2008 ENGINE

Engine Cooling - Ascender, Envoy & Trailblazer

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 & ROUTING DIAGRAMS

ENGINE COOLING SCHEMATICS

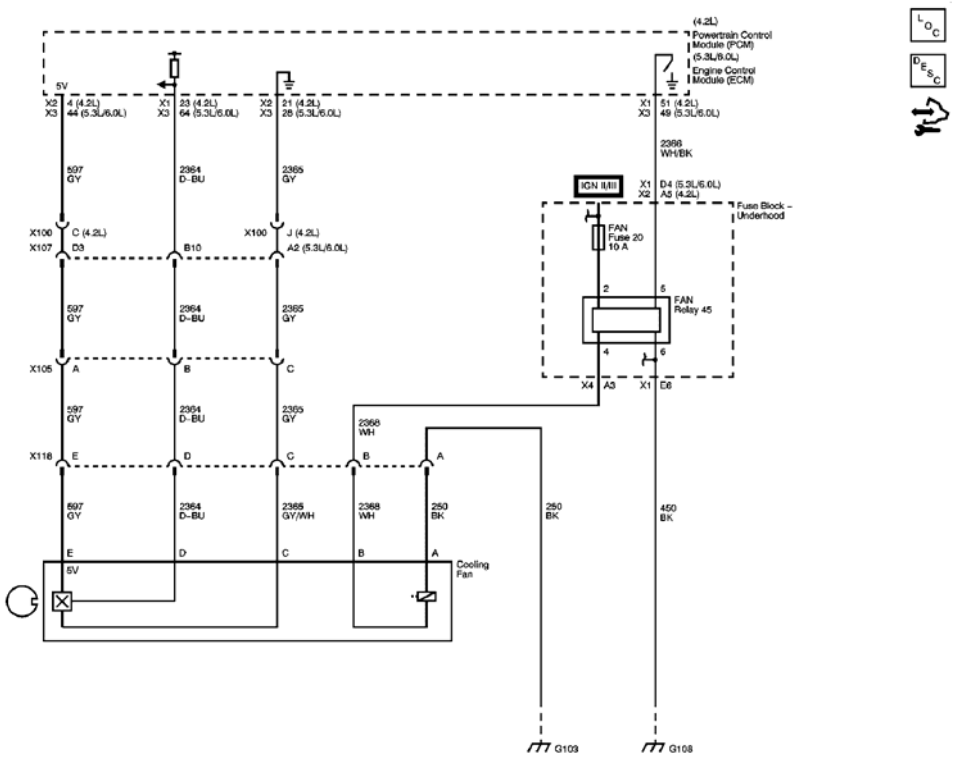


Fig. 1: Engine Cooling Schematic
Courtesy of GENERAL MOTORS CORP.

DIAGNOSTIC INFORMATION & PROCEDURES

DIAGNOSTIC STARTING POINT - ENGINE COOLING

Begin the system diagnosis with the **Diagnostic System Check - Vehicle** . 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.

DTC P1258

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.

- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptor

DTC P1258: Engine Coolant Over-temperature - Protection Mode Active

Circuit/System Description

The engine control module (ECM) uses the engine coolant temperature (ECT) sensor to monitor the engine for an over-temperature condition. This condition occurs when the coolant temperature is above a calibrated value for a calibrated length of time. The ECM will disable half of the cylinders by turning OFF the fuel injectors. By disabling half of cylinders, the ECM is able to reduce the temperature of the coolant.

Conditions for Running the DTC

- The engine is running.
- DTCs P0117 or P0118 are not set.

Conditions for Setting the DTC

Coolant temperature more than 130°C (266°F) for more than 10 seconds.

Action Taken When the DTC Sets

- DTC P1258 is a Type A DTC.
- The engine will operate in the Overheated Engine Protection Operating Mode.
- The engine coolant temperature indicator lamp, if equipped, will illuminate.
- The driver information center (DIC), if equipped, will display a message.

Conditions for Clearing the DTC

DTC P1258 is a Type A DTC.

Reference Information

Description and Operation

- **Cooling System Description and Operation**
- **Instrument Cluster Description and Operation**
- **Indicator/Warning Message Description and Operation**
- **Audible Warnings Description and Operation**

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Observe the engine coolant level. The engine coolant level should be within operating range. Refer to Capacities - Approximate Fluid, and Engine Coolant in the Owner's Manual.
2. Ensure that the vehicle has the correct engine coolant, with correct concentration, and is not old, contaminated or contains additives. Refer to Recommended Fluids and Lubricants in the Owner's Manual.
3. Inspect the cooling system for the following:
   - Leaks
   - Kinked or pinched hoses, especially at the radiator
   - Loose, missing, or damaged radiator air seals or deflectors
   - The radiator and A/C condenser for any air flow obstructions or bent fins--Refer to **Symptoms - Engine Cooling** .

Circuit/System Testing

1. Test the thermostat for correct operation. Refer to **Thermostat Diagnosis** .
2. Test the fan clutch for proper operation. Refer to **Fan Clutch Diagnosis** .
3. Test the engine cooling system for overheating. Refer to **Engine Overheating** .
4. Inspect the water pump and coolant flow for correct operation. Refer to **Water Pump Replacement** .
5. Inspect the engine for worn/leaking/cracked cylinder heads and engine block. Refer to the following procedures:
   - Coolant in Combustion Chamber and **Coolant in Engine Oil** for the 4.2L engine
   - Coolant in Combustion Chamber and Coolant in Engine Oil for the 5.3L and 6.0L engines

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

SYMPTOMS - ENGINE COOLING

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

Visual/Physical Inspection

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

Intermittent

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

Symptom List

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

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

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 **Cooling System Draining and Filling (LL8)** or **Cooling System Draining and Filling (LH6, LS2)**. 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** . 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**. 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 **Engine Coolant Thermostat Replacement (4.2L Engine)** or **Engine Coolant Thermostat Replacement (5.3L and 6.0L Engines)**. 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

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 - Vehicle** . Are any DTCs set?		Symptoms - Engine Cooling**Symptoms -**

	Is the action complete?	Go to **Step 3**	**Engine Cooling**
3	Inspect the coolant level. Is the coolant at the proper level?	Go to **Step 5**	Go to **Step 4**
4	Fill the cooling system to the proper level. Refer to **Cooling System Draining and Filling (LL8)** or **Cooling System Draining and Filling (LH6, LS2)**. 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 30**	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 32**	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 31**	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: • The auxiliary heater • The coolant bypass • The coolant reservoir • The heater • The radiator Are any of the hoses, clamps, or pipes leaking?	Go to **Step 21**	Go to **Step 12**

12	Visually inspect the following components: • The block heater • The coolant pressure cap • The coolant reservoir • The core plugs • The cylinder head gaskets • The engine block • The intake manifold • The radiator • The thermostat • The 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 33**	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 24**	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 26**	Go to **Step 34**
21	Repair or replace the leaking component. Refer to the appropriate repair. Is the repair complete?	Go to **Step 34**	-
22	Replace the coolant pressure cap. Is the repair complete?	Go to **Step 34**	-
23	Replace the heater core. Refer to **Heater Core Replacement** . Is the repair complete?	Go to **Step 34**	-
24	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 25**	Go to **Step 28**
25	1. Replace the radiator. Refer to **Radiator Replacement (LL8)** or **Radiator Replacement (LH6, LS2)**. 2. Service the engine oil and filter. Refer to **Engine Oil and Oil Filter Replacement** for the 4.2L engine or Engine Oil and Oil Filter Replacement for the 5.3L engine. Is the repair complete?	Go to **Step 34**	-
	1. Remove the transmission oil cooler lines from the radiator.		

26	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 27**	Go to **Step 28**
27	1. Replace the radiator. Refer to **Radiator Replacement (LL8)** or **Radiator Replacement (LH6, LS2)**. 2. Service the automatic transmission. Refer to **Automatic Transmission Fluid and Filter Replacement** . Is the repair complete?	Go to **Step 34**	-
28	Install the cooler lines to the radiator. Is the repair complete?	Go to **Step 34**	-
29	Repair the engine no crank condition. Refer to **Engine Will Not Crank - Crankshaft Will Not Rotate** for the 4.2L engine or Engine Will Not Crank - Crankshaft Will Not Rotate for the 5.3L engine. Is the repair complete?	Go to **Step 34**	-
30	Repair the engine overheating condition. Refer to **Engine Overheating**. Is the repair complete?	Go to **Step 34**	-
31	Repair the engine internal coolant leak. Refer to **Coolant in Combustion Chamber** for the 4.2L engine or Coolant in Engine Oil for the 5.3L engine. Is the repair complete?	Go to **Step 34**	-
32	Repair the engine knock. Refer to **Lower Engine Noise, Regardless of Engine Speed** for the 4.2L engine or Lower Engine Noise, Regardless of Engine Speed for the 5.3L engine. Is the repair complete?	Go to **Step 34**	-
33	Repair the combustion pressure in the cooling system problem. Refer to **Cylinder Leakage Test** for the 4.2L engine or Cylinder Leakage Test for the 5.3L engine. Is the repair complete?	Go to **Step 34**	-
34	Operate the system in order to verify the repair. Did you find and correct the condition?	System OK	Go to **Step 2**

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**. 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 **Engine Coolant Thermostat Replacement (4.2L Engine)** or **Engine Coolant Thermostat Replacement (5.3L and 6.0L Engines)**. 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 **Engine Coolant Thermostat Replacement (4.2L Engine)** or **Engine Coolant Thermostat Replacement (5.3L and 6.0L Engines)**. 2. Recheck the thermostat opening temperature as in Step 1. Does the engine still overheat?	Go to **Engine Overheating**	System OK

COOLANT HEATER INOPERATIVE

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

Circuit/System Description

The optional 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. There is an internal thermal switch in the power cord that prevents operation above -18°C (0°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.

Reference Information

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Wiring Repairs**

Circuit/System Testing

IMPORTANT: The power supply cord will read open due to an internal thermal switch if the ambient temperature is above -18°C (0°F).

1. Test the engine coolant heater for an open or short to ground.
    - If open or shorted, replace the heater.
2. If the heater tests normal, replace the coolant heater power cord.

Repair Procedures

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Coolant Heater Replacement (LL8)** or **Coolant Heater Replacement (LH6 and LS2)**
- **Coolant Heater Cord Replacement**

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		

2	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 **Cooling System Draining and Filling (LL8)** or **Cooling System Draining and Filling (LH6, LS2)**. 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 **Engine Coolant Thermostat Replacement (4.2L Engine)** or **Engine Coolant Thermostat Replacement (5.3L and 6.0L Engines)**. 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**.
- **J 42401** Radiator Cap / Surge Tank Test Adapter. See **Special Tools**.

Pressure Cap Testing

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

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

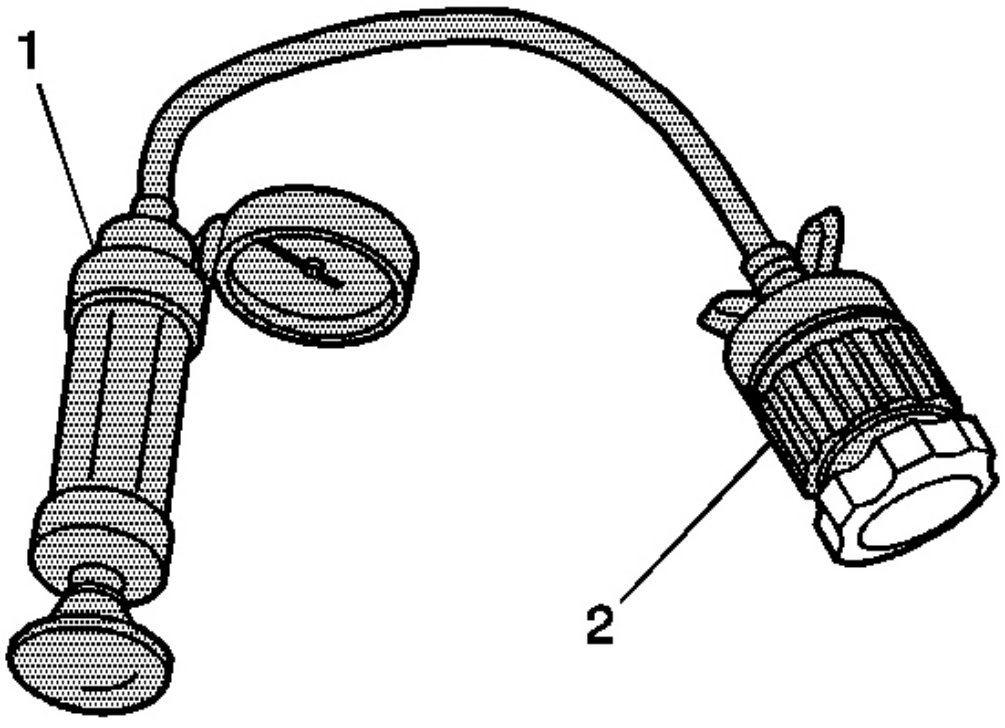


Fig. 2: Pressure Testing Radiator Cap
Courtesy of GENERAL MOTORS CORP.

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

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.

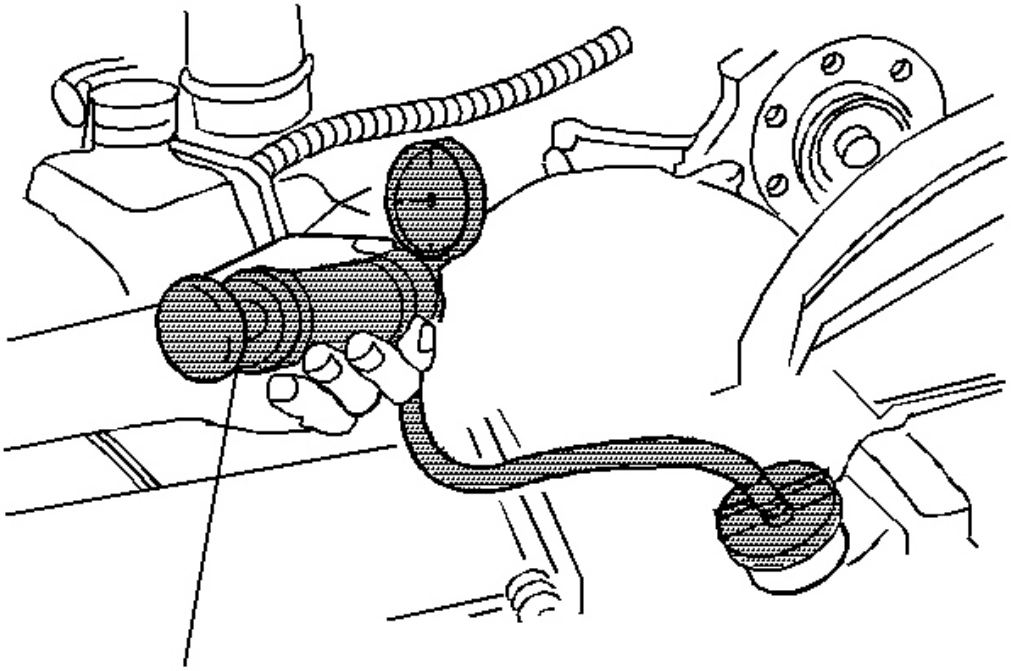


Fig. 3: Pressure Testing Cooling System Using J 24460-01
Courtesy of GENERAL MOTORS CORP.

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

   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.

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 Symptoms or another diagnostic table?	Go to Step 2	Go to **Symptoms - Engine Cooling**
2	Is there excessive fan air noise?	Go to Step 3	Go to Step 4
3	Fan air noise is normal during cold engine start up. Does the fan noise go away at normal engine operating temperature?	Go to Step 13	Go to Step 4
4	Important: The engine must be turned off and the engine temperature should be cold. Rotate the fan clutch. Does the fan clutch rotate?	Go to Step 5	Go to Step 14
5	Visually inspect the fan blades for cracks, looseness or damage. Are the fan blades in good condition?	Go to Step 6	Go to Step 15
6	Visually inspect the fan clutch for signs of silicone leakage. * 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 (in) movement at the	Go to Step 14	Go to Step 9

	tip of the fan blade is normal. 2. Inspect for fan clutch lateral movement. Is the fan clutch lateral movement excessive?		
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 **Fastener Tightening Specifications** . Is the repair complete?	Go to Step 16	--
11	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 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. Note the thermometer reading when the fan clutch engages. 10. Do not continue this test if the fan clutch does not engage between 85-96°C (185-205°F). Fan clutch engagement will be indicated by an increase in fan air noise, fan speed, and a temperature drop of about 3-10°C (5-15°F) on the thermometer. Did the fan clutch engage between 85-96°C (185-205°F)?	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** .	Go to Step 16	--

	Is the repair complete?		
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

EXCESSIVE FAN NOISE

Circuit Description

The electro-viscous clutch is controlled by the powertrain control module (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 hydraulic fluid. There are 2 chambers for the fluid. These 2 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 percent command with the engine at 2,000 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 2,000 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** .

Test Description

The numbers below refer to the step numbers on 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.

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

Step	Action	Yes	No
Schematic Reference: Engine Cooling Schematics **Connector End View Reference: Component Connector End Views** DEFINITION: The cooling fan clutch has excessive fan noise.			
1	Did you perform the Diagnostic System Check - Vehicle?	Go to **Step 2**	Go to **Diagnostic System Check - Vehicle**
2	Rotate the cooling fan 3 complete revolutions? Is the resistance of the cooling fan clutch even throughout 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 13**	Go to **Step 11**
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 8**
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 the cooling fan relay.		

	4. Disconnect the cooling fan clutch connector. 5. Start the engine. 6. Raise the engine speed to 2,000 RPM for 2 minutes. Does the cooling fan disengage?	System OK	Go to **Step 6**
6	1. Turn OFF the ignition. 2. If the A/C system was operating, then wait for approximately 2 minutes. 3. Install **J 43600** ACR 2000 Air Conditioning Service Center. 4. Turn ON the ignition, with the engine OFF. 5. With a scan tool, observe the A/C High Side Pressure Sensor parameter. 6. Compare the A/C high side pressure on the scan tool to the high side pressure on **J 43600** . Are the high side pressure values within 138 kPa (20 psi) of each other?	Go to **Step 7**	Go to **Step 9**
7	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 DTCs. 5. Start the engine. 6. Test drive the vehicle. 7. With a scan tool, observe the DTC list. Does the scan tool display any cooling system DTCs?	Go to **Diagnostic Trouble Code (DTC) List - Vehicle**	System OK
8	Inspect for poor connections at the harness connector of the cooling fan clutch. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** . 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 A/C high side pressure sensor. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** . Did you find and correct the condition?	Go to **Step 12**	Go to **Step 10**
10	Replace the A/C refrigerant pressure sensor. Refer to **Air Conditioning (A/C) Refrigerant Pressure Sensor Replacement** . Did you complete the replacement?	Go to **Step 13**	-

11	Replace the cooling fan clutch. Refer to **Fan Clutch Replacement**. Did you complete the replacement?	Go to **Step 13**	-
12	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to **Step 8**
13	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to **Step 3**

REPAIR INSTRUCTIONS

COOLING SYSTEM DRAINING & FILLING (LL8)

Tools Required

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

Draining Procedure

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

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

1. Park the vehicle on a level surface.
2. Allow the engine to cool.
3. Remove the radiator cap.
4. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
5. Place a drain pan under the lower radiator hose connection at the bottom of the radiator.
6. Using **J 38185** slide the hose clamp back on the hose. See **Special Tools**.
7. Slowly remove the outlet (lower) radiator hose and drain the coolant into the drain pan.
8. Inspect the engine coolant for the following conditions:
   - 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 plug located on the LH side of the block.

Coolant 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 plug.
2. Install the outlet (lower) radiator hose.
3. Using **J 38185** slide the clamp into the original position. See **Special Tools**.
4. Lower the vehicle.

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

5. Remove coolant recovery reservoir cap.
6. Fill the coolant recovery reservoir with the remaining coolant.
7. Install coolant recovery reservoir cap.
8. Install the radiator cap.
9. Start the engine.
10. Run the engine at 1,000-3,000 RPM in 30 second intervals until the engine reaches normal operating temperature.
11. Allow the engine to idle for 3 minutes.
12. Shut the engine OFF.
13. Allow the engine to cool.
14. Top off the coolant recovery reservoir as necessary.
15. Rinse away any excess coolant from the engine and the engine compartment.
16. Inspect the cooling system for leaks.
17. Inspect the concentration of the engine coolant using **J 26568** . See **Special Tools**.

COOLING SYSTEM DRAINING & FILLING (LH6, LS2)

Tools Required

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

Draining Procedure

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

IMPORTANT: Draining the cooling system with the pressure cap installed will syphon

the coolant from the overflow tank.

1. Park the vehicle on a level surface.
2. Allow the engine to cool.
3. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
4. Place a drain pan under the lower radiator hose connection at the bottom of the radiator.
5. Using the pliers **J 38185** , slide the hose clamp back on the hose. See **Special Tools**.
6. Slowly remove the lower radiator hose and drain the coolant into the drain pan.
7. Inspect the engine coolant for the following conditions:
   - 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 (LH6 and LS2)**.
8. Remove the radiator cap.

Coolant 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 (LH6 and LS2)**.
2. Install the lower radiator hose.
3. Using the pliers **J 38185** , slide the clamp into the original position. See **Special Tools**.
4. Lower the vehicle.

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

5. Install the radiator cap.
6. Remove coolant recovery reservoir cap.
7. Slowly add a mixture of 50/50 DEX-COOL antifreeze and deionized water to the cooling system through the coolant recovery reservoir. Refer to **Approximate Fluid Capacities** .
8. Fill the coolant recovery reservoir with the remaining coolant.
9. Install the coolant recovery reservoir cap.
10. Start the engine.
11. Run the engine from 1,000-3,000 RPM in 30-second intervals until the engine reaches normal operating temperature.
12. Allow the engine to idle for 3 minutes before repeating the last step.

13. Shut the engine OFF.
14. Allow the engine to cool.
15. Top off the coolant recovery reservoir as necessary.
16. Rinse away any excess coolant from the engine and the engine compartment.
17. Inspect the cooling system for leaks.
18. Inspect the concentration of the engine coolant using the fluid tester **J 26568** . See **Special Tools**.

FLUSHING

IMPORTANT: Do not use a chemical flush.
Store used coolant in the proper manner, such as in a used engine coolant holding tank. Do not pour used coolant down a drain. Ethylene glycol antifreeze is a very toxic chemical. Do not dispose of coolant into the sewer system or ground water. This is illegal and ecologically unsound.
Various methods and equipment can be used to flush the cooling system. If special equipment is used, such as a back flusher, follow the manufacturer's instruction. Always remove the thermostat before flushing the cooling system.

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

1. Drain the cooling system. Refer to **Cooling System Draining and Filling (LL8)** or **Cooling System Draining and Filling (LH6, LS2)**.
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 **Engine Coolant Thermostat Replacement (4.2L Engine)** or **Engine Coolant Thermostat Replacement (5.3L and 6.0L Engines)**.
6. Follow the drain and fill procedure using only clean, drinkable water. Refer to **Cooling System Draining and Filling (LL8)** or **Cooling System Draining and Filling (LH6, LS2)**.
7. Run the engine for 20 minutes.
8. Stop the engine.
9. Drain the cooling system. Refer to **Cooling System Draining and Filling (LL8)** or **Cooling System Draining and Filling (LH6, LS2)**.
10. Repeat the procedure if necessary, until the fluid is nearly colorless.
11. Install the thermostat. Refer to **Engine Coolant Thermostat Replacement (4.2L Engine)** or **Engine Coolant Thermostat Replacement (5.3L and 6.0L Engines)**.
12. Fill the cooling system. Refer to **Cooling System Draining and Filling (LL8)** or **Cooling System Draining and Filling (LH6, LS2)**.

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** for the 4.2L engine or Air Cleaner Assembly Replacement for the 4.8L, 5.3L, 6.0L, 6.2L, or 7.0L engine.

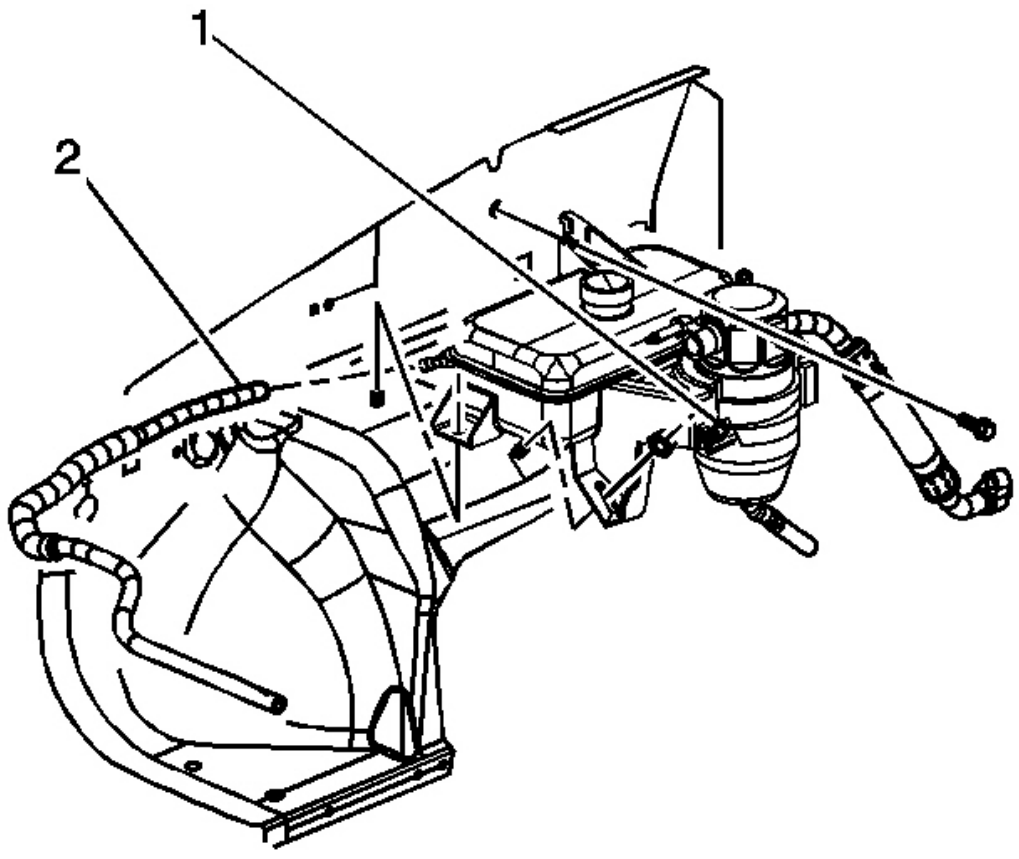


Fig. 4: View Of Coolant Recovery Reservoir
Courtesy of GENERAL MOTORS CORP.

2. Remove the accumulator. Refer to **Accumulator Replacement** .
3. Remove the coolant hoses from the coolant recovery reservoir and plug the hoses and the coolant recovery reservoir outlets with suitable plugs (2).
4. Remove the nut and bolt securing the coolant recovery reservoir.
5. Remove the coolant recovery reservoir.

Installation Procedure

1. Install the coolant recovery reservoir.

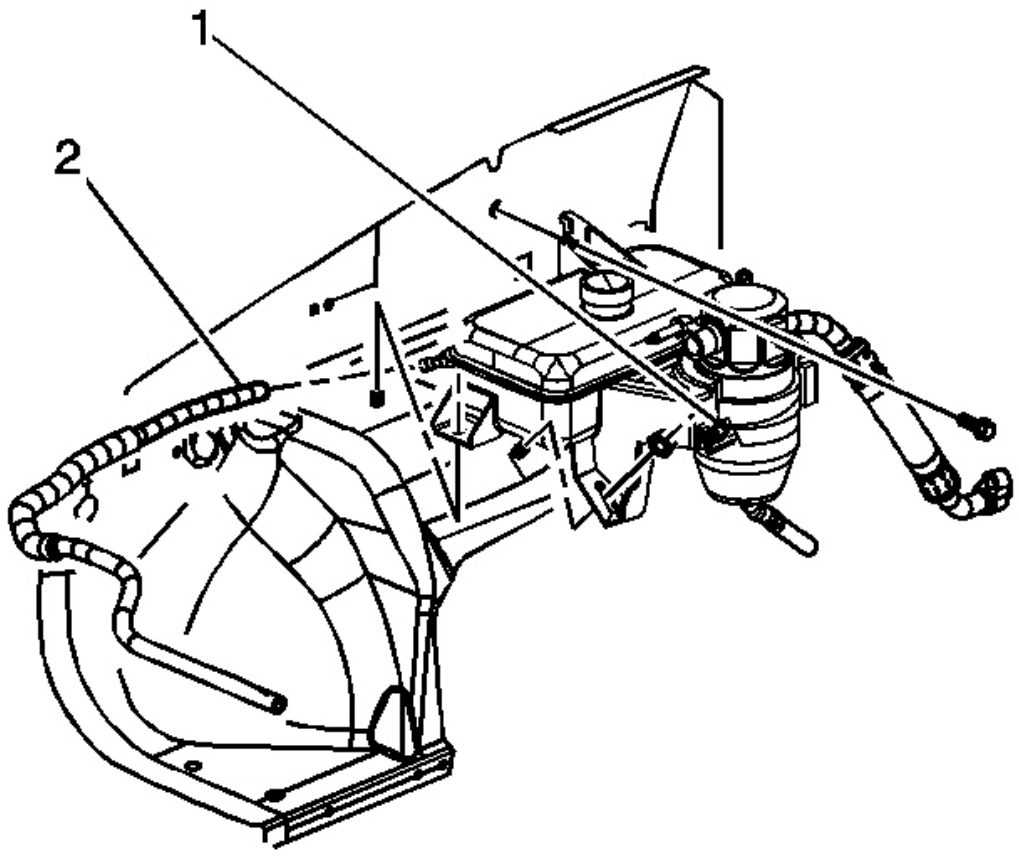


Fig. 5: View Of Coolant Recovery Reservoir
Courtesy of GENERAL MOTORS CORP.

NOTE: **Refer to Fastener Notice .**

2. Install the coolant recovery reservoir bolt.

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

3. Install the coolant recovery reservoir nut.

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

4. Install the coolant hose to the coolant recovery reservoir (2).
5. Install the accumulator. Refer to **Accumulator Replacement** .
6. Install the air cleaner assembly. Refer to **Air Cleaner Assembly Replacement** for the 4.2L engine or Air

Cleaner Assembly Replacement for the 4.8L, 5.3L, 6.0L, 6.2L, or 7.0L engine.

RADIATOR INLET HOSE REPLACEMENT (LL8)

Tools Required

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

Removal Procedure

1. Drain the cooling system. Refer to **Cooling System Draining and Filling (LL8)** or **Cooling System Draining and Filling (LH6, LS2)**.
2. Remove the air cleaner outlet resonator. Refer to **Air Cleaner Outlet Resonator Replacement** .

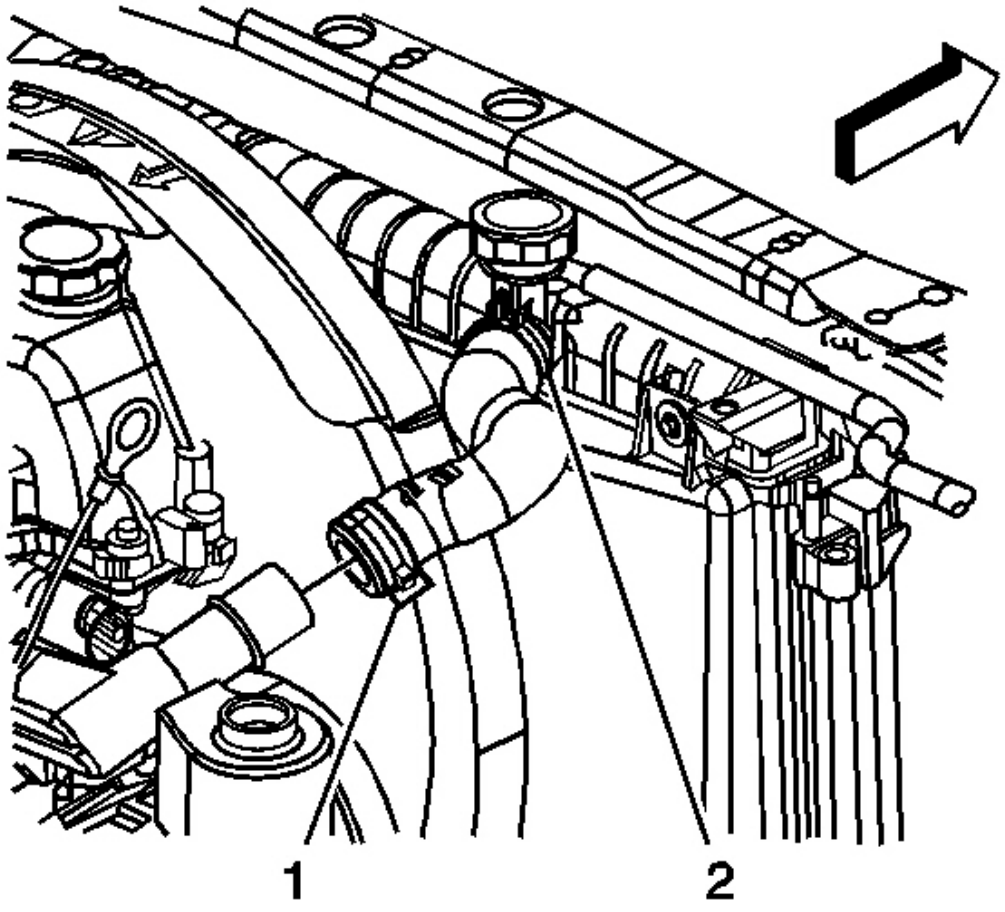


Fig. 6: View Of Radiator Hose Clamps
Courtesy of GENERAL MOTORS CORP.

3. Using **J 38185** reposition the radiator inlet hose clamp (1) from the engine. See **Special Tools**.
4. Remove the radiator outlet hose from the engine.
5. Using **J 38185** reposition the radiator inlet hose clamp (2) from the radiator. See **Special Tools**.
6. Remove the radiator inlet hose from the radiator.

Installation Procedure

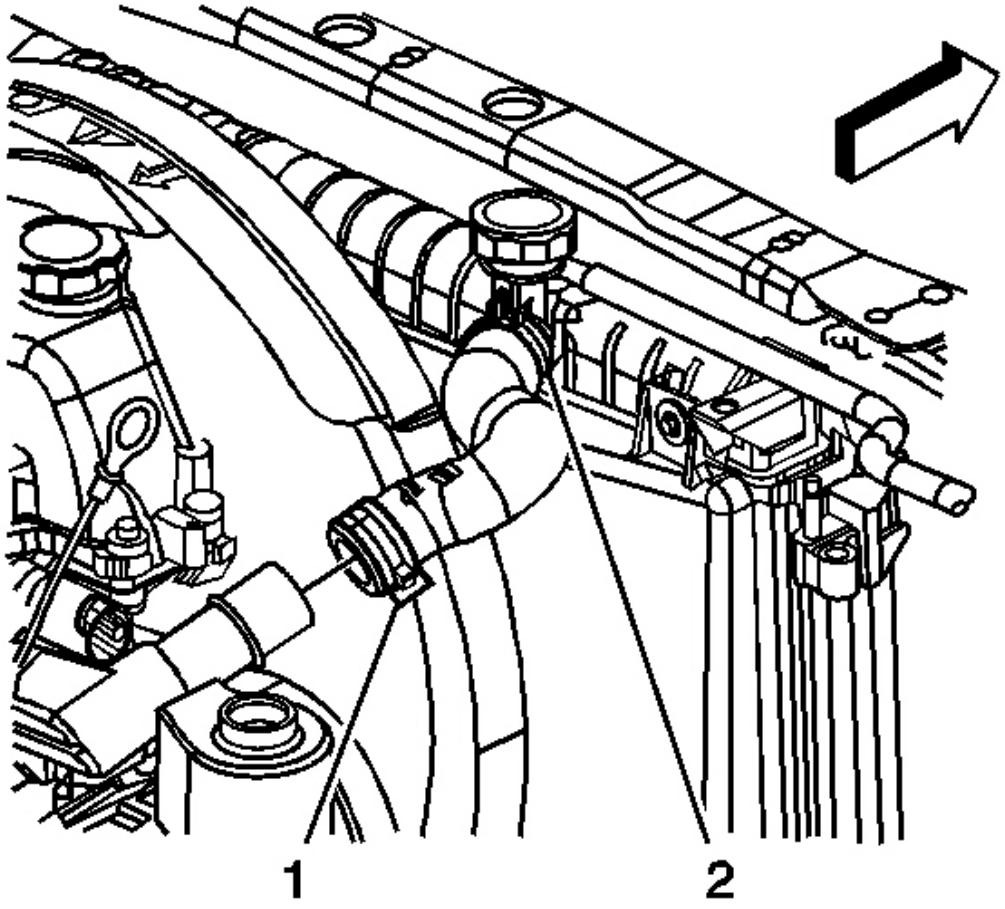


Fig. 7: View Of Radiator Hose Clamps
Courtesy of GENERAL MOTORS CORP.

1. Install the radiator inlet hose to the radiator.

2. Using **J 38185** reposition the radiator inlet hose clamp (2) to the radiator. See **Special Tools**.
3. Install the radiator inlet hose to the engine.
4. Using **J 38185** reposition the radiator inlet hose clamp (1) to the engine. See **Special Tools**.
5. Install the air cleaner outlet resonator. Refer to **Air Cleaner Outlet Resonator Replacement** .
6. Fill the cooling system. Refer to **Cooling System Draining and Filling (LL8)** or **Cooling System Draining and Filling (LH6, LS2)**.

RADIATOR INLET HOSE REPLACEMENT (LH6, LS2)

Special Tools

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

Removal Procedure

1. Drain the cooling system. Refer to **Cooling System Draining and Filling (LL8)** or **Cooling System Draining and Filling (LH6, LS2)**.
2. Remove the air intake resonator. Refer to Air Cleaner Resonator Outlet Duct Replacement .

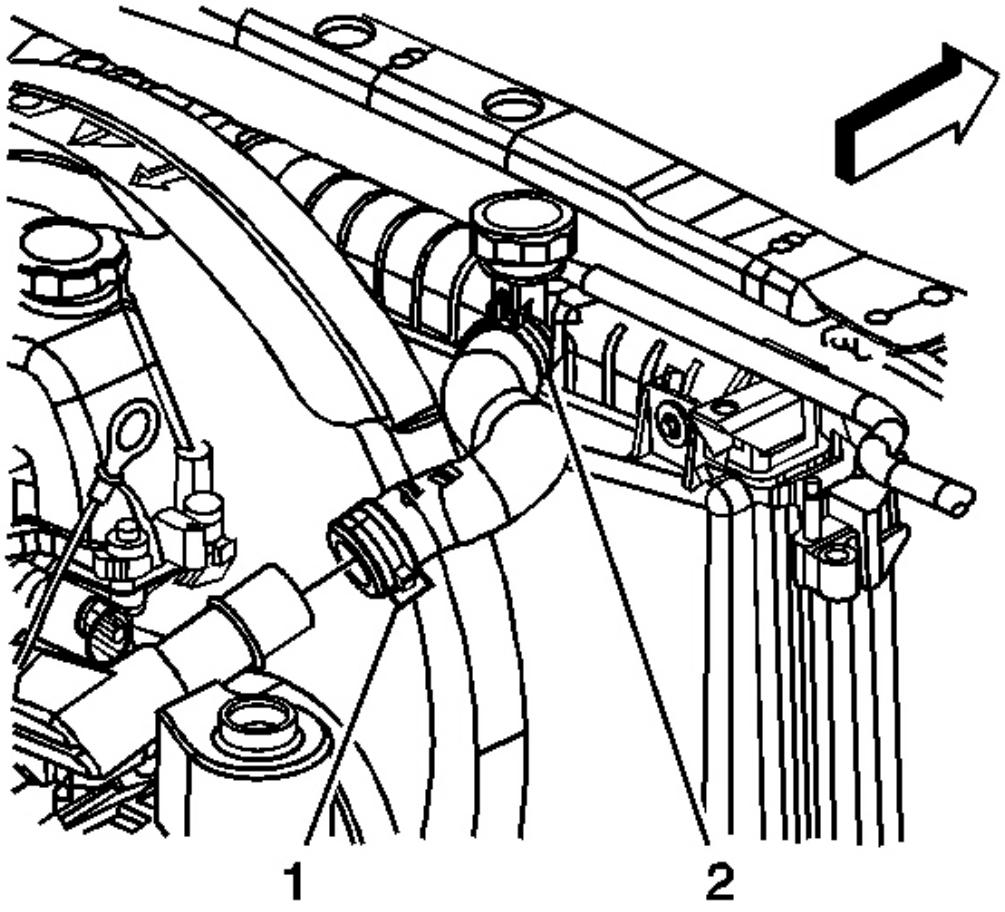


Fig. 8: View Of Radiator Hose Clamps
Courtesy of GENERAL MOTORS CORP.

3. Using **J 38185** reposition the radiator inlet hose clamp (1) from the engine. See **Special Tools**.
4. Remove the outlet hose from the engine.

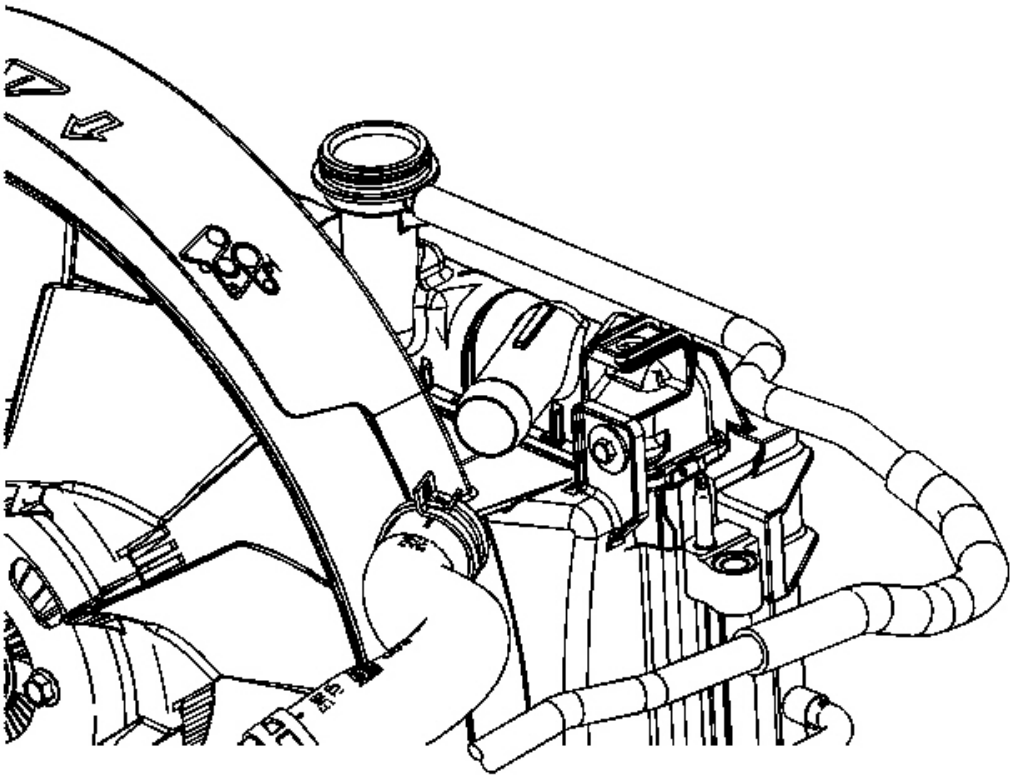


Fig. 9: Identifying Radiator Inlet Hose
Courtesy of GENERAL MOTORS CORP.

5. Using **J 38185** reposition the radiator inlet hose clamp (2) from the radiator. See **Special Tools**.
6. Remove the radiator outlet hose from the radiator.

Installation Procedure

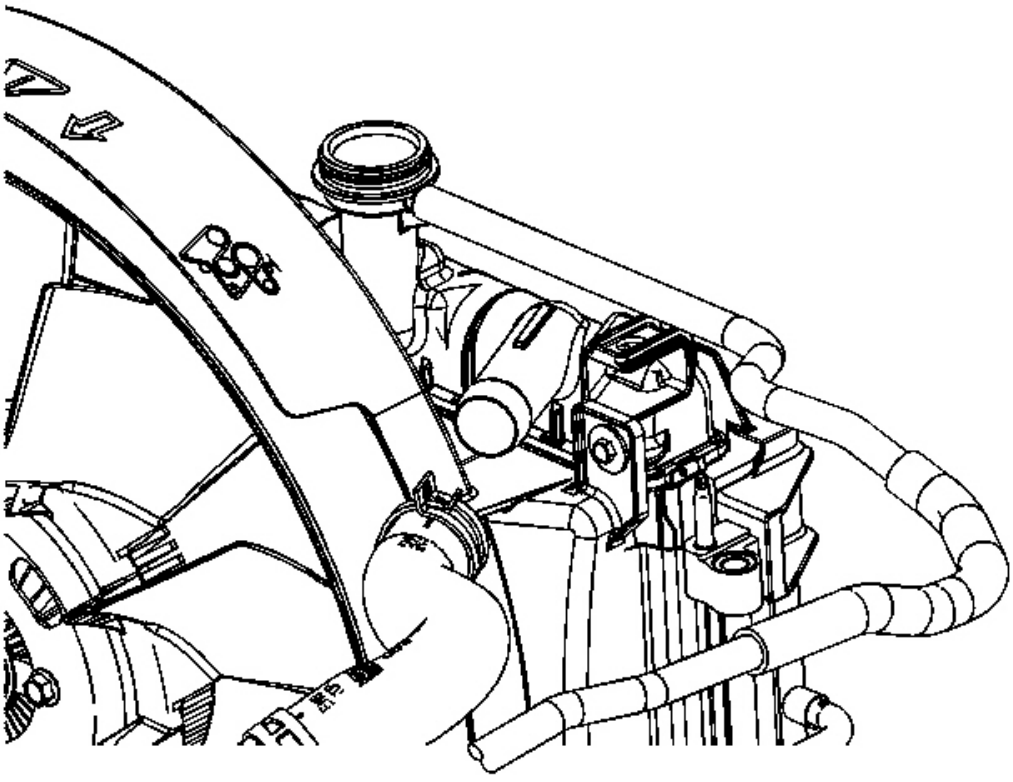


Fig. 10: Identifying Radiator Inlet Hose
Courtesy of GENERAL MOTORS CORP.

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

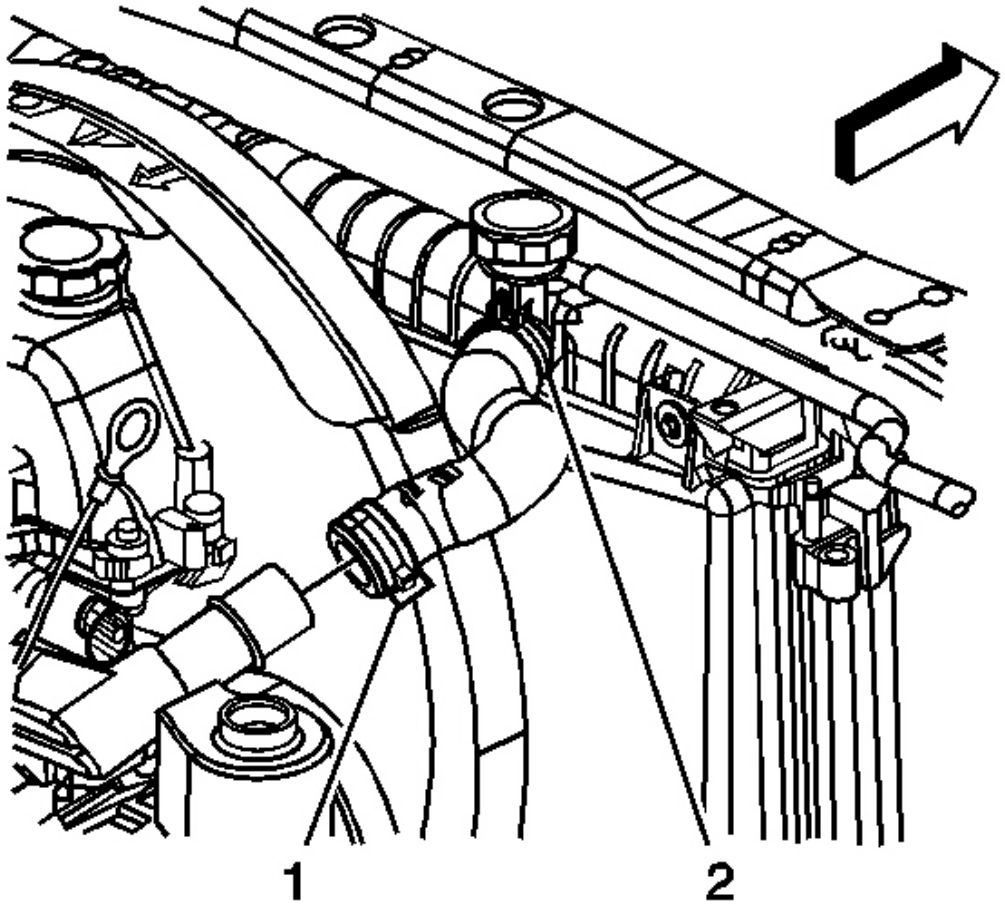


Fig. 11: View Of Radiator Hose Clamps
Courtesy of GENERAL MOTORS CORP.

3. Install the inlet hose to the engine.
4. Using **J 38185** reposition the radiator inlet hose clamp to the engine (1). See **Special Tools**.
5. Install the air intake resonator. Refer to Air Cleaner Resonator Outlet Duct Replacement .
6. Fill the cooling system. Refer to **Cooling System Draining and Filling (LL8)** or **Cooling System Draining and Filling (LH6, LS2)**.

RADIATOR OUTLET HOSE REPLACEMENT (LL8)

Tools Required

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

Removal Procedure

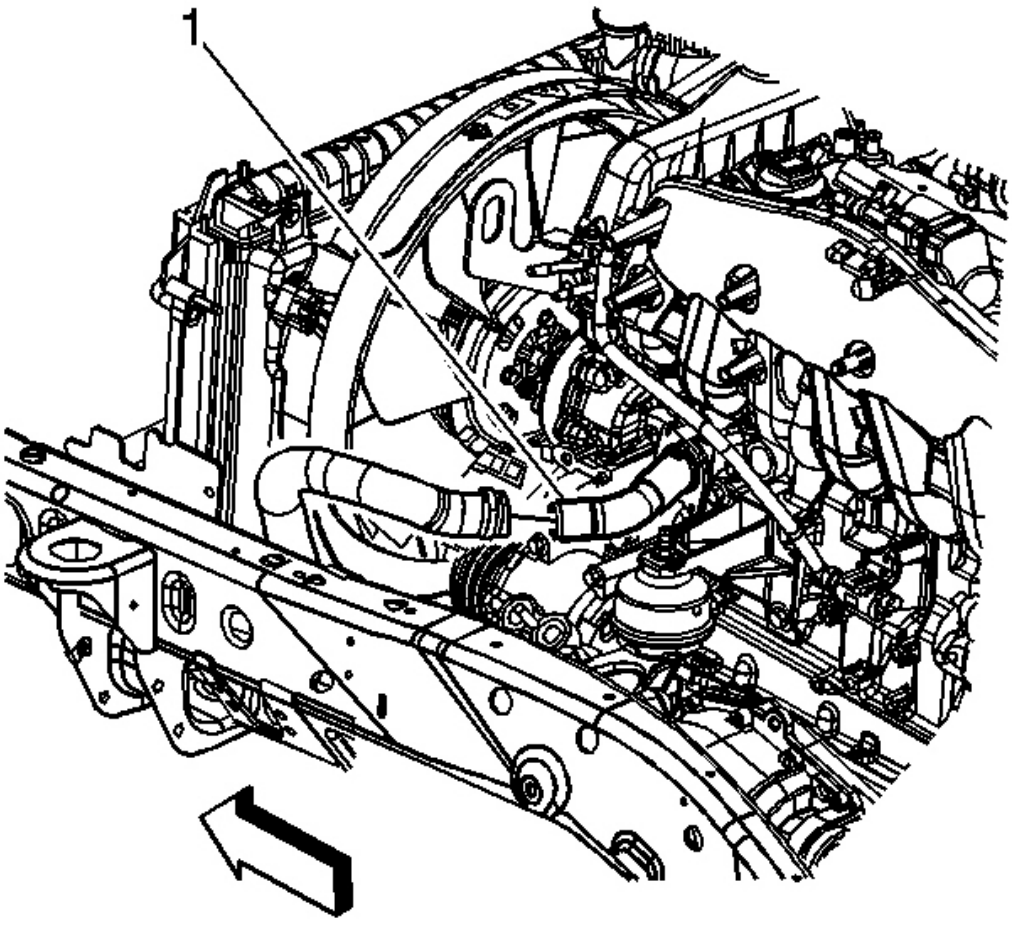


Fig. 12: Locating Thermostat Housing
Courtesy of GENERAL MOTORS CORP.

1. Drain the cooling system. Refer to **Cooling System Draining and Filling (LL8)** or **Cooling System Draining and Filling (LH6, LS2)**.
2. Using **J 38185** reposition the radiator outlet hose clamp. See **Special Tools**.
3. Remove the radiator outlet hose from the radiator.
4. Using **J 38185** reposition the radiator outlet hose clamp. See **Special Tools**.
5. Remove the radiator outlet hose from the engine (1).
6. Remove the radiator outlet hose.

Installation Procedure

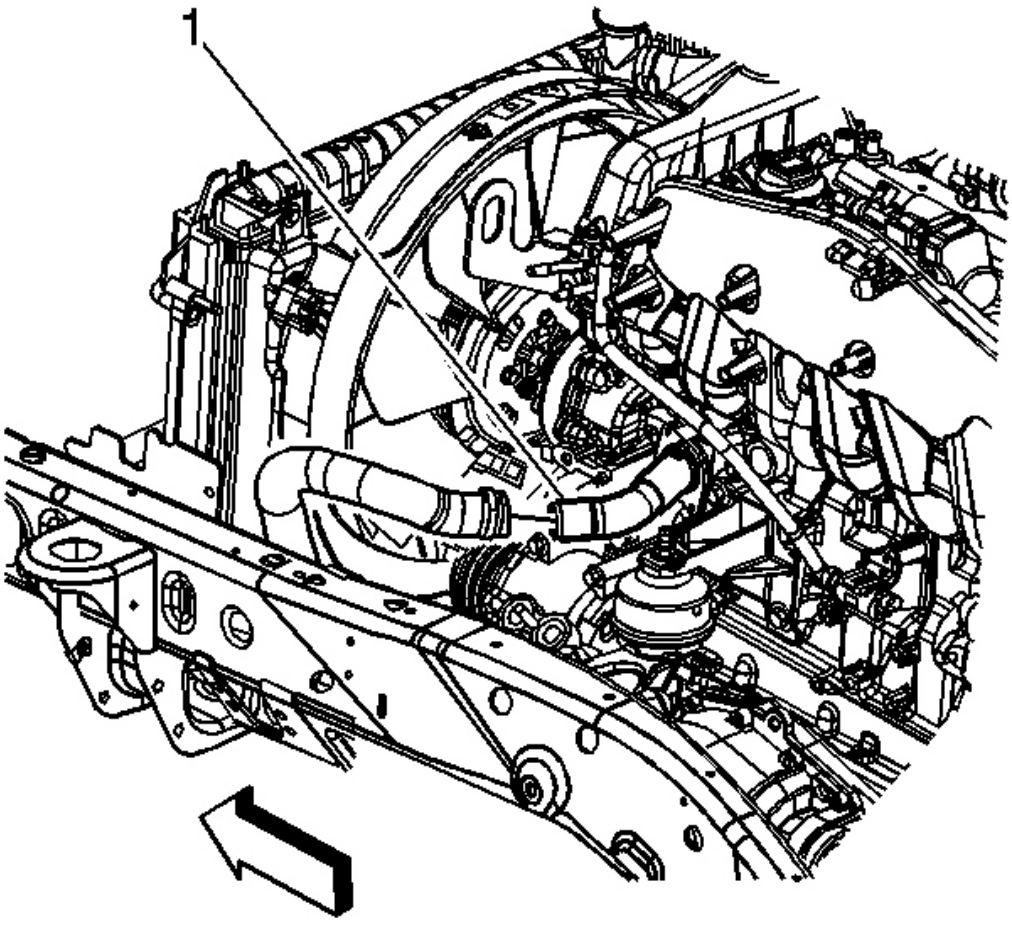


Fig. 13: Locating Thermostat Housing
Courtesy of GENERAL MOTORS CORP.

1. Install the radiator outlet hose to the engine (1).
2. Using **J 38185** reposition the radiator outlet hose clamp. See **Special Tools**.
3. Install the radiator outlet hose to the radiator.
4. Using **J 38185** reposition the radiator outlet hose clamp. See **Special Tools**.
5. Lower the vehicle.
6. Fill the cooling system. Refer to **Cooling System Draining and Filling (LL8)** or **Cooling System Draining and Filling (LH6, LS2)**.

RADIATOR OUTLET HOSE REPLACEMENT (LH6, LS2)

Tools Required

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

Removal Procedure

1. Drain the cooling system. Refer to **Cooling System Draining and Filling (LL8)** or **Cooling System Draining and Filling (LH6, LS2)**.

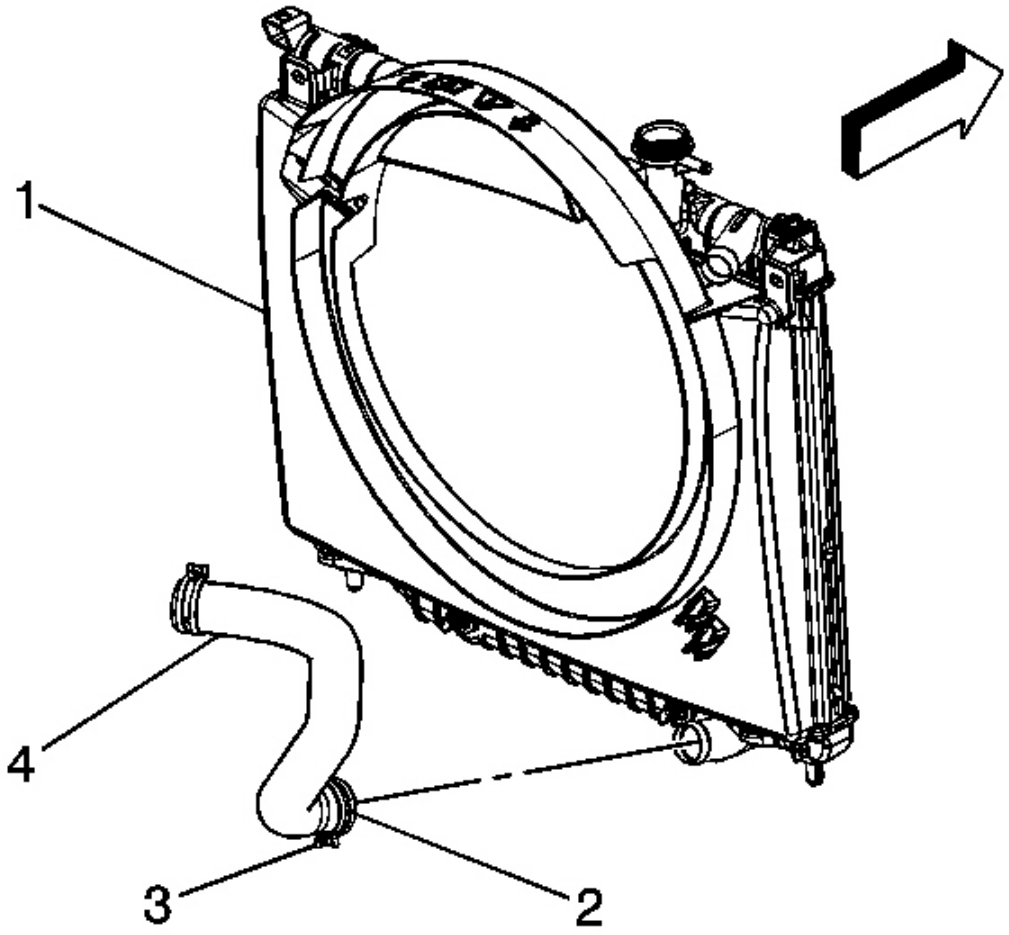


Fig. 14: View Of Radiator, Hose & Clamp
Courtesy of GENERAL MOTORS CORP.

2. Using **J 38185** reposition the radiator outlet hose clamp (3). See **Special Tools**.
3. Remove the radiator outlet hose (2) from the radiator.

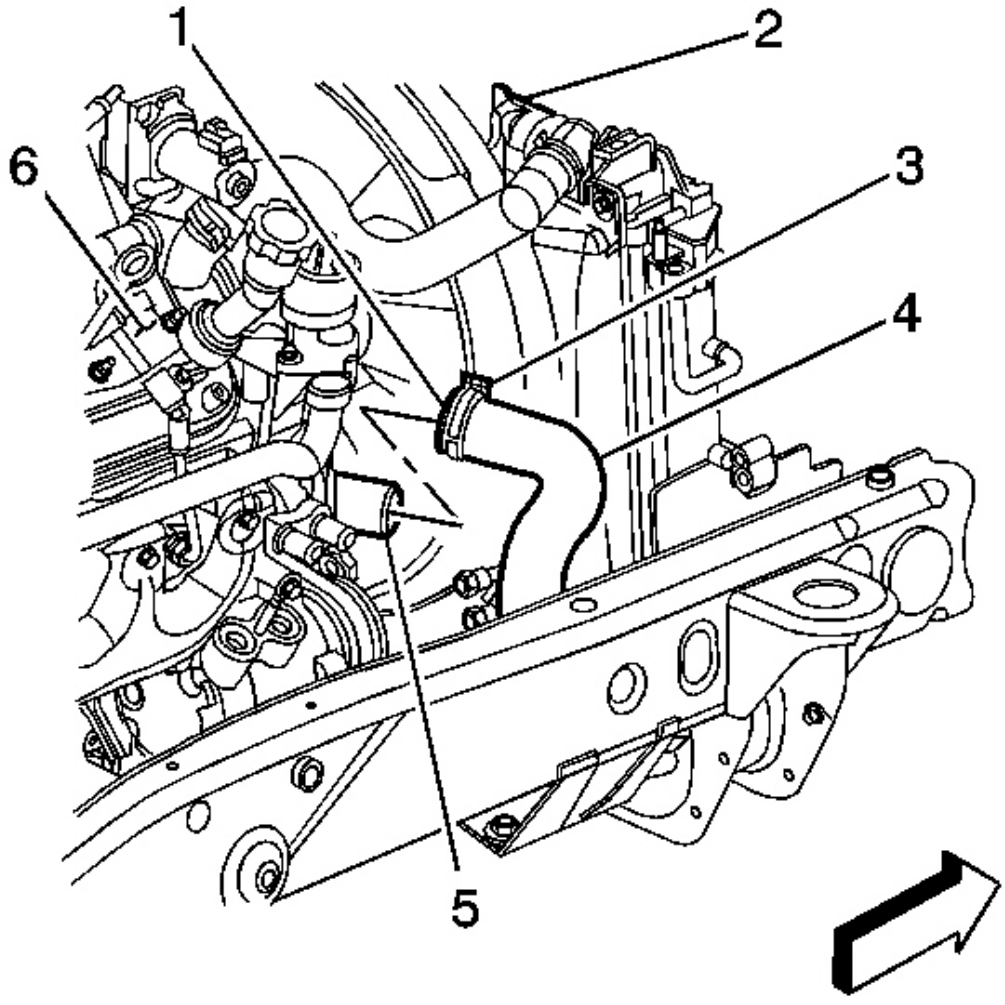


Fig. 15: View Of Inlet Hose & Clamp
Courtesy of GENERAL MOTORS CORP.

4. Using **J 38185** reposition the radiator outlet hose clamp. See **Special Tools**.
5. Remove the radiator outlet hose from the engine (5).
6. Remove the radiator outlet hose.

Installation Procedure

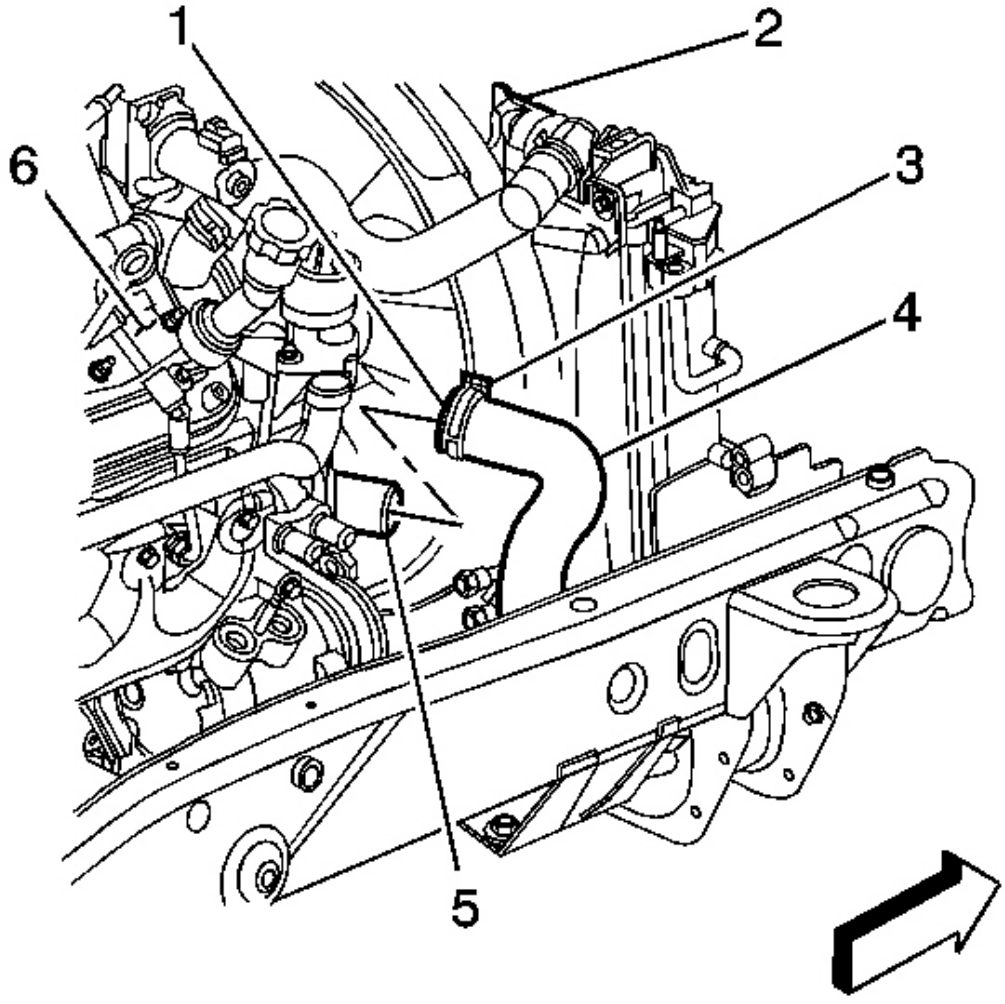


Fig. 16: View Of Inlet Hose & Clamp
Courtesy of GENERAL MOTORS CORP.

1. Install the radiator outlet hose to the engine (5).
2. Using **J 38185** reposition the radiator outlet hose clamp (3). See **Special Tools**.

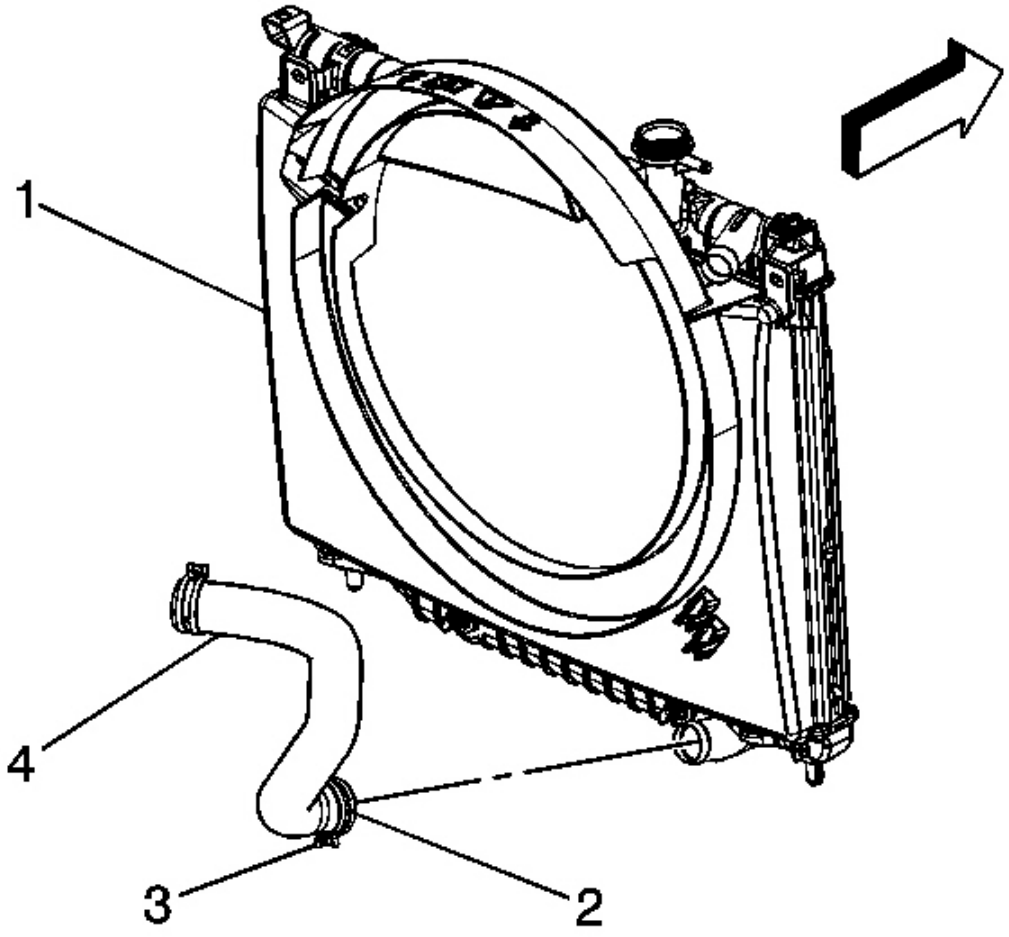


Fig. 17: View Of Radiator, Hose & Clamp
Courtesy of GENERAL MOTORS CORP.

3. Install the radiator outlet hose (2) to the radiator (1).
4. Using **J 38185** reposition the radiator outlet hose clamp (3). See **Special Tools**.
5. Lower the vehicle.
6. Fill the cooling system. Refer to **Cooling System Draining and Filling (LL8)** or **Cooling System Draining and Filling (LH6, LS2)**.

RADIATOR VENT INLET HOSE REPLACEMENT

Removal Procedure

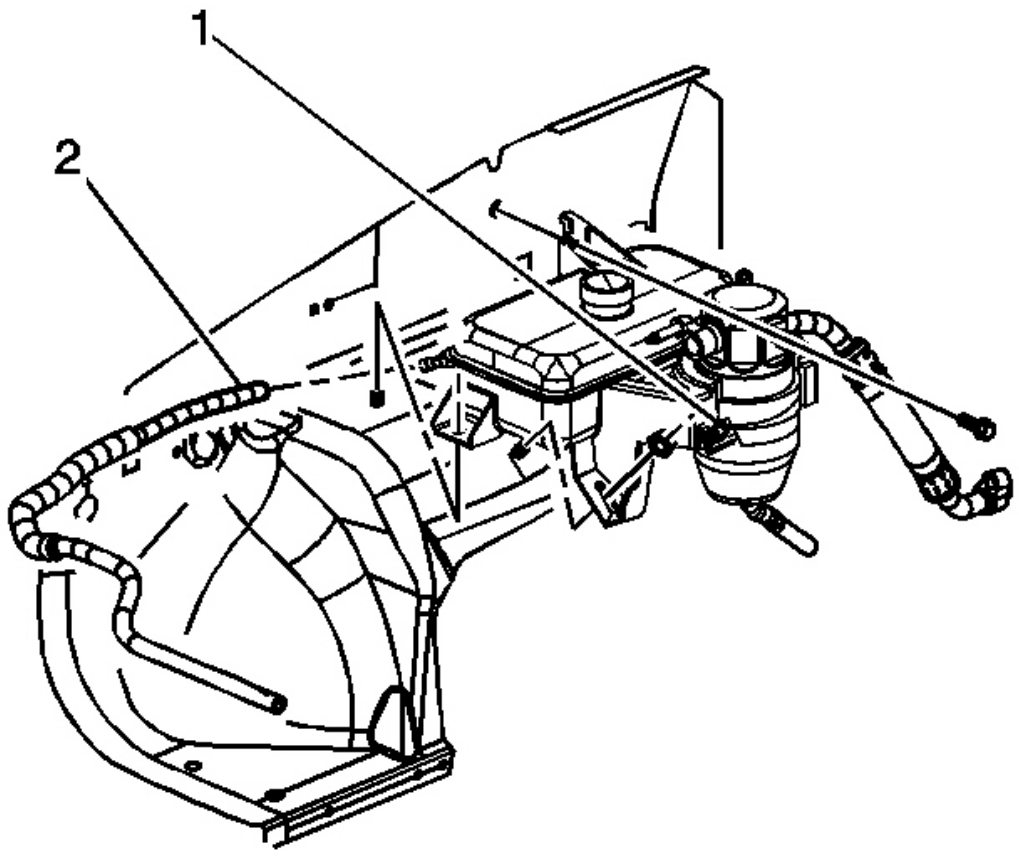


Fig. 18: View Of Coolant Recovery Reservoir
Courtesy of GENERAL MOTORS CORP.

1. Partially drain the cooling system. Refer to **Cooling System Draining and Filling (LL8)** or **Cooling System Draining and Filling (LH6, LS2)**.
2. Remove the vent inlet hose from the radiator (2).
3. Remove the vent inlet hose from the surge tank (1).

Installation Procedure

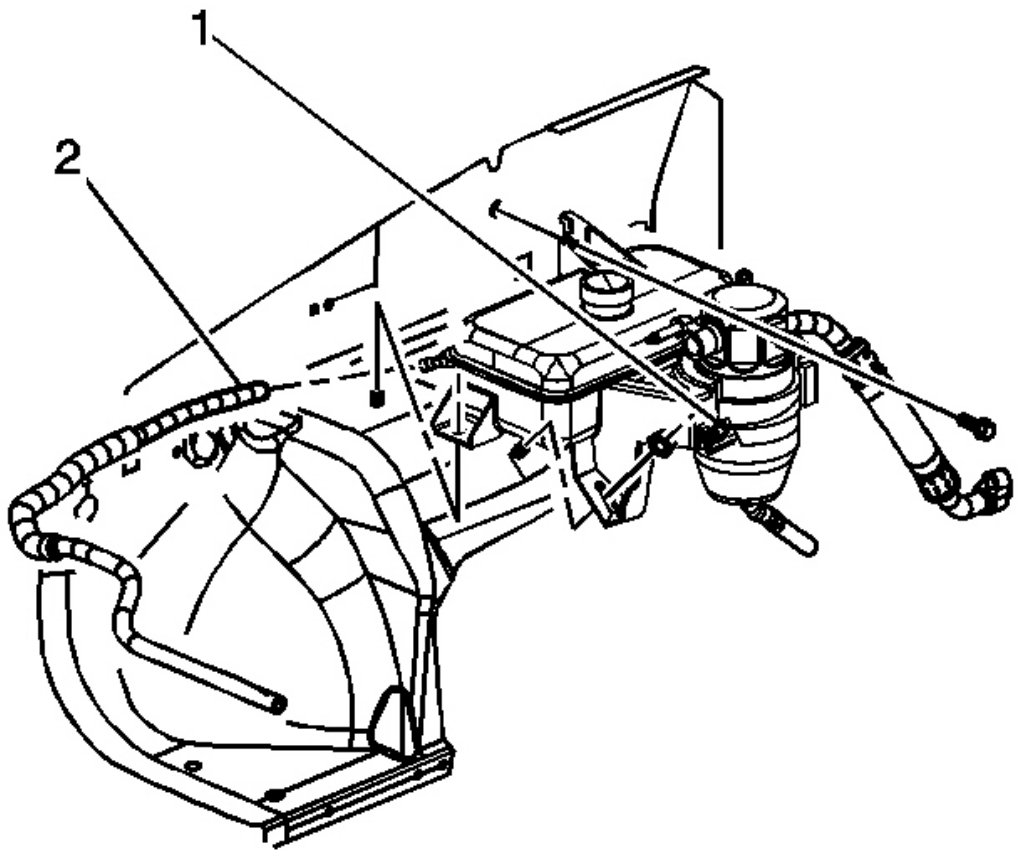


Fig. 19: View Of Coolant Recovery Reservoir
Courtesy of GENERAL MOTORS CORP.

1. Install the vent inlet hose to the surge tank (1).
2. Install the vent inlet hose to the radiator (2).
3. Fill the cooling system. Refer to **Cooling System Draining and Filling (LL8)** or **Cooling System Draining and Filling (LH6, LS2)**.

FAN CLUTCH REPLACEMENT

Removal Procedure

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

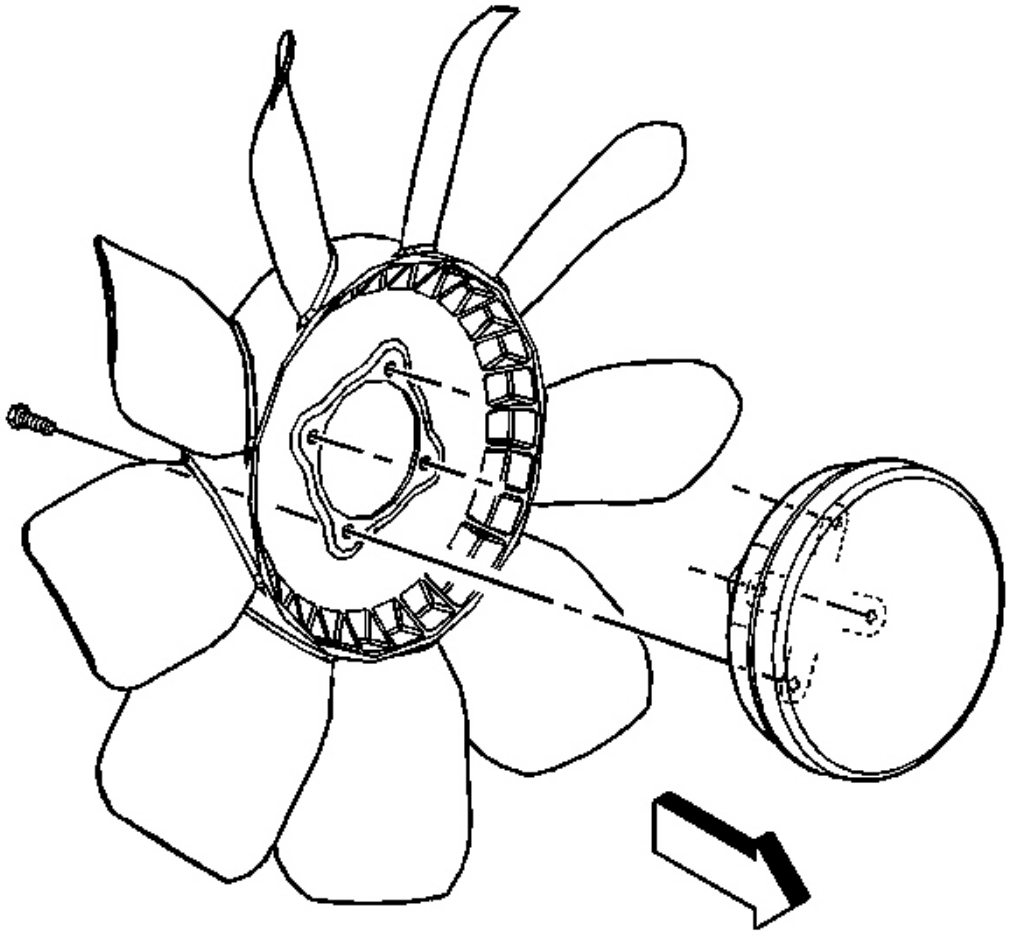


Fig. 20: View Of Fan Blade & Fan Clutch
Courtesy of GENERAL MOTORS CORP.

2. Remove the push-pin and release the fan clutch electrical connector from the fan shroud.
3. Remove the fan clutch from the fan shroud.
4. Remove the bolts retaining the fan blade to the fan clutch.
5. Separate the fan blade from the fan clutch.

Installation Procedure

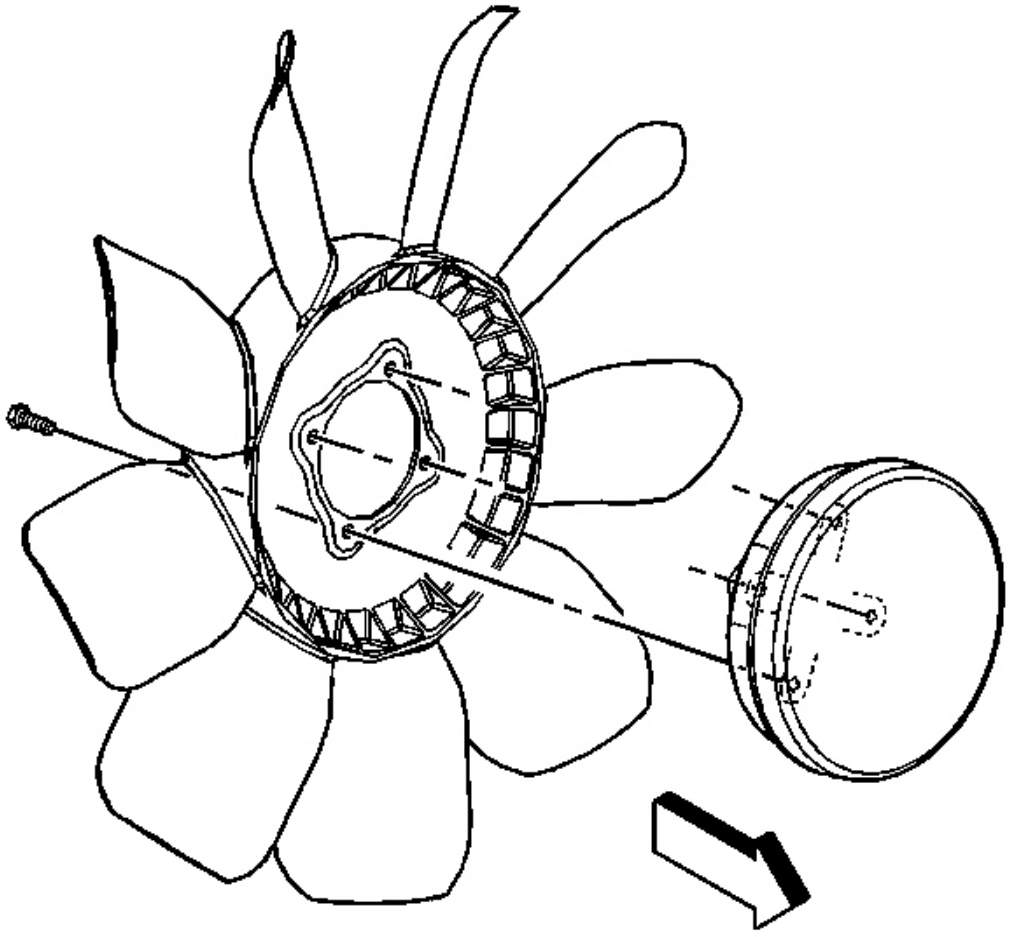


Fig. 21: View Of Fan Blade & Fan Clutch
Courtesy of GENERAL MOTORS CORP.

1. Assemble the fan blade to the fan clutch.

   NOTE: Refer to Fastener Notice .

2. Install the 4 bolts to the fan blade.

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

3. Install the fan clutch to the fan shroud.
4. Install the push-pin to the fan clutch electrical connector.

5. Install the cooling fan and shroud. Refer to **Cooling Fan and Shroud Replacement**.

COOLING FAN & SHROUD REPLACEMENT

Special Tools

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

Removal Procedure

1. Drain the cooling system. Refer to **Cooling System Draining and Filling (LL8)** or **Cooling System Draining and Filling (LH6, LS2)**.
2. Remove the air cleaner assembly. Refer to **Air Cleaner Assembly Replacement** for the 4.2L engine or Air Cleaner Assembly Replacement for the 4.8L, 5.3L, 6.0L, 6.2L, or 7.0L engine.
3. Remove the air resonator assembly. Refer to **Air Cleaner Outlet Resonator Replacement** for the 4.2L engine or Air Cleaner Resonator Outlet Duct Replacement for the 4.8L, 5.3L, 6.0L, 6.2L, or 7.0L engine.
4. Remove the inlet radiator hose. Refer to **Radiator Inlet Hose Replacement (LL8)** or **Radiator Inlet Hose Replacement (LH6, LS2)**.

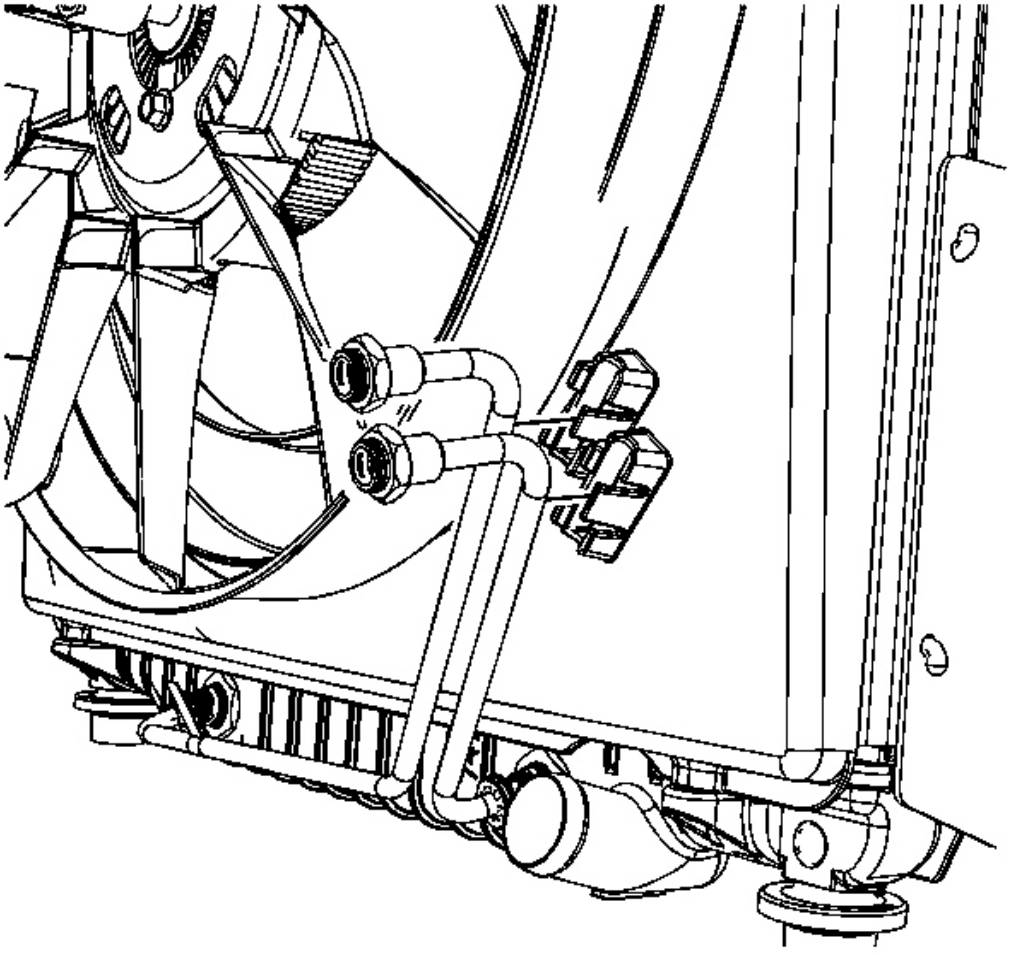


Fig. 22: Identifying Transmission Oil Cooler Lines
Courtesy of GENERAL MOTORS CORP.

5. Remove the transmission oil cooler lines from the fan shroud.

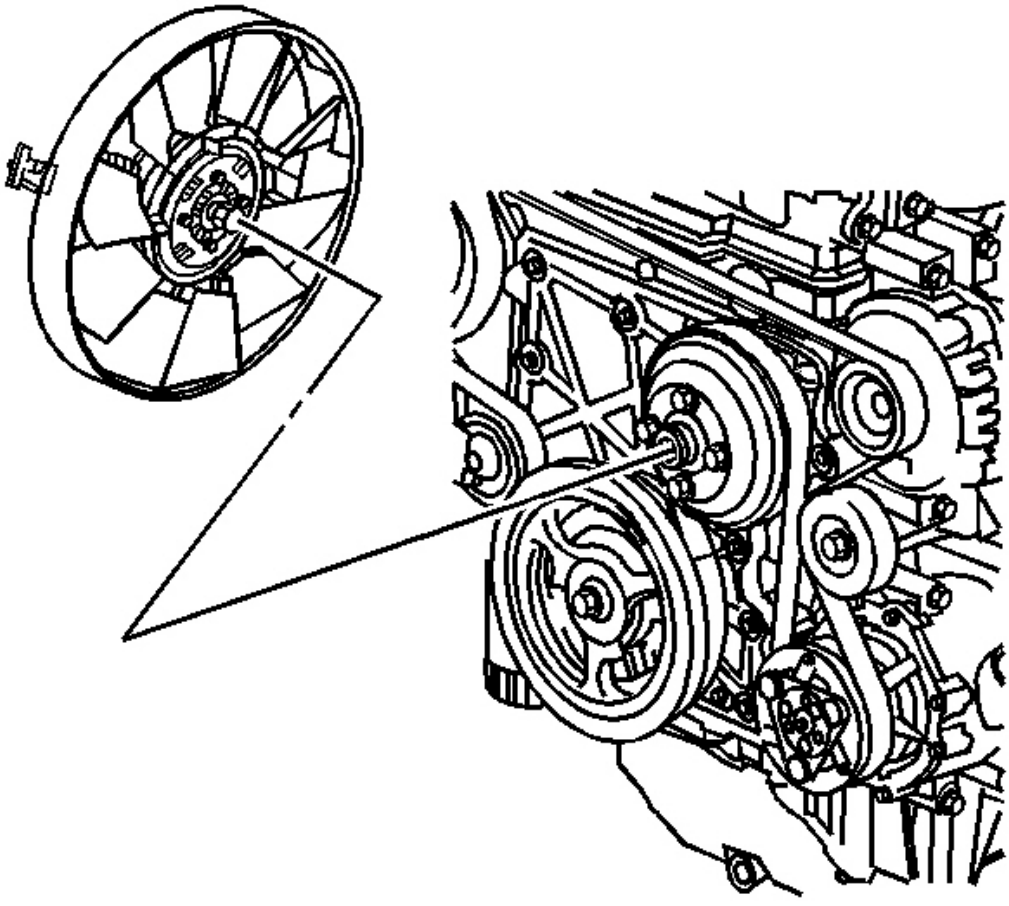


Fig. 23: Identifying Cooling Fan
Courtesy of GENERAL MOTORS CORP.

6. Disconnect the fan clutch electrical connector.
7. Using **J 46406** remove the fan clutch from the water pump. See **Special Tools**.

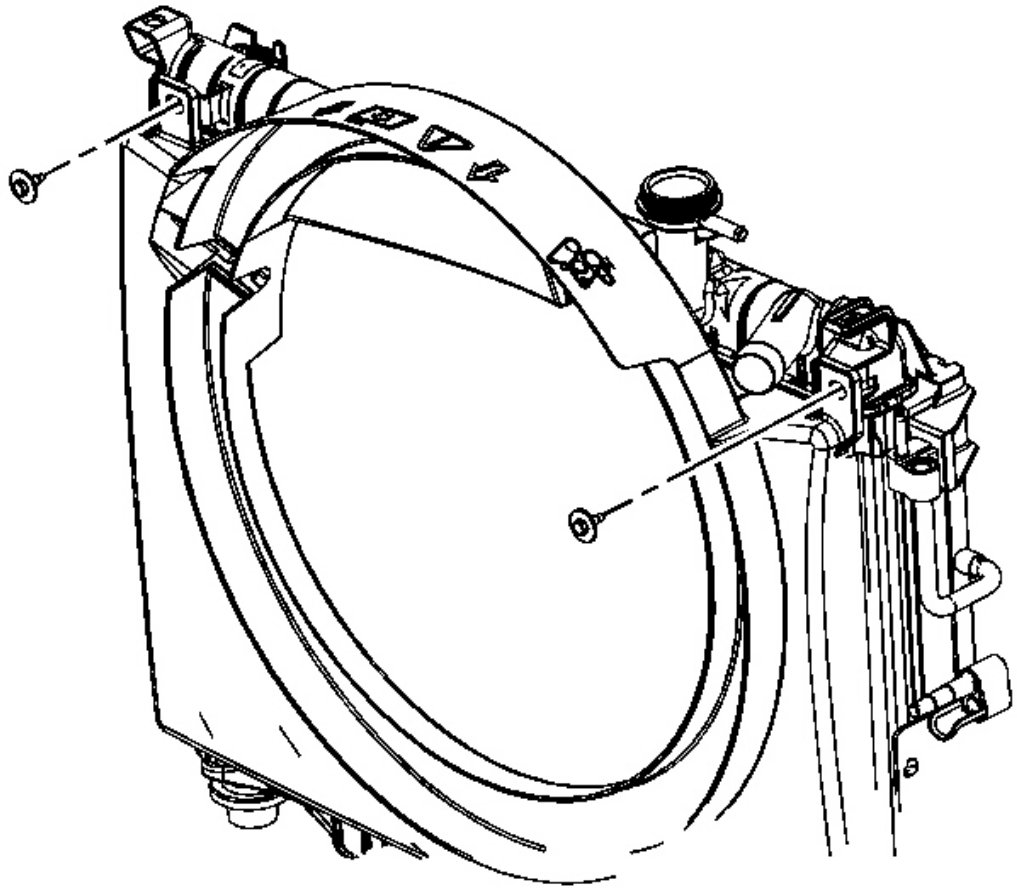


Fig. 24: View Of Upper Fan Shroud
Courtesy of GENERAL MOTORS CORP.

8. Remove the mounting bolts from the upper fan shroud.
9. Lift and push the fan shroud inward to clear the filler neck on the radiator.
10. Remove the fan and the shroud.

Installation Procedure

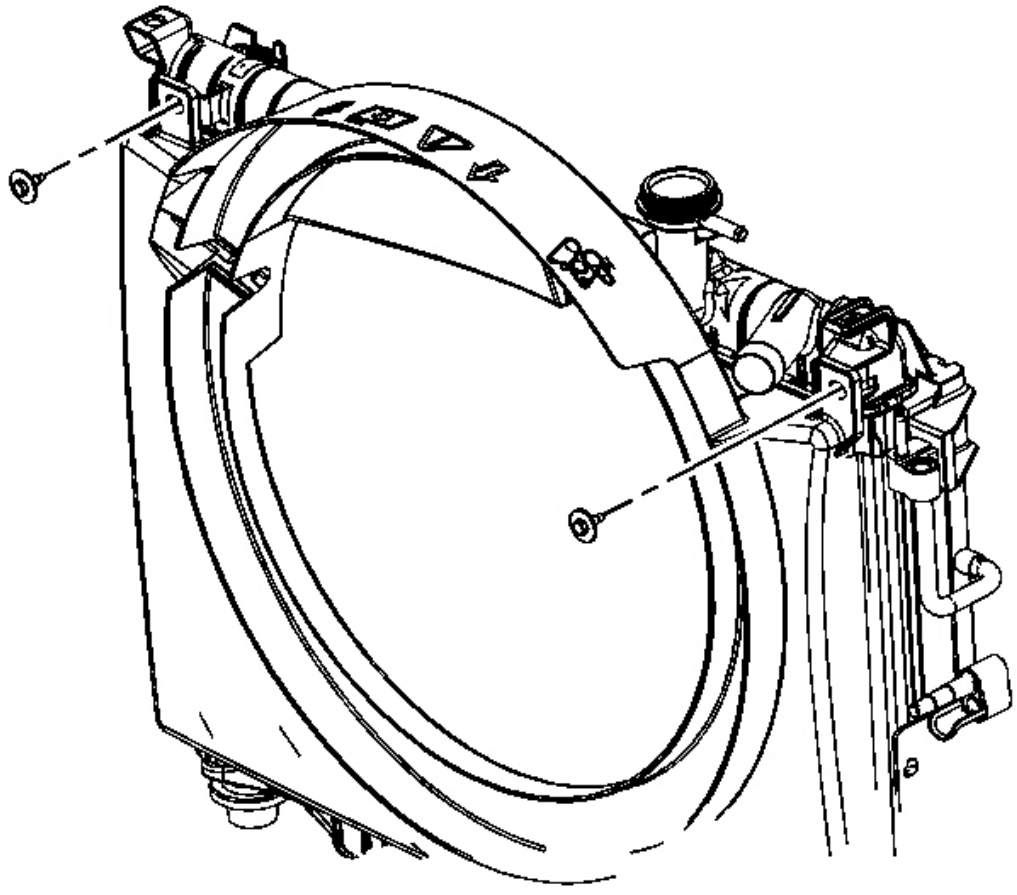


Fig. 25: View Of Upper Fan Shroud
Courtesy of GENERAL MOTORS CORP.

1. Install the fan and the shroud.

   NOTE: Refer to Fastener Notice .

2. Install the mounting bolts to the upper fan shroud.

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

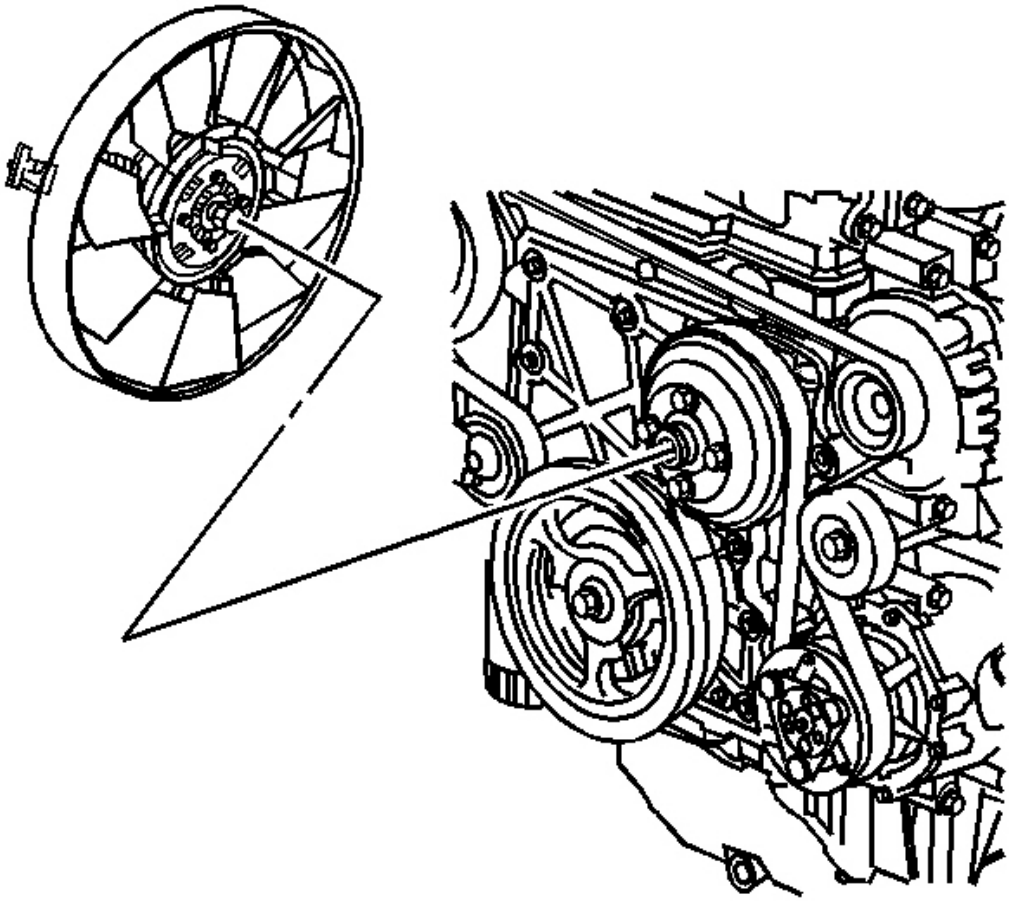


Fig. 26: Identifying Cooling Fan
Courtesy of GENERAL MOTORS CORP.

3. Using **J 46406** install the fan clutch to the water pump. See **Special Tools**.
4. Connect the fan clutch electrical connector.

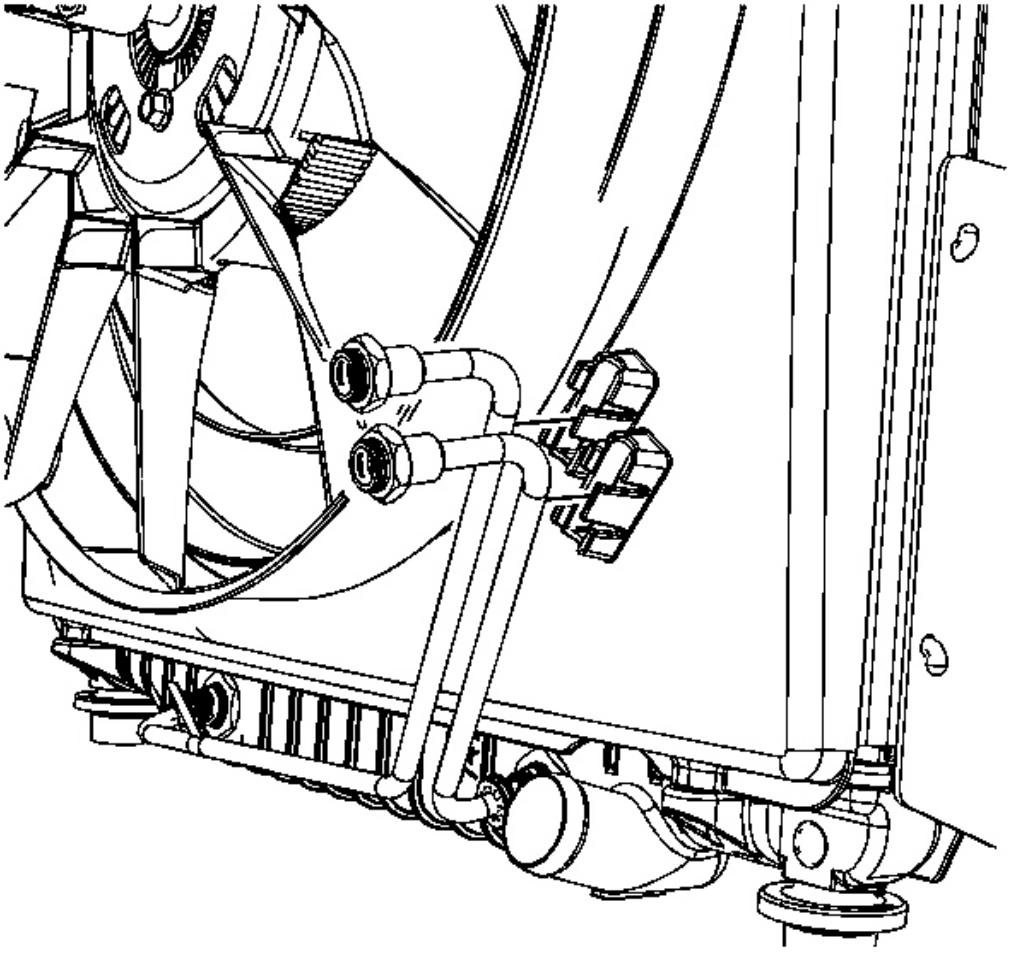


Fig. 27: Identifying Transmission Oil Cooler Lines
Courtesy of GENERAL MOTORS CORP.

5. Install the transmission oil cooler lines to the fan shroud.
6. Install the inlet radiator hose. Refer to **Radiator Inlet Hose Replacement (LL8)** or **Radiator Inlet Hose Replacement (LH6, LS2)**.
7. Install the air resonator assembly. Refer to **Air Cleaner Outlet Resonator Replacement** for the 4.2L engine or Air Cleaner Resonator Outlet Duct Replacement for the 4.8L, 5.3L, 6.0L, 6.2L, or 7.0L engine.
8. Install the air cleaner assembly. Refer to **Air Cleaner Assembly Replacement** for the 4.2L engine or Air Cleaner Assembly Replacement for the 4.8L, 5.3L, 6.0L, 6.2L, or 7.0L engine.
9. Fill the cooling system. Refer to **Cooling System Draining and Filling (LL8)** or **Cooling System Draining and Filling (LH6, LS2)**.

COOLING FAN RELAY REPLACEMENT

Tools Required

J 43244 Relay Puller Pliers

Removal Procedure

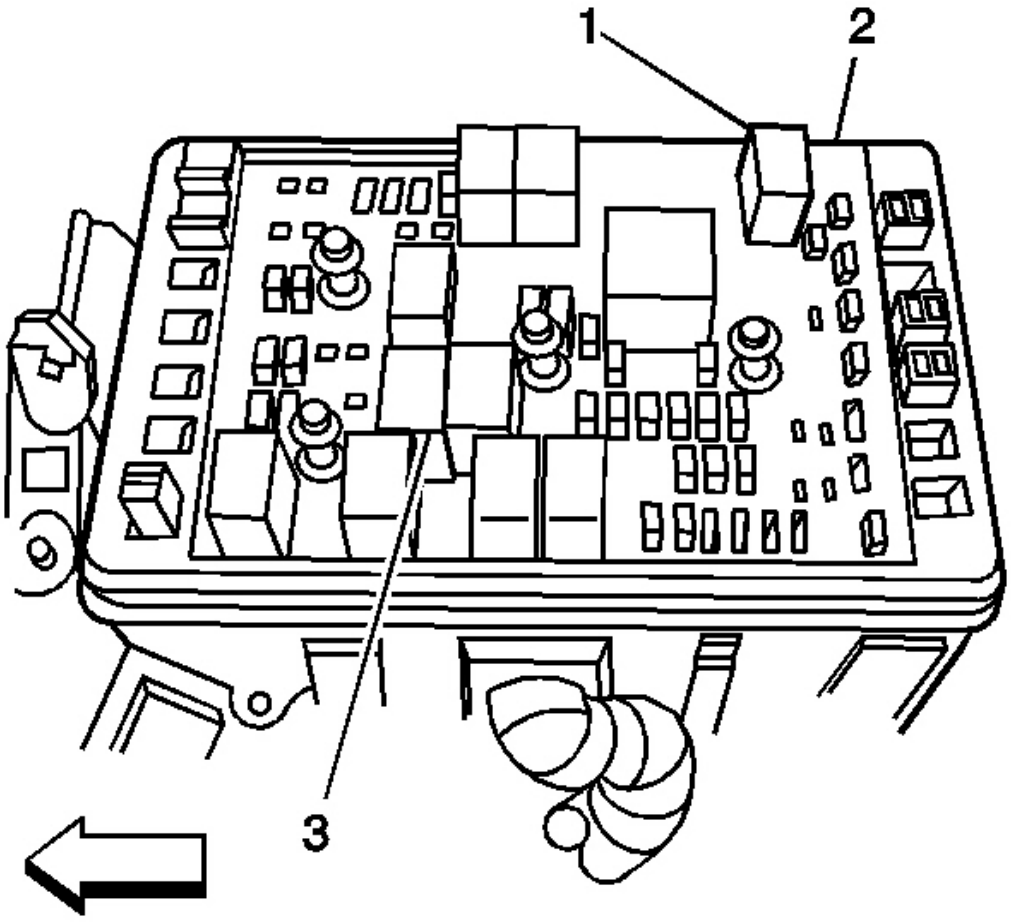


Fig. 28: View Of Cooling Fan Relay
Courtesy of GENERAL MOTORS CORP.

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.

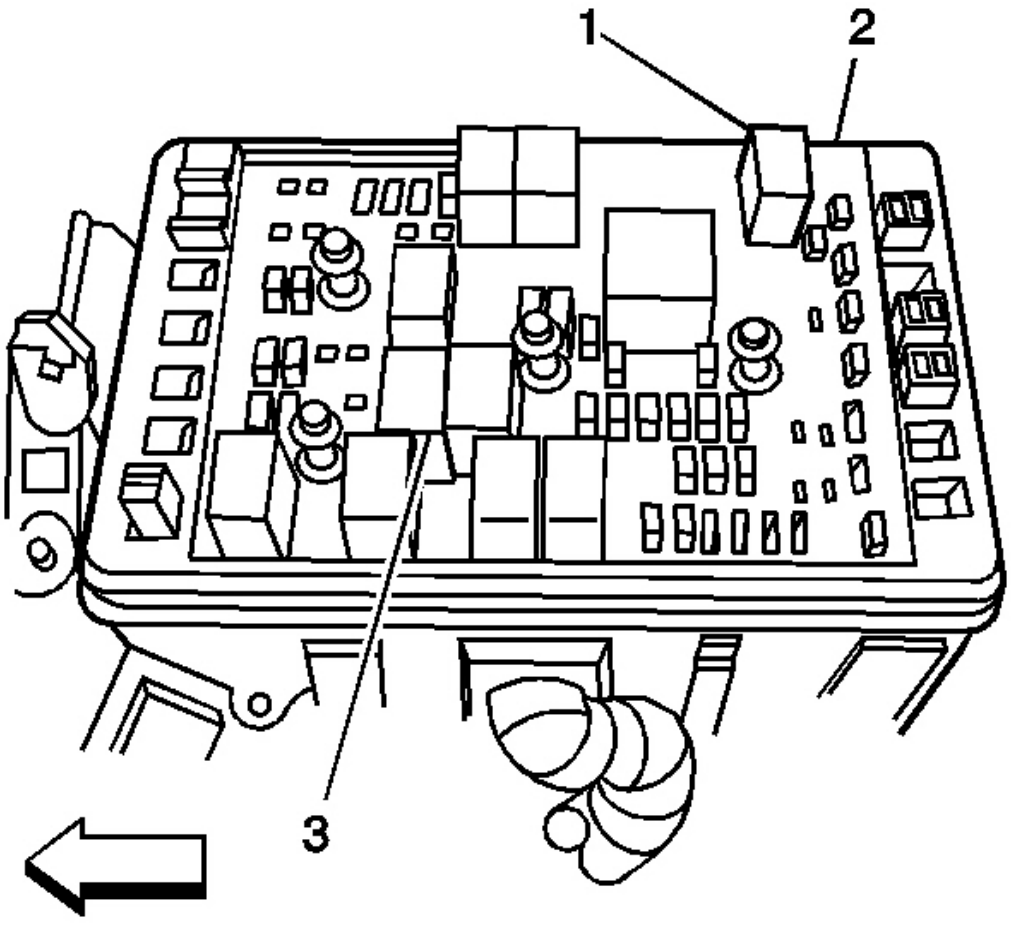


Fig. 29: View Of Cooling Fan Relay
Courtesy of GENERAL MOTORS CORP.

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

ENGINE COOLANT THERMOSTAT REPLACEMENT (4.2L ENGINE)

Tools Required

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

Removal Procedure

1. Remove the necessary coolant from the radiator. Refer to **Cooling System Draining and Filling (LL8)** or **Cooling System Draining and Filling (LH6, LS2)**.
2. Remove the generator. Refer to **Generator Replacement (With 4.2L Engine)** or **Generator Replacement (With V8 Engine)** .

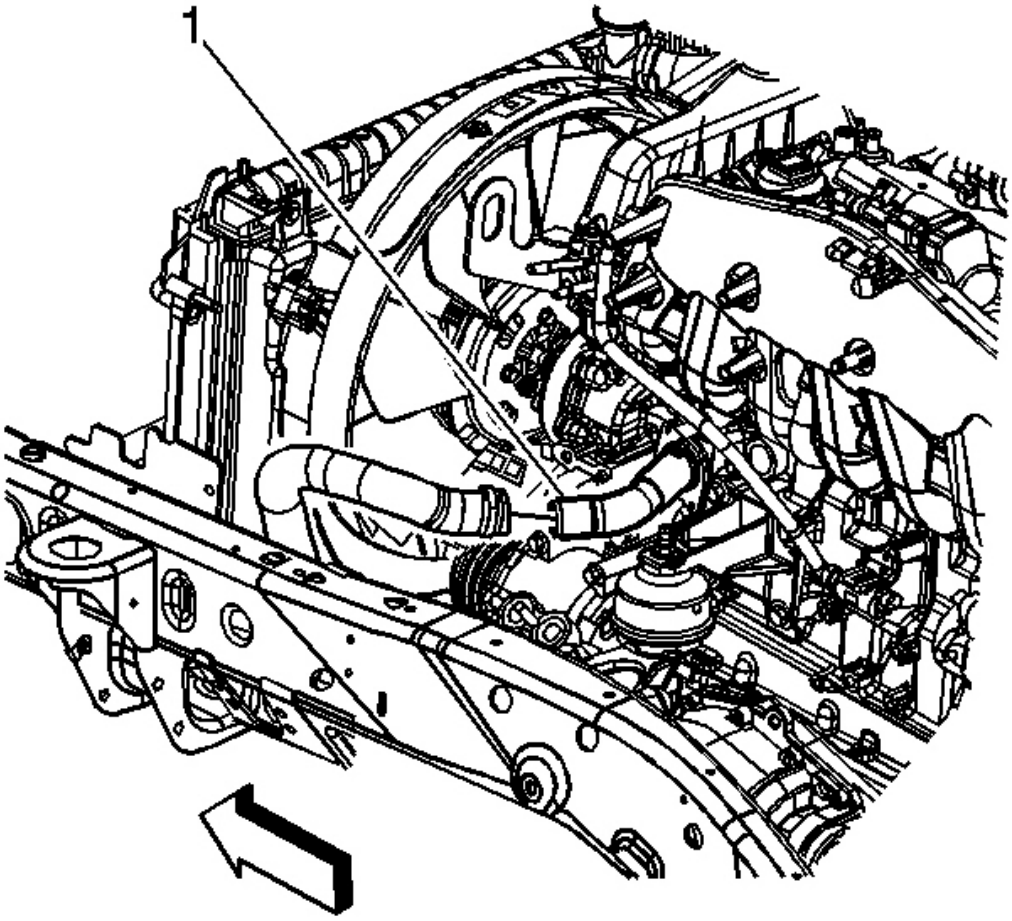


Fig. 30: Locating Thermostat Housing
Courtesy of GENERAL MOTORS CORP.

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

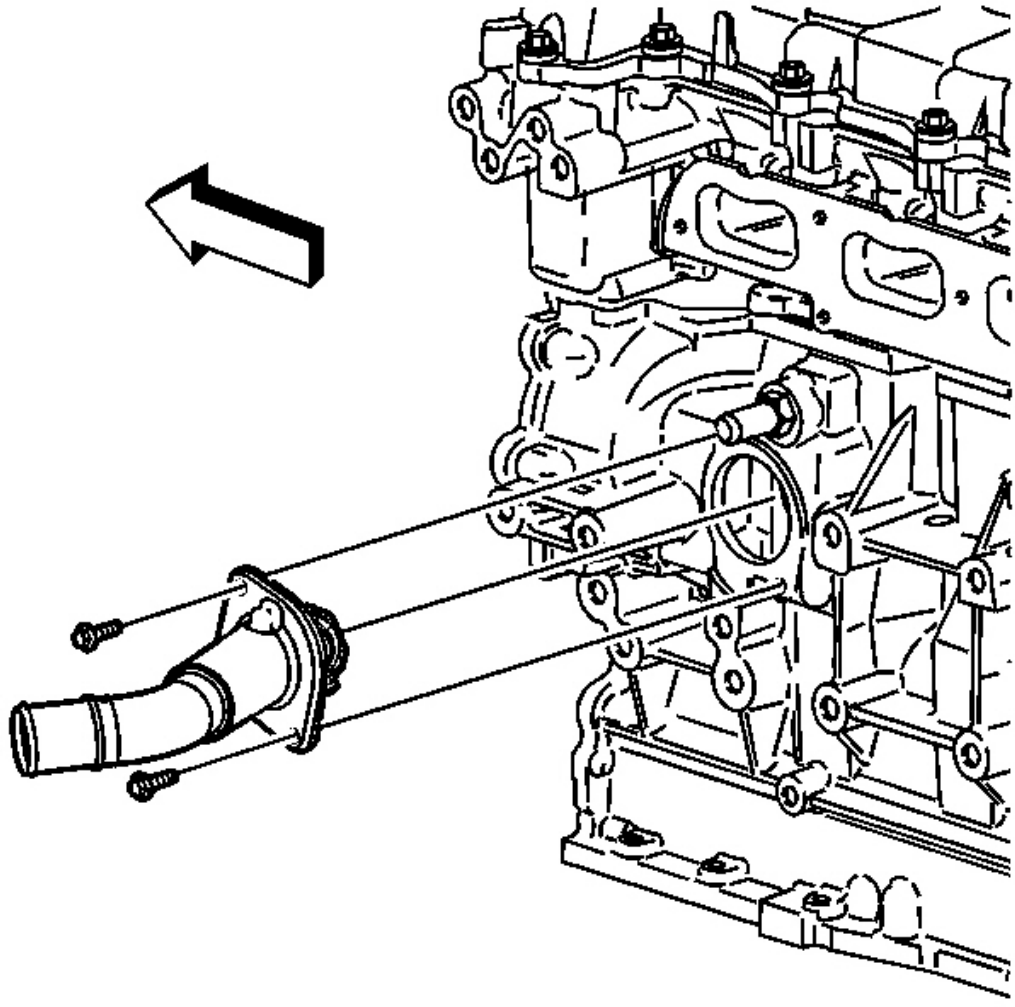


Fig. 31: View Of Thermostat Housing & Bolts
Courtesy of GENERAL MOTORS CORP.

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

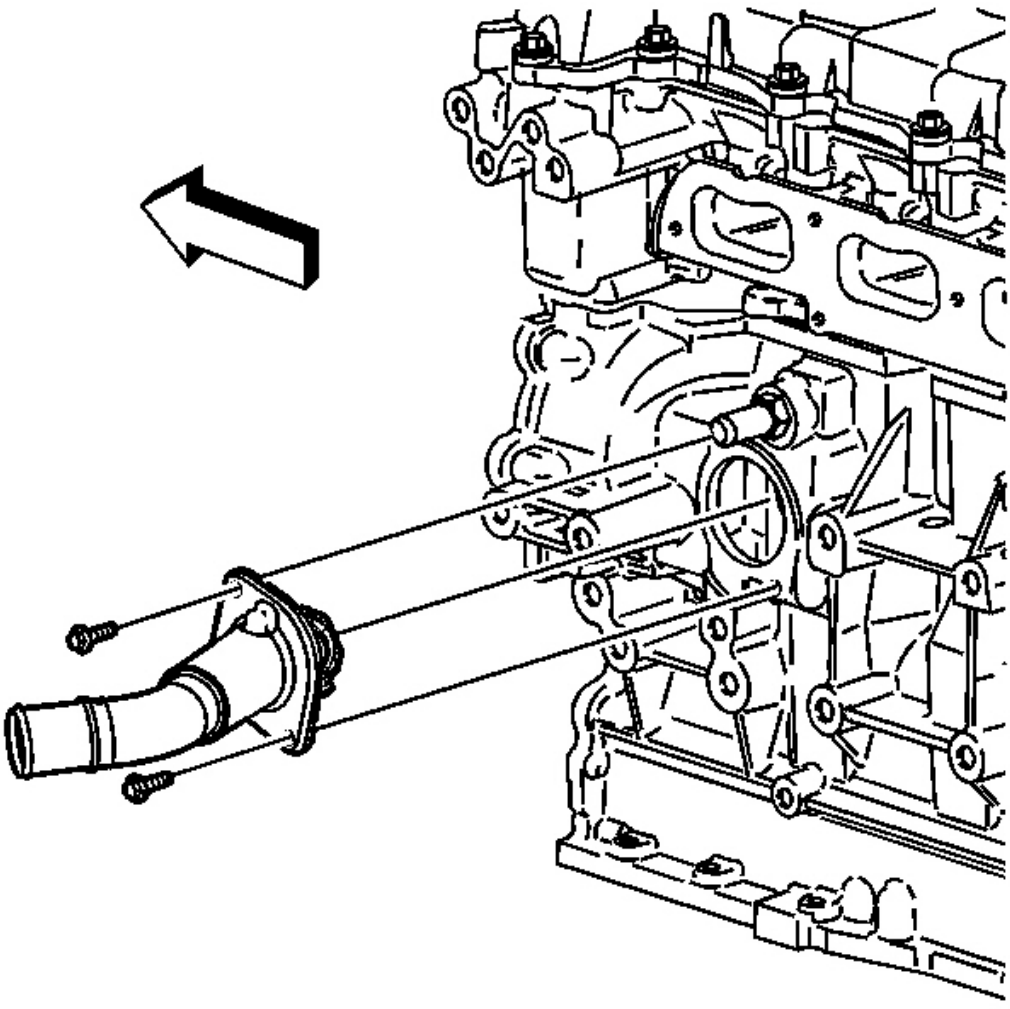


Fig. 32: View Of Thermostat Housing & Bolts
Courtesy of GENERAL MOTORS CORP.

1. Install the thermostat housing to the engine block.

   NOTE: Refer to Fastener Notice .

2. Install the thermostat housing bolts.

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

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

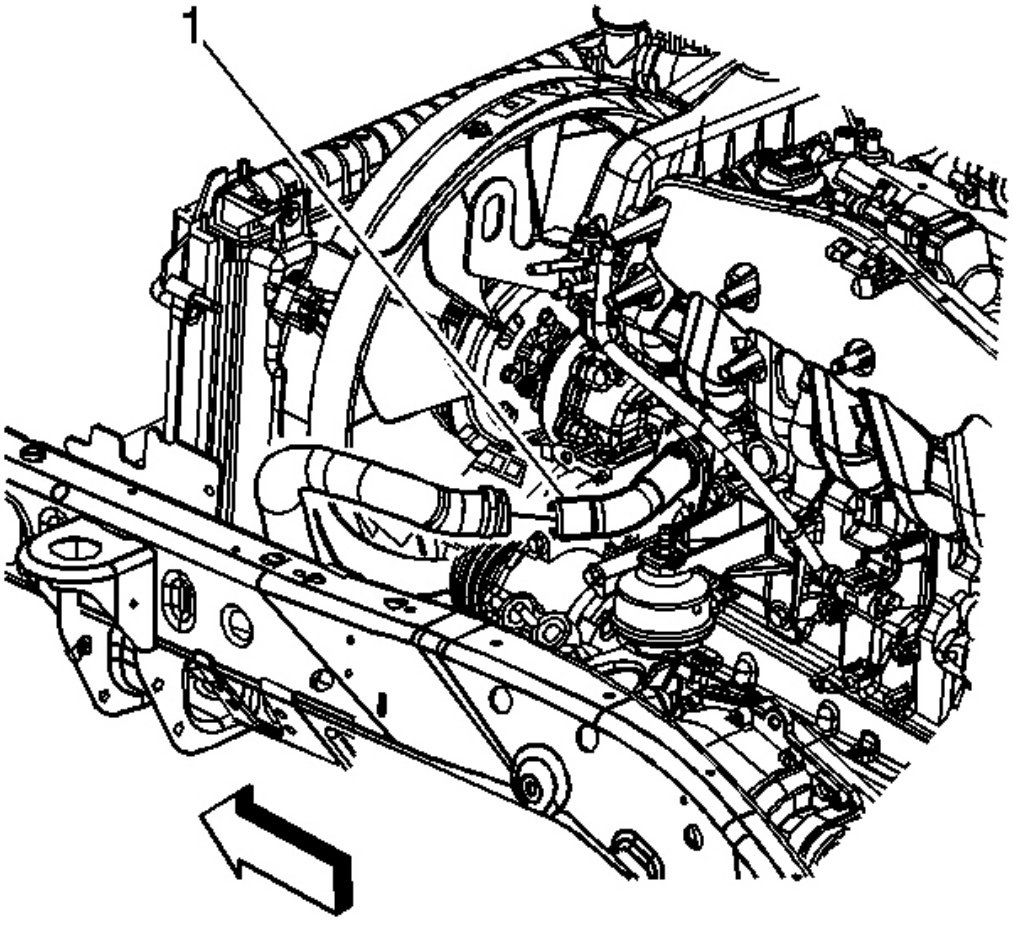


Fig. 33: Locating Thermostat Housing
Courtesy of GENERAL MOTORS CORP.

4. Install the outlet hose to the thermostat housing (1). Secure the hose with the clamp.
5. Install the generator. Refer to **Generator Replacement (With 4.2L Engine)** or **Generator Replacement (With V8 Engine)** .
6. Fill the cooling system with specified coolant and concentration. Refer to **Cooling System Draining and Filling (LL8)** or **Cooling System Draining and Filling (LH6, LS2)**.
7. Inspect all sealing surfaces for leaks after starting the engine.

ENGINE COOLANT THERMOSTAT REPLACEMENT (5.3L & 6.0L ENGINES)

Removal Procedure

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

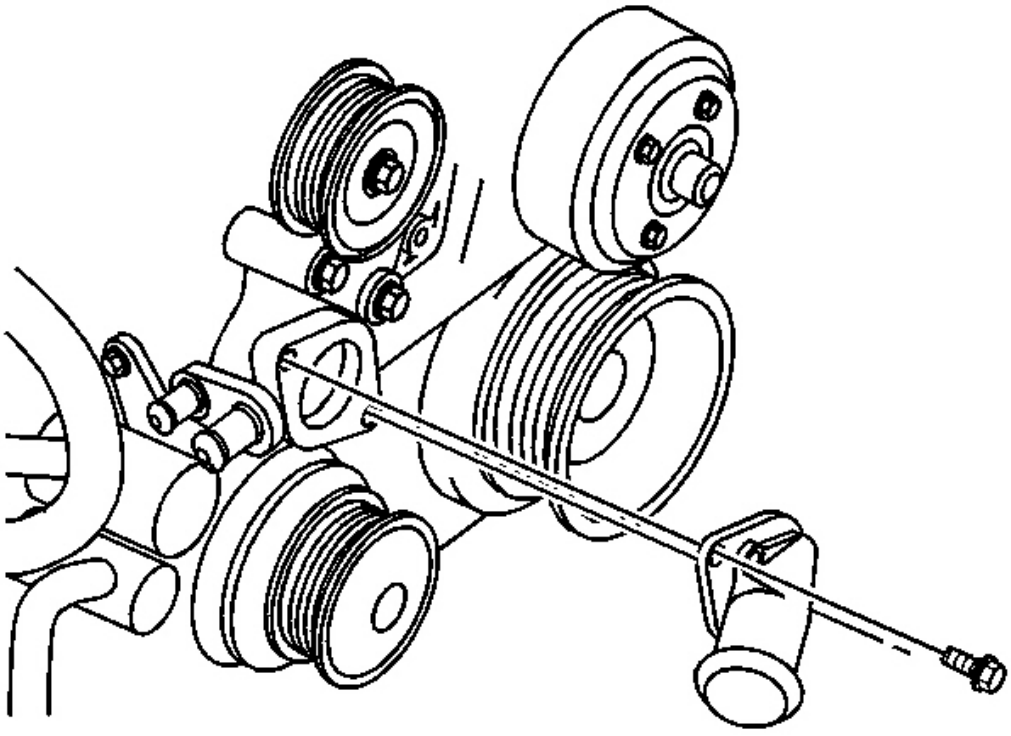


Fig. 34: View Of Water Pump Inlet
Courtesy of GENERAL MOTORS CORP.

1. Remove the radiator outlet hose. Refer to **Radiator Outlet Hose Replacement (LL8)** or **Radiator Outlet Hose Replacement (LH6, LS2)**.
2. Remove the water pump inlet bolts.
3. Remove the water pump inlet and thermostat from the water pump.

Installation Procedure

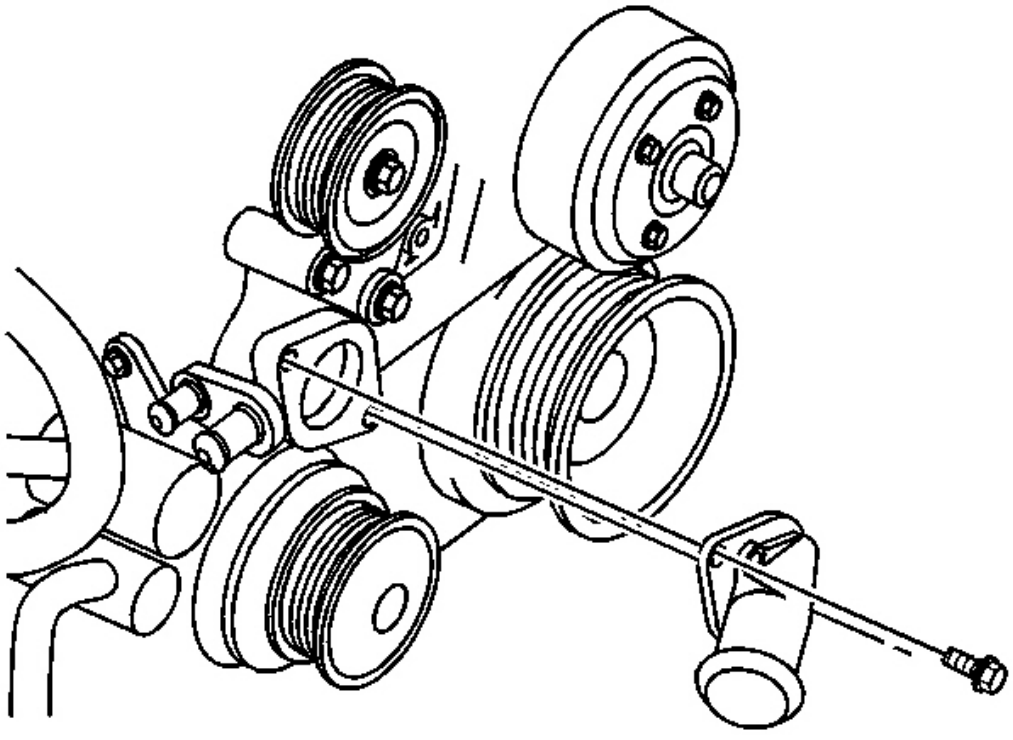


Fig. 35: View Of Water Pump Inlet
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice .

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 Outlet Hose Replacement (LL8)** or **Radiator Outlet Hose Replacement (LH6, LS2)**.

COOLANT AIR BLEED PIPE ASSEMBLY REPLACEMENT

Removal Procedure

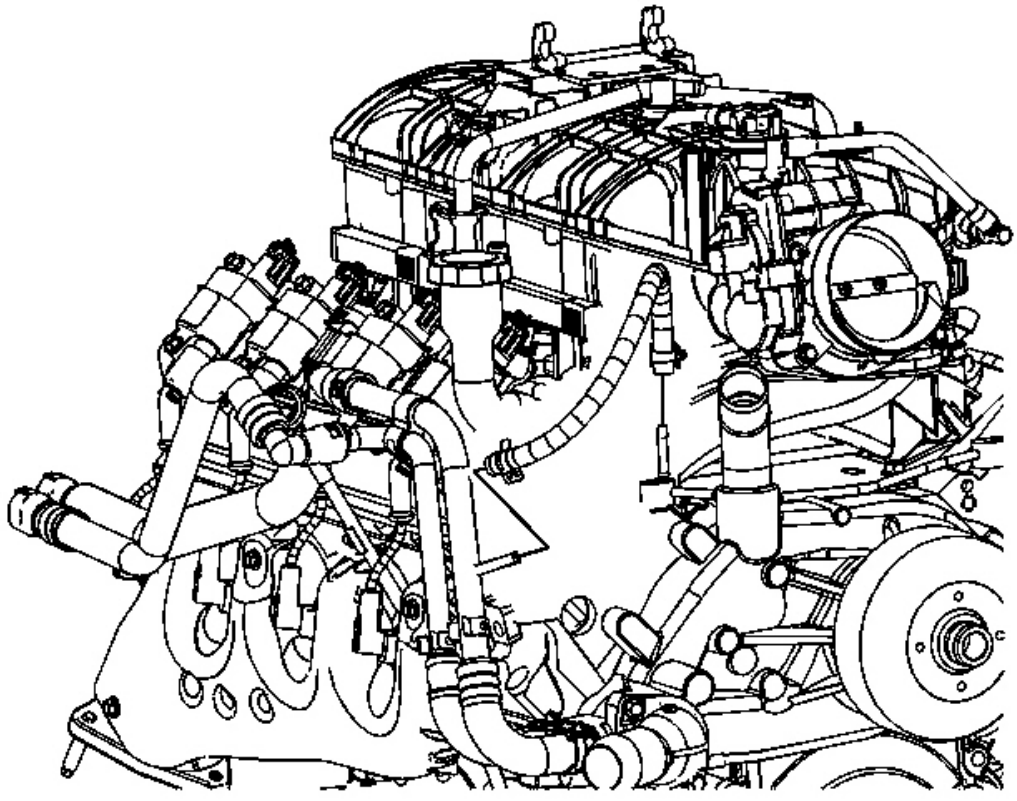


Fig. 36: View Of Coolant Air Bleed Pipe Assembly
Courtesy of GENERAL MOTORS CORP.

1. Drain the cooling system, if necessary. Refer to **Cooling System Draining and Filling (LL8)** or **Cooling System Draining and Filling (LH6, LS2)**.
2. Remove the air cleaner resonator outlet duct. Refer to Air Cleaner Resonator Outlet Duct Replacement .
3. Reposition the coolant air bleed hose clamp at the coolant air bleed pipe.
4. Remove the coolant air bleed hose from the coolant air bleed pipe.

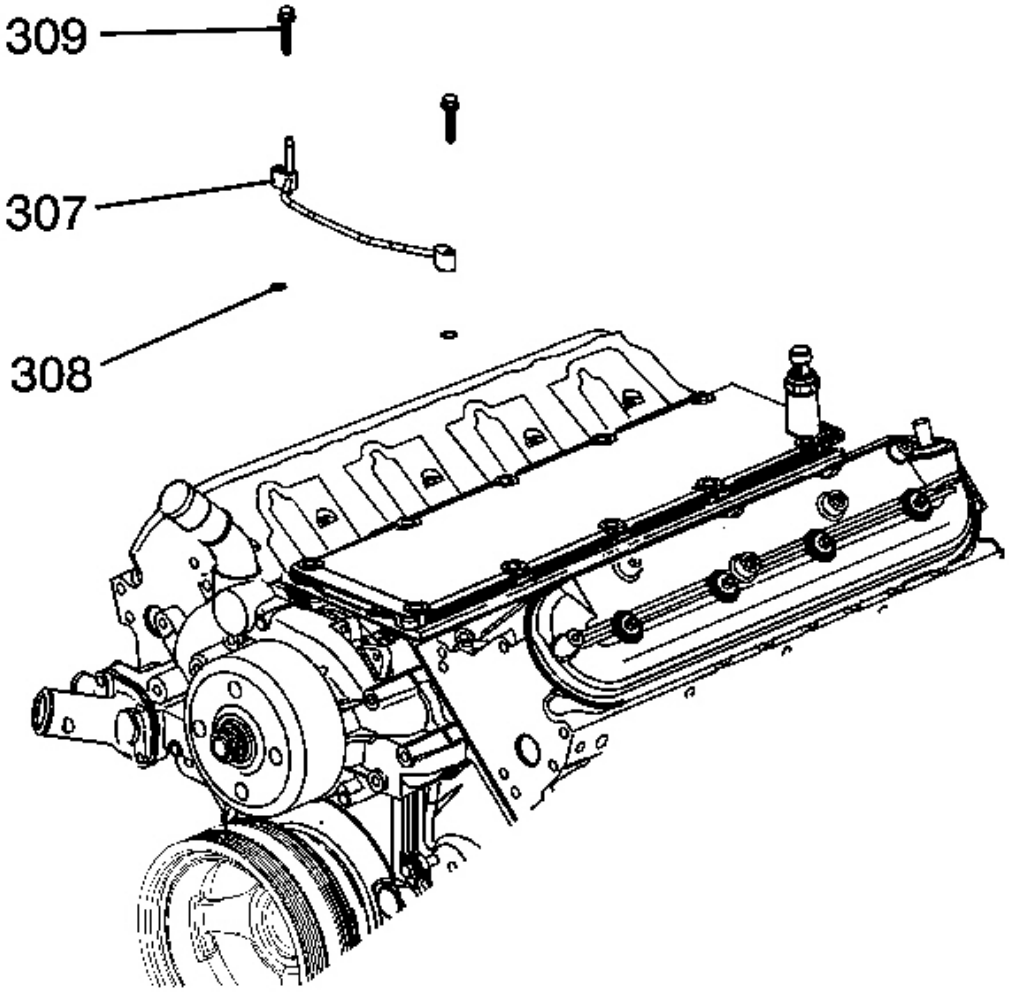


Fig. 37: View Of Engine Coolant Air Bleed Pipe Components
Courtesy of GENERAL MOTORS CORP.

5. Remove the coolant air bleed pipe bolts (309).
6. Remove the coolant air bleed pipe (307) with seals (308).

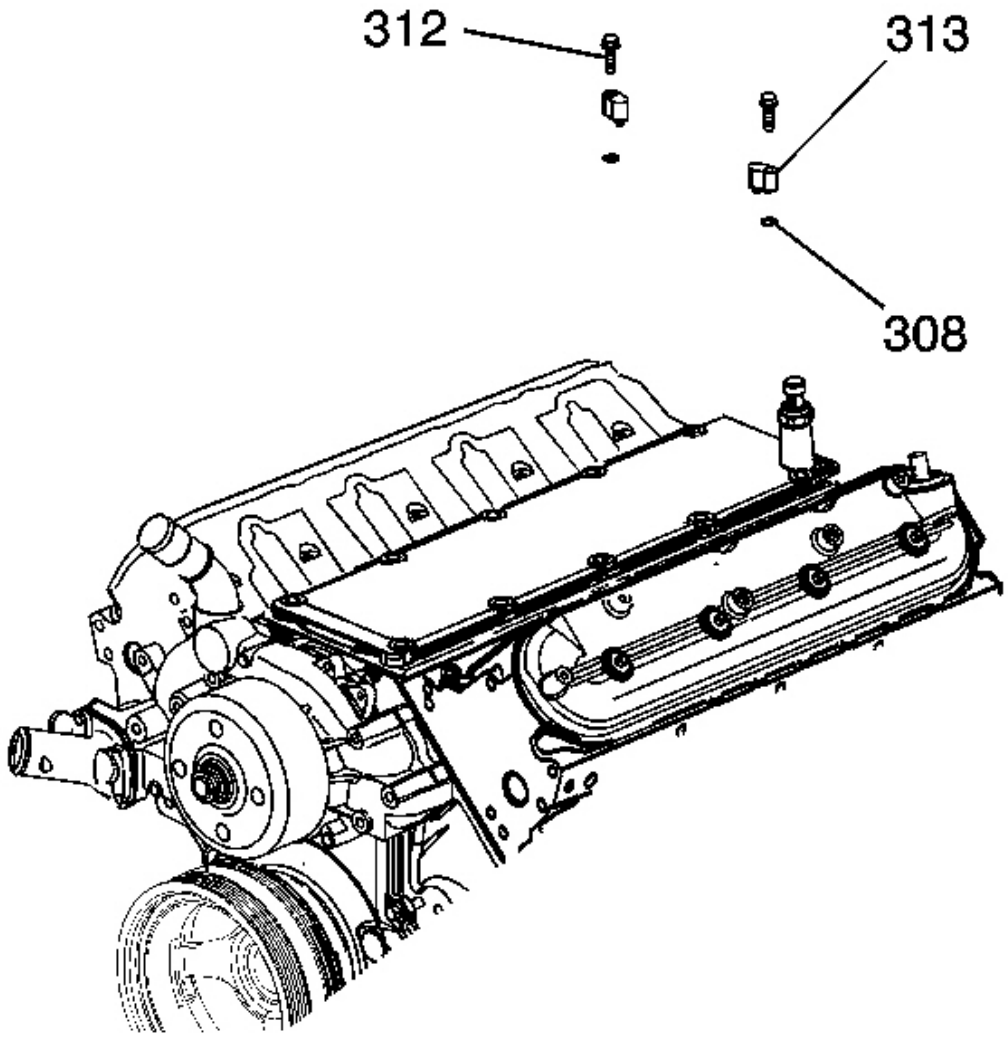


Fig. 38: View Of Coolant Air Bleed Cover Bolts
Courtesy of GENERAL MOTORS CORP.

7. Remove the coolant air bleed pipe cover bolts (312), if necessary.
8. Remove the coolant air bleed covers (313) with seals (308), if necessary.

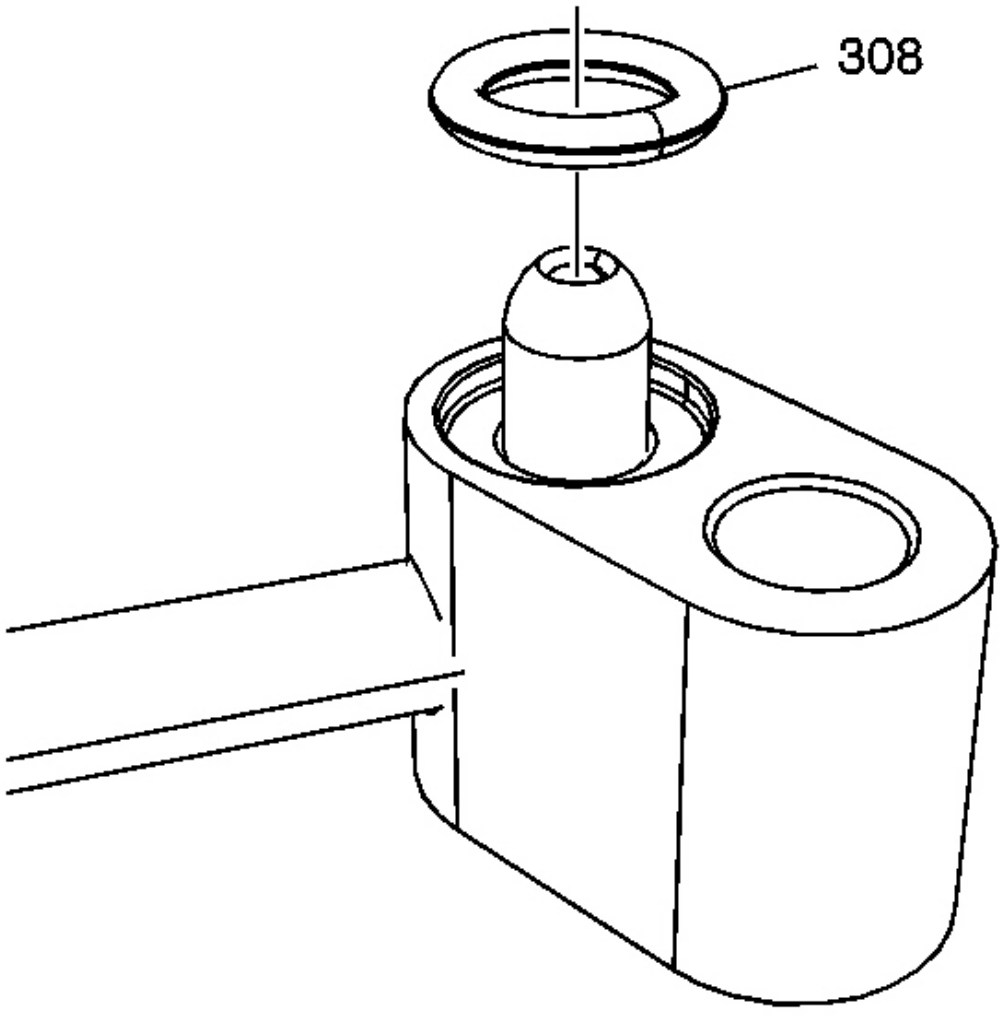


Fig. 39: View Of Coolant Air Bleed Pipe Seal
Courtesy of GENERAL MOTORS CORP.

9. Remove and discard the seals (308) from the coolant air bleed pipe and covers.

Installation Procedure

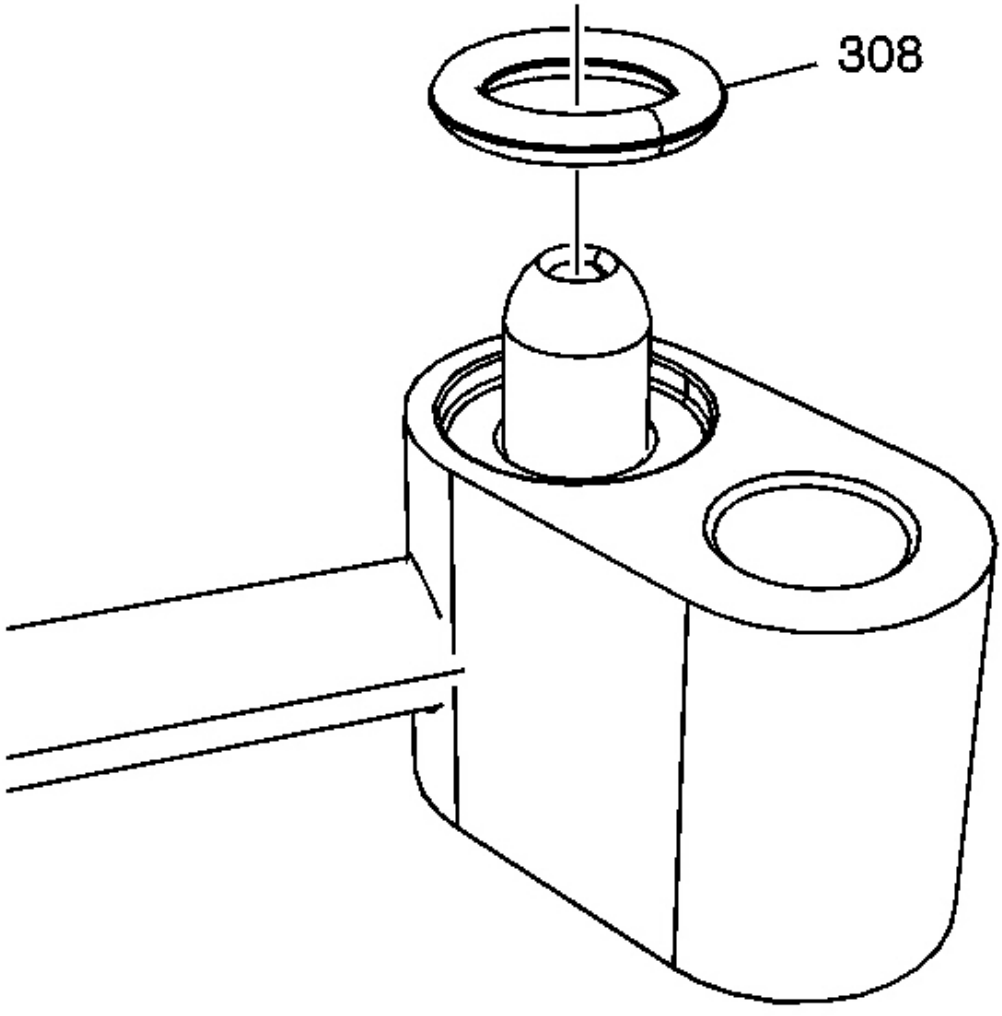


Fig. 40: View Of Coolant Air Bleed Pipe Seal
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Position the gasket O-ring seal (308) onto the nipple portion of the pipe.

1. Install the seals (308) onto the coolant air bleed pipe and covers.

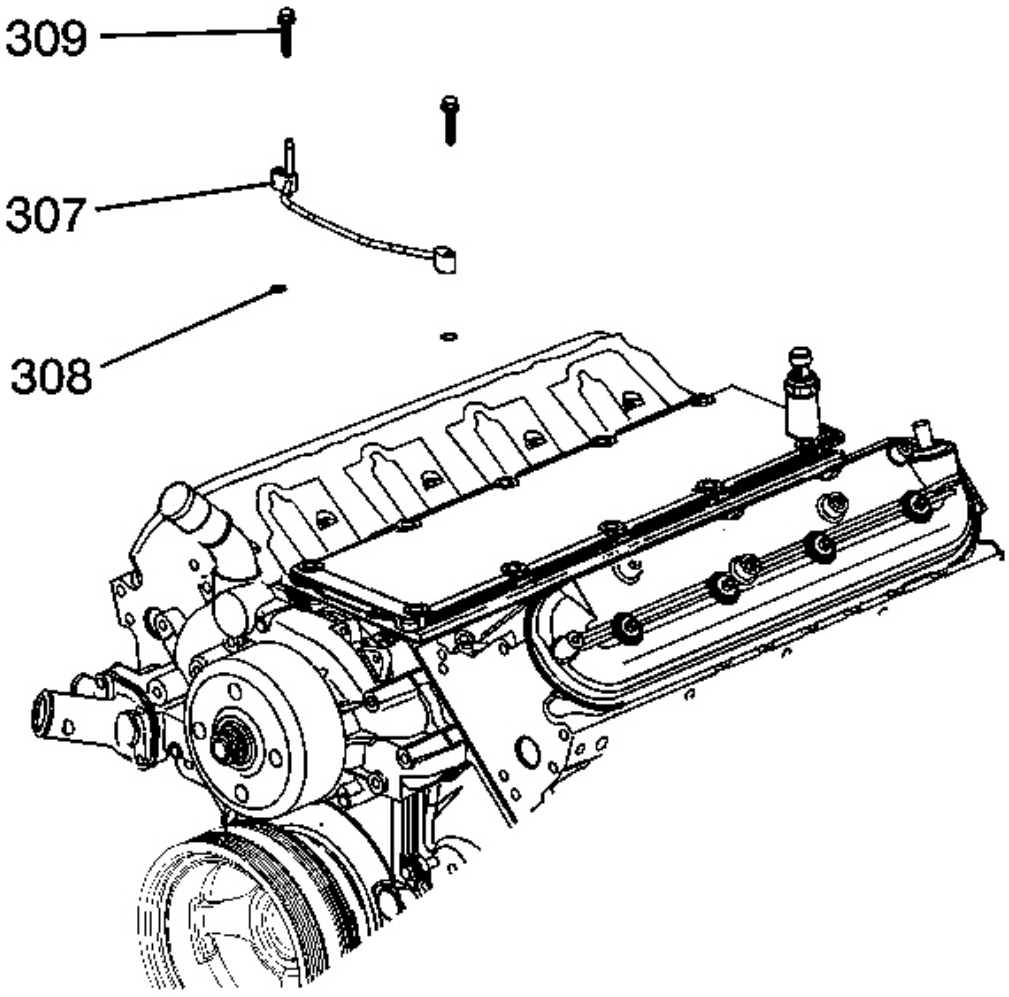


Fig. 41: View Of Engine Coolant Air Bleed Pipe Components
Courtesy of GENERAL MOTORS CORP.

2. Install the coolant air bleed pipe (307) with seals (308).

NOTE: Refer to Fastener Notice .

3. Install the coolant air bleed pipe bolts (309).

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

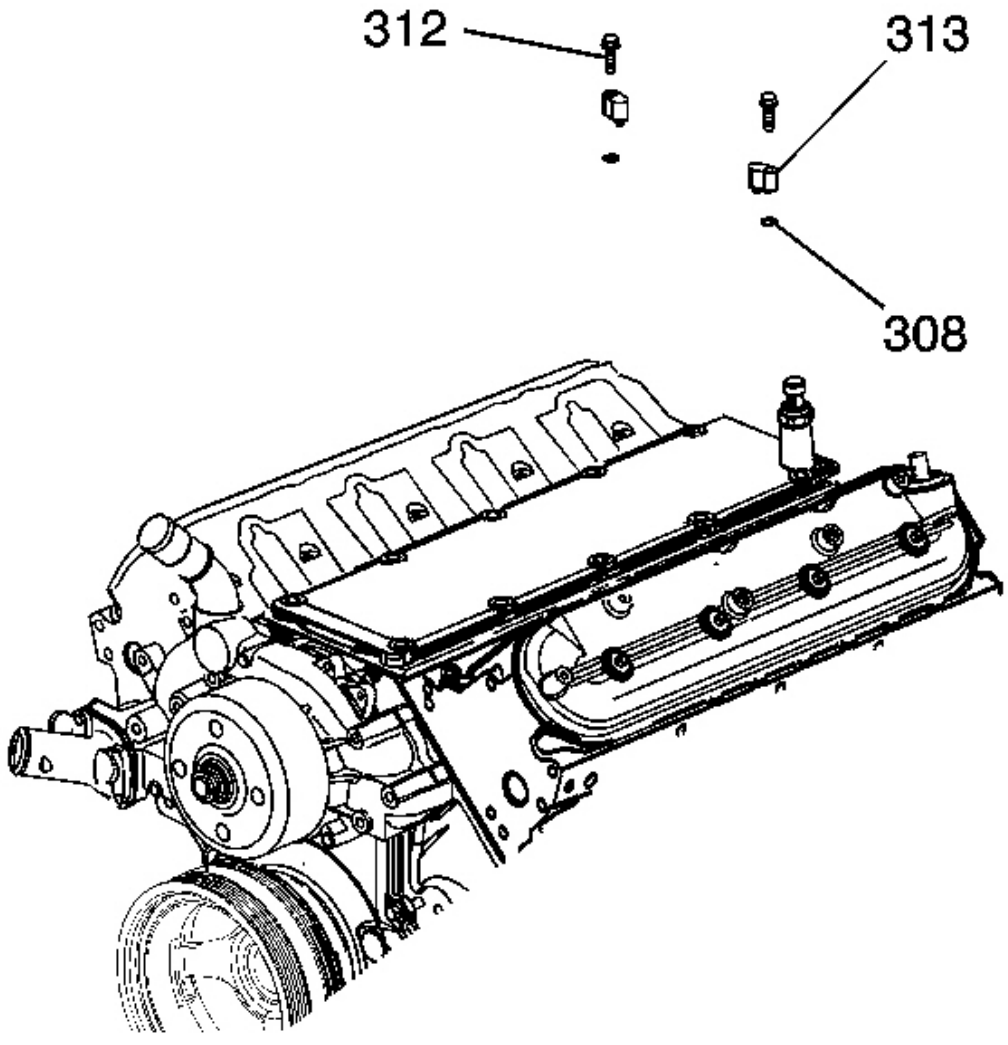


Fig. 42: View Of Coolant Air Bleed Cover Bolts
Courtesy of GENERAL MOTORS CORP.

4. Install the coolant air bleed covers (313) with seals (308), if necessary.
5. Remove the coolant air bleed pipe cover bolts (312), if necessary.

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

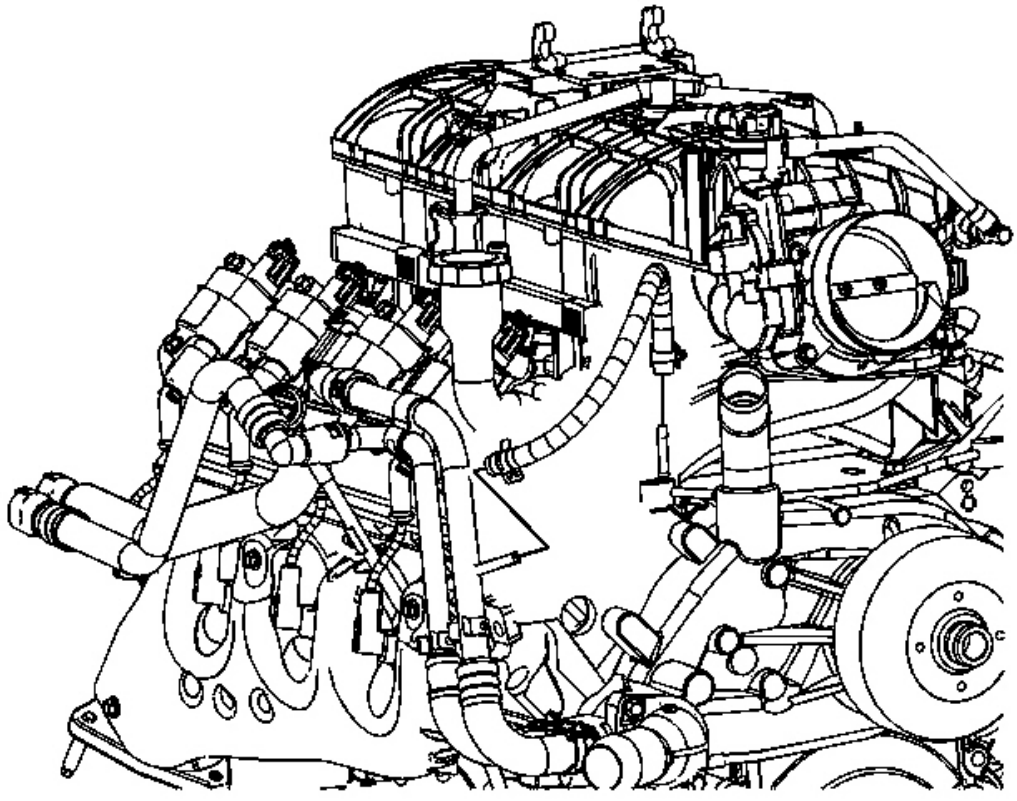


Fig. 43: View Of Coolant Air Bleed Pipe Assembly
Courtesy of GENERAL MOTORS CORP.

6. Install the coolant air bleed hose to the coolant air bleed pipe.
7. Position the coolant air bleed hose clamp at the coolant air bleed pipe.
8. Fill the cooling system, if necessary. Refer to **Cooling System Draining and Filling (LL8)** or **Cooling System Draining and Filling (LH6, LS2)**.
9. Install the air cleaner resonator outlet duct. Refer to Air Cleaner Resonator Outlet Duct Replacement .

COOLANT AIR BLEED HOSE REPLACEMENT

Removal Procedure

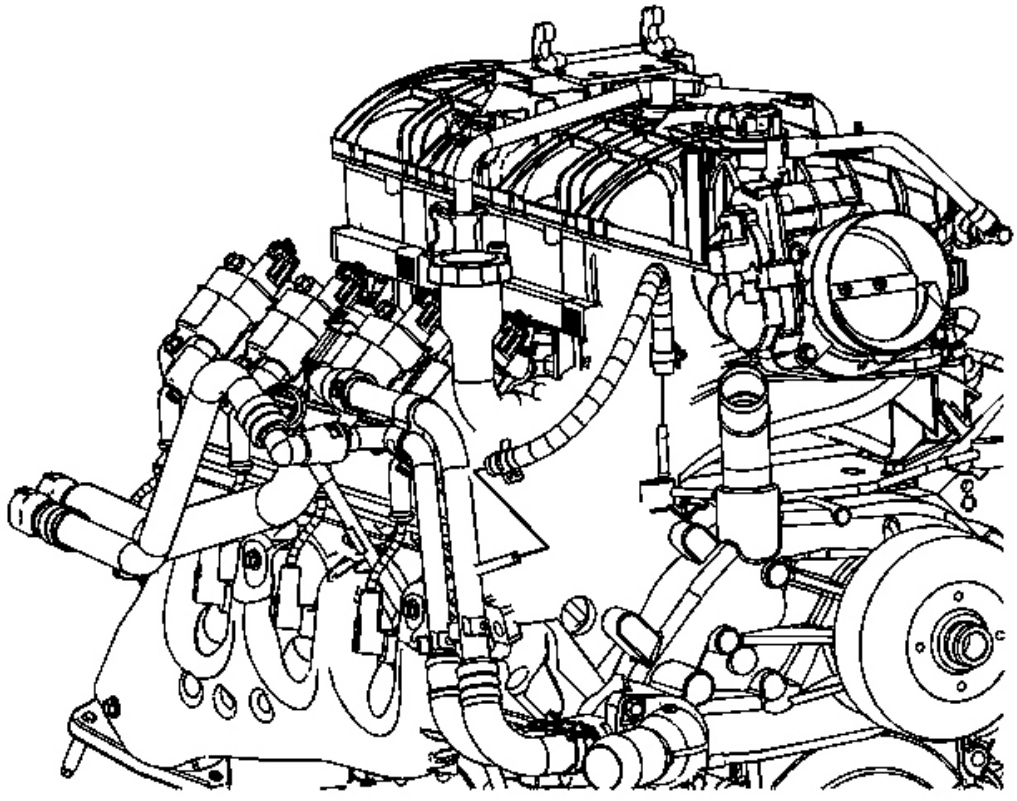


Fig. 44: View Of Coolant Air Bleed Pipe Assembly
Courtesy of GENERAL MOTORS CORP.

1. Drain the cooling system, if necessary. Refer to **Cooling System Draining and Filling (LL8)** or **Cooling System Draining and Filling (LH6, LS2)**.
2. Reposition the coolant air bleed hose clamp at the coolant air bleed pipe.
3. Reposition the coolant air bleed hose clamp at the heater outlet hose.
4. Remove the coolant air bleed hose from the air bleed pipe and the heater hose.

Installation Procedure

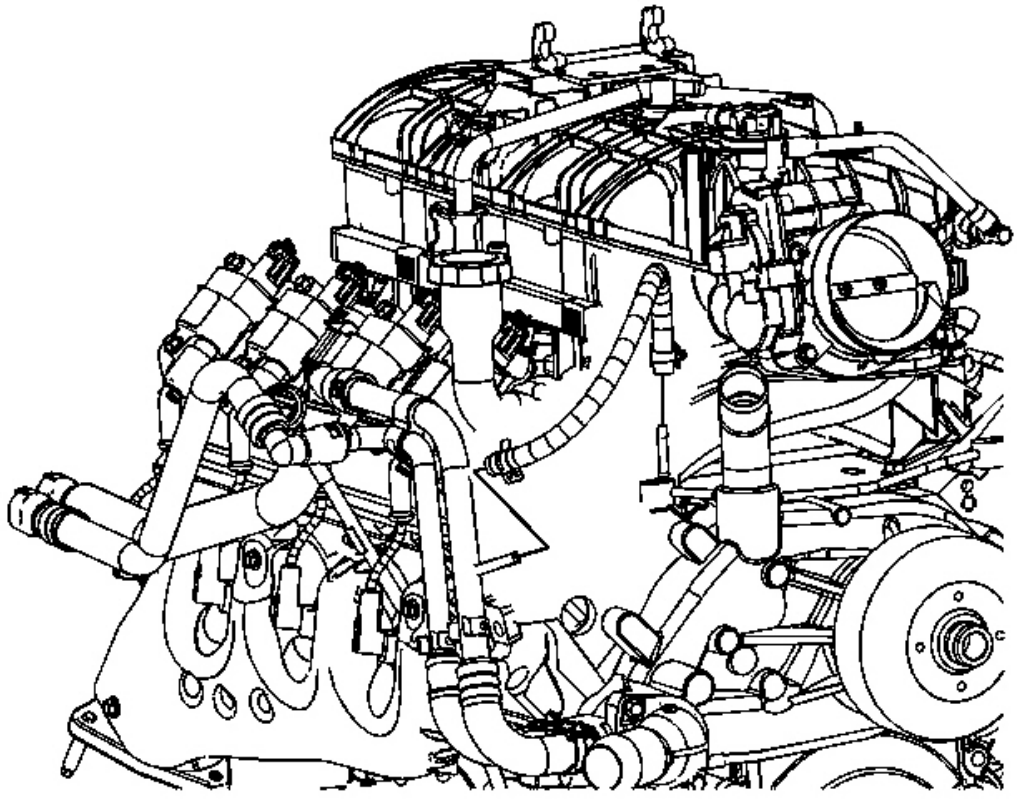


Fig. 45: View Of Coolant Air Bleed Pipe Assembly
Courtesy of GENERAL MOTORS CORP.

1. Install the coolant air bleed hose to the air bleed pipe and the heater hose.
2. Position the coolant air bleed hose clamp at the coolant air bleed pipe.
3. Position the coolant air bleed hose clamp at the heater outlet hose.
4. Fill the cooling system, if necessary. Refer to **Cooling System Draining and Filling (LL8)** or **Cooling System Draining and Filling (LH6, LS2)**.

WATER OUTLET HOUSING REPLACEMENT

Removal Procedure

1. Disconnect the radiator inlet hose from the water outlet housing. Refer to **Radiator Outlet Hose Replacement (LL8)** or **Radiator Outlet Hose Replacement (LH6, LS2)**.
2. Remove the power steering pump bracket. Refer to **Power Steering Pump Bracket Replacement** .

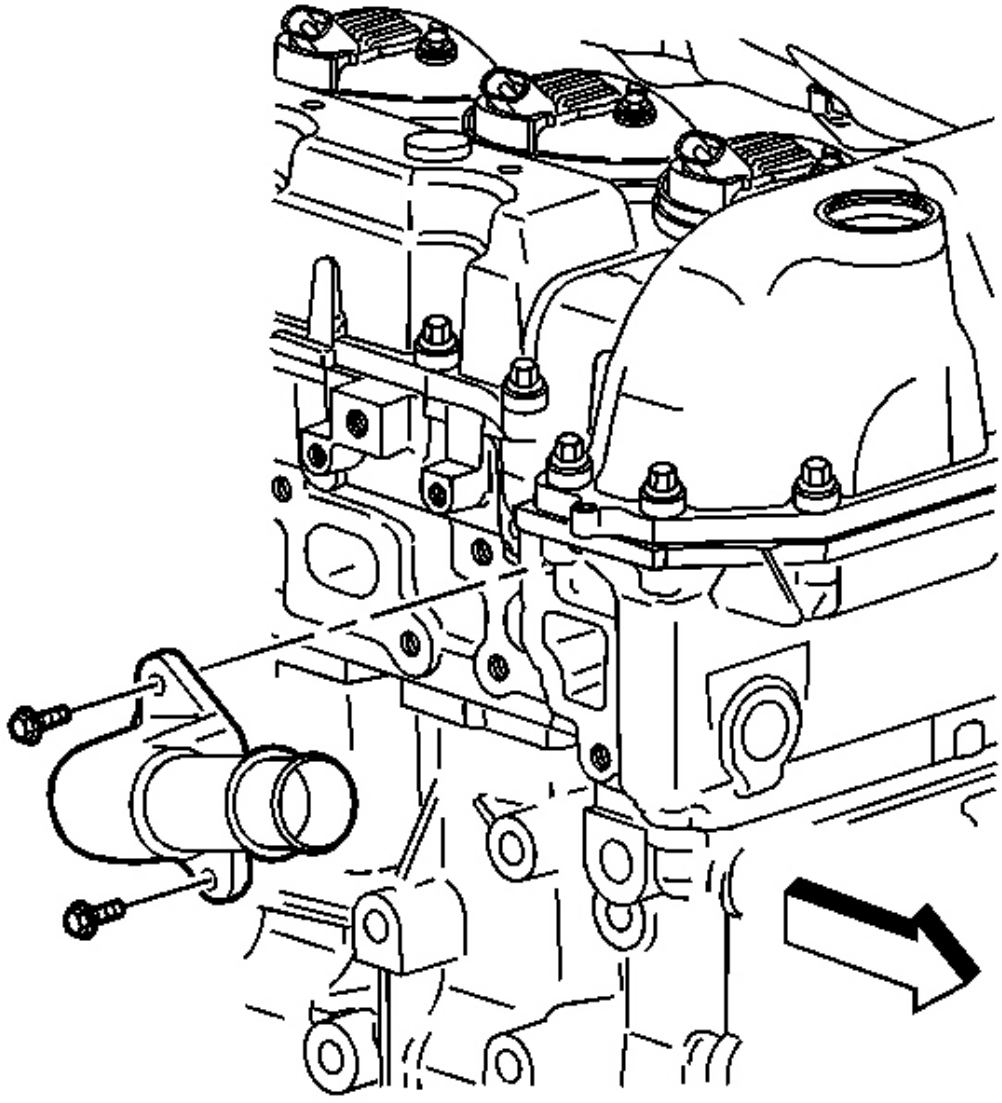


Fig. 46: View Of Water Outlet
Courtesy of GENERAL MOTORS CORP.

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.

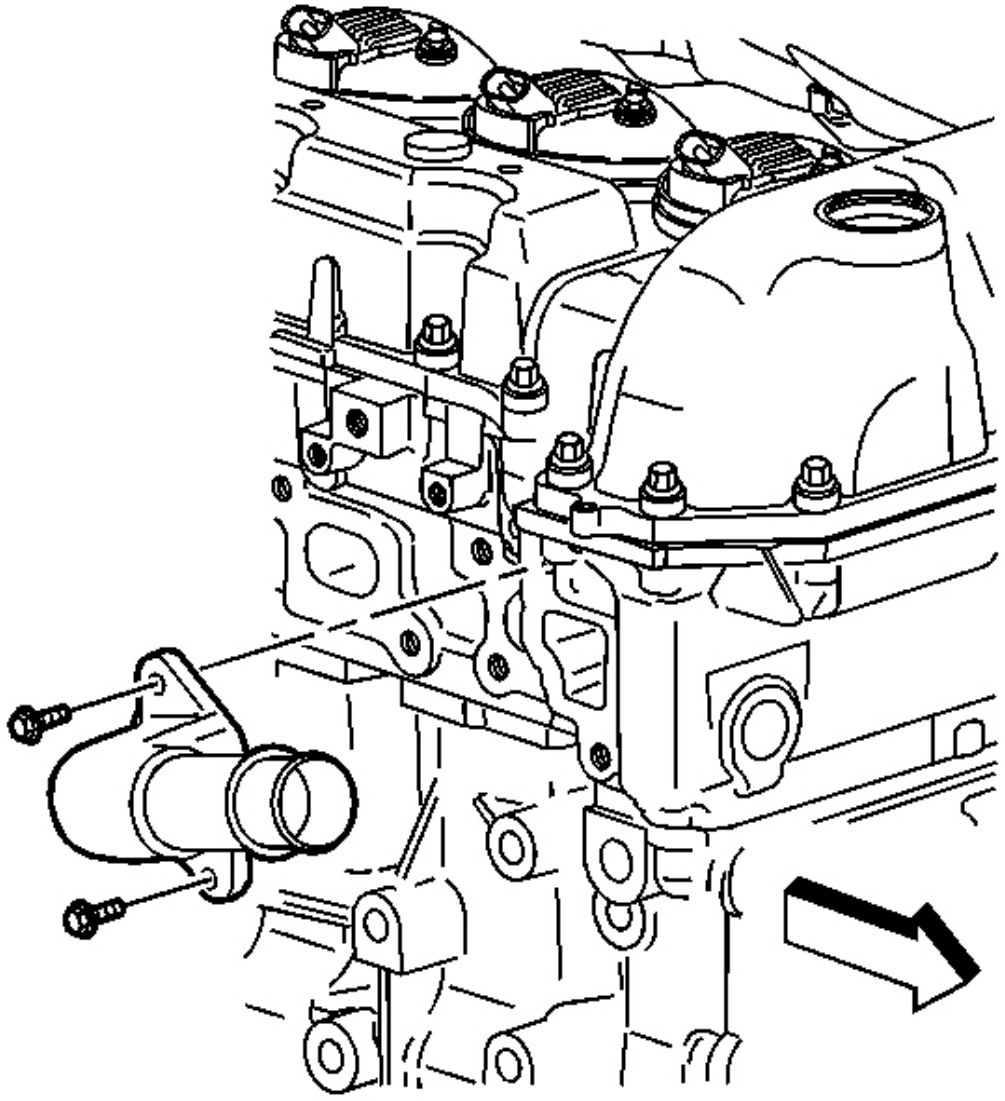


Fig. 47: View Of Water Outlet
Courtesy of GENERAL MOTORS CORP.

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

NOTE: **Refer to Fastener Notice .**

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 Outlet Hose Replacement (LL8)** or **Radiator Outlet Hose Replacement (LH6, LS2)**.
5. Install the power steering pump bracket. Refer to **Power Steering Pump Bracket Replacement** .

WATER PUMP REPLACEMENT

Special Tools

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

Removal Procedure

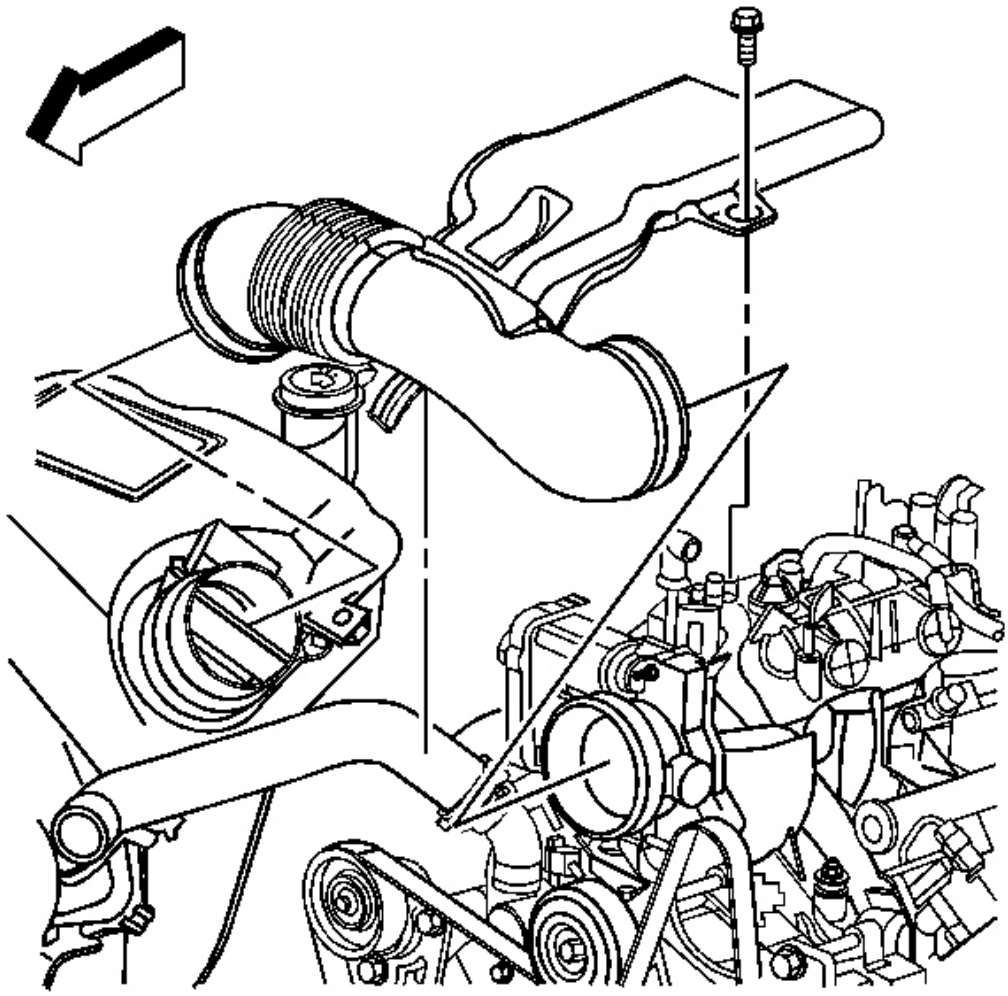


Fig. 48: View Of Intake Air Tube
Courtesy of GENERAL MOTORS CORP.

1. Drain the cooling system. Refer to **Cooling System Draining and Filling (LL8)** or **Cooling System Draining and Filling (LH6, LS2)**.
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 for the 5.3L/6.0L engine.

5. Remove the cooing fan and shroud. Refer to **Cooling Fan and Shroud Replacement**.

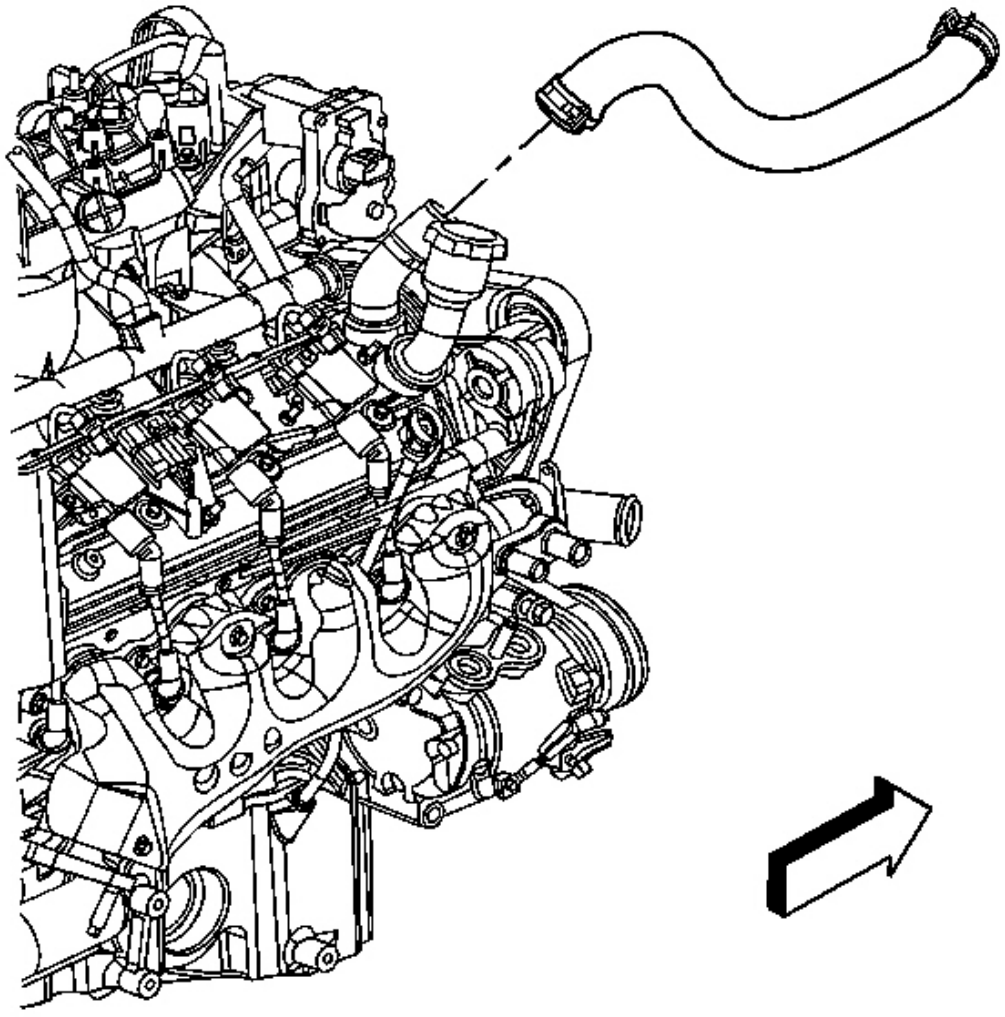


Fig. 49: View Of Inlet Hose
Courtesy of GENERAL MOTORS CORP.

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

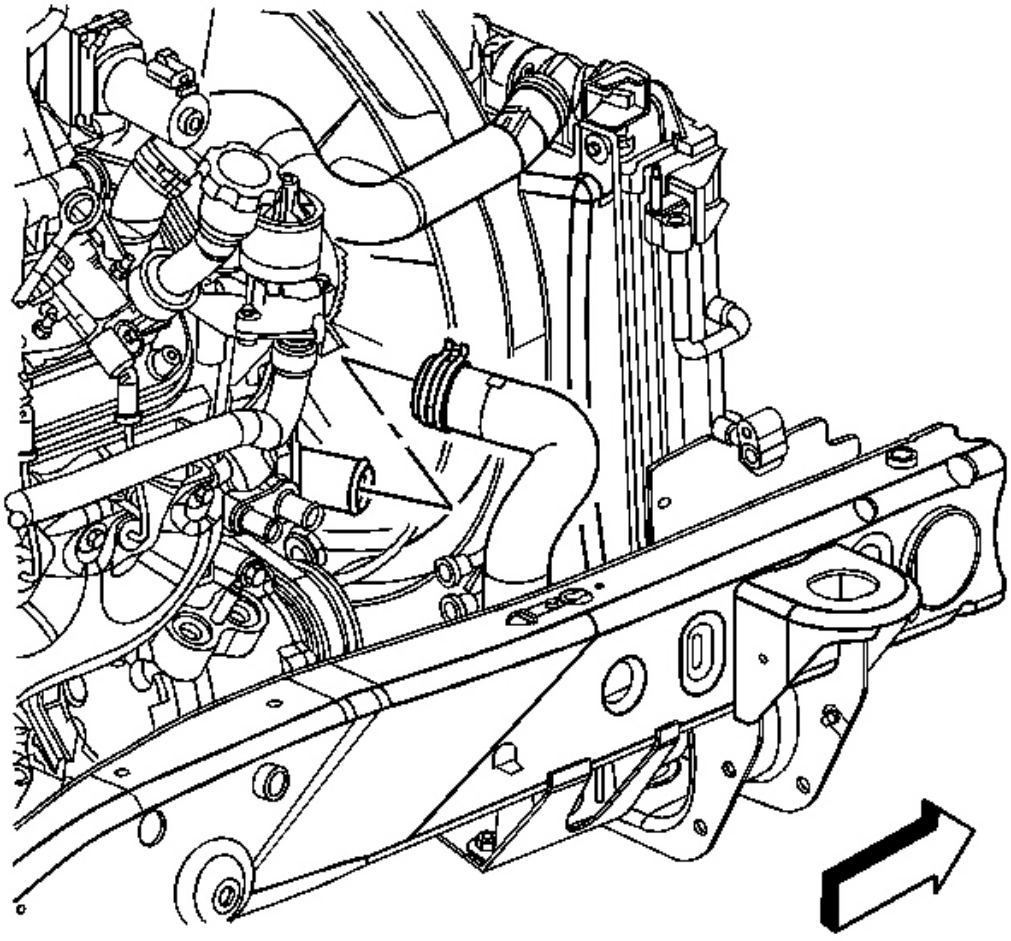


Fig. 50: View Of Outlet Hose
Courtesy of GENERAL MOTORS CORP.

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

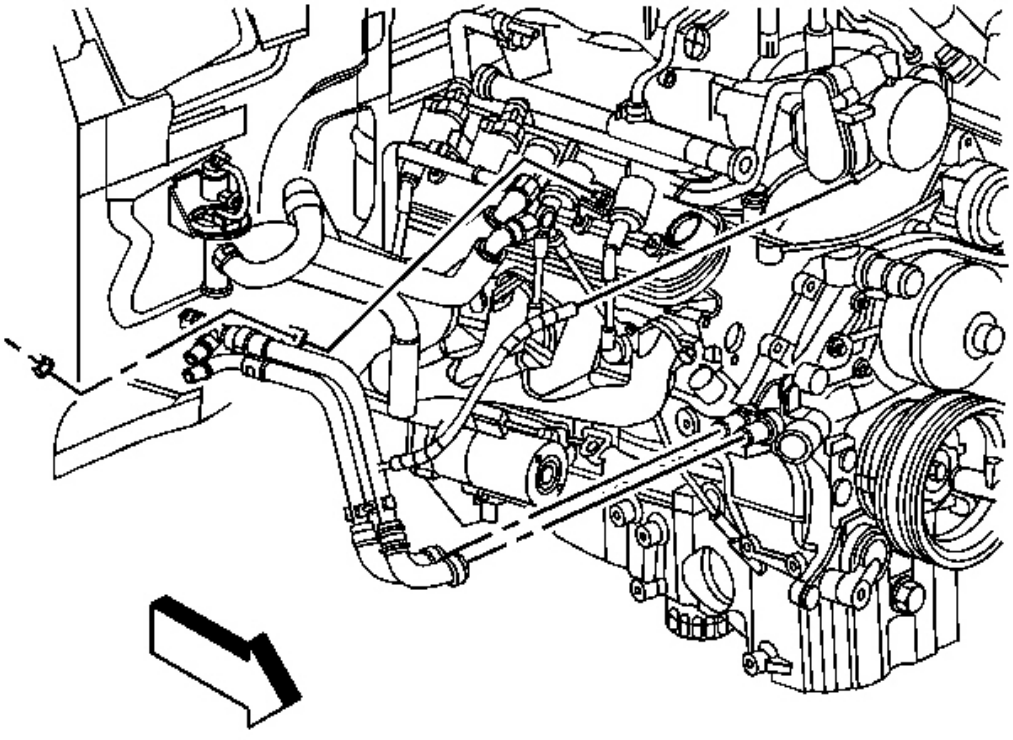


Fig. 51: View Of Auxiliary Heater Inlet & Outlet Hoses/Pipes
Courtesy of GENERAL MOTORS CORP.

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

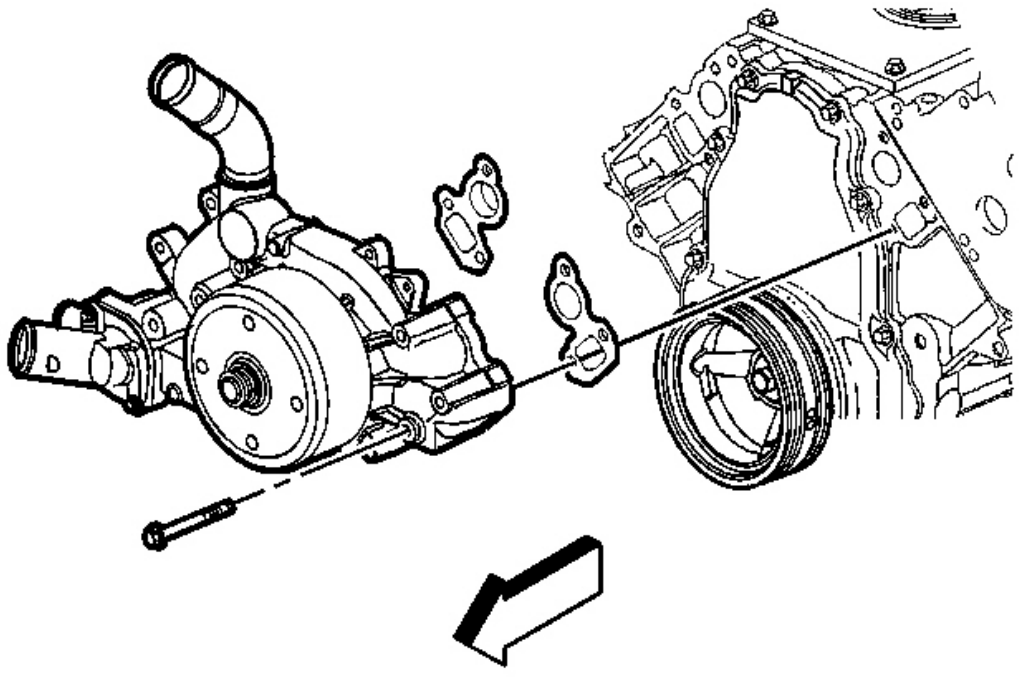


Fig. 52: View Of Water Pump, Gaskets & Bolts
Courtesy of GENERAL MOTORS CORP.

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

Installation Procedure

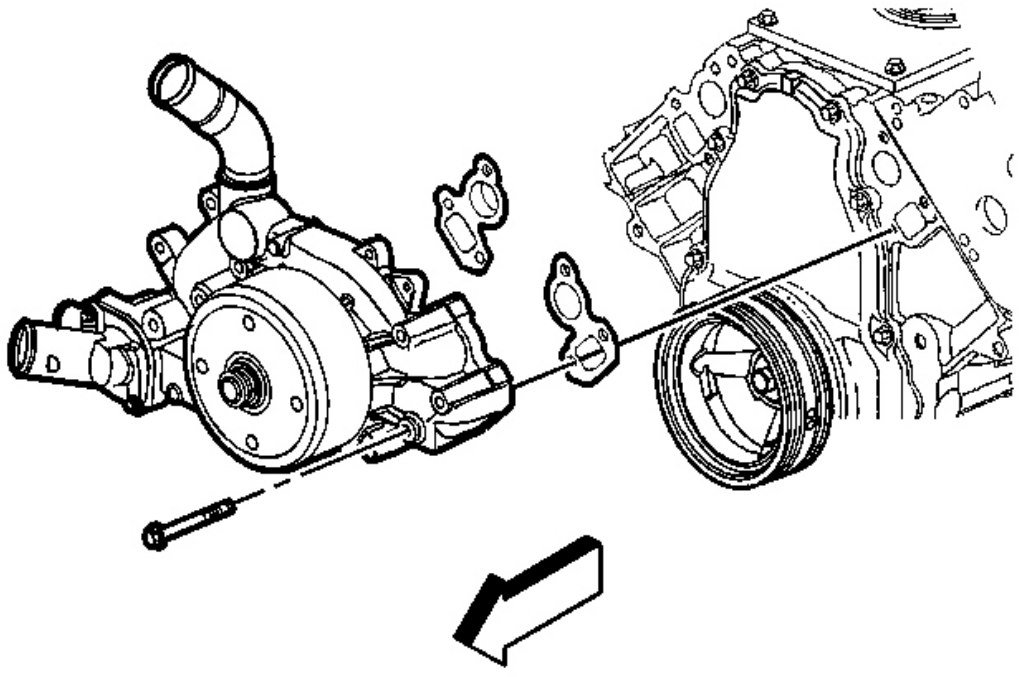


Fig. 53: View Of Water Pump, Gaskets & Bolts
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice .

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

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

Tighten:

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

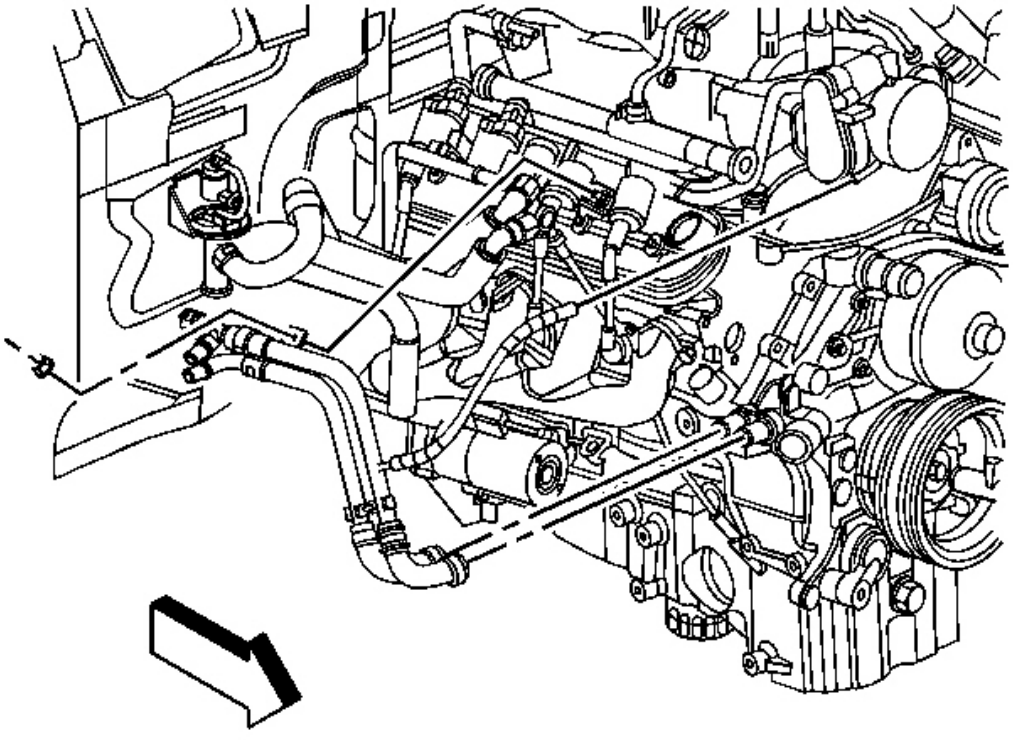


Fig. 54: View Of Auxiliary Heater Inlet & Outlet Hoses/Pipes
Courtesy of GENERAL MOTORS CORP.

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. See **Special Tools**.
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. See **Special Tools**.

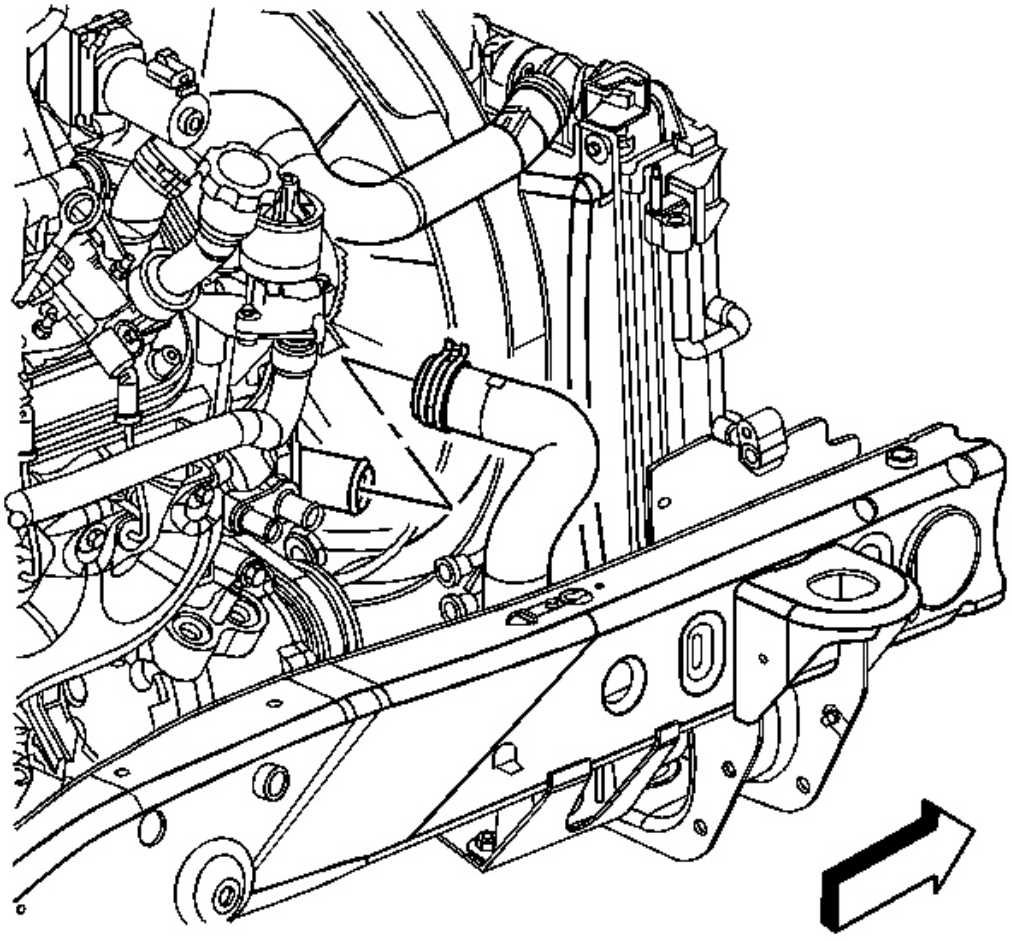


Fig. 55: View Of Outlet Hose
Courtesy of GENERAL MOTORS CORP.

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

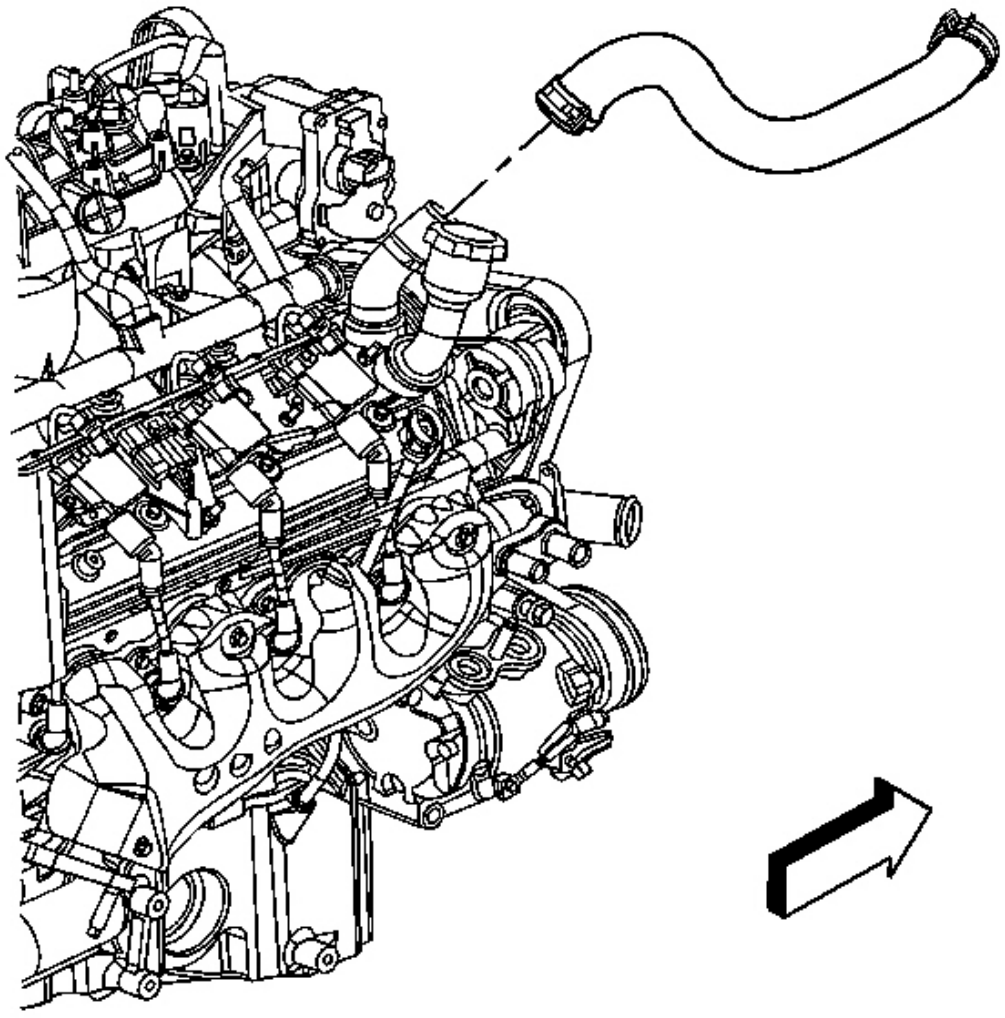


Fig. 56: View Of Inlet Hose
Courtesy of GENERAL MOTORS CORP.

10. Install the inlet hose to the water pump.
11. Using **J 38185** , position the inlet hose clamp at the water pump. See **Special Tools**.
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 for the 5.3L/6.0L engine.

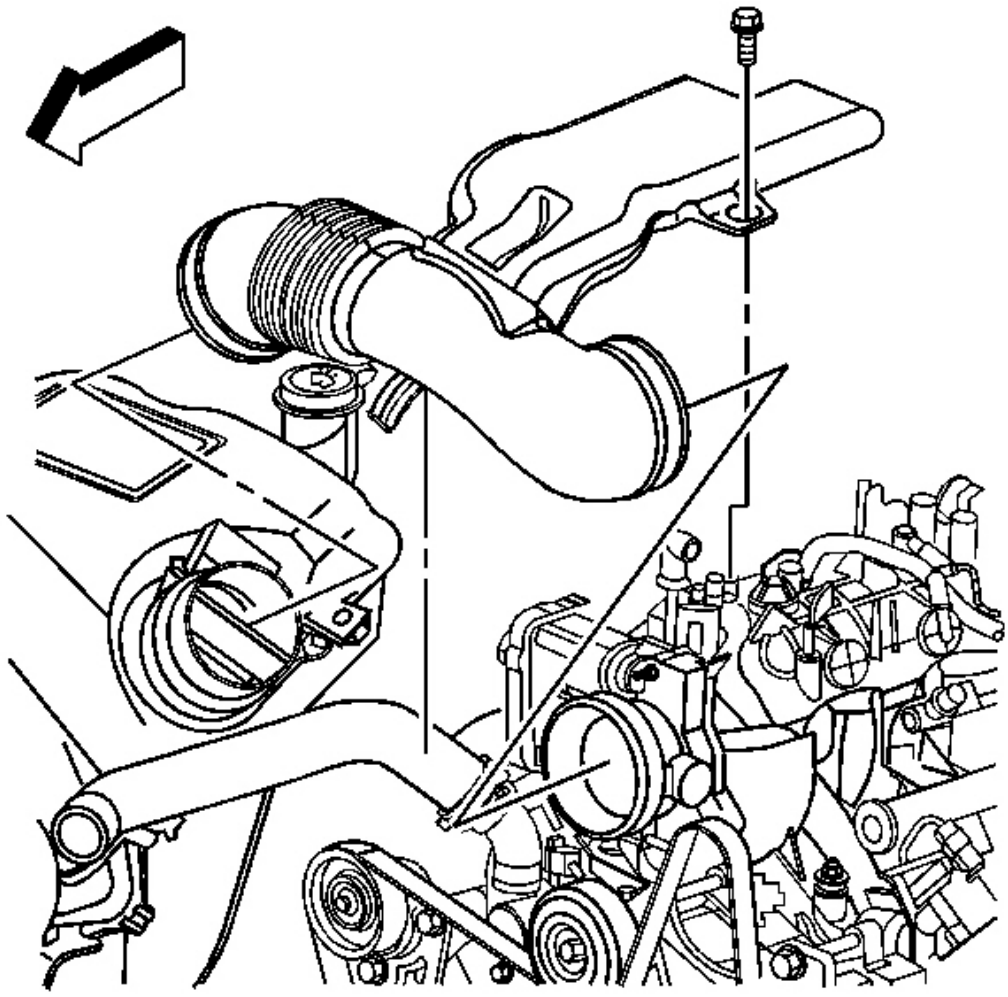


Fig. 57: View Of Intake Air Tube
Courtesy of GENERAL MOTORS CORP.

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 **Cooling System Draining and Filling (LL8)** or **Cooling System Draining and Filling (LH6, LS2)**.

RADIATOR REPLACEMENT (LL8)

Tools Required

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

Removal Procedure

1. Drain the coolant from the radiator. Refer to **Cooling System Draining and Filling (LL8)** or **Cooling System Draining and Filling (LH6, LS2)**.
2. Recover the refrigerant. Refer to **Refrigerant Recovery and Recharging** .
3. Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** .
4. Remove the lower radiator support shield, if equipped. Refer to **Radiator Support Shield Replacement** .

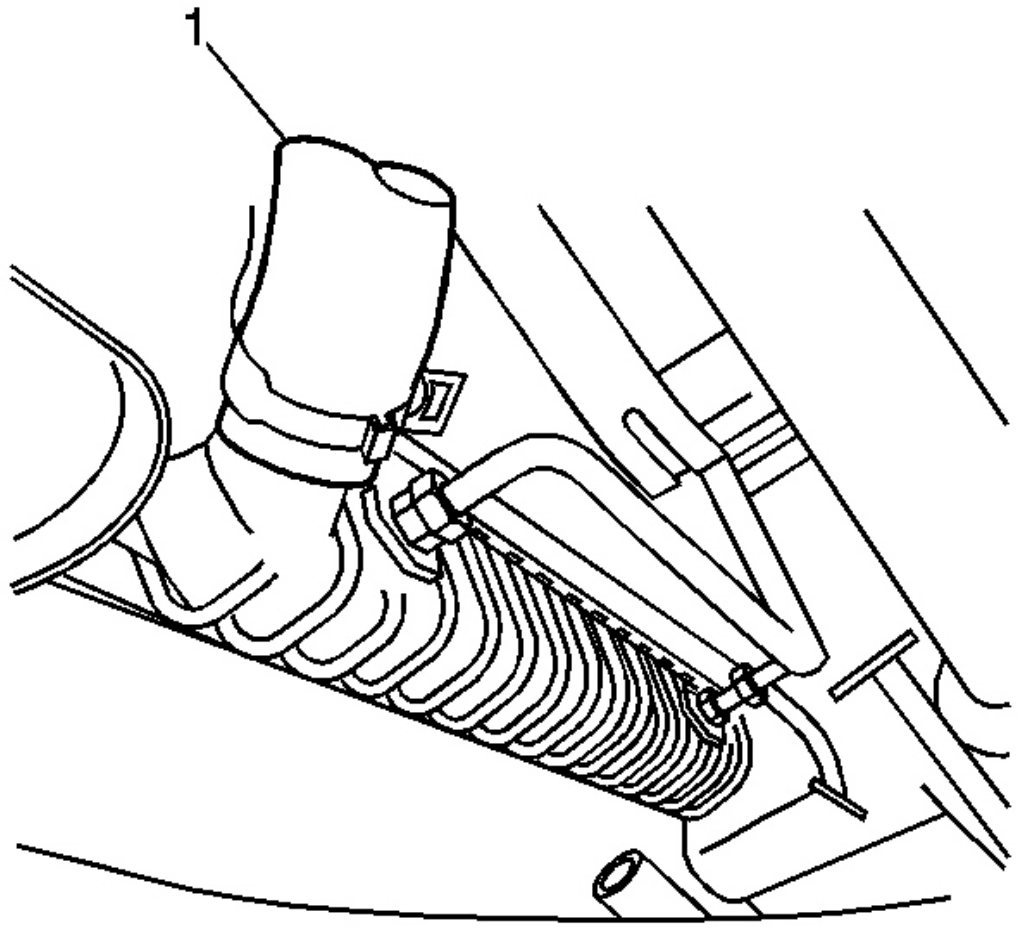


Fig. 58: View Of Radiator Hose
Courtesy of GENERAL MOTORS CORP.

5. Reposition the outlet radiator hose clamp using **J 38185** from the lower radiator hose (1). See **Special Tools**.
6. Remove the outlet radiator hose from the radiator.

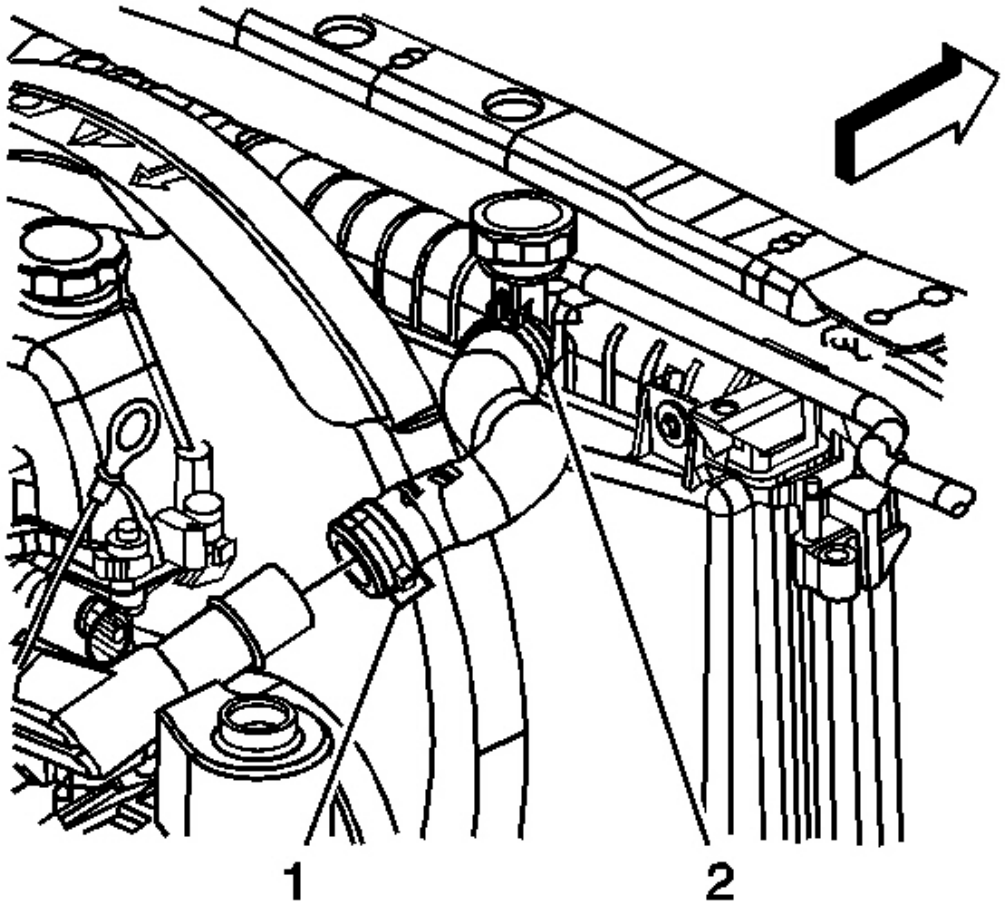


Fig. 59: View Of Radiator Hose Clamps
Courtesy of GENERAL MOTORS CORP.

7. Reposition the inlet radiator hose clamps (1) and remove hose (2).
8. Remove the transmission cooler lines from the radiator. Refer to **Transmission Fluid Cooler Hose/Pipe Quick-Connect Fitting Disconnection and Connection** .
9. Lower the vehicle.
10. Remove the cooling fan and shroud. Refer to **Cooling Fan and Shroud Replacement**.
11. Remove the radiator support diagonal brace. Refer to **Radiator Support Diagonal Brace Replacement** .
12. Remove the coolant recovery line from the radiator.

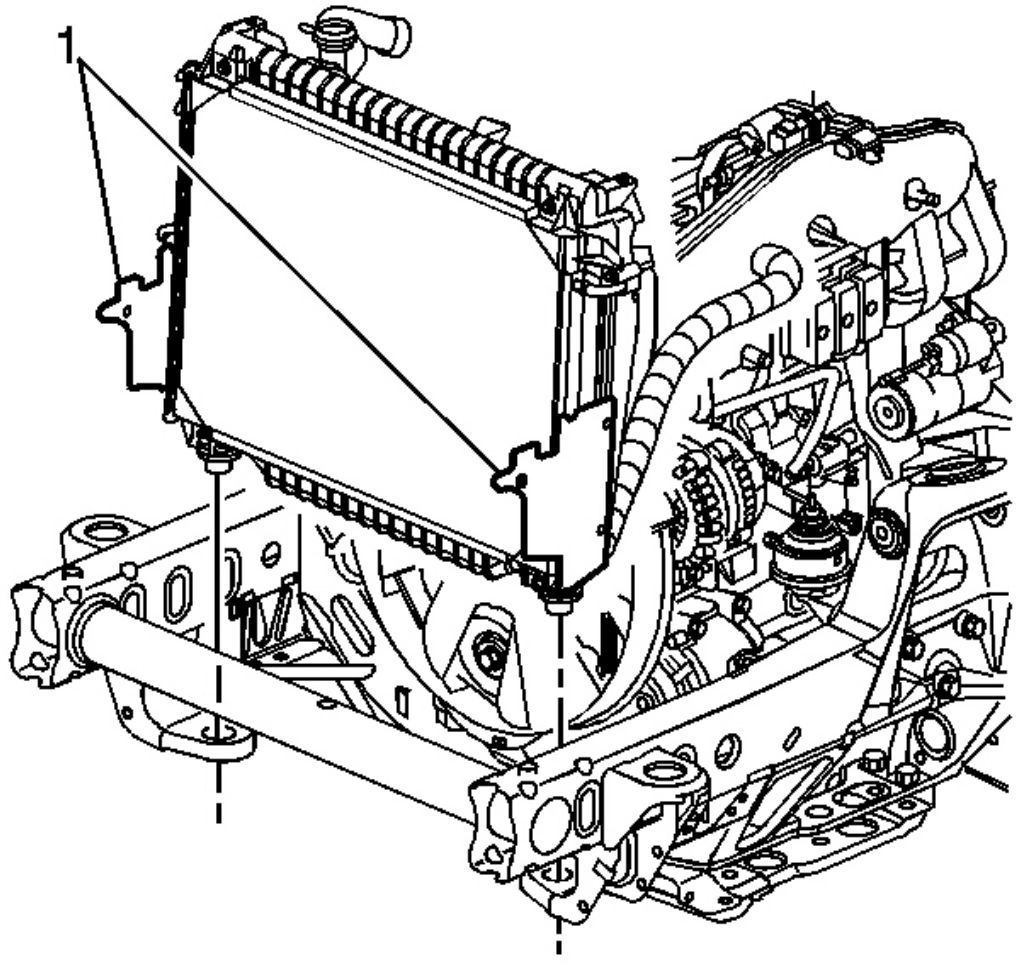


Fig. 60: View Of Radiator Side Panels
Courtesy of GENERAL MOTORS CORP.

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

Installation Procedure

1. Install the condenser to the radiator.

NOTE: Refer to Fastener Notice .

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

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

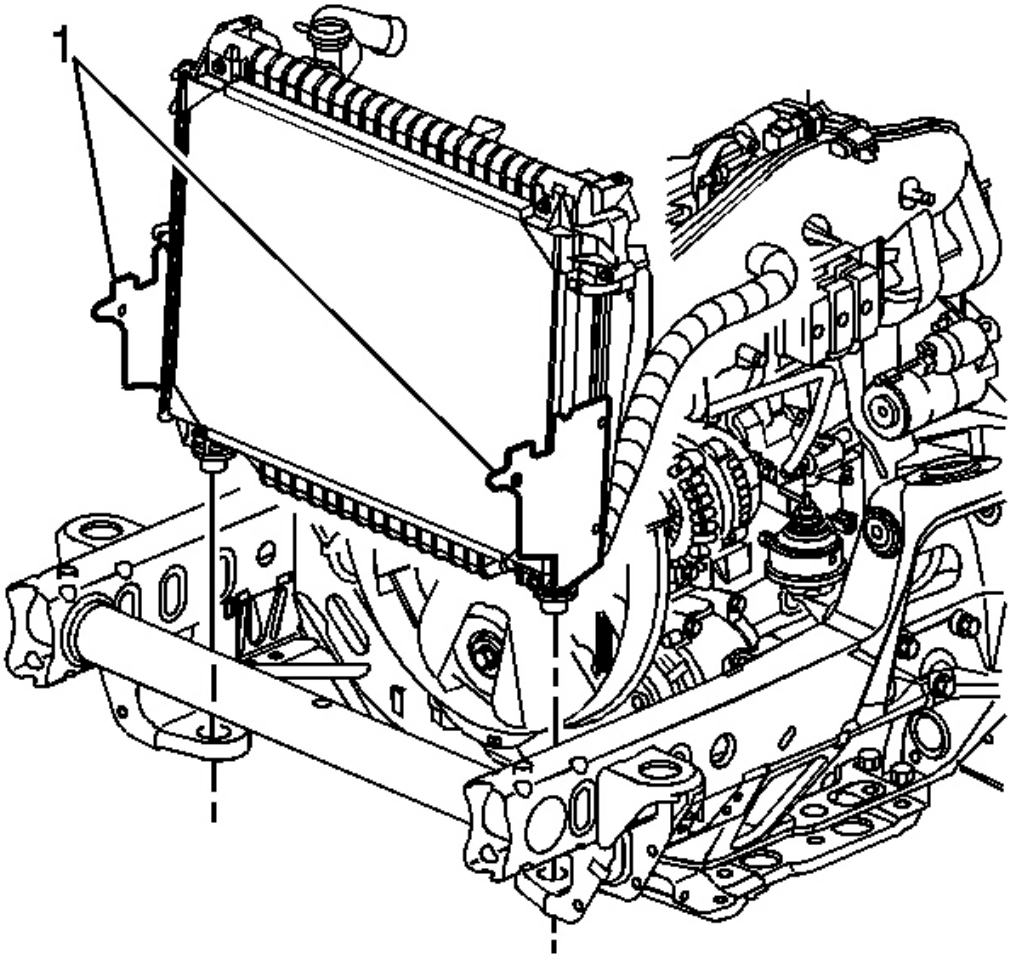


Fig. 61: View Of Radiator Side Panels
Courtesy of GENERAL MOTORS CORP.

3. Install the radiator.
4. Install the cooling fan and shroud. Refer to **Cooling Fan and Shroud Replacement**.
5. Raise the vehicle.

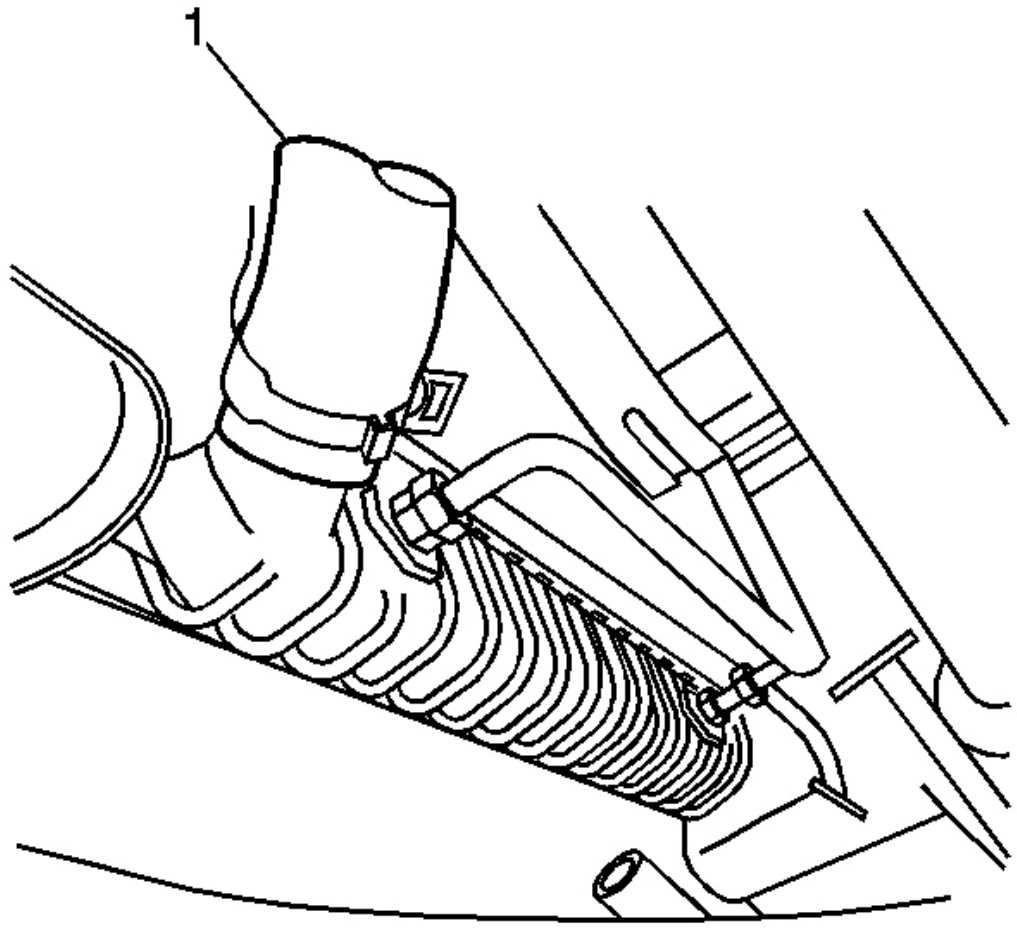


Fig. 62: View Of Radiator Hose
Courtesy of GENERAL MOTORS CORP.

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

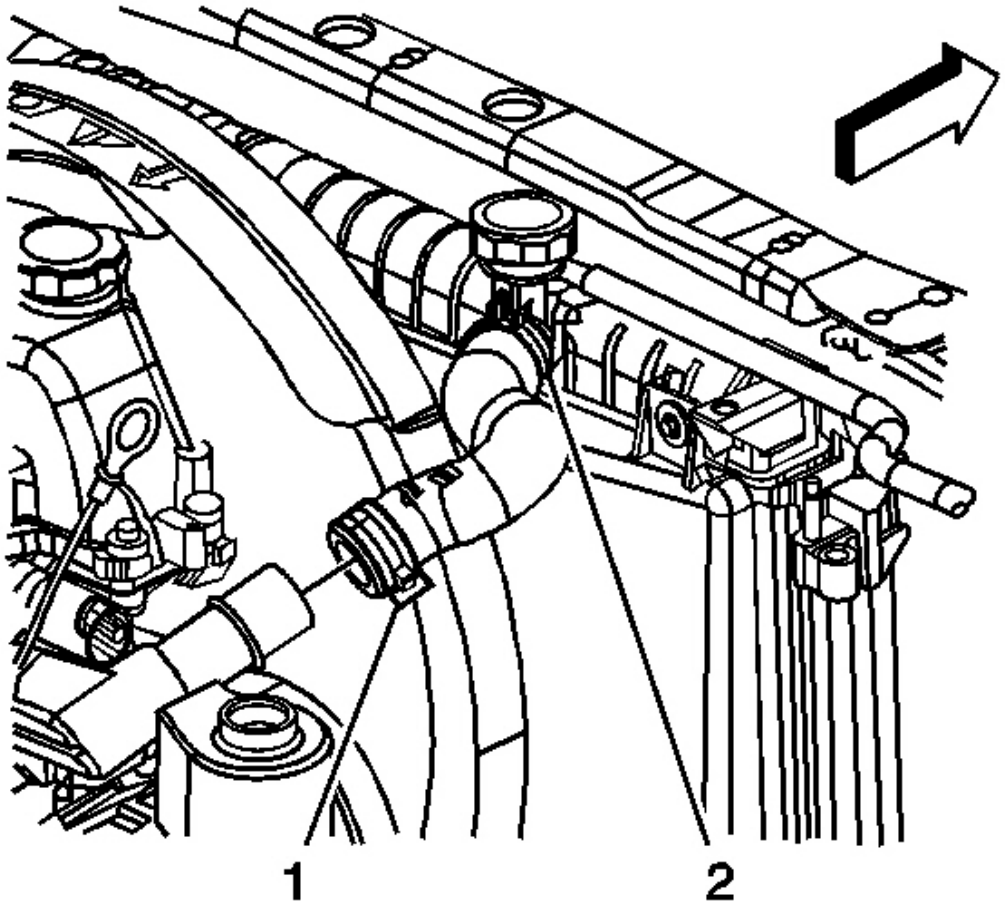


Fig. 63: View Of Radiator Hose Clamps
Courtesy of GENERAL MOTORS CORP.

7. Reposition the outlet radiator hose clamp (1) using **J 38185** . See **Special Tools**.
8. Connect the transmission cooler lines to the radiator. Refer to **Transmission Fluid Cooler Hose/Pipe Quick-Connect Fitting Disconnection and Connection** .
9. Install the lower radiator support shield, if equipped. Refer to **Radiator Support Shield Replacement** .
10. Lower the vehicle.
11. Install the coolant recovery hose to the radiator.
12. Install the radiator support diagonal brace. Refer to **Radiator Support Diagonal Brace Replacement** .
13. Fill the cooling system. Refer to **Cooling System Draining and Filling (LL8)** or **Cooling System Draining and Filling (LH6, LS2)**.

RADIATOR REPLACEMENT (LH6, LS2)

Tools Required

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

Removal Procedure

1. Drain the coolant from the radiator. Refer to **Cooling System Draining and Filling (LL8)** or **Cooling System Draining and Filling (LH6, LS2)**.
2. Remove the lower radiator support shield, if equipped. Refer to **Radiator Support Shield Replacement** .

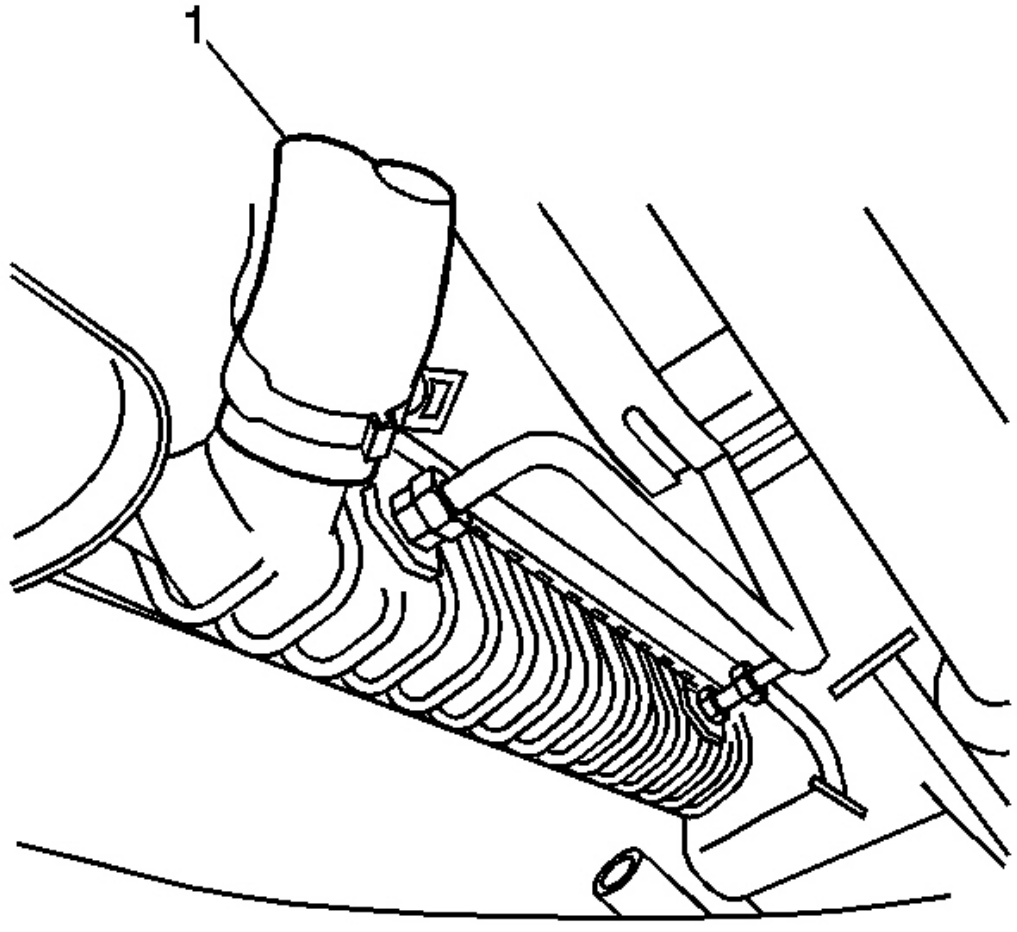


Fig. 64: View Of Radiator Hose

Courtesy of GENERAL MOTORS CORP.

3. Remove the transmission cooler lines from the radiator. Refer to **Transmission Fluid Cooler Hose/Pipe Quick-Connect Fitting Disconnection and Connection** for the 4L60-E/4L65-E transmission.
4. Reposition the outlet radiator hose clamp using **J 38185** . See **Special Tools**.
5. Remove the outlet radiator hose (1) from the radiator.
6. Lower the vehicle.

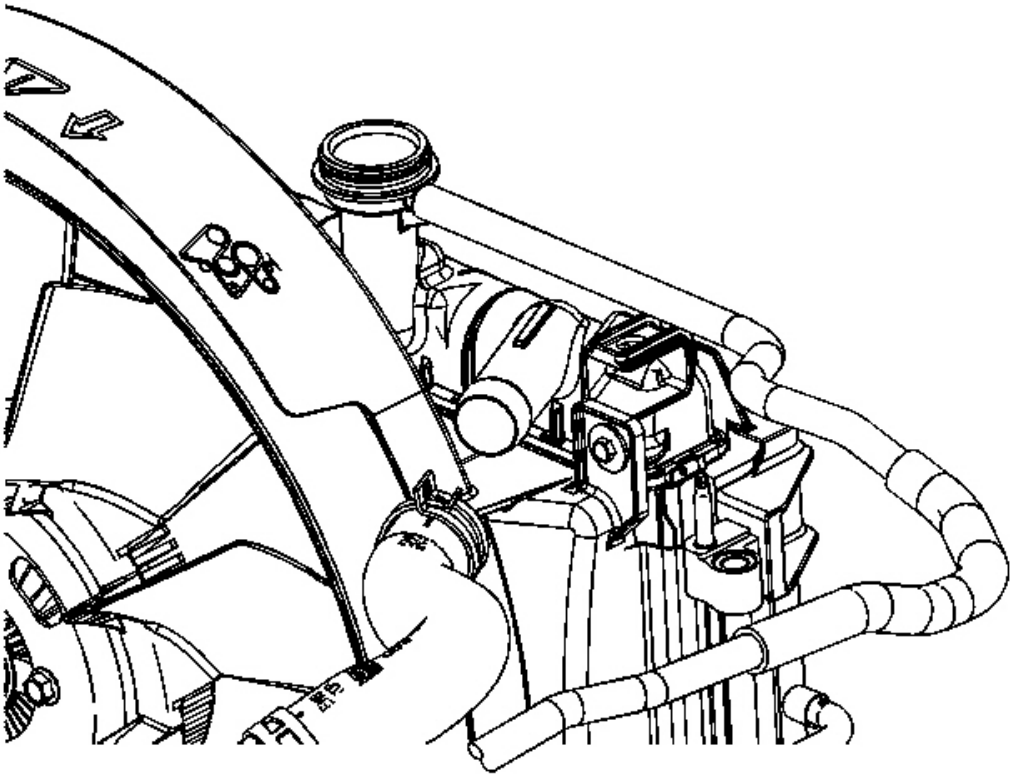


Fig. 65: Identifying Radiator Inlet Hose
Courtesy of GENERAL MOTORS CORP.

7. Reposition the inlet radiator hose clamp using **J 38185** . See **Special Tools**.
8. Remove the inlet radiator hose from the radiator.
9. Remove the cooling fan and shroud. Refer to **Cooling Fan and Shroud Replacement**.
10. Remove the air inlet grille. Refer to **Air Inlet Grille Panel Replacement (Envoy, TrailBlazer)** .

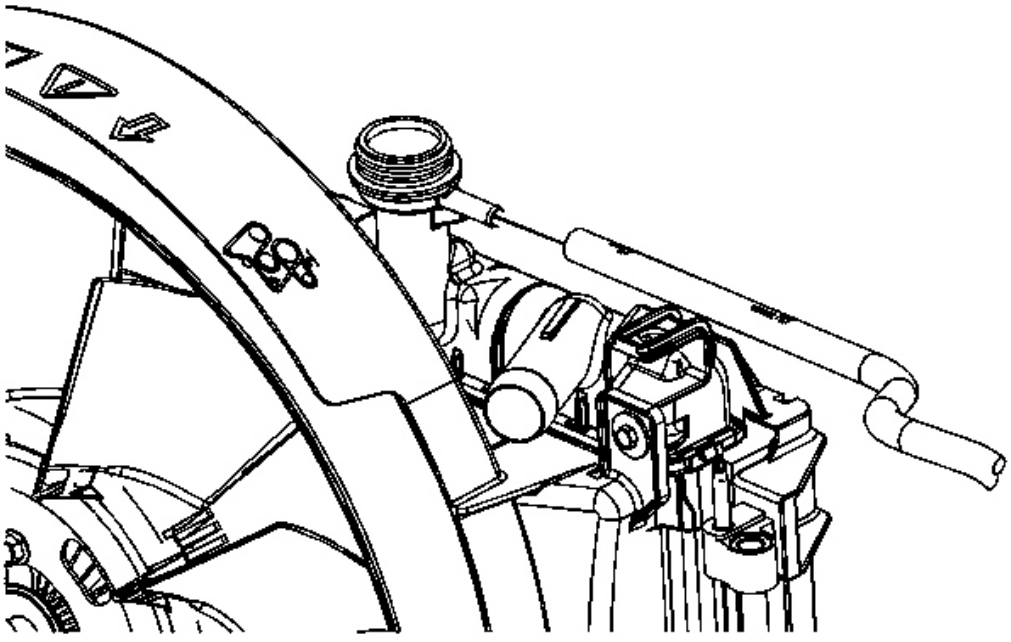


Fig. 66: View Of Coolant Recovery Line
Courtesy of GENERAL MOTORS CORP.

11. Remove the coolant recovery line from the radiator.

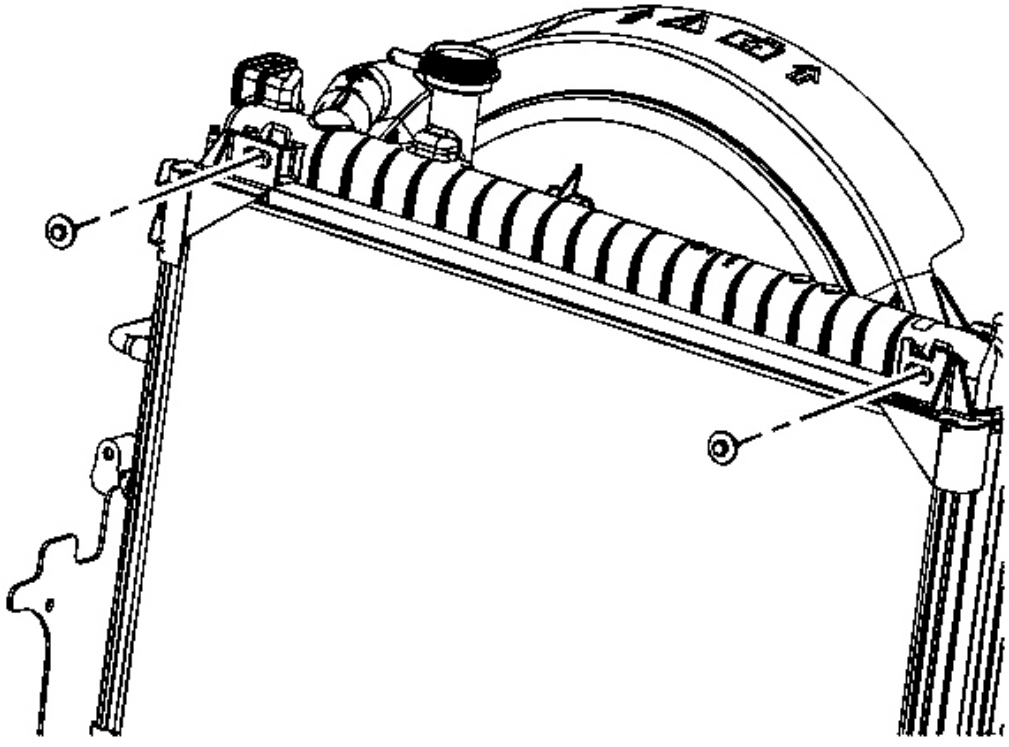


Fig. 67: Identifying Upper Radiator To Condenser Bolt
Courtesy of GENERAL MOTORS CORP.

12. Remove the upper radiator to condenser bolts.
13. Lift upward on the condenser to remove from the radiator retaining tab.
14. Remove the radiator.

Installation Procedure

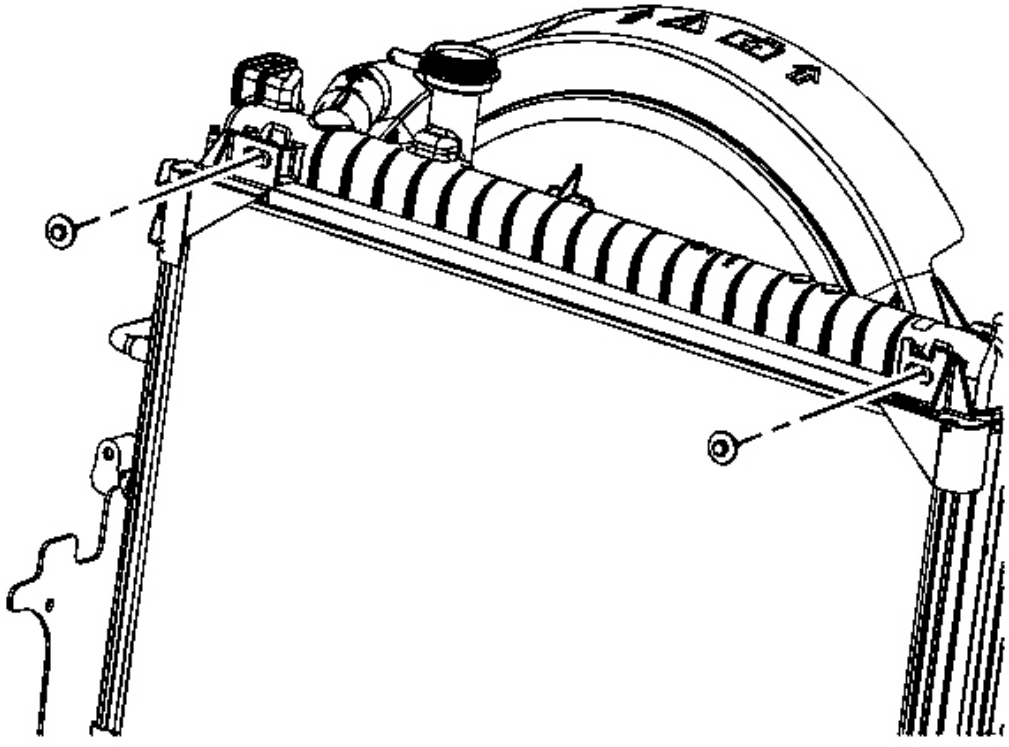


Fig. 68: Identifying Upper Radiator To Condenser Bolt
Courtesy of GENERAL MOTORS CORP.

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

NOTE: **Refer to Fastener Notice .**

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

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

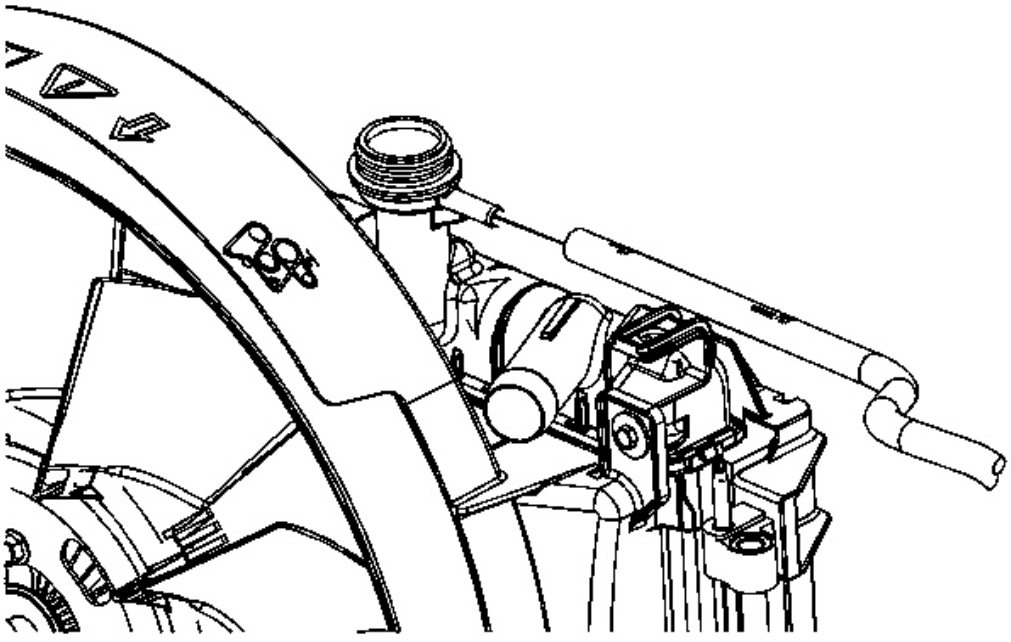


Fig. 69: View Of Coolant Recovery Line
Courtesy of GENERAL MOTORS CORP.

4. Install the coolant recovery line to the radiator.
5. Install the air inlet grille. Refer to **Air Inlet Grille Panel Replacement (Envoy, TrailBlazer)** .
6. Install the cooling fan and shroud. Refer to **Cooling Fan and Shroud Replacement**.

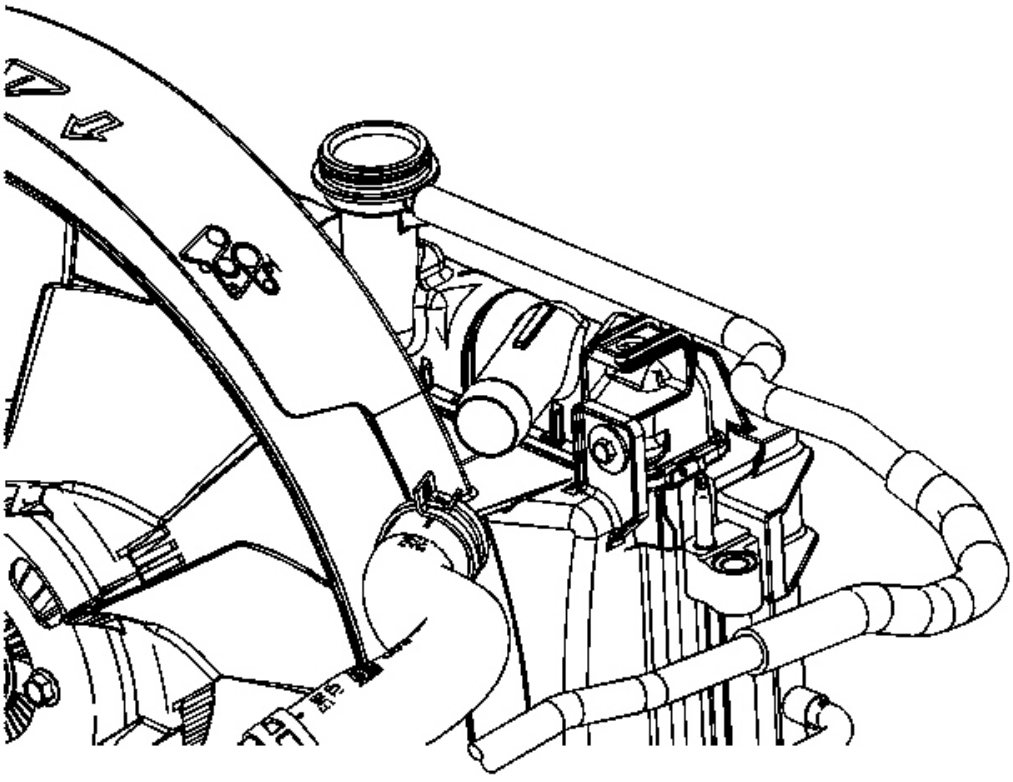


Fig. 70: Identifying Radiator Inlet Hose
Courtesy of GENERAL MOTORS CORP.

7. Install the inlet radiator hose to the radiator.
8. Reposition the inlet radiator hose clamp using **J 38185** . See **Special Tools**.
9. Raise the vehicle.

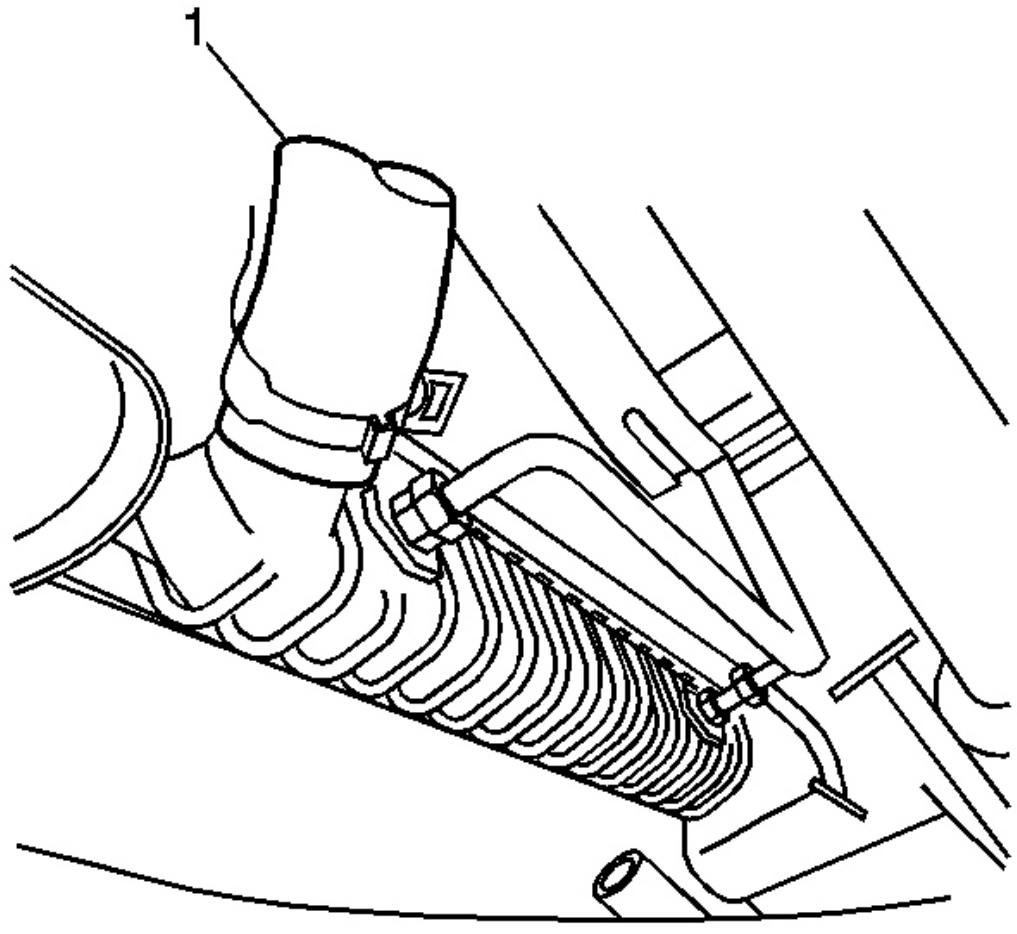


Fig. 71: View Of Radiator Hose
Courtesy of GENERAL MOTORS CORP.

10. Install the outlet radiator hose (1) to the radiator.
11. Reposition the outlet radiator hose clamp (1) using **J 38185** . See **Special Tools**.
12. Connect the transmission cooler lines to the radiator. Refer to **Transmission Fluid Cooler Hose/Pipe Quick-Connect Fitting Disconnection and Connection** for the 4L60-E/4L65-E transmission.
13. Install the lower radiator support shield, if equipped. Refer to **Radiator Support Shield Replacement** .
14. Lower the vehicle.
15. Fill the cooling system. Refer to **Cooling System Draining and Filling (LL8)** or **Cooling System Draining and Filling (LH6, LS2)**.

COOLANT HEATER REPLACEMENT (LL8)

Removal Procedure

1. Drain the engine coolant. Refer to **Cooling System Draining and Filling (LL8)** or **Cooling System Draining and Filling (LH6, LS2)**.

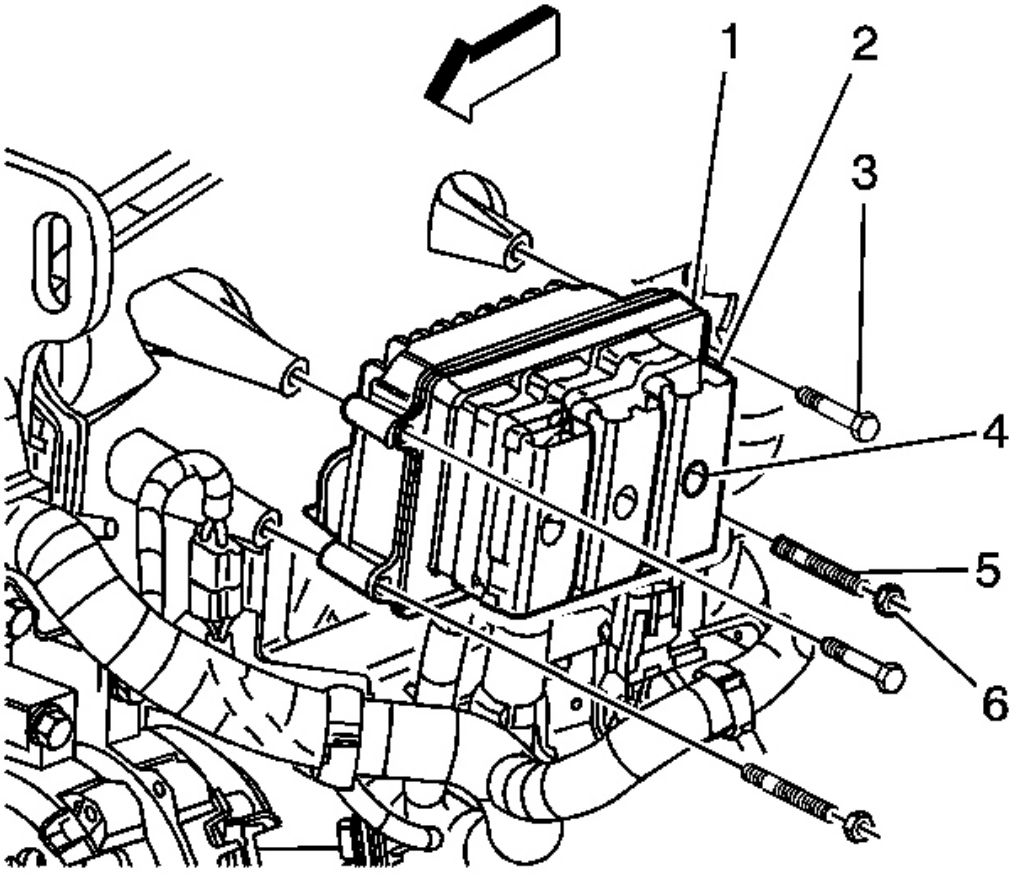


Fig. 72: View Of PCM Components
Courtesy of GENERAL MOTORS CORP.

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.

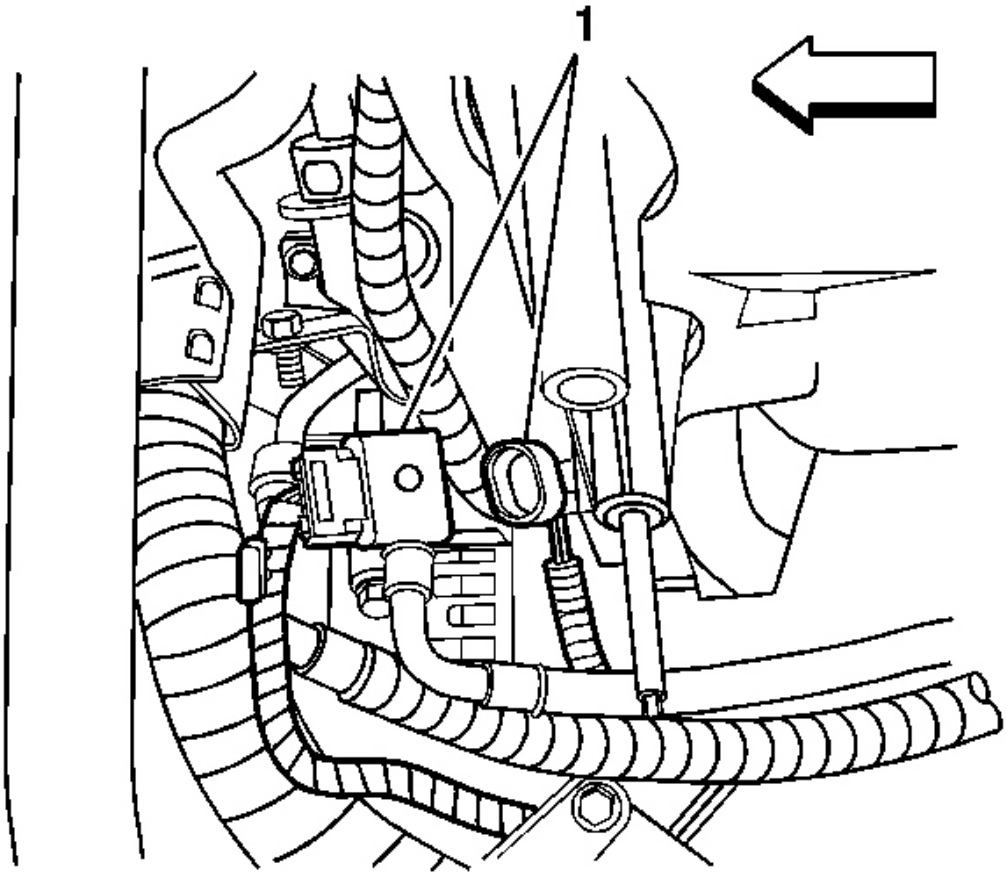


Fig. 73: View Of Engine Coolant Temperature Electrical Connector
Courtesy of GENERAL MOTORS CORP.

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

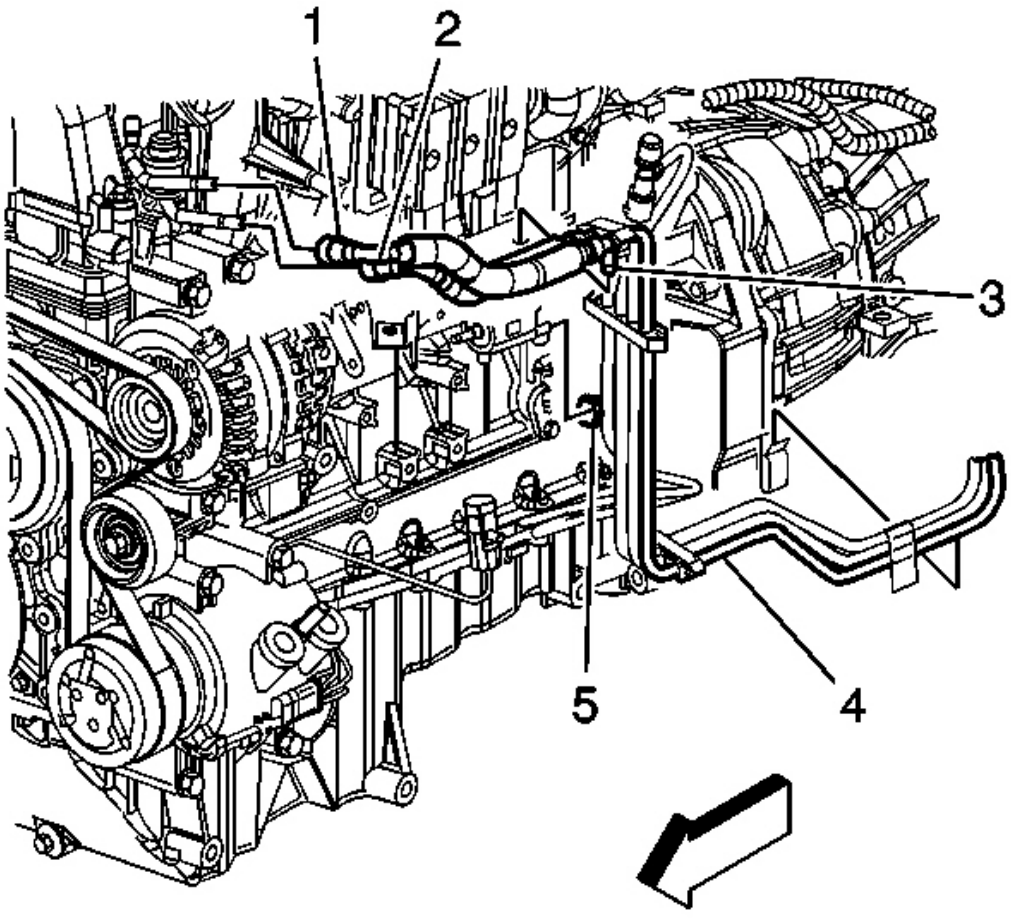


Fig. 74: Identifying Fuel Feed & Fuel Return Pipes (Left Side Of Engine)
Courtesy of GENERAL MOTORS CORP.

NOTE: **Refer to Fuel and Evaporative Emission Hose/Pipe Connection Cleaning Notice .**

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

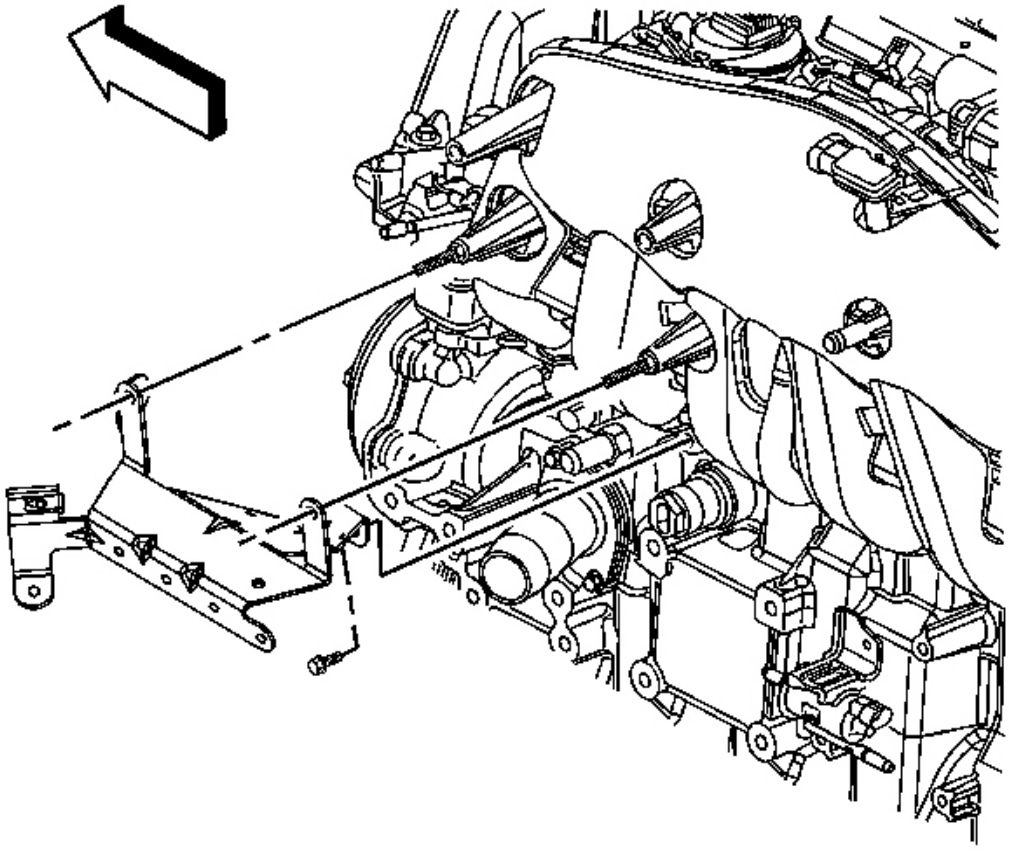


Fig. 75: View Of Engine Wire Harness Bracket & Bolts
Courtesy of GENERAL MOTORS CORP.

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

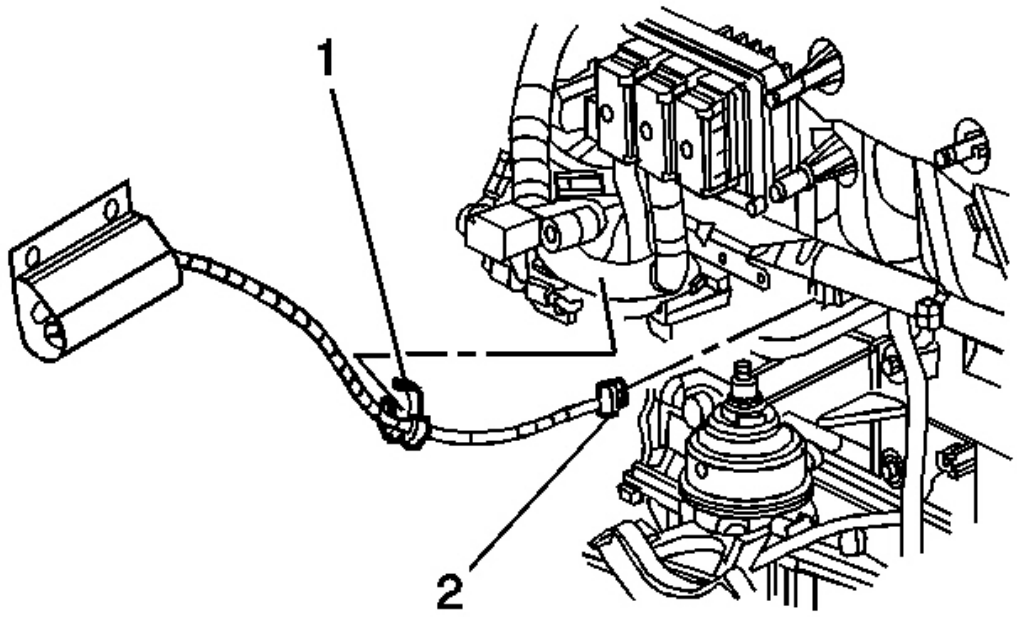


Fig. 76: View Of Engine Harness Bracket & Coolant Heater Cord
Courtesy of GENERAL MOTORS CORP.

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

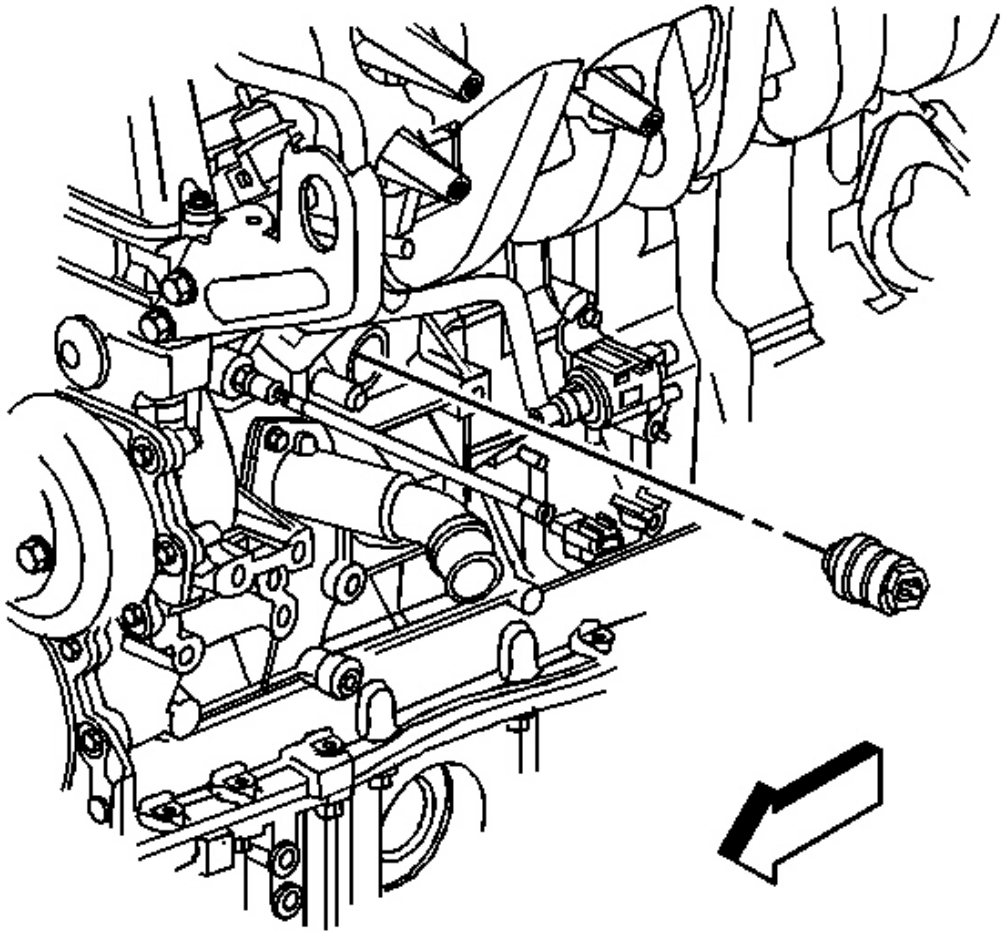


Fig. 77: View Of Coolant Heater (LL8)
Courtesy of GENERAL MOTORS CORP.

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.

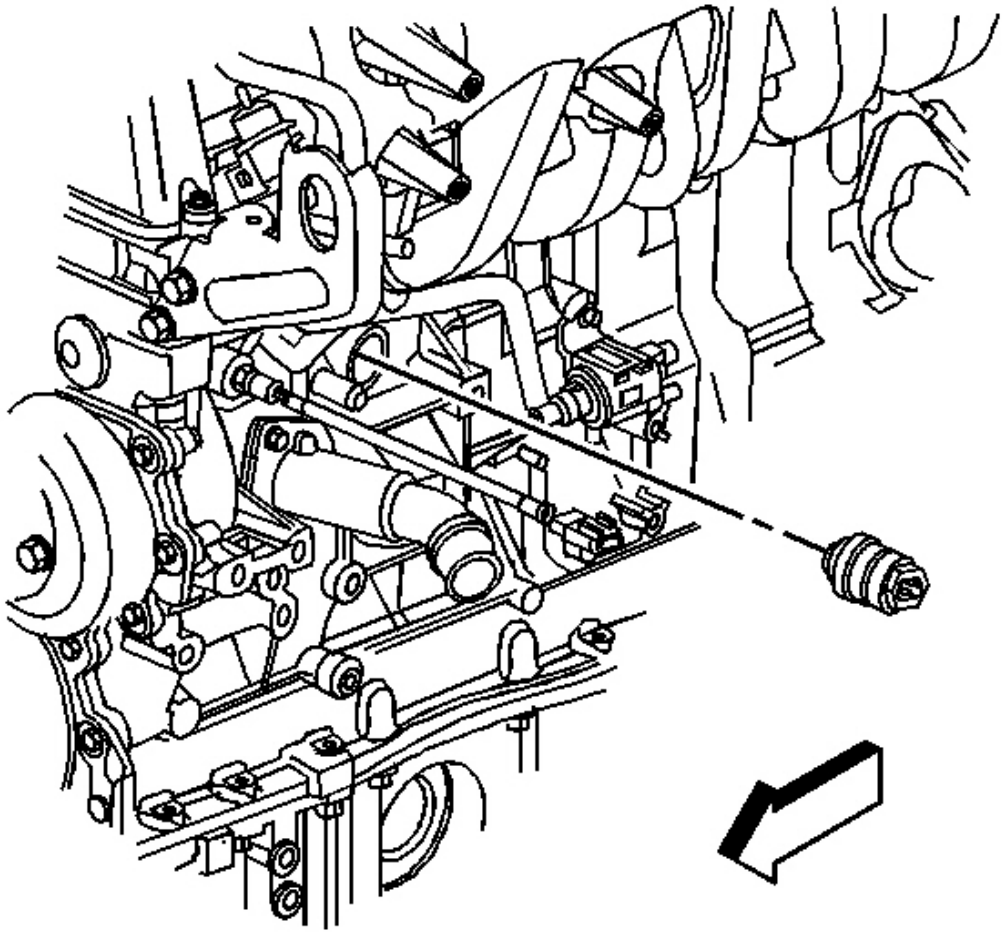


Fig. 78: View Of Coolant Heater (LL8)
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Component Fastener Tightening Notice .

3. Install the coolant heater to the engine block.

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

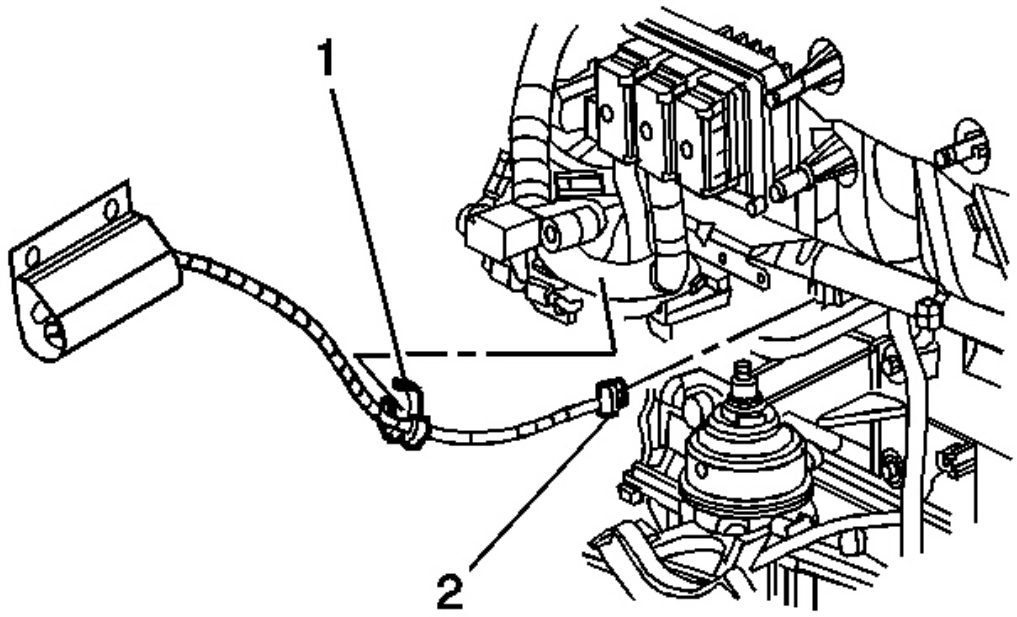


Fig. 79: View Of Engine Harness Bracket & Coolant Heater Cord
Courtesy of GENERAL MOTORS CORP.

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

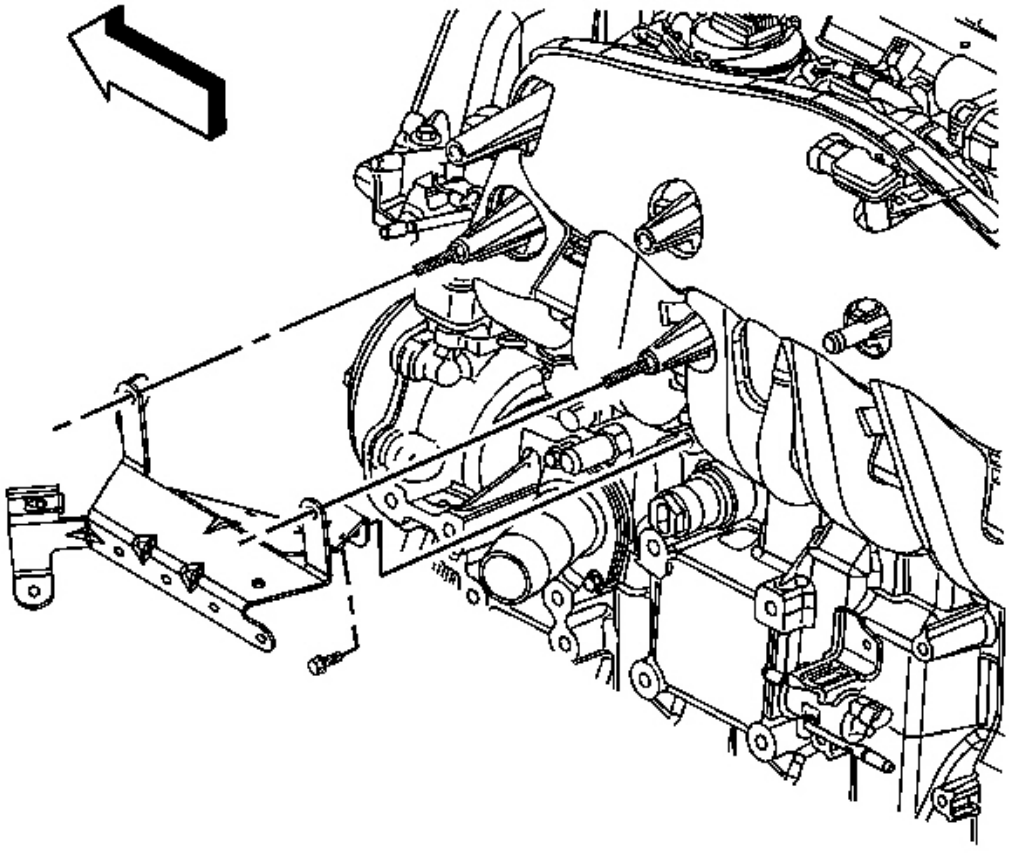


Fig. 80: View Of Engine Wire Harness Bracket & Bolts
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice .

6. Install the engine electrical harness bracket bolt.

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

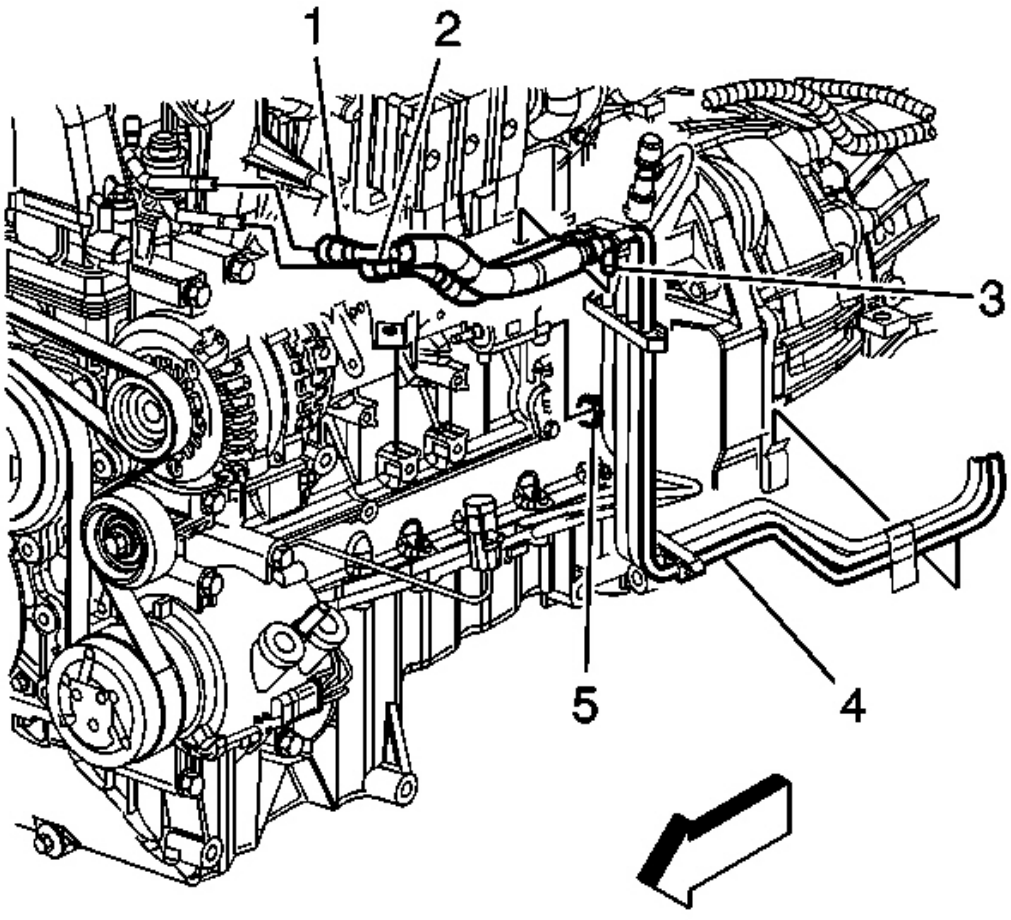


Fig. 81: Identifying Fuel Feed & Fuel Return Pipes (Left Side Of Engine)
Courtesy of GENERAL MOTORS CORP.

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 **Metal Collar Quick Connect Fitting Service** .

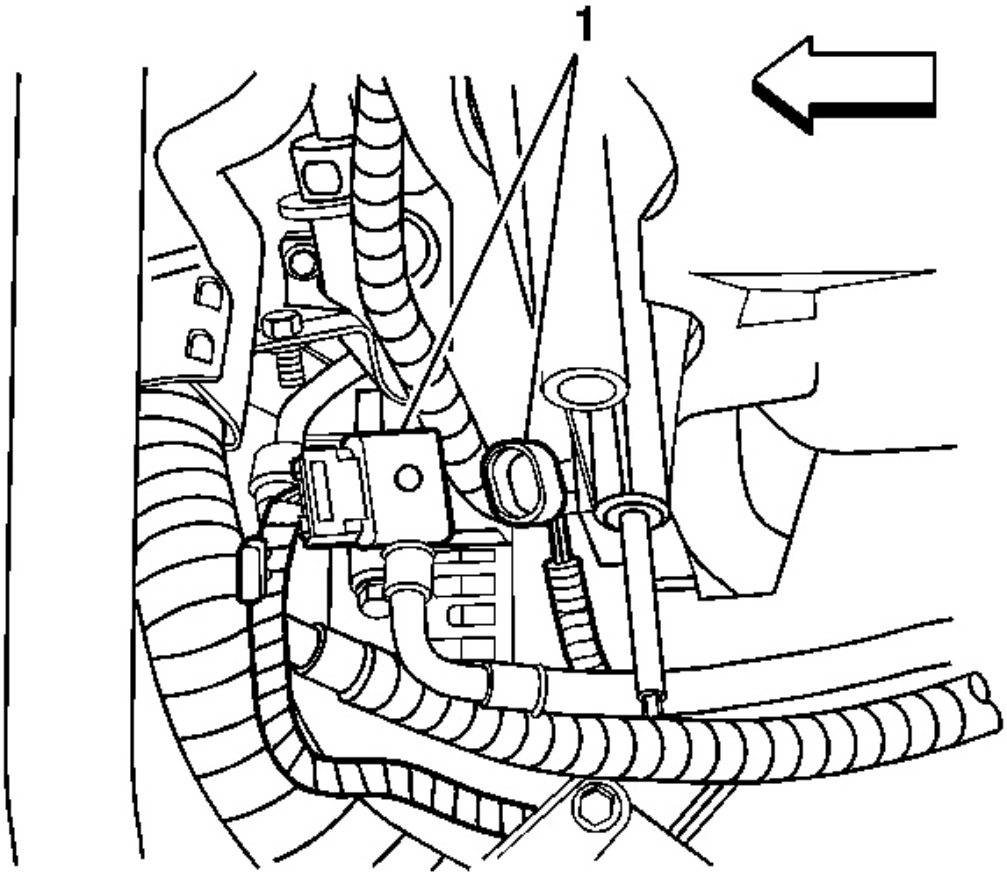


Fig. 82: View Of Engine Coolant Temperature Electrical Connector
Courtesy of GENERAL MOTORS CORP.

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

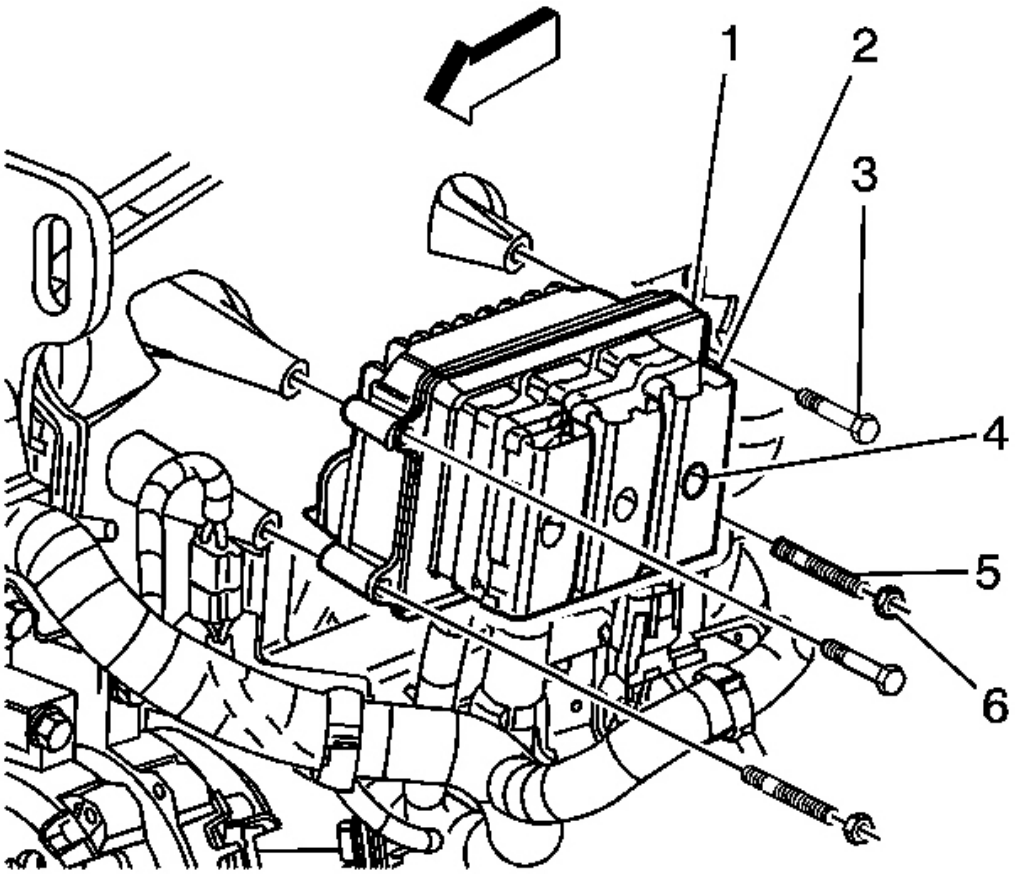


Fig. 83: View Of PCM Components
Courtesy of GENERAL MOTORS CORP.

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 **Cooling System Draining and Filling (LL8)** or **Cooling System Draining and Filling (LH6, LS2)**.

COOLANT HEATER REPLACEMENT (LH6 AND LS2)

Removal Procedure

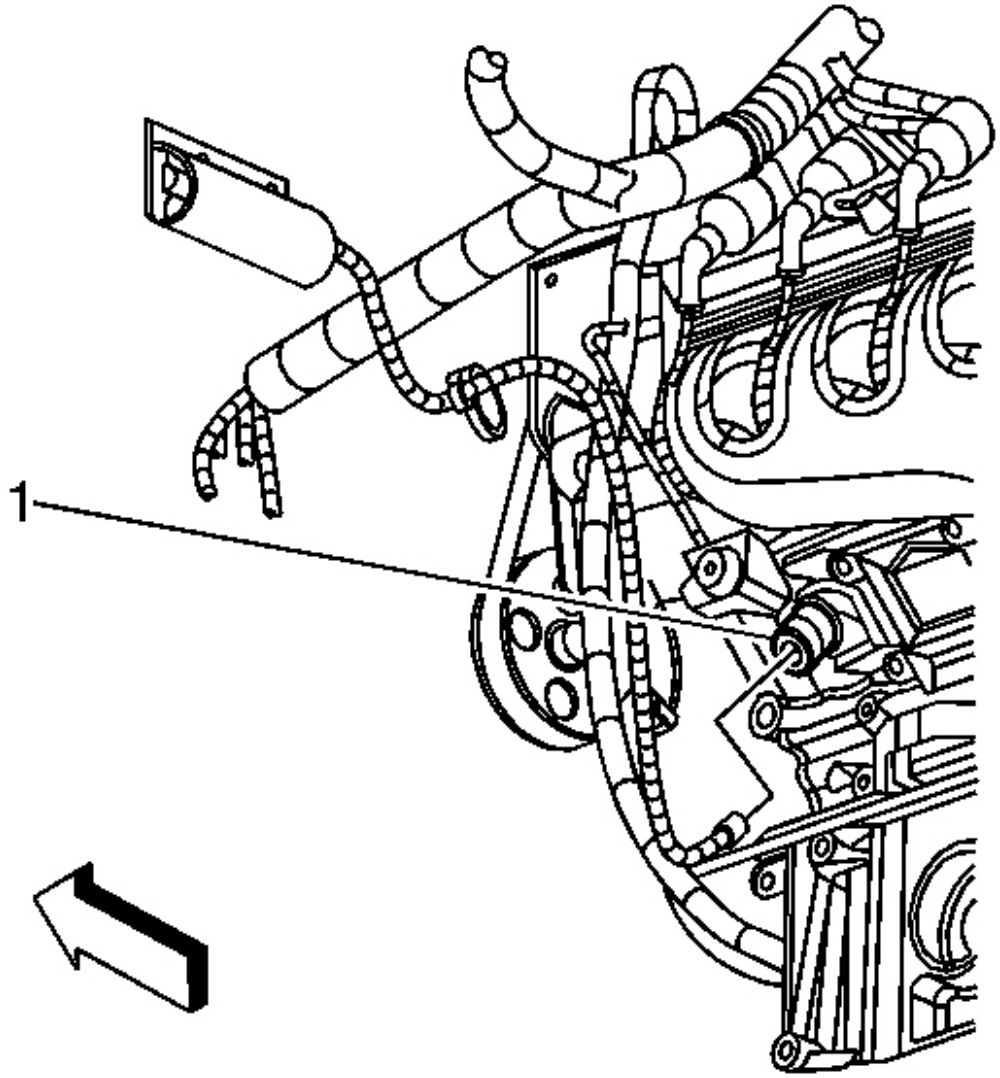


Fig. 84: View Of Coolant Heater (LM4)
Courtesy of GENERAL MOTORS CORP.

1. Drain the cooling system. Refer to **Cooling System Draining and Filling (LL8)** or **Cooling System Draining and Filling (LH6, LS2)**.
2. Raise and suitably support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
3. Disconnect the coolant heater (1) electrical connector.

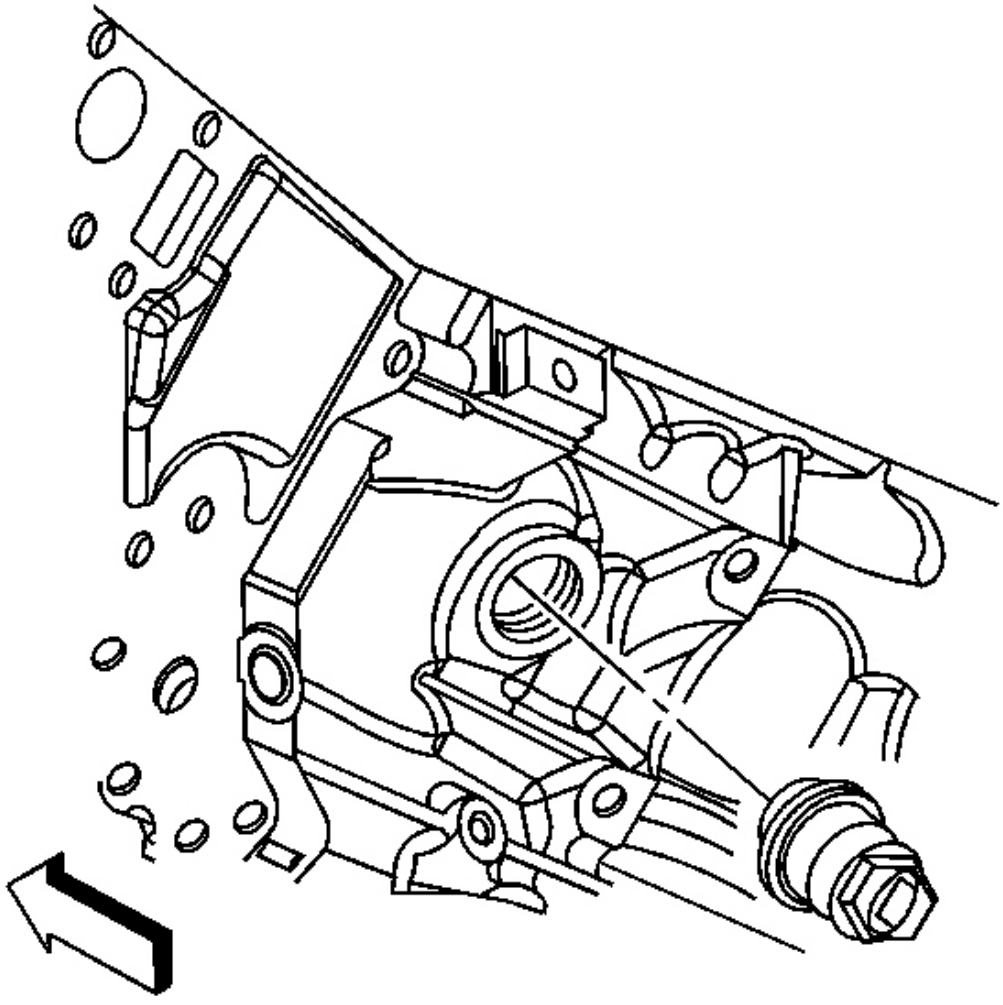


Fig. 85: View Of Coolant Heater & Engine Block
Courtesy of GENERAL MOTORS CORP.

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

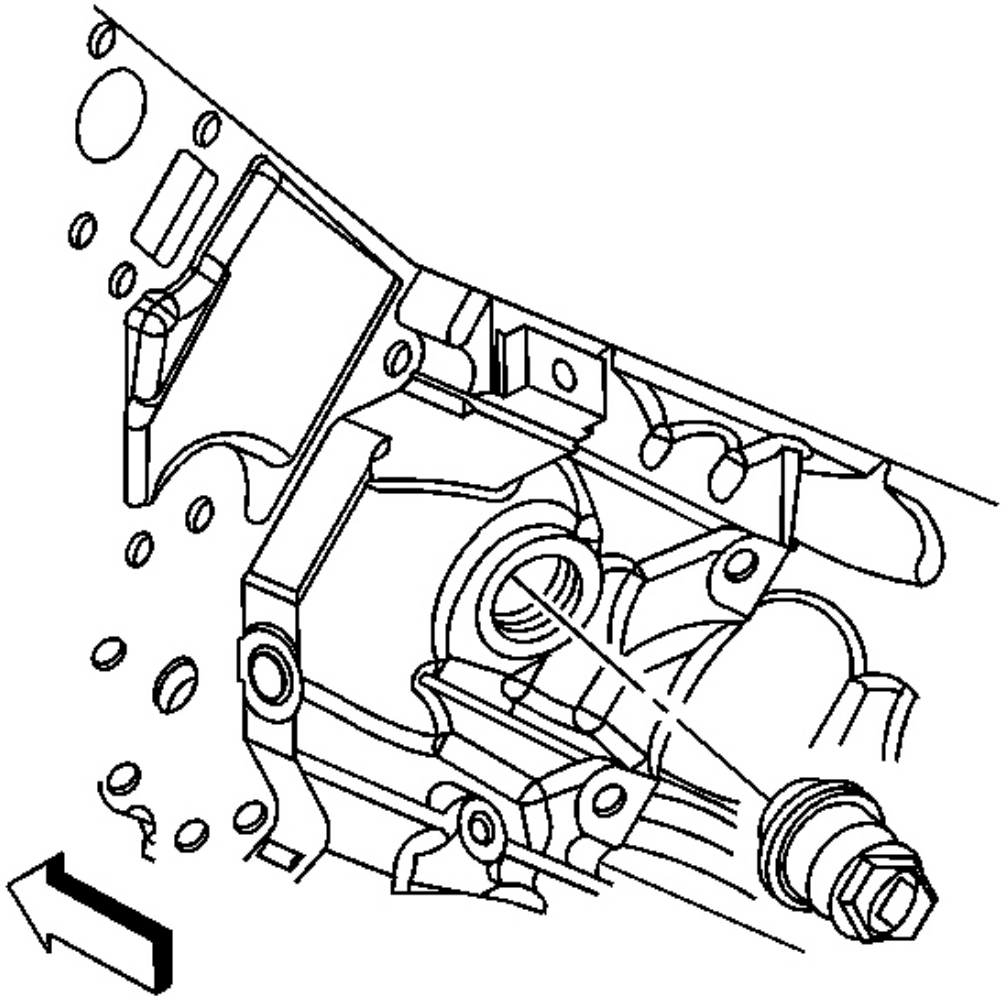


Fig. 86: View Of Coolant Heater & Engine Block
Courtesy of GENERAL MOTORS CORP.

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 .**

2. Install the coolant heater to the engine block.

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

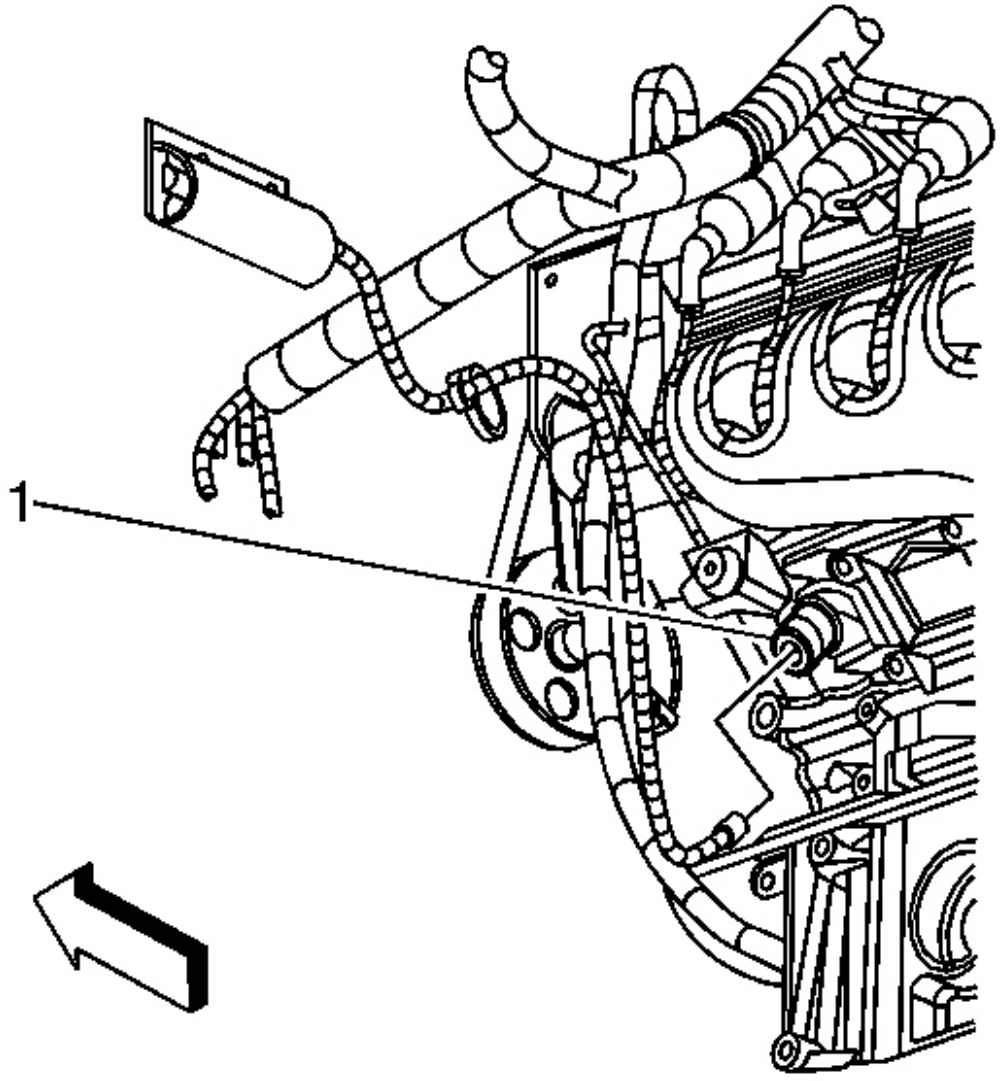


Fig. 87: View Of Coolant Heater (LM4)
Courtesy of GENERAL MOTORS CORP.

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 **Cooling System Draining and Filling (LL8)** or **Cooling System Draining and Filling (LH6, LS2)**.

COOLANT HEATER CORD REPLACEMENT

Removal Procedure

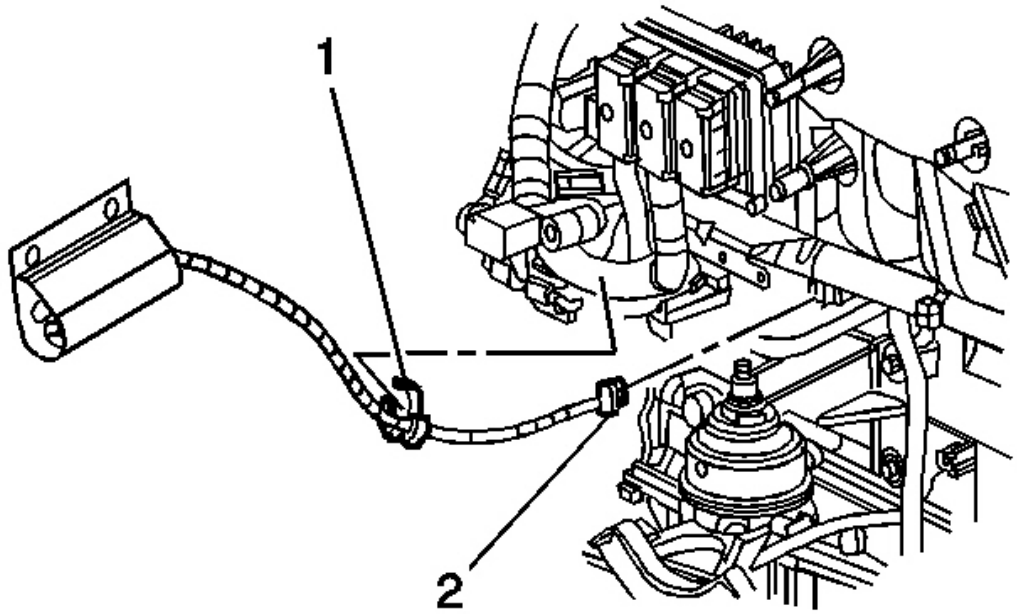


Fig. 88: View Of Engine Harness Bracket & Coolant Heater Cord
Courtesy of GENERAL MOTORS CORP.

1. If equipped with a 4.2L engine, remove the powertrain control module (PCM).
2. Remove the coolant heater cord from the engine harness bracket (1).
3. Remove the coolant heater cord from the coolant heater (2).

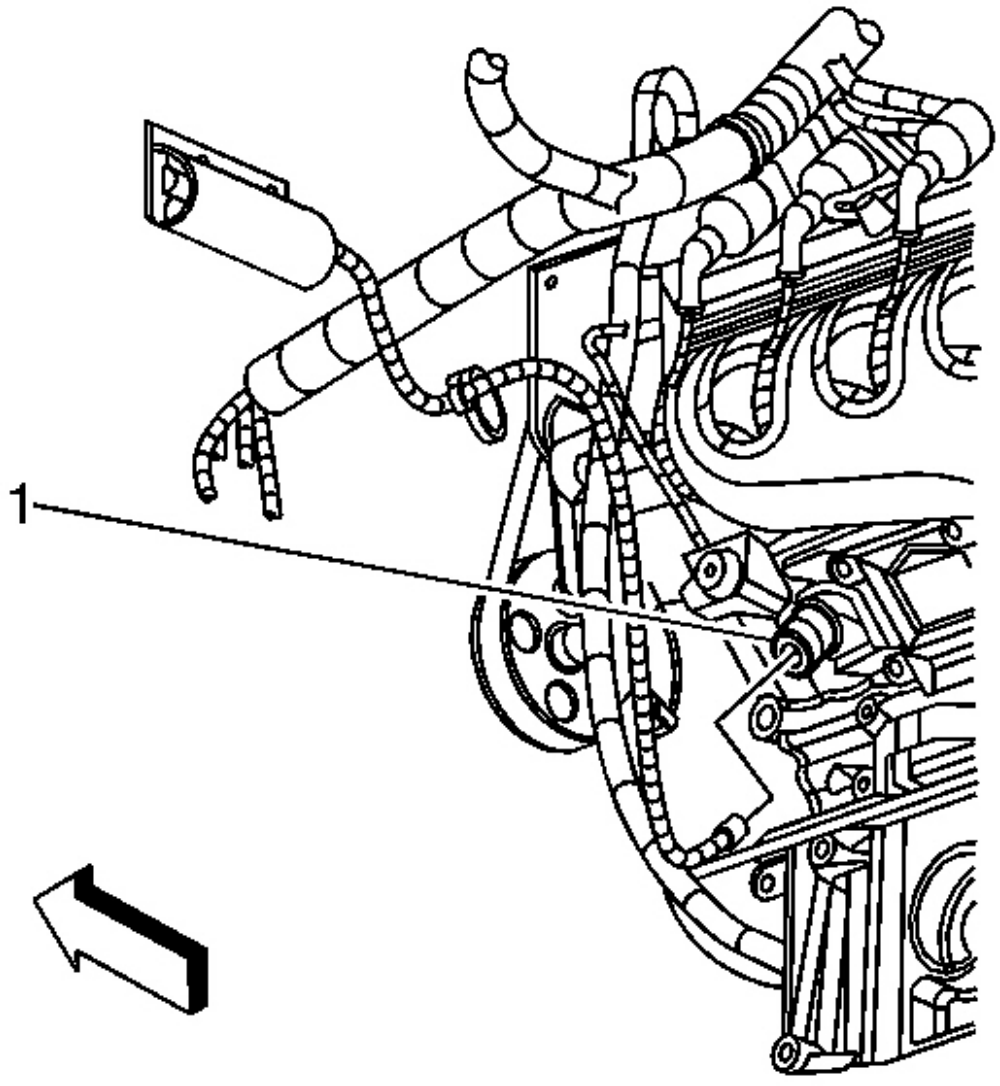


Fig. 89: View Of Coolant Heater (LM4)
Courtesy of GENERAL MOTORS CORP.

4. If equipped with a 5.3L or 6.0L engine, disconnect the coolant heater cord from the coolant heater (1).
5. Remove the coolant heater cord clip from the engine harness.

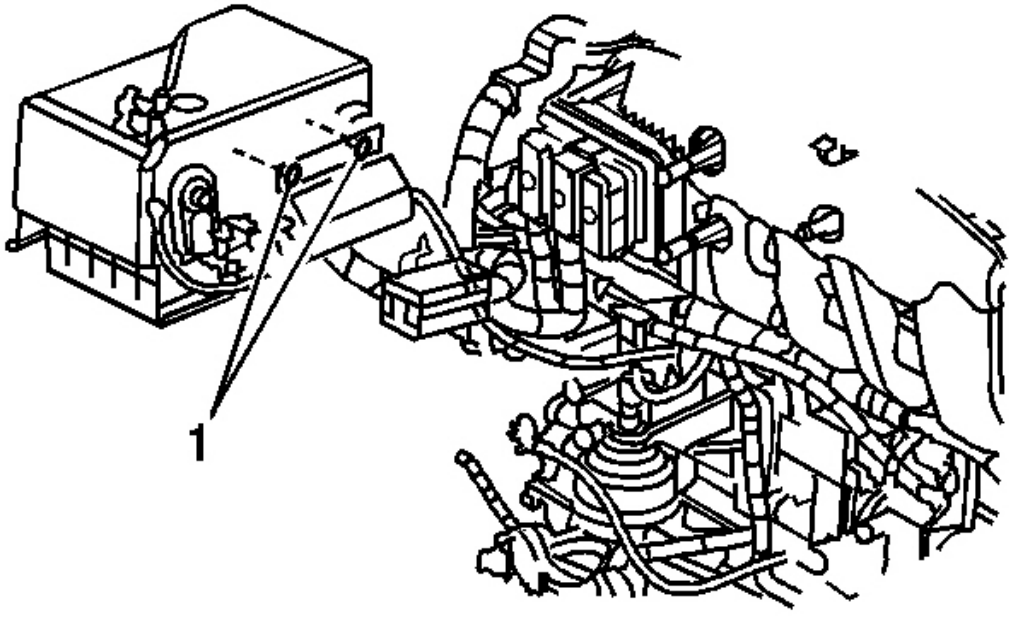


Fig. 90: View Of Coolant Heater Cord Retainers
Courtesy of GENERAL MOTORS CORP.

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

Installation Procedure

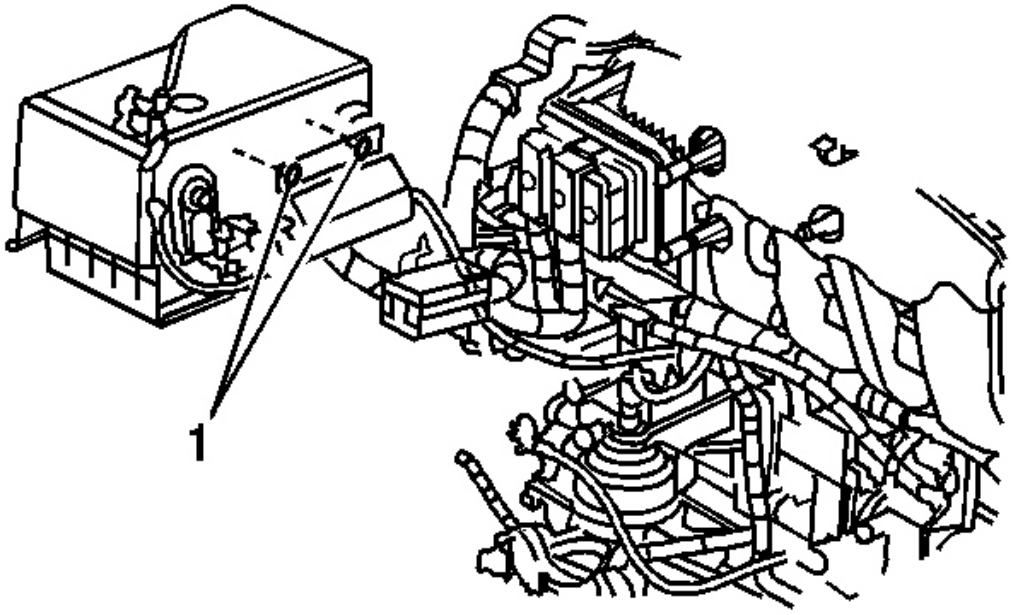


Fig. 91: View Of Coolant Heater Cord Retainers
Courtesy of GENERAL MOTORS CORP.

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

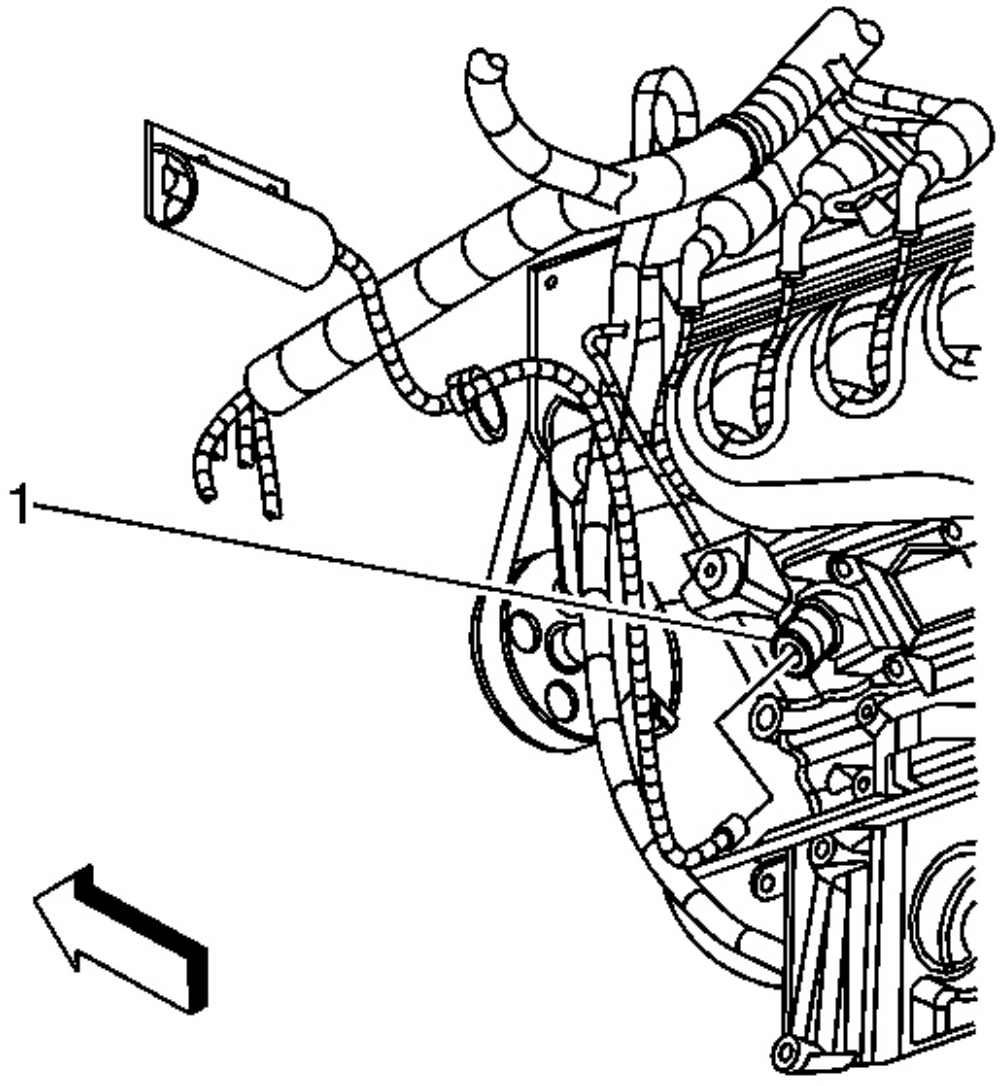


Fig. 92: View Of Coolant Heater (LM4)
Courtesy of GENERAL MOTORS CORP.

2. If equipped with a 5.3L or 6.0L engine, connect the coolant heater cord to the coolant heater (1).
3. Install the coolant heater cord clip to the engine harness.

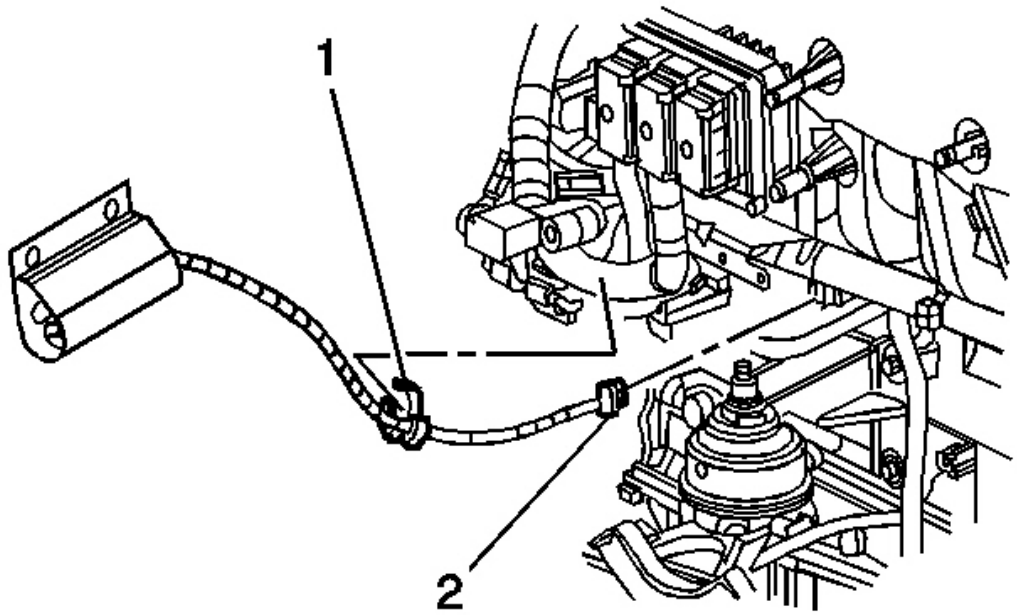


Fig. 93: View Of Engine Harness Bracket & Coolant Heater Cord
Courtesy of GENERAL MOTORS CORP.

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.

DESCRIPTION & OPERATION

COOLING SYSTEM DESCRIPTION & 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.

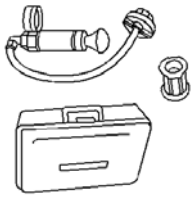
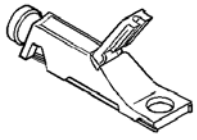
The transmission oil pump, pumps the fluid through the transmission oil cooler line to the transmission oil cooler. The fluid then flows through the cooler where the engine coolant absorbs heat from the fluid. The fluid is then pumped through the transmission oil cooler return line, to the transmission.

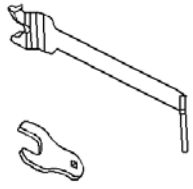
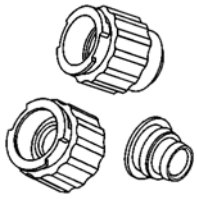
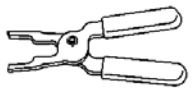
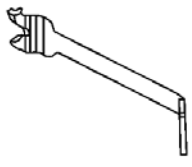
Coolant Heater

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 & EQUIPMENT

SPECIAL TOOLS

Illustration	Tool Number/ Description
	J 24460-01 Cooling System Pressure Tester
	J 24731 Tempil Stick
	J 26568 Coolant and Battery Fluid Tester
	J 38185

	Hose Clamp Pliers
	J 41240 Fan Clutch Remover and Installer
	J 42401 Radiator Cap and Surge Tank Test Adapters
	J 43244 Relay Puller Pliers
	J 46406 Fan Clutch Remover and Installer