

2002 Chevrolet Corvette

2002 ENGINE Engine Cooling - Corvette

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Engine Cooling - Corvette

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Application	Specification	
	Metric	English
Automatic Transmission Oil Cooler Line Fitting	25 N·m	18 lb ft
Coolant Air Bleed Bolt/Stud	12 N·m	106 lb in
Cooling Fan Motor Bolt	6 N·m	53 lb in
Engine Coolant Heater	40 N·m	30 lb ft
Engine Coolant Heater Cord Clip Bolt	32 N·m	24 lb ft
Fan Blade Nut	6 N·m	53 lb in
Radiator Baffle Bolt	10 N·m	89 lb in
Radiator Support Bolt	8 N·m	71 lb in
Radiator Surge Tank Nut	10 N·m	89 lb in
Stabilizer Shaft Bracket Bolt	58 N·m	43 lb ft
Water Pump Bolt (First Pass)	15 N·m	11 lb ft
Water Pump Bolt (Final Pass)	30 N·m	22 lb ft
Water Pump Inlet	15 N·m	11 lb ft

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Fig. 1: Fastener Tightening Specifications
Courtesy of GENERAL MOTORS CORP.

SCHEMATIC & ROUTING DIAGRAMS

ENGINE COOLING SCHEMATICS

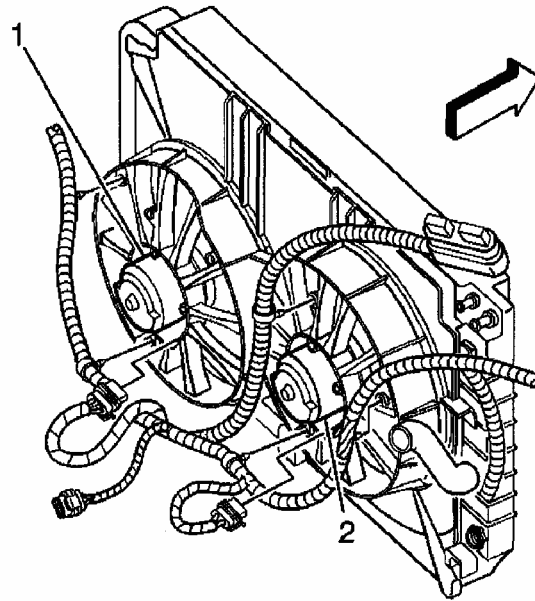
Refer to COOLING FAN .

COMPONENT LOCATOR

COOLING SYSTEM COMPONENT VIEWS

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(1) Cooling Fan-Left

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(2) Cooling Fan-Right

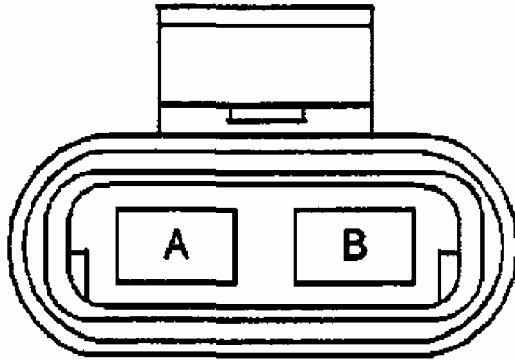
Fig. 2: Cooling Fans

Courtesy of GENERAL MOTORS CORP.

COOLING SYSTEM CONNECTOR END VIEWS

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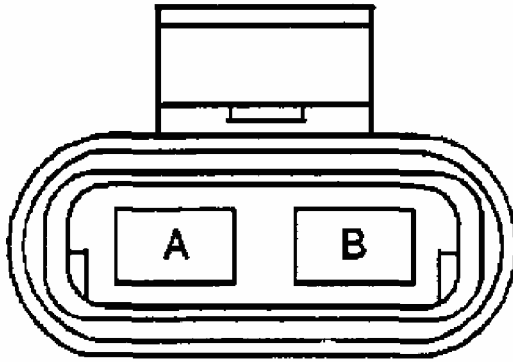
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Connector Part Information		<ul style="list-style-type: none">• 12020341• 2-Way F Metri-Pack 630 Series (BLK)	
Pin	Wire Color	Circuit No.	Function
A	GRY	532	Cooling Fan Motor Low Reference
B	LT BLU	409	Cooling Fan Motor Supply Voltage

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



Connector Part Information		<ul style="list-style-type: none">• 12020341• 2-Way F Metri-Pack 630 Series (BLK)	
Pin	Wire Color	Circuit No.	Function
A	BLK	250	Ground
B	WHT	504	Cooling Fan Motor Supply Voltage

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Fig. 4: Cooling Fan-Right

Courtesy of GENERAL MOTORS CORP.

DIAGNOSTIC INFORMATION & 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

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- 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 number(s) below refer to the step number(s) on the diagnostic table.

2. 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.
3. Determine if the Instrument Cluster or Powertrain Control Modules have set DTC's which may affect Engine Cooling operation are present.
4. 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.

Step	Action	Yes	No
1	Install a scan tool. Does the scan tool power up?	Go to Step 2	Go to Scan Tool Does Not Power Up in Data Link Communications
2	1. Turn ON the ignition, with the engine OFF. 2. Attempt to establish communication with the following control modules: <ul style="list-style-type: none">• Instrument Cluster• Powertrain Control Module Does the scan tool communicate with the control modules?	Go to Step 3	Go to Scan Tool Does Not Communicate with Class 2 Device in Data Link Communications
3	Select the powertrain control module display DTCs function on the scan tool. Does the scan tool display any DTCs?	Go to Step 4	Go to Symptoms - Engine Cooling
4	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 Diagnostic Trouble Code (DTC) List

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Fig. 5: Diagnostic System Check - Engine Cooling
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SCAN TOOL OUTPUT CONTROLS

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Scan Tool Output Control	Additional Menu Selection(s)	Description
Fan Relay 1	Fan Relays	The scan tool displays a Commanded State of None, Off or On. This allows you to communicate with the PCM and activate or deactivate the cooling fan 1 relay, manually turning the low speed fans On and Off.
Fan Relay 2 and 3	Fan Relays	The scan tool displays a Commanded State of None, Off or On. This allows you to communicate with the PCM to activate or deactivate the cooling fan 2 and 3 relays, manually turning the Right High speed fan On.
Fan Relay 1, 2 & 3	Fan Relays	The scan tool displays a Commanded State of None, Off or On. This allows you to communicate with the PCM to activate or deactivate the cooling fan 1, 2 & 3 relays, manually turning both High speed fans On.

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Fig. 6: Scan Tool Output Controls
Courtesy of GENERAL MOTORS CORP.

SCAN TOOL DATA LIST

Scan Tool Parameter	Data List	Units Displayed	Typical Data Value
Ignition ON/Engine OFF			
Engine Coolant Temperature	Data	Degrees Celsius (°C)/Degrees Fahrenheit (°F)	Varies
Coolant Level Input	Inputs	OK/Low	OK

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Fig. 7: Instrument Panel Cluster (IPC)
Courtesy of GENERAL MOTORS CORP.

Scan Tool Parameter	Data List	Units Displayed	Typical Data Value
Key ON, Engine OFF			
ECT Sensor	Engine Data 1, Engine Data 2, Engine Data 3	Degrees Celsius (°C)/Degrees Fahrenheit (°F)	Varies
FC Relay 1 Command	Engine Data 2, Engine Data 3	Off/On	Off
FC Relay 2 & 3 Command	Engine Data 2, Engine Data 3	Off/On	Off

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Fig. 8: Powertrain Control Module (PCM) 5.7 Liter LS1
Courtesy of GENERAL MOTORS CORP.

SCAN TOOL DATA DEFINITIONS

Coolant Temperature: The scan tool displays - 40°C to +151°C (-40°F to +304°F). This data is the coolant temperature the Instrument Cluster is attempting to display on the coolant temperature gage.

ECT: The scan tool displays -40°C to +151°C (-40°F to +304°F). The Engine Coolant Temperature (ECT) sensor is mounted in the coolant stream. The PCM applies 5 volts to the ECT sensor circuit. The sensor is a thermistor which changes internal resistance as temperature changes. When the sensor is cold (internal resistance high), the PCM monitors a

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high signal voltage and interprets it 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.

FC Relay 1 Command: The scan tool displays On or Off. This parameter indicates the state of the driver circuit for this device.

FC Relay 2 and 3 Command: The scan tool displays On or Off. This parameter indicates the state of the driver circuit for this device.

Coolant Level Input: The scan tool displays OK or Low. If the ground circuit opens, the scan too will display Low.

DIAGNOSTIC TROUBLE CODE (DTC) LIST

DTC	Diagnostic Procedure	Module(s)
P0480	<i>DTC P0480</i>	PCM
P0481	<i>DTC P0481</i>	PCM
P1258	<i>DTC P1258</i>	PCM

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Fig. 9: Diagnostic Trouble Code (DTC) List
Courtesy of GENERAL MOTORS CORP.

DTC P0480

Circuit Description

Battery positive voltage is supplied to the cool fan 1 relay from the cooling fan 1 fuse. The powertrain control module (PCM) controls the cooling fan 1 relay by grounding the low speed cooling fan relay control circuit via an internal solid state device called a driver. The primary function of the driver is to supply the ground for the component being controlled. Each driver has a fault line which is monitored by the PCM. When the PCM is commanding a component on, the voltage potential of the control circuit should be low (near 0 volts). When the PCM is commanding the control circuit to a component off, the voltage potential of the circuit should be high (near battery voltage). If the fault detection circuit senses a voltage other than what is expected, the DTC will set.

The PCM will monitor the control circuit for the following:

- A short to ground
- A short to voltage
- An open circuit
- An open relay coil
- An internally shorted or excessively low resistance relay coil.

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When the PCM detects any of the above conditions, the DTC will set and the affected driver will be disabled.

Conditions For Running The DTC

- The ignition voltage is between 6 and 18 volts.
- The engine speed is greater than 400 RPM.

Conditions For Setting The DTC

- An improper voltage level has been detected on the low speed cooling fan relay control circuit.
- The above conditions are present for at least 5 seconds.

Action Taken When The DTC Sets

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

Conditions For Clearing The MIL/DTC

- The PCM will turn OFF the MIL during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using the scan tool.

Diagnostic Aids

Check for the following conditions:

- A faulty connection at the PCM, inspect the harness connectors for the following conditions.
 - Backed out terminals
 - Improper mating
 - Broken locks
 - Improperly formed or damaged terminals
 - Faulty terminal to wire connections
- Inspect the wiring harness for damage.
- If the harness appears to be OK, disconnect the PCM, turn the ignition ON and observe a digital multimeter (DMM) connected between the low speed cooling fan relay control

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circuit of the cooling fan 1 relay and ground at the PCM harness connector. While moving connectors and the wiring harness related to the cooling fan 1 relay, a change in voltage will indicate the location of the fault.

Review the Freeze/Failure Records vehicle mileage since the diagnostic test last failed. This may help determine how often the condition that caused the DTC to be set occurs.

Test Description

The number(s) below refer to the step number(s) on the diagnostic table.

2. Listen for an audible click when the cooling fan 1 relay operates. Command both the ON and OFF states. Repeat the commands as necessary.
3. Tests for voltage at the coil side of the cooling fan 1 relay. The coolfan 1 fuse supplies battery positive voltage to the coil side of the cooling fan 1 relay.
4. Verifies that the PCM is providing ground to the cooling fan 1 relay.
5. Tests if ground is constantly being applied to the cooling fan 1 relay.

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Step	Action	Yes	No
Schematic Reference: <i>Cooling Fan</i>			
1	Did you perform the Engine Cooling Diagnostic System Check?	Go to Step 2	Go to <i>Diagnostic System Check - Engine Cooling</i>
2	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. 3. With a scan tool, command the Fan Relay 1 ON and OFF. Does the cooling fan 1 relay turn ON and OFF with each command?	Go to Diagnostic Aids	Go to Step 3
3	1. Turn OFF the ignition. 2. Disconnect the cooling fan 1 relay 3. Turn ON the ignition, with the engine OFF. 4. Probe the battery voltage circuit of the cooling fan 1 relay with a test lamp that is connected to a good ground. Does the test lamp illuminate?	Go to Step 4	Go to Step 10
4	1. Connect a test lamp between the control circuit of the cooling fan 1 relay and the battery positive voltage circuit of the cooling fan 1 relay. 2. With a scan tool, command the Fan Relay 1 ON and OFF. Does the test lamp turn ON and OFF with each command?	Go to Step 8	Go to Step 5
5	Does the test lamp remain illuminated with each command?	Go to Step 7	Go to Step 6
6	Test the control circuit of the cooling fan 1 relay for a short to voltage or an open. Refer to <i>Circuit Testing</i> and <i>Wiring Repairs</i> in Wiring Systems. Did you find and correct the condition?	Go to Step 14	Go to Step 9
7	Test the control circuit of the cooling fan 1 relay for a short to ground. Refer to <i>Circuit Testing</i> and <i>Wiring Repairs</i> in Wiring Systems. Did you find and correct the condition?	Go to Step 14	Go to Step 9
8	Inspect for poor connections at the cooling fan 1 relay. Refer to the following procedures in Wiring Systems. • <i>Circuit Testing</i> • <i>Wiring Repairs</i> 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 PCM. Refer to the following procedures in Wiring Systems. • <i>Circuit Testing</i> • <i>Wiring Repairs</i> Did you find and correct the condition?	Go to Step 14	Go to Step 13
10	Test the battery positive voltage circuit for an open or a short to ground. Refer to the following procedures in Wiring Systems: • <i>Circuit Testing</i> • <i>Wiring Repairs</i> Did you find and correct the condition?	Go to Step 14	Go to Step 11
11	Repair the cooling fan motor supply voltage circuit for a short to ground. Refer to <i>Wiring Repairs</i> in Wiring Systems. Did you complete the repair?	Go to Step 14	—
12	Replace the cooling fan 1 relay. Did you complete the replacement?	Go to Step 14	—
13	Important: Perform the set up procedure for the PCM. Replace the PCM. Refer to <i>Powertrain Control Module</i> . Did you complete the replacement?	Go to Step 14	—
14	1. Use the scan tool in order to clear the DTCs. 2. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text. Does the DTC reset?	Go to Step 2	System OK

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Fig. 10: DTC P0480
Courtesy of GENERAL MOTORS CORP.

DTC P0481

Circuit Description

Ignition 1 Voltage is supplied to the coil of the cooling fan 2 and cooling fan s/p relays from

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the cool fan 3 fuse. Battery positive voltage is supplied to the switch side of the cooling fan 2 relay from the cool fan 2 fuse. The powertrain control module (PCM) controls the relays by grounding the high speed cooling fan relay control circuit via an internal solid state device called a driver. The primary function of the driver is to supply the ground for the component being controlled. Each driver has a fault line which is monitored by the PCM. When the PCM is commanding a component on, the voltage potential of the control circuit should be low (near 0 volts). When the PCM is commanding the control circuit to a component off, the voltage potential of the circuit should be high (near battery voltage). If the fault detection circuit senses a voltage other than what is expected, the DTC will set.

The PCM will monitor the control circuit for the following:

- A short to ground
- A short to voltage
- An open circuit

When the PCM detects any of the above conditions, the DTC will set and the affected driver will be disabled.

Conditions For Running The DTC

- The ignition voltage is between 6 and 18 volts.
- The engine speed is greater than 400 RPM.

Conditions For Setting The DTC

- An improper voltage level has been detected on the high speed cooling fan relay control circuit.
- The above conditions are present for at least 5 seconds.

Action Taken When The DTC Sets

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

Conditions For Clearing The MIL/DTC

- The PCM will turn OFF the MIL during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using the scan tool.

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Diagnostic Aids

Check for the following conditions:

- A faulty connection at the PCM, inspect the harness connectors for the following conditions.
 - Backed out terminals
 - Improper mating
 - Broken locks
 - Improperly formed or damaged terminals
 - Faulty terminal to wire connections
- Inspect the wiring harness for damage.
- If the harness appears to be OK, disconnect the PCM, turn the ignition ON and observe a digital multimeter (DMM) connected between the high speed cooling fan relay control circuit and ground at the PCM harness connector. While moving connectors and the wiring harness related to the cooling fan s/p and the cooling fan 2 relays, a change in voltage will indicate the location of the fault.

Review the Freeze/Failure Records vehicle mileage since the diagnostic test last failed. This may help determine how often the condition that caused the DTC to be set occurs.

Test Description

The number(s) below refer to the step number(s) on the diagnostic table.

2. Listen for an audible click when the cooling fan 2 relay operates. Command both the ON and OFF states. Repeat the commands as necessary.
3. Tests for voltage at the coil side of the cooling fan 2 relay. The coolfan 3 fuse supplies ignition 1 voltage to the coil side of the cooling fan 2 relay.
4. Verifies that the PCM is providing ground to the cooling fan 2 relay.
5. Tests if ground is constantly being applied to the cooling fan 2 relay.

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Step	Action	Yes	No
Schematic Reference: <i>Cooling Fan</i>			
1	Did you perform the Engine Cooling Diagnostic System Check?	Go to Step 2	Go to <i>Diagnostic System Check - Engine Cooling</i>
2	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. 3. With a scan tool, command the Fan Relays 1, 2 & 3 ON and OFF. Does the cooling fan s/p and the cooling fan 2 relays turn ON and OFF with each command?	Go to Diagnostic Aids	Go to Step 3
3	1. Turn OFF the ignition. 2. Disconnect the cooling fan 2 relay 3. Turn ON the ignition, with the engine OFF. 4. Probe the Ignition 1 Voltage circuit of the cooling fan 2 relay with a test lamp that is connected to a good ground. Does the test lamp illuminate?	Go to Step 4	Go to Step 8
4	1. Connect a test lamp between the control circuit of the cooling fan 2 relay and the battery positive voltage circuit of the cooling fan 2 relay. 2. With a scan tool, command the Fan Relays 1, 2 & 3 ON and OFF. Does the test lamp turn ON and OFF with each command?	Go to Step 9	Go to Step 5
5	Does the test lamp remain illuminated with each command?	Go to Step 7	Go to Step 6
6	Test the control circuit of the cooling fan s/p relay and the cooling fan 2 relay for a short to voltage or an open. Refer to <i>Circuit Testing and Wiring Repairs</i> in Wiring Systems. Did you find and correct the condition?	Go to Step 12	Go to Step 9
7	Test the control circuit of the cooling fan s/p relay and the cooling fan 2 relay for a short to ground. Refer to <i>Circuit Testing and Wiring Repairs</i> in Wiring Systems. Did you find and correct the condition?	Go to Step 12	Go to Step 9
8	Test the Ignition 1 Voltage circuit of the cooling fan s/p relay and the cooling fan 2 relay for an open or a short to ground. Refer to <i>Circuit Testing and Wiring Repairs</i> in Wiring Systems. Did you find and correct the condition?	Go to Step 12	Go to Step 10
9	Inspect for poor connections at the harness connector of the PCM. Refer to <i>Testing for Intermittent and Poor Connections and Connector Repairs</i> in Wiring Systems. Did you find and correct the condition?	Go to Step 12	Go to Step 11
10	Repair the cooling fan motor supply voltage circuit for a short to ground. Refer to <i>Wiring Repairs</i> in Wiring Systems. Did you complete the repair?	Go to Step 12	—
11	Important: Perform the set up procedure for the PCM. Replace the PCM. Refer to <i>Powertrain Control Module</i> . Did you complete the replacement?	Go to Step 12	—
12	1. Use the scan tool in order to clear the DTCs. 2. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text. Does the DTC reset?	Go to Step 2	System OK

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Fig. 11: DTC P0481
Courtesy of GENERAL MOTORS CORP.

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 131°C (268°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

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cylinders, the PCM is able to reduce the temperature of the coolant.

Conditions For Running The DTC

The engine is running.

Conditions for Setting the DTC

The PCM detects an engine over temperature condition.

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

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

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Fig. 12: DTC P1258

Courtesy of GENERAL MOTORS CORP.

SYMPTOMS - ENGINE COOLING

Important: The following steps must be completed before using the symptom tables.

1. Perform the **DIAGNOSTIC SYSTEM CHECK - Engine Cooling** before using the Symptom Tables in order to verify that all of the following are true:
2. There are no DTCs set.

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3. The control module(s) can communicate via the serial data link.

Visual/Physical Inspection

1. Inspect for aftermarket devices which could affect cooling system operation. Refer to **CHECKING AFTERMARKET ACCESSORIES** in Wiring Systems.
2. Inspect the easily accessible or visible system components for obvious damage or conditions which could cause the symptom.

Intermittent

Faulty electrical connections or wiring may be the cause of intermittent conditions. Refer to **TESTING FOR INTERMITTENT & POOR CONNECTIONS** in Wiring Systems.

Symptom List

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

- **Low Engine Coolant Indicator Always On**
- **Cooling Fan Inoperative**
- **Coolant Heater Inoperative**
- **Loss Of Coolant**
- **Thermostat Diagnosis**
- **Engine Fails To Reach Normal Operating Temperature**

LOW ENGINE COOLANT INDICATOR ALWAYS ON

Step	Action	Yes	No
Schematic Reference: <i>Instrument Cluster</i>			
1	Did you perform the Engine Cooling Diagnostic System Check?	Go to Step 2	Go to <i>Diagnostic System Check - Engine Cooling</i>
2	Is the Low Coolant Indicator Always On?	Go to Step 3	Go to <i>Testing for Electrical Intermittents</i> in Wiring Systems
3	With the key in the RUN position. 1. Install a scan tool 2. With a scan tool, view the Engine Coolant Level input data in the Instrument Panel Cluster data list. Does the scan tool display Low?	Go to Step 4	Go to Step 5
4	Repair the open or high resistance in the ground circuit of the Low Coolant Level Input of the Instrument Cluster. Refer to <i>Wiring Repairs</i> in Wiring Systems. Did you find and correct the condition?	Go to Step 6	—
5	Replace the Instrument Panel Cluster. Refer to <i>Instrument Panel Cluster</i> . Did you complete the replacement?	Go to Step 6	—
6	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to Step 3

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Fig. 13: Low Engine Coolant Indicator Always On
Courtesy of GENERAL MOTORS CORP.

COOLING FAN ALWAYS ON

Step	Action	Yes	No
Schematic Reference: <i>Cooling Fan</i>			
DEFINITION: One or both engine cooling fan motors run continuously in high or low speed.			
1	Did you perform the Engine Cooling Diagnostic System Check?	Go to <i>Step 2</i>	Go To <i>Diagnostic System Check - Engine Cooling</i>
2	Turn ON the ignition, with the engine OFF. Are one or both cooling fans ON?	Go to <i>Step 3</i>	Go to <i>Testing for Intermittent and Poor Connections</i> in Wiring Systems
3	Are both cooling fans running continuously?	Go to <i>Step 5</i>	Go to <i>Step 4</i>
4	Remove the cooling fan S/P relay. Did the right cooling fan turn OFF?	Go to <i>Step 6</i>	Go to <i>Step 7</i>
5	Repair the short to voltage in the left cooling fan motor supply voltage circuit. Refer to <i>Wiring Repairs</i> in Wiring Systems. Did you complete the repair?	Go to <i>Step 8</i>	—
6	Repair the short to voltage in the left cooling fan low reference circuit. Refer to <i>Wiring Repairs</i> in Wiring Systems. Did you complete the repair?	Go to <i>Step 8</i>	—
7	Repair the short to voltage in the right cooling fan motor supply voltage circuit. Refer to <i>Wiring Repairs</i> in Wiring Systems. Did you complete the repair?	Go to <i>Step 8</i>	—
8	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to <i>Step 2</i>

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Fig. 14: Cooling Fan Always On
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COOLING FAN INOPERATIVE

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Step	Action	Yes	No
Schematic Reference: <i>Cooling Fan</i> DEFINITION: One or both engine cooling fan motors do not operate properly in high or low speed modes.			
1	Did you perform the Engine Cooling Diagnostic System Check?	Go to Step 2	Go to <i>Diagnostic System Check - Engine Cooling</i>
2	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. 3. With a scan tool, command the Fan Relay 1 ON and OFF. Do the low speed engine cooling fans turn ON and OFF with each command?	Go to Step 3	Go to Step 4
3	With a scan tool, command the Fan Relays 1, 2 & 3 ON and OFF. Do the high speed engine cooling fans turn ON and OFF with each command?	Go to <i>Testing for Intermittent and Poor Connections in Wiring Systems</i>	Go to Step 11
4	Important: Do NOT remove the 20-A fused jumper wire connected during this step. Use a second 20-A fused jumper wire while performing the following steps. 1. Disconnect the cooling fan 1 relay. 2. Connect the first 20-A fused jumper between the battery positive voltage circuit of the cooling fan 1 relay and the cooling fan motor supply voltage circuit of the cooling fan 1 relay. Do both cooling fans operate in low speed?	Go to Step 13	Go to Step 5
5	1. Disconnect the cooling fan S/P relay. 2. Connect the second 20-A fused jumper between the left cooling fan circuit of the cooling fan S/P relay and the right cooling fan motor supply voltage circuit of the cooling fan S/P relay. Do both cooling fans operate in low speed?	Go to Step 14	Go to Step 6
6	Connect the second 20-A fused jumper from the battery positive voltage to the cooling fan motor supply voltage circuit of the cooling fan S/P relay. Does the right cooling fan operate in high speed?	Go to Step 9	Go to Step 7
7	1. Install the cooling fan S/P relay. 2. Disconnect the right cooling fan electrical connector. 3. Connect the second 20-Amp fused jumper wire from the cooling fan motor supply voltage circuit of the right electrical connector to the cooling fan ground circuit of the right electrical connector. Does the left cooling fan operate in high speed?	Go to Step 16	Go to Step 8
8	Connect the second 20-Amp fused jumper wire from the cooling fan supply voltage circuit of the right cooling fan electrical connector to a good ground. Does the left cooling fan motor operate in high speed?	Go to Step 20	Go to Step 21
9	1. Install the cooling fan S/P relay. 2. Disconnect the left cooling fan electrical connector. 3. Connect the second 20-Amp fused jumper from the cooling fan motor supply voltage circuit of the left cooling fan electrical connector to the low reference circuit of the left cooling fan electrical connector. Does the right cooling fan motor operate in high speed?	Go to Step 17	Go to Step 10
10	Connect the second 20-Amp fused jumper wire from battery positive voltage to the left cooling fan low reference circuit of the left cooling fan electrical connector. Does the right cooling fan operate in high speed?	Go to Step 18	Go to Step 22
11	Does the right cooling fan operate in high speed?	Go to Step 12	Go to Step 15

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Fig. 15: Cooling Fan Inoperative (1 Of 2)
Courtesy of GENERAL MOTORS CORP.

2002 Chevrolet Corvette

2002 ENGINE Engine Cooling - Corvette

Step	Action	Yes	No
12	1. Disconnect the cooling fan S/P relay. 2. Connect a 20-A fused jumper between the left cooling fan low reference circuit of the cooling fan S/P relay and the ground circuit of the cooling fan S/P relay. Does the left cooling fan operate properly in high speed?	Go to Step 14	Go to Step 19
13	Inspect for poor connections at the cooling fan 1 relay. Refer to <i>Testing for Intermittent and Poor Connections</i> and <i>Connector Repairs</i> in Wiring Systems. Did you find and correct the condition?	Go to Step 28	Go to Step 23
14	Inspect for poor connections at the cooling fan S/P relay. Refer to <i>Testing for Intermittent and Poor Connections</i> and <i>Connector Repairs</i> in Wiring Systems. Did you find and correct the condition?	Go to Step 28	Go to Step 24
15	Inspect for poor connections at the cooling fan 2 relay. Refer to <i>Testing for Intermittent and Poor Connections</i> and <i>Connector Repairs</i> in Wiring Systems. Did you find and correct the condition?	Go to Step 28	Go to Step 25
16	Inspect for poor connections at the harness connector of the right cooling fan. Refer to <i>Testing for Intermittent and Poor Connections</i> and <i>Connector Repairs</i> in Wiring Systems. Did you find and correct the condition?	Go to Step 28	Go to Step 26
17	Inspect for poor connections at the harness connector of the left cooling fan. Refer to <i>Testing for Intermittent and Poor Connections</i> and <i>Connector Repairs</i> in Wiring Systems. Did you find and correct the condition?	Go to Step 28	Go to Step 27
18	Repair the left cooling fan motor supply voltage circuit. Refer to <i>Wiring Repairs</i> in Wiring Systems. Did you complete the repair?	Go to Step 28	—
19	Repair the left cooling fan ground circuit. Refer to <i>Wiring Repairs</i> in Wiring Systems. Did you complete the repair?	Go to Step 28	—
20	Repair the right cooling fan ground circuit. Refer to <i>Wiring Repairs</i> in Wiring Systems. Did you complete the repair?	Go to Step 28	—
21	Repair the right cooling fan motor supply voltage circuit. Refer to <i>Wiring Repairs</i> in Wiring Systems. Did you complete the repair?	Go to Step 28	—
22	Repair the left cooling fan low reference circuit. Refer to <i>Wiring Repairs</i> in Wiring Systems. Did you complete the repair?	Go to Step 28	—
23	Replace the cooling fan 1 relay. Is the repair complete?	Go to Step 28	—
24	Replace the cooling fan S/P relay. Is the repair complete?	Go to Step 28	—
25	Replace the cooling fan 2 relay. Is the repair complete?	Go to Step 28	—
26	Replace the right cooling fan. Refer to <i>Cooling Fan Motor Replacement - Electric</i> . Is the repair complete?	Go to Step 28	—
27	Replace the left cooling fan. Refer to <i>Cooling Fan Motor Replacement - Electric</i> . Is the repair complete?	Go to Step 28	—
28	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to Step 3

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Fig. 16: Cooling Fan Inoperative (2 Of 2)
Courtesy of GENERAL MOTORS CORP.

ENGINE OVERHEATING

2002 Chevrolet Corvette

2002 ENGINE Engine Cooling - Corvette

Step	Action	Yes	No
1	Inspect for a missing or damaged radiator upper or lower 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. Refer to <i>Loss of Coolant</i> . Does the engine overheat?	Go to Step 4	System OK
4	Inspect for low coolant 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 <i>DTC P0117: ECT Sensor Circuit - Low Voltage, DTC P0118: ECT Sensor Circuit - High Voltage</i> or <i>DTC P0125: Excessive Time to Enter Closed Loop Fuel Control</i> . Is the sensor operating properly?	Go to Step 7	Go to Step 8
7	Inspect for a cracked coolant surge tank or a leaking hose. Is the coolant surge tank cracked or is the hose leaking?	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 <i>Water Pump Replacement</i> . 2. Inspect for a damaged water pump driveshaft. Is the water pump driveshaft damaged or is the seal leaking?	Go to Step 8	Go to Step 11
11	Inspect for obstructed radiator air flow or bent radiator fins. Is the radiator air flow obstructed?	Go to Step 8	Go to Step 12
12	Inspect for blocked cooling system passages. Are the cooling system passages blocked?	Go to Step 8	Go to Step 13
13	Inspect for inoperative cooling fans. Refer to <i>Cooling Fan Inoperative</i> . Are the cooling fans and the motors operating correctly?	Go to Step 14	Go to Step 8
14	Inspect the thermostat. Refer to <i>Thermostat Diagnosis</i> . Is the thermostat stuck in the closed position?	Go to Step 15	Go to Step 16
15	Replace the thermostat. Refer to <i>Thermostat Replacement</i> . 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 <i>Radiator Replacement</i> . Is the repair complete?	System OK	—

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Fig. 17: Engine Overheating
Courtesy of GENERAL MOTORS CORP.

LOSS OF COOLANT

2002 Chevrolet Corvette

2002 ENGINE Engine Cooling - Corvette

Step	Action	Yes	No
1	Inspect for a leaking radiator. Is the radiator leaking?	Go to Step 2	Go to Go to Step 3
2	Repair or install new parts as necessary. Is the repair complete?	System OK	—
3	Inspect for a leaking heater core. Is the heater core leaking?	Go to Step 2	Go to Step 4
4	Inspect for a faulty surge tank cap. Is the surge tank cap operating properly?	Go to Step 5	Go to Step 2
5	Inspect for a cracked surge tank. Is the surge tank leaking?	Go to Step 2	Go to Step 6
6	Inspect for any loose or damaged hoses. Are any hoses damaged or leaking?	Go to Step 2	Go to Step 7
7	Inspect for a leaking water outlet. Is the water outlet leaking?	Go to Step 2	Go to Step 8
8	Inspect for a leaking water pump. Is the water pump leaking?	Go to Step 2	Go to Step 9
9	Replace the water pump. Refer to <i>Water Pump Replacement</i> . Is the repair complete?	System OK	Go to Step 10
10	Inspect for a leaking engine block coolant drain plug. Are any drain plugs leaking?	Go to Step 2	Go to Step 11
11	Inspect for any leaking cylinder head core plugs. Are the cylinder head core plugs leaking?	Go to Step 2	Go to Step 12
12	Inspect for a leaking cylinder head gasket or a cracked cylinder head. Are the cylinder head gaskets leaking or is the cylinder head cracked?	Go to Step 2	Go to Step 13
13	Inspect for a leaking throttle body. Is the throttle body leaking?	Go to Step 2	Go to Step 14
14	Inspect for a cracked cylinder block. Is the cylinder block cracked?	Go to Step 2	Go to Step 15
15	Inspect for any porosity leaks Are the castings OK?	System OK	—

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Fig. 18: Loss of Coolant
Courtesy of GENERAL MOTORS CORP.

THERMOSTAT DIAGNOSIS

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

Tools Required

J 24731 Tempilstick

Thermostat Test Procedure Using Tempilsticks

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.

2002 Chevrolet Corvette

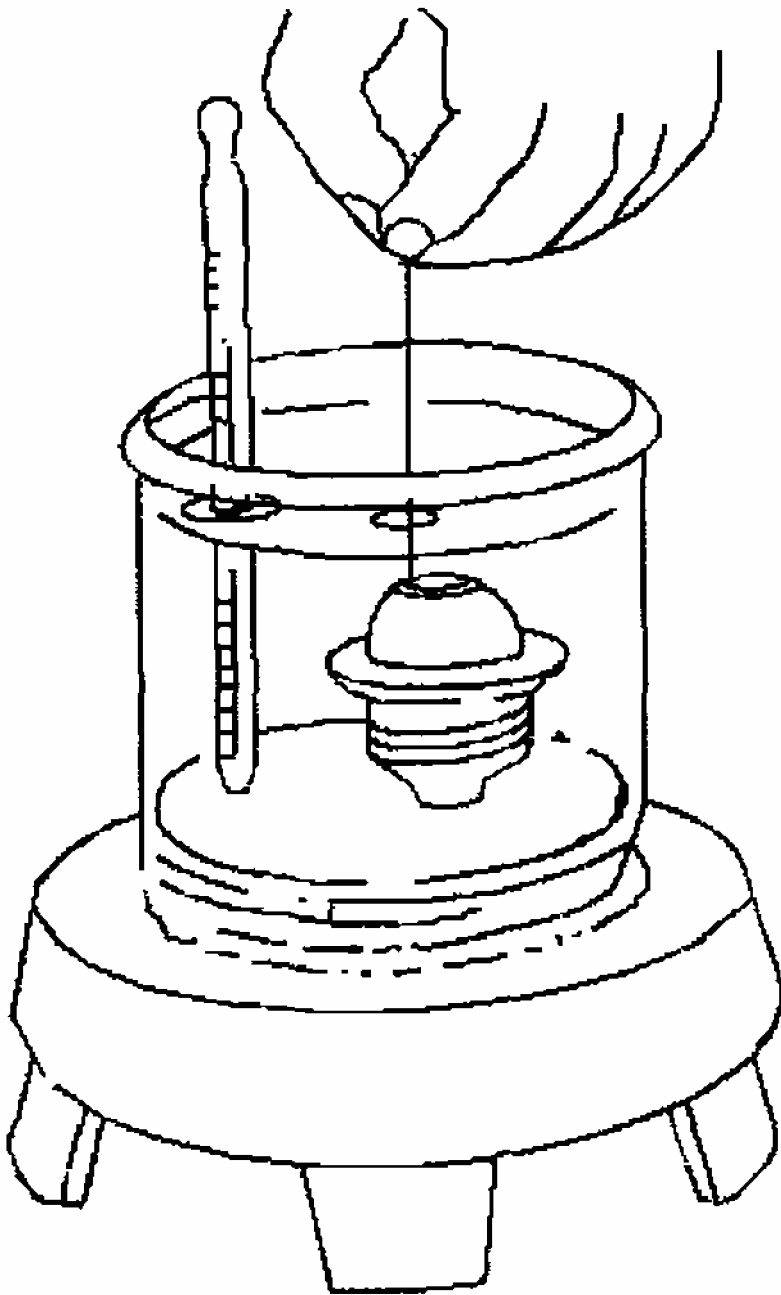
2002 ENGINE Engine Cooling - Corvette

1. Use a tempilstick in order to find the opening and the closing temperatures of the coolant thermostat.
 - J 24731-188 tempilstick melts at 87°C (188°F). The thermostat should begin to open.
 - J 24731-206 tempilstick melts at 97°C (206°F). 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 33 percent glycol solution.

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



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Fig. 19: Checking Thermostat
Courtesy of GENERAL MOTORS CORP.

1. Completely submerge the thermostat in a 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.

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

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 <i>Circuit Testing</i> 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 <i>Coolant Heater Cord Replacement</i> . 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 <i>Testing for Intermittent and Poor Connections</i> and <i>Connector Repairs</i> 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 one of the following procedures: <i>Coolant Heater Replacement</i> 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

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Fig. 20: Coolant Heater Inoperative
Courtesy of GENERAL MOTORS CORP.

ENGINE FAILS TO REACH NORMAL OPERATING TEMPERATURE

Step	Action	Yes	No
1	Inspect the coolant level. Is the coolant level below the add mark?	Go to Step 2	Go to Step 3
2	1. Add coolant as necessary. Refer to <i>Draining and Filling Cooling System</i> . 2. Perform a cooling system pressure test. Is the repair complete?	System OK	—
3	Inspect for a stuck open, missing, or wrong type of thermostat. Refer to <i>Thermostat Diagnosis</i> . Is the thermostat operating properly?	System OK	Go to Step 4
4	Install the correct replacement thermostat. Refer to <i>Thermostat Replacement</i> . Is the repair complete?	System OK	—

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Fig. 21: Engine Fails To Reach Normal Operating Temperature
Courtesy of GENERAL MOTORS CORP.

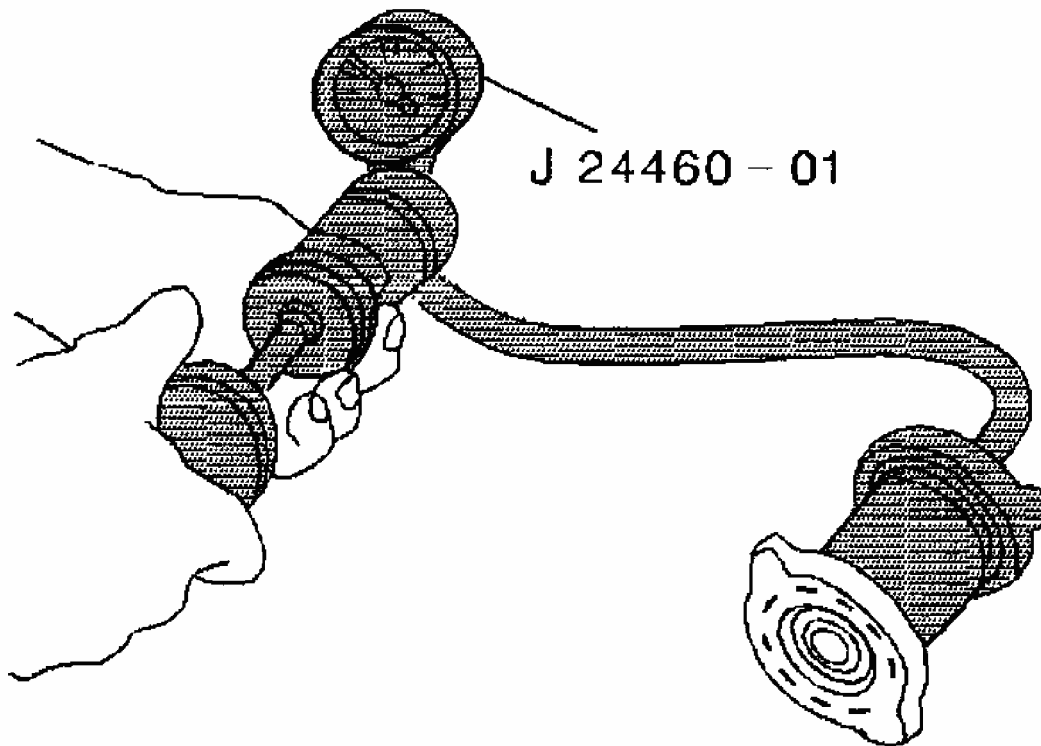
PRESSURE CAP TESTING

Tools Required

J 24460-01 Cooling System Pressure Tester

WARNING: 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. 22: Identifying Cooling System Pressure Tester
Courtesy of GENERAL MOTORS CORP.

3. Use the J 24460-01 in order to test the pressure cap.
4. Test the pressure cap for the following conditions:
 - Pressure release when the J 24460-01 exceeds the pressure rating of the pressure cap.

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- Maintain the rated pressure for at least 10 seconds.

Note the rate of pressure loss.

5. Replace the pressure cap under the following conditions:

- The pressure cap does not release pressure which exceeds the rated pressure of the cap.
- The pressure cap does not hold the rated pressure.

COOLING SYSTEM LEAK TESTING

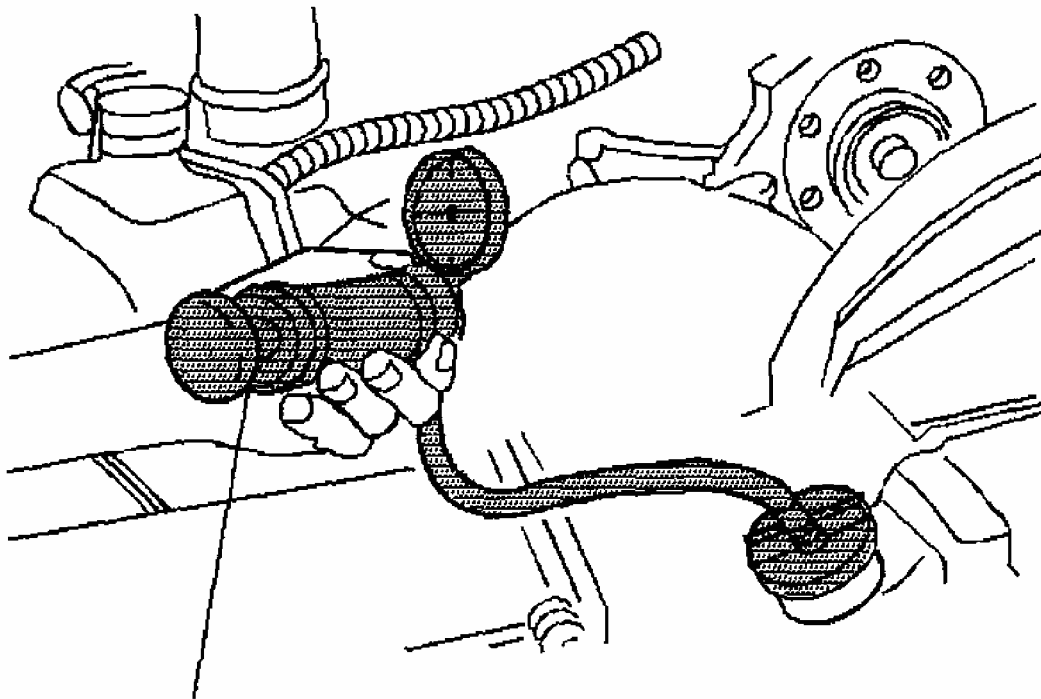
Tools Required

J 24460-01 Cooling System Pressure Tester

WARNING: 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.

WARNING: 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.



J24460-01

G01694724

Fig. 23: Checking Cooling System Pressure
Courtesy of GENERAL MOTORS CORP.

4. Use the J 24460-01 in order to apply pressure to the cooling system. Do not exceed the pressure cap rating.
5. The cooling system should hold the rated pressure for at least 2 minutes. Observe the gage for any pressure loss.
6. Repair any leaks as required.

REPAIR INSTRUCTIONS

DRAINING & FILLING COOLING SYSTEM

CAUTION: With a pressurized cooling system, the coolant temperature in the radiator can be considerably higher than the boiling point of the solution at atmospheric pressure. Removal of the surge tank cap, while the cooling system is hot and under high pressure, causes the solution to boil instantaneously with explosive force. This will cause the solution to spew out over the engine, the fenders, and the

person removing the cap. Serious bodily injury may result.

Important: If the procedure below is not followed a low or high coolant level condition and/or vehicle damage could result.

1. Park the vehicle on a level surface.
2. Remove the surge tank cap:
3. Raise and suitably support the vehicle. Refer to **LIFTING AND JACKING THE VEHICLE** .
4. Place a drain pan under the drain cock.
5. Open the radiator drain cock.
6. Allow the cooling system to drain completely.
7. Inspect the engine coolant for the following:
 - Discolored - follow the flush procedure below.
 - Normal in appearance - continue with the next step.

CAUTION: When adding coolant, use DEX-COOL(R) coolant. If silicated coolant is added to the system, premature engine, heater core or radiator corrosion may result. In addition, the engine coolant will require change sooner-at 50 000 km (30,000 mi) or 24 months.

CAUTION: Refer to FASTENER NOTICE .

8. Close the radiator drain cock.

Tighten

Tighten the radiator drain cock to 2 N.m (18 lb in).

9. Fill the cooling system through the surge tank.
10. Fill the cooling system with a 50/50 mixture of DEX-COOL(R) coolant and deionized water.
11. Start the engine.
12. Allow the engine to idle for 1 minute.
13. Install surge tank cap.
14. Cycle the engine RPMs from idle to 3000 in 30 second intervals until the coolant temperature reaches 99°C (210°F).
15. Shut off the engine.

16. Remove the surge tank cap.
17. Start the engine.
18. Allow the engine to Idle for 1 minute. Fill the surge tank to 12.7 mm (0.5 in) above the COLD FULL mark on the surge tank.
19. Install the surge tank cap.
20. Cycle the engine RPMs from idle to 3000 in 30 second intervals until the coolant reaches 99°C (210°F).
21. Shut off the engine.
22. Remove the surge tank cap.
23. Top off the coolant as necessary, 12.7 mm (0.5 in) above FULL COLD mark on the surge tank.
24. Rinse away any excess coolant from the engine and the engine compartment.
25. Inspect the concentration of the engine coolant.
26. Install the surge tank cap.

FLUSHING

Important: Do not use a chemical flush.

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

Various methods and equipment can be used to flush the cooling system. If special equipment is used, such as a back flusher, follow the manufacturer's instruction. 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 & Filling Cooling System** .
7. Fill the coolant reservoir to the FULL HOT mark.
8. Fill the cooling system. Refer to **DRAINING & Filling Cooling System** .

RADIATOR CLEANING

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

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

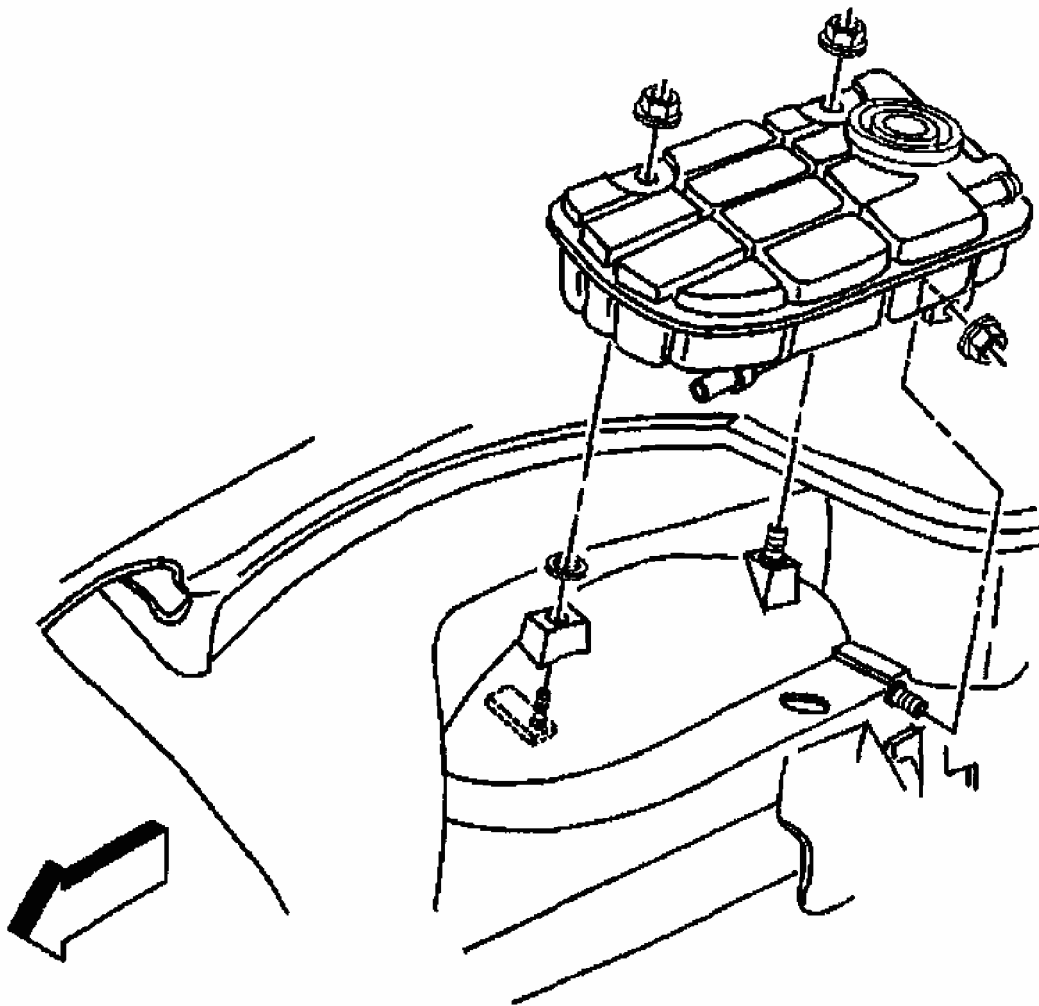
Important: Remove bugs, leaves, dirt and other debris by blowing compressed air through the engine side of the radiator.

- 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

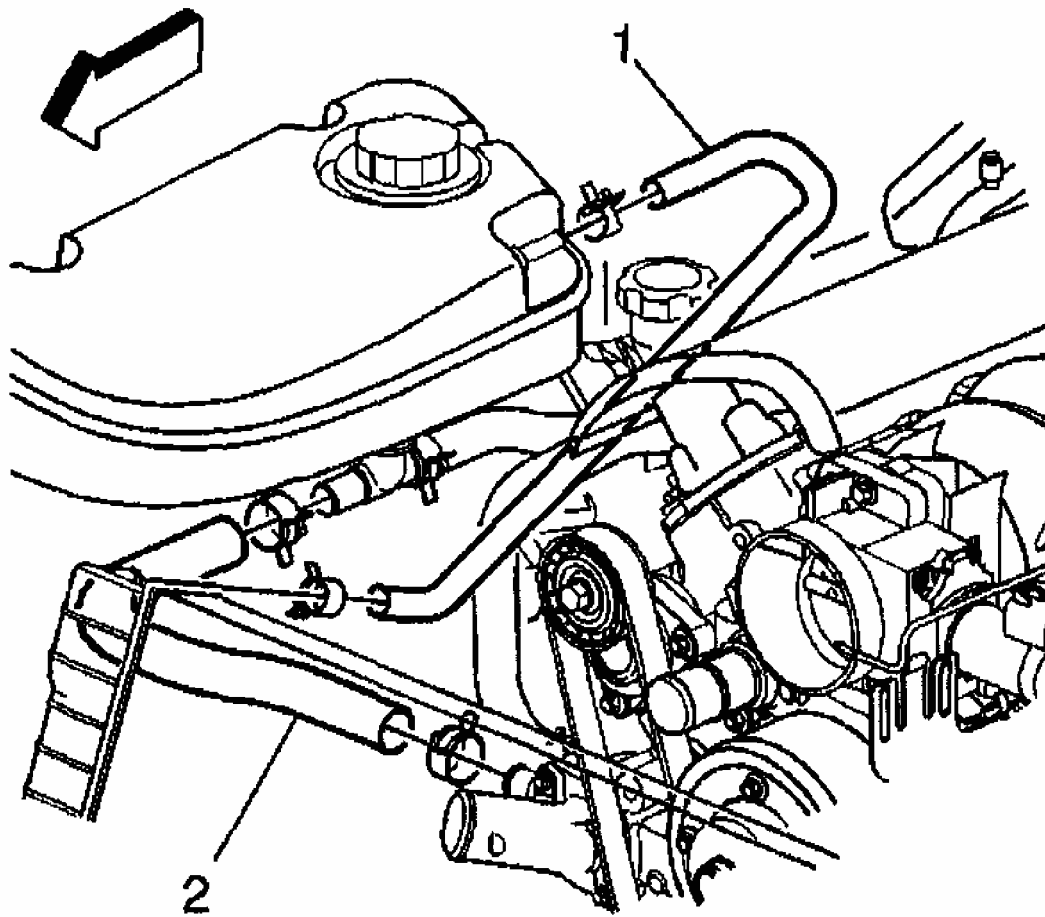
1. Drain the cooling system. Refer to **DRAINING & Filling Cooling System** .
2. Remove the surge tank nuts.
3. Loosen the surge tank side nut.



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Fig. 24: Removing Surge Tank Nuts
Courtesy of GENERAL MOTORS CORP.

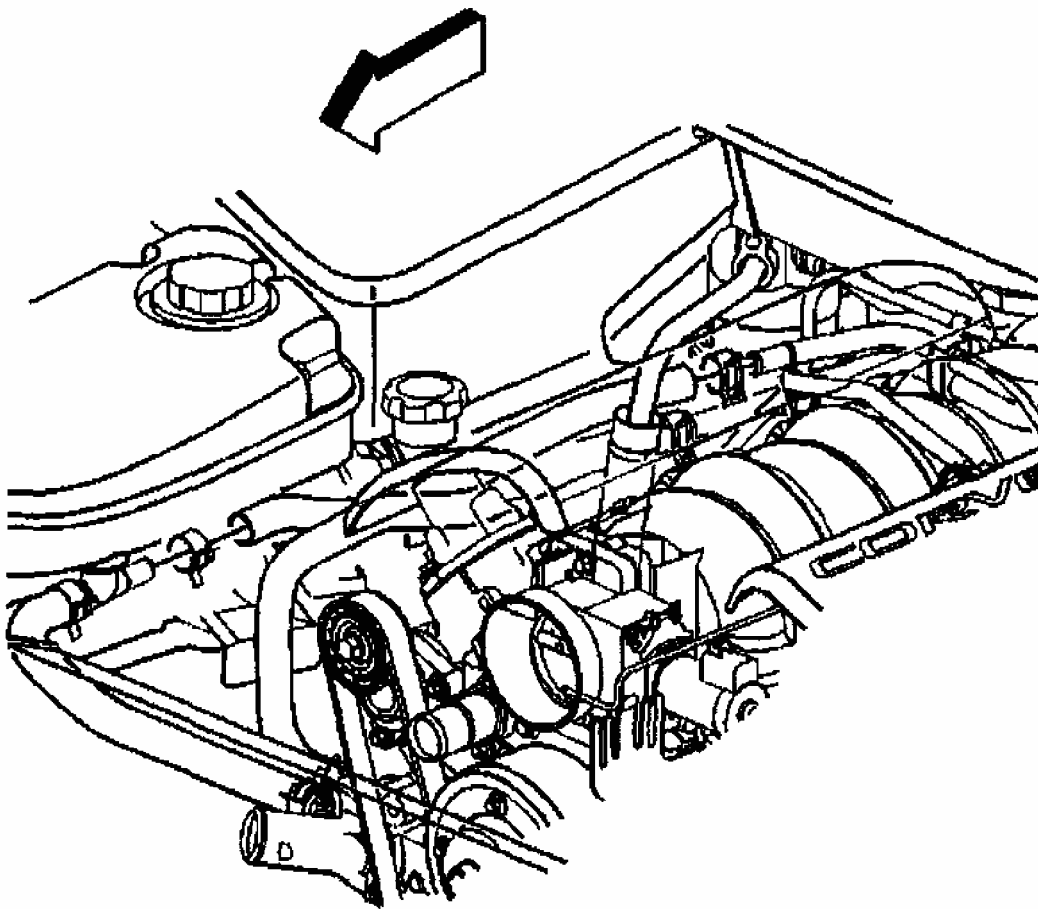
4. Reposition the surge tank inlet hose (1) clamp.
5. Remove the surge tank inlet (1) hose from the surge tank.
6. Reposition the surge tank outlet hose (2) clamp.
7. Remove the surge tank outlet hose (2).



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Fig. 25: Removing Surge Tank Inlet Hose
Courtesy of GENERAL MOTORS CORP.

8. Reposition the heater outlet hose clamp from the surge tank.
9. Remove the heater outlet hose from the surge tank.
10. Remove the surge tank.



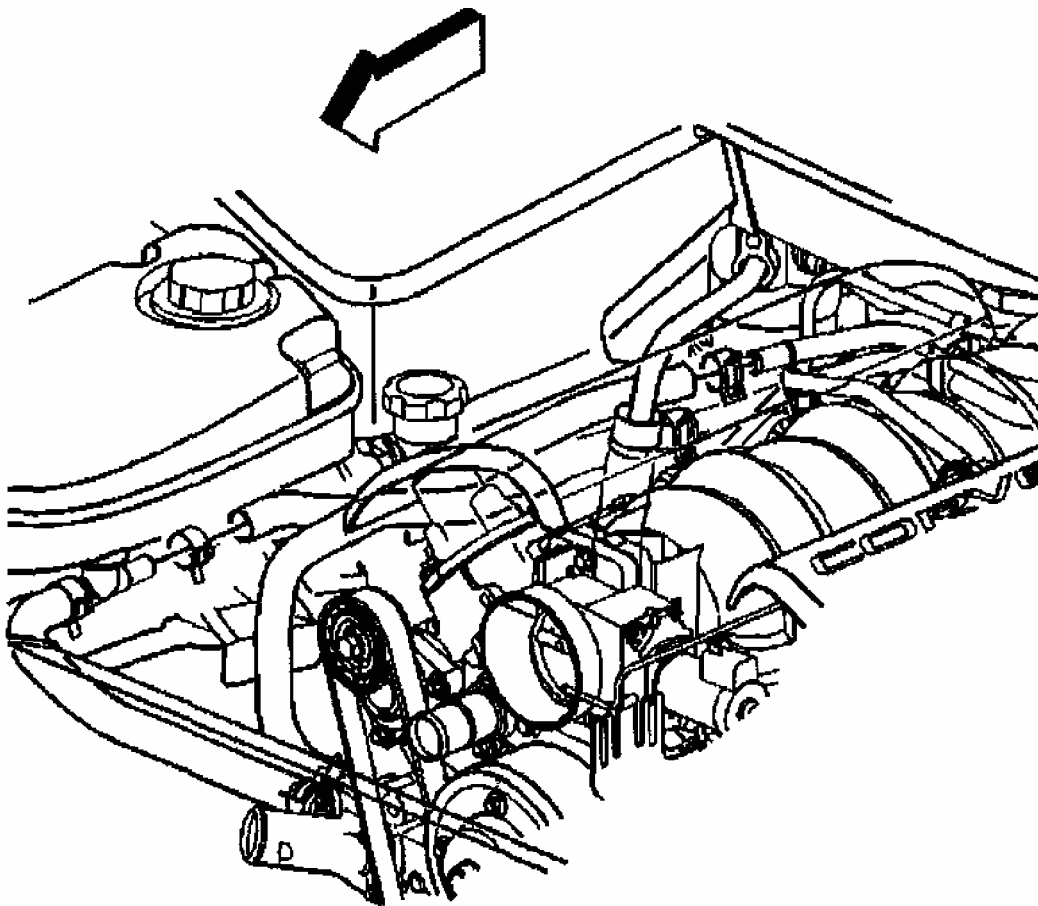
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Fig. 26: Removing Heater Outlet Hose
Courtesy of GENERAL MOTORS CORP.

Installation Procedure

Important: Lubricate the inside diameters of the hoses with clean coolant prior to installation.

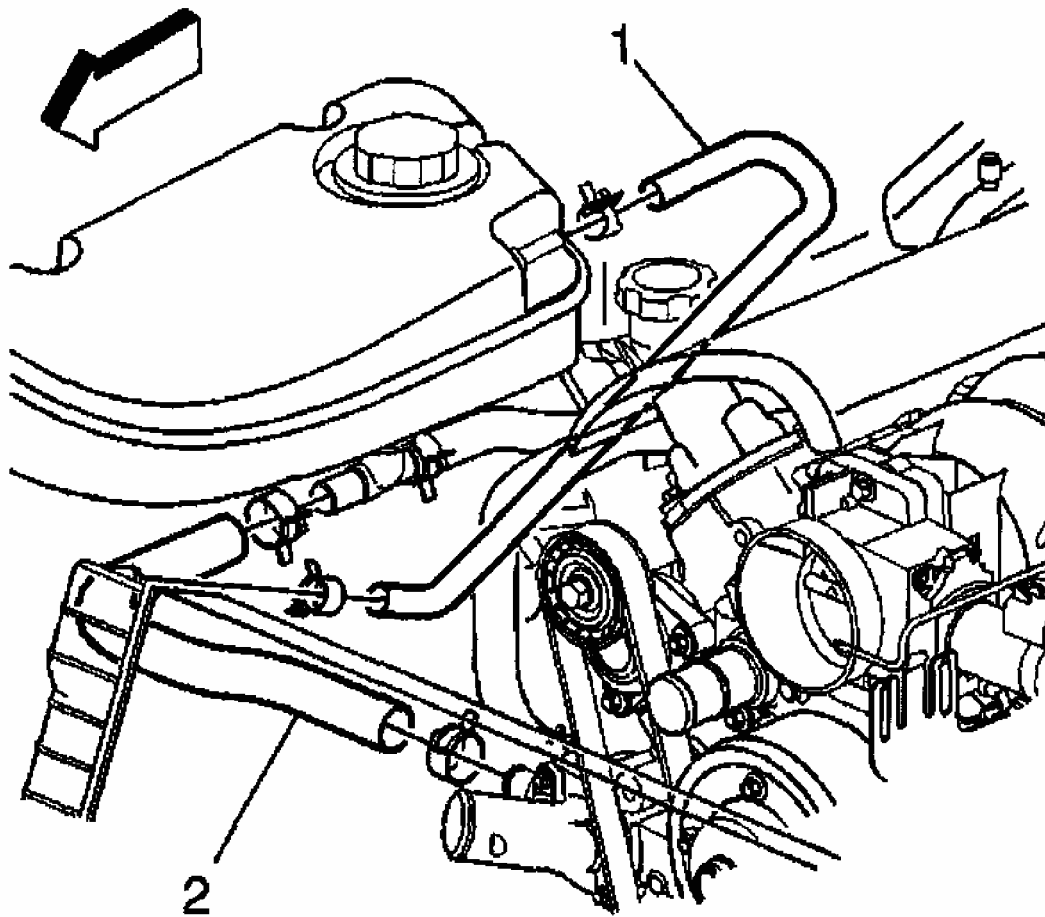
1. Install the surge tank.
2. Install the heater outlet hose to the surge tank.
3. Reposition the heater outlet hose clamp to the surge tank.



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Fig. 27: Installing Heater Outlet Hose
Courtesy of GENERAL MOTORS CORP.

4. Install the surge tank inlet (1) hose to the surge tank.
5. Reposition the surge tank inlet hose clamp.
6. Install the surge tank outlet hose to the surge tank.
7. Reposition the surge tank outlet hose clamp (2) to the surge tank.



G01694729

Fig. 28: Installing Surge Tank Inlet Hose
Courtesy of GENERAL MOTORS CORP.

Important: When installing the surge tank ensure that the front stud is fully seated in the slot.

8. Install the surge tank onto the studs.

CAUTION: Refer to FASTENER NOTICE .

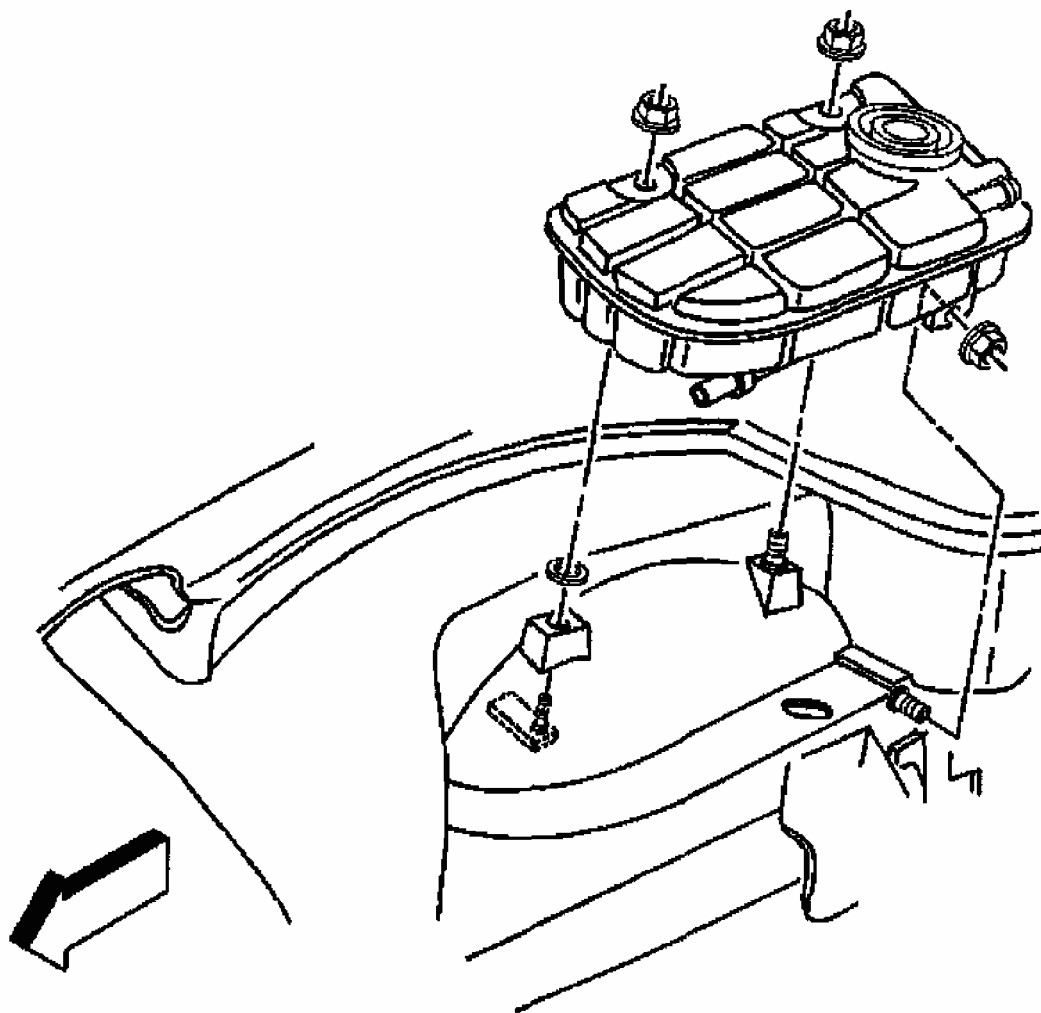
9. Install the surge tank upper nuts.
10. Tighten the nuts in the following sequence:
 - 10.1. Bottom
 - 10.2. Top rear

10.3. Top front

Tighten

Tighten the radiator surge tank nuts to 10 N.m (89 lb in)

11. Fill the cooling system. Refer to **DRAINING & Filling Cooling System** .



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Fig. 29: Installing Radiator Surge Tank Nuts
Courtesy of GENERAL MOTORS CORP.

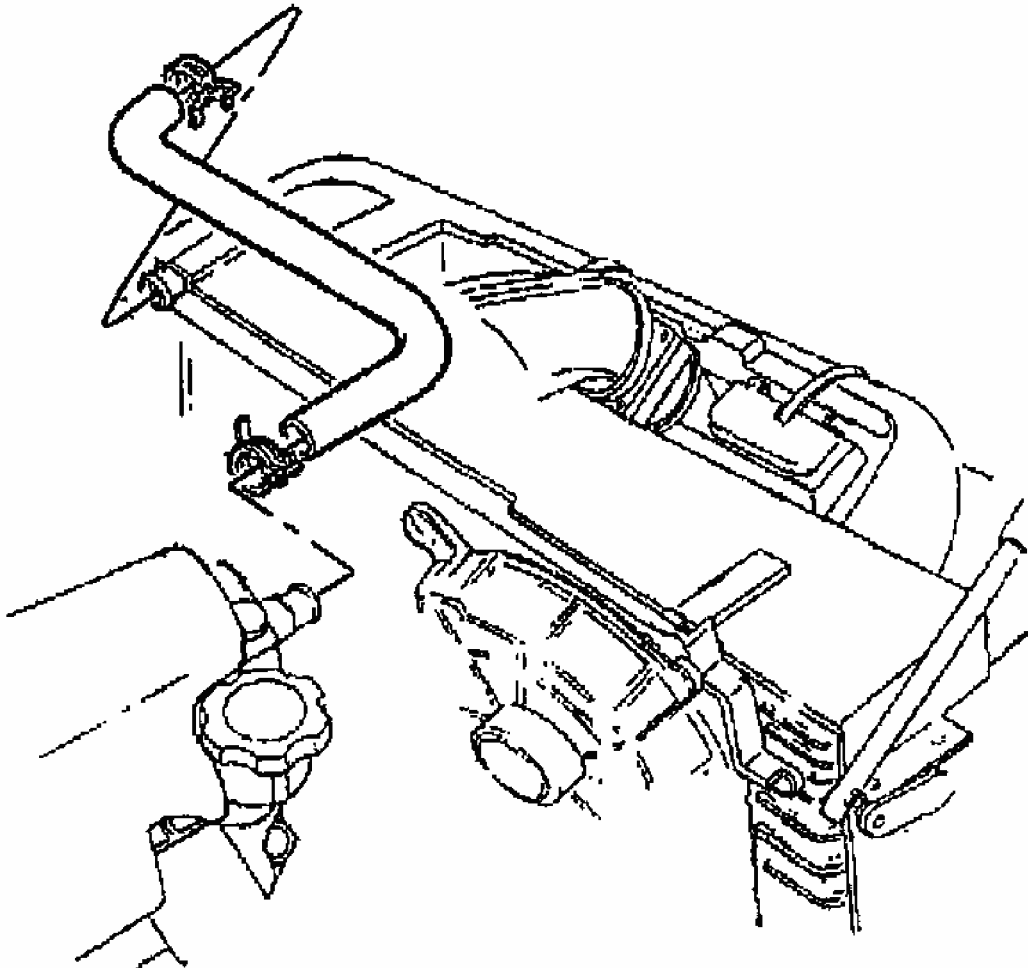
RADIATOR HOSE REPLACEMENT - INLET

Tools Required

J 38185 Hose Clamp Pliers

Removal Procedure

1. Drain the cooling system. Refer to **DRAINING & Filling Cooling System** .
2. Remove the radiator upper support. Refer to **Radiator Support Replacement** .
3. Reposition the radiator inlet hose clamp from the radiator using **J 38185**.
4. Reposition the radiator inlet hose clamp from the water pump using **J 38185**.
5. Remove the radiator inlet hose from the radiator.
6. Remove the radiator inlet from the water pump.

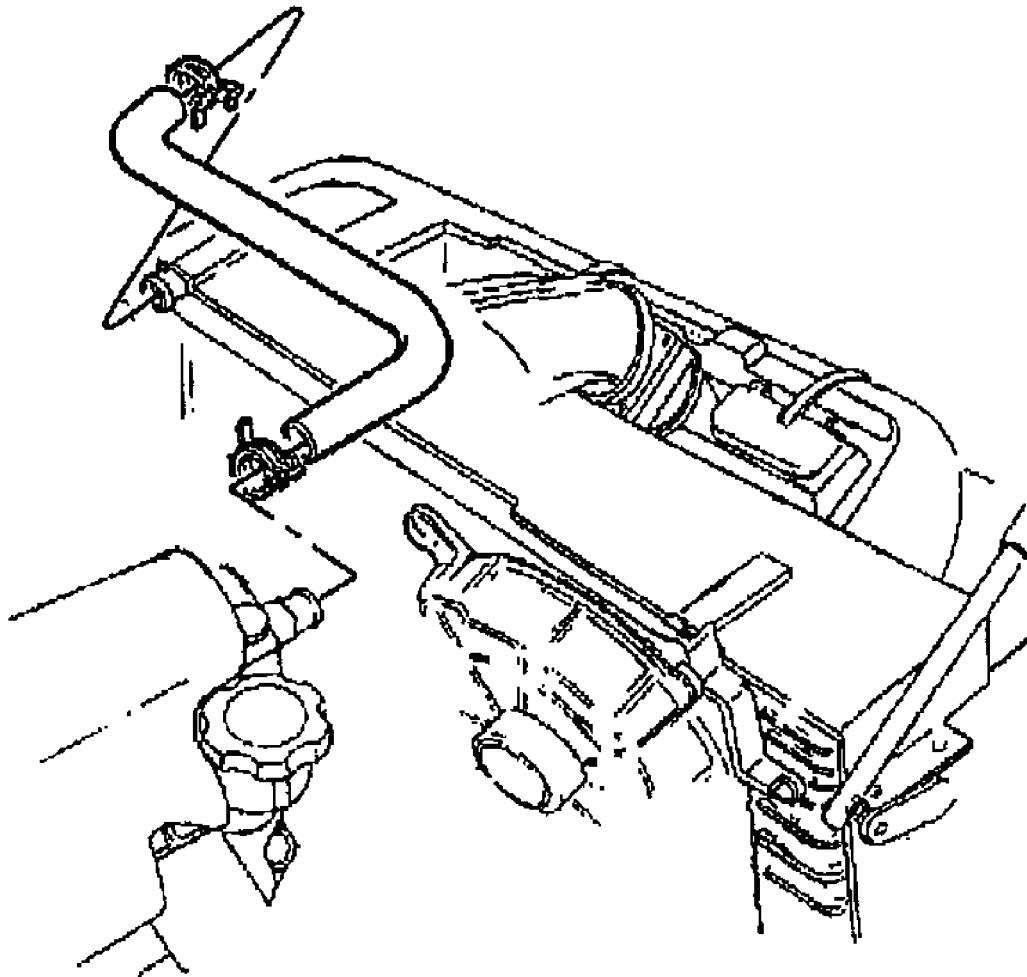


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Fig. 30: Removing Radiator Inlet Hose
Courtesy of GENERAL MOTORS CORP.

Installation Procedure

1. Install the radiator inlet hose to the radiator.
2. Reposition the radiator inlet hose clamp to the radiator using **J 38185**.
3. Install the radiator inlet hose to the water pump.
4. Reposition the radiator inlet hose clamp to the water pump using **J 38185**.
5. Install the radiator upper support. Refer to **Radiator Support Replacement** .
6. Fill the cooling system. Refer to **DRAINING & Filling Cooling System** .



G01694732

Fig. 31: Installing Radiator Inlet Hose
Courtesy of GENERAL MOTORS CORP.

Removal Procedure

Tools Required

J 38185

1. Drain the cooling system. Refer to **Radiator Support Replacement** .
2. Reposition the radiator outlet hose clamp from the water pump inlet using **J 38185**
3. Remove the radiator outlet hose from the water pump inlet.
4. Raise and suitably support the vehicle. Refer to **LIFTING AND JACKING THE VEHICLE** .
5. Reposition the radiator outlet hose clamp from the radiator using **J 38185**
6. Remove the radiator outlet hose from the radiator.

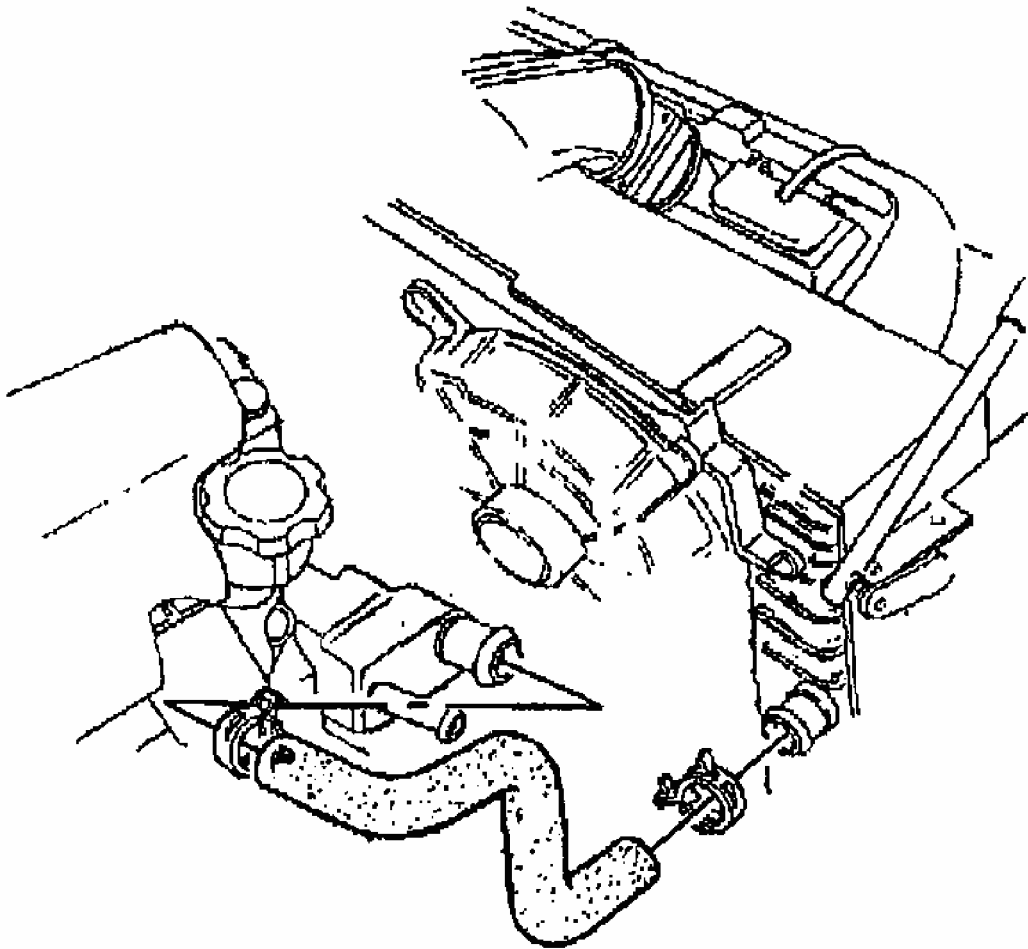
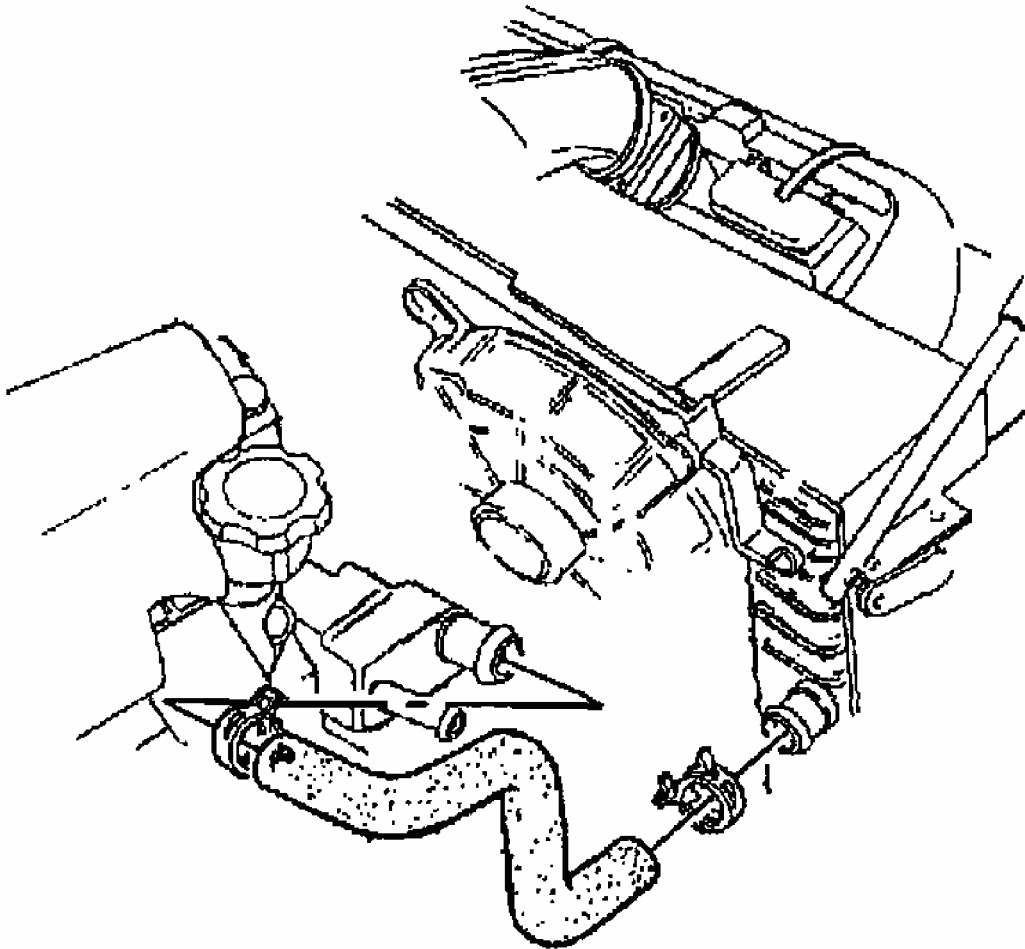


Fig. 32: Removing Radiator Outlet Hose
Courtesy of GENERAL MOTORS CORP.

Installation Procedure

1. Install the radiator outlet hose to the radiator.
2. Reposition the radiator outlet hose clamp to the radiator using **J 38185**
3. Lower the vehicle.
4. Install the radiator outlet hose to the water pump inlet.
5. Reposition the radiator outlet hose clamp to the water pump inlet using **J 38185**
6. Fill the cooling system. Refer to **DRAINING & Filling Cooling System** .



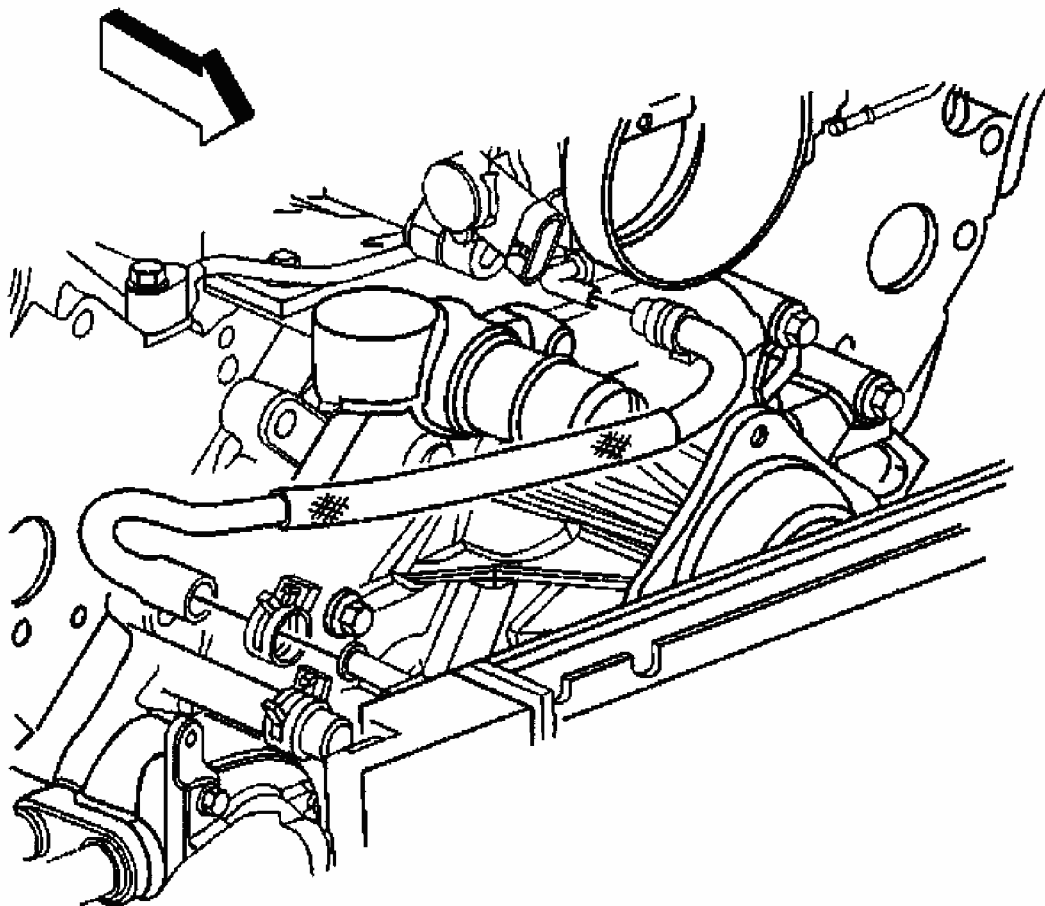
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Fig. 33: Installing Radiator Outlet Hose
Courtesy of GENERAL MOTORS CORP.

THROTTLE BODY HEATER HOSE REPLACEMENT - OUTLET

Removal Procedure

1. Drain the cooling system. Refer to **DRAINING & Filling Cooling System** .
2. Remove the radiator support. Refer to **Radiator Support Replacement** .
3. Reposition the throttle body heater outlet hose clamps at the radiator and throttle body.
4. Remove the throttle body heater outlet hose from the radiator and throttle body.



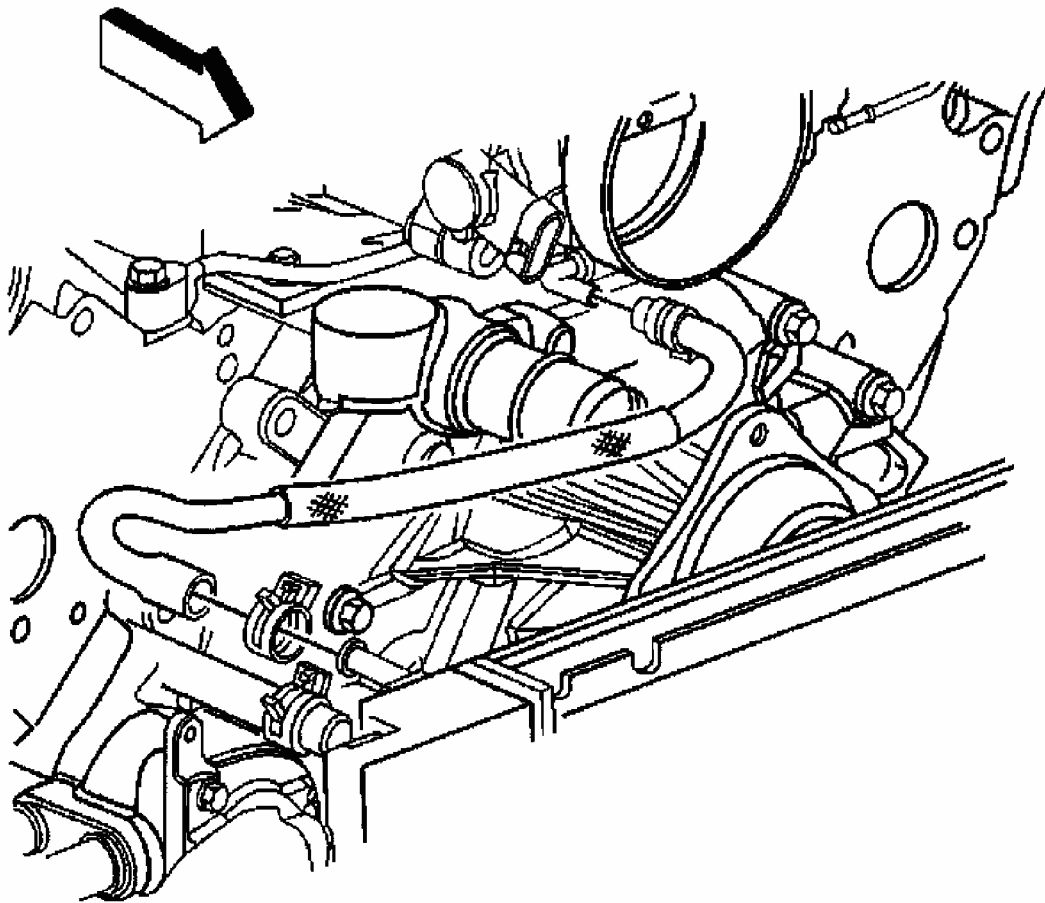
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Fig. 34: Removing Throttle Body Heater Outlet Hose
Courtesy of GENERAL MOTORS CORP.

Installation Procedure

1. Install the throttle body heater outlet hose to the radiator and throttle body.
2. Position the throttle body heater outlet hose clamps at the radiator and throttle body.
3. Install the radiator support. Refer to **Radiator Support Replacement** .

4. Fill the cooling system. Refer to **DRAINING & Filling Cooling System** .



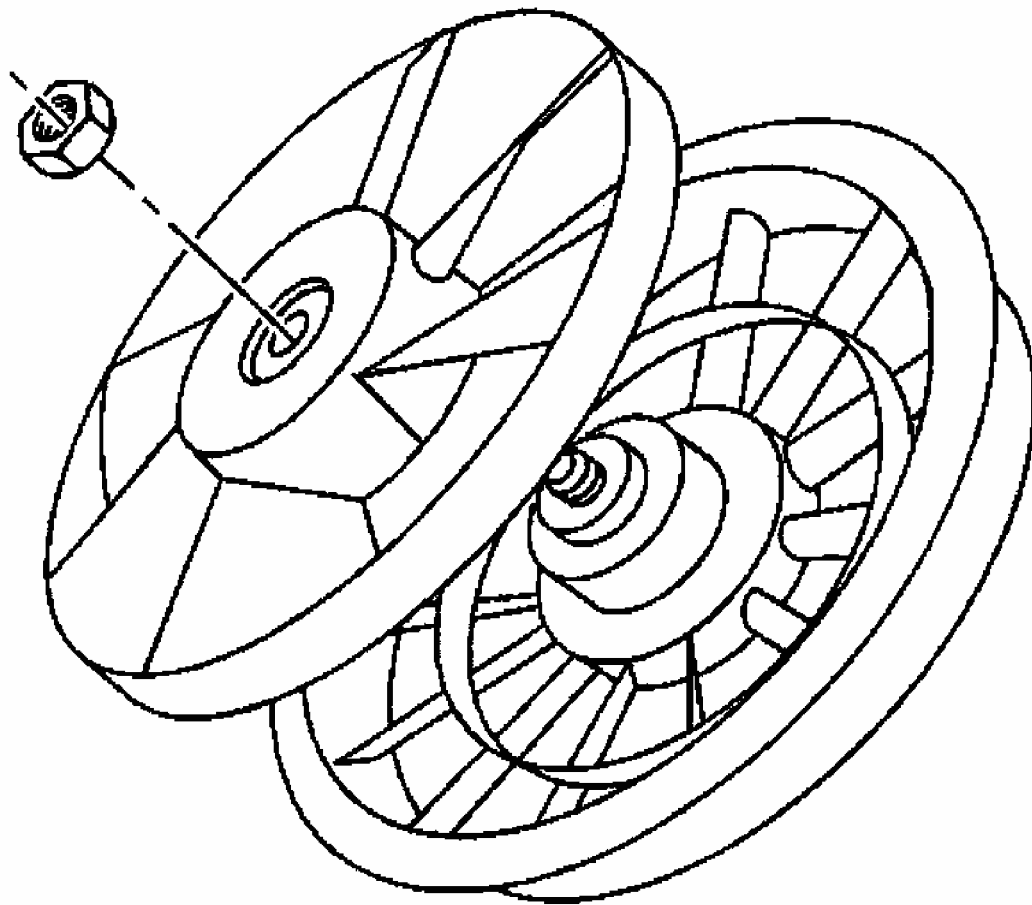
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Fig. 35: Installing Throttle Body Heater Outlet Hose
Courtesy of GENERAL MOTORS CORP.

COOLING FAN REPLACEMENT - ELECTRIC

Removal Procedure

1. Remove the fan shroud. Refer to **Fan Shroud Replacement** .
2. Remove the cooling fan blade nut.
3. Remove the cooling fan blade.



G01694737

Fig. 36: Removing Cooling Fan Blade Nut
Courtesy of GENERAL MOTORS CORP.

Installation Procedure

1. Install the cooling fan blade.

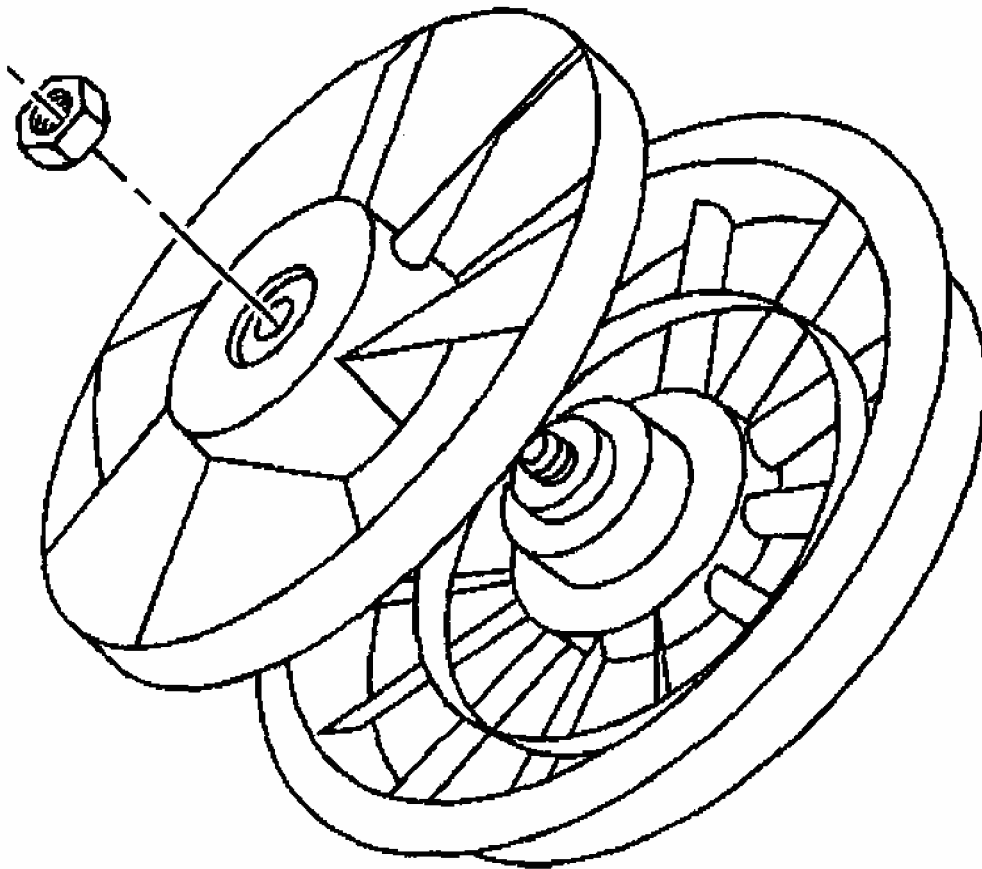
CAUTION: Refer to FASTENER NOTICE .

2. Install the cooling fan blade nut.

Tighten

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

3. Install the fan shroud. Refer to **Fan Shroud Replacement** .



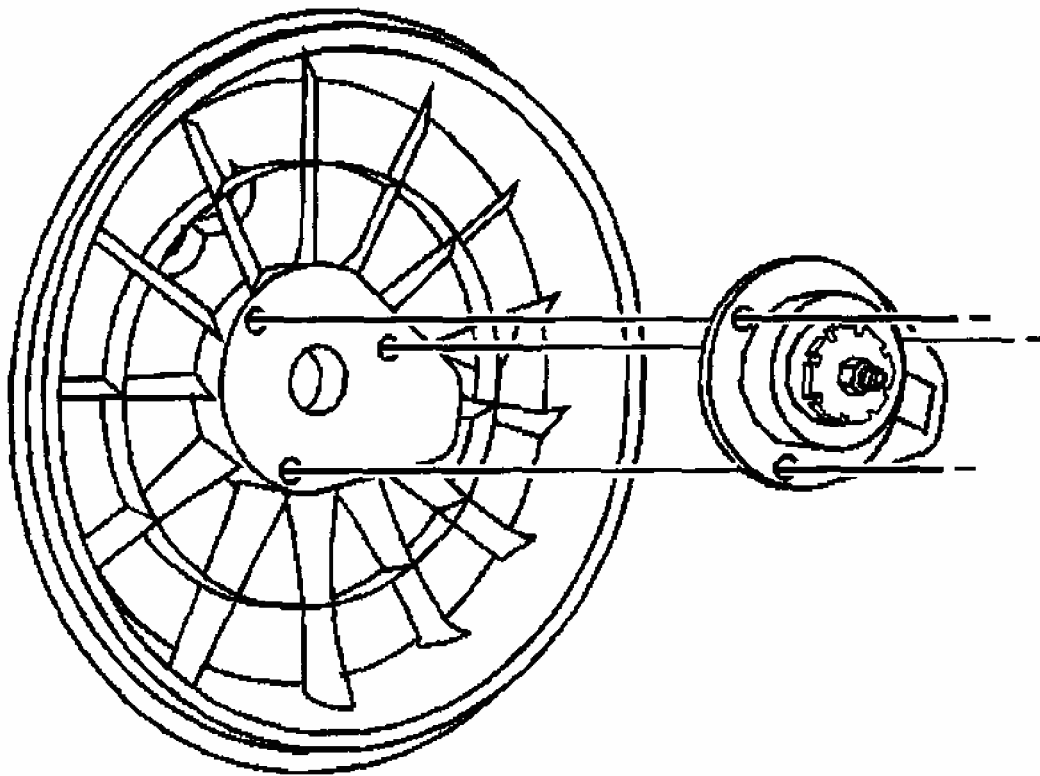
G01694738

Fig. 37: Installing Cooling Fan Blade Nut
Courtesy of GENERAL MOTORS CORP.

COOLING FAN MOTOR REPLACEMENT - ELECTRIC

Removal Procedure

1. Remove the cooling fan. Refer to **COOLING FAN REPLACEMENT - Electric** .
2. Remove the fan motor bolts.
3. Remove the fan motor from the shroud.



G01694739

Fig. 38: Removing Fan Motor Bolts
Courtesy of GENERAL MOTORS CORP.

Installation Procedure

1. Install the fan motor to the shroud.

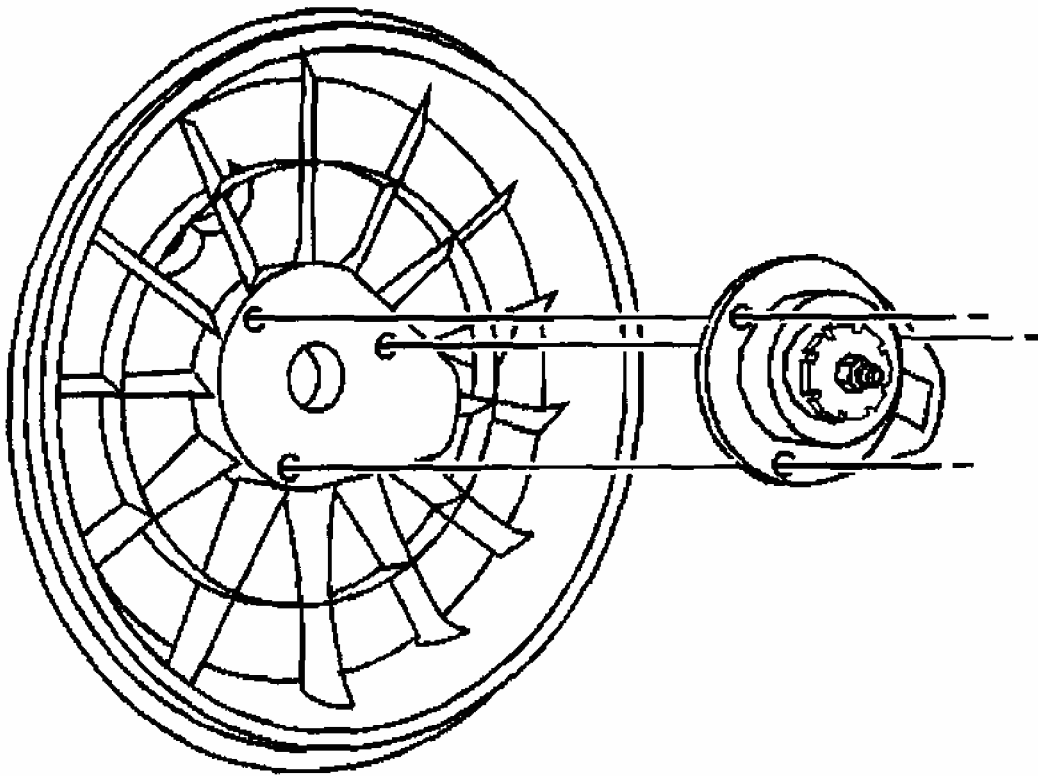
CAUTION: FASTENER
NOTICE .

2. Install the fan motor bolts.

Tighten

Tighten the cooling fan motor bolts to 6 N.m (53 lb in).

3. Install the cooling fan. Refer to **COOLING FAN REPLACEMENT - Electric** .



G01694740

Fig. 39: Installing Fan Motor Bolts
Courtesy of GENERAL MOTORS CORP.

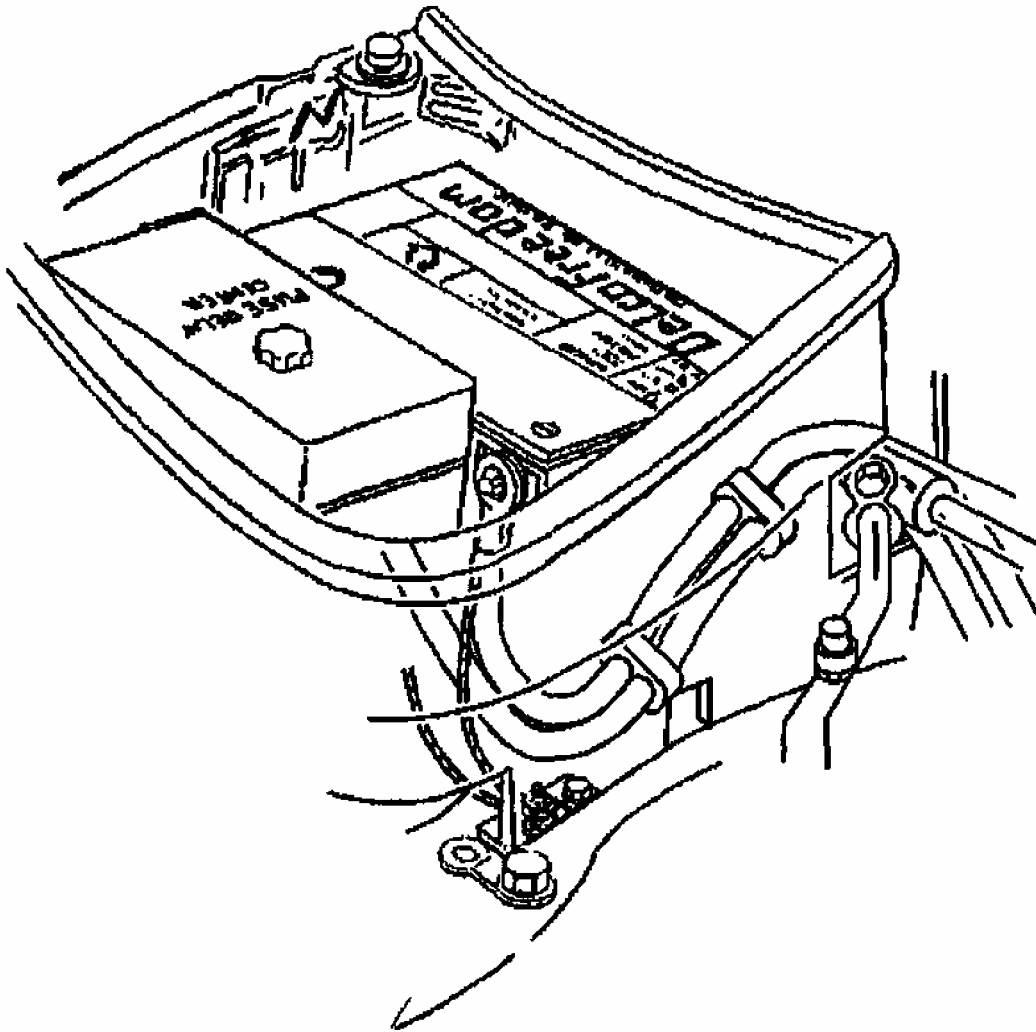
COOLING FAN RELAY REPLACEMENT

Tools Required

J 43244 Relay Puller Pliers

Removal Procedure

1. Remove the underhood electrical center cover.
2. Using the **J 43244** , remove the cooling fan relay. Refer to **BUZZERS, RELAYS & TIMERS** .



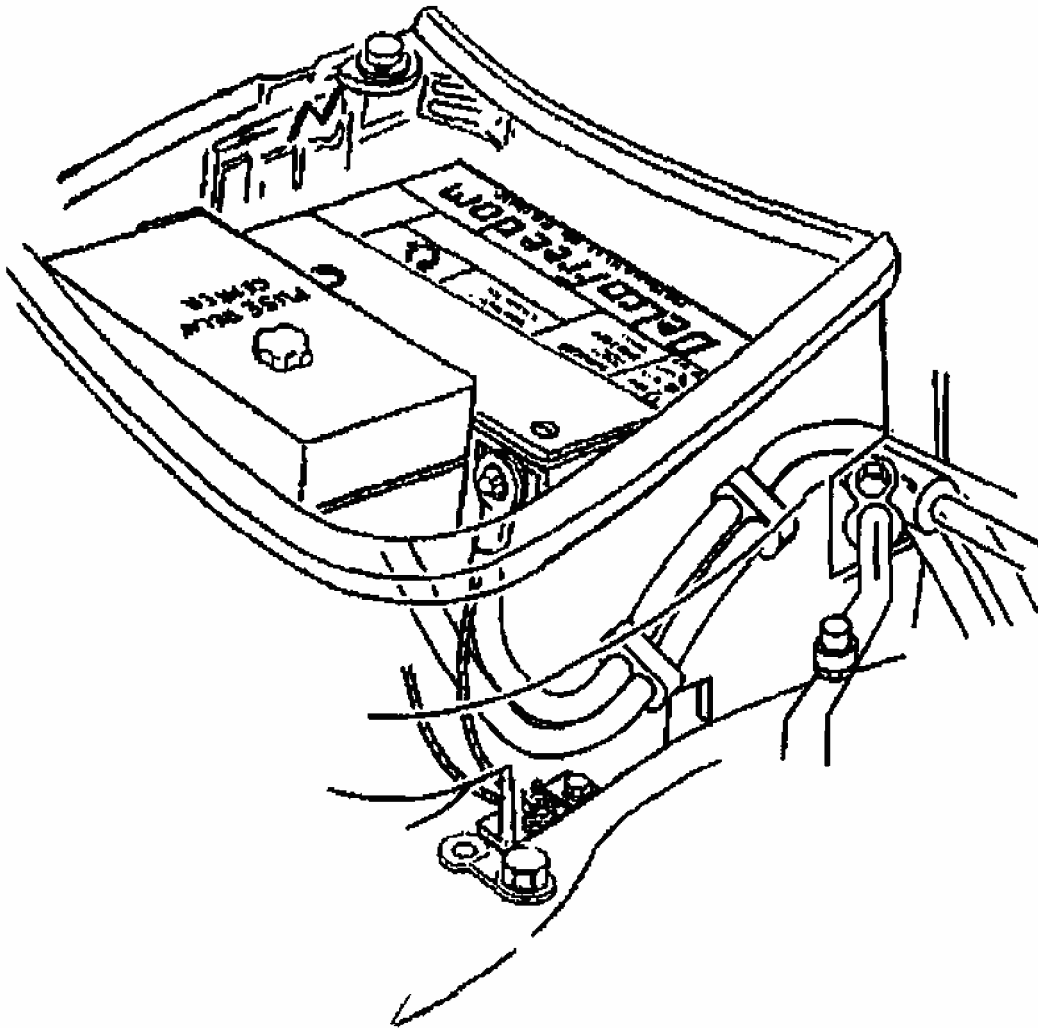
G01694741

Fig. 40: Identifying Underhood Electrical Center Cover
Courtesy of GENERAL MOTORS CORP.

Installation Procedure

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

1. Install the cooling fan relay. Refer to **BUZZERS, RELAYS & TIMERS** .
2. Install the underhood electrical center cover.



G01694742

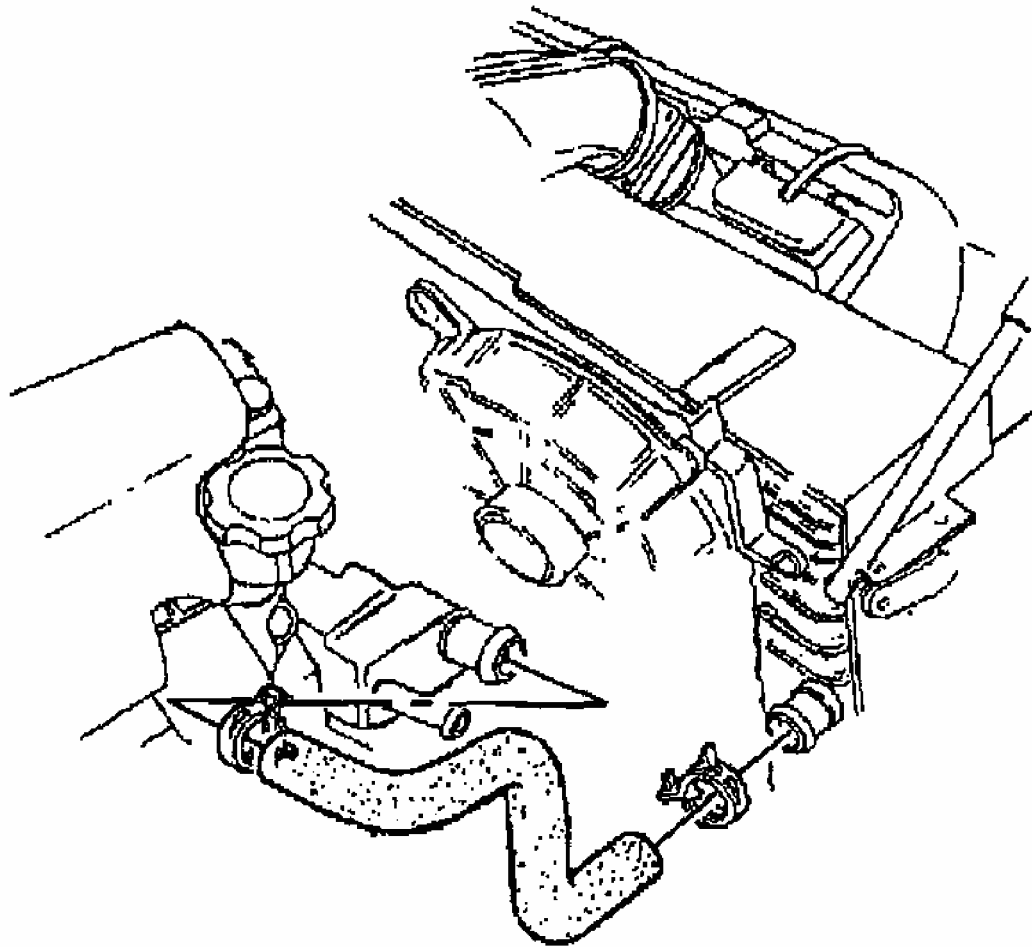
Fig. 41: Identifying Underhood Electrical Center Cover
Courtesy of GENERAL MOTORS CORP.

THERMOSTAT REPLACEMENT

Removal Procedure

Important: The water pump inlet and thermostat **MUST** be replaced as an assembly. The thermostat is not serviceable separately.

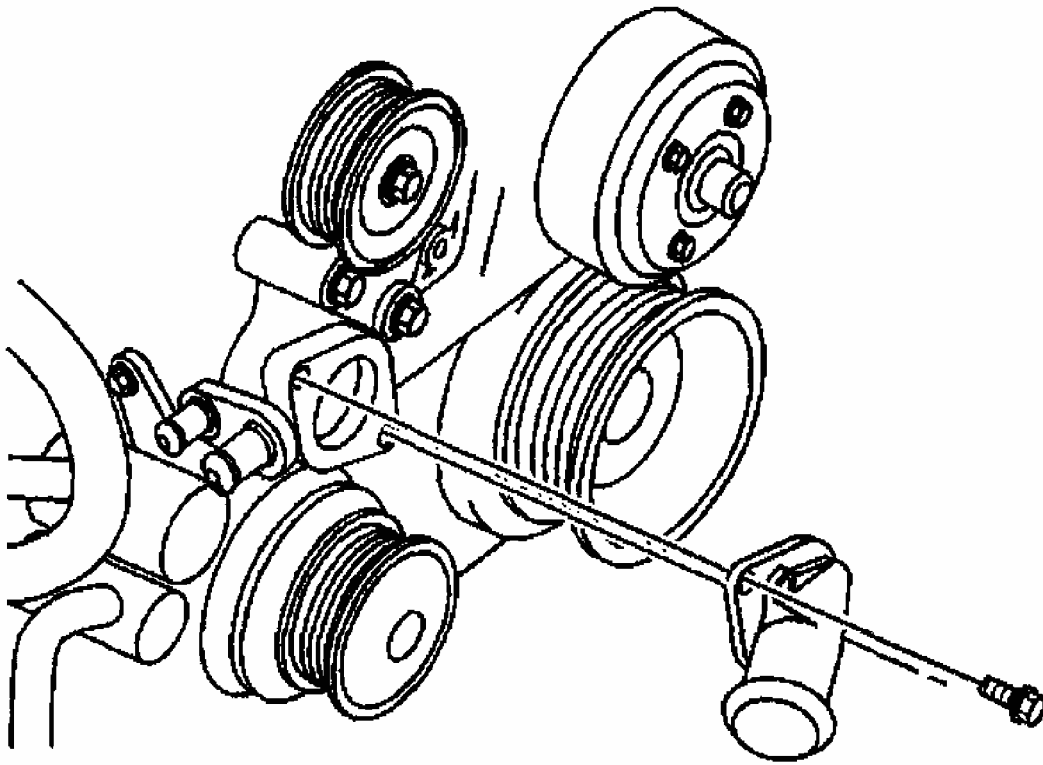
1. Drain the cooling system. Refer to **DRAINING & Filling Cooling System** .
2. Reposition the outlet hose clamp at the water pump inlet.
3. Remove the outlet hose from the water pump inlet.



G01694743

Fig. 42: Removing Outlet Hose
Courtesy of GENERAL MOTORS CORP.

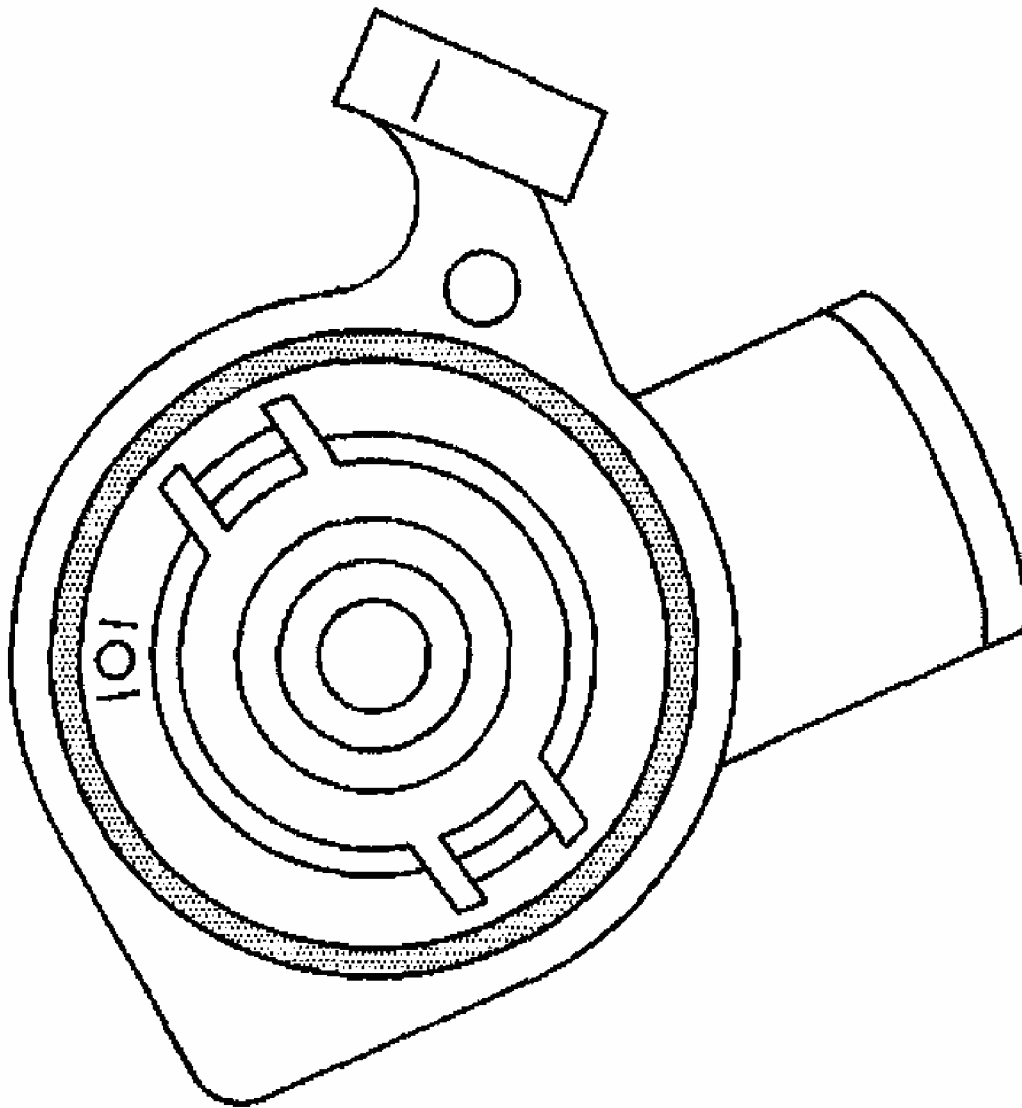
4. Remove the water pump inlet bolts.
5. Remove the water pump inlet.



G01694744

Fig. 43: Removing Water Pump Inlet Bolts
Courtesy of GENERAL MOTORS CORP.

6. The O-ring seal is integral to the thermostat housing.
7. Remove the thermostat housing.

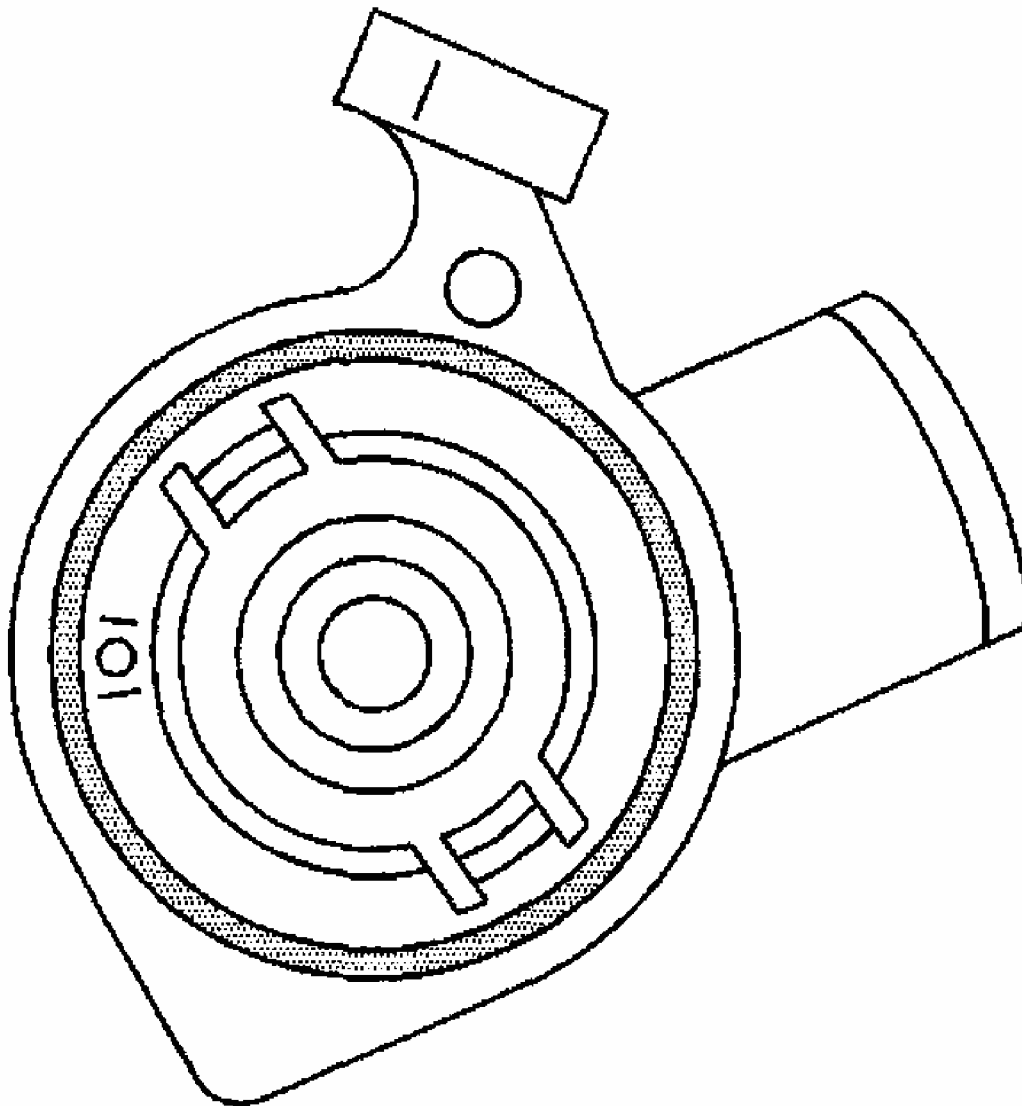


G01694745

Fig. 44: Identifying Thermostat Housing O-Ring
Courtesy of GENERAL MOTORS CORP.

Installation Procedure

1. Install a new thermostat housing.
2. Ensure that the new thermostat housing has an O-ring seal and is in the groove correctly.



G01694746

Fig. 45: Identifying Thermostat Housing O-Ring
Courtesy of GENERAL MOTORS CORP.

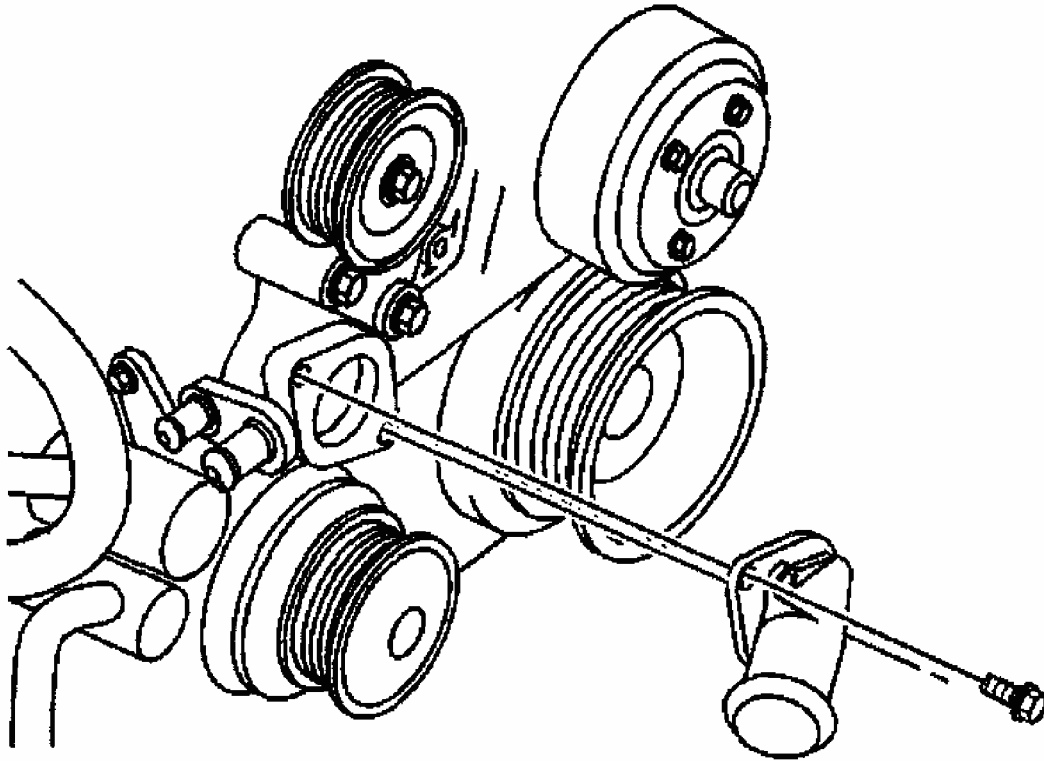
3. Install the water pump inlet (with thermostat).

CAUTION: Refer to FASTENER NOTICE .

4. Install the water pump inlet bolts.

Tighten

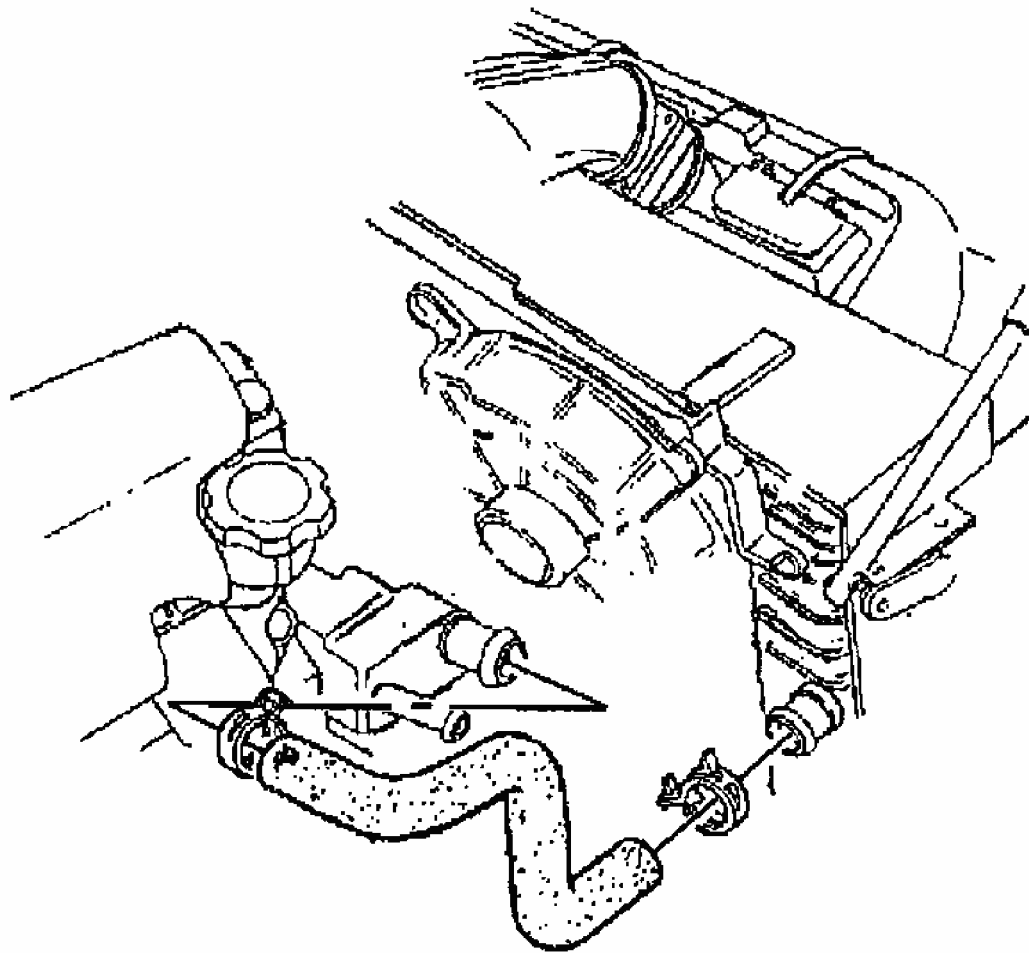
Tighten the water pump inlet bolts to 15 N.m (11 lb ft).



G01694747

Fig. 46: Installing Water Pump Inlet Bolts
Courtesy of GENERAL MOTORS CORP.

5. Install the outlet hose to the water pump inlet.
6. Position the outlet hose clamp at the water outlet.
7. Fill the cooling system. Refer to **DRAINING & Filling Cooling System** .



G01694748

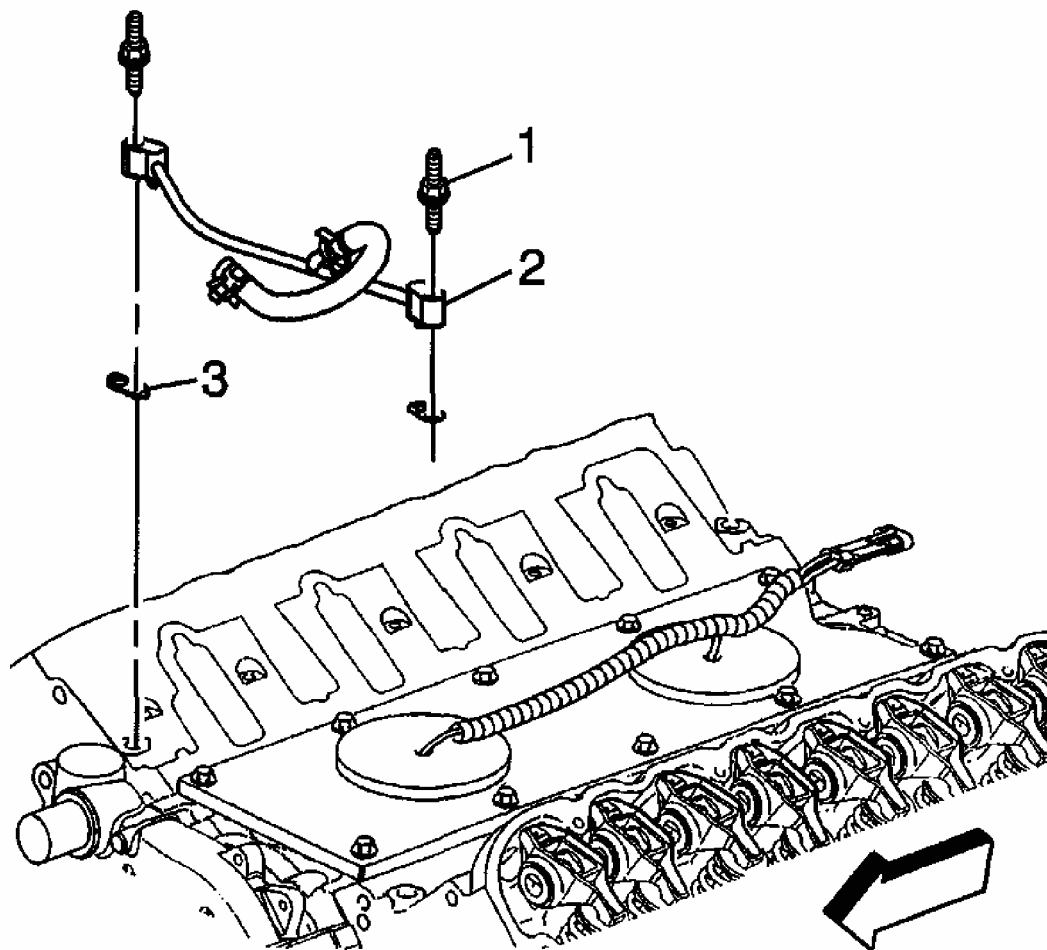
Fig. 47: Installing Outlet Hose
Courtesy of GENERAL MOTORS CORP.

COOLANT AIR BLEED PIPE ASSEMBLY REPLACEMENT

Removal Procedure

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

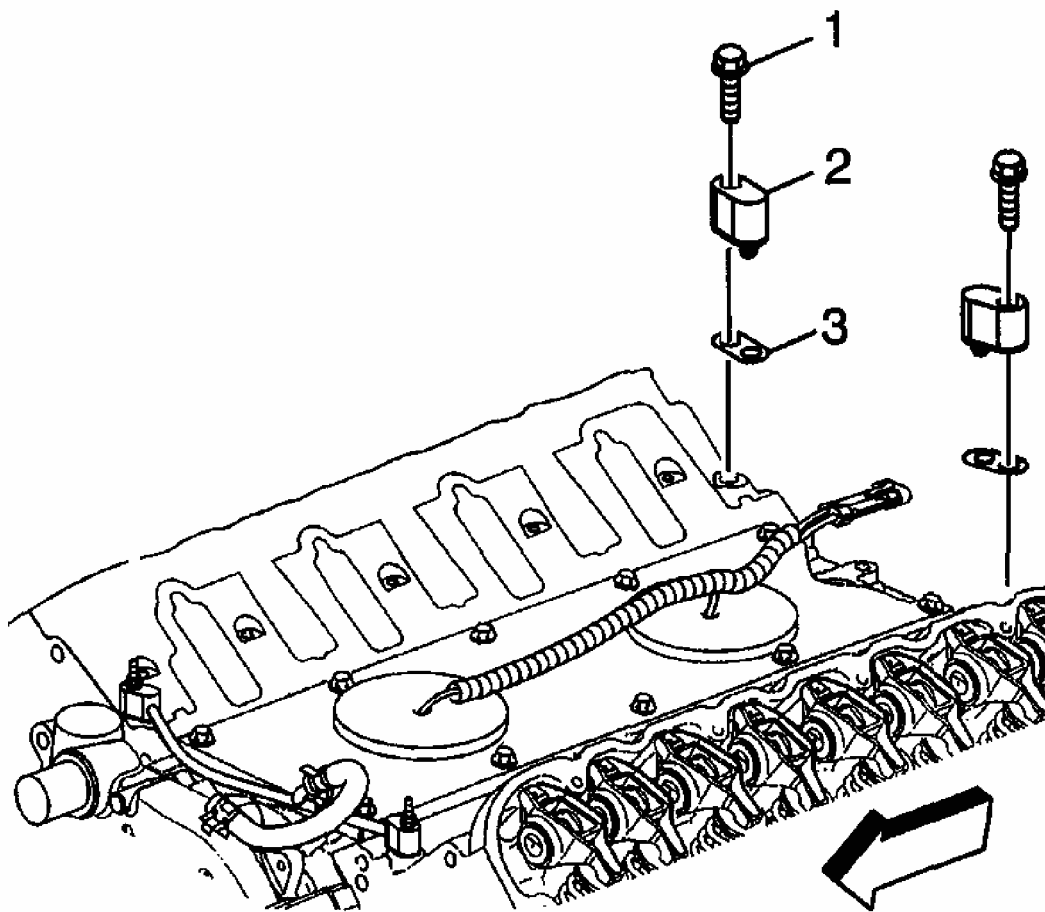
1. Remove the intake manifold, if required. Refer to **INTAKE MANIFOLD REPLACEMENT**.
2. Remove the coolant air bleed hose from the throttle body, if required.
3. Remove the coolant air bleed pipe studs (1).
4. Remove the coolant air bleed pipe (2) with gaskets (3).



G01694749

Fig. 48: Removing Coolant Air Bleed Pipe Studs
Courtesy of GENERAL MOTORS CORP.

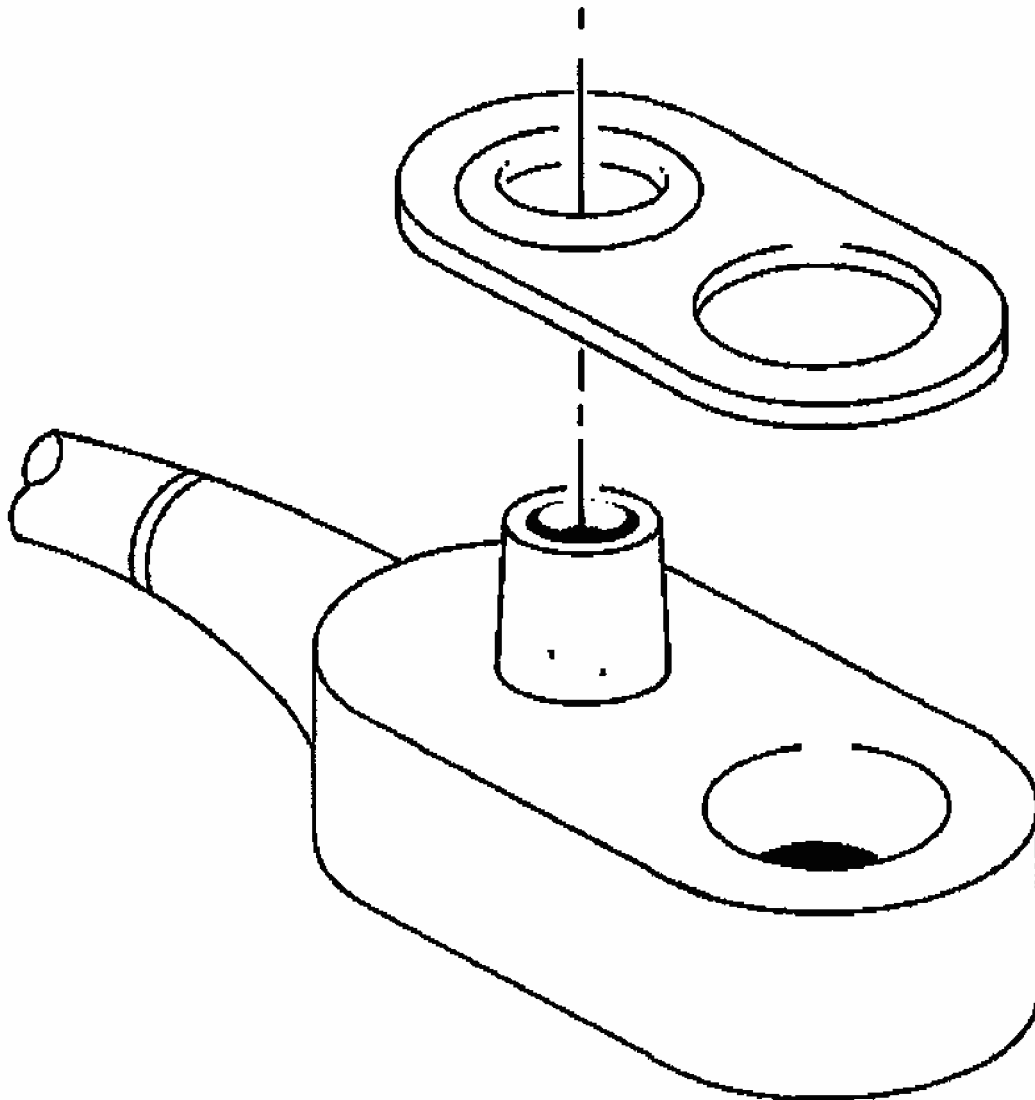
5. Remove the coolant air bleed pipe cover bolts (1), if required.
6. Remove the coolant air bleed pipe covers (2) with gaskets (3), if required.



G01694750

Fig. 49: Removing Coolant Air Bleed Pipe Cover Bolts
Courtesy of GENERAL MOTORS CORP.

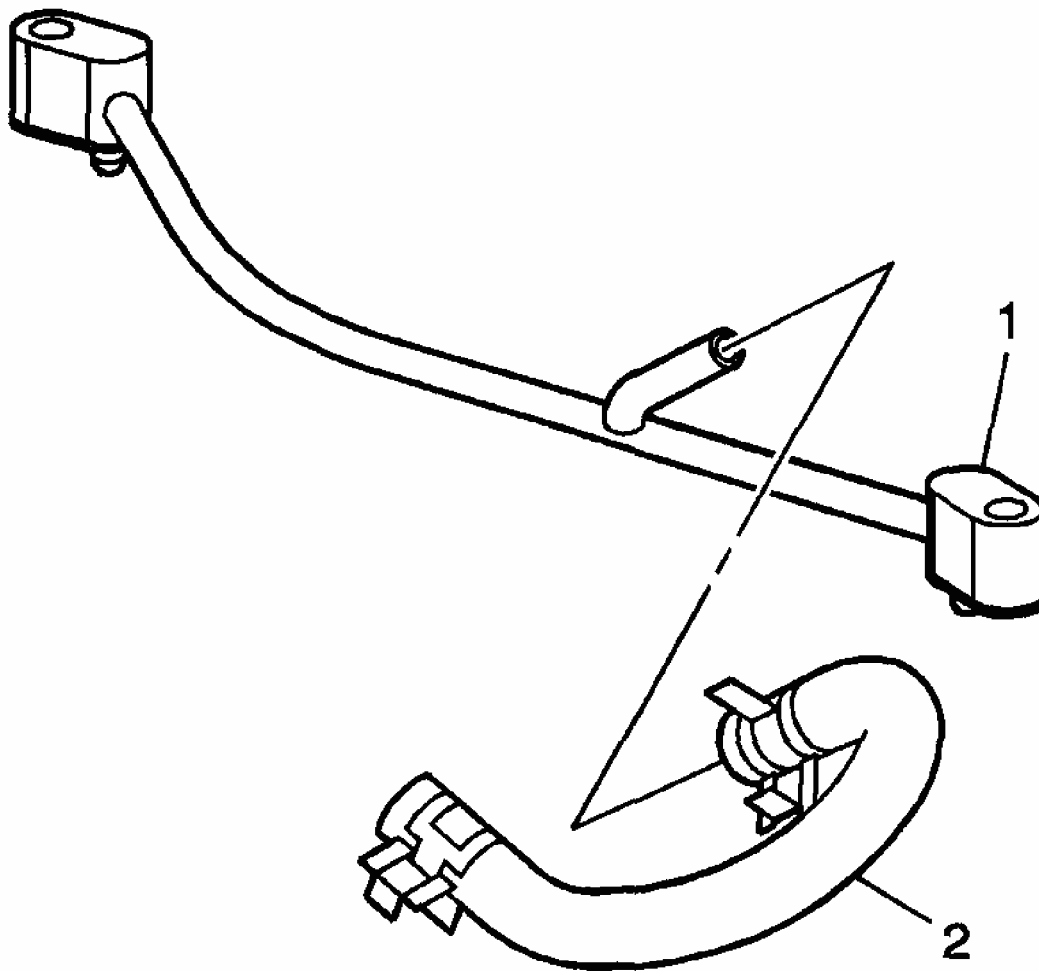
7. Remove the gaskets from the coolant air bleed pipe and covers. Discard the gaskets.



G01694751

Fig. 50: Removing Coolant Air Bleed Pipe Cover Gaskets
Courtesy of GENERAL MOTORS CORP.

8. Remove the coolant air bleed hose (2) from the pipe (1).
9. Clean and inspect the coolant air bleed pipe. Refer to **COOLANT AIR BLEED PIPE CLEANING AND INSPECTION.**

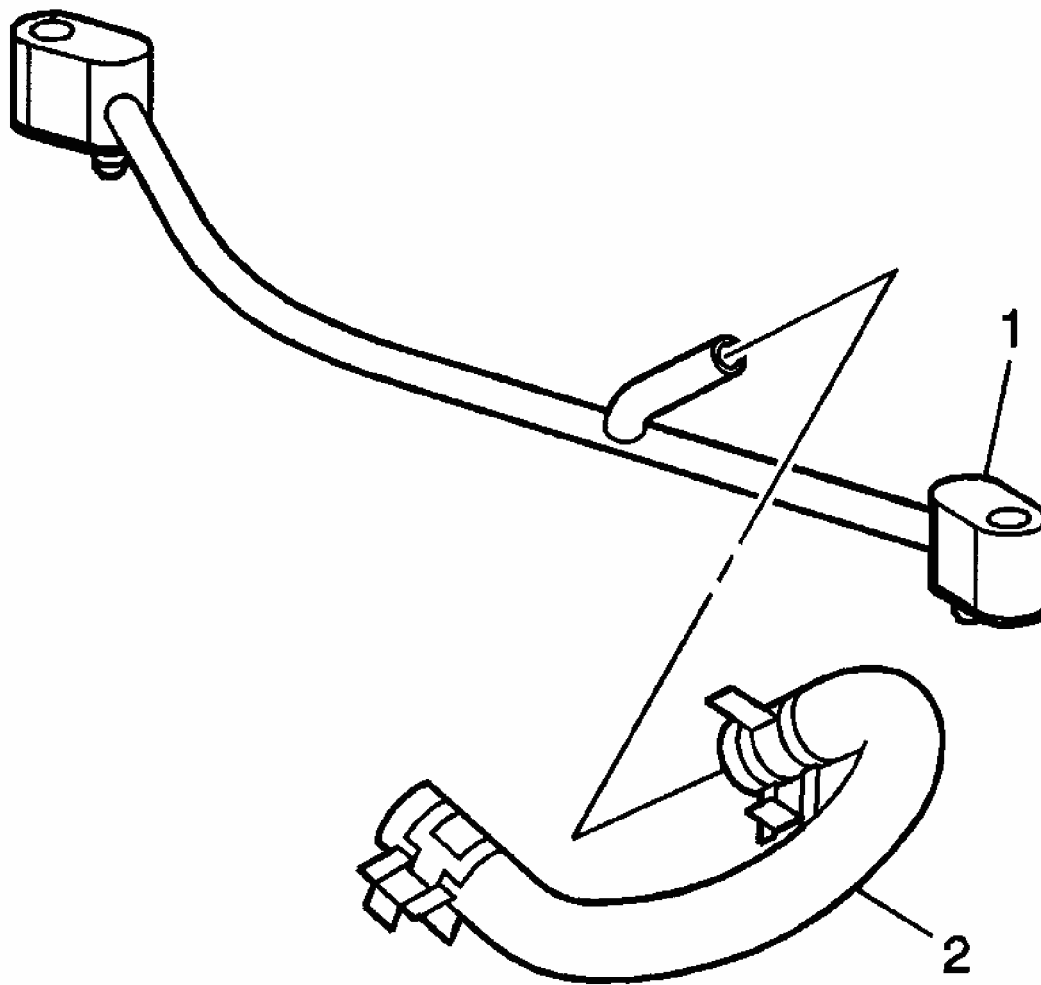


G01694752

Fig. 51: Removing Coolant Air Bleed Hose
Courtesy of GENERAL MOTORS CORP.

Installation Procedure

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

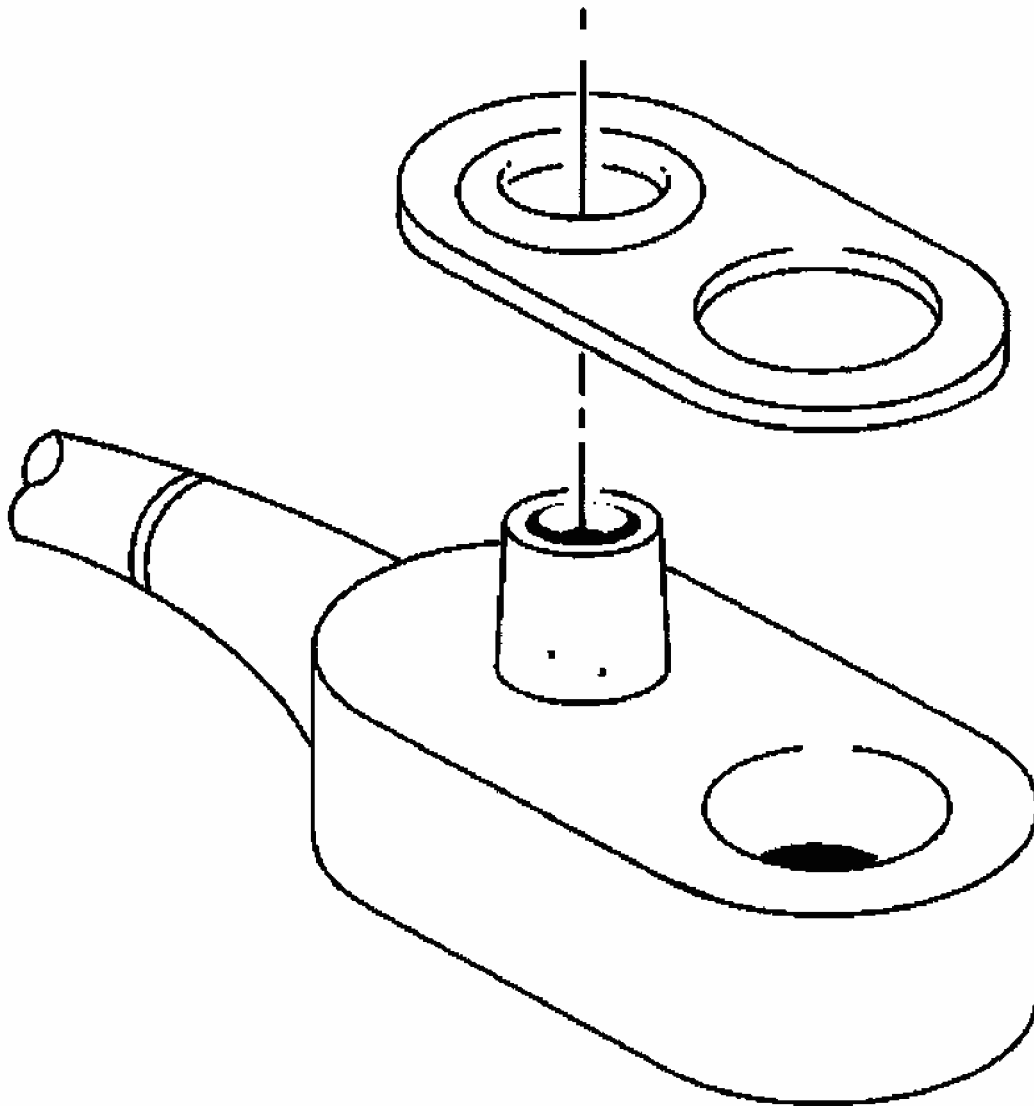


G01694753

Fig. 52: Installing Coolant Air Bleed Hose
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, if required.



G01694754

Fig. 53: Installing Coolant Air Bleed Pipe Cover Gaskets
Courtesy of GENERAL MOTORS CORP.

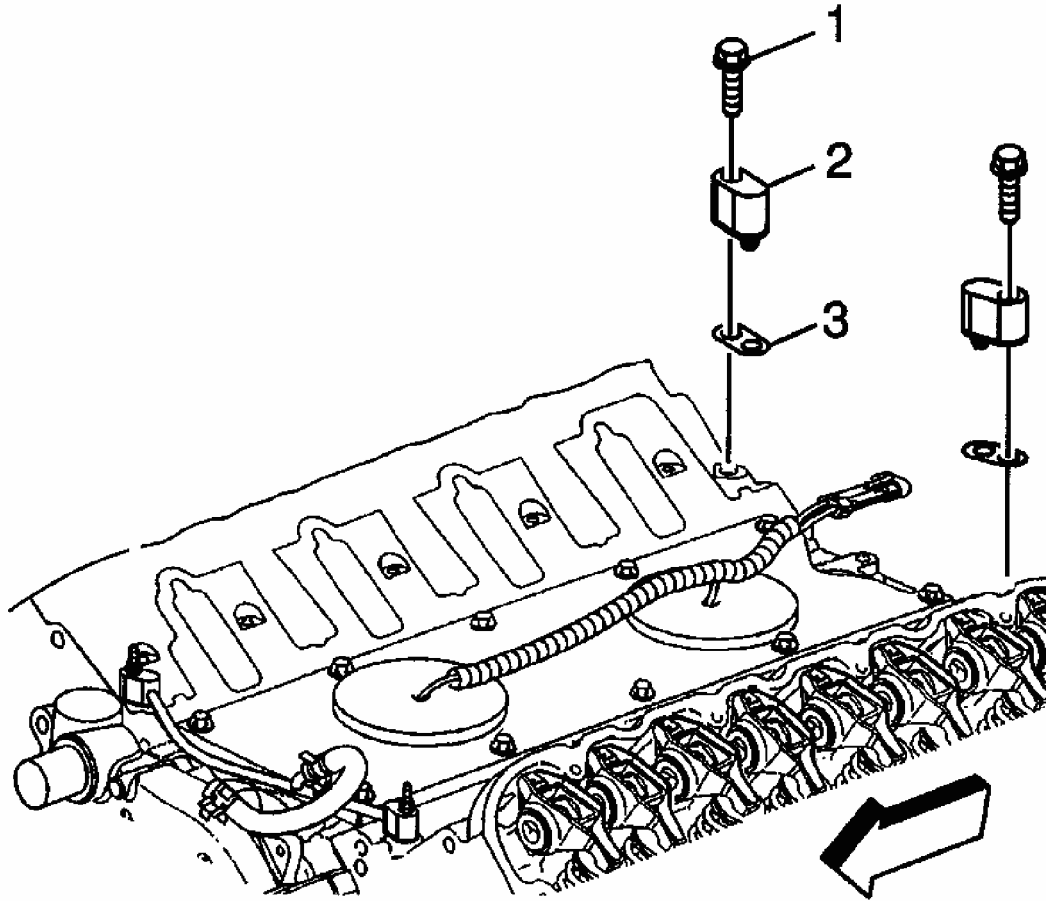
3. Install the coolant air bleed pipe covers (2) with gaskets (3), if required.

CAUTION: Refer to FASTENER NOTICE .

4. Install the coolant air bleed pipe cover bolts (1).

Tighten

Tighten the coolant air bleed pipe cover bolts to 12 N.m (106 lb in).



G01694755

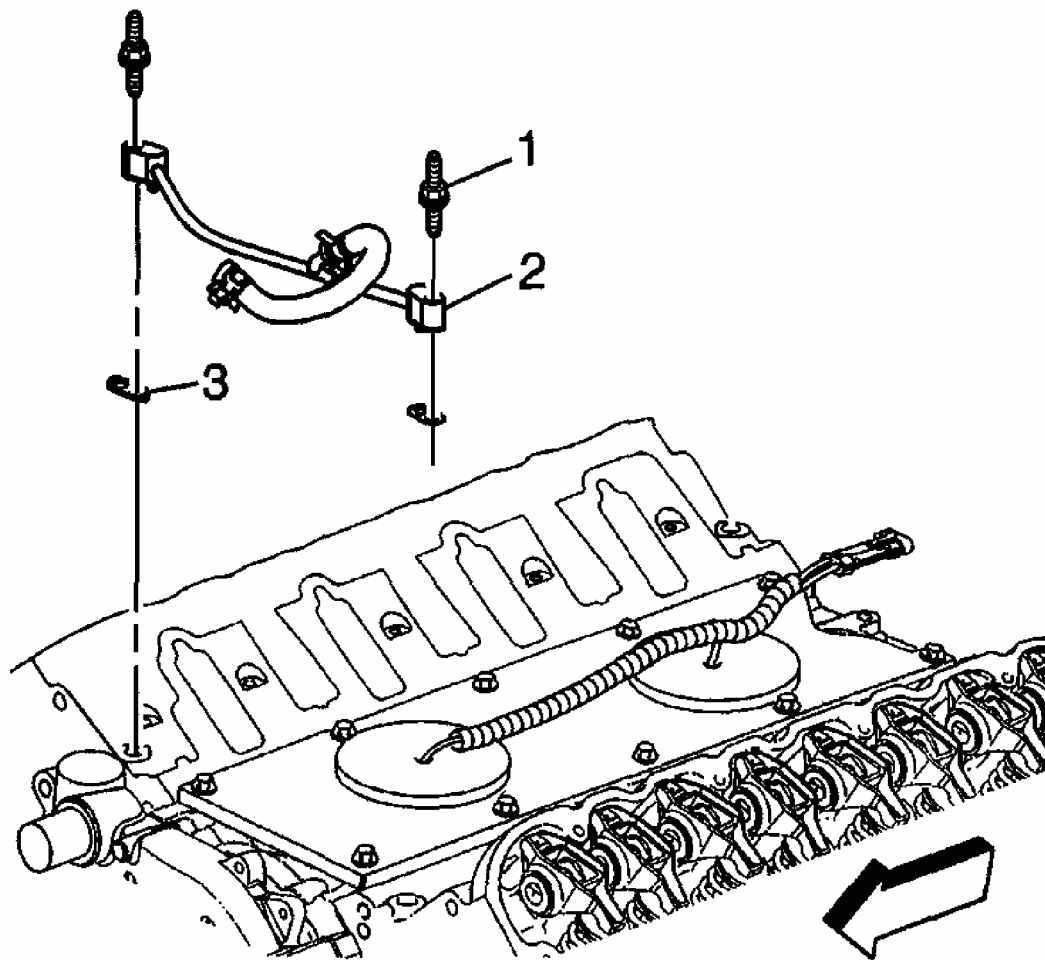
Fig. 54: Installing Coolant Air Bleed Pipe Cover Bolts
Courtesy of GENERAL MOTORS CORP.

5. Install the coolant air bleed pipe (2) with gaskets (3).
6. Install the coolant air bleed pipe studs (1).

Tighten

Tighten the coolant air bleed studs to 12 N.m (106 lb in).

7. Install the coolant air bleed hose to the throttle body, if required.
8. Install the intake manifold, if required. Refer to **COOLANT AIR BLEED PIPE CLEANING AND INSPECTION.**



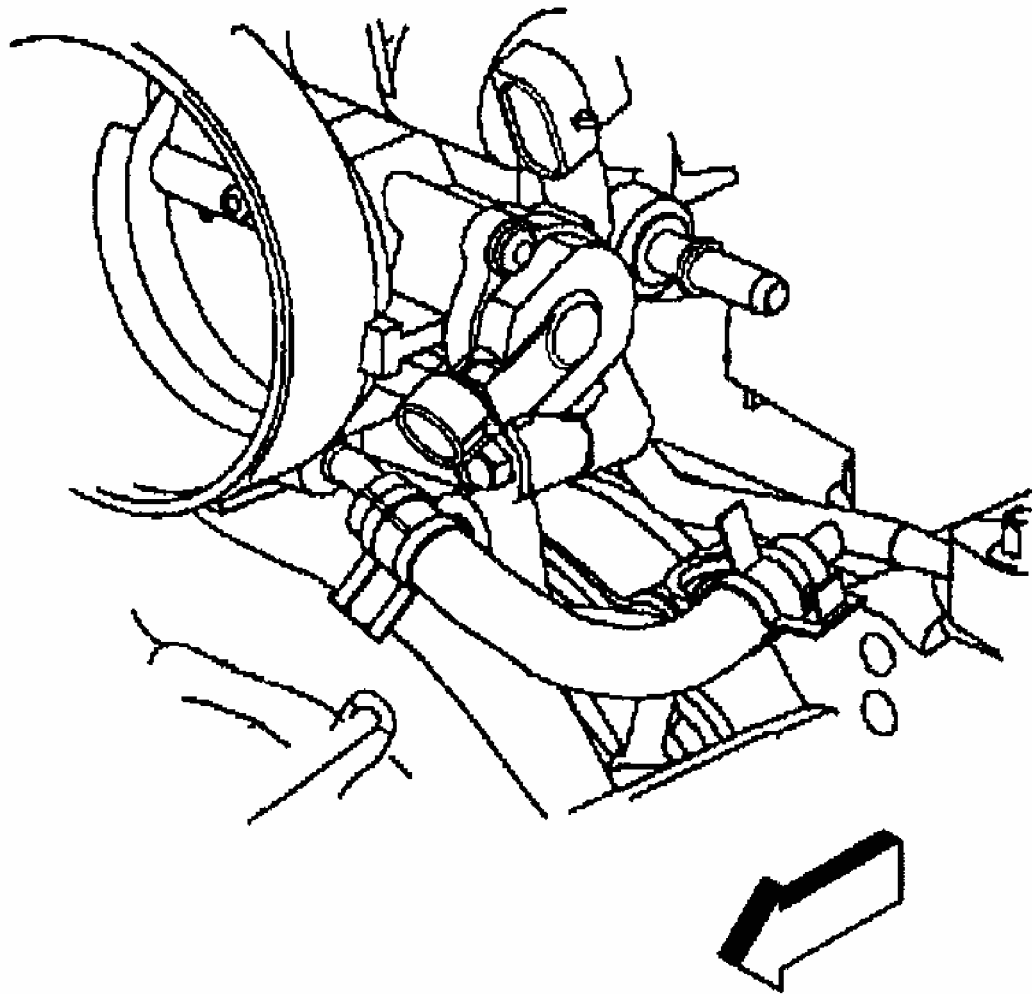
G01694756

Fig. 55: Installing Coolant Air Bleed Pipe Studs
Courtesy of GENERAL MOTORS CORP.

COOLANT AIR BLEED HOSE REPLACEMENT

Removal Procedure

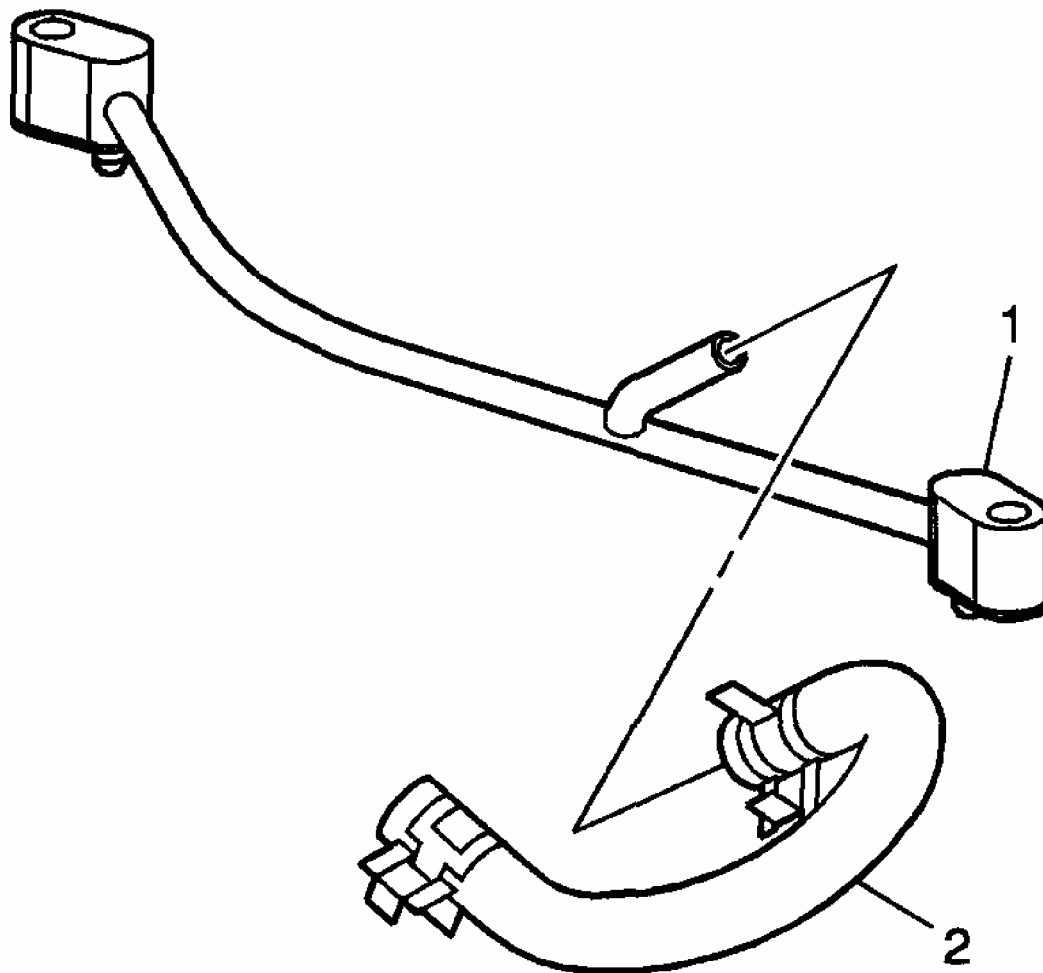
1. Reposition the coolant air bleed hose clamp at the throttle body.
2. Remove the coolant air bleed hose from the throttle body.



G01694757

Fig. 56: Loosening Coolant Air Bleed Hose Clamp
Courtesy of GENERAL MOTORS CORP.

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

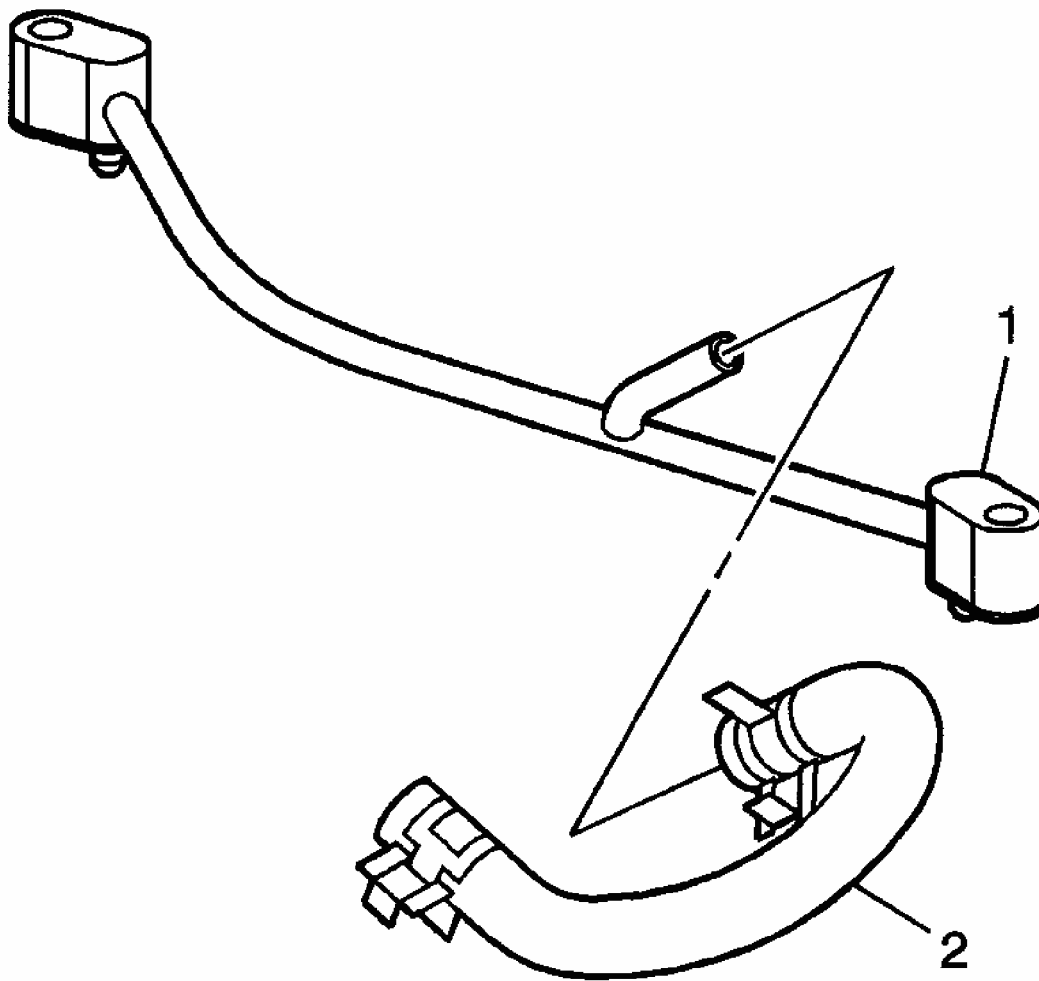


G01694758

Fig. 57: Removing Coolant Air Bleed Hose
Courtesy of GENERAL MOTORS CORP.

Installation Procedure

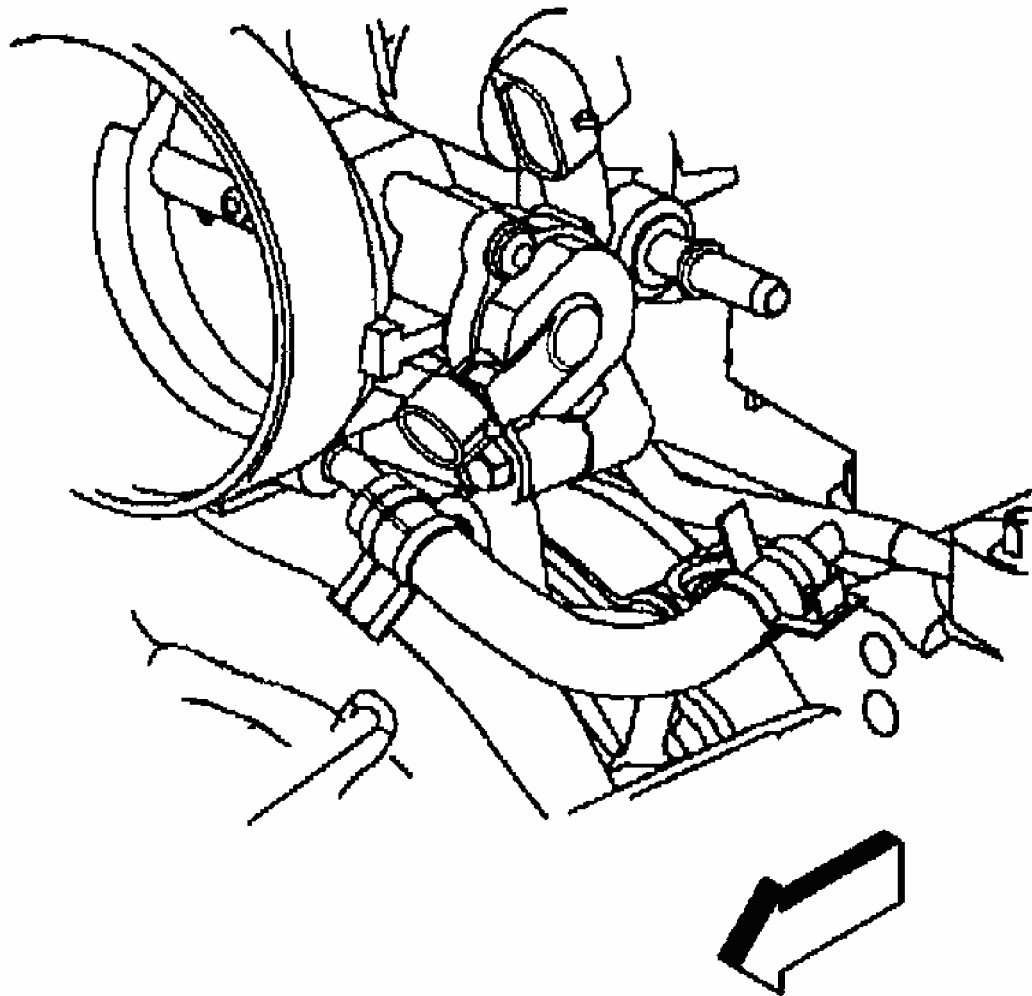
1. Install the coolant air bleed hose (2) to the pipe (1).
2. Position the coolant air bleed hose clamp at the pipe.



G01694759

Fig. 58: Installing Coolant Air Bleed Hose
Courtesy of GENERAL MOTORS CORP.

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



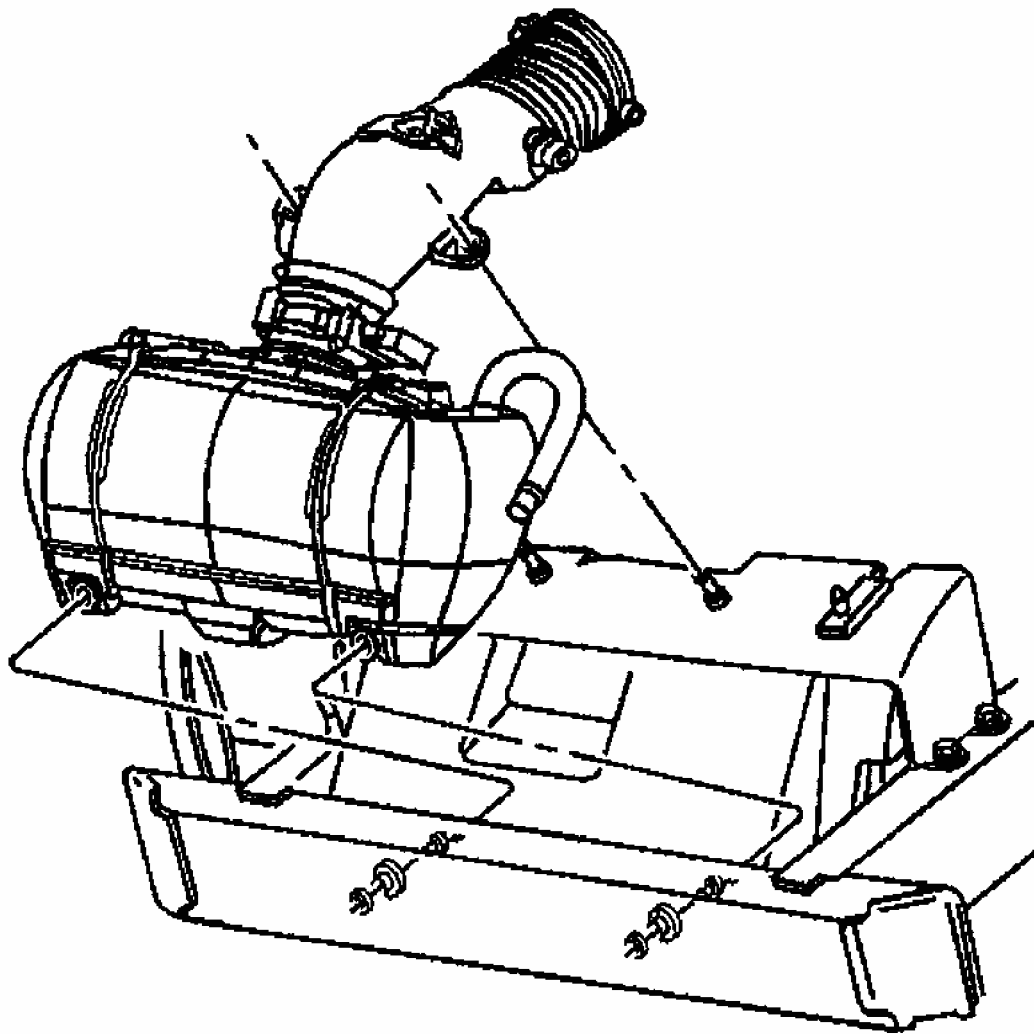
G01694760

Fig. 59: Securing Coolant Air Bleed Hose Clamp
Courtesy of GENERAL MOTORS CORP.

WATER PUMP REPLACEMENT

Removal Procedure

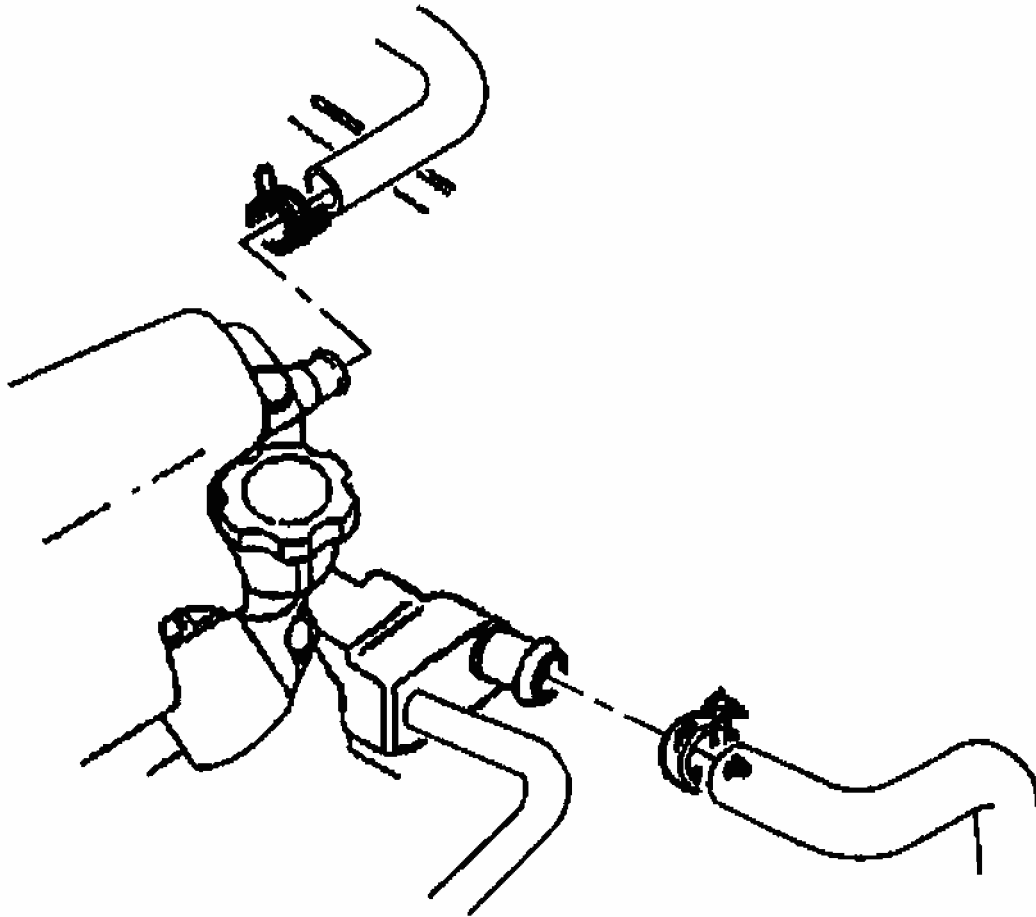
1. Remove the air cleaner intake duct.
2. Remove the accessory drive belt. Refer to **DRIVE BELT REPLACEMENT -- ACCESSORY**.
3. Drain the cooling system. Refer to **DRAINING & Filling Cooling System**.



G01694761

Fig. 60: Removing Air Cleaner Intake Duct
Courtesy of GENERAL MOTORS CORP.

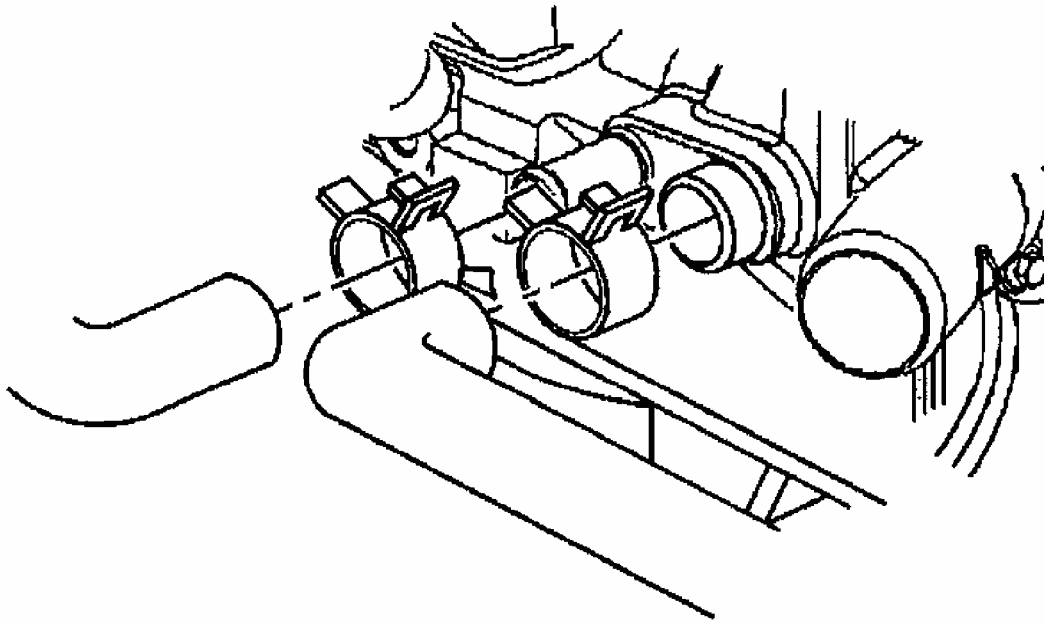
4. Reposition the inlet and outlet hose clamps at the water pump.
5. Remove the inlet and outlet hoses from the water pump.



G01694762

Fig. 61: Removing Inlet & Outlet Water Pump Hoses
Courtesy of GENERAL MOTORS CORP.

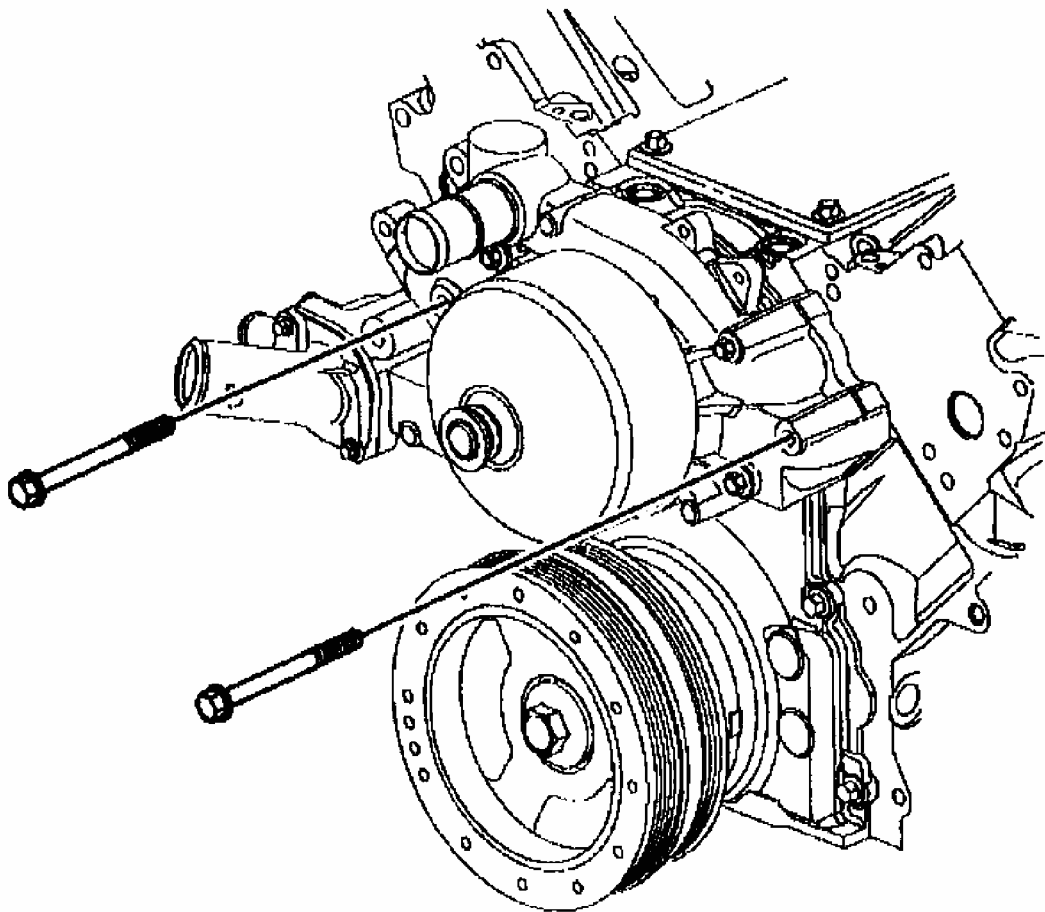
6. Reposition the heater inlet and surge tank outlet hose clamps at the water pump.
7. Remove the heater inlet and surge tank outlet hoses from the water pump.



G01694763

Fig. 62: Removing Inlet & Outlet Water Pump Hoses Clamps
Courtesy of GENERAL MOTORS CORP.

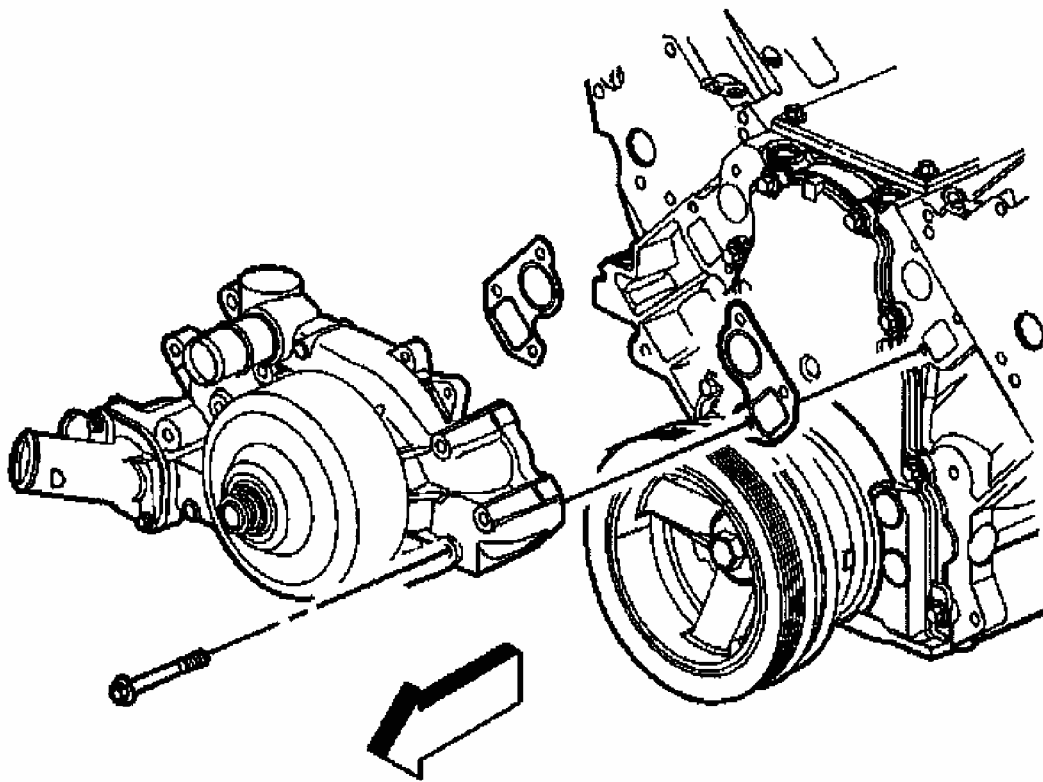
8. Remove the water pump bolts.



G01694764

Fig. 63: Removing Water Pump Mounting Bolts
Courtesy of GENERAL MOTORS CORP.

9. Remove the water pump.
10. Remove the water pump gaskets.
11. Clean and inspect the water pump. Refer to **WATER PUMP CLEANING AND INSPECTION.**

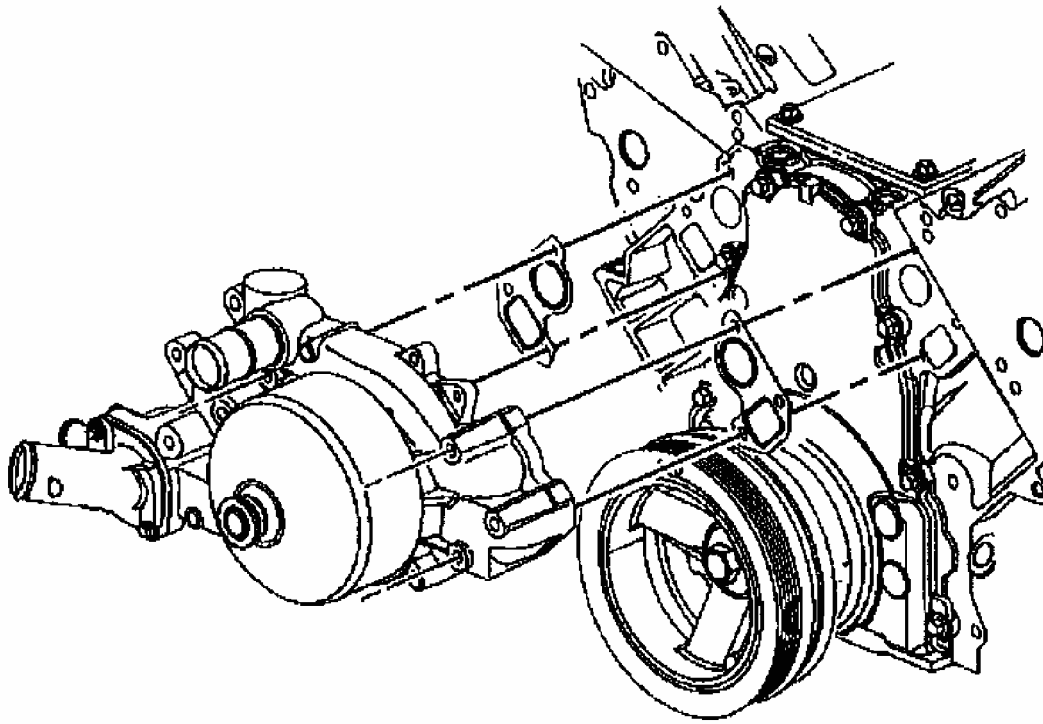


G01694765

Fig. 64: Removing Water Pump
Courtesy of GENERAL MOTORS CORP.

Installation Procedure

1. Install the water pump and gaskets to the engine block.



G01694766

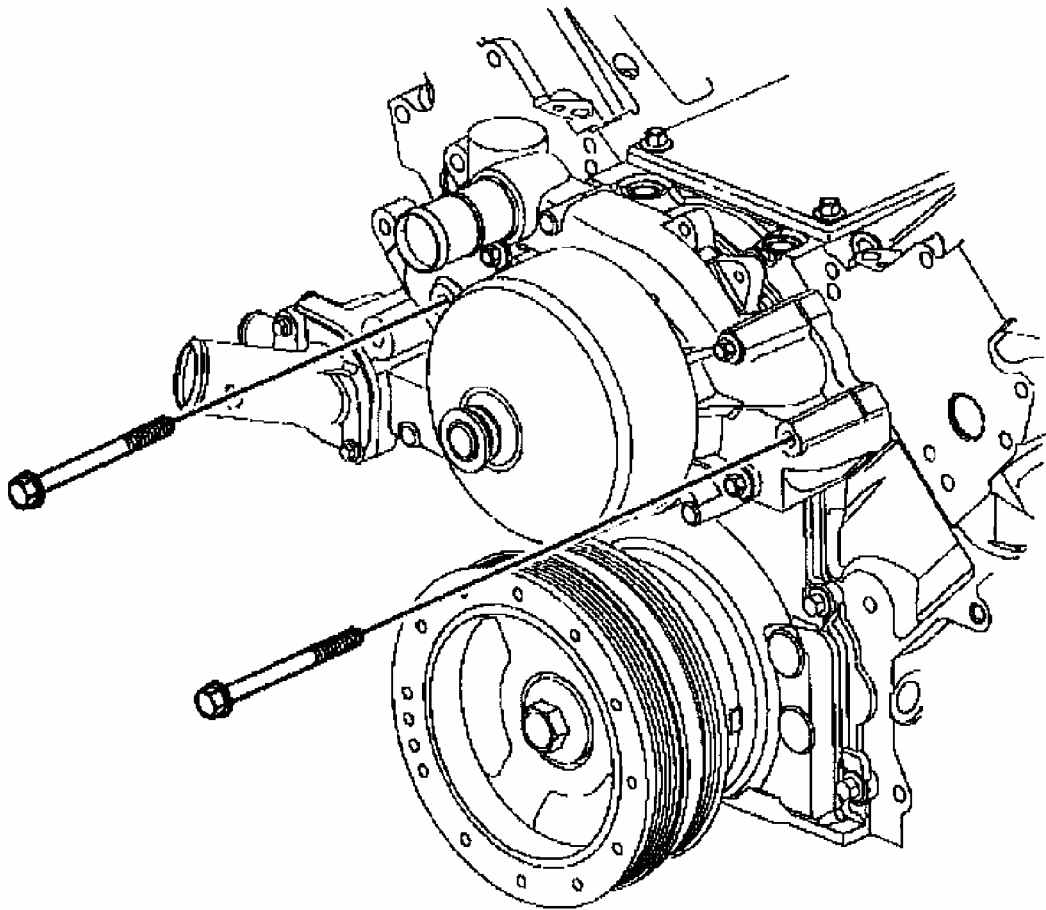
Fig. 65: Installing Water Pump
Courtesy of GENERAL MOTORS CORP.

CAUTION: Refer to FASTENER NOTICE .

2. Install the water pump bolts.

Tighten

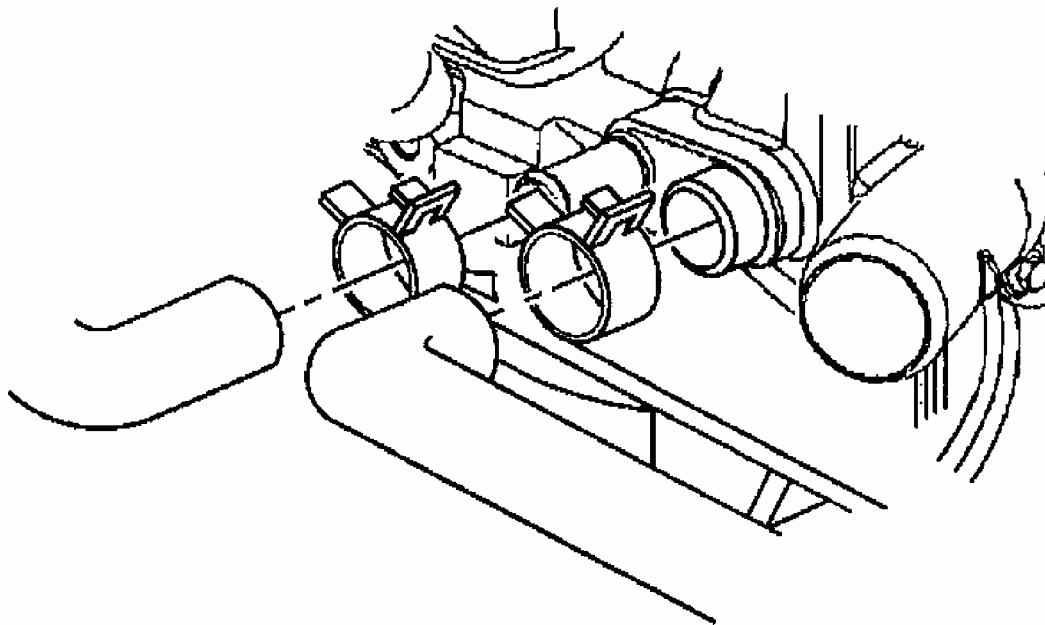
- 2.1. Tighten the water pump bolts a first pass to 15 N.m (11 lb ft).
- 2.2. Tighten the water pump bolts a final pass to 30 N.m (22 lb ft).



G01694767

Fig. 66: Installing Water Pump Mounting Bolts
Courtesy of GENERAL MOTORS CORP.

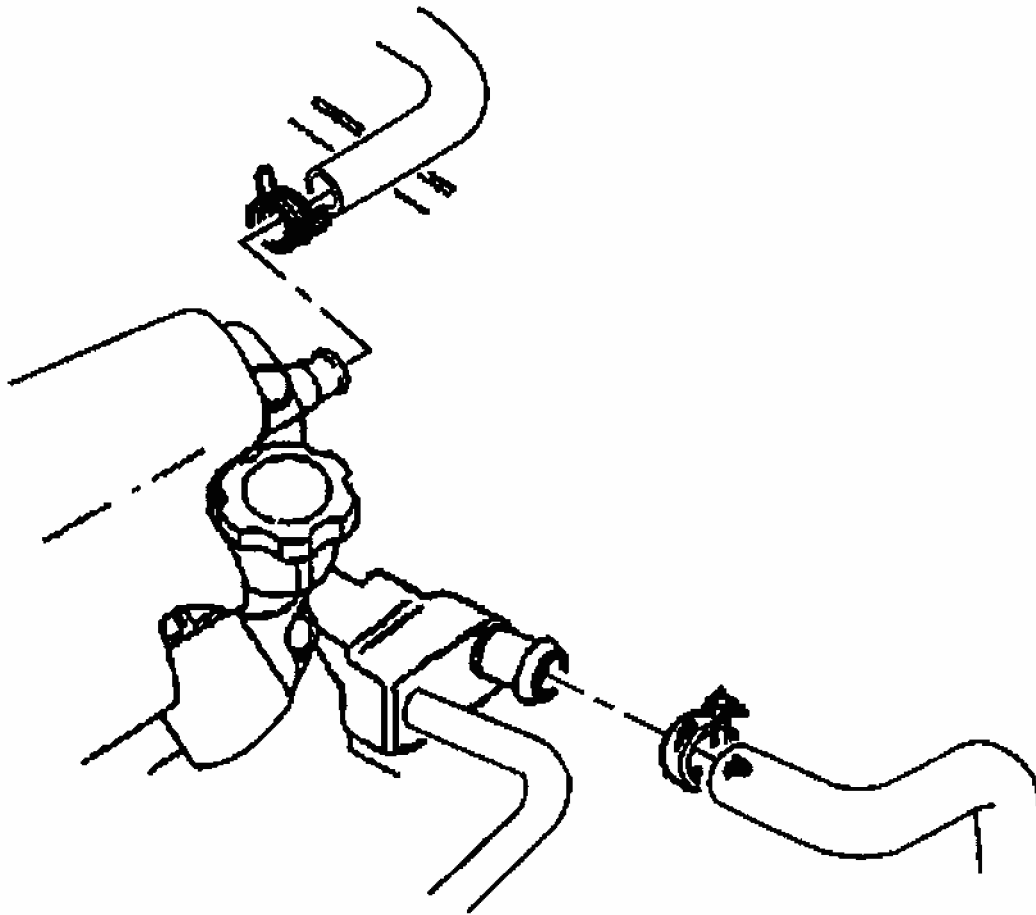
3. Install the heater inlet and surge tank outlet hoses to the water pump.
4. Position the heater inlet and surge tank outlet hose clamps at the water pump.



G01694768

Fig. 67: Installing Inlet & Outlet Water Pump Hoses Clamps
Courtesy of GENERAL MOTORS CORP.

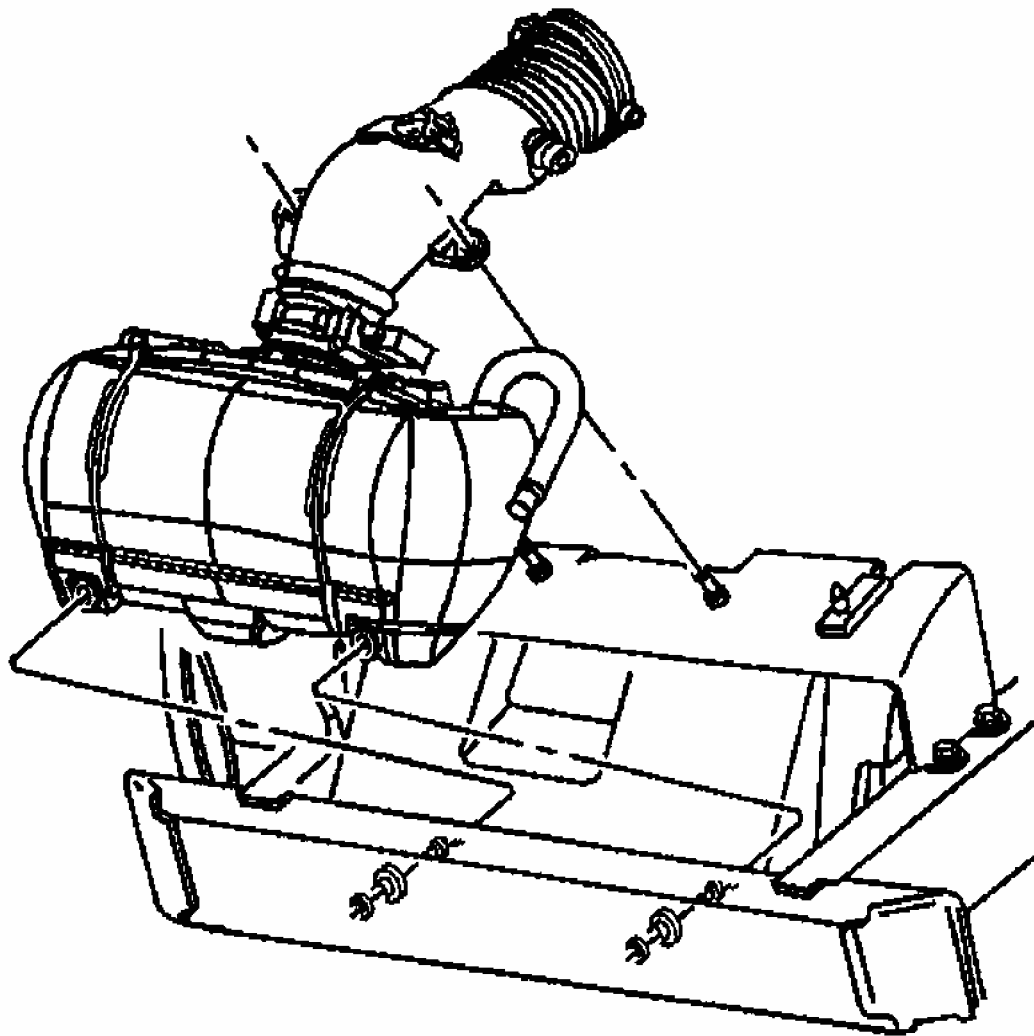
5. Install the inlet and outlet hoses to the water pump.
6. Position the inlet and outlet hose clamps at the water pump.
7. Install the accessory drive belt. Refer to **DRIVE BELT REPLACEMENT -- ACCESSORY** .
8. Fill the cooling system. Refer to **DRAINING & Filling Cooling System** .



G01694769

Fig. 68: Installing Inlet & Outlet Water Pump Hoses
Courtesy of GENERAL MOTORS CORP.

9. Install the air cleaner intake duct.



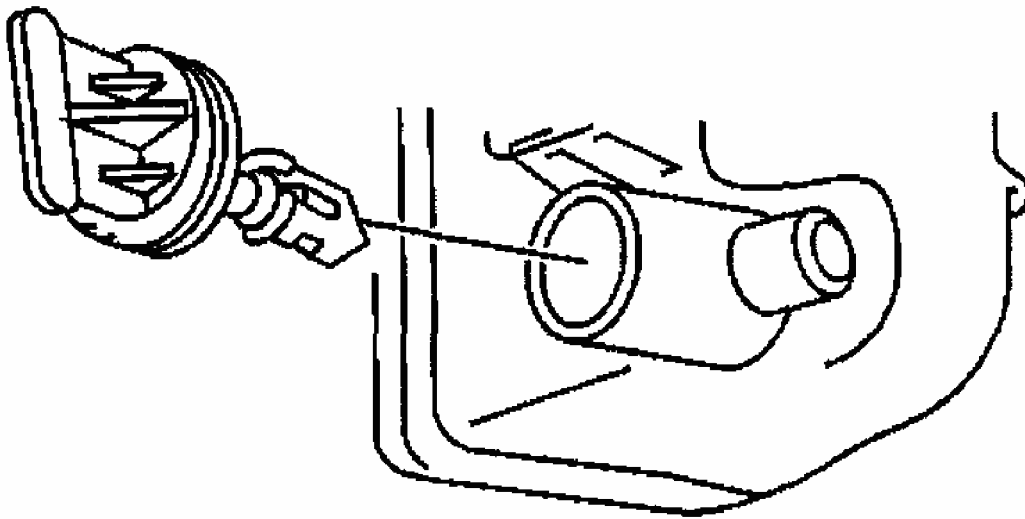
G01694770

Fig. 69: Installing Air Cleaner Intake Duct
Courtesy of GENERAL MOTORS CORP.

DRAIN COCK REPLACEMENT

Removal Procedure

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

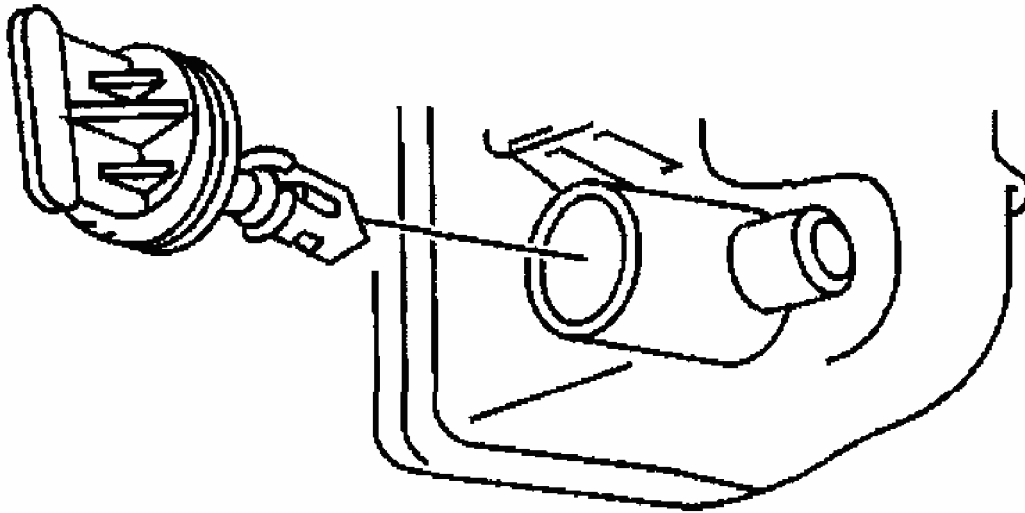


G01694771

Fig. 70: Removing Drain Cock
Courtesy of GENERAL MOTORS CORP.

Installation Procedure

1. Install the radiator drain cock.
2. Refill the cooling system. Refer to **DRAINING & Filling Cooling System** .



G01694772

Fig. 71: Installing Drain Cock
Courtesy of GENERAL MOTORS CORP.

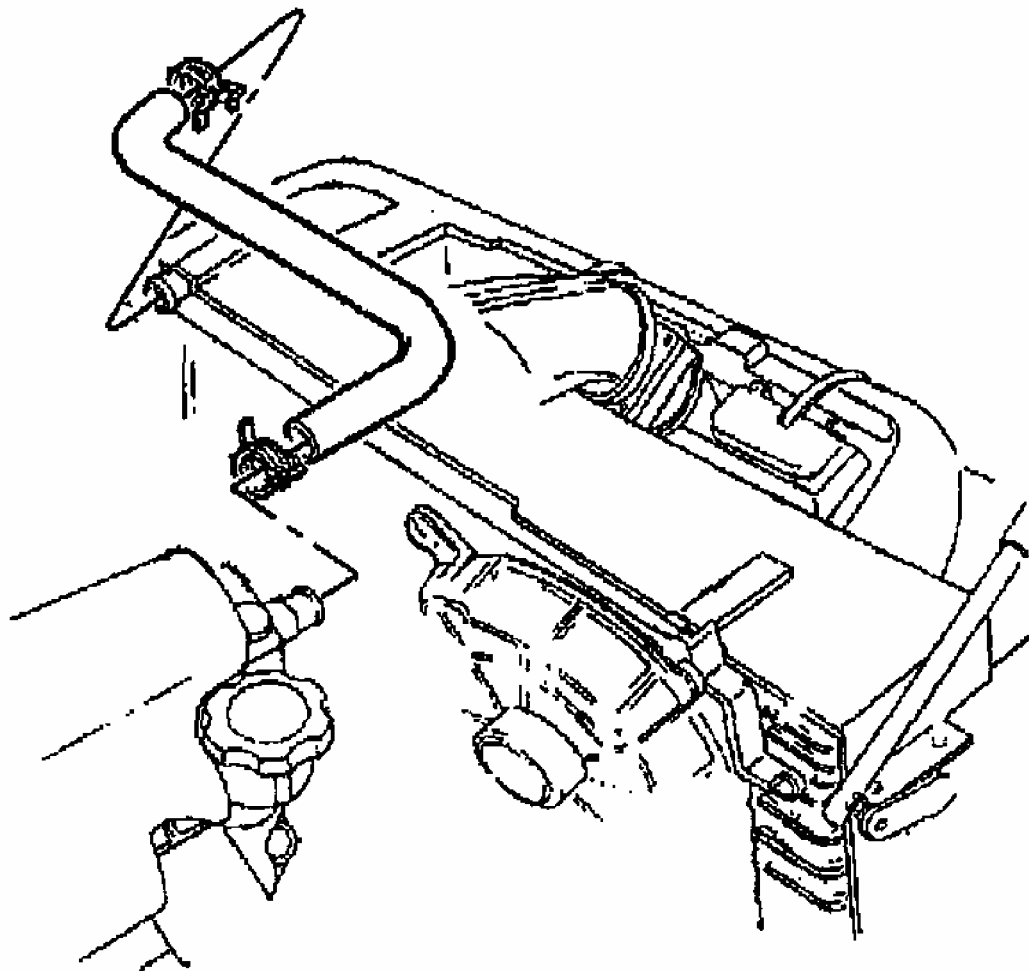
FAN SHROUD REPLACEMENT

Tools Required

J 38185 Hose Clamp Pliers

Removal Procedure

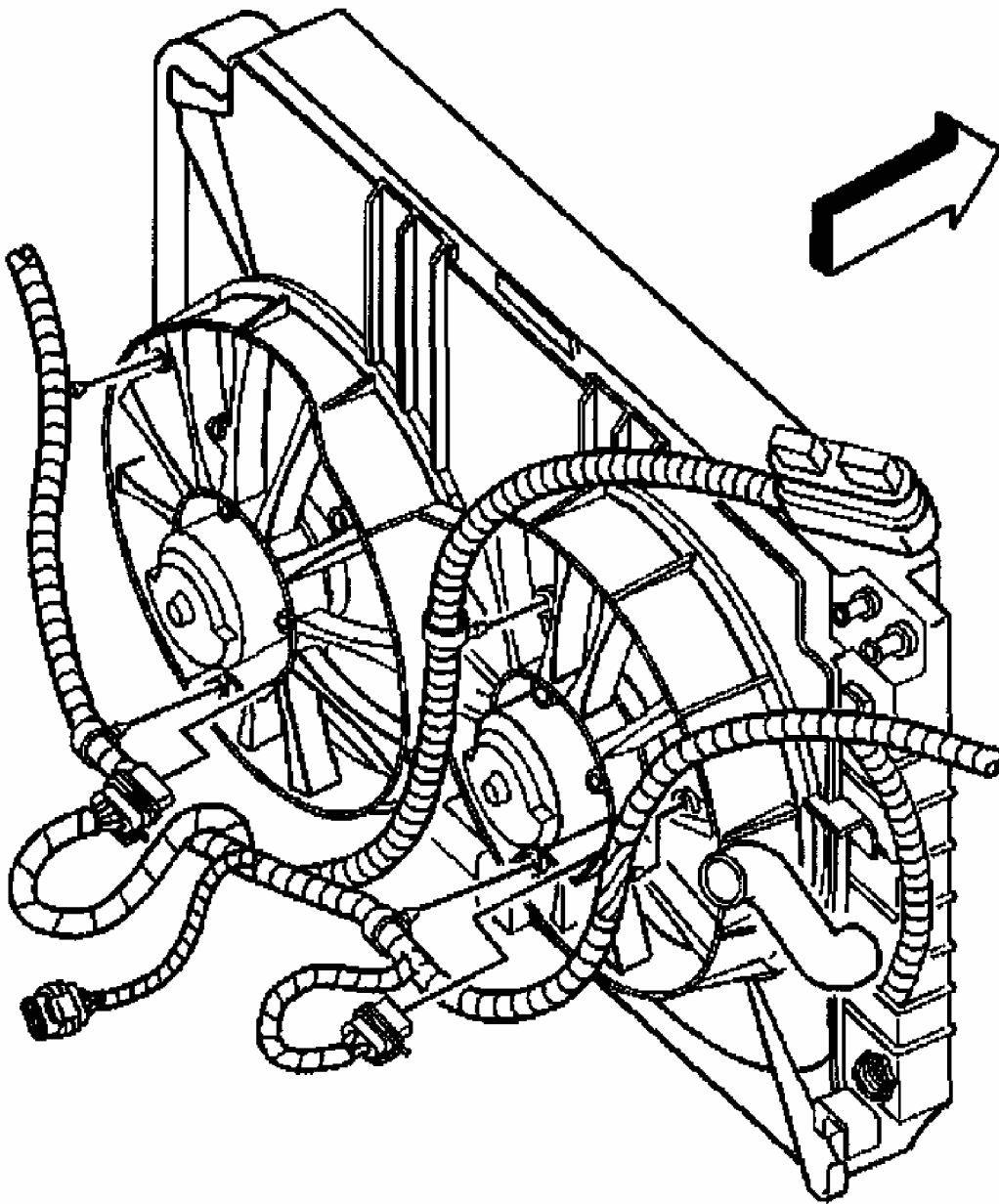
1. Drain the cooling system. Refer to **DRAINING & Filling Cooling System** .
2. Remove the radiator support. Refer to **Radiator Support Replacement** .
3. Reposition the radiator inlet hose clamp from the radiator using **J 38185**.
4. Remove the radiator inlet hose from the radiator.
5. Raise and suitably support the vehicle. Refer to **LIFTING AND JACKING THE VEHICLE** .



G01694773

Fig. 72: Removing Radiator Inlet Hose
Courtesy of GENERAL MOTORS CORP.

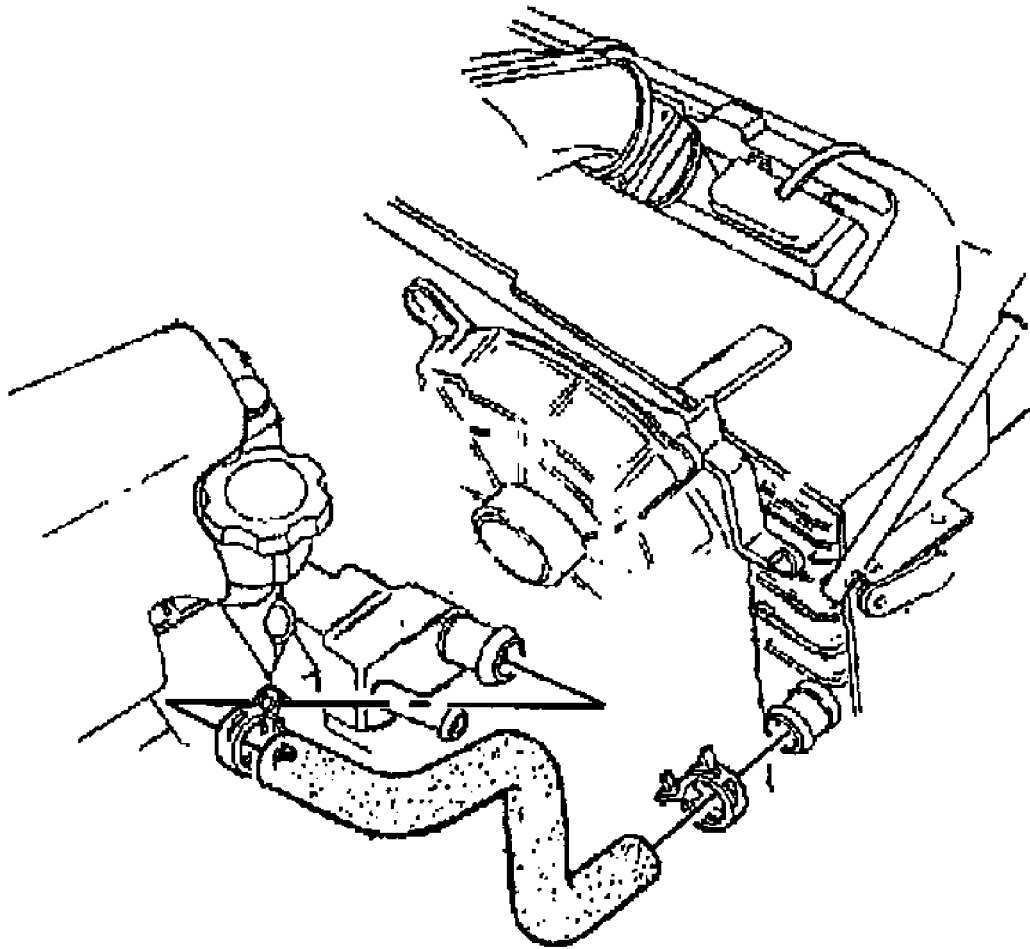
6. Disconnect the cooling fan electrical connectors.
7. Remove the forward lamp harness from the retaining clips on the shroud.



G01694774

Fig. 73: Disconnecting Cooling Fan Electrical Connectors
Courtesy of GENERAL MOTORS CORP.

8. Reposition the radiator outlet hose clamp from the radiator using **J 38185**.
9. Remove the radiator outlet hose from the radiator.
10. Lower the vehicle.
11. Remove fan shroud.

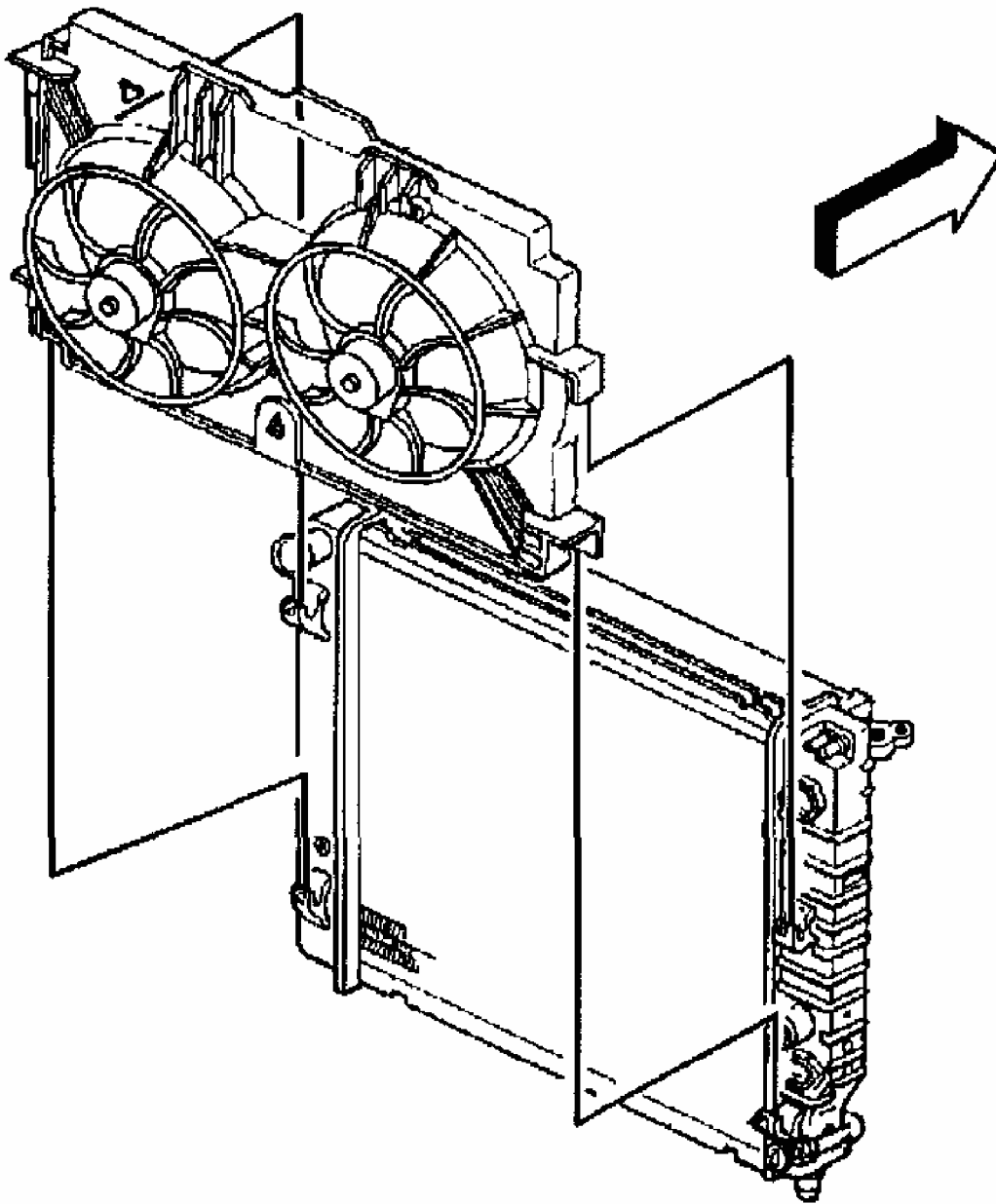


G01694775

Fig. 74: Removing Radiator Outlet Hose
Courtesy of GENERAL MOTORS CORP.

Installation Procedure

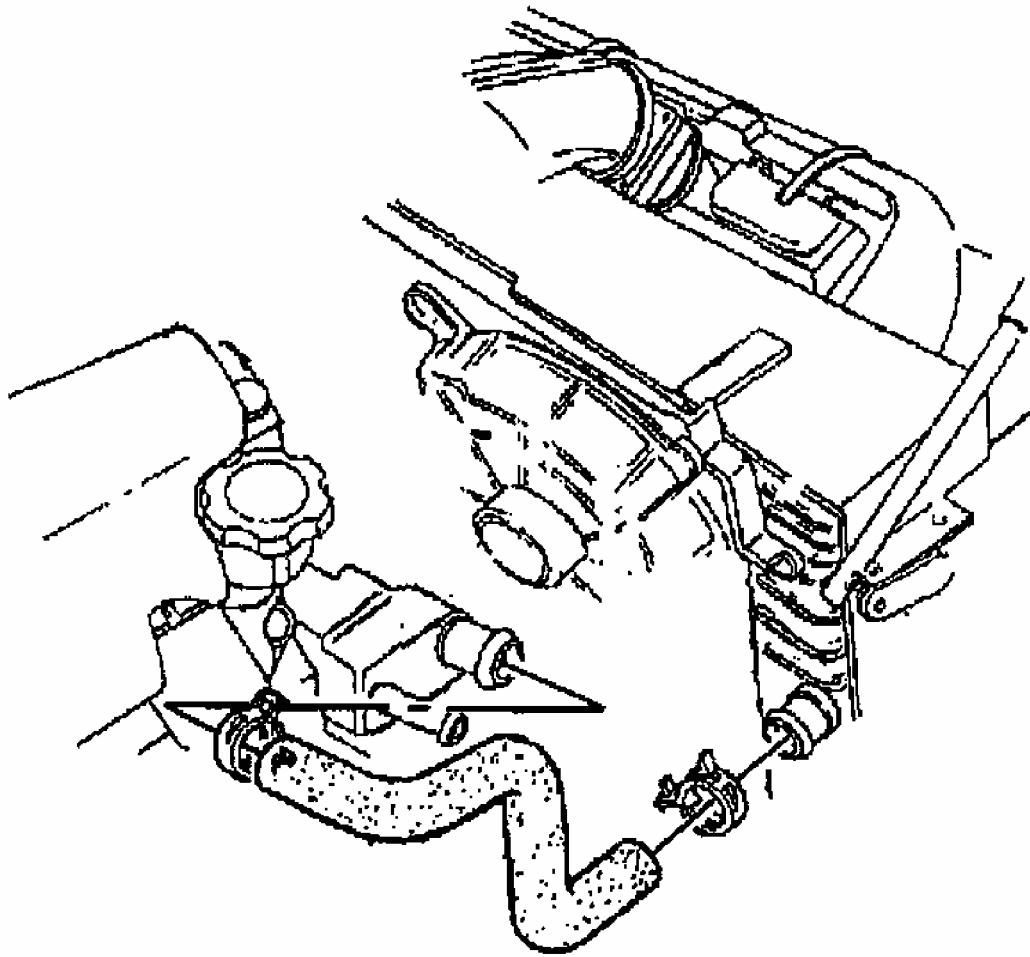
1. Install the fan shroud.
2. Raise the vehicle.



G01694776

Fig. 75: Installing Fan Shroud
Courtesy of GENERAL MOTORS CORP.

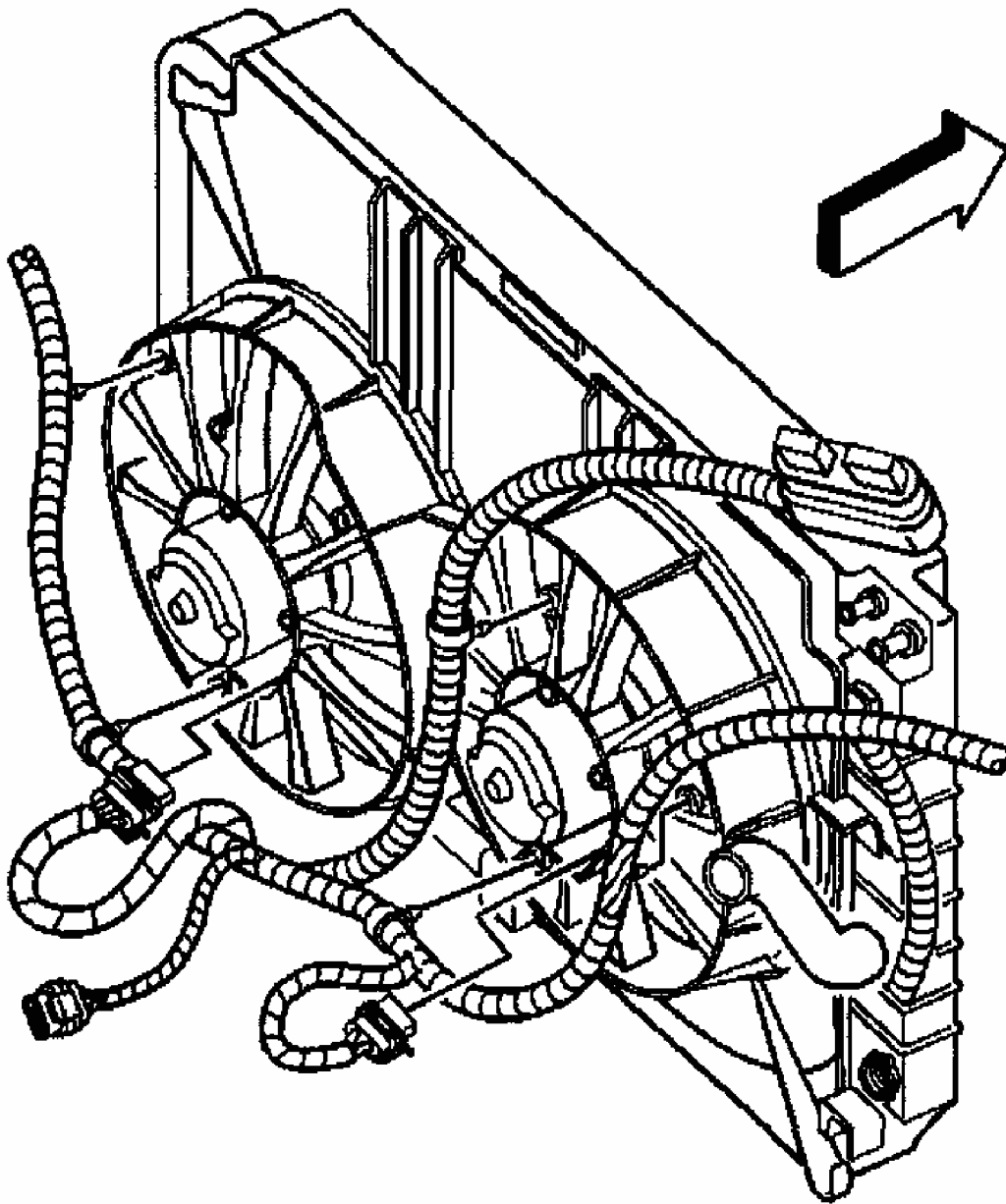
3. Install the radiator outlet hose to the radiator.
4. Reposition the radiator outlet hose clamp to the radiator using **J 38185**.



G01694777

Fig. 76: Installing Radiator Outlet Hose
Courtesy of GENERAL MOTORS CORP.

5. Install the forward lamp harness to the retaining clips on the fan shroud.
6. Connect the cooling fan electrical connectors.

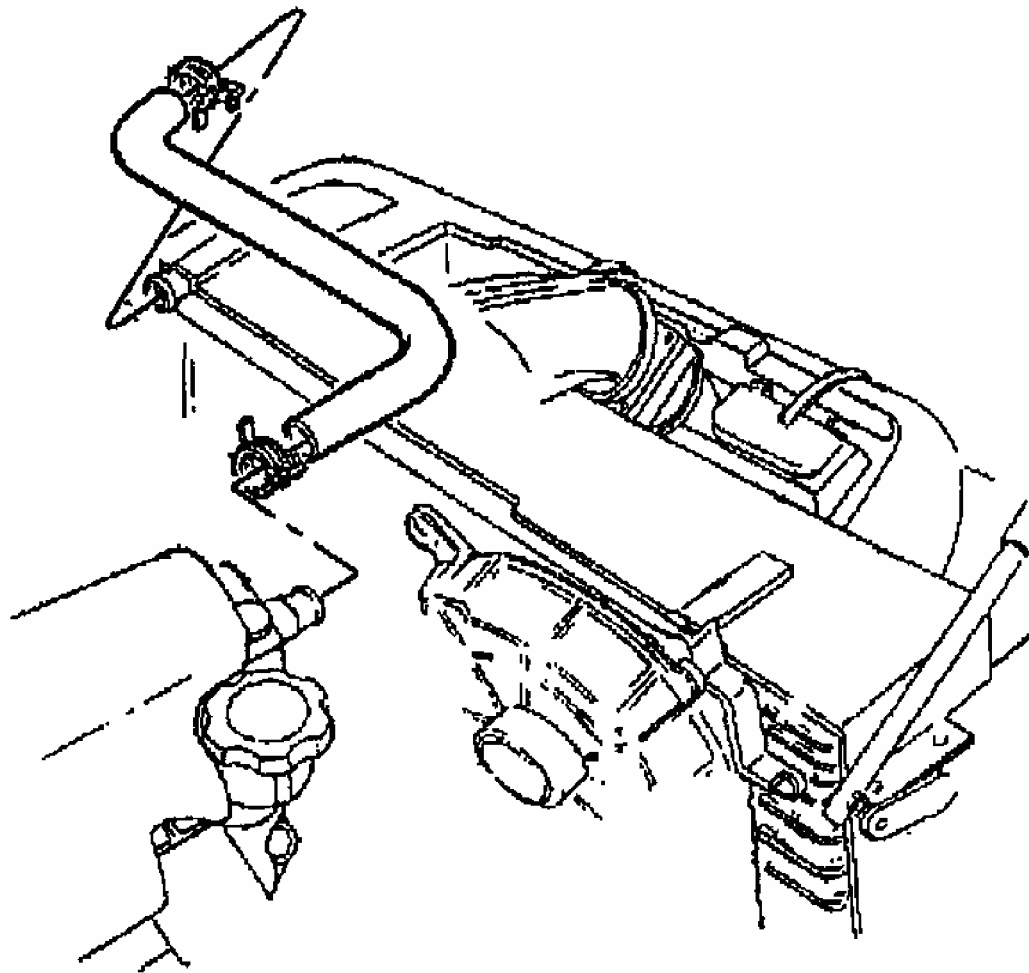


G01694778

Fig. 77: Installing Forward Lamp Harness
Courtesy of GENERAL MOTORS CORP.

7. Lower the vehicle.
8. Install the radiator inlet hose to the radiator.
9. Reposition the radiator inlet hose clamp to the radiator using **J 38185**.
10. Install the radiator support. Refer to **Radiator Support Replacement**.

11. Fill the cooling system. Refer to **DRAINING & Filling Cooling System** .



G01694779

Fig. 78: Installing Radiator Inlet Hose
Courtesy of GENERAL MOTORS CORP.

RADIATOR REPLACEMENT

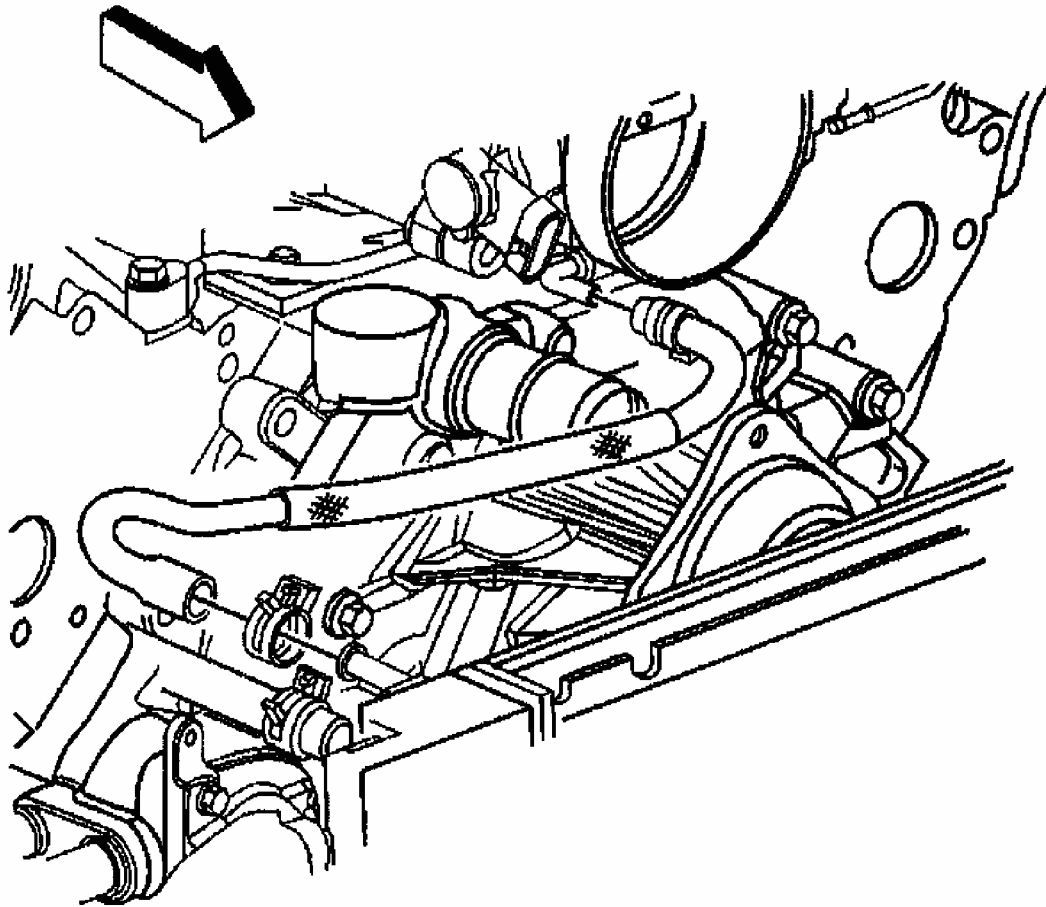
Tools Required

J 38185 Hose Clamp Pliers

Removal Procedure

1. Remove the fan shroud. Refer to **Fan Shroud Replacement** .
2. Reposition the throttle body heater outlet hose clamp from the radiator using **J 38185**.

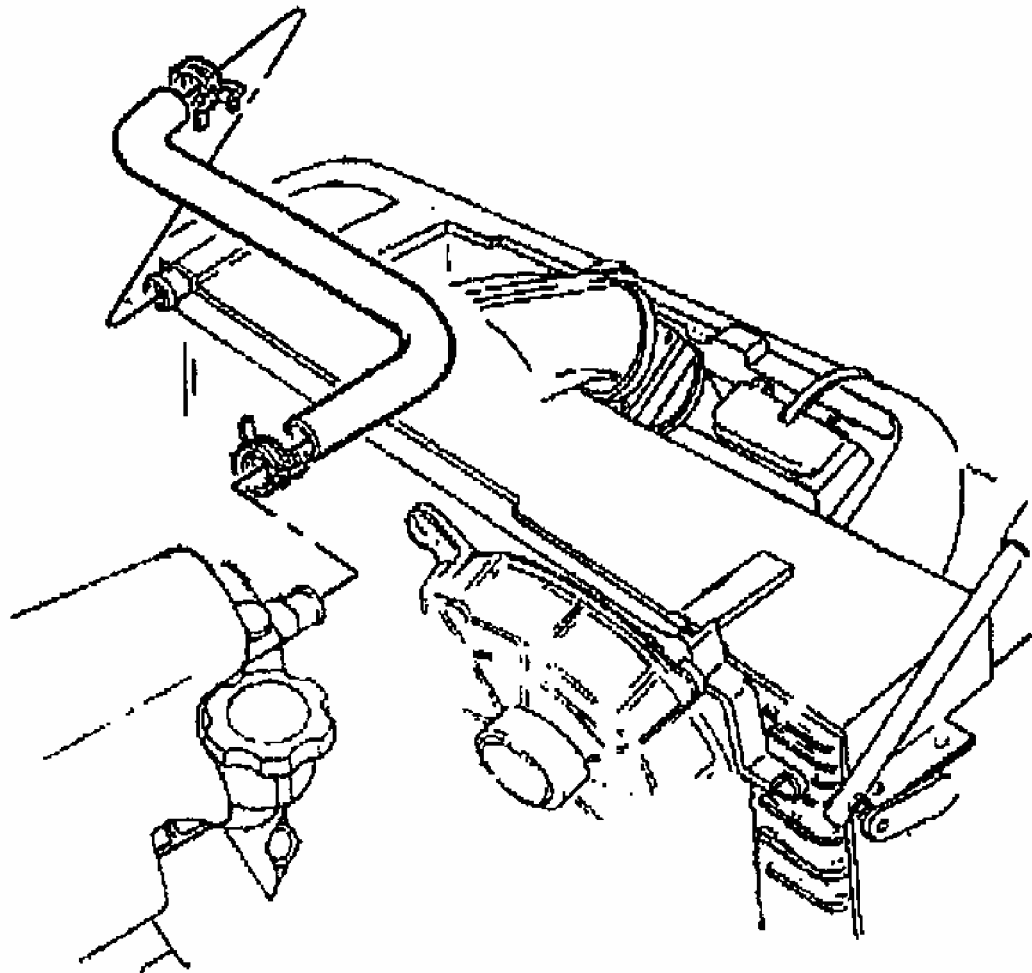
3. Remove the throttle body heater outlet hose from the radiator.



G01694780

Fig. 79: Removing Throttle Body Heater Outlet Hose
Courtesy of GENERAL MOTORS CORP.

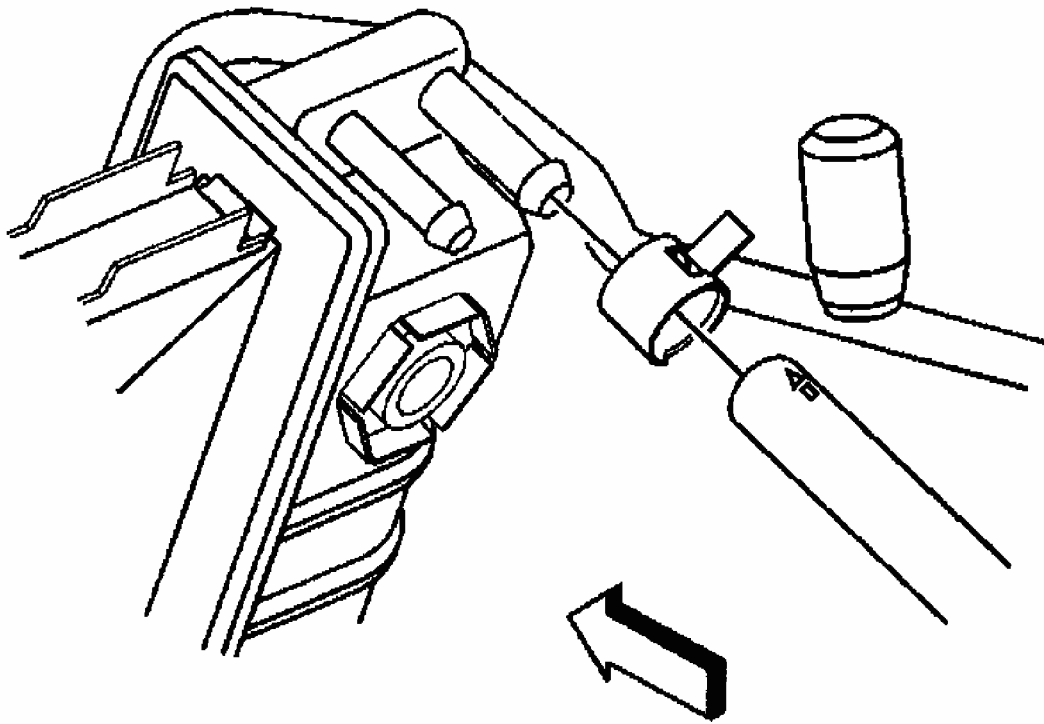
4. Reposition the radiator inlet hose clamp from the water pump using **J 38185**.
5. Remove the radiator inlet hose from the water pump.



G01694781

Fig. 80: Removing Radiator Inlet Hose
Courtesy of GENERAL MOTORS CORP.

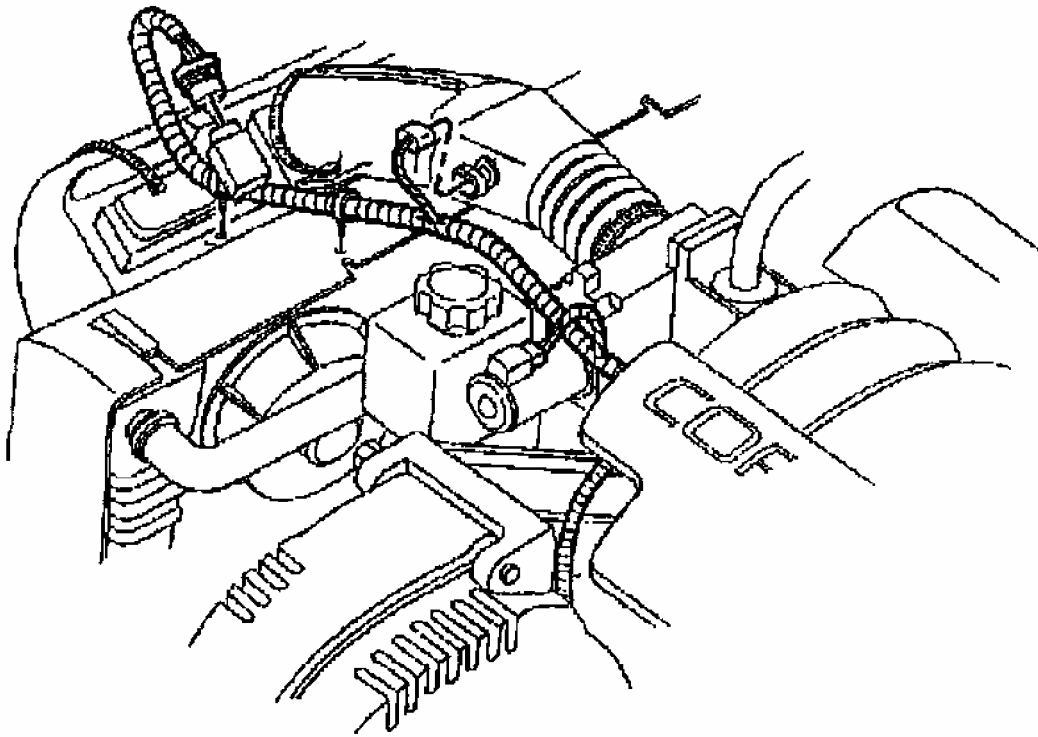
6. Reposition the surge tank inlet hose clamp from the radiator using **J 38185**.
7. Remove the surge tank inlet hose from the radiator.



G01694782

Fig. 81: Removing Surge Tank Inlet Hose Clamp
Courtesy of GENERAL MOTORS CORP.

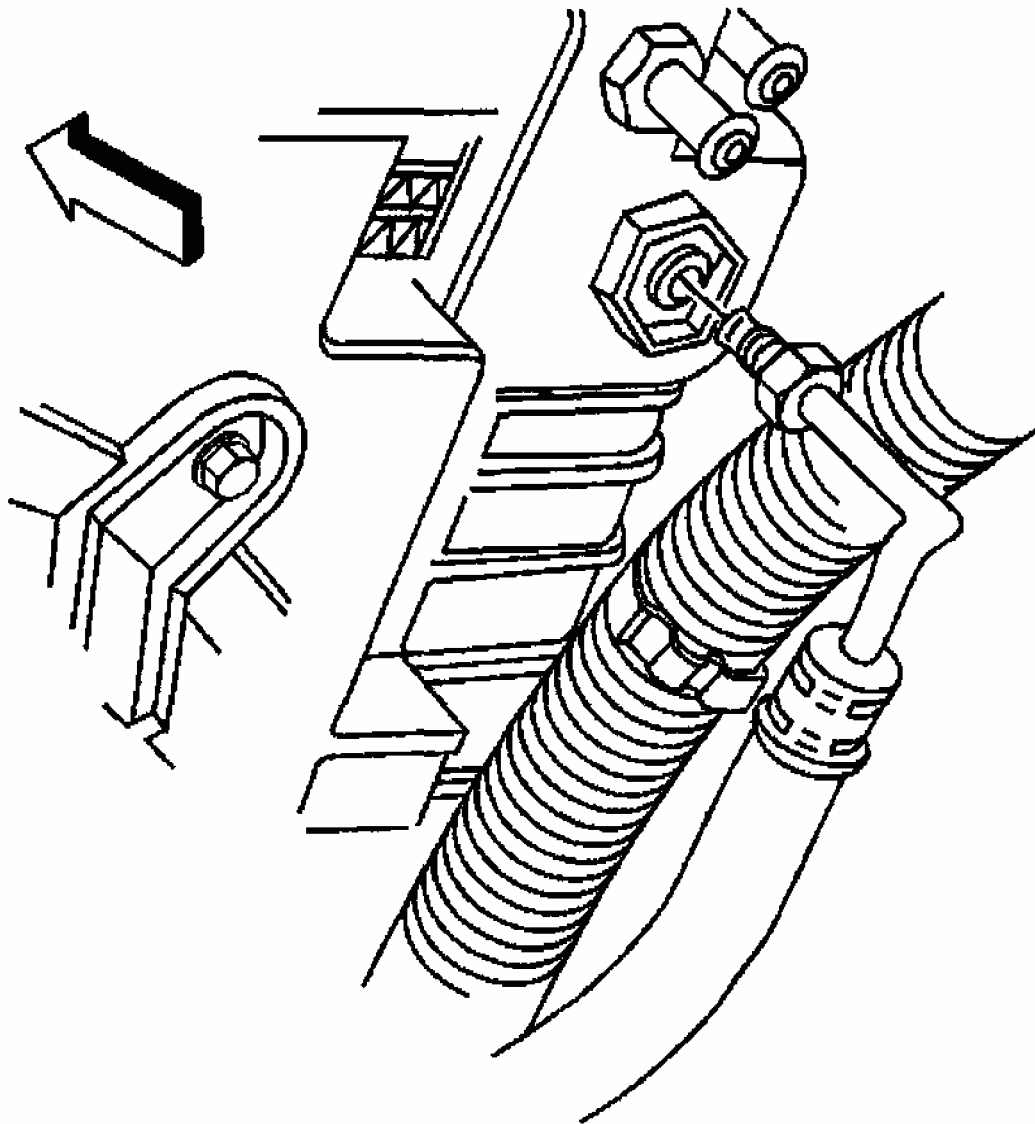
8. Remove the connector position assurance lock.
9. Disconnect the mass air flow sensor electrical connector.



G01694783

Fig. 82: Disconnecting Mass Air Flow Sensor Electrical Connector
Courtesy of GENERAL MOTORS CORP.

10. If equipped, remove the automatic transmission oil cooler lines from the radiator.

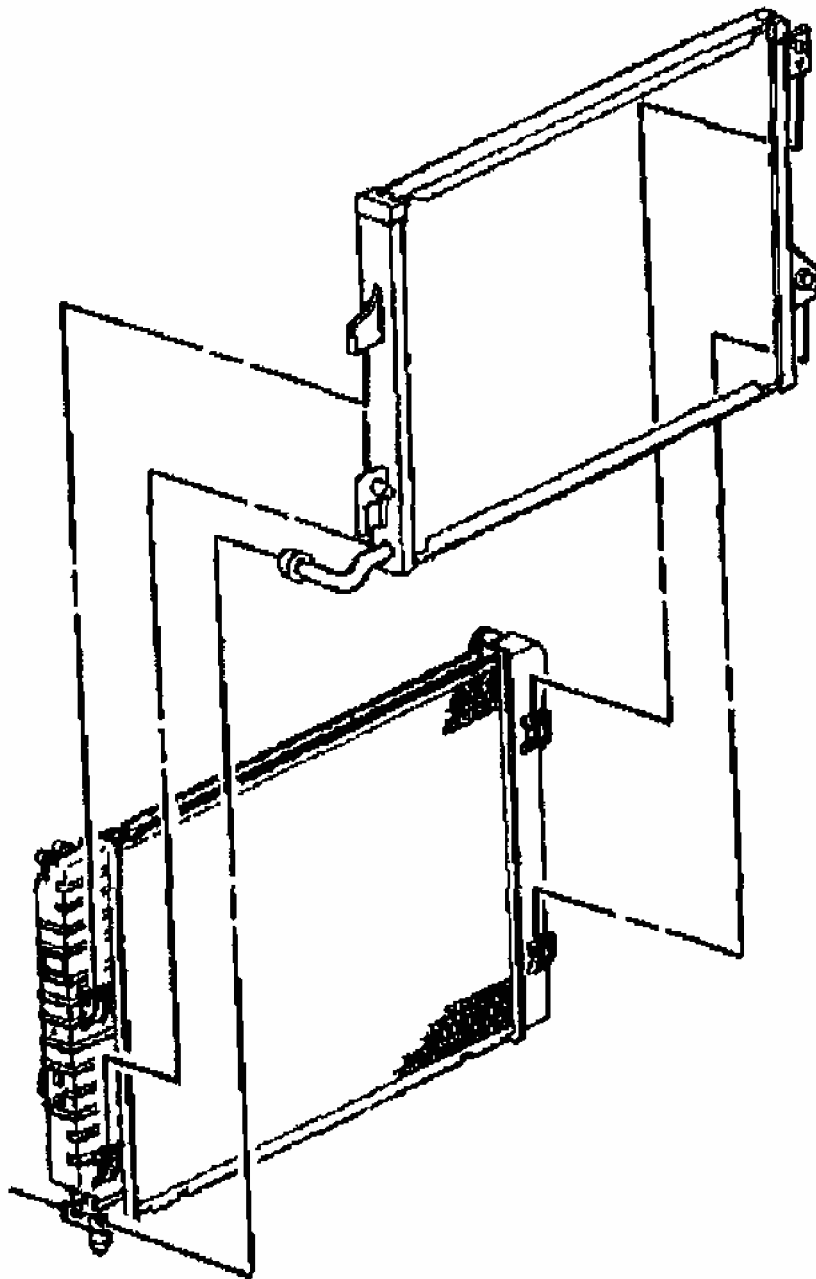


G01694784

Fig. 83: Removing Automatic Transmission Oil Cooler Line
Courtesy of GENERAL MOTORS CORP.

Important: It is not necessary to disconnect the air conditioning lines from the condenser.

11. Remove the condenser from the radiator and position it forward.
12. Remove the radiator from the vehicle.

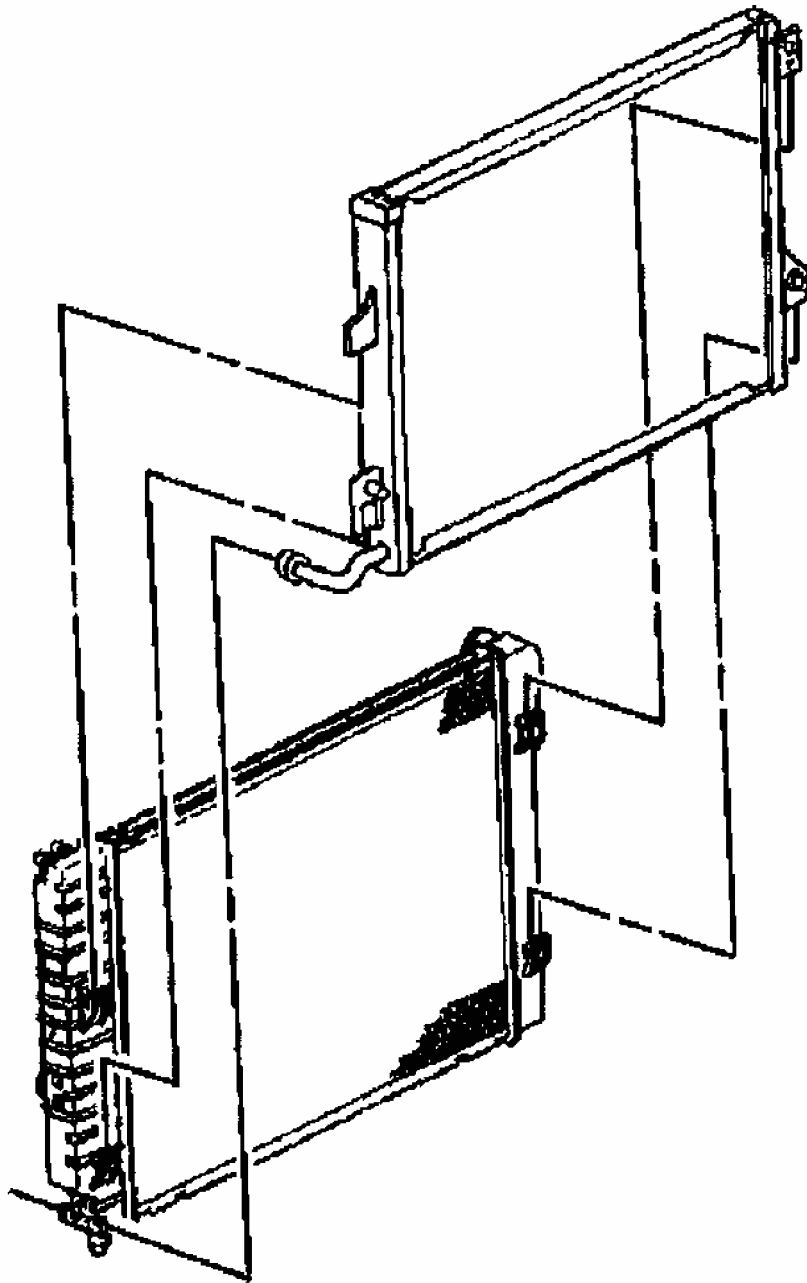


G01694785

Fig. 84: Removing Radiator Condenser
Courtesy of GENERAL MOTORS CORP.

Installation Procedure

1. Install the radiator.
2. Install the condenser into the four retaining tabs on the radiator.



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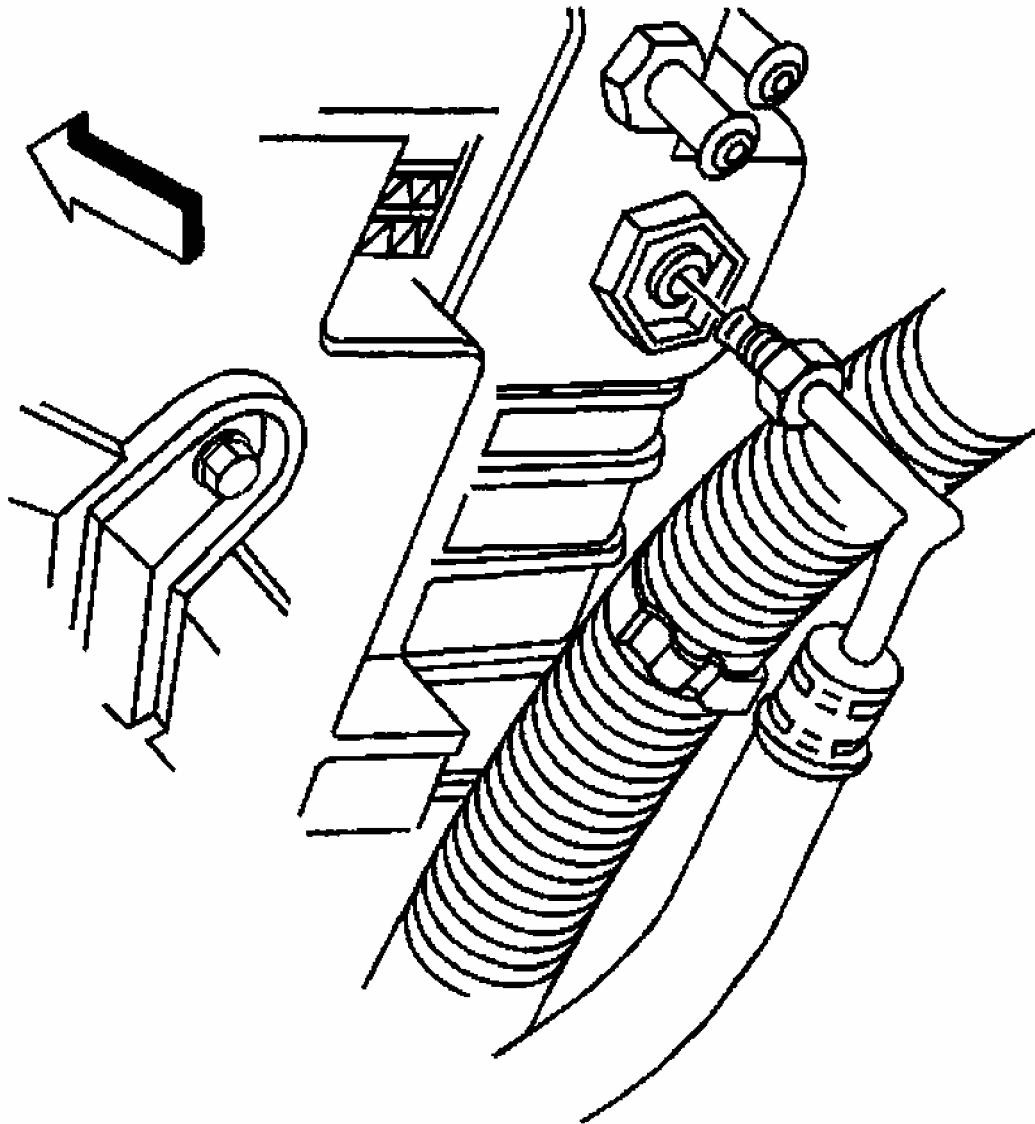
Fig. 85: Installing Radiator Condenser
Courtesy of GENERAL MOTORS CORP.

CAUTION: Refer to FASTENER NOTICE .

3. If equipped, install the automatic transmission oil cooler lines to the radiator.

Tighten

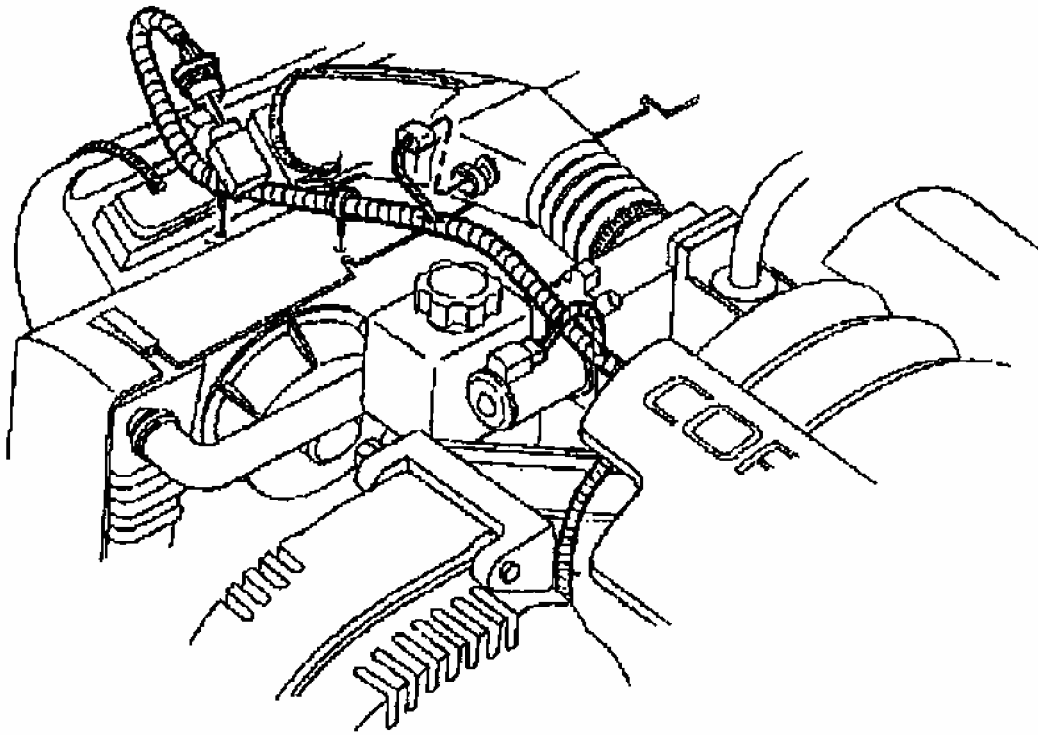
Tighten the cooler lines to 25 N.m (18 lb ft).



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Fig. 86: Installing Automatic Transmission Oil Cooler Line
Courtesy of GENERAL MOTORS CORP.

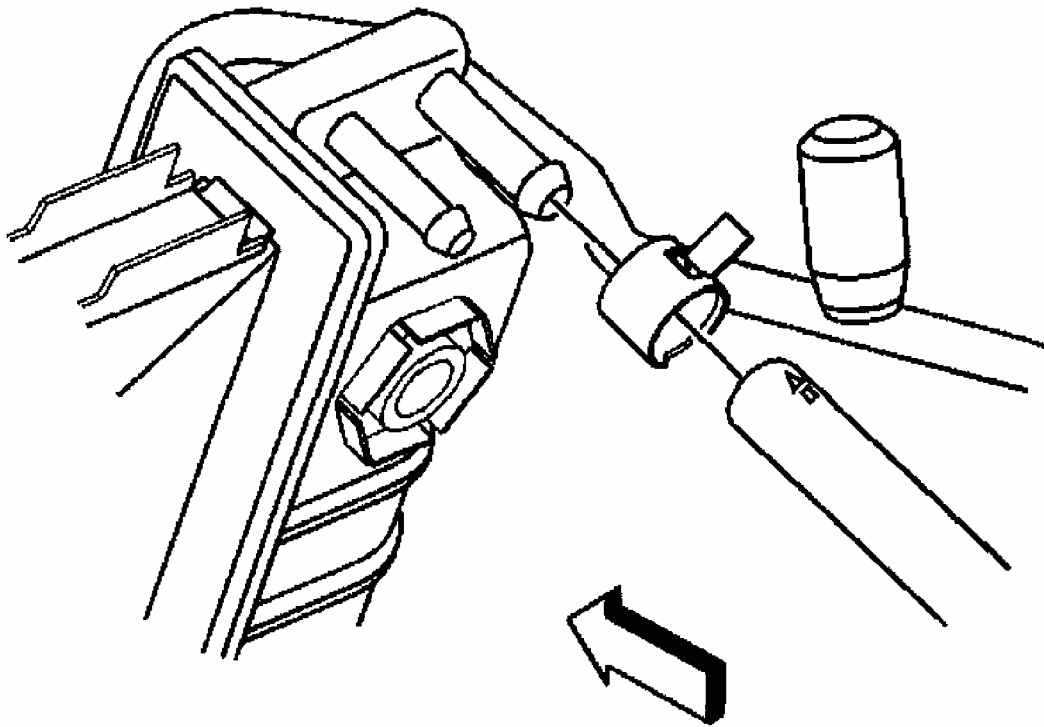
4. Connect the mass air flow sensor electrical connector.
5. Install the connector position assurance lock.



G01694788

Fig. 87: Connecting Mass Air Flow Sensor Electrical Connector
Courtesy of GENERAL MOTORS CORP.

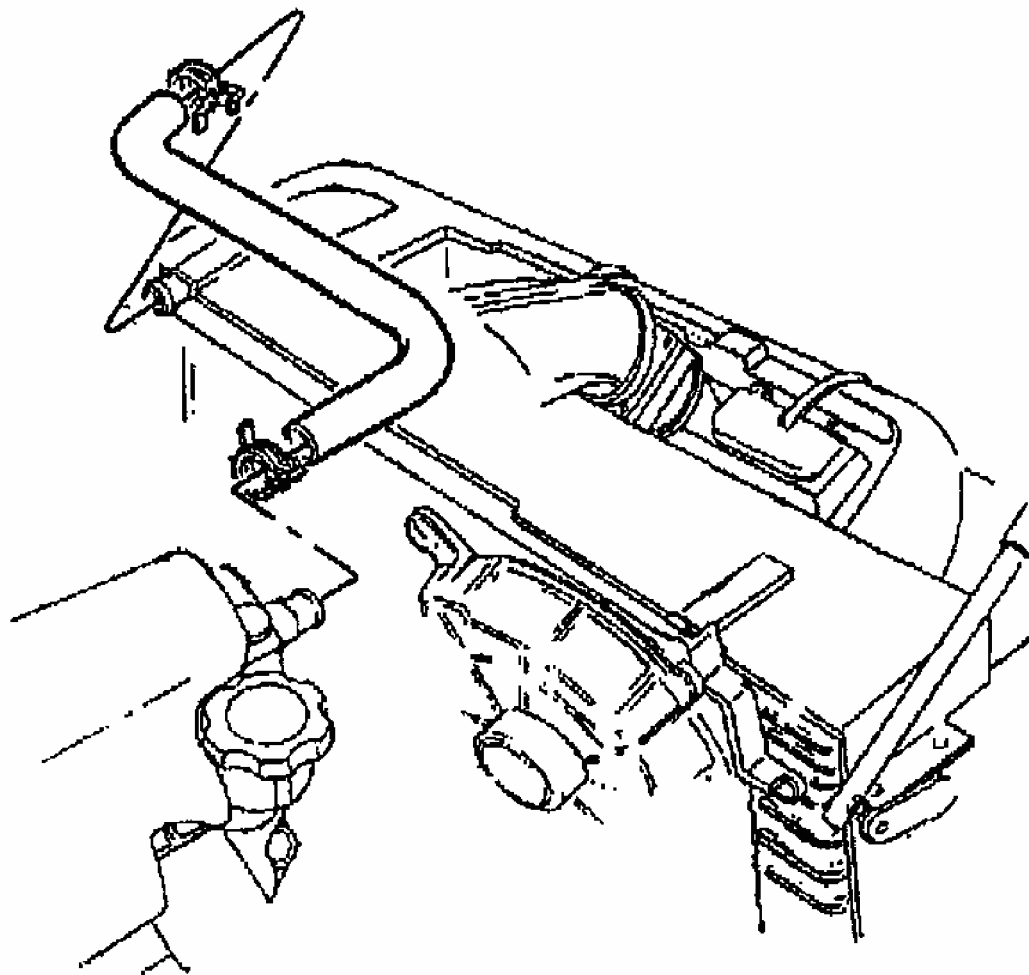
6. Install the surge tank inlet hose to the radiator.
7. Reposition the surge tank inlet hose clamp to the radiator using **J 38185**.



G01694789

Fig. 88: Installing Surge Tank Inlet Hose
Courtesy of GENERAL MOTORS CORP.

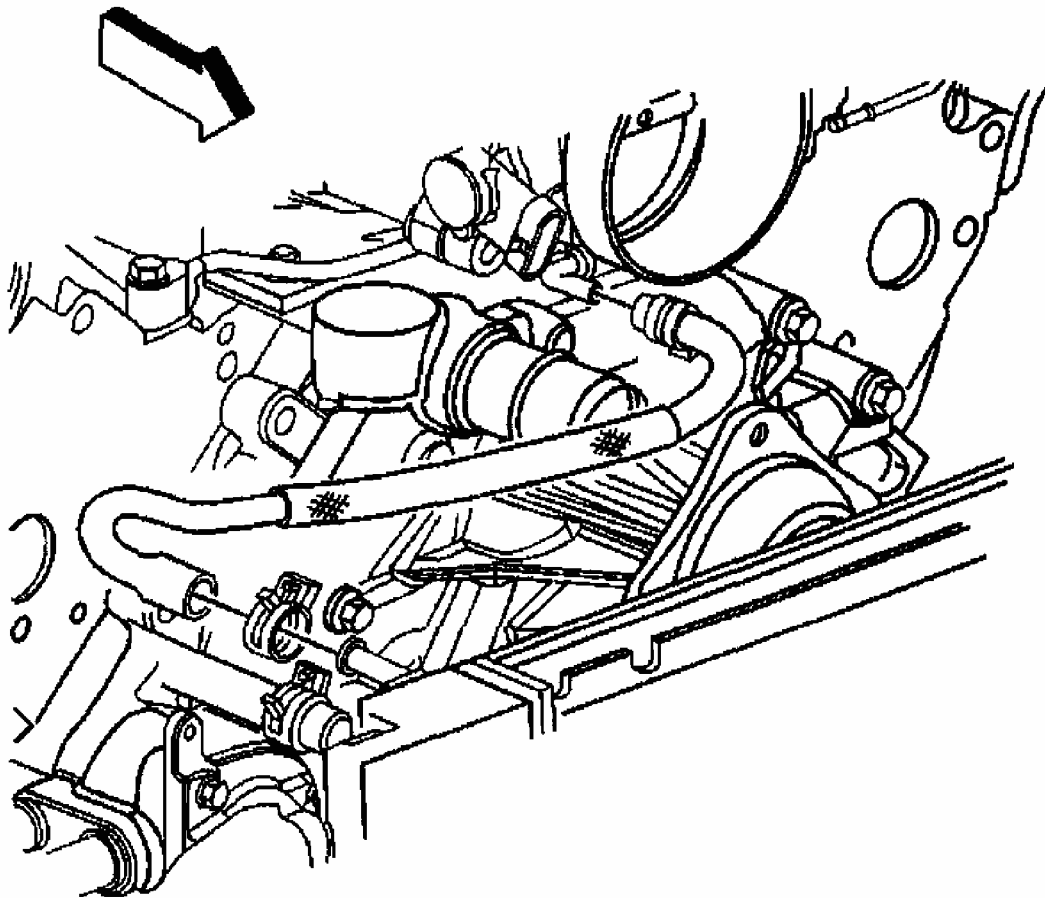
8. Install the radiator inlet hose to the water pump.
9. Reposition the radiator inlet hose clamp to the water pump using **J 38185**.



G01694790

Fig. 89: Installing Radiator Inlet Hose
Courtesy of GENERAL MOTORS CORP.

10. Install the throttle body heater outlet hose to the radiator.
11. Reposition the throttle body heater outlet hose clamp to the radiator using **J 38185**.
12. Install the fan shroud. Refer to **Fan Shroud Replacement** .



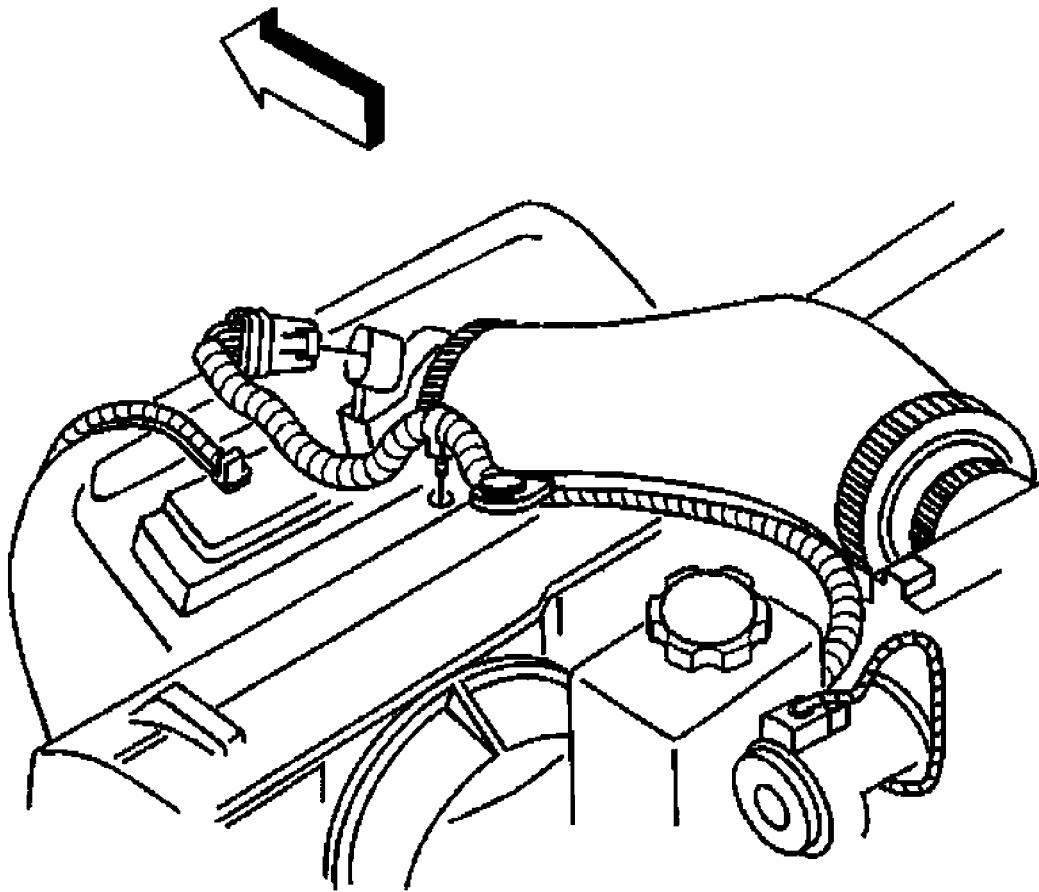
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Fig. 90: Installing Throttle Body Heater Outlet Hose
Courtesy of GENERAL MOTORS CORP.

RADIATOR SUPPORT REPLACEMENT

Removal Procedure

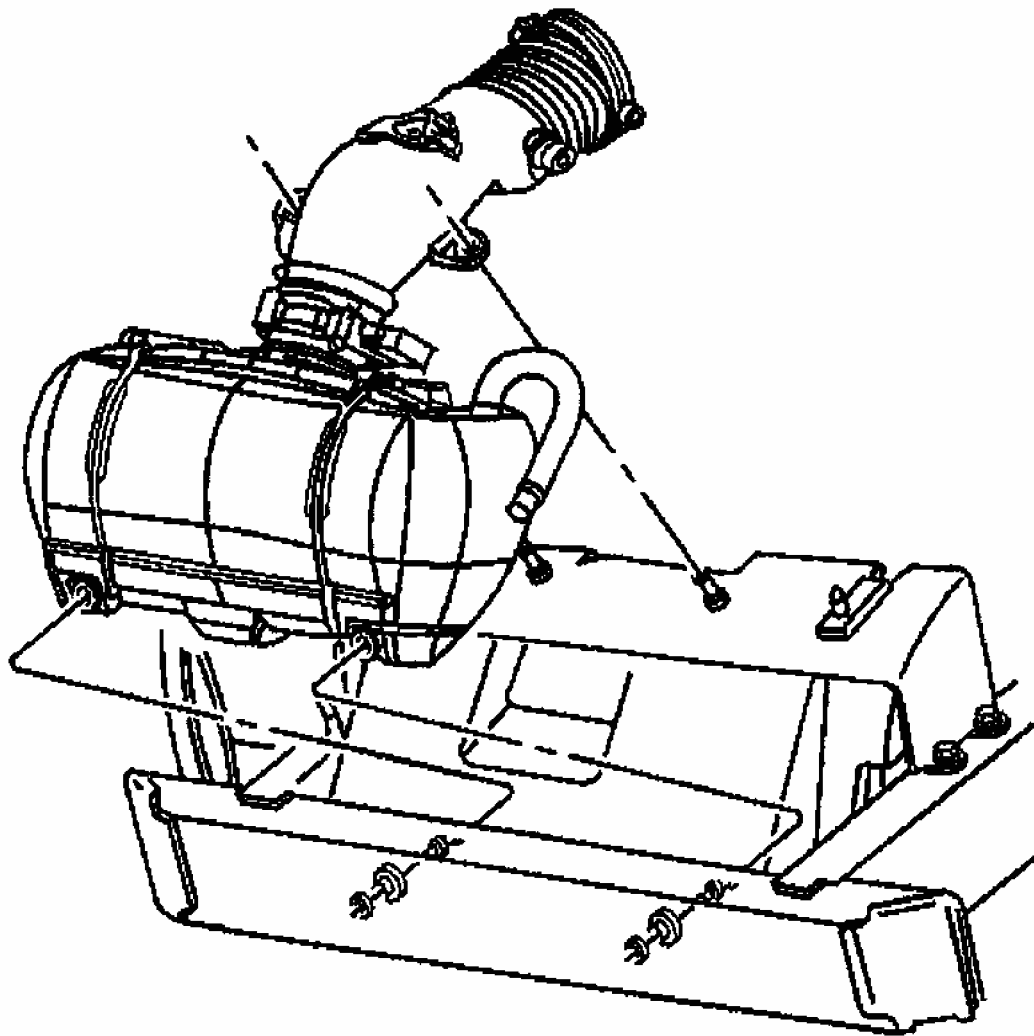
1. Disconnect the mass air flow sensor electrical connector.
2. Remove the engine wiring harness from the clip on the radiator support.



G01694792

Fig. 91: Disconnect Mass Air Flow Sensor Electrical Connector
Courtesy of GENERAL MOTORS CORP.

3. Remove the air cleaner intake duct.

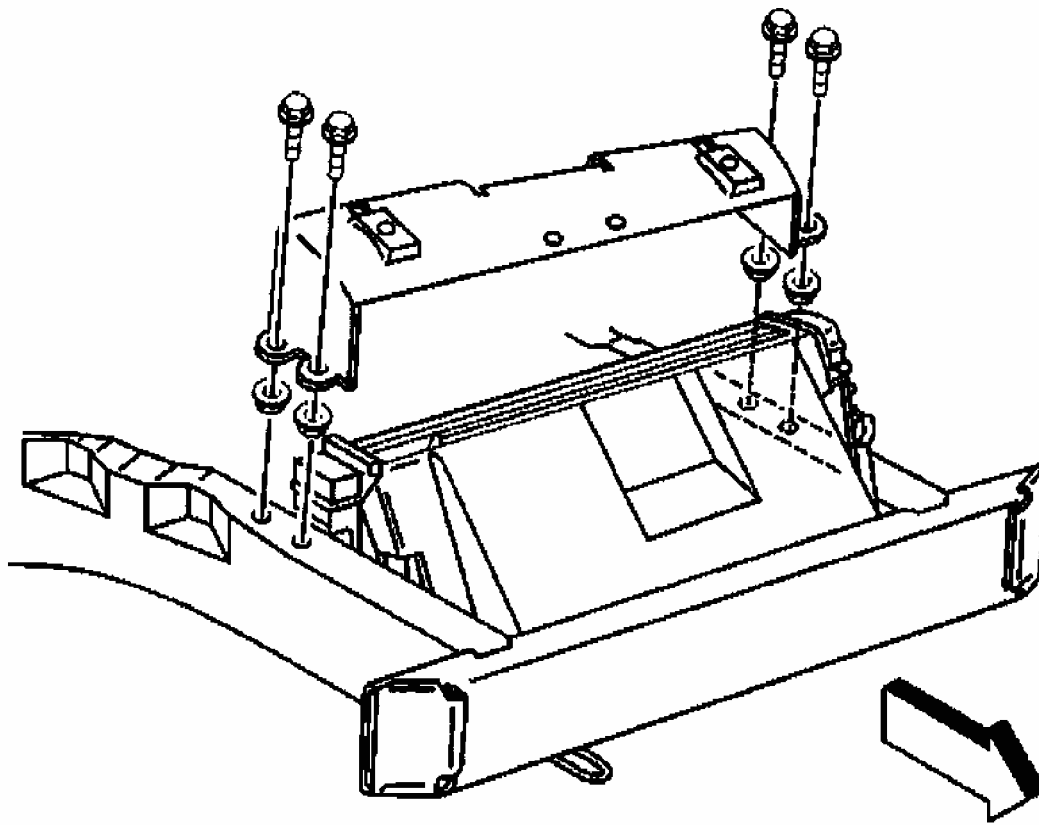


G01694793

Fig. 92: Removing Air Cleaner Intake Duct
Courtesy of GENERAL MOTORS CORP.

Important: Note the position of the radiator upper support in relationship to the fan shroud. This must be reassembled correctly in order to retain the fan shroud.

4. Remove the radiator support bolts.
5. Remove the radiator support.

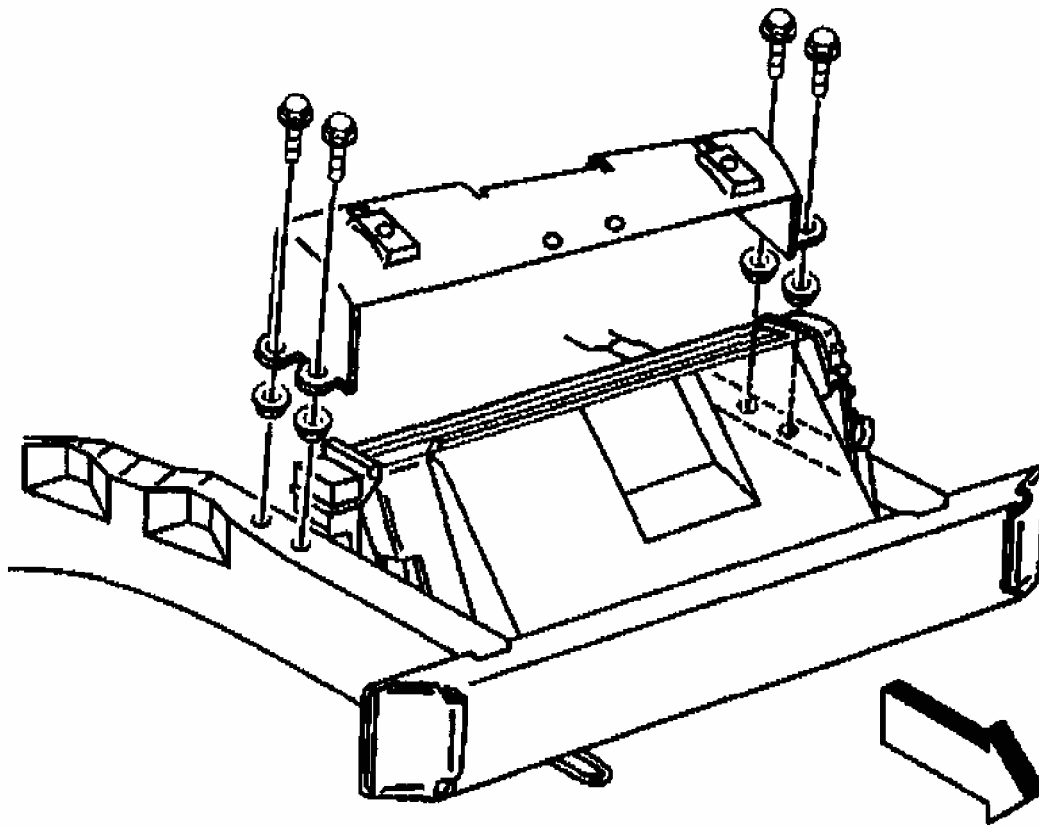


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Fig. 93: Removing Radiator Support Bolts
Courtesy of GENERAL MOTORS CORP.

Installation Procedure

1. Install the radiator support.



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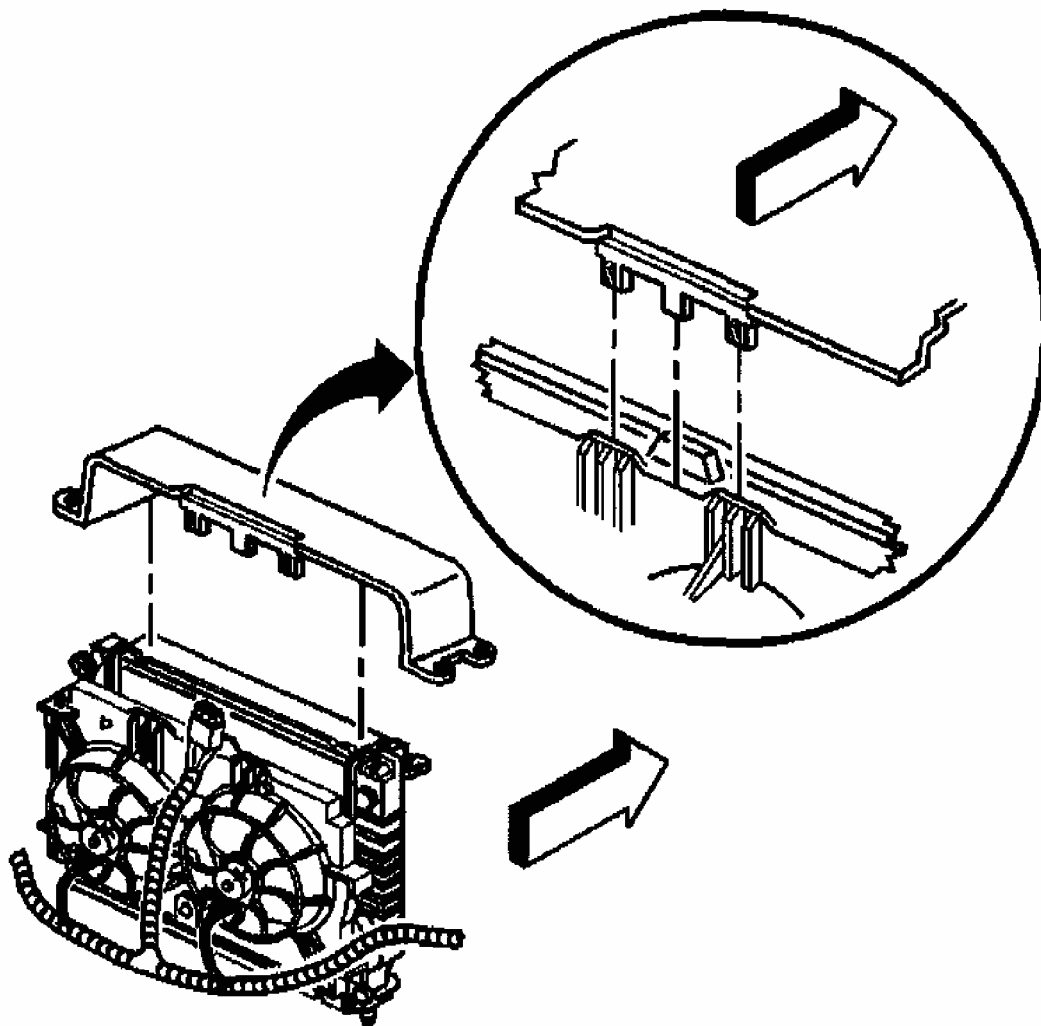
Fig. 94: Installing Radiator Support
Courtesy of GENERAL MOTORS CORP.

CAUTION: Refer to FASTENER NOTICE .

2. Install the radiator support bolts.

Tighten

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

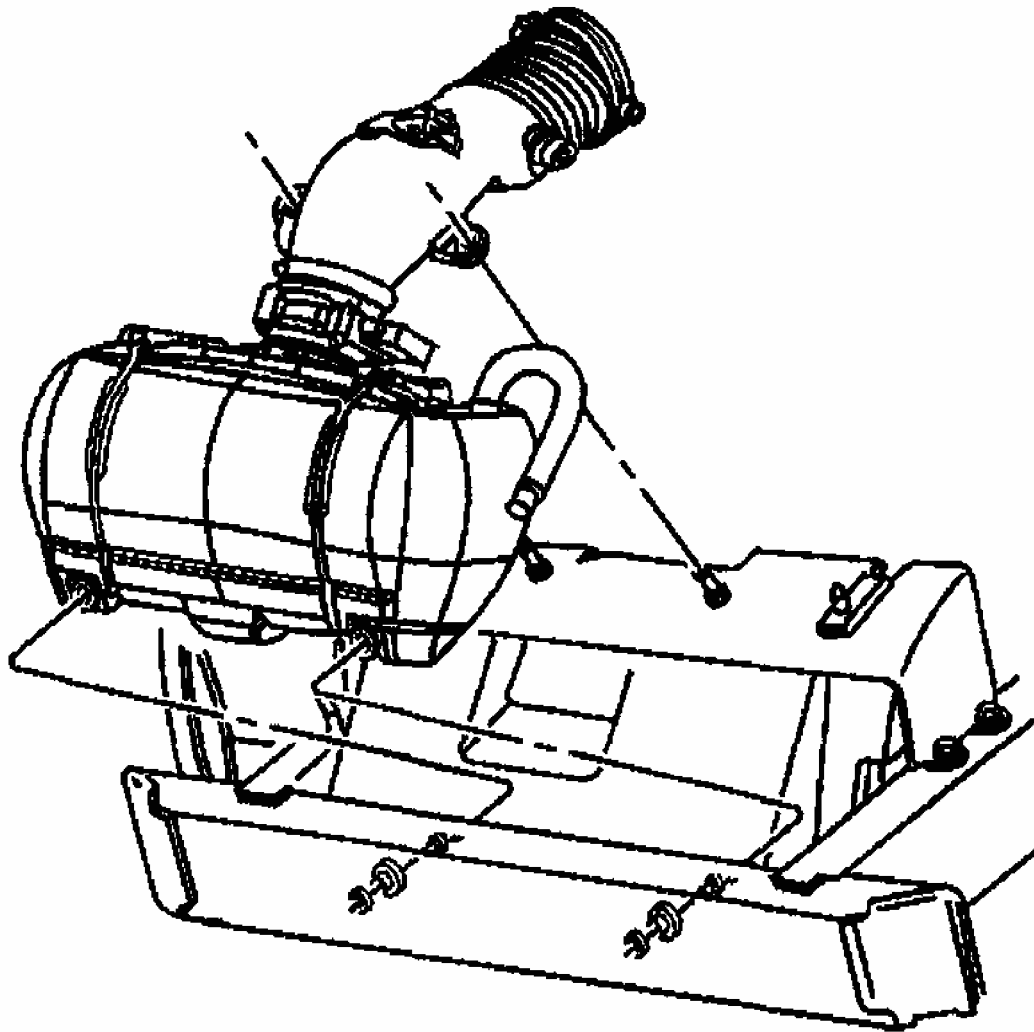


G01694796

Fig. 95: Installing Radiator Support Bolts
Courtesy of GENERAL MOTORS CORP.

Important: Seat the air cleaner retaining grommets fully. If necessary moisten the grommets with water prior to installation.

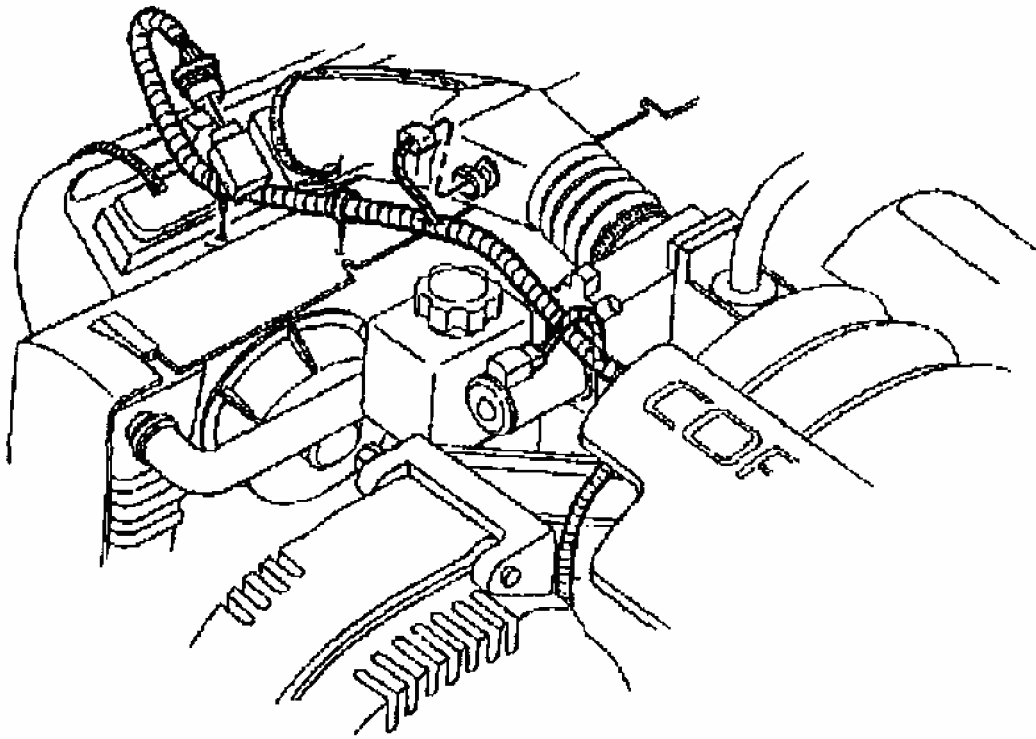
3. Install the air cleaner intake duct.



G01694797

Fig. 96: Installing Air Cleaner Intake Duct
Courtesy of GENERAL MOTORS CORP.

4. Install the engine wiring harness to the clip on the radiator support.
5. Connect the mass air flow sensor electrical connector.



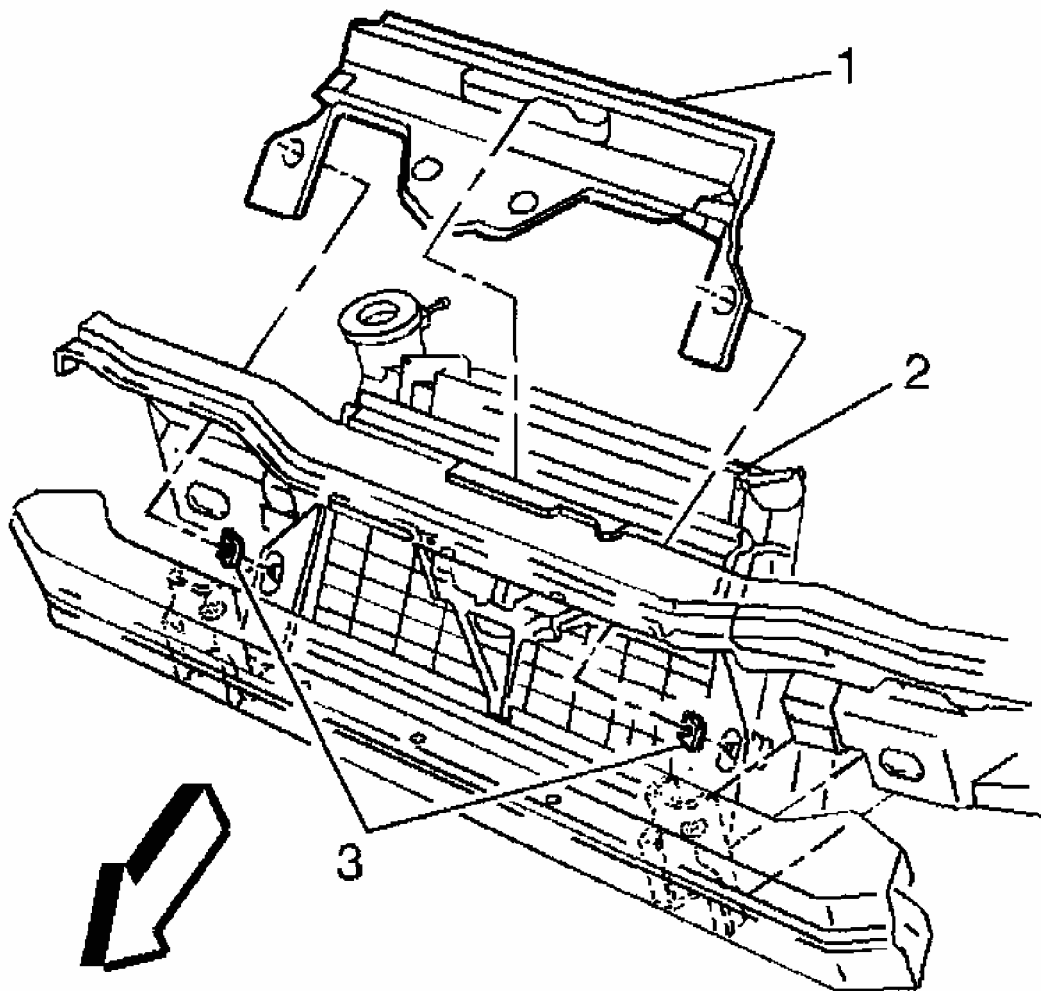
G01694798

Fig. 97: Installing Engine Wiring Harness
Courtesy of GENERAL MOTORS CORP.

RADIATOR AIR BAFFLE ASSEMBLIES & DEFLECTORS

Removal Procedure

1. Remove the air cleaner assembly.
2. Raise and suitably support the vehicle. Refer to **LIFTING AND JACKING THE VEHICLE** .
3. Remove the radiator air baffle lower bolts.
4. Lower the vehicle.
5. Disconnect the hood light and air temperature sensor electrical connectors.
6. Disconnect the radiator air baffle connectors (3).
7. Remove the radiator air baffle (1).



G01694799

Fig. 98: Removing Radiator Air Baffle
Courtesy of GENERAL MOTORS CORP.

Installation Procedure

1. Install the radiator air baffle (1).
2. Connect the radiator air baffle connectors (3).
3. Connect the hood light and air temperature sensor electrical connectors.
4. Raise the vehicle.

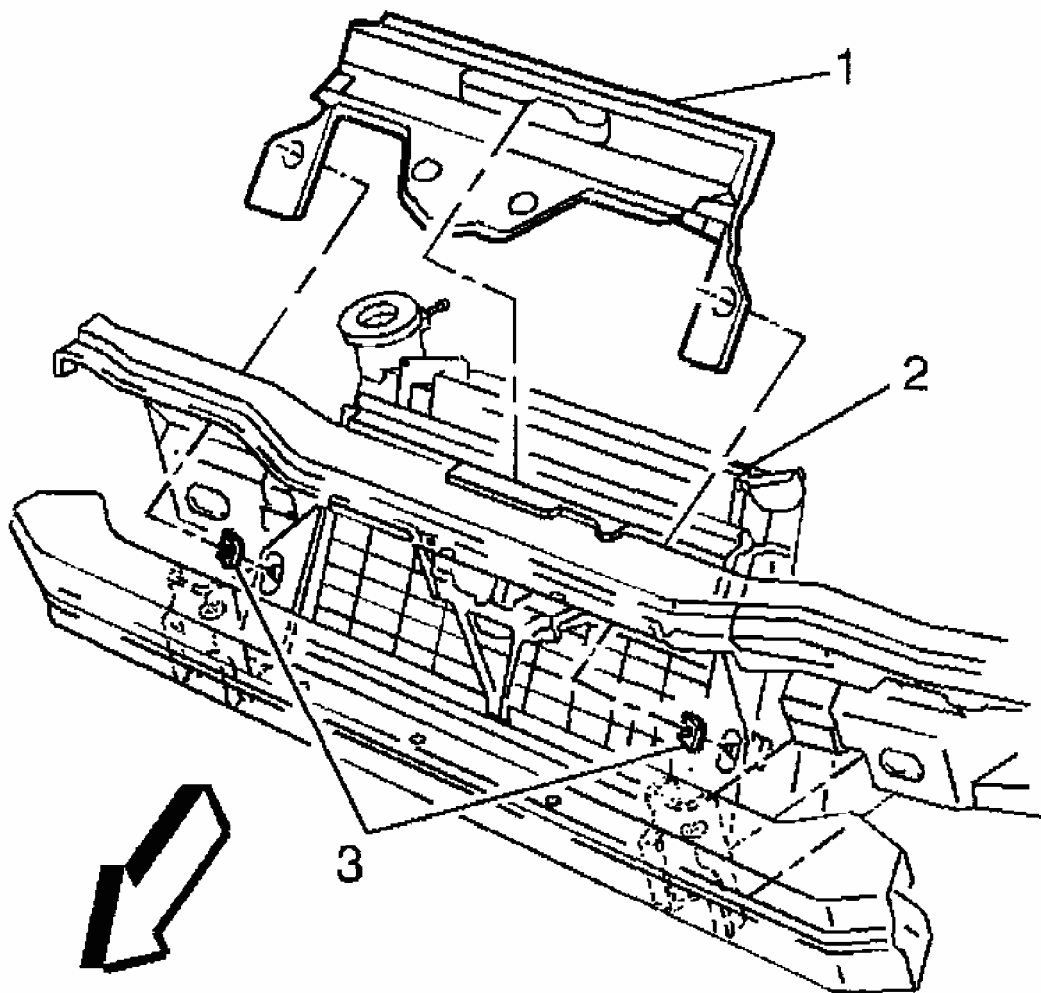
**CAUTION: Refer to FASTENER
NOTICE .**

5. Install the radiator air baffle lower bolts.

Tighten

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

6. Lower the vehicle.
7. Install the air cleaner assembly.



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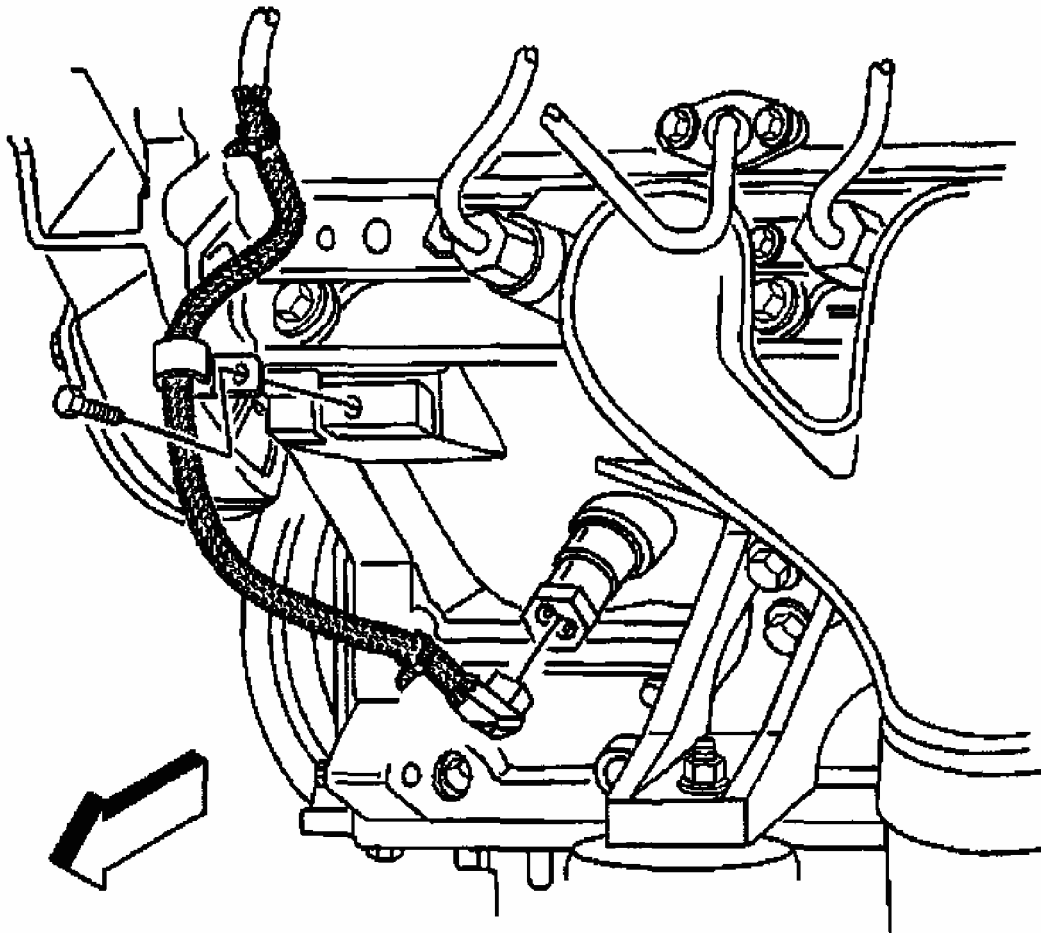
Fig. 99: Installing Radiator Air Baffle
Courtesy of GENERAL MOTORS CORP.

COOLANT HEATER REPLACEMENT

Removal Procedure

1. Drain the cooling system. Refer to **DRAINING & Filling Cooling System** .

2. Remove the tire and wheel, if necessary. Refer to **TIRE & WHEEL REMOVAL & INSTALLATION** in Tires and Wheels.
3. Disconnect the engine coolant heater cord from the engine coolant heater.

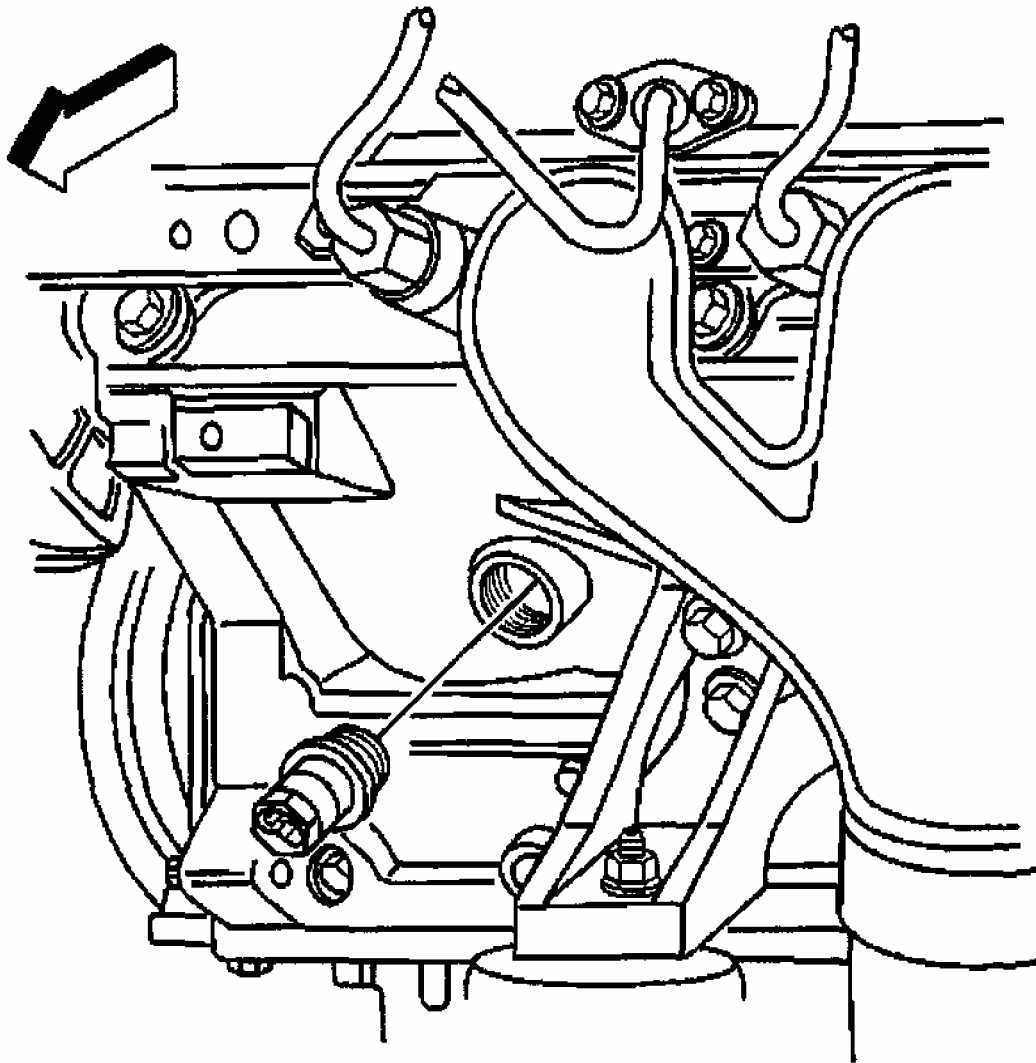


G01694801

Fig. 100: Disconnecting Engine Coolant Heater Cord
Courtesy of GENERAL MOTORS CORP.

Important: Take care not to damage the surface of the opening in the engine block.

4. Remove the engine coolant heater.
5. Clean the opening in the engine block, remove any burrs, sealing compound, or paint.



G01694802

Fig. 101: Removing Engine Coolant Heater
Courtesy of GENERAL MOTORS CORP.

Installation Procedure

Important: The engine coolant heater sealing washer may be reused if not bent, scored or otherwise damaged.

1. Apply a 3.175 mm (0.125 in) bead of sealant GM P/N 12346004 (Canadian P/N 10953480) or equivalent to the engine coolant heater sealing washer.
2. Insert the engine coolant heater.

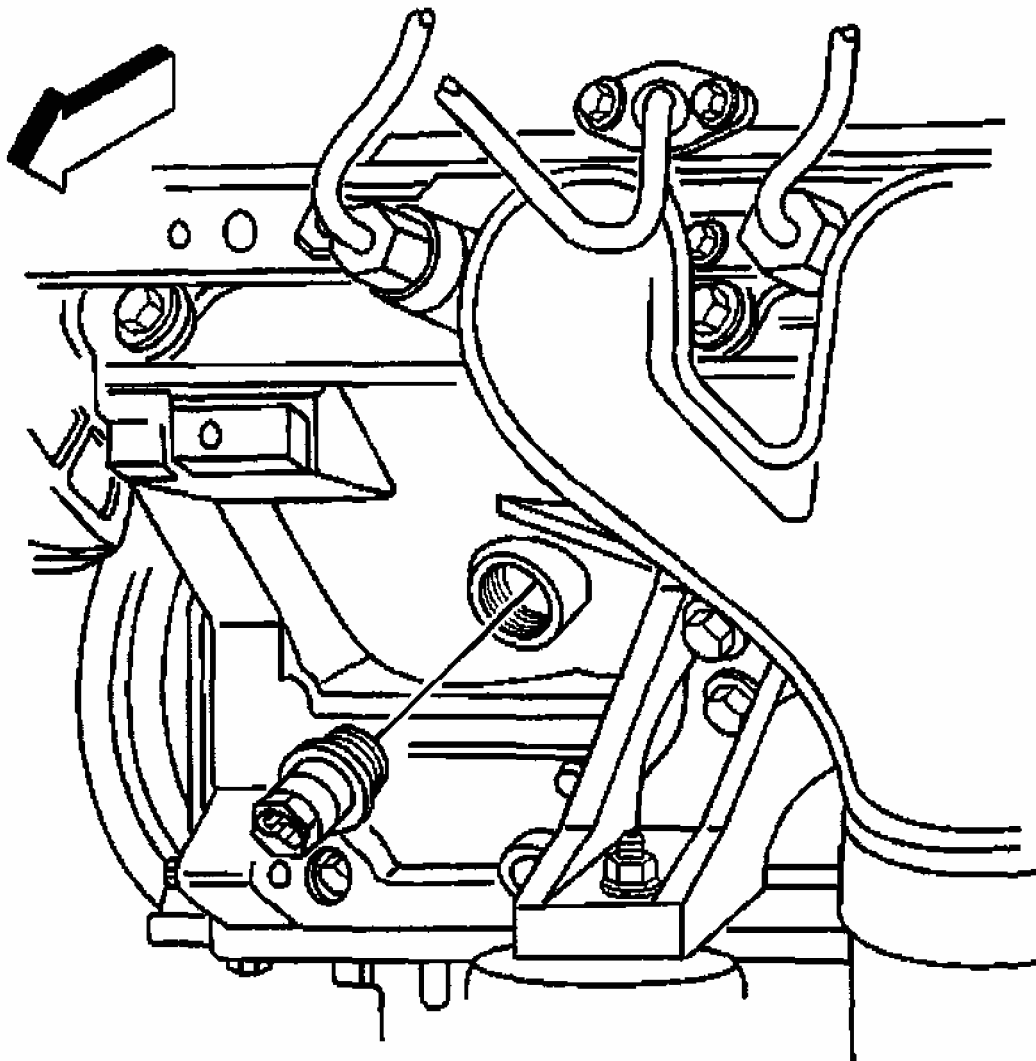
CAUTION: Refer to FASTENER

NOTICE .

3. Tighten the engine coolant heater.

Tighten

Tighten the engine coolant heater to 40 N.m (30 lb ft).

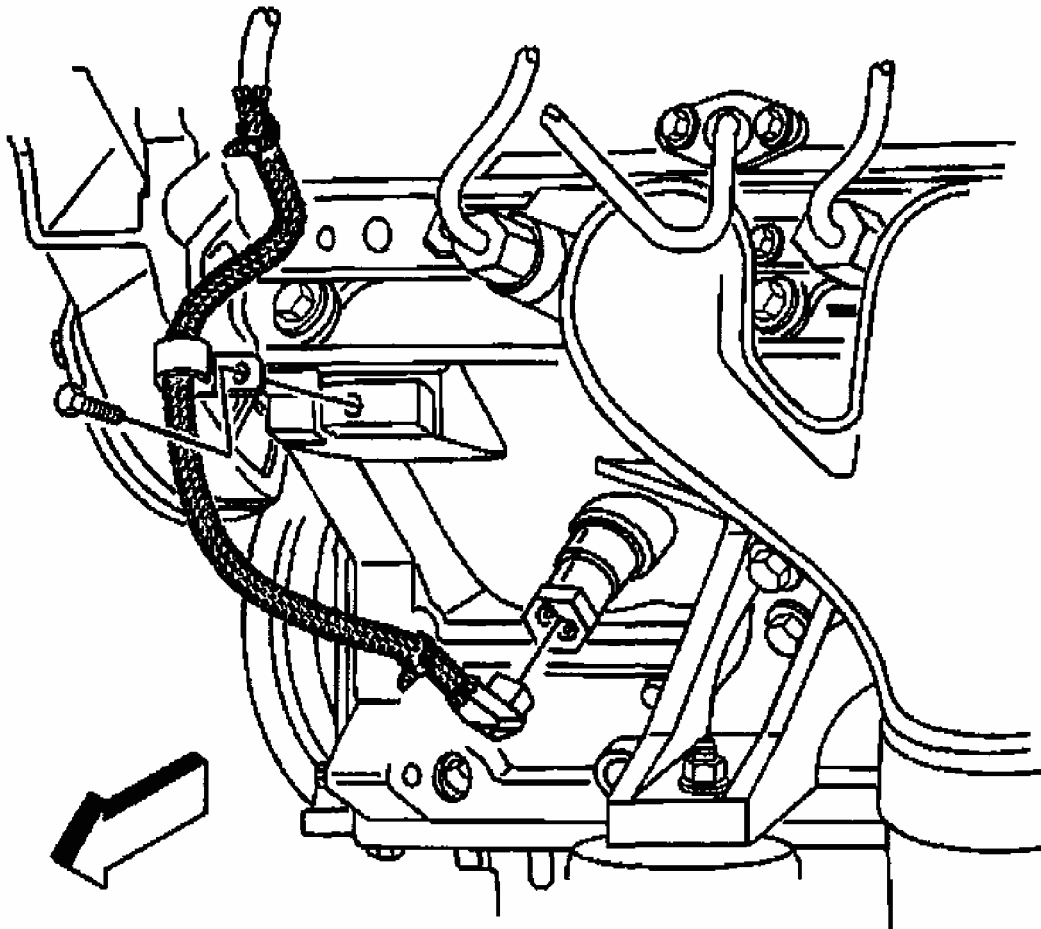


G01694803

Fig. 102: Installing Engine Coolant Heater
Courtesy of GENERAL MOTORS CORP.

4. Install the engine coolant heater cord to the engine coolant heater.

5. Install the tire and wheel, if necessary. Refer to **TIRE & WHEEL REMOVAL & INSTALLATION** in Tires and Wheels.
6. Fill the cooling system. Refer to **DRAINING & Filling Cooling System** .



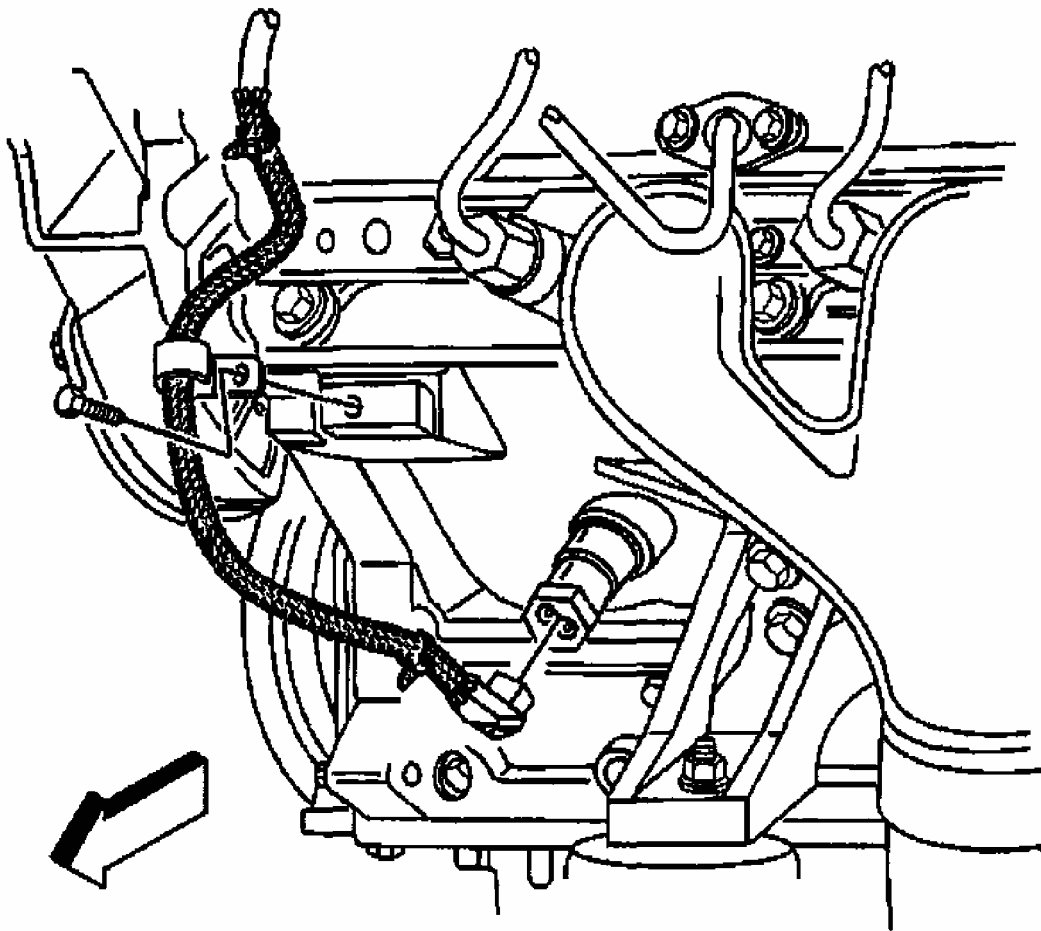
G01694804

Fig. 103: Installing Engine Coolant Heater Cord
Courtesy of GENERAL MOTORS CORP.

COOLANT HEATER CORD REPLACEMENT

Removal Procedure

1. Disconnect the engine coolant heater cord from the engine coolant heater.
2. Remove the engine coolant heater cord clip bolt.
3. Remove the engine coolant heater cord strap at the secondary air injection pump hose.
4. Remove the engine coolant heater cord.



G01694805

Fig. 104: Removing Engine Coolant Heater Cord
Courtesy of GENERAL MOTORS CORP.

Installation Procedure

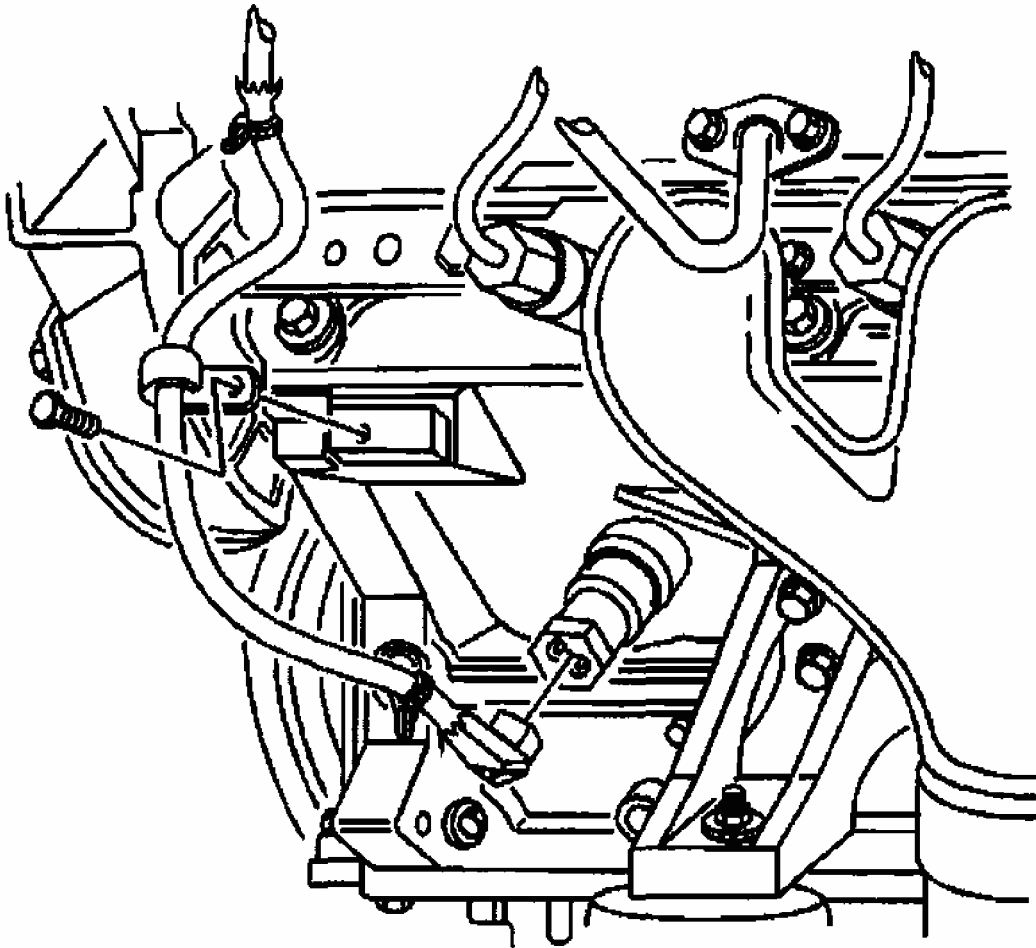
1. Install the engine coolant heater cord to the engine coolant heater.

CAUTION: Refer to FASTENER NOTICE .

2. Position the engine coolant heater cord clip and install the bolt.

Tighten

Tighten the engine coolant heater cord clip bolt to 32 N.m (24 lb ft).

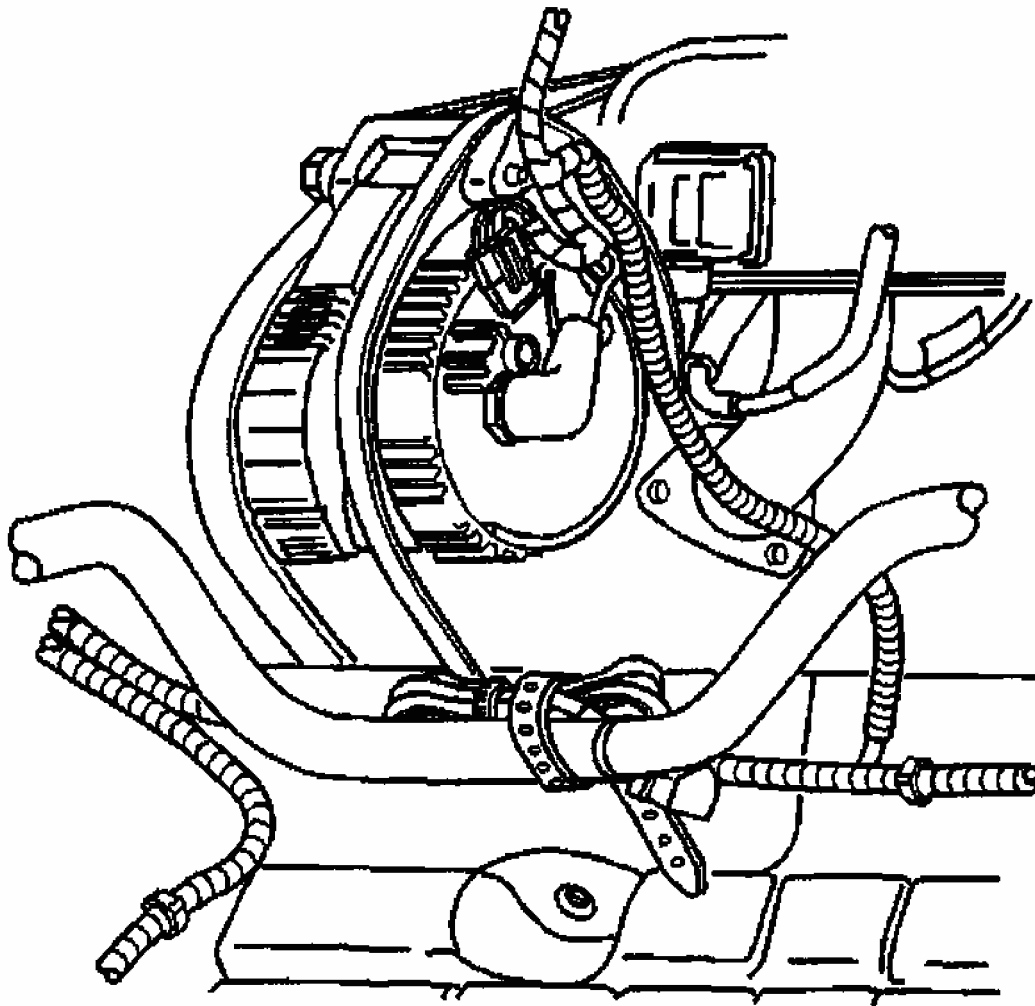


G01694806

Fig. 105: Installing Engine Coolant Heater Cord
Courtesy of GENERAL MOTORS CORP.

Important: The engine coolant heater cord must not contact the engine, pipes, manifold or any moving parts. Always keep the electrical cord neatly rolled up with the plug end of the cord tucked into the center of the coil and secured in place with the supplied tie straps.

3. Route the engine coolant heater cord over the generator.
4. Coil the engine coolant heater cord into a bundle and secure the bundle to the secondary air injection hose pump with the strap.



G01694807

Fig. 106: Securing Engine Coolant Heater Cord
Courtesy of GENERAL MOTORS CORP.

DESCRIPTION & OPERATION

COOLING SYSTEM DESCRIPTION & OPERATION

Cooling Fan Control

The engine cooling fan system consists of two electrical cooling fans and three fan relays. The relays are arranged in a series/parallel configuration that allows the powertrain control module (PCM) to operate both fans together at low or high speeds. The cooling fans and fan relays receive battery positive voltage and ignition 1 voltage from the underhood electrical center. The ground path is provided at G102.

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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 cooling fan 1 relay coil, closes the relay contacts, and supplies battery positive voltage 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 3 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 cooling fan 1 relay through the low speed cooling fan relay control circuit. After a 3-second delay, the PCM supplies a ground path for the cooling fan 2 relay and the cooling fan 3 relay through the high speed cooling fan relay control circuit. This energizes the cooling fan 3 relay coil, closes the relay contacts, and provides a ground path for the left cooling fan. At the same time the cooling fan 2 relay coil is energized closing the relay contacts and provides battery positive voltage 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.

Engine Coolant Indicator(s)

COOLANT OVER TEMP

The IPC illuminates the COOLANT OVER TEMP indicator in the message center when the following occurs:

- The PCM detects that the engine coolant temperature exceeds 124°C (256°F). The IPC receives a class 2 message from the PCM indicating the high coolant temperature.
- The IPC will also illuminate the CHECK GAGES indicator and a chime sounds when this condition exists.

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 system cools slowly or not at all. 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. Some coolant will then be pumped from the water pump, to the heater core, then back to the water pump. This provides the passenger compartment with heat and defrost.

Coolant is also pumped through the water pump outlet and into the engine block. In the engine block, the coolant circulates through the water jackets surrounding the cylinders where it absorbs heat.

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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 keeping the throttle body cool.

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

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

Coolant

The engine coolant is a solution made up of a 50-50 mixture of DEX-COOL and clean drinkable 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 crossflow tube and fin design. This is a series of tubes that extend side to side from the inlet tank to the outlet tank. Fins are placed around the outside of the tubes to improve heat transfer from the coolant to the atmosphere. The inlet and outlet tanks are molded with a high temperature, nylon reinforced plastic. A high temperature rubber gasket seals the tank flange edge. The tanks are clamped to the core with clinch tabs. The tabs are part of the aluminum header at each end of the core. The radiator also has a drain cock which is located in the bottom of the left hand tank. The drain cock includes the drain cock and drain cock seal.

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

During vehicle use, the coolant heats and expands. The coolant that is displaced by this expansion flows into the surge tank. As the coolant circulates, air is allowed to exit. This is an advantage to the cooling system. Coolant without bubbles absorbs heat much better than coolant with bubbles.

Pressure Cap

The pressure cap is a cap that seals and pressurizes the cooling system. It contains a blow off or pressure valve and a vacuum or atmospheric valve. The pressure valve is held against its

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seat by a spring of predetermined strength, which protects the radiator by relieving pressure if it exceeds 15 psi. 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 to collapse.

The pressure cap allows pressure in the cooling system to build up. As the pressure builds, the boiling point of the coolant goes up as well. Therefore, the 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 moves from the radiator to the cooler, passing air. The pressure in the cooling system can get too high, however. When the pressure exceeds the strength of the spring, it raises the pressure valve so that the excess pressure can escape. 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 cooling system. This equalizes the pressure in the cooling system with atmospheric pressure, preventing the radiator from collapsing.

Coolant Recovery System

The coolant recovery system consists of a plastic coolant recovery reservoir and overflow tube. The recovery reservoir is also called a recovery tank or expansion tank. It is partially filled with coolant and is connected to the radiator fill neck with the overflow tube. Coolant can flow back and forth between the radiator and the reservoir.

In effect, a cooling system with a coolant recovery reservoir is a closed system. When the pressure in the cooling system gets too high, it will open the pressure valve in the pressure cap. This allows the coolant, which has expanded due to being heated, is allowed to flow through the overflow tube and into the recovery reservoir. As the engine cools down, the temperature of the coolant drops and a vacuum is created in the cooling system. This vacuum opens the vacuum valve in the pressure cap, allowing some of the coolant in the reservoir to be siphoned back into the radiator. Under normal operating conditions, no coolant is lost. Although the coolant level in the recovery reservoir goes up and down, the radiator and cooling system are kept full. An advantage to using a coolant recovery reservoir is that it eliminates almost all air bubbles from the cooling system. Coolant without bubbles absorbs heat much better than coolant with bubbles.

Air Baffles and Seals

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

Water Pump

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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 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 one or more sealed bearings. These sealed bearings never need to be lubricated. With a sealed bearing, grease cannot leak out, and dirt and water cannot get in.

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

Thermostat

The thermostat is a coolant flow control component. Its purpose is to regulate the operating temperature of the engine. It 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 diaphragm. 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 91°C (195°F), the thermostat valve remains closed. This prevents circulation of the coolant to the radiator and allows the engine to warm up quickly. After the coolant temperature reaches 91°C (195°F), 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, even after it has opened. This restriction creates a pressure difference which prevents cavitation at the water pump and forces coolant to circulate through the engine block.

Transmission Oil Cooler

The transmission oil cooler is a heat exchanger. It is located inside the right side end tank of the radiator. The transmission fluid temperature is regulated by the temperature of the engine coolant that surrounds the oil cooler as the transmission fluid passes down through the cooler.

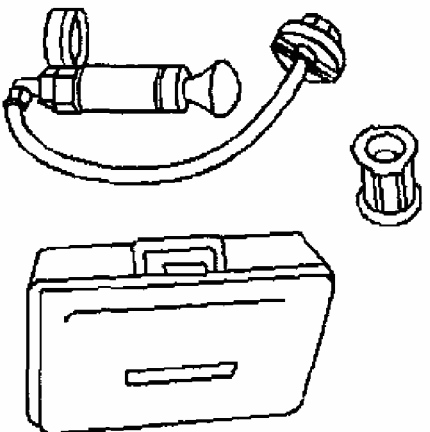
The transmission oil pump, pumps the fluid through the transmission oil cooler feed line to the oil cooler. The fluid then flows down through the cooler while the engine coolant absorbs heat from the fluid. The fluid is then pumped through the transmission oil cooler return line, to the transmission.

Coolant Heater

The optional engine coolant heater (RPO K05) is rated at 400 watts and supplies 1365 btu/hr. The engine coolant heater operates using 110-volt AC external power and is designed to warm the coolant in the engine block area for improved starting in very cold weather -29°C (-20°F). The coolant heater helps reduce fuel consumption when a cold engine is warming up. The unit is equipped with a detachable AC power cord. A weather shield on the cord is

provided to protect the plug when not in use.

SPECIAL TOOLS & EQUIPMENT

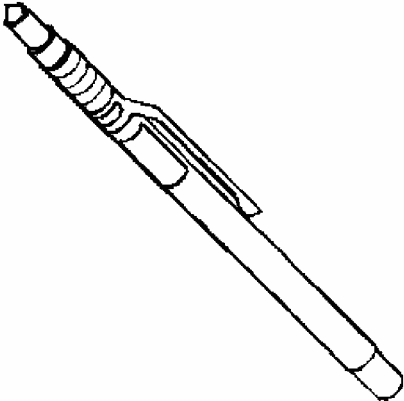
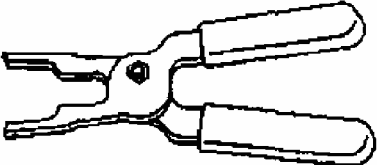
Illustration	Tool Number/ Description
 The illustration shows two tools. The top tool is a Radiator Pressure Tester, consisting of a cylindrical body with a pressure gauge, a hose with a quick-connect fitting, and a separate pressure cap. The bottom tool is a pair of Hose Clamp Pliers, which have long, curved handles and a specialized head designed to grip and adjust hose clamps.	<p>J 24460-01 Radiator Pressure Tester</p> <p>J 38185 Hose Clamp Pliers</p>

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Fig. 107: Special Tools & Equipment (1 Of 2)
Courtesy of GENERAL MOTORS CORP.

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Illustration	Tool Number/ Description
	J 24731 Tempilstick
	J 43244 Relay Puller Pliers

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Fig. 108: Special Tools & Equipment (2 Of 2)
Courtesy of GENERAL MOTORS CORP.