2004 ENGINE

Engine Cooling - Ascender

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Air Cleaner Outlet Duct Bolt (5.3L)	10 N.m	89 lb in
Air Cleaner Outlet Duct Clamp (5.3L)	7 N.m	62 lb in
Air Conditioning Condenser Bolt	28 N.m	21 lb ft
Auxiliary Heater Inlet and Outlet Hose/Pipe Nut (5.3L)	10 N.m	89 lb in
Coolant Air Bleed Pipe Bolt (5.3L)	12 N.m	106 lb in
Coolant Air Bleed Pipe Cover Bolt (5.3L)	12 N.m	106 lb in
Coolant Heater	50 N.m	37 lb ft
Coolant Recovery Reservoir Bolt	12 N.m	106 lb in
Coolant Recovery Reservoir Nut	10 N.m	89 lb in
Cooling Fan Nut	56 N.m	41 lb ft
Engine Harness Bracket Bolt (4.2L)	45 N.m	33 lb ft
Fan Blade Bolt	27 N.m	20 lb ft
Fan Shroud Bolt	28 N.m	21 lb ft
Thermostat Housing Bolt (4.2L)	10 N.m	89 lb in
Thermostat Housing Bolt (5.3L)	15 N.m	11 lb ft
Water Pump Bolt (4.2L)	10 N.m	89 lb in
Water Pump Bolt (5.3L)		
• First Pass	15 N.m	11 lb ft
• Final Pass	30 N.m	22 lb ft
Water Pump Pulley Bolt (4.2L)	25 N.m	18 lb ft

SCHEMATIC AND ROUTING DIAGRAMS

ENGINE COOLING SCHEMATICS

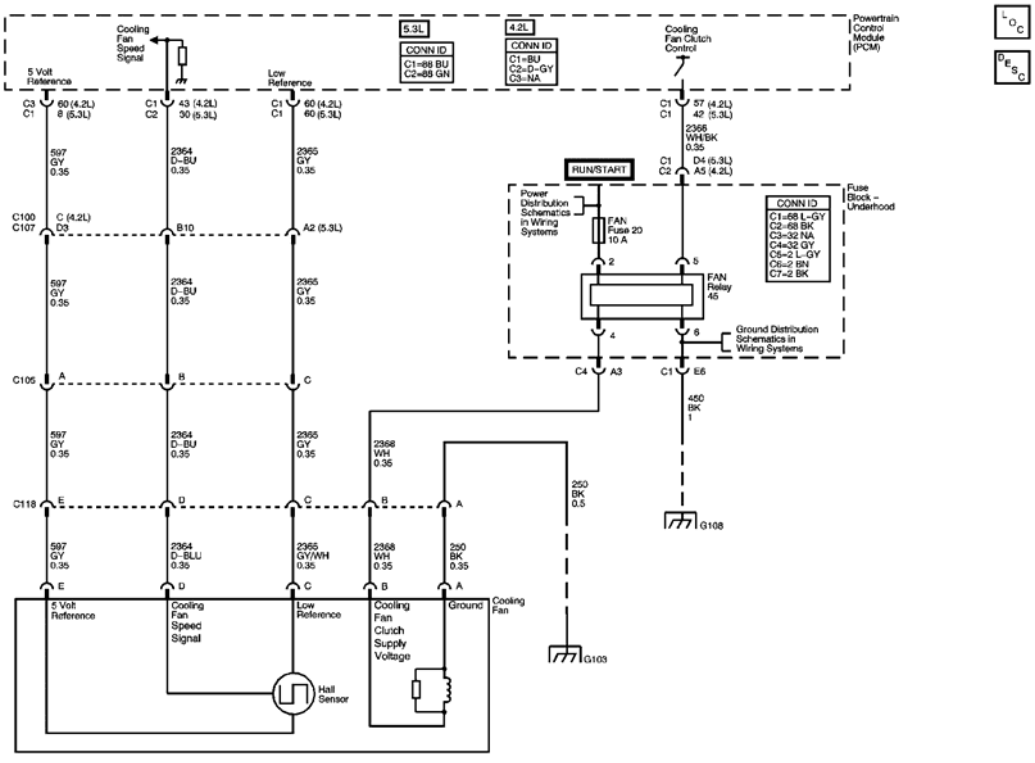


Fig. 1: Engine Cooling Schematic
Courtesy of GENERAL MOTORS CORP.

COMPONENT LOCATOR

COOLING SYSTEM COMPONENT VIEWS

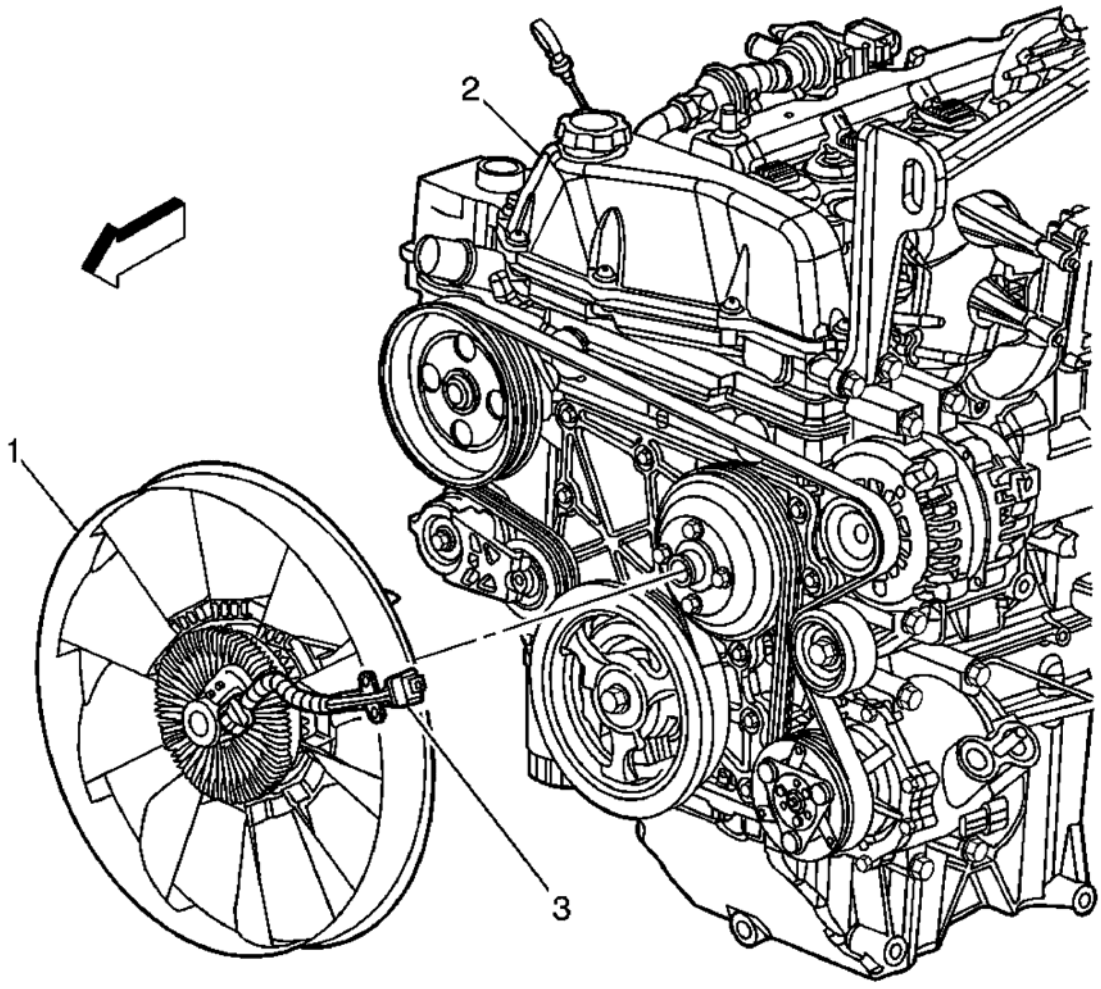


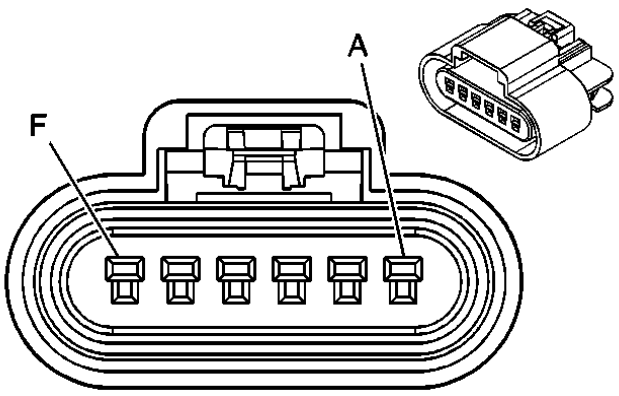
Fig. 2: Engine Cooling Fan
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 2

Callout	Component Name
1	Engine Cooling Fan
2	Engine
3	C118

COOLING SYSTEM CONNECTOR END VIEWS

Cooling Fan Connector End View



Connector Part Information		• 15326829 • 6-Way F Metri-Pack 150 Series (BK)	
Pin	**Wire Color**	**Circuit No.**	**Function**
A	BK	250	Ground
B	WH	2368	Cooling Fan Clutch Supply Voltage
C	GY/WH	2365	Low Reference
D	D-BU	2364	Cooling Fan Speed Signal
E	GY	597	5-Volt Reference
F	-	-	Not Used

DIAGNOSTIC INFORMATION AND PROCEDURES

DIAGNOSTIC STARTING POINT - ENGINE COOLING

Begin the system diagnosis with the **Diagnostic System Check - Engine Cooling**. The Diagnostic System Check 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 circuit.
- The identification of any stored diagnostic trouble codes (DTCs) and their status.

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

DIAGNOSTIC SYSTEM CHECK - ENGINE COOLING

Test Description

The numbers below refer to the step numbers on the diagnostic table.

3: Lack of communication may be due to a partial malfunction of the class 2 serial data circuit or due to a total malfunction of the class 2 serial data circuit. The specified procedure will determine the particular condition.

4: Determine if the instrument cluster or powertrain control modules (PCMs) have set DTCs which may affect Engine Cooling operation are present.

5: The presence of DTCs which begin with "U" indicate some other module is not communicating. The specified procedure will compile all the available information before tests are performed.

6: If DTC P1484 or P0495 is set along with DTC P0113 and the weather conditions are cold, the cooling fan codes may be false.

Diagnostic System Check - Engine Cooling

Step	Action	Yes	No
1	Did you review a Diagnostic Starting Point-Engine Cooling?	Go to **Step 2**	Go to **Diagnostic Starting Point - Engine Cooling**
2	Install a scan tool. Does the scan tool power up?	Go to **Step 3**	Go to **Scan Tool Does Not Power Up** in Data Link Communications
3	1. Turn ON the ignition, with the engine OFF. 2. Attempt to establish communication with the following control modules: • The instrument cluster • The powertrain control module Does the scan tool communicate with the control modules?	Go to **Step 4**	Go to **Scan Tool Does Not Communicate with Class 2 Device** in Data Link Communications
4	Select the powertrain control module display DTCs function on the scan tool. Does the scan tool display any DTCs?	Go to **Step 5**	Go to **Symptoms - Engine Cooling**
5	Does the scan tool display any DTCs which begin with a "U"?	Go to **Scan Tool Does Not Communicate with Class 2 Device** in Data Link Communications	Go to **Step 6**
6	Does the scan tool display any DTCs that are associated with the Engine Cooling System?	Go to **Diagnostic Trouble Code**	Go to **Diagnostic Trouble Code (DTC) List** in Engine Controls - 4.2L or **Diagnostic Trouble Code (DTC) List** in Engine Controls -

		(DTC) List	4.8L, 5.3L, and 6.0L

SCAN TOOL OUTPUT CONTROLS

PCM - 4.2L, 5.3L

Scan Tool Output Control	Additional Menu Selection(s)	Description
Electro-viscous Fan	-	The scan tool displays a Commanded State of None or percentage. This allows you to communicate with the PCM to increase or decrease the cooling fan speed in 10% increments.

SCAN TOOL DATA LIST

Powertrain Control Module (PCM) 4.2 L (LL8), 5.3L (LM4)

Scan Tool Parameter	Data List	Units Displayed	Typical Data Value
Ignition Switch in RUN/Engine Running/Automatic Transmission in PARK/Manual Transmission in NEUTRAL/Air Conditioner is OFF			
Desired Fan Speed	ENG 2, ENG 3	RPM	Varies
ECT Sensor	ENG 1, ENG 2, ENG 3, EVAP, Misfire, HO2S	Degrees	°C/°F
Fan Speed	ENG 2, ENG 3	RPM	Varies
IAT Sensor	ENG 1, ENG 2, ENG 3, EVAP, Misfire, HO2S	Degrees	°C/°F

Instrument Panel Cluster

Scan Tool Parameter	Data List	Units Displayed	Typical Data Value
Ignition Switch in RUN/Engine Running/Automatic Transmission in PARK/Manual Transmission in NEUTRAL/Air Conditioner is OFF			
Displayed Coolant Temp	Data 1	°C/°F	Varies
Monitored Coolant Temp	Data 1	°C/°F	Varies

SCAN TOOL DATA DEFINITIONS

Desired Fan Speed

This parameter indicates the desired cooling fan speed in RPM. This value is determined by engine load, temperature, and speed.

Displayed Coolant Temperature - Range: 32-127°C (89-260°F)

This data is the coolant temperature the Instrument Cluster is attempting to display on the coolant

temperature gauge. This data may differ from the monitored coolant temperature for a period of time due to filtering. The data may also differ from the monitored coolant temperature when coolant temperature is not in the range of 71-127°C (160-260°F) since the display is limited to these values. If a Class 2 communication failure occurs, this data will be at the minimum value of 32°C (89°F).

ECT Sensor

The scan tool displays -40°C to 151°C (-40°F to 304°F). The Engine Coolant Temperature (ECT) sensor is mounted in the coolant stream. The 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 and internal resistance is high, the PCM monitors a high signal voltage and interprets it as a cold engine. As the sensor warms and internal resistance decreases, the voltage signal decreases and the PCM interprets the lower voltage as a warm engine.

Fan Speed

This parameter indicates the actual speed of the cooling fan in RPM.

IAT Sensor

The scan tool displays -40°C to 151°C (-40°F to 304°F). The PCM converts the signal of the IAT sensor into degrees. The PCM uses the IAT in order to adjust fuel delivery, spark timing, and cooling fan speed according to the incoming air temperature.

Monitored Coolant Temperature - Range: 40-215°C (40-419°F)

This data is the clusters measurement of the engine coolant temperature as provided by the PCM on the Class 2 serial data line.

DIAGNOSTIC TROUBLE CODE (DTC) LIST

Diagnostic Trouble Code (DTC) List

DTC	Diagnostic Procedure	Modules
P0116	**DTC P0116** in Engine Controls - 4.8L, 5.3L, and 6.0L	PCM
P0117	• **DTC P0117** in Engine Controls - 4.2L • **DTC P0117** in Engine Controls - 4.8L, 5.3L, and 6.0L	PCM
P0118	• **DTC P0118** in Engine Controls - 4.2L • **DTC P0118** in Engine Controls - 4.8L, 5.3L, and 6.0L	PCM
P0125	• **DTC P0125** in Engine Controls - 4.2L • **DTC P0125** in Engine Controls - 4.8L, 5.3L, and 6.0L	PCM

P0128	• **DTC P0128** in Engine Controls - 4.2L • **DTC P0128** in Engine Controls - 4.8L, 5.3L, and 6.0L	PCM
P0480	**DTC P0480**	PCM
P0483	**DTC P0483 or P0493**	PCM
P0493	**DTC P0483 or P0493**	PCM
P0495	**DTC P0495**	PCM
P0526	**DTC P0526**	PCM
P1258	**DTC P1258**	PCM
P1481	**DTC P1481**	PCM
P1482	**DTC P1482**	PCM
P1484	**DTC P1484**	PCM

DTC P0480

Circuit Description

The powertrain control module (PCM) sends a pulse width modulation (PWM) signal of 0-12 volts via the cooling fan clutch control circuit to the cooling fan relay. The PCM monitors the cooling fan clutch control circuit during vehicle operation. When the cooling fan is commanded on by the PCM, the control circuit is at a low voltage. When the cooling fan is commanded off, the control circuit is near battery voltage. The PCM uses this PWM to control the position of the oil control valve located inside the cooling fan clutch. If during operation, the PCM detects an improper circuit condition on the cooling fan clutch control circuit DTC P0480 will set.

Conditions for Running the DTC

- The engine speed is greater than 400 RPM.
- The ignition voltage is greater than 10 volts and less than 18 volts.

Conditions for Setting the DTC

- The PCM detects that the commanded state of the relay and the actual state of the control circuit do not match.
- The above condition is present for at least 5 seconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) during the second consecutive trip in which the diagnostic test has been run and failed.
- The PCM stores the conditions present when the DTC sets as Freeze Frame/Failure Records data.
- A history DTC is stored.
- The PCM commands the cooling fan to 100%.

Conditions for Clearing the MIL/DTC

- The PCM turns OFF the malfunction indicator lamp (MIL) after the third consecutive trip the diagnostic has run and passed.
- The history DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using the scan tool Clear DTC Information function.

Diagnostic Aids

- An inline connector could cause an intermittent DTC. Ensure to test for poor connections and pin retention at all inline connectors. Refer to system schematics for connectors and locations.
- If the condition is not present, refer to **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems.
- Disconnect the harness connector of the cooling fan from the shroud. Inspect the exposed wires between the harness connector and the tubing.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

2: Tests for the ability of the PCM to control fan speed. If answer to question is Yes, ensure to refer to all Diagnostic Aids.

3: Verifies the ignition 1 voltage circuit of the cooling fan relay.

DTC P0480

Step	Action	Values	Yes	No
Schematic Reference: Engine Cooling Schematics **Connector End View Reference: Cooling System Connector End Views**				
1	Did you perform the Engine Cooling Diagnostic System Check?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Cooling**
2	1. Install a scan tool. 2. Start the engine. 3. Observe the Fan Speed parameter in the powertrain control module Output Controls. 4. With a scan tool, command the fan speed to increase. Does the Fan Speed parameter increase?	-	Go to Diagnostic Aids	Go to **Step 3**
	1. Turn OFF the ignition. 2. Disconnect the cooling fan relay.			

3	3. Turn ON the ignition, with the engine OFF. 4. Probe the ignition 1 voltage circuit of the cooling fan relay with a test lamp connected a good ground. Does the test lamp illuminate?	-	Go to **Step 4**	Go to **Step 10**
4	Test the cooling fan clutch control circuit of the cooling fan relay for a short to voltage or an open. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 13**	Go to **Step 5**
5	Test the cooling fan clutch control circuit of the cooling fan relay for a short to ground. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 13**	Go to **Step 6**
6	1. Connect a test lamp to the cooling fan clutch control circuit of the cooling fan relay and ground. 2. Connect a digital multimeter (DMM) to the test lamp probe and ground. 3. Set the DMM to A/C range and select frequency. 4. Start the engine. 5. Verify that the Fan Control is commanded to 0%. Is the frequency less than the specified value?	OL	Go to **Step 9**	Go to **Step 7**
7	Command the Fan Control to 100%. Does the frequency fluctuate?	-	Go to **Step 8**	Go to **Step 9**
8	Inspect for poor connections at the cooling fan relay. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 13**	Go to **Step 11**
9	Inspect for poor connections at the harness connector of the PCM. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 13**	Go to **Step 12**
10	Repair the ignition 1 voltage circuit of the cooling fan relay. Refer to **Wiring Repairs** in	-		-

	Wiring Systems. Did you complete the repair?		Go to **Step 13**	
11	Replace the cooling fan relay. Did you complete the replacement?	-	Go to **Step 13**	-
12	**IMPORTANT:** **Perform the programming procedure for the PCM.** Replace the PCM. Refer to **Powertrain Control Module (PCM) Replacement** in Engine Controls-4.8L, 5.3L, and 6.0L.Did you complete the replacement?	-	Go to **Step 13**	-
13	1. Use the scan tool in order to clear the DTCs. 2. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text. Does the DTC reset?	-	Go to **Step 2**	System OK

DTC P0483 OR P0493

Circuit Description

The following DTCs are for the cooling fan clutch.

- P0483 is for the difference of the commanded cooling fan speed compared to actual cooling fan speed is greater than 1,000 RPM.
- P0493 is for a cooling fan clutch over speed condition, approximately 6,800 RPM.

The cooling fan relay sends a pulse width modulation (PWM) signal of 12-14 volts to the cooling fan clutch through the cooling fan clutch supply voltage circuit. The powertrain control module (PCM) uses this PWM signal in order to control the speed of the cooling fan clutch. The signal controls the position of the oil control valve inside the cooling fan clutch. If the cooling fan RPM is different than the PCM is expecting, DTC P0483 will set. The actual cooling fan RPM vs the desired cooling fan RPM is not always exactly the same. There can be up to an 800 RPM difference. If the PCM detects that the cooling fan speed is over 6,800 RPM then DTC P0493 will set.

Conditions for Running the DTC

- For DTC P0483:
  - The engine is running.
  - The system voltage is greater than 8.5 volts.
  - The intake air temperature (IAT) is greater than -7°C (19°F).

  - DTCs P0480 and P0526 are not set.
  - The engine speed is less than 3,200 RPM.
  - The engine speed is not changing more than 250 RPM for 5 seconds.
  - Fan command is greater than 0 percent.
- For DTC P0493 is that the engine is running.

Conditions for Setting the DTC

- For DTC P0483 is the difference between commanded and actual cooling fan speed is greater than 1,000 RPM for 100 seconds.
- For DTC P0493 the cooling fan RPM is greater than 6,800 RPM.

Action Taken When the DTC Sets

- For DTC P0483:
  - The PCM illuminates the malfunction indicator lamp (MIL) during the second consecutive trip in which the diagnostic test has been run and failed.
  - The PCM will store the conditions as Freeze Frame/Failure Records data.
  - The PCM commands the cooling fan clutch to 100 percent.
- For DTC P0493:
  - The Reduced Engine Power indicator illuminates.
  - The PCM will store the conditions as Freeze Frame/Failure Records data.

Conditions for Clearing the MIL/DTC

The PCM turns OFF the MIL after the third consecutive trip that the diagnostic test has run and passed.

Diagnostic Aids

- An inline connector could cause an intermittent DTC. Ensure to test for poor connections and pin retention at all inline connectors. Refer to system schematics for connector and locations.
- If the condition is not present, refer to **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems.
- Disconnect the harness connector of the cooling fan clutch from the shroud. Inspect the exposed wires between the harness connector and the tubing.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

2: This step ensures that the DTC has failed this ignition cycle. If the scan tool displays Passed, then the answer is No.

3: The cooling fan noise should increase as the cooling fan clutch engages. It can take up to 2 minutes for full cooling fan clutch engagement. If cooling fan clutch is previously fully engaged, then there will not

be a noticeable change in cooling fan noise. Compare noise to a known good vehicle. If fan noise is louder than the known good vehicle, then answer Yes.

4: In the previous step the cooling fan clutch was fully engaged. This step tests to ensure that the cooling fan clutch will disengage. A noticeable noise difference should be heard between a fully engaged cooling fan clutch and a disengaged cooling fan. The cooling fan clutch is completely disengaged when the excessive fan noise is not heard.

5: Tests the PCM's ability to control the cooling fan clutch. If answer to question is Yes, ensure to refer to all Diagnostic Aids.

6: Inspect for a mechanical condition which causes the DTC to set.

7: Tests for voltage on the cooling fan clutch supply voltage circuit of the cooling fan clutch. The cooling fan connector is a seal connector. You must use jumper wires for testing or damage to wiring or connector could happen.

8: Tests the cooling fan relay for a PWM signal on the cooling fan clutch supply voltage circuit of the cooling fan.

DTC P0483 or P0493

Step	Action	Values	Yes	No
Schematic Reference: Engine Cooling Schematics **Connector End View Reference: Cooling System Connector End Views**				
1	Did you perform the Engine Cooling Diagnostic System Check?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Cooling**
2	1. With a scan tool, observe the Powertrain DTC list. 2. Start the engine. 3. Operate the vehicle within the Conditions for Running in the DTC. Does the scan tool indicate the DTC Failed this ignition cycle?	-	Go to **Step 5**	Go to **Step 3**
3	**IMPORTANT:** **P0480, for 5.3L (LM4), will set when the cooling fan relay is disconnected.** 1. Turn OFF the ignition. 2. Disconnect the coolant fan relay. 3. Connect a 10-amp fused jumper wire between the cooling fan clutch supply voltage circuit of the cooling fan and the ignition 3 voltage circuit of the cooling fan relay.	-		

	4. Start the engine. 5. Raise engine speed to 2,000 RPM for 2 minutes. Does the cooling fan clutch engage?		Go to **Step 4**	Go to **Step 5**
4	**IMPORTANT:** **Continuously excessive fan noise is due to the PCM commanding the cooling fan clutch to 100 percent engaged or a mechanical failure. If the fan noise decreases during this step, then this DTC is due to an electrical malfunction. Replacing the cooling fan clutch will not correct the condition.** 1. Turn OFF the ignition. 2. Remove the 10-amp fused jumper wire. 3. Install cooling fan relay. 4. Disconnect the cooling fan clutch connector. 5. Start the engine. 6. Raise engine speed to 2,000 RPM for 2 minutes. Does the cooling fan clutch disengage?	-	Go to **Step 5**	Go to **Step 18**
5	1. Install a scan tool. 2. Start the engine. 3. With a scan tool, observe the Fan Speed and the Desired Fan Speed parameters in the powertrain control module Output Controls. 4. Command the cooling fan clutch to 100 percent. 5. Operate the engine at 2,000 RPM for 2 minutes. Is the Desired Fan Speed within the specified speed of the Fan Speed?	with 4.2L (LL8) 1,000 RPM with 5.3L (LM4) 2,000 RPM	Go to Diagnostic Aids	Go to **Step 6**
	1. Turn OFF the ignition. 2. Inspect the cooling fan and the drive belt for the following conditions: • A cracked drive belt • A loose or a worn drive belt			

6	• A misrouted drive belt • Oil leaks at the cooling fan clutch • A free-spinning cooling fan • A seized cooling fan clutch • A broken cooling fan 3. If the above conditions exist, refer to one of the following procedures: • **Cooling Fan and Shroud Replacement** • **Drive Belt Excessive Wear Diagnosis** in Engine Mechanical-4.8L, 5.3L, and 6.0L • **Drive Belt Tensioner Diagnosis** in Engine Mechanical-4.8L, 5.3L, and 6.0L Did you find and correct the condition?	-	Go to **Step 20**	Go to **Step 7**
7	1. Disconnect the cooling fan clutch connector at the fan shroud. 2. Connect a jumper wire between each of the cooling fan clutch circuits. 3. Connect a digital multimeter (DMM) between the clutch supply voltage circuit of the cooling fan clutch and ground. 4. Start the engine. 5. Command the Fan Control to 0 percent. Does the voltage measure greater than the specified value?	0.16 V	Go to **Step 10**	Go to **Step 8**
8	Command the Fan Control to 100 percent. Does the voltage fluctuate?	-	Go to **Step 11**	Go to **Step 9**
9	1. Turn OFF the ignition. 2. Disconnect the cooling fan relay. 3. Turn ON the ignition, with the engine OFF. 4. Probe the ignition 1 voltage circuit of the cooling fan relay with a test lamp connected to a good ground. Does the test lamp illuminate?	-	Go to **Step 12**	Go to **Step 17**
	Disconnect the cooling fan relay.			

10	Does the voltage measure greater than the specified value?	0.16 V	Go to **Step 14**	Go to **Step 11**
11	Test the cooling fan ground for an open. Refer to **Circuit Testing** and to **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 20**	Go to **Step 16**
12	Test the ground circuit of the cooling fan relay for an open or a high resistance. Refer to **Circuit Testing** and to **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 20**	Go to **Step 13**
13	Test the clutch supply voltage circuit of the cooling fan clutch for an open or a short to ground. Refer to **Circuit Testing** and to **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 20**	Go to **Step 15**
14	Test the clutch supply voltage circuit of the cooling fan clutch for a short to voltage. Refer to **Circuit Testing** and to **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 20**	-
15	Inspect for poor connections at the cooling fan relay. Refer to **Testing for Intermittent Conditions and Poor Connections** and to **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 20**	Go to **Step 19**
16	Inspect for poor connections at the harness connector of the cooling fan clutch. Refer to **Testing for Intermittent Conditions and Poor Connections** and to **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 20**	Go to **Step 18**
17	Repair the ignition 1 voltage circuit of the cooling fan relay. Refer to **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 20**	-
18	Replace the cooling fan clutch. Refer to **Fan Clutch Replacement**. Did you complete the replacement?	-	Go to **Step 20**	-
19	Replace the cooling fan relay. Did you complete the replacement?	-	Go to **Step 20**	-
	IMPORTANT: **Follow this procedure in order to clear DTC P0483 or DTC P0493 after making a repair.**			

20	1. Use the Clear DTC Information function of the scan tool. 2. Perform an ignition key cycle. 3. Operate the vehicle within the Conditions for Running in the DTC. Does the DTC reset?	-	Go to **Step 2**	System OK

DTC P0495

Circuit Description

The cooling fan relay sends a pulse width modulation (PWM) signal (12-14 volts) to the cooling fan by the cooling fan clutch supply voltage circuit. The powertrain control module (PCM) uses the PWM signal, which controls the speed of the cooling fan clutch by controlling the position of the oil control valve inside the clutch. If the cooling fan clutch RPM is to high when the PCM is commanding 0%, DTC P0495 will set.

Conditions for Running the DTC

- The engine is running.
- The system voltage is greater than 8.5 volts.
- The intake air temperature (IAT) is greater than -7°C (19°F).
- Zero percent duty cycle is commanded, and the engine RPM has been over 1800 RPM for at least 120 seconds.

Conditions for Setting the DTC

Cooling fan RPM exceeds 1600 RPM for 81 seconds.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) during the second consecutive trip in which the diagnostic test has been run and failed.
- The PCM will store the conditions as Freeze Frame/Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM turns the MIL OFF after the third consecutive trip that the diagnostic procedure has run and passed.
- Clear the DTC using the Clear DTC Information function of the scan tool.

Diagnostic Aids

- An inline connector could cause an intermittent DTC. Ensure to test for poor connections and pin retention at all inline connectors. Refer to system schematics for connector and locations.

- If the condition is not present, refer to **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems.
- If DTCs P0495 and P0113 are set and the weather is cold, the cooling fan code may be false. Clear DTC P0495, and after an IAT repair, check if the DTC will reset.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

2: This step ensures that the DTC has failed this ignition cycle. If the scan tool displays Passed, then the answer is No.

3: The cooling fan noise should increase as the cooling fan clutch engages. It can take up to 2 minutes for full cooling fan clutch engagement. If cooling fan clutch is previously fully engaged, then there will not be a noticeable change in cooling fan noise. Compare noise to a known good vehicle. If fan noise is louder than the known good vehicle, then answer Yes.

4: In the previous step the cooling fan clutch was fully engaged. This step tests to ensure that the cooling fan clutch will disengage. A noticeable noise difference should be heard between a fully engaged cooling fan clutch and a disengaged cooling fan clutch. The cooling fan clutch is completely disengaged when the excessive fan noise is not heard.

5: Tests the ability of the PCM to control the cooling fan speed. If answer to question is Yes, ensure to refer to all Diagnostic Aids.

6: Disconnecting the cooling fan clutch and running the engine ensure that the cooling fan clutch is not engaged. When rotating the cooling fan clutch it should spin freely. If not then the cooling fan clutch will not disengage.

DTC P0495

Step	Action	Yes	No
Schematic Reference: Engine Cooling Schematics **Connector End View Reference: Cooling System Connector End Views**			
1	Did you perform the Engine Cooling Diagnostic System Check?	Go to **Step 2**	Go to **Diagnostic System Check - Engine Cooling**
2	1. With a scan tool, observe the Powertrain DTC list. 2. Start the engine. 3. Operate the vehicle within the Conditions for Running in the DTC. Does the scan tool indicate the DTC Failed this ignition cycle?	Go to **Step 5**	Go to **Step 3**
	IMPORTANT: **DTC P1482, for 4.2L (LL8), and P0480, for 5.3L (LM4), will set when the cooling fan relay is disconnected.**		

3	1. Turn OFF the ignition. 2. Disconnect the cooling fan relay. 3. Connect a 10 amp fused jumper wire between the cooling fan clutch supply voltage circuit of the cooling fan clutch and the ignition 3 voltage circuit of the cooling fan relay. 4. Start the engine. 5. Raise engine speed to 2000 RPM for 2 minutes. Does the cooling fan clutch engage?	Go to **Step 4**	Go to **Step 5**
4	**IMPORTANT:** **Continuously excessive fan noise is due to the PCM commanding the cooling fan clutch to 100% engaged or a mechanical failure. If the fan noise decreases during this step, then this DTC is due to an electrical malfunction. Replacing the cooling fan clutch will not correct the condition.** 1. Turn OFF the ignition. 2. Remove the 10 amp fused jumper wire. 3. Install cooling fan relay. 4. Disconnect the cooling fan clutch connector. 5. Start the engine. 6. Raise engine speed to 2000 RPM for 2 minutes. Does the cooling fan clutch disengage?	Go to **Step 5**	Go to **Step 11**
5	1. Install a scan tool. 2. Start the engine. 3. With a scan tool, observe the Fan Speed parameter in the PCM ENG 2 data list. 4. Operate the engine at 2000 RPM for 2 minutes. Is the Fan Speed parameter less than 1600 RPM?	Go to Diagnostic Aids	Go to **Step 6**
6	1. Turn OFF the ignition. 2. Disconnect the cooling fan clutch connector. 3. Start the engine. 4. Run the engine at 2000 RPM for 2 minutes. 5. Turn OFF the engine. 6. Rotate the cooling fan 2 revolutions. Does the cooling fan rotate freely?	Go to **Step 7**	Go to **Step 13**

7	1. Disconnect the harness connector at the shroud. 2. Turn ON the ignition. 3. Connect a test lamp between the cooling fan clutch supply voltage circuit of the cooling fan clutch and ground. Does the test lamp illuminate?	Go to **Step 8**	Go to **Step 11**
8	Disconnect the cooling fan relay. Does the test lamp remain illuminated?	Go to **Step 9**	Go to **Step 10**
9	Repair the cooling fan clutch supply voltage circuit of the cooling fan clutch for a short to voltage. Refer to **Wiring Repairs** in Wiring Systems. Did you complete the repair?	Go to **Step 14**	-
10	Inspect for poor connections at the cooling fan relay. Refer to **Testing for Intermittent Conditions and Poor Connections** and to **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 14**	Go to **Step 12**
11	Inspect for poor connections at the cooling fan clutch. Refer to **Testing for Intermittent Conditions and Poor Connections** and to **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 14**	Go to **Step 13**
12	Replace the cooling fan relay. Did you complete the replacement?	Go to **Step 14**	-
13	Replace the cooling fan clutch. Refer to **Fan Clutch Replacement**. Did you complete the replacement?	Go to **Step 14**	-
14	1. Use the scan tool in order to clear the DTCs. 2. Operate the vehicle within the Conditions for Running in the DTC. Does the DTC reset?	Go to **Step 2**	System OK

DTC P0526

Circuit Description

The powertrain control module (PCM) uses the cooling fan speed signal in order to determine the actual fan speed in relation to the desired fan speed. The PCM uses the cooling fan speed signal in order to reduce the cooling fan noise and in order to maintain the powertrain cooling requirements. The PCM supplies power and ground to the clutch hall effect sensor of the cooling fan clutch. The hall effect sensor returns a signal pulse through the speed signal circuit in response to the reluctor track, which is located inside the fan clutch. If during operation, the PCM detects a loss of the cooling fan speed signal, DTC P0526 will set.

Conditions for Running the DTC

- The engine is running.
- System voltage is greater than 8.5 volts.

Conditions for Setting the DTC

- The PCM has detected a loss of cooling fan speed signal.
- The above condition is present for at least 11 seconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) during the second consecutive trip in which the diagnostic test has been run and failed.
- The PCM will store the condition as Freeze Frame/Failure Records data.
- The PCM commands the cooling fan to 100%.

Conditions for Clearing the MIL/DTC

- The PCM turns OFF the malfunction indicator lamp (MIL) after the third consecutive trip that the diagnostic test has run and passed.
- Clear the DTC by using the Clear DTC Information function of the scan tool.

Diagnostic Aids

- An inline connector could cause an intermittent DTC. Ensure to test for poor connections and pin retention at all inline connectors. Refer to system schematics for connectors and locations.
- If the condition is not present, refer to **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems.
- Disconnect the harness connector of the cooling fan clutch from the shroud. Inspect the exposed wires between the harness connector and the tubing.
- Inspect the cooling fan clutch harness in order to ensure that the clutch supply voltage circuit is not shorted to the following circuits:
  - The 5-volt reference circuit.
  - The cooling fan speed signal circuit.
  - The low reference circuit.
- DTC P0526 will set if the engine is started without the drive belt ON.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

2: Tests that the PCM receives a cooling fan speed signal through the cooling fan speed signal circuit. If answer to question is Yes, ensure to refer to all Diagnostic Aids.

3: Tests for the proper operation of the cooling fan clutch hall effect sensor. The voltage should fluctuate between 0 and 5 volts. If the voltage stays at 0 volts, the signal circuit is shorted to ground.

4: Tests for the proper operation of the 5-volt reference circuit and of the low reference circuit of the cooling fan clutch.

DTC P0526

Step	Action	Values	Yes	No
Schematic Reference: Engine Cooling Schematics **Connector End View Reference: Cooling System Connector End Views**				
1	Did you perform the Engine Cooling Diagnostic System Check?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Cooling**
2	1. Install a scan tool. 2. Start the engine. 3. With the scan tool, observe the Fan Speed parameter in the PCM ENG 2 data list. Does the scan tool indicate that the Fan Speed parameter is within the specified range?	Approximately 800 RPM	Go to Diagnostic Aids	Go to **Step 3**
3	1. Turn OFF the ignition. 2. Disconnect the cooling fan clutch harness connector at the shroud. 3. Connect a jumper wire between each of the following circuits: • The 5-volt reference circuit • The cooling fan speed signal circuit • The low reference circuit 4. Measure the voltage of the cooling fan speed sensor circuit and a good ground. 5. Turn ON the ignition, with the engine OFF. 6. Manually rotate the cooling fan clutch. Does the voltage change from 0 to 5 volts?	0-5 V	Go to **Step 10**	Go to **Step 4**
4	1. Disconnect the jumper wires. 2. Measure the voltage between the 5-volt reference circuit and the low reference circuit of the cooling fan clutch. Is the voltage measurement near than the	5 V		

	specified value?		Go to **Step 7**	Go to **Step 5**
5	1. Turn OFF the ignition. 2. Probe the low reference circuit of the cooling fan clutch with a test lamp connected to battery positive voltage. Does the test lamp illuminate?	-	Go to **Step 6**	Go to **Step 9**
6	Test the 5-volt reference circuit of the cooling fan clutch for a high resistance, or for an open. Refer to **Circuit Testing** and to **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 15**	Go to **Step 7**
7	Test the cooling fan speed signal circuit of the cooling fan clutch for a short to ground, for a high resistance, or for an open. Refer to **Circuit Testing** and to **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 15**	Go to **Step 8**
8	Test the cooling fan speed signal circuit of the cooling fan clutch for a short to voltage. Refer to **Circuit Testing** and to **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 15**	Go to **Step 11**
9	Test the low reference circuit of the cooling fan clutch for a high resistance or for an open. Refer to **Circuit Testing** and to **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 15**	Go to **Step 12**
10	1. Disconnect the jumper wires. 2. Test the cooling fan speed signal circuit of the cooling fan clutch for an open. Refer to **Circuit Testing** and to **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 15**	Go to **Step 12**
11	Inspect for a poor connection at the harness connector of the cooling fan clutch. Refer to **Testing for Intermittent Conditions and Poor Connections** and to **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 15**	Go to **Step 13**
12	Inspect for poor connections at the harness connector of the PCM. Refer to **Testing for Intermittent Conditions and Poor Connections** and to **Connector Repairs** in	-		

	Wiring Systems. Did you find and correct the condition?		Go to **Step 15**	Go to **Step 14**
13	Replace the cooling fan clutch. Refer to **Fan Clutch Replacement**. Did you complete the replacement?	-	Go to **Step 15**	-
14	**IMPORTANT:** **Program the PCM.** Replace the PCM. Refer to **Powertrain Control Module (PCM) Replacement** in Engine Controls-4.8L, 5.3L, and 6.0L.Did you complete the replacement?	-	Go to **Step 15**	-
15	1. Use the scan tool in order to clear the DTCs. 2. Operate the vehicle within the Conditions for Running in the DTC. Does the DTC reset?	-	Go to **Step 2**	System OK

DTC P1258

Circuit Description

The PCM uses the ECT sensor to monitor the engine for an over temperature condition. This condition occurs when the coolant temperature is above 132°C (270°F). When an over temperature condition is present, DTC P1258 will set. The PCM will disable two groups of four cylinders by turning OFF the fuel injectors. By switching between the two groups of cylinders, the PCM is able to reduce the temperature of the coolant.

Conditions for Running the DTC

- DTCS P0117, P0118, P1114, and P1115 are not active.
- The engine is running.

Conditions for Setting the DTC

The engine coolant temperature is above 132°C (270°F) for 10 seconds or more.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator Lamp (MIL) during the first trip in which the diagnostic test has been run and failed.
- The PCM will signal the IPC to turn ON the Service Engine Soon indicator.
- The PCM will alternately disable two groups of four cylinders by turning OFF the fuel injectors.
- The PCM will store conditions which were present when the DTC set as Freeze Frame and File Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF after 3 consecutive trips that the diagnostic has been run and passed.
- The history DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using the scan tool Clear DTC Information function.

DTC P1258

Step	Action	Yes	No
1	Was the Diagnostic System Check for Engine Cooling performed?	Go to **Step 2**	Go to **Diagnostic System Check - Engine Cooling**
2	Check the engine cooling fans for proper operation. Are the engine cooling fans operative?	Go to **Engine Overheating**	Go to **Symptoms - Engine Cooling**

DTC P1481

Circuit Description

The powertrain control module (PCM) uses the cooling fan speed signal in order to determine the actual fan speed in relation to the desired fan speed. The PCM uses the cooling fan speed signal in order to reduce the cooling fan noise and in order to maintain the powertrain cooling requirements. The PCM supplies power and ground to the clutch hall effect sensor of the cooling fan clutch. The hall effect sensor returns a signal pulse through the speed signal circuit in response to the reluctor track, which is located inside the fan clutch. If during operation, the PCM detects a loss of the cooling fan speed signal, DTC P1481 will set.

Conditions for Running the DTC

- The engine is running.
- System voltage is greater than 8.5 volts.

Conditions for Setting the DTC

- The PCM has detected a loss of cooling fan speed signal.
- The above condition is present for at least 11 seconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) during the second consecutive trip in which the diagnostic test has been run and failed.
- The PCM will store the condition as Freeze Frame/Failure Records data.
- The PCM commands the cooling fan clutch to 100%.

Conditions for Clearing the MIL/DTC

- The PCM turns OFF the malfunction indicator lamp (MIL) after the third consecutive trip that the

diagnostic test has run and passed.

- The history DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- Clear the DTC by using the Clear DTC Information function of the scan tool.

Diagnostic Aids

- An inline connector could cause an intermittent DTC. Ensure to test for poor connections and pin retention at all inline connectors. Refer to system schematics for connector and locations.
- If the condition is not present, refer to **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems.
- Disconnect the harness connector of the cooling fan clutch from the shroud. Inspect the exposed wires between the harness connector and the tubing.
- Inspect the cooling fan clutch harness in order to ensure that the clutch supply voltage circuit is not shorted to the following circuits: The 5-volt reference circuit. The cooling fan speed signal circuit. The low reference circuit.
- DTC P1481 will set if the engine is started without the drive belt ON.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

2: Tests that the PCM receives a cooling fan speed signal through the cooling fan speed signal circuit. If answer to question is Yes, ensure to refer to all Diagnostic Aids.

3: Tests for the proper operation of the clutch hall effect sensor.

4: Tests for the proper operation of the 5-volt reference circuit and of the low reference circuit of the cooling fan.

DTC P1481

Step	Action	Values	Yes	No
Schematic Reference: Engine Cooling Schematics **Connector End View Reference: Cooling System Connector End Views**				
1	Did you perform the Engine Cooling Diagnostic System Check?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Cooling**
2	1. Install a scan tool. 2. Start the engine. 3. With the scan tool, observe the Fan Speed parameter in the PCM ENG 3 data list. Does the scan tool indicate that the Fan Speed parameter is within the specified range?	550-800 RPM	Go to Diagnostic Aids	Go to **Step 3**

3	1. Turn OFF the ignition. 2. Disconnect the cooling fan clutch harness connector at the shroud. 3. Connect a jumper wire between each of the following circuits: • The 5-volt reference circuit • The cooling fan speed signal circuit • The low reference circuit 4. Connect a digital multimeter (DMM) to the cooling fan speed signal circuit and ground. 5. Turn ON the ignition with the engine OFF. 6. Manually rotate the cooling fan. Does the DMM voltage change?	0-5 V	Go to **Step 10**	Go to **Step 4**
4	1. Disconnect the jumper wires. 2. Measure the voltage between the 5-volt reference circuit and the low reference circuit of the cooling fan. Is the voltage measurement near than the specified value?	5 V	Go to **Step 5**	Go to **Step 7**
5	1. Turn OFF the ignition. 2. Probe the low reference circuit of the cooling fan clutch with a test lamp connected to battery positive voltage. Does the test lamp illuminate?	-	Go to **Step 6**	Go to **Step 9**
6	Test the 5-volt reference circuit of the cooling fan clutch for a high resistance, or for an open. Refer to **Circuit Testing** and to **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 15**	Go to **Step 7**
7	Test the cooling fan speed signal circuit of the cooling fan clutch for a short to ground, for a high resistance, or for an open. Refer to **Circuit Testing** and to **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 15**	Go to **Step 8**
8	Test the cooling fan speed signal circuit of the cooling fan clutch for a short to voltage. Refer to **Circuit Testing** and to **Wiring Repairs** in Wiring Systems.	-		

	Did you find and correct the condition?		Go to **Step 15**	Go to **Step 11**
9	1. Disconnect the PCM. 2. Test the low reference circuit of the cooling fan for a high resistance or for an open. Refer to **Circuit Testing** and to **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 15**	Go to **Step 12**
10	1. Disconnect the jumper wires. 2. Test the cooling fan speed signal circuit of the cooling fan clutch for an open. Refer to **Circuit Testing** and to **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 15**	Go to **Step 12**
11	Inspect for a poor connection at the harness connector of the cooling fan clutch. Refer to **Testing for Intermittent Conditions and Poor Connections** and to **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 15**	Go to **Step 13**
12	Inspect for poor connections at the harness connector of the PCM. Refer to **Testing for Intermittent Conditions and Poor Connections** and to **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 15**	Go to **Step 14**
13	Replace the cooling fan clutch. Refer to **Fan Clutch Replacement**. Did you complete the replacement?	-	Go to **Step 15**	-
14	**IMPORTANT:** **Program the PCM.** Replace the PCM. Refer to **Powertrain Control Module (PCM) Replacement** in Engine Controls-4.2L.Did you complete the replacement?	-	Go to **Step 15**	-
15	1. Use the scan tool in order to clear the DTCs. 2. Operate the vehicle within the Conditions for Running in the DTC. Does the DTC reset?	-	Go to **Step 2**	System OK

DTC P1482

Circuit Description

The powertrain control module (PCM) sends a pulse width modulation (PWM) signal of 0-12 volts via the cooling fan clutch control circuit to the cooling fan relay. The PCM uses this PWM to control the position of the oil control valve located inside the cooling fan clutch. If during operation, the PCM detects an improper circuit condition on the cooling fan clutch control circuit DTC P1482 will set.

Conditions for Running the DTC

System voltage is greater than 8.5 volts.

Conditions for Setting the DTC

- An improper voltage level has been detected on the cooling fan clutch control circuit.
- The above condition is present for at least 6 seconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) during the second consecutive trip in which the diagnostic test has been run and failed.
- The PCM stores the conditions present when the DTC sets as Freeze Frame/Failure Records data.
- The PCM commands the cooling fan clutch to 100%.

Conditions for Clearing the MIL/DTC

- The PCM turns OFF the malfunction indicator lamp (MIL) after the third consecutive trip the diagnostic has run and passed.
- The history DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using the scan tool Clear DTC Information function.

Diagnostic Aids

- An inline connector could cause an intermittent DTC. Ensure to test for poor connections and pin retention at all inline connectors. Refer to system schematics for connector and locations.
- If the condition is not present, refer to **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems.
- Disconnect the harness connector of the cooling fan clutch from the shroud. Inspect the exposed wires between the harness connector and the tubing.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

2: This step ensures that the DTC has failed this ignition cycle. If the scan tool displays Passed, then the

answer is No.

3: The cooling fan noise should increase as the cooling fan clutch engages. It can take up to 2 minutes for full cooling fan clutch engagement. If cooling fan clutch is previously fully engaged, then there will not be a noticeable change in cooling fan noise. Compare noise to a known good vehicle. If fan noise is louder than the known good vehicle, then answer Yes.

4: In the previous step the cooling fan clutch was fully engaged. This step tests to ensure that the cooling fan clutch will disengage. A noticeable noise difference should be heard between a fully engaged cooling fan clutch and a disengaged cooling fan clutch. The cooling fan clutch is completely disengaged when the excessive fan noise is not heard.

5: Tests for the ability of the PCM to control cooling fan clutch speed. If answer to question is Yes, ensure to refer to all Diagnostic Aids.

6: Verifies the ignition 1 voltage circuit of the cooling fan relay.

DTC P1482

Step	Action	Values	Yes	No
Schematic Reference: Engine Cooling Schematics **Connector End View Reference: Cooling System Connector End Views**				
1	Did you perform the Engine Cooling Diagnostic System Check?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Cooling**
2	1. With a scan tool, observe the Powertrain DTC list. 2. Start the engine. 3. Operate the vehicle within the Conditions for Running in the DTC. Does the scan tool indicate the DTC Failed this ignition cycle?	-	Go to **Step 5**	Go to **Step 3**
3	**IMPORTANT:** **DTC P1482, for 4.2L (LL8) will set when the cooling fan relay is disconnected.** 1. Turn OFF the ignition. 2. Disconnect the coolant fan relay. 3. Connect a 10 amp fused jumper wire between the cooling fan clutch supply voltage circuit of the cooling fan and the ignition 3 voltage circuit of the cooling fan relay. 4. Start the engine. 5. Raise engine speed to 2000 RPM for 2	-		

	minutes. Does the cooling fan engage?		Go to **Step 4**	Go to **Step 5**
4	**IMPORTANT:** **Continuously excessive fan noise is due to the PCM commanding the cooling fan to 100% engaged or a mechanical failure. If the fan noise decreases during this step, then this DTC is due to an electrical malfunction. Replacing the cooling fan will not correct the condition.** 1. Turn OFF the ignition. 2. Remove the 10 amp fused jumper wire. 3. Install cooling fan relay. 4. Disconnect the cooling fan clutch connector. 5. Start the engine. 6. Raise engine speed to 2000 RPM for 2 minutes. Does the cooling fan clutch disengage?	-	Go to **Step 5**	Go to **Step 17**
5	1. Install a scan tool. 2. Start the engine. 3. Observe the Fan Speed parameter in the powertrain control module Output Controls. 4. With a scan tool, command the fan speed to increase. Does the Fan Speed increase?	-	Go to Diagnostic Aids	Go to **Step 6**
6	1. Turn OFF the ignition. 2. Disconnect the cooling fan relay. 3. Turn ON the ignition, with the engine OFF. 4. Probe the ignition 1 voltage circuit of the cooling fan relay with a test lamp connected a good ground. Does the test lamp illuminate?	-	Go to **Step 7**	Go to **Step 11**
7	Test the cooling fan clutch control circuit of the cooling fan relay for a short to voltage or an open. Refer to **Circuit Testing** and **Wiring**	-		

	Repairs in Wiring Systems. Did you find and correct the condition?		Go to **Step 19**	Go to **Step 8**
8	Test the cooling fan clutch control circuit of the cooling fan relay for a short to ground. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 19**	Go to **Step 9**
9	1. Connect a test lamp to the cooling fan clutch control circuit of the cooling fan relay and ground. 2. Connect a digital multimeter (DMM) to the test lamp probe and ground. 3. Set the DMM to A/C range and select frequency. 4. Start the engine. 5. Verify that the Fan Control is commanded to 0%. Is the frequency less than the specified value?	OL	Go to **Step 14**	Go to **Step 10**
10	Command the Fan Control to 100%. Does the frequency fluctuate?	-	Go to **Step 13**	Go to **Step 14**
11	Inspect the Eng Fan fuse. Is the fuse open?	-	Go to **Step 12**	Go to **Step 15**
12	Test the cooling fan clutch control circuit of the cooling fan relay for a short to ground. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 19**	Go to **Step 15**
13	Inspect for poor connections at the cooling fan relay. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 19**	Go to **Step 16**
14	Inspect for poor connections at the harness connector of the PCM. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 19**	Go to **Step 18**
15	Repair the ignition 1 voltage circuit of the cooling fan relay. Refer to **Wiring Repairs** in Wiring Systems. Did you complete the repair?	-	Go to **Step 19**	-
16	Replace the cooling fan relay.	-		-

	Did you complete the replacement?		Go to **Step 19**	
17	Replace the cooling fan clutch. Refer to **Fan Clutch Replacement** Did you complete the replacement?	-	Go to **Step 19**	-
18	**IMPORTANT:** **Perform the programming procedure for the PCM.** Replace the PCM. Refer to **Powertrain Control Module (PCM) Replacement** in Engine Controls-4.2L.Did you complete the replacement?	-	Go to **Step 19**	-
19	1. Use the scan tool in order to clear the DTCs. 2. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text. Does the DTC reset?	-	Go to **Step 2**	System OK

DTC P1484

Circuit Description

The cooling fan relay sends a pulse width modulation (PWM) signal of 12-14 volts to the cooling fan clutch through the cooling fan clutch supply voltage circuit. The powertrain control module (PCM) uses this PWM signal in order to control the speed of the cooling fan clutch. The signal controls the position of the oil control valve inside the cooling fan clutch. If the cooling fan RPM is different than the PCM is expecting, DTC P1484 will set. The actual cooling fan RPM vs the desired cooling fan RPM is not always exactly the same. There can be up to an 800-RPM difference.

Conditions for Running the DTC

- The engine is running.
- The system voltage is greater than 8.5 volts.
- The intake air temperature (IAT) is greater than -7°C (19°F).
- DTCs P1481 and P1482 are not set.
- The engine speed is less than 3200 RPM.
- The engine speed is not changing more than 250 RPM for 5 seconds.
- Fan command is greater than 0%.

Conditions for Setting the DTC

- The maximum allowable error of 1000 RPM in the cooling fan speed occurs for 100 seconds.

- The PCM detects that the cooling fan clutch is locked up.

Action Taken When the DTC Sets

- The Reduced Engine Power indicator illuminates only if the PCM detects that the cooling fan clutch is locked up.
- The PCM illuminates the malfunction indicator lamp (MIL) during the second consecutive trip in which the diagnostic test has been run and failed.
- The PCM will store the conditions as Freeze Frame/Failure Records data.
- The PCM commands the cooling fan clutch to 100%.

Conditions for Clearing the MIL/DTC

IMPORTANT: Follow this procedure in order to clear DTC P1484 after completing a repair.

1. Use the Clear DTC Information function on the scan tool.
2. Perform an ignition key cycle.

The PCM turns OFF the MIL after the third consecutive trip that the diagnostic test has run and passed.

The history DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.

Diagnostic Aids

- An inline connector could cause an intermittent DTC. Ensure to test for poor connections and pin retention at all inline connectors. Refer to system schematics for connector and locations.
- If the condition is not present, refer to **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems.
- Disconnect the harness connector of the cooling fan clutch from the shroud. Inspect the exposed wires between the harness connector and the tubing.
- If DTCs P1484 and P0113 are set, and the weather conditions are cold, the cooling fan code may be false. Clear DTC P1484, and after an IAT sensor check, allow the DTC to reset.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

2: This step ensures that the DTC has failed this ignition cycle. If the scan tool displays Passed, then the answer is No.

3: The cooling fan noise should increase as the cooling fan clutch engages. It can take up to 2 minutes for full cooling fan clutch engagement. If cooling fan clutch is previously fully engaged, then there will not be a noticeable change in cooling fan noise. Compare noise to a known good vehicle. If fan noise is louder than the known good vehicle, then answer Yes.

4: In the previous step the cooling fan clutch was fully engaged. This step tests to ensure that the cooling

fan clutch will disengage. A noticeable noise difference should be heard between a fully engaged cooling fan clutch and a disengaged cooling fan clutch. The cooling fan clutch is completely disengaged when the excessive fan noise is not heard.

5: Tests the PCM's ability to control the cooling fan. If answer to question is Yes, ensure to refer to all Diagnostic Aids.

6: Inspect for a mechanical condition which causes the DTC to set.

7: Tests for voltage on the cooling fan clutch supply voltage circuit of the cooling fan clutch. The cooling fan clutch connector is a seal connector. You must use jumper wires for testing or damage to wiring or connector could happen.

8: Tests the cooling fan relay for a PWM signal on the cooling fan clutch supply voltage circuit of the cooling fan clutch.

DTC P1484

Step	Action	Values	Yes	No
Schematic Reference: Engine Cooling Schematics **Connector End View Reference: Cooling System Connector End Views**				
1	Did you perform the Engine Cooling Diagnostic System Check?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Cooling**
2	1. With a scan tool, observe the Powertrain DTC list. 2. Start the engine. 3. Operate the vehicle within the Conditions for Running in the DTC. Does the scan tool indicate the DTC Failed this ignition cycle?	-	Go to **Step 5**	Go to **Step 3**
3	**IMPORTANT:** **DTC P1482, for 4.2L (LL8) will set when the cooling fan relay is disconnected.** 1. Turn OFF the ignition. 2. Disconnect the coolant fan relay. 3. Connect a 10 amp fused jumper wire between the cooling fan clutch supply voltage circuit of the cooling fan and the ignition 3 voltage circuit of the cooling fan relay. 4. Start the engine. 5. Raise engine speed to 2000 RPM for 2 minutes.	-		

	Does the cooling fan engage?		Go to **Step 4**	Go to **Step 5**
4	**IMPORTANT:** **Continuously excessive fan noise is due to the PCM commanding the cooling fan to 100% engaged or a mechanical failure. If the fan noise decreases during this step, then this DTC is due to an electrical malfunction. Replacing the cooling fan clutch will not correct the condition.** 1. Turn OFF the ignition. 2. Remove the 10 amp fused jumper wire. 3. Install cooling fan relay. 4. Disconnect the cooling fan clutch connector. 5. Start the engine. 6. Raise engine speed to 2000 RPM for 2 minutes. Does the cooling fan clutch disengage?	-	Go to **Step 5**	Go to **Step 18**
5	1. Install a scan tool. 2. Start the engine. 3. With a scan tool, observe the Fan Speed and the Desired Fan Speed parameters in the powertrain control module Output Controls. 4. Command the cooling fan clutch to 100%. 5. Operate the engine at 2000 RPM for 2 minutes. Is the Desired Fan Speed within the specified speed of the Fan Speed?	1000 RPM	Go to Diagnostic Aids	Go to **Step 6**
	1. Turn OFF the ignition. 2. Inspect the cooling fan and the drive belt for the following conditions: • A cracked drive belt • A loose or a worn drive belt • A misrouted drive belt • Oil leaks at the cooling fan clutch • A free-spinning cooling fan • A seized cooling fan clutch • A broken cooling fan			

6	3. If the above conditions exist, refer to one of the following procedures: • **Cooling Fan and Shroud Replacement** • **Drive Belt Excessive Wear Diagnosis** in Engine Mechanical-4.2L • **Drive Belt Tensioner Diagnosis** in Engine Mechanical-4.2L Did you find and correct the condition?	-	Go to **Step 20**	Go to **Step 7**
7	1. Disconnect the cooling fan clutch connector at the fan shroud. 2. Connect a jumper wire between each of the cooling fan clutch circuits. 3. Connect a digital multimeter (DMM) between the clutch supply voltage circuit of the cooling fan clutch and ground. 4. Start the engine. 5. Command the Fan Control to 0%. Does the voltage measure greater than the specified value?	0.16 V	Go to **Step 10**	Go to **Step 8**
8	Command the fan control to 100%. Does the voltage fluctuate?	-	Go to **Step 11**	Go to **Step 9**
9	1. Turn OFF the ignition. 2. Disconnect the cooling fan relay. 3. Turn ON the ignition, with the engine OFF. 4. Probe the ignition 1 voltage circuit of the cooling fan relay with a test lamp connected to a good ground. Does the test lamp illuminate?	-	Go to **Step 12**	Go to **Step 17**
10	Disconnect the cooling fan relay. Does the voltage measure greater than the specified value?	0.16 V	Go to **Step 14**	Go to **Step 11**
11	Test the cooling fan clutch ground for an open. Refer to **Circuit Testing** and to **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 20**	Go to **Step 16**
	Test the ground circuit of the cooling fan relay for an open or a high resistance. Refer to **Circuit**			

12	**Testing** and to **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 20**	Go to **Step 13**
13	Test the clutch supply voltage circuit of the cooling fan clutch for an open or a short to ground. Refer to **Circuit Testing** and to **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 20**	Go to **Step 15**
14	Test the clutch supply voltage circuit of the cooling fan clutch for a short to voltage. Refer to **Circuit Testing** and to **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 20**	-
15	Inspect for poor connections at the cooling fan relay. Refer to **Testing for Intermittent Conditions and Poor Connections** and to **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 20**	Go to **Step 19**
16	Inspect for poor connections at the harness connector of the cooling fan clutch. Refer to **Testing for Intermittent Conditions and Poor Connections** and to **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 20**	Go to **Step 18**
17	Repair the ignition 1 voltage circuit of the cooling fan relay. Refer to **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 20**	-
18	Replace the cooling fan clutch. Refer to **Fan Clutch Replacement**. Did you complete the replacement?	-	Go to **Step 20**	-
19	Replace the cooling fan relay. Did you complete the replacement?	-	Go to **Step 20**	-
20	**IMPORTANT:** **Follow this procedure in order to clear DTC P1484 after making a repair.** 1. Use the Clear DTC Information function of the scan tool. 2. Perform an ignition key cycle. 3. Operate the vehicle within the Conditions for Running in the DTC. Does the DTC reset?	-	Go to **Step 2**	System OK

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** in Wiring Systems.
- 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** in Wiring Systems.

Symptom List

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

- **Engine Coolant Temperature Indicator Always On**
- **Engine Overheating**
- **Loss of Coolant**
- **Thermostat Diagnosis**
- **Coolant Heater Inoperative**
- **Engine Fails To Reach Normal Operating Temperature**
- **Excessive Fan Noise**

ENGINE COOLANT TEMPERATURE INDICATOR ALWAYS ON

Engine Coolant Temperature Indicator Always On

Step	Action	Yes	No
Connector End View Reference: Cooling System Connector End Views			
1	Did you perform the Engine Cooling Diagnostic System Check?	Go to **Step 2**	Go to **Diagnostic System Check - Engine Cooling**
2	Start the engine. Does the engine coolant temperature (ECT) indicator illuminate?	Go to **Step 3**	Go to **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems
	With the scan tool, observe the engine coolant temperature parameter in the powertrain control		

3	module (PCM) data list. Does the scan tool indicate that the coolant temperature is within the temperature range shown on the temperature gage?	Go to **Engine Overheating**	Go to **Step 4**
4	Replace the instrument panel cluster (IPC). Refer to **Instrument Panel Cluster (IPC) Replacement** in Instrument Panel, Gages, and Console. Did you complete the repair?	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**

ENGINE OVERHEATING

Engine Overheating

Step	Action	Values	Yes	No
1	Inspect for a loss of system pressure and/or coolant. Is there a loss of system pressure and/or coolant?	-	Go to **Step 2**	Go to **Step 3**
2	Inspect and repair any faulty hose connections or radiator cap. Fill the system to the proper level, then retest. Does the engine still overheat beyond the specified value?	125°C (257° F)	Go to **Step 3**	System OK
3	Inspect the coolant concentration for low temperature protection below the specified value. Is the proper low temperature protection present?	-37°C (-34°F)	Go to **Step 5**	Go to **Step 4**
4	Replace the coolant. Refer to **Draining and Filling Cooling System (Body Vin Code 6)**. Does the engine still overheat?	-	Go to **Step 5**	System OK
5	Inspect the drive belt for excessive wear or low tension. Is the drive belt worn or is the tension too low?	-	Go to **Step 6**	Go to **Step 7**
6	Replace the drive belt. Refer to **Drive Belt Replacement** in Engine Mechanical - 4.2L. Does the engine still overheat?	-	Go to **Step 7**	System OK
7	Inspect the radiator fins for obstruction. Are the radiator fins obstructed?	-	Go to **Step 8**	Go to **Step 9**
8	Inspect and clean the radiator. Refer to **Radiator Cleaning**. Does the engine still overheat?	-	Go to **Step 9**	System OK
9	Inspect the water pump for physical damage. Is the water pump damaged or inoperative?	-	Go to **Step 10**	Go to **Step 11**
10	Replace the water pump. Refer to **Water Pump Replacement (LL8)** or **Water Pump Replacement (LM4)**.	-		

	Does the engine still overheat?		Go to **Step 11**	System OK
11	Inspect the cooling system passages for obstruction. Is the cooling system passage blocked?	-	Go to **Step 12**	Go to **Step 13**
12	Inspect and flush the system. Refer to **Flushing**. Does the engine still overheat?	-	Go to **Step 13**	System OK
13	Inspect the electro-viscous fan. Is the electro-viscous fan inoperative?	-	Go to **Step 14**	Go to **Step 15**
14	Replace the electro-viscous fan. Does the engine still overheat?	-	Go to **Step 15**	System OK
15	Inspect for a stuck thermostat. Refer to **Thermostat Diagnosis**. Is the thermostat stuck in the closed position?	-	Go to **Step 16**	Go to **Step 17**
16	Replace the thermostat. Refer to **Thermostat Replacement (4.2L Engine)** or **Thermostat Replacement (5.3L Engine)**. Does the engine still overheat?	-	Go to **Step 17**	System OK
17	The following factors may cause the engine to overheat: • A heavy vehicle payload • The A/C system • Excess engine oil • Restricted air flow through the radiator • Extreme air temperature Correct or repair as necessary. Does the engine still overheat?	-	-	System OK

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 **Symptoms - Engine Cooling**
2	Repair any present DTCs. Refer to **Diagnostic Trouble Code (DTC) List**. Is the action complete?	Go to **Step 3**	-
3	Inspect the coolant level. Is the coolant at the proper level?	Go to **Step 5**	Go to **Step 4**
	Fill the cooling system to the proper level. Refer to **Draining and Filling Cooling System (Body Vin**		

4	**Code 6)**. Is the action complete?	Go to **Step 5**	-
5	If the engine is suspected to have a coolant leak into the cylinder, the coolant can hydraulically lock the cylinder. Does the engine crankshaft rotate?	Go to **Step 6**	Go to **Step 30**
6	Engine overheating can cause a loss of coolant. Is the engine overheating?	Go to **Step 31**	Go to **Step 7**
7	Extended engine operation with a low coolant level can cause engine internal component failure. Is the engine knocking?	Go to **Step 33**	Go to **Step 8**
8	1. Idle the engine at normal operating temperature. 2. Inspect for heavy white smoke coming out of the exhaust pipe. Is a heavy white smoke present from the exhaust pipe?	Go to **Step 9**	Go to **Step 10**
9	• 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. Does the white smoke have a burning coolant type odor?	Go to **Step 32**	Go to **Step 10**
10	With the engine idling, inspect the coolant recovery system. Does the coolant recovery system discharge coolant while the engine is idling?	Go to **Step 15**	Go to **Step 11**
11	Visually inspect the hoses, pipes and hose clamps at the following locations: • Auxiliary heater • Coolant bypass • Coolant reservoir • Heater • Radiator Are any of the hoses, clamps or pipes leaking?	Go to **Step 21**	Go to **Step 12**
	Visually inspect the following components: • Block heater • Coolant pressure cap • Coolant reservoir		

12	• Core plugs • Cylinder head gaskets • Engine block • Intake manifold • Radiator • Thermostat • Water pump Are any of the listed components leaking?	Go to **Step 21**	Go to **Step 13**
13	1. Pressure test the cooling system. Refer to **Cooling System Leak Testing**. 2. Visually inspect the components listed in steps 11 and 12 again. Are any leaks present?	Go to **Step 21**	Go to **Step 14**
14	Pressure test the coolant pressure cap. Refer to **Pressure Cap Testing**. Does the coolant pressure cap hold pressure?	Go to **Step 16**	Go to **Step 22**
15	Pressure test the coolant pressure cap. Refer to **Pressure Cap Testing**. Does the coolant pressure cap hold pressure?	Go to **Step 34**	Go to **Step 22**
16	Inspect for the following conditions: • A coolant smell inside of the vehicle. • Coolant in the HVAC module drain tube. • Coolant on the vehicles floor covering under the HVAC module. Is coolant present?	Go to **Step 23**	Go to **Step 17**
17	If equipped with auxiliary heating, inspect for the following: • A coolant smell inside of the vehicle. • Coolant in the auxiliary HVAC module drain tube. • Coolant on the floor covering near the auxiliary HVAC module. Is coolant present?	Go to **Step 24**	Go to **Step 18**

18	Inspect the underside of the oil fill cap for a gray/white milky substance. Is there a milky substance under the oil fill cap?	Go to **Step 19**	Go to **Step 20**
19	Inspect the engine oil fluid level indicator for a gray/white milky substance. Is there a milky substance on the engine fluid level indicator?	Go to **Step 25**	Go to **Step 20**
20	Inspect the automatic transmission oil fluid level indicator, if equipped, for a gray/white milky substance. Is there a milky substance on the automatic transmission fluid level indicator?	Go to **Step 27**	Go to **Step 35**
21	Repair or replace the leaking component. Refer to the appropriate repair. Is the repair complete?	Go to **Step 35**	-
22	Replace the coolant pressure cap. Is the repair complete?	Go to **Step 35**	-
23	Replace the heater core. Refer to **Heater Core Replacement** in Heating, Ventilation and Air Conditioning. Is the repair complete?	Go to **Step 35**	-
24	Replace the auxiliary heater core. Refer to **Heater Core Replacement - Auxiliary** in Heating, Ventilation and Air Conditioning. Is the repair complete?	Go to **Step 35**	-
25	1. Remove the engine oil cooler lines from the radiator, if equipped. 2. Pressure test the cooling system. Refer to **Cooling System Leak Testing**. 3. Inspect the engine oil cooler for coolant. Is coolant present in the engine oil cooler?	Go to **Step 26**	Go to **Step 29**
26	1. Replace the radiator. Refer to **Radiator Replacement (SWB - Short Wheel Base)** or **Radiator Replacement (LWB - Long Wheel Base)**. 2. Service the engine oil and filter. Refer to **Engine Oil and Oil Filter Replacement** in Engine Mechanical - 4.2L or **Engine Oil and Oil Filter Replacement** in Engine Mechanical - 4.8L, 5.3L and 6.0L. Is the repair complete?	Go to **Step 35**	-
	1. Remove the transmission oil cooler lines from		

27	the radiator. 2. Pressure test the cooling system. Refer to **Cooling System Leak Testing**. 3. Inspect the transmission oil cooler for coolant. Is coolant present in the transmission oil cooler?	Go to **Step 28**	Go to **Step 29**
28	1. Replace the radiator. Refer to **Radiator Replacement (SWB - Short Wheel Base)** or **Radiator Replacement (LWB - Long Wheel Base)**. 2. Service the automatic transmission. Refer to **Automatic Transmission Fluid/Filter Replacement** in Automatic Transmission - 4L60-E/4L65-E. Is the repair complete?	Go to **Step 35**	-
29	Install the cooler lines to the radiator. Is the repair complete?	Go to **Step 35**	-
30	Repair the engine no crank condition. Refer to **Engine Will Not Crank - Crankshaft Will Not Rotate** in Engine Mechanical - 4.2L or **Engine Will Not Crank - Crankshaft Will Not Rotate** in Engine Mechanical - 4.8L, 5.3L and 6.0L. Is the repair complete?	Go to **Step 35**	-
31	Repair the engine overheating condition. Refer to **Engine Overheating**. Is the repair complete?	Go to **Step 35**	-
32	Repair the engine internal coolant leak. Refer to **Coolant in Combustion Chamber** in Engine Mechanical - 4.2L or **Coolant in Combustion Chamber** in Engine Mechanical - 4.8L, 5.3L and 6.0L. Is the repair complete?	Go to **Step 35**	-
33	Repair the engine knock. Refer to **Lower Engine Noise, Regardless of Engine Speed** in Engine Mechanical - 4.2L or **Lower Engine Noise, Regardless of Engine Speed** in Engine Mechanical - 4.8L, 5.3L and 6.0L. Is the repair complete?	Go to **Step 35**	-
34	Repair the combustion pressure in the cooling system problem. Refer to **Cylinder Leakage Test** in Engine Mechanical - 4.2L or **Cylinder Leakage Test** in Engine Mechanical - 4.8L, 5.3L and 6.0L. Is the repair complete?	Go to **Step 35**	-
35	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 Diagnosis

Step	Action	Yes	No
IMPORTANT: **The temperature stick is a pencil-like device that has a wax material containing certain chemicals which melt at a given temperature. Use the temperature sticks to determine a thermostat's operating temperature by rubbing 87°C (188°F) and 97°C (206°F) sticks on the thermostat housing. The marks made by the sticks should melt when coolant temperatures reach 87°C (188°F) and 97°C (206°F), respectively. These temperatures are the normal operating range of the thermostat.**			
1	1. Remove the radiator cap. 2. Rub a 87°C (188°F) and a 97°C (206°F) **J 24731** on the engine water outlet housing which connects to the radiator inlet hose. See **Special Tools and Equipment**. 3. Warm up the engine at fast idle. 4. Check for coolant flow before engine reaches proper operating temperature. Is there coolant flow before either mark begins to melt?	Go to **Step 2**	Go to **Step 3**
2	The thermostat may be stuck open, prematurely opening or missing. 1. Replace the thermostat. Refer to **Thermostat Replacement (4.2L Engine)** or **Thermostat Replacement (5.3L Engine)**. 2. Recheck the thermostat opening temperature as in Step 1. Does the engine still fail to reach proper operating temperature?	Go to **Engine Fails To Reach Normal Operating Temperature**	System OK
3	Does the coolant begin to flow by the time one or both of the temperature stick marks on the engine water outlet housing begin to melt?	System OK	Go to **Step 4**
4	The thermostat may be stuck closed or opening too slowly. 1. Replace the thermostat. Refer to **Thermostat Replacement (4.2L Engine)** or **Thermostat Replacement (5.3L Engine)**. 2. Recheck the thermostat opening temperature as in Step 1. Go to **Engine**		

	Does the engine still overheat?	**Overheating**	System OK

COOLANT HEATER INOPERATIVE

Coolant Heater Inoperative

Step	Action	Yes	No
Connector End View Reference: Cooling System Connector End Views			
1	Did you perform the necessary inspections?	Go to **Step 2**	Go to **Symptoms - Engine Cooling**
2	Test the engine coolant heater power supply cord for an open or short to ground. Refer to **Circuit Testing** in Wiring Systems. Did you find a condition?	Go to **Step 3**	Go to **Step 4**
3	Replace the engine coolant heater power supply cord. Refer to **Coolant Heater Cord Replacement**. 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 **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 6**	Go to **Step 5**
5	Replace the engine coolant heater. Refer to **Coolant Heater Replacement (LL8)** or **Coolant Heater Replacement (LM4)**. 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**

ENGINE FAILS TO REACH NORMAL OPERATING TEMPERATURE

Engine Fails To Reach Normal Operating Temperature

Step	Action	Yes	No
1	Did you review the Symptoms-Engine Cooling Diagnosis information and perform the necessary inspections?	Go to **Step 2**	Go to **Symptoms - Engine Cooling**
2	Verify that the engine does not reach normal operating temperature. Does the engine reach normal operating temperature?	System OK	Go to **Step 3**
3	Inspect the coolant level. Is the coolant level below the add mark?	Go to **Step 4**	Go to **Step 5**
4	1. Add coolant as necessary. Refer to **Draining and Filling Cooling System (Body Vin Code 6)**. 2. Perform a cooling system pressure test.		

	Is the repair complete?	System OK	Go to **Step 5**
5	Inspect for a stuck open, missing, or wrong type of thermostat. Refer to **Thermostat Diagnosis**. Is the thermostat operating properly?	System OK	Go to **Step 6**
6	Install the correct replacement thermostat. Refer to **Thermostat Replacement (4.2L Engine)** or **Thermostat Replacement (5.3L Engine)**. Is the repair complete?	System OK	Go to **Step 7**
7	Run the engine in order to verify the repair. Does the engine fail to reach normal operating temperature?	Go to **Step 1**	System OK

PRESSURE CAP TESTING

Tools required

- **J 24460-01** Cooling System Pressure Tester. See **Special Tools and Equipment**.
- **J 42401** Radiator Cap / Surge Tank Test Adapter. See **Special Tools and Equipment**.

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.

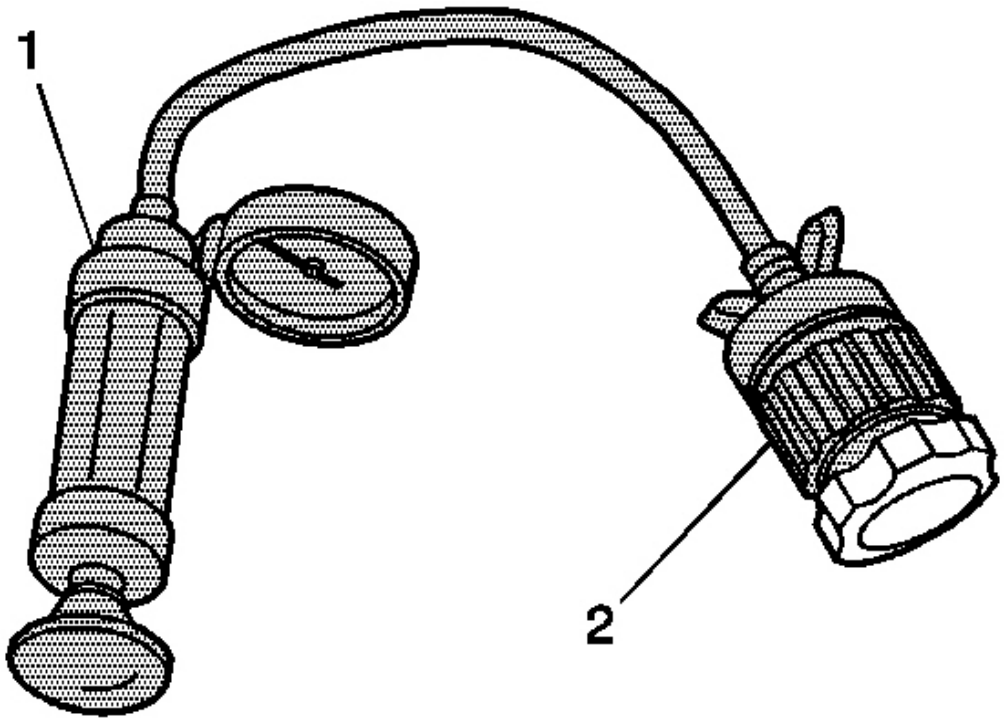


Fig. 3: Pressure Testing Radiator Cap
Courtesy of GENERAL MOTORS CORP.

3. Use the **J 24460-01** (1) with **J 42401** (2) in order to test the pressure cap. See **Special Tools and Equipment**.
4. Test the pressure cap for the following conditions:
   - Pressure release when the exceeds the pressure rating of the pressure cap **J 24460-01** . See **Special Tools and Equipment**.
   - 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 and Equipment**.

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**.
3. Wash the pressure cap mating surface with water.

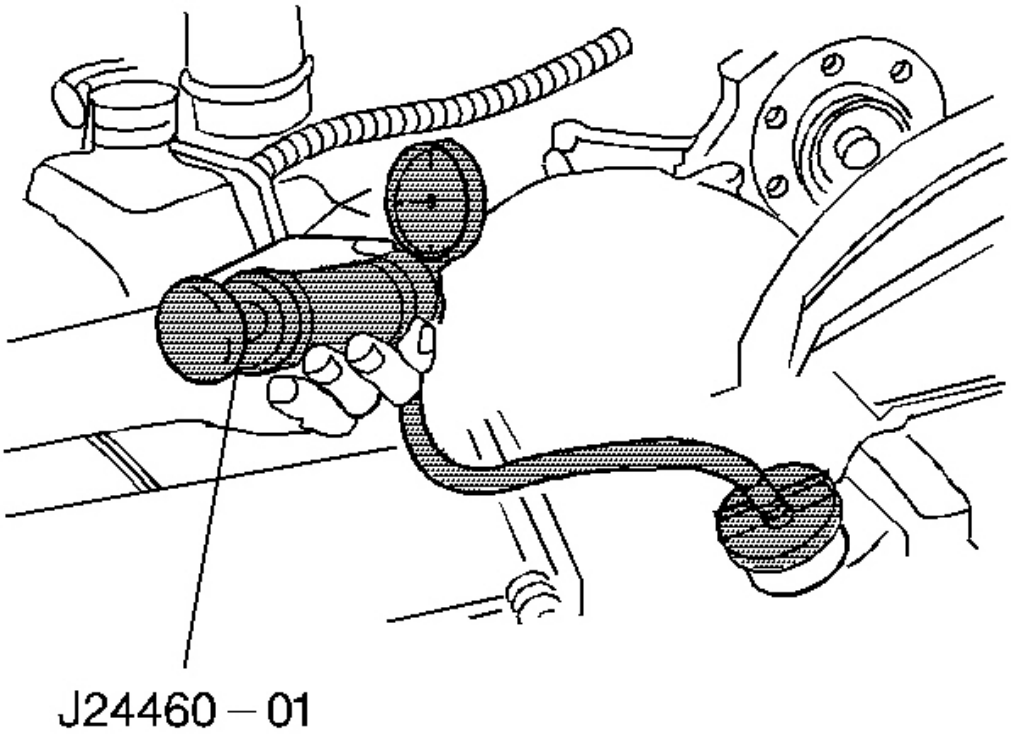


Fig. 4: Pressure Testing Cooling System Using J 24460-01
Courtesy of GENERAL MOTORS CORP.

4. Use the **J 24460-01** in order to apply pressure to the cooling system. See **Special Tools and Equipment**.

   Do not exceed the pressure cap rating.

5. The cooling system should hold the rated pressure for at least 2 minutes.

   Observe the gauge for any pressure loss.

6. Repair any leaks as required.

EXCESSIVE FAN NOISE

Circuit Description

The electro-viscous clutch is controlled by the PCM. The PCM controls a solenoid that regulates a fluid pressure that controls slip of the fan clutch. Internal to the fan is a centrifugal fluid pump, solenoid, hall effect sensor, valve lever and a hydraulic fluid. There is two chambers for the fluid, these two chambers are separated

by a valve lever. The first chamber is the storage chamber, which holds excess fluid. The second chamber is the working chamber. As the pressure of the fluid is increased in the working chamber the amount of slip the fan has is decreased. The position of the valve lever is controlled by an electric solenoid.

Diagnostic Aids

- Turning off the engine when the cooling fan clutch is engaged, the cooling fan clutch will be engaged at engine restart. This may cause an excessive noise concern. This is a normal condition.
- If the engine is turned off for an extended period of time, usually over night, the hydraulic fluid may fill working chamber and cause limited slip at engine restart. This may cause the excessive noise condition. This is a normal condition.
- To engage the cooling fan clutch, it can take up to 2 minutes for a 100% command with the engine at 2000 RPM. The lower the engine speed, the longer it will take the cooling fan clutch to engage.
- To disengage the cooling fan clutch, it can take up to 2 minutes with the engine at 2000 RPM. The lower the engine speed, the longer it will take to disengage.
- In lower ambient air temperatures the cooling fan clutch will engage in less time, however it will take longer to disengage.
- An inline connector could cause an intermittent DTC. Ensure to test for poor connections and pin retention at all inline connectors. Refer to system schematics for connector and locations.
- If the condition is not present, refer to **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems.

Test Description

The numbers below refer to the step numbers in the diagnostic table.

2: There should be no binding or increased resistance as the cooling fan clutch is rotated.

4: The cooling fan noise should increase as the cooling fan clutch engages. It can take up to 2 minutes for full cooling fan clutch engagement. If cooling fan clutch is previously fully engaged, then there will not be a noticeable change in cooling fan noise. Compare noise to a known good vehicle. If fan noise is louder than the known good vehicle, then answer Yes.

5: In the previous step the cooling fan clutch was fully engaged. This step tests to ensure that the cooling fan clutch will disengage. A noticeable noise difference should be heard between a fully engaged cooling fan clutch and a disengaged cooling fan. The cooling fan clutch is completely disengaged when the excessive fan noise is not heard.

6: This step clears DTC that were set during previous steps. Test driving the vehicle will attempt to set DTC not previous found in the Engine Cooling Diagnostic Check. If no DTC is set the condition is normal operation of the cooling fan.

Excessive Fan Noise

Step	Action	Yes	No
Schematic Reference: Engine Cooling Schematics **Connector End View Reference: Cooling System Connector End Views** DEFINITION: The cooling fan clutch has excessive fan noise.			

1	Did you perform the Engine Cooling Diagnostic System Check?	Go to **Step 2**	Go to **Diagnostic System Check - Engine Cooling**
2	Rotate the cooling fan 3 complete revolutions? Is the resistance of the cooling fan clutch even through out each rotation?	Go to **Step 4**	Go to **Step 3**
3	Inspect the cooling fan clutch for proper installation. Refer to **Fan Clutch Replacement**. Did you find and correct the condition?	Go to **Step 9**	Go to **Step 7**
4	**IMPORTANT:** **DTC P1482, for 4.2L (LL8), and P0480, for 5.3L (LM4), will set when the cooling fan relay is disconnected.** 1. Turn OFF the ignition. 2. Disconnect the coolant fan relay. 3. Connect a 10-amp fused jumper wire between the cooling fan clutch supply voltage circuit of the cooling fan and the ignition 3 voltage circuit of the cooling fan relay. 4. Start the engine. 5. Raise engine speed to 2,000 RPM for 2 minutes. Does the cooling fan clutch engage?	Go to **Step 5**	Go to **Step 7**
5	**IMPORTANT:** **Continuous excessive fan noise is due to a mechanical failure. If the fan noise decreases during this step, then there is an electrical malfunction. Replacing the cooling fan clutch will not correct the condition.** 1. Turn OFF the ignition. 2. Remove the 10-amp fused jumper wire. 3. Install cooling fan relay. 4. Disconnect the cooling fan clutch connector. 5. Start the engine. 6. Raise engine speed to 2,000 RPM for 2 minutes. Does the cooling fan disengage?	System OK	Go to **Step 6**
	1. Turn OFF the ignition. 2. Connect the cooling fan clutch connector. 3. Turn ON the ignition, with the engine OFF. 4. With a scan tool, clear all DTC.		

6	5. Start the engine. 6. Test drive vehicle. 7. With a scan tool, observe the DTC list. Does the scan tool display any cooling system DTC?	Go to **Diagnostic Trouble Code (DTC) List**	System OK
7	Inspect for poor connections at the harness connector of the cooling fan clutch. Refer to **Testing for Intermittent Conditions and Poor Connections** and to **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 9**	Go to **Step 8**
8	Replace the cooling fan clutch. Refer to **Fan Clutch Replacement**. Did you complete the replacement?	Go to **Step 9**	-
9	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to **Step 3**

FAN CLUTCH DIAGNOSIS

Fan Clutch Diagnosis

Step	Action	Yes	No
DEFINITION: Testing the engagement and disengagement of the fan clutch.			
1	Were you sent here from the diagnostic system check?	Go to **Step 2**	Go to **Diagnostic System Check - Engine Cooling**
2	Is there excessive fan air noise?	Go to **Step 3**	Go to **Excessive Fan Noise**
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 **Excessive Fan Noise**
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. • 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. 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**
8	Inspect the fan clutch for wear. 1. Move the fan blade back and forth in a lateral motion. **IMPORTANT:** **Approximately 6.5 mm (1/4 in) movement at the tip of the fan blade is normal.** 2. Inspect for fan clutch lateral movement. Is the fan clutch lateral movement excessive?	Go to **Step 14**	Go to **Step 9**
9	The fan clutch should have more turning resistance when the engine is at or above normal operating temperature. Does the fan clutch have more resistance when the engine temperature is raised?	Go to **Step 11**	Go to **Step 14**
10	Tighten the fan. Refer to **Fan Clutch Replacement**. Is the action complete?	Go to **Step 16**	-
	Perform a fan clutch engagement test. 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. **IMPORTANT:** **Do not allow engine temperature to exceed**		

11	**121°C (250°F).** 6. Start the engine. 7. Turn the A/C ON, if equipped. 8. Operate the engine at approximately 2,000 RPM. 9. Inspect 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). Fan clutch engagement will be indicated by an increase in fan air noise, fan speed, and a drop of about 3-10°C (5-15°F) on the thermometer reading. Did the fan clutch engage between 85-96°C (185-205° F)?	Go to **Step 12**	Go to **Step 14**
12	Once the fan clutch engages, perform the following steps: 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. Did the engine return to normal operating temperature?	Go to **Step 13**	-
13	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?	Go to **Step 16**	Go to **Step 14**
14	Replace the fan clutch. Refer to **Fan Clutch Replacement**. 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

DRAINING AND FILLING COOLING SYSTEM (BODY VIN CODE 6)

Tools Required

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

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 syphon the coolant from the overflow tank.

1. Park the vehicle on a level surface.
2. Allow the engine to cool.
3. Using the **J 38185** slide the coolant air bleed hose clamp back on to the hose.
4. Remove the coolant air bleed hose from the throttle body.
5. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
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 hose.
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 or plug located on the LH side of the block. Refer to **Coolant Heater Replacement (LL8)** or **Coolant Heater Replacement (LM4)**.
10. Remove the radiator cap.

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 or plug. Refer to **Coolant Heater Replacement (LL8)** or **Coolant Heater Replacement (LM4)**.
2. Install the lower radiator hose.
3. Using the **J 38185** slide the clamp into the original position.
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 Capacities - Approximate Fluid in Maintenance and Lubrication.

5. Install the radiator cap.
6. Remove coolant recovery reservoir cap.
7. Slowly add a mixture of 50/50 DEX-COOL antifreeze and deionized water to the cooling system through the coolant recovery reservoir. Refer to **Capacities - Approximate Fluid** in Maintenance and Lubrication.
8. Fill the coolant recovery reservoir with the remaining coolant.
9. Install coolant recovery reservoir cap.
10. Install the coolant air bleed hose to the throttle body.
11. Using the **J 38185** slide the coolant air bleed hose clamp back to the original position.
12. Start the engine.
13. Run the engine at 2,000-2,500 RPM until the engine reaches normal operating temperature.
14. Allow the engine to idle for 3 minutes.
15. Shut the engine OFF.
16. Allow the engine to cool.
17. Top off the coolant recovery reservoir as necessary.
18. Inspect the cooling system for leaks.
19. Rinse away any excess coolant from the engine and the engine compartment.
20. Inspect the concentration of the engine coolant using **J 26568** . See **Special Tools and Equipment**.

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 **Draining and Filling Cooling System (Body Vin Code 6)**.
2. Remove the coolant recovery reservoir. Refer to **Coolant Recovery Reservoir Replacement**.
3. Clean and flush the coolant recovery reservoir with clean, drinkable water.
4. Install the coolant recovery reservoir. Refer to **Coolant Recovery Reservoir Replacement**.
5. Remove the thermostat. Refer to **Thermostat Replacement (4.2L Engine)** or **Thermostat Replacement**

(5.3L Engine).

6. Follow the drain and fill procedure using only clean, drinkable water. Refer to **Draining and Filling Cooling System (Body Vin Code 6)**.
7. Run the engine for 20 minutes.
8. Stop the engine.
9. Drain the cooling system. Refer to **Draining and Filling Cooling System (Body Vin Code 6)**.
10. Repeat the procedure if necessary, until the fluid is nearly colorless.
11. Install the thermostat. Refer to **Thermostat Replacement (4.2L Engine)** or **Thermostat Replacement (5.3L Engine)**.
12. Fill the cooling system. Refer to **Draining and Filling Cooling System (Body Vin Code 6)**.

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

Removal Procedure

1. Remove the air cleaner assembly. Refer to **Air Cleaner Assembly Replacement** in Engine Controls-4.2 L.

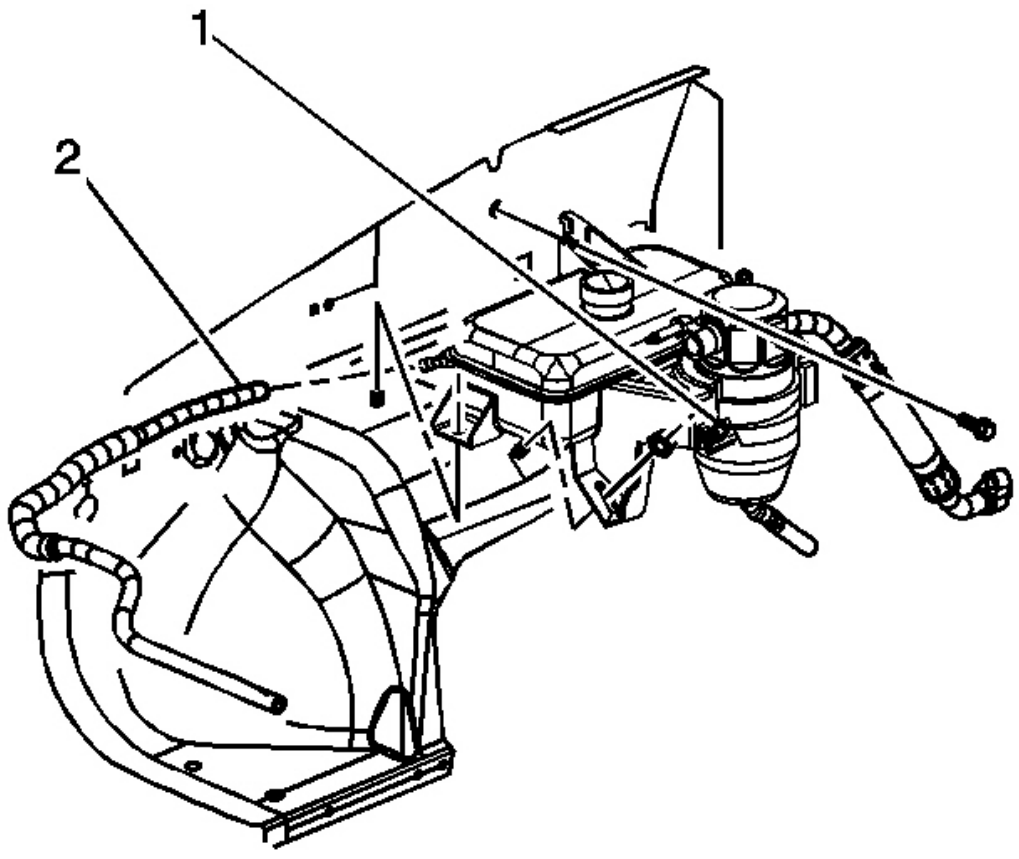


Fig. 5: View Of Coolant Recovery Reservoir
Courtesy of GENERAL MOTORS CORP.

2. Remove the bracket bolt securing the accumulator to the coolant recovery reservoir (1).
3. Move the accumulator out of the way.
4. Remove the coolant hoses from the coolant recovery reservoir and plug the hoses and the coolant recovery reservoir outlets with suitable plugs (2).
5. Remove the nut and bolt securing the coolant recovery reservoir.
6. Remove the coolant recovery reservoir.

Installation Procedure

1. Install the coolant recovery reservoir.

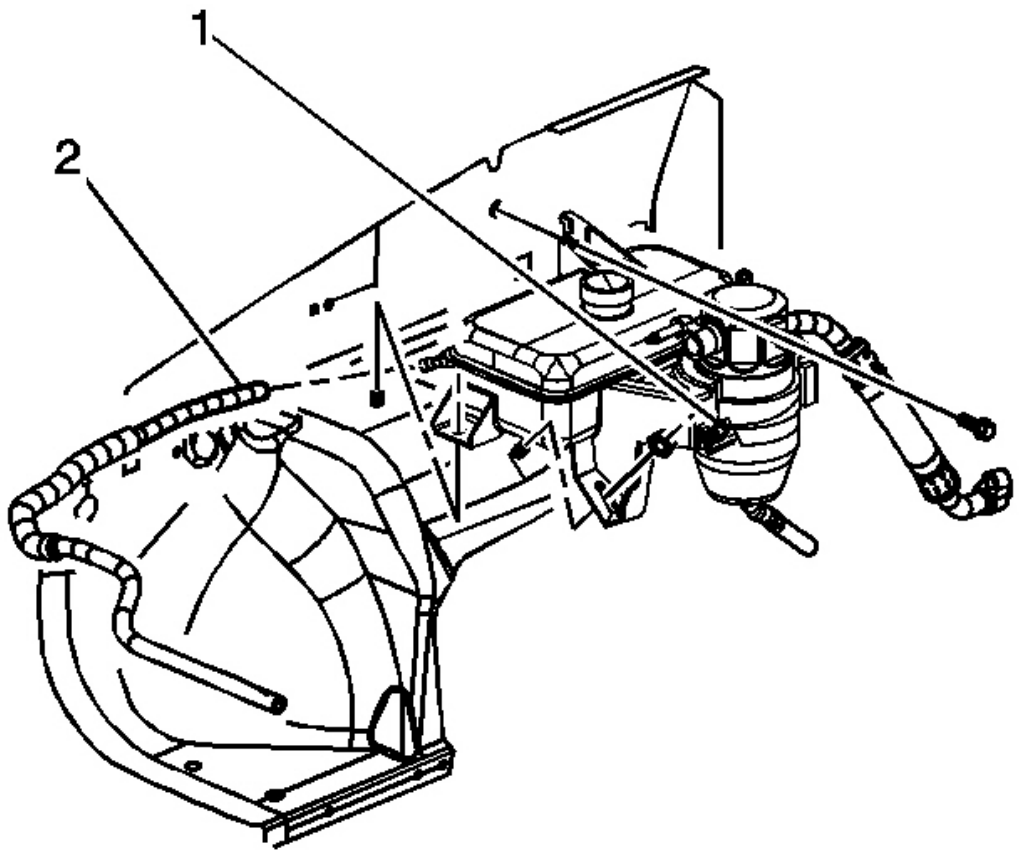


Fig. 6: View Of Coolant Recovery Reservoir
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice in Cautions and Notices.

2. Install the retaining bolt to the front wheel house panel.

   Tighten: Tighten the bolt to 12 N.m (106 lb in).

3. Secure the coolant recovery reservoir to the wheel house panel with the nut.

   Tighten: Tighten the nut to 10 N.m (88 lb in).

4. Install the coolant hose to the coolant recovery reservoir (2).
5. Install the accumulator to the coolant recovery reservoir and secure the accumulator with the bracket and the bolt (1).

6. Install the air cleaner assembly. Refer to **Air Cleaner Assembly Replacement** in Engine Controls-4.2 L.

RADIATOR HOSE REPLACEMENT - INLET (SWB (SHORT WHEEL BASE))

Tools Required

J 38185 Hose Clamp Pliers

Removal Procedure

1. Drain the coolant. Refer to **Draining and Filling Cooling System (Body Vin Code 6)**.

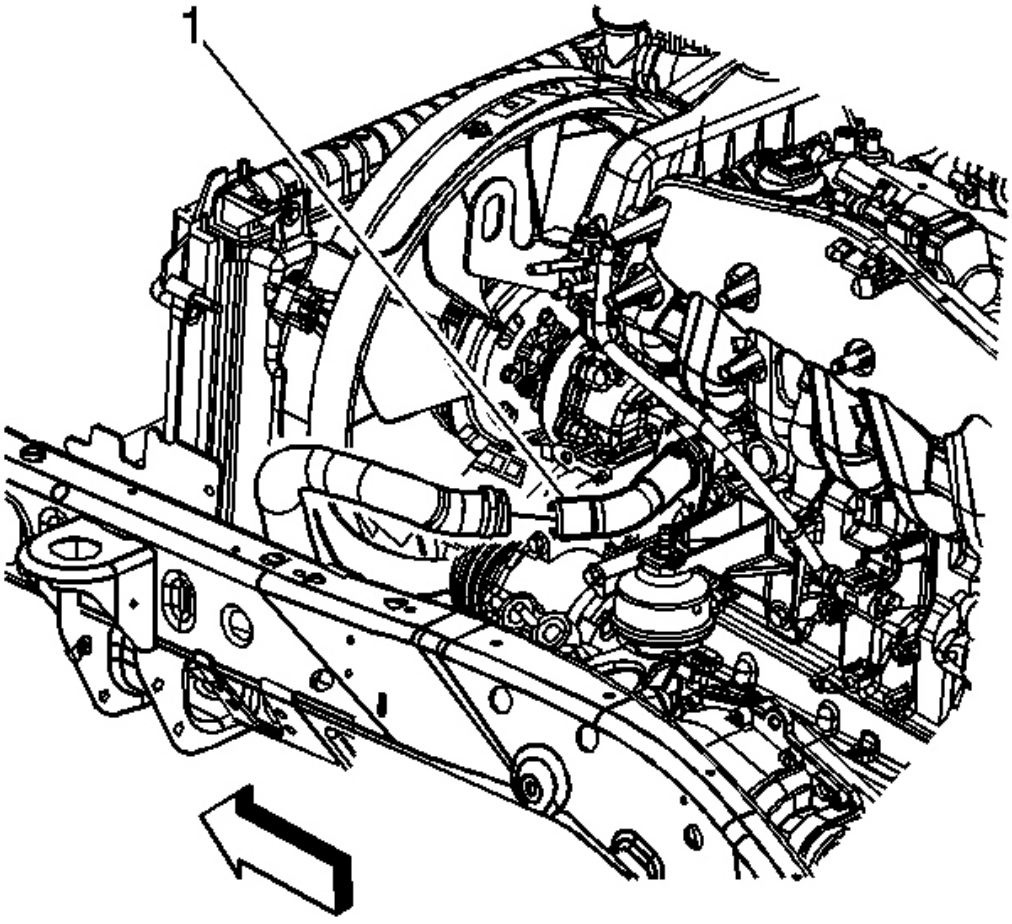


Fig. 7: Locating Thermostat Housing
Courtesy of GENERAL MOTORS CORP.

2. Reposition the inlet radiator hose clamp at the thermostat (1) using **J 38185** .
3. Remove the inlet radiator hose from the thermostat.
4. Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
5. Remove the lower radiator support shield, if equipped. Refer to **Radiator Support Shield Replacement** in Frame and Underbody.

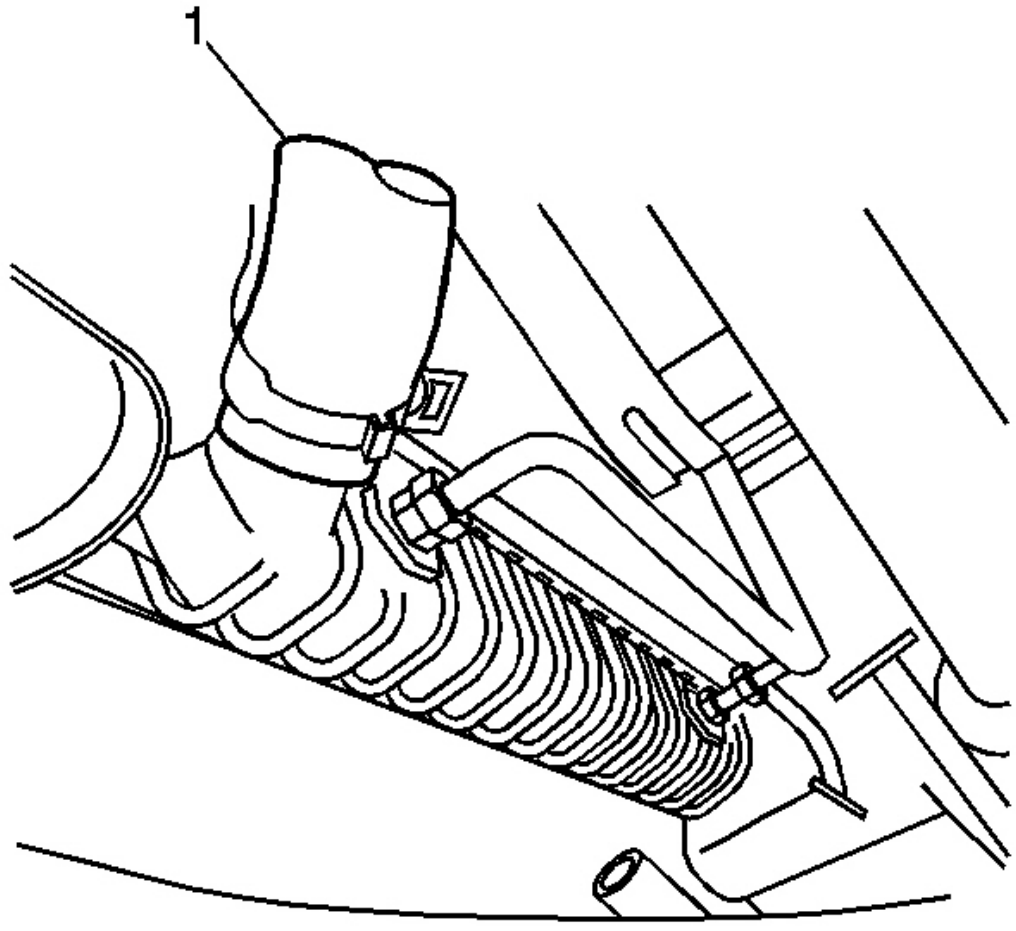


Fig. 8: View Of Radiator Hose
Courtesy of GENERAL MOTORS CORP.

6. Reposition the inlet radiator hose clamp at the radiator using **J 38185** .
7. Remove the inlet radiator hose (1) from the radiator.

Installation Procedure

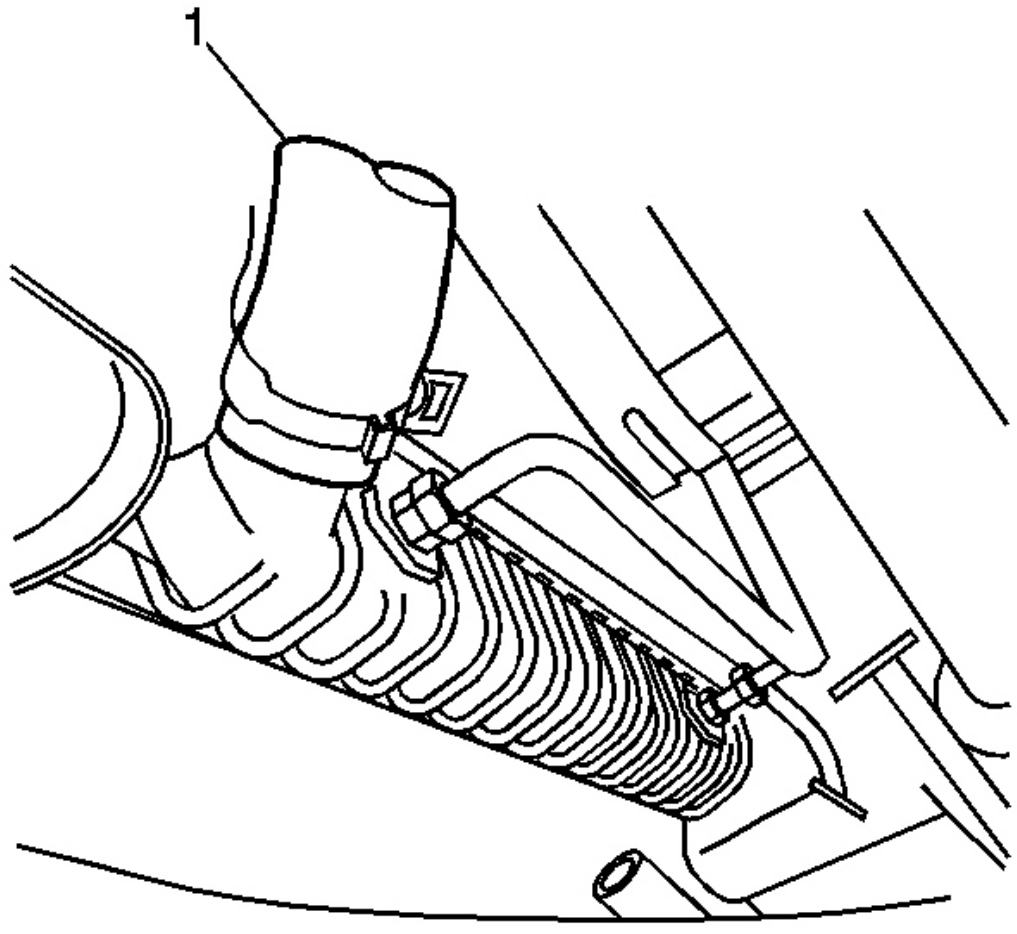


Fig. 9: View Of Radiator Hose
Courtesy of GENERAL MOTORS CORP.

1. Install the inlet radiator hose clamps to the radiator hose (1).
2. Install the inlet radiator hose (1) to the radiator.
3. Reposition the inlet radiator hose clamp using **J 38185** .
4. Install the lower radiator support shield, if equipped. Refer to **Radiator Support Shield Replacement** in Frame and Underbody.
5. Lower the vehicle.

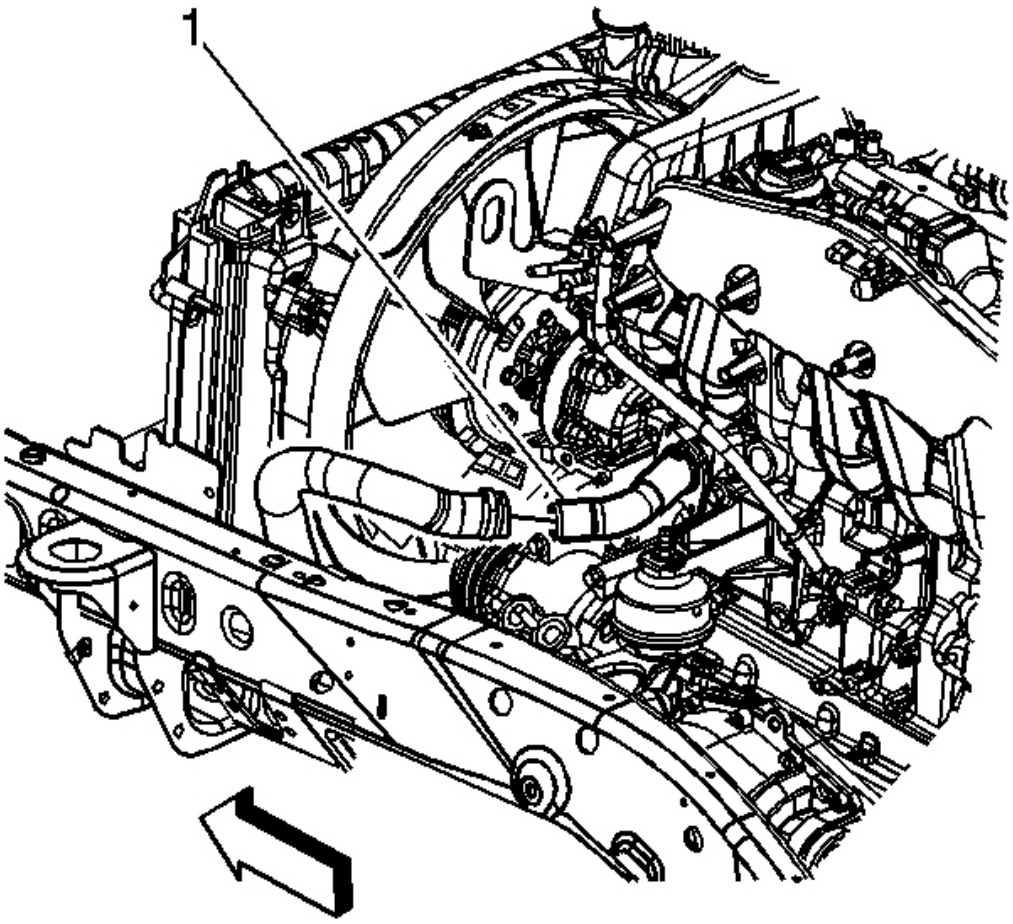


Fig. 10: Locating Thermostat Housing
Courtesy of GENERAL MOTORS CORP.

6. Install the inlet radiator hose to the thermostat (1).
7. Reposition the inlet radiator hose using **J 38185** .
8. Fill the cooling system. Refer to **Draining and Filling Cooling System (Body Vin Code 6)**.

RADIATOR HOSE REPLACEMENT - INLET (LWB (LONG WHEEL BASE))

Tools Required

J 38185 Hose Clamp Pliers

Removal Procedure

1. Drain the cooling system. Refer to **Draining and Filling Cooling System (Body Vin Code 6)**.
2. Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.

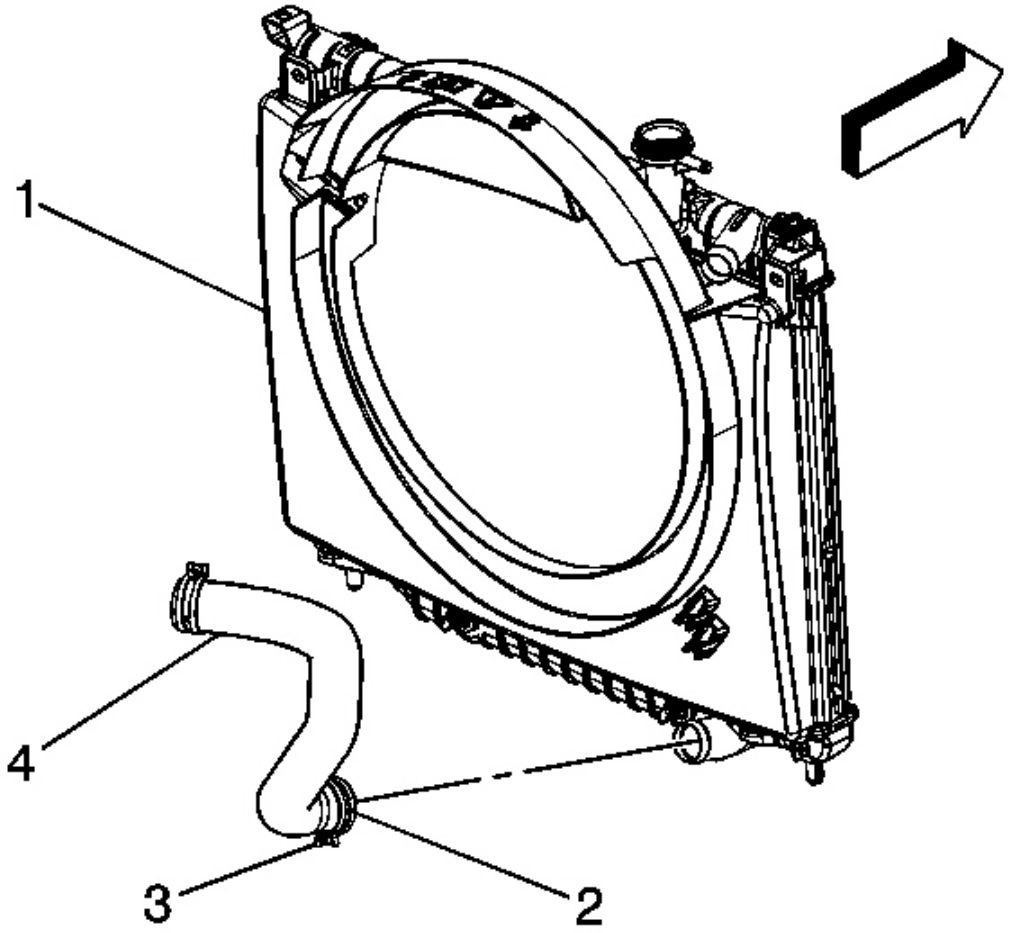


Fig. 11: View Of Radiator, Hose & Clamp
Courtesy of GENERAL MOTORS CORP.

3. Reposition the inlet radiator hose clamp (3) using **J 38185** .
4. Remove the inlet radiator hose (2) from the radiator (1).

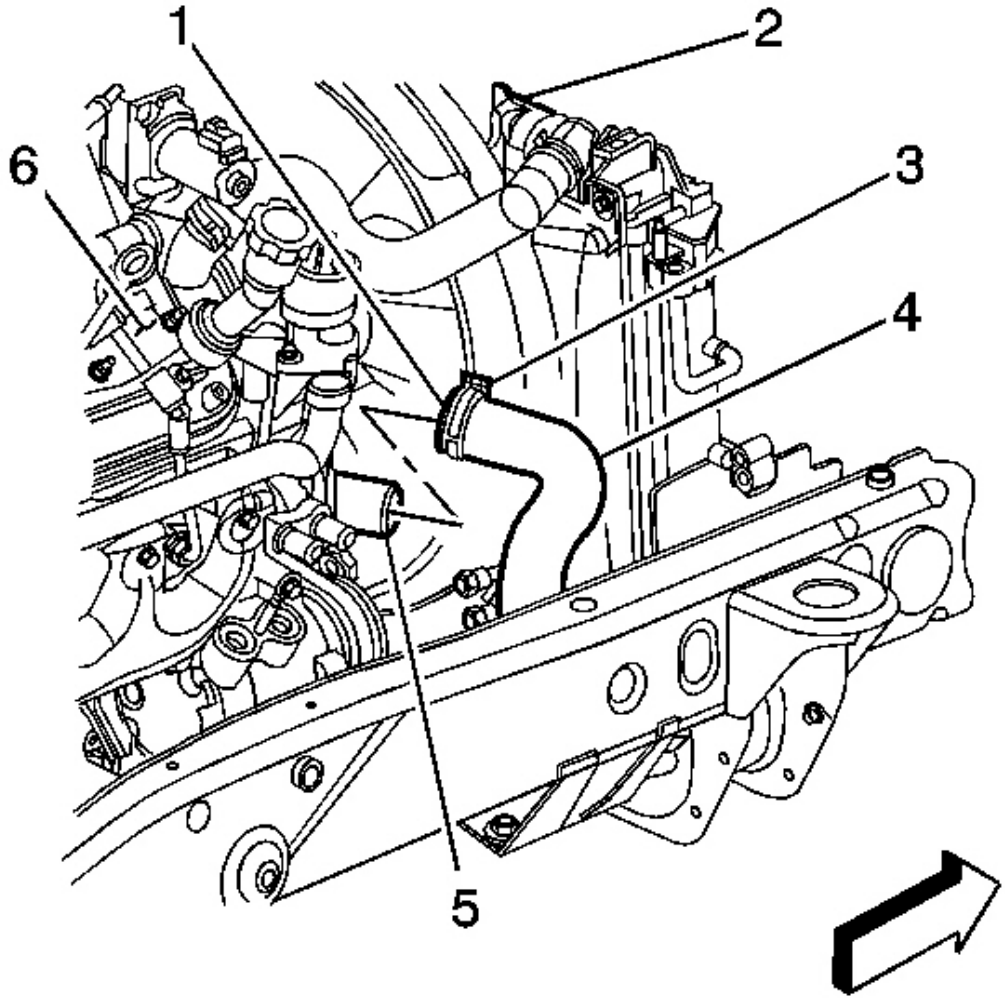


Fig. 12: View Of Inlet Hose & Clamp
Courtesy of GENERAL MOTORS CORP.

5. Reposition the inlet radiator hose clamp (3) using **J 38185** .
6. Remove the radiator inlet hose from the engine (5).
7. Remove the radiator inlet hose.

Installation Procedure

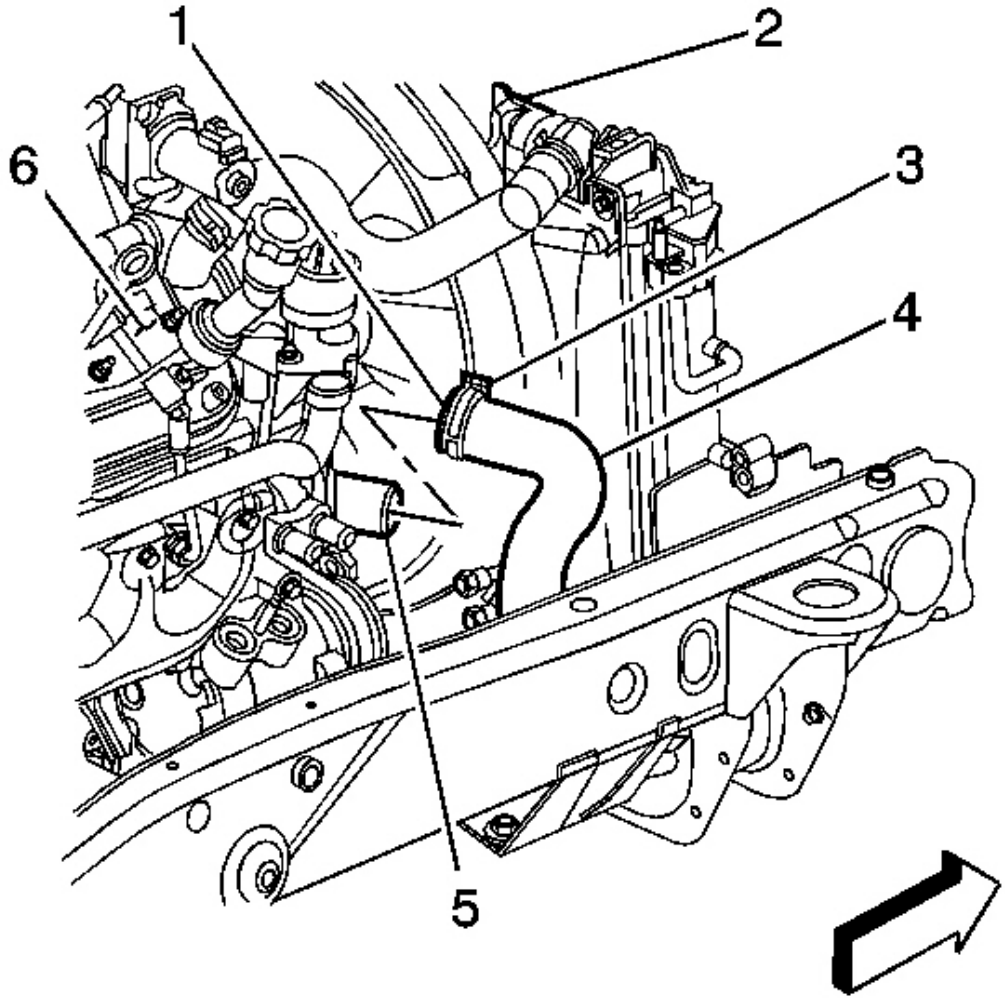


Fig. 13: View Of Inlet Hose & Clamp
Courtesy of GENERAL MOTORS CORP.

1. Install the radiator inlet hose to the engine (5).
2. Reposition the inlet radiator hose clamp (3).

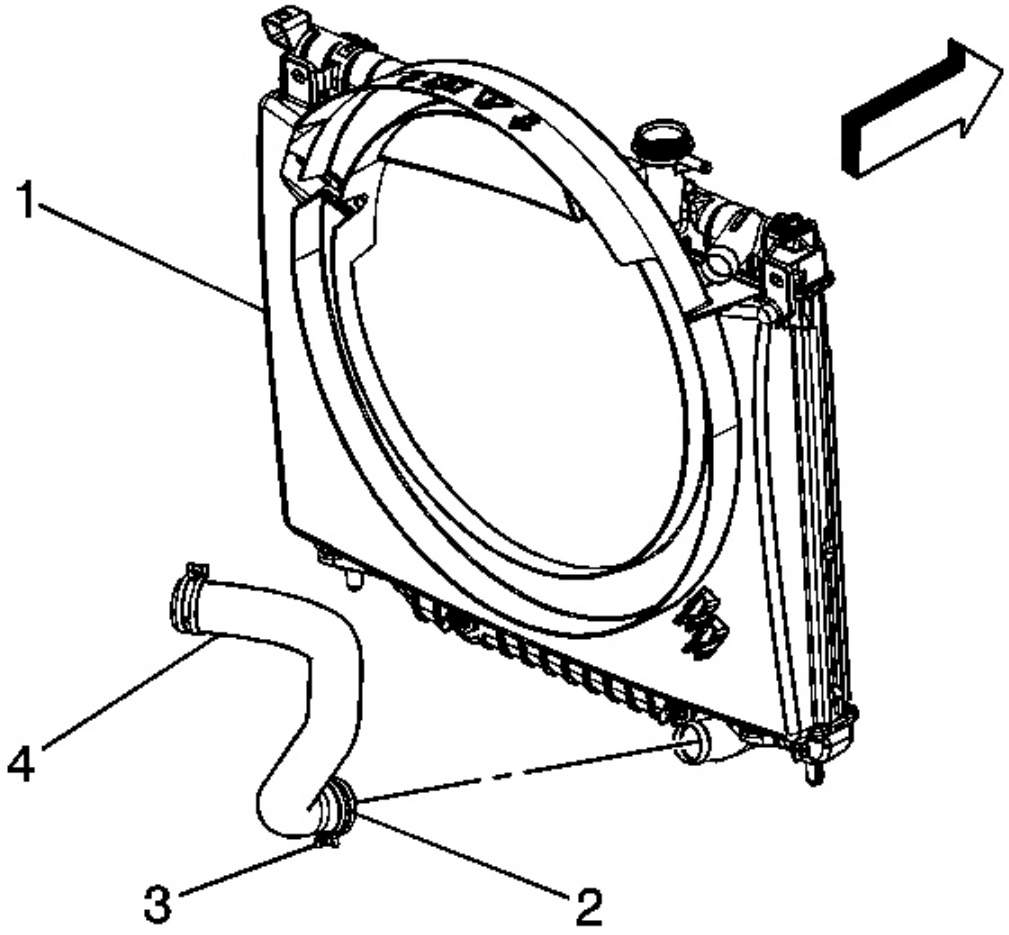


Fig. 14: View Of Radiator, Hose & Clamp
Courtesy of GENERAL MOTORS CORP.

3. Install the inlet radiator hose (2) to the radiator (1).
4. Reposition the inlet radiator hose clamp (3).
5. Lower the vehicle.
6. Fill the cooling system. Refer to **Draining and Filling Cooling System (Body Vin Code 6)**.

RADIATOR HOSE REPLACEMENT - OUTLET (SWB (SHORT WHEEL BASE))

Tools Required

J 38185 Hose Clamp Pliers

Removal Procedure

1. Drain the engine coolant. Refer to **Draining and Filling Cooling System (Body Vin Code 6)**.

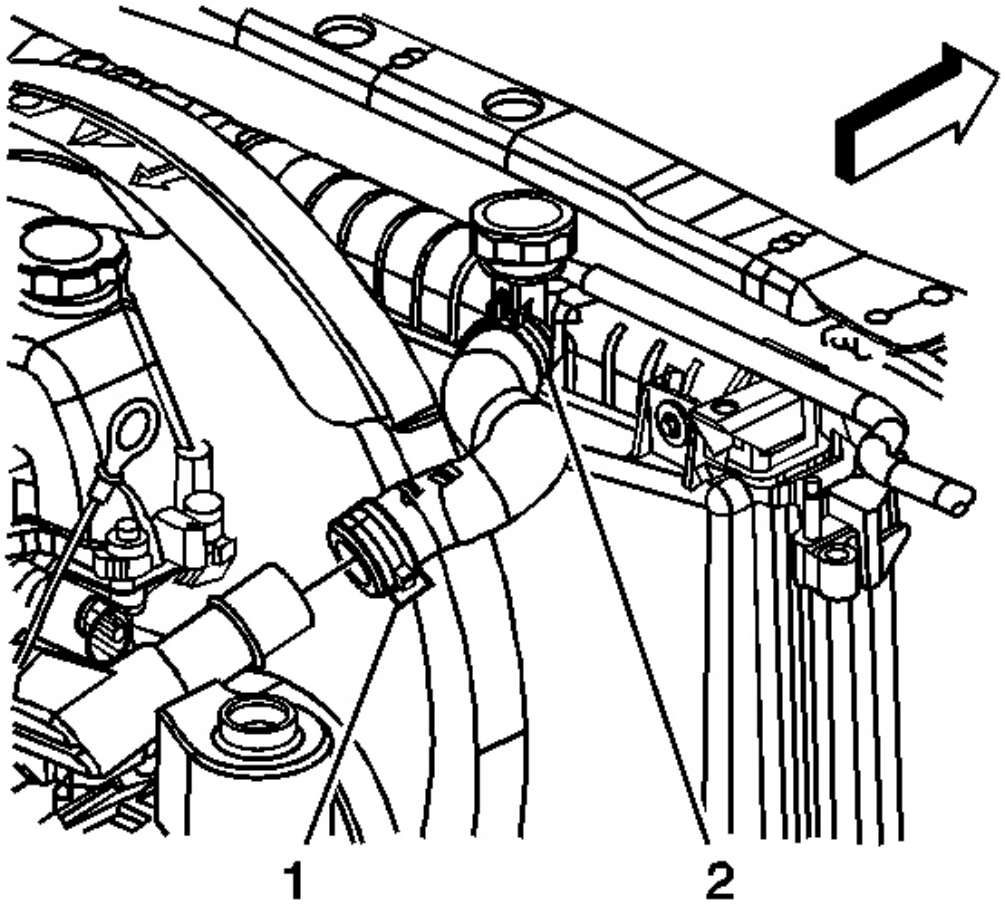


Fig. 15: View Of Radiator Hose Clamps
Courtesy of GENERAL MOTORS CORP.

2. Reposition the inlet radiator hose clamp (2) at the radiator using **J 38185** .
3. Remove the inlet radiator hose from the radiator.
4. Reposition the inlet radiator hose clamp (1) at the engine outlet using **J 38185** .
5. Remove the inlet radiator hose from the engine.

Installation Procedure

1. Install the inlet radiator hose clamps (1, 2) to the radiator hose.

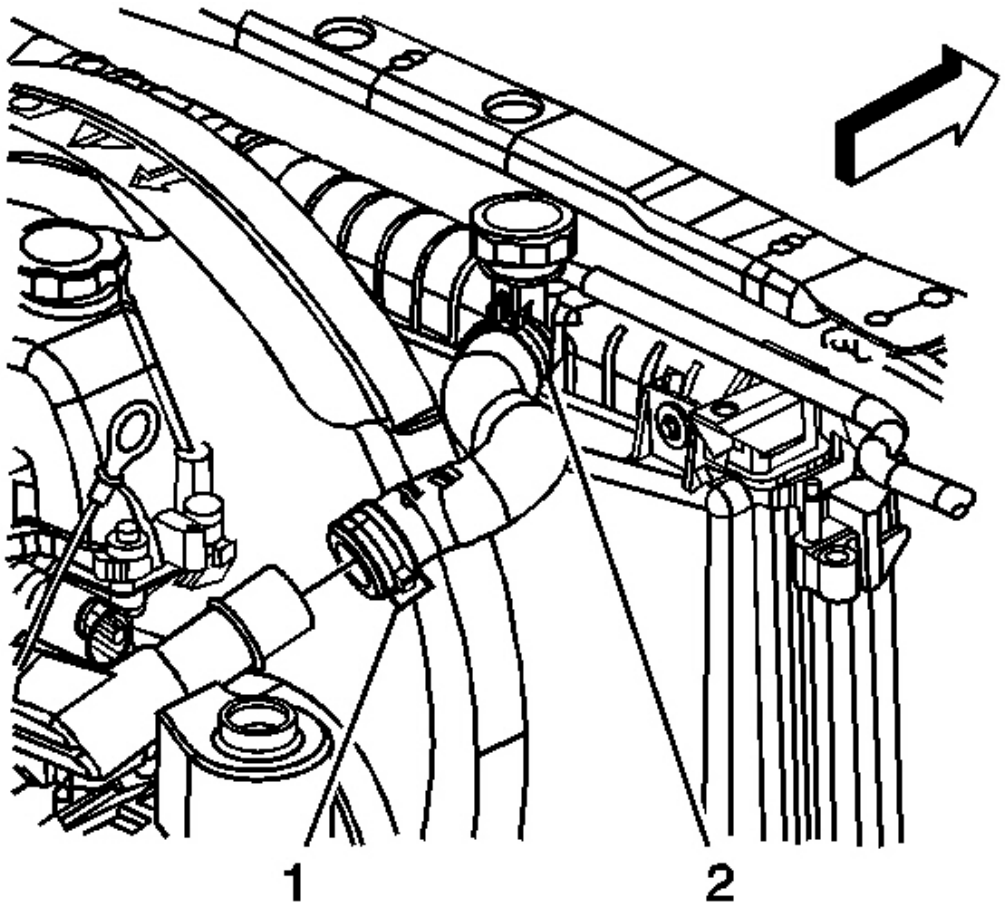


Fig. 16: View Of Radiator Hose Clamps
Courtesy of GENERAL MOTORS CORP.

2. Install the inlet radiator hose to the engine.
3. Reposition the inlet radiator hose clamp (1) using **J 38185** .
4. Install the inlet radiator hose to the radiator.
5. Reposition the inlet radiator hose clamp (2) using **J 38185** .
6. Fill the cooling system. Refer to **Draining and Filling Cooling System (Body Vin Code 6)**.

RADIATOR HOSE REPLACEMENT - OUTLET (LWB (LONG WHEEL BASE))

Tools Required

J 38185 Hose Clamp Pliers

Removal Procedure

1. Drain the cooling system. Refer to **Draining and Filling Cooling System (Body Vin Code 6)**.
2. Remove the air intake resonator. Refer to **Air Cleaner Resonator Outlet Duct Replacement** in Engine Controls - 4.8L, 5.3L and 6.0L.

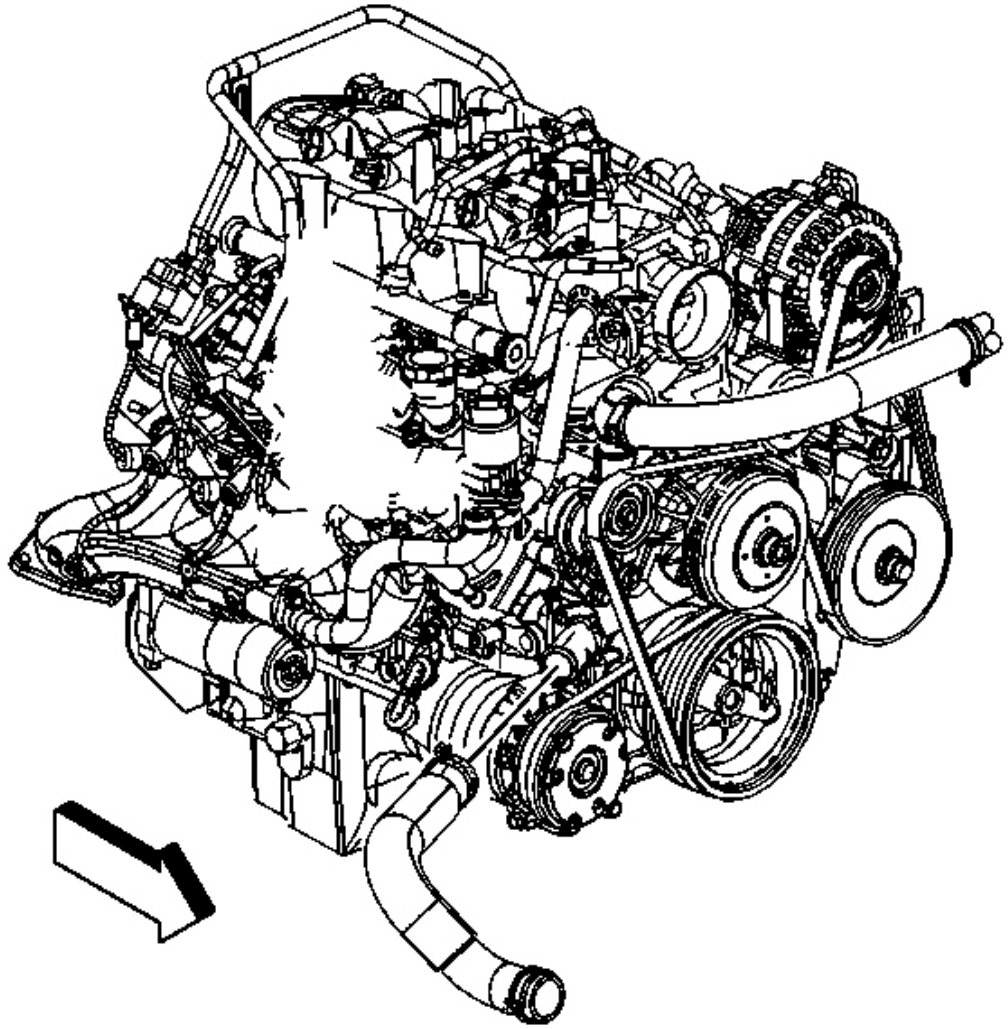


Fig. 17: View Of Outlet Hose & Water Pump

Courtesy of GENERAL MOTORS CORP.

3. Reposition the outlet hose clamp from the water pump.
4. Remove the outlet hose from the water pump.

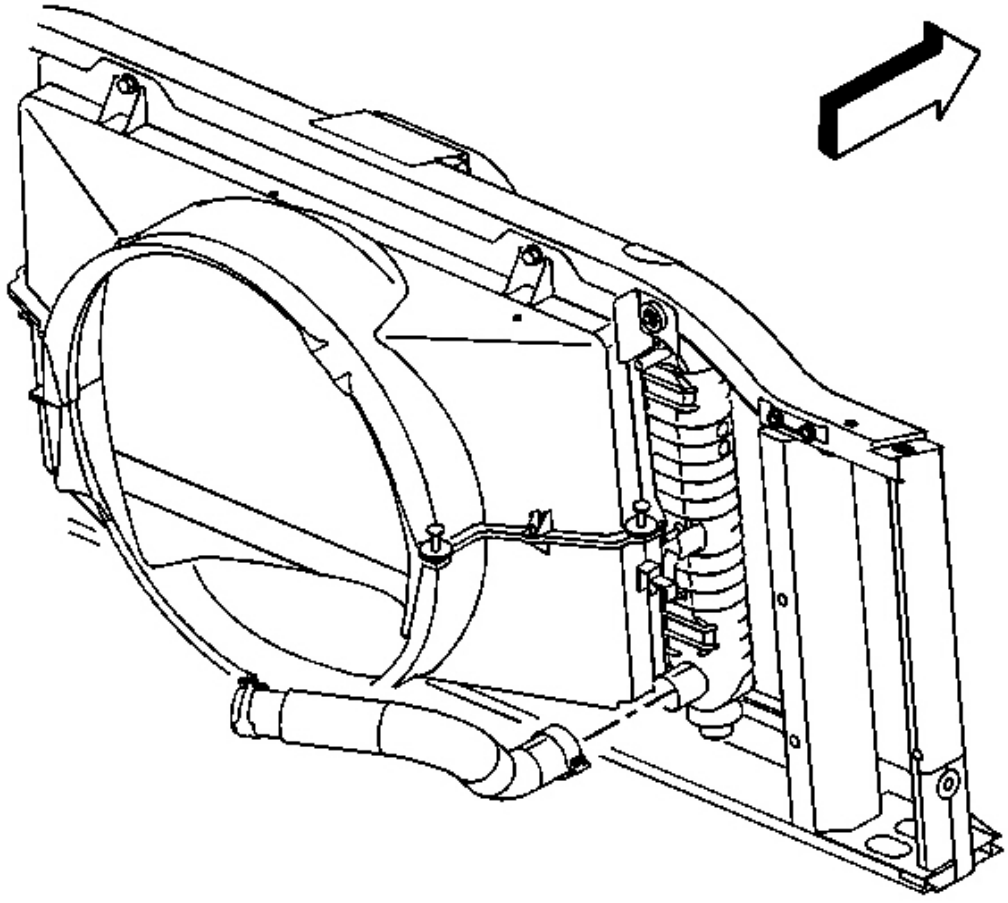


Fig. 18: View Of Outlet Hose & Clamp
Courtesy of GENERAL MOTORS CORP.

5. Reposition the outlet hose clamp from the radiator.
6. Remove the outlet hose from the radiator.

Installation Procedure

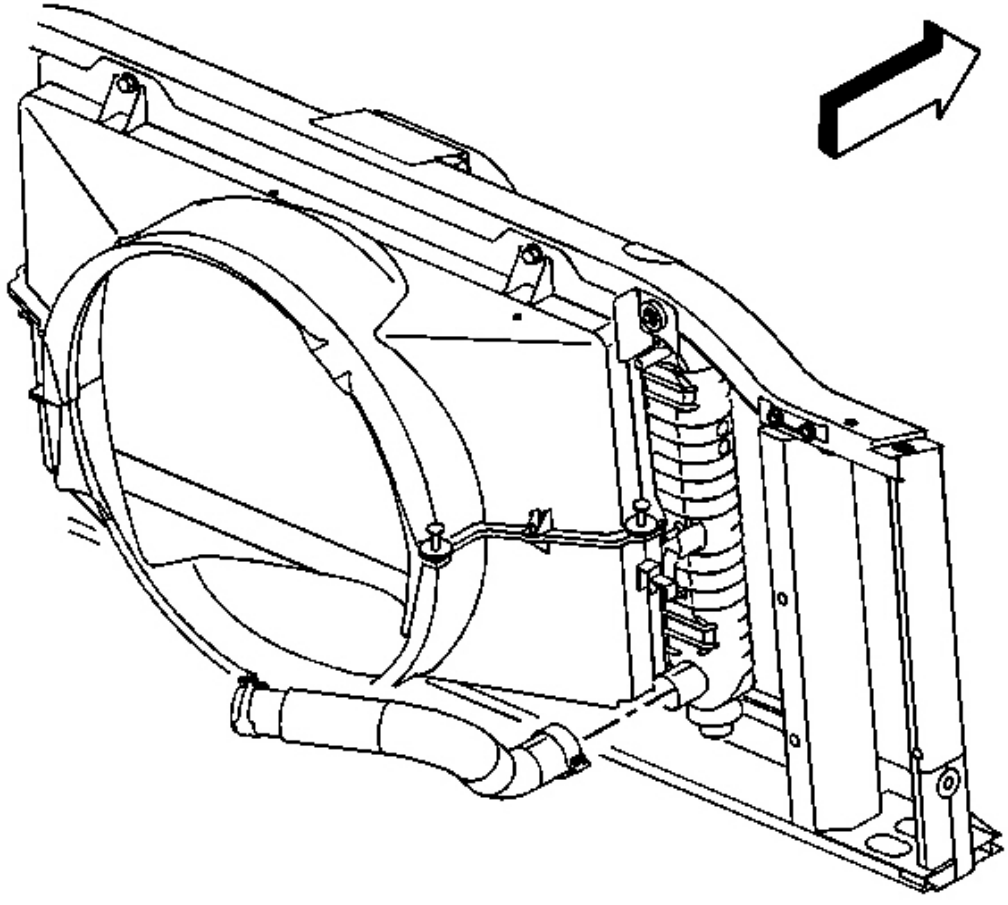


Fig. 19: View Of Outlet Hose & Clamp
Courtesy of GENERAL MOTORS CORP.

1. Install the outlet hose to the radiator.
2. Reposition the outlet hose clamp to the radiator.

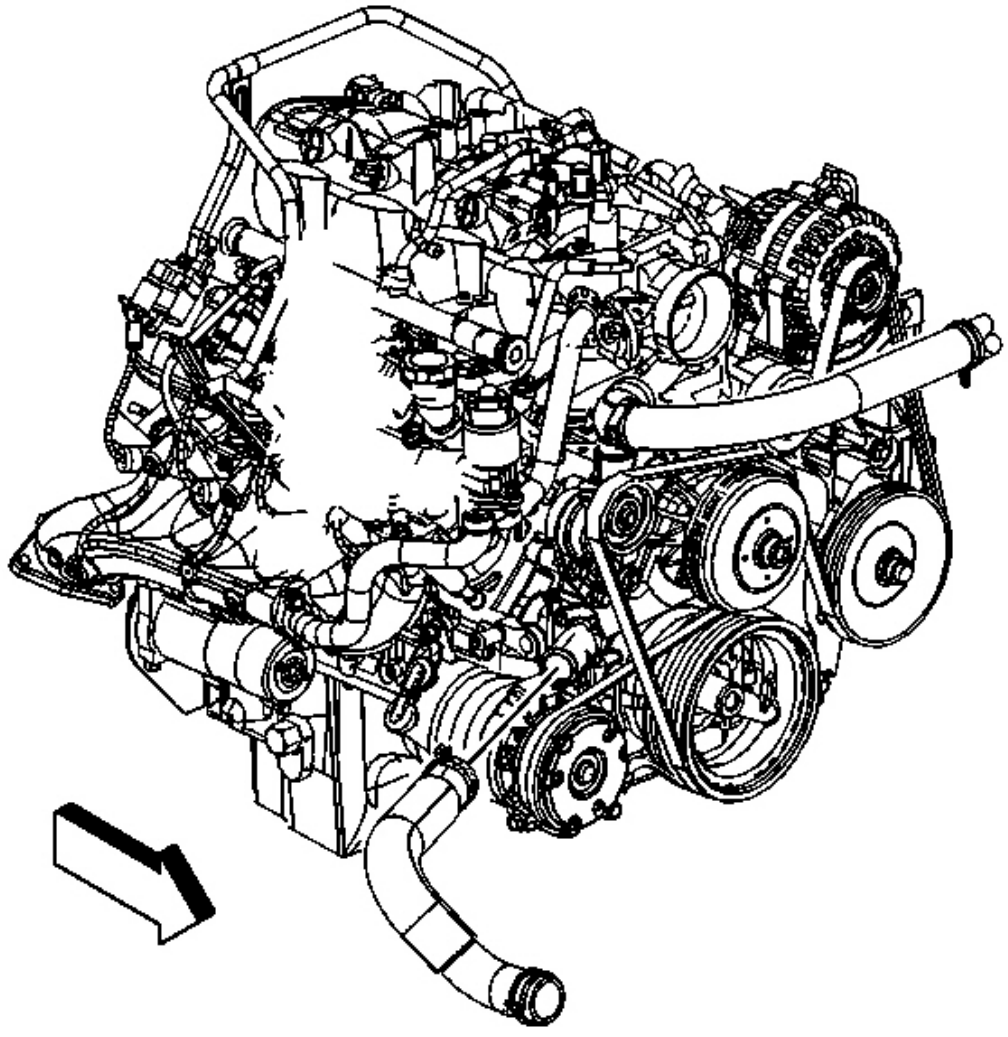


Fig. 20: View Of Outlet Hose & Water Pump
Courtesy of GENERAL MOTORS CORP.

3. Install the outlet hose to the water pump.
4. Reposition the outlet hose clamp to the water pump.
5. Install the air intake resonator. Refer to **Air Cleaner Resonator Outlet Duct Replacement** in Engine Controls - 4.8L, 5.3L and 6.0L.
6. Install the radiator inlet hose clip to the outlet duct.
7. Fill the cooling system. Refer to **Draining and Filling Cooling System (Body Vin Code 6)**.

RADIATOR VENT INLET HOSE REPLACEMENT

Removal Procedure

1. Partially drain the cooling system. Refer to **Draining and Filling Cooling System (Body Vin Code 6)**.
2. Remove the vent inlet hose from the radiator.
3. Remove the vent inlet hose from the surge tank.

Installation Procedure

1. Install the vent inlet hose to the surge tank.
2. Install the vent inlet hose to the radiator.
3. Fill the cooling system. Refer to **Draining and Filling Cooling System (Body Vin Code 6)**.

FAN CLUTCH REPLACEMENT

Removal Procedure

1. Remove the cooling fan and shroud. Refer to **Cooling Fan and Shroud Replacement**.

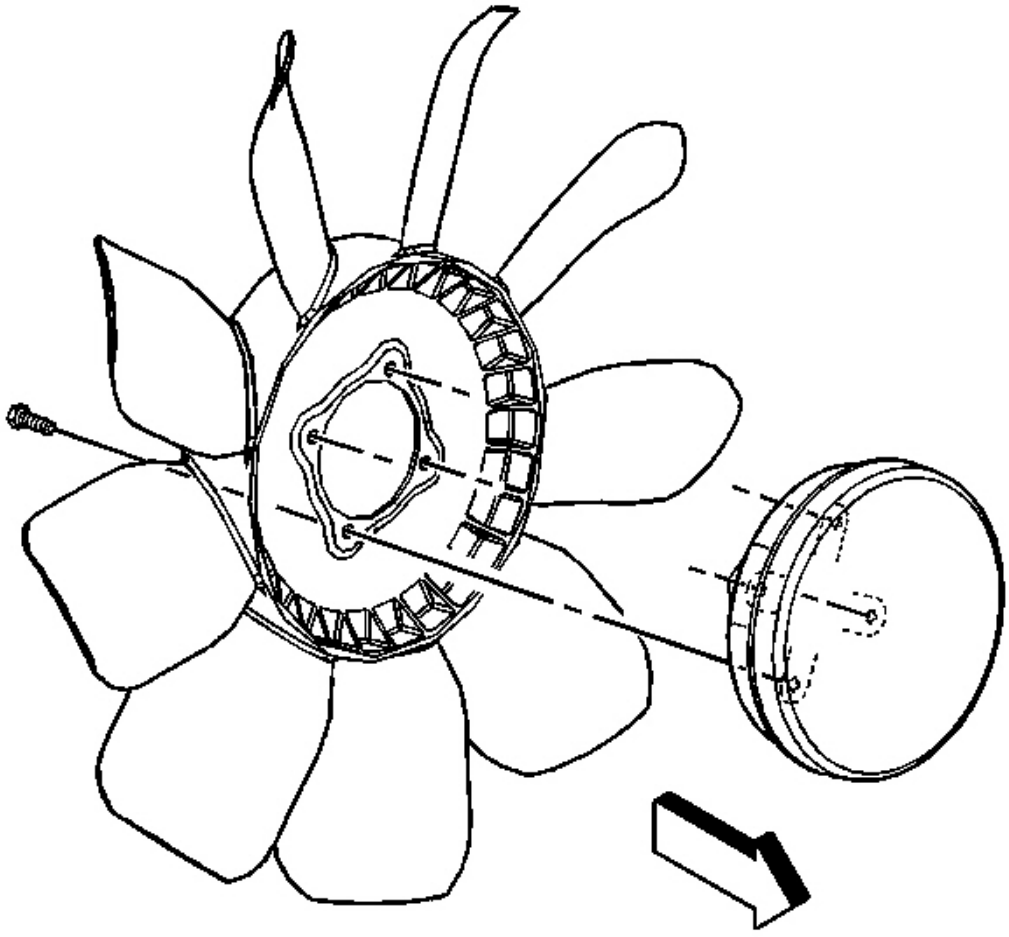


Fig. 21: View Of Fan Blade & Fan Clutch
Courtesy of GENERAL MOTORS CORP.

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

Installation Procedure

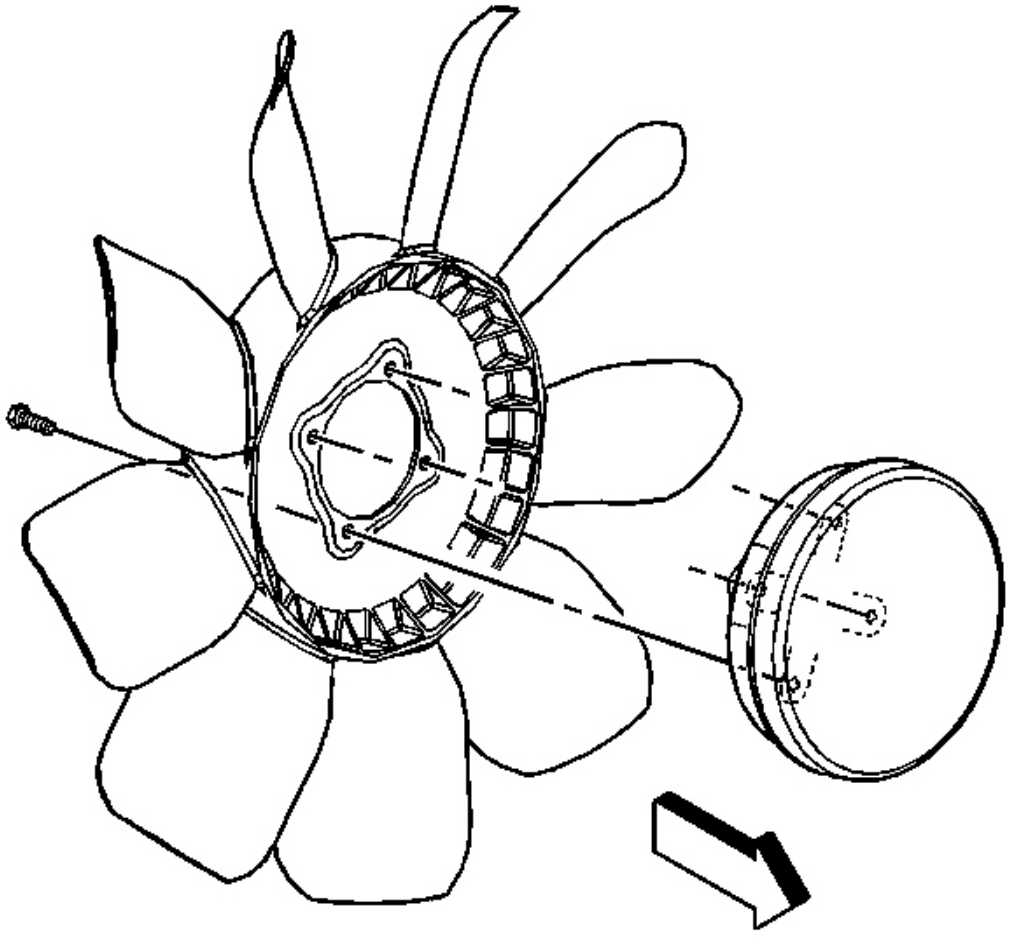


Fig. 22: View Of Fan Blade & Fan Clutch
Courtesy of GENERAL MOTORS CORP.

1. Assemble the fan to the fan clutch.

   NOTE: Refer to Fastener Notice in Cautions and Notices.

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 and shroud. Refer to **Cooling Fan and Shroud Replacement**.

COOLING FAN AND SHROUD REPLACEMENT

Tools Required

- **J 41240** Fan Clutch Remover and Installer
- **J 38185** Hose Clamp Pliers
- **J 46406** Fan Clutch Remover and Installer. See **Special Tools and Equipment**.

Removal Procedure

1. Remove the hood latch support. Refer to **Hood Latch Support Replacement** in Body Front End.

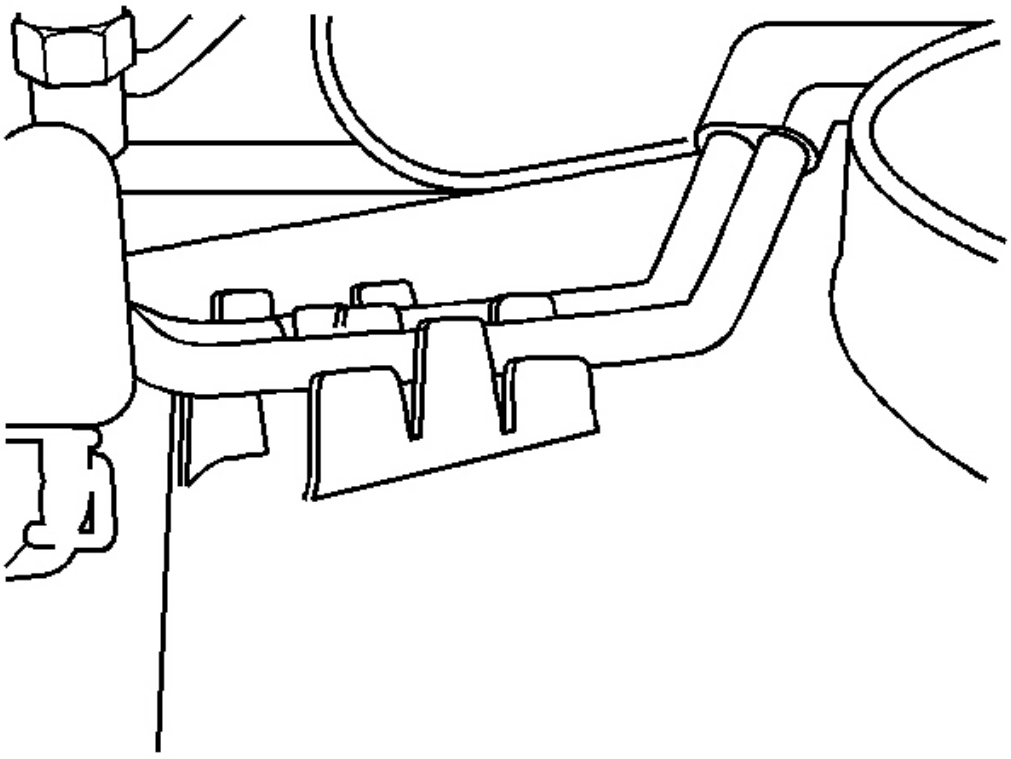


Fig. 23: View Of Transmission Cooler Lines
Courtesy of GENERAL MOTORS CORP.

2. Disconnect the transmission cooler lines at the engine and release the lines from the fan shroud.
3. Remove the 2 upper bolts on the fan shroud.
4. Drain the cooling system. Refer to **Draining and Filling Cooling System (Body Vin Code 6)**.

5. Reposition the upper inlet radiator hose clamp using **J 38185** .
6. Remove the upper inlet radiator hose from the radiator.
7. Remove the electrical connector from the shroud.
8. Position the water pump so the bolts are aligned in the vertical.

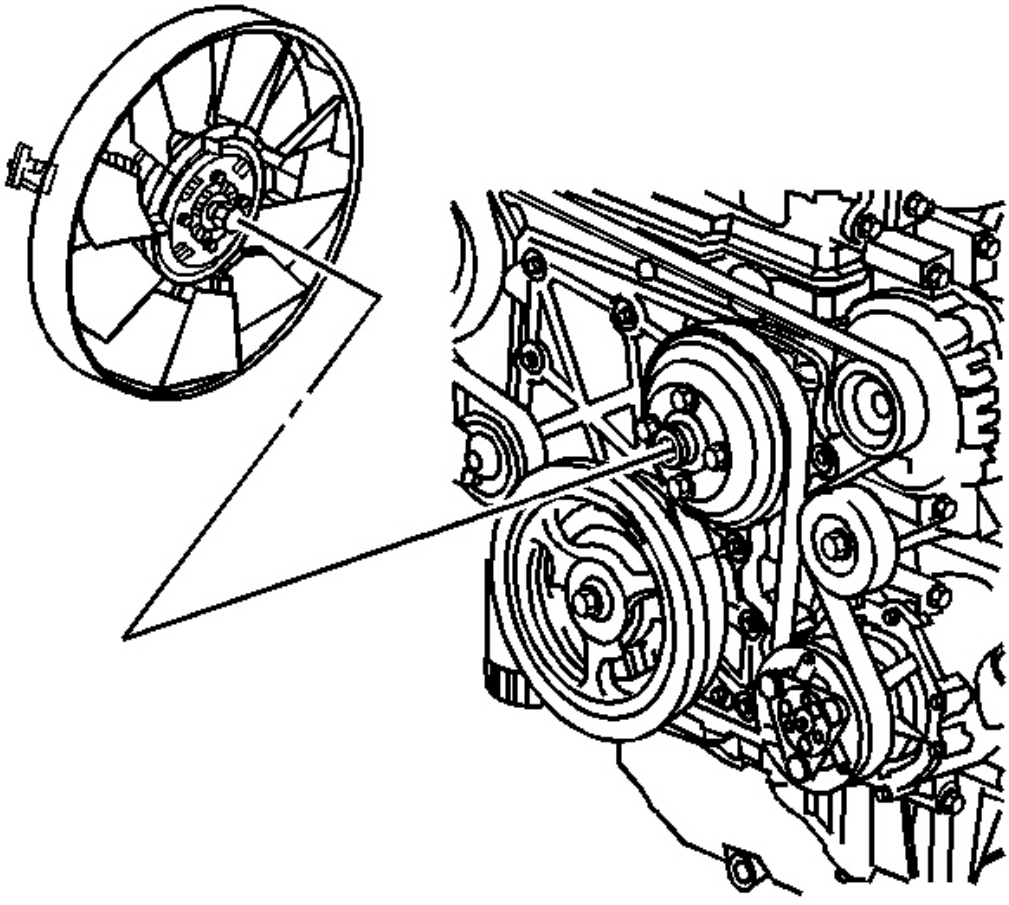


Fig. 24: Identifying Cooling Fan
Courtesy of GENERAL MOTORS CORP.

9. Remove the fan hub nut from the water pump shaft in a counterclockwise rotation. Using the **J 46406** , in order to secure the water pump pulley, loosen the cooling fan hub nut from the water pump shaft. See **Special Tools and Equipment**.

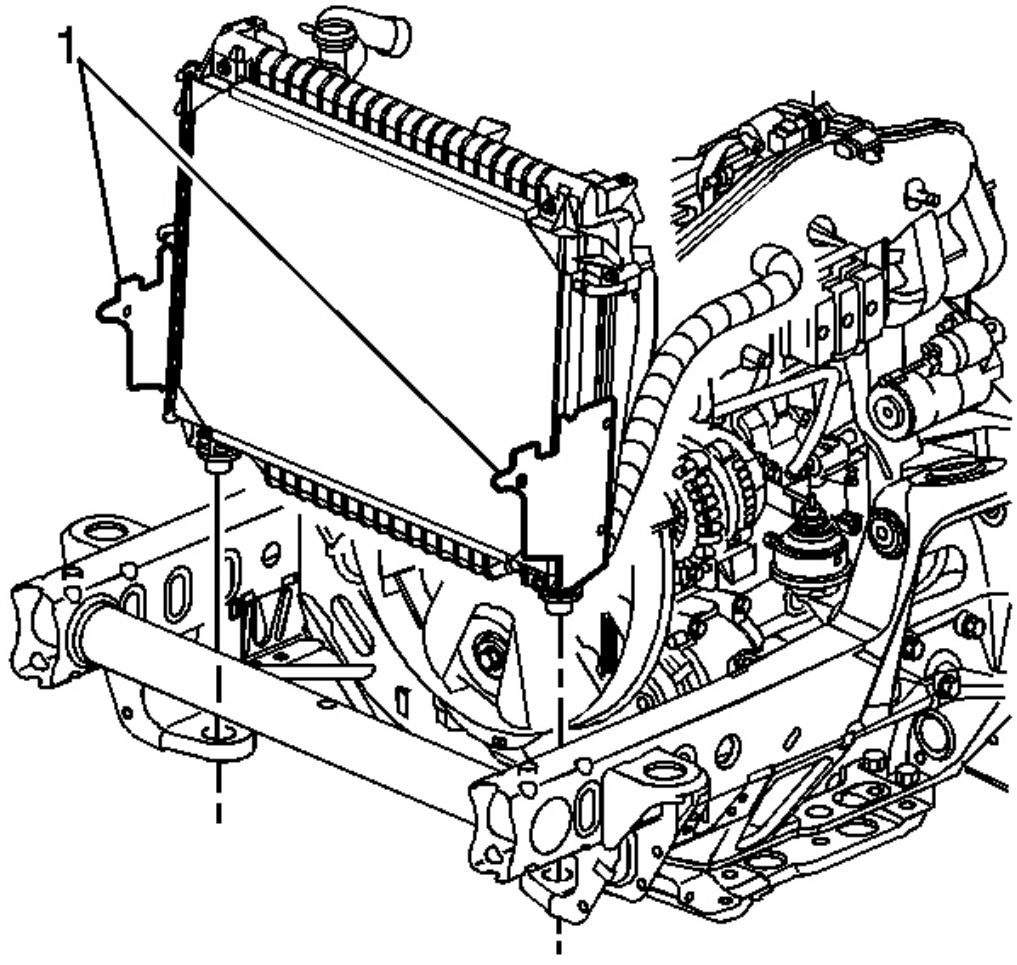


Fig. 25: View Of Condenser
Courtesy of GENERAL MOTORS CORP.

10. Unclip the fan shroud from the radiator at the side panels (1).
11. Tilt the radiator and the condenser forward.
12. Lift the fan and the shroud up and out towards the engine to release the fan from the radiator to clear the radiator inlet.

Installation Procedure

1. Install the fan and the shroud onto the lip of the radiator bottom.

NOTE: Refer to Fastener Notice in Cautions and Notices.

2. Install the 2 bolts into the upper fan shroud and tighten.

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

3. Connect the electrical connector.

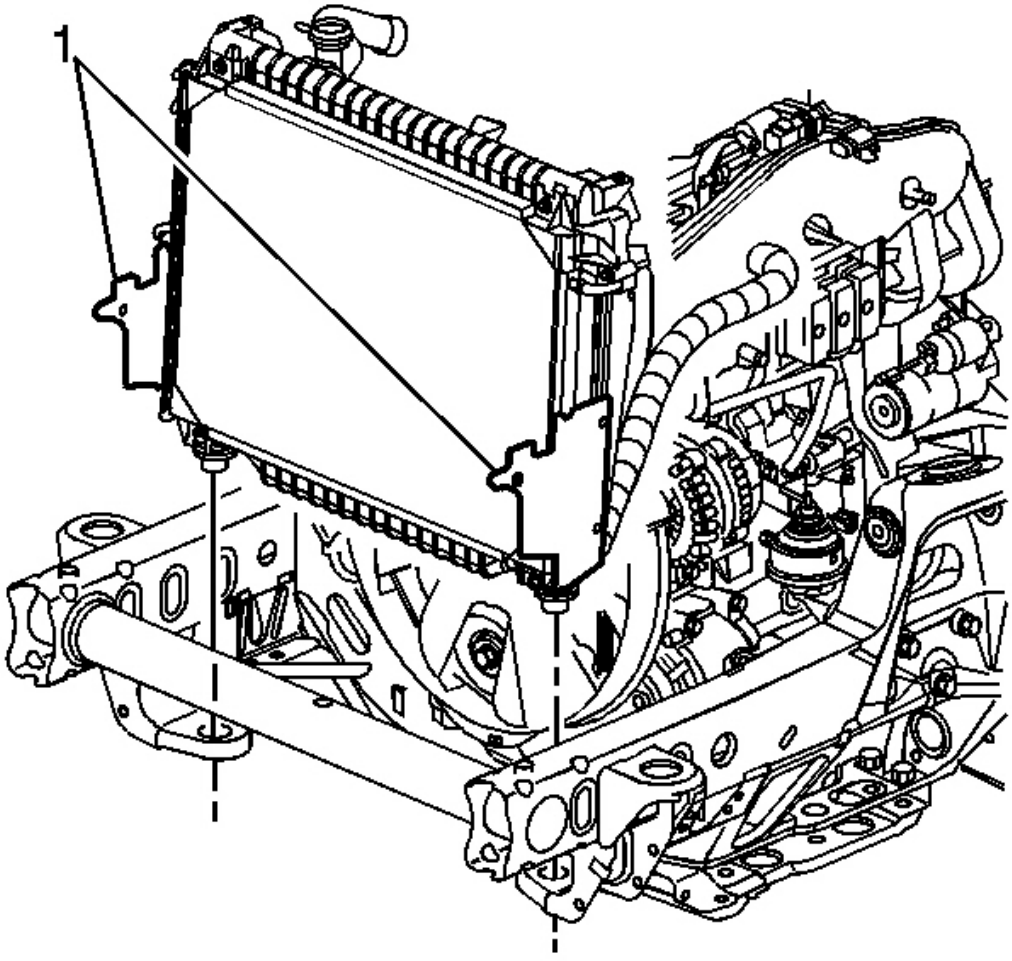


Fig. 26: View Of Condenser
Courtesy of GENERAL MOTORS CORP.

4. Clip the fan shroud to the radiator at the side panels (1).

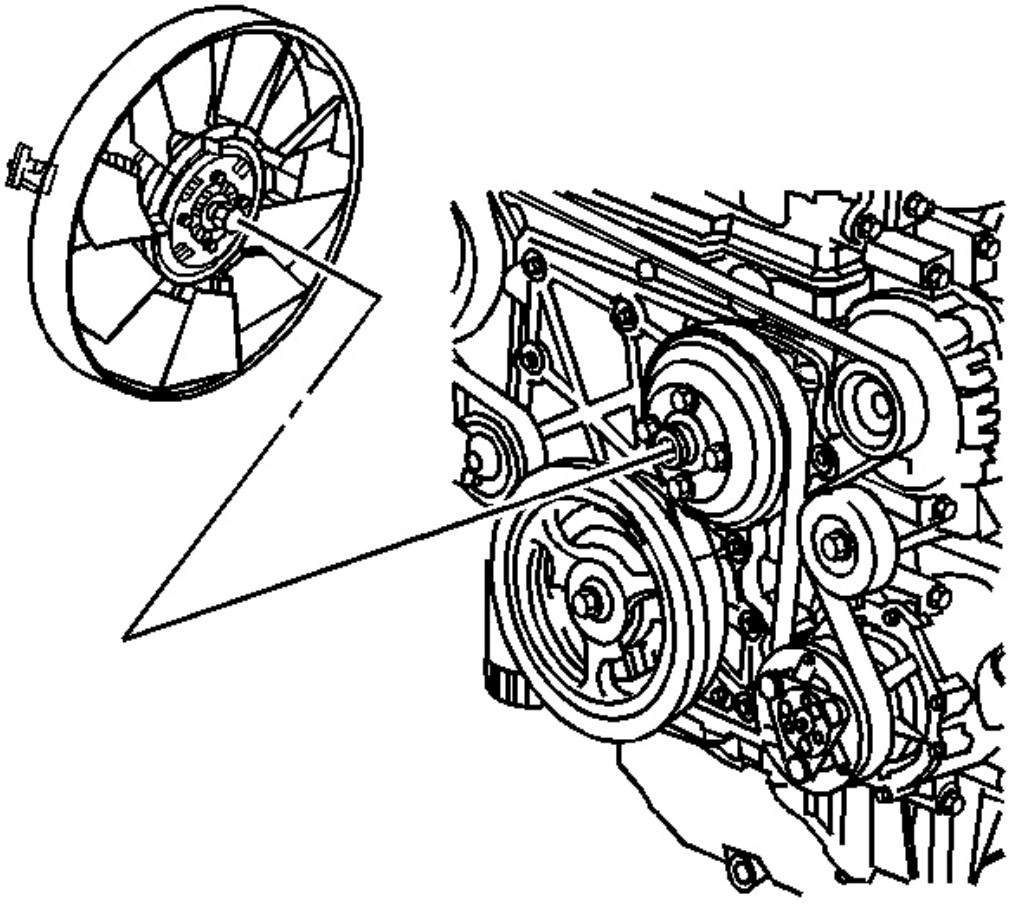


Fig. 27: Identifying Cooling Fan
Courtesy of GENERAL MOTORS CORP.

5. Using the **J 46406** , secure the water pump pulley, install the fan nut to the water pump shaft in a clockwise rotation. See **Special Tools and Equipment**.

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

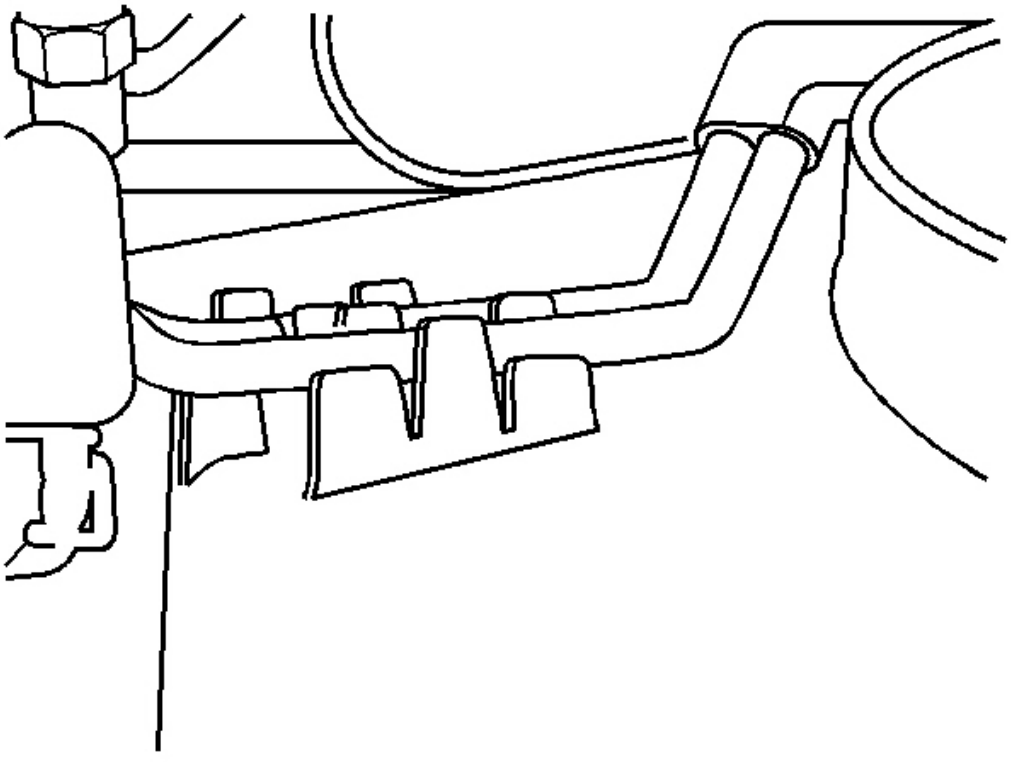


Fig. 28: View Of Transmission Cooler Lines
Courtesy of GENERAL MOTORS CORP.

6. Install the transmission cooler lines to the engine and clip into the fan shroud.
7. Install the hood latch support. Refer to **Hood Latch Support Replacement** in Body Front End.
8. Install the upper inlet radiator hose to the radiator.
9. Reposition the upper inlet radiator hose clamp using **J 38185** .
10. Fill the cooling system. Refer to **Draining and Filling Cooling System (Body Vin Code 6)**.

COOLING FAN RELAY REPLACEMENT

Tools Required

J 43244 Relay Puller Pliers

Removal Procedure

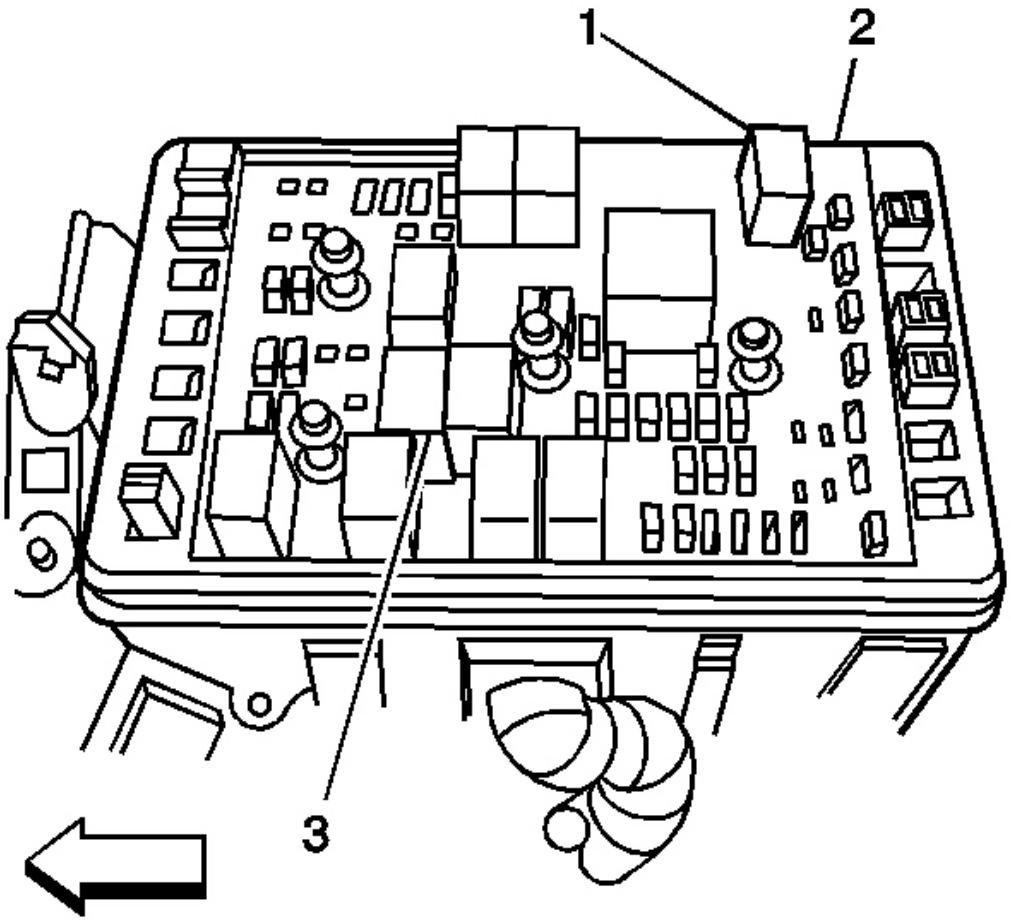


Fig. 29: View Of Cooling Fan Relay
Courtesy of GENERAL MOTORS CORP.

1. Remove the underhood electrical center cover.
2. Using the **J 43244** , remove the cooling fan relay (3).

Installation Procedure

NOTE: Installation of the proper relay is critical. If an enhanced relay - equipped with a diode - is installed into a position requiring a standard relay - equipped without a diode - excessive current will damage any components associated with the relay or its associated circuits.

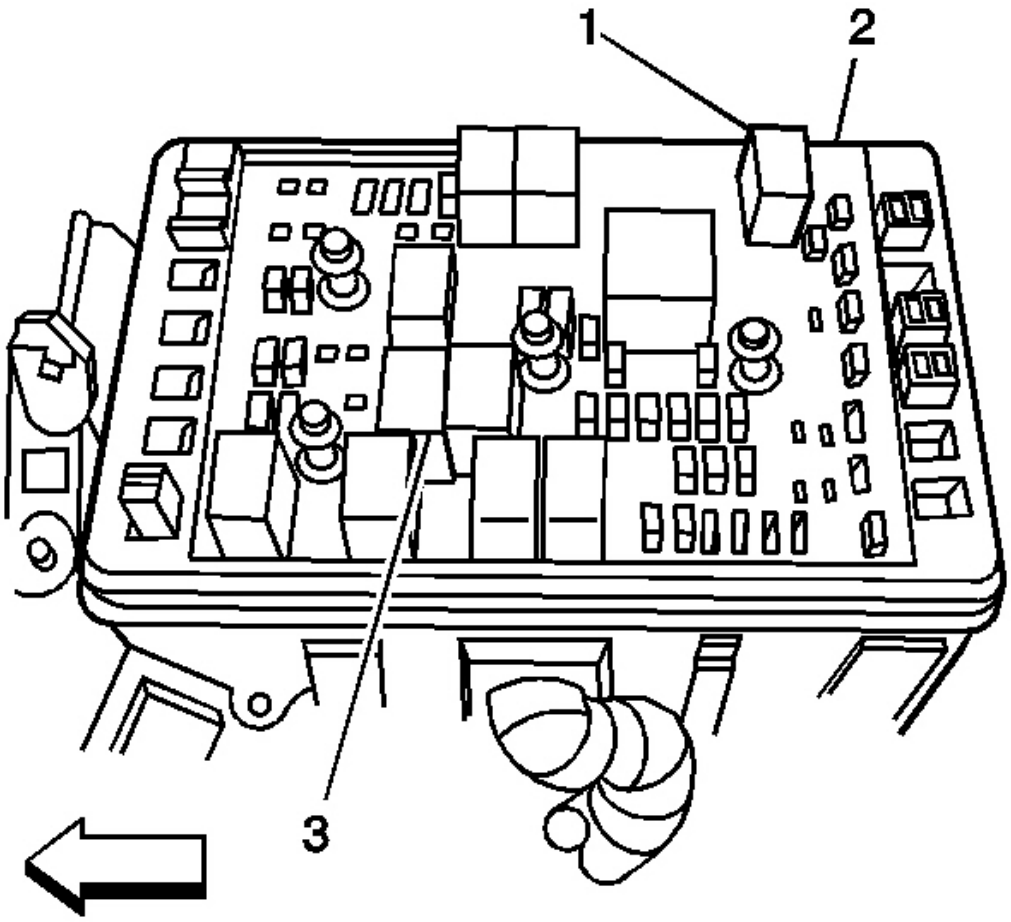


Fig. 30: View Of Cooling Fan Relay
Courtesy of GENERAL MOTORS CORP.

1. Install the cooling fan relay (3).
2. Install the underhood electrical center cover.

THERMOSTAT REPLACEMENT (4.2L ENGINE)

Tools Required

J 38185 Hose Clamp Pliers

Removal Procedure

1. Remove the necessary coolant from the radiator. Refer to **Draining and Filling Cooling System (Body Vin Code 6)**.
2. Remove the generator. Refer to **Generator Replacement (4.2L Engine)** or **Generator Replacement (5.3L Engine)** in Engine Electrical

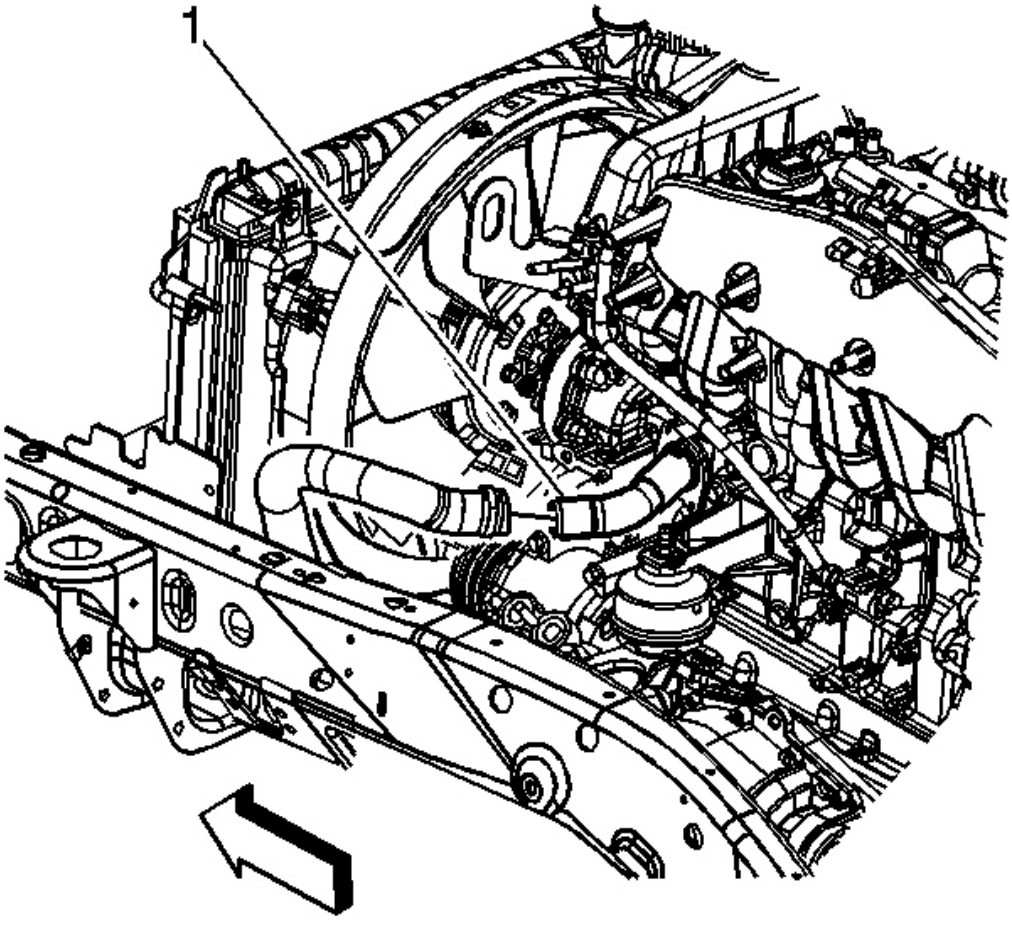


Fig. 31: Locating Thermostat Housing
Courtesy of GENERAL MOTORS CORP.

3. Loosen the outlet hose clamp at the thermostat housing (1). Remove the outlet hose from the thermostat housing.

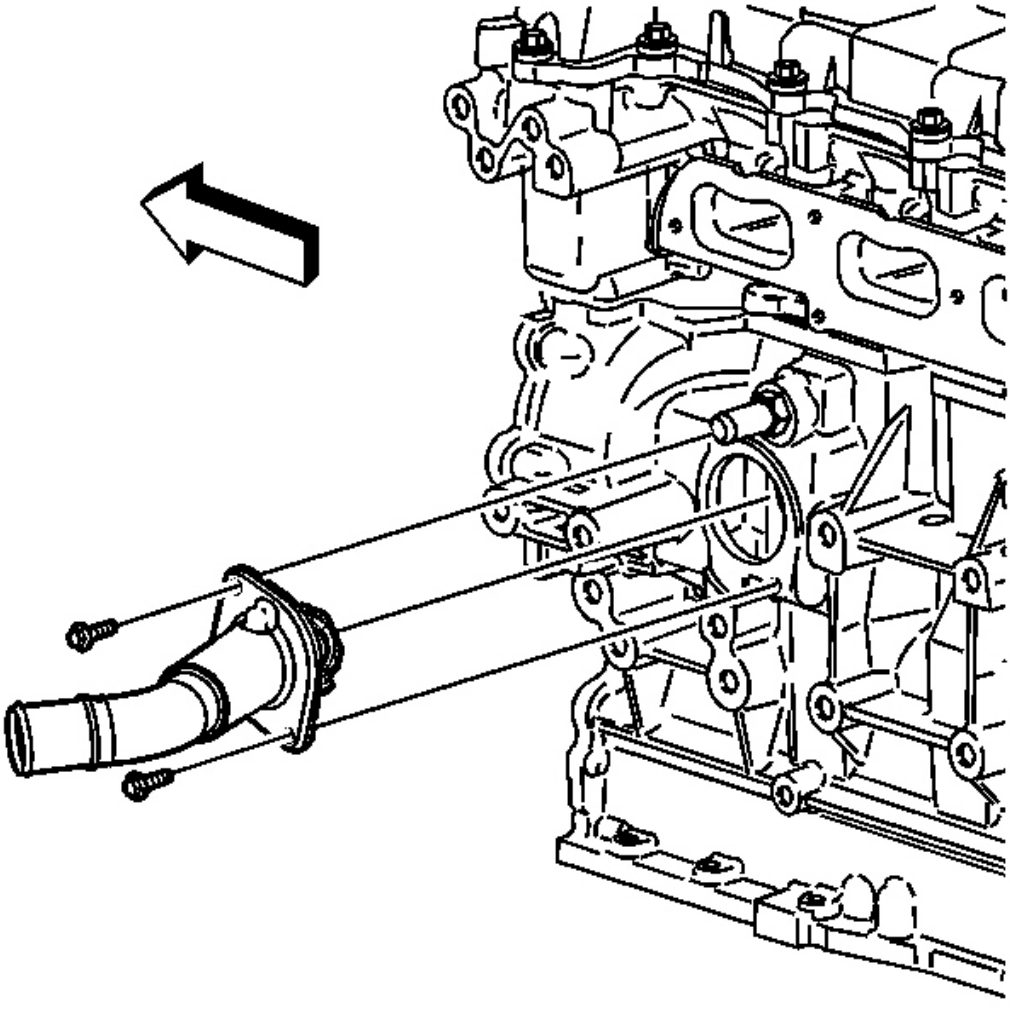


Fig. 32: View Of Thermostat Housing & Bolts
Courtesy of GENERAL MOTORS CORP.

4. Remove the thermostat housing bolts.
5. Remove the thermostat housing from the engine block.
6. Clean all of the surfaces of the thermostat housing.
7. Clean the sealing surface of the engine block.

Installation Procedure

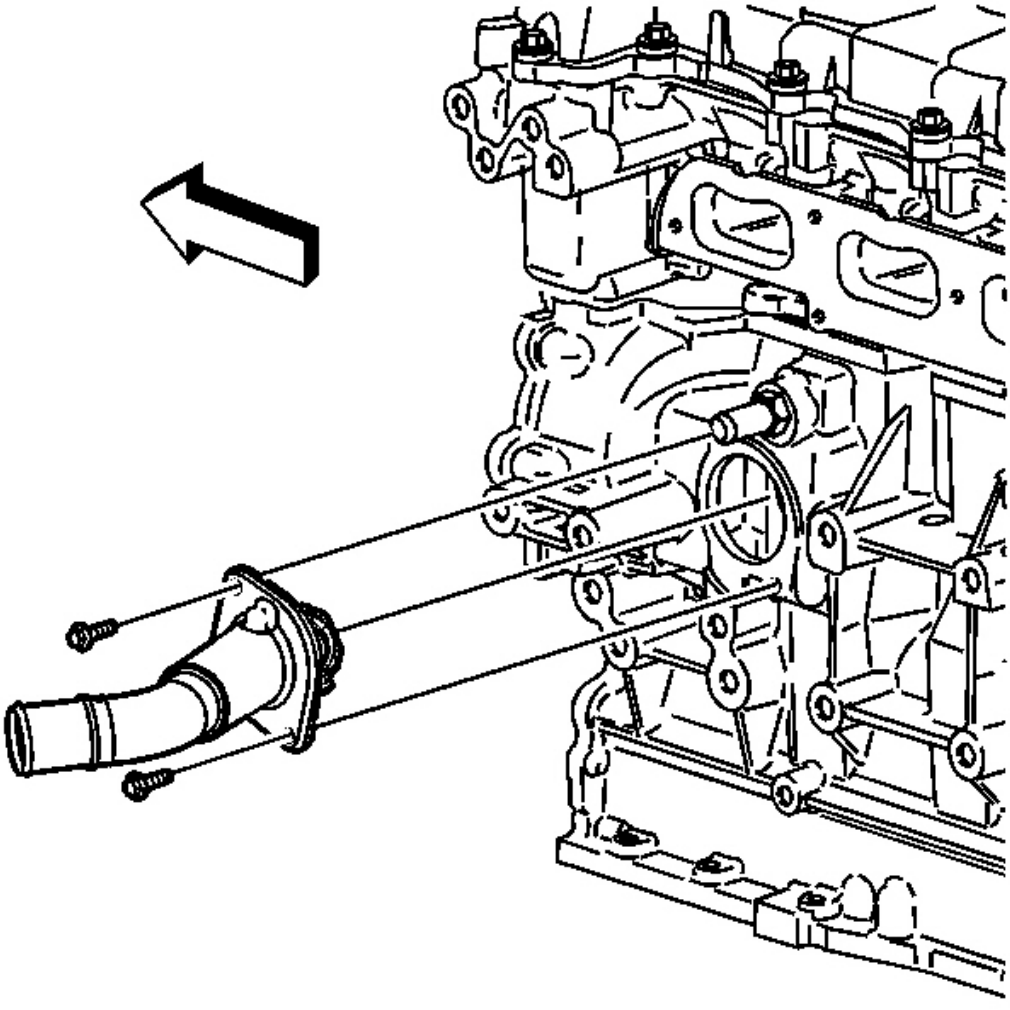


Fig. 33: View Of Thermostat Housing & Bolts
Courtesy of GENERAL MOTORS CORP.

1. Install the thermostat housing to the engine block.

NOTE: Refer to Fastener Notice in Cautions and Notices.

2. Install the thermostat housing bolts.

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

3. Lubricate the inner diameter of the radiator hose with engine coolant.

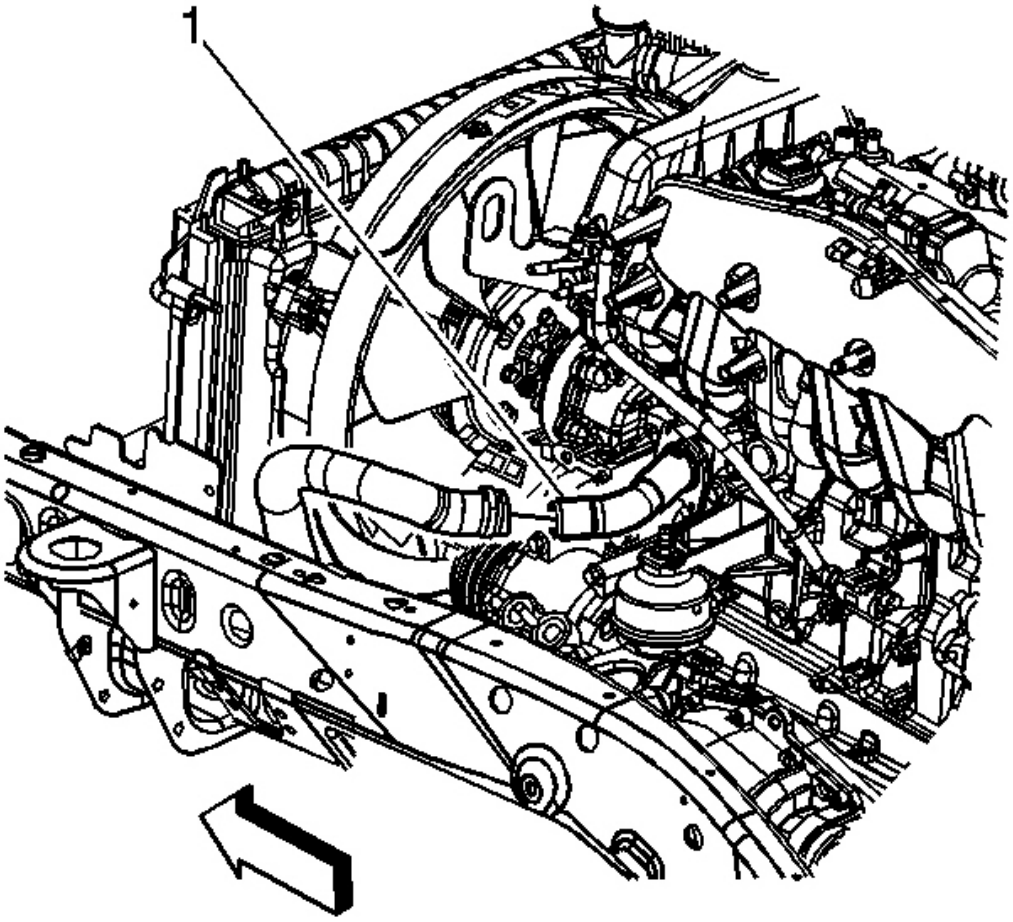


Fig. 34: Locating Thermostat Housing
Courtesy of GENERAL MOTORS CORP.

4. Install the outlet hose to the thermostat housing (1). Secure the hose with the clamp.
5. Install the generator. Refer to **Generator Replacement (4.2L Engine)** or **Generator Replacement (5.3L Engine)** in Engine Electrical
6. Fill the cooling system with specified coolant and concentration. Refer to **Draining and Filling Cooling System (Body Vin Code 6)**.
7. Inspect all sealing surfaces for leaks after starting the engine.

THERMOSTAT REPLACEMENT (5.3L ENGINE)

Removal Procedure

IMPORTANT: The thermostat is not serviceable separately. The water pump inlet and thermostat must be replaced as an assembly.

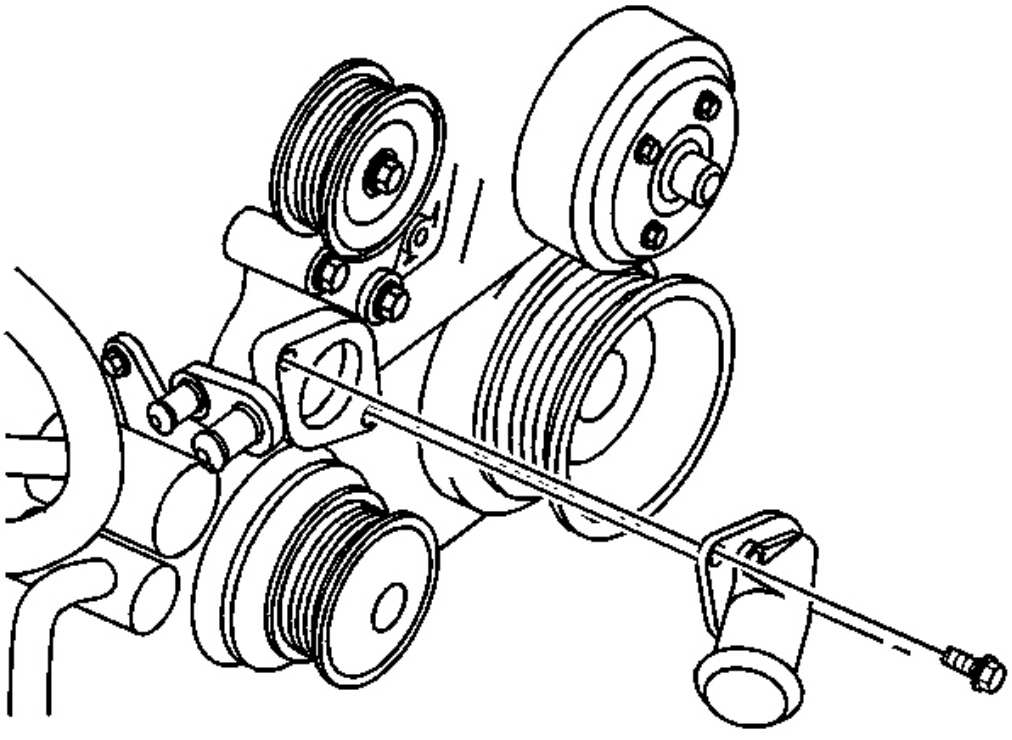


Fig. 35: View Of Water Pump Inlet
Courtesy of GENERAL MOTORS CORP.

1. Remove the radiator outlet hose. Refer to **Radiator Hose Replacement - Outlet (SWB (Short Wheel Base))** or **Radiator Hose Replacement - Outlet (LWB (Long Wheel Base))**.
2. Remove the water pump inlet bolts.
3. Remove the water pump inlet and thermostat from the water pump.

Installation Procedure

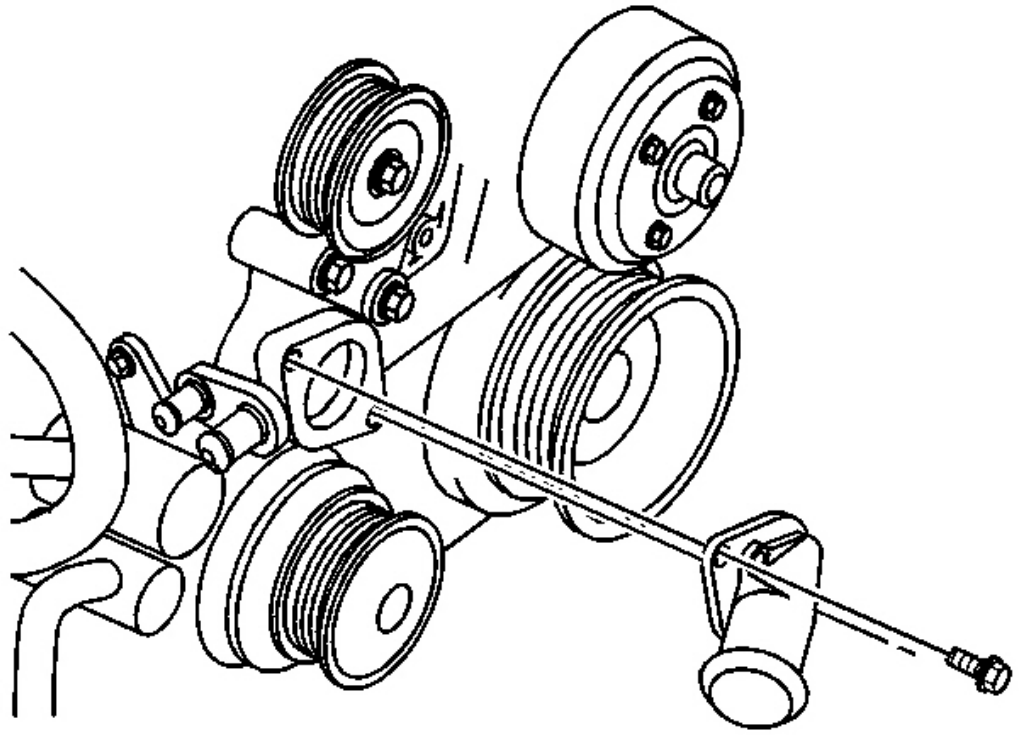


Fig. 36: View Of Water Pump Inlet
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice in Cautions and Notices.

1. Install the thermostat and thermostat housing to the water pump.
2. Install the thermostat housing bolts.

   Tighten: Tighten the bolts to 15 N.m (11 lb ft).

3. Install the radiator outlet hose. Refer to **Radiator Hose Replacement - Outlet (SWB (Short Wheel Base))** or **Radiator Hose Replacement - Outlet (LWB (Long Wheel Base))**.

COOLANT AIR BLEED PIPE ASSEMBLY REPLACEMENT (5.3L ENGINE)

Removal Procedure

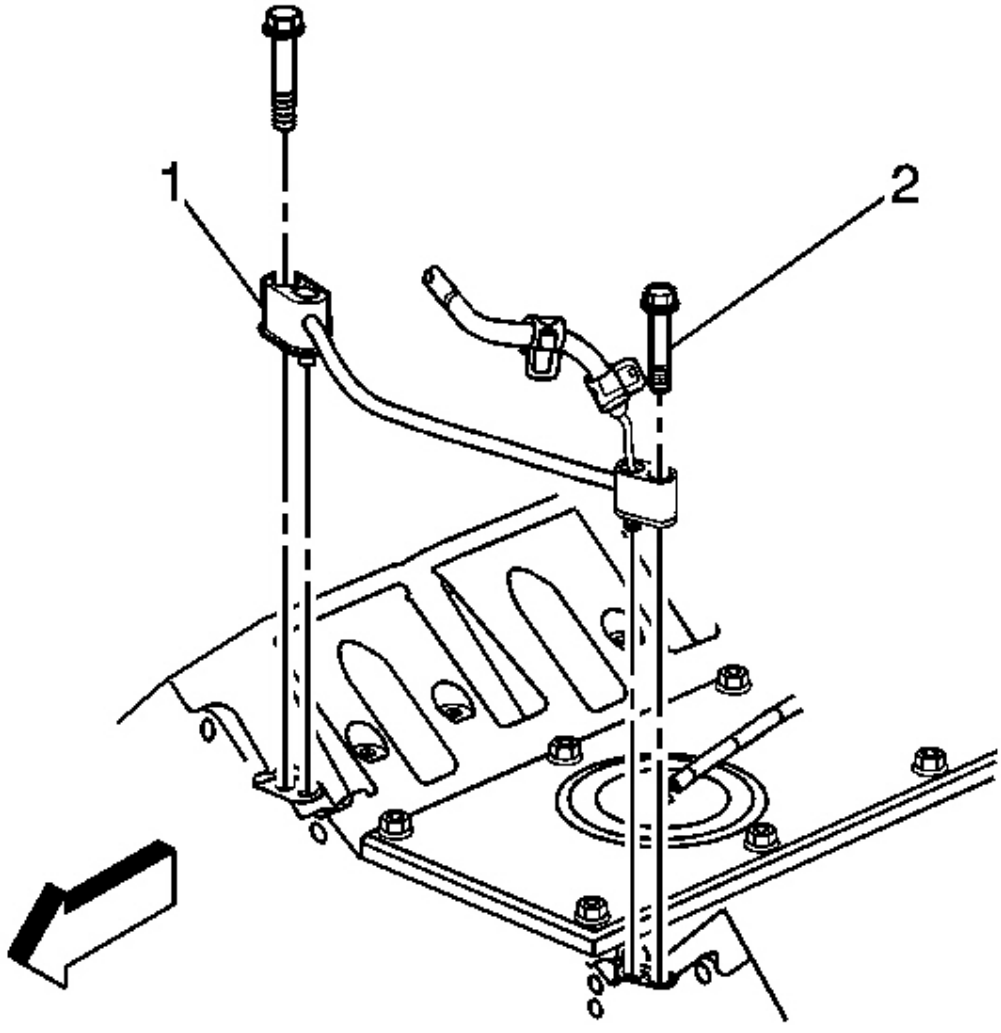


Fig. 37: View Of Coolant Air Bleed Pipe & Bolts
Courtesy of GENERAL MOTORS CORP.

1. Remove the coolant air bleed pipe bolts (2).
2. Remove the coolant air bleed pipe (1) with gaskets.

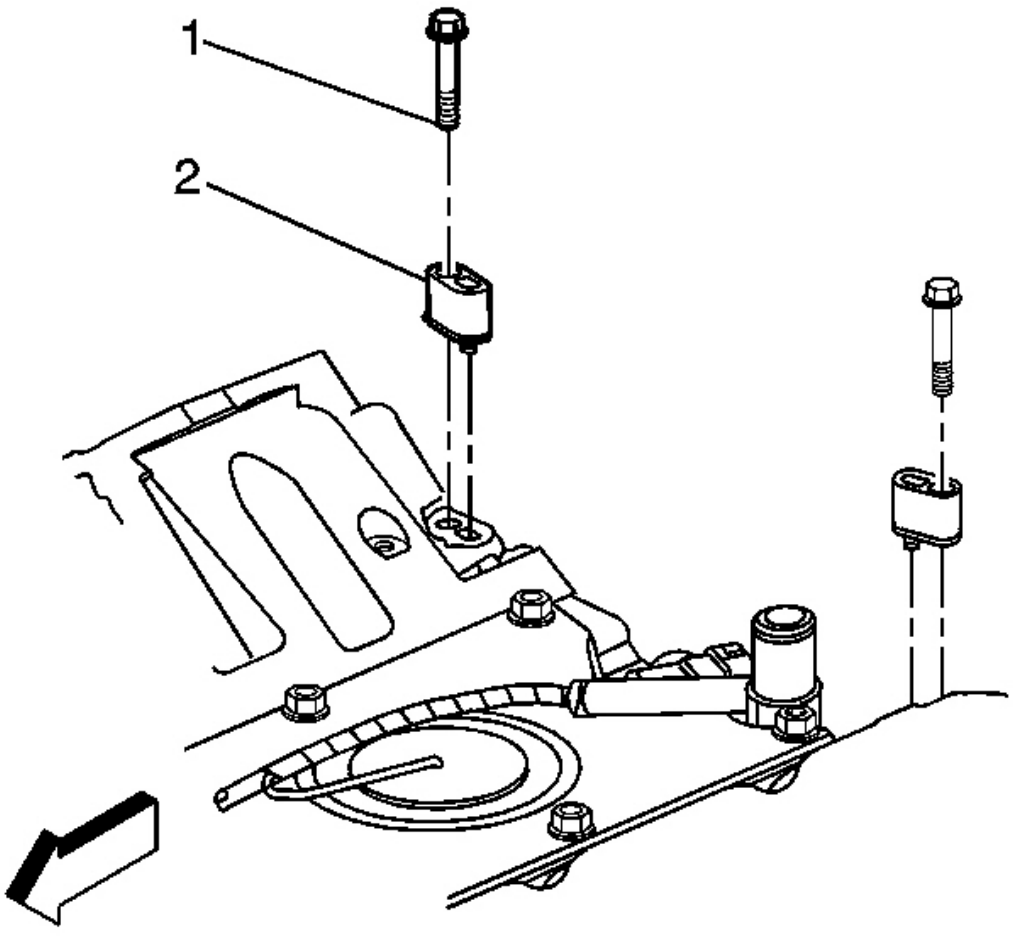


Fig. 38: View Of Coolant Air Pipe Covers & Bolts
Courtesy of GENERAL MOTORS CORP.

3. Remove the coolant air bleed pipe cover bolts (1) and covers (2).

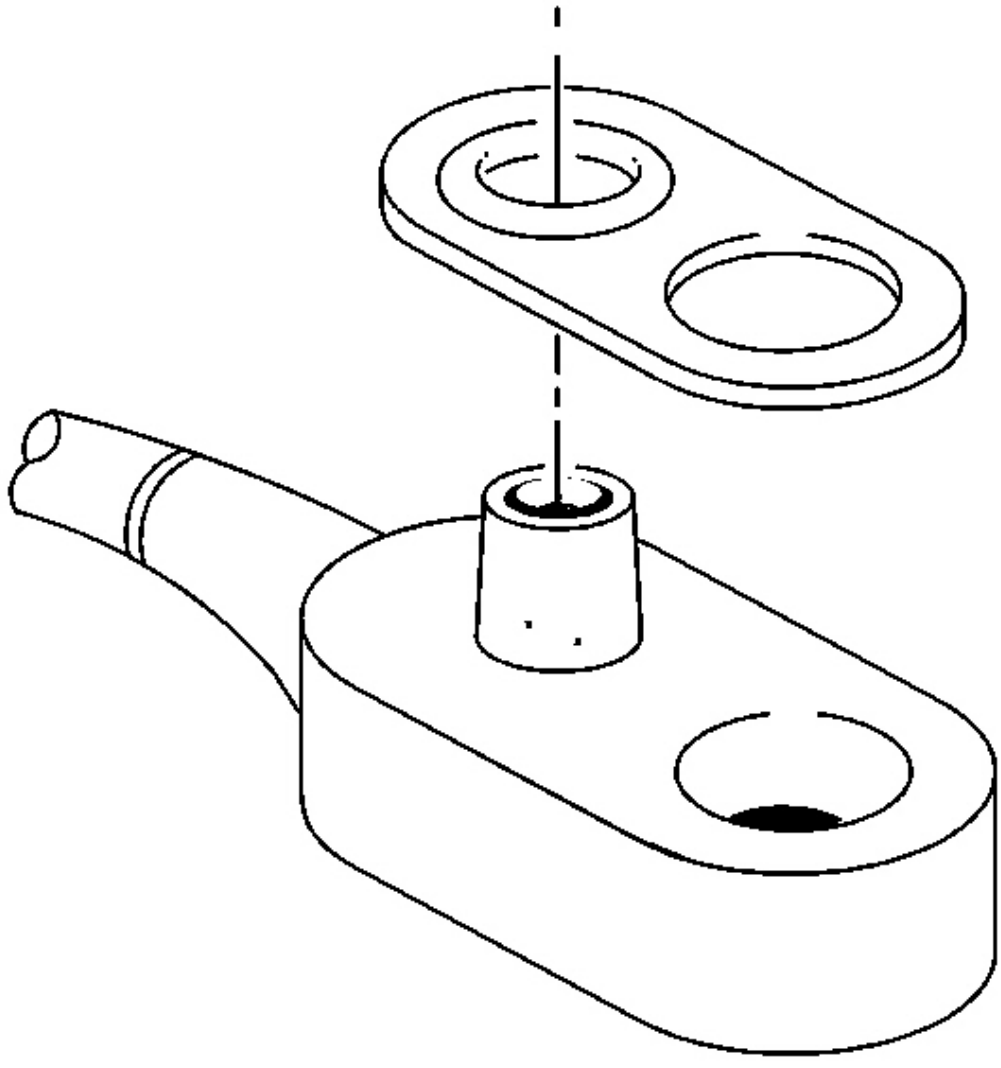


Fig. 39: View Of Air Bleed Pipe Sealing Gasket
Courtesy of GENERAL MOTORS CORP.

4. Remove the gaskets from the coolant air bleed pipe and covers.
5. Discard the gaskets.

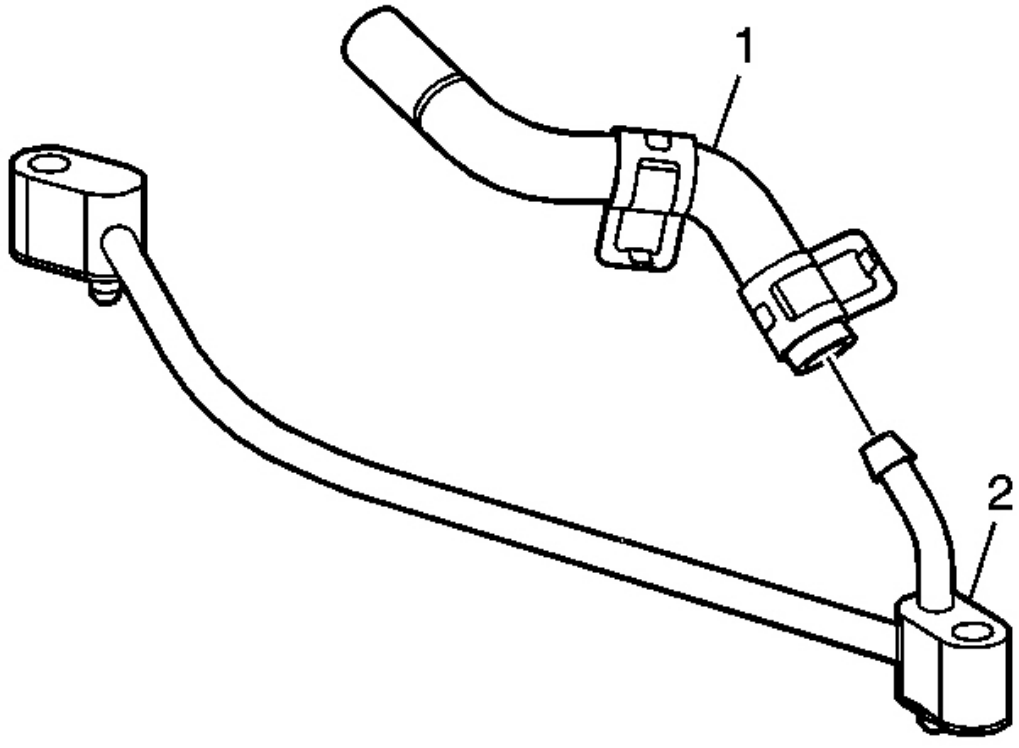


Fig. 40: Coolant Air Bleed Hose & Pipe
Courtesy of GENERAL MOTORS CORP.

6. Remove the coolant air bleed hose (1) from the pipe (2).

Installation Procedure

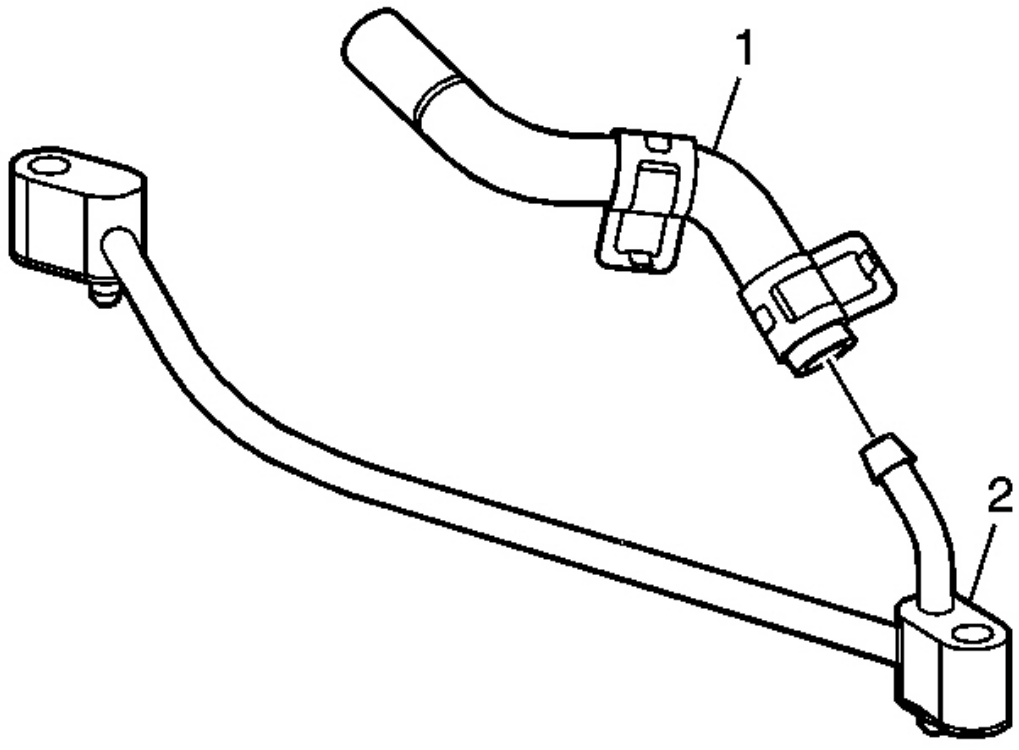


Fig. 41: Coolant Air Bleed Hose & Pipe
Courtesy of GENERAL MOTORS CORP.

1. Install the coolant air bleed hose (1) onto the pipe (2).

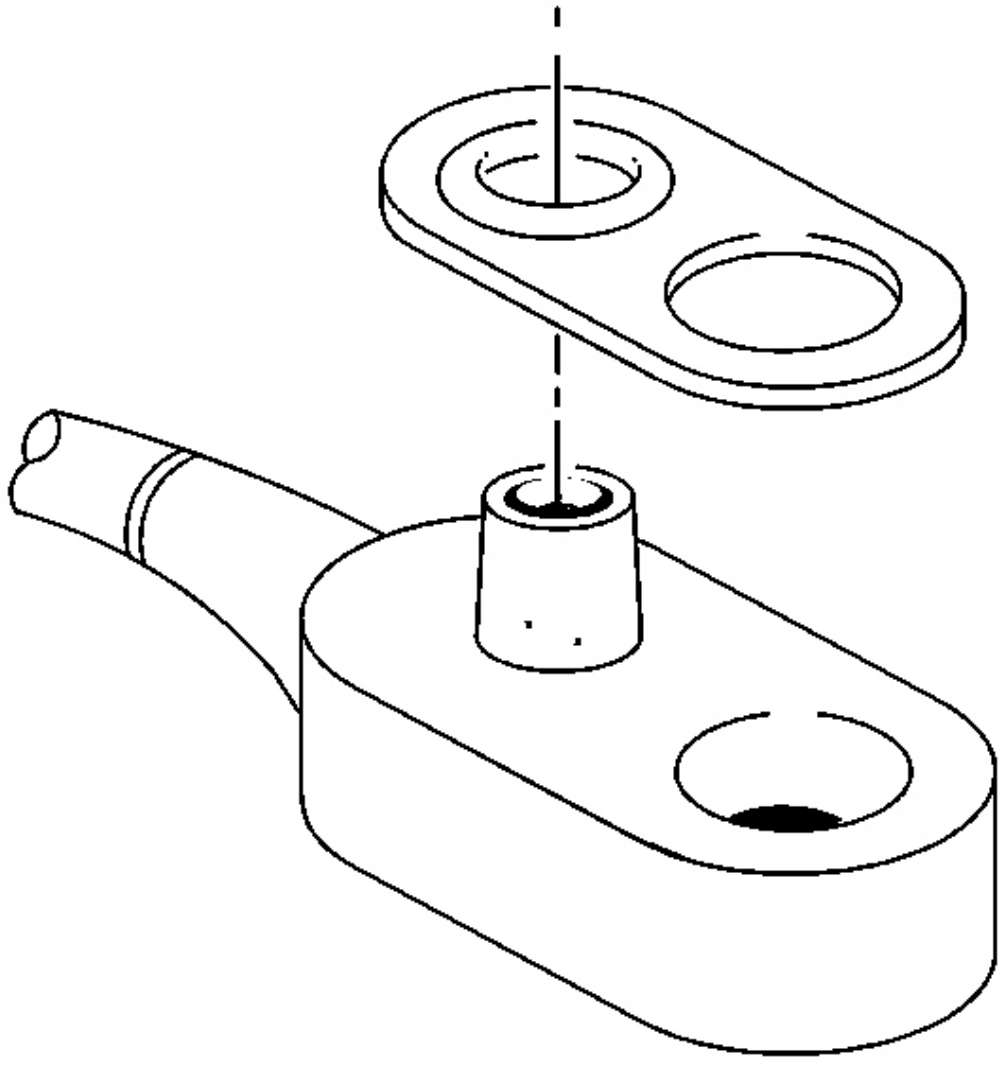


Fig. 42: View Of Air Bleed Pipe Sealing Gasket
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Install the gaskets properly onto the pipe and covers. Position the O-ring seal onto the nipple portion of the pipe.

2. Install the gaskets onto the coolant air bleed pipe and covers.

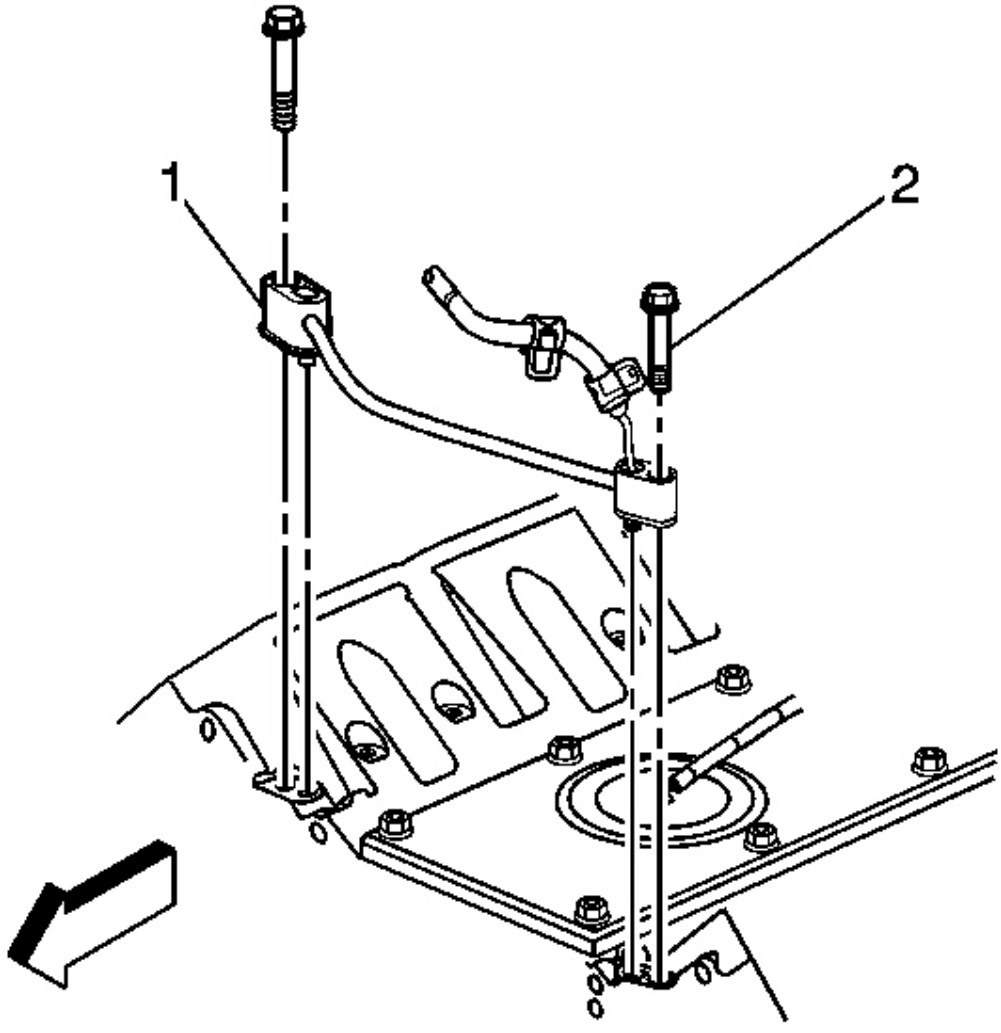


Fig. 43: View Of Coolant Air Bleed Pipe & Bolts
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice in Cautions and Notices.

3. Install the coolant air bleed pipe (1) and gaskets onto the cylinder heads.
4. Install the coolant air bleed pipe bolts (2).

Tighten: Tighten the bolts to 12 N.m (106 lb in).

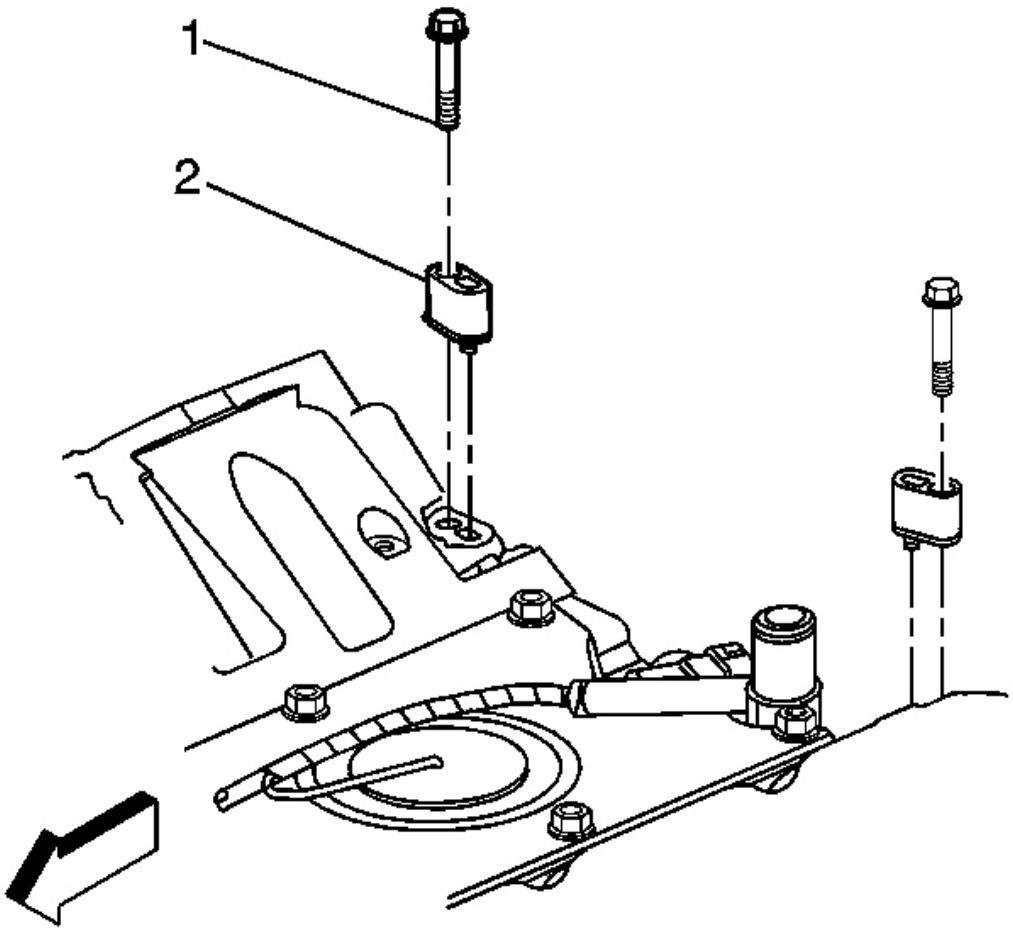


Fig. 44: View Of Coolant Air Pipe Covers & Bolts
Courtesy of GENERAL MOTORS CORP.

5. Install the coolant air bleed pipe covers (2) and bolts (1).

   Tighten: Tighten the bolts to 12 N.m (106 lb in).

COOLANT AIR BLEED HOSE REPLACEMENT (5.3L ENGINE)

Removal Procedure

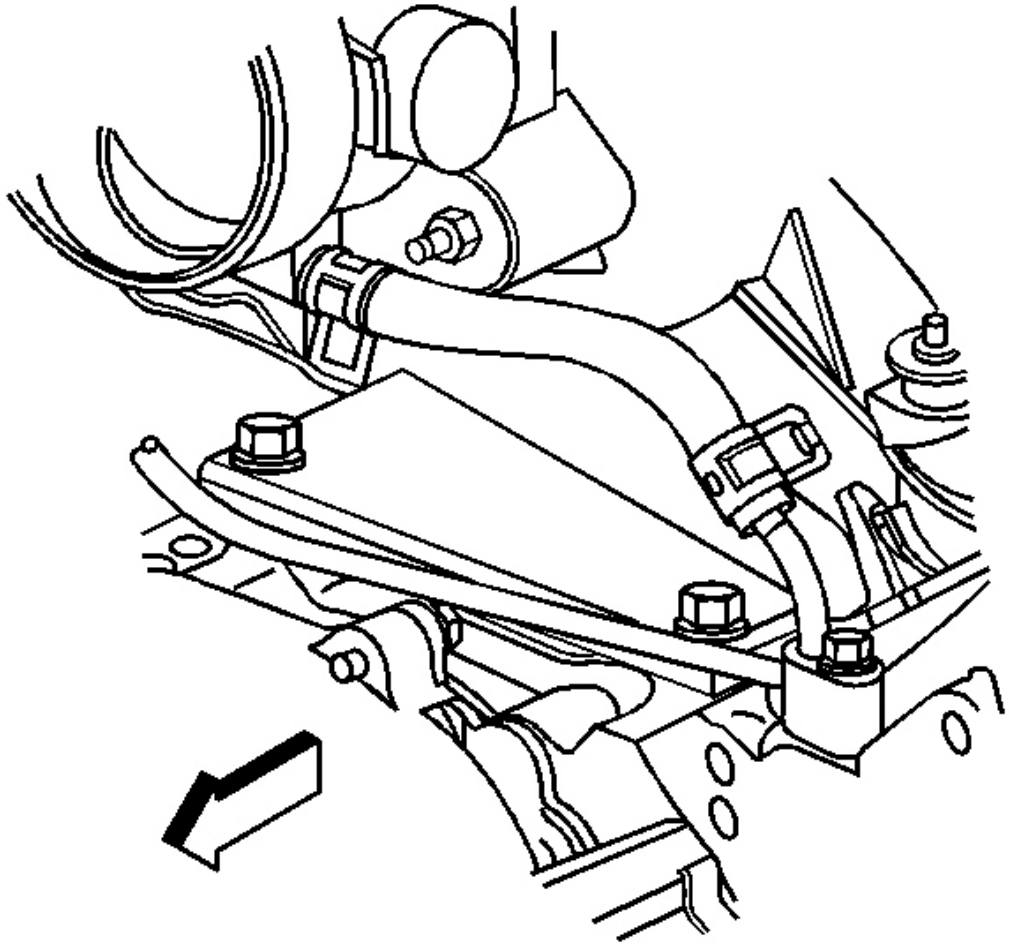


Fig. 45: View Of Coolant Air Bleed Hose & Clamp
Courtesy of GENERAL MOTORS CORP.

1. Reposition the coolant air bleed hose clamp at the throttle body.
2. Remove the coolant air bleed hose from the throttle body.

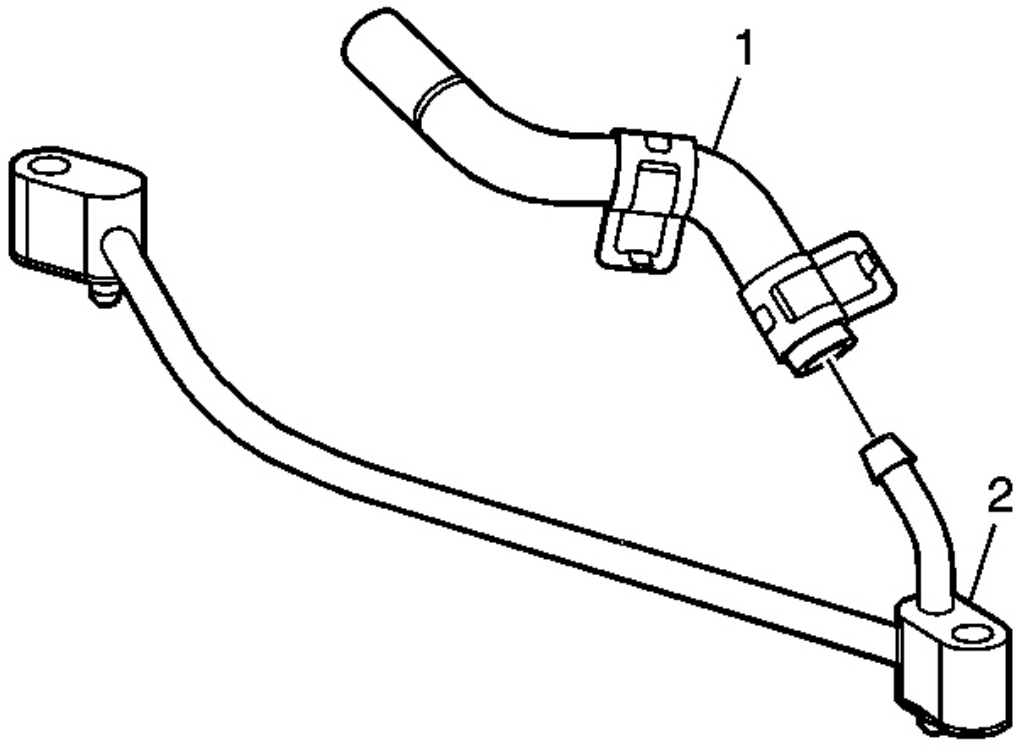


Fig. 46: Coolant Air Bleed Hose & Pipe
Courtesy of GENERAL MOTORS CORP.

3. Reposition the coolant air bleed hose clamp at the pipe.
4. Remove the coolant air bleed hose (1) from the pipe (2).

Installation Procedure

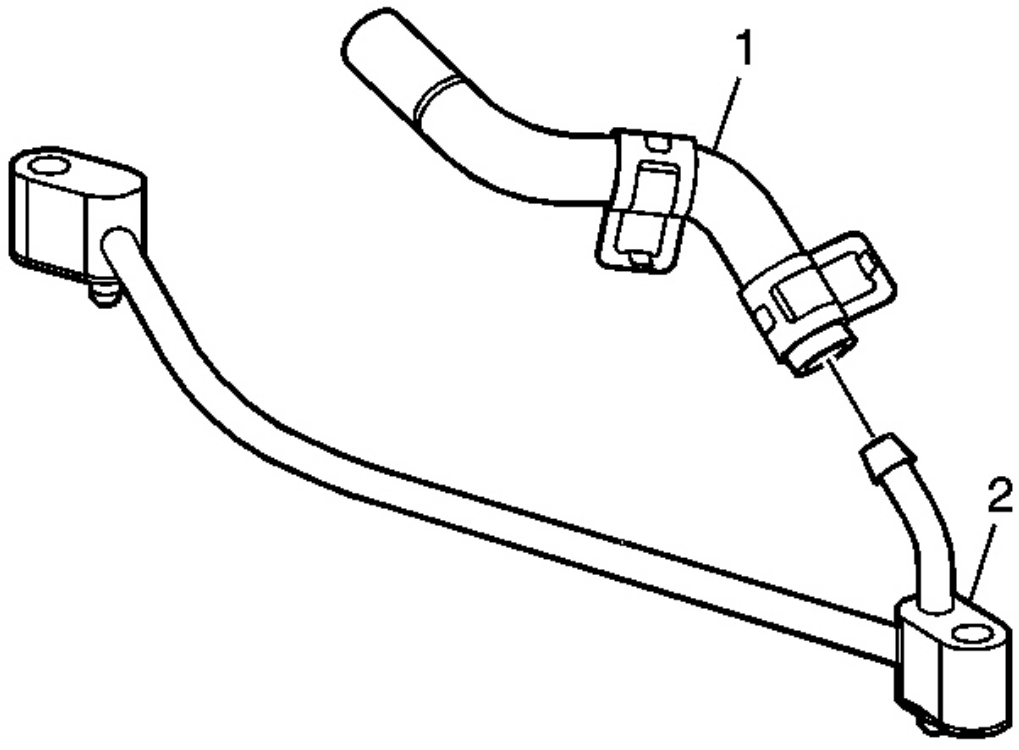


Fig. 47: Coolant Air Bleed Hose & Pipe
Courtesy of GENERAL MOTORS CORP.

1. Install the coolant air bleed hose (1) to the pipe (2).
2. Position the coolant air bleed hose clamp at the pipe.

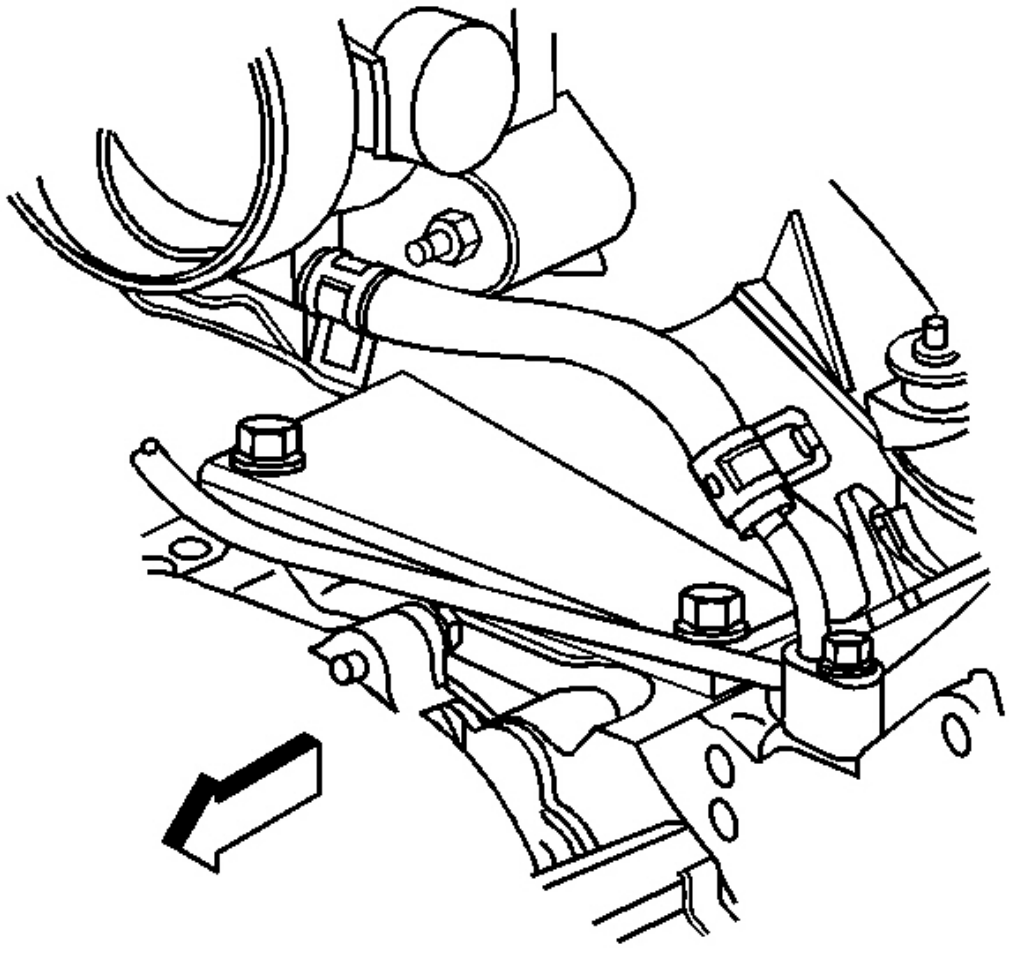


Fig. 48: View Of Coolant Air Bleed Hose & Clamp
Courtesy of GENERAL MOTORS CORP.

3. Install the coolant air bleed hose to the throttle body.
4. Position the coolant air bleed hose clamp at the throttle body.
5. Add engine coolant, if necessary.

WATER OUTLET HOUSING REPLACEMENT

Removal Procedure

1. Disconnect the radiator inlet hose from the water outlet housing. Refer to **Radiator Hose Replacement - Outlet (SWB (Short Wheel Base))** or **Radiator Hose Replacement - Outlet (LWB (Long Wheel**

Base)).

2. Remove the power steering pump bracket. Refer to **Power Steering Pump Bracket Replacement** in Power Steering System.

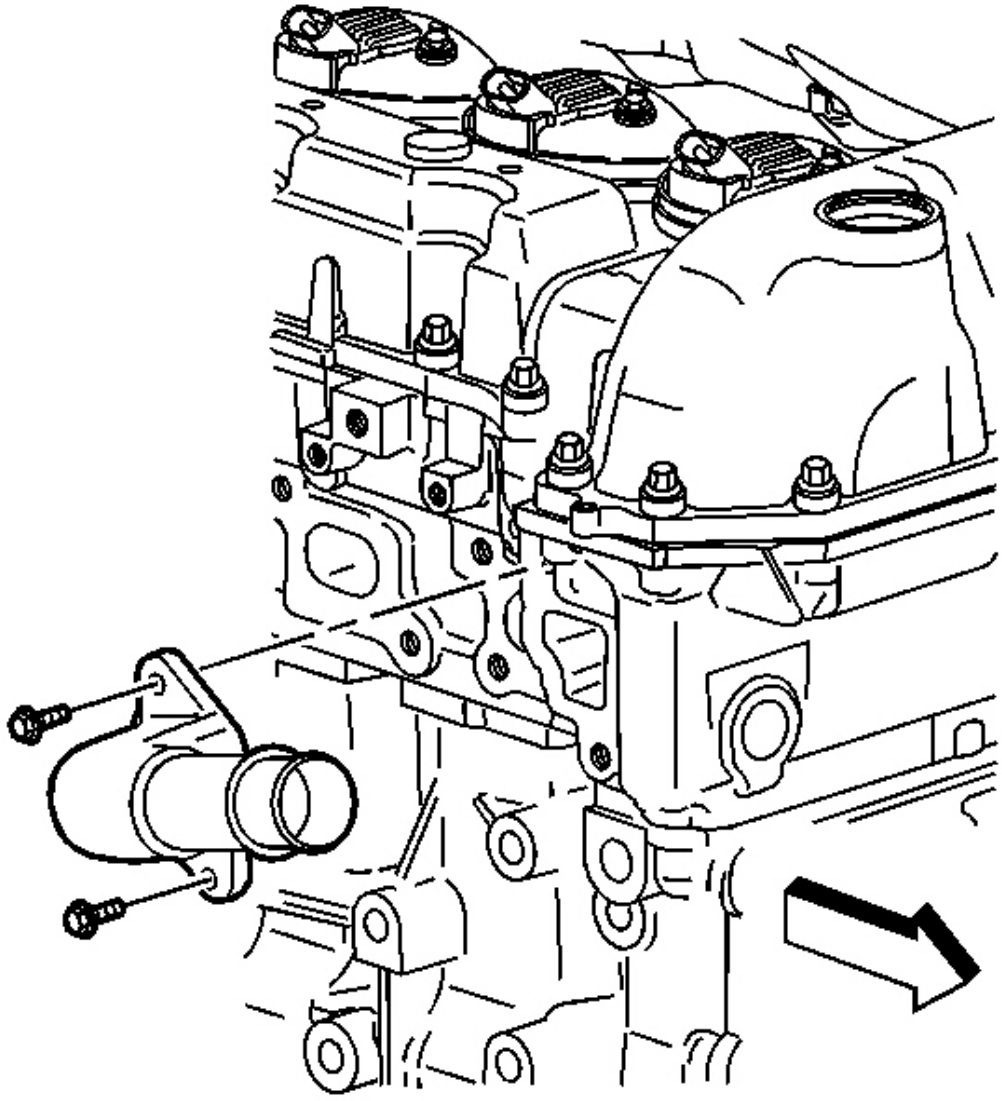


Fig. 49: View Of Water Outlet
Courtesy of GENERAL MOTORS CORP.

3. Remove the water outlet housing bolts.

4. Remove the water outlet housing and seal. Discard the old seal.

Installation Procedure

1. Remove any burrs or foreign material from the sealing surface of the engine cylinder head and the water outlet housing.

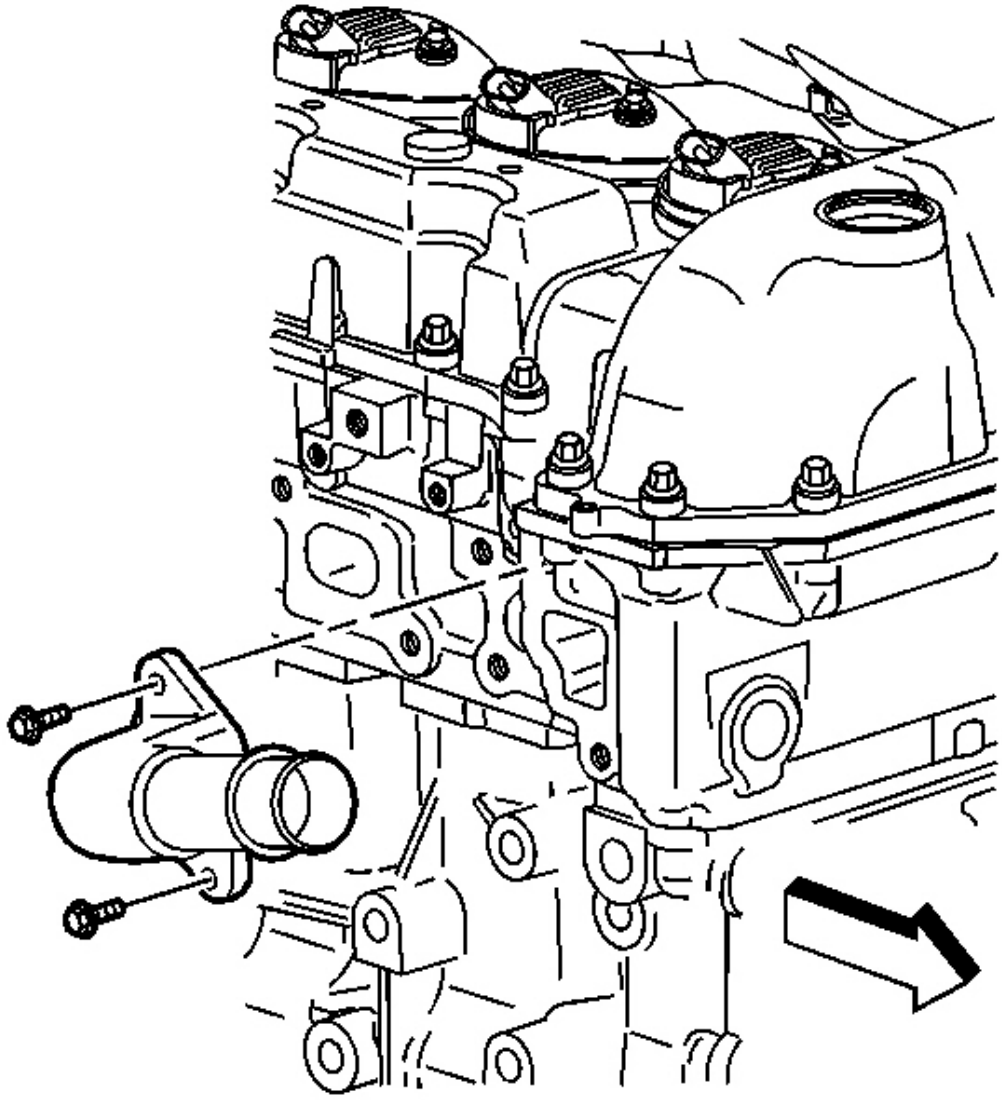


Fig. 50: View Of Water Outlet
Courtesy of GENERAL MOTORS CORP.

2. Install a NEW seal and the water outlet housing.

NOTE: Refer to Fastener Notice in Cautions and Notices.

3. Install the water outlet housing bolts.

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

4. Connect the radiator inlet hose to the water outlet housing. Refer to **Radiator Hose Replacement - Outlet (SWB (Short Wheel Base))** or **Radiator Hose Replacement - Outlet (LWB (Long Wheel Base))**.
5. Install the power steering pump bracket. Refer to **Power Steering Pump Bracket Replacement** in Power Steering System.

WATER PUMP REPLACEMENT (LL8)

Tool Required

J 41240 Fan Clutch Remover and Installer

Removal Procedure

1. Drain the coolant. Refer to **Draining and Filling Cooling System (Body Vin Code 6)**.
2. Remove the fan and shroud. Refer to **Cooling Fan and Shroud Replacement**.
3. Remove the drive belt. Refer to **Drive Belt Replacement** in Engine Mechanical - 4.2L.

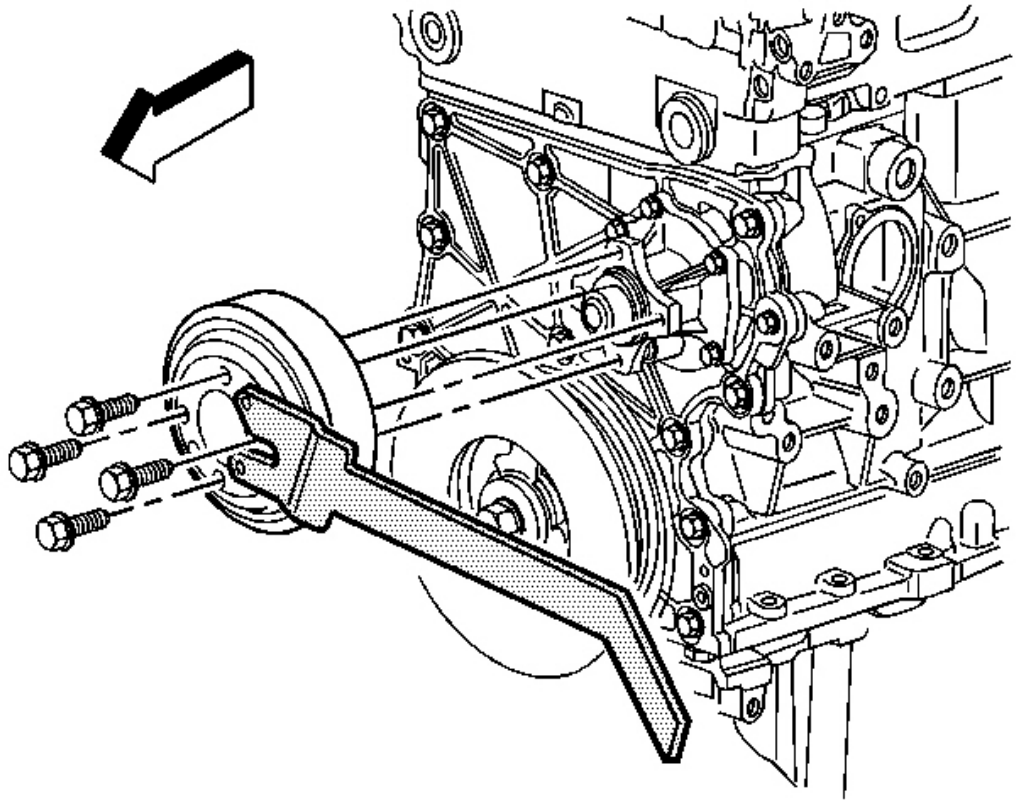


Fig. 51: View Of Water Pump Pulley & Bolts
Courtesy of GENERAL MOTORS CORP.

4. Using the **J 41240** , secure the water pump pulley and remove the water pump pulley bolts.
5. Remove the **J 41240** .
6. Remove the water pump pulley.

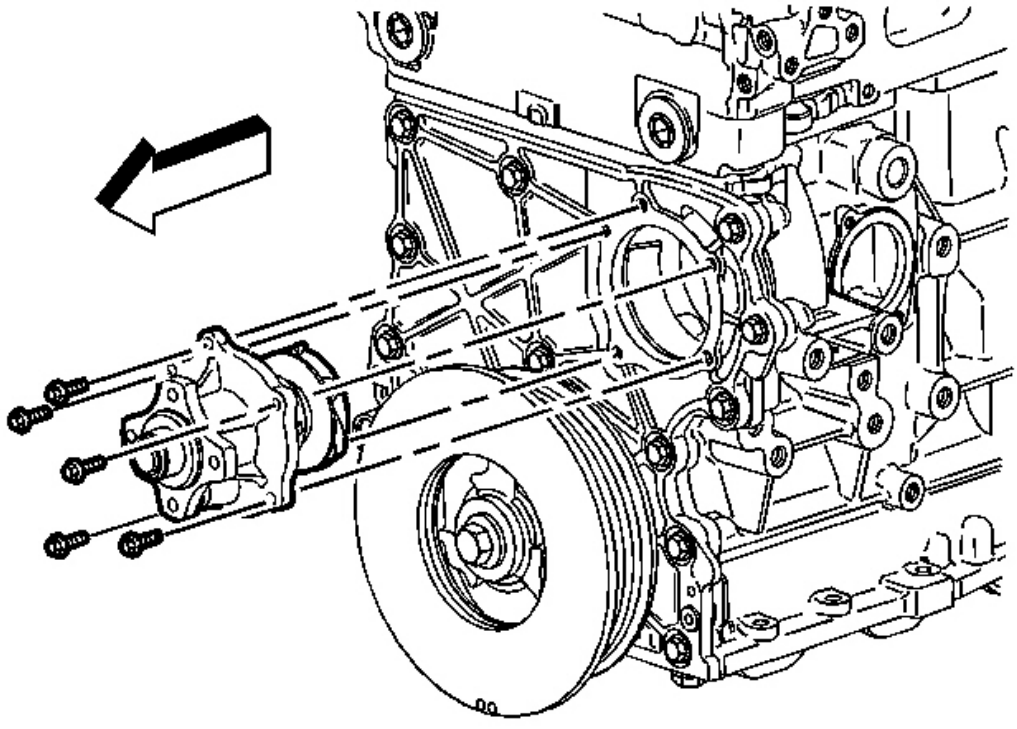


Fig. 52: View Of Water Pump & Bolts
Courtesy of GENERAL MOTORS CORP.

7. Loosen and remove the water pump bolts.
8. Remove the water pump.
9. Clean and inspect the water pump. Refer to **Water Pump Cleaning and Inspection** in Engine Mechanical - 4.2L Unit Repair.
10. Discard and replace the gasket.

Installation Procedure

1. Install a new water pump gasket.

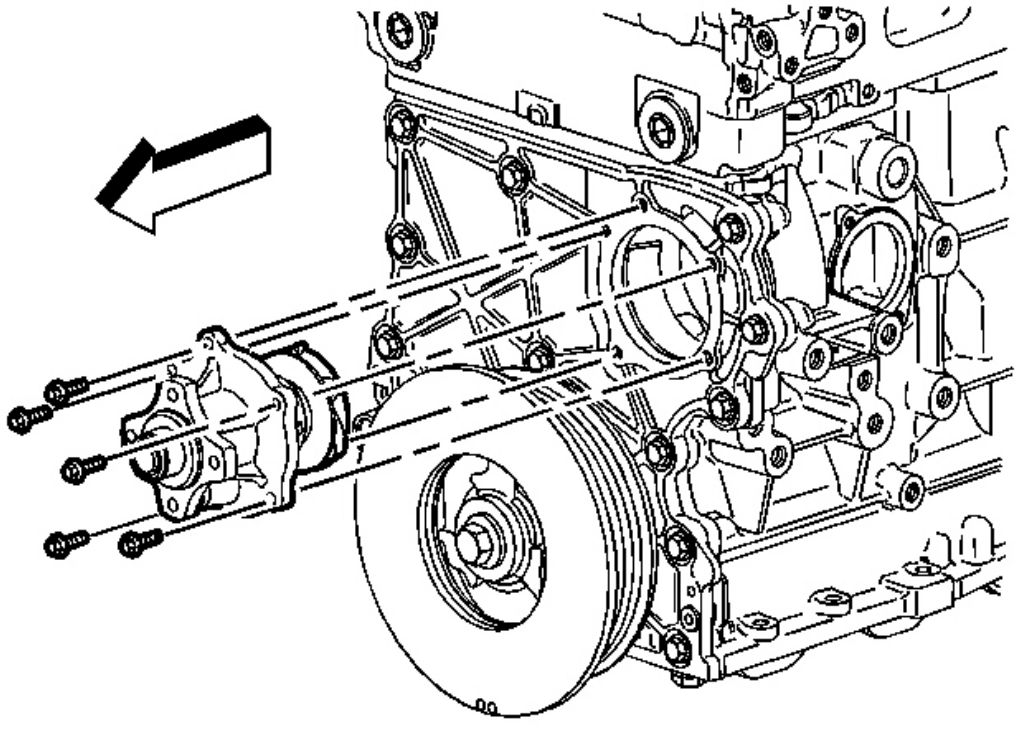


Fig. 53: View Of Water Pump & Bolts
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice in Cautions and Notices.

2. Install the water pump and secure the water pump with the bolts.

Tighten:

- On the initial pass, tighten the bolts to 4 N.m (35 lb in).
- On the final pass, tighten the bolts to 10 N.m (89 lb in).

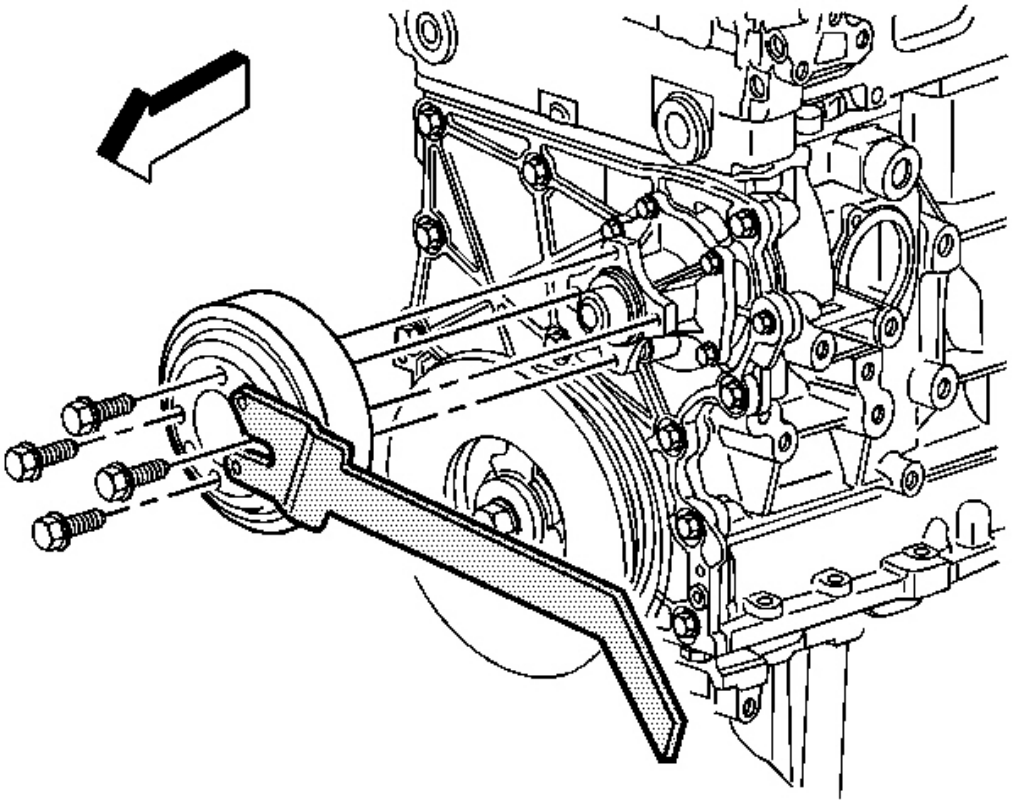


Fig. 54: View Of Water Pump Pulley & Bolts
Courtesy of GENERAL MOTORS CORP.

3. Install the water pump pulley.
4. Install the water pump pulley bolts.
5. Using the **J 41240** , secure the water pump pulley while tightening the water pump pulley bolts.

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

6. Remove the **J 41240** .
7. Install the drive belt. Refer to **Drive Belt Replacement** in Engine Mechanical - 4.2L.
8. Install the fan and the shroud. Refer to **Cooling Fan and Shroud Replacement**.
9. Fill the cooling system with the specified coolant and concentration. Refer to **Draining and Filling Cooling System (Body Vin Code 6)**.
10. Inspect for leaks.

WATER PUMP REPLACEMENT (LM4)

Tools Required

J 38185 Hose Clamp Pliers

Removal Procedure

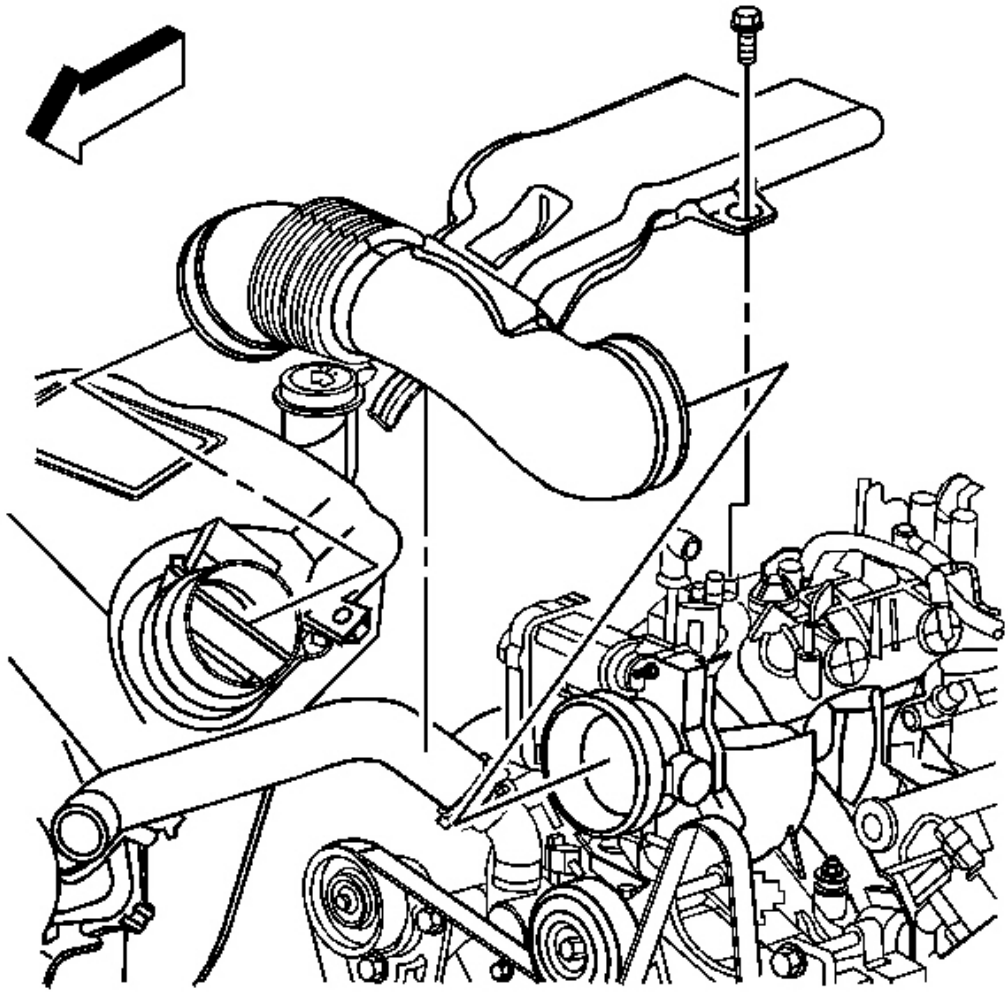


Fig. 55: View Of Intake Air Tube
Courtesy of GENERAL MOTORS CORP.

1. Drain the cooling system. Refer to **Draining and Filling Cooling System (Body Vin Code 6)**.

2. Loosen the air cleaner outlet duct clamps at the following locations:
   - Throttle body
   - Mass air flow (MAF)/intake air temperature (IAT) sensor
3. Remove the air cleaner outlet duct bolt and duct.
4. Remove the accessory drive belt tensioner. Refer to **Drive Belt Tensioner Replacement - Accessory** in Engine Mechanical - 4.8L, 5.3L, and 6.0L.
5. Remove the cooing fan and shroud. Refer to **Cooling Fan and Shroud Replacement**.

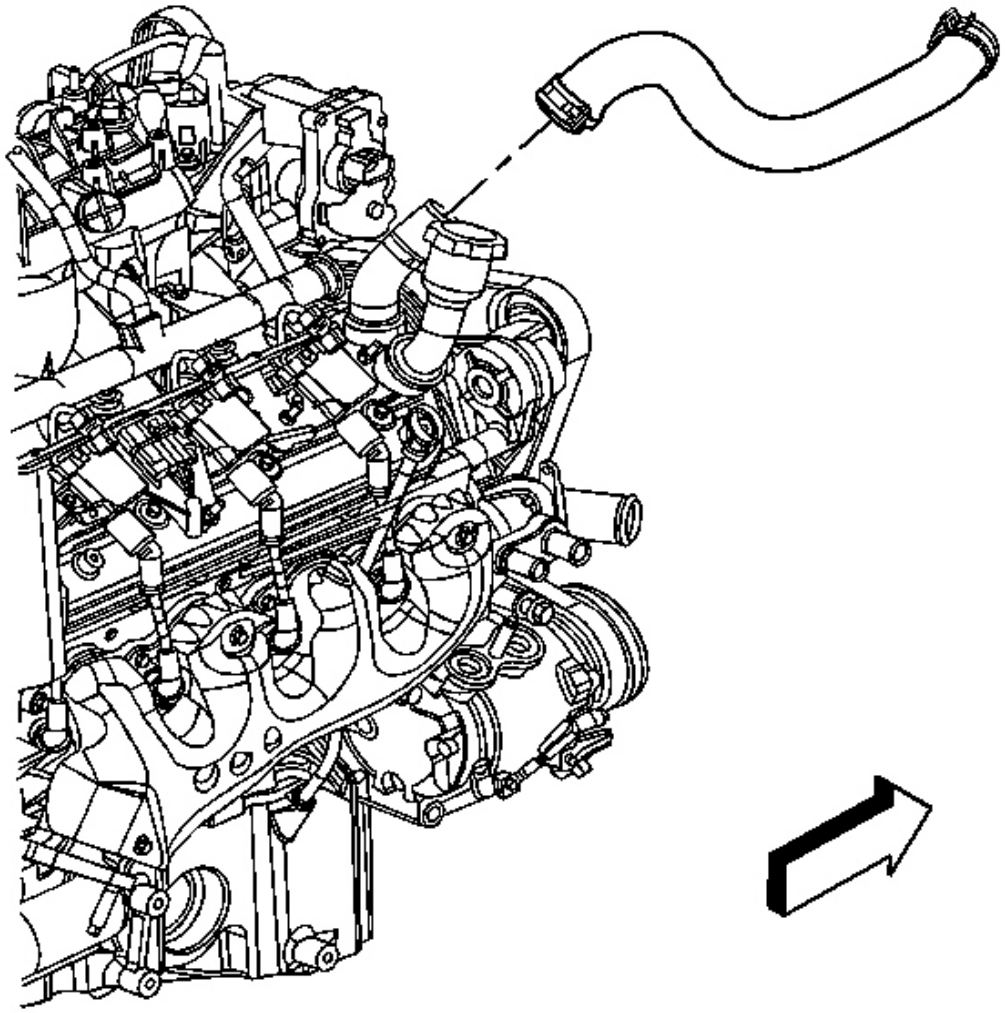


Fig. 56: View Of Inlet Hose
Courtesy of GENERAL MOTORS CORP.

6. Using **J 38185** , reposition the inlet hose clamp at the water pump.
7. Remove the inlet hose from the water pump.

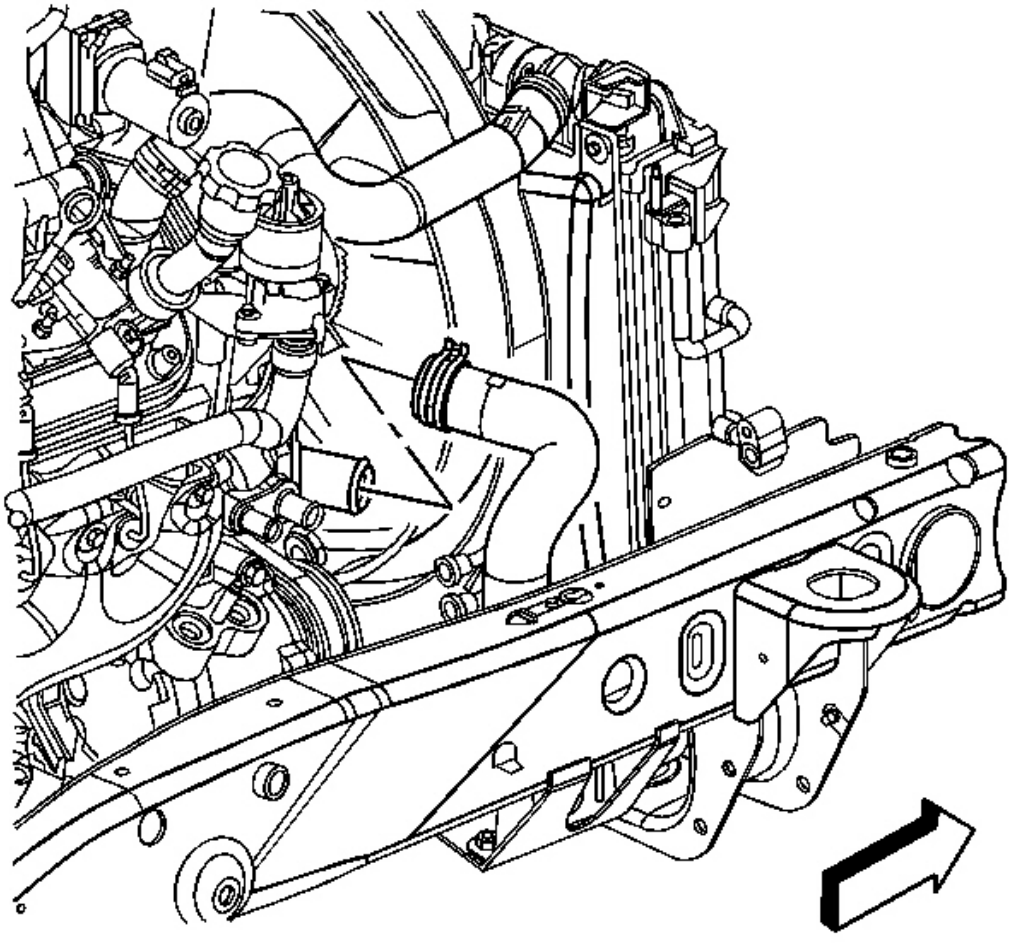


Fig. 57: View Of Outlet Hose
Courtesy of GENERAL MOTORS CORP.

8. Using **J 38185** , reposition the outlet hose clamp at the water pump.
9. Remove the outlet hose from the water pump.

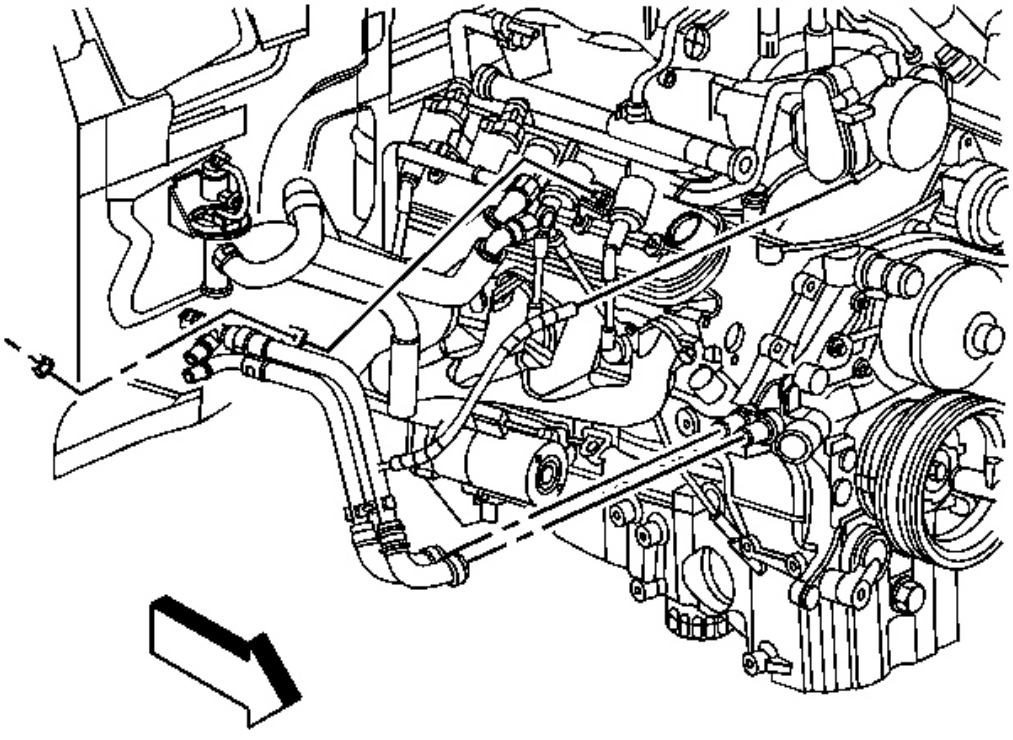


Fig. 58: View Of Auxiliary Heater Inlet & Outlet Hoses/Pipes
Courtesy of GENERAL MOTORS CORP.

10. Remove the auxiliary heater inlet and outlet hose/pipe nut.
11. Using **J 38185** , reposition the throttle body hose clamp at the throttle body.
12. Remove the hose from the throttle body.
13. Using **J 38185** , reposition the auxiliary heater inlet and outlet hose/pipe clamps at the water pump.
14. Remove the inlet and outlet hoses/pipes from the water pump.

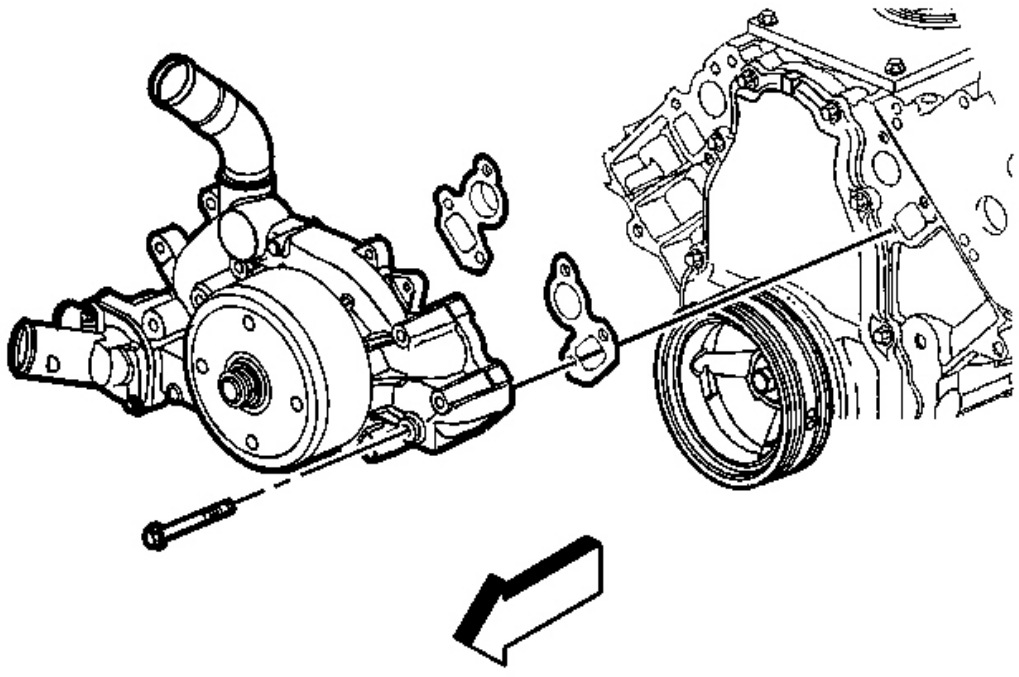


Fig. 59: View Of Water Pump, Gaskets & Bolts
Courtesy of GENERAL MOTORS CORP.

15. Remove the water pump bolts.
16. Remove the water pump and gaskets.
17. Discard the water pump gaskets.

Installation Procedure

IMPORTANT: All gaskets surfaces are to be free of oil or other foreign material during assembly.

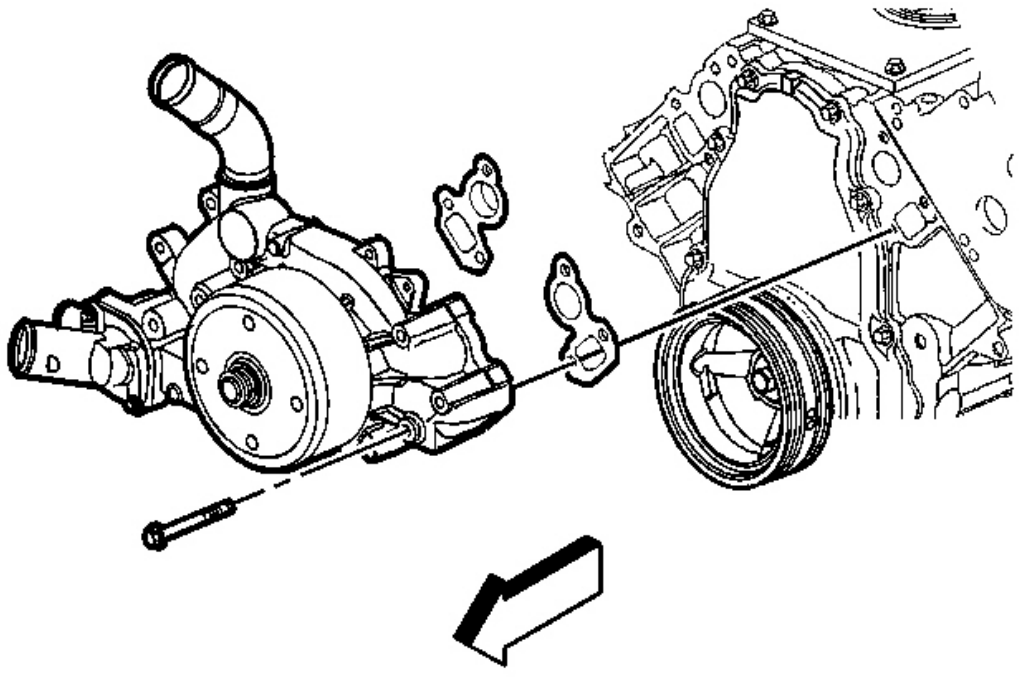


Fig. 60: View Of Water Pump, Gaskets & Bolts
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice in Cautions and Notices.

1. Install the water pump and NEW gaskets.
2. Install the water pump bolts.

Tighten:

- On the initial pass, tighten the bolts to 15 N.m (11 lb ft).
- On the final pass, tighten the bolts to 30 N.m (22 lb ft).

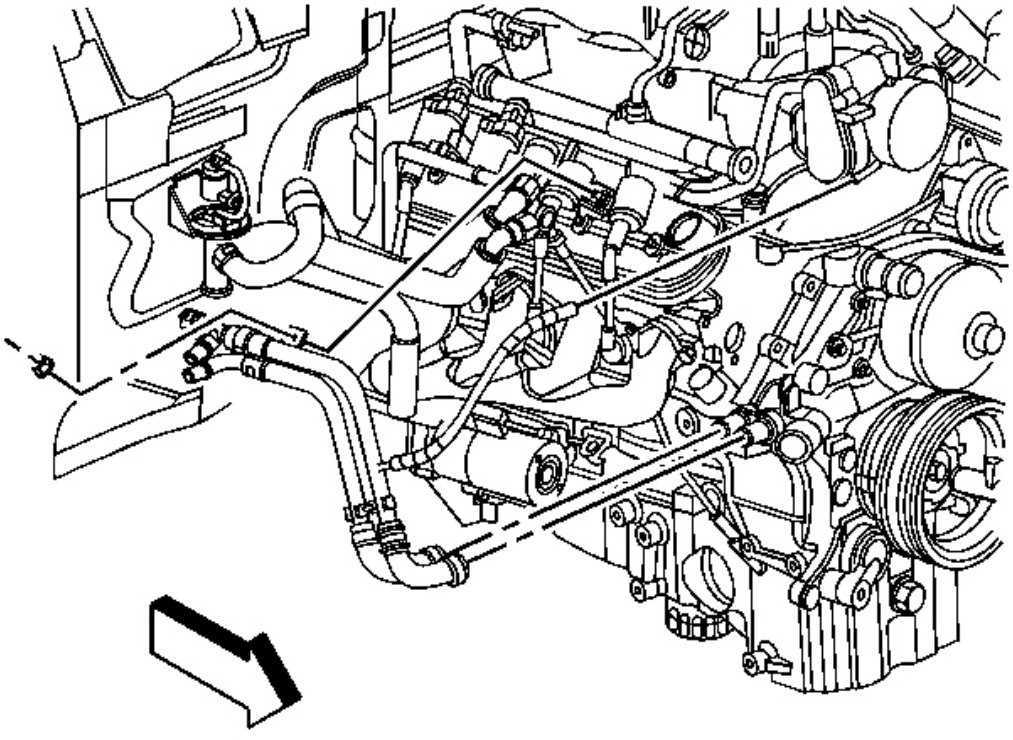


Fig. 61: View Of Auxiliary Heater Inlet & Outlet Hoses/Pipes
Courtesy of GENERAL MOTORS CORP.

3. Install the auxiliary heater inlet and outlet hose/pipe nut.

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

4. Install the hose to the throttle body.
5. Using **J 38185** , position the throttle body hose clamp at the throttle body.
6. Install the inlet and outlet hoses/pipes to the water pump.
7. Using **J 38185** , position the auxiliary heater inlet and outlet hose/pipe clamps at the water pump.

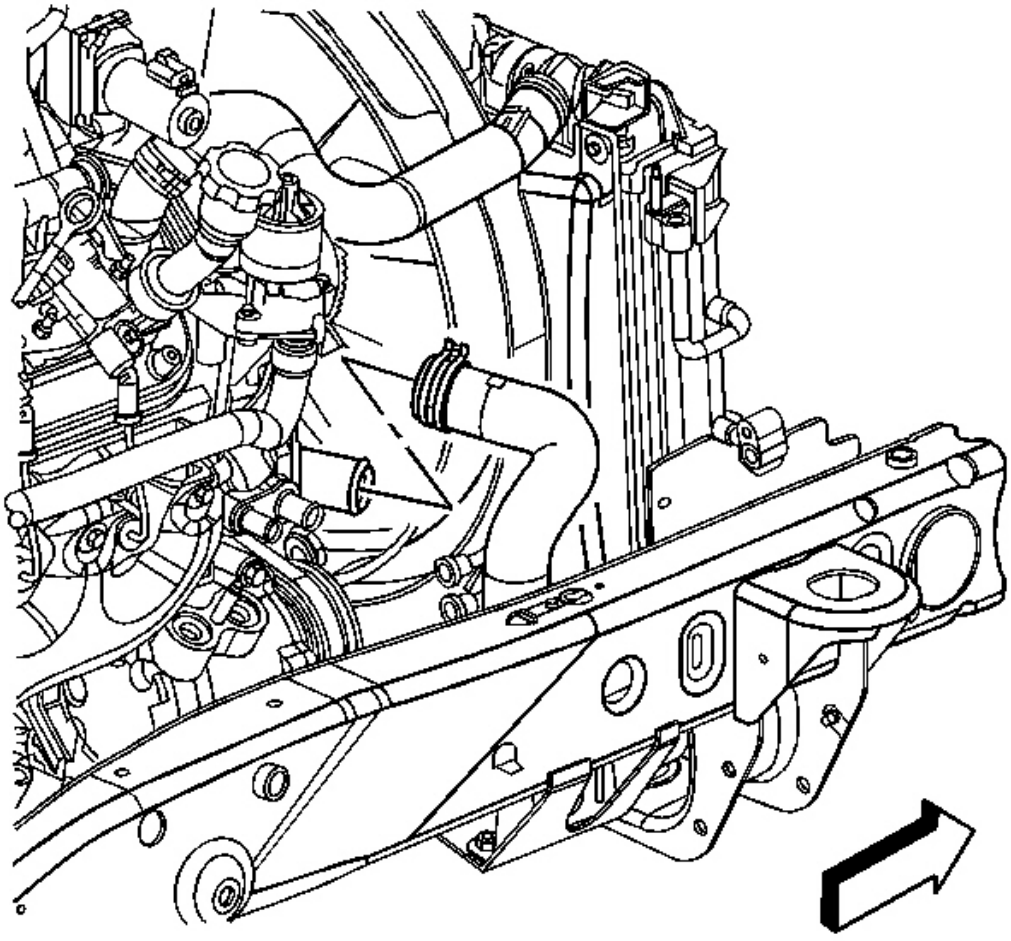


Fig. 62: View Of Outlet Hose
Courtesy of GENERAL MOTORS CORP.

8. Install the outlet hose to the water pump.
9. Using **J 38185** , position the outlet hose clamp at the water pump.

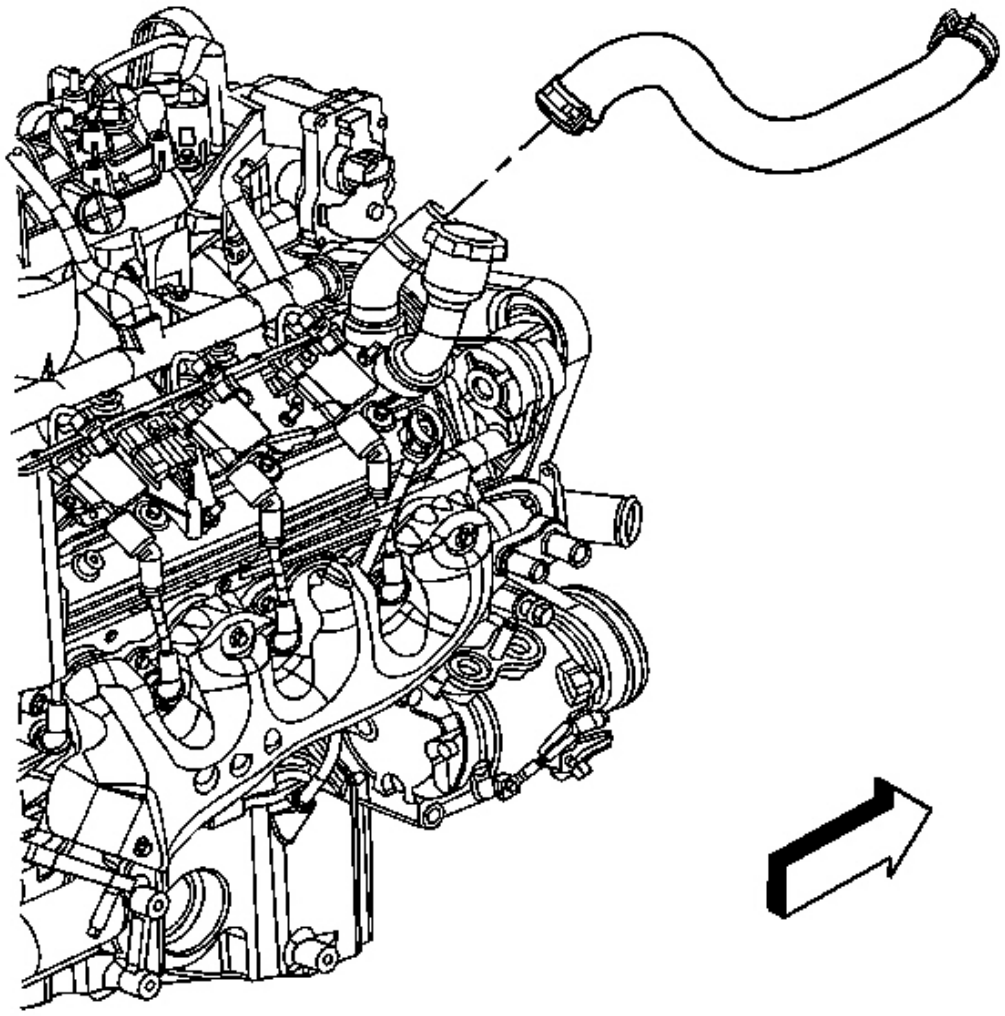


Fig. 63: View Of Inlet Hose
Courtesy of GENERAL MOTORS CORP.

10. Install the inlet hose to the water pump.
11. Using **J 38185** , position the inlet hose clamp at the water pump.
12. Install the cooing fan and shroud. Refer to **Cooling Fan and Shroud Replacement**.
13. Install the accessory drive belt tensioner. Refer to **Drive Belt Tensioner Replacement - Accessory** in Engine Mechanical - 4.8L, 5.3L, and 6.0L.

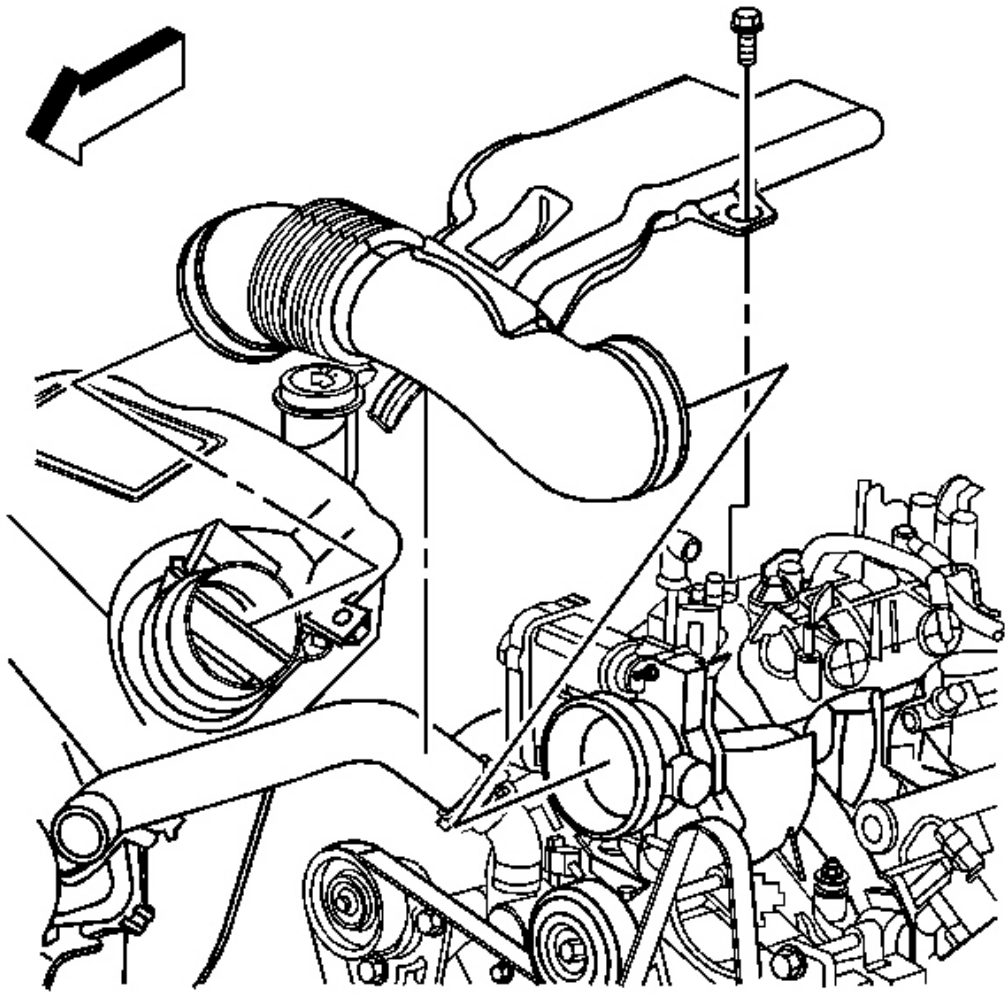


Fig. 64: View Of Intake Air Tube
Courtesy of GENERAL MOTORS CORP.

14. Install the air cleaner outlet duct and bolt.

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

15. Tighten the air cleaner outlet duct clamps at the following locations:
    - Throttle body
    - MAF/IAT sensor

Tighten: Tighten the clamps to 7 N.m (62 lb in).

16. Fill the cooling system. Refer to **Draining and Filling Cooling System (Body Vin Code 6)**.

RADIATOR REPLACEMENT (SWB - SHORT WHEEL BASE)

Tools Required

J 38185 Hose Clamp Pliers

Removal Procedure

1. Drain the coolant from the radiator. Refer to **Draining and Filling Cooling System (Body Vin Code 6)**.
2. Recover the refrigerant. Refer to **Refrigerant Recovery and Recharging** in Heating, Ventilation and Air Conditioning.
3. Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
4. Remove the lower radiator support shield, if equipped. Refer to **Radiator Support Shield Replacement** in Frame and Underbody.

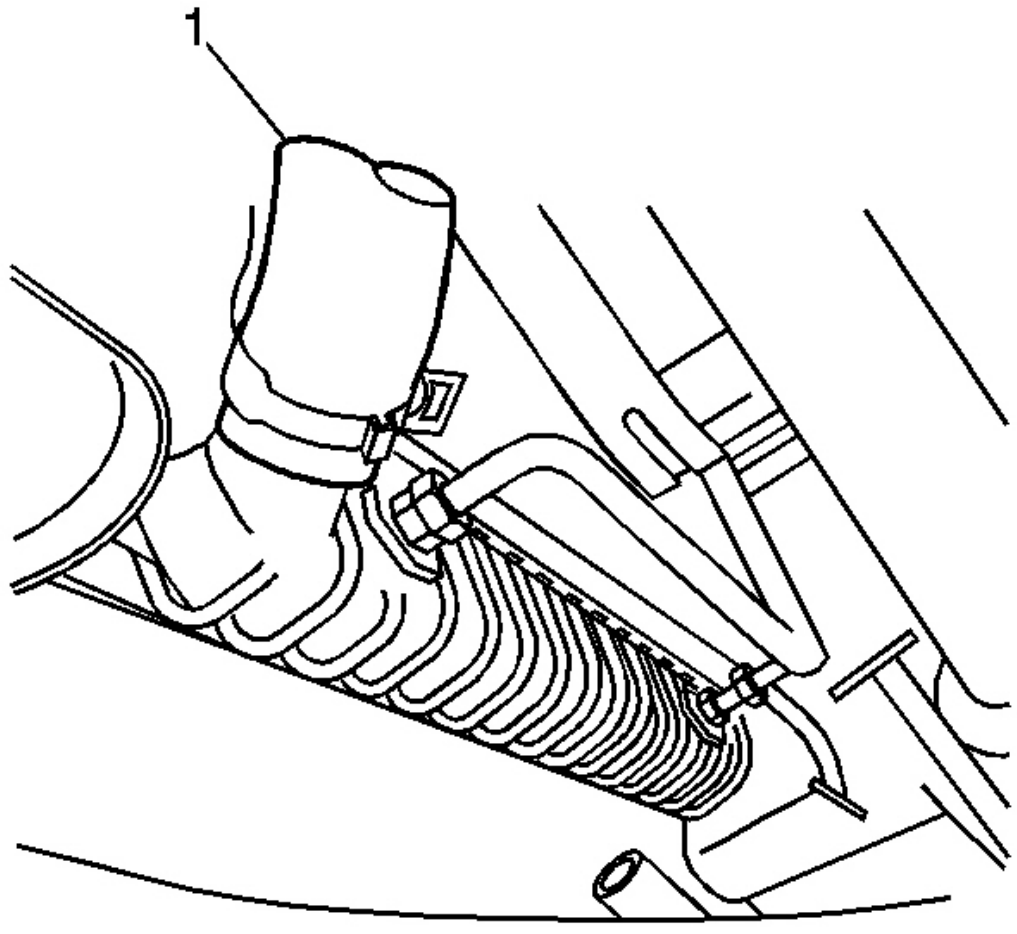


Fig. 65: View Of Radiator Hose
Courtesy of GENERAL MOTORS CORP.

5. Reposition the outlet radiator hose clamp using **J 38185** .
6. Remove the outlet radiator hose (1) from the radiator.
7. Remove the transmission cooler lines from the radiator. Refer to **Transmission Fluid Cooler Line Quick Connect Fitting** in Automatic Transmission - 4L60-E/4L65-E.
8. Lower the vehicle.
9. Remove the cooling fan and shroud. Refer to **Cooling Fan and Shroud Replacement**.
10. Remove the radiator support diagonal brace. Refer to **Brace Replacement - Radiator Support Diagonal** in Body Front End.

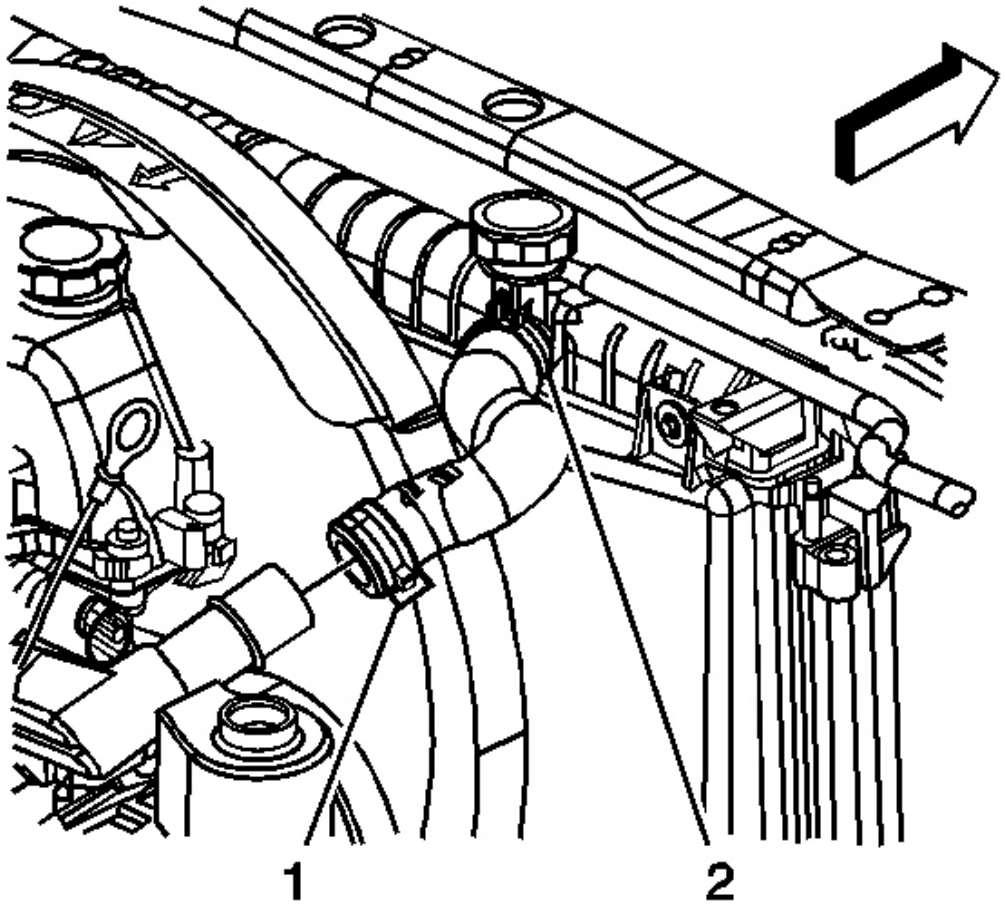


Fig. 66: View Of Radiator Hose Clamps
Courtesy of GENERAL MOTORS CORP.

11. Remove the coolant recovery line from the radiator.
12. Reposition the inlet radiator hose clamp (2) using **J 38185** .
13. Remove the inlet radiator hose from the radiator.

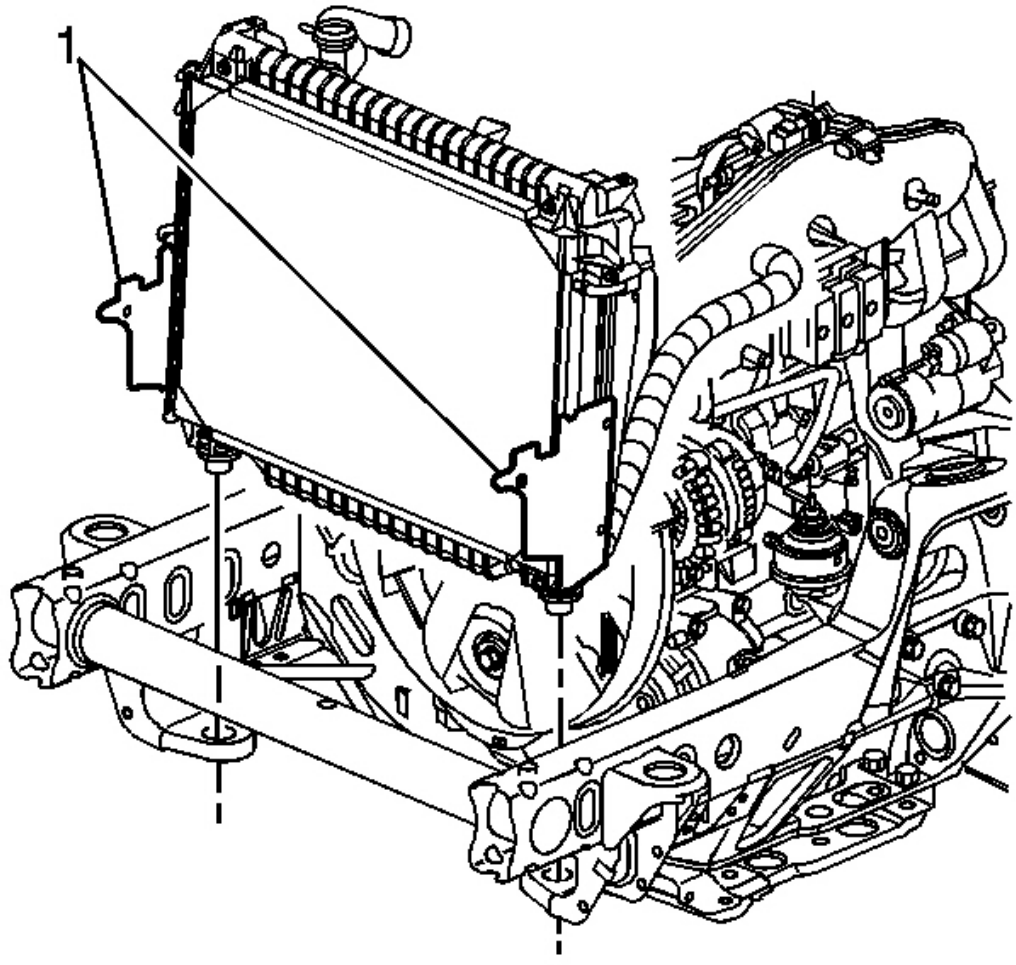


Fig. 67: View Of Condenser
Courtesy of GENERAL MOTORS CORP.

14. Disconnect the radiator side panels from the shroud (1).
15. Remove the radiator.
16. Remove the bolts retaining the condenser to the radiator.

Installation Procedure

1. Install the condenser to the radiator.

NOTE: Refer to Fastener Notice in Cautions and Notices.

2. Install the bolts retaining the condenser to the radiator.

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

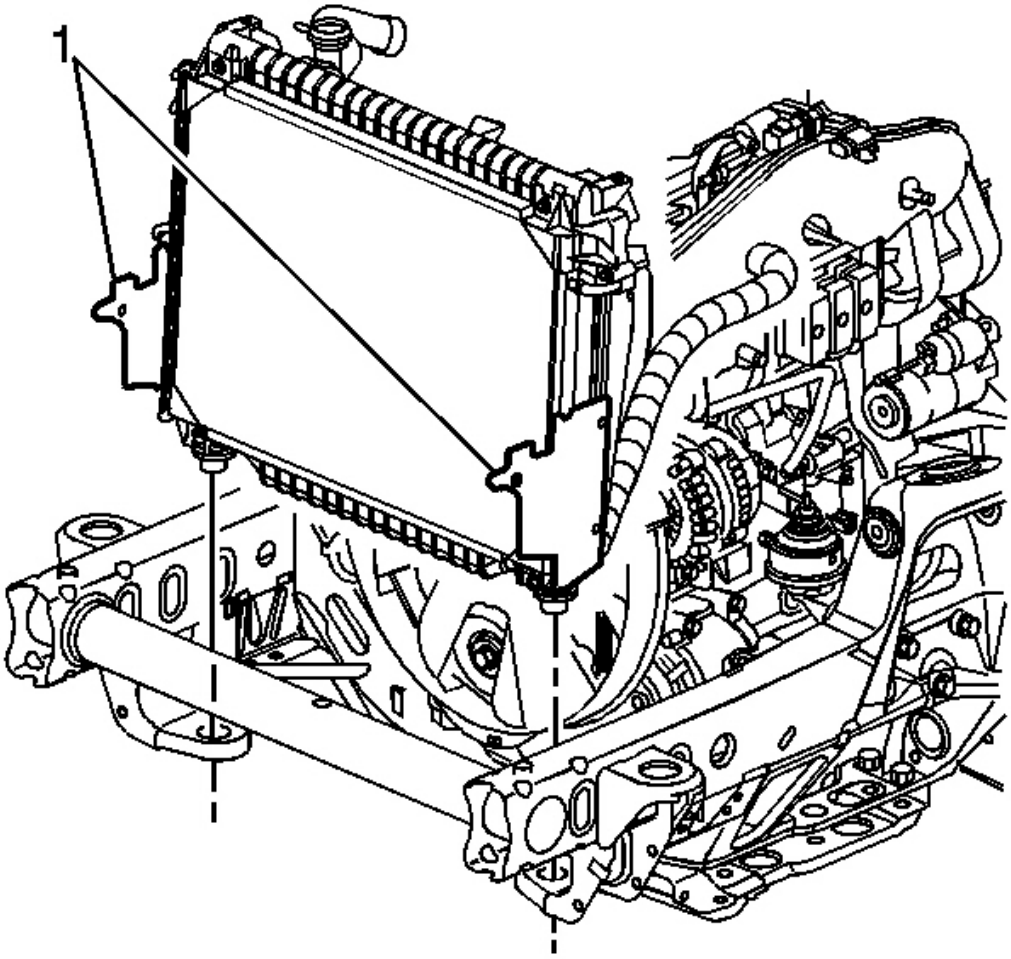


Fig. 68: View Of Condenser
Courtesy of GENERAL MOTORS CORP.

3. Install the radiator.
4. Install the cooling fan and shroud. Refer to **Cooling Fan and Shroud Replacement**.
5. Connect the radiator side panels to the shroud (1).
6. Raise the vehicle.

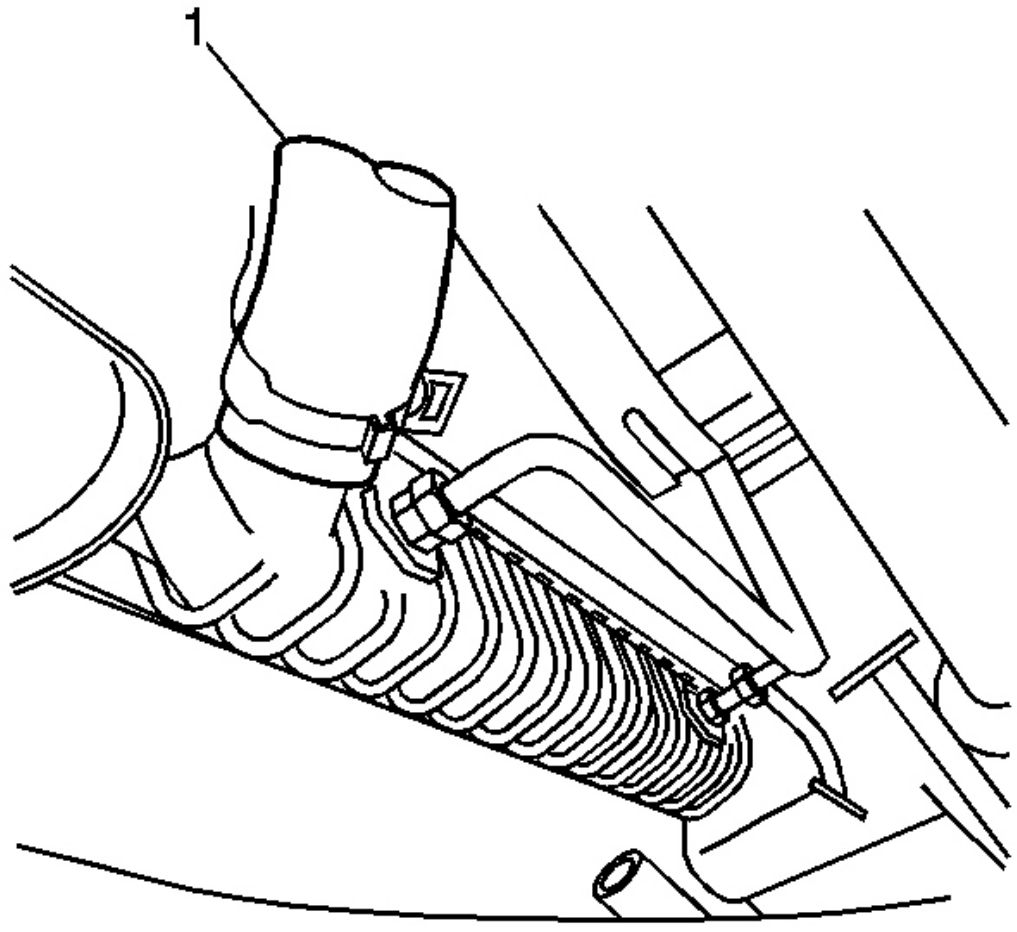


Fig. 69: View Of Radiator Hose
Courtesy of GENERAL MOTORS CORP.

7. Install the outlet radiator hose (1) to the radiator.

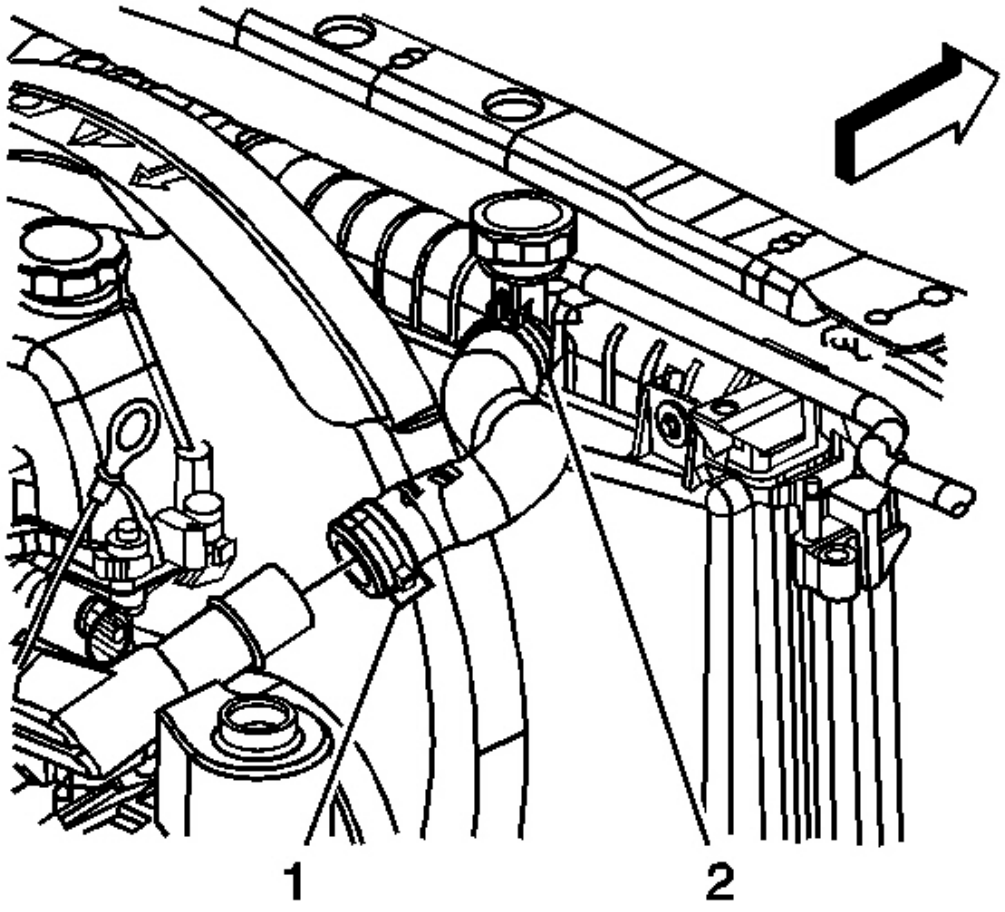


Fig. 70: View Of Radiator Hose Clamps
Courtesy of GENERAL MOTORS CORP.

8. Reposition the outlet radiator hose clamp (1) using **J 38185** .
9. Connect the transmission cooler lines to the radiator. Refer to **Transmission Fluid Cooler Line Quick Connect Fitting** in Automatic Transmission - 4L60-E/4L65-E.
10. Install the lower radiator support shield, if equipped. Refer to **Radiator Support Shield Replacement** in Frame and Underbody.
11. Lower the vehicle.
12. Install the coolant recovery hose to the radiator.
13. Install the radiator support diagonal brace. Refer to **Brace Replacement - Radiator Support Diagonal** in Body Front End.
14. Fill the cooling system. Refer to **Draining and Filling Cooling System (Body Vin Code 6)**.

RADIATOR REPLACEMENT (LWB - LONG WHEEL BASE)

Tools Required

- **J 41240** Fan Clutch Wrench
- **J 38185** Hose Clamp Pliers

Removal Procedure

1. Drain the coolant from the radiator. Refer to **Draining and Filling Cooling System (Body Vin Code 6)**.
2. Remove the lower radiator support shield, if equipped. Refer to **Radiator Support Shield Replacement** in Frame and Underbody.

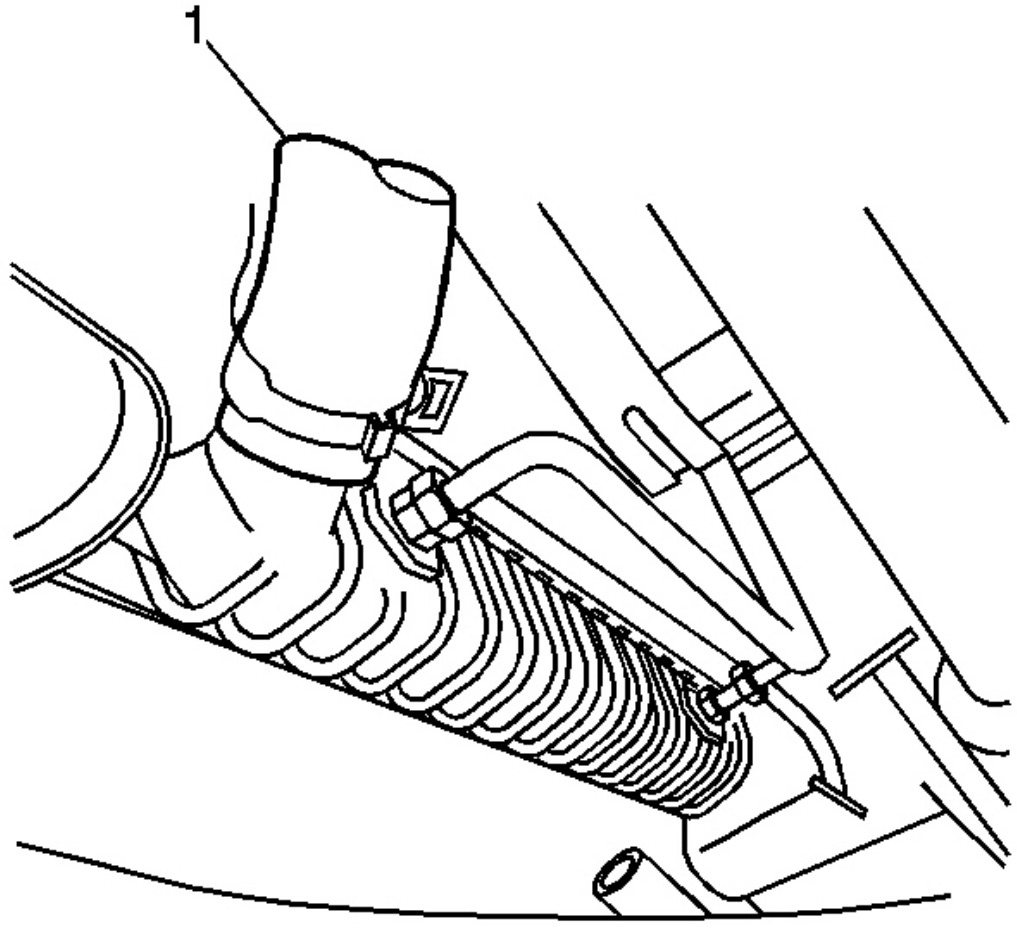


Fig. 71: View Of Radiator Hose

Courtesy of GENERAL MOTORS CORP.

3. Remove the transmission cooler lines from the radiator. Refer to **Transmission Fluid Cooler Line Quick Connect Fitting** in Automatic Transmission - 4L60-E/4L65-E.
4. Reposition the outlet radiator hose clamp using **J 38185** .
5. Remove the outlet radiator hose from the radiator.
6. Lower the vehicle.
7. Remove the cooling fan and shroud. Refer to **Cooling Fan and Shroud Replacement**.
8. Remove the grille. Refer to **Grille Replacement** in Exterior Trim.
9. Remove the upper radiator to condenser bolts.

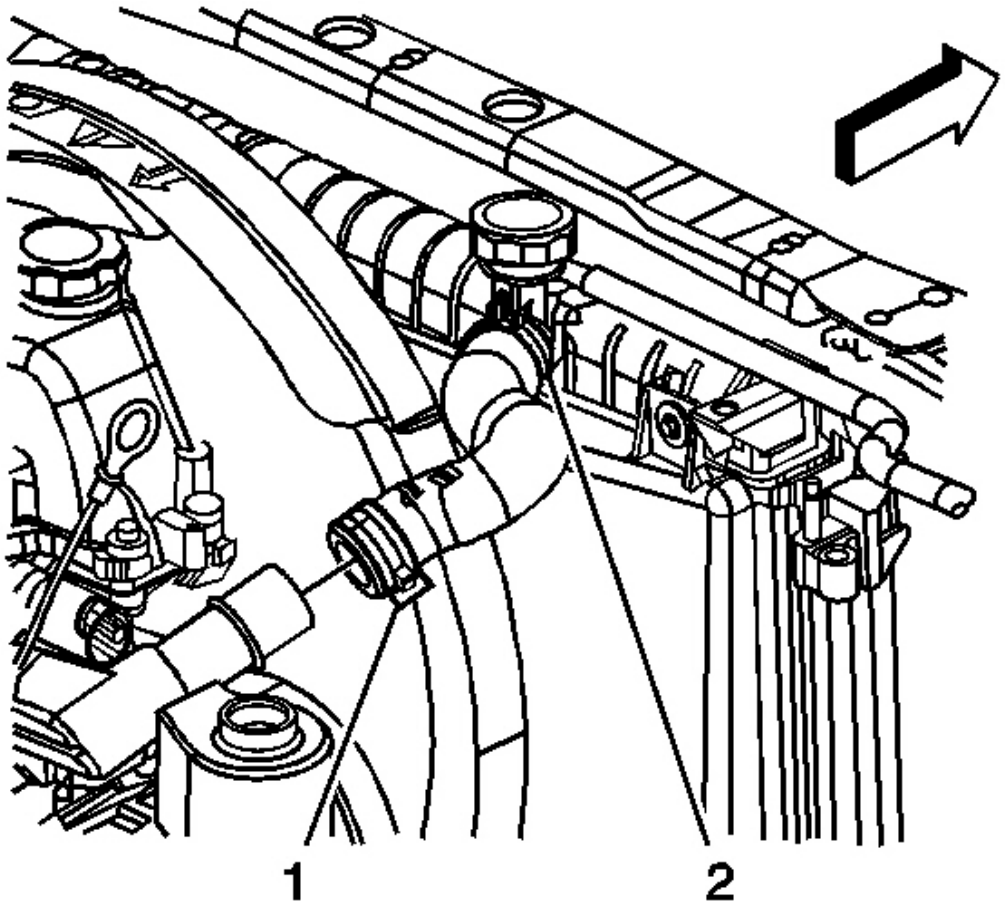


Fig. 72: View Of Radiator Hose Clamps
Courtesy of GENERAL MOTORS CORP.

10. Remove the coolant recovery line from the radiator.
11. Reposition the inlet radiator hose clamp (2) using **J 38185** .
12. Remove the inlet radiator hose from the radiator.
13. Lift upward on the condenser to remove from the radiator retaining tab.
14. Remove the radiator.

Installation Procedure

1. Install the radiator.
2. Install the condenser to the radiator retaining tab.

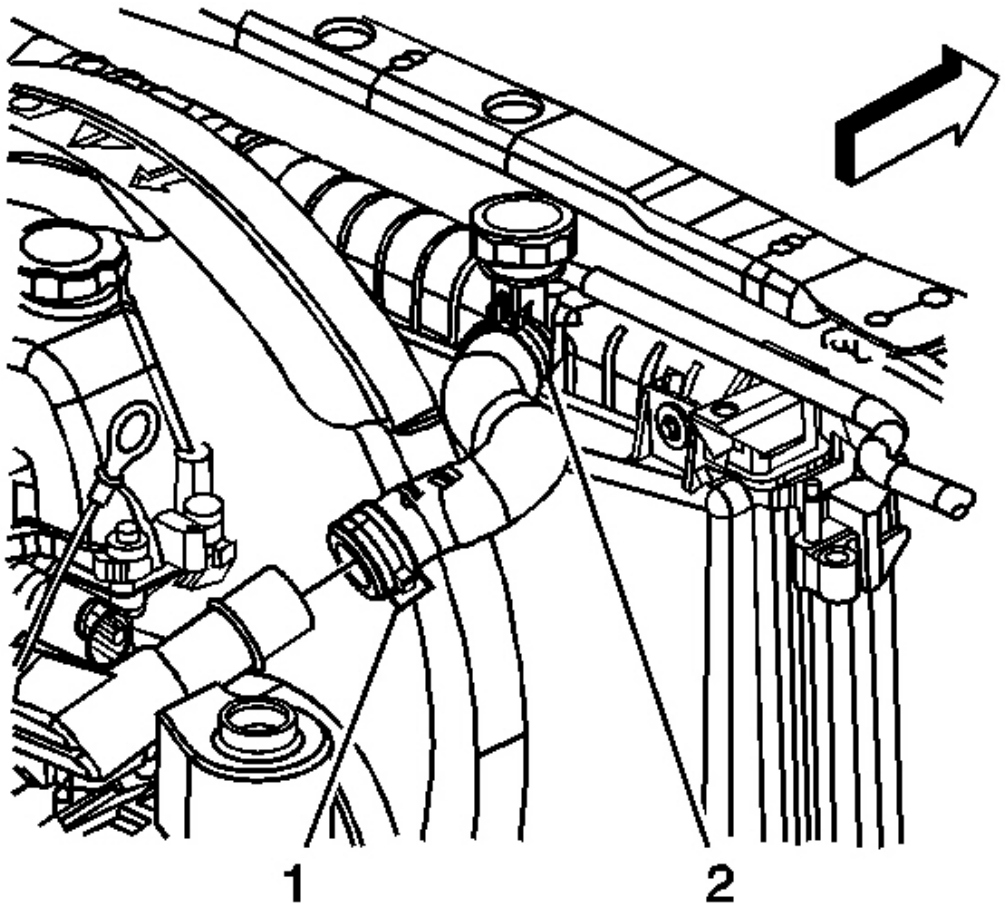


Fig. 73: View Of Radiator Hose Clamps
Courtesy of GENERAL MOTORS CORP.

3. Install the coolant recovery line to the radiator.

NOTE: Refer to Fastener Notice in Cautions and Notices.

4. Install the bolts retaining the condenser to the radiator.

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

5. Reposition the inlet radiator hose clamp (2) using **J 38185** .
6. Install the inlet radiator hose to the radiator.
7. Install the grille. Refer to **Grille Replacement** in Exterior Trim.
8. Install the cooling fan and shroud. Refer to **Cooling Fan and Shroud Replacement**.
9. Raise the vehicle.

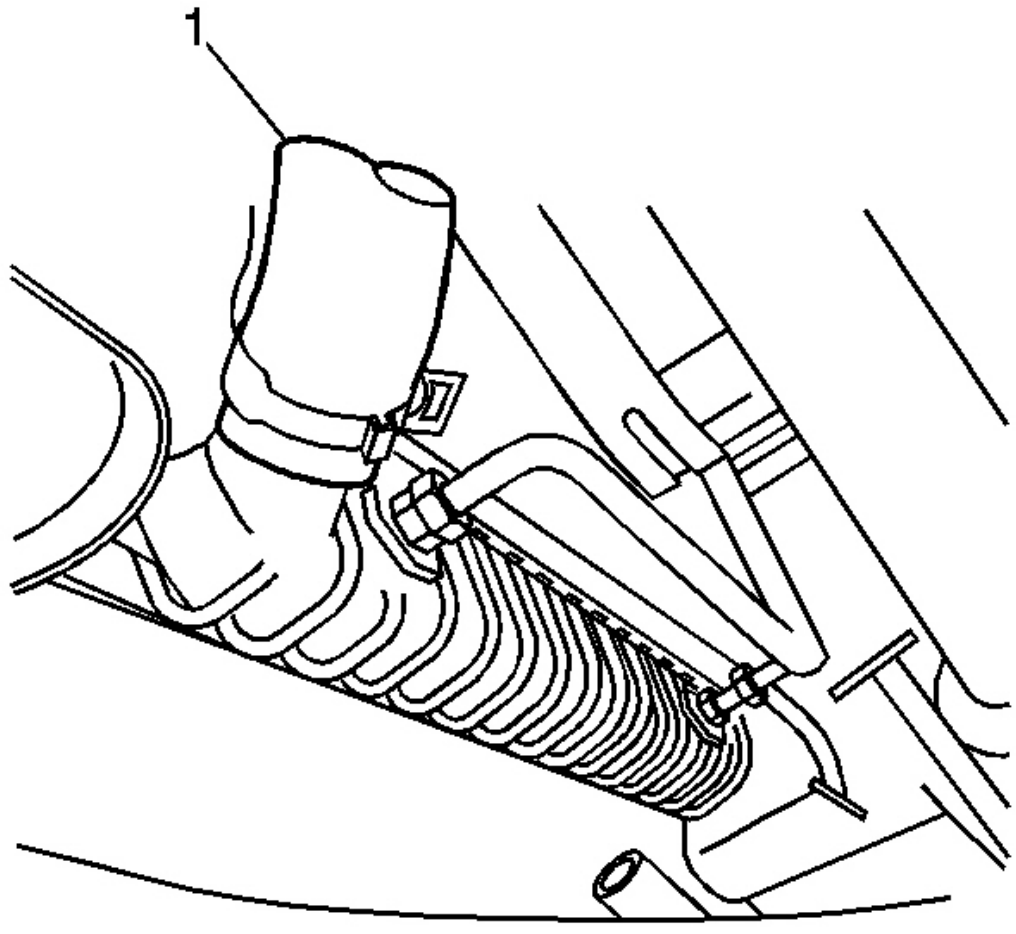


Fig. 74: View Of Radiator Hose
Courtesy of GENERAL MOTORS CORP.

10. Install the outlet radiator hose (1) to the radiator.
11. Reposition the outlet radiator hose clamp (1) using **J 38185** .
12. Connect the transmission cooler lines to the radiator. Refer to **Transmission Fluid Cooler Line Quick Connect Fitting** in Automatic Transmission - 4L60-E/4L65-E.
13. Install the lower radiator support shield, if equipped. Refer to **Radiator Support Shield Replacement** in Frame and Underbody.
14. Lower the vehicle.
15. Fill the cooling system. Refer to **Draining and Filling Cooling System (Body Vin Code 6)**.

COOLANT HEATER REPLACEMENT (LL8)

Removal Procedure

1. Drain the engine coolant. Refer to **Draining and Filling Cooling System (Body Vin Code 6)**.

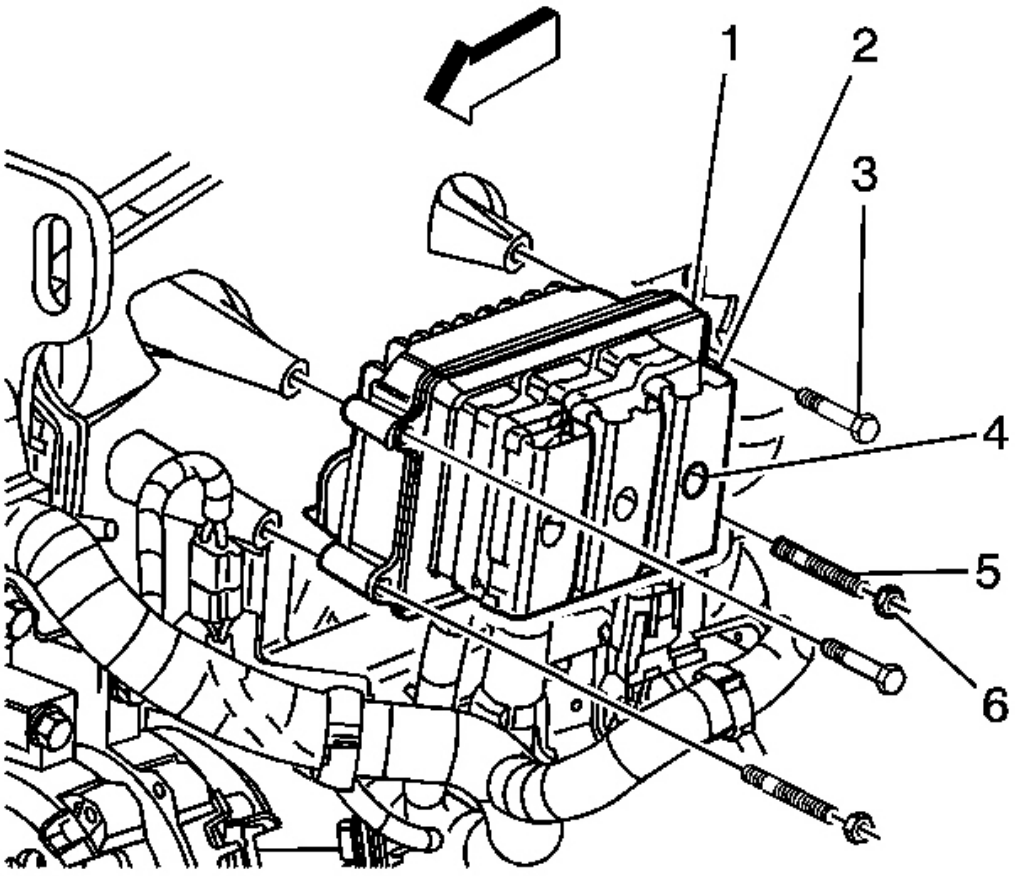


Fig. 75: View Of PCM Assembly
Courtesy of GENERAL MOTORS CORP.

2. Remove the powertrain control module (PCM) retaining bolts (3) and nuts (6).
3. Remove the PCM mounting studs (5) and position the PCM out of the way.

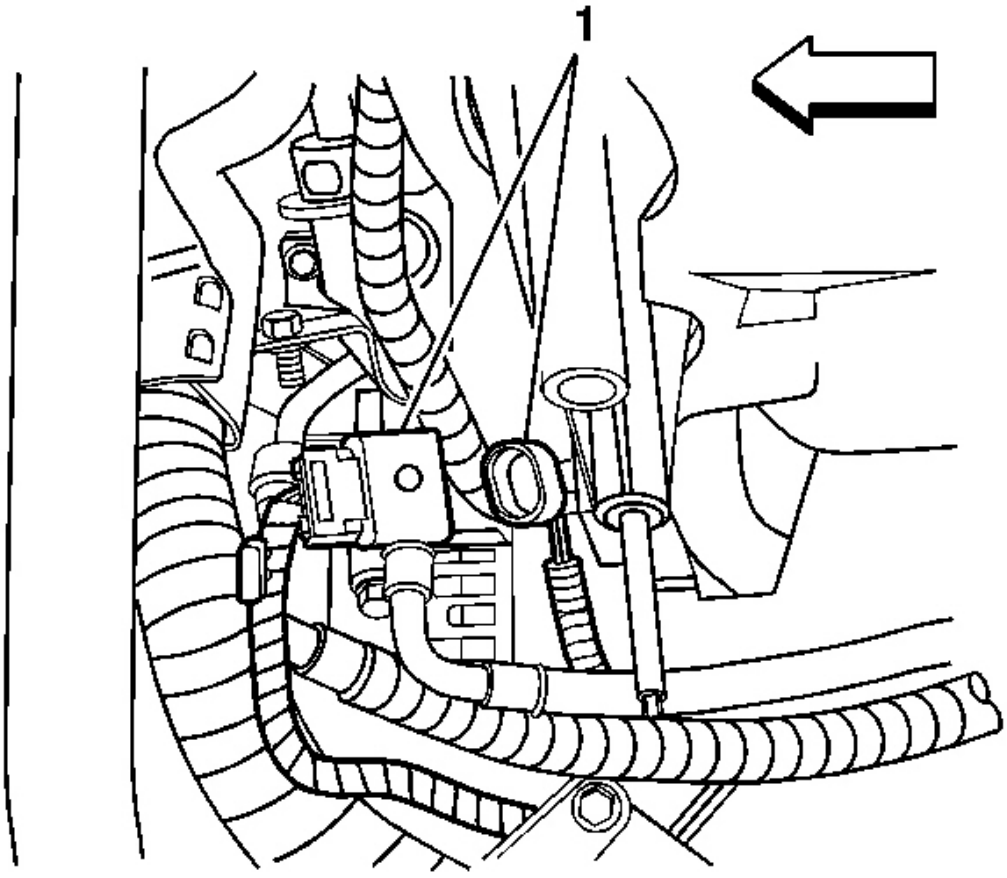


Fig. 76: View Of Engine Coolant Temperature Electrical Connector
Courtesy of GENERAL MOTORS CORP.

4. Disconnect the engine coolant temperature (ECT) sensor electrical connector (1).

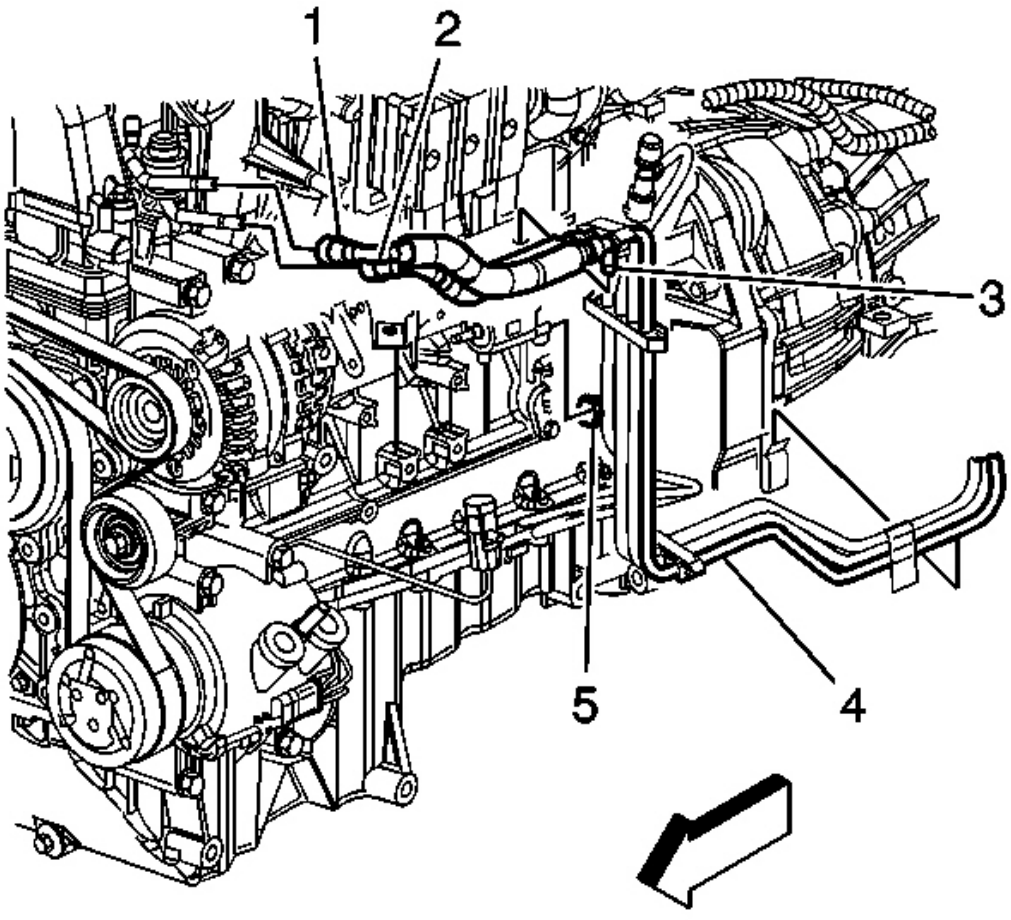


Fig. 77: Fuel Feed And Fuel Return Pipes (Left Side Of Engine)
Courtesy of GENERAL MOTORS CORP.

NOTE: **Refer to Fuel and Evaporative Emission (EVAP) Hose/Pipe Connection Cleaning Notice in Cautions and Notices.**

5. Disconnect the fuel feed (1) and fuel return (2) pipes from the fuel rail. Refer to **Quick Connect Fitting (s) Service (Metal Collar)** in Engine Controls - 4.2L.
6. Disconnect the integral clip (3) from the wire harness bracket.

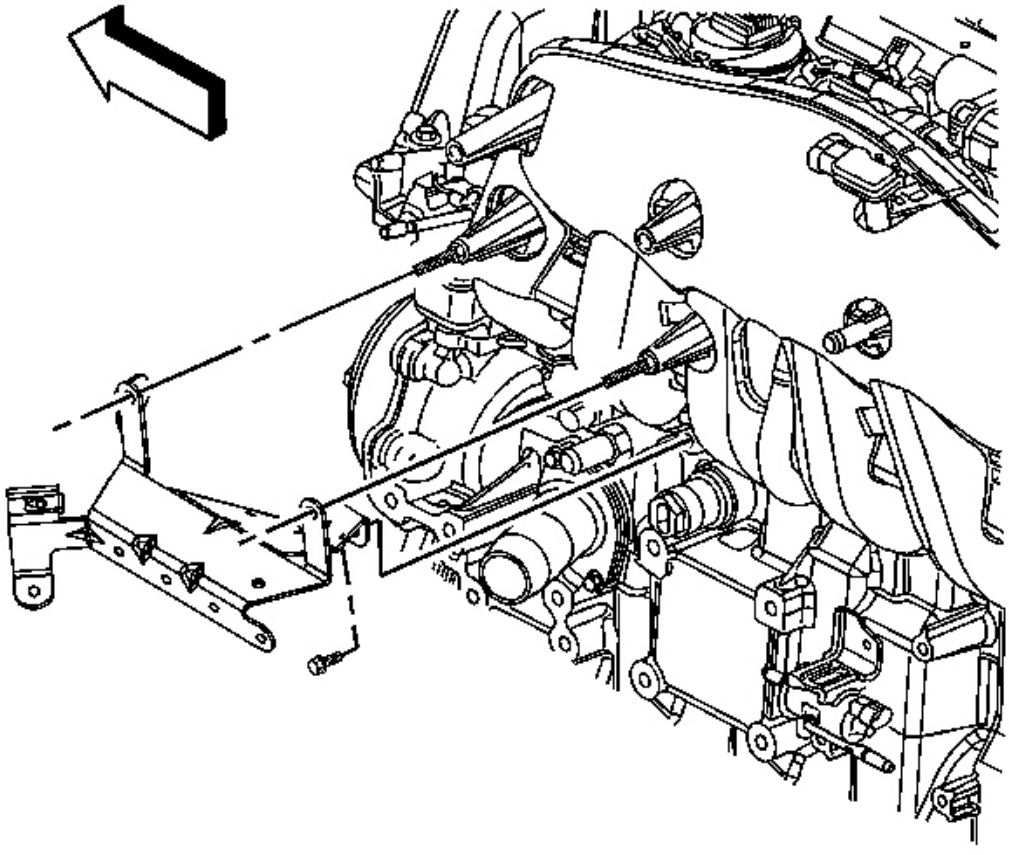


Fig. 78: View Of Engine Wire Harness Bracket Bolt
Courtesy of GENERAL MOTORS CORP.

7. Remove the engine wire harness bracket bolt.
8. Position the engine electrical wire harness bracket with wires attached out of the way.

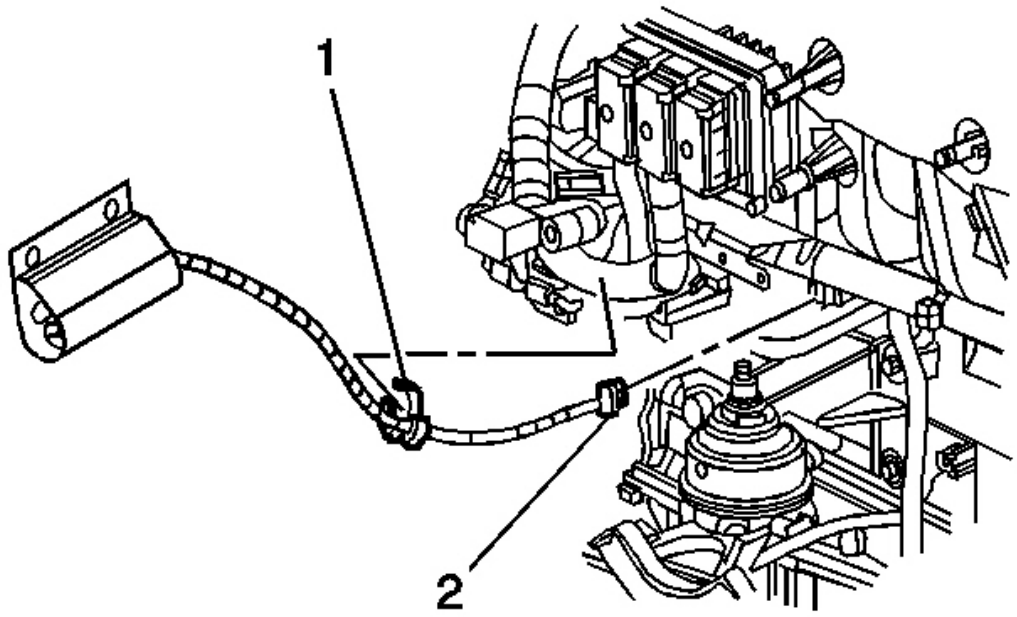


Fig. 79: View Of Engine Harness Bracket & Coolant Heater Cord
Courtesy of GENERAL MOTORS CORP.

9. Remove the coolant heater cord from the heater (2).

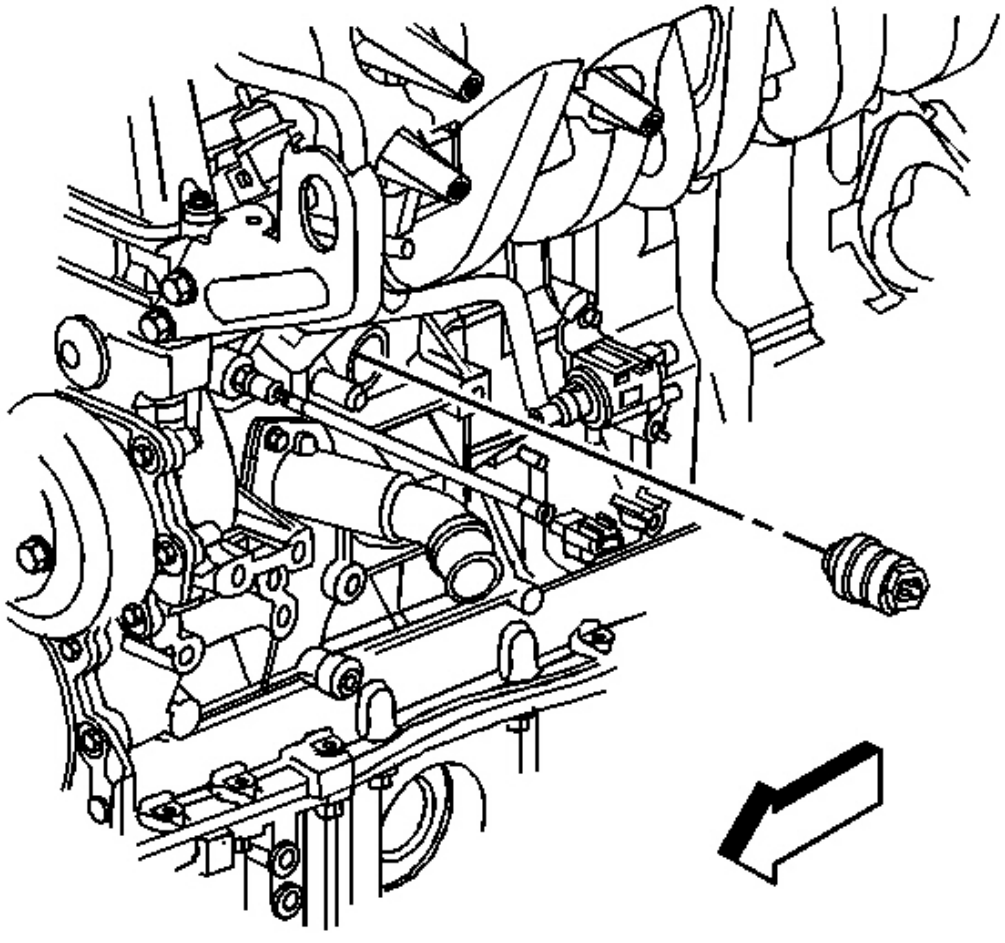


Fig. 80: View Of Coolant Heater (LL8)
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Do not score the surface of the engine block hole when removing the coolant heater.

10. Remove the coolant heater from the block.

Installation Procedure

1. Remove any burrs, sealer, paint or other foreign material from the threads/sealing surface of the engine block and from the old coolant heater if the heater is to be reused.
2. If reusing the old coolant heater, apply thread sealant GM P/N 12346004 (Canadian P/N 10953480), or

equivalent to the threads.

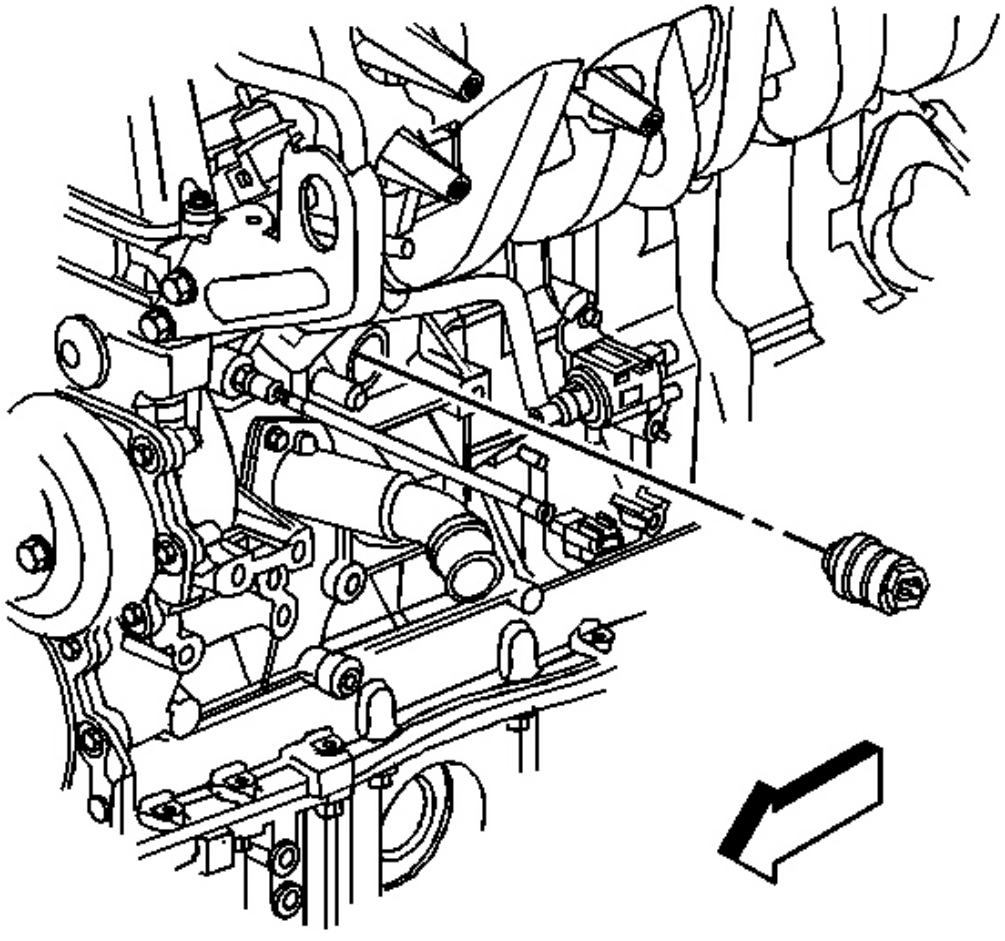


Fig. 81: View Of Coolant Heater (LL8)
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Component Fastener Tightening Notice in Cautions and Notices.

3. Install the coolant heater to the engine block.

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

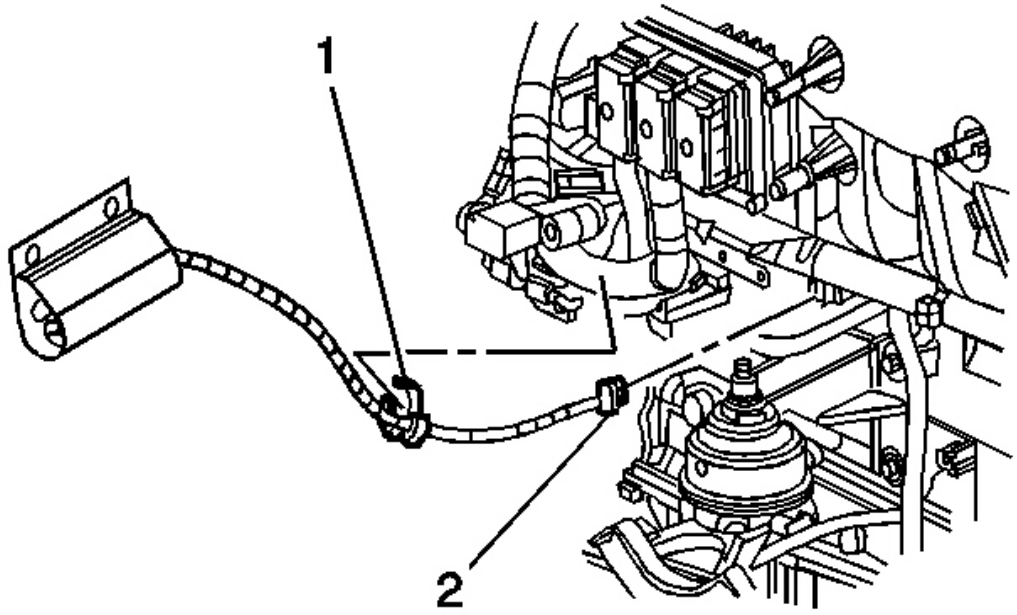


Fig. 82: View Of Engine Harness Bracket & Coolant Heater Cord
Courtesy of GENERAL MOTORS CORP.

4. Install the coolant heater cord to the heater (2).
5. Properly position the engine electrical harness bracket to the intake manifold.

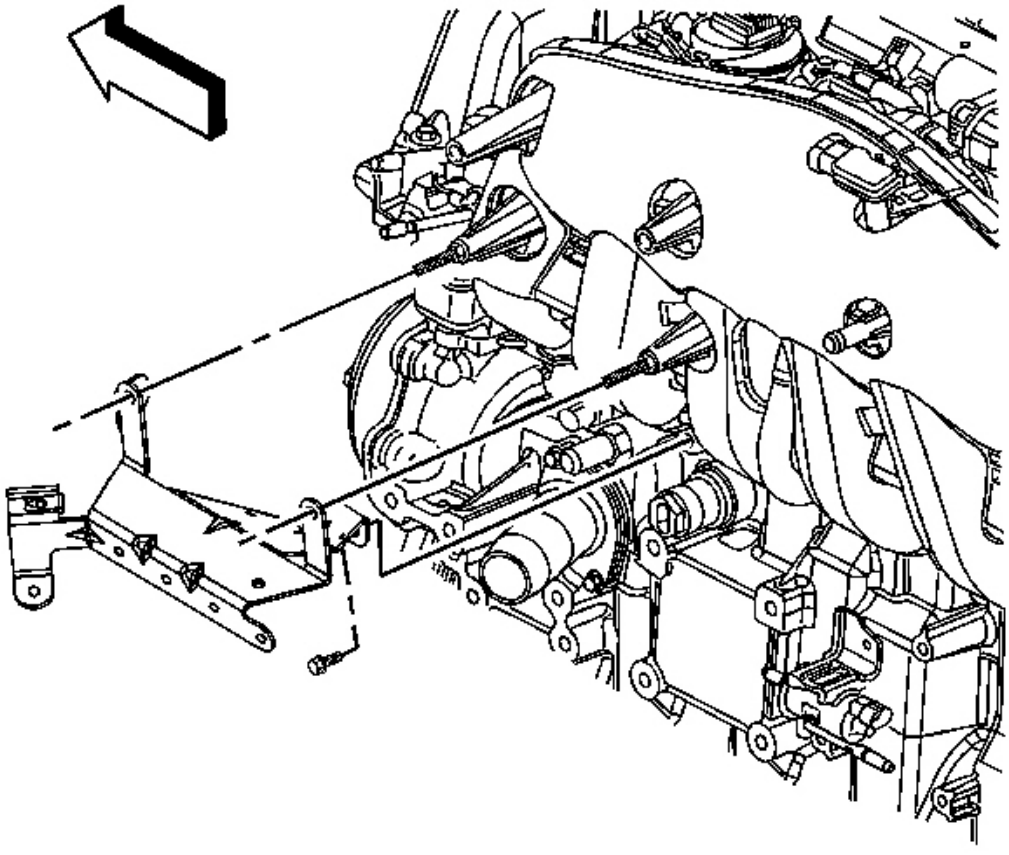


Fig. 83: View Of Engine Wire Harness Bracket Bolt
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice in Cautions and Notices.

6. Install the engine electrical harness bracket bolt.

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

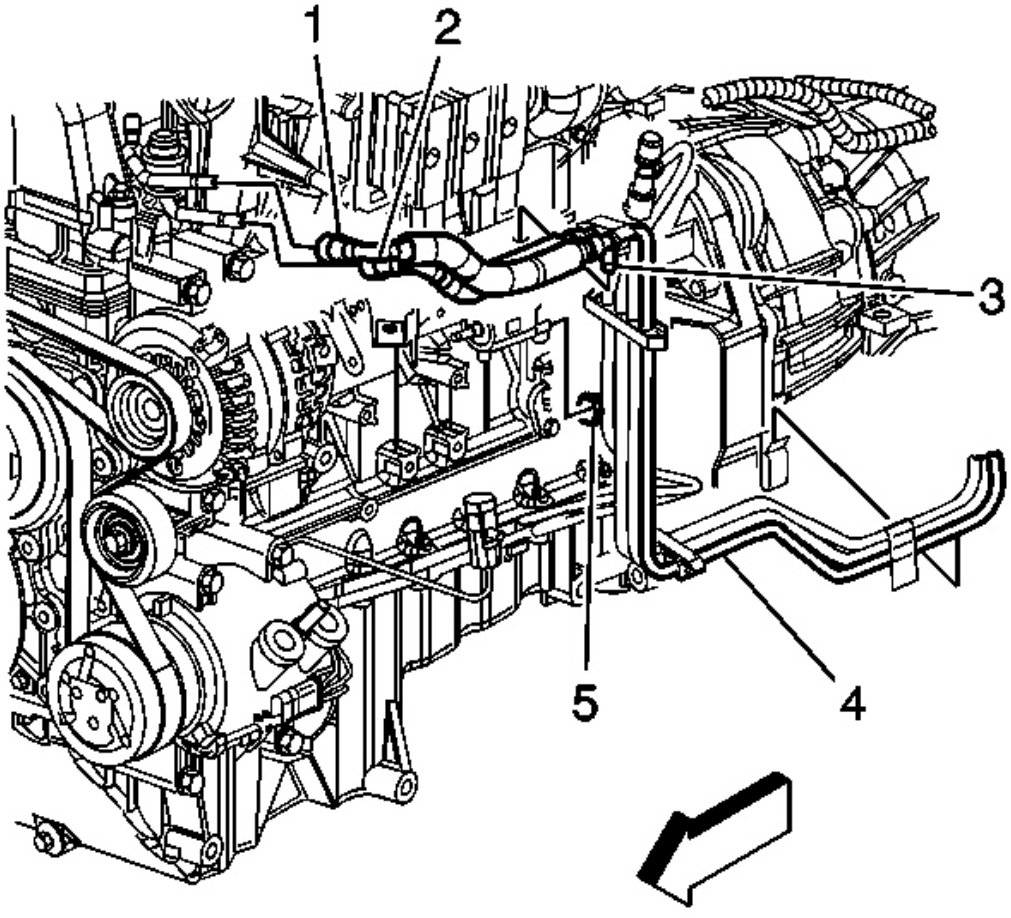


Fig. 84: Fuel Feed And Fuel Return Pipes (Left Side Of Engine)
Courtesy of GENERAL MOTORS CORP.

7. Connect the integral clip (3) to the wire harness bracket.
8. Connect the fuel feed (1) and fuel return (2) pipes to the fuel rail. Refer to **Quick Connect Fitting(s) Service (Metal Collar)** in Engine Controls - 4.2L.

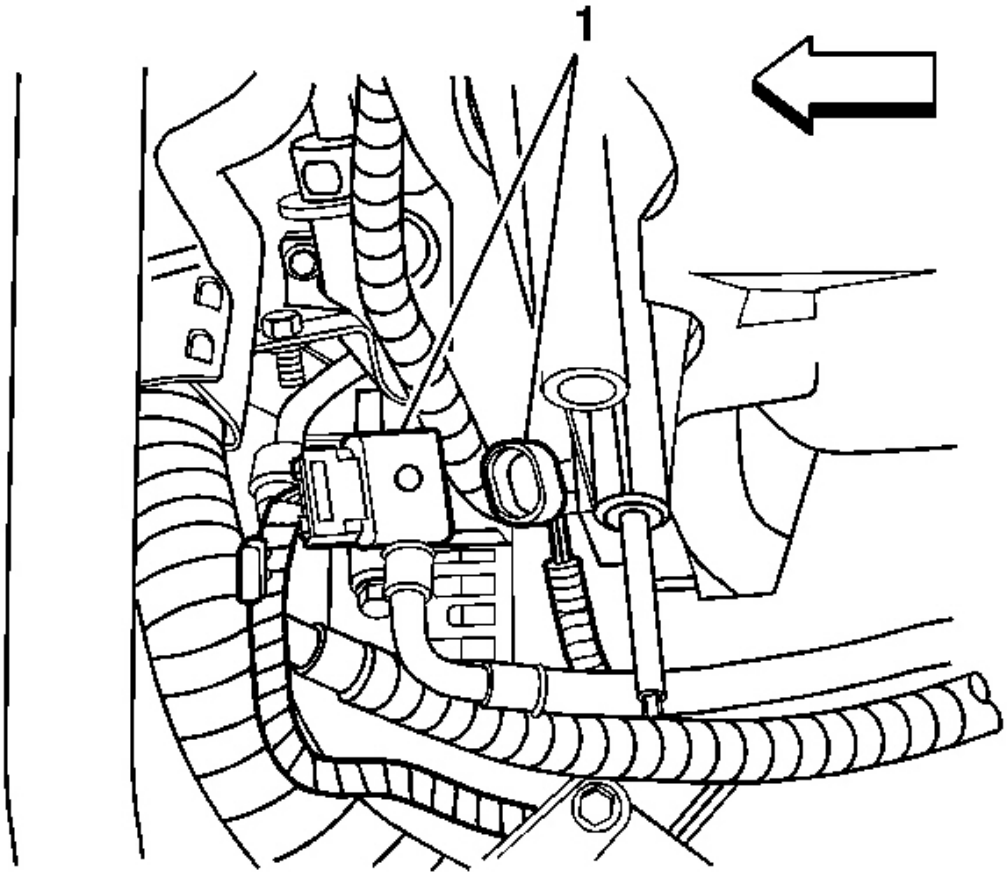


Fig. 85: View Of Engine Coolant Temperature Electrical Connector
Courtesy of GENERAL MOTORS CORP.

9. Connect the ECT sensor electrical connector (1).

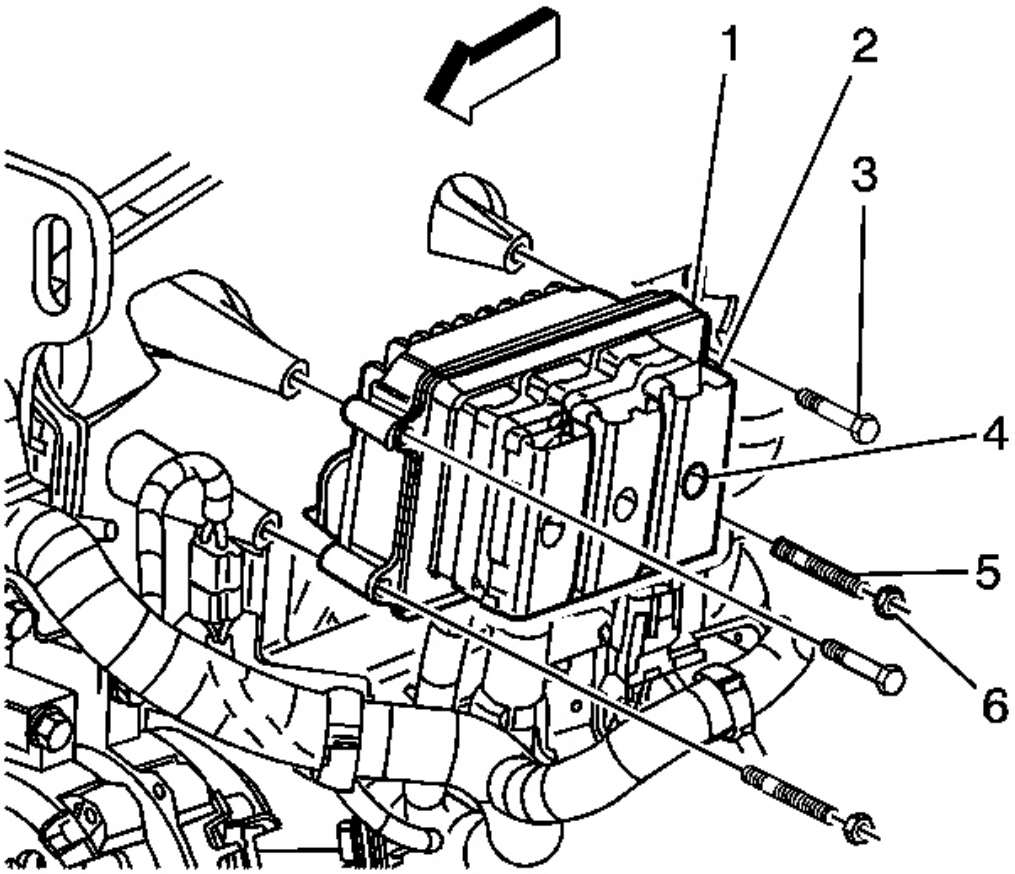


Fig. 86: View Of PCM Assembly
Courtesy of GENERAL MOTORS CORP.

10. Install the PCM mounting studs (5) to the intake manifold.

    Tighten: Tighten the studs to 6 N.m (53 lb in).

11. Install the PCM (1) onto the studs (5).
12. Install the PCM retaining bolts (3).

    Tighten: Tighten the bolts to 8 N.m (71 lb in).

13. Install the PCM retaining nuts (6).

    Tighten: Tighten the nuts to 8 N.m (71 lb in).

14. Fill the cooling system. Refer to **Draining and Filling Cooling System (Body Vin Code 6)**.

COOLANT HEATER REPLACEMENT (LM4)

Removal Procedure

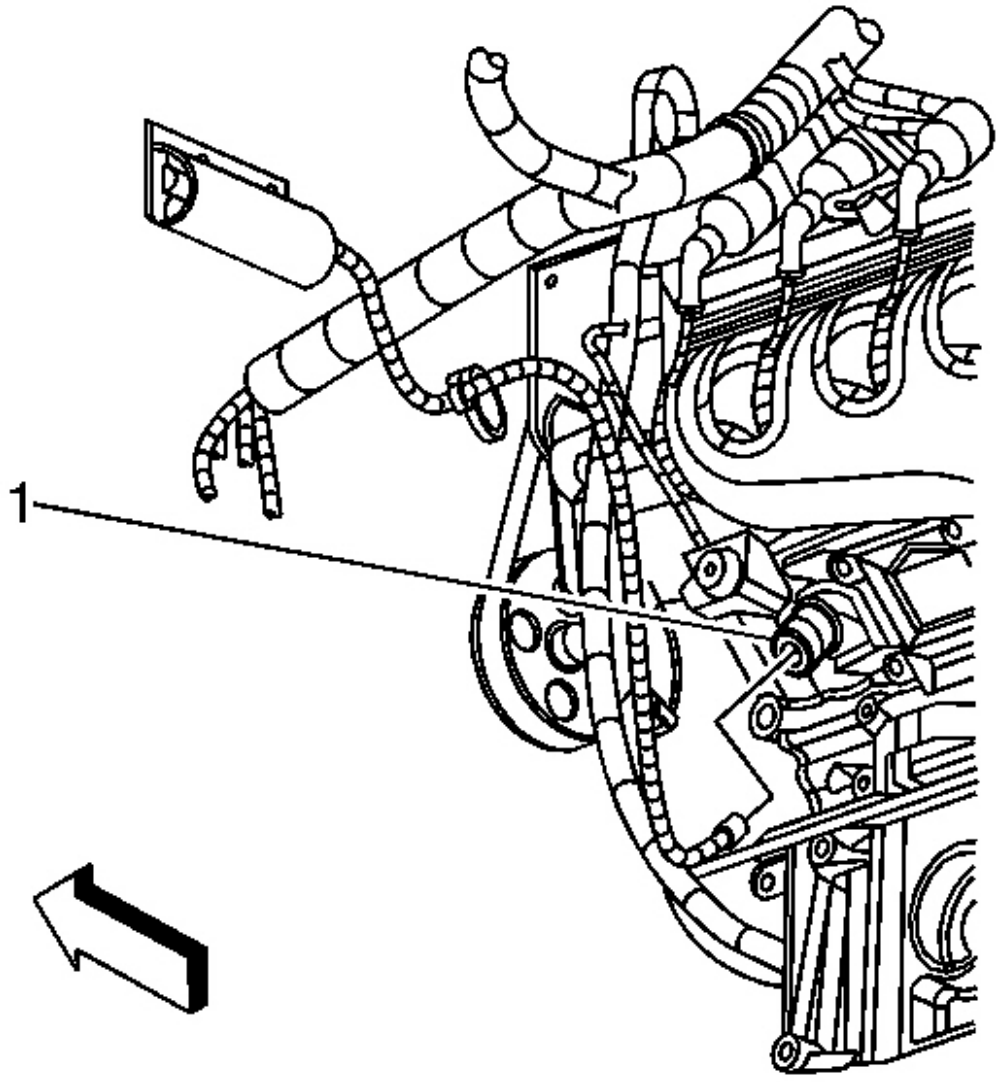


Fig. 87: View Of Coolant Heater (LM4)
Courtesy of GENERAL MOTORS CORP.

1. Drain the cooling system. Refer to **Draining and Filling Cooling System (Body Vin Code 6)**.
2. Raise and suitably support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
3. Disconnect the coolant heater (1) electrical connector.

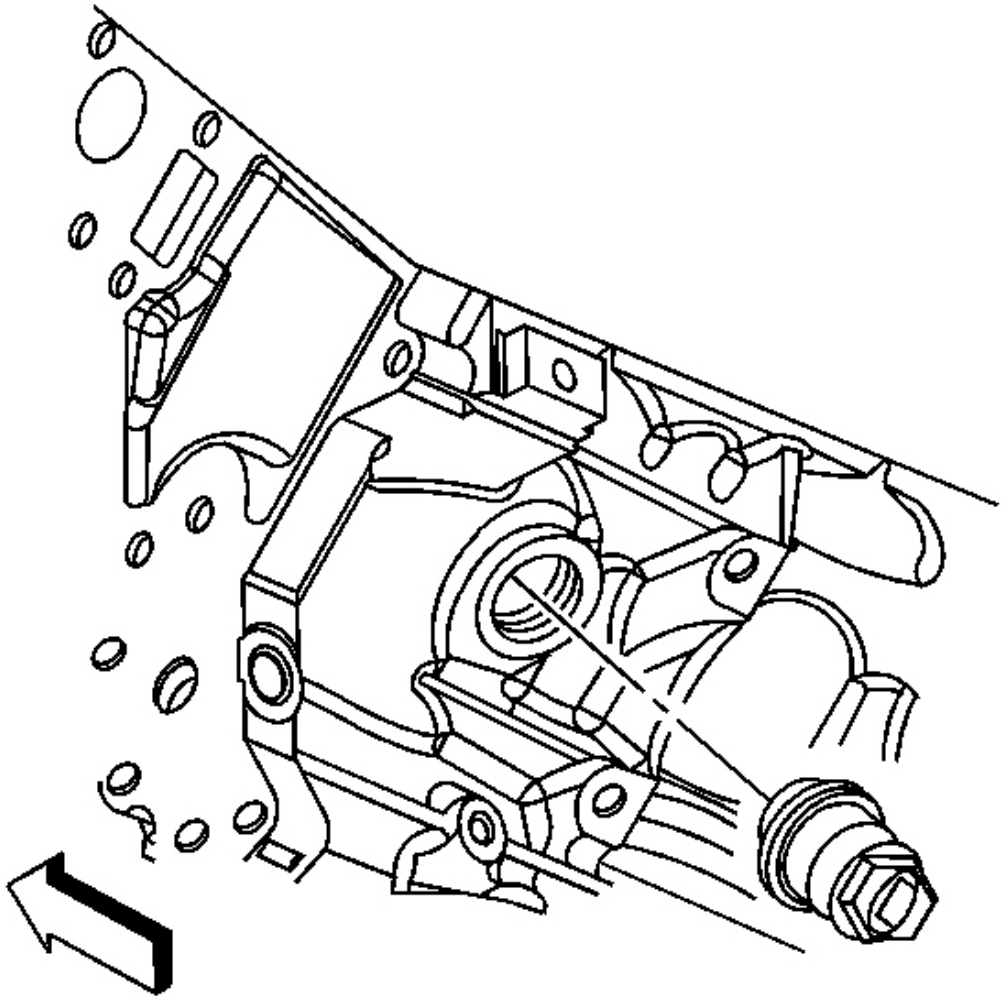


Fig. 88: View Of Coolant Heater & Engine Block
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Do not score the surface of the engine block hole when removing the coolant heater.

4. Remove the coolant heater from the engine block.
5. Remove any burrs, sealer, paint or other rough spots.

Installation Procedure

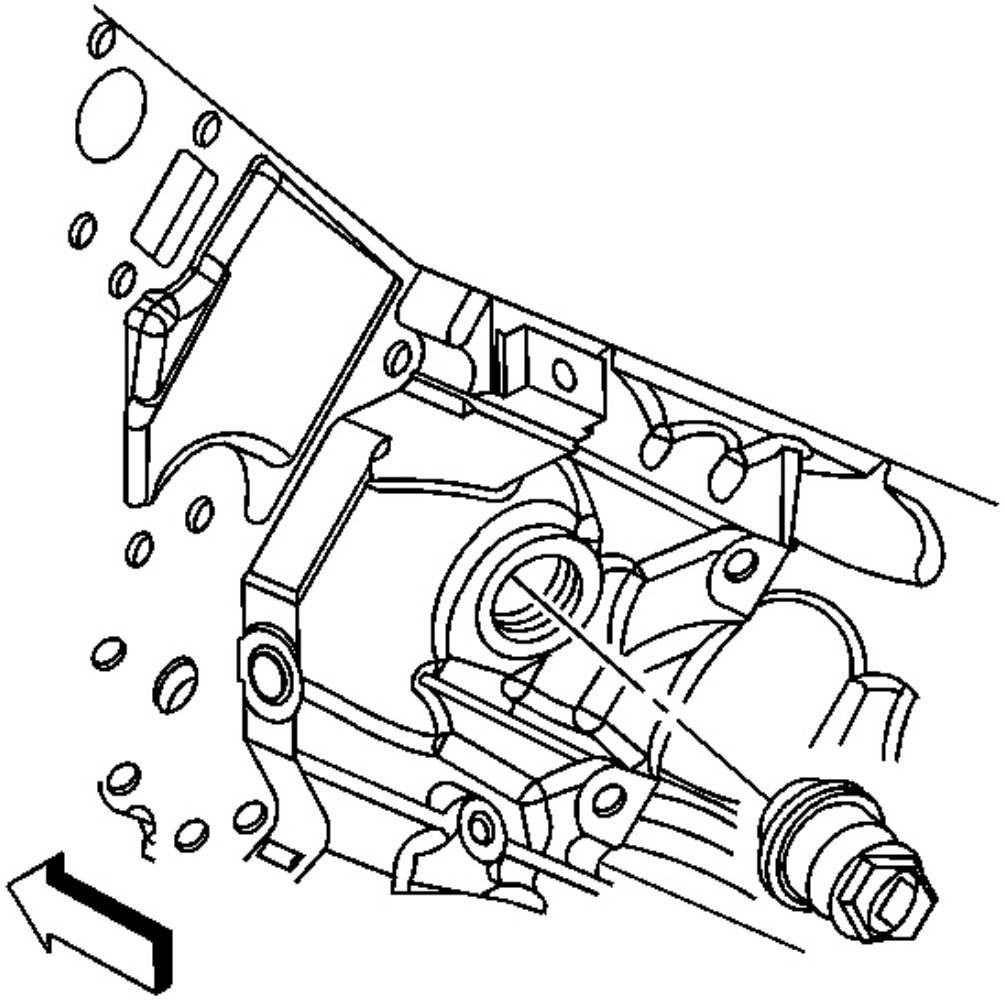


Fig. 89: View Of Coolant Heater & Engine Block
Courtesy of GENERAL MOTORS CORP.

1. If re-using the old coolant heater, apply thread sealant GM P/N 12346004 (Canadian P/N 10953480), or equivalent to the threads.

NOTE: Refer to Fastener Notice in Cautions and Notices.

2. Install the coolant heater to the engine block.

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

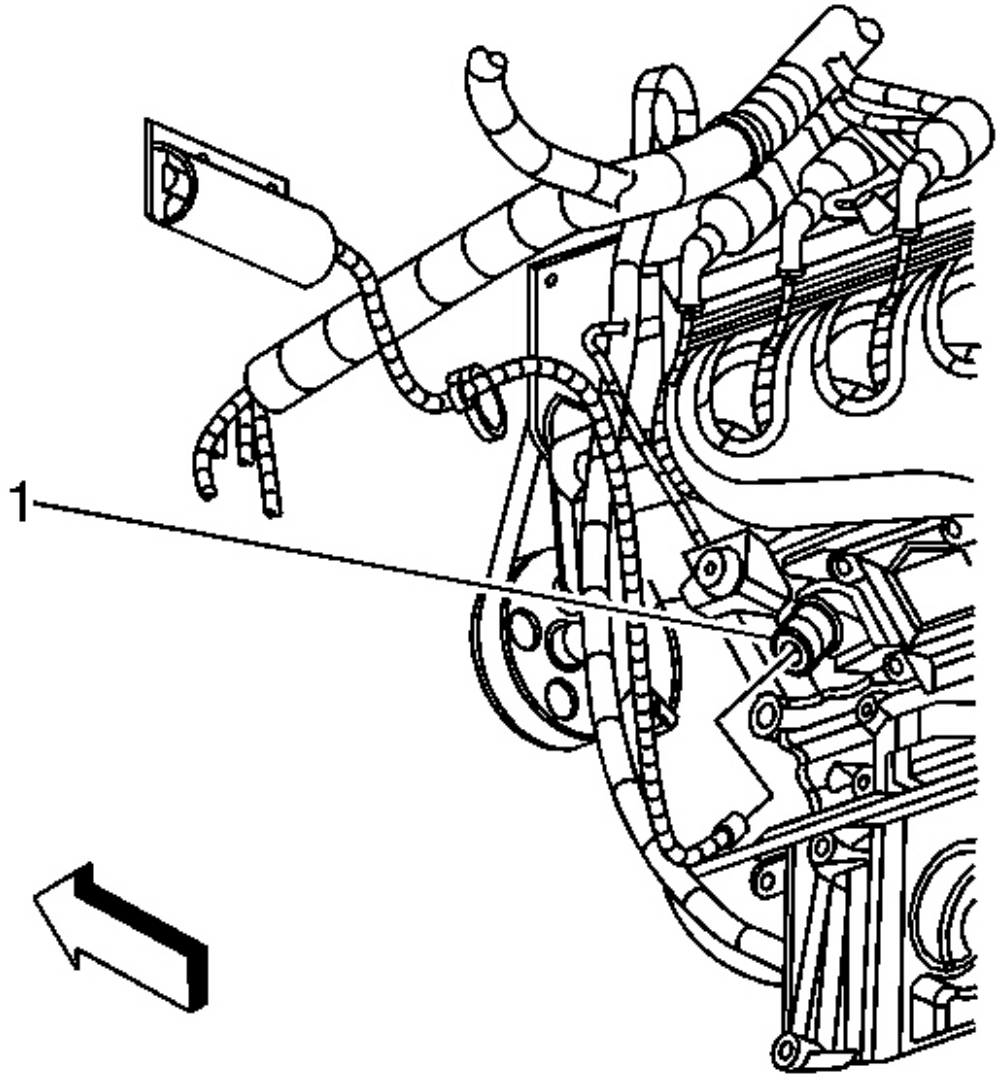


Fig. 90: View Of Coolant Heater (LM4)
Courtesy of GENERAL MOTORS CORP.

NOTE: The heater cord must not touch the engine, hot pipes, manifold, or any moving parts. Route the cord to the left front of the engine compartment securing with tie straps as necessary to prevent damage.

3. Connect the coolant heater (1) electrical connector.
4. Lower the vehicle.
5. Fill the cooling system. Refer to **Draining and Filling Cooling System (Body Vin Code 6)**.

COOLANT HEATER CORD REPLACEMENT

Removal Procedure

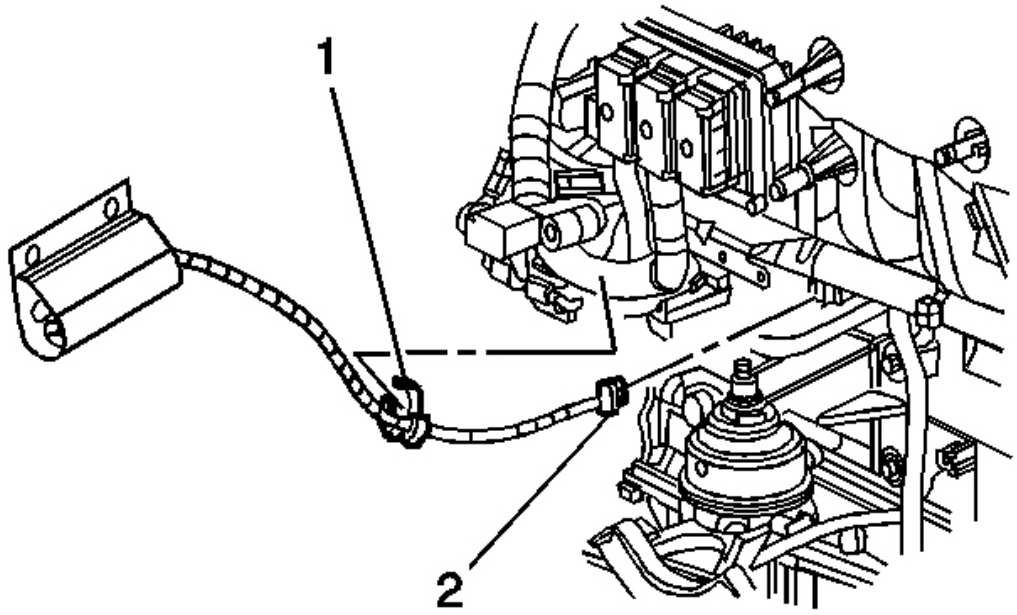


Fig. 91: View Of Engine Harness Bracket & Coolant Heater Cord
Courtesy of GENERAL MOTORS CORP.

1. If equipped with a 4.2L engine, remove the PCM. Refer to **Powertrain Control Module (PCM) Replacement** in Engine Controls - 4.2L.
2. Remove the coolant heater cord from the engine harness bracket (1).
3. Remove the coolant heater cord from the coolant heater (2).

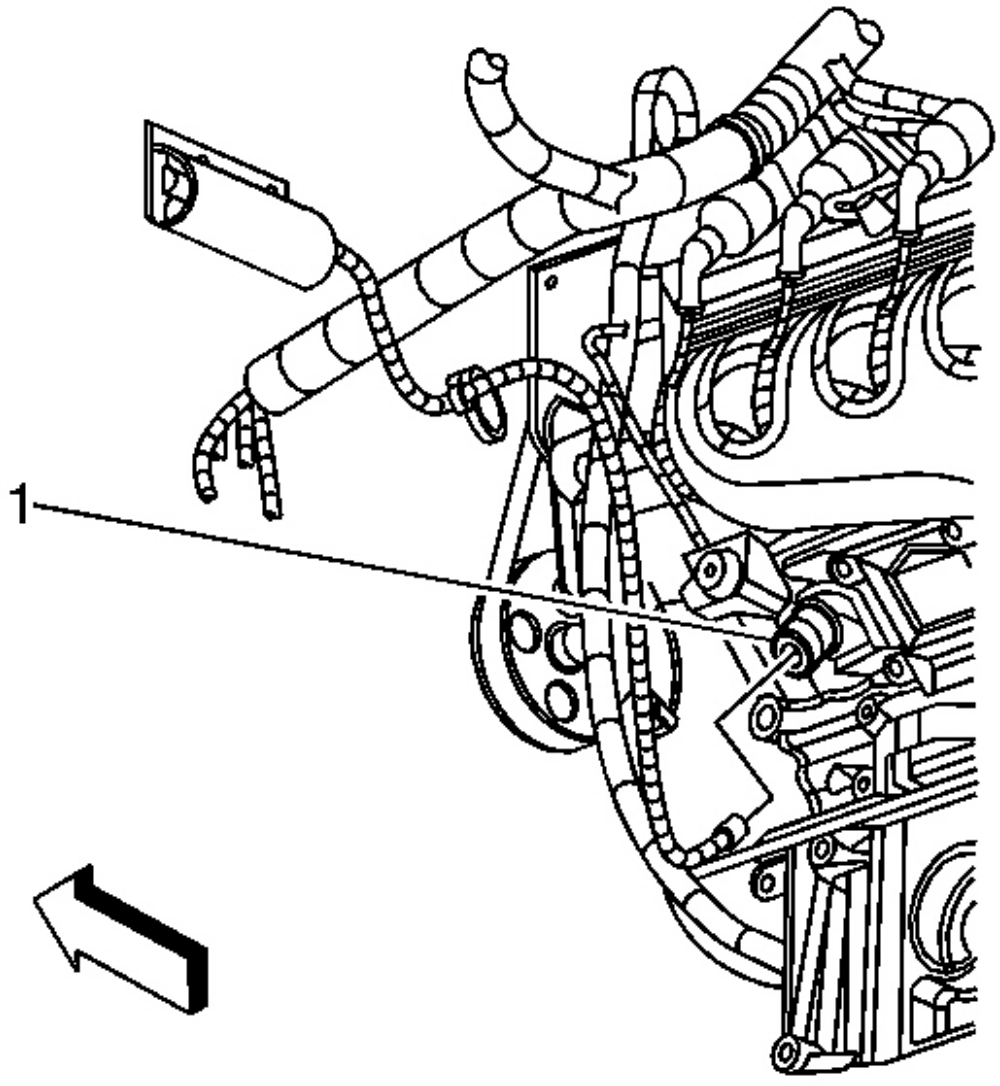


Fig. 92: View Of Coolant Heater (LM4)
Courtesy of GENERAL MOTORS CORP.

4. If equipped with a 5.3L engine, disconnect the coolant heater cord from the coolant heater (1).
5. Remove the coolant heater cord clip from the engine harness.

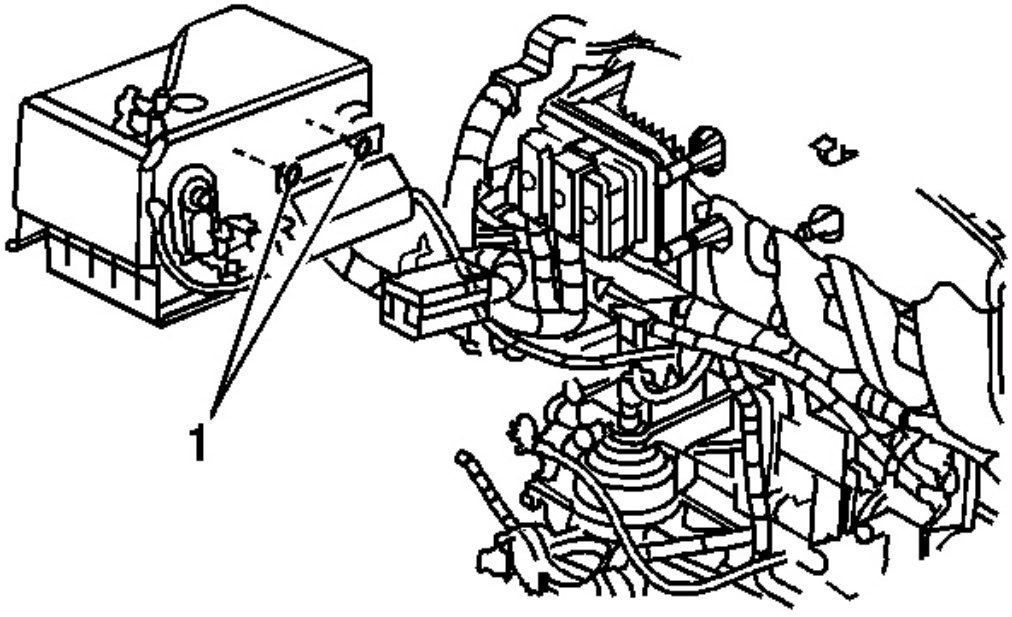


Fig. 93: View Of Coolant Heater Cord Retainers
Courtesy of GENERAL MOTORS CORP.

6. Disconnect the coolant heater cord retainers (1) from the battery cover.

Installation Procedure

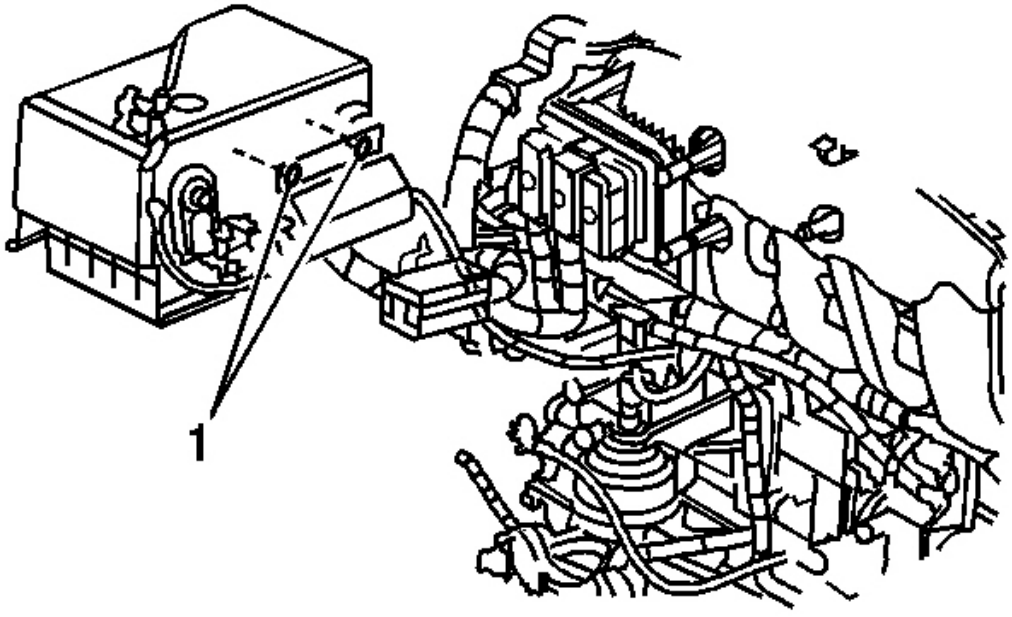


Fig. 94: View Of Coolant Heater Cord Retainers
Courtesy of GENERAL MOTORS CORP.

1. Connect the coolant heater cord retainers (1) to the battery cover.

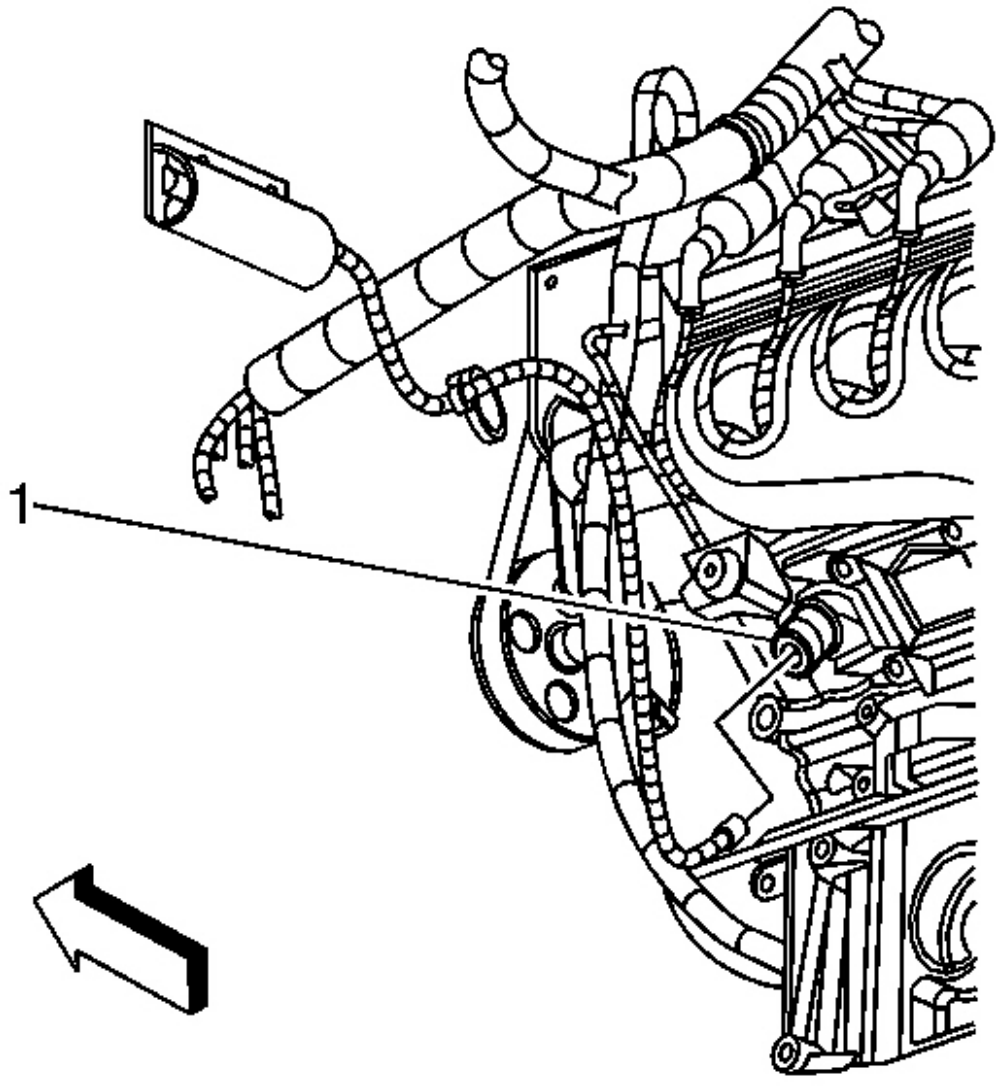


Fig. 95: View Of Coolant Heater (LM4)
Courtesy of GENERAL MOTORS CORP.

2. If equipped with a 5.3L engine, connect the coolant heater cord to the coolant heater (1).
3. Install the coolant heater cord clip to the engine harness.

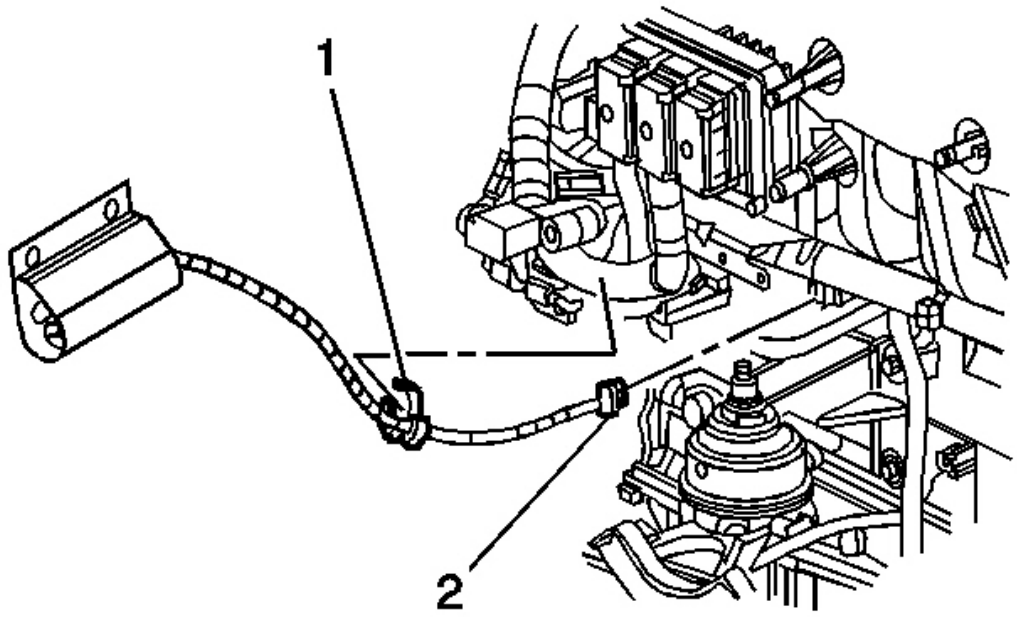


Fig. 96: View Of Engine Harness Bracket & Coolant Heater Cord
Courtesy of GENERAL MOTORS CORP.

4. If equipped with a 4.2L engine, install the coolant heater cord to the coolant heater (2).
5. Install the coolant heater cord to the engine harness bracket (1).
6. Install the PCM. Refer to **Powertrain Control Module (PCM) Replacement** in Engine Controls - 4.2L.

DESCRIPTION AND OPERATION

COOLING SYSTEM DESCRIPTION AND OPERATION

Cooling Fan Control

The purpose of the electro-viscous (EV) fan clutch is to maintain powertrain cooling requirements. The powertrain control module (PCM) monitors the following sensors to regulate the fan speed;

- Engine coolant temperature sensor
- A/C refrigerant pressure sensor
- Vehicle speed sensor
- Intake air temperature sensor
- Transmission fluid temperature sensor

- Ambient air temperature sensor

The PCM controls the electro-viscous fan clutch engagement. The PCM regulates a 12-volt pulse width modulated signal (PWM) to the cooling fan relay. The PWM signal determines the ON time of the relay. As the commanded state of the fan clutch increases, so does the ON time of the relay. This ON time directly effects the amount of time the solenoid, which is internal to the fan clutch, is energized. When the solenoid in the fan clutch is energized, it opens the spring loaded valve and allows fluid to flow from the storage chamber to the fluid coupling of the cooling fan clutch, increasing the fan speed. When the solenoid is de-energized, the spring loaded valve closes, and blocks the path of the fluid to the fluid coupling of the fan clutch, reducing fan speed.

The fan has the ability to create a feedback signal, so the PCM has an actual fan speed input. This is done with a hall effect sensor internal to the fan clutch. The PCM supplies a 5-volt reference and a low reference to the hall effect sensor. The hall effect sensor returns a signal pulse through the cooling fan speed signal circuit in response to the reluctor track passing by the magnetic field of the hall effect sensor.

The PCM commands the cooling fan to 100% under the following conditions:

- Engine coolant temperature exceeds approximately 129°C (264°F).
- The transmission oil temperature exceeds approximately 151°C (304°F).
- A/C refrigerant pressure exceeds 1655 kPa (240 psi).
- When certain DTC's set. These include P0116, P0117, P0118, P0125, P1481, P1482, and P1484.

The scan tool can engage the cooling fan clutch. This is done with the engine controls special function menu screen. To engage the cooling fan, It can take up to 2 minutes for a 100% command with the engine at 2000 RPM. The lower the engine speed, the longer it will take the fan to engage. To disengage the cooling fan, it can take up to 2 minutes with the engine at 2000 RPM. The lower the engine speed, the longer it will take to disengage. In lower ambient air temperatures the cooling fan will engage in less time, however, it will take longer to disengage due to the properties of the fluid vs. temperature.

Under certain conditions the cooling fan may be engaged at engine restart. They are as follows;

- The cooling fan was engaged at the time the engine was turned off
- The fluid may bleed from the storage chamber into the fluid coupling of the cooling fan

Although the fan is commanded off at this time due to a cold start condition. This is the most likely time a vehicle driver will notice that the fan noise is excessive compared to normal engine starts with out cooling fan engaged. As the engine speed is increased the fan noise will be louder than before. These are normal conditions that can be very intermittent.

Engine Coolant Indicator

ENGINE COOLANT HOT IDLE ENGINE

The radio activates an audible warning as requested by the instrument panel cluster (IPC). The IPC sends a class 2 message to the radio indicating the chime duration of 4 pulses. The warning sounds and the appropriate indicator illuminates in the driver information center (DIC) when the following occurs:

- The IPC determines that the coolant temperature is greater than 125°C (257°F). The IPC receives a class 2 message from the PCM indicating coolant temperature.
- The IPC performs the displays test at the start of each ignition cycle. The indicator illuminates for approximately 3 seconds.

The IPC turns OFF the engine coolant indicator when the engine coolant falls below 122°C (252°F).

Cooling System

The cooling system's function is to maintain an efficient engine operating temperature during all engine speeds and operating conditions. The cooling system is designed to remove approximately 1/3 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 is drawn from the radiator outlet and into the water pump inlet by the water pump. Coolant will then be pumped through the water pump outlet and into the engine block. In the engine block, the coolant circulates through the water jackets surrounding the cylinders, where the coolant absorbs heat.

Some coolant is also pumped from the water pump to the heater core, then back to the water pump. This provides the passenger compartment with heat and defrost.

The coolant is then forced 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 the coolant absorbs additional heat.

Coolant is also directed to the throttle body. There the coolant circulates through passages in the casting. During initial start up, the coolant assists in warming the throttle body. During normal operating temperatures, the coolant assists in keeping the throttle body cool.

From the cylinder heads, the coolant is then forced to the thermostat. The flow of coolant will either be stopped at the thermostat until the engine is warmed, or the coolant will flow through the thermostat and into the radiator where the coolant is cooled and the coolant cycle is completed.

Operation of the cooling system requires proper functioning of all cooling system components. The cooling system consists of the following components, which are described below:

- The coolant
- The radiator
- The pressure cap
- The coolant recovery system
- The air baffles and seals

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

Pressure Cap

The pressure cap seals the cooling system, and contains a blow-off or pressure valve, and a vacuum or atmospheric valve. The pressure valve is held against the seat by a spring, which protects the radiator from excess cooling system pressure. The vacuum valve is held against the seat by a spring, which permits the opening of the valve to relieve the vacuum created in the cooling system as the coolant 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, the pressure valve opens, venting the excess pressure.

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. This reservoir 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, the pressure valve opens in the pressure cap. This allows the coolant, which has expanded due to being heated, is allowed 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, coolant is not 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 most of the air bubbles are eliminated from the cooling system. Coolant without bubbles absorbs heat much better than coolant with bubbles.

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.

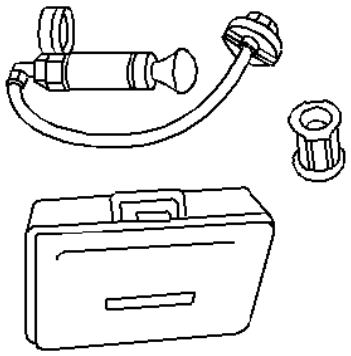
Coolant Heater

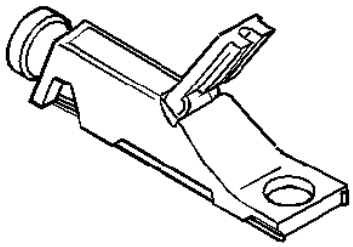
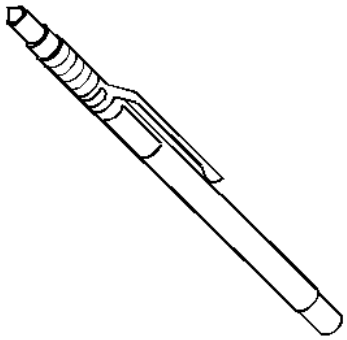
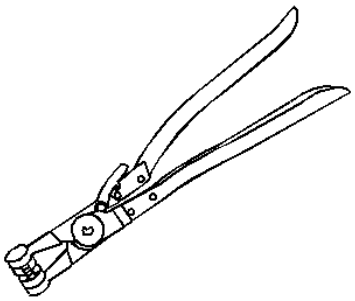
The optional engine coolant heater (RPO K05) is rated at 400 watts and supplies 1365 btu/hr. The engine coolant heater operates using 110 volt AC external power and is designed to warm the coolant in the engine block area for improved starting in very cold weather -29°C (-20°F). The coolant heater helps 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.

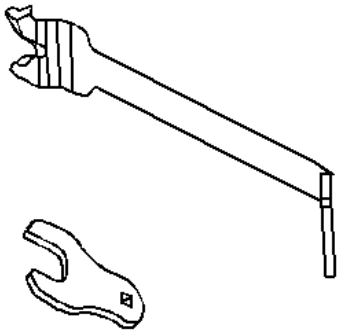
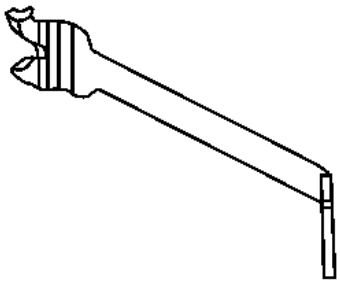
SPECIAL TOOLS AND EQUIPMENT

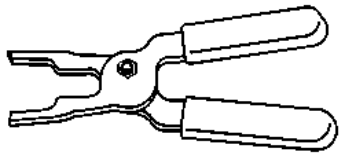
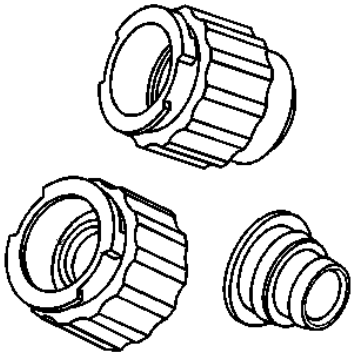
SPECIAL TOOLS

Special Tools

Illustration	Tool Number/ Description
	J 24460-01 Cooling System and Cap Pressure Tester
	J 26568 Coolant and Battery Fluid Tester

	
	J 24731 Tempil Stick
	J 38185 Hose Clamp Pliers
	J 39200

	Digital Multimeter
	J 41240 Fan Clutch Remover and Installer
	J 46406 Fan Clutch Remover and Installer

	J 43244 Relay Puller Pliers
	J 42401 Radiator Cap and Surge Tank Test Adapters