2007 ENGINE

Engine Cooling - Avalanche, Escalade, Suburban, Tahoe & Yukon

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Air Cleaner Outlet Duct Clamp	4 N.m	35 lb in
Coolant Air Bleed Pipe Bolt	12 N.m	106 lb in
Coolant Heater Cord Bolt	8 N.m	71 lb in
Coolant Heater	50 N.m	37 lb ft
Cooling Fan Bolt	10 N.m	89 lb in
Engine Block Coolant Drain Plug	60 N.m	44 lb ft
Fan Shroud Bolt	9 N.m	80 lb in
Front Drive Axle Bolt/Nut	100 N.m	75 lb ft
Oil Cooler Hose Adapter Bolt	12 N.m	106 lb in
Oil Cooler Hose Bracket Bolt	25 N.m	18 lb ft
Oil Pan Skid Plate Bolt	20 N.m	15 lb ft
Radiator Bolt	25 N.m	18 lb ft
Surge Tank Bolt/Nut	10 N.m	89 lb in
Water Pump Bolt		
• First Pass	15 N.m	11 lb ft
• Final Pass	30 N.m	22 lb ft
Water Pump Inlet Bolt	15 N.m	11 lb ft

SCHEMATIC AND ROUTING DIAGRAMS

ENGINE COOLING SCHEMATICS

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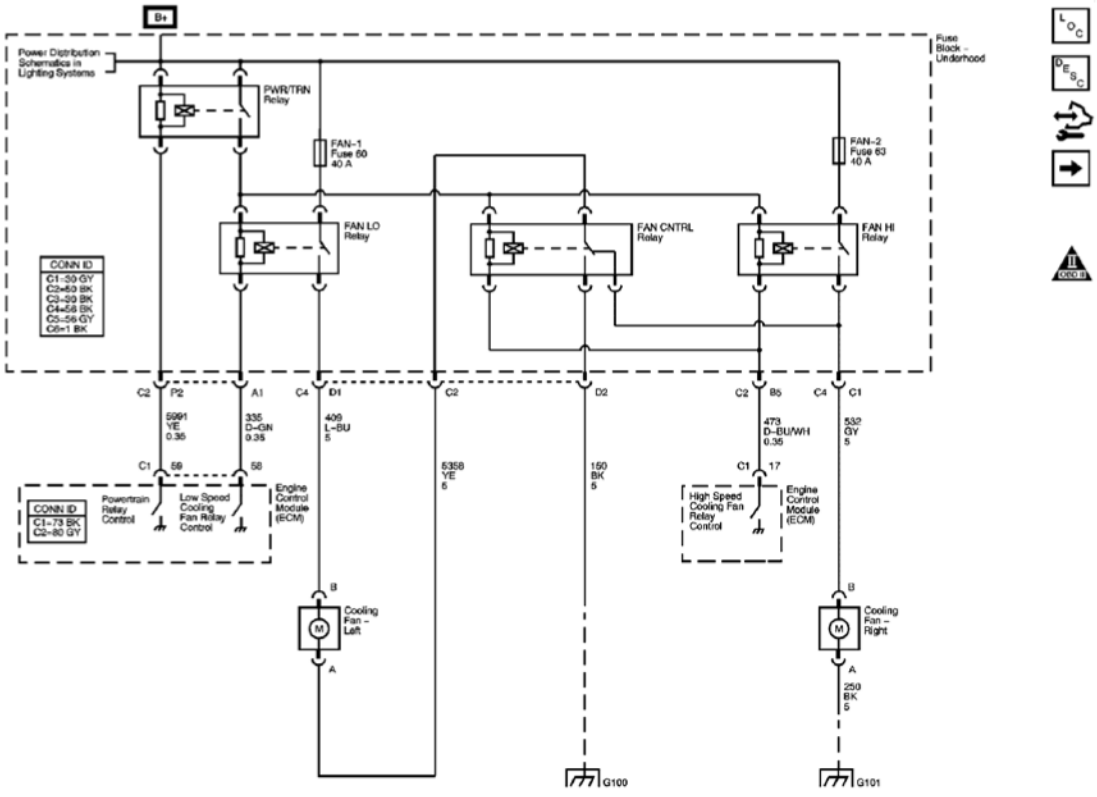


Fig. 1: Engine Cooling Schematic
Courtesy of GENERAL MOTORS CORP.

COMPONENT LOCATOR

COOLING SYSTEM COMPONENT VIEWS

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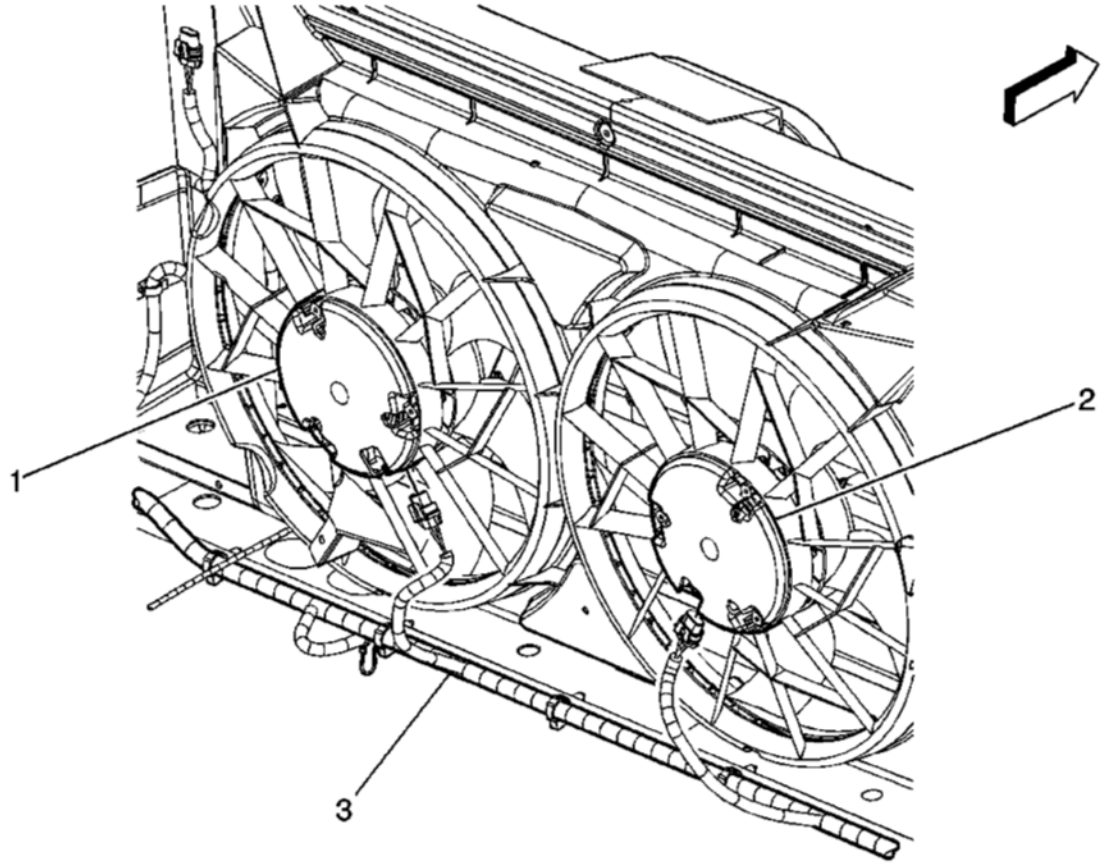


Fig. 2: Cooling Fans
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 2

Callout	Component Name
1	Cooling Fan - Left
2	Cooling Fan - Right
3	Forward Lamp Harness

COOLING SYSTEM CONNECTOR END VIEWS

Cooling Fan - Left

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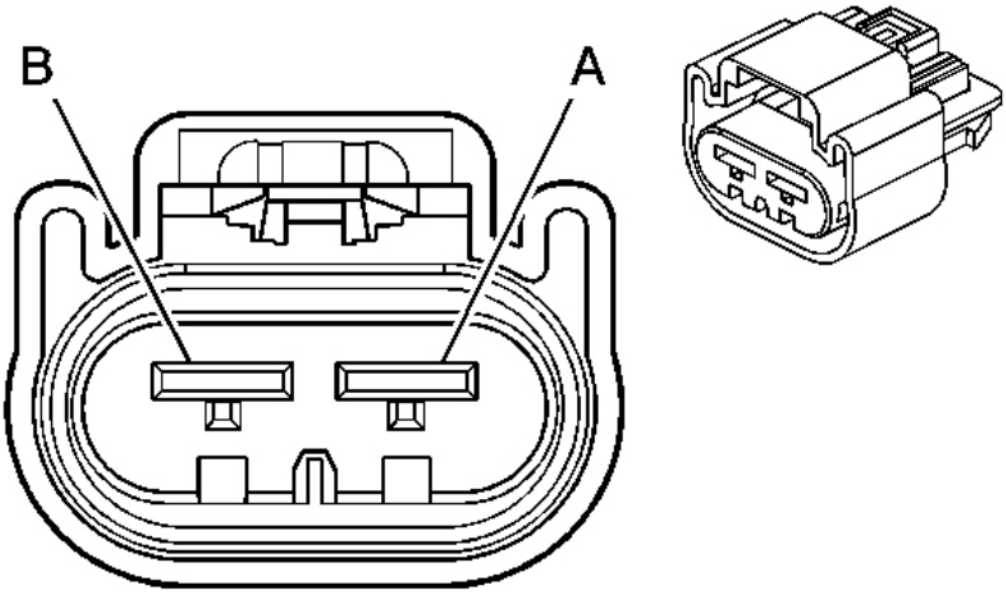


Fig. 3: Cooling Fan - Left Connector End View
Courtesy of GENERAL MOTORS CORP.

Cooling Fan - Left Connector Parts Information

Connector Part Information

- OEM: 15454358
- Service: 88987983
- Description: 2-Way F 630 GT Series Sealed (BK)

Terminal Part Information

- Terminal/Tray: 15455571/23
- Core/Insulation Crimp: F/3
- Release Tool/Test Probe: 15315247/J-35616-42 (RD)

Cooling Fan - Left Connector Terminal Identification

Pin	Wire Color	Circuit No.	Function
A	YE	5358	Auxiliary Cooling Fan Motor Supply Voltage
B	L-BU	409	Cooling Fan Motor Supply Voltage

Cooling Fan - Right

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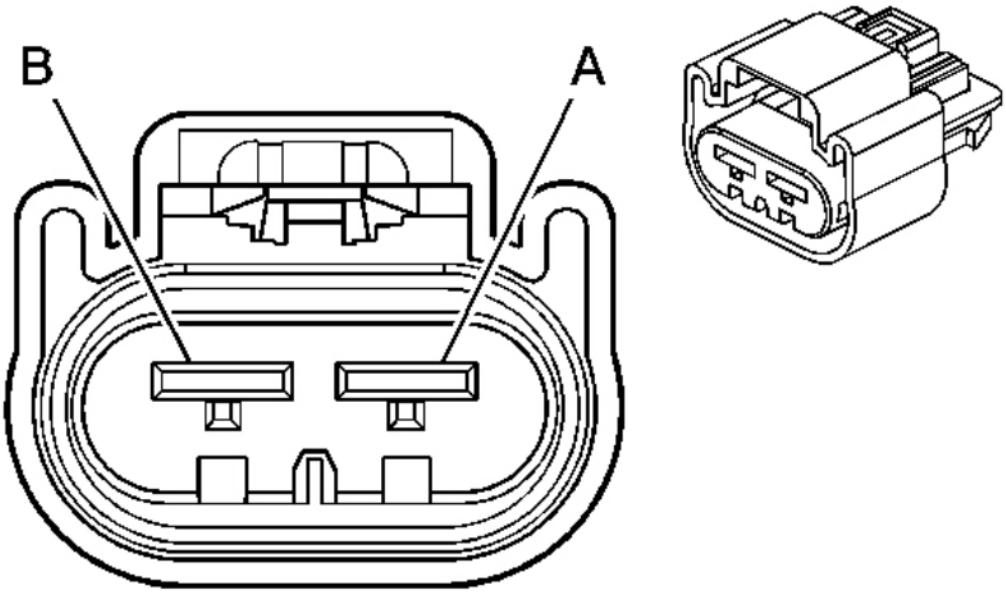


Fig. 4: Cooling Fan - Right Connector End View
Courtesy of GENERAL MOTORS CORP.

Cooling Fan - Right Connector Parts Information

Connector Part Information

- OEM: 15454358
- Service: 88987983
- Description: 2-Way F 630 GT Series Sealed (BK)

Terminal Part Information

- Terminal/Tray: 15455571/23
- Core/Insulation Crimp: F/3
- Release Tool/Test Probe: 15315247/J-35616-42 (RD)

Cooling Fan - Right Connector Terminal Identification

Pin	Wire Color	Circuit No.	Function
A	BK	250	Ground
B	GY	532	Cooling Fan Motor Supply Voltage

DIAGNOSTIC INFORMATION AND PROCEDURES

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DIAGNOSTIC CODE INDEX

DIAGNOSTIC CODE INDEX

DTC	Description
DTC P0480 or P0481	Cooling Fan Relay Control Circuit
DTC P1258	Engine Coolant Overtemperature - Protection Mode Active

DIAGNOSTIC STARTING POINT - ENGINE COOLING

Begin the system diagnosis with **Diagnostic System Check - Vehicle** The Diagnostic System Check - Vehicle will provide the following information:

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

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

SCAN TOOL OUTPUT CONTROLS

Scan Tool Output Controls

Scan Tool Output Control	Additional Menu Selection(s)	Description
Fan Relay 1	Cooling Fan	Commands the FAN LO relay ON and OFF. Both cooling fans will activate on low speed.
Fan Relays 2 and 3	Cooling Fan	Commands the FAN CNTRL and FAN HI relays ON and OFF. The driver side fan will be OFF. The passenger side fan will activate on high speed.
Fan Relays 1, 2, and 3	Cooling Fan	Commands the FAN LO, FAN HI, and FAN CNTRL relays ON and OFF. Both fans will activate on high speed.

SCAN TOOL DATA LIST

The Scan Tool Data List contains all engine cooling related parameters that are available on the scan tool. The list is arranged in alphabetical order. A given parameter may appear more than once, or in more than one data list in order to group certain related parameters together.

Use the Scan Tool Data List only after the following is determined:

- The Diagnostic System Check - Vehicle is completed.
- No diagnostic trouble codes (DTCs)
- On-board diagnostics are functioning properly.

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Scan tool values from a properly cooling system may be used for comparison with the system you are diagnosing. The Scan Tool Data List represents values that would be seen on a normal cooling system.

IMPORTANT: A scan tool that displays faulty data should not be used. The scan tool problem should be reported to the manufacturer. Use of a faulty scan tool can result in misdiagnosis and unnecessary parts replacement.

Only the parameters listed below are referenced in this service manual for use in diagnosis. If all values are within the typical range described below, refer to **Symptoms - Engine Cooling** for diagnosis.

The column labeled Data List indicates where a parameter can be located on the scan tool. Refer to the scan tool operating manual for the exact locations of the data lists. The following is a description of each term listed:

Scan Tool Data List

Scan Tool Parameter	Parameter Range/Units	Typical Data Values
Engine Idling/Radiator Hose Hot/Closed Throttle/Park/Closed Loop/Accessories OFF		
5-Volt Reference 1 Circuit Status	OK/Fault	OK
5-Volt Reference 2 Circuit Status	OK/Fault	OK
5-Volt Reference 1	Volts	4.5 V
5-Volt Reference 2	Volts	4.5 V
Cooling Fan Command	ON/OFF	OFF
Desired Fan Speed	RPM	0
ECT Sensor	-39 to +140°C (-38 to +284°F)	88-105°C (190-221°F)
Engine Load	0-100%	18% @ Idle 21% @ 2500 RPM
Engine Oil Temperature Calculated	Degrees C/F	85-105°C (185-220°F)
Engine Run Time	Hrs, Min, Sec	Varies
Engine Speed	0-10,000 RPM	500-700 RPM
Fan Speed	RPM	0
FC Circuit Status	OK, Incomplete, Short B+, Short Gnd/Open	OK/Incomplete
Fan Relay 1 Command	ON/OFF	OFF
Fan Relay 2 Command	ON/OFF	OFF
Fan Relay 2 and 3 Command	ON/OFF	OFF
Fan Relay 3 Command	ON/OFF	OFF
Hot Open Loop	Active/Inactive	Inactive
IAT Sensor	-39 to +140°C (-38 to +284°F)	35°C (91°F) Depends on Ambient Temperature
Ignition 1 Signal	0-25 Volts	11.5-14.5 Volts
Spark	Degrees	10-17°
Start-Up ECT	°C/°F	Varies
Start-Up IAT	°C/°F	Varies
Total Knock Retard	Degrees	0°

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TFT Sensor	°C/°F	Varies
Vehicle Speed Sensor	km/h mph	0

DTC P0480 OR P0481

DTC Descriptor

DTC P0480

Cooling Fan Relay 1 Control Circuit

DTC P0481

Cooling Fan Relay 2 Control Circuit

Diagnostic Fault Information

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

DTC P0480 or P0481

Circuit	Short to Ground	High Resistance	Open	Short to Voltage
Low Speed Cooling Fan Relay Control Circuit	P0480	P0480	P0480	P0480
High Speed Cooling Fan Relay Control Circuit	P0481	P0481	P0481	P0481

Circuit/System Description

The engine control module (ECM) commands the fans ON in either high speed or low speed, depending on cooling requirements. In low speed, the fans are configured in series. In high speed, the fans are configured in parallel.

In low speed operation, the ECM applies ground to the coil side of the fan low relay. Voltage is applied directly to the left cooling fan through the switch side of the fan low relay, which is fed by the fan 1 fuse. The right fan is connected in series to the left fan through the de-energized fan control relay so that both operate at low speed.

In high speed operation, the ECM applies a ground to the coil side of the fan low relay, the fan control relay, and the fan high relay. Voltage is applied directly to the right cooling fan through the switch side of the relay, which is fed by the fan 2 fuse. The left cooling fan obtains voltage through the fan low relay and ground through the fan control relay.

The ECM monitors the low and high speed cooling fan relay control circuits for the following conditions:

- Short to ground
- Short to voltage

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- An open circuit

If the ECM detects an improper voltage level on the low or high speed ECM driver circuits, then DTC P0480 or P0481 will set and the affected ECM driver will be disabled.

Conditions for Running the DTC

- The battery voltage is between 9-18 volts.
- The engine speed is greater than 400 RPM.

Conditions for Setting the DTC

- The commanded state of the output driver module (ODM) and the actual state of the control circuit do not match.
- The condition is present for more than 5 seconds.

Action Taken When the DTC Sets

DTCs P0480 and P0481 are Type B DTCs.

Conditions for Clearing the MIL/DTC

DTCs P0480 and P0481 are Type B DTCs.

Diagnostic Aids

- This test procedure requires that the vehicle battery has passed a load test and is completely charged. Refer to **Battery Inspection/Test** .
- When disconnecting electrical connectors or removing fuses and relays from a fuse block, always inspect the component electrical terminals for corrosion and the mating electrical terminals for tightness.
- Use the **J 35616** Connector Test Adapter Kit for any test that requires probing the underhood fuse block terminals, component wire harness terminals, or the ECM wire harness connector terminals.

Reference Information

Schematic Reference

Engine Cooling Schematics

Connector End View Reference

- **Engine Controls Connector End Views**
- **Electrical Center Identification Views**
- **Engine Control Module Connector End Views**

Description and Operation

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Cooling Fan Description and Operation

Electrical Information Reference

- Circuit Testing
- Connector Repairs
- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

- Scan Tool Data List
- Scan Tool Data Definitions
- Scan Tool Output Controls

Special Tools Required

J 43244 Relay Puller Pliers

Circuit/System Verification

1. Ignition ON, command the cooling fan relay 1 ON and OFF several times using the scan tool output control function. You should hear both fans turn ON and OFF. Both should run on low speed when turned ON.
2. Ignition ON, command the cooling fan relays 2 and 3 ON and OFF several times using the scan tool output control function. When turned ON, the right fan should run on high and the left fan should remain OFF.
3. Ignition ON, command the cooling fan relays 1, 2, and 3 ON and OFF several times using the scan tool output control function. When turned ON, both fans should run on high speed.

Circuit/System Testing

P0480

1. Ignition OFF, disconnect the cooling fan low relay from the underhood fuse block.
2. Ignition ON, verify that a test lamp illuminates between the fan low relay coil voltage supply circuit and ground.
    - If the test lamp does not illuminate, test the fan low relay coil voltage supply circuit for and open/high resistance.
3. Connect a test lamp between the fan low relay coil supply voltage circuit and the fan low relay coil control circuit. With a scan tool, command the fan relay 1 ON and OFF. Verify that the test lamp turns

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ON and OFF with each command.

- If the test lamp remains illuminated with each command, test the relay coil control circuit for a short to ground. If the circuit tests normal, replace the control module.
- If the test lamp does not illuminate, test the relay coil control circuit for and open or a short to voltage. If the circuit tests normal, replace the control module.

4. If the circuits test normal, replace the fan low relay.

P0481

1. Ignition OFF, disconnect the cooling fan high relay from the underhood fuse block.
2. Ignition ON, verify that a test lamp illuminates between the fan high relay coil voltage supply circuit and ground.
   - If the test lamp does not illuminate, test the fan high relay coil voltage supply circuit for and open/high resistance.
3. Connect a test lamp between the fan high relay coil supply voltage circuit and the fan high relay coil control circuit. With a scan tool, command the fan relays 2 and 3 ON and OFF. Verify that the test lamp turns ON and OFF with each command.
   - If the test lamp remains illuminated with each command, remove the fan control relay and retest. If the test lamp now turns ON and OFF with the fan control relay removed, replace the fan control relay. If the test lamp still remains illuminated when commanded ON and OFF, test the fan high relay coil control circuit for a short to ground. If the circuit tests normal, replace the control module.
   - If the test lamp does not illuminate, test the fan high relay coil control circuit for and open or a short to voltage. If the circuit tests normal, replace the control module.
4. If all circuits test normal, replace the fan high relay.

Repair Procedures

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

- **Relay Replacement (Attached to Wire Harness)** or **Relay Replacement (Within an Electrical Center)**
- **Underhood Electrical Center or Junction Block Replacement**
- **Control Module References** for ECM replacement, setup, and programming

DTC P1258

DTC Descriptor

DTC P1258

Engine Coolant Overtemperature - Protection Mode Active

Diagnostic Fault Information

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

Circuit/System Description

The engine control module (ECM) uses the engine coolant temperature (ECT) sensor to monitor the engine for an over-termperature 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 of cylinders by turning OFF the fuel injectors. By disabling half of the cylinders, the ECM is able to reduce the temperature of the coolant.

Conditions for Running the DTC

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

Conditions for Setting the DTC

Coolant temperature more than 132°C (270°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 driver information center (DIC), if equipped, may 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

Engine Cooling

- **Scan Tool Data List**

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- **Scan Tool Output Controls**

Circuit/System Verification

If DTCs P0480 or P0481 are set, diagnose those DTCs first.

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**.

IMPORTANT: A small delay occurs before the ECM changes the cooling fan speed.

4. Command the cooling fans in both low and high speed.
   - If the cooling fans do not operate in both speeds, refer to **Cooling Fan Inoperative**.

Circuit/System Testing

1. Test the thermostat for correct operation. Refer to **Thermostat Diagnosis**.
2. Test the engine cooling system for overheating. Refer to **Engine Overheating**.
3. Inspect the water pump and coolant flow for correct operation. Refer to **Water Pump Replacement (RPOs LY2/LC9/LY5/LMG)** or **Water Pump Replacement (RPOs LY6/L76/L92)**.
4. Inspect the engine mechanical for worn/leaking/cracked cylinder heads and engine block. Refer to **Coolant in Combustion Chamber** and **Coolant in Engine Oil** .

Repair Procedures

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 the following:

- **Cooling System Description and Operation**
- **Cooling Fan Description and Operation**
- **Cooling System Description and Operation**

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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:

- **Cooling Fan Always On**
- **Cooling Fan Inoperative**
- **Engine Overheating**
- **Loss of Coolant**
- **Thermostat Diagnosis**
- **Engine Fails To Reach Normal Operating Temperature**

COOLING FAN ALWAYS ON

Circuit/System Description

The engine control module (ECM) commands the fans ON in either high speed or low speed, depending on cooling requirements. In low speed, both fans are turned ON at a reduced speed. High speed has both fans turned ON at full speed.

In low speed operation, the ECM applies ground to the coil side of the fan low relay. This energizes the coil and applies voltage directly to the left cooling fan through the switch side of the fan low relay, which is fed by the fan 1 fuse. The right fan is connected in series to the left fan through the de-energized fan control relay so that both operate at low speed.

In high speed operation, the ECM applies a ground to the coil side of the fan low relay, the fan control relay, and the fan high relay. On the fan high relay, the energized coil closes the switch side of the relay and applies voltage directly to the right cooling fan through the switch side of the relay, which is fed by the fan 2 fuse. At the same time, the ECM energizes fan control relay pulling the switch side over, providing a direct path to ground for the left cooling fan, which has voltage applied through the energized fan low relay. In high speed mode, the fans are operated as a parallel circuit with full voltage applied to each.

Reference Information

Schematic Reference

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Engine Cooling Schematics

Connector End View Reference

Cooling System Connector End Views

Description and Operation

Cooling Fan Description and Operation

Electrical Information Reference

- Circuit Testing
- Connector Repairs
- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs

Circuit/System Verification

1. If DTCs P0480 or P0481 are set, perform those diagnostics first.
2. Ignition ON, verify with a scan tool that the control module is not commanding fan activation.
3. Ignition ON, observe that the fans are not activated.

Circuit/System Testing

1. Ignition OFF, disconnect the fan high relay.
2. Ignition ON, observe that both fans are now OFF.
    - If both fans are OFF, replace the fan high relay. If either fan is still activated, remove the fan low relay. If both fans are now OFF replace the fan low relay. If either fan is still activated, test for a short to voltage in the fan voltage supply circuit.

Repair Procedures

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

Repair Verification

1. Ignition ON, verify with a scan tool that the control module is not commanding fan activation.
2. Ignition ON, observe that the fans are not activated.

COOLING FAN INOPERATIVE

Diagnostic Fault Information

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

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Circuit/System Description

The engine control module (ECM) commands the fans ON in either high speed or low speed, depending on cooling requirements. In low speed, both fans are turned ON at a reduced speed. High speed has both fans turned ON at full speed.

In low speed operation, the ECM applies ground to the coil side of the fan low relay. This energizes the coil and applies voltage directly to the left cooling fan through the switch side of the fan low relay, which is fed by the fan 1 fuse. The right fan is connected in series to the left fan through the de-energized fan control relay so that both operate at low speed.

In high speed operation, the ECM applies a ground to the coil side of the fan low relay, the fan control relay, and the fan high relay. On the fan high relay, the energized coil closes the switch side of the relay and applies voltage directly to the right cooling fan through the switch side of the relay, which is fed by the fan 2 fuse. At the same time, the ECM energizes fan control relay pulling the switch side over, providing a direct path to ground for the left cooling fan, which has voltage applied through the energized fan low relay. In high speed mode, the fans are operated as a parallel circuit with full voltage applied to each.

Diagnostic Aids

The ECM has the capability of providing command to the fan relays even while a scan tool output control is being used. Always refer to the fan control command parameters on the scan tool to know which fans are being commanded ON by the ECM.

Reference Information

Schematic Reference

Engine Controls Schematics

Description and Operation

Cooling Fan Description and Operation

Connector End View Reference

- **Engine Controls Connector End Views**
- **Electrical Center Identification Views**
- **Engine Control Module Connector End Views**

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

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Scan Tool Reference

- **Scan Tool Data List**
- **Scan Tool Data Definitions**
- **Scan Tool Output Controls**

Circuit/System Verification

1. Verify that the following DTCs are not set: P0480 or P0481.
    - If either of the DTCs is set, repair the DTC first.
2. Ignition ON, command high and low speed fans ON and OFF with a scan tool. Observe to verify that the fans turn ON and OFF when changing between the commanded states.

Circuit/System Testing

1. Ignition OFF, disconnect fan high, fan low, and fan control relays.
2. Connect a 30-amp fused jumper between the normally-open switch contact terminals at the fan control relay connector in order to complete the left fan ground circuit. Leave this jumper in place for the remainder of this procedure.
3. One at a time, connect a 30-amp fused jumper between the positive terminal at the battery and the fan voltage supply circuit terminal at each relay connection and verify the appropriate fan activation.
    - If the appropriate fan does not activate, test the fan voltage supply circuit for a short to ground or open/high resistance. If the circuit tests normal, test the fan ground circuit for open/high resistance. If the circuits test normal, replace the fan.
4. Ignition ON, connect a 30-amp fused jumper between the relay switch voltage supply circuit terminal and the fan voltage supply circuit terminal at the low speed and then the high speed relay connections and verify the appropriate fan activation.
    - If the appropriate fan does not activate, test the relay switch voltage supply circuit for a short to ground or high resistance.
5. If the circuits and fans test normal, replace the relay.

Repair Procedures

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

- **Cooling Fan Motor Replacement - Electric**
- **Relay Replacement (Attached to Wire Harness)** or **Relay Replacement (Within an Electrical Center)**

Repair Verification

Ignition ON, command the fan relay ON and OFF with a scan tool. Observe to verify that the appropriate fan turns ON and OFF with each command.

ENGINE OVERHEATING

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Engine Overheating

Step	Action	Yes	No
1	Inspect for a missing or damaged radiator side or upper baffle and/or radiator air deflector. Is the baffle and/or deflector missing or damaged?	Go to **Step 8**	Go to **Step 2**
2	Inspect for a loss of coolant. Is there a loss of coolant?	Go to **Step 3**	Go to **Step 4**
3	Fill the system to the specified level. Does the engine overheat?	Go to **Step 4**	System OK
4	Inspect for low temperature protection. Is the coolant to the correct concentration?	Go to **Step 5**	Go to **Step 8**
5	Inspect for a loss of cooling system pressure. Is there a loss of system pressure?	Go to **Step 8**	Go to **Step 6**
6	Inspect for a faulty engine coolant temperature (ECT) sensor. Refer to **DTC P0117 or P0118** . Is the sensor operating properly?	Go to **Step 7**	Go to **Step 8**
7	Inspect for the following: • Damaged coolant surge tank • Leaking hose • Bad/incorrect surge tank or radiator cap Were any of the above found?	Go to **Step 8**	Go to **Step 3**
8	Repair or install new parts as necessary, then retest. Does the engine overheat?	Go to **Step 9**	System OK
9	Inspect for incorrect drive belt tension. Is the belt tension correct?	Go to **Step 10**	Go to **Step 8**
10	1. Remove the water pump. Refer to **Water Pump Replacement (RPOs LY2/LC9/LY5/LMG)** or **Water Pump Replacement (RPOs LY6/L76/L92)**. 2. Inspect for a damaged water pump shaft/hub. Is the water pump driveshaft damaged or is the seal leaking?	Go to **Step 8**	Go to **Step 11**
11	Inspect for obstructed radiator air flow or bent radiator fins. Is the radiator air flow obstructed?	Go to **Step 8**	Go to **Step 12**
12	Inspect for blocked cooling system passages. Are the cooling system passages blocked?	Go to **Step 8**	Go to **Step 13**
13	Inspect the thermostat. Refer to **Thermostat Diagnosis**. Is the thermostat stuck in the closed position?	Go to **Step 15**	Go to **Step 16**
	Replace the thermostat. Refer to **Engine Coolant**		

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14	**Thermostat Housing Replacement**. Does the engine overheat?	Go to **Step 16**	System OK
15	Inspect the radiator cooling capacity. Is the proper sized radiator being used on the vehicle?	Go to **Step 3**	Go to **Step 17**
16	Consult the current parts catalog and replace the radiator. Refer to **Radiator Replacement**. Is the repair complete?	System OK	-

LOSS OF COOLANT

Loss of Coolant

Step	Action	Yes	No
DEFINITION: The cooling system is loosing 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 System Check - Vehicle** . Is the action complete?	Go to **Step 3**	-
3	Inspect the coolant level. Is the coolant at the proper level?	Go to **Step 5**	Go to **Step 4**
4	Fill the cooling system to the proper level. Refer to **Draining and Filling Cooling System**. Is the action complete?	Go to **Step 5**	-
5	Engine overheating can cause a loss of coolant. Is the engine overheating?	Go to **Step 19**	Go to **Step 6**
6	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 7**	Go to **Step 8**
7	• 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 20**	Go to **Step 8**
8	Visually inspect the hoses, pipes and hose clamps. Are any of the hoses, clamps or pipes leaking?	Go to **Step 21**	Go to **Step 9**
	Visually inspect the following components: • Block heater • Coolant pressure cap		

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9	• Core plugs • Throttle body • Engine block • Intake manifold • Radiator • Thermostat housing • Water pump Are any of the listed components leaking?	Go to **Step 21**	Go to **Step 10**
10	1. Pressure test the cooling system. Refer to **Cooling System Leak Testing**. 2. With the cooling system pressurized, visually inspect the components listed in steps 7 and 8. Are any leaks present?	Go to **Step 21**	Go to **Step 11**
11	Pressure test the coolant pressure cap. Refer to **Pressure Cap Testing**. Does the coolant pressure cap hold pressure?	Go to **Step 12**	Go to **Step 16**
12	Inspect for the following conditions: • A coolant smell inside of the vehicle • Coolant in the HVAC module drain tube • Coolant on the vehicle floor covering near the HVAC module Is coolant present?	Go to **Step 21**	Go to **Step 13**
13	Inspect the underside of the engine oil fill cap for a gray/white milky substance. Is there a milky substance under the oil fill cap?	Go to **Step 14**	Go to **Step 15**
14	Inspect the engine oil fluid level indicator for a gray/white milky substance. Is there a milky substance on the engine oil fluid level indicator?	Go to **Step 17**	Go to **Step 15**
15	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 18**	Go to **Step 22**
16	Replace the coolant pressure cap. Is the repair complete?	Go to **Step 22**	-
	1. Replace the radiator. Refer to **Radiator**		

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17	**Replacement**. 2. Replace the oil and filter. Refer to **Engine Oil and Oil Filter Replacement** Is the repair complete?	Go to **Step 22**	-
18	1. Replace the radiator. Refer to **Radiator Replacement**. 2. Service the automatic transmission. Refer to one of the following: • **Engine Coolant/Water in Transmission** for the 4L60-E/4L65-E transmission • **Engine Coolant/Water in Transmission** for the 4L80-E/4L85-E transmission Is the repair complete?	Go to **Step 22**	-
19	Repair the engine overheating condition. Refer to **Engine Overheating**. Is the repair complete?	Go to **Step 22**	-
20	Repair the engine internal coolant leak. Refer to **Coolant in Combustion Chamber** or, **Coolant in Engine Oil** . Is the repair complete?	Go to **Step 22**	-
21	Repair or replace the leaking component. Refer to the appropriate repair. Is the repair complete?	Go to **Step 22**	-
22	Operate the system in order to verify the repair. Did you find and correct the condition?	System OK	Go to **Step 2**

THERMOSTAT DIAGNOSIS

Tools Required

J 24731 Tempil Stick. See **Special Tools**.

Use one of the following procedures in testing for a malfunctioning thermostat.

Thermostat Test Procedure Using Tempil Sticks

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

1. Use a tempil stick in order to find the opening and the closing temperatures of the coolant thermostat.
   - **J 24731** -188 tempil stick melts at 87°C (188°F). See **Special Tools**. The thermostat should begin

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to open.

- **J 24731** -206 tempil stick melts at 97°C (206°F). See **Special Tools**. The thermostat should be fully open.

2. Replace the coolant thermostat if it does not operate properly between this temperature range.

Thermostat Test Procedure Using Glycol

Inspect the operation of the thermostat by hanging the thermostat on a hook in a 50/50 percent solution of DEX-COOL® and clean drinkable water.

In order to inspect if the thermostat valve is opening properly, perform the following test:

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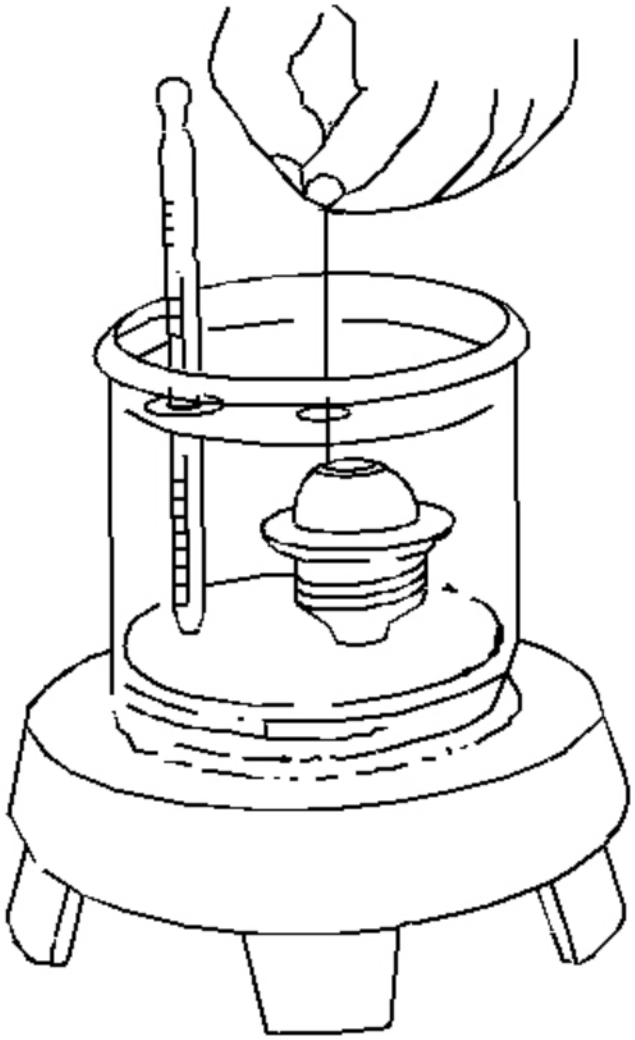


Fig. 5: View Of Thermostat Test Procedure Using Glycol
Courtesy of GENERAL MOTORS CORP.

1. Completely submerge the thermostat in the glycol solution. The solution should be 11°C (22°F) above the temperature indicated on the thermostat valve.
2. Thoroughly agitate the solution. Under these conditions, the thermostat valve should open.

In order to inspect if the thermostat valve is closing properly, perform the following test:

1. Completely submerge the thermostat in a glycol solution. The solution should be 6°C (10°F) below the

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temperature indicated on the thermostat valve.

2. Thoroughly agitate the solution. Under these conditions, the thermostat valve should close completely.

COOLANT HEATER INOPERATIVE

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**
- **Testing for Intermittent Conditions and Poor Connections**
- **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 (RPOs LC9/L76/L92)** or **Coolant Heater Replacement (RPOs LY2/LMG/LY5/LY6)**
- **Coolant Heater Cord Replacement (RPO LY6)** or **Coolant Heater Cord Replacement (RPOs LC9/L76/L92)** or **Coolant Heater Cord Replacement (RPOs LY2/LY5/LMG)**

ENGINE FAILS TO REACH NORMAL OPERATING TEMPERATURE

Engine Fails To Reach Normal Operating Temperature

Step	Action	Yes	No
	Did you review the Symptoms-Engine Cooling		

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1	diagnostic information and perform the necessary inspections?	Go to **Step 2**	Go to **Symptoms - Engine Cooling**
2	Verify that the engine does not reach normal operating temperature. Does the engine reach normal operating temperature?	System OK	Go to **Step 3**
3	Inspect the coolant level. Is the coolant level below the add mark?	Go to **Step 4**	Go to **Step 5**
4	1. Add coolant as necessary. 2. Perform a cooling system pressure test. Does the cooling system hold pressure?	System OK	Go to **Step 5**
5	Inspect for a stuck open, missing, or incorrect 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 Housing Replacement**. Is the repair complete?	Go to **Step 7**	-
7	Run the engine in order to verify the repair. Does the engine fail to reach normal operating temperature?	-	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.

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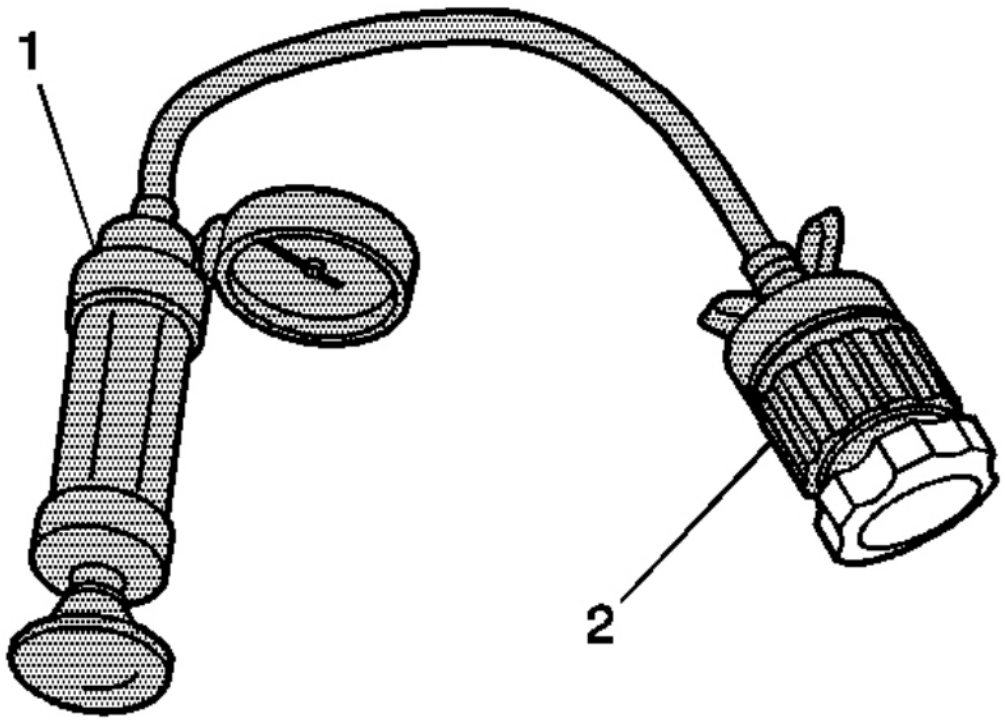


Fig. 6: Pressure Testing Radiator Cap
Courtesy of GENERAL MOTORS CORP.

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

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

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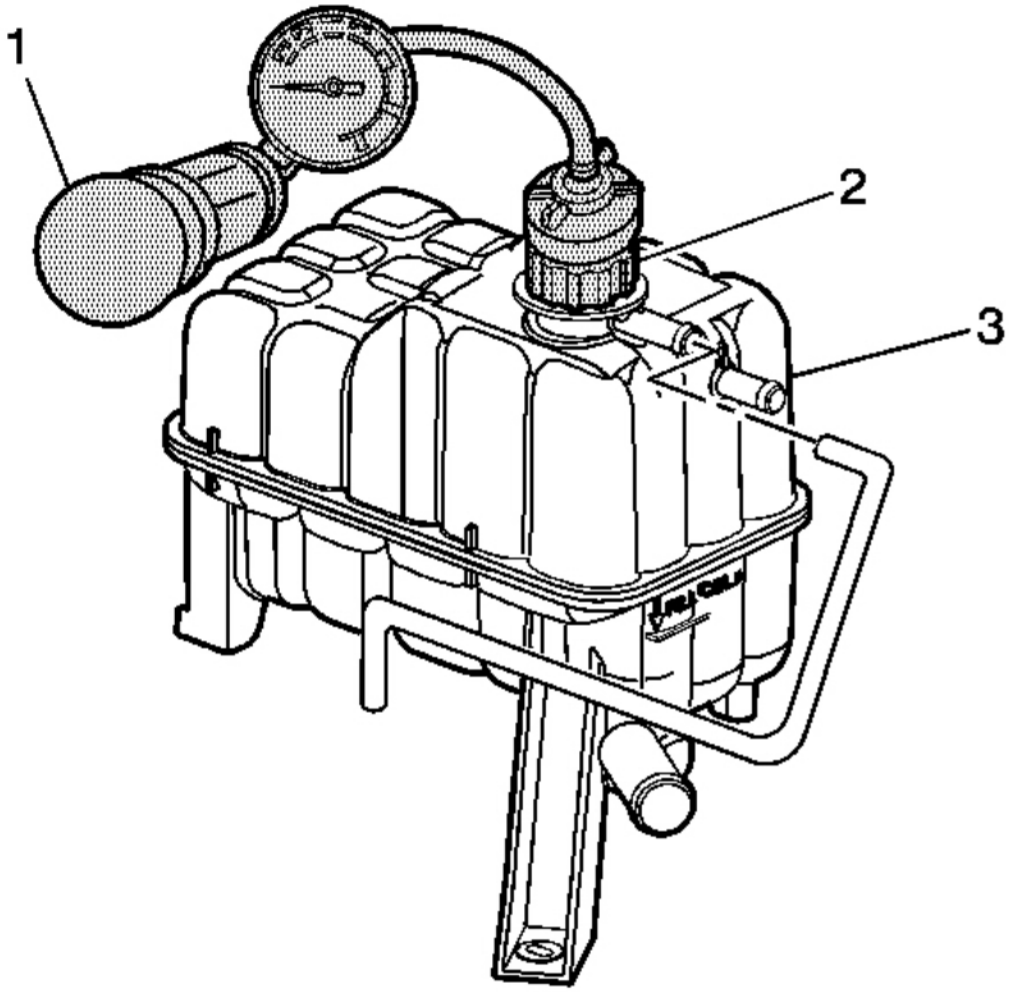


Fig. 7: Applying Pressure To Cooling System Using J 42401
Courtesy of GENERAL MOTORS CORP.

4. Use the **J 24460-01** with the. See **Special Tools**.**J 42401** 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 gage for any pressure loss.

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6. Repair any leaks as required.

REPAIR INSTRUCTIONS

DRAINING AND FILLING COOLING SYSTEM

Tools Required

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

1. Follow the steps below in order to remove the surge tank fill cap:
    1. Slowly rotate the cap counterclockwise.
    2. Stop rotating and allow the hissing to stop.
    3. After all the hissing stops, continue turning counterclockwise in order to remove the cap.
2. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
3. Place a drain pan under the lower radiator hose.
4. Using the **J 38185** , reposition the lower radiator hose clamp. See **Special Tools**.
5. Remove the lower radiator hose from the radiator.
6. Drain the cooling system.

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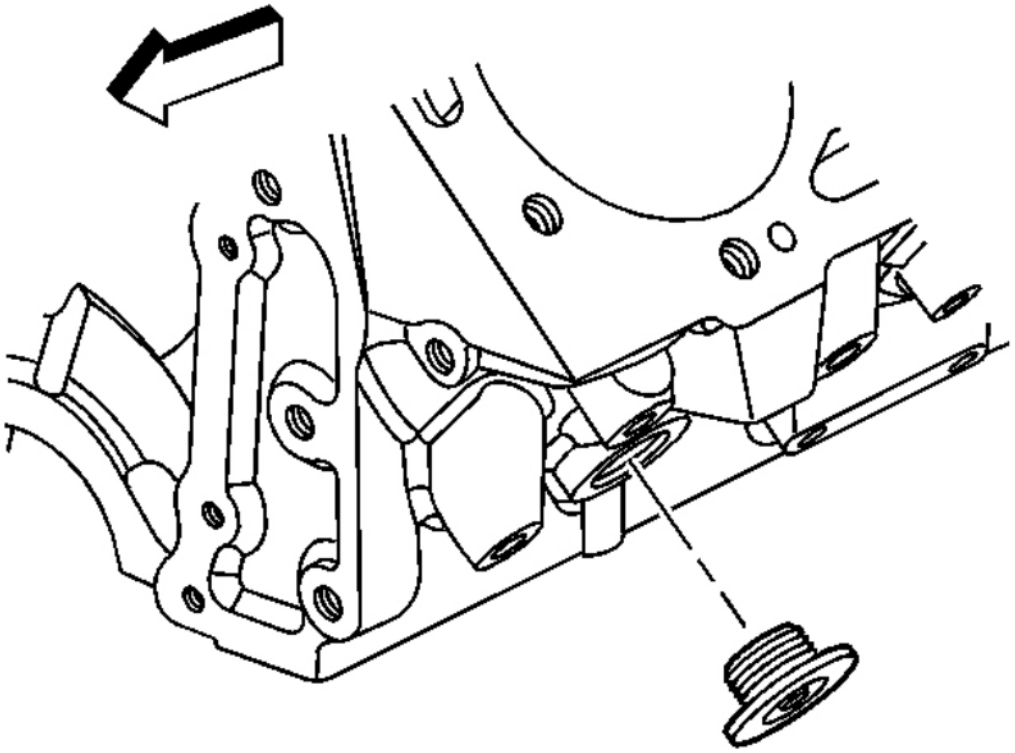


Fig. 8: View Of Engine Coolant Drain Hole Plug
Courtesy of GENERAL MOTORS CORP.

7. If a complete engine block drain is required, remove the left and right engine block coolant drain plugs.
8. Remove the engine block coolant heater, if equipped. Refer to **Coolant Heater Replacement (RPOs LC9/L76/L92)** or **Coolant Heater Replacement (RPOs LY2/LMG/LY5/LY6)**.
9. Inspect the coolant.
10. Follow the appropriate procedure based on the condition of the coolant:
    - Normal in appearance-Follow the filling procedure.
    - Discolored-Follow the flush procedure. Refer to **Flushing** .

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. Install the lower radiator hose to the radiator.

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2. Using the **J 38185** , reposition the lower radiator hose clamp. See **Special Tools**.

NOTE: **Refer to Fastener Notice .**

3. If the left and right engine block coolant drain plugs were removed, perform the following:
   1. Apply pipe sealer to the drain plugs.
   2. Install the drain plugs.

   Tighten: Tighten the drain plugs to 60 N.m (44 lb ft).

4. Install the engine block coolant heater, if equipped. Refer to **Coolant Heater Replacement (RPOs LC9/L76/L92)** or **Coolant Heater Replacement (RPOs LY2/LMG/LY5/LY6)**.
5. Lower the vehicle.

IMPORTANT: Use a 50/50 mixture of DEX-COOL antifreeze and clean, drinkable water.

6. Slowly fill the cooling system with a 50/50 coolant mixture. Refer to **Capacities - Approximate Fluid** .
7. Install the coolant pressure cap.
8. Start the engine.
9. Run the engine at 2,000-2,500 RPM until the engine reaches normal operating temperature.
10. Allow the engine to idle for 3 minutes.
11. Shut the engine OFF.
12. Allow the engine to cool.
13. Top off the coolant as necessary.
14. Inspect the concentration of the engine coolant using the **J 26568** . See **Special Tools**.
15. Rinse away any excess coolant from the engine and the engine compartment.

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 instructions. However, always remove the thermostat before back flushing the system.**

1. **Block the drive wheels.**

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2. **Place the transmission in park (P) or neutral (N).**
3. **Engage the park brake.**
4. **Run the engine until the thermostat opens.**
5. **Stop the engine.**
6. **Follow the drain and fill procedure unsing only clean drinkable water. Repeat the procedure if necessary, until the fluid is nearly colorless. Refer to Draining and Filling Cooling System.**
7. **Fill the coolant reservoir to the FULL HOT mark.**
8. **Fill the cooling system. Refer to Draining and Filling Cooling System.**

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.

SURGE TANK REPLACEMENT

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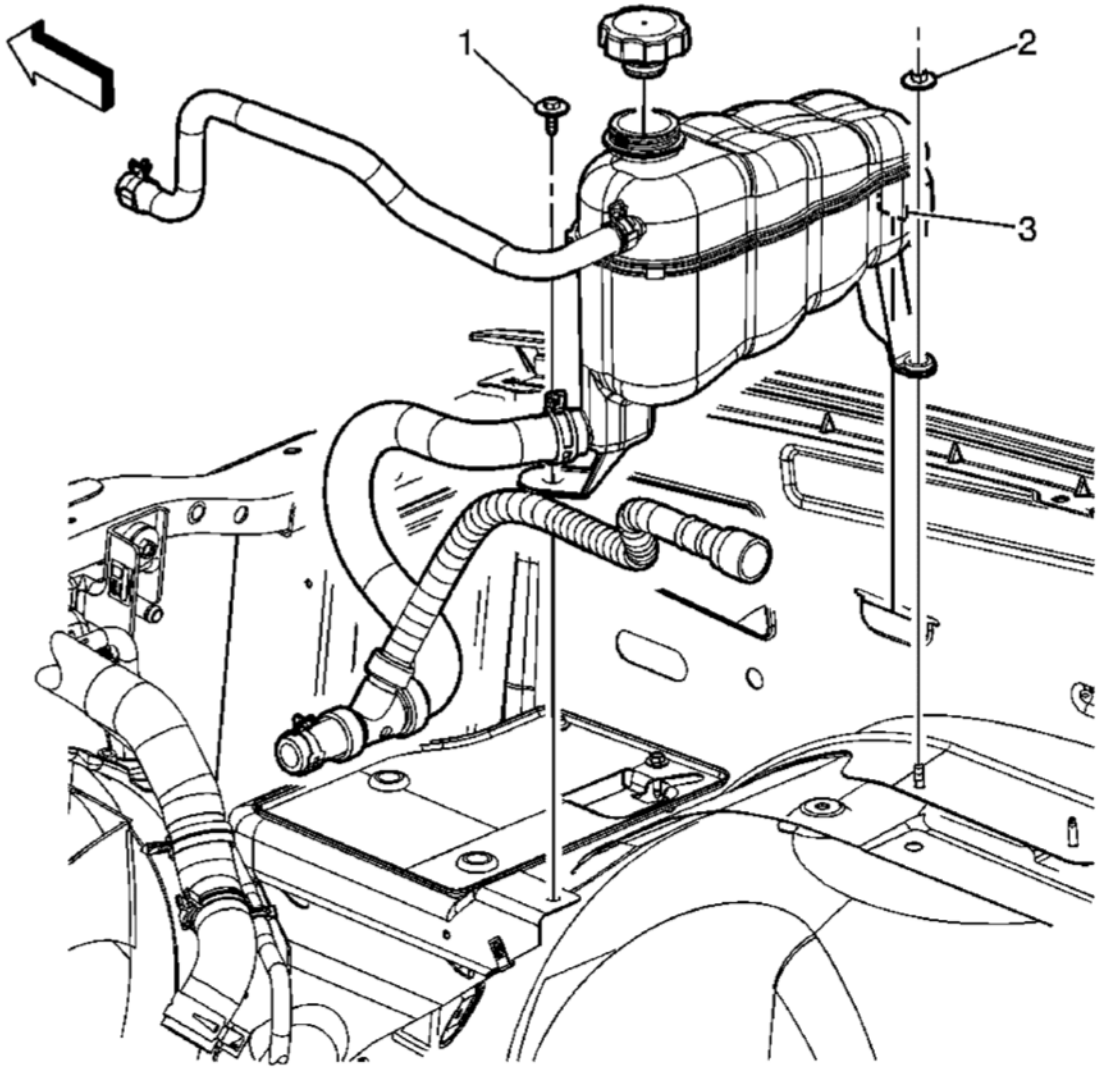


Fig. 9: View Of Surge Tank, Nut & Bolt
Courtesy of GENERAL MOTORS CORP.

Surge Tank Replacement

Callout	Component Name
Preliminary Procedure 1. Drain the cooling system. Refer to **Draining and Filling Cooling System**. 2. Remove the air cleaner assembly. Refer to **Air Cleaner Assembly Replacement** .	
1	Surge Tank Bolt **NOTE:** **Refer to Fastener Notice .**

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	Tighten: 10 N.m (89 lb in)
2	Surge Tank Nut **Tighten:** 10 N.m (89 lb in)
3	Surge Tank **Tip:** Remove the surge tank hoses from the surge tank.

SURGE TANK HOSE/PIPE REPLACEMENT - INLET

Removal Procedure

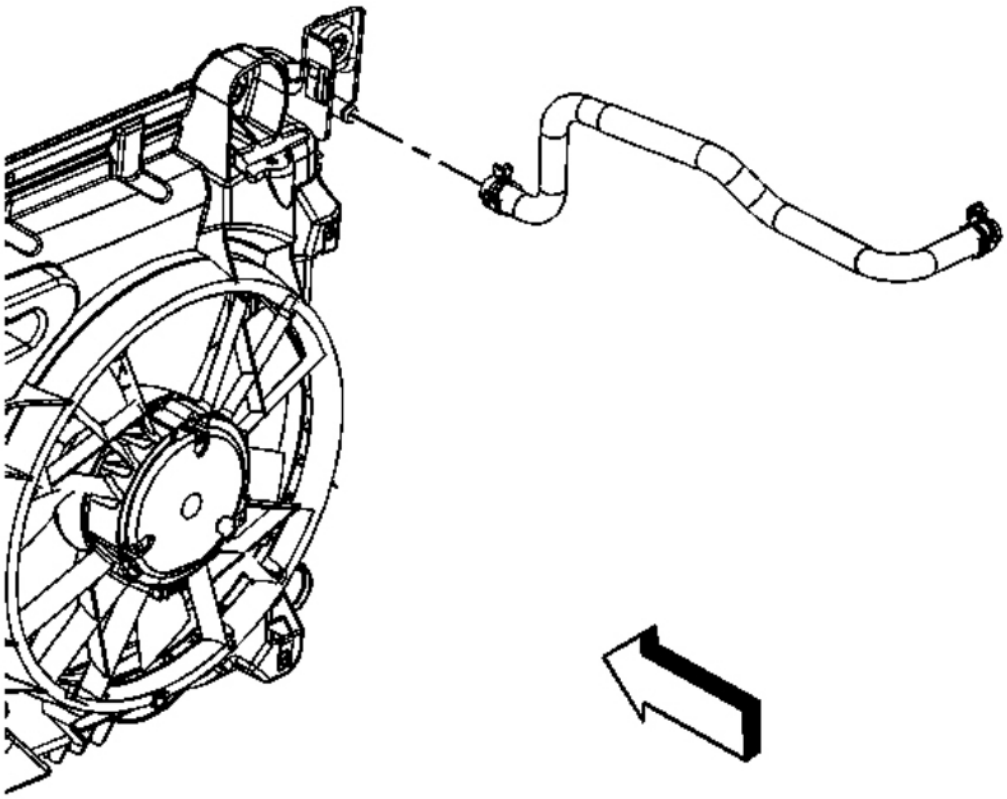


Fig. 10: View Of Surge Tank Inlet Hose & Clamps
Courtesy of GENERAL MOTORS CORP.

1. Drain the cooling system. Refer to **Draining and Filling Cooling System**.
2. Reposition the surge tank inlet hose clamp from the radiator.

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3. Remove the surge tank inlet hose from the radiator.

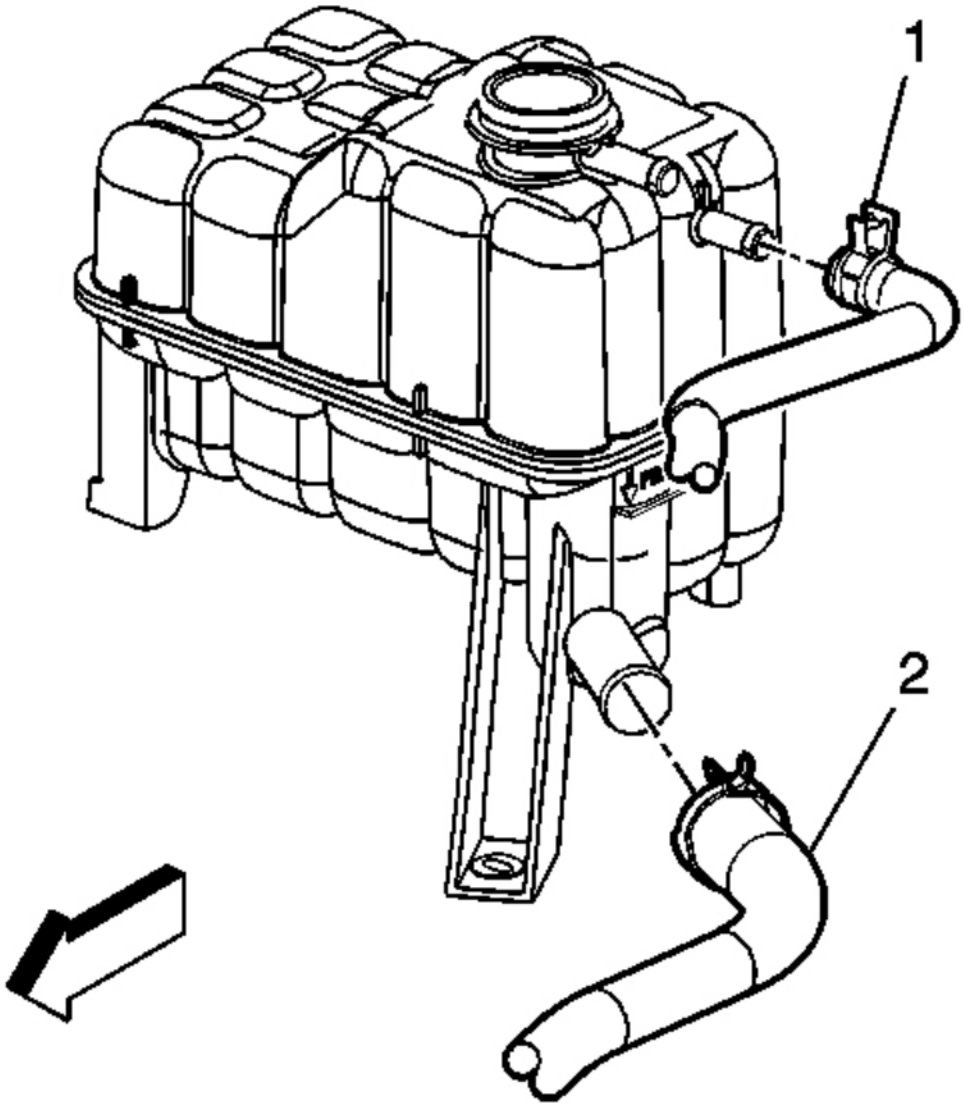


Fig. 11: View Of Surge Tank Outlet Hose & Surge Tank
Courtesy of GENERAL MOTORS CORP.

4. Reposition the surge tank inlet hose clamp at the surge tank.
5. Remove the surge tank inlet hose (1) from the surge tank.

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Installation Procedure

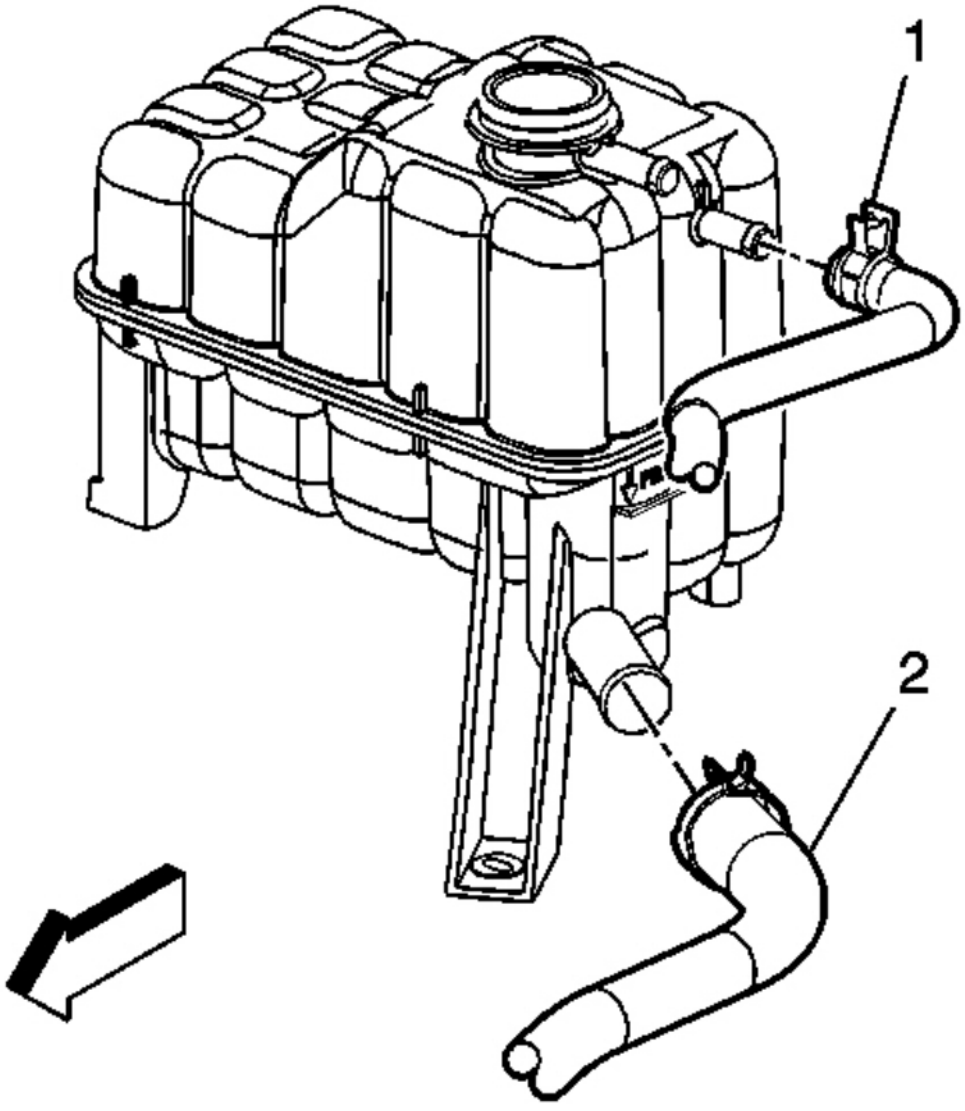


Fig. 12: View Of Surge Tank Outlet Hose & Surge Tank
Courtesy of GENERAL MOTORS CORP.

1. Install the surge tank inlet hose (1) to the surge tank.
2. Position the surge tank inlet hose clamp to the surge tank.

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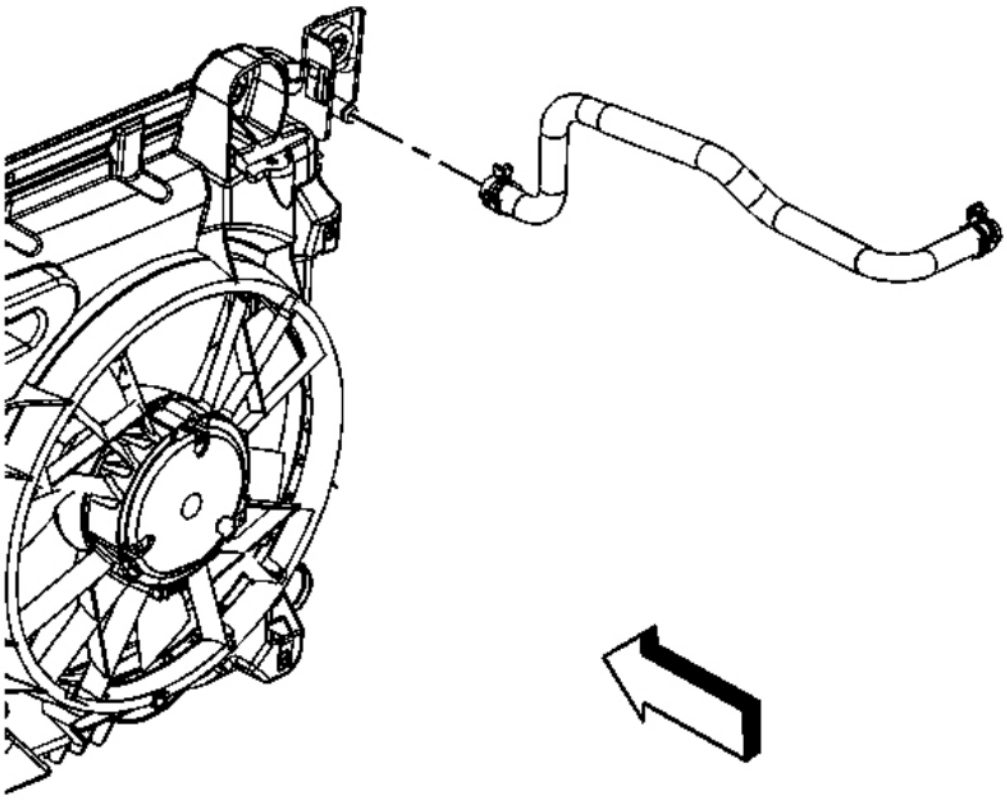


Fig. 13: View Of Surge Tank Inlet Hose & Clamps
Courtesy of GENERAL MOTORS CORP.

3. Install the surge tank inlet hose to the radiator.
4. Position the surge tank inlet hose clamp to the radiator.
5. Fill the cooling system. Refer to **Draining and Filling Cooling System**.

RADIATOR INLET HOSE REPLACEMENT

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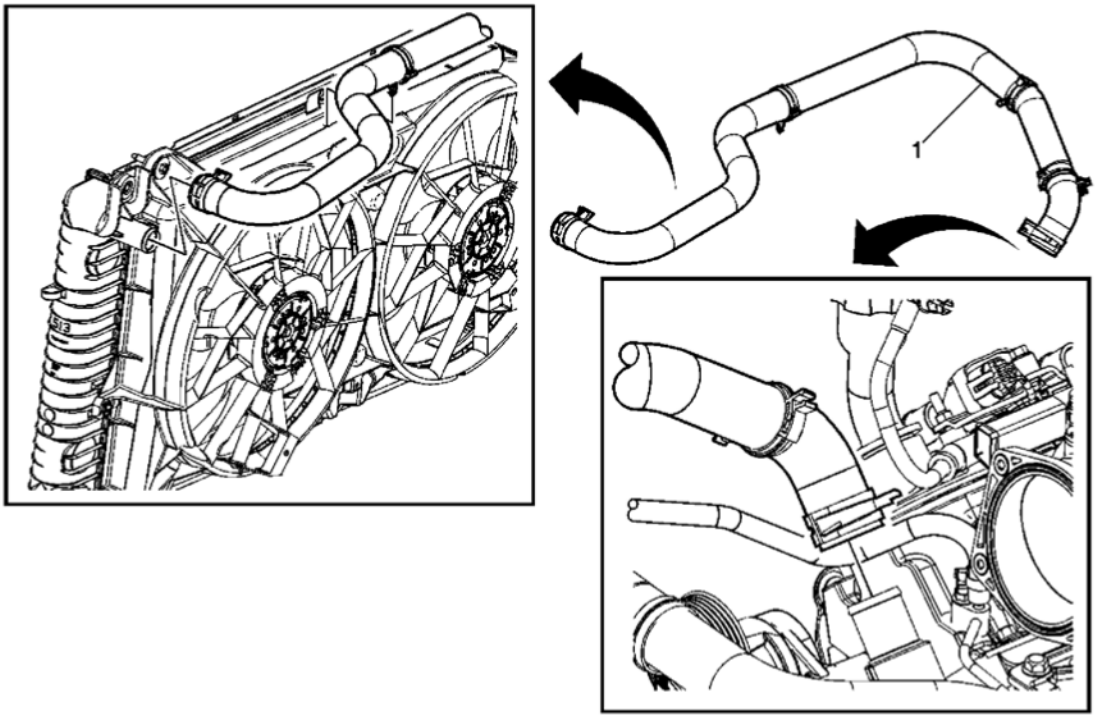


Fig. 14: View Of Radiator Inlet Hose
Courtesy of GENERAL MOTORS CORP.

Radiator Inlet Hose Replacement

Callout	Component Name
Preliminary Procedure 1. Drain the cooling system. Refer to **Draining and Filling Cooling System**. 2. Remove the air cleaner outlet duct. Refer to **Air Cleaner Resonator Outlet Duct Replacement** .	
1	Radiator Inlet Hose **Tip:** • Remove the radiator vent hose from the radiator inlet hose clips. • Using **J 38185** reposition the radiator inlet hose clamps. See **Special Tools**.

RADIATOR OUTLET HOSE REPLACEMENT

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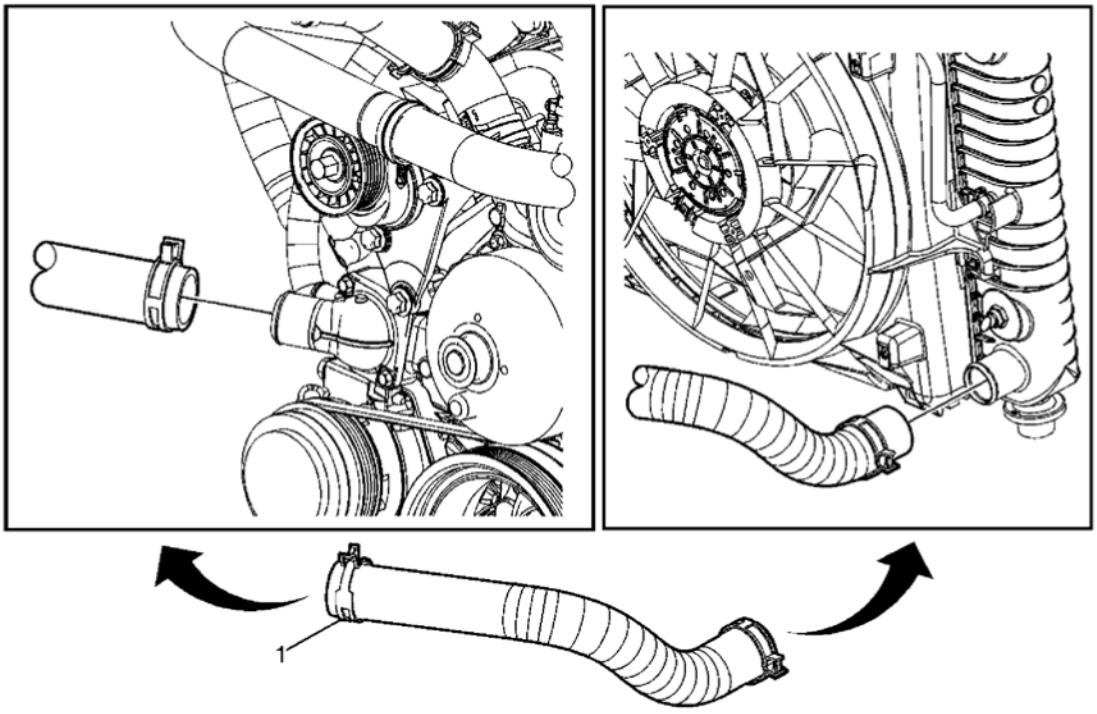


Fig. 15: View Of Radiator Outlet Hose
Courtesy of GENERAL MOTORS CORP.

Radiator Outlet Hose Replacement

Callout	Component Name
Preliminary Procedure 1. Drain the cooling system. Refer to **Draining and Filling Cooling System**. 2. Remove the air cleaner outlet duct. Refer to **Air Cleaner Resonator Outlet Duct Replacement** . 3. Remove air cleaner housing. Refer to **Air Cleaner Assembly Replacement**	
1	Radiator Outlet Hose **Tip:** Using **J 38185** reposition the radiator outlet hose clamps. See **Special Tools**.

RADIATOR VENT INLET HOSE REPLACEMENT

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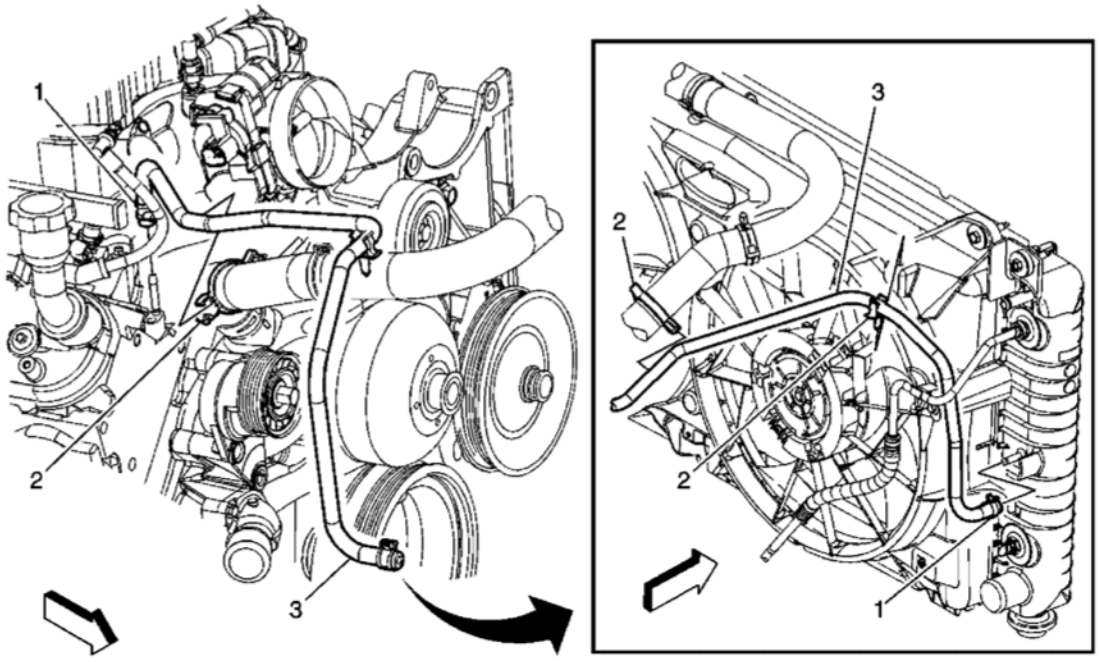


Fig. 16: View Of Radiator Vent Inlet Hose & Components
Courtesy of GENERAL MOTORS CORP.

Radiator Vent Inlet Hose Replacement

Callout	Component Name
Preliminary Procedure 1. Drain the cooling system. Refer to **Draining and Filling Cooling System**. 2. If necessary, remove air cleaner resonator duct. Refer to **Air Cleaner Resonator Outlet Duct Replacement**	
1	Remove Radiator Vent Inlet Hose Clamps (Qty: 2)
2	Remove Radiator Vent Inlet Hose Support Clips (Qty: 2)
3	Radiator Vent Inlet Hose

ENGINE OIL COOLER PIPE/HOSE QUICK CONNECT FITTING

Removal Procedure

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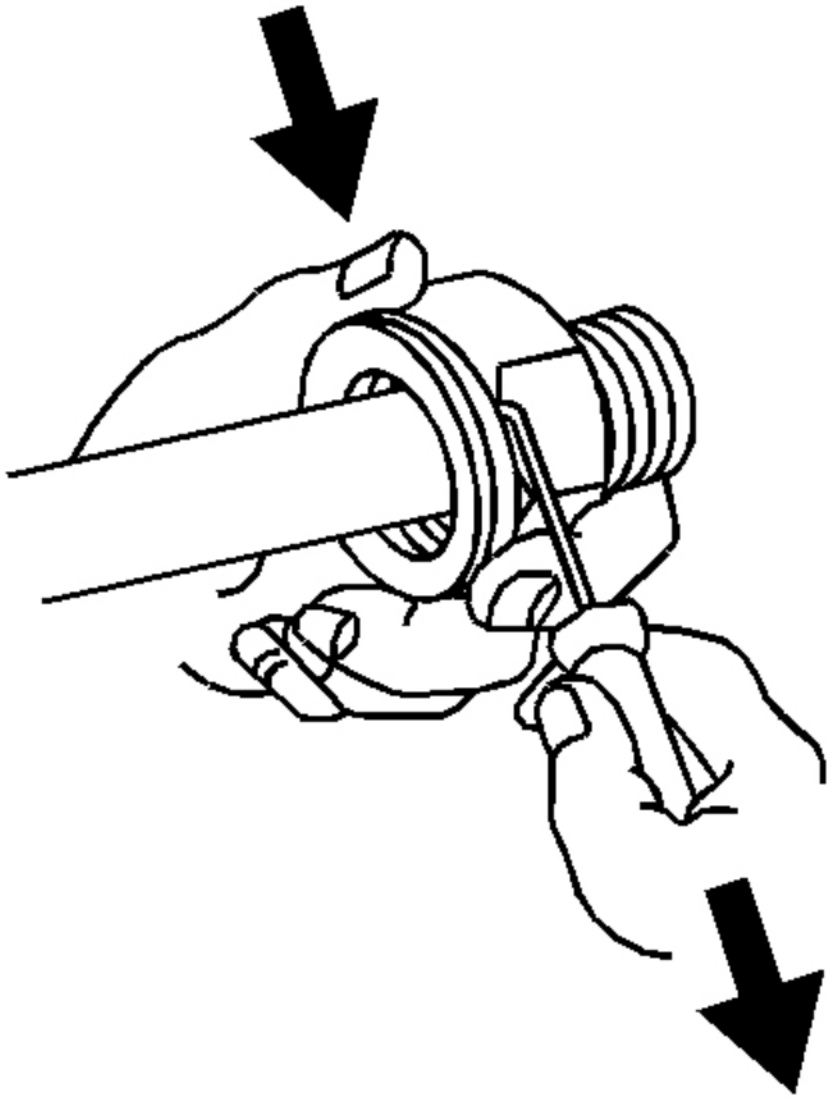


Fig. 17: Rotating Retaining Ring Using Screwdriver
Courtesy of GENERAL MOTORS CORP.

1. Disengage the plastic caps from the quick connect fittings. Pull the caps back along the pipe.
2. Using a bent-tip screwdriver or equivalent, pull on one of the open ends of the retaining ring in order to rotate the retaining ring.
3. Rotate the retaining ring around the quick connector until the retaining ring is out of position and can be completely removed.

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Discard the retaining rings.

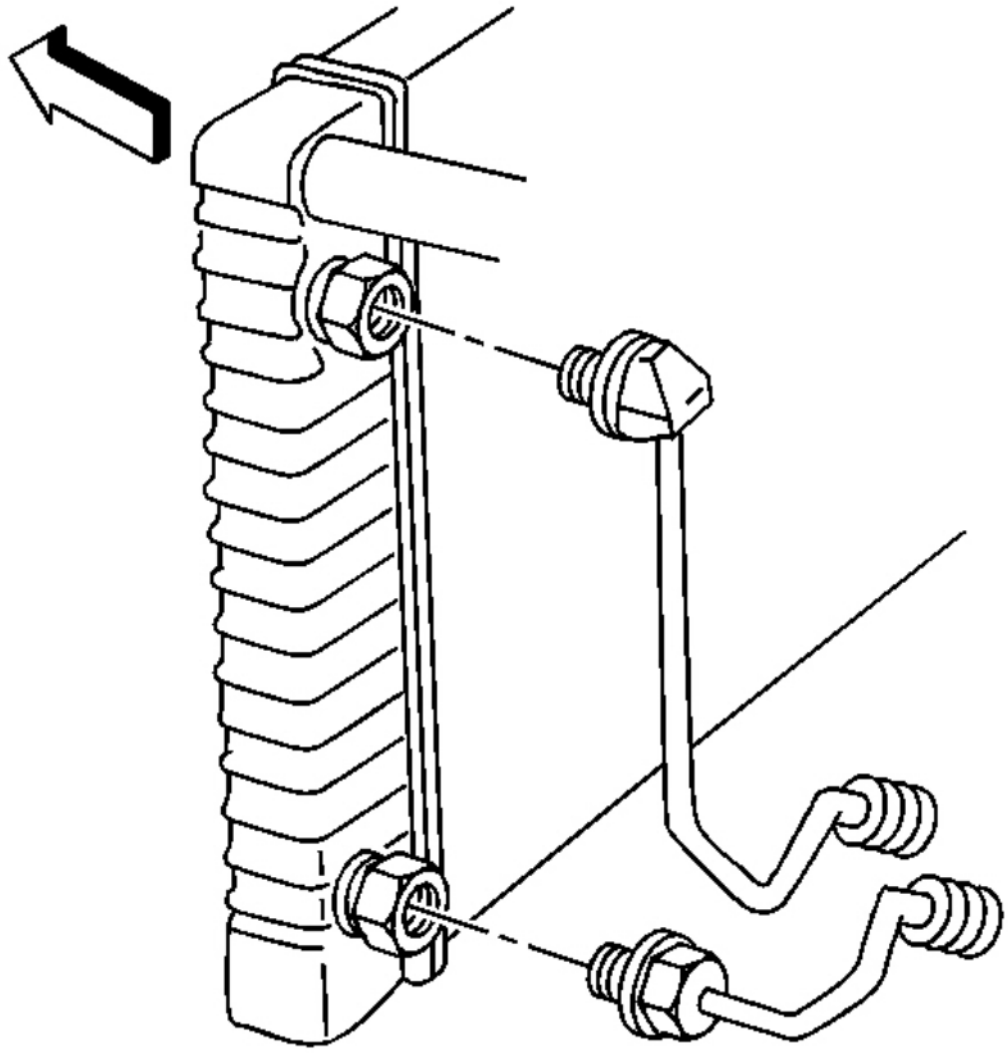


Fig. 18: View Of Engine Oil Cooler Line Connections
Courtesy of GENERAL MOTORS CORP.

4. Remove the engine oil cooler line from the quick connector fitting at the radiator.

   Pull the lines straight out from the connectors.

5. Clean all of the components in a suitable solvent, and dry them with compressed air.

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6. Inspect the fittings, the connectors, the cooler lines, and the cooler for damage, distortion, or restriction. Replace parts as necessary.

Installation Procedure

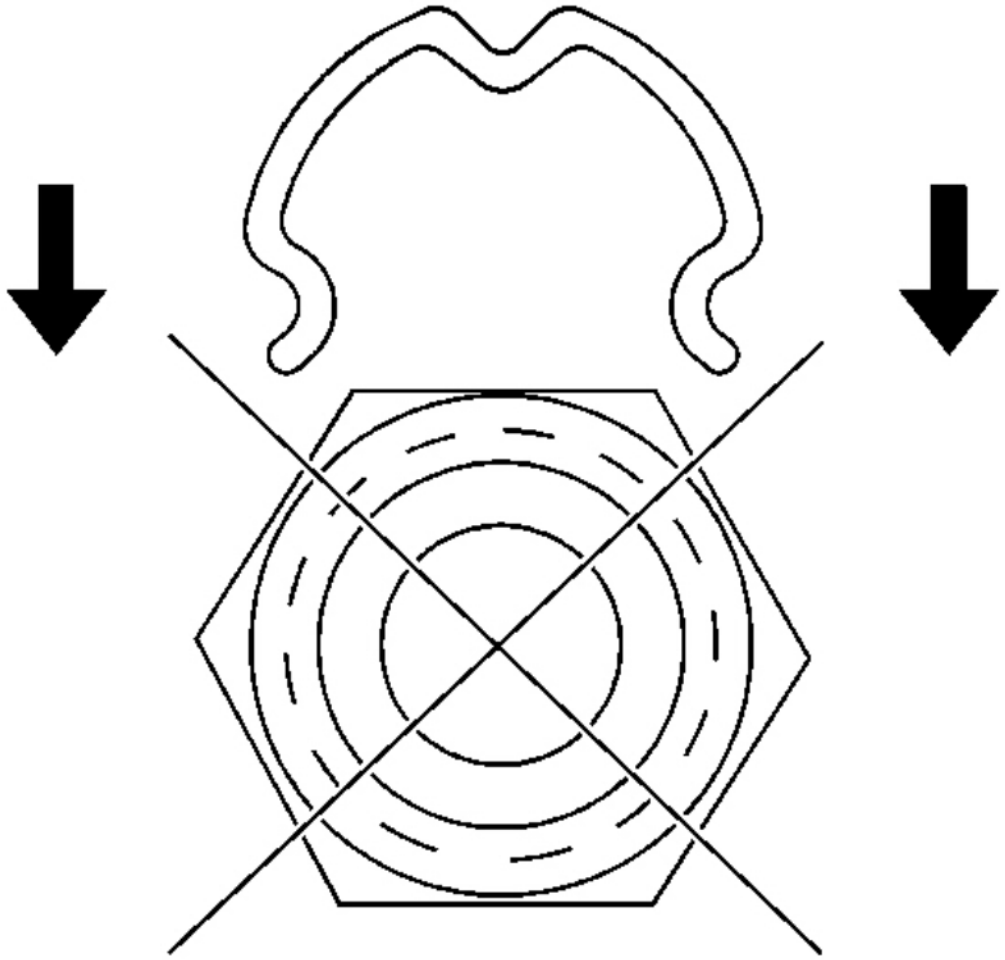


Fig. 19: View Of Retaining Ring & Quick Connector
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: When performing the following procedure, do not reuse the old retaining rings. Replace the old retaining rings with new ones.
Do not install the new retaining ring onto the fitting by pushing the retaining ring down over the fitting.

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1. Install a new retaining ring into each quick connector fitting.

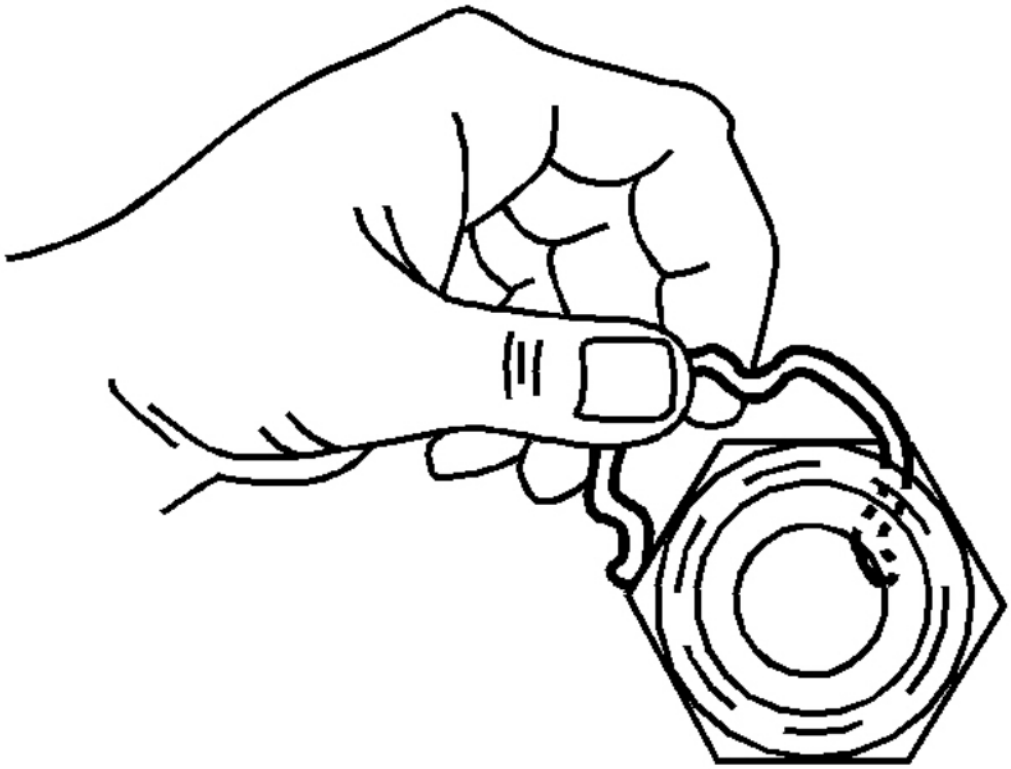


Fig. 20: Identifying Retaining Ring Hook
Courtesy of GENERAL MOTORS CORP.

2. Hook one of the open ends of the retaining ring in one of the slots in the quick connector.

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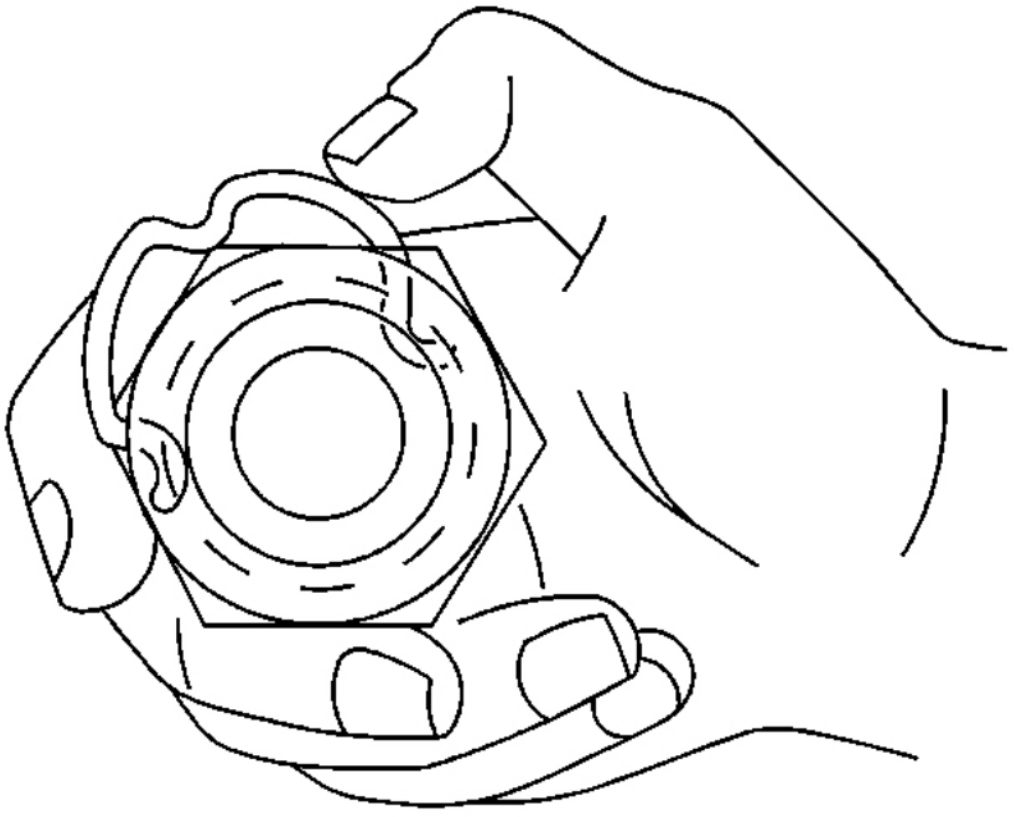


Fig. 21: View Of Retaining Ring & Connector
Courtesy of GENERAL MOTORS CORP.

3. Rotate the retaining ring around the connector until the retaining ring is positioned with all 3 ears through the 3 slots.

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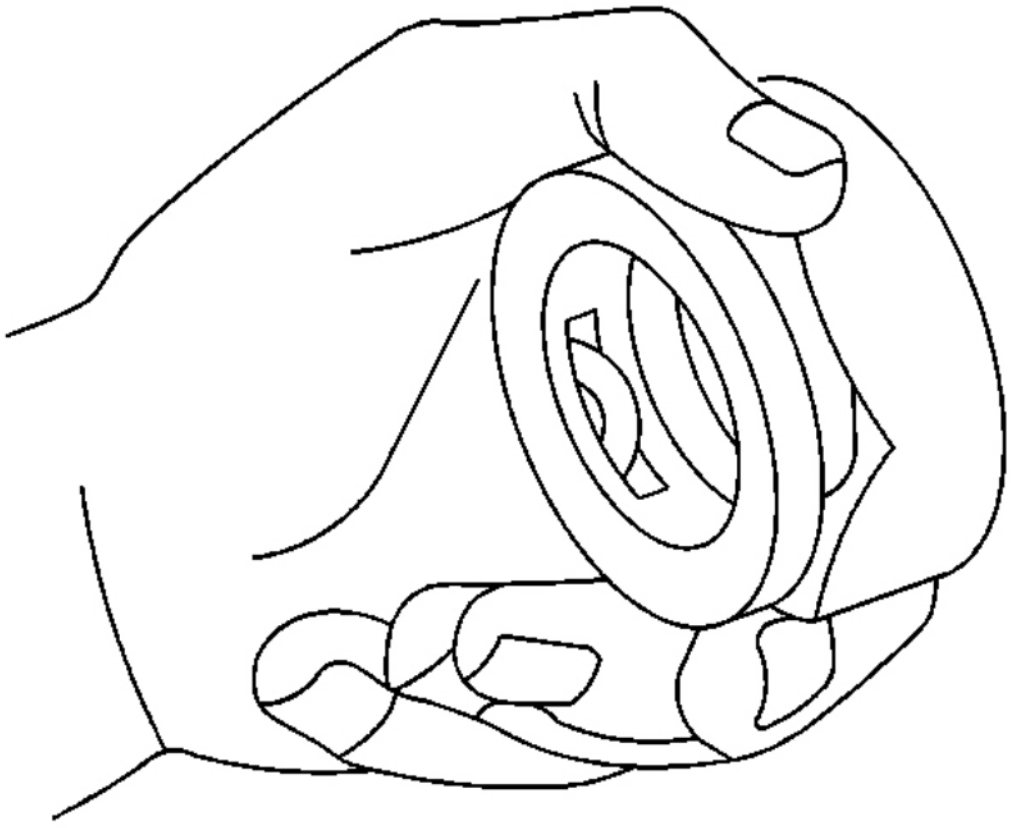


Fig. 22: View Of Retaining Ring Ears From Inside Of Connector
Courtesy of GENERAL MOTORS CORP.

4. Ensure the 3 retaining ring ears can be seen from the inside of the connector and the retaining ring can move freely in the slots.

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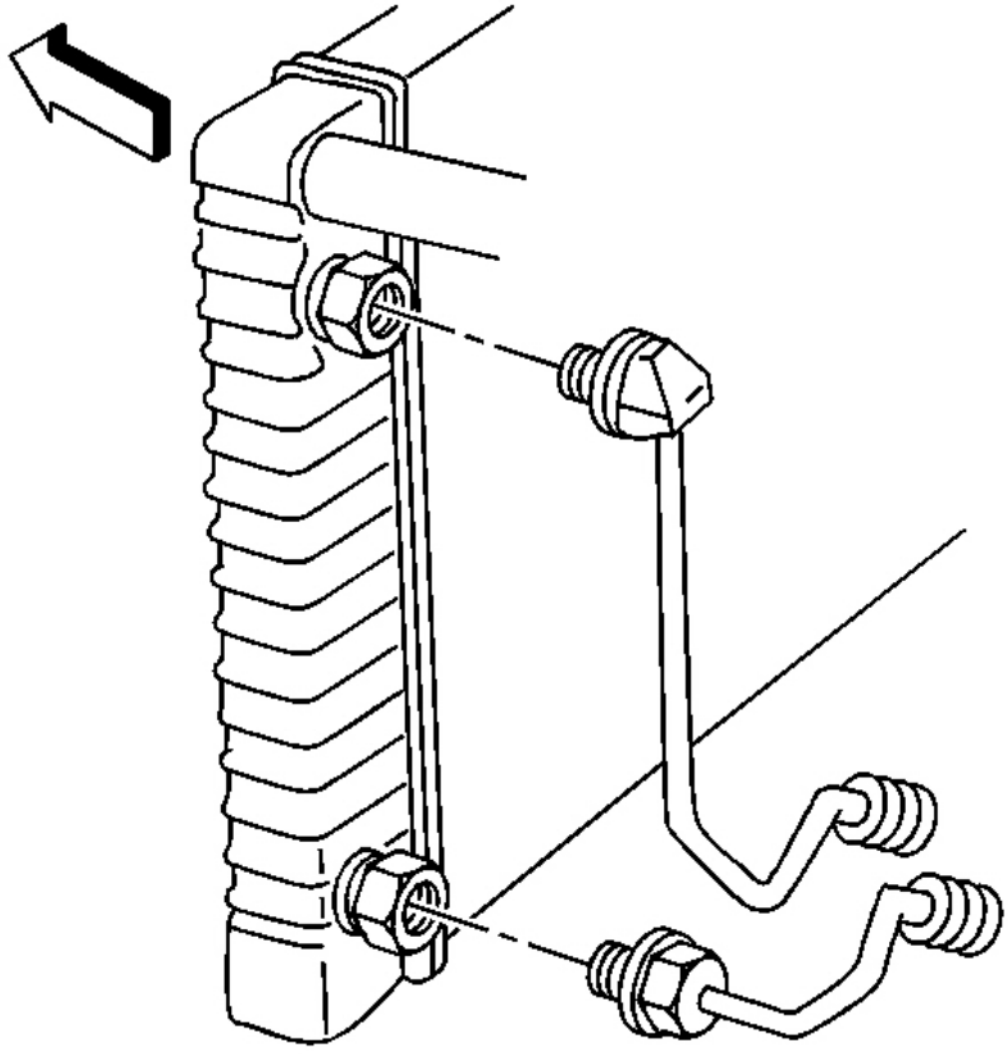


Fig. 23: View Of Engine Oil Cooler Line Connections
Courtesy of GENERAL MOTORS CORP.

5. Install the engine oil cooler line into the quick connector fitting until a click is heard or felt.

   Pull back on the engine oil cooler lines to ensure a proper connection.

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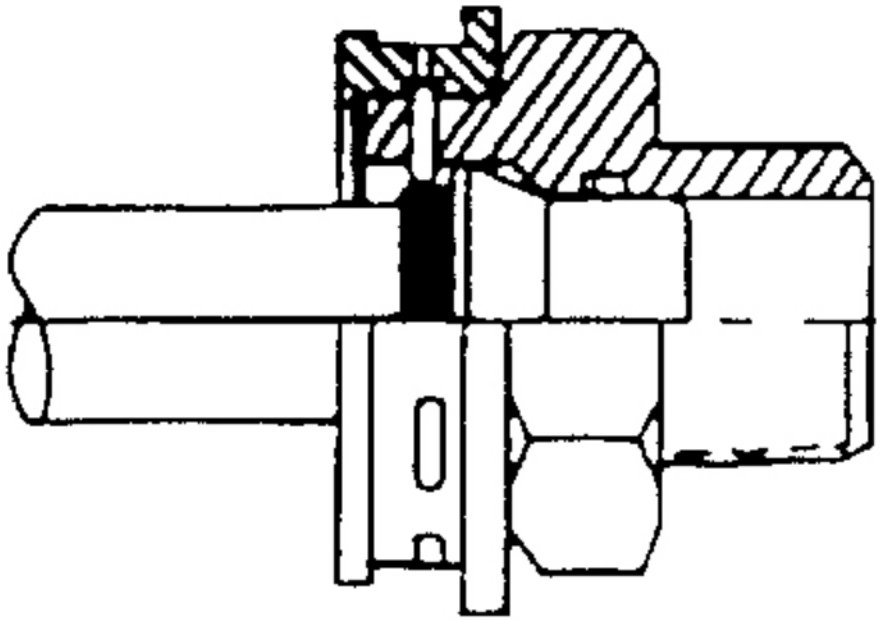


Fig. 24: View Of Cooler Line & Plastic Cap
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Do not manually depress the retaining clip when installing the plastic cap.

6. Snap the plastic cap onto the quick connect fitting.
7. Ensure that the plastic cap is fully seated against the fitting.

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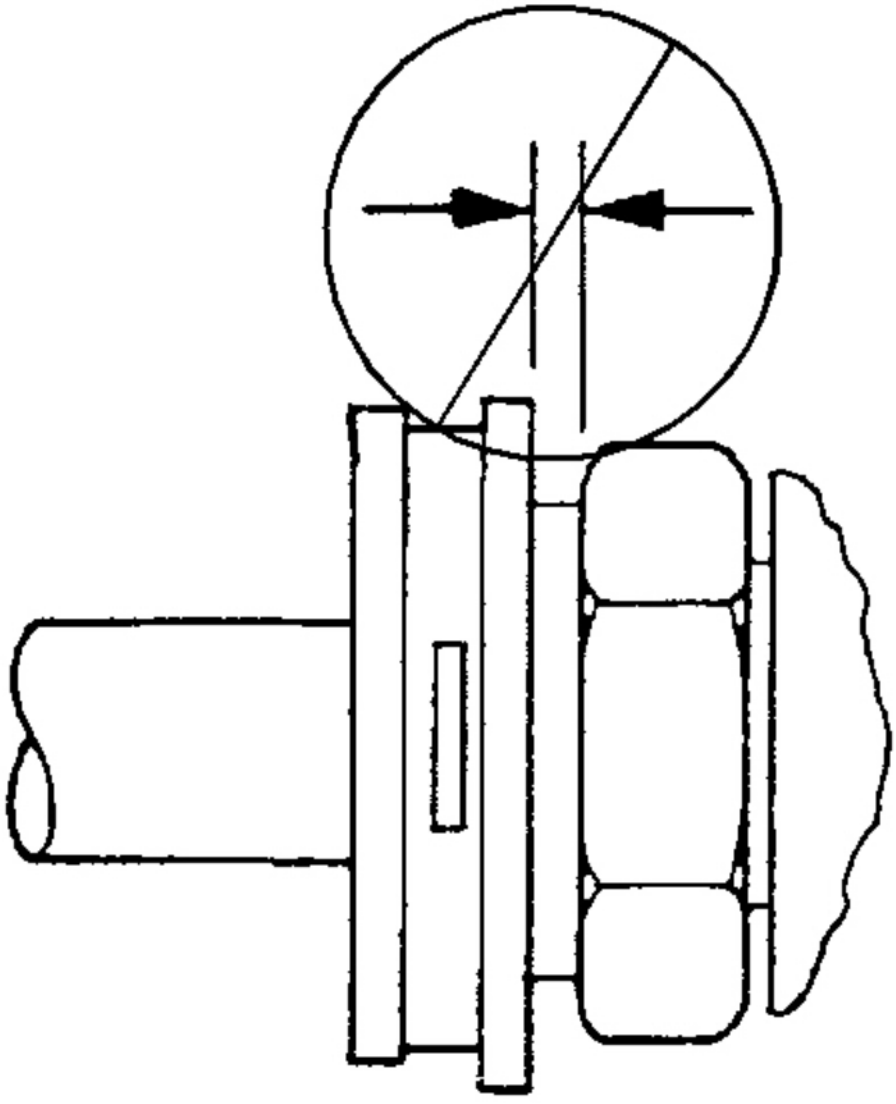


Fig. 25: Checking For Gap Between Cap & Fitting
Courtesy of GENERAL MOTORS CORP.

8. Ensure that no gap is present between the cap and the fitting.
9. Inspect and fill the engine oil to the proper level.

ENGINE OIL COOLER HOSE/PIPE REPLACEMENT

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Removal Procedure

The optional oil cooler is either an integral part of the radiator or a separate unit placed in front of the radiator. The cooler lines and hoses are serviceable.

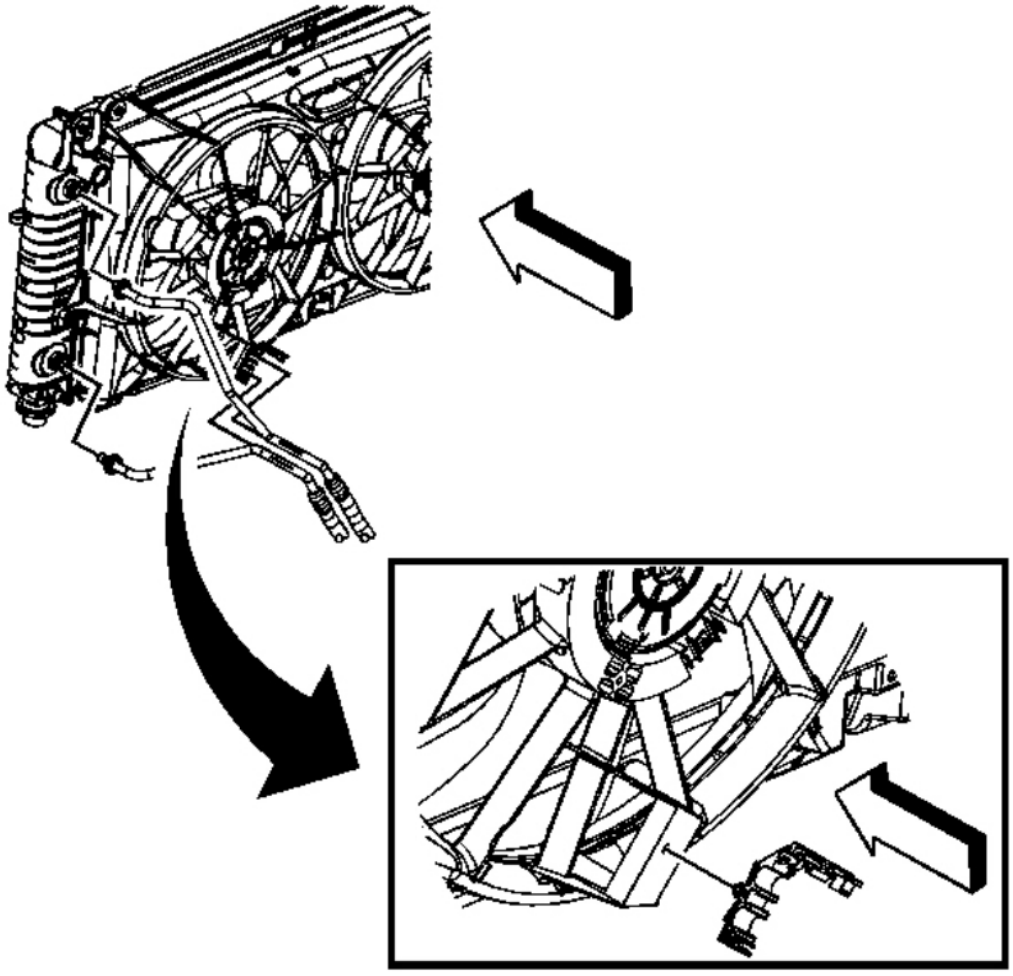


Fig. 26: Locating Quick Connect Fitting
Courtesy of GENERAL MOTORS CORP.

1. Disconnect the engine oil cooler quick connect fittings. Refer to **Engine Oil Cooler Pipe/Hose Quick Connect Fitting**.
2. If equipped with regular production option (RPO) L76 (6.0L) engine, perform the following.
    1. Open the oil cooler hose clip located on the lower fan shroud.

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2. Remove the oil cooler hoses from the clip.
3. Raise and suitably support the vehicle. Refer to **Lifting and Jacking the Vehicle** .

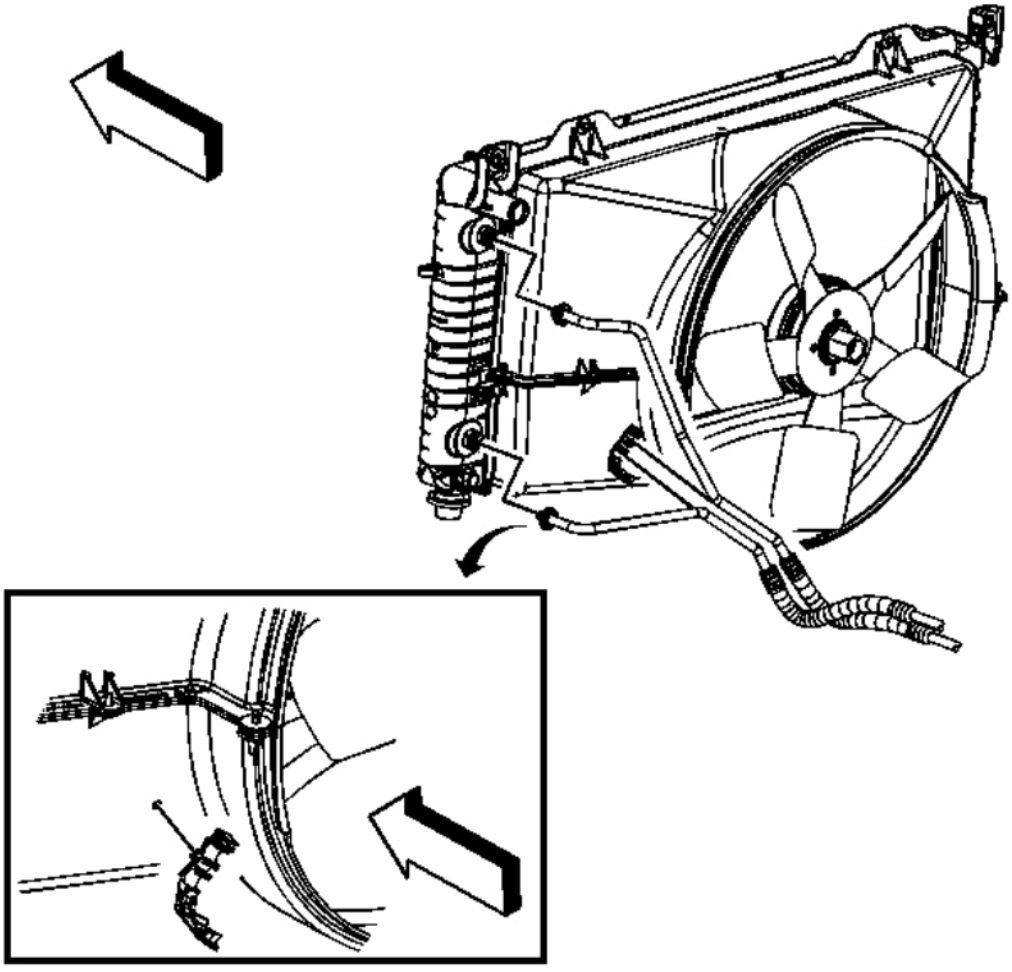


Fig. 27: View Of Oil Cooler Hoses & Clips
Courtesy of GENERAL MOTORS CORP.

4. If equipped with RPO LY6 (6.0L) engine, remove the oil cooler hoses from the clip.
5. Place a jack or utility stands at the rear of the vehicle.
6. If equipped, remove the engine protection shield. Refer to **Engine Shield Replacement** .
7. If equipped, remove the front differential carrier shield. Refer to **Shield Replacement** .

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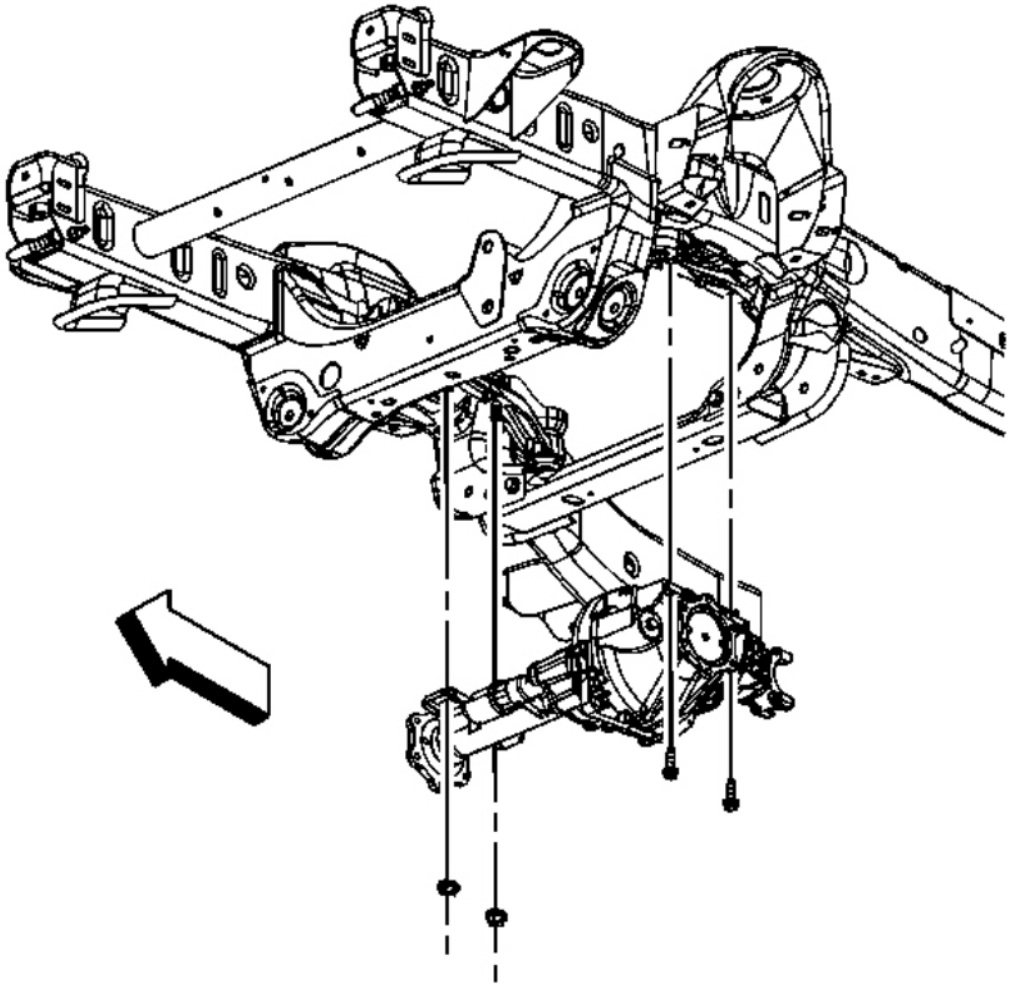


Fig. 28: Locating Differential Carrier Nuts
Courtesy of GENERAL MOTORS CORP.

8. For both 1500 and 2500 series, support the front differential carrier with a suitable adjustable jack.
9. For 1500 series vehicles, remove the differential carrier right side nuts.

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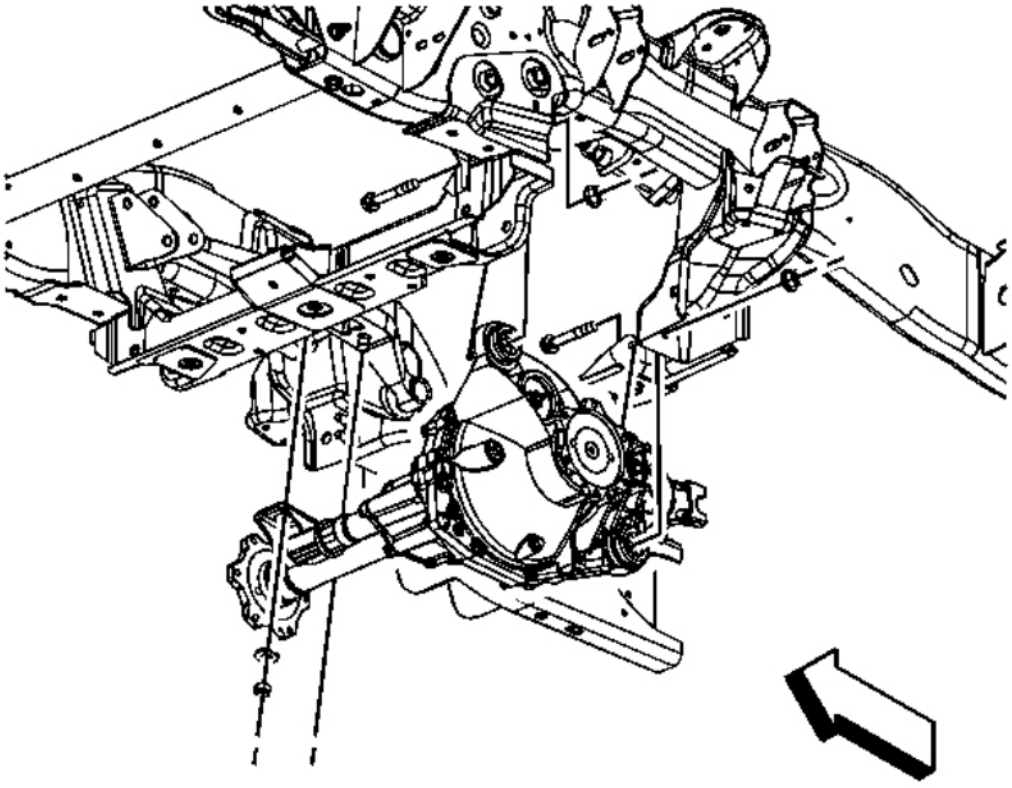


Fig. 29: View Of Differential Carrier Bolts
Courtesy of GENERAL MOTORS CORP.

10. Remove the differential carrier left side bolts.
11. Lower the differential carrier.
12. For 2500 series vehicles, remove the differential carrier right side nuts.

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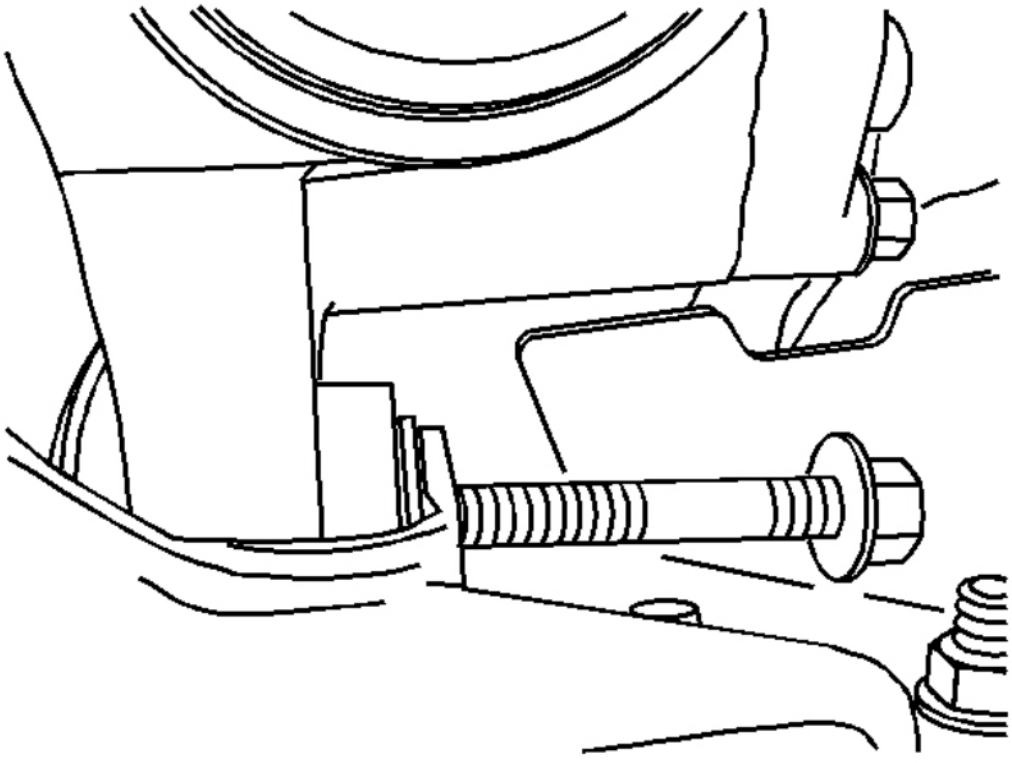


Fig. 30: View Of Differential Carrier Lower Mounting Bolt
Courtesy of GENERAL MOTORS CORP.

13. Remove the differential carrier upper mounting bolt and nut.
14. Remove the differential carrier lower mounting bolt and nut.

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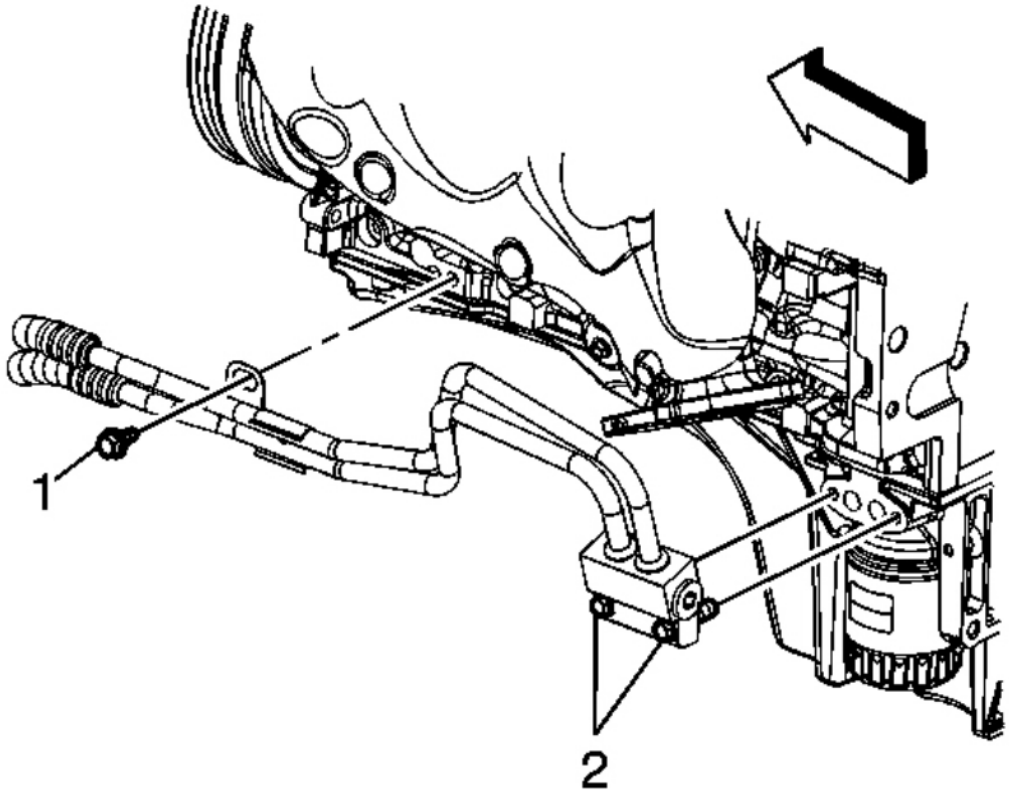


Fig. 31: Locating Oil Cooler Hose Bracket & Adapter Bolts
Courtesy of GENERAL MOTORS CORP.

15. If equipped with RPO L76 (6.0L) engine, perform the following:
    1. Lower the differential carrier.
    2. Remove the oil cooler hose adapter bolts (2).
    3. Remove the oil cooler hose assembly and gasket. Discard the gasket.
    4. Inspect the fittings, connectors, and cooler hoses for damage or distortion.

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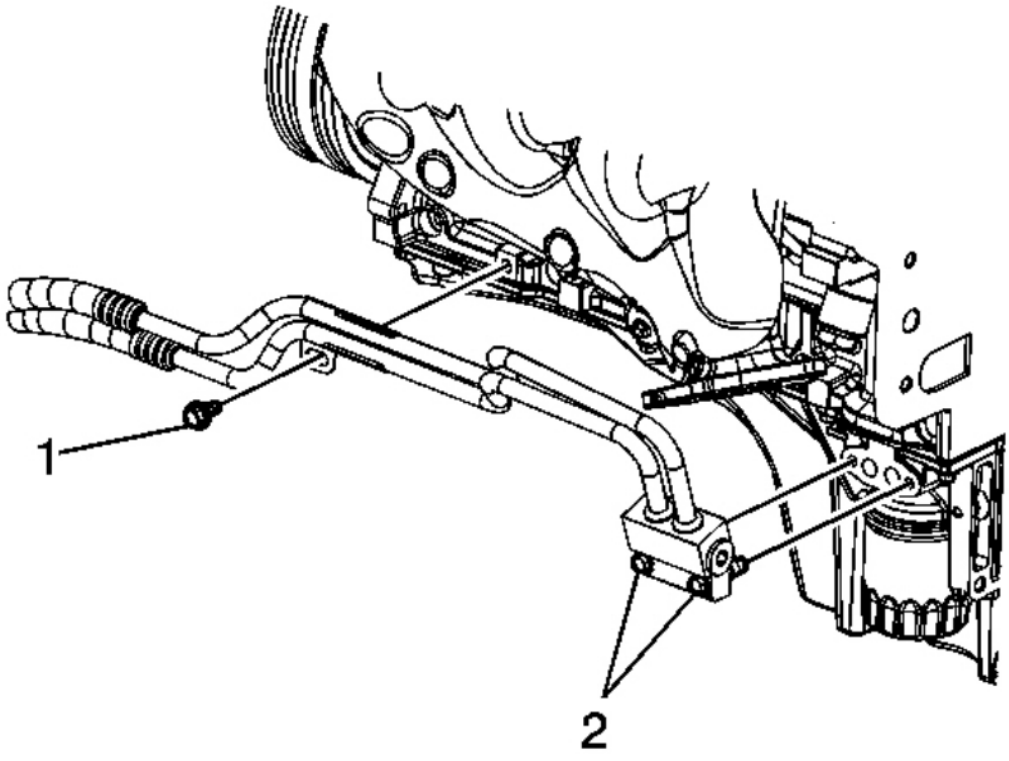


Fig. 32: Locating Oil Cooler Hose Bracket & Adapter Bolts
Courtesy of GENERAL MOTORS CORP.

16. If equipped with RPO LY6 (6.0L) engine, perform the following:
    1. Remove the oil cooler hose bracket bolt. (1)
    2. Remove the oil cooler hose adapter bolts. (2)
    3. Remove the oil cooler hose assembly. Discard the gasket.
    4. Inspect the fittings, connectors, and cooler hoses for damage or distortion.

Installation Procedure

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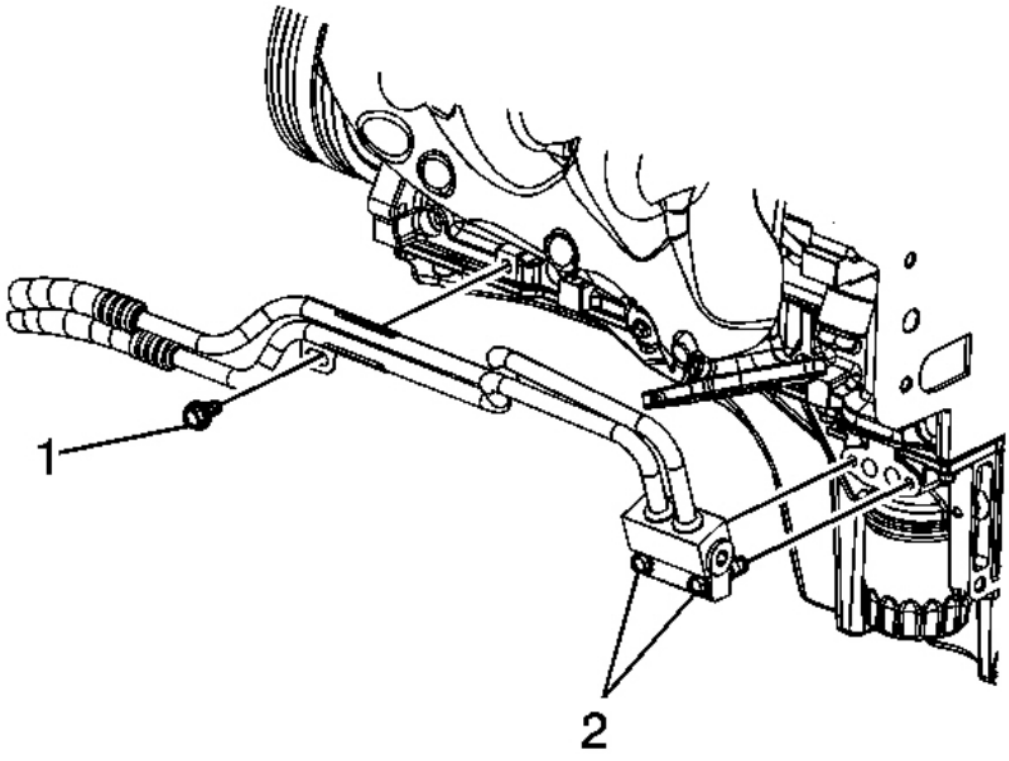


Fig. 33: Locating Oil Cooler Hose Bracket & Adapter Bolts
Courtesy of GENERAL MOTORS CORP.

NOTE: **Refer to Fastener Notice .**

1. If equipped with RPO LY6 (6.0L) engine, perform the following:
    1. Install the oil cooler hose assembly and a NEW gasket.
    2. Install the oil cooler hose adapter bolts (2).

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

    3. Install the oil cooler hose bracket bolt.

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

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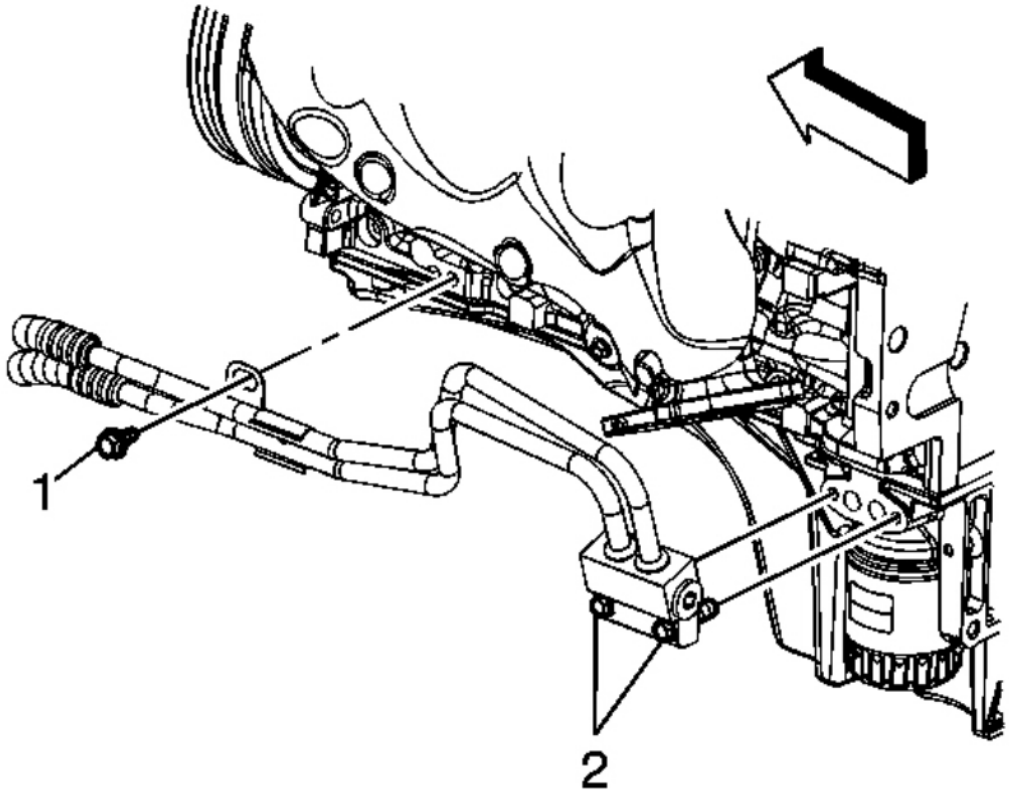


Fig. 34: Locating Oil Cooler Hose Bracket & Adapter Bolts
Courtesy of GENERAL MOTORS CORP.

2. If equipped with a RPO L76 (6.0L) engine, perform the following.
    1. Install the oil cooler hose assembly and a NEW gasket.
    2. Install the oil cooler hose adapter bolts (2).

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

    3. Install the oil cooler hose bracket bolt (1).

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

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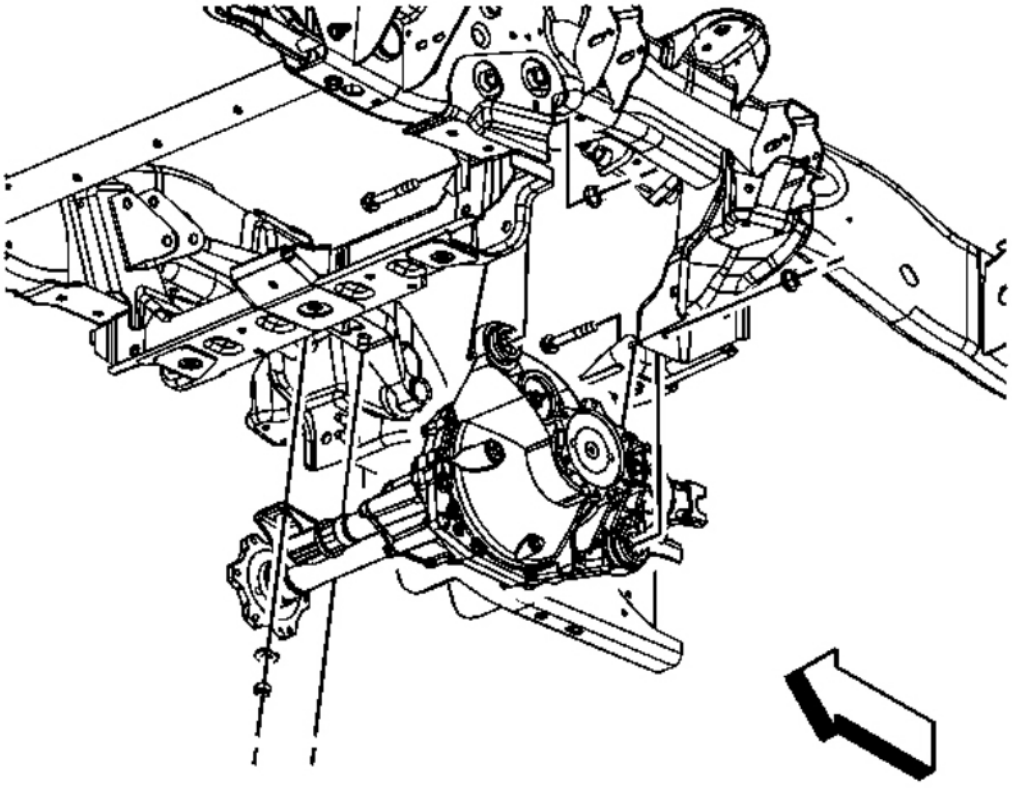


Fig. 35: View Of Differential Carrier Bolts
Courtesy of GENERAL MOTORS CORP.

3. For 2500 series vehicles, raise the differential carrier into position.
4. Install the differential carrier left side upper bolt and nut until snug.
5. Install the differential carrier left side lower bolt and nut until snug.
6. Install the differential carrier right side nuts.

Tighten: Tighten the bolt to 100 N.m (74 lb ft).

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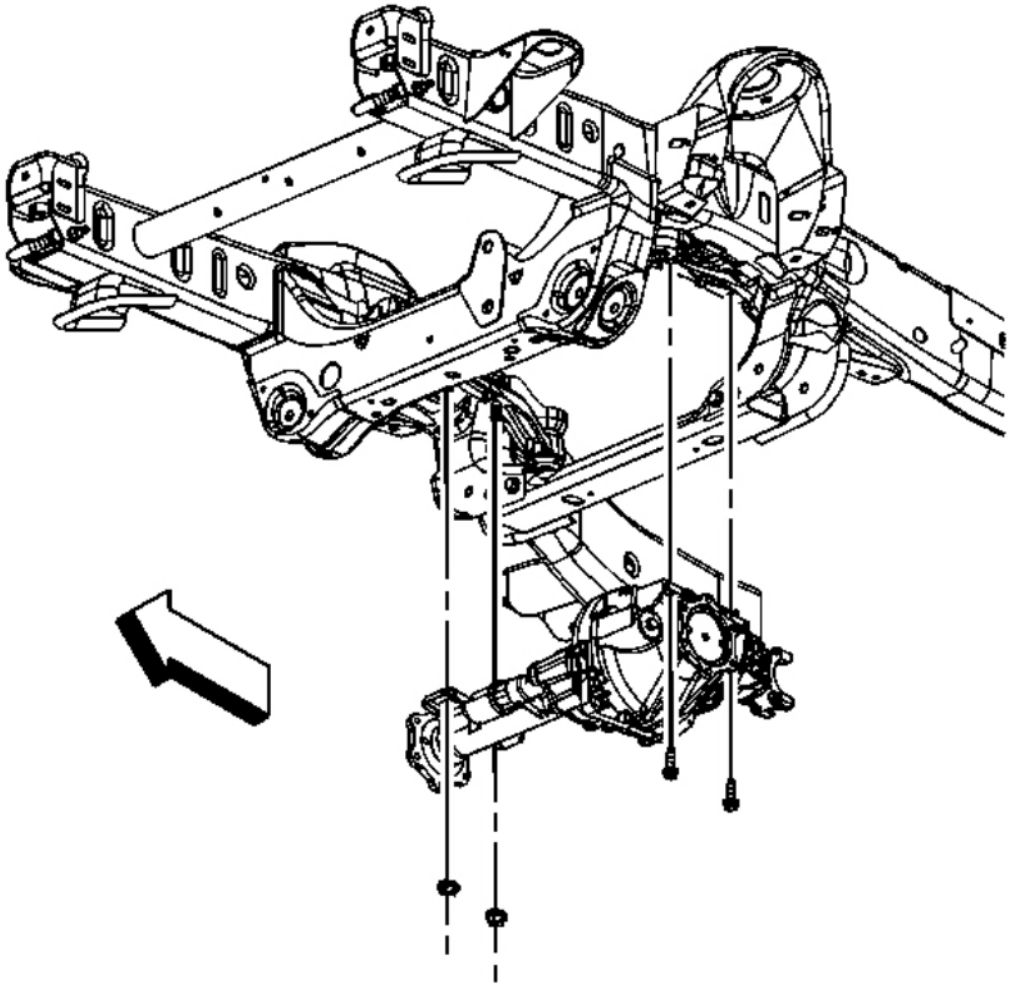


Fig. 36: Locating Differential Carrier Nuts
Courtesy of GENERAL MOTORS CORP.

7. For 1500 series vehicles, raise the differential carrier into position.
8. Install the differential carrier right side nuts.
9. Install the differential carrier left side bolts.

Tighten: Tighten the bolts/nuts to 100 N.m (74 lb ft).

10. If equipped, install the engine protection shield. Refer to **Engine Shield Replacement** .
11. Remove the jack or utility stand from the rear of the vehicle.

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12. Lower the vehicle.

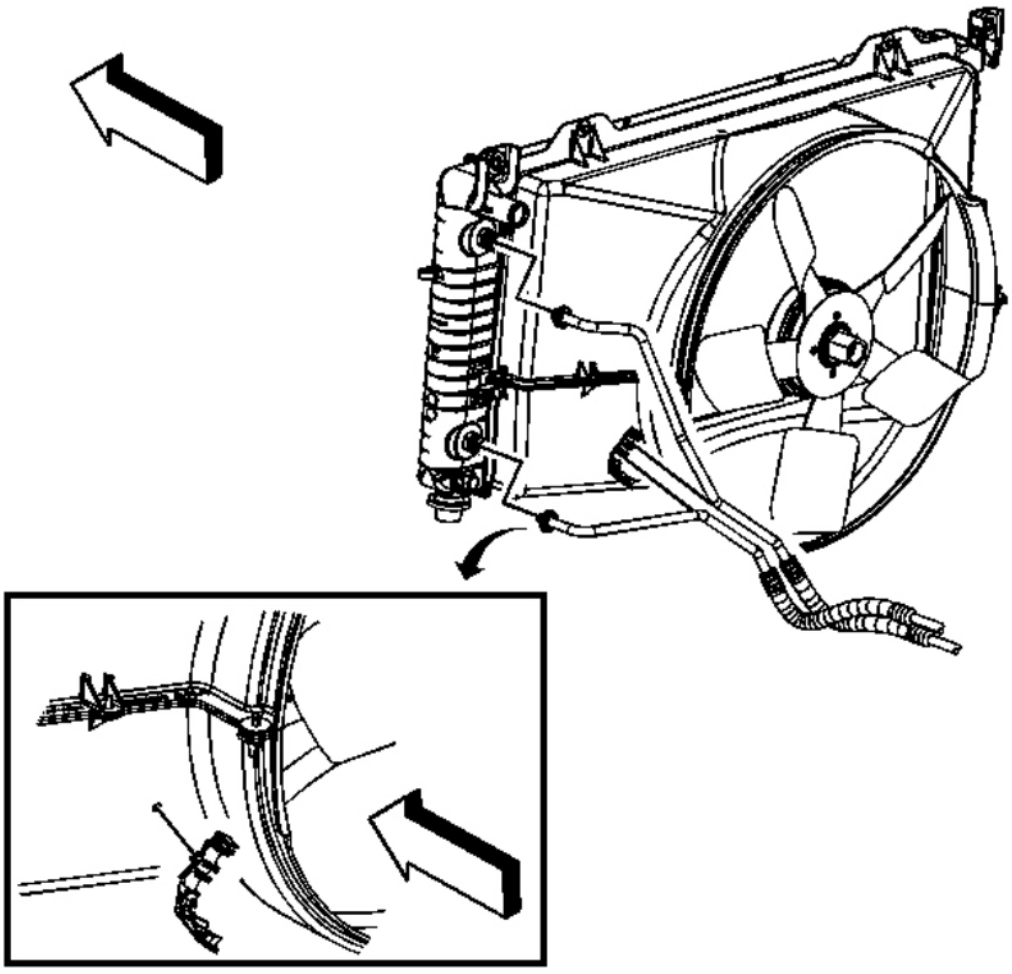


Fig. 37: View Of Oil Cooler Hoses & Clips
Courtesy of GENERAL MOTORS CORP.

IMPORTANT:

- **Ensure the oil cooler line being installed has a plastic cap on the end that connects to the quick connect fitting. If no plastic cap exists, or the plastic cap is damaged, obtain a new cap. Install the cap onto the cooler line prior cooler line installation.**
- **Do not use the plastic cap in order to install the cooler line into the fitting.**

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13. If equipped with RPO LY6 (6.0L) engine, install the oil cooler hoses to the clip.

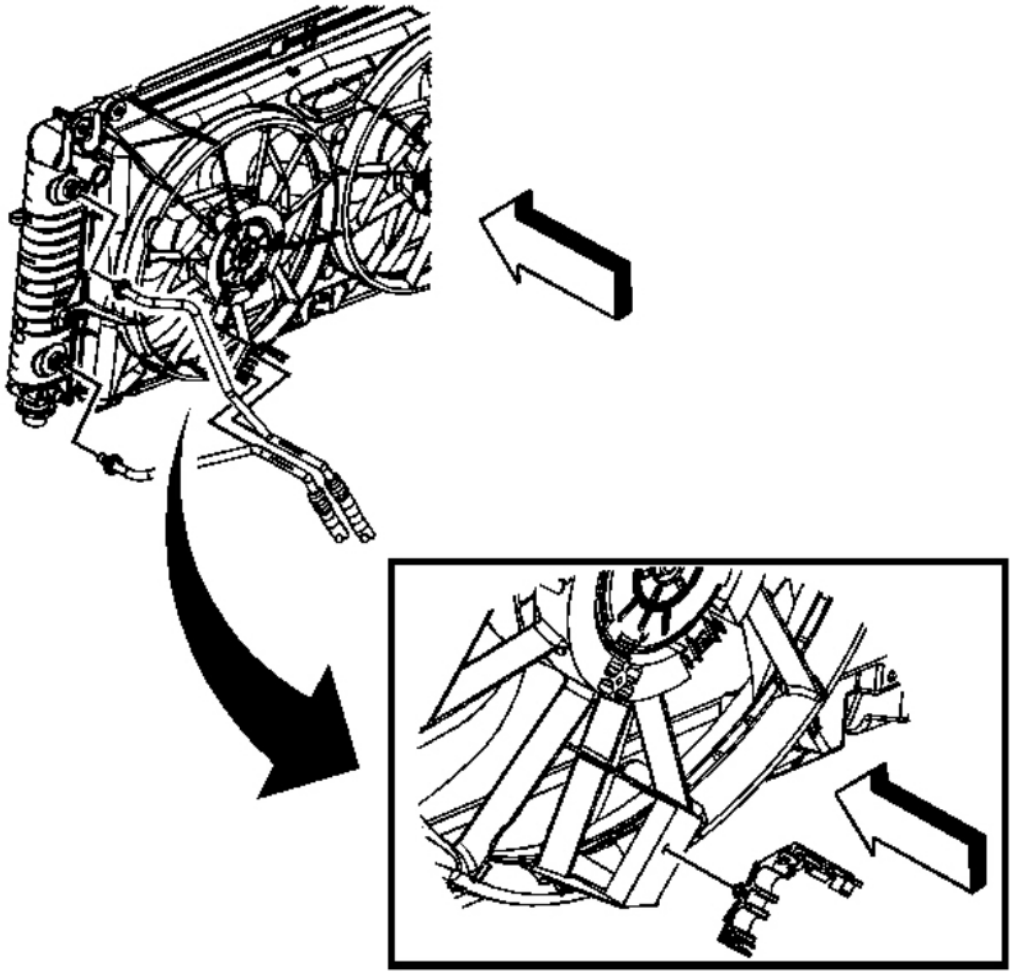


Fig. 38: Locating Quick Connect Fitting
Courtesy of GENERAL MOTORS CORP.

IMPORTANT:

- **Ensure the oil cooler line being installed has a plastic cap on the end that connects to the quick connect fitting. If no plastic cap exists, or the plastic cap is damaged, obtain a new cap. Install the cap onto the cooler line prior cooler line installation.**
- **Do not use the plastic cap in order to install the cooler line into the fitting.**

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14. If equipped with RPO L76 (6.0L) engine, perform the following:
    1. Install the oil cooler hoses to the hose clip on the fan shroud.
    2. Snap the oil cooler hose clip shut.
15. Install the oil cooler lines to the radiator. Refer to **Engine Oil Cooler Pipe/Hose Quick Connect Fitting**.

FAN REPLACEMENT (GASOLINE)

Tools Required

J 46406 Fan Clutch Remover and Installer

Removal Procedure

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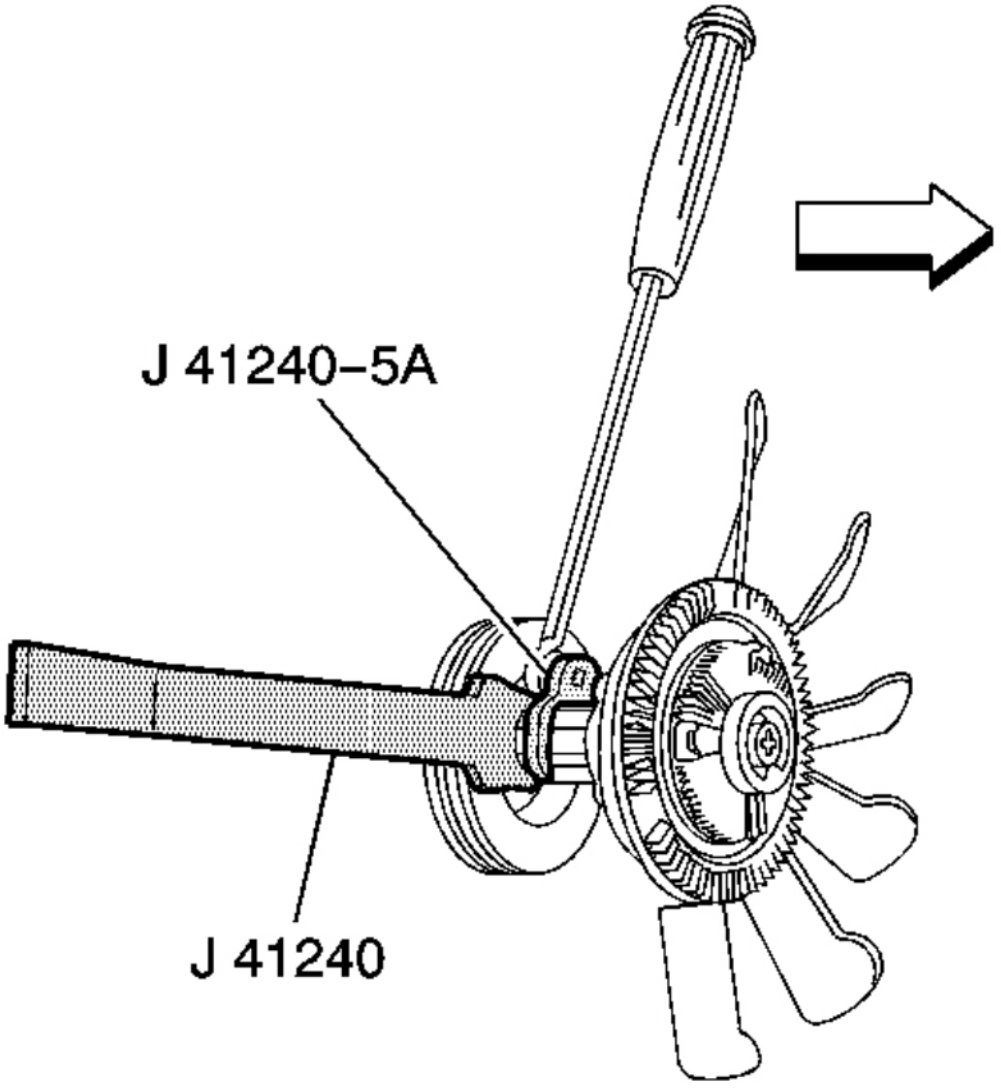


Fig. 39: View Of Fan Clutch Special Tools
Courtesy of GENERAL MOTORS CORP.

1. Remove the upper fan shroud. Refer to **Fan Shroud Replacement - Upper**.
2. Install the **J 46406** to the fan clutch.

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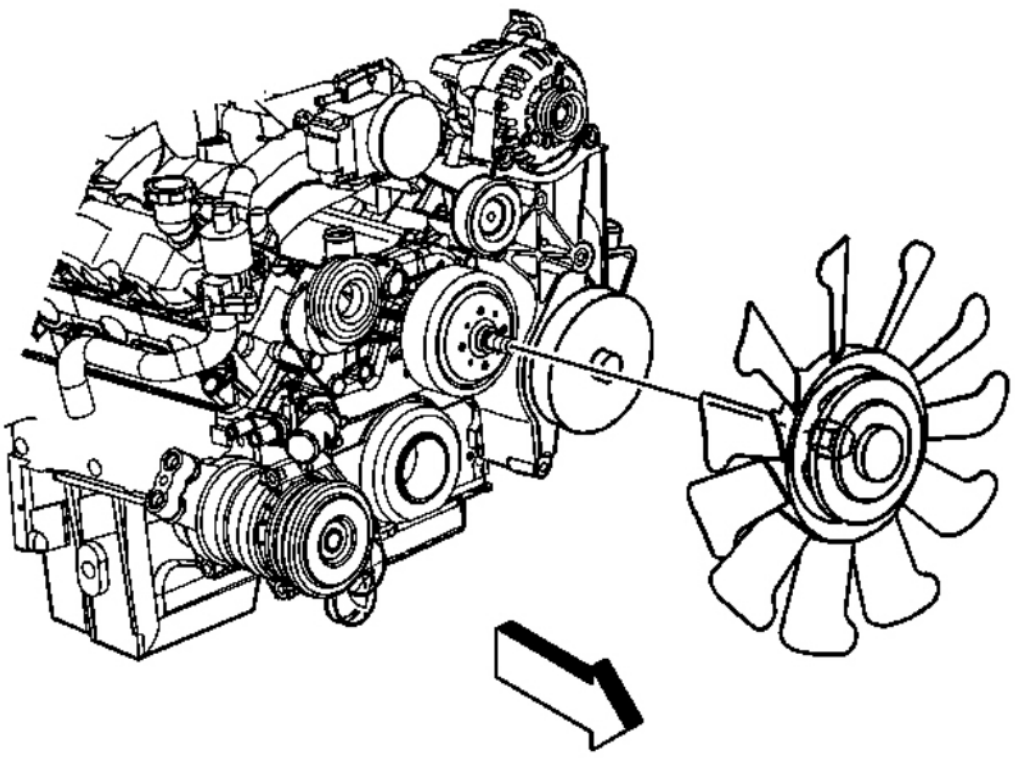


Fig. 40: View Of Fan Assembly Removed
Courtesy of GENERAL MOTORS CORP.

3. Remove the fan hub nut from the water pump in a counterclockwise rotation.

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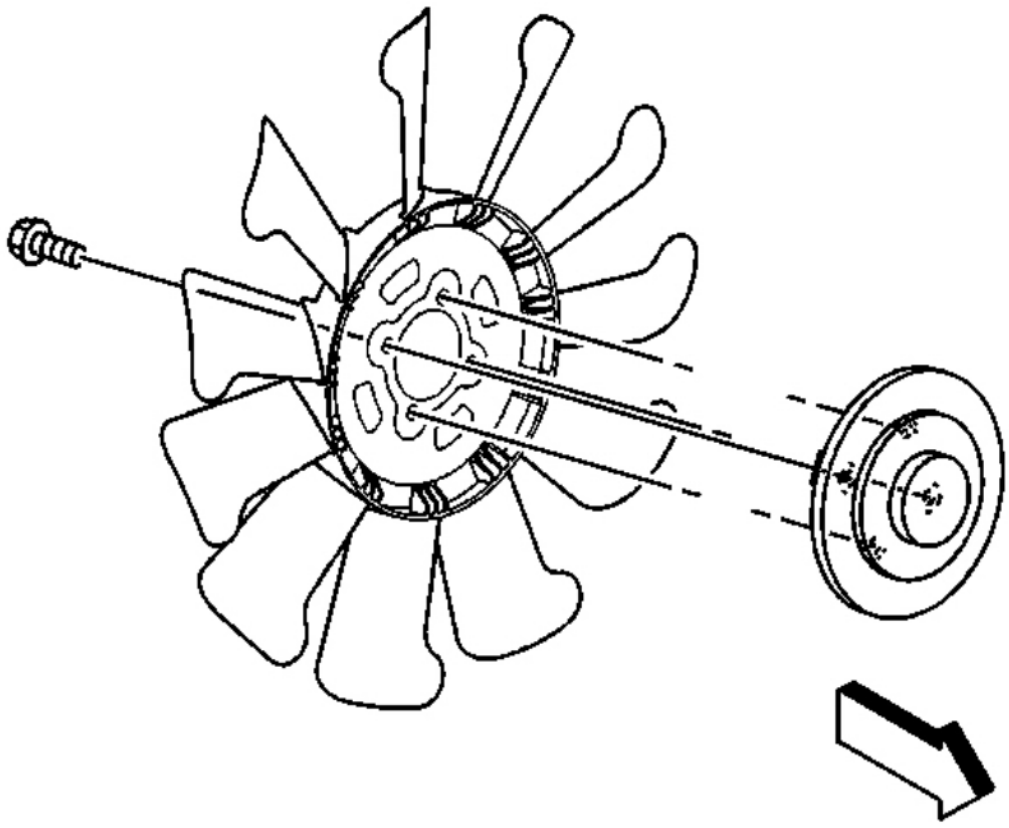


Fig. 41: View Of Fan Clutch & Fan Blade
Courtesy of GENERAL MOTORS CORP.

4. Remove the fan clutch bolts from the rear of the fan blade.
5. Separate the fan clutch from the fan blade.

Installation Procedure

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

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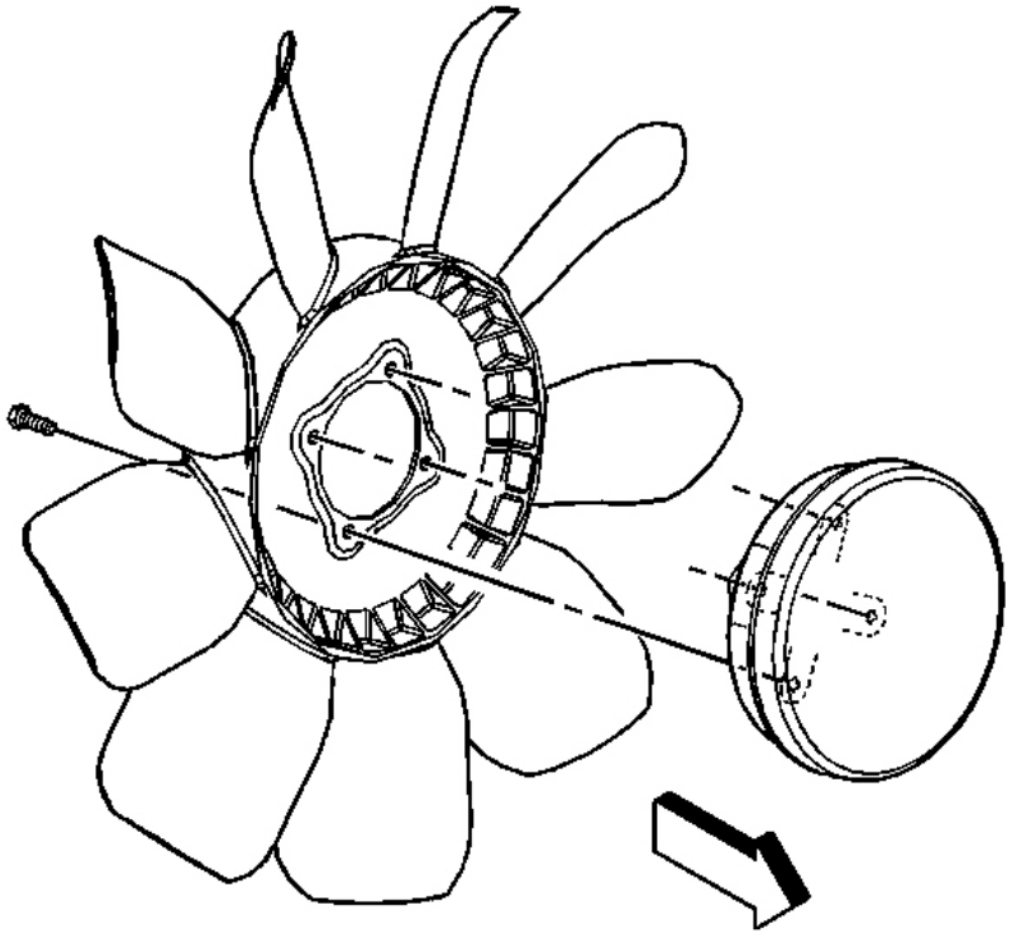


Fig. 42: View Of Fan Blade & Fan Clutch
Courtesy of GENERAL MOTORS CORP.

1. Install the fan clutch onto the fan blade.

NOTE: **Refer to Fastener Notice .**

2. Install the fan clutch bolts

Tighten: Tighten the bolts to 23 N.m (17 lb ft).

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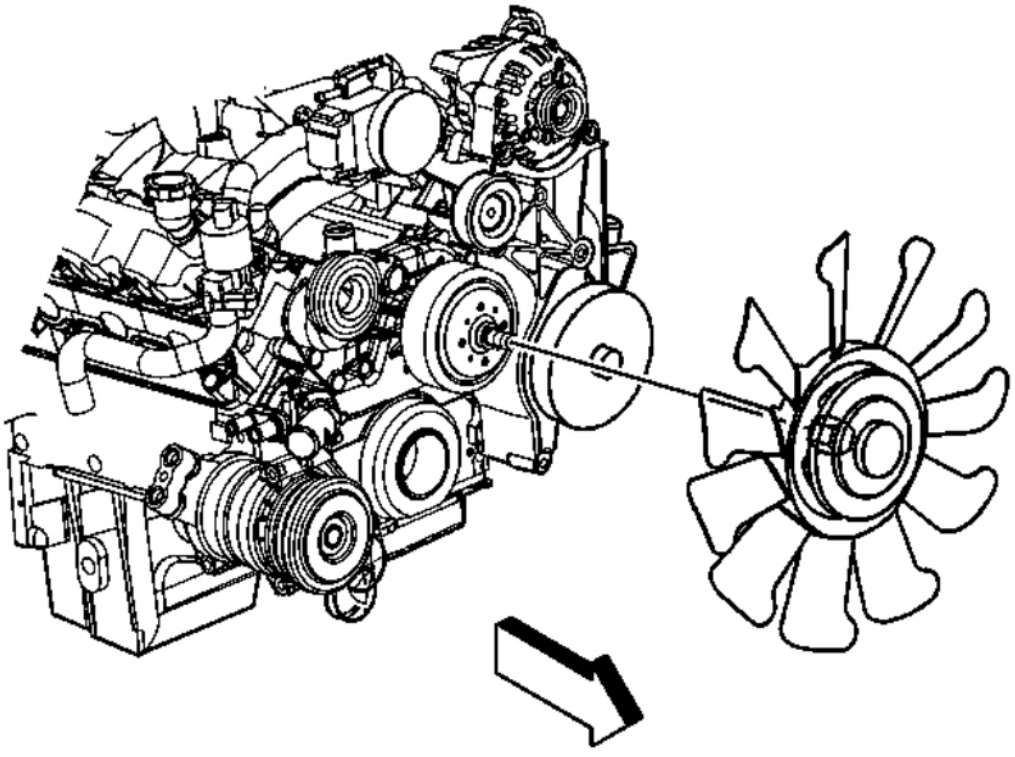


Fig. 43: View Of Fan Assembly Removed
Courtesy of GENERAL MOTORS CORP.

3. Install the fan assembly.

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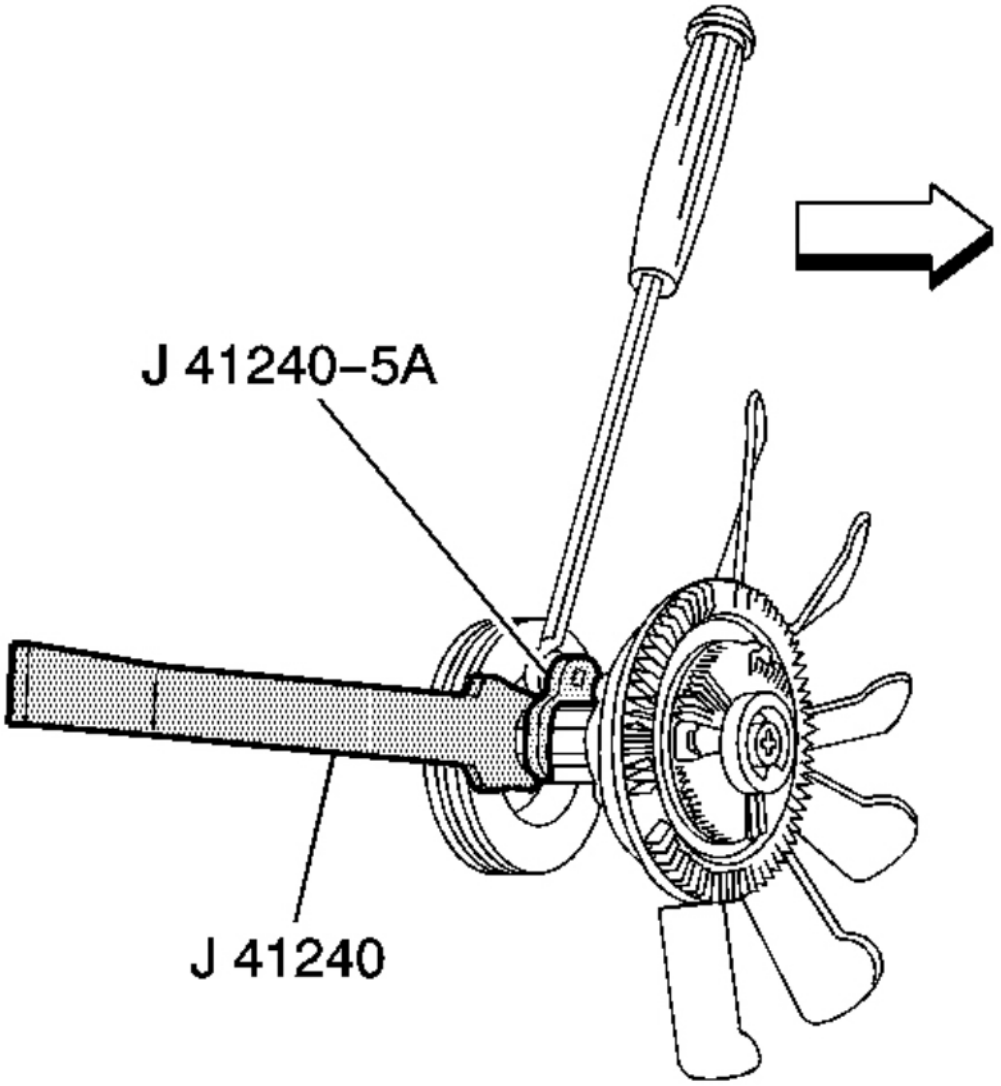


Fig. 44: View Of Fan Clutch Special Tools
Courtesy of GENERAL MOTORS CORP.

4. Install the **J 46406** to the fan clutch.

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

5. Install the upper fan shroud. Refer to **Fan Shroud Replacement - Upper**.

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COOLING FAN REPLACEMENT - ELECTRIC

Removal Procedure

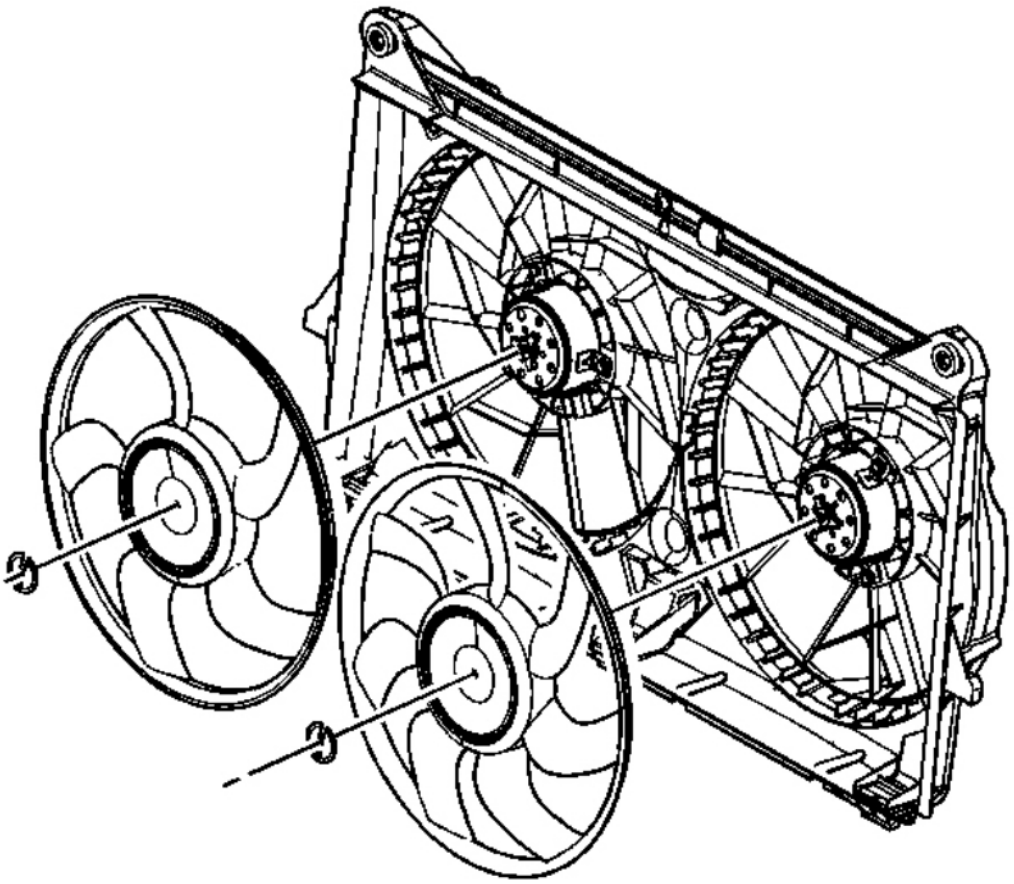


Fig. 45: Cooling Fan & Retainers
Courtesy of GENERAL MOTORS CORP.

1. Remove the cooling fan and shroud. Refer to **Cooling Fan and Shroud Replacement**.
2. Remove the cooling fan blade retainers.
3. Remove the cooling fan blades.

Installation Procedure

IMPORTANT: The electric cooling fan assembly uses a 5-blade fan and a 7-blade fan. It does not matter which side the fan blades are installed on. DO NOT install two 5-

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blade assemblies or two 7-blade assemblies, as this would cause a noise issue.

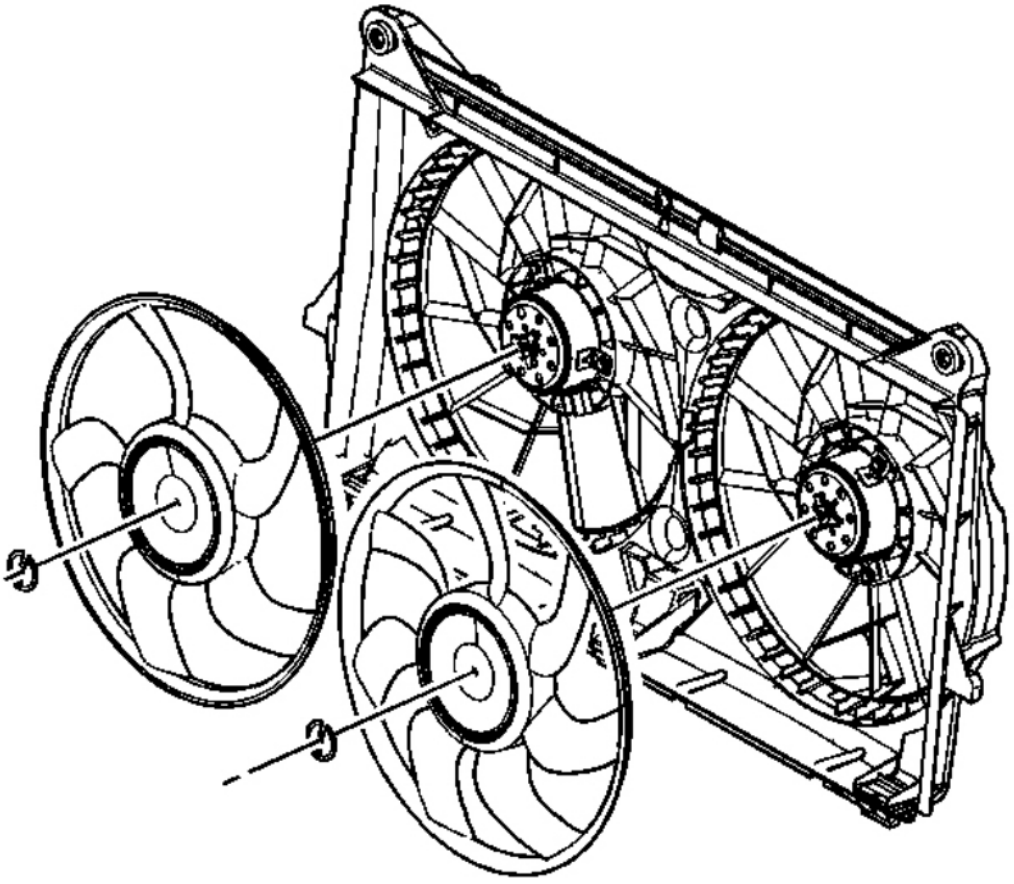


Fig. 46: Cooling Fan & Retainers
Courtesy of GENERAL MOTORS CORP.

1. Install the cooling fan blades.
2. Install the cooling fan blade retainers.
3. Install the cooling fan and shroud. Refer to **Cooling Fan and Shroud Replacement**.

COOLING FAN MOTOR REPLACEMENT - ELECTRIC

Removal Procedure

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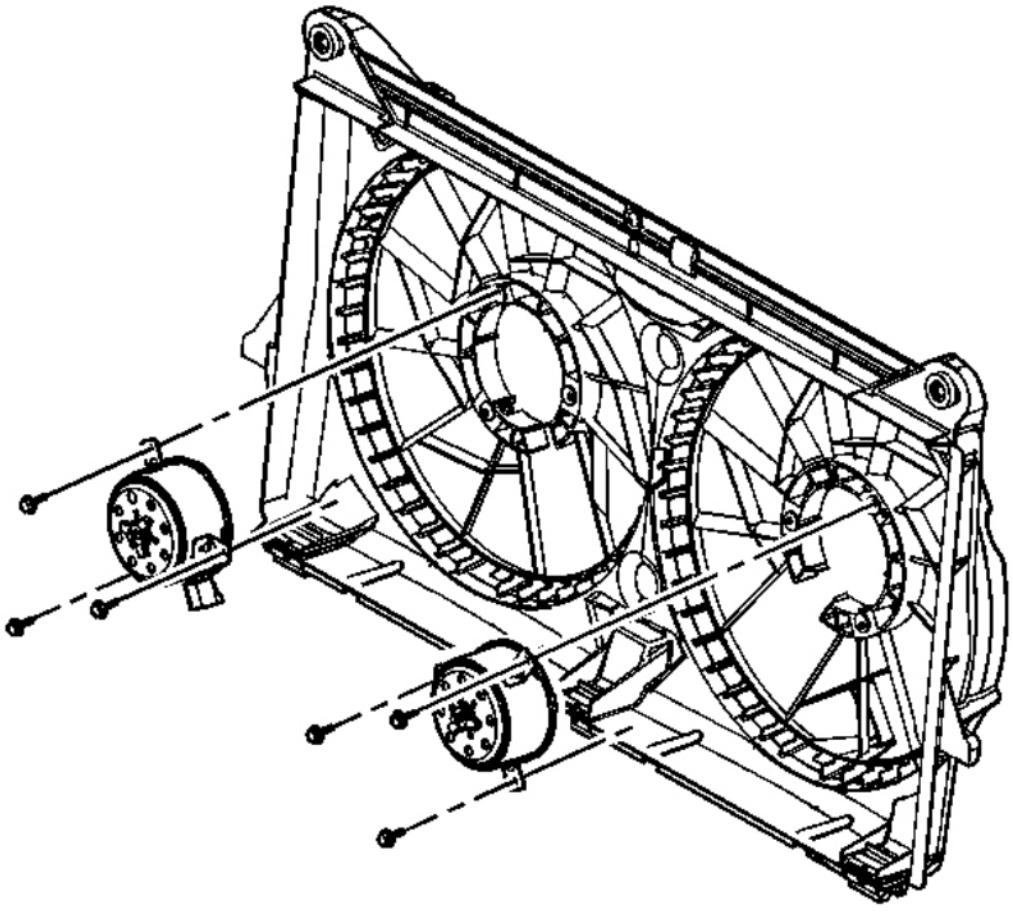


Fig. 47: Cooling Fan Motor & Bolts
Courtesy of GENERAL MOTORS CORP.

1. Remove the cooling blade(s). Refer to **Cooling Fan Replacement - Electric**.
2. Remove the cooling fan motor bolts.
3. Remove the cooling fan motor(s).

Installation Procedure

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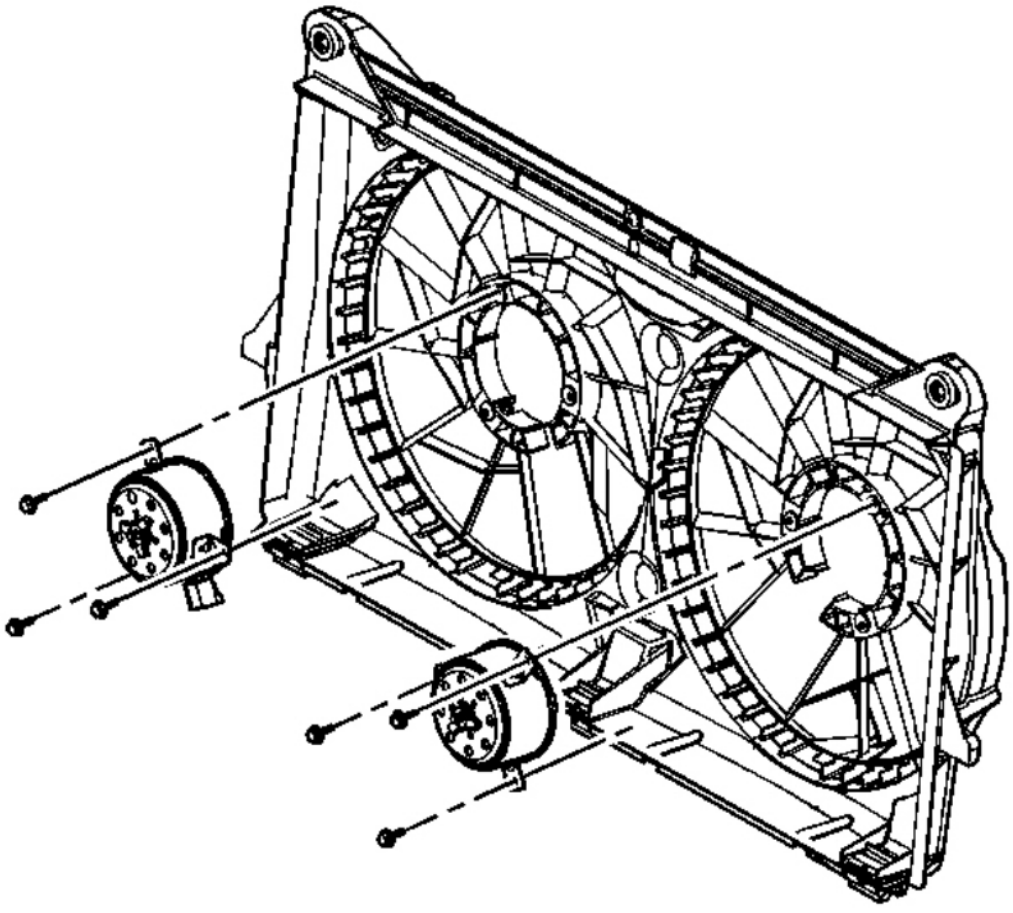


Fig. 48: Cooling Fan Motor & Bolts
Courtesy of GENERAL MOTORS CORP.

NOTE: **Refer to Fastener Notice .**

1. Install the cooling fan motor(s).
2. Install the cooling fan motor bolts.

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

3. Install the cooling fan blades. Refer to **Cooling Fan Replacement - Electric**.

COOLING FAN AND SHROUD REPLACEMENT

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Removal Procedure

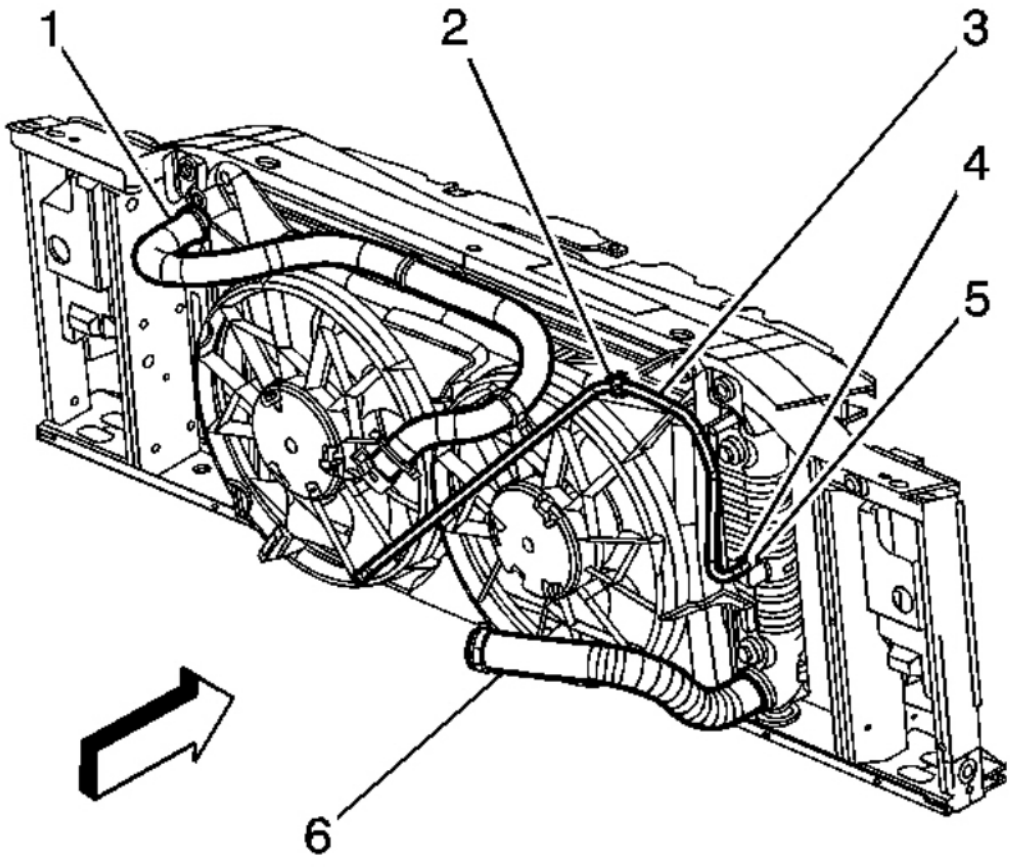


Fig. 49: Radiator, Inlet & Outlet Hose & Clamps
Courtesy of GENERAL MOTORS CORP.

1. Disengage the radiator inlet hose clip (2) at the fan shroud.

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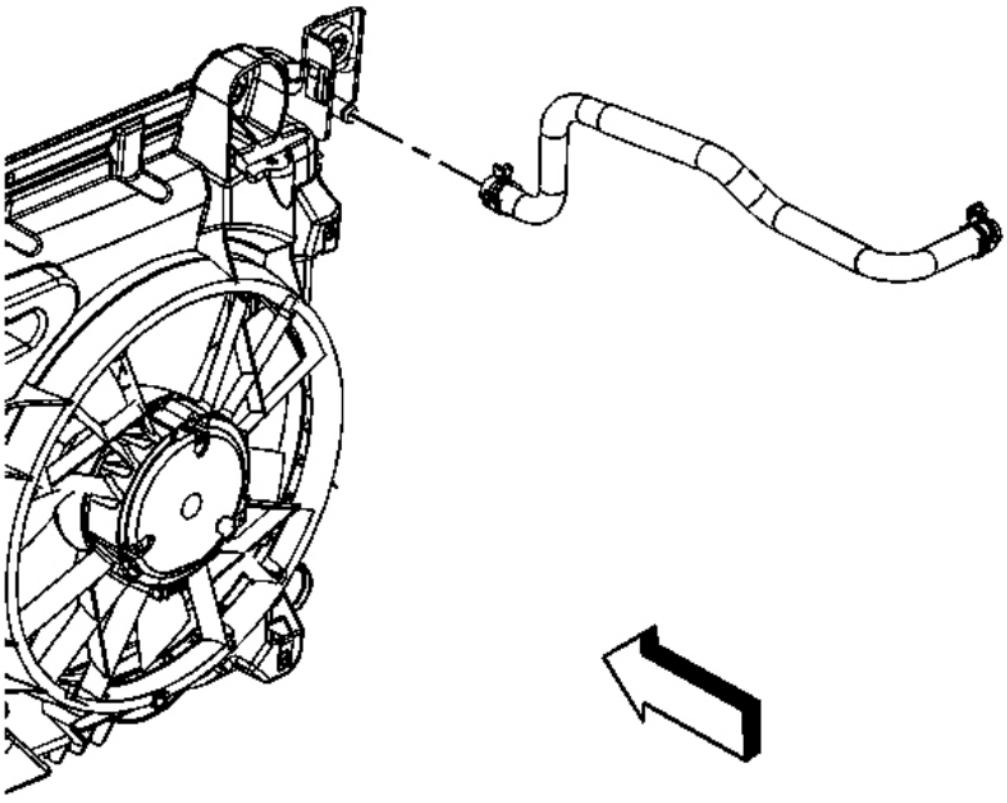


Fig. 50: View Of Surge Tank Inlet Hose & Clamp
Courtesy of GENERAL MOTORS CORP.

2. If necessary, reposition the surge tank inlet hose clamp at the radiator.
3. If necessary, remove the surge tank inlet hose from the radiator.

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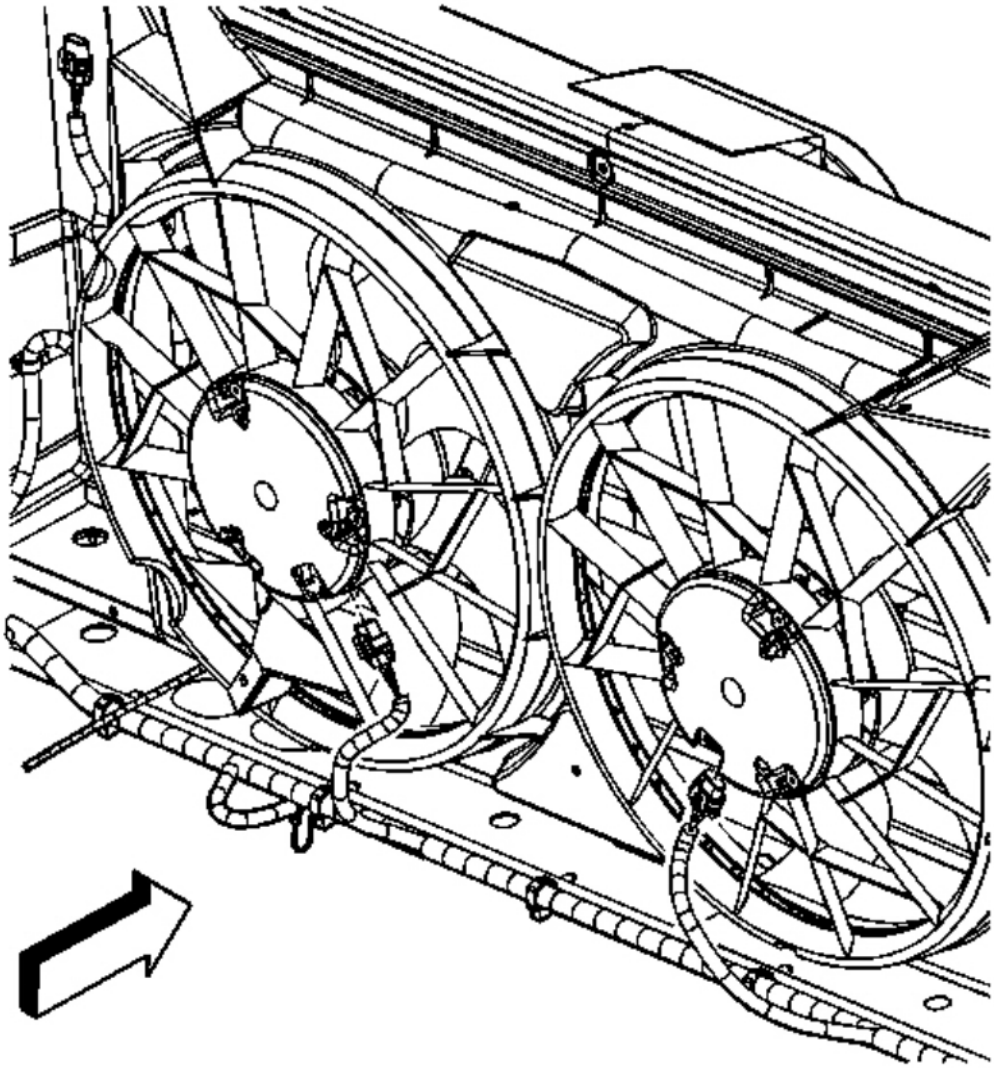


Fig. 51: Cooling Fan Electrical Connectors
Courtesy of GENERAL MOTORS CORP.

4. Disconnect the electrical connectors from the cooling fans.
5. Remove the clip attaching the wiring harness to the shroud.
6. Remove transmission cooler lines bolts from fan shroud, (Qty: 2).

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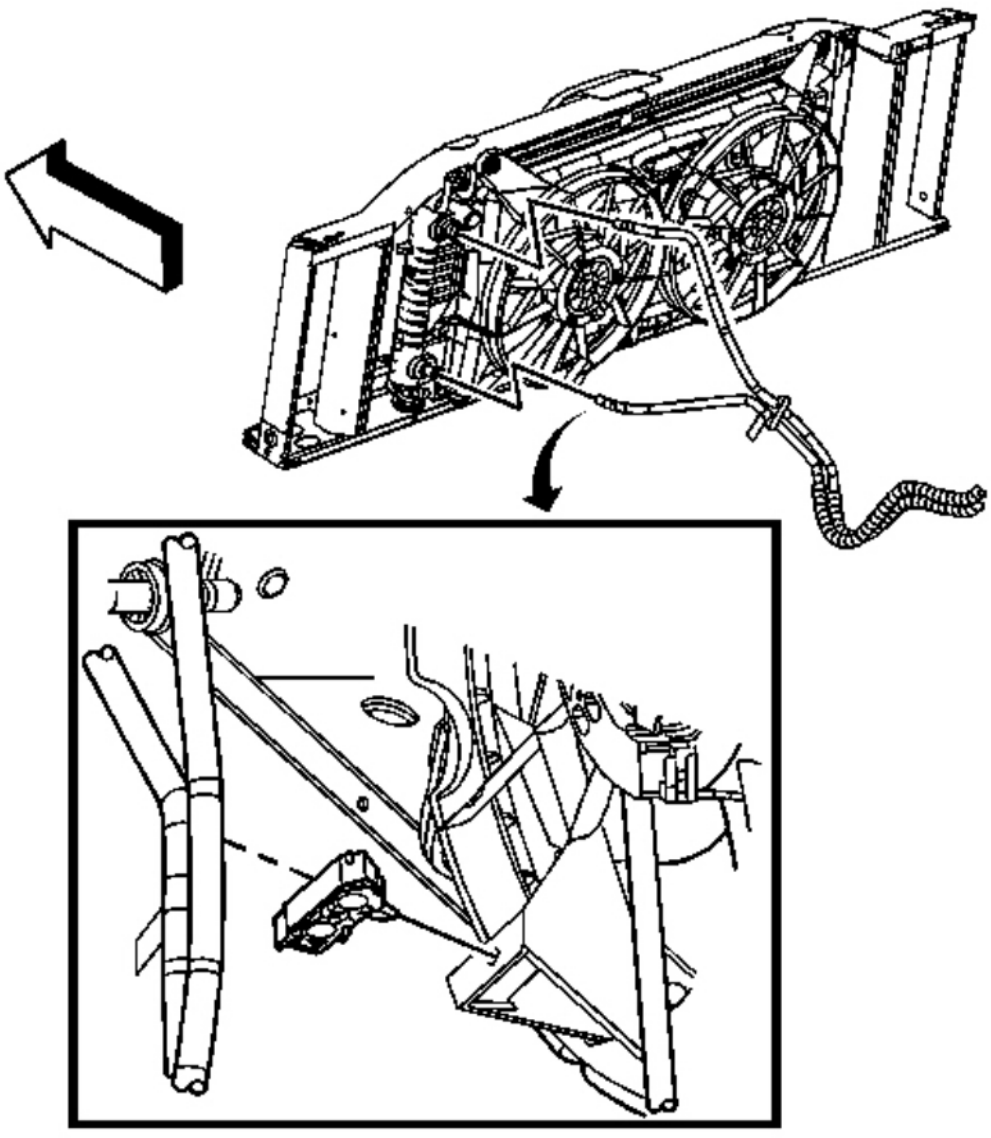


Fig. 52: Engine Oil Cooler Quick Connect Fittings
Courtesy of GENERAL MOTORS CORP.

7. If necessary, open the engine oil cooler line clip and remove the cooler lines from the clip.

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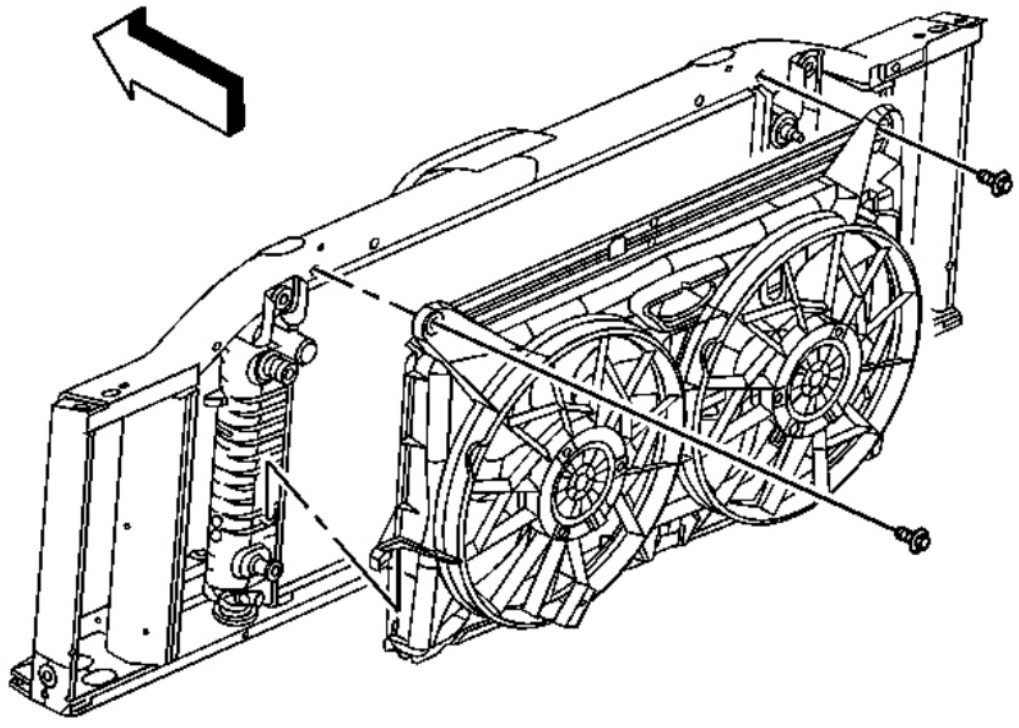


Fig. 53: Cooling Fan Shroud & Bolts
Courtesy of GENERAL MOTORS CORP.

8. Remove the cooling fan shroud bolts.
9. Remove the cooling fan and shroud.

Installation Procedure

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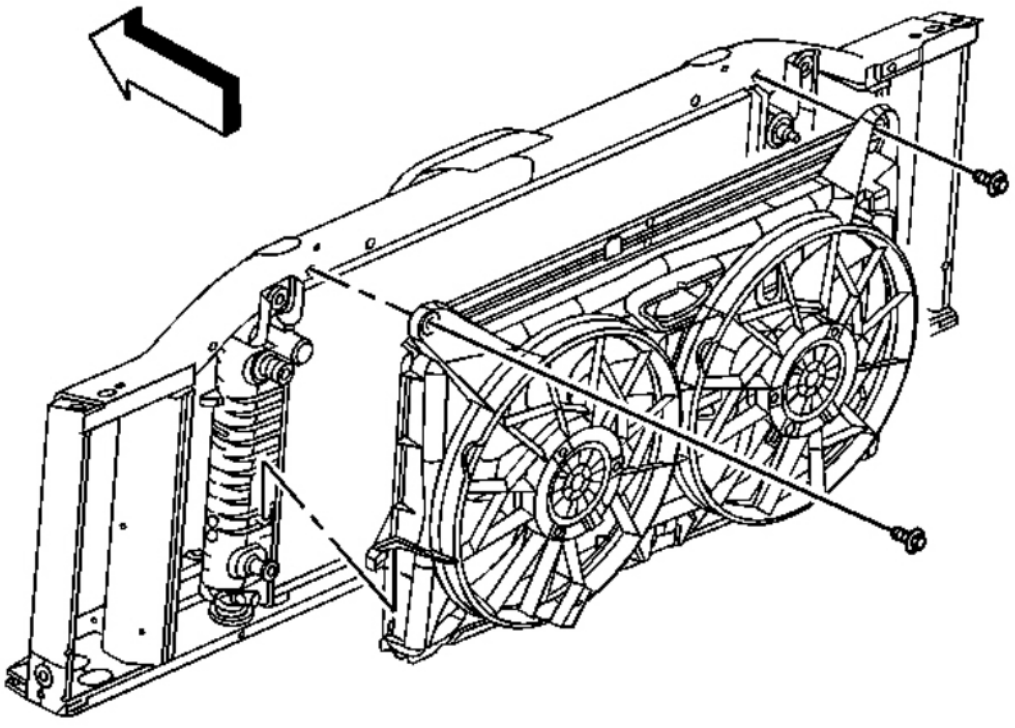


Fig. 54: Cooling Fan Shroud & Bolts
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Insert the 3 lower tabs into the radiator support flange. Keeping the shroud parallel to the radiator will ensure the correct installation of the lower tabs.

1. Install the cooling fan and shroud.

   NOTE: Refer to Fastener Notice .

2. Install the cooling fan shroud bolts.

   Tighten: Tighten the bolts to 9 N.m (80 lb in).

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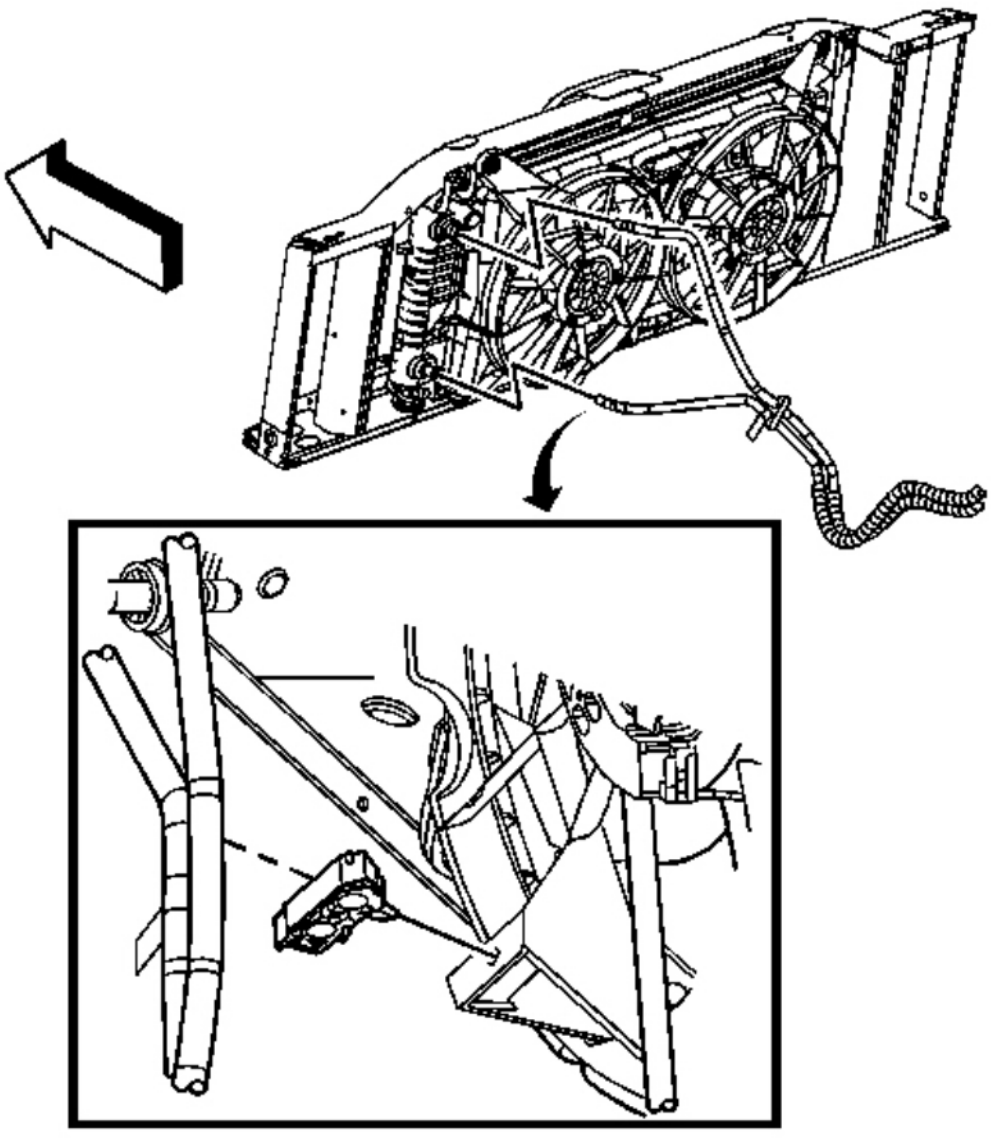


Fig. 55: Engine Oil Cooler Quick Connect Fittings
Courtesy of GENERAL MOTORS CORP.

3. If equipped, install the cooler lines to the clip and close the clip.

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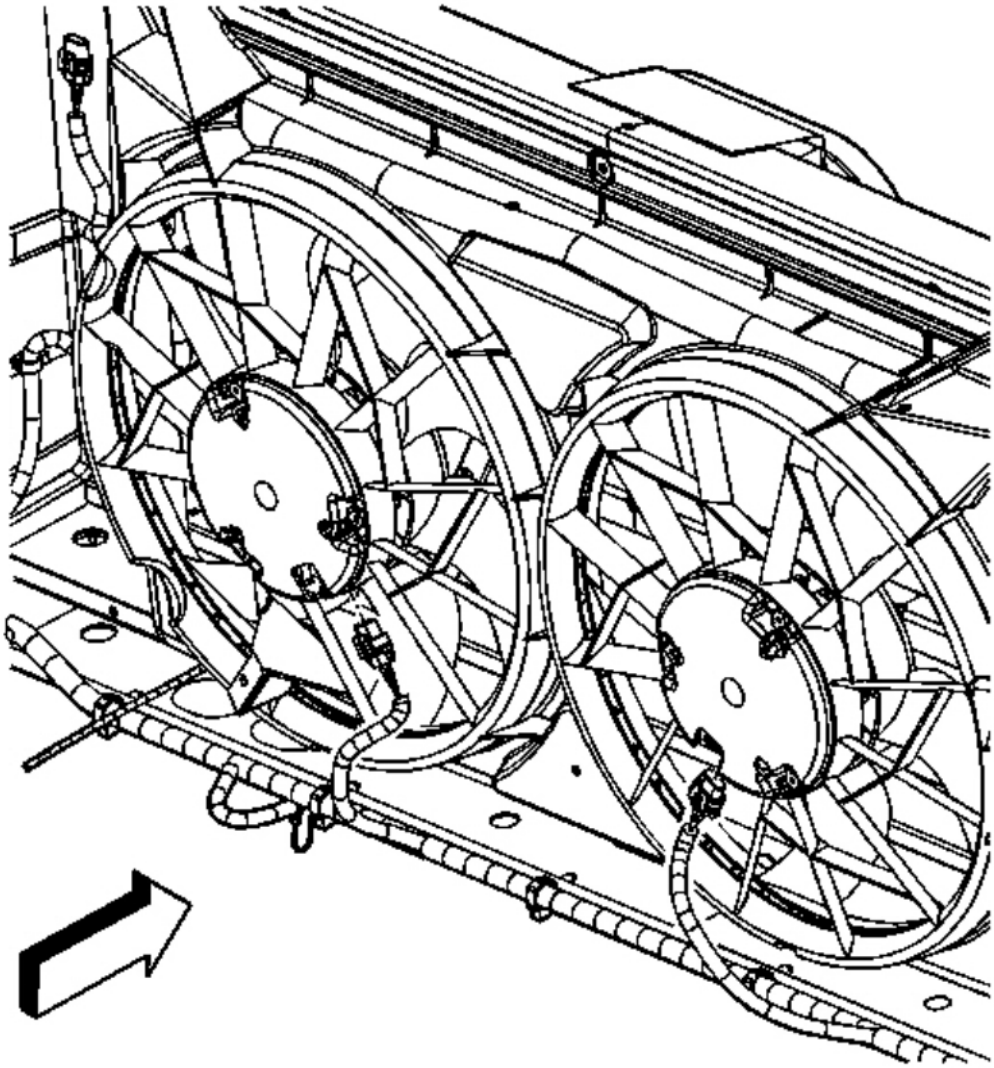


Fig. 56: Cooling Fan Electrical Connectors
Courtesy of GENERAL MOTORS CORP.

4. Connect the electrical connectors to the cooling fans.
5. Install the clip attaching the wiring harness to the shroud.
6. Install transmission cooling lines bolts to fan shroud.

Tighten: Tighten the bolts to 4 N.m (35 lb in).

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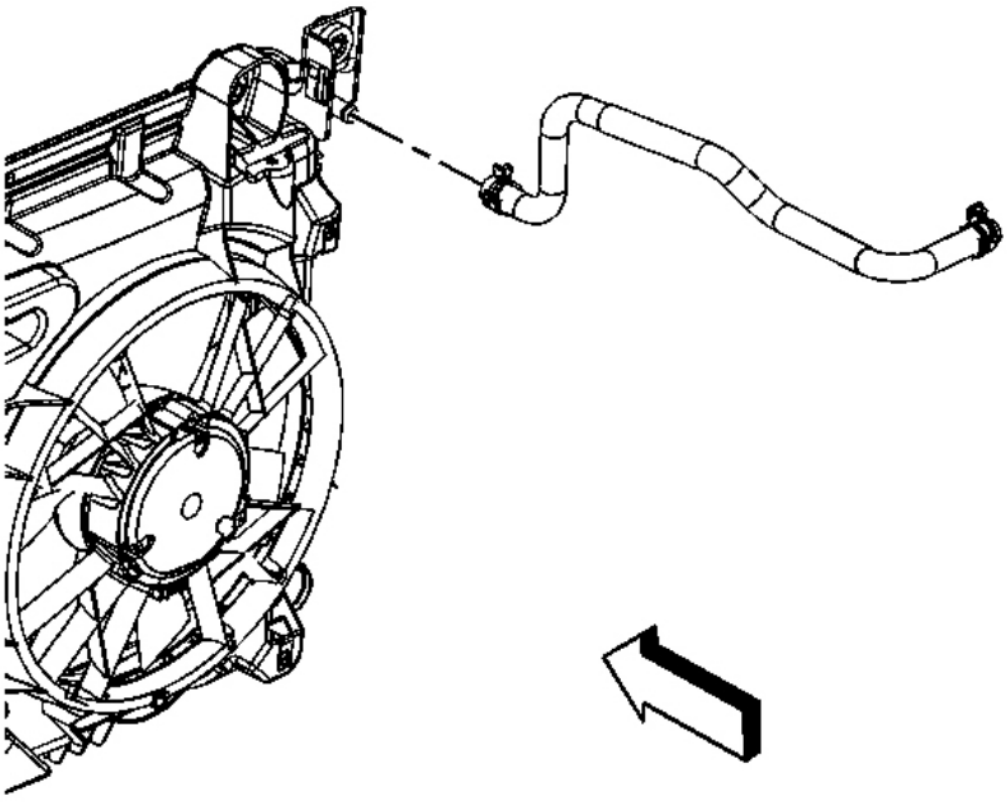


Fig. 57: View Of Surge Tank Inlet Hose & Clamp
Courtesy of GENERAL MOTORS CORP.

7. If necessary, install the surge tank inlet hose to the radiator.
8. If necessary, reposition the surge tank inlet hose clamp at the radiator.

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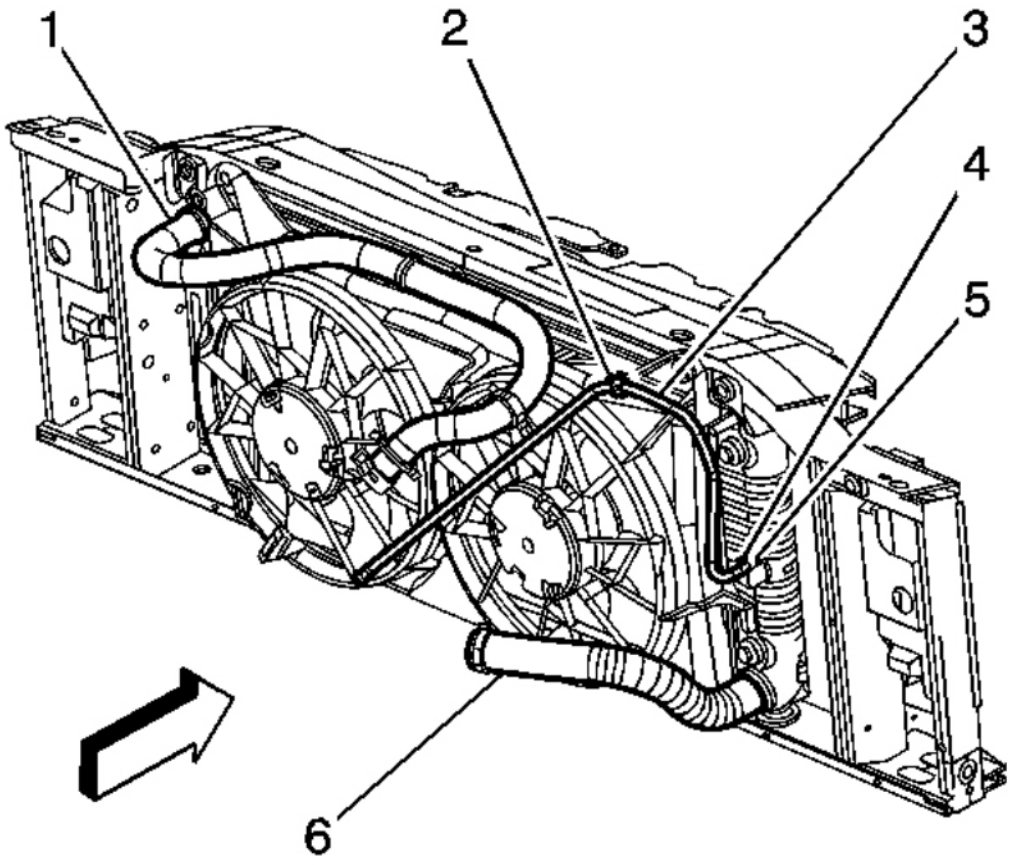


Fig. 58: Radiator, Inlet & Outlet Hose & Clamps
Courtesy of GENERAL MOTORS CORP.

9. Engage the radiator inlet hose clip (2) at the fan shroud.

ENGINE COOLANT THERMOSTAT HOUSING REPLACEMENT

Removal Procedure

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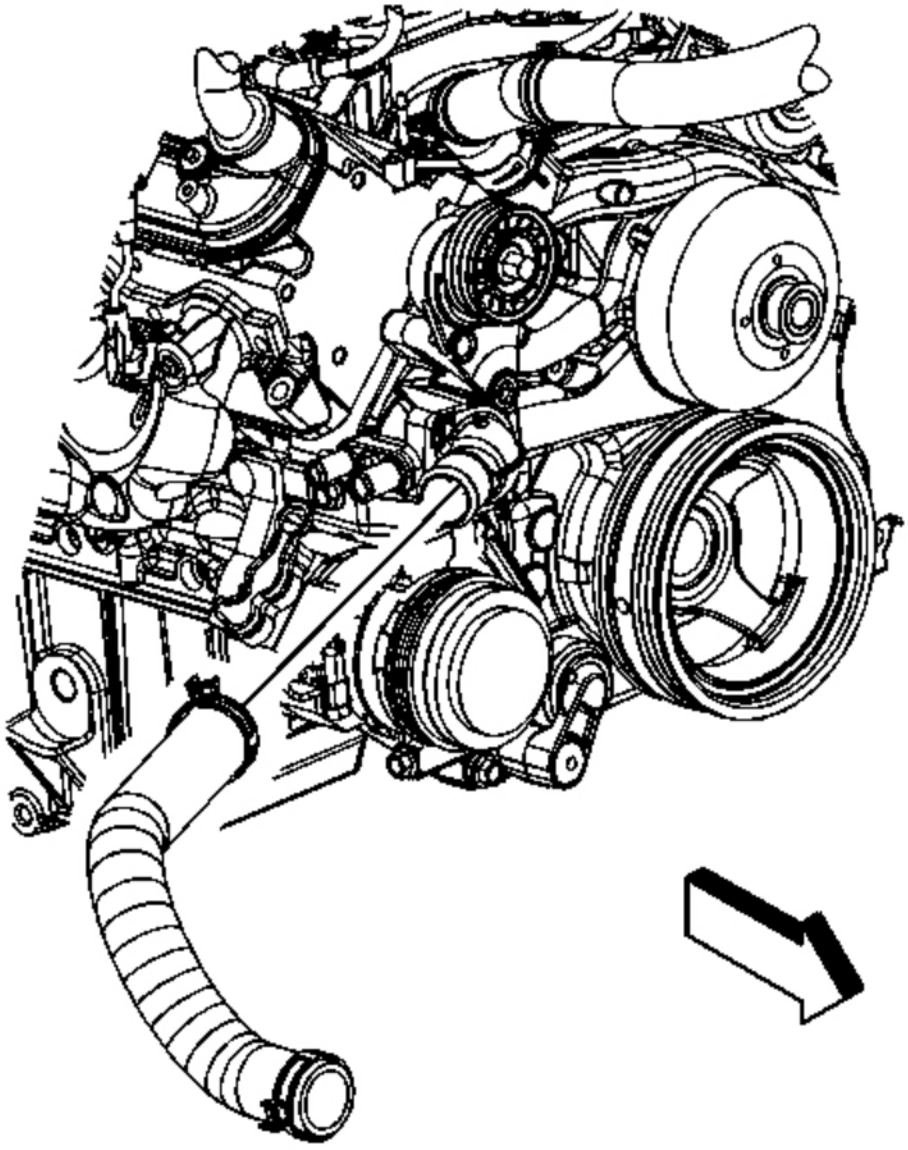


Fig. 59: View Of Radiator Outlet Hose
Courtesy of GENERAL MOTORS CORP.

1. Drain the cooling system. Refer to **Draining and Filling Cooling System**.
2. Remove the air cleaner outlet duct. Refer to **Air Cleaner Resonator Outlet Duct Replacement** .
3. Reposition the radiator outlet hose clamp at the water pump inlet.

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4. Remove the radiator outlet hose from the water pump inlet.

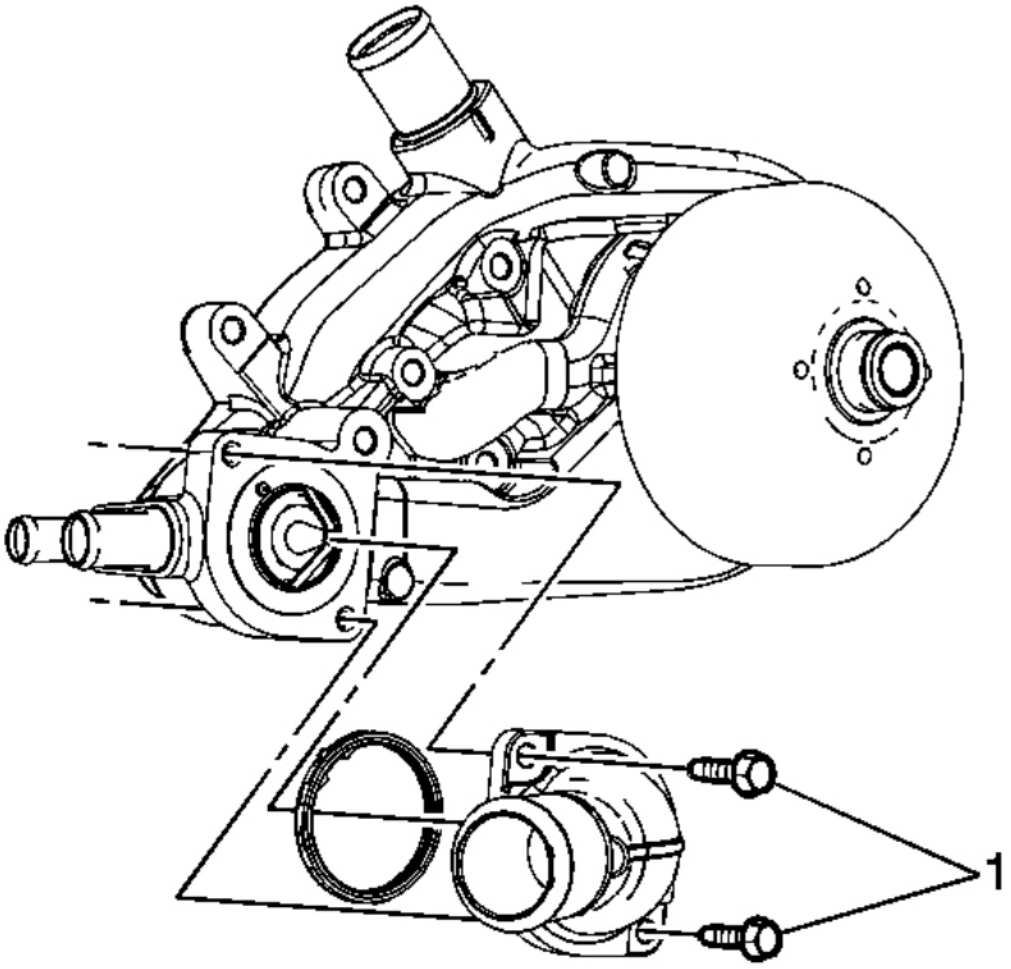


Fig. 60: View Of Water Pump Inlet Seal
Courtesy of GENERAL MOTORS CORP.

5. Remove the water pump inlet bolts.
6. Remove the water pump inlet from the water pump.
7. Remove and discard the water pump inlet seal.

Installation Procedure

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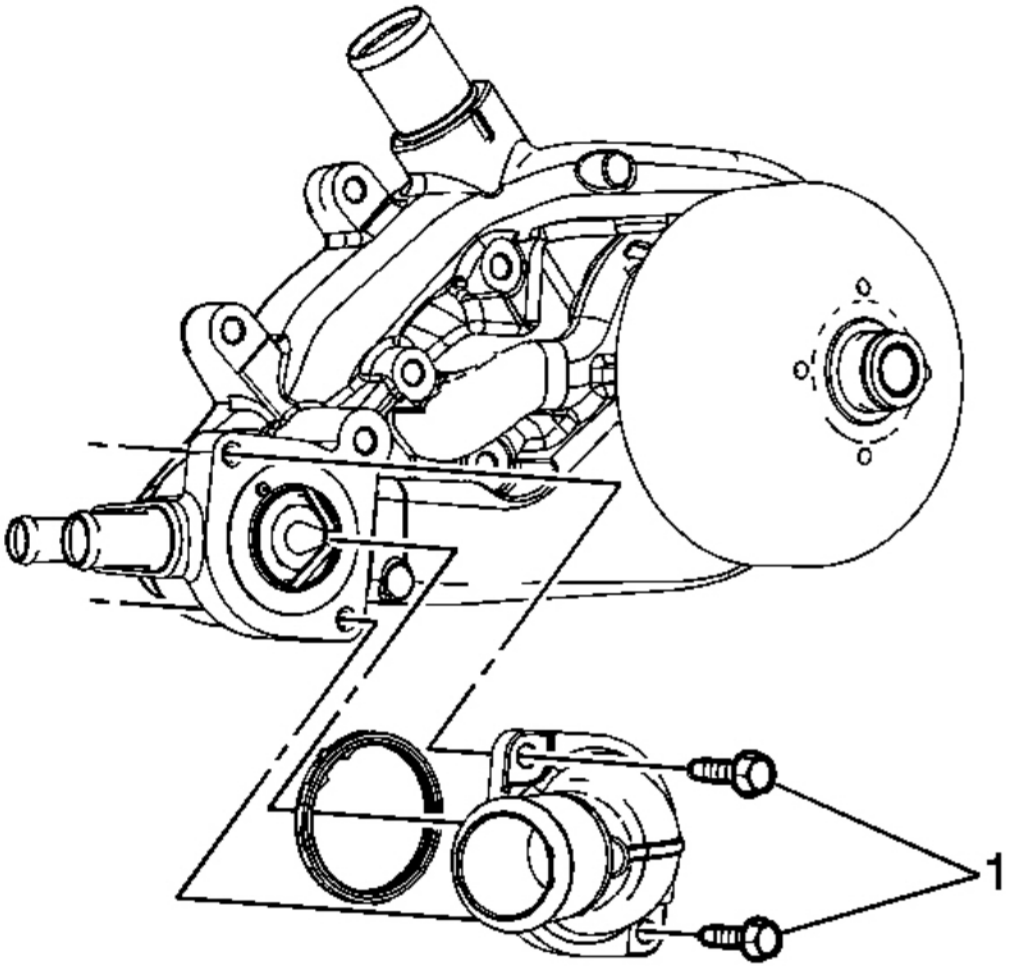


Fig. 61: View Of Water Pump Inlet Seal
Courtesy of GENERAL MOTORS CORP.

1. Install a NEW water pump inlet seal to the water pump inlet.
2. Position the water pump inlet to the water pump.

NOTE: **Refer to Fastener Notice .**

3. Install the water pump inlet bolts.

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

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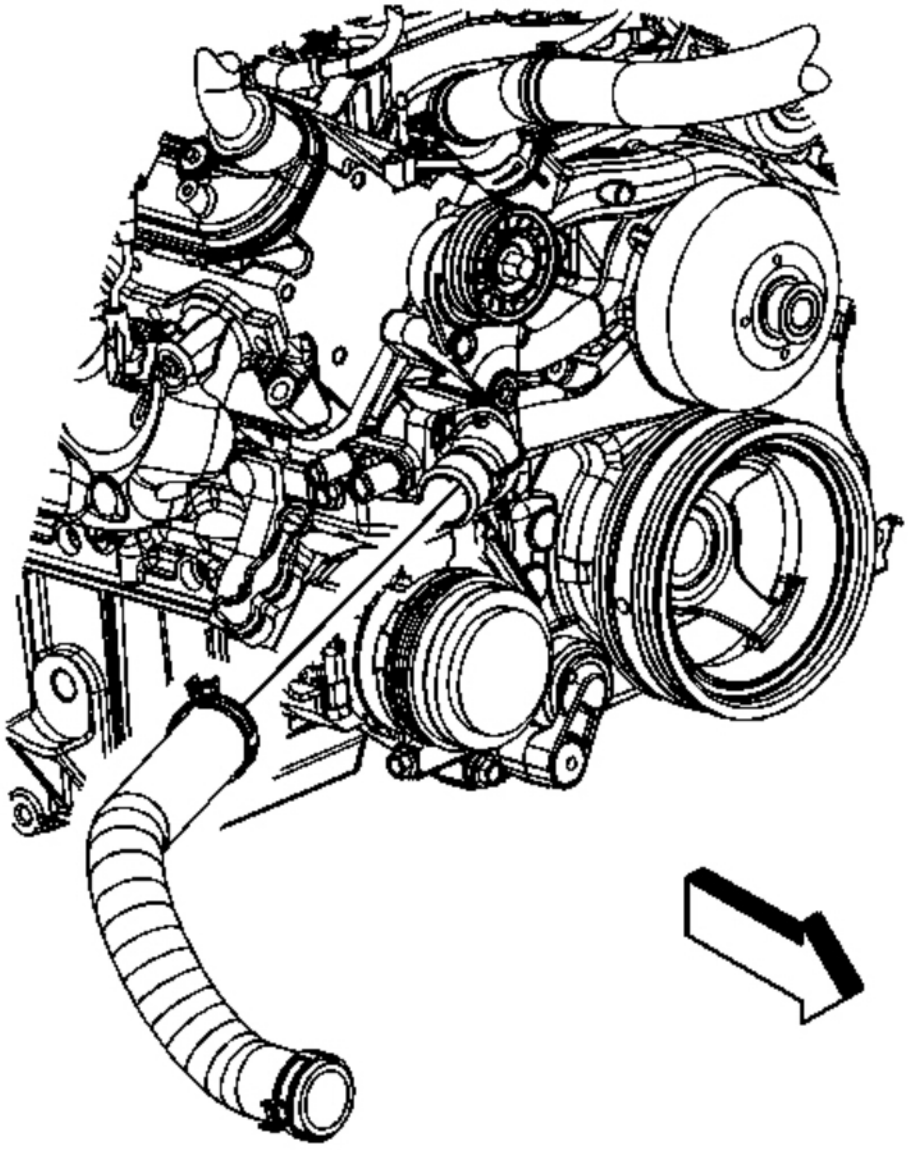


Fig. 62: View Of Radiator Outlet Hose
Courtesy of GENERAL MOTORS CORP.

4. Install the radiator outlet hose to the water pump inlet.
5. Position the radiator outlet hose clamp at the water pump inlet.
6. Install the air cleaner outlet duct. Refer to **Air Cleaner Resonator Outlet Duct Replacement** .

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7. Fill the cooling system. Refer to **Draining and Filling Cooling System**.

THERMOSTAT REPLACEMENT

Removal Procedure

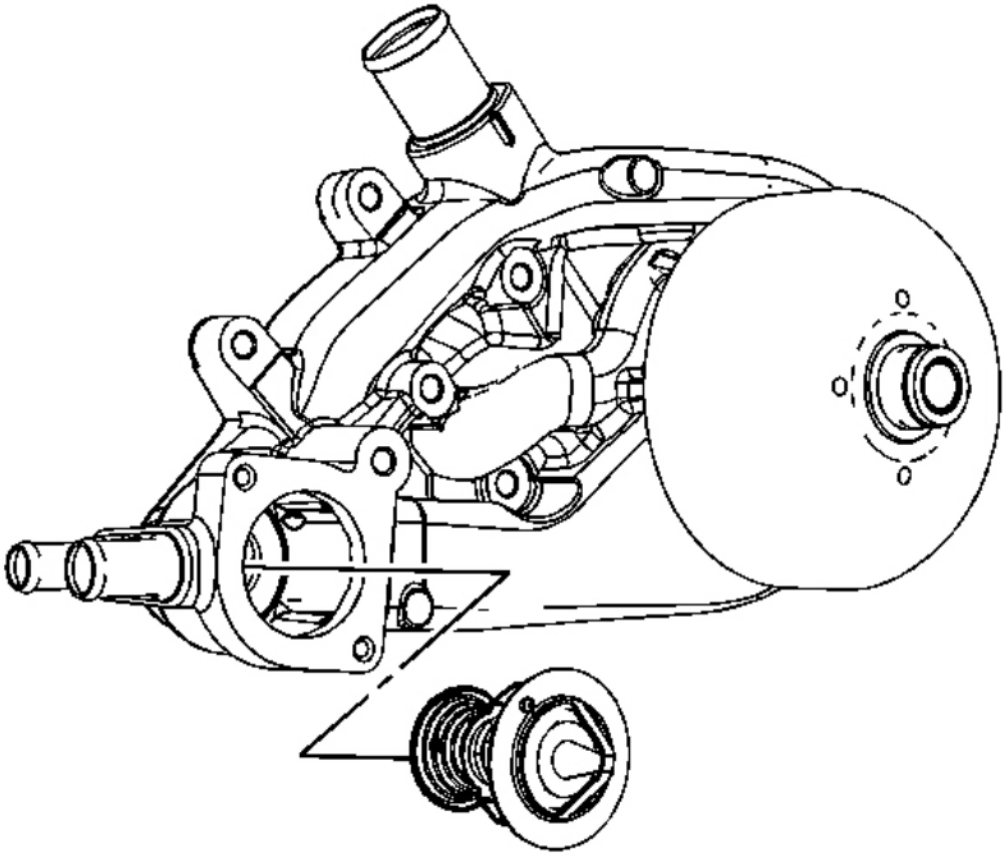


Fig. 63: View Of Thermostat & Housing
Courtesy of GENERAL MOTORS CORP.

1. Remove the thermostat housing. Refer to **Engine Coolant Thermostat Housing Replacement**.
2. Remove the thermostat.

Installation Procedure

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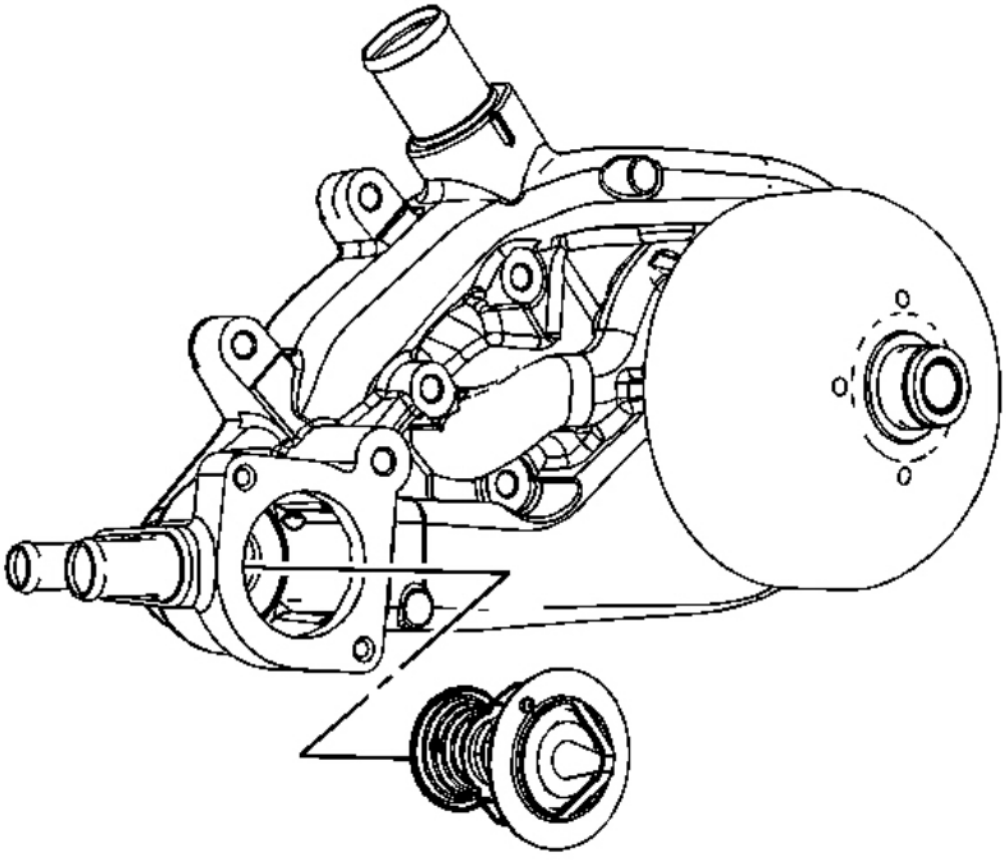


Fig. 64: View Of Thermostat & Housing
Courtesy of GENERAL MOTORS CORP.

1. Install the thermostat.
2. Install the thermostat housing. Refer to **Engine Coolant Thermostat Housing Replacement**.

COOLANT AIR BLEED PIPE ASSEMBLY REPLACEMENT (RPOS LC9/LY5/LMG/L76/L92)

Removal Procedure

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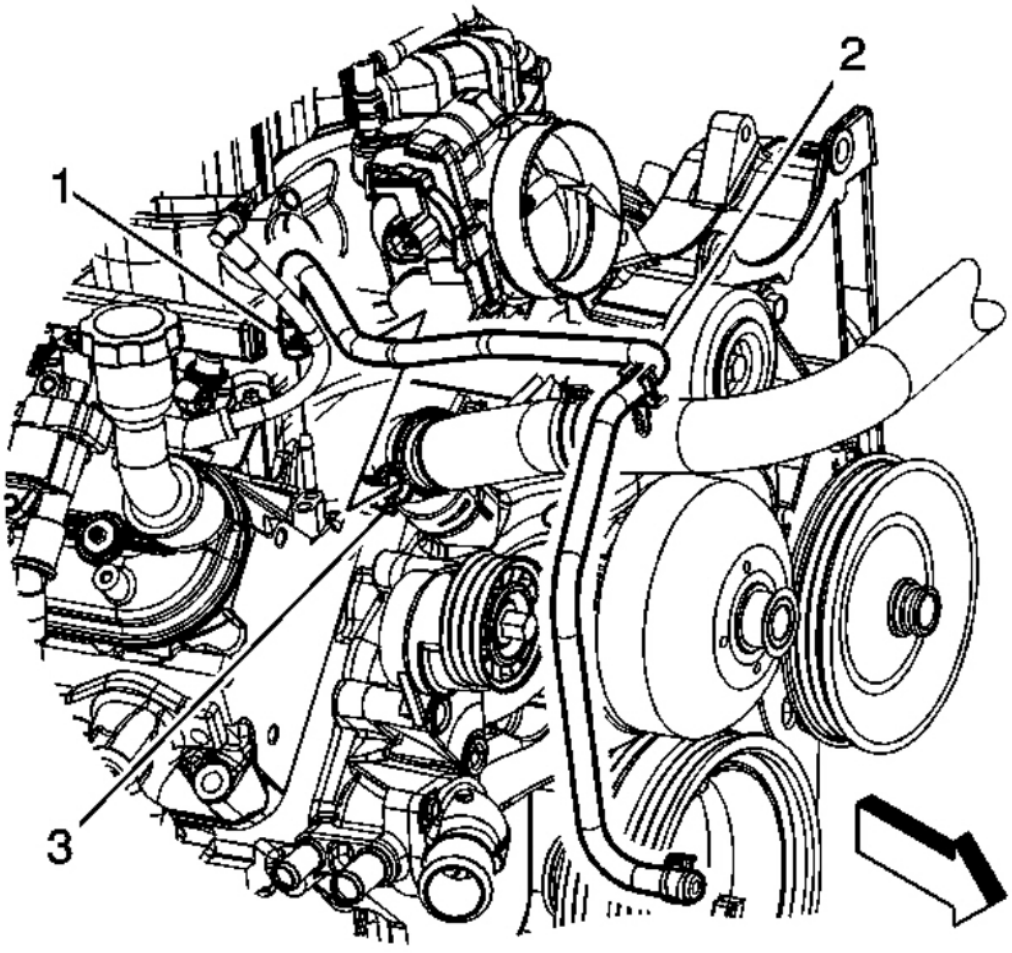


Fig. 65: View Of Radiator Vent Inlet Hose & Clamps
Courtesy of GENERAL MOTORS CORP.

1. If replacing the rear coolant air bleed covers, remove the intake manifold. Refer to **Intake Manifold Replacement (RPOs LC9/LMG/LY5/L76/L92)** or **Intake Manifold Replacement (RPOs LY2/LY6)** . Otherwise proceed to the next step.
2. Remove the air cleaner outlet duct. Refer to **Air Cleaner Resonator Outlet Duct Replacement** .
3. Drain the cooling system. Refer to **Draining and Filling Cooling System**.
4. Reposition the radiator vent inlet hose clamp (1) at the coolant air bleed pipe fitting.
5. Remove the radiator vent inlet hose (2) from the coolant air bleed pipe fitting.

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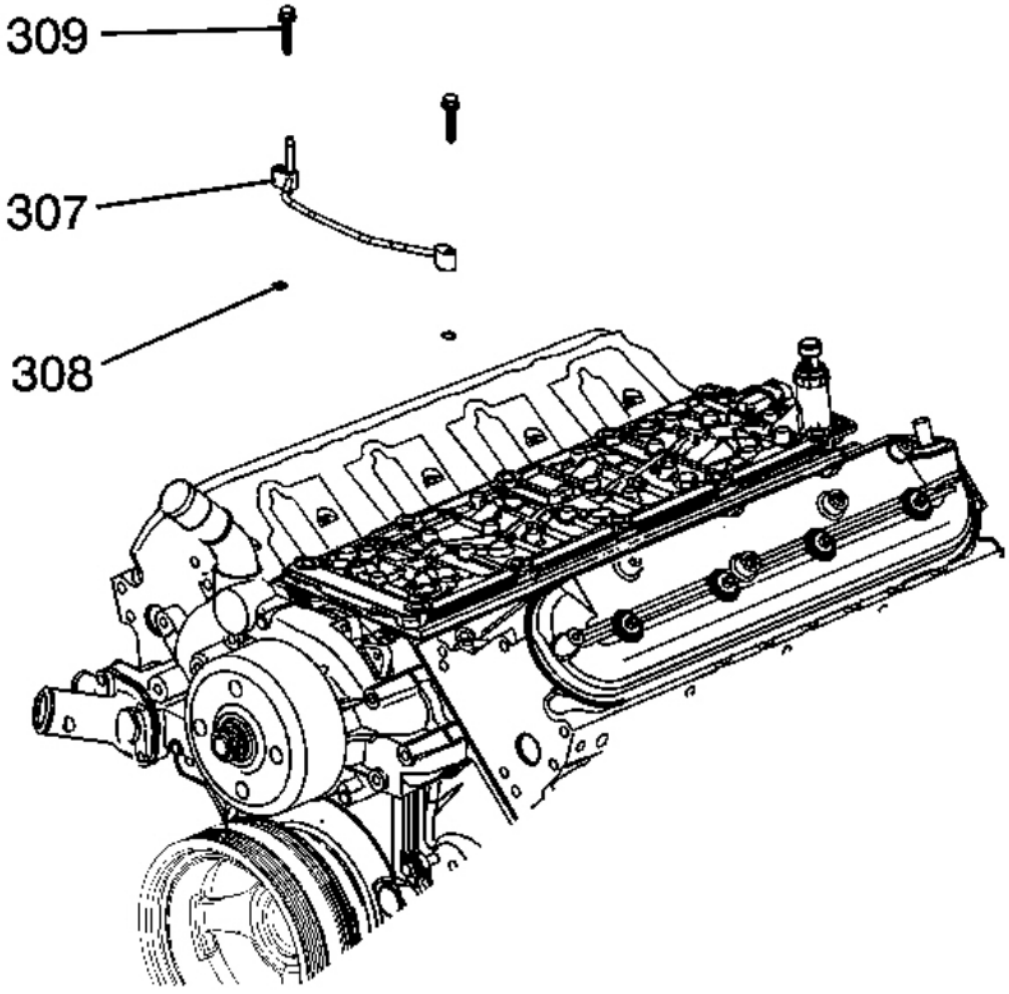


Fig. 66: Engine Coolant Air Bleed Pipe
Courtesy of GENERAL MOTORS CORP.

6. Remove the coolant air bleed pipe bolts (309) (intake manifold shown removed for clarity).
7. Remove the coolant air bleed pipe (307) and seals (308).

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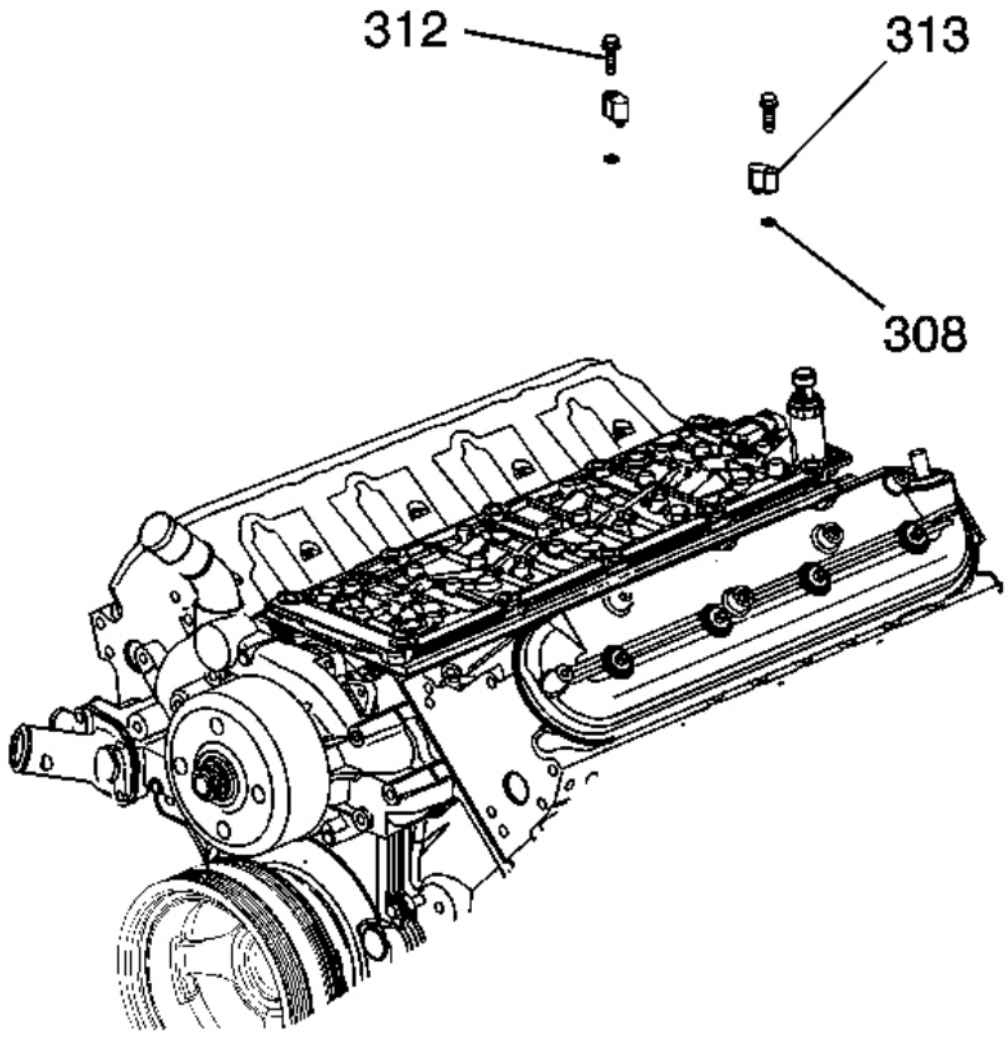


Fig. 67: Engine Coolant Air Bleed Cover Bolts
Courtesy of GENERAL MOTORS CORP.

8. Remove the coolant air bleed cover bolts (312), if required.
9. Remove the coolant air bleed covers (313) and seals (308), if required.

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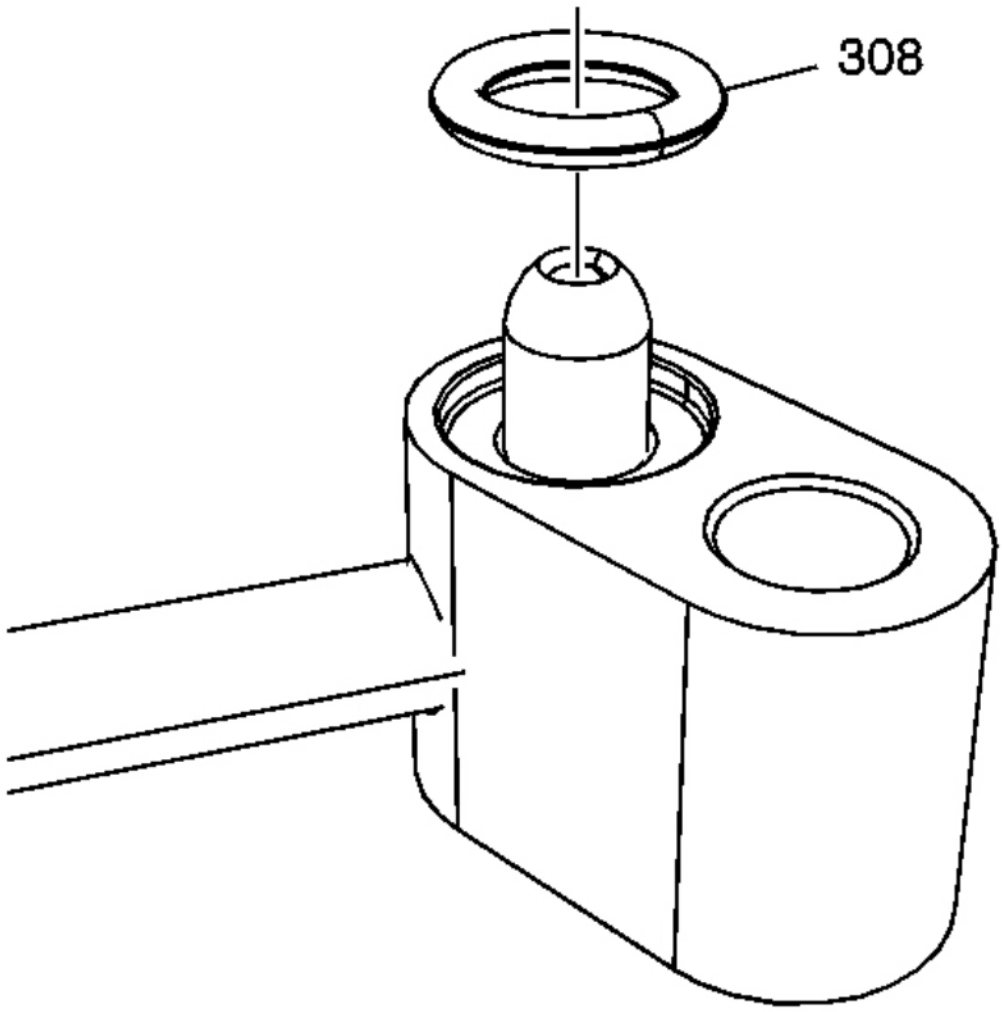


Fig. 68: View Of Coolant Air Bleed Pipe Seal
Courtesy of GENERAL MOTORS CORP.

10. Remove the seals (308) from the coolant air bleed pipe and/or covers.
11. Discard the seals.

Installation Procedure

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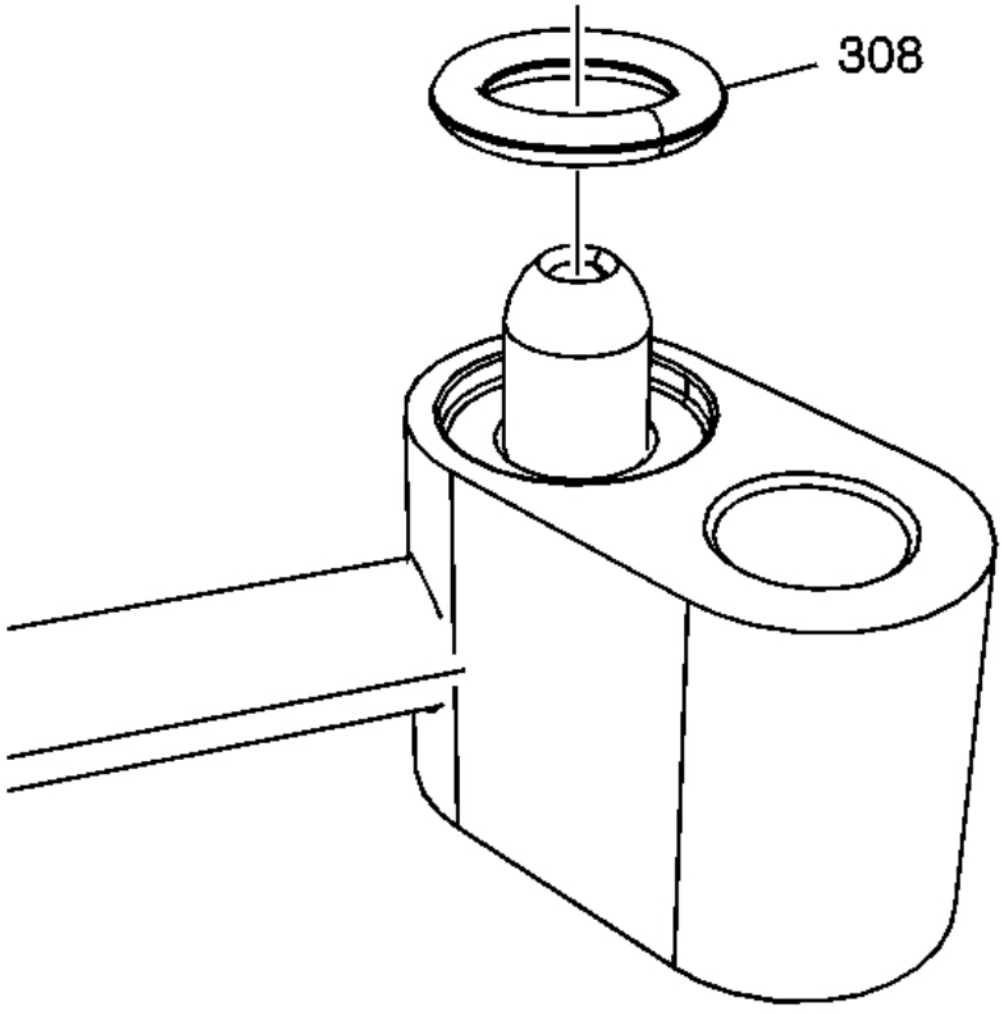


Fig. 69: View Of Coolant Air Bleed Pipe Seal
Courtesy of GENERAL MOTORS CORP.

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

1. Install the seals onto the coolant air bleed pipe and/or covers.

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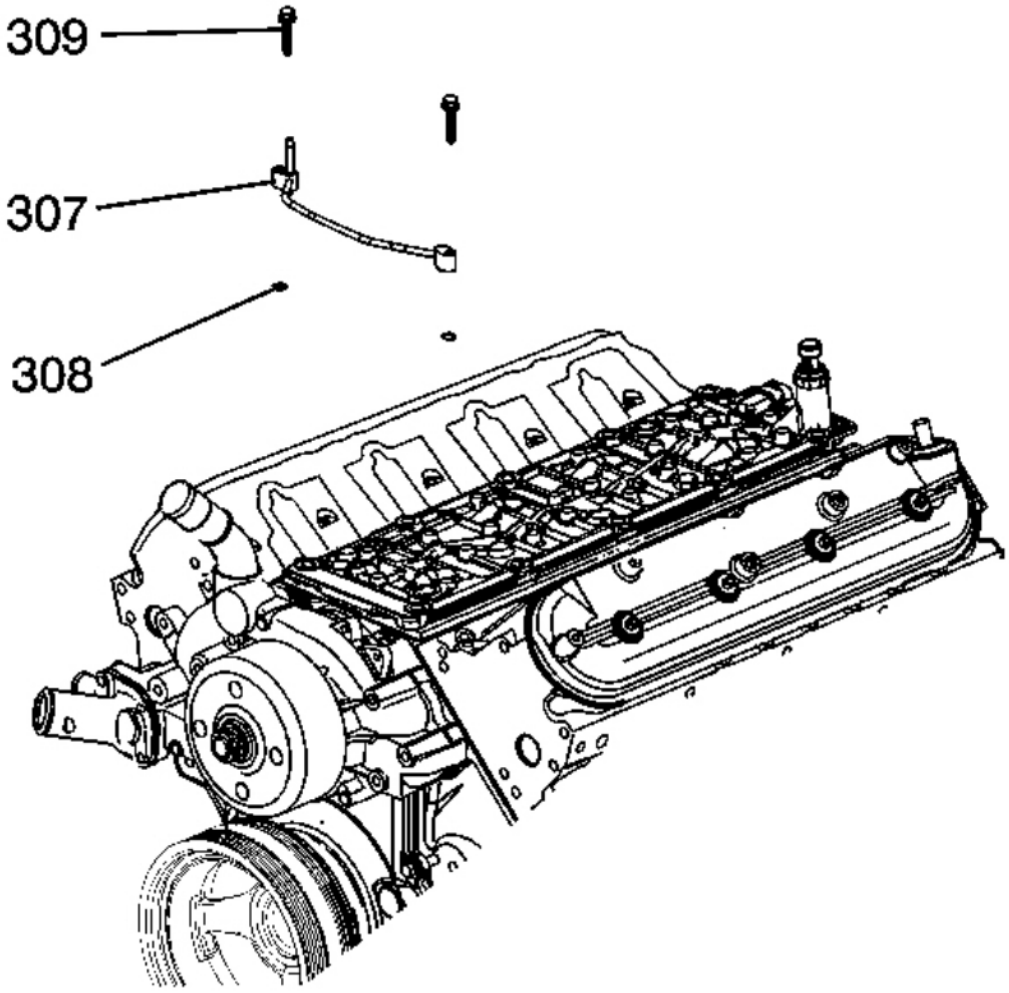


Fig. 70: Engine Coolant Air Bleed Pipe
Courtesy of GENERAL MOTORS CORP.

2. Install the coolant air bleed pipe (307) and seals (308) onto the cylinder heads.

NOTE: Refer to Fastener Notice in Cautions and Notices.

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

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

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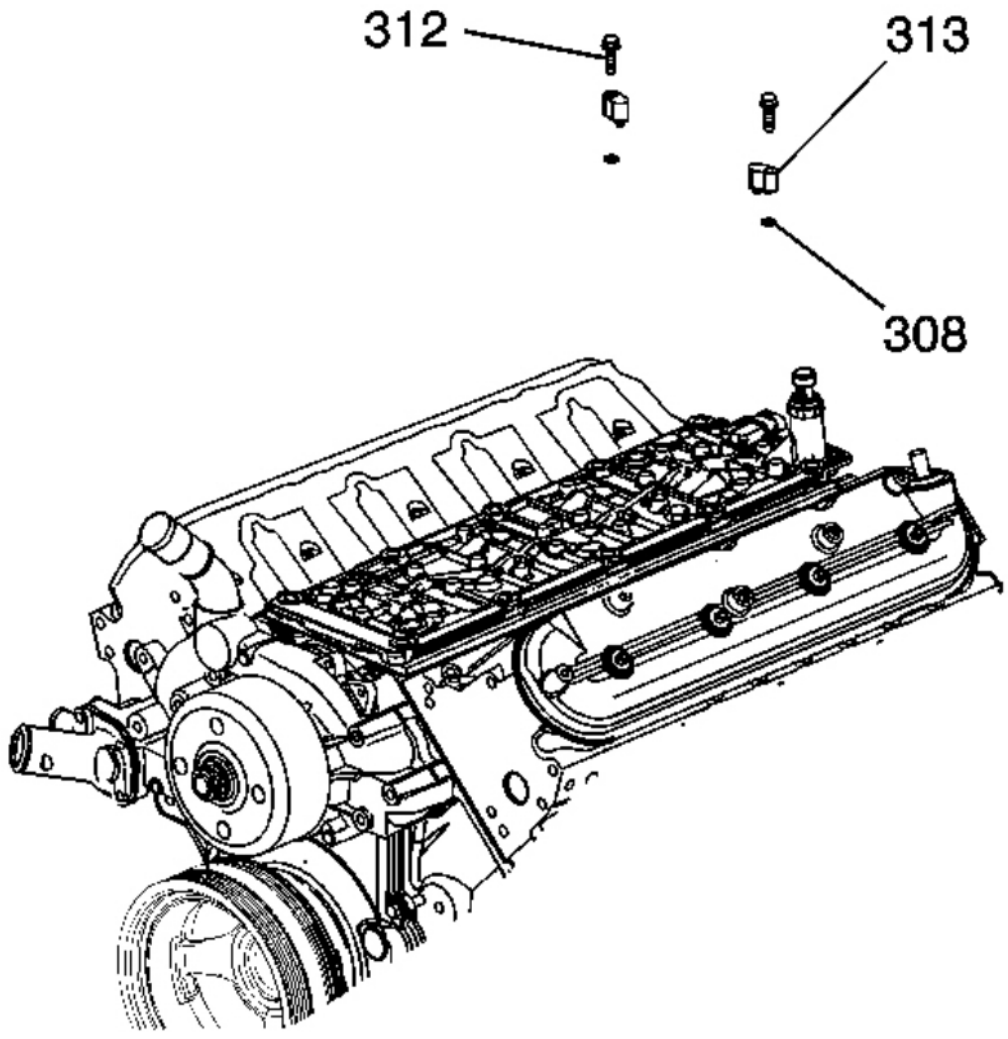


Fig. 71: Engine Coolant Air Bleed Cover Bolts
Courtesy of GENERAL MOTORS CORP.

4. Install the coolant air bleed covers (313) and seals (308), if required.
5. Install the coolant air bleed cover bolts (312), if required.

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

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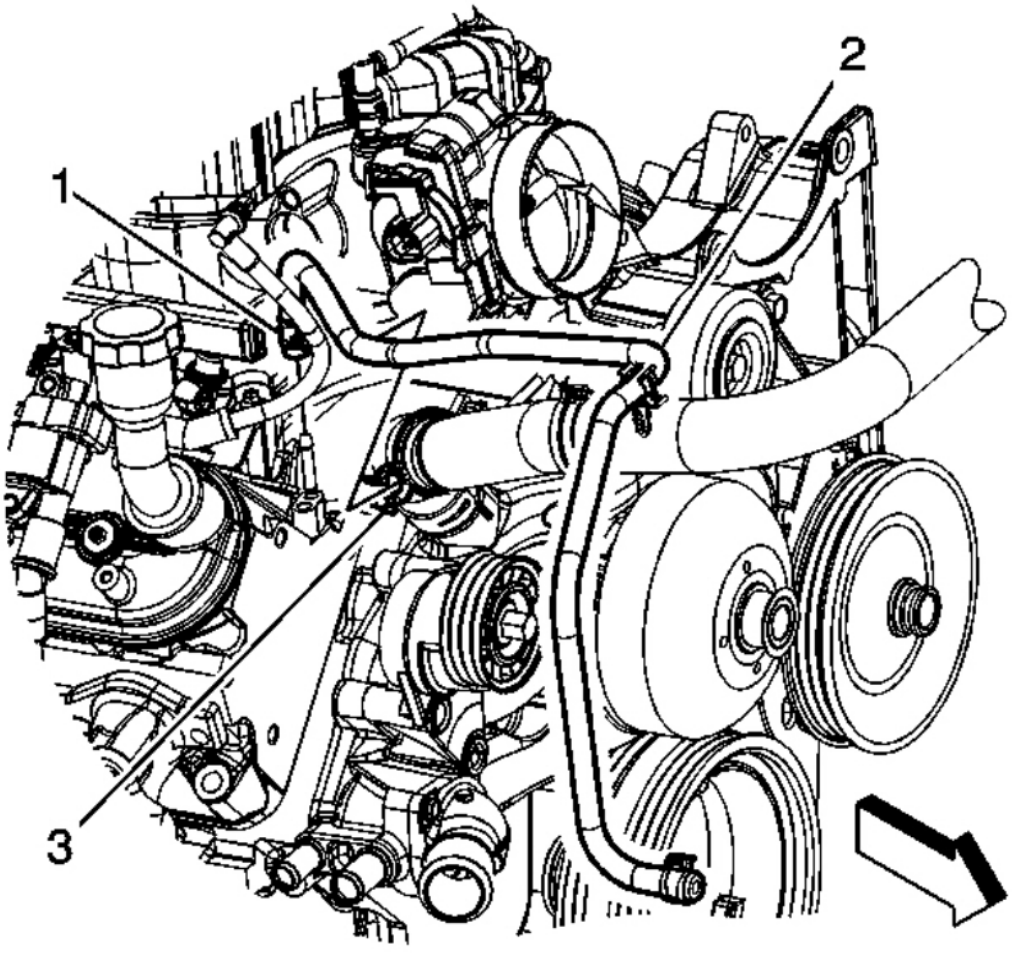


Fig. 72: View Of Radiator Vent Inlet Hose & Clamps
Courtesy of GENERAL MOTORS CORP.

6. Install the radiator vent inlet hose (2) to the coolant air bleed pipe fitting.
7. Position the radiator vent inlet hose clamp (1) at the coolant air bleed pipe fitting.
8. Install the air cleaner outlet duct. Refer to **Air Cleaner Resonator Outlet Duct Replacement** .
9. Fill the cooling system. Refer to **Draining and Filling Cooling System**.
10. If the rear coolant air bleed covers were replaced, install the intake manifold. Refer to **Intake Manifold Replacement (RPOs LC9/LMG/LY5/L76/L92)** or **Intake Manifold Replacement (RPOs LY2/LY6)** .

COOLANT AIR BLEED PIPE ASSEMBLY REPLACEMENT (RPOS LY2/LY6)

Removal Procedure

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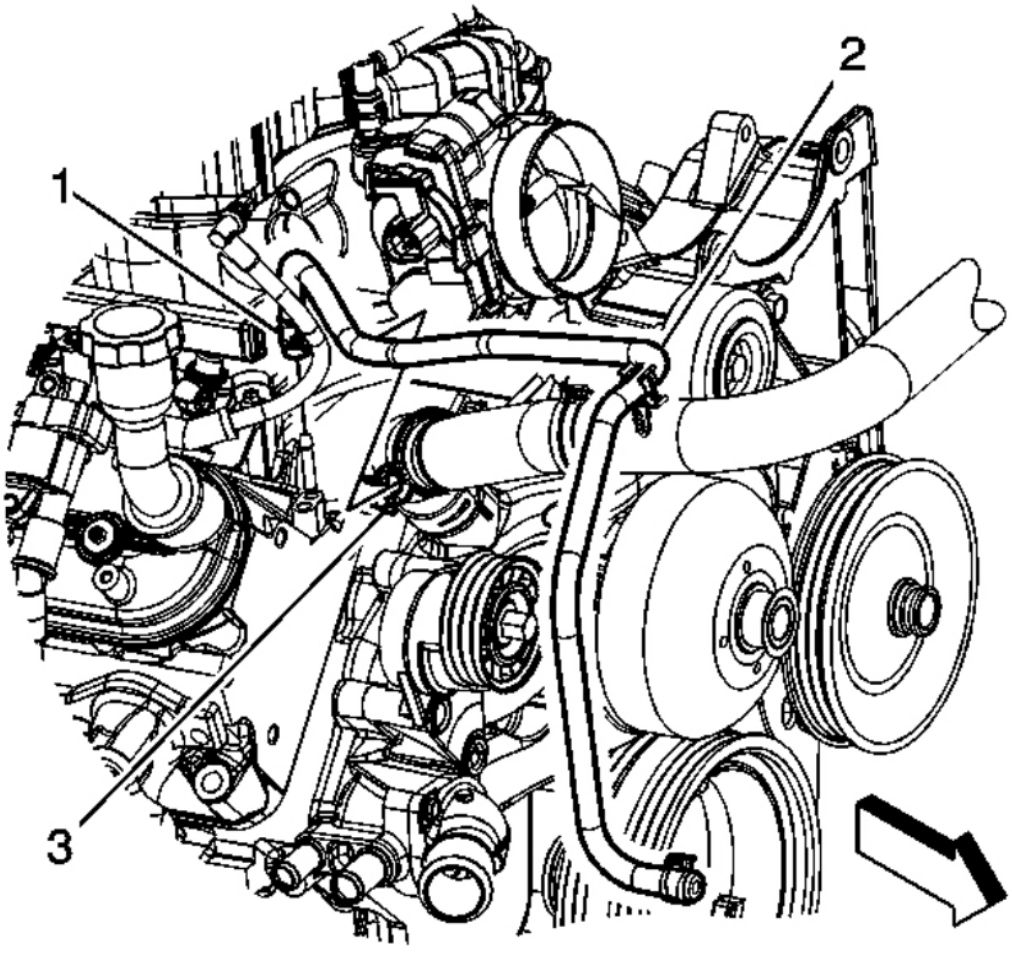


Fig. 73: View Of Radiator Vent Inlet Hose & Clamps
Courtesy of GENERAL MOTORS CORP.

1. If replacing the rear coolant air bleed covers, remove the intake manifold. Refer to **Intake Manifold Replacement (RPOs LC9/LMG/LY5/L76/L92)** or **Intake Manifold Replacement (RPOs LY2/LY6)** . Otherwise proceed to the next step.
2. Remove the air cleaner outlet duct. Refer to **Air Cleaner Resonator Outlet Duct Replacement** .
3. Drain the cooling system. Refer to **Draining and Filling Cooling System**.
4. Reposition the radiator vent inlet hose clamp (1) at the coolant air bleed pipe fitting.
5. Remove the radiator vent inlet hose (2) from the coolant air bleed pipe fitting.

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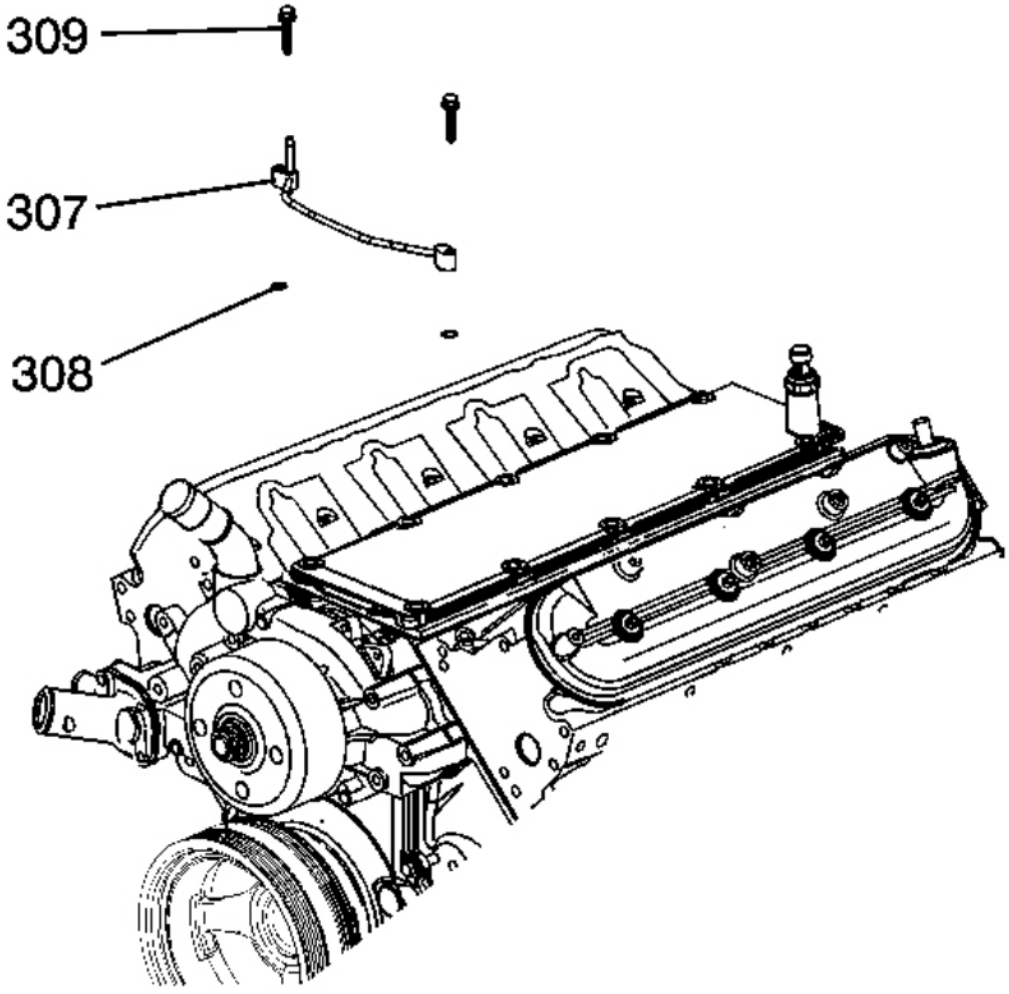


Fig. 74: Identifying Engine Coolant Air Bleed Pipe
Courtesy of GENERAL MOTORS CORP.

6. Remove the coolant air bleed pipe bolts (309) (intake manifold shown removed for clarity).
7. Remove the coolant air bleed pipe (307) and seals (308).

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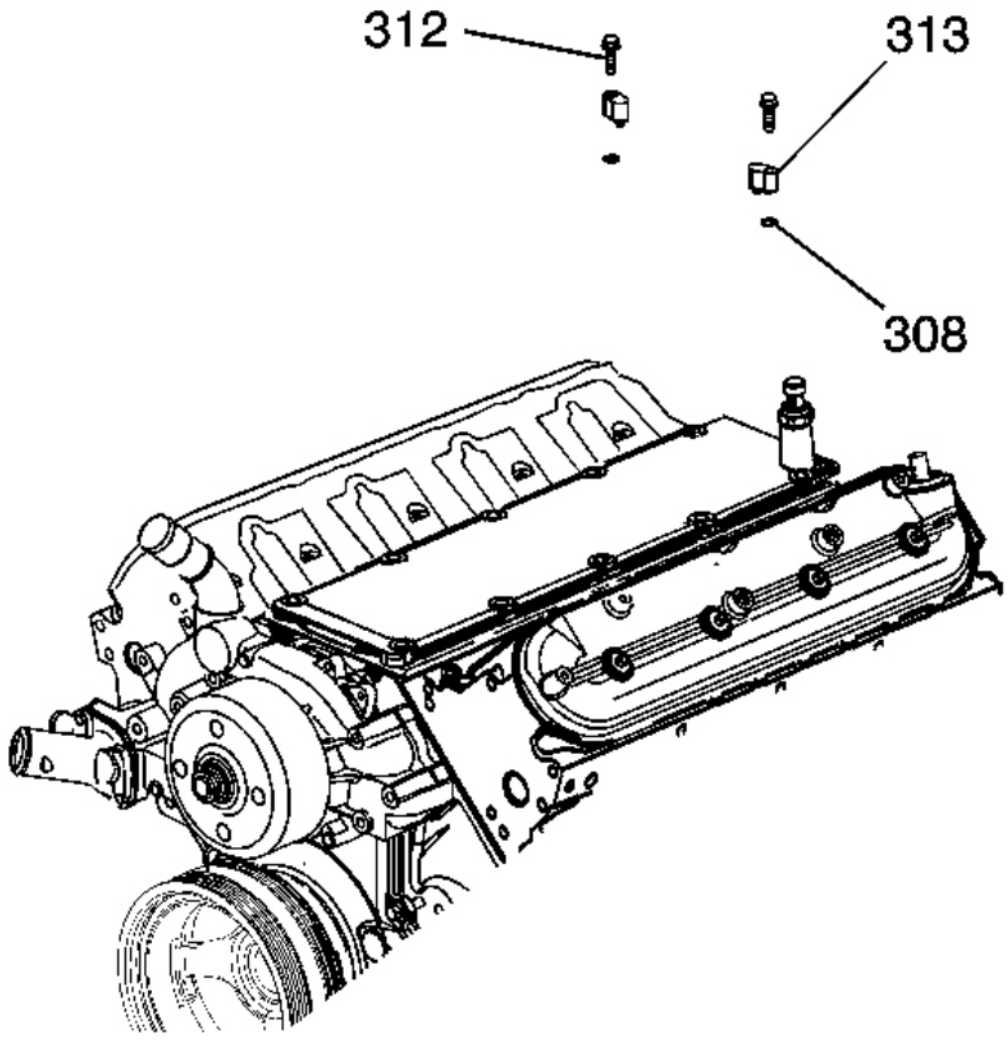


Fig. 75: Identifying Coolant Air Bleed Cover Bolts
Courtesy of GENERAL MOTORS CORP.

8. Remove the coolant air bleed cover bolts (312), if required.
9. Remove the coolant air bleed covers (313) and seals (308), if required.

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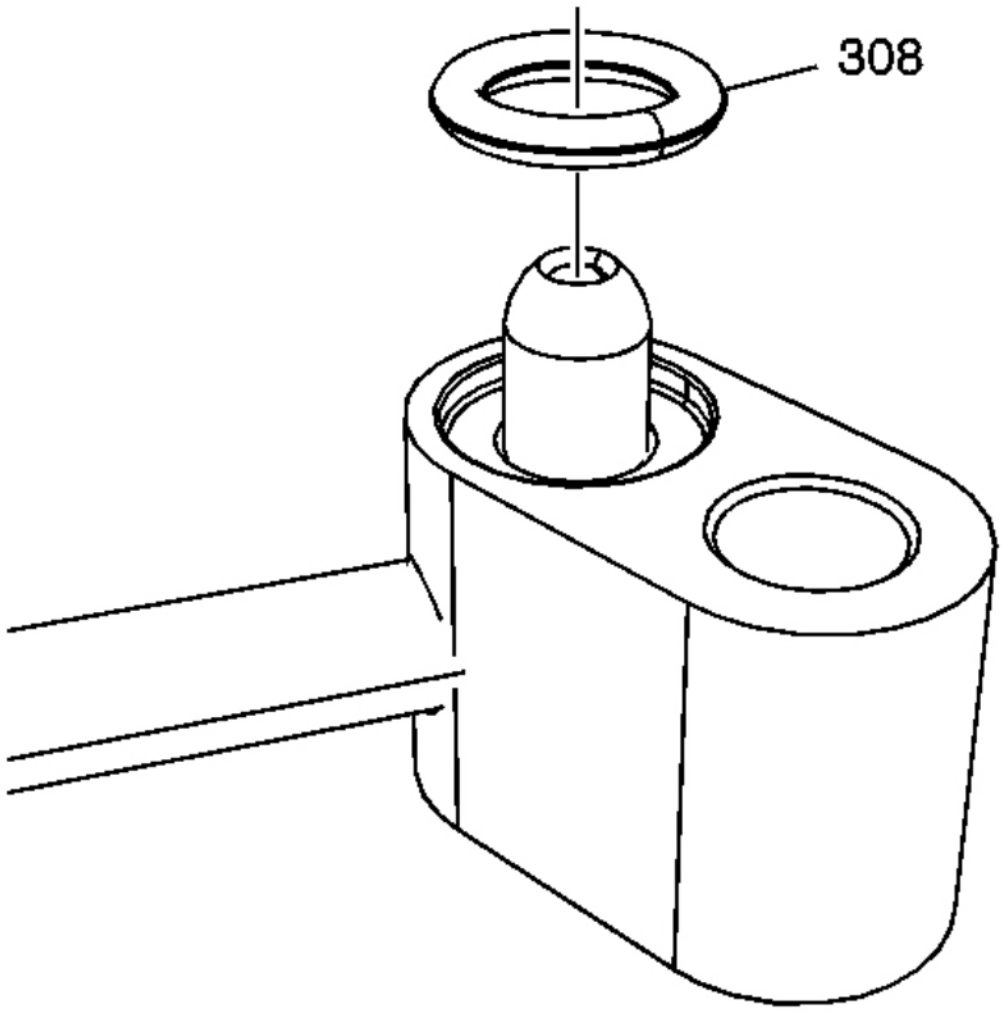


Fig. 76: View Of Coolant Air Bleed Pipe Seal
Courtesy of GENERAL MOTORS CORP.

10. Remove the seals (308) from the coolant air bleed pipe and/or covers.
11. Discard the seals.

Installation Procedure

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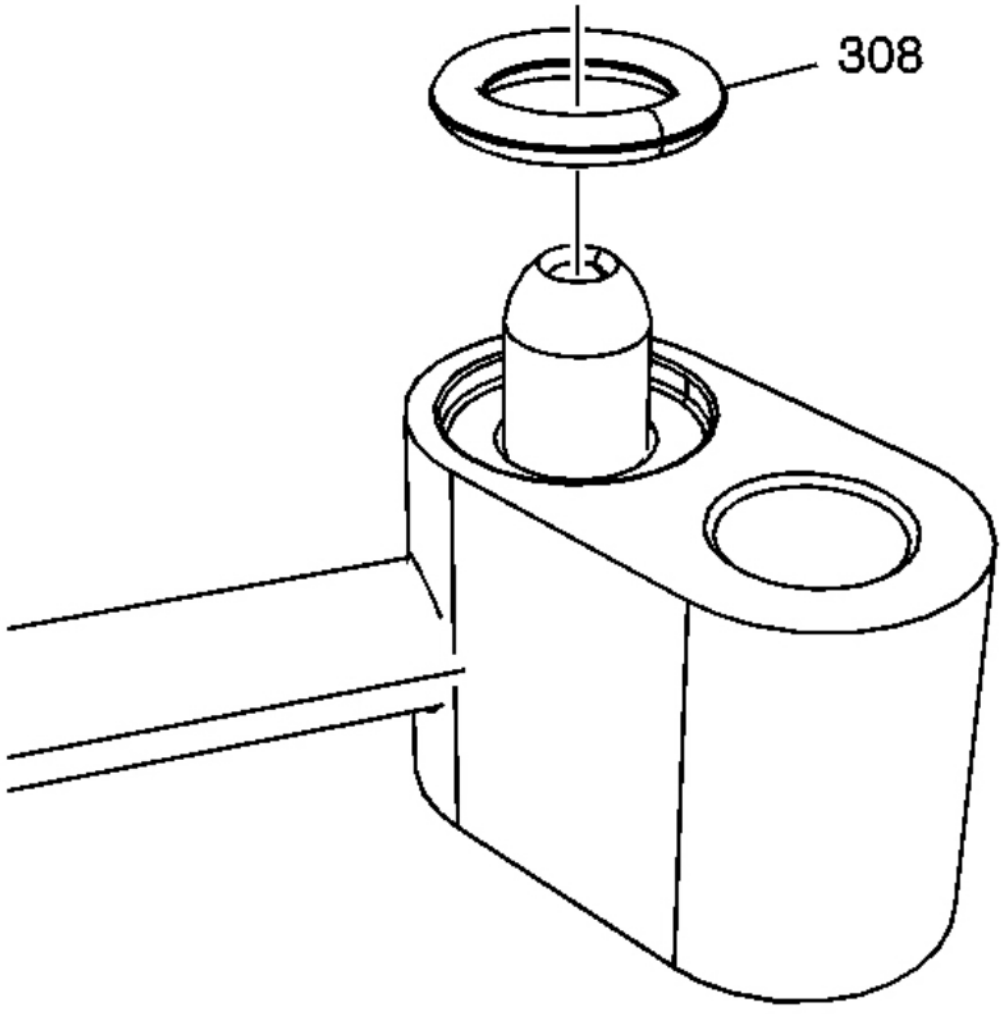


Fig. 77: View Of Coolant Air Bleed Pipe Seal
Courtesy of GENERAL MOTORS CORP.

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

1. Install the seals onto the coolant air bleed pipe and/or covers.

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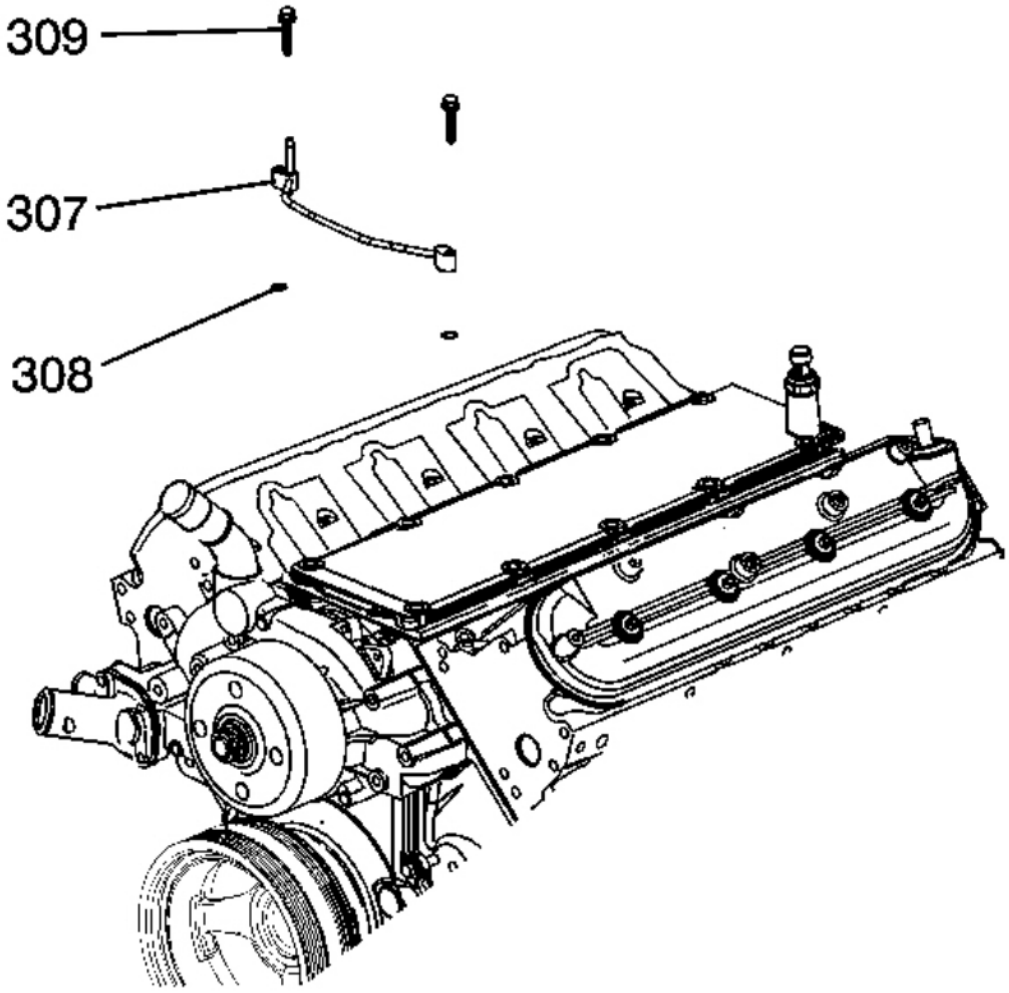


Fig. 78: Identifying Engine Coolant Air Bleed Pipe
Courtesy of GENERAL MOTORS CORP.

2. Install the coolant air bleed pipe (307) and seals (308) onto the cylinder heads.

NOTE: Refer to Fastener Notice in Cautions and Notices.

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

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

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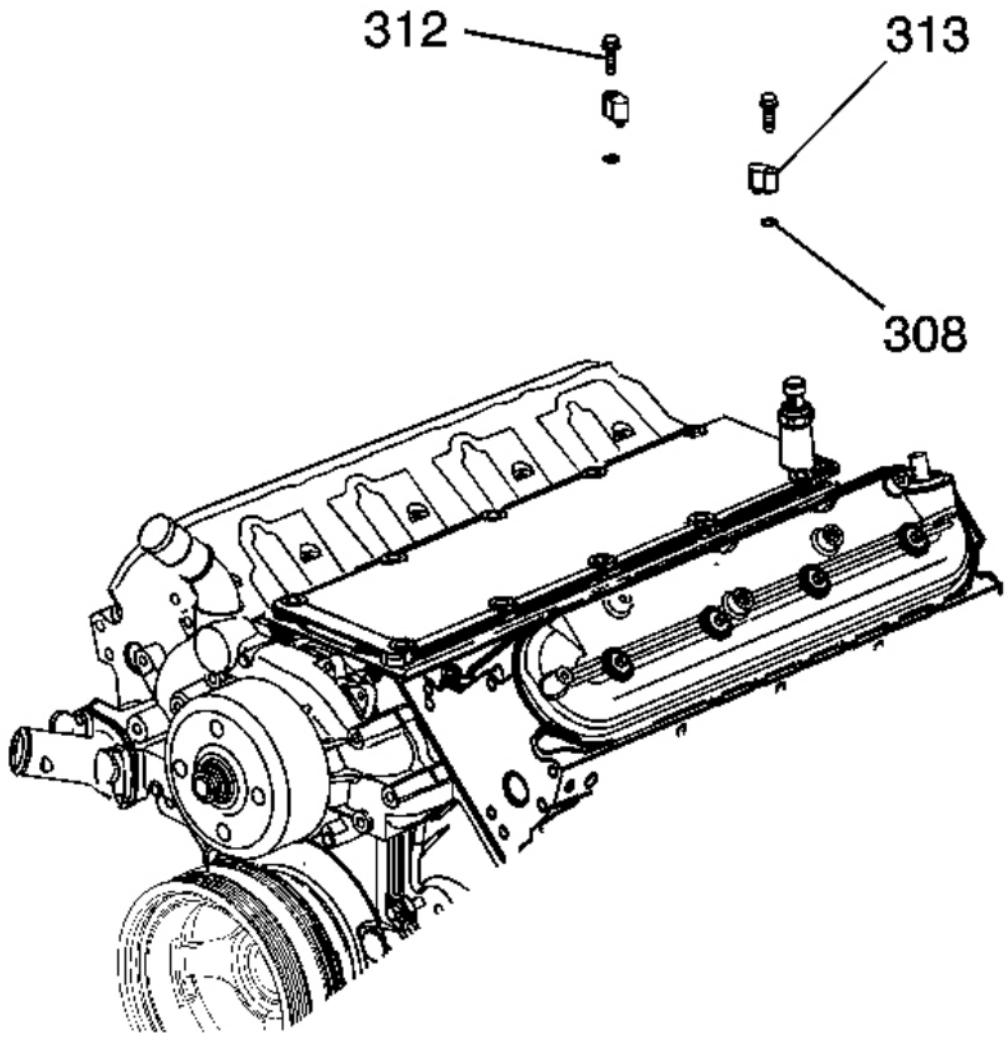


Fig. 79: Identifying Coolant Air Bleed Cover Bolts
Courtesy of GENERAL MOTORS CORP.

4. Install the coolant air bleed covers (313) and seals (308), if required.
5. Install the coolant air bleed cover bolts (312), if required.

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

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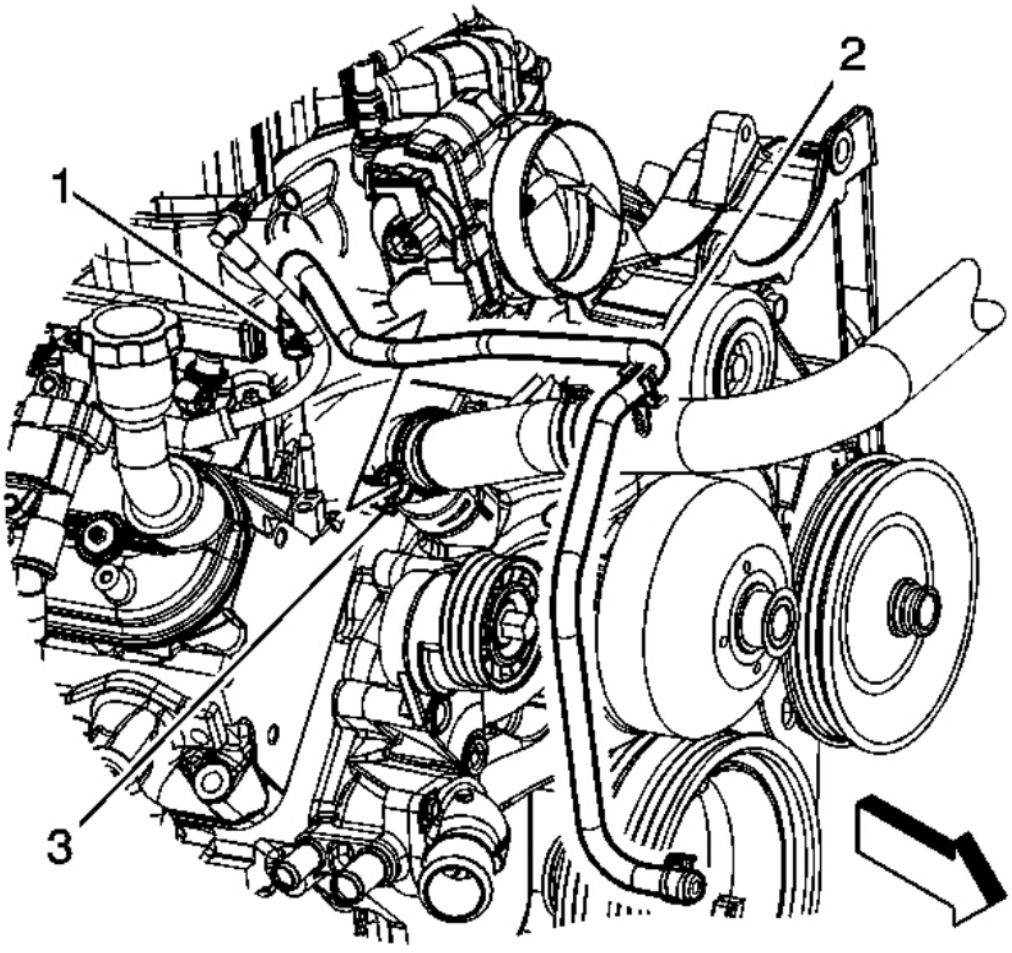


Fig. 80: View Of Radiator Vent Inlet Hose & Clamps
Courtesy of GENERAL MOTORS CORP.

6. Install the radiator vent inlet hose (2) to the coolant air bleed pipe fitting.
7. Position the radiator vent inlet hose clamp (1) at the coolant air bleed pipe fitting.
8. Install the air cleaner outlet duct. Refer to **Air Cleaner Resonator Outlet Duct Replacement** .
9. Fill the cooling system. Refer to **Draining and Filling Cooling System**.
10. If the rear coolant air bleed covers were replaced, install the intake manifold. Refer to **Intake Manifold Replacement (RPOs LC9/LMG/LY5/L76/L92)** or **Intake Manifold Replacement (RPOs LY2/LY6)** .

COOLANT AIR BLEED HOSE REPLACEMENT

Removal Procedure

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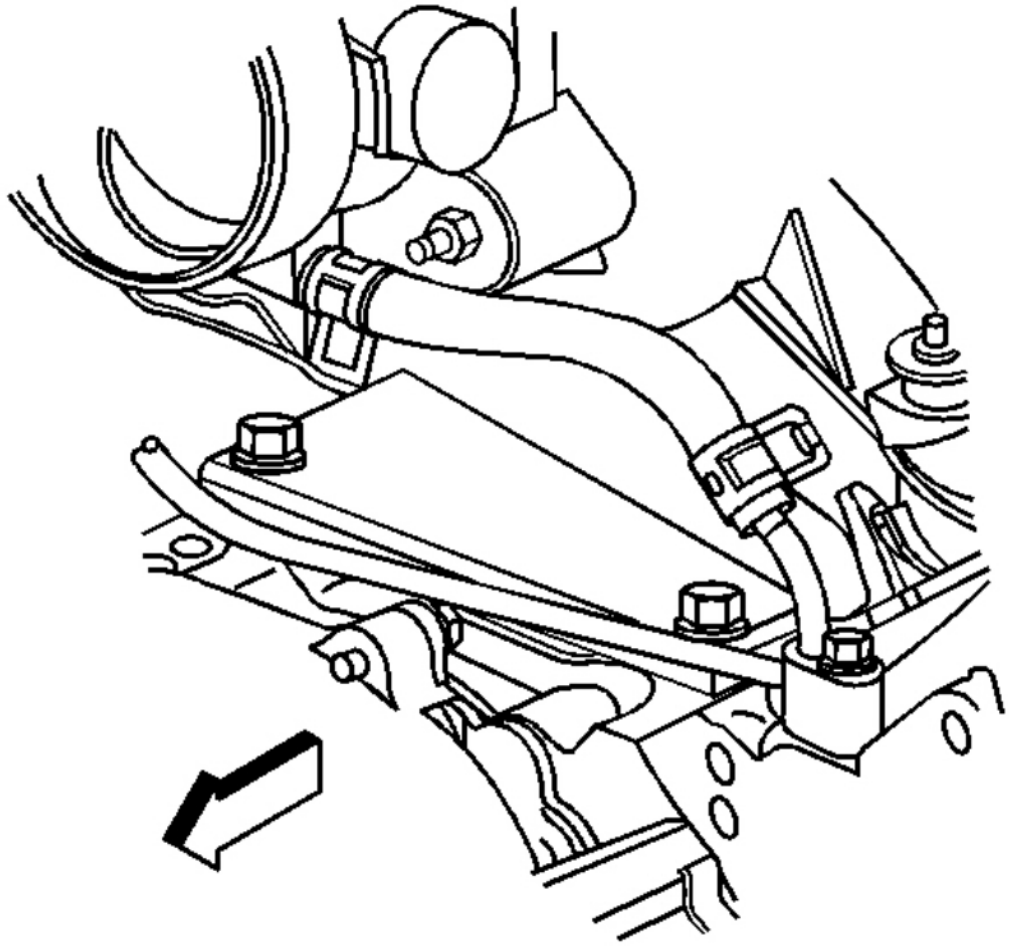


Fig. 81: View Of Coolant Air Bleed Hose & Throttle Body
Courtesy of GENERAL MOTORS CORP.

1. If necessary, remove the engine sight shield. Refer to **Upper Intake Manifold Sight Shield Replacement** for the 4.8L, 5.3L, and 6.0L engines.
2. Position the coolant air bleed hose clamp at the throttle body.
3. Remove the coolant air bleed hose from the throttle body.

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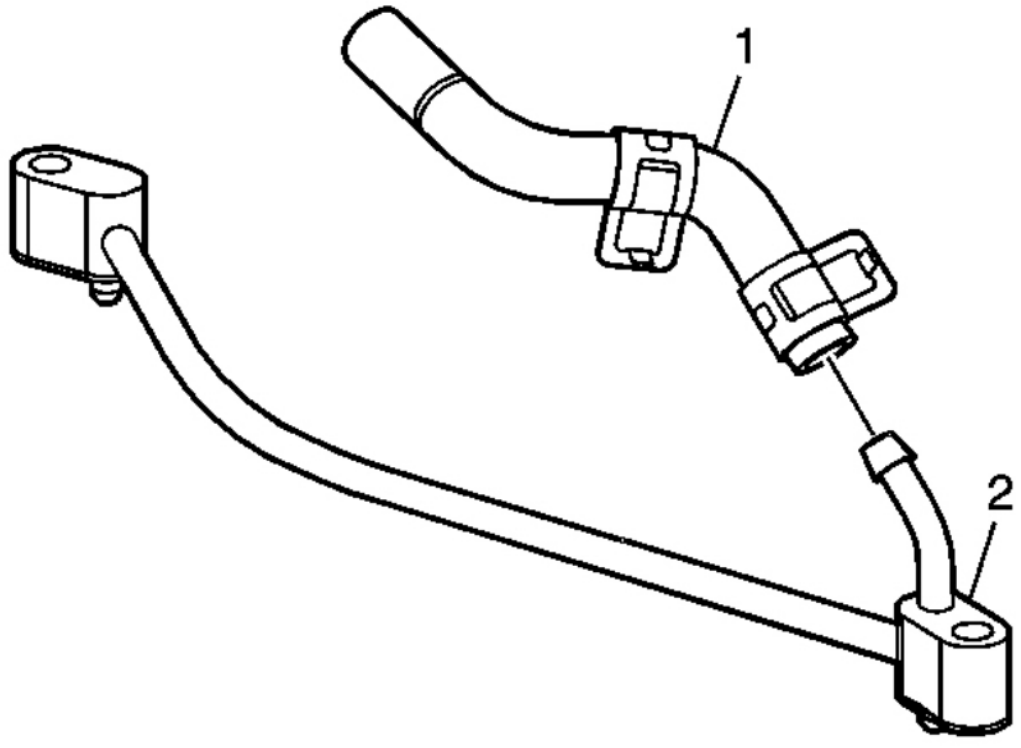


Fig. 82: Coolant Air Bleed Hose & Pipe
Courtesy of GENERAL MOTORS CORP.

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

Installation Procedure

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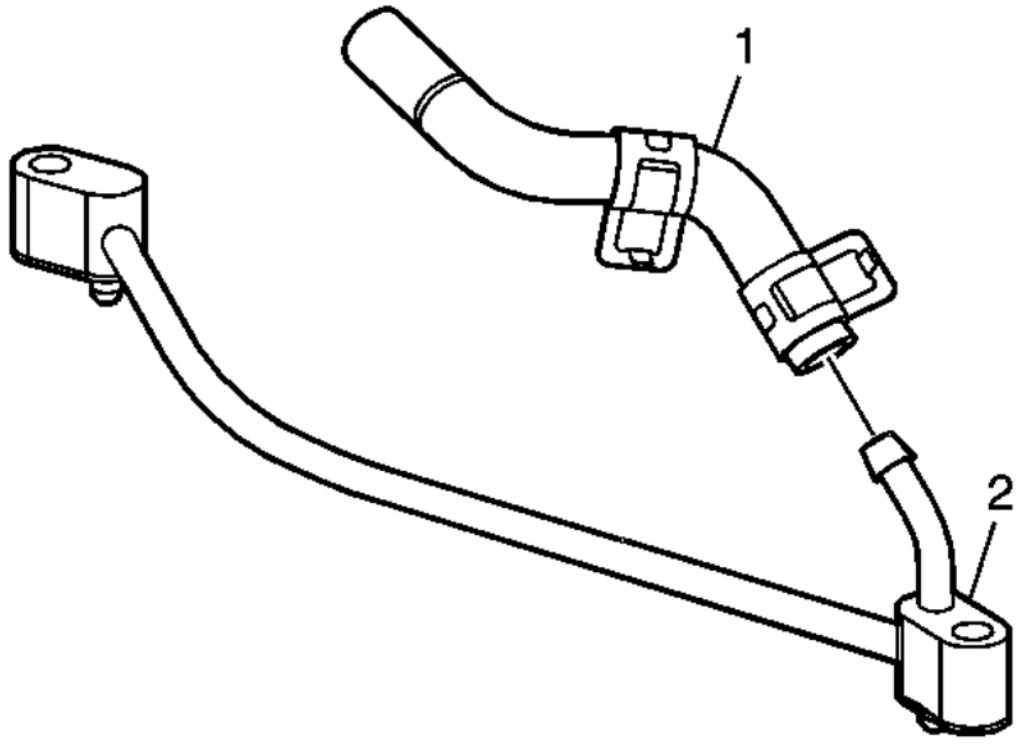


Fig. 83: Coolant Air Bleed Hose & Pipe
Courtesy of GENERAL MOTORS CORP.

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

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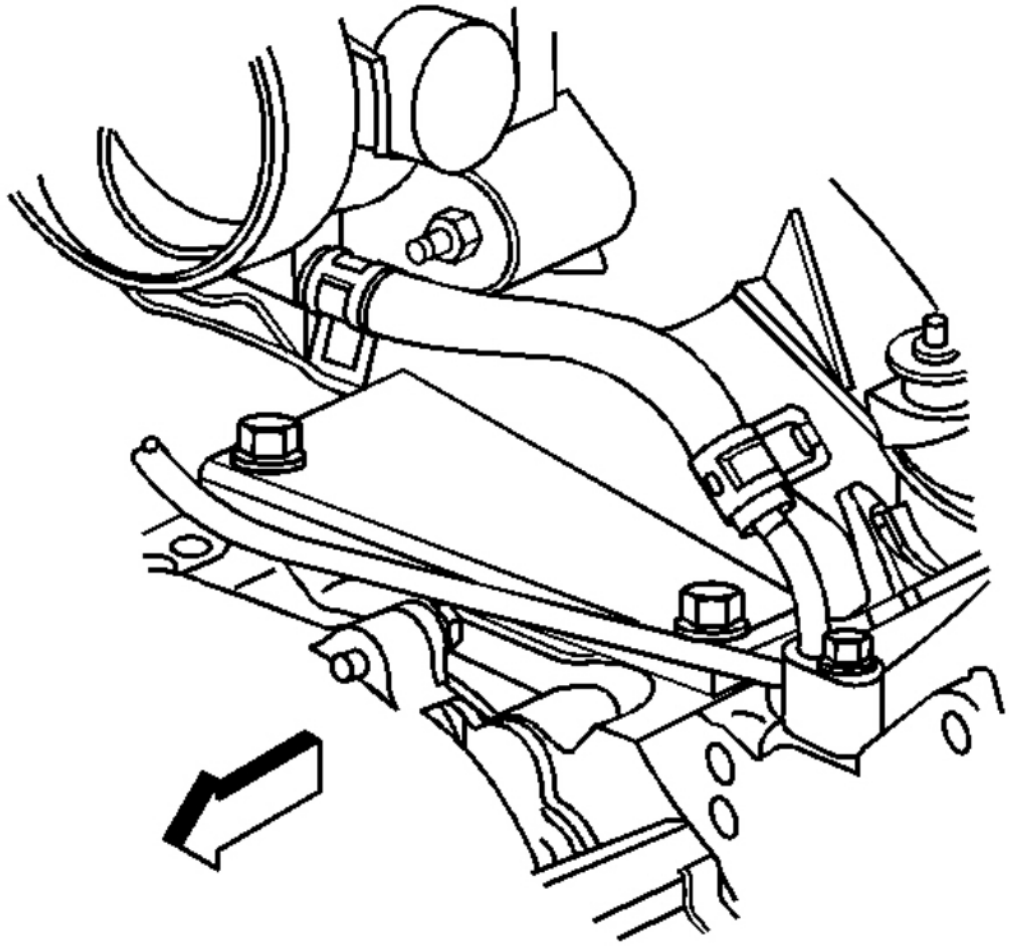


Fig. 84: View Of Coolant Air Bleed Hose & Throttle Body
Courtesy of GENERAL MOTORS CORP.

3. Install the coolant air bleed hose to the throttle body.
4. Position the coolant air bleed hose clamp at the throttle body.
5. If necessary, install the engine sight shield. Refer to **Upper Intake Manifold Sight Shield Replacement** for the 4.8L, 5.3L, and 6.0L engines.
6. Add engine coolant, if necessary.

WATER PUMP REPLACEMENT (RPOS LY2/LC9/LY5/LMG)

Removal Procedure

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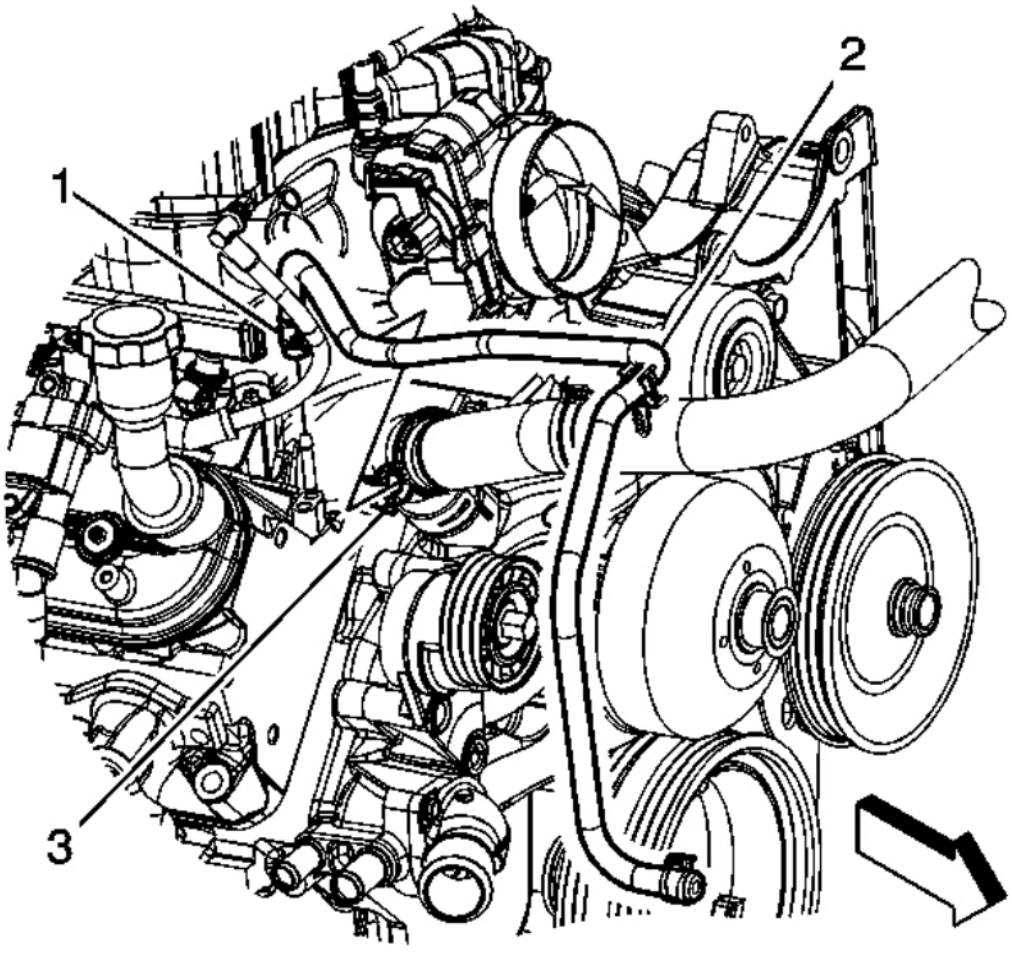


Fig. 85: View Of Radiator Vent Inlet Hose & Clamps
Courtesy of GENERAL MOTORS CORP.

1. Remove the air cleaner outlet duct. Refer to **Air Cleaner Resonator Outlet Duct Replacement** .
2. Drain the cooling system. Refer to **Draining and Filling Cooling System**.
3. Reposition the radiator vent inlet hose clamp (1) at the coolant air bleed pipe fitting.
4. Remove the radiator vent inlet hose (2) from the coolant air bleed pipe fitting.

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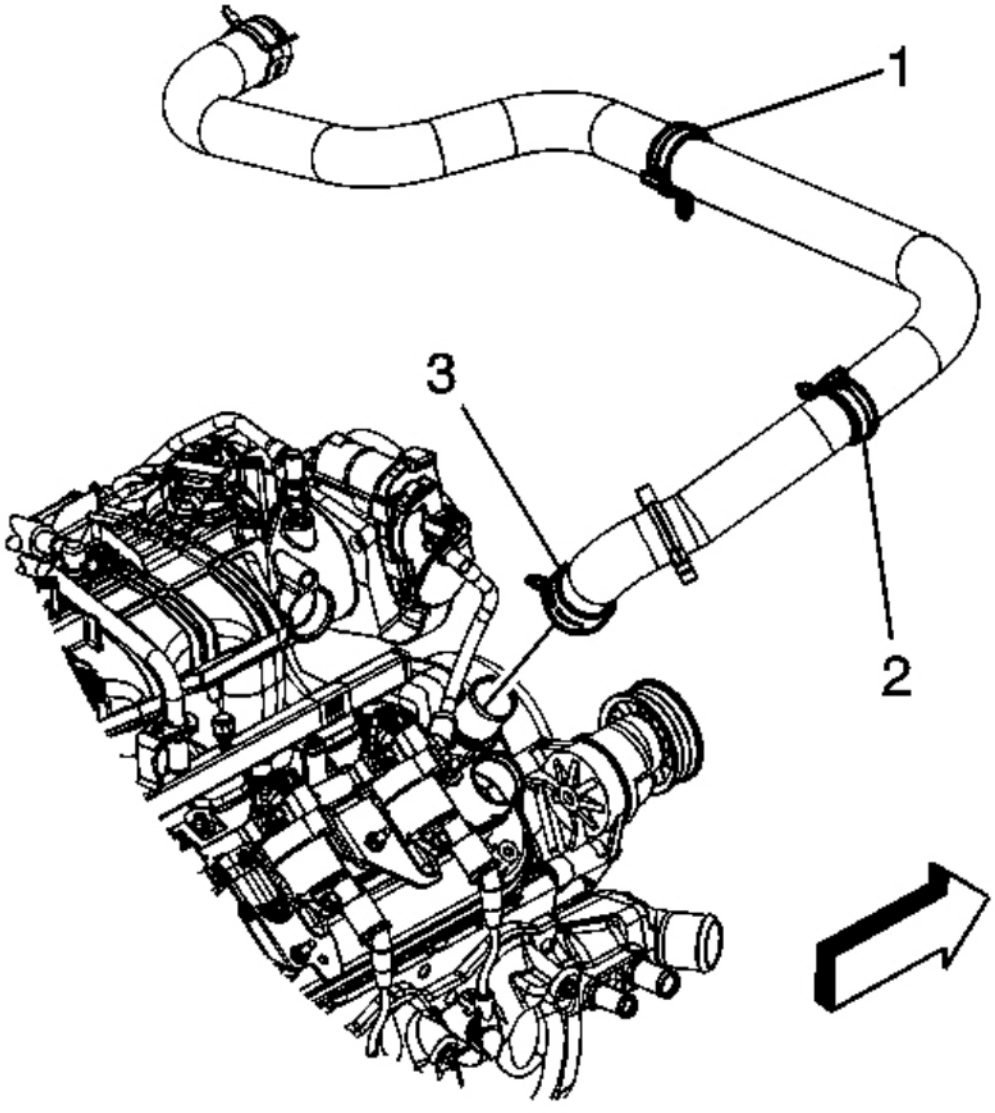


Fig. 86: View Of Radiator Vent Inlet Hose Clamp At Water Pump
Courtesy of GENERAL MOTORS CORP.

5. Reposition the radiator inlet hose clamp (3) at the water pump.
6. Remove the radiator inlet hose from the water pump.
7. Reposition the radiator inlet hose and vent inlet hose out of the way.
8. Remove the accessory drive belt. Refer to **Drive Belt Replacement - Accessory** .

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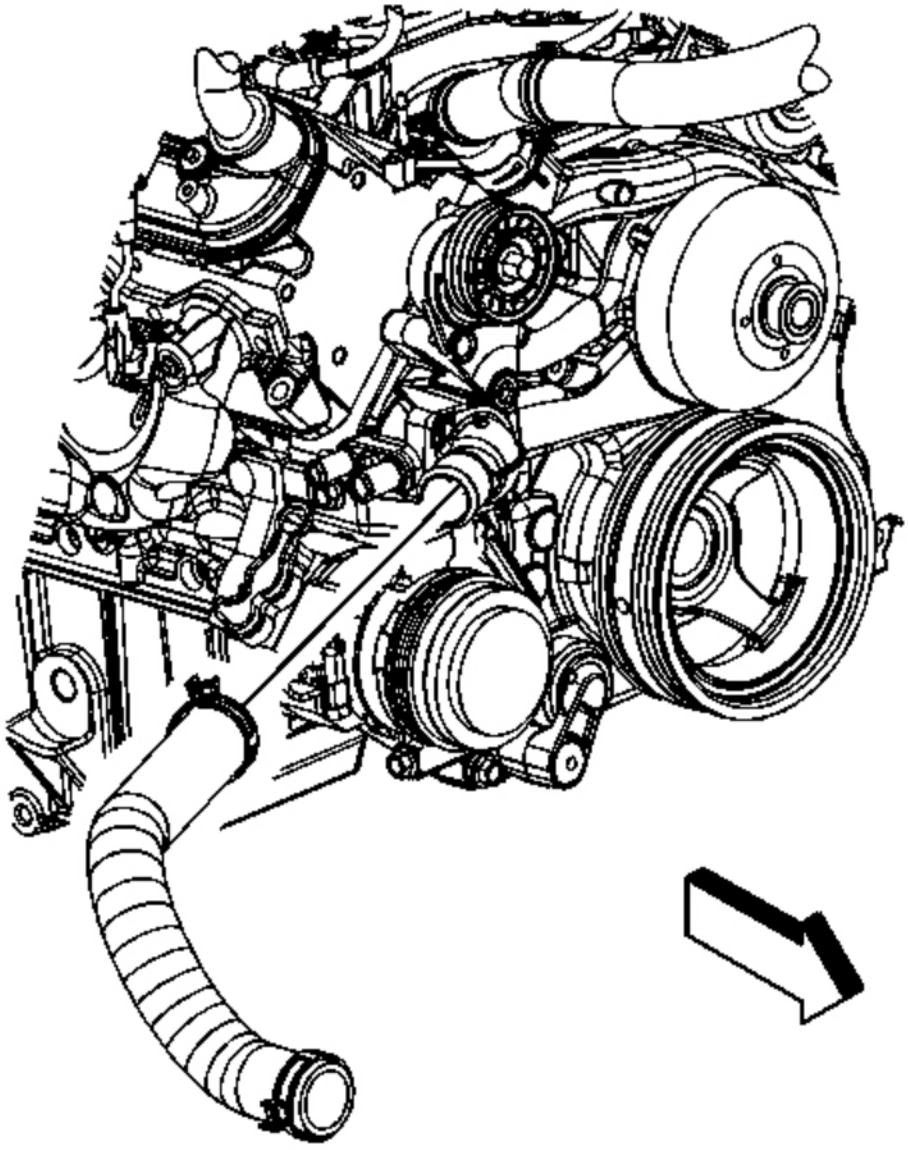


Fig. 87: View Of Radiator Outlet Hose
Courtesy of GENERAL MOTORS CORP.

9. Reposition the radiator outlet hose clamp at the water pump.
10. Remove the radiator outlet hose from the water pump.
11. Reposition the outlet hose out of the way.

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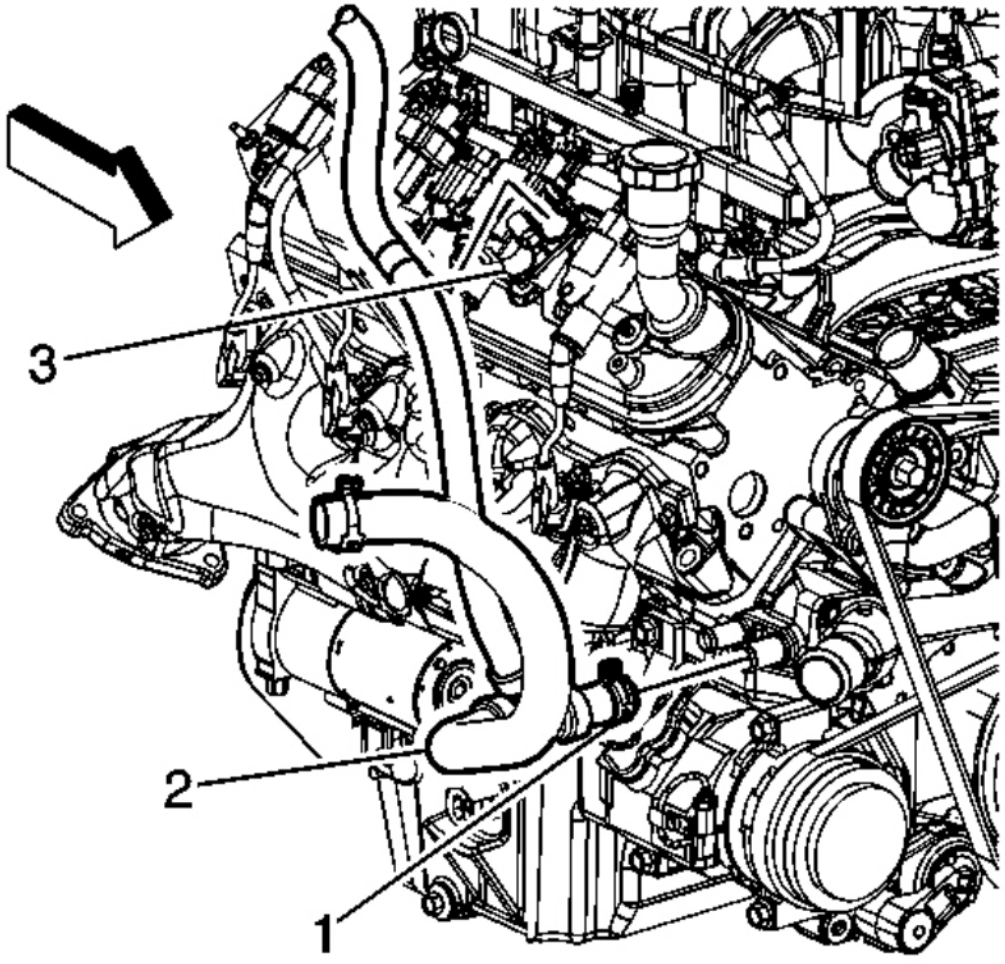


Fig. 88: View Of Radiator Surge Tank Outlet Hose, Clamp & Water Pump
Courtesy of GENERAL MOTORS CORP.

12. Reposition the radiator surge tank outlet hose clamp (1) at the water pump.
13. Remove the radiator surge tank outlet hose (2) from the water pump.
14. Reposition the outlet hose out of the way.

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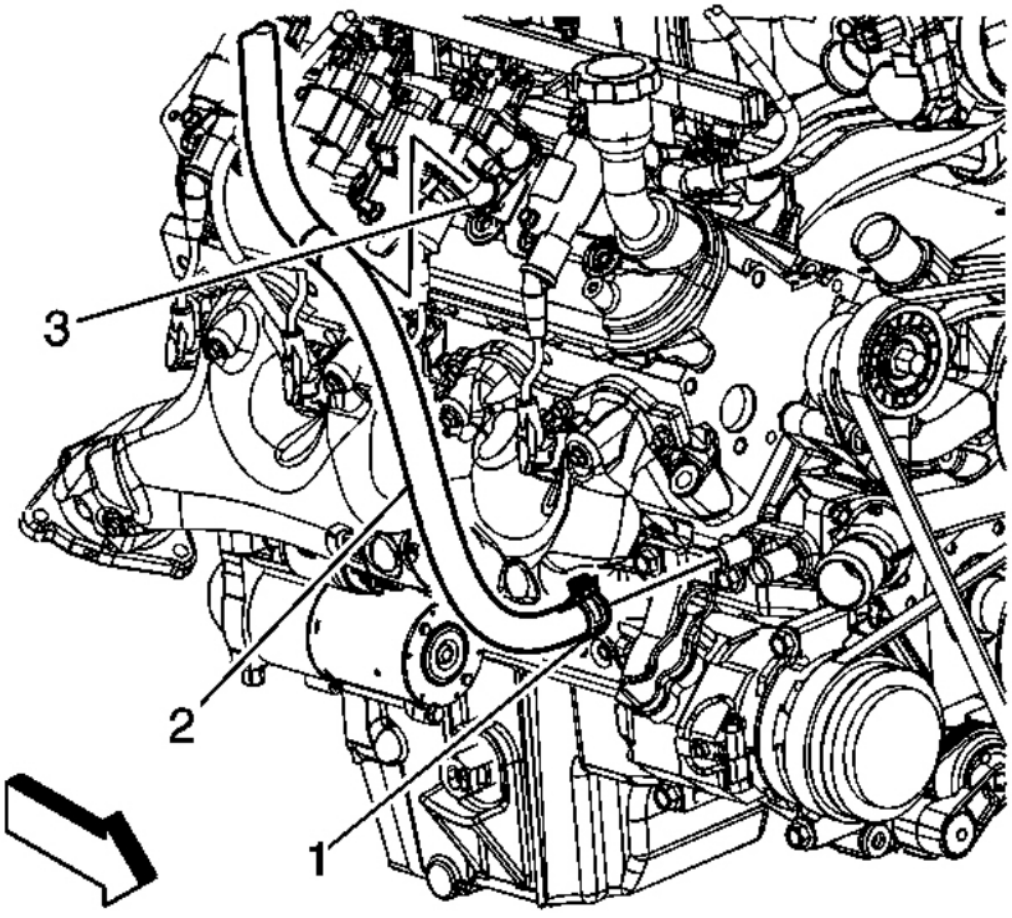


Fig. 89: View Of Heater Inlet Hose, Clamp & Waterpump
Courtesy of GENERAL MOTORS CORP.

15. Reposition the heater inlet hose clamp (1) at the water pump.
16. Remove the heater inlet hose (2) from the water pump.
17. Reposition the inlet hose out of the way.

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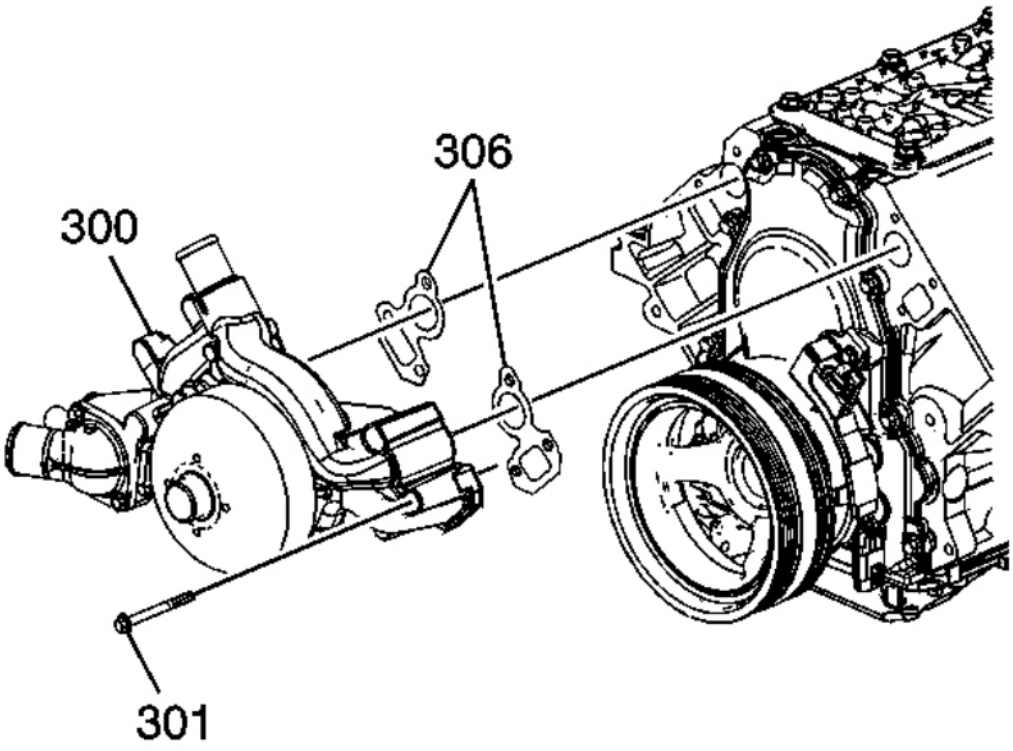


Fig. 90: View Of Water Pump, Bolts & Gaskets
Courtesy of GENERAL MOTORS CORP.

18. Remove the water pump bolts (301).
19. Remove the water pump (300) and gaskets (309). Discard the gaskets.

Installation Procedure

NOTE: DO NOT use cooling system seal tabs, or similar compounds, unless otherwise instructed. The use of cooling system seal tabs, or similar compounds, may restrict coolant flow through the passages of the cooling system or the engine components. Restricted coolant flow may cause engine overheating and/or damage to the cooling system or the engine components/assembly.

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

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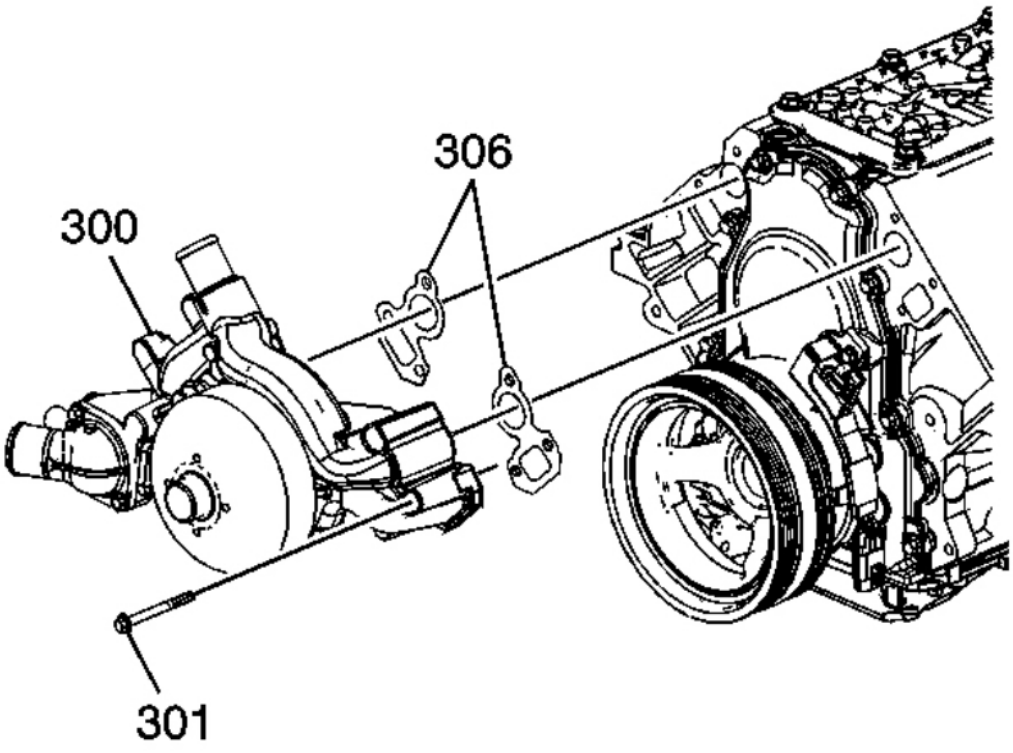


Fig. 91: View Of Water Pump, Bolts & Gaskets
Courtesy of GENERAL MOTORS CORP.

1. Position the water pump (300) and NEW gaskets (306) to the engine block.
2. Install the water pump bolts (301).

Tighten:

1. Tighten the bolts a first pass to 15 N.m (11 lb ft).
2. Tighten the bolts a final pass to 30 N.m (22 lb ft).

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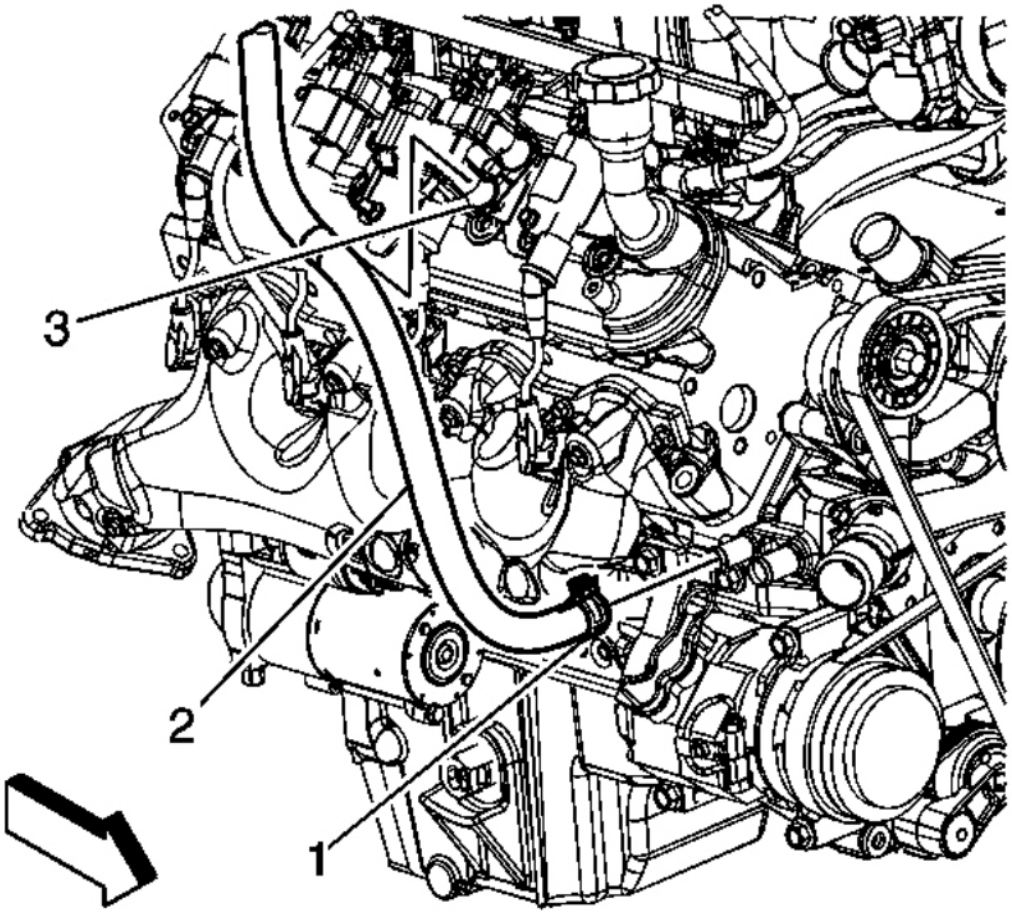


Fig. 92: View Of Heater Inlet Hose, Clamp & Waterpump
Courtesy of GENERAL MOTORS CORP.

3. Position and install the heater inlet hose (2) to the water pump.
4. Position the heater inlet hose clamp (1) at the water pump.

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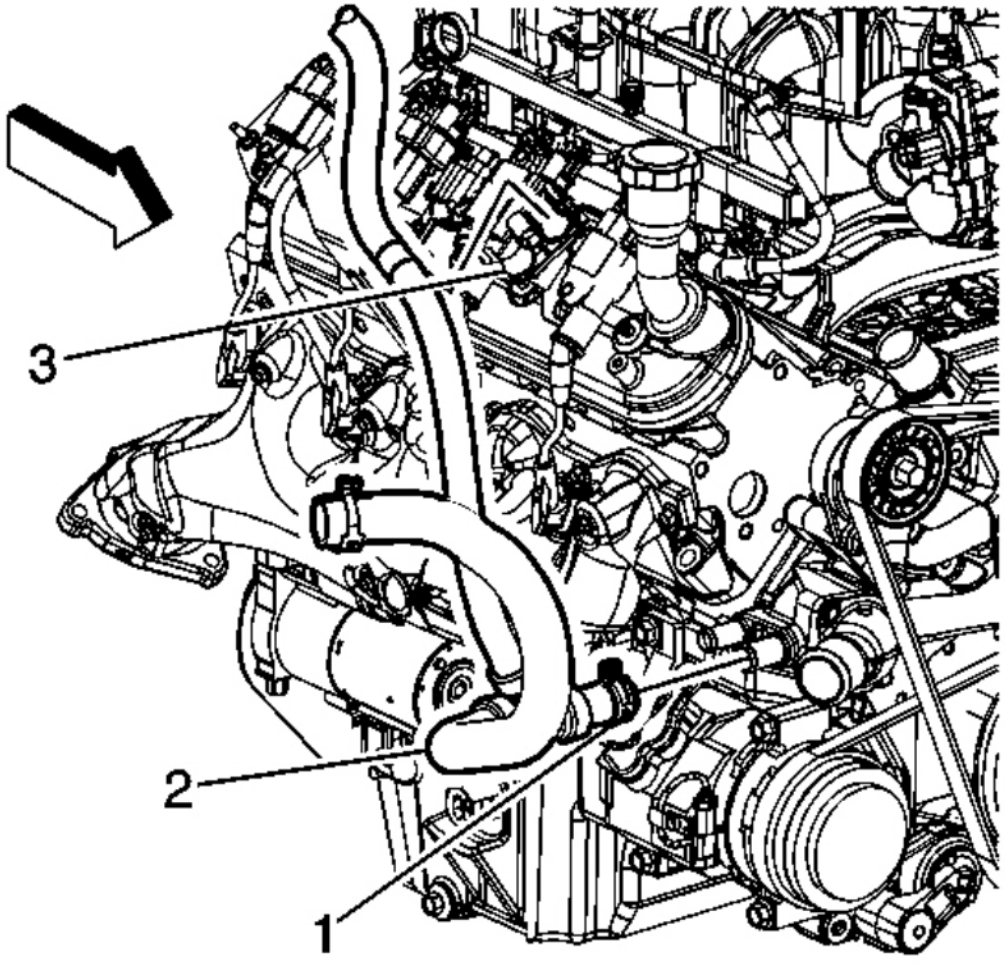


Fig. 93: View Of Radiator Surge Tank Outlet Hose, Clamp & Water Pump
Courtesy of GENERAL MOTORS CORP.

5. Position and install the radiator surge tank outlet hose (2) to the water pump.
6. Position the radiator surge tank outlet hose clamp (1) at the water pump.

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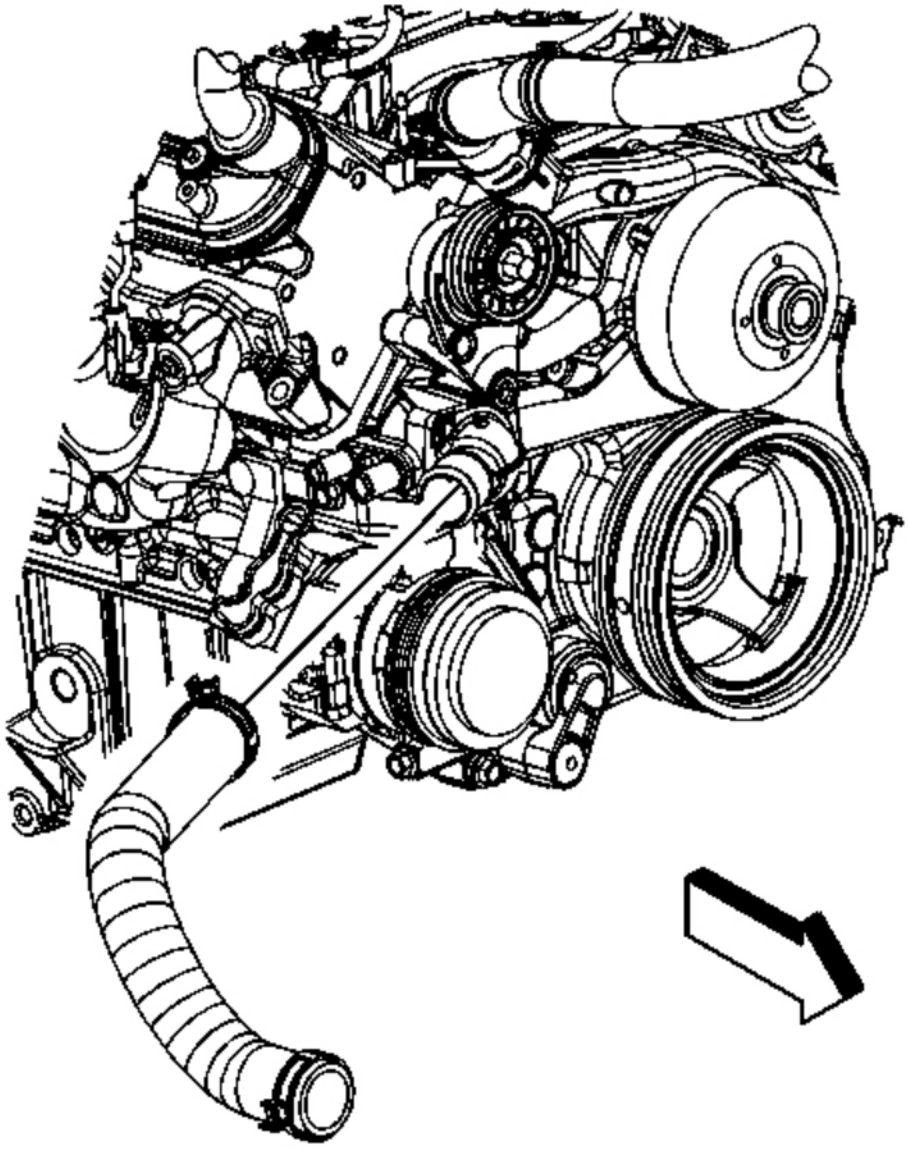


Fig. 94: View Of Radiator Outlet Hose
Courtesy of GENERAL MOTORS CORP.

7. Position and install the radiator outlet hose to the water pump.
8. Position the radiator outlet hose clamp at the water pump.
9. Install the accessory drive belt. Refer to **Drive Belt Replacement - Accessory** .

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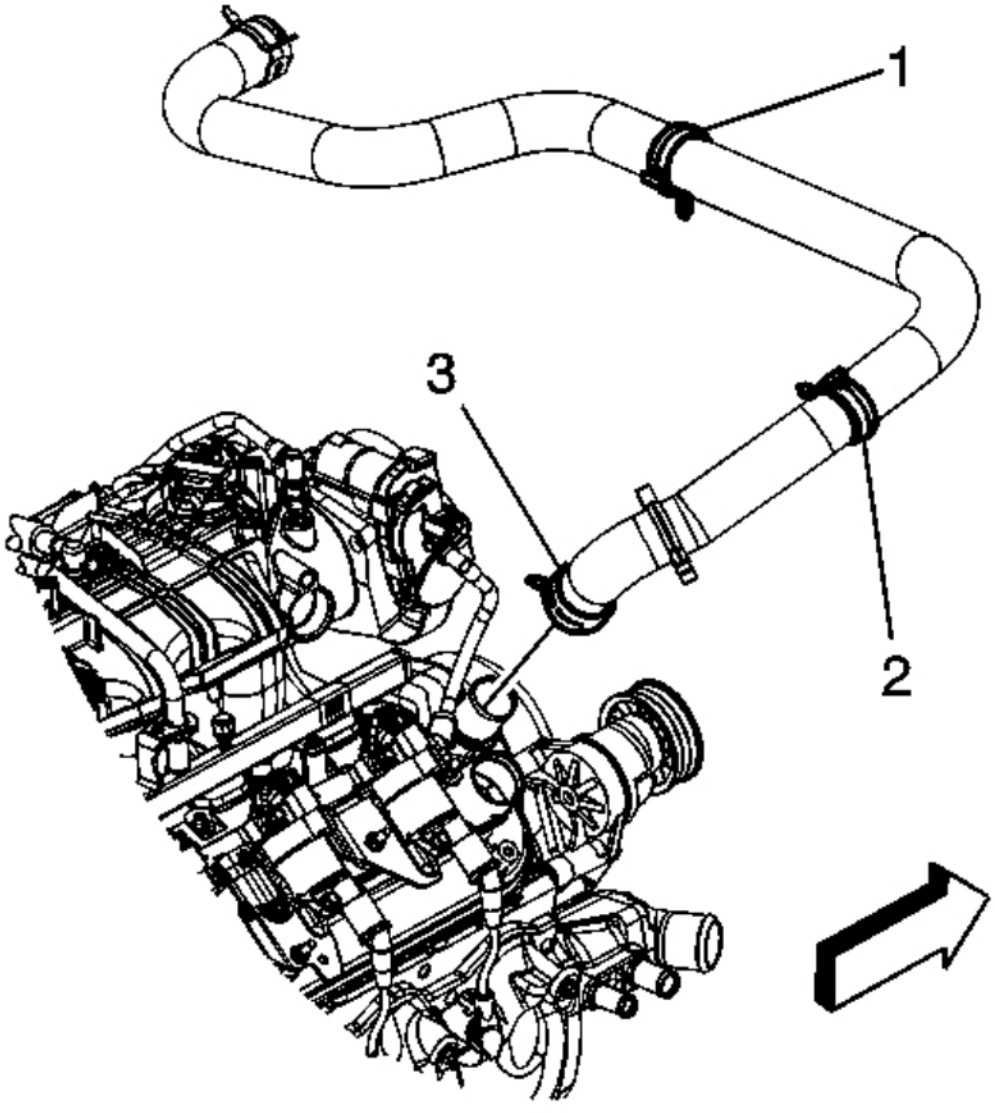


Fig. 95: View Of Radiator Vent Inlet Hose Clamp At Water Pump
Courtesy of GENERAL MOTORS CORP.

10. Position the radiator inlet hose and vent inlet hose to the correct position.
11. Install the radiator inlet hose to the water pump.
12. Position the radiator inlet hose clamp (3) at the water pump.

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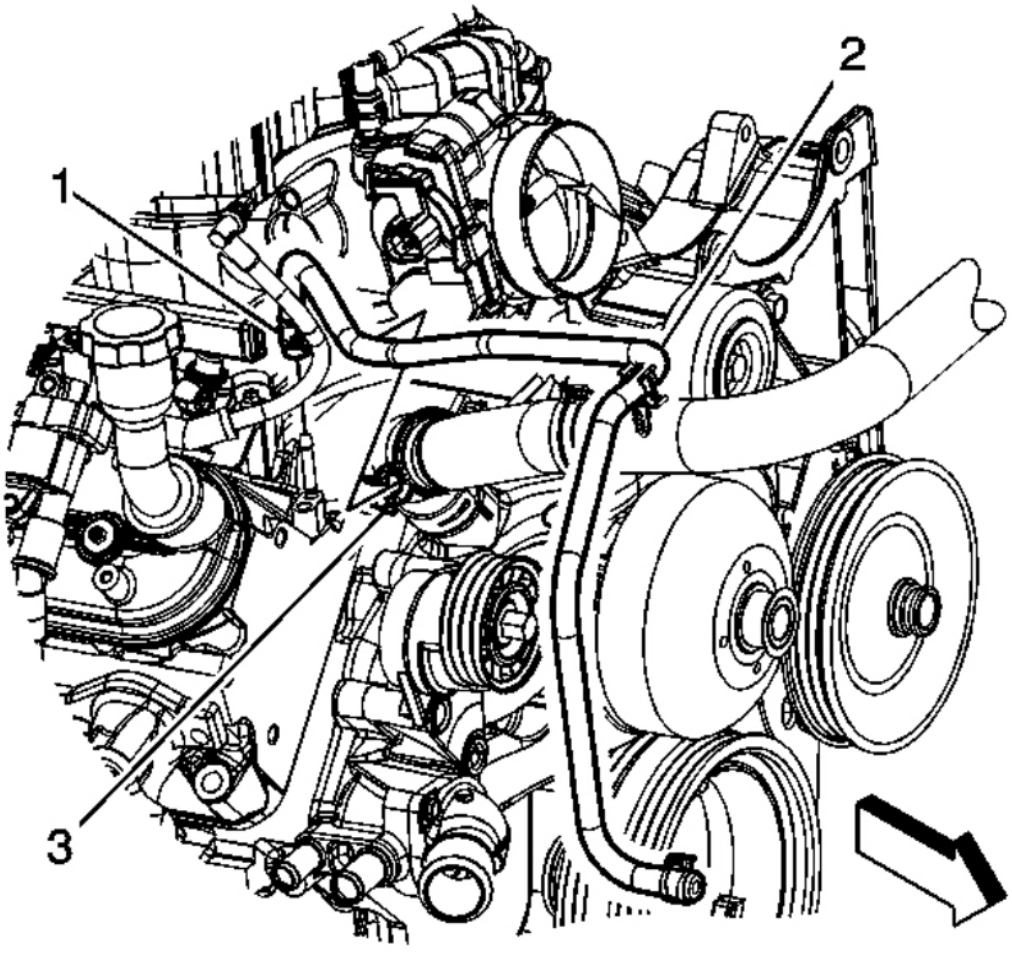


Fig. 96: View Of Radiator Vent Inlet Hose & Clamps
Courtesy of GENERAL MOTORS CORP.

13. Install the radiator vent inlet hose (2) to the coolant air bleed pipe fitting.
14. Position the radiator vent inlet hose clamp (1) at the coolant air bleed pipe fitting.
15. Fill the cooling system. Refer to **Draining and Filling Cooling System**.
16. Install the air cleaner outlet duct. Refer to **Air Cleaner Resonator Outlet Duct Replacement** .

WATER PUMP REPLACEMENT (RPOS LY6/L76/L92)

Removal Procedure

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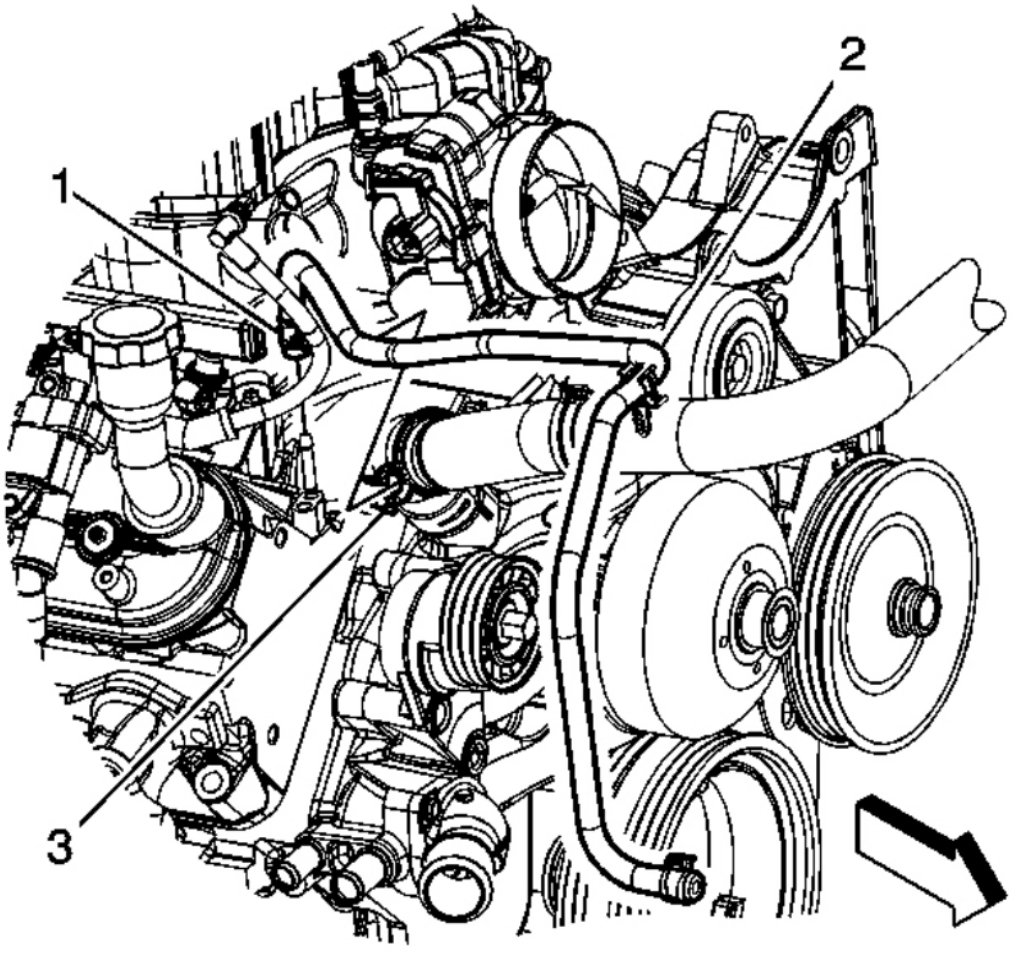


Fig. 97: View Of Radiator Vent Inlet Hose & Clamps
Courtesy of GENERAL MOTORS CORP.

1. Remove the air cleaner outlet duct. Refer to **Air Cleaner Resonator Outlet Duct Replacement** .
2. Drain the cooling system. Refer to **Draining and Filling Cooling System**.
3. Reposition the radiator vent inlet hose clamp (1) at the coolant air bleed pipe fitting.
4. Remove the radiator vent inlet hose (2) from the coolant air bleed pipe fitting.

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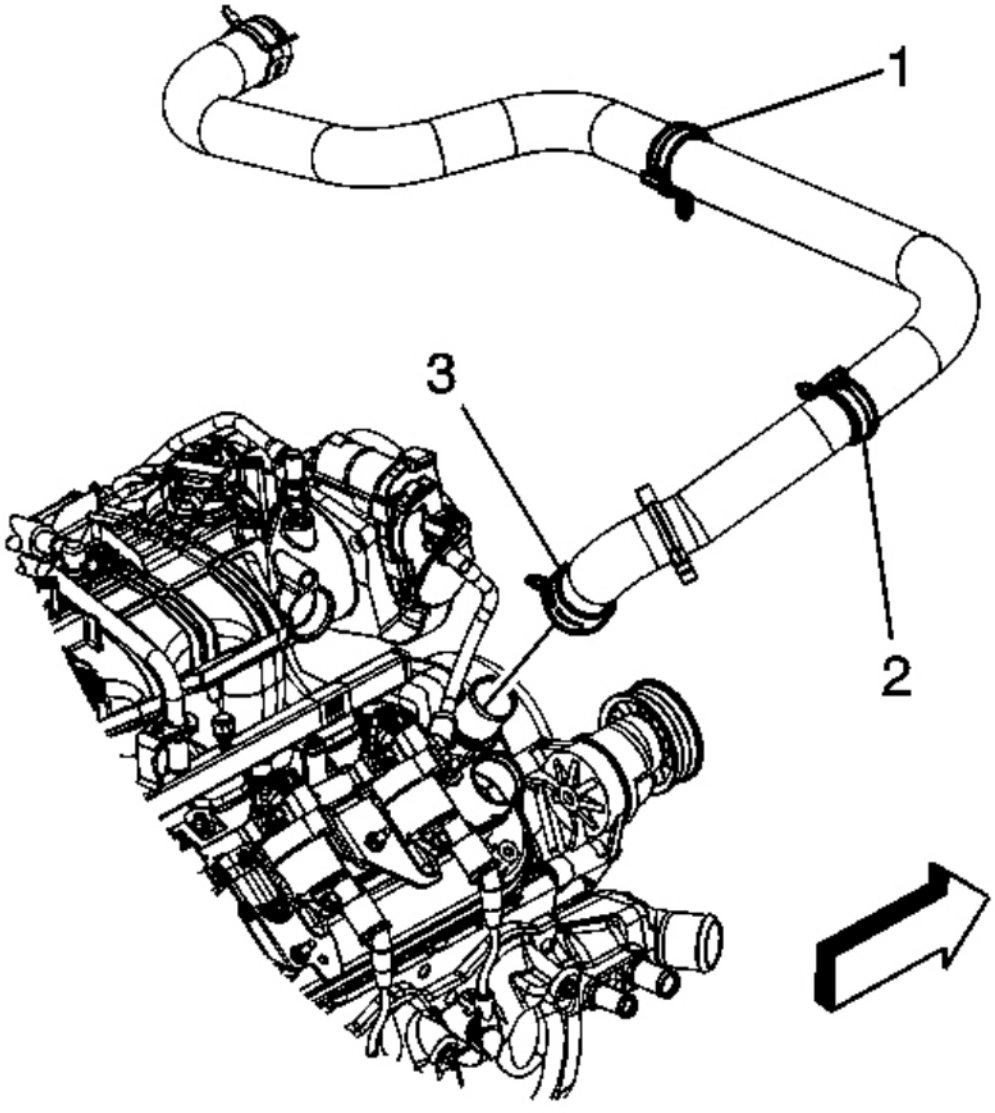


Fig. 98: View Of Radiator Vent Inlet Hose Clamp At Water Pump
Courtesy of GENERAL MOTORS CORP.

5. Reposition the radiator inlet hose clamp (3) at the water pump.
6. Remove the radiator inlet hose from the water pump.
7. Reposition the radiator inlet hose and vent inlet hose out of the way.
8. Remove the accessory drive belt. Refer to **Drive Belt Replacement - Accessory** .

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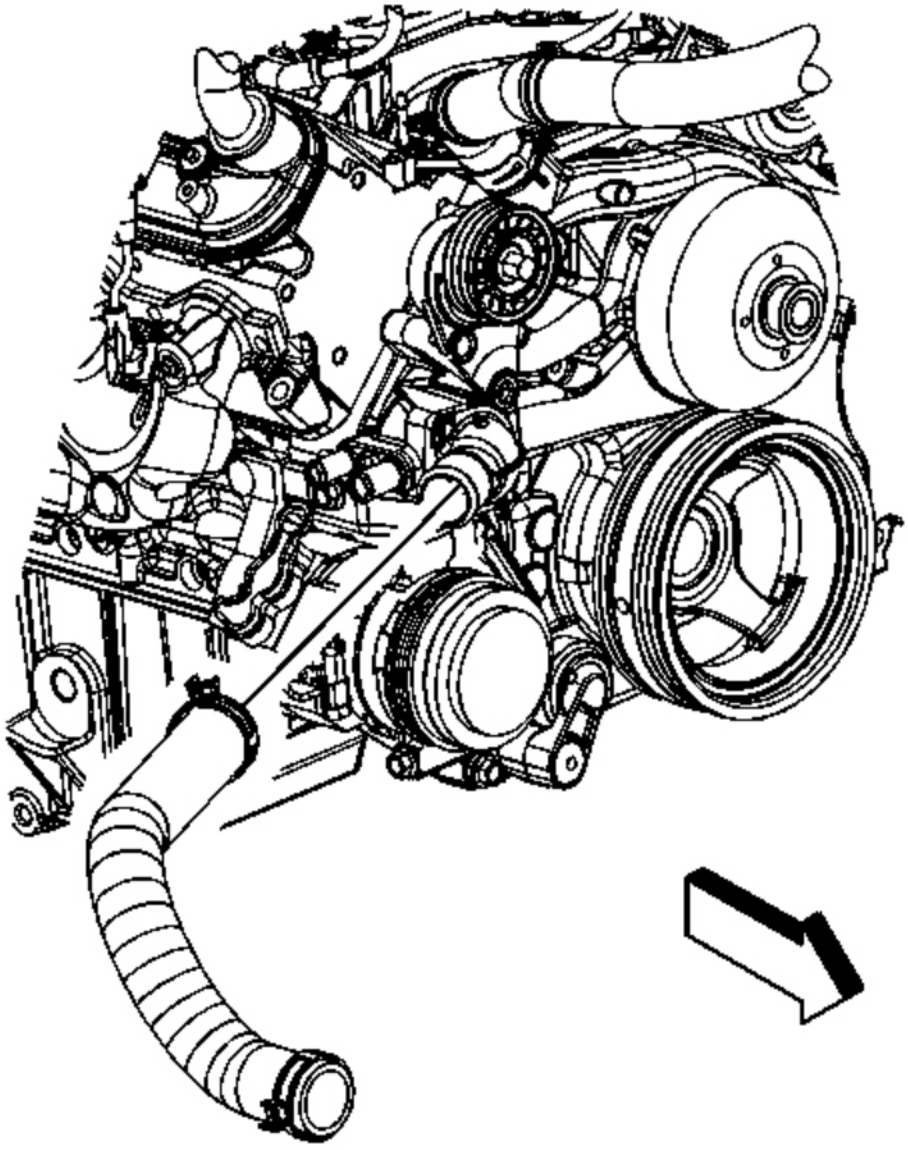


Fig. 99: View Of Radiator Outlet Hose
Courtesy of GENERAL MOTORS CORP.

9. Reposition the radiator outlet hose clamp at the water pump.
10. Remove the radiator outlet hose from the water pump.
11. Reposition the outlet hose out of the way.

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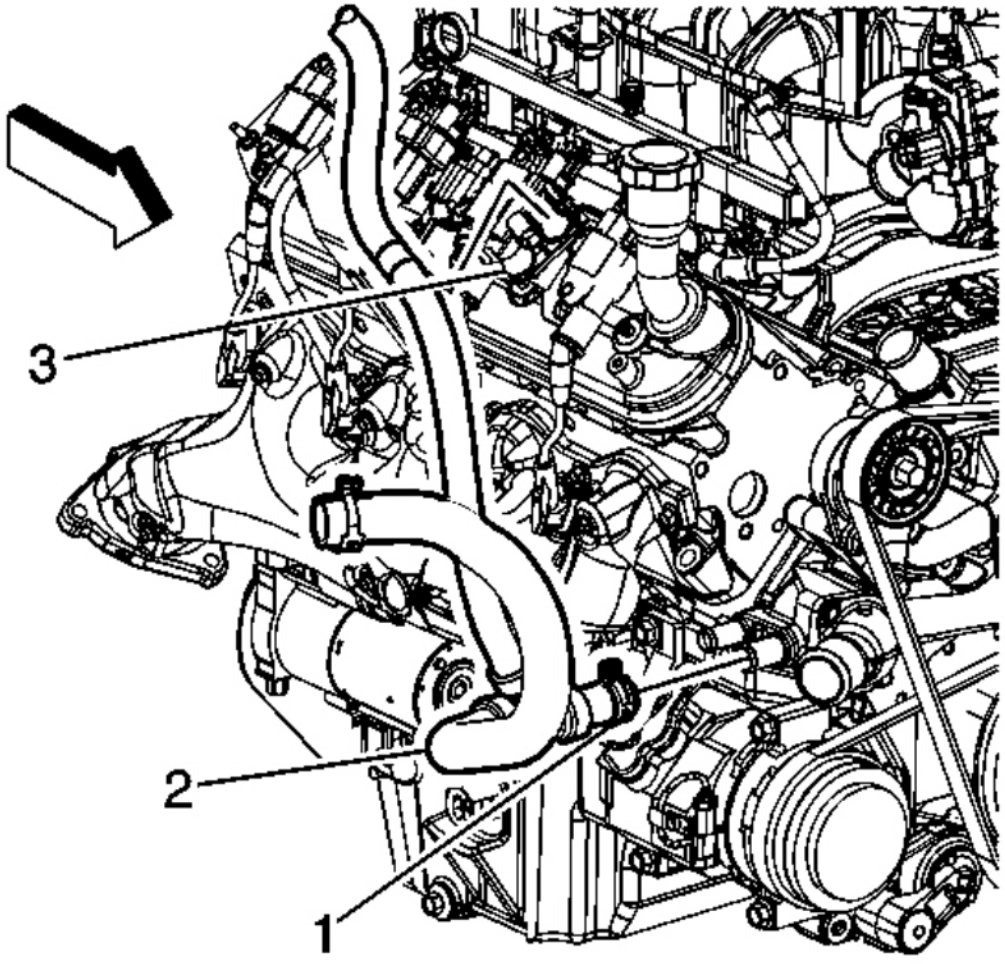


Fig. 100: View Of Radiator Surge Tank Outlet Hose, Clamp & Water Pump
Courtesy of GENERAL MOTORS CORP.

12. Reposition the radiator surge tank outlet hose clamp at the water pump (1).
13. Remove the radiator surge tank outlet hose (2) from the water pump.
14. Reposition the outlet hose out of the way.

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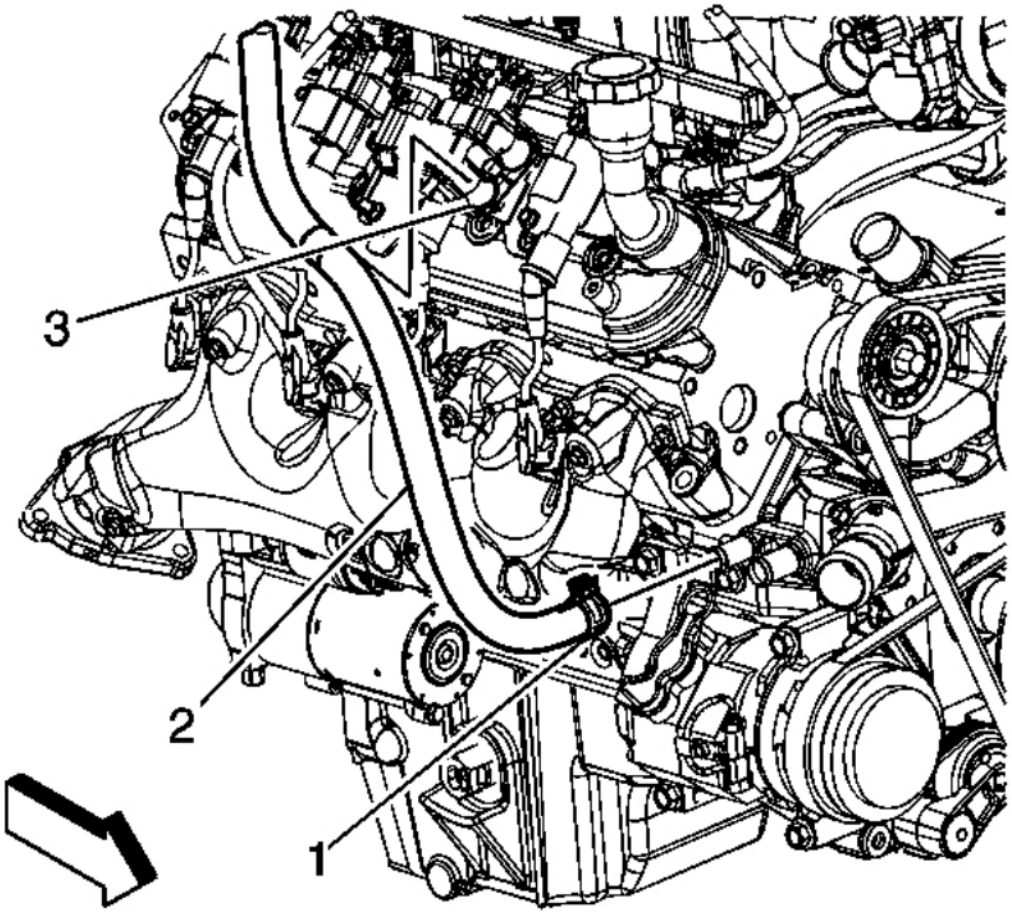


Fig. 101: View Of Heater Inlet Hose, Clamp & Waterpump
Courtesy of GENERAL MOTORS CORP.

15. Reposition the heater inlet hose clamp (1) at the water pump.
16. Remove the heater inlet hose (2) from the water pump.
17. Reposition the inlet hose out of the way.

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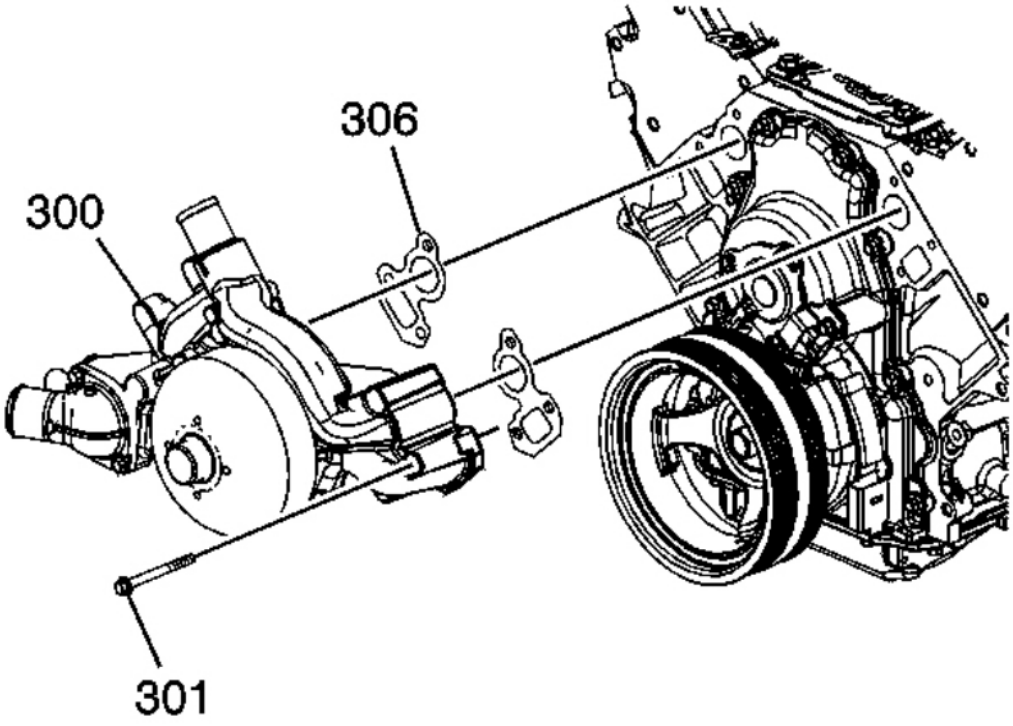


Fig. 102: View Of Water Pump, Bolts & Gaskets
Courtesy of GENERAL MOTORS CORP.

18. Remove the water pump bolts (301).
19. Remove the water pump (300) and gaskets (309). Discard the gaskets.

Installation Procedure

NOTE: DO NOT use cooling system seal tabs, or similar compounds, unless otherwise instructed. The use of cooling system seal tabs, or similar compounds, may restrict coolant flow through the passages of the cooling system or the engine components. Restricted coolant flow may cause engine overheating and/or damage to the cooling system or the engine components/assembly.

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

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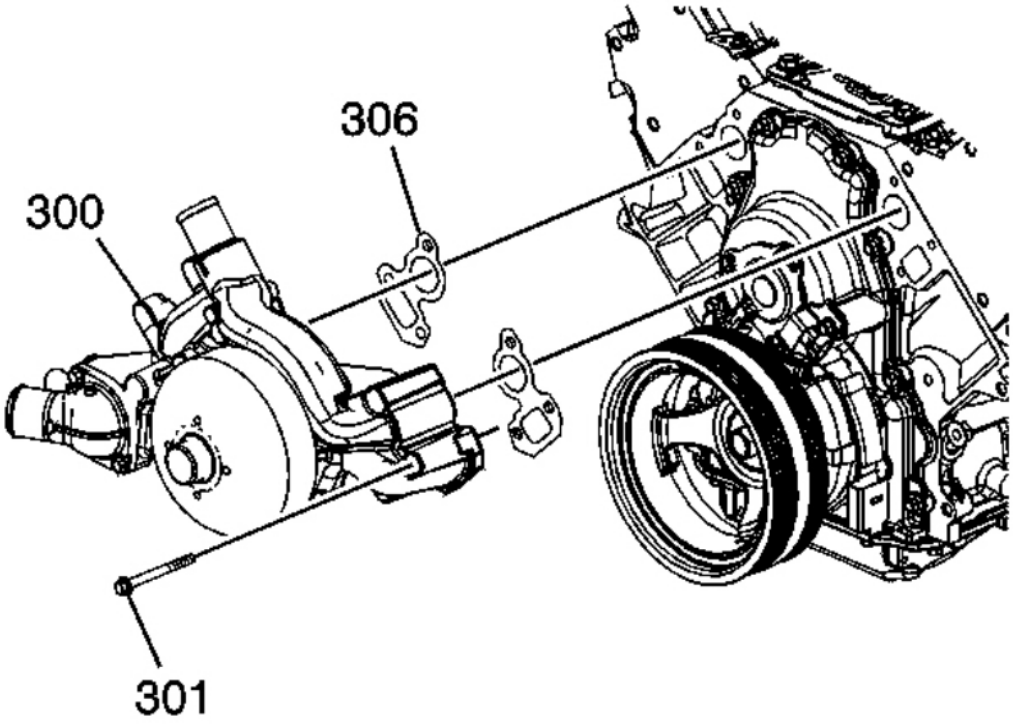


Fig. 103: View Of Water Pump, Bolts & Gaskets
Courtesy of GENERAL MOTORS CORP.

1. Position the water pump (300) and NEW gaskets (306) to the engine block.
2. Install the water pump bolts (301).

Tighten:

1. Tighten the bolts a first pass to 15 N.m (11 lb ft).
2. Tighten the bolts a final pass to 30 N.m (22 lb ft).

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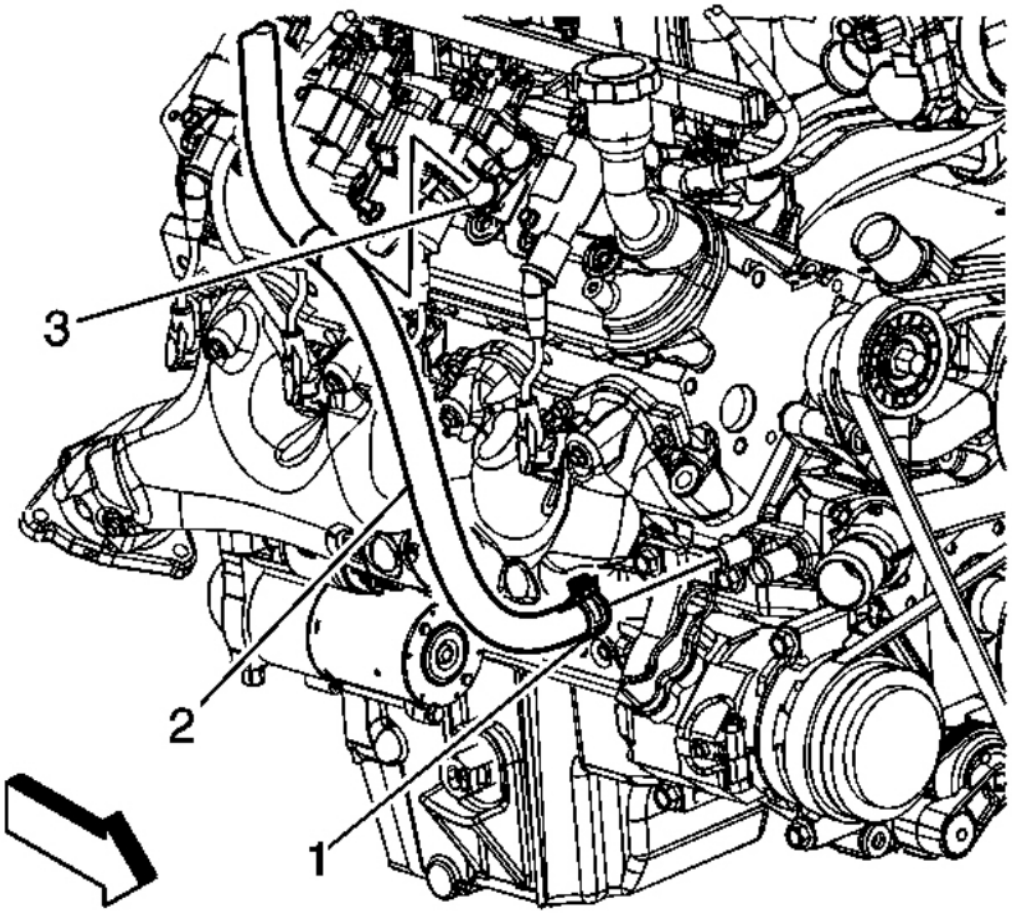


Fig. 104: View Of Heater Inlet Hose, Clamp & Waterpump
Courtesy of GENERAL MOTORS CORP.

3. Position and install the heater inlet hose (2) to the water pump.
4. Position the heater inlet hose clamp (1) at the water pump.

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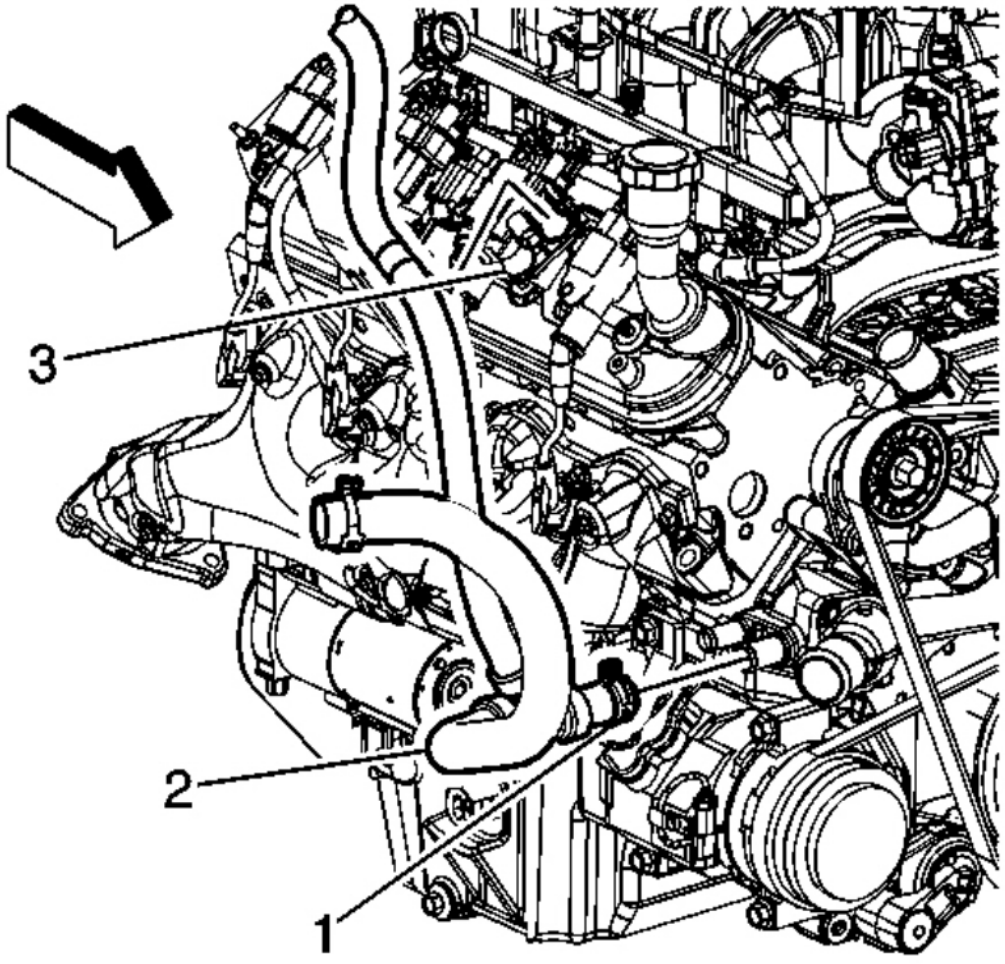


Fig. 105: View Of Radiator Surge Tank Outlet Hose, Clamp & Water Pump
Courtesy of GENERAL MOTORS CORP.

5. Position and install the radiator surge tank outlet hose (2) to the water pump.
6. Position the radiator surge tank outlet hose clamp at the water pump (1).

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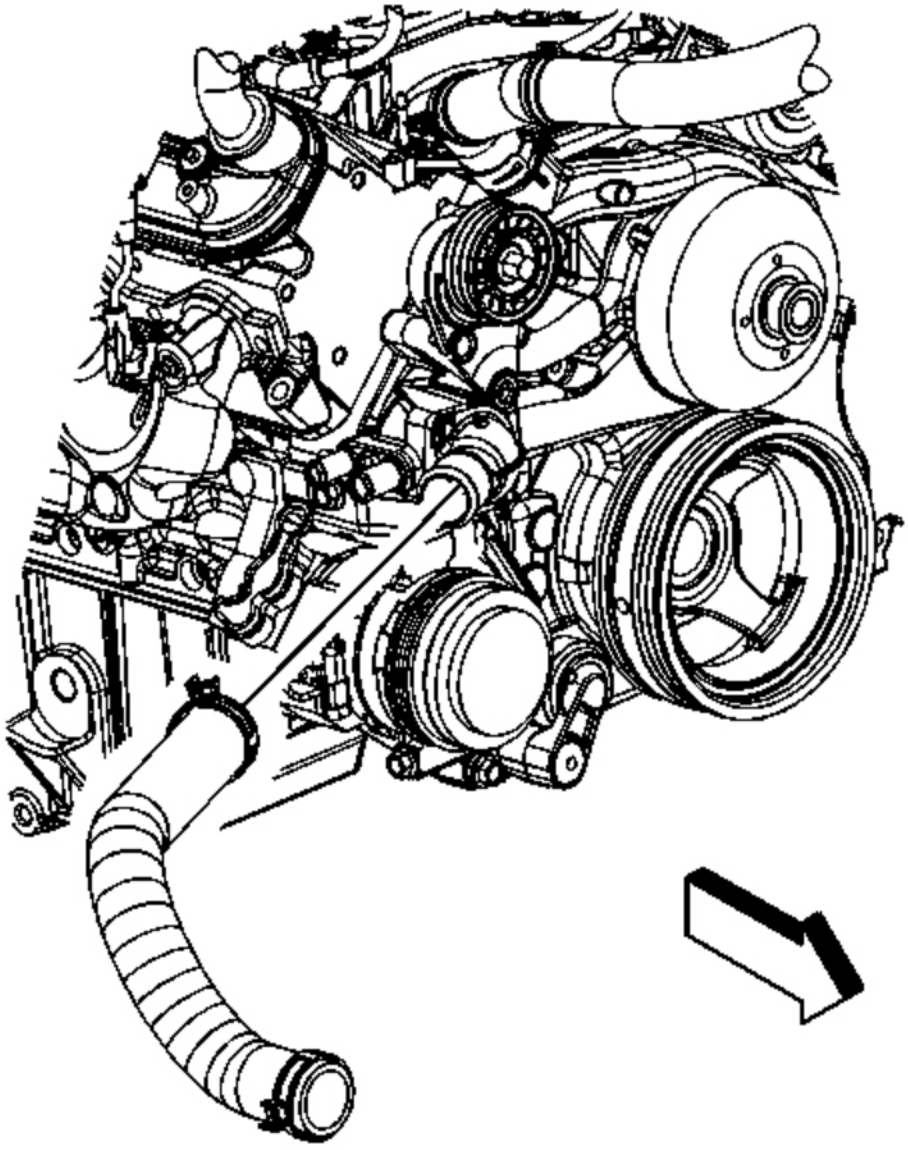


Fig. 106: View Of Radiator Outlet Hose
Courtesy of GENERAL MOTORS CORP.

7. Position and install the radiator outlet hose to the water pump.
8. Position the radiator outlet hose clamp at the water pump.
9. Install the accessory drive belt. Refer to **Drive Belt Replacement - Accessory** .

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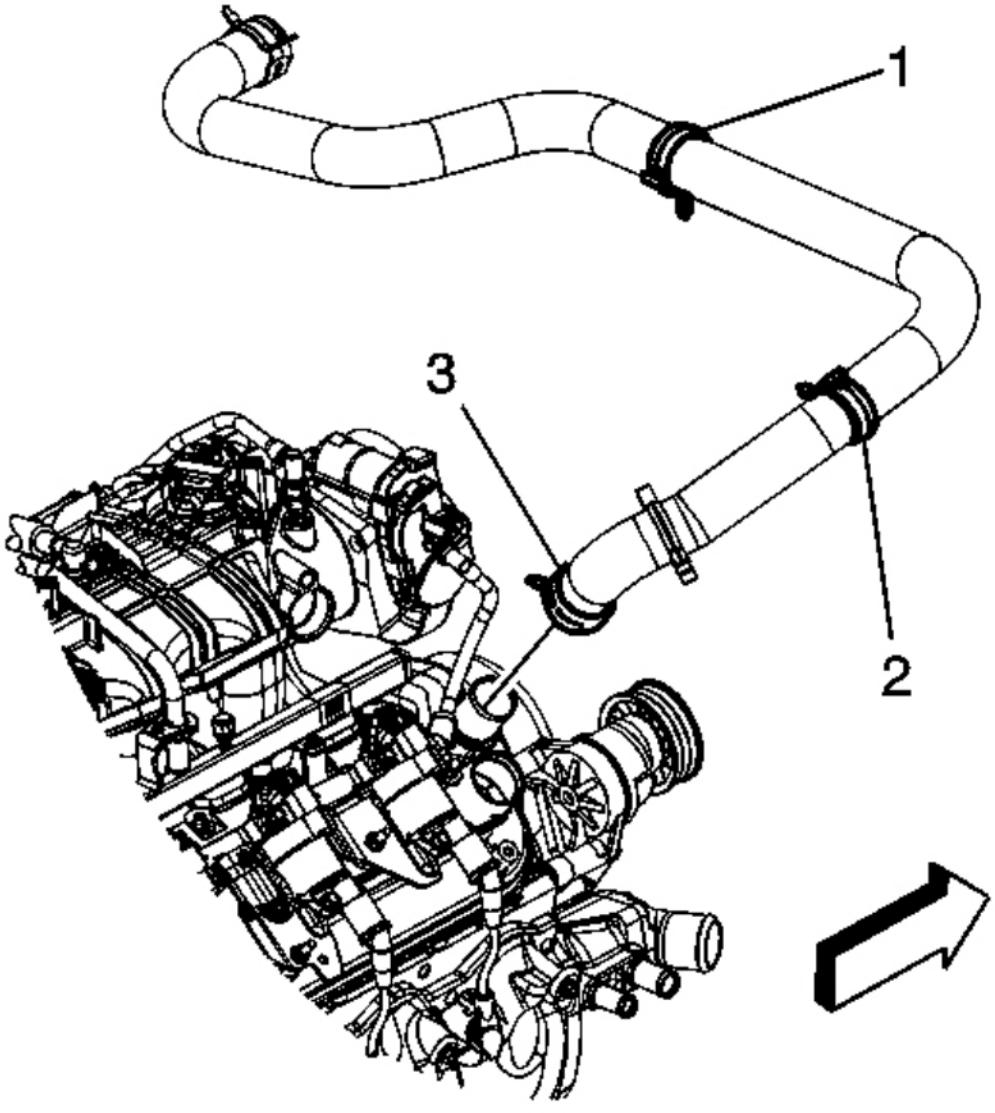


Fig. 107: View Of Radiator Vent Inlet Hose Clamp At Water Pump
Courtesy of GENERAL MOTORS CORP.

10. Position the radiator inlet hose and vent inlet hose to the correct position.
11. Install the radiator inlet hose to the water pump.
12. Position the radiator inlet hose clamp (3) at the water pump.

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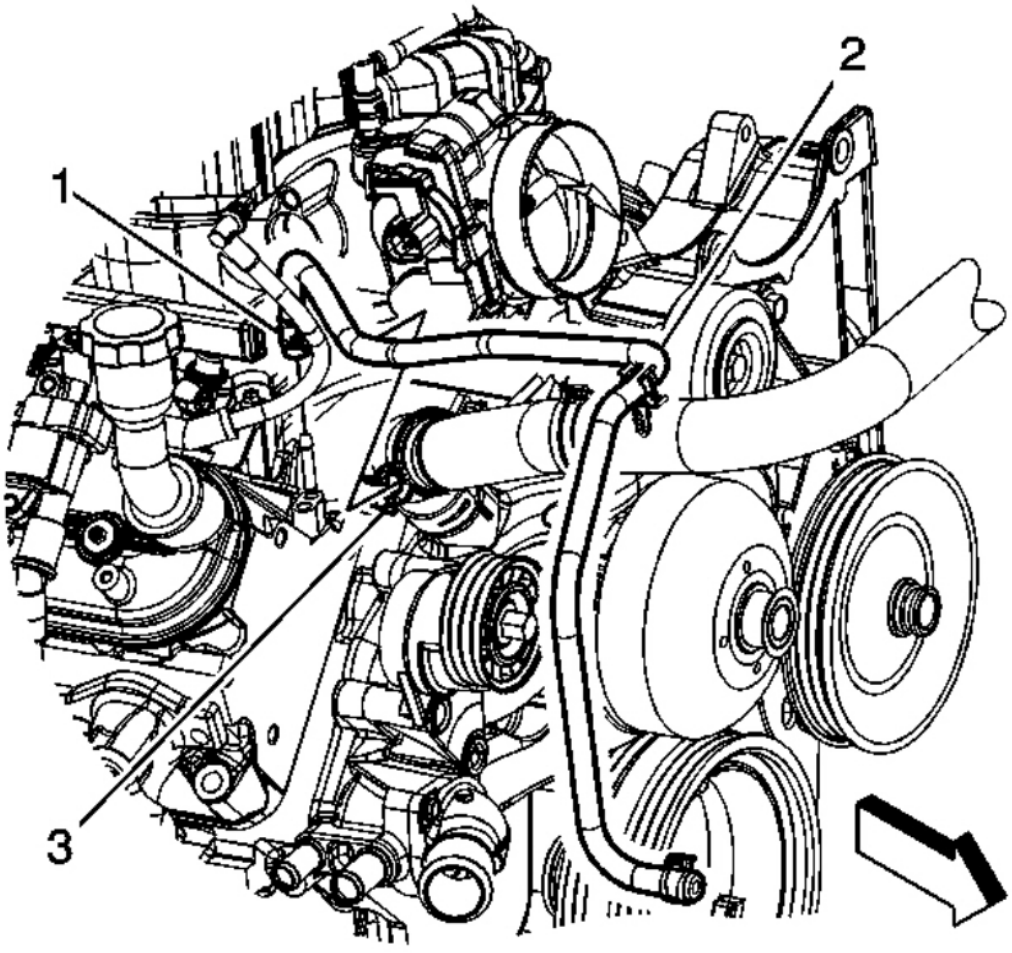


Fig. 108: View Of Radiator Vent Inlet Hose & Clamps
Courtesy of GENERAL MOTORS CORP.

13. Install the radiator vent inlet hose (2) to the coolant air bleed pipe fitting.
14. Position the radiator vent inlet hose clamp (1) at the coolant air bleed pipe fitting.
15. Fill the cooling system. Refer to **Draining and Filling Cooling System**.
16. Install the air cleaner outlet duct. Refer to **Air Cleaner Resonator Outlet Duct Replacement** .

FAN SHROUD REPLACEMENT - UPPER

Removal Procedure

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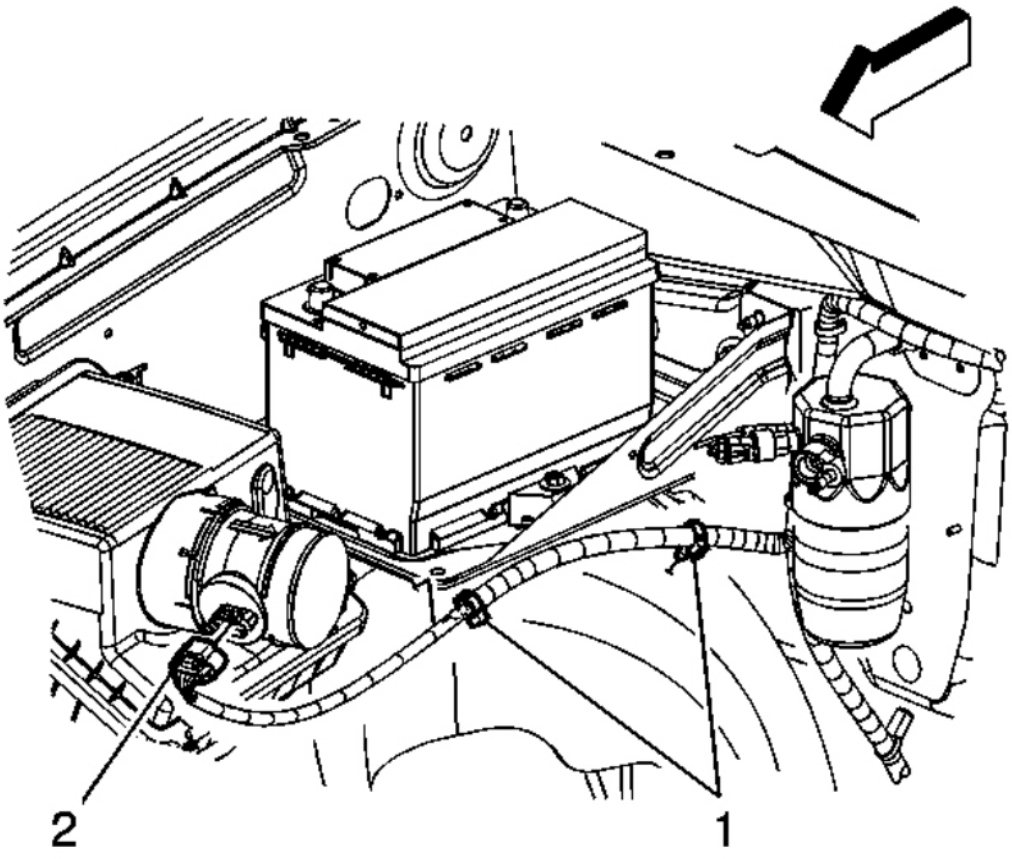


Fig. 109: View Of Throttle Body Heater Hose & Retainers
Courtesy of GENERAL MOTORS CORP.

1. Loosen the air cleaner outlet duct clamps from the throttle body.
2. Loosen the air cleaner outlet duct clamps from the mass airflow sensor.
3. Remove the air cleaner outlet duct.
4. If equipped remove the throttle body heater hose retainer from the fan shroud.
5. If equipped remove the inlet radiator hose retainer from the fan shroud.

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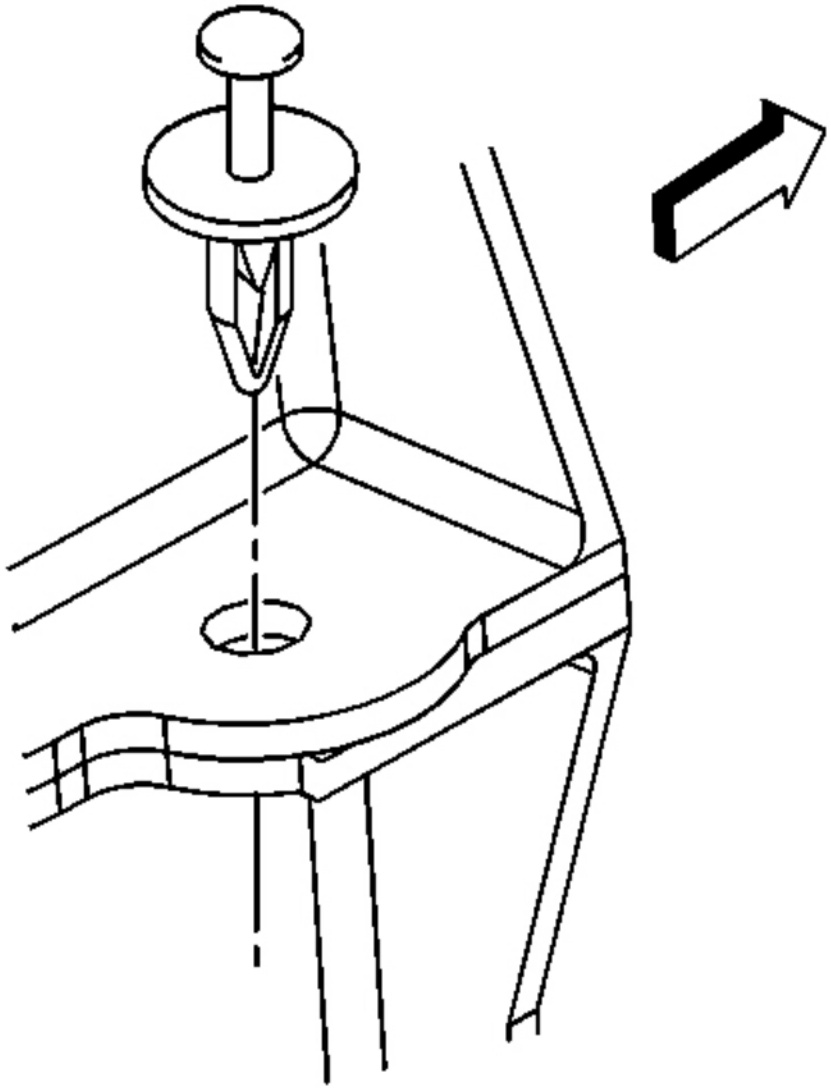


Fig. 110: View Of Fan Shroud Retainers
Courtesy of GENERAL MOTORS CORP.

6. Remove the fan shroud retainers.

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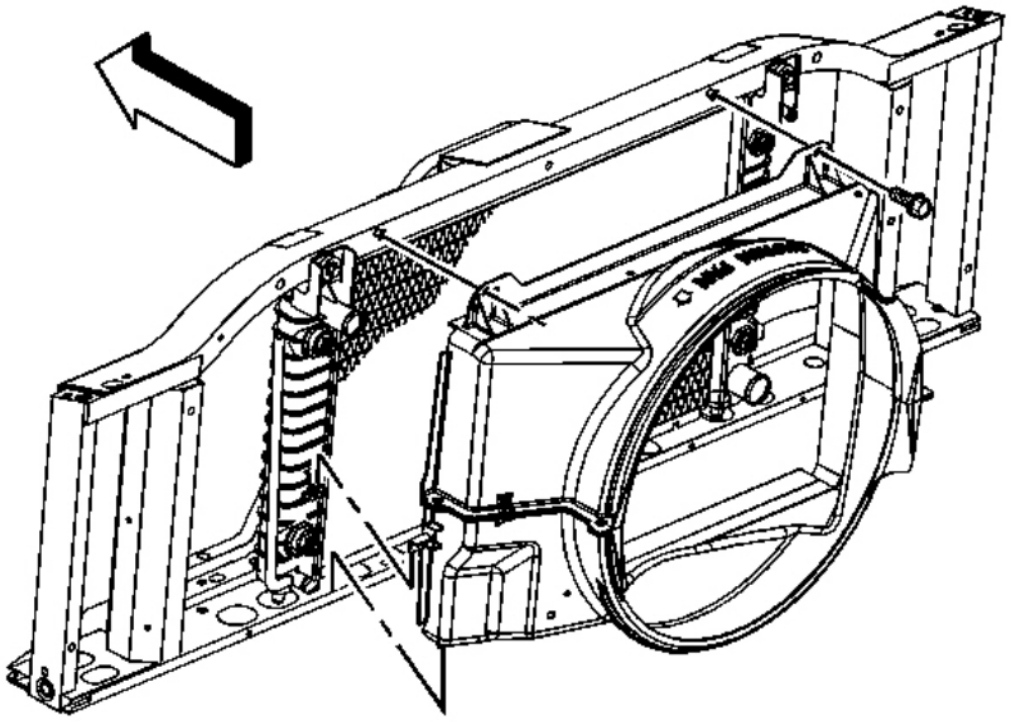


Fig. 111: View Of Fan Shroud & Bolts
Courtesy of GENERAL MOTORS CORP.

7. Remove the fan shroud bolts
8. Remove the upper fan shroud.

Installation Procedure

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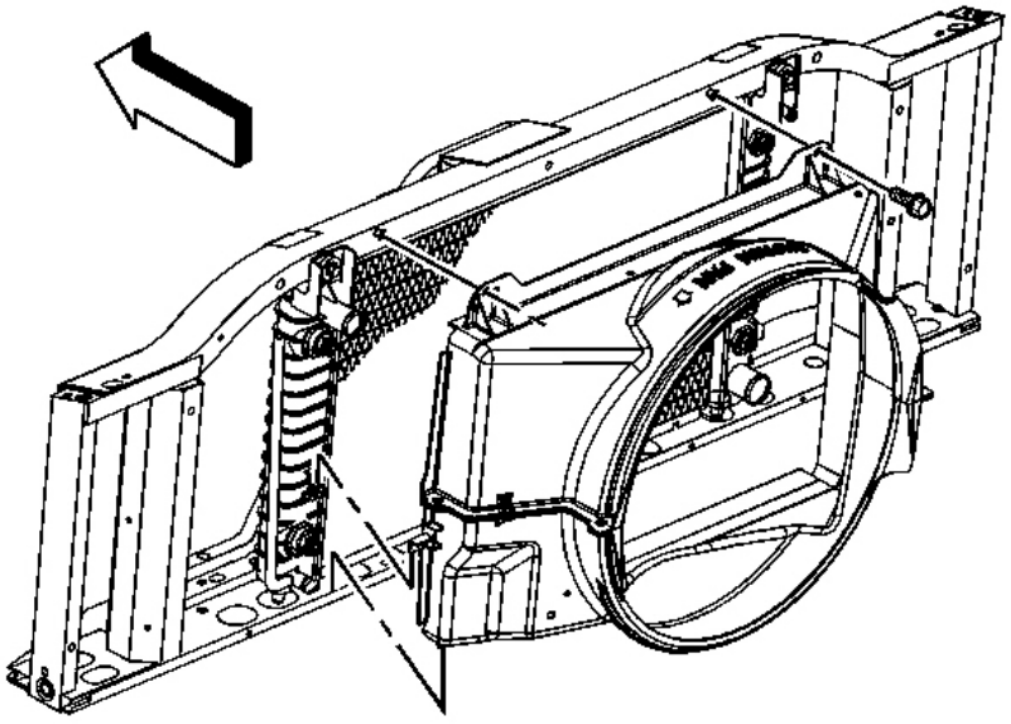


Fig. 112: View Of Fan Shroud & Bolts
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice in Cautions and Notices.

1. Install the upper fan shroud.
2. Install the fan shroud bolts.

Tighten: Tighten the bolts to 9 N.m (80 lb in).

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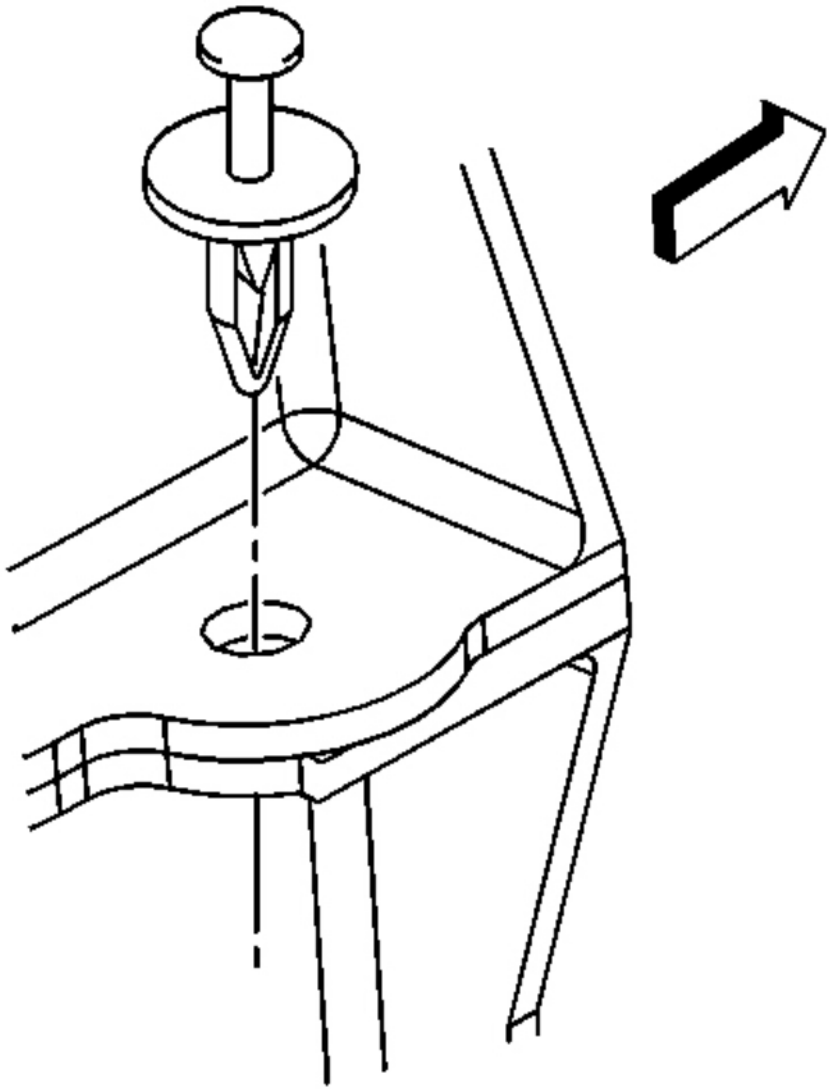


Fig. 113: View Of Fan Shroud Retainers
Courtesy of GENERAL MOTORS CORP.

3. Install the fan shroud retainers.
4. If equipped install the inlet radiator hose retainer to the fan shroud
5. If equipped install the throttle body heater hose retainer to the fan shroud.

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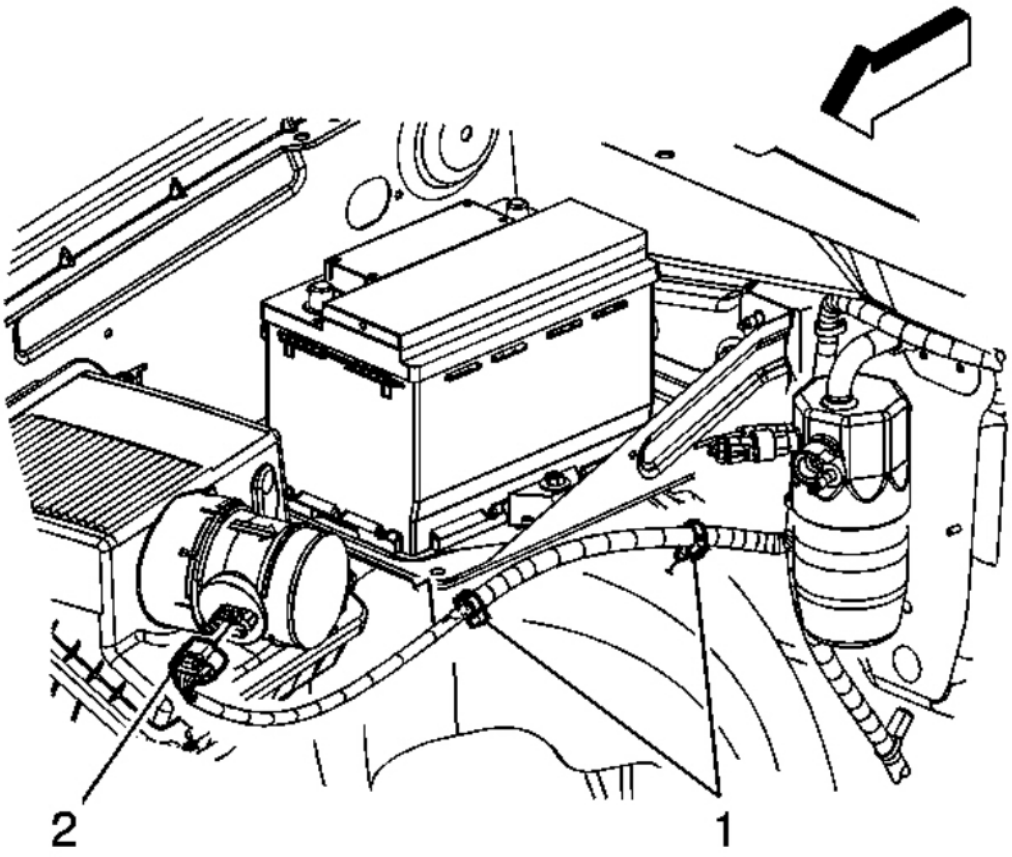


Fig. 114: View Of Throttle Body Heater Hose & Retainers
Courtesy of GENERAL MOTORS CORP.

6. Install the air cleaner outlet duct.
7. Tighten the air cleaner outlet duct clamp at the throttle body.

   Tighten: Tighten the clamp to 4 N.m (35 lb in).

8. Tighten the air cleaner outlet duct clamp at the mass airflow sensor.

   Tighten: Tighten the clamp to 4 N.m (35 lb in).

FAN SHROUD REPLACEMENT - LOWER

Removal Procedure

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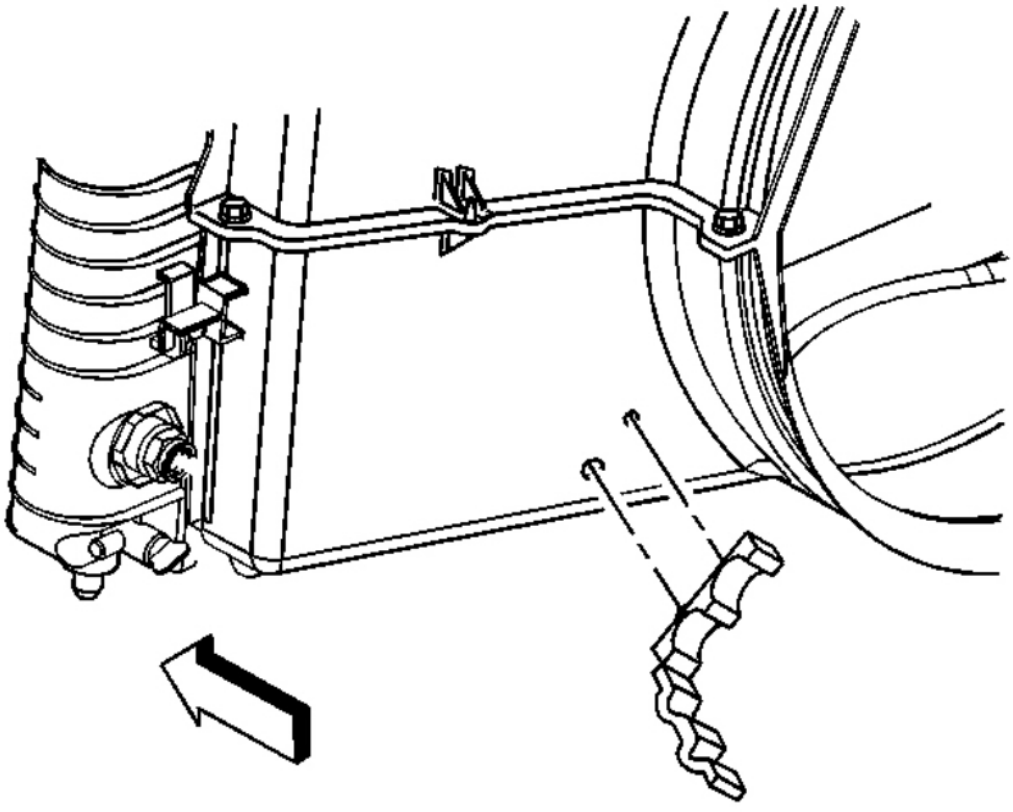


Fig. 115: View Of Oil Cooler Hose Clip At Lower Fan Shroud
Courtesy of GENERAL MOTORS CORP.

1. Remove the cooling fan. Refer to **Fan Replacement (Gasoline)**.
2. If equipped with engine oil cooler, remove the oil cooler hose clip from the lower fan shroud.
3. Lift the lower fan shroud up in order to disengage the fan shroud from the retaining clips on the radiator.

Installation Procedure

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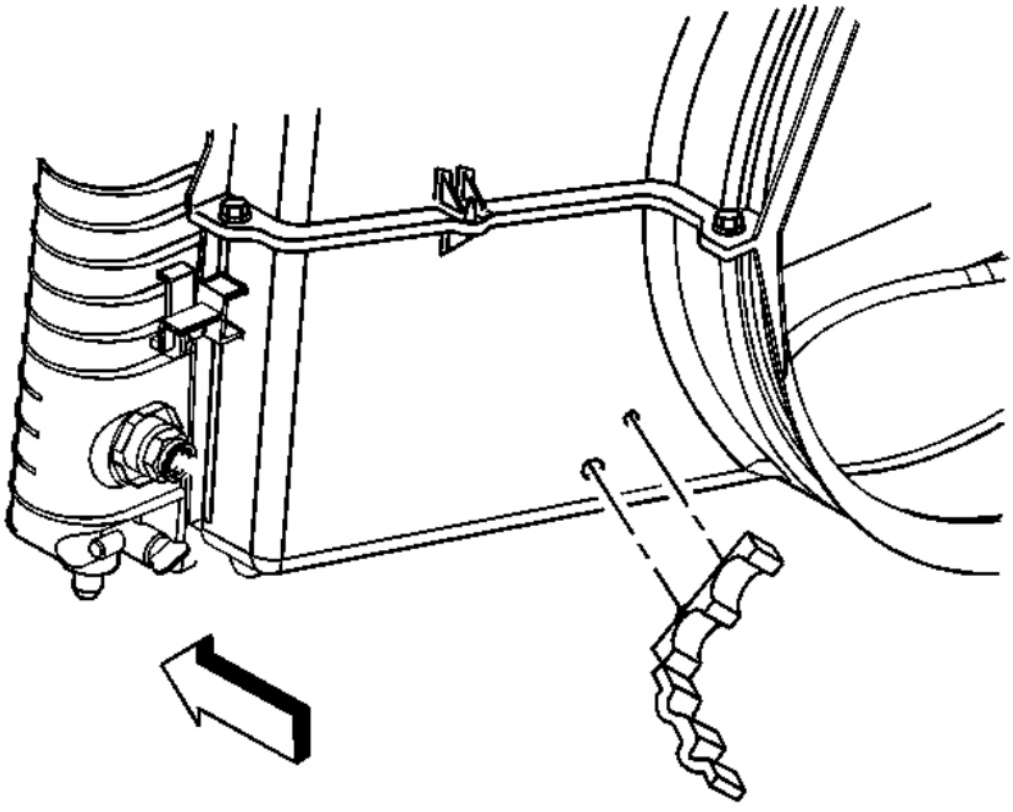


Fig. 116: View Of Oil Cooler Hose Clip At Lower Fan Shroud
Courtesy of GENERAL MOTORS CORP.

1. Install the lower fan shroud and ensure it is centered over lower radiator support.
2. If equipped with the engine oil cooler, Install the oil cooler hose clip to the lower fan shroud.
3. Install the cooling fan. Refer to **Fan Replacement (Gasoline)**.

RADIATOR REPLACEMENT

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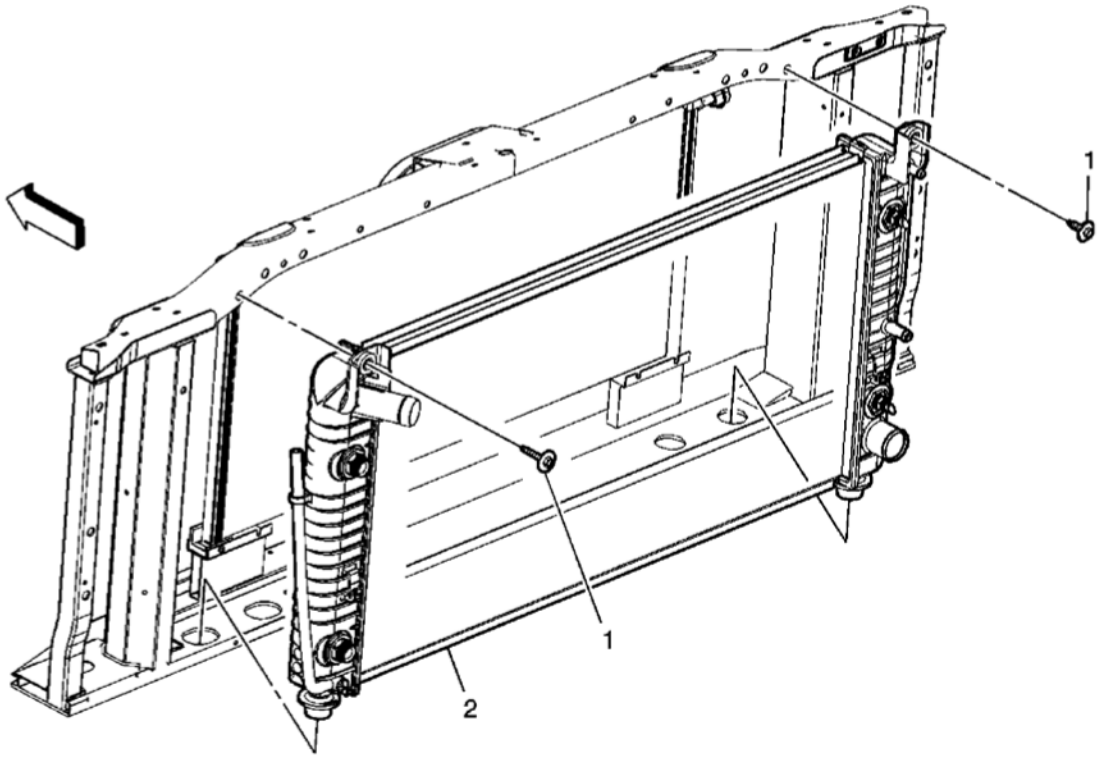


Fig. 117: View Of Radiator Assembly & Bolts
Courtesy of GENERAL MOTORS CORP.

Radiator Replacement

Callout	Component Name
Preliminary Procedure 1. Drain the cooling system. Refer to **Draining and Filling Cooling System**. 2. Remove surge tank hose/pipe. Refer to **Surge Tank Hose/Pipe Replacement - Inlet**. 3. Remove radiator hose inlet. Refer to **Radiator Inlet Hose Replacement**. 4. Remove radiator hose outlet. Refer to **Radiator Outlet Hose Replacement**. 5. Remove cooling fan and shroud. Refer to **Cooling Fan and Shroud Replacement**. 6. Remove engine oil cooler pipe/hose quick connect. Refer to **Engine Oil Cooler Pipe/Hose Quick Connect Fitting**. 7. Remove transmission oil cooler lines. Refer to **Transmission Fluid Cooler Hose/Pipe Replacement** .	
1	Bolts, Radiator (Qty: 2) **NOTE:** **Refer to Fastener Notice .**

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	Tighten: 25 N.m (18 lb ft)
2	Radiator Assembly

RADIATOR AIR UPPER BAFFLE AND DEFLECTOR REPLACEMENT (CADILLAC)

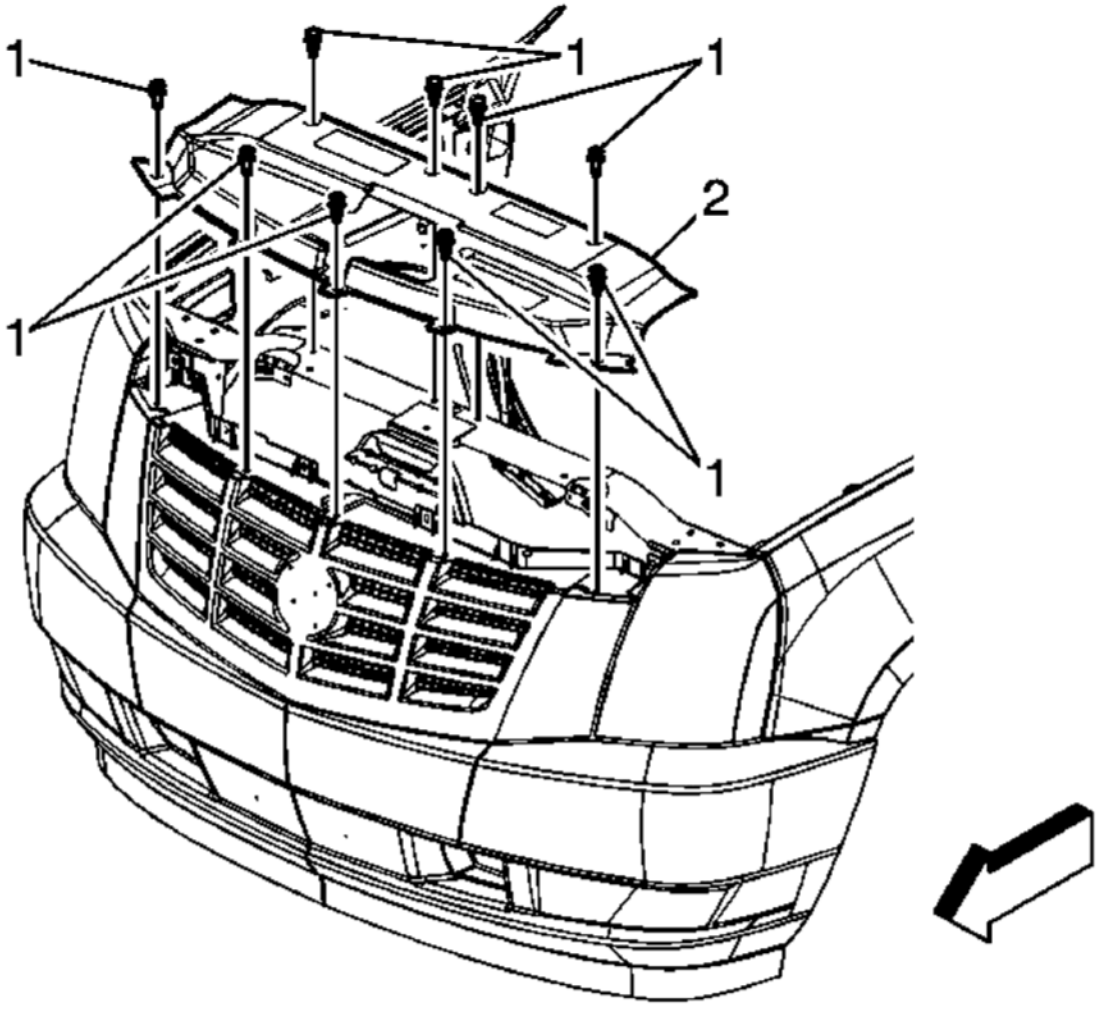


Fig. 118: View Of Radiator Air Upper Baffle & Fasteners
Courtesy of GENERAL MOTORS CORP.

Radiator Air Upper Baffle and Deflector Replacement (Cadillac)

Callout	Component Name
1	Pushpin Fasteners, Radiator Air Baffle (Qty: 9)
2	Baffle, Radiator Air Upper

RADIATOR AIR UPPER BAFFLE AND DEFLECTOR REPLACEMENT (YUKON)

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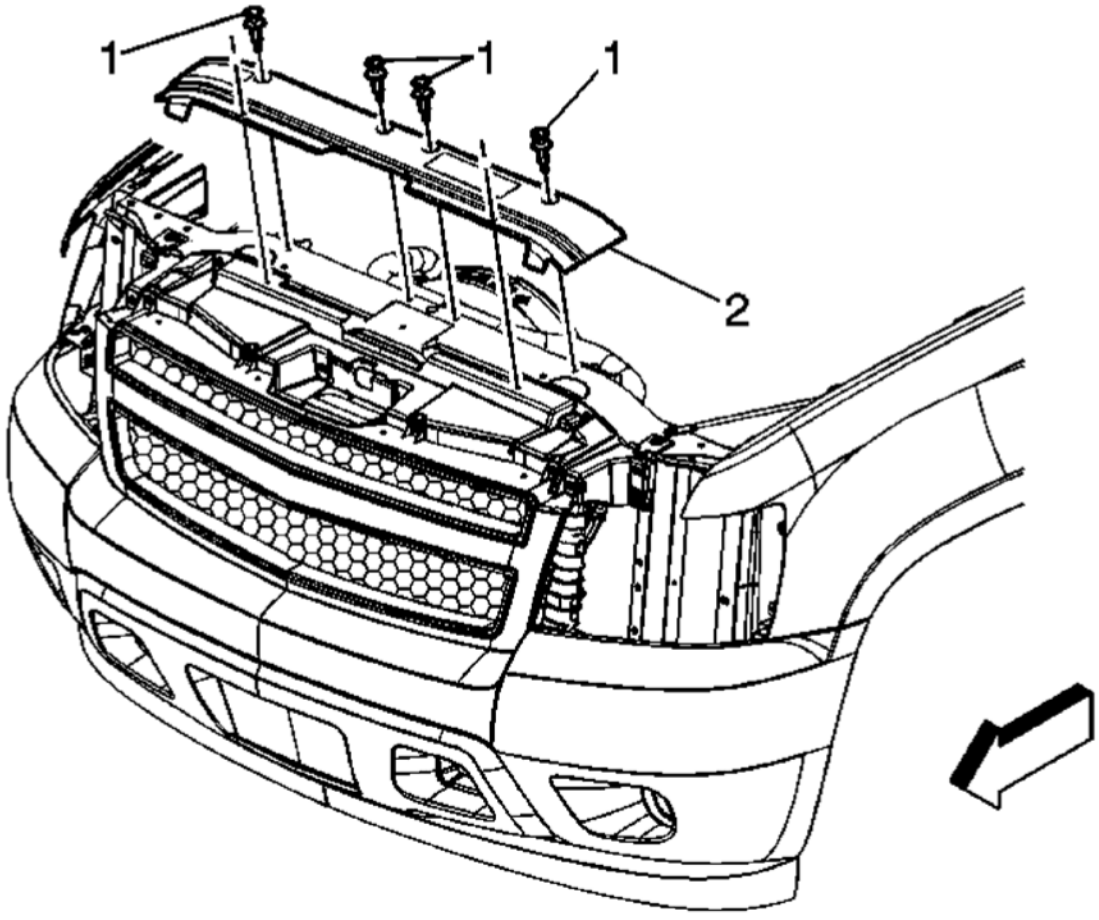


Fig. 119: View Of Radiator Air Upper Baffle & Fasteners
Courtesy of GENERAL MOTORS CORP.

Radiator Air Upper Baffle and Deflector Replacement (Yukon)

Callout	Component Name
1	Radiator Air Baffle Pushpin Fasteners (Qty: 4)
2	Radiator Air Upper Baffle

COOLANT HEATER REPLACEMENT (RPOS LC9/L76/L92)

Removal Procedure

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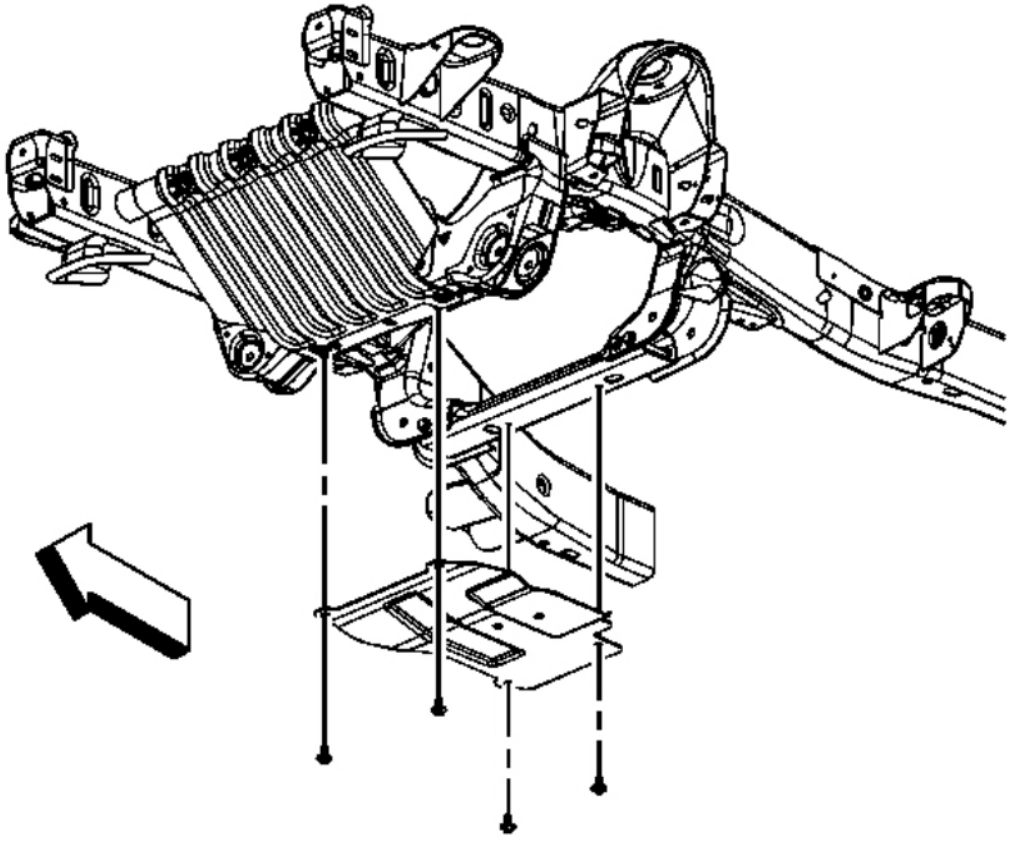


Fig. 120: View Of Oil Pan Skid Plate & Bolts
Courtesy of GENERAL MOTORS CORP.

1. Drain the cooling system/engine block. Refer to **Draining and Filling Cooling System**.
2. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
3. Remove the oil pan skid plate bolts and plate, if equipped.

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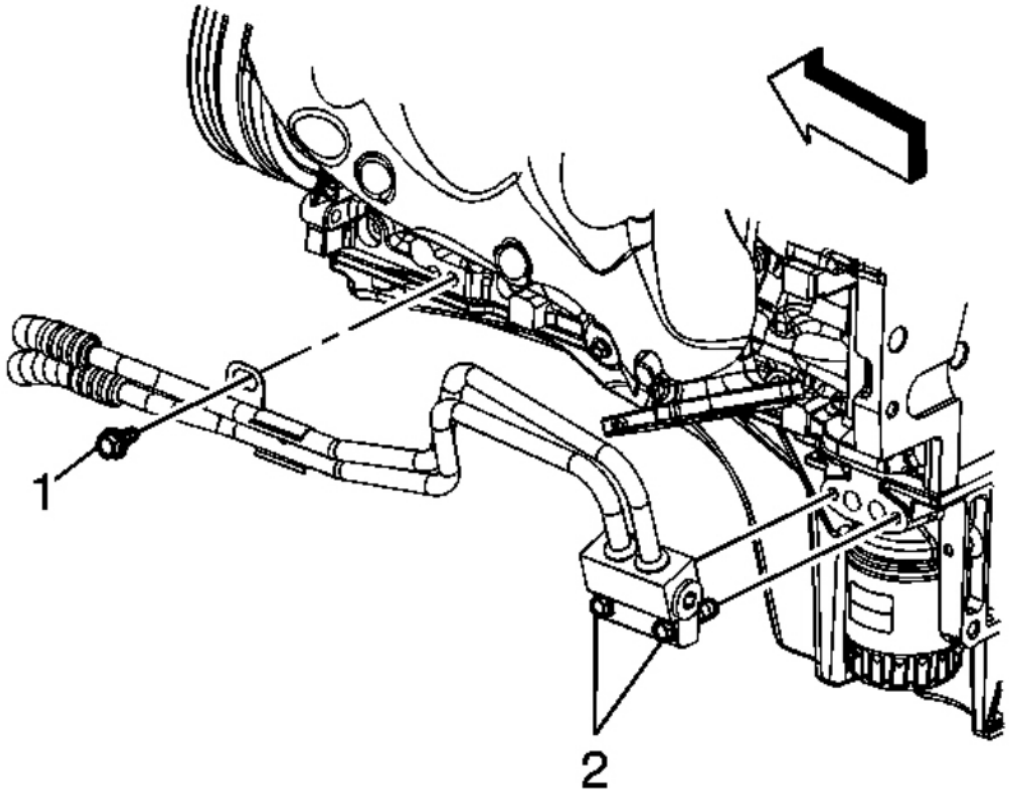


Fig. 121: Locating Oil Cooler Hose Bracket & Adapter Bolts
Courtesy of GENERAL MOTORS CORP.

4. For vehicles with regular production option (RPO) L76 (6.0L), perform the following steps. Otherwise, proceed to step 9.
5. Remove the oil cooler hose bracket bolt (1), if equipped.
6. Remove the oil cooler hose adapter bolts (2), if equipped.
7. Remove and discard the oil cooler hose adapter gasket, if equipped.
8. Position the oil cooler hose adapter end out of the way, if equipped.

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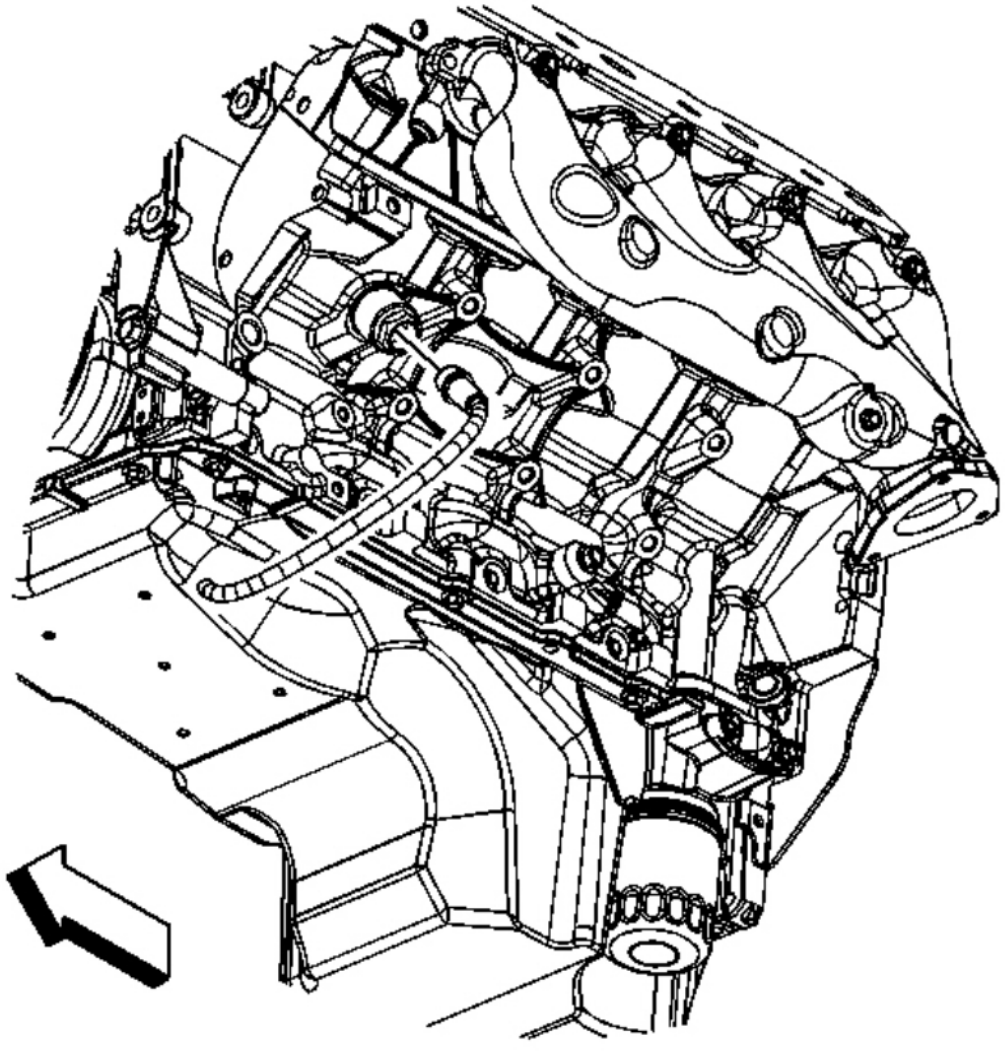


Fig. 122: View Of Coolant Heater Cord
Courtesy of GENERAL MOTORS CORP.

9. Disconnect the coolant heater cord electrical connector.

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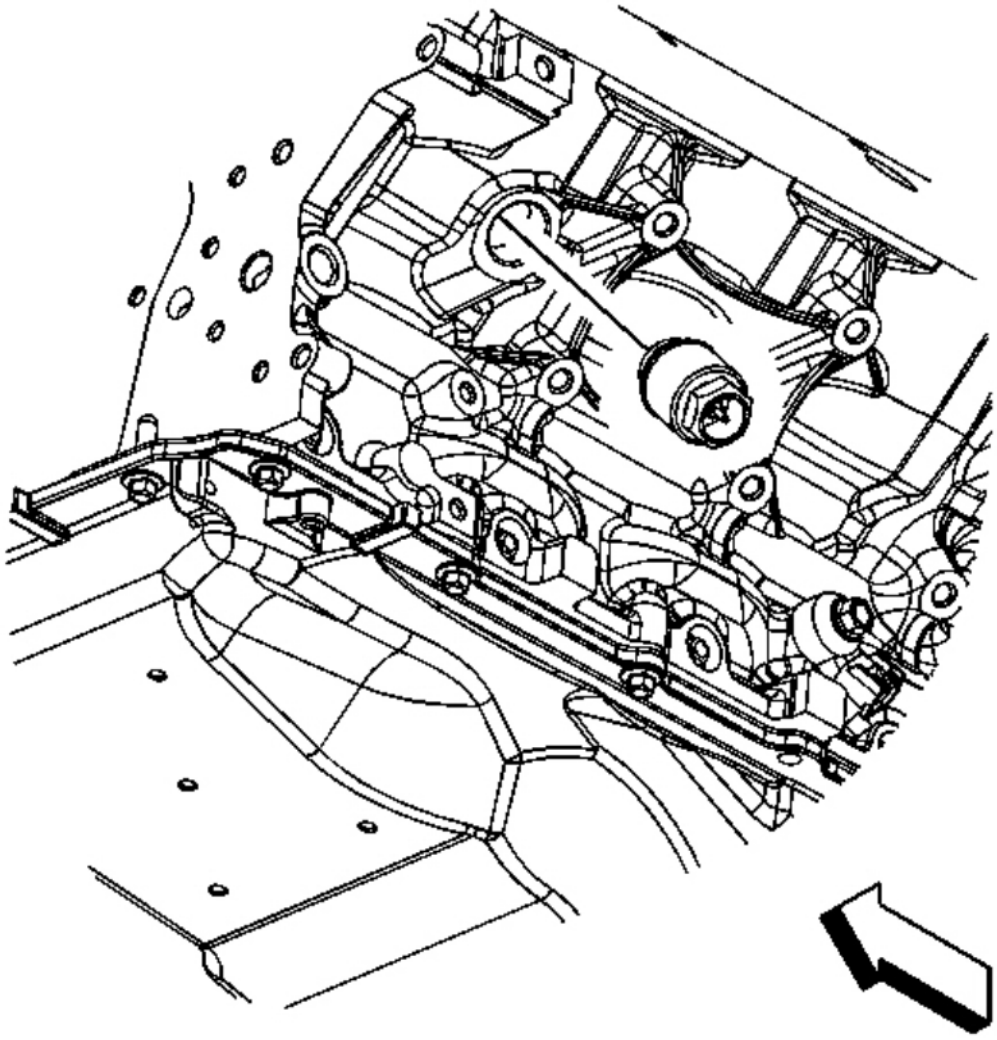


Fig. 123: Locating Coolant Heater
Courtesy of GENERAL MOTORS CORP.

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

10. Remove the coolant heater from the engine block.
11. Remove any burrs, sealer, or other rough spots.

Installation Procedure

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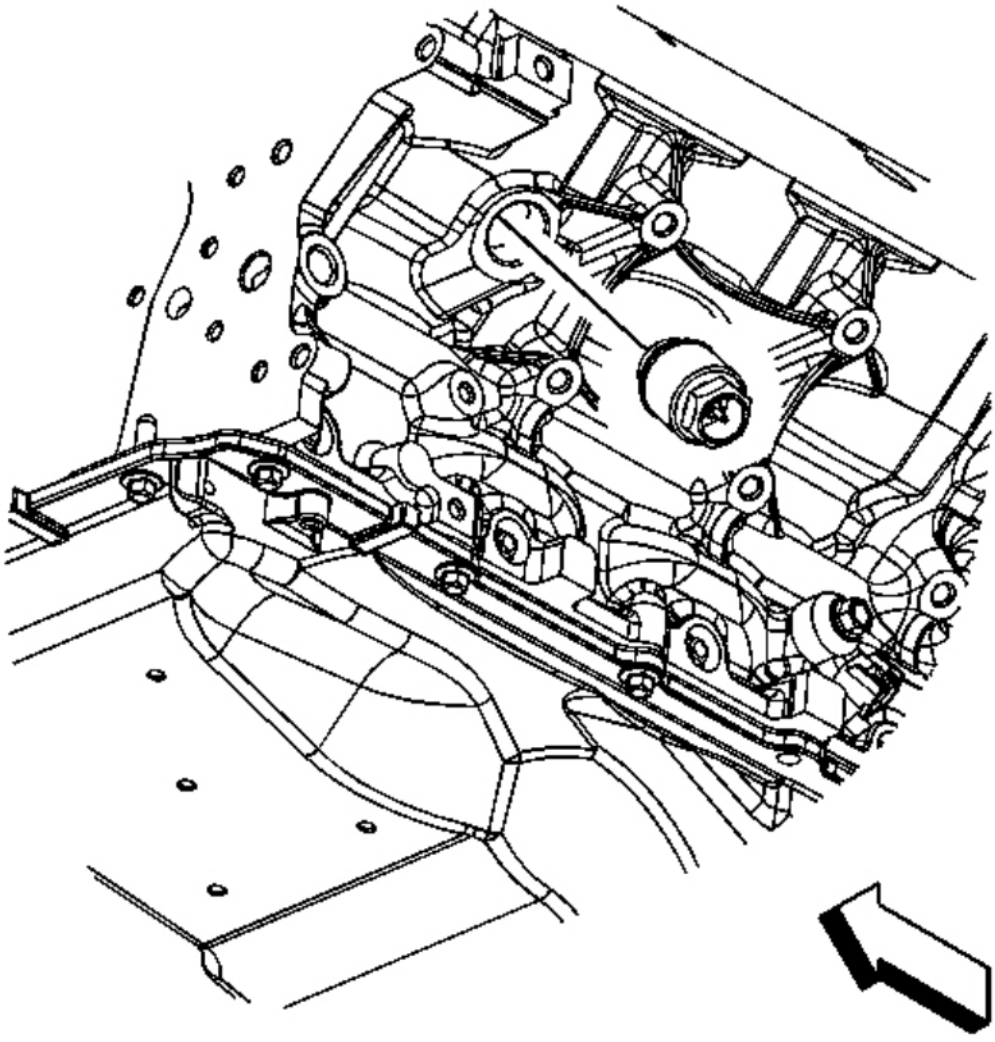


Fig. 124: Locating Coolant Heater
Courtesy of GENERAL MOTORS CORP.

1. If reusing 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.

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

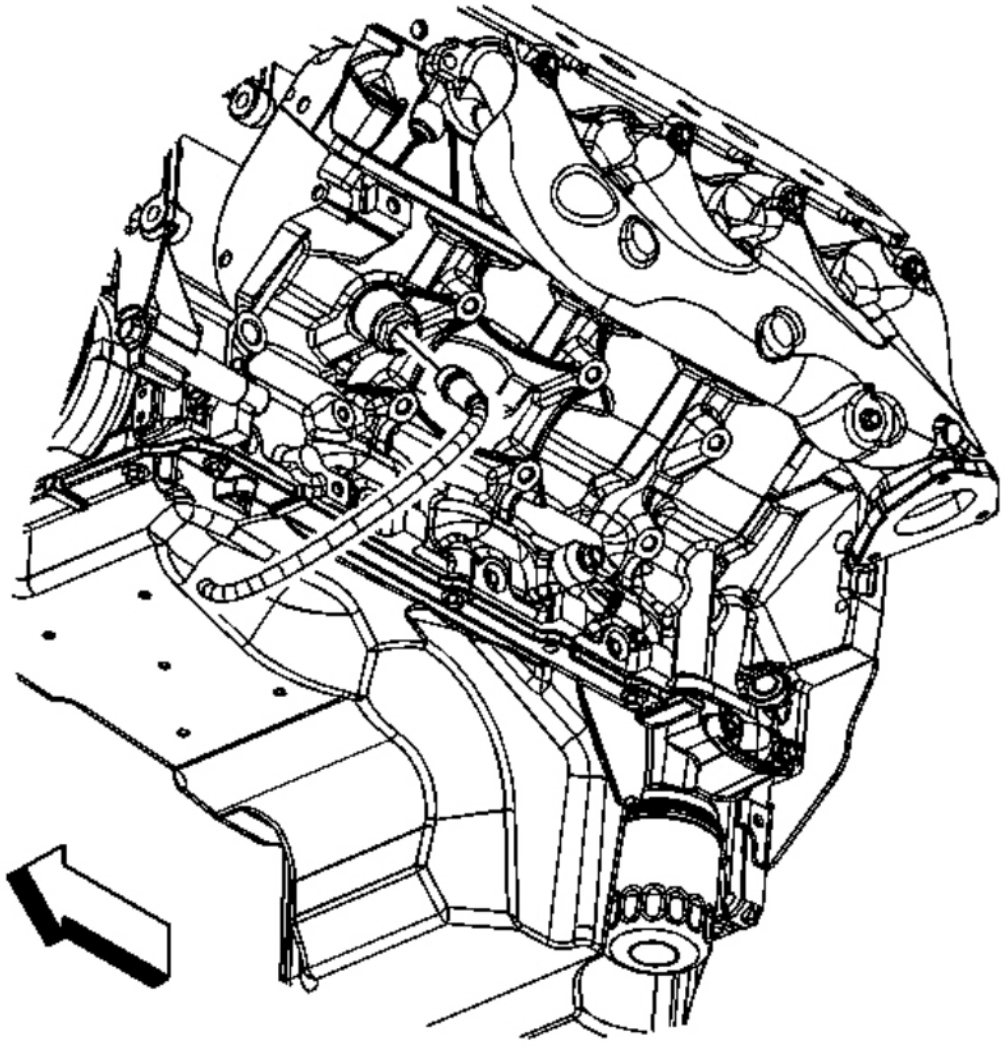


Fig. 125: View Of Coolant Heater Cord
Courtesy of GENERAL MOTORS CORP.

3. Connect the coolant heater cord electrical connector.

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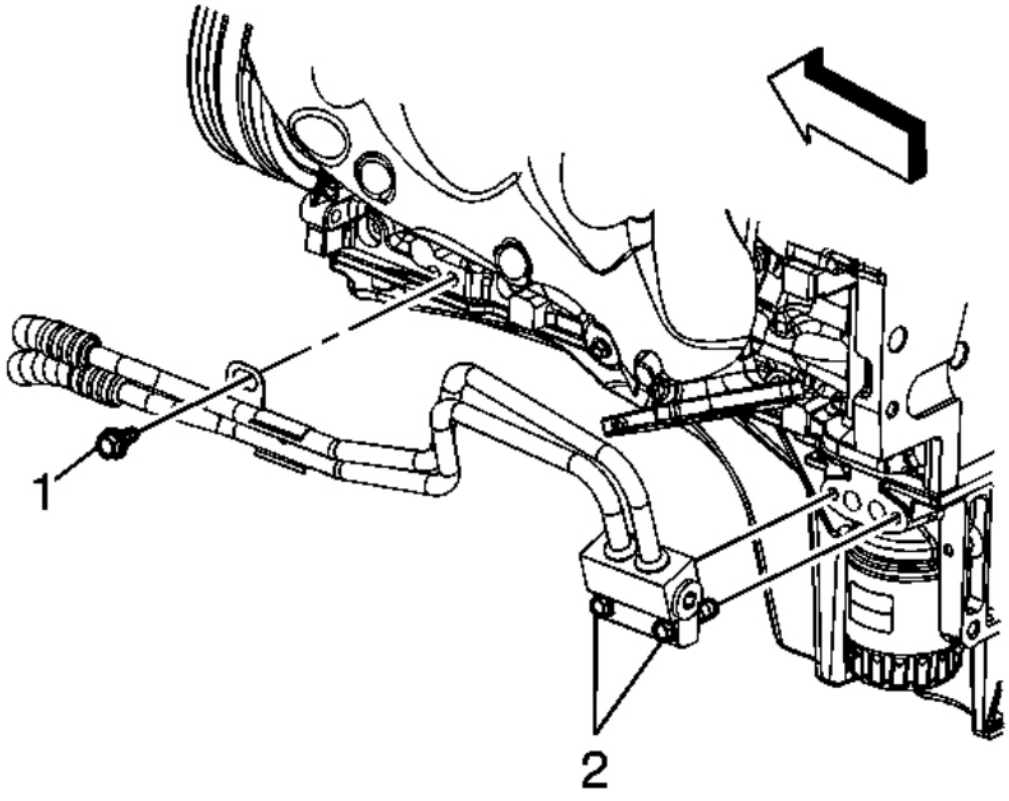


Fig. 126: Locating Oil Cooler Hose Bracket & Adapter Bolts
Courtesy of GENERAL MOTORS CORP.

4. For vehicles with RPO L76 (6.0L) perform the following steps otherwise proceed to step 9.
5. Position the oil cooler hose adapter end, if equipped.
6. Install a NEW oil cooler hose adapter gasket, if equipped.
7. Install the oil cooler hose adapter bolts (2), if equipped.

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

8. Install the oil cooler hose bracket bolt (1), if equipped.

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

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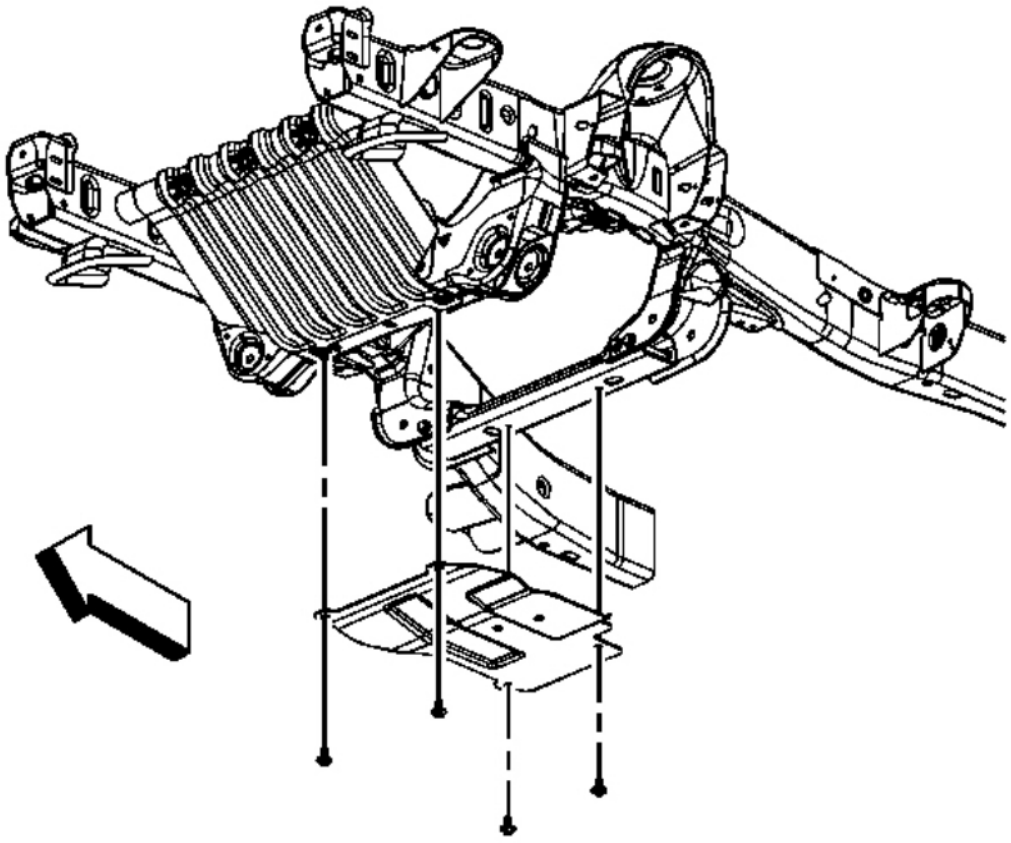


Fig. 127: View Of Oil Pan Skid Plate & Bolts
Courtesy of GENERAL MOTORS CORP.

9. Position and install the oil pan skid plate and bolts, if equipped

   Tighten: Tighten the bolts to 20 N.m (15 lb ft).

10. Lower the vehicle.
11. Fill the cooling system/engine block. Refer to **Draining and Filling Cooling System**.

COOLANT HEATER REPLACEMENT (RPOS LY2/LMG/LY5/LY6)

Removal Procedure

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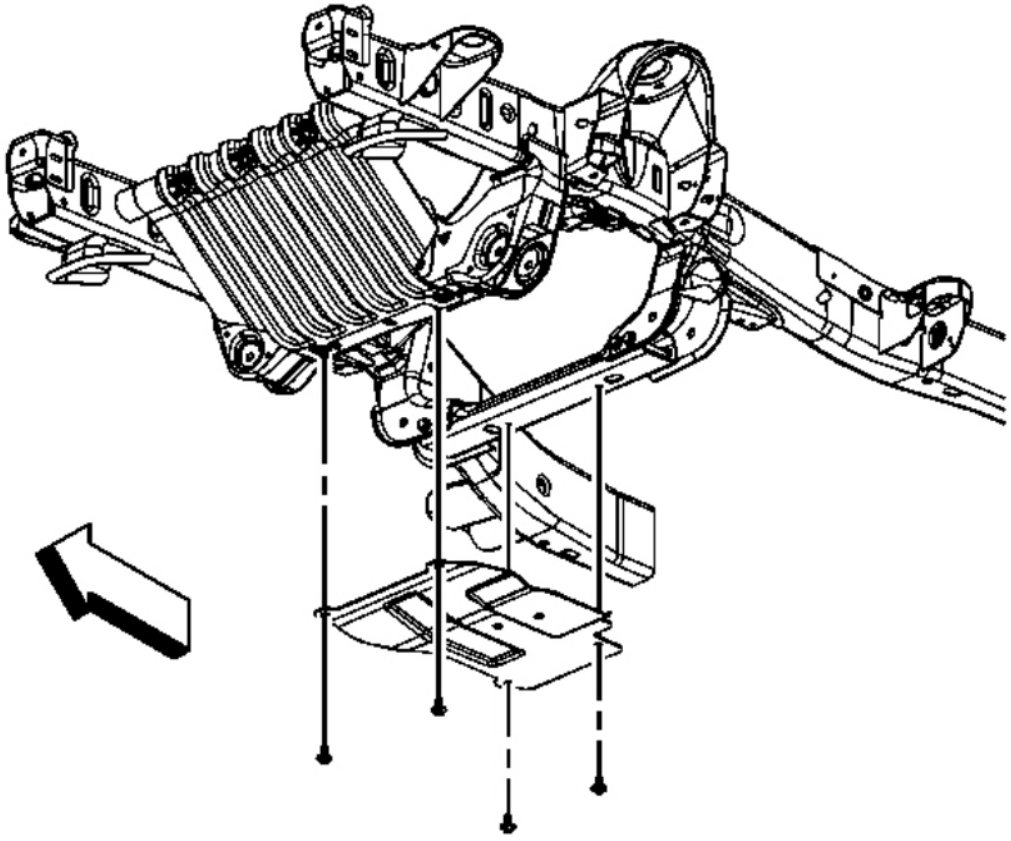


Fig. 128: View Of Oil Pan Skid Plate & Bolts
Courtesy of GENERAL MOTORS CORP.

1. Drain the cooling system/engine block. Refer to **Draining and Filling Cooling System**.
2. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
3. For 1500 series vehicles, remove the oil pan skid plate bolts and plate, if equipped.

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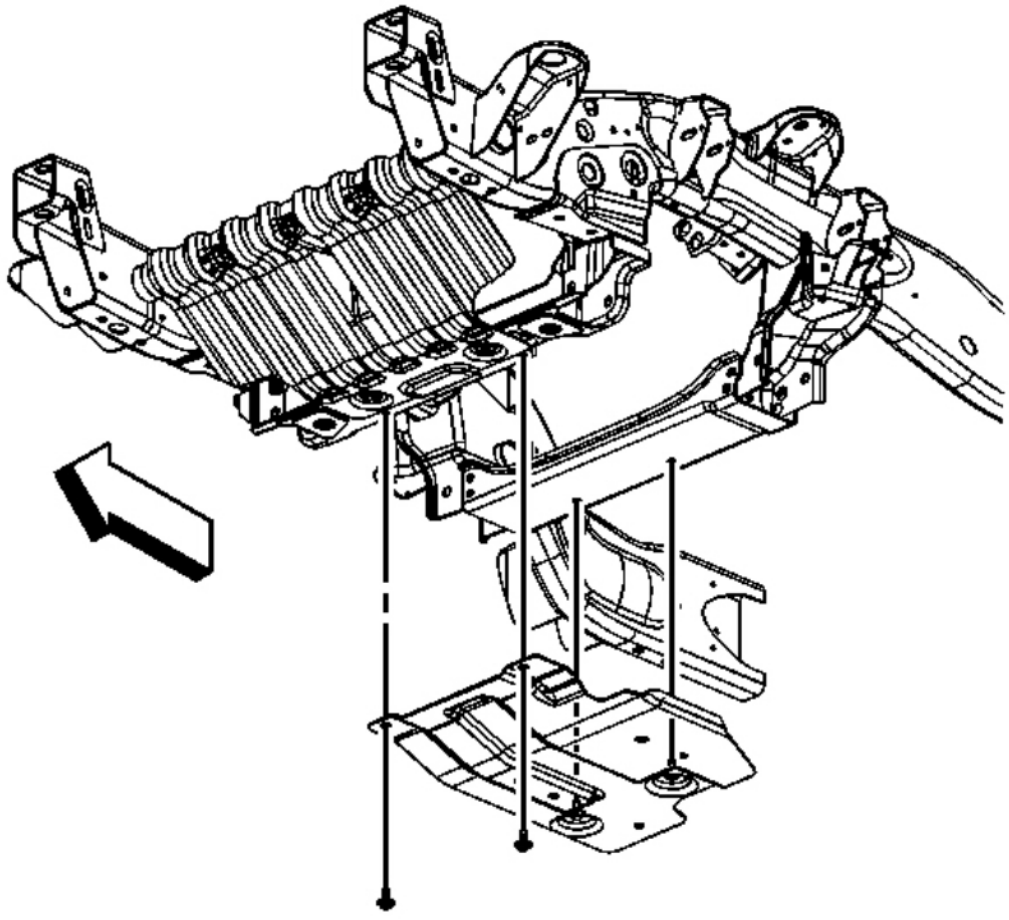


Fig. 129: View Of Oil Pan Skid Plate & Bolts
Courtesy of GENERAL MOTORS CORP.

4. For 2500 series vehicle, remove the front 2 oil pan skid plate bolts, loosen the 2 rear bolts and remove the skid plate, if equipped.

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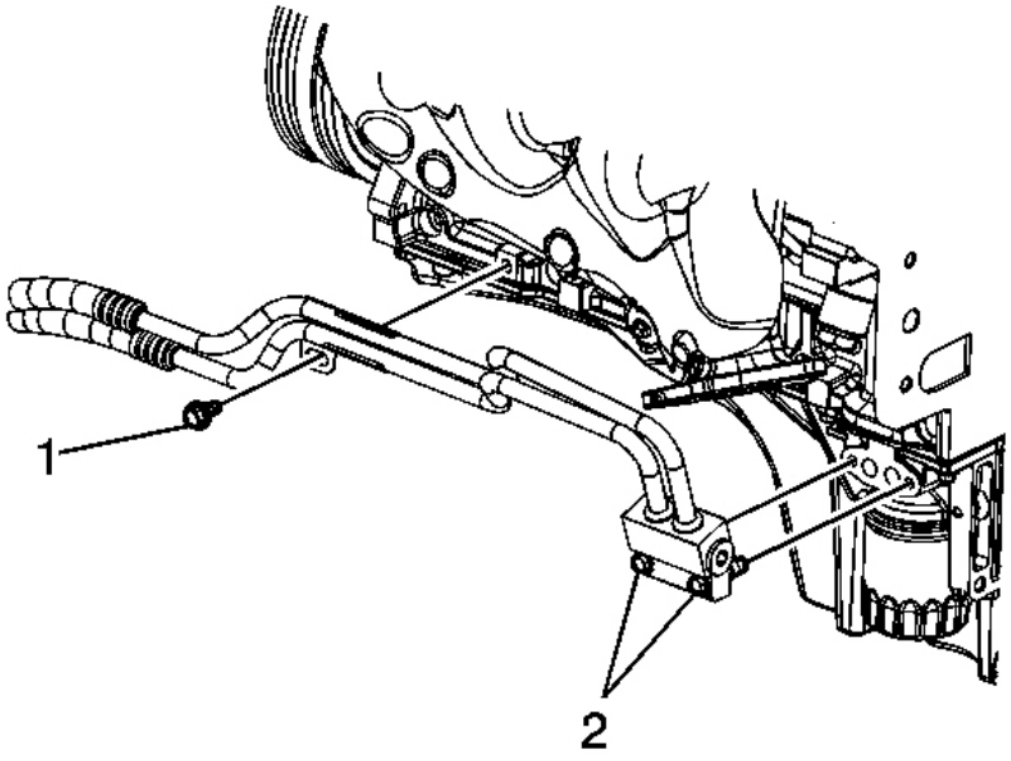


Fig. 130: Locating Oil Cooler Hose Bracket & Adapter Bolts
Courtesy of GENERAL MOTORS CORP.

5. For vehicles with regular production option (RPO) LY6 (6.0L) perform the following steps otherwise proceed to step 10.
6. Remove the oil cooler hose bracket bolt (1).
7. Remove the oil cooler hose adapter bolts (2).
8. Remove and discard the oil cooler hose adapter gasket.
9. Reposition the oil cooler hose adapter end out of the way.

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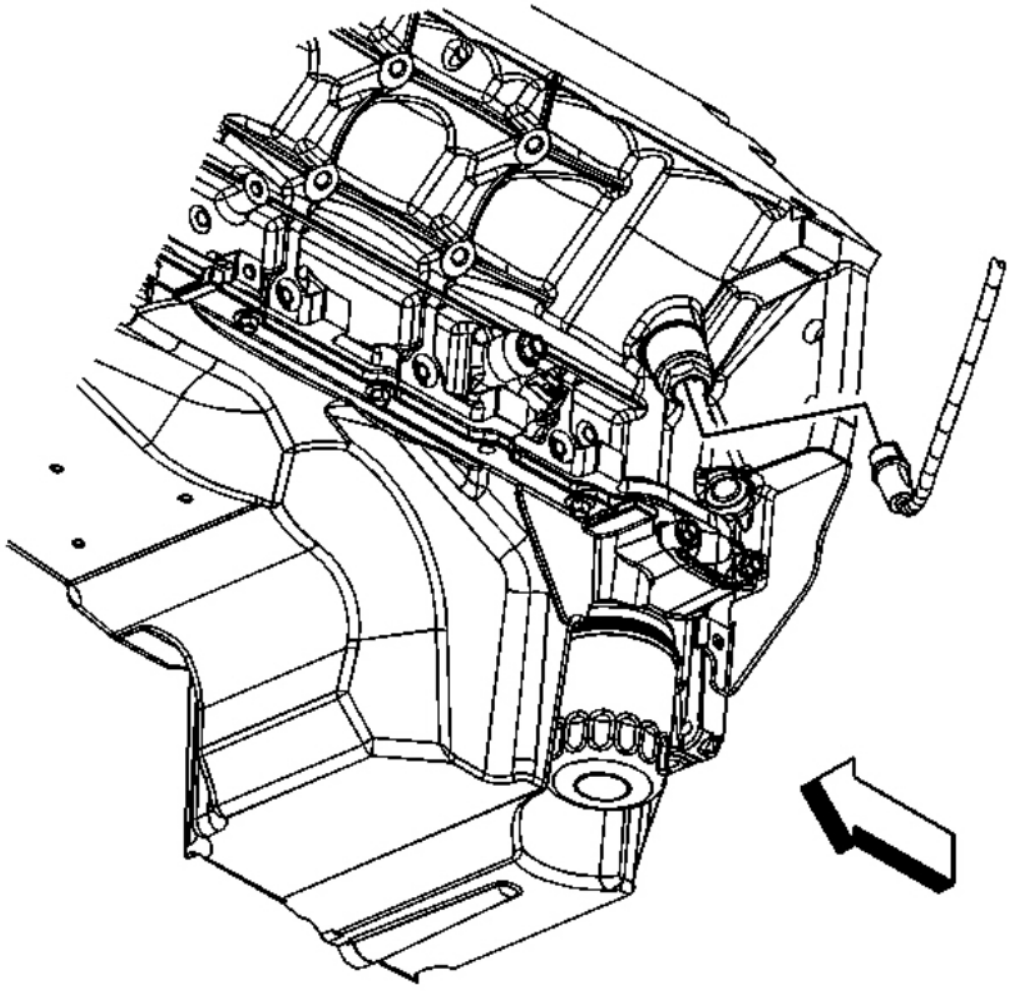


Fig. 131: View Of Coolant Heater Cord
Courtesy of GENERAL MOTORS CORP.

10. Disconnect the coolant heater cord electrical connector.

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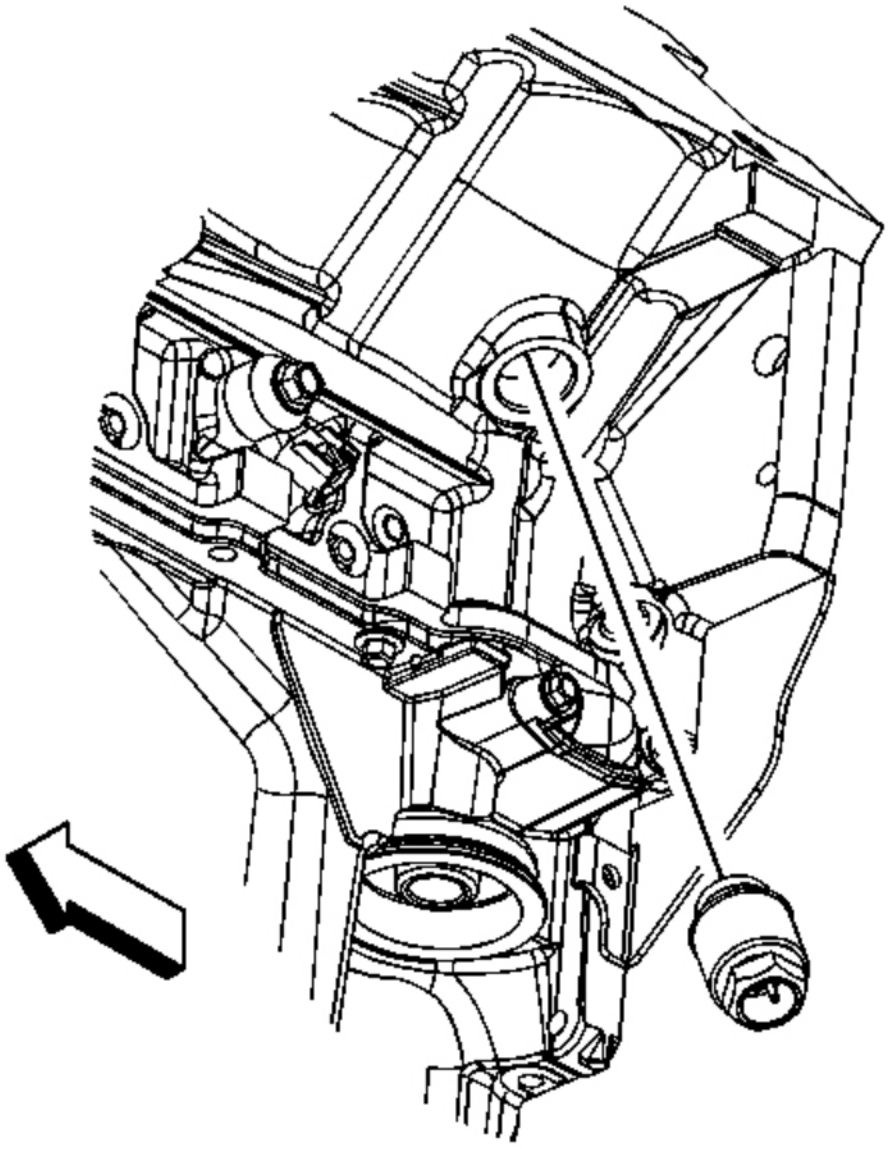


Fig. 132: Locating Coolant Heater
Courtesy of GENERAL MOTORS CORP.

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

11. Remove the coolant heater from the engine block.

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12. Remove any burrs, sealer, or other rough spots.

Installation Procedure

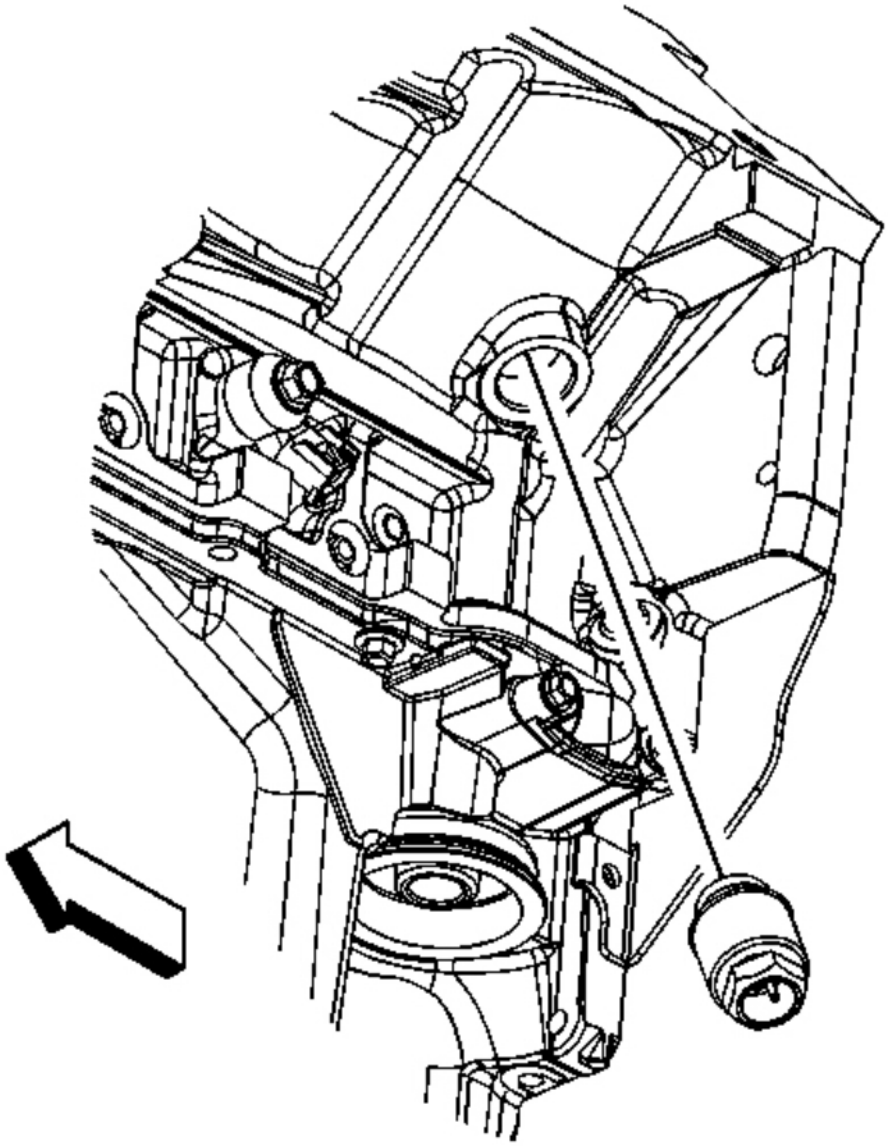


Fig. 133: Locating Coolant Heater
Courtesy of GENERAL MOTORS CORP.

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

NOTE: **Refer to Fastener Notice in Cautions and Notices.**

2. Install the coolant heater to the engine block.

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

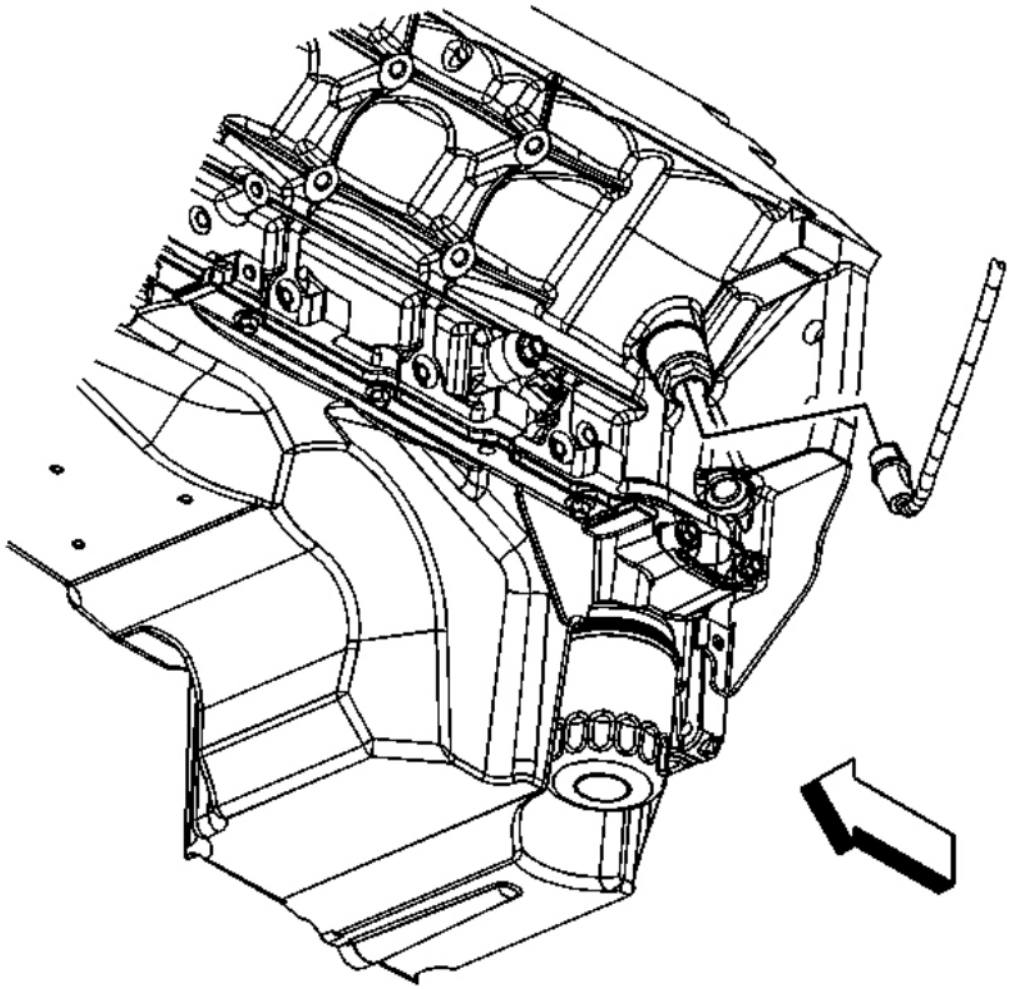


Fig. 134: View Of Coolant Heater Cord
Courtesy of GENERAL MOTORS CORP.

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3. Connect the coolant heater cord electrical connector.

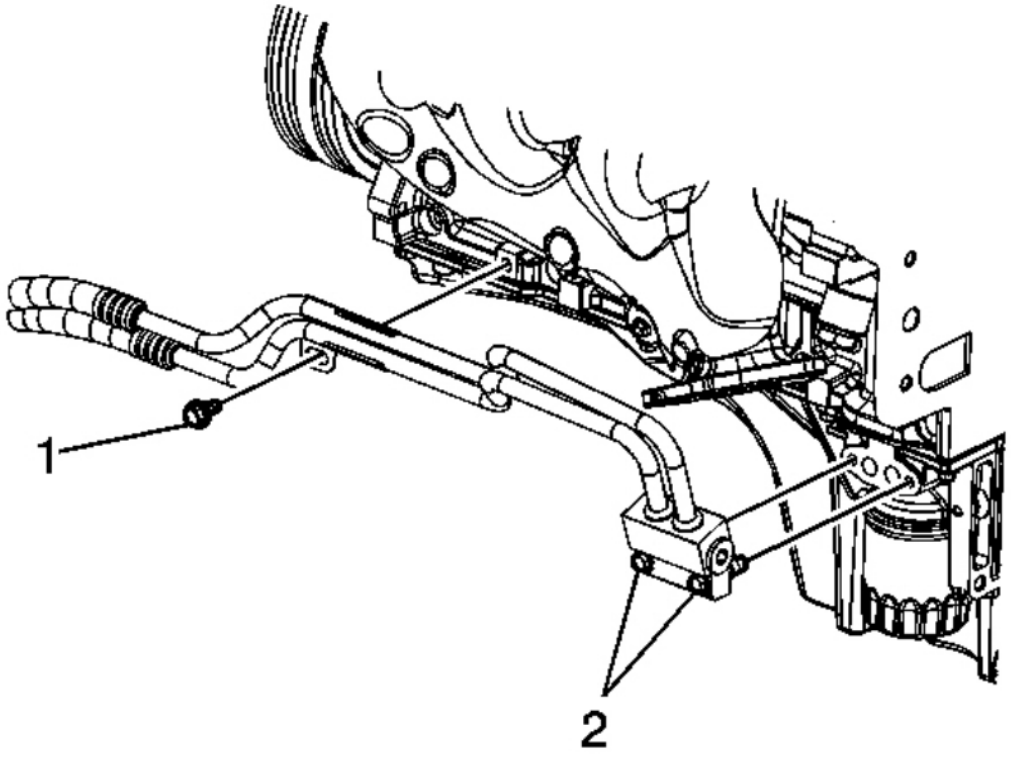


Fig. 135: Locating Oil Cooler Hose Bracket & Adapter Bolts
Courtesy of GENERAL MOTORS CORP.

4. For vehicles with RPO LY6 (6.0L) perform the following steps otherwise proceed to step 9.
5. Position the oil cooler hose adapter end.
6. Install a NEW oil cooler hose adapter gasket.
7. Install the oil cooler hose adapter bolts (2).

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

8. Install the oil cooler hose bracket bolt (1).

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

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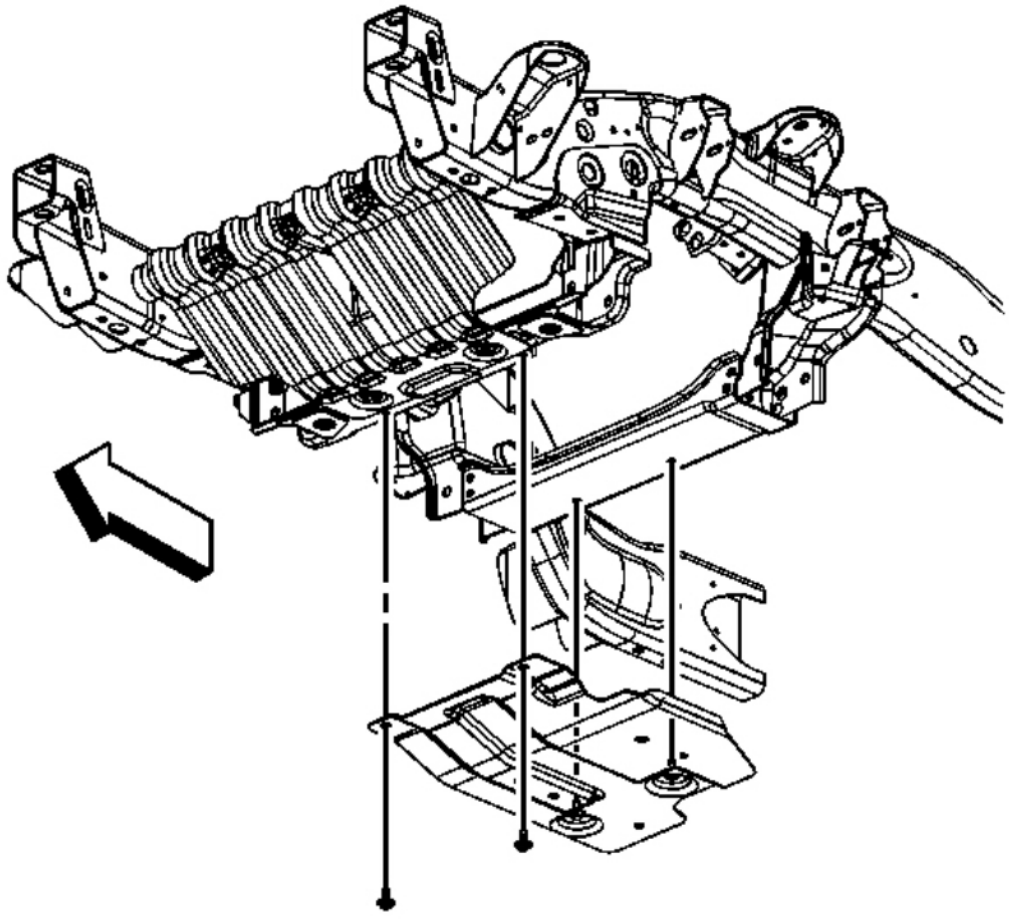


Fig. 136: View Of Oil Pan Skid Plate & Bolts
Courtesy of GENERAL MOTORS CORP.

9. For 2500 series vehicles, position the oil pan skid plate and install the 2 front bolts and tighten the 2 rear bolts, if equipped.

   Tighten: Tighten the bolts to 20 N.m (15 lb ft).

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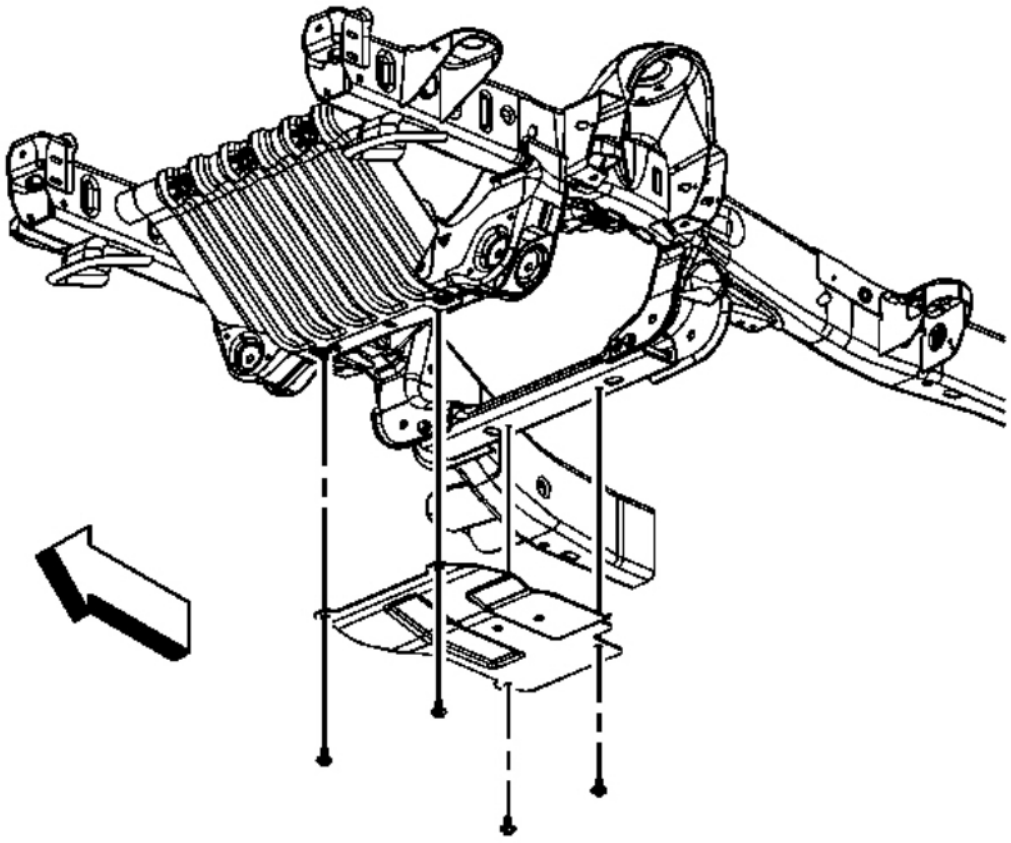


Fig. 137: View Of Oil Pan Skid Plate & Bolts
Courtesy of GENERAL MOTORS CORP.

10. For 1500 series vehicles position and install the oil pan skid plate and bolts, if equipped.

    Tighten: Tighten the bolts to 20 N.m (15 lb ft).

11. Lower the vehicle.
12. Fill the cooling system/engine block. Refer to **Draining and Filling Cooling System**.

COOLANT HEATER CORD REPLACEMENT (RPO LY6)

Removal Procedure

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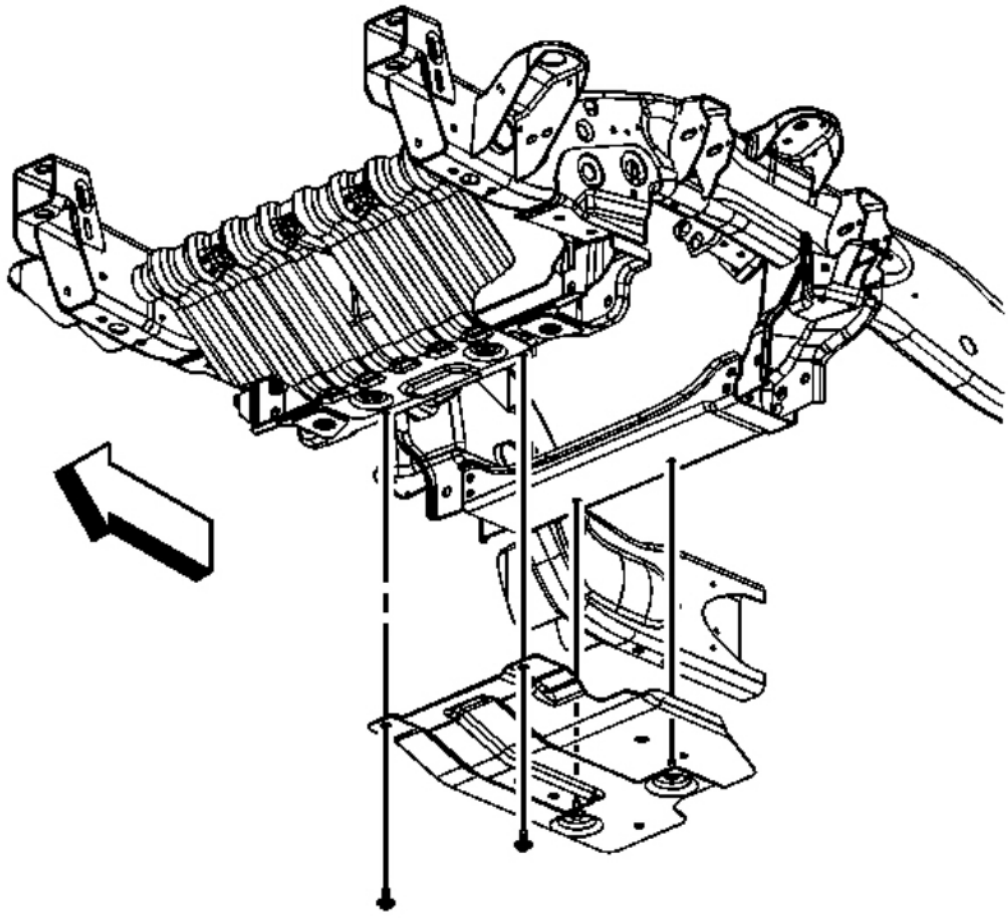


Fig. 138: View Of Oil Pan Skid Plate & Bolts
Courtesy of GENERAL MOTORS CORP.

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
2. Remove the front 2 oil pan skid plate bolts, loosen the 2 rear bolts and remove the skid plate, if equipped.

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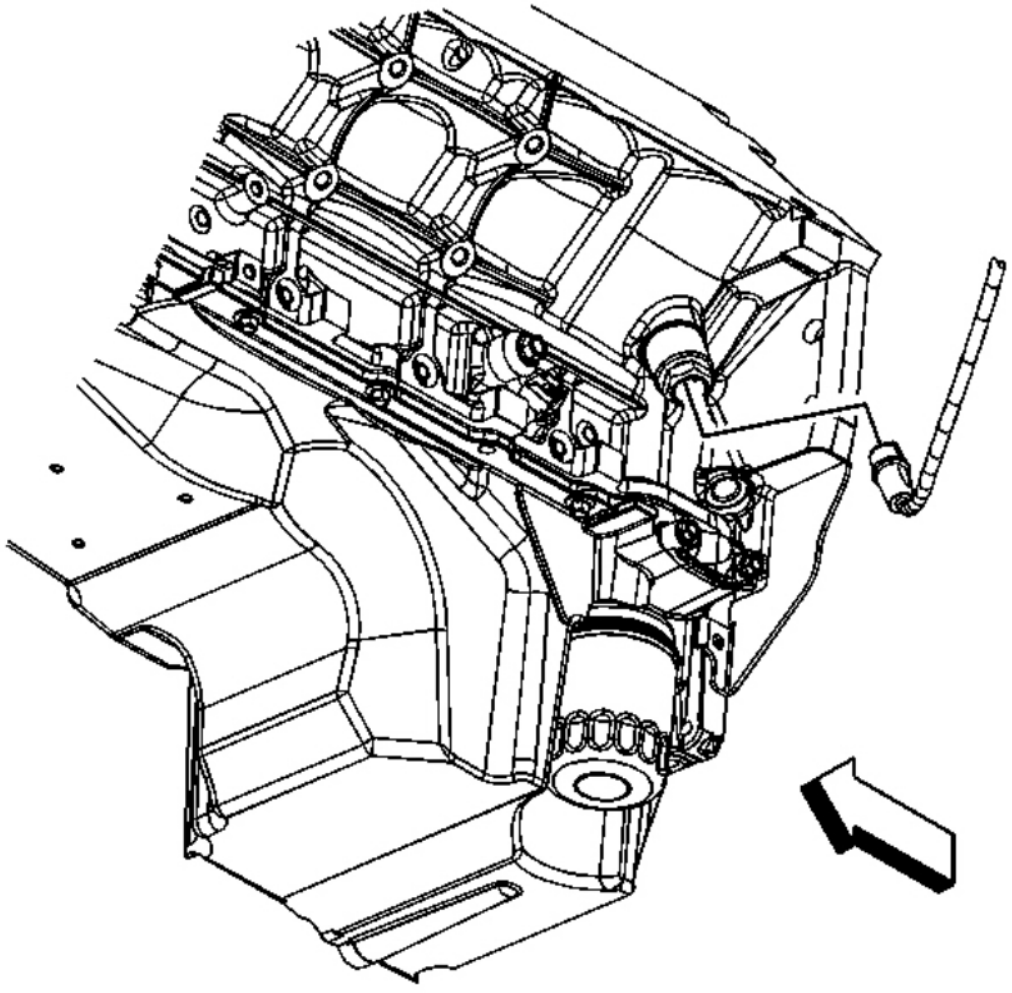


Fig. 139: View Of Coolant Heater Cord
Courtesy of GENERAL MOTORS CORP.

3. Disconnect the coolant heater cord electrical connector.

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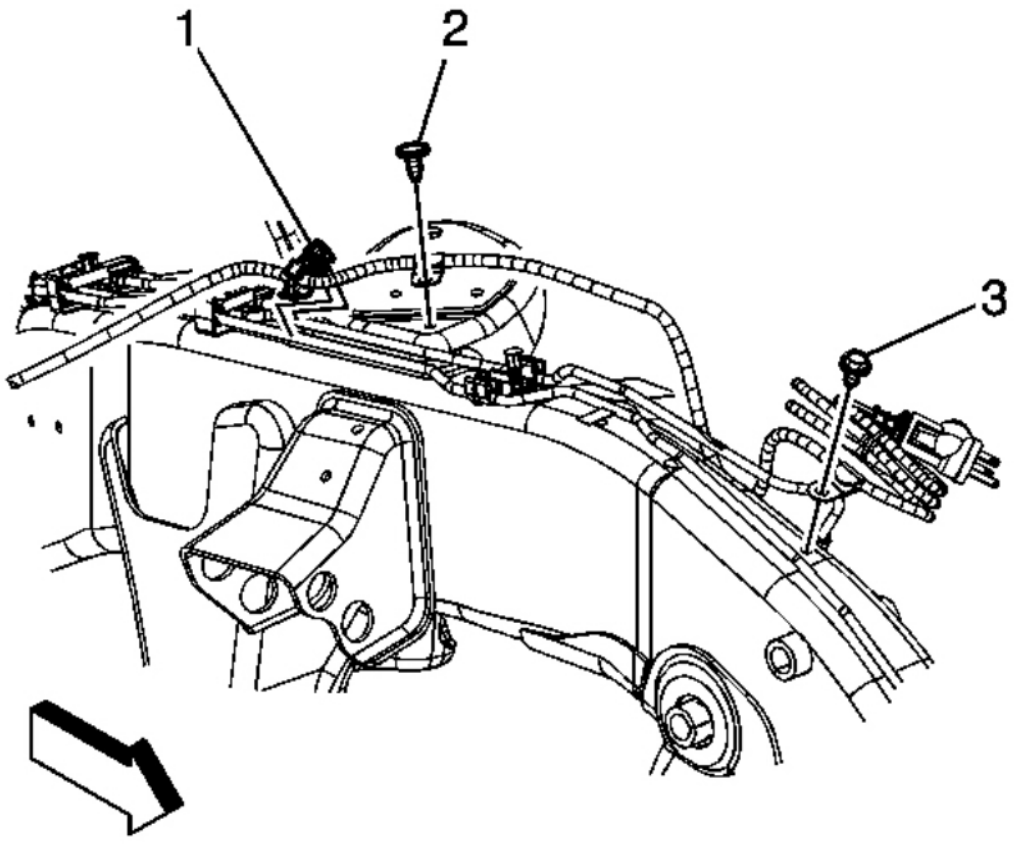


Fig. 140: View Of Coolant Heater Cord, Clip Retainer & Bolt
Courtesy of GENERAL MOTORS CORP.

4. Remove the coolant heater cord clip (1) from the front brake front pipes.
5. Remove the coolant heater cord clip retainer (2) from the frame.
6. Lower the vehicle.
7. Remove the coolant heater cord bolt (3) from the frame.
8. Remove the coolant heater cord from the vehicle.

Installation Procedure

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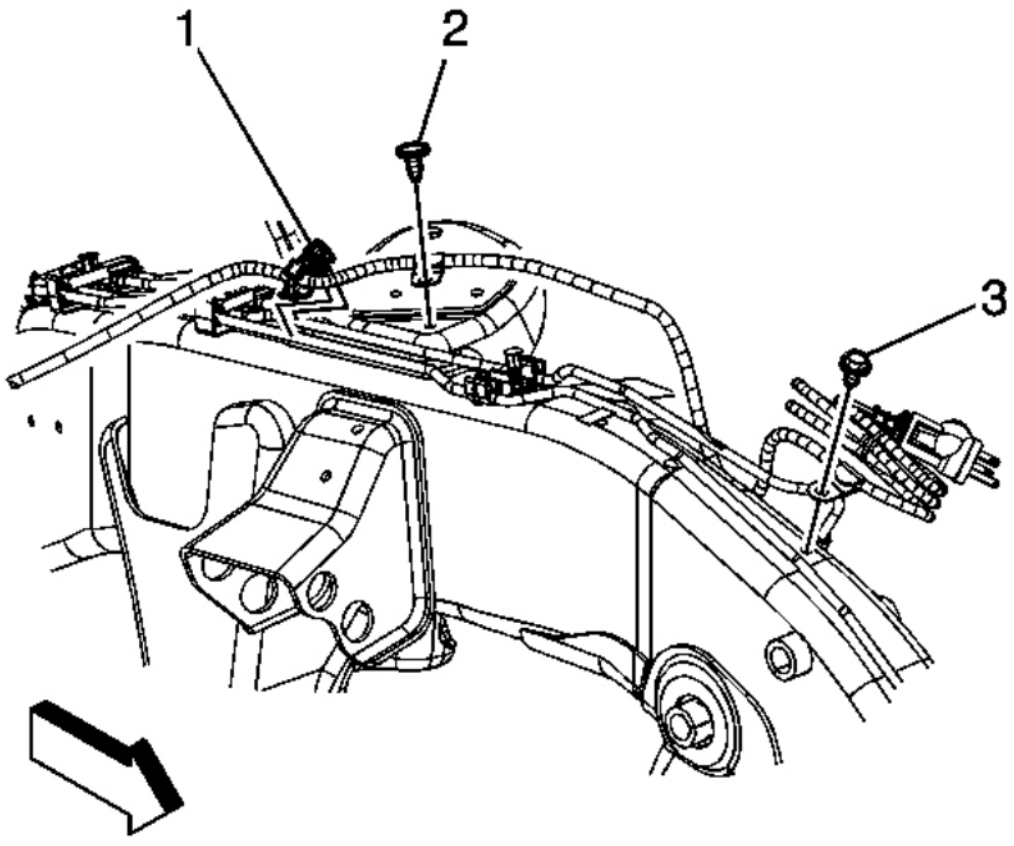


Fig. 141: View Of Coolant Heater Cord, Clip Retainer & Bolt
Courtesy of GENERAL MOTORS CORP.

1. Install the coolant heater cord to the vehicle.

NOTE: **Refer to Fastener Notice in Cautions and Notices.**

2. Position the coolant heater cord clip to the frame and install the coolant heater cord bolt (3).

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

3. Raise the vehicle.
4. Install the coolant heater cord clip retainer (2) to the frame.
5. Install the coolant heater cord clip (1) to the front brake front pipes.

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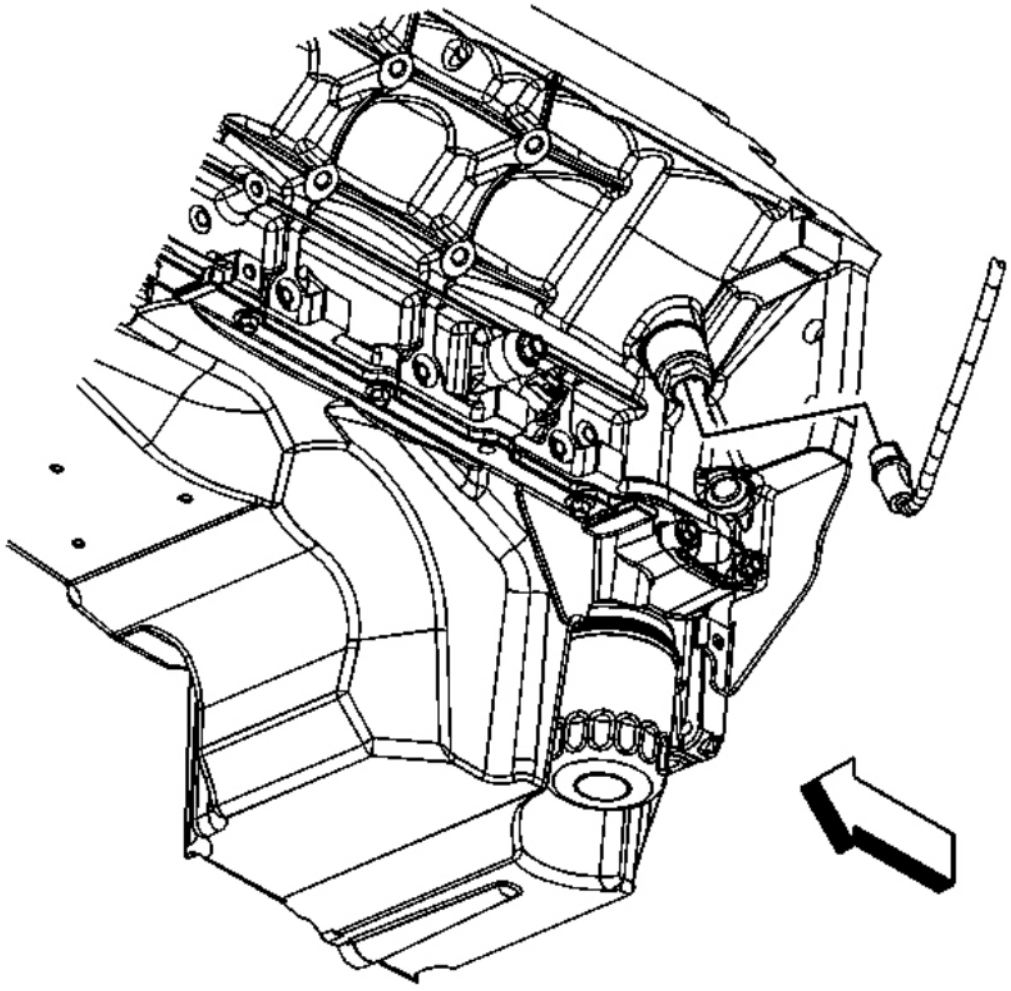


Fig. 142: View Of Coolant Heater Cord
Courtesy of GENERAL MOTORS CORP.

6. Connect the coolant heater cord electrical connector.

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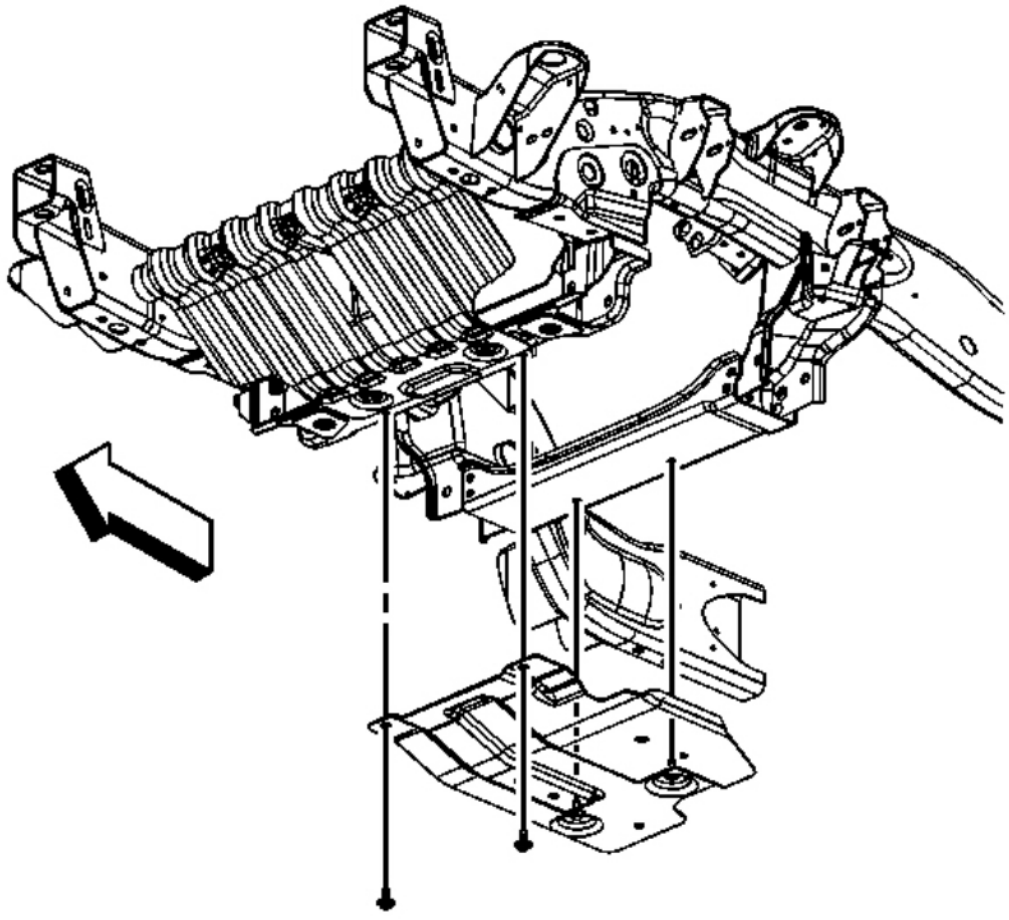


Fig. 143: View Of Oil Pan Skid Plate & Bolts
Courtesy of GENERAL MOTORS CORP.

7. Position the oil pan skid plate and install the 2 front bolts and tighten the 2 rear bolts, if equipped.

   Tighten: Tighten the bolts to 20 N.m (15 lb ft).

8. Lower the vehicle.

COOLANT HEATER CORD REPLACEMENT (RPOS LC9/L76/L92)

Removal Procedure

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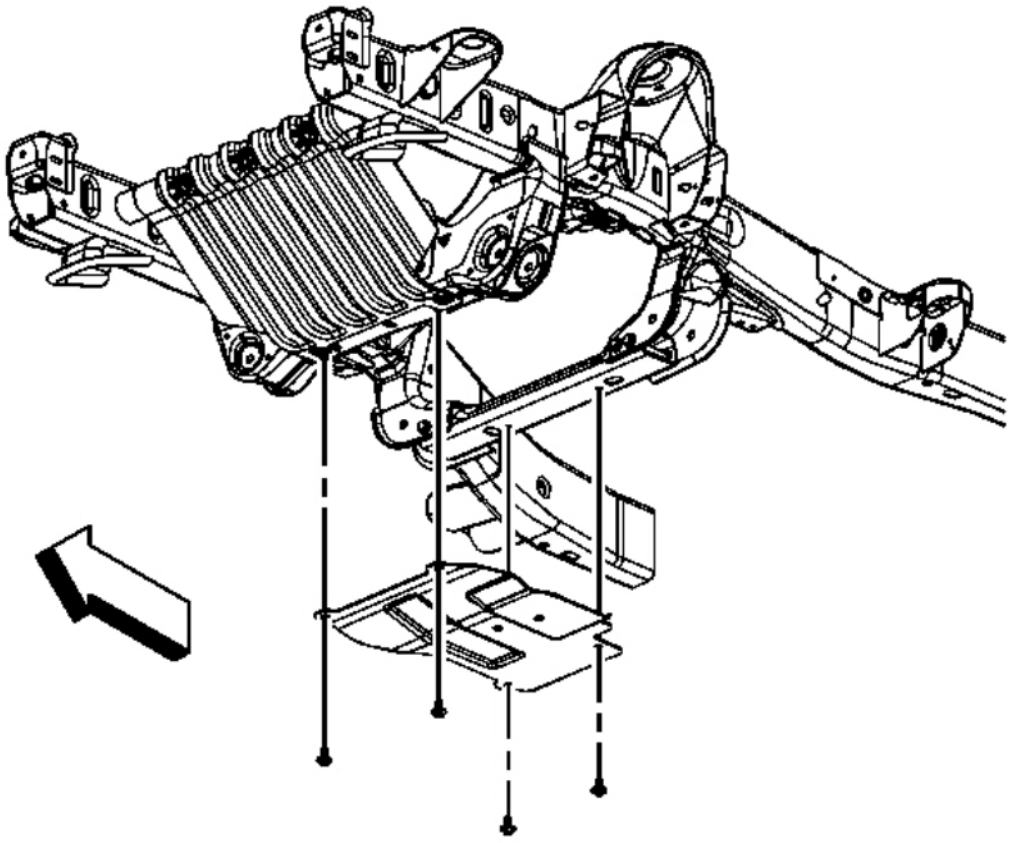


Fig. 144: View Of Oil Pan Skid Plate & Bolts
Courtesy of GENERAL MOTORS CORP.

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
2. Remove the oil pan skid plate bolts and plate, if equipped.

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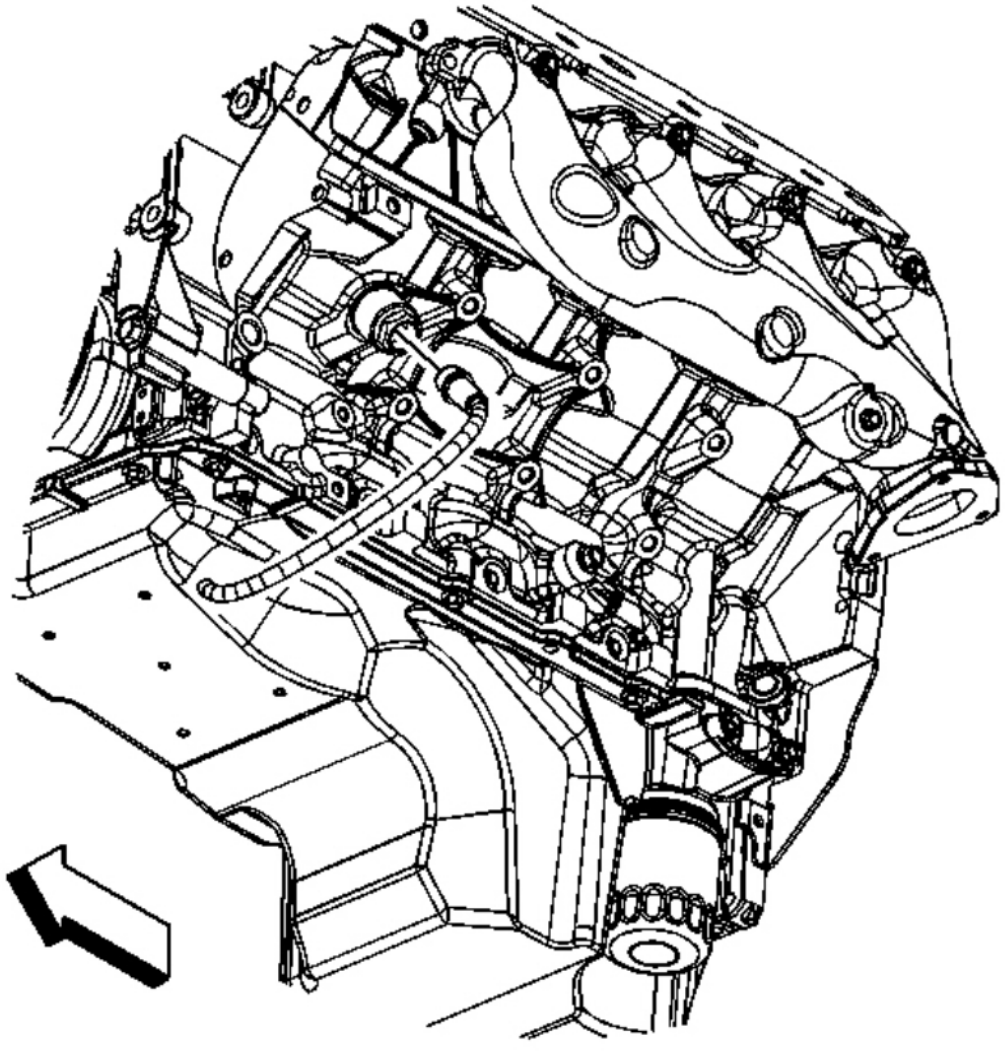


Fig. 145: View Of Coolant Heater Cord
Courtesy of GENERAL MOTORS CORP.

3. Disconnect the coolant heater cord electrical connector.

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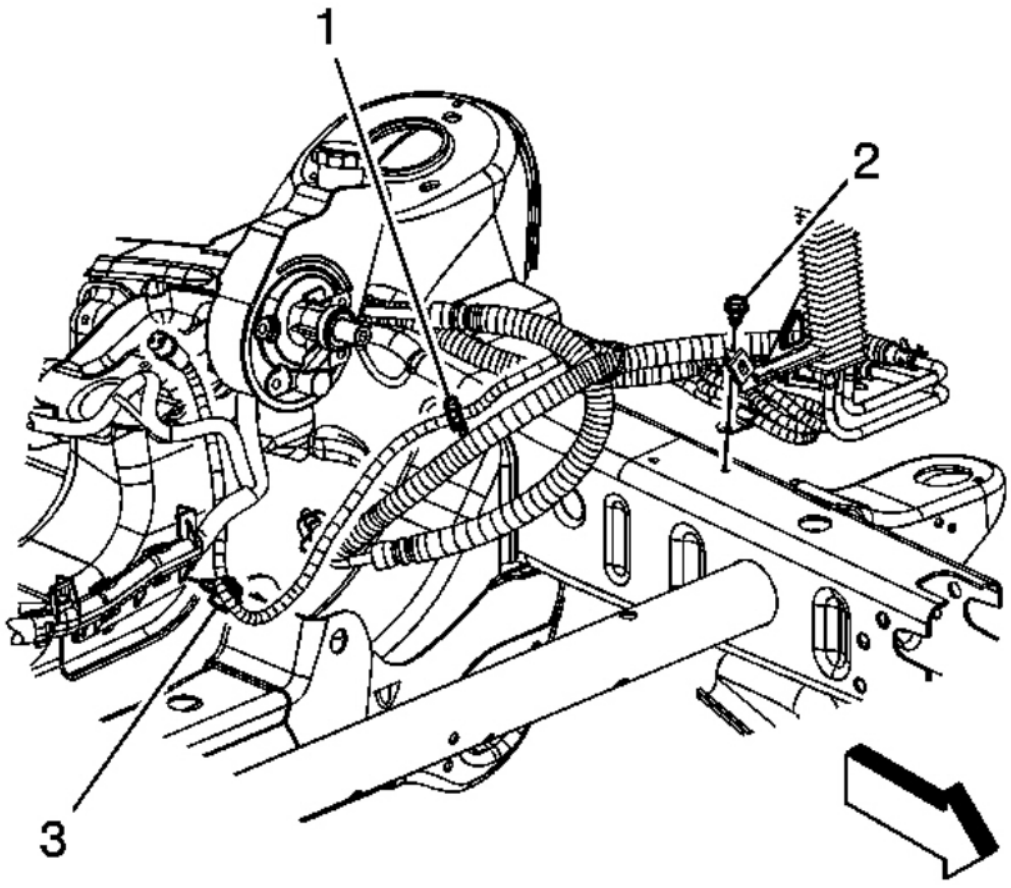


Fig. 146: View Of Coolant Heater Cord Clips & Bolt
Courtesy of GENERAL MOTORS CORP.

4. Remove the coolant heater cord clip (3) from the engine harness channel.
5. Remove the coolant heater cord clip (1) from the power steering gear outlet hose.
6. Lower the vehicle.
7. Remove the coolant heater cord bolt (2) from the frame.
8. Remove the coolant heater cord from the vehicle.

Installation Procedure

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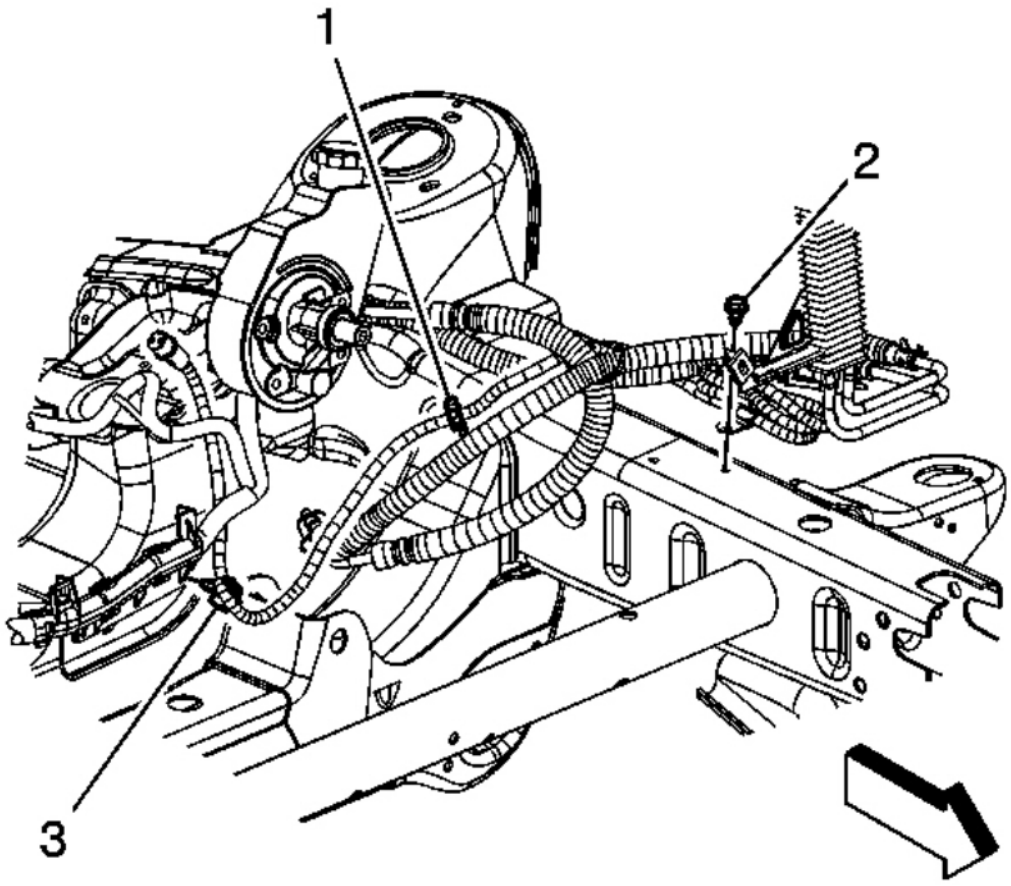


Fig. 147: View Of Coolant Heater Cord Clips & Bolt
Courtesy of GENERAL MOTORS CORP.

1. Install the coolant heater cord to the vehicle.

NOTE: **Refer to Fastener Notice in Cautions and Notices.**

2. Position the coolant heater cord clip to the frame and install the coolant heater cord bolt (2).

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

3. Raise the vehicle.
4. Install the coolant heater cord clip (1) to the power steering gear outlet hose.
5. Install the coolant heater cord clip (3) to the engine harness channel.

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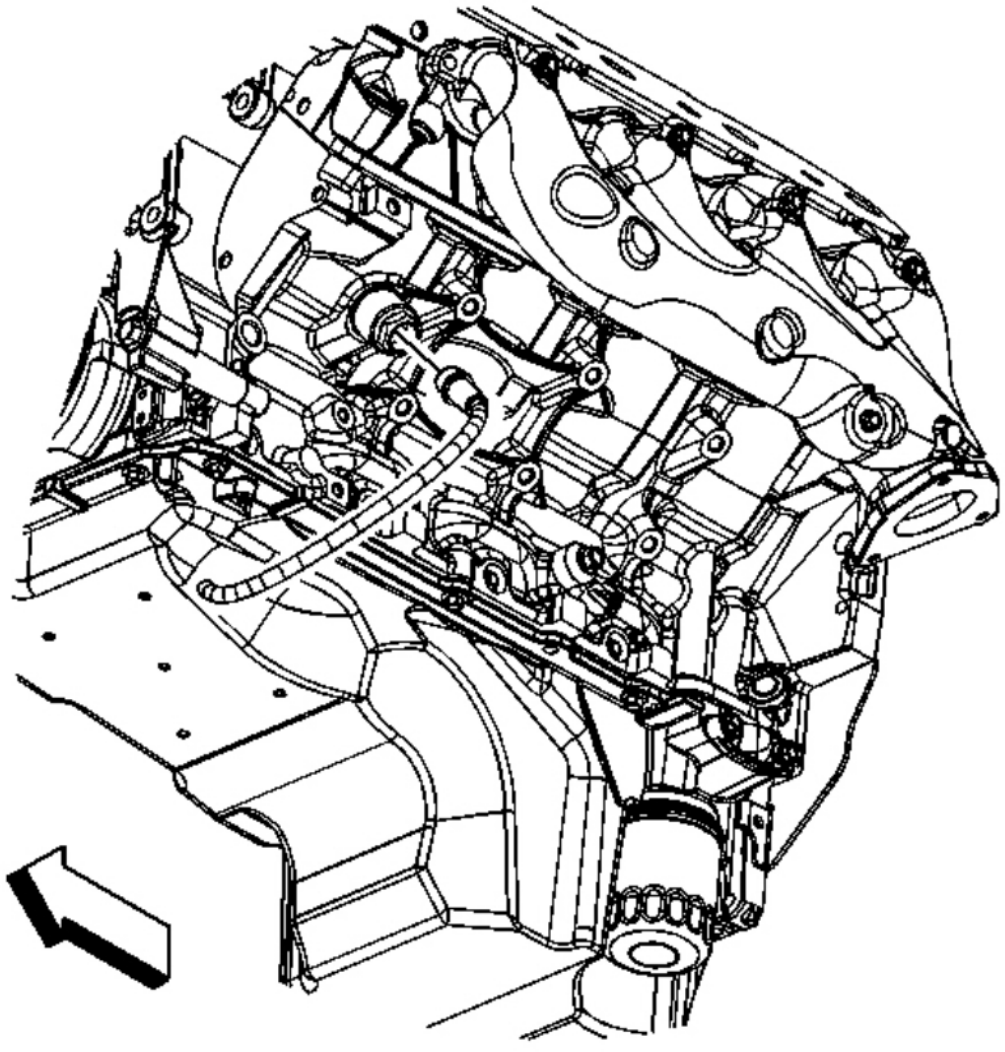


Fig. 148: View Of Coolant Heater Cord
Courtesy of GENERAL MOTORS CORP.

6. Connect the coolant heater cord electrical connector.

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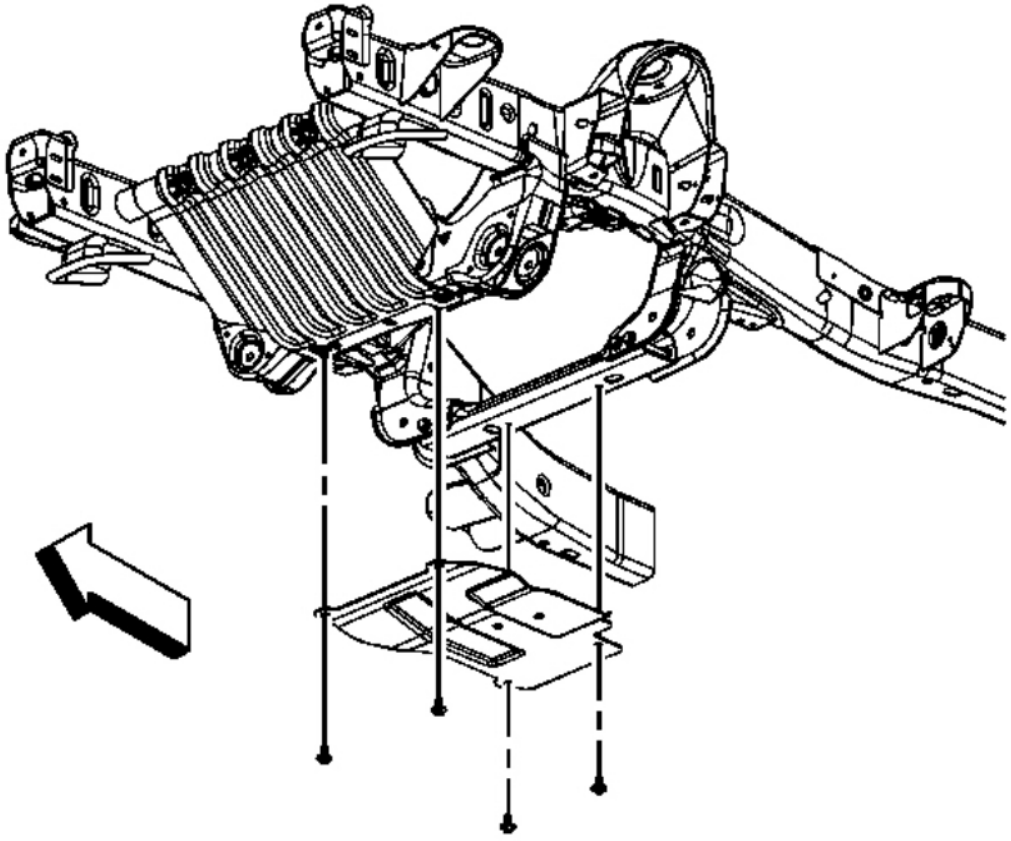


Fig. 149: View Of Oil Pan Skid Plate & Bolts
Courtesy of GENERAL MOTORS CORP.

7. Position and install the oil pan skid plate and bolts, if equipped.

   Tighten: Tighten the bolts to 20 N.m (15 lb ft).

8. Lower the vehicle.

COOLANT HEATER CORD REPLACEMENT (RPOS LY2/LY5/LMG)

Removal Procedure

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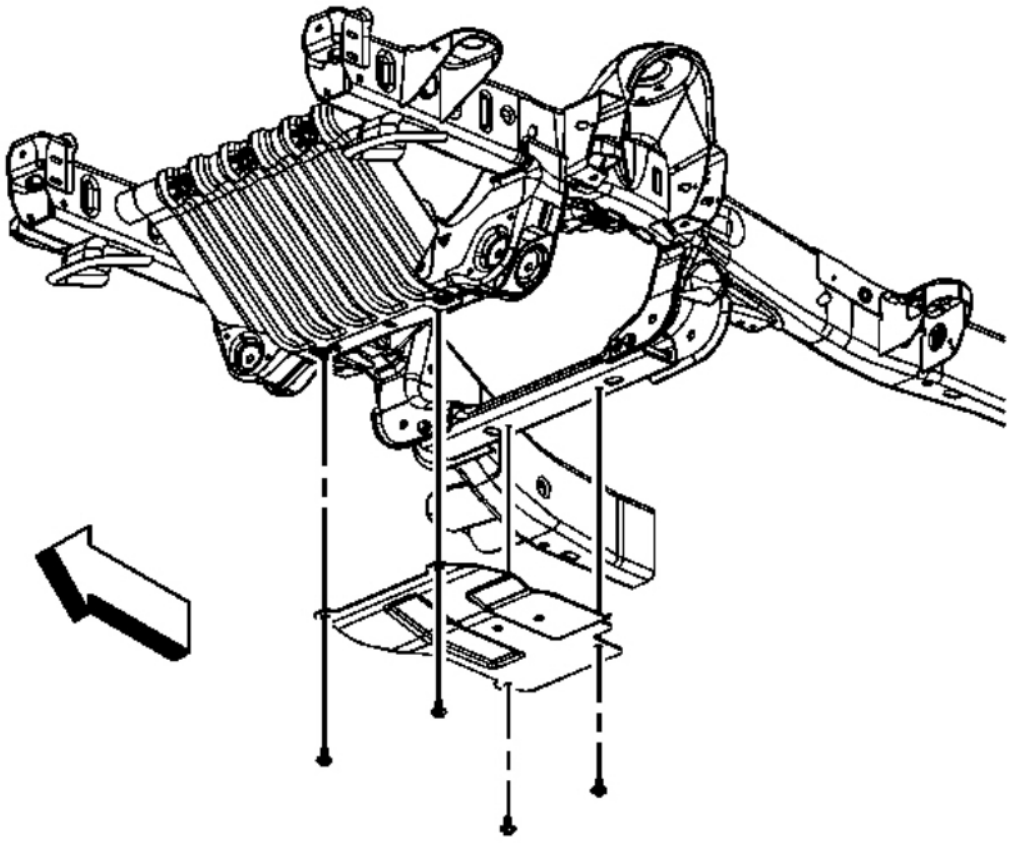


Fig. 150: View Of Oil Pan Skid Plate & Bolts
Courtesy of GENERAL MOTORS CORP.

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
2. Remove the oil pan skid plate bolts and plate, if equipped.

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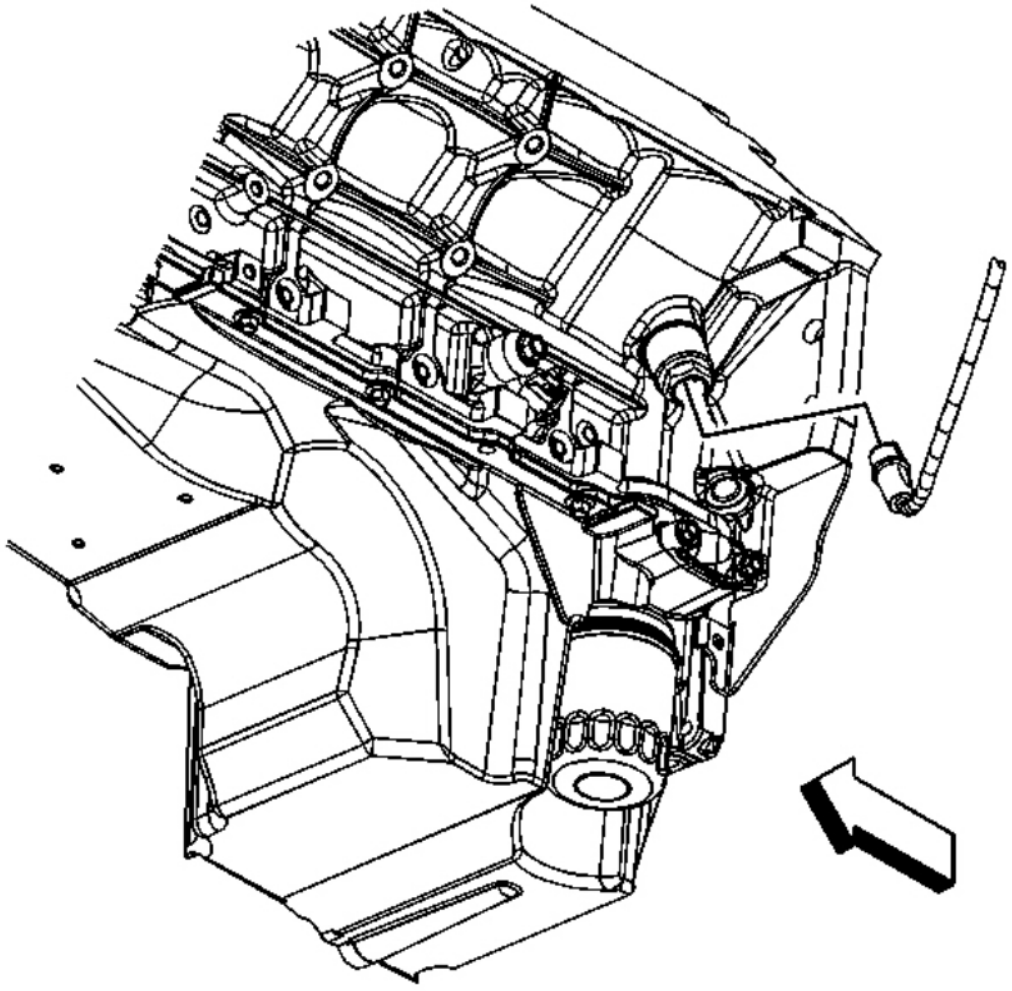


Fig. 151: View Of Coolant Heater Cord
Courtesy of GENERAL MOTORS CORP.

3. Disconnect the coolant heater cord electrical connector.

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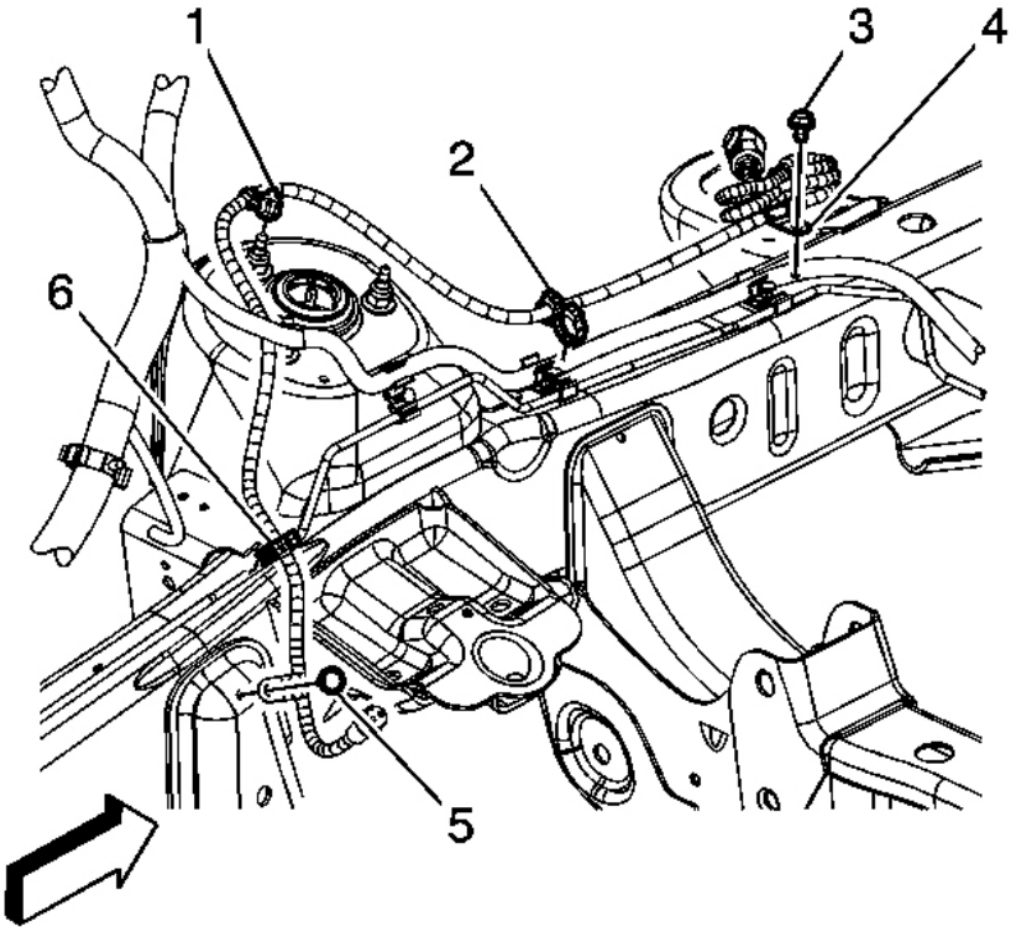


Fig. 152: View Of Coolant Heater Cord & Components
Courtesy of GENERAL MOTORS CORP.

4. Remove the coolant heater cord retainer (5) from the frame.
5. Remove the coolant heater cord clip (6) from the front brake front pipe.
6. Lower the vehicle.
7. Remove the coolant heater cord bolt (4) from the frame.
8. Remove the coolant heater cord clip (2) from the chassis harness.
9. Remove the coolant heater cord clip (1) from the front spring stud.
10. Remove the coolant heater cord from the vehicle.

Installation Procedure

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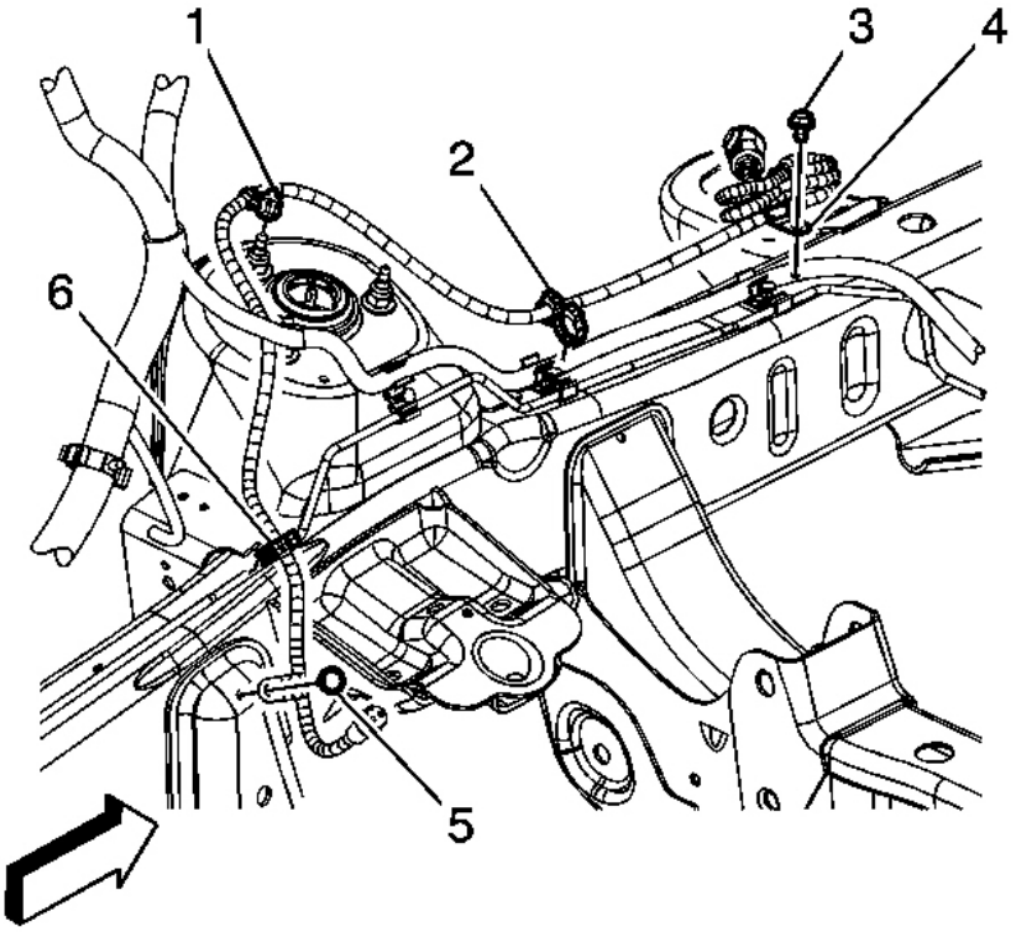


Fig. 153: View Of Coolant Heater Cord & Components
Courtesy of GENERAL MOTORS CORP.

1. Install the coolant heater cord to the vehicle.
2. Install the coolant heater cord clip (1) to the front spring stud.
3. Install the coolant heater cord clip (2) to the chassis harness.

NOTE: Refer to Fastener Notice in Cautions and Notices.

4. Position the coolant heater cord clip to the frame and install the coolant heater cord bolt (4).

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

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5. Raise the vehicle.
6. Install the coolant heater cord clip (6) to the front brake front pipe.
7. Position the coolant heater cord clip to the frame and install the coolant heater cord retainer (5).

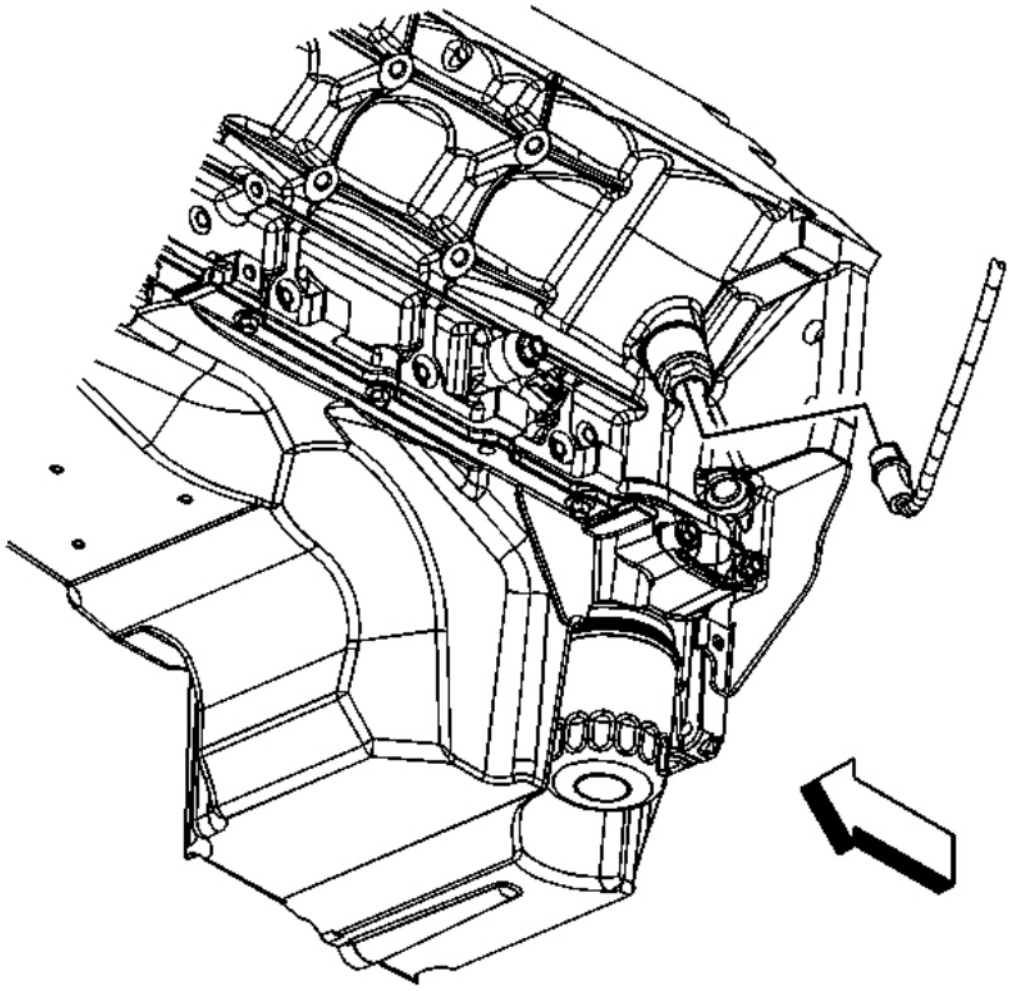


Fig. 154: View Of Coolant Heater Cord
Courtesy of GENERAL MOTORS CORP.

8. Connect the coolant heater cord electrical connector.

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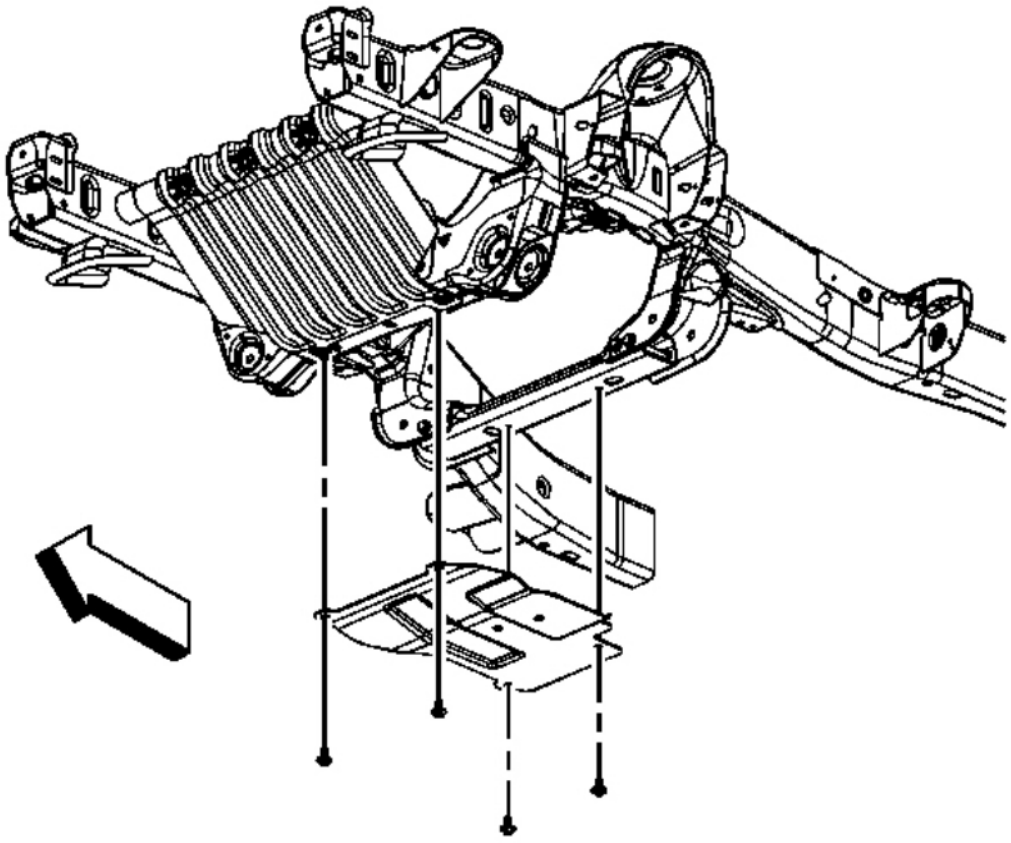


Fig. 155: View Of Oil Pan Skid Plate & Bolts
Courtesy of GENERAL MOTORS CORP.

9. Position and install the oil pan skid plate and bolts, if equipped.

   Tighten: Tighten the bolts to 20 N.m (15 lb ft).

10. Lower the vehicle.

DESCRIPTION AND OPERATION

COOLING FAN DESCRIPTION AND OPERATION

Cooling Fan Control - Two Fan System

The engine cooling fan system consists of 2 electrical cooling fans and 3 fan relays. The relays are arranged in a

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series/parallel configuration that allows the engine control module (ECM) to operate both fans together at low or high speeds. The cooling fans receive positive voltage from the cooling fan relays which receive battery positive voltage from the underhood fuse block. The fan relay coils receive ignition 1 voltage from the powertrain relay.

During low speed operation, the ECM supplies the ground path for the low speed fan relay through the low speed cooling fan relay control circuit. This energizes the low speed fan relay coil, closes the relay contacts, and supplies battery positive voltage from the low fan fuse through the cooling fan motor supply voltage circuit to the left cooling fan. The ground path for the left cooling fan is through the cooling fan control relay and the right cooling fan. The result is a series circuit with both fans running at low speed.

During high speed operation the ECM supplies the ground path for the low speed fan relay through the low speed cooling fan relay control circuit. The ECM grounds the high speed fan relay and the cooling fan control relay through the high speed cooling fan relay control circuit. This energizes the cooling fan control relay coil, closes the relay contacts, and provides a ground path for the left cooling fan. At the same time the high speed fan relay coil is energized closing the relay contacts and provides battery positive voltage from the high fan fuse on the cooling fan motor supply voltage circuit to the right cooling fan. During high speed fan operation, both engine cooling fans have their own ground path. The result is a parallel circuit with both fans running at high speed.

Reference Information

Schematic Reference

Engine Cooling Schematics

COOLING SYSTEM DESCRIPTION AND OPERATION

Engine Coolant Indicators

ENGINE COOLANT HOT

The instrument panel cluster (IPC) displays ENGINE COOLANT HOT message when the IPC receives a class 2 message from the powertrain control module (PCM) requesting illumination of this driver warning.

ENGINE OVERHEATED

The IPC displays ENGINE OVERHEATED message when the IPC receives a class 2 message from the PCM requesting illumination of this driver warning.

LOW COOLANT LEVEL

The IPC displays LOW COOLANT LEVEL message when the IPC receives a class 2 message from the PCM requesting illumination of this driver warning.

REDUCED ENGINE POWER

The IPC displays REDUCED ENGINE POWER message when the IPC detects a reduced engine power

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condition from the PCM. The IPC receives a class 2 message from the PCM requesting illumination when the engine temperature reaches 132°C (270°F).

Cooling Fan Control - Two Fan System

The engine cooling fan system consists of 2 electrical cooling fans and 3 fan relays. The relays are arranged in a series/parallel configuration that allows the powertrain control module (PCM) to operate both fans together at low or high speeds. The cooling fans and fan relays receive battery positive voltage from the underhood fuse block.

During low speed operation, the PCM supplies the ground path for the low speed fan relay through the low speed cooling fan relay control circuit. This energizes the low speed fan relay coil, closes the relay contacts, and supplies battery positive voltage from the low fan fuse through the cooling fan motor supply voltage circuit to the left cooling fan. The ground path for the left cooling fan is through the cooling fan s/p relay and the right cooling fan. The result is a series circuit with both fans running at low speed.

During high speed operation the PCM supplies the ground path for the low speed fan relay through the low speed cooling fan relay control circuit. After a 3 second delay, the PCM supplies a ground path for the high speed fan relay and the cooling fan s/p relay through the high speed cooling fan relay control circuit. This energizes the cooling fan s/p relay coil, closes the relay contacts, and provides a ground path for the left cooling fan. At the same time the high speed fan relay coil is energized closing the relay contacts and provides battery positive voltage from the high fan fuse on the cooling fan motor supply voltage circuit to the right cooling fan. During high speed fan operation, both engine cooling fans have there own ground path. The result is a parallel circuit with both fans running at high speed.

IMPORTANT: The right and left cooling fan connectors are interchangeable. When servicing the fans be sure that the connectors are plugged into the correct fan.

The PCM commands the low speed cooling fans ON under the following conditions:

- Engine coolant temperature exceeds approximately 94.5°C (202°F).
- A/C refrigerant pressure exceeds 1447 kPa (210 psi).
- After the vehicle is shut OFF if the engine coolant temperature at key-off is greater than 101°C (214°F) the low speed fans will run for a minimum of 60 seconds After 60 seconds, if the coolant temperature drops below 101°C (214°F) the fans will shut OFF. The fans will automatically shut OFF after 3 min. regardless of coolant temperature.

The PCM commands the high speed fans ON under the following conditions:

- Engine coolant temperature exceeds approximately 104.25°C (220°F).
- A/C refrigerant pressure exceeds approximately 1824 kPa (265 psi).
- When certain DTCs set.

At idle and very low vehicle speeds the cooling fans are only allowed to increase in speed if required. This insures idle stability by preventing the fans from cycling between high and low speed.

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Coolant Level Control (If Equipped)

The engine cooling system contains an engine coolant level switch to alert the driver in the event of a coolant loss. The powertrain control module (PCM) sends out a coolant loss signal over the coolant level switch signal circuit. When the engine coolant level switch reads a low coolant level in the fill tank, the switch opens. The message center receives its power from engine wiring harness junction block on the battery positive voltage circuit. Ground is provided by the ground circuits via the body wiring harness junction block and the engine wiring harness junction block. The cluster receives the class 2 message from the PCM indicating Low Coolant and displays the LOW COOLANT LEVEL message on the driver information center (DIC).

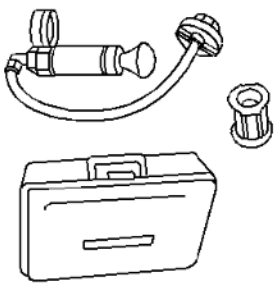
Coolant Heater

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

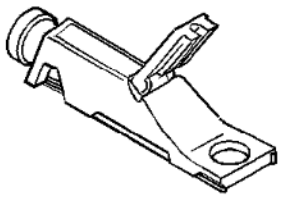
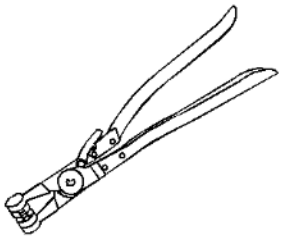
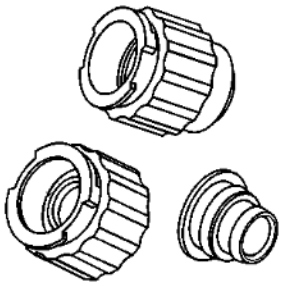
SPECIAL TOOLS AND EQUIPMENT

SPECIAL TOOLS

Special Tools

Illustration	Tool Number/ Description
	J 24731 Tempil Stick
	J 24460-1 Cooling System Pressure Tester

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	J 26568 Coolant and Battery Fluid Tester
	J 38185 Hose Clamp Pliers
	J 42401 Radiator Cap/Surge Tank Test Adapter

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