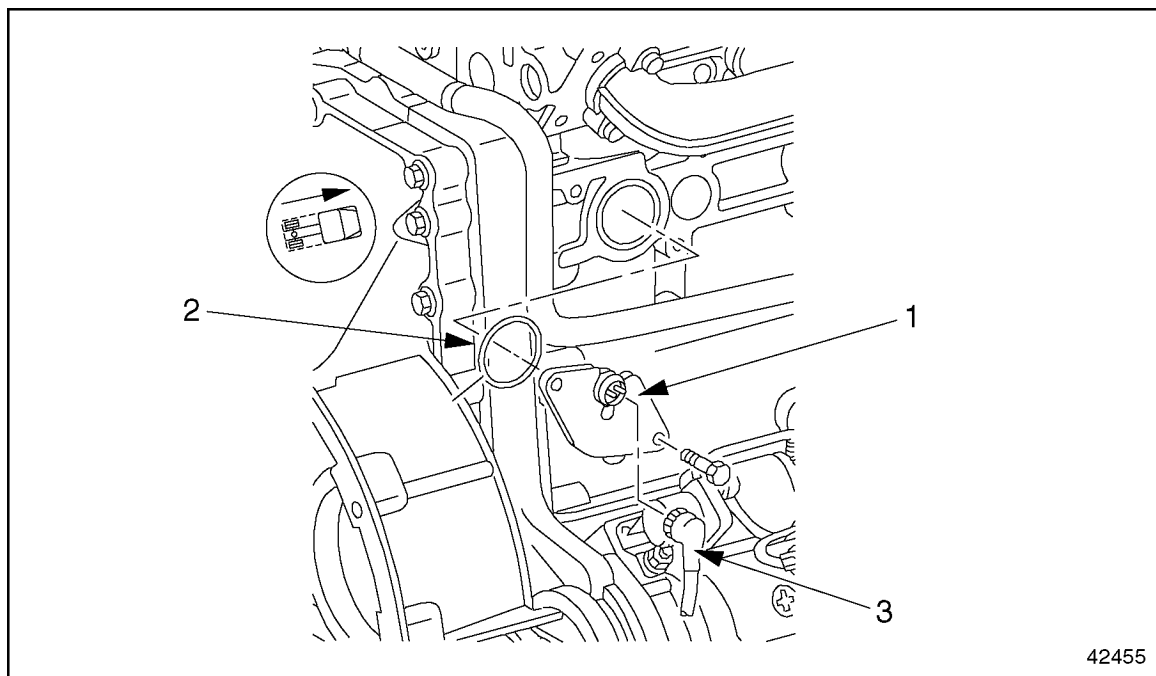
To avoid injury from the expulsion of hot coolant, never remove the cooling system pressure cap while the engine is at operating temperature. Remove the cap slowly to relieve pressure. Wear adequate protective clothing (face shield or safety goggles, rubber gloves, apron, and boots).

- [a] Open the cap on the surge tank slowly, to allow excess pressure to escape.
- [b] Place a receptacle underneath the coolant drain plug. Choose one that is large enough to hold the expected quantity of coolant.

NOTE:

Make sure the coolant can flow unobstructed into the receptacle.

- [c] Open the coolant drain plug on the bottom of the radiator.
2. Disconnect the electrical connector from the coolant pre-heater. See Figure 5-2.



1. Coolant Pre-heater

3. Electrical Connector

2. O-ring

Figure 5-2 Coolant Pre-Heater

3. Remove the coolant pre-heater from the engine access hole. Discard the O-ring.

NOTE:

Collect any coolant that runs out of the access hole.

5.1.2 Coolant Pre-Heater Installation

Install the coolant pre-heater as follows:

1. Install the coolant pre-heater in the engine access hole. Replace the O-ring with a new one.
2. Connect the electrical connector to the coolant pre-heater.
3. Fill the engine with the coolant.
 - [a] Tighten the coolant drain plug on the bottom of the radiator.
 - [b] Add coolant up to the maximum fill level on the surge tank.
4. Check the coolant level and check the cooling system for leaks.

**CAUTION:**

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

- ☐ **Always start and operate an engine in a well ventilated area.**
- ☐ **If operating an engine in an enclosed area, vent the exhaust to the outside.**
- ☐ **Do not modify or tamper with the exhaust system or emission control system.**

- [a] Start the engine and run it for about one minute at varying speeds to release air pockets in the cooling system.
 - [b] Check all hoses at the radiator, coolant pump, and surge tank for leaks.
 - [c] Check the coolant level and add more coolant if necessary.
5. Shut down the engine.
6. Close and tighten the cap on the surge tank.

5.2 COOLANT PUMP – NON-EGR ENGINE

The coolant pump is driven by a belt with automatic belt tensioner.

5.2.1 Coolant Pump Removal

Remove the coolant pump as follows:

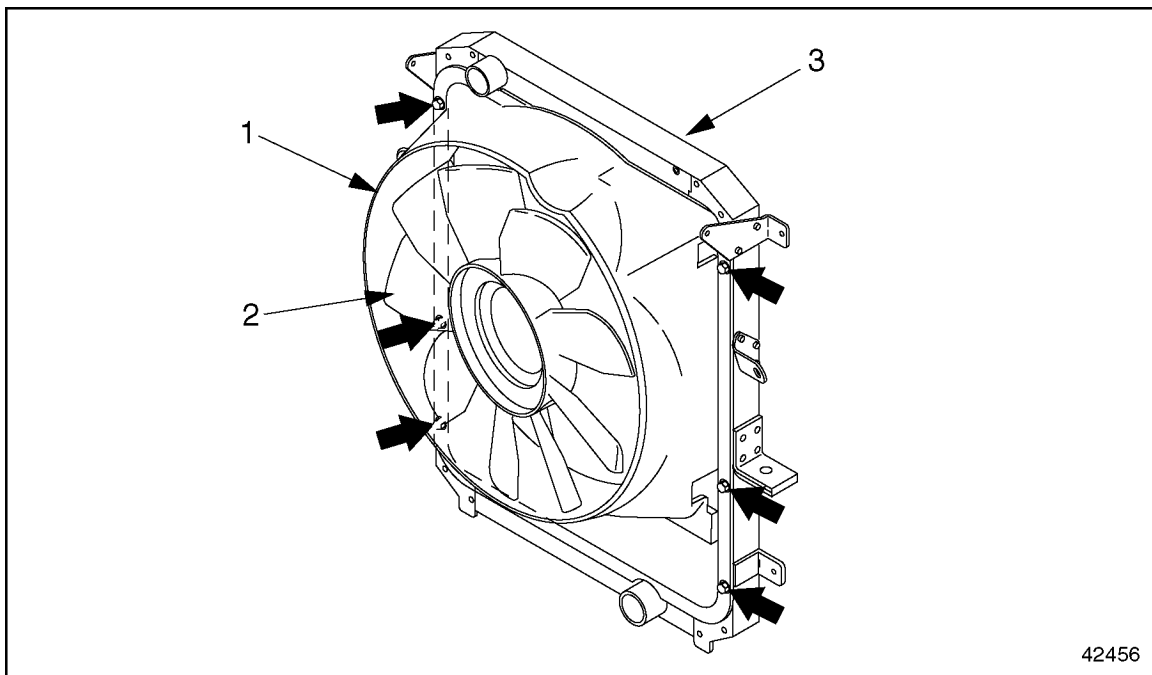
CAUTION:

To avoid injury from the expulsion of hot coolant, never remove the cooling system pressure cap while the engine is at operating temperature. Remove the cap slowly to relieve pressure. Wear adequate protective clothing (face shield or safety goggles, rubber gloves, apron, and boots).

1. Drain the coolant from the engine.
2. Remove the six bolts attaching the fan shroud to the radiator. See Figure 5-3.

NOTE:

Remove the bolts indicated by the arrows. See Figure 5-3.



1. Fan Shroud
2. Fan Blade

3. Radiator

Figure 5-3 Fan Shroud Mounting Bolts

3. Remove the fan and fan shroud from the vehicle.

- [a] Remove the fan blade.
- [b] Remove the fan shroud.
- [c] Remove the fan hub.

**CAUTION:**

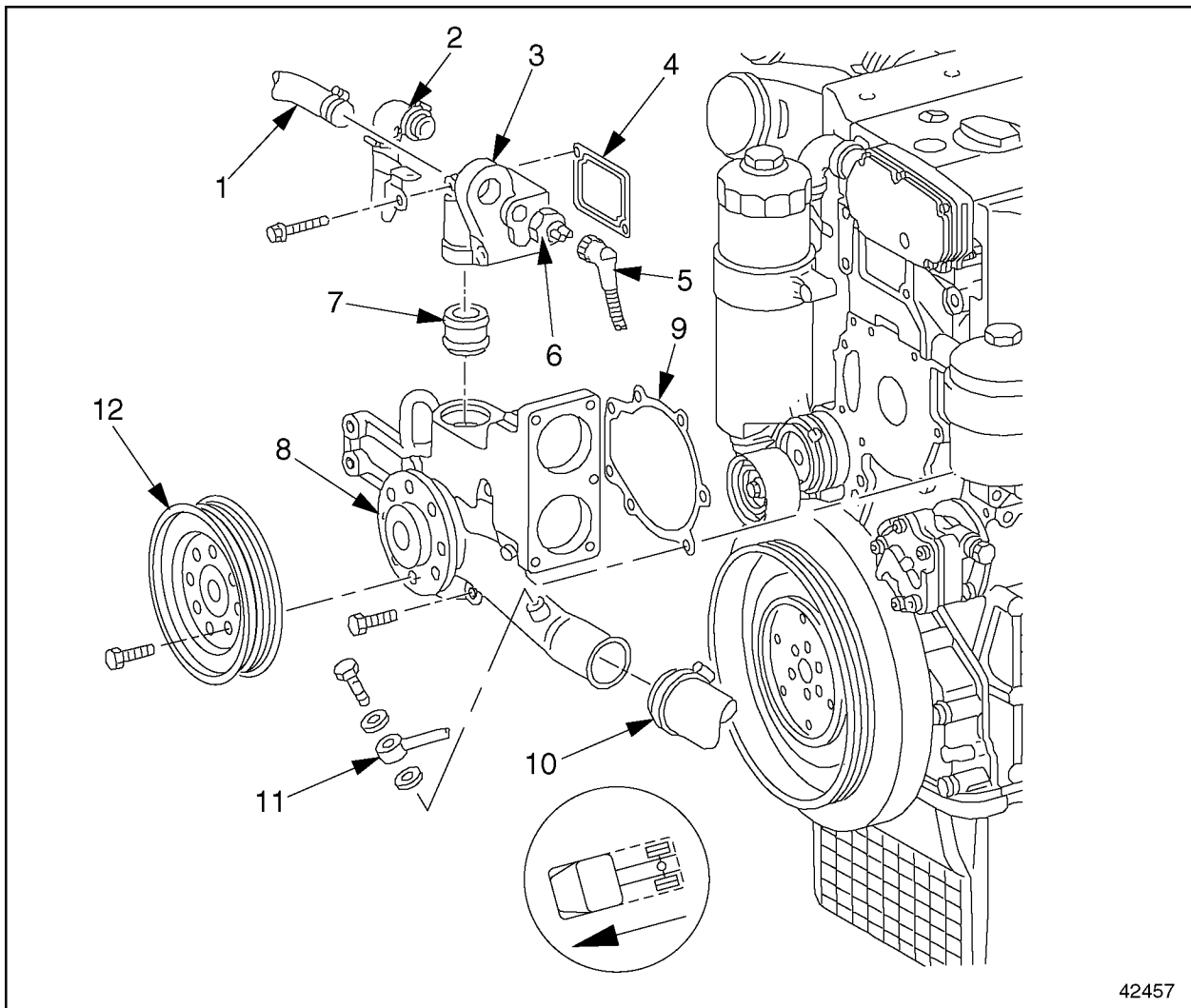
To avoid injury from flying parts when working with components under spring tension, wear adequate eye protection (face shield or safety goggles).

4. Release the tension on the poly-V belt and set the belt aside.

NOTE:

On 6-cylinder engines, there are two thermostats. On 4-cylinder engines, there is only one thermostat.

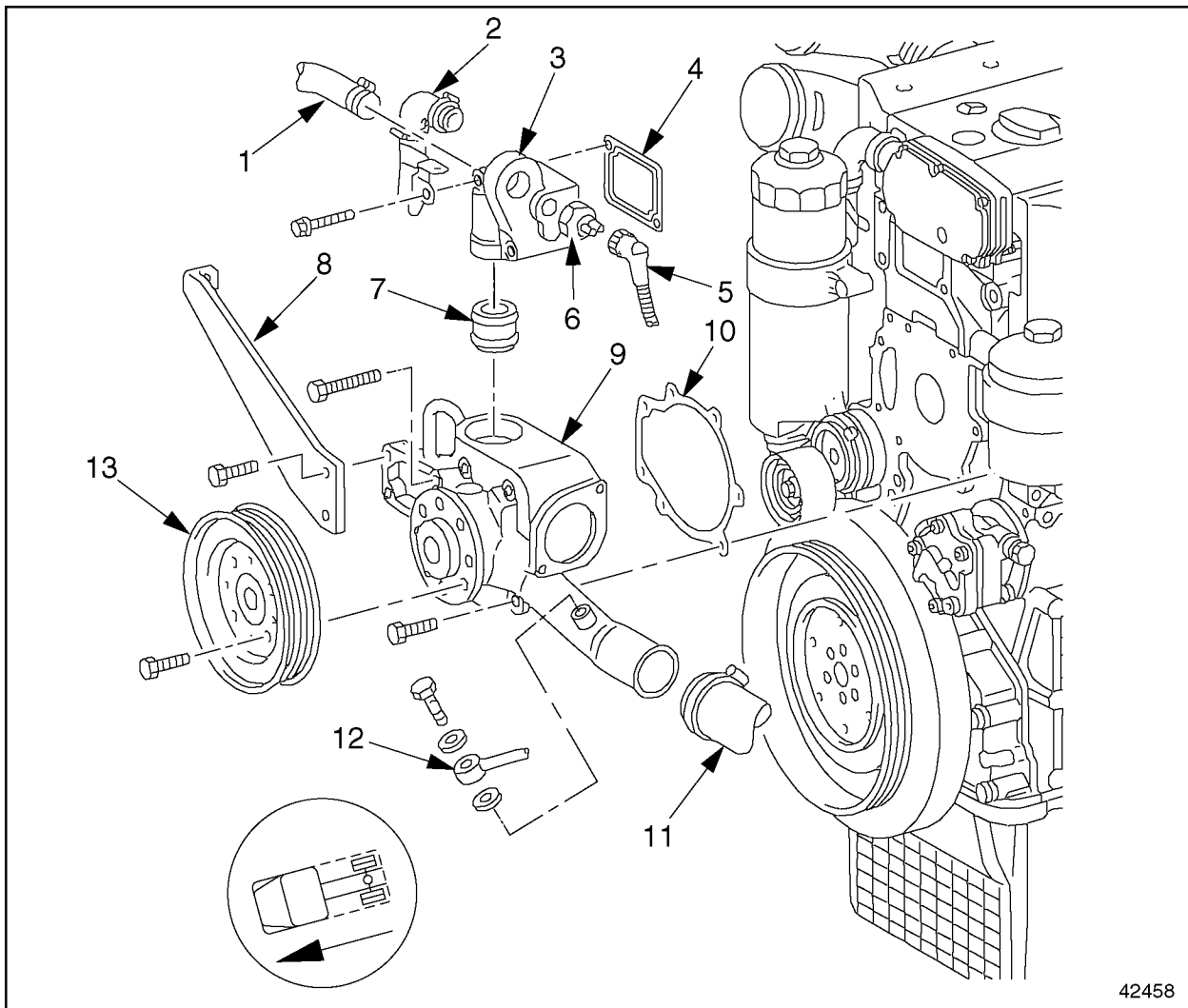
5. Loosen the fan pulley. Keep the pulley from turning while loosening the pulley mounting bolts. See Figure 5-4 for 6-cylinder engines and see Figure 5-5 for 4-cylinder engines.



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- | | |
|--|-----------------------------------|
| 1. Coolant Delivery Hose (from surge tank) | 7. Coolant Pump Connector Fitting |
| 2. Crankcase Breather Hose | 8. Coolant Pump |
| 3. Front Connector Housing | 9. Coolant Pump Gasket |
| 4. Connector Housing Gasket | 10. Lower Coolant Hose |
| 5. Electrical Connector | 11. Coolant Line |
| 6. Engine Coolant Temperature Sensor | 12. Fan Pulley |

Figure 5-4 Coolant Pump (6-cylinder) Non-EGR Engine



- | | |
|--|-------------------------|
| 1. Coolant Delivery Hose (from surge tank) | 8. Mounting Bracket |
| 2. Crankcase Breather Hose | 9. Coolant Pump |
| 3. Front Connector Housing | 10. Coolant Pump Gasket |
| 4. Connector Housing Gasket | 11. Lower Coolant Hose |
| 5. Electrical Connector | 12. Coolant Line |
| 6. Engine Coolant Temperature Sensor | 13. Fan Pulley |
| 7. Coolant Pump Connector Fitting | |

Figure 5-5 Coolant Pump (4-cylinder) Non-EGR Engine

6. Remove the fan pulley.
7. Remove the belt tensioner.
8. On 4-cylinder engines only, remove the mounting bracket from the coolant pump and the charge air pipes.
9. Disconnect the electrical connector from the coolant temperature sensor.

10. Remove the front connector housing, front connector gasket, and coolant pump connector fitting. Discard the gasket and fitting.
11. Disconnect the lower coolant hose and the coolant line from the coolant pump. Discard the seal rings on the coolant line banjo fitting.

NOTE:

Collect any coolant that runs out of the lower coolant hose or coolant pump.

12. Remove the coolant pump from the engine. Discard the gasket.
13. On both the coolant pump and the engine block, clean the sealing surfaces (where the gasket was attached) of any adhering gasket material.
14. Remove the upper coolant hose inlet (thermostat housing), thermostat(s), and O-ring(s) from the coolant pump.

5.2.2 Coolant Pump Installation

Install the coolant pump as follows:

1. Install the upper coolant hose inlet, thermostat(s), and O-ring(s) onto the coolant pump.
2. Install the coolant pump on the engine block, using a new gasket. Tighten the mounting bolts 25 N·m (18 lb·ft).

NOTE:

On 4-cylinder engines, secure the coolant pump with six bolts. The seventh bolt will be added when the mounting bracket is installed.

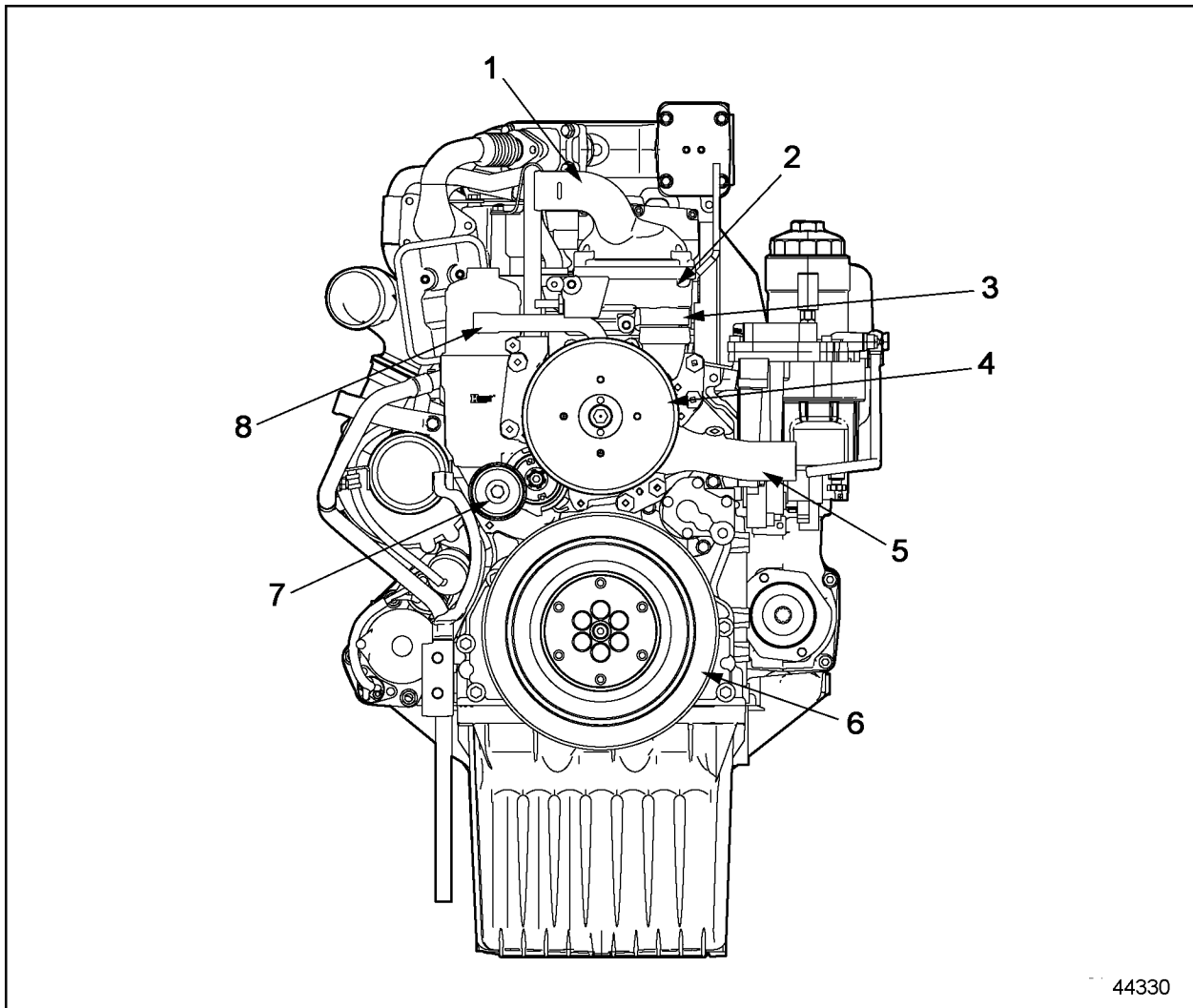
3. Connect the lower coolant hose and the coolant line to the coolant pump. Install new seal rings on the coolant line banjo fitting.
4. Install the front connector housing onto the coolant pump. Install a new gasket and coolant pump connector fitting. Tighten the mounting bolt attaching the front connector housing to the cylinder head 25 N·m (18 lb·ft).
5. Connect the electrical connector to the coolant temperature sensor.
6. On 4-cylinder engines only, install the mounting bracket on the coolant pump and the fastener to the charge air pipes. Tighten the mounting bolts 50 N·m (37 lb·ft).
7. Install the belt tensioner.
8. Install the fan pulley on the coolant pump. Tighten the fan pulley mounting bolts 25 N·m (18 lb·ft).
9. Install the fan hub on the fan pulley.
10. Release the belt tensioner. Route the poly-V belt round the fan pulley and restore the belt tension.
11. Install the fan blade and fan shroud on the vehicle.
 - [a] Position the fan shroud on the radiator.

- [b] Tighten the fan shroud mounting bolts until firm.
- 12. Fill the engine with the removed coolant, and check for leaks.

5.3 COOLANT PUMP – EGR ENGINE

5.3.1 Coolant Pump Removal – EGR Engine

Remove the coolant pump as follows (see Figure 5-6 for component location):



- | | |
|-----------------------------|----------------------|
| 1. Upper Thermostat Housing | 5. Coolant Pump |
| 2. Lower Thermostat Housing | 6. Crankshaft Damper |
| 3. Connector Tube | 7. Belt Tensioner |
| 4. Pulley | 8. Cab Heater Tube |

Figure 5-6 Coolant Pump and Related Components EGR Engine

1. Drain engine coolant.
2. Remove the fan and fan shroud from the vehicle.
3. Release the tension on the poly-V belt tensioner (7) and remove belt. See Figure 5-6.

4. Remove the pulley mounting bolts and pulley (4). See Figure 5-6.
5. Remove EGR delivery pipe. Refer to section 3.9.1.
6. Remove EGR coolant inlet tube. Refer to section 3.7.1.
7. Remove EGR coolant return tube. Refer to section 3.8.1.
8. Remove charge air intake housing. Refer to section 3.3.1.
9. Remove engine trim panel.
10. Remove two bolts and spacers from charge air housing support bracket.
11. Remove engine valve cover. Refer to section 1.1.1.
12. Remove three bolts securing heater supply tube (8). Remove tube and discard seal ring. See Figure 5-6.
13. Disconnect temperature sensor connector on thermostat housing. If required remove temperature sensor from housing.
14. Remove three bolts securing thermostat housing (2) and remove housing and gasket. Discard gasket. See Figure 5-6.
15. Remove water connector tube (3) from thermostat housing (2) and discard tube. See Figure 5-6.
16. Remove banjo bolt and washers from air compressor coolant line on pump (5). Discard washers.
17. Remove hexagon socket-head bolt from belt tensioner (7) and remove tensioner. See Figure 5-6.
18. Remove banjo bolt and two washers from rear of oil filter housing going to turbocharger. Discard washers. See Figure 5-6.
19. Remove bolts securing coolant pump (5) and seal ring to rear housing of coolant pump and remove. Discard seal ring. See Figure 5-6.

NOTE:

The oil filter is part of the rear coolant pump housing and must be removed as an assembly.

NOTE:

Only five bolts can be removed during the removal of the rear coolant pump housing and oil filter assembly due to interference with damper. Loosening the bolt near the damper completely will allow remove of assembly.

20. Unscrew the oil filter to allow oil in the canister to drain back into the engine prior to removing.
21. Remove six bolts securing coolant pump (5) and oil filter assembly to the cylinder block. Discard two seals on rear of housing. See Figure 5-6.

5.3.2 Coolant Pump Installation – EGR Engine

Install the coolant pump as follows (see Figure 5-6 for component location):

1. Install two new seals on rear of coolant pump (5) and oil filter assembly. See Figure 5-6.

NOTE:

One lower bolt, near the damper, must be installed in rear coolant pump and oil filter assembly prior to installation due to interference by damper.

NOTE:

The oil filter is part of the coolant pump housing and must be installed as an assembly.

2. Secure the coolant pump housing and oil filter assembly to the cylinder block with six bolts. Tighten bolts to 31-35 N·m (23-26 lb·ft).

NOTE:

The belt tensioner has two locating pins on the rear that must align with corresponding holes in the cylinder block.

3. Install the hexagon socket-head bolt in the belt tensioner (7) and secure to cylinder block. Tighten bolt to 50 N·m (37 lb·ft). See Figure 5-6.
4. Install the banjo bolt and two new washers and secure water tube to the coolant pump.
5. Install a new seal ring on the heater supply tube (8) and secure tube to coolant pump with three bolts. Tighten bolts to 31-35 N·m (23-26 lb·ft). See Figure 5-6.
6. Install a new gasket and secure the thermostat housing to the coolant pump with three bolts. Tighten bolts to 31-35 N·m (23-26 lb·ft).
7. Connect temperature sensor electrical connector at thermostat housing.
8. Install the banjo bolt and two new washer and secure tube on rear of oil filter housing going to turbocharger.
9. Install engine valve cover. Refer to section 1.1.2.
10. Install the charge air housing bracket, two bolts and spacers and secure bracket to cylinder head.
11. Install the engine trim panel.
12. Install charge air intake housing. Refer to section 3.3.2.
13. Install EGR coolant return tube. Refer to section 3.8.2.
14. Install EGR coolant inlet tube. Refer to section 3.7.2.
15. Install EGR delivery pipe. Refer to section 3.9.2.
16. Install pulley and secure with bolts. Tighten bolts to 31-35 N·m (23-26 lb·ft).
17. Release the belt tensioner. Route the poly-V belt around the fan pulley and restore belt tension.

18. Install the fan blade and fan shroud on the vehicle then position the fan shroud on the radiator. Tighten the fan shroud mounting bolts until firm.
19. Fill the engine with removed coolant, and check and test for leaks. Refer to section 3.5.2.1.

5.4 FRONT CONNECTOR HOUSING – NON-EGR ENGINE

5.4.1 Front Connector Housing Removal

Remove the front connector housing as follows:



CAUTION:

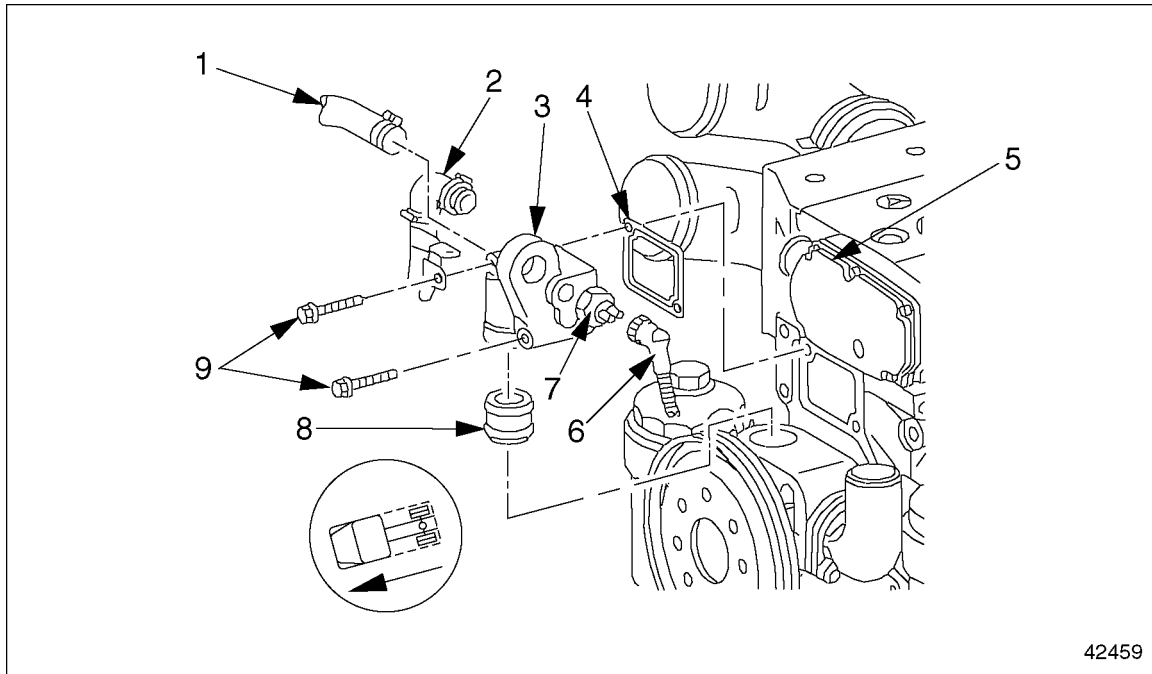
To avoid injury from the expulsion of hot coolant, never remove the cooling system pressure cap while the engine is at operating temperature. Remove the cap slowly to relieve pressure. Wear adequate protective clothing (face shield or safety goggles, rubber gloves, apron, and boots).

1. Drain the coolant from the engine.

2. Remove the hose clamp attaching the (surge tank) coolant delivery hose to the front connector housing. See Figure 5-7.

NOTE:

Collect any coolant that runs out of the hose.



- | | |
|--|--------------------------------------|
| 1. Coolant Delivery Hose (from surge tank) | 6. Electrical Connector |
| 2. Crankcase Breather Hose | 7. Engine Coolant Temperature Sensor |
| 3. Front Connector Housing | 8. Coolant Pump Connector Fitting |
| 4. Connector Housing Gasket | 9. Mounting Bolt |
| 5. Oil Separator | |

Figure 5-7 Front Connector Housing

3. Disconnect the wiring harness that runs to the coolant temperature sensor.
 - [a] Disconnect the electrical connector from the coolant temperature sensor located on the left-hand side of the front connector housing, just below the front lifting eye.
 - [b] Remove the clip that attaches the harness to mounting bracket for the crankcase breather hose.
4. Remove the mounting bolt attaching the crankcase breather hose to the front connector housing and the oil separator.
5. Remove the mounting bolt attaching the front connector housing to the cylinder head.
6. Pull the front connector housing upward until it comes free of the coolant pump connector fitting.
7. Discard the connector housing gasket and the coolant pump connector fitting.

5.4.2 Front Connector Housing Installation

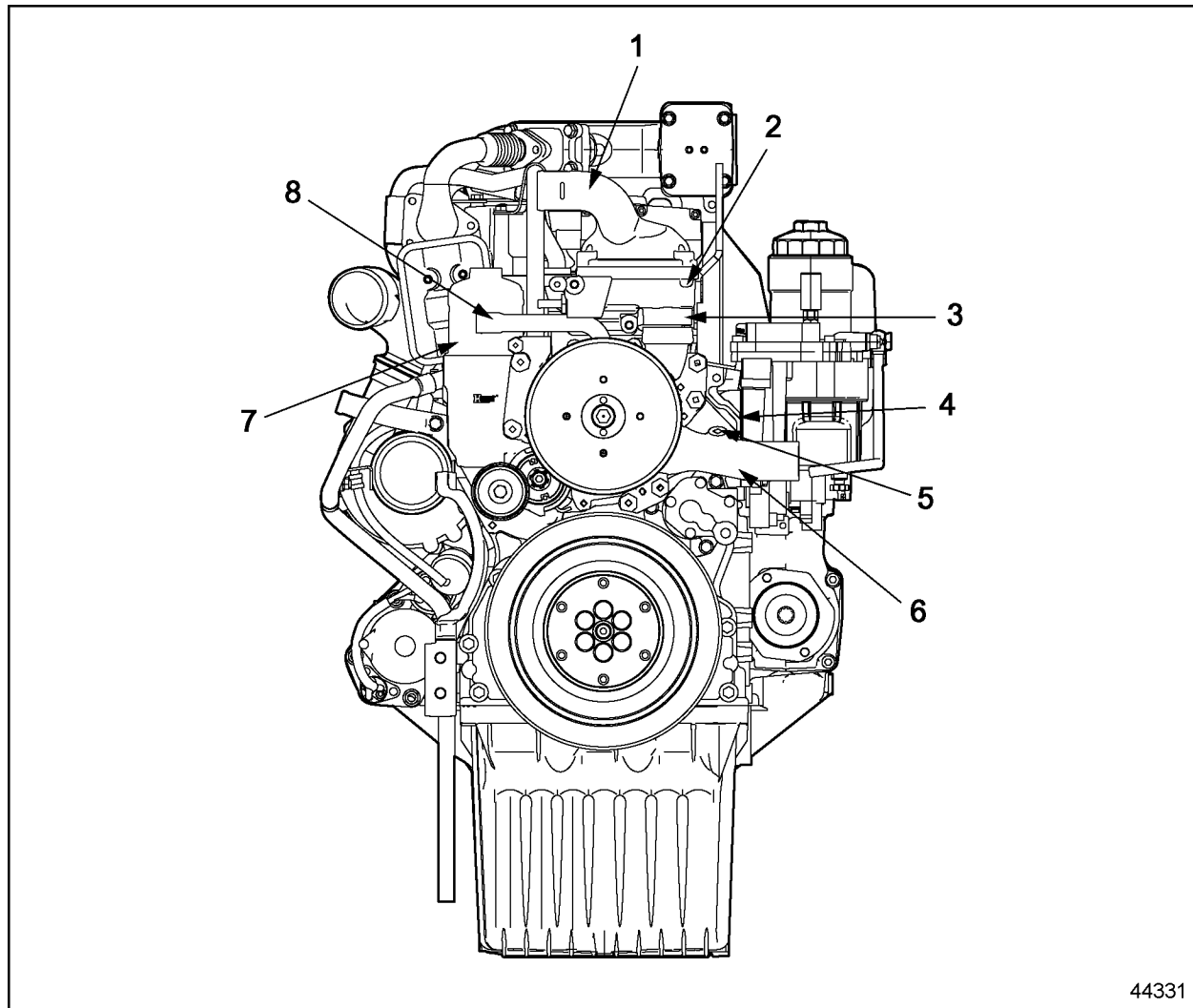
Install the front connector housing as follows:

1. Install a new connector housing gasket on the front connector housing.
2. Install a new coolant pump connector fitting on the coolant pump.
3. Install the front connector housing on the coolant pump connector fitting.
4. Install the front connector housing on the cylinder head. Tighten the mounting to bolt 25 N·m (18 lb·ft).
5. Connect the wiring harness that runs to the coolant temperature sensor.
 - [a] Connect the electrical connector to the coolant temperature sensor.
 - [b] Install the clip that attaches the harness to mounting bracket for the crankcase breather hose.
6. Install the mounting bolt attaching the crankcase breather hose to the front connector housing and the oil separator. Tighten the mounting bolt 25 N·m (18 lb·ft).
7. Install the hose clamp attaching the (surge tank) coolant delivery hose to the front connector housing.
8. Fill the engine with the removed coolant, and check for leaks and proper operation.

5.5 FRONT CONNECTOR HOUSING – EGR ENGINE

5.5.1 Thermostat Housing Removal – EGR Engine

Remove the thermostat housing as follows(see Figure 5-8 for component location):



- | | |
|--------------------------------|--------------------|
| 1. Upper Thermostat Housing | 5. Banjo Bolt |
| 2. Lower Thermostat Housing | 6. Coolant Pump |
| 3. Connector Tube | 7. Oil Filter |
| 4. Air Compressor Coolant Line | 8. Cab Heater Tube |

Figure 5-8 Coolant Pump – EGR Engine

1. Drain engine coolant.
2. Remove the fan and fan shroud from the vehicle.
3. Release the tension on the poly-V belt and remove belt.

4. Remove the pulley mounting bolts and pulley.
5. Remove EGR delivery pipe. Refer to section 3.9.1.
6. Remove EGR coolant inlet tube. Refer to section 3.7.1.
7. Remove EGR coolant return tube. Refer to section 3.8.1.
8. Remove charge air intake housing. Refer to section 3.3.1.
9. Remove engine trim panel.
10. Remove engine valve cover. Refer to section 1.1.1.
11. Remove three bolts securing heater supply tube (1). Remove tube and discard seal ring. See Figure 5-8.
12. Disconnect coolant temperature sensor connector from lower thermostat housing (2). If required remove temperature sensor (6) from housing. See Figure 5-8.
13. Remove two bolts securing thermostat housing and remove housing and gasket. Discard gasket.
14. Remove water connector tube (3) from lower thermostat housing (2) and discard tube. See Figure 5-8.
15. Remove three bolts securing upper thermostat housing (1) to lower thermostat housing (2) and remove cover. See Figure 5-8.
16. Remove thermostat(s) and O-ring(s) from thermostat housing. Discard O-rings.
17. Check thermostat(s). Refer to section 5.6.1.1.

5.5.2 Thermostat Housing Installation – EGR Engine

Install the thermostat housing as follows:

1. Install a new O-ring on each thermostat and install thermostats in lower housing.
2. Secure the thermostat upper housing (1) to lower thermostat housing (2) with three bolts. Tighten bolts to 31-35 N·m (23-26 lb·ft). See Figure 5-8.
3. Install a new water connector tube (3) with seal in coolant pump (6). See Figure 5-8.
4. Install a new gasket and secure the thermostat housing (2) to the coolant pump (6) with two bolts. Tighten bolts to 31-35 N·m (23-26 lb·ft).
5. Secure coolant inlet tube at clamp on thermostat with bolt. Tighten bolts to 31-35 N·m (23-26 lb·ft).
6. If removed, install temperature sensor in thermostat housing.
7. Position thermostat housing (2) over connector tube (3).
8. Install a new gasket and secure the thermostat housing (2) to the coolant pump (6) with two bolts. See Figure 5-4. Tighten bolts to 31-35 N·m (23-26 lb·ft).
9. Connect temperature sensor electrical connector at thermostat housing.
10. Install engine valve cover. Refer to section 1.1.2.

11. Install engine trim panel.
12. Install charge air intake housing. Refer to section 3.3.2.
13. Install EGR coolant return tube. Refer to section 3.8.2.
14. Install the EGR coolant inlet tube. Refer to section 3.7.2.
15. Install EGR delivery pipe. Refer to section 3.9.2.
16. Install water pump pulley and secure with bolts Tighten bolts to 31-35 N·m (23-26 lb·ft).
17. Release the belt tensioner. Route the poly-V belt around the fan pulley and restore belt tension.
18. Install the fan blade and fan shroud on the vehicle. Position the fan shroud on the radiator and tighten the fan shroud mounting bolts until firm.
19. Fill the engine with removed coolant, and check for leaks. Refer to section 3.5.2.1.

5.6 THERMOSTAT

The vehicle is cooled by a closed system using recirculated coolant; temperature is regulated automatically by a thermostat.

5.6.1 Thermostat Removal

Remove the thermostat as follows:

**CAUTION:**

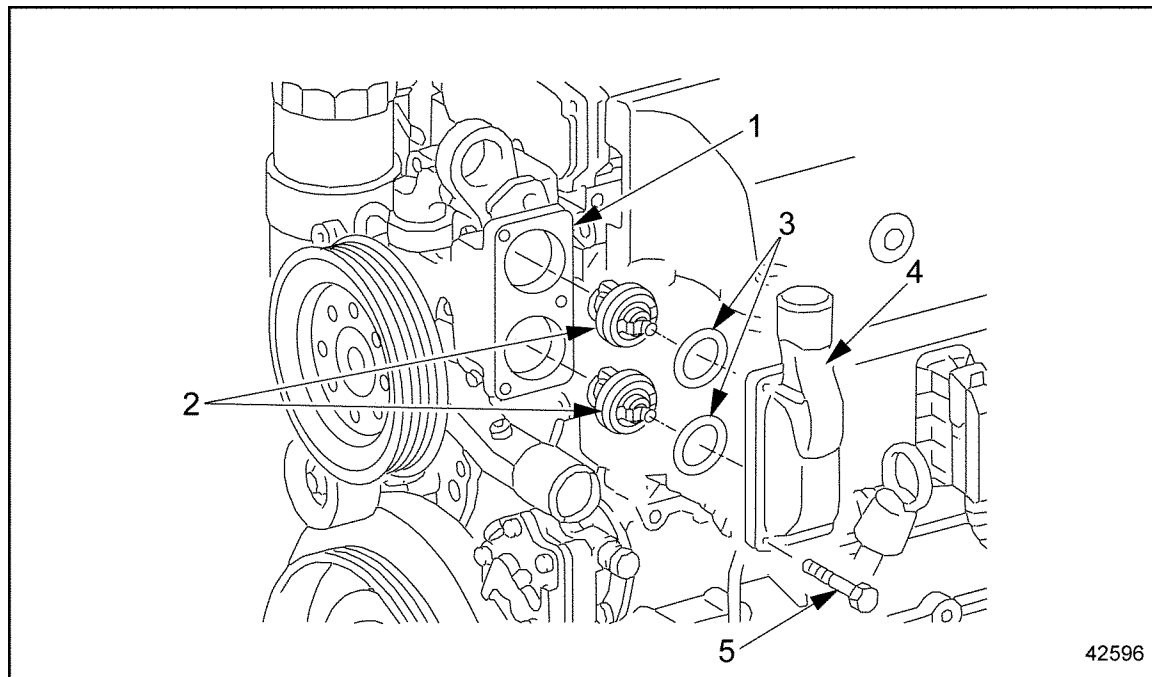
To avoid injury from the expulsion of hot coolant, never remove the cooling system pressure cap while the engine is at operating temperature. Remove the cap slowly to relieve pressure. Wear adequate protective clothing (face shield or safety goggles, rubber gloves, apron, and boots).

Check the thermostat as follows:

NOTE:

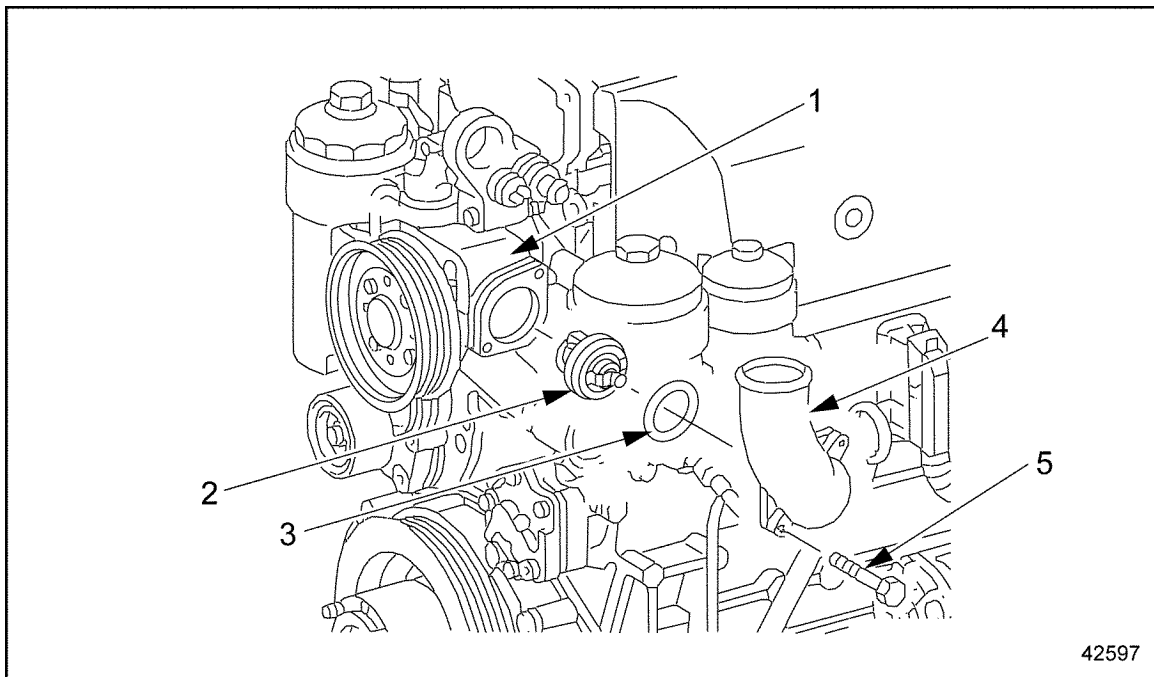
On 6-cylinder engines, there are two thermostats. On 4-cylinder engines, there is only one thermostat.

1. Drain the coolant from the engine.
2. For non-EGR engines remove the fuel filter housing. Refer to section 2.14.1.
3. Remove the upper coolant hose inlet (thermostat housing). See Figure 5-9 for the 6-cylinder non-EGR engine and Figure 5-10 for the 4-cylinder non-EGR engine, and see Figure 5-11 for EGR engines.



- | | |
|-----------------|---------------------------|
| 1. Coolant Pump | 4. Coolant Hose Inlet |
| 2. Thermostat | 5. Mounting Bolt (3 qty.) |
| 3. O-ring | |

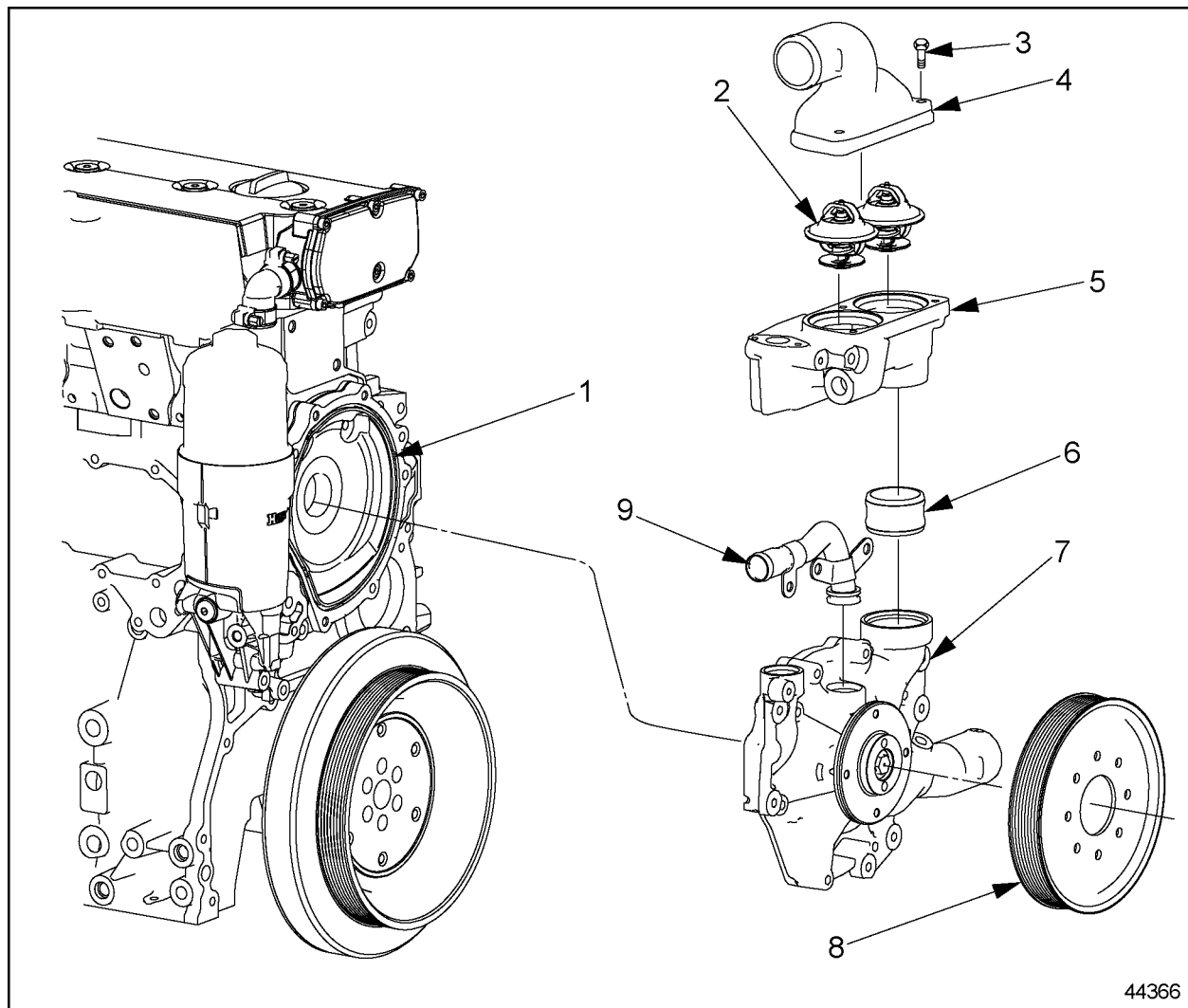
Figure 5-9 Thermostat Removal (6-cylinder) Non-EGR Engine



- 1. Coolant Pump
- 2. Thermostat
- 3. O-ring

- 4. Coolant Hose Inlet
- 5. Mounting Bolts (2 qty.)

Figure 5-10 Thermostat Removal (4-cylinder) Non-EGR Engine



- | | |
|--------------------------------------|--------------------|
| 1. Oil Filter and Water Pump Housing | 6. Connector Tube |
| 2. Thermostats | 7. Water Pump |
| 3. Bolt | 8. Pulley |
| 4. Upper Thermostat Housing | 9. Cab Heater Tube |
| 5. Lower Thermostat Housing | |

Figure 5-11 Thermostat Removal for EGR Engines

- [a] Remove the hose clamp attaching the upper coolant hose to the inlet.
- [b] For non-EGR engines remove the mounting bolts attaching the inlet to the coolant pump.
- [c] For EGR engines, remove three bolts securing the upper thermostat housing to lower thermostat housing.

NOTE:

Collect any coolant that runs out of the inlet or coolant pump.

4. Remove the thermostat(s) and O-ring(s) from the coolant pump. Discard the O-ring(s).
5. Check the thermostat(s) for proper operation. Refer to section 5.6.1.1. Replace any thermostat that fails one or more tests.

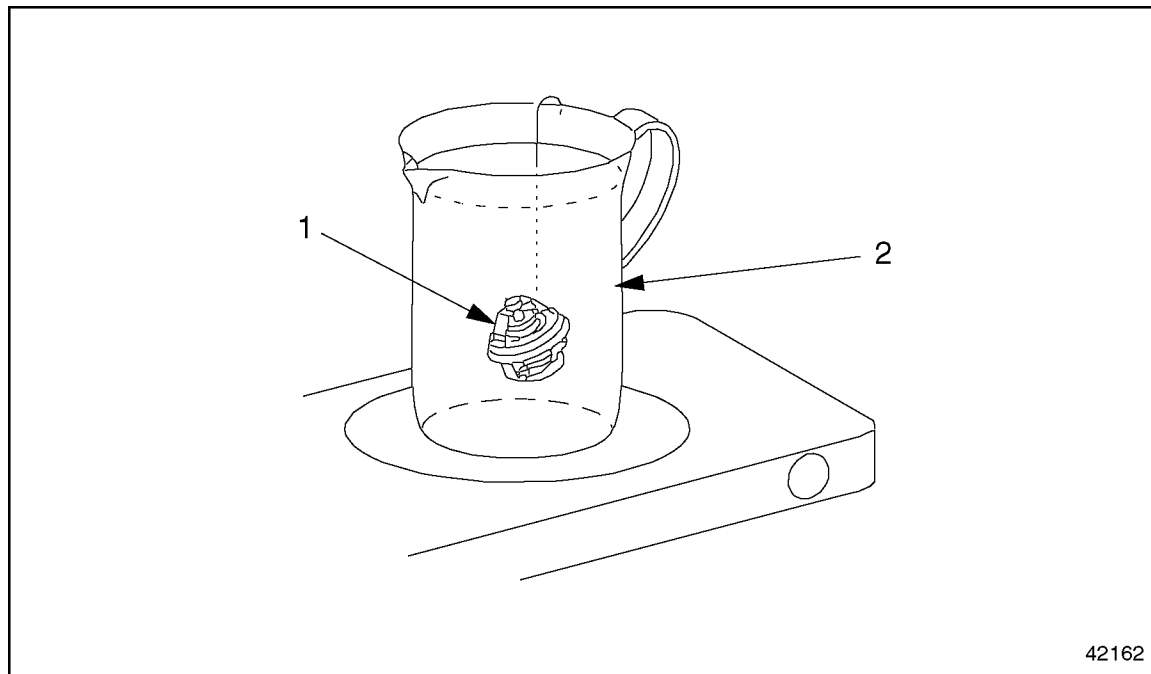
5.6.1.1 Thermostat Checking

Check the thermostat as follows:

NOTE:

On 6-cylinder engines, there are two thermostats. On 4-cylinder engines, there is only one thermostat.

1. Hang the thermostat by a wire inside a container filled with water. See Figure 5-12.



1. Thermostat

2. Container

Figure 5-12 Heat the Thermostat

NOTE:

To allow the thermostat to heat evenly, make sure it is not touching the sides of the container.

NOTICE:

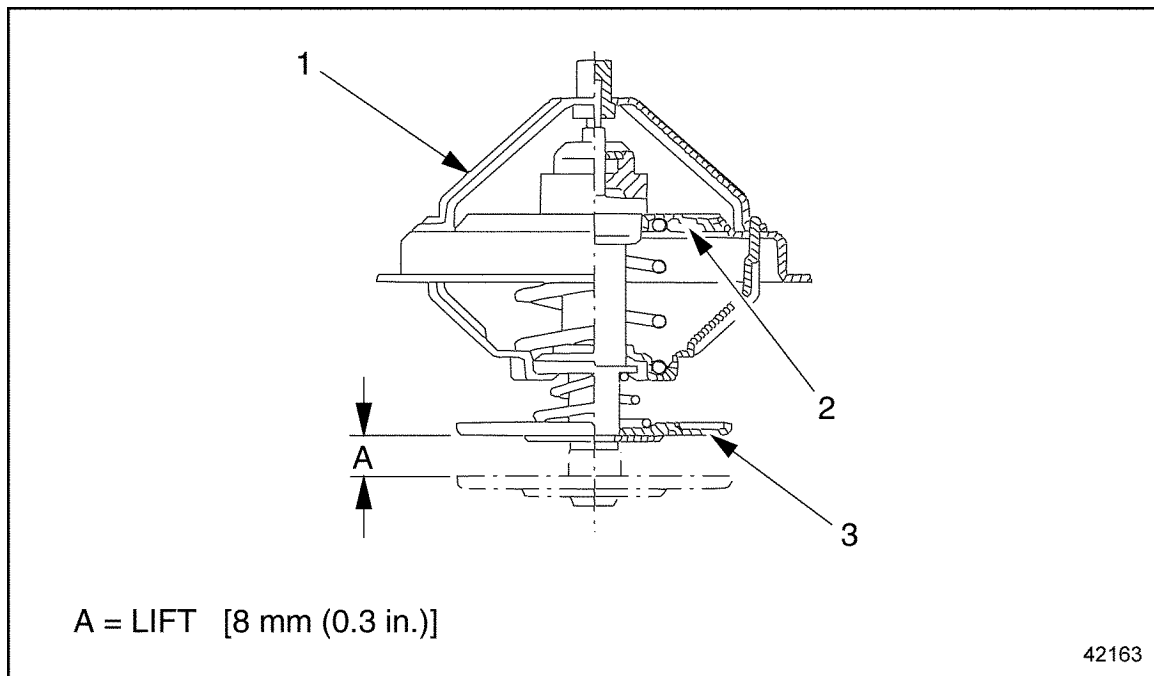
To prevent damage to the thermostat or heating container, do not ever use a welding torch or soldering gun as a source of heat.

2. Heat the water with a suitable heating element. Stir the water occasionally to help equalize the temperature.

⚠ CAUTION:

To avoid injury from scalding, use lifting tools and wear heat-resistant gloves when retrieving the thermostat from boiling water.

- [a] Measure the water temperature. As the temperature climbs to around 75°C (165°F), slow the rate of heating down to about 1 to 2°C (2 to 3°F) per minute.
 - [b] In about five minutes, the main valve should begin to open.
3. Continue to heat the water at this rate for about six to eight minutes until it reaches the opening temperature of the main valve. If the main valve is not completely open, replace the thermostat. See Figure 5-13.



1. Thermostat

3. Short Circuit Valve

2. Main Valve

Figure 5-13 Thermostat Valves

4. Check all the test values listed in Table 5-2. If any of the values are not met, replace the thermostat.

Description	Temperature	Distance
Main Valve Starts To Open	81 to 85°C (178 to 185°F)	—
Short Circuit Valve Fully Closed	92°C (198°F)	—
Main Valve Fully Open	95°C (203°F)	—
Main Valve Minimum Lift (A)	—	8 mm (0.3 in.)

Table 5-2 Thermostat Test Values

- [a] At the temperature of 85°C (185°F), check that the main valve has started to open.
 - [b] At the temperature of 92°C (198°F), check that the short circuit valve is fully closed.
 - [c] At the opening temperature of 95°C (203°F), check that the main valve is fully open.
 - [d] Check the minimum lift of the main valve at the opening temperature.
5. Install the original or replacement thermostat(s), as necessary.
6. Install the upper coolant hose inlet and new O-ring(s) on the coolant pump.
7. Fill the engine with the removed coolant, and check for leaks and proper operation.

5.6.2 Thermostat Installation

Install the thermostat as follows:

1. Install a new O-ring on each thermostat.
2. Install the original or replacement thermostat(s). See Figure 5-14.

NOTE:

Mount each thermostat with the breather orifice pointing upward for non-EGR engines and pointing forward for EGR engines.

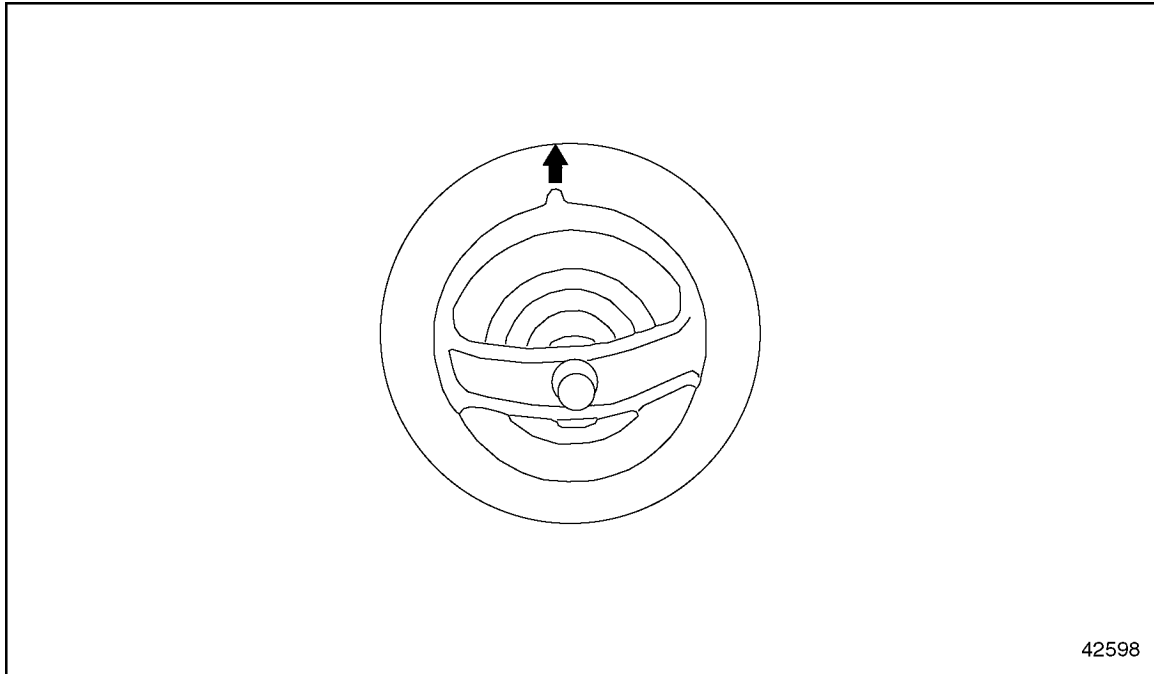
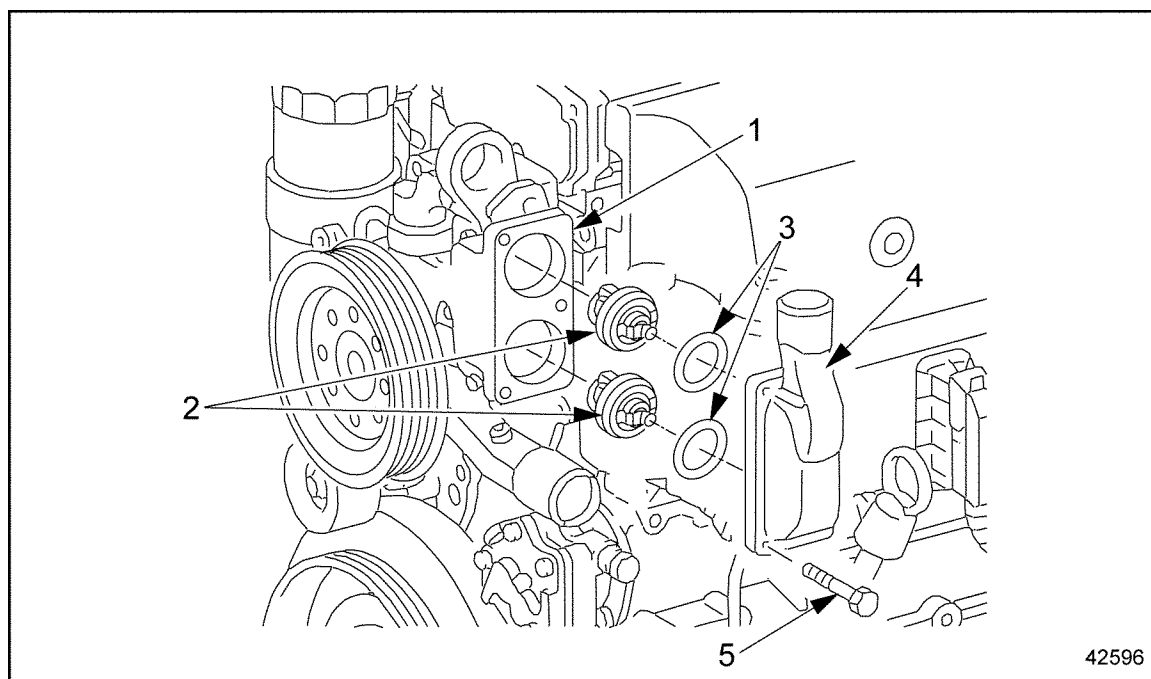


Figure 5-14 Breather Orifice

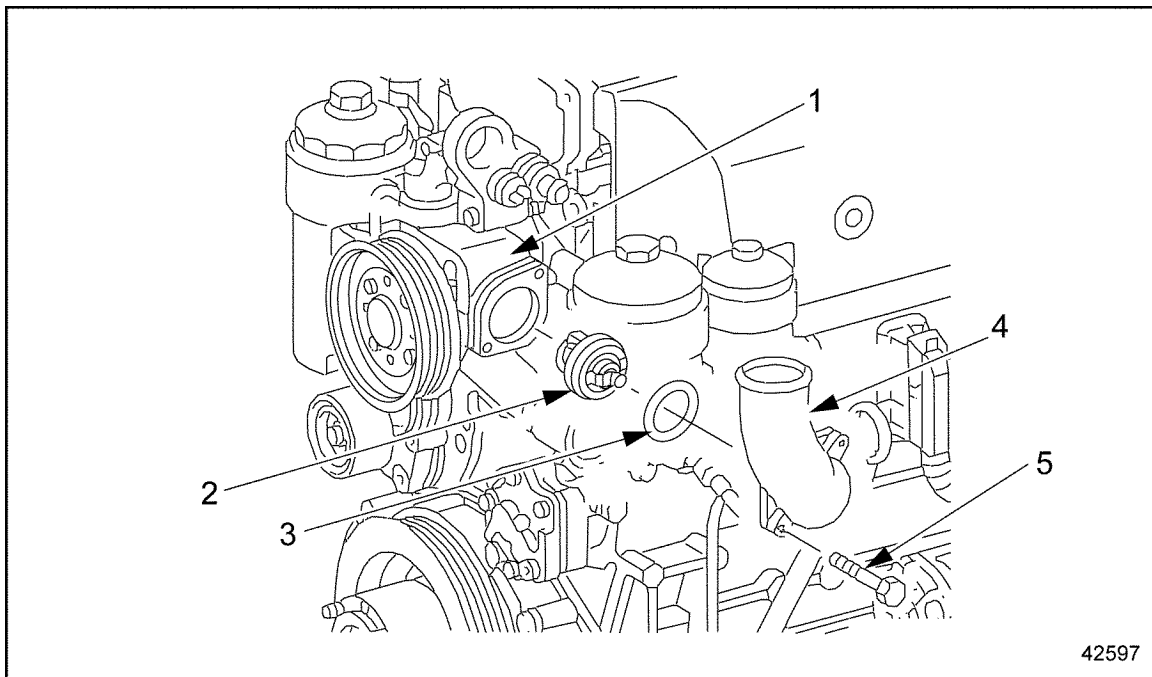
3. Install the upper coolant hose inlet. See Figure 5-15 for the 6-cylinder non-EGR engines and see Figure 5-16 for the 4-cylinder non-EGR engines.



- 1. Coolant Pump
- 2. Thermostat
- 3. O-ring

- 4. Coolant Hose Inlet
- 5. Mounting Bolts (3 qty.)

Figure 5-15 Thermostat Installation (6-cylinder)



- | | |
|-----------------|----------------------------|
| 1. Coolant Pump | 4. Coolant Hose Inlet |
| 2. Thermostat | 5. Mounting Bolts (2 qty.) |
| 3. O-ring | |

Figure 5-16 Thermostat Installation (4-cylinder)

- [a] For non-EGR engines install the mounting bolts attaching the coolant hose inlet to the coolant pump. Tighten each mounting bolts 25 N·m (18 lb·ft).
 - [b] For EGR engines install the mounting bolts attaching the upper thermostat housing to lower thermostat housing. Tighten bolts to 31-35 N·m (23-26 lb·ft).
 - [c] Install the hose clamp attaching the upper coolant hose to the inlet.
- 4. For non-EGR engines only, install the fuel filter housing. Refer to section 2.14.2.
 - 5. Fill the engine with the removed coolant, and check for leaks and proper operation.

5.A Additional Information

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SPECIFICATIONS

The cooling system capacity is listed in Table 5-3.

Description	4-Cylinder L (qt)	6-Cylinder L (qt)
Total capacity	19 (20)	23 (24)
Antifreeze quantity at 50%	9.5 (10.0)	11.5 (12.0)
Antifreeze quantity at 55%	10.5 (11.1)	12.7 (13.4)

Table 5-3 Cooling System Capacity

Listed in Table 5-4 are the thermostat test values.

Description	Temperature	Distance
Main Valve Starts To Open	81 to 85°C (178 to 185°F)	—
Short Circuit Valve Fully Closed	92°C (198°F)	—
Main Valve Fully Open	95°C (203°F)	—
Main Valve Minimum Lift	—	8 mm (0.3 in.)

Table 5-4 Thermostat Test Values

