

2007 Hummer H3

2007 ENGINE Engine Cooling - H3

2007 ENGINE

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SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Coolant Heater	50 N.m	37 lb ft
Coolant Recovery Reservoir Bolt	10 N.m	89 lb in
Fan Blade Bolt	27 N.m	20 lb ft
Fan Clutch Nut	56 N.m	41 lb ft
Thermostat Housing Bolt	10 N.m	89 lb in
Water Outlet Housing Bolt	10 N.m	89 lb in
Water Pump Bolt	10 N.m	89 lb in
Water Pump Pulley Bolt	25 N.m	18 lb ft

DIAGNOSTIC INFORMATION AND PROCEDURES

DIAGNOSTIC STARTING POINT - ENGINE COOLING

Begin the system diagnosis with the diagnostic system check. Refer to **Diagnostic System Check - Vehicle** . The Diagnostic System Check - Vehicle will provide the following information:

- The identification of the control modules which command the system
- The ability of the control modules to communicate through the serial data circuits
- The identification of any stored DTCs and their status

The use of the Diagnostic System Check - Vehicle will identify the correct procedure for diagnosing the system and where the procedure is located.

SCAN TOOL DATA LIST

Powertrain Control Module

Scan Tool Parameter	Data List	Units Displayed	Typical Data Value

2007 Hummer H3

2007 ENGINE Engine Cooling - H3

Ignition Switch in RUN/Engine running/Automatic Transmission in PARK/Manual Transmission in NEUTRAL/Air Conditioner is OFF

ECT Sensor	Engine Data 1, Engine Data 2, Engine Data 3	°C/°F	Varies
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SCAN TOOL DATA DEFINITIONS

ECT Sensor

The scan tool displays -39°C to +140°C (-38°F to +284°F). The Engine Coolant Temperature (ECT) sensor is mounted in the coolant stream. The powertrain control module (PCM) applies 5 volts to the ECT sensor circuit. The sensor is a thermistor which changes internal resistance as temperature changes. When the sensor is cold (internal resistance high), the PCM monitors a high signal voltage and interprets it as a cold engine. As the sensor warms (internal resistance decreases), the voltage signal decreases and the PCM interprets the lower voltage as a warm engine.

SYMPTOMS - ENGINE COOLING

IMPORTANT: Review the system operation in order to familiarize yourself with the system functions. Refer to Cooling System Description and Operation.

Visual/Physical Inspection

- Inspect for aftermarket devices which could affect the operation of the Cooling System. Refer to Checking Aftermarket Accessories .
- Inspect the easily accessible or visible system components for obvious damage or conditions which could cause the symptom.

Intermittent

Faulty electrical connections or wiring may be the cause of intermittent conditions. Refer to Testing for Intermittent Conditions and Poor Connections .

Symptom List

Refer to a symptom diagnostic procedure from the following list in order to diagnose the symptom:

2007 Hummer H3

2007 ENGINE Engine Cooling - H3

- **Engine Overheating**
- **Loss of Coolant**
- **Thermostat Diagnosis**
- **Coolant Heater Inoperative**
- **Engine Fails To Reach Normal Operating Temperature**

ENGINE OVERHEATED INDICATOR ALWAYS ON

Engine Overheated Indicator Always On

Step	Action	Yes	No
DEFINITION: The Engine Hot indicator is always ON.			
1	Did you perform the Diagnostic System Check - Vehicle?	Go to Step 2	Go to <u>Diagnostic System Check - Vehicle</u>
2	Start the engine. Does the Check Gages indicator illuminate?	Go to Step 3	Go to <u>Testing for Intermittent Conditions and Poor Connections</u>
3	1. Install a scan tool. 2. With the scan tool, observe the ECT Sensor parameter in the powertrain control module (PCM) data list. Does the scan tool indicate that the ECT Sensor parameter is within the temperature range shown on the temperature gage?	Go to <u>Engine Overheating</u>	Go to Step 4
4	Replace the instrument panel cluster (IPC). Refer to <u>Instrument Cluster Replacement (Left Hand Drive)</u> or <u>Instrument Cluster Replacement (Right Hand Drive)</u> . Did you complete the replacement?	Go to Step 5	-
5	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to Step 2

2007 Hummer H3

2007 ENGINE Engine Cooling - H3

ENGINE OVERHEATING

Diagnostic Aids

The engine may overheat due to an intermittent operation of the thermostat.

Engine Overheating

Step	Action	Values	Yes	No
DEFINITION: Engine temperature lamp comes ON and stays ON or the temperature gage shows hot or coolant overflows from the coolant recovery reservoir onto the ground while the engine is running.				
1	Did you perform the Diagnostic System Check - Vehicle?	-	Go to Step 2	<u>Go to Diagnostic System Check - Vehicle</u>
2	Inspect the coolant recovery reservoir for low coolant. Is there a loss of coolant?	-	<u>Go to Loss of Coolant</u>	Go to Step 3
3	IMPORTANT: Do not allow the engine temperature to exceed the specified value. Start the engine and allow to reach normal operating temperature. Does the engine begin to exceed the specified value?	107°C (225°F)	Go to Step 4	Go to Diagnostic Aids
4	Inspect for loose, damaged, and/or missing of the following: <ul style="list-style-type: none"> • The A/C condenser seals • The front air deflector • The side seals Repair the system as necessary. Does the engine still overheat?	-	Go to Step 5	Go to Step 17
	Using the J 23688 Coolant and Battery Fluid Tester, test for			

2007 Hummer H3

2007 ENGINE Engine Cooling - H3

5	insufficient coolant concentration. See Special Tools . Is the coolant protection greater than the specified value?	-37°C (-34° F)	Go to Step 6	Go to Step 7
6	Correct the coolant concentration as necessary. Does the engine still overheat?	-	Go to Step 7	Go to Step 17
7	Inspect for obstructed radiator air flow or bent radiator fins. Is the radiator air flow obstructed?	-	Go to Step 8	Go to Step 9
8	Clean the radiator. Refer to Radiator Cleaning . Does the engine still overheat?	-	Go to Step 9	Go to Step 17
9	Inspect the drive belt tensioner. Refer to Drive Belt Tensioner Diagnosis . Is the drive belt tensioner working properly and is the tension correct?	-	Go to Step 11	Go to Step 10
10	Replace the drive belt tensioner. Refer to Drive Belt Tensioner Replacement . Does the engine still overheat?	-	Go to Step 11	Go to Step 17
11	Inspect the thermostat for proper operation. Refer to Thermostat Diagnosis . Does the thermostat operate properly?	-	Go to Step 13	Go to Step 12
12	Replace the thermostat. Refer to Engine Coolant Thermostat Replacement . Does the engine still overheat?	-	Go to Step 13	Go to Step 17
13	Inspect for an inoperative fan clutch. Refer to Fan Clutch Diagnosis . Does the engine still overheat?	-	Go to Step 14	Go to Step 17
14	Inspect for blocked cooling system passages. Are the cooling system passages blocked?	-	Go to Step 15	Go to Step 16
15	Replace the radiator. Refer to Radiator Replacement .	-	Go to Step	Go to Step

2007 Hummer H3

2007 ENGINE Engine Cooling - H3

	Does the engine still overheat?		16	17
16	Replace the engine water pump. Refer to <u>Water Pump Replacement</u> . Did you complete the repair?	-	Go to Step 17	-
17	Operate the system in order to verify the repair. Did you correct the condition?	-	System OK	Go to Step 2

LOSS OF COOLANT

Loss of Coolant

Step	Action	Yes	No
DEFINITION: The cooling system is losing coolant either internally or externally.			
1	Were you sent here from Symptoms or another diagnostic table?	Go to Step 2	Go to <u>Symptoms - Engine Cooling</u>
2	Repair any present DTCs. Refer to <u>Diagnostic System Check - Vehicle</u> . Is the action complete?	Go to Step 3	-
3	Inspect the coolant level. Is the coolant at the proper level?	Go to Step 6	Go to Step 4
4	Fill the cooling system to the proper level. Refer to <u>Cooling System Draining and Filling (Static Fill)</u> or <u>Cooling System Draining and Filling (Vac-N-Fill)</u> . Is the action complete?	Go to Step 5	-
5	If the engine is suspected to have a coolant leak into a cylinder, the coolant can hydraulically lock the engine. Does the engine crankshaft rotate?	Go to Step 6	Go to Step 28
6	Engine overheating can cause a loss of coolant. Is the engine overheating?	Go to Step 29	Go to Step 7
7	Extended operation with a low coolant level can cause engine internal component failure. Is the engine knocking?	Go to Step 31	Go to Step 8
	1. Idle the engine at normal operating temperature.		

2007 Hummer H3

2007 ENGINE Engine Cooling - H3

8	<p>2. Inspect for heavy white smoke coming out of the exhaust pipe.</p> <p>Is a heavy white smoke present from the exhaust pipe?</p>	Go to Step 9	Go to Step 10
9	<ul style="list-style-type: none"> • Coolant in the exhaust system creates a distinctive, burning coolant odor in the exhaust. • Condensation in the exhaust system can cause an odorless white smoke during engine warm up. <p>Does the white smoke have a burning coolant type odor?</p>	Go to Step 30	Go to Step 10
10	<p>With the engine idling, inspect the coolant recovery system.</p> <p>Does the coolant recovery system discharge coolant while the engine is idling?</p>	Go to Step 15	Go to Step 11
11	<p>Visually inspect the hoses, pipes and hose clamps at the following locations:</p> <ul style="list-style-type: none"> • Coolant reservoir • Heater core • Radiator <p>Are any of the hoses, clamps or pipes leaking?</p>	Go to Step 20	Go to Step 12
12	<p>Visually inspect the following components:</p> <ul style="list-style-type: none"> • Block heater • Coolant pressure cap • Core plugs • Cylinder head gaskets • Engine block • Intake manifold • Radiator • Thermostat housing 		

2007 Hummer H3

2007 ENGINE Engine Cooling - H3

	<ul style="list-style-type: none"> • Water pump 		
	Are any of the listed components leaking?	Go to Step 20	Go to Step 13
13	<ol style="list-style-type: none"> 1. Pressure test the cooling system. Refer to <u>Cooling System Leak Testing</u>. 2. With the cooling system pressurized, visually inspect the components listed in steps 11 and 12. 		
	Are any leaks present?	Go to Step 20	Go to Step 14
14	Pressure test the coolant pressure cap. Refer to <u>Pressure Cap Testing</u> .		
	Does the coolant pressure cap hold pressure?	Go to Step 16	Go to Step 21
15	Pressure test the coolant pressure cap. Refer to <u>Pressure Cap Testing</u> .		
	Does the coolant pressure cap hold pressure?	Go to Step 32	Go to Step 21
16	Inspect for the following conditions: <ul style="list-style-type: none"> • A coolant smell inside of the vehicle • Coolant in the HVAC module drain tube • Coolant on the vehicle floor covering near the HVAC module 		
	Is coolant present?	Go to Step 22	Go to Step 17
17	Inspect the underside of the engine oil fill cap for a gray/white milky substance.		
	Is there a milky substance under the oil fill cap?	Go to Step 18	Go to Step 19
18	Inspect the engine oil fluid level indicator for a gray/white milky substance.		
	Is there a milky substance on the engine oil fluid level indicator?	Go to Step 23	Go to Step 19
19	Inspect the automatic transmission oil fluid level indicator, if equipped, for a gray/white milky substance.		
	Is there a milky substance on the automatic		

2007 Hummer H3

2007 ENGINE Engine Cooling - H3

	transmission fluid level indicator?	Go to Step 25	Go to Step 33
20	Repair or replace the leaking component. Refer to the appropriate repair. Is the repair complete?	Go to Step 33	-
21	Replace the coolant pressure cap. Is the repair complete?	Go to Step 33	-
22	Replace the heater core. Refer to <u>Heater Core Replacement (Left Hand Drive)</u> or <u>Heater Core Replacement (Right Hand Drive)</u> . Is the repair complete?	Go to Step 33	-
23	<ol style="list-style-type: none"> 1. Remove the engine oil cooler lines from the radiator. 2. Pressure test the cooling system. Refer to <u>Cooling System Leak Testing</u>. 3. Inspect the engine oil cooler for coolant. Is coolant present?	Go to Step 24	Go to Step 27
24	<ol style="list-style-type: none"> 1. Replace the radiator. Refer to <u>Radiator Replacement</u>. 2. Service the engine oil and filter. Refer to <u>Engine Oil and Oil Filter Replacement</u> . Is the repair complete?	Go to Step 33	-
25	<ol style="list-style-type: none"> 1. Remove the transmission oil cooler lines from the radiator. 2. Pressure test the cooling system. Refer to <u>Cooling System Leak Testing</u>. 3. Inspect the transmission oil cooler for coolant. Is coolant present?	Go to Step 26	Go to Step 27
26	<ol style="list-style-type: none"> 1. Replace the radiator. Refer to <u>Radiator Replacement</u>. 2. Service the automatic transmission. 		

2007 Hummer H3

2007 ENGINE Engine Cooling - H3

	Refer to <u>Engine Coolant/Water in Transmission</u> .		
	Is the repair complete?	Go to Step 33	-
27	Install the cooler lines to the radiator. Is the action complete?	Go to Step 33	-
28	Repair the engine no crank condition. Refer to <u>Engine Will Not Crank - Crankshaft Will Not Rotate</u> . Is the repair complete?	Go to Step 33	-
29	Repair the engine overheating condition. Refer to <u>Engine Overheating</u> . Is the repair complete?	Go to Step 33	-
30	Repair the engine internal coolant leak. Refer to <u>Coolant in Engine Oil</u> . Is the repair complete?	Go to Step 33	-
31	Repair the engine knock. Refer to <u>Lower Engine Noise, Regardless of Engine Speed</u> . Is the repair complete?	Go to Step 33	-
32	Repair the combustion pressure in the cooling system problem. Refer to <u>Cylinder Leakage Test</u> . Is the repair complete?	Go to Step 33	-
33	Operate the system in order to verify the repair. Did you find and correct the condition?	System OK	Go to Step 2

THERMOSTAT DIAGNOSIS

Thermostat Test Procedure Using Tempilsticks

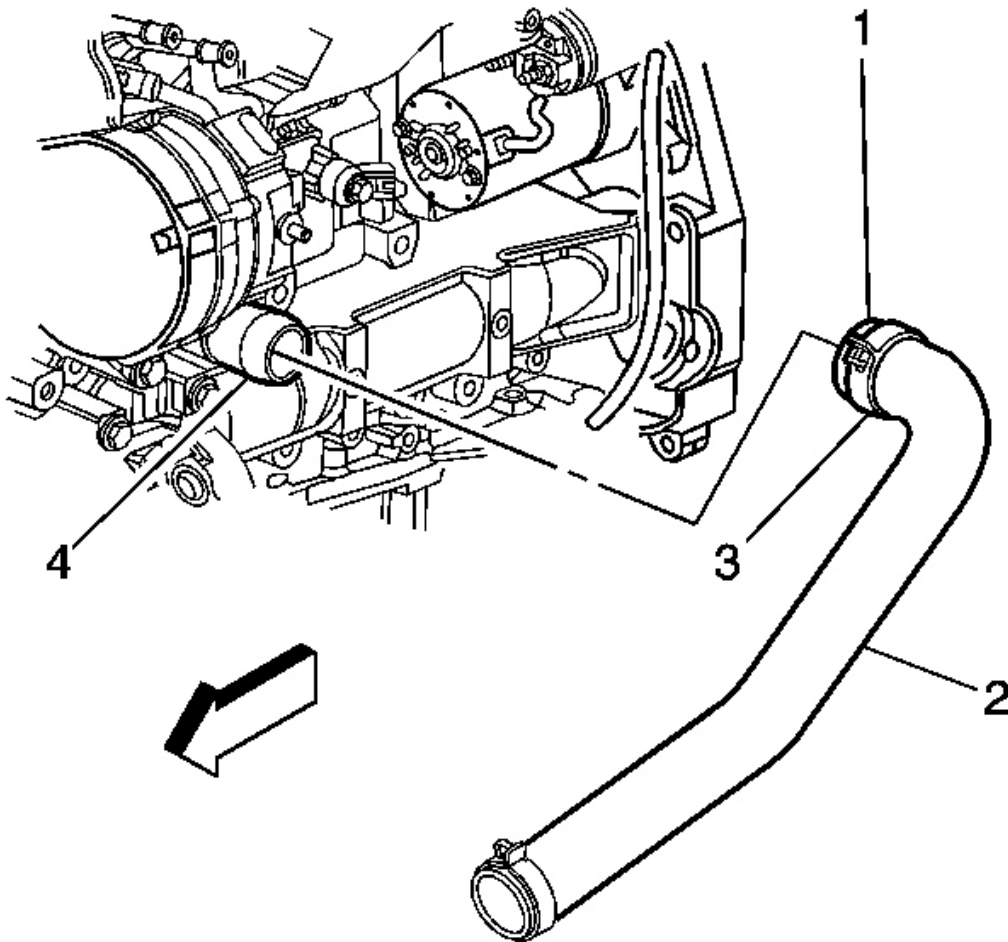


Fig. 1: View Of Radiator Inlet Hose & Thermostat Housing
Courtesy of GENERAL MOTORS CORP.

The coolant thermostat can be tested using a temperature (tempil) stick. The temperature stick is a pencil like device. It has a wax material containing certain chemicals which melt at a given temperature. Temperature sticks can be used to determine a thermostat's operating range, by rubbing 87°C (188°F) and 97°C (206°F) sticks on the thermostat housing (4).

Tools Required

J 24731 Tempilstick. See **Special Tools**.

2007 Hummer H3

2007 ENGINE Engine Cooling - H3

1. Use a tempilstick in order to find the opening and the closing temperatures of the coolant thermostat.
 - J 24731-188 tempilstick melts at 87°C (188°F). The thermostat should begin to open at 90°C (194°F).
 - J 24731-206 tempilstick melts at 97°C (206°F). The thermostat should be fully open at 107°C (225°F).
2. Replace the coolant thermostat if it does not operate properly between this temperature range. Refer to **Engine Coolant Thermostat Replacement**.

COOLANT HEATER INOPERATIVE

Coolant Heater Inoperative

Step	Action	Yes	No
DEFINITION: The Engine Hot indicator is always ON.			
1	Did you perform the necessary inspections?	Go to Step 2	Go to <u>Symptoms - Engine Cooling</u>
2	Test the engine coolant heater power supply cord for an open or short to ground. Refer to <u>Circuit Testing</u> . Did you find a condition?	Go to Step 3	Go to Step 4
3	Replace the engine coolant heater power supply cord. Refer to <u>Coolant Heater Cord Replacement</u> . Did you complete the repair?	Go to Step 6	-
4	Inspect for poor connections at the harness connector of the engine coolant heater. Refer to <u>Testing for Intermittent Conditions and Poor Connections</u> and <u>Connector Repairs</u> . Did you find and correct the condition?	Go to Step 6	Go to Step 5
5	Replace the engine coolant heater. Refer to <u>Coolant Heater Replacement</u> . Did you complete the repair?	Go to Step 6	-
6	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to Step 2

2007 Hummer H3

2007 ENGINE Engine Cooling - H3

ENGINE FAILS TO REACH NORMAL OPERATING TEMPERATURE

Diagnostic Aids

The engine may fail to reach normal operating temperature due to an intermittent operation of the thermostat.

Engine Fails To Reach Normal Operating Temperature

Step	Action	Yes	No
DEFINITION: Normal coolant temperature readings will be expected to vary from 92-107° C (198-225°F).			
1	Did you perform the Diagnostic System Check - Vehicle?	Go to Step 2	Go to <u>Diagnostic System Check - Vehicle</u>
2	Verify that the engine fails to reach normal operating temperature. Is the engine failing to reach normal operating temperature?	Go to Step 3	Go to Diagnostic Aids
3	Inspect the coolant recovery reservoir for low coolant. Is there a loss of coolant?	Go to <u>Loss of Coolant</u>	Go to Step 4
4	Inspect the thermostat for proper operation. Refer to <u>Thermostat Diagnosis</u> . Does the thermostat operate properly?	Go to Step 6	Go to Step 5
5	Replace the thermostat. Refer to <u>Engine Coolant Thermostat Replacement</u> . Did you complete the repair?	Go to Step 6	-
6	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to Step 2

PRESSURE CAP TESTING

Tools Required

J 24460-01 Cooling System Pressure Tester. See **Special Tools**.

Pressure Cap Testing

CAUTION: To avoid being burned, do not remove the radiator cap or surge tank cap while the engine is hot. The cooling system will release scalding fluid and steam under pressure if radiator cap or surge tank cap is removed while the engine and radiator are still hot.

1. Remove the pressure cap.
2. Wash the pressure cap sealing surface with water.

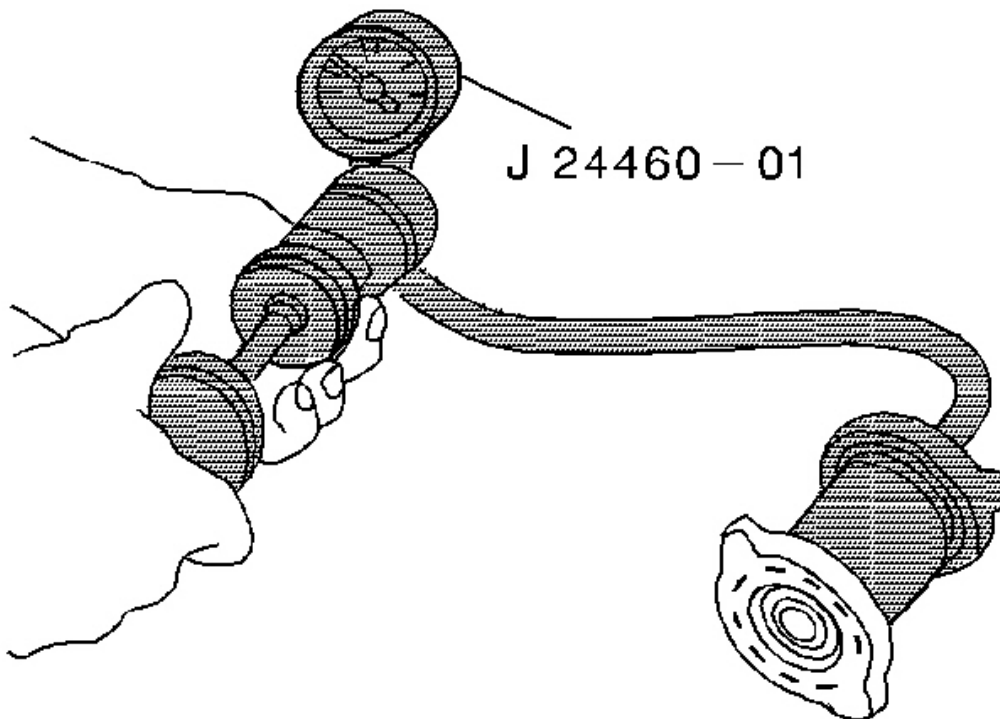


Fig. 2: Identifying Cooling System Tester J 24460-01
Courtesy of GENERAL MOTORS CORP.

3. Use the **J 24460-01** in order to test the pressure cap. See **Special Tools**.
4. Test the pressure cap for the following conditions:
 - Pressure release when the **J 24460-01** exceeds the pressure rating of the pressure cap.
 - Maintain the rated pressure for at least 10 seconds.

Note the rate of pressure loss.

5. Replace the pressure cap under the following conditions:

- The pressure cap does not release pressure which exceeds the rated pressure of the cap.
- The pressure cap does not hold the rated pressure.

COOLING SYSTEM LEAK TESTING

Tools Required

J 24460-01 Cooling System Pressure Tester. See Special Tools.

Test Procedure

CAUTION: Under pressure, the temperature of the solution in the radiator can be considerably higher, without boiling. Removing the radiator cap while the engine is hot (pressure is high), will cause the solution to boil instantaneously, with explosive force. The solution will spew out over the engine, fenders and the person removing the cap. Serious bodily injury may result. Flammable antifreeze, such as alcohol, is not recommended for use at any time. Flammable antifreeze could cause a serious fire.

CAUTION: In order to help avoid being burned, do not remove the radiator cap while the engine and the radiator are hot. Scalding fluid and steam can be blown out under pressure if the cap is removed too soon.

1. Remove the pressure cap.
2. Test the operation of the pressure cap. Refer to Pressure Cap Testing.

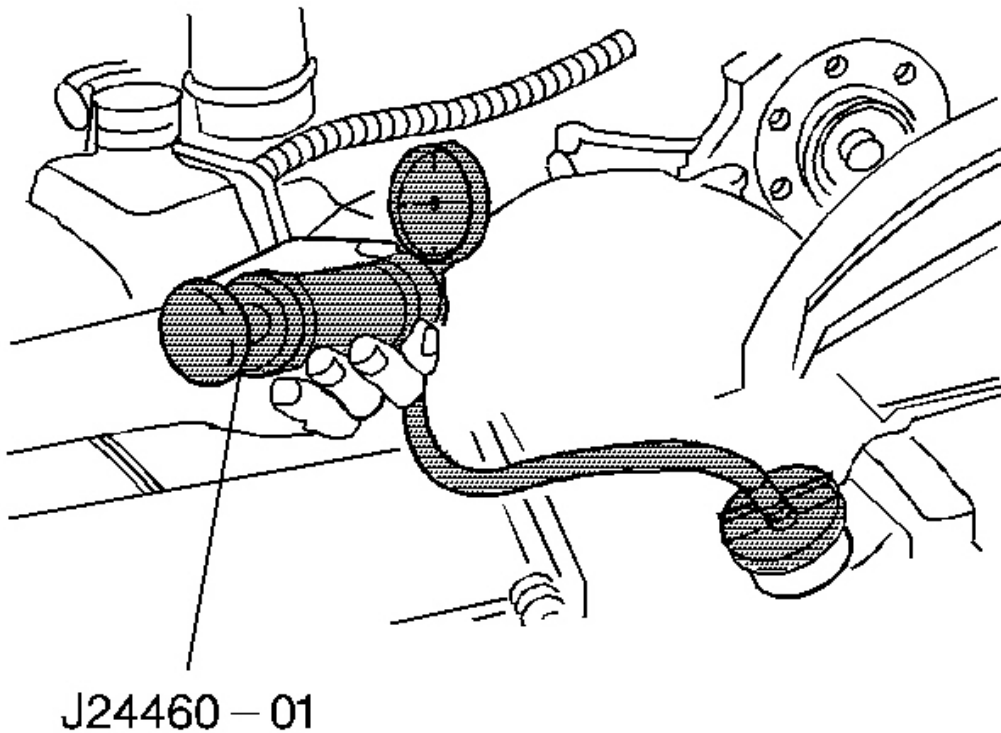


Fig. 3: Pressure Testing Cooling System Using J 24460-01
 Courtesy of GENERAL MOTORS CORP.

3. Use the **J 24460-01** in order to apply pressure to the cooling system. See **Special Tools**.
 Do not exceed the pressure cap rating.
4. The cooling system should hold the rated pressure for at least 2 minutes.
 Observe the gage for any pressure loss.
5. Repair any leaks as required.

FAN CLUTCH DIAGNOSIS

Fan Clutch Diagnosis

Step	Action	Yes	No

2007 Hummer H3

2007 ENGINE Engine Cooling - H3

DEFINITION: Testing the engagement and disengagement of the fan clutch.

1	Were you sent here from Symptoms or another diagnostic table?	Go to Step 2	Go to Symptoms - Engine Cooling
2	Is there excessive fan air noise?	Go to Step 3	Go to Step 4
3	Fan air noise is normal during cold engine start up. Does the fan noise go away at normal engine operating temperature?	Go to Step 13	Go to Step 4
4	IMPORTANT: The engine must be turned off and the engine temperature should be cold. Rotate the fan clutch.Does the fan clutch rotate?	Go to Step 5	Go to Step 14
5	Visually inspect the fan blades for cracks, looseness or damage. Are the fan blades in good condition?	Go to Step 6	Go to Step 15
6	Visually inspect the fan clutch for signs of silicone leakage. <ul style="list-style-type: none"> • Slight silicone leakage may not effect the fan clutch engagement. • Excessive leakage will prevent the fan clutch from engaging. Is the silicone fluid leakage excessive?	Go to Step 14	Go to Step 7
7	Inspect the fan clutch for proper installation. <ol style="list-style-type: none"> 1. Move the fan blade back and forth in a lateral motion. 2. Inspect for fan blade to fan clutch movement. Is the fan blade loose at the fan clutch?	Go to Step 10	Go to Step 8
	Inspect the fan clutch for wear.		

2007 Hummer H3

2007 ENGINE Engine Cooling - H3

8	<p>1. Move the fan blade back and forth in a lateral motion.</p> <p>IMPORTANT: Approximately 6.5 mm (1/4 in) movement at the tip of the fan blade is normal.</p> <p>2. Inspect for fan clutch lateral movement.</p> <p>Is the fan clutch lateral movement excessive?</p>	Go to Step 14	Go to Step 9
9	<p>The fan clutch should have more turning resistance when the engine is at or above normal operating temperature.</p> <p>Does the fan clutch have more resistance when the engine temperature is raised?</p>	Go to Step 11	Go to Step 14
10	<p>Tighten the fan. Refer to <u>Fastener Tightening Specifications</u>.</p> <p>Is the repair complete?</p>	Go to Step 16	-
	<p>Perform a fan clutch engagement test.</p> <ol style="list-style-type: none"> 1. Ensure the engine coolant level is full. 2. Ensure the cooling fan drive belt tension is correct and not slipping. 3. Position and secure a thermometer between the fan clutch and the radiator. 4. Ensure the cooling fan is disengaged before starting this test. 5. Sufficiently cover the radiator grille to restrict the air flow. <p>IMPORTANT: Do not allow engine temperature to exceed 121°C (250°F).</p>		

2007 Hummer H3

2007 ENGINE Engine Cooling - H3

<p>11</p>	<p>6. Start the engine. 7. Turn the A/C ON, if equipped. 8. Operate the engine at approximately 2,000 RPM. 9. Note the thermometer reading when the fan clutch engages. 10. Do not continue this test if the fan clutch does not engage between 85-96°C (185-205°F).</p> <p>Fan clutch engagement will be indicated by an increase in fan air noise, fan speed and a temperature drop of about 3-10°C (5-15°F) on the thermometer. Did the fan clutch engage between 85-96°C (185-205°F)?</p>	<p>Go to Step 12</p>	<p>Go to Step 14</p>
<p>12</p>	<p>Once the fan clutch engages, perform the following steps:</p> <ol style="list-style-type: none"> 1. Uncover the radiator grille. 2. Turn the A/C OFF, if equipped. 3. Operate the engine at approximately 2,500 RPM to reduce the engine operating temperature. 4. Remove the thermometer. <p>Did the engine return to normal operating temperature?</p>	<p>Go to Step 13</p>	<p>-</p>
<p>13</p>	<p>As the engine temperature returns to normal, the fan clutch will disengage, indicated by a reduction in fan air noise and fan speed. Did the fan clutch disengage?</p>	<p>Go to Step 16</p>	<p>Go to Step 14</p>
<p>14</p>	<p>Replace the fan clutch. Refer to Fan Clutch Replacement.</p>		

2007 Hummer H3

2007 ENGINE Engine Cooling - H3

	Is the repair complete?	Go to Step 16	-
15	Replace the fan blades. Refer to Fan Clutch Replacement .		
	Is the repair complete?	Go to Step 16	-
16	Operate the fan clutch to verify proper operation.		
	Did you find and correct the condition?	System OK	Go to Step 2

REPAIR INSTRUCTIONS

COOLING SYSTEM DRAINING AND FILLING (STATIC FILL)

Tools Required

- **J 26568** Coolant and Battery Tester. See **Special Tools**.
- **J 38185** Hose Clamp Pliers.

Draining Procedure

CAUTION: To avoid being burned, do not remove the radiator cap or surge tank cap while the engine is hot. The cooling system will release scalding fluid and steam under pressure if radiator cap or surge tank cap is removed while the engine and radiator are still hot.

IMPORTANT: Draining the cooling system with the pressure cap installed will siphon the coolant from the overflow tank.

1. Park the vehicle on a level surface.
2. Allow the engine to cool.
3. Remove the radiator cap.
4. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
5. Remove the engine shield. Refer to **Engine Shield Replacement** .
6. Place a drain pan under the lower radiator hose connection at the bottom of the radiator.
7. Using **J 38185** slide the hose clamp back on the lower radiator hose. See **Special Tools**.
8. Slowly remove the lower radiator hose and drain the coolant into the drain pan.
9. Inspect the engine coolant for the following:

- Discolored appearance - follow the flush procedure. Refer to **Flushing**.
- Normal in appearance - follow the filling procedure.
- If a complete block drain is required, remove the coolant heater located on the LH side of the block. Refer to **Coolant Heater Replacement**.

Filling Procedure

NOTE: The procedure below must be followed. Improper coolant level could result in a low or high coolant level condition, causing engine damage.

1. If a complete block drain was required, install the coolant heater. Refer to **Coolant Heater Replacement**.
2. Install the lower radiator hose.
3. Using the **J 38185** slide the lower radiator hose clamp into the original position. See **Special Tools**.
4. Lower the vehicle.

IMPORTANT: Slowly add a mixture of 50/50 DEX-COOL antifreeze and deionized water to the cooling system through the top of the radiator until full. Refer to **Approximate Fluid Capacities** .

5. Install the radiator cap.
6. Remove coolant recovery reservoir cap.
7. Fill the coolant recovery reservoir with the remaining coolant.
8. Install coolant recovery reservoir cap.
9. Start the engine.
10. Run the engine at 2,000-2,500 RPM until the engine reaches normal operating temperature.
11. Allow the engine to idle for 3 minutes.
12. Shut the engine off.
13. Allow the engine to cool.
14. Top off the coolant recovery reservoir as necessary.
15. Inspect the cooling system for leaks.
16. Rinse away any excess coolant from the engine and the engine compartment.
17. Inspect the concentration of the engine coolant using **J 26568** . See **Special Tools**.

COOLING SYSTEM DRAINING AND FILLING (VAC-N-FILL)

Tools Required

- **J 26568** Coolant and Battery Tester. See Special Tools.
- **J 38185** Hose Clamp Pliers. See Special Tools.
- **GE-47716** Vac-N-Fill Coolant Refill Tool. See Special Tools.
- **J 42401** Radiator Cap and Surge Tank Test Adapter. See Special Tools.

Draining Procedure

CAUTION: To avoid being burned, do not remove the radiator cap or surge tank cap while the engine is hot. The cooling system will release scalding fluid and steam under pressure if radiator cap or surge tank cap is removed while the engine and radiator are still hot.

IMPORTANT: Draining the cooling system with the pressure cap installed will siphon the coolant from the overflow tank.

1. Park the vehicle on a level surface.
2. Allow the engine to cool.
3. Remove the radiator cap.
4. Raise and support the vehicle. Refer to Lifting and Jacking the Vehicle .
5. Place a drain pan under the lower radiator hose connection at the bottom of the radiator.
6. Using **J 38185** slide the hose clamp back on the lower radiator hose. See Special Tools.
7. Slowly remove the lower radiator hose and drain the coolant into the drain pan.
8. Inspect the engine coolant for the following:
 - Discolored appearance-Follow the flush procedure. Refer to Flushing .
 - Normal in appearance-Follow the filling procedure.
 - If a complete block drain is required, remove the coolant heater located on the LH side of the block. Refer to Coolant Heater Replacement .

Vac-N-Fill Procedure

IMPORTANT: To prevent boiling of the coolant/water mixture in the vehicles cooling system, do not apply vacuum to a cooling system above

49°C (120°F). The tool will not operate properly when the coolant is boiling.

1. Install the **J 42401** . See **Special Tools**.

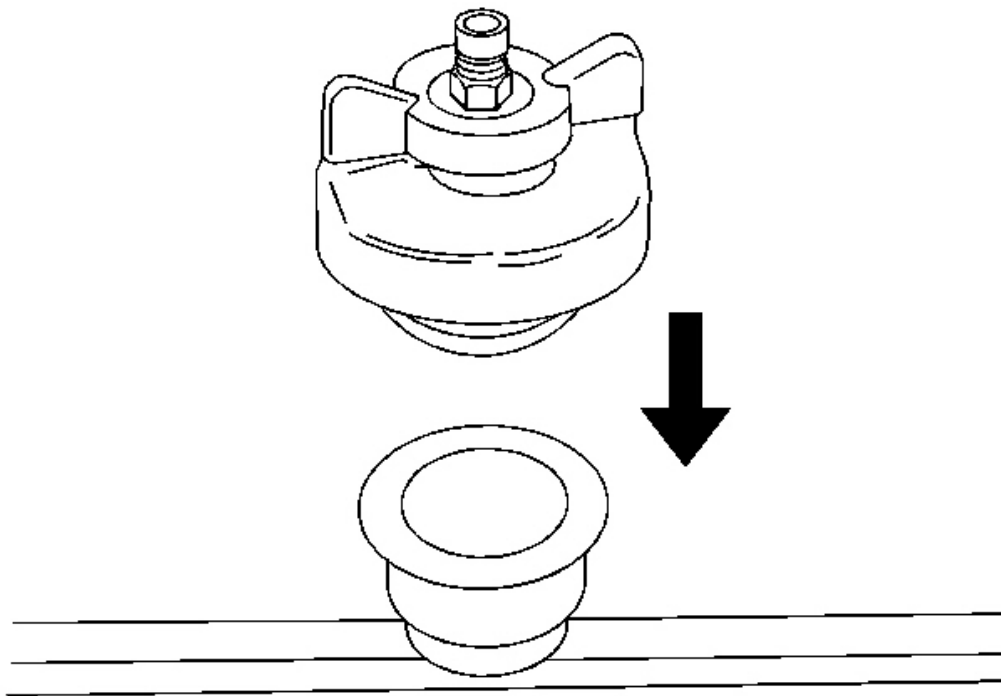


Fig. 4: Identifying Vac-N-Fill Cap
Courtesy of GENERAL MOTORS CORP.

2. Attach the Van-N-Fill cap to the vehicles coolant fill port.

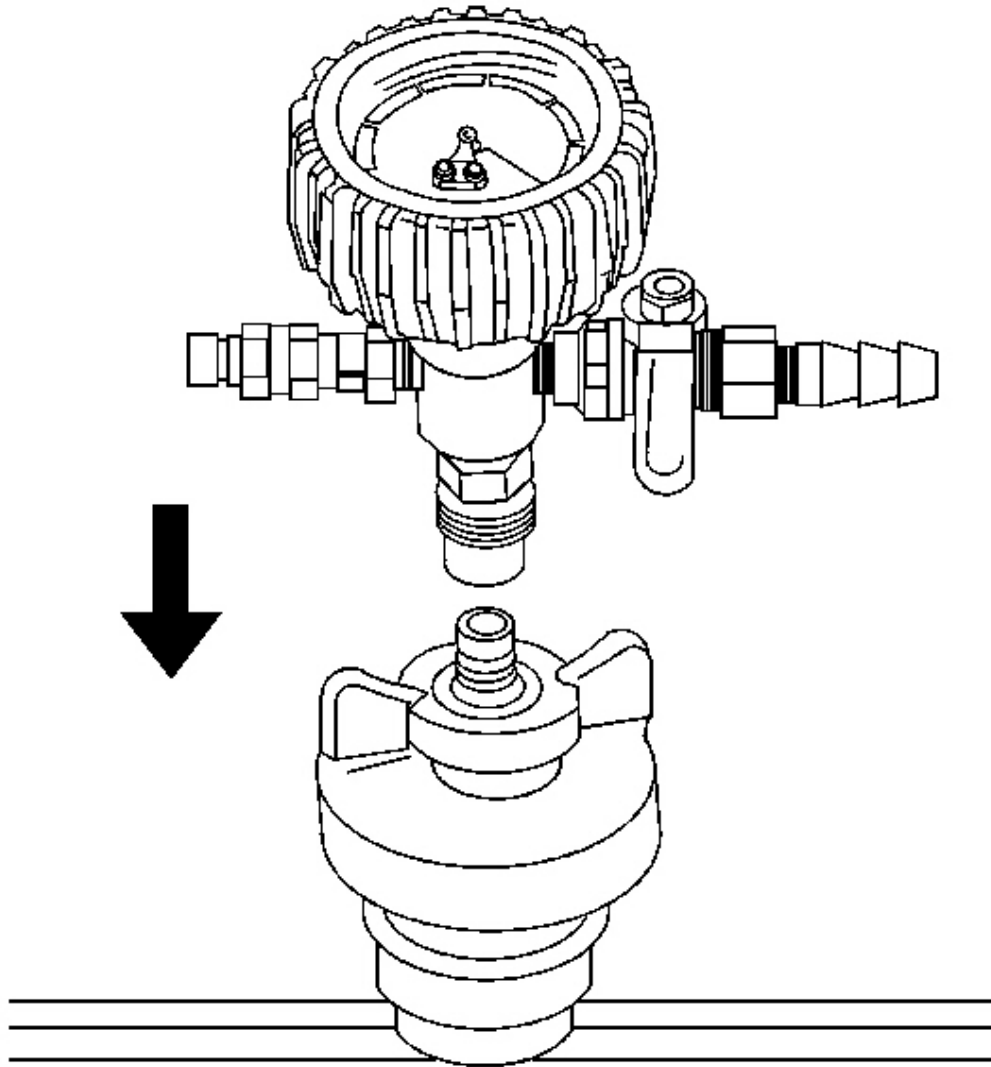


Fig. 5: Identifying Vacuum Gage Assembly
Courtesy of GENERAL MOTORS CORP.

3. Attach the vacuum gage assembly to the Vac-N-Fill cap.

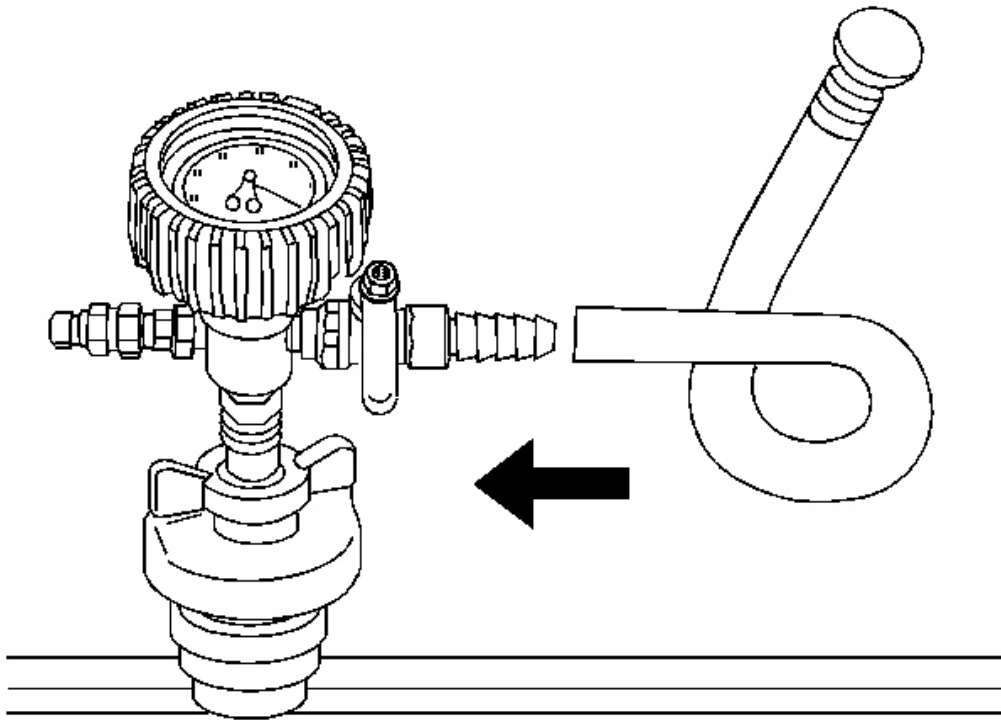


Fig. 6: Identifying Fill Hose
Courtesy of GENERAL MOTORS CORP.

4. Attach the fill hose to the barb fitting on the vacuum gage assembly.

Ensure that the valve is closed.

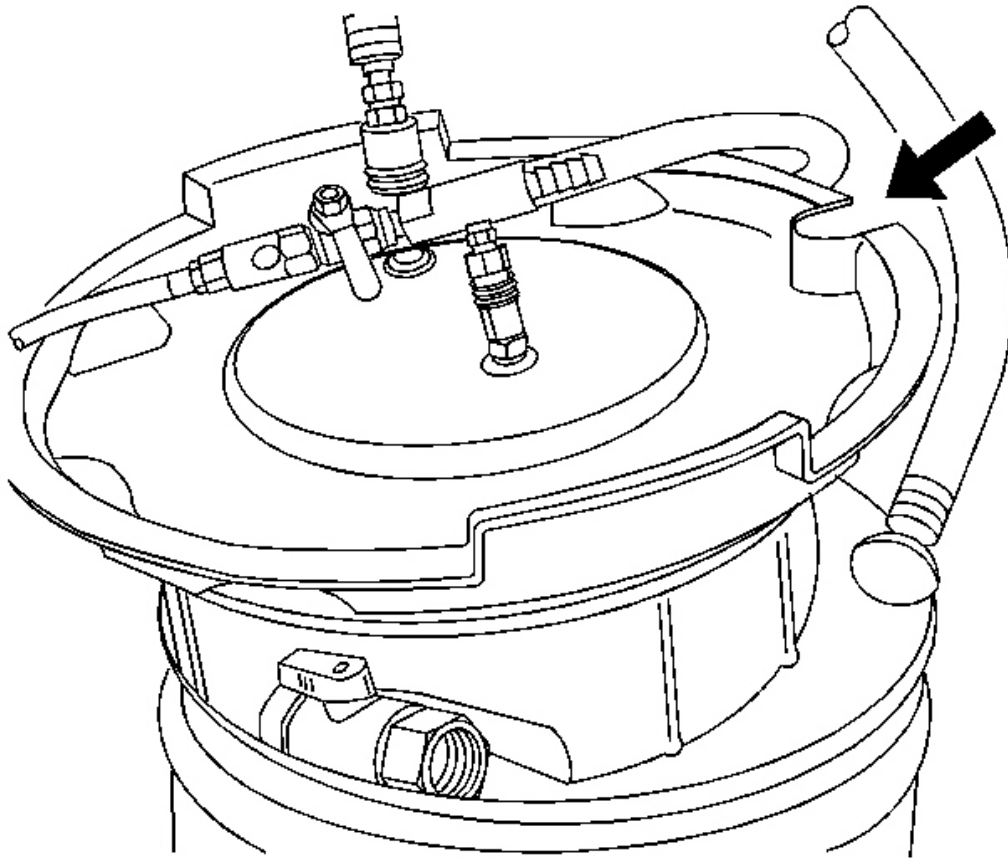


Fig. 7: View Of Graduated Reservoir & Hose
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Use a 50/50 mixture of DEX-COOL antifreeze and clean, drinkable water. Always use more coolant than necessary. This will eliminate air from being drawn into the cooling system.

5. Pour the coolant mixture into the graduated reservoir.
6. Place the fill hose in the graduated reservoir.

IMPORTANT: Prior to installing the vacuum tank onto the graduated reservoir, ensure that the drain valve located on the bottom

of the tank is closed.

7. Install the vacuum tank on the graduated reservoir with the fill hose routed through the cut-out area in the vacuum tank.

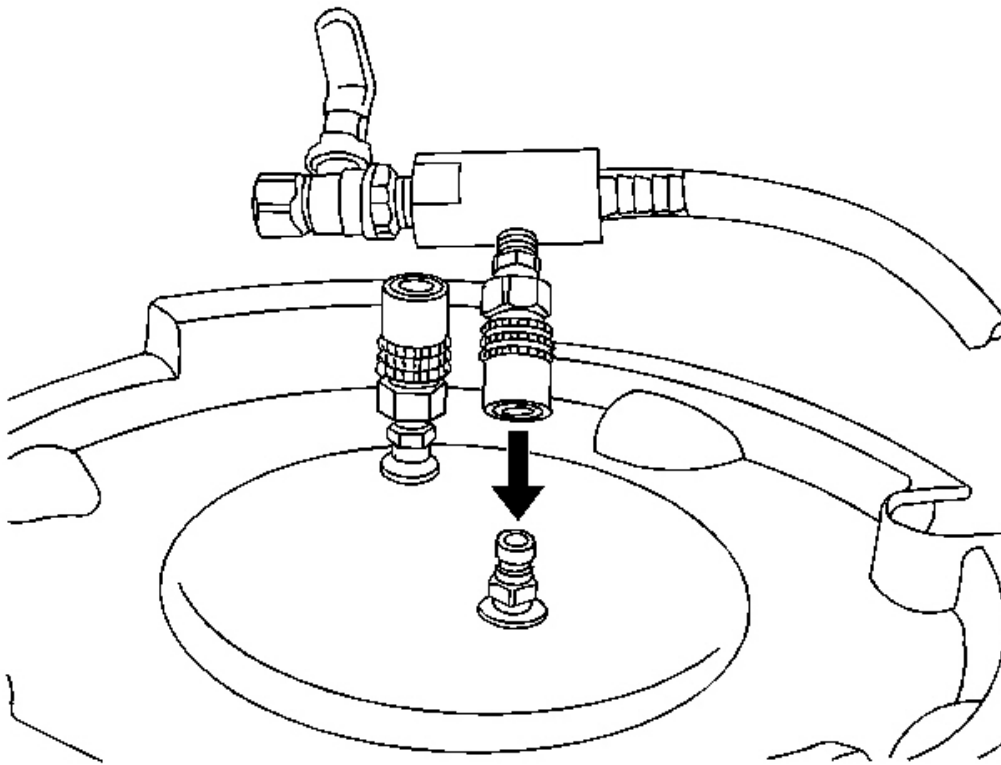


Fig. 8: Identifying Venturi Assembly
Courtesy of GENERAL MOTORS CORP.

8. Attach the venture assembly to the vacuum tank.

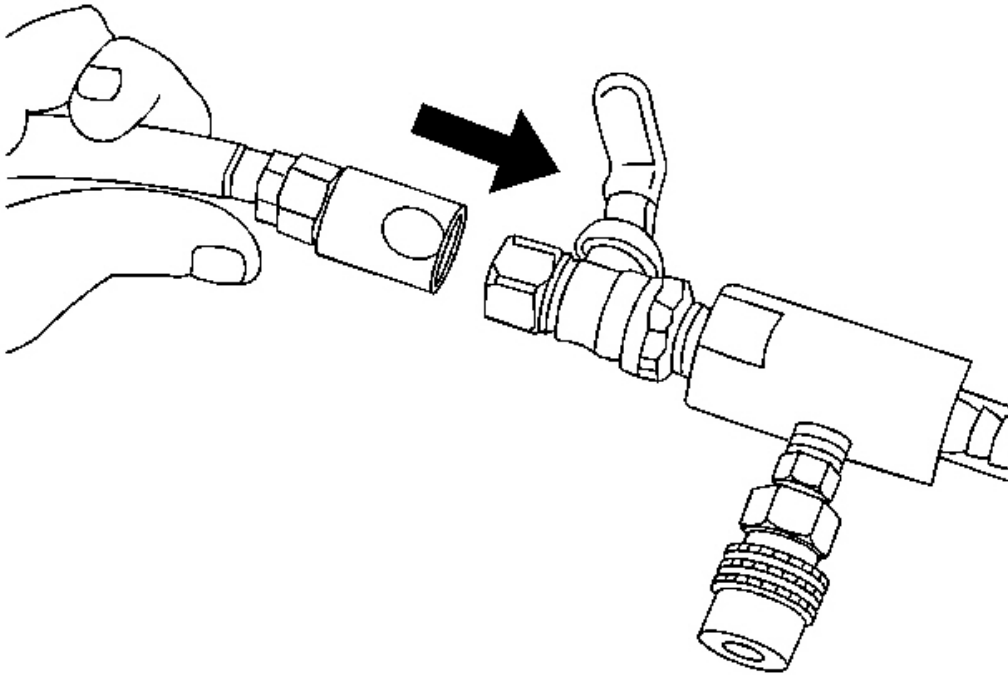


Fig. 9: Attaching Shop Air Hose To Venturi Assembly
Courtesy of GENERAL MOTORS CORP.

9. Attach a shop air hose to the venture assembly.

Ensure the valve on the venture assembly is closed.

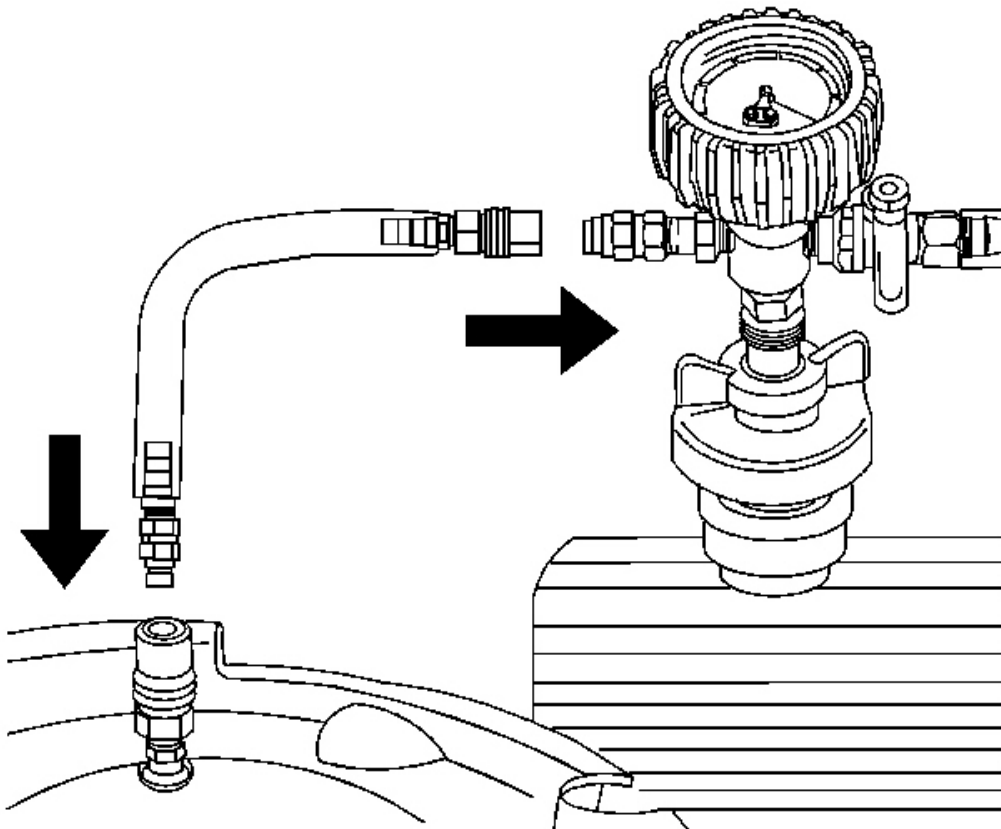


Fig. 10: Attaching Vacuum Hose To Vacuum Gauge Assembly & Vacuum Tank
Courtesy of GENERAL MOTORS CORP.

10. Attach the vacuum hose to the vacuum gage assembly and the vacuum tank.
11. Clamp off the overflow hose.

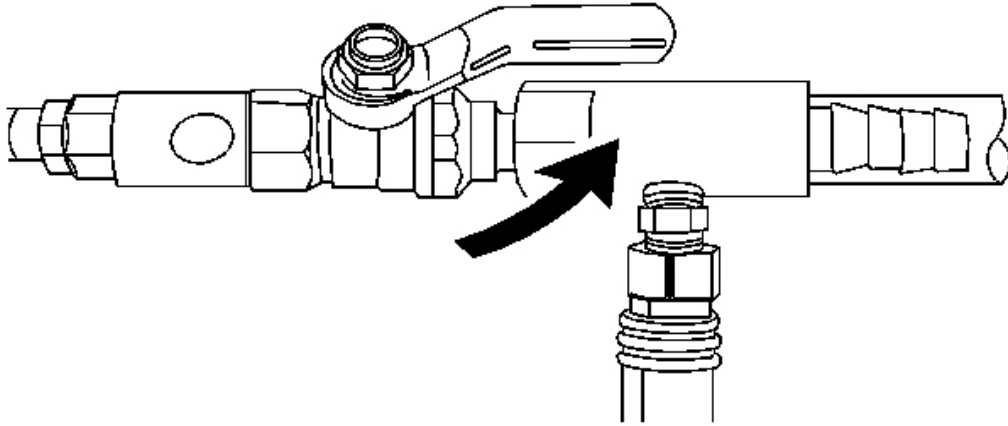


Fig. 11: Opening Valve On Venturi Assembly
Courtesy of GENERAL MOTORS CORP.

12. Open the valve on the venture assembly. The vacuum gage will begin to rise and a hissing noise will be present.

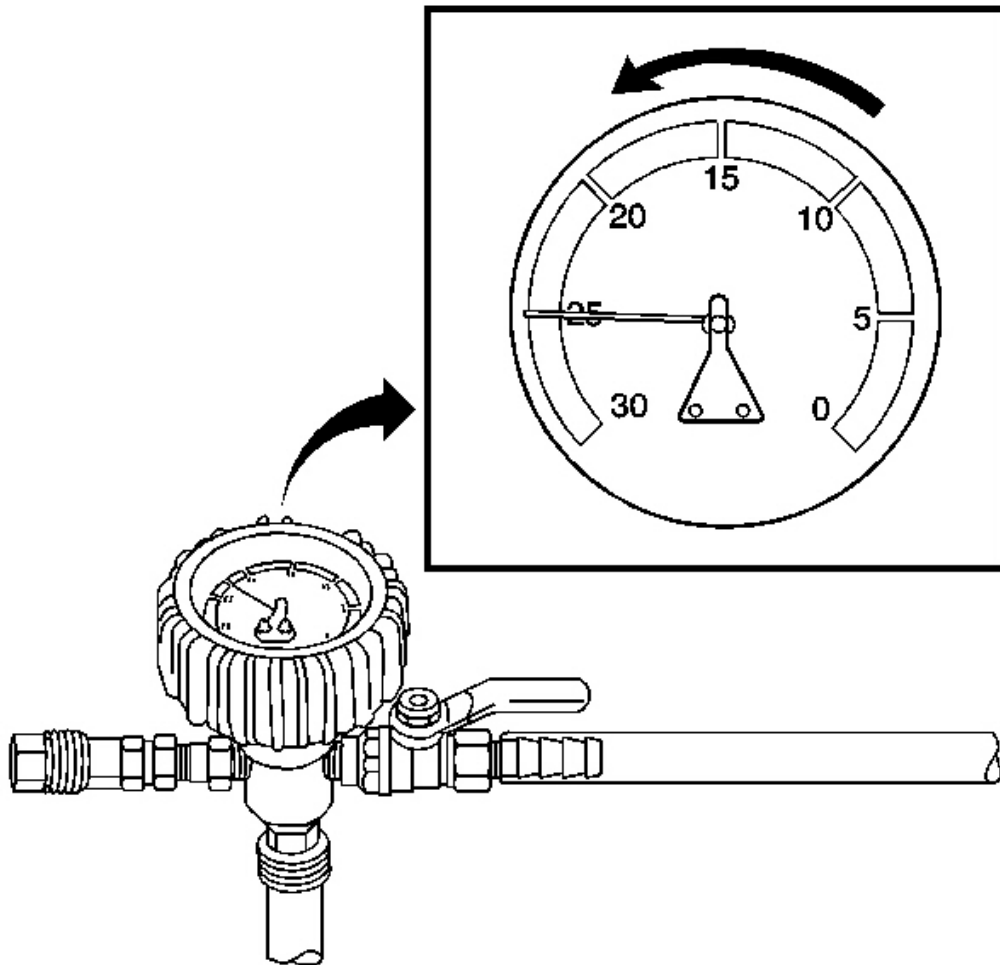


Fig. 12: Monitoring System Vacuum
Courtesy of GENERAL MOTORS CORP.

13. Continue to draw vacuum until the needle stops rising. This should be 610-660 mm Hg (24-26 in HG).

Cooling hoses may start to collapse. This is normal due to vacuum draw.

14. To aid in the fill process, position the graduated reservoir above the coolant fill port.

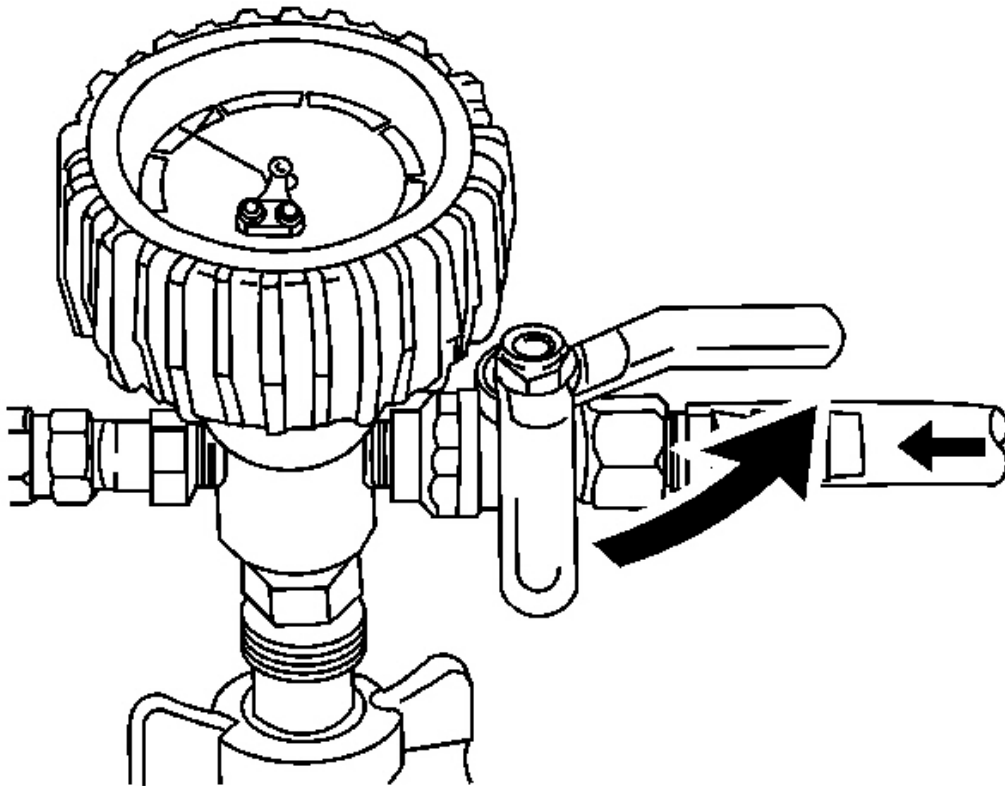


Fig. 13: Slowly Opening Valve On Vacuum Gage Assembly
Courtesy of GENERAL MOTORS CORP.

15. Slowly open the valve on the vacuum gage assembly. When the coolant reaches the top of the fill hose, close the valve. This will eliminate air from the fill hose.
16. Close the valve on the venture assembly.
17. If there is a suspected leak in the cooling system, allow the system to stabilize under vacuum and monitor for vacuum loss.

If vacuum loss is observed, refer to **Loss of Coolant**.

18. Open the valve on the vacuum gage assembly. The vacuum gage will drop as coolant is drawn into the system.

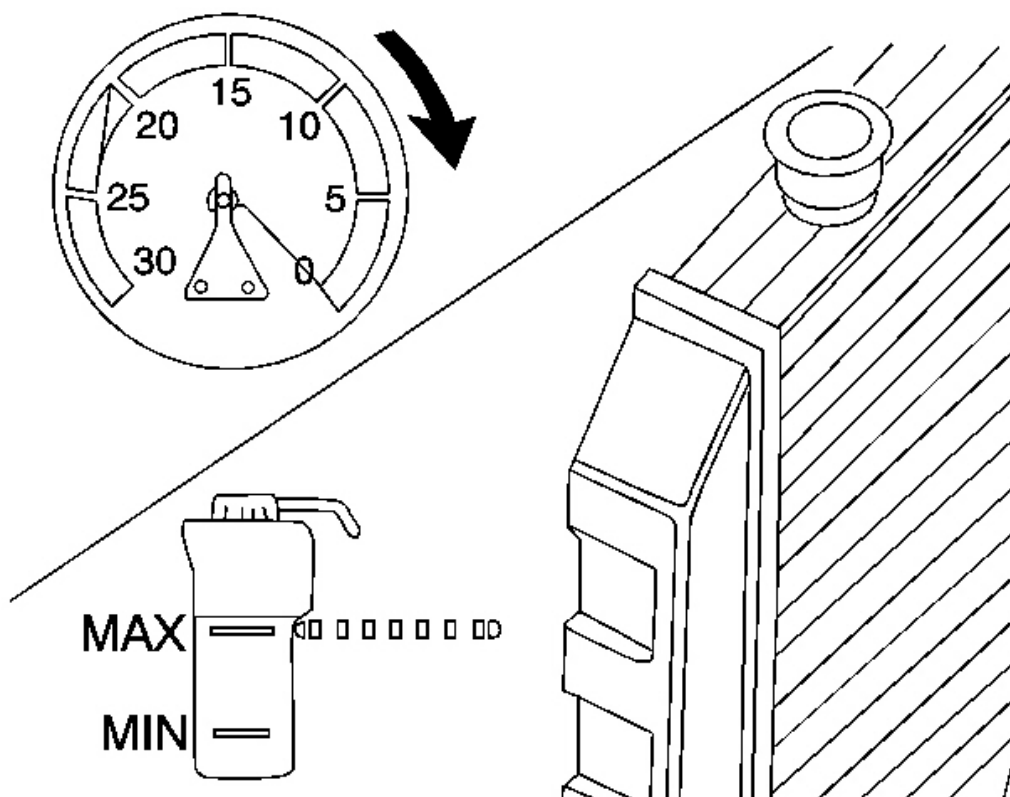


Fig. 14: View Of Vacuum Gauge & Radiator
Courtesy of GENERAL MOTORS CORP.

19. Once the vacuum gage reaches zero, close the valve on the vacuum gage assembly and repeat steps 11-17.
20. Remove the **J 42401** . See **Special Tools**.
21. Detach the Vac-N-Fill cap from the vehicles coolant fill port.
22. Add coolant to the system as necessary.
23. Inspect the concentration of the coolant mixture using **J 26568** .

IMPORTANT: After filling the cooling system, the extraction hose can be used to remove excess coolant to achieve the proper coolant level.

24. Detach the vacuum hose from the vacuum gage assembly.

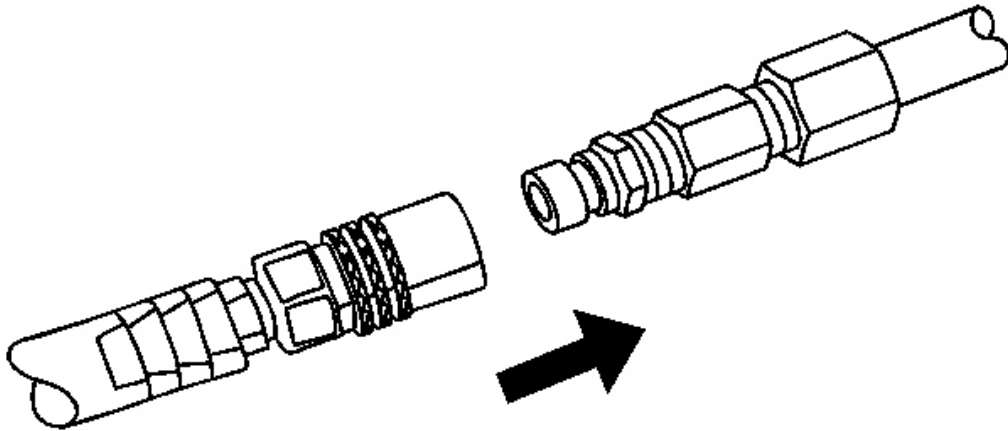


Fig. 15: Identifying Extraction Hose
Courtesy of GENERAL MOTORS CORP.

25. Attach the extraction hose to the vacuum hose.

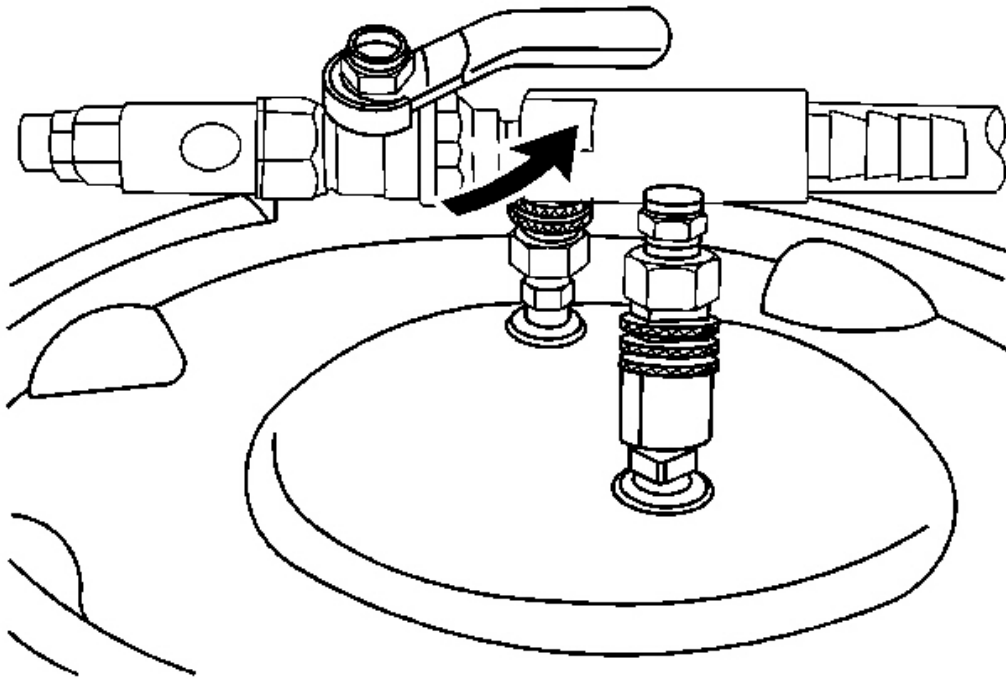


Fig. 16: Opening Venturi Assembly Valve
Courtesy of GENERAL MOTORS CORP.

26. Open the valve on the venture assembly to start a vacuum draw.

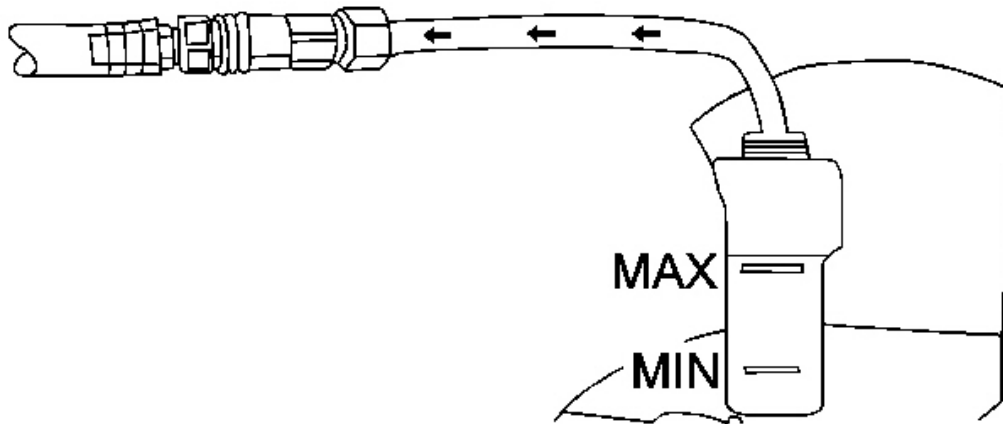


Fig. 17: Drawing Out Coolant
Courtesy of GENERAL MOTORS CORP.

27. Use the extraction hose to draw out coolant to the proper level.
28. The vacuum tank has a drain valve on the bottom of the tank. Open the valve to drain coolant from the vacuum tank into a suitable container for disposal.

FLUSHING

IMPORTANT: Do not use a chemical flush.

Store used coolant in the proper manner, such as in a used engine coolant holding tank. Do not pour used coolant down a drain. Ethylene glycol antifreeze is a very toxic chemical. Do not dispose of coolant into the sewer system or ground water. This is illegal and ecologically unsound.

Various methods and equipment can be used to flush the cooling system. If special equipment is used, such as a back flusher, follow the manufacturer's instruction. Always remove the thermostat before flushing the cooling system.

When the cooling system becomes contaminated, the cooling system should be flushed thoroughly to remove the contaminants before the engine is seriously damaged.

1. Drain the cooling system. Refer to **Cooling System Draining and Filling (Static Fill)** or

Cooling System Draining and Filling (Vac-N-Fill).

2. Remove the coolant recovery reservoir. Refer to **Coolant Recovery Reservoir Replacement (Left Hand Drive)** or **Coolant Recovery Reservoir Replacement (Right Hand Drive)**.
3. Clean and flush the coolant recovery reservoir with clean, drinkable water.
4. Install the coolant recovery reservoir. Refer to **Coolant Recovery Reservoir Replacement (Left Hand Drive)** or **Coolant Recovery Reservoir Replacement (Right Hand Drive)**.
5. Follow the drain and fill procedure using only clean, drinkable water. Refer to **Cooling System Draining and Filling (Static Fill)** or **Cooling System Draining and Filling (Vac-N-Fill)**.
6. Run the engine for 20 minutes.
7. Stop the engine.
8. Drain the cooling system. Refer to **Cooling System Draining and Filling (Static Fill)** or **Cooling System Draining and Filling (Vac-N-Fill)**.
9. Repeat the procedure if necessary, until the fluid is nearly colorless.
10. Fill the cooling system. Refer to **Cooling System Draining and Filling (Static Fill)** or **Cooling System Draining and Filling (Vac-N-Fill)**.

RADIATOR CLEANING

CAUTION: NEVER spray water on a hot radiator. The resulting steam could cause personal injury.

NOTE: The radiator fins are necessary for good heat transfer. Do not brush the fins. This may cause damage to the fins, reducing heat transfer.

IMPORTANT: Remove bugs, leaves, dirt and other debris by blowing compressed air through the engine side of the radiator.

- Some conditions may require the use of warm water and a mild detergent.
- Clean the A/C condenser fins.
- Clean between the A/C condenser and radiator.
- Clean the radiator cooling fins.
- Straighten any damaged cooling fins.

COOLANT RECOVERY RESERVOIR REPLACEMENT (LEFT HAND DRIVE)

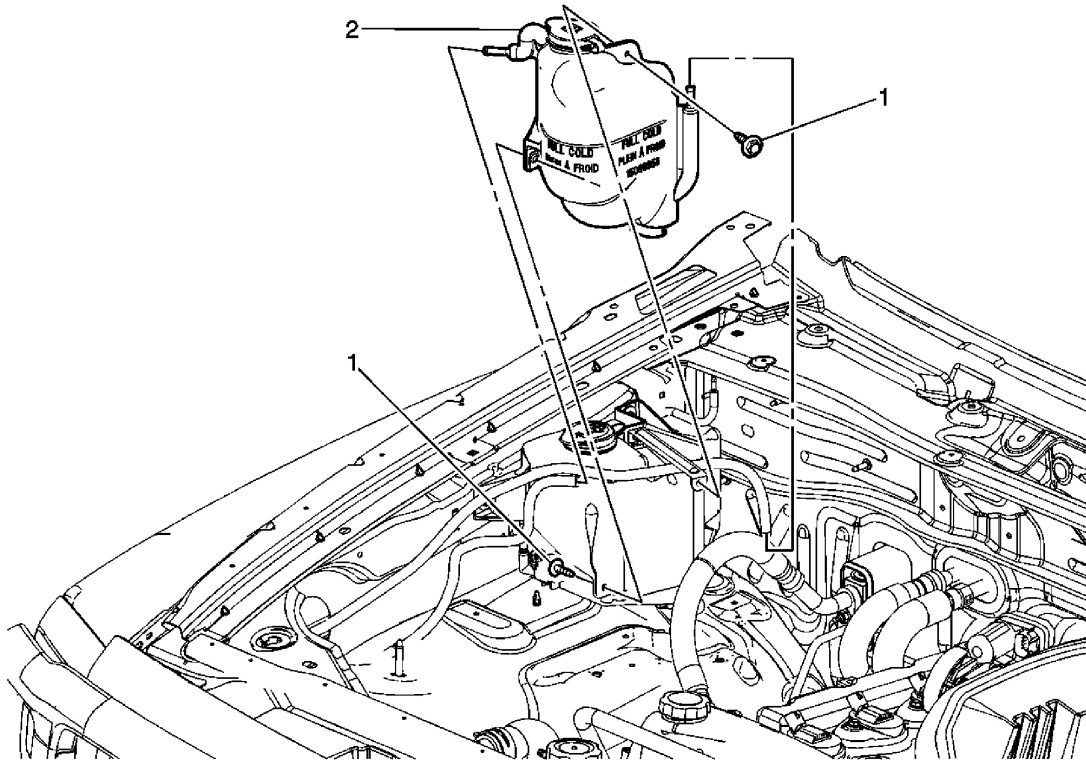


Fig. 18: Coolant Recovery Reservoir Replacement (Left Hand Drive)
 Courtesy of GENERAL MOTORS CORP.

Coolant Recovery Reservoir Replacement (Left Hand Drive)

Callout	Component Name
<p>NOTE: Refer to <u>Fastener Notice</u> .</p> <p>Fastener Tightening Specifications: Refer to <u>Fastener Tightening Specifications</u>.</p> <p>Preliminary Procedure</p> <ol style="list-style-type: none"> 1. Drain the cooling system. Refer to <u>Cooling System Draining and Filling (Static Fill)</u> or <u>Cooling System Draining and Filling (Vac-N-Fill)</u>. 2. Remove the air cleaner assembly. Refer to <u>Air Cleaner Assembly Replacement</u> . 	
<p>1</p>	<p>Coolant Reservoir Bolt Tip: Remove the coolant reservoir hoses from the coolant reservoir. Tighten: 10 N.m (89 lb in)</p>

2 | Coolant Reservoir

COOLANT RECOVERY RESERVOIR REPLACEMENT (RIGHT HAND DRIVE)

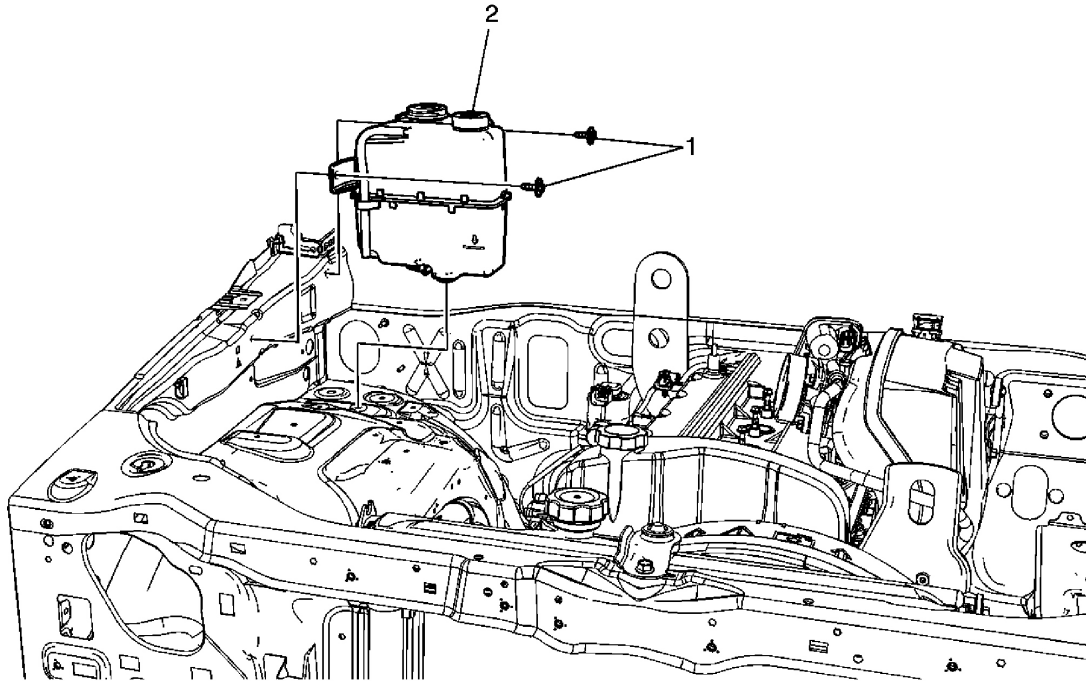


Fig. 19: Coolant Recovery Reservoir Replacement (Right Hand Drive)
 Courtesy of GENERAL MOTORS CORP.

Coolant Recovery Reservoir Replacement (Right Hand Drive)

Callout	Component Name
Preliminary Procedure	
<ol style="list-style-type: none"> 1. Drain the cooling system. Refer to <u>Cooling System Draining and Filling (Static Fill)</u> or <u>Cooling System Draining and Filling (Vac-N-Fill)</u>. 2. Remove the air cleaner assembly. Refer to <u>Air Cleaner Assembly Replacement</u>. 	
1	Coolant Reservoir Bolt (Qty: 2) NOTE: Refer to <u>Fastener Notice</u> .
Tip: Remove the coolant reservoir hoses from the coolant reservoir.	

	Tighten: 10 N.m (89 lb in)
2	Coolant Reservoir

RADIATOR INLET HOSE REPLACEMENT (LLR)

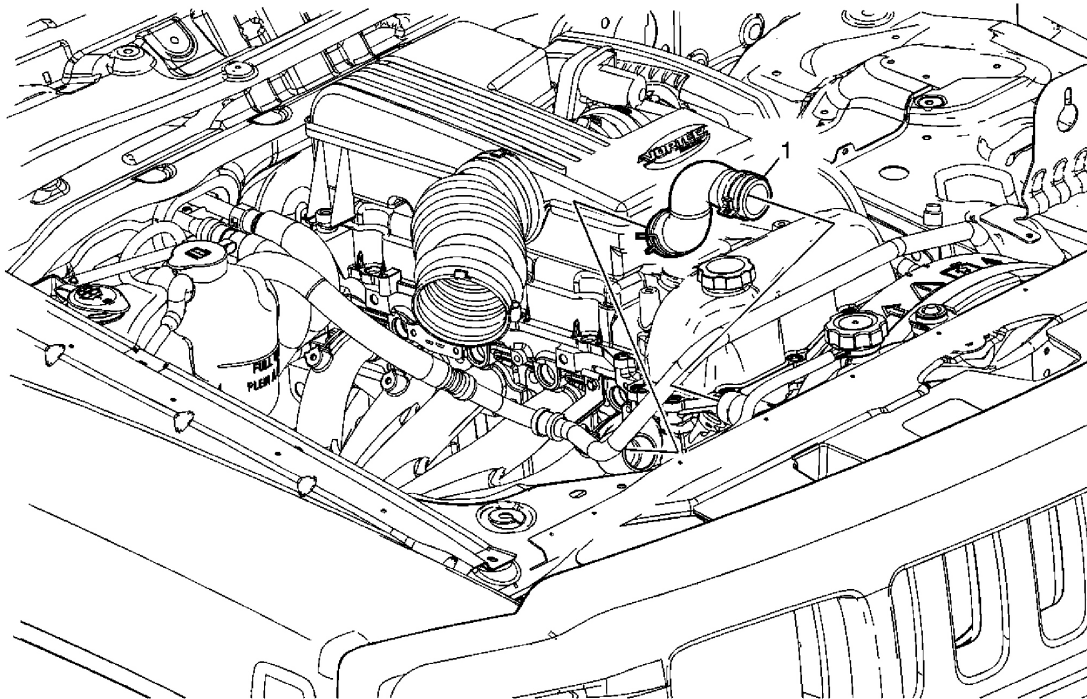


Fig. 20: Radiator Hose Replacement - Inlet
Courtesy of GENERAL MOTORS CORP.

Radiator Inlet Hose Replacement (LLR)

Callout	Component Name
Fastener Tightening Specifications: Refer to Fastener Tightening Specifications .	
Preliminary Procedure: Drain the cooling system. Refer to Cooling System Draining and Filling (Static Fill) or Cooling System Draining and Filling (Vac-N-Fill) .	
1	Radiator Inlet Hose Tip: Use J 38185 to release the radiator hose clamps. See Special Tools .

RADIATOR OUTLET HOSE REPLACEMENT (LLR)

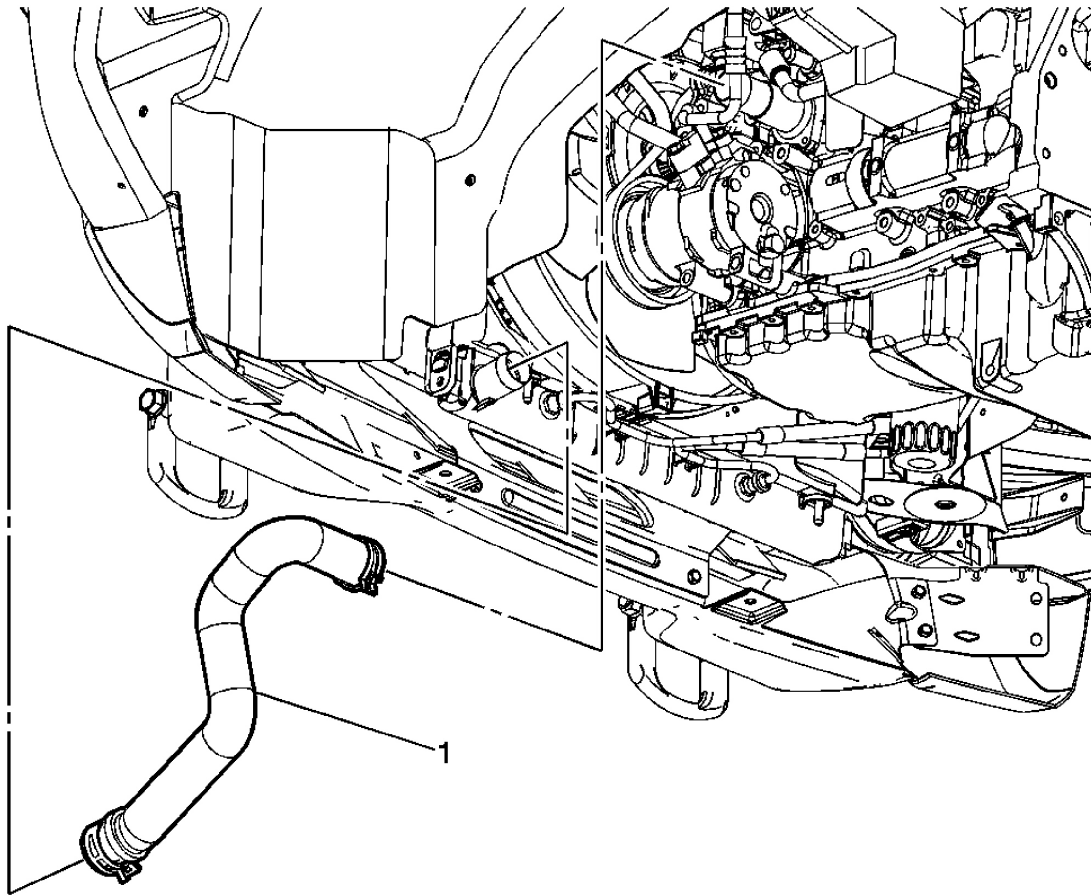


Fig. 21: Radiator Hose Replacement - Outlet
 Courtesy of GENERAL MOTORS CORP.

Radiator Outlet Hose Replacement (LLR)

Callout	Component Name
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Fastener Tightening Specifications: Refer to Fastener Tightening Specifications.

Preliminary Procedure

1. Raise and support the vehicle. Refer to Lifting and Jacking the Vehicle .
2. Drain the cooling system. Refer to Cooling System Draining and Filling (Static Fill) or Cooling System Draining and Filling (Vac-N-Fill).
3. Remove the left front wheelhouse panel. Refer to Wheelhouse Panel Replacement (Front) or Wheelhouse Panel Replacement (Rear) .
4. Remove the engine shield. Refer to Engine Shield Replacement .

	Radiator Outlet Hose
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1 **Tip:** Use **J 38185** to release the radiator hose clamps. See **Special Tools**.

RADIATOR VENT INLET HOSE REPLACEMENT (LEFT HAND DRIVE)

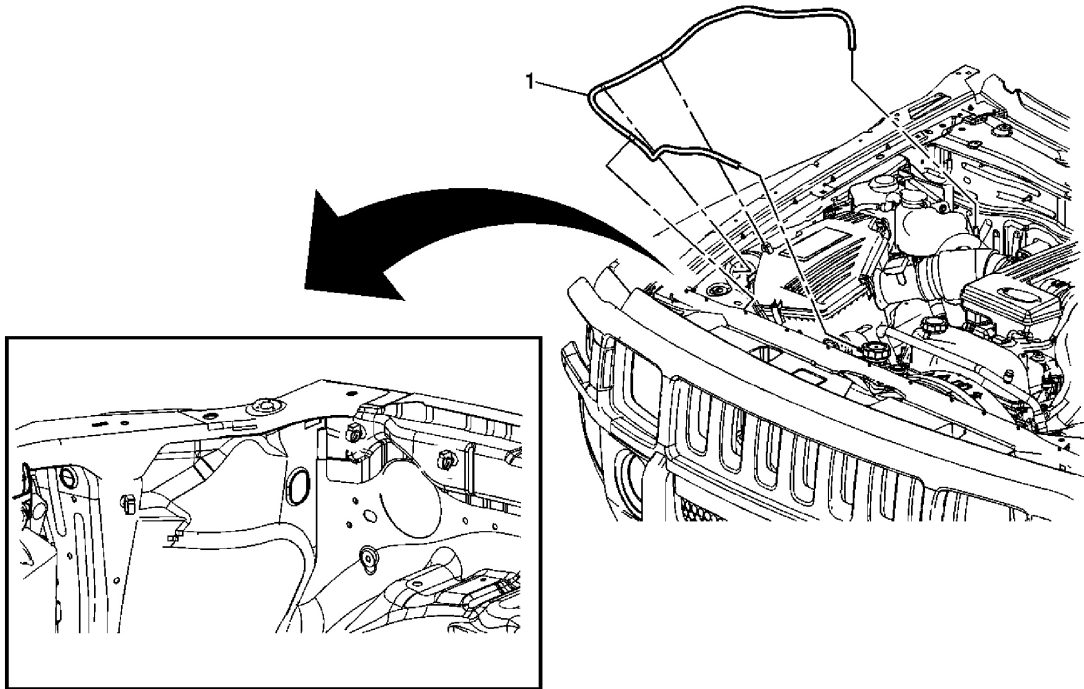


Fig. 22: Radiator Vent Inlet Hose Replacement (Left Hand Drive)
 Courtesy of GENERAL MOTORS CORP.

Radiator Vent Inlet Hose Replacement (Left Hand Drive)

Callout	Component Name
Fastener Tightening Specifications: Refer to Fastener Tightening Specifications .	
Preliminary Procedure:	
Drain the cooling system. Refer to Cooling System Draining and Filling (Static Fill) or Cooling System Draining and Filling (Vac-N-Fill) .	
1	Radiator Inlet Vent Hose Tip: Note routing of radiator inlet vent hose for proper installation.

RADIATOR VENT INLET HOSE REPLACEMENT (RIGHT HAND DRIVE)

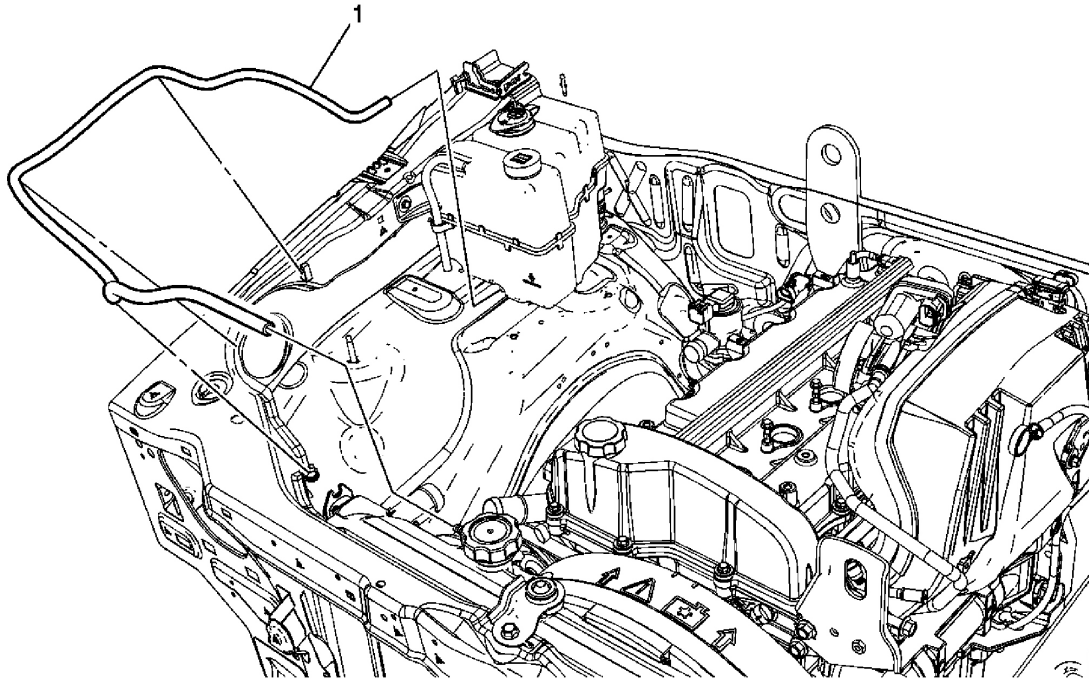


Fig. 23: Radiator Vent Inlet Hose Replacement (Right Hand Drive)
 Courtesy of GENERAL MOTORS CORP.

Radiator Vent Inlet Hose Replacement (Right Hand Drive)

Callout	Component Name
Preliminary Procedure	
1. Drain the cooling system. Refer to <u>Cooling System Draining and Filling (Static Fill)</u> or <u>Cooling System Draining and Filling (Vac-N-Fill)</u> .	
2. Remove the air cleaner assembly. Refer to <u>Air Cleaner Assembly Replacement</u> .	
1	Radiator Inlet Vent Hose

FAN REPLACEMENT

Tools Required

- **J 41240** Fan Clutch Remover and Installer. See **Special Tools**.
- **J 46406** Fan Clutch Remover and Installer. See **Special Tools**.

Removal Procedure

1. Remove the fan shroud. Refer to **Fan Shroud Replacement (LLR)**.

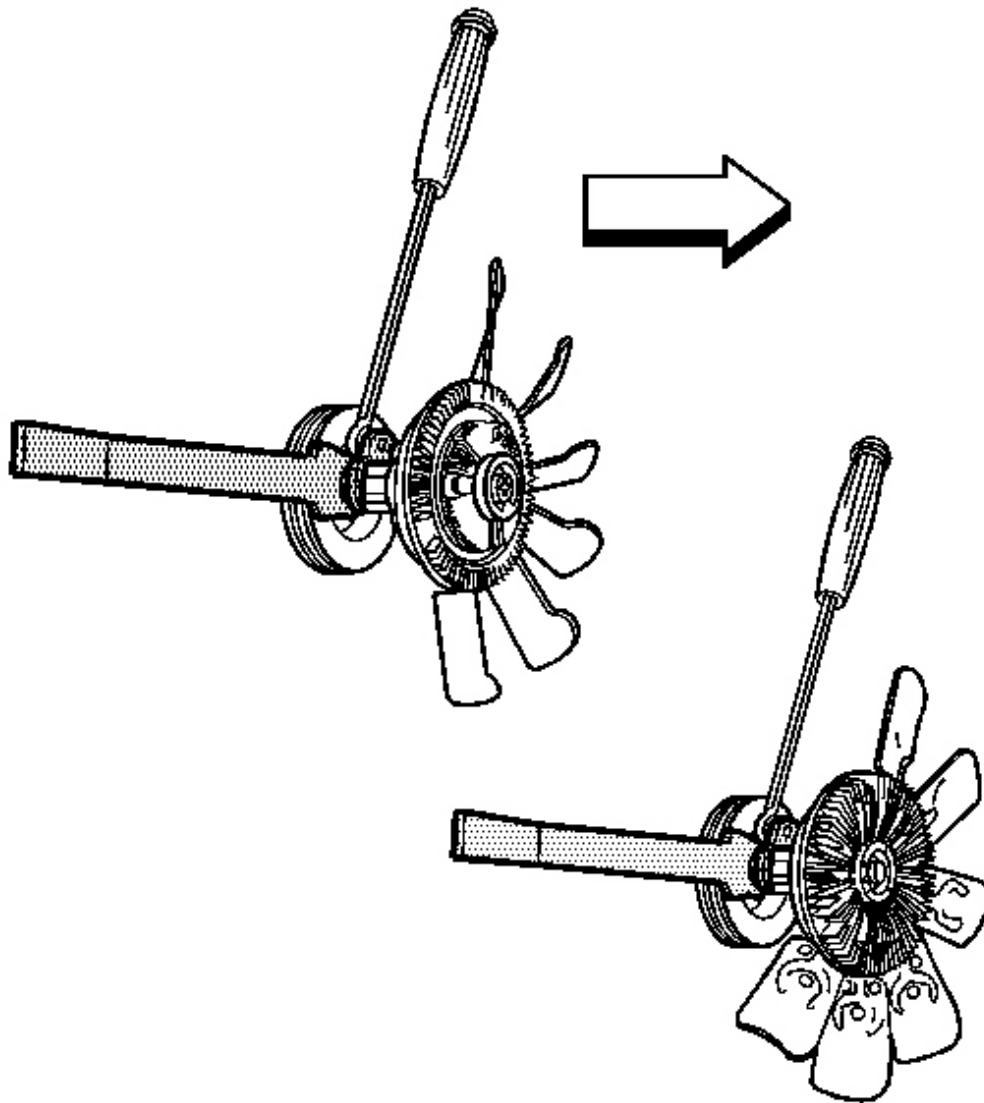


Fig. 24: Removing/Installing Fan Clutch
Courtesy of GENERAL MOTORS CORP.

2. Using **J 41240** and **J 46406** loosen the fan clutch. See **Special Tools**.

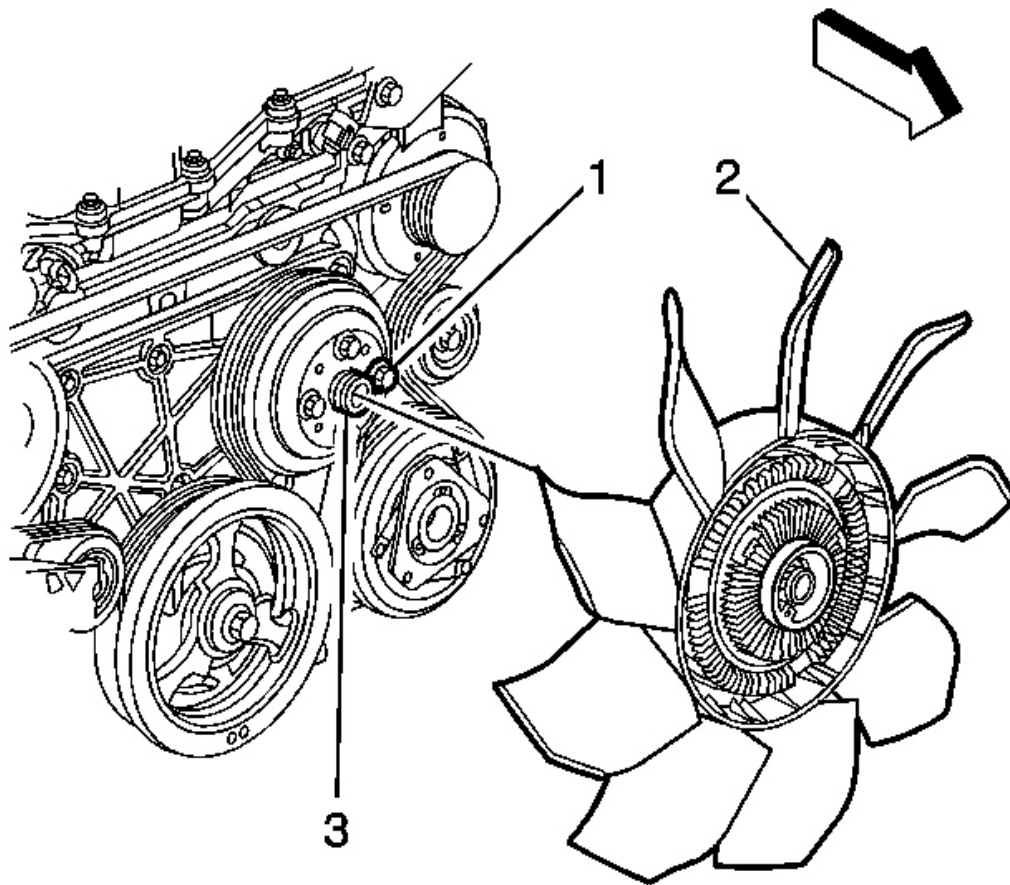


Fig. 25: View Of Fan
Courtesy of GENERAL MOTORS CORP.

3. Remove the fan hub nut in a counterclockwise rotation.
4. Remove the cooling fan (2) from the fan clutch. Refer to **Fan Clutch Replacement**.

Installation Procedure

1. Install the cooling fan to the fan clutch. Refer to **Fan Clutch Replacement**.

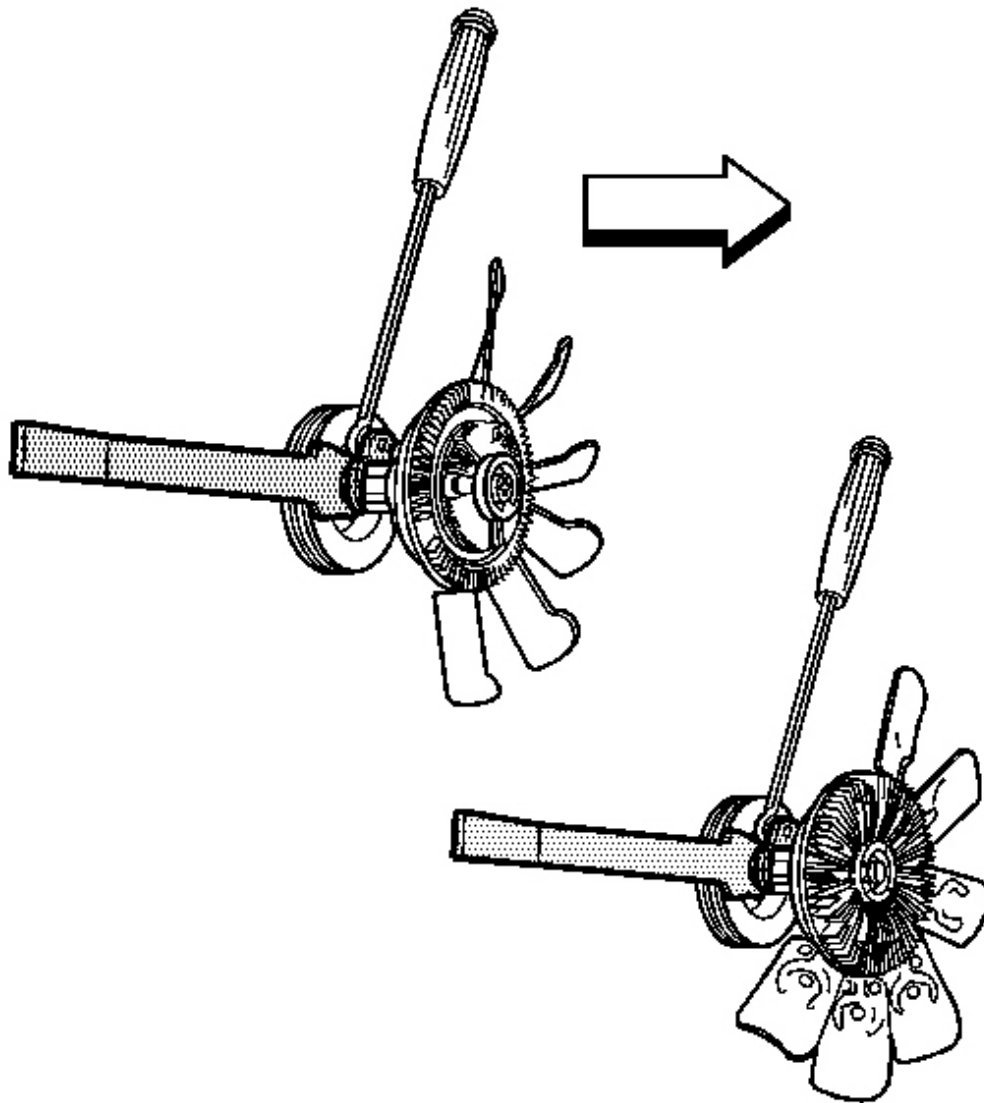


Fig. 26: Removing/Installing Fan Clutch
Courtesy of GENERAL MOTORS CORP.

CAUTION: Do not use or attempt to repair a damaged cooling fan assembly. Replace damaged fans with new assemblies. An unbalanced cooling fan could fly apart causing personal injury and property damage.

2. Install the **J 46406** and the **J 41240** to the fan clutch. See **Special Tools**.

NOTE: Refer to **Fastener Notice** .

3. Install the fan hub nut to the pulley and hand tighten in a clockwise rotation.

Tighten: Tighten the fan clutch nut clockwise to 56 N.m (41 lb ft).

4. Install the fan shroud. Refer to **Fan Shroud Replacement (LLR)**.

FAN CLUTCH REPLACEMENT

Removal Procedure

1. Remove the cooling fan. Refer to **Fan Replacement**.

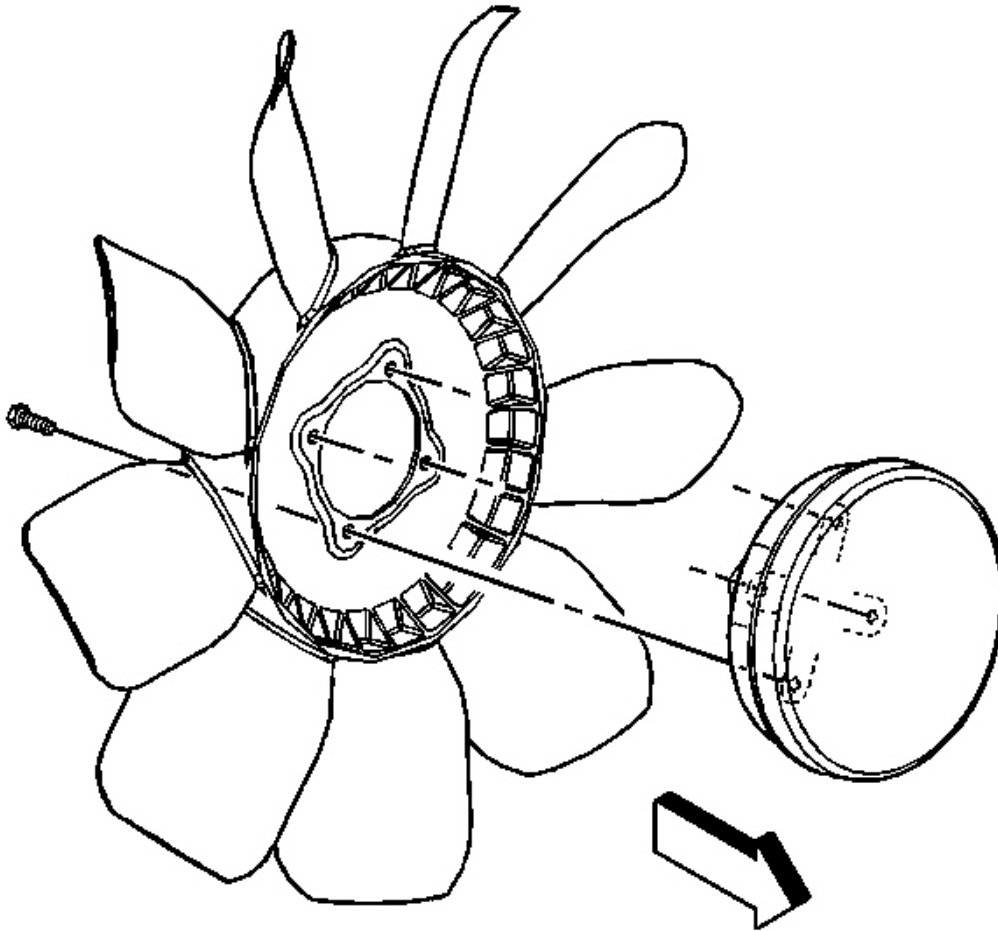


Fig. 27: View Of Fan Blade & Fan Clutch
Courtesy of GENERAL MOTORS CORP.

2. Remove the bolts retaining the fan blade to the fan clutch.
3. Separate the fan blade from the fan clutch.

Installation Procedure

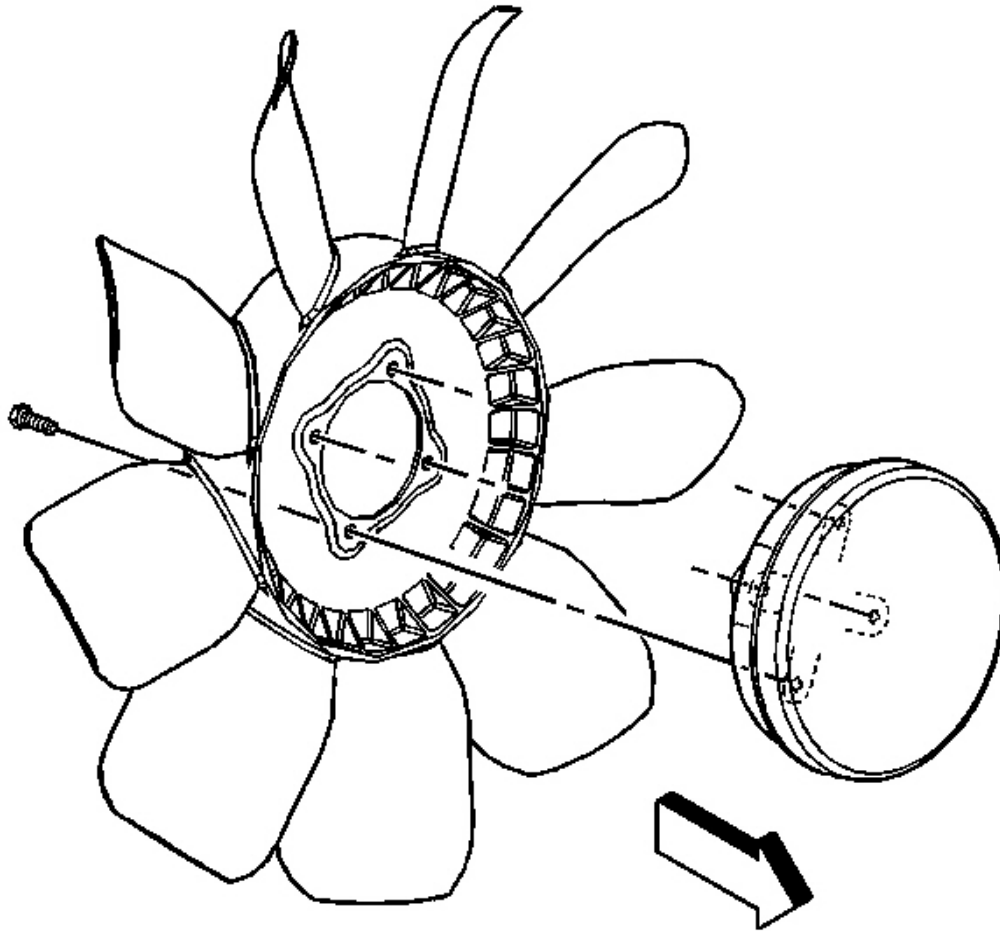


Fig. 28: View Of Fan Blade & Fan Clutch
Courtesy of GENERAL MOTORS CORP.

1. Assemble the fan to the fan clutch.

NOTE: Refer to **FASTENER NOTICE** .
Use the correct fastener in the correct location. Replacement fasteners must be the correct part number for that application. Fasteners requiring replacement or fasteners requiring the use of thread locking compound or sealant are identified in the service procedure. Do not use paints, lubricants or corrosion

inhibitors on fasteners or fastener joint surfaces unless specified. These coatings affect fastener torque and joint clamping force and may damage the fastener. Use the correct tightening sequence and specifications when installing fasteners in order to avoid damage to parts and systems.

2. Install the 4 bolts to the fan blade and tighten.

Tighten: Tighten the bolts to 27 N.m (20 lb ft).

3. Install the cooling fan. Refer to **Fan Replacement**.

ENGINE COOLANT THERMOSTAT REPLACEMENT (WITH LLR)

Tools Required

J 38185 Hose Clamp Pliers. See **Special Tools**.

Removal Procedure

1. Drain the cooling system. Refer to **Cooling System Draining and Filling (Static Fill)** or **Cooling System Draining and Filling (Vac-N-Fill)**.

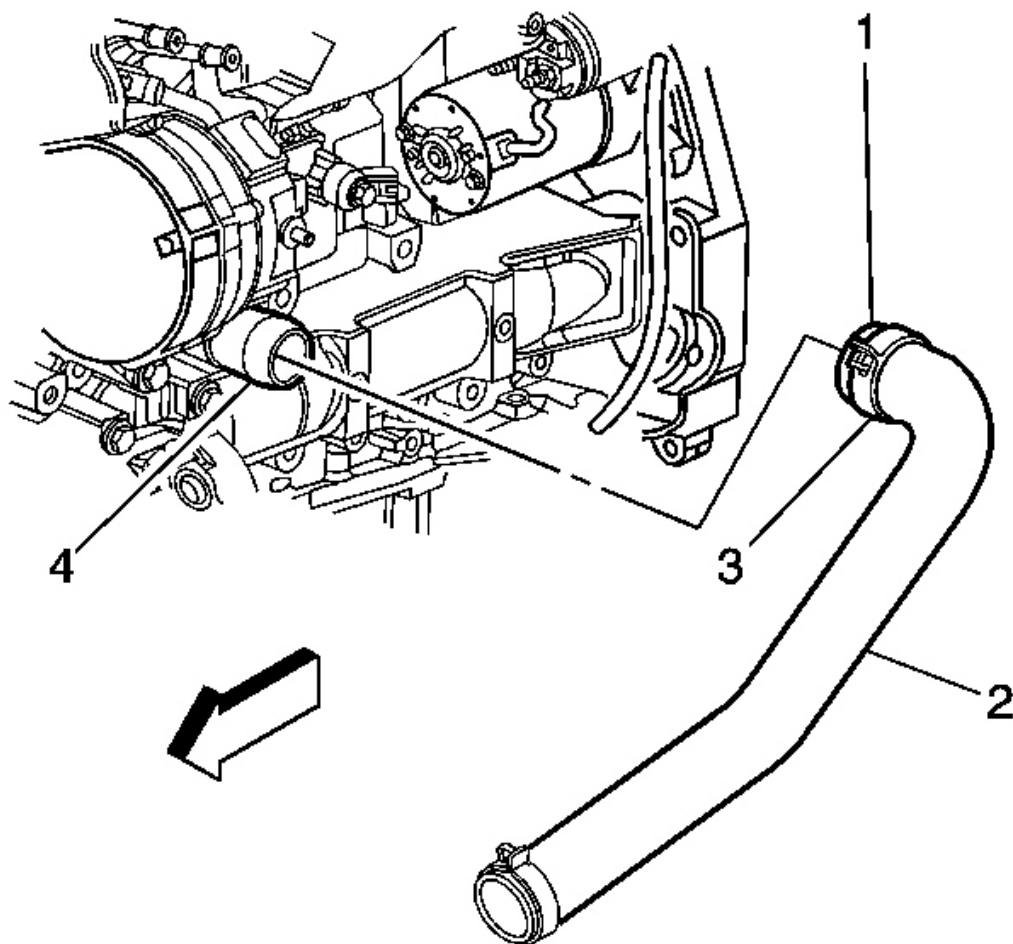


Fig. 29: View Of Radiator Inlet Hose & Thermostat Housing
Courtesy of GENERAL MOTORS CORP.

2. Raise and support the vehicle only high enough to access the thermostat housing (4) through the wheelhouse. Refer to **Lifting and Jacking the Vehicle** .
3. Remove the left wheelhouse liner. Refer to **Wheelhouse Panel Replacement (Front)** or **Wheelhouse Panel Replacement (Rear)** .
4. Position the **J 38185** to the clamp (3) in order to remove the radiator inlet hose (2) from the thermostat housing (4). See **Special Tools**.

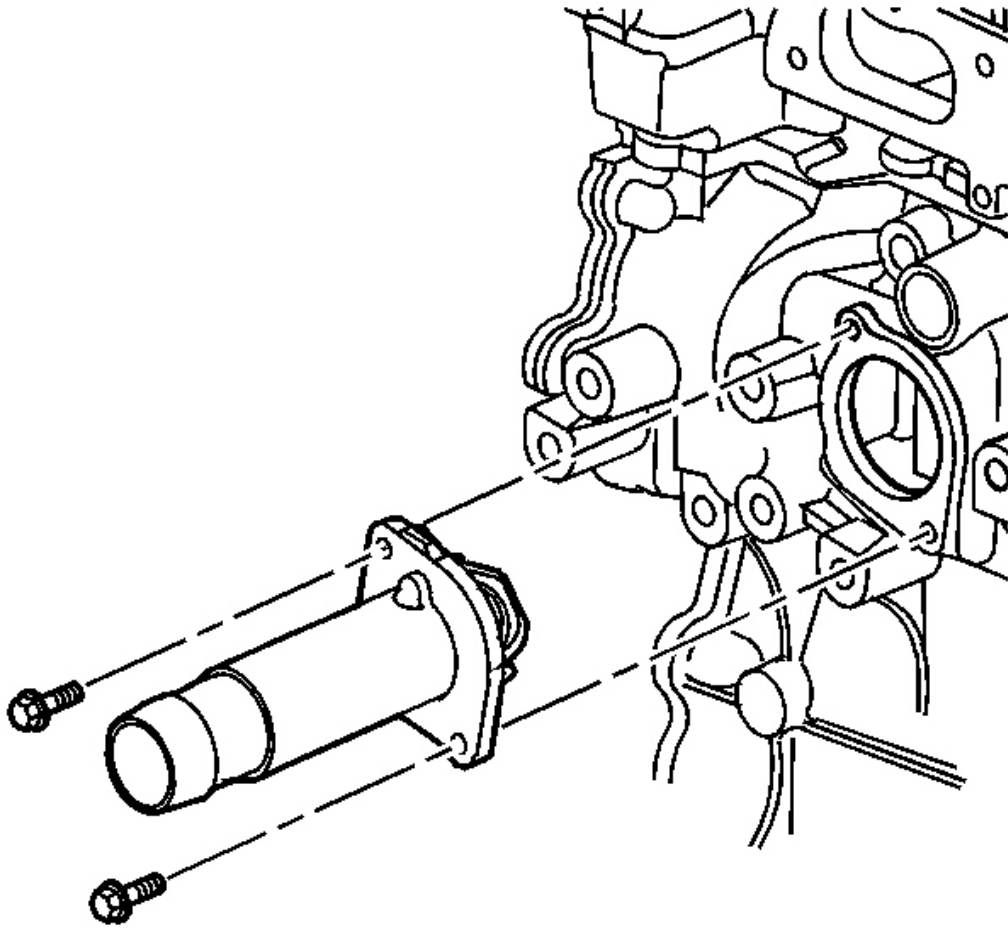


Fig. 30: View Of Thermostat Housing
Courtesy of GENERAL MOTORS CORP.

5. Remove the thermostat housing bolts.
6. Remove the thermostat housing from the engine block.
7. Clean and inspect the thermostat housing.
8. Clean and inspect the sealing surface of the engine block.

Installation Procedure

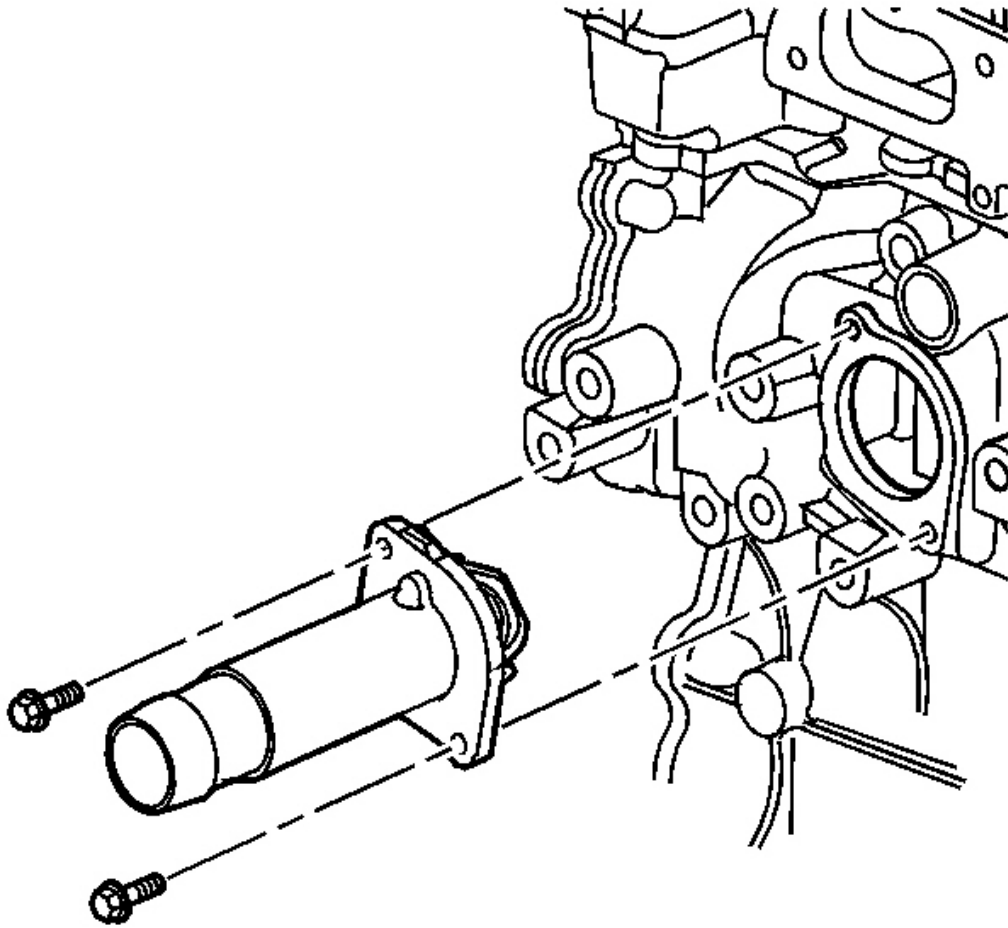


Fig. 31: View Of Thermostat Housing
Courtesy of GENERAL MOTORS CORP.

1. Position the thermostat housing to the engine block.

NOTE: Refer to Fastener Notice .

2. Install the thermostat housing bolts.

Tighten: Tighten the bolts to 10 N.m (89 lb in).

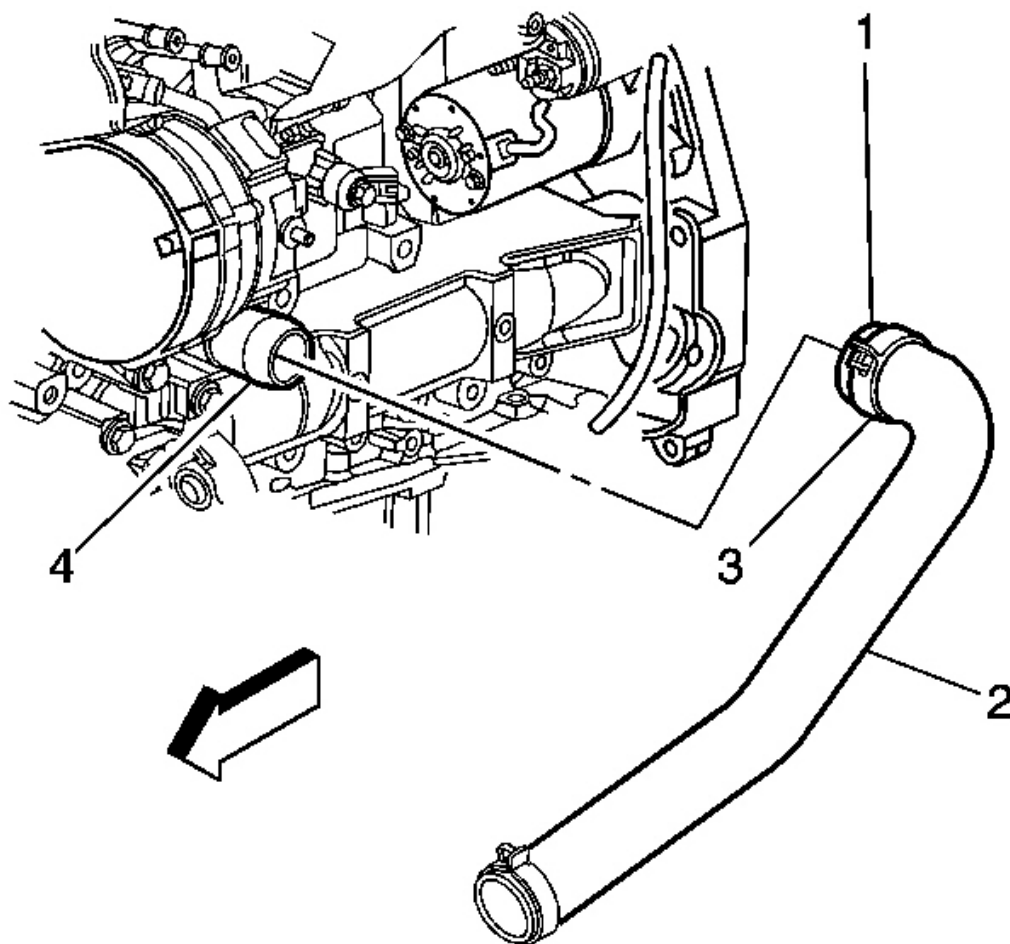


Fig. 32: View Of Radiator Inlet Hose & Thermostat Housing
Courtesy of GENERAL MOTORS CORP.

3. Position the **J 38185** to the clamp (3) in order to connect the radiator inlet hose (2) to the thermostat housing (4). See **Special Tools**.
4. Install the left wheelhouse liner. Refer to **Wheelhouse Panel Replacement (Front)** or **Wheelhouse Panel Replacement (Rear)**.
5. Lower the vehicle.
6. Fill the cooling system. Refer to **Cooling System Draining and Filling (Static Fill)** or **Cooling System Draining and Filling (Vac-N-Fill)**.
7. Inspect all sealing surfaces for leaks after starting the engine.

WATER OUTLET HOUSING REPLACEMENT (WITH LLR)**Tools Required**

J 38185 Hose Clamp Pliers. See **Special Tools**.

Removal Procedure

1. Drain the cooling system. Refer to **Cooling System Draining and Filling (Static Fill)** or **Cooling System Draining and Filling (Vac-N-Fill)**.

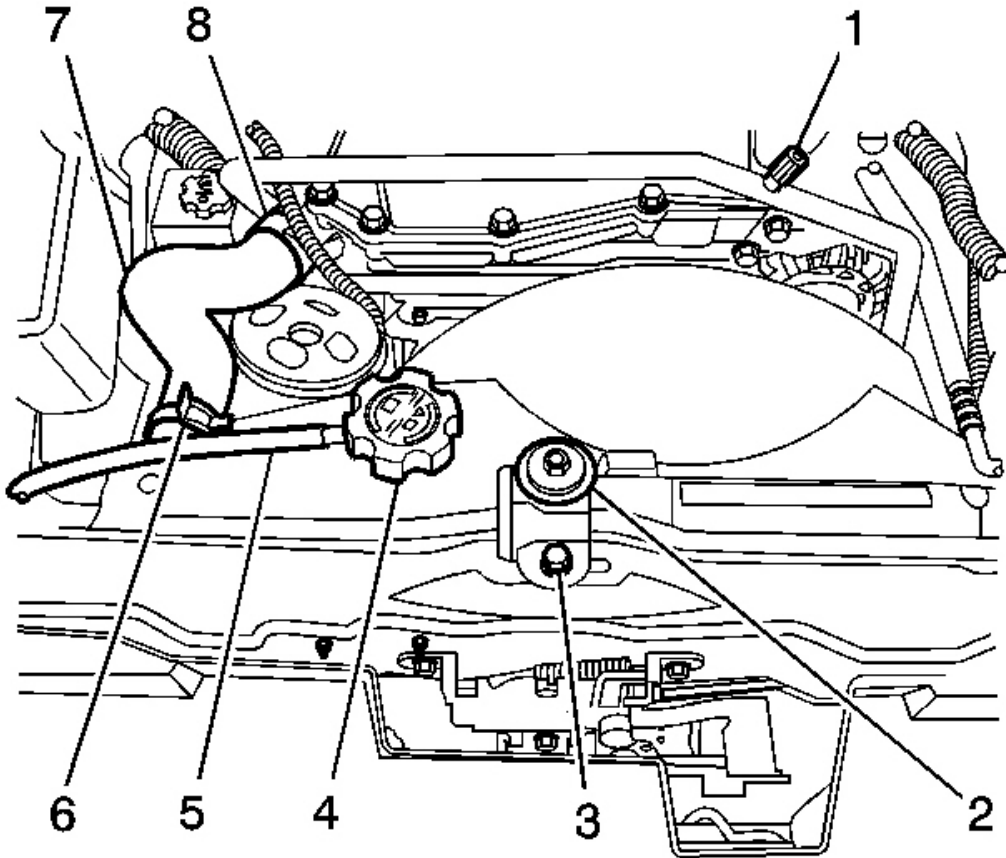


Fig. 33: Locating Radiator Outlet Hose To Water Outlet Housing Clamp
Courtesy of GENERAL MOTORS CORP.

2. Position the **J 38185** to the clamp (8) in order to remove the radiator outlet hose (7) from

the water outlet housing. See **Special Tools**.

3. Remove the power steering pump bracket. Refer to **Power Steering Pump Bracket Replacement** .

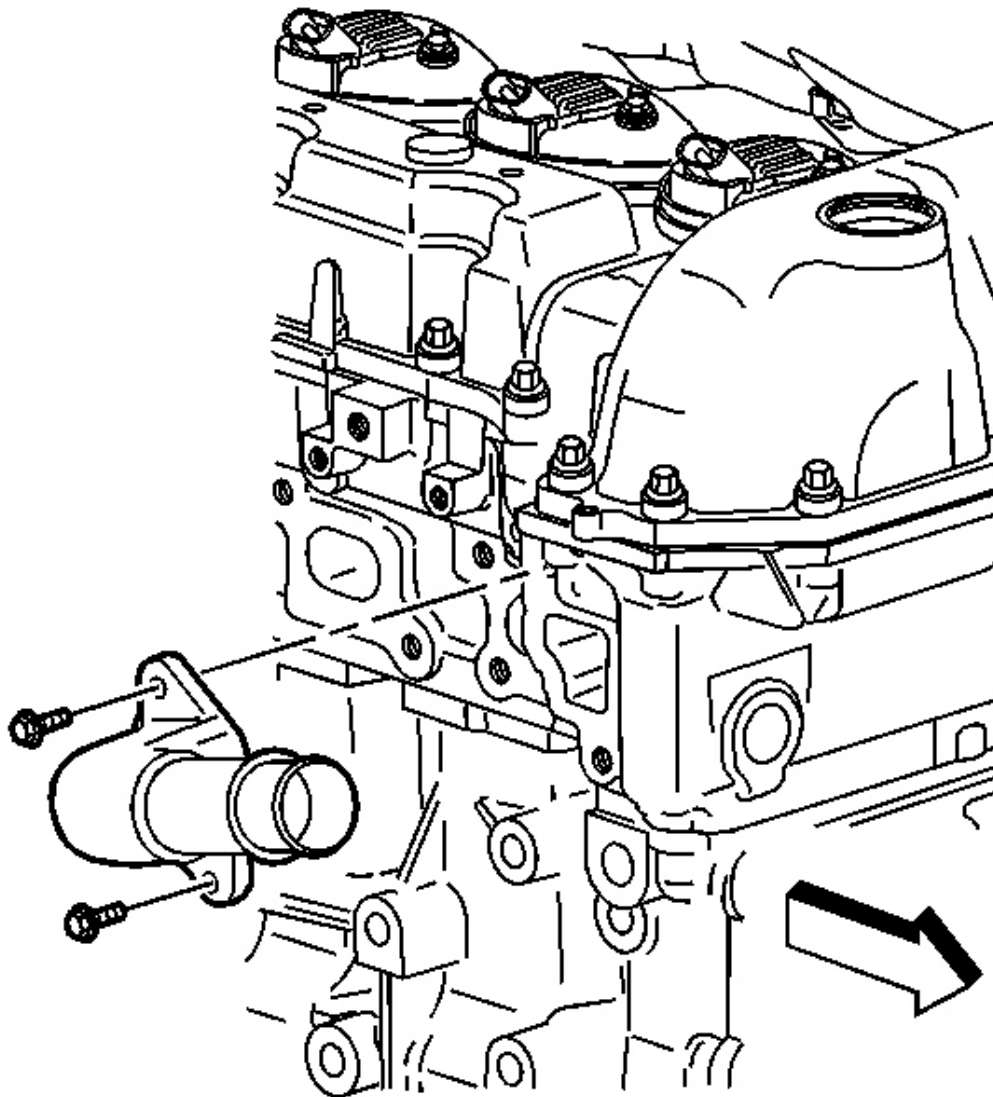


Fig. 34: View Of Water Outlet
Courtesy of GENERAL MOTORS CORP.

4. Remove the water outlet housing bolts.
5. Remove the water outlet housing from the cylinder head.
6. Clean and inspect the water outlet housing.
7. Clean and inspect the sealing surface of the cylinder head.

Installation Procedure

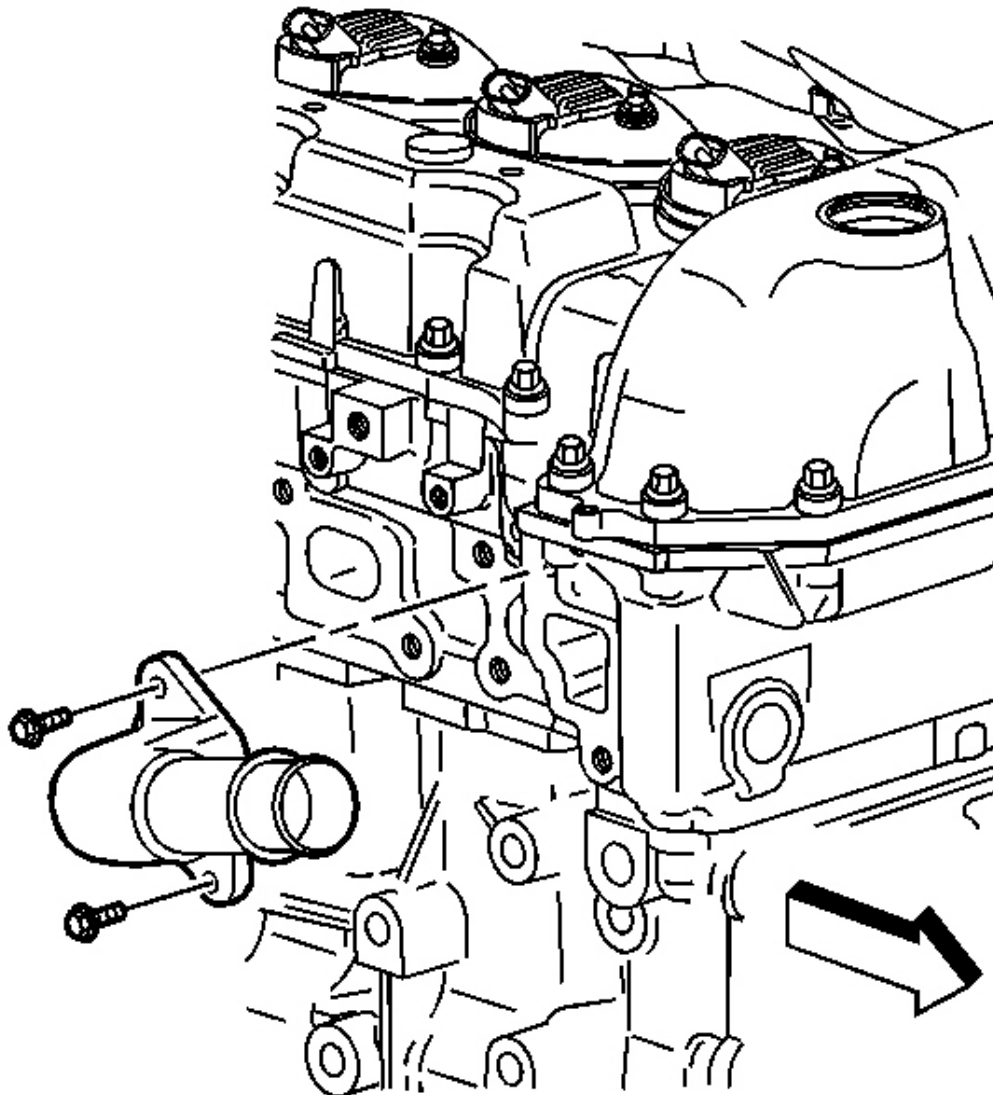


Fig. 35: View Of Water Outlet
Courtesy of GENERAL MOTORS CORP.

1. Position the water outlet housing to the cylinder head.

NOTE: Refer to Fastener Notice .

2. Install the water outlet housing bolts.

Tighten: Tighten the bolts to 10 N.m (89 lb in).

3. Install the power steering pump bracket. Refer to Power Steering Pump Bracket Replacement .

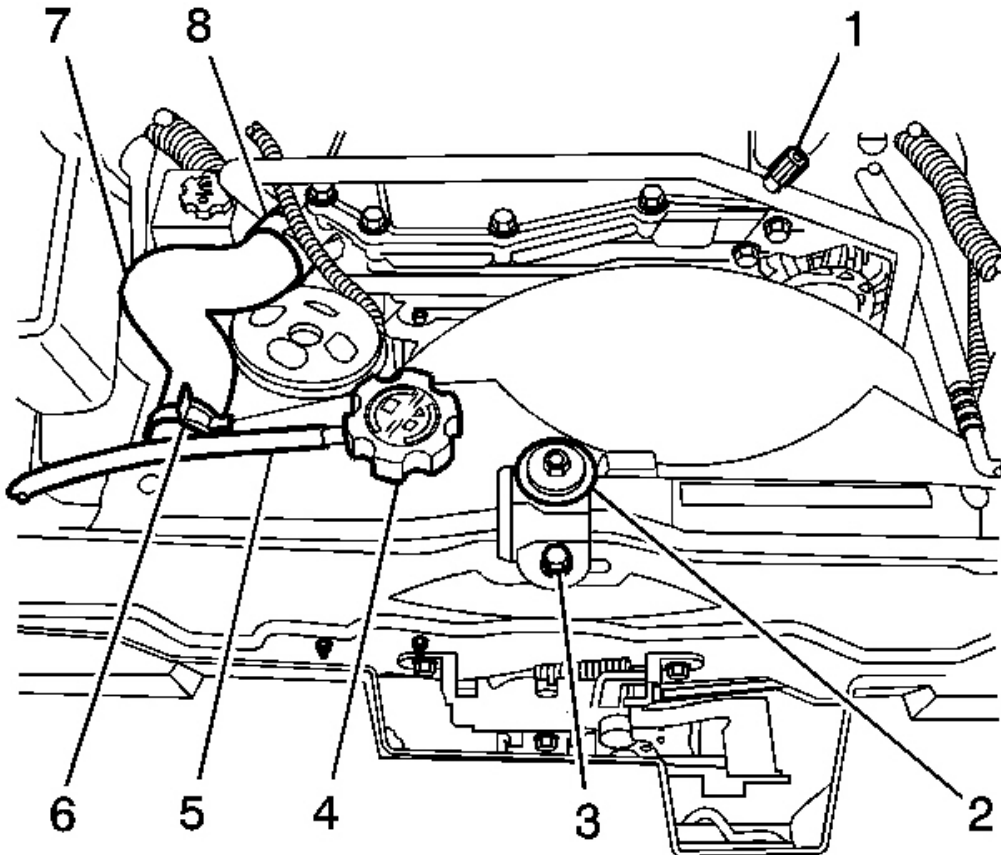


Fig. 36: Locating Radiator Outlet Hose To Water Outlet Housing Clamp
Courtesy of GENERAL MOTORS CORP.

4. Position the **J 38185** to the clamp (8) in order to connect the radiator outlet hose (7) to the water outlet housing. See **Special Tools**.
5. Fill the cooling system. Refer to **Cooling System Draining and Filling (Static Fill)** or **Cooling System Draining and Filling (Vac-N-Fill)**.
6. Inspect all sealing surfaces for leaks after starting the engine.

WATER PUMP REPLACEMENT (WITH LLR)

Tool Required

J 46406 Fan Clutch Remover and Installer. See **Special Tools**.

Removal Procedure

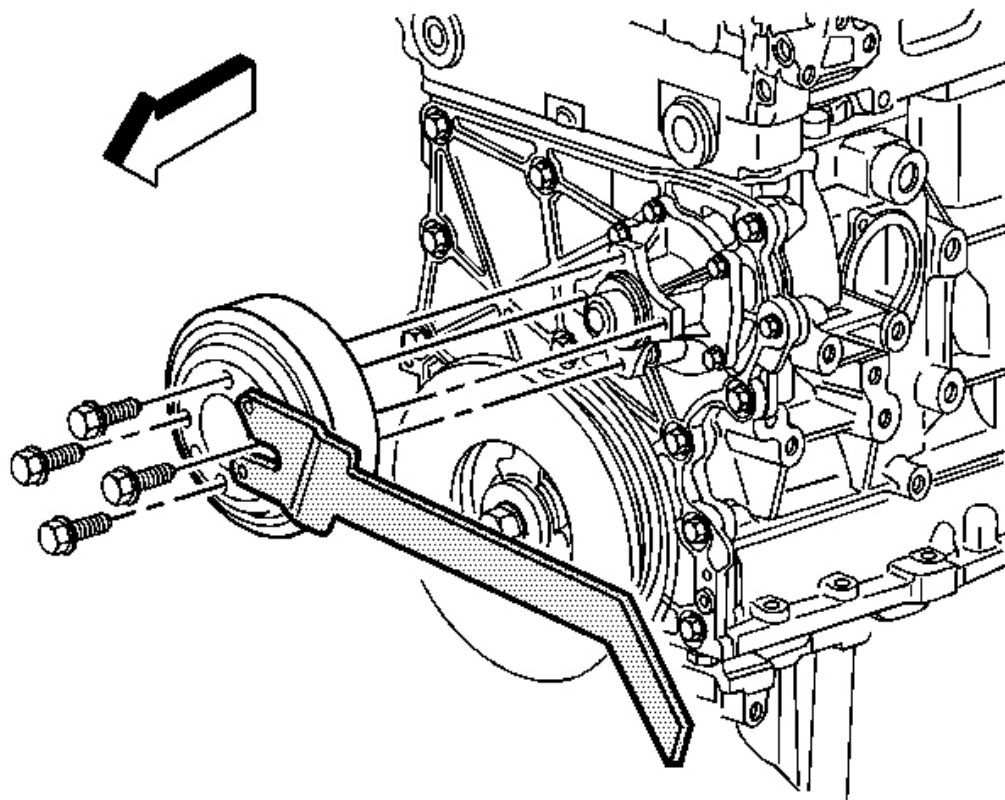


Fig. 37: View Of Water Pump Pulley & Bolts
Courtesy of GENERAL MOTORS CORP.

1. Drain the coolant. Refer to **Cooling System Draining and Filling (Static Fill)** or **Cooling System Draining and Filling (Vac-N-Fill)**.
2. Remove the fan. Refer to **Fan Replacement**.
3. Remove the drive belt. Refer to **Drive Belt Replacement (Without A/C)** or **Drive Belt Replacement (With A/C)** .
4. Using the **J 46406** , secure the water pump pulley and remove the water pump pulley bolts. See **Special Tools**.
5. Remove the **J 46406** .
6. Remove the water pump pulley.

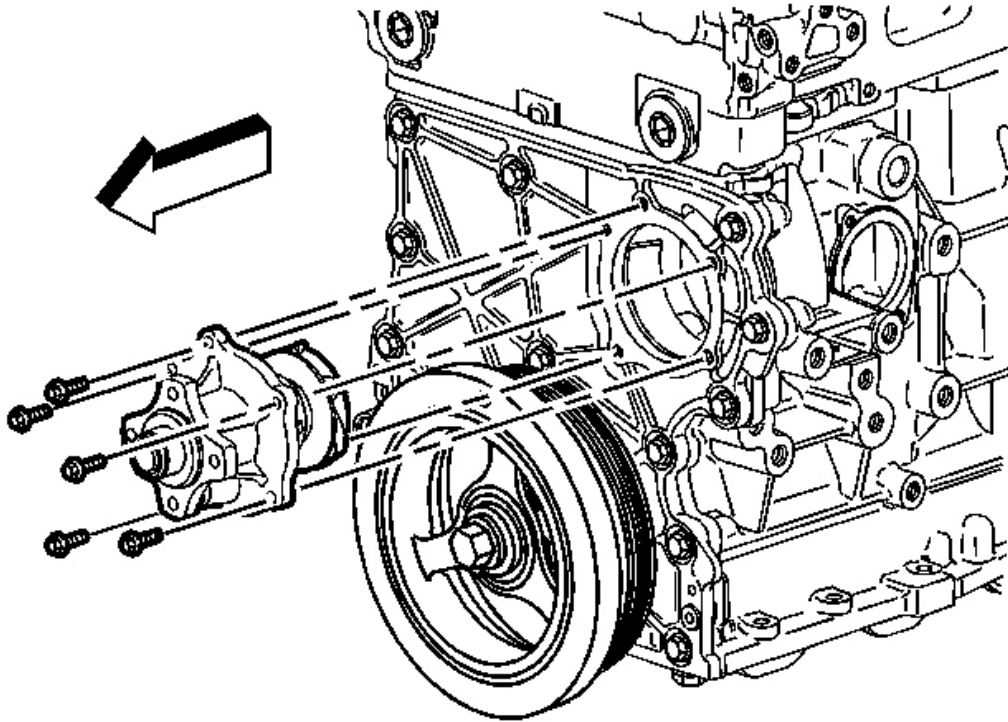


Fig. 38: View Of Water Pump, Gasket & Bolts
Courtesy of GENERAL MOTORS CORP.

7. Remove the water pump bolts.
8. Remove the water pump.
9. Clean and inspect the water pump. Refer to **Water Pump Cleaning and Inspection** .
10. Discard the gasket.

Installation Procedure

1. Install a new water pump gasket.

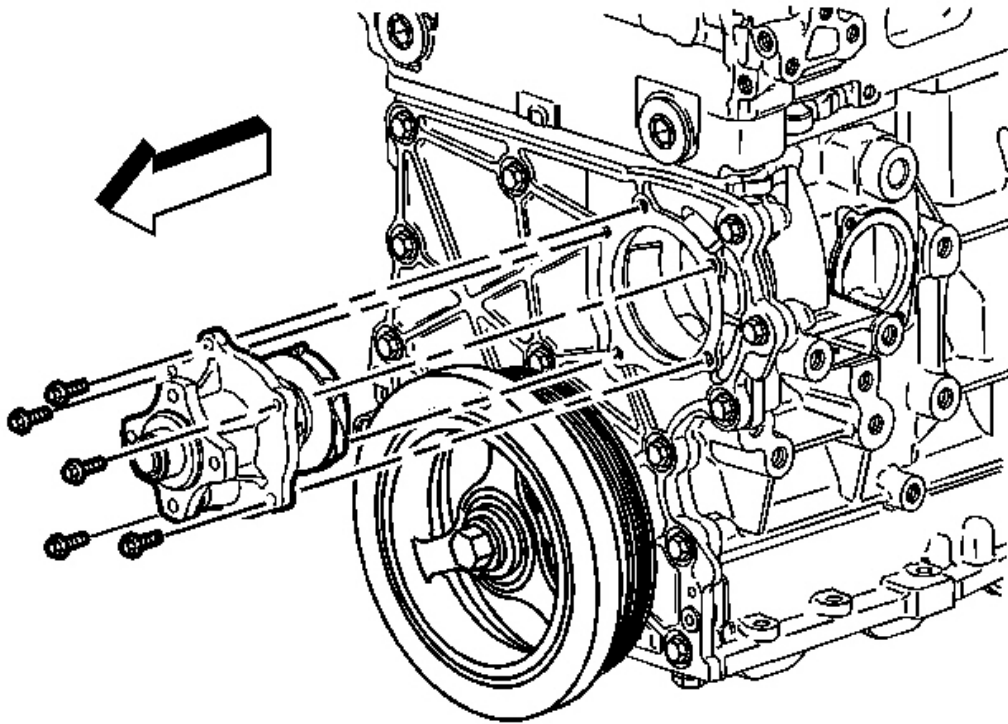


Fig. 39: View Of Water Pump, Gasket & Bolts
Courtesy of GENERAL MOTORS CORP.

2. Position the water pump to the engine.

NOTE: Refer to Fastener Notice .

3. Install the water pump bolts.

Tighten: Tighten the bolts to 10 N.m (89 lb in).

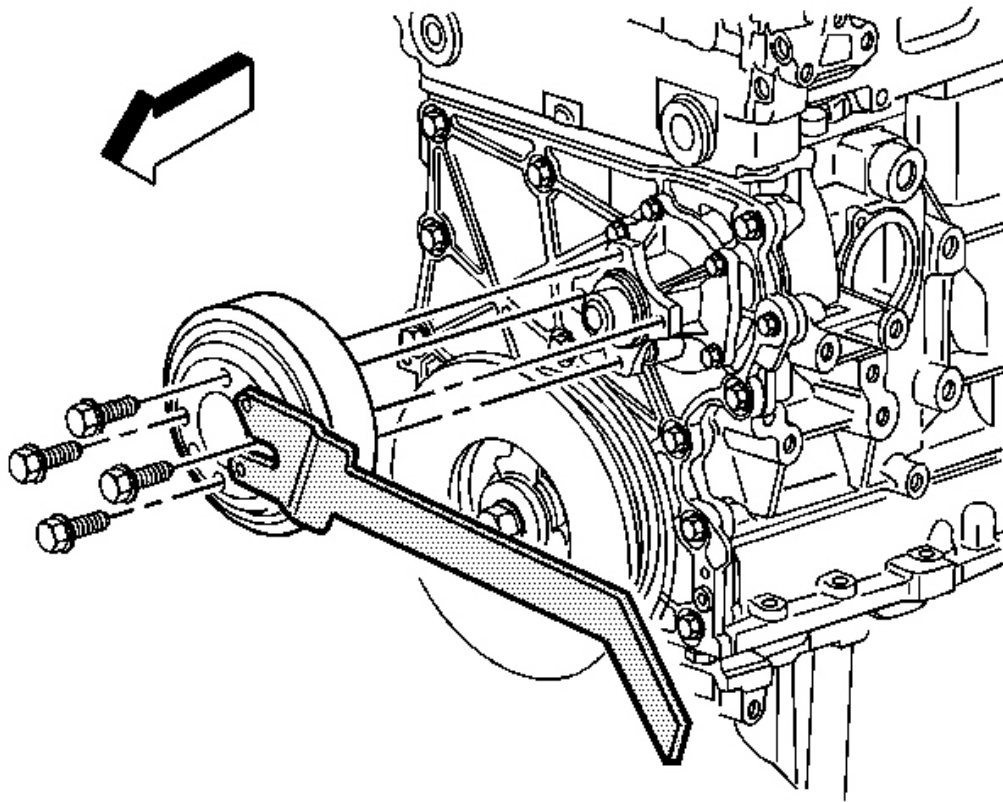


Fig. 40: View Of Water Pump Pulley & Bolts
Courtesy of GENERAL MOTORS CORP.

4. Install the water pump pulley.
5. Install the water pump pulley bolts.
6. Using the **J 46406** , secure the water pump pulley while tightening the water pump pulley bolts. See **Special Tools**.

Tighten: Tighten the bolts to 25 N.m (18 lb ft).

7. Remove the **J 41240** .
8. Install the drive belt. Refer to **Drive Belt Replacement (Without A/C)** or **Drive Belt Replacement (With A/C)** .
9. Install the fan. Refer to **Fan Replacement**.

10. Fill the cooling system with the specified coolant and concentration. Refer to Cooling System Draining and Filling (Static Fill) or Cooling System Draining and Filling (Vac-N-Fill).
11. Inspect for leaks.

FAN SHROUD REPLACEMENT (LLR)

Removal Procedure

1. Remove the radiator hose-inlet. Refer to Radiator Inlet Hose Replacement (LLR).

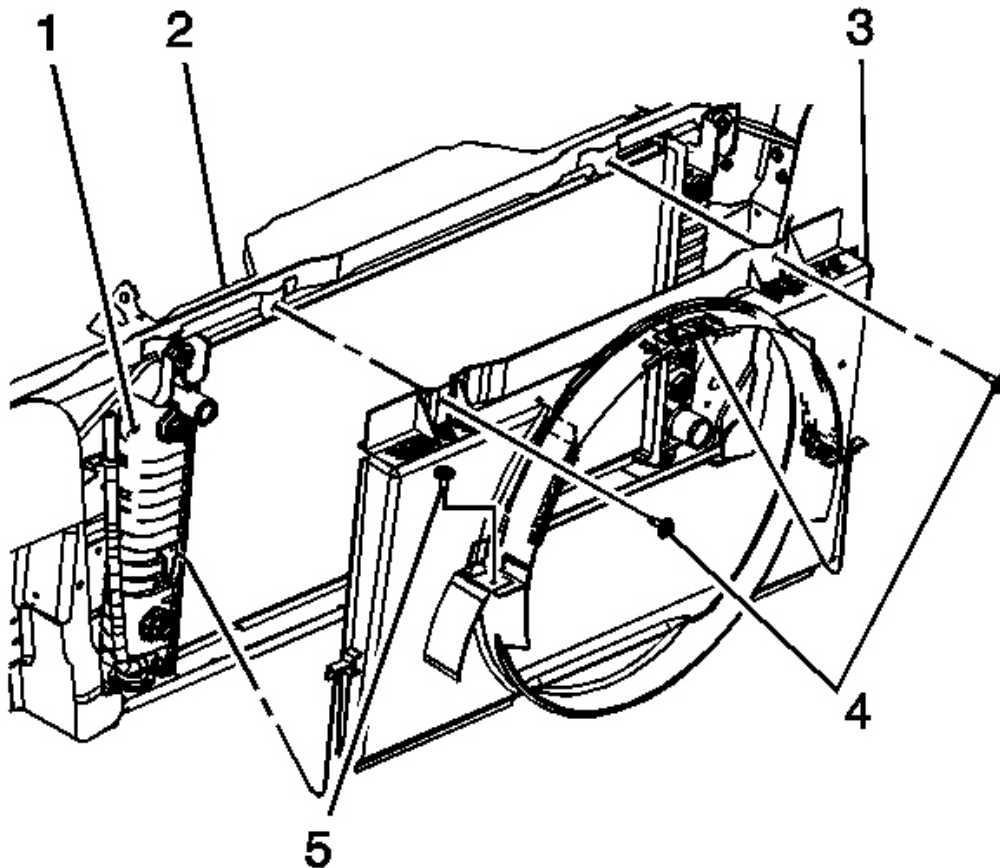


Fig. 41: Identifying Fan Shroud
Courtesy of GENERAL MOTORS CORP.

2. Remove the transmission oil cooler lines from the fan shroud retainer.
3. Rotate the slip ring from under the fan shroud.
4. Disconnect the cam sensor electrical connector.
5. Remove the fan shroud (3).

Installation Procedure

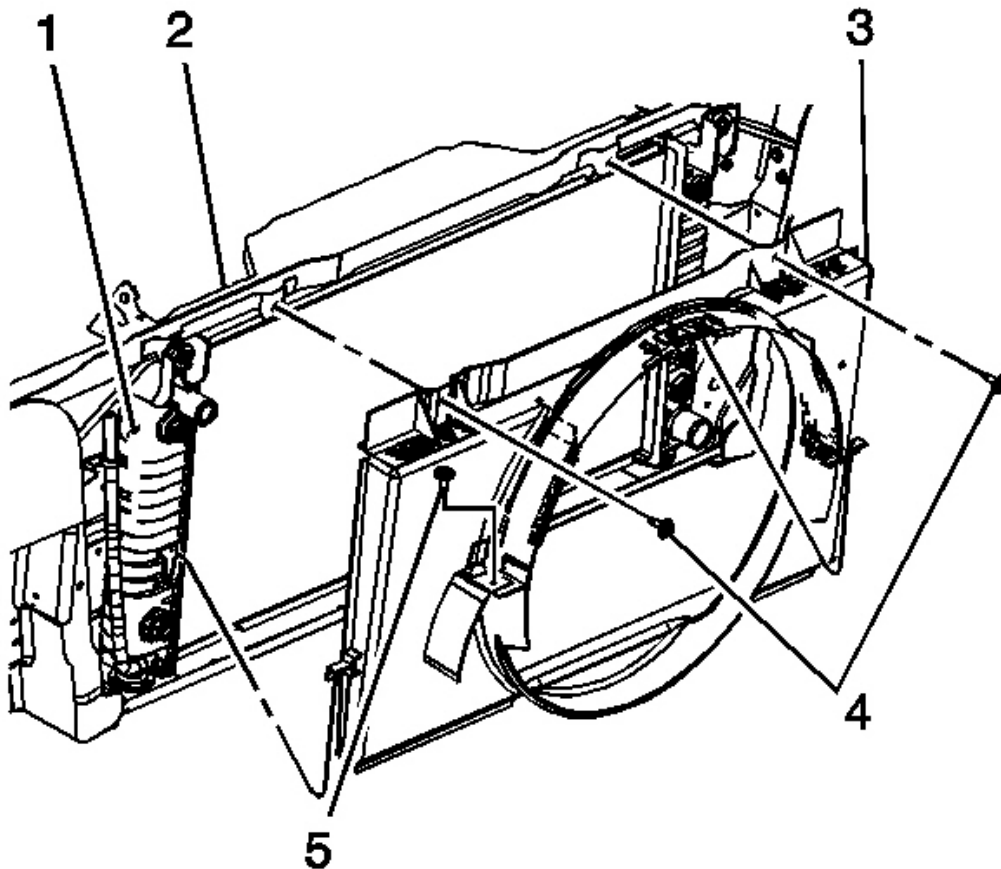


Fig. 42: Identifying Fan Shroud
Courtesy of GENERAL MOTORS CORP.

1. Install the fan shroud (3) to the vehicle.
2. Install the transmission oil cooler lines to the fan shroud retainer.

3. Rotate the slip ring to the original position.
4. Connect the cam sensor electrical connector.
5. Install the radiator hose-inlet. Refer to **Radiator Inlet Hose Replacement (LLR)**.

RADIATOR REPLACEMENT

Tools Required

J 38185 Hose Clamp Pliers. See **Special Tools**.

Removal Procedure

1. Drain the coolant from the radiator. Refer to **Cooling System Draining and Filling (Static Fill)** or **Cooling System Draining and Filling (Vac-N-Fill)**.
2. Recover the refrigerant. Refer to **REFRIGERANT RECOVERY AND RECHARGING** .
3. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
4. Remove the oil pan skid plate.
5. Install the engine shield. Refer to **Engine Shield Replacement** .

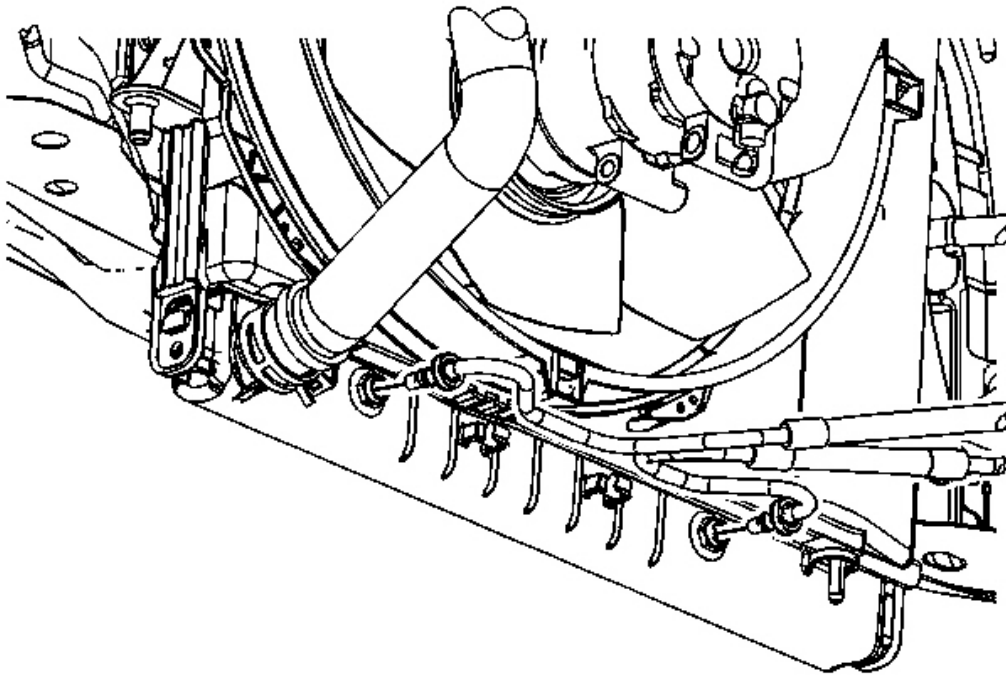


Fig. 43: View Of Transmission Cooler Lines At Radiator
Courtesy of GENERAL MOTORS CORP.

6. Remove the transmission cooler lines from the radiator. Refer to **Transmission Fluid Cooler Hose/Pipe Quick-Connect Fitting Disconnection and Connection** for the 4L60-E/4L65-E transmission, if equipped.
7. Using **J 38185** reposition the radiator outlet hose clamp from the radiator. See **Special Tools**.

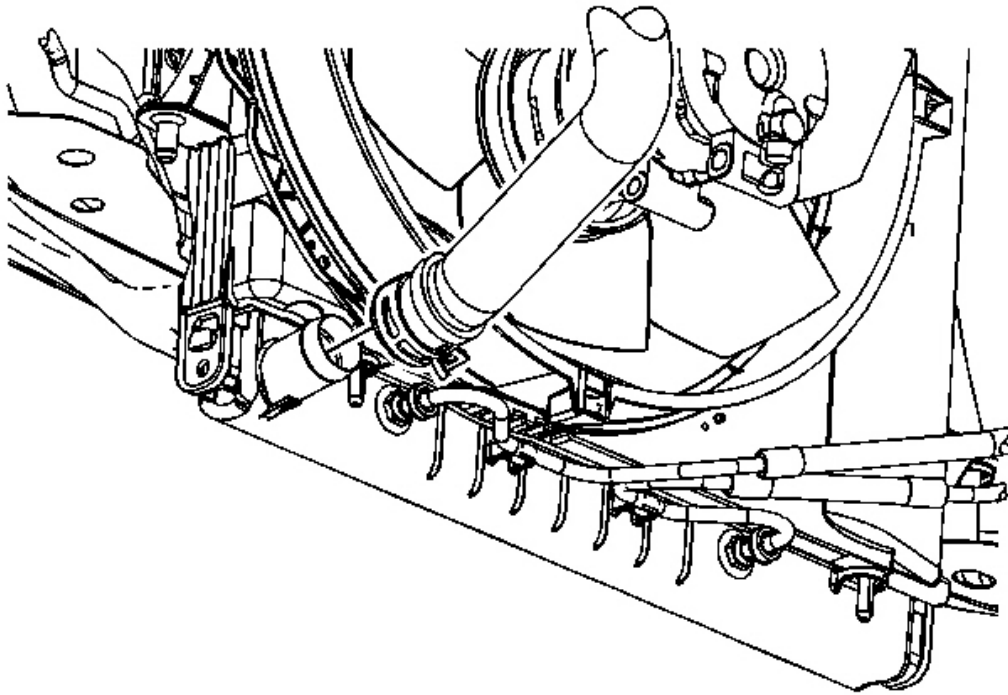


Fig. 44: Identifying Radiator Outlet Hose
Courtesy of GENERAL MOTORS CORP.

8. Remove the radiator outlet hose from the radiator.
9. Lower the vehicle.
10. Remove the cooling fan. Refer to **Fan Replacement**.

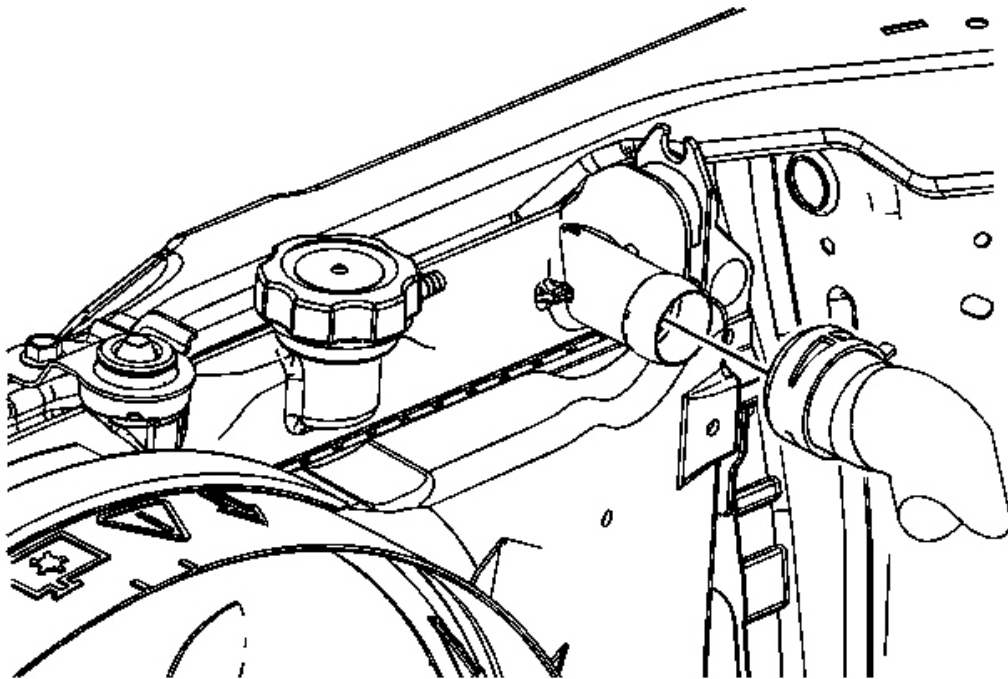


Fig. 45: Identifying Radiator Inlet Hose
Courtesy of GENERAL MOTORS CORP.

11. Using **J 38185** reposition the radiator inlet hose clamp. See **Special Tools**.
12. Remove the radiator inlet hose from the radiator.
13. Remove the radiator vent inlet hose from the radiator.

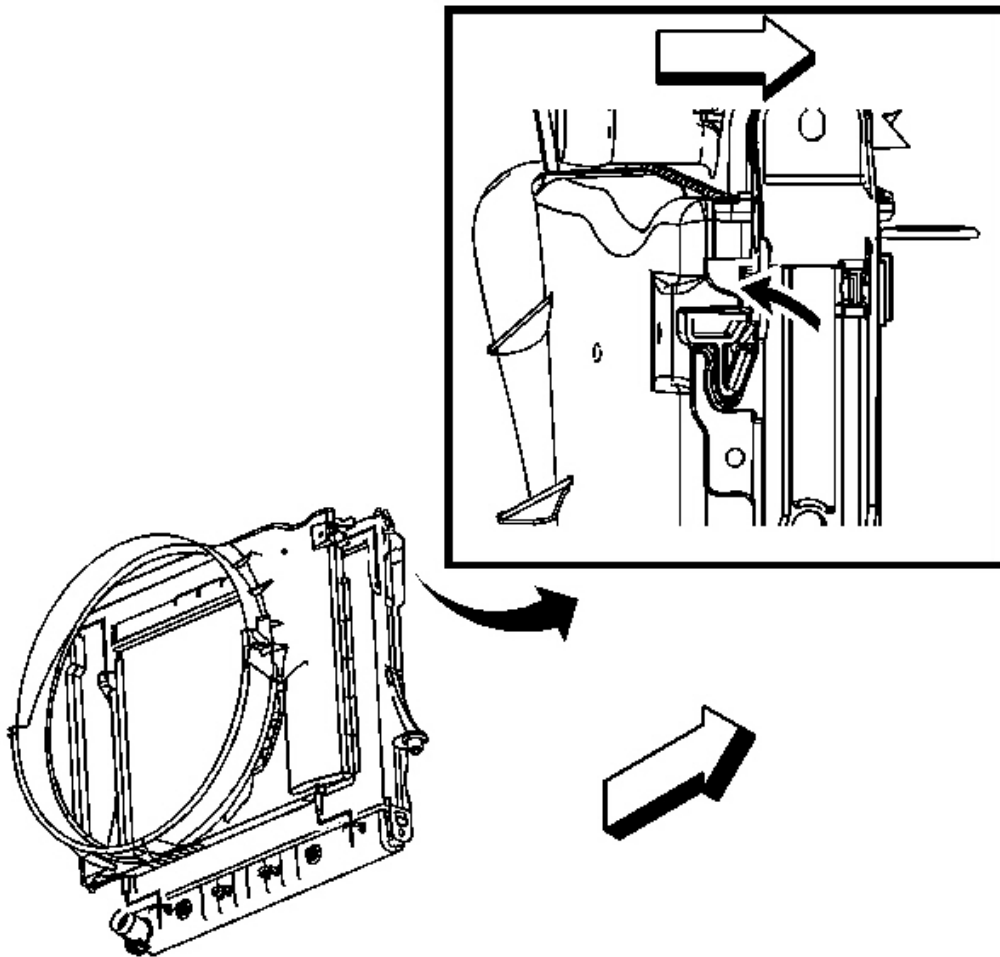


Fig. 46: View If Fan Shroud & Radiator
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Push retainers back to release the fan shroud from the radiator.

14. Remove the fan shroud from the radiator.
15. Remove the discharge hose. Refer to **DISCHARGE HOSE REPLACEMENT** .
16. Remove the evaporator tube. Refer to **EVAPORATOR TUBE REPLACEMENT (LEFT HAND DRIVE)** or **EVAPORATOR TUBE REPLACEMENT (RIGHT HAND DRIVE)** .

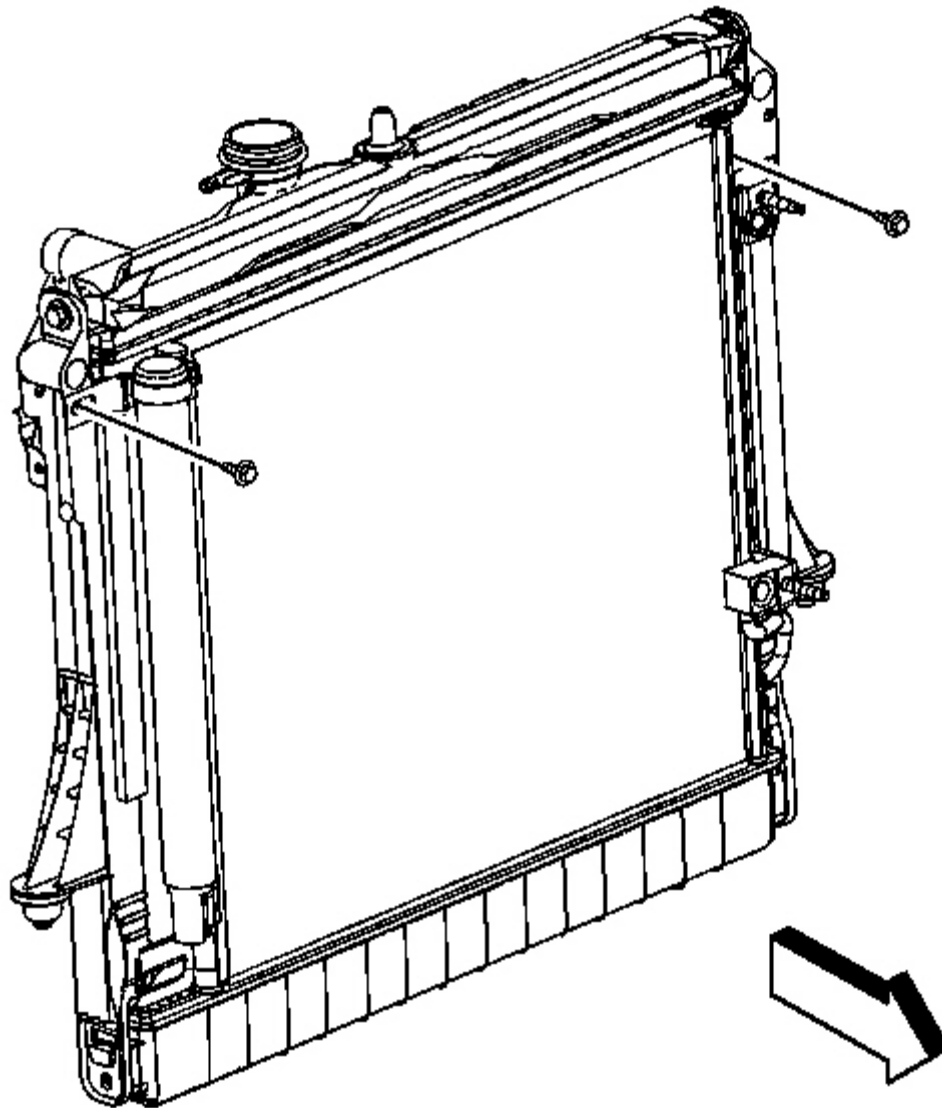


Fig. 47: Identifying Condenser-To-Radiator Retaining Bolts
Courtesy of GENERAL MOTORS CORP.

17. Remove the condenser to radiator retaining bolts.

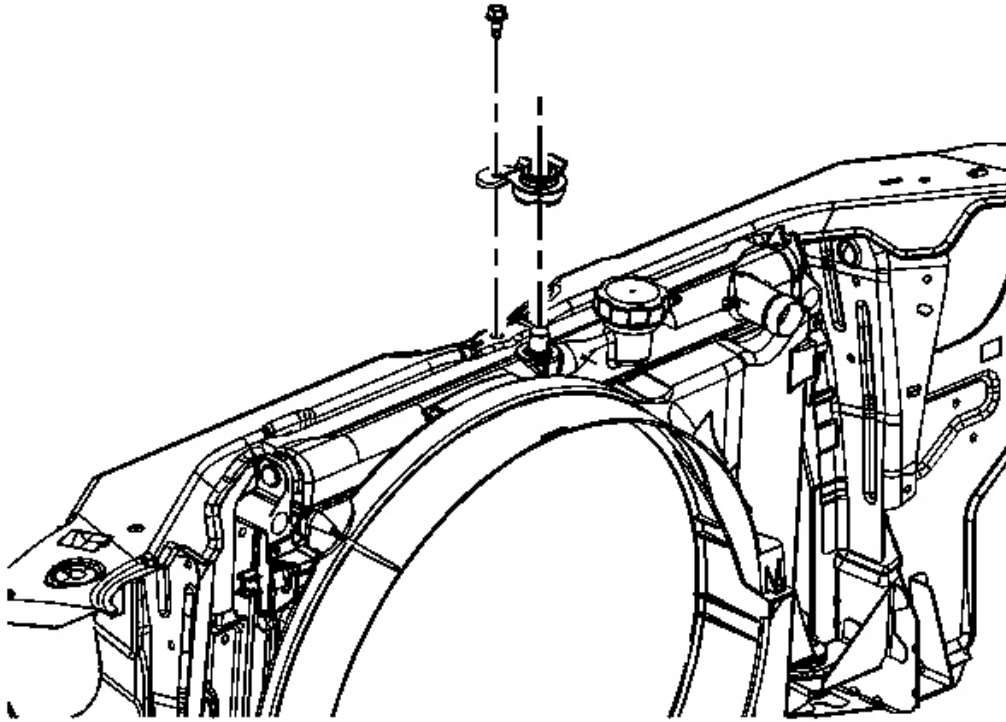


Fig. 48: Identifying Radiator Support Bracket Retaining Bolt
Courtesy of GENERAL MOTORS CORP.

18. Remove the radiator support bracket retaining bolt.
19. Remove the radiator support bracket.

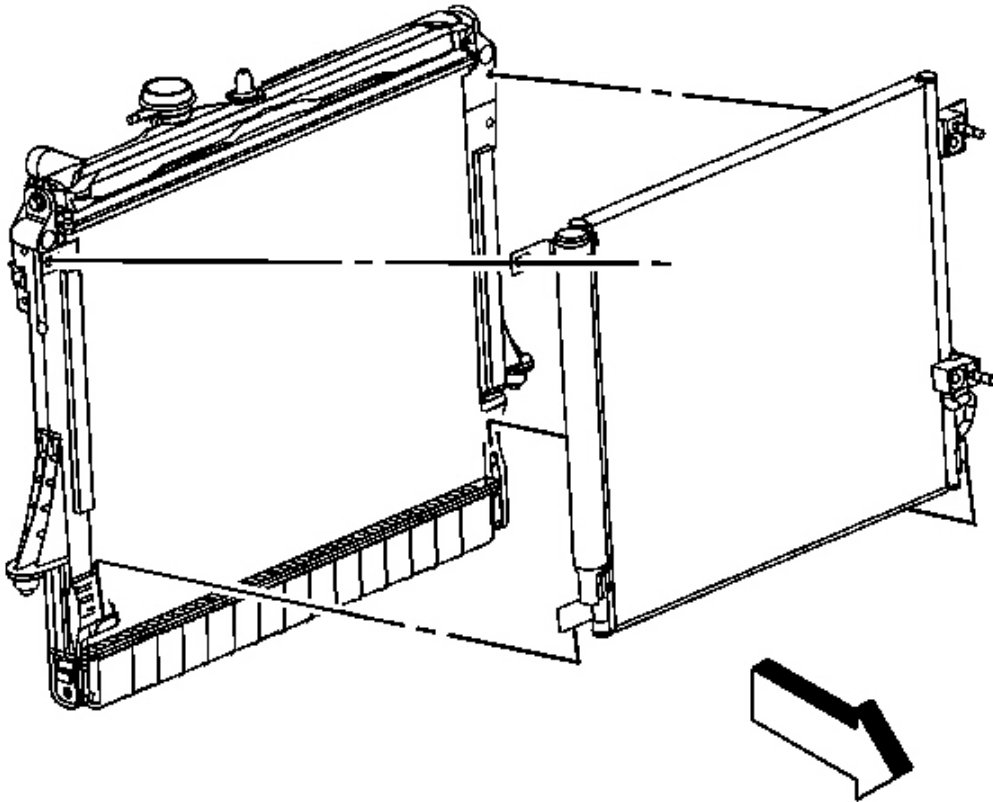


Fig. 49: View Of Condenser & Radiator
Courtesy of GENERAL MOTORS CORP.

20. Reposition the condenser from the radiator.
21. Remove the radiator from the vehicle.

Installation Procedure

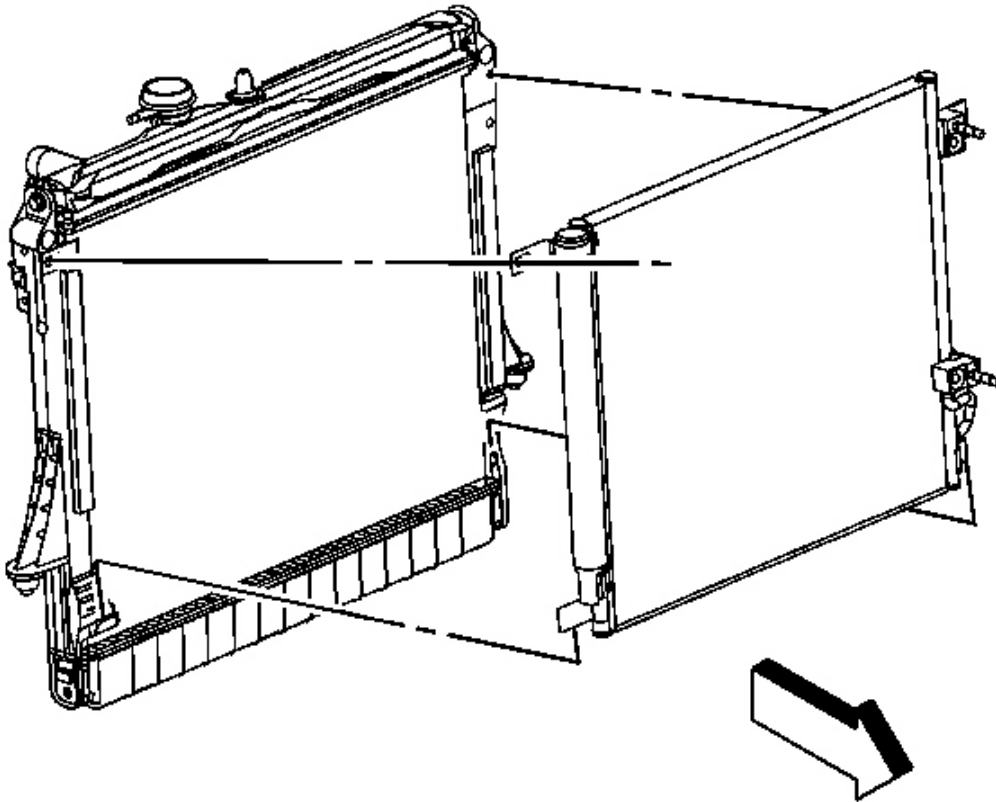


Fig. 50: View Of Condenser & Radiator
Courtesy of GENERAL MOTORS CORP.

1. Install the radiator assembly to the vehicle.
2. Reposition the condenser to the radiator.
3. Install the cooling fan. Refer to **Fan Replacement**.

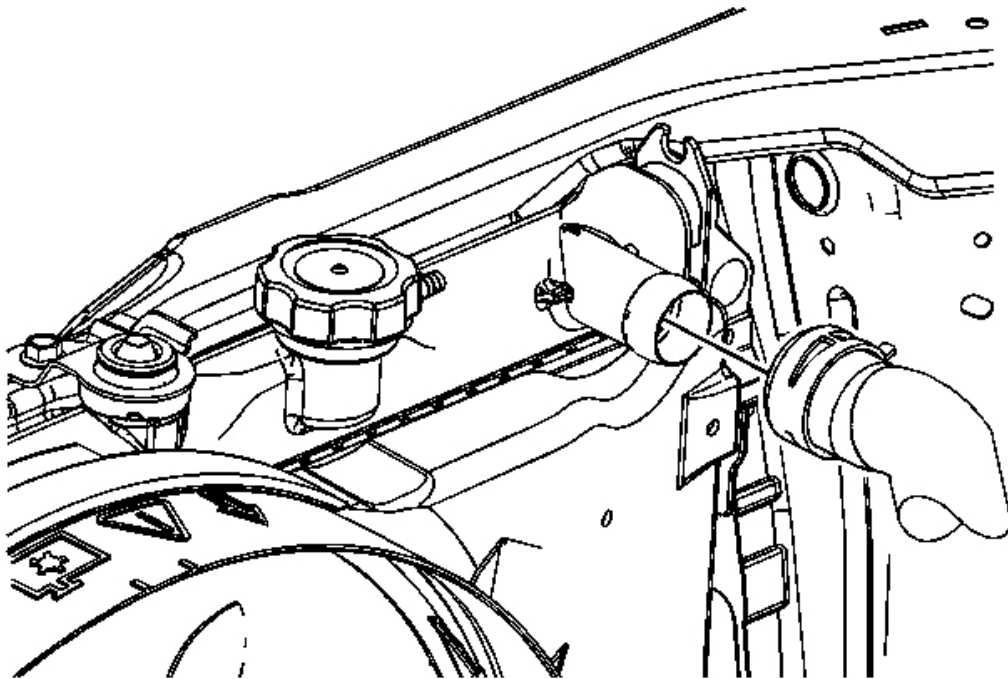


Fig. 51: Identifying Radiator Inlet Hose
Courtesy of GENERAL MOTORS CORP.

4. Install the radiator inlet hose to the radiator.
5. Using **J 38185** reposition the radiator inlet hose clamp. See **Special Tools**.

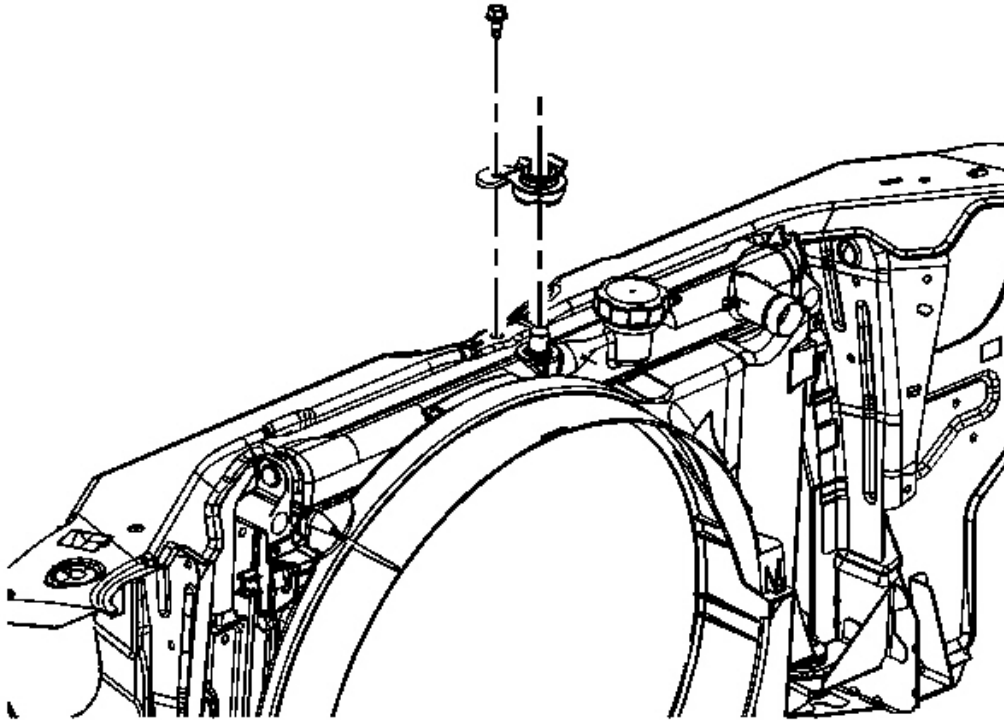


Fig. 52: Identifying Radiator Support Bracket Retaining Bolt
Courtesy of GENERAL MOTORS CORP.

6. Install the radiator support bracket.

NOTE: Refer to Fastener Notice .

7. Install the radiator support bracket retaining bolt.

Tighten: Tighten the bolt to 25 N.m (18 lb ft).

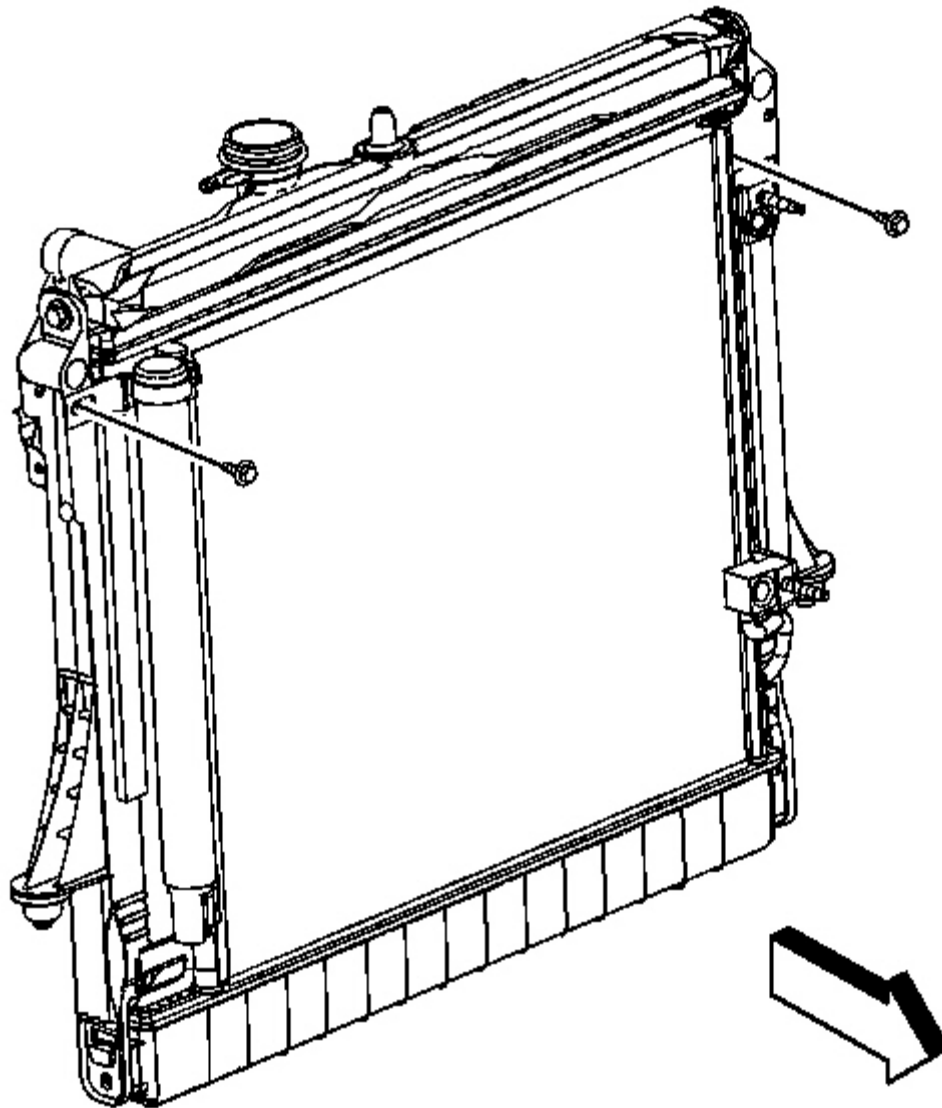


Fig. 53: Identifying Condenser-To-Radiator Retaining Bolts
Courtesy of GENERAL MOTORS CORP.

8. Install the condenser to radiator retaining bolts.

Tighten: Tighten the bolts to 28 N.m (21 lb ft).

9. Install the discharge hose. Refer to **DISCHARGE HOSE REPLACEMENT** .
10. Install the evaporator tube. Refer to **EVAPORATOR TUBE REPLACEMENT (LEFT HAND DRIVE)** or **EVAPORATOR TUBE REPLACEMENT (RIGHT HAND DRIVE)** .

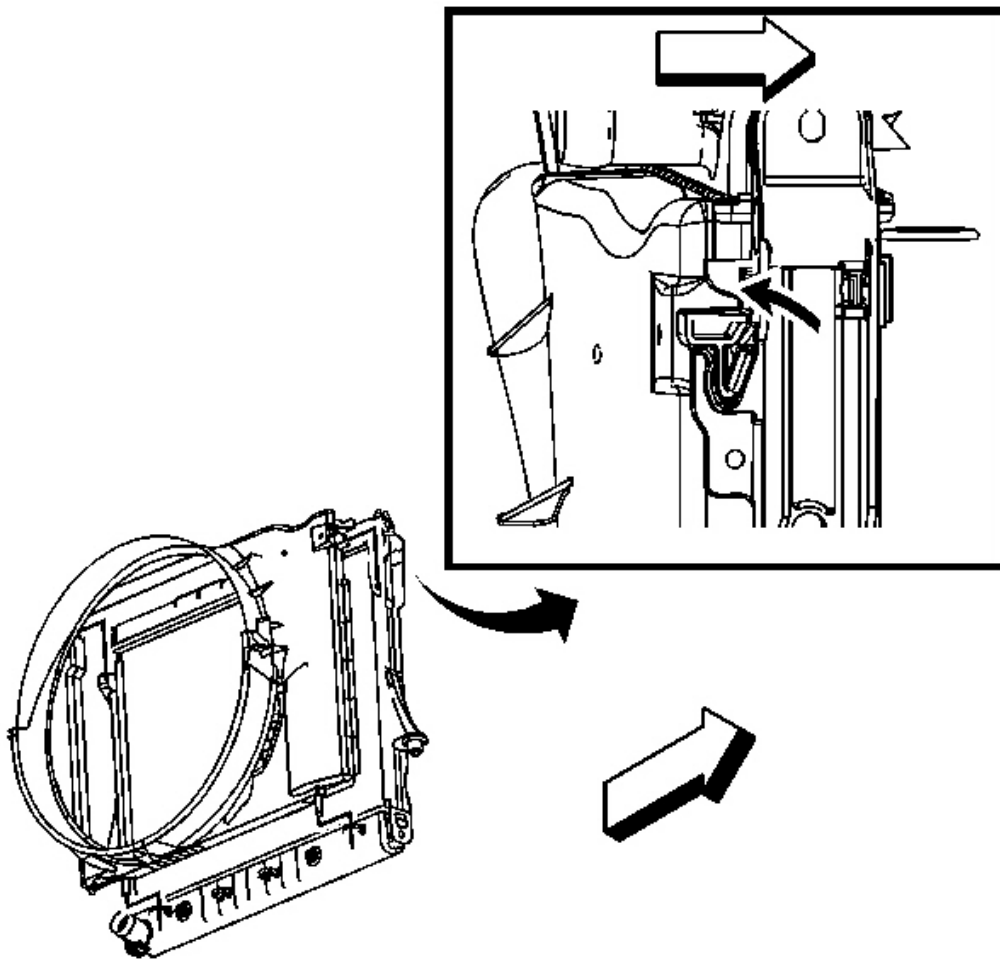


Fig. 54: View If Fan Shroud & Radiator
Courtesy of GENERAL MOTORS CORP.

11. Install the fan shroud to the radiator.
12. Raise the vehicle.

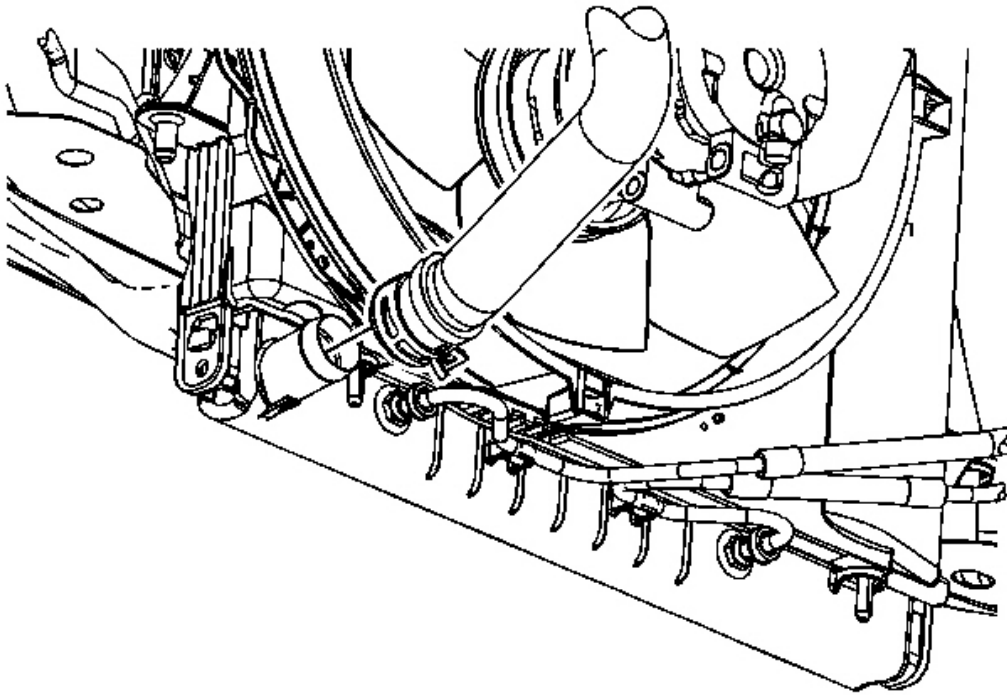


Fig. 55: Identifying Radiator Outlet Hose
Courtesy of GENERAL MOTORS CORP.

13. Install the radiator outlet hose to the radiator.
14. Using **J 38185** reposition the radiator outlet hose clamp to the radiator. See **Special Tools**.

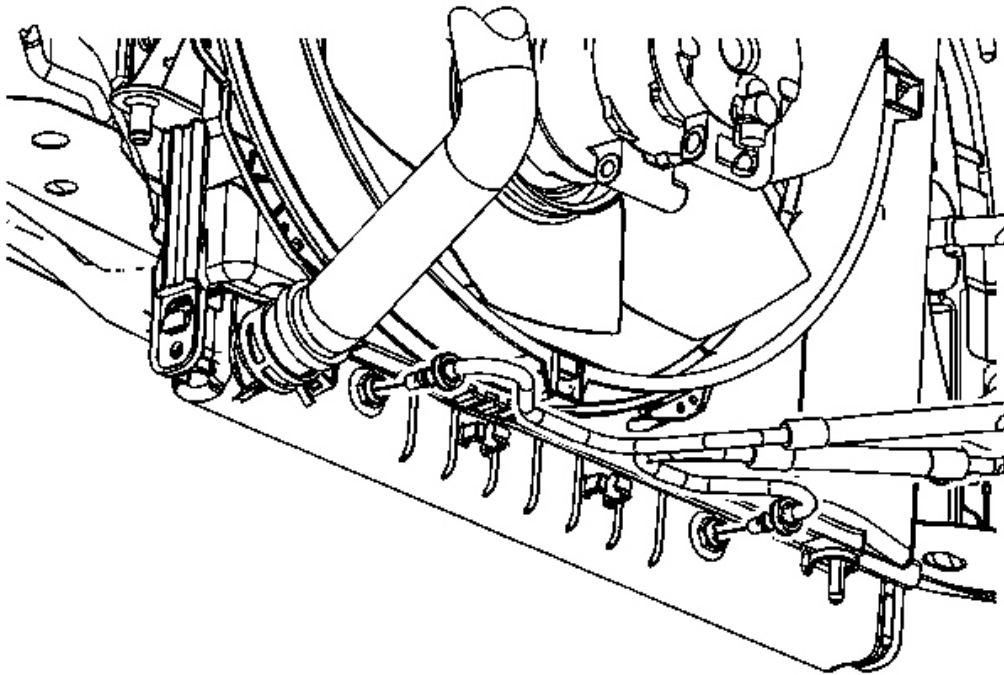


Fig. 56: View Of Transmission Cooler Lines At Radiator
Courtesy of GENERAL MOTORS CORP.

15. Connect the transmission cooler lines to the radiator. Refer to **Transmission Fluid Cooler Hose/Pipe Quick-Connect Fitting Disconnection and Connection** for the 4L60-E/4L65-E transmission, if equipped.
16. Install the oil pan skid plate.
17. Install the engine shield. Refer to **Engine Shield Replacement** .
18. Lower the vehicle.
19. Install the radiator vent inlet hose to the radiator.
20. Evacuate and recharge the A/C system. Refer to **REFRIGERANT RECOVERY AND RECHARGING** .
21. Fill the cooling system. Refer to **Cooling System Draining and Filling (Static Fill)** or **Cooling System Draining and Filling (Vac-N-Fill)**.

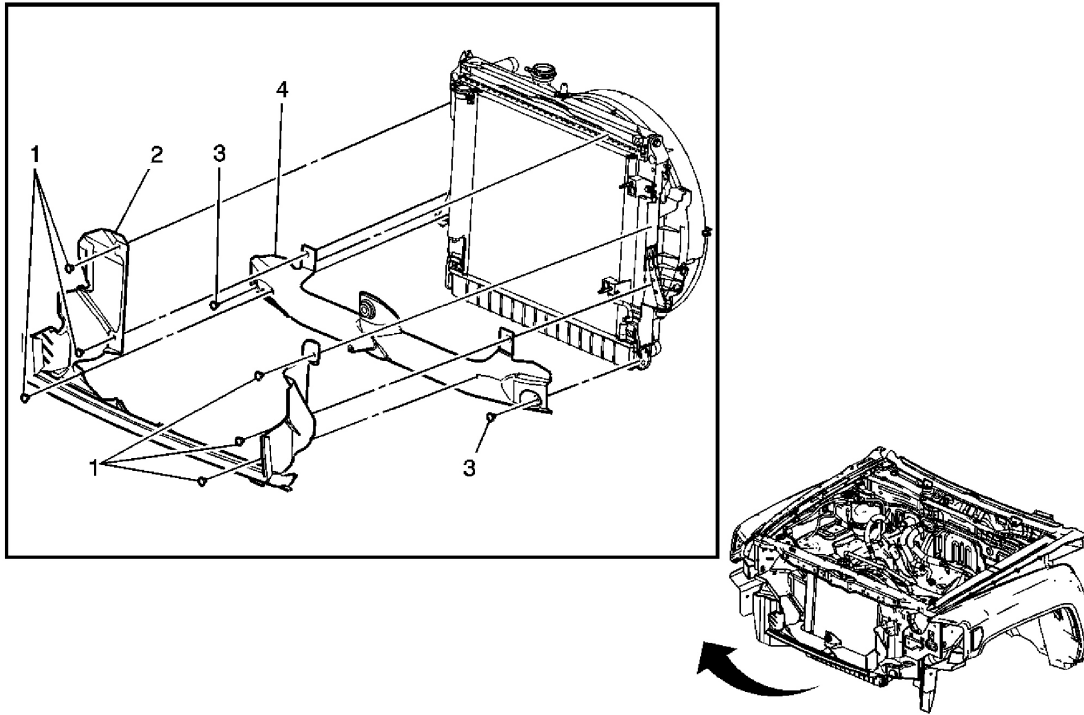


Fig. 57: Identifying Radiator Air Baffle Assemblies & Deflectors
 Courtesy of GENERAL MOTORS CORP.

Radiator Air Baffle Assemblies and Deflectors

Callout	Component Name
Preliminary Procedure	
1. Remove the grille guard. Refer to <u>Grille Guard/Brush Guard Replacement (Base)</u> or <u>Grille Guard/Brush Guard Replacement (H3X)</u> .	
2. Remove the grille. Refer to <u>Grille Replacement</u> .	
1	Push Pin Retainer
2	Radiator Front Baffle Assembly Tip: NOT used on 20U, 22U, 41U, 46U color trucks.
3	Push Pin Retainer
4	Radiator Front Baffle Assembly

COOLANT HEATER REPLACEMENT (WITH LLR)

Removal Procedure

1. Drain the engine coolant. Refer to **Cooling System Draining and Filling (Static Fill)** or

Cooling System Draining and Filling (Vac-N-Fill).

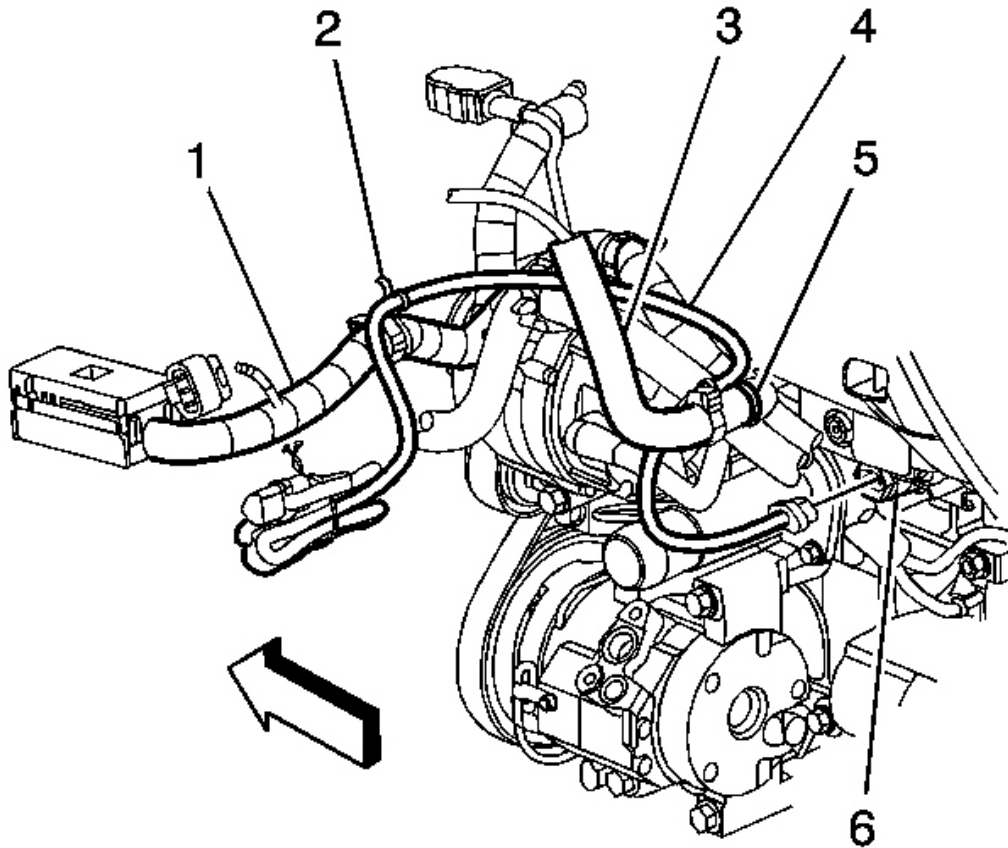


Fig. 58: Locating Coolant Heater & Cord
Courtesy of GENERAL MOTORS CORP.

2. Raise and support the vehicle only high enough to access the coolant heater (6) through the wheelhouse. Refer to Lifting and Jacking the Vehicle .
3. Remove the left wheelhouse liner. Refer to Wheelhouse Panel Replacement (Front) or Wheelhouse Panel Replacement (Rear) .
4. Disconnect the coolant heater cord (4) from the coolant heater (6).

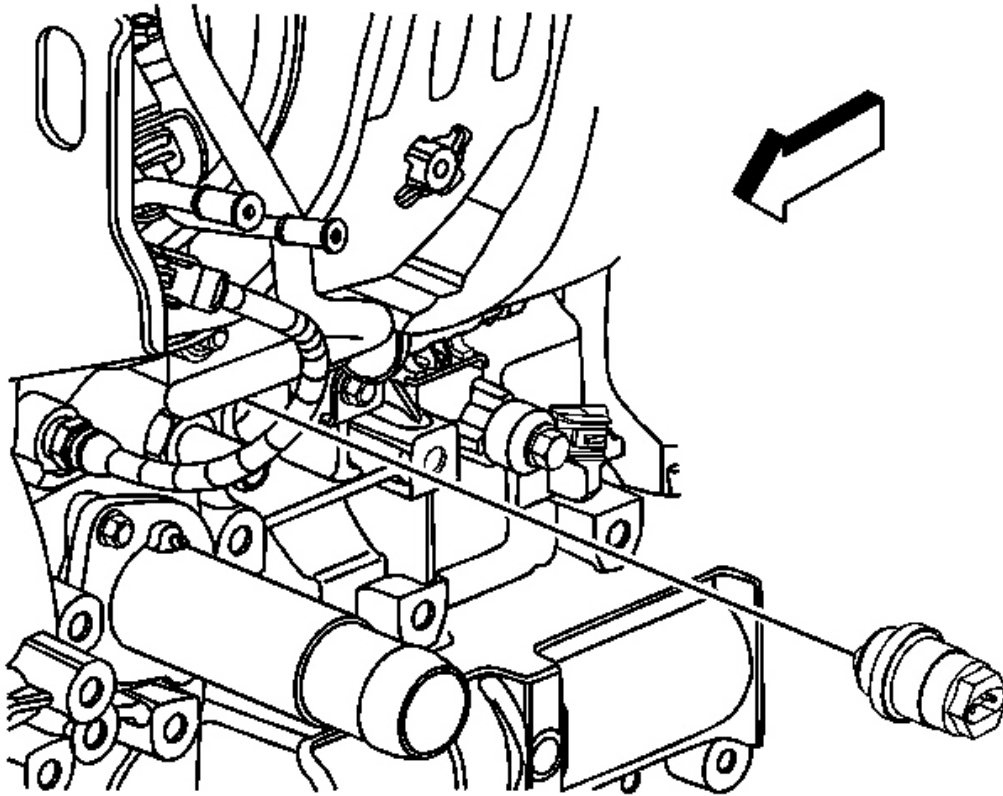


Fig. 59: View Of Coolant Heater
Courtesy of GENERAL MOTORS CORP.

5. Remove the coolant heater from the engine block.

Installation Procedure

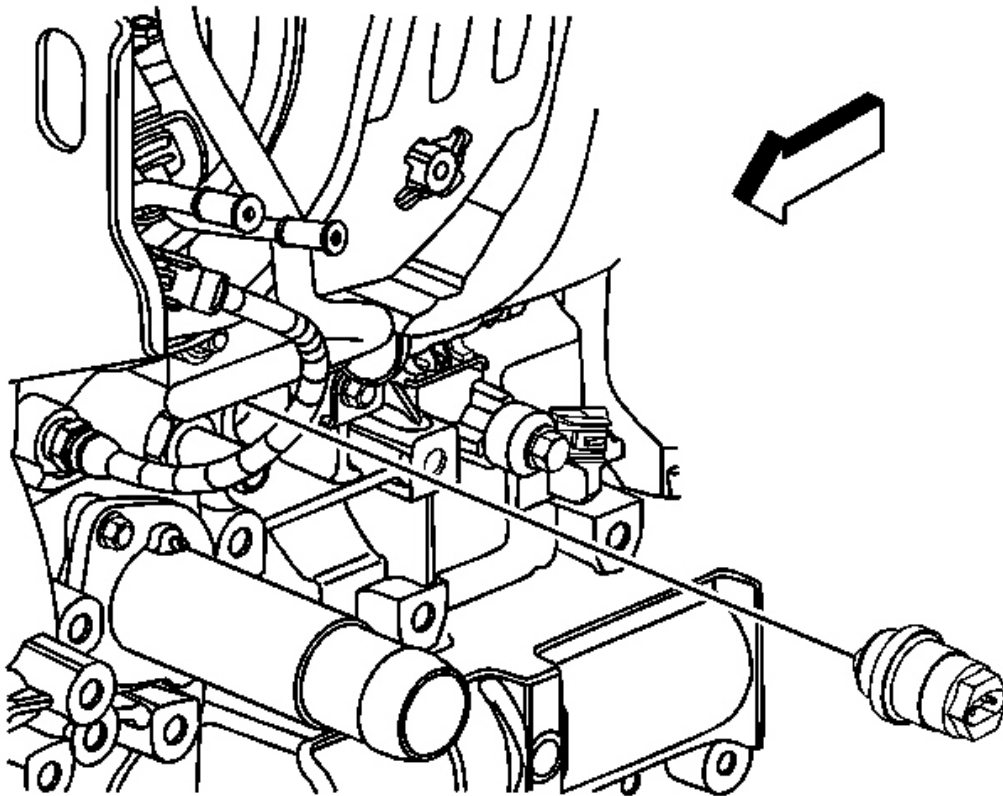


Fig. 60: View Of Coolant Heater
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Component Fastener Tightening Notice .

1. Install the coolant heater into the engine block.

Tighten: Tighten the coolant heater to 50 N.m (37 lb ft).

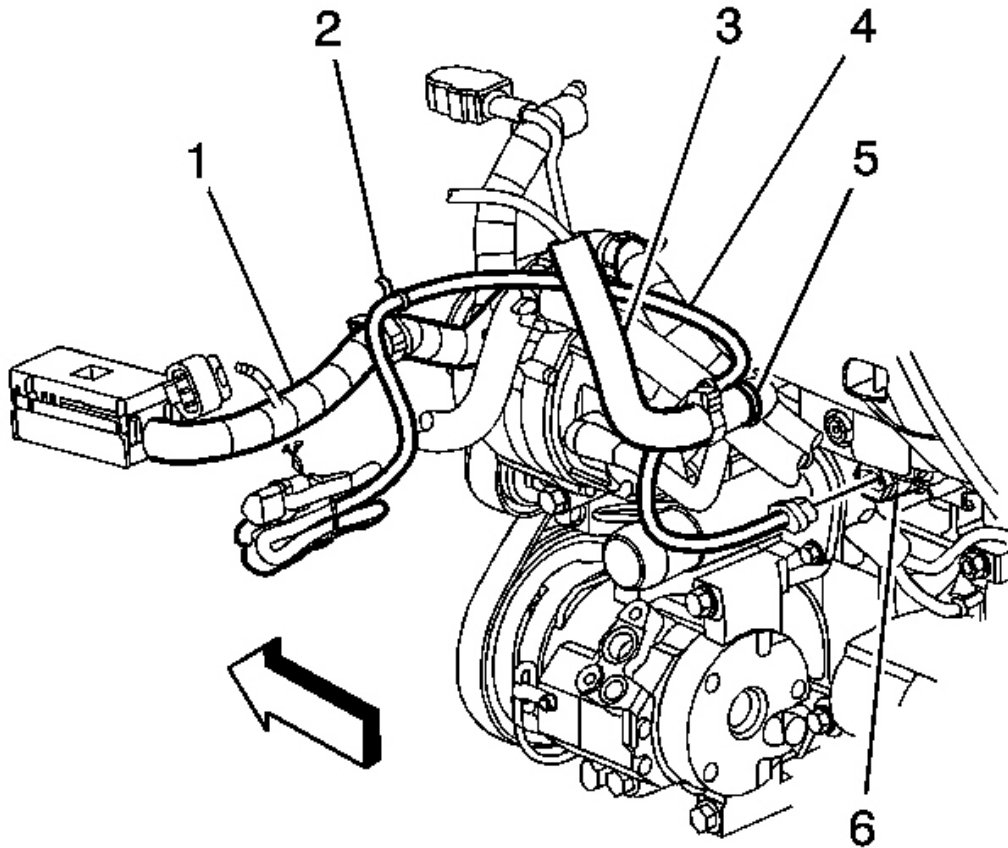


Fig. 61: Locating Coolant Heater & Cord
Courtesy of GENERAL MOTORS CORP.

2. Connect the coolant heater cord (4) to the coolant heater (6).
3. Install the left wheelhouse liner. Refer to [Wheelhouse Panel Replacement \(Front\)](#) or [Wheelhouse Panel Replacement \(Rear\)](#) .
4. Lower the vehicle.
5. Fill the cooling system. Refer to [Cooling System Draining and Filling \(Static Fill\)](#) or [Cooling System Draining and Filling \(Vac-N-Fill\)](#).

COOLANT HEATER CORD REPLACEMENT

Removal Procedure

1. Remove the battery box. Refer to **Battery Box Replacement** .

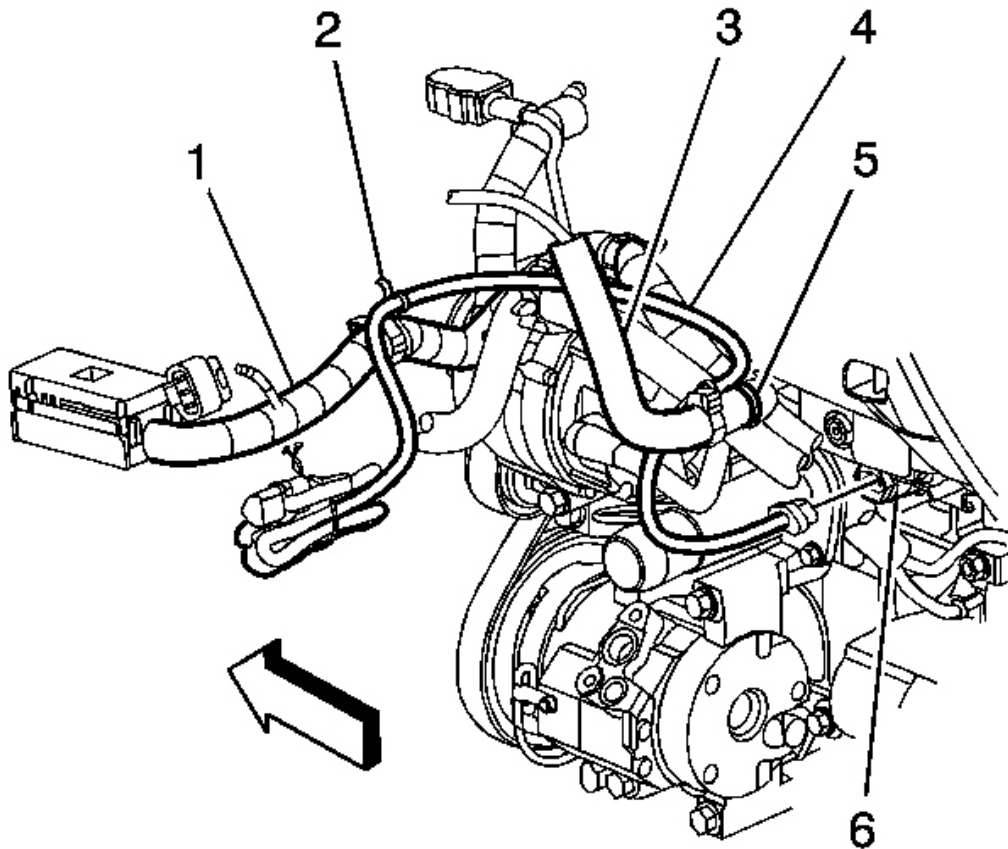


Fig. 62: Locating Coolant Heater & Cord
Courtesy of GENERAL MOTORS CORP.

2. Disconnect the coolant heater cord (4) from the coolant heater (6).
3. Cut the coolant heater cord ties (2, 5) from the following:
 - The battery cables conduit (3)
 - The engine wiring harness conduit (1)
4. Remove the coolant heater cord (4) from the vehicle.

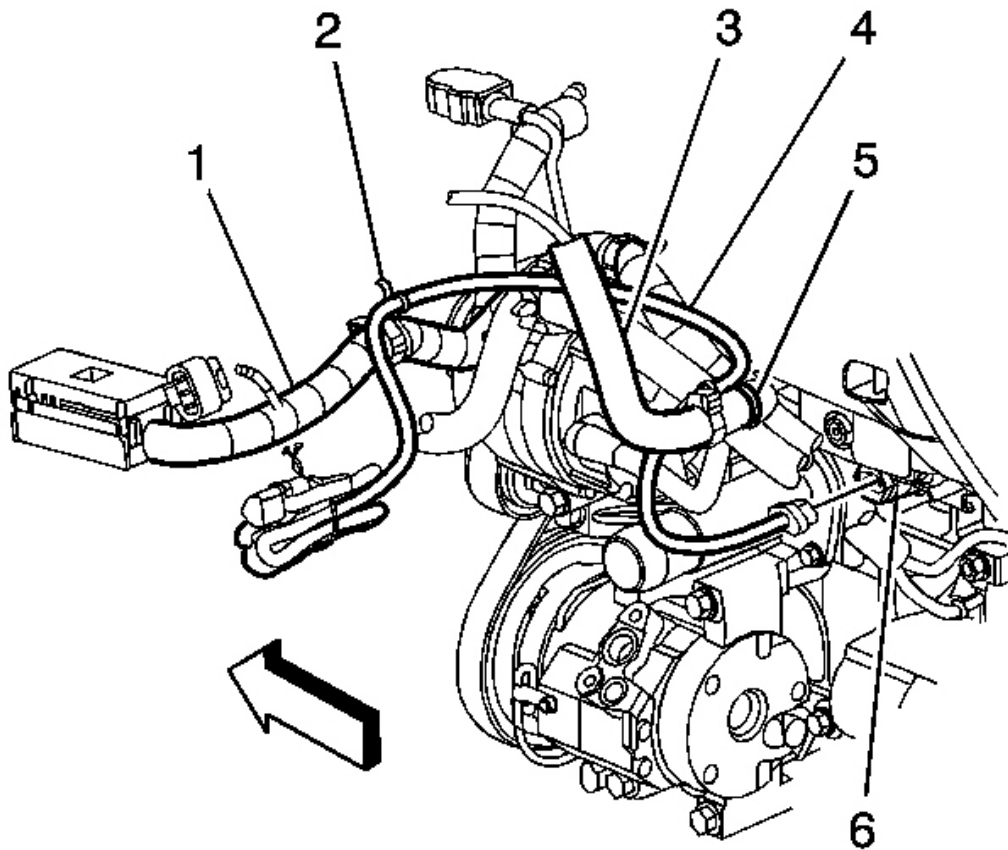


Fig. 63: Locating Coolant Heater & Cord
Courtesy of GENERAL MOTORS CORP.

1. Position the coolant heater cord (4) to the engine.
2. Route the coolant heater cord (4) along the engine wiring harness conduit (1) and battery cables conduit (3).
3. Connect the coolant heater cord (4) to the coolant heater (6).
4. Secure the coolant heater cord ties (2, 5) to the following:
 - The battery cables conduit (3)
 - The engine wiring harness conduit (1)
5. Install the battery box. Refer to **Battery Box Replacement** .
6. Place the remaining coolant heater cord (4) between the following:

- The battery box
- The underhood fuse block

DESCRIPTION AND OPERATION

COOLING SYSTEM DESCRIPTION AND OPERATION

Coolant Heater

The optional engine coolant heater (RPO K05) operates using 110-volt AC external power and is designed to warm the coolant in the engine block area for improved starting in very cold weather -29°C (-20°F). The coolant heater helps reduce fuel consumption when a cold engine is warming up. The unit is equipped with a detachable AC power cord. A weather shield on the cord is provided to protect the plug when not in use.

Cooling System

The cooling systems function is to maintain an efficient engine operating temperature during all engine speeds and operating conditions. The cooling system is designed to remove approximately one-third of the heat produced by the burning of the air-fuel mixture. When the engine is cold, the coolant does not flow to the radiator until the thermostat opens. This allows the engine to warm quickly.

Cooling Cycle

Coolant flows from the radiator outlet and into the water pump inlet. Some coolant flows from the water pump, to the heater core, then back to the water pump. This provides the passenger compartment with heat and defrost capability as the coolant warms up.

Coolant also flows from the water pump outlet and into the engine block. In the engine block, the coolant circulates through the water jackets surrounding the cylinders where it absorbs heat.

The coolant then flows through the cylinder head gasket openings and into the cylinder heads. In the cylinder heads, the coolant flows through the water jackets surrounding the combustion chambers and valve seats, where it absorbs additional heat.

From the cylinder heads, the coolant flows to the thermostat. The flow of coolant will either be stopped at the thermostat until the engine reaches normal operating temperature or it will flow through the thermostat and into the radiator where it is cooled. At this point, the coolant flow cycle is completed.

Efficient operation of the cooling system requires proper functioning of all cooling system

components. The cooling system consists of the following components:

Coolant

The engine coolant is a solution made up of a 50-50 mixture of DEX-COOL and suitable drinking water. The coolant solution carries excess heat away from the engine to the radiator, where the heat is dissipated to the atmosphere.

Radiator

The radiator is a heat exchanger. It consists of a core and 2 tanks. The aluminum core is a tube and fin crossflow design that extends from the inlet tank to the outlet tank. Fins are placed around the outside of the tubes to improve heat transfer to the atmosphere.

The inlet and outlet tanks are a molded, high temperature, nylon reinforced plastic material. A high temperature rubber gasket seals the tank flange edge to the aluminum core. The tanks are clamped to the core with clinch tabs. The tabs are part of the aluminum header at each end of the core.

The radiator also has a drain cock located in the bottom of the left hand tank. The drain cock unit includes the drain cock and drain cock seal.

The radiator removes heat from the coolant passing through it. The fins on the core transfer heat from the coolant passing through the tubes. As air passes between the fins, it absorbs heat and cools the coolant.

Pressure Cap

The pressure cap seals the cooling system. It contains a blow off or pressure valve and a vacuum or atmospheric valve. The pressure valve is held against its seat by a spring, which protects the radiator from excessive cooling system pressure. The vacuum valve is held against its seat by a spring, which permits opening of the valve to relieve vacuum created in the cooling system as it cools off. The vacuum, if not relieved, might cause the radiator and/or coolant hoses to collapse.

The pressure cap allows cooling system pressure to build up as the temperature increases. As the pressure builds, the boiling point of the coolant increases. Engine coolant can be safely run at a temperature much higher than the boiling point of the coolant at atmospheric pressure. The hotter the coolant is, the faster the heat transfers from the radiator to the cooler, passing air.

The pressure in the cooling system can get too high. When the cooling system pressure exceeds the rating of the pressure cap, it raises the pressure valve, venting the excess pressure.

2007 Hummer H3

2007 ENGINE Engine Cooling - H3

As the engine cools down, the temperature of the coolant drops and a vacuum is created in the cooling system. This vacuum causes the vacuum valve to open, allowing outside air into the surge tank. This equalizes the pressure in the cooling system with atmospheric pressure, preventing the radiator and coolant hoses from collapsing.

Coolant Recovery System

The coolant recovery system consists of a plastic coolant recovery reservoir and overflow tube. The recovery reservoir is also called a recovery tank or expansion tank. It is partially filled with coolant and is connected to the radiator fill neck with the overflow tube. Coolant can flow back and forth between the radiator and the reservoir.

In effect, a cooling system with a coolant recovery reservoir is a closed system. When the pressure in the cooling system gets too high, it will open the pressure valve in the pressure cap. This allows the coolant, which has expanded due to being heated, to flow through the overflow tube and into the recovery reservoir. As the engine cools down, the temperature of the coolant drops and a vacuum is created in the cooling system. This vacuum opens the vacuum valve in the pressure cap, allowing some of the coolant in the reservoir to be siphoned back into the radiator. Under normal operating conditions, no coolant is lost. Although the coolant level in the recovery reservoir goes up and down, the radiator and cooling system are kept full. An advantage to using a coolant recovery reservoir is that it eliminates almost all air bubbles from the cooling system. Coolant without bubbles absorbs heat much better than coolant with bubbles.

Cooling Fan and Clutch

The engine cooling fan and clutch are driven by the crankshaft via the drive belt. The cooling fan draws air through the radiator to improve the transfer of heat from the coolant to the atmosphere. As the fan blades spin, they pull cool, outside air past the radiator core. The fan clutch drives the cooling fan. The fan clutch controls the amount of torque that is transmitted from the crankshaft to the fan blades. The clutch allows more torque to engage on the fan when the engine operating temperature increases and/or the vehicle speed is low. As the torque increases, the fan turns more quickly. The fan clutch decreases the torque applied to the cooling fan when the engine temperature decreases and/or the vehicle speed is high. As the torque decreases, the fan speed decreases.

Air Baffles and Seals

The cooling system uses deflectors, air baffles and air seals to increase cooling system capability. Deflectors are installed under the vehicle to redirect airflow beneath the vehicle and through the radiator to increase engine cooling. Air baffles are also used to direct airflow through the radiator and increase cooling capability. Air seals prevent air from bypassing the radiator and A/C condenser and prevent recirculation of hot air for better hot weather cooling and A/C condenser

performance.

Water Pump

The water pump is a centrifugal vane impeller type pump. The pump consists of a housing with coolant inlet and outlet passages and an impeller. The impeller is mounted on the pump shaft and consists of a series of flat or curved blades or vanes on a flat plate. When the impeller rotates, the coolant between the vanes is thrown outward by centrifugal force.

The impeller shaft is supported by one or more sealed bearings. The sealed bearings never need to be lubricated. Grease cannot leak out, dirt and water cannot get in as long as the seal is not damaged or worn.

The purpose of the water pump is to circulate coolant throughout the cooling system. The water pump is driven by the crankshaft via the drive belt.

Thermostat

The thermostat is a coolant flow control component. Its purpose is to help regulate the operating temperature of the engine. It utilizes a temperature sensitive wax-pellet element. The element connects to a valve through a small piston. When the element is heated, it expands and exerts pressure against the small piston. This pressure forces the valve to open. As the element is cooled, it contracts. This contraction allows a spring to push the valve closed.

When the coolant temperature is below the rated thermostat opening temperature, the thermostat valve remains closed. This prevents circulation of the coolant to the radiator and allows the engine to warm up. After the coolant temperature reaches the rated thermostat opening temperature, the thermostat valve will open. The coolant is then allowed to circulate through the thermostat to the radiator where the engine heat is dissipated to the atmosphere. The thermostat also provides a restriction in the cooling system, after it has opened. This restriction creates a pressure difference which prevents cavitation at the water pump and forces coolant to circulate through the engine block.

Transmission Oil Cooler

The transmission oil cooler is a heat exchanger. It is located inside the right side end tank of the radiator. The transmission fluid temperature is regulated by the temperature of the engine coolant in the radiator.

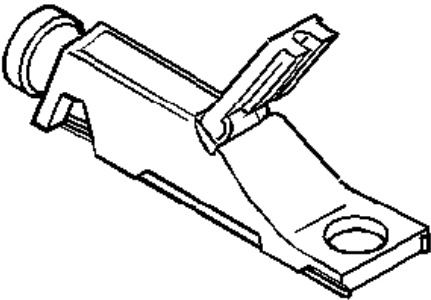
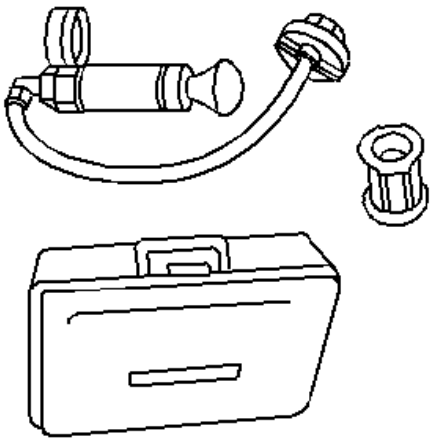
The transmission oil pump, pumps the fluid through the transmission oil cooler line to the transmission oil cooler. The fluid then flows through the cooler where the engine coolant absorbs heat from the fluid. The fluid is then pumped through the transmission oil cooler return line, to the

transmission.

SPECIAL TOOLS AND EQUIPMENT

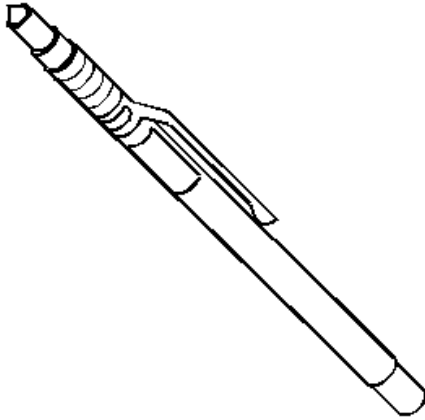
SPECIAL TOOLS

Special Tools

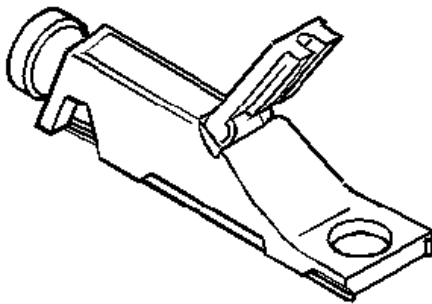
Illustration	Tool Number/Description
	J 23688 Coolant and Battery Fluid Tester
	J 24460-01 Cooling System Pressure Tester

2007 Hummer H3

2007 ENGINE Engine Cooling - H3



J 24731
Tempil Stick

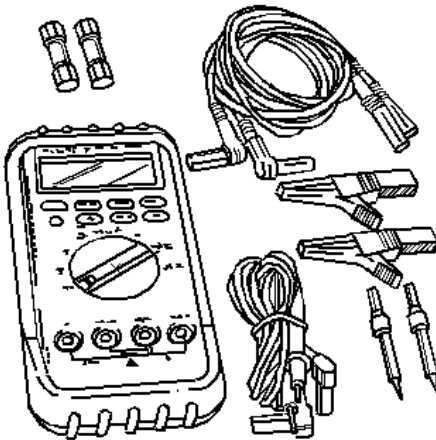
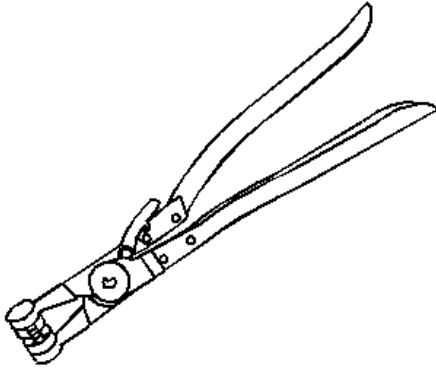


J 26568
Coolant and Battery Fluid Tester

J 38185
Hose Clamp Pliers

2007 Hummer H3

2007 ENGINE Engine Cooling - H3

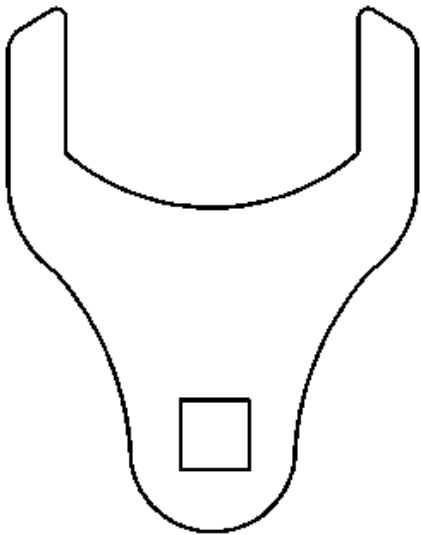
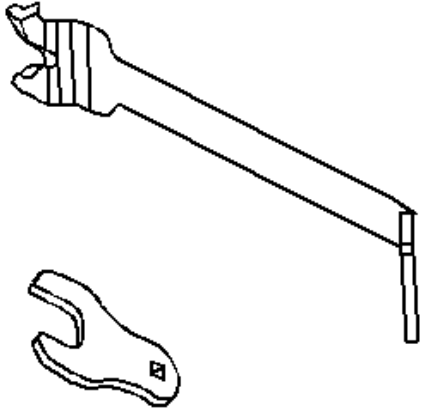


J 39200
Digital Multimeter

J 41240
Fan Clutch Remover and Installer

2007 Hummer H3

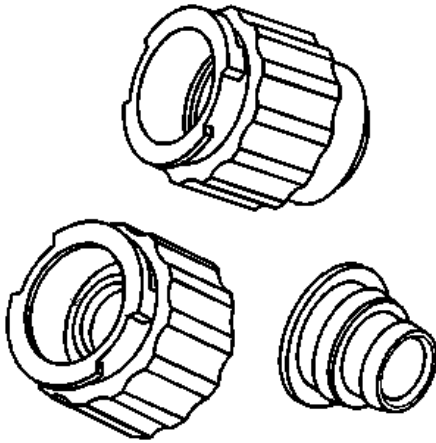
2007 ENGINE Engine Cooling - H3



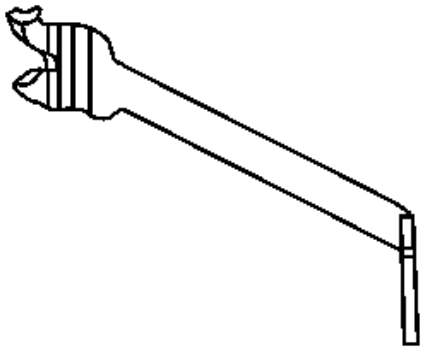
J 41240-5A
Fan Clutch Wrench

2007 Hummer H3

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J 42401
Radiator Cap and Surge Tank Test
Adapter



J 46406
Fan Clutch Remover and Installer

GE 47716
Vac-N-Fill Coolant Refill Tool

2007 Hummer H3

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