

2008 Buick LaCrosse CXL

2008 ENGINE Engine Cooling - LaCrosse

2008 ENGINE**Engine Cooling - LaCrosse****SPECIFICATIONS****FASTENER TIGHTENING SPECIFICATIONS**

Application	Specification	
	Metric	English
A/C Condenser Bracket Mounting Bolt	6 N.m	53 lb in
A/C Line Clip to Fan Shroud Screw	4.5 N.m	40 lb in
Coolant Air Bleed Pipe/Cover Bolt (LS4)	12 N.m	106 lb in
Coolant Heater Bolt (LS4)	50 N.m	37 lb ft
Coolant Heater Bolt (L26)	2 N.m	18 lb in
Coolant Inlet Pipe to Cylinder Head Bolt	50 N.m	37 lb ft
Coolant Inlet Pipe to Thermostat Housing Bolt	10 N.m	89 lb in
Coolant Recovery Reservoir Mounting Nut	3.3 N.m	29 lb in
Cooling Fan Blade Nut	6 N.m	53 lb in
Cooling Fan Motor Bolt	6 N.m	53 lb in
Cooling Fan Shroud Bolt to Radiator	10 N.m	89 lb in
Drive Belt Shield Bolt	10 N.m	89 lb in
Heater Pipe Bolt	10 N.m	89 lb in
Knock Sensor	19 N.m	14 lb ft
Thermostat Housing Bolt	20 N.m	15 lb ft
Upper Fan Shroud Bracket Mounting Bolt	10 N.m	89 lb in
Water Outlet Housing Bolt (LS4)	15 N.m	11 lb ft
Water Outlet Housing Bolt/Stud (L26)	27 N.m	20 lb ft
Water Pump Bolt	10 N.m	89 lb in
Water Pump Bolt (LS4)	12 N.m	106 lb in
Water Pump Bolt (LY7)	10 N.m	89 lb in
Water Pump Bolt (Long) (L26)	34 N.m	25 lb ft
Water Pump Bolt (Short) (L26)	22 N.m	16 lb ft

2008 Buick LaCrosse CXL

2008 ENGINE Engine Cooling - LaCrosse

Water Pump Manifold Bolt (LS4)

• First Pass	15 N.m	11 lb ft
• Final Pass	30 N.m	22 lb ft
Water Pump Pulley Bolt (L26)	13 N.m	115 lb in
Water Pump Pulley Bolt (LY7)	12 N.m	106 lb in

SCHEMATIC AND ROUTING DIAGRAMS

ENGINE COOLING SCHEMATICS

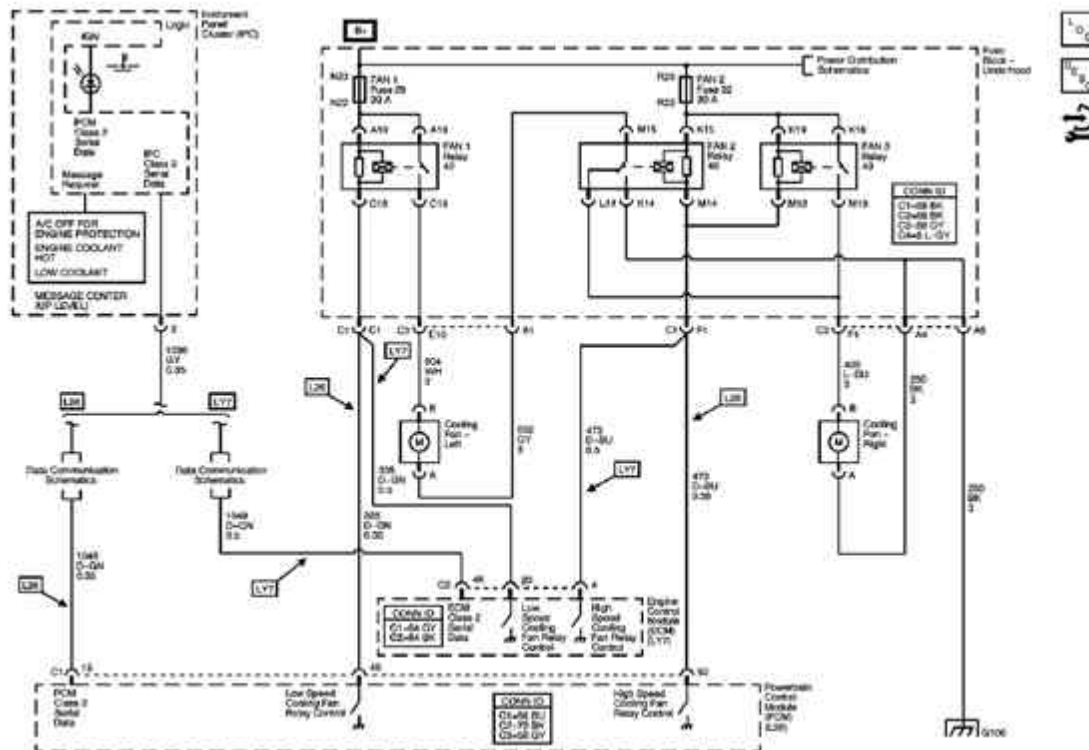


Fig. 1: Engine Cooling Schematic - L26/LY7
Courtesy of GENERAL MOTORS CORP.

2008 Buick LaCrosse CXL

2008 ENGINE Engine Cooling - LaCrosse

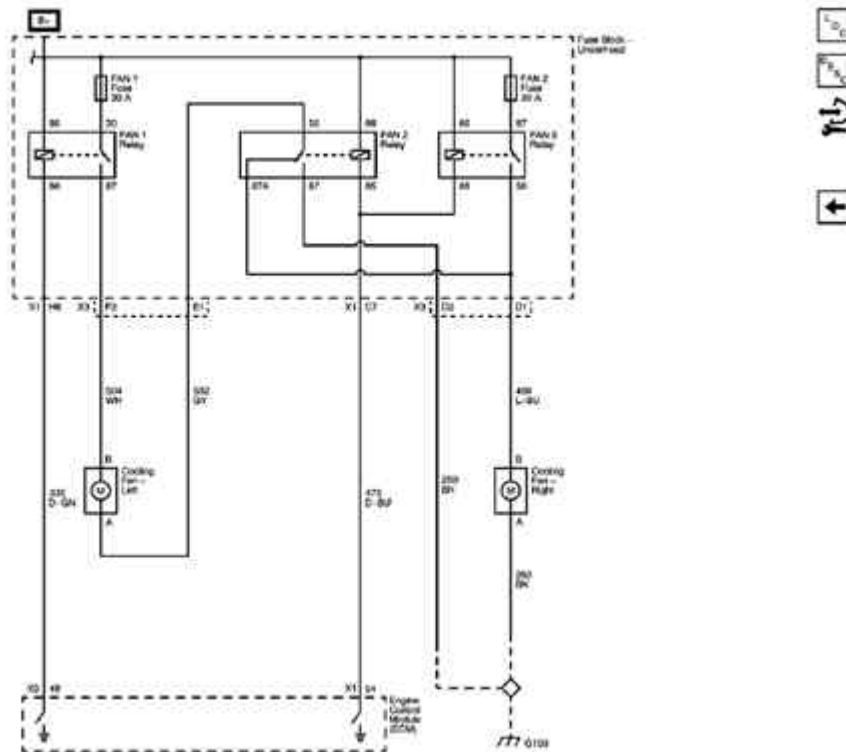


Fig. 2: Engine Cooling Schematic - LS4
Courtesy of GENERAL MOTORS CORP.

DIAGNOSTIC INFORMATION AND PROCEDURES

DIAGNOSTIC CODE INDEX

DIAGNOSTIC CODE INDEX

DTC	Description
DTC P0480 or P0481 (5.3 (LS4))	P0480: Cooling Fan Relay 1 Control Circuit P0481: Cooling Fan Relay 2 Control Circuit
DTC P0480, P0481, P0691, P0692, P0693, or P0694 (3.8L (L26))	P0480: Cooling Fan Relay 1 Control Circuit P0481: Cooling Fan Relay 2 Control Circuit
DTC P0480, P0481, P0691, P0692, P0693, or P0694 (3.6L LY7)	P0480: Cooling Fan Relay 1 Control Circuit P0481: Cooling Fan Relay 2 Control Circuit P0691: Cooling Fan Relay 1 Control Circuit Low Voltage

2008 Buick LaCrosse CXL
2008 ENGINE Engine Cooling - LaCrosse

	P0692: Cooling Fan Relay 1 Control Circuit High Voltage P0693: Cooling Fan Relay 2 Control Circuit Low Voltage P0694: Cooling Fan Relay 2 Control Circuit High Voltage
<u>DTC P1258 (L26)</u>	P1258: Engine Coolant Overtemperature - Protection Mode Active
<u>DTC P1258 LY7)</u>	P1258: Engine Coolant Overtemperature - Protection Mode Active
<u>DTC P1258 (LS4)</u>	P1258: Engine Coolant Over temperature - Protection Mode Active

DIAGNOSTIC STARTING POINT - ENGINE COOLING

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

- The identification of the control modules which command the system
- The ability of the control modules to communicate through the Class 2 serial data circuit
- The identification of any stored diagnostic trouble codes (DTCs) and their status

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

DTC P0480 OR P0481 (5.3 (LS4))

Diagnostic Instructions

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

2008 Buick LaCrosse CXL

2008 ENGINE Engine Cooling - LaCrosse

DTC Descriptors**DTC P0480**

Cooling Fan Relay 1 Control Circuit

DTC P0481

Cooling Fan Relay 2 Control Circuit

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Low Speed Cooling Fan Relay Control Circuit for Fan 1 Relay	P0480	P0480	P0480	-
Fan 1 Relay Voltage Supply Circuit	P0480	P0480	P0480	-
High Speed Cooling Fan Relay Control Circuit for Fan 3 Relay	P0481	P0481	P0481	-
Fan 3 Relay Coil Voltage Supply Circuit	P0481	P0481	P0481	-
High Speed Cooling Fan Relay Control Circuit for Fan 2 Relay	P0481	P0481	P0481	-
Fan 2 Relay Voltage Supply Circuit	P0481	P0481	P0481	-

Circuit/System Description

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 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.

2008 Buick LaCrosse CXL
2008 ENGINE Engine Cooling - LaCrosse

During low speed operation, the ECM supplies the ground path for the low speed fan relay, which is fan 1 relay, through the low speed cooling fan relay control circuit. This energizes the fan 1 relay coil, closes the relay contacts, and supplies battery positive voltage from the fan 1 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 series/parallel relay, which is fan 2 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, which is fan 3 relay, and the series/parallel relay through the high speed cooling fan relay control circuit. This energizes the series/parallel 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 fan 2 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.

Conditions for Running the DTC

- The ignition is ON.
- The system voltage is between 9-18 volts.
- The relay control circuit is transitioned from OFF to ON, or ON to OFF.

Conditions for Setting the DTC

- An improper voltage level has been detected on the cooling fan relay control circuit.
- The condition must be present for a minimum of 30 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.

Reference Information**Schematic Reference****Engine Cooling Schematics****Connector End View Reference****Component Connector End Views****Description and Operation****Cooling Fan Description and Operation****Electrical Information Reference**

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

DTC Type Reference**Powertrain Diagnostic Trouble Code (DTC) Type Definitions****Scan Tool Reference****Control Module References** for scan tool information**Circuit/System Verification**

1. Verify with a scan tool that the ECM is not commanding fan relay activation.
2. Ignition ON, command each relay ON and OFF with a scan tool. Feel or listen to verify that each relay turns ON and OFF with each command.
3. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.

Circuit/System Testing

1. Ignition OFF, disconnect the series/parallel relay, which is fan 2 relay.
2. Connect a 30A fused jumper between the normally-open switch contact terminals at the series/parallel relay connector in order to complete the fan ground circuit. Leave this jumper in place for the remainder of this procedure.
3. Ignition OFF, disconnect the affected relay.
4. Ignition ON, connect a test lamp between the positive terminal at the battery and the affected relay control circuit terminal.
5. Command the affected relay ON and OFF with a scan tool. The test lamp should turn ON and OFF when changing between the commanded states.
 - If the test lamp is always ON, test the relay control circuit for a short to ground. If the circuit tests normal, replace the ECM.
 - If the test lamp is always OFF, test the relay control circuit for a short to voltage or an open/high resistance. If the circuit tests normal, replace the ECM.
6. Connect a 30A fused jumper between the positive voltage terminal at the battery and the fan voltage supply circuit terminal at the affected relay connector and verify fan activation.
 - If the fan does not activate, test the fan voltage supply circuit for a short to ground or an open/high resistance. If the circuit tests normal, replace the fan.
7. Ignition ON, connect a 30A fused jumper between the relay switch voltage supply circuit terminal and the fan voltage supply circuit terminal at the affected relay connector and verify fan activation.
 - If the fan does not activate, test the affected relay switch voltage supply circuit for a short to ground or an open/high resistance. If the circuit tests normal and its fuse is open, test all connected components and replace as necessary.
8. Ignition ON, verify that a test lamp illuminates between the affected relay coil voltage supply circuit terminal and ground.
 - If the test lamp does not illuminate, test the affected relay coil voltage supply circuit for a short to ground or an open/high resistance. If the circuit tests normal and its fuse is open, test all connected components and replace as necessary.

9. If all circuits and the ECM test normal, replace the affected 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 P0480, P0481, P0691, P0692, P0693, OR P0694 (3.8L (L26))

Diagnostic Instructions

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

DTC Descriptors

DTC P0480

Cooling Fan Relay 1 Control Circuit

DTC P0481

Cooling Fan Relay 2 Control Circuit

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Low Speed Cooling Fan Relay Control Circuit for	P0480	P0480	P0480	-

2008 Buick LaCrosse CXL

2008 ENGINE Engine Cooling - LaCrosse

Fan 1 Relay 42				
Fan 1 Relay 42 Voltage Supply Circuit	P0480	P0480	P0480	-
High Speed Cooling Fan Relay Control Circuit for Fan 3 Relay 43	P0481	P0481	P0481	-
Fan 3 Relay 43 Coil Voltage Supply Circuit	P0481	P0481	P0481	-
High Speed Cooling Fan Relay Control Circuit for Fan 2 Relay 46	P0481	P0481	P0481	-
Fan 2 Relay 46 Voltage Supply Circuit	P0481	P0481	P0481	-

Circuit/System Description

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 receive positive voltage from the cooling fan relays which 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, which is fan 1 relay 42, through the low speed cooling fan relay control circuit. This energizes the fan 1 relay coil, closes the relay contacts, and supplies battery positive voltage from the fan 1 fuse 29 through the cooling fan motor supply voltage circuit to the left cooling fan. The ground path for the left cooling fan is through the series/parallel relay, which is fan 2 relay 46, 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. The PCM grounds the high speed fan relay, which is fan 3 relay 43, and the series/parallel relay through the high speed cooling fan relay control circuit. This energizes the series/parallel 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

2008 Buick LaCrosse CXL
2008 ENGINE Engine Cooling - LaCrosse

closing the relay contacts and provides battery positive voltage from the fan 2 fuse 32 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.

Conditions for Running the DTC

- The ignition is ON.
- The system voltage is between 9-18 volts.
- The relay control circuit is transitioned from OFF to ON, or ON to OFF.

Conditions for Setting the DTC

- An improper voltage level has been detected on the cooling fan relay control circuit.
- The condition must be present for a minimum of 30 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.

Reference Information

Schematic Reference

Engine Cooling Schematics

Connector End View Reference

Component Connector End Views

Description and Operation

Cooling Fan Description and Operation

Electrical Information Reference

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

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Verify with a scan tool that the PCM is not commanding fan relay activation.
2. Ignition ON, command each relay ON and OFF with a scan tool. Feel or listen to verify that each relay turns ON and OFF with each command.
3. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.

Circuit/System Testing

1. Ignition OFF, disconnect the series/parallel relay, which is fan 2 relay 46.
2. Connect a 30A fused jumper between the normally-open switch contact terminals at the series/parallel relay connector in order to complete the fan ground circuit. Leave this jumper in place for the remainder of this procedure.
3. Ignition OFF, disconnect the affected relay.
4. Ignition ON, connect a test lamp between the positive terminal at the battery and the affected relay control circuit terminal.
5. Command the affected relay ON and OFF with a scan tool. The test lamp should turn ON and OFF when changing between the commanded states.
 - If the test lamp is always ON, test the relay control circuit for a short to ground. If the circuit tests normal, replace the PCM.
 - If the test lamp is always OFF, test the relay control circuit for a short to voltage or an open/high resistance. If the circuit tests normal, replace the

PCM.

6. Connect a 30A fused jumper between the positive voltage terminal at the battery and the fan voltage supply circuit terminal at the affected relay connector and verify fan activation.
 - If the fan does not activate, test the fan voltage supply circuit for a short to ground or an open/high resistance. If the circuit tests normal, replace the fan.
7. Ignition ON, connect a 30A fused jumper between the relay switch voltage supply circuit terminal and the fan voltage supply circuit terminal at the affected relay connector and verify fan activation.
 - If the fan does not activate, test the affected relay switch voltage supply circuit for a short to ground or an open/high resistance. If the circuit tests normal and its fuse is open, test all connected components and replace as necessary.
8. Ignition ON, verify that a test lamp illuminates between the affected relay coil voltage supply circuit terminal and ground.
 - If the test lamp does not illuminate, test the affected relay coil voltage supply circuit for a short to ground or an open/high resistance. If the circuit tests normal and its fuse is open, test all connected components and replace as necessary.
9. If all circuits and the PCM test normal, replace the affected 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 PCM replacement, setup, and programming

DTC P0480, P0481, P0691, P0692, P0693, OR P0694 (3.6L LY7)

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

DTC Descriptors

DTC P0480

Cooling Fan Relay 1 Control Circuit

DTC P0481

Cooling Fan Relay 2 Control Circuit

DTC P0691

Cooling Fan Relay 1 Control Circuit Low Voltage

DTC P0692

Cooling Fan Relay 1 Control Circuit High Voltage

DTC P0693

Cooling Fan Relay 2 Control Circuit Low Voltage

DTC P0694

Cooling Fan Relay 2 Control Circuit High Voltage

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Relay Coil Ignition Circuit	P0691, P0693	P0480, P0481	-	-

2008 Buick LaCrosse CXL

2008 ENGINE Engine Cooling - LaCrosse

Relay Switch Ignition Circuit	1	1	-	-
Fan Relay 1 Control Circuit	P0691	P0480	P0692	-
Fan Relay 2 and Fan Relay 3 Control Circuit	P0693	P0481	P0694	-
Relay Controlled Output Circuit	1	1	2	-
1. Fans inoperative without a DTC. 2. Fans always ON without a DTC.				

Typical Scan Tool Data

Cooling Fan Relays

Circuit	Short to Ground	Open	Short to Voltage
Operating Conditions: The engine is operating in closed loop			
Parameter Normal Operation: FC Relay Circuit Status: Indeterminate			
FC Relay 1 Circuit Status	Fault	Fault	Fault
FC Relay 2 and 3 Circuit Status	Fault	Fault	Fault

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 low speed fan 1 relay. This energizes the coil and applies voltage directly to the left cooling fan through the switch side of the low relay. The left fan is connected in series to the right cooling fan through the de-energized series/parallel fan 2 relay. The series circuit operates both fans at low speed.

In high speed operation, the ECM applies a ground to the coil side of the low speed fan 1 relay, the series/parallel fan 2 relay, and the high speed fan 3 relay. When

energized, the high speed fan 3 relay applies voltage directly to the right cooling fan through the switch side of the relay. Simultaneously, the low speed fan 1 relay and the series/parallel fan 2 relay provide ignition voltage and a direct path to ground for the left cooling fan. With both fans connected in a parallel circuit, each fan receives full voltage and operates at high speed.

Conditions for Running the DTC

- The ignition voltage is between 8-18 volts.
- The engine speed is more than 40 RPM.
- The ECM driver transitions from ON to OFF or from OFF to ON.

Conditions for Setting the DTC**P0480**

The ECM detects an open on the low speed cooling fan 1 relay control circuit for more than 1 second.

P0481

The ECM detects an open circuit on the high speed cooling fan 2 relay control circuit for more than 1 second.

P0691

The ECM detects a short to ground on the low speed cooling fan 1 relay control circuit for more than 1 second.

P0692

The ECM detects a short to voltage on the low speed cooling fan 1 relay control circuit for more than 1 second.

P0693

The ECM detects a short to ground on the high speed cooling fan 2 relay control circuit for more than 1 second.

P0694

The ECM detects a short to voltage on the high speed cooling fan 2 relay control circuit for more than 1 second.

Action Taken When the DTC Sets

DTCs P0480, P0481, P0691, P0692, P0693, and P0694 are Type B DTCs.

Conditions for Clearing the MIL/DTC

DTCs P0480, P0481, P0691, P0692, P0693, and P0694 are Type B DTCs.

Reference Information**Schematic Reference****Engine Cooling Schematics****Connector End View Reference****Component Connector End Views****Description and Operation****Cooling System 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****Control Module References** for scan tool information

Circuit/System Verification

1. Ignition ON, command the appropriate fan relay ON and OFF with a scan tool. Listen or feel the relay click.
2. Operate the vehicle within the Conditions for Running the DTC to verify the DTC does not reset. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.

Circuit/System Testing

1. Ignition OFF, disconnect all three cooling fan relays.

IMPORTANT: The following test must be performed on all three fan relay circuits.

2. Ignition ON, verify that a test lamp illuminates between ground and the relay coil B+ circuit terminal listed below:
 - Low speed fan 1 relay terminal A19
 - High speed fan 3 relay terminal K19
 - Series/parallel fan 2 relay terminal K15
 - If the test lamp does not illuminate, test the relay coil B+ circuit for a short to ground or an open/high resistance. If the circuit tests normal and the relay coil B+ circuit fuse is open, test all components connected to the ignition circuit and replace as necessary.

IMPORTANT: The following test must be performed on all three fan relay circuits.

3. Test for 2.6-4.6 volts between ground and the relay coil control circuit terminal listed below:
 - Low speed fan 1 relay terminal C18
 - High speed fan 3 relay terminal M18
 - Series/parallel fan 2 relay terminal M14
 - If less than the specified range, test the relay coil control circuit for an open/high resistance or for a short to ground. If the circuit tests normal,

replace the ECM.

- If greater than the specified range, test the relay coil control circuit for a short to voltage. If the circuit tests normal, replace the ECM.

IMPORTANT: The following test must be performed on all three fan relay circuits.

4. Connect a test lamp between the relay coil control circuit and the relay coil ignition circuit terminals listed below:
 - Low speed fan 1 relay terminal C18 and terminal A19
 - High speed fan 3 relay terminal M18 and terminal K19
 - Series/parallel fan 2 relay terminal M14 and terminal K15
5. Command the fan relay ON and OFF with a scan tool. The test lamp should turn ON and OFF when changing between the commanded states.
 - If the test lamp is always OFF, replace the ECM.
6. If all circuits test normal, test or replace the relay.

Component Testing

1. Ignition OFF, disconnect the cooling fan relay.
2. Test for 70-110 ohms between terminals 85 and 86.
 - If the resistance is not within the specified range, replace the relay.
3. Test for infinite resistance between the following terminals:
 - 30 and 86
 - 30 and 87
 - 30 and 85
 - 85 and 87
 - If not the specified range, replace the relay.
4. Test for less than 2 ohms between terminals 30 and 87A.
 - If greater than the specified range, replace the relay.
5. Install a 20A fused jumper wire between relay terminal 85 and 12 volts. Install a jumper wire between relay terminal 86 and ground. Test for less than 2 ohms between terminals 30 and 87.

- If greater than the specified range, replace the 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)**
- **Control Module References** for ECM replacement, setup, and programming

DTC P1258 (L26)

Diagnostic Instructions

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

DTC Descriptor

DTC P1258

Engine Coolant Overtemperature - Protection Mode Active

Circuit/System Description

The engine control module (ECM) or powertrain control module (PCM) uses the engine coolant temperature (ECT) sensor to monitor the engine for an over-temperature condition. This condition occurs when the coolant temperature is above a calibrated value. The ECM or PCM will alternately disable 2 groups of cylinders by turning OFF the fuel injectors. By switching between the 2 groups of cylinders, the ECM or PCM is able to reduce the temperature of the coolant.

Conditions for Running the DTC

- The engine is running.

2008 Buick LaCrosse CXL

2008 ENGINE Engine Cooling - LaCrosse

- DTC P0116, P0117, P0118, or P0128 are not set.

Conditions for Setting the DTC

The coolant temperature is more than 131°C (267.8°F) for more than 7 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 IP will illuminate the coolant indicator lamp and 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
- Cooling Fan Description and Operation
- Instrument Cluster Description and Operation
- Indicator/Warning Message Description and Operation
- Audible Warnings Description and Operation

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. If DTC P0480, P0481, P0691, P0692, P0693, or P0694 are set, diagnose those DTCs first.

2. Observe the engine coolant level. The engine coolant level should be within the operating range. Refer to Capacities - Approximate Fluid, and Engine Coolant in the Owner's Manual.
3. 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.
4. 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
 - Air flow obstructions or bent fins at the radiator or the A/C condenser- Refer to **Symptoms - Engine Cooling**.

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

5. Command the cooling fans ON and OFF, low and high speed. The engine cooling fans should turn ON and OFF with each command.
 - If the cooling fans do not function as indicated, refer to **Cooling Fan Inoperative (3.8L (L26))**.

Circuit/System Testing

1. Test the thermostat for correct operation. Refer to **Thermostat Diagnosis (3.6L (LY7))**.
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 the following procedures:
 - **Water Pump Cleaning and Inspection** for the 3.8L engine
4. Inspect the engine mechanical for worn/leaking/cracked cylinder heads or engine block. Refer to the following procedures:
 - **Coolant in Combustion Chamber** and **Coolant in Engine Oil** for the 3.8L engine

Repair Procedures

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

DTC P1258 (LY7)**Diagnostic Instructions**

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

DTC Descriptor**DTC P1258**

Engine Coolant Overtemperature - Protection Mode Active

Circuit/System Description

The engine control module (ECM) or powertrain control module (PCM) uses the engine coolant temperature (ECT) sensor to monitor the engine for an over-temperature condition. This condition occurs when the coolant temperature is above a calibrated value. The ECM or PCM will alternately disable 2 groups of cylinders by turning OFF the fuel injectors. By switching between the 2 groups of cylinders, the ECM or PCM is able to reduce the temperature of the coolant.

Conditions for Running the DTC

- The engine is running.
- DTC P0116, P0117, P0118, or P0128 are not set.

Conditions for Setting the DTC

The coolant temperature is more than 131°C (267.8°F) for more than 7 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 IP will illuminate the coolant indicator lamp and 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**
- **Cooling Fan Description and Operation**
- **Instrument Cluster Description and Operation**
- **Indicator/Warning Message Description and Operation**
- **Audible Warnings Description and Operation**

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. If DTC P0480, P0481, P0691, P0692, P0693, or P0694 are set, diagnose those DTCs first.
2. Observe the engine coolant level. The engine coolant level should be within the operating range. Refer to Capacities - Approximate Fluid, and Engine Coolant in the Owner's Manual.
3. 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.

4. 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
- Air flow obstructions or bent fins at the radiator or the A/C condenser-
Refer to **Symptoms - Engine Cooling**.

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

5. Command the cooling fans ON and OFF, low and high speed. The engine cooling fans should turn ON and OFF with each command.

- If the cooling fans do not function as indicated, refer to **Cooling Fan Inoperative (3.6L LY7)**.

Circuit/System Testing

1. Test the thermostat for correct operation. Refer to **Thermostat Diagnosis (3.6L (LY7))**.
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 the following procedures:
 - **Water Pump Cleaning and Inspection** for the 3.6L engine
 - **Water Pump Cleaning and Inspection** for the 3.8L engine
4. Inspect the engine mechanical for worn/leaking/cracked cylinder heads or engine block. Refer to the following procedures:
 - **Coolant in Combustion Chamber** and **Coolant in Engine Oil** for the 3.6L engine
 - **Coolant in Combustion Chamber** and **Coolant in Engine Oil** for the 3.8L engine

Repair Procedures

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

procedure.

DTC P1258 (LS4)

Diagnostic Instructions

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

DTC Descriptor

DTC P1258

Engine Coolant Over temperature - Protection Mode Active

Circuit/System Description

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

Conditions for Running the DTC

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

Conditions for Setting the DTC

Coolant temperature more than 132°C (270°F) for greater than 10 seconds.

Action Taken When the DTC Sets

- DTC P1258 is a Type A DTC.
- The engine will operate in the Overheated Engine Protection Operating Mode.

- The engine coolant temperature indicator lamp, if equipped, will illuminate.
- The driver information center (DIC), if equipped, 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****Control Module References** for scan tool information**Circuit/System Verification****IMPORTANT: If DTC P1482 is set, diagnose that DTC 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 fan speed from 0% to 100% with a scan tool.
 - If the fan speed does not transition with the commanded states, refer to **Cooling Fan Inoperative (3.8L (L26))** or **Cooling Fan Inoperative (3.6L LY7)** or **Cooling Fan Inoperative (w/LS4)**.

Circuit/System Testing

1. Test the thermostat for correct operation. Refer to **Thermostat Diagnosis (3.6L (LY7))**.
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 (LY7)** or **Water Pump Replacement (RPOs L26/L32)** or **Water Pump Replacement (LS4)**.
4. Inspect the engine 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 Preliminary Inspections Before Starting

Before using the Symptom diagnosis, perform the following:

- Perform **Diagnostic System Check - Vehicle** and verify all of the following items:
 - Ensure that the engine control module (ECM) or powertrain control

module (PCM) and indicator lamp are operating correctly.

- Ensure that there are no diagnostic trouble codes (DTCs) that are stored.
- Scan tool data is within a normal operating range.
- Verify the customer concern.
- Perform the Visual/Physical Inspection in this section. The visual/physical inspection is extremely important, and can lead to correcting a condition without additional testing. It may also help reveal the cause of an intermittent condition.
- Locate the correct symptom. Perform the tests and inspections associated with the symptom.

Review the system operation in order to familiarize yourself with the system functions.

Visual/Physical Inspection

NOTE: Use the connector test adapter kit J 35616-A for any test that requires probing the following items:

- The PCM harness connectors
- The electrical center fuse/relay cavities
- The component terminals
- The component harness connector

Using this kit will prevent damage caused by the improper probing of connector terminals.

Several of the symptom procedures call for a careful visual and physical inspection. This can lead to correcting a condition without further tests and can save time. This inspection should include the following areas:

- Ensure that the control module grounds are clean, tight, and correctly located.
- Inspect cooling system hoses and pipes for splits, kinks, and proper connections. Inspect thoroughly for any type of a leak or a restriction.

- Inspect for a dirty or restricted radiator and HVAC condenser.
- Inspect for aftermarket devices which could affect the operation of the Cooling System.
- Inspect the easily accessible or visible system components for obvious damage or conditions which could cause the symptom.
- Inspect the surge tank reservoir for the proper coolant level.

Identifying Intermittent Conditions

Many intermittent conditions occur with harness or connector movement due to engine torque, rough pavement, vibration or physical movement of a component. Refer to the following for a list to help determine an intermittent condition:

- Moisture and water intrusion in connectors, terminals, and components
- Connector mating
- Terminal contact
- High circuit or component resistance-High resistance can include any resistance, regardless of the amount, which can interrupt the operation of the component.
- Harness that is located too tight, or chaffed circuits
- High or low ambient temperature
- High or low engine coolant temperatures
- High underhood temperatures
- Heat build up in component or circuit due to circuit resistance, poor terminal contact, or high electrical load
- High or low system voltage
- High vehicle load conditions
- Rough road surface
- Electro-magnetic interference (EMI)/circuit interference from relays, solenoids or other electrical surge
- Incorrect installation of non-factory, aftermarket, and after factory add on accessories

If an intermittent is determined, refer to **Testing for Intermittent Conditions and Poor Connections** for specific strategies in diagnosing intermittent conditions.

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 (3.8L (L26)) or Cooling Fan Inoperative (3.6L LY7) or Cooling Fan Inoperative (w/LS4)**
- **Engine Overheating**
- **Loss of Coolant**
- **Thermostat Diagnosis (3.6L (LY7))**
- **Coolant Heater Inoperative**
- **Engine Fails To Reach Normal Operating Temperature (3.6L (LY7))**

COOLING FAN ALWAYS ON

Circuit/System Description

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 engine control module (ECM), or powertrain control module (PCM), 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.

During low speed operation, the ECM or PCM supplies the ground path for the low speed fan relay, which is fan 1 relay 42, 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 fan 1 fuse 29 through the cooling fan motor supply voltage circuit to the left cooling fan. The ground path for the left cooling fan is through the series/parallel relay, which is fan 2 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 or PCM supplies the ground path for the low

speed fan relay through the low speed cooling fan relay control circuit. The ECM or PCM grounds the high speed fan relay, which is fan 3 relay 43, and the series/parallel relay through the high speed cooling fan relay control circuit. This energizes the series/parallel 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 fan 2 fuse 32 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

Connector End View Reference

Component Connector End Views

Description and Operation

Cooling Fan Description and Operation

Electrical Information Reference

- Circuit Testing
- Connector Repairs
- Wiring Repairs

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Verify that DTCs P0480, P0481, P0691, P0692, P0693 and P0694 are not set.
 - If any of the DTCs are set, refer to **Diagnostic Trouble Code (DTC) List**

- Vehicle .

2. Ignition ON, verify with a scan tool that the ECM or PCM is not commanding fan activation.
3. Ignition ON, observe that the fans are not activated.

Circuit/System Testing

IMPORTANT: You must perform the Circuit/System Verification before proceeding with Circuit/System Testing.

1. Ignition OFF, leave the series/parallel relay, which is fan 2 relay 46, in place while disconnecting the other relays.
2. Ignition ON, observe that the fans are not activated.
 - If the fans are not activated, replace the faulty relay.
 - If a fan is activated, test the fan voltage supply circuits for a short to voltage.

Repair Procedures

- **Underhood Electrical Center or Junction Block Replacement**
- **Relay Replacement (Attached to Wire Harness) or Relay Replacement (Within an Electrical Center)**

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 (3.8L (L26))

Diagnostic Instructions

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

category.

Circuit/System Description

The 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 engine control module (ECM), or powertrain control module (PCM) 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.

During low speed operation, the ECM or PCM supplies the ground path for the low speed fan relay, which is fan 1 relay 42, 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 fan 1 fuse 29 through the cooling fan motor supply voltage circuit to the left cooling fan. The ground path for the left cooling fan is through the series/parallel relay, which is fan 2 relay 46, and the right cooling fan. The result is a series circuit with both fans running at low speed.

During high speed operation the ECM or PCM supplies the ground path for the low speed fan relay through the low speed cooling fan relay control circuit. The ECM or PCM grounds the high speed fan relay, which is fan 3 relay 43, and the series/parallel relay through the high speed cooling fan relay control circuit. This energizes the series/parallel 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 fan 2 fuse 32 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

Connector End View Reference

Component Connector End Views

Description and Operation

Cooling Fan Description and Operation

Electrical Information Reference

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

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. If DTCs P0480 or P0481 are set, perform those diagnostics first.
2. Verify with a scan tool that the ECM or PCM is not commanding fan relay activation.
3. Ignition ON, command each relay ON and OFF with a scan tool. Observe to verify that the fan turns ON and OFF with each command.

Circuit/System Testing

1. Ignition OFF, disconnect the series/parallel fan relay, which is fan 2 relay 46.
2. Ignition ON, activate the cooling fan relay 1 with a scan tool. The fan should be OFF.
 - If the fan is activated, test the left fan ground circuit for a short to ground.
3. Ignition OFF, disconnect the remaining fan relays.
4. Connect a 30A fused jumper between the normally-open switch contact terminals at the series/parallel relay connector in order to complete the fan ground circuit. Leave this jumper in place for the remainder of this procedure.
5. One at a time, connect a 30A fused jumper between the positive terminal at the battery and the fan voltage supply circuit terminal at the low speed fan relay

and the high speed fan relay connections and verify 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.
6. Ignition ON, connect a 30A fused jumper between the relay switch voltage supply circuit terminal and the fan voltage supply circuit terminal at the low speed fan relay and the high speed fan relay connection and verify the fan activation.
- If the fan does not activate, test the relay switch voltage supply circuit for a short to ground or an open/high resistance. If the circuit tests normal and its fuse is open, test all connected components and replace as necessary.
7. If the circuits and fans test normal, replace the relay.

Repair Procedures

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

- **Engine Coolant Fan Motor Replacement (L26) or Engine Coolant Fan Motor Replacement (LY7) or Engine Coolant Fan Motor Replacement (LS4)**
- **Underhood Electrical Center or Junction Block Replacement**
- **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.

COOLING FAN INOPERATIVE (3.6L LY7)

Diagnostic Instructions

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

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

Circuit/System Description

The 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 low speed fan 1 relay. This energizes the coil and applies voltage directly to the left cooling fan through the switch side of the low relay. The left fan is connected in series to the right cooling fan through the de-energized series/parallel fan 2 relay. The series circuit operates both fans at low speed.

In high speed operation, the ECM applies a ground to the coil side of the low speed fan 1 relay, the series/parallel fan 2 relay, and the high speed fan 3 relay. When energized, the high speed fan 3 relay applies voltage directly to the right cooling fan through the switch side of the relay. Simultaneously, the low speed fan 1 relay and the series/parallel fan 2 relay provide ignition voltage and a direct path to ground for the left cooling fan. With both fans connected in a parallel circuit, each fan receives full voltage and operates at high speed.

Reference Information**Schematic Reference****Engine Cooling Schematics****Connector End View Reference****Component Connector End Views****Description and Operation****Cooling System Description and Operation**

Electrical Information Reference

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

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Verify that DTCs P0480, P0481, P0691, P0692, P0693 and P0694 are not set.
 - If any cooling system DTCs are set, repair the DTC first. Refer to **DTC P0480, P0481, P0691, P0692, P0693, or P0694 (3.8L (L26)) or DTC P0480, P0481, P0691, P0692, P0693, or P0694 (3.6L LY7)**.
2. Ignition ON, command the appropriate fan relay ON and OFF with a scan tool. Verify that the fans turn ON and OFF when changing between the commanded states.

Circuit/System Testing

1. Ignition OFF, disconnect the cooling fan relays.
2. Connect a 30A fused jumper between the relay switch circuit terminal M15 and the ground circuit terminal K14 at the fan 2 relay connector. This will complete the left side fan ground circuit. Leave this jumper in place for the remainder of this procedure.

IMPORTANT: The following test must be performed on both the high speed fan 2 relay circuit and the low speed fan 1 relay circuit.

3. Ignition ON, verify that a test lamp illuminates between ground and the relay switch B+ circuit terminal listed below:
 - High speed fan 3 relay terminal K18

- Low speed fan 1 relay terminal A18
- If the test lamp does not illuminate, test the appropriate relay switch B+ circuit for a short to ground or an open/high resistance. If the circuit tests normal and the relay switch B+ circuit fuse is open, test the relay controlled output circuit for a short to ground. If the circuit tests normal, test or replace the relay.

IMPORTANT: The following test must be performed first on the high speed fan 2 relay circuit and next on the low speed fan 1 relay circuit. Leave the jumper connected to the low speed fan 1 relay circuit for the next test.

4. Connect a 30A fused jumper between the relay switch B+ circuit and the relay controlled output circuit terminals listed below. Verify the appropriate fan is activated
 - High speed fan 3 relay terminal K18 and terminal M19
 - Low speed fan 1 relay terminal A18 and terminal C19
 - If the appropriate fan does not activate, test the relay controlled output circuit for a short to ground or an open/high resistance. If the circuit tests normal, test the fan ground circuit for an open/high resistance. If the circuit tests normal, replace the fan.
5. Install the series/parallel fan 2 relay. Verify both fans activate at low speed.
 - If both fans do not activate, test the relay controlled output circuit terminal L14 of the fan 2 relay for a short to ground or an open/high resistance.
6. If all circuits test normal, test or replace the relay.

Component Testing

1. Ignition OFF, disconnect the cooling fan relay.
2. Test for 70-110 ohms of resistance between terminals 85 and 86.
 - If the resistance is not within the specified range, replace the relay.
3. Test for infinite resistance between the following terminals:
 - 30 and 86

- 30 and 87
 - 30 and 85
 - 85 and 87
 - If not the specified range, replace the relay.
4. Test for less than 2 ohms of resistance between terminals 30 and 87A.
 - If greater than the specified range, replace the relay.
5. Install a 20A fused jumper wire between relay terminal 85 and 12 volts. Install a jumper wire between relay terminal 86 and ground. Test for less than 2 ohms of resistance between terminals 30 and 87.
 - If greater than the specified range, replace the 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)**
- **Engine Coolant Fan Motor Replacement (L26)** or **Engine Coolant Fan Motor Replacement (LY7)** or **Engine Coolant Fan Motor Replacement (LS4)**

COOLING FAN INOPERATIVE (W/LS4)

Diagnostic Instructions

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

Circuit/System Description

The 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 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.

During low speed operation, the ECM supplies the ground path for the low speed fan relay, which is fan 1 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 fan 1 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 series/parallel relay, which is fan 2 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, which is fan 3 relay, and the series/parallel relay through the high speed cooling fan relay control circuit. This energizes the series/parallel 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 fan 2 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

Connector End View Reference

Component Connector End Views

Description and Operation

Cooling Fan Description and Operation

Electrical Information Reference

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

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. If DTCs P0480 or P0481 are set, perform those diagnostics first.
2. Verify with a scan tool that the ECM is not commanding fan relay activation.
3. Ignition ON, command each relay ON and OFF with a scan tool. Observe to verify that the fan turns ON and OFF with each command.

Circuit/System Testing

1. Ignition OFF, disconnect the series/parallel fan relay, which is fan 2 relay.
2. Ignition ON, activate the cooling fan relay 1 with a scan tool. The fan should be OFF.
 - If the fan is activated, test the left fan ground circuit for a short to ground.
3. Ignition OFF, disconnect the remaining fan relays.
4. Connect a 30A fused jumper between the normally-open switch contact terminals at the series/parallel relay connector in order to complete the fan ground circuit. Leave this jumper in place for the remainder of this procedure.
5. One at a time, connect a 30A fused jumper between the positive terminal at the battery and the fan voltage supply circuit terminal at the low speed fan relay and the high speed fan relay connections and verify 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.
6. Ignition ON, connect a 30A fused jumper between the relay switch voltage supply circuit terminal and the fan voltage supply circuit terminal at the low speed fan relay and the high speed fan relay connection and verify the fan

activation.

- If the fan does not activate, test the relay switch voltage supply circuit for a short to ground or an open/high resistance. If the circuit tests normal and its fuse is open, test all connected components and replace as necessary.

7. If the circuits and fans test normal, replace the relay.

Repair Procedures

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

- **Engine Coolant Fan Motor Replacement (L26)** or **Engine Coolant Fan Motor Replacement (LY7)** or **Engine Coolant Fan Motor Replacement (LS4)**
- **Relay Replacement (Attached to Wire Harness)** or **Relay Replacement (Within an Electrical Center)**
- **Underhood Electrical Center or Junction Block Replacement**

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

Step	Action	Yes	No
DEFINITION: Either of the following conditions indicate a probable engine overheat condition.			
• The engine temperature gage is in the red (overheat) zone and/or the engine temperature indicator is ON. • Hot engine coolant overflows from the coolant recovery reservoir and/or radiator cap onto the ground while the engine is running.			
	1. Inspect and fill the cooling system, as necessary. Refer to <u>Cooling System Draining and Filling (L26,</u>		

2008 Buick LaCrosse CXL

2008 ENGINE Engine Cooling - LaCrosse

1	<u>LY7 GE 47716 Fill</u> or <u>Cooling System Draining and Filling (L26 Static Fill)</u> or <u>Cooling System Draining and Filling (LY7 Static Fill)</u> or <u>Cooling System Draining and Filling (LS4 GE47716 Fill)</u> or <u>Cooling System Draining and Filling (LS4 Static Fill)</u>. 2. Inspect the cooling system for leaks, as necessary. 3. Repair the cooling system leaks, as necessary. Has the inspection/repair been performed?	Go to Step 2	-
2	1. Start the engine and allow the engine to run at approximately 1,200 RPM. 2. Use the scan tool in order to verify the overheat condition. Does the scan tool verify the engine overheat condition?	Go to Step 3	Go to <u>Diagnostic System Check - Vehicle</u>
3	1. Verify that the cooling fans are operating properly. 2. Repair the cooling fan system, as necessary. Does the engine still overheat?	Go to Step 4	System OK
	Perform the following inspections: - Inspect the radiator and the A/C condenser cooling fins for debris or any other obstruction. - Inspect the drive belt system and the		

2008 Buick LaCrosse CXL

2008 ENGINE Engine Cooling - LaCrosse

4	drive belt tensioner for proper operation in order to ensure that the coolant pump is rotating properly. • Inspect for loose, damaged and/or missing air deflector(s). Refer to <u>Radiator Air Lower Baffle and Deflector Replacement</u>, <u>Radiator Air Side Baffle and Deflector Replacement</u> or <u>Radiator Air Upper Baffle and Deflector Replacement</u>. • Inspect for a pinched or kinked cooling system hose. • Repair the systems as necessary.		
	Does the engine still overheat?	Go to Step 5	System OK
5	Inspect the thermostat for proper operation. Refer to <u>Thermostat Diagnosis (3.6L (LY7))</u>. Is the thermostat operating properly?	Go to Step 7	Go to Step 6
6	Replace the thermostat. Refer to <u>Engine Coolant Thermostat Replacement (LY7)</u> or <u>Engine Coolant Thermostat Replacement (RPOs L26/L32)</u> or <u>Engine Coolant Thermostat Replacement (LS4)</u>. Does the engine still overheat?	Go to Step 7	System OK
	IMPORTANT: Excessive coolant freeze point protection MAY cause the coolant to boil at low temperatures. 1. Inspect for the proper coolant concentration (mixture). Correct the coolant concentration as necessary.		

2008 Buick LaCrosse CXL

2008 ENGINE Engine Cooling - LaCrosse

7	2. Remove the radiator cap. 3. Start the engine and inspect for a constant flow of air bubbles in the engine coolant. Is there a constant flow of air bubbles in the engine coolant?	Go to Step 8	Go to Step 9
8	The probable cause of the engine overheat is combustion chamber gasses leaking into the cooling system. This condition is usually caused by the following: • A worn or damaged cylinder head gasket • A worn or damaged cylinder head • A worn and/or damaged engine block Verify this condition by inspecting the spark plug electrodes and porcelain surrounding the spark plug electrode for signs of coolant. Replace and/or repair the engine internal component(s), as necessary, in order to repair the engine internal coolant leak. Does the engine still overheat?	Go to Step 1	System OK
9	The engine overheat may be caused by a cooling system blockage. Flush the cooling system. Refer to Flushing. Does the engine still overheat?	Go to Step 10	System OK
	IMPORTANT: It is unlikely that the water pump is the cause of the overheat condition.		

2008 Buick LaCrosse CXL

2008 ENGINE Engine Cooling - LaCrosse

10	If NONE of the cooling system passages are restricted, replace the coolant pump. Refer to <u>Water Pump Replacement (LY7)</u> or <u>Water Pump Replacement (RPOs L26/L32)</u> or <u>Water Pump Replacement (LS4)</u> . Does the engine still overheat?	Go to Step 1	System OK
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LOSS OF COOLANT

Step	Action	Yes	No
DEFINITION: The cooling system is losing coolant either internally or externally.			
1	Were you sent here from Symptoms or another diagnostic table?	Go to Step 2	Go to <u>Symptoms - Engine Cooling</u>
2	Repair any present DTCs. Refer to <u>Diagnostic System Check - Vehicle</u> . Is the action complete?	Go to Step 3	-
3	Inspect the coolant level. Is the coolant at the proper level?	Go to Step 6	Go to Step 4
4	Fill the cooling system to the proper level. Refer to <u>Cooling System Draining and Filling (L26, LY7 GE 47716 Fill)</u> or <u>Cooling System Draining and Filling (L26 Static Fill)</u> or <u>Cooling System Draining and Filling (LY7 Static Fill)</u> or <u>Cooling System Draining and Filling (LS4 GE47716 Fill)</u> or <u>Cooling System Draining and Filling (LS4 Static Fill)</u> . Is the action complete?	Go to Step 5	-
5	If the engine is suspected to have a coolant leak into a cylinder, the coolant can hydraulically lock the engine.		

2008 Buick LaCrosse CXL

2008 ENGINE Engine Cooling - LaCrosse

	Does the engine crankshaft rotate?	Go to Step 6	Go to Step 26
6	Engine overheating can cause a loss of coolant. Is the engine overheating?	Go to Step 27	Go to Step 7
7	Extended operation with a low coolant level can cause engine internal component failure. Is the engine knocking?	Go to Step 29	Go to Step 8
8	1. Idle the engine at normal operating temperature. 2. Inspect for heavy white smoke coming out of the exhaust pipe. Is a heavy white smoke present from the exhaust pipe?	Go to Step 9	Go to Step 10
9	• Coolant in the exhaust system creates a distinctive, burning coolant odor in the exhaust. • Condensation in the exhaust system can cause an odorless white smoke during engine warm up. Does the white smoke have a burning coolant type odor?	Go to Step 28	Go to Step 10
10	With the engine idling, inspect the coolant recovery system. Does the coolant recovery system discharge coolant while the engine is idling?	Go to Step 15	Go to Step 11
	Visually inspect the hoses, pipes and hose clamps at the following locations: • Coolant bypass • Coolant reservoir		

2008 Buick LaCrosse CXL

2008 ENGINE Engine Cooling - LaCrosse

11	• Heater core • Radiator Are any of the hoses, clamps or pipes leaking?	Go to Step 20	Go to Step 12
12	Visually inspect the following components: • Block heater • Coolant pressure cap • Core plugs • Cylinder head gaskets • Engine block • Intake manifold • Radiator • Thermostat housing • Water pump Are any of the listed components leaking?	Go to Step 20	Go to Step 13
13	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 11 and 12. Are any leaks present?	Go to Step 20	Go to Step 14
14	Pressure test the coolant pressure cap. Refer to Pressure Cap Testing. Does the coolant pressure cap hold		

2008 Buick LaCrosse CXL

2008 ENGINE Engine Cooling - LaCrosse

	pressure?	Go to Step 16	Go to Step 21
15	Pressure test the coolant pressure cap. Refer to Pressure Cap Testing . Does the coolant pressure cap hold pressure?	Go to Step 30	Go to Step 21
16	Inspect for the following conditions: • A coolant smell inside of the vehicle • Coolant in the HVAC module drain tube • Coolant on the vehicles floor covering near the HVAC module Is coolant present?	Go to Step 22	Go to Step 17
17	Inspect the underside of the engine oil fill cap for a gray/white milky substance. Is there a milky substance on the oil fill cap?	Go to Step 18	Go to Step 19
18	Inspect the engine oil fluid level indicator for a gray/white milky substance. Is there a milky substance on the engine fluid level indicator?	Go to Step 28	Go to Step 19
19	Inspect the automatic transmission oil fluid level indicator for a gray/white milky substance. Is there a milky substance on the automatic transmission fluid level indicator?	Go to Step 23	Go to Step 31
20	Repair or replace the leaking component. Refer to the appropriate repair. Is the repair complete?	Go to Step 31	-
21	Replace the coolant pressure cap.		-

2008 Buick LaCrosse CXL

2008 ENGINE Engine Cooling - LaCrosse

	Is the repair complete?	Go to Step 31	
22	Replace the heater core. Refer to <u>Heater Core Replacement</u> . Is the repair complete?	Go to Step 31	-
23	1. Remove the transmission oil cooler lines from the radiator. 2. Pressure test the cooling system. Refer to <u>Cooling System Leak Testing</u>. 3. Inspect the transmission oil cooler for coolant. Is coolant present?	Go to Step 24	Go to Step 25
24	1. Replace the radiator. Refer to <u>Radiator Replacement (L26, LY7)</u> or <u>Radiator Replacement (LS4)</u>. 2. Service the automatic transmission. Refer to <u>Engine Coolant/Water in Transmission</u> . Is the repair complete?	Go to Step 31	-
25	Install the cooler lines to the radiator. Is the repair complete?	Go to Step 31	-
26	Repair the engine no crank condition. Refer to the appropriate procedure: • <u>Engine Will Not Crank - Crankshaft Will Not Rotate</u> for the 3.6L (LY7) engine • <u>Engine Will Not Crank - Crankshaft Will Not Rotate</u> for the 3.8L engine • <u>Engine Will Not Crank - Crankshaft Will Not Rotate</u> for the		-

2008 Buick LaCrosse CXL

2008 ENGINE Engine Cooling - LaCrosse

	5.3L engine		
	Is the repair complete?	Go to Step 31	
27	Repair the engine overheating condition. Refer to <u>Engine Overheating</u> . Is the repair complete?	Go to Step 31	-
28	Repair the engine internal coolant leak. Refer to the appropriate procedure: • <u>Coolant in Combustion Chamber</u> for the 3.6L (LY7) engine • <u>Coolant in Engine Oil</u> for the 3.6L (LY7) engine • <u>Coolant in Combustion Chamber</u> for the 3.8L engine • <u>Coolant in Engine Oil</u> for the 3.8L engine • <u>Coolant in Combustion Chamber</u> for the 5.3L engine • <u>Coolant in Engine Oil</u> for the 5.3L engine		-
	Is the repair complete?	Go to Step 31	
29	Repair the engine knock. Refer to the appropriate procedure: • <u>Lower Engine Noise, Regardless of Engine Speed</u> for the 3.6L (LY7) engine • <u>Lower Engine Noise, Regardless of Engine Speed</u> for the 3.8L engine • <u>Lower Engine Noise, Regardless</u>		-

	<u>of Engine Speed</u> for the 5.3L engine		
	Is the repair complete?	Go to Step 31	
30	Repair the combustion pressure in the cooling system problem. Refer to the appropriate procedure: • <u>Cylinder Leakage Test</u> for the 3.6L (LY7) engine • <u>Cylinder Leakage Test</u> for the 3.8L engine • <u>Cylinder Leakage Test</u> for the 5.3L engine		-
	Is the repair complete?	Go to Step 31	
31	Operate the system in order to verify the repair. Did you find and correct the condition?	System OK	Go to Step 2

THERMOSTAT DIAGNOSIS (3.6L (LY7))

Tools Required

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

The coolant thermostat can be tested using a temperature (tempil) stick. The temperature stick is a pencil-like device which has a wax material containing certain chemicals that 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 outlet coolant pipe.

Diagnosis Procedure

1. Use a tempilstick in order to find the opening and the closing temperatures of the thermostat.

- **J 24731** 188 tempilstick melts at 87°C (188°F). See **Special Tools**. The thermostat should begin to open at 90°C (194°F).
 - **J 24731** 206 tempilstick melts at 97°C (206°F). See **Special Tools**. The thermostat should be fully open at 107°C (225°F).
2. Replace the thermostat if it does not operate properly between this temperature range.

COOLANT HEATER INOPERATIVE

Diagnostic Instructions

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

Circuit/System Description

The optional coolant heater operates using 110 volt AC external power and is designed to warm the coolant in the engine block area for improved starting in very cold weather. There is an internal thermal switch in the power cord that prevents operation above -18°C (0°F). The coolant heater helps reduce fuel consumption when a cold engine is warming up. The unit is equipped with a detachable AC power cord. A weather shield on the cord is provided to protect the plug when not in use.

Reference Information

Electrical Information Reference

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

Circuit/System Testing

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

1. Test the engine coolant heater for an open or short to ground.
 - o 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 (3.8L)** or **Coolant Heater Replacement (LY7)** or **Coolant Heater Replacement (LS4)**
- **Coolant Heater Cord Replacement (LY7)** or **Coolant Heater Cord Replacement (3.8L)** or **Coolant Heater Cord Replacement (LS4)**

ENGINE FAILS TO REACH NORMAL OPERATING TEMPERATURE (3.6L (LY7))

Step	Action	Yes	No
1	1. Ensure that the cooling system is full. 2. Allow the engine to cool. 3. Start the engine. 4. Turn the air conditioning system OFF. 5. Inspect the engine cooling fans. Is the electric cooling fan on?	Go to Step 2	Go to Step 3
2	1. Diagnose and repair the cooling fan system. Refer to <u>Cooling Fan Always On.</u> 2. Verify the customer complaint.		

2008 Buick LaCrosse CXL

2008 ENGINE Engine Cooling - LaCrosse

	Does the engine still fail to reach normal operating temperature?	Go to Step 3	System OK
3	Install the scan tool to the data link connector (DLC). Compare the scan tool coolant temperature reading to the instrument panel (I/P) cluster coolant temperature. Is the I/P cluster coolant temperature close to the reading on the scan tool?	Go to Step 5	Go to Step 4
4	1. Diagnose and repair the coolant temperature gage system. 2. Verify the customer complaint. Does the engine still fail to reach normal operating temperature?	Go to Step 5	System OK
5	Inspect the thermostat for proper operation. Refer to <u>Thermostat Diagnosis (3.6L (LY7))</u> . Is the thermostat operating properly?	Go to Step 1	Go to Step 6
6	1. Replace the thermostat. Refer to <u>Engine Coolant Thermostat Replacement (LY7)</u> or <u>Engine Coolant Thermostat Replacement (RPOs L26/L32)</u> or <u>Engine Coolant Thermostat Replacement (LS4)</u> . 2. Verify the customer complaint. Does the engine still fail to reach normal operating temperature?	Go to Step 1	System OK

PRESSURE CAP TESTING**Tools Required**

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

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

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

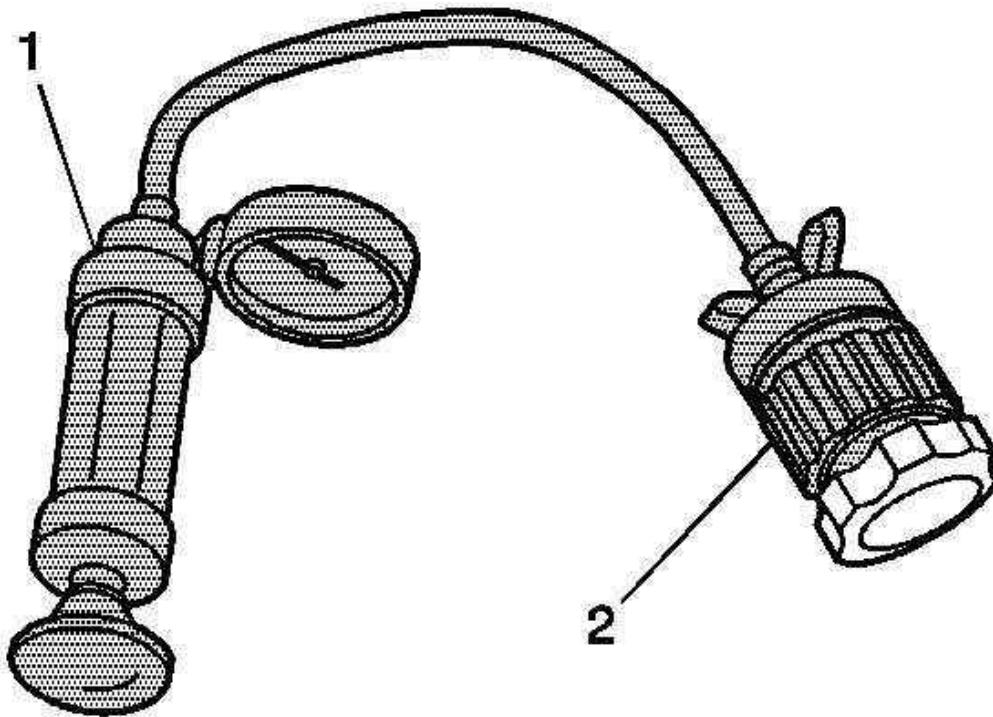


Fig. 3: Identifying Pressure Cap Testing Tool J 42401

Courtesy of GENERAL MOTORS CORP.

3. Use the **J 24460-01** (1) with **J 42401** (2) in order to test the pressure cap. See **Special Tools**.
4. Test the pressure cap for the following conditions:
 - Pressure release when the **J 24460-01** exceeds the pressure rating of the pressure cap. See **Special Tools**.
 - Maintain the rated pressure for at least 10 seconds.

Note the rate of pressure loss.

5. Replace the pressure cap under the following conditions:
 - The pressure cap does not release pressure which exceeds the rated pressure of the cap.
 - The pressure cap does not hold the rated pressure.

COOLING SYSTEM LEAK TESTING

Tools Required

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

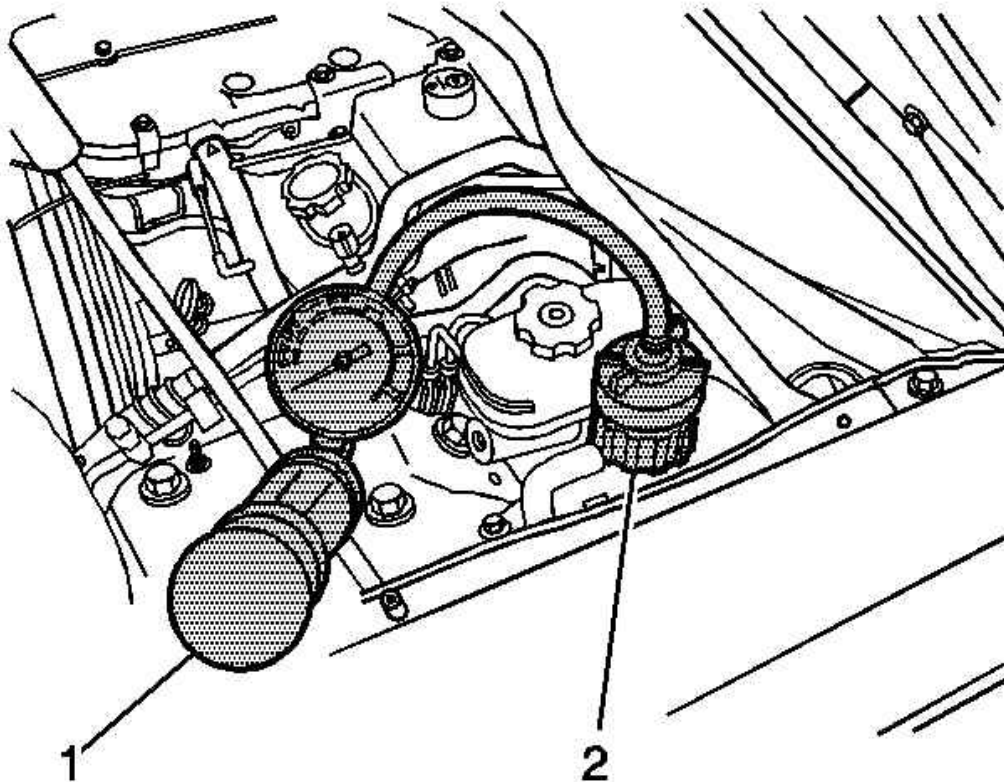


Fig. 4: Applying Pressure To Cooling System
Courtesy of GENERAL MOTORS CORP.

4. Use the **J 24460-01** (1) with **J 42401** (2) 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.

6. Repair any leaks as required.

REPAIR INSTRUCTIONS

COOLING SYSTEM DRAINING AND FILLING (L26, LY7 GE 47716 FILL)

Tools Required

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

Draining Procedure

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

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

1. Remove the coolant pressure cap.
2. Place a drain pan under the drain cock.
3. Open the radiator drain cock.
4. Drain the cooling system.
5. If a complete engine block drain is required, remove the knock sensors for the 3.8L engine or the engine block drain plugs for the 3.6L engine. Refer to **Knock Sensor 1 Replacement** and **Knock Sensor 2 Replacement** for the

- 3.8L engine or to **Engine Block Disassemble** for the 3.6L (LY7) engine.
6. Inspect the coolant.
 7. 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** .

Vac-N-Fill Procedure

1. If a complete engine block drain was required, install the knock sensors for the 3.8L engine or the engine block drain plugs for the 3.6L engine. Refer to **Knock Sensor 1 Replacement** and **Knock Sensor 2 Replacement** for the 3.8L engine or to **Engine Block Disassemble** for the 3.6L (LY7) engine.

IMPORTANT: To prevent boiling of the coolant/water mixture in the vehicle's cooling system, do not apply vacuum to a cooling system above 49°C (120°F). The tool will not operate properly when the coolant is boiling.

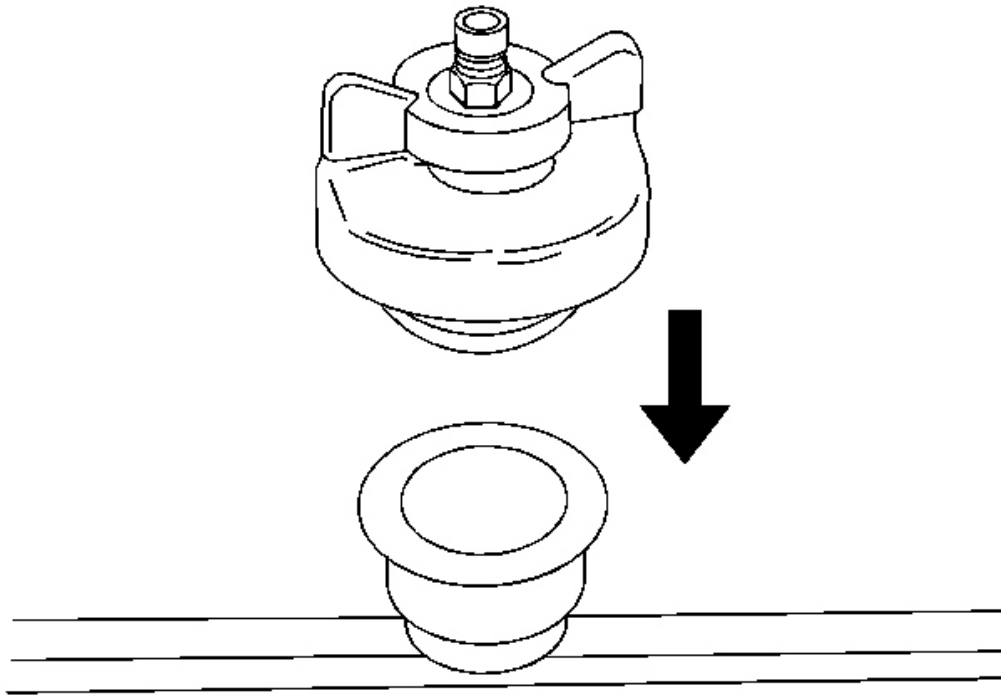


Fig. 5: Identifying Vac-N-Fill Cap
Courtesy of GENERAL MOTORS CORP.

2. Install the **J 42401** to the coolant fill port. See **Special Tools**.

Attach the Vac N Fill cap to **J 42401** . See **Special Tools**.

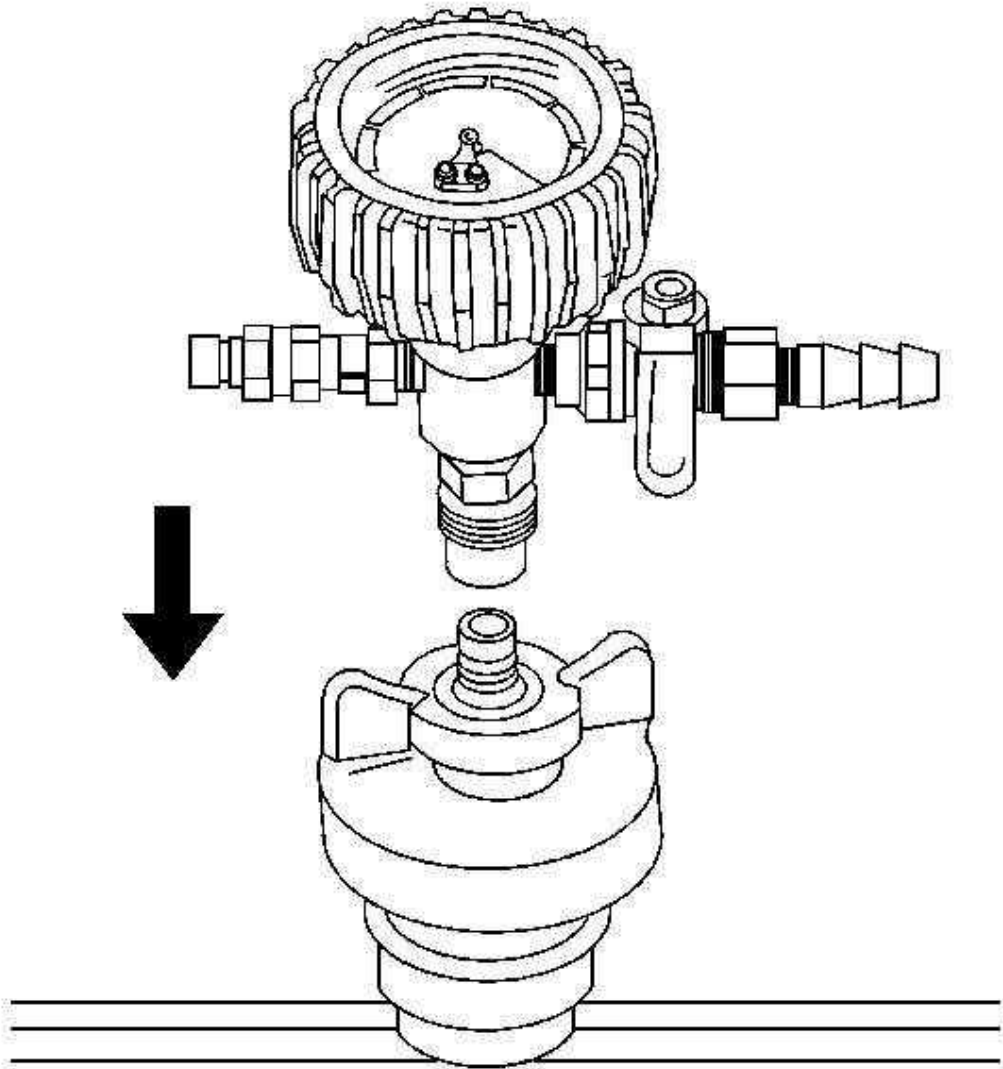


Fig. 6: Attaching Vacuum Gage Assembly To Vac-N-Fill Cap
Courtesy of GENERAL MOTORS CORP.

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

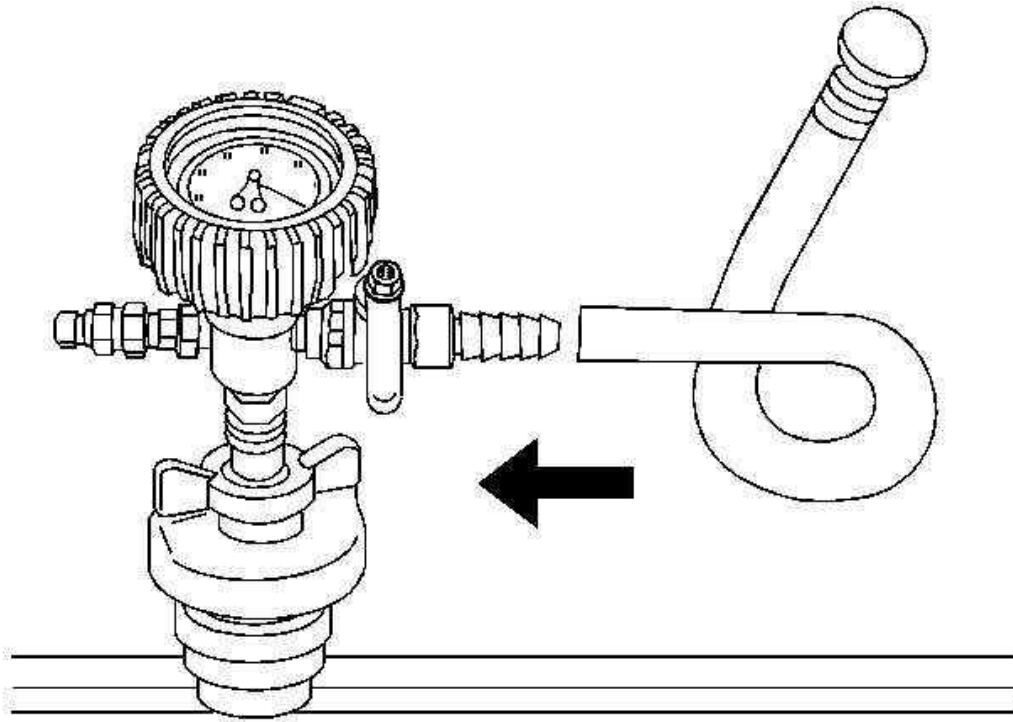


Fig. 7: View Of Fill Hose & Vacuum Gage Assembly
Courtesy of GENERAL MOTORS CORP.

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

Ensure that the valve is closed.

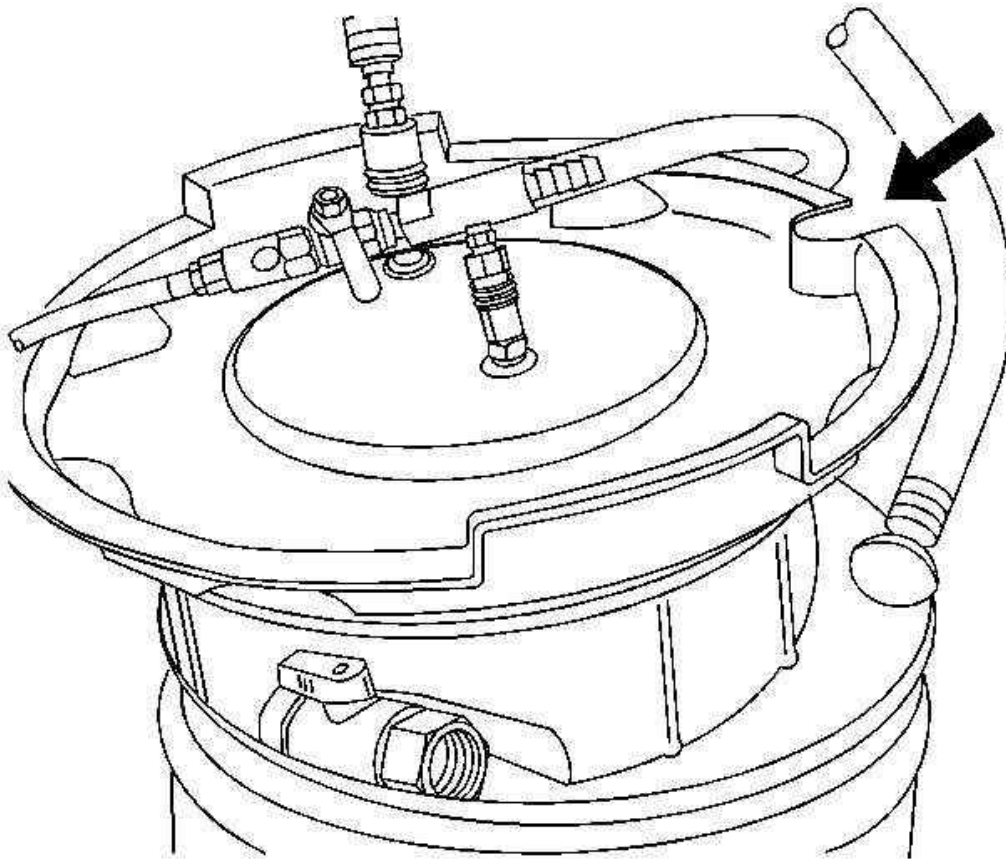


Fig. 8: View Of Graduated Reservoir & Hose
Courtesy of GENERAL MOTORS CORP.

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

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

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

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

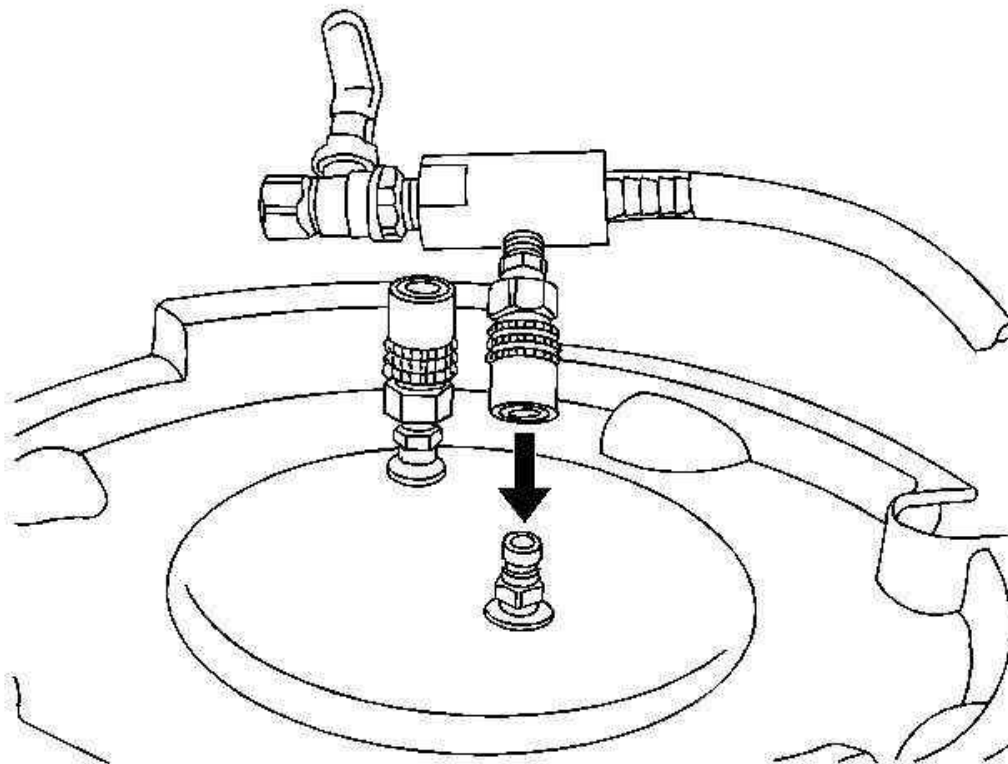


Fig. 9: View Of Venturi Assembly & Vacuum Tank
Courtesy of GENERAL MOTORS CORP.

8. Attach the venturi assembly to the vacuum tank.

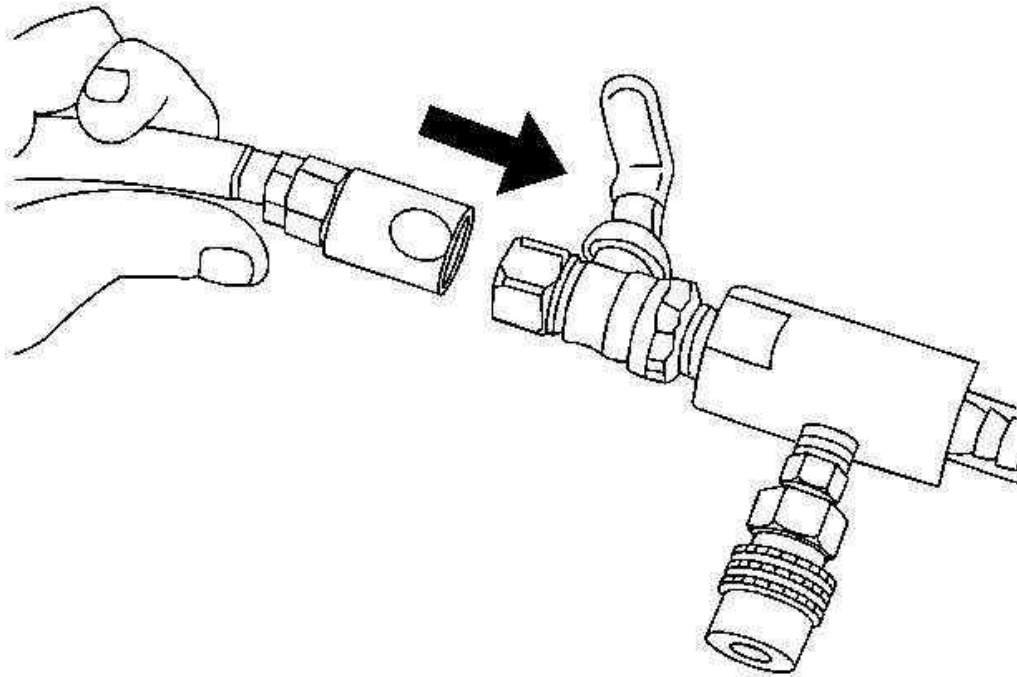


Fig. 10: View Of Shop Air Hose & Venturi Assembly
Courtesy of GENERAL MOTORS CORP.

9. Attach a shop air hose to the venturi assembly.
Ensure the valve on the venturi assembly is closed.

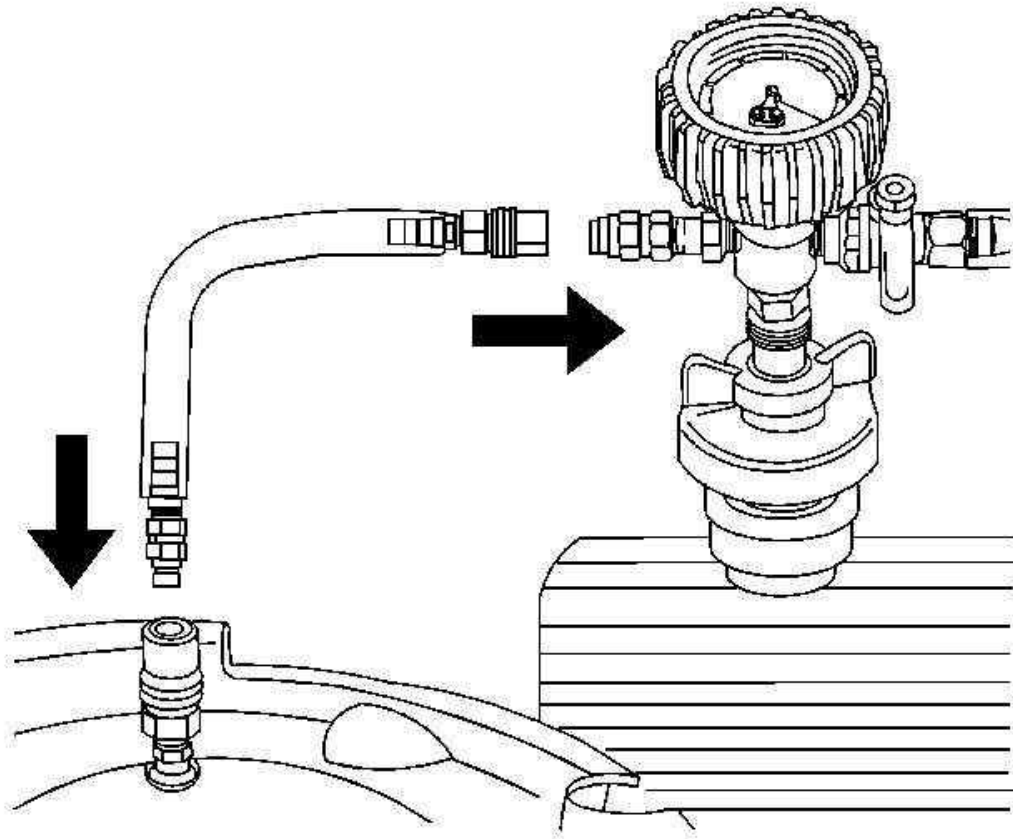


Fig. 11: Identifying Vacuum Hose To Vacuum Gage Assembly & Vacuum Tank

Courtesy of GENERAL MOTORS CORP.

10. Attach the vacuum hose to the vacuum gage assembly and the vacuum tank.

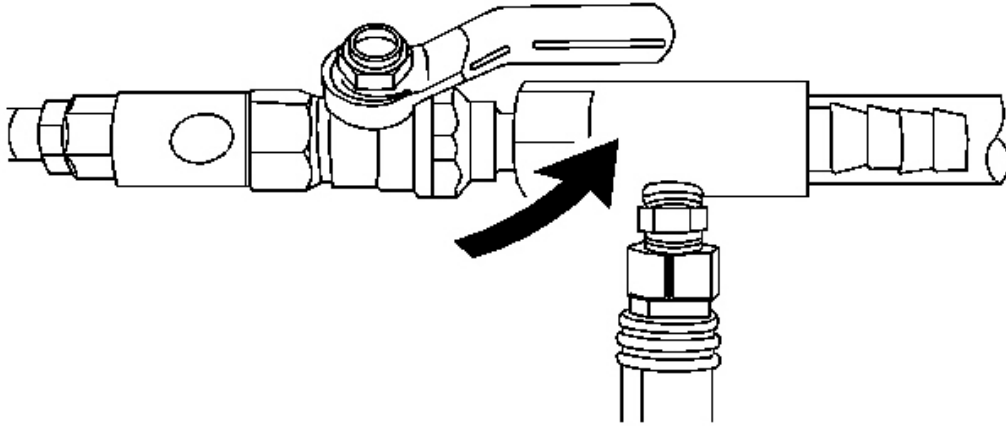


Fig. 12: Identifying Valve On Venturi Assembly
Courtesy of GENERAL MOTORS CORP.

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

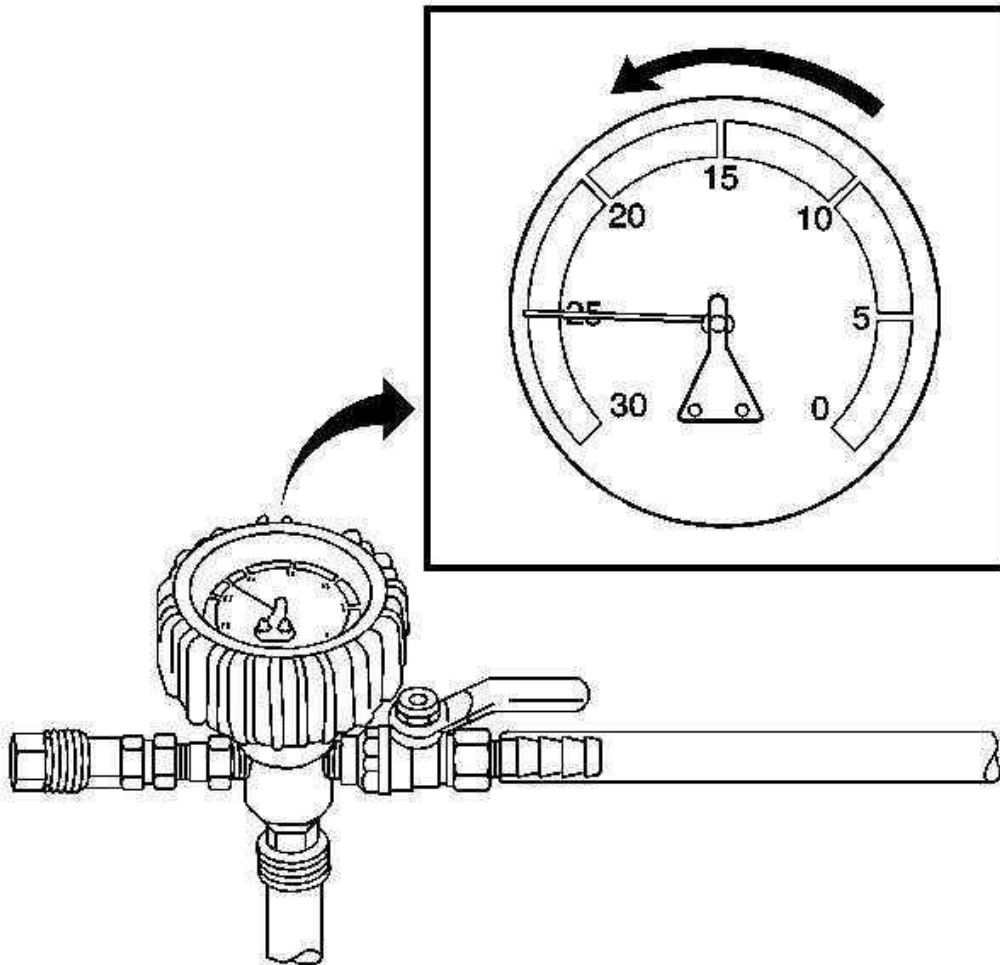


Fig. 13: View Of Vacuum Gauge
Courtesy of GENERAL MOTORS CORP.

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

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

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

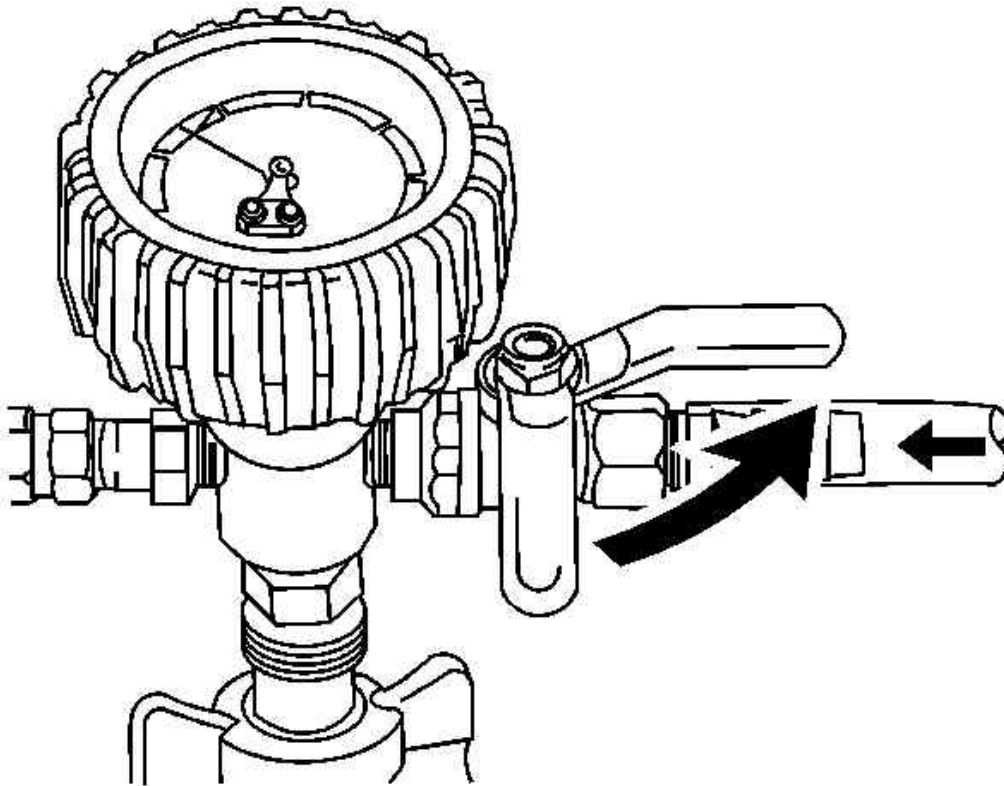


Fig. 14: Identifying Valve On Vacuum Gage Assembly
Courtesy of GENERAL MOTORS CORP.

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

If vacuum loss is observed. Refer to **Loss of Coolant**.

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

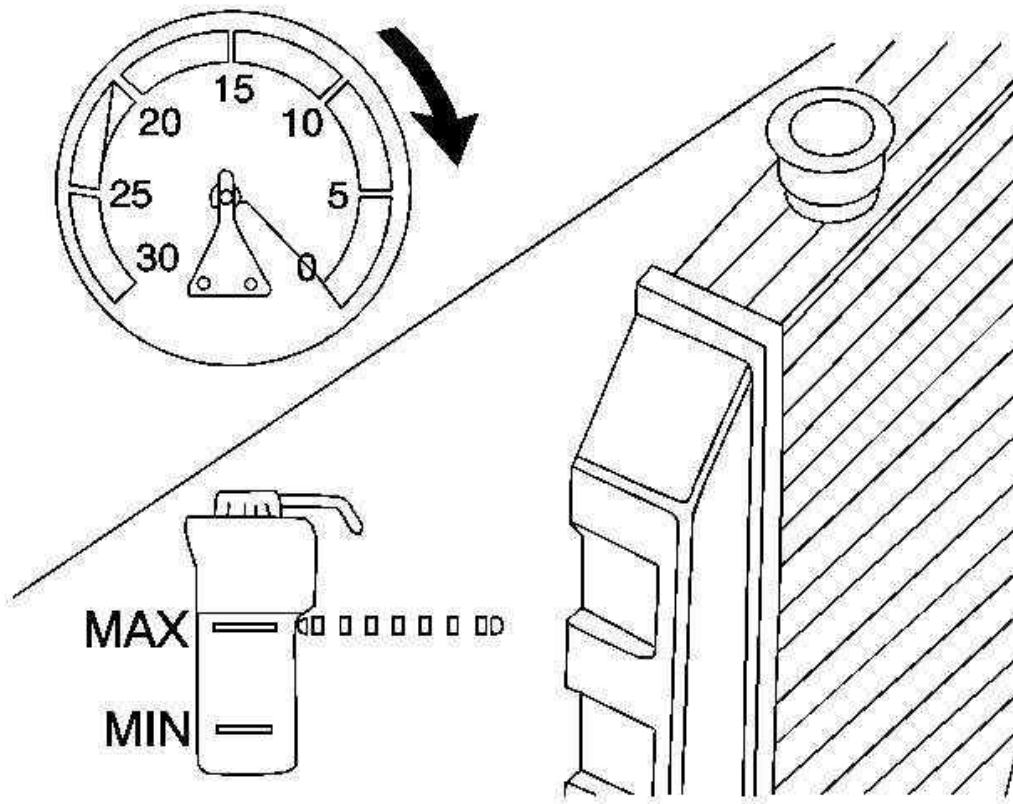


Fig. 15: View Of Vacuum Gauge & Radiator
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Complete 2 vacuum pulls to sufficiently fill the cooling system.

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

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

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

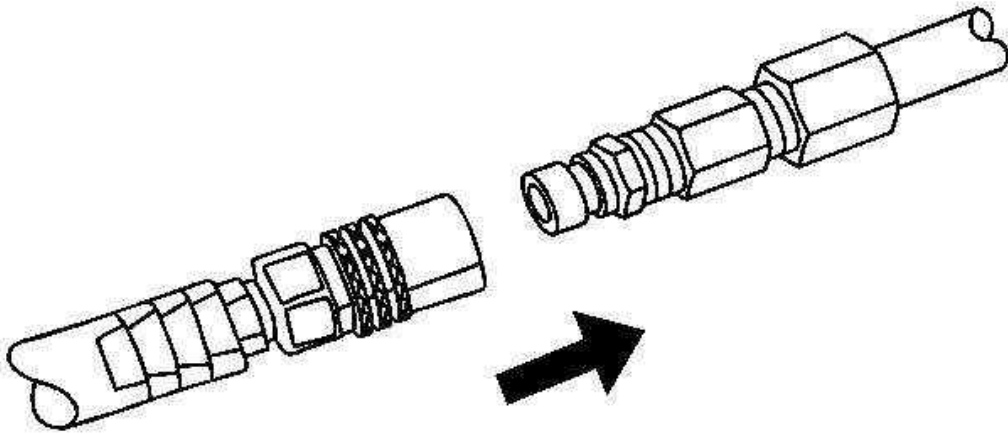


Fig. 16: Identifying Extraction Hose & Vacuum Hose
Courtesy of GENERAL MOTORS CORP.

24. Attach the extraction hose to the vacuum hose.

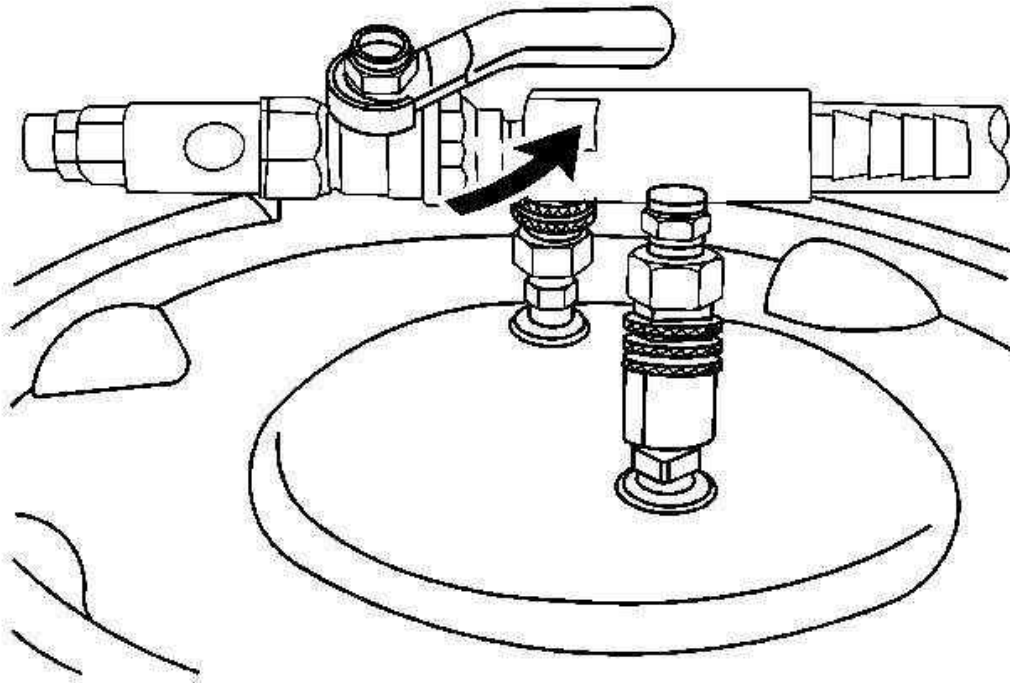


Fig. 17: Identifying Valve On Venturi Assembly
Courtesy of GENERAL MOTORS CORP.

25. Open the valve on the venturi assembly to start a vacuum draw.

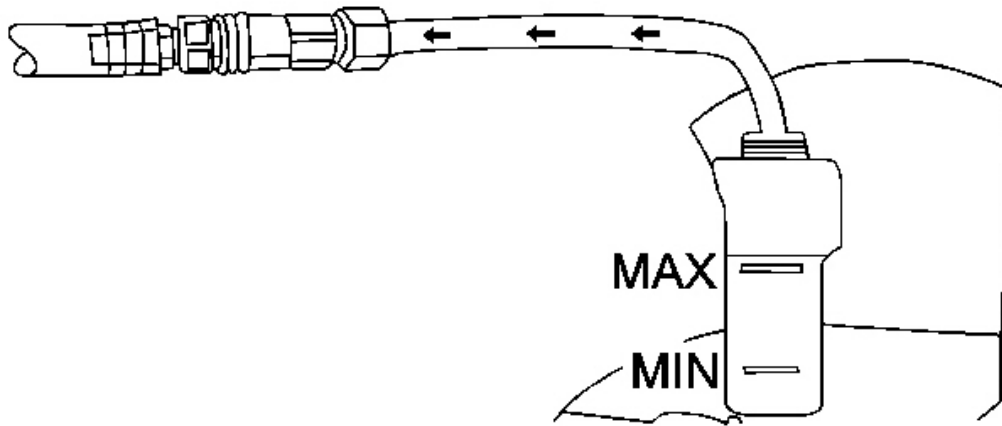


Fig. 18: Using Extraction Hose To Draw Out Coolant
Courtesy of GENERAL MOTORS CORP.

26. Use the extraction hose to draw out coolant to the proper level.
27. The vacuum tank has a drain valve on the bottom of the tank. Open the valve to drain coolant from the vacuum tank into a suitable container for disposal.
28. Fill the coolant recovery bottle to the indicator line, then add 400 milliliters (13.5 ounces) more.
29. Install the coolant pressure cap.
30. Start the engine and run it above 2500 RPM until it is hot enough to open the thermostat.
31. Complete a series of three, four-second-duration idles with four-second-duration 3000 RPM cycles.
32. Turn the engine off and allow it to cool down to room temperature.
33. Ensure the coolant recovery bottle is filled to the indicator line or above.

COOLING SYSTEM DRAINING AND FILLING (L26 STATIC FILL)

Tools Required

J 26568 Coolant and Battery Fluid Tester. See **Special Tools**.

Draining Procedure

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

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

1. Remove the coolant pressure cap.
2. Place a drain pan under the drain cock.
3. Open the radiator drain cock.
4. Drain the cooling system.
5. If a complete engine block drain is required, remove the knock sensors. Refer to **Knock Sensor 1 Replacement** and **Knock Sensor 2 Replacement** .
6. Inspect the coolant.
7. 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.

NOTE: Refer to **FASTENER NOTICE** .

1. Close the radiator drain cock.
2. If the engine block was drained, install the knock sensors. Refer to **Knock Sensor 1 Replacement** and **Knock Sensor 2 Replacement** .

3. Open the cooling system bleeder screw.

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

4. Slowly fill the cooling system with a 50/50 coolant mixture. Refer to **Approximate Fluid Capacities** .
5. After the coolant is visible and stable at the filler neck, push down on the upper radiator hose to remove air. While pushing down on the radiator hose ensure that the filler neck is full of coolant.
6. Close the cooling system bleeder screw.
7. Release the upper radiator hose and add coolant to the filler neck.
8. Push down on the upper radiator hose and try to move any air in the upper hose back to the radiator. Repeat this step three times and add coolant to the filler neck each time.
9. Install the coolant pressure cap.
10. Fill the coolant recovery bottle to the indicator line, then add 400 milliliters (13.5 ounces) more.
11. Start the engine.
12. Run the engine at 2,500 RPM until the engine is hot enough to open the thermostat.
13. Allow the engine to idle for 3 minutes.
14. Shut the engine OFF.
15. Allow the engine to cool.
16. Top off the coolant as necessary.
17. Inspect the concentration of the engine coolant using the **J 26568** . See **Special Tools**.
18. Rinse away any excess coolant from the engine and the engine compartment.

COOLING SYSTEM DRAINING AND FILLING (LY7 STATIC FILL)

Tools Required

J 26568 Coolant and Battery Fluid Tester. See **Special Tools**.

Draining Procedure

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

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

1. Remove the coolant pressure cap.
2. Place a drain pan under the drain cock.
3. Open the radiator drain cock.
4. Drain the cooling system.
5. If a complete engine block drain is required, remove the coolant drain plugs from the engine block. Refer to **Engine Block Disassemble** .
6. Inspect the coolant.
7. 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.

NOTE: Refer to **FASTENER NOTICE** .

1. Close the radiator drain cock.
2. If a complete engine block drain was required, install the coolant drain plugs to the engine block. Refer to **Engine Block Disassemble** .

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

3. Slowly fill the cooling system with a 50/50 coolant mixture until the coolant level is visible and stable. Refer to **Approximate Fluid Capacities**
4. Install the pressure cap loosely (threaded on about one turn).
5. Start the engine and raise the engine speed to 2,500 RPM and hold it there for 40 seconds, then shut engine off.
6. Remove the pressure cap and fill the coolant system until the level is visible and stable.
7. Install the pressure cap loosely (threaded on about one turn).
8. Start the engine and raise the engine speed to 2,500 RPM and hold it there for 30 seconds, then shut engine off.
9. Remove the pressure cap and fill the coolant system until the level is visible and stable.
10. Install the pressure cap loosely (threaded on about one turn).
11. Start the engine and raise the engine speed to 2,500 RPM and hold it there for 20 seconds, then shut engine off.
12. Remove the pressure cap and fill the coolant system until the level is visible and stable.
13. Install the pressure cap, fully threaded on.
14. Fill the coolant recovery bottle to the indicator line, then add 400 milliliters (13.5 ounces) more.
15. Start the engine and run it above 2500 RPM until it is hot enough to open the thermostat, this will allow the trapped air to be purged from the engine.
16. Complete a series of three, four-second-duration idles with four-second-duration 3000 RPM cycles.
17. Turn the engine off and allow it to cool down.
18. Fill the coolant recovery bottle to the indicator line.
19. Inspect the concentration of the engine coolant using the **J 26568** . See **Special Tools**.
20. Rinse away any excess coolant from the engine and the engine compartment.

COOLING SYSTEM DRAINING AND FILLING (LS4 GE47716 FILL)

Tools Required

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

Draining Procedure

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

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

1. Remove the coolant pressure cap.
2. Place a drain pan under the drain cock.
3. Open the radiator drain cock.
4. Drain the cooling system.
5. If a complete engine block drain is required, remove the engine block drain plugs. Refer to **Draining Fluids and Oil Filter Removal** .
6. Inspect the coolant.
7. 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**.

Vac-N-Fill Procedure

1. If a complete engine block drain was required, install the engine block drain plugs. Refer to **Draining Fluids and Oil Filter Removal** .

IMPORTANT: To prevent boiling of the coolant/water mixture in the vehicle's cooling system, do not apply vacuum to a cooling system above 49°C (120°F). The tool will not operate properly when the coolant is boiling.

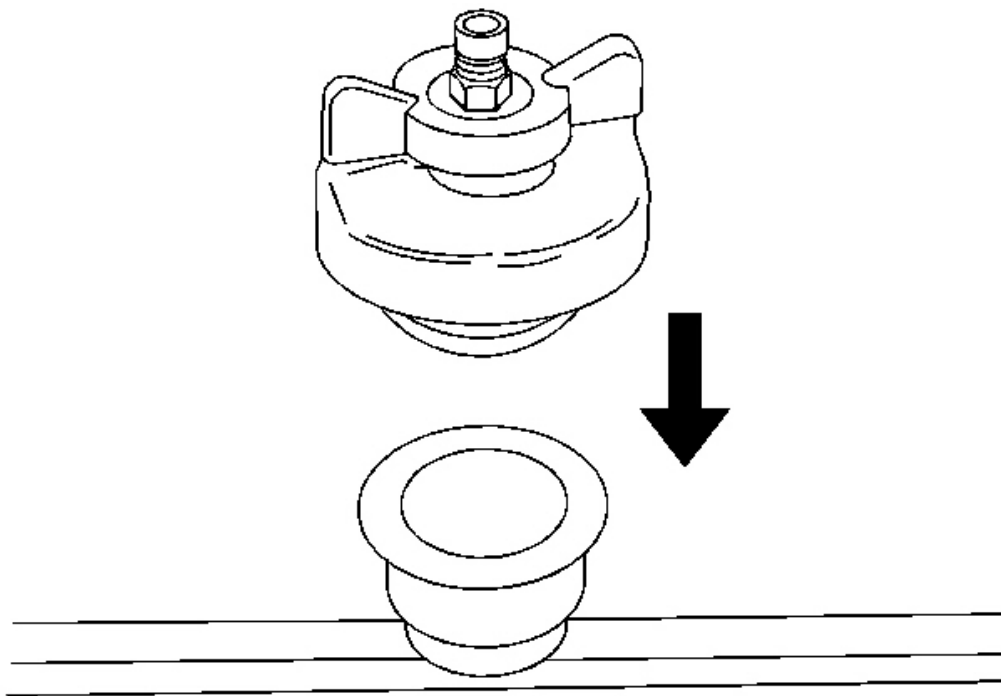


Fig. 19: Identifying Vac-N-Fill Cap
Courtesy of GENERAL MOTORS CORP.

2. Install the **J 42401** to the coolant fill port. See **Special Tools**.

Attach the Vac N Fill cap to the **J 42401** . See **Special Tools**.

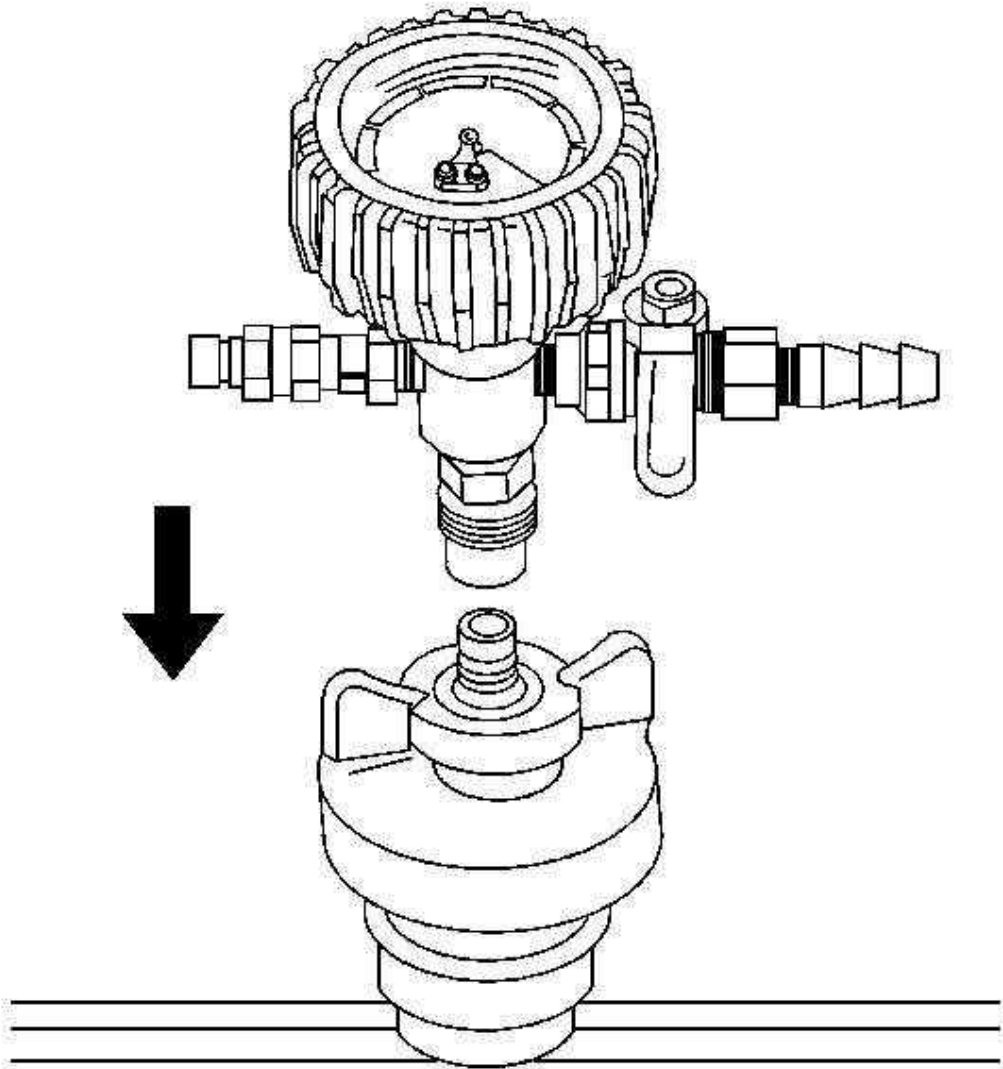


Fig. 20: Attaching Vacuum Gage Assembly To Vac-N-Fill Cap
Courtesy of GENERAL MOTORS CORP.

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

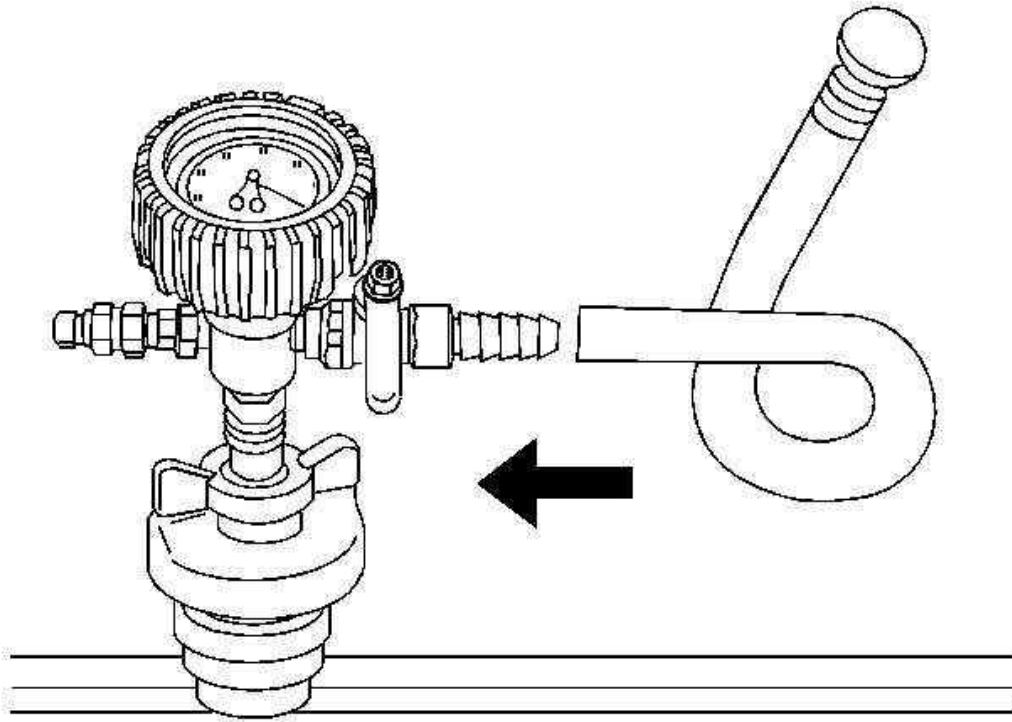


Fig. 21: View Of Fill Hose & Vacuum Gage Assembly
Courtesy of GENERAL MOTORS CORP.

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

Ensure that the valve is closed.

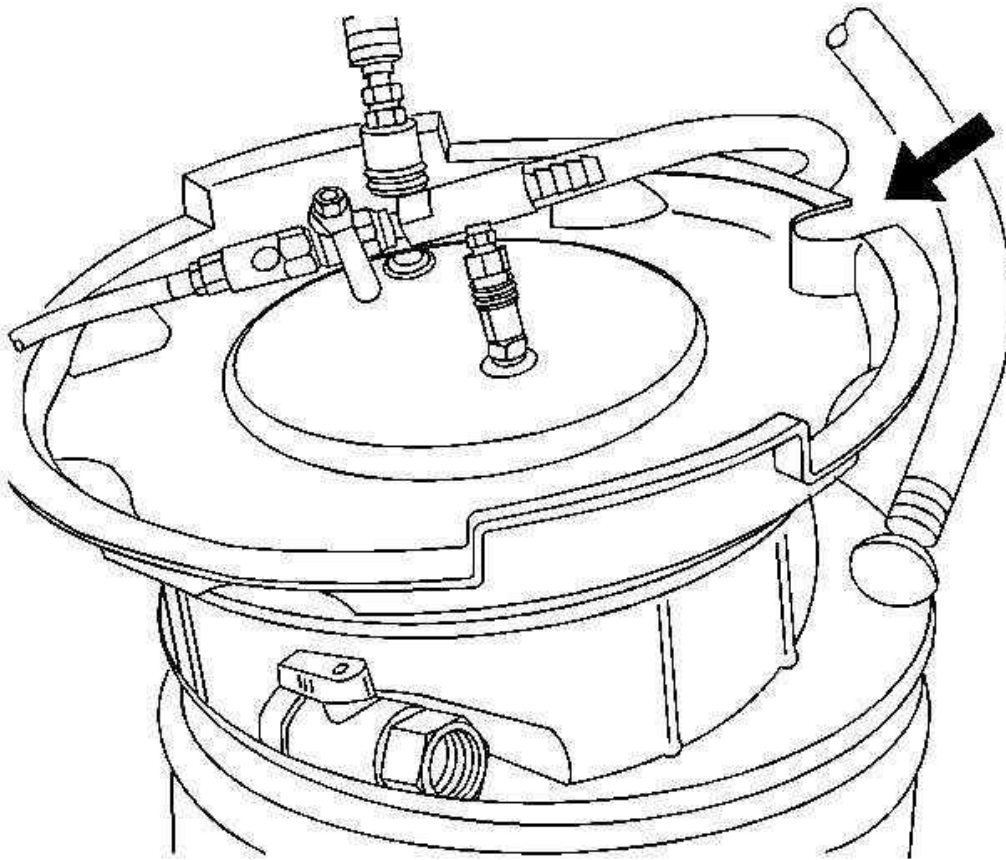


Fig. 22: View Of Graduated Reservoir & Hose
Courtesy of GENERAL MOTORS CORP.

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

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

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

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

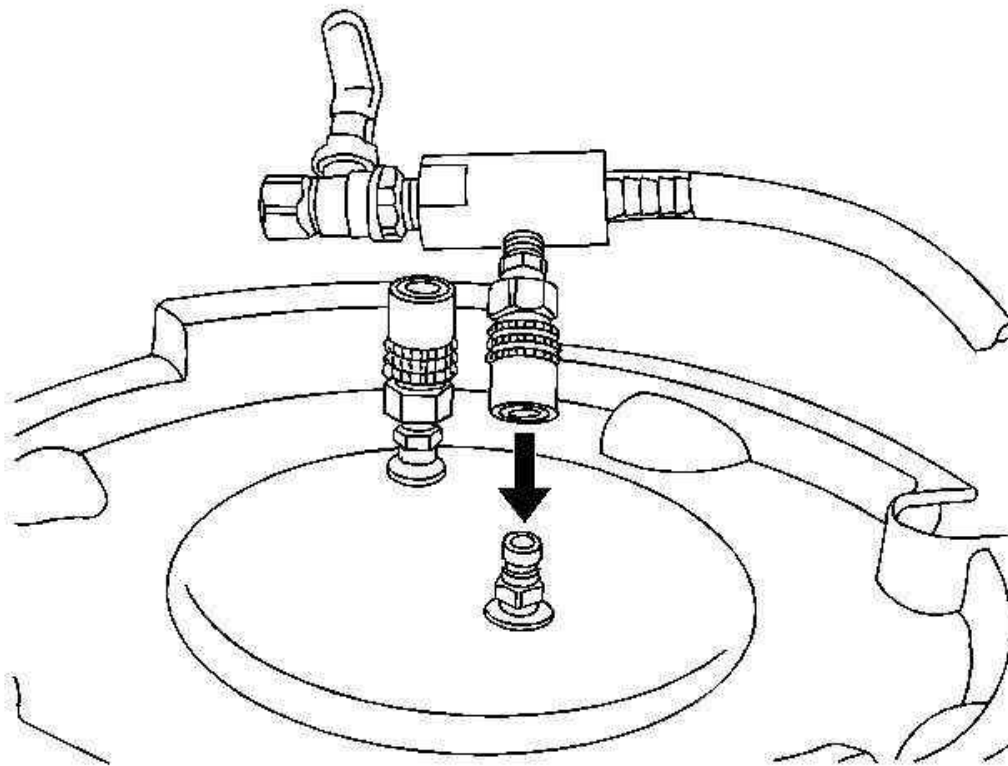


Fig. 23: View Of Venturi Assembly & Vacuum Tank
Courtesy of GENERAL MOTORS CORP.

8. Attach the venturi assembly to the vacuum tank.

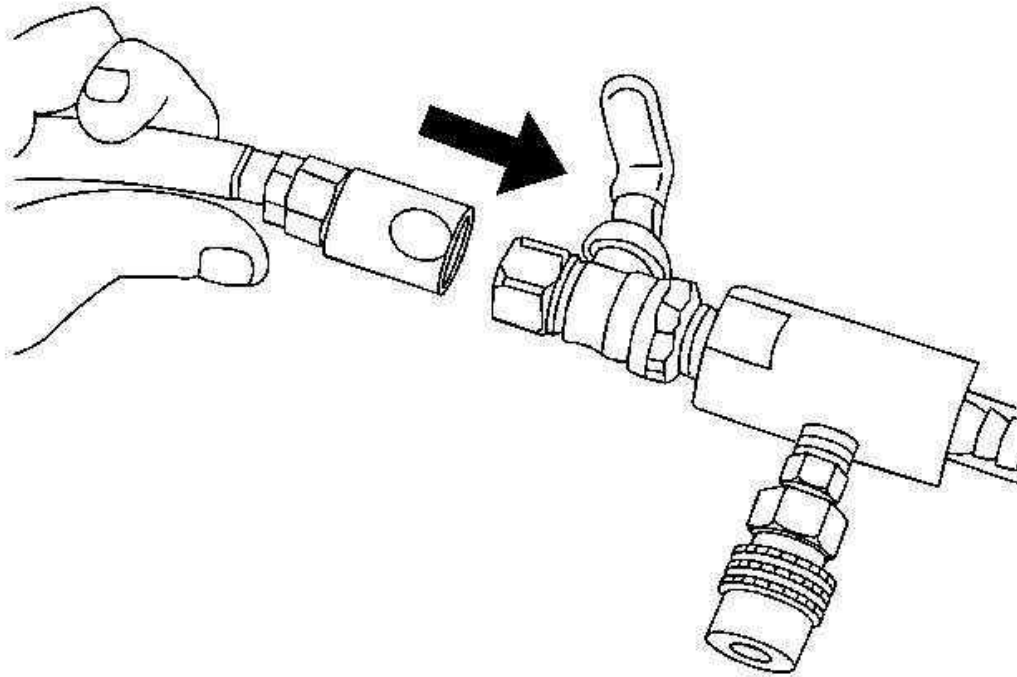


Fig. 24: View Of Shop Air Hose & Venturi Assembly
Courtesy of GENERAL MOTORS CORP.

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

Ensure the valve on the venturi assembly is closed.

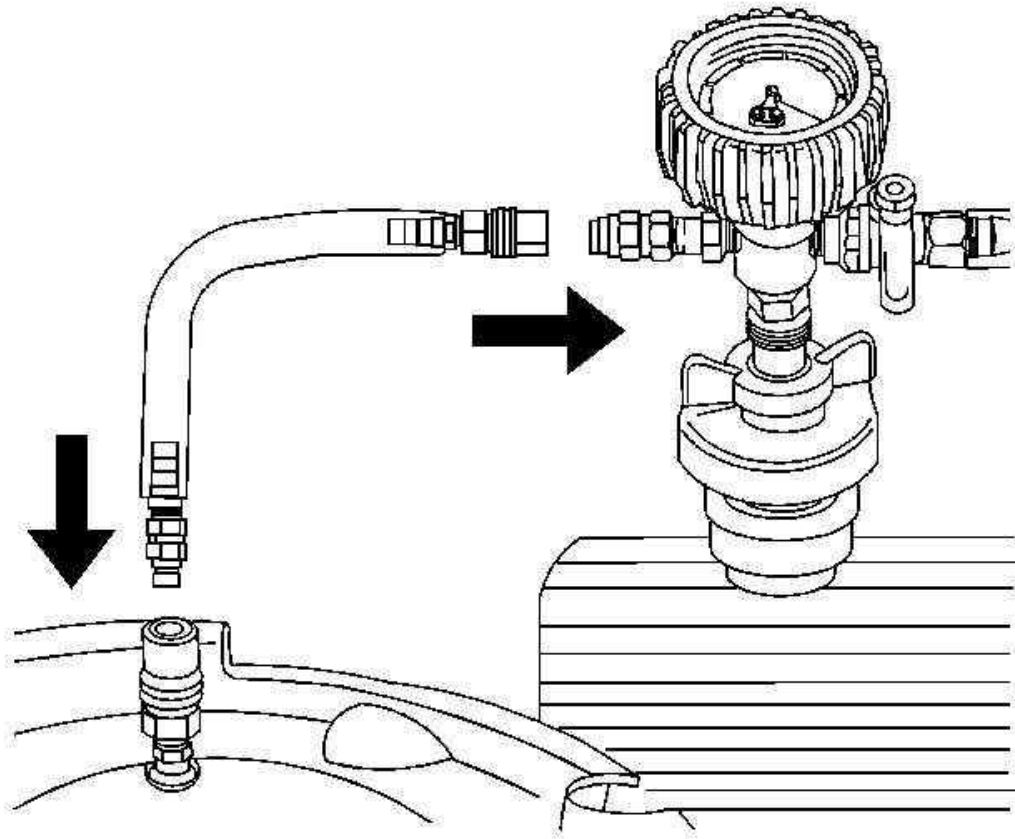


Fig. 25: Identifying Vacuum Hose To Vacuum Gage Assembly & Vacuum Tank

Courtesy of GENERAL MOTORS CORP.

10. Attach the vacuum hose to the vacuum gage assembly and the vacuum tank.

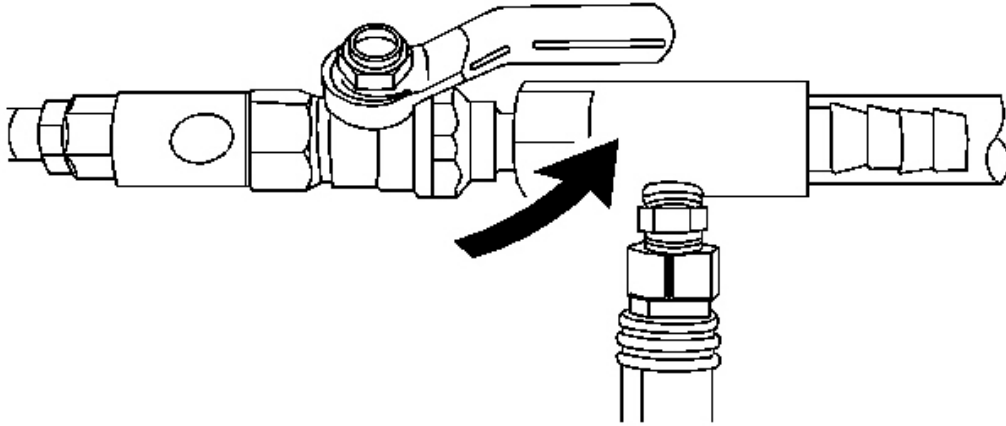


Fig. 26: Identifying Valve On Venturi Assembly
Courtesy of GENERAL MOTORS CORP.

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

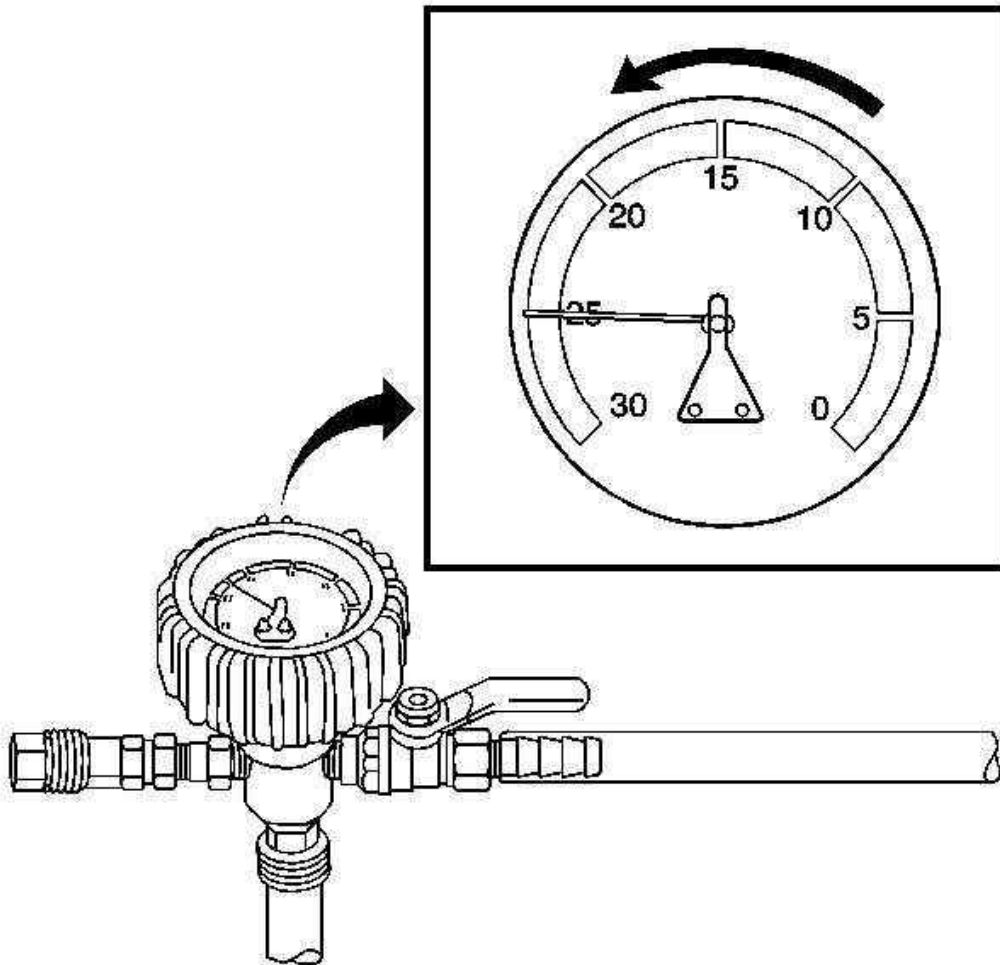


Fig. 27: View Of Vacuum Gauge
Courtesy of GENERAL MOTORS CORP.

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

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

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

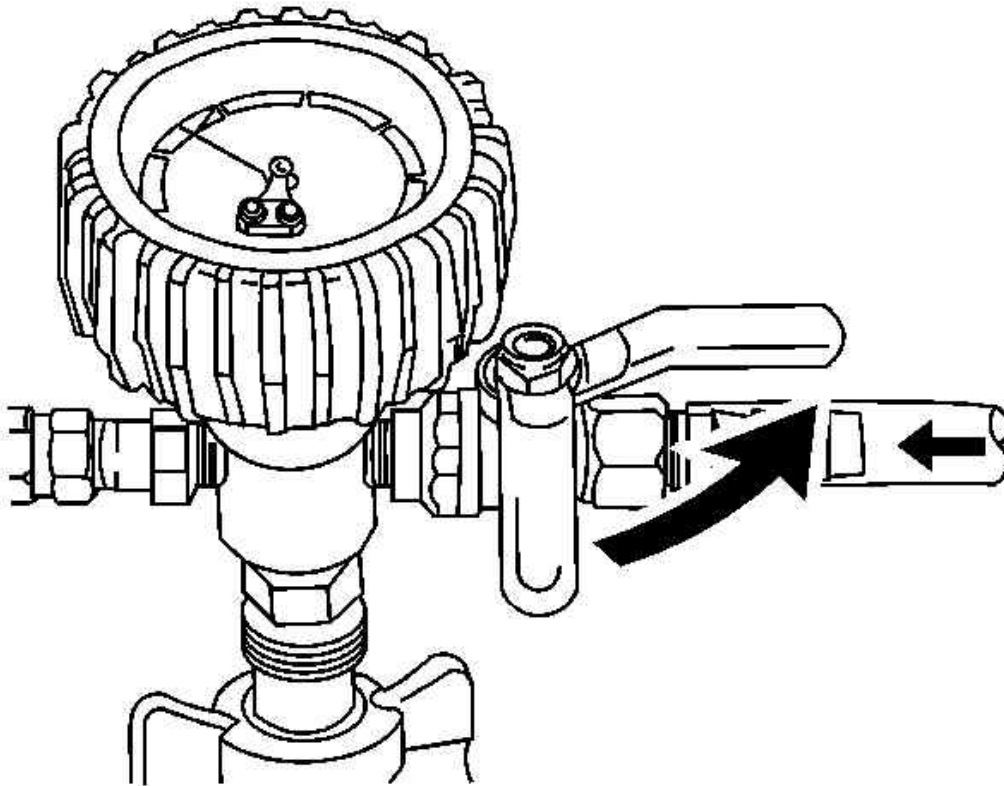


Fig. 28: Identifying Valve On Vacuum Gage Assembly
Courtesy of GENERAL MOTORS CORP.

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

If vacuum loss is observed. Refer to **Loss of Coolant**.

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

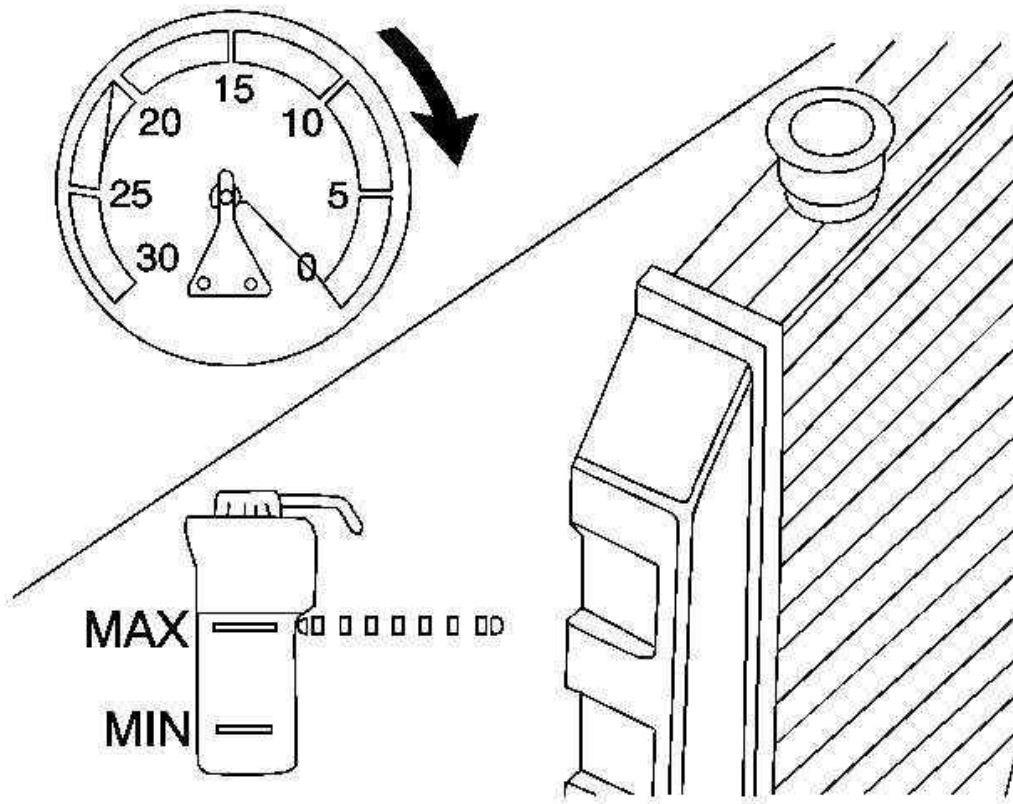


Fig. 29: View Of Vacuum Gauge & Radiator
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Complete 2 vacuum pulls to sufficiently fill the cooling system.

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

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

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

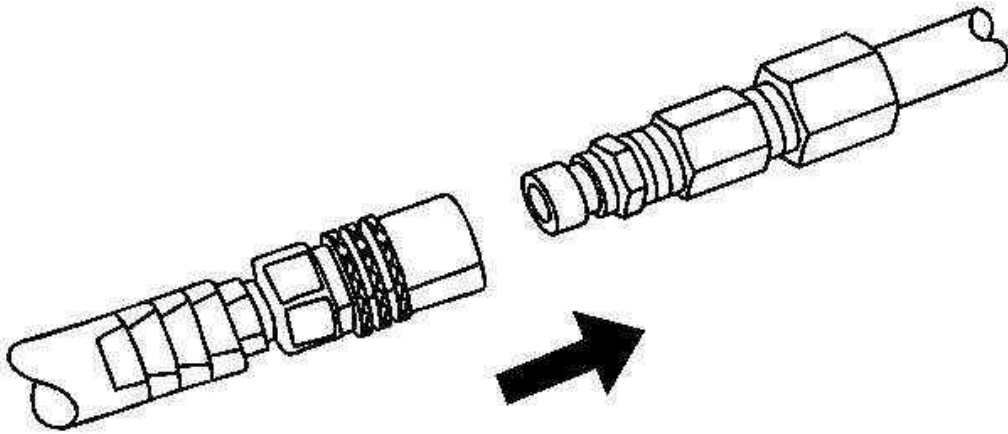


Fig. 30: Identifying Extraction Hose & Vacuum Hose
Courtesy of GENERAL MOTORS CORP.

24. Attach the extraction hose to the vacuum hose.

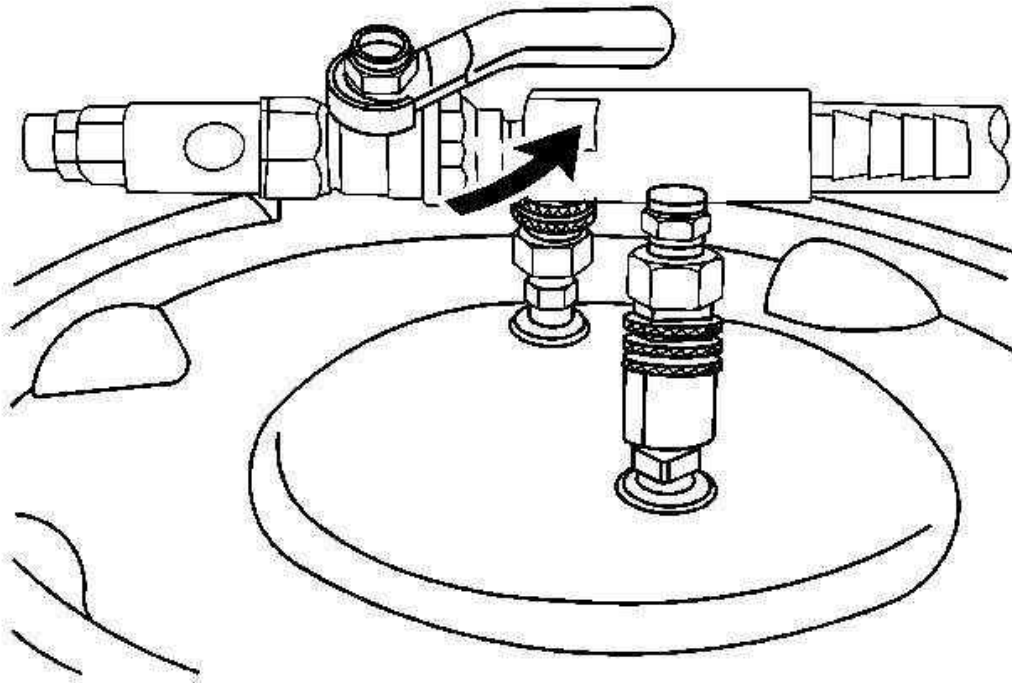


Fig. 31: Identifying Valve On Venturi Assembly
Courtesy of GENERAL MOTORS CORP.

25. Open the valve on the venturi assembly to start a vacuum draw.

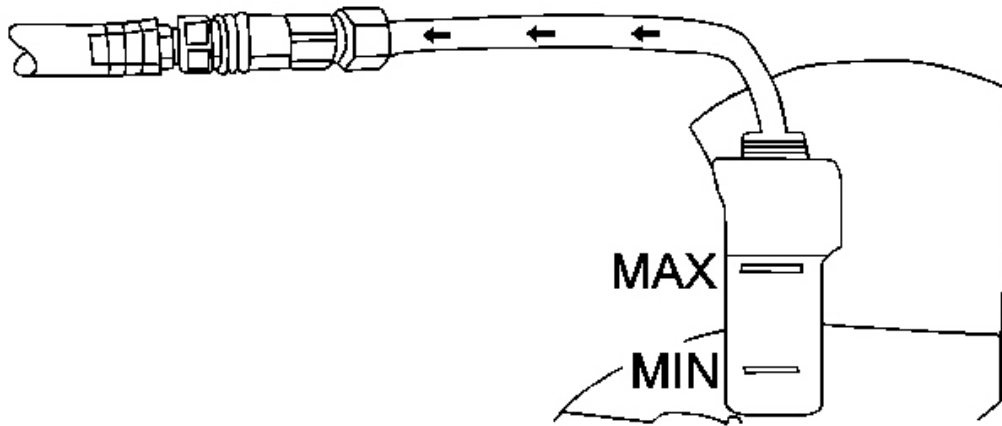


Fig. 32: Using Extraction Hose To Draw Out Coolant
Courtesy of GENERAL MOTORS CORP.

26. Use the extraction hose to draw out coolant to the proper level.
27. The vacuum tank has a drain valve on the bottom of the tank. Open the valve to drain coolant from the vacuum tank into a suitable container for disposal.
28. Fill the coolant recovery bottle to the indicator line, then add 400 milliliters (13.5 ounces) more.
29. Install the coolant pressure cap.
30. Start the engine and run it above 2500 RPM until it is hot enough to open the thermostat.
31. Complete a series of 3, 4-second-duration idles with 4-second-duration 3,000 RPM cycles.
32. Turn the engine OFF and allow it to cool down to room temperature.
33. Ensure the coolant recovery bottle is filled to the indicator line or above.

COOLING SYSTEM DRAINING AND FILLING (LS4 STATIC FILL)

Tools Required

J 26568 Coolant and Battery Tester. See **Special Tools**.

Draining Procedure

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

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

1. Remove the coolant pressure cap.
2. Place a drain pan under the drain cock.
3. Open the radiator drain cock.
4. Drain the cooling system.
5. If a complete engine block drain is required, remove the coolant drain plugs from the engine block. Refer to **Draining Fluids and Oil Filter Removal** .
6. Inspect the coolant.
7. 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.

NOTE: Refer to **FASTENER NOTICE** .

1. Close the radiator drain cock.
2. If a complete engine block drain was required, install the coolant drain plugs to the engine block. Refer to **Draining Fluids and Oil Filter Removal** .

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

3. Slowly fill the cooling system with a 50/50 coolant mixture until the coolant level is visible and stable. Refer to **Approximate Fluid Capacities** .
4. Install the pressure cap loosely (threaded on about one turn).
5. Start the engine and raise the engine speed to 2,500 RPM and hold it there for 40 seconds, then shut engine off.
6. Remove the pressure cap and fill the coolant system until the level is visible and stable.
7. Install the pressure cap loosely (threaded on about one turn).
8. Start the engine and raise the engine speed to 2,500 RPM and hold it there for 30 seconds, then shut engine off.
9. Remove the pressure cap and fill the coolant system until the level is visible and stable.
10. Install the pressure cap loosely (threaded on about one turn).
11. Start the engine and raise the engine speed to 2,500 RPM and hold it there for 20 seconds, then shut engine off.
12. Remove the pressure cap and fill the coolant system until the level is visible and stable.
13. Install the pressure cap, fully threaded on.
14. Fill the coolant recovery bottle to the indicator line, then add 400 milliliters (13.5 ounces) more.
15. Start the engine and run it above 2500 RPM until it is hot enough to open the thermostat, this will allow the trapped air to be purged from the engine.
16. Complete a series of three, four-second-duration idles with four-second-duration 3000 RPM cycles.
17. Turn the engine off and allow it to cool down.
18. Fill the coolant recovery bottle to the indicator line.
19. Inspect the concentration of the engine coolant using the **J 26568** . See **Special Tools**.
20. Rinse away any excess coolant from the engine and the engine compartment.

FLUSHING

IMPORTANT: Do not use a chemical flush.

Store used coolant in a properly labeled container. Do not pour used coolant down a drain. Ethylene glycol antifreeze is a very toxic chemical. Do not dispose of coolant into the sewer system or ground water. This is illegal and ecologically unsound.

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

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

1. Drain the cooling system. Refer to **Cooling System Draining and Filling (L26, LY7 GE 47716 Fill)** or **Cooling System Draining and Filling (L26 Static Fill)** or **Cooling System Draining and Filling (LY7 Static Fill)** or **Cooling System Draining and Filling (LS4 GE47716 Fill)** or **Cooling System Draining and Filling (LS4 Static Fill)**.
2. Remove the coolant recovery reservoir. Refer to **Coolant Recovery Reservoir Replacement (L27, LY7)** or **Coolant Recovery Reservoir Replacement (LS4)**.
3. Clean and flush the coolant recovery reservoir with clean, drinkable water.
4. Install the coolant recovery reservoir. Refer to **Coolant Recovery Reservoir Replacement (L27, LY7)** or **Coolant Recovery Reservoir Replacement (LS4)**.
5. Follow the drain and fill procedure using only clean, drinkable water. Refer to **Cooling System Draining and Filling (L26, LY7 GE 47716 Fill)** or **Cooling System Draining and Filling (L26 Static Fill)** or **Cooling System Draining and Filling (LY7 Static Fill)** or **Cooling System Draining and Filling (LS4 GE47716 Fill)** or **Cooling System Draining and Filling (LS4 Static Fill)**.
6. Run the engine for 20 minutes.
7. Stop the engine.
8. Drain the cooling system. Refer to **Cooling System Draining and Filling**

(L26, LY7 GE 47716 Fill) or Cooling System Draining and Filling (L26 Static Fill) or Cooling System Draining and Filling (LY7 Static Fill) or Cooling System Draining and Filling (LS4 GE47716 Fill) or Cooling System Draining and Filling (LS4 Static Fill).

9. Repeat the procedure if necessary, until the fluid is nearly colorless.
10. Fill the cooling system. Refer to **Cooling System Draining and Filling (L26, LY7 GE 47716 Fill) or Cooling System Draining and Filling (L26 Static Fill) or Cooling System Draining and Filling (LY7 Static Fill) or Cooling System Draining and Filling (LS4 GE47716 Fill) or Cooling System Draining and Filling (LS4 Static Fill).**

RADIATOR CLEANING

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

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

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

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

COOLANT RECOVERY RESERVOIR REPLACEMENT (L27, LY7)

Removal Procedure

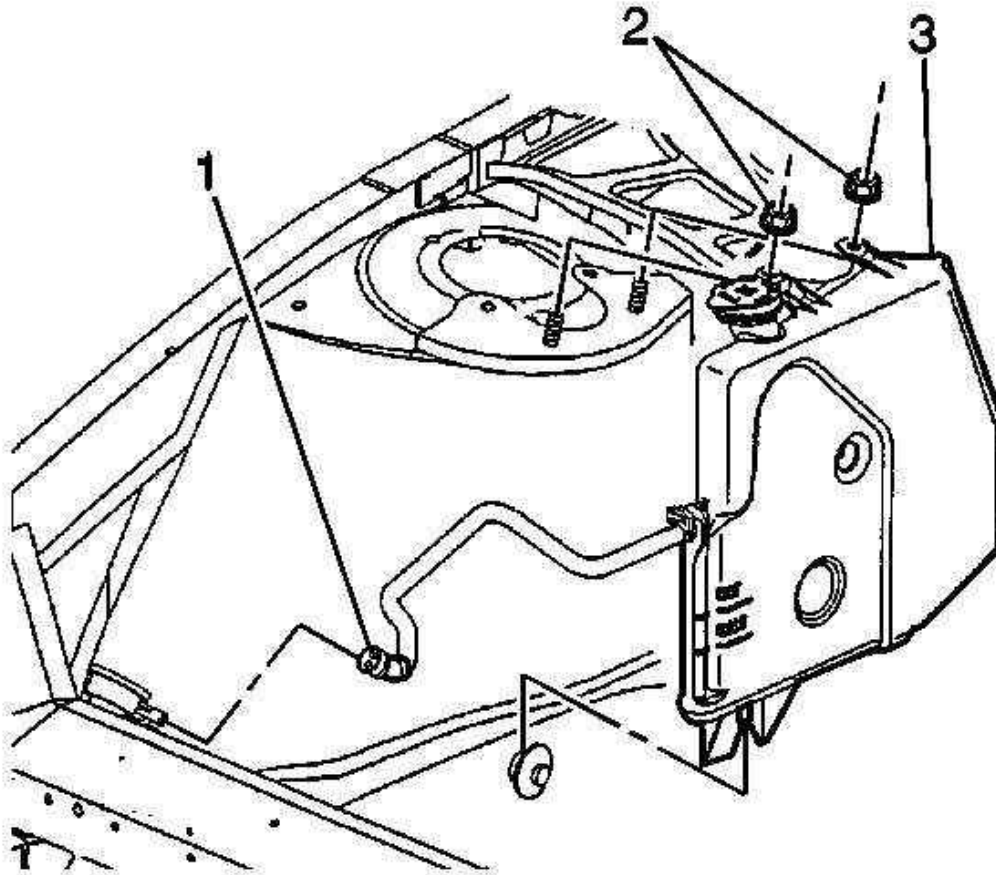


Fig. 33: Identifying Coolant Recovery Reservoir
Courtesy of GENERAL MOTORS CORP.

1. Reposition the coolant reservoir hose clamp (1) aside at the radiator overflow fitting.
2. Remove the coolant reservoir hose from the radiator overflow fitting.
3. Disconnect the coolant reservoir hose support retainer from the electrical harness.
4. Remove the coolant reservoir nuts (2) from the shock tower studs.
5. Remove the coolant recovery reservoir (3) from the lower retainer and the shock tower studs.

6. Drain the coolant from the recovery reservoir into a clean container.

Installation Procedure

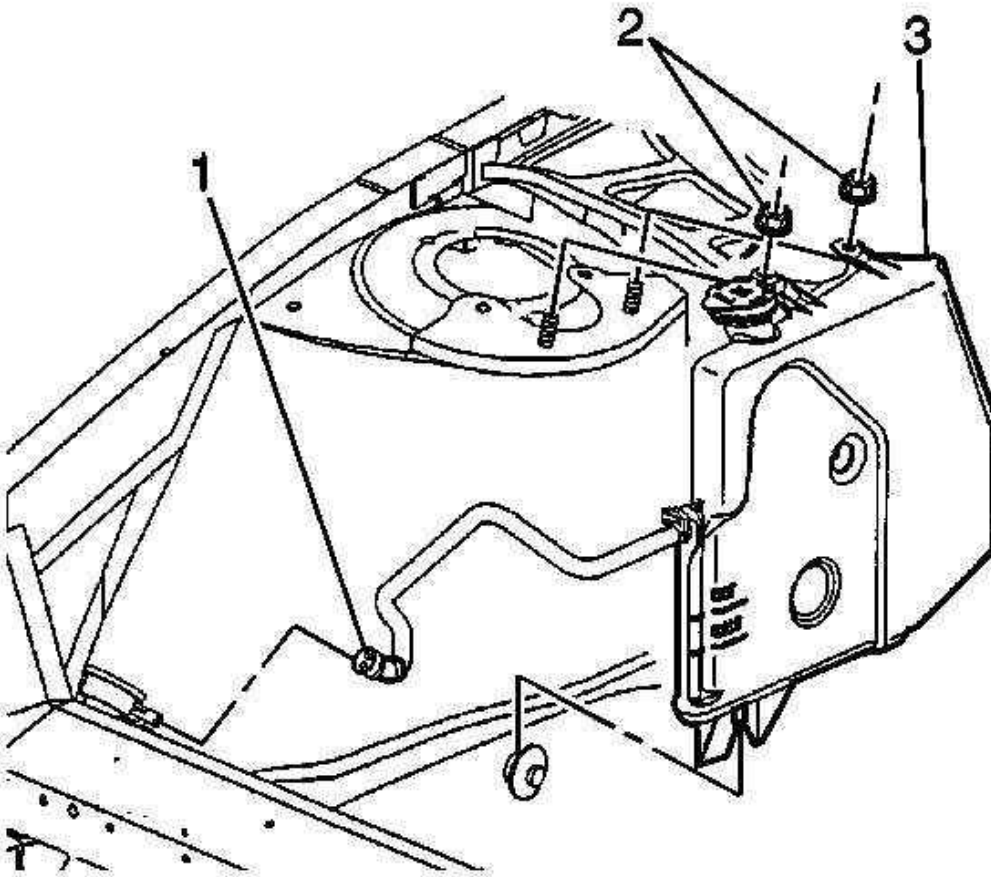


Fig. 34: Identifying Coolant Recovery Reservoir
Courtesy of GENERAL MOTORS CORP.

1. Install the coolant recovery reservoir (3) to the lower retainer and the shock tower studs.

NOTE: Refer to Fastener Notice .

2. Install the nuts (2) to the shock tower studs.

Tighten: Tighten the nuts to 3.3 N.m (29 lb in).

3. Lubricate the reservoir hose with clean water. Route the hose to the radiator overflow neck fitting.

IMPORTANT: The hose end must be flush against the radiator filler neck. Seat the clamp squarely between the radiator filler neck and the flared end of the fitting.

4. Install the coolant reservoir hose (1) to the radiator overflow fitting.
5. Connect the coolant reservoir hose support retainer to the electrical harness.
6. Position the coolant reservoir hose clamp to the radiator overflow fitting.
7. Fill the coolant recovery reservoir to the proper level.

COOLANT RECOVERY RESERVOIR REPLACEMENT (LS4)

Removal Procedure

1. Remove the front fender upper diagonal brace. Refer to **Front Fender Upper Diagonal Brace Replacement** .

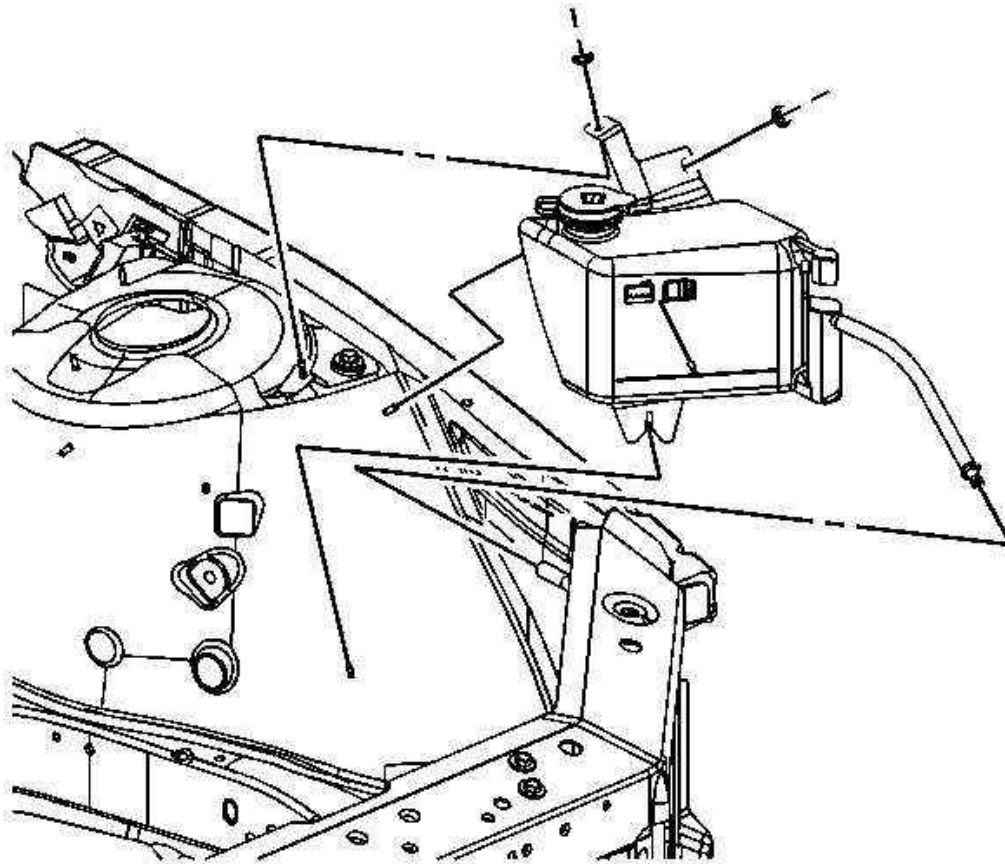


Fig. 35: View Of Coolant Recovery Reservoir
Courtesy of GENERAL MOTORS CORP.

2. Reposition the coolant recovery reservoir hose clamp aside at the radiator overflow fitting.
3. Disconnect the coolant recovery reservoir hose from the radiator overflow hose.
4. Remove the coolant recovery reservoir nuts from the shock tower studs.
5. Remove the coolant recovery reservoir from the lower retainer and the shock tower studs.
6. Drain the coolant from the coolant recovery reservoir into a clean container.

Installation Procedure

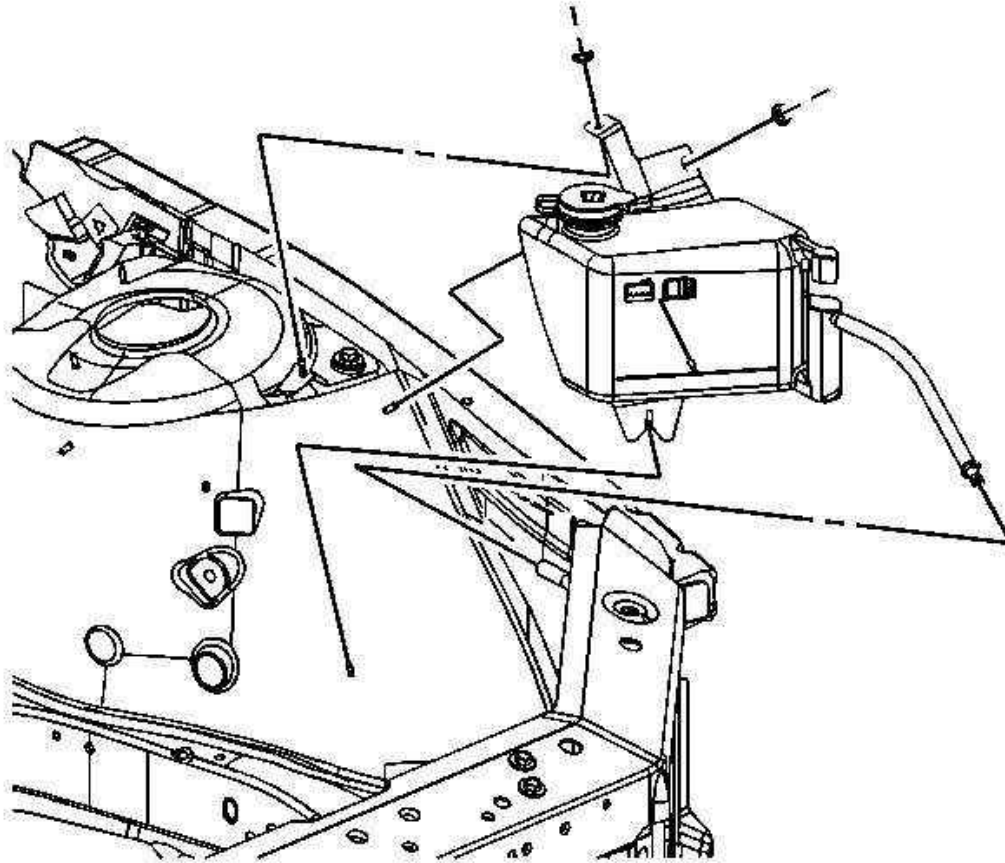


Fig. 36: View Of Coolant Recovery Reservoir
Courtesy of GENERAL MOTORS CORP.

1. Install the coolant recovery reservoir to the lower retainer and the shock tower studs.

NOTE: Refer to Fastener Notice .

2. Install the nuts to the shock tower studs.

Tighten: Tighten the nuts to 3.3 N.m (29 lb in).

3. Lubricate the reservoir hose with clean water. Install the coolant reservoir hose to the radiator overflow hose.
4. Position the coolant reservoir hose clamp to the radiator overflow hose fitting.
5. Install the front fender upper diagonal brace. Refer to **Front Fender Upper Diagonal Brace Replacement** .
6. Fill the coolant recovery reservoir to the proper level. Refer to **Cooling System Draining and Filling (L26, LY7 GE 47716 Fill)** or **Cooling System Draining and Filling (L26 Static Fill)** or **Cooling System Draining and Filling (LY7 Static Fill)** or **Cooling System Draining and Filling (LS4 GE47716 Fill)** or **Cooling System Draining and Filling (LS4 Static Fill)**.

RADIATOR INLET HOSE REPLACEMENT (L26)

Tools Required

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

Removal Procedure

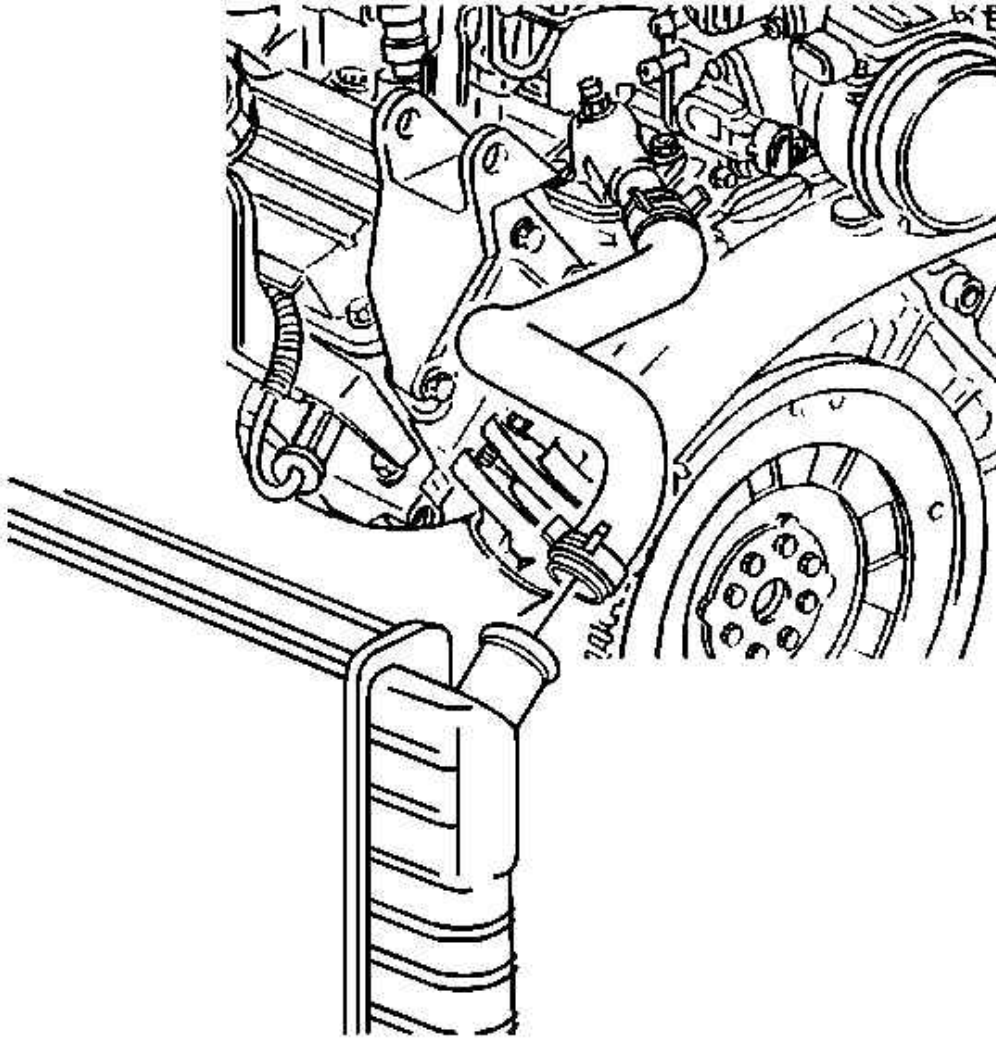


Fig. 37: Identifying Radiator Inlet Hose (3.8L)
Courtesy of GENERAL MOTORS CORP.

1. Partially drain the cooling system. Refer to **Cooling System Draining and Filling (L26, LY7 GE 47716 Fill)** or **Cooling System Draining and Filling (L26 Static Fill)** or **Cooling System Draining and Filling (LY7 Static Fill)** or **Cooling System Draining and Filling (LS4 GE47716 Fill)** or **Cooling System Draining and Filling (LS4 Static Fill)**.

2. Remove the left diagonal brace. Refer to **Front Fender Upper Diagonal Brace Replacement** .
3. Use the **J 38185** in order to reposition the hose clamp from the radiator. See **Special Tools**.
4. Remove the radiator inlet hose from the radiator.

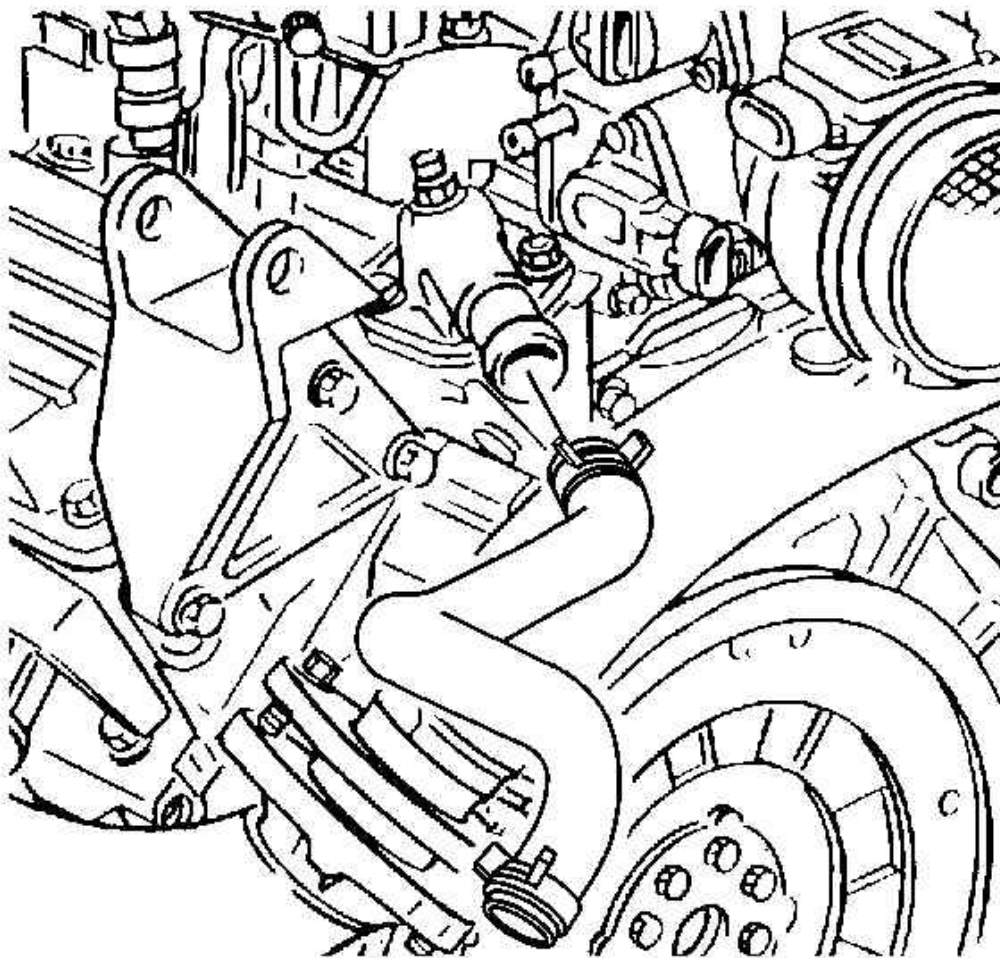


Fig. 38: View Of Radiator Inlet Hose To Water Outlet Housing
Courtesy of GENERAL MOTORS CORP.

5. Use the **J 38185** in order to reposition the hose clamp from the water outlet

housing. See **Special Tools**.

6. Remove the radiator inlet hose from the water outlet housing and the vehicle.

Installation Procedure

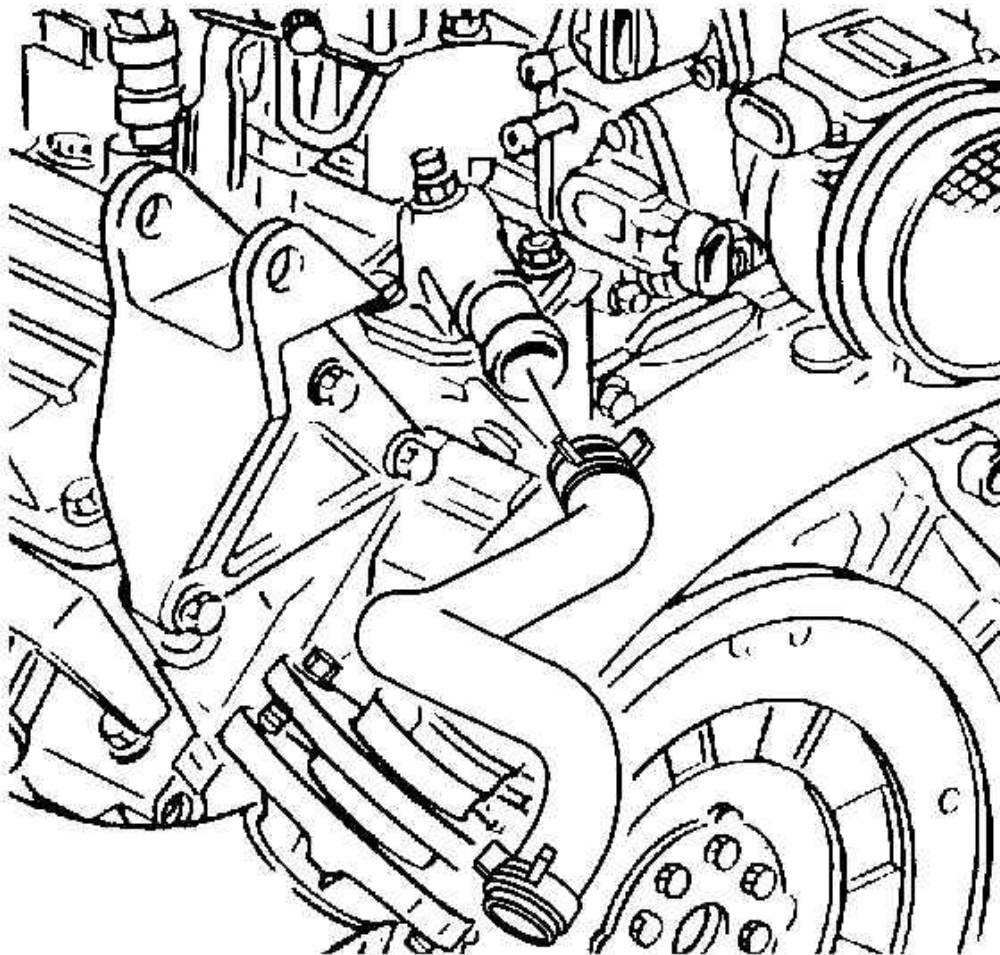


Fig. 39: View Of Radiator Inlet Hose To Water Outlet Housing
Courtesy of GENERAL MOTORS CORP.

1. Align the marks on the hose. Install the radiator inlet hose to the water outlet housing.

2. Use the **J 38185** in order to reposition and install the hose clamp to the water outlet housing. See **Special Tools**.

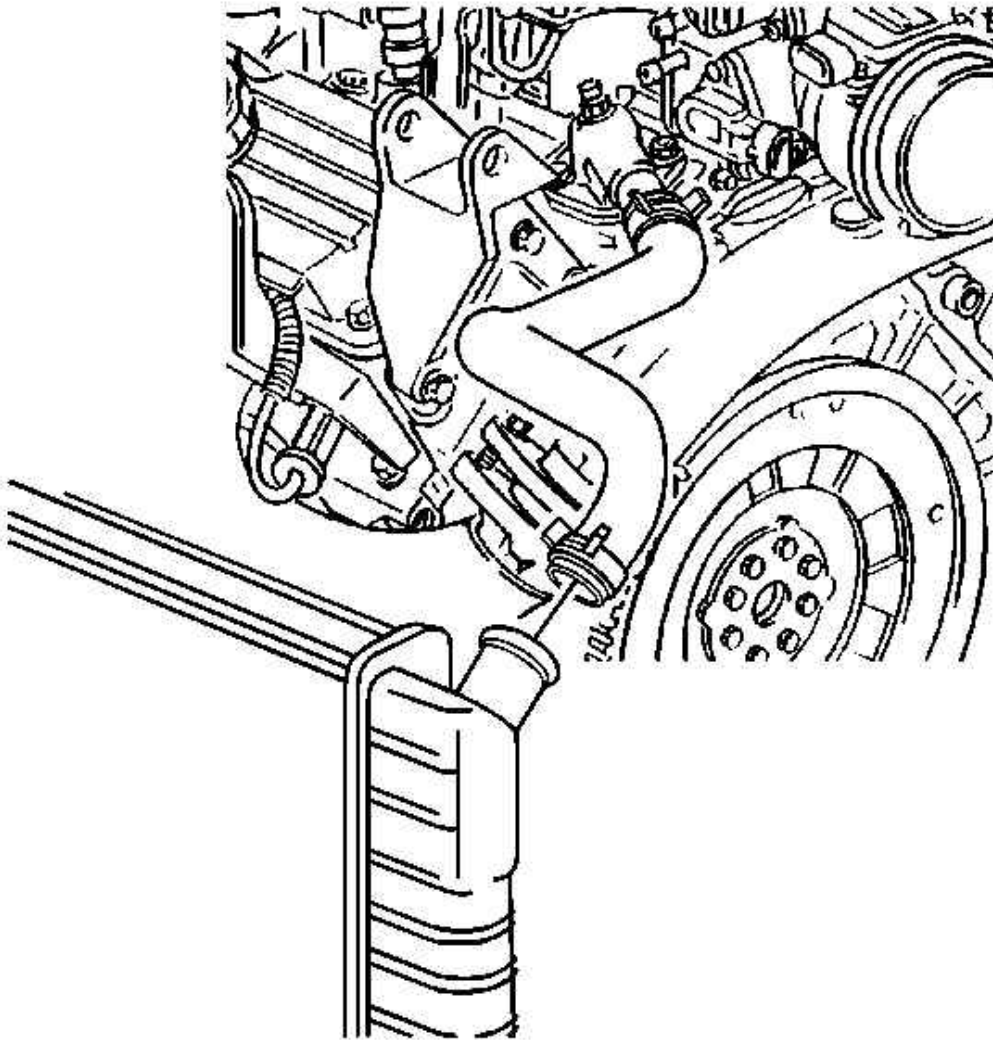


Fig. 40: Identifying Radiator Inlet Hose (3.8L)
Courtesy of GENERAL MOTORS CORP.

3. Install the radiator inlet hose to the radiator.
4. Use the **J 38185** in order to reposition and install the hose clamp to the

radiator. See **Special Tools**.

5. Install the left diagonal brace. Refer to **Front Fender Upper Diagonal Brace Replacement**.
6. Fill the cooling system. Refer to **Cooling System Draining and Filling (L26, LY7 GE 47716 Fill)** or **Cooling System Draining and Filling (L26 Static Fill)** or **Cooling System Draining and Filling (LY7 Static Fill)** or **Cooling System Draining and Filling (LS4 GE47716 Fill)** or **Cooling System Draining and Filling (LS4 Static Fill)**.

RADIATOR INLET HOSE REPLACEMENT (LY7)

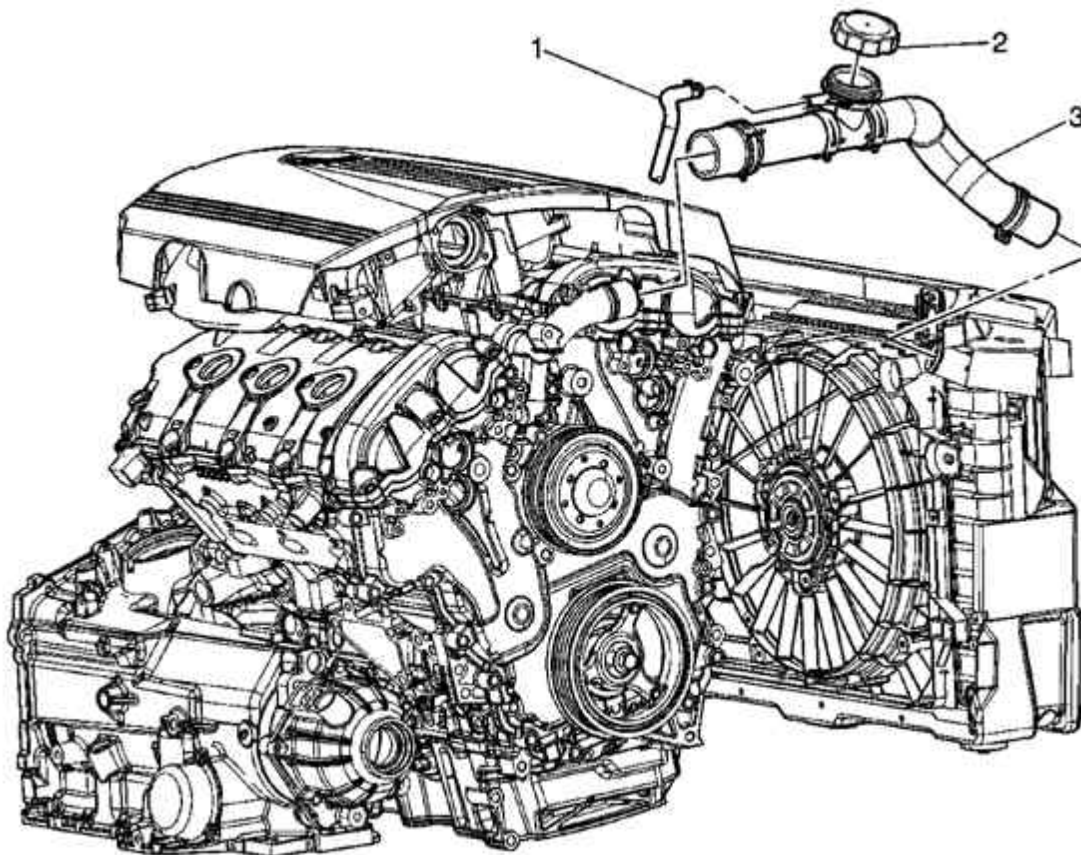


Fig. 41: View Of Radiator Inlet Hose
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Fastener Tightening Specifications: Refer to Fastener Tightening	

Specifications .**Preliminary Procedure:**

Drain the cooling system. Refer to **Cooling System Draining and Filling (L26, LY7 GE 47716 Fill)** or **Cooling System Draining and Filling (L26 Static Fill)** or **Cooling System Draining and Filling (LY7 Static Fill)** or **Cooling System Draining and Filling (LS4 GE47716 Fill)** or **Cooling System Draining and Filling (LS4 Static Fill)**.

1	Hose, Coolant Recovery Tip: Use J 38185 Hose Clamp Pliers, to release the clamp on the radiator inlet hose. See Special Tools .
2	Cap, Radiator
3	Hose, Radiator Inlet Tip: Use J 38185 Hose Clamp Pliers, to release the clamp on the radiator inlet hose. See Special Tools .

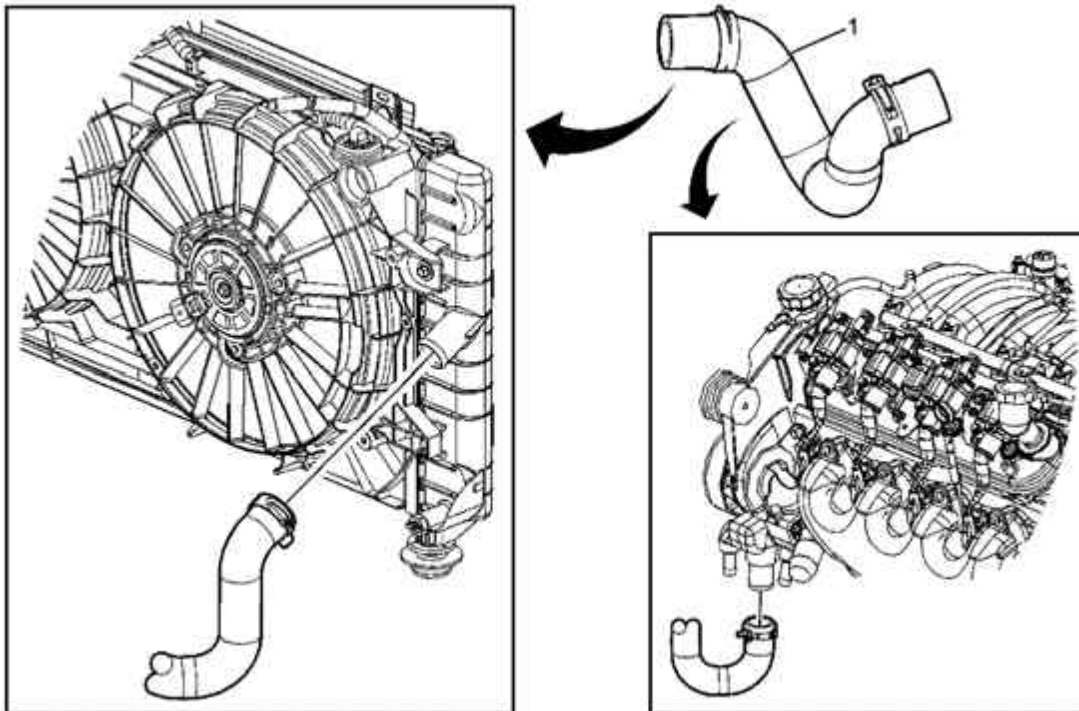
RADIATOR INLET HOSE REPLACEMENT (LS4)

Fig. 42: Replacing Inlet Radiator Hose
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Fastener Tightening Specifications: Refer to Fastener Tightening Specifications . Preliminary Procedure: Drain the cooling system. Refer to Cooling System Draining and Filling (L26, LY7 GE 47716 Fill) or Cooling System Draining and Filling (L26 Static Fill) or Cooling System Draining and Filling (LY7 Static Fill) or Cooling System Draining and Filling (LS4 GE47716 Fill) or Cooling System Draining and Filling (LS4 Static Fill) .	
1	Hose, Radiator Inlet Tip: Using J 38185 reposition the radiator inlet hose clamps. See Special Tools .

RADIATOR OUTLET HOSE REPLACEMENT (L26)

Tools Required

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

Removal Procedure

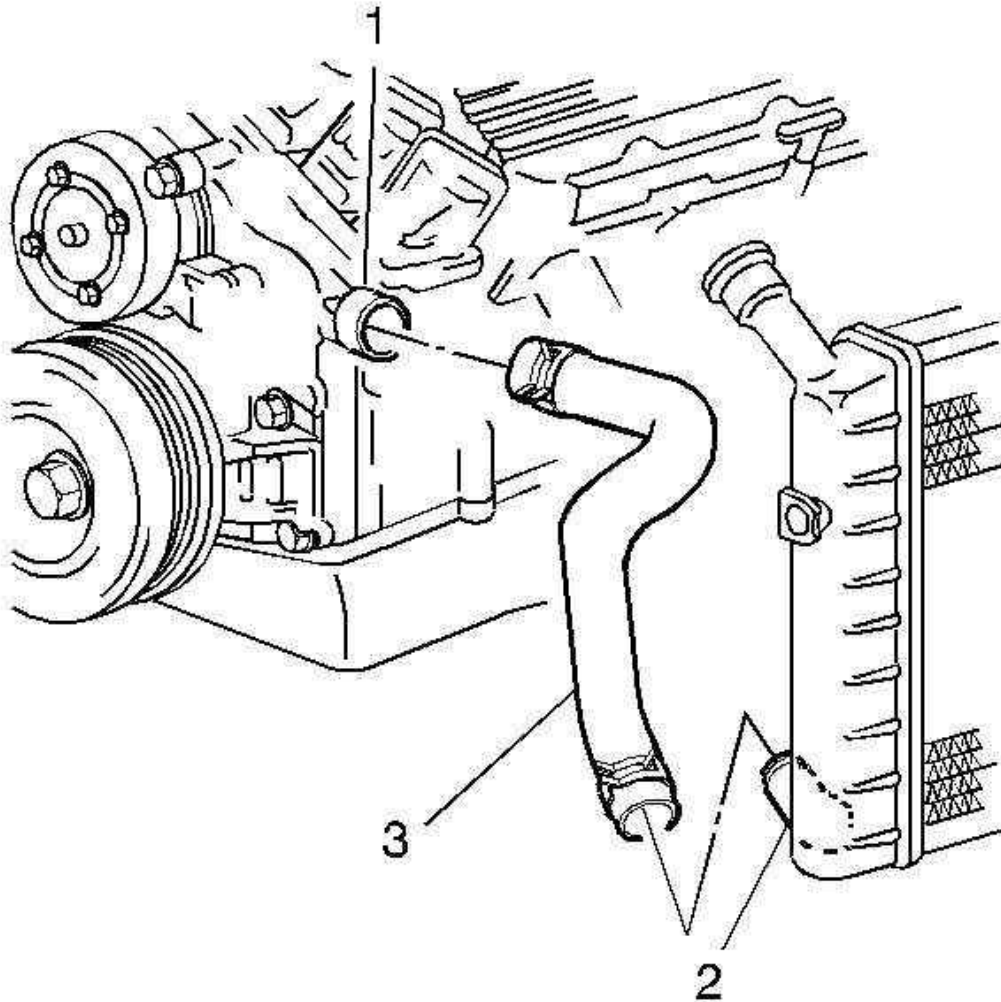


Fig. 43: View Of Radiator Hose & Outlet
Courtesy of GENERAL MOTORS CORP.

1. Drain the cooling system. Refer to **Cooling System Draining and Filling (L26, LY7 GE 47716 Fill)** or **Cooling System Draining and Filling (L26 Static Fill)** or **Cooling System Draining and Filling (LY7 Static Fill)** or **Cooling System Draining and Filling (LS4 GE47716 Fill)** or **Cooling System Draining and Filling (LS4 Static Fill)**.
2. Remove the lower radiator air deflector. Refer to **Radiator Air Lower Baffle**

and Deflector Replacement.

3. Use the **J 38185** in order to reposition the hose clamp from the radiator. See **Special Tools**.
4. Remove the radiator outlet hose (3) from the radiator (2).
5. Lower the vehicle.

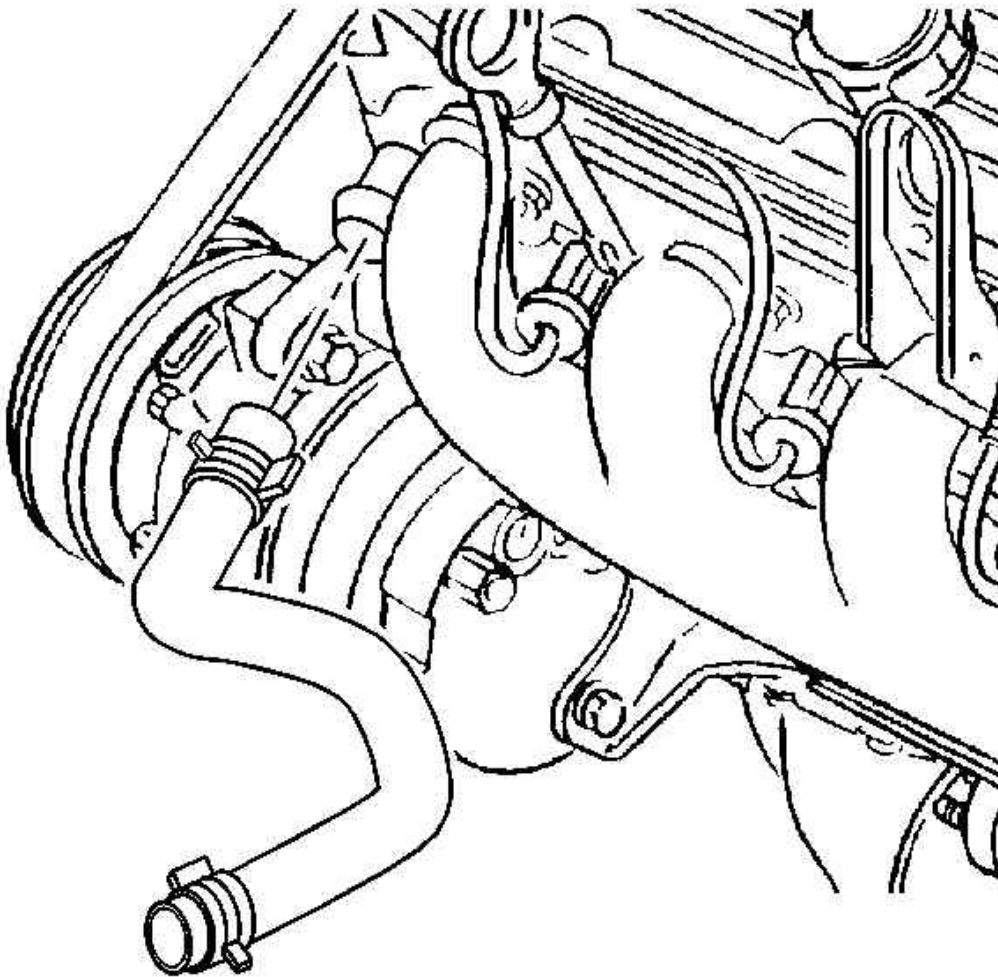


Fig. 44: View Of Radiator Outlet Hose (3.8L)
Courtesy of GENERAL MOTORS CORP.

6. Use **J 38185** in order to reposition the hose clamp from the water pump housing. See **Special Tools**.
7. Remove the radiator outlet hose from the water pump housing.

Installation Procedure

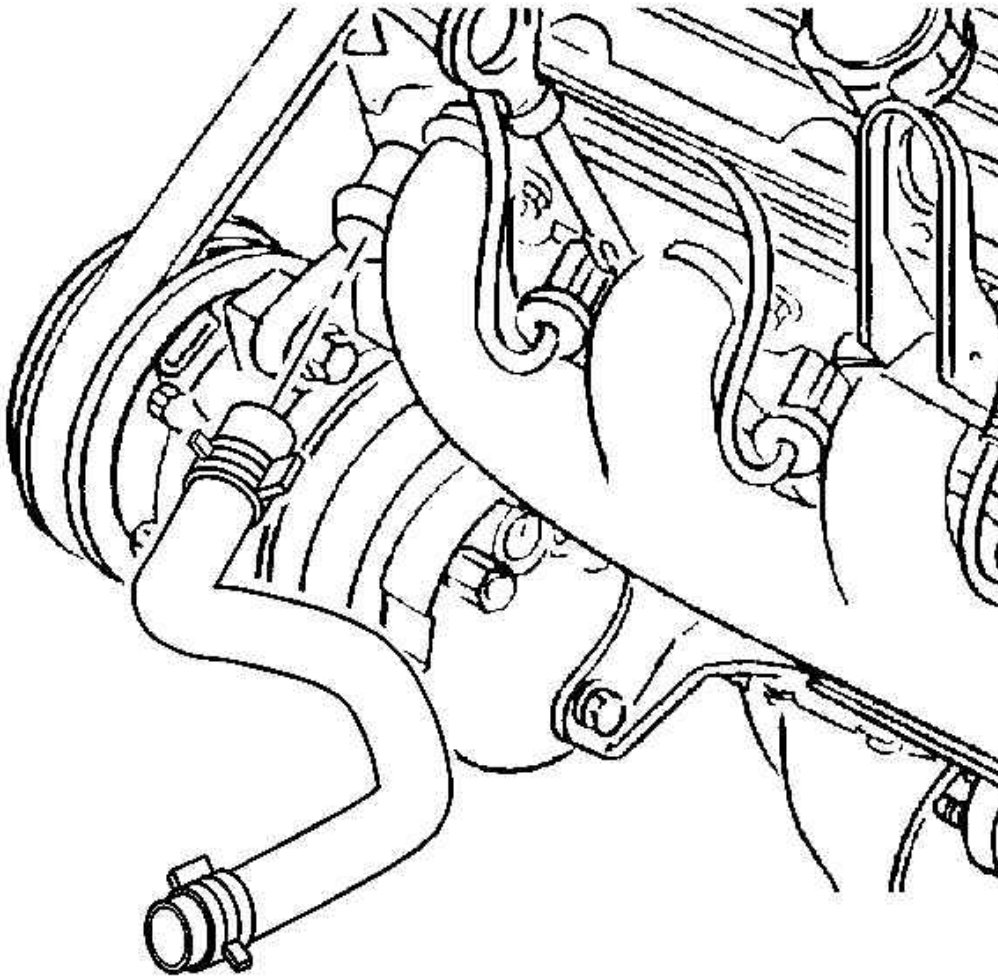


Fig. 45: View Of Radiator Outlet Hose (3.8L)
Courtesy of GENERAL MOTORS CORP.

1. Align the marks on the hose. Install the radiator outlet hose to the water pump

housing.

2. Use **J 38185** in order to reposition the hose clamp to the water pump housing. See **Special Tools**.
3. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle**.

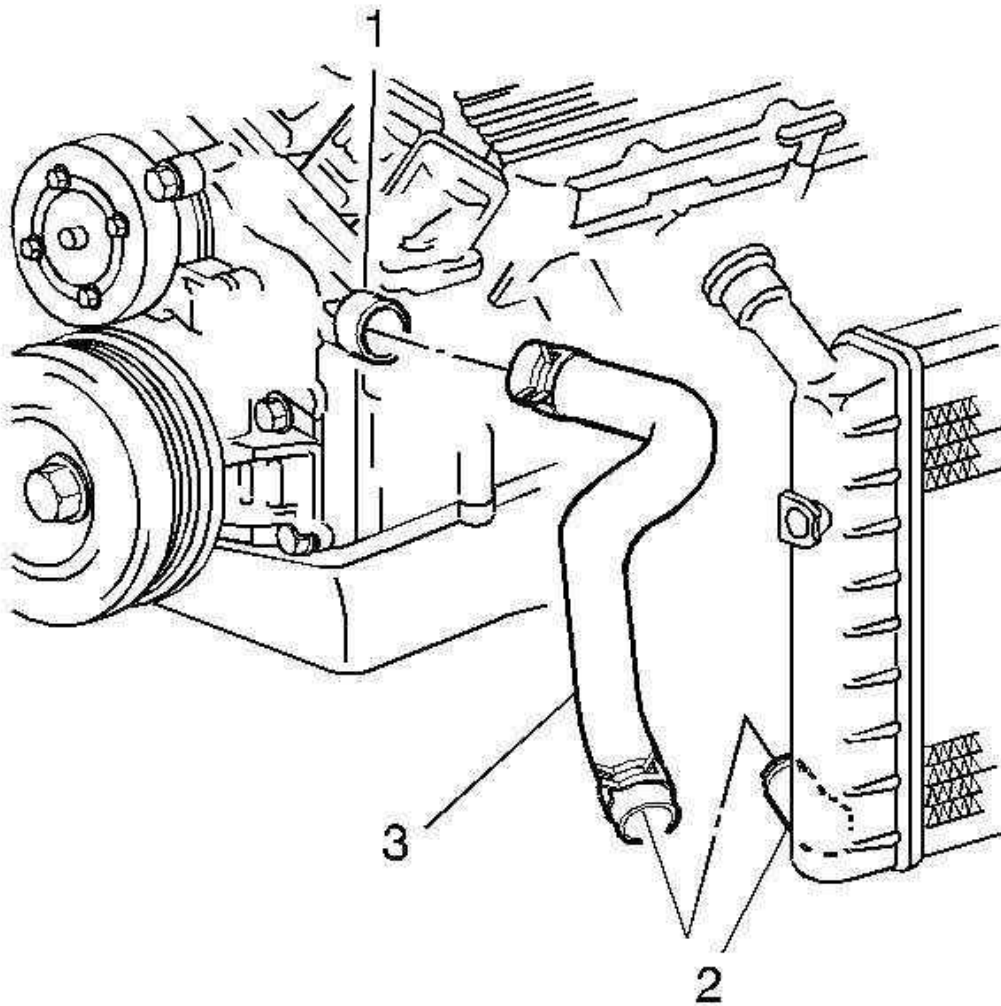


Fig. 46: View Of Radiator Hose & Outlet
Courtesy of GENERAL MOTORS CORP.

4. Install the radiator outlet hose (3) to the radiator (2).

5. Use **J 38185** in order to reposition the hose clamp to the radiator. See **Special Tools**.
6. Install the lower radiator air deflector. Refer to **Radiator Air Lower Baffle and Deflector Replacement**.
7. Fill the cooling system. Refer to **Cooling System Draining and Filling (L26, LY7 GE 47716 Fill)** or **Cooling System Draining and Filling (L26 Static Fill)** or **Cooling System Draining and Filling (LY7 Static Fill)** or **Cooling System Draining and Filling (LS4 GE47716 Fill)** or **Cooling System Draining and Filling (LS4 Static Fill)**.

RADIATOR OUTLET HOSE REPLACEMENT (LY7)

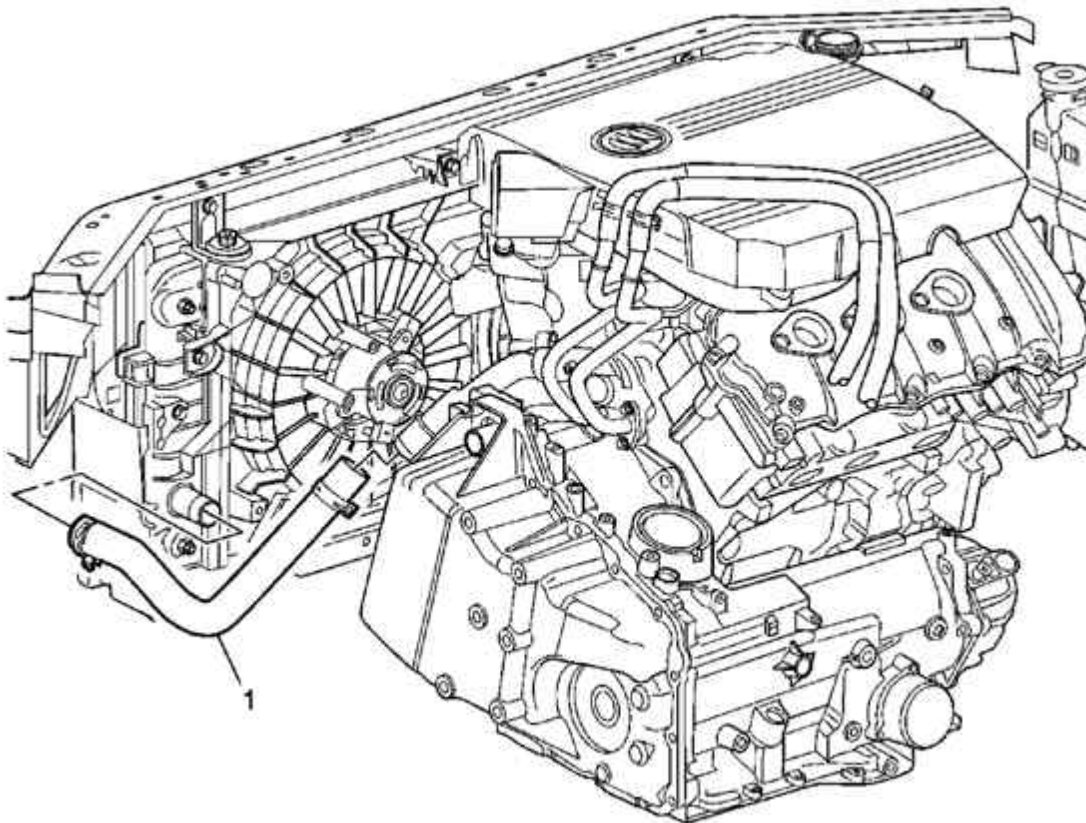


Fig. 47: View Of Radiator Outlet Hose
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name

Fastener Tightening Specifications: Refer to **Fastener Tightening Specifications** .

Preliminary Procedure

1. Drain the cooling system. Refer to **Cooling System Draining and Filling (L26, LY7 GE 47716 Fill)** or **Cooling System Draining and Filling (L26 Static Fill)** or **Cooling System Draining and Filling (LY7 Static Fill)** or **Cooling System Draining and Filling (LS4 GE47716 Fill)** or **Cooling System Draining and Filling (LS4 Static Fill)**.
2. Remove the air cleaner assembly. Refer to **Air Cleaner Assembly Replacement** for the 3.6L (LY7) engine.

1	Hose, Radiator Outlet Tip: Use J 38185 Hose Clamp Pliers to release the clamp on the radiator outlet hose. See Special Tools .
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RADIATOR OUTLET HOSE REPLACEMENT (LS4)

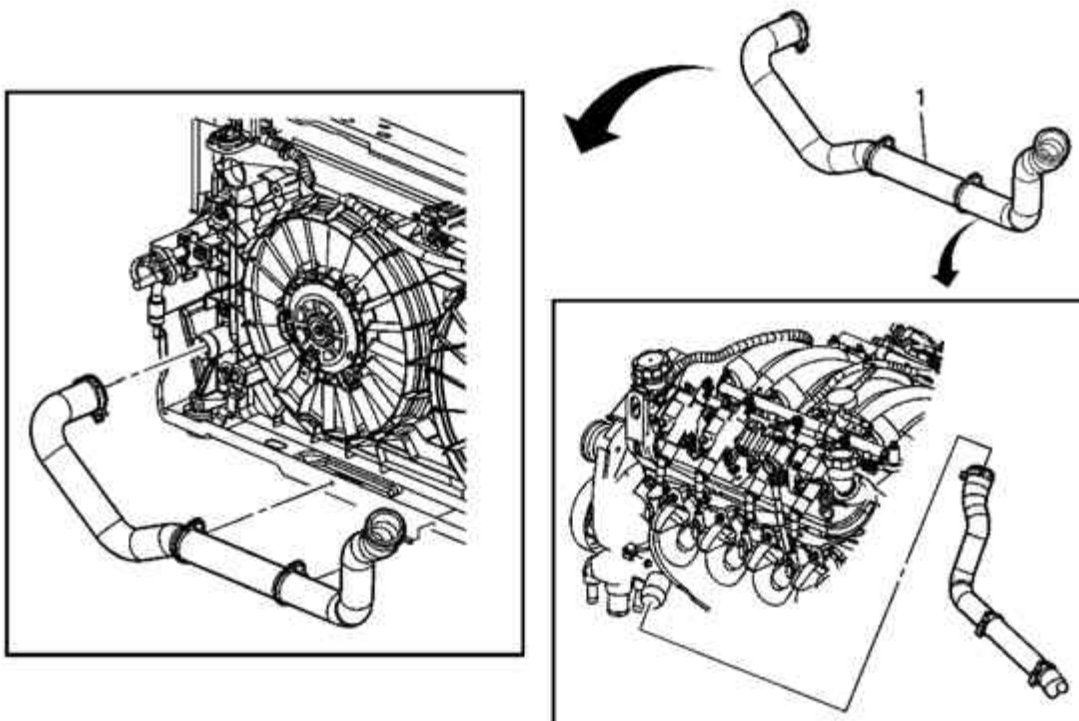


Fig. 48: Replacing Outlet Radiator Hose

2008 Buick LaCrosse CXL
2008 ENGINE Engine Cooling - LaCrosse

Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Fastener Tightening Specifications: Refer to Fastener Tightening Specifications . Preliminary Procedure: Drain the cooling system. Refer to Cooling System Draining and Filling (L26, LY7 GE 47716 Fill) or Cooling System Draining and Filling (L26 Static Fill) or Cooling System Draining and Filling (LY7 Static Fill) or Cooling System Draining and Filling (LS4 GE47716 Fill) or Cooling System Draining and Filling (LS4 Static Fill) .	
1	Hose, Radiator Outlet Tip: Using J 38185 reposition the radiator outlet hose clamps. See Special Tools .

RADIATOR OUTLET PIPE REPLACEMENT (LY7)

Removal Procedure

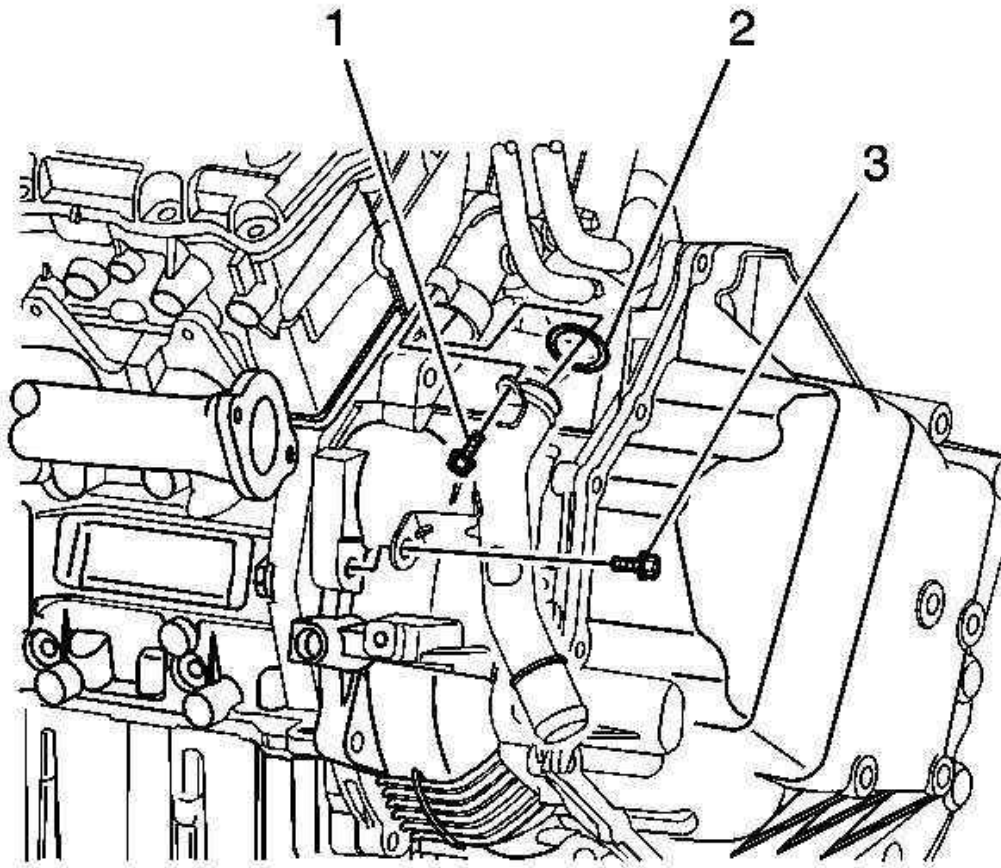


Fig. 49: Identifying Coolant Pipe/Thermostat Housing Bolts
Courtesy of GENERAL MOTORS CORP.

1. Drain the cooling system. Refer to **Cooling System Draining and Filling (L26, LY7 GE 47716 Fill)** or **Cooling System Draining and Filling (L26 Static Fill)** or **Cooling System Draining and Filling (LY7 Static Fill)** or **Cooling System Draining and Filling (LS4 GE47716 Fill)** or **Cooling System Draining and Filling (LS4 Static Fill)**.
2. Remove the air cleaner assembly. Refer to **Air Cleaner Assembly Replacement** .
3. Remove the radiator outlet hose from the radiator outlet pipe. Refer to **Radiator Outlet Hose Replacement (L26)** or **Radiator Outlet Hose**

Replacement (LY7) or Radiator Outlet Hose Replacement (LS4).

4. Remove the radiator outlet pipe bracket to transmission retaining bolt (3).
5. Remove the radiator outlet pipe bracket to thermostat housing retaining bolt (1).
6. Remove the radiator outlet pipe from the thermostat housing.

IMPORTANT: Install a new O-ring to the radiator outlet pipe.

7. Remove the radiator outlet pipe O-ring from the radiator outlet pipe.

Installation Procedure

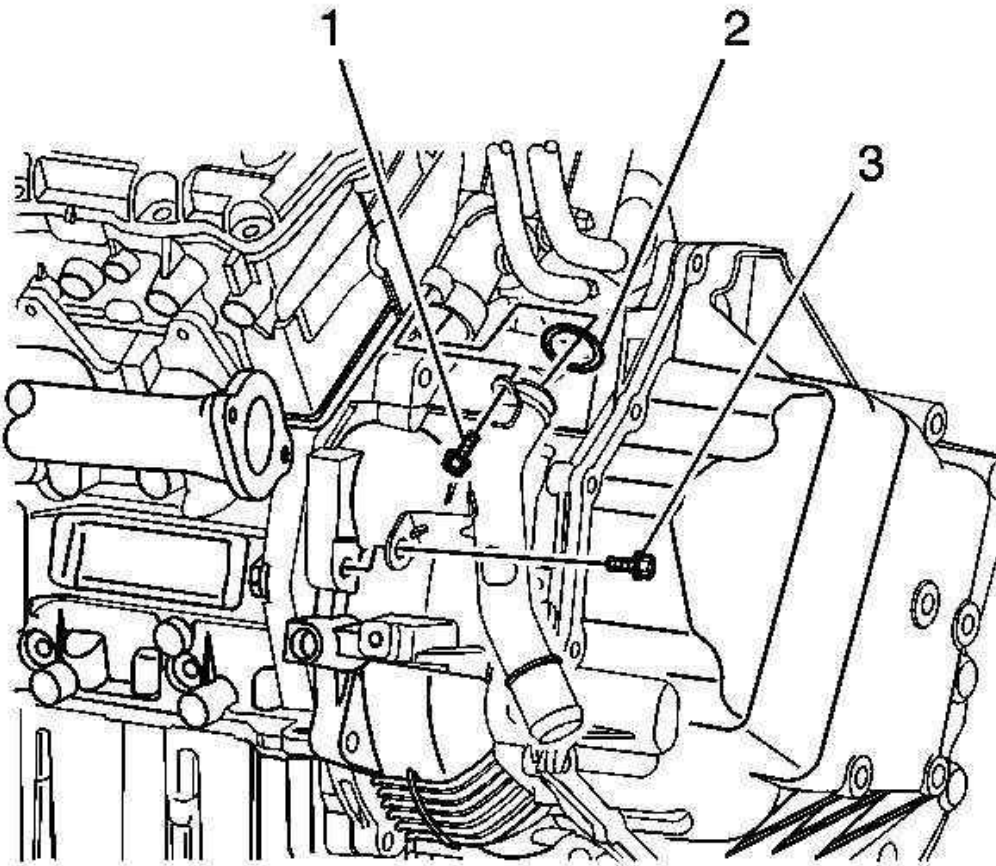


Fig. 50: Identifying Coolant Pipe/Thermostat Housing Bolts
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Install a new O-ring to the radiator outlet pipe.

1. Install the radiator outlet pipe O-ring to the radiator outlet pipe.
2. Install the radiator outlet pipe to the thermostat housing.
3. Install the radiator outlet pipe bracket to transmission retaining bolt (3).
4. Install the radiator outlet pipe bracket to thermostat housing retaining bolt (1).
5. Install the radiator outlet hose from the radiator outlet pipe. Refer to **Radiator Outlet Hose Replacement (L26)** or **Radiator Outlet Hose Replacement (LY7)** or **Radiator Outlet Hose Replacement (LS4)**.
6. Install the air cleaner assembly. Refer to **Air Cleaner Assembly Replacement**.
7. Fill the cooling system. Refer to **Cooling System Draining and Filling (L26, LY7 GE 47716 Fill)** or **Cooling System Draining and Filling (L26 Static Fill)** or **Cooling System Draining and Filling (LY7 Static Fill)** or **Cooling System Draining and Filling (LS4 GE47716 Fill)** or **Cooling System Draining and Filling (LS4 Static Fill)**.

THROTTLE BODY HEATER INLET HOSE/PIPE REPLACEMENT

Removal Procedure

1. Partially drain the cooling system. Refer to **Cooling System Draining and Filling (L26, LY7 GE 47716 Fill)** or **Cooling System Draining and Filling (L26 Static Fill)** or **Cooling System Draining and Filling (LY7 Static Fill)** or **Cooling System Draining and Filling (LS4 GE47716 Fill)** or **Cooling System Draining and Filling (LS4 Static Fill)**.

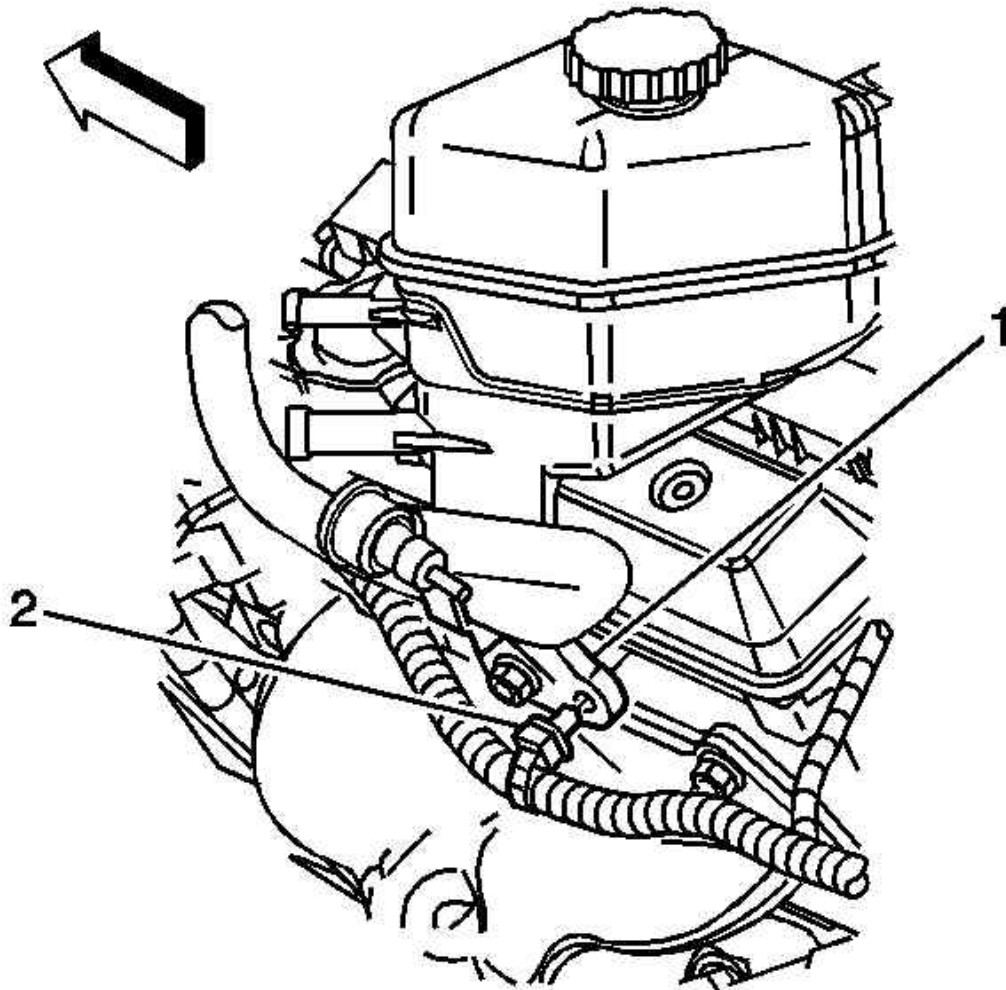


Fig. 51: Identifying Engine Wiring Harness & Remote Power Steering Fluid Reservoir

Courtesy of GENERAL MOTORS CORP.

2. Disconnect the following from the remote power steering fluid reservoir (1):
 - The brake booster hose
 - The wiring harness (2)

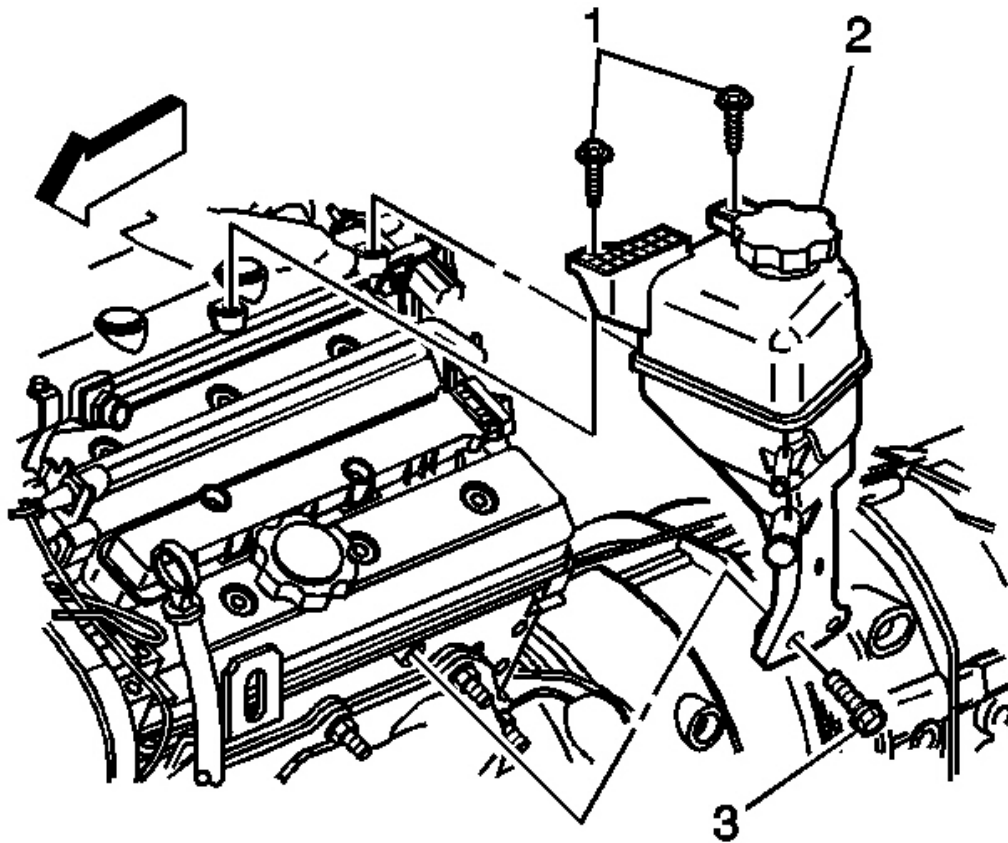


Fig. 52: Locating Remote Power Steering Fluid Reservoir Mounting Bolts
Courtesy of GENERAL MOTORS CORP.

3. Remove the remote power steering fluid reservoir mounting bolts (1, 3) ONLY, and position aside.
4. Remove the wiper motor module in order to gain access to the rear of the throttle body heater inlet hose. Refer to **Windshield Wiper Motor Replacement** and **Windshield Wiper System Module Replacement** .

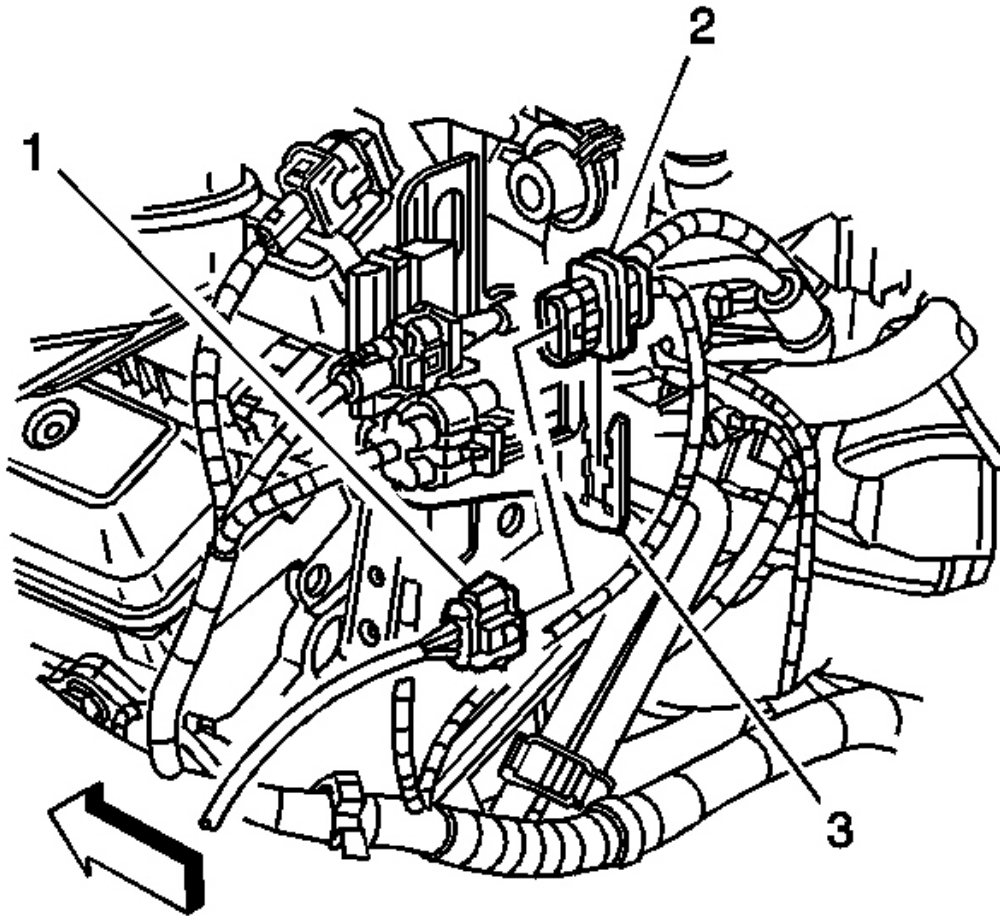


Fig. 53: Identifying Heated Oxygen Sensor Connector & Throttle Body Heater Inlet Hose/Pipe

Courtesy of GENERAL MOTORS CORP.

5. Disconnect the heated oxygen sensor connector (2) from the rear of the throttle body heater inlet hose/pipe (3).
6. Disconnect the throttle body heater inlet hose from the water crossover, using 90 degrees needlenose pliers.

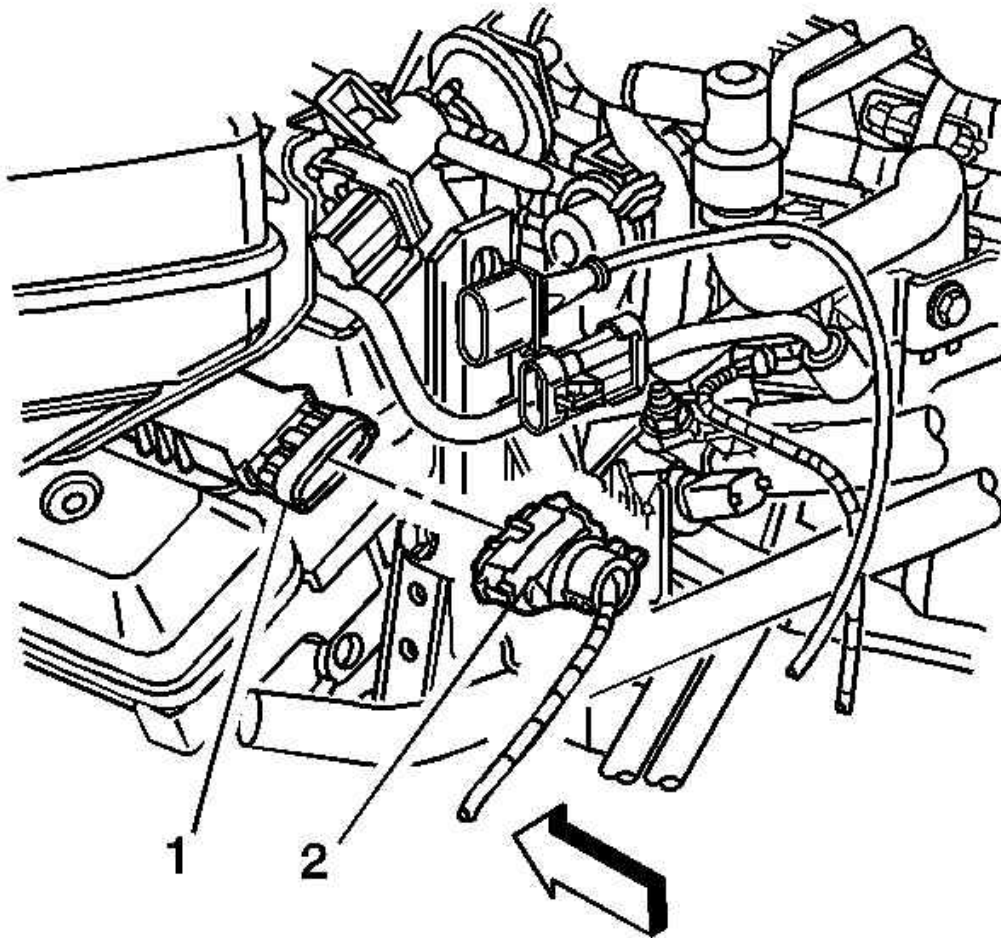


Fig. 54: Identifying Coil Pack Electrical Connector
Courtesy of GENERAL MOTORS CORP.

7. Disconnect the electrical connector (2) from the coil pack (1).

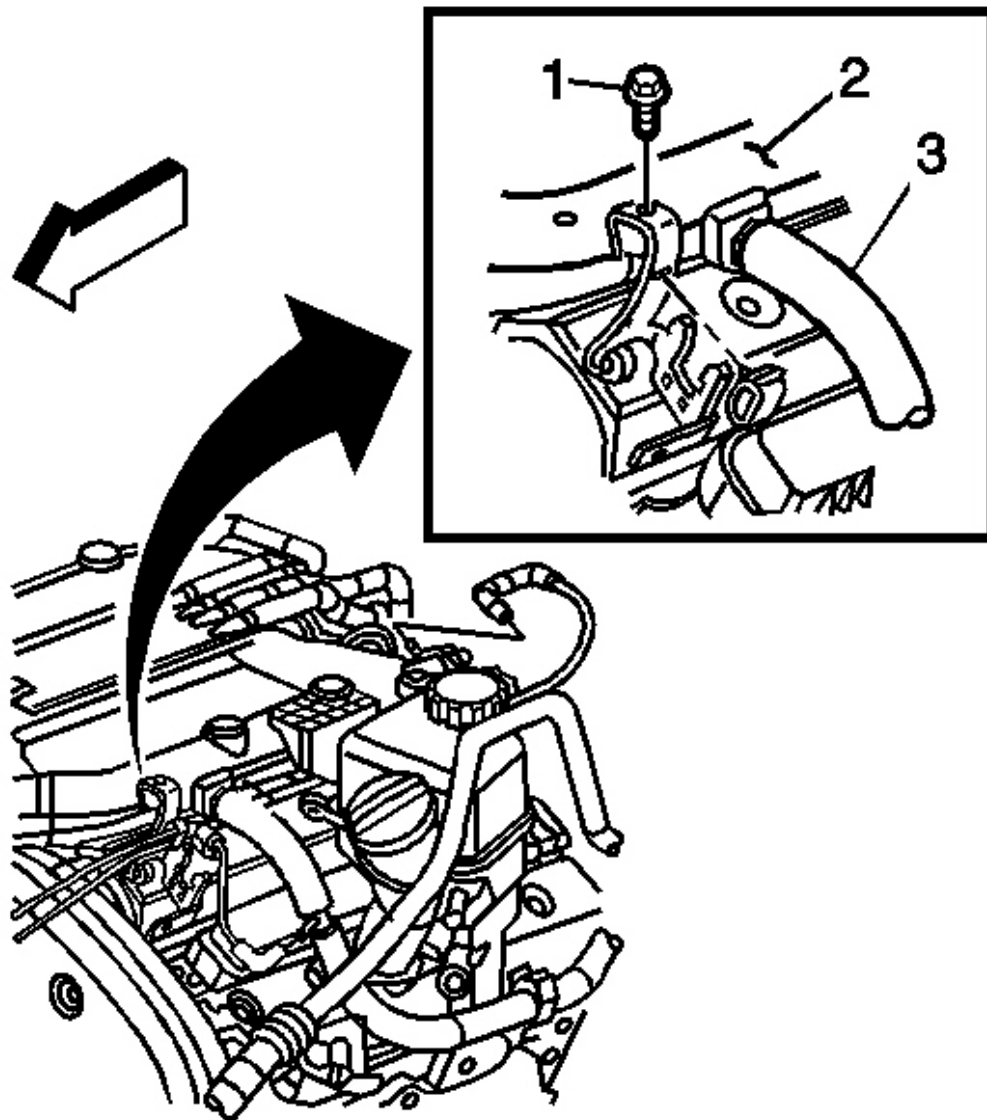


Fig. 55: Identifying Throttle Body Heater Inlet Hose/Pipe-To-Intake Plenum Bolt

Courtesy of GENERAL MOTORS CORP.

8. Disconnect the following from the front of the throttle body heater inlet hose/pipe:

- The camshaft position (CMP) sensor connector
 - The left knock sensor connector
 - The vacuum pipe retainer
9. Disconnect the vacuum brake booster hose (3) from the vacuum source.
 10. Remove the bolts securing the throttle body heater inlet hose/pipe to the following:
 - The intake plenum (2)
 - The engine rear lift bracket
 11. Disconnect the throttle body heater inlet hose from the throttle body.

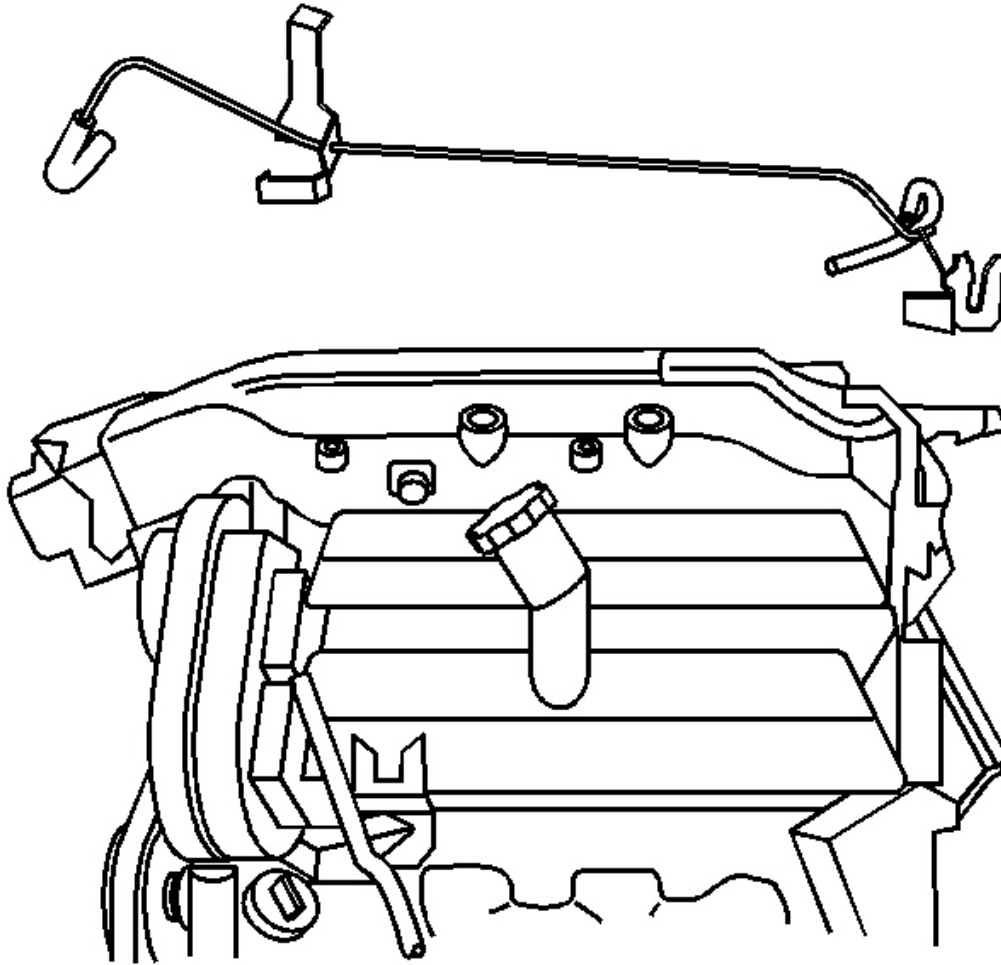


Fig. 56: View Of Throttle Body Heater Inlet Hose/Pipe
Courtesy of GENERAL MOTORS CORP.

12. Remove the throttle body heater inlet hose/pipe from the engine.

Installation Procedure

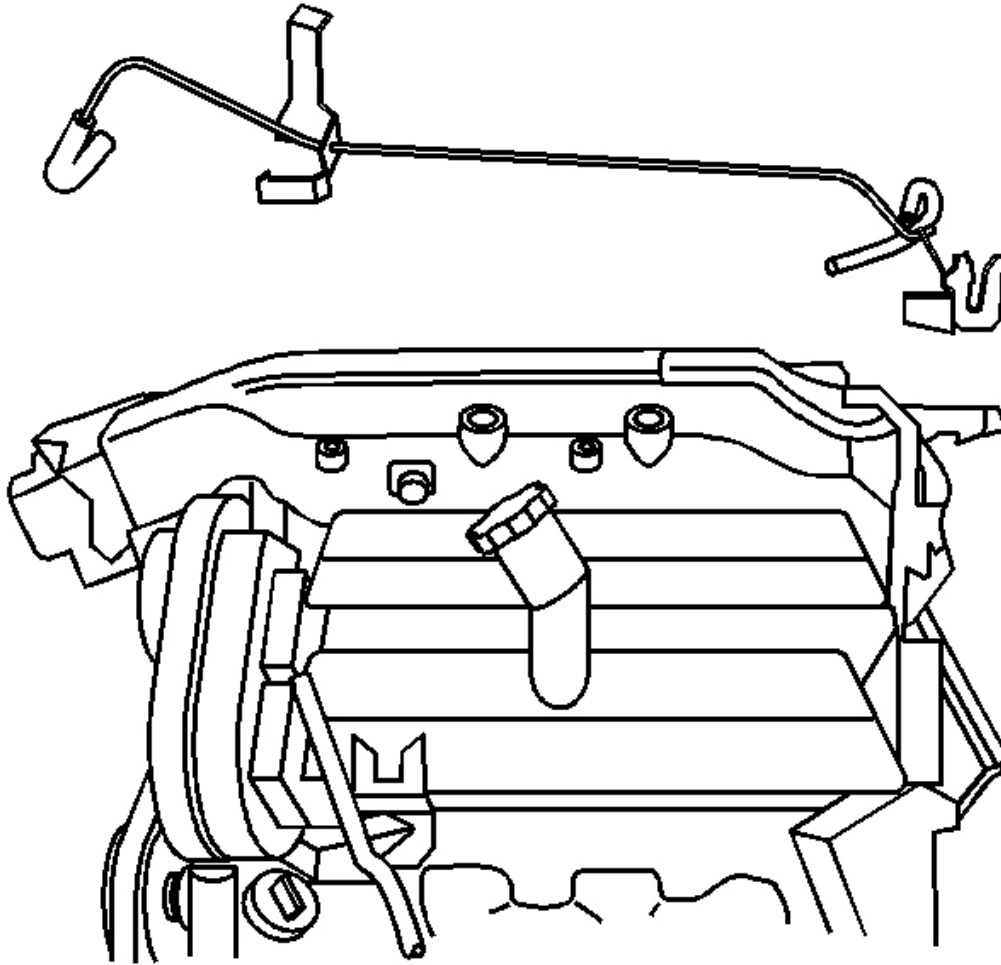


Fig. 57: View Of Throttle Body Heater Inlet Hose/Pipe
Courtesy of GENERAL MOTORS CORP.

1. Position the throttle body heater inlet hose/pipe to the engine.
2. Connect the throttle body heater inlet hose to the throttle body.

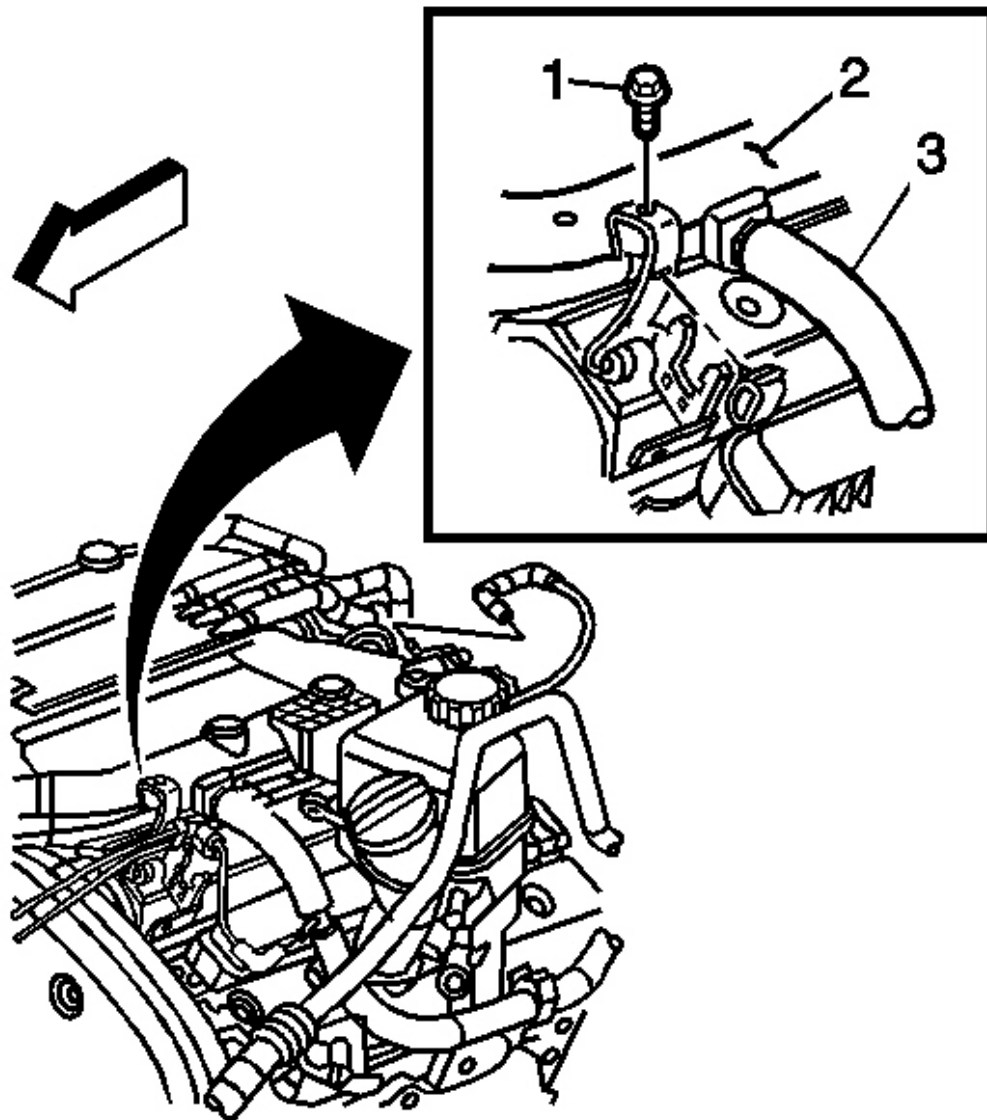


Fig. 58: Identifying Throttle Body Heater Inlet Hose/Pipe-To-Intake Plenum Bolt

Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice .

3. Install the bolts securing the throttle body heater inlet hose/pipe to the following:

- The intake plenum (2)
- The engine rear lift bracket

Tighten: Tighten the throttle body heater inlet hose/pipe bolts to 9 N.m (80 lb in).

4. Connect the vacuum brake booster hose (3) to the vacuum source.

5. Connect the following to the front of the throttle body heater inlet hose/pipe:

- The CMP sensor connector
- The left knock sensor connector
- The vacuum pipe retainer

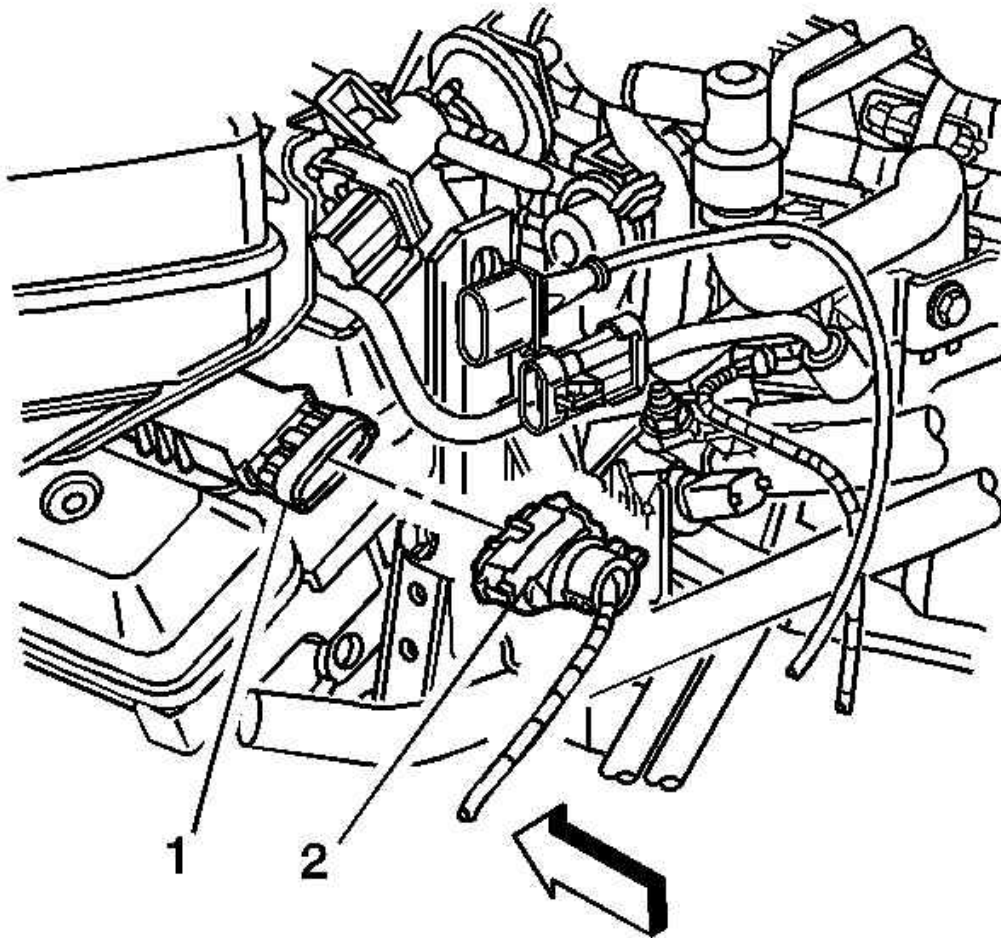


Fig. 59: Identifying Coil Pack Electrical Connector
Courtesy of GENERAL MOTORS CORP.

6. Connect the electrical connector (2) to the coil pack (1).
7. Connect the throttle body heater inlet hose to the water crossover, using 90 degrees needlenose pliers.

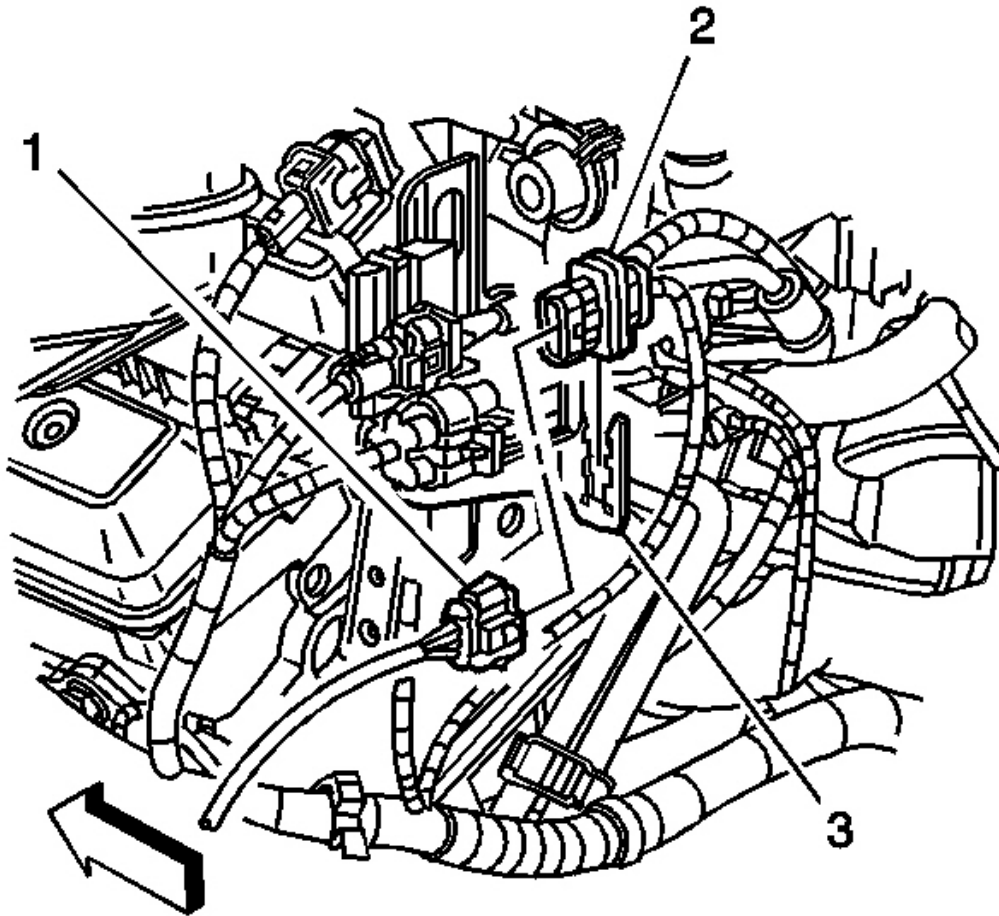


Fig. 60: Identifying Heated Oxygen Sensor Connector & Throttle Body Heater Inlet Hose/Pipe

Courtesy of GENERAL MOTORS CORP.

8. Connect the heated oxygen sensor connector (2) to the rear of the throttle body heater inlet hose/pipe (3).
9. Install the wiper motor module. Refer to **Windshield Wiper Motor Replacement** and **Windshield Wiper System Module Replacement**.

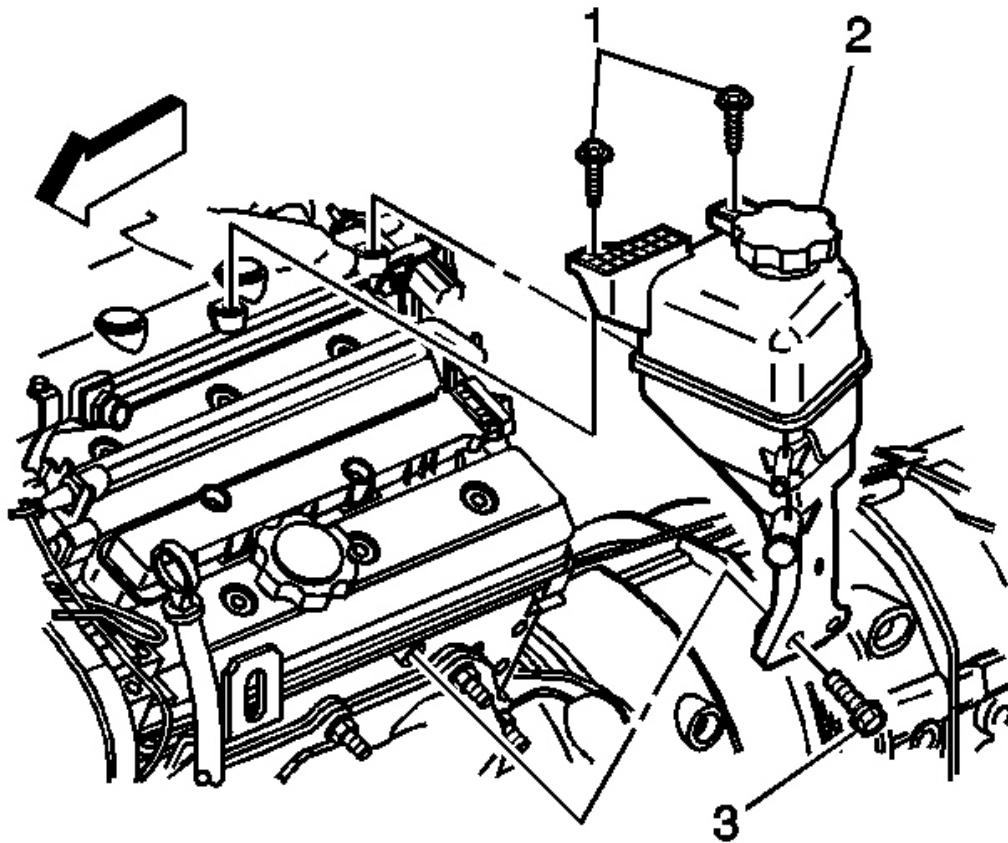


Fig. 61: Locating Remote Power Steering Fluid Reservoir Mounting Bolts
Courtesy of GENERAL MOTORS CORP.

10. Install the remote power steering fluid reservoir mounting bolts (1, 3).

Tighten:

- Tighten the remote power steering fluid reservoir to intake plenum mounting bolts to 9 N.m (80 lb in).
- Tighten the remote power steering fluid reservoir to cylinder head mounting bolt to 25 N.m (18 lb ft).

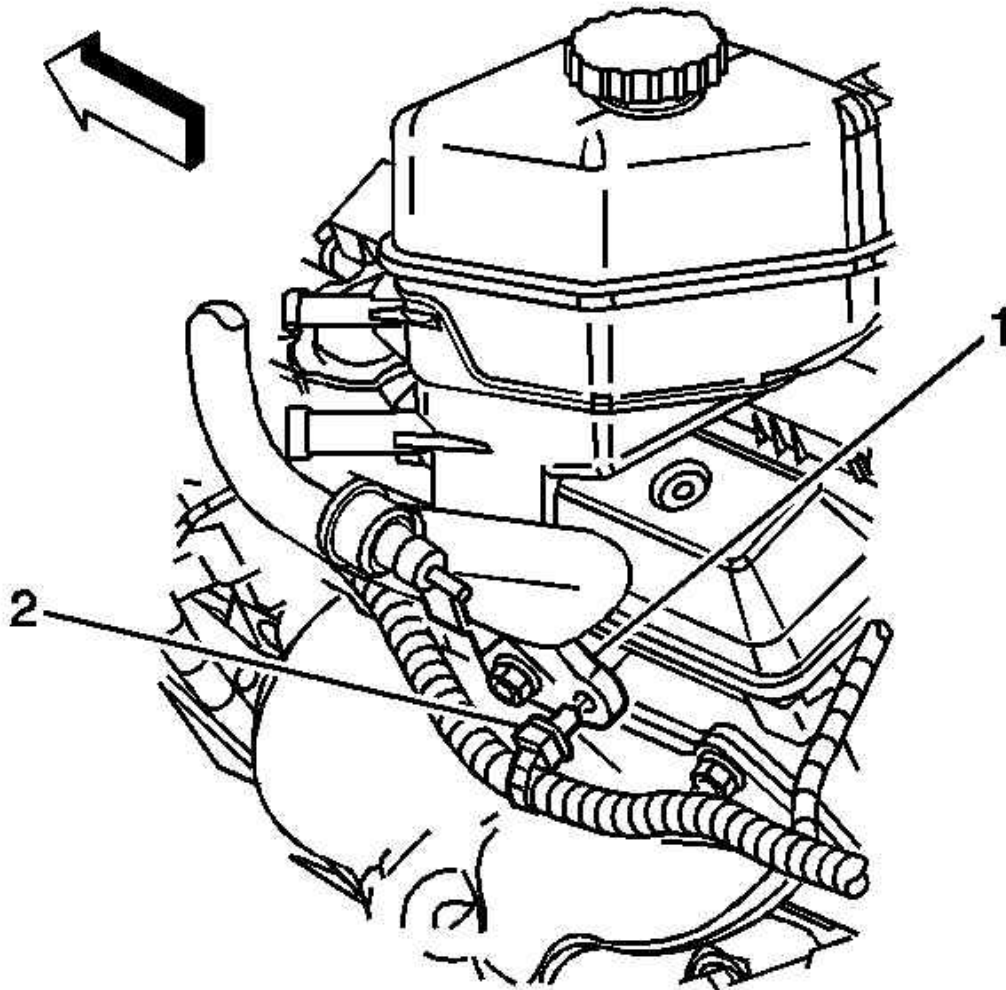


Fig. 62: Identifying Engine Wiring Harness & Remote Power Steering Fluid Reservoir

Courtesy of GENERAL MOTORS CORP.

11. Connect the following to the remote power steering fluid reservoir (1):
 - The brake booster hose
 - The wiring harness (2)
12. Fill the cooling system. Refer to **Cooling System Draining and Filling (L26, LY7 GE 47716 Fill)** or **Cooling System Draining and Filling (L26 Static**

Fill) or **Cooling System Draining and Filling (LY7 Static Fill)** or **Cooling System Draining and Filling (LS4 GE47716 Fill)** or **Cooling System Draining and Filling (LS4 Static Fill)**.

ENGINE COOLANT FAN MOTOR REPLACEMENT (L26)

Removal Procedure

CAUTION: Keep hands, tools, and clothing away from the electric engine coolant fans in order to help prevent personal injury. These fans are electric and can turn on whether or not the engine is running. The fans can start automatically with the ignition in the ON position.

CAUTION: An electric fan under the hood can start up even when the engine is not running and can injure you. Keep hands, clothing and tools away from any underhood electric fan.

CAUTION: To help avoid personal injury or damage to the vehicle, a bent, cracked, or damaged fan blade or housing should always be replaced.

CAUTION: Unless directed otherwise, the ignition and start switch must be in the OFF or LOCK position, and all electrical loads must be OFF before servicing any electrical component. Disconnect the negative battery cable to prevent an electrical spark should a tool or equipment come in contact with an exposed electrical terminal. Failure to follow these precautions may result in personal injury and/or damage to the vehicle or its components.

1. Disconnect the negative battery cable. Refer to **Battery Negative Cable**

Disconnection and Connection (L26) or Battery Negative Cable Disconnection and Connection (LY7) or Battery Negative Cable Disconnection and Connection (LS4) .

2. Remove the left and right engine mount struts. Refer to **Engine Mount Strut Replacement - Left Side** and to **Engine Mount Strut Replacement - Right Side** .
3. Remove the air cleaner assembly. Refer to **Air Cleaner Assembly Replacement** .
4. Remove the powertrain control module (PCM) harness retainer from the fan shroud.
5. Remove the transmission oil cooler lines from the lower fan shroud clip and reposition the oil cooler lines aside.
6. Remove the fan shroud clip from the condenser tubes.

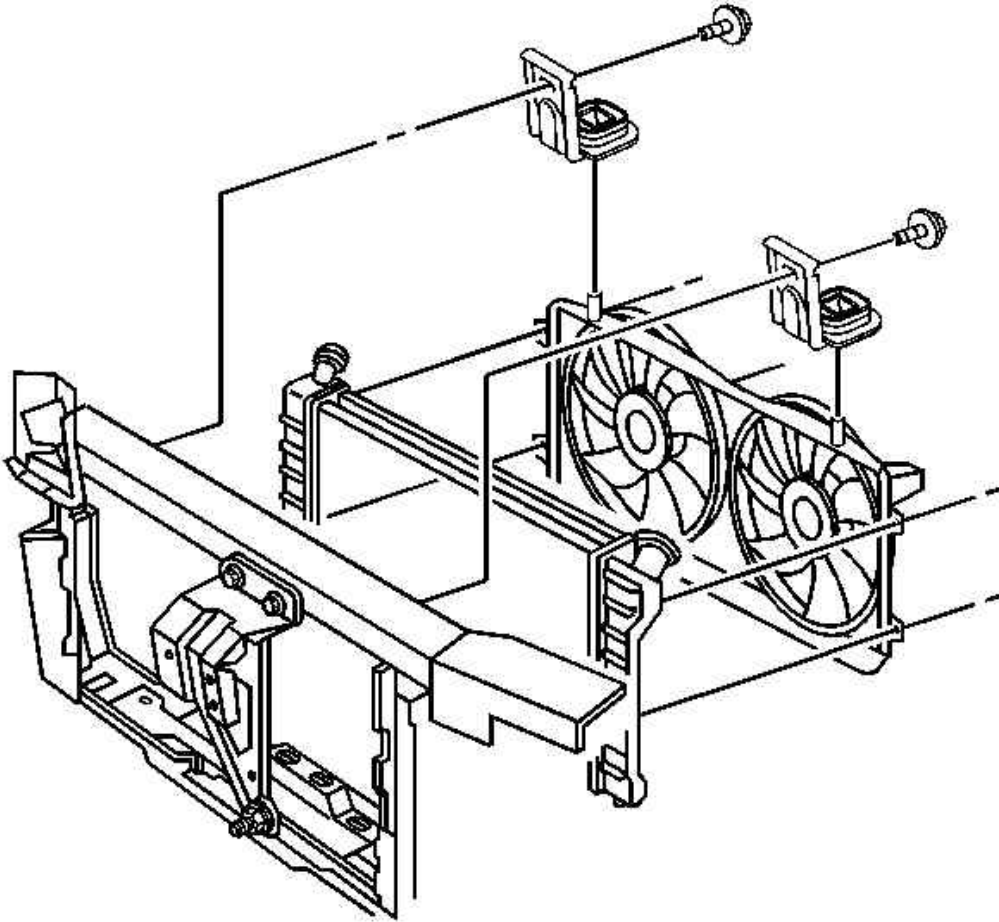


Fig. 63: View Of Fan Shroud To Radiator Upper Support Brackets
Courtesy of GENERAL MOTORS CORP.

7. Remove the radiator upper bracket bolts and brackets.

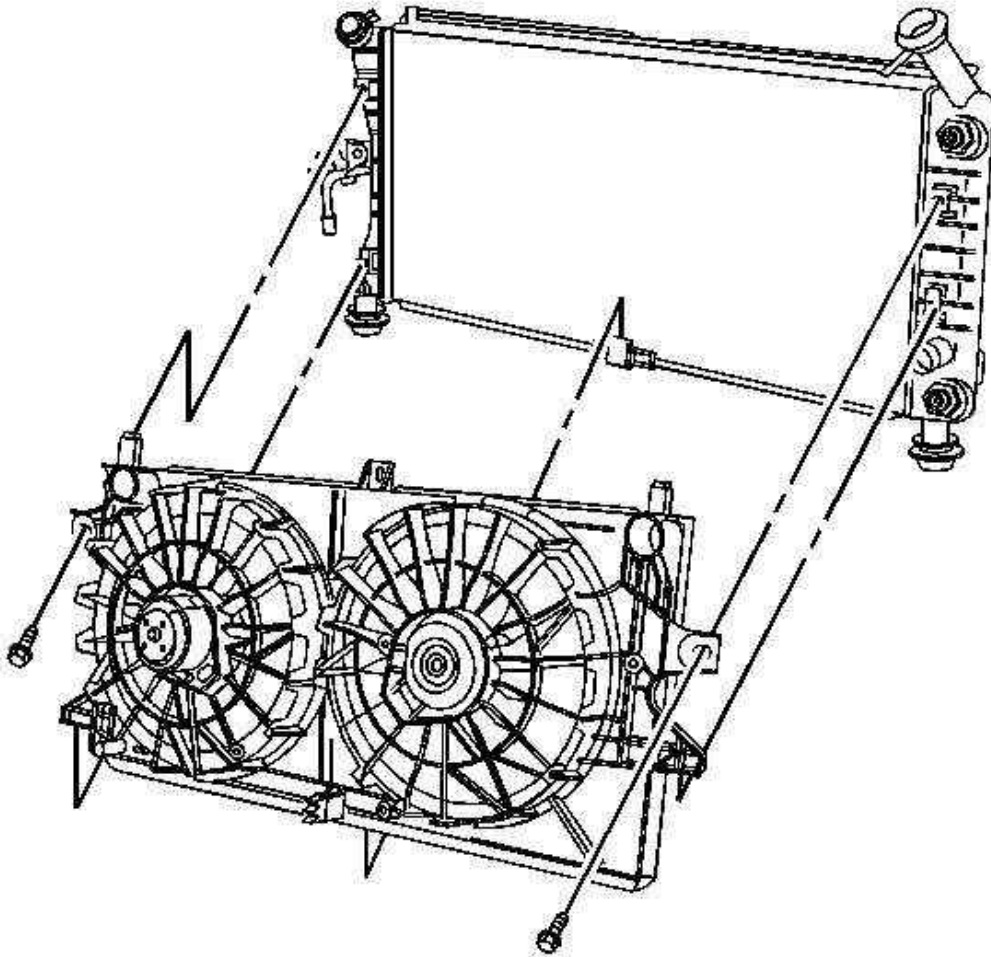


Fig. 64: Identifying Cooling Fan Shroud
Courtesy of GENERAL MOTORS CORP.

8. Remove the cooling fan shroud bolts.

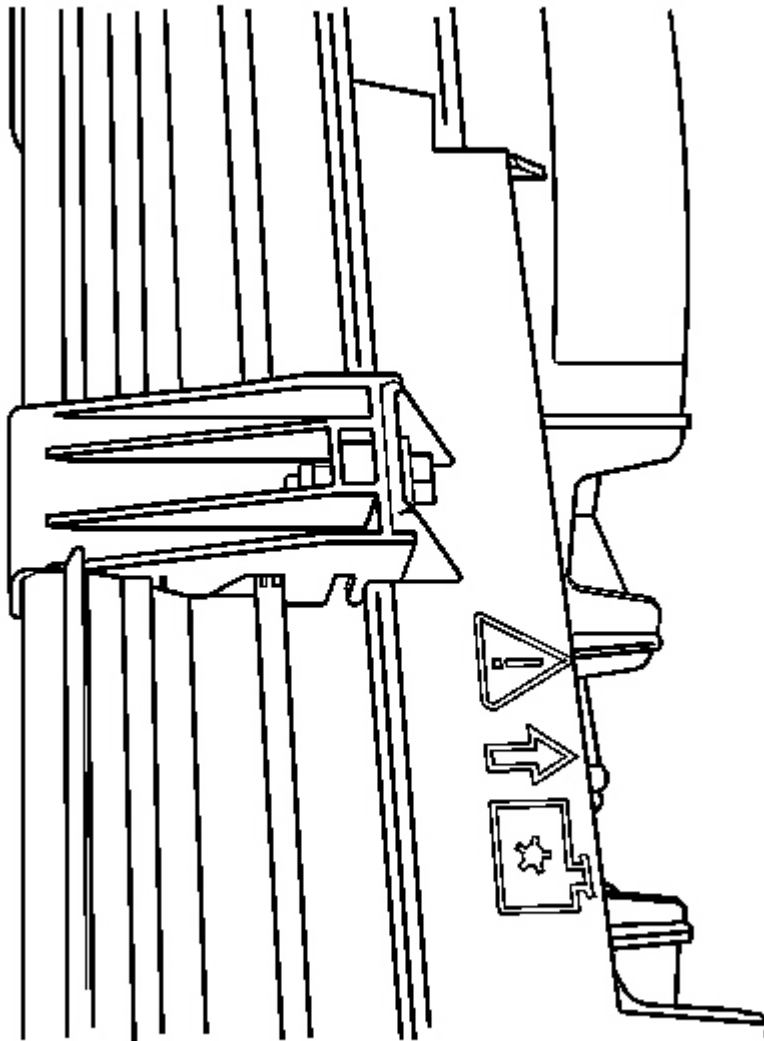


Fig. 65: Identifying Fan Shroud To Condenser Hold Down Bracket Bolt
Courtesy of GENERAL MOTORS CORP.

9. Remove the bolt that connects the fan shroud to the condenser hold down bracket.
10. Disconnect the engine cooling fan motors electrical connectors.
11. Remove the cooling fan electrical harness from the fan shroud clips.

12. Remove the cooling fan shroud.

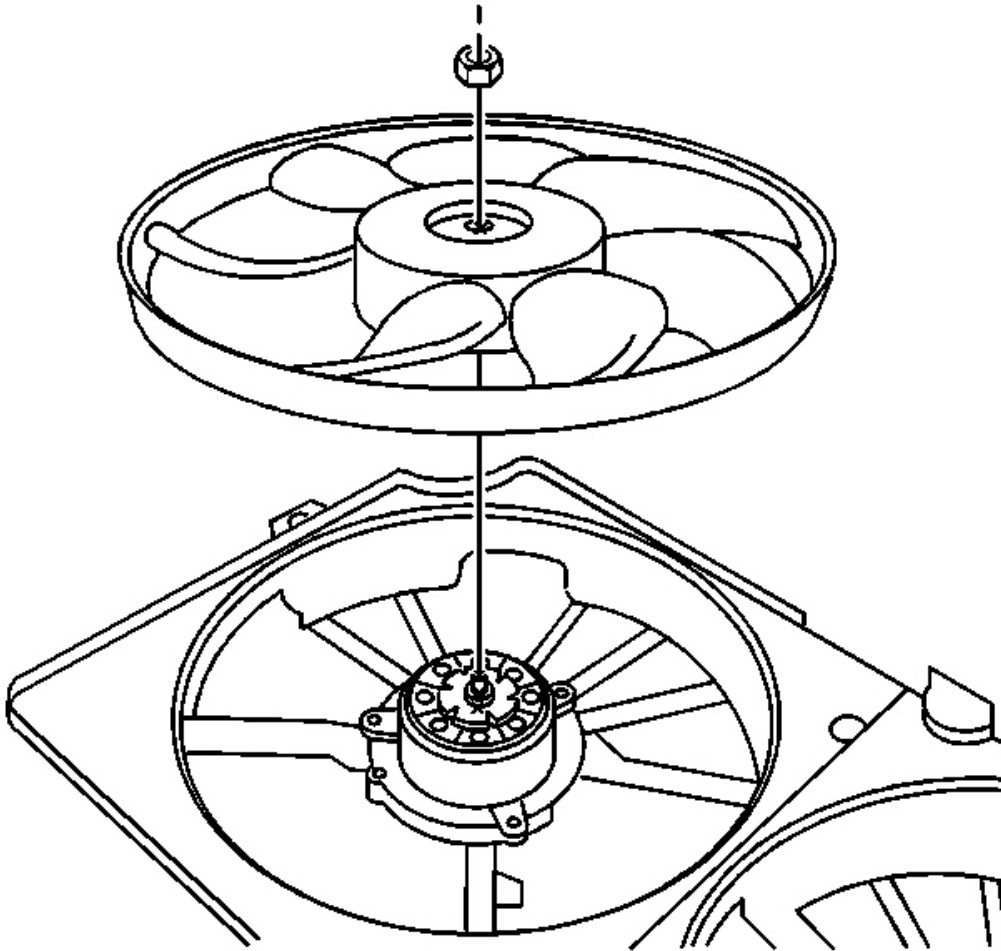


Fig. 66: Identifying Engine Cooling Fan Blade & Nut
Courtesy of GENERAL MOTORS CORP.

13. Remove the engine cooling fan blade nut.

14. Remove the engine cooling fan blade.

CAUTION: If a fan blade is bent or damaged in any way, do not repair or reuse the damaged part. Always

replace a bent or damaged fan blade. Fan blades that have been damaged can not be assured of proper balance and could fail and fly apart during subsequent use. This creates an extremely dangerous situation.

The fan blades must remain in proper balance. You cannot assure fan blade balance once a fan blade has been bent or damaged. A fan blade that is not in proper balance could fail and fly apart during use, creating an extremely dangerous situation.

15. Inspect the cooling fan blades for the following conditions:

- Bent or cracked cooling fan blades
- Smoothness of the cooling fan blade mating surfaces
- Remove burrs or other imperfections as necessary

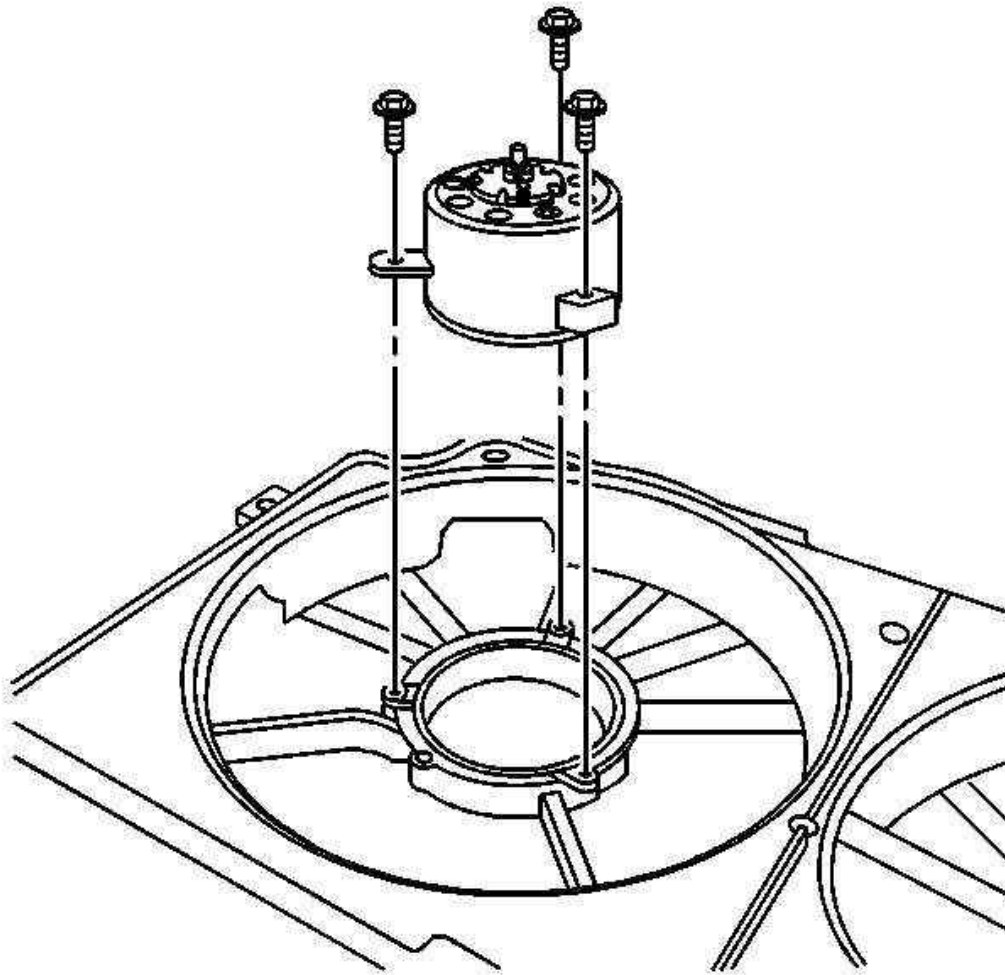


Fig. 67: Identifying Engine Cooling Fan Motor & Bolts
Courtesy of GENERAL MOTORS CORP.

16. Remove the engine cooling fan motor bolts.
17. Remove the engine cooling fan motor.

Installation Procedure

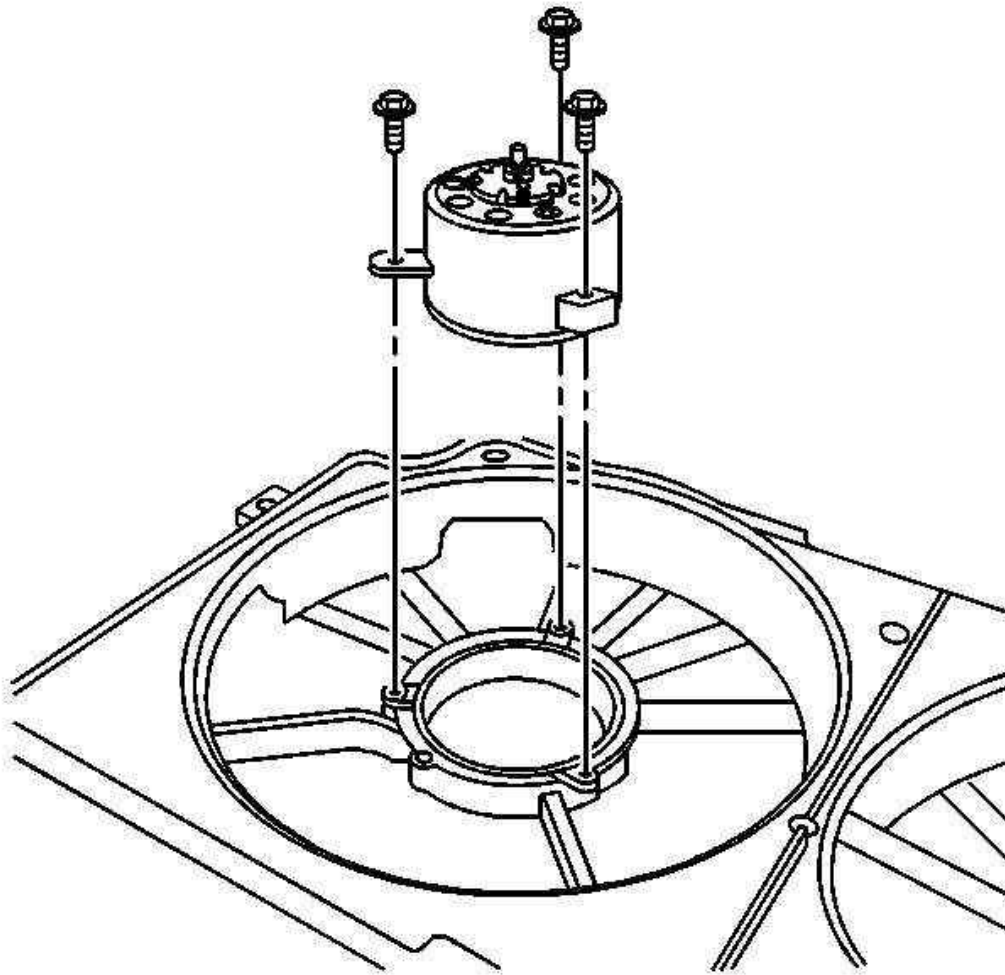


Fig. 68: Identifying Engine Cooling Fan Motor & Bolts
Courtesy of GENERAL MOTORS CORP.

1. Install the engine cooling fan motor.

NOTE: Refer to Fastener Notice .

2. Install the cooling fan motor bolts.

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

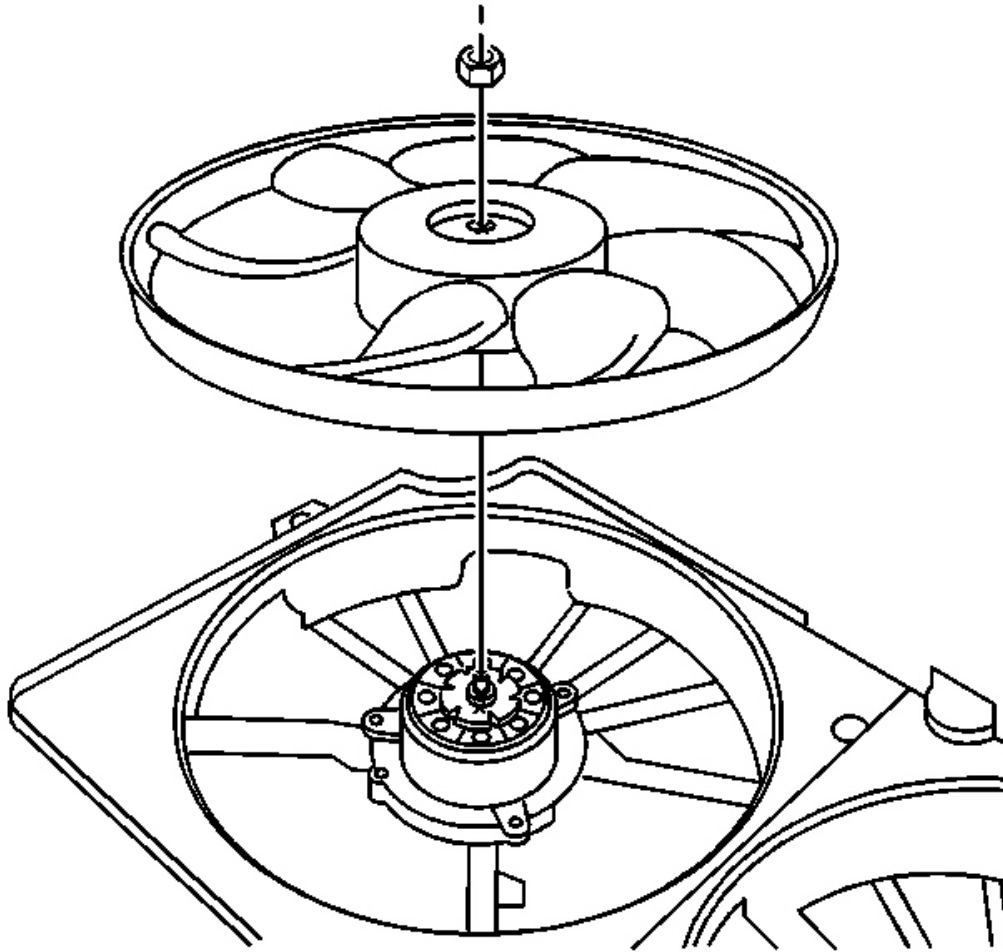


Fig. 69: Identifying Engine Cooling Fan Blade & Nut
Courtesy of GENERAL MOTORS CORP.

3. Install the engine cooling fan blade.
4. Install the engine cooling fan blade nut.

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

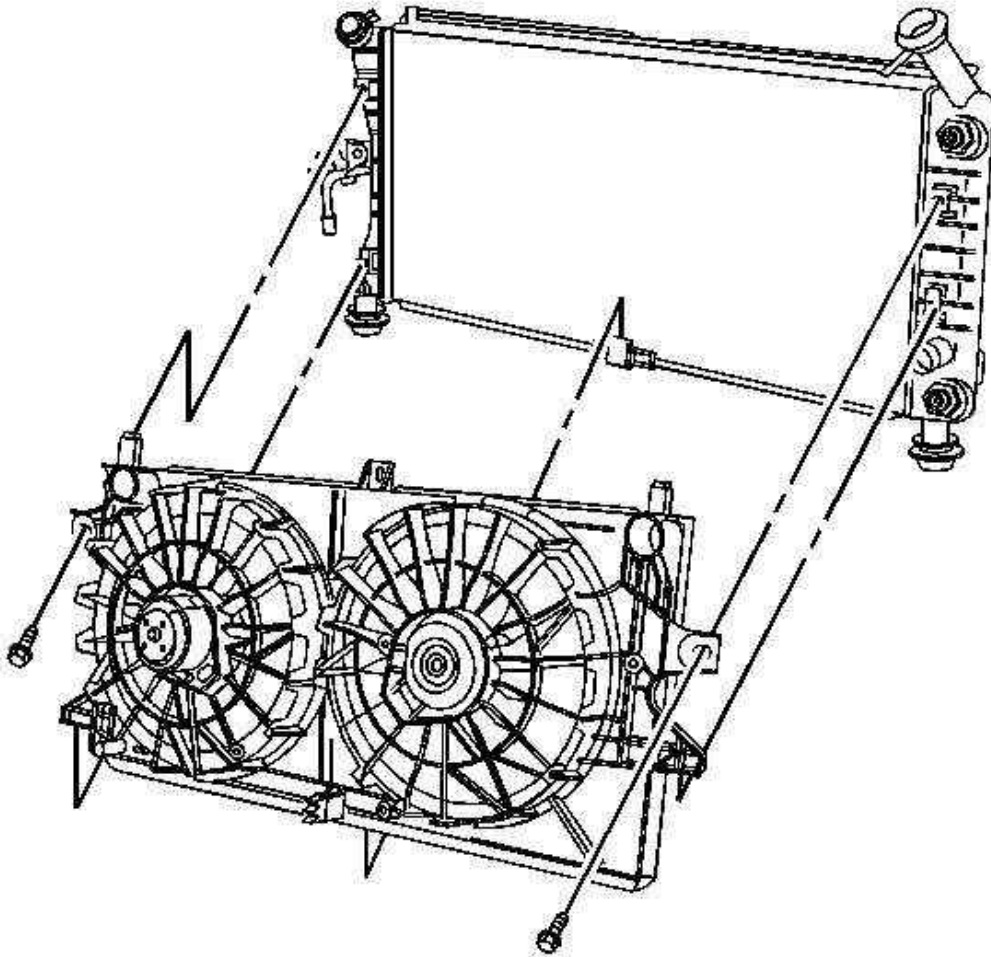


Fig. 70: Identifying Cooling Fan Shroud
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Ensure the lower edge of the fan shroud engages the clip at the bottom of the radiator.

5. Install the fan shroud.
6. Install the cooling fan shroud bolts.

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

7. Install the cooling fan electrical harness to the fan shroud clips.
8. Connect the engine cooling fan motors electrical connectors.
9. Install the fan shroud clip to the condenser tubes.

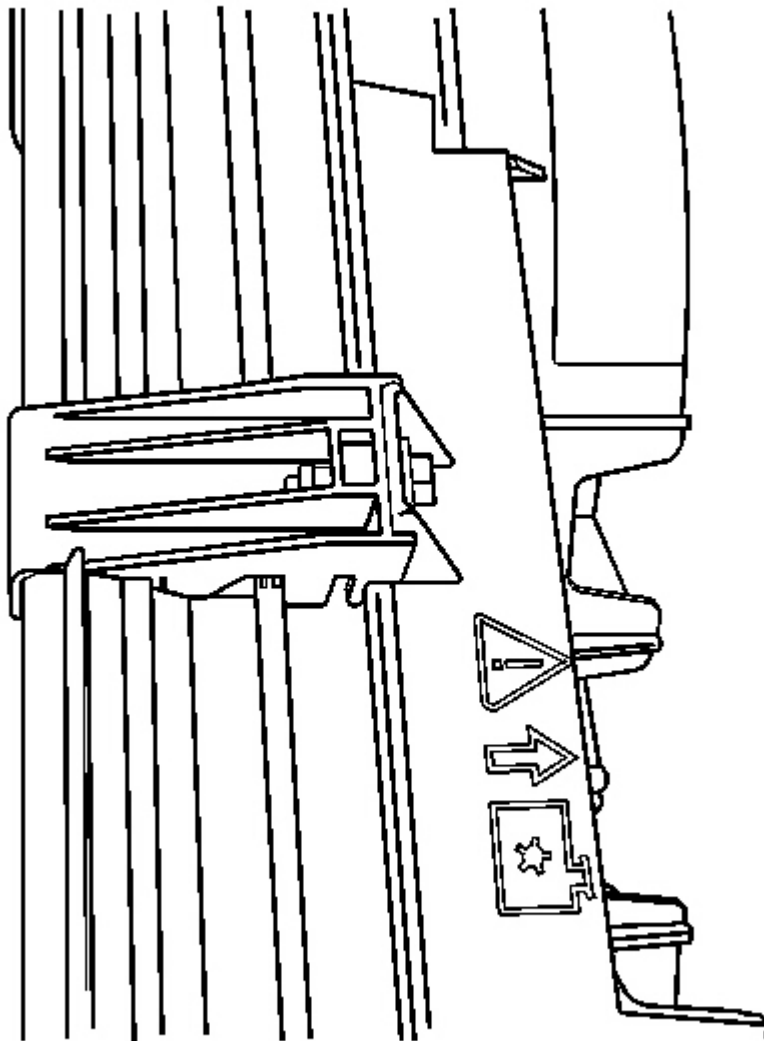


Fig. 71: Identifying Fan Shroud To Condenser Hold Down Bracket Bolt
Courtesy of GENERAL MOTORS CORP.

10. Install the bolt that connects the fan shroud to the condenser hold down bracket.

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

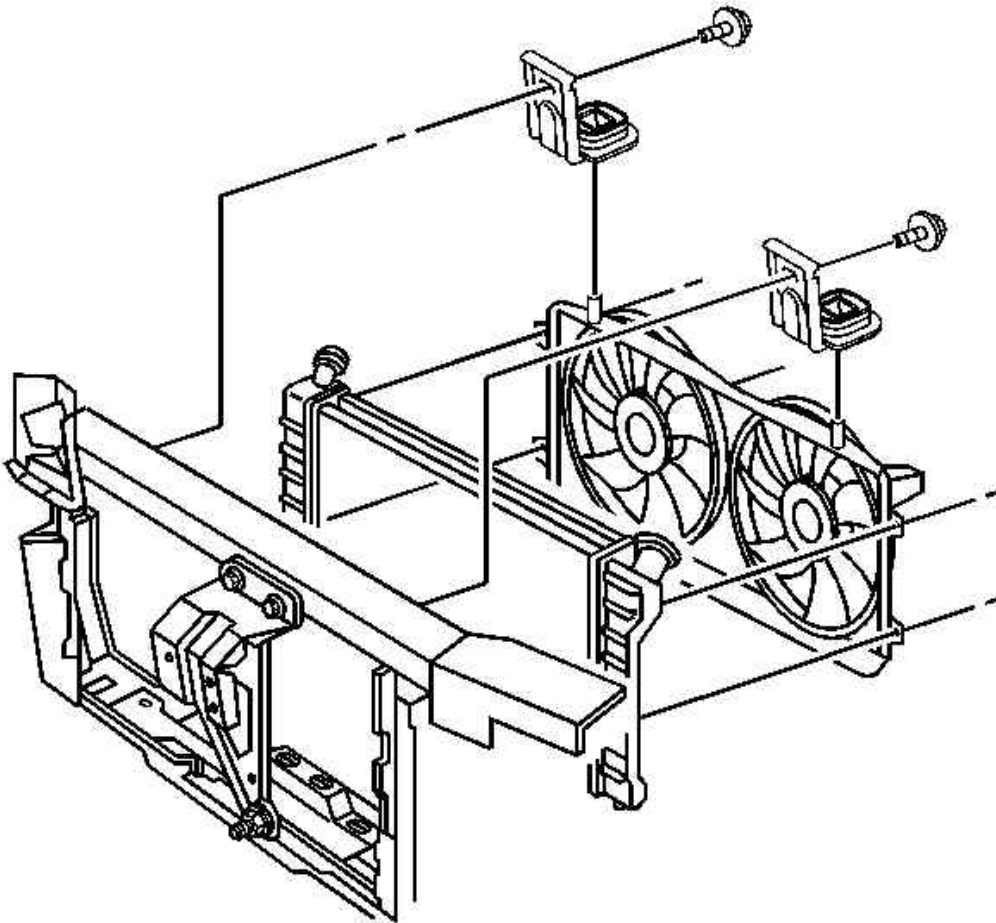


Fig. 72: View Of Fan Shroud To Radiator Upper Support Brackets
Courtesy of GENERAL MOTORS CORP.

11. Install the radiator upper support brackets and bolts.

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

12. Install the transmission oil cooler lines to the retainer at the bottom of the fan shroud.
13. Install the air cleaner assembly. Refer to **Air Cleaner Assembly Replacement** .
14. Install the PCM harness clip on to the fan shroud.
15. Install the engine mount struts. Refer to **Engine Mount Strut Replacement - Left Side** and to **Engine Mount Strut Replacement - Right Side** .
16. Connect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection (L26)** or **Battery Negative Cable Disconnection and Connection (LY7)** or **Battery Negative Cable Disconnection and Connection (LS4)** .
17. Inspect the engine cooling fans for proper operation.

ENGINE COOLANT FAN MOTOR REPLACEMENT (LY7)

Tools Required

GE-47827 Socket. See **Special Tools**.

Removal Procedure

CAUTION: An electric fan under the hood can start up even when the engine is not running and can injure you. Keep hands, clothing and tools away from any underhood electric fan.

CAUTION: To help avoid personal injury or damage to the vehicle, a bent, cracked, or damaged fan blade or housing should always be replaced.

CAUTION: Unless directed otherwise, the ignition and start switch must be in the OFF or LOCK position, and all electrical loads must be OFF before servicing any electrical component. Disconnect the negative battery cable to prevent an electrical spark should a tool or equipment come in contact with an exposed

electrical terminal. Failure to follow these precautions may result in personal injury and/or damage to the vehicle or its components.

1. Remove the fan shroud assembly from the vehicle. Refer to **Fan Shroud Replacement (LY7)** or **Fan Shroud Replacement (L26)** or **Fan Shroud Replacement (LS4)**.

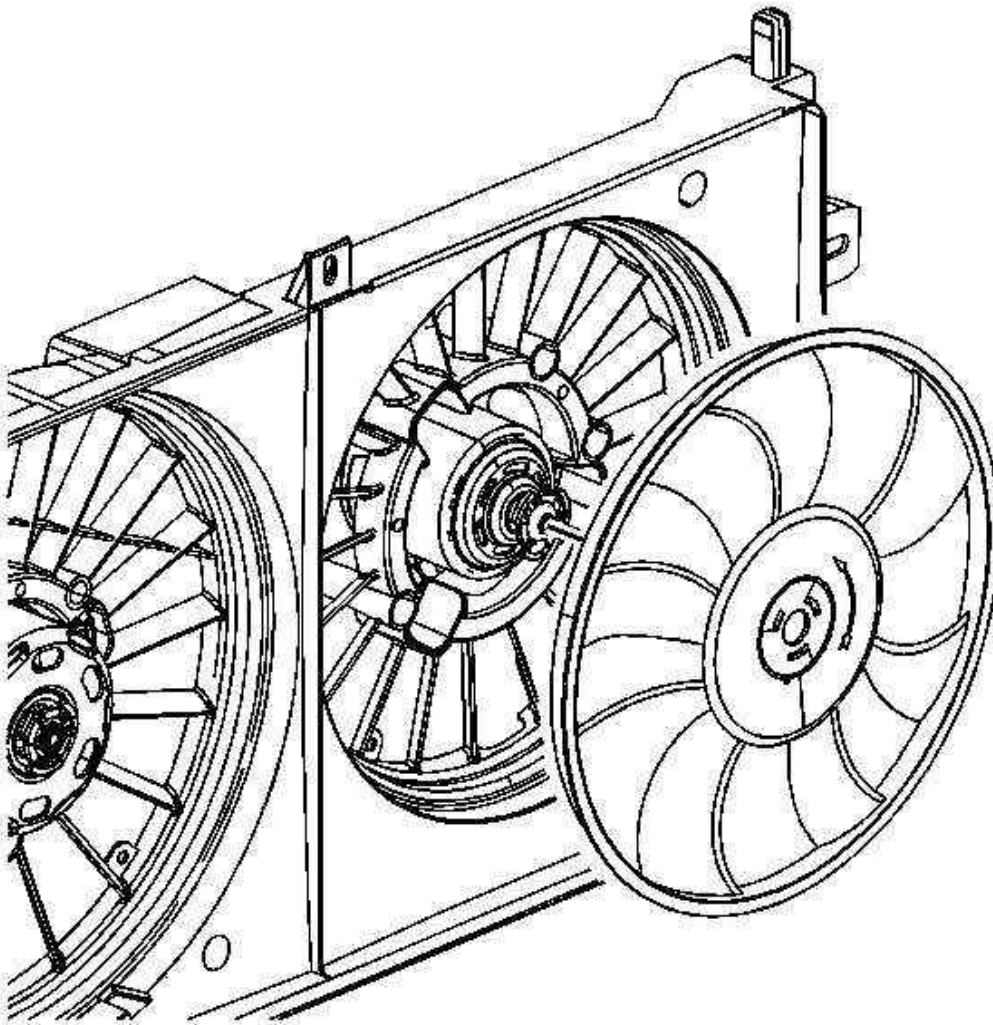


Fig. 73: Identifying Fan Shroud Assembly
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Hold the fan blade to prevent rotation.

2. Using **GE-47827** turn the fan motor drive plate in the opposite direction of the arrow on the fan blade until the motor drive plate disengages from the fan blade. See **Special Tools**.
3. Remove and discard the fan blade.

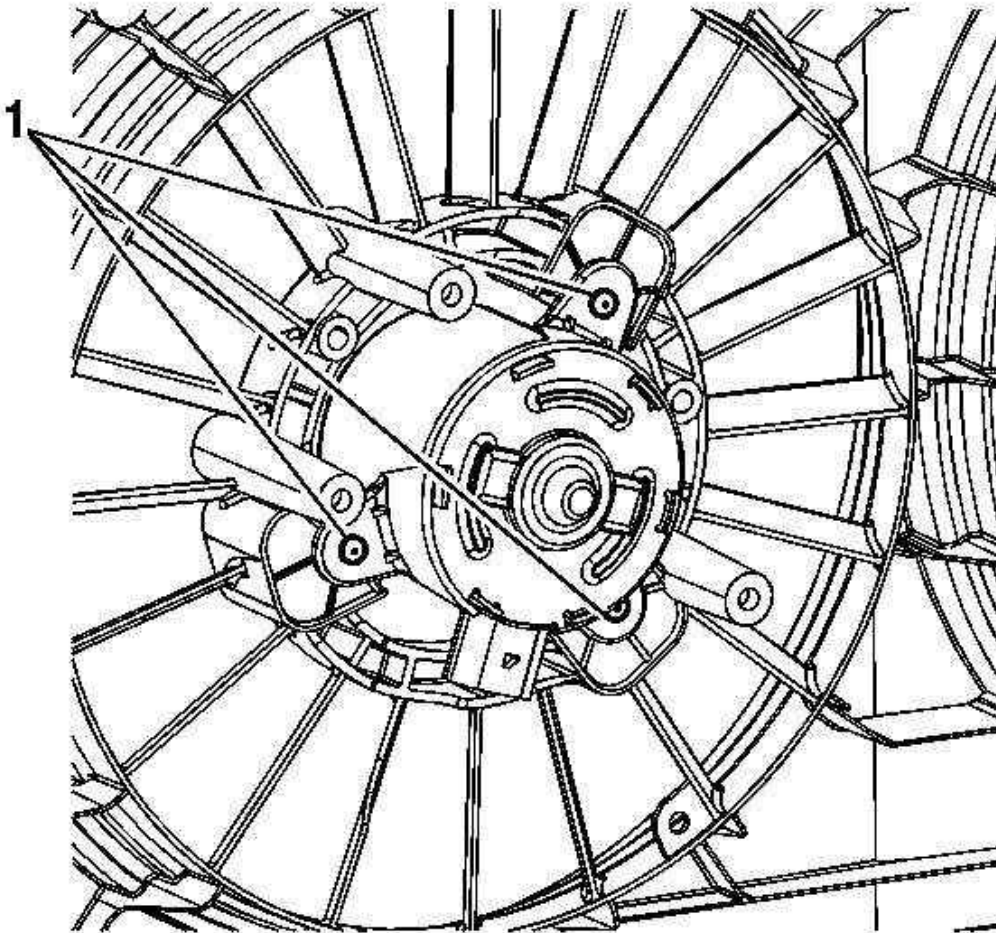


Fig. 74: Identifying Fan Blade

Courtesy of GENERAL MOTORS CORP.

NOTE: Failure to tape off all of the entry points to the cooling fan motor(s) will allow debris to enter and damage the motor(s).

IMPORTANT: When reusing the fan motor tape off the front and rear entry points of the fan motor before drilling the rivets.

4. Center punch each of the rivets (1) from the rear of the motor.
5. Drill the head of the rivets (1) from the fan motor using a 6.35 mm (0.25 in) drill bit.

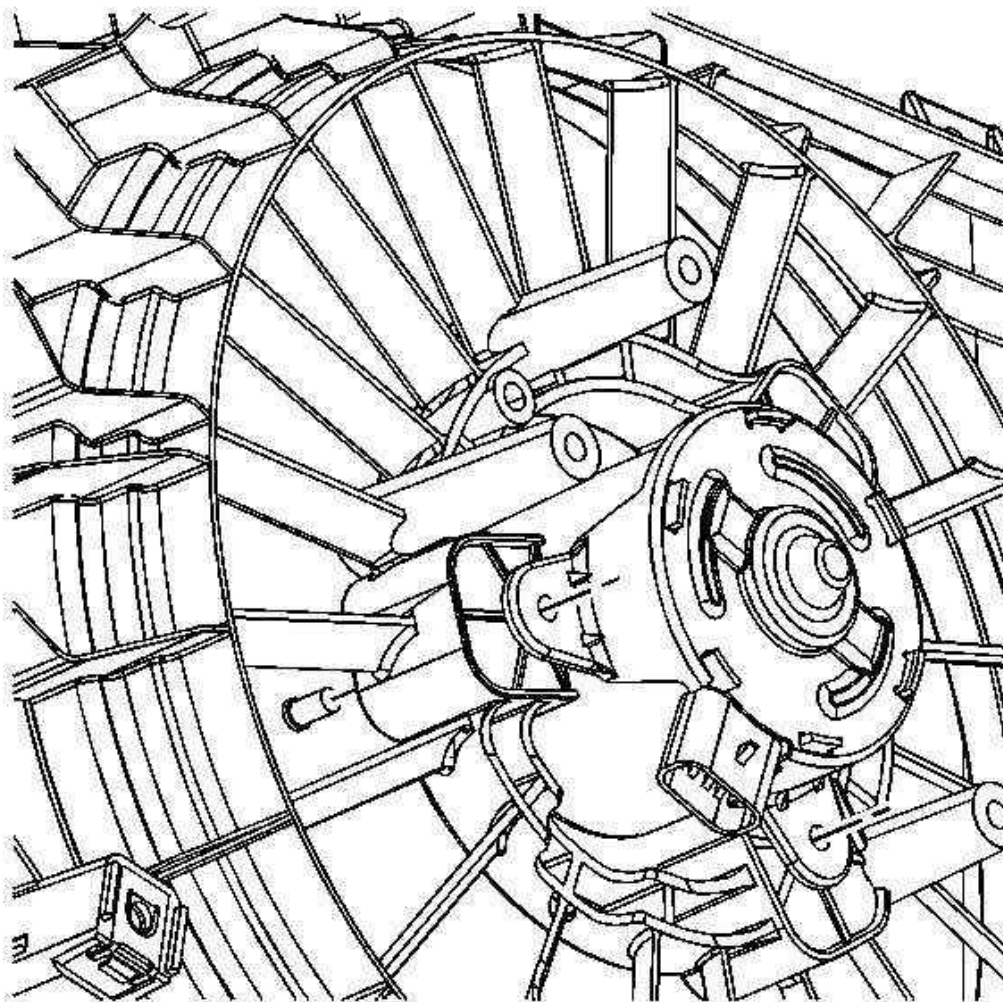


Fig. 75: Identifying Fan Rivets
Courtesy of GENERAL MOTORS CORP.

6. Tap the rivets out of the fan shroud.

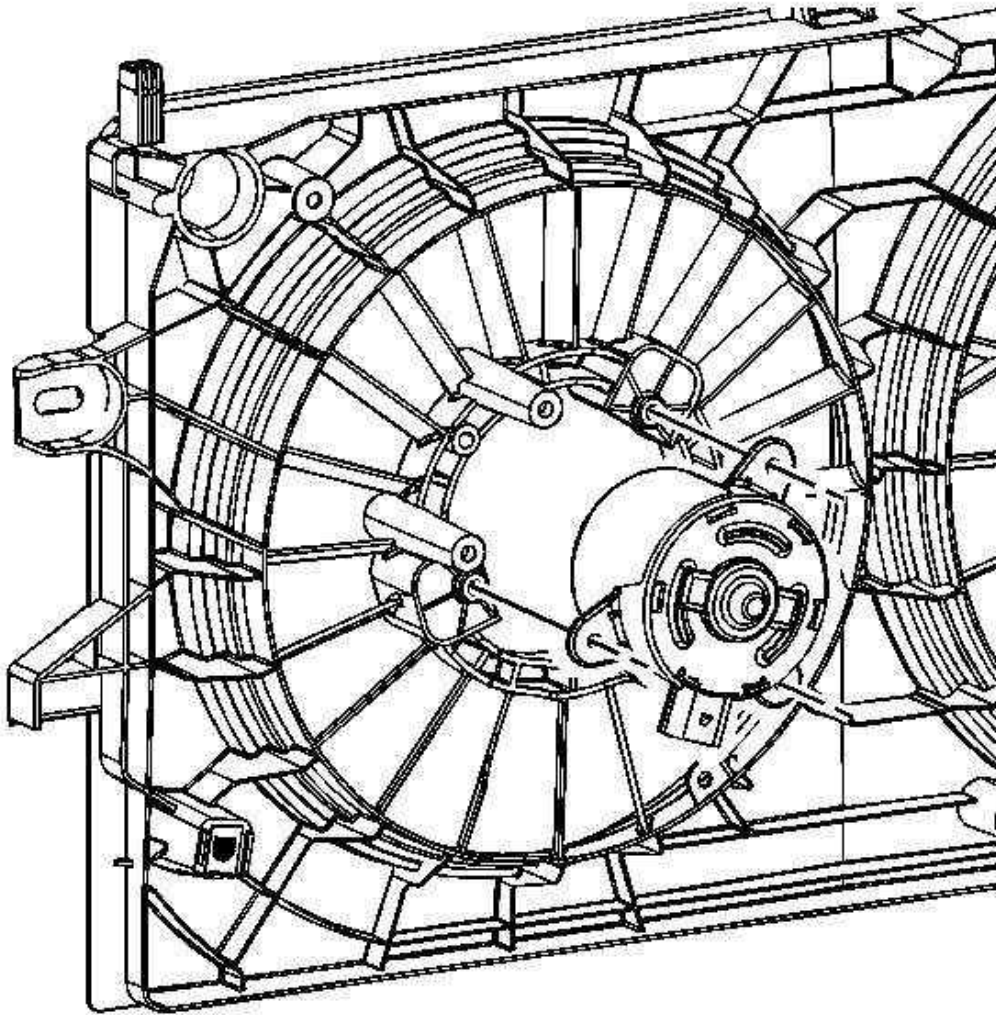


Fig. 76: View Of Fan Motor & Fan Shroud
Courtesy of GENERAL MOTORS CORP.

7. Remove the fan motor from the fan shroud.

IMPORTANT: Blow off any excess debris from the fan motor.

8. Remove the tape covering the entry points from the fan motor.

Installation Procedure

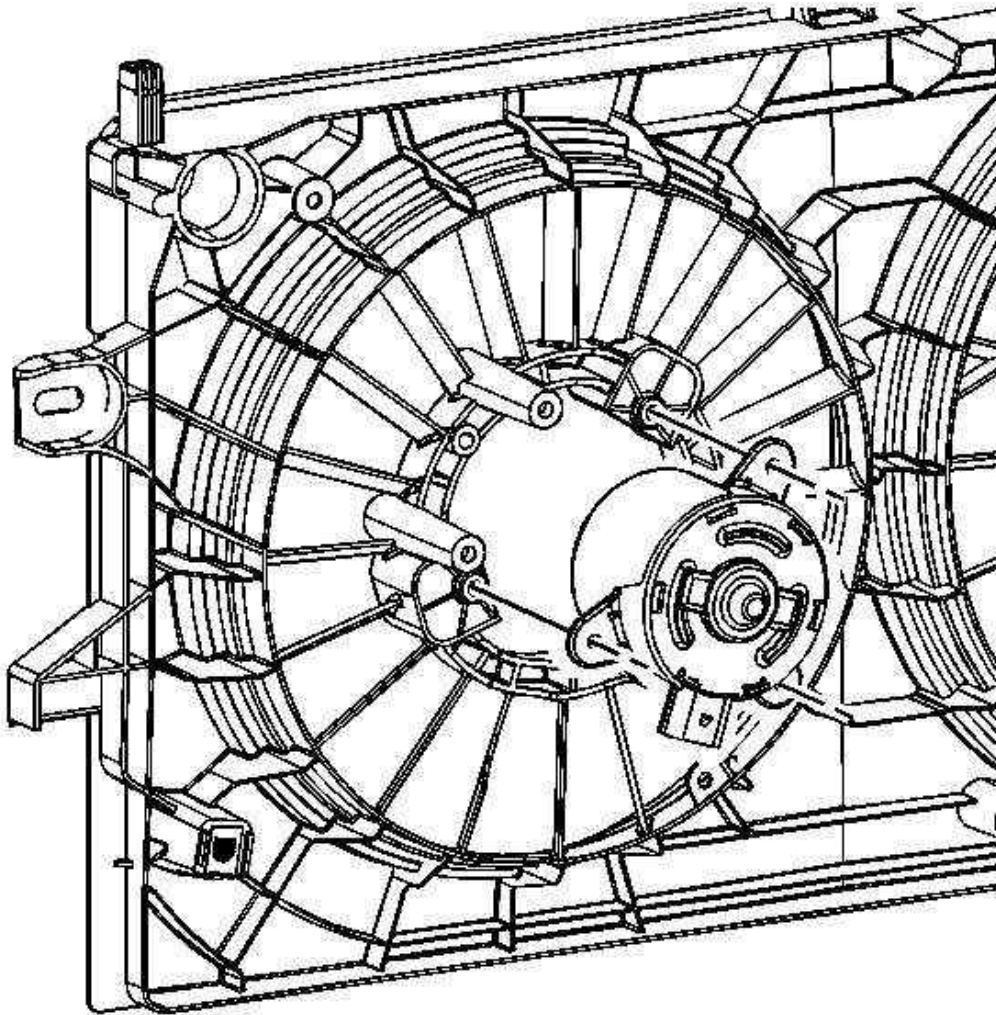


Fig. 77: View Of Fan Motor & Fan Shroud
Courtesy of GENERAL MOTORS CORP.

1. Install the engine cooling fan motor to the fan shroud.

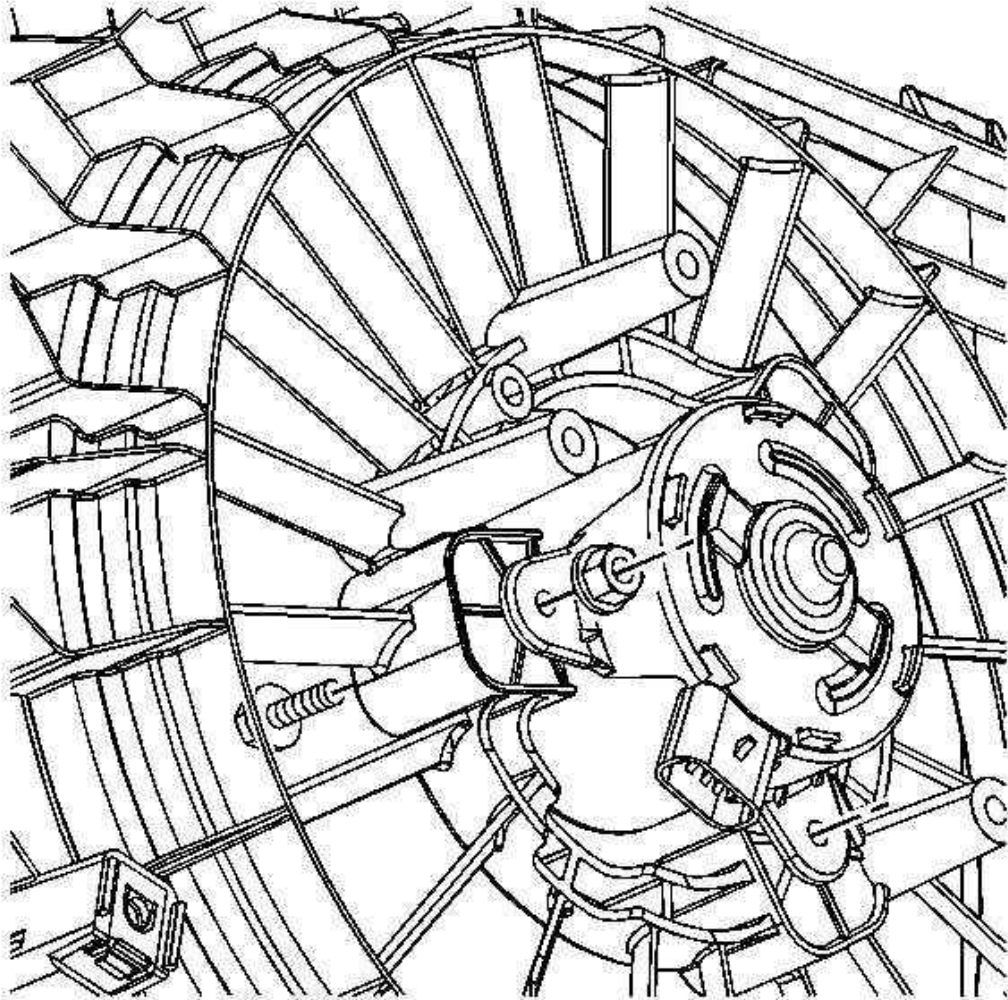


Fig. 78: Locating Cooling Fan Motor Bolts
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Position the fan motor to the fan shroud and insert the bolts from the front side.

2. Install the cooling fan motor bolts.

NOTE: Refer to Fastener Notice .

3. Install the cooling fan motor nuts.

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

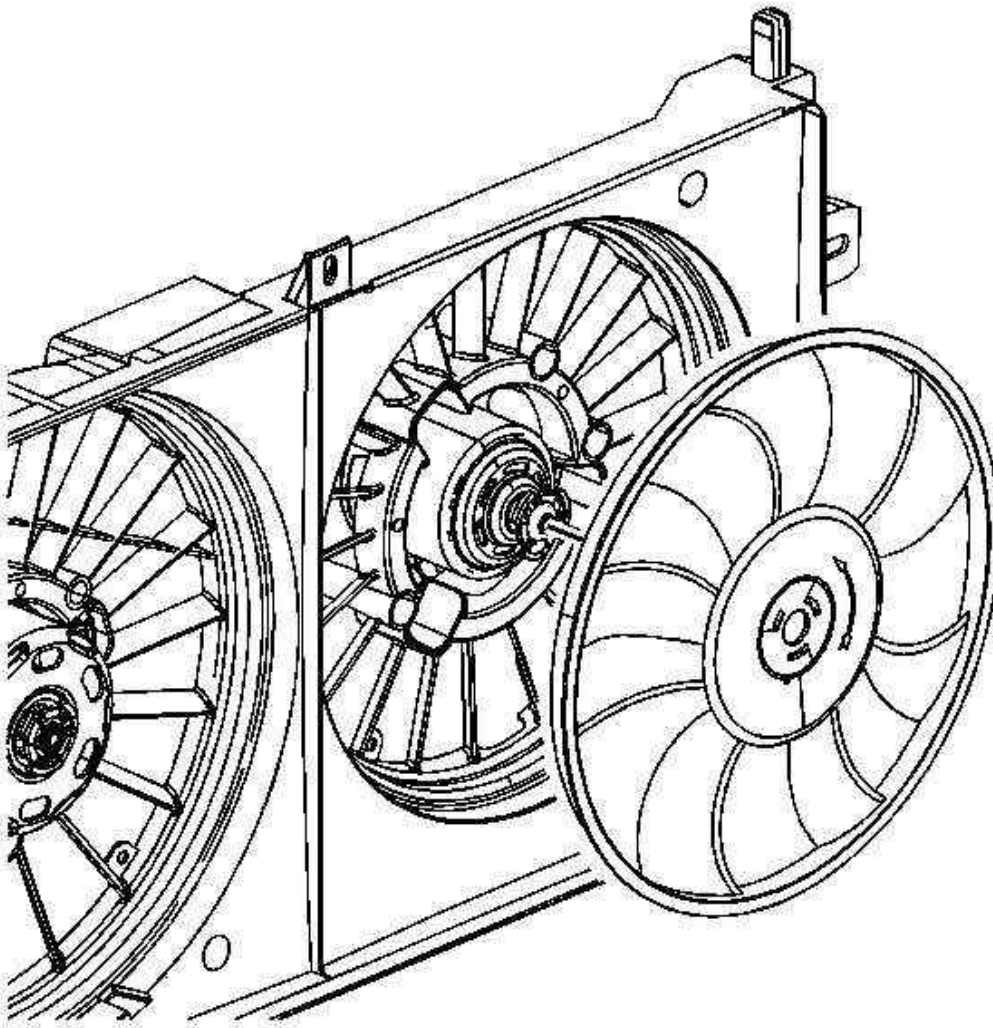


Fig. 79: Identifying Fan Shroud Assembly
Courtesy of GENERAL MOTORS CORP.

NOTE: Failure to heat the fan hub in hot tap water before

installation will result in cooling fan failure due to cracking. Allowing the heated fan to cool for more than one minute prior to installation will also result in failure due to cracking.

IMPORTANT: Using hot tap water at a minimum of 49°C (120°F), hold the new fan blade hub under the running water for a minimum of 60 seconds to heat the fan blade to the temperature of the water. Immediately after heating, position the fan blade on the fan motor drive plate.

4. Install the new engine cooling fan blade.

IMPORTANT: Hold the fan blade to prevent rotation.

5. Using the **GE-47827** turn the fan motor drive plate in the same direction of the arrow on the fan blade until the fan motor drive plate engages to the fan blade. See **Special Tools**. Full engagement is attained when the motor drive plate fully occupies the three slots in the face of the fan blade.
6. Rotate the cooling fan blade to ensure proper rotation.
7. Install the fan shroud assembly to the vehicle. Refer to **Fan Shroud Replacement (LY7)** or **Fan Shroud Replacement (L26)** or **Fan Shroud Replacement (LS4)**.

ENGINE COOLANT FAN MOTOR REPLACEMENT (LS4)

Tools Required

GE-47827 Socket. See **Special Tools**.

Removal Procedure

CAUTION: An electric fan under the hood can start up even when the engine is not running and can injure you. Keep hands, clothing and tools away from any underhood electric fan.

CAUTION: To help avoid personal injury or damage to the vehicle, a bent, cracked, or damaged fan blade or housing should always be replaced.

CAUTION: Refer to Battery Disconnect Caution .

1. Remove the fan shroud assembly from the vehicle. Refer to Fan Shroud Replacement (LY7) or Fan Shroud Replacement (L26) or Fan Shroud Replacement (LS4).

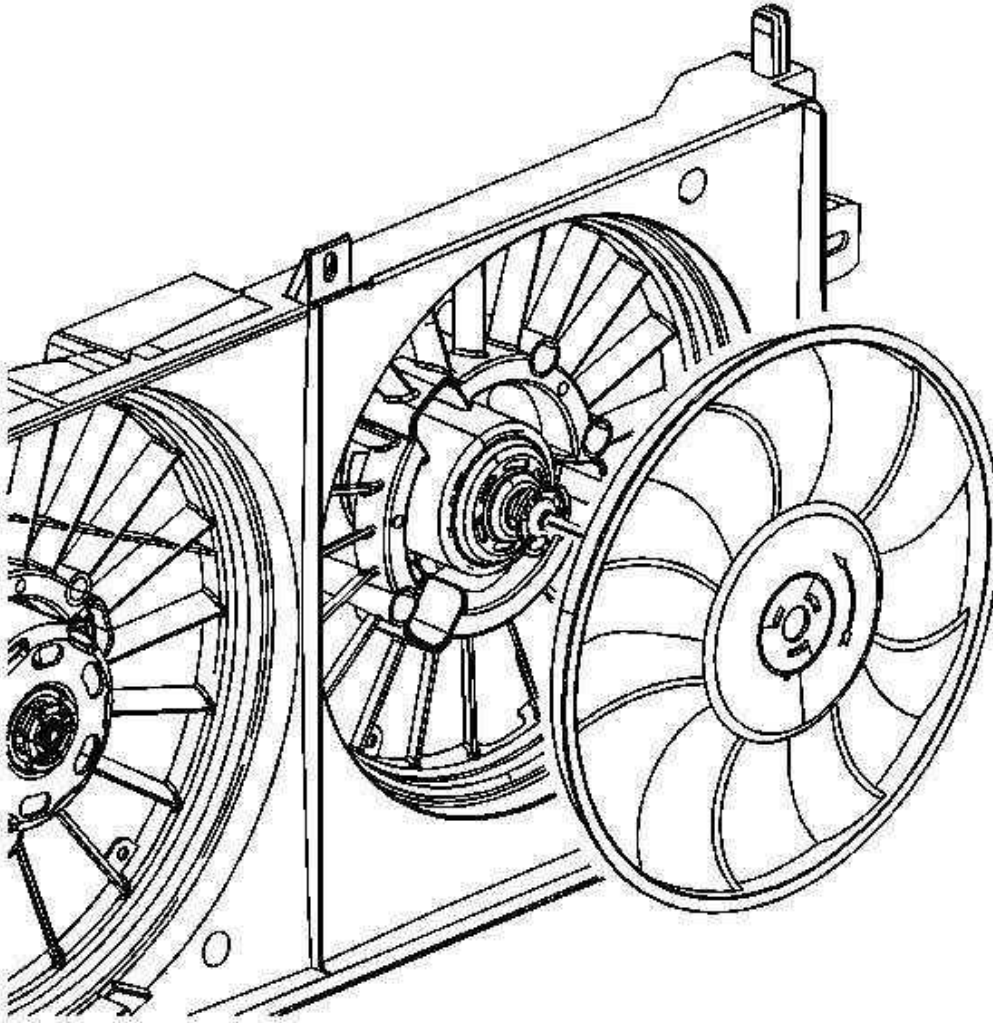


Fig. 80: Identifying Fan Shroud Assembly
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Hold the fan blade to prevent rotation.

2. Using **GE-47827** turn the fan motor drive plate in the opposite direction of the arrow on the fan blade until the motor drive plate disengages from the fan blade. See **Special Tools**.

3. Remove and discard the fan blade.

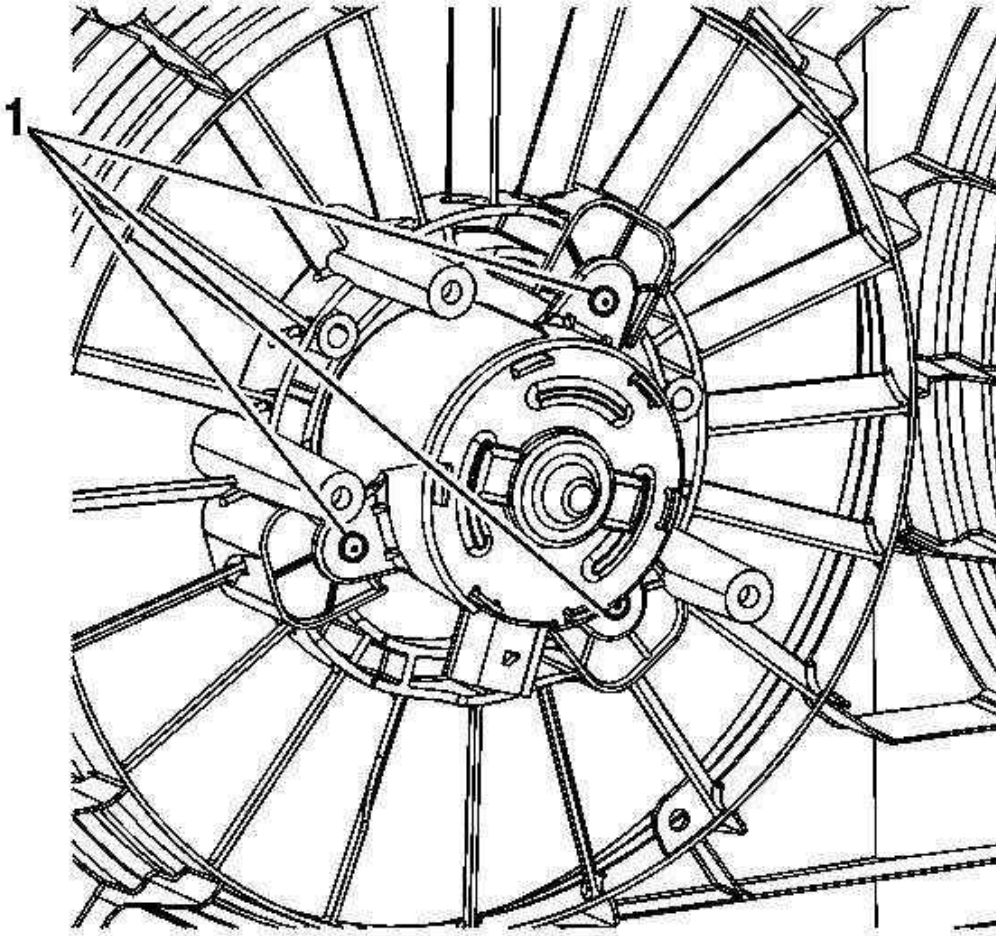


Fig. 81: Identifying Fan Blade

Courtesy of GENERAL MOTORS CORP.

NOTE: Failure to tape off all of the entry points to the cooling fan motor(s) will allow debris to enter and damage the motor(s).

IMPORTANT: When reusing the fan motor tape off the front and

rear entry points of the fan motor before drilling the rivets.

4. Center punch each of the rivets (1) from the rear of the motor.
5. Drill the head of the rivets (1) from the fan motor using a 6.35 mm (0.25 in) drill bit.

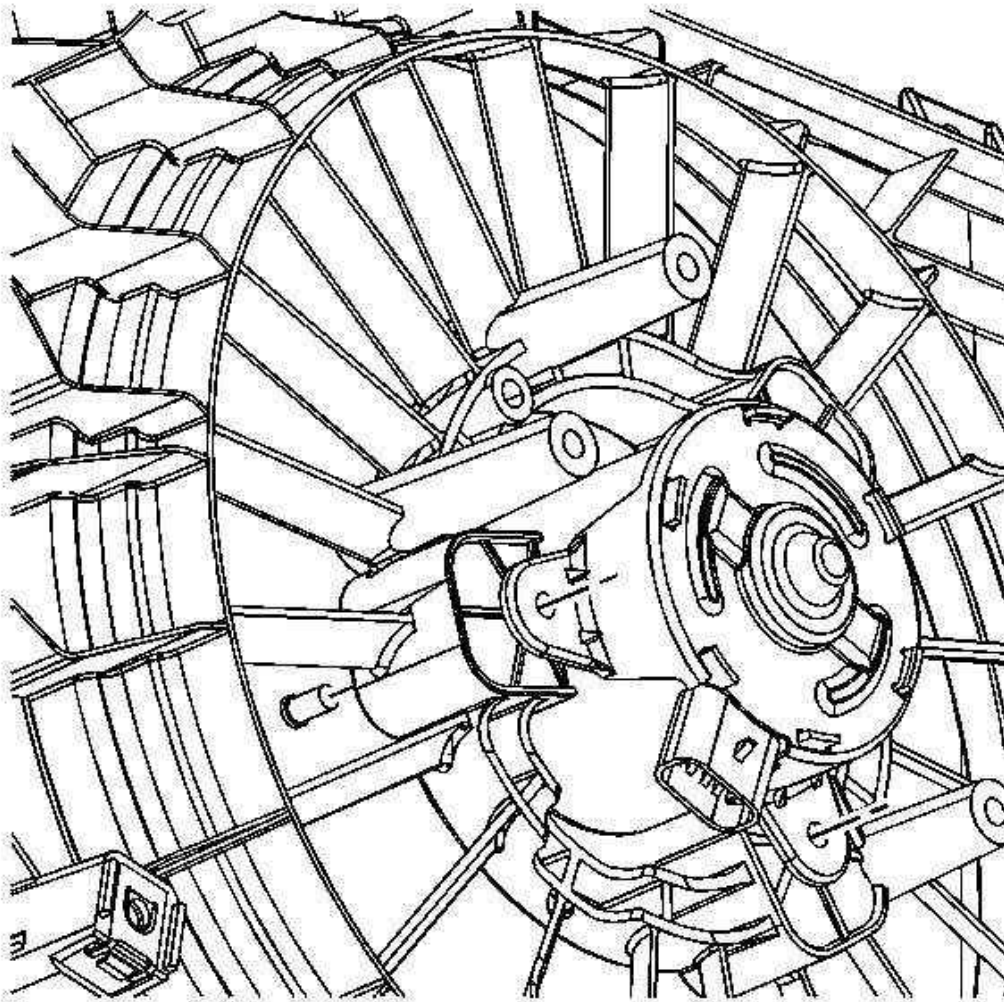


Fig. 82: Identifying Fan Rivets
Courtesy of GENERAL MOTORS CORP.

6. Tap the rivets out of the fan shroud.

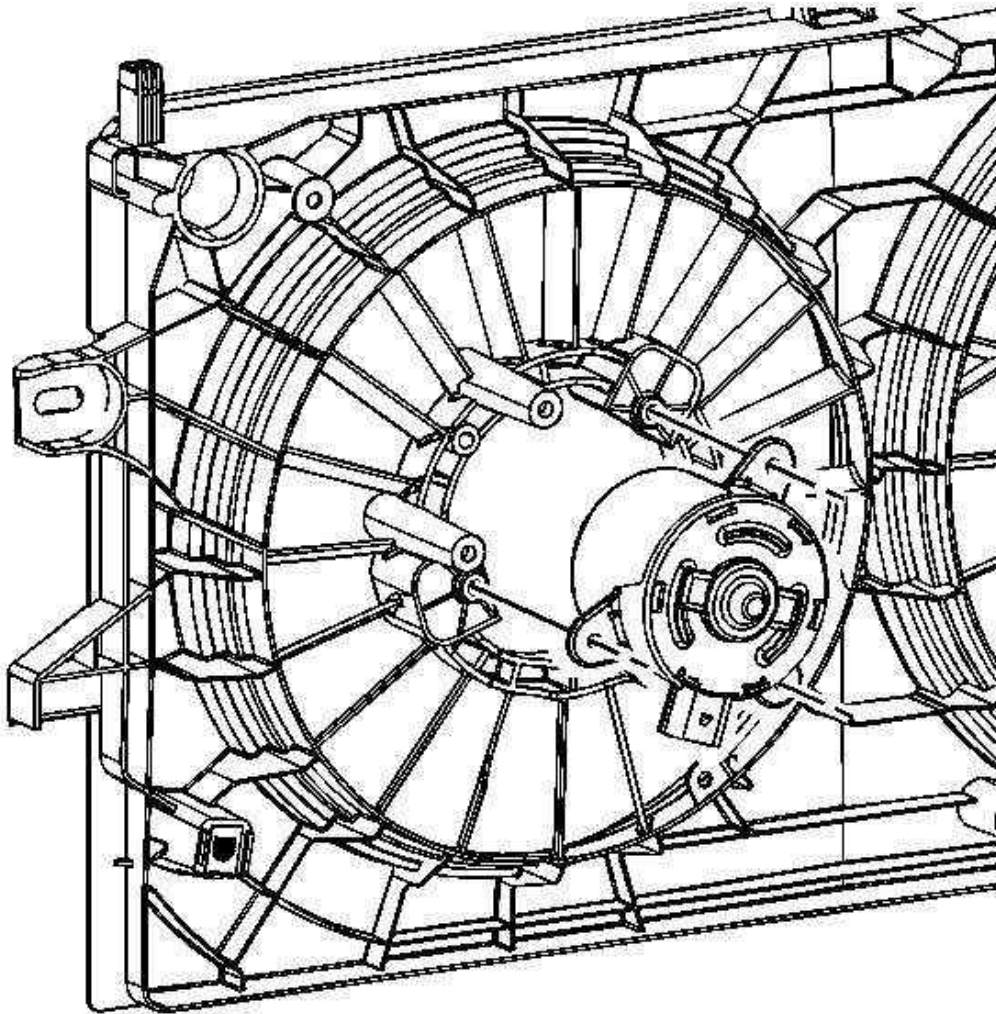


Fig. 83: View Of Fan Motor & Fan Shroud
Courtesy of GENERAL MOTORS CORP.

7. Remove the fan motor from the fan shroud.

IMPORTANT: Blow off any excess debris from the fan motor.

8. Remove the tape covering the entry points from the fan motor.

Installation Procedure

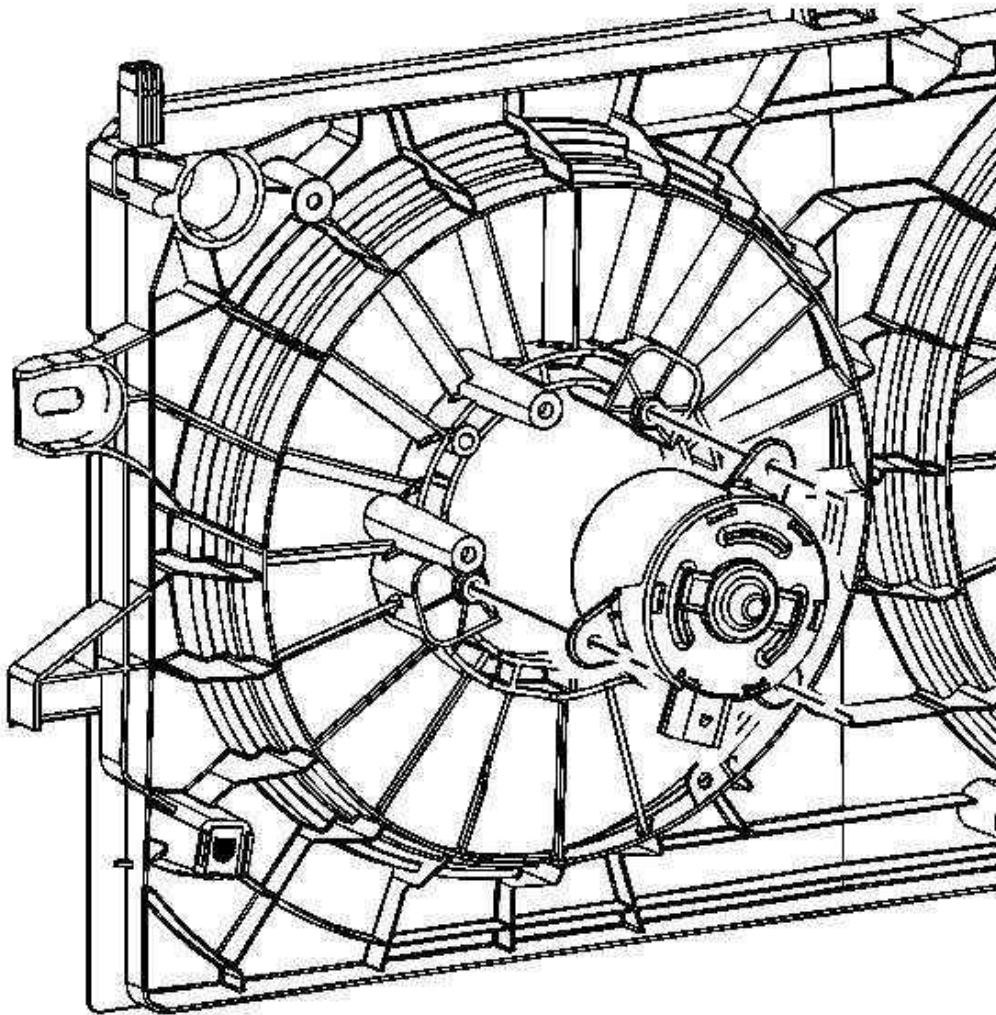


Fig. 84: View Of Fan Motor & Fan Shroud
Courtesy of GENERAL MOTORS CORP.

1. Install the engine cooling fan motor to the fan shroud.

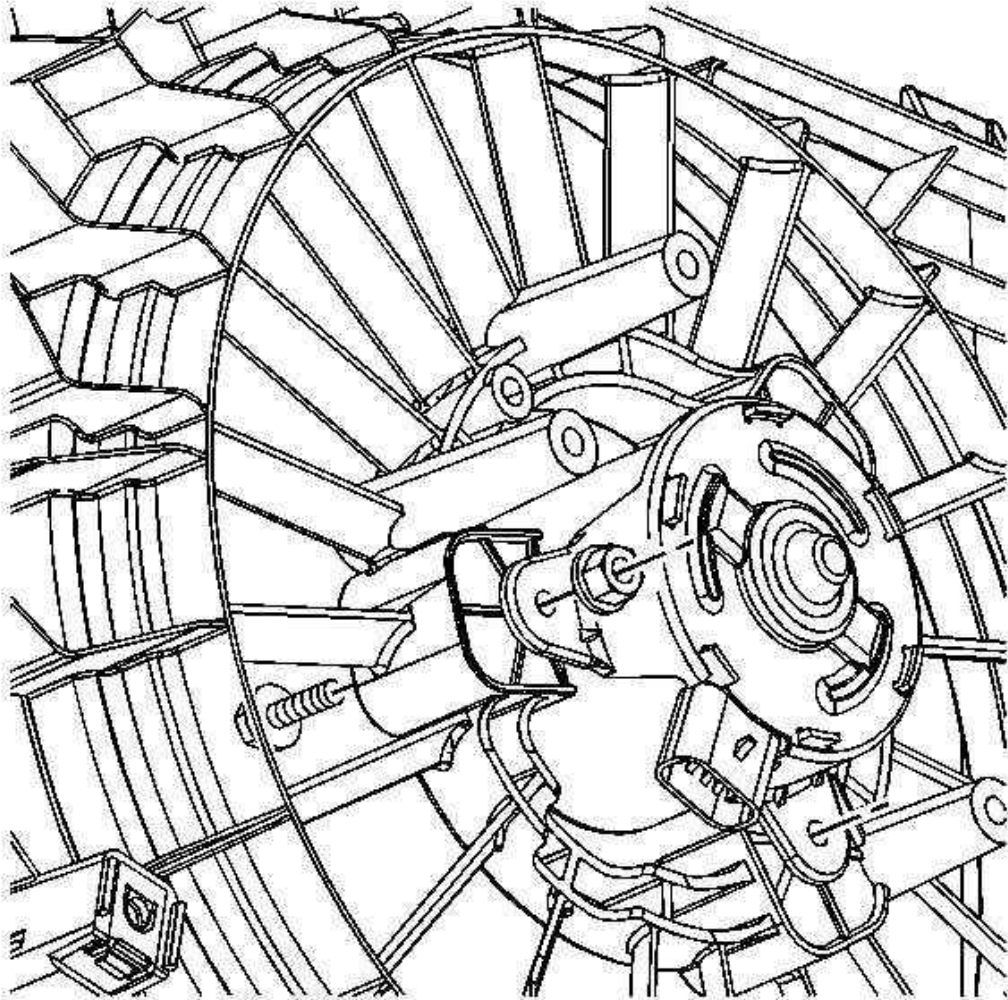


Fig. 85: Locating Cooling Fan Motor Bolts
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Position the fan motor to the fan shroud and insert the bolts from the front side.

2. Install the cooling fan motor bolts.

NOTE: Refer to Fastener Notice .

3. Install the cooling fan motor nuts.

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

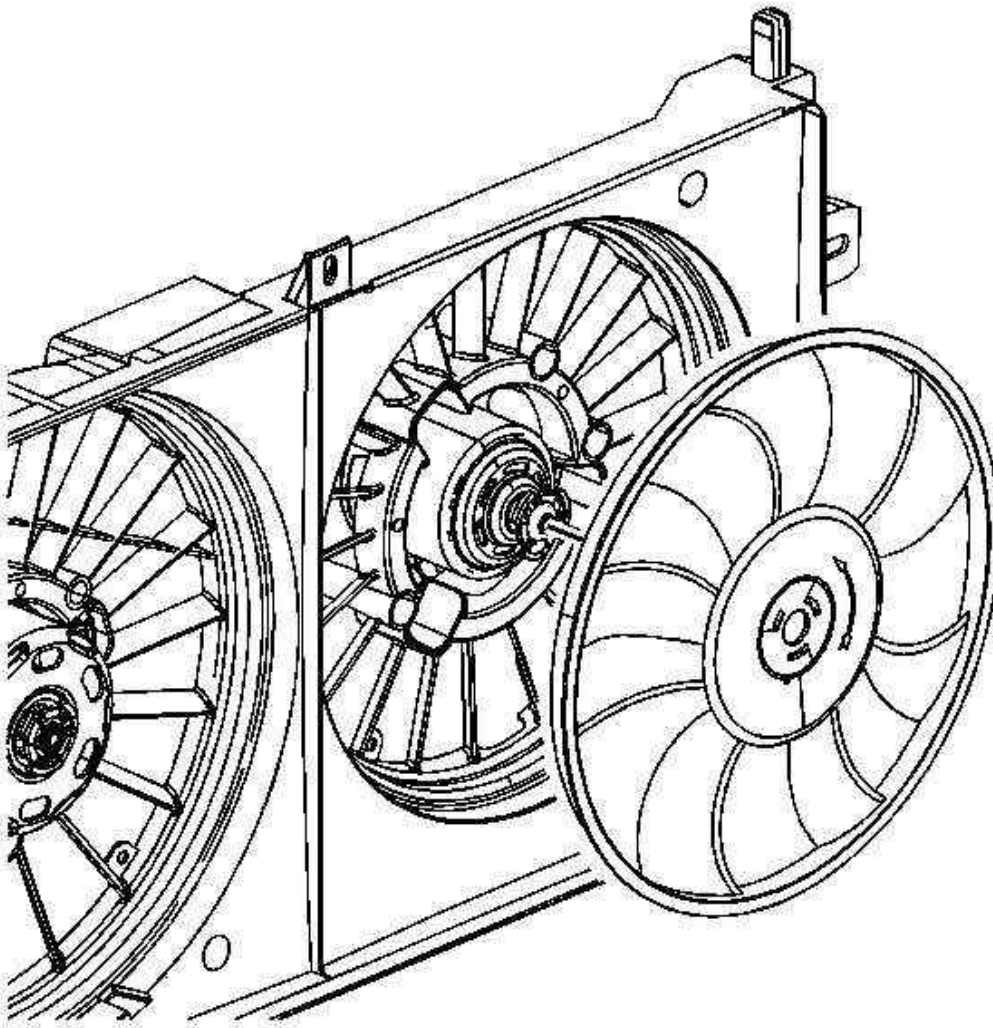


Fig. 86: Identifying Fan Shroud Assembly
Courtesy of GENERAL MOTORS CORP.

NOTE: Failure to heat the fan hub in hot tap water before

installation will result in cooling fan failure due to cracking. Allowing the heated fan to cool for more than one minute prior to installation will also result in failure due to cracking.

IMPORTANT: Using hot tap water at a minimum of 49°C (120°F), hold the new fan blade hub under the running water for a minimum of 60 seconds to heat the fan blade to the temperature of the water. Immediately after heating, position the fan blade on the fan motor drive plate.

4. Install the new engine cooling fan blade.

IMPORTANT: Hold the fan blade to prevent rotation.

5. Using the **GE-47827** turn the fan motor drive plate in the same direction of the arrow on the fan blade until the fan motor drive plate engages to the fan blade. See **Special Tools**. Full engagement is attained when the motor drive plate fully occupies the three slots in the face of the fan blade.
6. Rotate the cooling fan blade to ensure proper rotation.
7. Install the fan shroud assembly to the vehicle. Refer to **Fan Shroud Replacement (LY7)** or **Fan Shroud Replacement (L26)** or **Fan Shroud Replacement (LS4)**.

ENGINE COOLANT THERMOSTAT HOUSING REPLACEMENT (LY7)

Tools Required

J 28410 Gasket Remover. See **Special Tools**.

Removal Procedure

1. Disconnect the heater hoses from the heater core. Refer to **Heater Inlet Hose Replacement (LY7)** or **Heater Inlet Hose Replacement (L26)** or **Heater Inlet Hose Replacement (LS4)** or **Heater Outlet Hose Replacement (LY7)** or **Heater Outlet Hose Replacement (L26)** or **Heater Outlet Hose**

Replacement (LS4) .

2. Remove the thermostat. Refer to **Engine Coolant Thermostat Replacement (LY7)** or **Engine Coolant Thermostat Replacement (RPOs L26/L32)** or **Engine Coolant Thermostat Replacement (LS4)**.

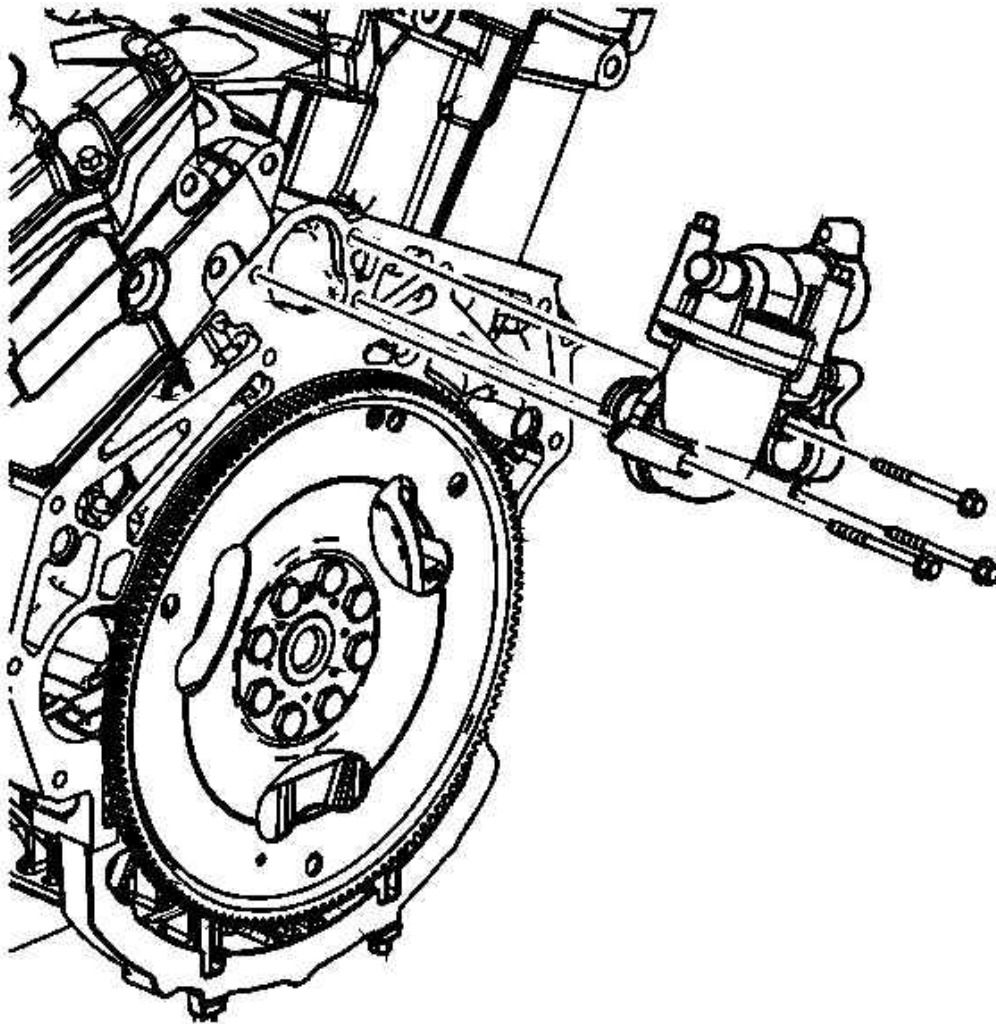


Fig. 87: View Of Thermostat Housing With Heater Pipes, Heater Hoses, Gasket & Bolts

Courtesy of GENERAL MOTORS CORP.

2008 Buick LaCrosse CXL
2008 ENGINE Engine Cooling - LaCrosse

3. Remove the thermostat housing bolts.
4. Remove the thermostat housing with the heater pipes, hoses and bolts.
5. Carefully clean the sealing surfaces with a plastic gasket scraper such as **J 28410** or equivalent. See **Special Tools**.

Installation Procedure

1. Assemble the heater pipes and hoses to the thermostat housing.
2. Install a new gasket to the thermostat housing.
3. Install the thermostat housing bolts to the thermostat housing.

Partially install the thermostat housing bolts in order to retain the gasket.

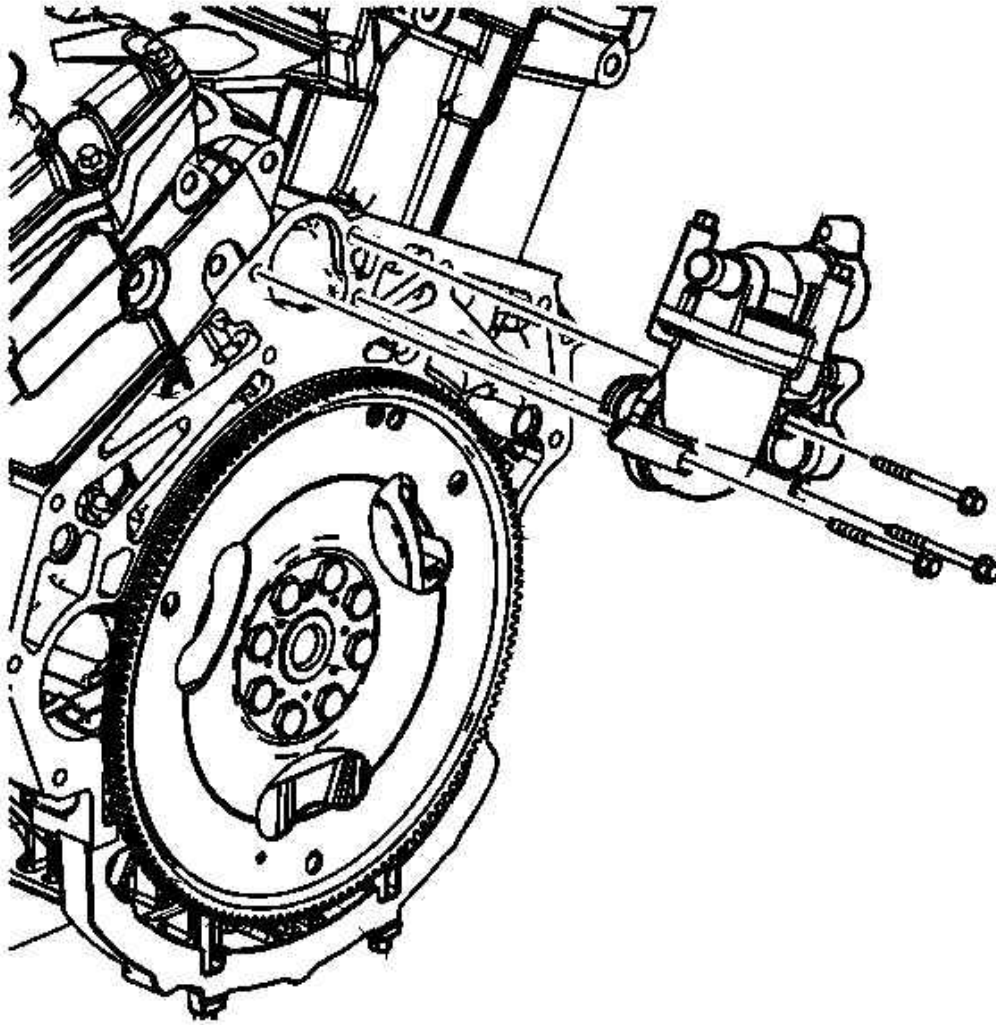


Fig. 88: View Of Thermostat Housing With Heater Pipes, Heater Hoses, Gasket & Bolts

Courtesy of GENERAL MOTORS CORP.

4. Install the thermostat housing with the heater pipes, heater hoses, gasket and bolts.

NOTE: Refer to Fastener Notice .

5. Install the thermostat housing bolts.

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

6. Install the thermostat. Refer to **Engine Coolant Thermostat Replacement (LY7)** or **Engine Coolant Thermostat Replacement (RPOs L26/L32)** or **Engine Coolant Thermostat Replacement (LS4)**.
7. Connect the heater hoses to the heater core. Refer to **Heater Inlet Hose Replacement (LY7)** or **Heater Inlet Hose Replacement (L26)** or **Heater Inlet Hose Replacement (LS4)** or **Heater Outlet Hose Replacement (LY7)** or **Heater Outlet Hose Replacement (L26)** or **Heater Outlet Hose Replacement (LS4)** .

ENGINE COOLANT THERMOSTAT HOUSING REPLACEMENT (RPOS L26/L32)

Tools Required

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

Removal Procedure

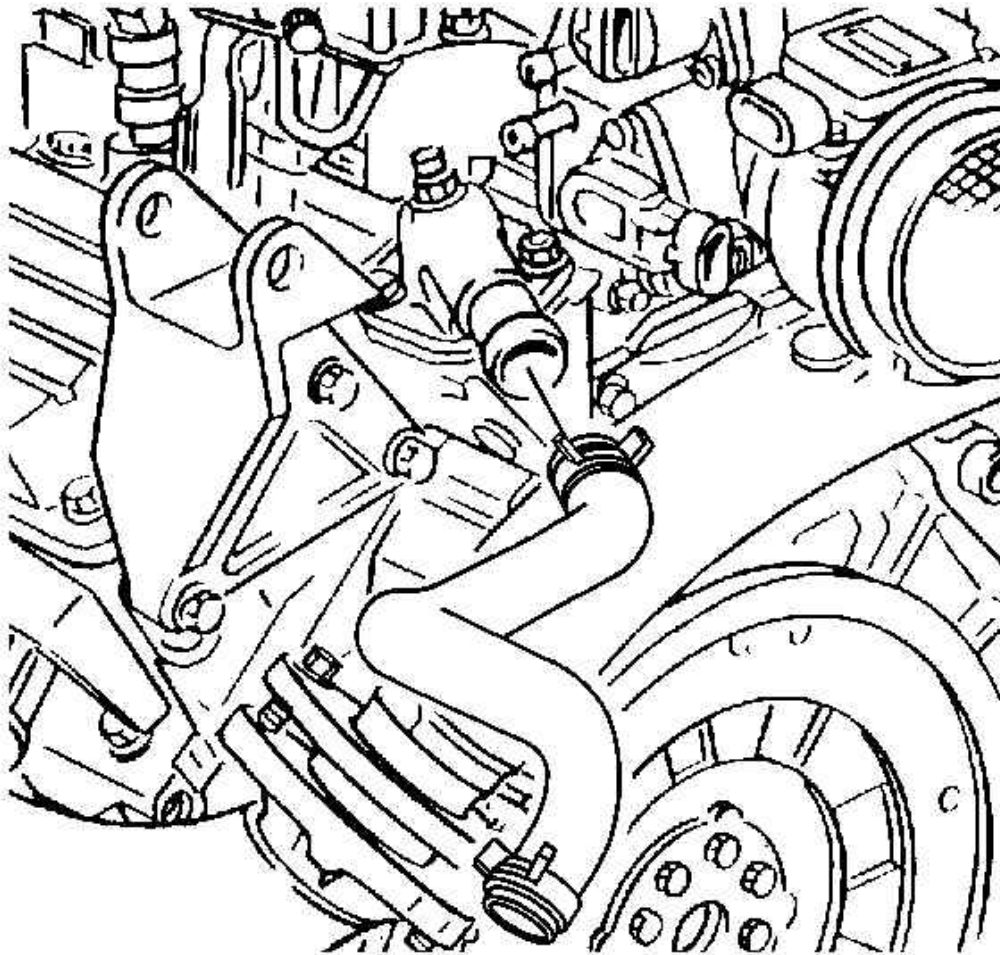


Fig. 89: View Of Radiator Inlet Hose To Water Outlet Housing
Courtesy of GENERAL MOTORS CORP.

1. Remove the fuel injector sight shield. Refer to **Fuel Injector Sight Shield Replacement** .
2. Partially drain the cooling system. Refer to **Cooling System Draining and Filling (L26, LY7 GE 47716 Fill)** or **Cooling System Draining and Filling (L26 Static Fill)** or **Cooling System Draining and Filling (LY7 Static Fill)** or **Cooling System Draining and Filling (LS4 GE47716 Fill)** or **Cooling System Draining and Filling (LS4 Static Fill)**.

3. Use the **J 38185** in order to reposition the hose clamp from the water outlet housing. See **Special Tools**.
4. Remove the radiator inlet hose from the water outlet housing.

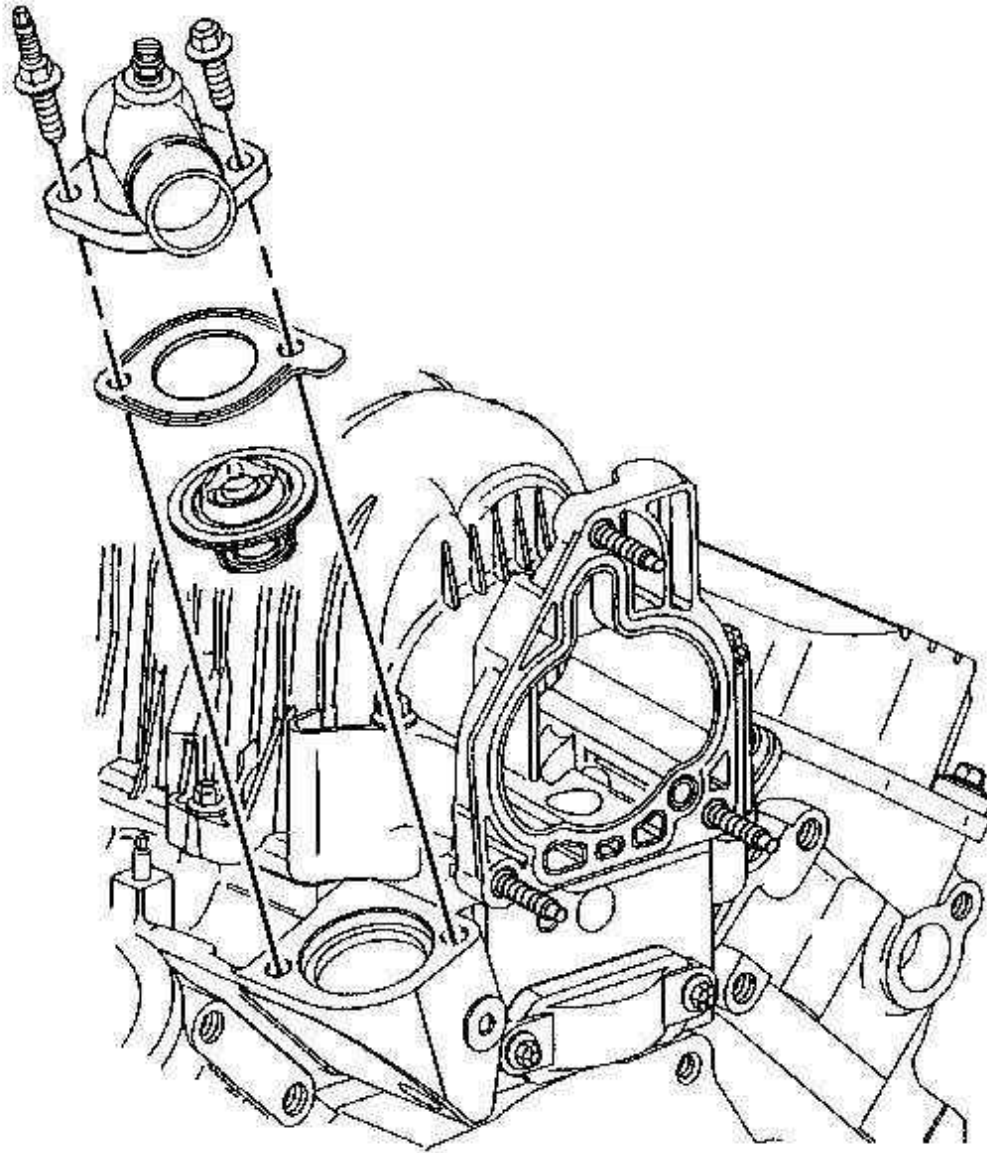


Fig. 90: Identifying Water Outlet Housing

Courtesy of GENERAL MOTORS CORP.

5. Reposition the wiring harness from the water outlet housing stud.
6. Remove the water outlet housing bolt and the stud.
7. Remove the water outlet housing and the gasket.
8. Remove the thermostat.
9. Clean and Inspect the water outlet housing gasket mating surfaces.

Installation Procedure

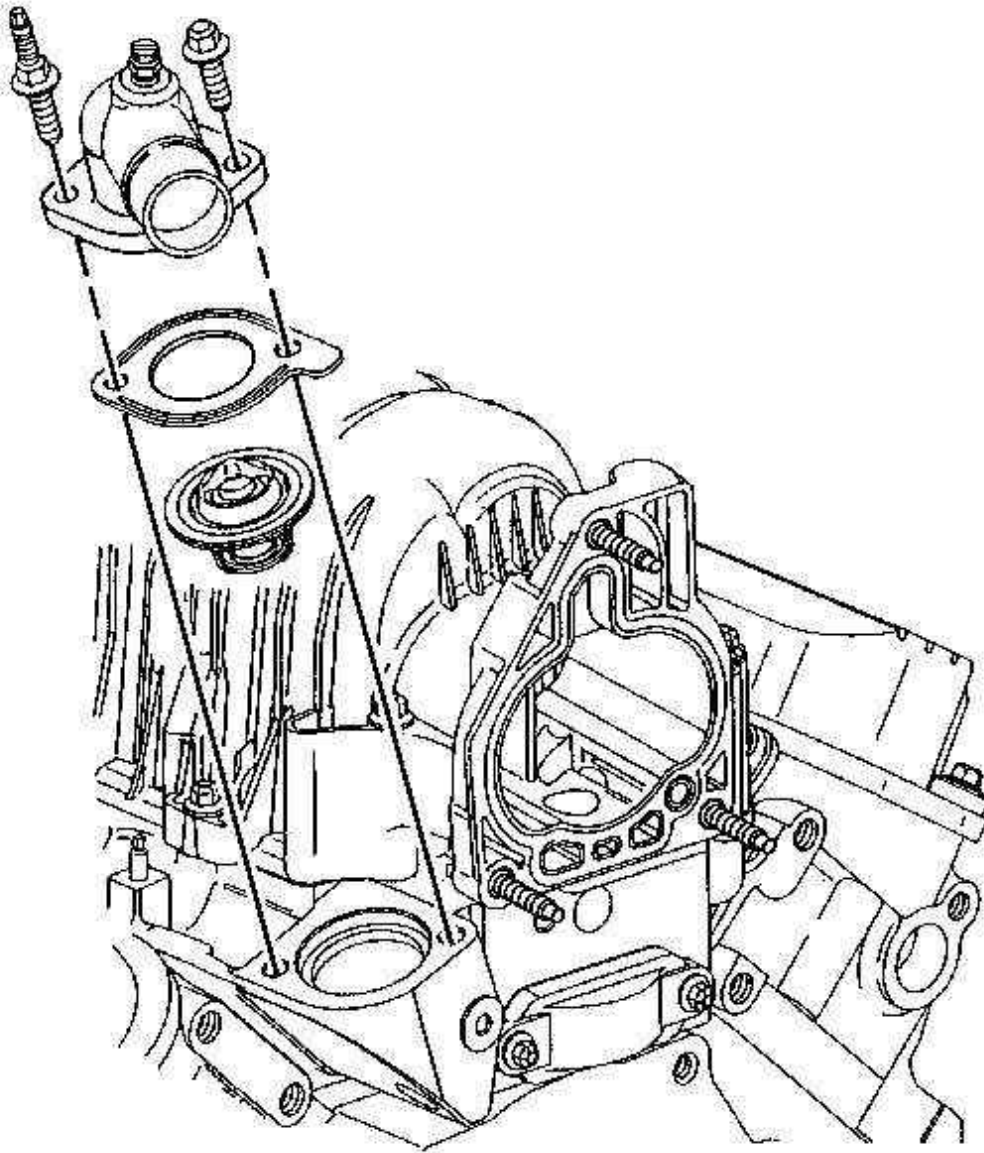


Fig. 91: Identifying Water Outlet Housing
Courtesy of GENERAL MOTORS CORP.

1. Install the thermostat.
2. Install the gasket and the water outlet housing.

NOTE: Refer to Fastener Notice .

3. Install the water outlet housing bolt and the stud to the water outlet housing.

Tighten: Tighten the bolt and the stud to 27 N.m (20 lb ft).

4. Install the wiring harness to the water outlet housing stud.

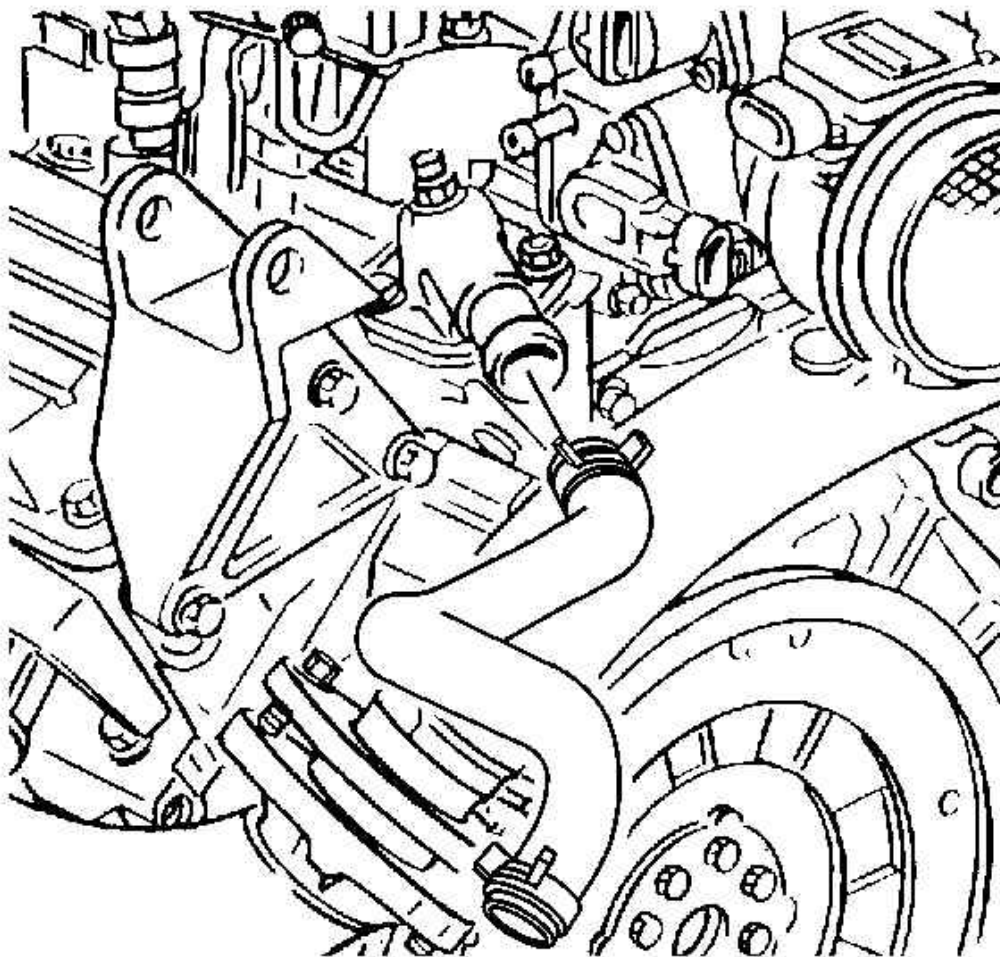


Fig. 92: View Of Radiator Inlet Hose To Water Outlet Housing
Courtesy of GENERAL MOTORS CORP.

5. Install the radiator inlet hose to the water outlet housing.
6. Use the **J 38185** in order to reposition and install the hose clamp to the water outlet housing. See **Special Tools**.
7. Fill the cooling system. Refer to **Cooling System Draining and Filling (L26, LY7 GE 47716 Fill)** or **Cooling System Draining and Filling (L26 Static Fill)** or **Cooling System Draining and Filling (LY7 Static Fill)** or **Cooling System Draining and Filling (LS4 GE47716 Fill)** or **Cooling System Draining and Filling (LS4 Static Fill)**.
8. Install the fuel injector sight shield. Refer to **Fuel Injector Sight Shield Replacement** .

ENGINE COOLANT THERMOSTAT HOUSING REPLACEMENT (LS4)

Tools Required

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

Removal Procedure

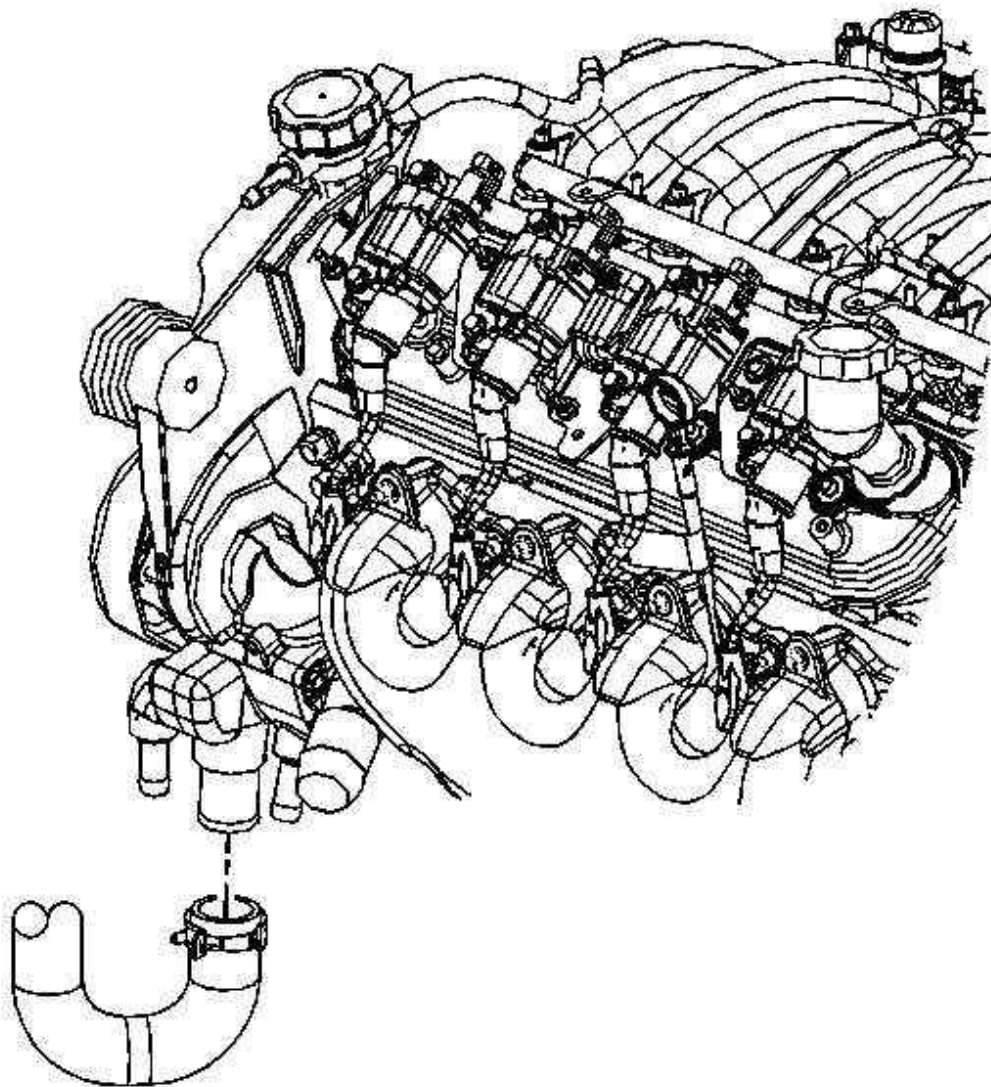


Fig. 93: View Of Radiator Inlet Hose & Water Outlet Housing (LS4)
Courtesy of GENERAL MOTORS CORP.

1. Partially drain the cooling system. Refer to **Cooling System Draining and Filling (L26, LY7 GE 47716 Fill)** or **Cooling System Draining and Filling (L26 Static Fill)** or **Cooling System Draining and Filling (LY7 Static Fill)** or **Cooling System Draining and Filling (LS4 GE47716 Fill)** or **Cooling**

System Draining and Filling (LS4 Static Fill).

2. Use the **J 38185** in order to reposition the hose clamp from the water outlet housing. See **Special Tools**.
3. Remove the radiator inlet hose from the water outlet housing.

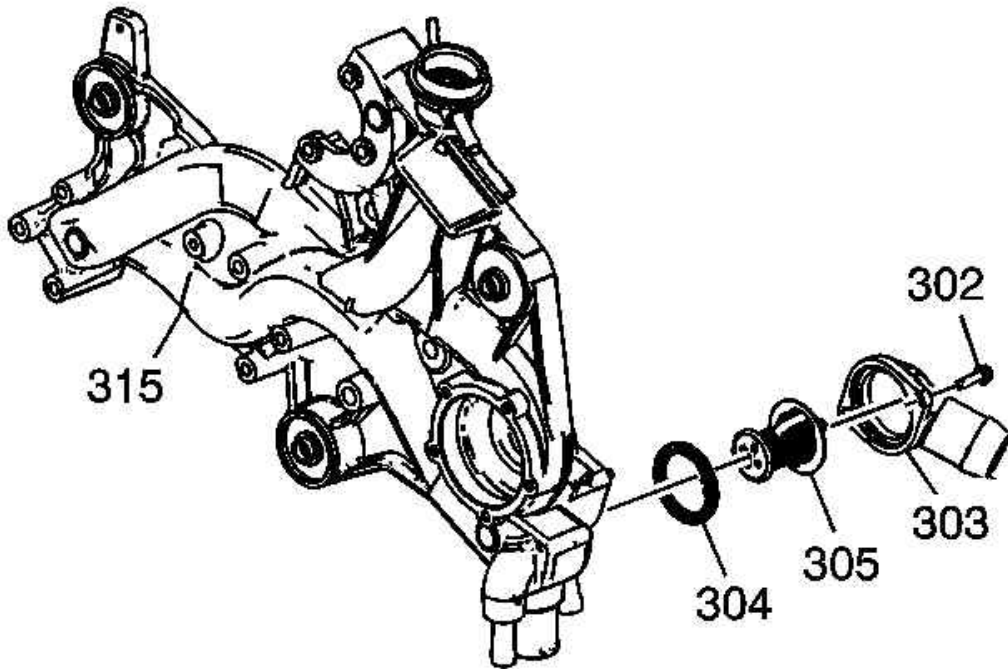


Fig. 94: View Of Thermostat Housing, Bolts, Thermostat, & O-Ring
Courtesy of GENERAL MOTORS CORP.

4. Remove the water outlet housing bolts (302).
5. Remove the water outlet housing (303) and O-ring seal (304).
6. Remove the thermostat (305).
7. Clean and inspect the water outlet housing O-ring seal mating surfaces.

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.

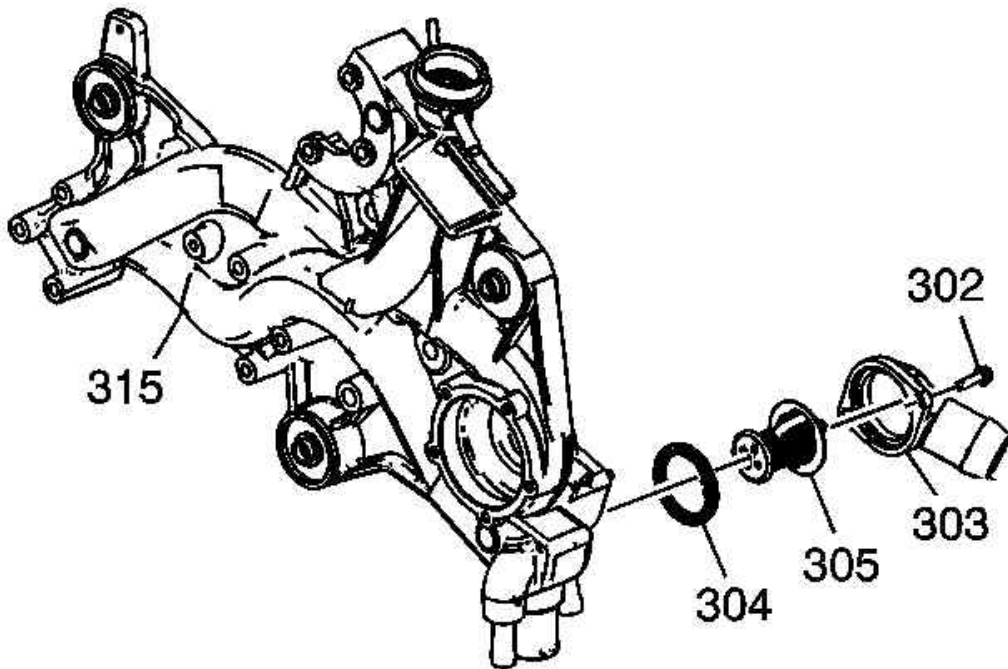


Fig. 95: View Of Thermostat Housing, Bolts, Thermostat, & O-Ring
Courtesy of GENERAL MOTORS CORP.

1. Install the thermostat (305).
2. Install the O-ring seal (304) and water outlet housing (303).

NOTE: Refer to Fastener Notice .

3. Install the water outlet housing bolts (302).

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

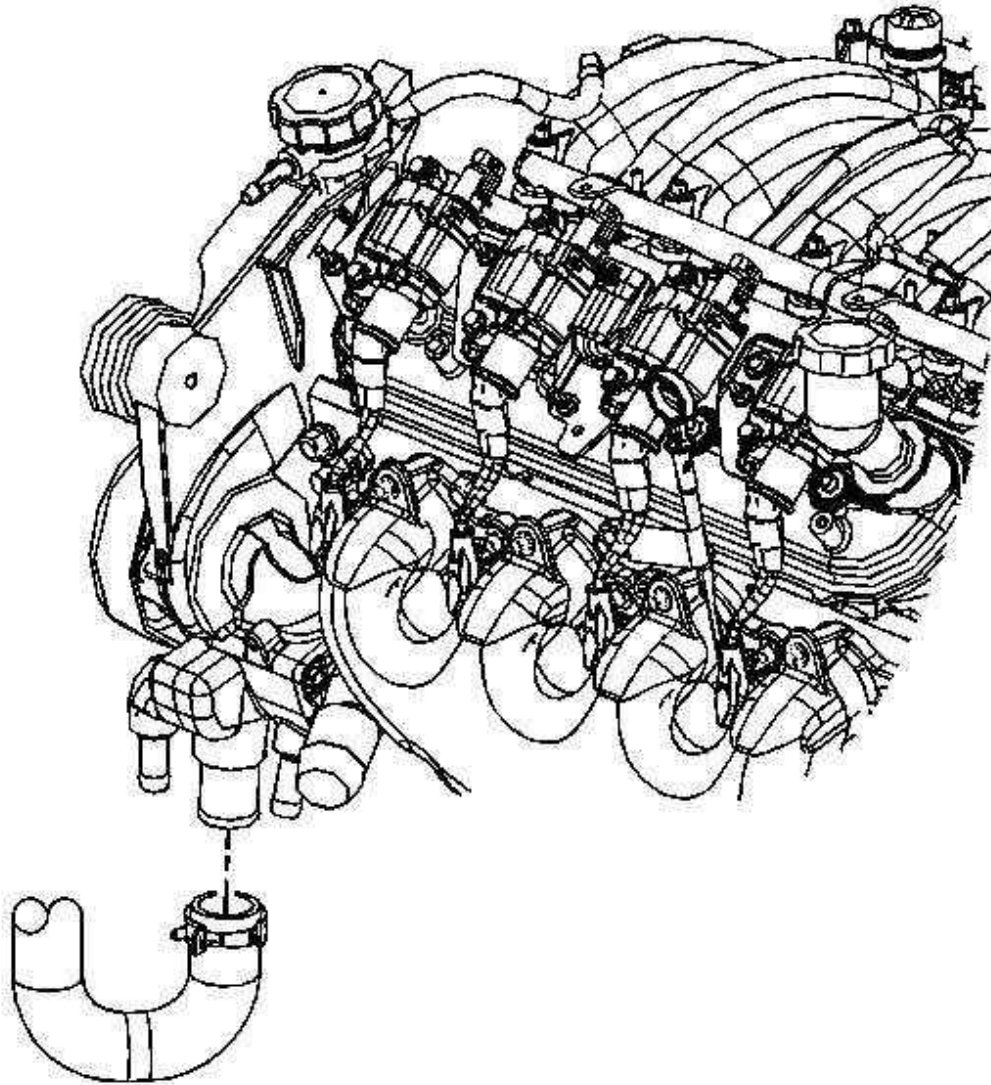


Fig. 96: View Of Radiator Inlet Hose & Water Outlet Housing (LS4)
Courtesy of GENERAL MOTORS CORP.

4. Install the radiator inlet hose to the water outlet housing.
5. Use the **J 38185** in order to reposition and install the hose clamp to the water

outlet housing. See **Special Tools**.

6. Fill the cooling system. Refer to **Cooling System Draining and Filling (L26, LY7 GE 47716 Fill)** or **Cooling System Draining and Filling (L26 Static Fill)** or **Cooling System Draining and Filling (LY7 Static Fill)** or **Cooling System Draining and Filling (LS4 GE47716 Fill)** or **Cooling System Draining and Filling (LS4 Static Fill)**.

ENGINE COOLANT THERMOSTAT REPLACEMENT (LY7)

Removal Procedure

1. Partially drain the cooling system. Refer to **Cooling System Draining and Filling (L26, LY7 GE 47716 Fill)** or **Cooling System Draining and Filling (L26 Static Fill)** or **Cooling System Draining and Filling (LY7 Static Fill)** or **Cooling System Draining and Filling (LS4 GE47716 Fill)** or **Cooling System Draining and Filling (LS4 Static Fill)**.

IMPORTANT: Do NOT separate the upper and lower intake manifolds.

2. Remove the upper intake manifold with the lower intake manifold. Refer to **Lower Intake Manifold Replacement**.
3. Disconnect the surge tank hose from the thermostat.

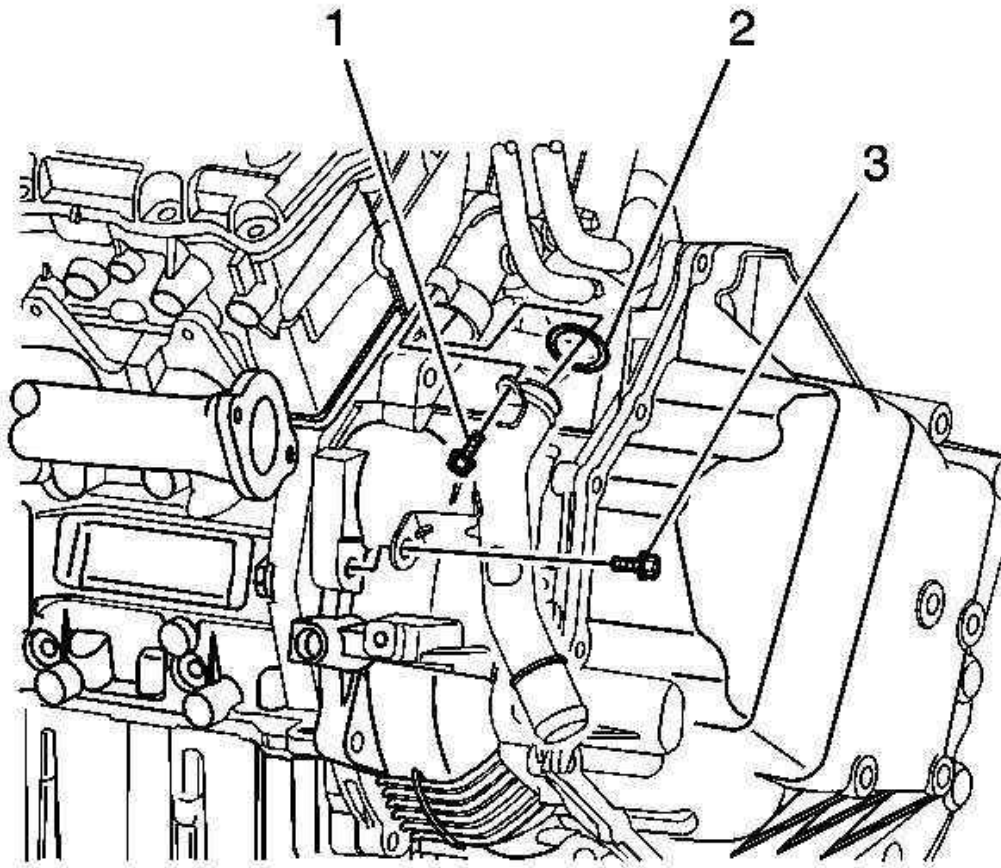


Fig. 97: Identifying Coolant Pipe/Thermostat Housing Bolts
Courtesy of GENERAL MOTORS CORP.

4. Remove the coolant pipe/thermostat housing bolt (1).
5. Remove the coolant pipe bolt (3).
6. Remove the coolant inlet pipe from the thermostat housing.
7. Remove and discard the coolant pipe O-ring seal (2).

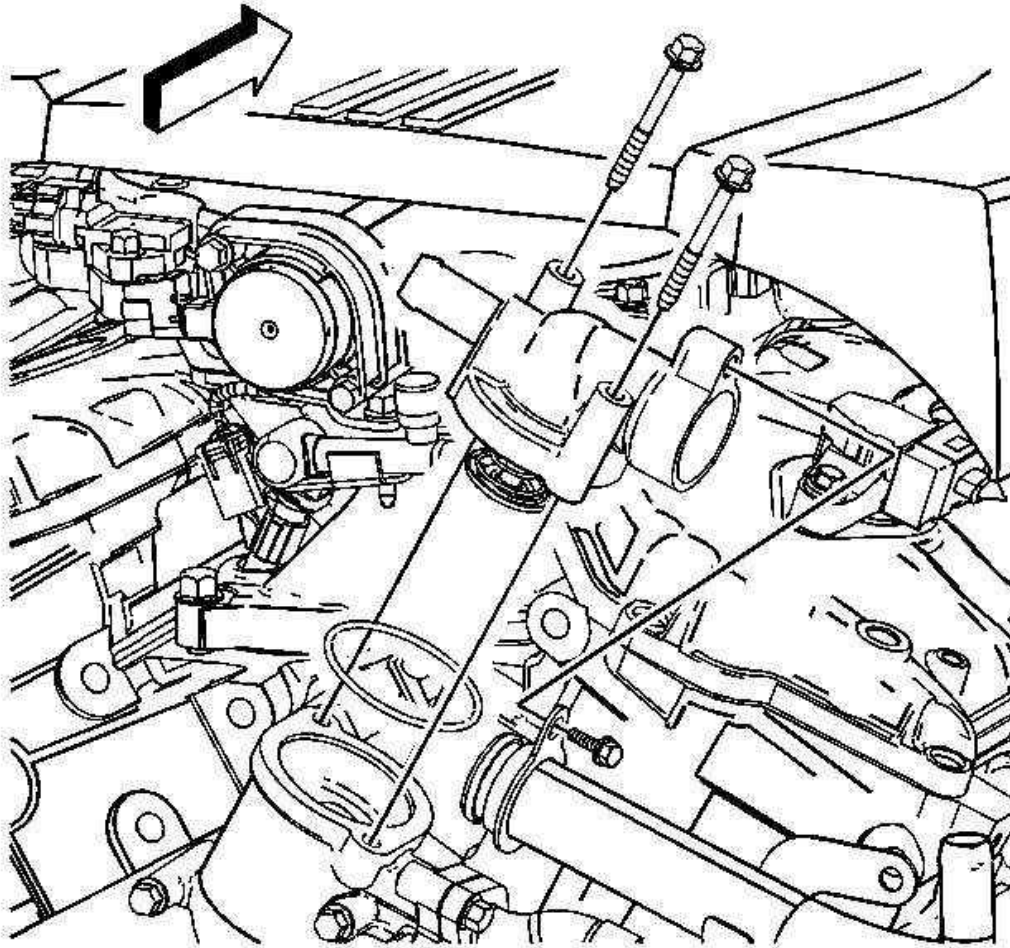


Fig. 98: View Of Thermostat
Courtesy of GENERAL MOTORS CORP.

8. Remove the thermostat bolts.
9. Remove the thermostat and discard the thermostat seal.

Installation Procedure

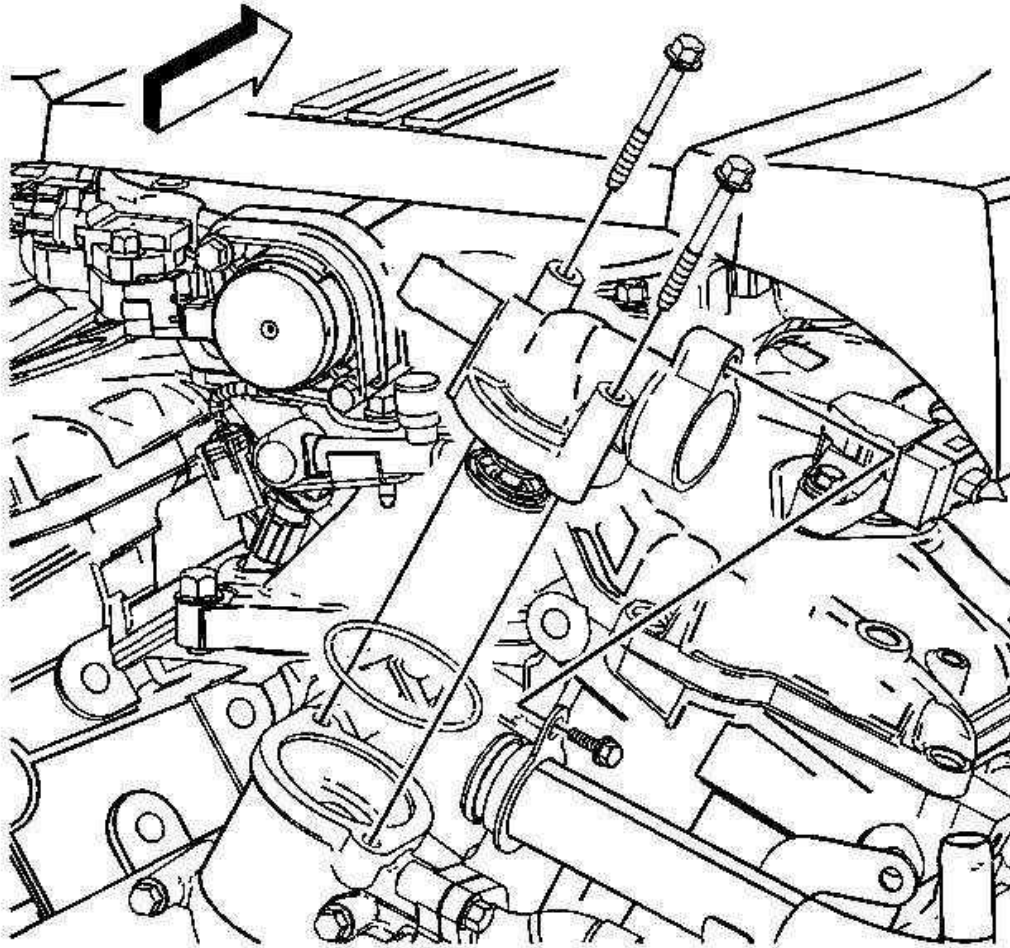


Fig. 99: View Of Thermostat
Courtesy of GENERAL MOTORS CORP.

1. Install the thermostat with a NEW thermostat seal.

NOTE: Refer to Fastener Notice .

2. Install the thermostat bolts.

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

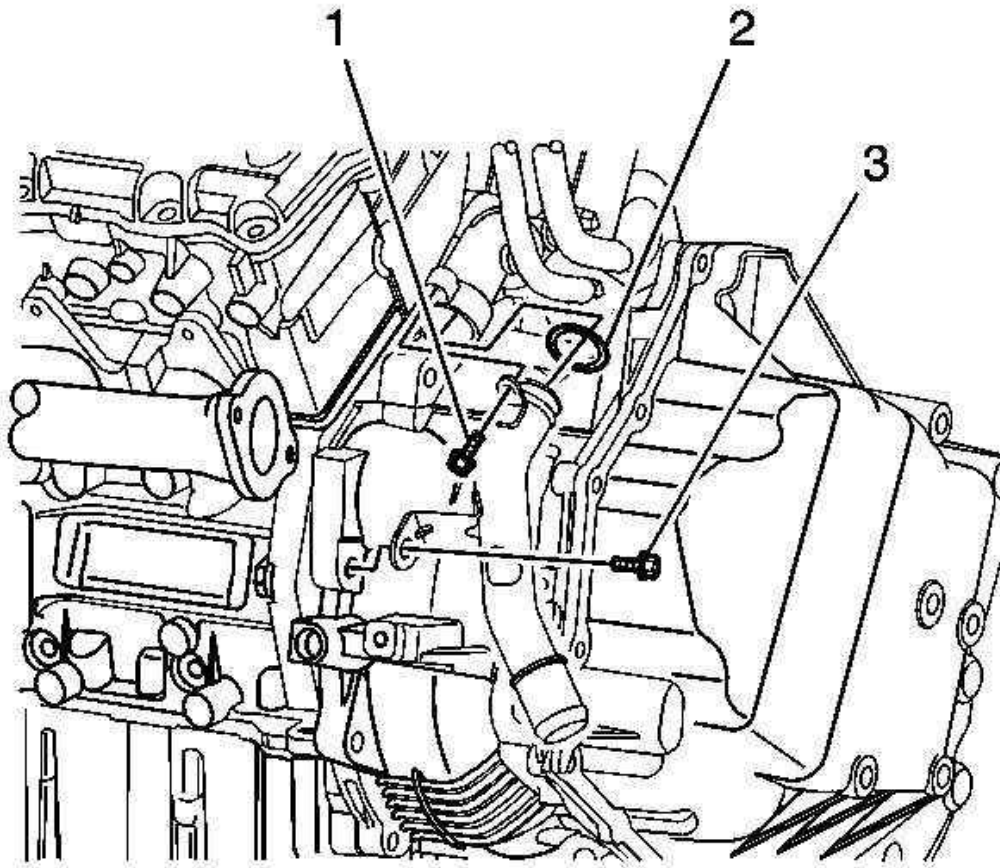


Fig. 100: Identifying Coolant Pipe/Thermostat Housing Bolts
Courtesy of GENERAL MOTORS CORP.

3. Install the coolant pipe, NEW seal (2), and fasteners (1 and 3). Refer to **Radiator Outlet Pipe Replacement (LY7)**.
4. Install the surge tank hose to the thermostat.
5. Install the upper intake manifold with the lower intake manifold. Refer to **Lower Intake Manifold Replacement**.
6. Fill the cooling system. Refer to **Cooling System Draining and Filling (L26, LY7 GE 47716 Fill)** or **Cooling System Draining and Filling (L26 Static Fill)** or **Cooling System Draining and Filling (LY7 Static Fill)** or **Cooling System Draining and Filling (LS4 GE47716 Fill)** or **Cooling System**

Draining and Filling (LS4 Static Fill).

ENGINE COOLANT THERMOSTAT REPLACEMENT (RPOS L26/L32)

Tools Required

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

Removal Procedure

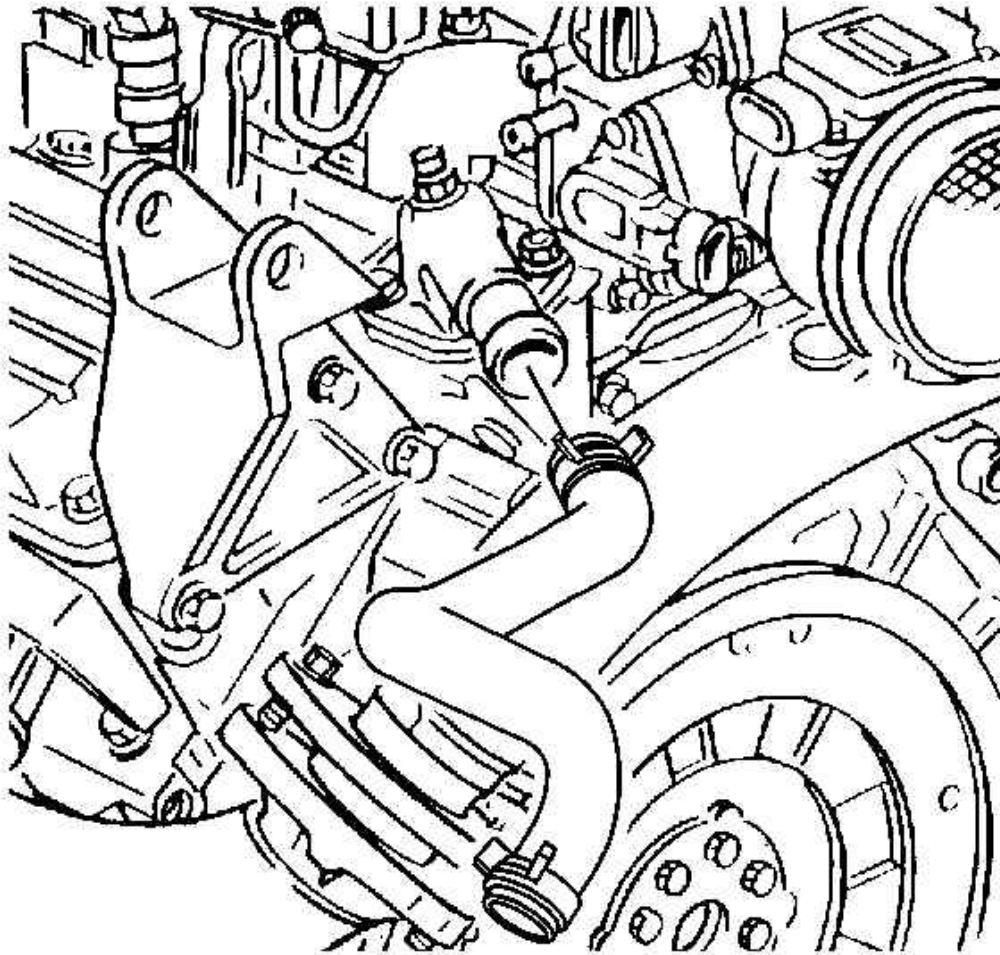


Fig. 101: View Of Radiator Inlet Hose To Water Outlet Housing
Courtesy of GENERAL MOTORS CORP.

1. Remove the fuel injector sight shield. Refer to **Fuel Injector Sight Shield Replacement** .
2. Partially drain the cooling system. Refer to **Cooling System Draining and Filling (L26, LY7 GE 47716 Fill)** or **Cooling System Draining and Filling (L26 Static Fill)** or **Cooling System Draining and Filling (LY7 Static Fill)** or **Cooling System Draining and Filling (LS4 GE47716 Fill)** or **Cooling System Draining and Filling (LS4 Static Fill)**.
3. Use the **J 38185** in order to reposition the hose clamp from the water outlet housing. See **Special Tools**.
4. Remove the radiator inlet hose from the water outlet housing.

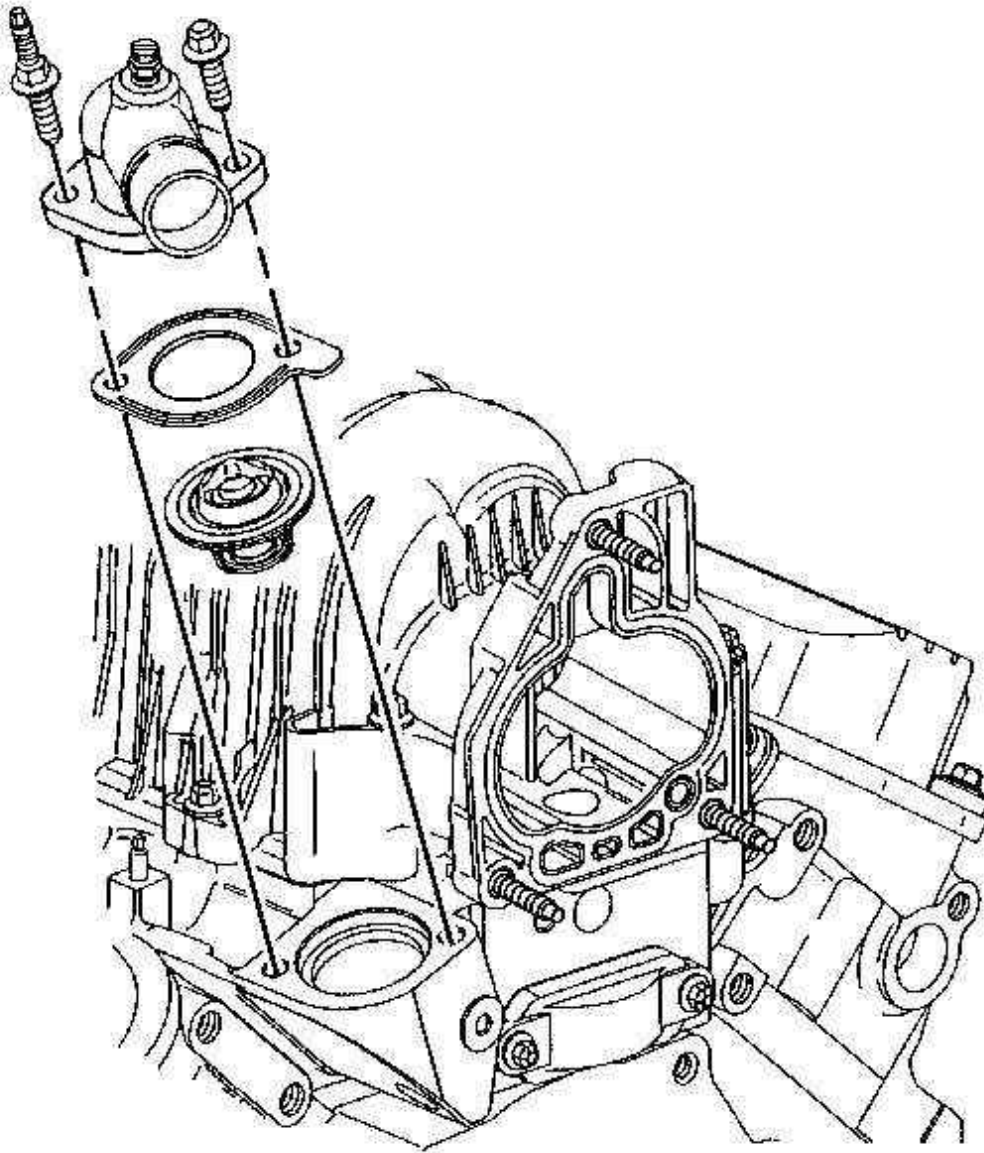


Fig. 102: Identifying Water Outlet Housing
Courtesy of GENERAL MOTORS CORP.

5. Reposition the wiring harness from the water outlet housing stud.
6. Remove the water outlet housing bolt and the stud.

2008 Buick LaCrosse CXL
2008 ENGINE Engine Cooling - LaCrosse

7. Remove the water outlet housing and the gasket.
8. Remove the thermostat.
9. Clean and Inspect the water outlet housing gasket mating surfaces.

Installation Procedure

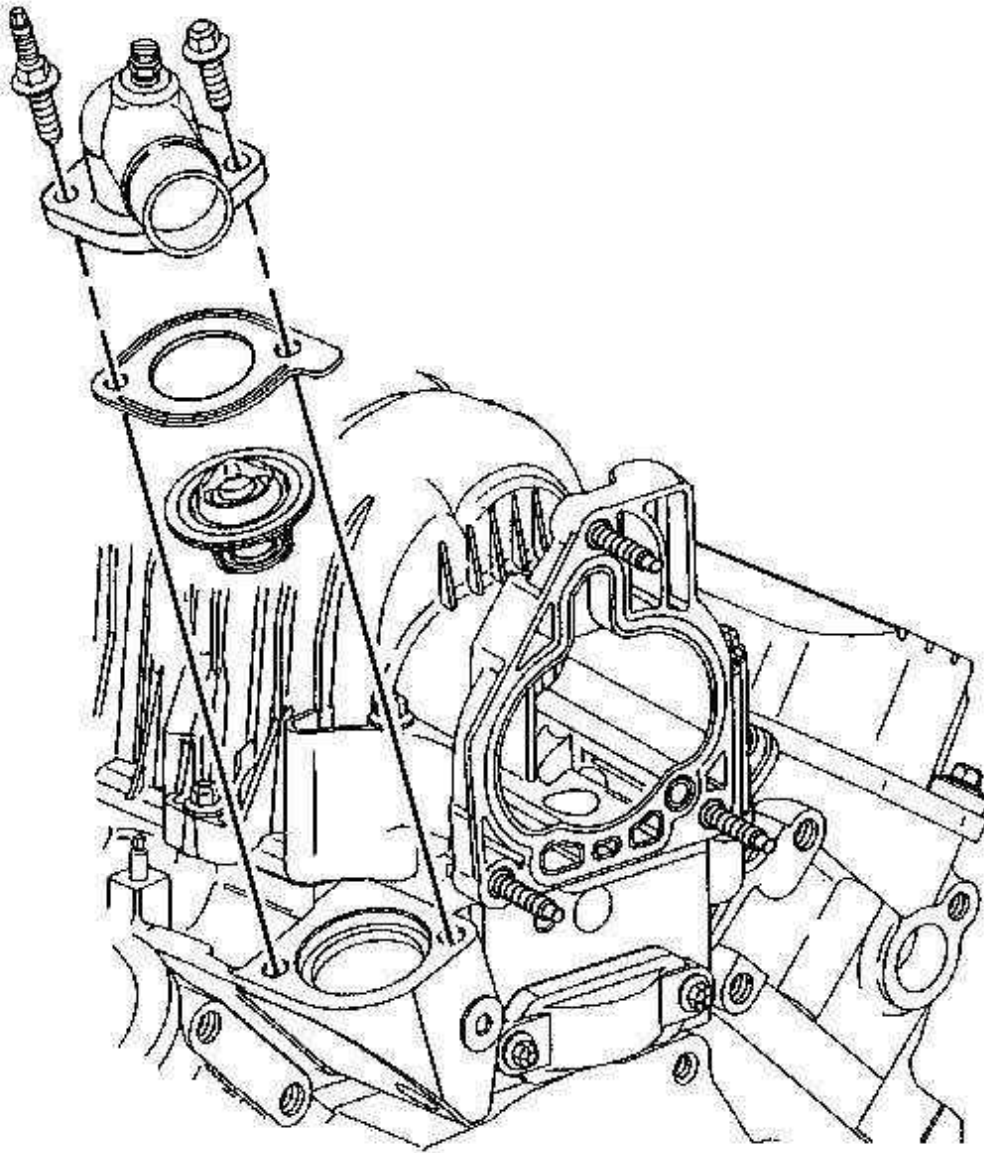


Fig. 103: Identifying Water Outlet Housing
Courtesy of GENERAL MOTORS CORP.

1. Install the thermostat.
2. Install the gasket and the water outlet housing.

NOTE: Refer to Fastener Notice .

3. Install the water outlet housing bolt and the stud to the water outlet housing.

Tighten: Tighten the bolt and the stud to 27 N.m (20 lb ft).

4. Install the wiring harness to the water outlet housing stud.

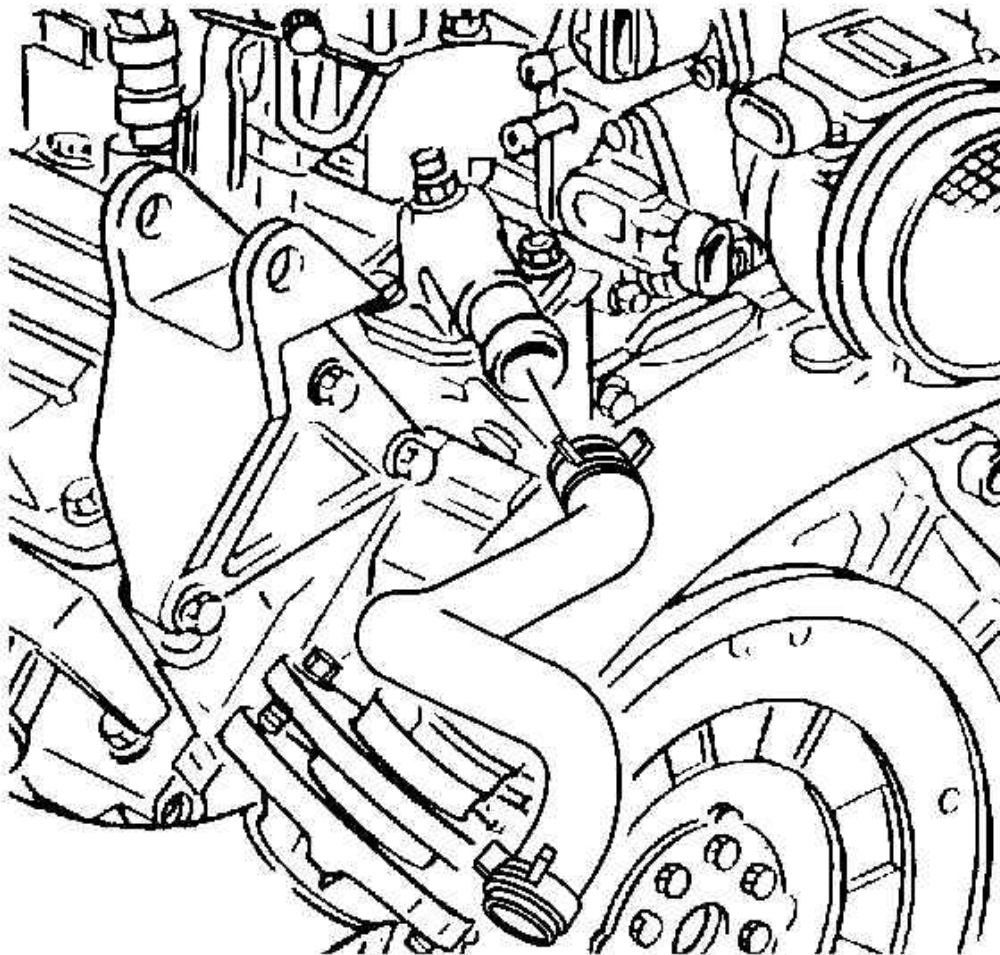


Fig. 104: View Of Radiator Inlet Hose To Water Outlet Housing
Courtesy of GENERAL MOTORS CORP.

5. Install the radiator inlet hose to the water outlet housing.
6. Use the **J 38185** in order to reposition and install the hose clamp to the water outlet housing. See **Special Tools**.
7. Fill the cooling system. Refer to **Cooling System Draining and Filling (L26, LY7 GE 47716 Fill)** or **Cooling System Draining and Filling (L26 Static Fill)** or **Cooling System Draining and Filling (LY7 Static Fill)** or **Cooling System Draining and Filling (LS4 GE47716 Fill)** or **Cooling System Draining and Filling (LS4 Static Fill)**.
8. Install the fuel injector sight shield. Refer to **Fuel Injector Sight Shield Replacement** .

ENGINE COOLANT THERMOSTAT REPLACEMENT (LS4)

Tools Required

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

Removal Procedure

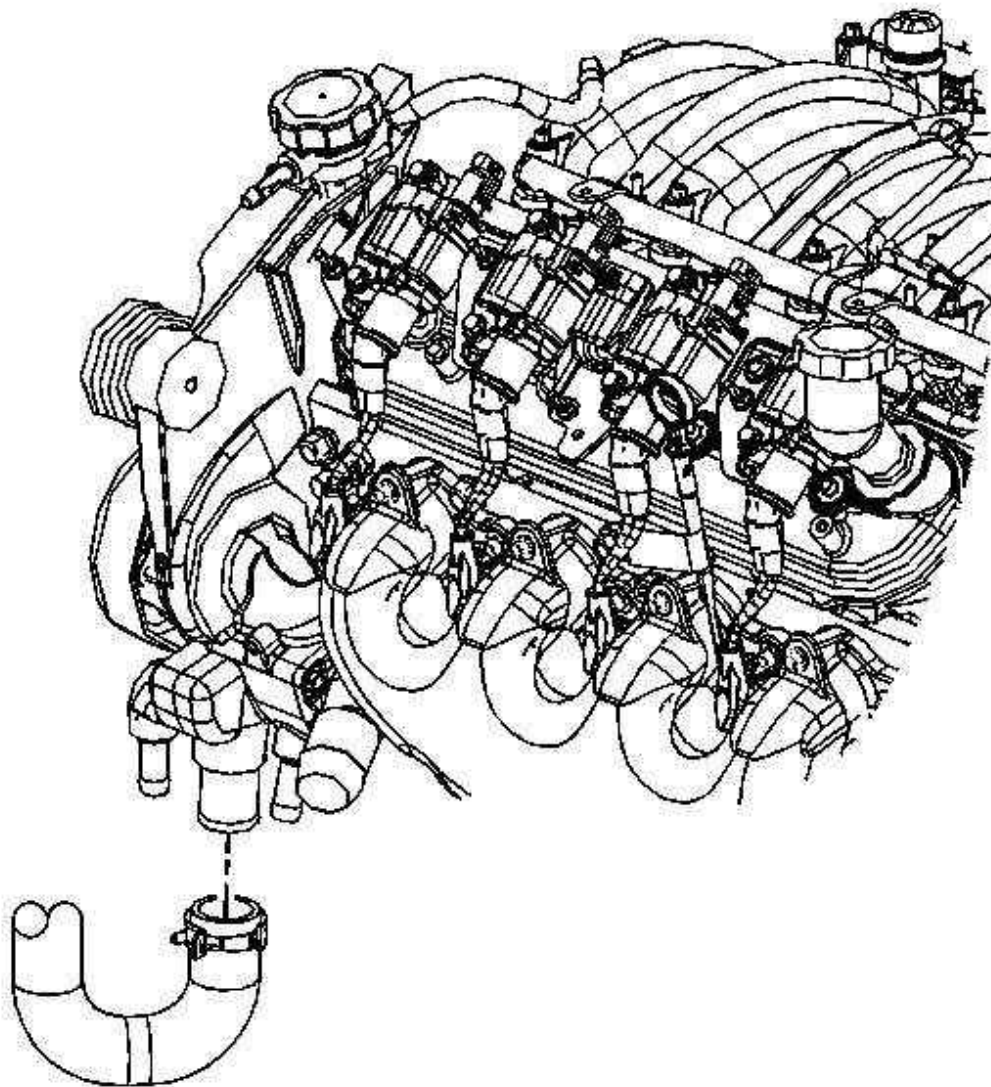


Fig. 105: View Of Radiator Inlet Hose & Water Outlet Housing (LS4)
Courtesy of GENERAL MOTORS CORP.

1. Remove the radiator air lower baffle and deflector. Refer to **Radiator Air Lower Baffle and Deflector Replacement**.
2. Reposition the radiator inlet hose. Refer to **Radiator Inlet Hose Replacement**

(L26) or Radiator Inlet Hose Replacement (LY7) or Radiator Inlet Hose Replacement (LS4).

3. Partially drain the cooling system. Refer to **Cooling System Draining and Filling (L26, LY7 GE 47716 Fill)** or **Cooling System Draining and Filling (L26 Static Fill)** or **Cooling System Draining and Filling (LY7 Static Fill)** or **Cooling System Draining and Filling (LS4 GE47716 Fill)** or **Cooling System Draining and Filling (LS4 Static Fill)**.
4. Use the **J 38185** in order to reposition the hose clamp from the water outlet housing. See **Special Tools**.
5. Remove the radiator inlet hose from the water outlet housing.

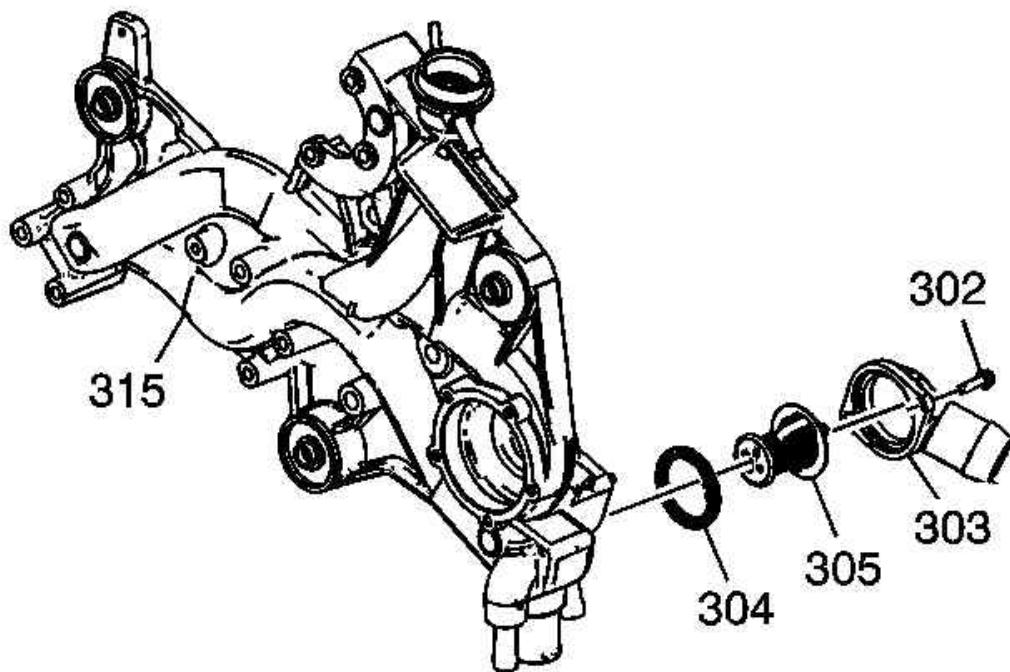


Fig. 106: View Of Thermostat Housing, Bolts, Thermostat, & O-Ring
Courtesy of GENERAL MOTORS CORP.

6. Remove the water outlet housing bolts (302).
7. Remove the water outlet housing (303) and O-ring seal (304).

8. Remove the thermostat (305).
9. Clean and inspect the water outlet housing O-ring seal mating surfaces.

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.

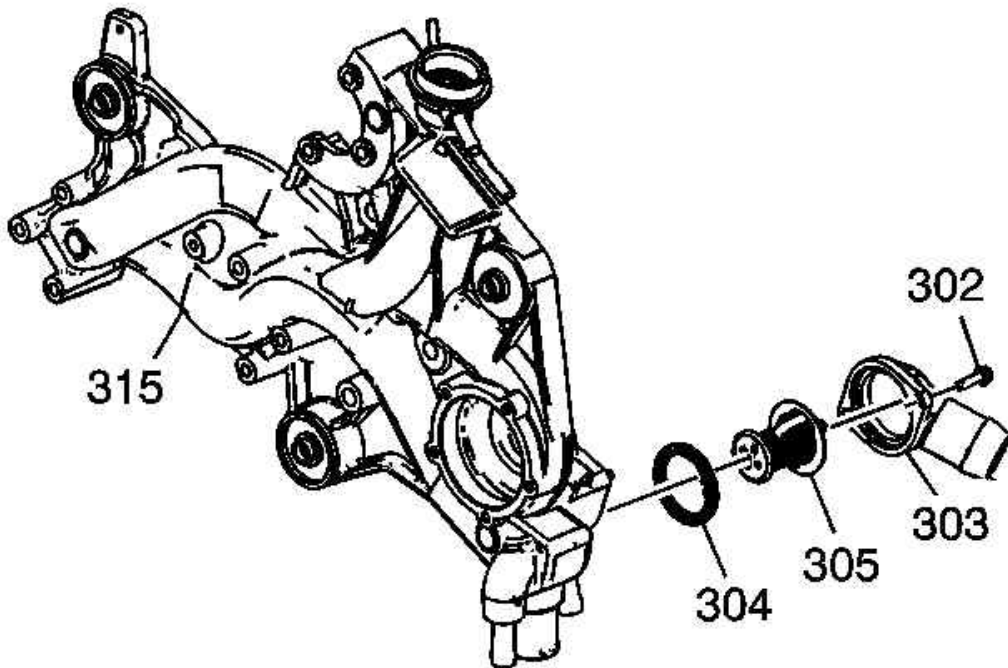


Fig. 107: View Of Thermostat Housing, Bolts, Thermostat, & O-Ring
Courtesy of GENERAL MOTORS CORP.

1. Install the thermostat (305).

2. Install the O-ring seal (304) and water outlet housing (303).

NOTE: Refer to **FASTENER NOTICE** .

3. Install the water outlet housing bolts (302).

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

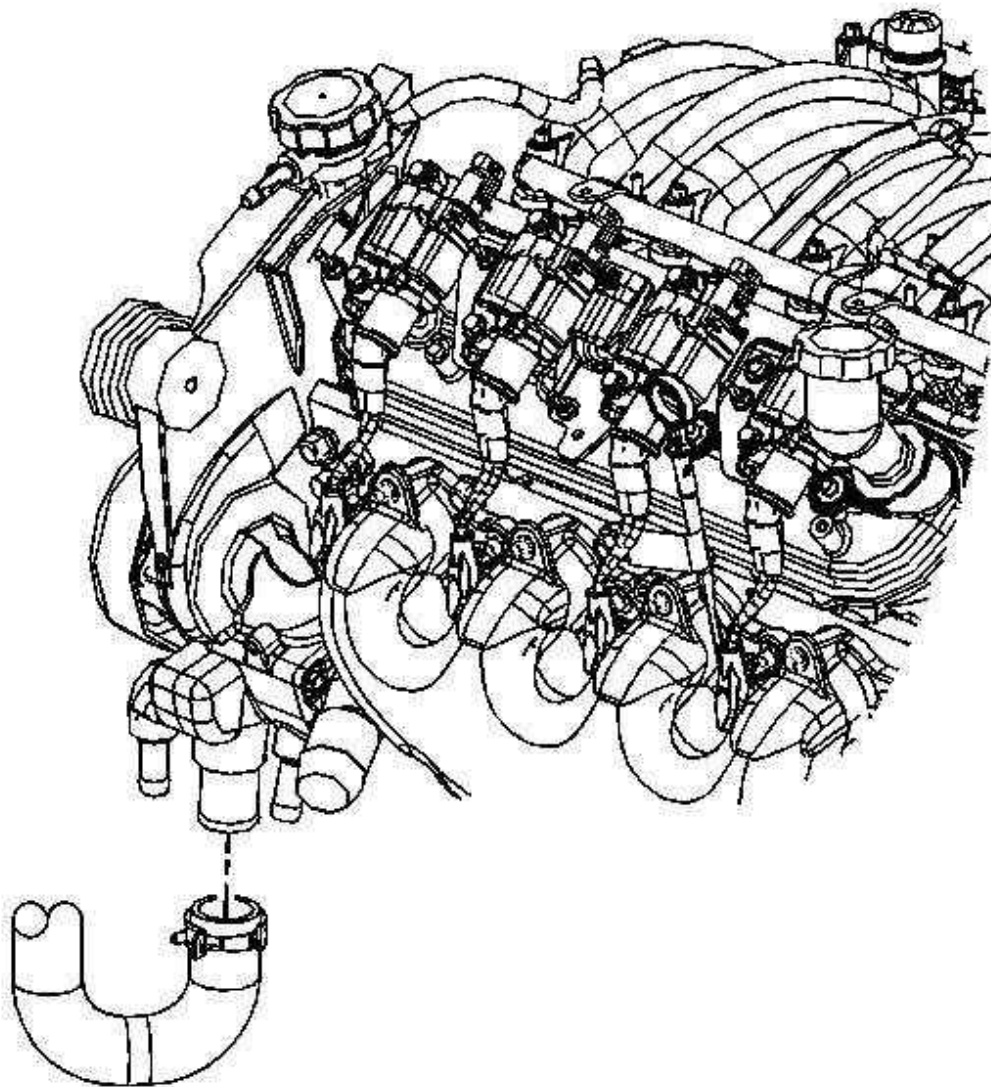


Fig. 108: View Of Radiator Inlet Hose & Water Outlet Housing (LS4)
Courtesy of GENERAL MOTORS CORP.

4. Install the radiator inlet hose to the water outlet housing.
5. Use the **J 38185** in order to reposition and install the hose clamp to the water outlet housing. See **Special Tools**.

6. Fill the cooling system. Refer to **Cooling System Draining and Filling (L26, LY7 GE 47716 Fill)** or **Cooling System Draining and Filling (L26 Static Fill)** or **Cooling System Draining and Filling (LY7 Static Fill)** or **Cooling System Draining and Filling (LS4 GE47716 Fill)** or **Cooling System Draining and Filling (LS4 Static Fill)**.
7. Install the radiator inlet hose. Refer to **Radiator Inlet Hose Replacement (L26)** or **Radiator Inlet Hose Replacement (LY7)** or **Radiator Inlet Hose Replacement (LS4)**.
8. Install the radiator air lower baffle and deflector. Refer to **Radiator Air Lower Baffle and Deflector Replacement**.

COOLANT AIR BLEED PIPE ASSEMBLY REPLACEMENT

Removal Procedure

IMPORTANT: Removal of the intake manifold is NOT required to service the coolant air bleed pipe, but is required to service the coolant air bleed pipe covers and/or gaskets.

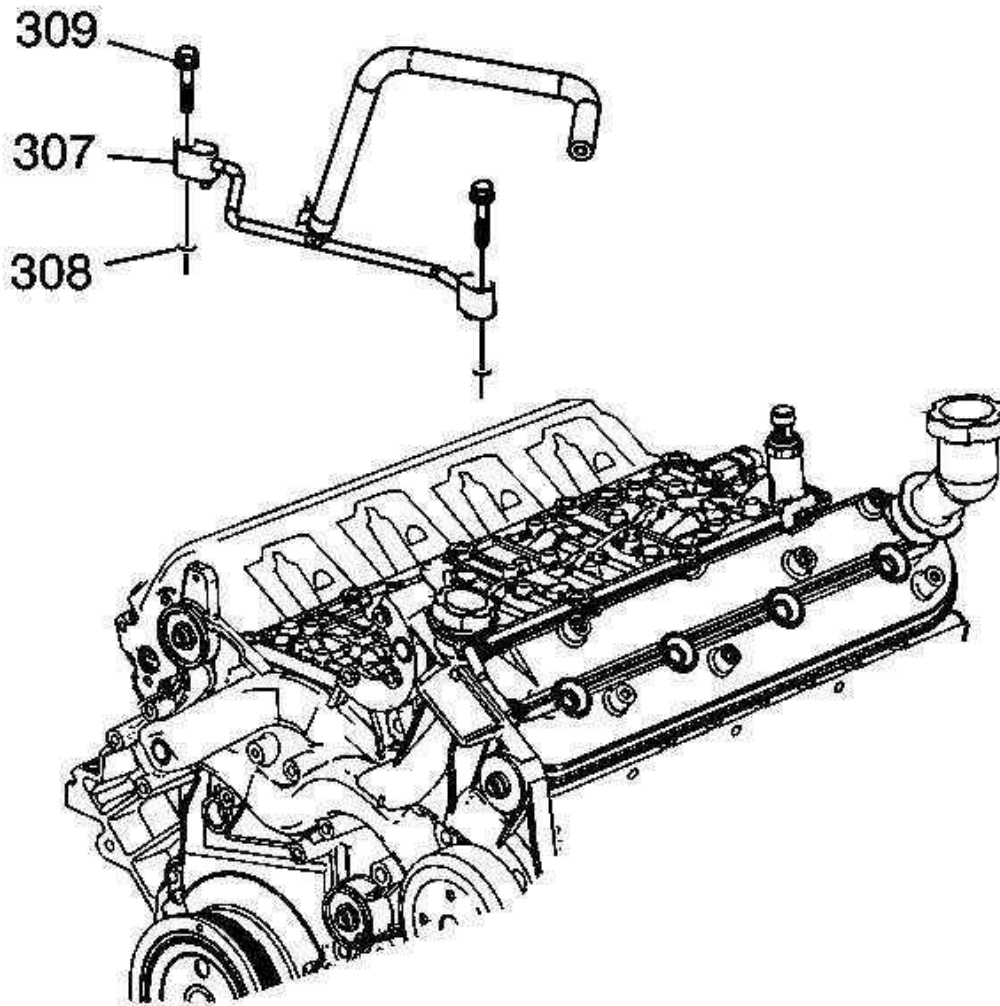


Fig. 109: View Of Coolant Air Bleed Pipe & Bolts
Courtesy of GENERAL MOTORS CORP.

1. Drain the cooling system. Refer to **Cooling System Draining and Filling (L26, LY7 GE 47716 Fill)** or **Cooling System Draining and Filling (L26 Static Fill)** or **Cooling System Draining and Filling (LY7 Static Fill)** or **Cooling System Draining and Filling (LS4 GE47716 Fill)** or **Cooling System Draining and Filling (LS4 Static Fill)**.
2. Remove the intake manifold. Refer to **Intake Manifold Replacement** .

3. Disconnect the hose clamp and hose from the coolant fill neck.
4. Remove the coolant air bleed pipe bolts (309).
5. Remove the coolant air bleed pipe (307) with hose and seals (308).

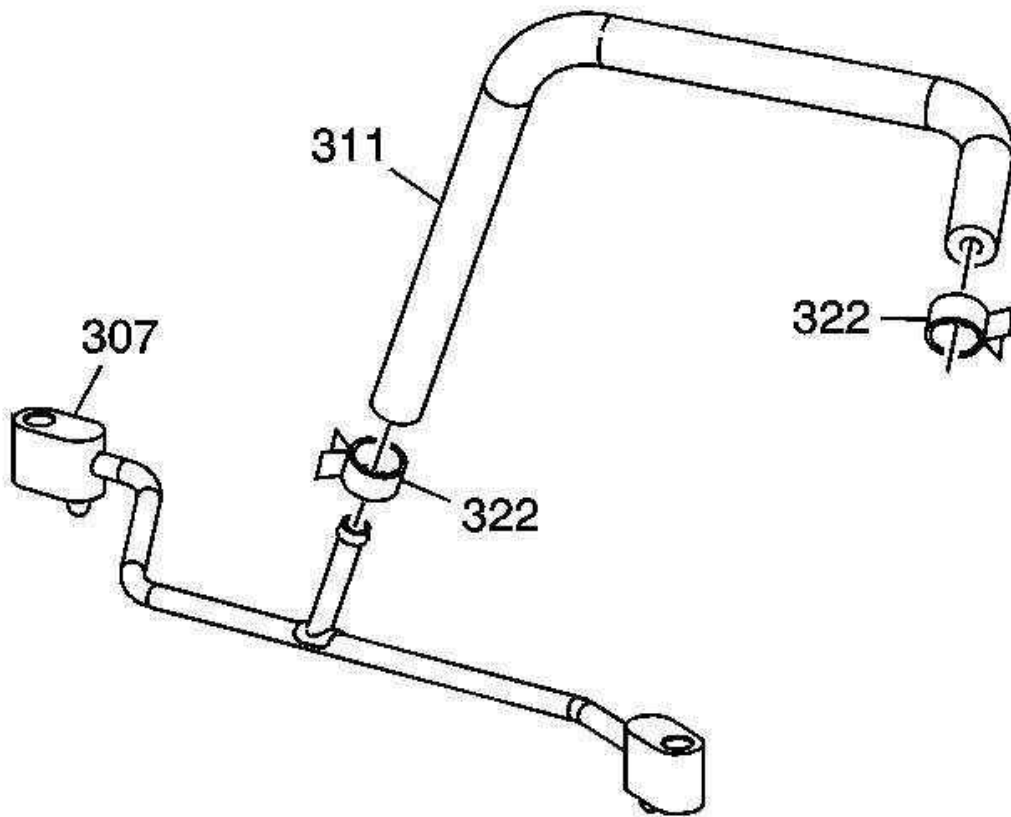


Fig. 110: View Of Coolant Air Bleed Pipe & Clamp
Courtesy of GENERAL MOTORS CORP.

6. Remove the hose (311) and clamps (322) from the coolant air bleed pipe (307) as required.

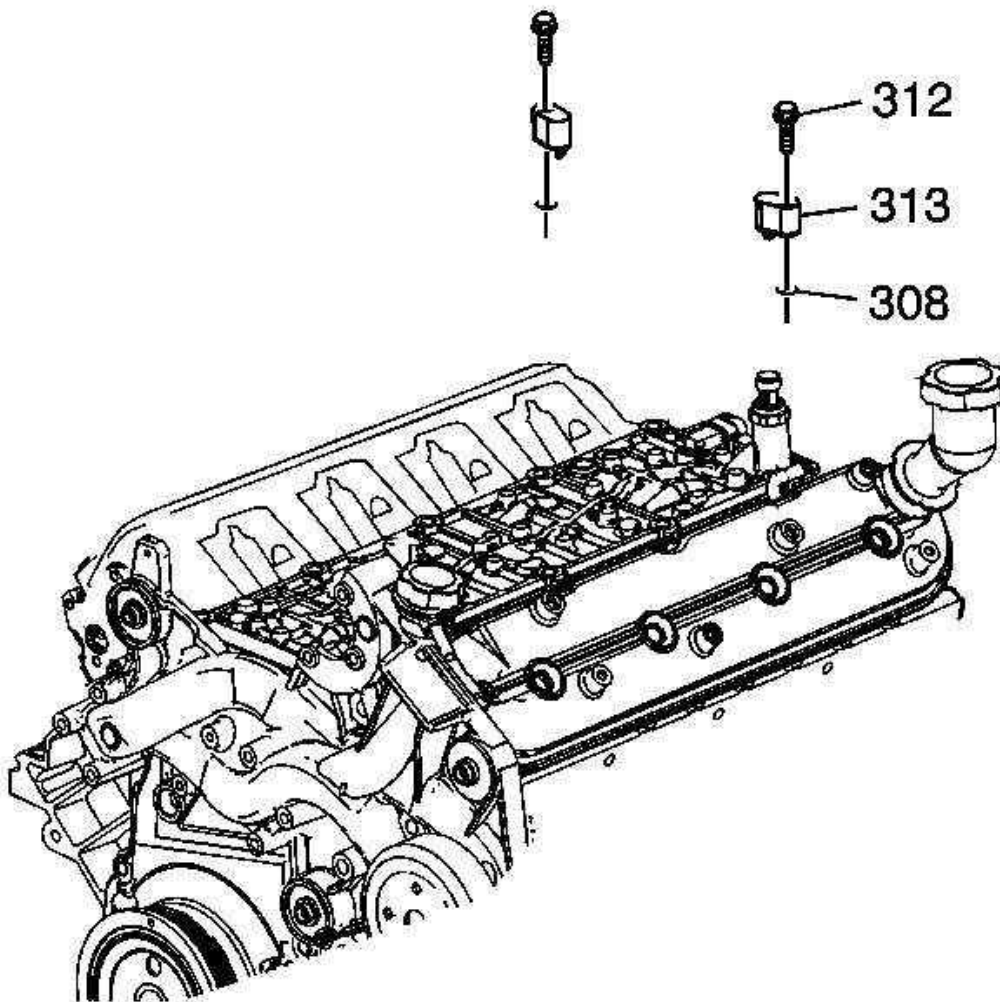


Fig. 111: View Of Engine Coolant Air Bleed Cover, Bolts & Gaskets
Courtesy of GENERAL MOTORS CORP.

7. Remove the engine coolant air bleed cover bolts (312).
8. Remove the covers (313) with seals (308).

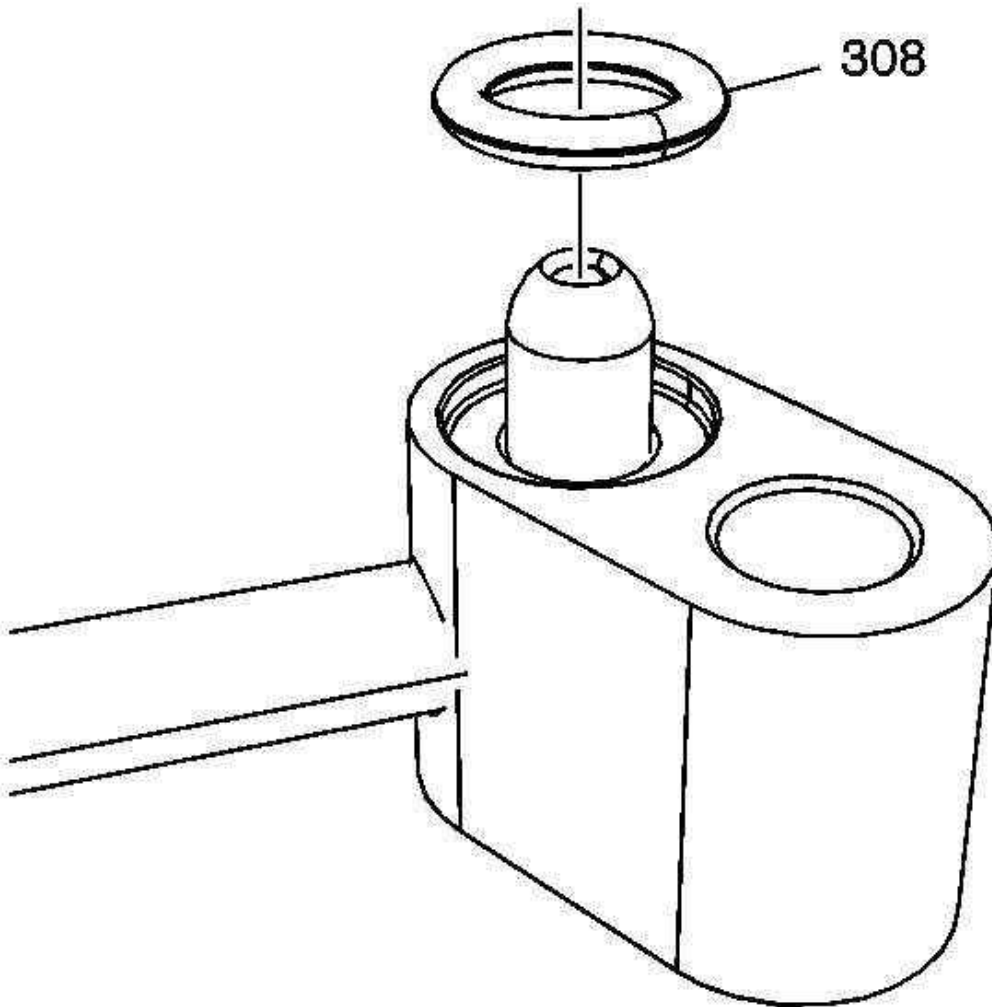


Fig. 112: View Of Coolant Air Bleed Pipe Seal
Courtesy of GENERAL MOTORS CORP.

9. Remove the seals (308) from the pipe and covers. Discard the seals.

Installation Procedure

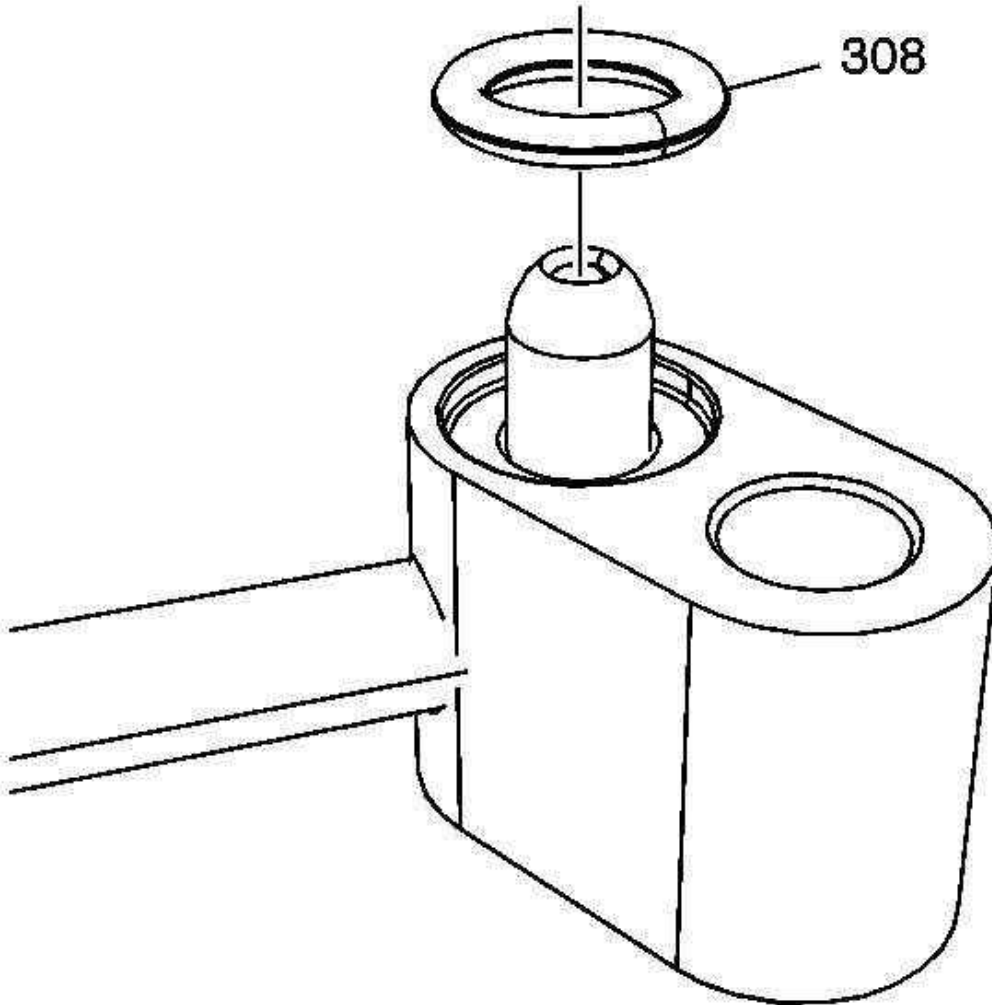


Fig. 113: View Of Coolant Air Bleed Pipe Seal
Courtesy of GENERAL MOTORS CORP.

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

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

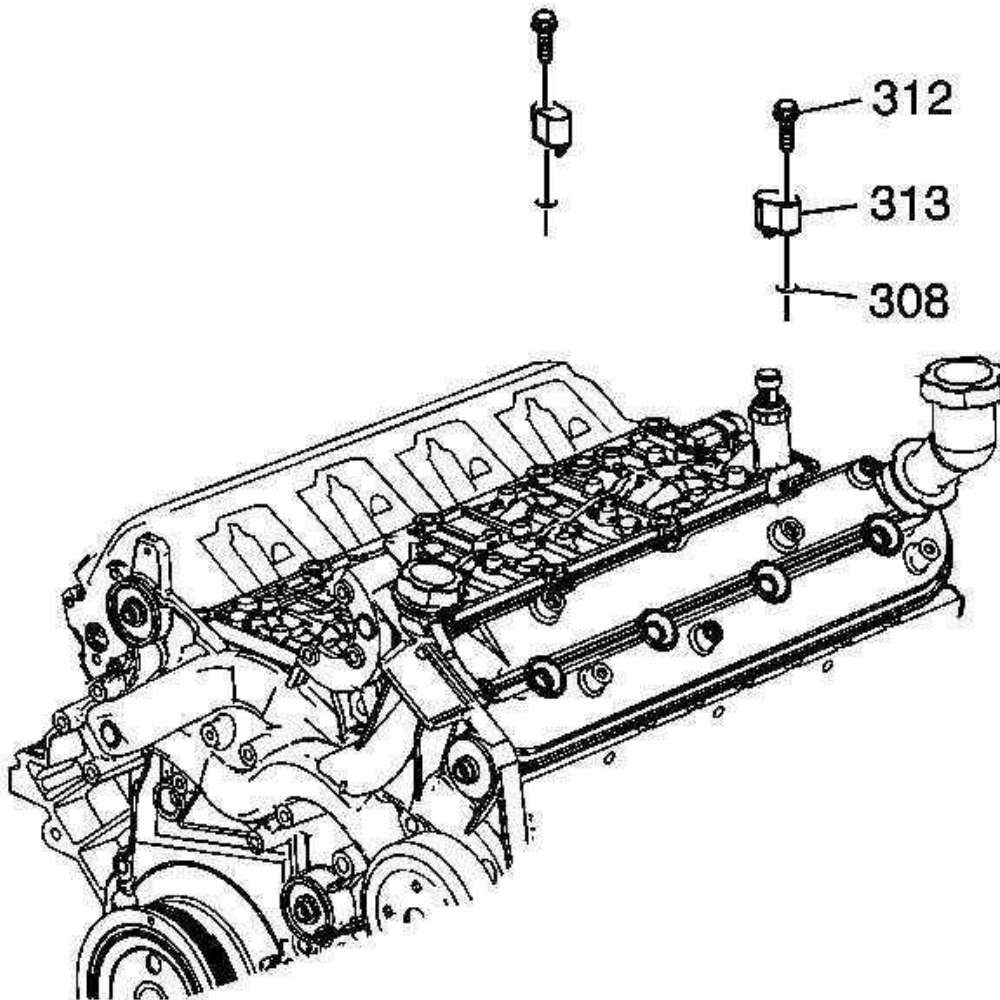


Fig. 114: View Of Engine Coolant Air Bleed Cover, Bolts & Gaskets
Courtesy of GENERAL MOTORS CORP.

2. Install the covers (313) with seals (308).

NOTE: Refer to Fastener Notice .

3. Install the engine coolant air bleed cover bolts (312).

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

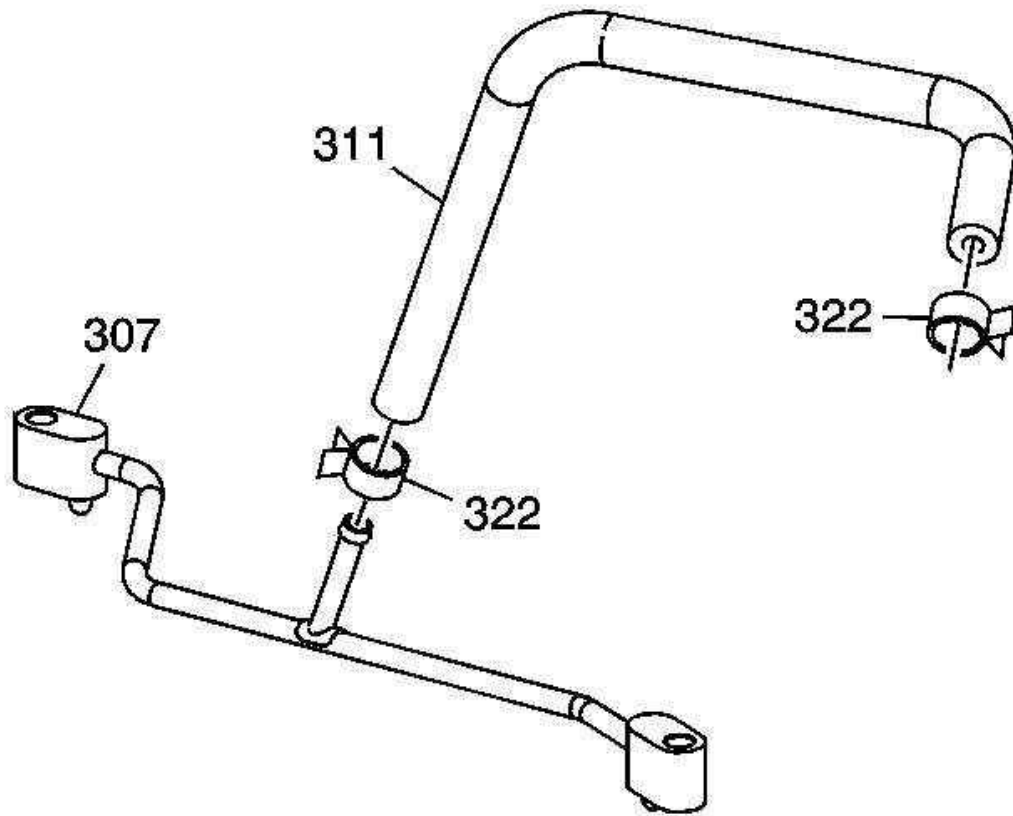


Fig. 115: View Of Coolant Air Bleed Pipe & Clamp
Courtesy of GENERAL MOTORS CORP.

4. Install the hose (311) and clamps (322) to the coolant air bleed pipe (307) as required.

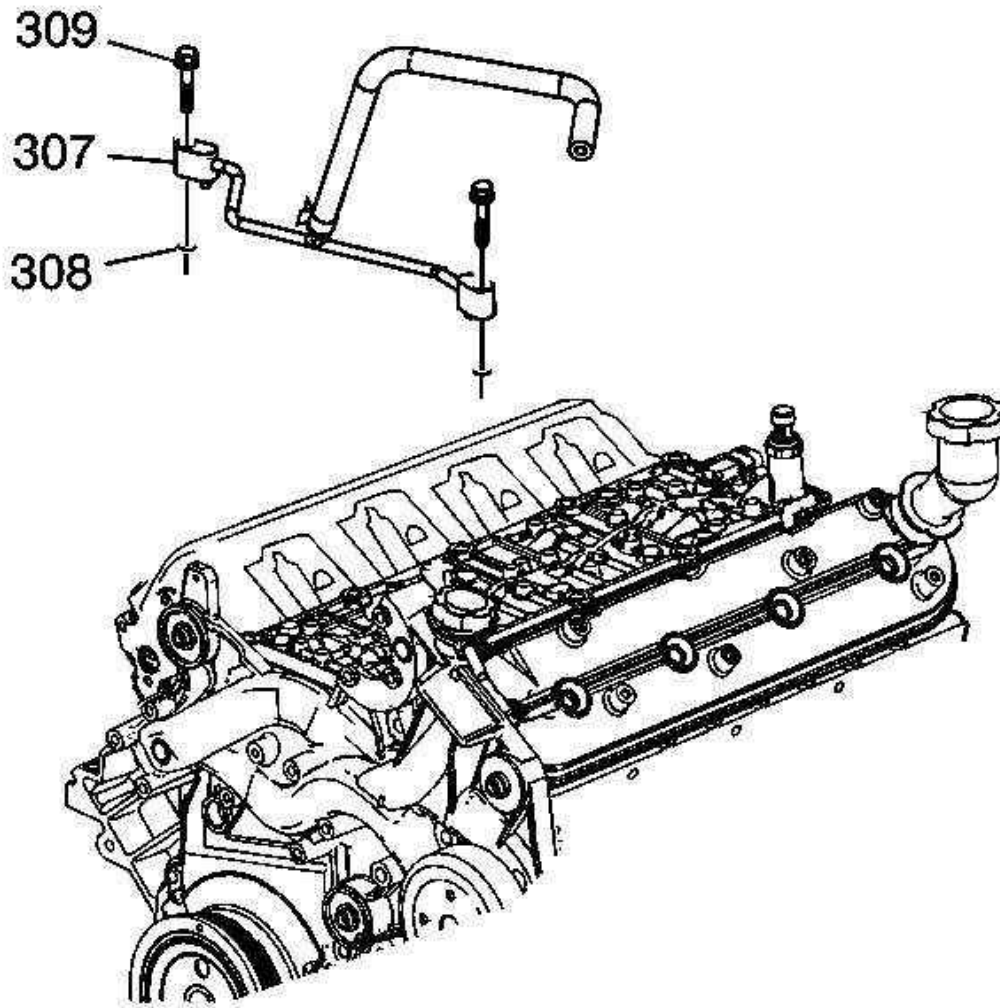


Fig. 116: View Of Coolant Air Bleed Pipe & Bolts
Courtesy of GENERAL MOTORS CORP.

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

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

7. Install the intake manifold. Refer to **Intake Manifold Replacement** .

8. Connect the clamp and hose to coolant fill neck.
9. Fill the cooling system. Refer to **Cooling System Draining and Filling (L26, LY7 GE 47716 Fill)** or **Cooling System Draining and Filling (L26 Static Fill)** or **Cooling System Draining and Filling (LY7 Static Fill)** or **Cooling System Draining and Filling (LS4 GE47716 Fill)** or **Cooling System Draining and Filling (LS4 Static Fill)**.

COOLANT AIR BLEED HOSE REPLACEMENT (LS4)

Removal Procedure

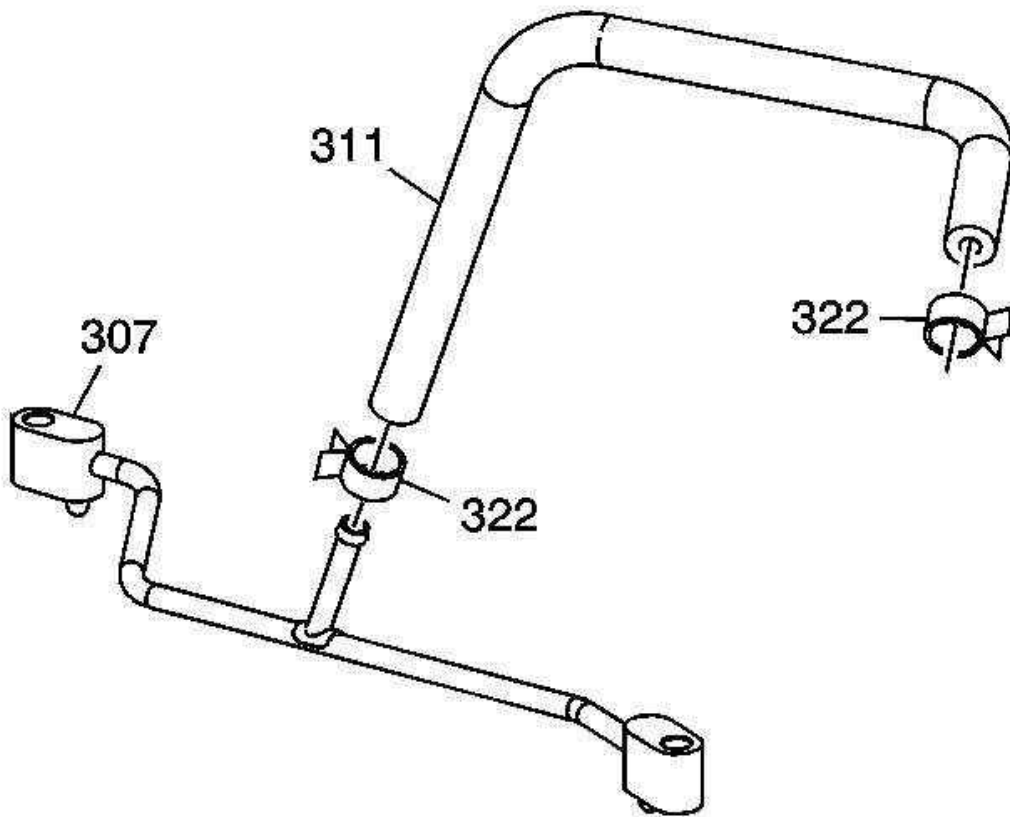


Fig. 117: View Of Coolant Air Bleed Pipe & Clamp
Courtesy of GENERAL MOTORS CORP.

1. Drain a small amount of coolant from the radiator. Refer to **Cooling System Draining and Filling (L26, LY7 GE 47716 Fill)** or **Cooling System Draining and Filling (L26 Static Fill)** or **Cooling System Draining and Filling (LY7 Static Fill)** or **Cooling System Draining and Filling (LS4 GE47716 Fill)** or **Cooling System Draining and Filling (LS4 Static Fill)**.
2. Reposition the coolant air bleed hose clamp (322) at the coolant air bleed pipe (307).
3. Reposition the coolant air bleed hose clamp (322) at the water manifold.
4. Remove the coolant air bleed hose from the water manifold.
5. Remove the coolant air bleed hose from the coolant air bleed pipe.
6. Remove the clamps from the coolant air bleed hose, if necessary.

Installation Procedure

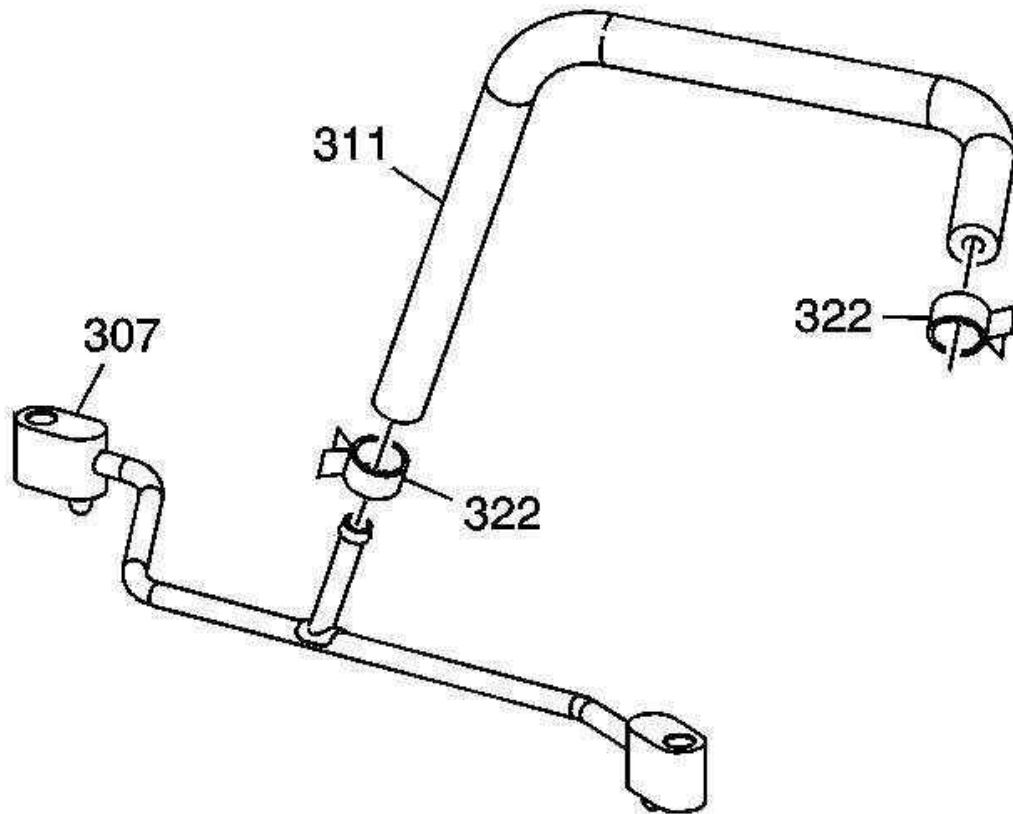


Fig. 118: View Of Coolant Air Bleed Pipe & Clamp
Courtesy of GENERAL MOTORS CORP.

1. Install the clamps onto the coolant air bleed hose, if necessary.
2. Install the coolant air bleed hose onto the coolant air bleed pipe.
3. Install the coolant air bleed hose onto the water manifold.
4. Position the coolant air bleed hose clamp (322) at the water manifold.
5. Position the coolant air bleed hose clamp (322) at the coolant air bleed pipe (307).
6. Refill the coolant system. Refer to **Cooling System Draining and Filling (L26, LY7 GE 47716 Fill)** or **Cooling System Draining and Filling (L26 Static Fill)** or **Cooling System Draining and Filling (LY7 Static Fill)** or

Cooling System Draining and Filling (LS4 GE47716 Fill) or Cooling System Draining and Filling (LS4 Static Fill), as necessary.

WATER PUMP REPLACEMENT (LY7)

Tools Required

EN 46104 Water Pump Pulley Holding Tool. See **Special Tools**.

Removal Procedure

1. Drain the cooling system. Refer to **Cooling System Draining and Filling (L26, LY7 GE 47716 Fill)** or **Cooling System Draining and Filling (L26 Static Fill)** or **Cooling System Draining and Filling (LY7 Static Fill)** or **Cooling System Draining and Filling (LS4 GE47716 Fill)** or **Cooling System Draining and Filling (LS4 Static Fill)**.
2. Remove the generator drive belt. Refer to **Drive Belt Replacement** .

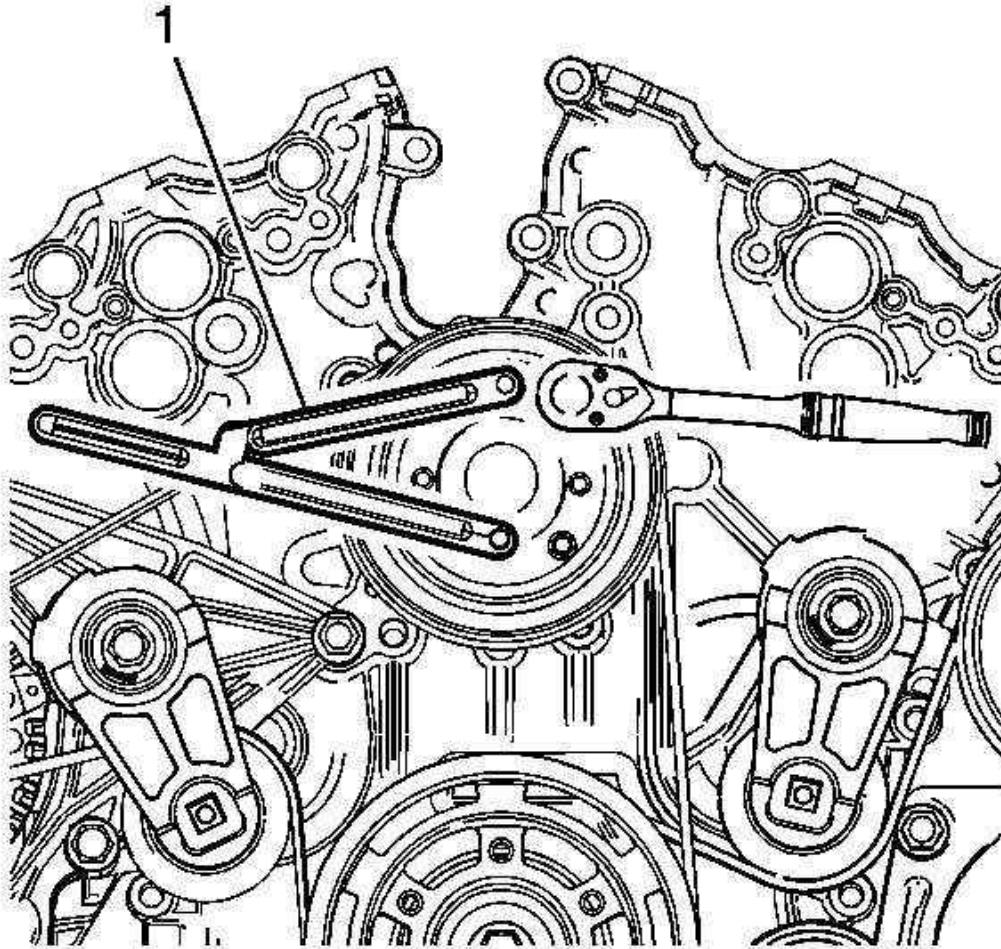


Fig. 119: Securing Water Pump Pulley With EN 46104
Courtesy of GENERAL MOTORS CORP.

3. Use the **EN 46104** (1) in order to retain the water pump pulley. See **Special Tools**.

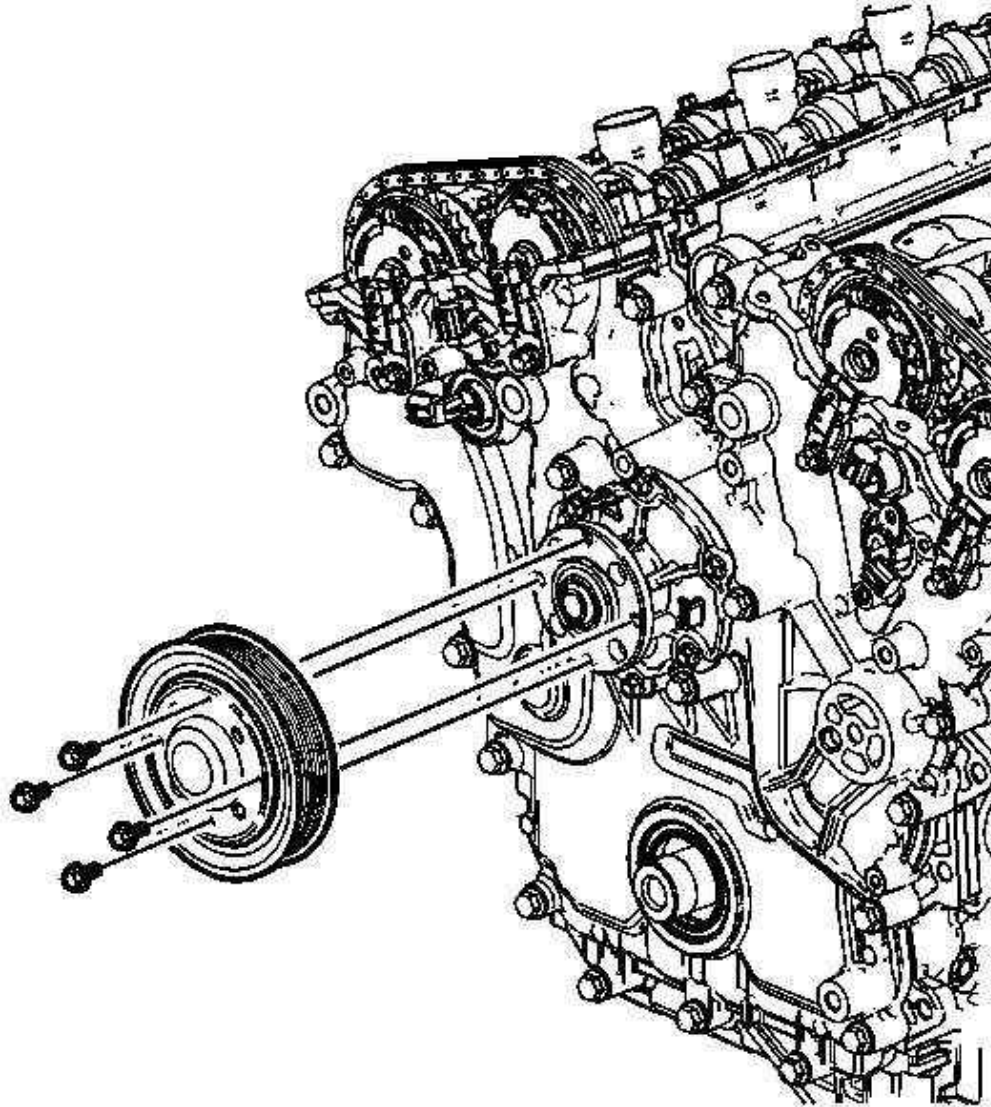


Fig. 120: View Of Water Pump Pulley
Courtesy of GENERAL MOTORS CORP.

4. Remove the water pump pulley bolts.
5. Remove the water pump pulley.

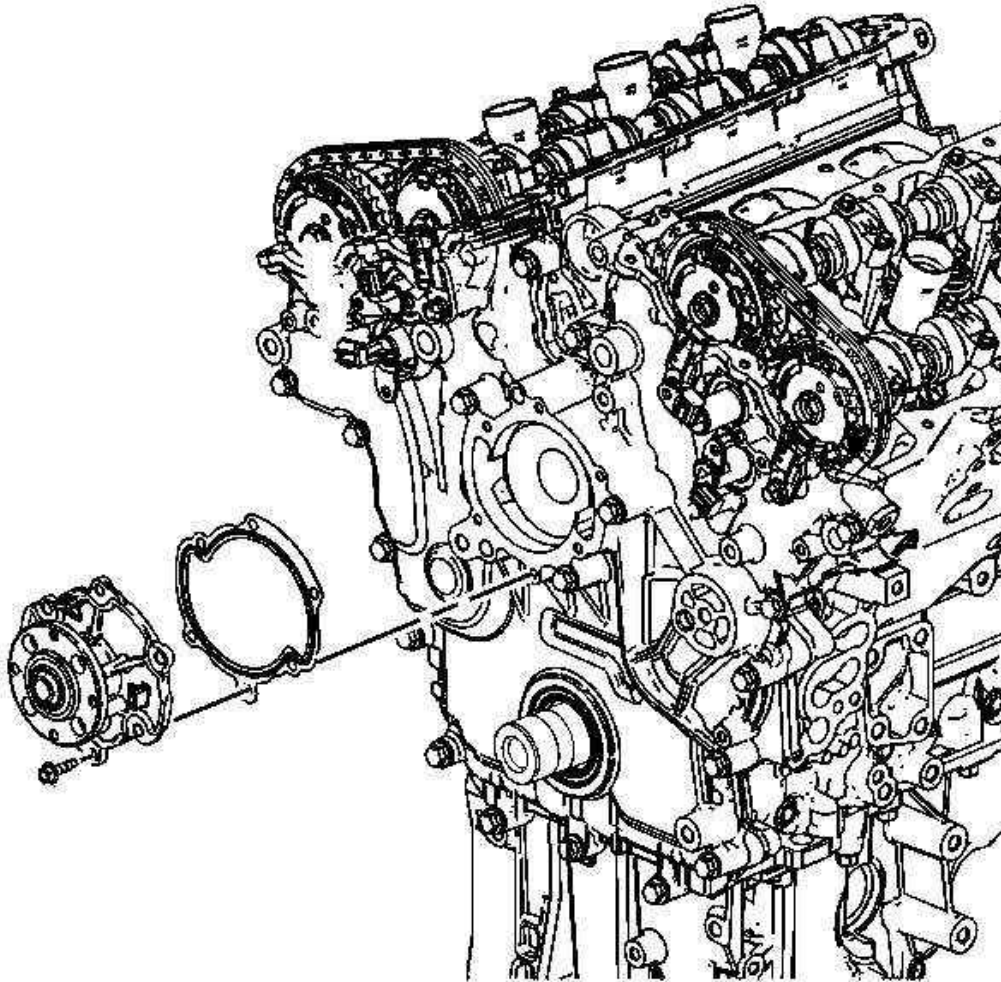


Fig. 121: View Of Water Pump
Courtesy of GENERAL MOTORS CORP.

6. Remove the water pump bolts.
7. Remove the water pump.
8. Remove and DISCARD the water pump seal.
9. Carefully clean the water pump sealing surfaces.

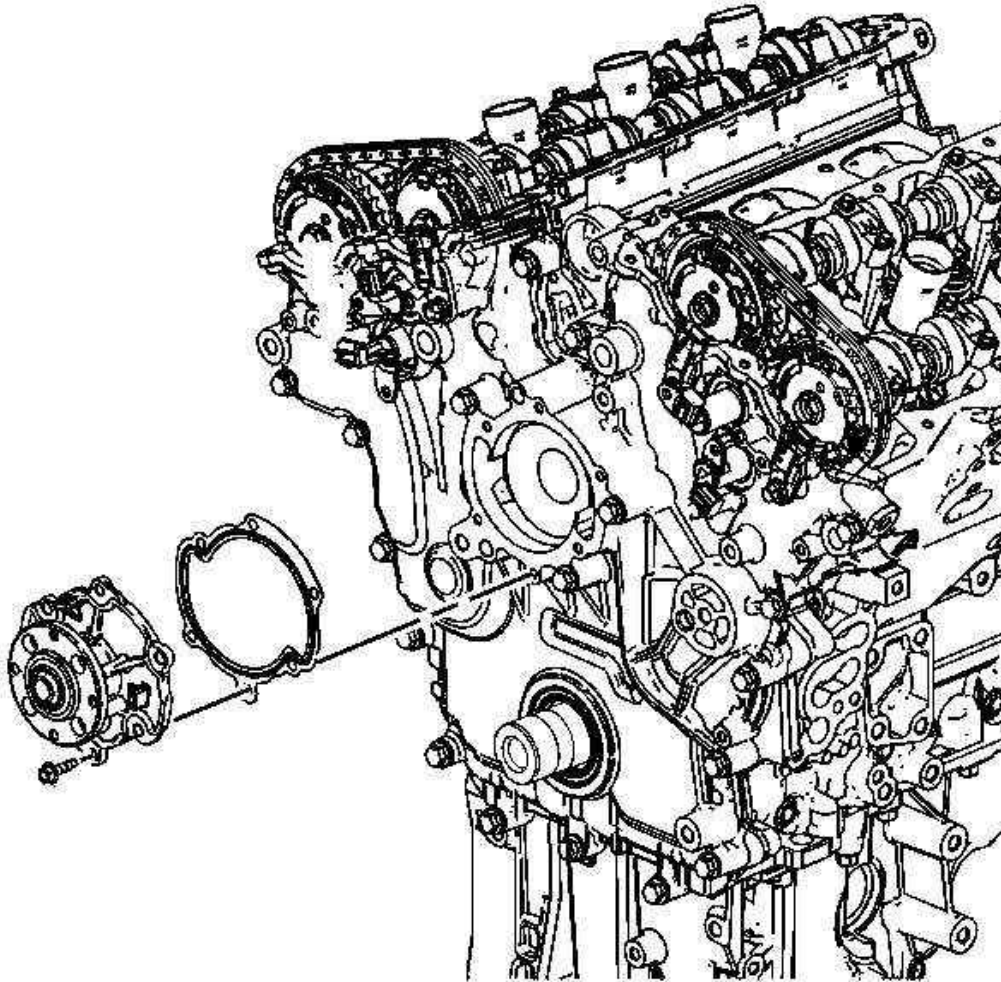


Fig. 122: View Of Water Pump
Courtesy of GENERAL MOTORS CORP.

1. Install a NEW water pump seal.
2. Install the water pump.

NOTE: Refer to Fastener Notice .

3. Install the water pump bolts.

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

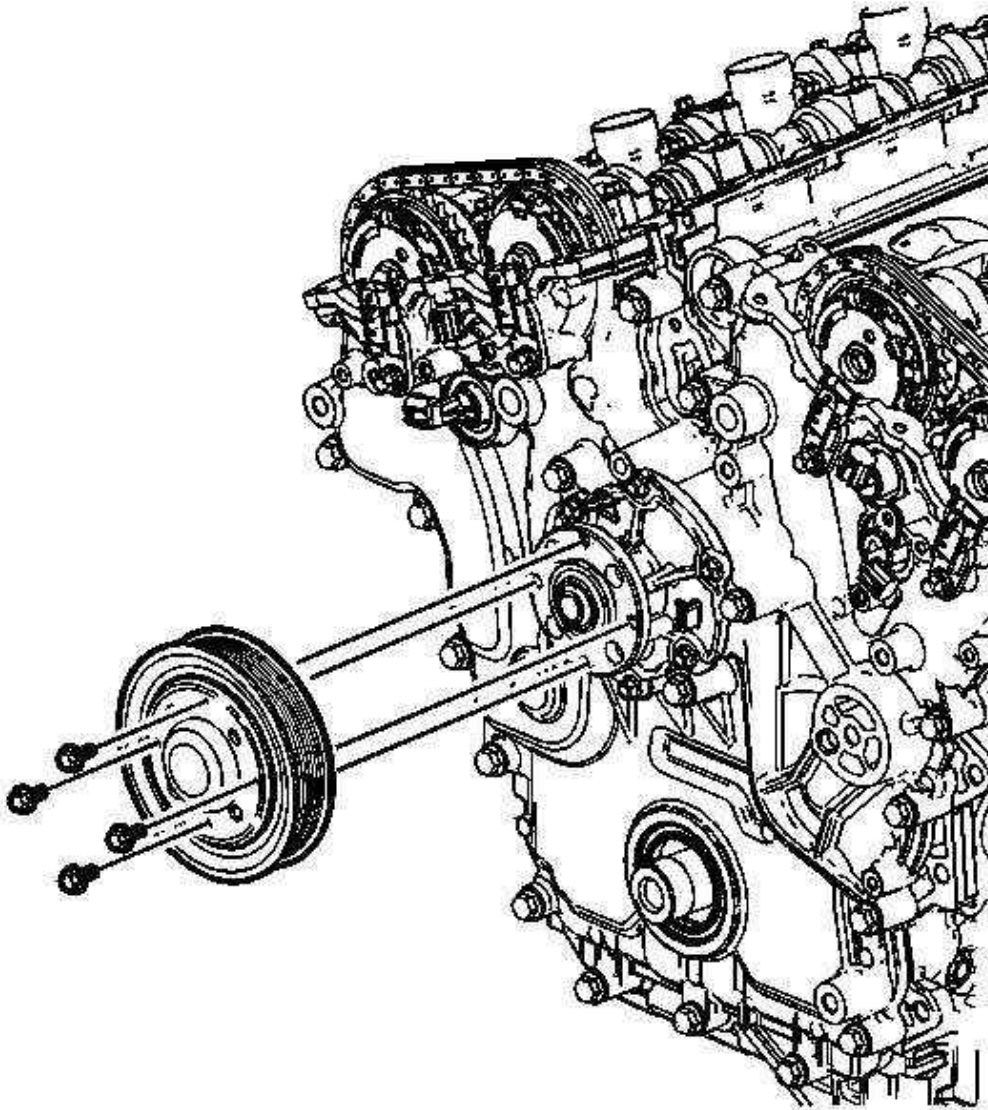


Fig. 123: View Of Water Pump Pulley
Courtesy of GENERAL MOTORS CORP.

4. Install the water pump pulley and the water pump pulley bolts.

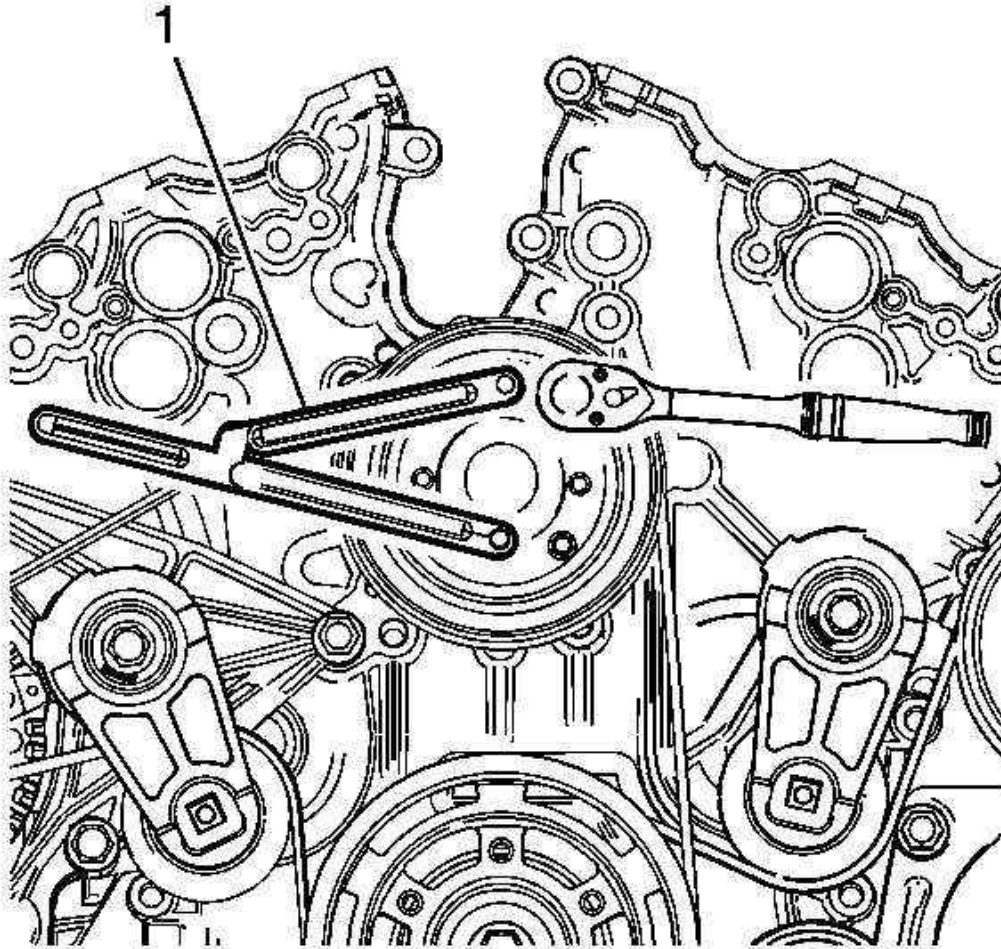


Fig. 124: Securing Water Pump Pulley With EN 46104
Courtesy of GENERAL MOTORS CORP.

5. Use the **EN 46104** (1) in order to retain the water pump pulley. See **Special Tools**.
6. Install the water pump pulley bolts.

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

7. Install the generator drive belt. Refer to **Drive Belt Replacement** .

8. Fill the cooling system. Refer to **Cooling System Draining and Filling (L26, LY7 GE 47716 Fill)** or **Cooling System Draining and Filling (L26 Static Fill)** or **Cooling System Draining and Filling (LY7 Static Fill)** or **Cooling System Draining and Filling (LS4 GE47716 Fill)** or **Cooling System Draining and Filling (LS4 Static Fill)**.

WATER PUMP REPLACEMENT (RPOS L26/L32)

Removal Procedure

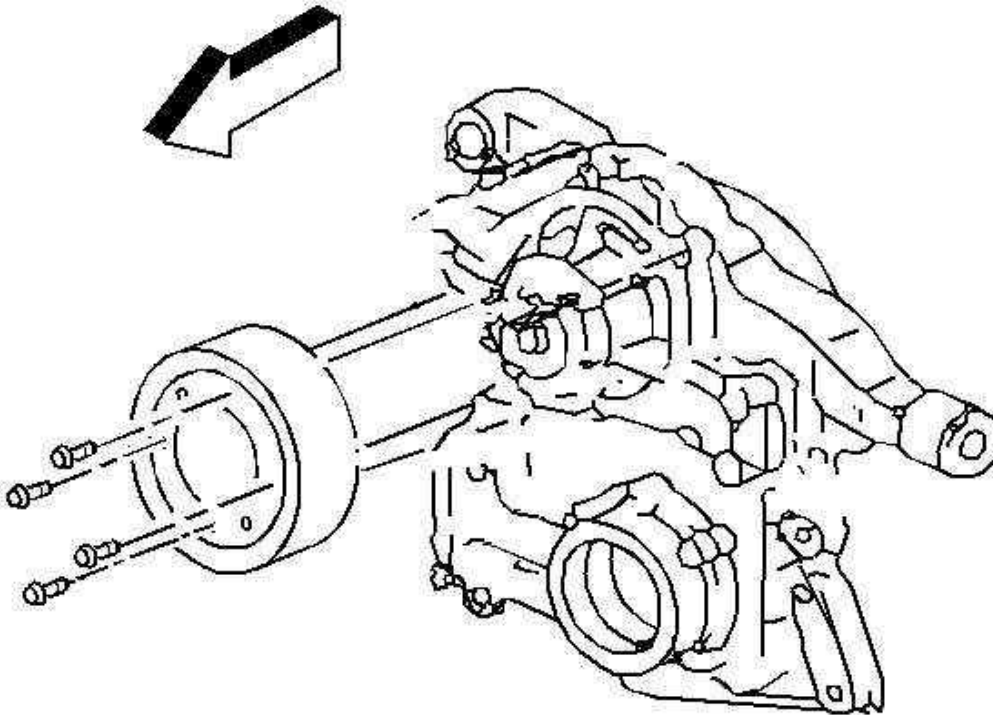


Fig. 125: View Of Water Pump Pulley & Bolts
Courtesy of GENERAL MOTORS CORP.

1. Drain the cooling system. Refer to **Cooling System Draining and Filling (L26, LY7 GE 47716 Fill)** or **Cooling System Draining and Filling (L26 Static Fill)** or **Cooling System Draining and Filling (LY7 Static Fill)** or

Cooling System Draining and Filling (LS4 GE47716 Fill) or Cooling System Draining and Filling (LS4 Static Fill).

2. Reposition the accessory wiring junction block.
3. Loosen the water pump pulley bolts.
4. Remove the drive belt. Refer to **Drive Belt Replacement (L26)** .
5. Remove the water pump pulley bolts.
6. Remove the water pump pulley.
7. Remove the power steering pump mounting bolts and reposition. Refer to **Power Steering Pump Replacement (L26)** or **Power Steering Pump Replacement (LY7)** or **Power Steering Pump Replacement (LS4)** .

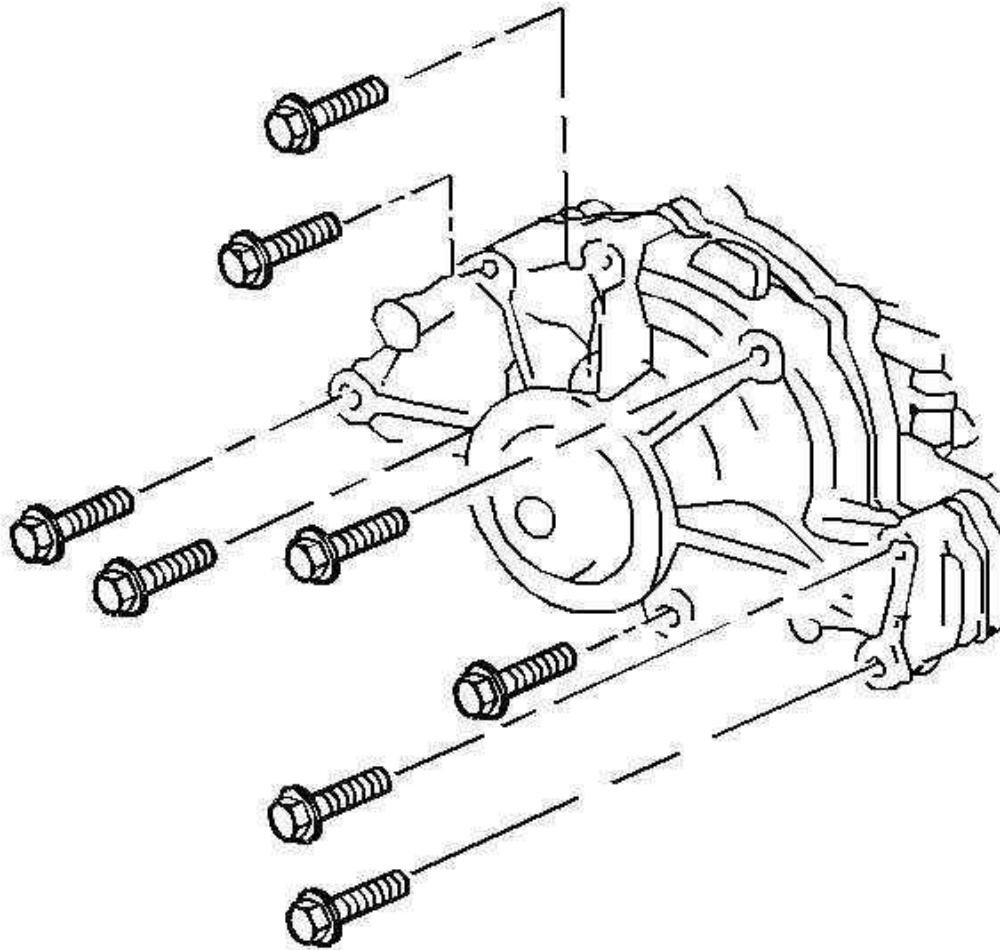


Fig. 126: Locating Water Pump Bolts
Courtesy of GENERAL MOTORS CORP.

8. Remove the water pump bolts.

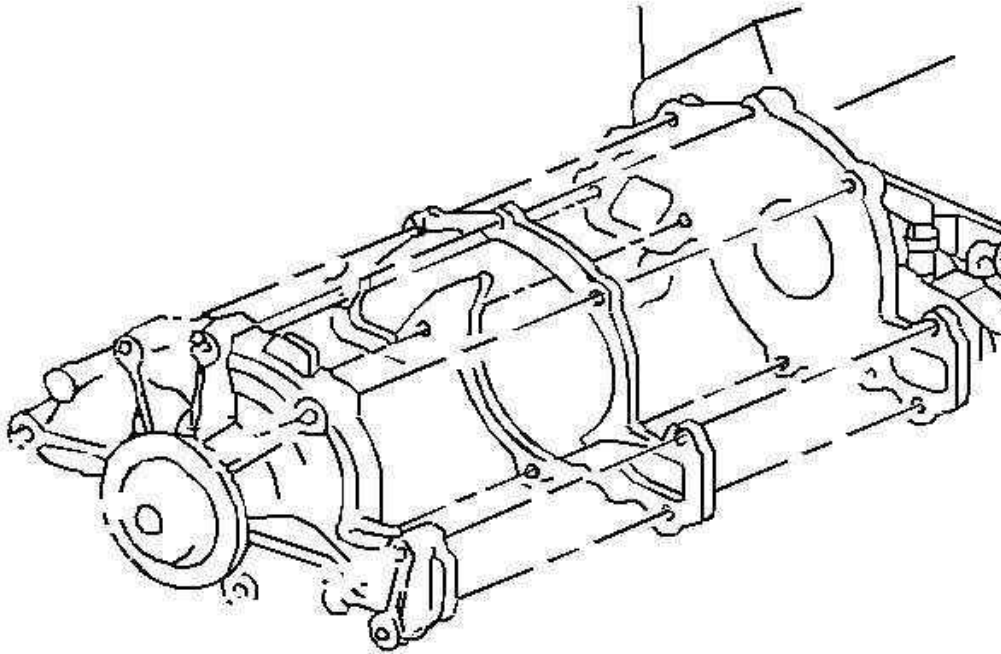


Fig. 127: View Of Water Pump & Gasket
Courtesy of GENERAL MOTORS CORP.

9. Remove the water pump.
10. Remove the water pump gasket.
11. Clean and inspect the water pump gasket mating surfaces.

Installation Procedure

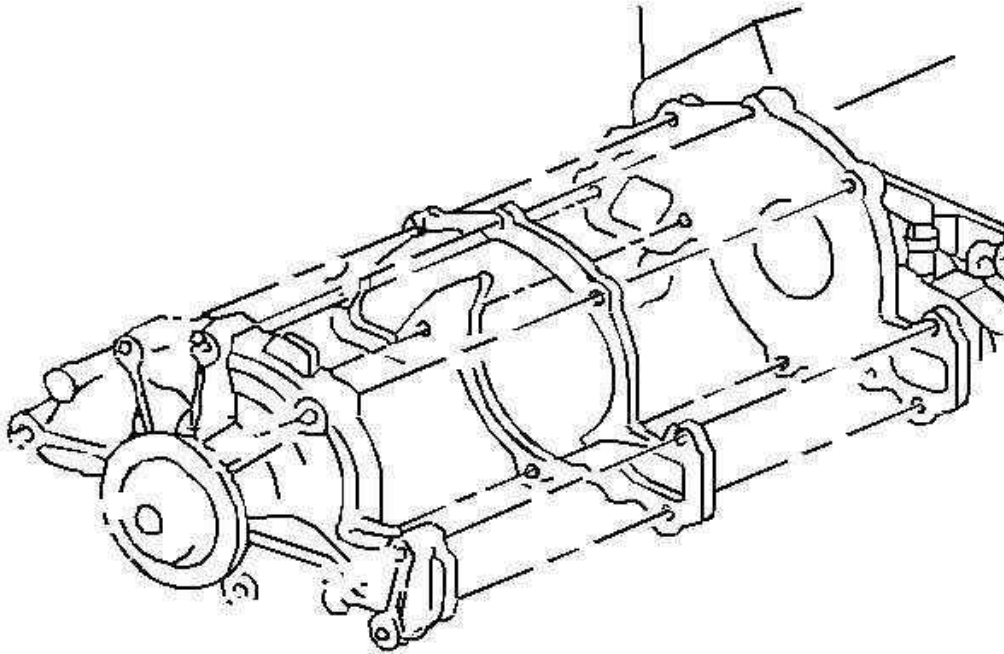


Fig. 128: View Of Water Pump & Gasket
Courtesy of GENERAL MOTORS CORP.

1. Install the gasket and the water pump.

NOTE: Refer to Fastener Notice .

2. Install the water pump bolts.

Tighten:

- Tighten the long water pump bolts to 34 N.m (25 lb ft).
- Tighten the short water pump bolts to 22 N.m (16 lb ft).

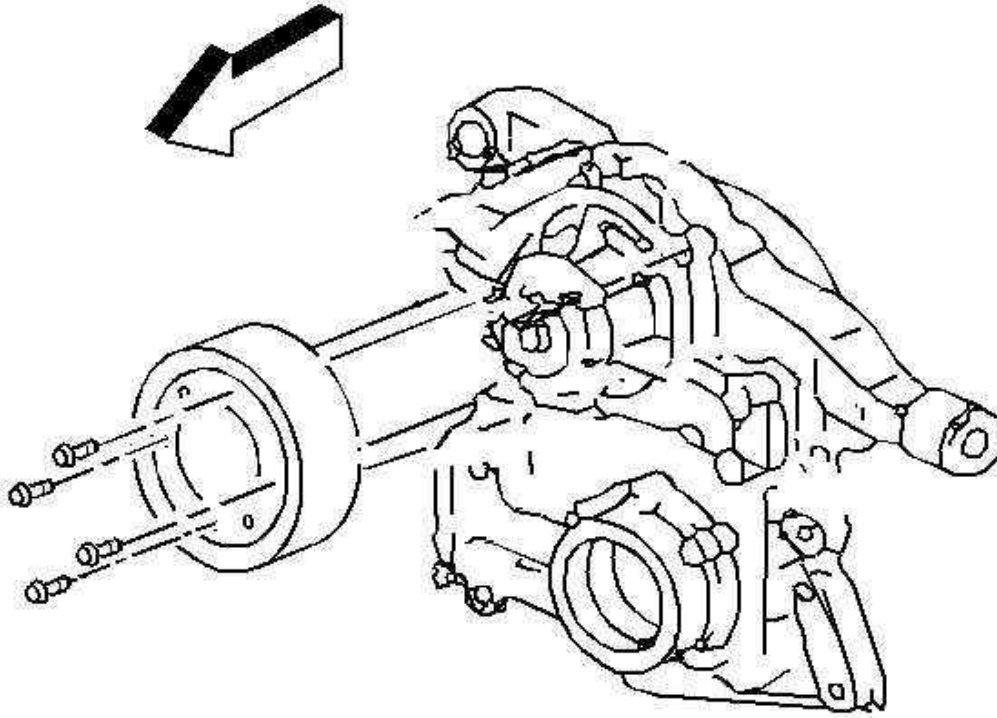


Fig. 129: View Of Water Pump Pulley & Bolts
Courtesy of GENERAL MOTORS CORP.

3. Install the water pump pulley.
4. Install the water pump pulley bolts.

Tighten: Tighten the bolts to 13 N.m (115 lb in).

5. Install the power steering pump. Refer to **Power Steering Pump Replacement (L26)** or **Power Steering Pump Replacement (LY7)** or **Power Steering Pump Replacement (LS4)** .
6. Install the drive belt. Refer to **Drive Belt Replacement (L26)** .
7. Install the accessory wiring junction block.
8. Fill the cooling system. Refer to **Cooling System Draining and Filling (L26,**

LY7 GE 47716 Fill) or Cooling System Draining and Filling (L26 Static Fill) or Cooling System Draining and Filling (LY7 Static Fill) or Cooling System Draining and Filling (LS4 GE47716 Fill) or Cooling System Draining and Filling (LS4 Static Fill).

WATER PUMP REPLACEMENT (LS4)

Removal Procedure

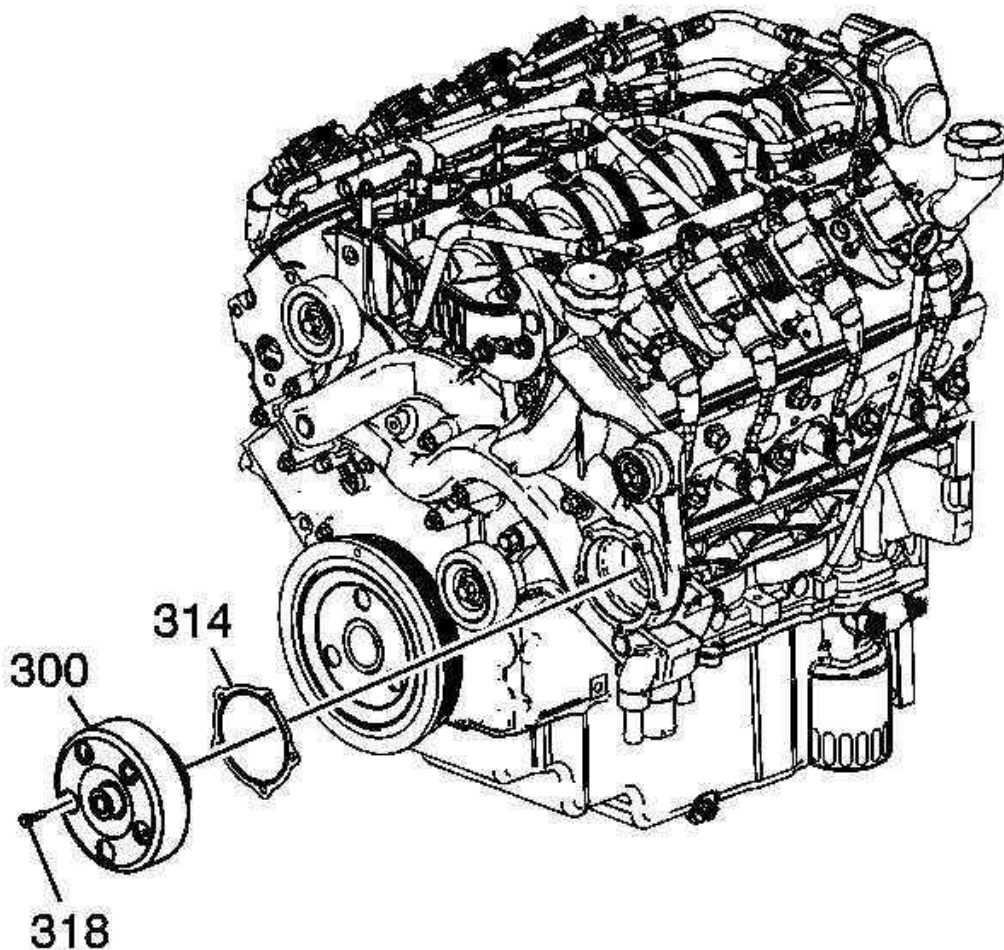


Fig. 130: View Of Water Pump, Bolts & Gasket
Courtesy of GENERAL MOTORS CORP.

1. Drain the cooling system. Refer to **Cooling System Draining and Filling (L26, LY7 GE 47716 Fill)** or **Cooling System Draining and Filling (L26 Static Fill)** or **Cooling System Draining and Filling (LY7 Static Fill)** or **Cooling System Draining and Filling (LS4 GE47716 Fill)** or **Cooling System Draining and Filling (LS4 Static Fill)**.
2. Remove the battery and battery tray. Refer to **Battery Tray Replacement (LY7)** or **Battery Tray Replacement (L26)** or **Battery Tray Replacement (LS4)** .
3. Remove the drive belt. Refer to **Drive Belt Replacement - Accessory** .
4. Remove the water pump bolts (318).
5. Remove the water pump (300) and gasket (314). Discard the gasket.
6. Clean and inspect the water pump gasket mating surfaces.

Installation Procedure

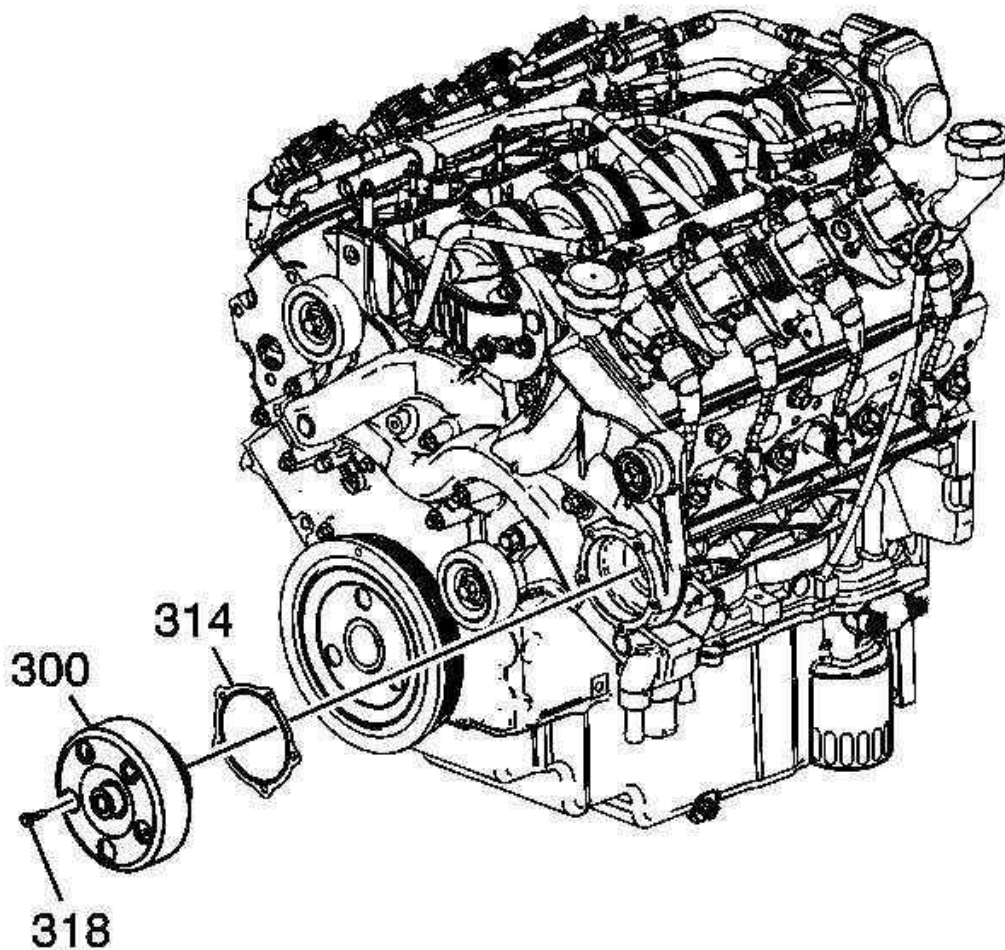


Fig. 131: View Of Water Pump, Bolts & Gasket
Courtesy of GENERAL MOTORS CORP.

1. Install the water pump (300) and a NEW gasket (314).

NOTE: Refer to Fastener Notice .

2. Tighten the water pump bolts (318).

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

3. Install the drive belt. Refer to **Drive Belt Replacement - Accessory** .
4. Install the battery tray and battery. Refer to **Battery Tray Replacement (LY7)** or **Battery Tray Replacement (L26)** or **Battery Tray Replacement (LS4)** .
5. Fill the cooling system. Refer to **Cooling System Draining and Filling (L26, LY7 GE 47716 Fill)** or **Cooling System Draining and Filling (L26 Static Fill)** or **Cooling System Draining and Filling (LY7 Static Fill)** or **Cooling System Draining and Filling (LS4 GE47716 Fill)** or **Cooling System Draining and Filling (LS4 Static Fill)**.

COOLANT PUMP MANIFOLD REPLACEMENT

Removal Procedure

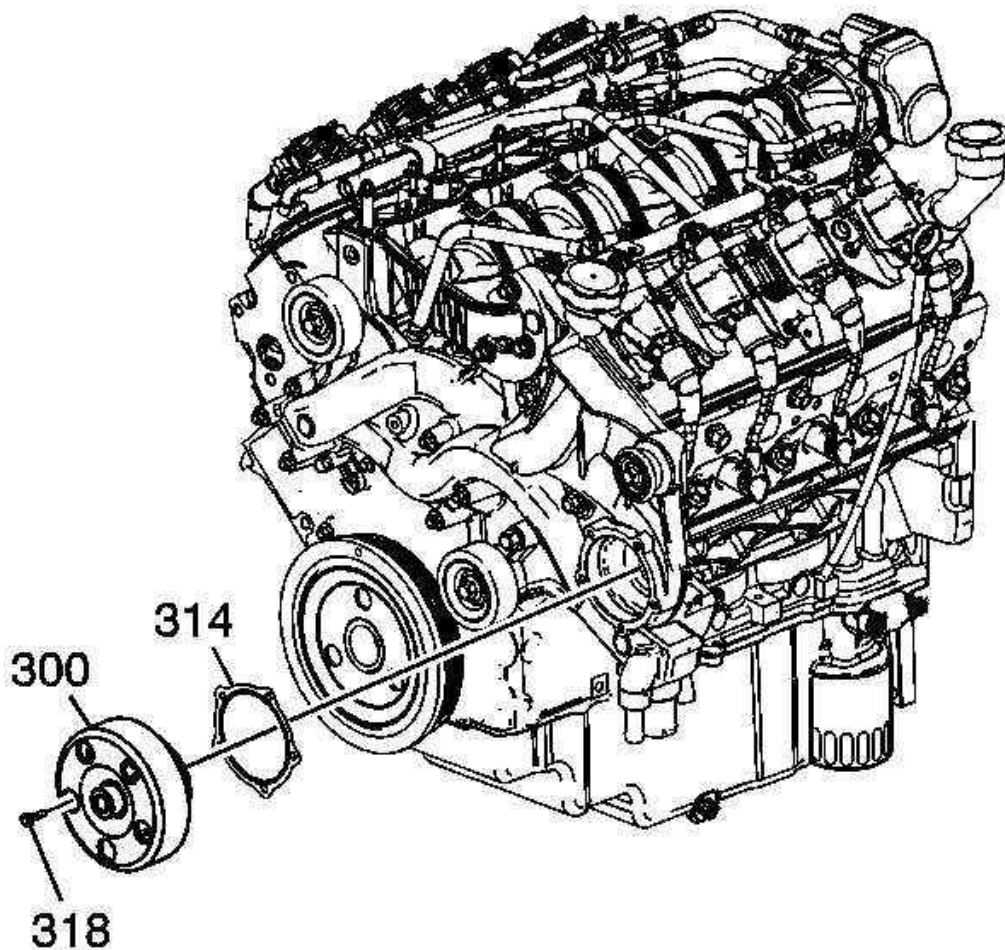


Fig. 132: View Of Water Pump, Bolts & Gasket
Courtesy of GENERAL MOTORS CORP.

1. Drain the cooling system. Refer to **Cooling System Draining and Filling (L26, LY7 GE 47716 Fill)** or **Cooling System Draining and Filling (L26 Static Fill)** or **Cooling System Draining and Filling (LY7 Static Fill)** or **Cooling System Draining and Filling (LS4 GE47716 Fill)** or **Cooling System Draining and Filling (LS4 Static Fill)**.
2. Loosen the water pump bolts (318).
3. Remove the drive belt. Refer to **Drive Belt Replacement - Accessory**.

4. Remove fluid from the power steering pump reservoir.
5. Remove the power steering pump pulley. Refer to **Power Steering Pump Pulley Replacement (L26)** or **Power Steering Pump Pulley Replacement (LS4)** or **Power Steering Pump Pulley Replacement (LY7)** .
6. Disconnect the power steering hoses and pipes from the power steering pump and reservoir. Refer to **Power Steering Cooler Pipe/Hose Replacement (LY7)** or **Power Steering Cooler Pipe/Hose Replacement (LS4)** or **Power Steering Cooler Pipe/Hose Replacement (L26)** and **Power Steering Pressure Pipe/Hose Replacement (L26)** or **Power Steering Pressure Pipe/Hose Replacement (LY7)** or **Power Steering Pressure Pipe/Hose Replacement (LS4)** .
7. Remove the bolt that retains a clip that retains the pressure pipe to the front of the engine.
8. Remove the water pump bolts (318).
9. Remove the water pump (300) and gasket (314). Discard the gasket.
10. Remove the camshaft position sensor. Refer to **Camshaft Position Sensor Replacement** .
11. Unclip the wiring harness from the front of the engine.

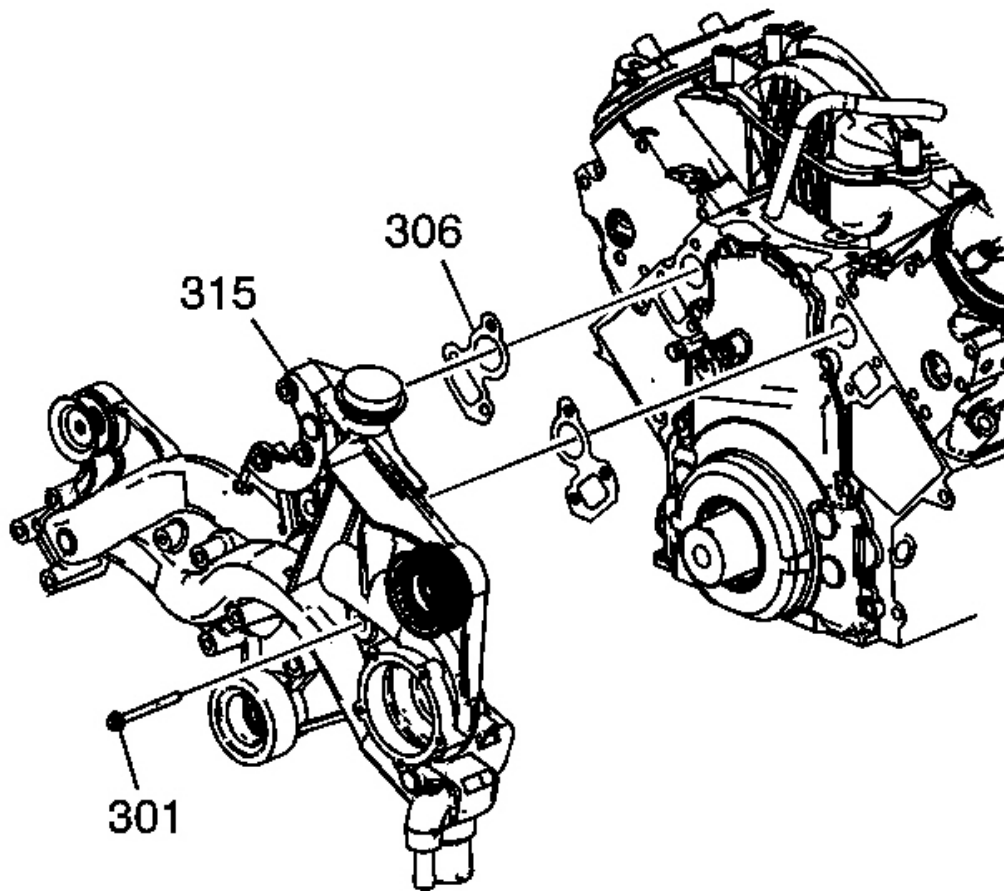


Fig. 133: View Of Water Manifold, Bolts & Gaskets
Courtesy of GENERAL MOTORS CORP.

12. Disconnect the engine coolant air bleed pipe hoses and clamps. Refer to **Coolant Air Bleed Hose Replacement (LS4)**.
13. Remove the three coolant pump manifold to cylinder head bolts.
14. Disconnect the heater hoses at the coolant pump manifold. Refer to **Heater Pipes Replacement (LY7)** or **Heater Pipes Replacement (LS4)** .
15. Disconnect the radiator hoses from the coolant pump manifold. Refer to **Radiator Inlet Hose Replacement (L26)** or **Radiator Inlet Hose Replacement (LY7)** or **Radiator Inlet Hose Replacement (LS4)** and

Radiator Outlet Hose Replacement (L26) or [Radiator Outlet Hose Replacement \(LY7\)](#) or [Radiator Outlet Hose Replacement \(LS4\)](#).

16. Remove the coolant pump manifold bolts (301).
17. Remove the coolant pump manifold (315) and gaskets (306). Discard the gaskets.
18. Clean and inspect the water pump manifold mounting surfaces.

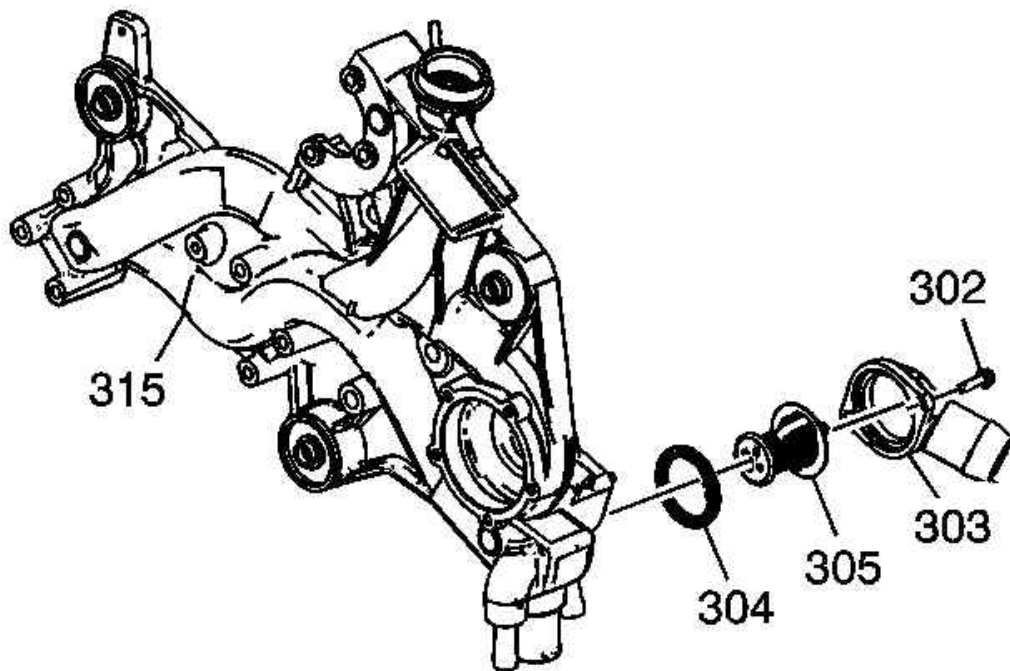


Fig. 134: View Of Thermostat Housing, Bolts, Thermostat, & O-Ring
Courtesy of GENERAL MOTORS CORP.

19. Remove the thermostat housing bolts (302), if necessary.
20. Remove the thermostat housing (303) and O-ring seal (304), if necessary.
21. Remove the thermostat (305), if necessary.
22. Remove the power steering pump and reservoir from the coolant pump manifold.

23. Remove the drive belt idler pulleys from the coolant pump manifold.

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 gasket surfaces are to be free of oil and other foreign material during assembly.

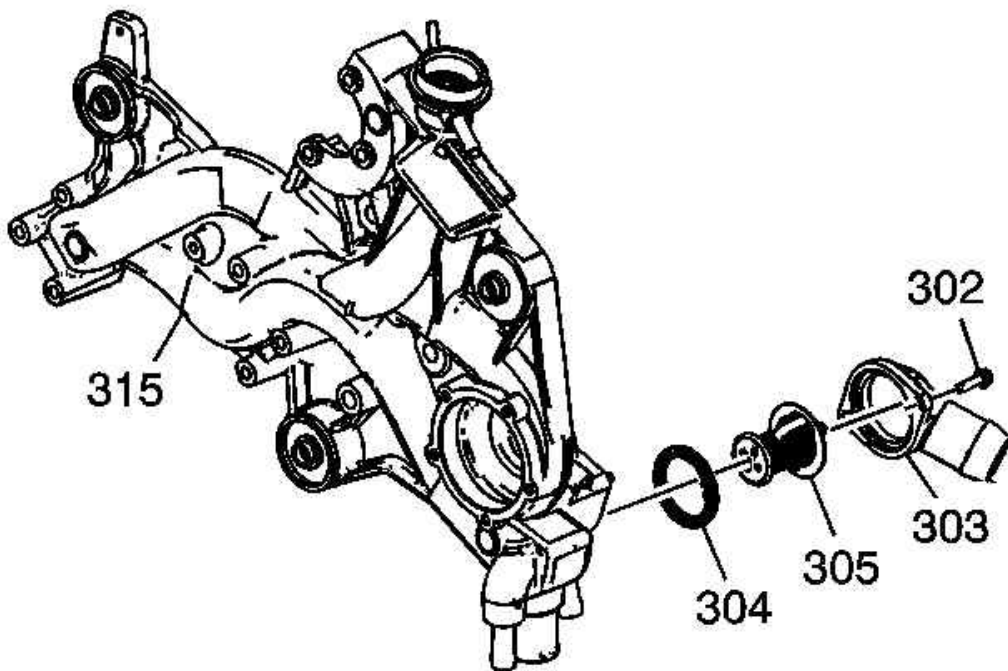


Fig. 135: View Of Thermostat Housing, Bolts, Thermostat, & O-Ring
Courtesy of GENERAL MOTORS CORP.

1. Install the drive belt idler pulleys to the coolant pump manifold. Refer to **Drive Belt Idler Pulley Replacement** .
2. Install the power steering pump and reservoir to the coolant pump manifold. Refer to **Power Steering Pump Replacement (L26)** or **Power Steering Pump Replacement (LY7)** or **Power Steering Pump Replacement (LS4)** and **Remote Power Steering Fluid Reservoir Replacement (LY7)** or **Remote Power Steering Fluid Reservoir Replacement (LS4)** .
3. Install the thermostat (305), if necessary.
4. Install the thermostat housing (303) and O-ring seal (304), if necessary.

NOTE: Refer to **Fastener Notice** .

5. Install the thermostat housing bolts (302), if necessary.

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

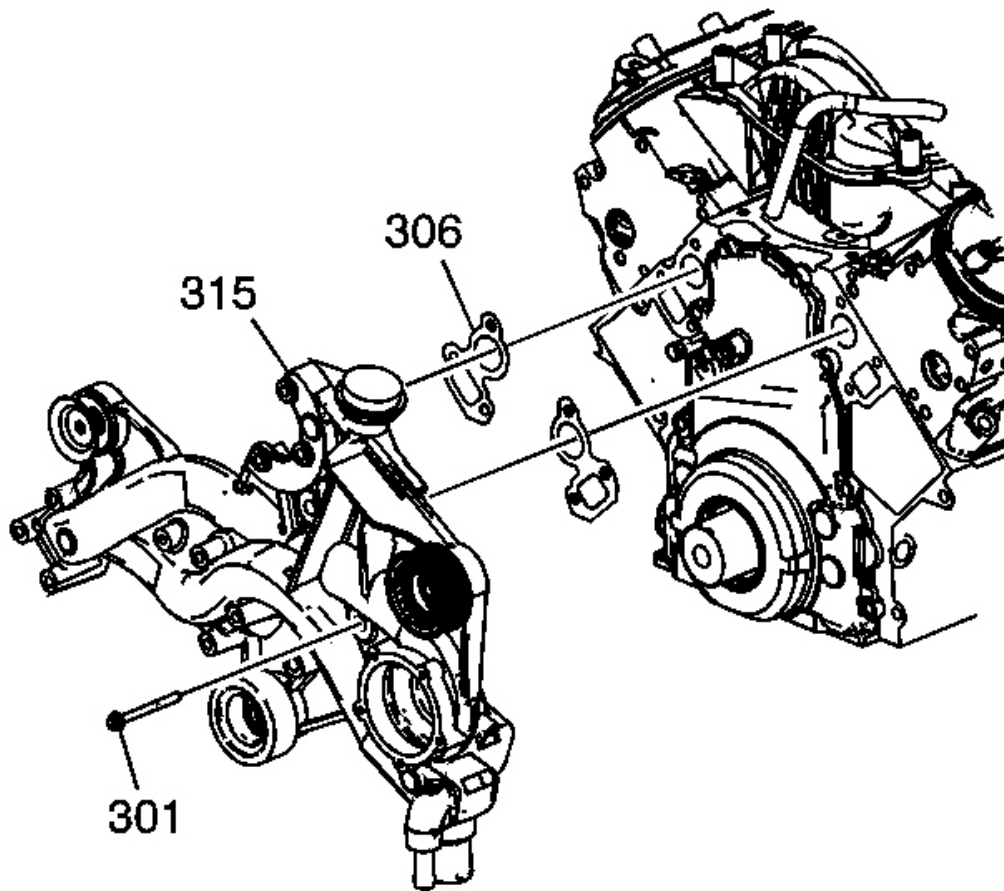


Fig. 136: View Of Water Manifold, Bolts & Gaskets
Courtesy of GENERAL MOTORS CORP.

6. Install the water pump manifold (315) and NEW gaskets (306).

Tighten:

1. Tighten the M10 bolts to 60 N.m (44 lb ft).
 2. Tighten the M8 bolts to 30 N.m (22 lb ft).
7. Install the water pump manifold bolts (301).
 8. Install the camshaft position sensor. Refer to **Camshaft Position Sensor**

Replacement .

9. Install the cylinder head to coolant pump manifold bolts.
10. Connect the engine coolant air bleed pipe hose and clamp.

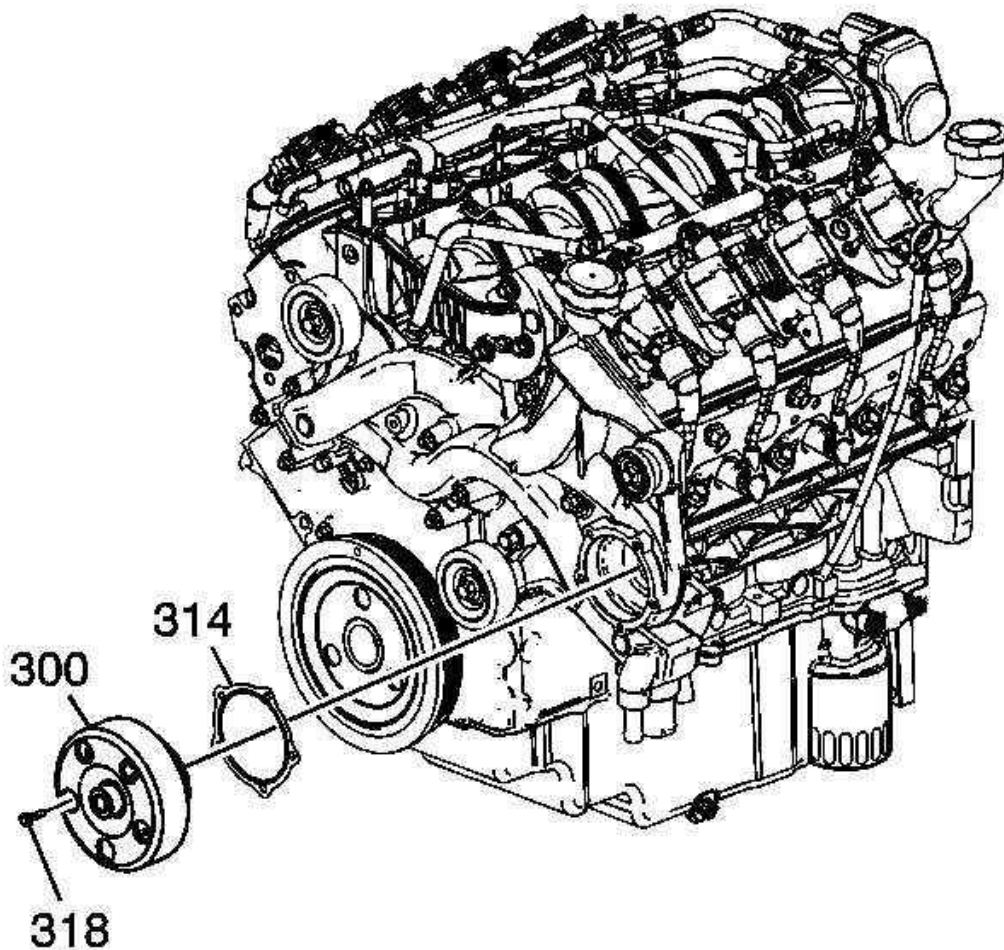


Fig. 137: View Of Water Pump, Bolts & Gasket
Courtesy of GENERAL MOTORS CORP.

11. Install the water pump (300) and a NEW gasket (314).
12. Install the water pump bolts (318) until snug.
13. Connect the power steering pipes and hoses to the pump and reservoir. Refer to

Power Steering Cooler Pipe/Hose Replacement (LY7) or Power Steering Cooler Pipe/Hose Replacement (LS4) or Power Steering Cooler Pipe/Hose Replacement (L26) and Power Steering Pressure Pipe/Hose Replacement (L26) or Power Steering Pressure Pipe/Hose Replacement (LY7) or Power Steering Pressure Pipe/Hose Replacement (LS4) .

14. Install the power steering pump pulley. Refer to **Power Steering Pump Pulley Replacement (L26) or Power Steering Pump Pulley Replacement (LS4) or Power Steering Pump Pulley Replacement (LY7) .**
15. Install the bolt that retains the power steering pipe to the front of the engine.
16. Install the wiring harness to the clips on the front of the engine.
17. Install the drive belt. Refer to **Drive Belt Replacement - Accessory .**
18. Tighten the water pump bolts (318).

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

19. Connect the heater hoses to the coolant pump manifold. Refer to **Heater Pipes Replacement (LY7) or Heater Pipes Replacement (LS4) .**
20. Connect the radiator hoses to the coolant pump manifold. Refer to **Radiator Inlet Hose Replacement (L26) or Radiator Inlet Hose Replacement (LY7) or Radiator Inlet Hose Replacement (LS4) and Radiator Outlet Hose Replacement (L26) or Radiator Outlet Hose Replacement (LY7) or Radiator Outlet Hose Replacement (LS4).**
21. Fill and bleed the power steering system. Refer to **Checking and Adding Power Steering Fluid and Power Steering System Bleeding .**
22. Fill the cooling system. Refer to **Cooling System Draining and Filling (L26, LY7 GE 47716 Fill) or Cooling System Draining and Filling (L26 Static Fill) or Cooling System Draining and Filling (LY7 Static Fill) or Cooling System Draining and Filling (LS4 GE47716 Fill) or Cooling System Draining and Filling (LS4 Static Fill).**

RADIATOR DRAIN COCK REPLACEMENT

Removal Procedure

1. Drain the cooling system. Refer to **Cooling System Draining and Filling (L26, LY7 GE 47716 Fill) or Cooling System Draining and Filling (L26**

Static Fill) or Cooling System Draining and Filling (LY7 Static Fill) or Cooling System Draining and Filling (LS4 GE47716 Fill) or Cooling System Draining and Filling (LS4 Static Fill).

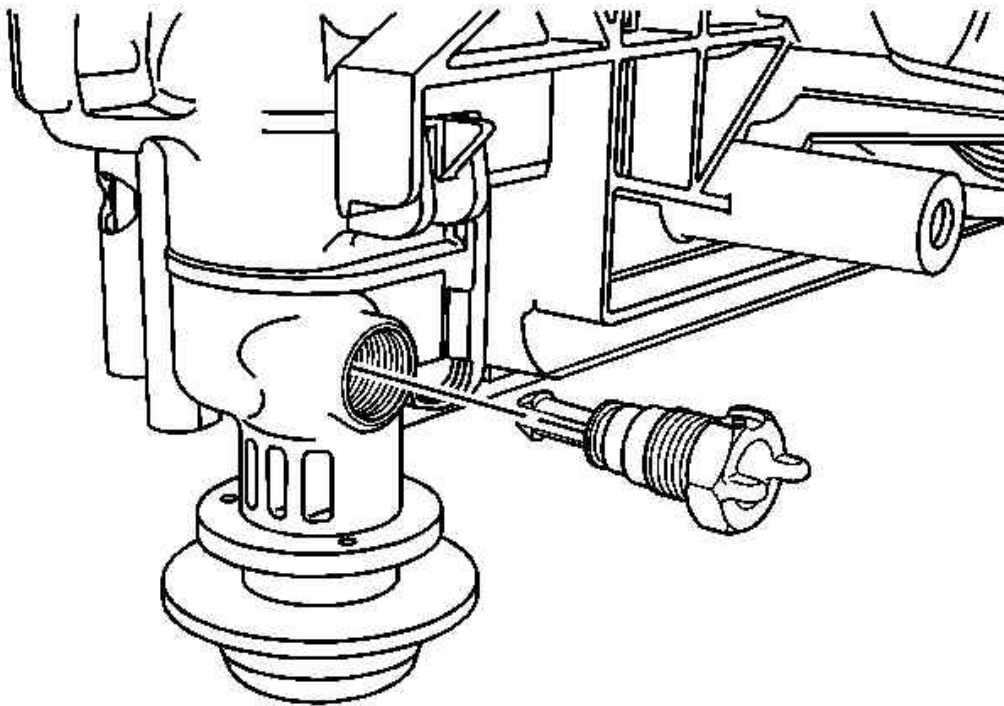


Fig. 138: Identifying Drain & Drain Plug
Courtesy of GENERAL MOTORS CORP.

2. Remove the radiator drain plug by unscrewing counter clockwise and pulling straight out. The seal usually comes out attached to the plug.
3. Clean the drain and the drain plug.

Installation Procedure

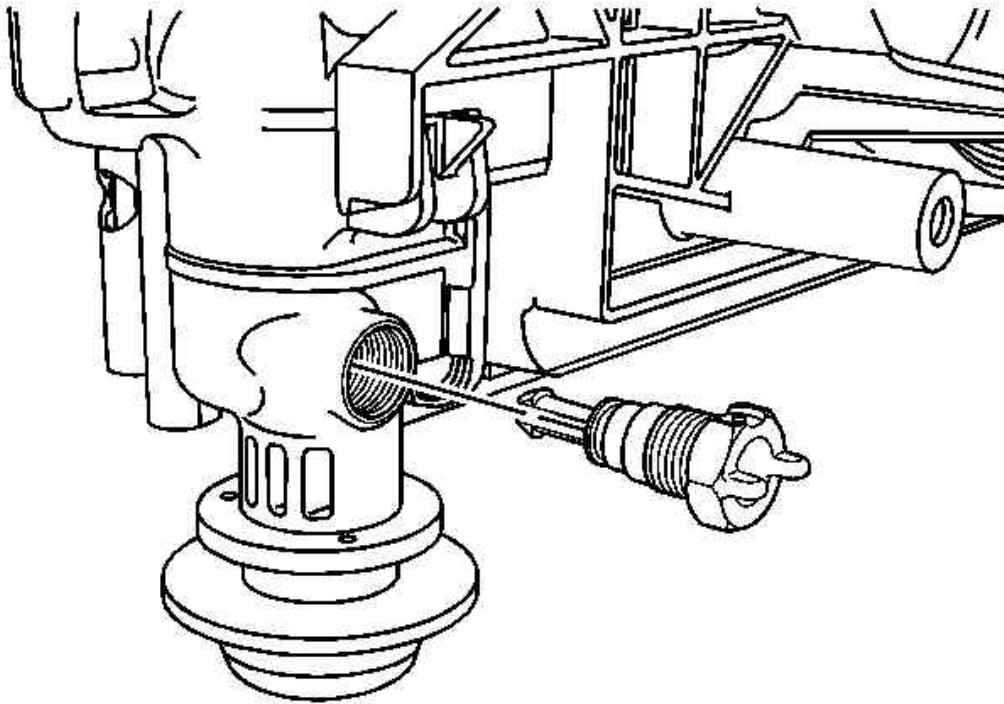


Fig. 139: Identifying Drain & Drain Plug
Courtesy of GENERAL MOTORS CORP.

1. Install the seal on the drain plug stem.
2. Install the drain plug by screwing in a clockwise direction. Make sure that the body is fully seated in the side tank.
3. Fill the cooling system. Refer to **Cooling System Draining and Filling (L26, LY7 GE 47716 Fill)** or **Cooling System Draining and Filling (L26 Static Fill)** or **Cooling System Draining and Filling (LY7 Static Fill)** or **Cooling System Draining and Filling (LS4 GE47716 Fill)** or **Cooling System Draining and Filling (LS4 Static Fill)**.

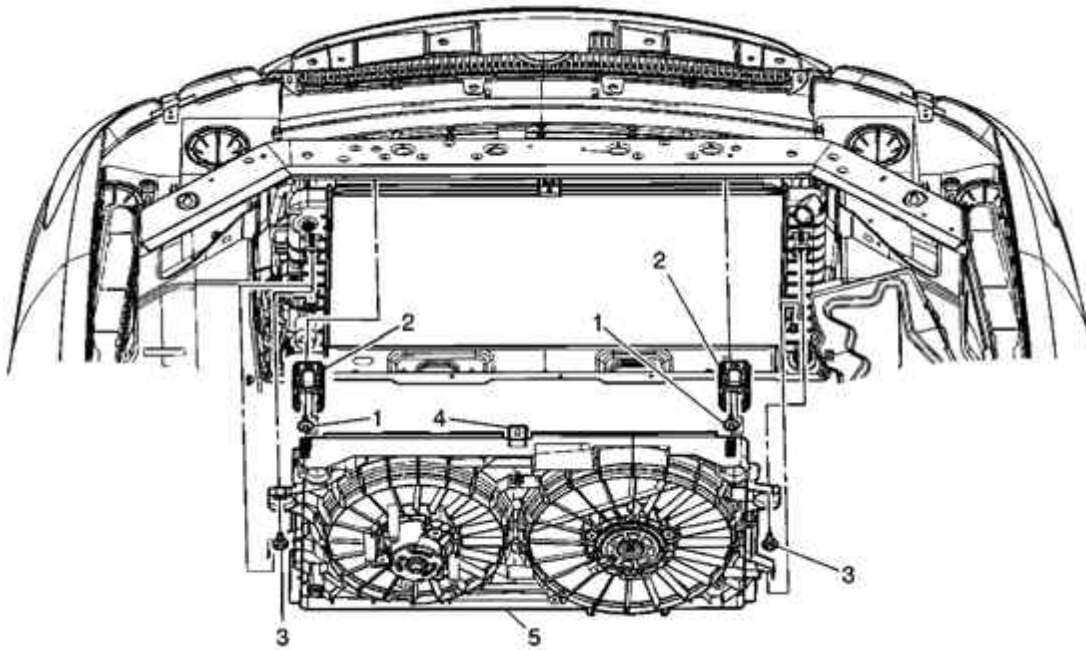


Fig. 140: Identifying Fan Shroud & Components
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
CAUTION: Keep hands, tools, and clothing away from the electric engine coolant fans in order to help prevent personal injury. These fans are electric and can turn on whether or not the engine is running. The fans can start automatically with the ignition in the ON position.	
CAUTION: An electric fan under the hood can start up even when the engine is not running and can injure you. Keep hands, clothing and tools away from any underhood electric fan.	
CAUTION: To help avoid personal injury or damage to the vehicle, a bent, cracked, or damaged fan blade or housing should always be replaced.	
CAUTION: Unless directed otherwise, the ignition and start switch must be in the OFF or LOCK position, and all electrical loads must be OFF before servicing any electrical component. Disconnect the negative battery cable to prevent an electrical spark should a tool or equipment come in contact with an exposed electrical terminal. Failure to follow these precautions may result in personal injury and/or damage to the vehicle or its components.	

Preliminary Procedures

1. Disconnect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection (L26)** or **Battery Negative Cable Disconnection and Connection (LY7)** or **Battery Negative Cable Disconnection and Connection (LS4)** .
2. Remove the air cleaner assembly. Refer to **Air Cleaner Assembly Replacement** .
3. Remove the engine mount struts. Refer to **Engine Mount Strut Replacement - Left Side** and **Engine Mount Strut Replacement - Right Side** .
4. Disconnect the upper transaxle oil cooler pipe from the radiator. Refer to **Transmission Fluid Cooler Hose/Pipe Quick-Connect Fitting Disconnection and Connection** .

1	Radiator Bracket Upper Support Bolt NOTE: Refer to <u>Fastener Notice</u> . Tighten: 10 N.m (89 lb in)
2	Radiator Upper Support Bracket
3	Fan Shroud Bolt Tighten: 6 N.m (53 lb in)
4	Fan Shroud Bolt Tighten: 6 N.m (53 lb in)
5	Fan Shroud Tip: When replacing the fan shroud, remove the cooling fan motors. Refer to <u>Engine Coolant Fan Motor Replacement (L26)</u> or <u>Engine Coolant Fan Motor Replacement (LY7)</u> or <u>Engine Coolant Fan Motor Replacement (LS4)</u> .

FAN SHROUD REPLACEMENT (L26)

Removal Procedure

CAUTION: An electric fan under the hood can start up even when the engine is not running and can injure you. Keep hands, clothing and tools away from any underhood electric fan.

CAUTION: To help avoid personal injury or damage to the vehicle, a bent, cracked, or damaged fan blade or housing should always be replaced.

CAUTION: Unless directed otherwise, the ignition and start switch must be in the OFF or LOCK position, and all electrical loads must be OFF before servicing any electrical component. Disconnect the negative battery cable to prevent an electrical spark should a tool or equipment come in contact with an exposed electrical terminal. Failure to follow these precautions may result in personal injury and/or damage to the vehicle or its components.

1. Disconnect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection (L26)** or **Battery Negative Cable Disconnection and Connection (LY7)** or **Battery Negative Cable Disconnection and Connection (LS4)** .
2. Remove the right and the left engine mount struts. Refer to **Engine Mount Strut Replacement - Left Side** and **Engine Mount Strut Replacement - Right Side** .
3. Remove the air cleaner assembly. Refer to **Air Cleaner Assembly Replacement** .
4. Remove the powertrain control module (PCM) harness clip from the fan shroud.
5. Remove the transmission oil cooler lines from the lower fan shroud clip and reposition the oil cooler lines aside.
6. Remove the fan shroud clip from the condenser tubes.

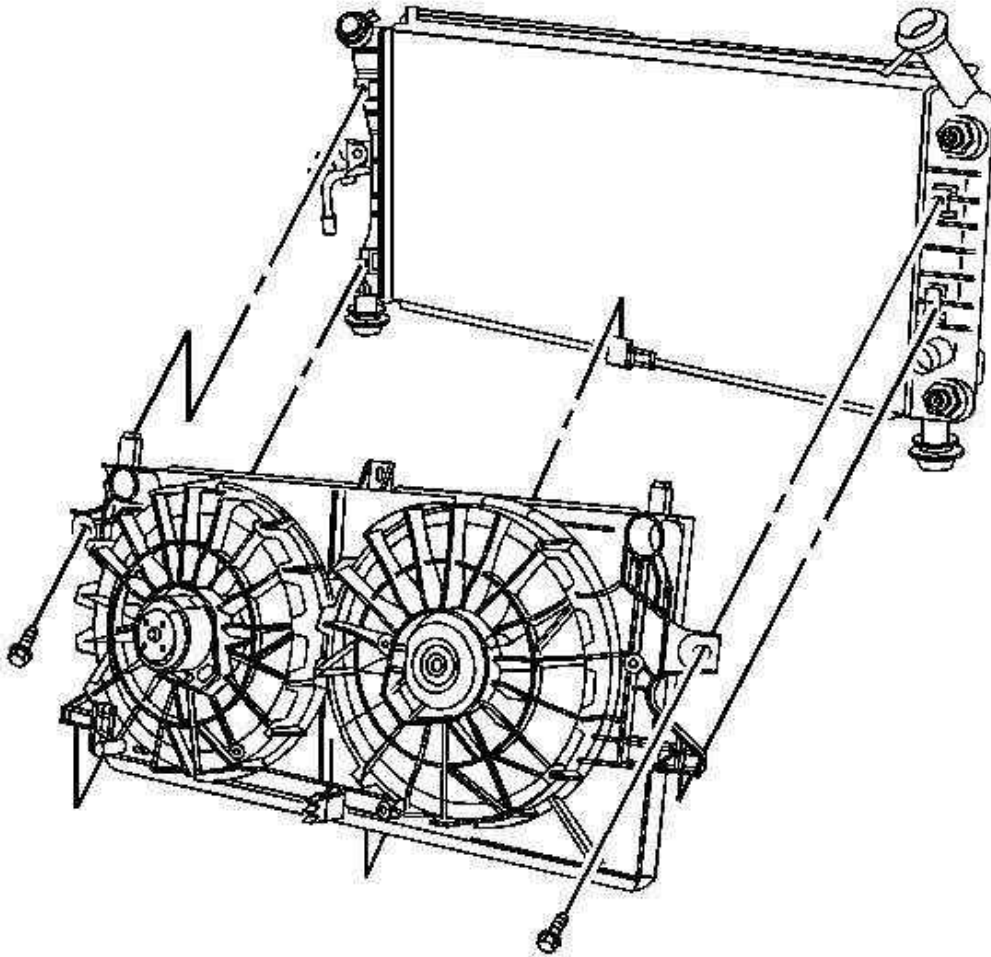


Fig. 141: Identifying Cooling Fan Shroud
Courtesy of GENERAL MOTORS CORP.

7. Remove the cooling fan shroud bolts.

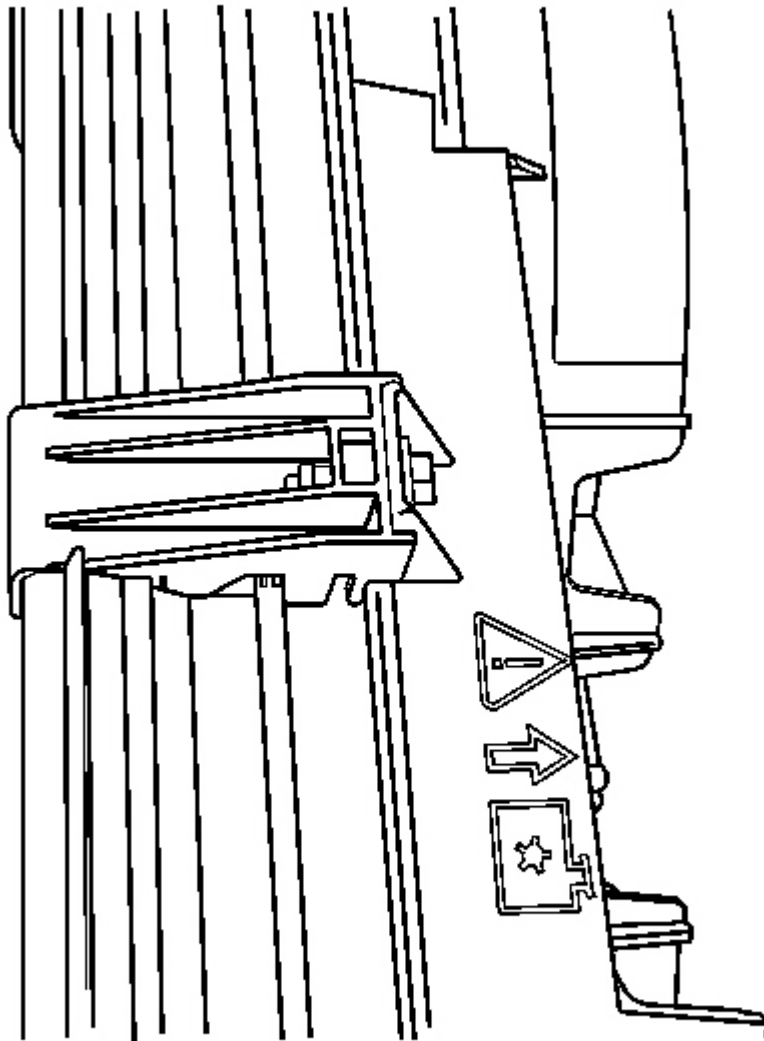


Fig. 142: Identifying Fan Shroud To Condenser Hold Down Bracket Bolt
Courtesy of GENERAL MOTORS CORP.

8. Remove the bolt that connects the fan shroud to the condenser hold down bracket.

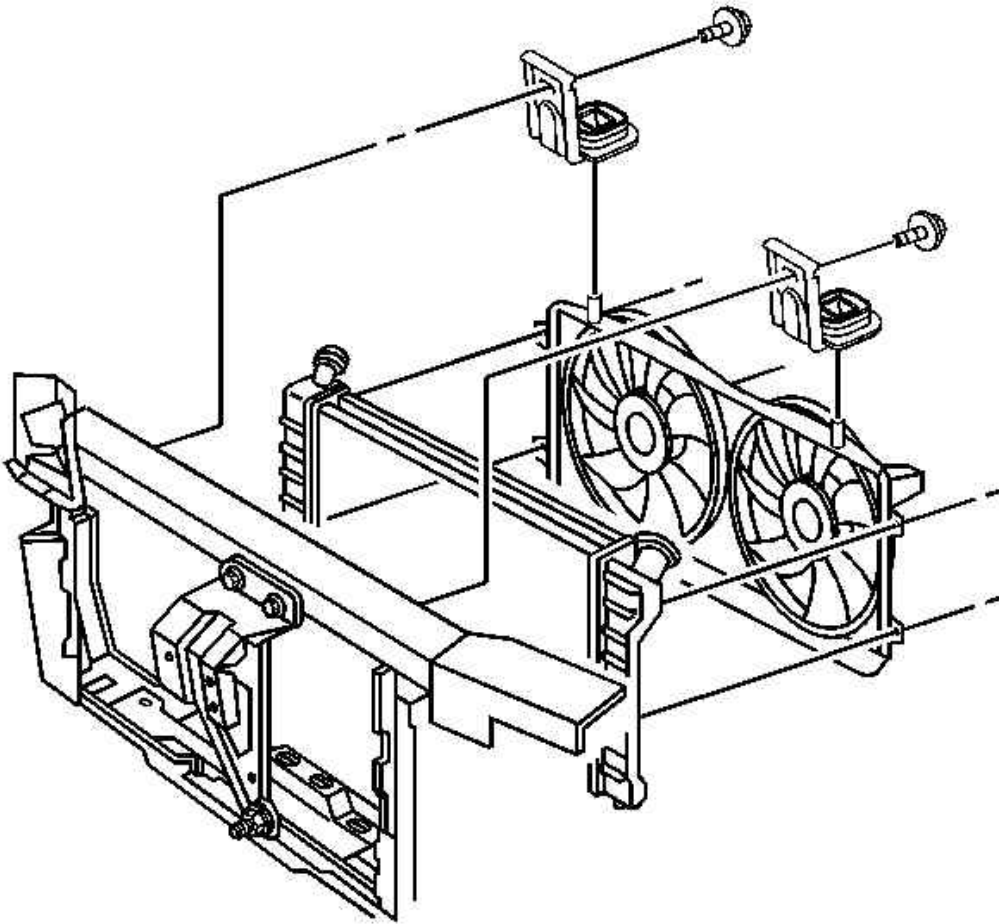


Fig. 143: View Of Fan Shroud To Radiator Upper Support Brackets
Courtesy of GENERAL MOTORS CORP.

9. Remove the radiator upper bracket bolts and brackets.
10. Disconnect the engine cooling fan motors electrical connectors.
11. Remove the cooling fans electrical harness from the fan shroud clips.
12. Remove the cooling fan shroud.

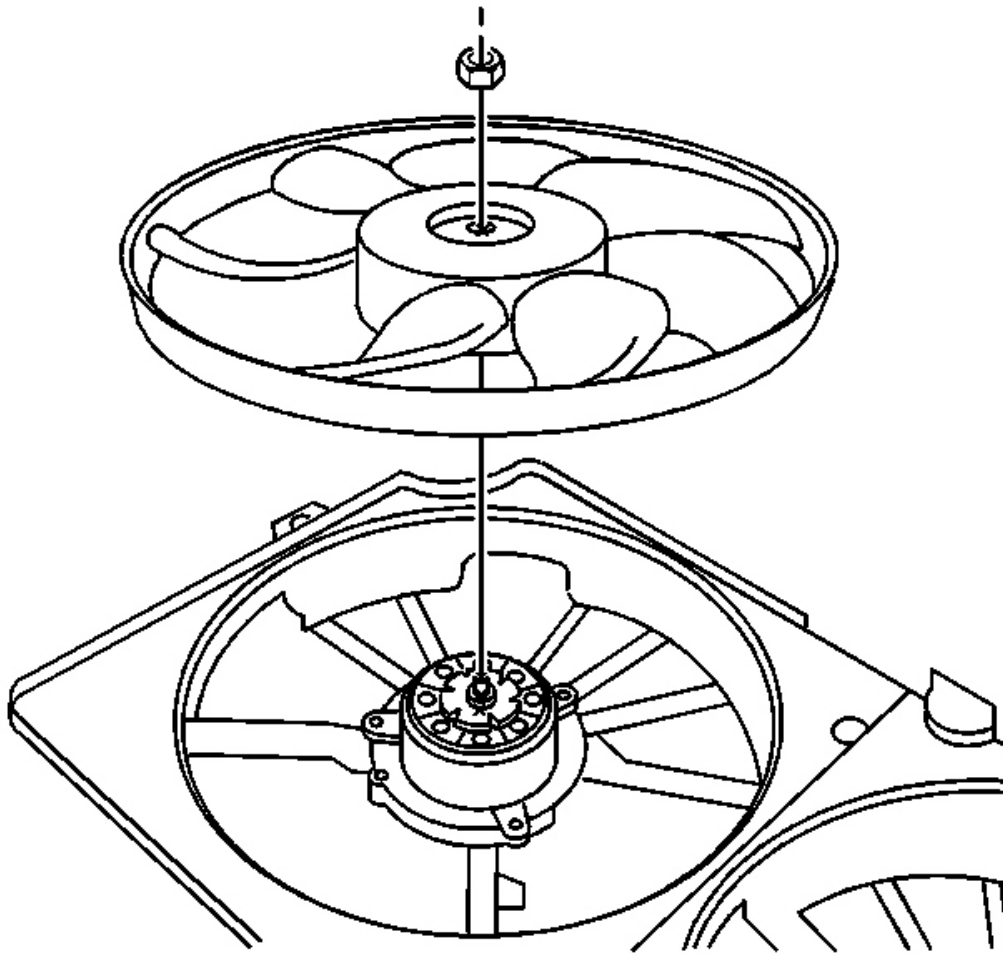


Fig. 144: Identifying Engine Cooling Fan Blade & Nut
Courtesy of GENERAL MOTORS CORP.

13. Remove the right and left engine cooling fan blade nut.
14. Remove the right and left engine cooling fan blade.

CAUTION: If a fan blade is bent or damaged in any way, do not repair or reuse the damaged part. Always replace a bent or damaged fan blade. Fan blades that have been damaged can not be assured of

proper balance and could fail and fly apart during subsequent use. This creates an extremely dangerous situation.

The fan blades must remain in proper balance. You cannot assure fan blade balance once a fan blade has been bent or damaged. A fan blade that is not in proper balance could fail and fly apart during use, creating an extremely dangerous situation.

15. Inspect the cooling fan blades for the following conditions:

- Bent or cracked cooling fan blades
- Smoothness of the cooling fan blade mating surfaces
- Remove burrs or other imperfections as necessary

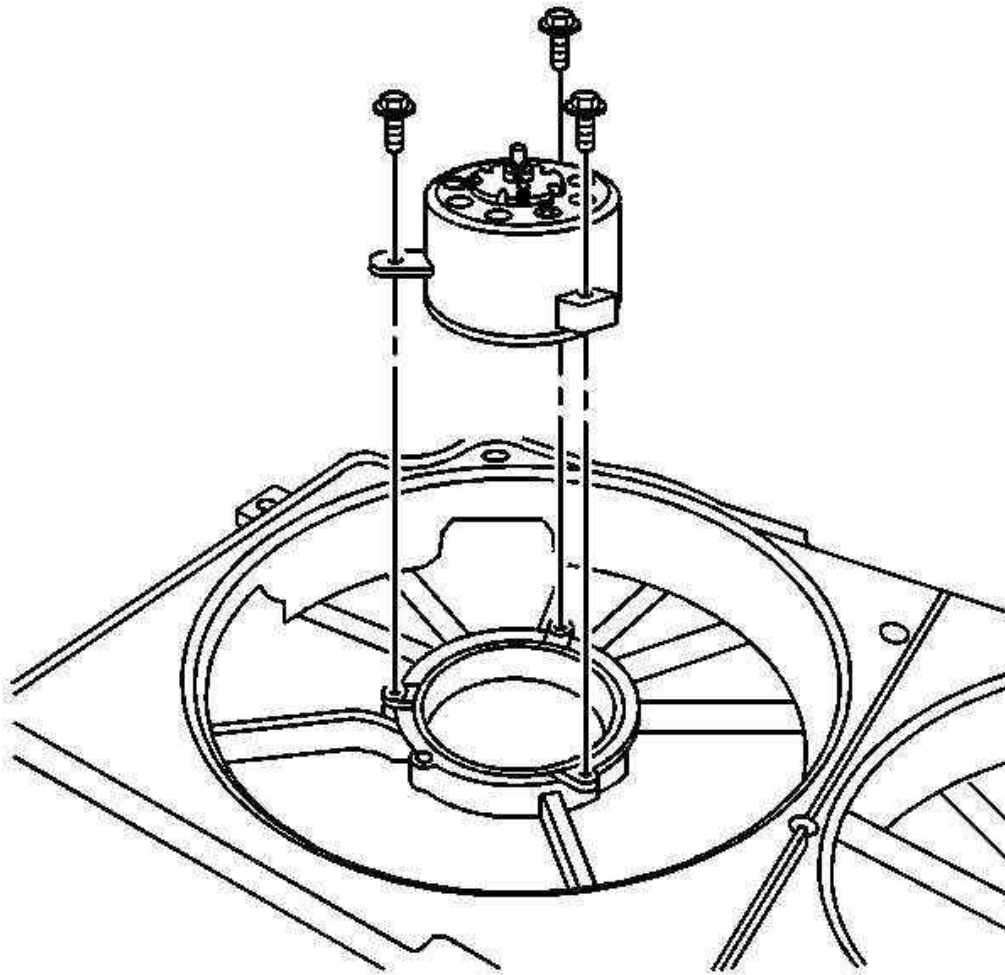


Fig. 145: View Of Engine Cooling Fan Motor & Bolts
Courtesy of GENERAL MOTORS CORP.

16. Remove the right and left engine cooling fan motor bolts.
17. Remove the right and left engine cooling fan motor from the fan shroud.
18. Remove the transmission oil cooler line retaining clip from the bottom of the fan shroud.
19. Remove the cooling fan motors electrical harness retaining clips from the fan shroud.

20. Remove the cooling fan motor heat shield retainers.
21. Remove the cooling fan motor heat shield.

Installation Procedure

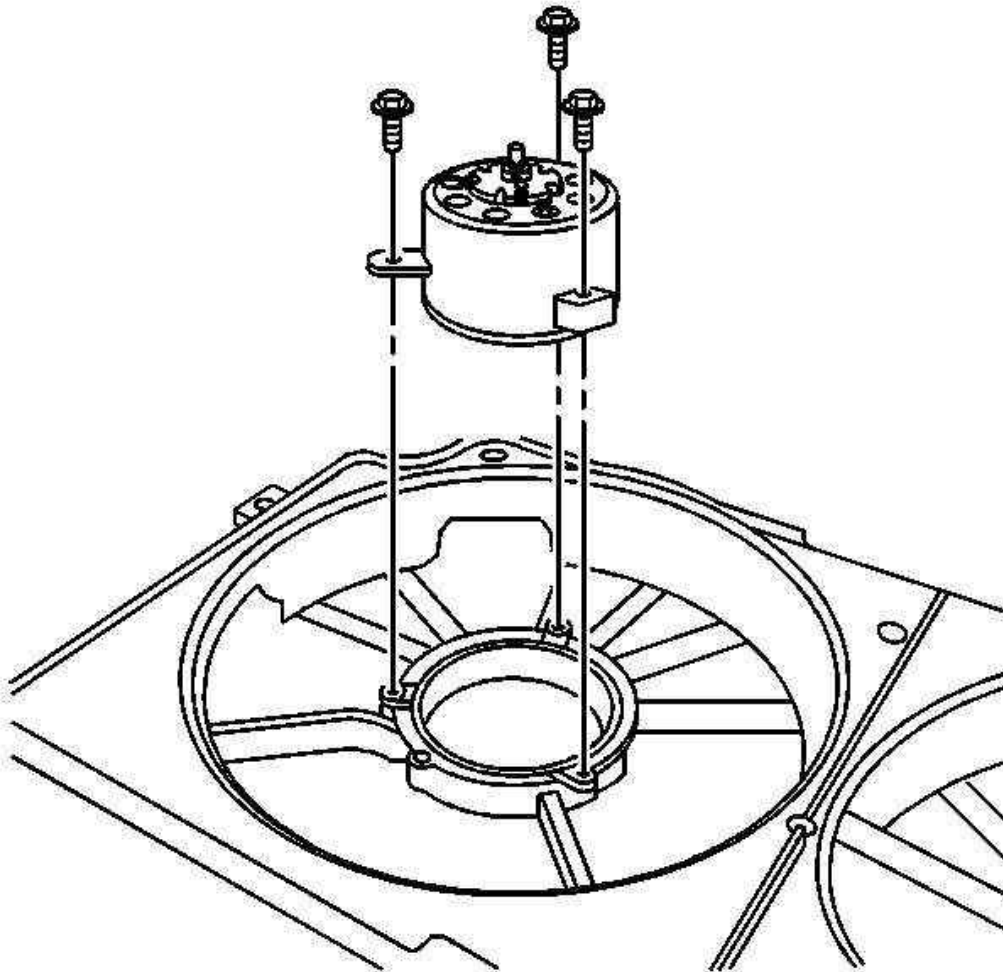


Fig. 146: View Of Engine Cooling Fan Motor & Bolts
Courtesy of GENERAL MOTORS CORP.

1. Install the right and left engine cooling fan motor to the fan shroud.

NOTE: Refer to Fastener Notice .

2. Install the right and left cooling fan motor bolts.

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

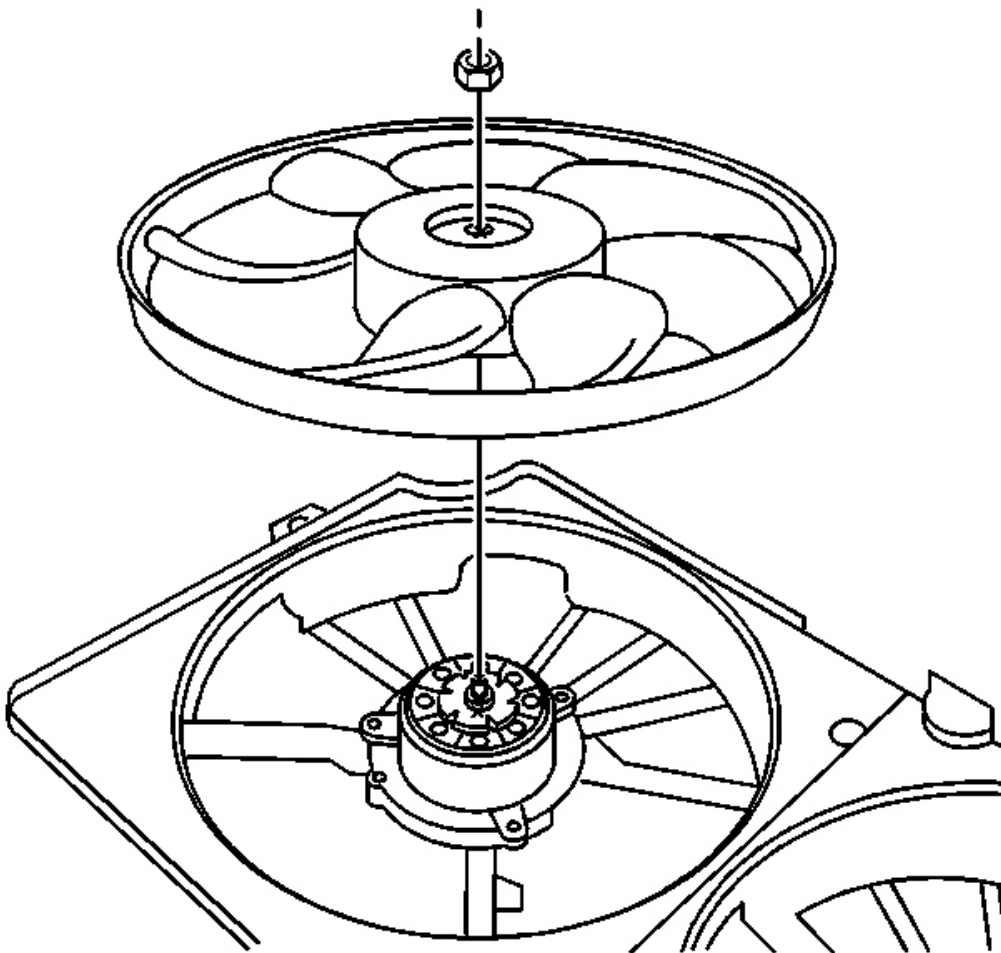


Fig. 147: View Of Engine Cooling Fan Blade & Nut
Courtesy of GENERAL MOTORS CORP.

3. Install the right and left engine cooling fan blade.
4. Install the right and left engine cooling fan blade nut.

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

5. Install the transmission oil cooler line retaining clip to the bottom of the fan shroud.
6. Install the engine cooling fan motor heat shield.
7. Install the engine cooling fan motor heat shield push in retainers.
8. Install the cooling fan motors electrical harness retaining clips to the fan shroud.

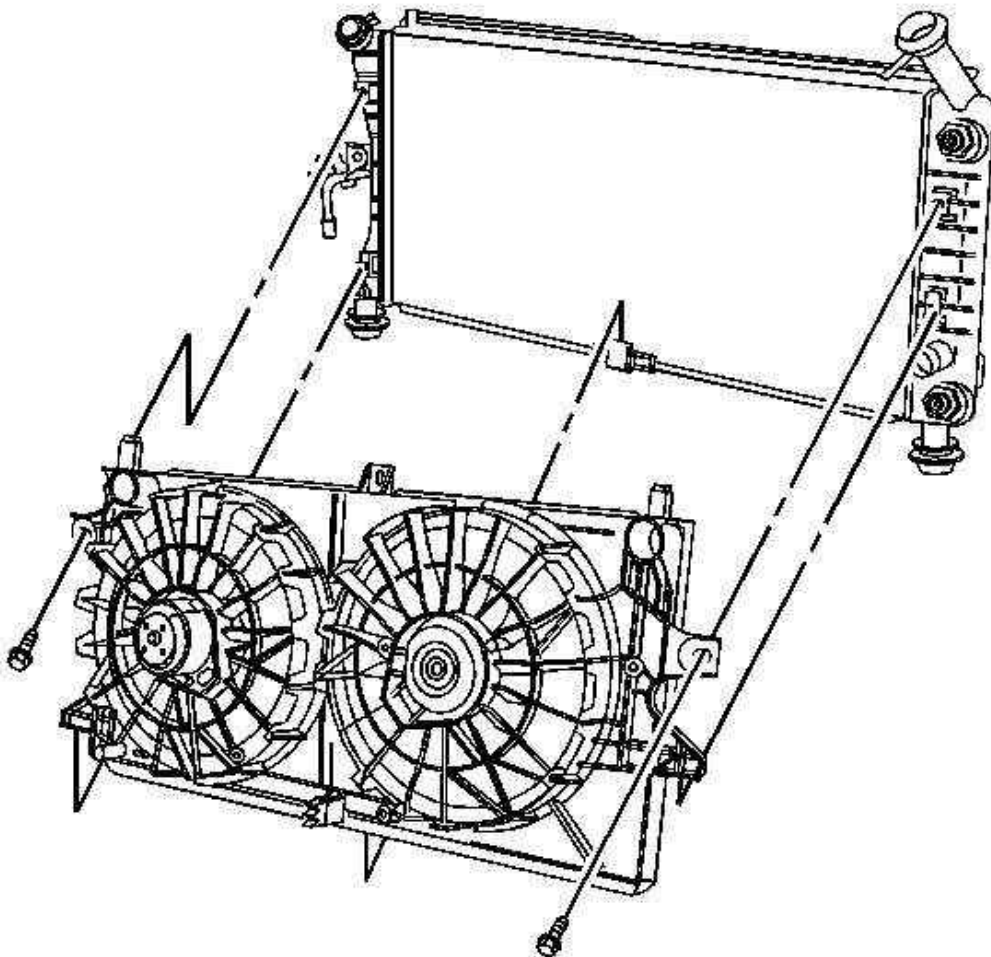


Fig. 148: Identifying Cooling Fan Shroud
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Ensure the lower edge of the fan shroud engages the clip at the bottom of the radiator.

9. Install the cooling fan shroud.
10. Install the cooling fan shroud bolts.

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

11. Install the cooling fan motors electrical harness to the fan shroud clips.
12. Connect the engine cooling fan motors electrical connectors.
13. Install the fan shroud clip to the condenser tubes.

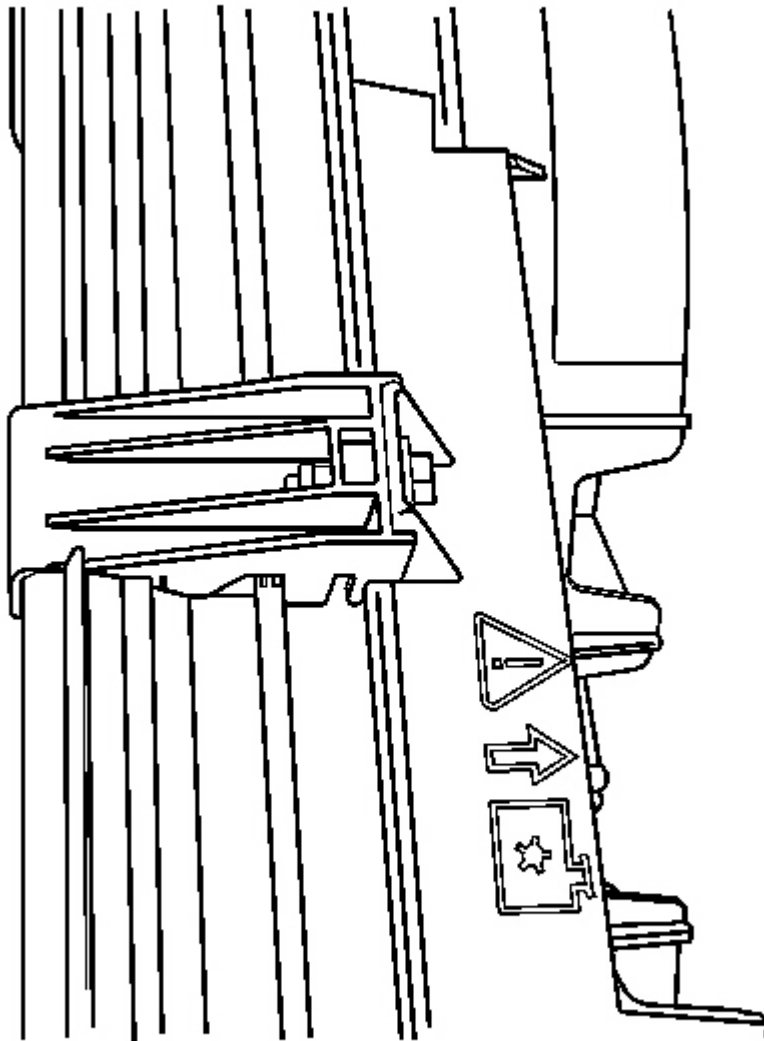


Fig. 149: Identifying Fan Shroud To Condenser Hold Down Bracket Bolt
Courtesy of GENERAL MOTORS CORP.

14. Install the bolt that connects the fan shroud to the condenser hold down bracket.

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

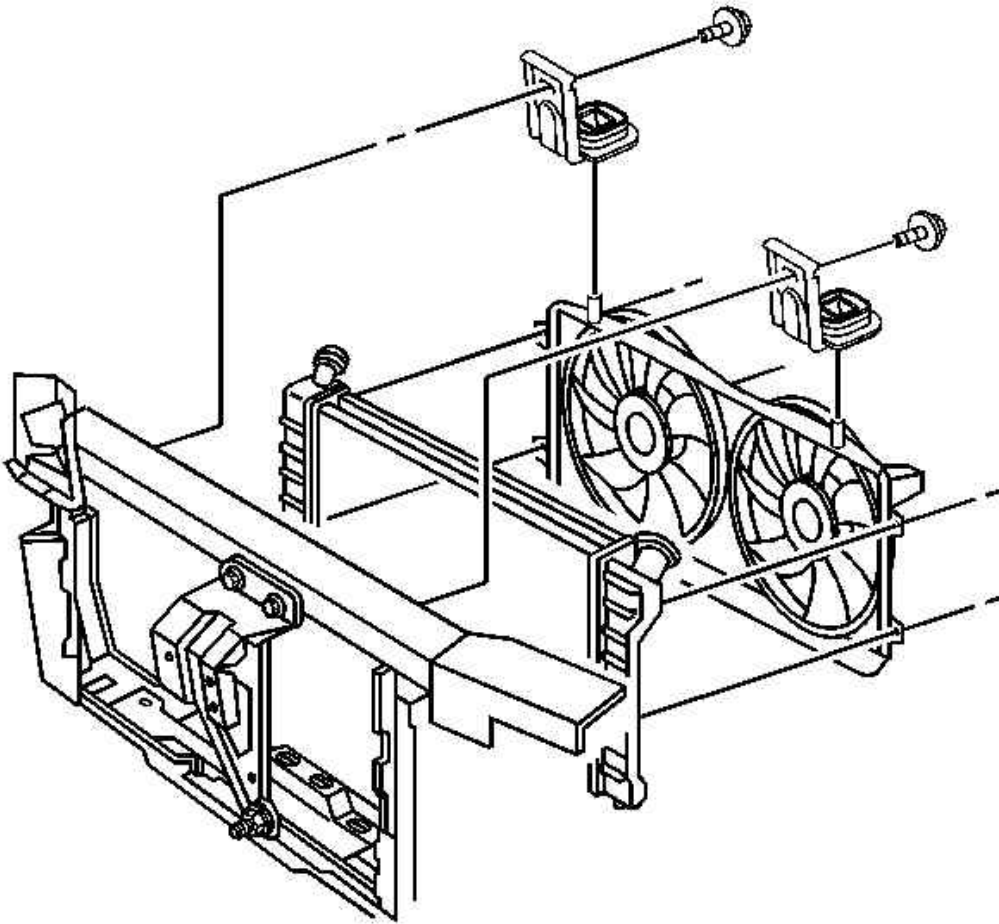


Fig. 150: View Of Fan Shroud To Radiator Upper Support Brackets
Courtesy of GENERAL MOTORS CORP.

15. Install the radiator upper support brackets and bolts that connect to the fan shroud.

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

16. Install the PCM harness clip to the fan shroud.
17. Install the transmission oil cooler lines to the retainer clip at the bottom of the cooling fan shroud.

18. Install the air cleaner assembly. Refer to **Air Cleaner Assembly Replacement** .
19. Install the right and left engine mount struts. Refer to **Engine Mount Strut Replacement - Left Side** and **Engine Mount Strut Replacement - Right Side** .
20. Connect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection (L26)** or **Battery Negative Cable Disconnection and Connection (LY7)** or **Battery Negative Cable Disconnection and Connection (LS4)** .
21. Inspect cooling fan's for proper operation.

FAN SHROUD REPLACEMENT (LS4)

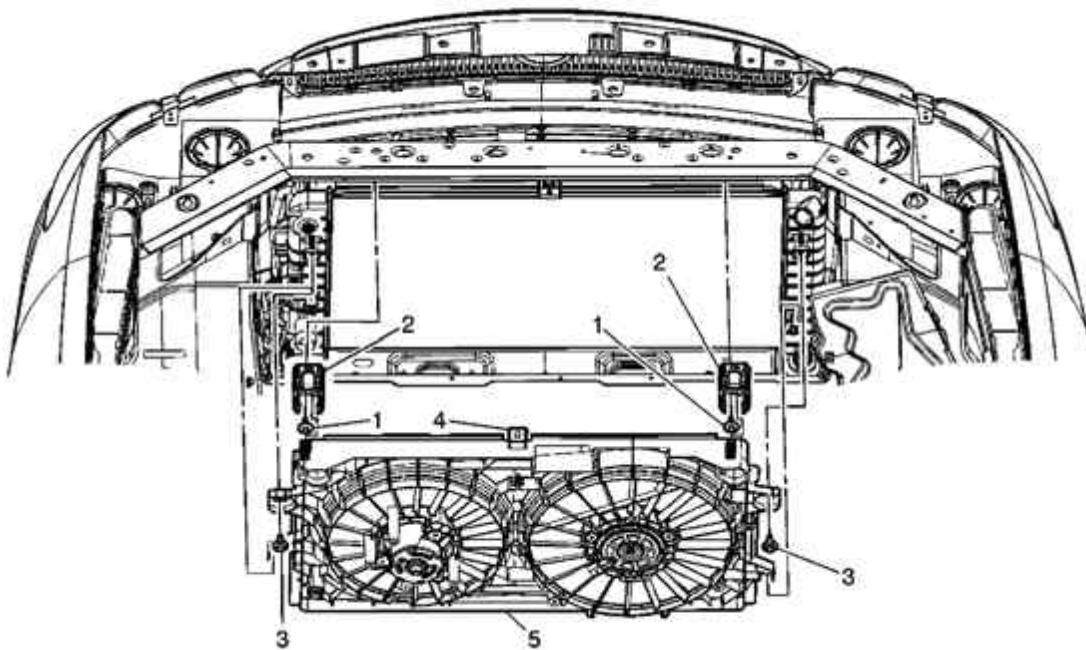


Fig. 151: Identifying Fan Shroud & Components
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
CAUTION: Keep hands, tools, and clothing away from the electric engine coolant fans in order to help prevent personal injury. These fans are electric and can turn on whether or not the engine is running. The fans can start automatically with the ignition in the ON position.	

CAUTION:

An electric fan under the hood can start up even when the engine is not running and can injure you. Keep hands, clothing and tools away from any underhood electric fan.

CAUTION:

To help avoid personal injury or damage to the vehicle, a bent, cracked, or damaged fan blade or housing should always be replaced.

CAUTION:

Refer to Battery Disconnect Caution .

Preliminary Procedure

1. Disconnect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection (L26)** or **Battery Negative Cable Disconnection and Connection (LY7)** or **Battery Negative Cable Disconnection and Connection (LS4)** .
2. Remove the air cleaner assembly. Refer to **Air Cleaner Assembly Replacement** .
3. Remove the engine mount struts. Refer to **Engine Mount Strut Replacement** .
4. Remove the coolant reservoir hose from the fan shroud LS4 only.
5. Disconnect the upper transaxle oil cooler pipe from the radiator. Refer to **Transmission Fluid Cooler Hose/Pipe Quick-Connect Fitting Disconnection and Connection** .

1	Radiator Bracket Upper Support Bolt NOTE: Refer to <u>Fastener Notice</u> . Tighten: 10 N.m (89 lb in)
2	Radiator Upper Support Bracket
3	Fan Shroud Bolt Tighten: 6 N.m (53 lb in)
4	Fan Shroud Bolt

	Tighten: 6 N.m (53 lb in)
5	Fan Shroud Tip: When replacing the fan shroud, remove the cooling fan motors. Refer to Engine Coolant Fan Motor Replacement (L26) or Engine Coolant Fan Motor Replacement (LY7) or Engine Coolant Fan Motor Replacement (LS4) .

RADIATOR REPLACEMENT (L26, LY7)

Tools Required

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

Removal Procedure

CAUTION: Unless directed otherwise, the ignition and start switch must be in the OFF or LOCK position, and all electrical loads must be OFF before servicing any electrical component. Disconnect the negative battery cable to prevent an electrical spark should a tool or equipment come in contact with an exposed electrical terminal. Failure to follow these precautions may result in personal injury and/or damage to the vehicle or its components.

1. Disconnect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection (L26)** or **Battery Negative Cable Disconnection and Connection (LY7)** or **Battery Negative Cable Disconnection and Connection (LS4)** .
2. Remove the air cleaner assembly. Refer to **Air Cleaner Assembly Replacement** for the 3.8L engine or to **Air Cleaner Assembly Replacement** for the 3.6L (LY7) engine.
3. Drain the cooling system. Refer to **Cooling System Draining and Filling (L26, LY7 GE 47716 Fill)** or **Cooling System Draining and Filling (L26 Static Fill)** or **Cooling System Draining and Filling (LY7 Static Fill)** or **Cooling System Draining and Filling (LS4 GE47716 Fill)** or **Cooling**

System Draining and Filling (LS4 Static Fill).

4. Remove the right and the left engine mount struts. Refer to **Engine Mount Strut Replacement - Left Side** and **Engine Mount Strut Replacement - Right Side** for the 3.8L engine or to **Engine Mount Strut Replacement - Left Side** for the 3.6L (LY7) engine and **Engine Mount Strut Replacement - Right Side** for the 3.6L (LY7) engine.

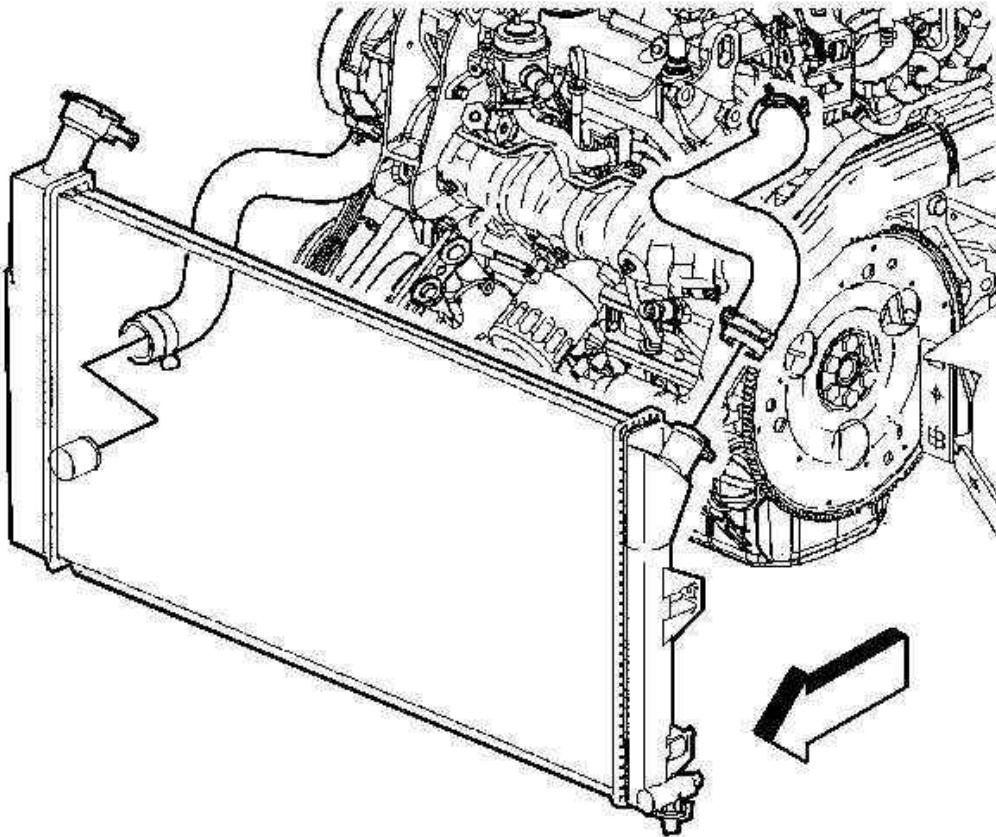


Fig. 152: View Of Radiator Hoses To/From Radiator
Courtesy of GENERAL MOTORS CORP.

5. Use **J 38185** to remove the inlet hose clamp from the radiator. See **Special Tools**.

6. Remove the inlet hose from the radiator.
7. Remove the powertrain control module (PCM) harness clip from the fan shroud.
8. Remove the transmission oil cooler lines from the retainer clip at the bottom of the cooling fan shroud.
9. Remove the fan shroud clip from the condenser tubes.

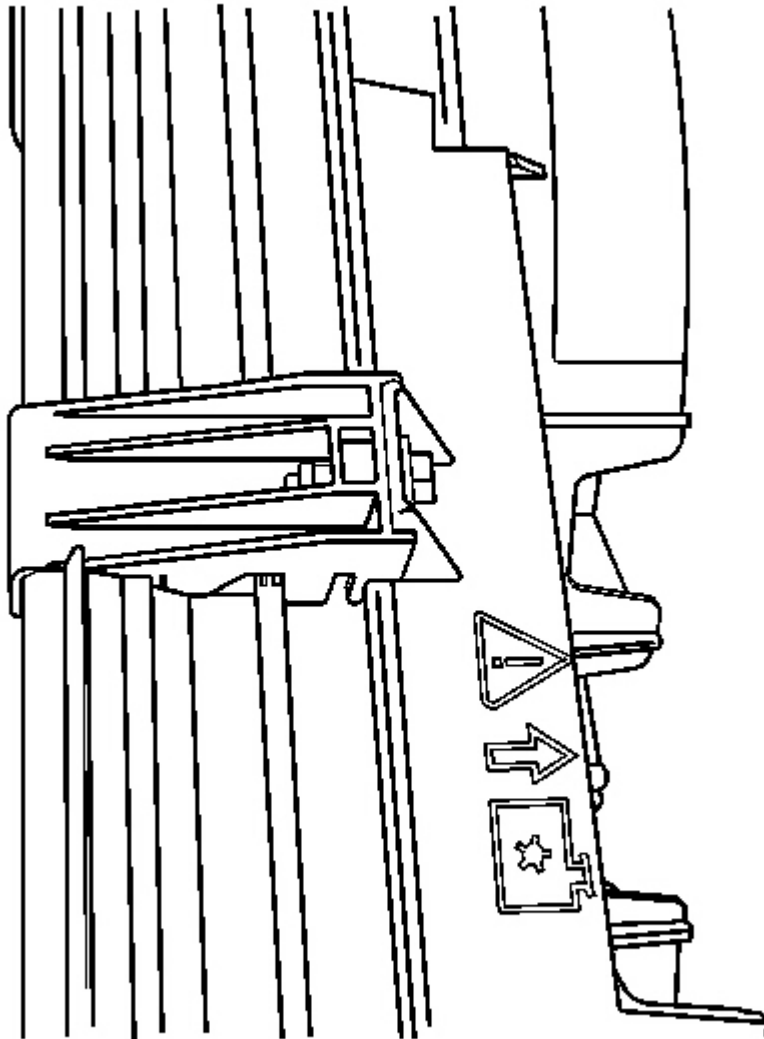


Fig. 153: Identifying Fan Shroud To Condenser Hold Down Bracket Bolt
Courtesy of GENERAL MOTORS CORP.

10. Remove the bolt that connects the fan shroud to the condenser hold down bracket.
11. Remove the air deflectors from the top of the radiator.

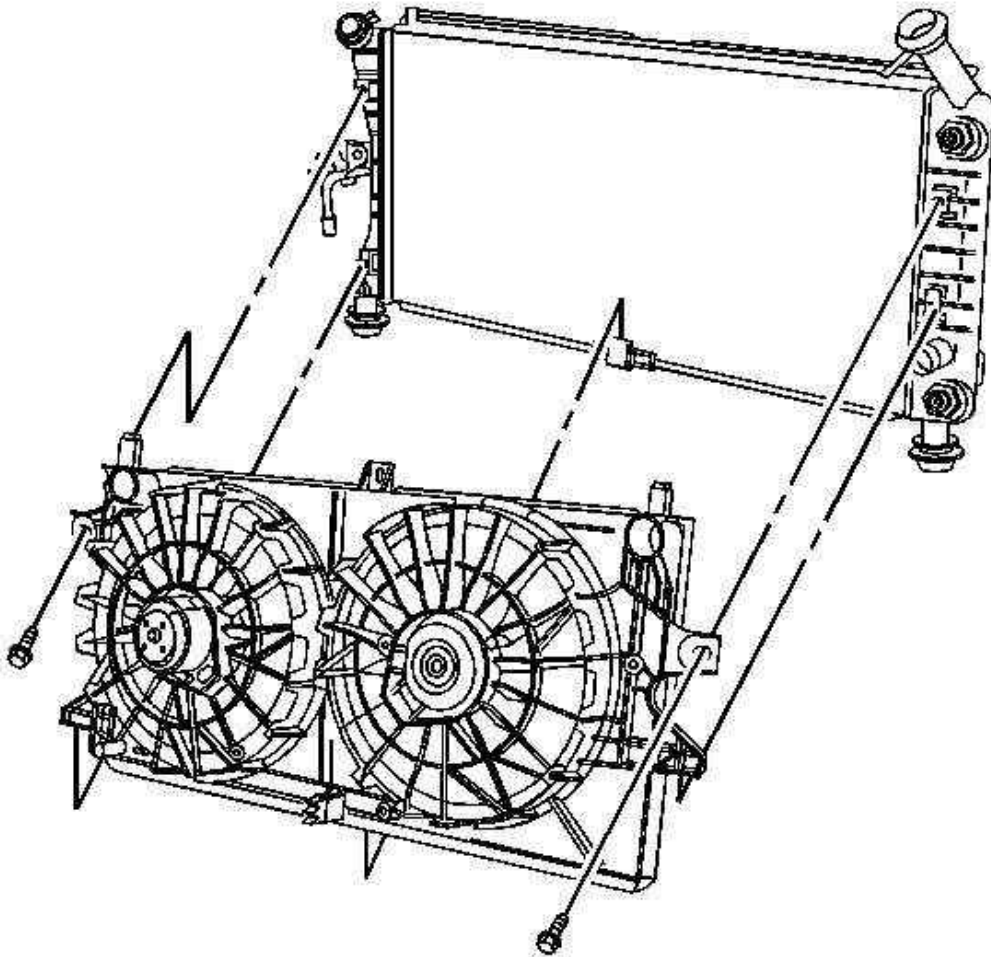


Fig. 154: Identifying Cooling Fan Shroud
Courtesy of GENERAL MOTORS CORP.

12. Remove the cooling fan shroud bolts.
13. Remove the coolant reservoir hose from the radiator overflow neck.

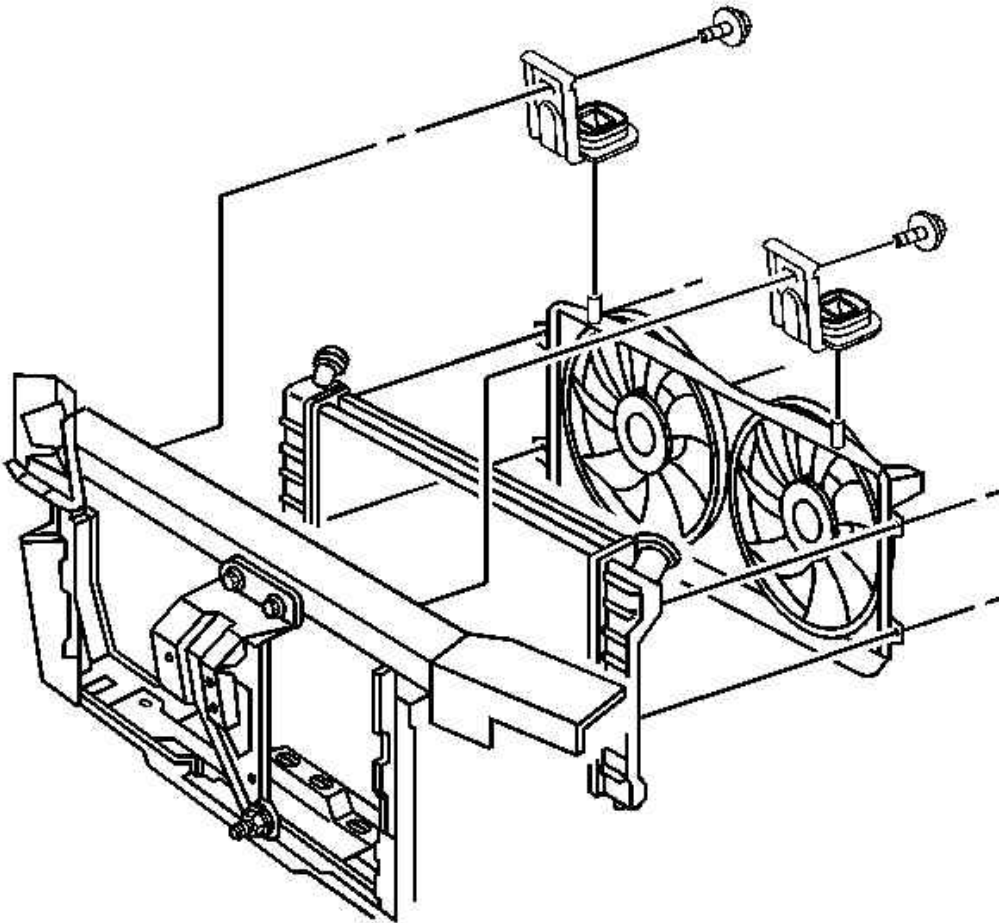


Fig. 155: View Of Fan Shroud To Radiator Upper Support Brackets
Courtesy of GENERAL MOTORS CORP.

14. Remove the radiator upper support brackets and bolts that connect to the fan shroud.
15. Disconnect the engine cooling fan motors electrical connectors.
16. Remove the cooling fan motors electrical harness from the fan shroud clips.

17. Remove the cooling fan shroud.
18. Use **J 38185** to remove the outlet hose clamp from the radiator. See **Special Tools**.
19. Remove the outlet hose from the radiator.
20. Disconnect the transaxle oil cooler pipes from the radiator. Refer to **Transmission Fluid Cooler Hose/Pipe Quick-Connect Fitting Disconnection and Connection**.
21. Tilt the top of the radiator rearward.

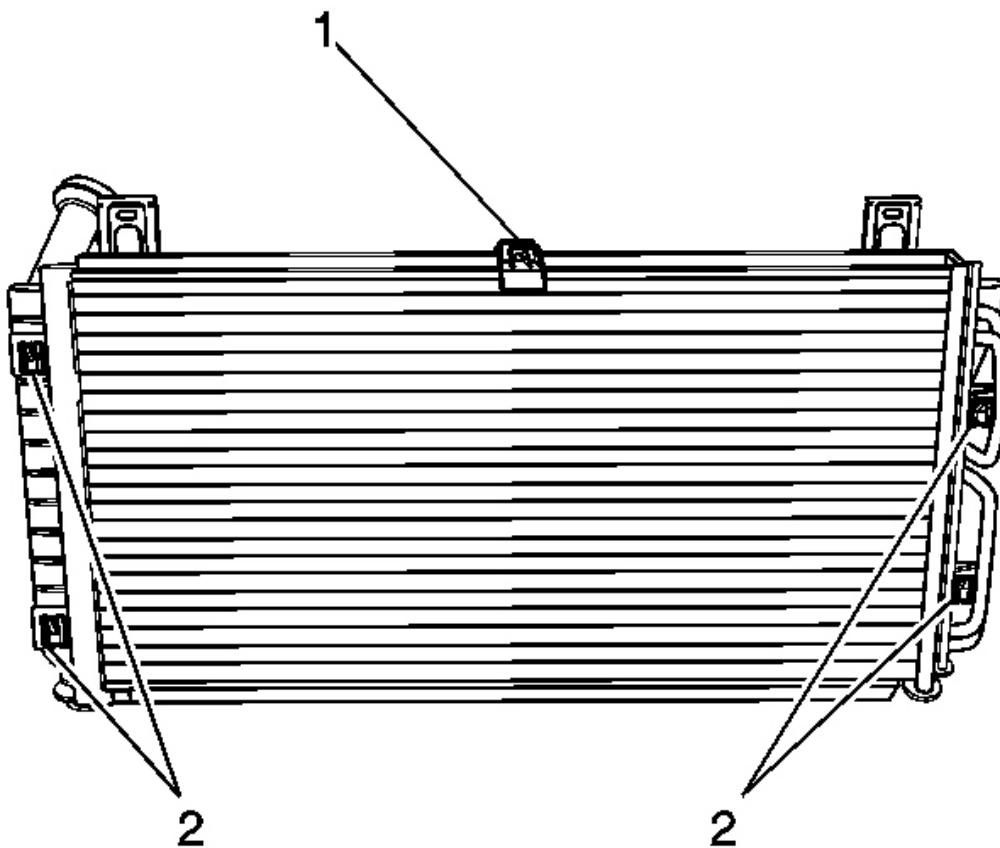


Fig. 156: Identifying Condenser Hold Down Bracket & Mount Tabs
Courtesy of GENERAL MOTORS CORP.

22. Remove the condenser hold down bracket (1) from the radiator.
23. Lift the condenser from the mounting tabs on the radiator (2). Position the condenser aside.
24. Remove the radiator.

Installation Procedure

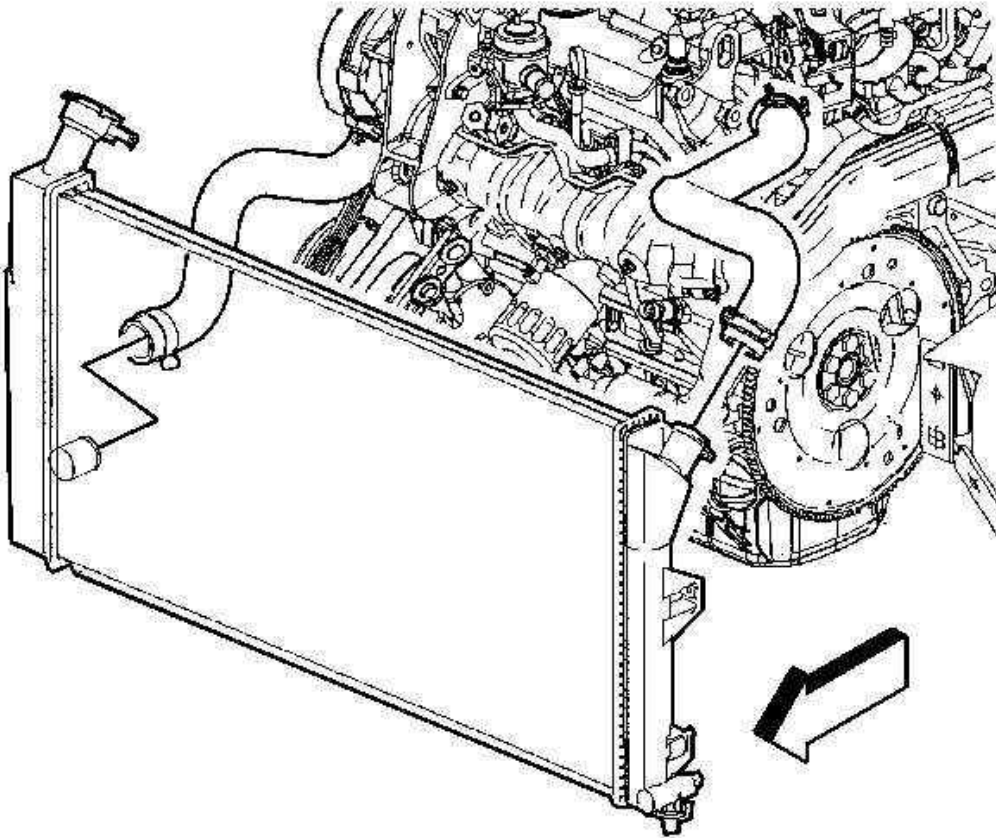


Fig. 157: View Of Radiator Hoses To/From Radiator
Courtesy of GENERAL MOTORS CORP.

1. Install the radiator to the lower mounts.

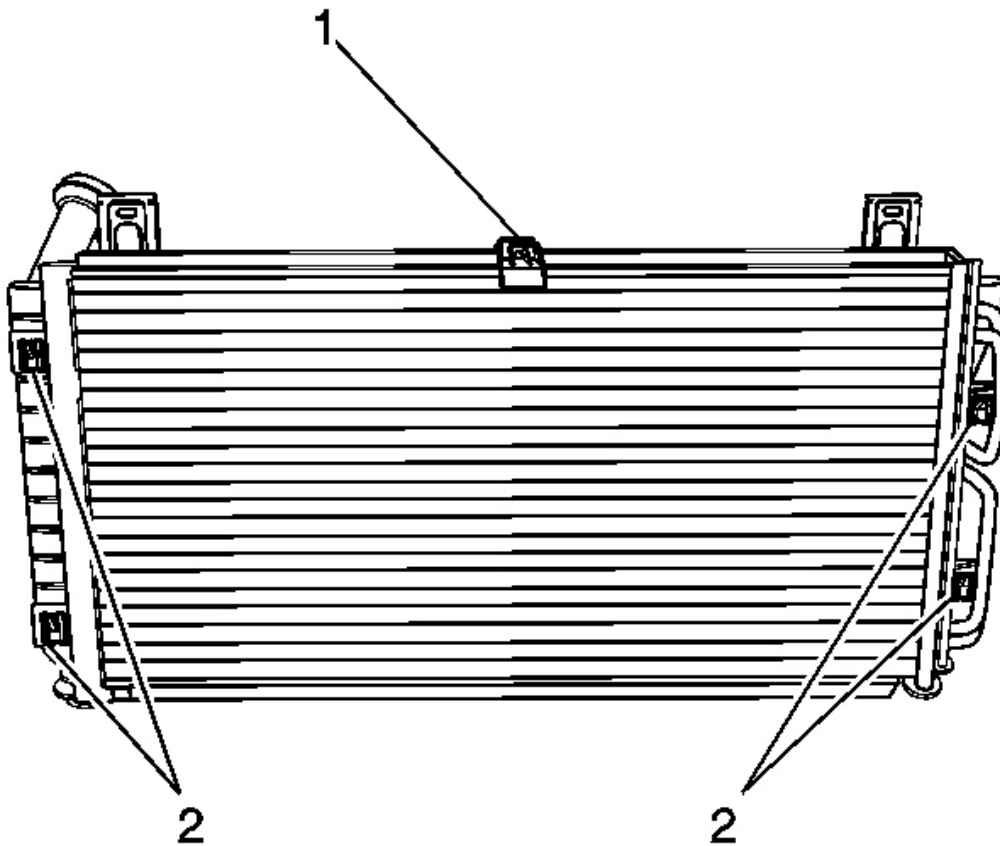


Fig. 158: Identifying Condenser Hold Down Bracket & Mount Tabs
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Verify that the condenser is fully seated in the radiator mounting tabs.

2. Install the condenser to the mounting tabs on the radiator (2).
3. Install the condenser hold down bracket (1) to the radiator and condenser.
4. Install the outlet hose to the radiator.
5. Use **J 38185** to install the outlet hose clamp to the radiator. See **Special Tools**.
6. Connect the transaxle oil cooler pipes to the radiator. Refer to **Transmission Fluid Cooler Hose/Pipe Quick-Connect Fitting Disconnection and**

Connection .

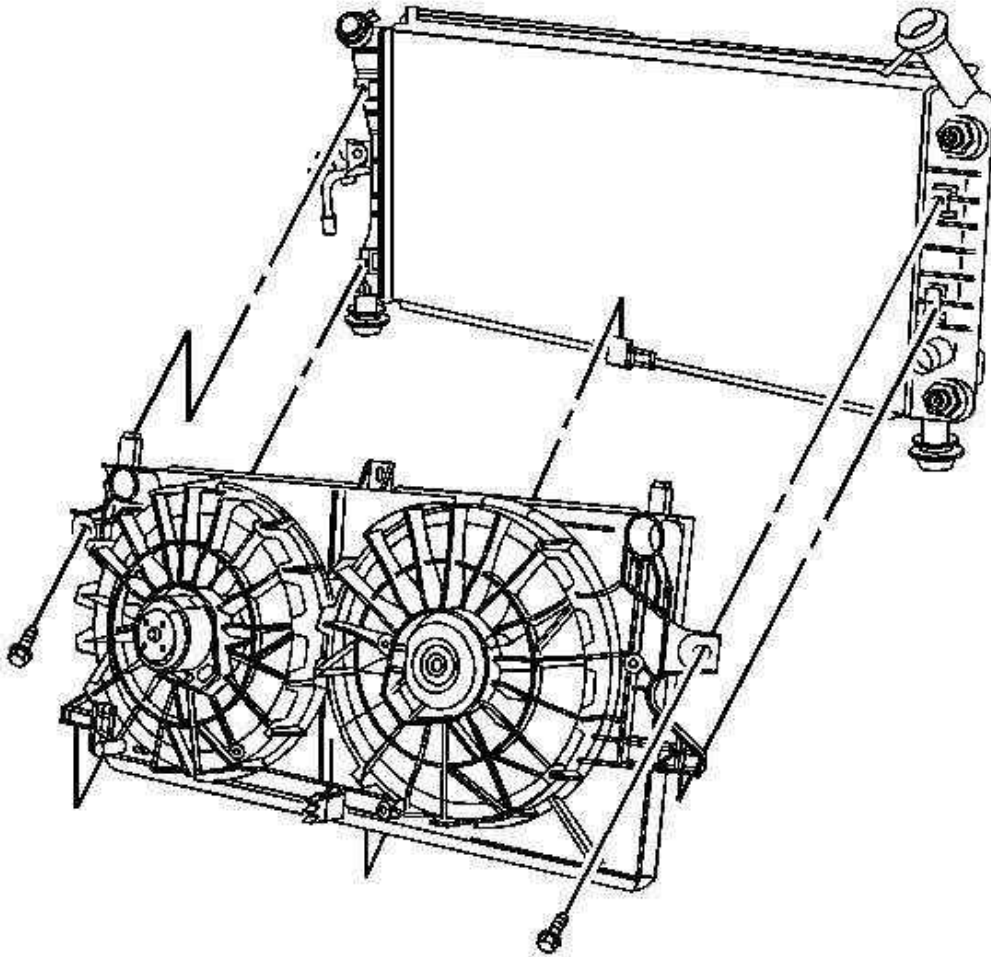


Fig. 159: Identifying Cooling Fan Shroud
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Ensure the lower edge of the fan shroud engages the clip at the bottom of the radiator.

7. Install the cooling fan shroud.
8. Install the cooling fan motors electrical harness to the fan shroud clips.

9. Connect the engine cooling fan motors electrical connectors.
10. Install the fan shroud clip to the condenser tubes.

NOTE: Refer to Fastener Notice .

11. Install the cooling fan shroud bolts.

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

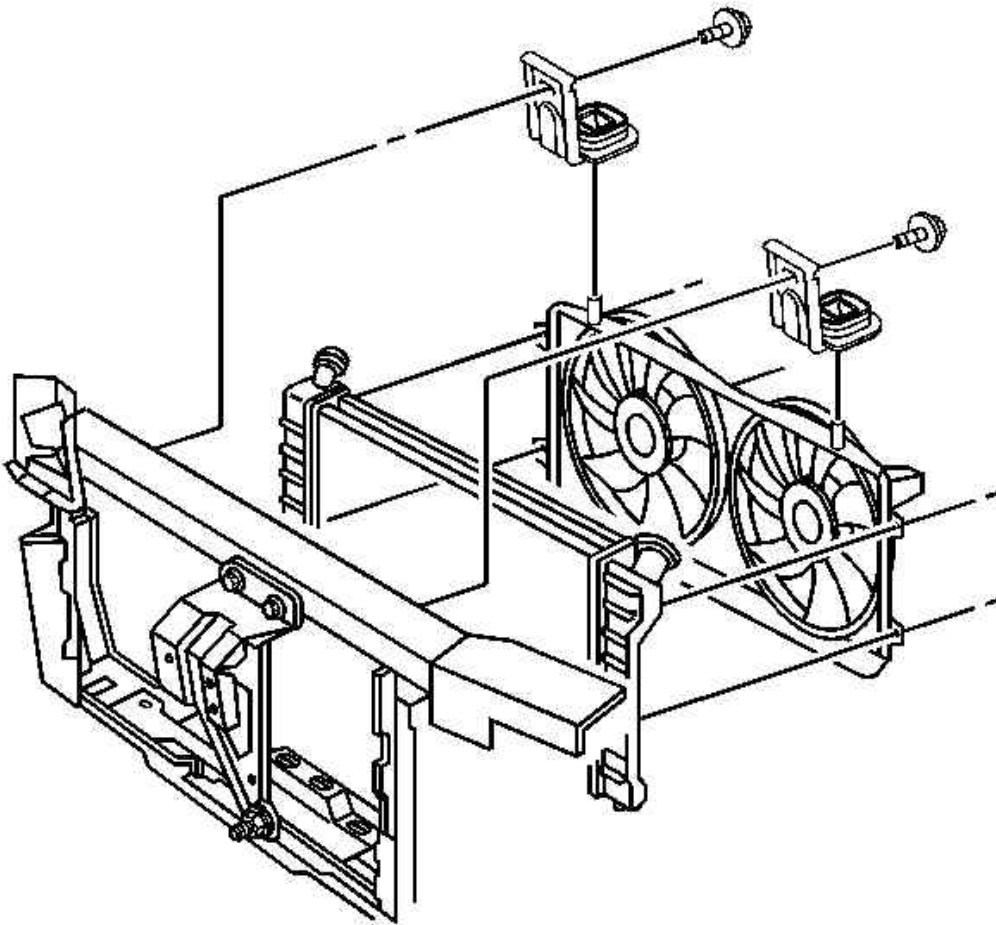


Fig. 160: View Of Fan Shroud To Radiator Upper Support Brackets
Courtesy of GENERAL MOTORS CORP.

12. Install the radiator upper support brackets and bolts that connect to the fan shroud.

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

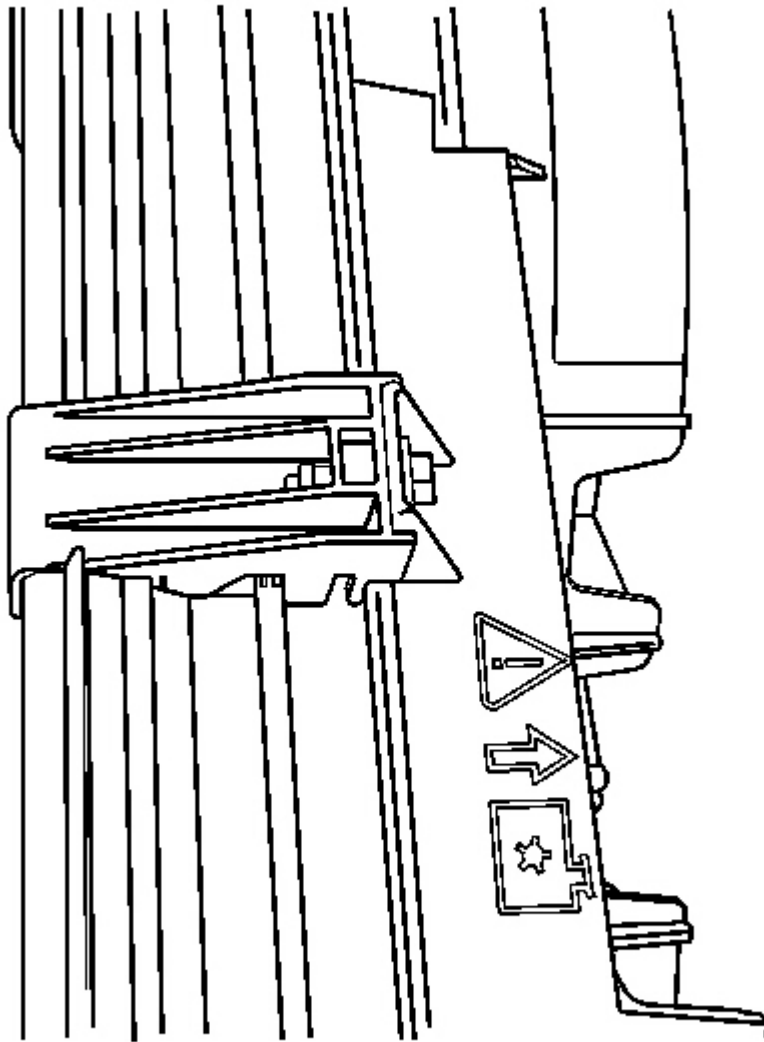


Fig. 161: Identifying Fan Shroud To Condenser Hold Down Bracket Bolt
Courtesy of GENERAL MOTORS CORP.

13. Install the air deflectors to the top of the radiator.
14. Install the bolt that connects the fan shroud to the condenser hold down bracket.

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

15. Install the PCM harness clip on to the fan shroud.
16. Install the inlet hose to the radiator.
17. Use **J 38185** to install the inlet hose clamp to the radiator. See **Special Tools**.
18. Install the air cleaner assembly. Refer to **Air Cleaner Assembly Replacement** for the 3.8L engine or to **Air Cleaner Assembly Replacement** for the 3.6L (LY7) engine.
19. Install the coolant reservoir hose to the radiator overflow neck.
20. Install the right and the left engine mount struts. Refer to **Engine Mount Strut Replacement - Left Side** and **Engine Mount Strut Replacement - Right Side** for the 3.8L engine or to **Engine Mount Strut Replacement - Left Side** for the 3.6L (LY7) engine and **Engine Mount Strut Replacement - Right Side** for the 3.6L (LY7) engine.
21. Install the transmission oil cooler lines to the retainer clip at the bottom of the cooling fan shroud.
22. Fill the cooling system. Refer to **Cooling System Draining and Filling (L26, LY7 GE 47716 Fill)** or **Cooling System Draining and Filling (L26 Static Fill)** or **Cooling System Draining and Filling (LY7 Static Fill)** or **Cooling System Draining and Filling (LS4 GE47716 Fill)** or **Cooling System Draining and Filling (LS4 Static Fill)**.
23. Connect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection (L26)** or **Battery Negative Cable Disconnection and Connection (LY7)** or **Battery Negative Cable Disconnection and Connection (LS4)** .

NOTE: Do NOT overfill the transaxle. The overfilling of the transaxle causes foaming, loss of fluid, shift complaints, and possible damage to the transaxle.

24. Adjust the transaxle fluid level.

RADIATOR REPLACEMENT (LS4)

Tools Required

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

Removal Procedure

CAUTION: Refer to Battery Disconnect Caution .

1. Disconnect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection (L26)** or **Battery Negative Cable Disconnection and Connection (LY7)** or **Battery Negative Cable Disconnection and Connection (LS4)** .
2. Remove the air cleaner assembly. Refer to **Air Cleaner Assembly Replacement** .
3. Drain the cooling system. Refer to **Cooling System Draining and Filling (L26, LY7 GE 47716 Fill)** or **Cooling System Draining and Filling (L26 Static Fill)** or **Cooling System Draining and Filling (LY7 Static Fill)** or **Cooling System Draining and Filling (LS4 GE47716 Fill)** or **Cooling System Draining and Filling (LS4 Static Fill)**.
4. Remove the engine mount struts. Refer to **Engine Mount Strut Replacement** .
5. Use **J 38185** to reposition the upper radiator hose clamp from the radiator. See **Special Tools**.
6. Remove the upper radiator hose from the radiator.
7. Remove the powertrain control module (PCM) harness clip from the fan shroud.
8. Remove the condenser tubes bracket bolt from the fan shroud.

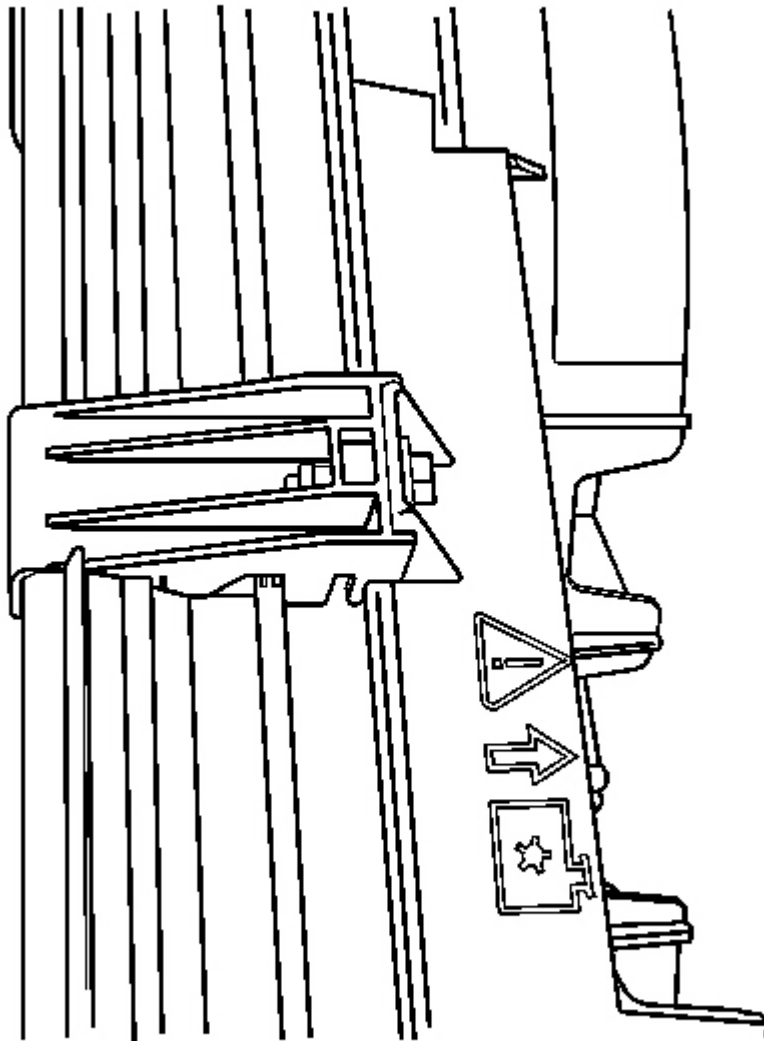


Fig. 162: Identifying Fan Shroud To Condenser Hold Down Bracket Bolt
Courtesy of GENERAL MOTORS CORP.

9. Remove the bolt that connects the fan shroud to the condenser hold down bracket.
10. Remove the condenser hold down bracket from the radiator and condenser.

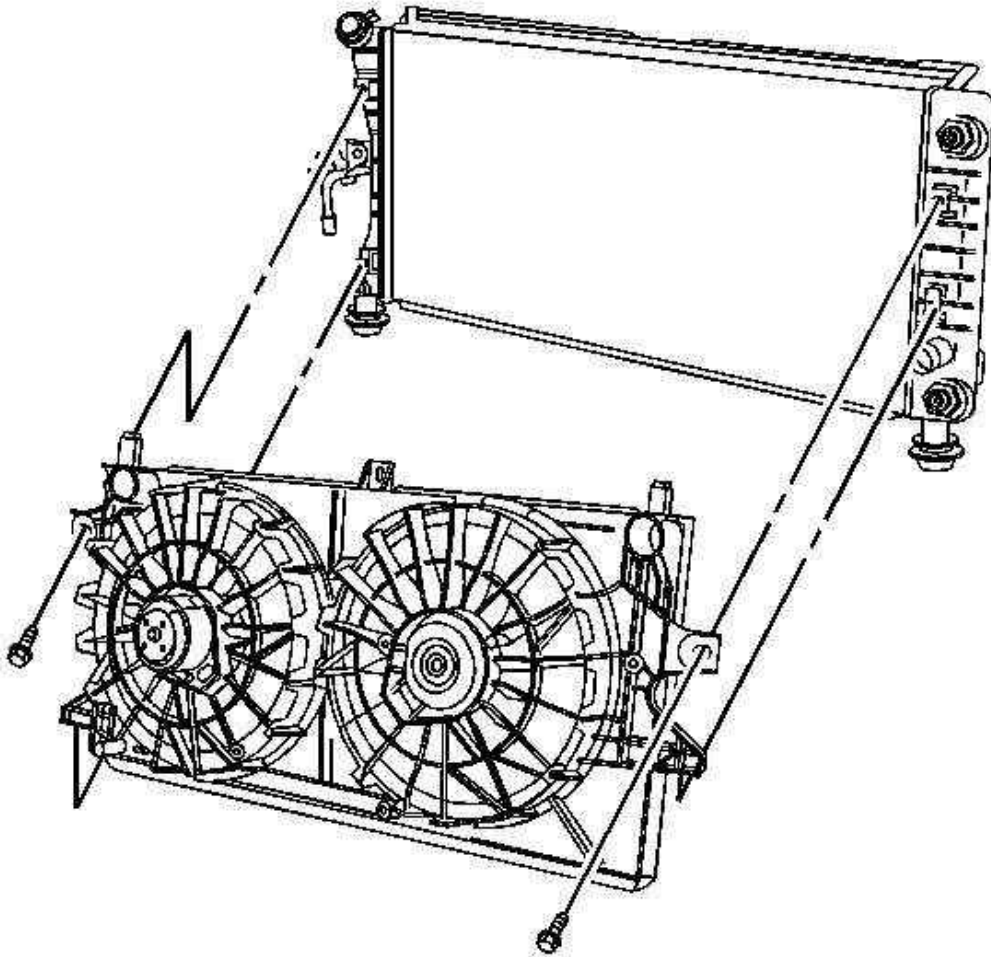


Fig. 163: View Of Cooling Fan Shroud Bolts
Courtesy of GENERAL MOTORS CORP.

11. Remove the cooling fan shroud bolts.
12. Remove the coolant reservoir hose from the fan shroud LS4 only.
13. Remove the radiator vent hose from the right upper radiator tank LS4 only.

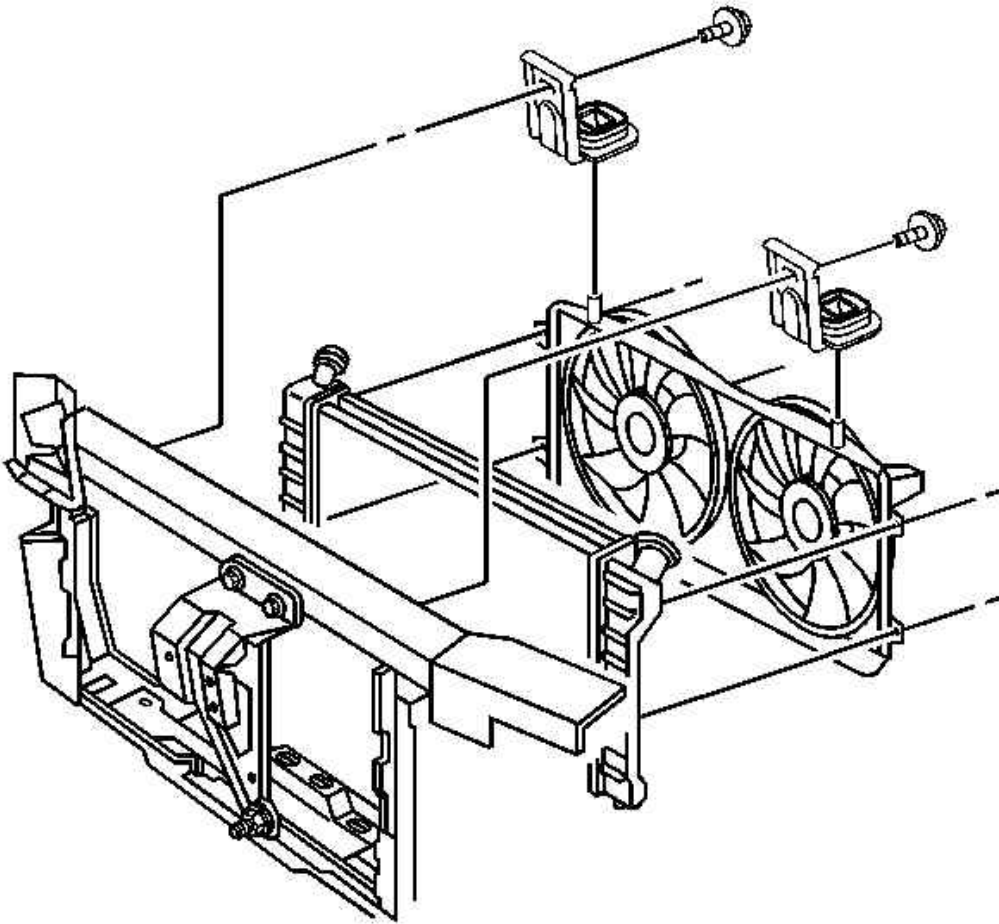


Fig. 164: View Of Fan Shroud To Radiator Upper Support Brackets
Courtesy of GENERAL MOTORS CORP.

14. Remove the radiator upper support brackets and bolts that connect to the fan shroud.
15. Disconnect the engine cooling fan motors electrical connectors.
16. Remove the cooling fan motors electrical harness from the fan shroud clips.
17. Remove the cooling fan shroud.
18. Use **J 38185** to reposition the lower radiator hose clamp from the radiator. See **Special Tools**.

19. Remove the lower radiator hose from the radiator.
20. Disconnect the transaxle oil cooler pipes from the radiator. Refer to **Transmission Fluid Cooler Hose/Pipe Quick-Connect Fitting Disconnection and Connection** .
21. Tilt the top of the radiator rearward.

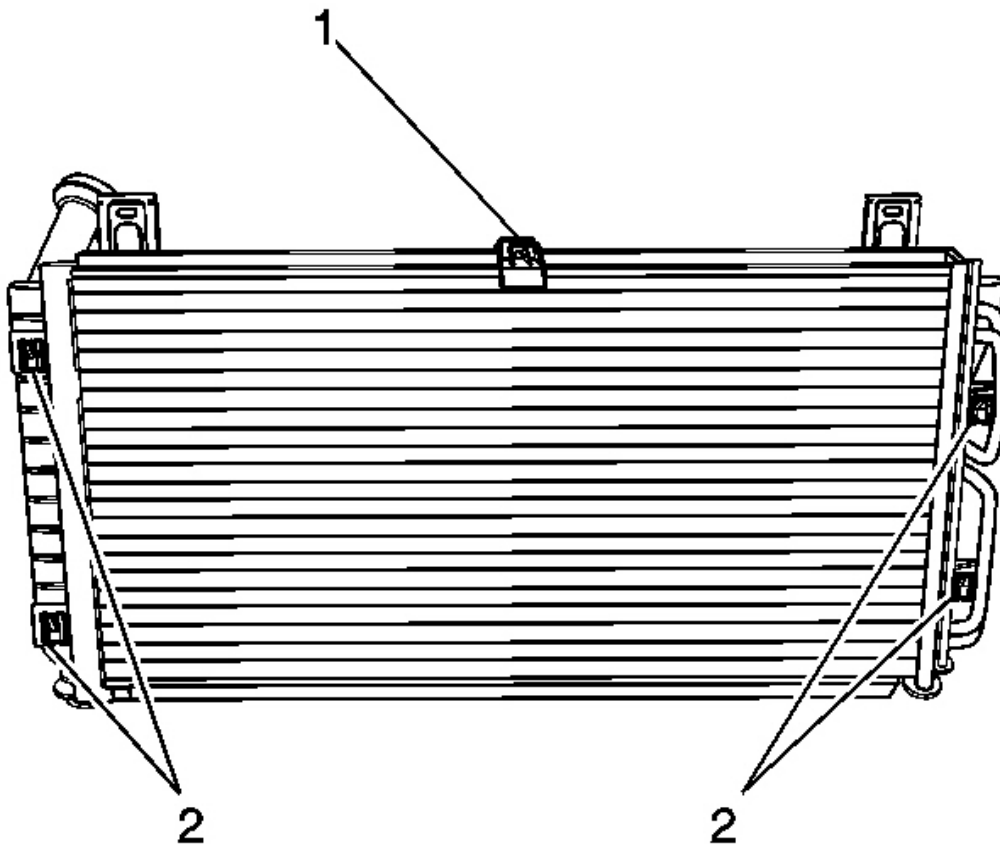


Fig. 165: Identifying Condenser Hold Down Bracket & Mount Tabs
Courtesy of GENERAL MOTORS CORP.

22. Lift the condenser from the mounting tabs on the radiator (2). Position the condenser aside.
23. Remove the radiator.

Installation Procedure

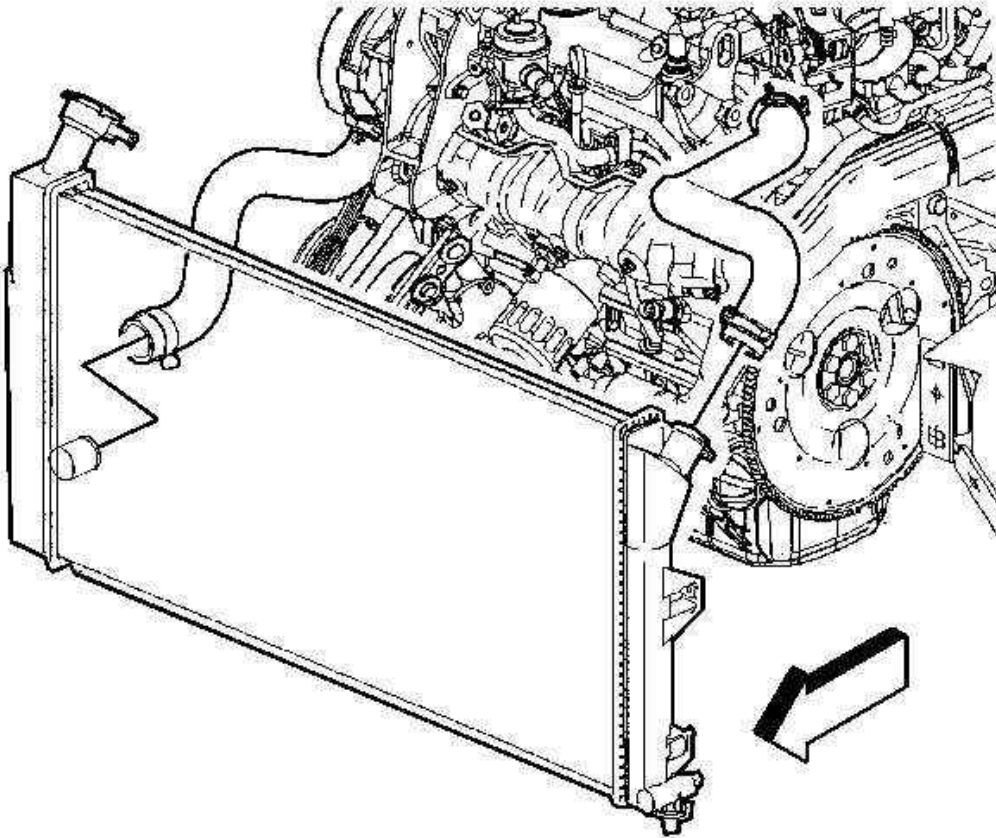


Fig. 166: View Of Radiator Hoses To/From Radiator
Courtesy of GENERAL MOTORS CORP.

1. Install the radiator to the lower mounts.

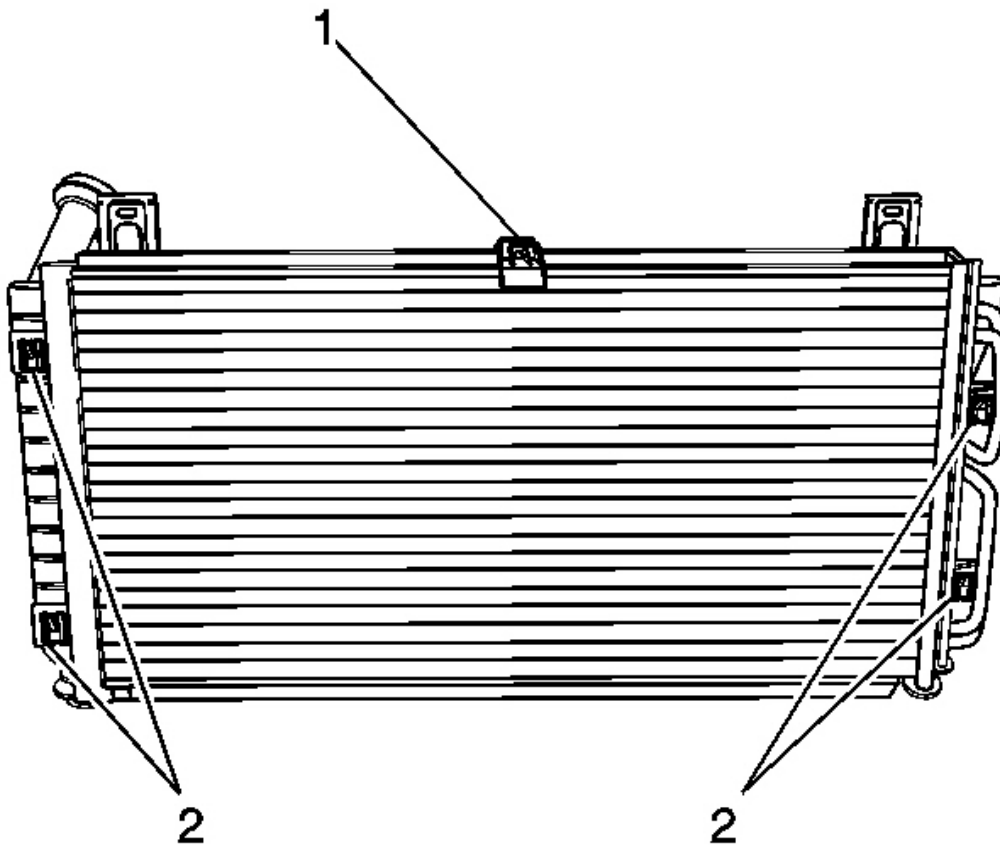


Fig. 167: Identifying Condenser Hold Down Bracket & Mount Tabs
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Verify that the condenser is fully seated in the radiator mounting tabs.

2. Install the condenser to the mounting tabs on the radiator (2).
3. Install the condenser hold down bracket (1) to the radiator and condenser.
4. Install the lower radiator hose to the radiator.
5. Use **J 38185** to install the lower radiator hose clamp to the radiator. See **Special Tools**.

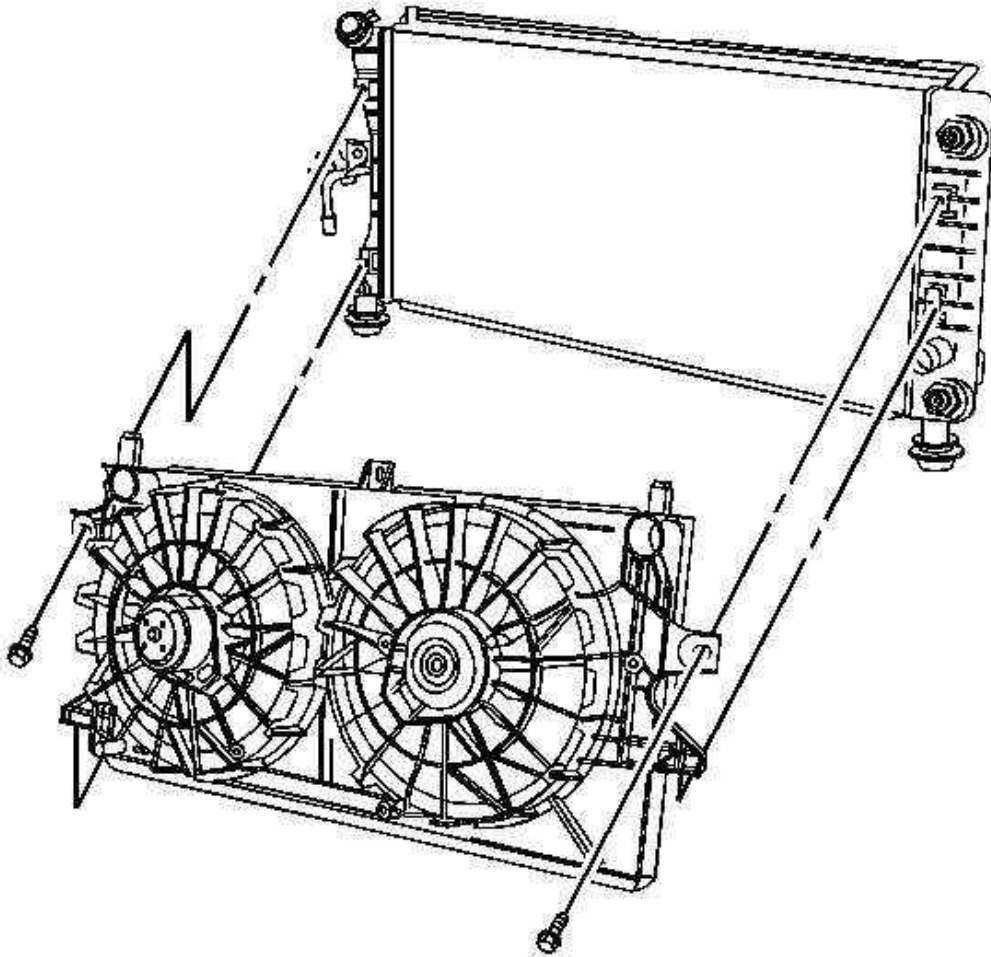


Fig. 168: View Of Cooling Fan Shroud Bolts
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Ensure the right and left edge of the fan shroud engages the radiator slots.

6. Install the cooling fan shroud.

NOTE: Refer to Fastener Notice .

7. Install the condenser tubes bracket bolt to the fan shroud.

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

8. Install the cooling fan motors electrical harness to the fan shroud clips.
9. Connect the engine cooling fan motors electrical connectors.
10. Install the cooling fan shroud bolts.

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

11. Connect the transaxle oil cooler pipes to the radiator. Refer to **Transmission Fluid Cooler Hose/Pipe Quick-Connect Fitting Disconnection and Connection** .

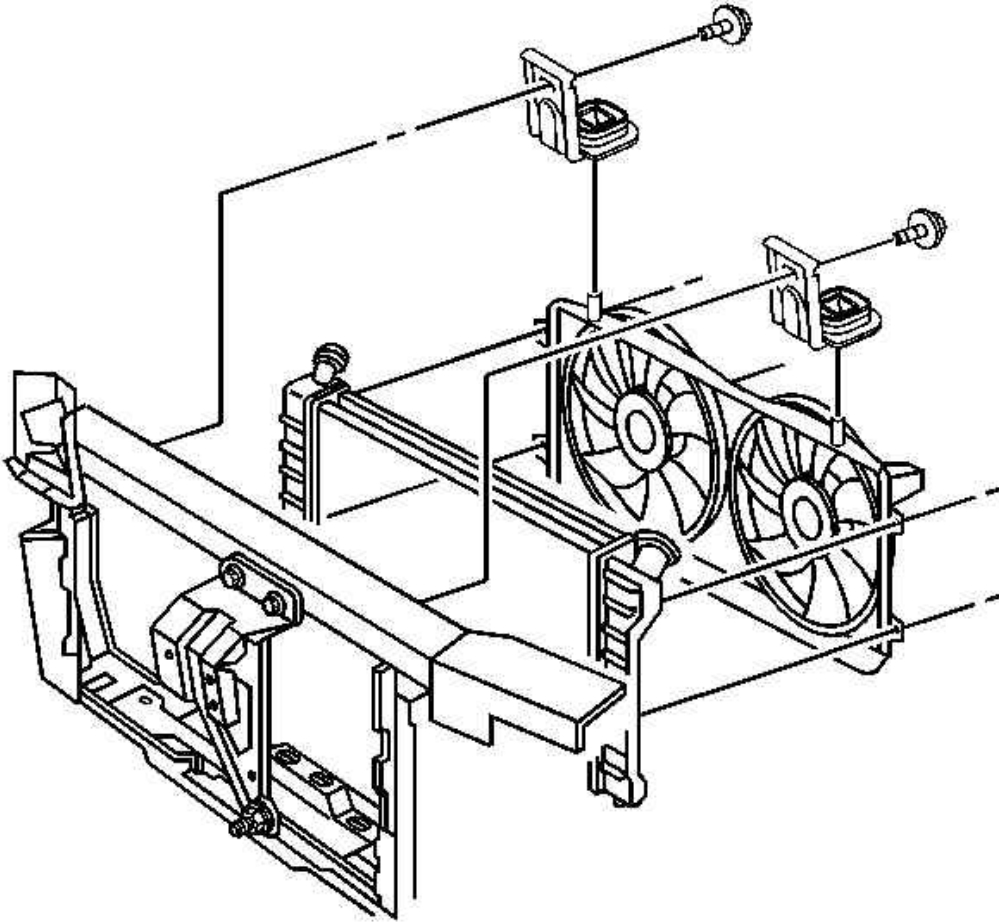


Fig. 169: View Of Fan Shroud To Radiator Upper Support Brackets
Courtesy of GENERAL MOTORS CORP.

12. Install the radiator upper support brackets and bolts that connect to the fan shroud.

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

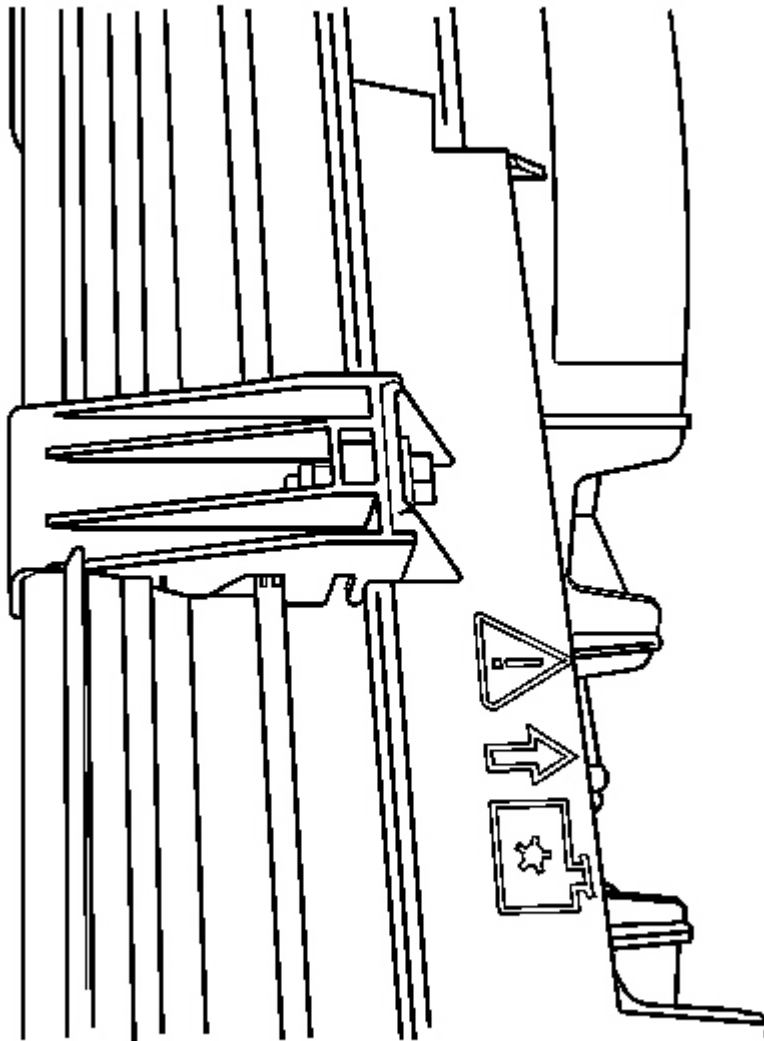


Fig. 170: Identifying Fan Shroud To Condenser Hold Down Bracket Bolt
Courtesy of GENERAL MOTORS CORP.

13. Install the bolt that connects the fan shroud to the condenser hold down bracket.

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

14. Install the PCM harness clip on to the fan shroud.
15. Install the upper radiator hose to the radiator.
16. Use **J 38185** to install the upper radiator hose clamp to the radiator. See **Special Tools**.
17. Install the air cleaner assembly. Refer to **Air Cleaner Assembly Replacement** .
18. Install the coolant reservoir hose to the fan shroud.
19. Install the radiator vent hose to the right upper radiator tank and fill neck.
20. Install the engine mount struts. Refer to **Engine Mount Strut Replacement** .
21. Fill the cooling system. Refer to **Cooling System Draining and Filling (L26, LY7 GE 47716 Fill)** or **Cooling System Draining and Filling (L26 Static Fill)** or **Cooling System Draining and Filling (LY7 Static Fill)** or **Cooling System Draining and Filling (LS4 GE47716 Fill)** or **Cooling System Draining and Filling (LS4 Static Fill)**.
22. Connect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection (L26)** or **Battery Negative Cable Disconnection and Connection (LY7)** or **Battery Negative Cable Disconnection and Connection (LS4)** .

NOTE: Do NOT overfill the transaxle. The overfilling of the transaxle causes foaming, loss of fluid, shift complaints, and possible damage to the transaxle.

23. Adjust the transaxle fluid level.

RADIATOR AIR LOWER BAFFLE AND DEFLECTOR REPLACEMENT

Removal Procedure

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
2. Remove the lower air deflector fog lamp access panels.

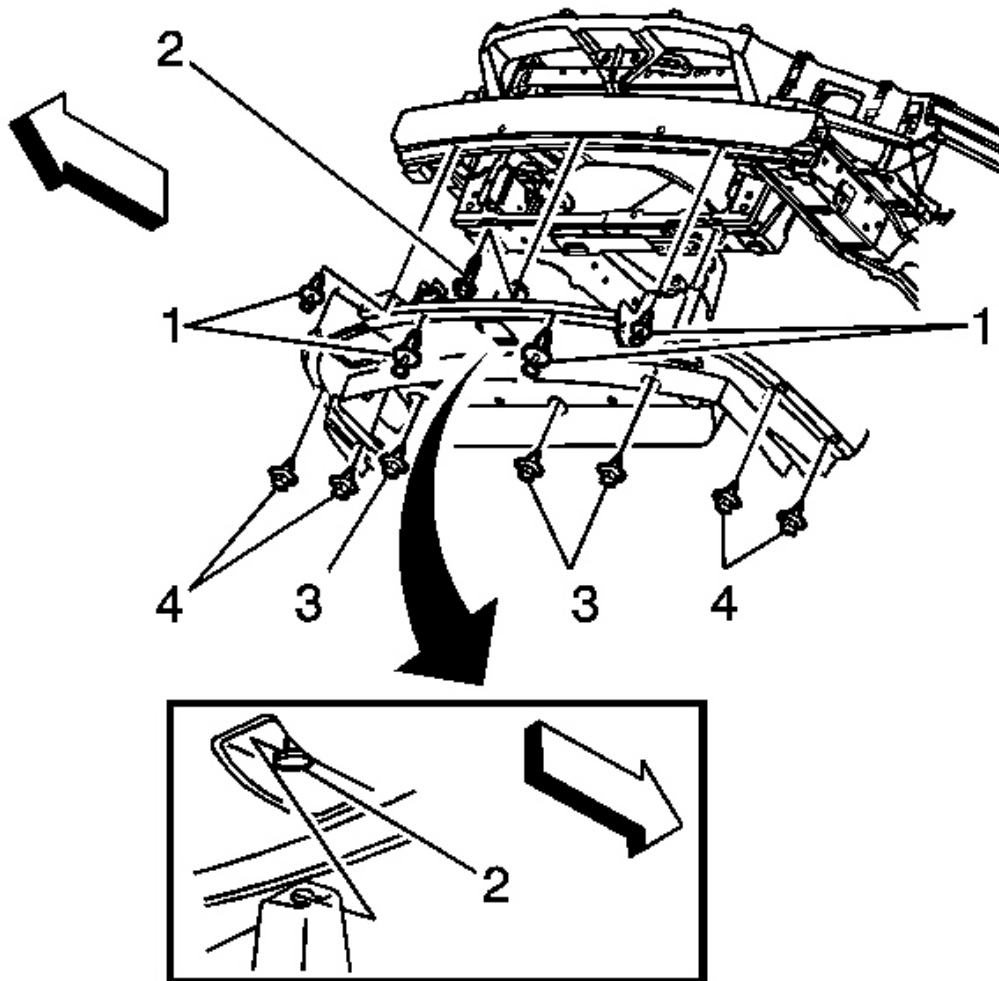


Fig. 171: View Of Air Baffle & Deflector Components
Courtesy of GENERAL MOTORS CORP.

3. Remove the lower air deflector retainers (1).
4. Remove the lower air deflector center retainer (2).
5. Remove the lower air deflector bolts (3).
6. Remove the lower air deflector screws (4).
7. Remove the right and left side lower front fender liner screws from the lower air deflector.

8. Remove the lower air deflector.

Installation Procedure

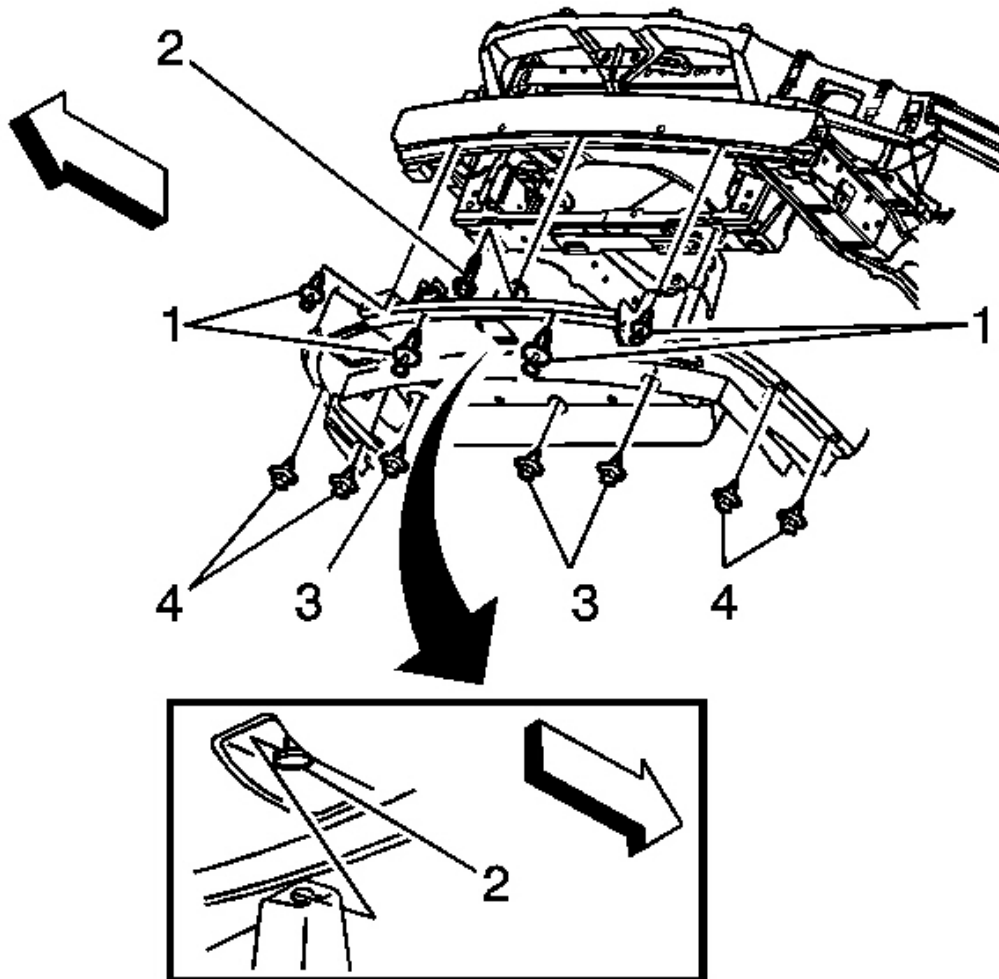


Fig. 172: View Of Air Baffle & Deflector Components
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice.

1. Install the lower air deflector.

Install the lower air deflector bolts (3).

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

2. Install the lower air deflector center retainer (2).
3. Install the lower air deflector retainers (1).
4. Install the lower air deflector screws (4).

Tighten: Tighten the screws to 2 N.m (18 lb in).

5. Install the right and left side lower front fender liner screws to the lower air deflector.

Tighten: Tighten the screws to 2 N.m (18 lb in).

6. Lower the vehicle.

RADIATOR AIR SIDE BAFFLE AND DEFLECTOR REPLACEMENT

Removal Procedure

1. Remove the upper air baffle. Refer to **Radiator Air Upper Baffle and Deflector Replacement**.

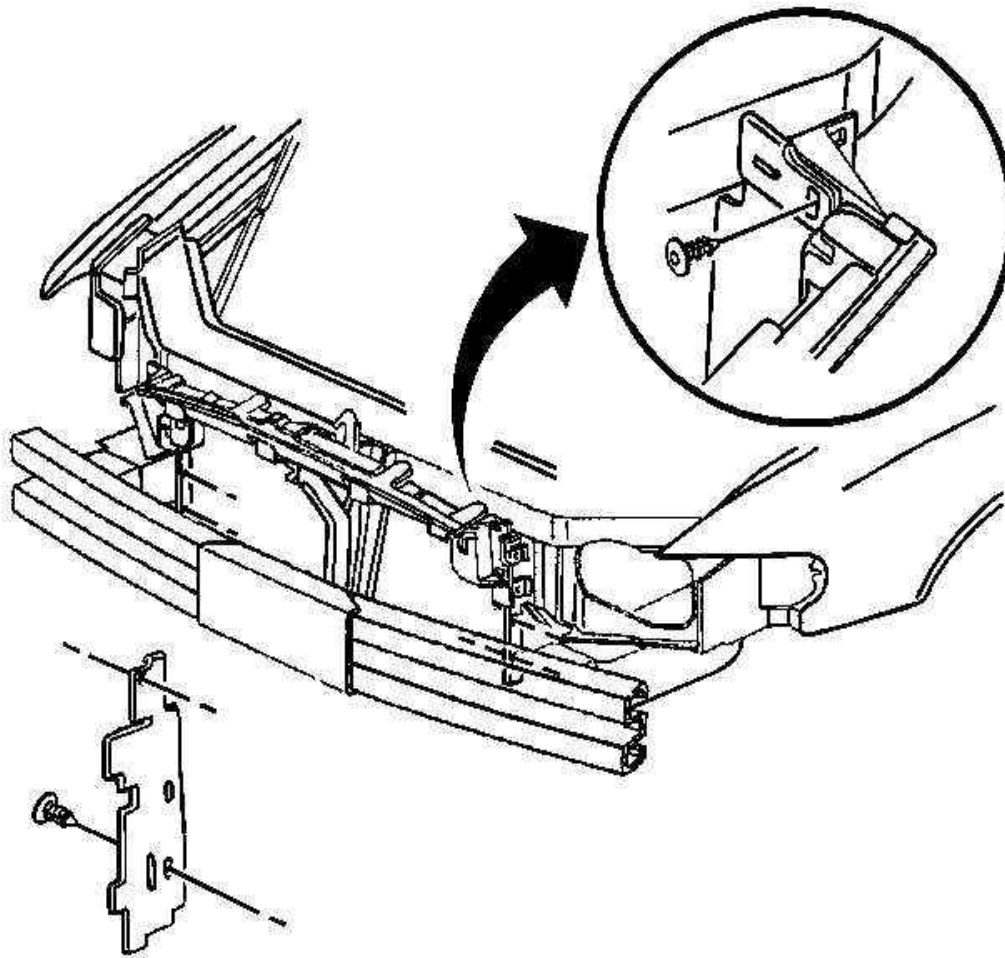


Fig. 173: Identifying Right & Left Side Air Baffles
Courtesy of GENERAL MOTORS CORP.

2. Remove the right and left side air baffle push-in retainers.
3. Remove the right and left side air baffles.

Installation Procedure

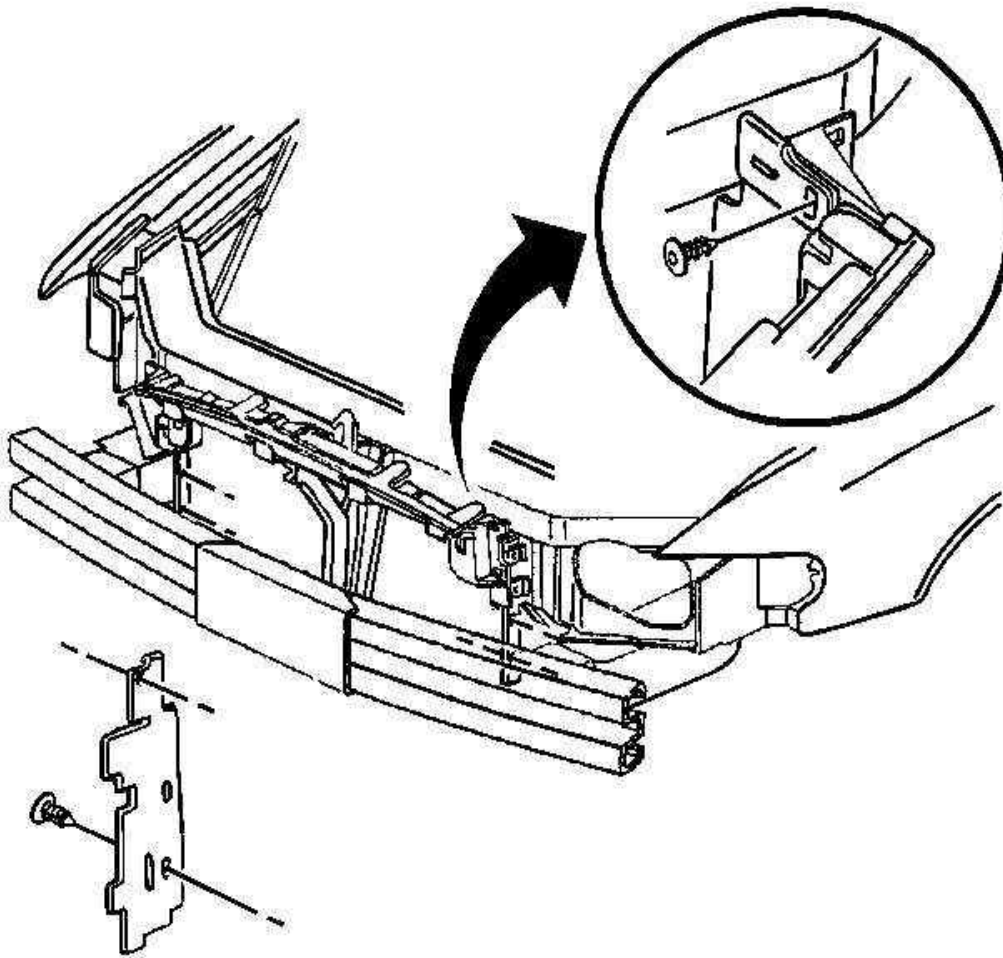


Fig. 174: Identifying Right & Left Side Air Baffles
Courtesy of GENERAL MOTORS CORP.

1. Install the right and left side air baffles to the vehicle.
2. Install the right and left side air baffle push-in retainers.
3. Install the upper air baffle. Refer to **Radiator Air Upper Baffle and Deflector Replacement**.

RADIATOR AIR UPPER BAFFLE AND DEFLECTOR REPLACEMENT

Removal Procedure

1. Open the hood.

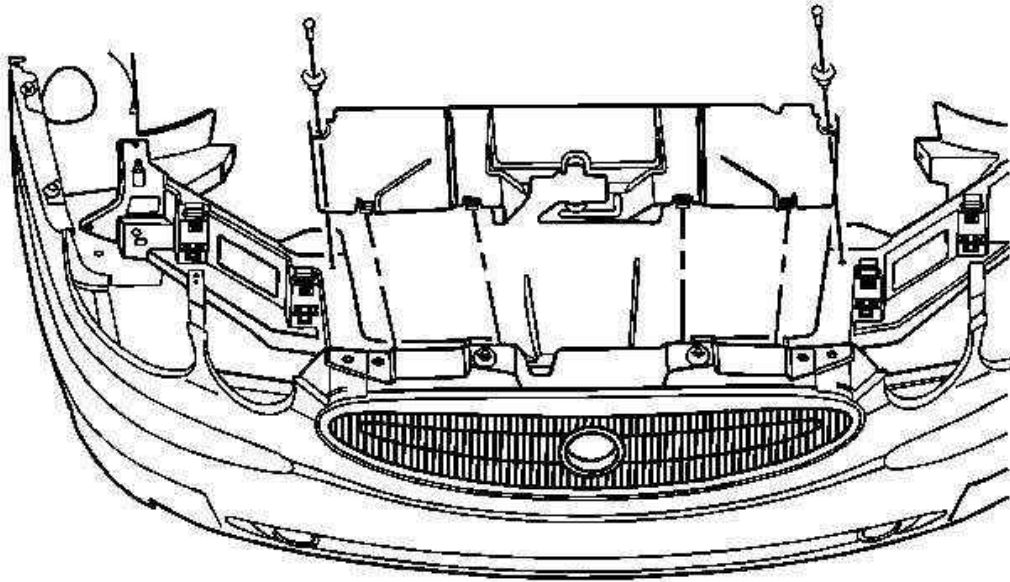


Fig. 175: View Of Upper Air Deflector
Courtesy of GENERAL MOTORS CORP.

2. Remove the retainers from the upper air deflector.
3. Remove the upper air deflector.

Installation Procedure

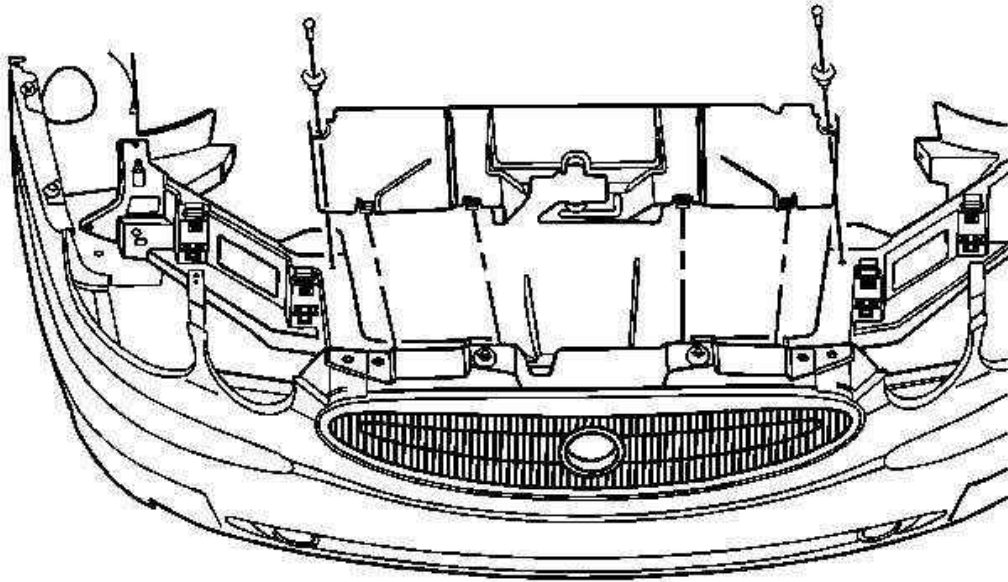


Fig. 176: Upper Air Deflector
Courtesy of GENERAL MOTORS CORP.

1. Install the upper air deflector.
2. Install the retainers to the upper air deflector.
3. Close the hood.

COOLANT HEATER REPLACEMENT (3.8L)

Removal Procedure

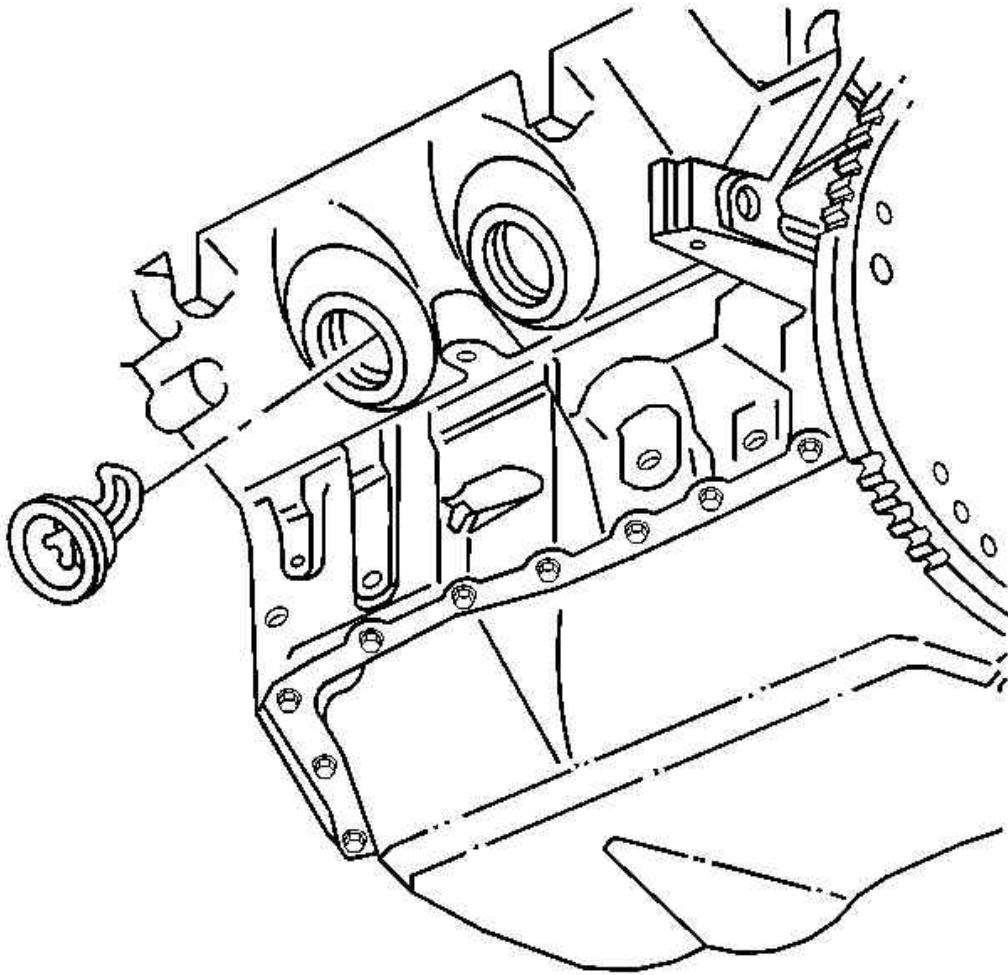


Fig. 177: Identifying Coolant Heater
Courtesy of GENERAL MOTORS CORP.

1. Drain the cooling system. Refer to **Cooling System Draining and Filling (L26, LY7 GE 47716 Fill)** or **Cooling System Draining and Filling (L26 Static Fill)** or **Cooling System Draining and Filling (LY7 Static Fill)** or **Cooling System Draining and Filling (LS4 GE47716 Fill)** or **Cooling System Draining and Filling (LS4 Static Fill)**.
2. Disconnect the coolant heater cord from the coolant heater.
3. Loosen the bolt at the coolant heater but do not remove.

4. Remove the coolant heater.
5. Remove and clean any burrs, compound, paint, or rough spots from the core plug hole.

Installation Procedure

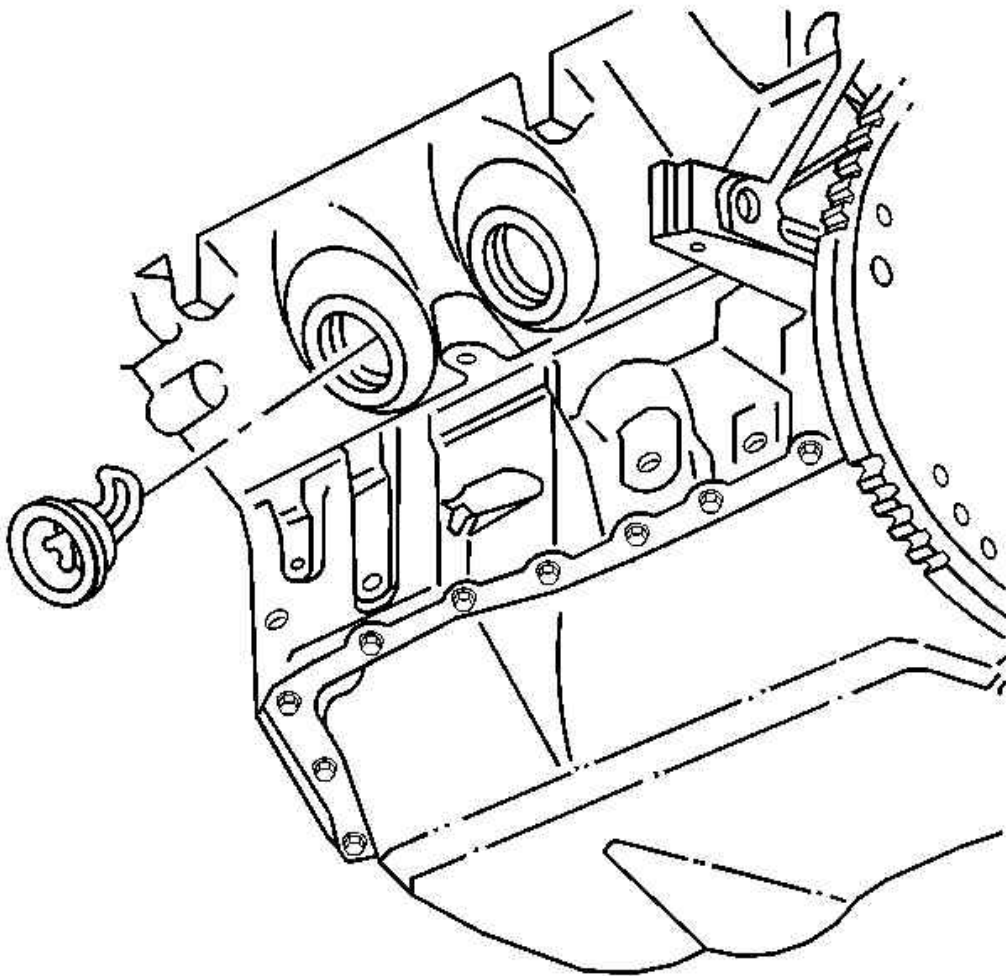


Fig. 178: Identifying Coolant Heater
Courtesy of GENERAL MOTORS CORP.

1. Apply a coat of GM P/N 12346004, (Canadian P/N 10953480) thread sealant

with Teflon or equivalent to the O-ring and clean the surface of the plug opening.

2. Install the coolant heater by pushing tight to the block.

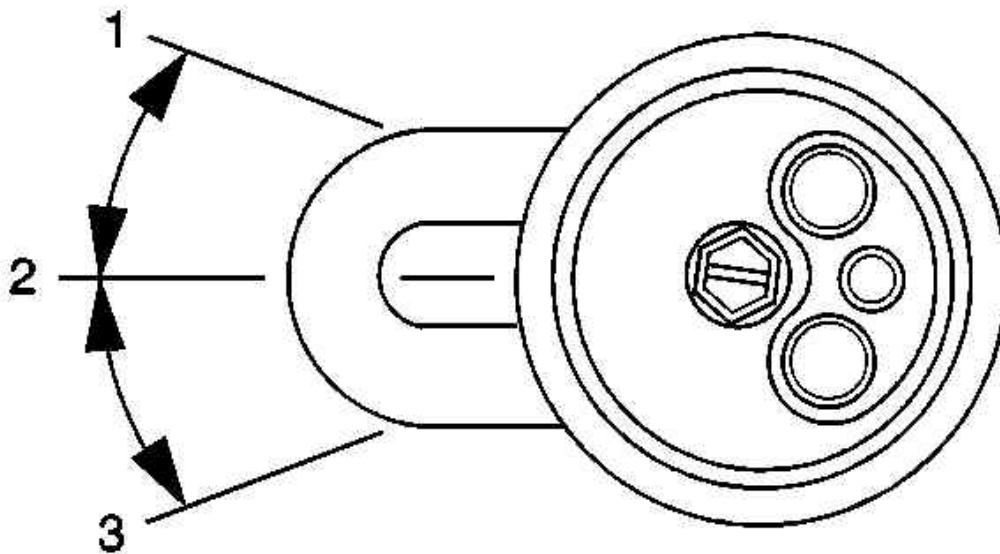


Fig. 179: Positioning Engine Coolant Heater Element
Courtesy of GENERAL MOTORS CORP.

3. Install the coolant heater so the element is at the 9 o'clock position (2).

NOTE: Refer to FASTENER NOTICE .

4. Tighten the coolant heater bolt until both locking wings draw tight against the inner wall of the engine block.

Tighten: Tighten the bolt to 2 N.m (17 lb in).

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

straps as necessary to prevent damage.

5. Connect the coolant heater cord to the coolant heater.
6. Fill the cooling system. Refer to **Cooling System Draining and Filling (L26, LY7 GE 47716 Fill)** or **Cooling System Draining and Filling (L26 Static Fill)** or **Cooling System Draining and Filling (LY7 Static Fill)** or **Cooling System Draining and Filling (LS4 GE47716 Fill)** or **Cooling System Draining and Filling (LS4 Static Fill)**.

COOLANT HEATER REPLACEMENT (LY7)

Removal Procedure

1. Turn the ignition OFF.
2. Raise and support the vehicle.
3. Disconnect the coolant heater cord from the coolant heater.

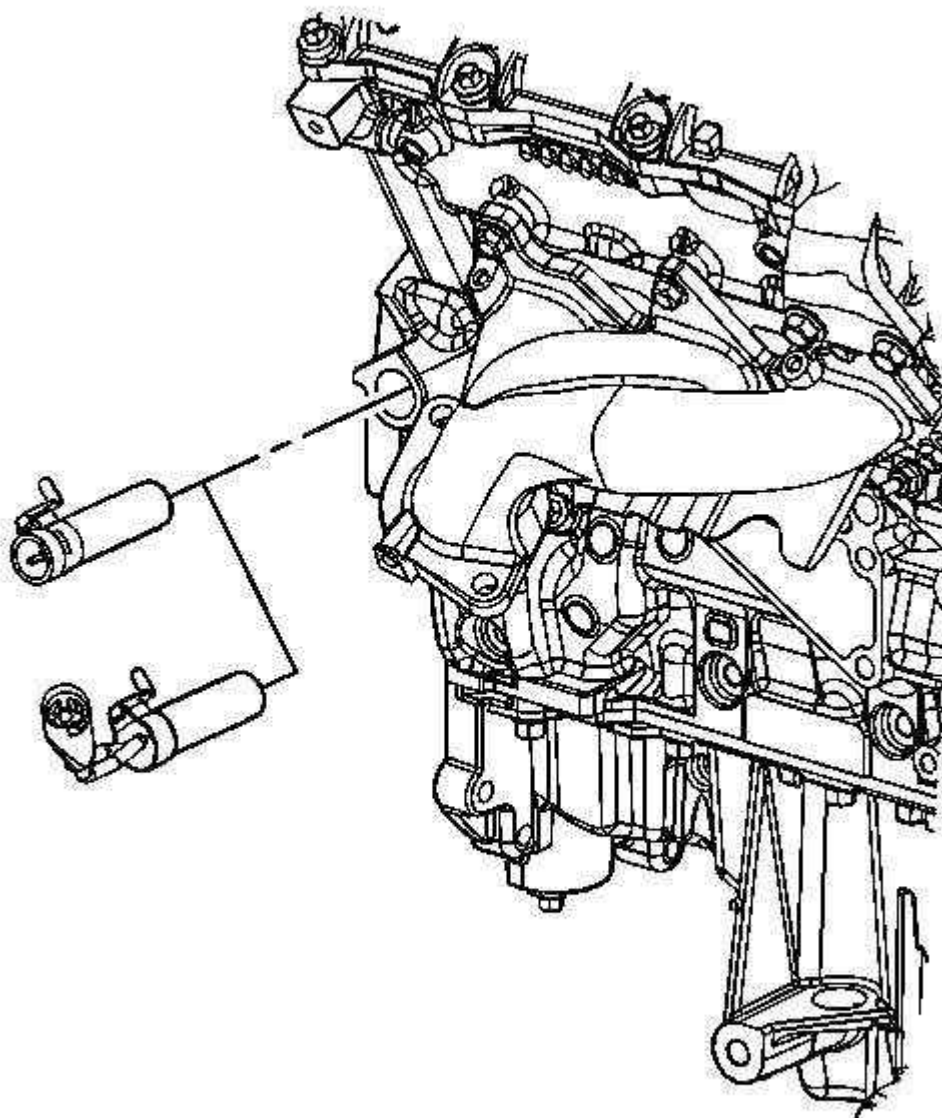


Fig. 180: View Of Coolant Heater - LY7, KO5
Courtesy of GENERAL MOTORS CORP.

4. Remove the coolant heater.

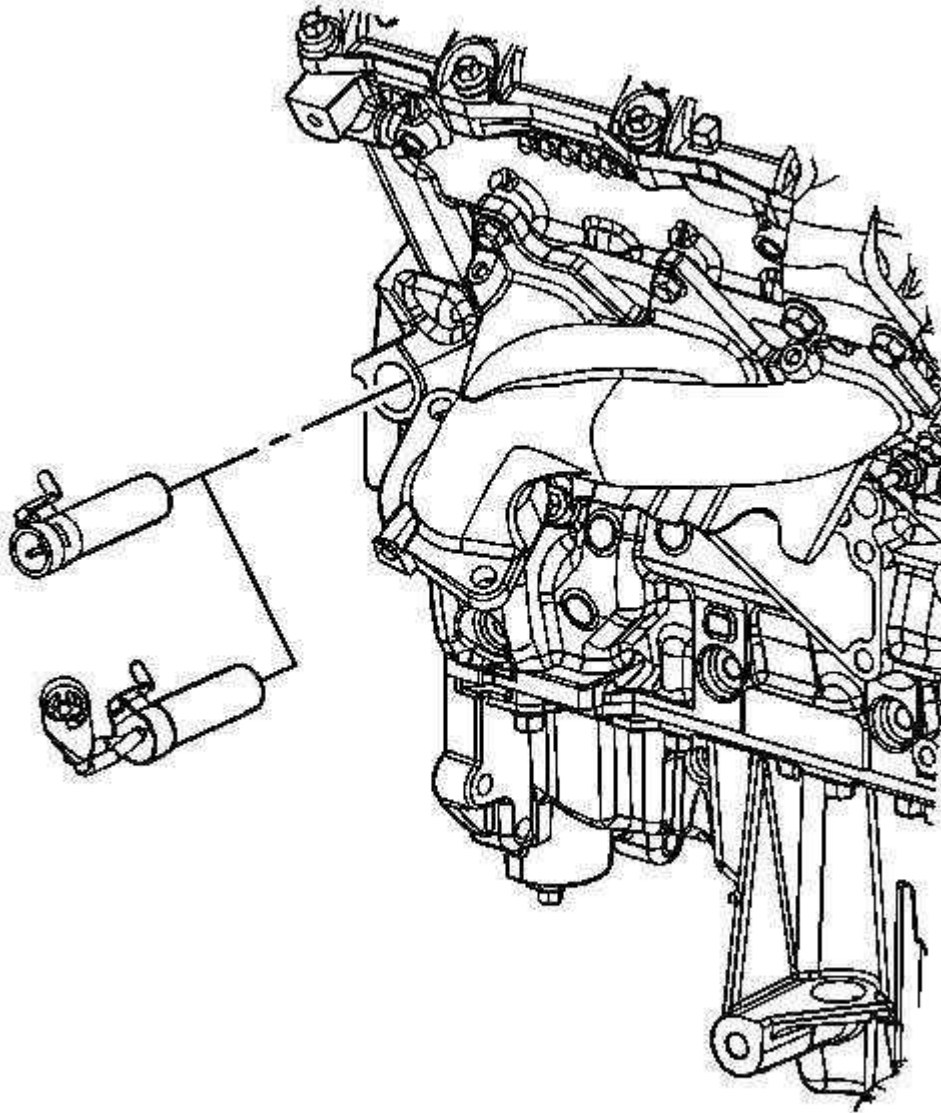


Fig. 181: View Of Coolant Heater - LY7, KO5
Courtesy of GENERAL MOTORS CORP.

1. Install the coolant heater.
2. Connect the coolant heater cord to the coolant heater.

3. Lower the vehicle.

COOLANT HEATER REPLACEMENT (LS4)

Removal Procedure

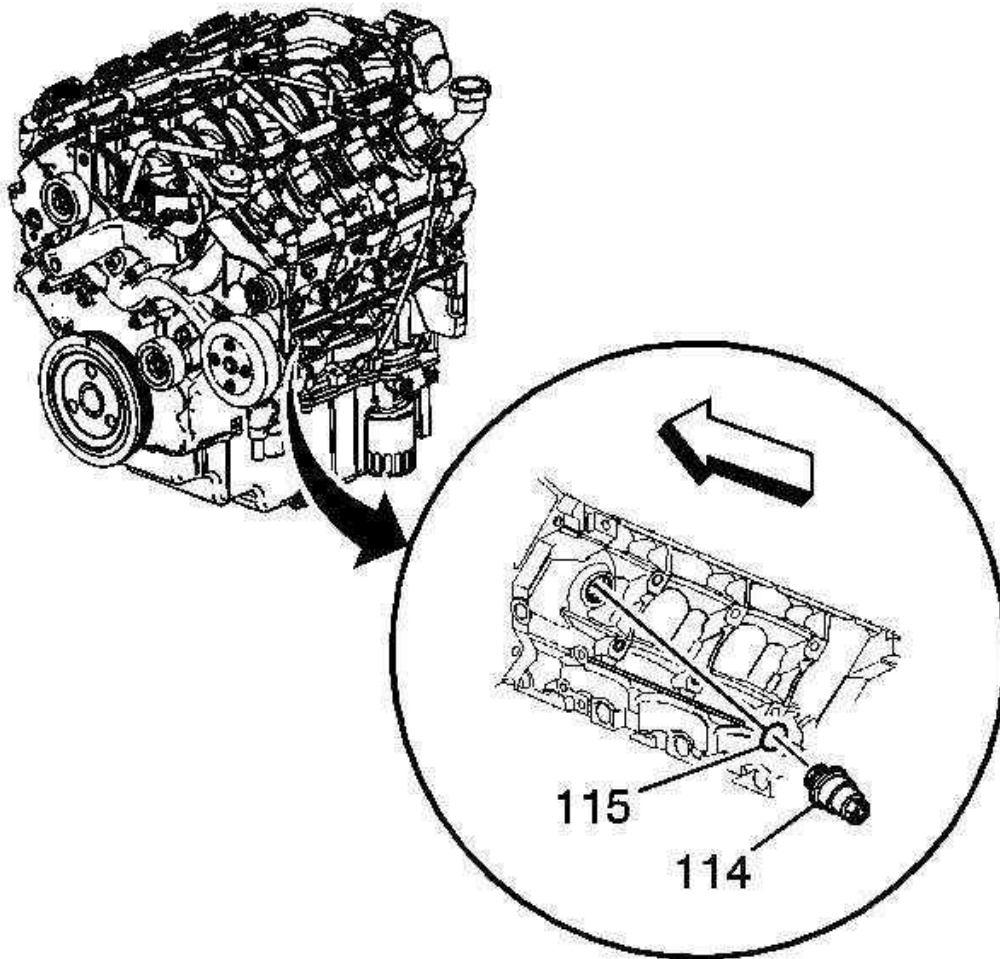


Fig. 182: View Of Engine Block Coolant Heater & Washer
Courtesy of GENERAL MOTORS CORP.

1. Drain the cooling system. Refer to Cooling System Draining and Filling (L26, LY7 GE 47716 Fill) or Cooling System Draining and Filling (L26

Static Fill) or **Cooling System Draining and Filling (LY7 Static Fill)** or **Cooling System Draining and Filling (LS4 GE47716 Fill)** or **Cooling System Draining and Filling (LS4 Static Fill)**).

2. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
3. Disconnect the coolant heater cord from the coolant heater.
4. Remove the coolant heater (114) and washer (115).
5. Remove and clean any burrs, compound, paint, or rough spots from the core plug hole.

Installation Procedure

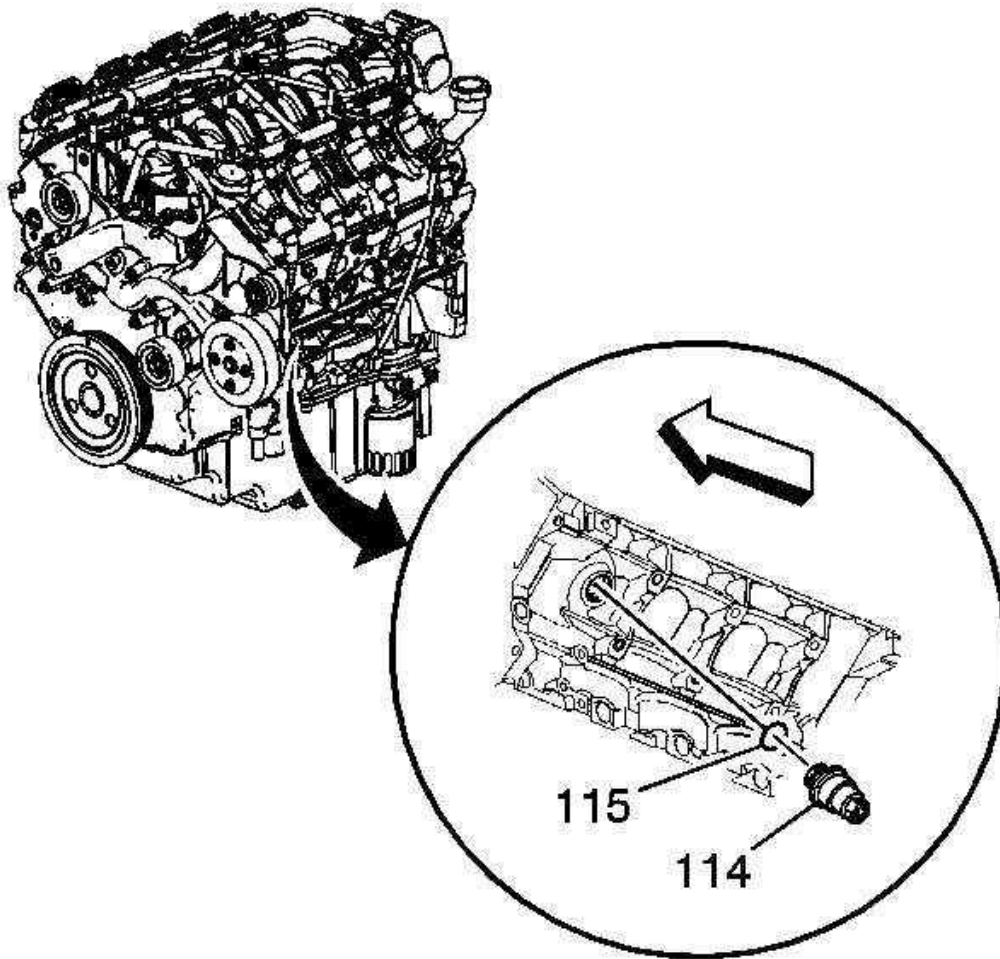


Fig. 183: View Of Engine Block Coolant Heater & Washer
Courtesy of GENERAL MOTORS CORP.

1. Apply a 3.175 mm (0.125 in) bead of sealant, GM P/N 12346004 (Canadian P/N 10953480) or equivalent to the coolant heater.

NOTE: Refer to Fastener Notice .

2. Install the coolant heater (114) and washer (115).

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

3. Connect the coolant heater cord to the coolant heater.
4. Lower the vehicle.
5. Fill the cooling system. Refer to **Cooling System Draining and Filling (L26, LY7 GE 47716 Fill)** or **Cooling System Draining and Filling (L26 Static Fill)** or **Cooling System Draining and Filling (LY7 Static Fill)** or **Cooling System Draining and Filling (LS4 GE47716 Fill)** or **Cooling System Draining and Filling (LS4 Static Fill)**.

COOLANT HEATER CORD REPLACEMENT (LY7)

Removal Procedure

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .

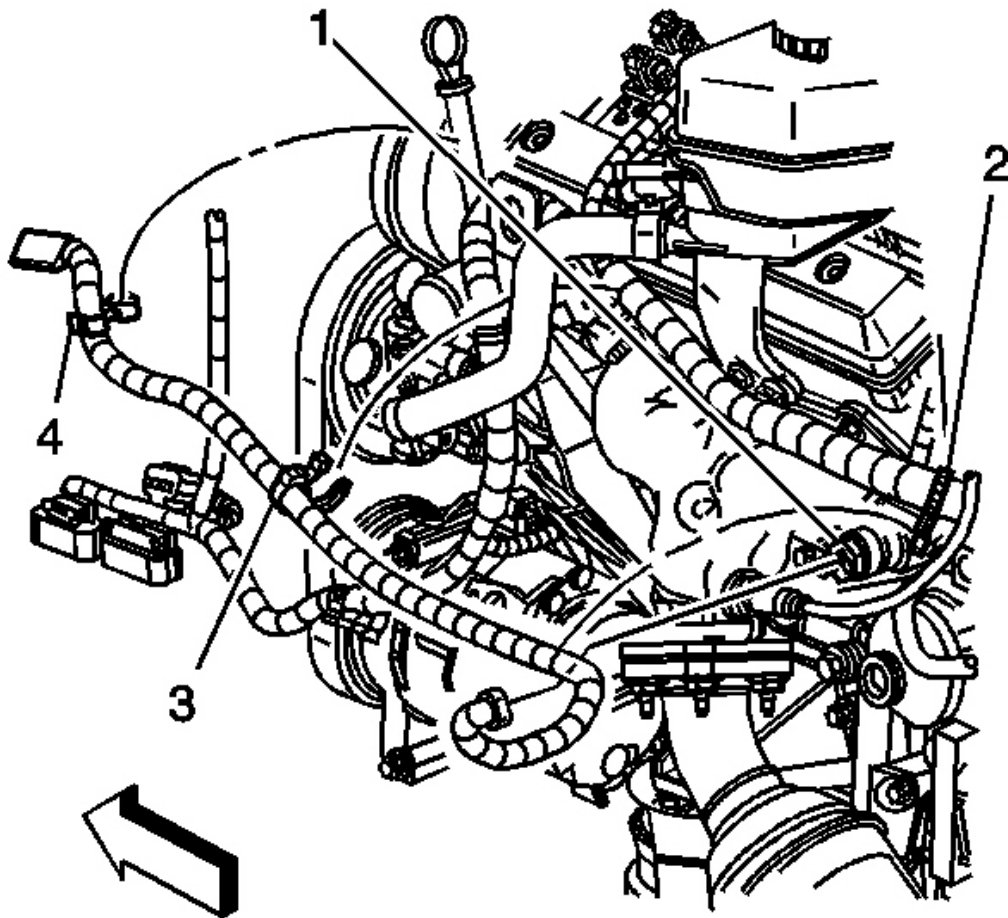


Fig. 184: View Of Coolant Heater Cord - LY7 (KO5)
Courtesy of GENERAL MOTORS CORP.

2. Disconnect the coolant heater power supply cord from the coolant heater (1).
3. Disconnect the coolant heater cord clip (2) from the coolant heater cord.
4. Lower the vehicle.
5. Disconnect the coolant heater cord clips (3, 4) from the following:
 - The engine wiring harness conduit
 - The engine oil level indicator tube
6. Remove the coolant heater cord from the vehicle.

Installation Procedure

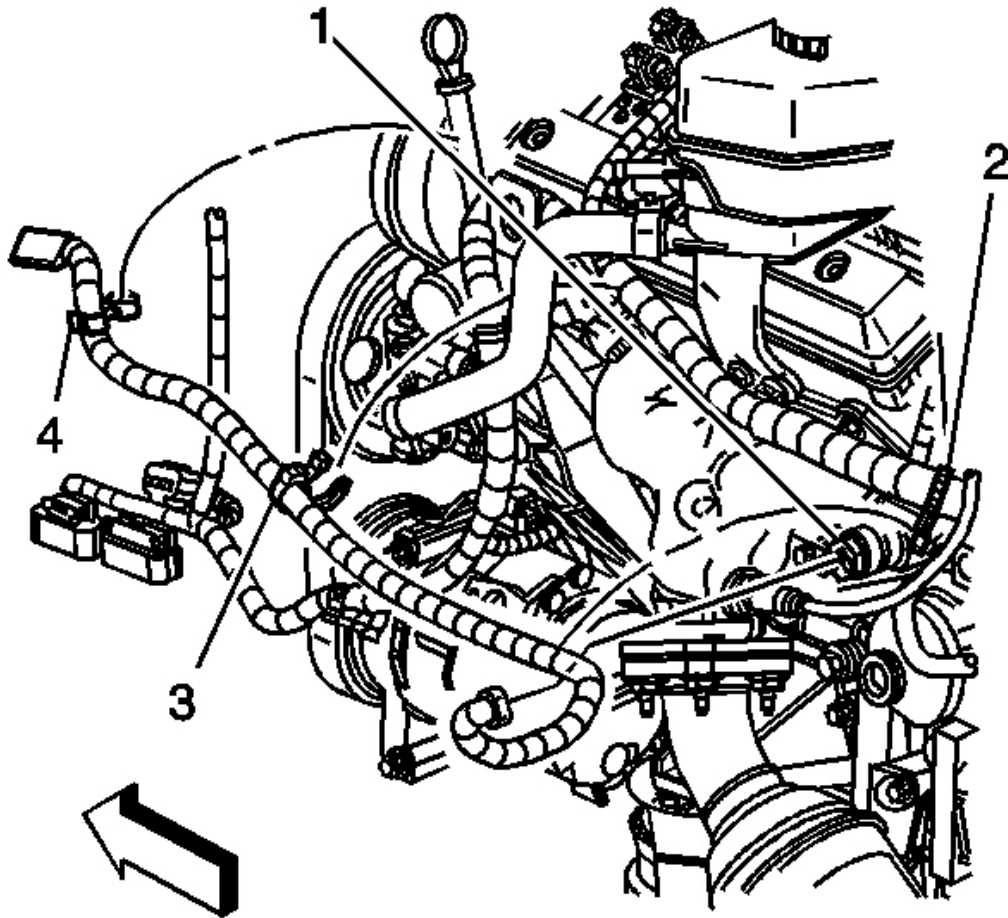


Fig. 185: View Of Coolant Heater Cord - LY7 (KO5)
Courtesy of GENERAL MOTORS CORP.

1. Position the coolant heater power supply cord to the engine.
2. Route the coolant heater cord along the engine wiring harness conduit.
3. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
4. Connect the coolant heater cord to the coolant heater (1).
5. Secure the coolant heater cord clip (2) to the coolant heater cord.

6. Lower the vehicle.
7. Secure the coolant heater cord clips (3, 4) to the following:
 - The engine wiring harness conduit
 - The engine oil level indicator tube

COOLANT HEATER CORD REPLACEMENT (3.8L)

Removal Procedure

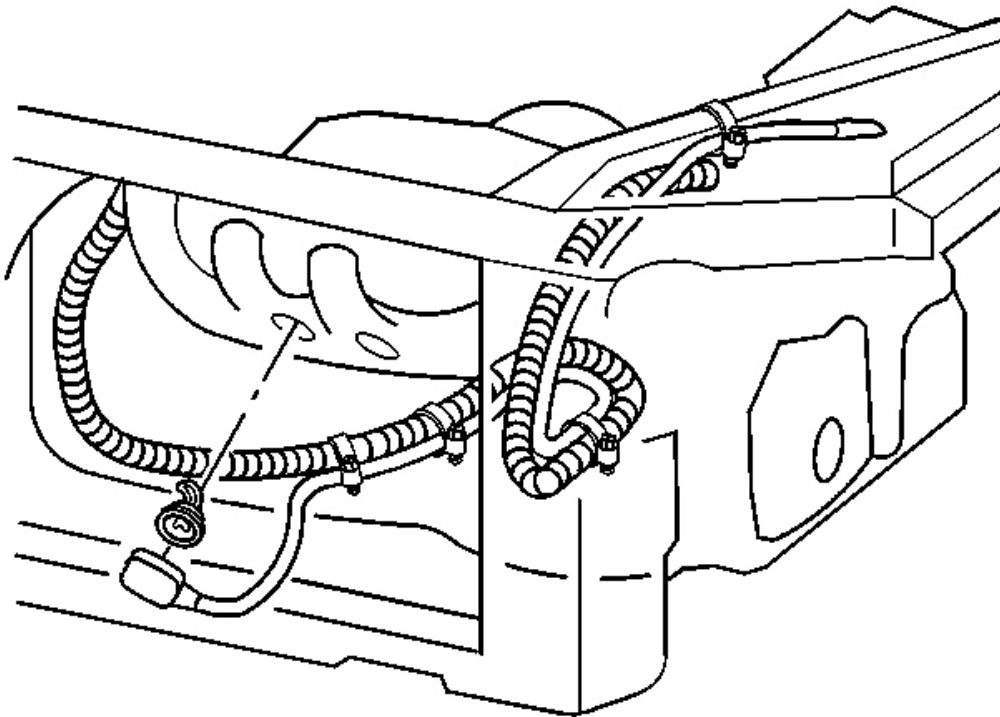


Fig. 186: Identifying Coolant Heater Cord
Courtesy of GENERAL MOTORS CORP.

1. Remove the coolant heater cord retainer from the upper radiator support.
2. Cut the coolant heater cord straps at the engine wiring harness.
3. Disconnect the coolant heater cord from the coolant heater.

4. Remove the coolant heater cord from the vehicle.

Installation Procedure

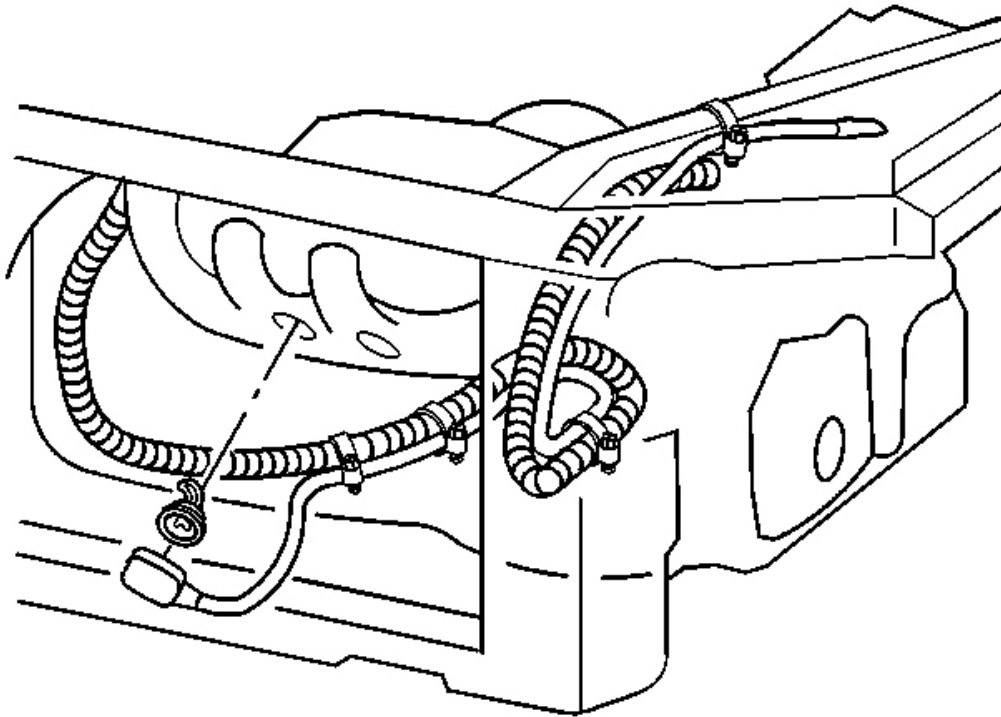


Fig. 187: Identifying Coolant Heater Cord
Courtesy of GENERAL MOTORS CORP.

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

1. Install the coolant heater cord to the vehicle.
2. Connect the coolant heater cord to the coolant heater.
3. Install a new coolant heater cord straps at the engine wiring harness.

4. Install the coolant heater cord retainer to the upper radiator support.

COOLANT HEATER CORD REPLACEMENT (LS4)

Removal Procedure

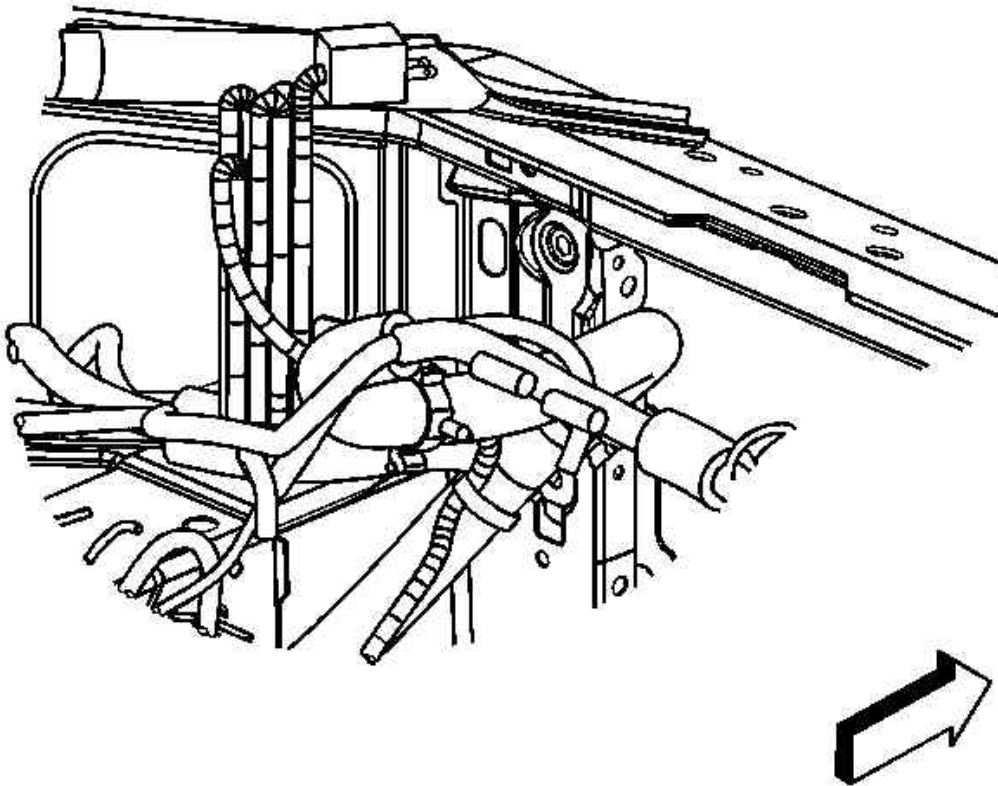


Fig. 188: View Of Coolant Heater Cord At Diagonal Brace
Courtesy of GENERAL MOTORS CORP.

1. Cut the tie strap attaching the coolant heater cord to the diagonal brace.

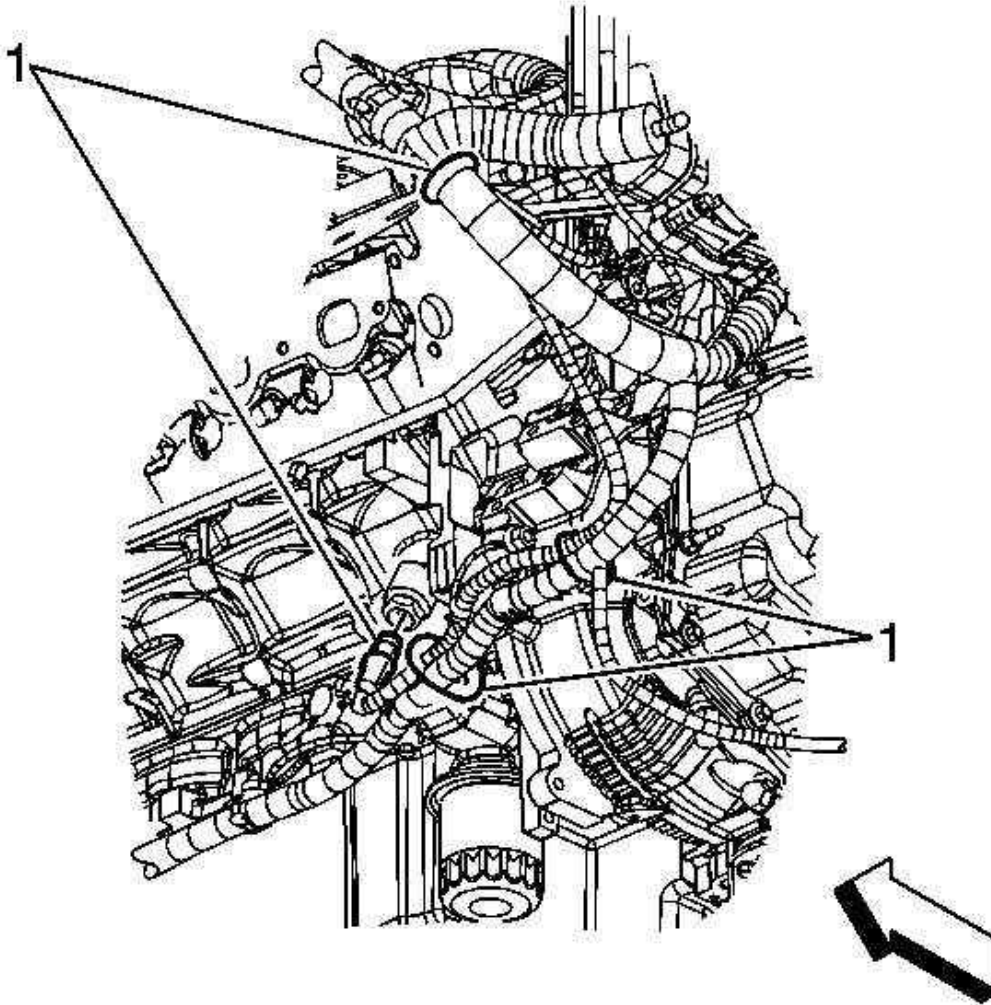


Fig. 189: Locating Tie Straps Attaching Coolant Heater Cord To Engine Wiring Harness

Courtesy of GENERAL MOTORS CORP.

2. Cut the tie straps (1) attaching the coolant heater cord to the engine wiring harness.
3. Disconnect the coolant heater cord connection from the coolant heater.
4. Remove the coolant heater cord.

Installation Procedure

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

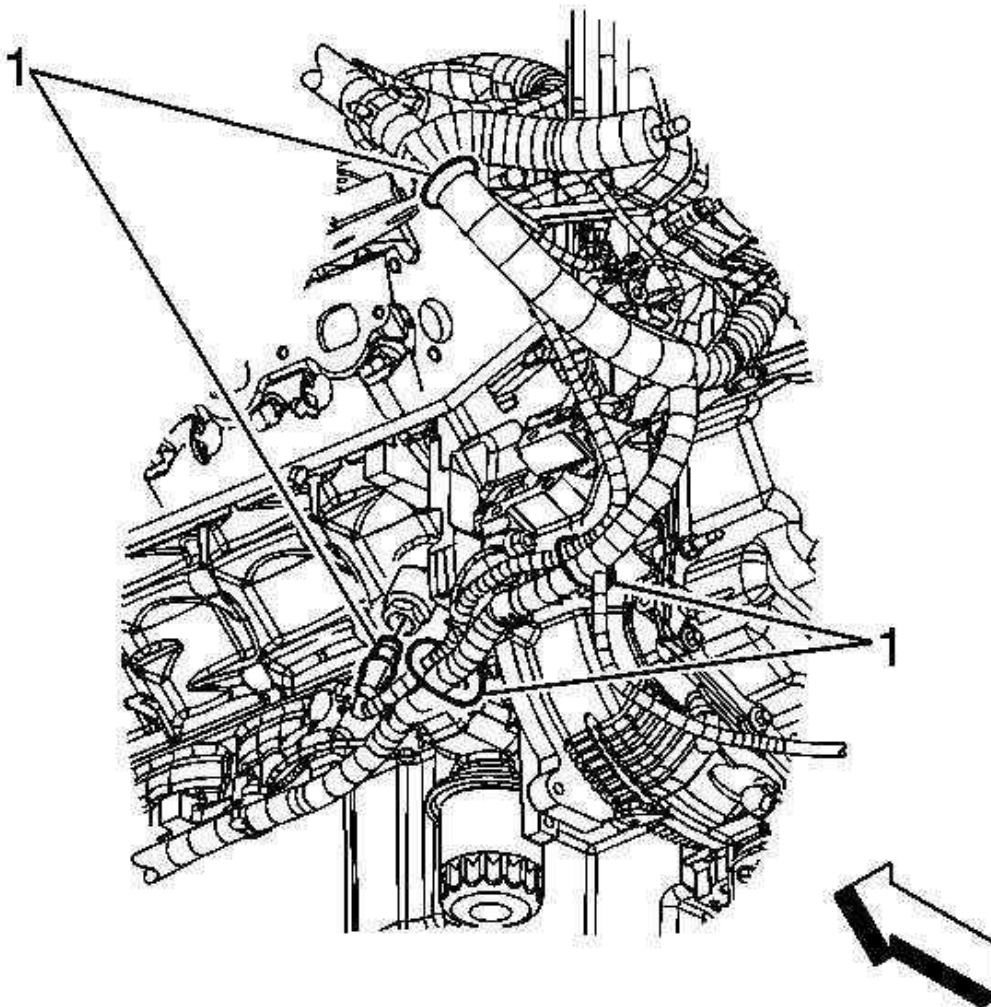


Fig. 190: Locating Tie Straps Attaching Coolant Heater Cord To Engine Wiring Harness

Courtesy of GENERAL MOTORS CORP.

1. Install the coolant heater cord.
2. Connect the coolant heater cord connection to the coolant heater.
3. Install NEW tie straps (1) attaching the coolant heater cord to the engine wiring harness.

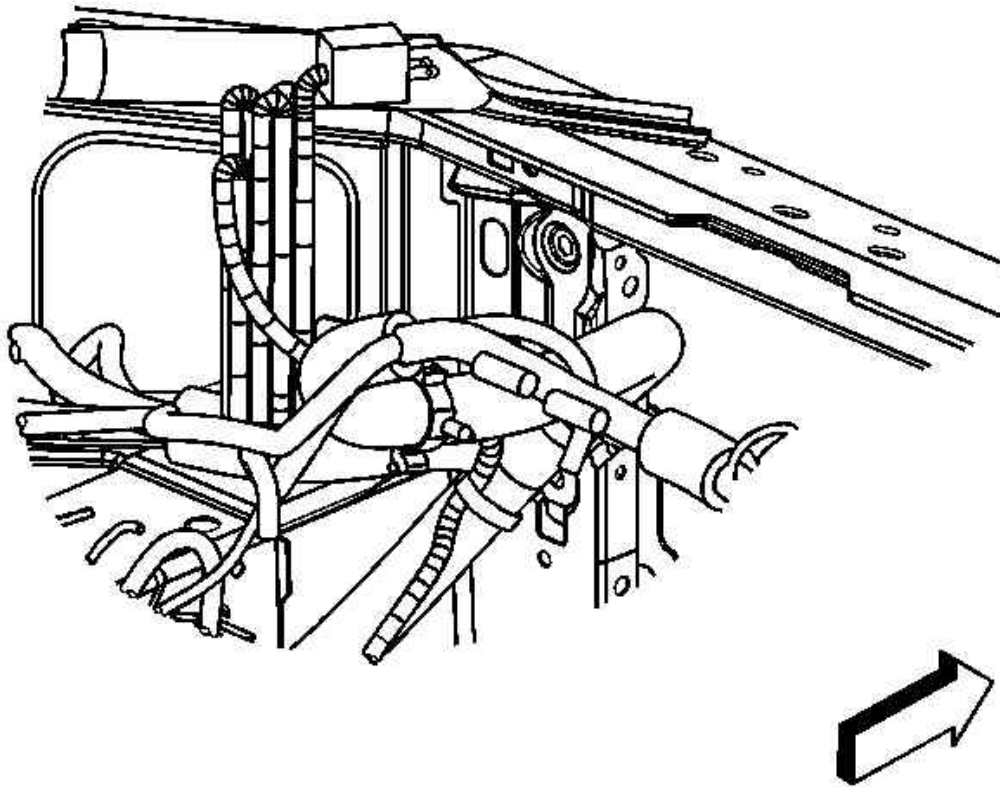


Fig. 191: View Of Coolant Heater Cord At Diagonal Brace
Courtesy of GENERAL MOTORS CORP.

4. Install a NEW tie strap attaching the coolant heater cord to the diagonal brace.

DESCRIPTION AND OPERATION

COOLING FAN DESCRIPTION AND OPERATION

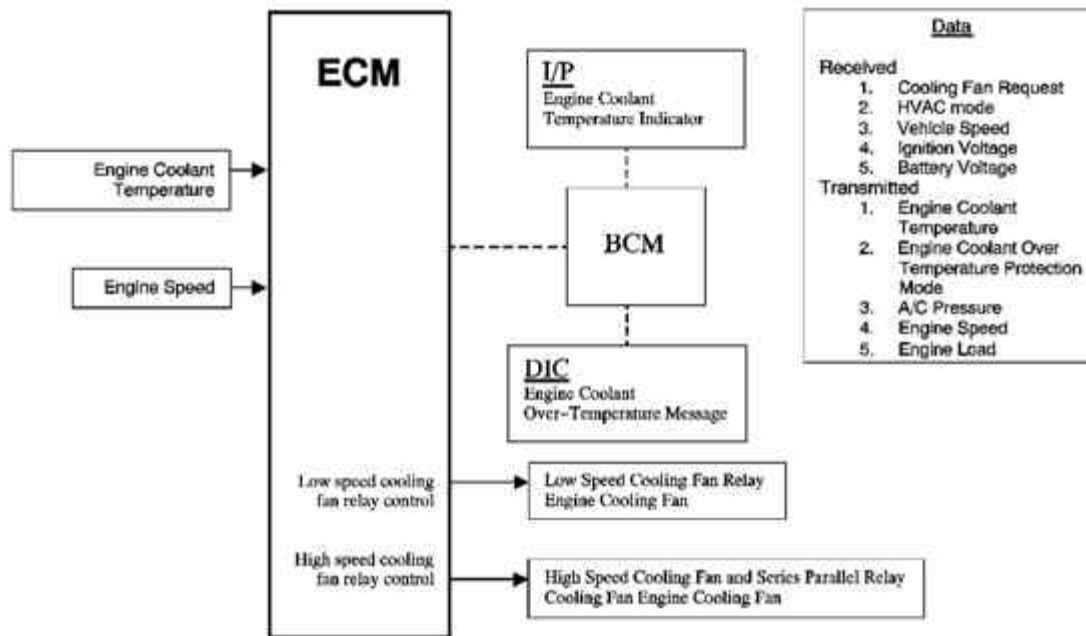


Fig. 192: Cooling Fan Description & Operation
Courtesy of GENERAL MOTORS CORP.

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 engine control module (ECM), or 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 ECM or PCM supplies the ground path for the low speed fan relay, which is the fan 1 relay 42, 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 fan 1 fuse 29 through the cooling fan motor supply voltage circuit to the left cooling fan. The ground path for the left cooling fan is through the series/parallel relay, which is the fan 2 relay 46, and the right cooling fan. The result is a series circuit with both fans running at low speed.

During high speed operation the ECM or PCM supplies the ground path for the low speed fan relay through the low speed cooling fan relay control circuit. The ECM or

PCM supplies a ground path for the high speed fan relay, which is the fan 3 relay 43, and the series/parallel relay, which is the fan 2 relay 46, through the high speed cooling fan relay control circuit. This energizes the series/parallel relay, 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 fan 2 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.

When the request for fan activation is withdrawn, the fan may not turn OFF until the ignition switch is moved to the OFF position or the vehicle speed exceeds approximately 10 mph. This is to prevent a fan from cycling ON and OFF excessively at idle.

When the request for fan activation is withdrawn, the fan may not turn OFF until the ignition switch is moved to the OFF position or the vehicle speed exceeds approximately 16 km/h (10 mph). This is to prevent a fan from cycling ON and OFF excessively at idle.

COOLING SYSTEM DESCRIPTION AND OPERATION

Cooling Fan Control

The engine cooling fan system consists of 2 electrical cooling fans and three 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. The ground path is provided at G100.

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 fan 1 relay coil, closes the relay contacts, and supplies battery positive voltage from the fan 1 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 fan 2 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 fan 1 relay through the low speed cooling fan relay control circuit. After a 3-second delay, the PCM supplies a ground path for the fan 2 relay and the fan 3 relay through the high speed cooling fan relay control circuit. This energizes the fan 2 relay coil, closes the relay contacts, and provides a ground path for the left cooling fan. At the same time the fan 3 relay coil is energized closing the relay contacts and provides battery positive voltage from the fan 2 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.

The PCM commands Low Speed Fans on under the following conditions:

- Engine coolant temperature exceeds approximately 100°C (212°F)
- When air conditioning (A/C) is requested and the ambient temperature is more than 4°C (39°F)
- A/C refrigerant pressure exceeds 1241 kPa (180 psi)
- After the vehicle is shut off if the engine coolant temperature at key-off is more than 117°C (242°F) and system voltage is more than 12 volts. The fans will stay on for approximately 3 minutes.

The PCM commands High Speed Fans on under the following conditions:

- Engine coolant temperature exceeds approximately 105°C (221°F)
- A/C refrigerant pressure exceeds 1655 kPa (240 psi)
- When certain DTCs set
- The PCM will command the cooling fans ON at any vehicle speed when the engine coolant temperature exceeds approximately 123°C (254°F)

Engine Coolant Indicators

TEMP

- The HOT COOLANT INDICATOR illuminates when the powertrain control module (PCM) determines that the coolant temperature is greater than 128°C (262°F). The HOT COOLANT INDICATOR control circuit is grounded by the

PCM, causing the HOT COOLANT INDICATOR to illuminate.

- The IPC performs the displays test at the start of each ignition cycle. The HOT COOLANT INDICATOR will illuminate during this test.

Coolant Heater

The optional engine coolant heater (RPO KO5) operates using 110-volt AC external power and is designed to warm the coolant in the engine block area for improved starting in very cold weather -29°C (-20°F). The coolant heater helps reduce fuel consumption when a cold engine is warming up. The unit is equipped with a detachable AC power cord. A weather shield on the cord is provided to protect the plug when not in use.

Cooling System

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

Cooling Cycle L26

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

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

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

Coolant is also directed to the throttle body with RPO L26. There the coolant

circulates through passages in the casting. During initial warm-up, the coolant assists in warming the throttle body.

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

Efficient operation of the cooling system requires proper functioning of all cooling system components. The cooling system consists of the following components.

Cooling Cycle LY7

Coolant is drawn from the radiator outlet to the thermostat. The flow of coolant will be stopped at the thermostat until the engine is warmed; while the thermostat is closed the water pump circulates coolant through the engine block and heater core. Coolant is returned to the water pump through the engine block and heater core outlet hose. This provides the passenger compartment with heat and defrost.

After the thermostat opens the coolant is pumped through the water pump outlet and into the engine block and heater core. In the engine block, the coolant circulates through the water jackets surrounding the cylinders where it absorbs heat.

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

From the cylinder heads, the coolant is then forced into the radiator where it is cooled and the coolant cycle is completed. Operation of the cooling system requires proper functioning of all cooling system components. The cooling system consists of the following components.

Cooling Cycle LS4

Coolant is drawn from the radiator outlet to the thermostat. The flow of coolant will be stopped at the thermostat until the engine is warmed; while the thermostat is closed the water pump circulates coolant through the engine block and heater core.

Coolant is returned to the water pump through the engine bypass and the heater core outlet hose. This provides the passenger compartment with heat and defrost.

After the thermostat opens, the coolant is pumped through the water pump outlet and into the engine block and heater core. In the engine block, the coolant circulates through the water jackets surrounding the cylinders where it absorbs heat.

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

From the cylinder heads, the coolant is then forced into the radiator where it is cooled and the coolant cycle is completed.

Operation of the cooling system requires proper functioning of all cooling system components. The cooling system consists of the following components:

Coolant

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

Radiator

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

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

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

Heat is removed from the coolant as the coolant passes through the radiator. The fins on the core transfer heat from the coolant passing through the tubes. Air passing between the fins absorbs the heat and cools the coolant.

Pressure Cap

The pressure cap seals and pressurizes the cooling system. The cap contains a blow off, or pressure valve and a vacuum, or an atmospheric valve:

- The pressure valve is held against the seat by a spring that protects the radiator by relieving pressure that exceeds 15 psi.
- The vacuum valve is held against the seat by a spring that permits opening of the valve to relieve vacuum created when the cooling system cools. The vacuum, if not relieved, might cause the radiator to collapse.

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

The pressure in the cooling system can get too high. When the pressure exceeds the strength of the spring, the pressure valve rises, venting the excess pressure.

As the engine cools, the temperature of the coolant drops and a vacuum is created in the cooling system. This vacuum causes the vacuum valve to open. This equalizes the pressure in the cooling system with the atmospheric pressure, preventing the radiator from collapsing.

Coolant Recovery System

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

In effect, a cooling system with a coolant recovery reservoir is a closed system.

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

Air Baffles and Seals

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

Water Pump

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

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

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

Thermostat

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

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

Transmission Oil Cooler

The transmission oil cooler is a heat exchanger. It is located inside the right side end tank of the radiator. The transmission fluid temperature is regulated by the temperature of the engine coolant that surrounds the oil cooler as the transmission fluid passes down through the cooler.

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

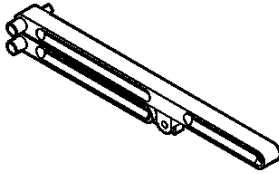
SPECIAL TOOLS AND EQUIPMENT

SPECIAL TOOLS

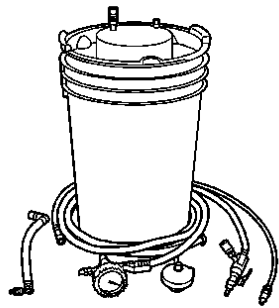
Illustration	Tool Number/ Description
	EN 46104

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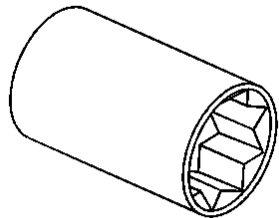
2008 ENGINE Engine Cooling - LaCrosse



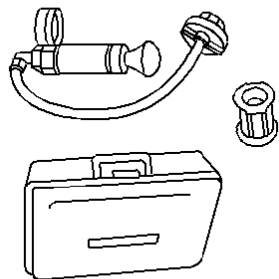
Water Pump Pulley Holding Tool



GE 47716
Vac N Fill Coolant Refill Tool



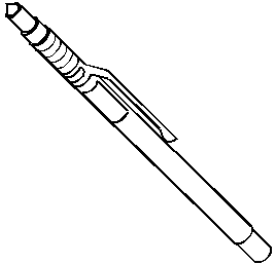
GE 47827
Socket



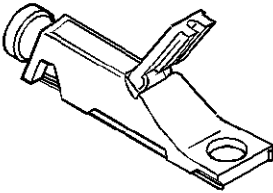
J 24460-01
Cooling System Pressure Tester

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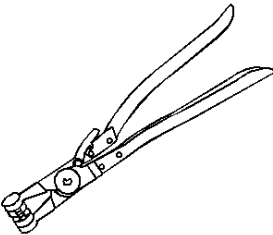
J 24731
Tempil Stick



J 26568
Coolant and Battery Fluid Tester



J 28410
Gasket Remover



J 38185
Hose Clamp Pliers

J 42401
Radiator Cap/Surge Tank Test Adapter

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