2004 ENGINE

Engine Cooling - C/K SUV

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Air Cleaner Outlet Duct Clamp Screw - 4.8L, 5.3L, and 6.0L Engines	7 N.m	62 lb in
Coolant Air Bleed Pipe Stud/Bolt - 4.8L, 5.3L, and 6.0L Engines	12 N.m	106 lb in
Coolant Crossover Bolt - 8.1L Engine	50 N.m	37 lb ft
Coolant Heater Cord Bolt	8 N.m	71 lb in
Coolant Heater - 4.8L, 5.3L, and 6.0L	50 N.m	37 lb ft
Coolant Heater - 8.1L	60 N.m	40 lb ft
Engine Block Coolant Drain Plug	60 N.m	44 lb ft
Fan Clutch Bolt	23 N.m	17 lb ft
Fan Clutch Nut	56 N.m	41 lb ft
Fan Shroud Bolt	9 N.m	80 lb in
Generator Bracket Stud	20 N.m	15 lb ft
Oil Cooler Hose Adapter Bolt - 6.0L Engine	12 N.m	106 lb in
Oil Cooler Hose Bracket Bolt - 6.0L Engine	25 N.m	18 lb ft
Oil Pan Skid Plate Bolt	20 N.m	15 lb ft
Radiator Bolt	25 N.m	18 lb ft
Surge Tank Bolt/Nut	9 N.m	80 lb in
Transmission Control Module (TCM) Cover Bolt	9 N.m	80 lb in
Transmission Control Module (TCM) Electrical Connector Bolt	8 N.m	71 lb in
Water Outlet Bolt - 8.1L Engine	30 N.m	22 lb ft
Water Pump Bolt - 4.8L, 5.3L, and 6.0L Engines		
• First Pass	15 N.m	11 lb ft
• Final Pass	30 N.m	22 lb ft
Water Pump Bolt - 8.1L Engine	50 N.m	37 lb ft
Water Pump Inlet Bolt	15 N.m	11 lb ft

SCHEMATIC AND ROUTING DIAGRAMS

ENGINE COOLING SCHEMATICS

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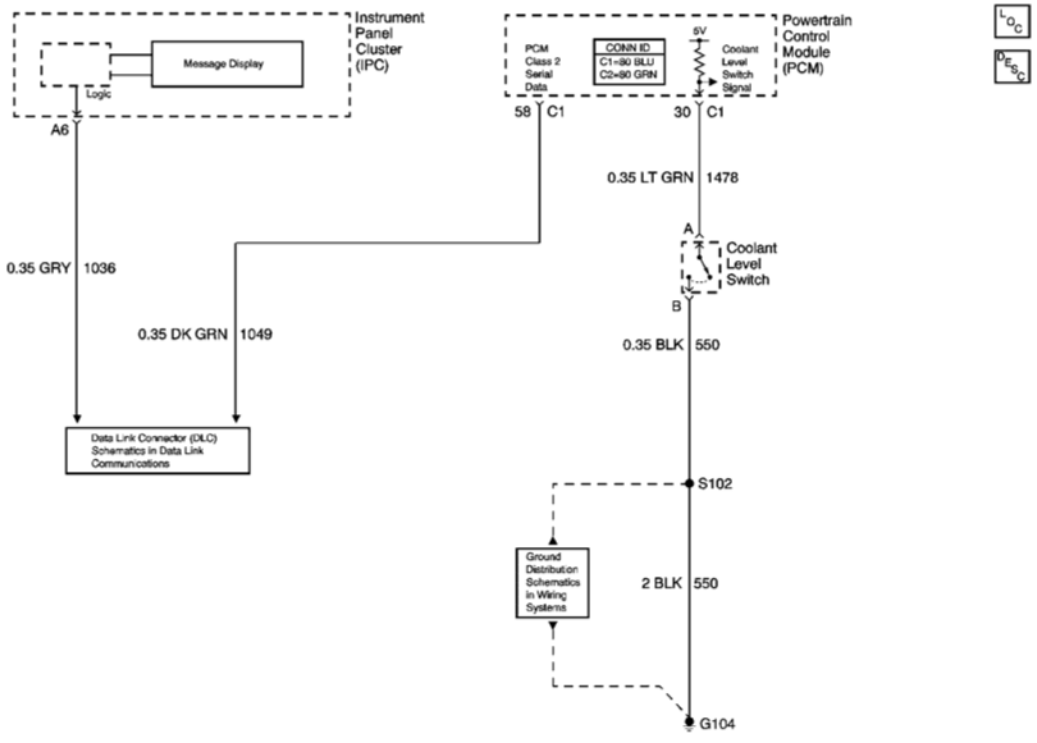


Fig. 1: Engine Coolant Level Switch Schematic
Courtesy of GENERAL MOTORS CORP.

COMPONENT LOCATOR

COOLING SYSTEM COMPONENT VIEWS

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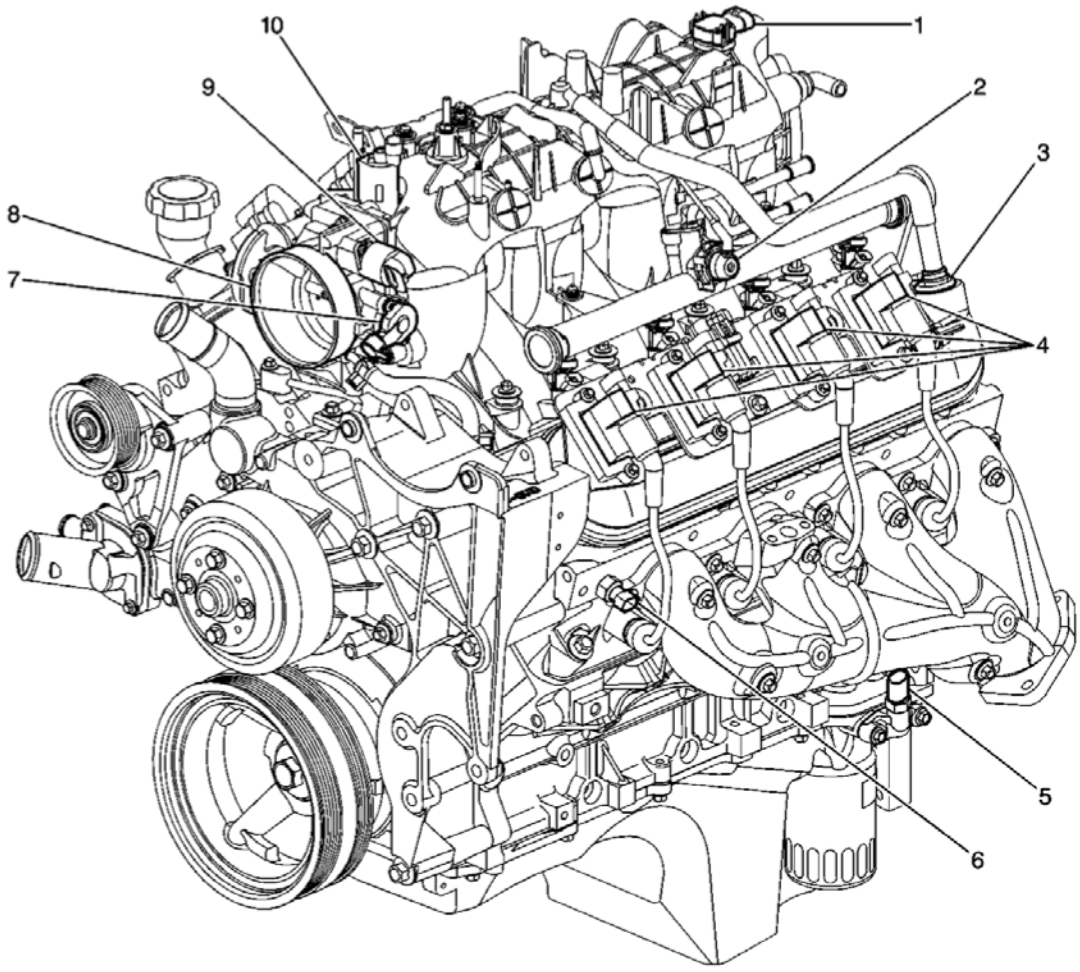


Fig. 2: Full Engine View - Left Side - 4.8L, 5.3L, 6.0L
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 2

Callout	Component Name
1	Manifold Absolute Pressure (MAP) sensor
2	Fuel Pressure Regulator
3	Positive Crankcase Ventilation (PCV) Valve
4	Left Bank Ignition Coils
5	Engine Oil Pressure (EOP) Sensor
6	Engine Coolant Temperature (ECT) Sensor
7	Throttle Position (TP) Sensor
8	Throttle Body
9	Idle Air Control (IAC) Valve
10	Evaporative Emission (EVAP) Canister Purge Solenoid

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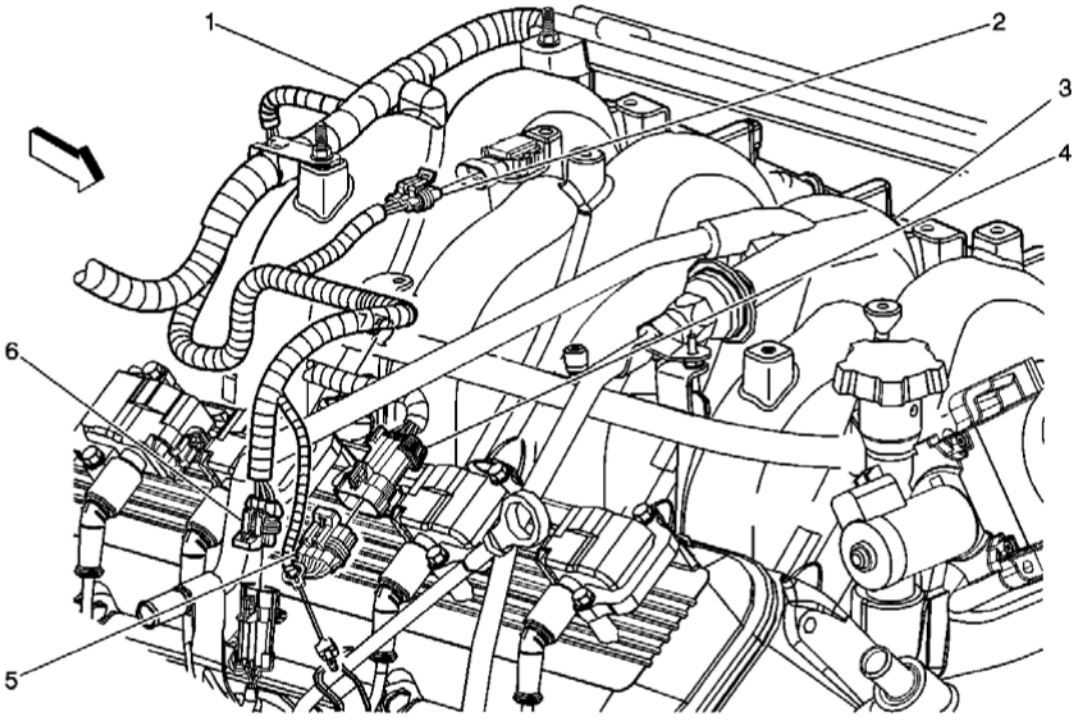


Fig. 3: Engine View - Upper Right - 8.1L
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 3

Callout	Component Name
1	Engine Harness
2	Manifold Absolute Pressure (MAP) Sensor Connector
3	Engine
4	Engine Coil Harness Connector
5	Engine Coil Connector
6	Engine Coolant Temperature (ECT) Sensor Connector

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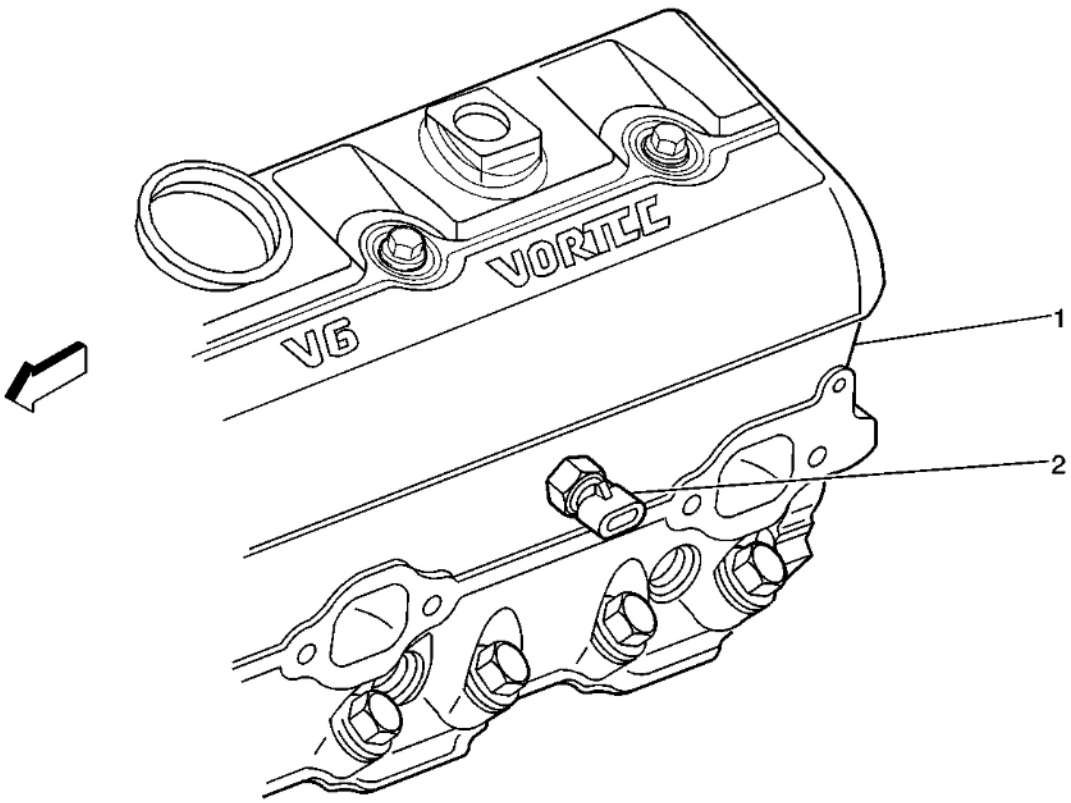


Fig. 4: Engine Coolant Temperature (ECT) Sensor Component View - 4.3L
Courtesy of GENERAL MOTORS CORP.

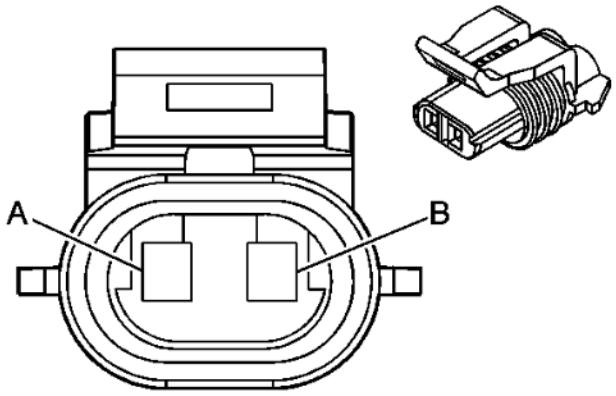
Callouts For Fig. 4

Callout	Component Name
1	Bank 1 Cylinder Head
2	Engine Coolant Temperature (ECT) Sensor

COOLING SYSTEM CONNECTOR END VIEWS

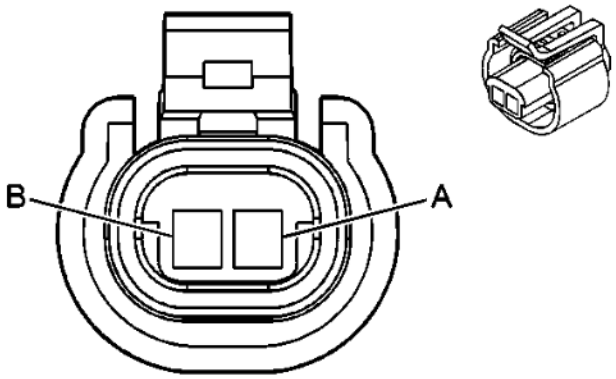
Coolant Level Switch Connector End View - Gas

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Connector Part Information		• 12052644 • 2-Way F Metri-Pack 150 Series Sealed (GRY)	
Pin	**Wire Color**	**Circuit No.**	**Function**
A	LT GRN	1478	Coolant Level Switch Signal
B	BLK	550	Ground

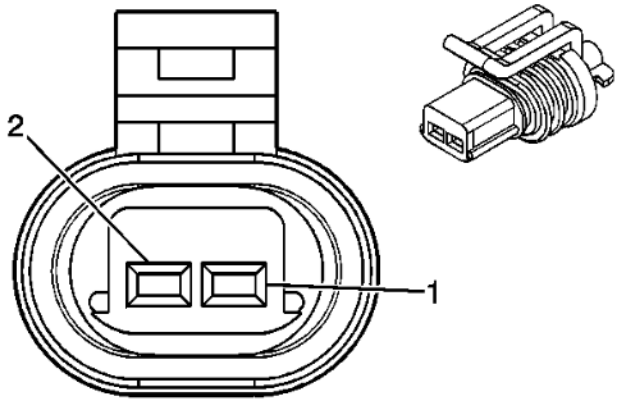
Coolant Level Switch Connector End View - Diesel



Connector Part Information		• 15324243 • 2-Way F Metri-Pack 150 Series Sealed (GRY)	
Pin	**Wire Color**	**Circuit No.**	**Function**
A	LT GRN	1478	Coolant Level Switch Signal
B	BLK	550	Ground

Engine Coolant Temperature (ECT) Sensor Connector End View

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Connector Part Information		• 15336024 • 2-Way F GT 150 Series Sealed (BLK)	
Pin	**Wire Color**	**Circuit No.**	**Function**
1	BLK	407	Low Reference
2	YEL	410	ECT Sensor Signal

DIAGNOSTIC INFORMATION AND PROCEDURES

DIAGNOSTIC STARTING POINT - ENGINE COOLING

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

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

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

DIAGNOSTIC SYSTEM CHECK - ENGINE COOLING

Test Description

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

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

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4: Determine if the Instrument Cluster or Powertrain Control Modules have set DTCs which may affect Engine Cooling operation are present.

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

Diagnostic System Check - Engine Cooling

Step	Action	Yes	No
1	Did you review a Diagnostic Starting Point-Engine Cooling?	Go to **Step 2**	Go to **Diagnostic Starting Point - Engine Cooling**
2	Install a scan tool. Does the scan tool power up?	Go to **Step 3**	Go to **Scan Tool Does Not Power Up** in Data Link Communications
3	1. Turn ON the ignition, with the engine OFF. 2. Attempt to establish communication with the following control modules: • The instrument cluster • The powertrain control module Does the scan tool communicate with the control modules?	Go to **Step 4**	Go to **Scan Tool Does Not Communicate with Class 2 Device** in Data Link Communications
4	Select the powertrain control module display DTCs function on the scan tool. Does the scan tool display any DTCs?	Go to **Step 5**	Go to **Symptoms - Engine Cooling**
5	Does the scan tool display any DTCs which begin with a "U"?	Go to **Scan Tool Does Not Communicate with Class 2 Device** in Data Link Communications	Go to **Step 6**
6	Does the scan tool display any DTCs that are associated with the Engine Cooling System?	Go to **Diagnostic Trouble Code (DTC) List**	Go to **Diagnostic Trouble Code (DTC) List** in Engine Controls - 4.8L, 5.3L, and 6.0L or **Diagnostic Trouble Code (DTC) List** in Engine Controls - 8.1L

SCAN TOOL OUTPUT CONTROLS

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Instrument Cluster Scan Tool Output Controls

Scan Tool Output Control	Additional Menu Selection(s)	Description
Check Coolant Temp	Lamp Test	Command the instrument cluster message center module to activate the output. The scan tool will displays the status of the selected output. This status information represents only what the scan tool has commanded, not what action was actually taken.
Check Engine Temp	Lamp Test	Command the instrument cluster message center module to activate the output. The scan tool will displays the status of the selected output. This status information represents only what the scan tool has commanded, not what action was actually taken.
Low Coolant	Lamp Test	Command the instrument cluster message center module to activate the output. The scan tool will displays the status of the selected output. This status information represents only what the scan tool has commanded, not what action was actually taken.
Reduced Engine Power	Lamp Test	Command the instrument cluster message center module to activate the output. The scan tool will displays the status of the selected output. This status information represents only what the scan tool has commanded, not what action was actually taken.

SCAN TOOL DATA LIST

Instrument Panel Cluster (IPC) Scan Tool Data List

Scan Tool Parameter	Data List	Units Displayed	Typical Data Value
Ignition Switch in RUN/Engine running/Automatic Transmission in PARK/Manual Transmission in NEUTRAL/Air Conditioner is OFF			
Check Coolant Temp	Outputs	On/Off	Off
Check Engine Temp	Outputs	On/Off	Off
Displayed Coolant Temp	Data	Celsius (C)/Fahrenheit (F)	87°C (189°F)
Low Coolant	Outputs	On/Off	Off
Monitored Coolant Temp	Data	Celsius (C)/Fahrenheit (F)	87°C (Fluctuates range 82-93°C) 189° F (Fluctuates range 180-200°F)
Reduced Engine Power	Outputs	On/Off	Off

Powertrain Control Module (PCM) Scan Tool Data List - 4.3L

Scan Tool Parameter	Data List	Units Displayed	Typical Data Value
Ignition Switch in RUN/Engine running/Automatic Transmission in PARK/Manual Transmission in NEUTRAL/Air Conditioner is OFF			

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Coolant Level Switch	Engine Data 2	Low/OK	OK
ECT Sensor	Engine Data 2	Degrees	87°C (189°F)

Powertrain Control Module (PCM) Scan Tool Data List - 4.8L, 5.3L & 6.0L

Scan Tool Parameter	Data List	Units Displayed	Typical Data Value
Ignition Switch in RUN/Engine running/Automatic Transmission in PARK/Manual Transmission in NEUTRAL/Air Conditioner is OFF			
Coolant Level Switch	Engine Data 2	Low/OK	OK
ECT Sensor	Engine Data 1 Engine Data 2	Degrees	87°C (189°F)

Powertrain Control Module (PCM) Scan Tool Data List - 8.1L

Scan Tool Parameter	Data List	Units Displayed	Typical Data Value
Ignition Switch in RUN/Engine running/Automatic Transmission in PARK/Manual Transmission in NEUTRAL/Air Conditioner is OFF			
Coolant Level Switch	Engine Data 2	Low/OK	No
ECT	Engine Data 1 Engine Data 2 Engine Data 3	Degrees	87°C (189°F)

SCAN TOOL DATA DEFINITIONS

Check Coolant Temp - Range: ON/OFF

This output refers to the commanded state of the Check Coolant Temp message located in the message center. The message will be added to the message center display based on the engine coolant temperature that is sent to the Instrument Cluster as a class 2 message from the PCM. If the engine temperature is greater than 121°C (250°F) the message will be added to the message center, unless the Check Engine Temp message has been added to the message center, and removed when the engine temperature is less than 118°C (245°F).

Check Engine Temp - Range: ON/OFF

This output refers to the commanded state of the Check Engine Temp message located in the message center. The message will be added to the message center display based on the engine coolant temperature that is sent to the Instrument Cluster as a class 2 message from the PCM. If the engine temperature is greater than 128°C (262°F) the message will be added to the message center and removed when the engine temperature is less than 125°C (257°F).

Coolant Level Switch - Range: Low/OK

This parameter indicates when the engine coolant level is low. The scan tool displays Low when the PCM detects the engine coolant level switch is open.

ECT - Range: -40°C to +150°C (-40°F to +302°F)

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The PCM applies 5.0 volts to the ECT sensor circuit. The sensor is a thermistor which changes internal resistance as the engine temperature changes. When the sensor is cold (internal resistance high), the PCM senses a high signal voltage and interprets the voltage as a cold engine. As the sensor warms (internal resistance decreases), the voltage signal decreases and the PCM interprets the lower voltage as a warm engine.

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

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

Low Coolant - Range: ON/OFF

This output refers to the command state of the Low Coolant message located in the message center. ON is displayed when the Instrument Cluster is commanding the Low Coolant message ON. OFF is displayed when the Instrument Cluster is not commanding the Low Coolant message ON. The Instrument Cluster will display the Low Coolant message when the Instrument Cluster receives a class 2 serial data message from the PCM.

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

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

Reduced Engine Power - Range: ON/OFF

This output refers to the commanded state of the Reduced Engine Power message located in the message center. On is displayed when the Instrument Cluster is commanding the Reduced Engine Power message ON. OFF is displayed when the Instrument Cluster is not commanding the Reduced Engine Power message ON. The Instrument Cluster will display the Reduced Engine Power message when the Instrument Cluster receives a class 2 serial data message from the PCM when the engine temperature reaches 132°C (270°F).

DIAGNOSTIC TROUBLE CODE (DTC) LIST

Diagnostic Trouble Code (DTC) List

DTC	Diagnostic Procedure	Module
P0116	• **DTC P0116** in Engine Controls - 4.8L, 5.3L, and 6.0L • **DTC P0116** in Engine Controls - 8.1L	PCM
P0117	• **DTC P0117** in Engine Controls - 4.8L, 5.3L, and 6.0L	PCM

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	• **DTC P0117** in Engine Controls - 8.1L	
P0118	• **DTC P0118** in Engine Controls - 4.8L, 5.3L, and 6.0L • **DTC P0118** in Engine Controls - 8.1L	PCM
P0125	• **DTC P0125** in Engine Controls - 4.8L, 5.3L, and 6.0L • **DTC P0125** in Engine Controls - 8.1L	PCM
P0128	• **DTC P0128** in Engine Controls - 4.8L, 5.3L, and 6.0L • **DTC P0128** in Engine Controls - 8.1L	PCM
P1258	**DTC P1258**	PCM

DTC P1258

Circuit Description

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

Conditions for Running the DTC

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

Conditions for Setting the DTC

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

Action Taken When the DTC Sets

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

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF after 3 consecutive trips that the diagnostic has been run and passed.
- The history DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.

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- The DTC can be cleared by using the scan tool Clear DTC Information function.

DTC P1258

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

SYMPTOMS - ENGINE COOLING

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

Visual/Physical Inspection

- Inspect for aftermarket devices which could affect the operation of the Cooling System. Refer to **Checking Aftermarket Accessories** in Wiring Systems.
- Inspect the easily accessible or visible system components for obvious damage or conditions which could cause the symptom.
- Inspect the surge tank reservoir for the proper coolant level.

Intermittent

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

Symptom List

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

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

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ENGINE OVERHEATED INDICATOR ALWAYS ON

Engine Overheated Indicator Always On

Step	Action	Yes	No
Connector End View Reference: Engine Cooling Schematics DEFINITION: One of the following engine coolant temperature indicators is always On: Engine Coolant, Engine Coolant Hot/Idle Engine, Engine Hot-AC Off, Engine Overheated/Stop Engine.			
1	Did you perform the Engine Cooling Diagnostic System Check?	Go to **Step 2**	Go To **Diagnostic System Check - Engine Cooling**
2	Start the engine. Does the Engine Coolant Temperature indicator illuminate?	Go to **Step 3**	Go to **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems
3	1. Install a scan tool. 2. With the scan tool, observe the engine coolant temperature parameter in the powertrain control module (PCM) data list. Does the scan tool indicate that the coolant temperature is within the temperature range shown on the temperature gage?	Go to **Engine Overheating**	Go to **Step 4**
4	Replace the instrument panel cluster (IPC). Refer to **Instrument Panel Cluster (IPC) Replacement** in Instrument Panel, Gages, and Console. Did you complete the replacement?	Go to **Step 5**	-
5	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to **Step 2**

ENGINE COOLANT TEMPERATURE INDICATOR ALWAYS ON

Engine Coolant Temperature Indicator Always On

Step	Action	Yes	No
Connector End View Reference: Cooling System Connector End Views DEFINITION: One of the following engine coolant temperature indicators is always On: Engine Coolant, Engine Coolant Hot/Idle Engine, Engine Hot-AC Off, Engine Overheated/Stop Engine.			
1	Did you perform the Engine Cooling Diagnostic System Check?	Go to **Step 2**	Go To **Diagnostic System Check - Engine Cooling**
2	Start the engine. Does the Engine Coolant Temperature indicator illuminate?	Go to **Step 3**	Go to **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems

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3	1. Install a scan tool. 2. With the scan tool, observe the engine coolant temperature parameter in the powertrain control module (PCM) data list. Does the scan tool indicate that the coolant temperature is within the temperature range shown on the temperature gage?	Go to **Engine Overheating**	Go to **Step 4**
4	Replace the instrument panel cluster (IPC). Refer to **Instrument Panel Cluster (IPC) Replacement** in Instrument Panel, Gages, and Console. Did you complete the replacement?	Go to **Step 5**	-
5	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to **Step 2**

LOW ENGINE COOLANT INDICATOR ALWAYS ON

Low Engine Coolant Indicator Always On

Step	Action	Yes	No
Connector End View Reference: Engine Cooling Schematics			
1	Did you perform the Engine Cooling Diagnostic System Check?	Go to **Step 2**	Go to **Diagnostic System Check - Engine Cooling**
2	1. Verify that the engine coolant is at the proper level. 2. Turn ON the ignition, with the engine OFF. Does the instrument panel cluster (IPC) display Low Engine Coolant?	Go to **Step 3**	Go to **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems
3	1. Install a scan tool. 2. With a scan tool, view the Coolant Level Switch data in the Engine Data 2 data list. Does the scan tool display Low?	Go to **Step 4**	Go to **Step 7**
4	1. Disconnect the coolant level sensor electrical connector. 2. Connect a 3-amp fused jumper between the coolant level switch signal circuit of the coolant level sensor electrical connector and the ground circuit of the coolant level sensor electrical connector. 3. With a scan tool, view the Coolant Level Switch data in the Engine Data 2 data list.		

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	Does the scan tool display OK?	Go to **Step 8**	Go to **Step 5**
5	1. Connect a 3-amp fused jumper between the coolant level switch signal circuit of the coolant level sensor electrical connector and a good ground. 2. With a scan tool, view the Coolant Level Switch data in the Engine Data 2 data list. Does the scan tool display OK?	Go to **Step 10**	Go to **Step 6**
6	Inspect the coolant level signal circuit for an open or short. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 14**	Go to **Step 9**
7	Inspect for poor connections at the harness connector of the IPC. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 14**	Go to **Step 11**
8	Inspect for poor connections at the harness connector of the coolant level sensor. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 14**	Go to **Step 12**
9	Inspect for poor connections at the harness connector of the powertrain control module (PCM). Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 14**	Go to **Step 13**
10	Repair the open in the ground circuit of the coolant level sensor. Refer to **Wiring Repairs** in Wiring Systems. Did you Complete the repair?	Go to **Step 14**	-
11	Replace the IPC. Refer to **Instrument Panel Cluster (IPC) Replacement** in Instrument Panel, Gages and Console. Did you Complete the repair?	Go to **Step 14**	-
12	Replace the surge tank. Refer to **Surge Tank Replacement**. Did you Complete the repair?	Go to **Step 14**	-
13	Replace the PCM. Refer to **Powertrain Control Module (PCM) Replacement** in Engine Controls. Did you Complete the repair?	Go to **Step 14**	-
14	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to **Step 3**

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ENGINE OVERHEATING

Engine Overheating

Step	Action	Yes	No
1	Inspect for a missing or damaged radiator side or upper baffle and/or radiator air deflector. Is the baffle and/or deflector missing or damaged?	Go to **Step 8**	Go to **Step 2**
2	Inspect for a loss of coolant. Is there a loss of coolant?	Go to **Step 3**	Go to **Step 4**
3	Fill the system to the specified level. Does the engine overheat?	Go to **Step 4**	System OK
4	Inspect for low temperature protection. Is the coolant to the correct concentration?	Go to **Step 5**	Go to **Step 8**
5	Inspect for a loss of cooling system pressure. Is there a loss of system pressure?	Go to **Step 8**	Go to **Step 6**
6	Inspect for a faulty engine coolant temperature (ECT) sensor. Refer to **DTC P0117** , **DTC P0118** in Engine Controls - 4.8L, 5.3L, and 6.0L, or to **DTC P0117** , **DTC P0118** in Engine Controls - 8.1L. Is the sensor operating properly?	Go to **Step 7**	Go to **Step 8**
7	Inspect for the following: • Damaged coolant surge tank • Leaking hose • Bad/incorrect surge tank or radiator cap Were any of the above found?	Go to **Step 8**	Go to **Step 3**
8	Repair or install new parts as necessary, then retest. Does the engine overheat?	Go to **Step 9**	System OK
9	Inspect for incorrect drive belt tension. Is the belt tension correct?	Go to **Step 10**	Go to **Step 8**
10	1. Remove the water pump. Refer to **Water Pump Replacement (4.8L, 5.3L, and 6.0L Engines)** or **Water Pump Replacement (8.1L Engine)**. 2. Inspect for a damaged water pump shaft/hub. Is the water pump driveshaft damaged or is the seal leaking?	Go to **Step 8**	Go to **Step 11**
11	Inspect for obstructed radiator air flow or bent radiator fins. Is the radiator air flow obstructed?	Go to **Step 8**	Go to **Step 12**
12	Inspect for blocked cooling system passages. Are the cooling system passages blocked?	Go to **Step 8**	Go to **Step 13**

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13	Inspect for inoperative fan clutch. Refer to **Fan Clutch Diagnosis**. Is the fan clutch operating correctly?	Go to **Step 14**	Go to **Step 8**
14	Inspect the thermostat. Refer to **Thermostat Diagnosis**. Is the thermostat stuck in the closed position?	Go to **Step 15**	Go to **Step 16**
15	Replace the thermostat. Refer to **Thermostat Housing Replacement (4.8L, 5.3L, and 6.0L Engines)** or **Thermostat Replacement (8.1L Engine)**. Does the engine overheat?	Go to **Step 16**	System OK
16	Inspect the radiator cooling capacity. Is the proper sized radiator being used on the vehicle?	Go to **Step 3**	Go to **Step 17**
17	Consult the current parts catalog and replace the radiator. Refer to **Radiator Replacement (EXC 8.1L)** or **Radiator Replacement (8.1L)**. Is the repair complete?	System OK	-

LOSS OF COOLANT

Loss of Coolant

Step	Action	Yes	No
DEFINITION: The cooling system is loosing coolant either internally or externally.			
1	Were you sent here from Symptoms, or another diagnostic table?	Go to **Step 2**	Go to **Symptoms - Engine Cooling**
2	Repair any present DTCs. Refer to **Diagnostic System Check - Engine Cooling**. Is the action complete?	Go to **Step 3**	-
3	Inspect the coolant level. Is the coolant at the proper level?	Go to **Step 5**	Go to **Step 4**
4	Fill the cooling system to the proper level. Refer to **Draining and Filling Cooling System**. Is the action complete?	Go to **Step 5**	-
5	Engine overheating can cause a loss of coolant. Is the engine overheating?	Go to **Step 19**	Go to **Step 6**
6	1. Idle the engine at normal operating temperature. 2. Inspect for heavy white smoke coming out of the exhaust pipe. Is a heavy white smoke present from the exhaust pipe?	Go to **Step 7**	Go to **Step 8**
7	• Coolant in the exhaust system creates a distinctive, burning coolant odor in the exhaust. • Condensation in the exhaust system can cause an odorless white smoke during engine warm up.		

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	Does the white smoke have a burning coolant type odor?	Go to **Step 20**	Go to **Step 8**
8	Visually inspect the hoses, pipes and hose clamps. Are any of the hoses, clamps or pipes leaking?	Go to **Step 21**	Go to **Step 9**
9	Visually inspect the following components: • Block heater • Coolant pressure cap • Core plugs • Throttle body • Engine block • Intake manifold • Radiator • Thermostat housing • Water pump Are any of the listed components leaking?	Go to **Step 21**	Go to **Step 10**
10	1. Pressure test the cooling system. Refer to **Cooling System Leak Testing**. 2. With the cooling system pressurized, visually inspect the components listed in steps 7 and 8. Are any leaks present?	Go to **Step 21**	Go to **Step 11**
11	Pressure test the coolant pressure cap. Refer to **Pressure Cap Testing**. Does the coolant pressure cap hold pressure?	Go to **Step 12**	Go to **Step 16**
12	Inspect for the following conditions: • A coolant smell inside of the vehicle • Coolant in the HVAC module drain tube • Coolant on the vehicle floor covering near the HVAC module Is coolant present?	Go to **Step 21**	Go to **Step 13**
13	Inspect the underside of the engine oil fill cap for a gray/white milky substance. Is there a milky substance under the oil fill cap?	Go to **Step 14**	Go to **Step 15**
14	Inspect the engine oil fluid level indicator for a gray/white milky substance. Is there a milky substance on the engine oil fluid level indicator?	Go to **Step 17**	Go to **Step 15**

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15	Inspect the automatic transmission oil fluid level indicator, if equipped, for a gray/white milky substance. Is there a milky substance on the automatic transmission fluid level indicator?	Go to **Step 18**	Go to **Step 22**
16	Replace the coolant pressure cap. Is the repair complete?	Go to **Step 22**	-
17	1. Replace the radiator. Refer to **Radiator Replacement (EXC 8.1L)** or **Radiator Replacement (8.1L)**. 2. Service the engine oil and filter. Refer to **Engine Oil and Oil Filter Replacement** in Engine Mechanical - 4.8L, 5.3L, and 6.0L. Is the repair complete?	Go to **Step 22**	-
18	1. Replace the radiator. Refer to **Radiator Replacement (EXC 8.1L)** or **Radiator Replacement (8.1L)**. 2. Service the automatic transmission. Refer to **Engine Coolant/Water in Transmission** in Automatic Transmission. Is the repair complete?	Go to **Step 22**	-
19	Repair the engine overheating condition. Refer to **Engine Overheating**. Is the repair complete?	Go to **Step 22**	-
20	Repair the engine internal coolant leak. Refer to **Coolant in Combustion Chamber** in Engine Mechanical - 4.8L, 5.3L, and 6.0L or **Coolant in Combustion Chamber** in Engine Mechanical - 8.1L or **Coolant in Engine Oil** in Engine Mechanical - 4.8L, 5.3L, and 6.0L or **Coolant in Engine Oil** in Engine Mechanical - 8.1L. Is the repair complete?	Go to **Step 22**	-
21	Repair or replace the leaking component. Refer to the appropriate repair. Is the repair complete?	Go to **Step 22**	-
22	Operate the system in order to verify the repair. Did you find and correct the condition?	System OK	Go to **Step 2**

THERMOSTAT DIAGNOSIS

Tools Required

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

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

Thermostat Test Procedure Using Tempil Sticks

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

1. Use a tempil stick in order to find the opening and the closing temperatures of the coolant thermostat.
   - **J 24731** -188 tempil stick melts at 87°C (188°F). See **Special Tools and Equipment**. The thermostat should begin to open.
   - **J 24731** -206 tempil stick melts at 97°C (206°F). See **Special Tools and Equipment**. The thermostat should be fully open.
2. Replace the coolant thermostat if it does not operate properly between this temperature range.

Thermostat Test Procedure Using Glycol

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

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

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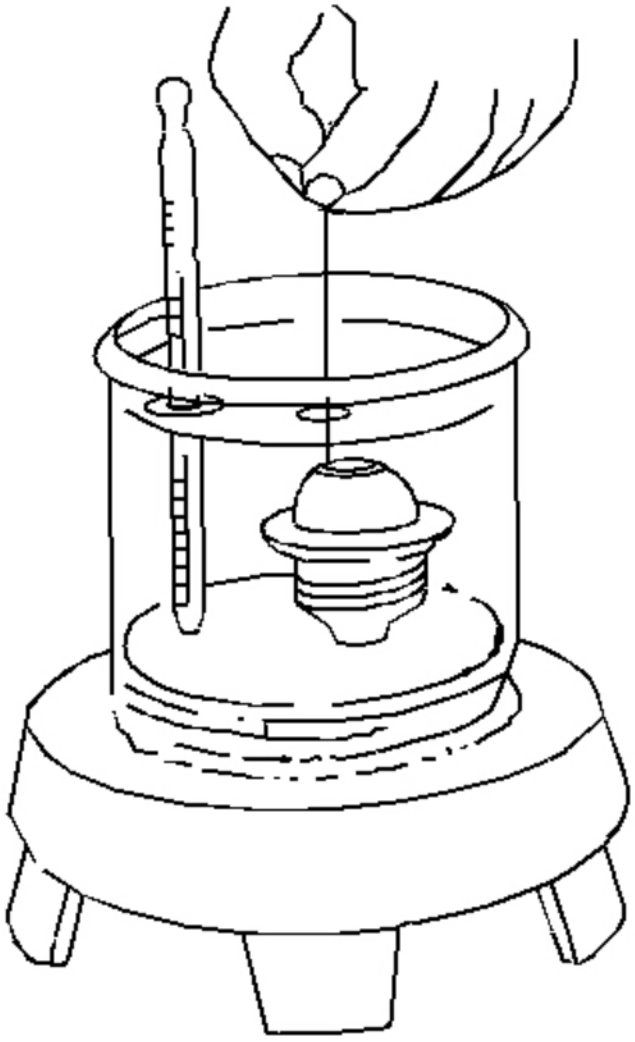


Fig. 5: View Of Thermostat Test Procedure Using Glycol
Courtesy of GENERAL MOTORS CORP.

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

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

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

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temperature indicated on the thermostat valve.

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

COOLANT HEATER INOPERATIVE

Coolant Heater Inoperative

Step	Action	Yes	No
1	Did you perform the necessary inspections?	Go to **Step 2**	Go to **Symptoms - Engine Cooling**
2	Test the engine coolant heater power supply cord for an open or short to ground. Refer to **Circuit Testing** in Wiring Systems. Did you find a condition?	Go to **Step 3**	Go to **Step 4**
3	Replace the engine coolant heater power supply cord. Refer to **Coolant Heater Cord Replacement**. Did you complete the repair?	Go to **Step 6**	-
4	Inspect for poor connections at the harness connector of the engine coolant heater. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 6**	Go to **Step 5**
5	Replace the engine coolant heater. Refer to **Coolant Heater Replacement (Dealer Installation - 6.0L Engine)** or **Coolant Heater Replacement (4.8L, 5.3L, and 6.0L Engines)** or **Coolant Heater Replacement (8.1L Engine)**. Did you complete the repair?	Go to **Step 6**	-
6	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to **Step 2**

ENGINE FAILS TO REACH NORMAL OPERATING TEMPERATURE

Engine Fails To Reach Normal Operating Temperature

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

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	Does the cooling system hold pressure?	System OK	Go to **Step 5**
5	Inspect for a stuck open, missing, or incorrect thermostat. Refer to **Thermostat Diagnosis**. Is the thermostat operating properly?	System OK	Go to **Step 6**
6	Install the correct replacement thermostat. Refer to **Thermostat Housing Replacement (4.8L, 5.3L, and 6.0L Engines)** or **Thermostat Replacement (8.1L Engine)**. Is the repair complete?	Go to **Step 7**	-
7	Run the engine in order to verify the repair. Does the engine fail to reach normal operating temperature?	-	System OK

PRESSURE CAP TESTING

Tools Required

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

Pressure Cap Testing

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

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

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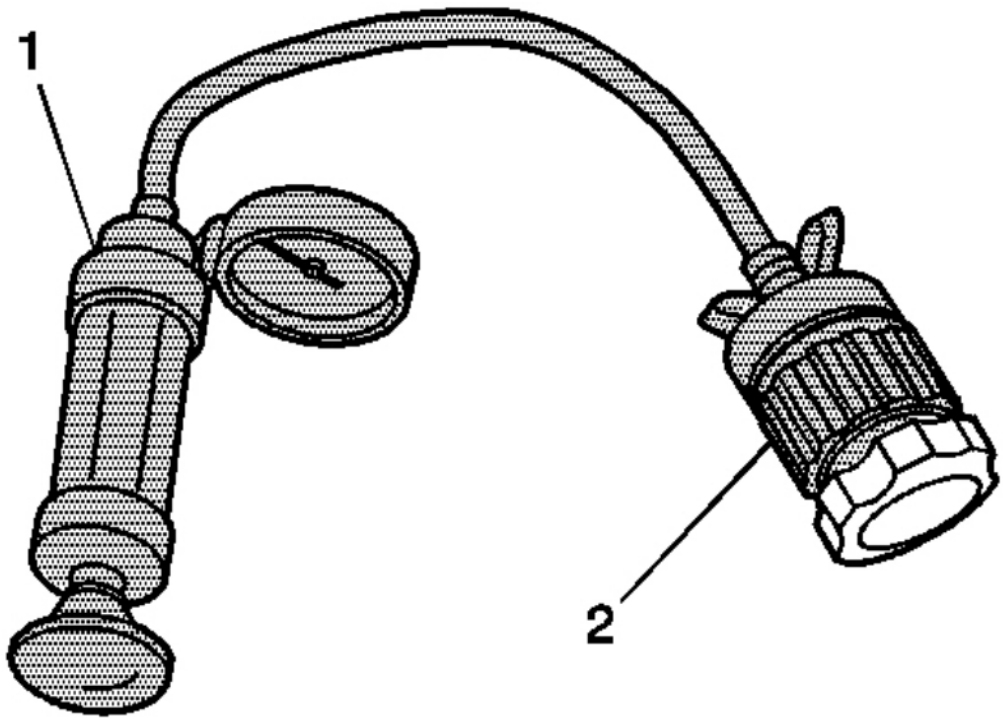


Fig. 6: Pressure Testing Radiator Cap
Courtesy of GENERAL MOTORS CORP.

3. Use the **J 24460-01** (1) with **J 42401** (2) in order to test the pressure cap. See **Special Tools and Equipment**.
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 and Equipment**.
   - Maintain the rated pressure for at least 10 seconds.

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

COOLING SYSTEM LEAK TESTING

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Tools Required

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

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

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

1. Remove the pressure cap.
2. Test the operation of the pressure cap. Refer to **Pressure Cap Testing**.
3. Wash the pressure cap mating surface with water.

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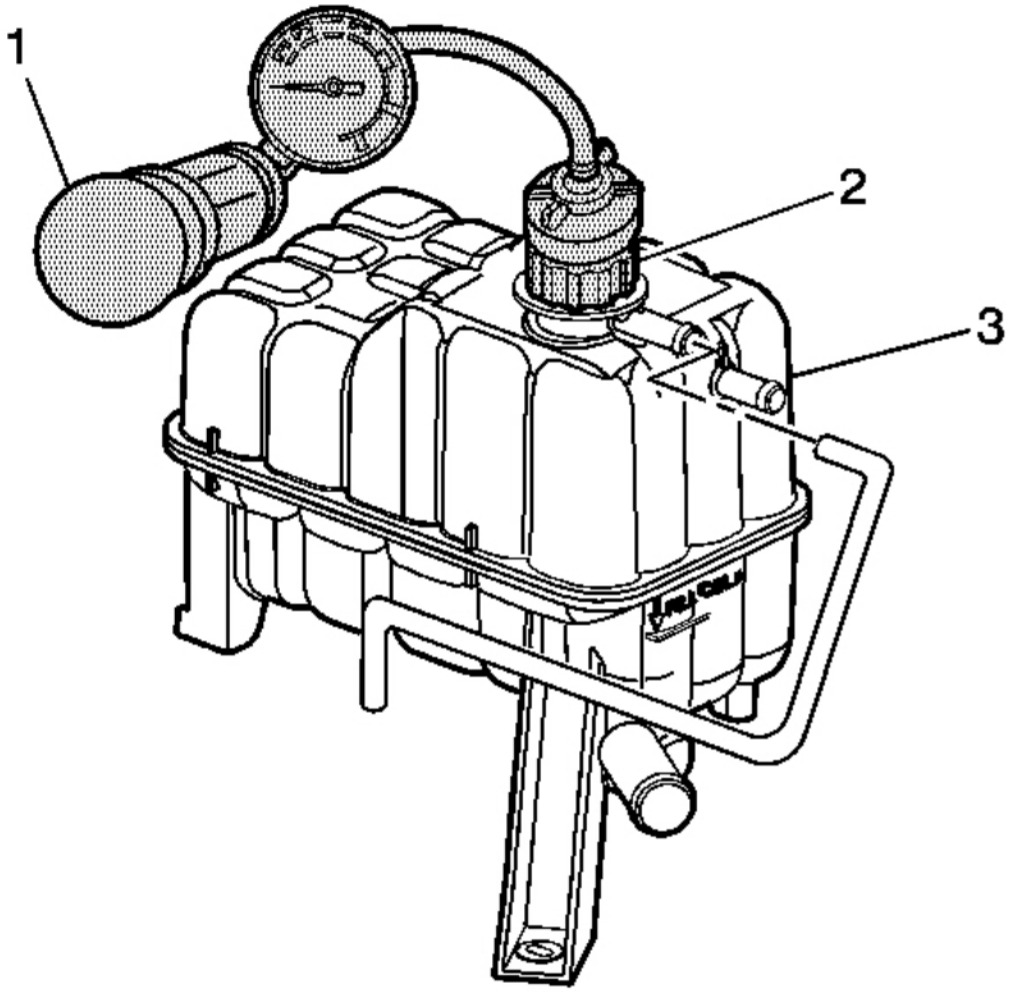


Fig. 7: Applying Pressure To Cooling System Using J 24460-01 & J 42401
Courtesy of GENERAL MOTORS CORP.

4. Use the **J 24460-01** with the **J 42401** in order to apply pressure to the cooling system. See **Special Tools and Equipment**.

   Do not exceed the pressure cap rating.

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

   Observe the gage for any pressure loss.

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6. Repair any leaks as required.

FAN CLUTCH DIAGNOSIS

Fan Clutch Diagnosis

Step	Action	Yes	No
1	Were you sent here from Symptoms or another diagnostic table?	Go to **Step 2**	Go to **Symptoms - Engine Cooling**
2	Is there excessive fan air noise?	Go to **Step 3**	Go to **Step 4**
3	Fan air noise is normal during cold engine start up. Does the fan noise go away at normal engine operating temperature?	Go to **Step 13**	Go to **Step 4**
4	**IMPORTANT:** **The engine must be turned OFF and the engine temperature should be cold.** Rotate the fan clutch.Does the fan clutch rotate?	Go to **Step 5**	Go to **Step 14**
5	Visually inspect the fan blades for cracks, looseness or damage. Are the fan blades in good condition?	Go to **Step 6**	Go to **Step 15**
6	Visually inspect the fan clutch for signs of silicone leakage. • Slight silicone leakage may not effect the fan clutch engagement. • Excess leakage will prevent the fan clutch from engaging. Is the silicone fluid leakage excessive?	Go to **Step 14**	Go to **Step 7**
7	Inspect the fan clutch for proper installation. 1. Move the fan blade back and forth in a lateral motion. 2. Inspect for fan blade to fan clutch movement. Is the fan blade loose at the fan clutch?	Go to **Step 10**	Go to **Step 8**
	Inspect the fan clutch for wear. 1. Move the fan blade back and forth in a lateral motion. **IMPORTANT:**		

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8	**Approximately 6.5 mm (1/4 in) movement at the tip of the fan blade is normal.** 2. Inspect for fan clutch lateral movement. Is the fan clutch lateral movement excessive?	Go to **Step 14**	Go to **Step 9**
9	The fan clutch should have more turning resistance when the engine is at or above normal operating temperature. Does the fan clutch have more resistance when the engine temperature is raised?	Go to **Step 11**	Go to **Step 14**
10	Tighten the fan. Refer to **Fastener Tightening Specifications**. Is the repair complete?	Go to **Step 16**	-
11	Perform a fan clutch engagement test. 1. Ensure the engine coolant level is full. 2. Ensure the cooling fan drive belt tension is correct and not slipping. 3. Position and secure a thermometer between the fan clutch and the radiator. 4. Ensure the cooling fan is disengaged before starting this test. 5. Sufficiently cover the radiator grille to restrict the air flow. **IMPORTANT:** **Do not allow engine temperature to exceed 121°C (250°F).** 6. Start the engine. 7. Turn the A/C ON, if equipped. 8. Operate the engine at approximately 2,000 RPM. 9. Inspect the thermometer reading when the fan clutch engages. 10. Do not continue this test if the fan clutch does not engage between 85-96°C (185-205°F). Fan clutch engagement will be indicated by an increase in fan air noise, fan speed, and a drop of about 3-10°C (5-15°F) on the thermometer reading. Did the fan clutch engage between 85-96°C (185-205°		

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	F)?	Go to **Step 12**	Go to **Step 14**
12	Once the fan clutch engages, perform the following steps: 1. Uncover the radiator grille. 2. Turn the A/C OFF, if equipped. 3. Operate the engine at approximately 2,500 RPM to reduce the engine operating temperature. 4. Remove the thermometer. Did the engine return to normal operating temperature?	Go to **Step 13**	-
13	As the engine temperature returns to normal, the fan clutch will disengage, indicated by a reduction in fan air noise and fan speed. Did the fan clutch disengage?	Go to **Step 16**	Go to **Step 14**
14	Replace the fan clutch. Refer to **Fan Clutch Replacement**. Is the repair complete?	Go to **Step 16**	-
15	Replace the fan blades. Refer to **Fan Replacement**. Is the repair complete?	Go to **Step 16**	-
16	Operate the fan clutch to verify proper operation. Did you find and correct the condition?	System OK	Go to **Step 2**

REPAIR INSTRUCTIONS

DRAINING AND FILLING COOLING SYSTEM

Tools Required

- J 26568 Coolant and Battery Tester
- **J 38185** Hose Clamp Pliers

Draining Procedure

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

1. Follow the steps below in order to remove the surge tank fill cap.
    1. Slowly rotate the cap counterclockwise.
    2. Stop rotating and allow the hissing to stop.
    3. After all the hissing stops, continue turning counterclockwise in order to remove the cap.

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2. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
3. Place a drain pan under the lower radiator hose.
4. Using the **J 38185** , reposition the lower radiator hose clamp.
5. Remove the lower radiator hose from the radiator.
6. Drain the cooling system.

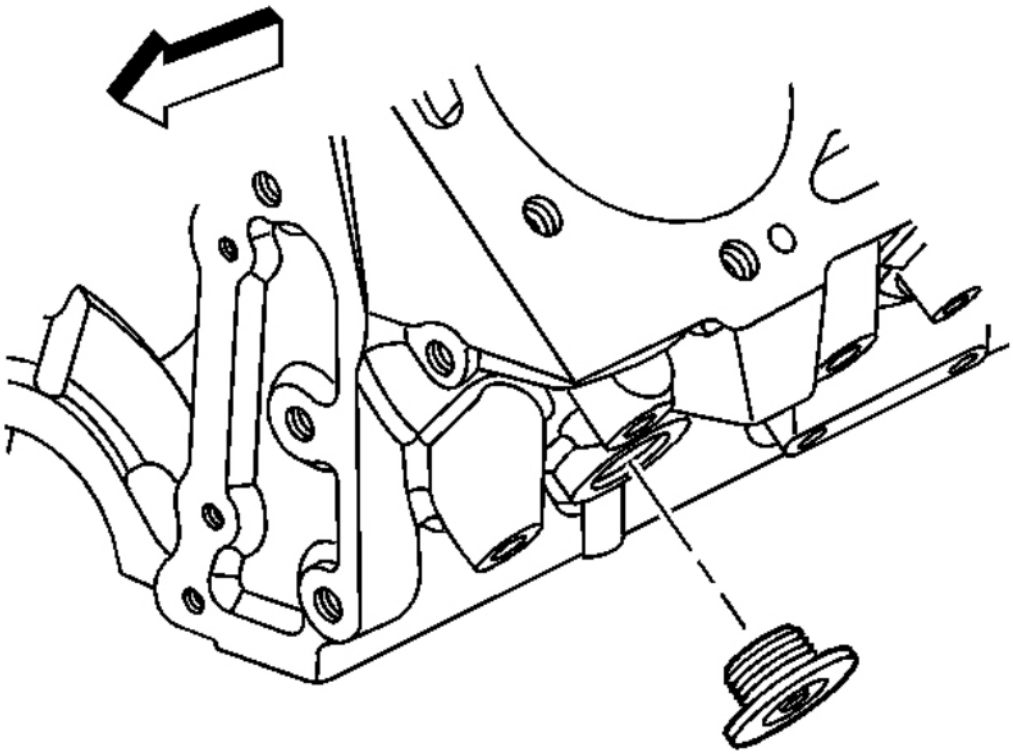


Fig. 8: View Of Engine Coolant Drain Hole Plug
Courtesy of GENERAL MOTORS CORP.

7. If a complete engine block drain is required, remove the left and right engine block coolant drain plugs.
8. Remove the engine block coolant heater, if equipped. Refer to **Coolant Heater Replacement (Dealer Installation - 6.0L Engine)** or **Coolant Heater Replacement (4.8L, 5.3L, and 6.0L Engines)** or **Coolant Heater Replacement (8.1L Engine)**.
9. Inspect the coolant.
10. Follow the appropriate procedure based on the condition of the coolant.
    - Normal in appearance-Follow the filling procedure.
    - Discolored-Follow the flush procedure. Refer to **Flushing**

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Filling Procedure

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

1. Install the lower radiator hose to the radiator.
2. Using the **J 38185** reposition the lower radiator hose clamp.
3. If the left and right engine block coolant drain plugs were removed, perform the following.
   1. Apply pipe sealer to the drain plugs.

      NOTE: Refer to Fastener Notice in Cautions and Notices.

   2. Install the drain plugs.

      Tighten: Tighten the drain plugs to 60 N.m (44 lb ft).
4. Install the engine block coolant heater, if equipped. Refer to **Coolant Heater Replacement (Dealer Installation - 6.0L Engine)** or **Coolant Heater Replacement (4.8L, 5.3L, and 6.0L Engines)** or **Coolant Heater Replacement (8.1L Engine)**.
5. Lower the vehicle.
6. Open the cooling system bleeder screws.

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

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

FLUSHING

IMPORTANT:

- **Do not use a chemical flush.**
- **Store used coolant in the proper manner, such as in a used engine**

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

- **Various methods and equipment can be used to flush the cooling system. If special equipment is used (such as a back flusher) follow the manufacturer's instructions. However, always remove the thermostat before back flushing the system.**

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

RADIATOR CLEANING

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

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

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

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

SURGE TANK REPLACEMENT

Removal Procedure

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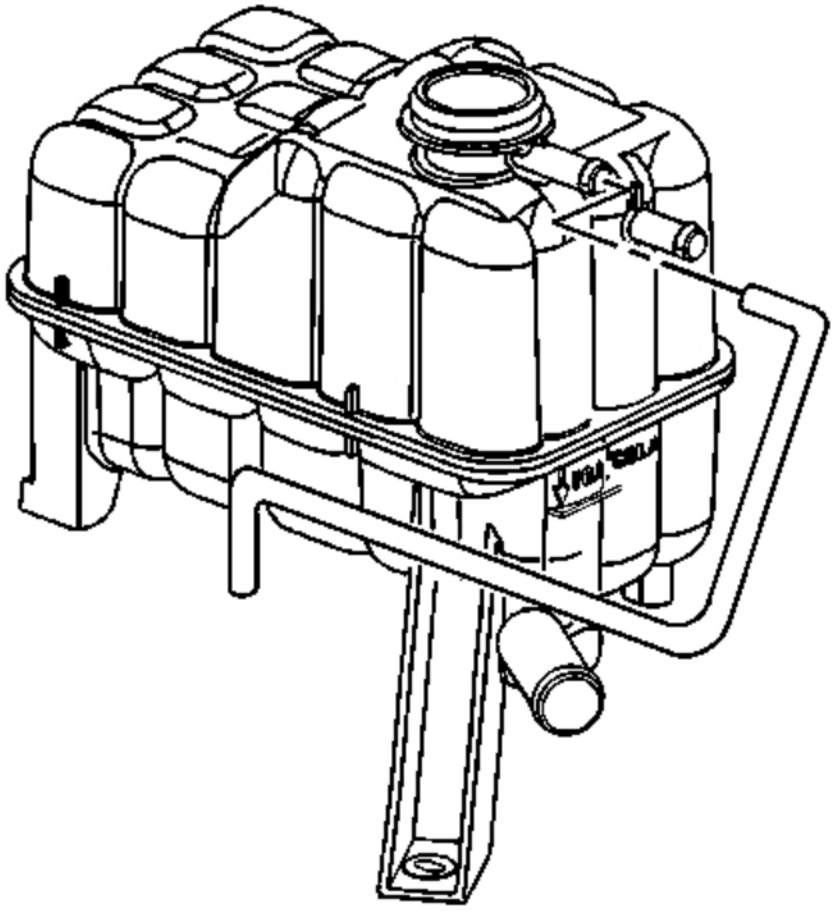


Fig. 9: View Of Surge Tank Overflow Hose
Courtesy of GENERAL MOTORS CORP.

1. Drain the cooling system. Refer to **Draining and Filling Cooling System**.
2. Remove the air cleaner assembly. Refer to **Air Cleaner Assembly Replacement** in Engine Controls - 4.8L, 5.3L, and 6.0L or **Air Cleaner Assembly Replacement** in Engine Controls - 8.1L.
3. Remove the surge tank overflow hose from the surge tank.

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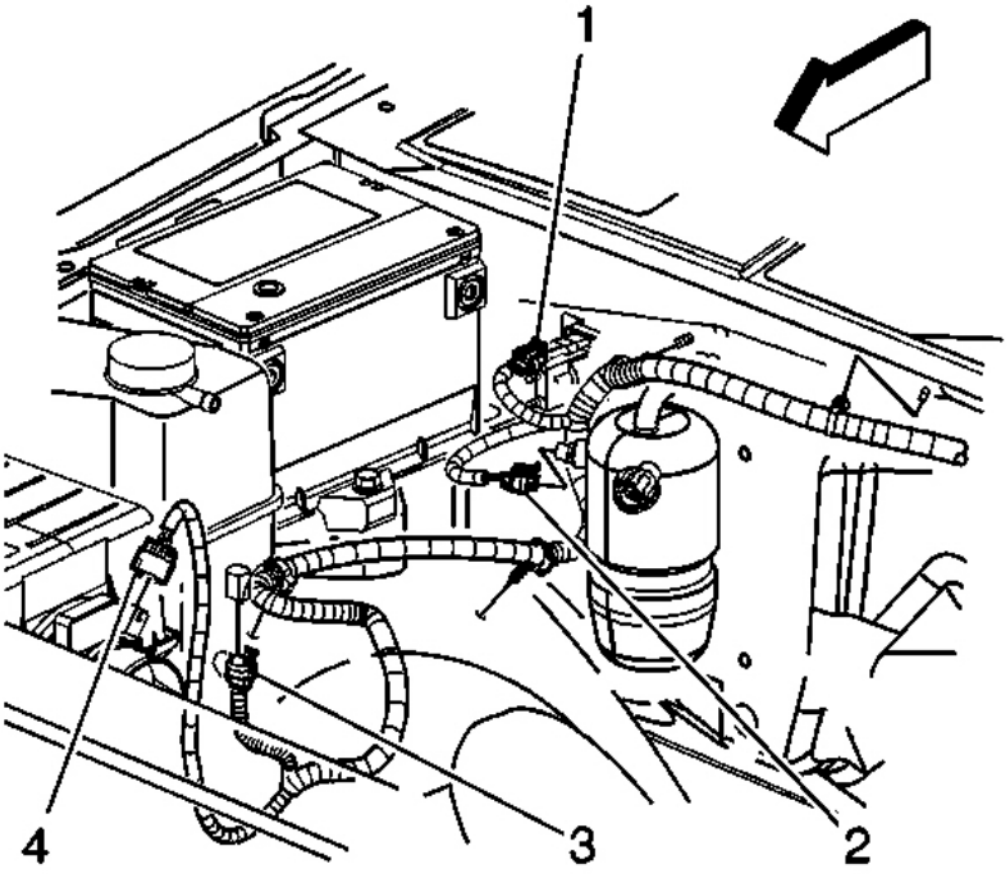


Fig. 10: View Of Auxiliary Battery Relay, MAF, IAT & Coolant Level Sensor Electrical Connectors
Courtesy of GENERAL MOTORS CORP.

4. Disconnect the low coolant level switch electrical connector (3).

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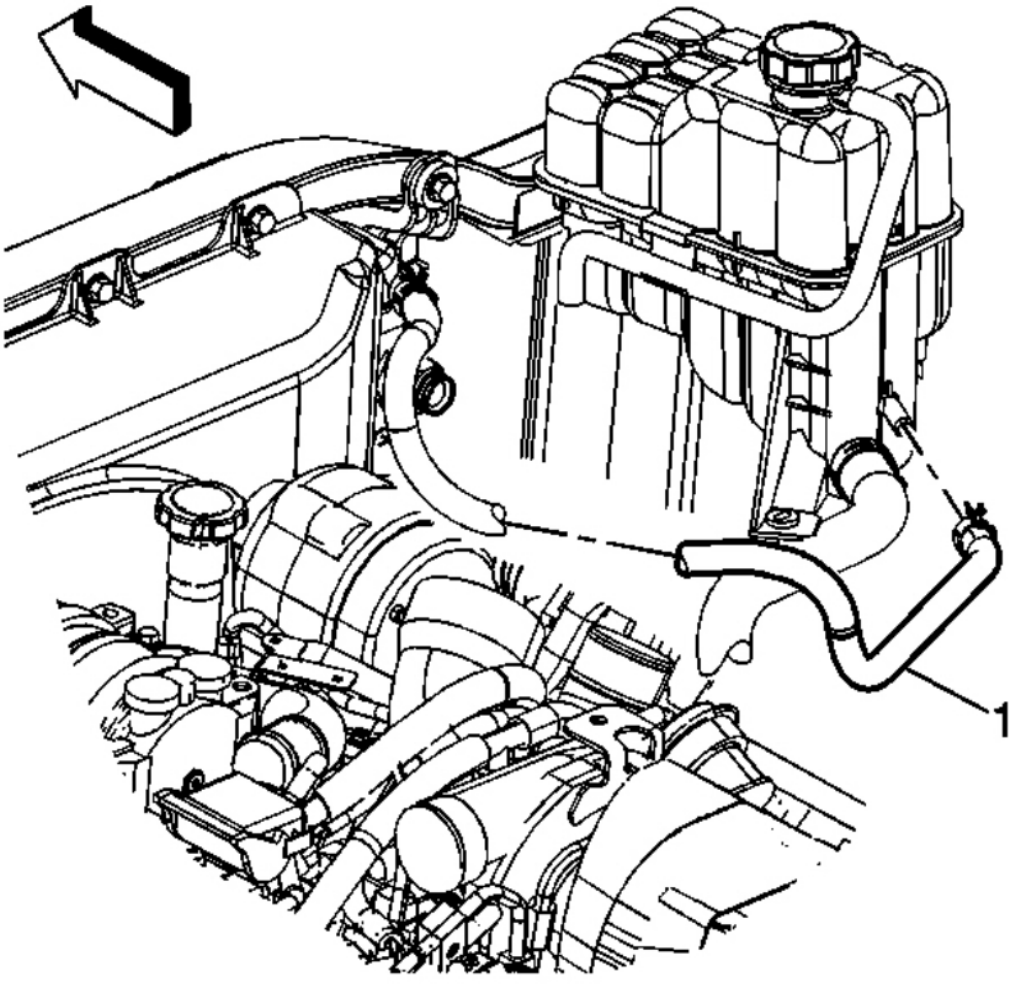


Fig. 11: View Of Surge Tank Inlet Hose
Courtesy of GENERAL MOTORS CORP.

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

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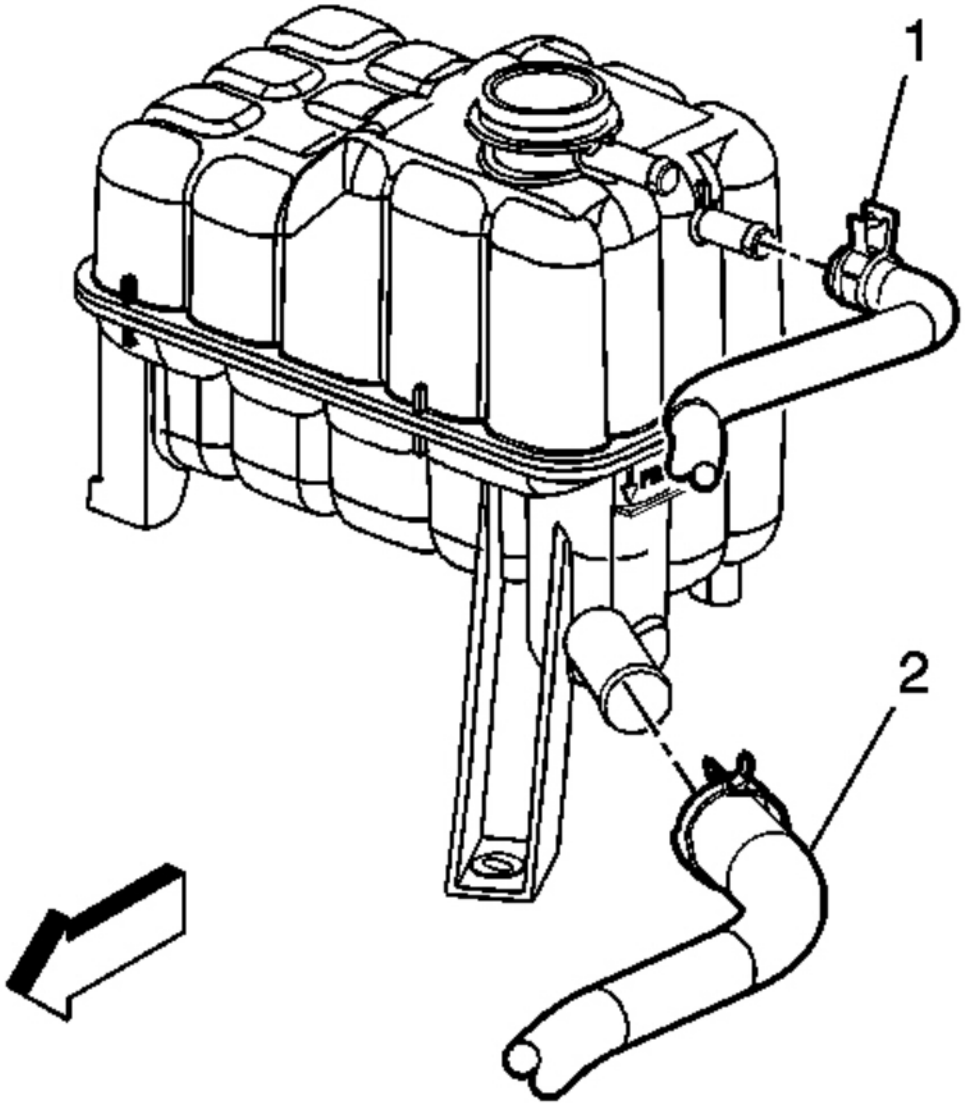


Fig. 12: View Of Surge Tank Outlet Hose & Surge Tank
Courtesy of GENERAL MOTORS CORP.

7. Reposition the surge tank outlet hose clamp.
8. Remove the surge tank outlet hose (2) from the surge tank.

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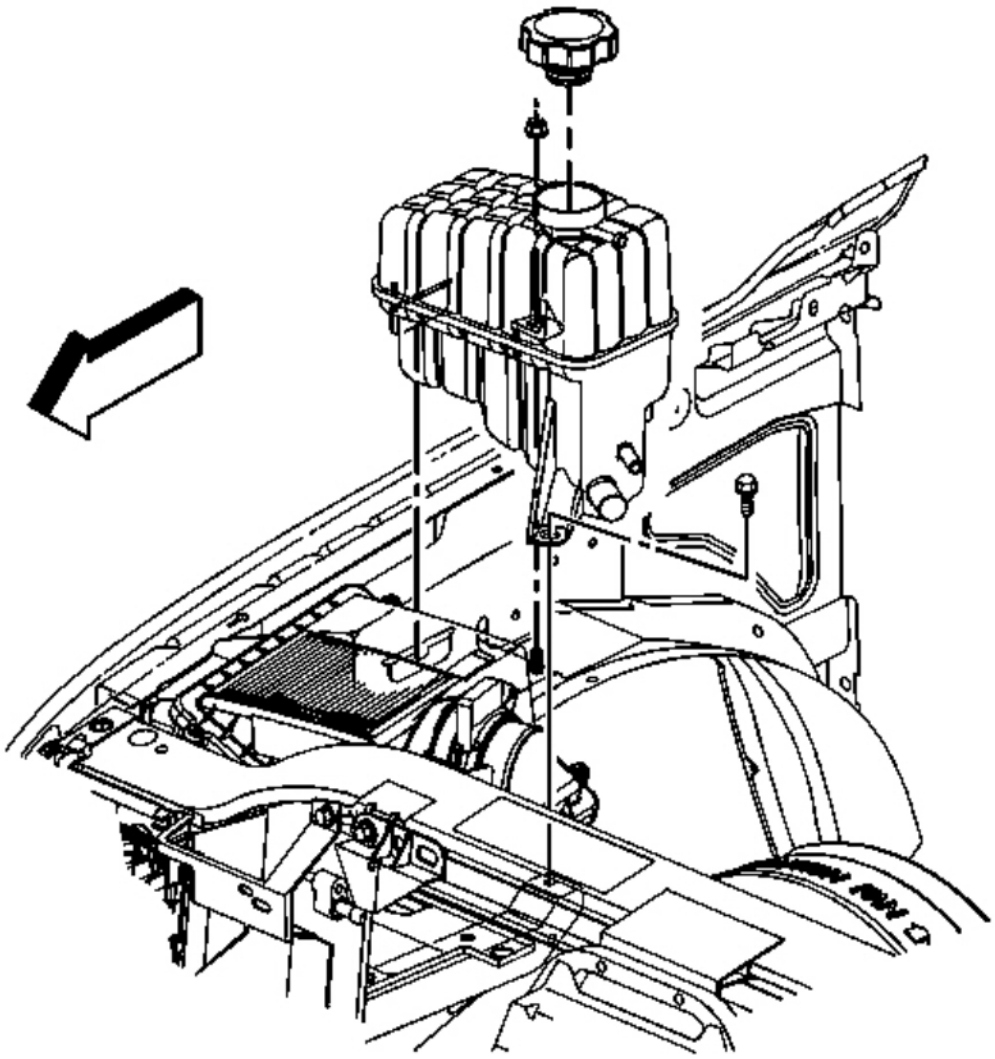


Fig. 13: View Of Surge Tank
Courtesy of GENERAL MOTORS CORP.

9. Remove the bolt from the surge tank.
10. Remove the nut from the surge tank.
11. Remove the surge tank.

Installation Procedure

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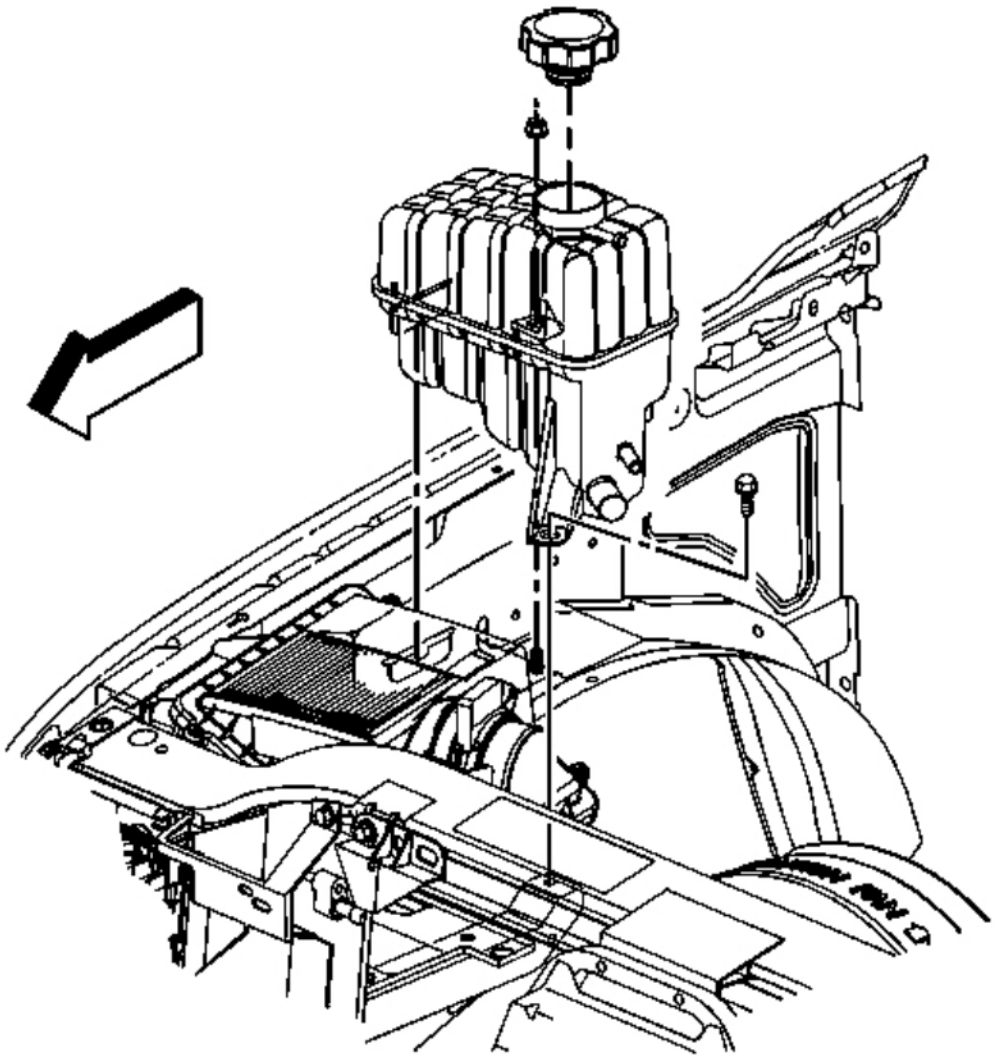


Fig. 14: View Of Surge Tank
Courtesy of GENERAL MOTORS CORP.

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

1. Install the surge tank.
2. Install the bolt to the surge tank.

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

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3. Install the nut to the surge tank.

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

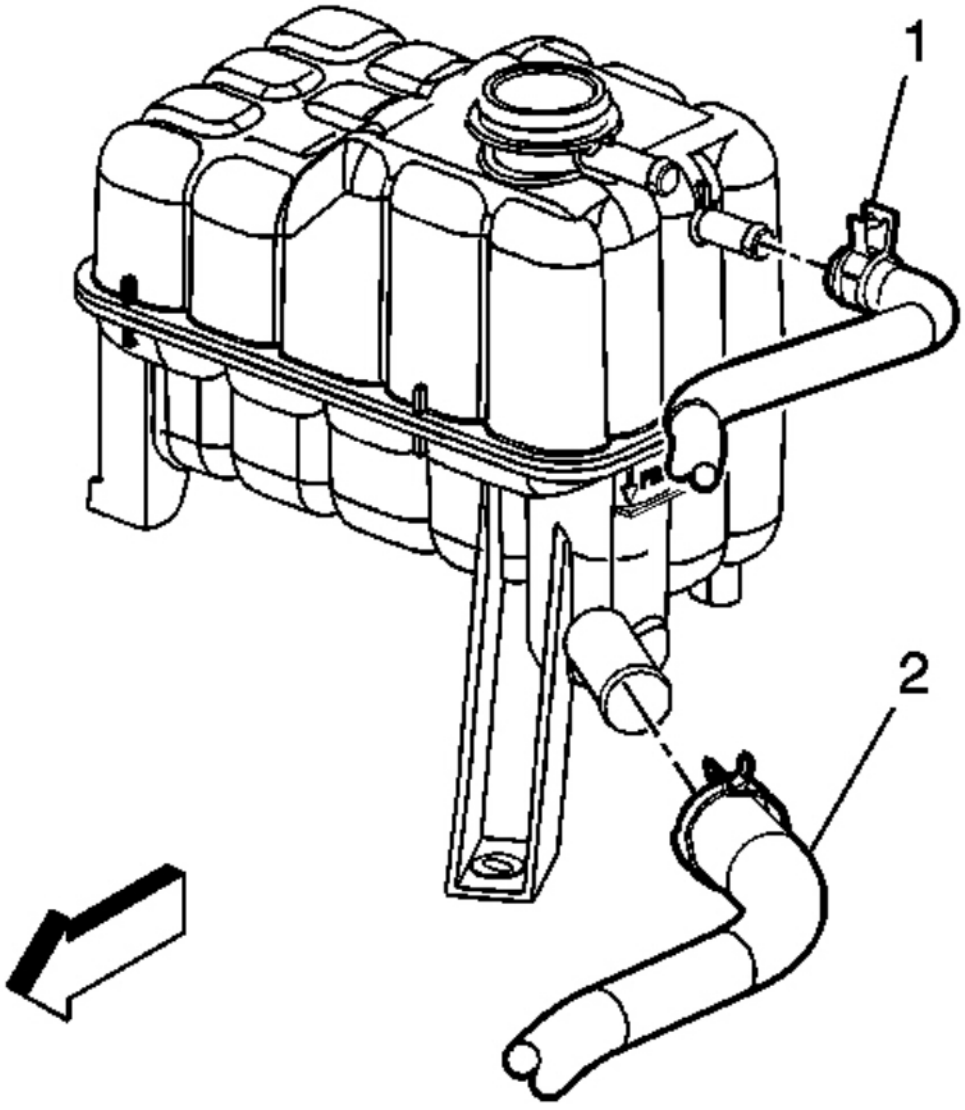


Fig. 15: View Of Surge Tank Outlet Hose & Surge Tank
Courtesy of GENERAL MOTORS CORP.

4. Install the surge tank outlet hose (2) to the surge tank.

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5. Position the surge tank outlet hose clamp.

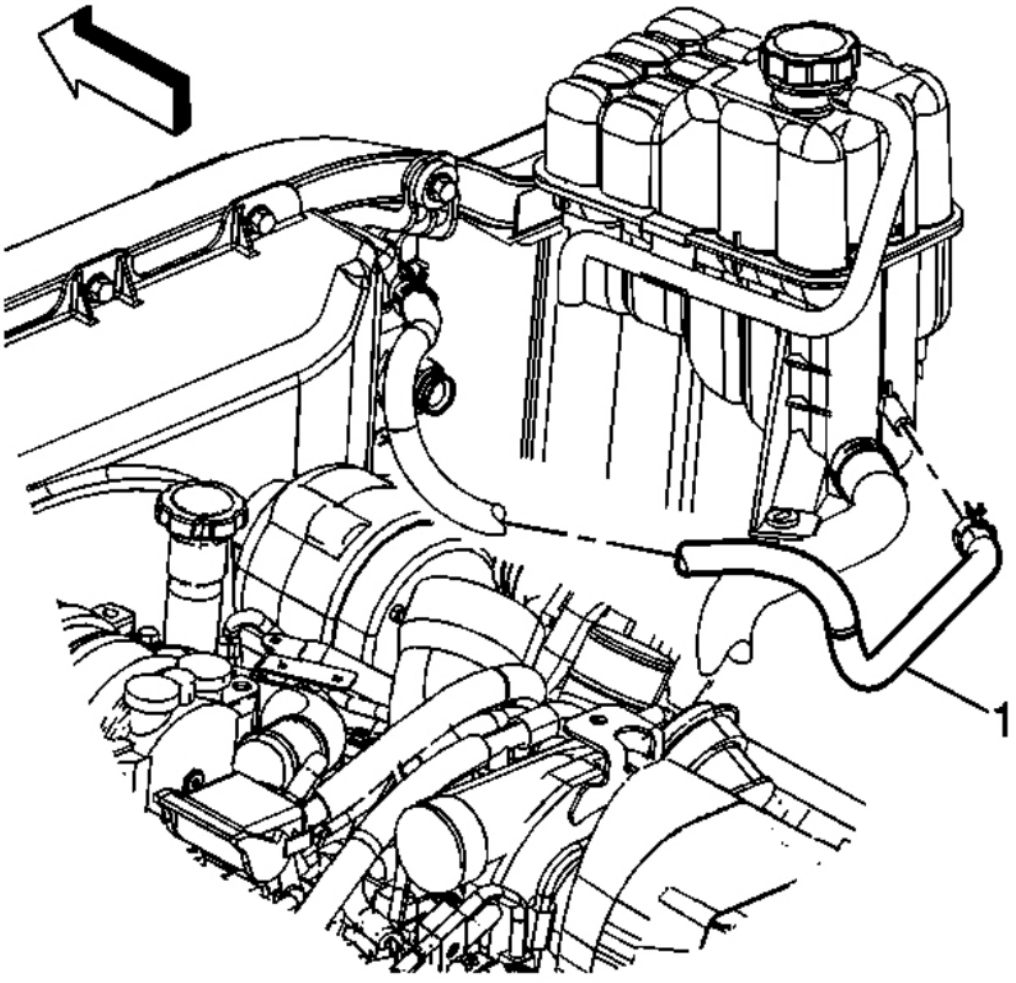


Fig. 16: View Of Surge Tank Inlet Hose
Courtesy of GENERAL MOTORS CORP.

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

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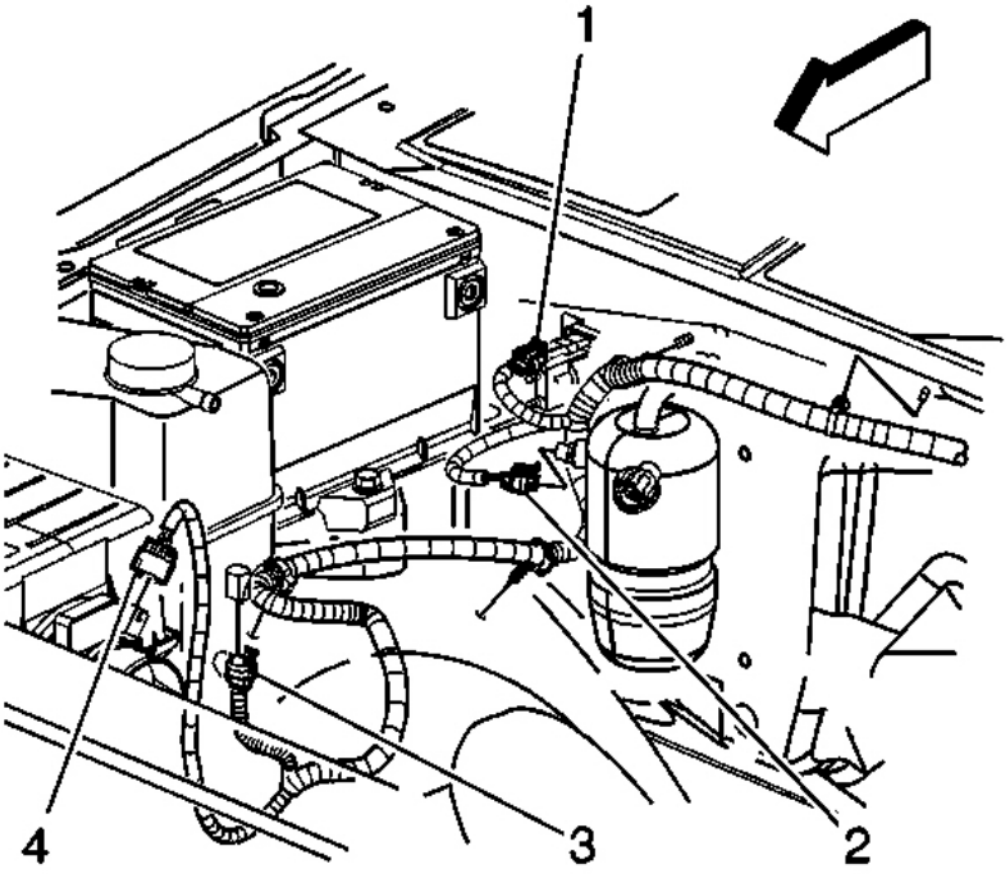


Fig. 17: View Of Auxiliary Battery Relay, MAF, IAT & Coolant Level Sensor Electrical Connectors
Courtesy of GENERAL MOTORS CORP.

8. Connect the low coolant level switch electrical connector (3).

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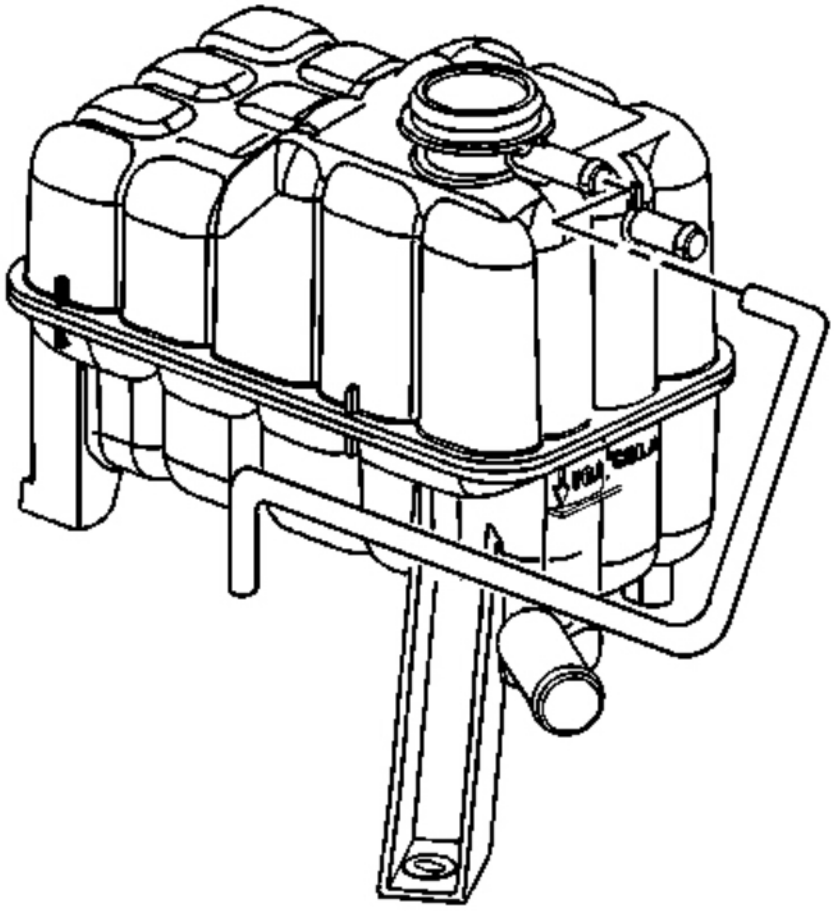


Fig. 18: View Of Surge Tank Overflow Hose
Courtesy of GENERAL MOTORS CORP.

9. Install the surge tank overflow hose.
10. Install the air cleaner assembly. Refer to **Air Cleaner Assembly Replacement** in Engine Controls - 4.8L, 5.3L, and 6.0L or **Air Cleaner Assembly Replacement** in Engine Controls - 8.1L.
11. Fill the cooling system. Refer to **Draining and Filling Cooling System**.

SURGE TANK HOSE/PIPE REPLACEMENT - INLET

Removal Procedure

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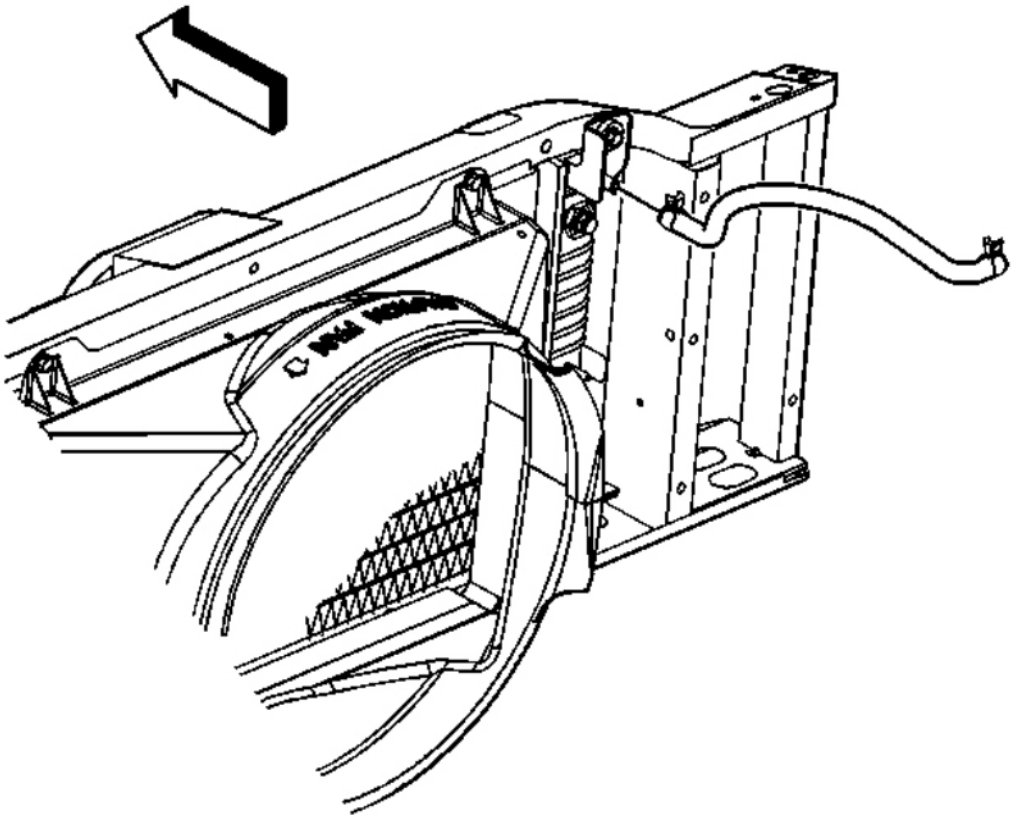


Fig. 19: View Of Surge Tank Inlet Hose & Radiator
Courtesy of GENERAL MOTORS CORP.

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

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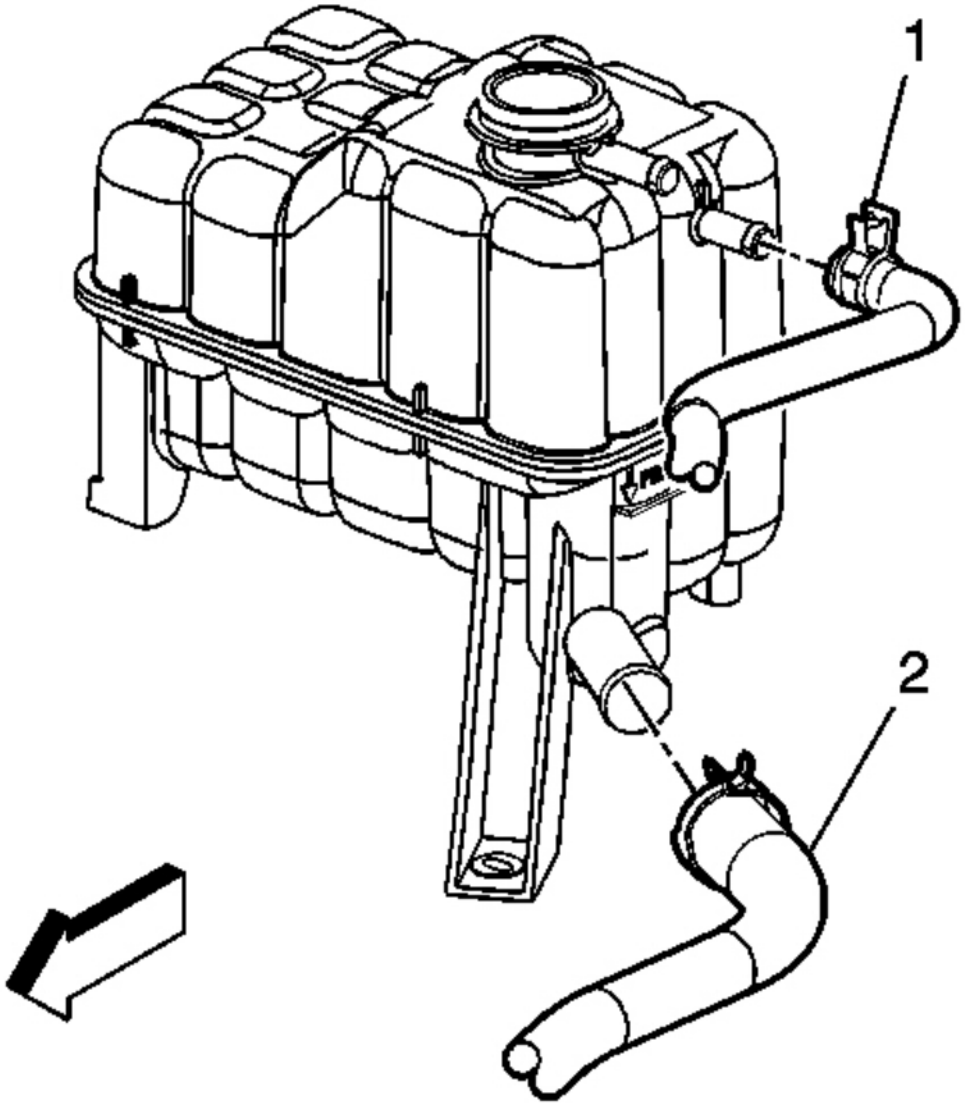


Fig. 20: View Of Surge Tank Outlet Hose & Surge Tank
Courtesy of GENERAL MOTORS CORP.

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

Installation Procedure

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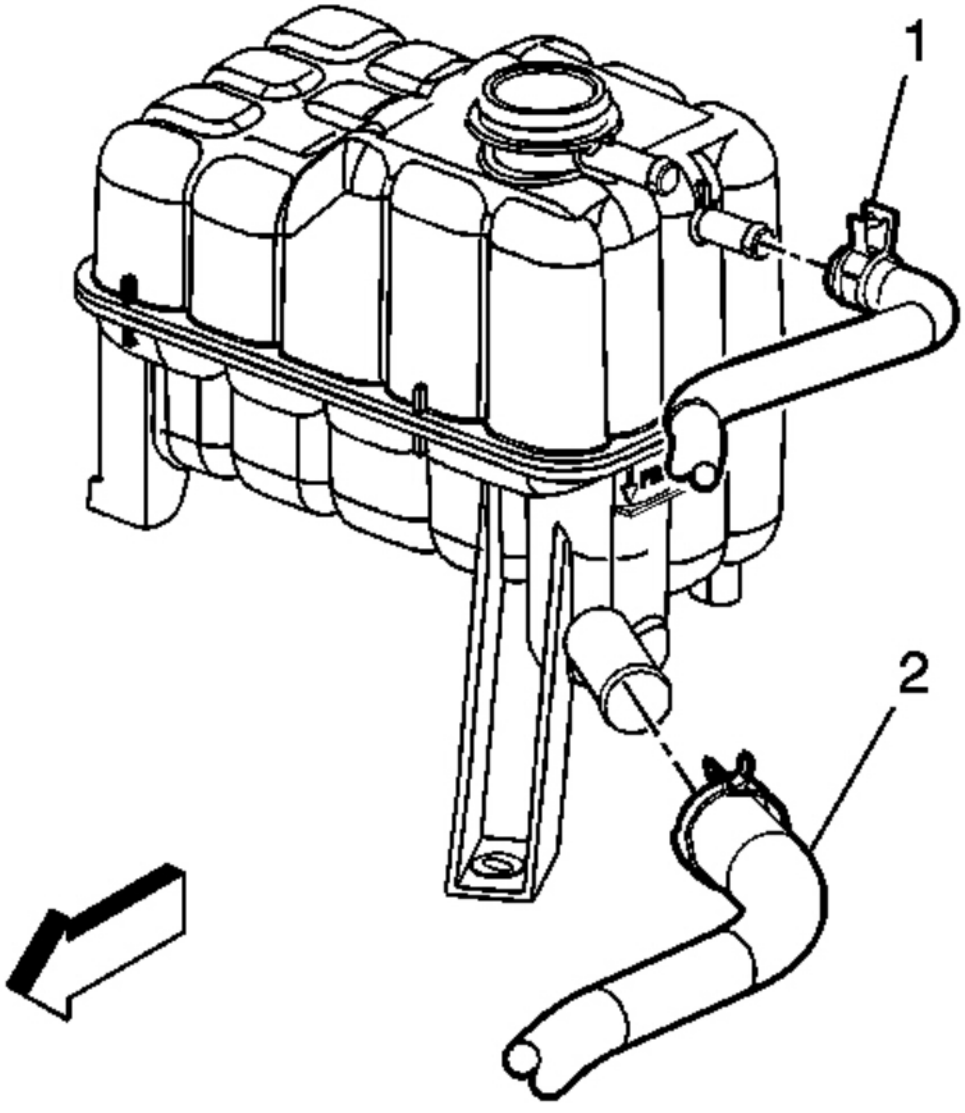


Fig. 21: View Of Surge Tank Outlet Hose & Surge Tank
Courtesy of GENERAL MOTORS CORP.

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

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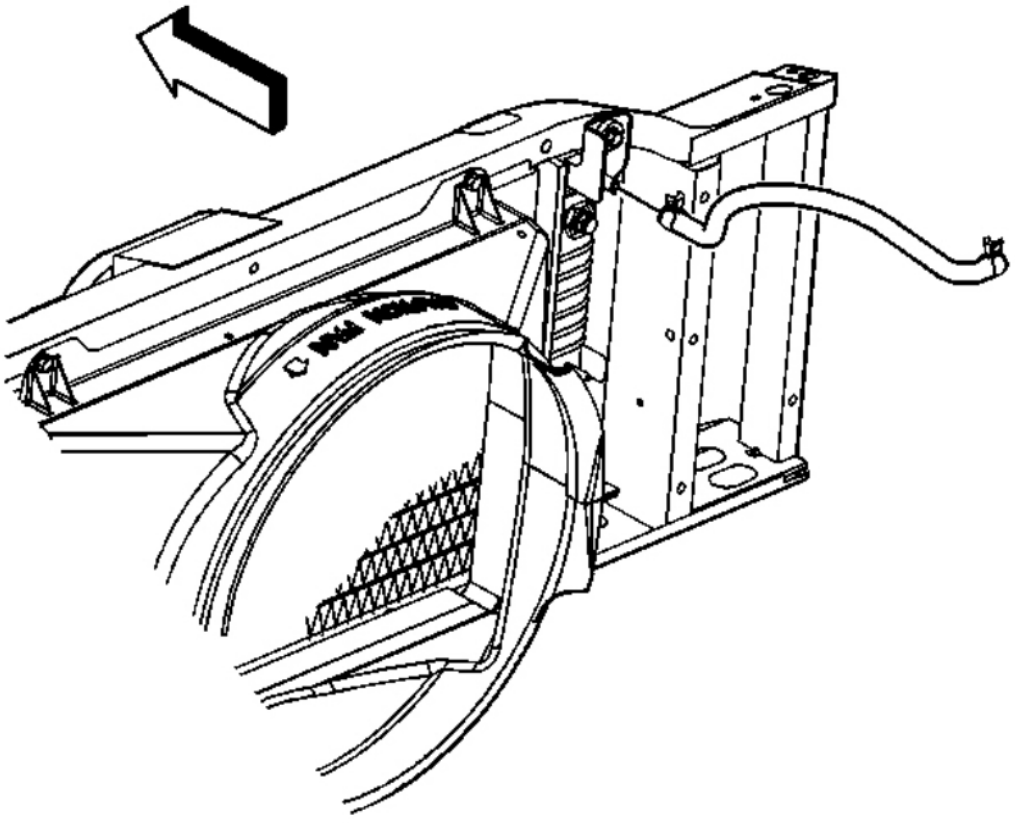


Fig. 22: View Of Surge Tank Inlet Hose & Radiator
Courtesy of GENERAL MOTORS CORP.

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

SURGE TANK HOSE/PIPE REPLACEMENT - OUTLET (4.8L, 5.3L, AND 6.0L ENGINES)

Tools Required

J 43181 Heater Line Quick Connect Release Tool. See **Special Tools and Equipment**.

Removal Procedure

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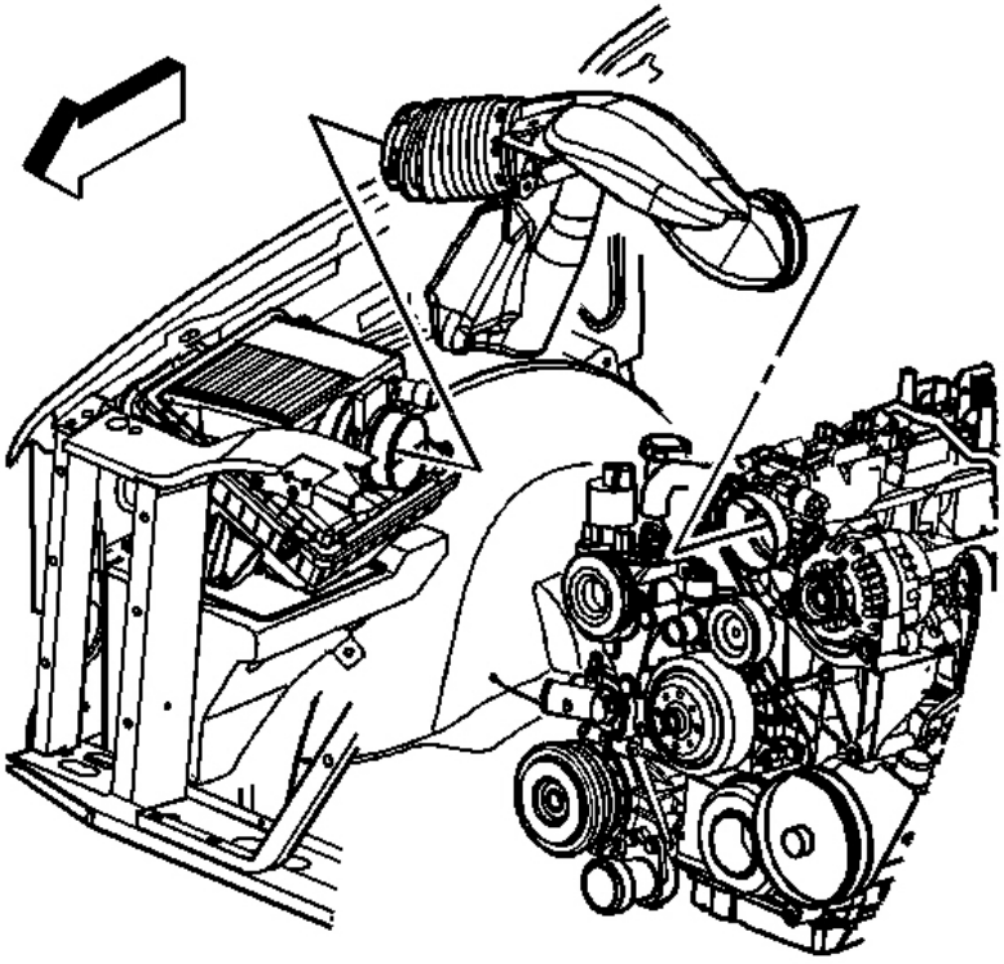


Fig. 23: View Of Air Cleaner Outlet Duct
Courtesy of GENERAL MOTORS CORP.

1. Drain the cooling system. Refer to **Draining and Filling Cooling System**.
2. Loosen the air cleaner outlet duct clamps at the following locations:
   - Throttle body
   - Mass airflow/intake air temperature (MAF/IAT) sensor
3. Remove the air cleaner outlet duct.

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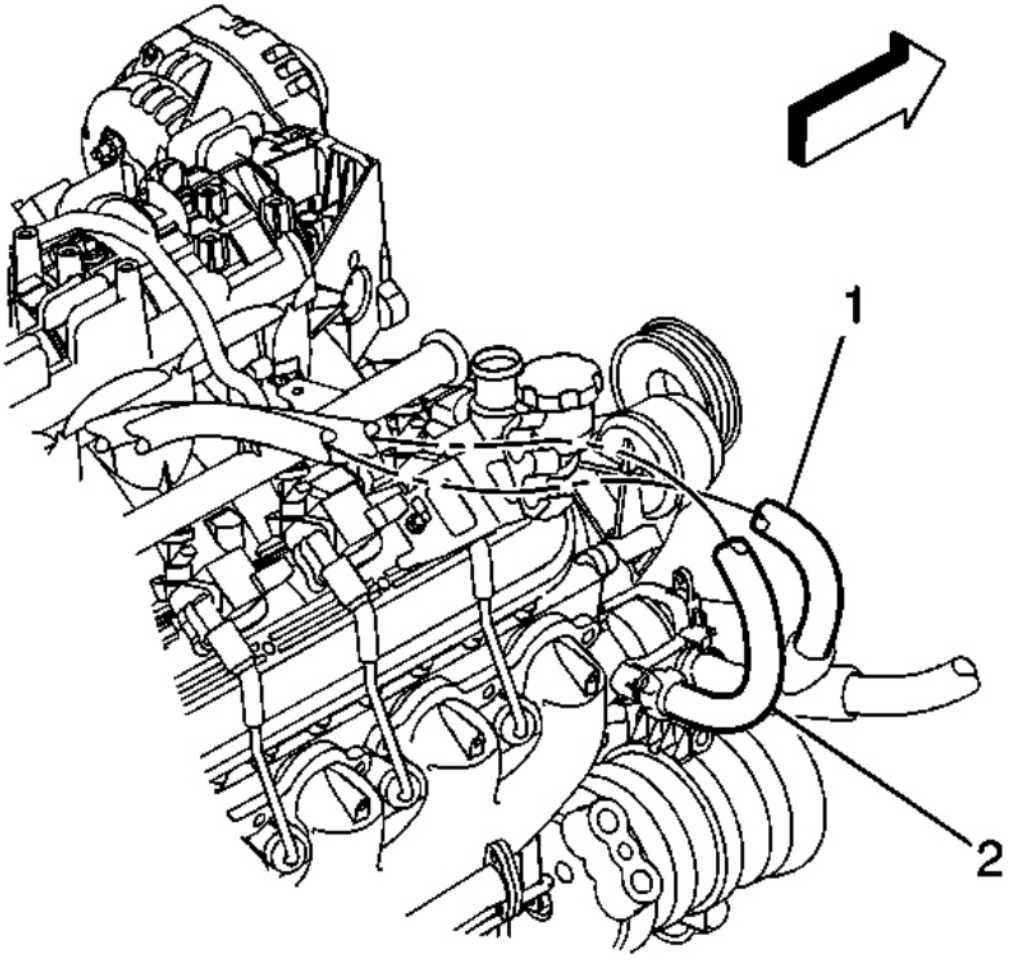


Fig. 24: View Of Surge Tank/Heater Outlet Hose To Mounting Clip (W/O RPO C36)
Courtesy of GENERAL MOTORS CORP.

4. If equipped without regular production option (RPO) C36 auxiliary heater, remove the surge tank/heater outlet hose (1) from the mounting clip.

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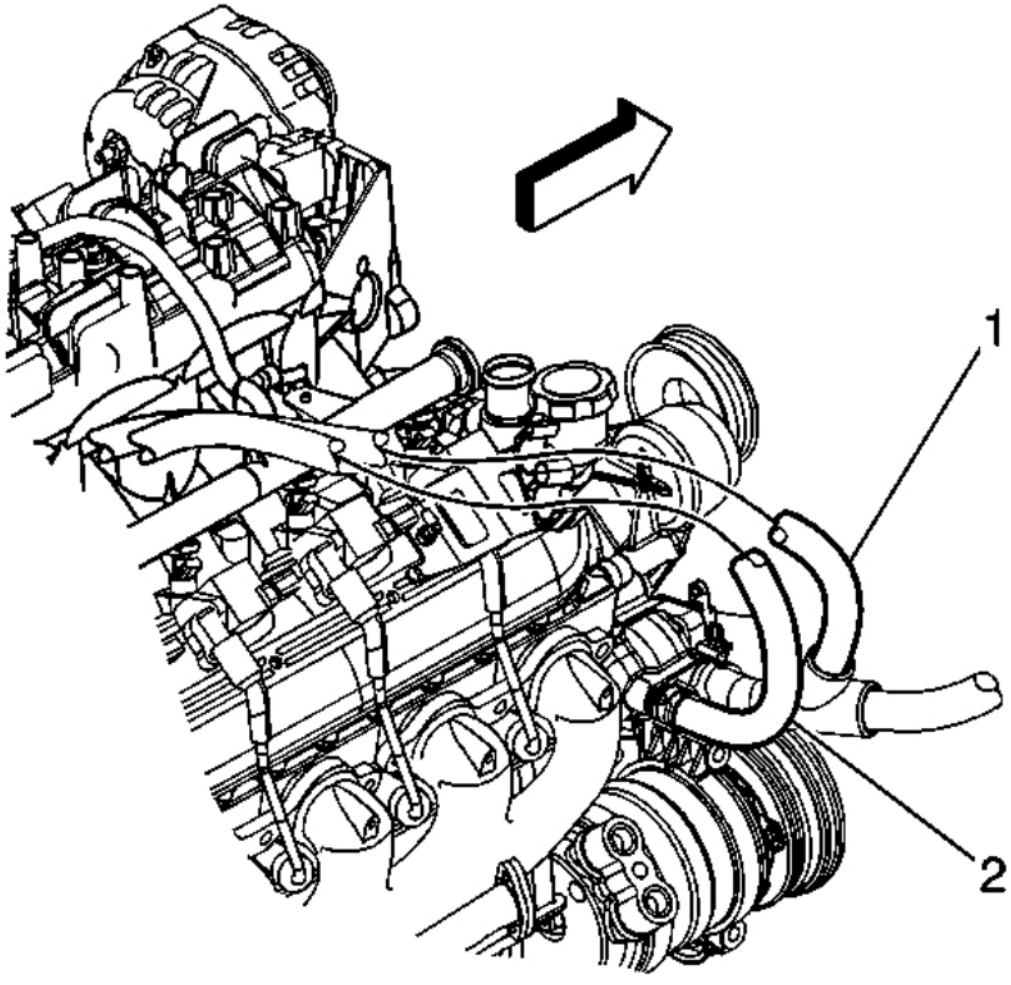


Fig. 25: View Of Surge Tank/Heater Outlet Hose To Mounting Clip (W/ RPO C36)
Courtesy of GENERAL MOTORS CORP.

5. If equipped with RPO C36 auxiliary heater, remove the surge tank/heater outlet hose (1) from the mounting clip.

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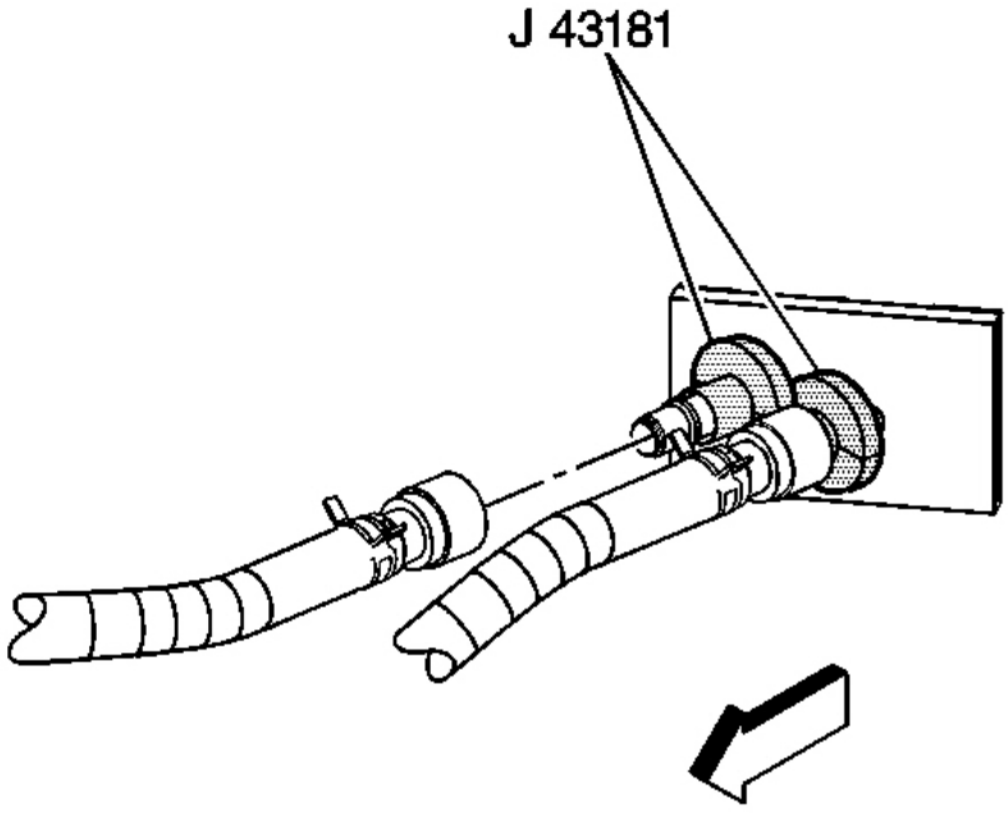


Fig. 26: Identifying Heater Hose To Heater Core Fittings
Courtesy of GENERAL MOTORS CORP.

6. Install the **J 43181** to the surge tank outlet hose (black connector). See **Special Tools and Equipment**.
7. Close the **J 43181** around the surge tank outlet hose. See **Special Tools and Equipment**.
8. Firmly pull the **J 43181** into the quick connect end of the outlet hose. See **Special Tools and Equipment**.

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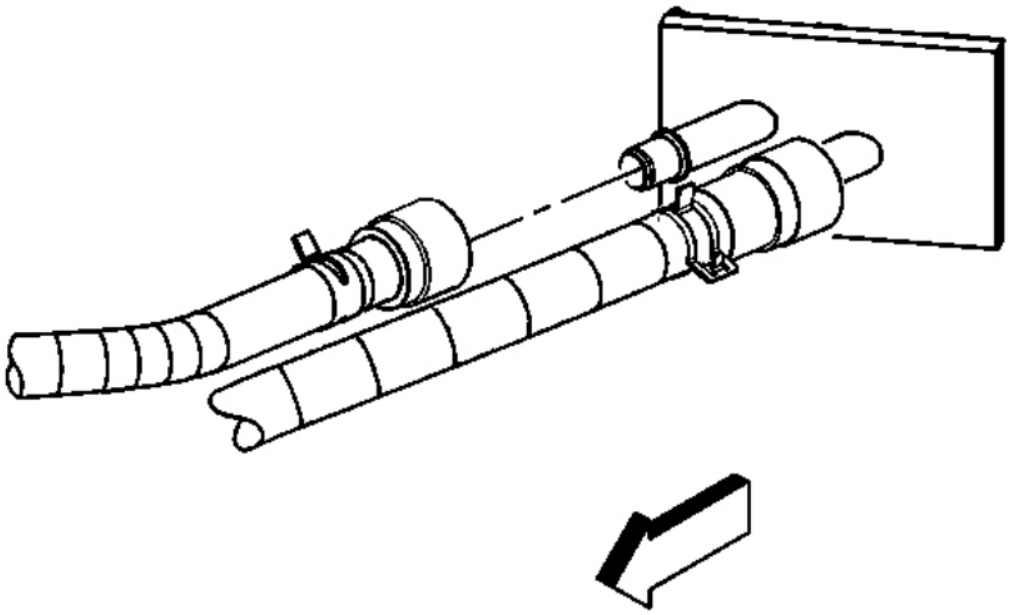


Fig. 27: View Of Outlet Hose To Heater & Blower Module (W/O RPO C36)
Courtesy of GENERAL MOTORS CORP.

9. If equipped without RPO C36 auxiliary heater, firmly grasp the outlet hose. Pull the outlet hose in order to disengage the hose from the heater and blower module.

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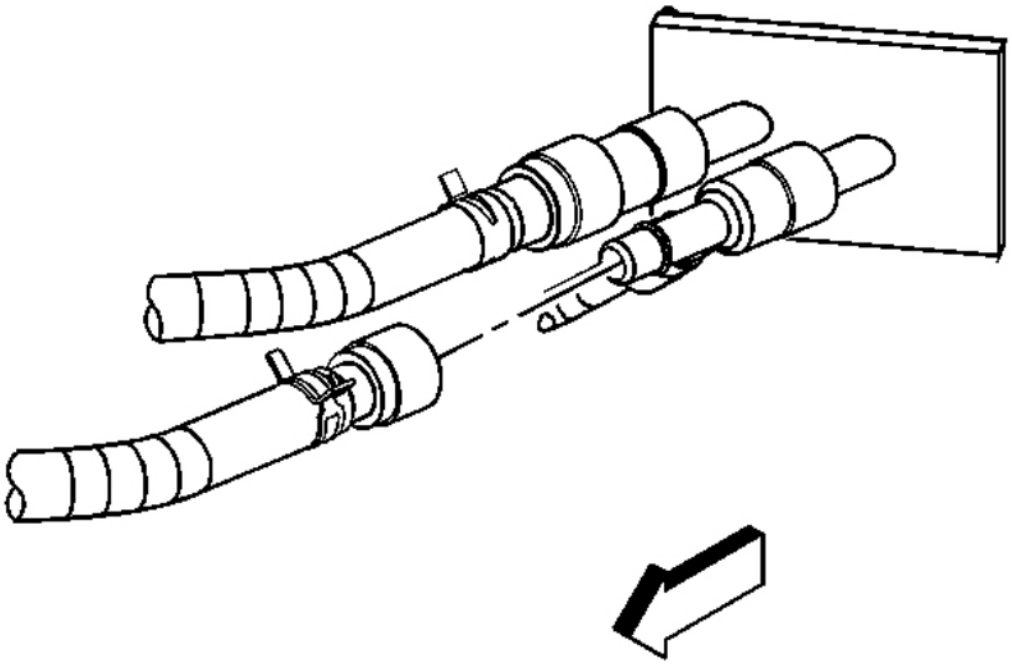


Fig. 28: View Of Outlet Hose To Heater & Blower Module (W/ RPO C36)
Courtesy of GENERAL MOTORS CORP.

10. If equipped with RPO C36 auxiliary heater, firmly grasp the outlet hose. Pull the outlet hose in order to disengage the hose from the heater and blower module.

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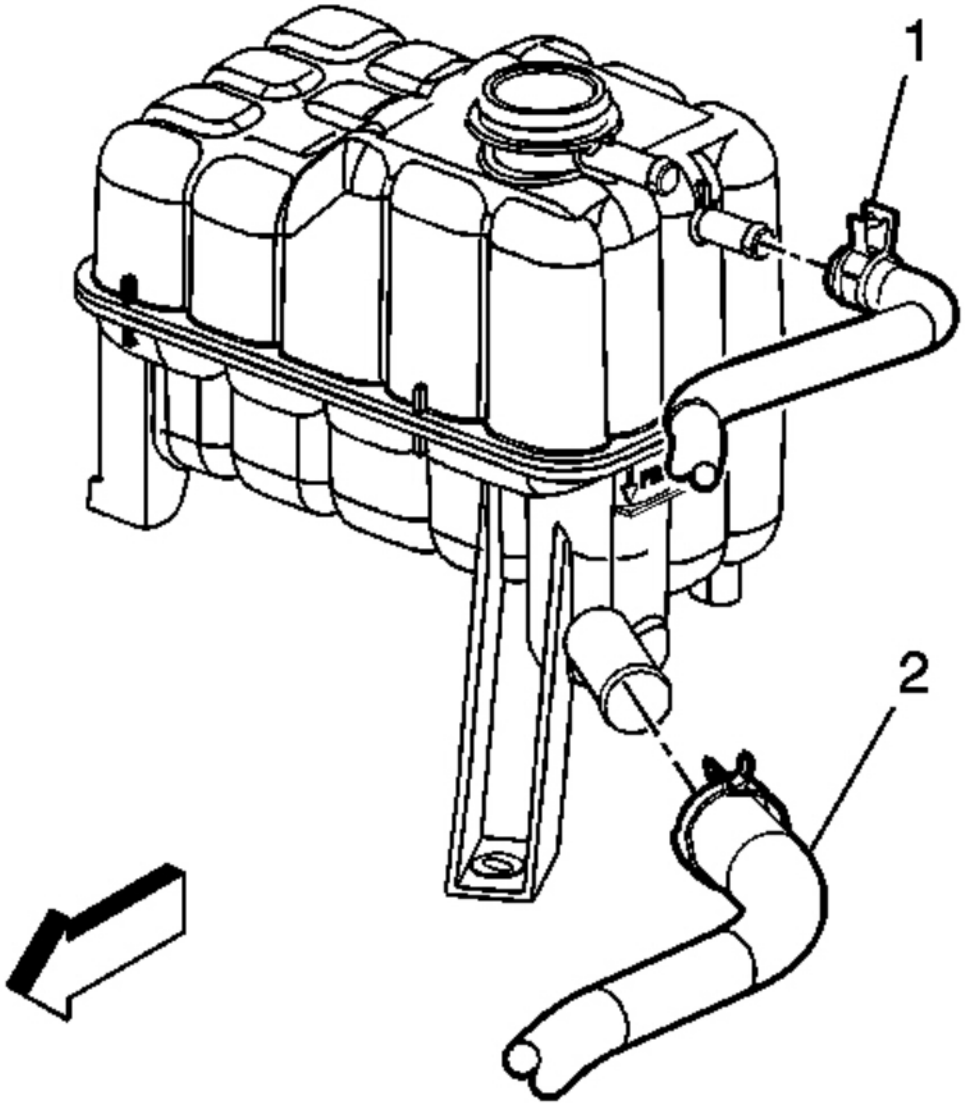


Fig. 29: View Of Surge Tank Outlet Hose & Surge Tank
Courtesy of GENERAL MOTORS CORP.

11. Reposition the surge tank outlet hose clamp at the surge tank.
12. Remove the surge tank outlet hose (2) from the surge tank.

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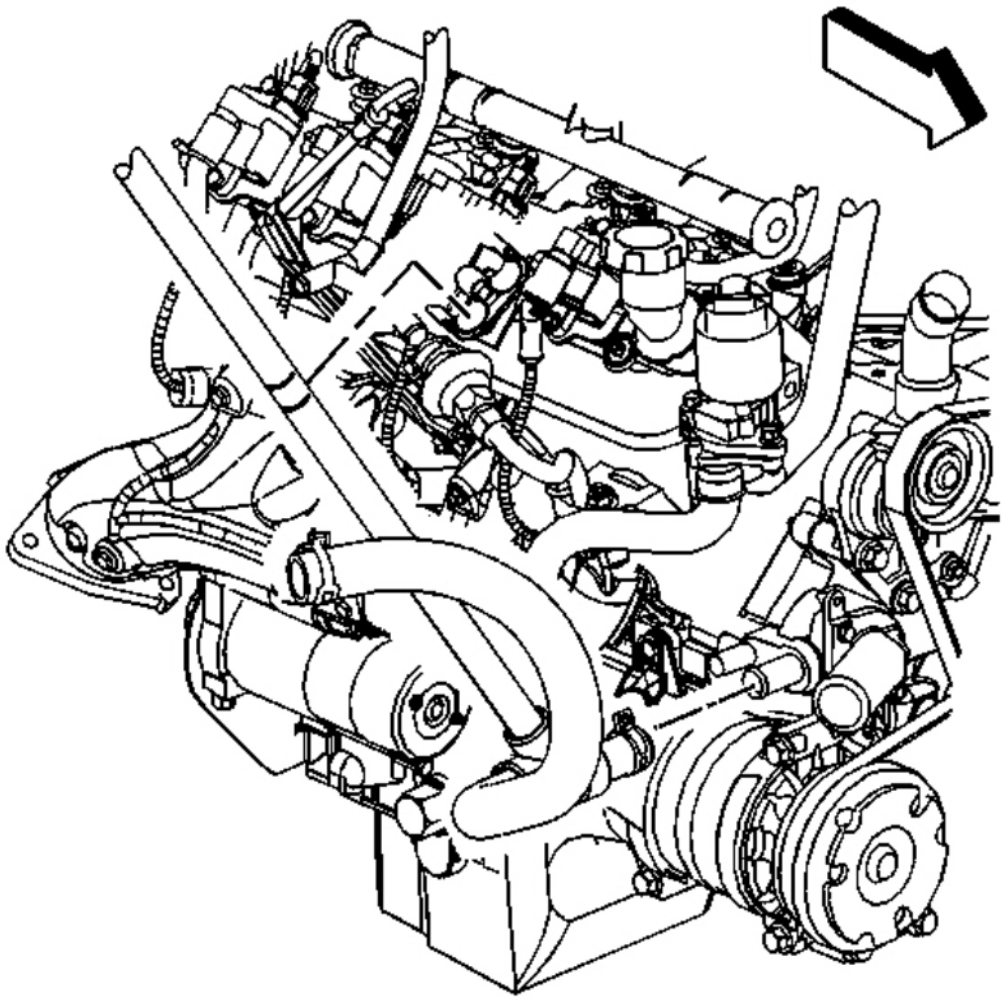


Fig. 30: View Of Surge Tank Outlet Hose To Water Pump
Courtesy of GENERAL MOTORS CORP.

13. Reposition the surge tank outlet hose clamp at the water pump.
14. Remove the surge tank outlet hose from the water pump.
15. Remove the surge tank outlet hose.

Installation Procedure

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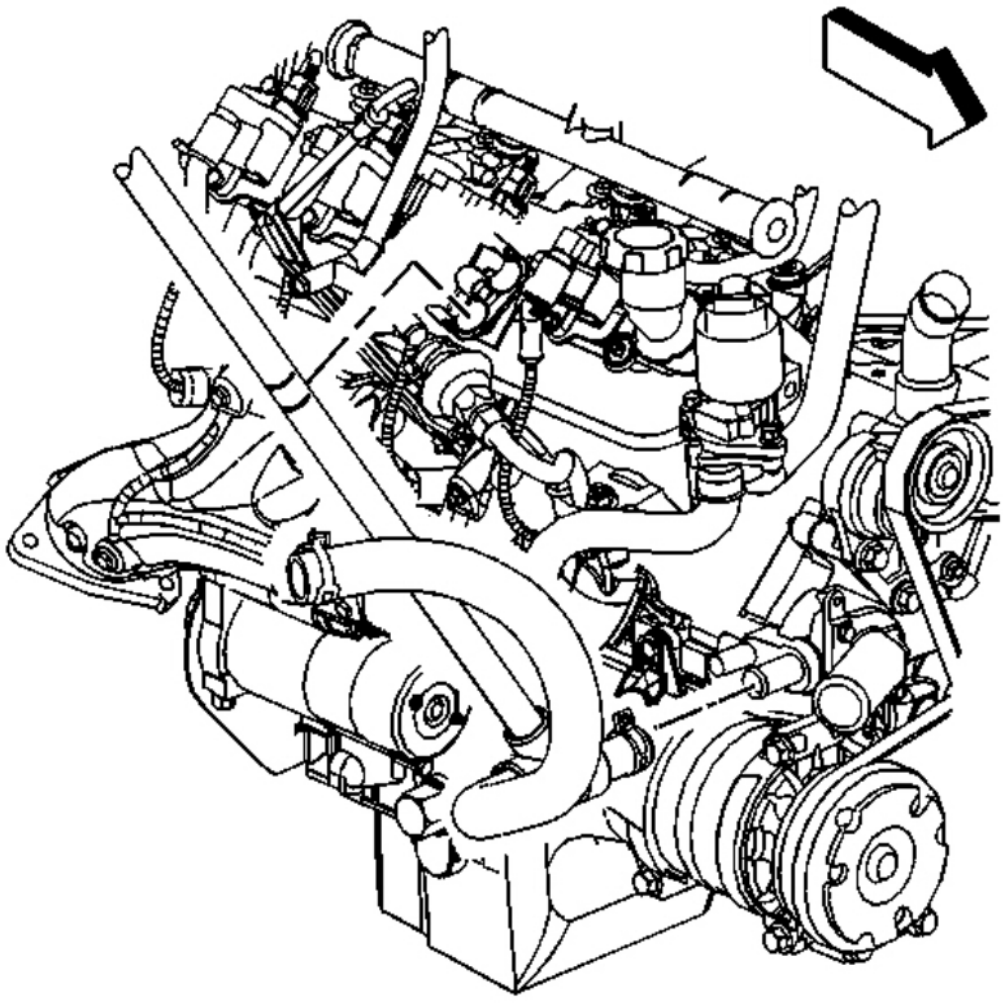


Fig. 31: View Of Surge Tank Outlet Hose To Water Pump
Courtesy of GENERAL MOTORS CORP.

1. Install the surge tank outlet hose.
2. Install the surge tank outlet hose to the water pump.
3. Position the surge tank outlet hose clamp to the water pump.

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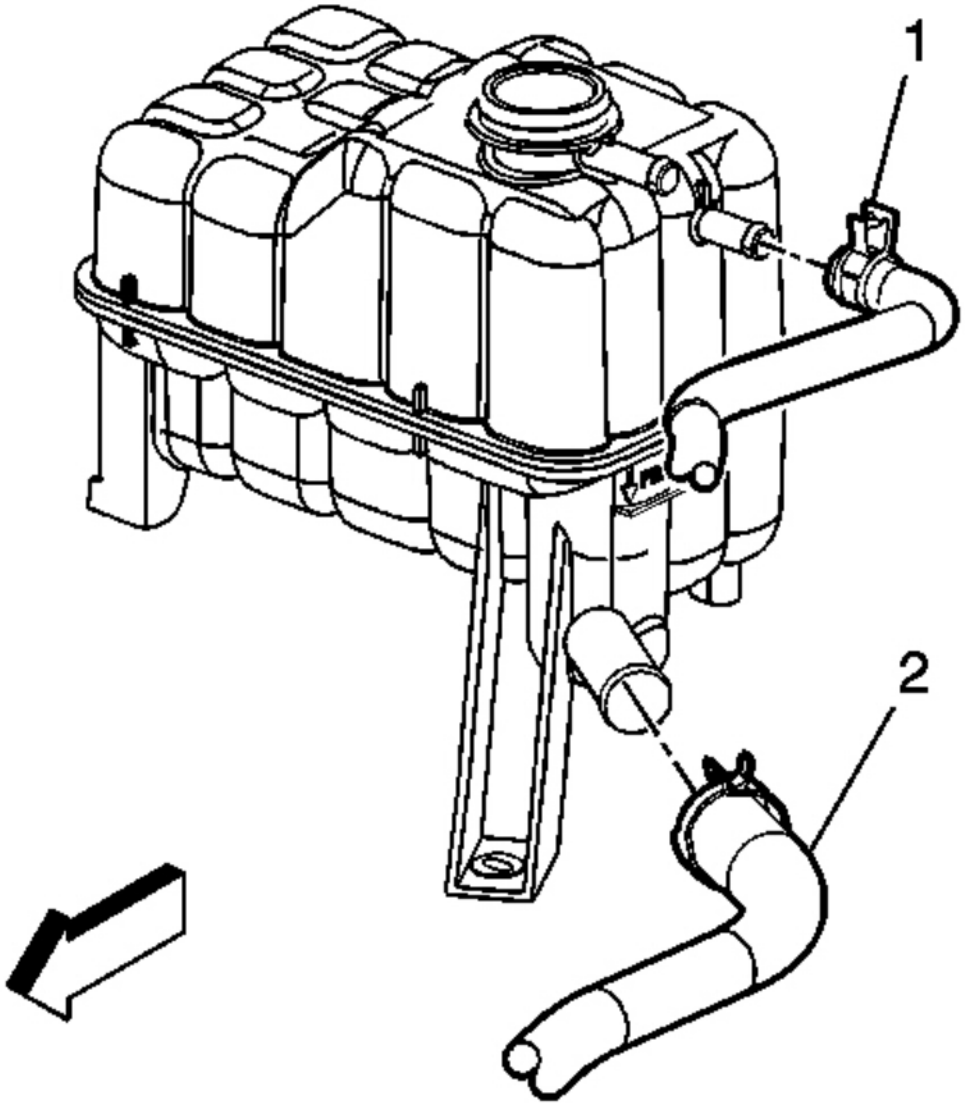


Fig. 32: View Of Surge Tank Outlet Hose & Surge Tank
Courtesy of GENERAL MOTORS CORP.

4. Install the surge tank outlet hose (2) to the surge tank.
5. Position the surge tank outlet hose clamp to the surge tank.

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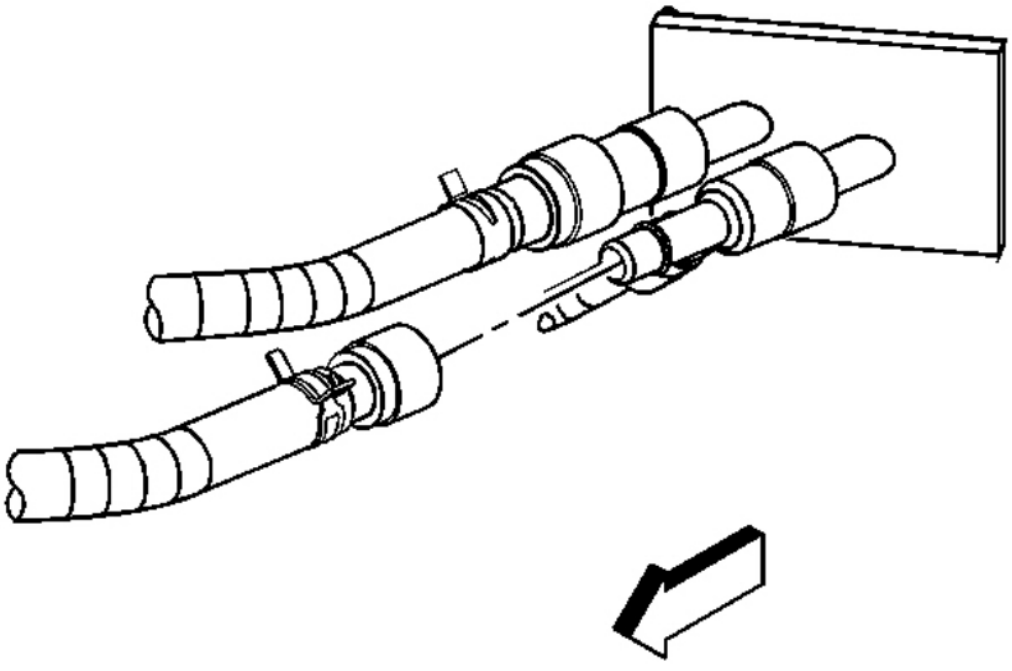


Fig. 33: View Of Outlet Hose To Heater & Blower Module (W/ RPO C36)
Courtesy of GENERAL MOTORS CORP.

6. If equipped with RPO C36 auxiliary heater, connect the surge tank outlet hose to the heater and blower module.

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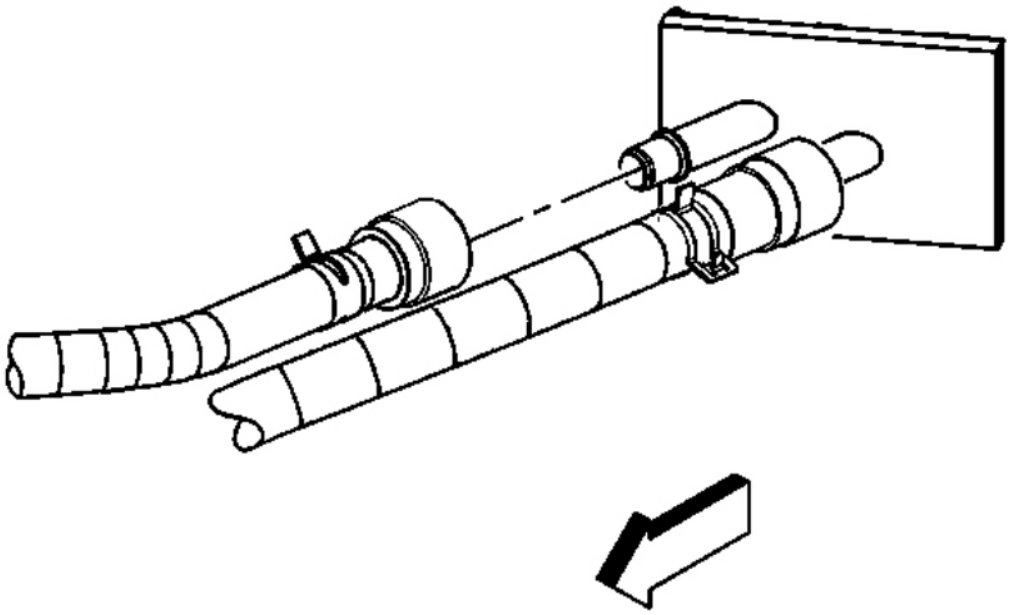


Fig. 34: View Of Outlet Hose To Heater & Blower Module (W/O RPO C36)
Courtesy of GENERAL MOTORS CORP.

7. If equipped without RPO C36 auxiliary heater, connect the surge tank outlet hose to the heater and blower module.

   Firmly push the hose onto the heater and blower module pipe until an audible click is heard.

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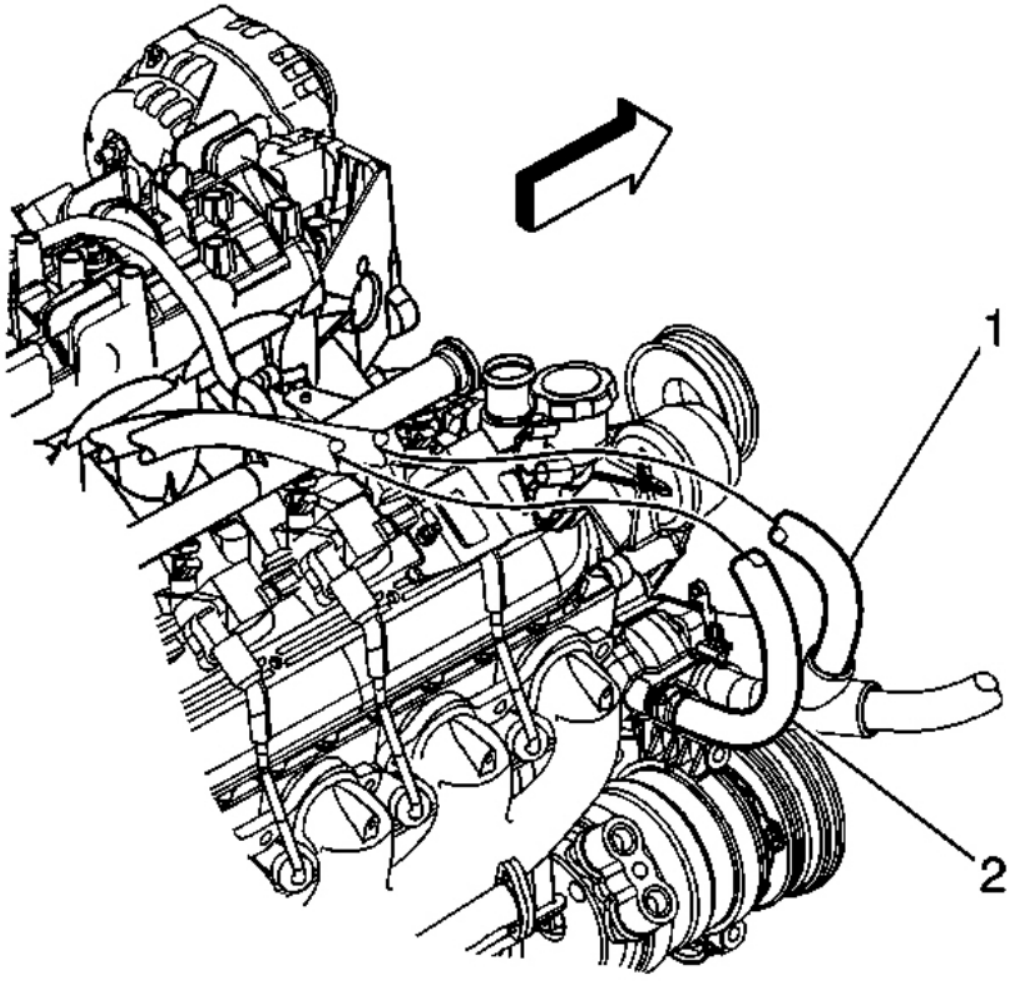


Fig. 35: View Of Surge Tank/Heater Outlet Hose To Mounting Clip (W/ RPO C36)
Courtesy of GENERAL MOTORS CORP.

8. If equipped with RPO C36 auxiliary heater, install the surge tank/heater outlet hose (1) to the mounting clip.

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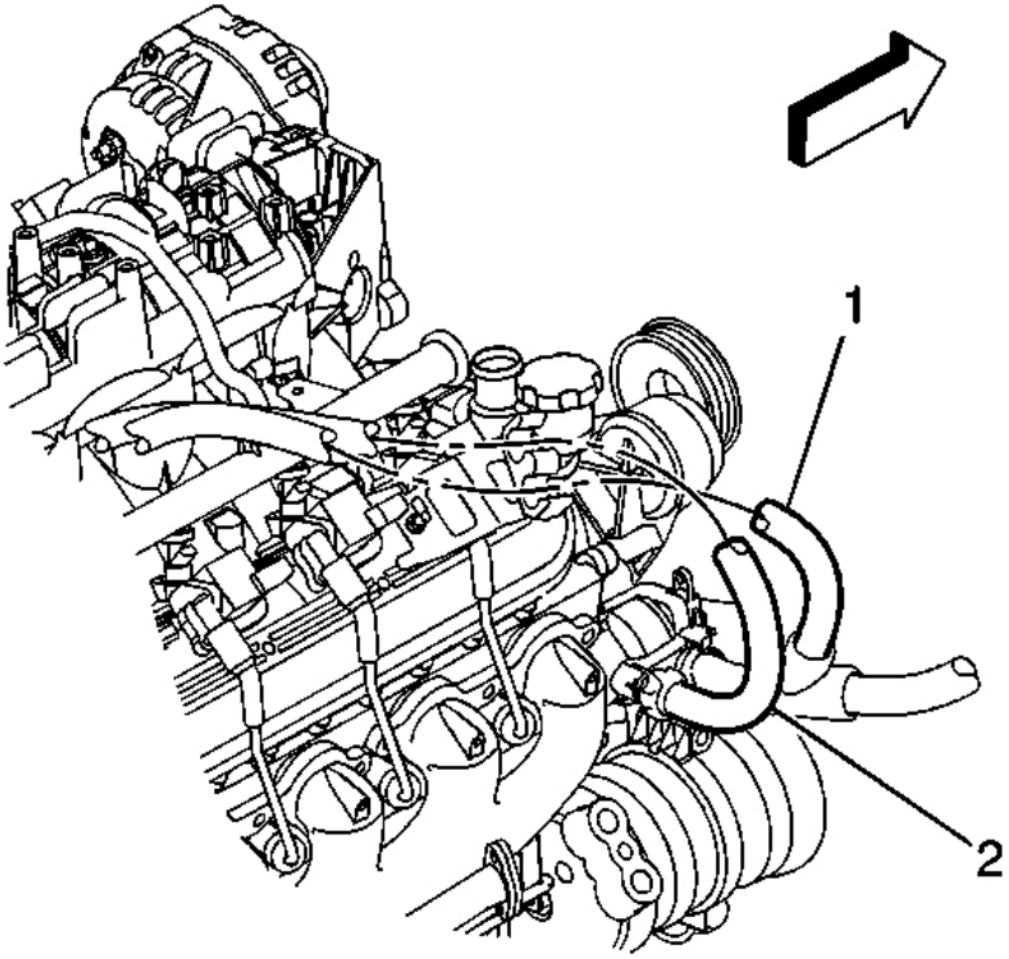


Fig. 36: View Of Surge Tank/Heater Outlet Hose To Mounting Clip (W/O RPO C36)
Courtesy of GENERAL MOTORS CORP.

9. If equipped without RPO C36 auxiliary heater, install the surge tank/heater outlet hose (1) to the mounting clip.

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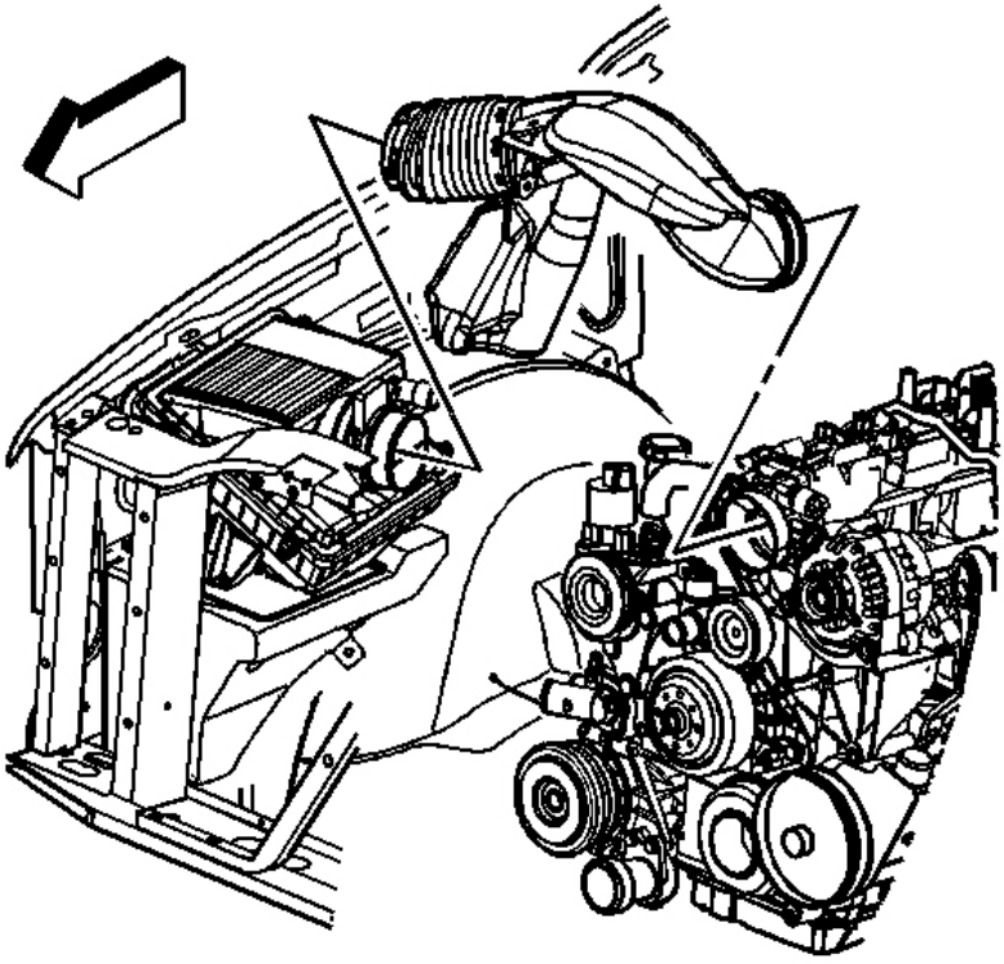


Fig. 37: View Of Air Cleaner Outlet Duct
Courtesy of GENERAL MOTORS CORP.

10. Install the air cleaner outlet duct.

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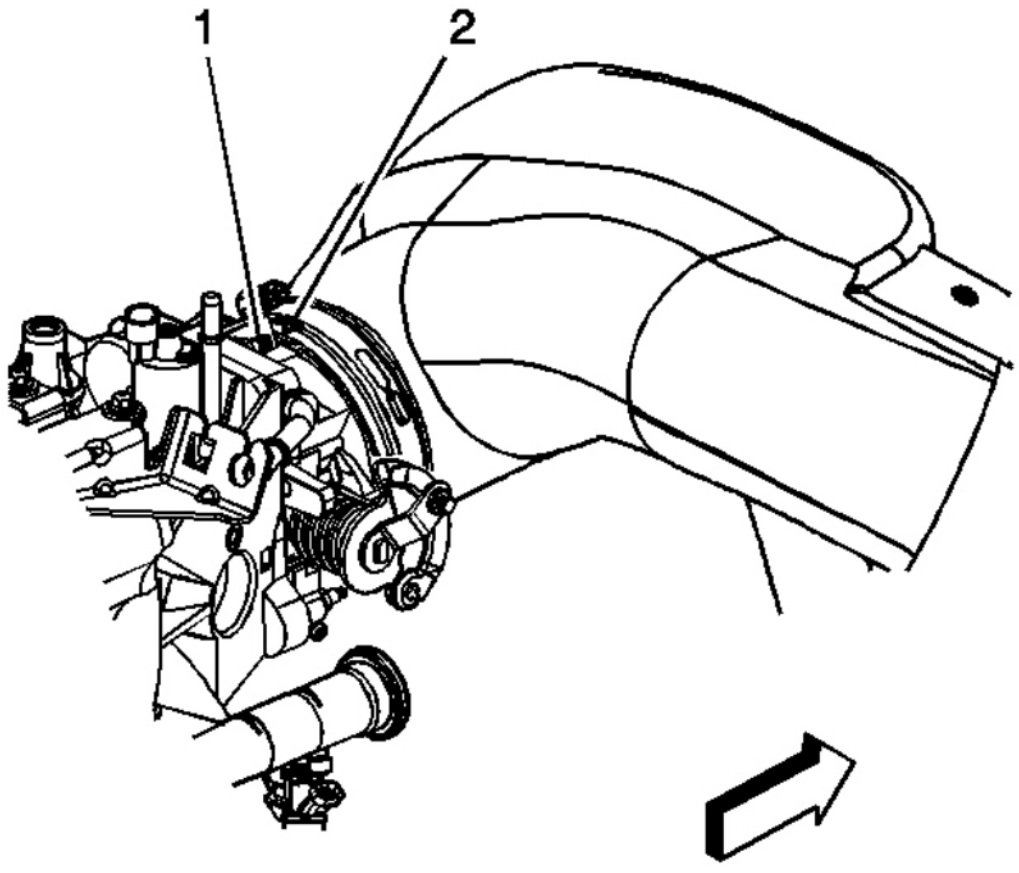


Fig. 38: View Of Air Cleaner Outlet Duct Clamps
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice in Cautions and Notices.

11. Align the arrow at the throttle body end of the duct with the throttle body attaching stud.
12. Tighten the air cleaner outlet duct clamps at the following locations:
    - Throttle body
    - MAF/IAT sensor

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

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

RADIATOR HOSE QUICK CONNECT FITTING

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Removal Procedure

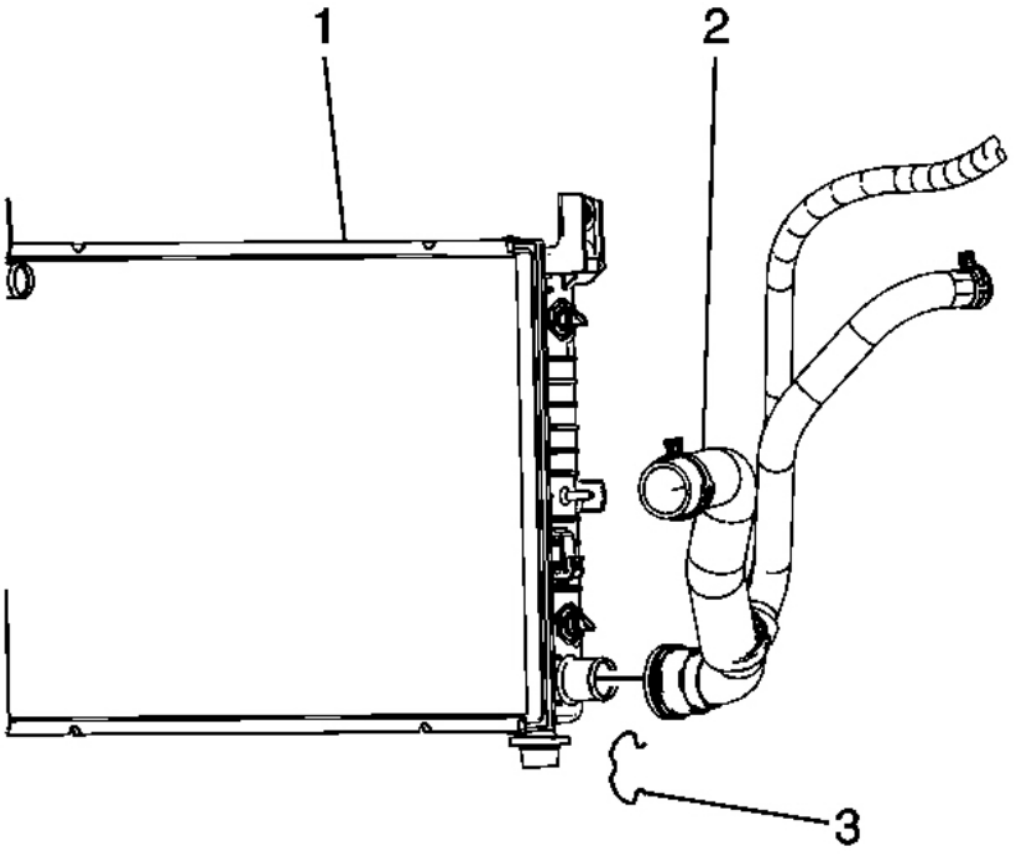


Fig. 39: Radiator Outlet Hose To The Radiator
Courtesy of GENERAL MOTORS CORP.

1. Using a bent-tip screwdriver or equivalent, pull on one of the open ends of the retaining ring in order to rotate the retaining ring.
2. Rotate the retaining ring (3) around the quick connector until the retaining ring is out of position and can be completely removed.
3. Remove the radiator outlet hose (2) from the quick connector fitting at the radiator (1).

Installation Procedure

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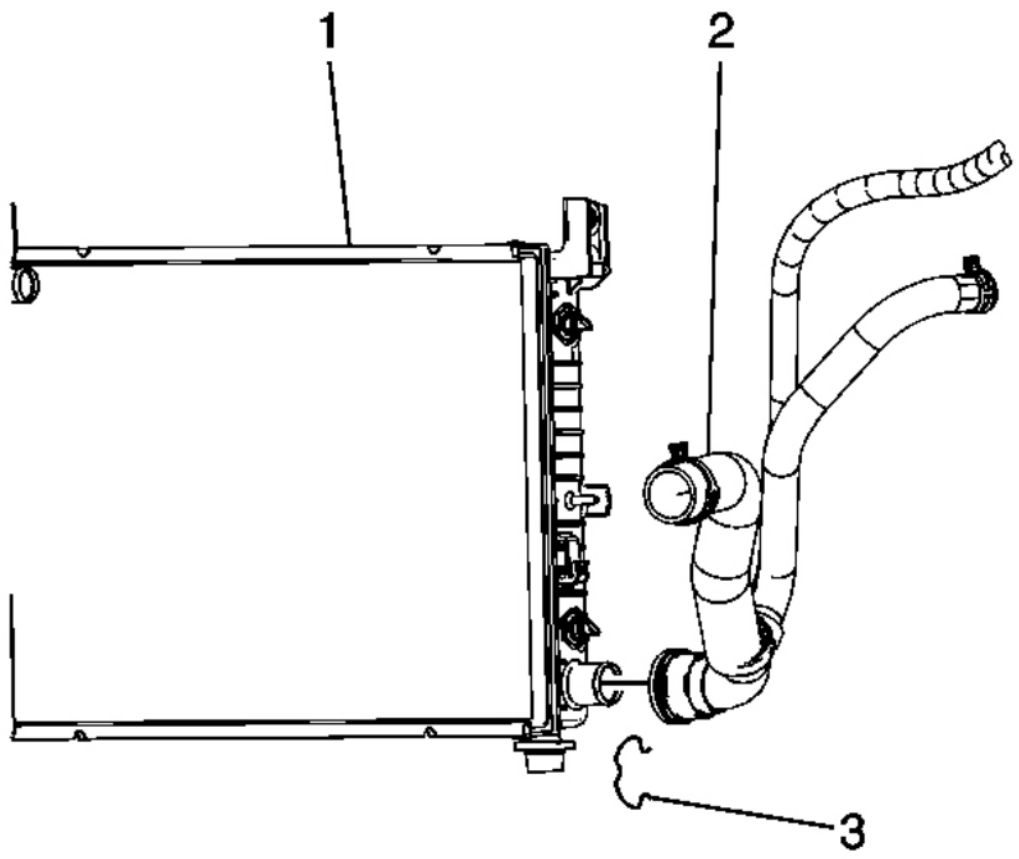


Fig. 40: Radiator Outlet Hose To The Radiator
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Do not install the retaining ring (3) onto the fitting by pushing the retaining ring down over the fitting.

1. Hook one of the open ends of the retaining ring (3) in one of the slots in the quick connector.
2. Rotate the retaining ring (3) around the connector until the retaining ring is positioned with all 3 ears through the 3 slots.
3. Ensure the 3 retaining ring ears can be seen from the inside of the connector and the retaining ring can move freely in the slots.
4. Install the radiator outlet hose (2) onto the radiator quick connector fitting until a click is heard or felt.

   Pull back on the radiator outlet hose (2) to ensure a proper connection.

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RADIATOR HOSE REPLACEMENT - INLET (4.8L, 5.3L, AND 6.0L ENGINES)

Removal Procedure

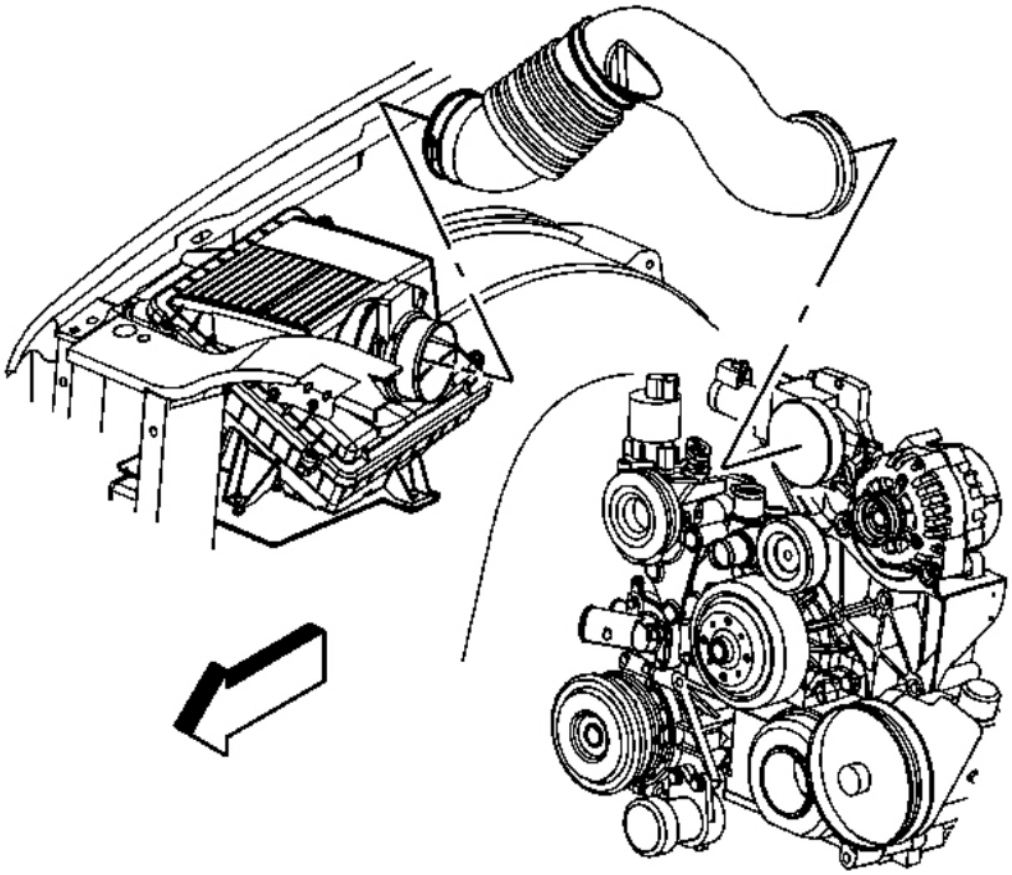


Fig. 41: View Of Air Cleaner Outlet Duct (W/HP2 Front)
Courtesy of GENERAL MOTORS CORP.

1. Drain the cooling system. Refer to **Draining and Filling Cooling System**.
2. Loosen the air cleaner outlet duct clamps at the following locations:
   - Throttle body
   - Mass airflow/intake air temperature (MAF/IAT) sensor
3. Remove the air cleaner outlet duct.
4. If necessary, remove the engine sight shield. Refer to **Engine Sight Shield Replacement (4.8L, 5.3L, and 6.0L (RPO LQ4))** or **Engine Sight Shield Replacement (6.0L (RPO LQ9))** in Engine Mechanical

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- 4.8L, 5.3L, and 6.0L.

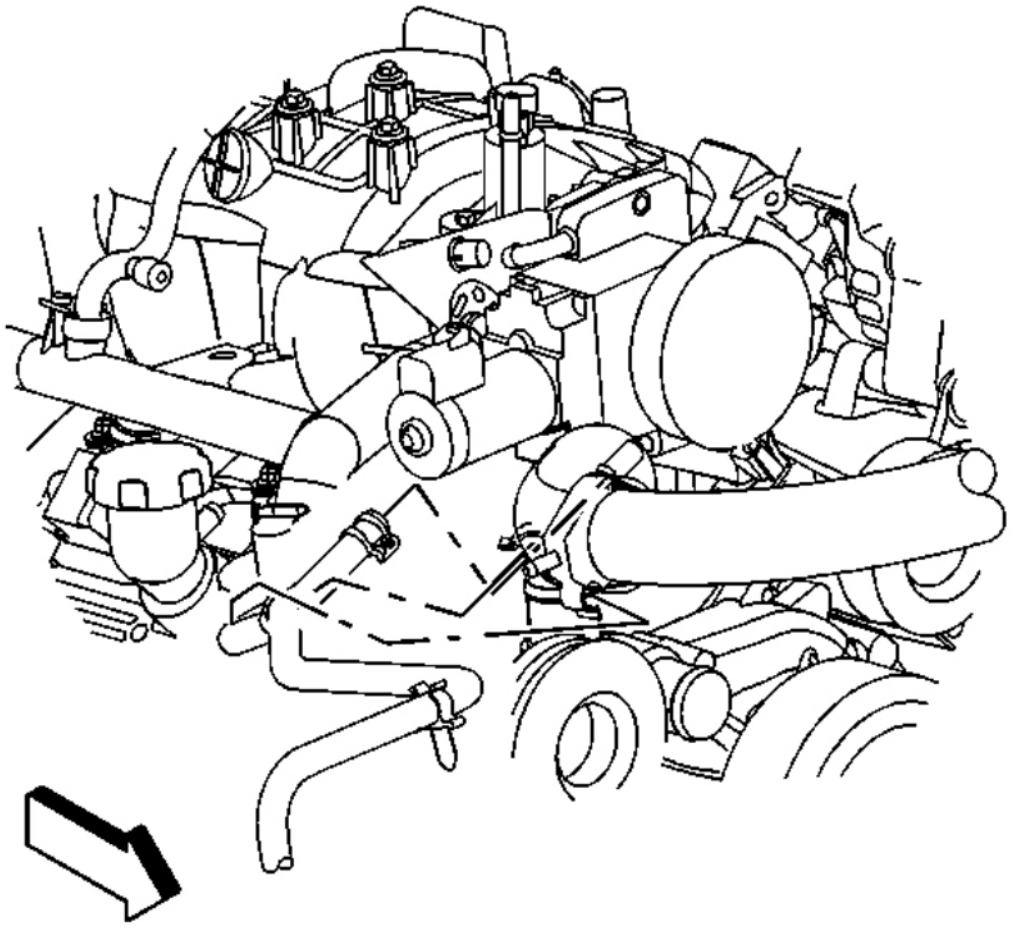


Fig. 42: View Of Vent Inlet Hose At Throttle Body
Courtesy of GENERAL MOTORS CORP.

5. Remove the radiator vent inlet hose from the radiator inlet hose clips.

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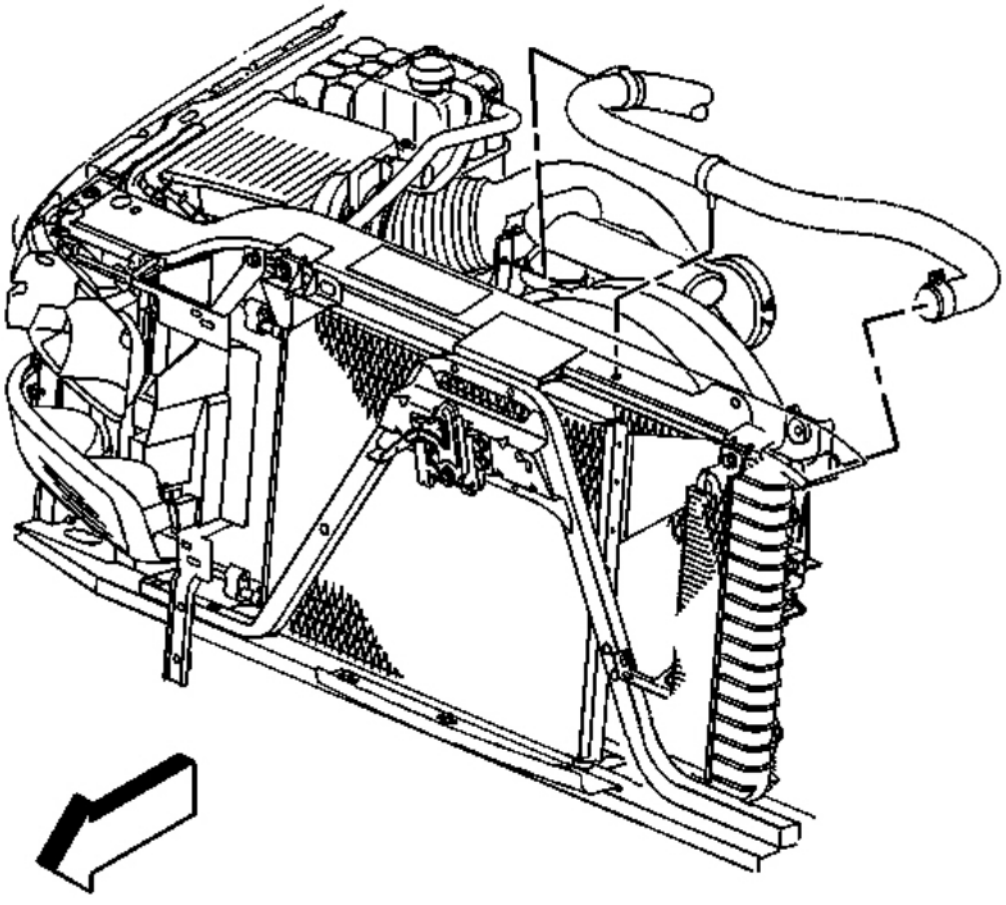


Fig. 43: View Of Inlet Hose & Radiator (4.8, 5.3, & 6.0L)
Courtesy of GENERAL MOTORS CORP.

6. Reposition the inlet hose clamp from the radiator.
7. Remove the inlet hose from the radiator.
8. Remove the inlet hose clip from the fan shroud.

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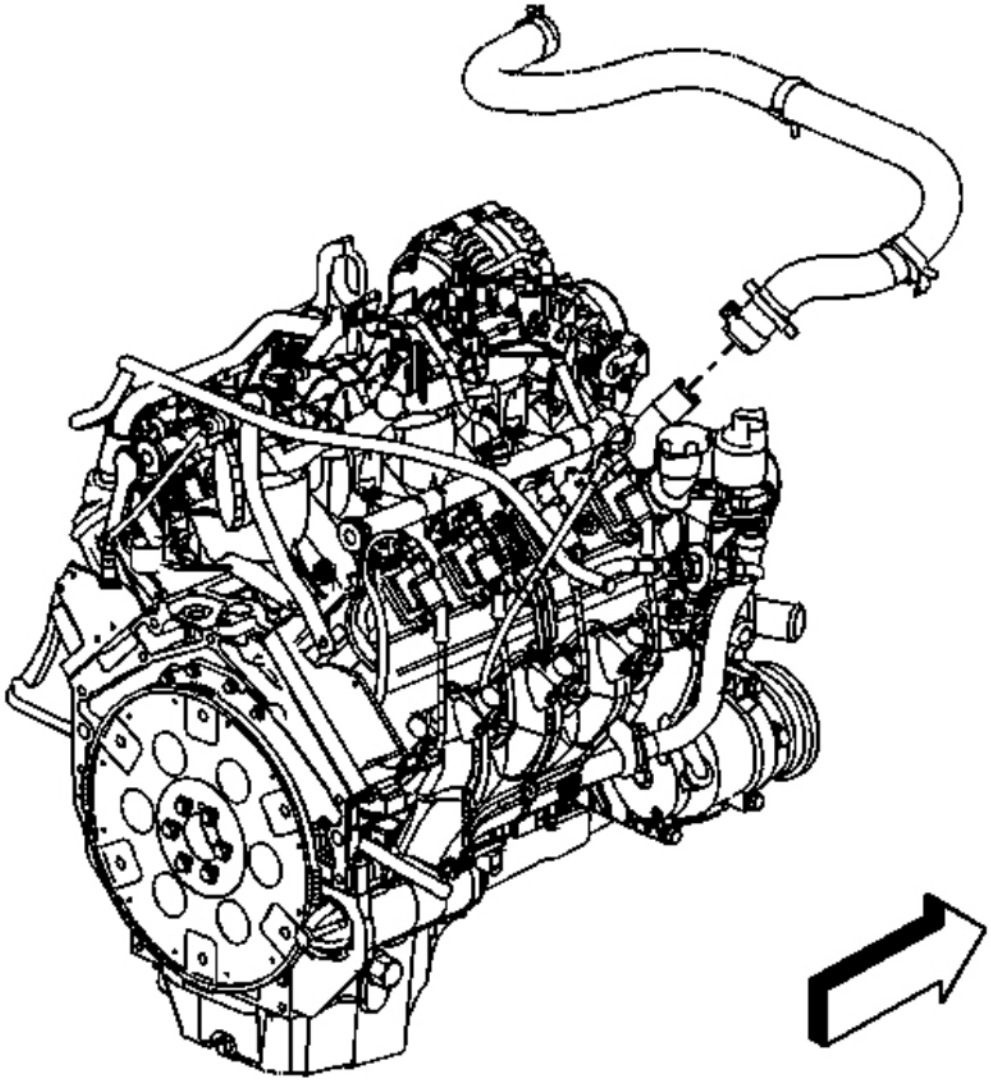


Fig. 44: View Of Inlet Hose & Water Pump
Courtesy of GENERAL MOTORS CORP.

9. Reposition the inlet hose clamp from the water outlet.
10. Remove the inlet hose from the water outlet.

Installation Procedure

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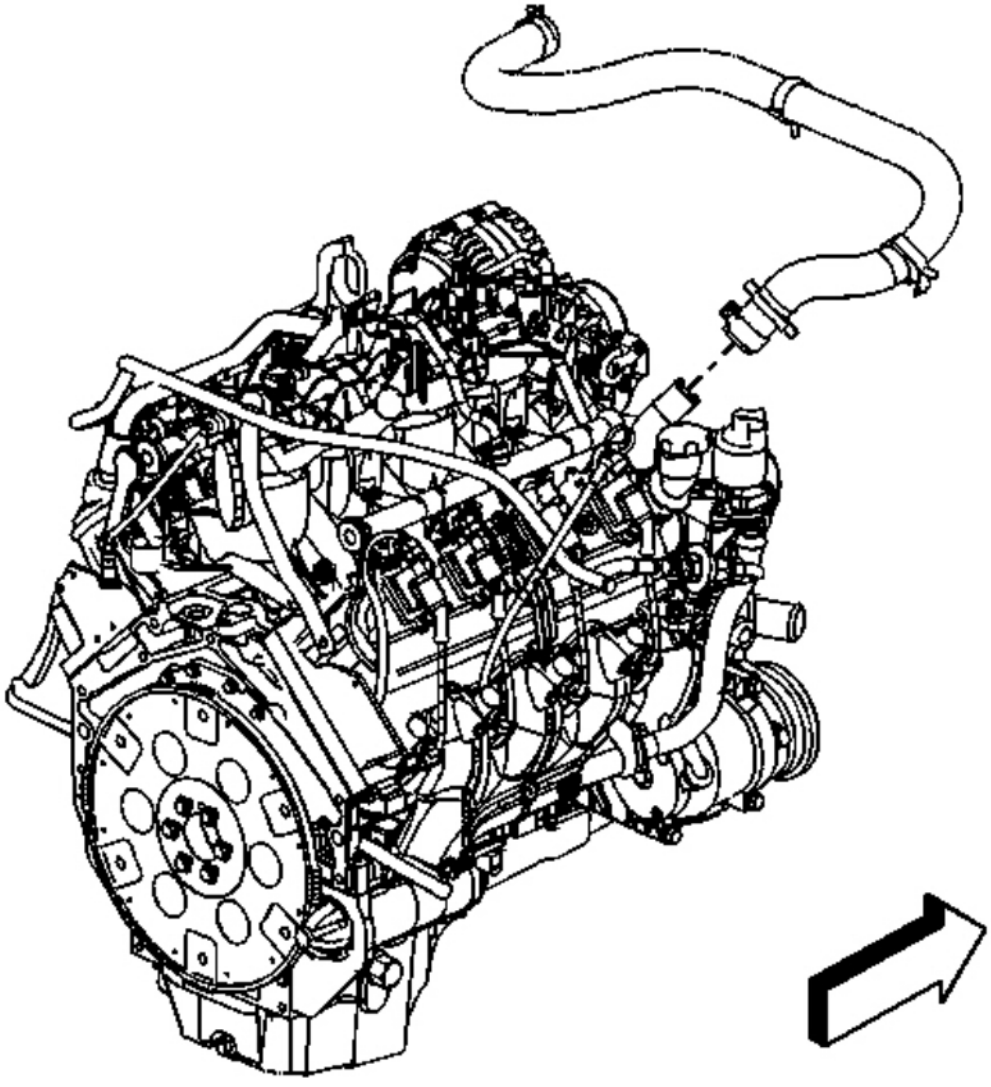


Fig. 45: View Of Inlet Hose & Water Pump
Courtesy of GENERAL MOTORS CORP.

1. Install the inlet hose to the water outlet.
2. Reposition the inlet hose clamp to the water outlet.
3. Install the inlet hose clip to the fan shroud.

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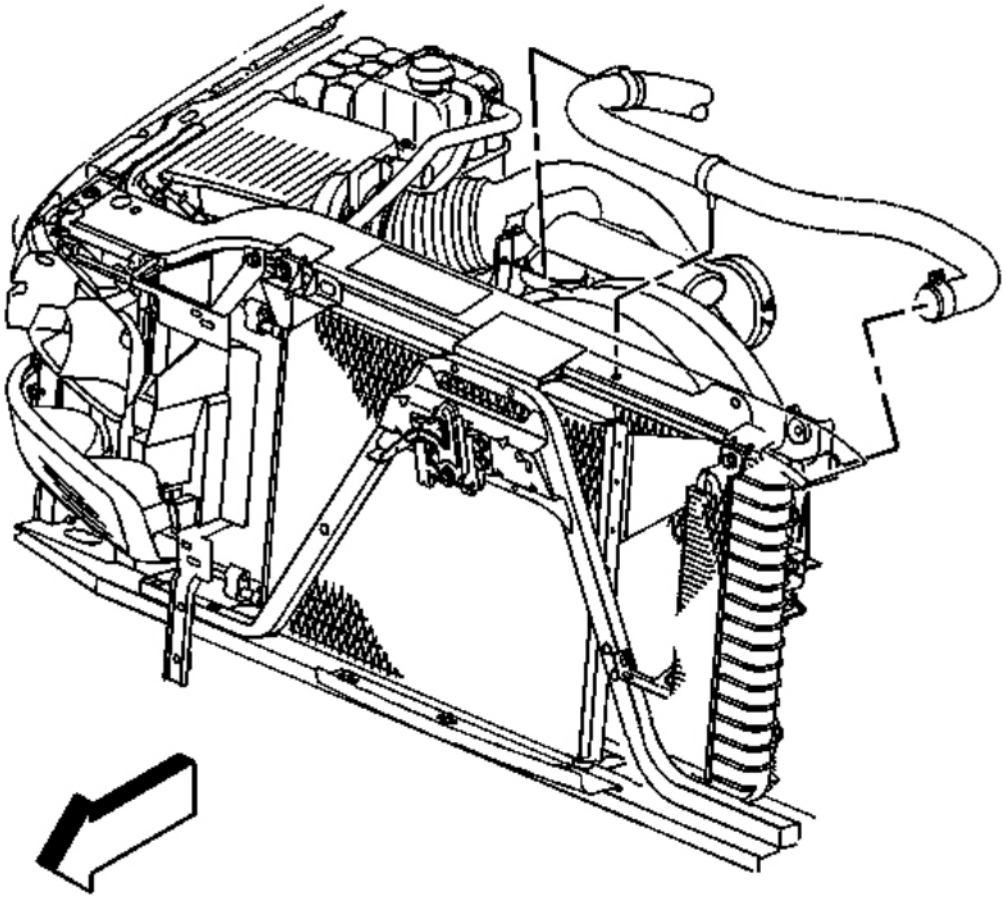


Fig. 46: View Of Inlet Hose & Radiator (4.8, 5.3, & 6.0L)
Courtesy of GENERAL MOTORS CORP.

4. Install the inlet hose to the radiator.
5. Reposition the inlet hose clamp to the radiator.

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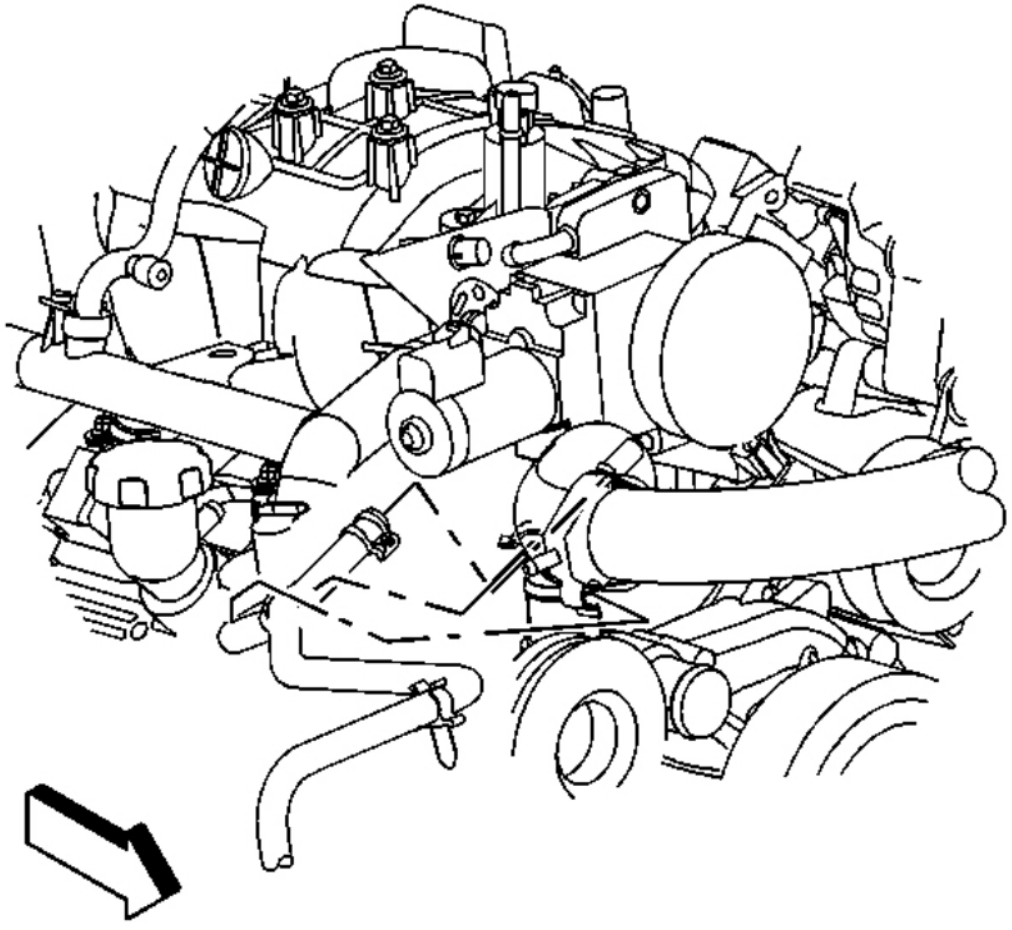


Fig. 47: View Of Vent Inlet Hose At Throttle Body
Courtesy of GENERAL MOTORS CORP.

6. Install the radiator vent inlet hose to the radiator inlet hose clips.
7. If necessary, install the engine sight shield. Refer to **Engine Sight Shield Replacement (4.8L, 5.3L, and 6.0L (RPO LQ4))** or **Engine Sight Shield Replacement (6.0L (RPO LQ9))** in Engine Mechanical - 4.8L, 5.3L, and 6.0L.

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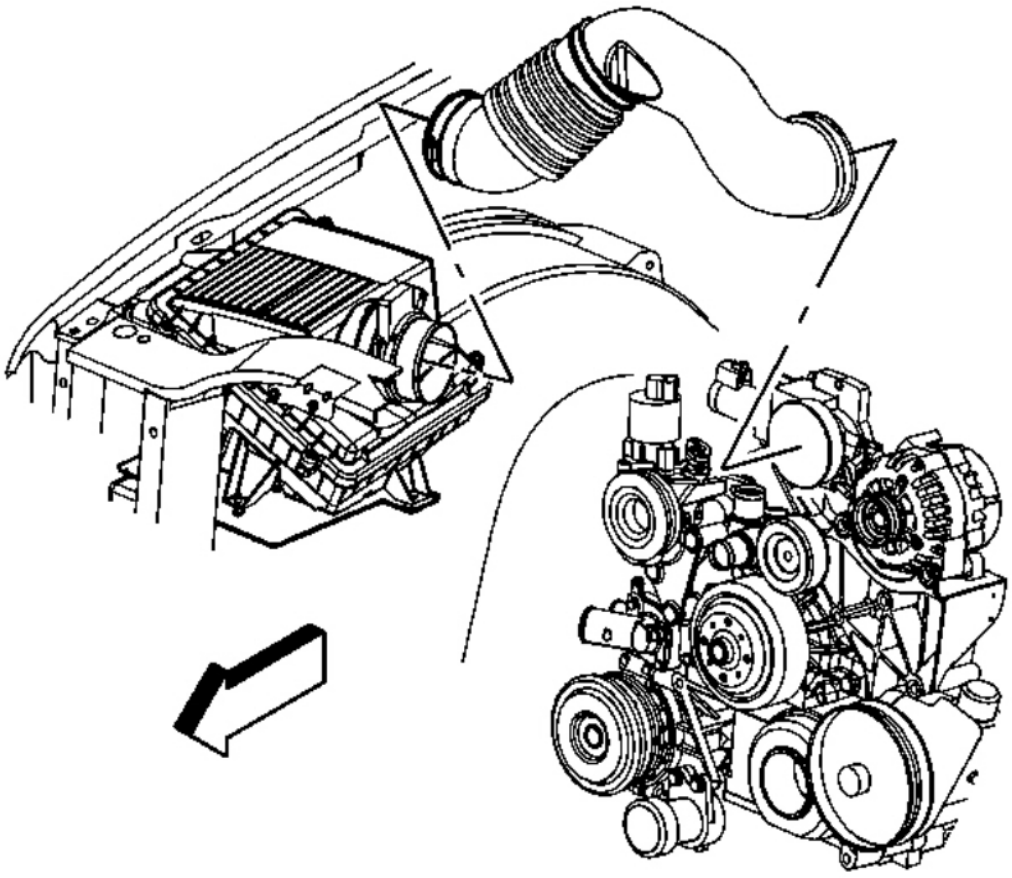


Fig. 48: View Of Air Cleaner Outlet Duct (W/HP2 Front)
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Align the arrow at the throttle body end of the duct with the throttle body attaching stud.

8. Install the air cleaner outlet duct.

NOTE: Refer to Fastener Notice in Cautions and Notices.

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

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Tighten: Tighten the air cleaner outlet duct clamp screws to 7 N.m (62 lb in).

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

RADIATOR HOSE REPLACEMENT - INLET (8.1L ENGINE)

Removal Procedure

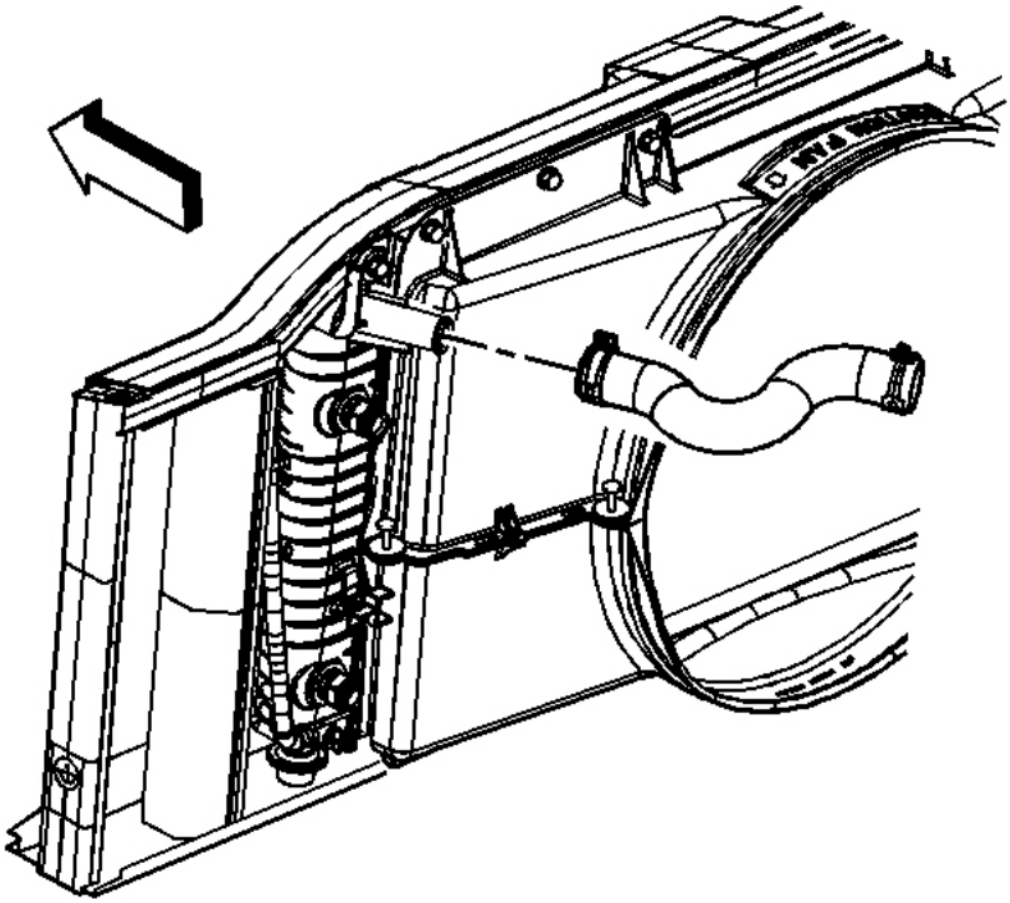


Fig. 49: View Of Inlet Hose & Radiator (8.1L)
Courtesy of GENERAL MOTORS CORP.

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

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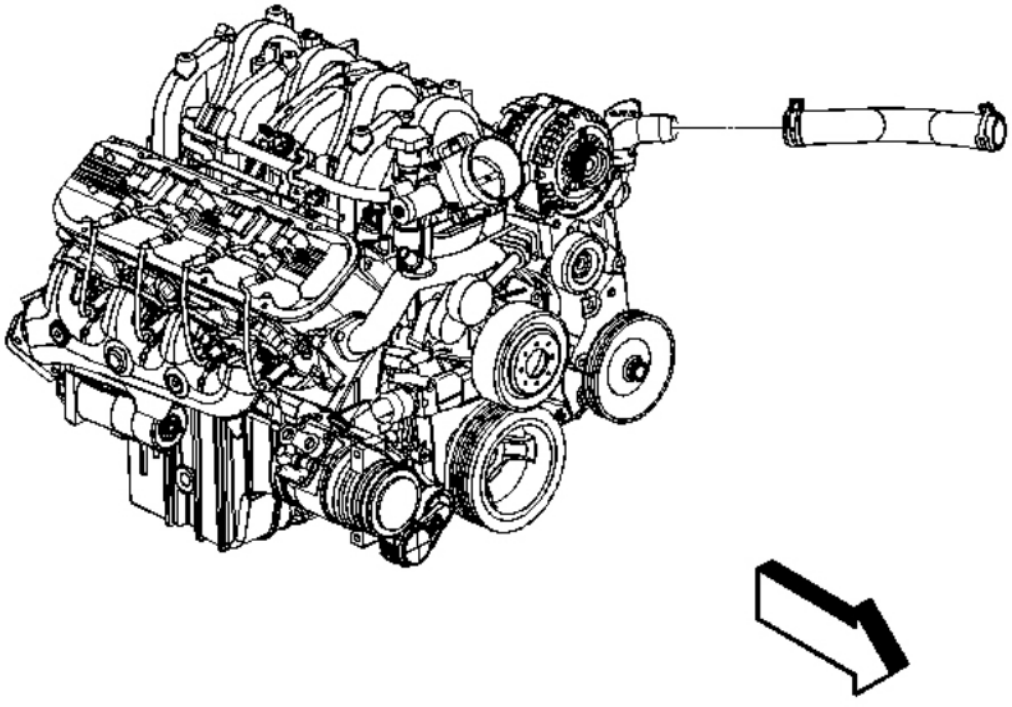


Fig. 50: View Of Inlet Hose Clamp & Water Crossover
Courtesy of GENERAL MOTORS CORP.

4. Reposition the inlet hose clamp from the water outlet.
5. Remove the inlet hose from the water outlet.

Installation Procedure

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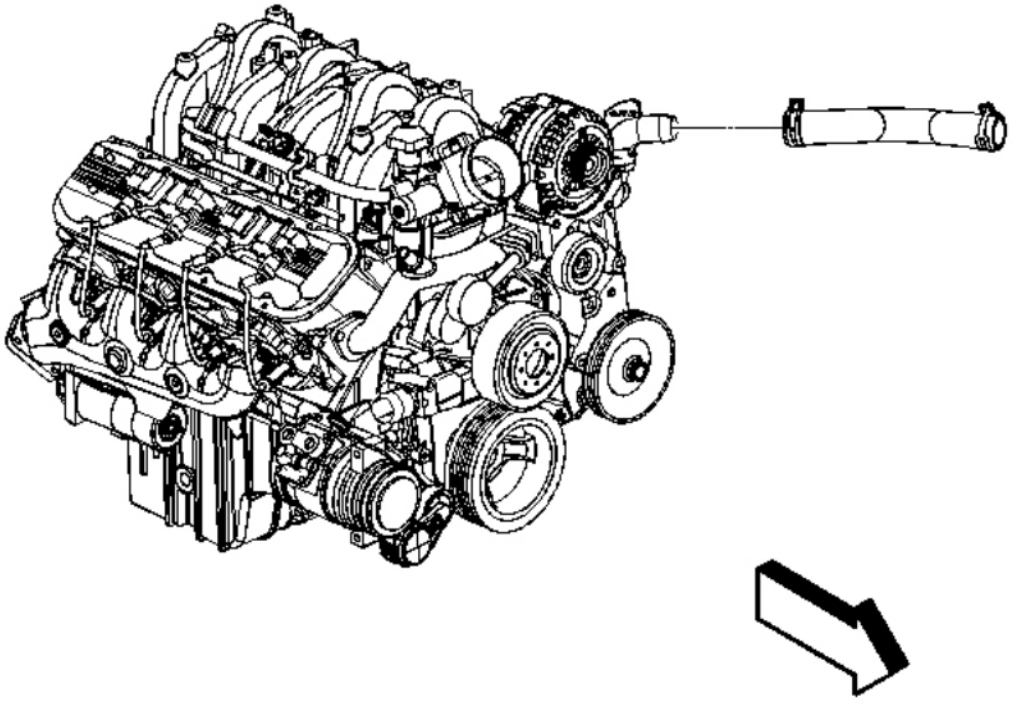


Fig. 51: View Of Inlet Hose Clamp & Water Crossover
Courtesy of GENERAL MOTORS CORP.

1. Install the inlet hose to the water outlet.
2. Reposition the inlet hose clamp to the water outlet.

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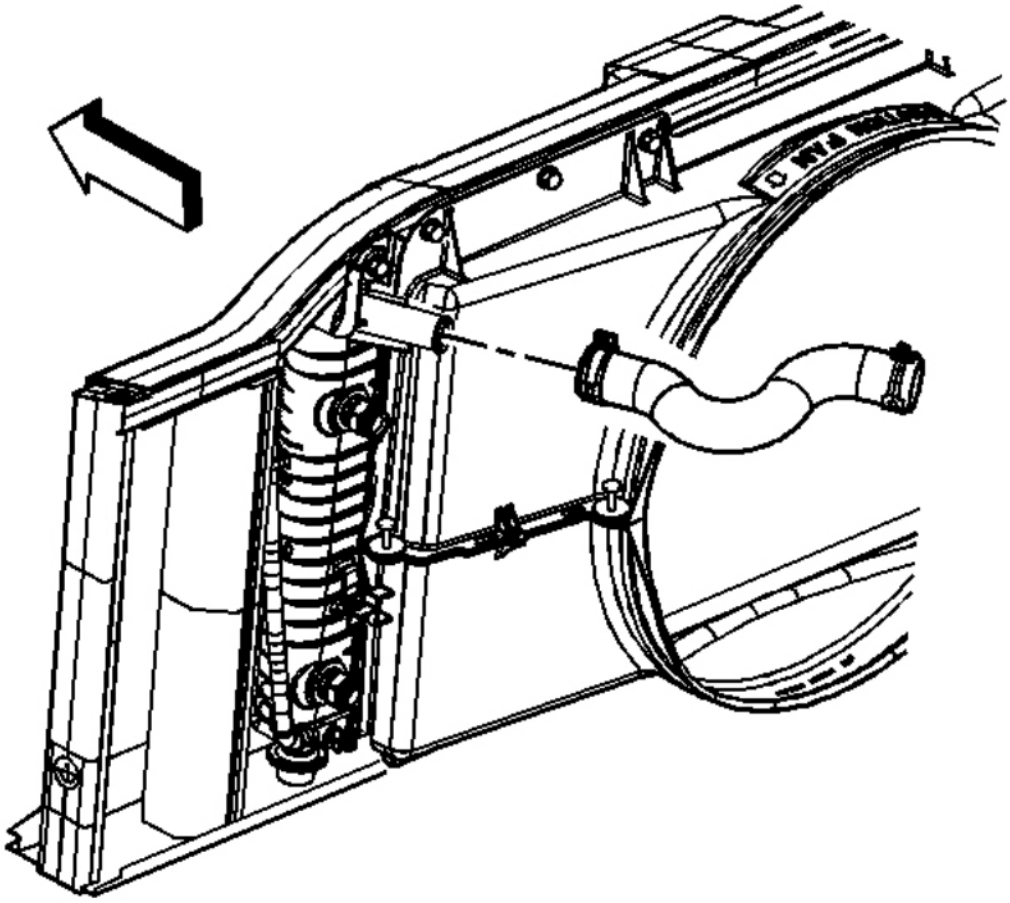


Fig. 52: View Of Inlet Hose & Radiator (8.1L)
Courtesy of GENERAL MOTORS CORP.

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

RADIATOR HOSE REPLACEMENT - OUTLET (4.8L, 5.3L, AND 6.0L ENGINES)

Removal Procedure

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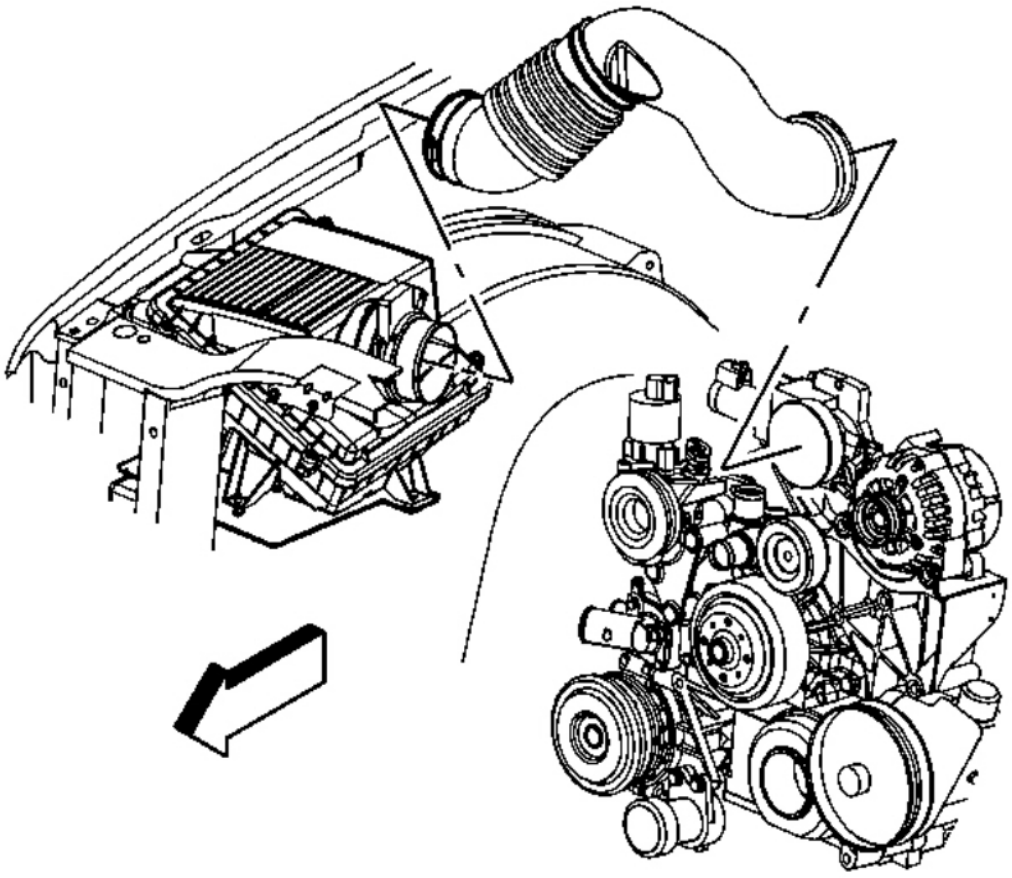


Fig. 53: View Of Air Cleaner Outlet Duct (W/HP2 Front)
Courtesy of GENERAL MOTORS CORP.

1. Drain the cooling system. Refer to **Draining and Filling Cooling System**.
2. Loosen the air cleaner outlet duct clamps at the following locations:
   - Throttle body
   - Mass airflow/intake air temperature (MAF/IAT) sensor
3. Remove the air cleaner outlet duct.

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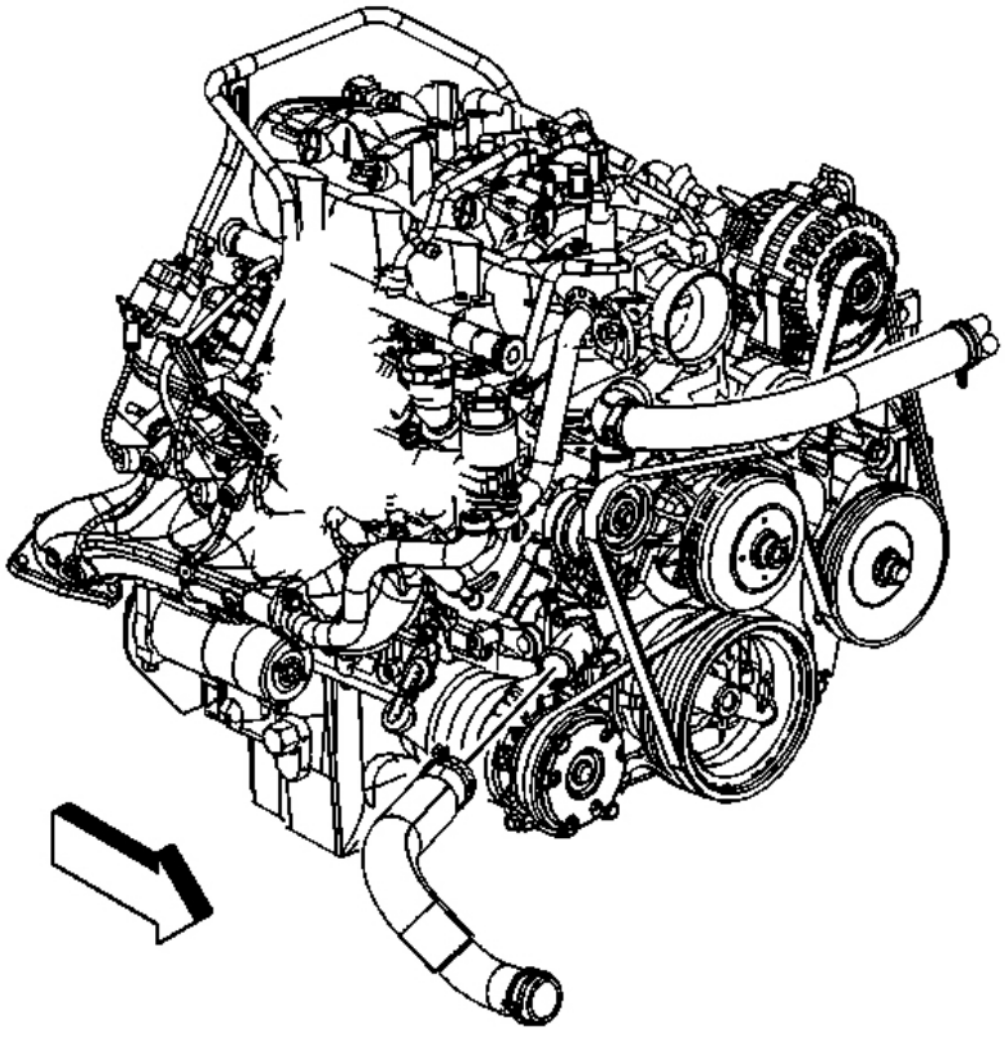


Fig. 54: View Of Outlet Hose & Water Pump
Courtesy of GENERAL MOTORS CORP.

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

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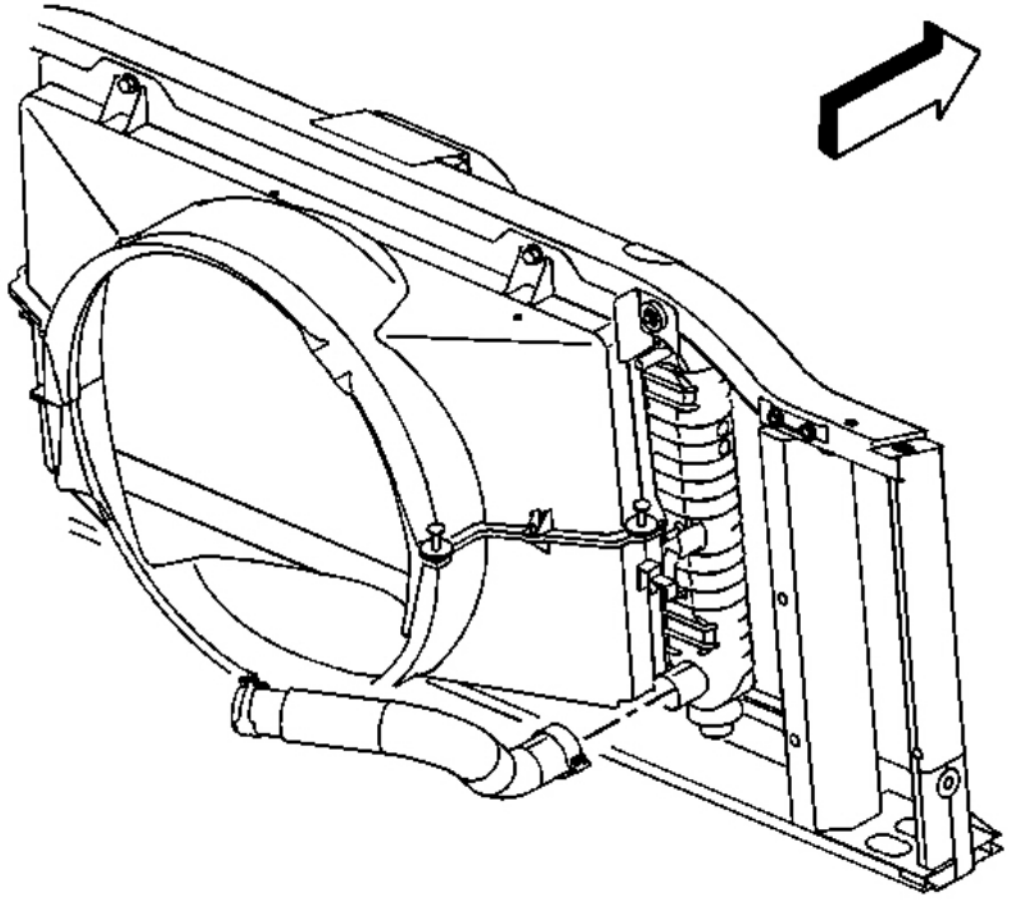


Fig. 55: View Of Outlet Hose & Radiator (4.8, 5.3, & 6.0L)
Courtesy of GENERAL MOTORS CORP.

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

Installation Procedure

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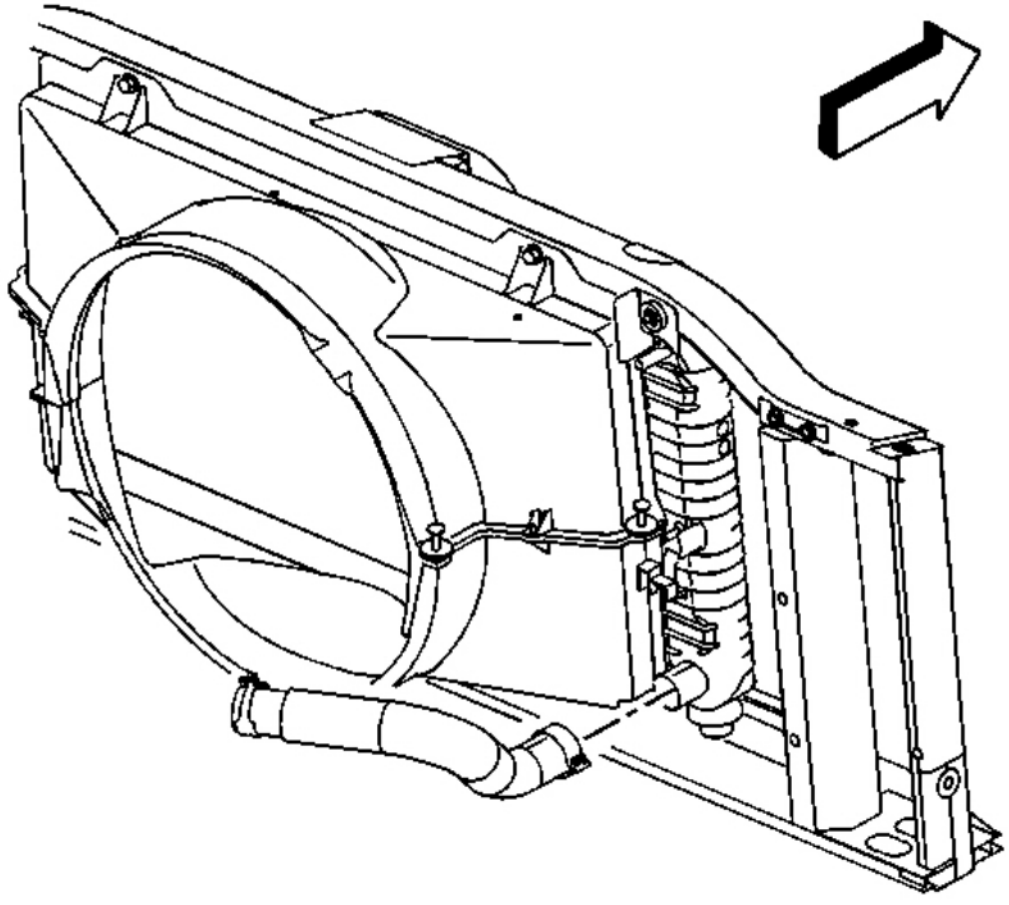


Fig. 56: View Of Outlet Hose & Radiator (4.8, 5.3, & 6.0L)
Courtesy of GENERAL MOTORS CORP.

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

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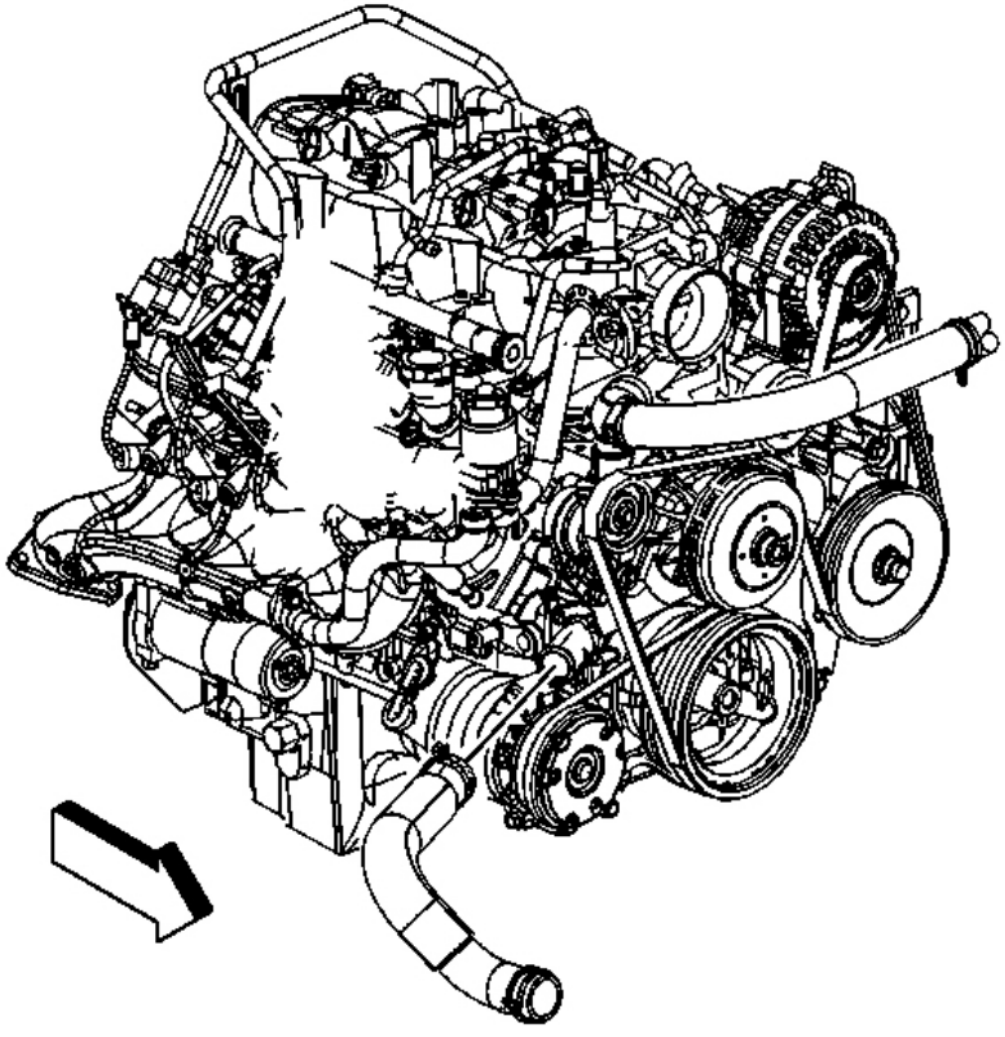


Fig. 57: View Of Outlet Hose & Water Pump
Courtesy of GENERAL MOTORS CORP.

3. Install the outlet hose to the water pump.
4. Reposition the outlet hose clamp to the water pump.

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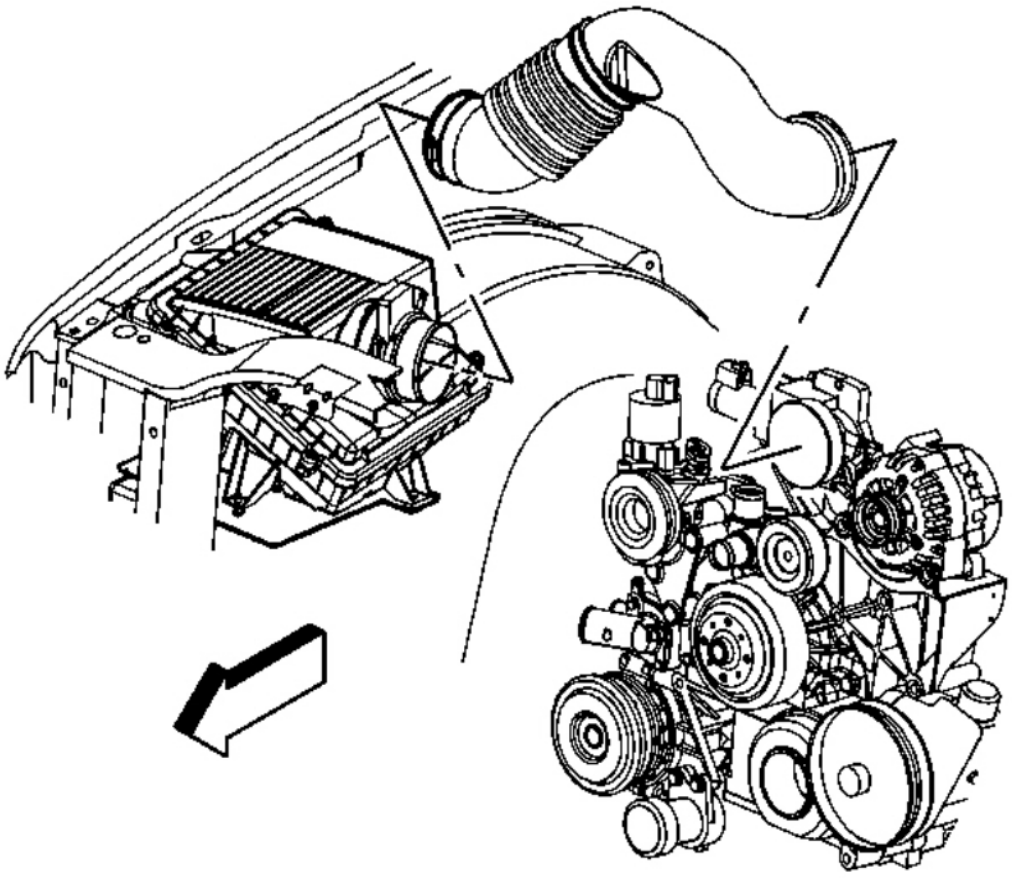


Fig. 58: View Of Air Cleaner Outlet Duct (W/HP2 Front)
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Align the arrow at the throttle body end of the duct with the throttle body attaching stud.

5. Install the air cleaner outlet duct.
6. Install the radiator inlet hose clip to the outlet duct.

NOTE: Refer to Fastener Notice in Cautions and Notices.

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

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Tighten: Tighten the air cleaner outlet duct clamp screws to 7 N.m (62 lb in).

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

RADIATOR HOSE REPLACEMENT - OUTLET (UTILITY 8.1L ENGINE)

Removal Procedure

1. Drain the cooling system. Refer to **Draining and Filling Cooling System**.
2. Remove the heater and surge tank hoses from the mounting clip.

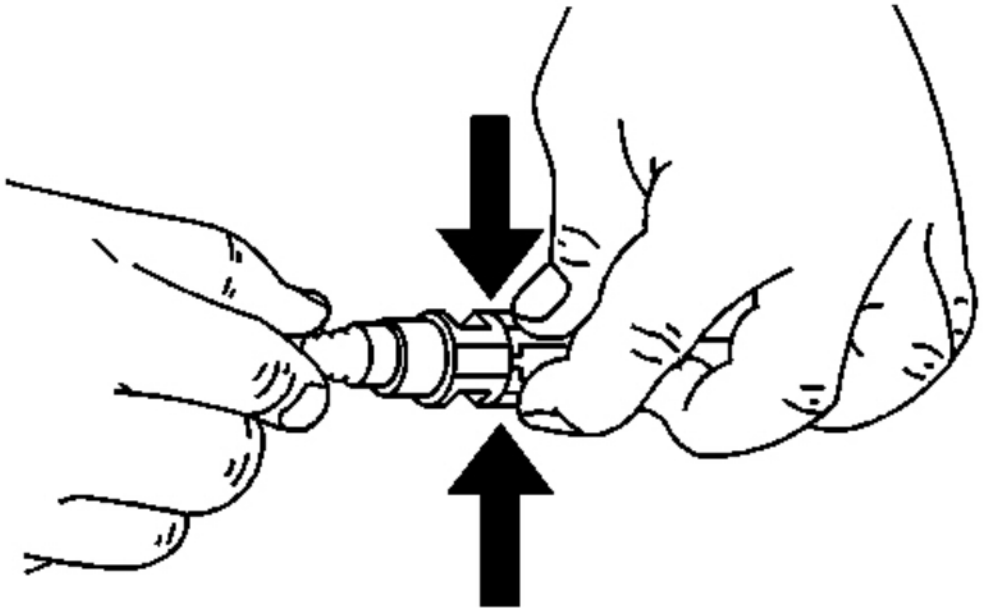


Fig. 59: Squeezing Quick Connect Fitting Release Tabs (Plastic Collar)
Courtesy of GENERAL MOTORS CORP.

3. Squeeze the plastic retainer release tabs.

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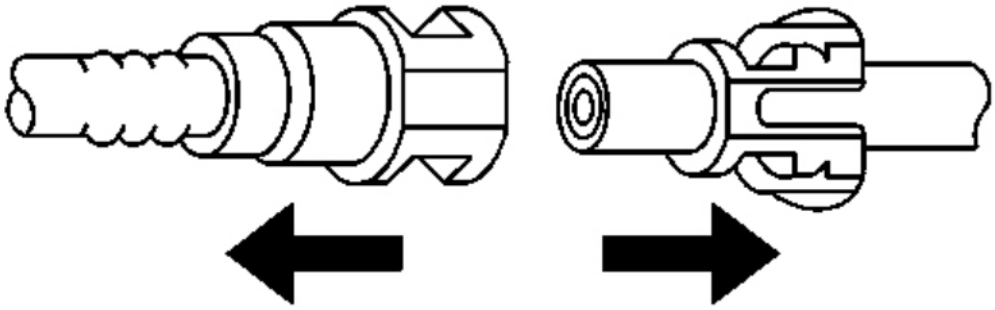


Fig. 60: Pulling Connection Apart (Plastic Collar)
Courtesy of GENERAL MOTORS CORP.

4. Pull the connection apart.

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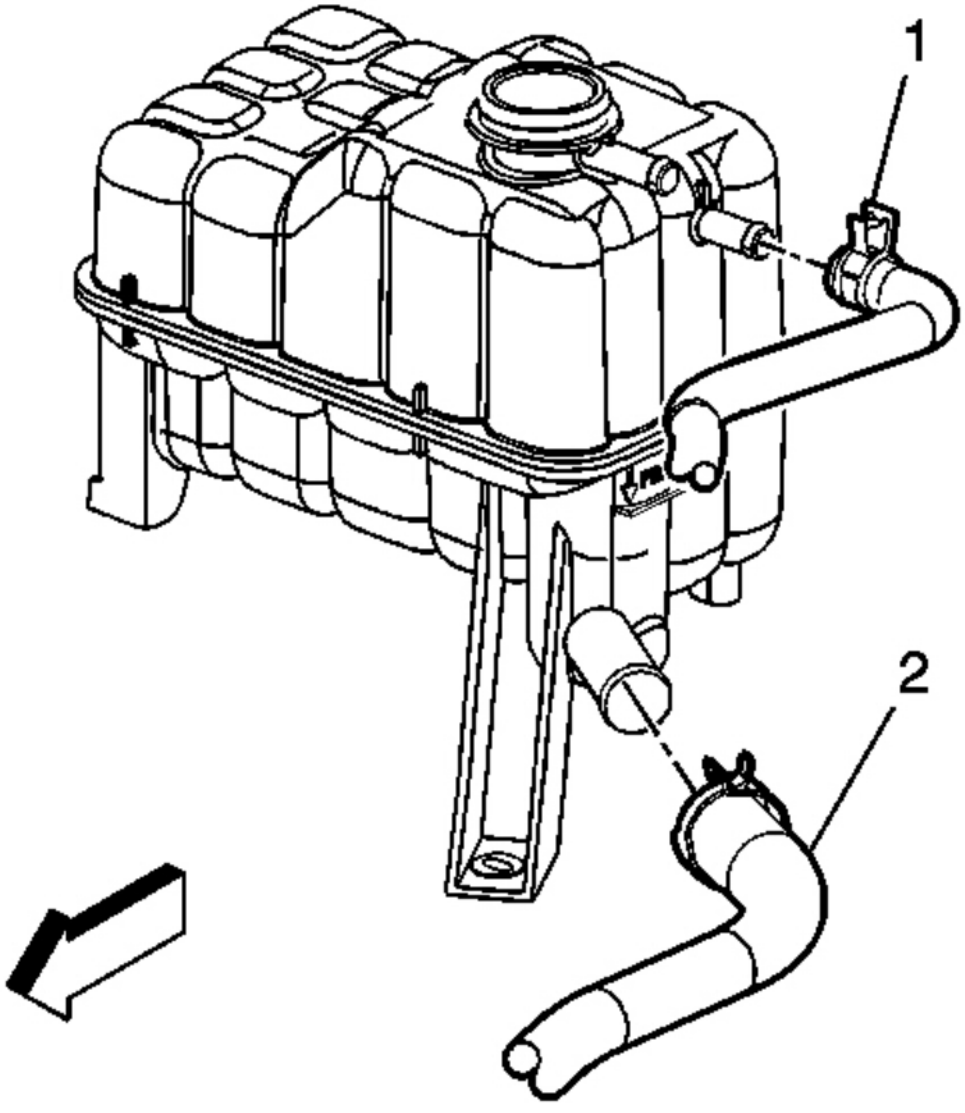


Fig. 61: View Of Surge Tank Outlet Hose & Surge Tank
Courtesy of GENERAL MOTORS CORP.

5. Reposition the surge tank outlet hose clamp at the surge tank.
6. Remove the surge tank outlet hose (2) from the surge tank.

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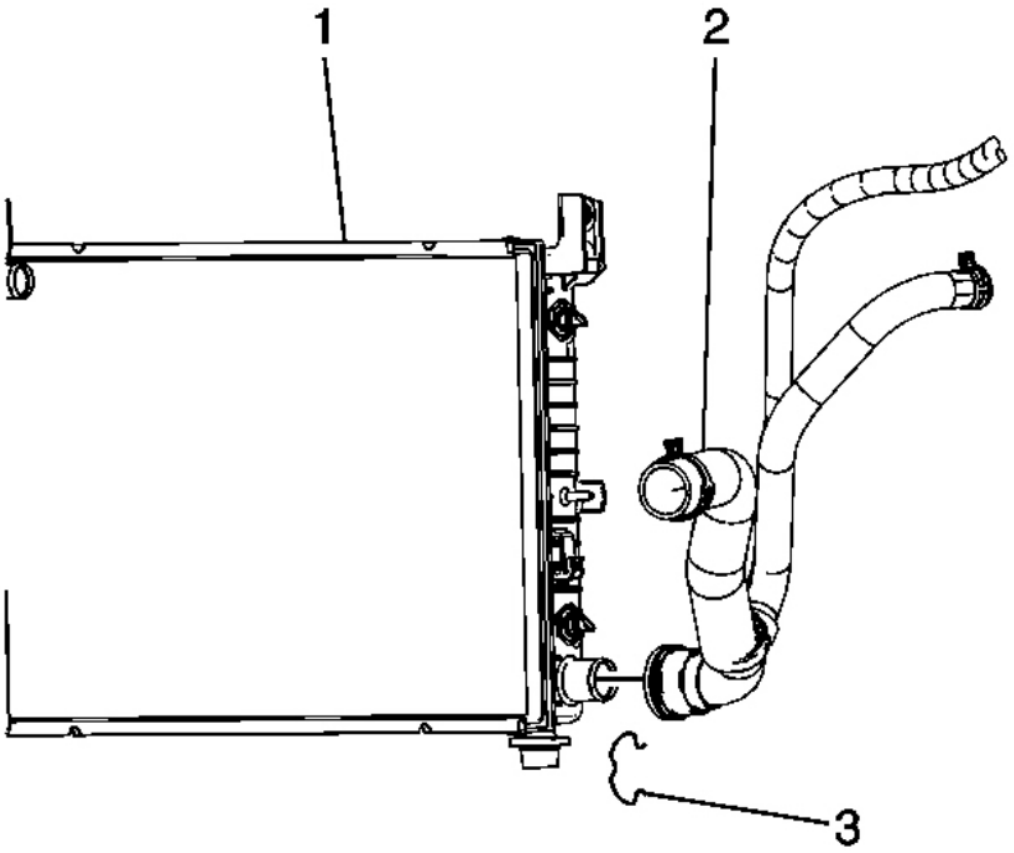


Fig. 62: Radiator Outlet Hose To The Radiator
Courtesy of GENERAL MOTORS CORP.

7. Remove the radiator outlet hose from the radiator. Refer to **Radiator Hose Quick Connect Fitting**.

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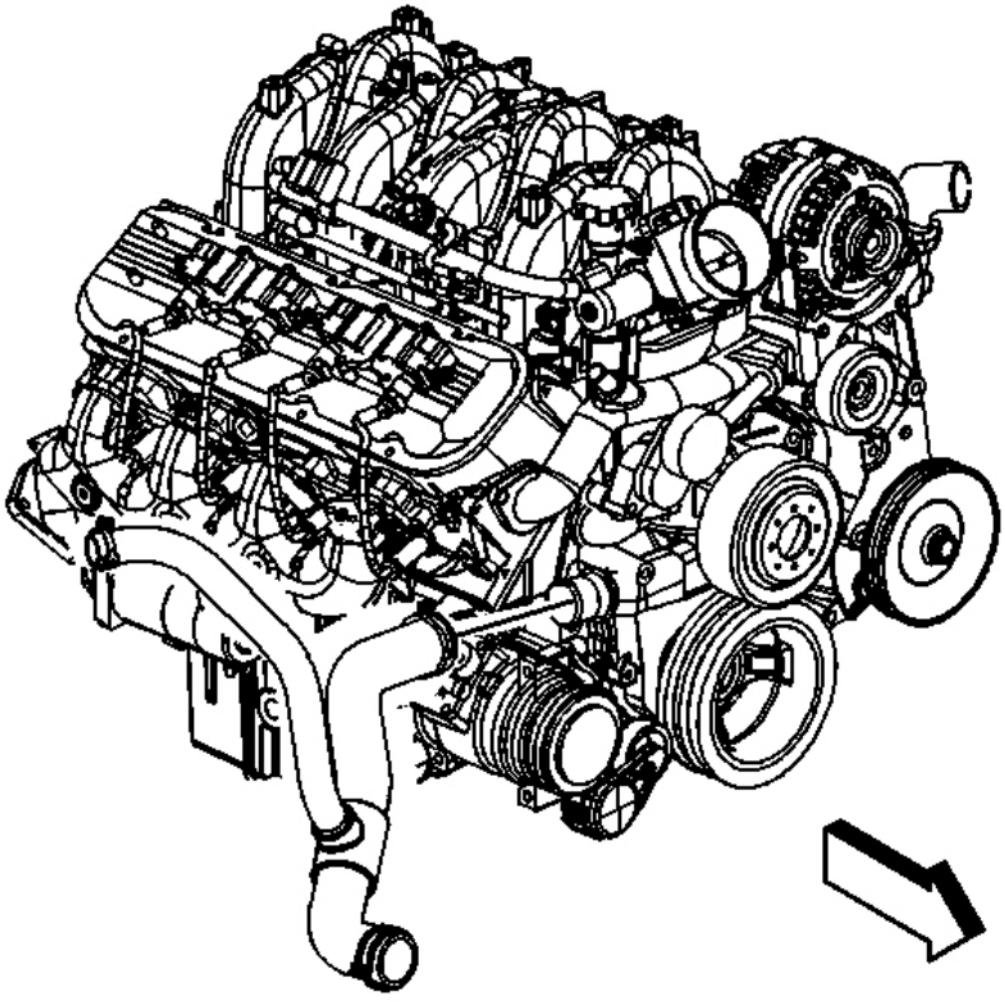


Fig. 63: Identifying Outlet Hose To The Water Pump
Courtesy of GENERAL MOTORS CORP.

8. Reposition the outlet hose clamp the water pump.
9. Remove the outlet hose from the water pump.

Installation Procedure

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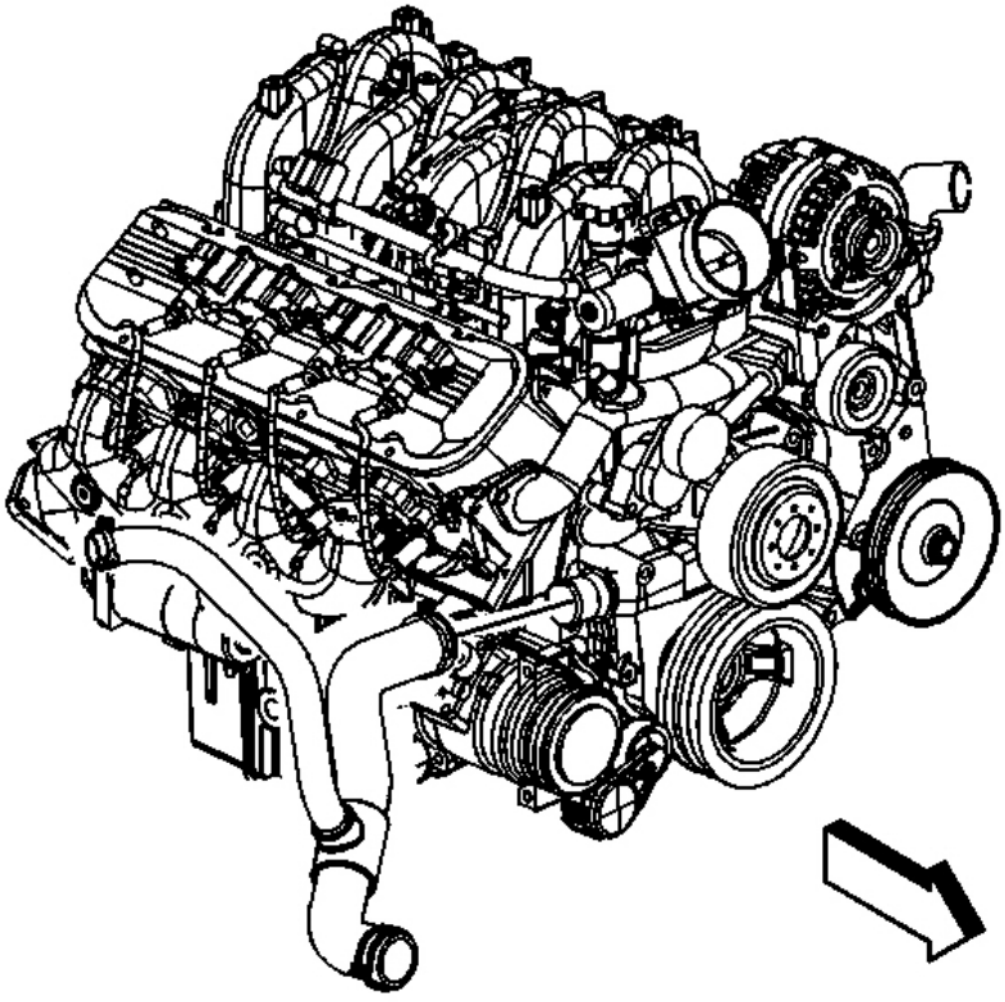


Fig. 64: Identifying Outlet Hose To The Water Pump
Courtesy of GENERAL MOTORS CORP.

1. Install the outlet hose to the water pump.
2. Position the outlet hose clamp to the water pump.

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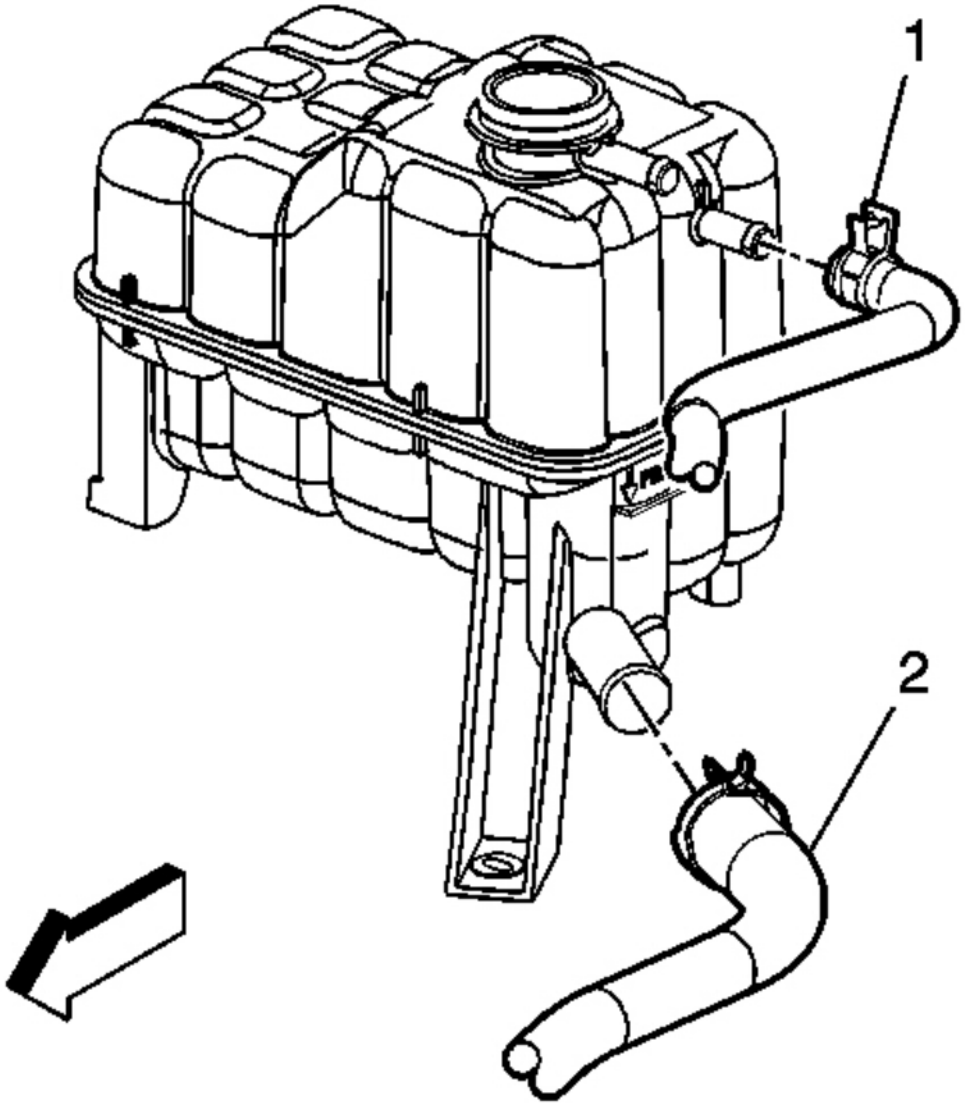


Fig. 65: View Of Surge Tank Outlet Hose & Surge Tank
Courtesy of GENERAL MOTORS CORP.

3. Install the surge tank outlet hose (2) from the surge tank.
4. Position the surge tank outlet hose clamp to the surge tank.

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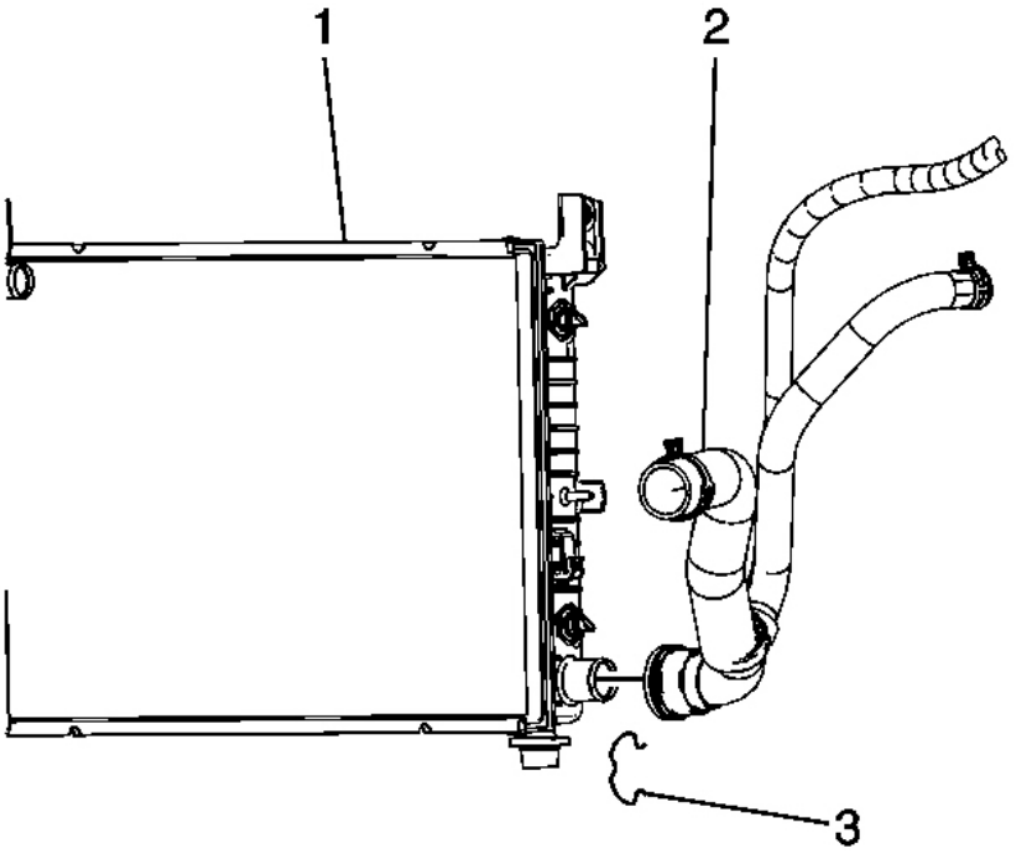


Fig. 66: Radiator Outlet Hose To The Radiator
Courtesy of GENERAL MOTORS CORP.

5. Install the radiator outlet hose to the radiator. Refer to **Radiator Hose Quick Connect Fitting**.

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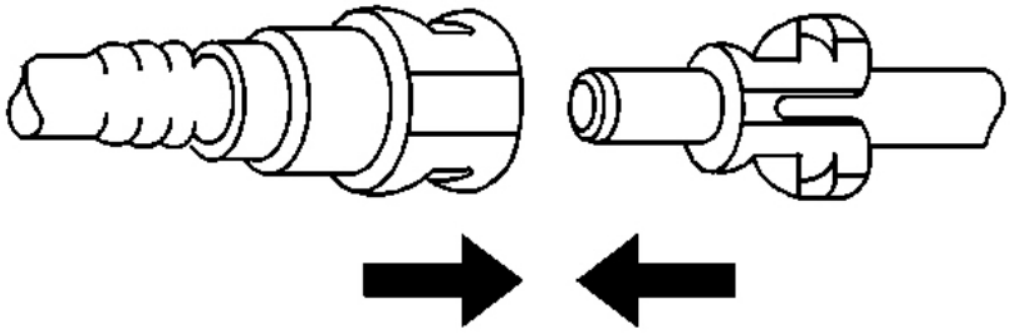


Fig. 67: Connecting Quick-Connect Fittings
Courtesy of GENERAL MOTORS CORP.

6. Connect the heater and surge tank hoses to the heater core.

IMPORTANT: Firmly push the quick connect onto the heater core pipe until you hear an audible click.

7. Pull the heater outlet hose to ensure the connection.
8. Install the heater and surge tank hoses to the mounting clip.
9. Fill the cooling system. Refer to **Draining and Filling Cooling System**.

RADIATOR HOSE REPLACEMENT - OUTLET (AVALANCHE/XLT 8.1L)

Tools Required

J 43181 Quick Connect Connector Removal Tool. See **Special Tools and Equipment**.

Removal Procedure

IMPORTANT: Most truck models use a spring-type hose clamp at the hose connections. When using this type of clamp, install the radiator hoses on dry, non-painted surfaces in order to ensure proper sealing. Reusing the spring-type clamps on aftermarket hoses is not recommended.

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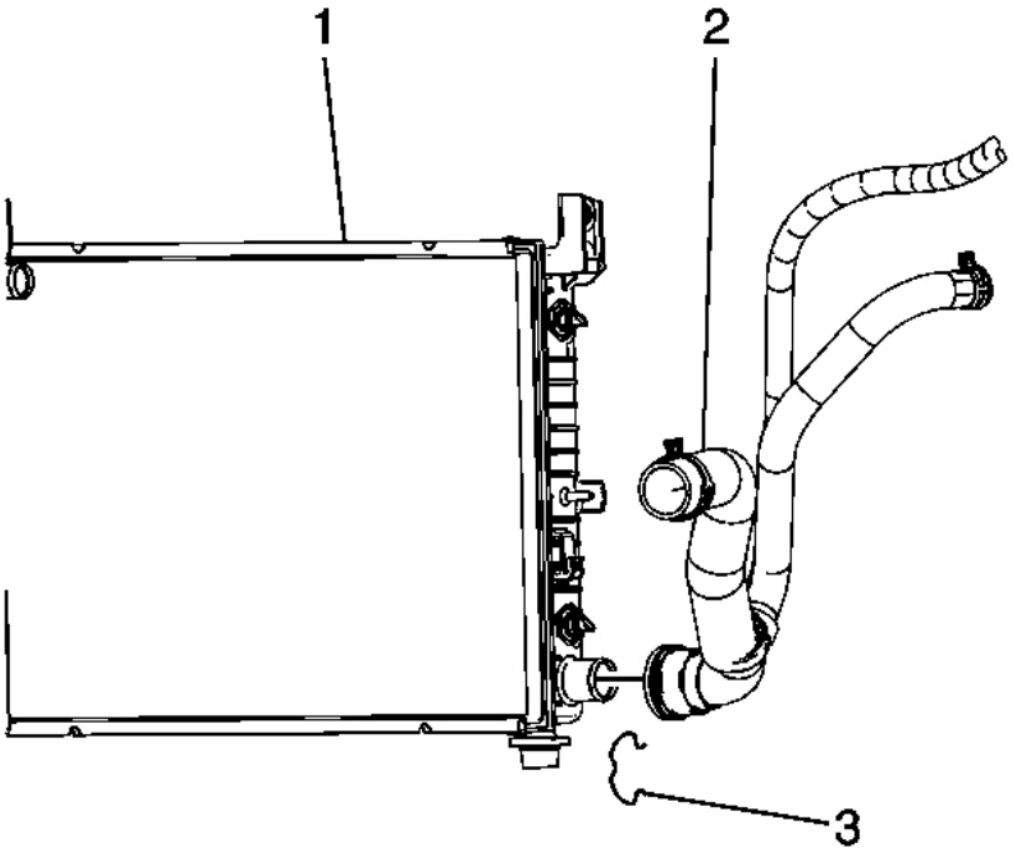


Fig. 68: Radiator Outlet Hose To The Radiator
Courtesy of GENERAL MOTORS CORP.

1. Drain the cooling system. Refer to **Draining and Filling Cooling System**.
2. Remove the radiator outlet hose from the radiator. Refer to **Radiator Hose Quick Connect Fitting**.

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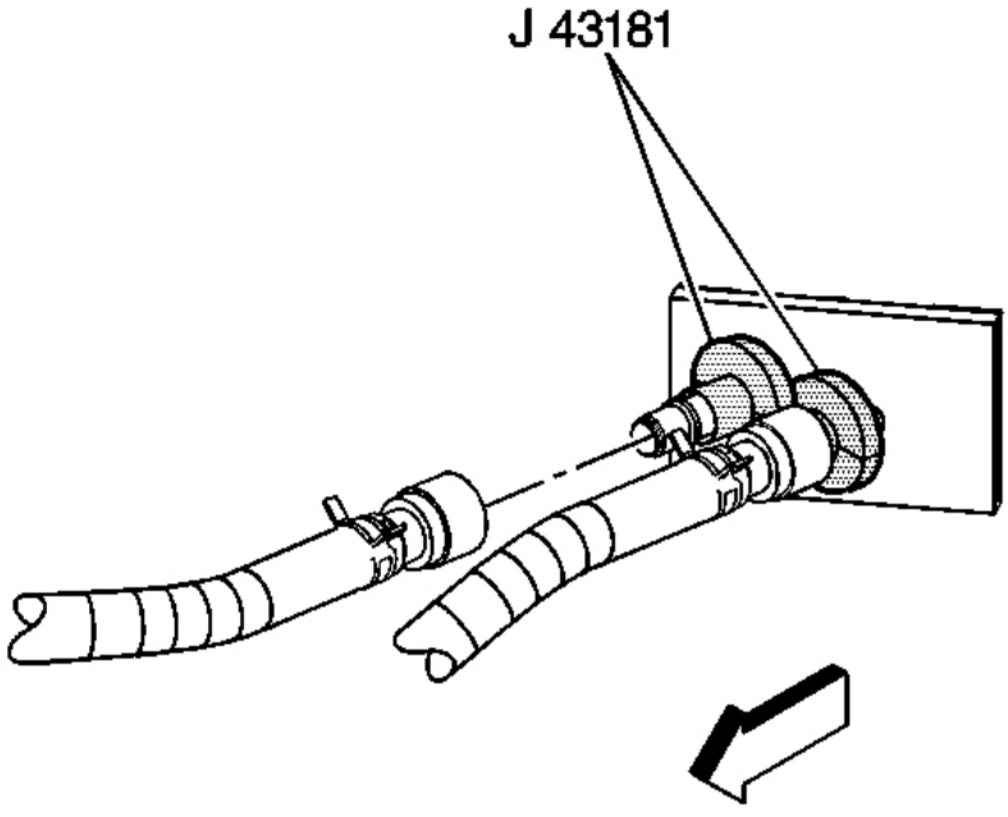


Fig. 69: Identifying Heater Hose To Heater Core Fittings
Courtesy of GENERAL MOTORS CORP.

3. Using the **J 43181** disconnect the heater hoses from the heater core outlet. See **Special Tools and Equipment**.
    1. Install the **J 43181** to the heater core pipe. See **Special Tools and Equipment**.
    2. Close the tool around the heater core pipe.
    3. Firmly pull the tool into the quick connect end of the heater hose.
    4. Firmly grasp the heater hose. Pull the heater hose forward in order to disengage the hose from the heater core.

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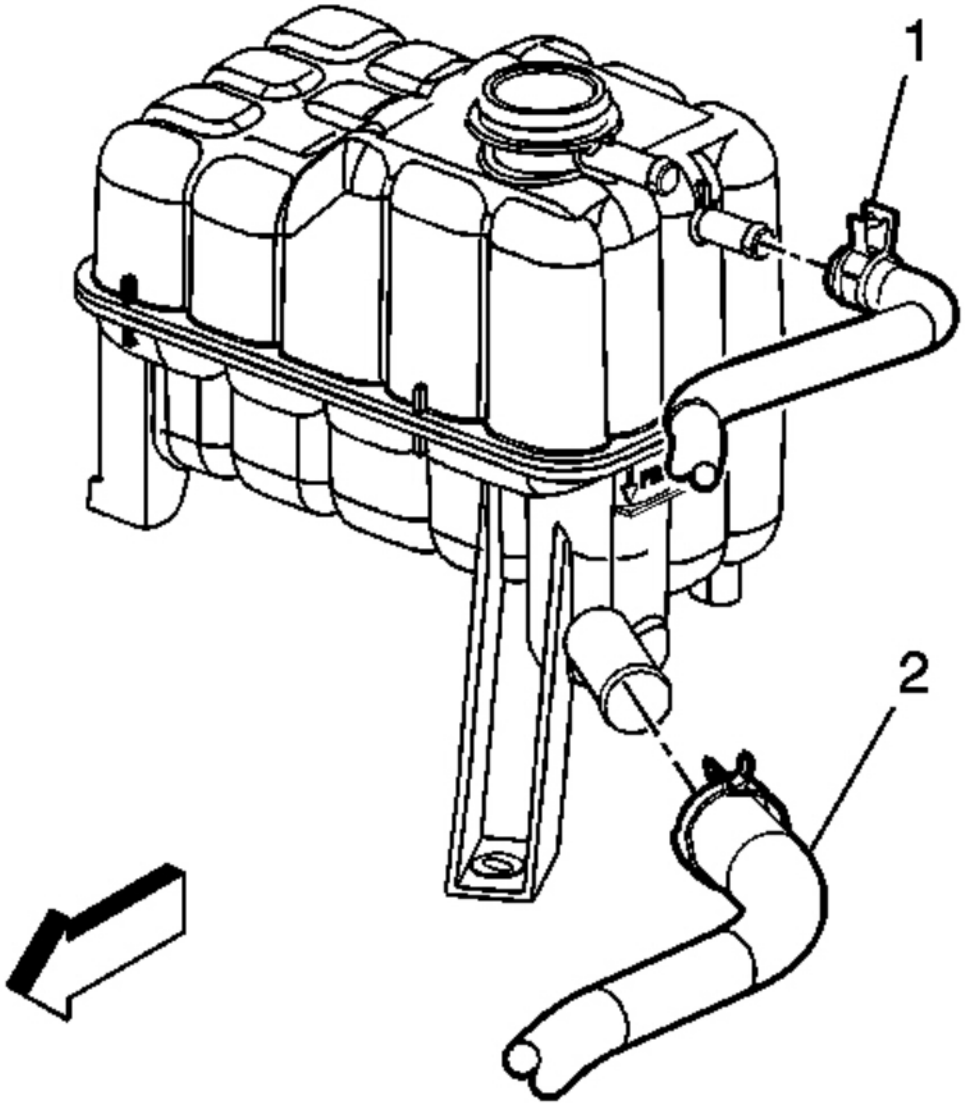


Fig. 70: View Of Surge Tank Outlet Hose & Surge Tank
Courtesy of GENERAL MOTORS CORP.

4. Reposition the surge tank outlet hose clamp at the surge tank.
5. Remove the surge tank outlet hose (2) from the surge tank.

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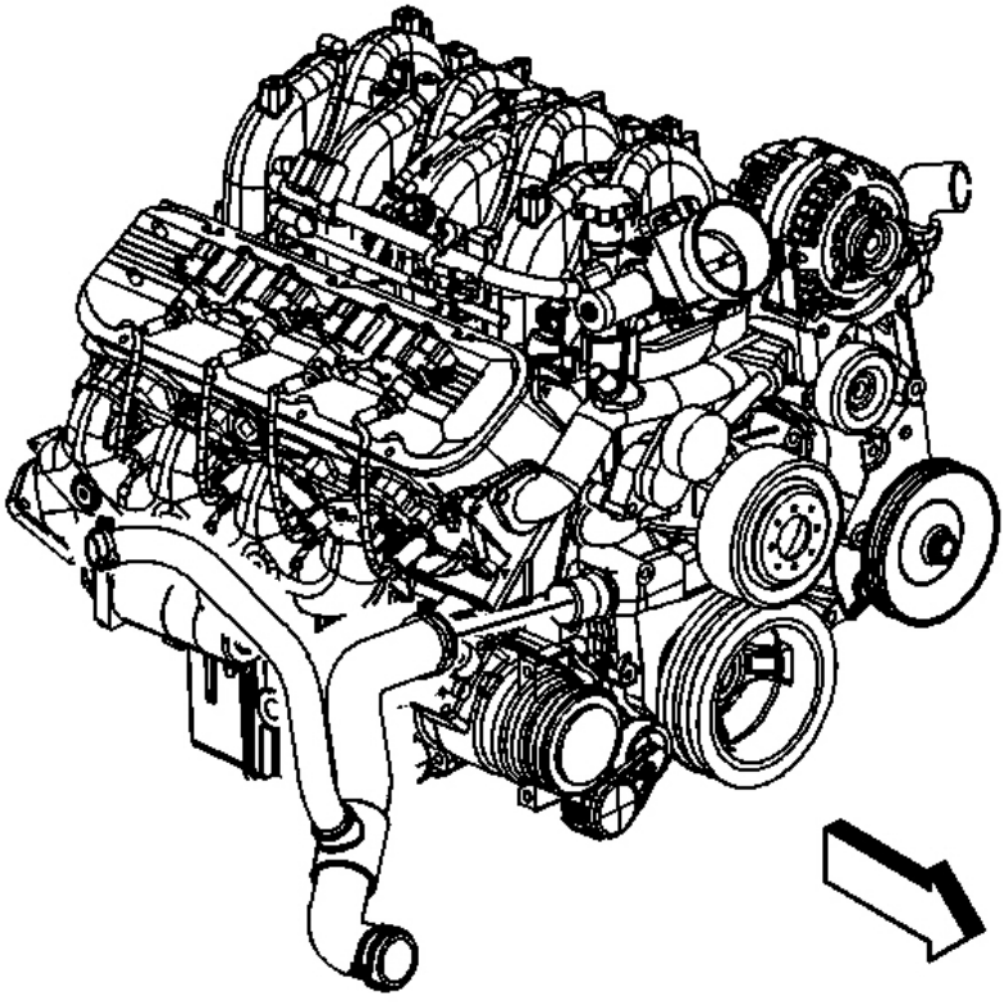


Fig. 71: Identifying Outlet Hose To The Water Pump
Courtesy of GENERAL MOTORS CORP.

6. Reposition the outlet hose clamp the water pump.
7. Remove the outlet hose from the water pump.

Installation Procedure

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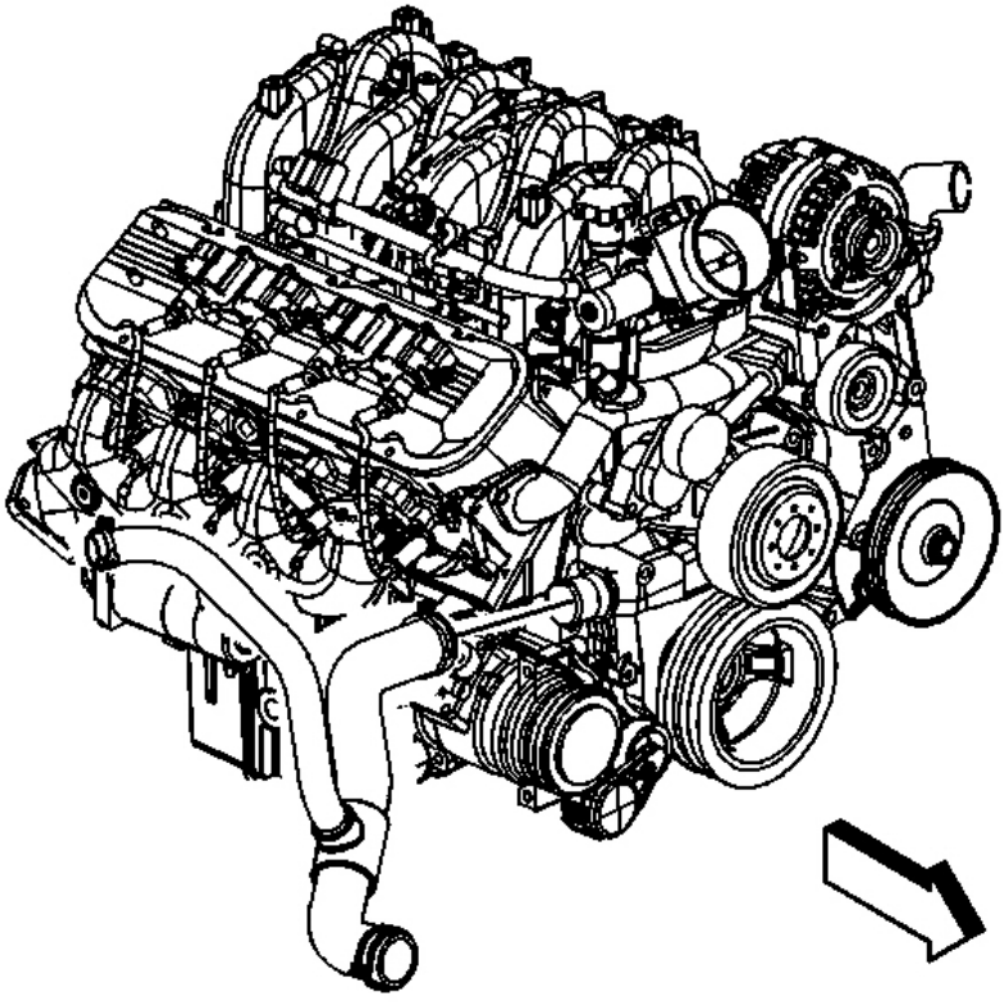


Fig. 72: Identifying Outlet Hose To The Water Pump
Courtesy of GENERAL MOTORS CORP.

1. Install the outlet hose to the water pump.
2. Position the outlet hose clamp to the water pump.

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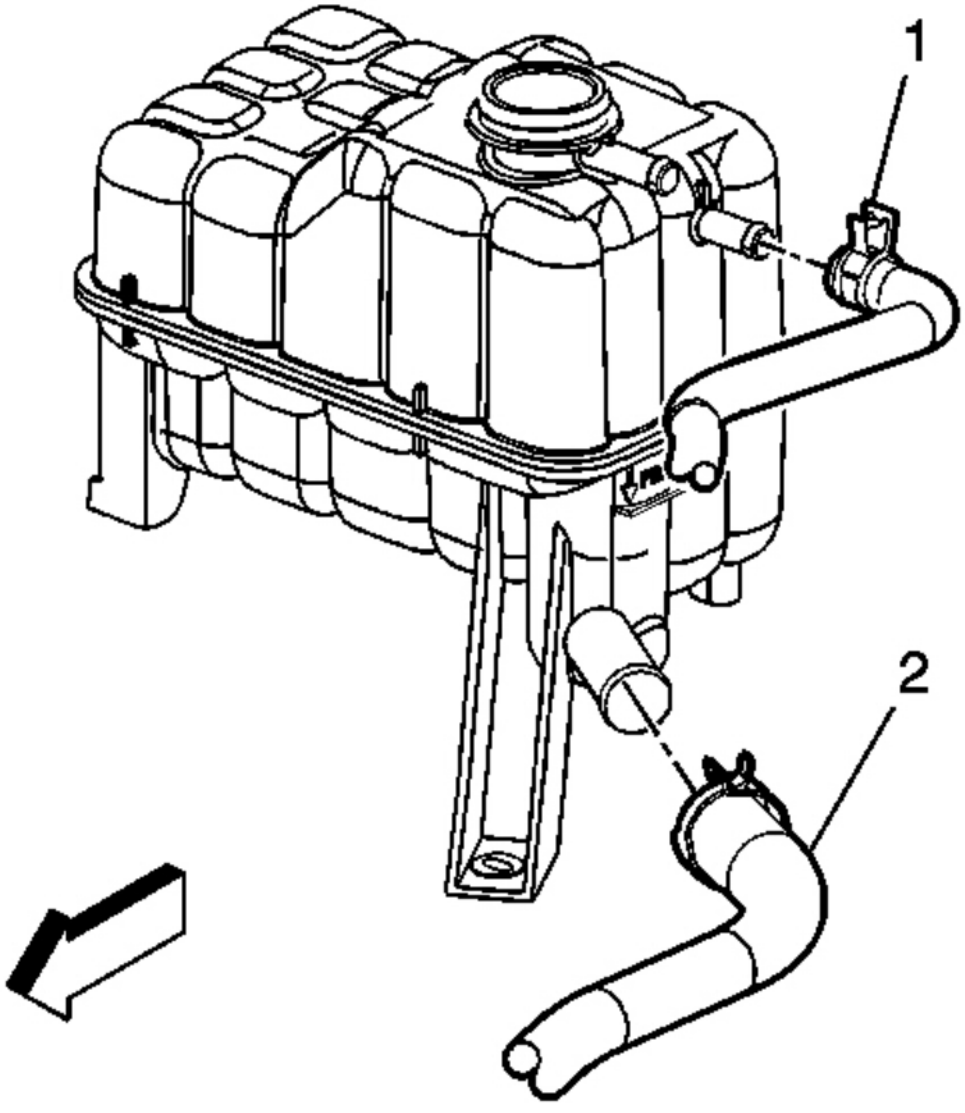


Fig. 73: View Of Surge Tank Outlet Hose & Surge Tank
Courtesy of GENERAL MOTORS CORP.

3. Install the surge tank outlet hose (2) from the surge tank.
4. Position the surge tank outlet hose clamp to the surge tank.

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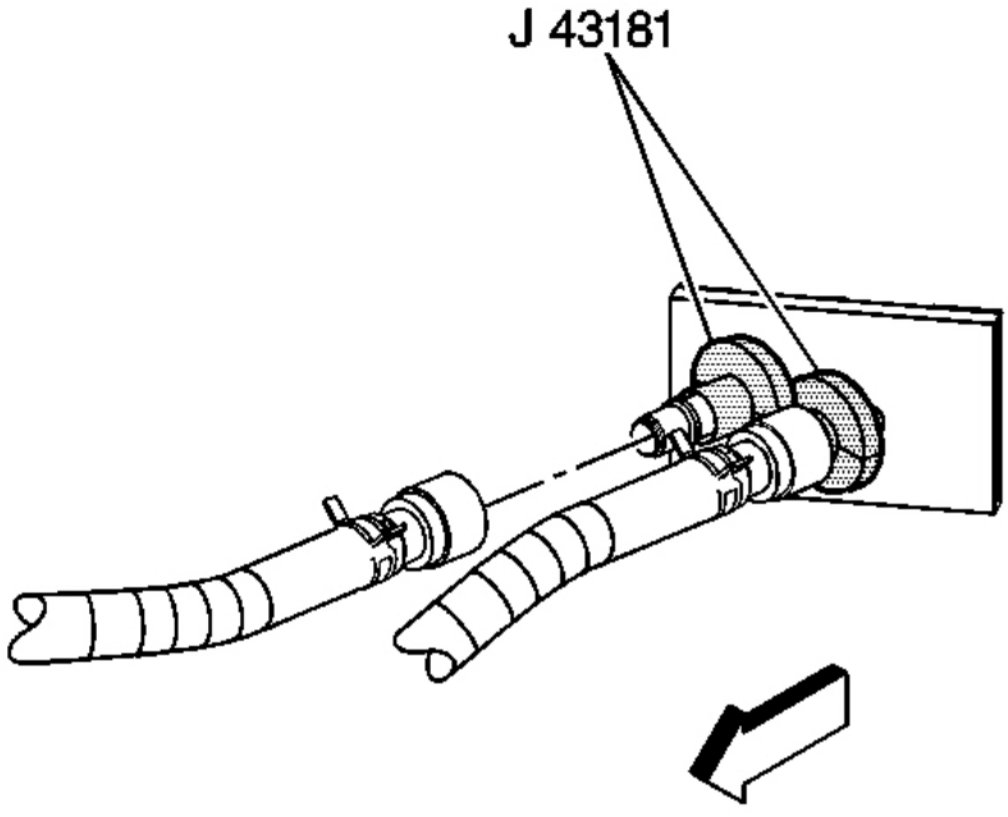


Fig. 74: Identifying Heater Hose To Heater Core Fittings
Courtesy of GENERAL MOTORS CORP.

5. Connect the heater and surge tank hoses to the heater core.

   Firmly push the quick connect onto the heater core pipe until you hear an audible click.

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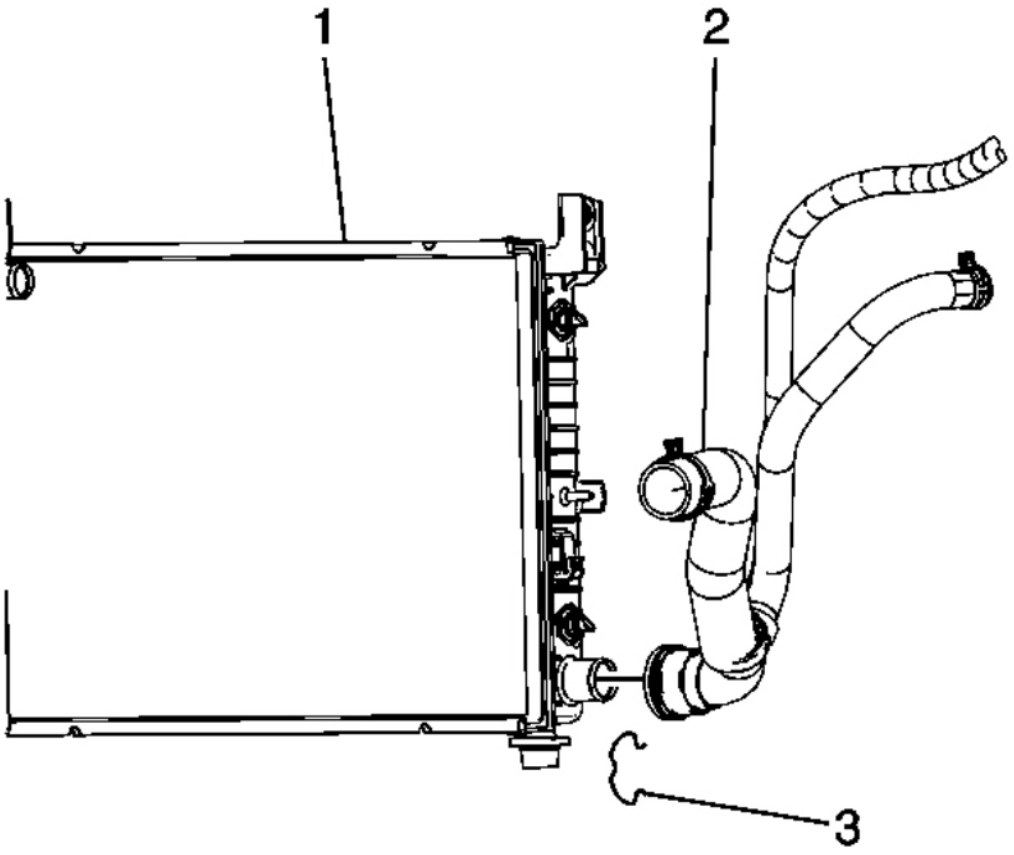


Fig. 75: Radiator Outlet Hose To The Radiator
Courtesy of GENERAL MOTORS CORP.

6. Install the radiator outlet hose to the radiator. Refer to **Radiator Hose Quick Connect Fitting**.
7. Fill the cooling system. Refer to **Draining and Filling Cooling System**.

RADIATOR VENT INLET HOSE REPLACEMENT

Removal Procedure

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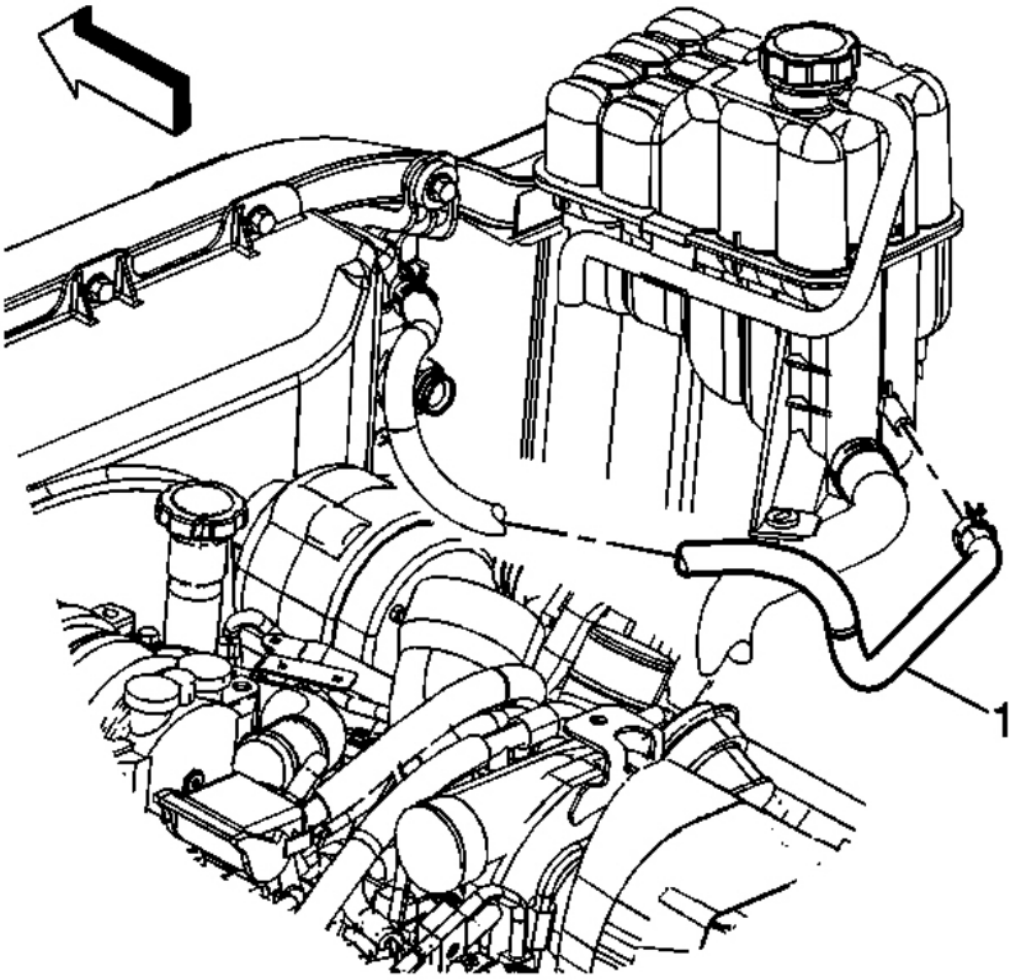


Fig. 76: View Of Surge Tank Inlet Hose
Courtesy of GENERAL MOTORS CORP.

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

Installation Procedure

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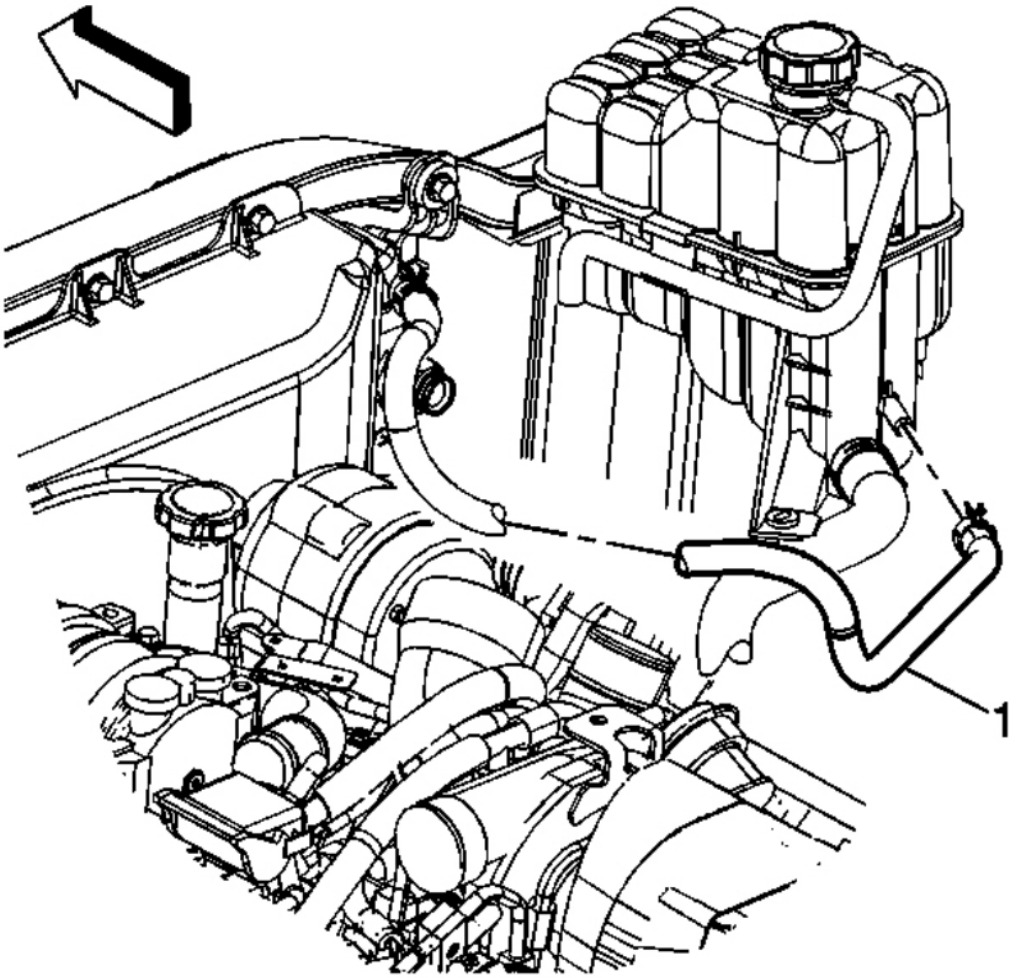


Fig. 77: View Of Surge Tank Inlet Hose
Courtesy of GENERAL MOTORS CORP.

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

ENGINE OIL COOLER PIPE/HOSE QUICK CONNECT FITTING

Removal Procedure

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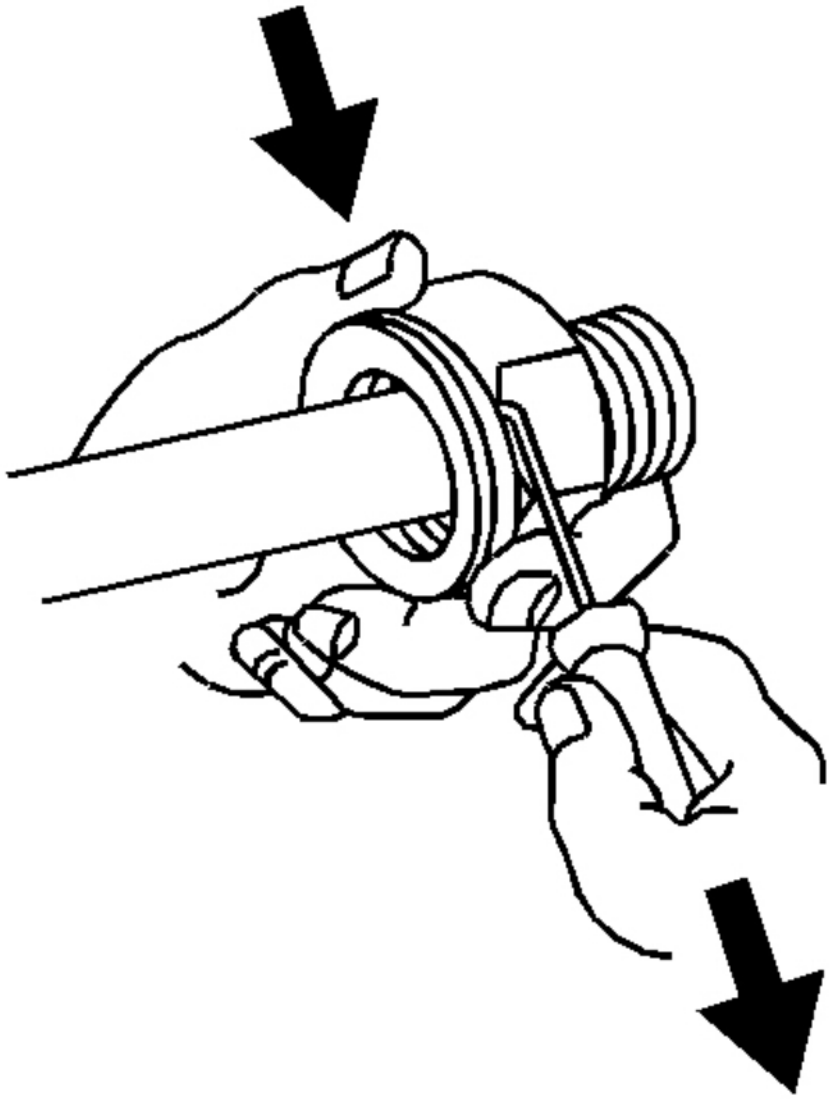


Fig. 78: Pulling Open End Of Retaining Ring Using Bent-Tip Screwdriver
Courtesy of GENERAL MOTORS CORP.

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

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Discard the retaining rings.

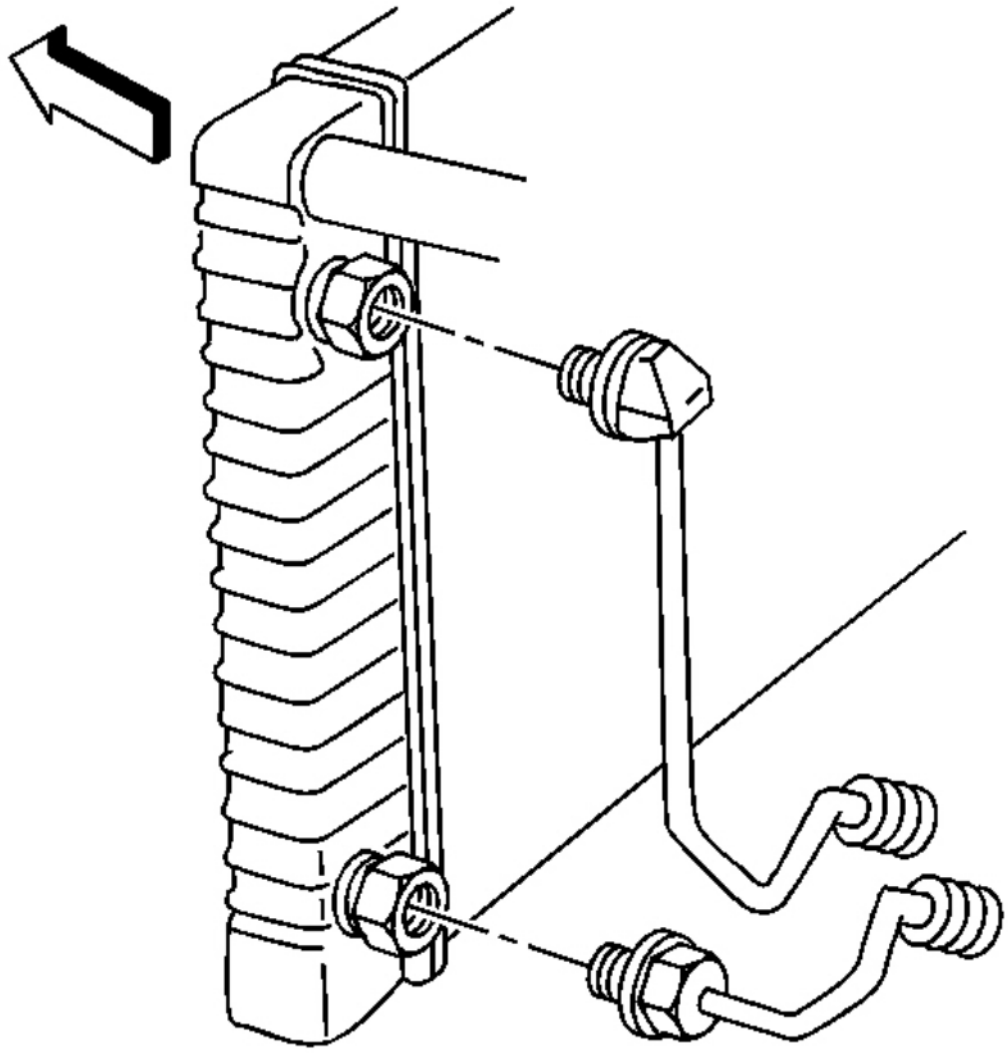


Fig. 79: View Of Engine Oil Cooler Line Connections
Courtesy of GENERAL MOTORS CORP.

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

   Pull the lines straight out from the connectors.

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

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

Installation Procedure

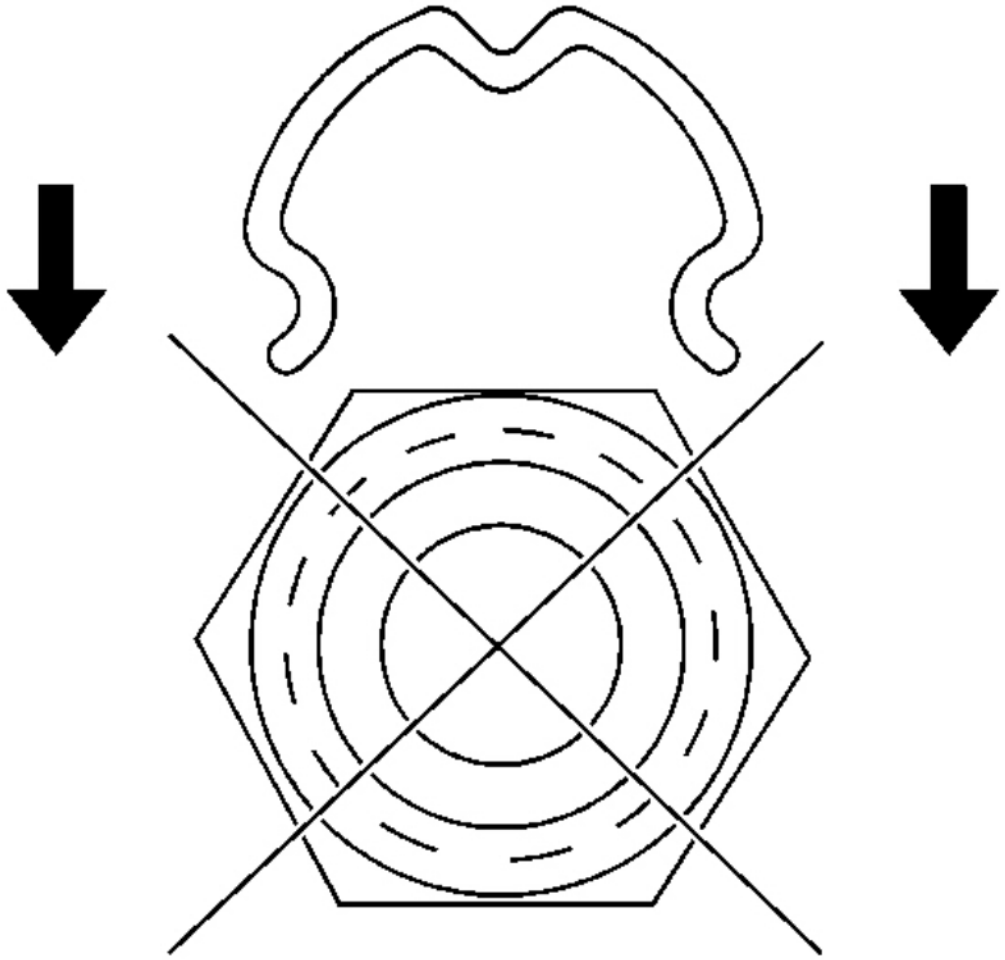


Fig. 80: Do Not Install Retaining Ring In This Manner
Courtesy of GENERAL MOTORS CORP.

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

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

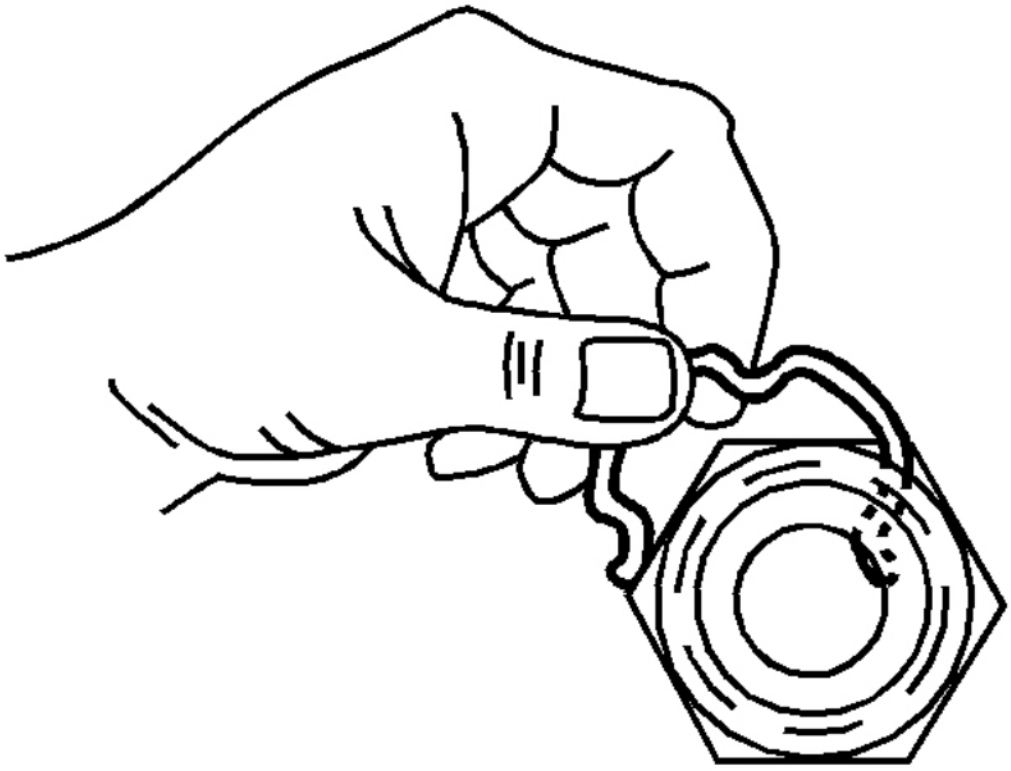


Fig. 81: Hooking Retaining Ring
Courtesy of GENERAL MOTORS CORP.

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

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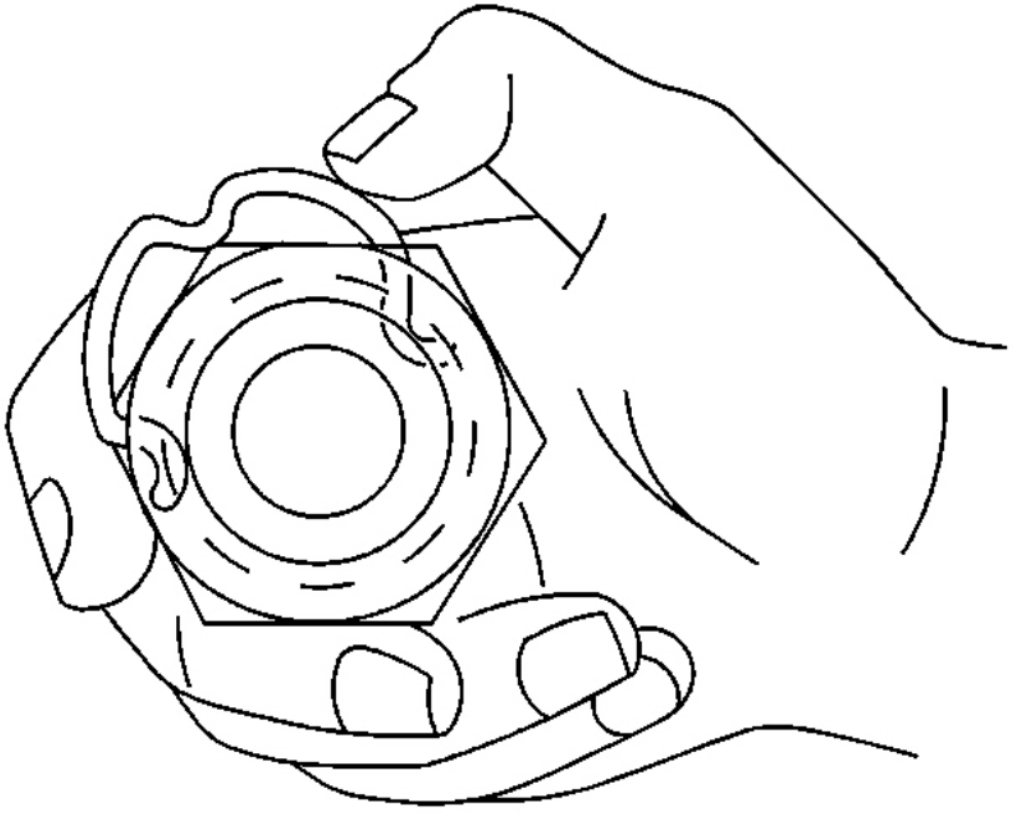


Fig. 82: Rotating Retaining Ring Around Connector
Courtesy of GENERAL MOTORS CORP.

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

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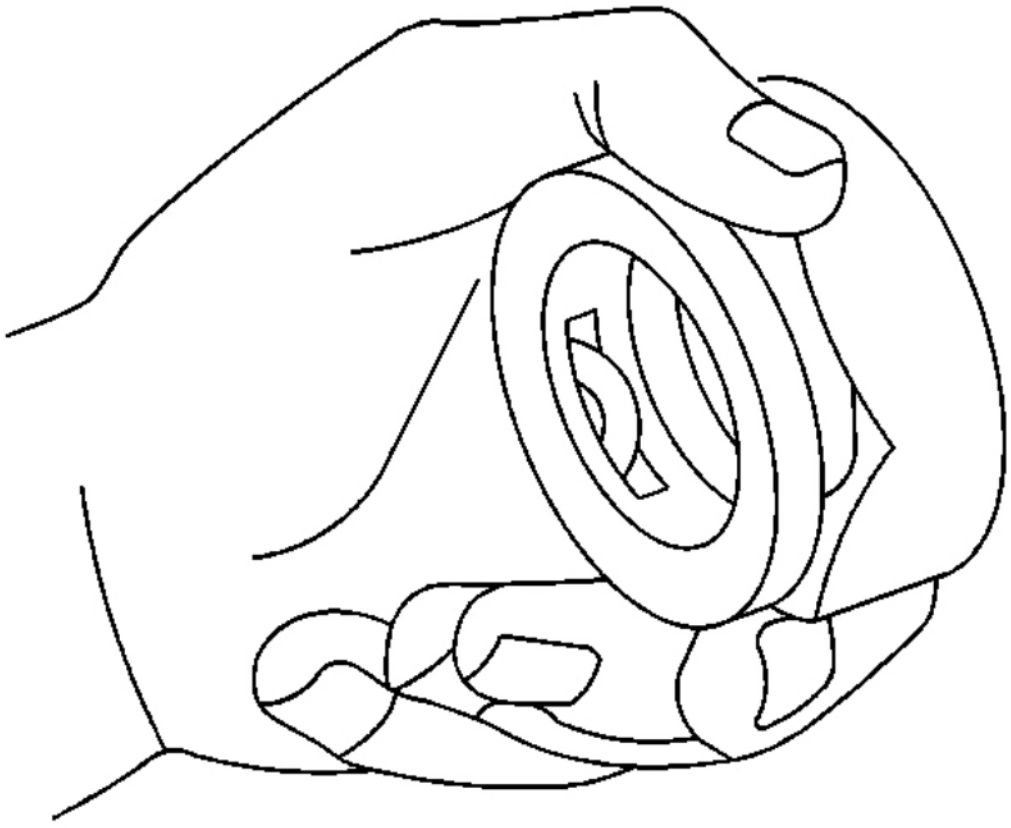


Fig. 83: Ensuring Retaining Ring Ears Are Seen From Inside Of Connector
Courtesy of GENERAL MOTORS CORP.

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

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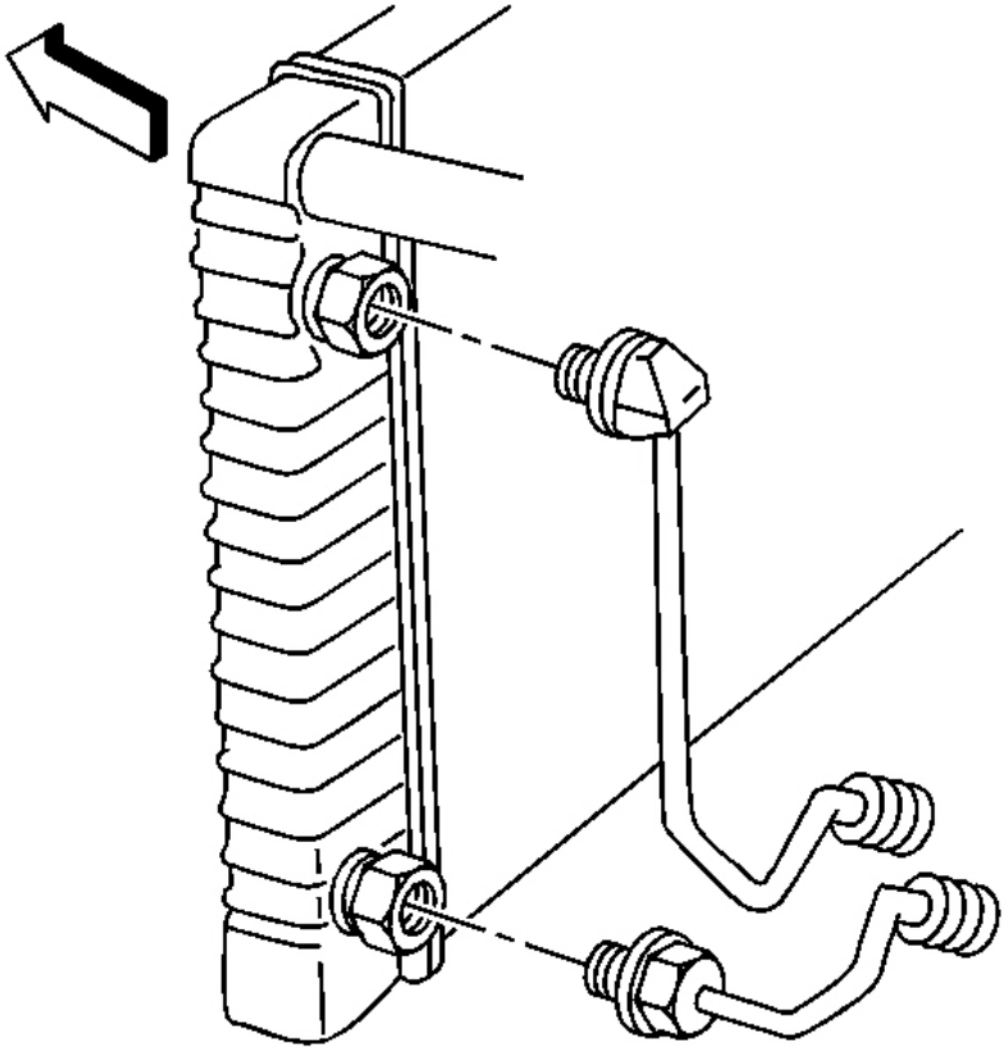


Fig. 84: View Of Engine Oil Cooler Line Connections
Courtesy of GENERAL MOTORS CORP.

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

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

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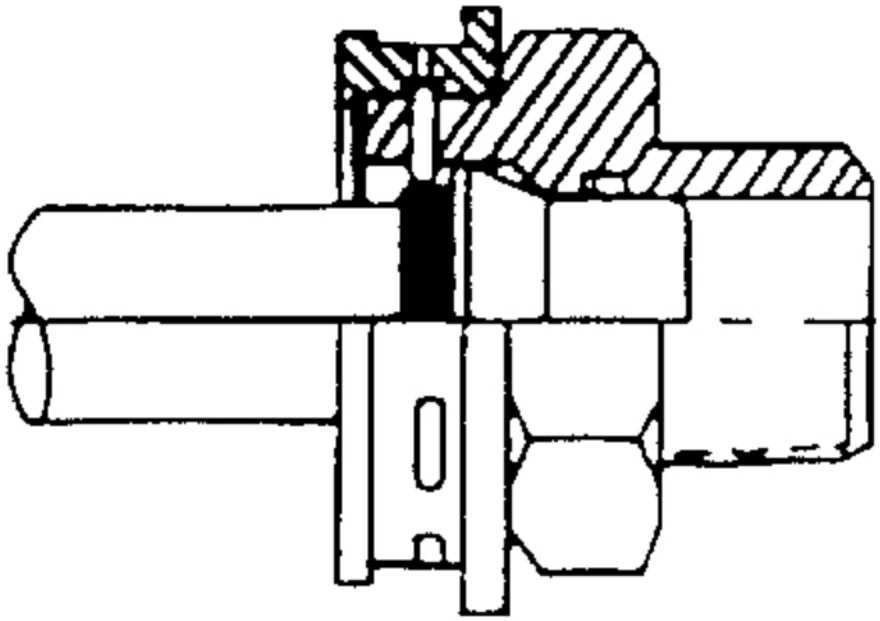


Fig. 85: View Of Cooler Line & Plastic Cap
Courtesy of GENERAL MOTORS CORP.

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

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

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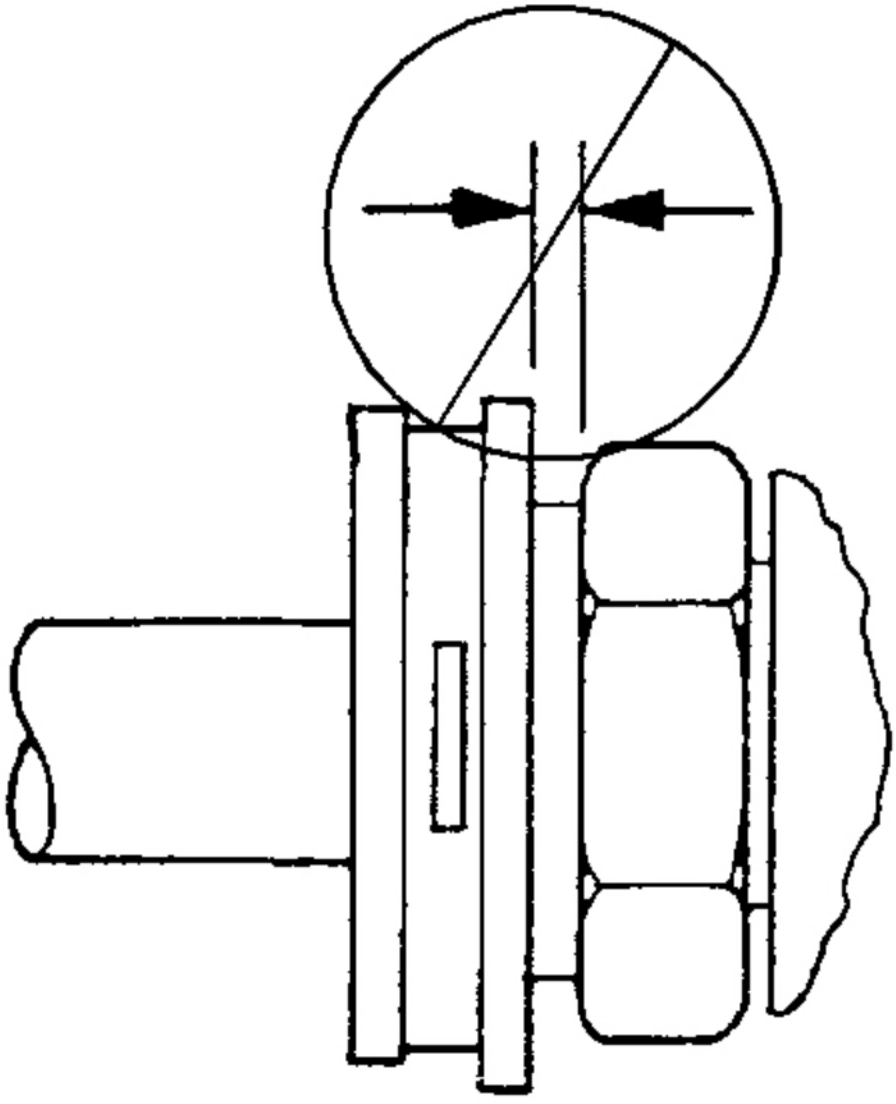


Fig. 86: Checking For Gap Between Cap & Fitting
Courtesy of GENERAL MOTORS CORP.

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

ENGINE OIL COOLER HOSE/PIPE REPLACEMENT (2WD)

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Removal Procedure

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

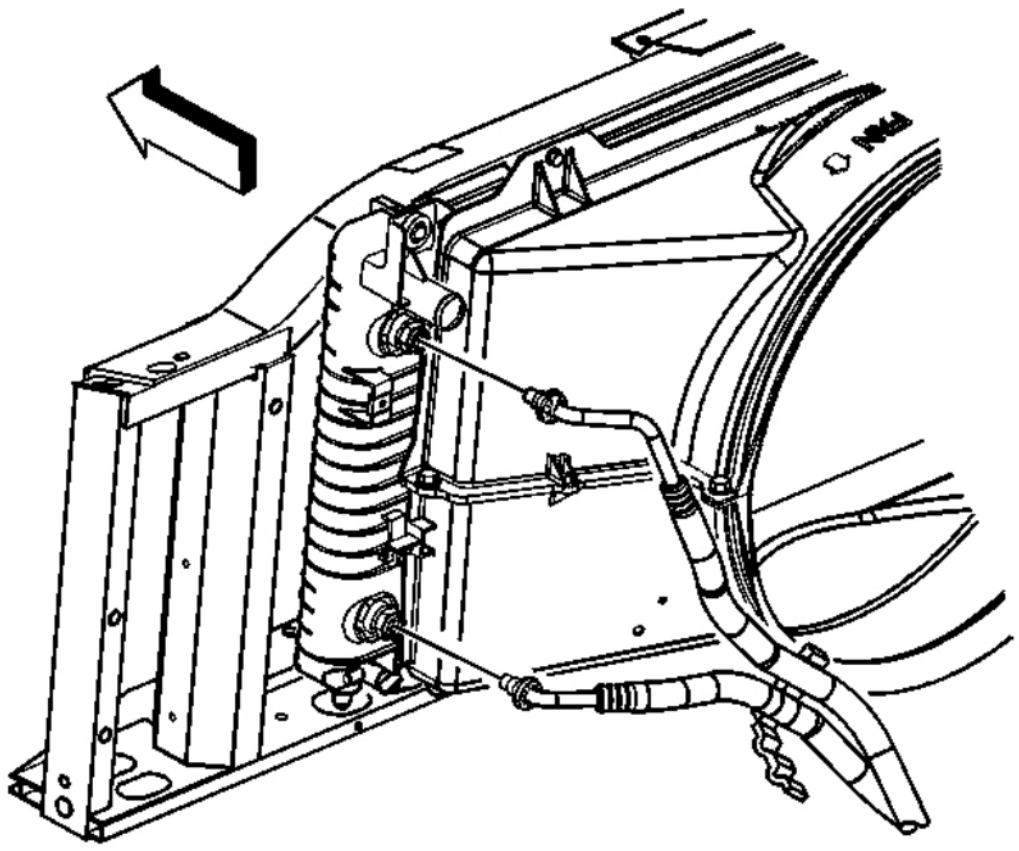


Fig. 87: View Of Engine Oil Cooler Quick Connect Fittings
Courtesy of GENERAL MOTORS CORP.

1. Disconnect the engine oil cooler quick connect fittings. Refer to **Engine Oil Cooler Pipe/Hose Quick Connect Fitting**.
2. If equipped with a 5.3L, or 6.0L engine, perform the following:
    1. Open the oil cooler hose clip located on the lower fan shroud.
    2. Remove the oil cooler hoses from the clip.
    3. Gently pull the oil cooler pipe fittings straight out from the radiator quick connect fittings.

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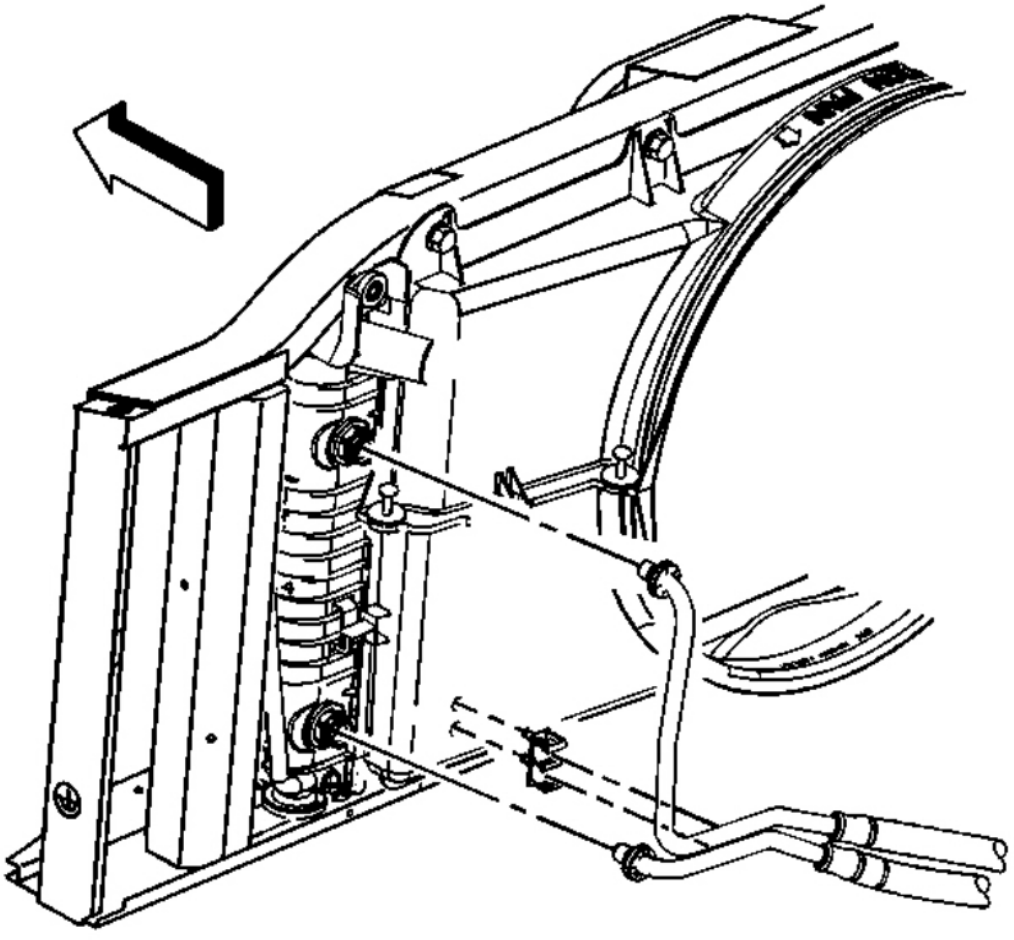


Fig. 88: View Of Oil Cooler Hoses
Courtesy of GENERAL MOTORS CORP.

3. If equipped with a 8.1L engine, remove the oil cooler hoses from the clip
4. Raise and suitably support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.

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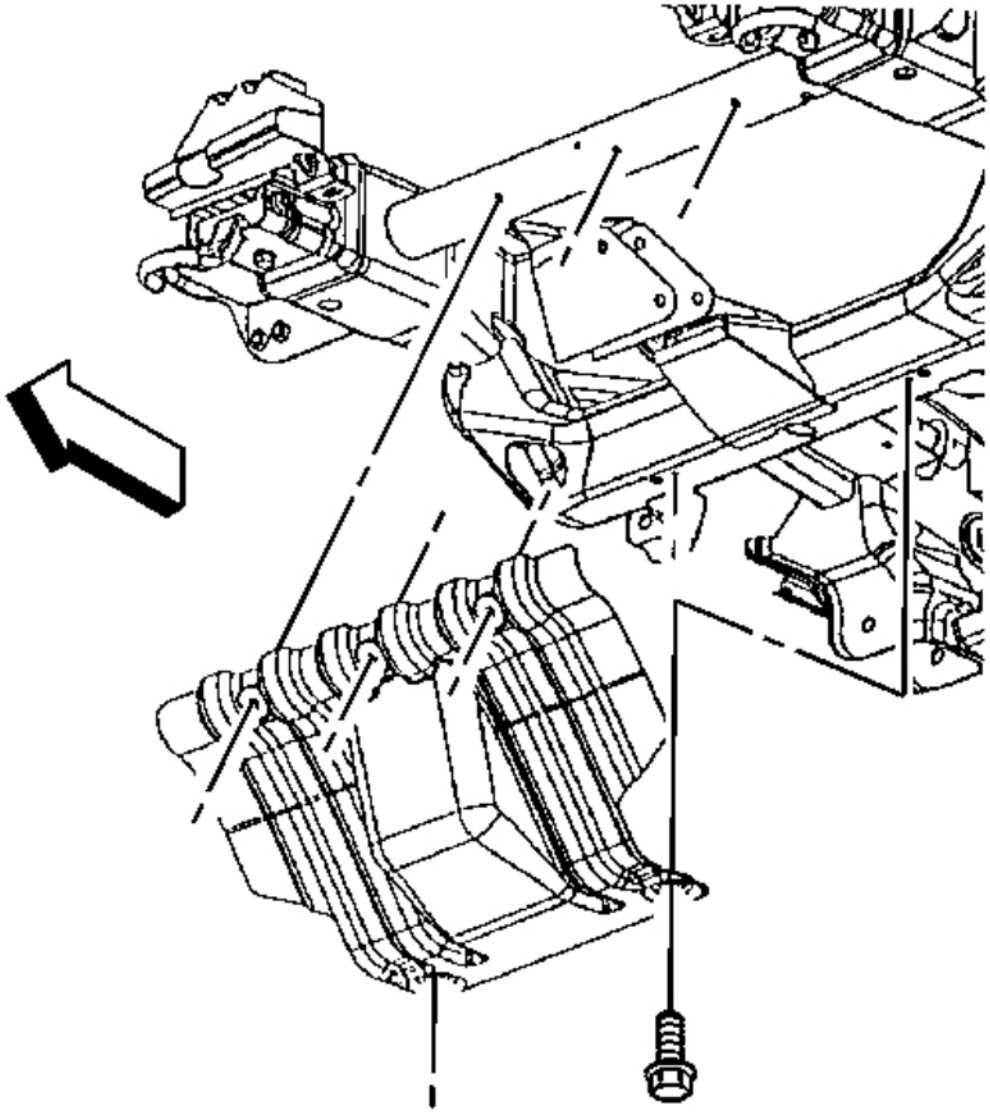


Fig. 89: View Of Engine Protection Shield
Courtesy of GENERAL MOTORS CORP.

5. If equipped, remove the engine shield bolts.
6. Remove the engine shield.

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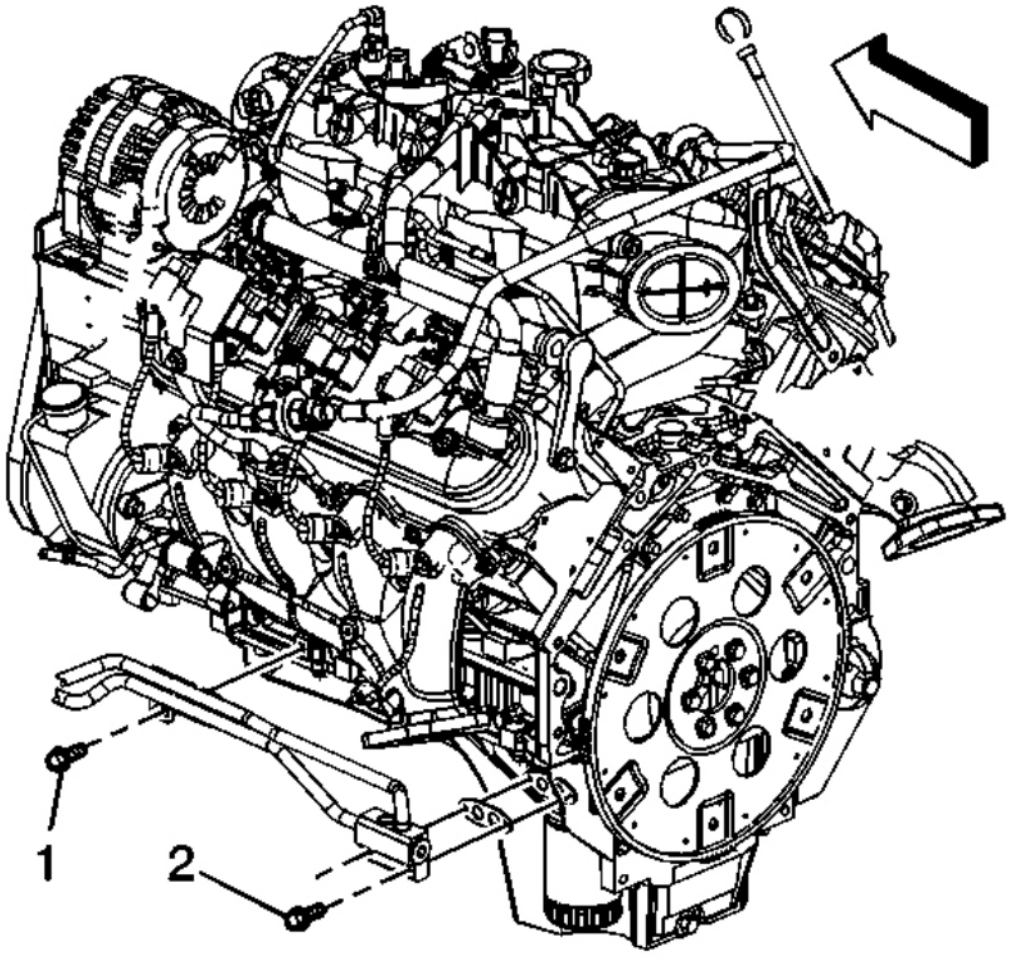


Fig. 90: View Of Oil Cooler Hose Bracket Bolt & Adapter Bolts
Courtesy of GENERAL MOTORS CORP.

7. If equipped with a 5.3L, or 6.0L engine, perform the following:
    1. Remove the oil cooler hose bracket bolt (1).
    2. Remove the oil cooler hose adapter bolts (2).
    3. Remove the oil cooler hose assembly and gasket. Discard the gasket.
    4. Inspect the fittings, connectors and cooler hoses for damage or distortion.

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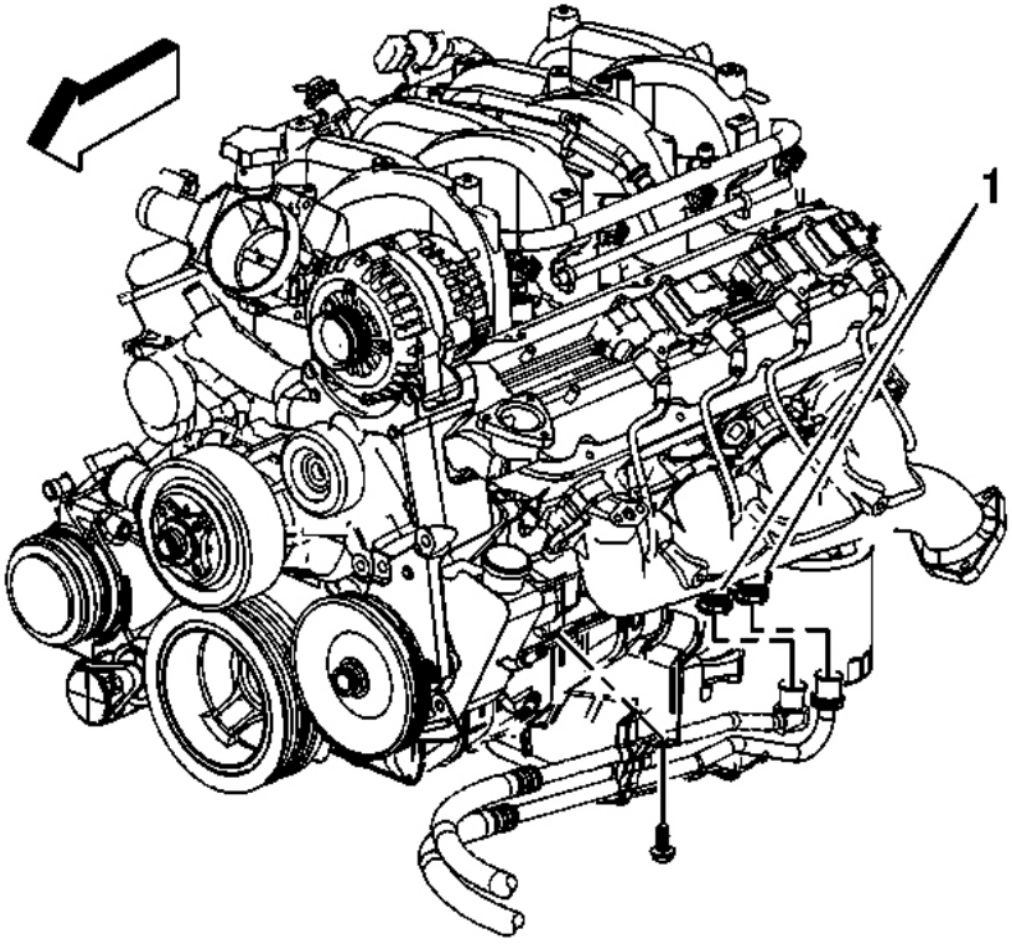


Fig. 91: View Of Quick Connect Fittings, Oil Cooler Hose Assembly & Bracket Bolt (8.1L)
Courtesy of GENERAL MOTORS CORP.

8. If equipped with a 8.1L engine, perform the following:
    1. Remove the oil cooler hose bracket bolt.
    2. Disconnect the quick connect fittings (1) at the engine.
    3. Remove the oil cooler hose assembly. Discard the gasket.
    4. Inspect the fittings, connectors and cooler hoses for damage or distortion.

Installation Procedure

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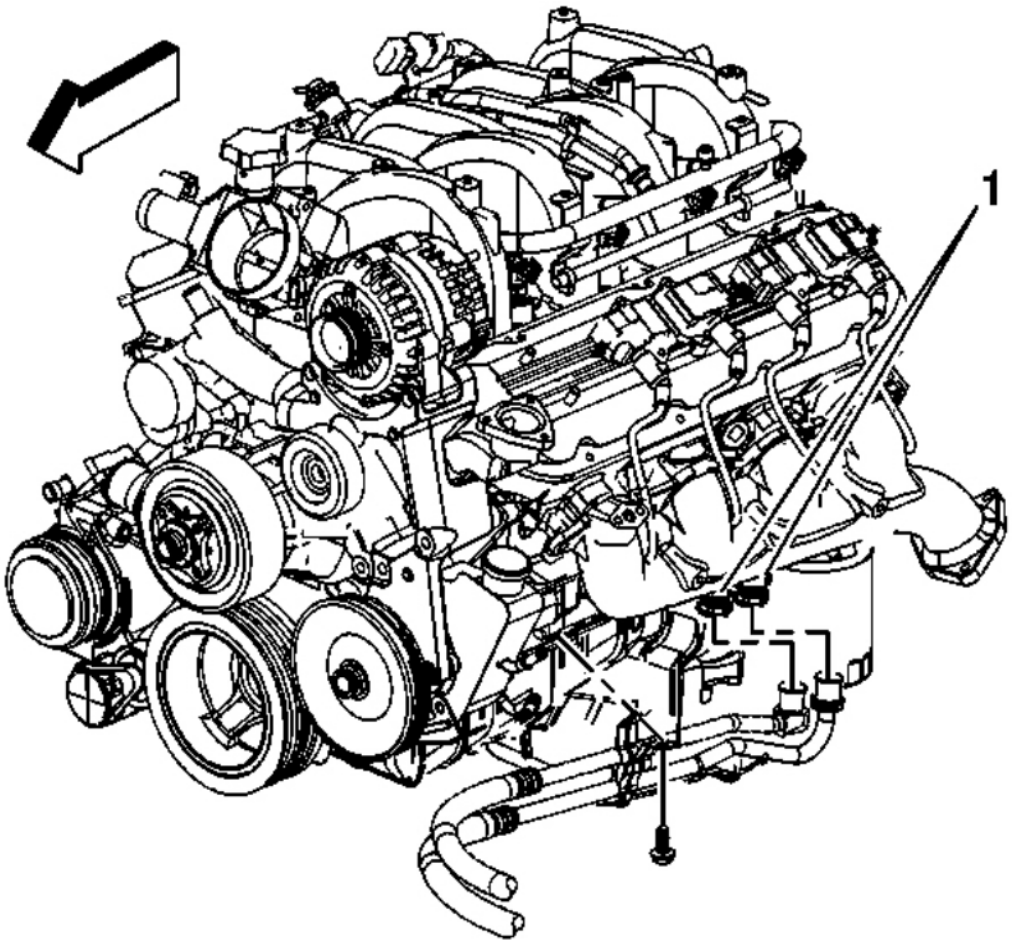


Fig. 92: View Of Quick Connect Fittings, Oil Cooler Hose Assembly & Bracket Bolt (8.1L)
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: A distinct snap should be heard when assembling the tube ends of the hose assembly to quick connectors. To ensure the tube is fully inserted into the connector, check by giving the tube a forceful pull.

1. If equipped with a 8.1L engine, perform the following:
    1. Remove the oil cooler hose assembly.
    2. Connect the quick connect fittings (1) at the engine.

NOTE: Refer to Fastener Notice in Cautions and Notices.

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3. Install the oil cooler hose bracket bolt.

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

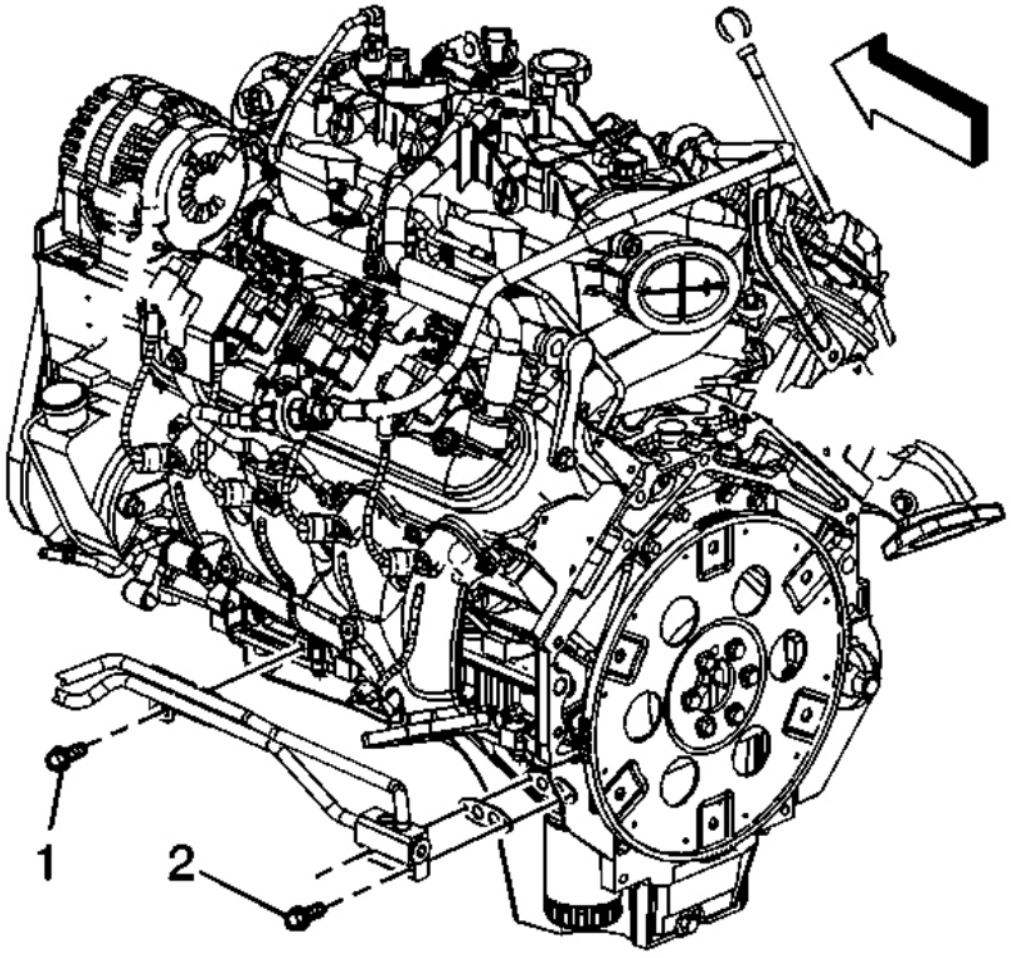


Fig. 93: View Of Oil Cooler Hose Bracket Bolt & Adapter Bolts
Courtesy of GENERAL MOTORS CORP.

2. If equipped with a 5.3L, or 6.0L engine, perform the following:
   1. Install the oil cooler hose assembly and a new gasket.
   2. Install the oil cooler hose adapter bolts (2).

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

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

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

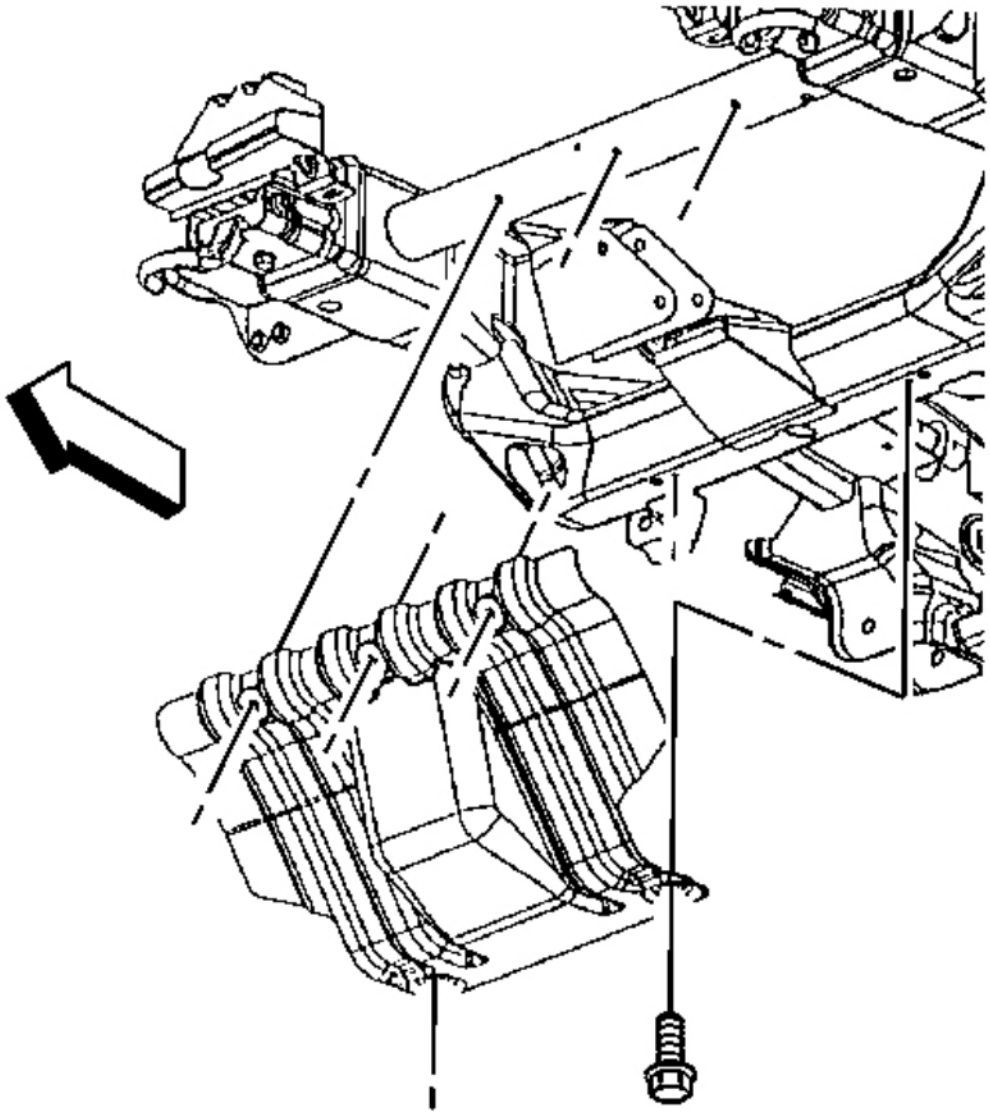


Fig. 94: View Of Engine Protection Shield
Courtesy of GENERAL MOTORS CORP.

3. If equipped, install the engine shield.

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4. Install the engine shield bolts.

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

5. Lower the vehicle.

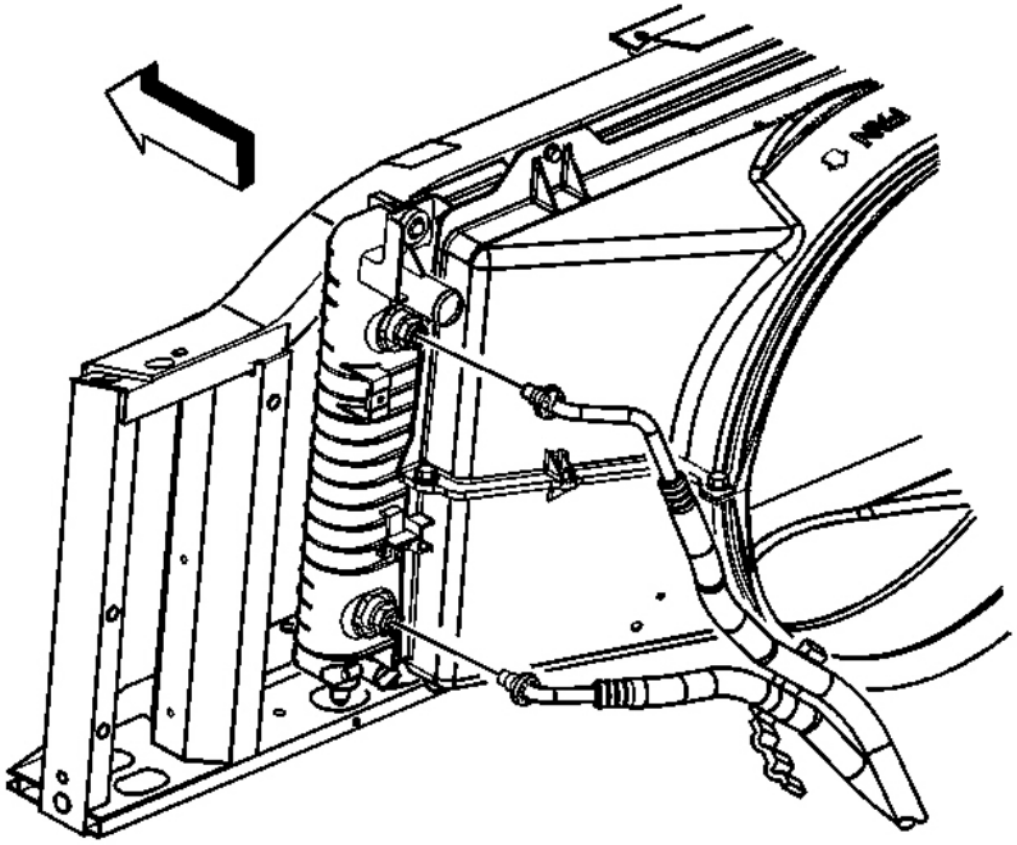


Fig. 95: View Of Engine Oil Cooler Quick Connect Fittings
Courtesy of GENERAL MOTORS CORP.

6. If equipped with a 5.3L, or 6.0L engine, perform the following:
   1. Install the oil cooler hoses to the hose clip on the fan shroud.
   2. Snap the oil cooler hose clip shut.

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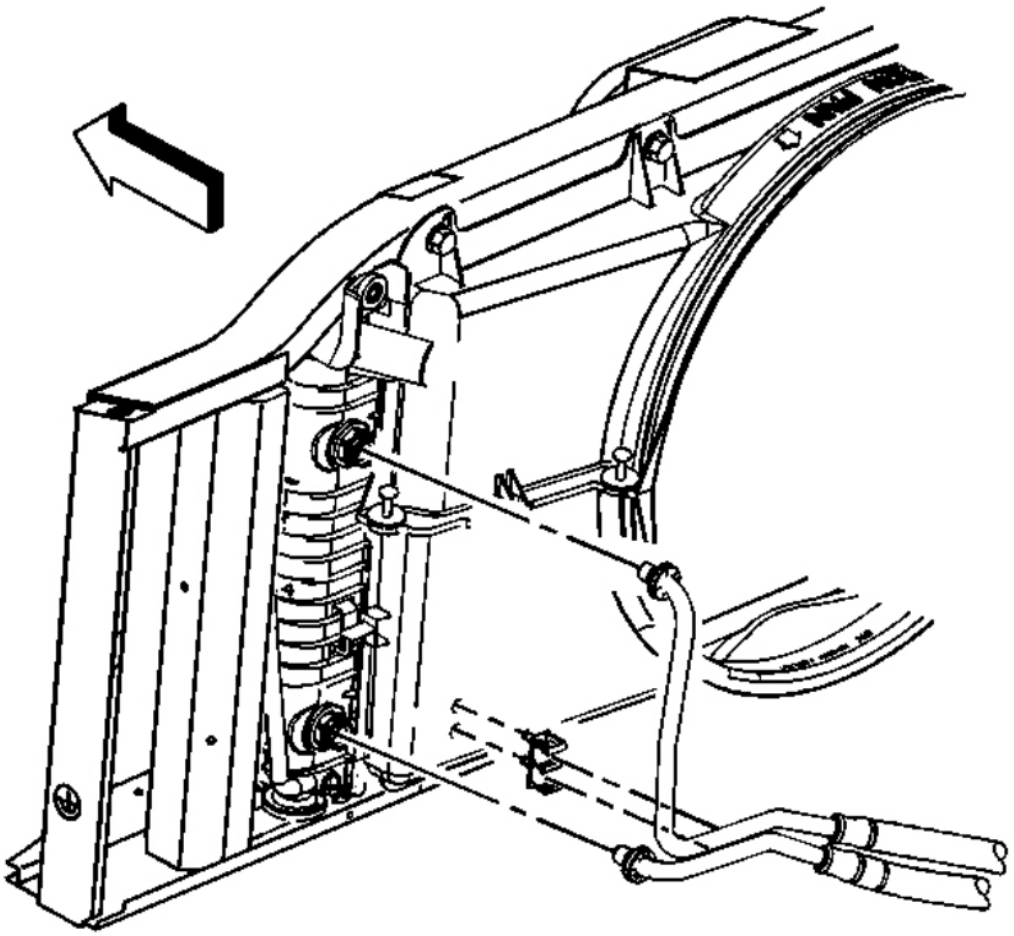


Fig. 96: View Of Oil Cooler Hoses
Courtesy of GENERAL MOTORS CORP.

IMPORTANT:

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

7. If equipped with a 8.1L engine, install the oil cooler hoses to the clip.
8. Connect the engine oil cooler quick connect fittings. Refer to **Engine Oil Cooler Pipe/Hose Quick Connect Fitting**.

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ENGINE OIL COOLER HOSE/PIPE REPLACEMENT (4WD)

Removal Procedure

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

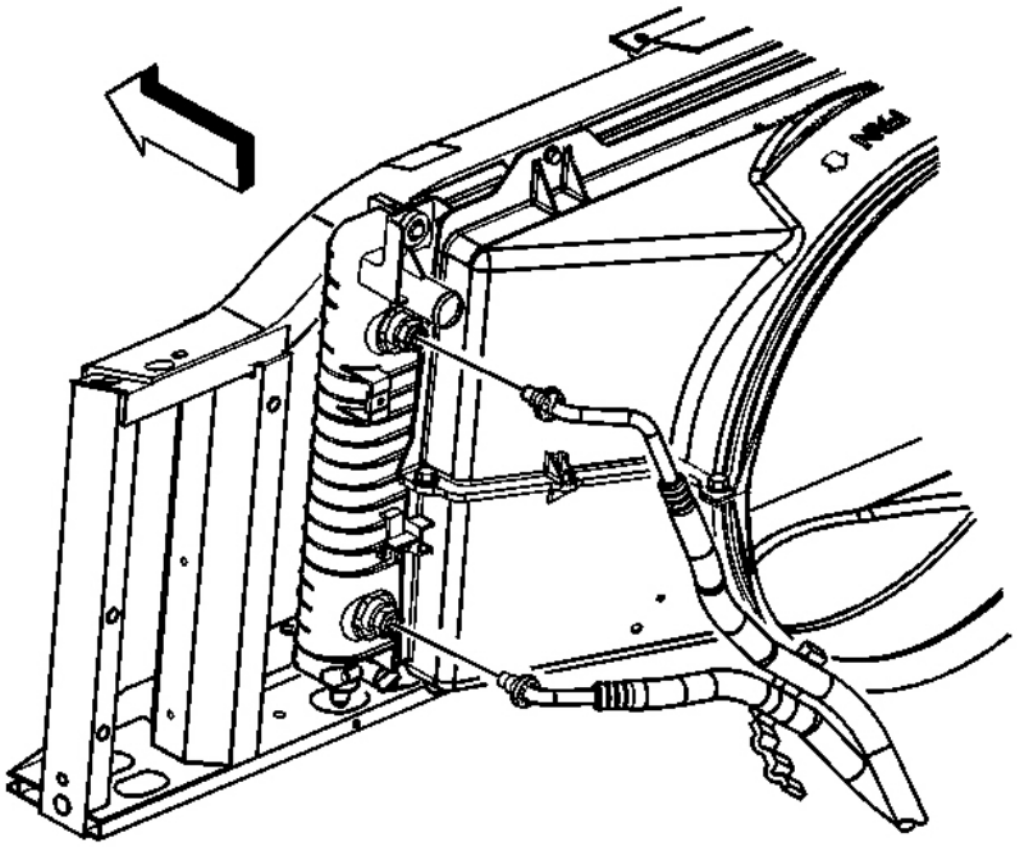


Fig. 97: View Of Engine Oil Cooler Quick Connect Fittings
Courtesy of GENERAL MOTORS CORP.

1. Disconnect the engine oil cooler quick connect fittings. Refer to **Engine Oil Cooler Pipe/Hose Quick Connect Fitting**.
2. If equipped with a 5.3L or 6.0L engine, perform the following:
    1. Open the oil cooler hose clip located on the lower fan shroud.
    2. Remove the oil cooler hoses from the clip.

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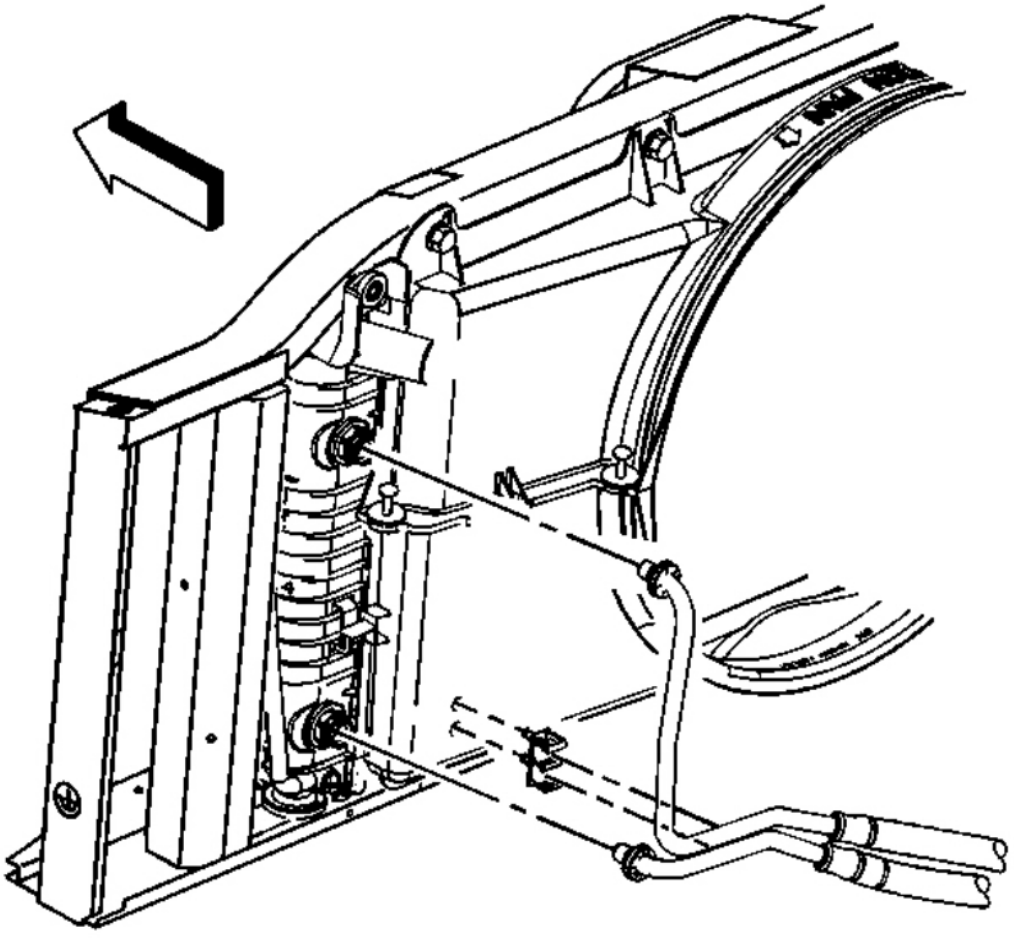


Fig. 98: View Of Oil Cooler Hoses
Courtesy of GENERAL MOTORS CORP.

3. If equipped with a 8.1L engine, remove the oil cooler hoses from the clip.
4. Raise and suitably support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
5. Place jack or utility stands at the rear of the vehicle.
6. If equipped, remove the engine protection shield. Refer to **Engine Protection Shield Replacement** .
7. If equipped, remove the front differential carrier shield. Refer to **Shield Replacement** .

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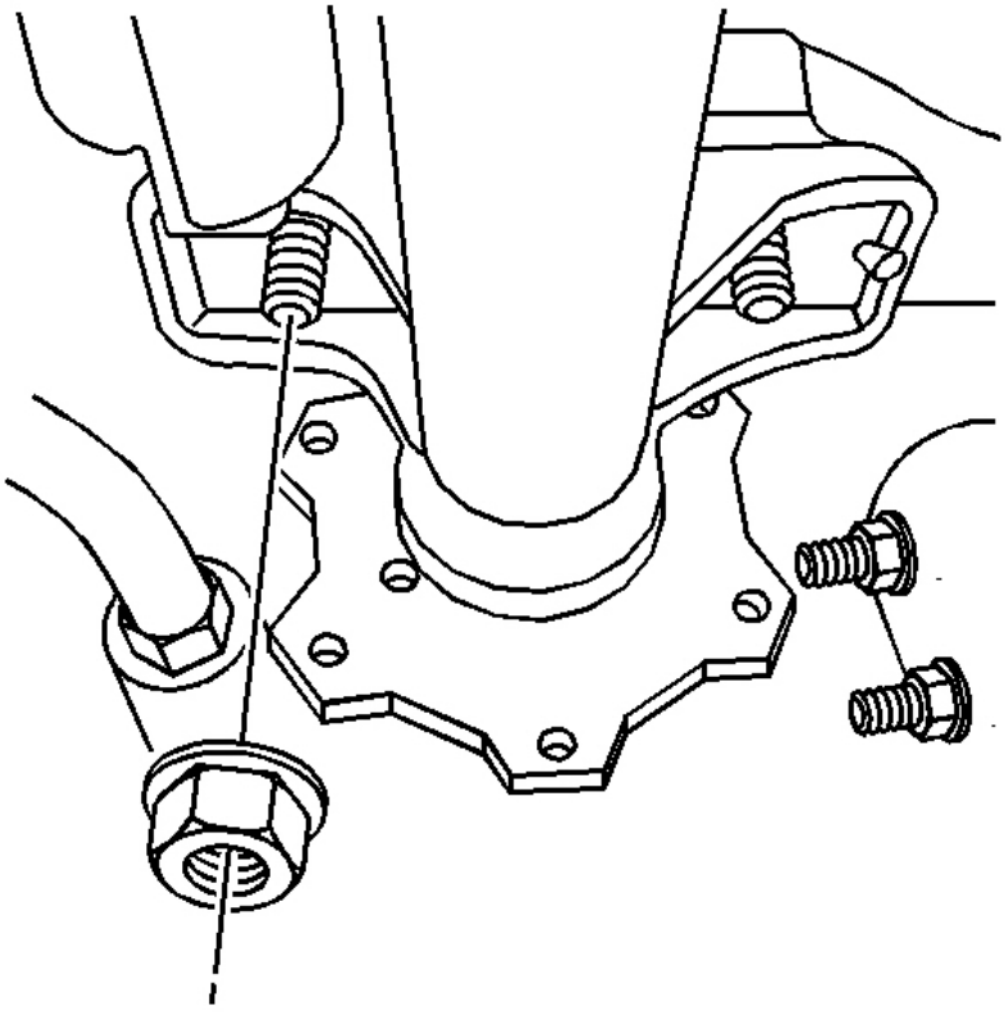


Fig. 99: View Of Inner Axle Housing Nuts
Courtesy of GENERAL MOTORS CORP.

8. Place an adjustable jack under the front differential carrier.
9. Remove the inner axle housing nuts and washers from the bracket.

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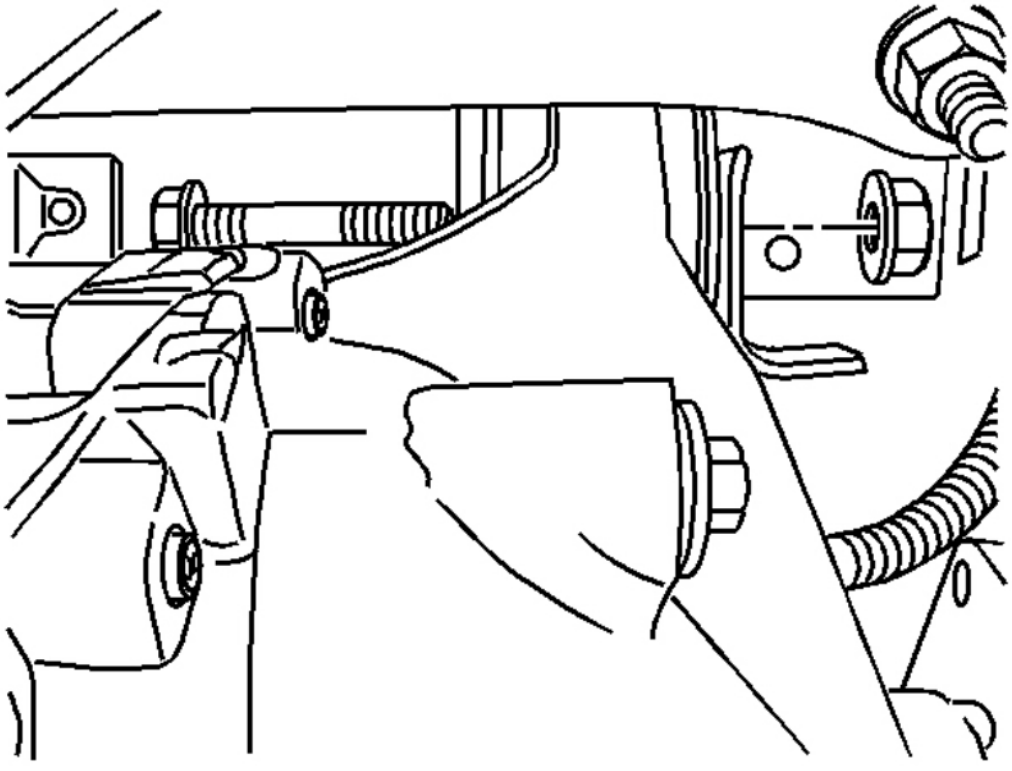


Fig. 100: View Of Differential Carrier Upper Mounting Bolt
Courtesy of GENERAL MOTORS CORP.

10. Remove the differential carrier upper mounting bolt and nut.
11. Pivot the differential carrier forward and down on the lower mount bolt while it is being supported by the adjustable jack.
12. Secure the differential carrier to the jack.

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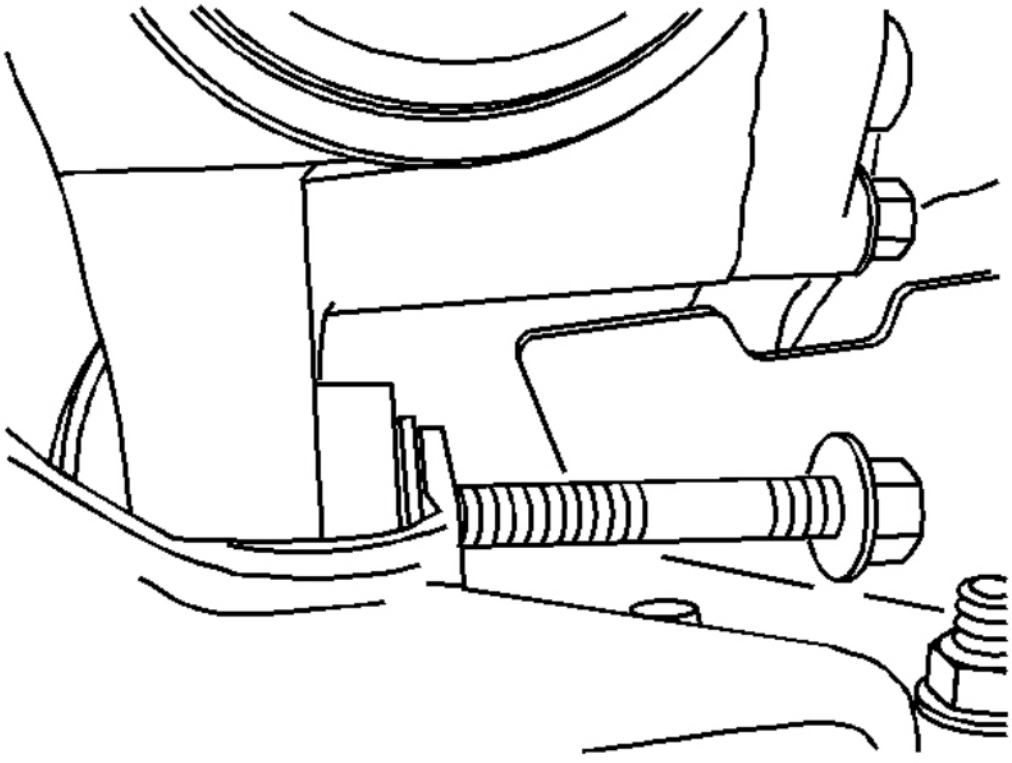


Fig. 101: View Of Differential Carrier Lower Mounting Bolt
Courtesy of GENERAL MOTORS CORP.

13. Remove the differential carrier lower mounting bolt and nut.
14. Lower the jack 4 to 6 inches.

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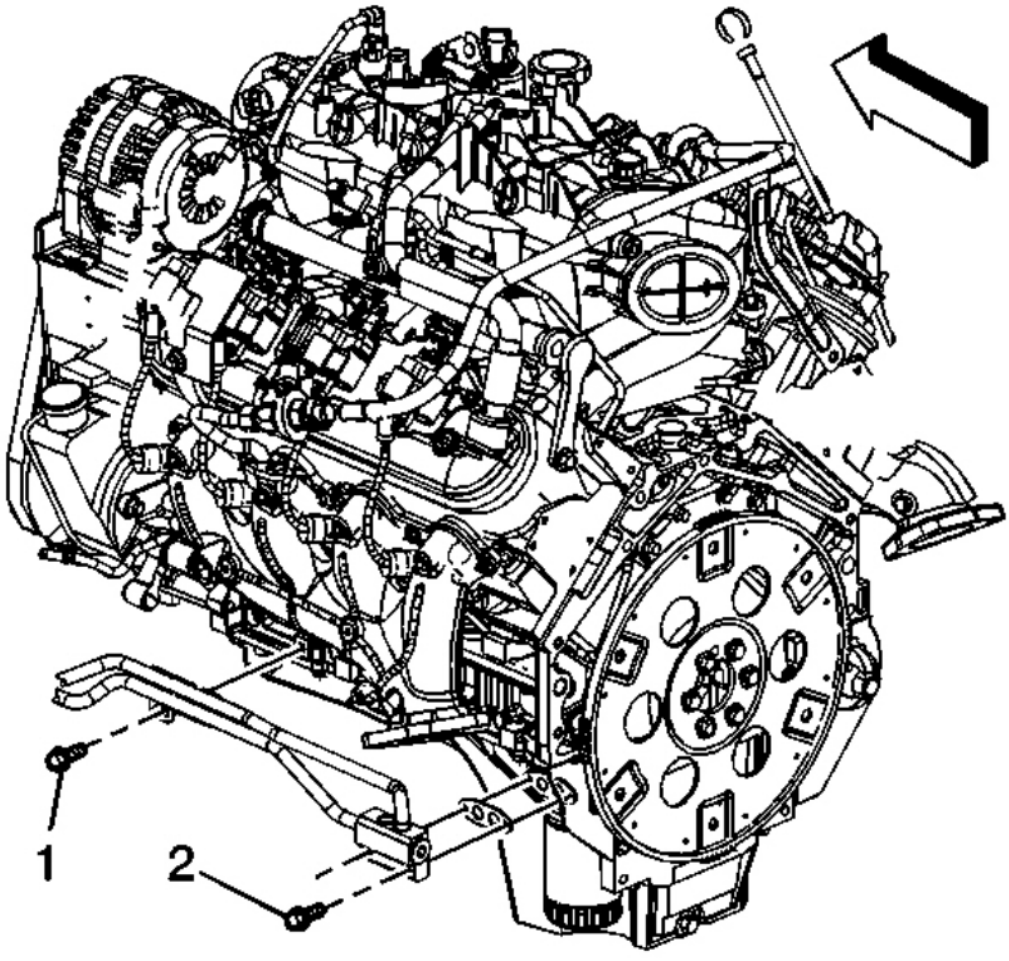


Fig. 102: View Of Oil Cooler Hose Bracket Bolt & Adapter Bolts
Courtesy of GENERAL MOTORS CORP.

15. If equipped with a 5.3L or 6.0L engine, perform the following:
    1. Remove the oil cooler hose bracket bolt (1).
    2. Remove the oil cooler hose adapter bolts (2).
    3. Remove the oil cooler hose assembly and gasket. Discard the gasket.
    4. Inspect the fittings, connectors and cooler hoses for damage or distortion.

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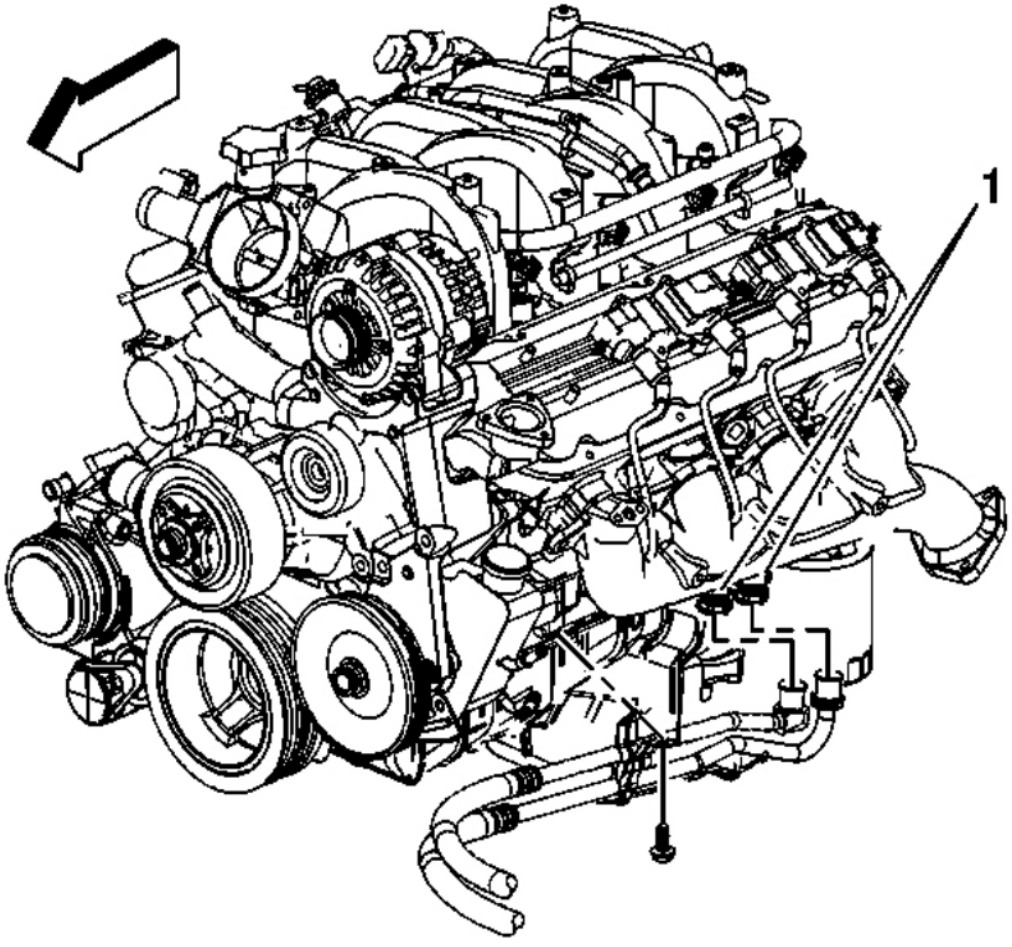


Fig. 103: View Of Quick Connect Fittings, Oil Cooler Hose Assembly & Bracket Bolt (8.1L)
Courtesy of GENERAL MOTORS CORP.

16. If equipped with a 8.1L engine, perform the following:
    1. Remove the oil cooler hose bracket bolt.
    2. Disconnect the quick connect fittings (1) at the engine.
    3. Remove the oil cooler hose assembly. Discard the gasket.
    4. Inspect the fittings, connectors and cooler hoses for damage or distortion.

Installation Procedure

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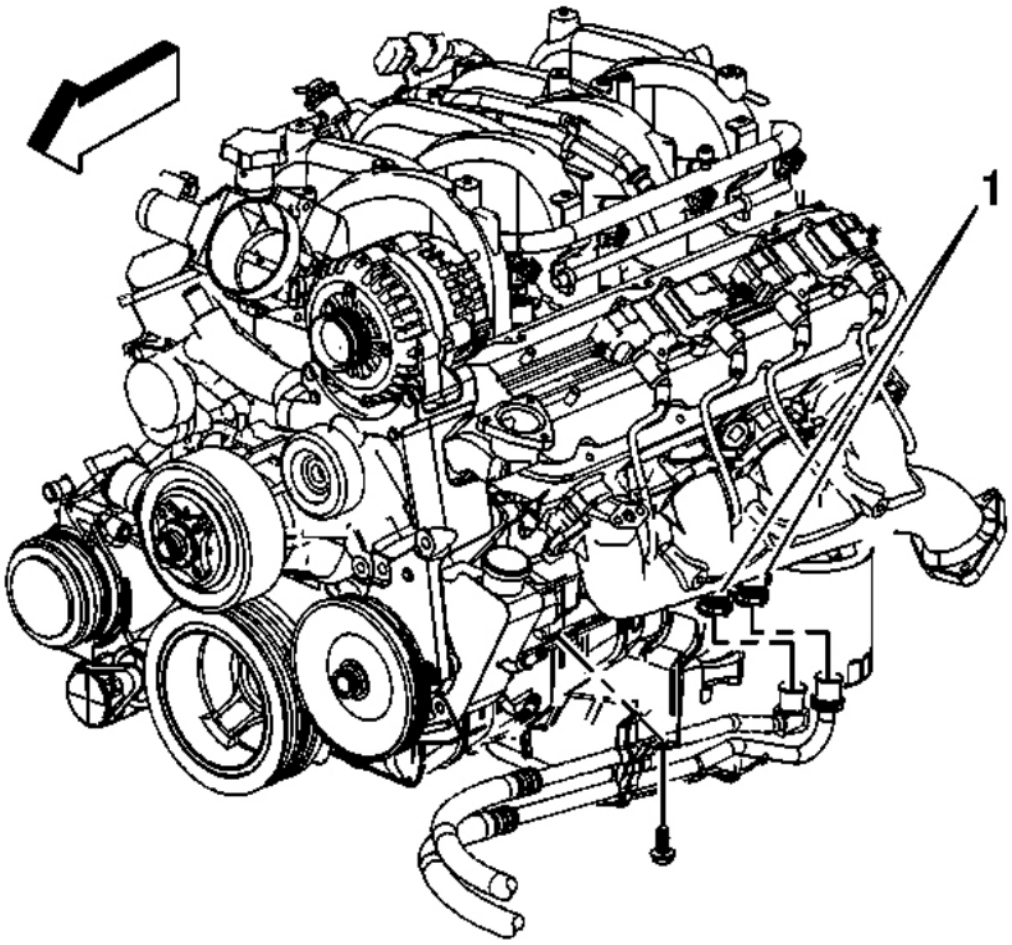


Fig. 104: View Of Quick Connect Fittings, Oil Cooler Hose Assembly & Bracket Bolt (8.1L)
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: A distinct snap should be heard when assembling the tube ends of the hose assembly to the quick connectors. To ensure the tube is fully inserted into the connector, check by giving the tube a forceful pull.

1. If equipped with a 8.1L engine, perform the following:
    1. Install the oil cooler hose assembly and a NEW gasket.
    2. Connect the quick connect fittings (1) at the engine.

NOTE: Refer to Fastener Notice in Cautions and Notices.

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3. Install the oil cooler hose bracket bolt.

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

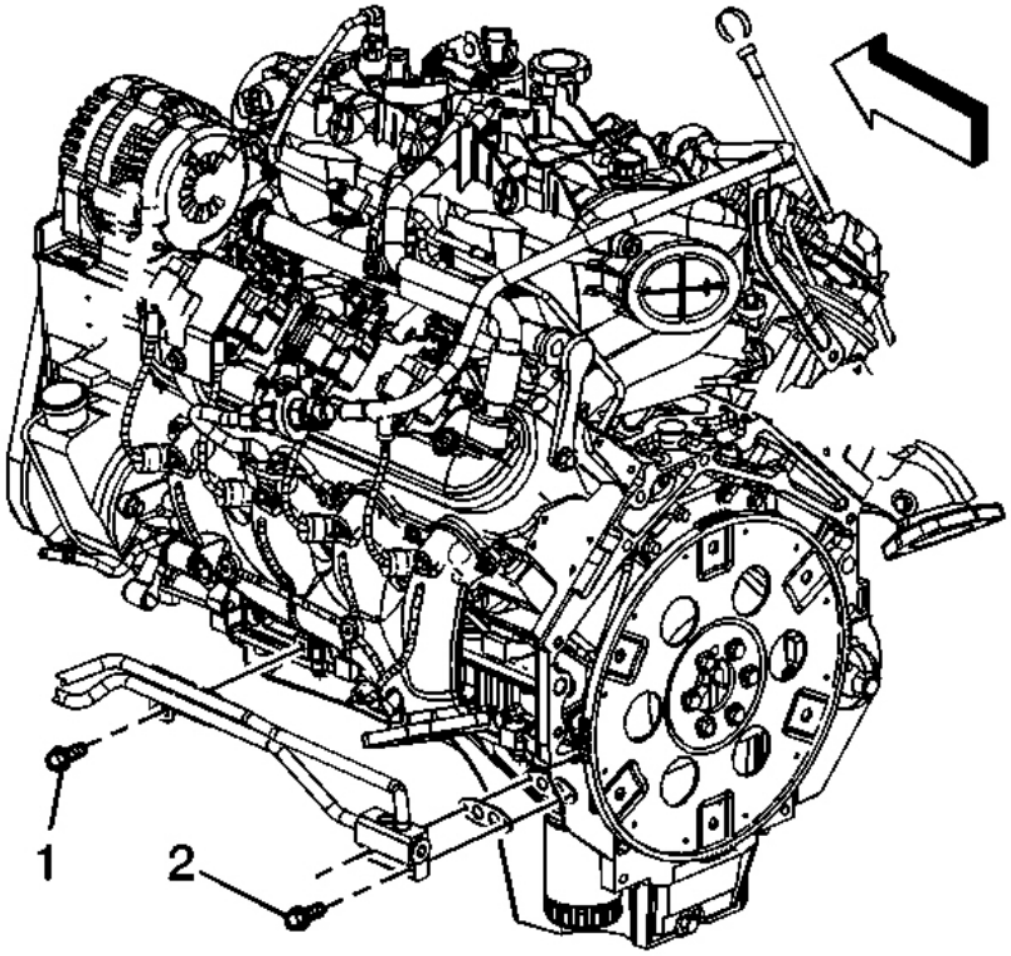


Fig. 105: View Of Oil Cooler Hose Bracket Bolt & Adapter Bolts
Courtesy of GENERAL MOTORS CORP.

2. If equipped with a 5.3L or 6.0L engine, perform the following:
   1. Install the oil cooler hose assembly and a NEW gasket.
   2. Install the oil cooler hose adapter bolts (2).

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

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

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

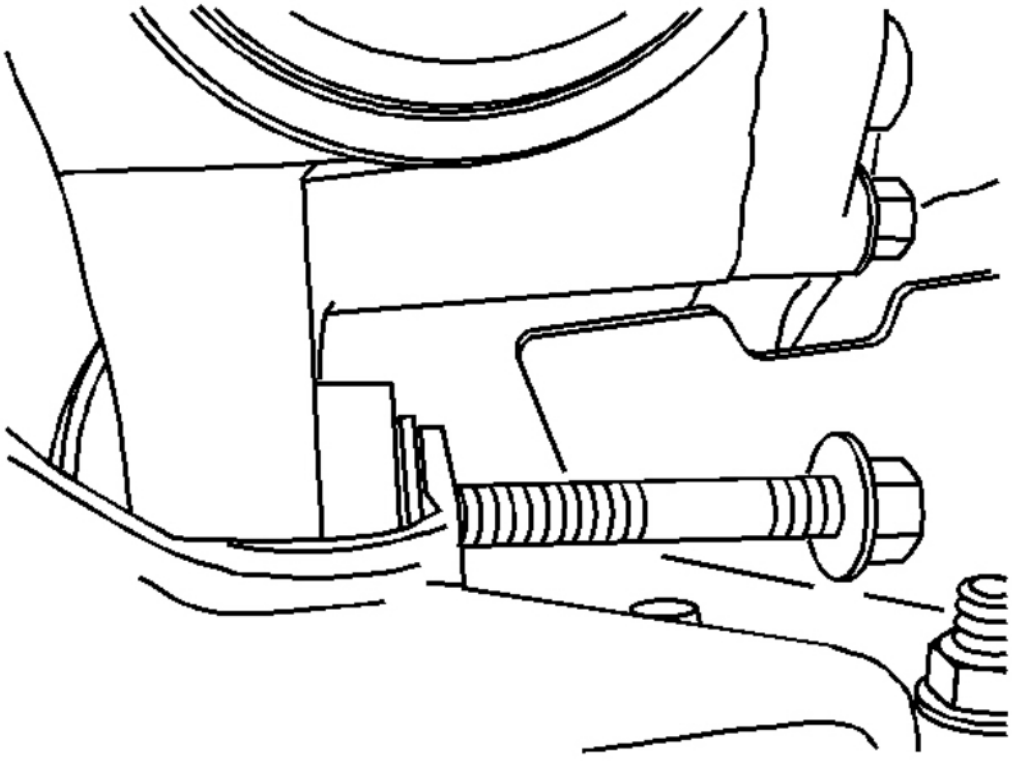


Fig. 106: View Of Differential Carrier Lower Mounting Bolt
Courtesy of GENERAL MOTORS CORP.

3. Raise the jack in order to position the differential carrier.
4. Install the differential carrier lower mounting bolt and nut. Do not tighten the bolt at this time.
5. Pivot the differential carrier up and back on the lower mount bolt while it is being supported by the jack.

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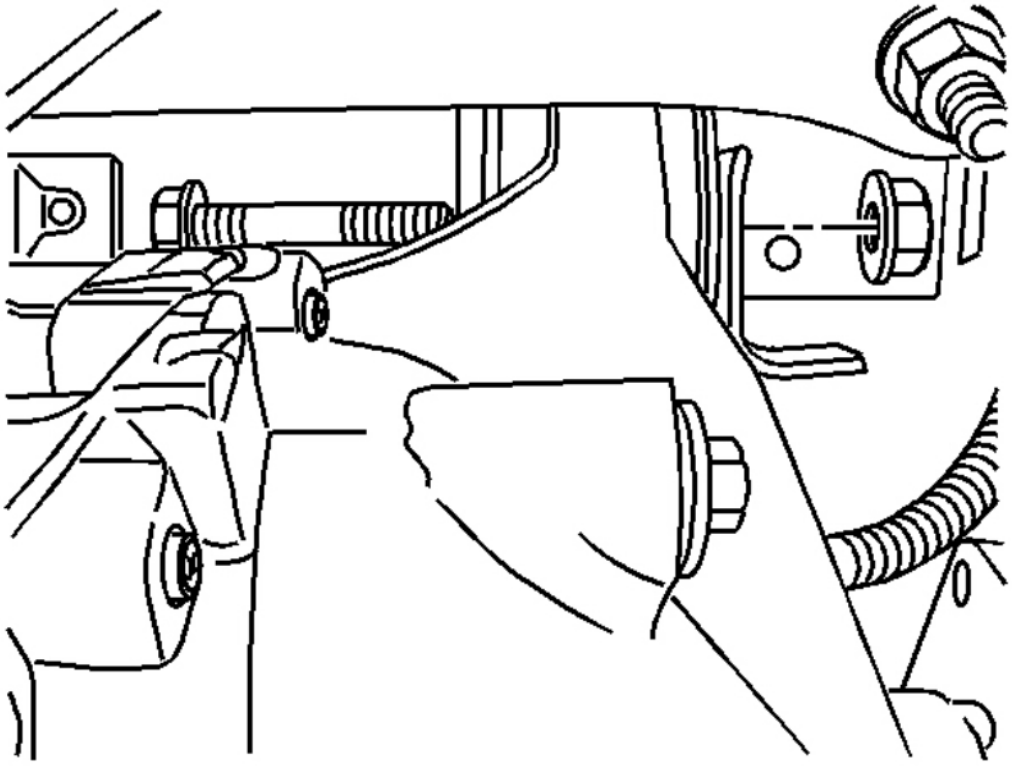


Fig. 107: View Of Differential Carrier Upper Mounting Bolt
Courtesy of GENERAL MOTORS CORP.

6. Install the differential carrier upper mounting bolt and nut. Do not tighten the bolt at this time.

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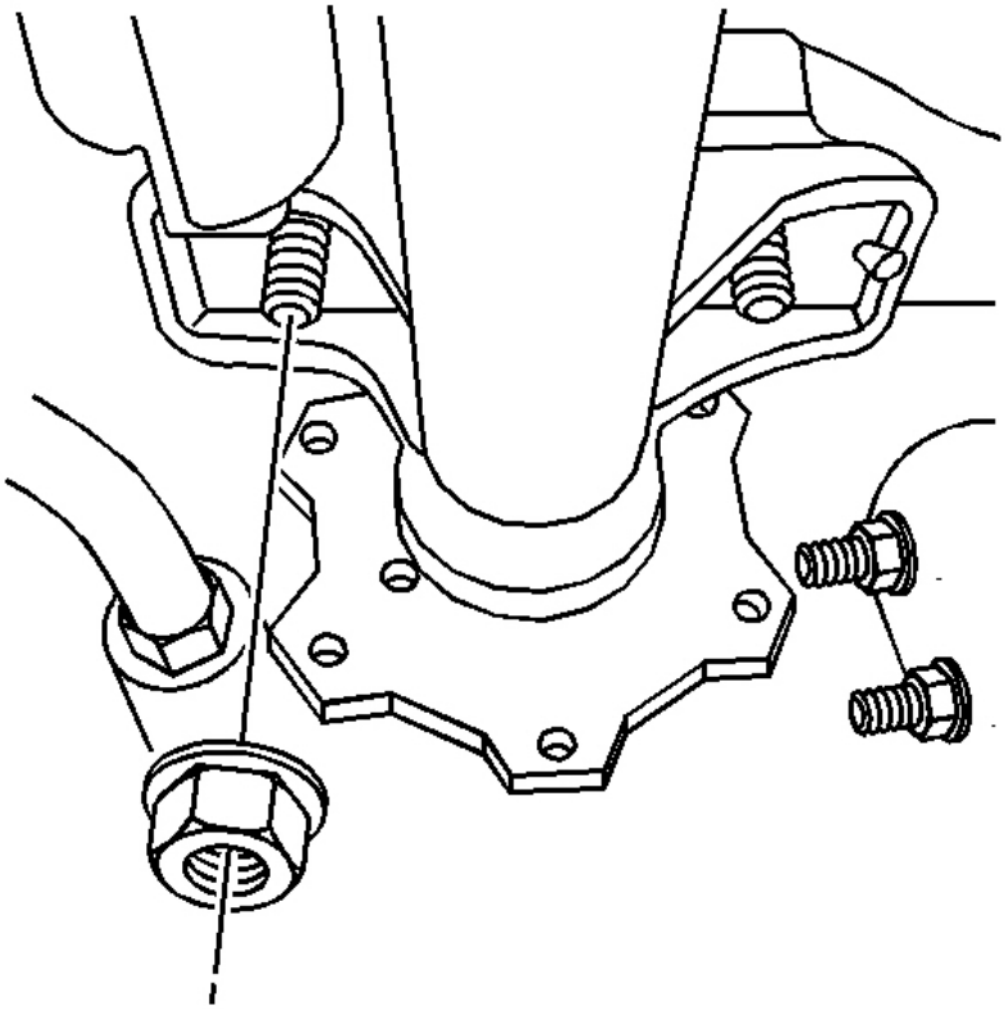


Fig. 108: View Of Inner Axle Housing Nuts
Courtesy of GENERAL MOTORS CORP.

7. Install the inner axle housing washers and nuts to the brackets.

   Tighten:

   - The inner axle housing bolts to 100 N.m (75 lb ft).
   - The upper and lower differential carrier bolts to 100 N.m (75 lb ft).

8. Remove the adjustable jack from under the front differential carrier.
9. If equipped, install the front differential carrier shield. Refer to **Shield Replacement** .

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

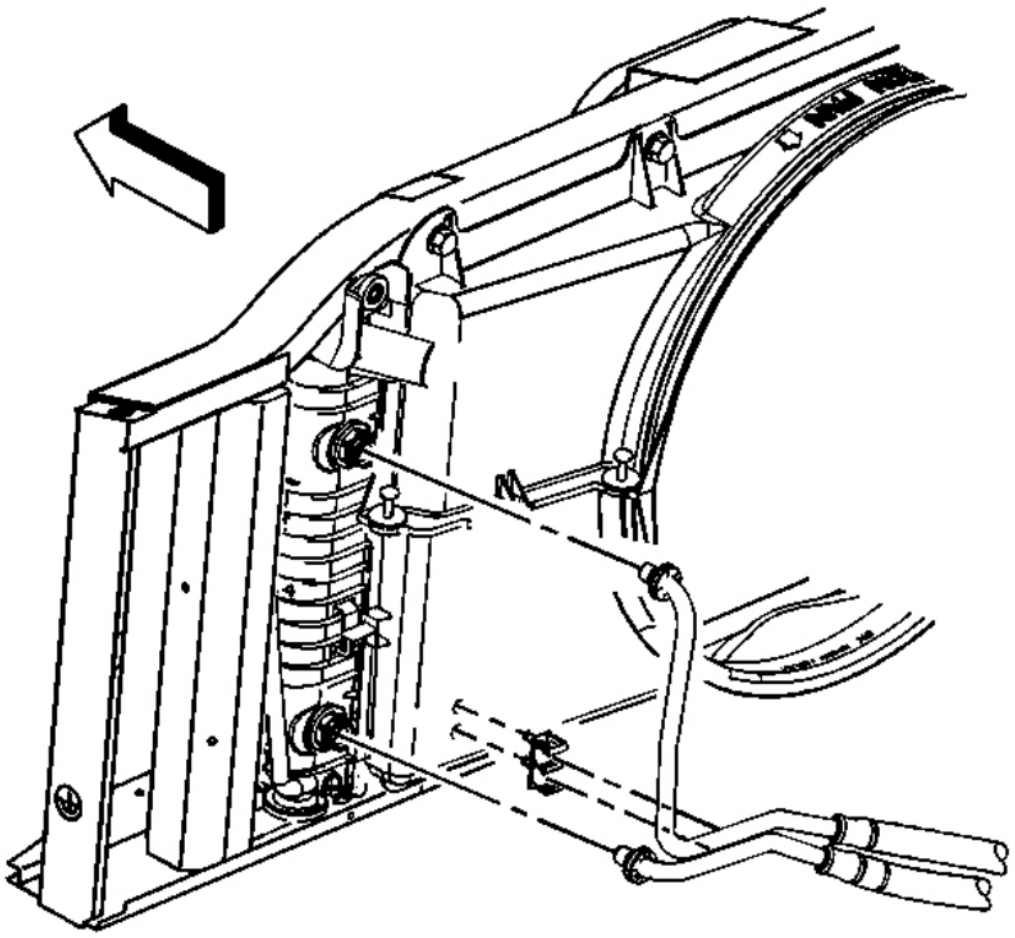


Fig. 109: View Of Oil Cooler Hoses
Courtesy of GENERAL MOTORS CORP.

IMPORTANT:

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

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fitting.

13. If equipped with a 8.1L engine perform the following:
14. Install the oil cooler hoses to the clip.

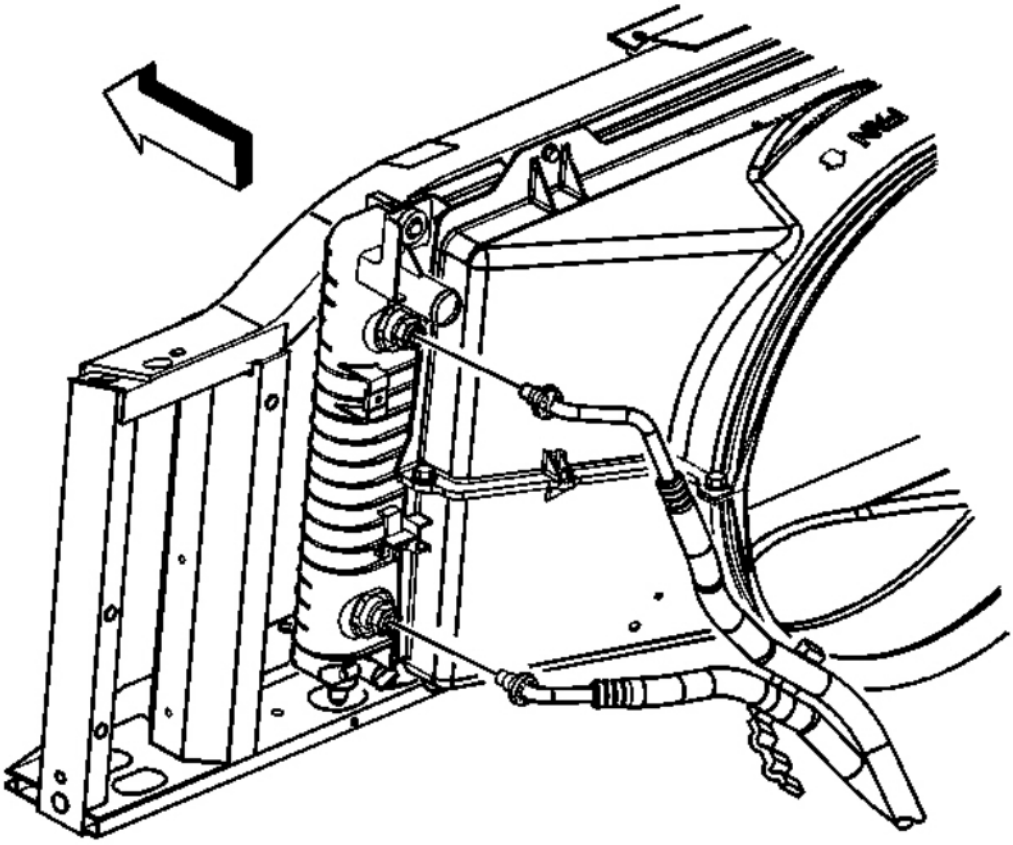


Fig. 110: View Of Engine Oil Cooler Quick Connect Fittings
Courtesy of GENERAL MOTORS CORP.

15. If equipped with a 5.3L or 6.0L engine, perform the following:
    1. Install the oil cooler hoses to the hose clip on the fan shroud.
    2. Snap the oil cooler hose clip shut.
16. Connect the engine oil cooler quick connect fittings. Refer to **Engine Oil Cooler Pipe/Hose Quick Connect Fitting**.

FAN REPLACEMENT

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Tools Required

- **J 46406** Fan Clutch Remover and Installer. See **Special Tools and Equipment**.
- **J 41240-5A** Fan Clutch Wrench. See **Special Tools and Equipment**.

Removal Procedure

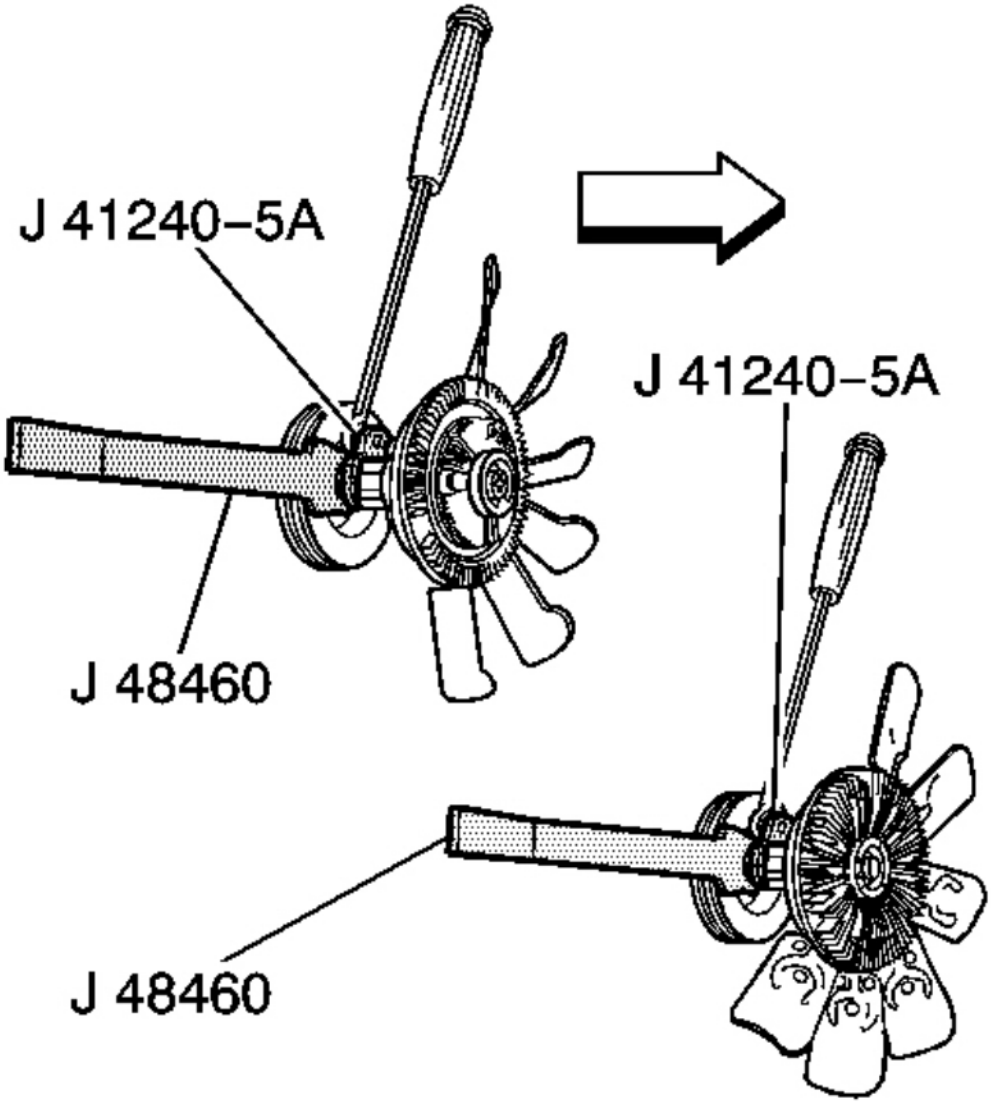


Fig. 111: Using Special Tools For Fan Clutch

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Courtesy of GENERAL MOTORS CORP.

1. Remove the upper fan shroud. Refer to **Fan Shroud Replacement - Upper (W/O M74)** or **Fan Shroud Replacement - Upper (W/M74)**.
2. Install the **J 46406** and the **J 41240-5A** to the fan clutch. See **Special Tools and Equipment**.

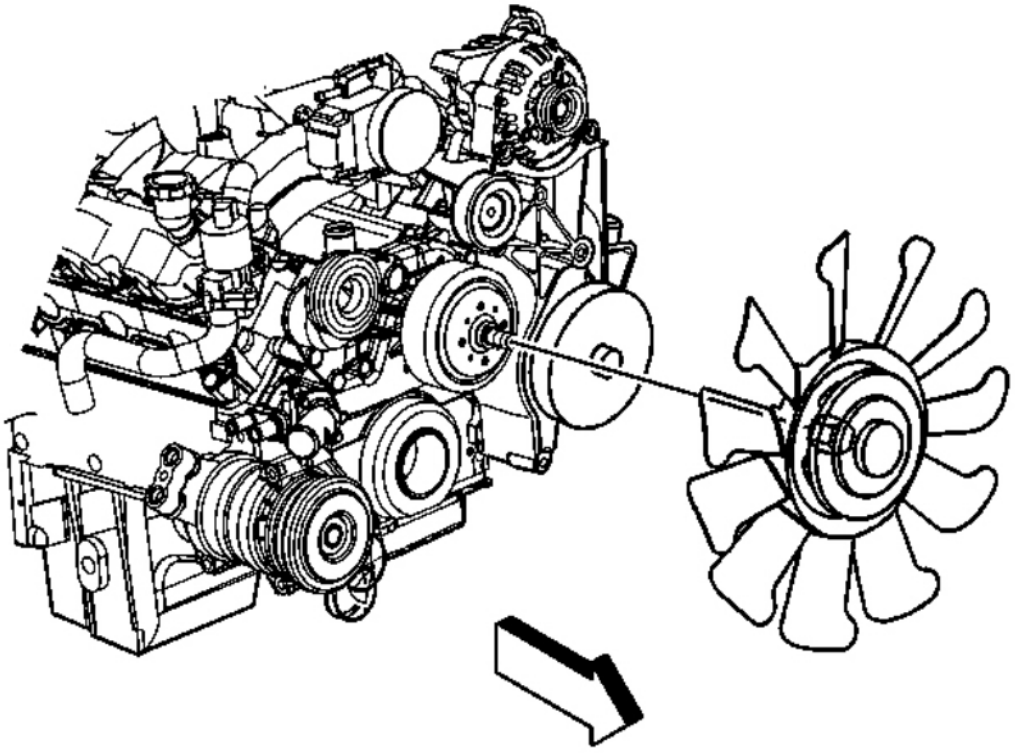


Fig. 112: View Of Fan Assembly Removed
Courtesy of GENERAL MOTORS CORP.

3. Remove the fan hub nut from the water pump in a counterclockwise rotation.
4. Lay the fan blade face down on a workbench.

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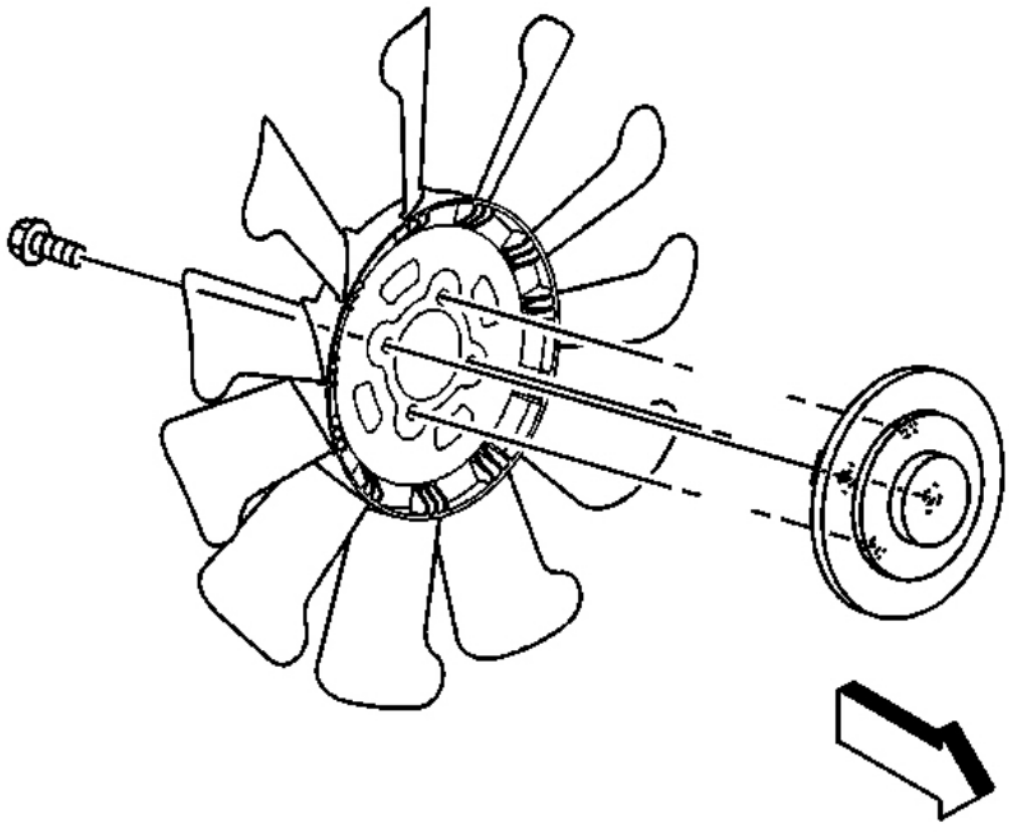


Fig. 113: View Of Fan Clutch & Fan Blade
Courtesy of GENERAL MOTORS CORP.

5. Remove the fan clutch bolts from the rear of the fan blade, if necessary.
6. Separate the fan clutch from the fan blade.

Installation Procedure

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

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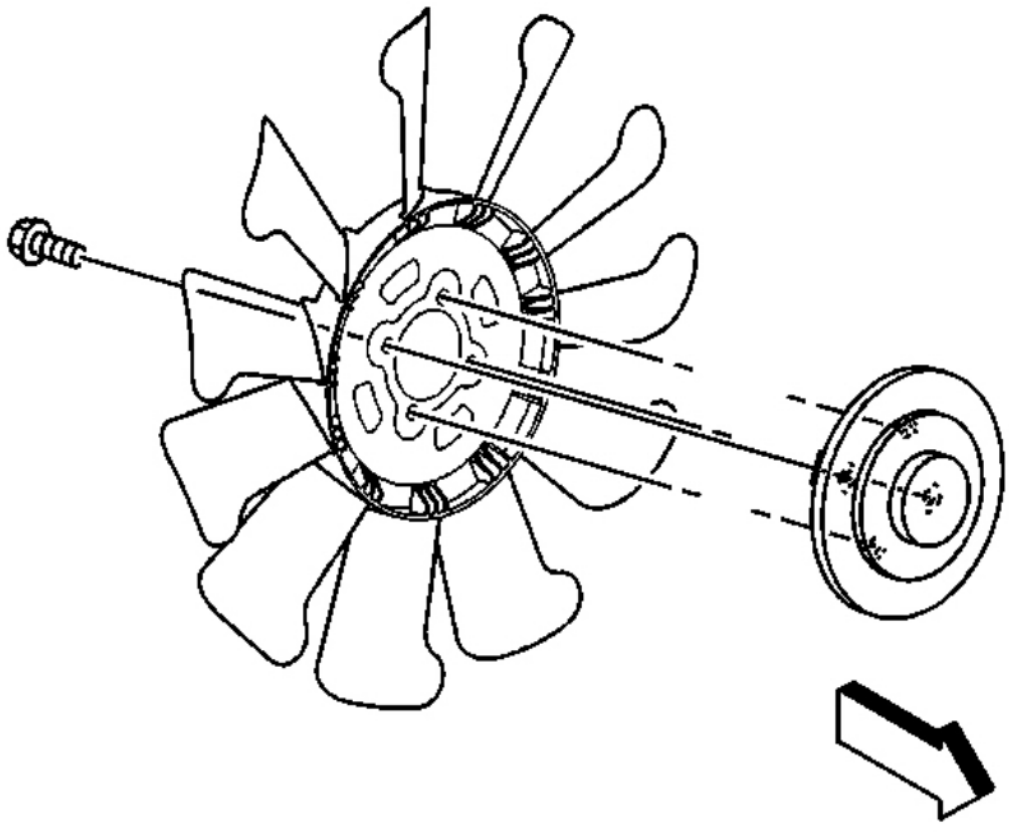


Fig. 114: View Of Fan Clutch & Fan Blade
Courtesy of GENERAL MOTORS CORP.

1. Install the fan clutch bolts.
2. Install the fan clutch onto the fan blade, if necessary.

NOTE: Refer to Fastener Notice in Cautions and Notices.

3. Install the fan clutch bolts.

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

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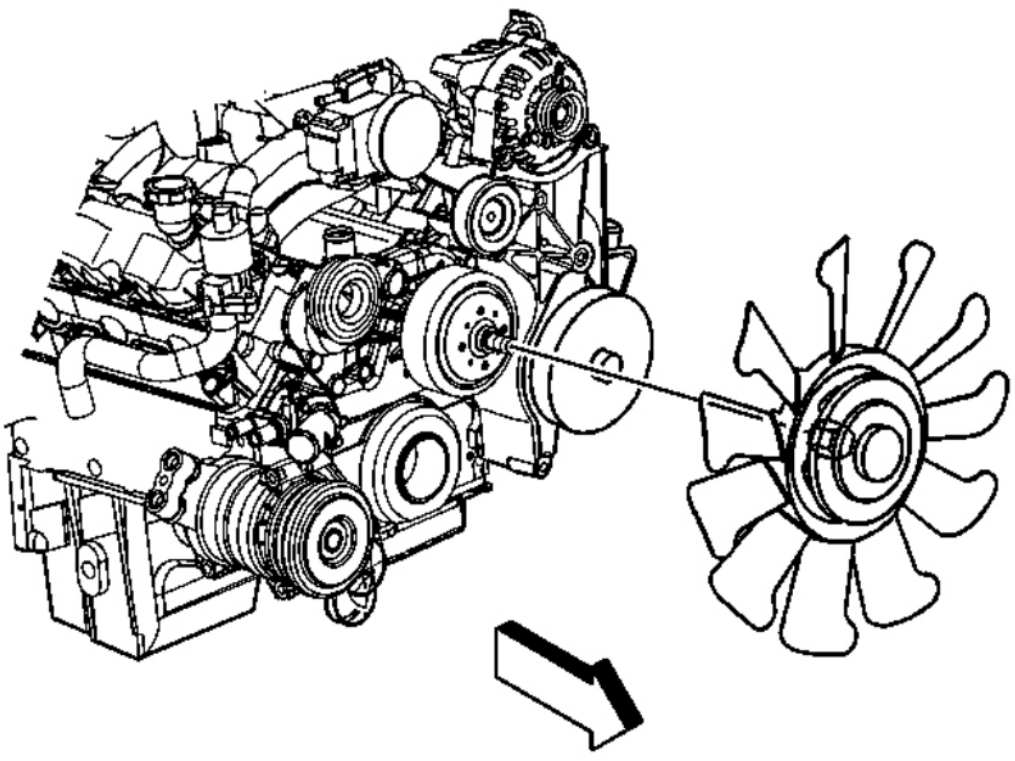


Fig. 115: View Of Fan Assembly Removed
Courtesy of GENERAL MOTORS CORP.

4. Install the fan blade.

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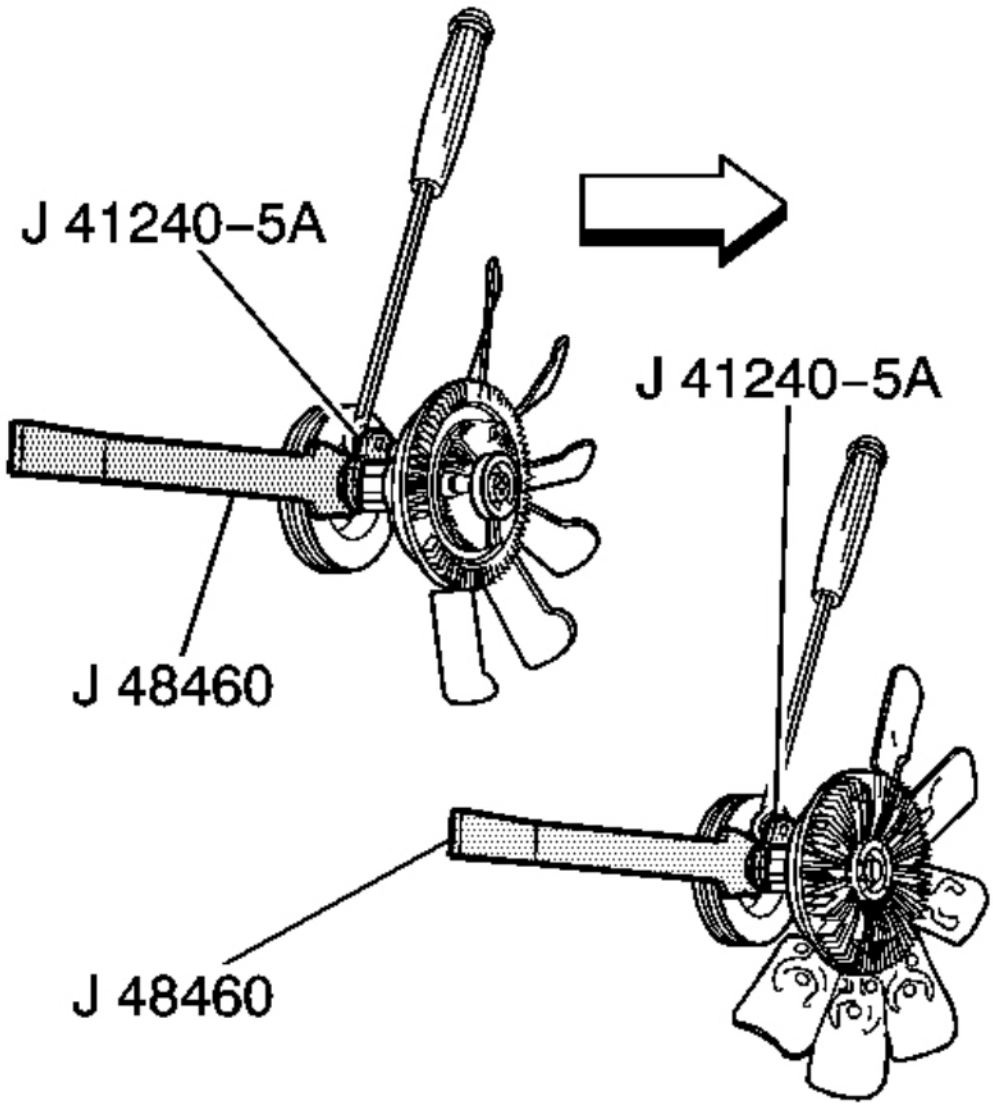


Fig. 116: Using Special Tools For Fan Clutch
Courtesy of GENERAL MOTORS CORP.

5. Install the **J 46406** and the **J 41240-5A** to the fan clutch. See **Special Tools and Equipment**.

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

6. Install the upper fan shroud. Refer to **Fan Shroud Replacement - Upper (W/O M74)** or **Fan Shroud**

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Replacement - Upper (W/M74).

FAN CLUTCH REPLACEMENT

Tools Required

- **J 46406** Fan Clutch Remover and Installer. See **Special Tools and Equipment**.
- **J 41240-5A** Fan Clutch Wrench. See **Special Tools and Equipment**.

Removal Procedure

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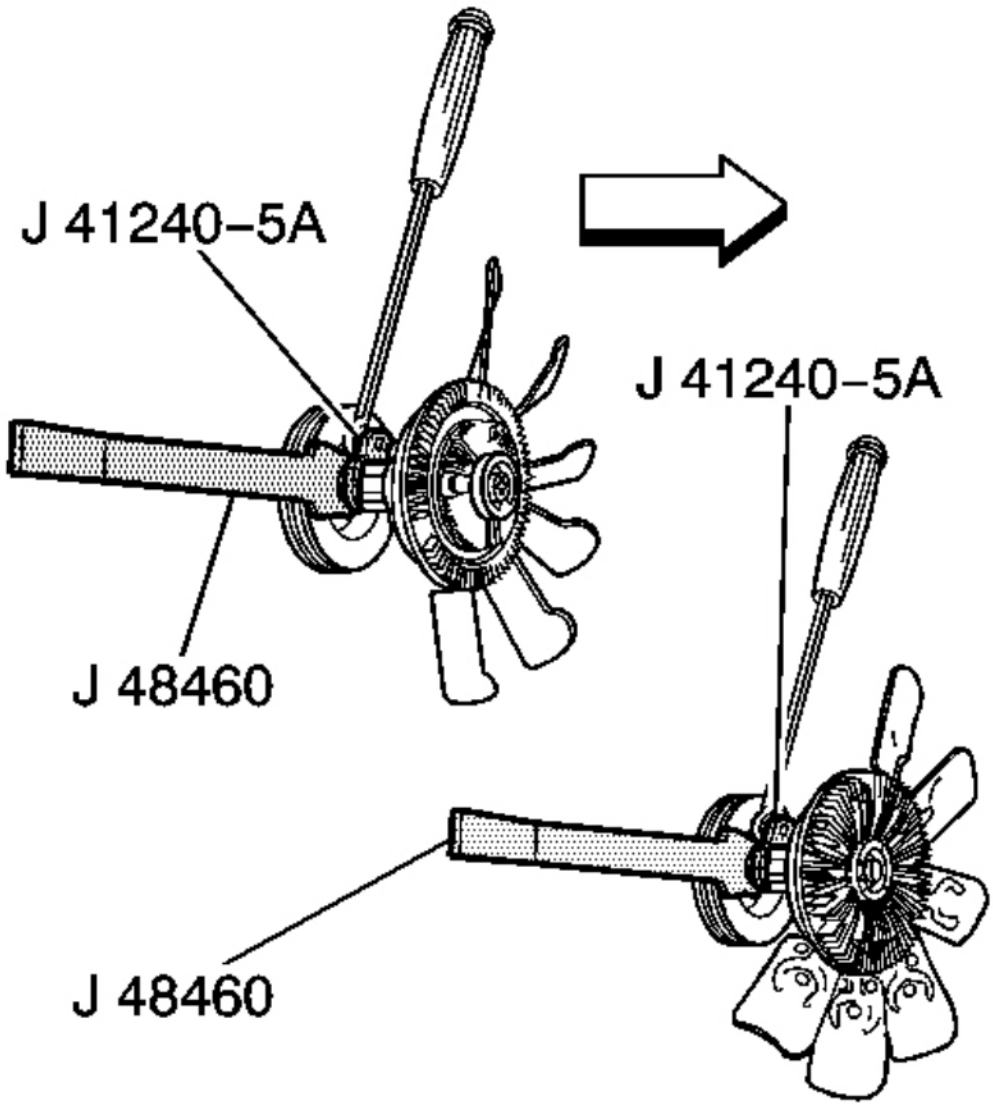


Fig. 117: Using Special Tools For Fan Clutch
Courtesy of GENERAL MOTORS CORP.

1. Remove the upper fan shroud. Refer to **Fan Shroud Replacement - Upper (W/O M74)** or **Fan Shroud Replacement - Upper (W/M74)**.
2. Install the **J 46406** and the **J 41240-5A** to the fan clutch. See **Special Tools and Equipment**.

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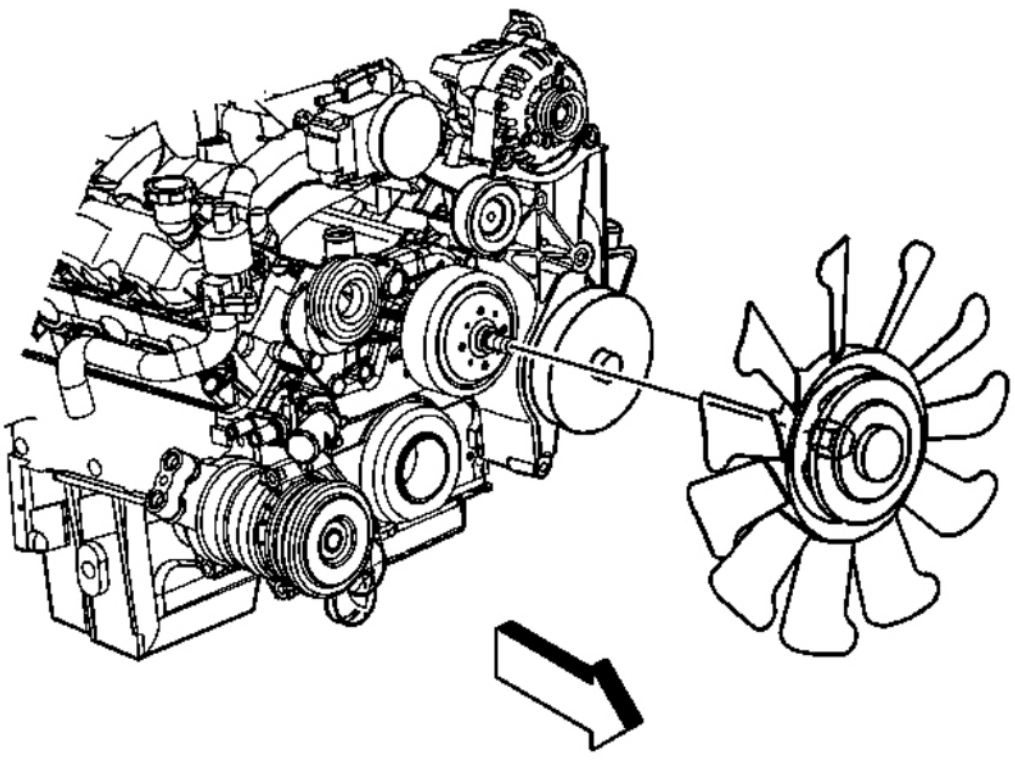


Fig. 118: View Of Fan Assembly Removed
Courtesy of GENERAL MOTORS CORP.

3. Remove the fan hub nut from the water pump in a counterclockwise rotation.
4. Lay the fan blade face down on a workbench.

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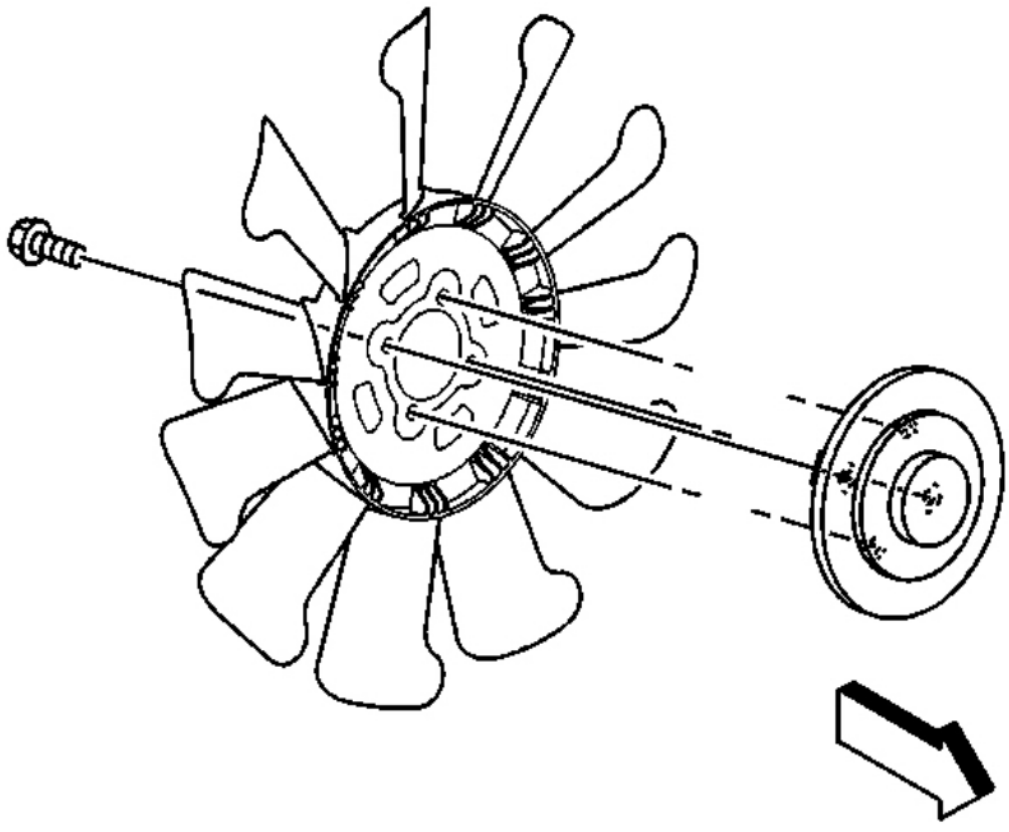


Fig. 119: View Of Fan Clutch & Fan Blade
Courtesy of GENERAL MOTORS CORP.

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

Installation Procedure

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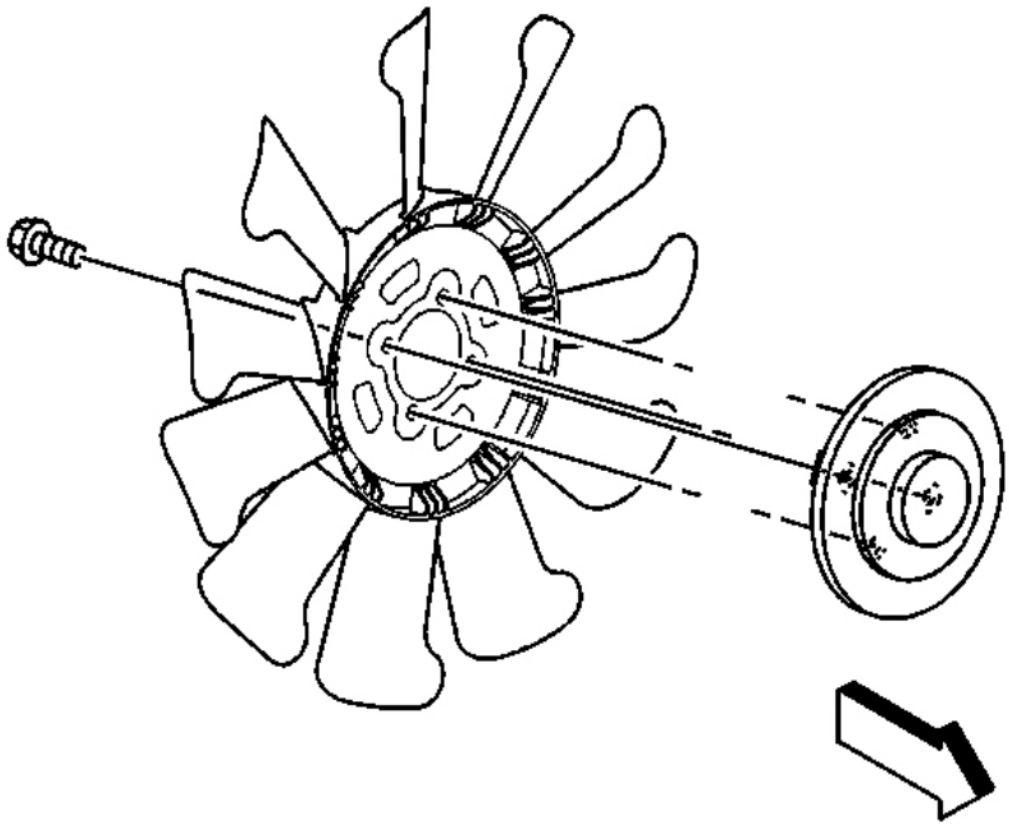


Fig. 120: View Of Fan Clutch & Fan Blade
Courtesy of GENERAL MOTORS CORP.

1. Install the fan clutch bolts.
2. Install the fan clutch onto the fan blade.

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

3. Install the fan clutch bolts.

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

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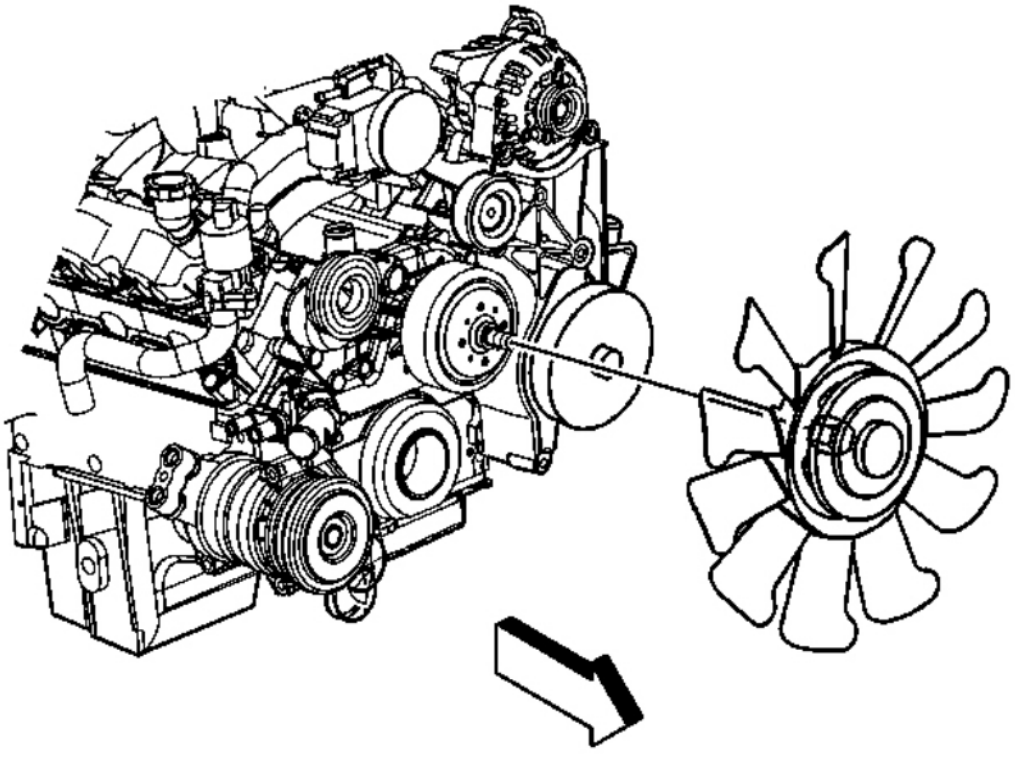


Fig. 121: View Of Fan Assembly Removed
Courtesy of GENERAL MOTORS CORP.

4. Install the fan blade.

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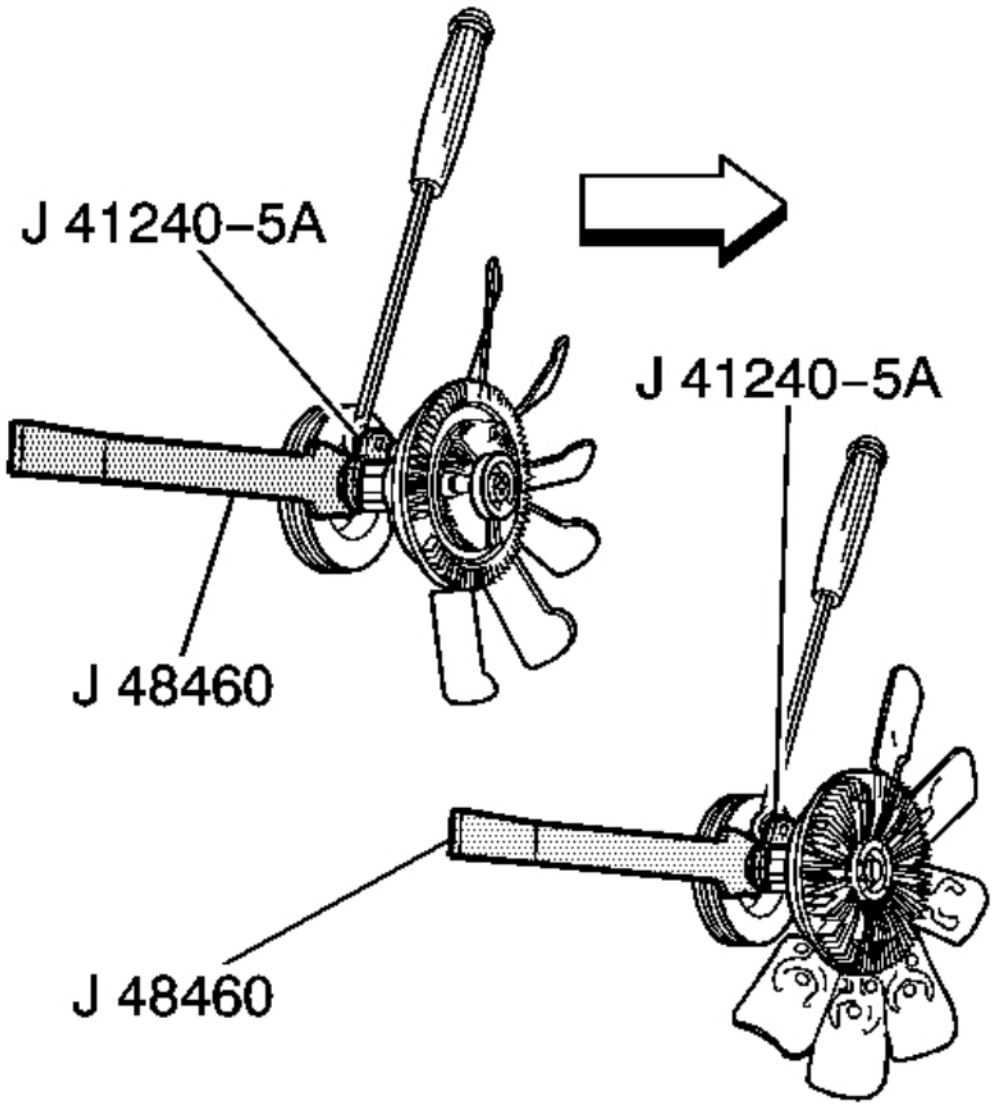


Fig. 122: Using Special Tools For Fan Clutch
Courtesy of GENERAL MOTORS CORP.

5. Install the **J 46406** and the **J 41240-5A** to the fan clutch. See **Special Tools and Equipment**.

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

6. Install the upper fan shroud. Refer to **Fan Shroud Replacement - Upper (W/O M74)** or **Fan Shroud**

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Replacement - Upper (W/M74).

THERMOSTAT HOUSING REPLACEMENT (4.8L, 5.3L, AND 6.0L ENGINES)

Removal Procedure

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

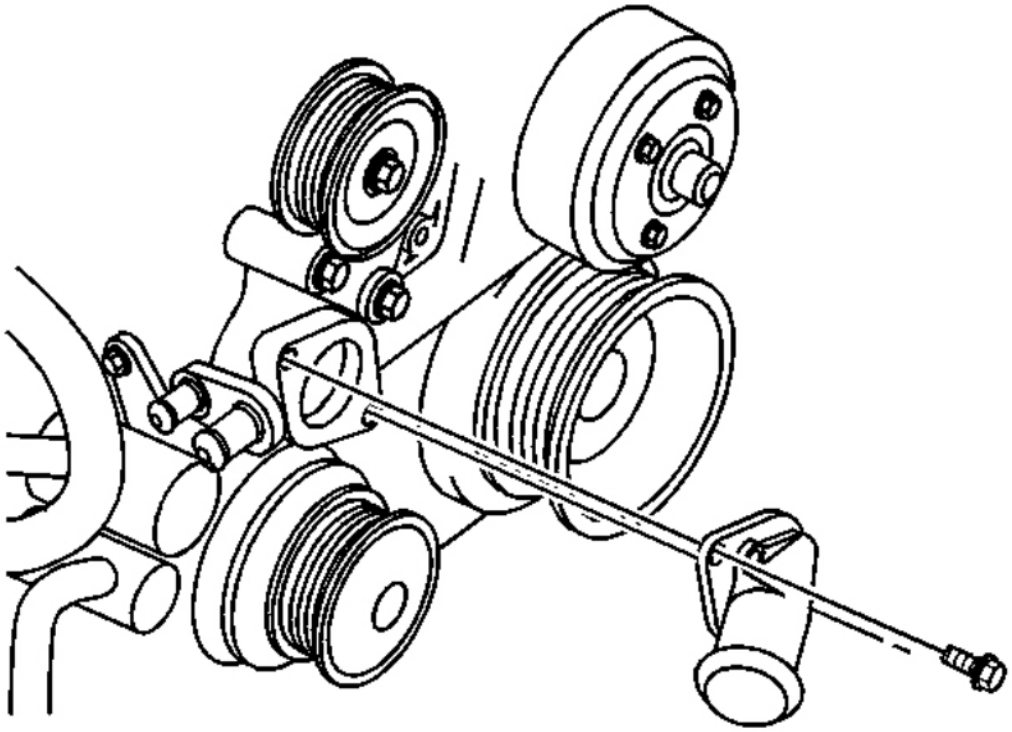


Fig. 123: View Of Water Pump Inlet
Courtesy of GENERAL MOTORS CORP.

1. Remove the radiator outlet hose. Refer to **Radiator Hose Replacement - Outlet (4.8L, 5.3L, and 6.0L Engines)** or **Radiator Hose Replacement - Outlet (Utility 8.1L Engine)** or **Radiator Hose Replacement - Outlet (Avalanche/XLT 8.1L)**.
2. Remove the water pump inlet bolts.
3. Remove the water pump inlet from the water pump.

Installation Procedure

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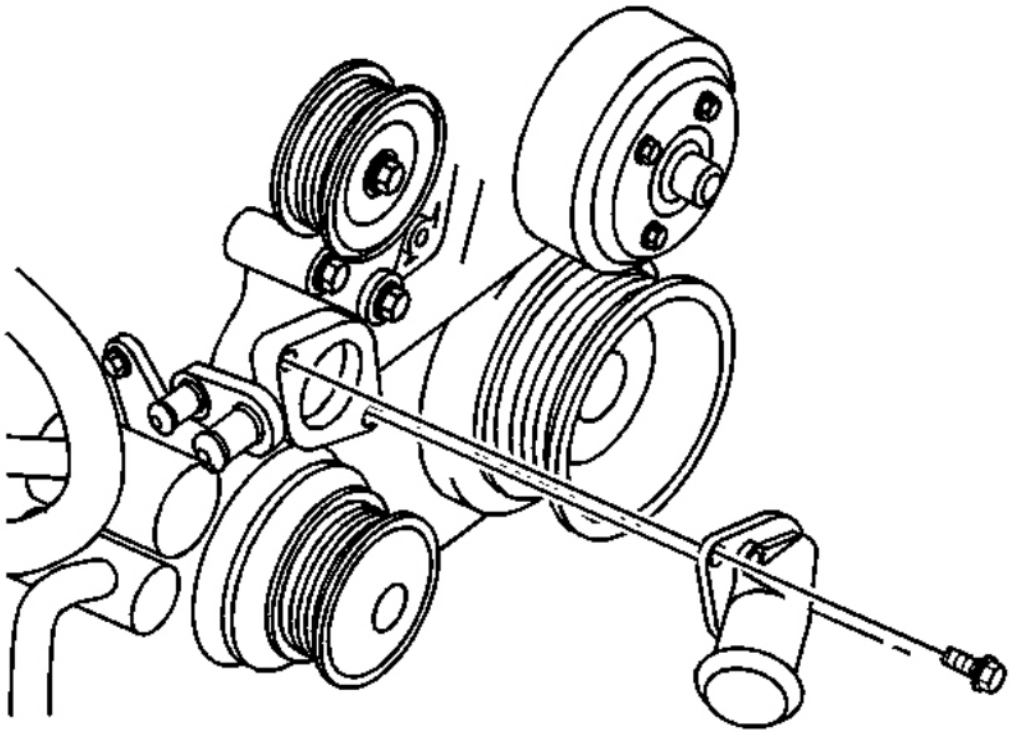


Fig. 124: View Of Water Pump Inlet
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice in Cautions and Notices.

1. Install the water pump inlet to the water pump.
2. Install the water pump inlet bolts.

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

3. Install the radiator outlet hose. Refer to **Radiator Hose Replacement - Outlet (4.8L, 5.3L, and 6.0L Engines)** or **Radiator Hose Replacement - Outlet (Utility 8.1L Engine)** or **Radiator Hose Replacement - Outlet (Avalanche/XLT 8.1L)**.

THERMOSTAT REPLACEMENT (8.1L ENGINE)

Removal Procedure

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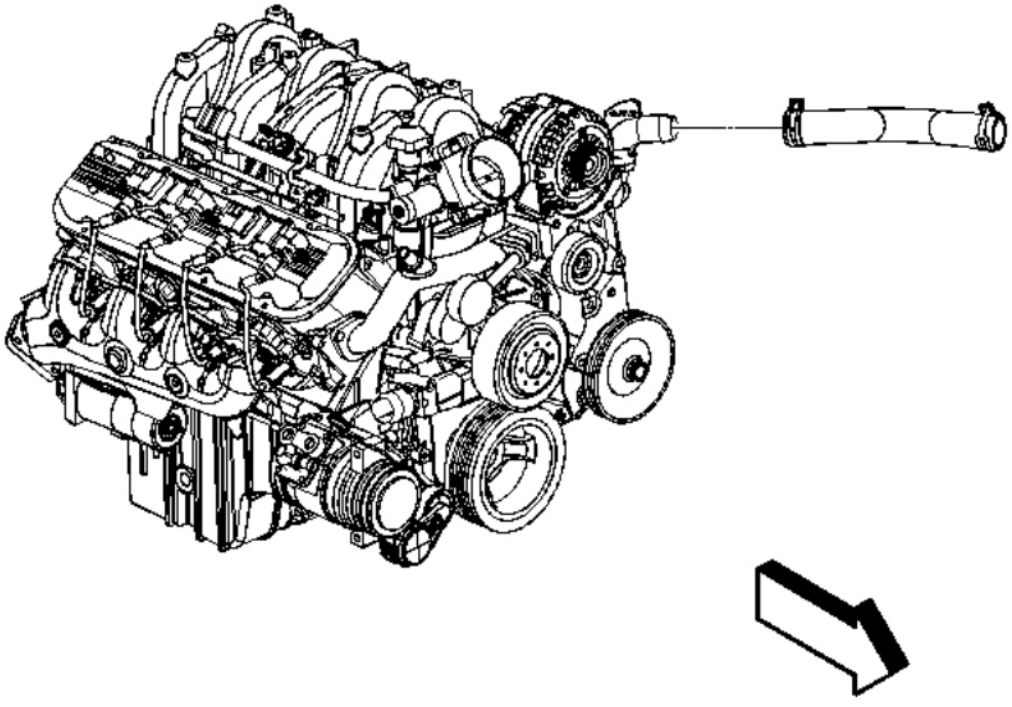


Fig. 125: View Of Inlet Hose Clamp & Water Crossover
Courtesy of GENERAL MOTORS CORP.

1. Drain the cooling system. Refer to **Draining and Filling Cooling System**.
2. Reposition the inlet hose clamp at the water outlet.
3. Remove the inlet hose from the water outlet.

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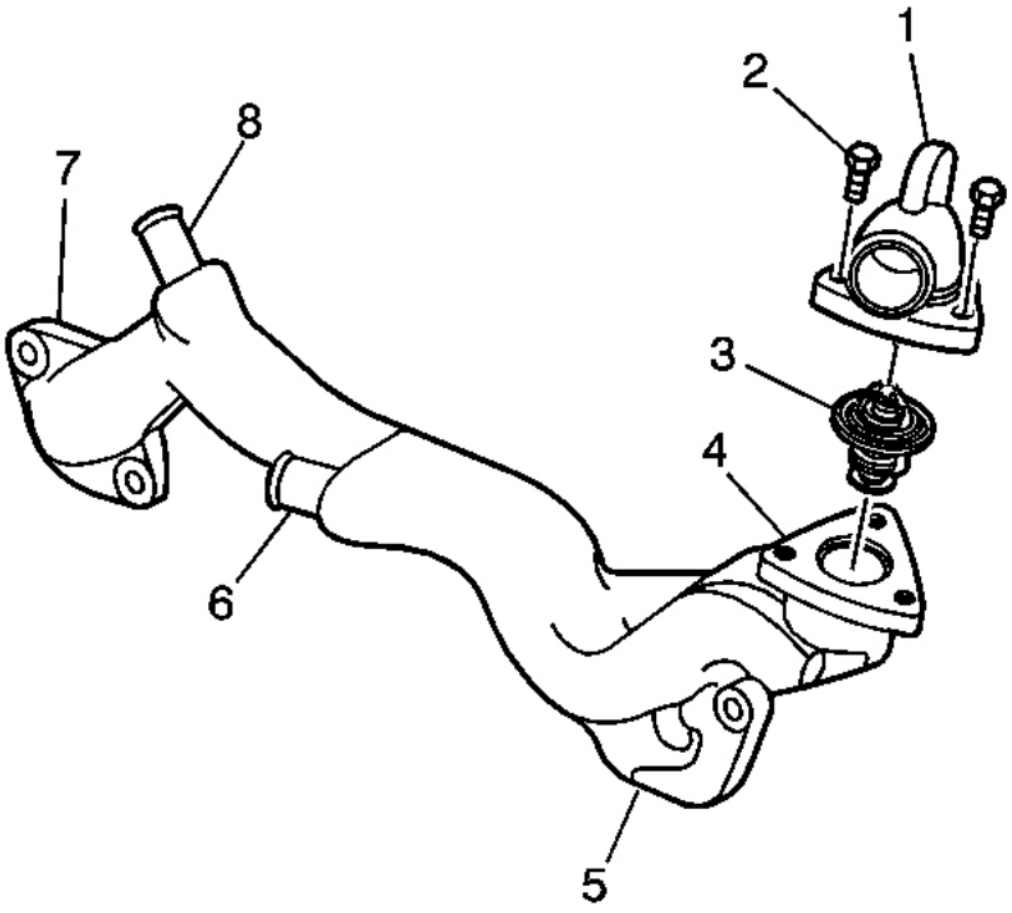


Fig. 126: View Of Water Outlet, Bolts & Thermostat
Courtesy of GENERAL MOTORS CORP.

4. Remove the water outlet bolts (2).
5. Remove the water outlet (1).
6. Remove the thermostat (3).

Installation Procedure

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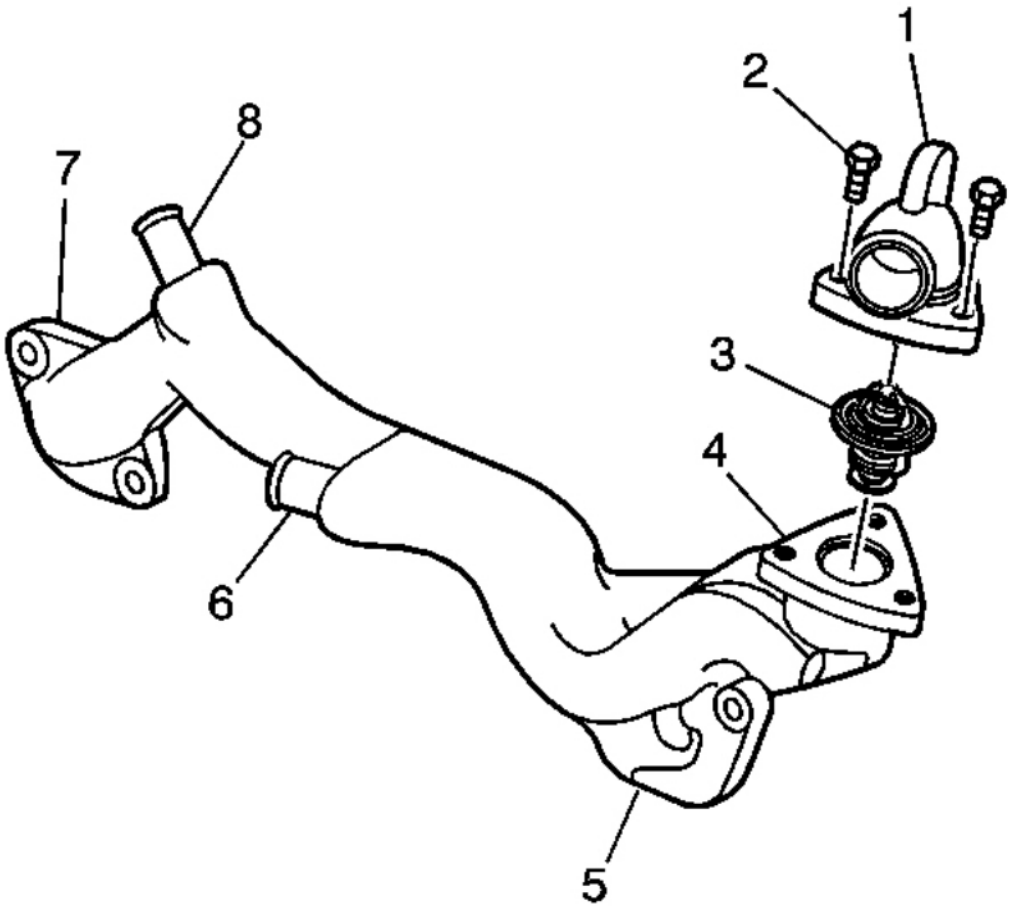


Fig. 127: View Of Water Outlet, Bolts & Thermostat
Courtesy of GENERAL MOTORS CORP.

1. Install the thermostat (3).
2. Install the water outlet (1).

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

3. Install the water outlet bolts (2).

Tighten: Tighten the bolts to 30 N.m (22 lb ft).

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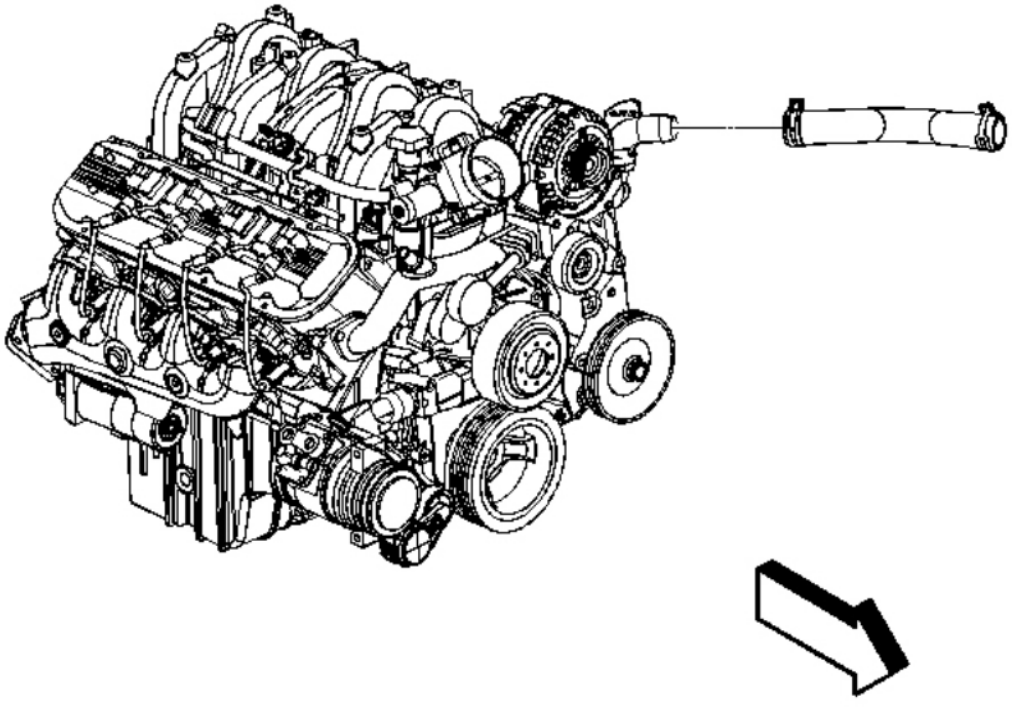


Fig. 128: View Of Inlet Hose Clamp & Water Crossover
Courtesy of GENERAL MOTORS CORP.

4. Install the inlet hose to the water outlet.
5. Position the inlet hose clamp at the water outlet.
6. Fill the cooling system. Refer to **Draining and Filling Cooling System**.

COOLANT CROSSOVER PIPE REPLACEMENT (8.1L ENGINE)

Removal Procedure

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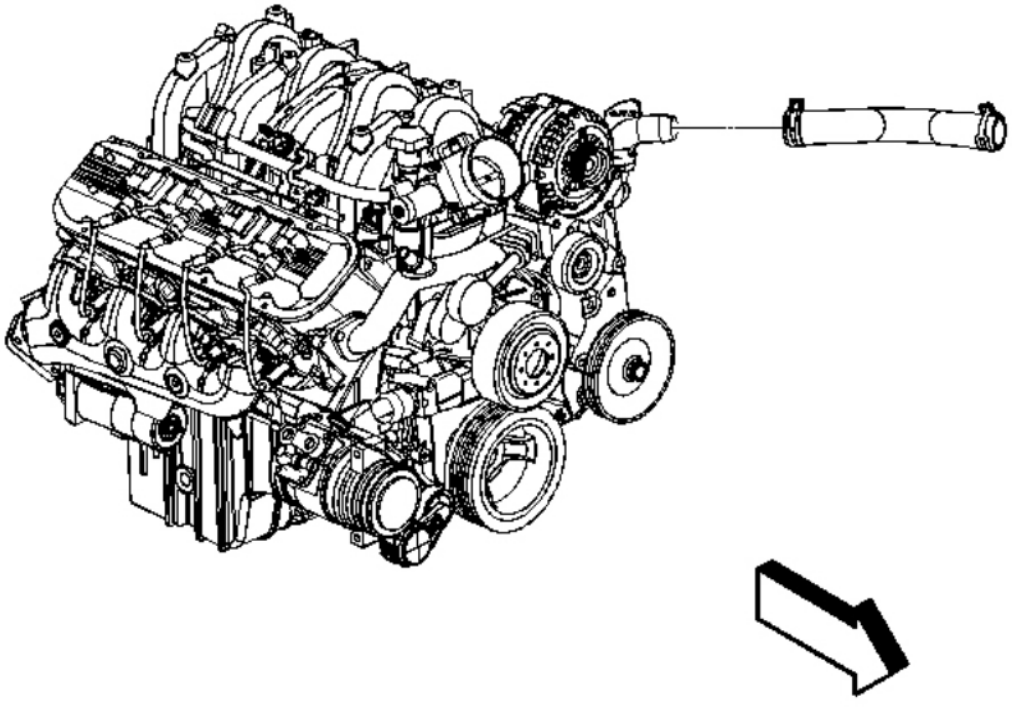


Fig. 129: View Of Inlet Hose Clamp & Water Crossover
Courtesy of GENERAL MOTORS CORP.

1. Drain the cooling system. Refer to **Draining and Filling Cooling System**.
2. Remove the drive belt tensioner. Refer to **Drive Belt Tensioner Replacement - Accessory** in Engine Mechanical - 8.1 L.
3. Position the inlet hose clamp at the water crossover.
4. Remove the inlet hose from the water crossover.

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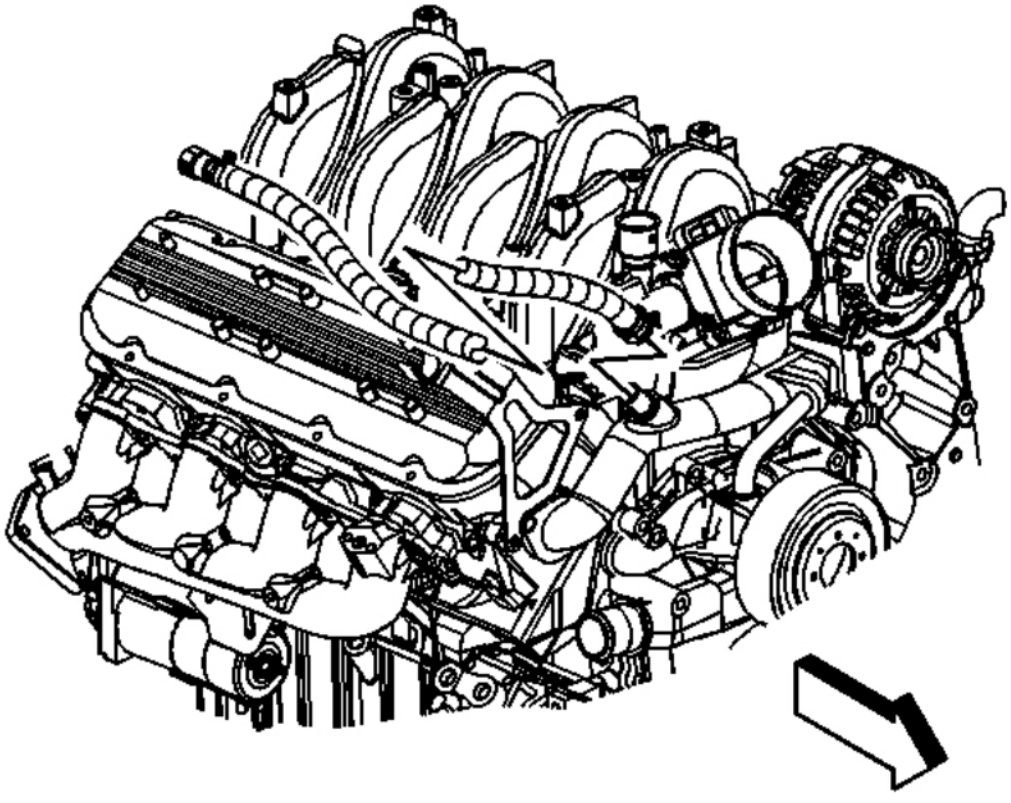


Fig. 130: View Of Heater Inlet Hose At Water Crossover (8.1L)
Courtesy of GENERAL MOTORS CORP.

5. Position the heater inlet hose clamp at the water crossover.
6. Remove the heater inlet hose from the water crossover.

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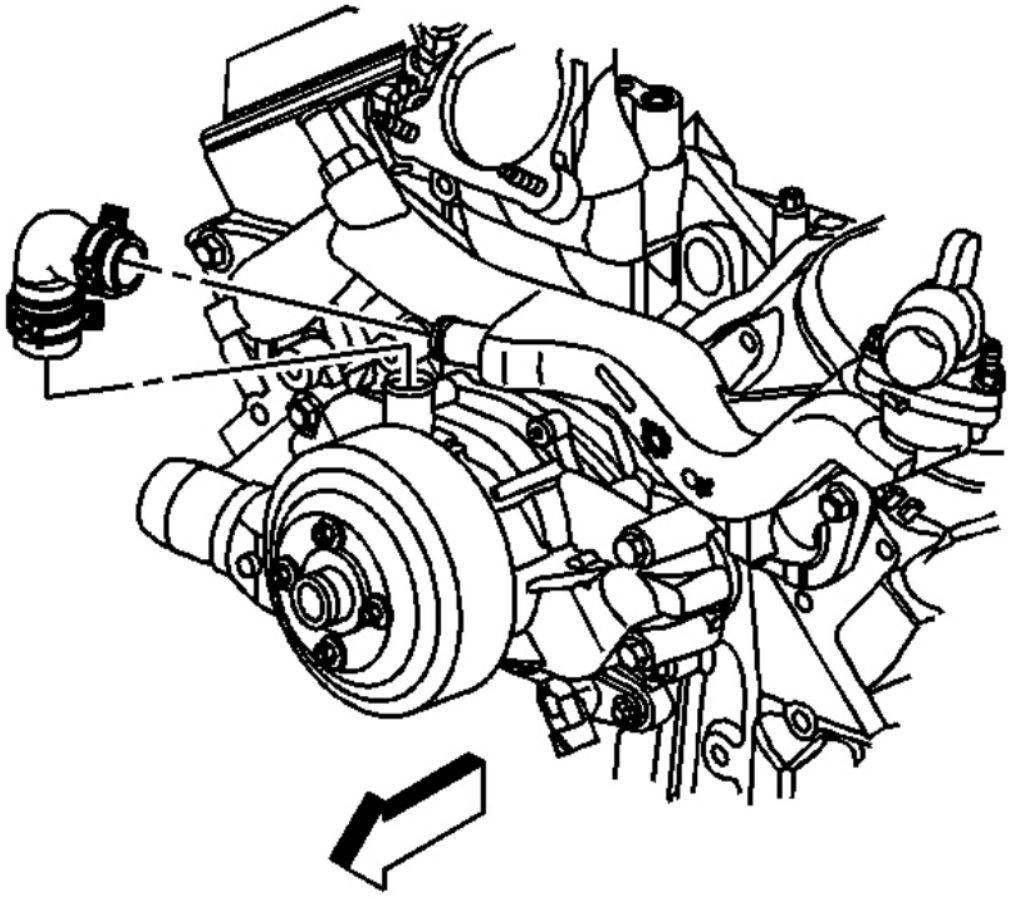


Fig. 131: View Of Bypass Hose (8.1L)
Courtesy of GENERAL MOTORS CORP.

7. Position the bypass hose clamps at the water crossover and water pump.
8. Remove the bypass hose.

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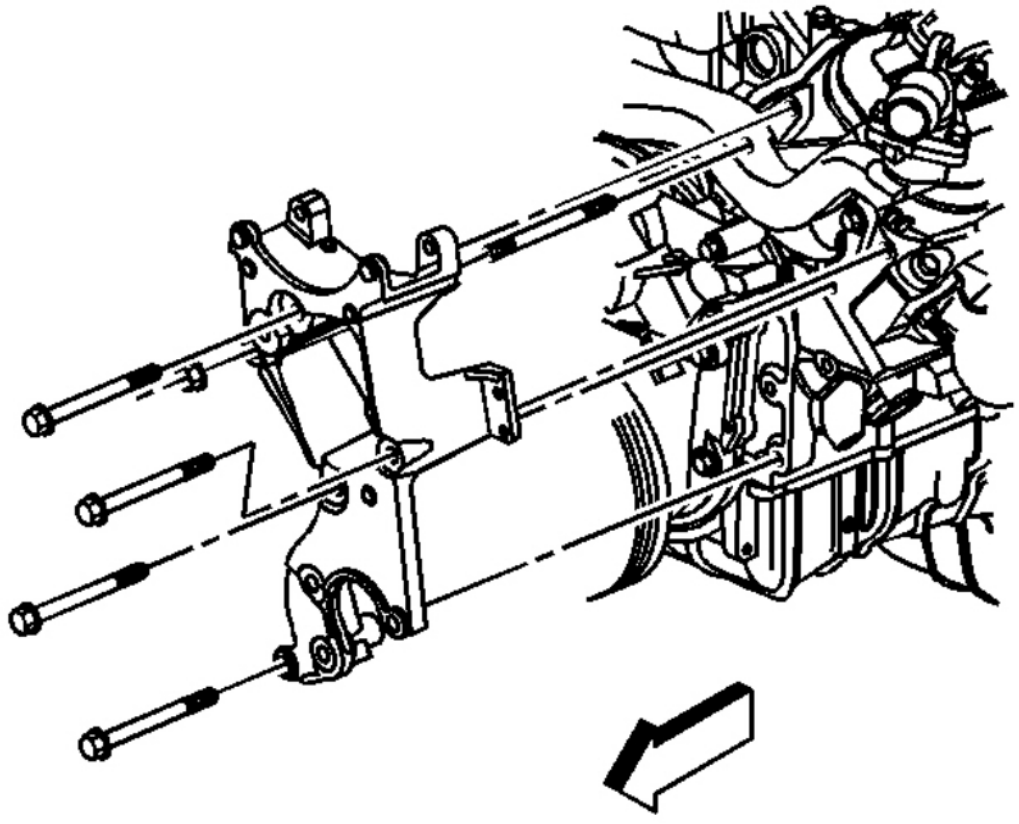


Fig. 132: View Of Generator Bracket, Bolts, Nut & Stud
Courtesy of GENERAL MOTORS CORP.

9. Remove the generator. Refer to **Generator Replacement (4.8L, 5.3L, and 6.0L Engines)** or **Generator Replacement (8.1L Engine)** in Engine Electrical.
10. Remove the power steering pump. Refer to **Power Steering Pump Replacement (4.8L, 5.3L and 6.0L)** or **Power Steering Pump Replacement (8.1L)** in Power Steering System.
11. Remove the generator bracket bolts and nut.
12. Remove the generator bracket stud.
13. Remove the generator bracket.

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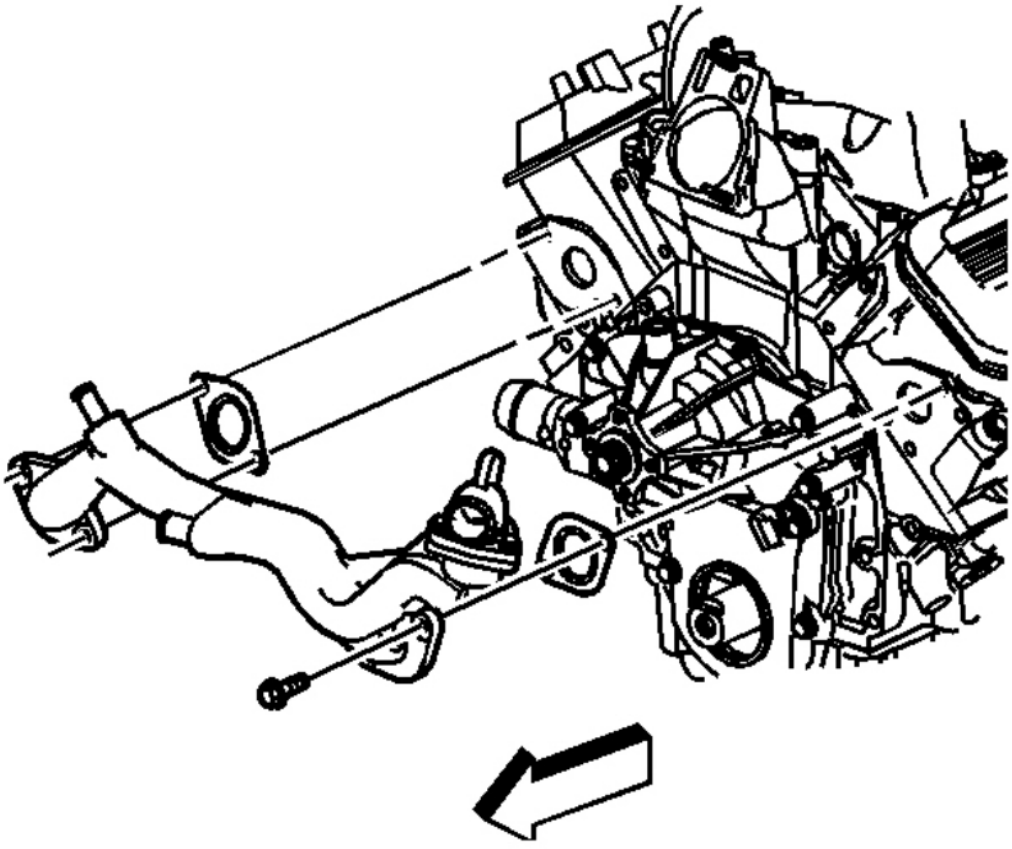


Fig. 133: View Of Engine Coolant Crossover & Gasket
Courtesy of GENERAL MOTORS CORP.

14. Remove the water crossover bolts.
15. Remove the water crossover.
16. Remove and discard the water crossover gaskets.

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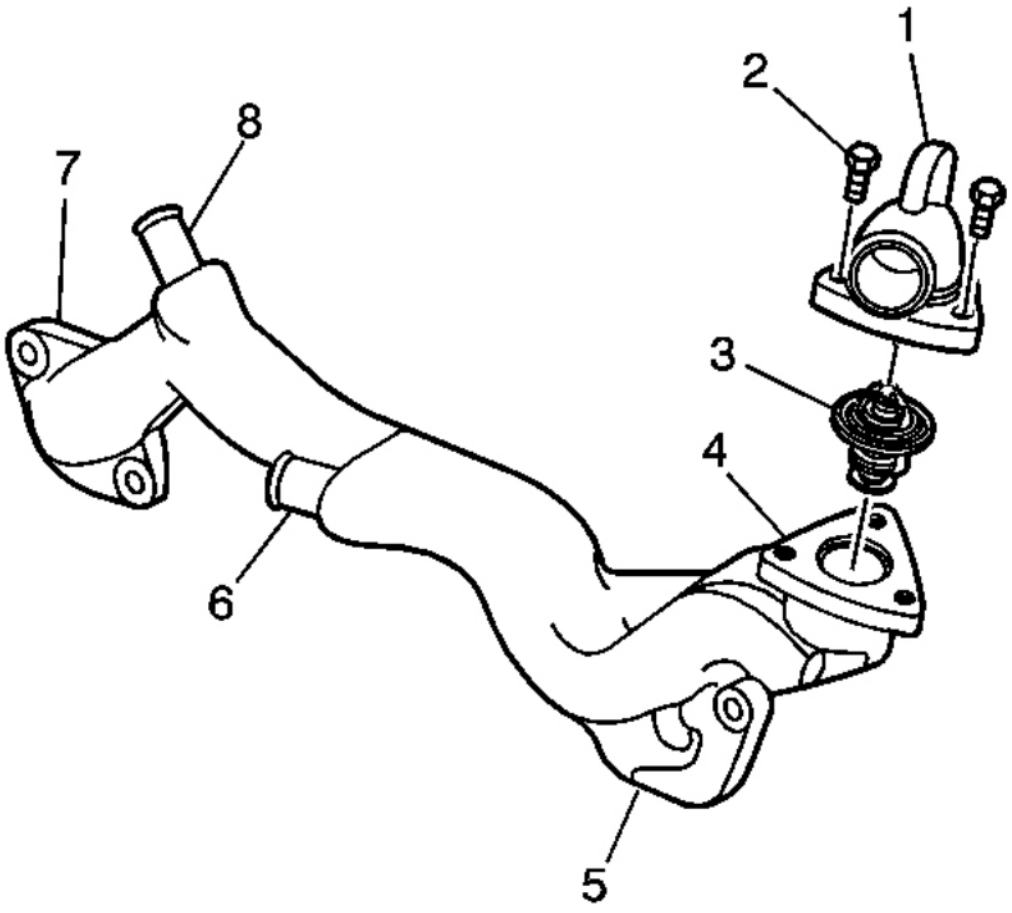


Fig. 134: View Of Water Outlet, Bolts & Thermostat
Courtesy of GENERAL MOTORS CORP.

17. If replacing the water crossover remove the following:
    1. Water outlet bolts (2)
    2. Water outlet (1)
    3. Thermostat (3)

Installation Procedure

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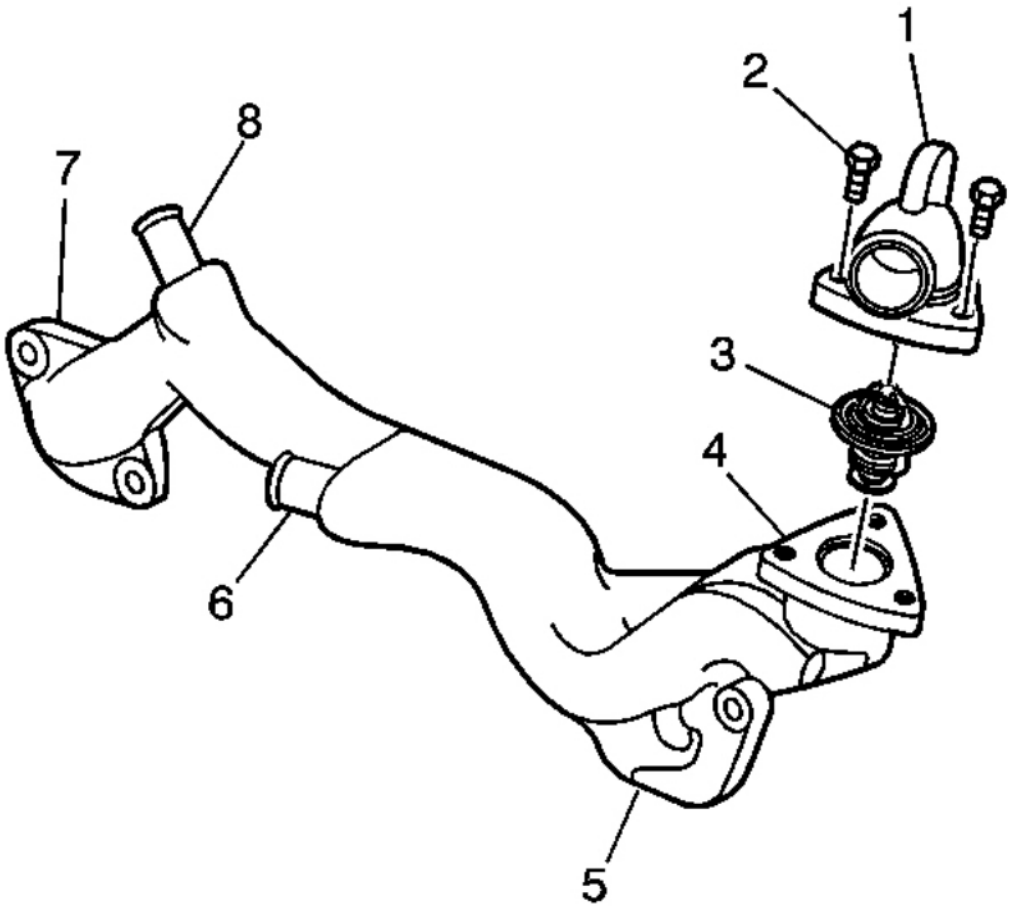


Fig. 135: View Of Water Outlet, Bolts & Thermostat
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice in Cautions and Notices.

1. If replacing the water crossover install the following:
    1. Thermostat (3)
    2. Water outlet (1)
    3. Water outlet bolts (2)

    Tighten: Tighten the bolts to 30 N.m (22 lb ft).

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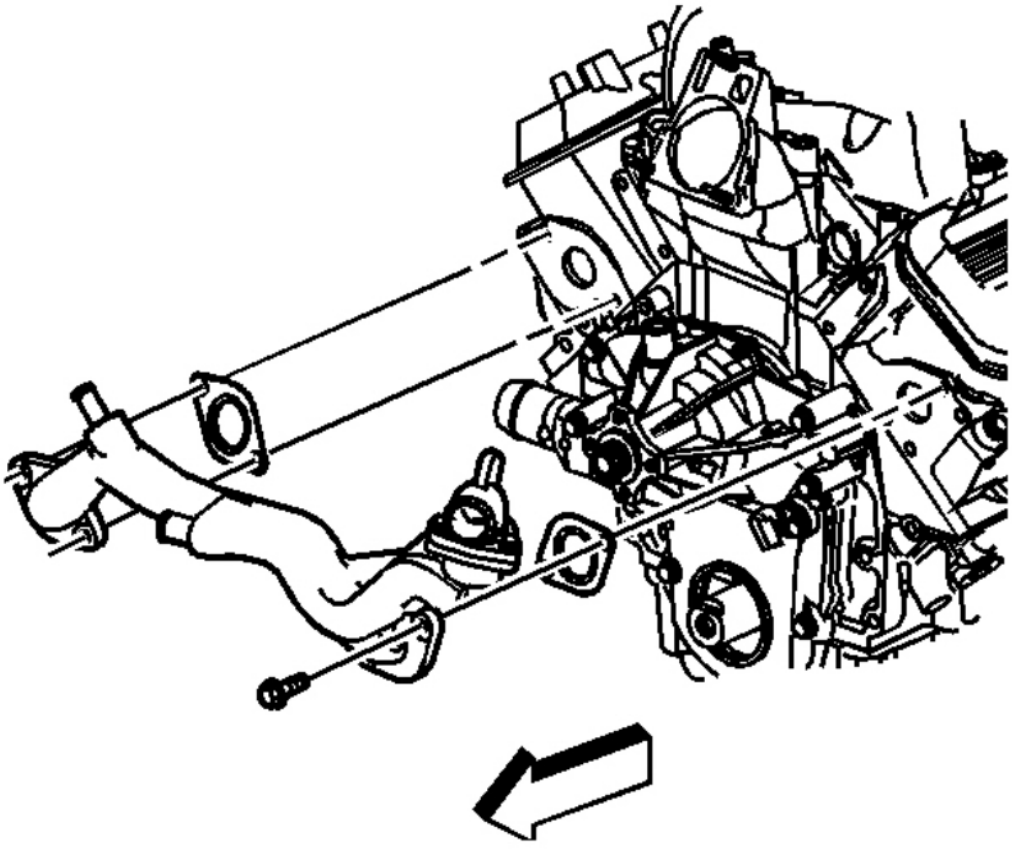


Fig. 136: View Of Engine Coolant Crossover & Gasket
Courtesy of GENERAL MOTORS CORP.

2. Install NEW water crossover gaskets.
3. Install the water crossover.
4. Install the water crossover bolts.

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

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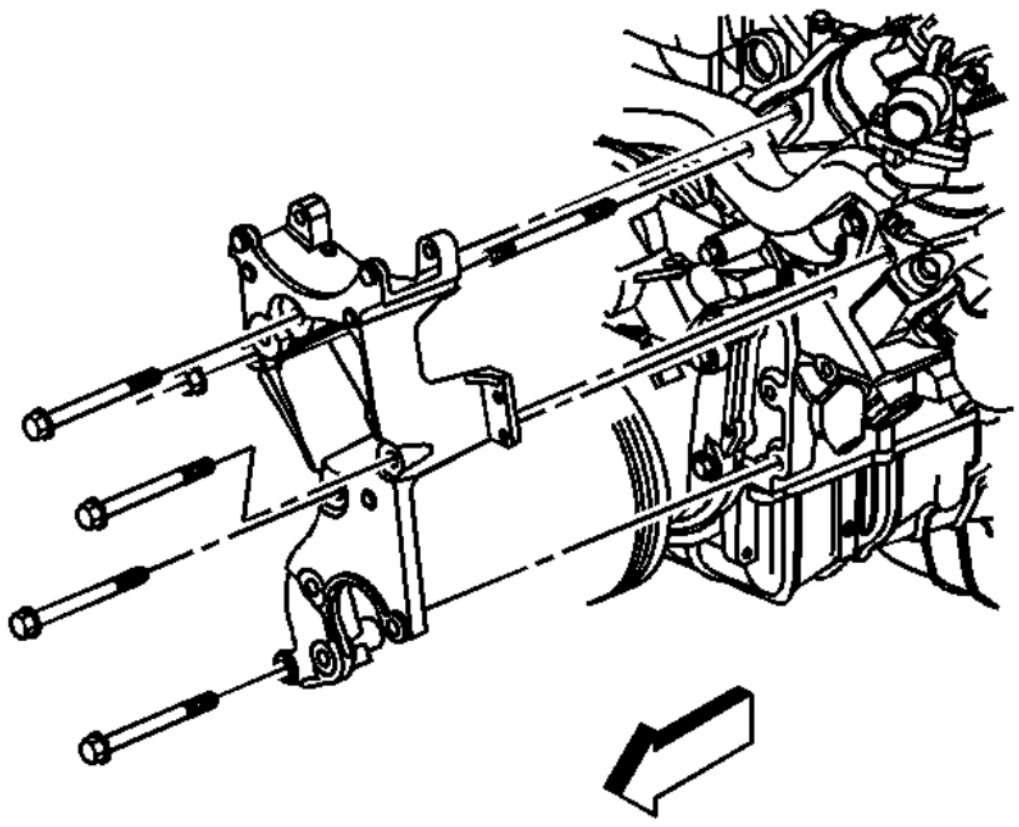


Fig. 137: View Of Generator Bracket, Bolts, Nut & Stud
Courtesy of GENERAL MOTORS CORP.

5. Install the generator bracket.
6. Install the generator bracket stud.

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

7. Install the generator bracket bolts and nut.

   Tighten: Tighten the bolts and nut to 50 N.m (37 lb ft).

8. Install the power steering pump. Refer to **Power Steering Pump Replacement (4.8L, 5.3L and 6.0L)** or **Power Steering Pump Replacement (8.1L)** in Power Steering System.
9. Install the generator. Refer to **Generator Replacement (4.8L, 5.3L, and 6.0L Engines)** or **Generator Replacement (8.1L Engine)** in Engine Electrical.

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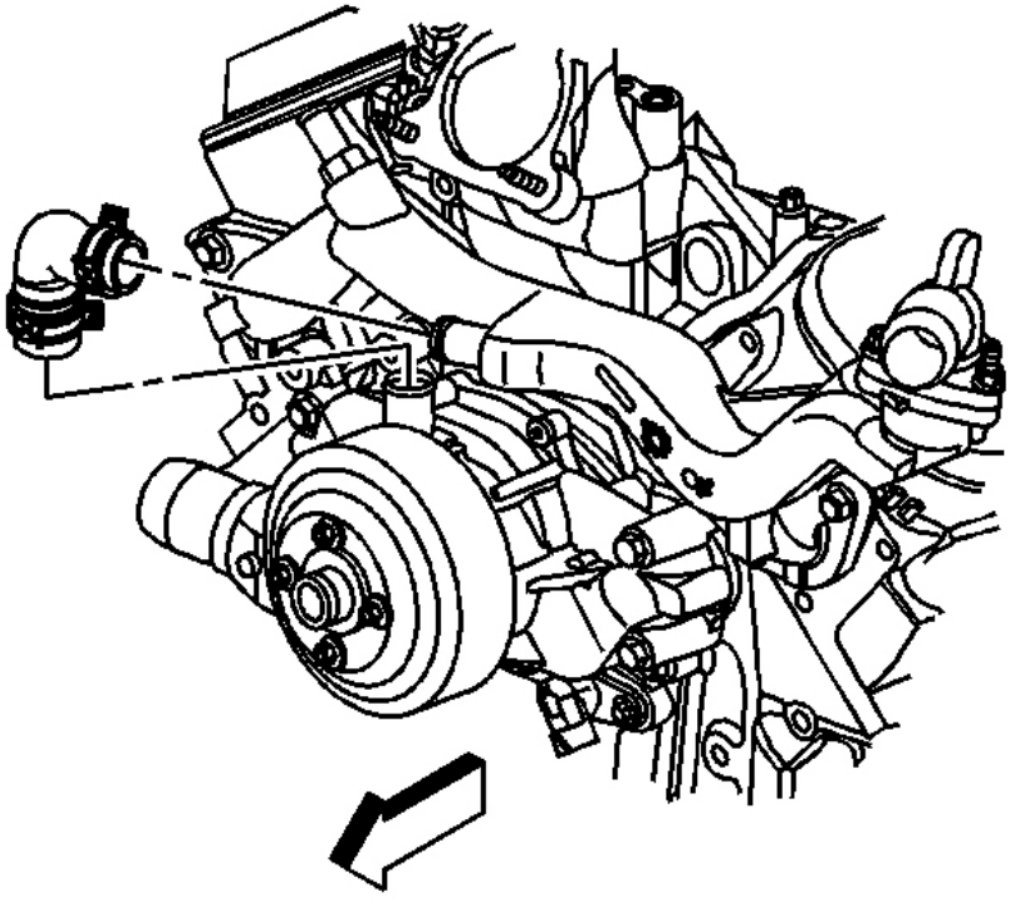


Fig. 138: View Of Bypass Hose (8.1L)
Courtesy of GENERAL MOTORS CORP.

10. Install the bypass hose.
11. Position the bypass hose clamps at the water crossover and water pump.

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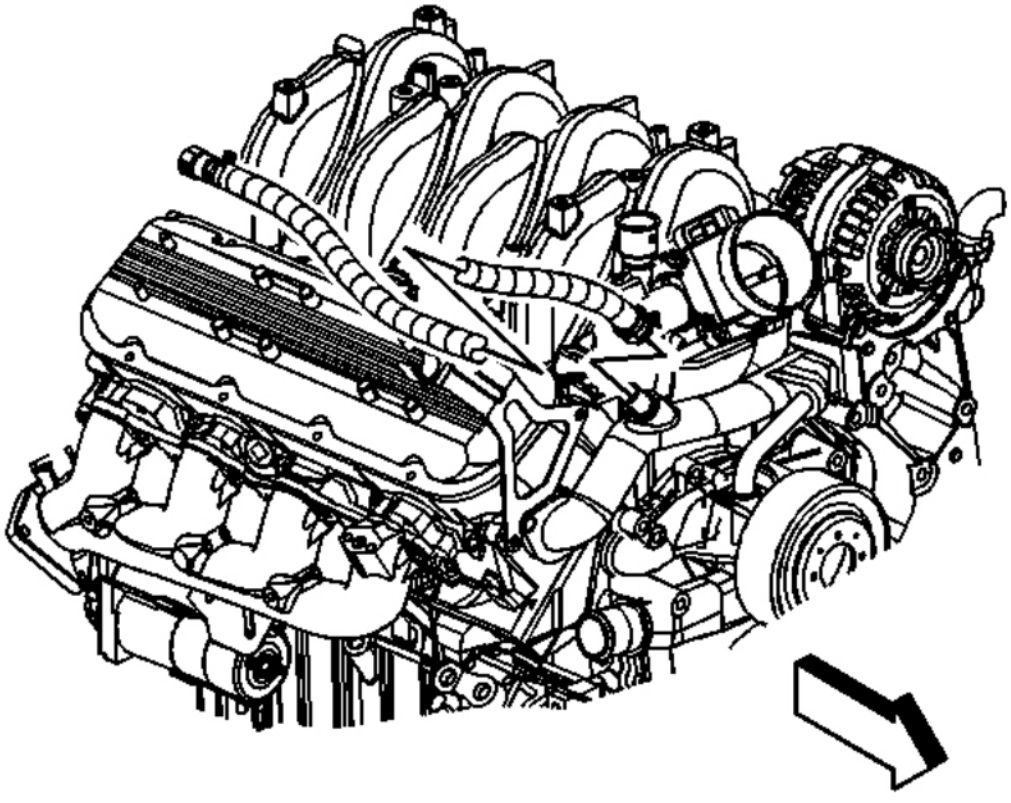


Fig. 139: View Of Heater Inlet Hose At Water Crossover (8.1L)
Courtesy of GENERAL MOTORS CORP.

12. Install the heater inlet hose to the water crossover.
13. Position the heater inlet hose clamp at the water crossover.

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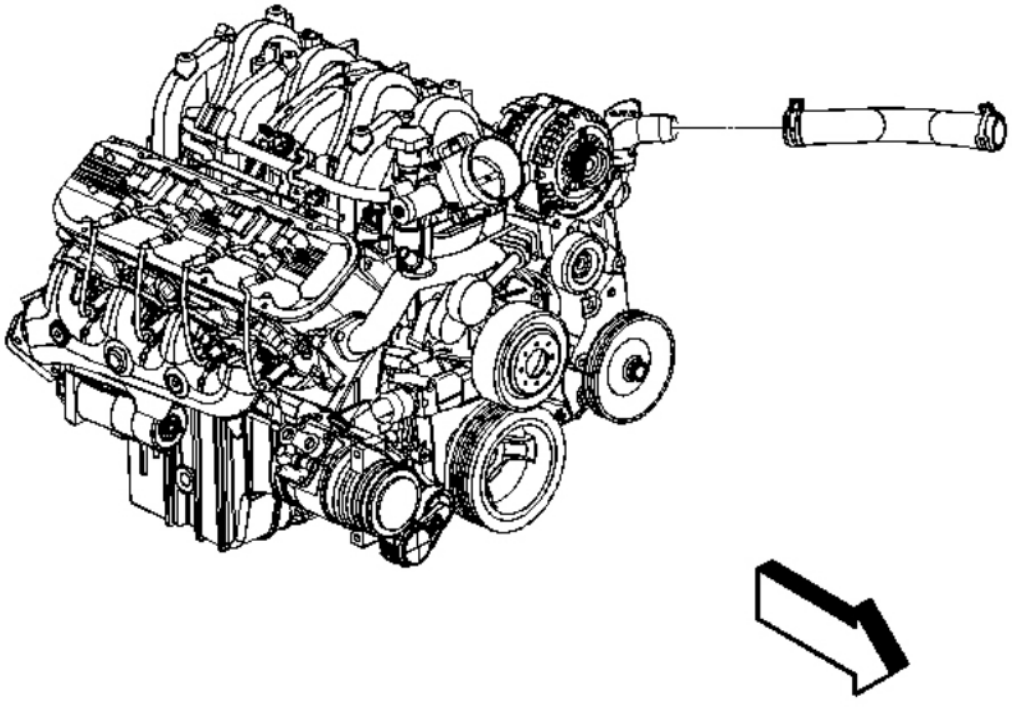


Fig. 140: View Of Inlet Hose Clamp & Water Crossover
Courtesy of GENERAL MOTORS CORP.

14. Install the inlet hose to the water crossover.
15. Position the inlet hose clamp at the water crossover.
16. Install the drive belt tensioner. Refer to **Drive Belt Tensioner Replacement - Accessory** in Engine Mechanical - 8.1 L.
17. Fill the cooling system. Refer to **Draining and Filling Cooling System**.

COOLANT AIR BLEED PIPE ASSEMBLY REPLACEMENT (4.8L, 5.3L, AND 6.0L ENGINES)

Removal Procedure

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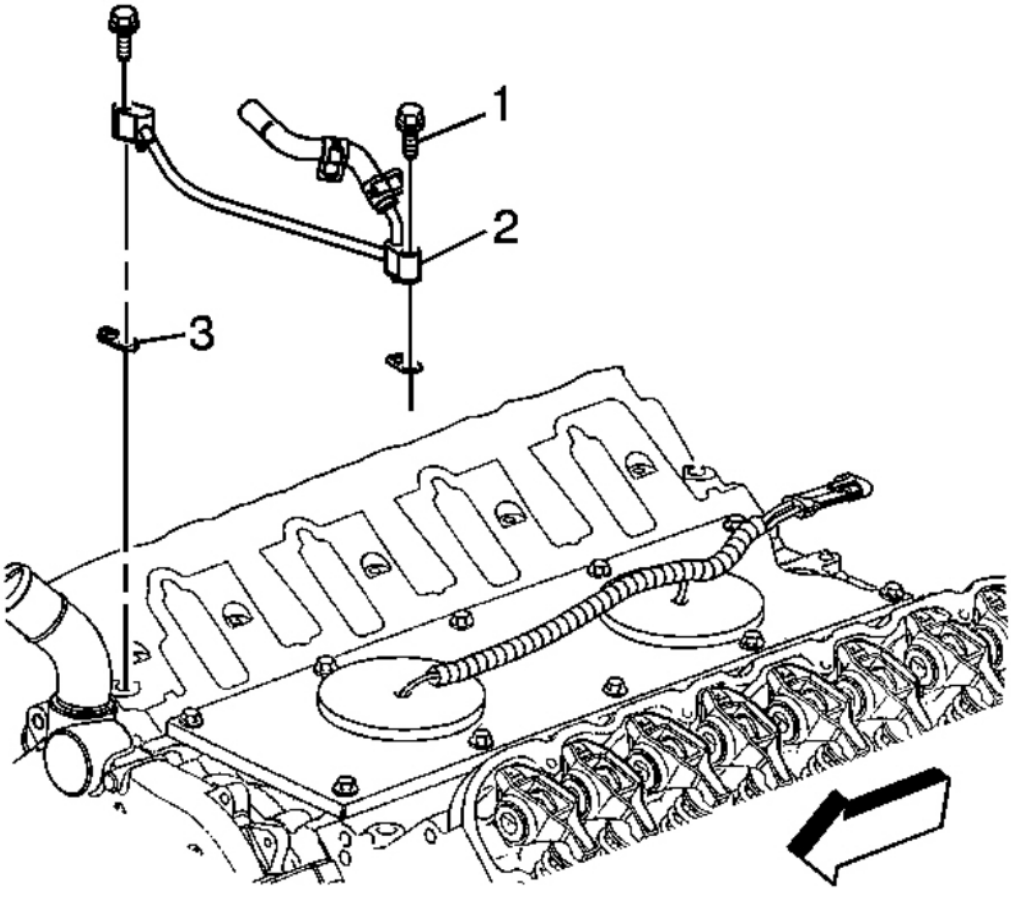


Fig. 141: Identifying Coolant Air Bleed Pipe And Bolts
Courtesy of GENERAL MOTORS CORP.

1. Drain the cooling system. Refer to **Draining and Filling Cooling System**.
2. Remove the coolant air bleed pipe studs (1).
3. Remove the coolant air bleed pipe (2) with gaskets (3).

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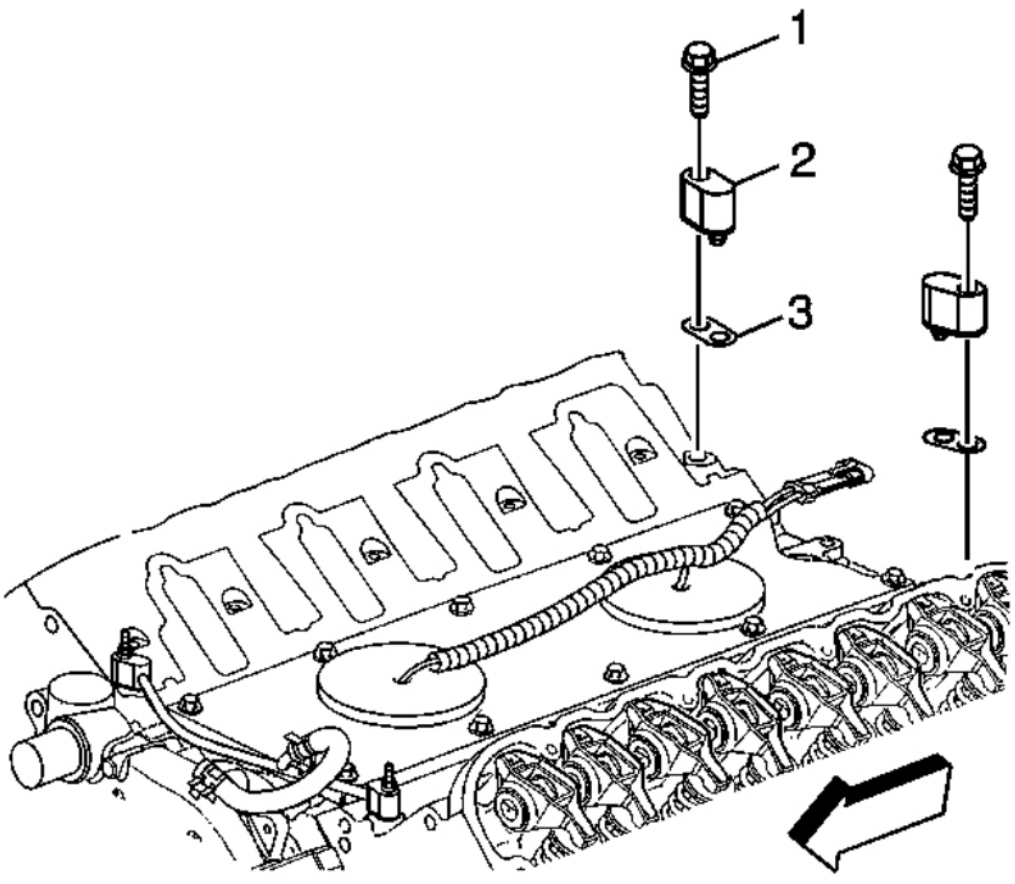


Fig. 142: View Of Coolant Air Bleed Pipe Covers & Bolts (4.8L, 5.3L & 6.0L)
Courtesy of GENERAL MOTORS CORP.

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

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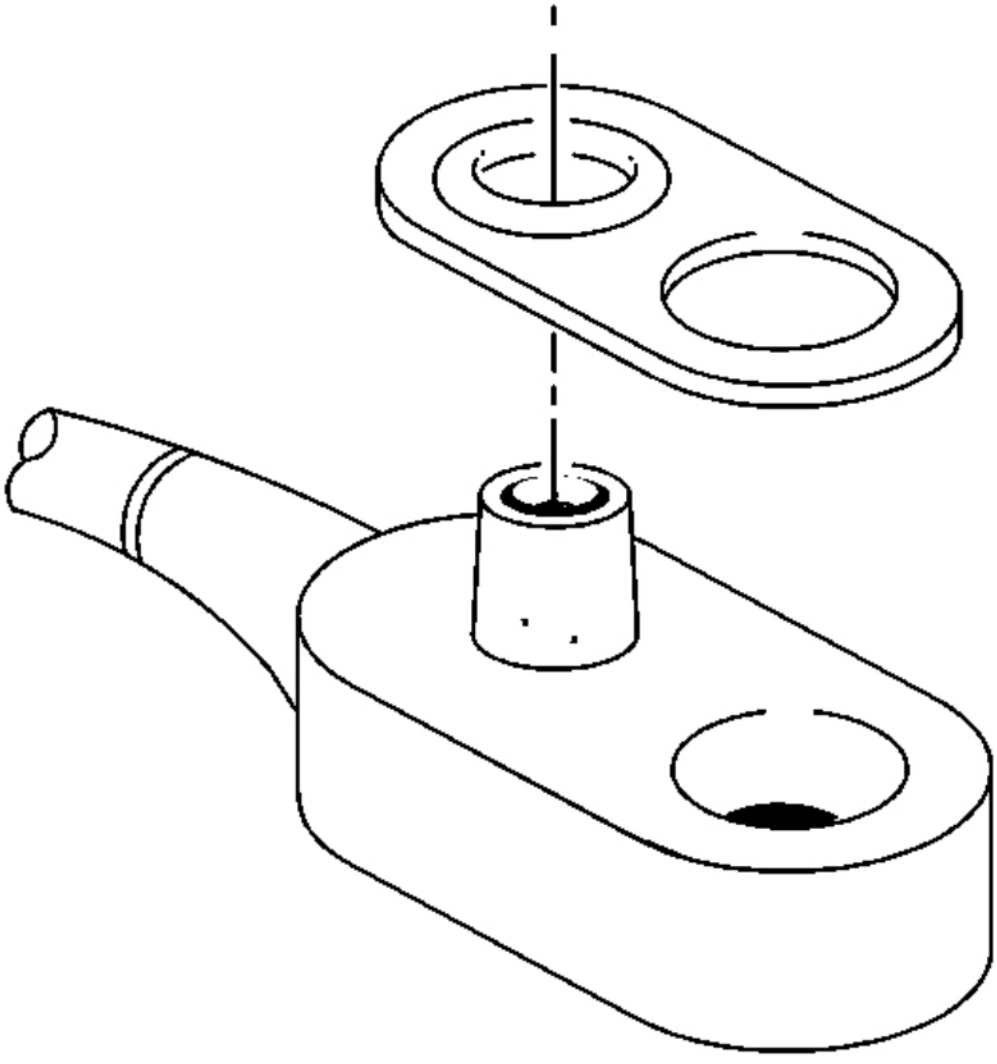


Fig. 143: View Of Air Bleed Pipe Sealing Gasket
Courtesy of GENERAL MOTORS CORP.

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

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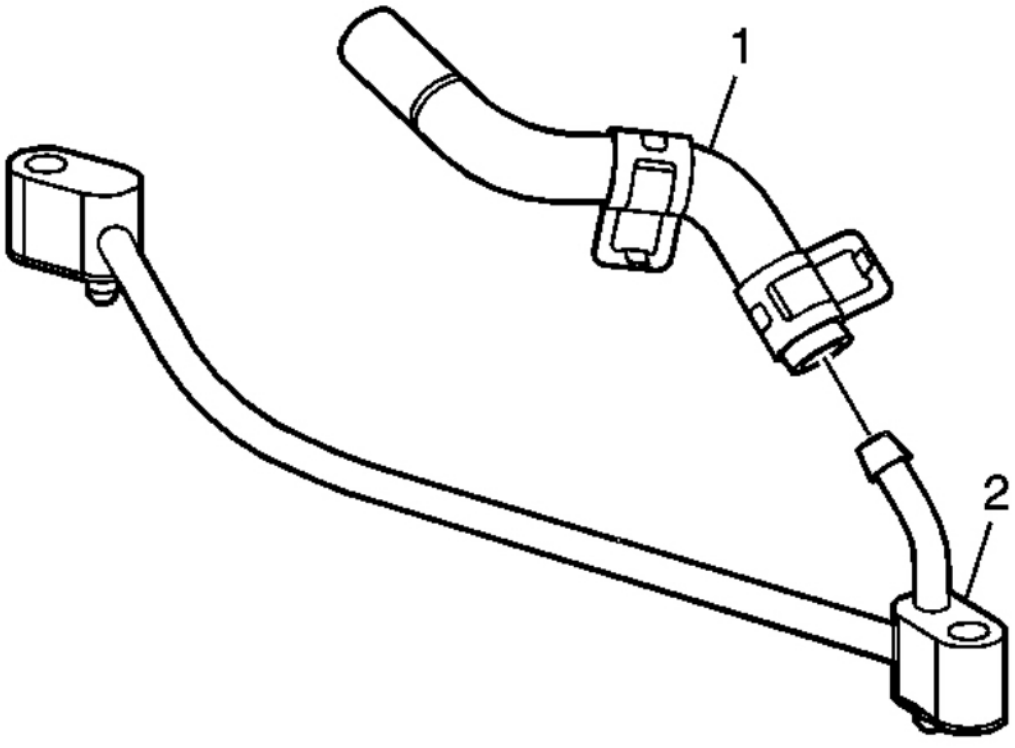


Fig. 144: Coolant Air Bleed Hose & Pipe
Courtesy of GENERAL MOTORS CORP.

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

Installation Procedure

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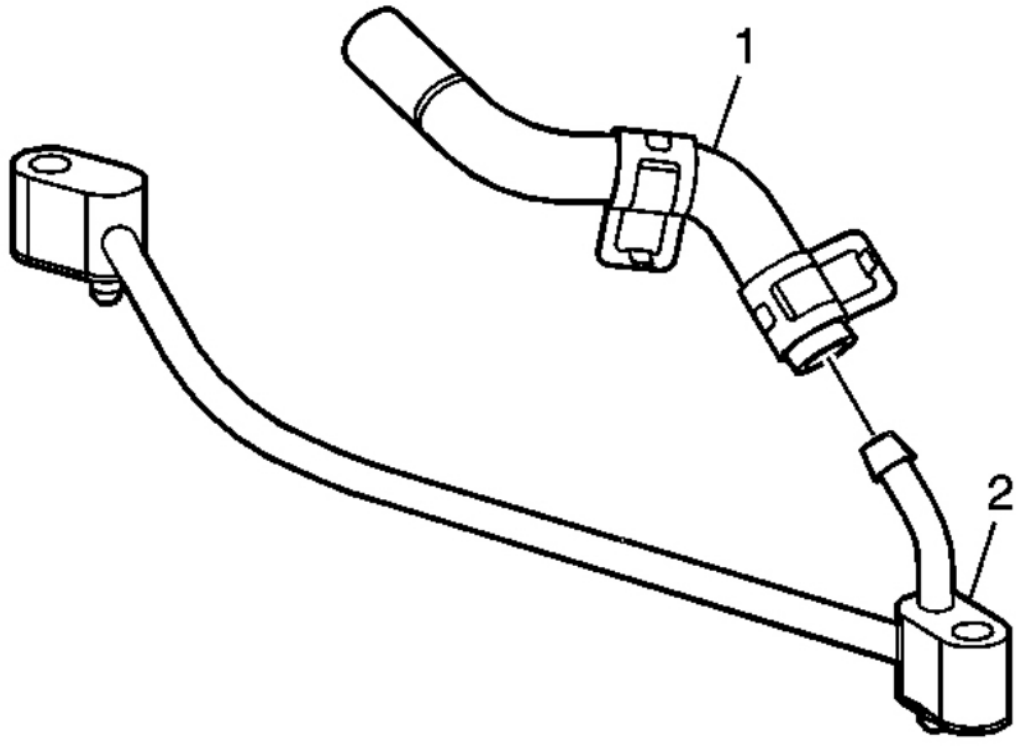


Fig. 145: Coolant Air Bleed Hose & Pipe
Courtesy of GENERAL MOTORS CORP.

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

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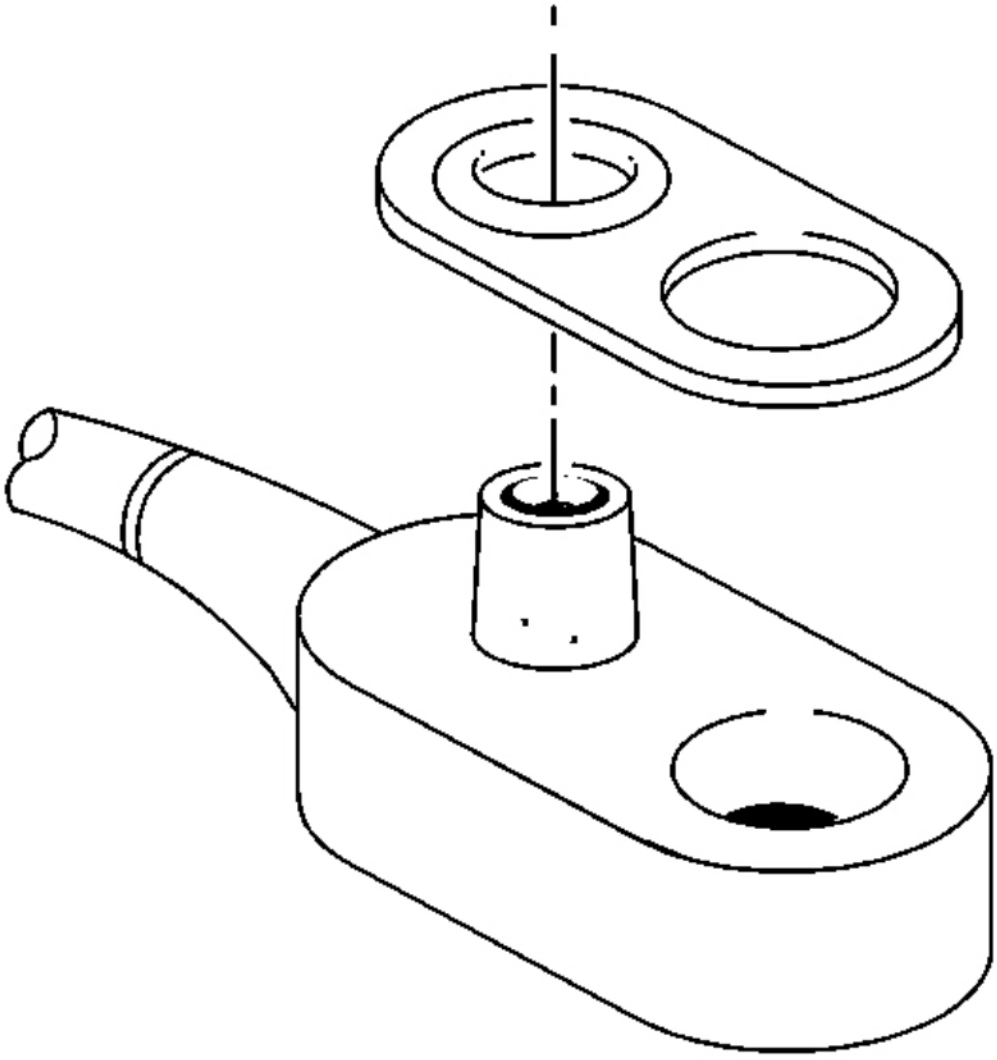


Fig. 146: View Of Air Bleed Pipe Sealing Gasket
Courtesy of GENERAL MOTORS CORP.

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

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

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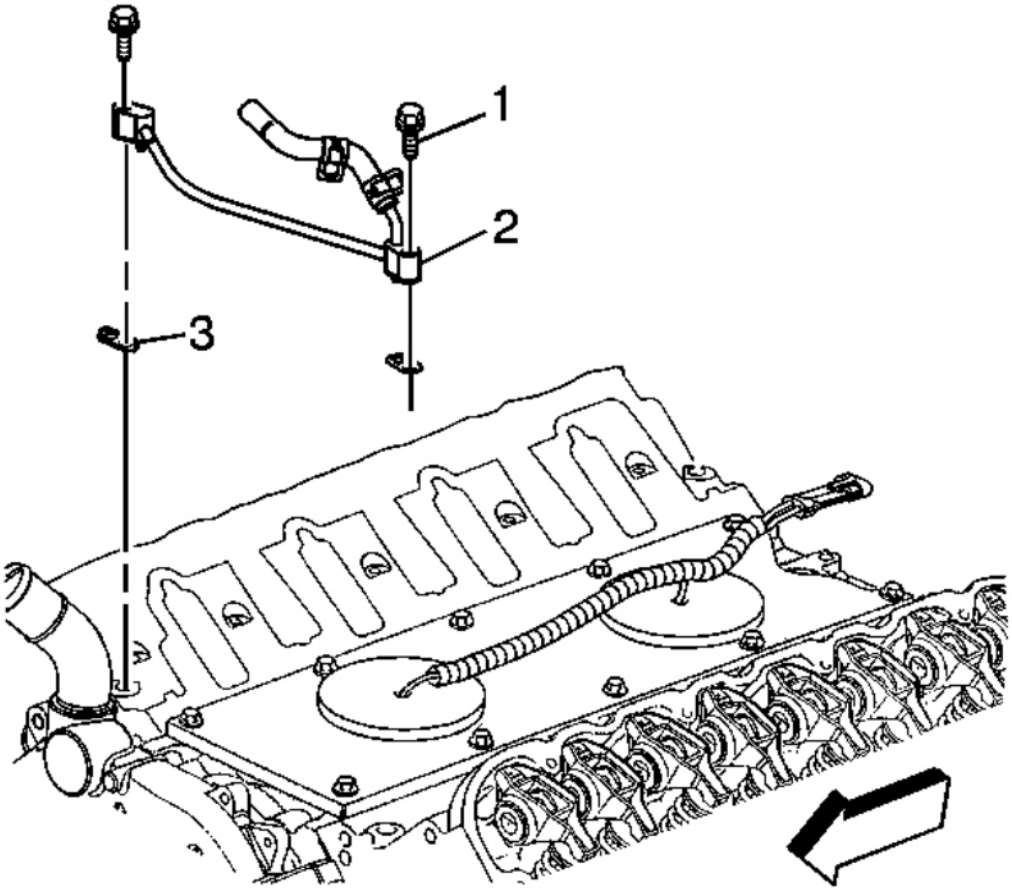


Fig. 147: Identifying Coolant Air Bleed Pipe And Bolts
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice in Cautions and Notices.

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

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

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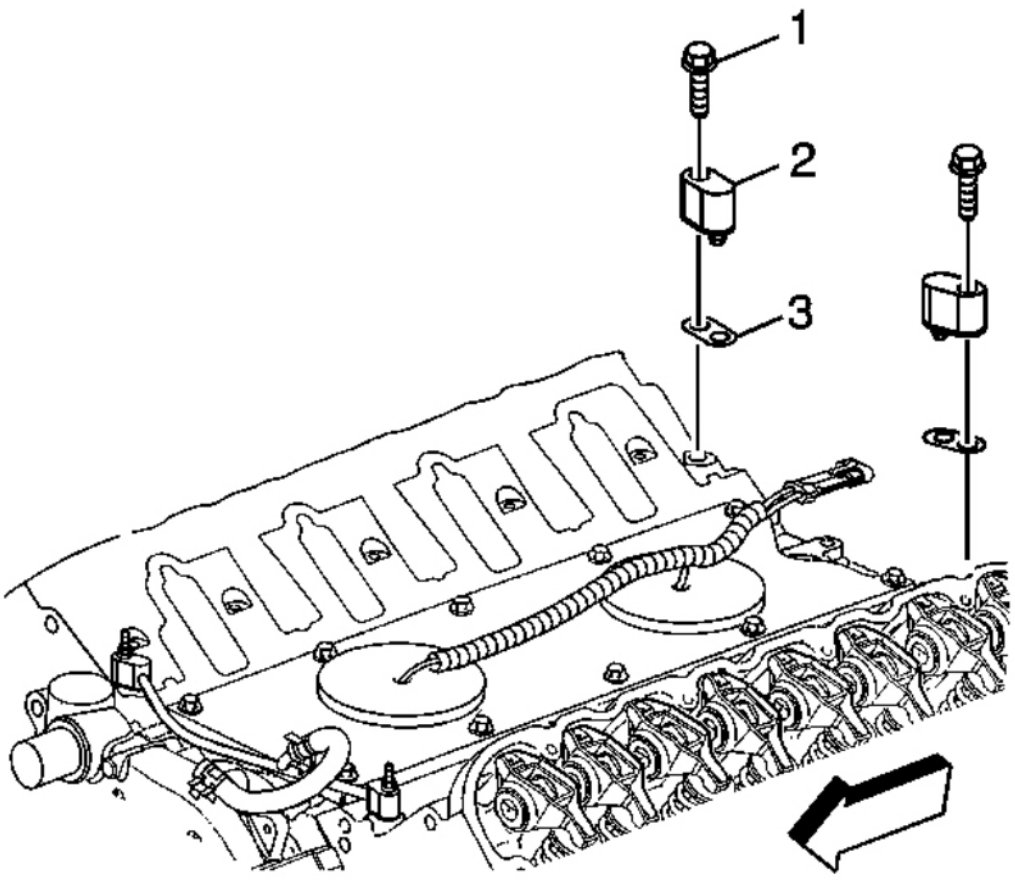


Fig. 148: View Of Coolant Air Bleed Pipe Covers & Bolts (4.8L, 5.3L & 6.0L)
Courtesy of GENERAL MOTORS CORP.

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

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

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

COOLANT AIR BLEED HOSE REPLACEMENT (4.8L, 5.3L, AND 6.0L ENGINES)

Removal Procedure

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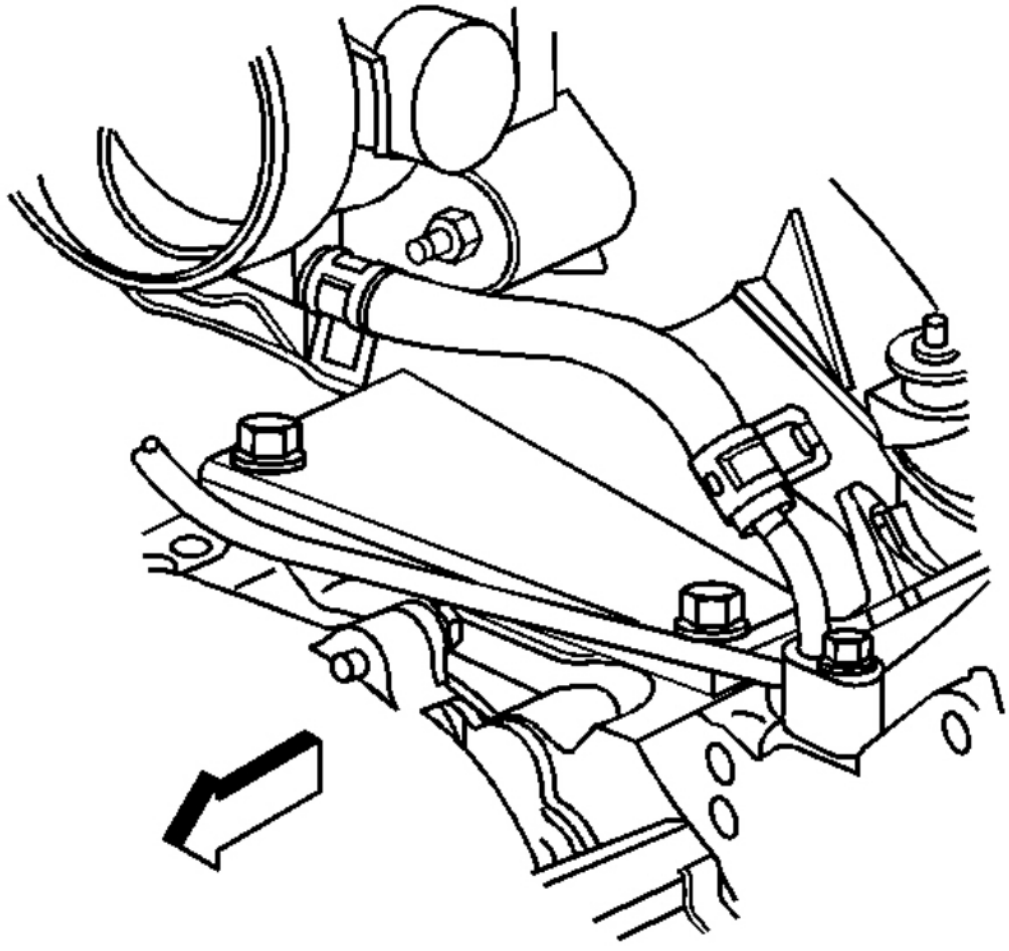


Fig. 149: View Of Coolant Air Bleed Hose At Throttle Body (4.8L, 5.3L & 6.0L)
Courtesy of GENERAL MOTORS CORP.

1. If necessary, remove the engine sight shield. Refer to **Engine Sight Shield Replacement (4.8L, 5.3L, and 6.0L (RPO LQ4))** or **Engine Sight Shield Replacement (6.0L (RPO LQ9))** in Engine Mechanical - 4.8L, 5.3L, and 6.0L.
2. Position the coolant air bleed hose clamp at the throttle body.
3. Remove the coolant air bleed hose from the throttle body.

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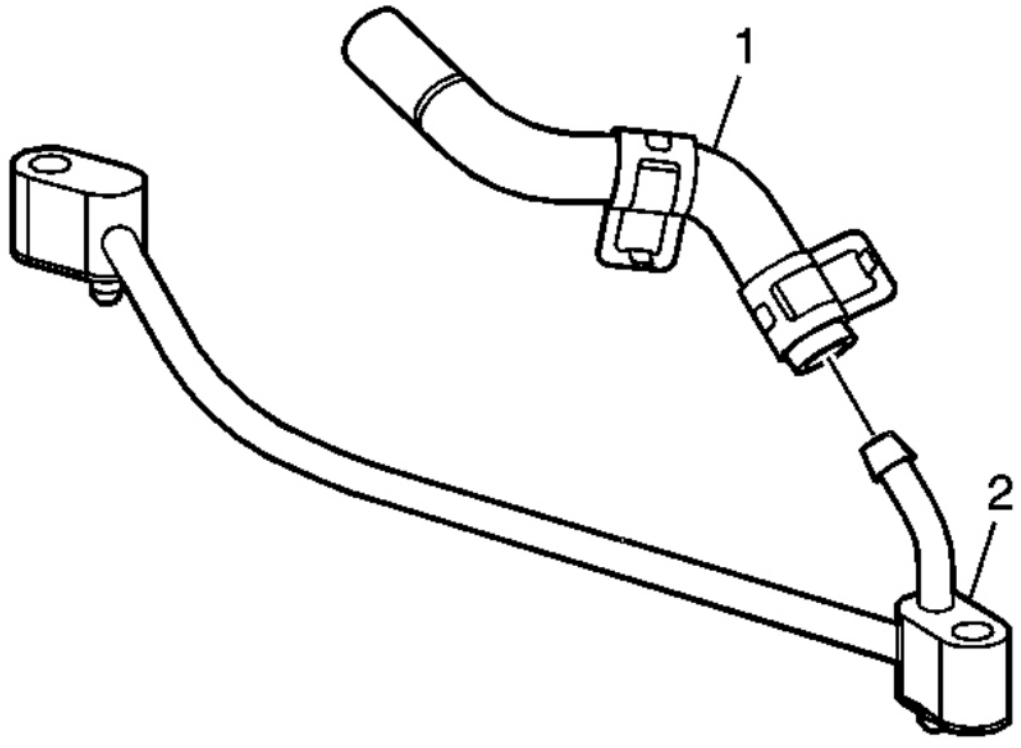


Fig. 150: Coolant Air Bleed Hose & Pipe
Courtesy of GENERAL MOTORS CORP.

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

Installation Procedure

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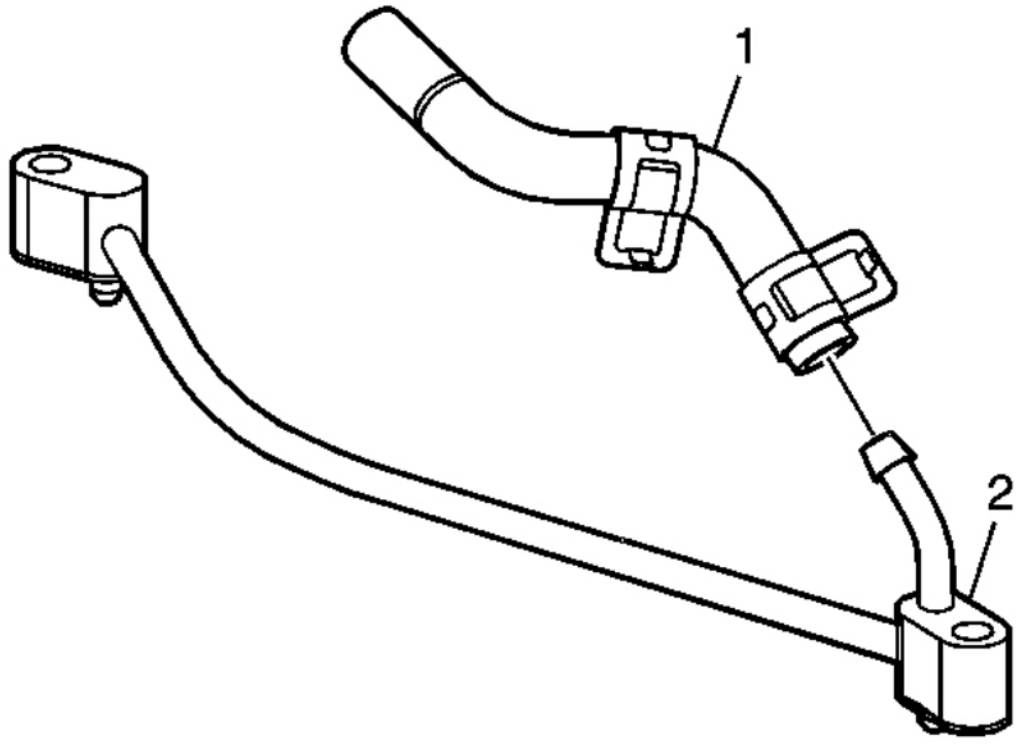


Fig. 151: Coolant Air Bleed Hose & Pipe
Courtesy of GENERAL MOTORS CORP.

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

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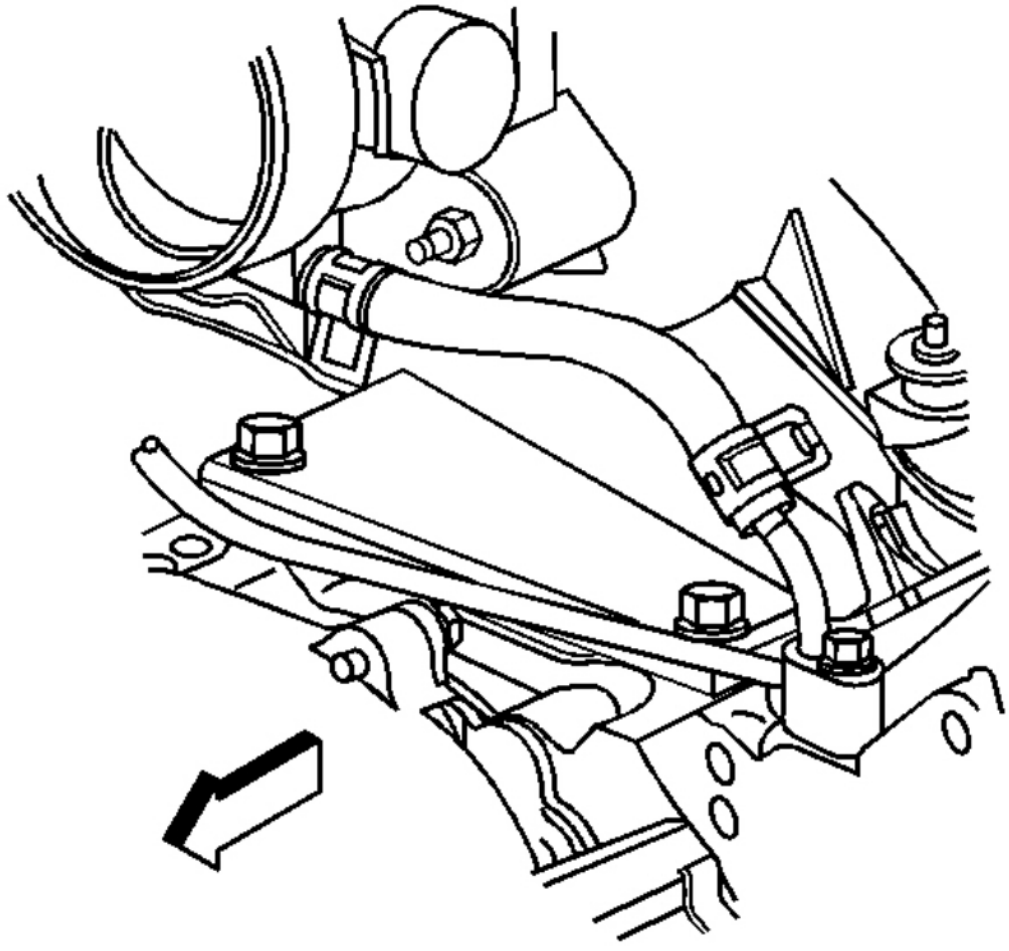


Fig. 152: View Of Coolant Air Bleed Hose At Throttle Body (4.8L, 5.3L & 6.0L)
Courtesy of GENERAL MOTORS CORP.

3. Install the coolant air bleed hose to the throttle body.
4. Position the coolant air bleed hose clamp at the throttle body.
5. If necessary, install the engine sight shield. Refer to **Engine Sight Shield Replacement (4.8L, 5.3L, and 6.0L (RPO LQ4))** or **Engine Sight Shield Replacement (6.0L (RPO LQ9))** in Engine Mechanical - 4.8L, 5.3L, and 6.0L.
6. Add engine coolant, if necessary.

WATER PUMP REPLACEMENT (4.8L, 5.3L, AND 6.0L ENGINES)

Removal Procedure

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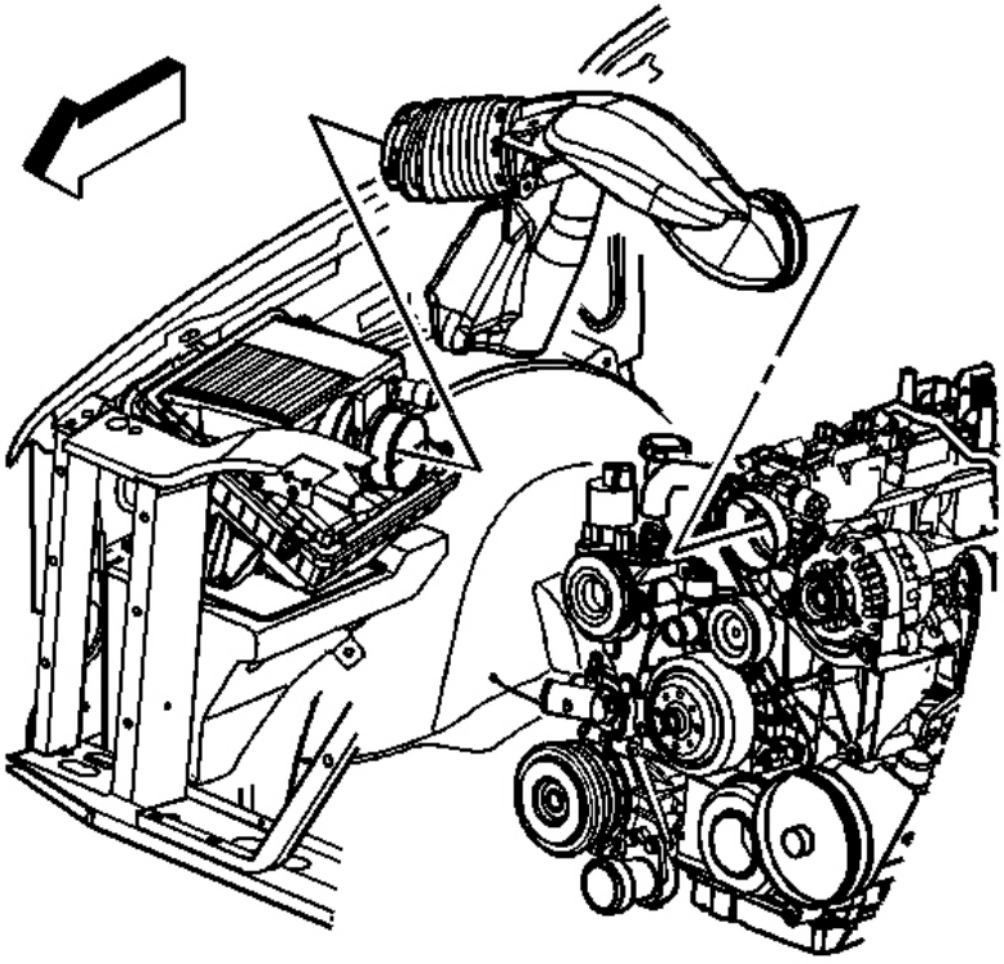


Fig. 153: View Of Air Cleaner Outlet Duct
Courtesy of GENERAL MOTORS CORP.

1. Drain the cooling system. Refer to **Draining and Filling Cooling System**.
2. Loosen the air cleaner outlet duct clamps at the following locations:
   - Throttle body
   - Mass airflow/intake air temperature (MAF/IAT) sensor
3. Remove the radiator inlet hose clip from the outlet duct.
4. Remove the air cleaner outlet duct.

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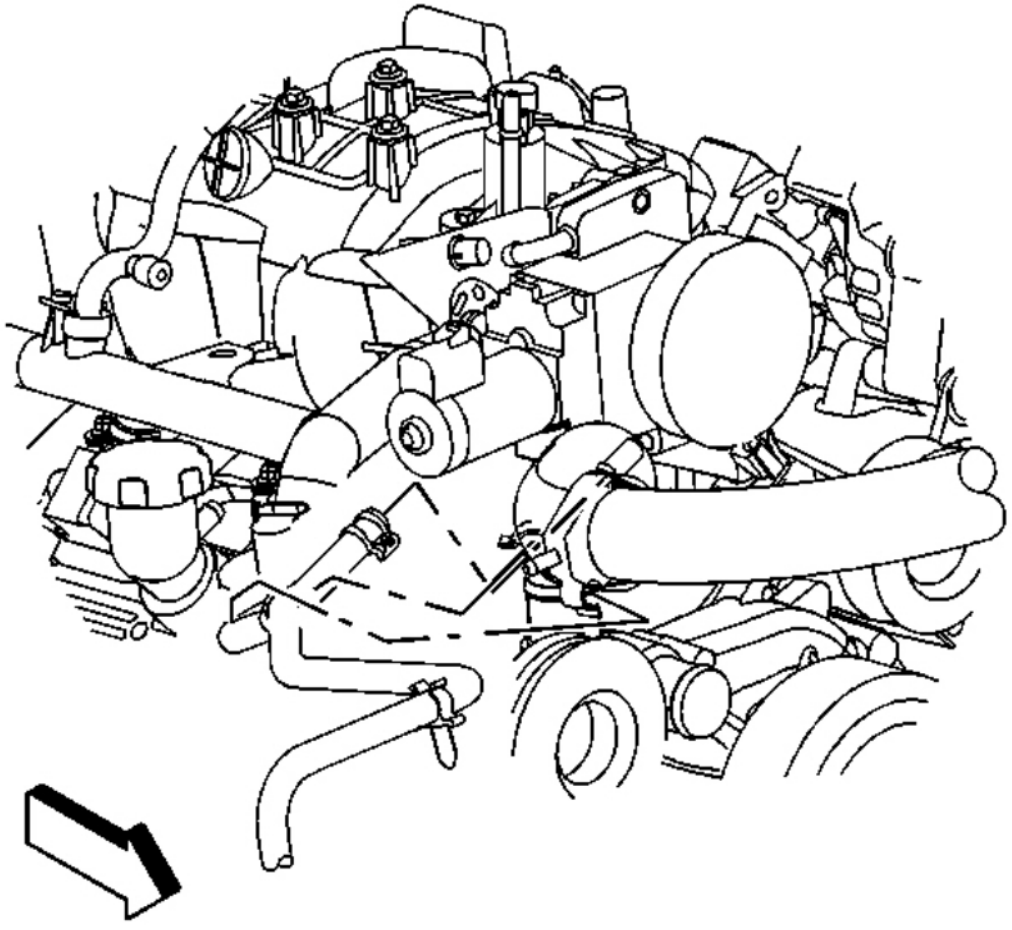


Fig. 154: View Of Vent Inlet Hose At Throttle Body
Courtesy of GENERAL MOTORS CORP.

5. If necessary, remove the engine sight shield. Refer to **Engine Sight Shield Replacement (4.8L, 5.3L, and 6.0L (RPO LQ4))** or **Engine Sight Shield Replacement (6.0L (RPO LQ9))** in Engine Mechanical - 4.8L, 5.3L, and 6.0L.
6. Remove the radiator vent inlet hose from the radiator hose clips.

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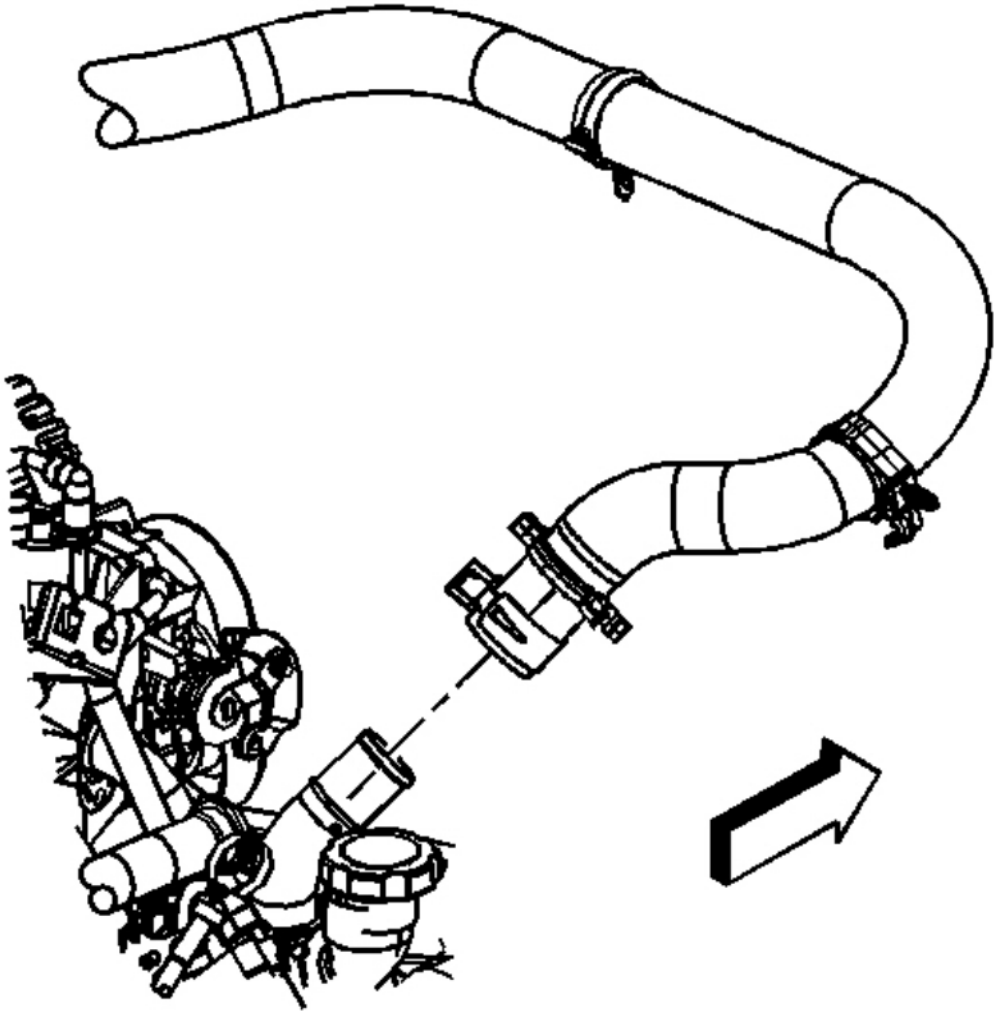


Fig. 155: View Of Radiator Inlet Hose
Courtesy of GENERAL MOTORS CORP.

7. Position the inlet hose clamp at the water pump.
8. Remove the inlet hose from the water pump.
9. Remove the fan blade. Refer to **Fan Replacement**.
10. Remove the accessory drive belt. Refer to **Drive Belt Replacement - Accessory** in Engine Mechanical - 4.8L, 5.3L, and 6.0L.

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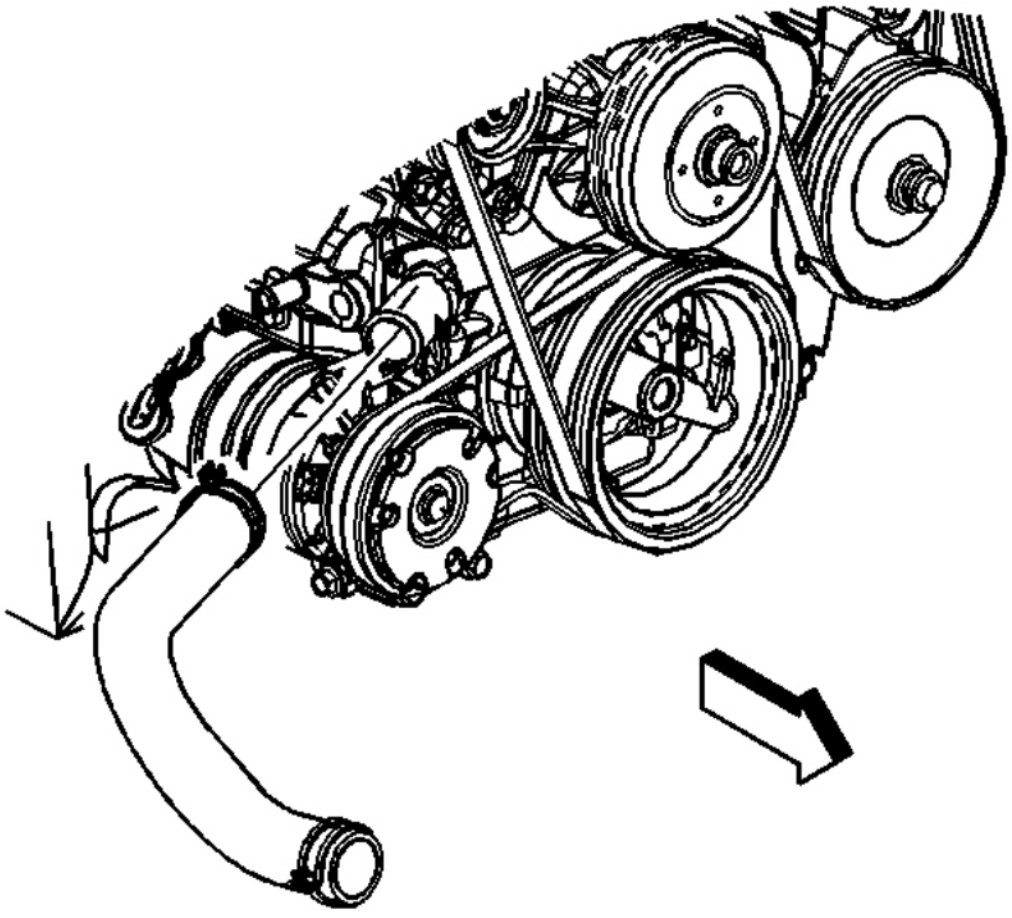


Fig. 156: View Of Outlet Hose At Water Pump
Courtesy of GENERAL MOTORS CORP.

11. Position the outlet hose clamp at the water pump.
12. Remove the outlet hose from the water pump.

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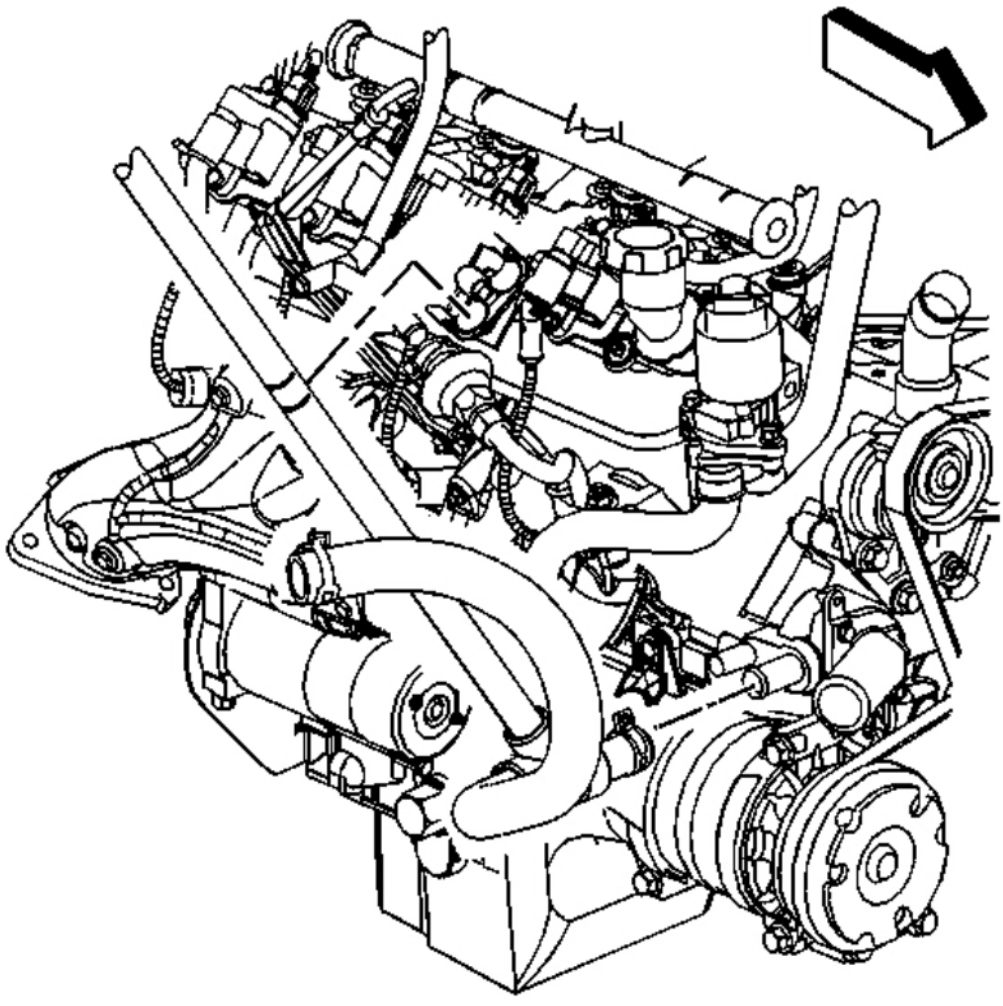


Fig. 157: View Of Surge Tank Outlet Hose To Water Pump
Courtesy of GENERAL MOTORS CORP.

13. Position the surge tank outlet hose clamp at the water pump.
14. Remove the surge tank outlet hose from the water pump.

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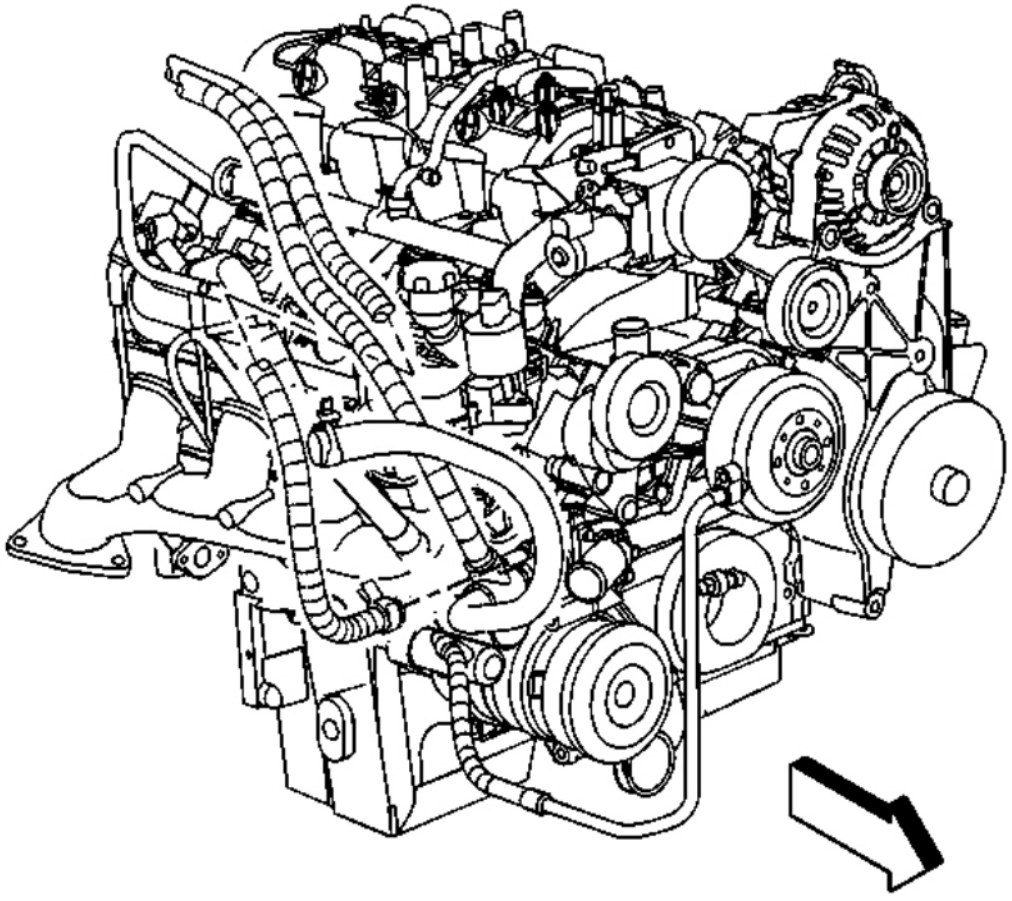


Fig. 158: View Of Heater Inlet Hose At Water Pump
Courtesy of GENERAL MOTORS CORP.

15. Position the heater inlet hose clamp at the water pump.
16. Remove the heater inlet hose from the water pump.

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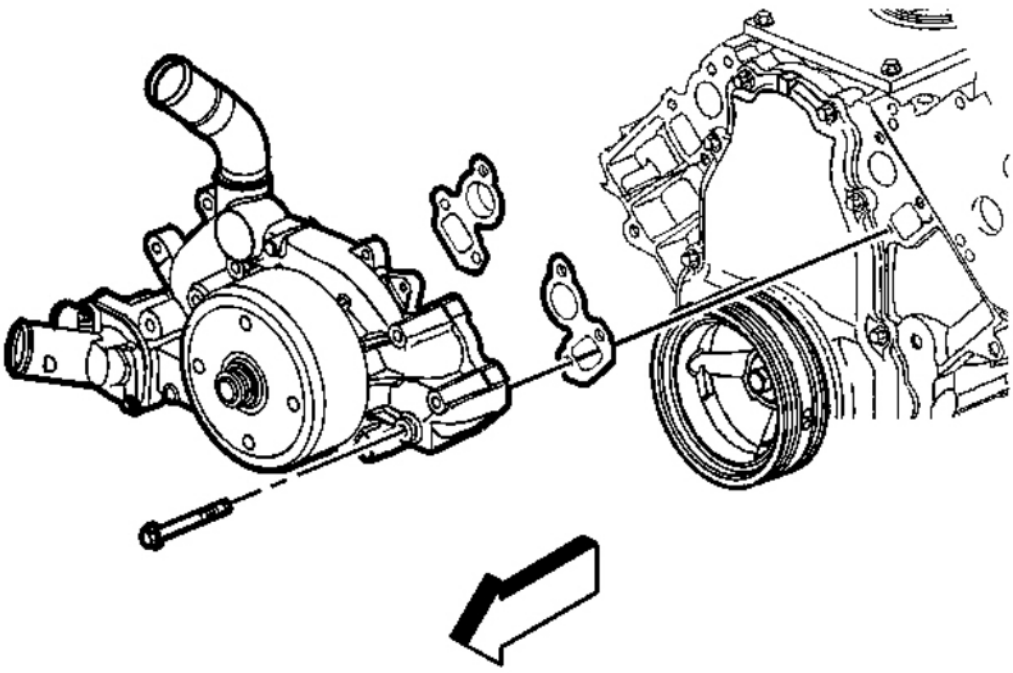


Fig. 159: View Of Water Pump, Gaskets & Bolts
Courtesy of GENERAL MOTORS CORP.

17. Remove the water pump bolts.
18. Remove the water pump and gaskets.
19. Discard the water pump gaskets.

Installation Procedure

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

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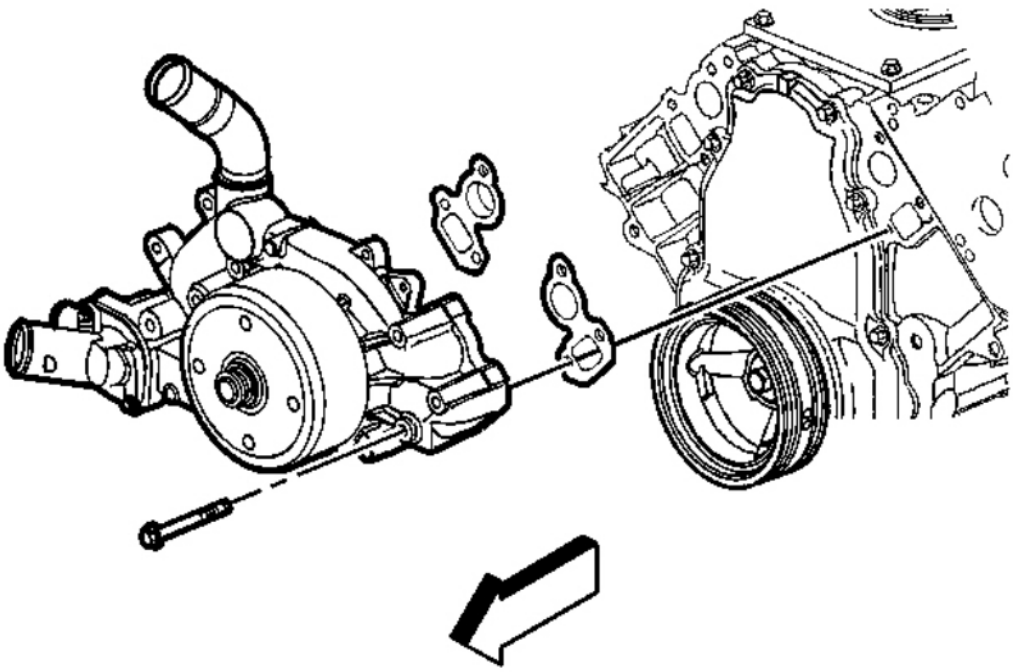


Fig. 160: View Of Water Pump, Gaskets & Bolts
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice in Cautions and Notices.

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

Tighten:

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

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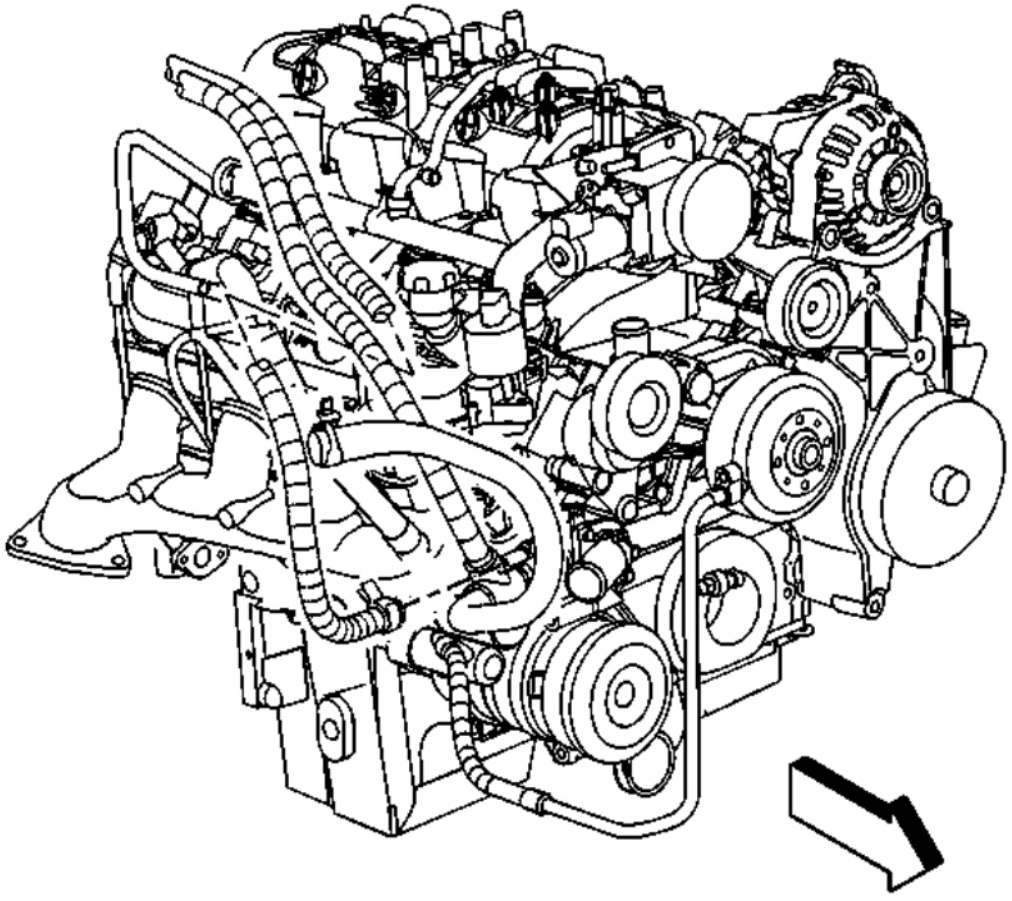


Fig. 161: View Of Heater Inlet Hose At Water Pump
Courtesy of GENERAL MOTORS CORP.

3. Install the heater inlet hose to the water pump.
4. Position the heater inlet hose clamp at the water pump.

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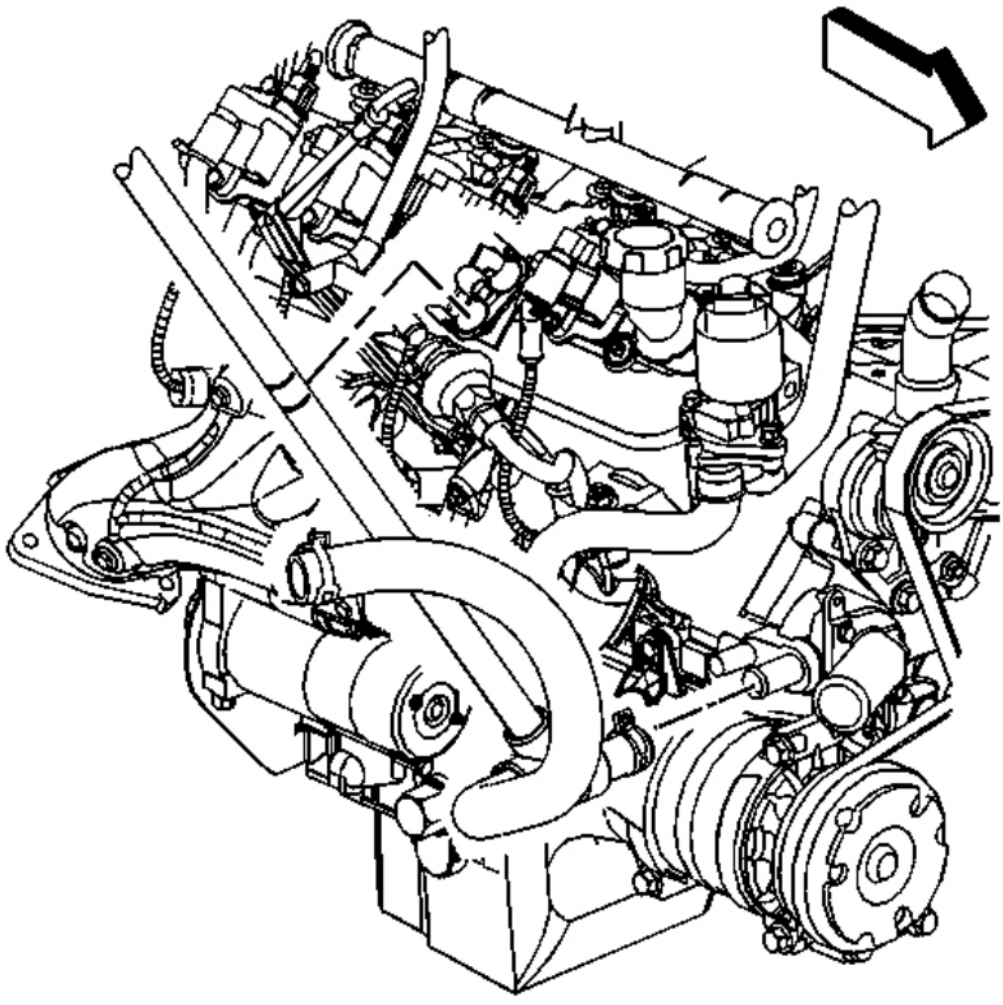


Fig. 162: View Of Surge Tank Outlet Hose To Water Pump
Courtesy of GENERAL MOTORS CORP.

5. Install the surge tank outlet hose to the water pump.
6. Position the surge tank outlet hose clamp at the water pump.

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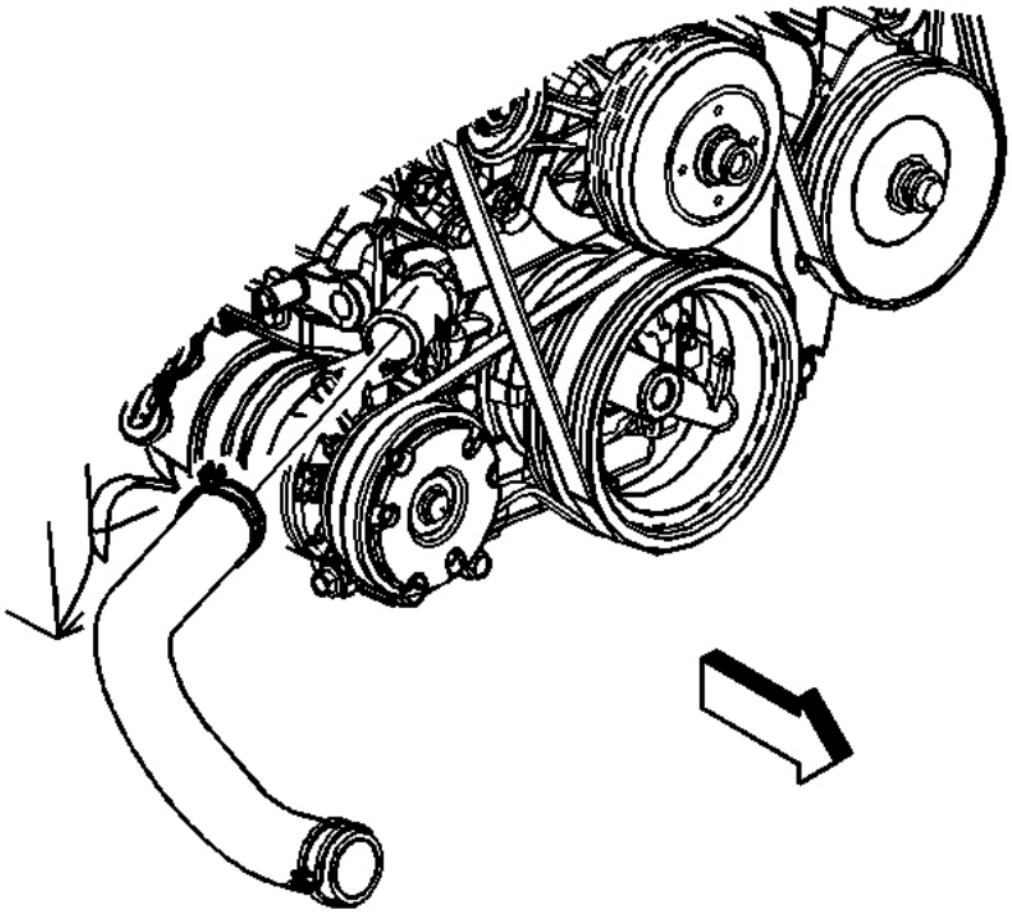


Fig. 163: View Of Outlet Hose At Water Pump
Courtesy of GENERAL MOTORS CORP.

7. Install the outlet hose to the water pump.
8. Position the outlet hose clamp at the water pump.
9. Install the accessory drive belt. Refer to **Drive Belt Replacement - Accessory** in Engine Mechanical - 4.8L, 5.3L, and 6.0L.
10. Install the fan blade. Refer to **Fan Replacement**.

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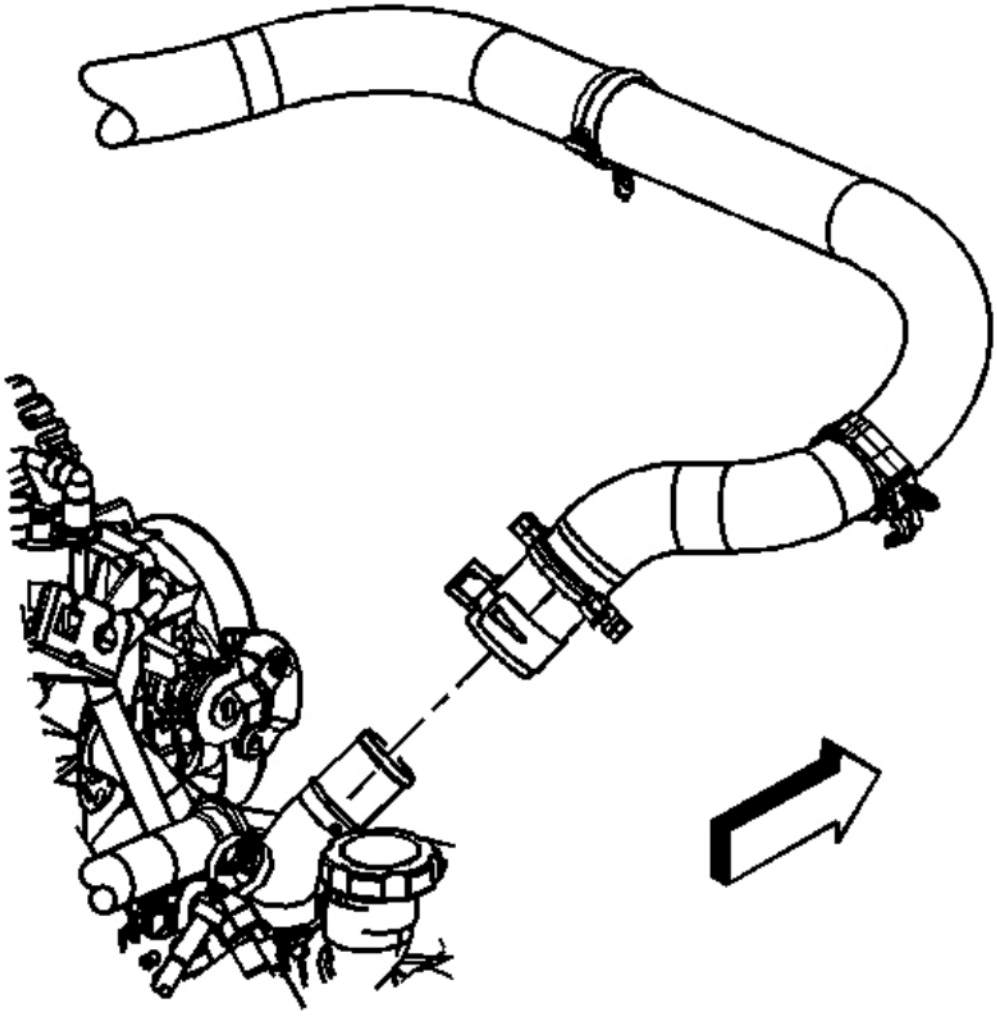


Fig. 164: View Of Radiator Inlet Hose
Courtesy of GENERAL MOTORS CORP.

11. Install the inlet hose to the water pump.
12. Position the inlet hose clamp at the water pump.

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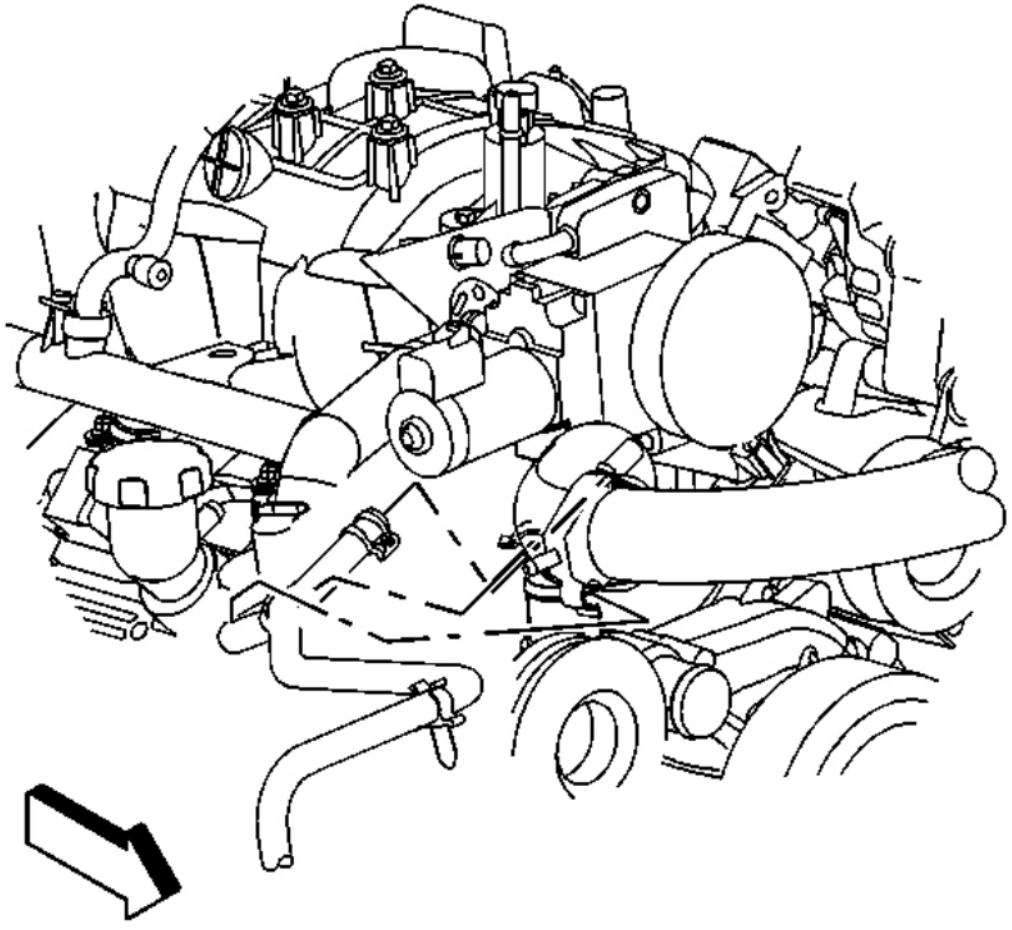


Fig. 165: View Of Vent Inlet Hose At Throttle Body
Courtesy of GENERAL MOTORS CORP.

13. Install the engine vent inlet hose to the radiator hose clips.
14. If necessary, install the engine sight shield. Refer to **Engine Sight Shield Replacement (4.8L, 5.3L, and 6.0L (RPO LQ4))** or **Engine Sight Shield Replacement (6.0L (RPO LQ9))** in Engine Mechanical - 4.8L, 5.3L, and 6.0 L.

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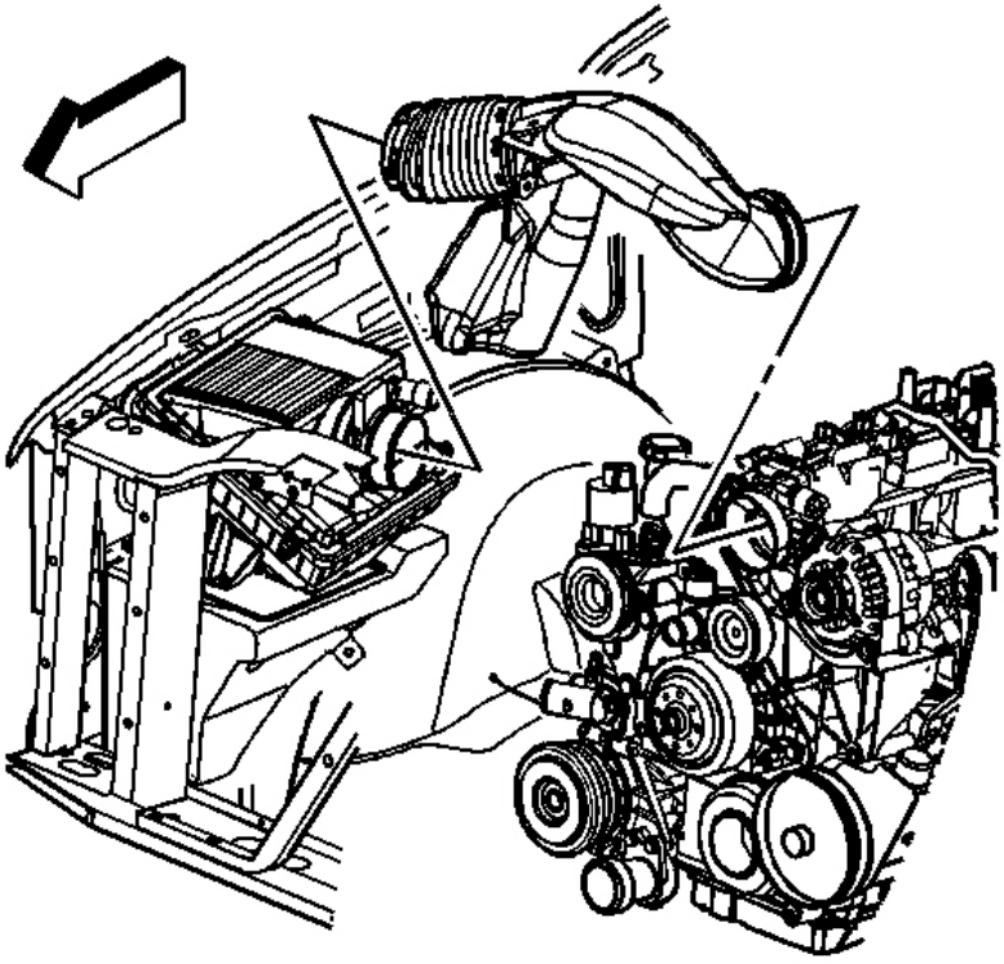


Fig. 166: View Of Air Cleaner Outlet Duct
Courtesy of GENERAL MOTORS CORP.

15. Install the air cleaner outlet duct.

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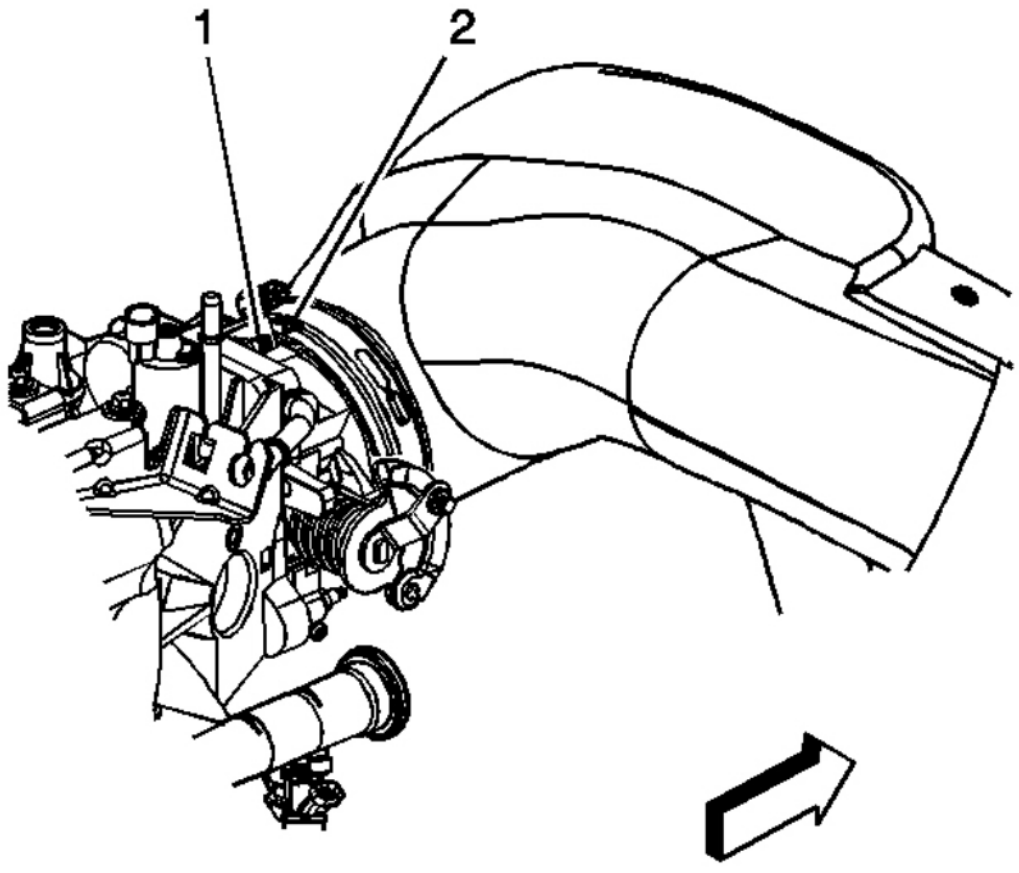


Fig. 167: View Of Air Cleaner Outlet Duct Clamps
Courtesy of GENERAL MOTORS CORP.

16. Align the arrow at the throttle body end of the duct with the throttle body attaching stud.
17. Install the radiator inlet hose clip to the outlet duct.
18. Tighten the air cleaner outlet duct clamps at the following locations:
    - Throttle body
    - MAF/IAT sensor

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

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

WATER PUMP REPLACEMENT (8.1L ENGINE)

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Removal Procedure

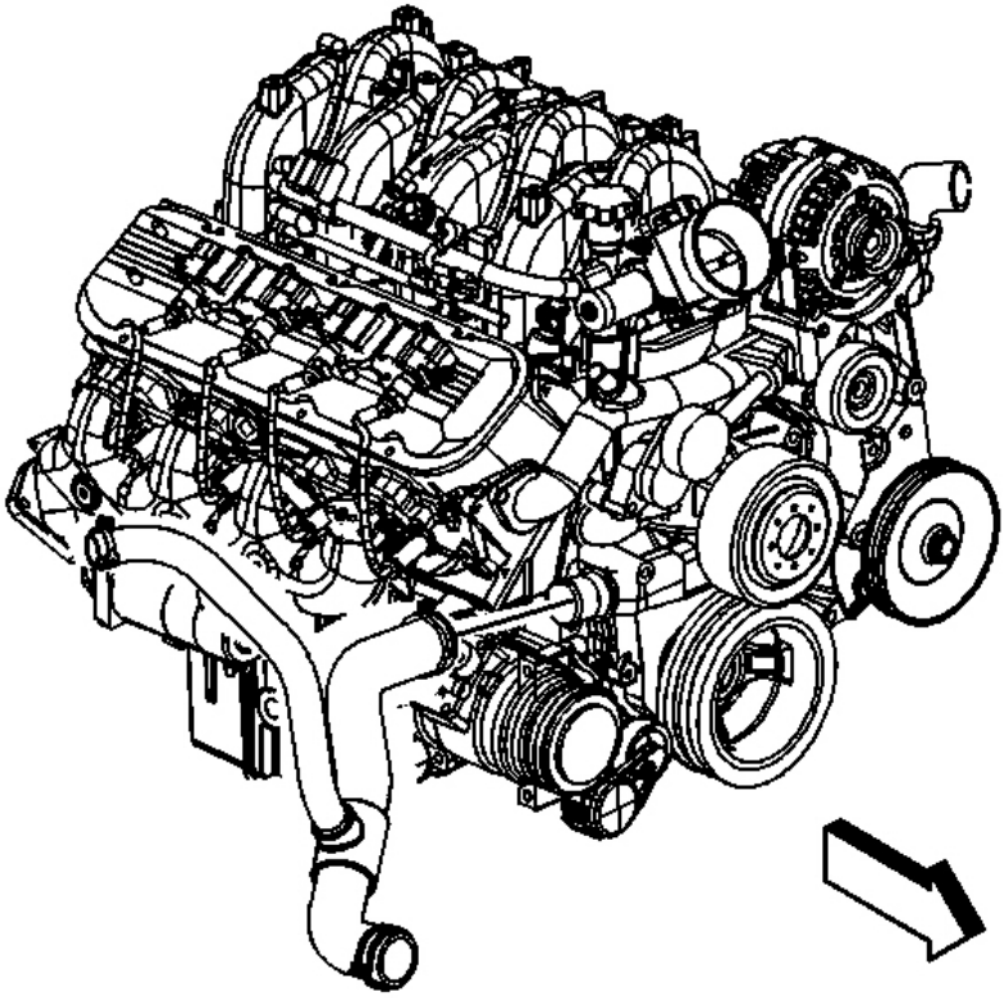


Fig. 168: Identifying Outlet Hose To The Water Pump
Courtesy of GENERAL MOTORS CORP.

1. Drain the cooling system. Refer to **Draining and Filling Cooling System**.
2. Remove the drive belt. Refer to **Drive Belt Replacement - Accessory** in Engine Mechanical - 8.1 L.
3. Remove the fan clutch. Refer to **Fan Clutch Replacement**.
4. Position the outlet hose clamp at the water pump.
5. Remove the outlet hose from the water pump.

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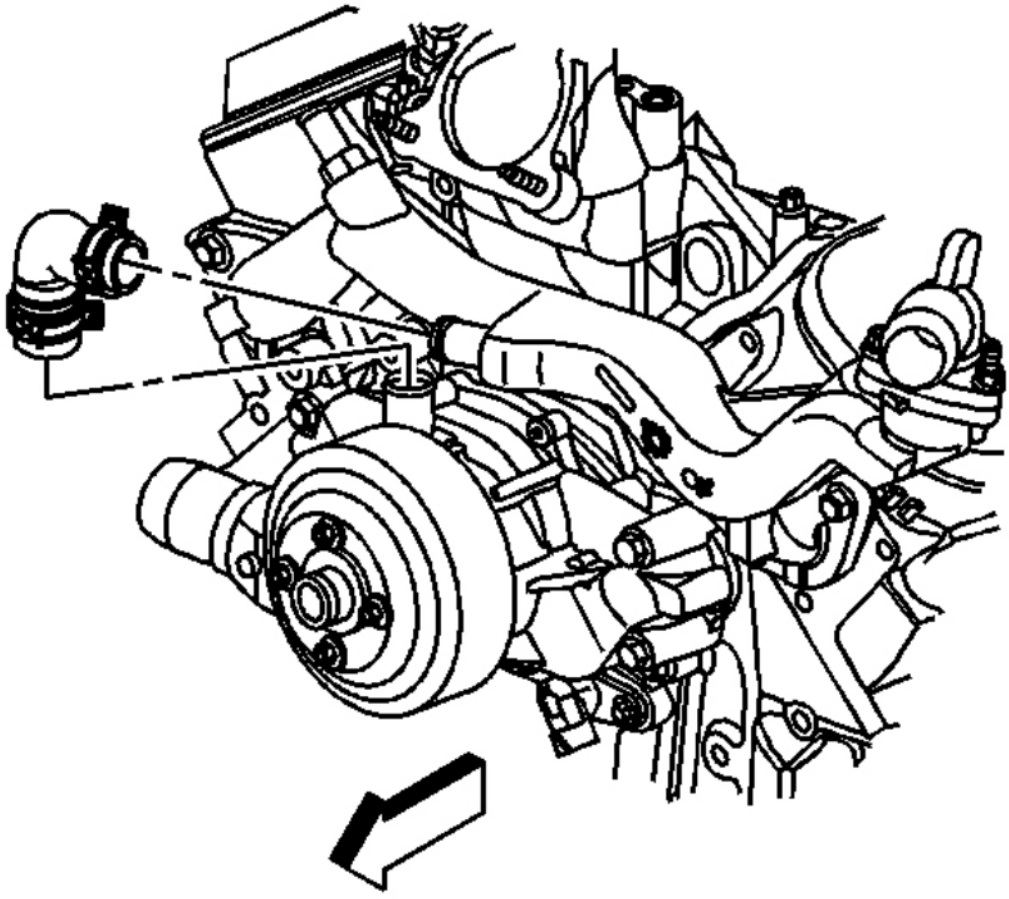


Fig. 169: View Of Bypass Hose (8.1L)
Courtesy of GENERAL MOTORS CORP.

6. Position the bypass hose clamps at the water pump and water crossover.
7. Remove the bypass hose.

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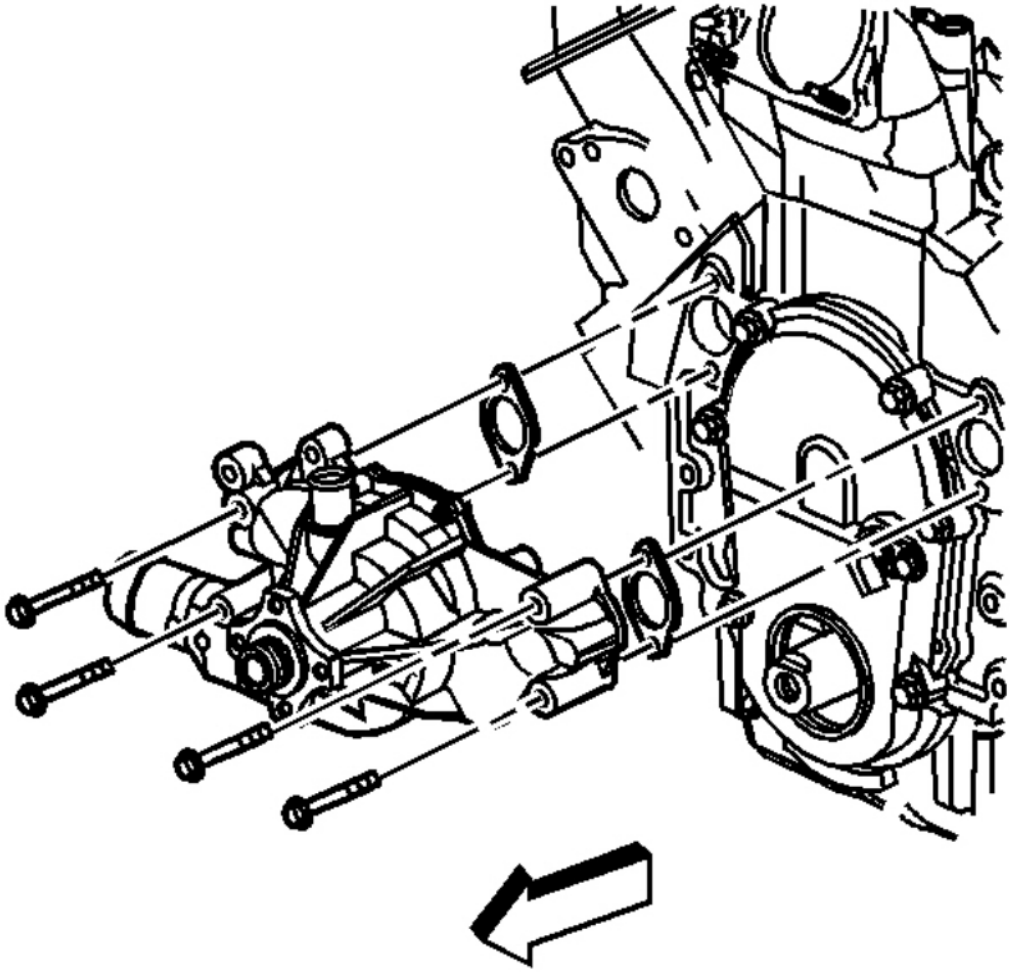


Fig. 170: View Of Water Pump & Gasket
Courtesy of GENERAL MOTORS CORP.

8. Remove the water pump bolts.
9. Remove the water pump.
10. Remove and discard the water pump gaskets.

Installation Procedure

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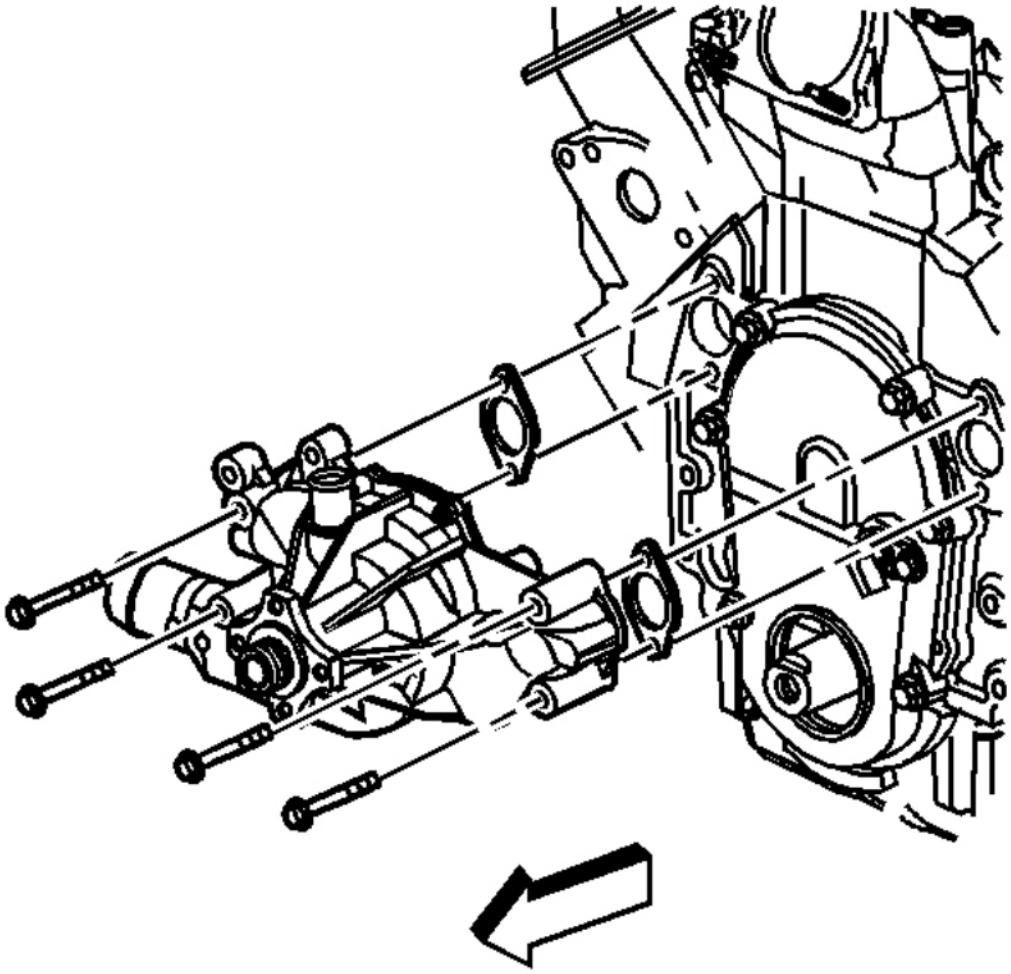


Fig. 171: View Of Water Pump & Gasket
Courtesy of GENERAL MOTORS CORP.

1. Place NEW water pump gaskets into place.
2. Install the water pump.

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

3. Install the water pump bolts.

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

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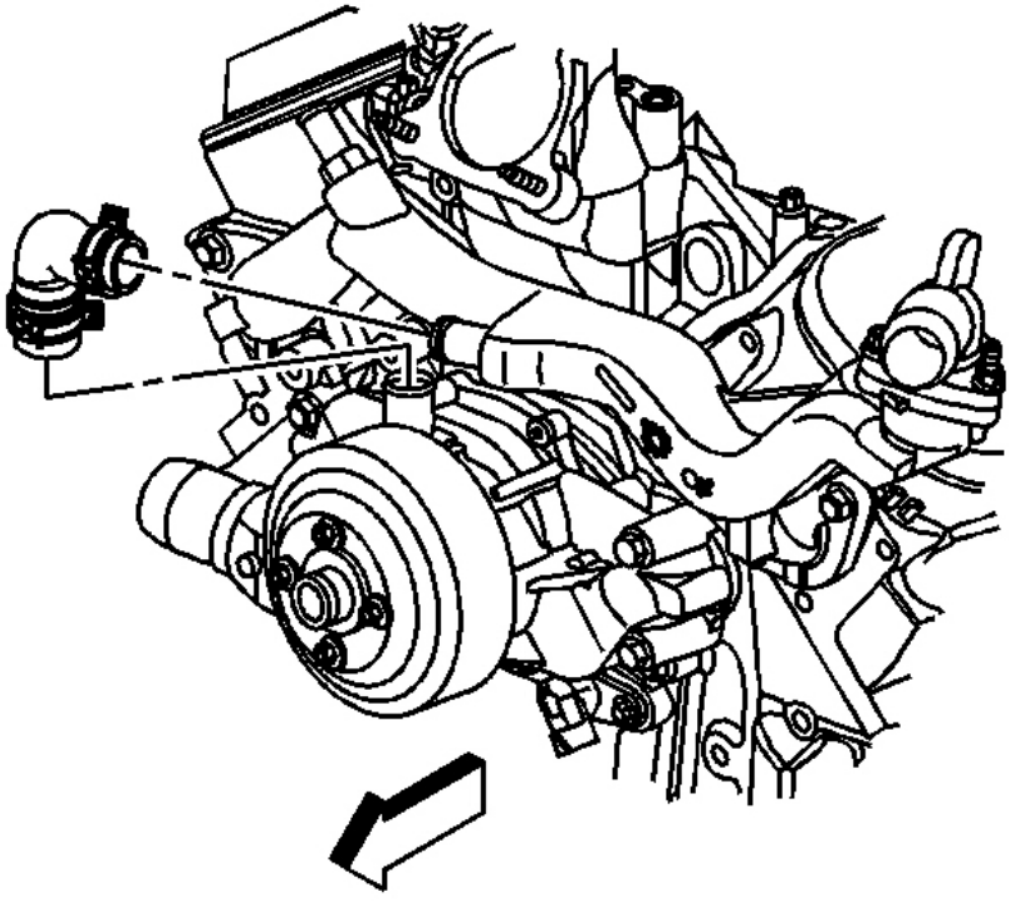


Fig. 172: View Of Bypass Hose (8.1L)
Courtesy of GENERAL MOTORS CORP.

4. Install the bypass hose.
5. Position the bypass hose clamps at the water pump and water crossover.

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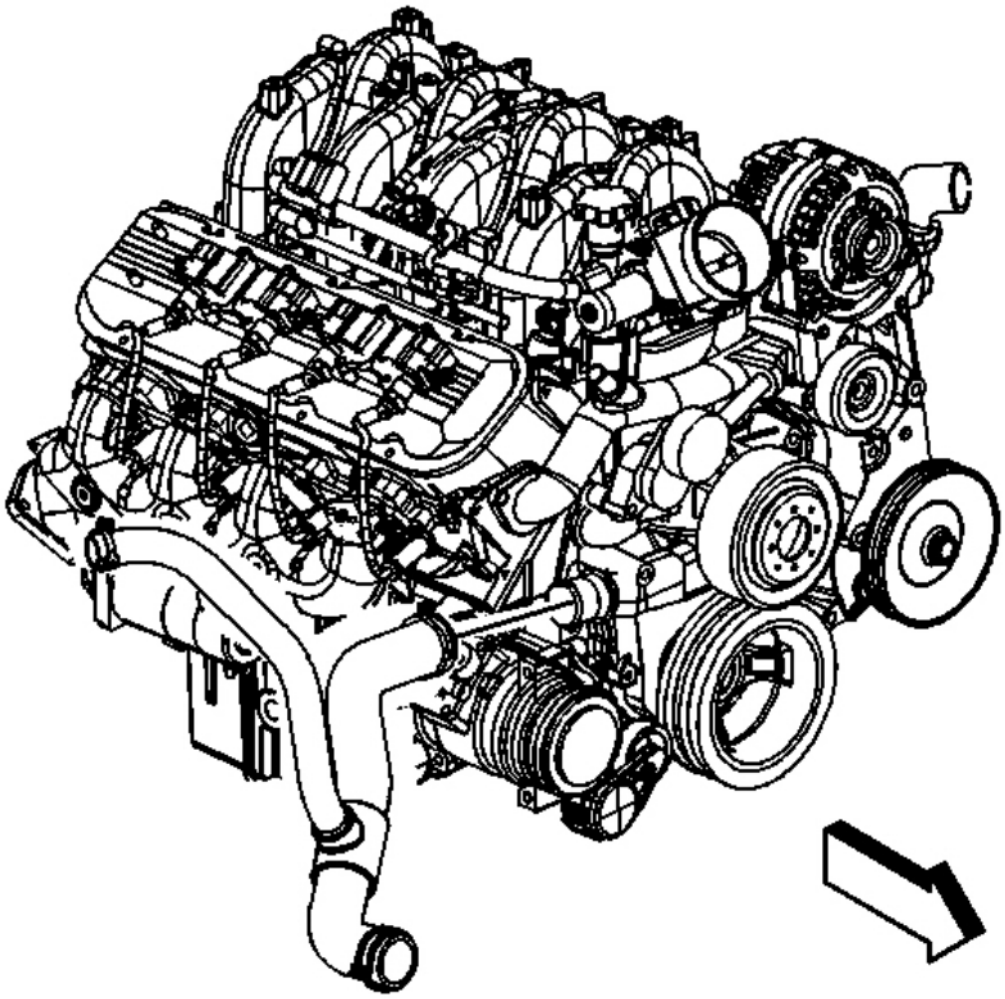


Fig. 173: Identifying Outlet Hose To The Water Pump
Courtesy of GENERAL MOTORS CORP.

6. Install the outlet hose to the water pump.
7. Position the outlet hose clamp at the water pump.
8. Install the fan clutch. Refer to **Fan Clutch Replacement**.
9. Install the drive belt. Refer to **Drive Belt Replacement - Accessory** in Engine Mechanical - 8.1 L.
10. Fill the cooling system. Refer to **Draining and Filling Cooling System**.

DRAIN COCK REPLACEMENT

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Removal Procedure

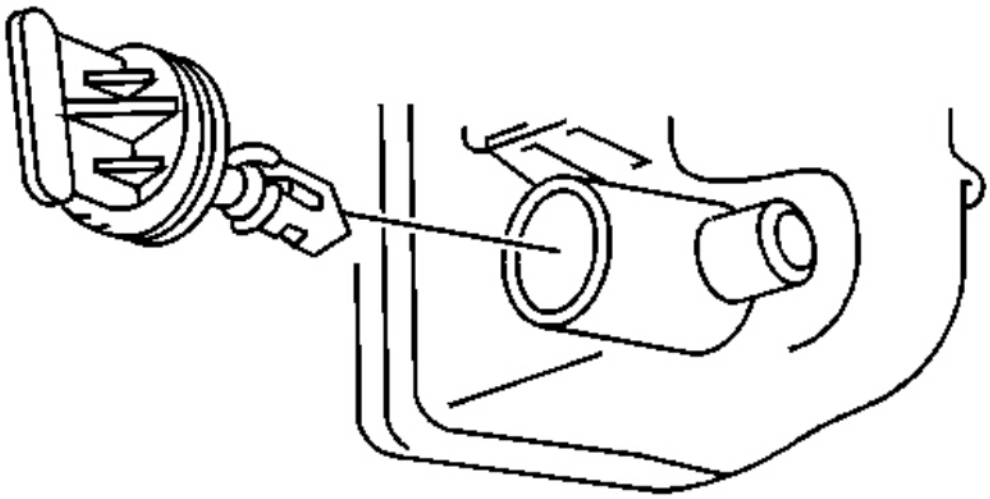


Fig. 174: View Of Radiator Drain Cock
Courtesy of GENERAL MOTORS CORP.

1. Drain the cooling system. Refer to **Draining and Filling Cooling System**.
2. Remove the radiator drain cock.

Installation Procedure

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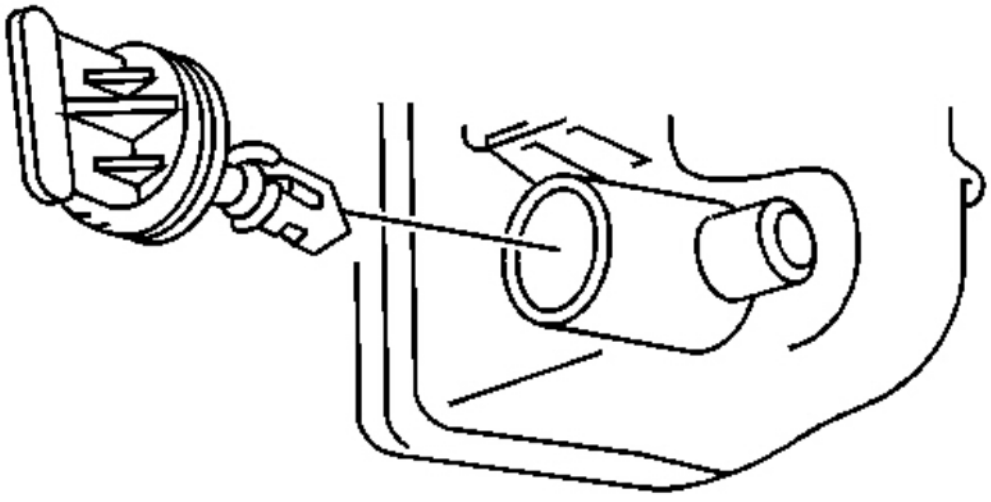


Fig. 175: View Of Radiator Drain Cock
Courtesy of GENERAL MOTORS CORP.

1. Install the radiator drain cock.
2. Fill the cooling system. Refer to **Draining and Filling Cooling System**.

FAN SHROUD REPLACEMENT - UPPER (W/O M74)

Removal Procedure

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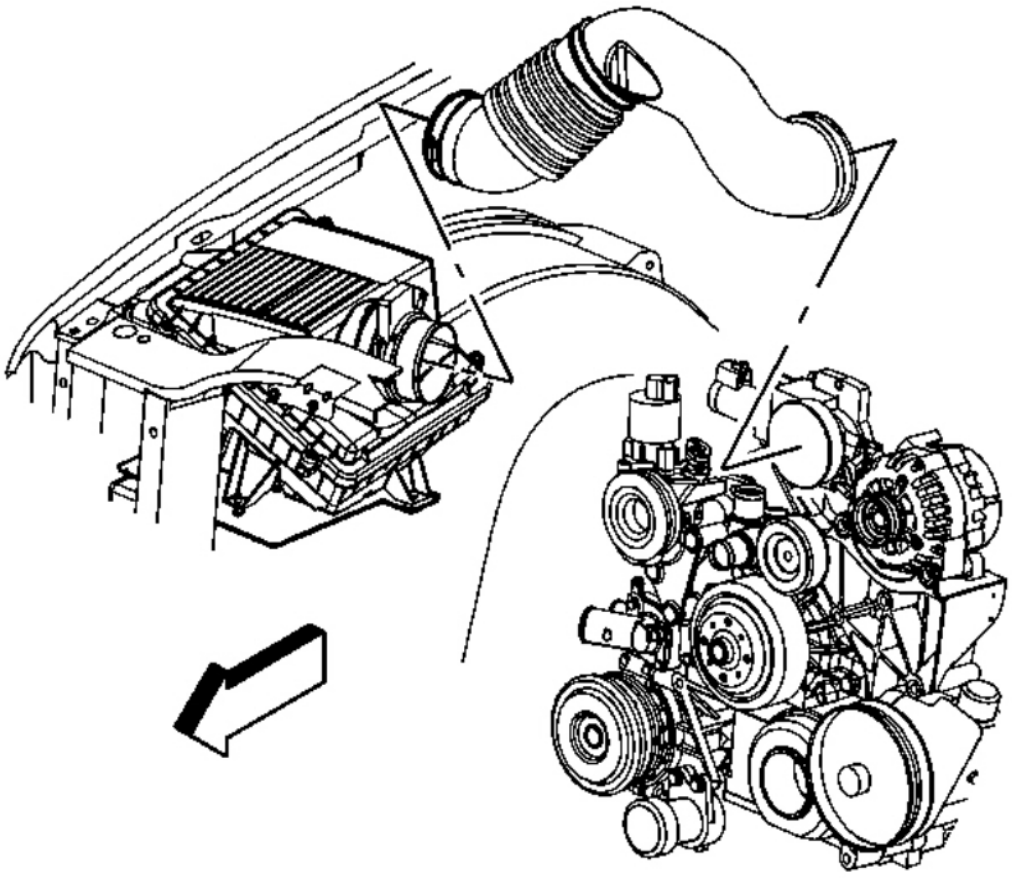


Fig. 176: View Of Air Cleaner Outlet Duct (W/HP2 Front)
Courtesy of GENERAL MOTORS CORP.

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

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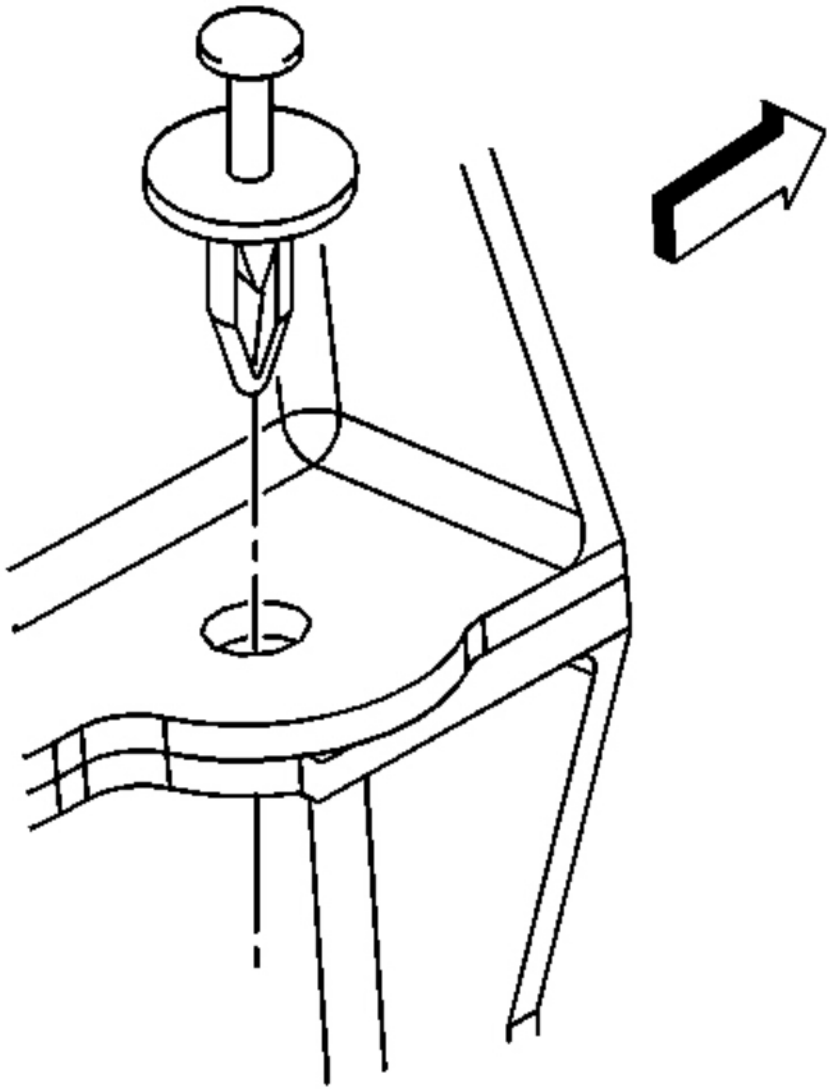


Fig. 177: View Of Fan Shroud Retainers
Courtesy of GENERAL MOTORS CORP.

6. Remove the fan shroud retainers.

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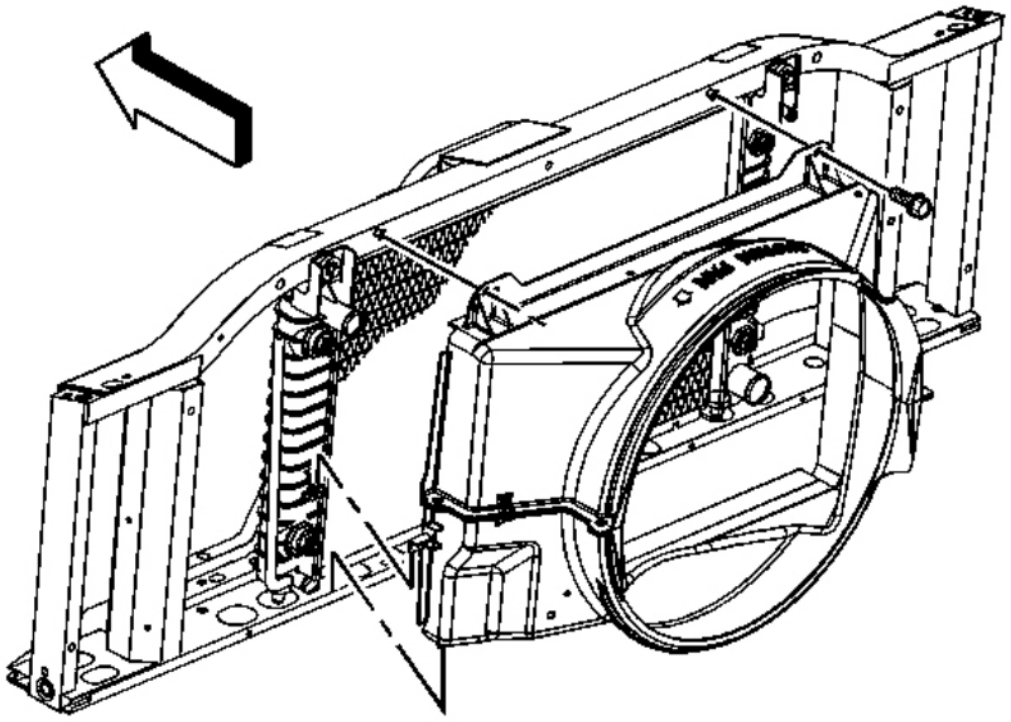


Fig. 178: View Of Upper Fan Shroud
Courtesy of GENERAL MOTORS CORP.

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

Installation Procedure

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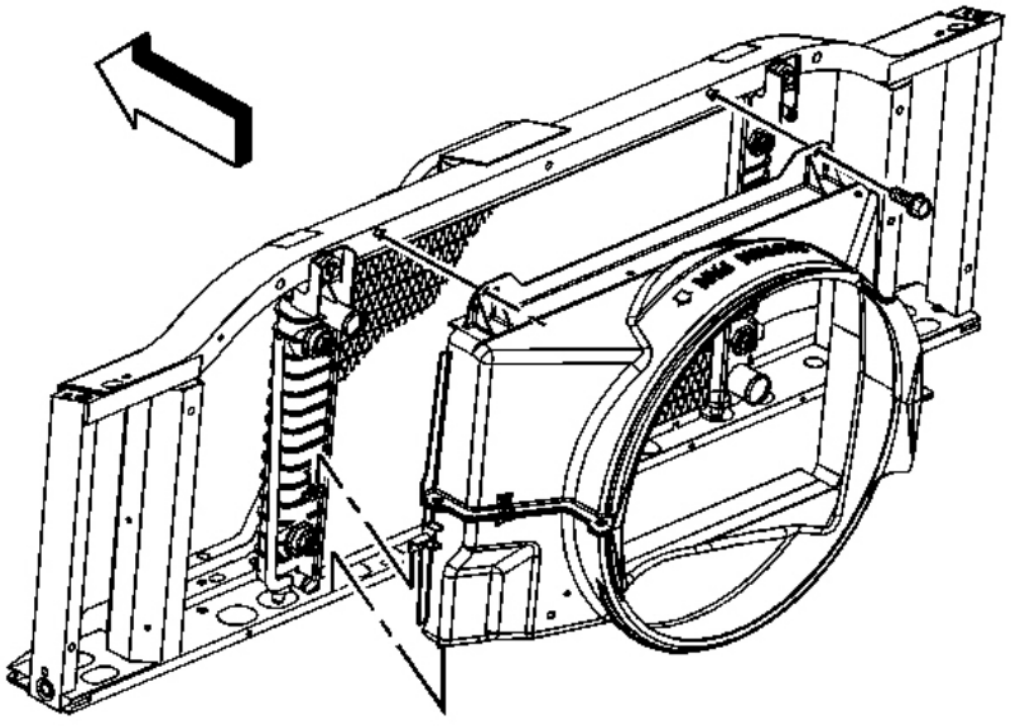


Fig. 179: View Of Upper Fan Shroud
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice in Cautions and Notices.

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

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

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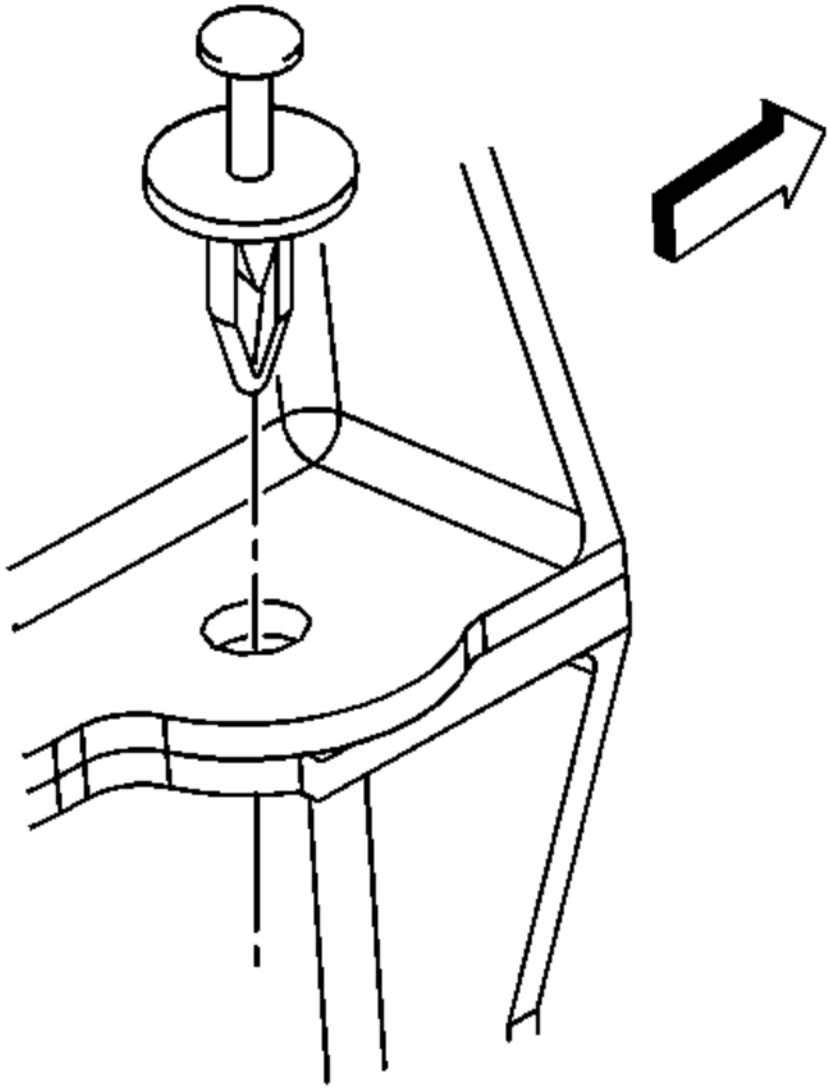


Fig. 180: View Of Fan Shroud Retainers
Courtesy of GENERAL MOTORS CORP.

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

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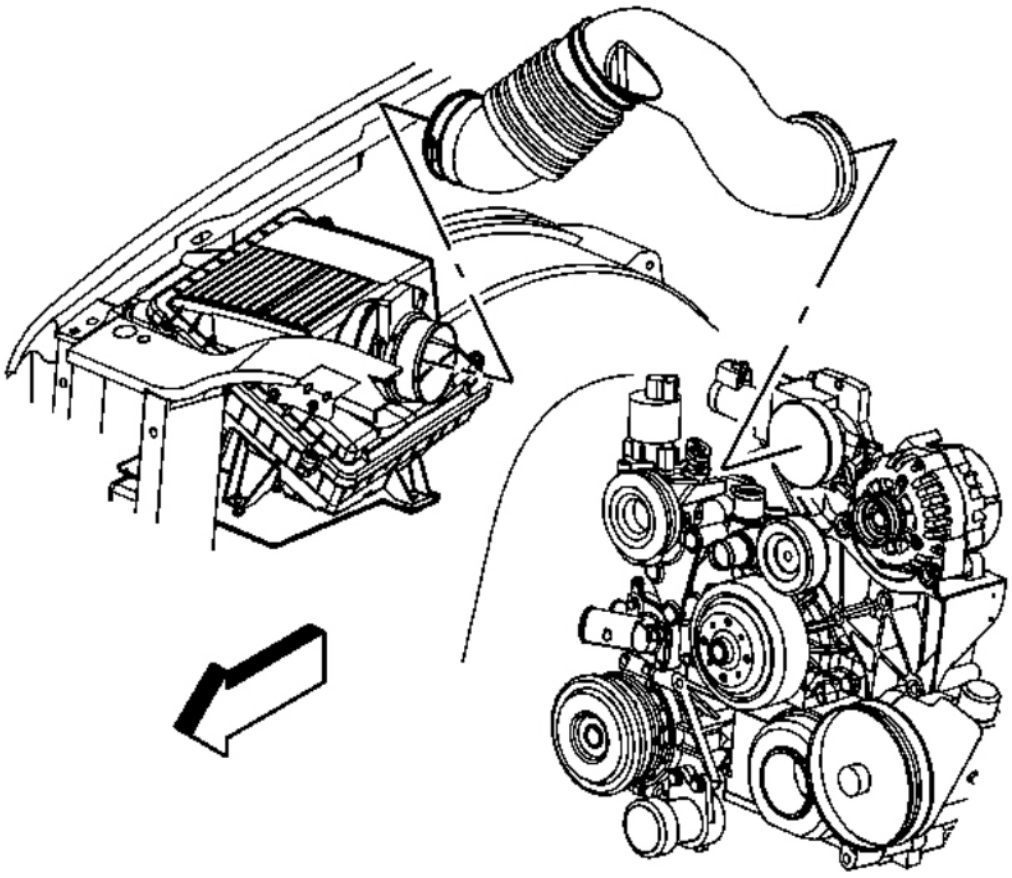


Fig. 181: View Of Air Cleaner Outlet Duct (W/HP2 Front)
Courtesy of GENERAL MOTORS CORP.

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

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

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

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

FAN SHROUD REPLACEMENT - UPPER (W/M74)

Removal Procedure

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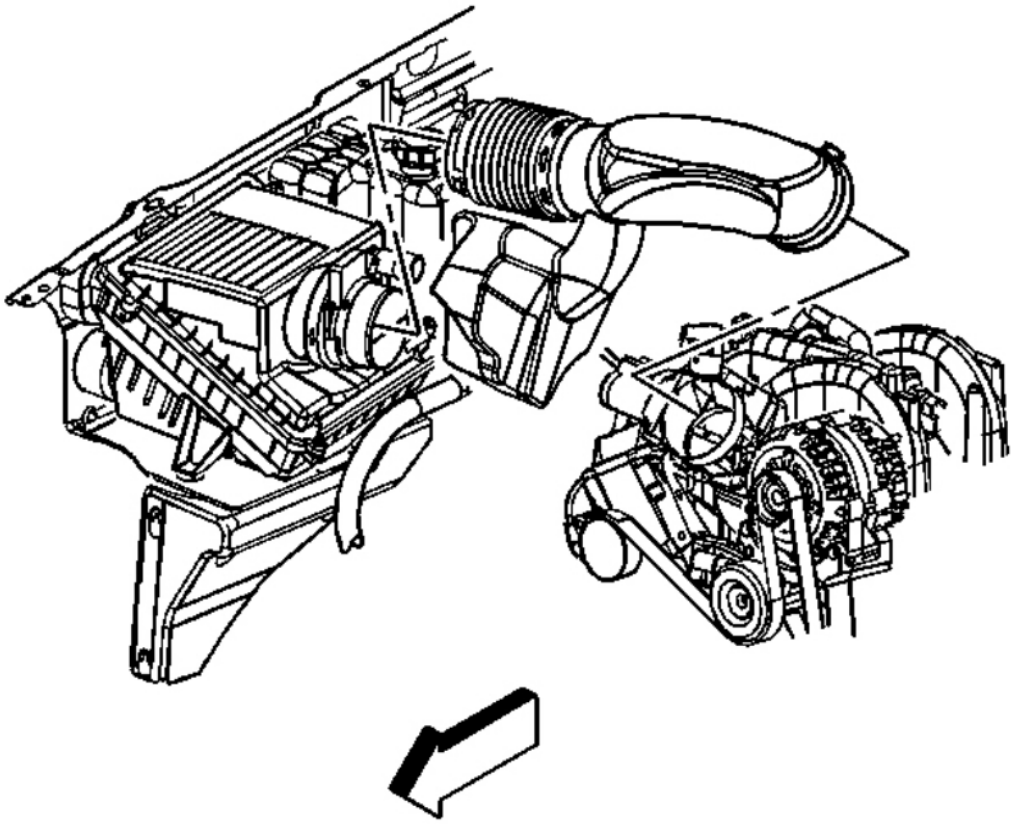


Fig. 182: View Of Air Cleaner Outlet Duct
Courtesy of GENERAL MOTORS CORP.

1. Loosen the air cleaner outlet duct clamps from the throttle body.
2. Loosen the air cleaner outlet duct clamps from the mass airflow sensor.
3. Remove the air cleaner outlet duct.
4. Remove the A/C line retainer from the fan shroud.

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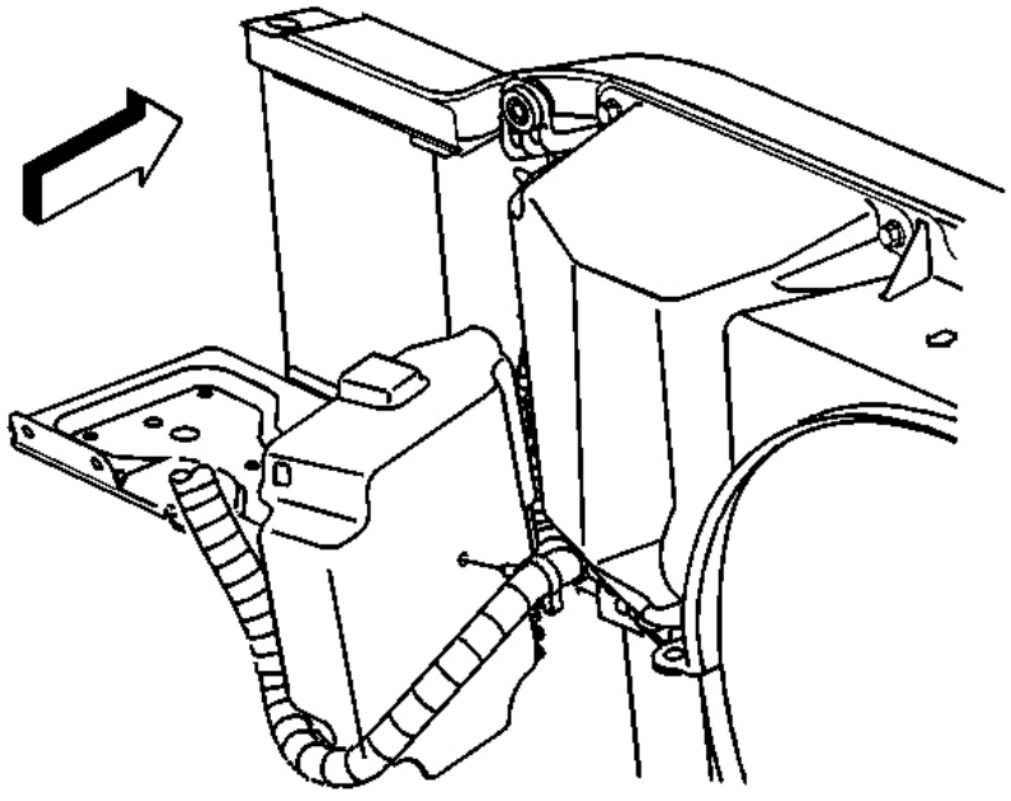


Fig. 183: View Of Engine Harness Clip At PCM Cover
Courtesy of GENERAL MOTORS CORP.

5. Remove the engine harness clip from the PCM cover.

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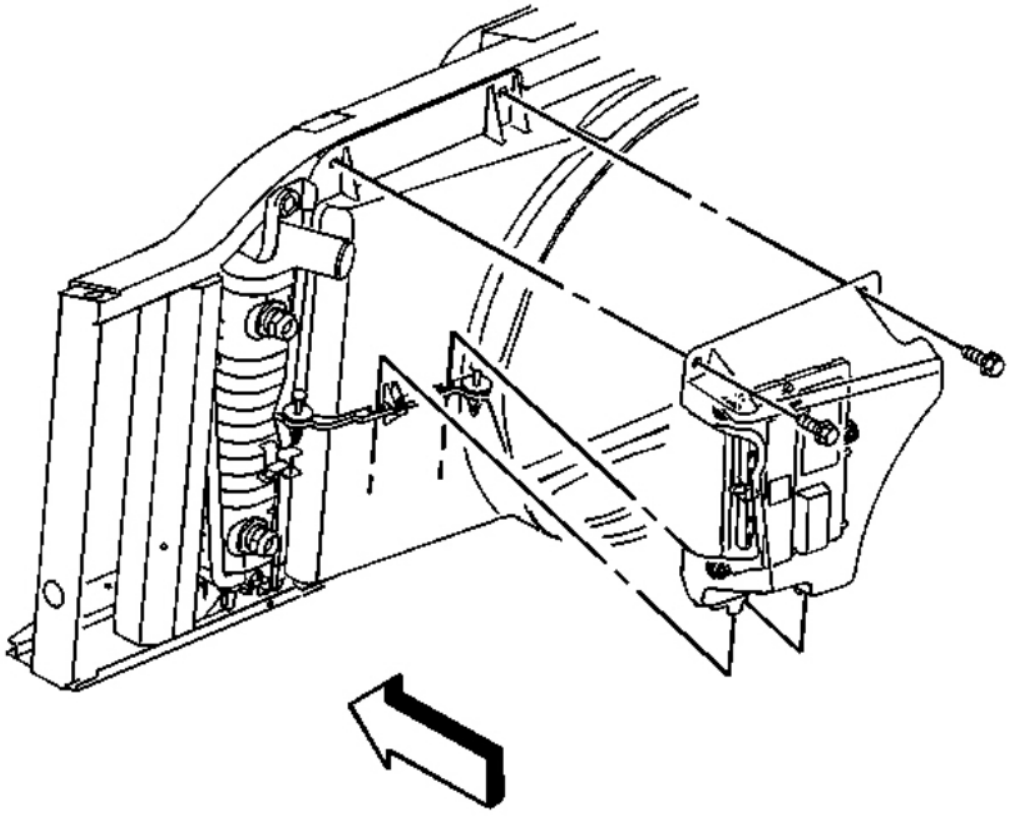


Fig. 184: View Of TCM Cover & Bolts
Courtesy of GENERAL MOTORS CORP.

6. Remove the TCM cover bolts.
7. Remove TCM cover from the fan shroud.

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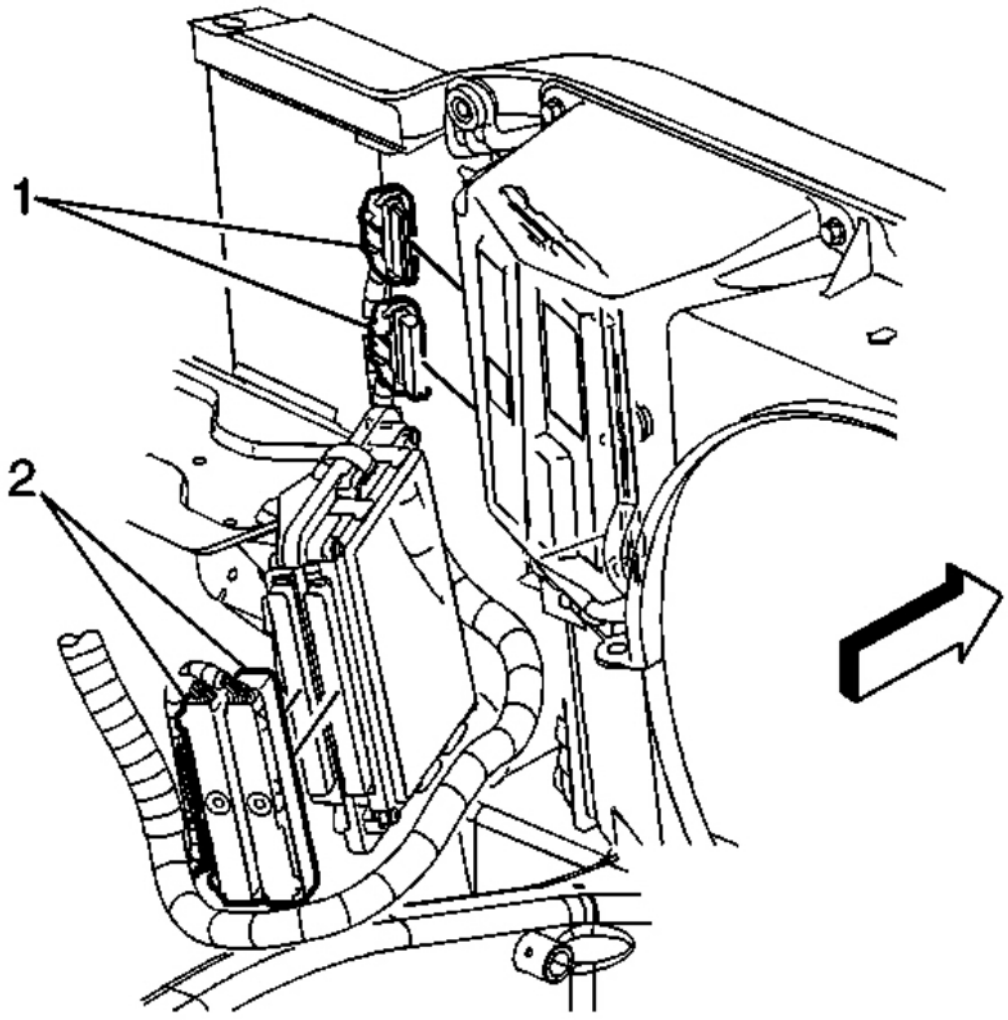


Fig. 185: View Of TCM Electrical Connectors
Courtesy of GENERAL MOTORS CORP.

8. Loosen the TCM electrical connector bolts.
9. Disconnect the TCM electrical connectors (1).
10. Remove the TCM and cover.

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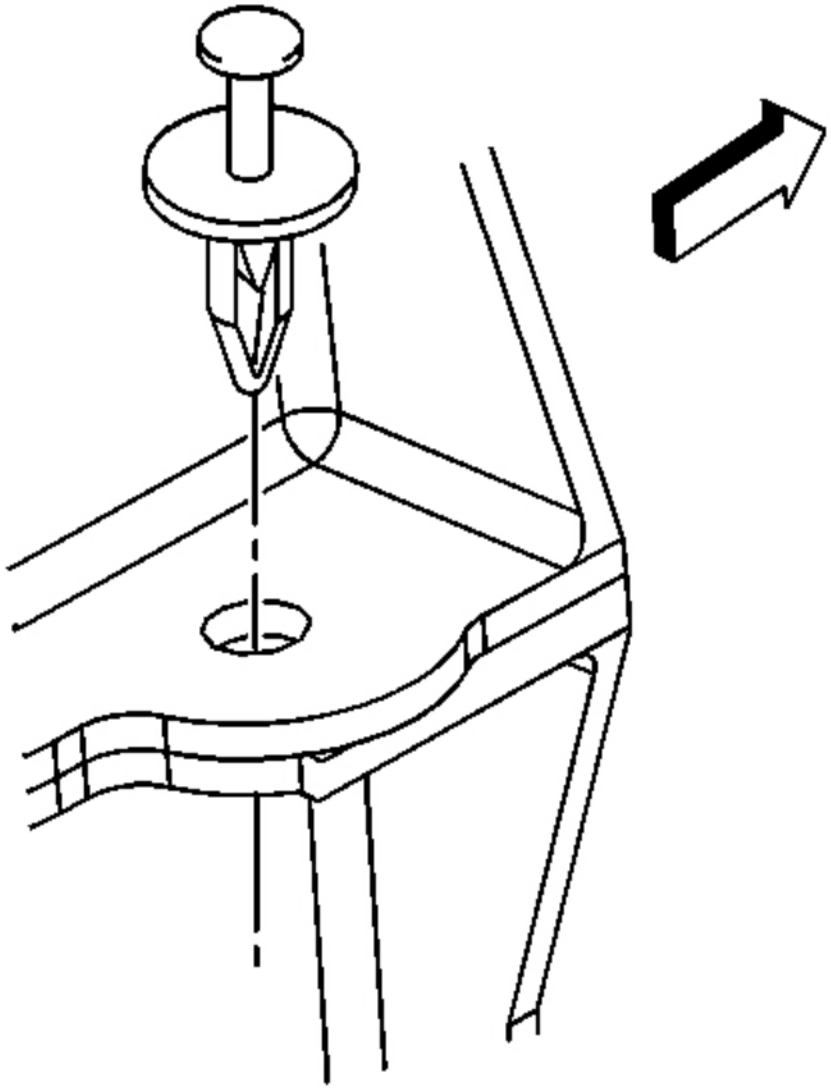


Fig. 186: View Of Fan Shroud Retainers
Courtesy of GENERAL MOTORS CORP.

11. Remove the fan shroud retainers.

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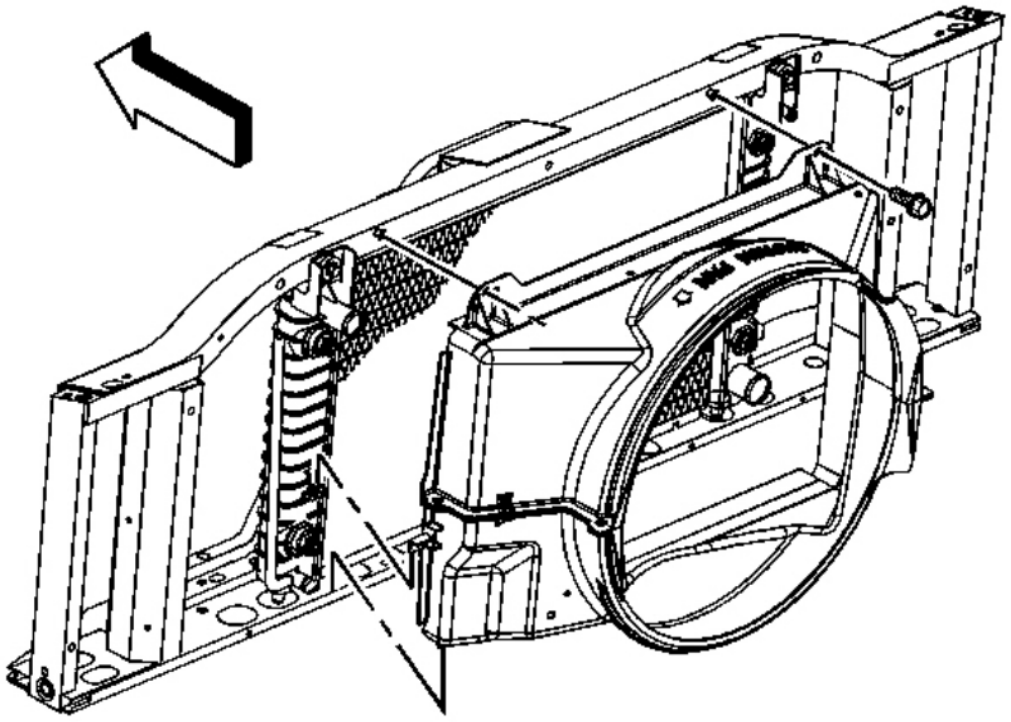


Fig. 187: View Of Upper Fan Shroud
Courtesy of GENERAL MOTORS CORP.

12. Remove the fan shroud bolts
13. Remove the upper fan shroud.

Installation Procedure

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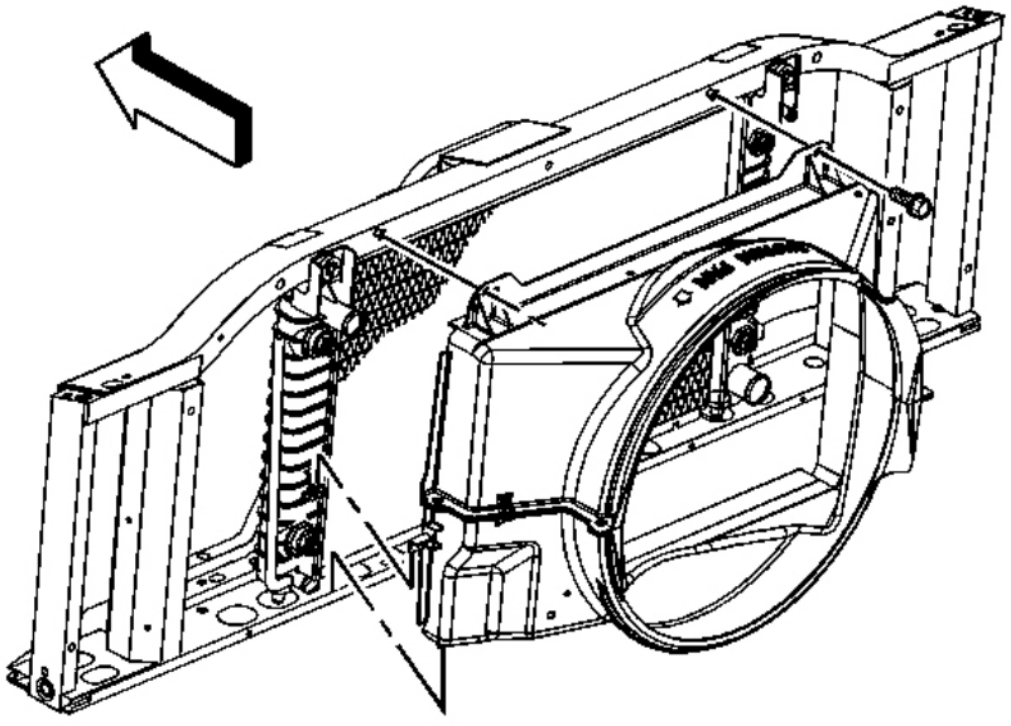


Fig. 188: View Of Upper Fan Shroud
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice in Cautions and Notices.

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

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

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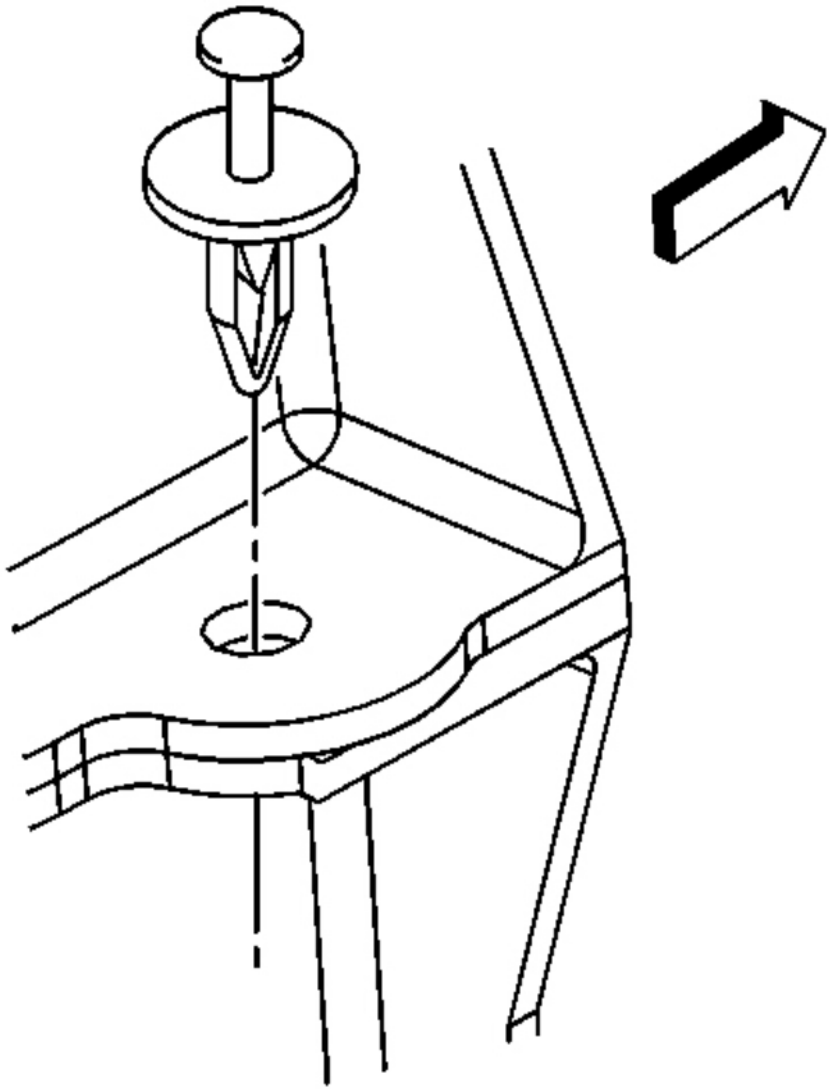


Fig. 189: View Of Fan Shroud Retainers
Courtesy of GENERAL MOTORS CORP.

3. Install the fan shroud retainers.

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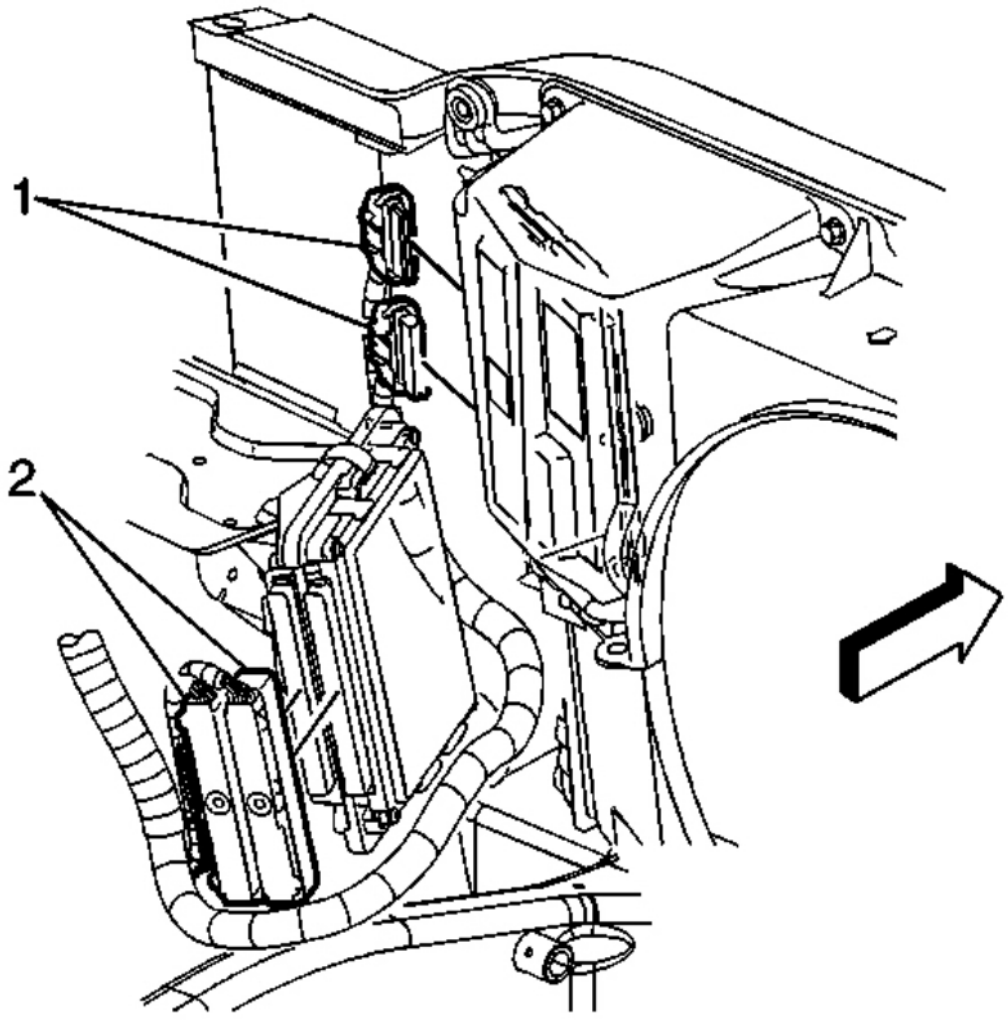


Fig. 190: View Of TCM Electrical Connectors
Courtesy of GENERAL MOTORS CORP.

4. Connect the TCM electrical connectors (1).
5. Install the TCM and cover.
6. Tighten the TCM electrical connector bolts.

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

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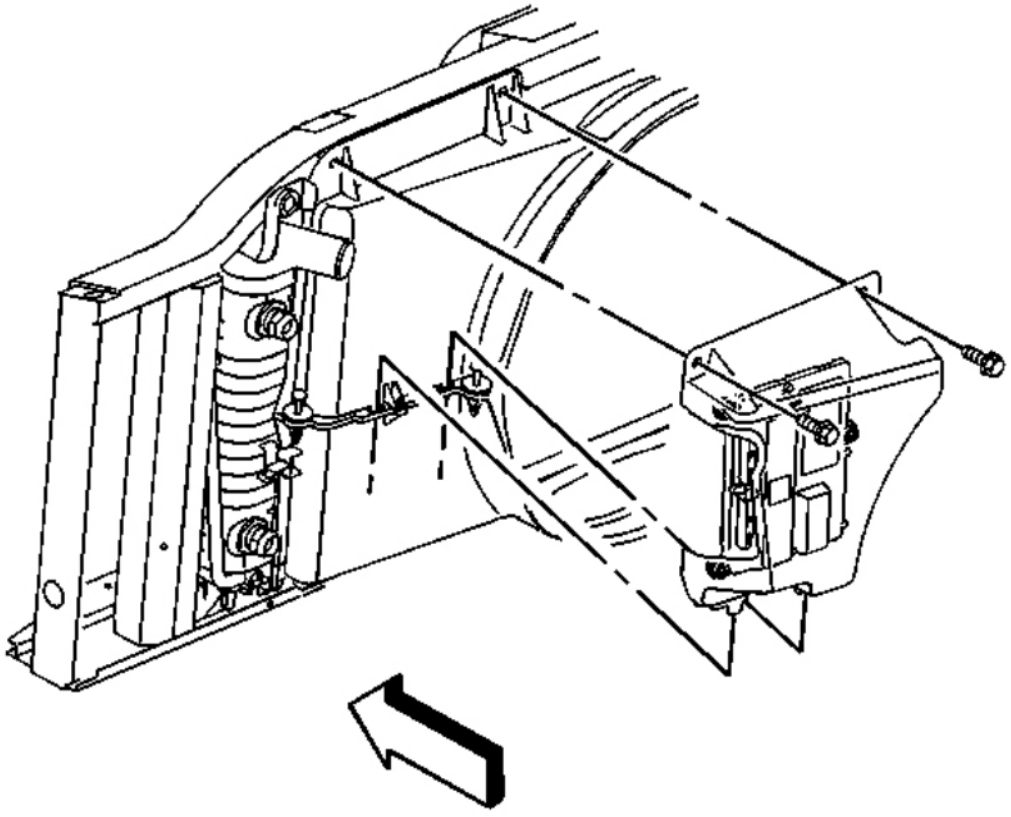


Fig. 191: View Of TCM Cover & Bolts
Courtesy of GENERAL MOTORS CORP.

7. Install the TCM cover to the fan shroud.
8. Install the TCM cover bolts.

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

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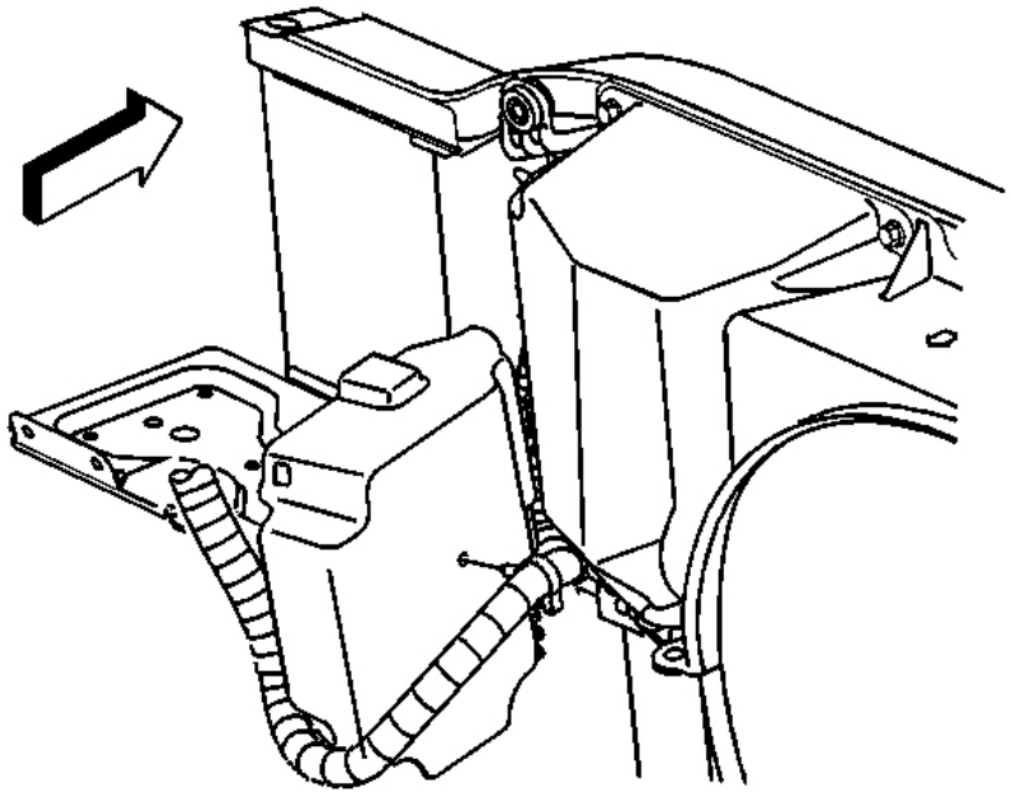


Fig. 192: View Of Engine Harness Clip At PCM Cover
Courtesy of GENERAL MOTORS CORP.

9. Install the engine harness clip to the PCM cover.
10. Install the A/C line retainer to the fan shroud.

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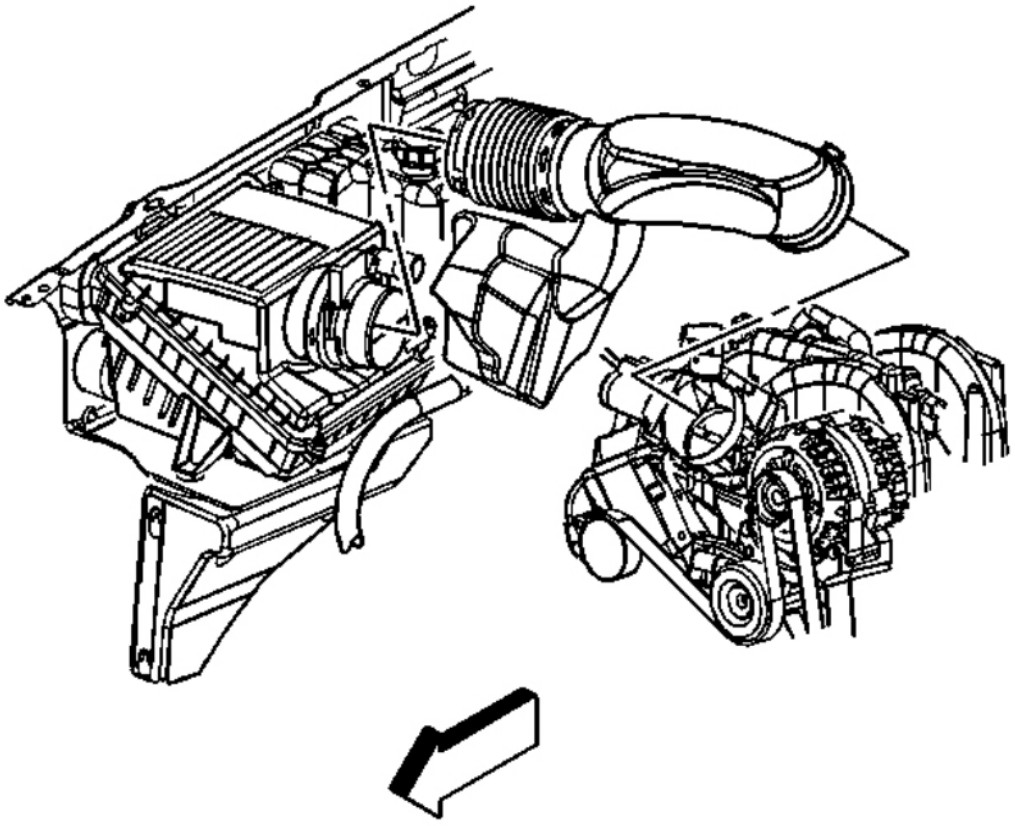


Fig. 193: View Of Air Cleaner Outlet Duct
Courtesy of GENERAL MOTORS CORP.

11. Install the air cleaner outlet duct.
12. Tighten the air cleaner outlet duct clamp at the throttle body.

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

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

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

FAN SHROUD REPLACEMENT - LOWER

Removal Procedure

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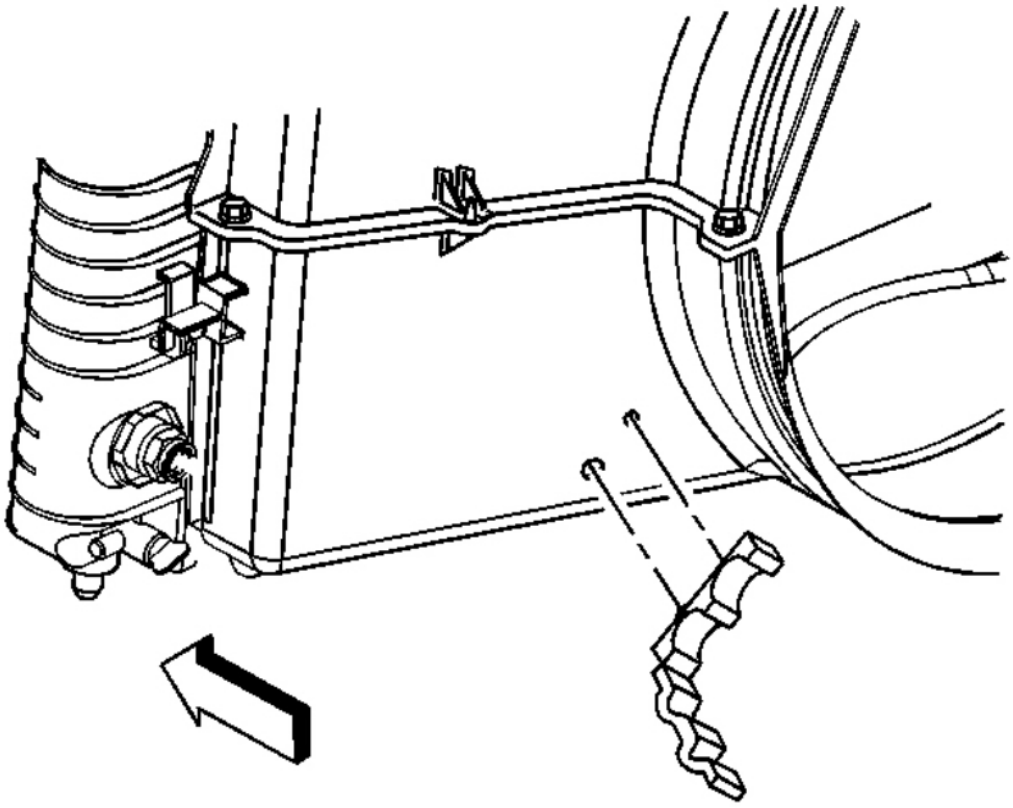


Fig. 194: View Of Oil Cooler Hose Clip
Courtesy of GENERAL MOTORS CORP.

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

Installation Procedure

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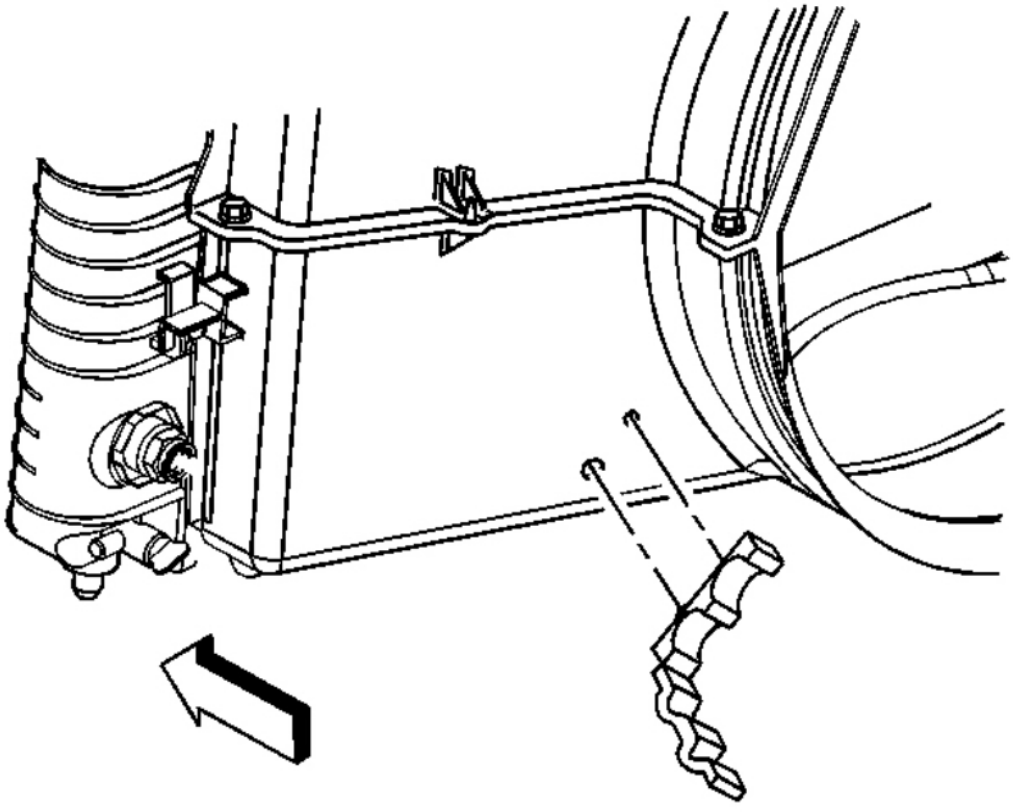


Fig. 195: View Of Oil Cooler Hose Clip
Courtesy of GENERAL MOTORS CORP.

1. Install the lower fan shroud to the retaining clips on the radiator and firmly push down.
2. If equipped with the engine oil cooler, install the oil cooler hose clip to the lower fan shroud.
3. Install the cooling fan. Refer to **Fan Replacement**.

RADIATOR REPLACEMENT (EXC 8.1L)

Removal Procedure

1. Drain the cooling system. Refer to **Draining and Filling Cooling System**.

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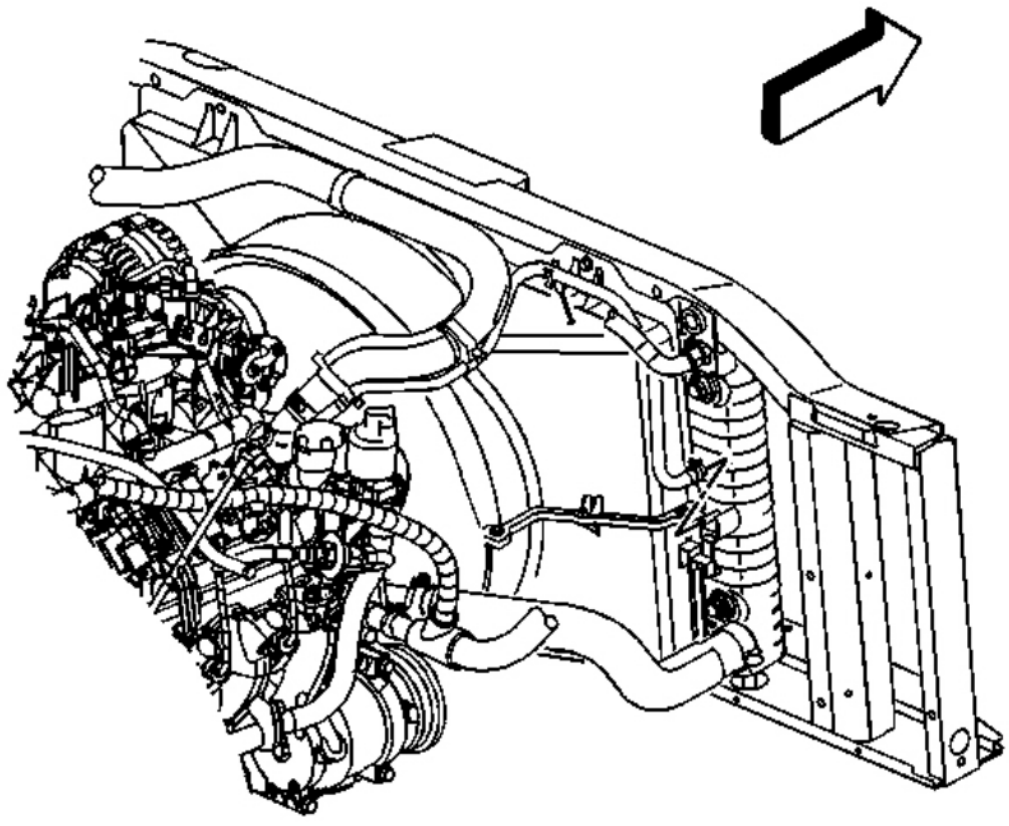


Fig. 196: View Of Inlet Hose At Radiator
Courtesy of GENERAL MOTORS CORP.

2. Position the inlet hose clamp from the radiator.
3. Remove the inlet hose from the radiator.
4. Position the outlet hose clamp from the radiator.
5. Remove the radiator outlet hose from the radiator.
6. Remove the lower fan shroud. Refer to **Fan Shroud Replacement - Lower**.

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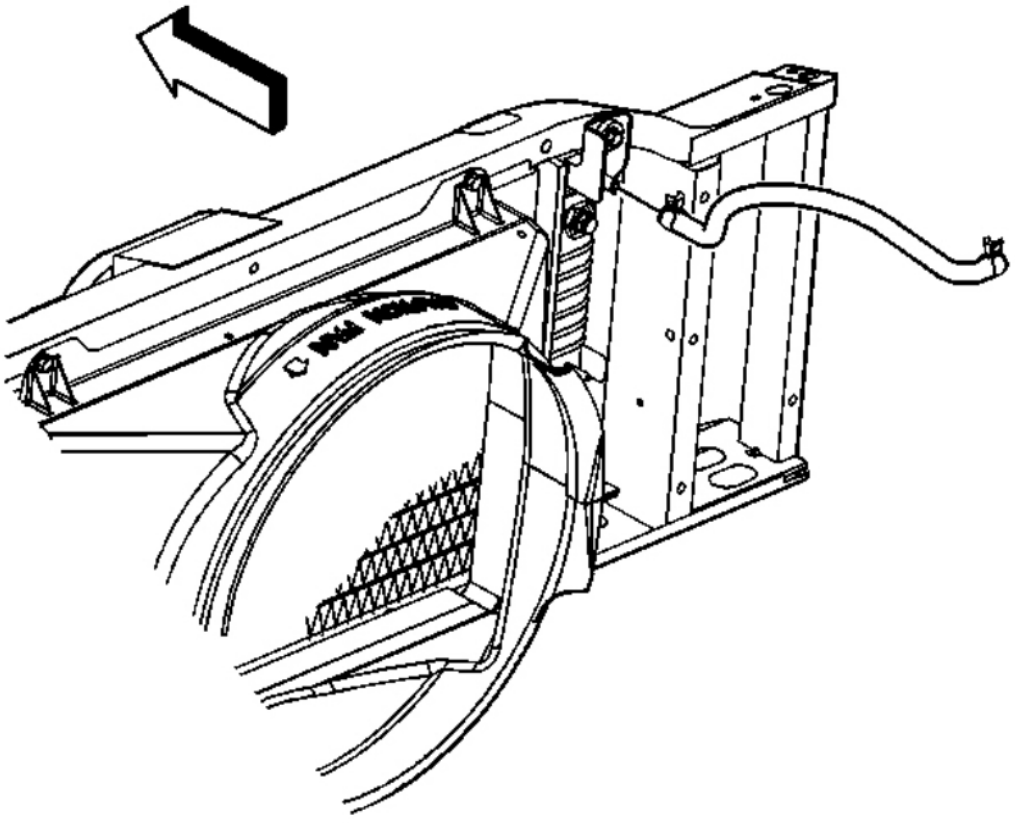


Fig. 197: View Of Surge Tank Inlet Hose & Radiator
Courtesy of GENERAL MOTORS CORP.

7. Position the radiator vent inlet hose clamp from the radiator.
8. Remove the vent inlet hose from the radiator.
9. Remove the engine oil cooler lines from the radiator. Refer to **Engine Oil Cooler Pipe/Hose Quick Connect Fitting**.
10. Remove the transmission oil cooler lines from the radiator. Refer to **Transmission Fluid Cooler Line Quick Connect Fitting** in Transmission 4L80E or **Transmission Fluid Cooler Line Quick Connect Fitting** in Transmission 4L60E.

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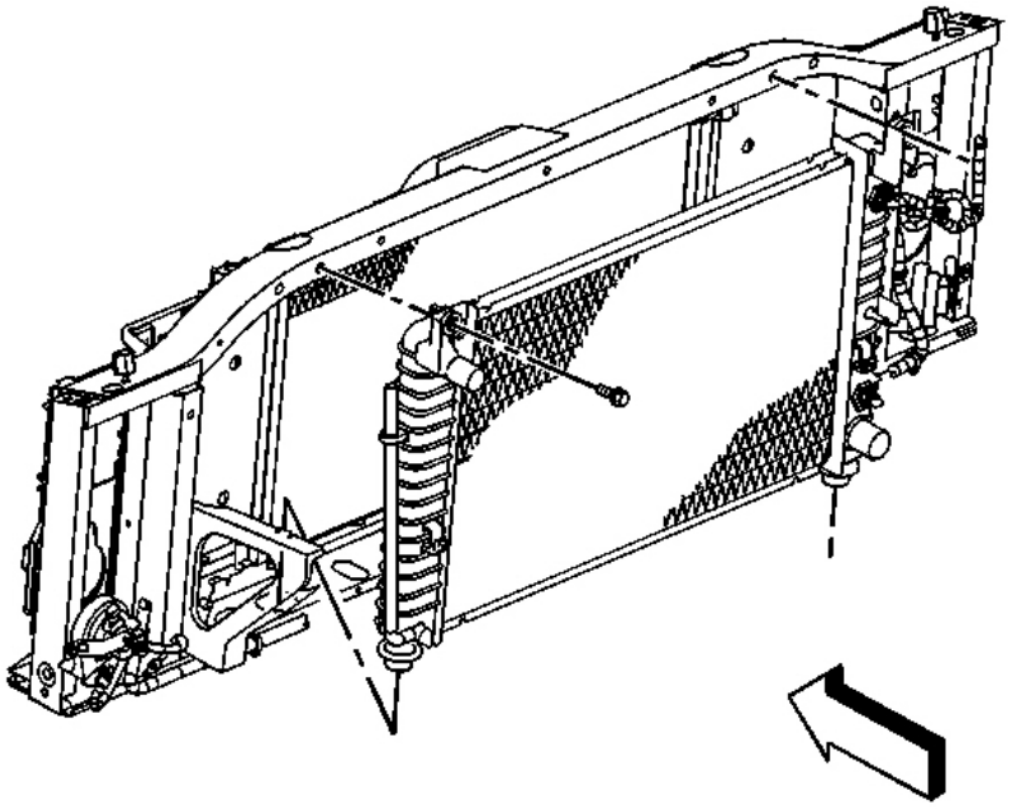


Fig. 198: View Of Radiator & Bolts
Courtesy of GENERAL MOTORS CORP.

11. Remove the radiator bolts.
12. Remove the radiator from the vehicle.

Installation Procedure

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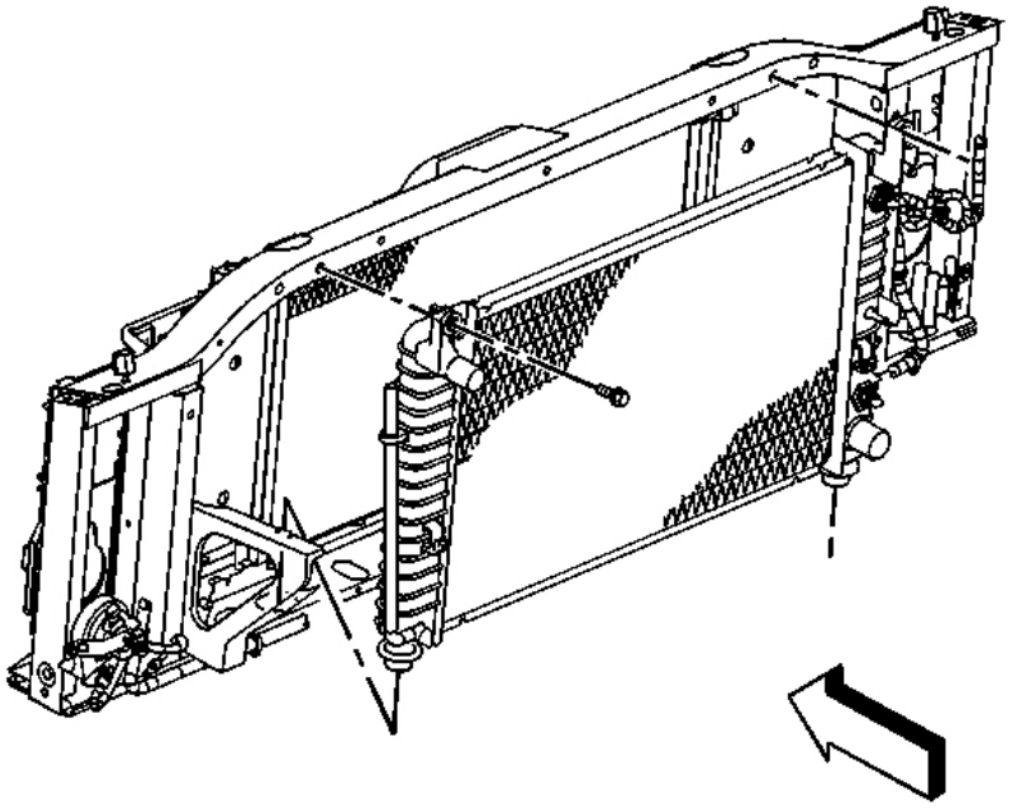


Fig. 199: View Of Radiator & Bolts
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice in Cautions and Notices.

1. Install the radiator to the vehicle.
2. Install the radiator bolts.

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

3. Install the engine oil cooler lines to the radiator. Refer to **Engine Oil Cooler Pipe/Hose Quick Connect Fitting**.
4. Install the transmission oil cooler lines to the radiator. Refer to **Transmission Fluid Cooler Line Quick Connect Fitting** in Transmission 4L80E or **Transmission Fluid Cooler Line Quick Connect Fitting** in Transmission 4L60E.

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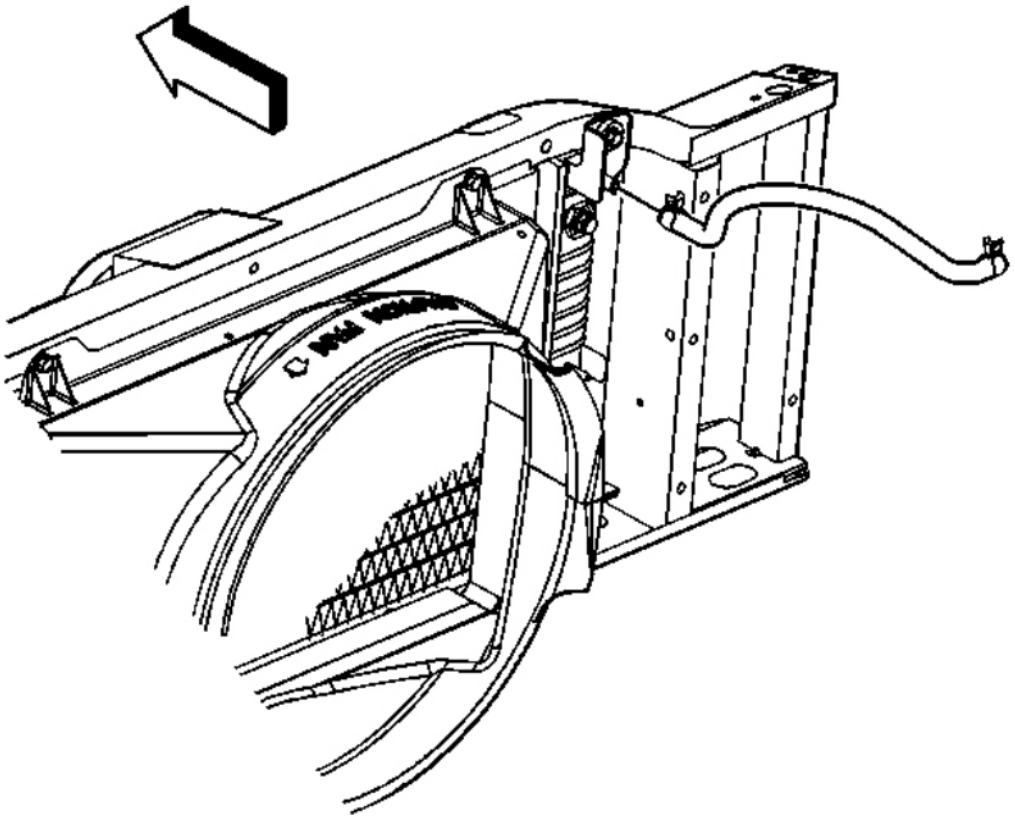


Fig. 200: View Of Surge Tank Inlet Hose & Radiator
Courtesy of GENERAL MOTORS CORP.

5. Install the radiator vent inlet hose to the radiator.
6. Reposition the radiator vent inlet hose clamp to the radiator.
7. Install the lower fan shroud. Refer to **Fan Shroud Replacement - Lower**.
8. Install the outlet hose to the radiator.
9. Reposition the outlet hose clamp to the radiator.
10. Install the inlet hose to the radiator.
11. Reposition the inlet hose clamp to the radiator.
12. Fill the cooling system. Refer to **Draining and Filling Cooling System**.

RADIATOR REPLACEMENT (8.1L)

Removal Procedure

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1. Drain the cooling system. Refer to **Draining and Filling Cooling System**.

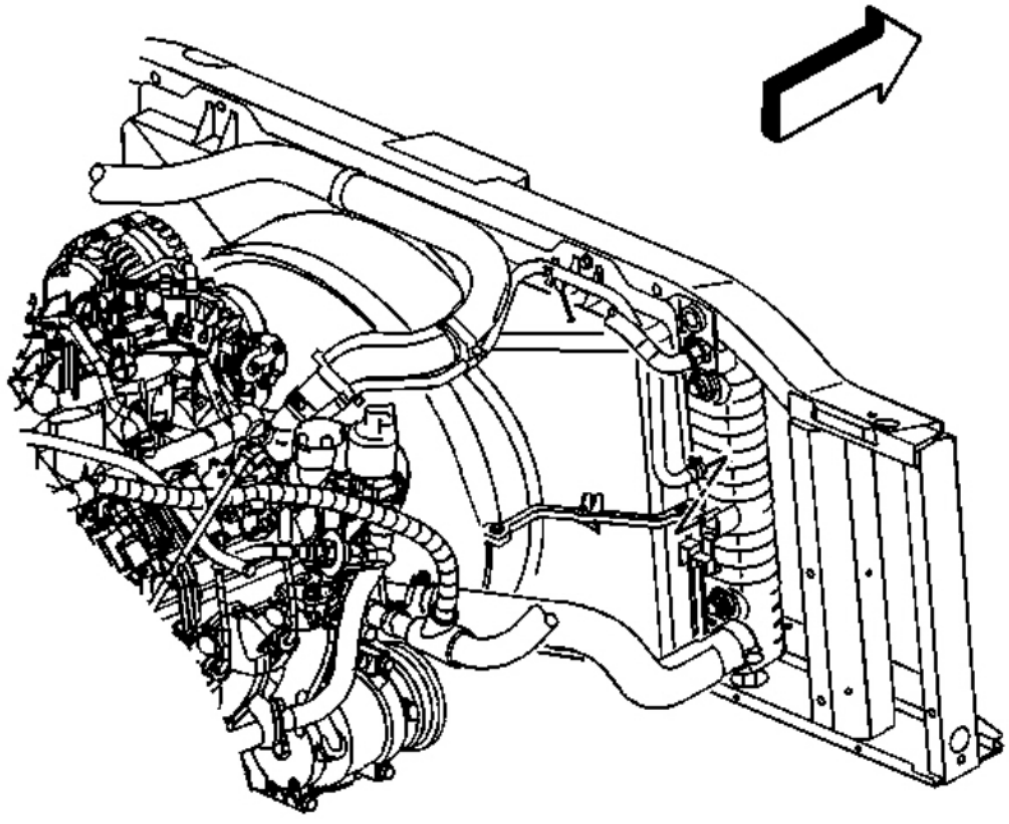


Fig. 201: View Of Inlet Hose At Radiator
Courtesy of GENERAL MOTORS CORP.

2. Reposition the inlet hose clamp from the radiator.
3. Remove the inlet hose from the radiator.
4. Remove the radiator outlet hose from the radiator. Refer to **Radiator Hose Quick Connect Fitting**.
5. Remove the lower fan shroud. Refer to **Fan Shroud Replacement - Lower**.

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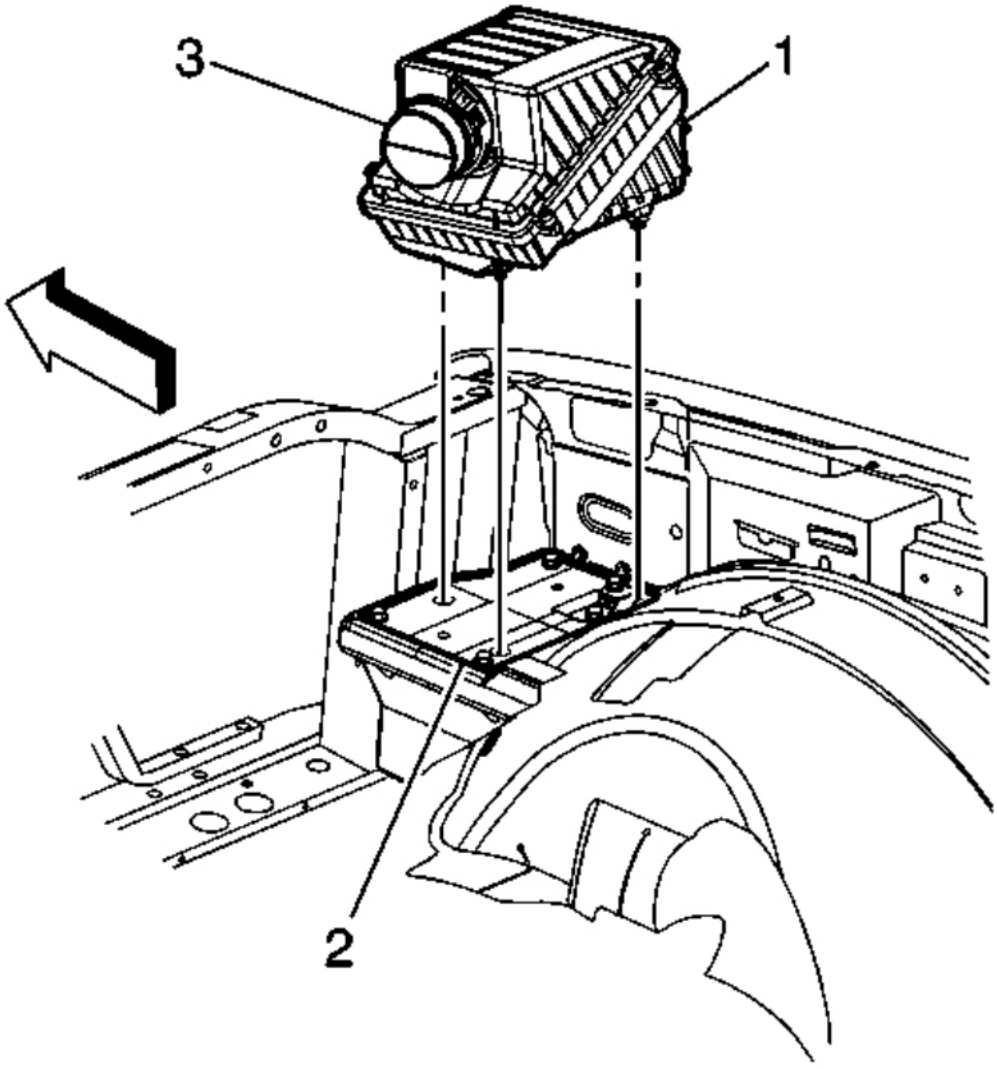


Fig. 202: View Of Air Cleaner Adapter
Courtesy of GENERAL MOTORS CORP.

6. Remove the air cleaner assembly. Refer to **Air Cleaner Assembly Replacement** in Engine Controls - 8.1L.
7. Remove the push pin from the air cleaner adapter (2).
8. Remove the bolts from the air cleaner adapter (2).
9. Remove the air cleaner adapter (2) from the vehicle.

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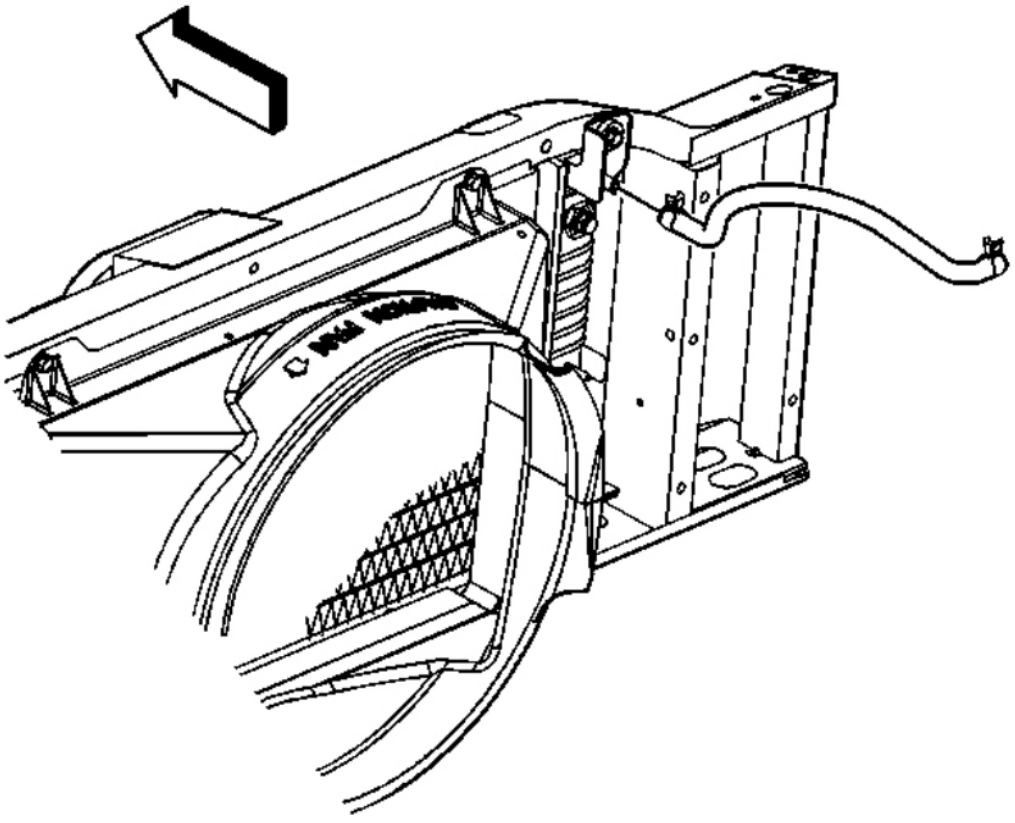


Fig. 203: View Of Surge Tank Inlet Hose & Radiator
Courtesy of GENERAL MOTORS CORP.

10. Position the radiator vent inlet hose clamp from the radiator.
11. Remove the vent inlet hose from the radiator.
12. Remove the engine oil cooler lines from the radiator. Refer to **Engine Oil Cooler Pipe/Hose Quick Connect Fitting**.
13. Remove the transmission oil cooler lines from the radiator. Refer to **Transmission Fluid Cooler Line Quick Connect Fitting** in Automatic Transmission - 4L80-E/4L85-E.

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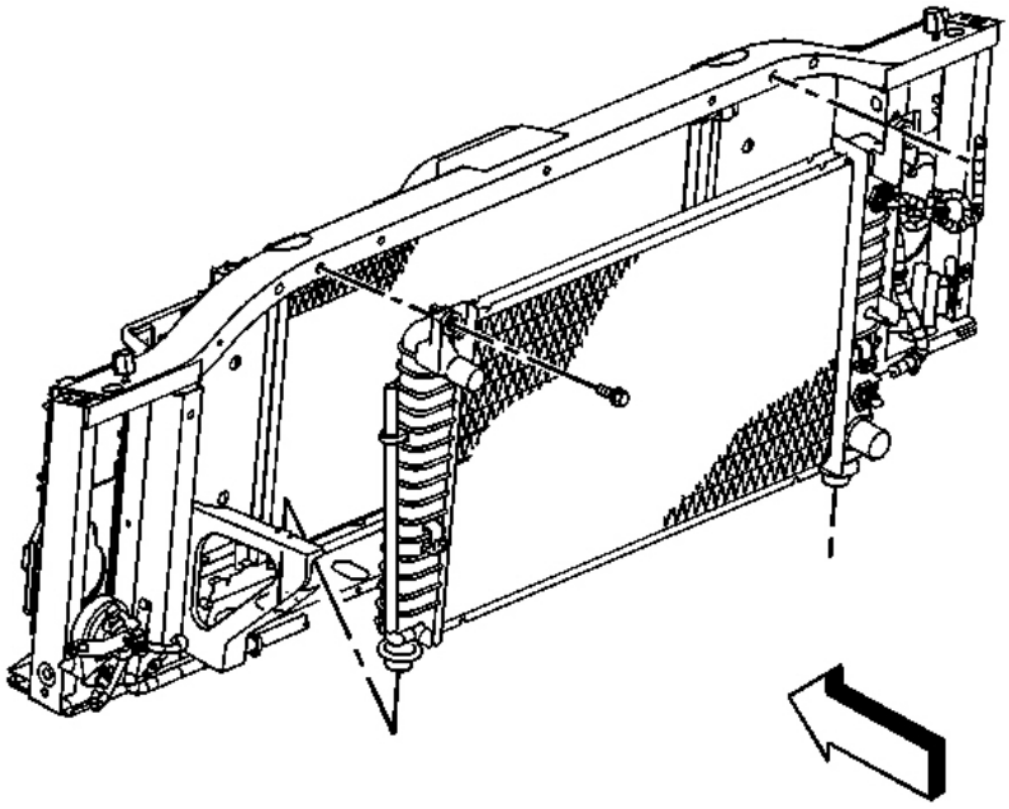


Fig. 204: View Of Radiator & Bolts
Courtesy of GENERAL MOTORS CORP.

14. Remove the radiator bolts.
15. Remove the radiator from the vehicle.

Installation Procedure

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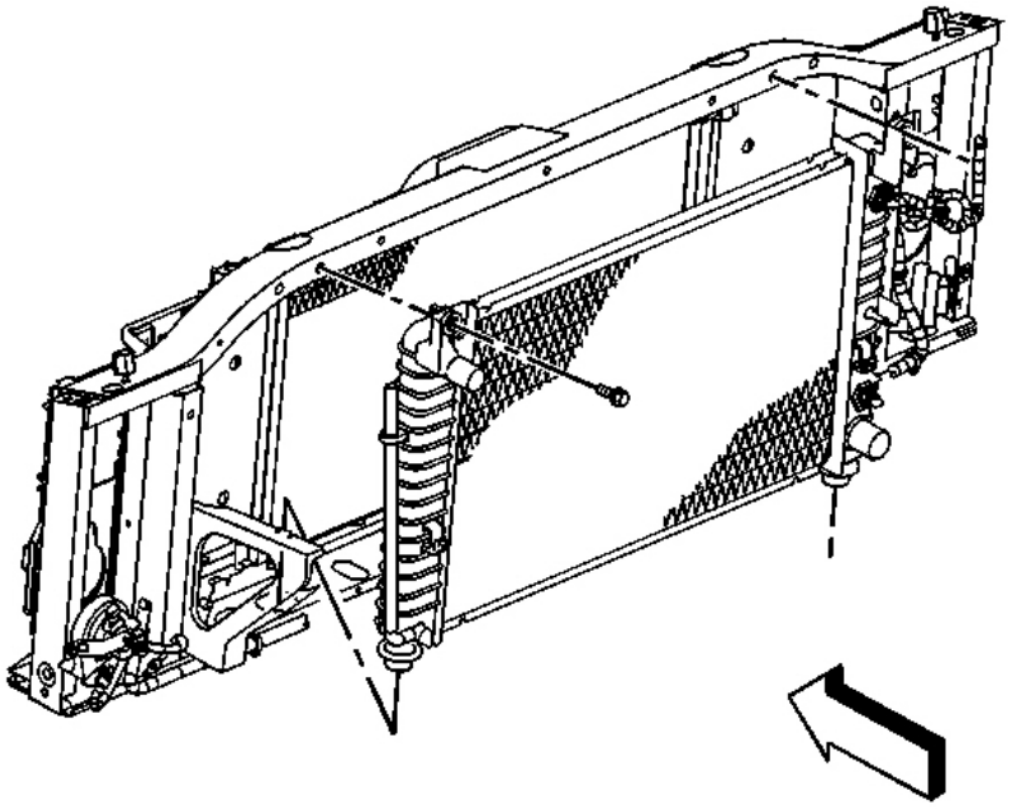


Fig. 205: View Of Radiator & Bolts
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice in Cautions and Notices.

1. Install the radiator to the vehicle.
2. Install the radiator bolts.

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

3. Install the engine oil cooler lines to the radiator. Refer to **Engine Oil Cooler Pipe/Hose Quick Connect Fitting**.
4. Install the transmission oil cooler lines to the radiator. Refer to **Transmission Fluid Cooler Line Quick Connect Fitting** in Automatic Transmission - 4L80-E/4L85-E.

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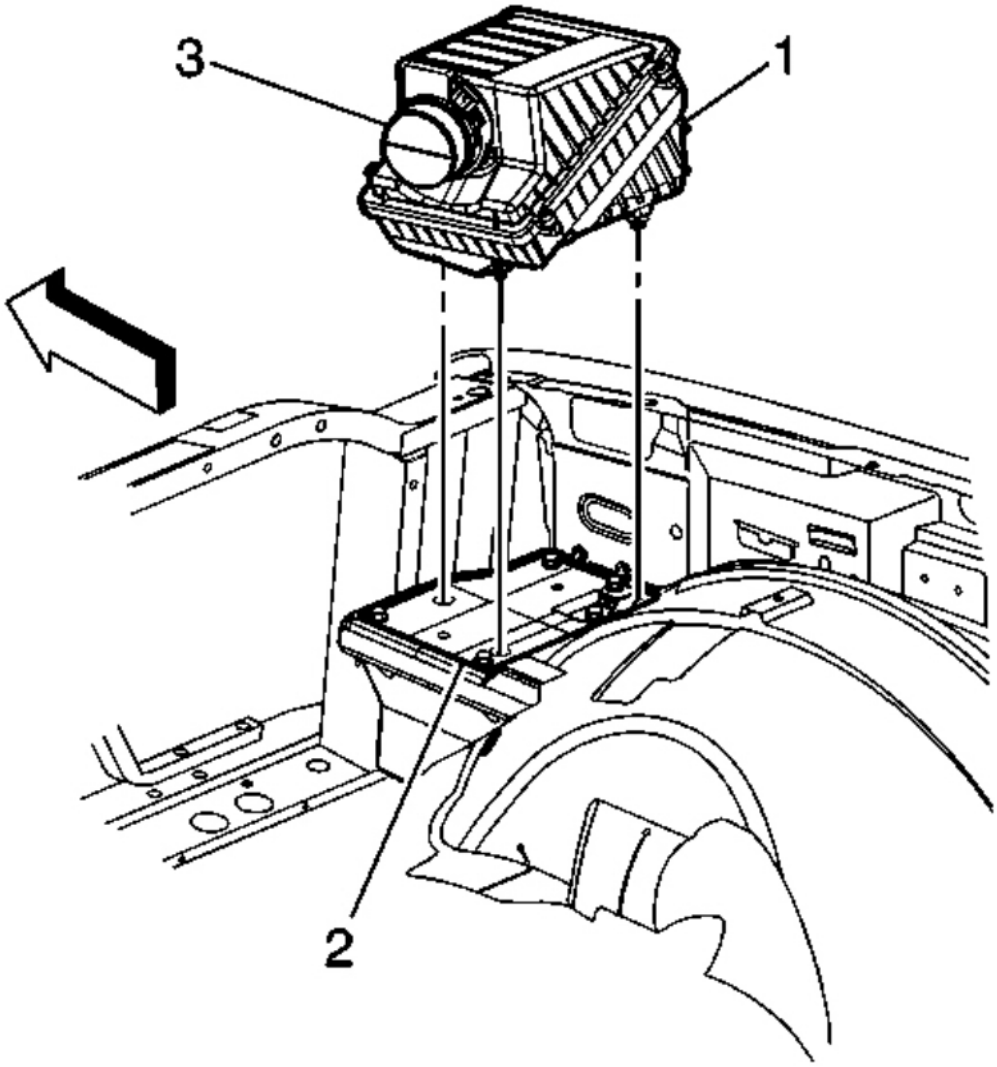


Fig. 206: View Of Air Cleaner Adapter
Courtesy of GENERAL MOTORS CORP.

5. Install the air cleaner adapter (2) to the vehicle.
6. Install the bolts to the air cleaner adapter (2).

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

7. Install the push pin to the air cleaner adapter (2).

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8. Install the air cleaner assembly. Refer to **Air Cleaner Assembly Replacement** in Engine Controls - 8.1L.

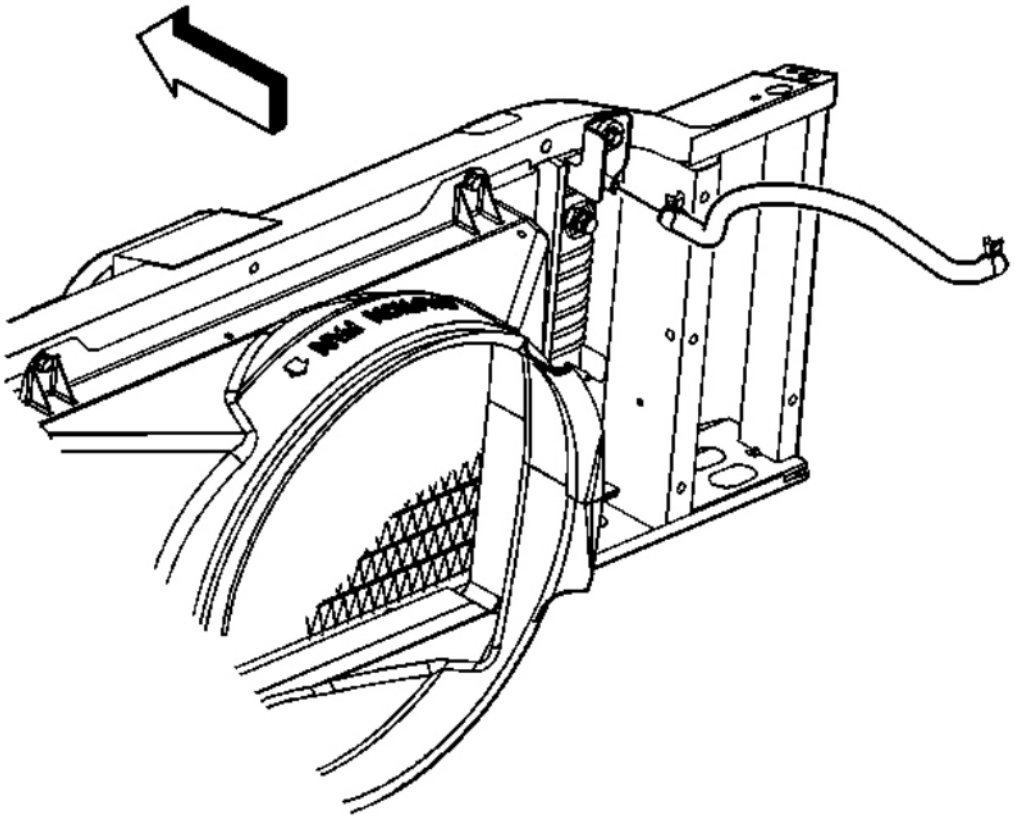


Fig. 207: View Of Surge Tank Inlet Hose & Radiator
Courtesy of GENERAL MOTORS CORP.

9. Install the radiator vent inlet hose to the radiator.
10. Reposition the radiator vent inlet hose clamp to the radiator.
11. Install the lower fan shroud. Refer to **Fan Shroud Replacement - Lower**.
12. Install the outlet hose to the radiator. Refer to **Radiator Hose Quick Connect Fitting**.
13. Install the inlet hose to the radiator.
14. Reposition the inlet hose clamp to the radiator.
15. Fill the cooling system. Refer to **Draining and Filling Cooling System**.

RADIATOR AIR BAFFLE AND DEFLECTOR REPLACEMENT - SIDE

Removal Procedure

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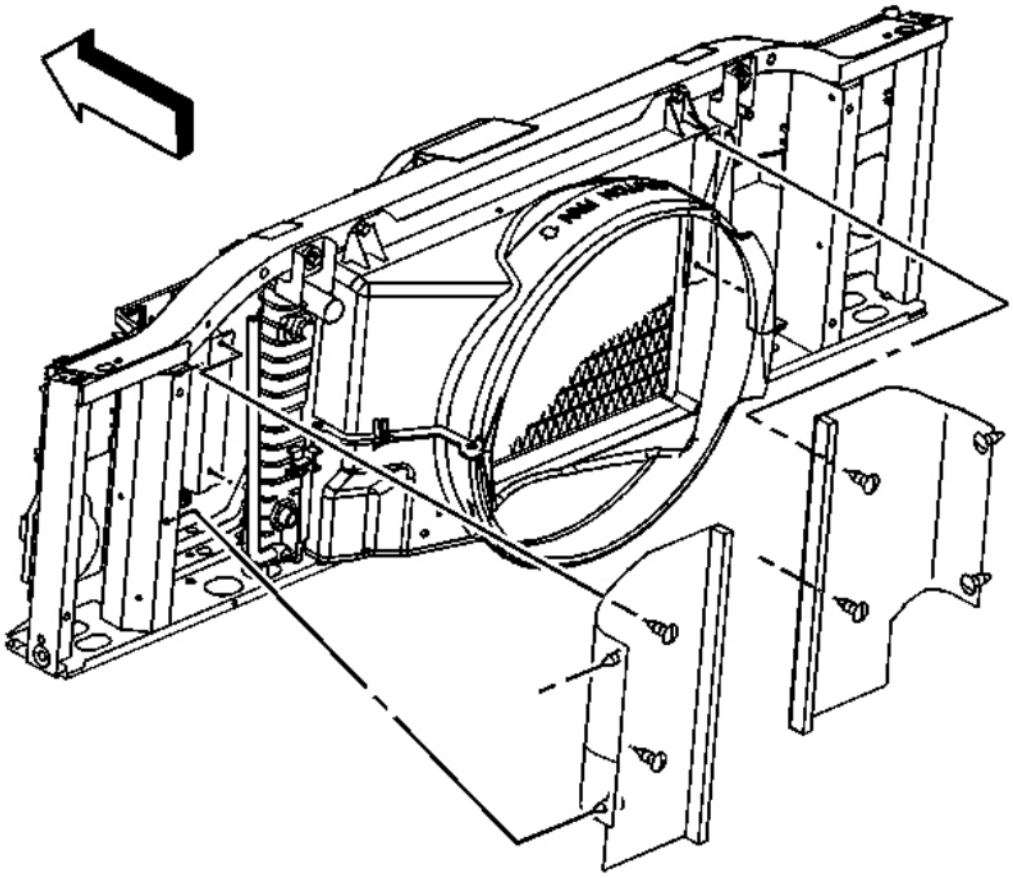


Fig. 208: View Of Side Radiator Air Baffles & Retainers
Courtesy of GENERAL MOTORS CORP.

1. Remove the radiator. Refer to **Radiator Replacement (EXC 8.1L)** or **Radiator Replacement (8.1L)**.
2. Remove the radiator air baffle retainers.
3. Remove the radiator air baffles.

Installation Procedure

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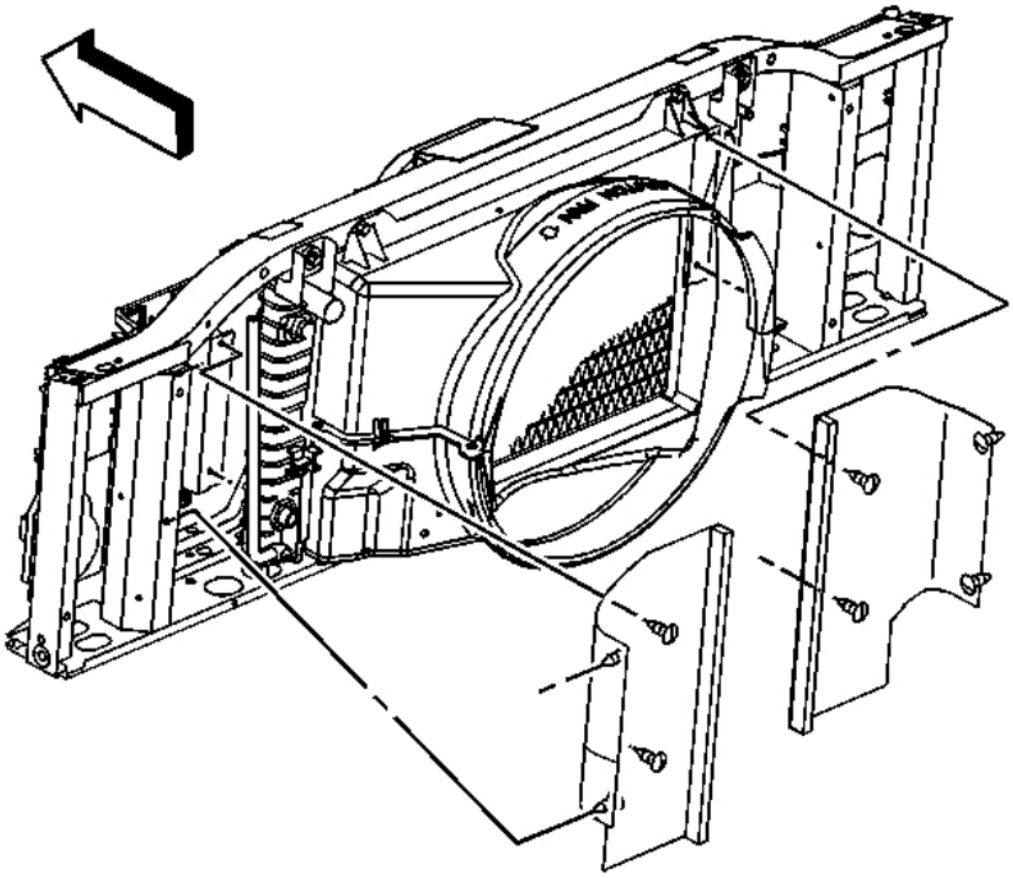


Fig. 209: View Of Side Radiator Air Baffles & Retainers
Courtesy of GENERAL MOTORS CORP.

1. Install the radiator air baffles.
2. Install the radiator air baffle retainers.
3. Install the radiator. Refer to **Radiator Replacement (EXC 8.1L)** or **Radiator Replacement (8.1L)**.

RADIATOR AIR BAFFLE AND DEFLECTOR REPLACEMENT - UPPER

Removal Procedure

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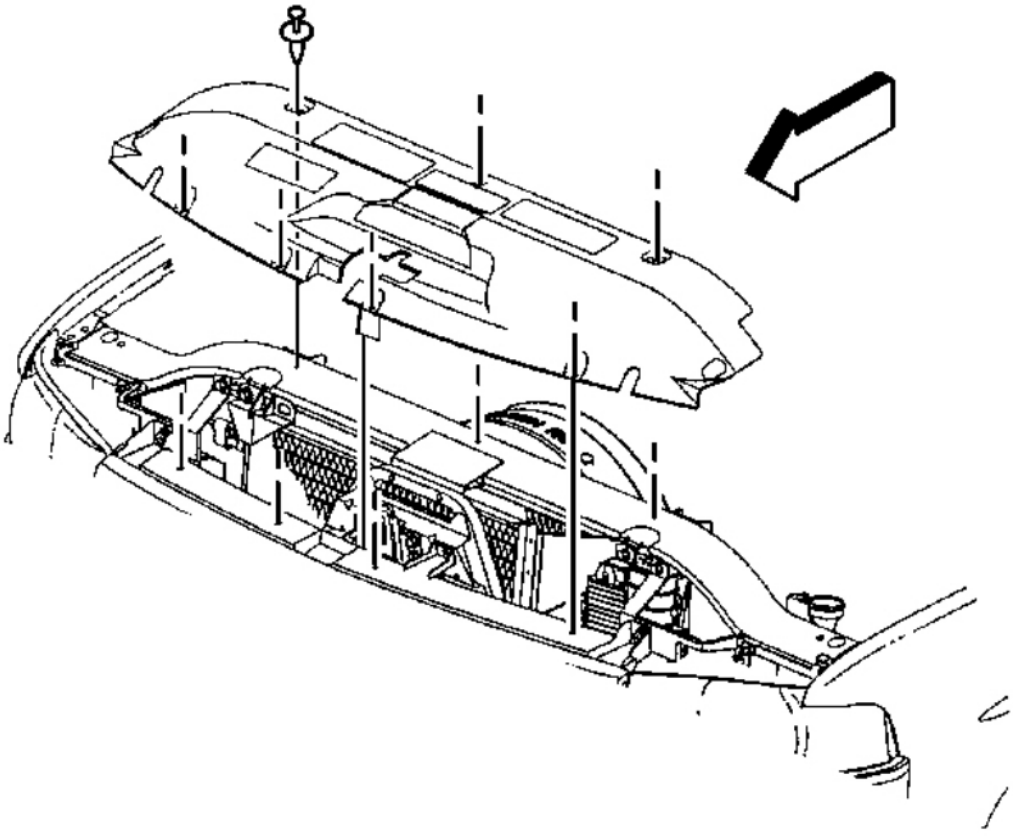


Fig. 210: View Of Upper Grille Baffle
Courtesy of GENERAL MOTORS CORP.

1. Remove the radiator air upper baffle retainers.
2. Remove the radiator air upper baffle.

Installation Procedure

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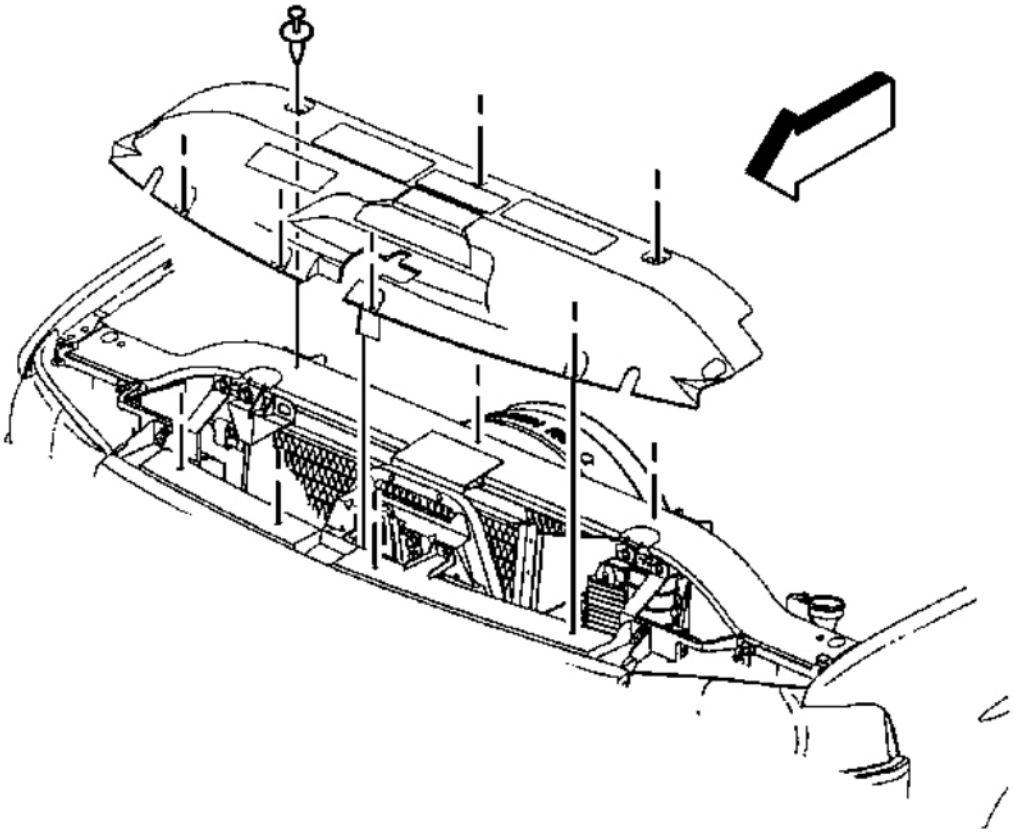


Fig. 211: View Of Upper Grille Baffle
Courtesy of GENERAL MOTORS CORP.

1. Install the radiator air upper baffle.
2. Install the radiator air upper baffle retainers.

COOLANT HEATER REPLACEMENT (DEALER INSTALLATION - 6.0L ENGINE)

Dealer Installation Only

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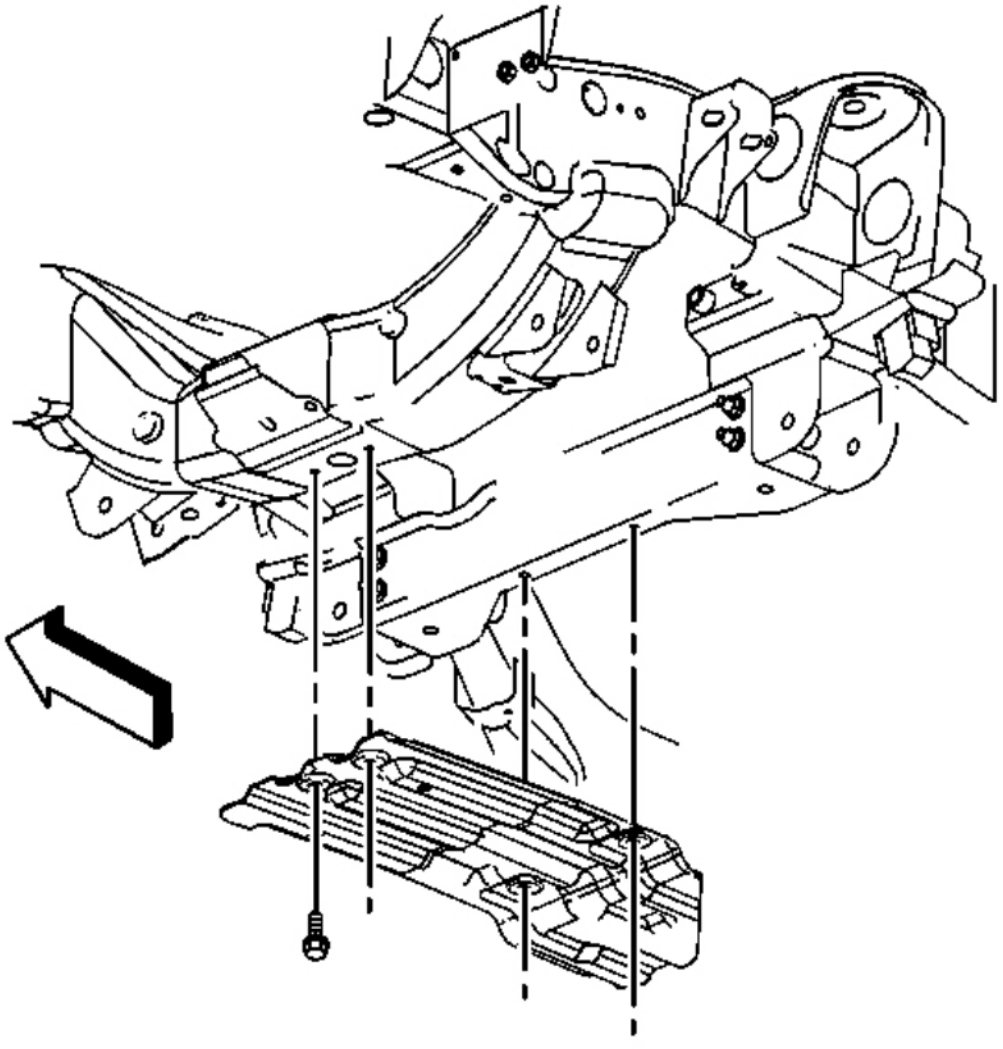


Fig. 212: Identifying Oil Pan Skid Plate
Courtesy of GENERAL MOTORS CORP.

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

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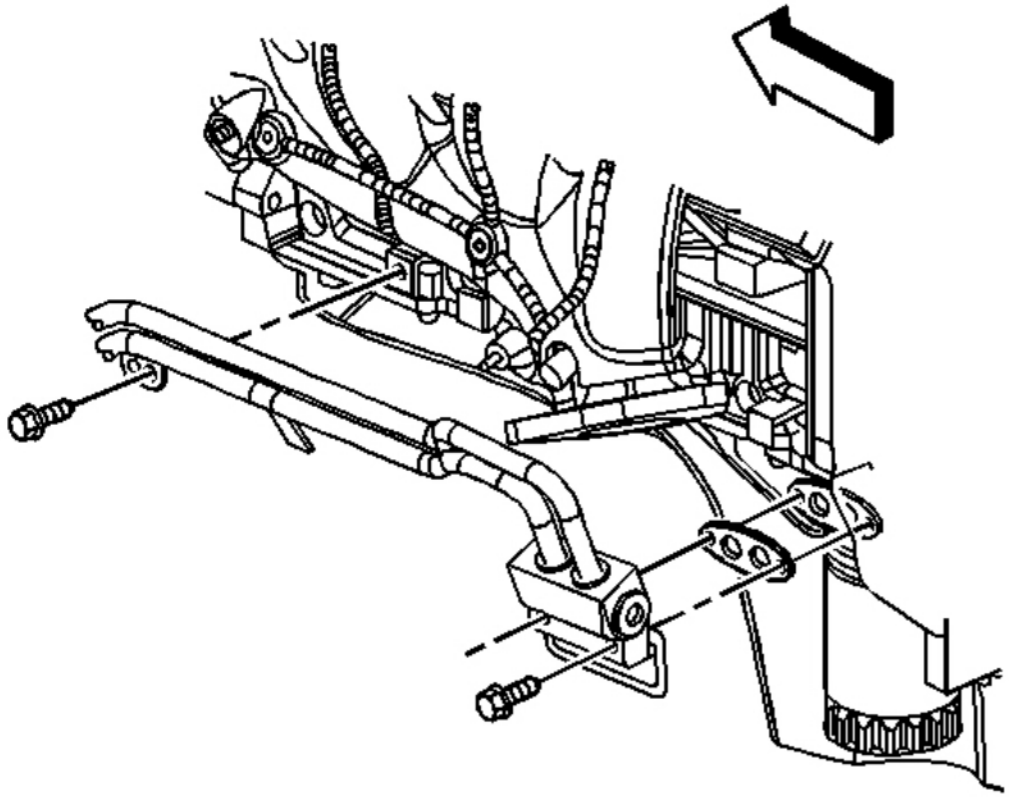


Fig. 213: View Of Oil Cooler Hose Adapter, Bolts & Gasket
Courtesy of GENERAL MOTORS CORP.

4. Remove the oil cooler hose bracket bolt.
5. Remove the oil cooler hose adapter bolts.
6. Remove and discard the oil cooler hose adapter gasket.
7. Position the oil cooler hose adapter end out of the way.

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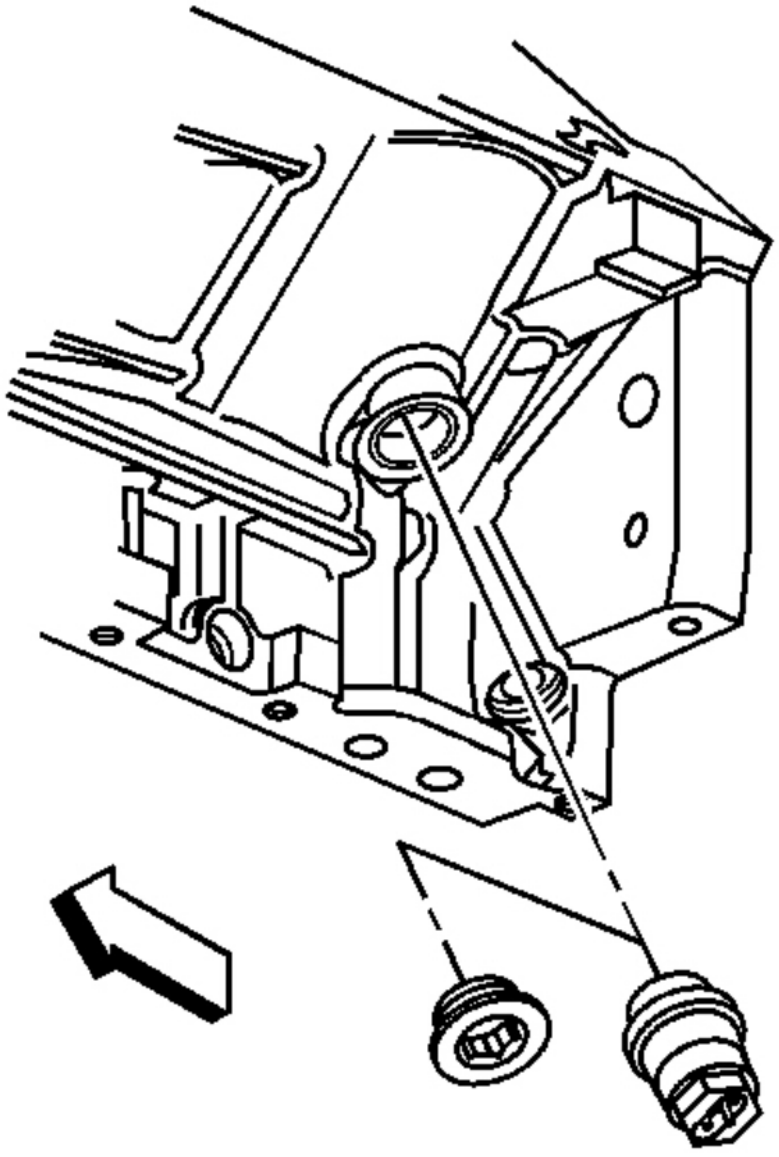


Fig. 214: Installing Coolant Heater In Place Of Drain Plug
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice in Cautions and Notices.

8. Install the coolant heater in place of the drain plug.

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

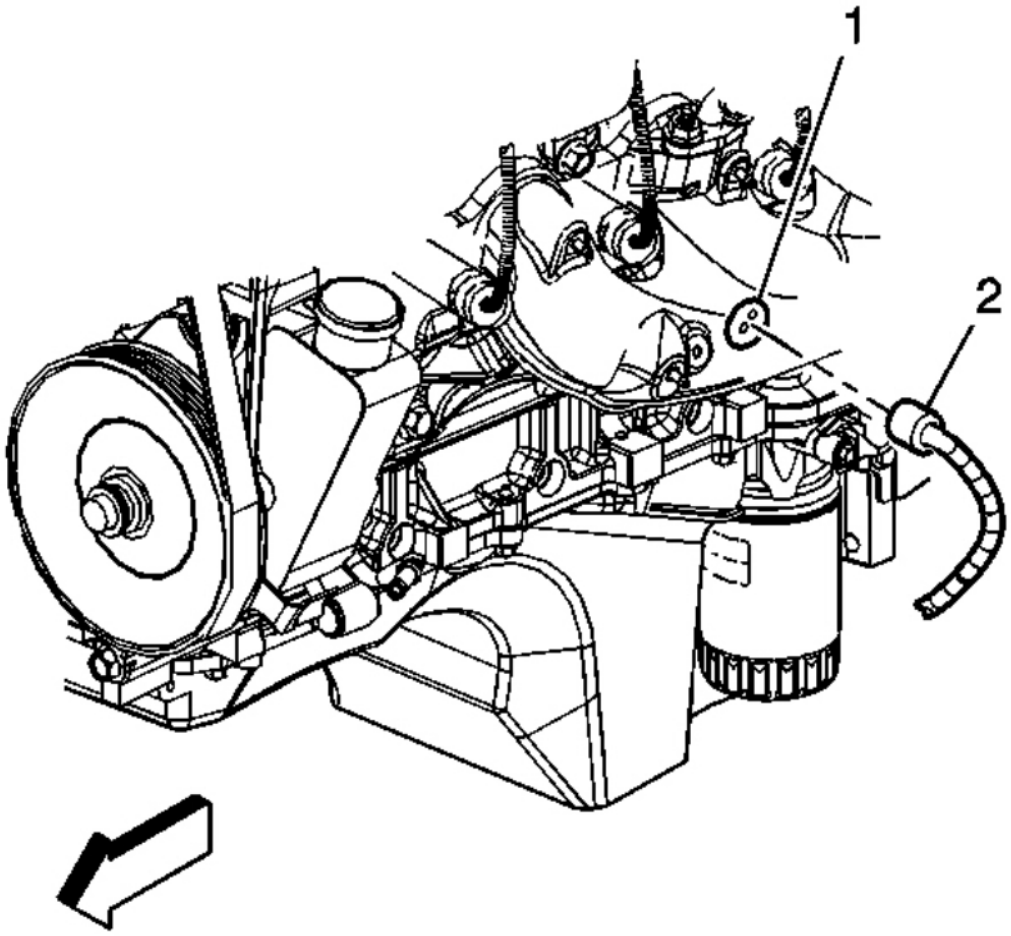


Fig. 215: Identifying Coolant Heater Cord & Electrical Connector
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: The engine coolant heater cord must not touch the engine, hot pipes, manifold, or any moving parts. Always keep the electrical cord neatly rolled up with the end of the cord tucked in the center of the coil and secured in place.

9. Push the engine coolant heater cord electrical connector (2) firmly into the coolant heater (1).

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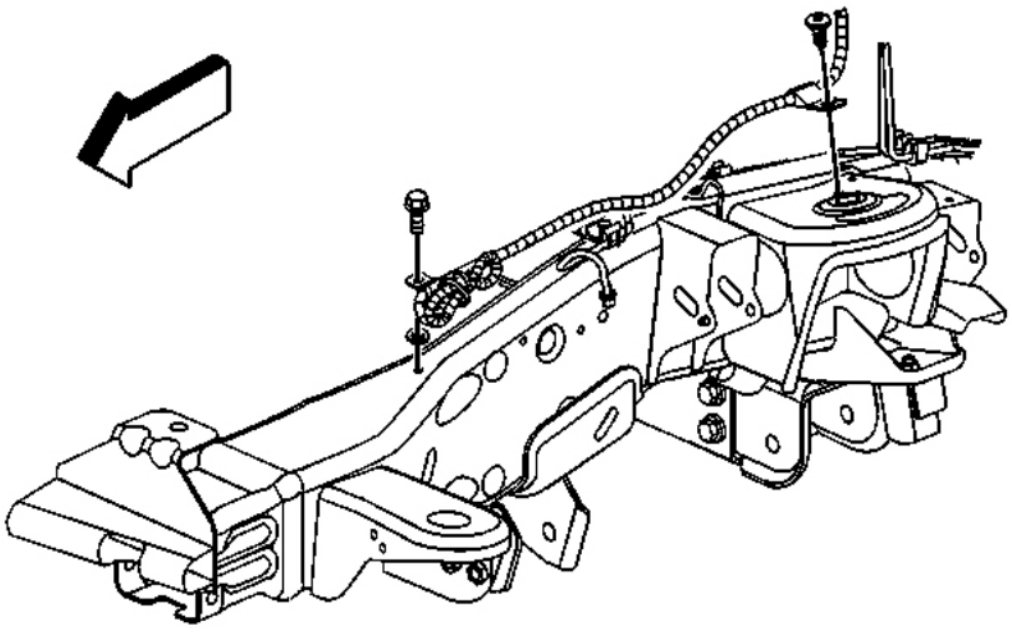


Fig. 216: View Of Coolant Heater Cord, Retainer & Bolts
Courtesy of GENERAL MOTORS CORP.

10. Place the cord into position.
11. Install the heater cord bolt and retainer.

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

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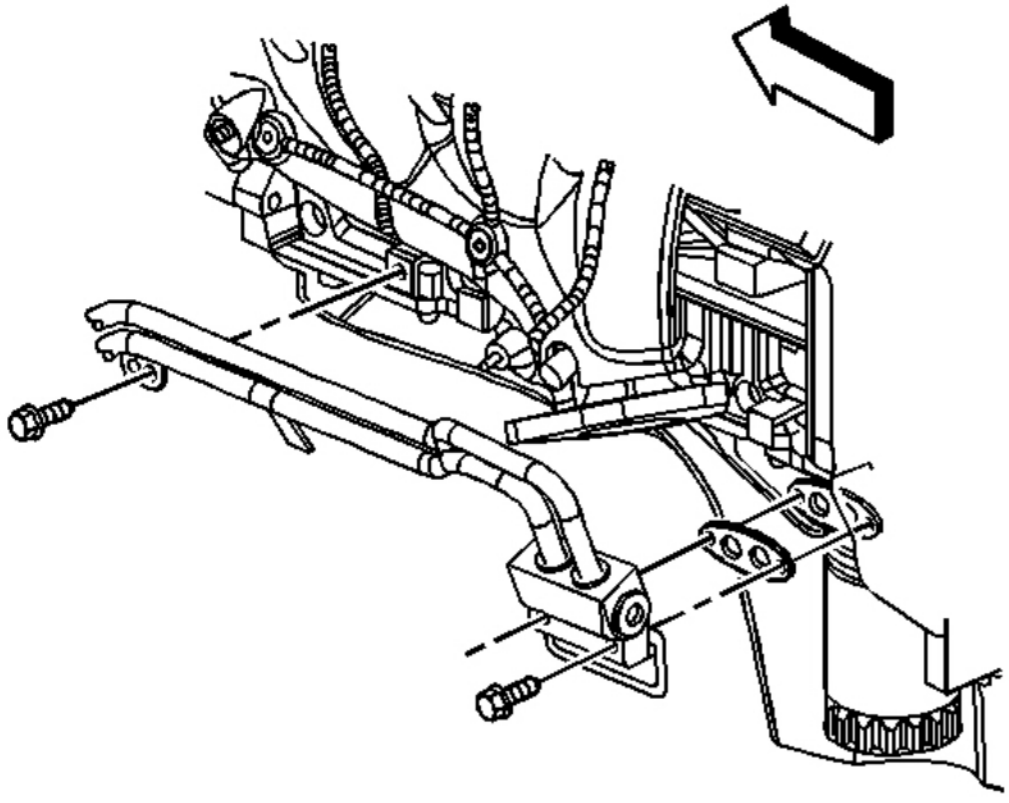


Fig. 217: View Of Oil Cooler Hose Adapter, Bolts & Gasket
Courtesy of GENERAL MOTORS CORP.

12. Position the oil cooler hose adapter.
13. Install a NEW oil cooler hose adapter gasket.
14. Install the oil cooler hose adapter bolts.

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

15. Install the oil cooler hose bracket bolt.

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

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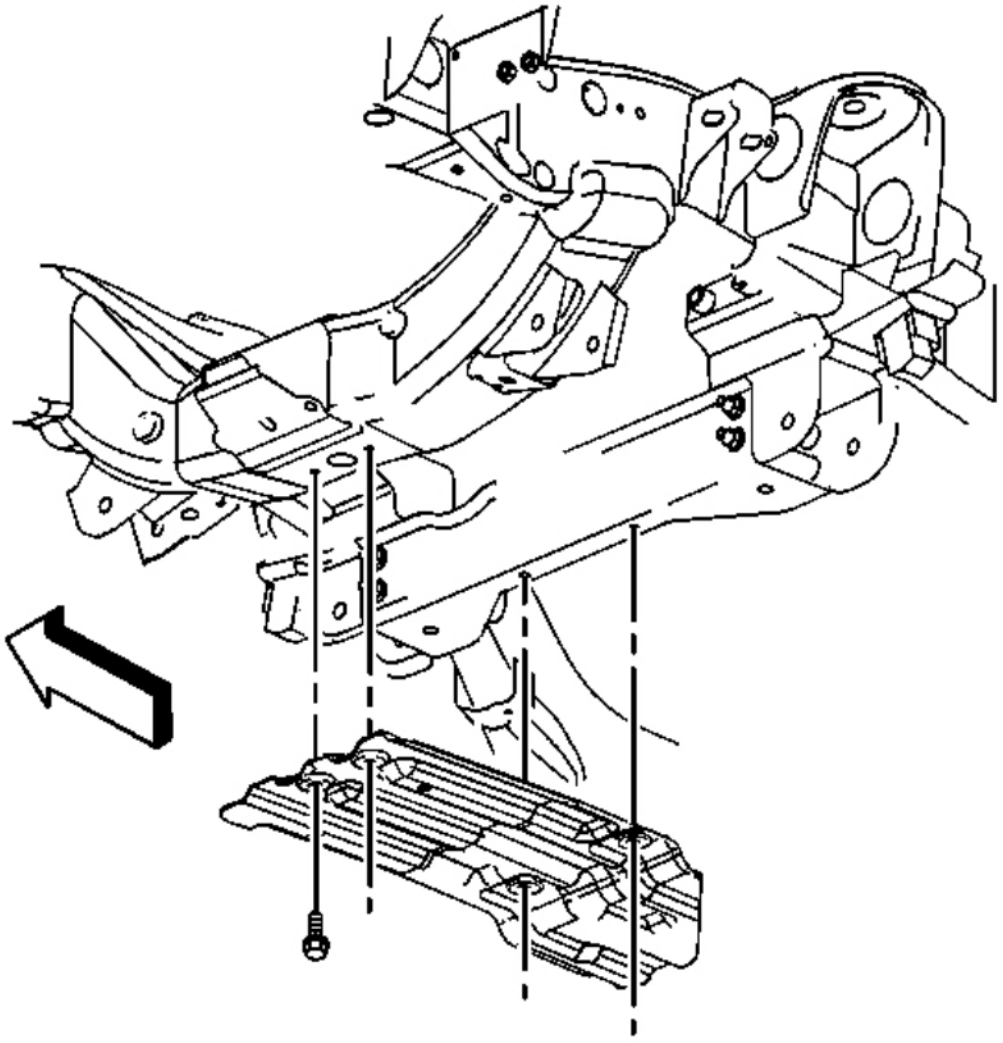


Fig. 218: Identifying Oil Pan Skid Plate
Courtesy of GENERAL MOTORS CORP.

16. Install the oil pan skid plate and bolts.

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

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

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COOLANT HEATER REPLACEMENT (4.8L, 5.3L, AND 6.0L ENGINES)

Removal Procedure

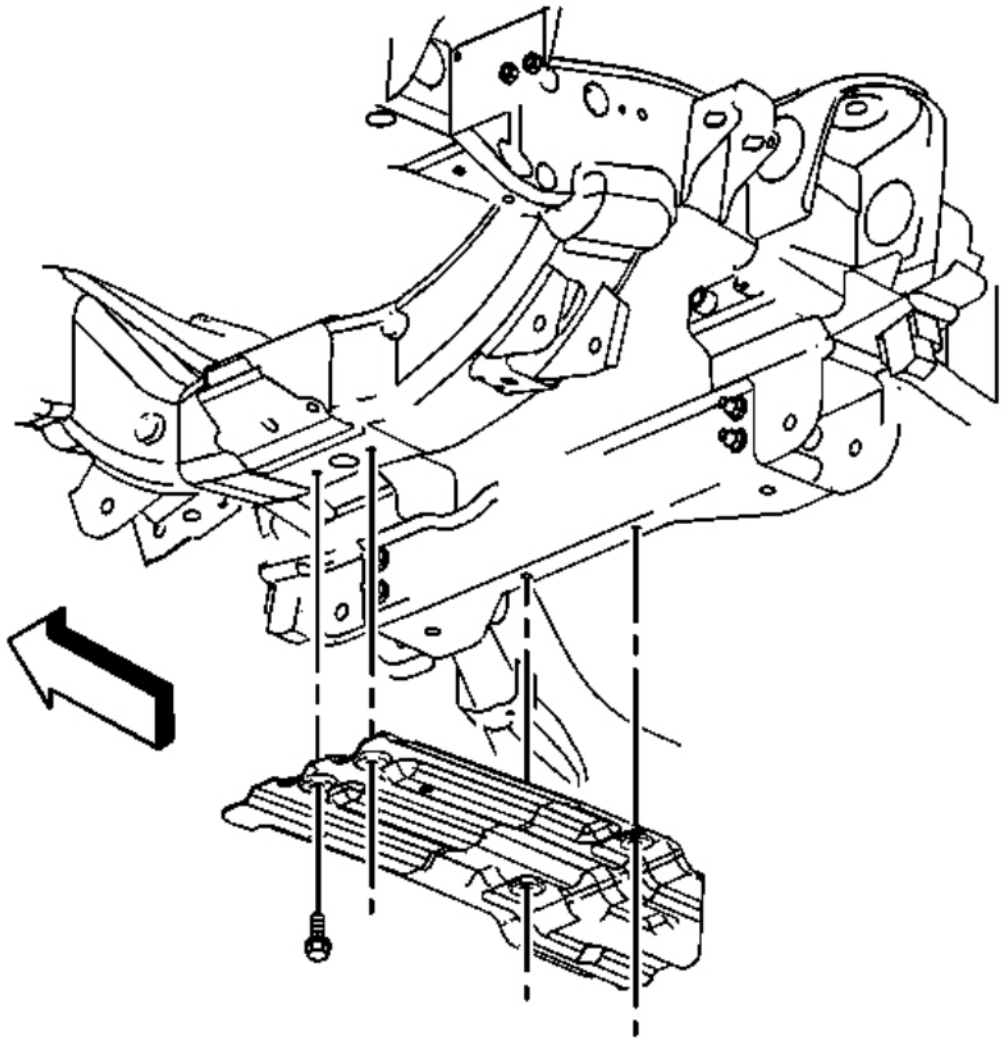


Fig. 219: Identifying Oil Pan Skid Plate
Courtesy of GENERAL MOTORS CORP.

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

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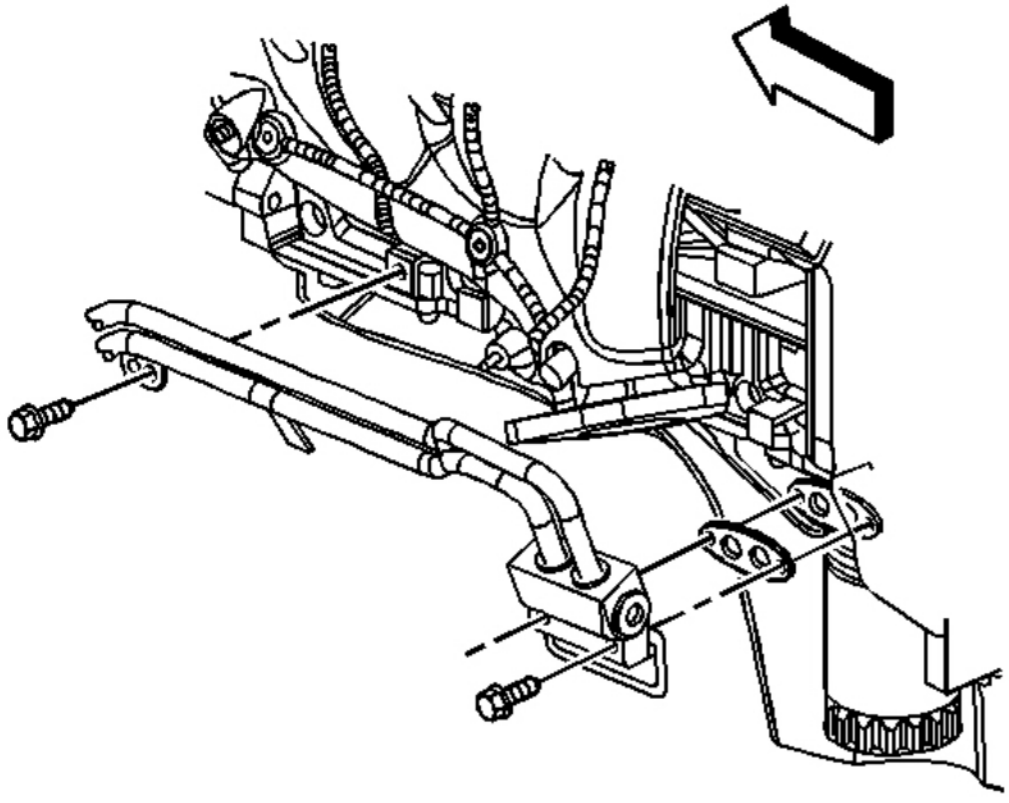


Fig. 220: View Of Oil Cooler Hose Adapter, Bolts & Gasket
Courtesy of GENERAL MOTORS CORP.

4. Remove the oil cooler hose bracket bolt.
5. Remove the oil cooler hose adapter bolts.
6. Remove and discard the oil cooler hose adapter gasket.
7. Position the oil cooler hose adapter end out of the way.

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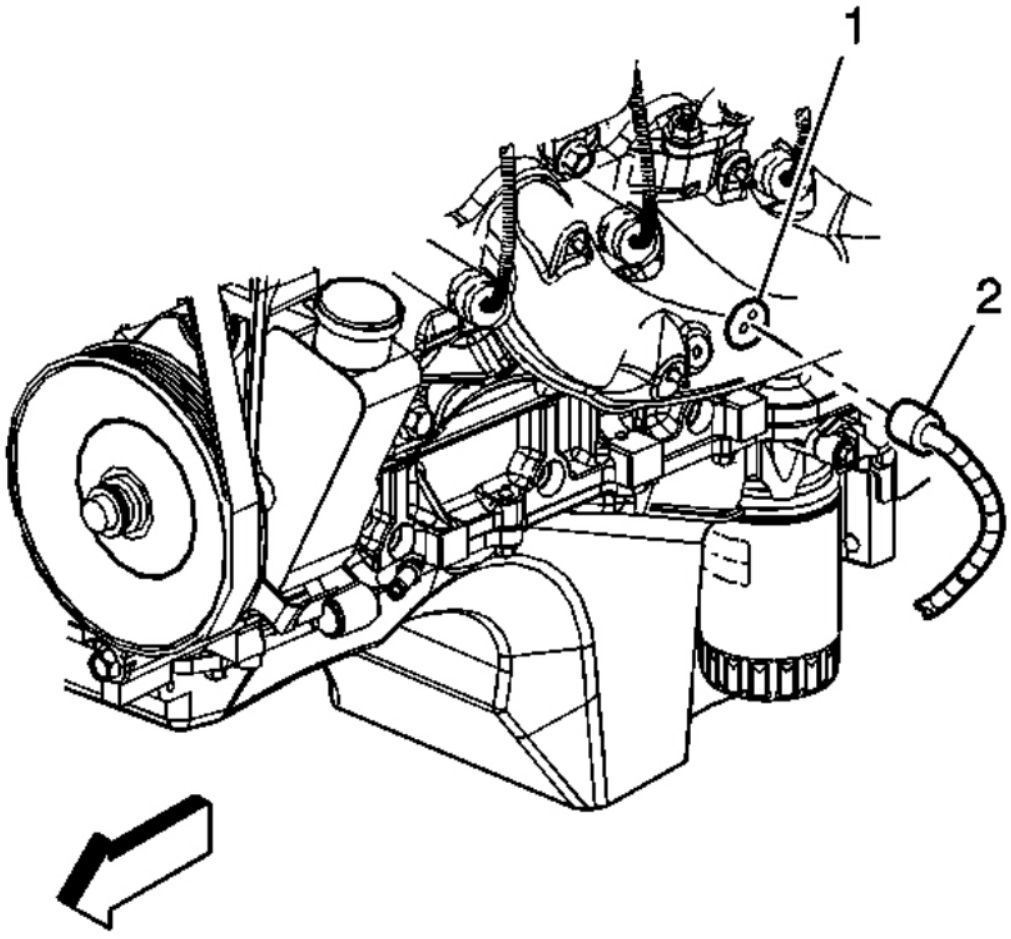


Fig. 221: Identifying Coolant Heater Cord & Electrical Connector
Courtesy of GENERAL MOTORS CORP.

8. Disconnect the coolant heater electrical connector (2).

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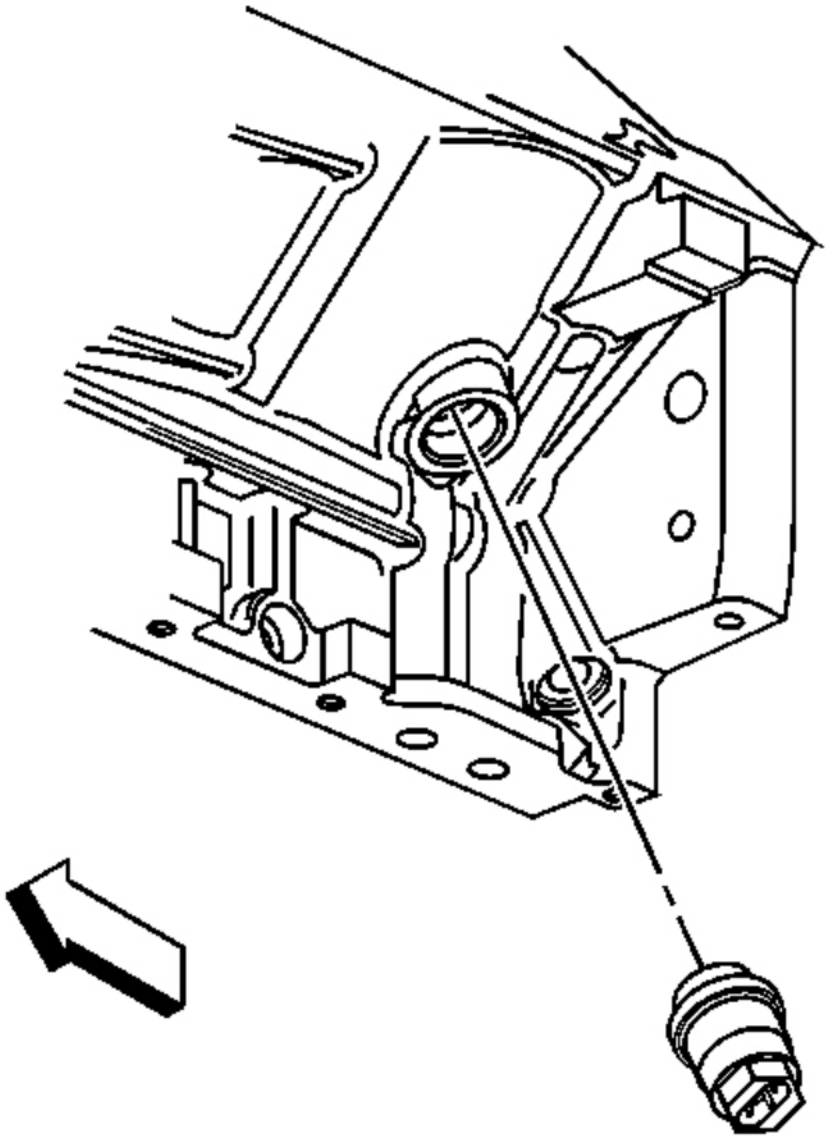


Fig. 222: View Of Coolant Heater At Engine Block (4.8L, 5.3L & 6.0L)
Courtesy of GENERAL MOTORS CORP.

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

9. Remove the coolant heater from the engine block.

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

Installation Procedure

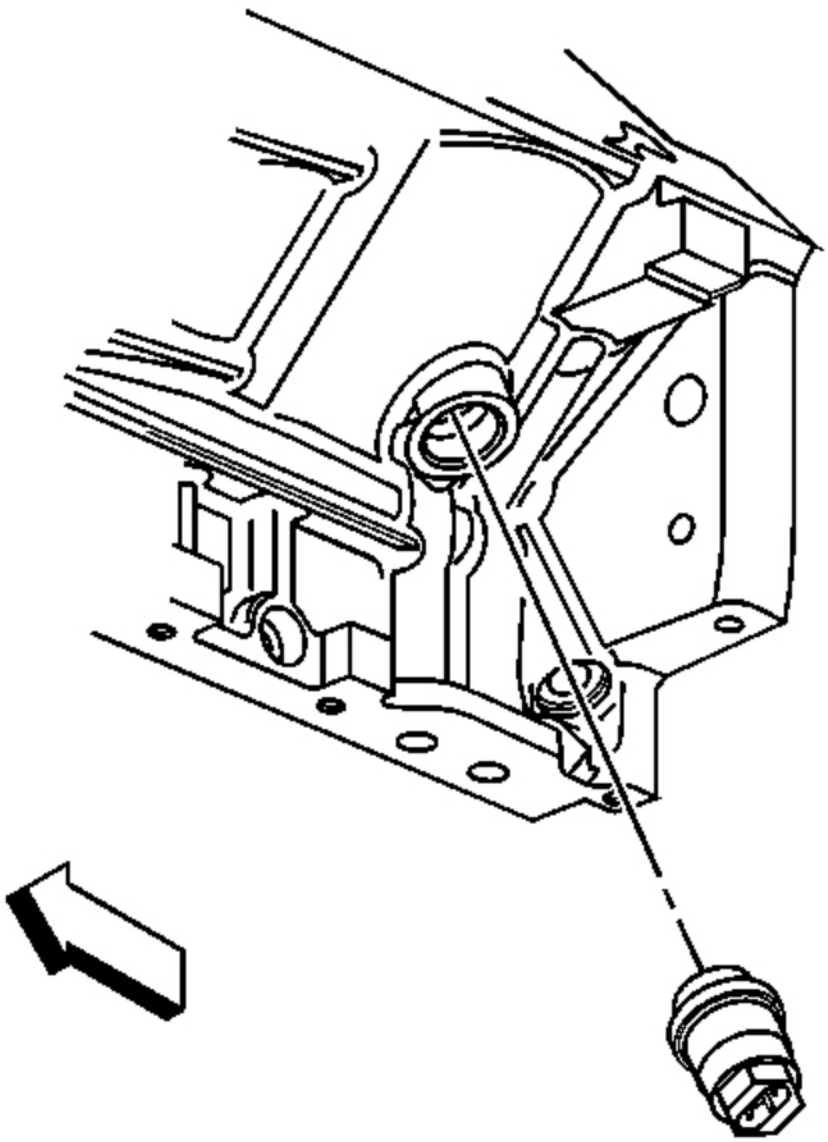


Fig. 223: View Of Coolant Heater At Engine Block (4.8L, 5.3L & 6.0L)
Courtesy of GENERAL MOTORS CORP.

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

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

2. Install the coolant heater to the engine block.

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

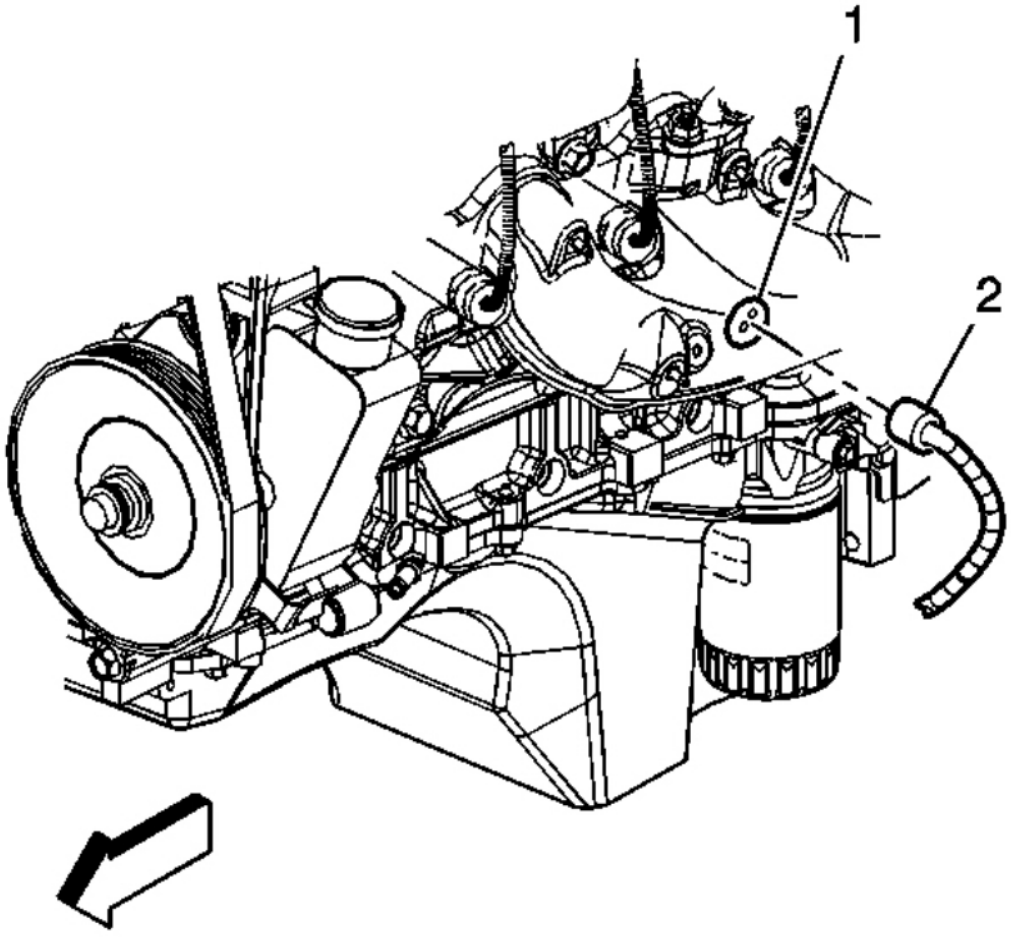


Fig. 224: Identifying Coolant Heater Cord & Electrical Connector
Courtesy of GENERAL MOTORS CORP.

3. Connect the coolant heater electrical connector (2).

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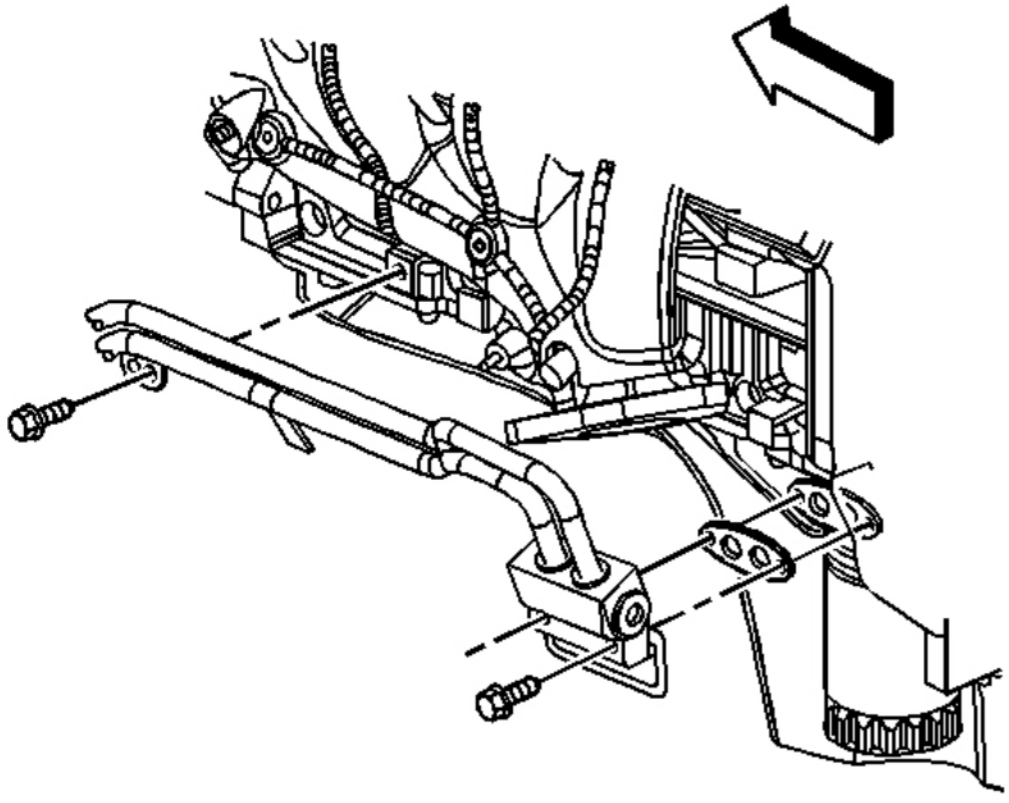


Fig. 225: View Of Oil Cooler Hose Adapter, Bolts & Gasket
Courtesy of GENERAL MOTORS CORP.

4. Position the oil cooler hose adapter end.
5. Install a NEW oil cooler hose adapter gasket.
6. Install the oil cooler hose adapter bolts.

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

7. Install the oil cooler hose bracket bolt.

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

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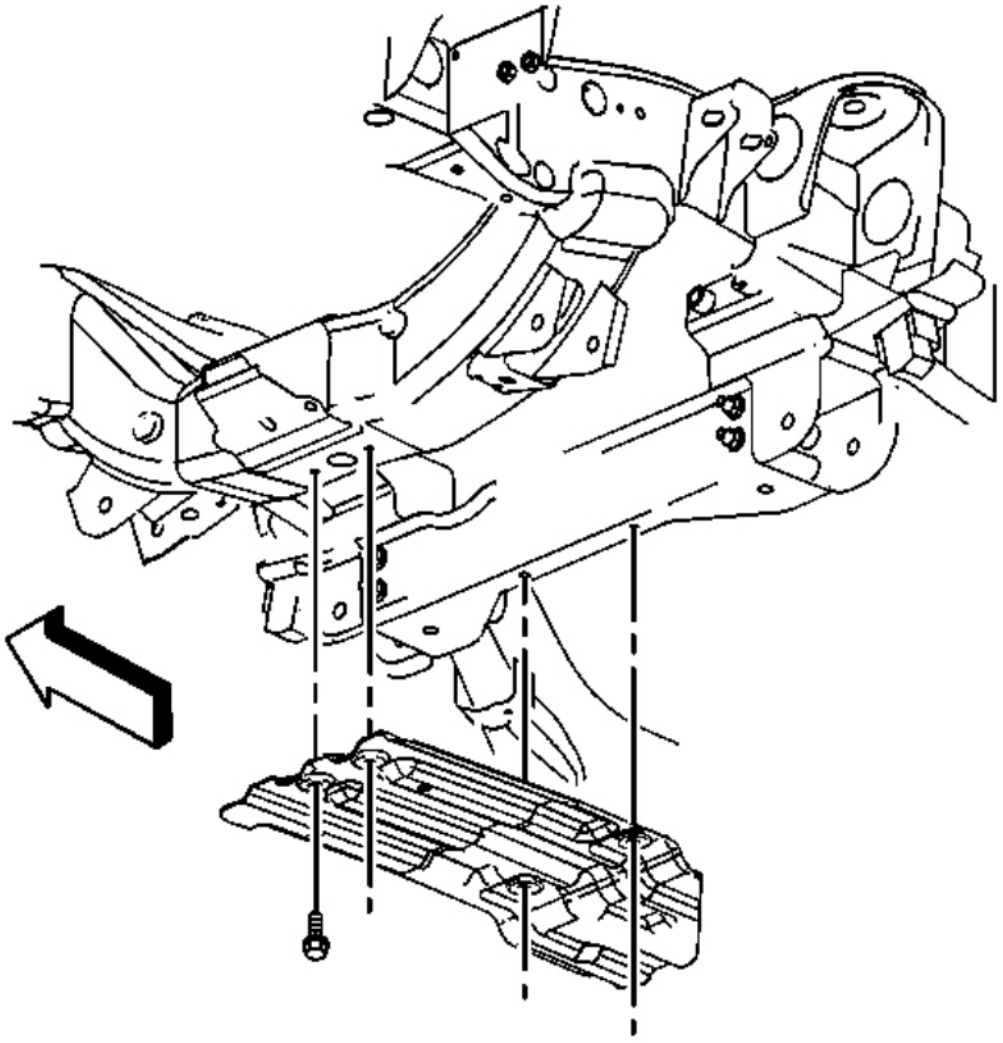


Fig. 226: Identifying Oil Pan Skid Plate
Courtesy of GENERAL MOTORS CORP.

8. Install the oil pan skid plate and bolts.

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

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

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COOLANT HEATER REPLACEMENT (8.1L ENGINE)

Removal Procedure

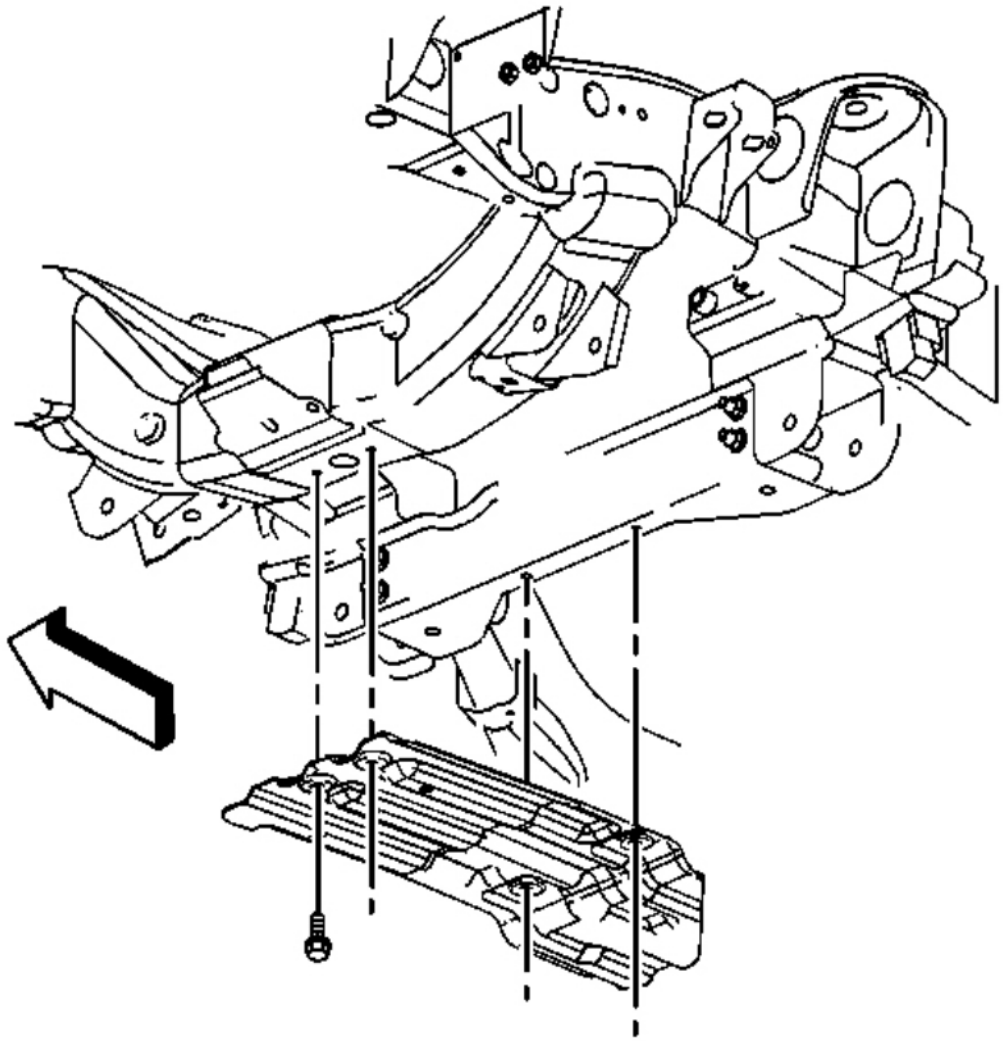


Fig. 227: Identifying Oil Pan Skid Plate
Courtesy of GENERAL MOTORS CORP.

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

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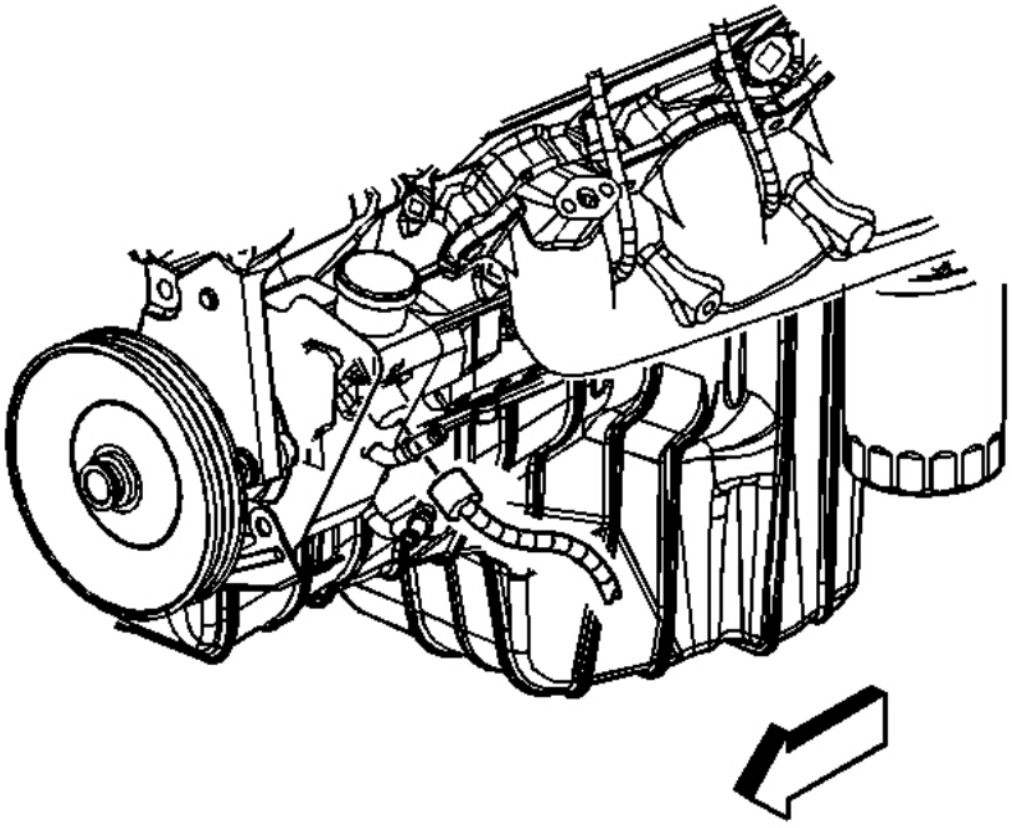


Fig. 228: View Of Coolant Heater Electrical Connector (8.1L)
Courtesy of GENERAL MOTORS CORP.

4. Disconnect the coolant heater electrical connector.

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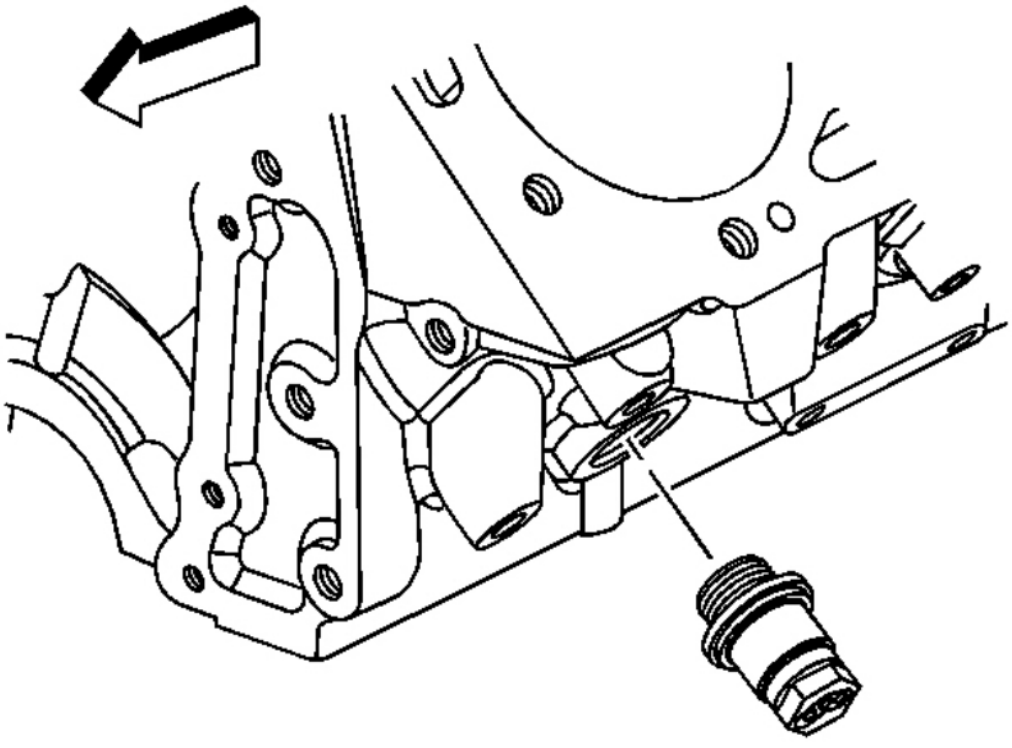


Fig. 229: View Of Engine Block Coolant Heater
Courtesy of GENERAL MOTORS CORP.

5. Remove the coolant heater from the engine block.

Installation Procedure

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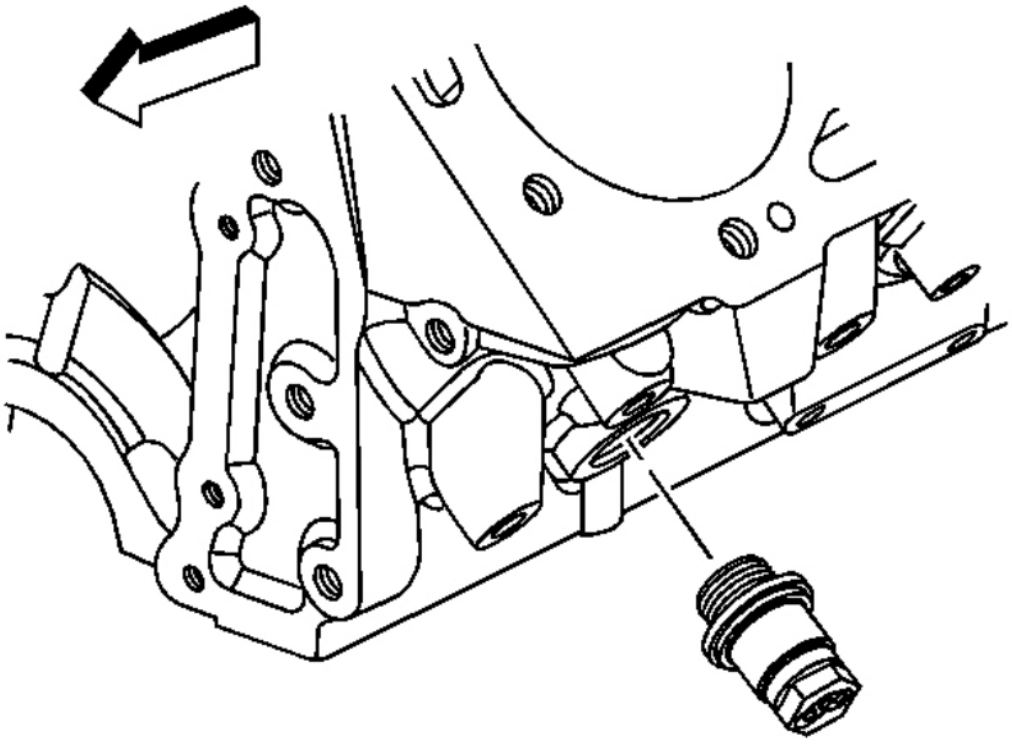


Fig. 230: View Of Engine Block Coolant Heater
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice in Cautions and Notices.

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

Tighten: Tighten the coolant heater to 60 N.m (40 lb ft).

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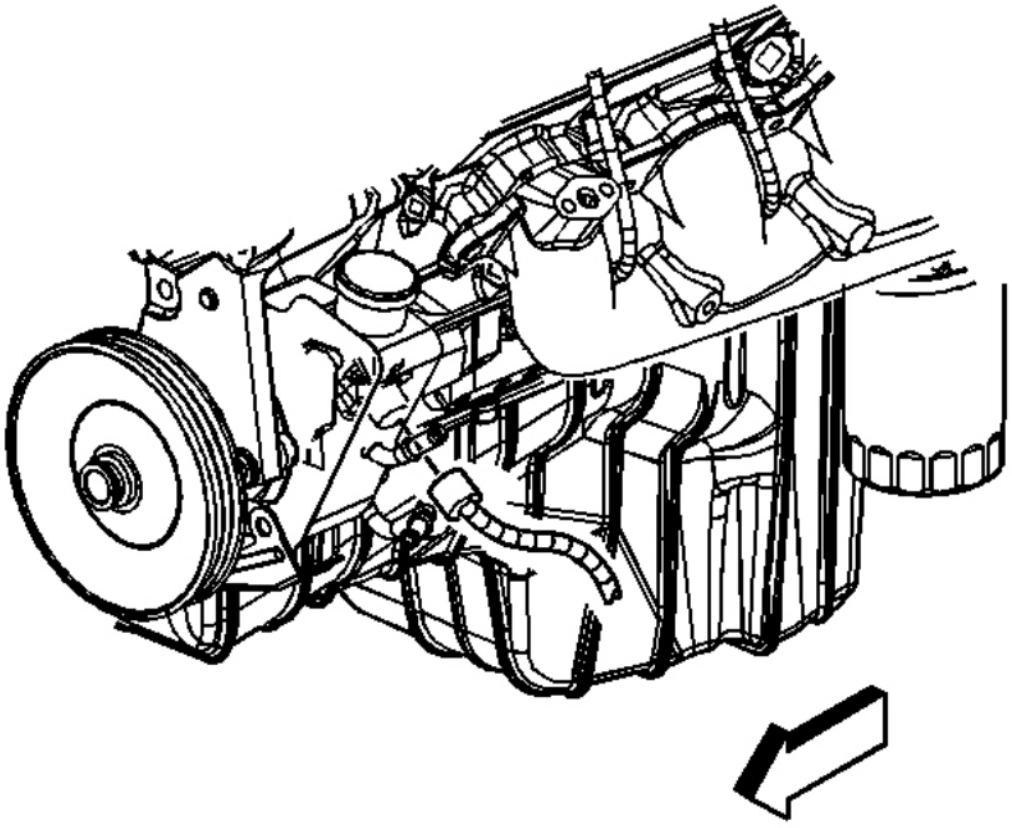


Fig. 231: View Of Coolant Heater Electrical Connector (8.1L)
Courtesy of GENERAL MOTORS CORP.

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

3. Connect the coolant heater electrical connector.
4. Fill the cooling system/engine block. Refer to **Draining and Filling Cooling System**.

COOLANT HEATER CORD REPLACEMENT

Removal Procedure

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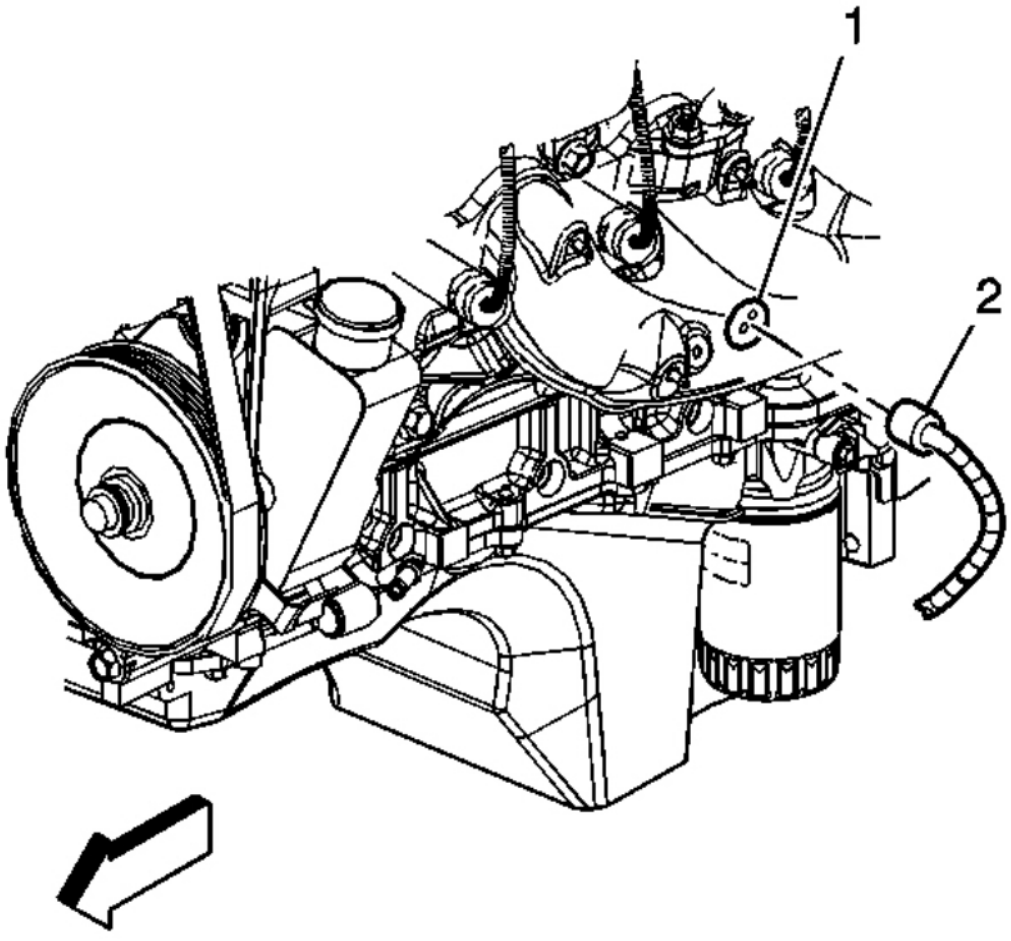


Fig. 232: Identifying Coolant Heater Cord & Electrical Connector
Courtesy of GENERAL MOTORS CORP.

1. Raise and suitably support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
2. Disconnect the coolant heater electrical connector (2).

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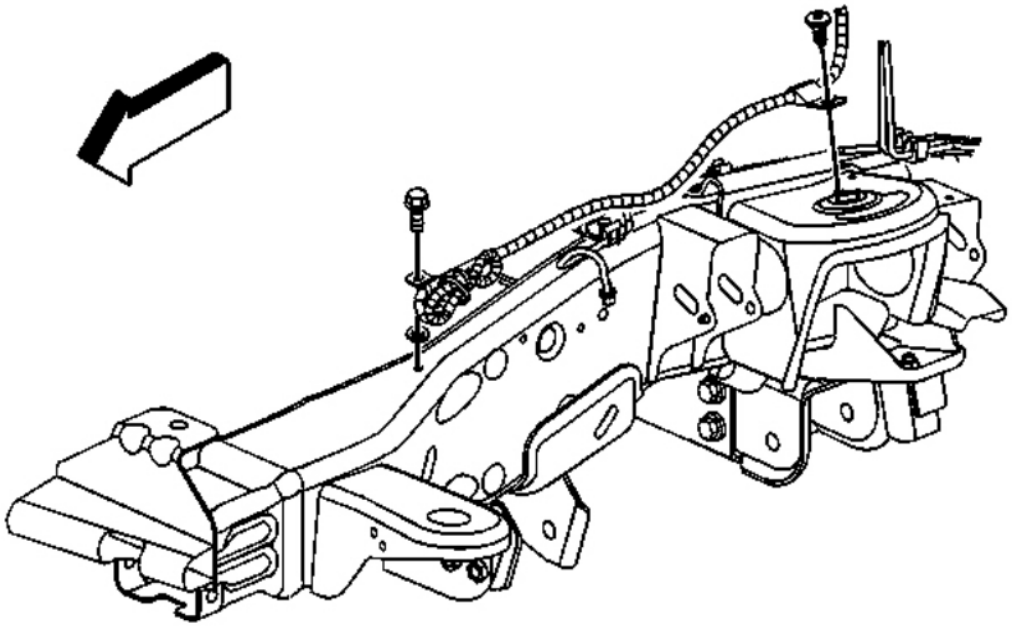


Fig. 233: View Of Coolant Heater Cord, Retainer & Bolts
Courtesy of GENERAL MOTORS CORP.

3. Remove the coolant heater cord retainer and bolts.
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.

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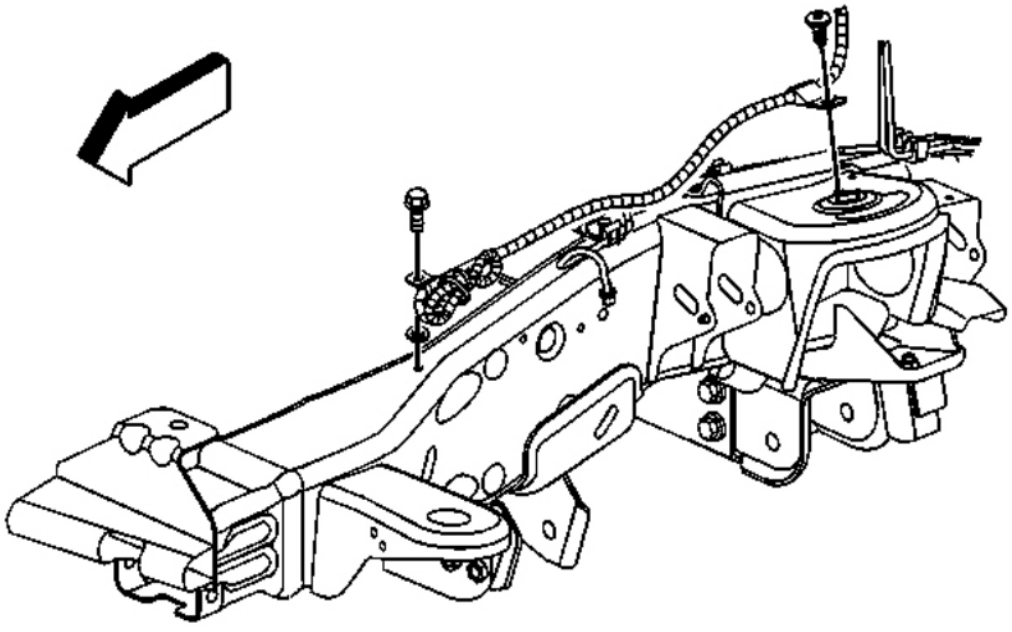


Fig. 234: View Of Coolant Heater Cord, Retainer & Bolts
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice in Cautions and Notices.

1. Install the coolant heater cord.
2. Install the coolant heater cord bolts and retainer.

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

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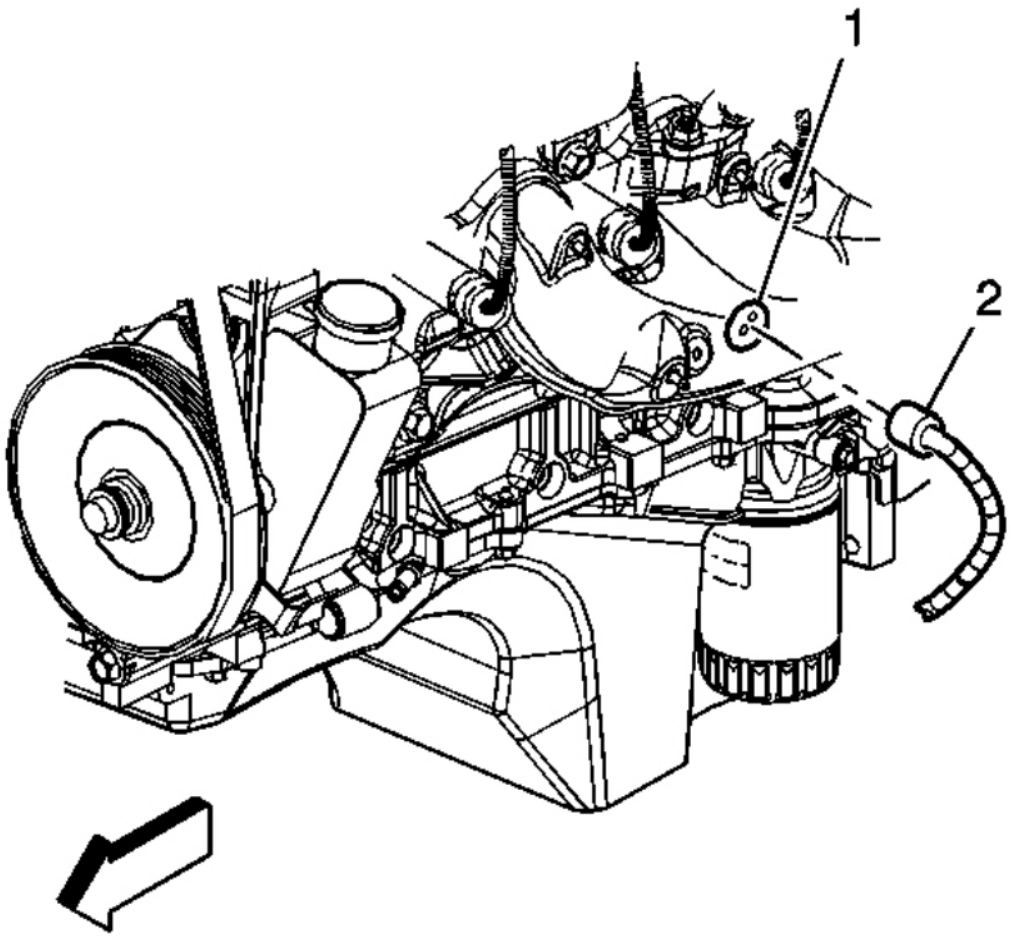


Fig. 235: Identifying Coolant Heater Cord & Electrical Connector
Courtesy of GENERAL MOTORS CORP.

3. Connect the coolant heater electrical connector (2).
4. Lower the vehicle.

DESCRIPTION AND OPERATION

COOLING SYSTEM DESCRIPTION AND OPERATION

Engine Coolant Indicators

ENGINE COOLANT HOT

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

ENGINE OVERHEATED

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

LOW COOLANT LEVEL B

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

REDUCED ENGINE POWER

The IPC displays REDUCED ENGINE POWER message when the IPC detects a reduced engine power condition from the PCM. The IPC receives a class 2 message from the PCM requesting illumination when the engine temperature reaches 132°C (270°F).

Cooling Fan Control - Two Fan System

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

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

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

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

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

- Engine coolant temperature exceeds approximately 94.5°C (202°F).

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

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

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

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

Coolant Level Control (If Equipped)

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

Coolant Heater

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

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

Coolant is drawn from the radiator outlet and into the water pump inlet by the water pump. Coolant will then be pumped through the water pump outlet and into the engine block. In the engine block, the coolant circulates through the water pump outlet and into the engine block. In the engine block, the coolant circulates through the water jackets surrounding the cylinders, where it absorbs heat.

Some coolant is also pumped from the water pump to the heater core, then back to the water pump. This

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provides the passenger compartment with heat and defrost.

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

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

Cooling Cycle (6.6L Diesel Engine)

Coolant is drawn from the radiator outlet and into the water pump inlet by the water pump. The coolant flows to the heater core while the engine is running. This provides the passenger compartment with heat and defrost.

Coolant is then pumped through the water pump outlet and through the coolant pipe to the engine oil cooler. The coolant flows around the oil cooler element and to the rear engine cover. The rear engine cover distributes the coolant flow to both banks of the engine block. 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.

Coolant is also directed to the turbocharger. There it circulates through passages in the center housing. During engine warm-up cycle the bypass valve located in the turbocharger inlet hose at the outlet pipe prevents coolant flow. During normal operating temperatures, the coolant assists in keeping the turbocharger cool.

From the cylinder heads, the coolant flows to the thermostats. The coolant flows from the thermostat housing to the water pump through the bypass pipe until the engine reaches 85°C (185°F).

Operation of the cooling system requires proper functioning of all cooling system components. The cooling system consists of the following components:

Coolant

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

Radiator

The radiator is a heat exchanger. It consists of a core and two 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

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tabs. The tabs are part of the aluminum header at each end of the core.

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

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

Surge Tank

The surge tank is a plastic tank with a threaded pressure cap. The tank is mounted at a point higher than all other coolant passages. The surge tank provides an air space in the cooling system that allows the coolant to expand and contract. The surge tank provides a coolant fill point and a central air bleed location.

During vehicle use, the coolant heats and expands. The increased coolant volume flows into the surge tank. As the coolant circulates, any air is allowed to bubble out. Coolant without air bubbles absorbs heat much better than coolant with bubbles.

Pressure Cap

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

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

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

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

Cooling Fan and Clutch

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

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decreases.

Air Baffles and Seals

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

Water Pump

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

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

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

Water Pump (6.6L Diesel Engine)

The water pump is a centrifugal vane impeller type pump. The water pump is gear driven by the crankshaft gear. The pump consists of a housing with coolant inlet and outlet passages and an impeller. The impeller is a flat plate mounted on the pump shaft with a series of flat or curved blades or vanes. When the impeller rotates, the coolant between the vanes is thrown outward by centrifugal force. The impeller shaft is supported by bearings. Splash of the engine oil lubricates the bearings. The bearings and shaft are sealed to prevent engine oil to mix with the coolant. If the seal fails, coolant will leak out the vent hole in the water pump housing.

The purpose of the water pump is to circulate coolant throughout the cooling system.

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

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circulate through the engine block.

Thermostats (6.6L Diesel Engine)

The thermostats are coolant flow control components. The purpose of the thermostats are to regulate the correct operating temperature of the engine. The thermostats utilizes a temperature sensitive wax-pellet element. The element connects to a valve through a piston. When the element is heated, it expands and exerts pressure against a rubber 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.

The 6.6L diesel engine requires two thermostats for correct coolant flow. The front thermostat is a dual purpose thermostat. The front thermostat controls the coolant flow to the bypass port and to the water outlet. The rear thermostat only controls the coolant flow to the water outlet.

When the coolant temperature is below the rated thermostat opening temperature, the front thermostat valve remains closed to the water outlet and is opened to the bypass port. The bottom portion of the thermostat is raised off of the bypass port while at the same time the top portion closes the coolant flow to the water outlet. The rear thermostat also is closed to the water outlet during engine warm-up. This prevents circulation of the coolant to the radiator and allows the engine to warm up quickly. After the coolant temperature reaches 82°C (180°F) the front thermostat primary valve opening temperature, the front thermostat primary valve will start to open. The coolant is then allowed to circulate through the thermostat to the radiator where the engine heat is dissipated to the atmosphere. As the engine coolant reaches 85°C (185°F) and more coolant demand is required the front thermostat secondary valve begins to close the bypass port and the rear thermostat begins to open coolant flow to the water outlet. The thermostats will continue to control the coolant flow by opening and closing. The front thermostat will be fully open when the coolant temperature reaches 95°C (203°F) the rear thermostat will be fully open when the coolant temperature reaches 100°C (212°F). The thermostat also provides a restriction in the cooling system, even after the 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.

Engine Oil Cooler

The engine oil cooler is a heat exchanger. It is located inside the left side end tank of the radiator. The engine oil temperature is controlled by the temperature of the engine coolant that surrounds the oil cooler in the radiator.

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

Engine Oil Cooler (6.6L Diesel Engine)

The engine oil cooler is a heat exchanger. The engine oil cooler is mounted to the left lower corner of the engine. The oil filter is attached to the oil cooler housing. The engine coolant flows around the oil cooler element. The oil cooler element is a series of plates. The engine oil temperature is regulated by the temperature of the engine coolant that surrounds the oil cooler as the engine oil passes through the cooler.

The engine oil pump, pumps the oil through the engine oil feed line to the oil cooler. The oil then flows down through the cooler while the engine coolant absorbs heat from the oil. The oil is then pumped through the oil return line, to the oil filter, then to the main engine oil passage.

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Transmission Oil Cooler

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

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

Turbocharger Bypass Valve (6.6L Diesel Engine)

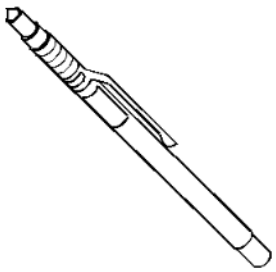
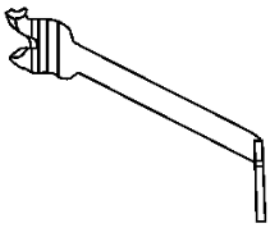
The turbocharger bypass valve is a temperature control valve. The valve is located in the turbocharger coolant inlet hose at the water outlet tube.

The purpose of the valve is to close the coolant flow through the turbocharger. Closing off the coolant flow through the turbocharger avoids turbocharger overcooling.

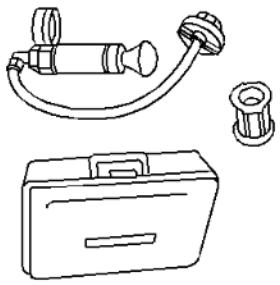
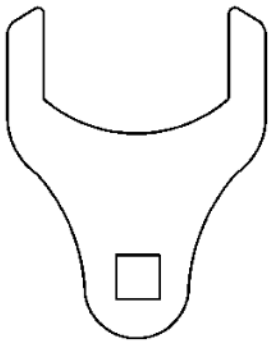
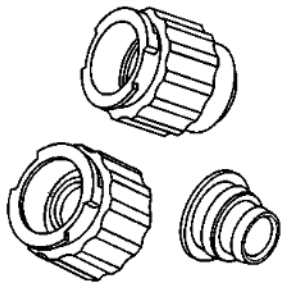
SPECIAL TOOLS AND EQUIPMENT

SPECIAL TOOLS

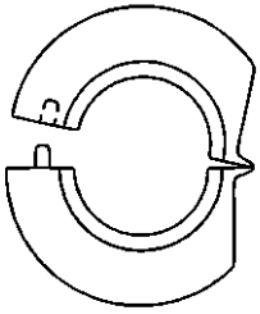
Special Tools

Illustration	Tool Number/ Description
	J 24731 Tempil Stick
	J 46406 Fan Clutch Remover and Installer

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	J 24460-1 Cooling System Pressure Tester
	J 41240-5A Fan Clutch Wrench
	J 42401 Radiator Cap/Surge Tank Test Adapter
	J 43181 Heater Line Quick Connect Release Tool

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