

[2009 Chevrolet Aveo](#) | [Aveo, Wave, G3, Barina \(VIN S/T\) Service Manual](#) | [Engine](#) | [Engine Controls and Fuel - 1.6L \(LXV\)](#)
[Specifications](#) | **Document ID: 1591851**

Temperature Versus Resistance

°C	°F	ECT Ohms	IAT Ohms
Temperature vs Resistance Values (Approximate)			
100	212	177	187
90	194	241	246
80	176	332	327
70	158	467	441
60	140	667	603
50	122	973	837
45	113	1188	991
40	104	1459	1180
35	95	1802	1412
30	86	2238	1700
25	77	2796	2055
20	68	3520	2500
15	59	4450	3055
10	50	5670	3760
5	41	7280	4651
0	32	9420	5800
-5	23	12300	7273
-10	14	16180	9200
-15	5	21450	9200
-20	-4	28680	15080
-30	-22	52700	25600
-40	-40	100700	45300

Altitude Versus Barometric Pressure

Altitude Measured in Meters (m)	Altitude Measured in Feet (ft)	Barometric Pressure Measured in Kilopascals (kPa)
Determine your altitude by contacting a local weather station or by using another reference source.		
4 267	14,000	56-64
3 962	13,000	58-66
3 658	12,000	61-69
3 353	11,000	64-72
3 048	10,000	66-74
2 743	9,000	69-77
2 438	8,000	71-79
2 134	7,000	74-82
1 829	6,000	77-85
1 524	5,000	80-88
1 219	4,000	83-91
914	3,000	87-95
610	2,000	90-98
305	1,000	94-102
0	0 Sea Level	96-104
-305	-1,000	101-105

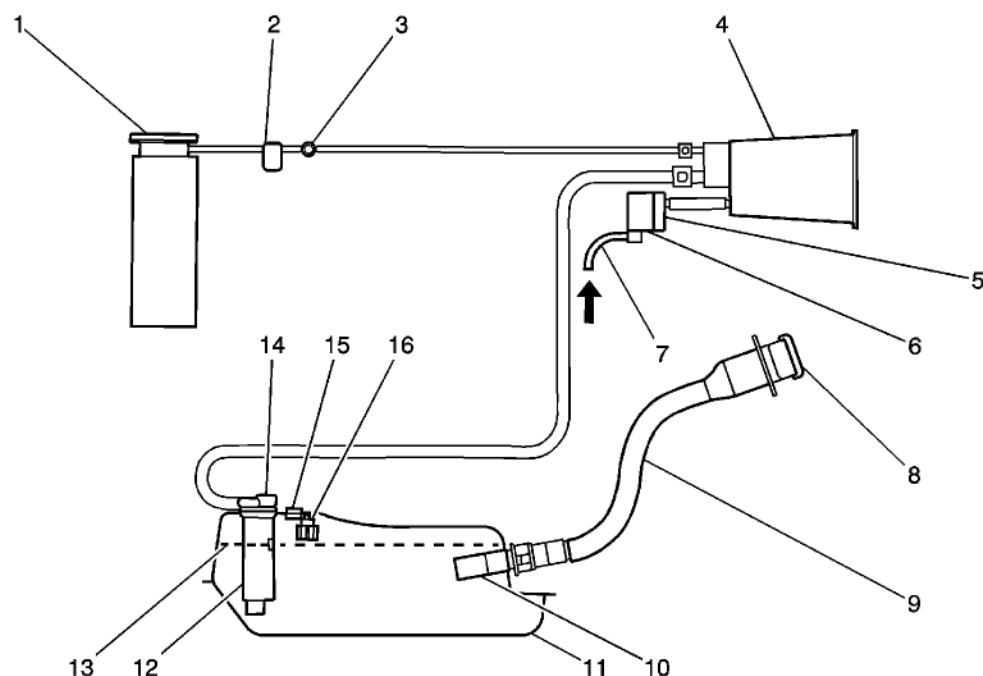
Ignition System Specifications

Application	Specification	
	Metric	English
Firing Order	1-3-4-2	
Spark Plug Gap	1.0-1.1 mm	0.039-0.043 in
Spark Plug Torque	25 N·m	18 lb ft
Spark Plug Type	Woojin NGK - ZFR6U-II	

Fastener Tightening Specifications

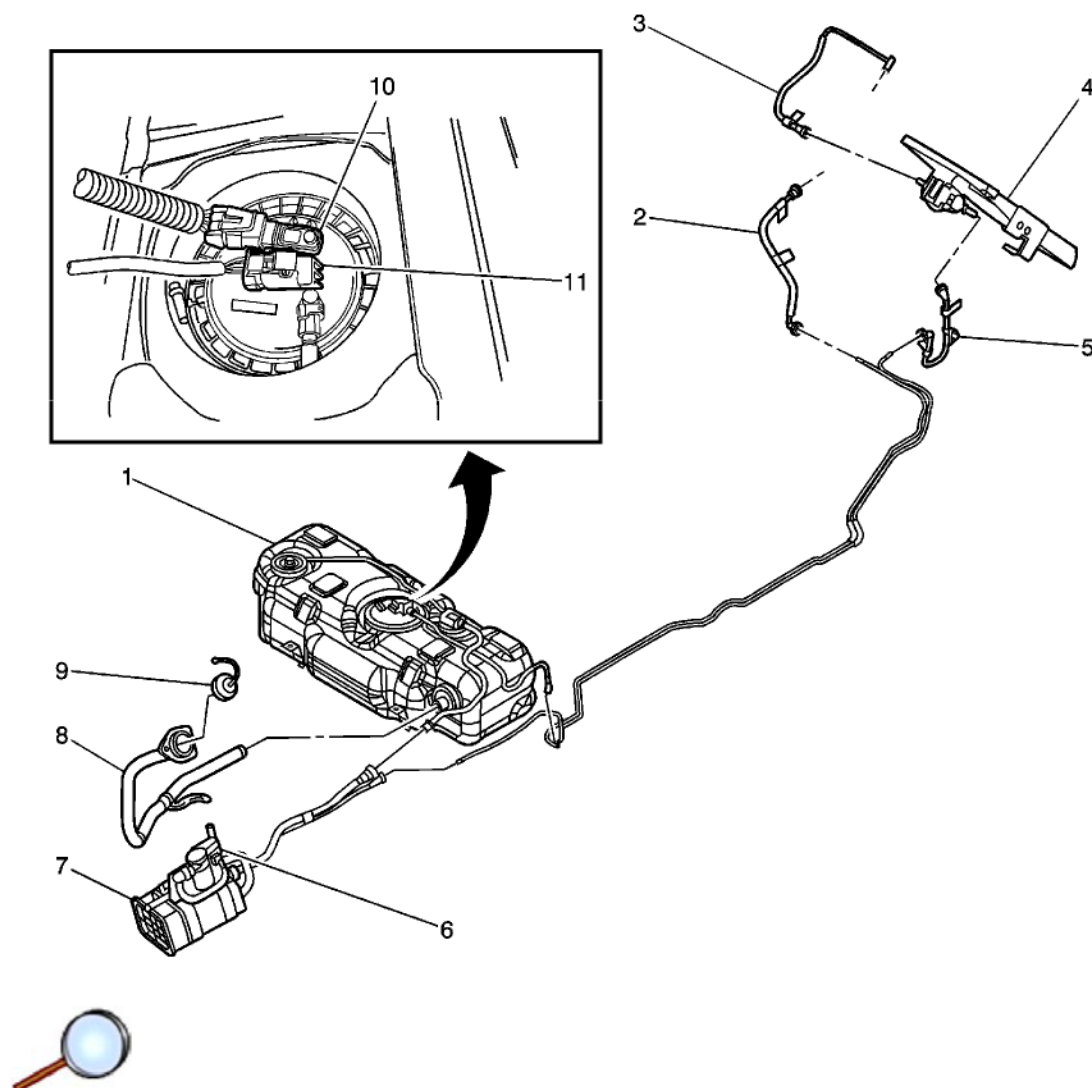
Application	Specifications	
	Metric	English
Accelerator Pedal Nut	12 N·m	106 lb in
Camshaft Position Actuator Solenoid Valve Bolt	6 N·m	53 lb in
Crankshaft Position (CKP) Sensor Bolt	4.5 N·m	40 lb in
Engine Control Module (ECM) Nuts	8 N·m	71 lb in
Engine Coolant Temperature 2 (ECT2) Sensor	20 N·m	15 lb ft
Fuel Filter Bracket Bolt	4 N·m	35 lb in
Fuel Rail Bolt	8 N·m	71 lb in
Heated Oxygen Sensor (HO2S)	40 N·m	30 lb ft
Ignition Coil Bolt	8 N·m	71 lb in
Knock Sensor (KS) Bolt	20 N·m	15 lb ft
Map Sensor Screw	8 N·m	71 lb in
Throttle Body Bolts	8 N·m	71 lb in

Evaporative Emissions Hose Routing Diagram



- (1) Intake Manifold
- (2) Evaporative Emissions (EVAP) Canister Purge Solenoid Valve
- (3) Service Port
- (4) Evaporative Emissions (EVAP) Canister
- (5) Evaporative Emissions (EVAP) Canister Vent Solenoid Valve
- (6) Air Filter
- (7) Fresh Air Intake
- (8) Fuel Filler Cap
- (9) Fuel Filler Tube
- (10) Check Valve
- (11) Fuel Tank
- (12) Fuel Fill Vent Valve
- (13) Fuel Level at Shut-Off
- (14) Fuel Pressure Relief Valve
- (15) Fuel Tank Pressure Sensor
- (16) Rollover Valve

Fuel Hose / Pipes Routing Diagram



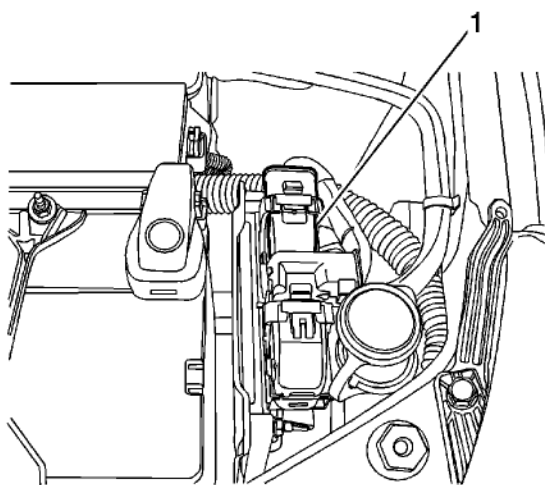
- (1) Fuel Tank
- (2) Fuel Line to Fuel Rail
- (3) EVAP Canister Purge Vacuum Line to Intake Manifold
- (4) EVAP Canister Purge Solenoid Valve
- (5) EVAP Service Port
- (6) EVAP Canister Vent Solenoid Valve
- (7) EVAP Canister
- (8) Fuel Fill Tube
- (9) Fuel Filler Cap
- (10) Fuel Tank Pressure Sensor (FTP)
- (11) Fuel Sender Assembly

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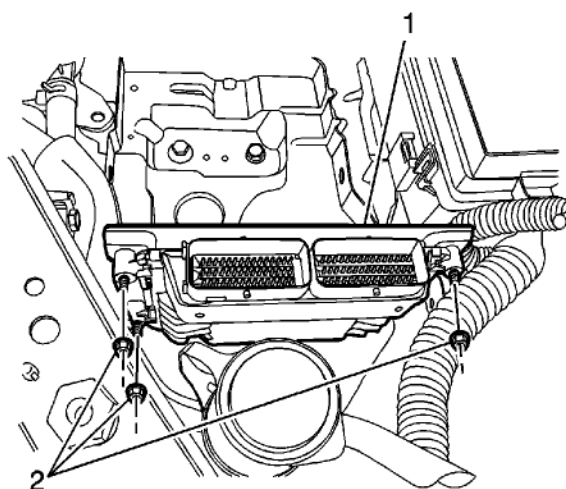
Engine Control Module Replacement

Removal Procedure

Warning: Refer to [Battery Disconnect Warning](#) in the Preface section.



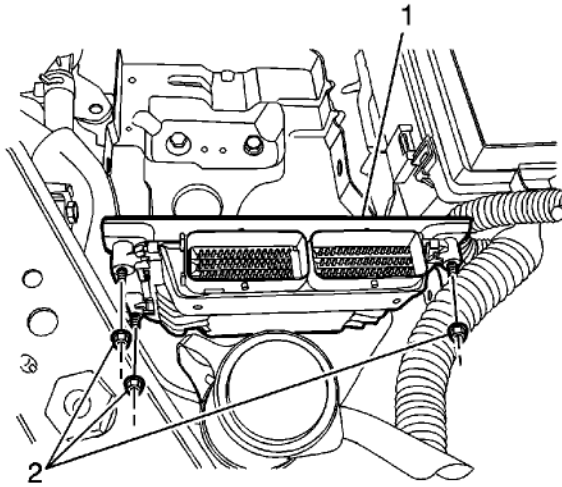
1. Disconnect the battery negative cable. Refer to [Battery Negative Cable Disconnection and Connection](#).
2. Unlock the ECM connector locking lever (1).



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3. Remove the ECM retaining nuts (2).
4. Remove the ECM (1).

Installation Procedure



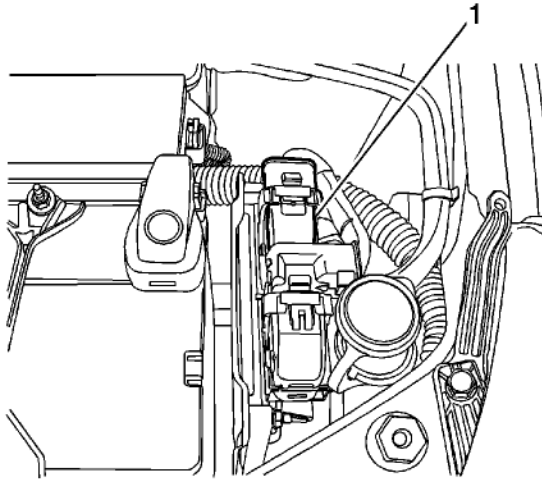
1. Install the ECM (1).

Caution: Refer to [Fastener Caution](#) in the Preface section.

2. Install the ECM retaining nuts (2).

Tighten

Tighten the ECM retaining nuts to 8 N·m (70.8 lb in).



3. Lock the ECM connector locking lever (1).
4. Connect the battery negative cable. Refer to [Battery Negative Cable Disconnection and Connection](#).

Crankshaft Position System Variation Learn

Note: The crankshaft position (CKP) system variation learn procedure is required when the following service procedures have been performed, regardless of whether DTC P0315 is set:

- Engine replacement
- Engine control module (ECM) replacement
- Crankshaft damper replacement
- Crankshaft replacement
- CKP sensor replacement
- Any engine repairs which disturb the crankshaft to CKP sensor relationship

Note: The scan tool monitors certain component signals to determine if all the conditions are met to continue with the CKP system variation learn procedure. The scan tool only displays the condition that inhibits the procedure. The scan tool monitors the following components:

- CKP sensor activity--If there is a CKP sensor condition, refer to the applicable DTC that set.
- Camshaft position (CMP) signal activity--If there is a CMP signal condition, refer to the applicable DTC that set.
- Engine coolant temperature (ECT)--If the engine coolant temperature is not warm enough, idle the engine until the engine coolant temperature reaches the correct temperature.

1. Install a scan tool.
2. Monitor the ECM for DTCs with a scan tool. If other DTCs are set, except DTC P0315, refer to [Diagnostic Trouble Code \(DTC\) List - Vehicle](#) for the applicable DTC that set.
3. With a scan tool, select the CKP system variation learn procedure and perform the following:
 - 3.1. Observe the fuel cut-off for the applicable engine.
 - 3.2. Block the drive wheels.
 - 3.3. Set the parking brake.
 - 3.4. Place the vehicle's transmission in Park or Neutral.
 - 3.5. Turn the air conditioning (A/C) OFF.
 - 3.6. Cycle the ignition from OFF to ON.
 - 3.7. Apply and hold the brake pedal for the duration of the procedure.
 - 3.8. Start and idle the engine.
 - 3.9. Accelerate to wide open throttle (WOT). The engine should not accelerate beyond the calibrated fuel cut-off RPM value noted in step 3.1. Release the throttle immediately if the value is exceeded.

Note: While the learn procedure is in progress, release the throttle immediately when the engine starts to decelerate. The engine control is returned to the operator and the engine responds to throttle position after the learn procedure is complete.

- 3.10. Release the throttle when fuel cut-off occurs.
4. The scan tool displays Learn Status: Learned this Ignition. If the scan tool indicates that DTC P0315 ran and passed, the CKP variation learn procedure is complete. If the scan tool indicates DTC P0315 failed or did not run, refer to [DTC P0315](#). If any other DTCs set, refer to [Diagnostic Trouble Code \(DTC\) List - Vehicle](#) for the applicable DTC that set.

5. Turn OFF the ignition for 30 seconds after the learn procedure is completed successfully.

Idle Learn

Description

The engine control module (ECM) learns the airflow through the throttle body to ensure the correct idle. The learned airflow values are stored within the ECM. These values are learned to adjust for production variation and will continuously learn during the life of the vehicle to compensate for reduced airflow due to throttle body coking. Anytime the throttle body airflow rate changes, for example due to cleaning or replacing, the values must be relearned.

An engine that had a heavily coked throttle body that has been cleaned or replaced may take several drive cycles to learn out the coking. To accelerate the process, the scan tool has the ability to reset all learned values back to zero. A new ECM will also have values set to zero.

The idle may be unstable or a DTC may set if the learned values do not match the actual airflow.

Conditions for Running the Idle Learn Procedure

With Scan Tool - Reset Procedure

- DTCs P0068, P0101, P0102, P0103, P0106, P0107, P0108, P0116, P0117, P0118, P0119, P0121, P0122, P0123, P0128, P0171, P0172, P0201, P0202, P0203, P0204, P0222, P0223, P0300, P0351, P0352, P0353, P0354, P0496, P0601, P0604, P0606, P0641, P0651, P0697, P06A3, P1516, P2101, P2119, P2122, P2123, P2127, P2128, P2135, P2138, or P2176 are not set.
- Ignition ON, engine OFF.
- The vehicle speed sensor (VSS) is 0 km/h (0 mph).

Without Scan Tool - Learn Procedure

- DTCs P0068, P0101, P0102, P0103, P0106, P0107, P0108, P0116, P0117, P0118, P0119, P0121, P0122, P0123, P0128, P0171, P0172, P0201, P0202, P0203, P0204, P0222, P0223, P0300, P0351, P0352, P0353, P0354, P0496, P0601, P0604, P0606, P0641, P0651, P0697, P06A3, P1516, P2101, P2119, P2122, P2123, P2127, P2128, P2135, P2138, or P2176 are not set.
- The engine speed is between 450-4,000 RPM.
- The engine vacuum is greater than 5 kPa.
- The mass air flow (MAF) is greater than 2 g/s.
- The ignition 1 voltage is greater than 10 volts.

Idle Learn Procedure

With Scan Tool - Reset Procedure

1. Ignition ON, engine OFF, with a scan tool, perform the Idle Learn Reset in Module Setup.
 2. Start the engine, monitor the TB Idle Airflow Compensation parameter. The TB Idle Airflow
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Compensation value should equal 0 percent and the engine should be idling at a normal idle speed.

3. Clear the DTCs with a scan tool.

Without Scan Tool - Learn Procedure

Note: Do NOT perform this procedure if DTCs are set. Refer to [Diagnostic Trouble Code \(DTC\) List - Vehicle](#).

1. Start and idle the engine in park/neutral for 3 minutes.
2. With a scan tool, monitor the desired and the actual engine speed.
3. The ECM will start to learn the new idle cells and the desired engine speed should start to decrease.
4. Ignition OFF for 60 seconds.
5. Start and idle the engine in park/neutral for 3 minutes.
6. After the 3 minute run time the engine should be idling normal.

Note:

- During the drive cycle the malfunction indicator lamp (MIL) may illuminate and idle speed DTCs set. If idle speed DTCs set, clear the DTCs so the ECM can continue to learn.
- If the vehicle is driven for more than 10 km (6 mi) a BARO update is necessary so the ECM can continue to learn. To update the BARO, accelerate to wide open throttle (WOT) and then release the throttle.

⇒ If the engine idle speed has not been learned the vehicle will need to be driven at speeds above 70 km/h (44 mph) with several decelerations and extended idles.

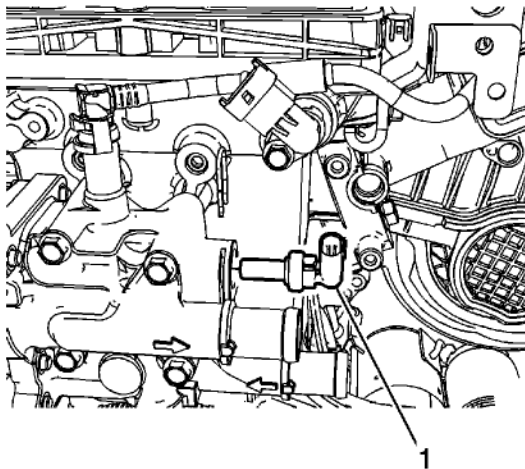
7. After the drive cycle, the engine should be idling normally.
 - ⇒ If the engine idle speed has not been learned, turn OFF the ignition for 60 seconds and repeat step 6.
8. Once the engine speed has returned to normal, clear the DTCs with a scan tool.

Engine Coolant Temperature Sensor Replacement (ECT 1)

Removal Procedure

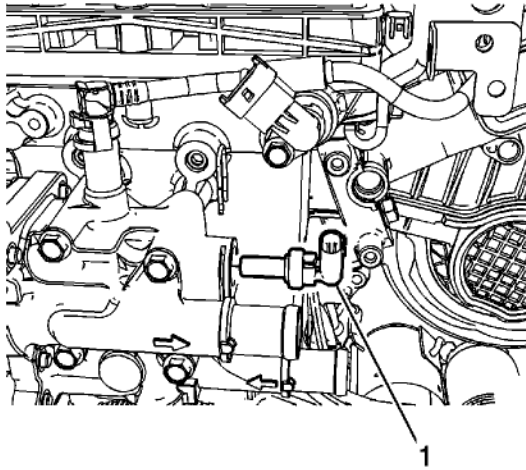
Warning: Refer to [Battery Disconnect Warning](#) in the Preface section.

1. Disconnect the battery negative cable. Refer to [Battery Negative Cable Disconnection and Connection](#).
2. Drain the engine coolant. Refer to [Cooling System Draining and Filling](#).
3. Disconnect the ECT sensor connector.



4. Remove the ECT retaining clip.
5. Remove the ECT (1) from the coolant distributor.

Installation Procedure

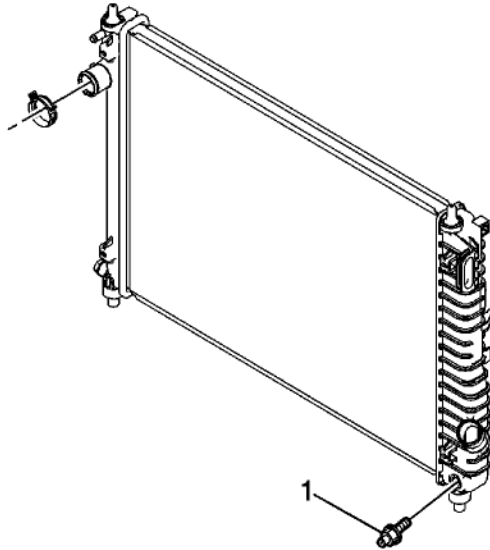


1. Install the ECT (1) to the coolant distributor.
2. Install the ECT retaining clip.
3. Connect the ECT sensor connector.
4. Refill the engine coolant. Refer to [Cooling System Draining and Filling](#).
5. Connect the battery negative cable. Refer to [Battery Negative Cable Disconnection and Connection](#).

Engine Coolant Temperature Sensor Replacement (ECT 2)

Removal Procedure

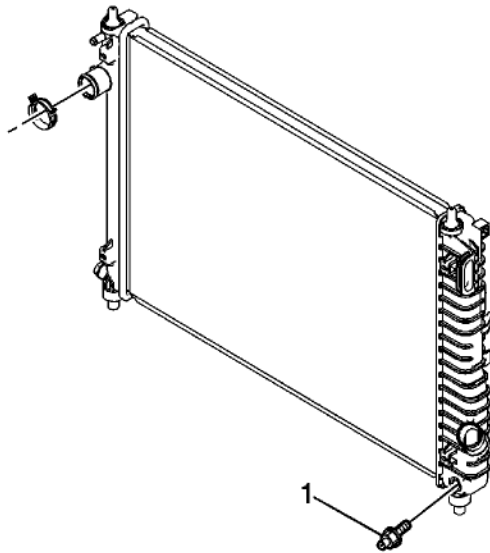
Warning: Refer to [Battery Disconnect Warning](#) in the Preface section.



1. Disconnect the battery negative cable. Refer to [Battery Negative Cable Disconnection and Connection](#).
2. Drain the engine coolant. Refer to [Cooling System Draining and Filling](#).
3. Disconnect the ECT 2 sensor connector.
4. Remove the ECT 2 sensor (1) from the radiator.

Installation Procedure

Caution: Refer to [Fastener Caution](#) in the Preface section.



1. Install the ECT 2 sensor (1) to the radiator.

Tighten

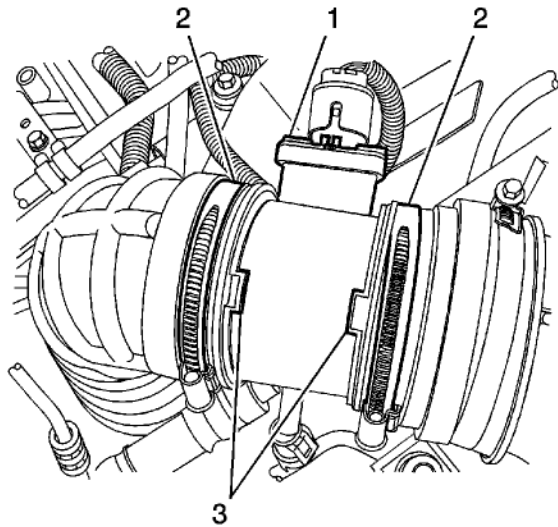
Tighten the ECT 2 sensor to 20 N·m (15 lb ft).

2. Connect the ECT 2 sensor connector.
3. Fill the engine coolant. Refer to [Cooling System Draining and Filling](#).
4. Connect the battery negative cable. Refer to [Battery Negative Cable Disconnection and Connection](#).

Mass Airflow Sensor with Intake Air Temperature Sensor Replacement

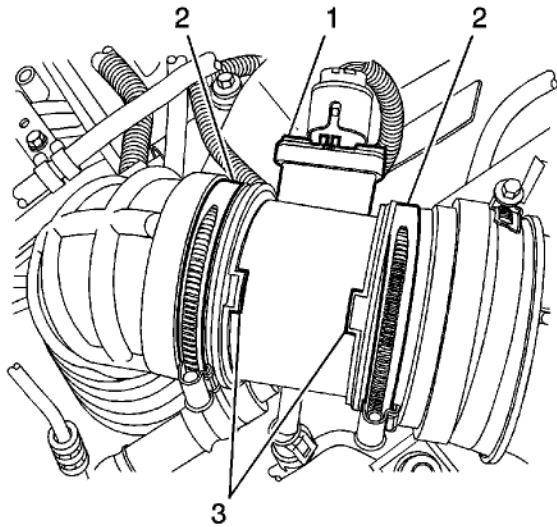
Removal Procedure

Warning: Refer to [Battery Disconnect Warning](#) in the Preface section.



1. Disconnect the battery negative cable. Refer to [Battery Negative Cable Disconnection and Connection](#).
2. Disconnect the mass airflow sensor connector (1).
3. Loosen the two clamps (2).
4. Remove the mass airflow sensor.

Installation Procedure



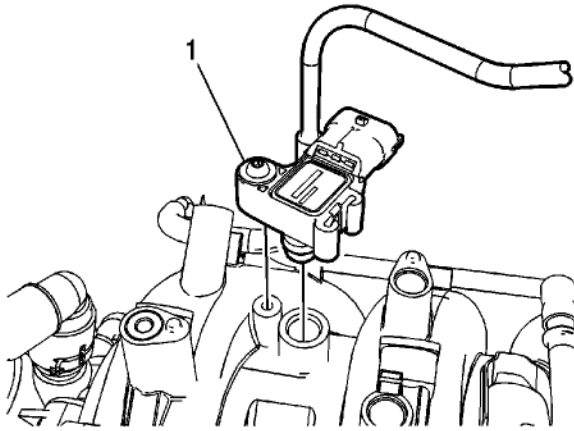
Note: Ensure the mass airflow sensor is installed correctly. The arrow indicates direction of airflow and the tabs of the hoses and notches (3) of the sensor must be aligned as illustrated. Failure to do so may cause drivability concerns and DTC's.

1. Install the mass airflow sensor.
2. Tighten the clamps (2).
3. Connect the mass airflow sensor connector (1).
4. Connect the battery negative cable. Refer to [Battery Negative Cable Disconnection and Connection](#).

Manifold Absolute Pressure Sensor Replacement

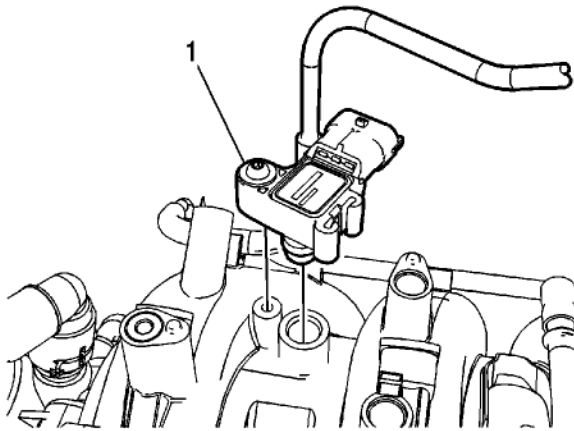
Removal Procedure

Warning: Refer to [Battery Disconnect Warning](#) in the Preface section.



1. Disconnect the battery negative cable. Refer to [Battery Negative Cable Disconnection and Connection](#).
2. Disconnect the manifold air pressure (MAP) sensor connector.
3. Remove the MAP sensor (1).

Installation Procedure



1. Install the MAP sensor (1).
2. Connect the MAP sensor connector.
3. Connect the battery negative cable. Refer to [Battery Negative Cable Disconnection and Connection](#).

Heated Oxygen Sensor Replacement - Sensor 1

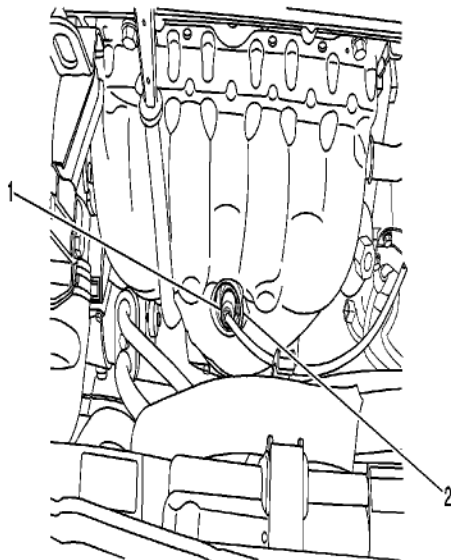
Special Tools

[EN-48259](#) Oxygen Sensor Remover/Installer

Removal Procedure

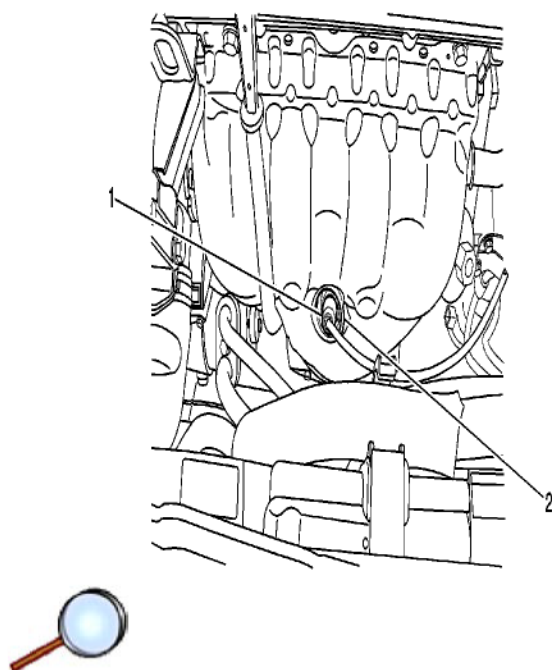
Warning: Refer to [Battery Disconnect Warning](#) in the Preface section.

Caution: Refer to [Heated Oxygen and Oxygen Sensor Caution](#) in the Preface section.



1. Disconnect the battery negative cable. Refer to [Battery Negative Cable Disconnection and Connection](#).
2. Disconnect the HO2S1 connector.
3. Install the [EN-48259](#).
4. Remove the HO2S1 (1).

Installation Procedure



Note: A special anti-seize compound is used on the oxygen sensor threads. This compound consists of a liquid graphite and glass beads. The graphite will burn away, but the glass beads will remain, making the sensor easier to remove. New or service sensors will already have the compound applied to the threads. If a sensor is removed from any engine and if for any reason it is to be reinstalled, the threads must have anti seize compound applied before reinstallation.

1. Coat the threads of the HO2S1 with an anti-seize compound, if needed.

Caution: Refer to [Fastener Caution](#) in the Preface section.

Note: Ensure the HO2S1 sensor heat shield (2) is installed with the slot facing away from the exhaust manifold.

2. Install the HO2S1 (1) into the exhaust manifold.

Tighten

Tighten the HO2S1 to 40 N·m (29.5 lb ft).

3. Connect the battery negative cable. Refer to [Battery Negative Cable Disconnection and Connection](#).

Heated Oxygen Sensor Replacement - Sensor 2

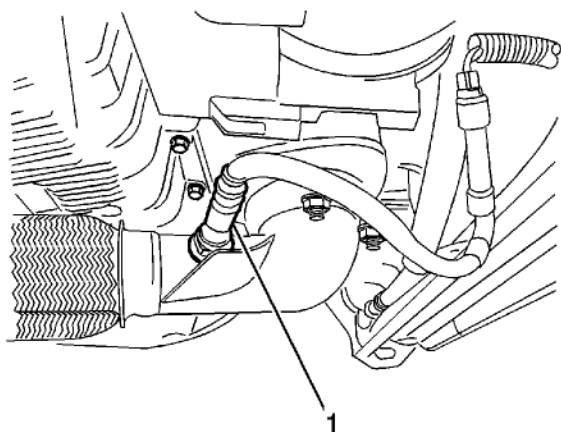
Special Tools

[EN-48259](#) Oxygen Sensor Remover/Installer

Removal Procedure

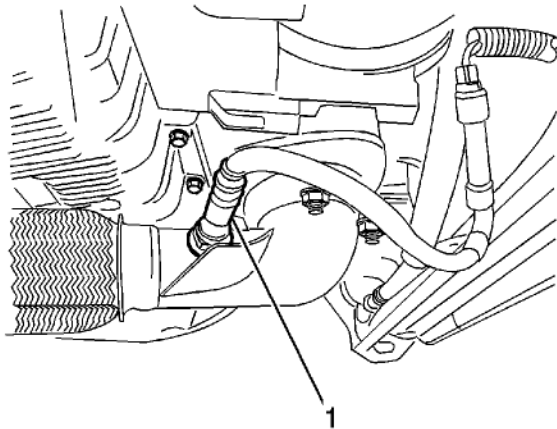
Warning: Refer to [Battery Disconnect Warning](#) in the Preface section.

Caution: Refer to [Heated Oxygen and Oxygen Sensor Caution](#) in the Preface section.



1. Disconnect the battery negative cable. Refer to [Battery Negative Cable Disconnection and Connection](#).
2. Disconnect the HO2S2 connector.
3. Install the [EN-48259](#).
4. Remove the HO2S2 (1).

Installation Procedure



Note: A special anti-seize compound is used on the oxygen sensor threads. This compound consists of a liquid graphite and glass beads. The graphite will burn away, but the glass beads will remain, making the sensor easier to remove. New or service sensors will already have the compound applied to the threads. If a sensor is removed from any engine and if for any reason it is to be reinstalled, the threads must have anti seize compound applied before reinstallation.

1. Coat the threads of the HO2S2 with an anti-seize compound, if needed.
2. Install the HO2S2 (1) into the exhaust manifold.

Tighten

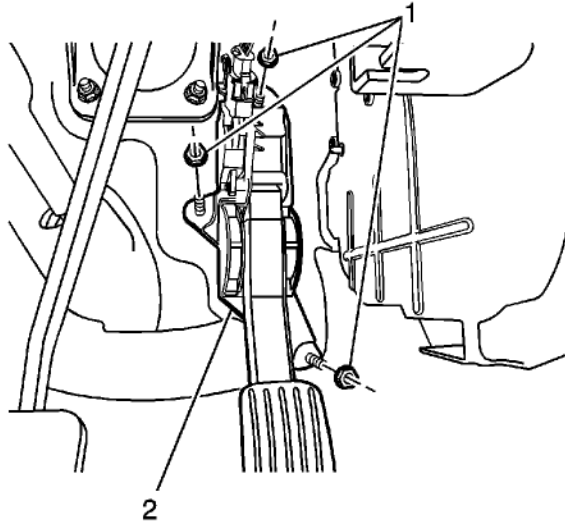
Tighten the HO2S1 to 40 N·m (29.5 lb ft).

3. Connect the battery negative cable. Refer to [Battery Negative Cable Disconnection and Connection](#).

Accelerator Pedal Position Sensor Replacement

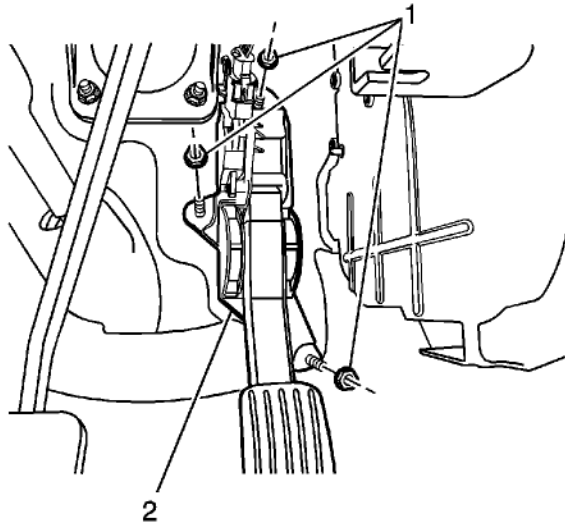
Removal Procedure

Warning: Refer to [Battery Disconnect Warning](#) in the Preface section.



1. Disconnect the battery negative cable. Refer to [Battery Negative Cable Disconnection and Connection](#).
2. Disconnect the accelerator pedal position sensor connector.
3. Remove the 3 accelerator pedal retaining nuts (1).
4. Remove the accelerator pedal (2).

Installation Procedure



1. Install the accelerator pedal (2).

Caution: Refer to [Fastener Caution](#) in the Preface section.

2. Install the 3 accelerator pedal retaining nuts (1).

Tighten

Tighten the accelerator pedal retaining nuts to 19 N·m (14 lb ft).

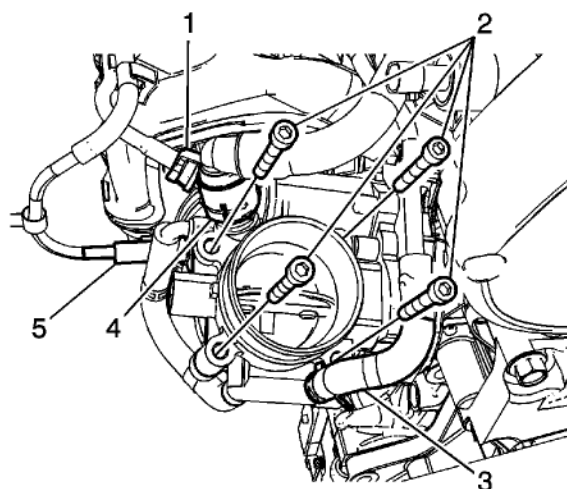
3. Connect the accelerator pedal position sensor connector.
4. Connect the battery cable. Refer to [Battery Negative Cable Disconnection and Connection](#).

Throttle Body Assembly Replacement

Removal Procedure

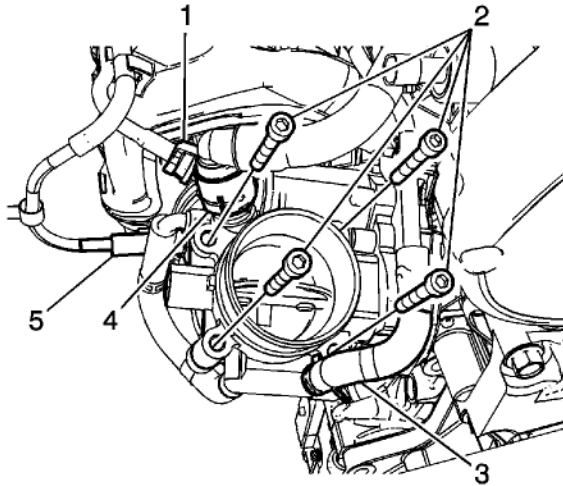
Warning: Refer to [Battery Disconnect Warning](#) in the Preface section.

1. Disconnect the negative battery cable. Refer to [Battery Negative Cable Disconnection and Connection](#).
2. Drain the engine coolant. Refer to [Cooling System Draining and Filling](#).
3. Remove the air cleaner assembly. Refer to [Air Cleaner Assembly Replacement](#).



4. Disconnect the ETC connector.
5. Disconnect the coolant inlet hose (3).
6. Disconnect the coolant outlet hose (1).
7. Disconnect the EVAP hose (5).
8. Detach the PCV hose (4).
9. Remove the ETC tightening bolts (2).
10. Remove the ETC with the seal ring.

Installation Procedure



1. Install the ETC with the seal ring.

Caution: Refer to [Fastener Caution](#) in the Preface section.

2. Install the ETC tightening bolts (2).

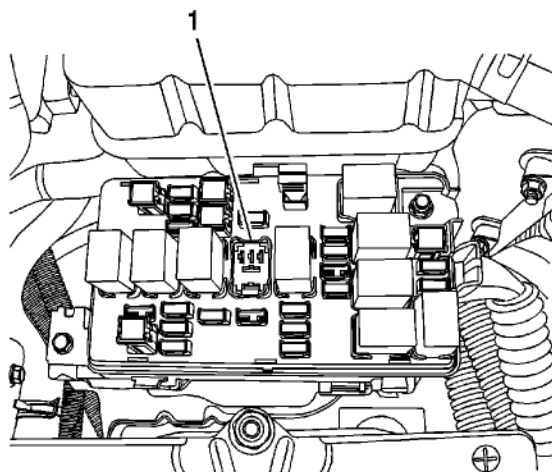
Tighten

Tighten the ETC tightening bolts to 8 N·m (70.8 lb in).

3. Connect the coolant inlet hose (3).
4. Connect the coolant outlet hose (1).
5. Connect the EVAP hose (5).
6. Connect the PCV hose (4).
7. Connect the ETC connector.
8. Install the air-cleaner assembly. Refer to [Air Cleaner Assembly Replacement](#)
9. Refill the engine coolant. Refer to [Cooling System Draining and Filling](#)
10. Disconnect the battery negative cable. Refer to [Battery Negative Cable Disconnection and Connection](#).

Fuel Pressure Relief

Caution: Refer to [Fuel Pressure Caution](#) in the Preface section.



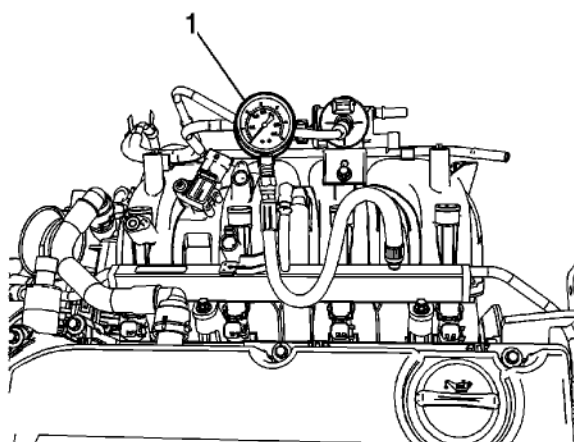
1. Remove the fuel cap.
2. Remove the fuel pump fuse (1) from the engine fuse block.
3. Start the engine and allow the engine to stall.
4. Crank the engine for an additional 10 seconds.

Fuel Pressure Gage Installation and Removal

Special Tools

DW-100-763 Fuel Pressure Gauge

Caution: Refer to [Fuel Pressure Caution](#) in the Preface section.



1. Relieve the fuel pressure. Refer to [Fuel Pressure Relief](#).
2. Install the DW-100-763 gauge (1).
3. Measure the fuel pressure.

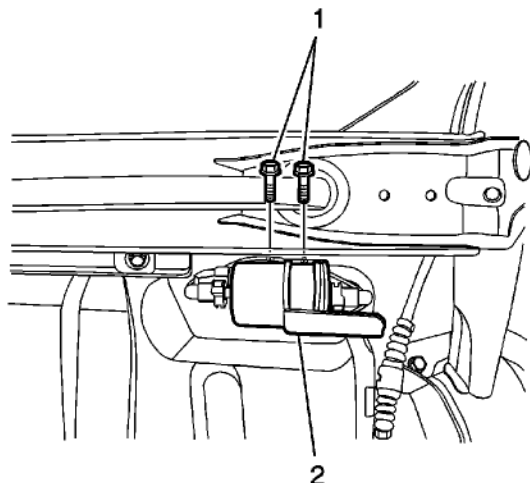
Specification

Fuel Pressure Specification: 380 kPa (Battery Voltage: 13.2V)

Fuel Filter Replacement

Removal Procedure

Caution: Refer to [Fuel Pressure Caution](#) in the Preface section.

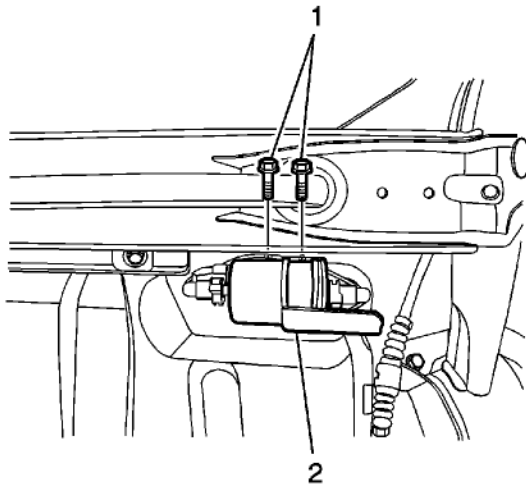


1. Relieve the fuel pressure. Refer to [Fuel Pressure Relief](#).

Warning: Refer to [Battery Disconnect Warning](#) in the Preface section.

2. Disconnect the battery negative cable. Refer to [Battery Negative Cable Disconnection and Connection](#).
3. Disconnect the inlet/outlet fuel lines by moving the line connector lock forward and pulling the hose off of the fuel filter tube.
4. Remove the fuel filter bracket bolts (1).
5. Remove the fuel filter (2).

Installation Procedure

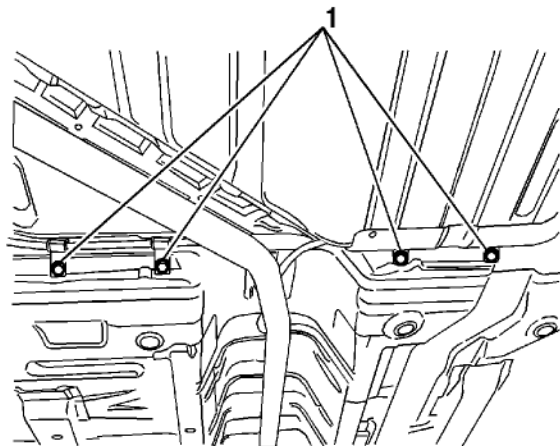


1. Install the fuel filter (2).
2. Install the fuel filter bracket bolts (1).
3. Connect the inlet/outlet quick connector lines.
4. Connect the battery negative cable. Refer to [Battery Negative Cable Disconnection and Connection](#).

Fuel Tank Replacement

Removal Procedure

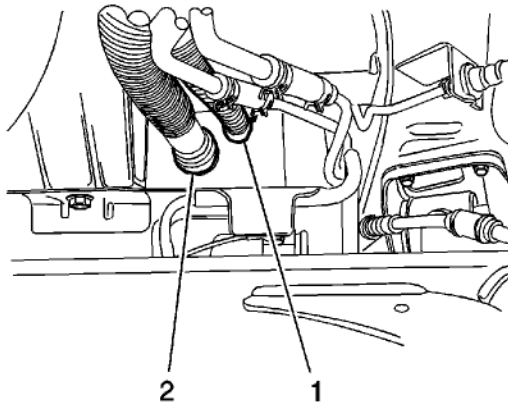
Warning: Refer to [Fuel Pressure Caution](#) in the Preface section.



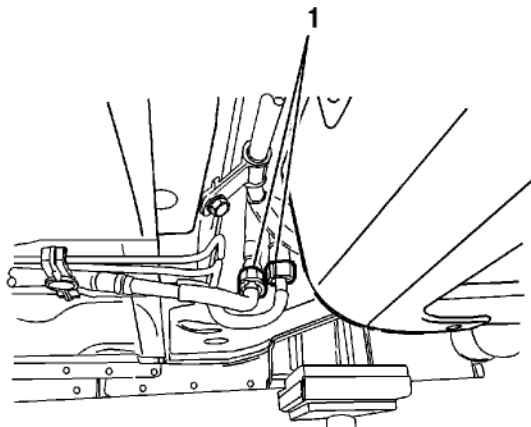
1. Relieve the fuel pressure. Refer to [Fuel Pressure Relief](#).

Warning: Refer to [Battery Disconnect Warning](#) in the Preface section.

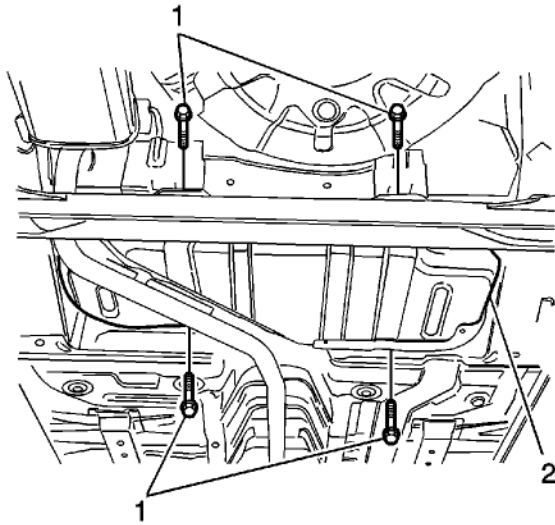
2. Disconnect the battery negative cable. Refer to [Battery Negative Cable Disconnection and Connection](#).
3. Drain the fuel tank.
4. Disconnect the parking brake cable retainer clamps (1) and the support along the fuel tank to provide clearance for the tank.



5. Remove the fuel tank filler tube clamp at the fuel tank.
6. Disconnect the fuel tank filler tube (2) and vent tube (1).
7. Disconnect the canister vapor tube at control valve vapor tube.



8. Disconnect the fuel pump harness connector at the right rear corner of the fuel tank.
9. Disconnect the fuel lines (1) near the right front of the fuel tank.
10. Disconnect the wiring harness clips and the fuel line clips as needed.

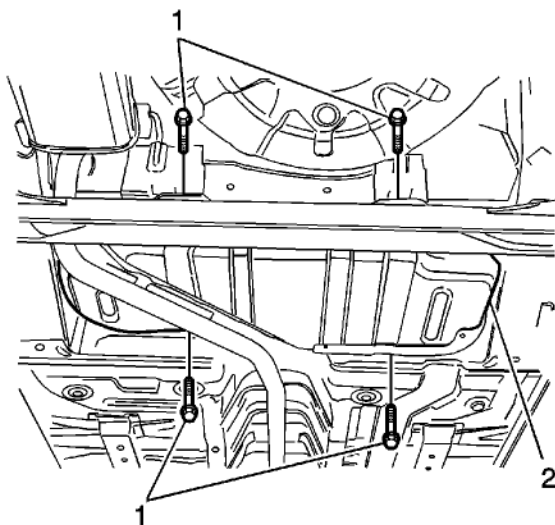


11. Support the fuel tank.
12. Remove the fuel tank retaining bolts (1).
13. Carefully lower the fuel tank.
14. Remove the fuel tank.

Installation Procedure

1. Raise the fuel tank into position.

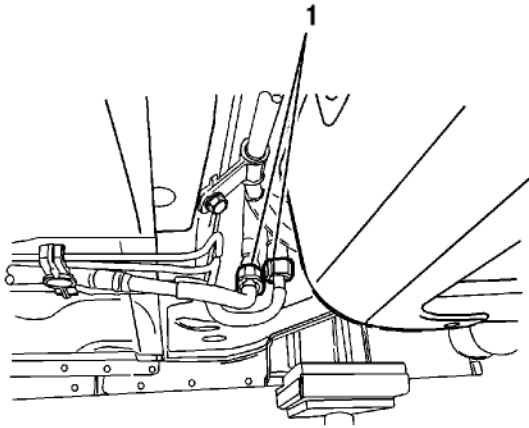
Caution: Refer to [Fastener Caution](#) in the Preface section.



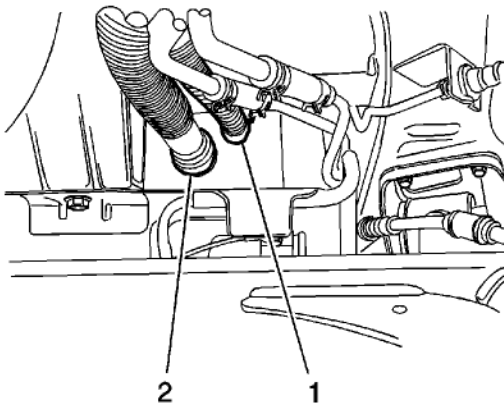
2. Install the fuel tank mounting bolts (1).

Tighten

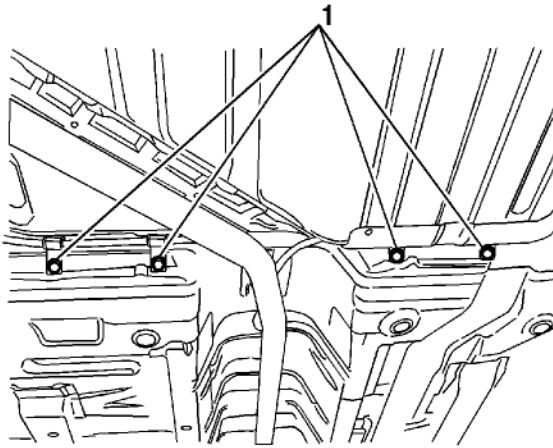
Tighten the fuel tank retaining bolts to 20 N·m (15 lb ft).



3. Connect the fuel lines (1).
4. Connect the wiring harness clips and the fuel line clips as needed.
5. Connect the fuel pump electrical connector.
6. Connect the fuel vapor line.



7. Connect the fuel tank filler tube (2) and fuel tank vent tube (1).
8. Install the fuel tank filler tube clamp at the fuel tank.



9. Install the parking brake cable retainer clamps (1) and the support.

Tighten

Tighten the parking brake cable retainer clamps to 10 N·m (89 lb in).

10. Connect the battery negative cable. Refer to [Battery Negative Cable Disconnection and Connection](#).
11. Fill the fuel tank.
12. Perform a leak check of the fuel tank and the fuel line connections.

Fuel Tank Pressure Sensor Replacement

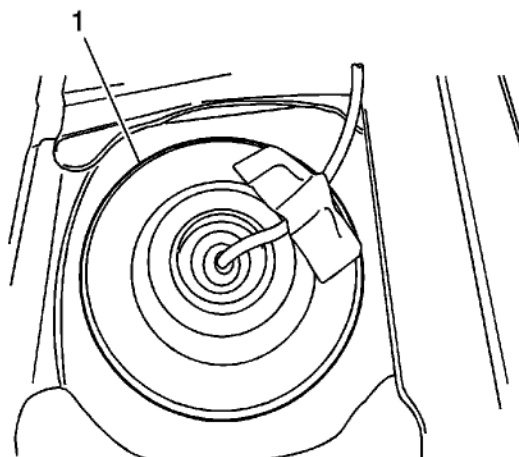
Removal Procedure

Warning: Refer to [Fuel Pressure Caution](#) in the Preface section.

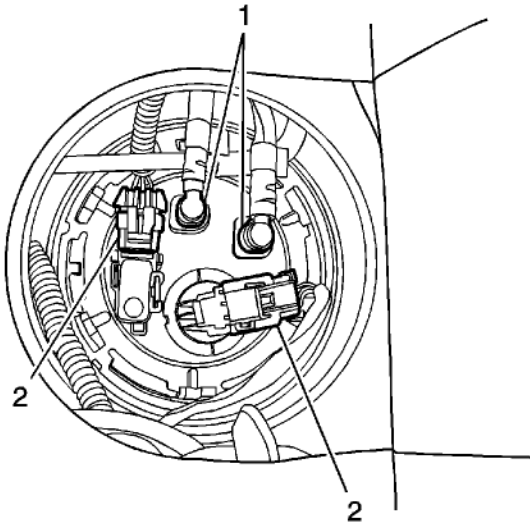
1. Relieve the fuel pressure. Refer to [Fuel Pressure Relief](#).

Warning: Refer to [Battery Disconnect Warning](#) in the Preface section.

2. Disconnect the battery negative cable. Refer to [Battery Negative Cable Disconnection and Connection](#).
3. Remove the rear seat. Refer to [Rear Seat Replacement](#).



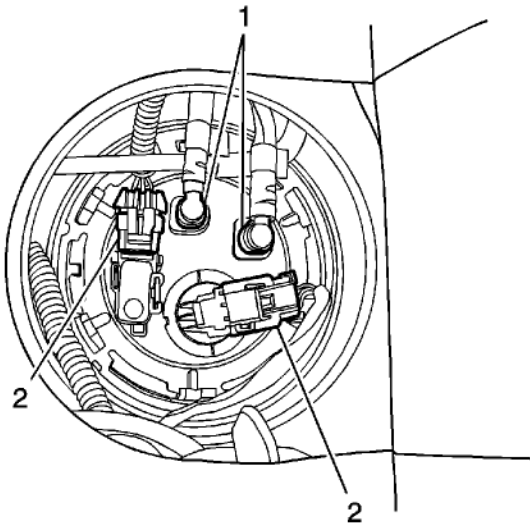
4. Remove the fuel pump access cover (1).



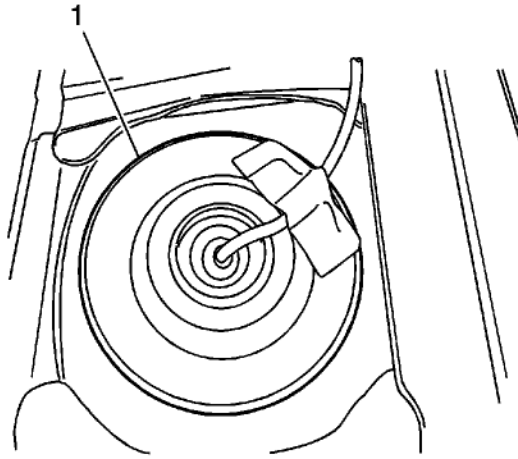
5. Disconnect the fuel tank pressure sensor connector (2).
6. Remove the fuel tank pressure sensor.

Installation Procedure

1. Install the fuel tank pressure sensor.



2. Connect the fuel tank pressure sensor connector (2).



3. Install the fuel pump access cover (1).
4. Connect the battery negative cable. Refer to [Battery Negative Cable Disconnection and Connection](#).
5. Install the rear seat. Refer to [Rear Seat Replacement](#).

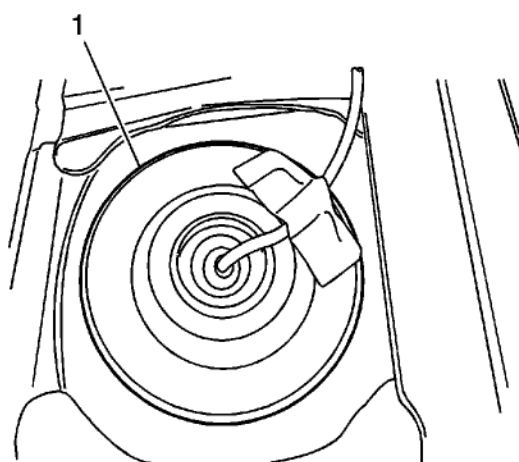
Fuel Sender Assembly Replacement

Special Tools

EN-49090 Remover/Installer -- Fuel Pump Lock Ring

Removal Procedure

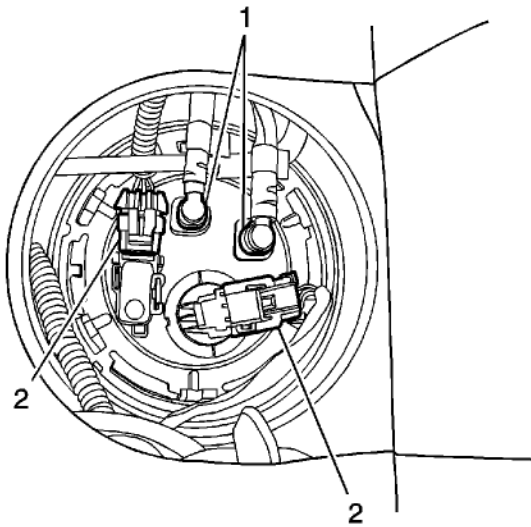
Caution: Refer to [Fuel Pressure Caution](#) in the Preface section.



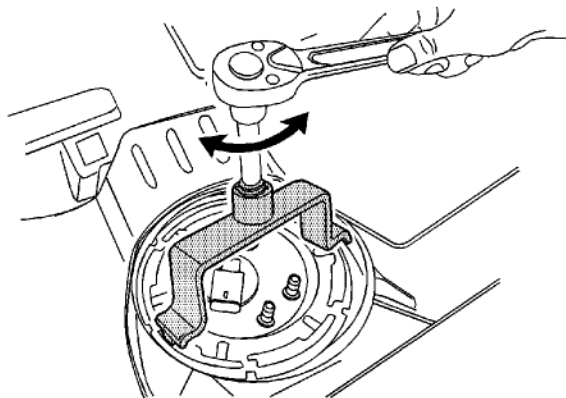
1. Relieve the fuel pressure. Refer to [Fuel Pressure Relief](#).

Warning: Refer to [Battery Disconnect Warning](#) in the Preface section.

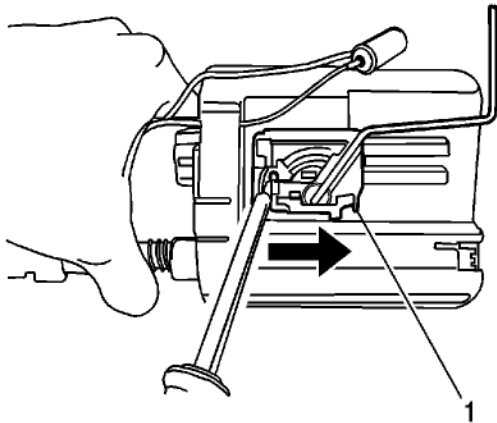
2. Disconnect the battery negative cable. Refer to [Battery Negative Cable Disconnection and Connection](#).
3. Remove the rear seat. Refer to [Rear Seat Replacement](#).
4. Remove the fuel pump access cover (1).



5. Disconnect the electrical connectors (2) at the fuel pump assembly.
6. Disconnect the fuel lines (1).

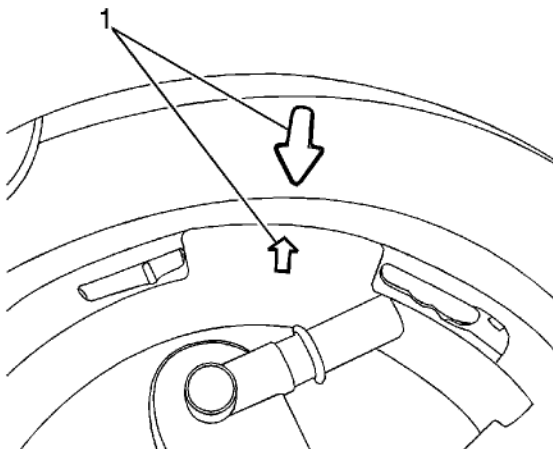


7. Remove the fuel pump lock ring by using *EN-49090* ring .
8. Remove the fuel pump.
9. Disconnect the insulator.



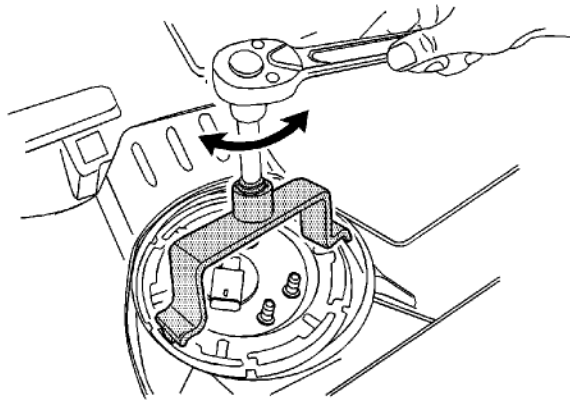
10. Remove the fuel sender assembly (1).

Installation Procedure

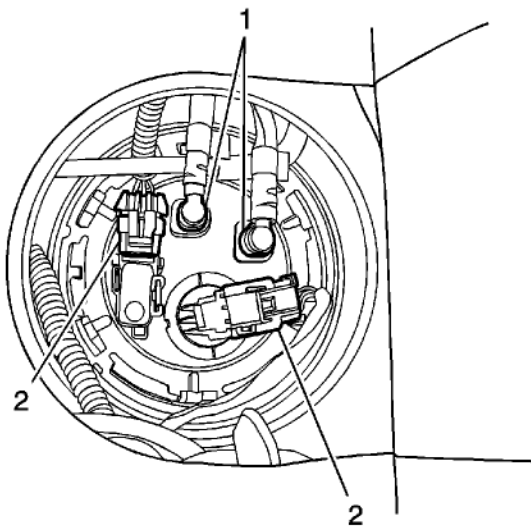


Note: Be careful to install the fuel sender to fuel pump housing exactly. If not installed exactly, fuel indicating may be incorrect.

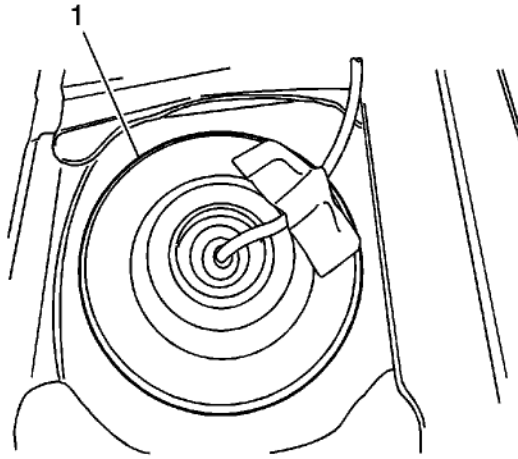
1. Install the fuel sender assembly. Align marks (1).
2. Connect the fuel sender insulator.



3. Install the fuel pump to fuel tank.
4. Install the fuel pump lock ring by using *EN-49090* ring .



5. Connect the electrical connectors (2) at the fuel pump assembly.
6. Connect the fuel lines (1).



7. Install the fuel pump access cover (1).
8. Connect the battery negative cable. Refer to [Battery Negative Cable Disconnection and Connection](#).
9. Perform an operational check of the fuel pump.
10. Install the rear seat. Refer to [Rear Seat Replacement](#).

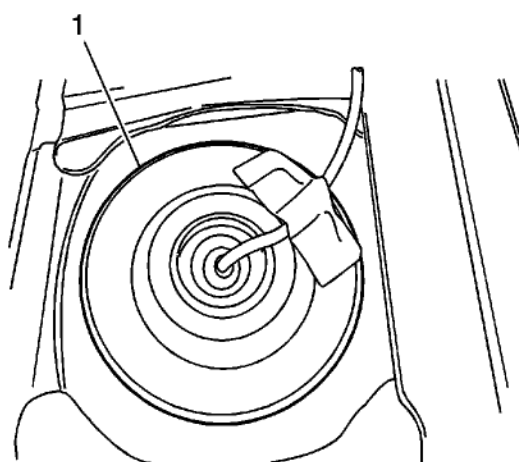
Fuel Pump Replacement

Special Tools

EN-49090 Remover/Installer -- Fuel Pump Lock Ring

Removal Procedure

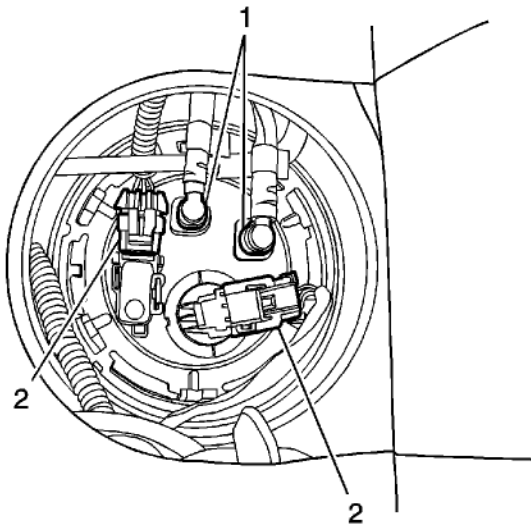
Caution: Refer to [Fuel Pressure Caution](#) in the Preface section.



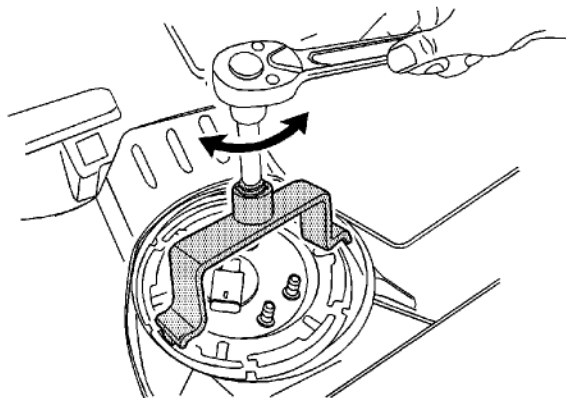
1. Relieve the fuel pressure. Refer to [Fuel Pressure Relief](#).

Warning: Refer to [Battery Disconnect Warning](#) in the Preface section.

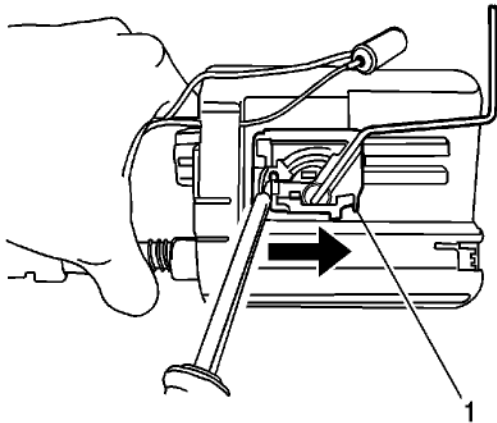
2. Disconnect the battery negative cable. Refer to [Battery Negative Cable Disconnection and Connection](#).
3. Remove the rear seat. Refer to [Rear Seat Replacement](#).
4. Remove the fuel pump access cover (1).



5. Disconnect the electrical connectors (2) at the fuel pump assembly.
6. Disconnect the fuel lines (1).

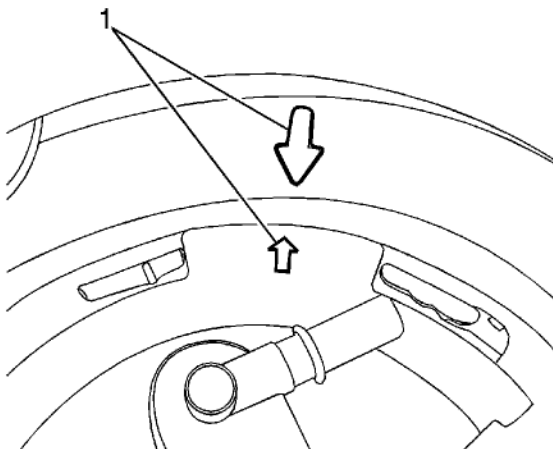


7. Remove the fuel pump lock ring by using *EN-49090* ring .
8. Remove the fuel pump.
9. Disconnect the insulator.



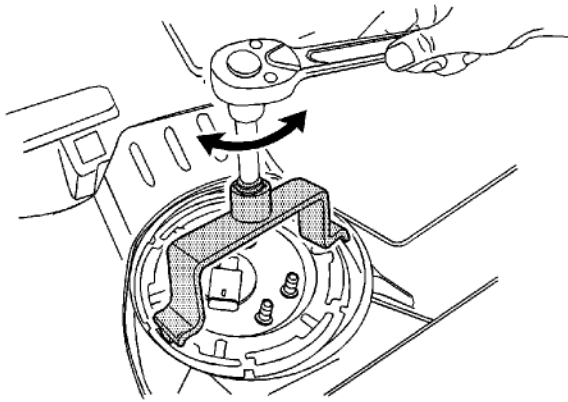
10. Remove the fuel sender assembly (1).

Installation Procedure

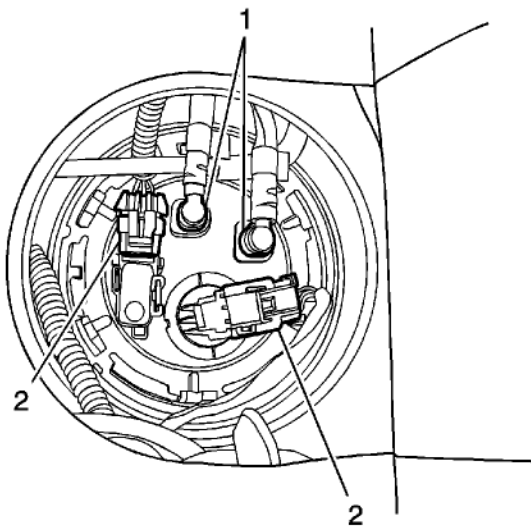


Note: Be careful to install the fuel sender to fuel pump housing exactly. If not installed exactly, fuel indicating may be incorrect.

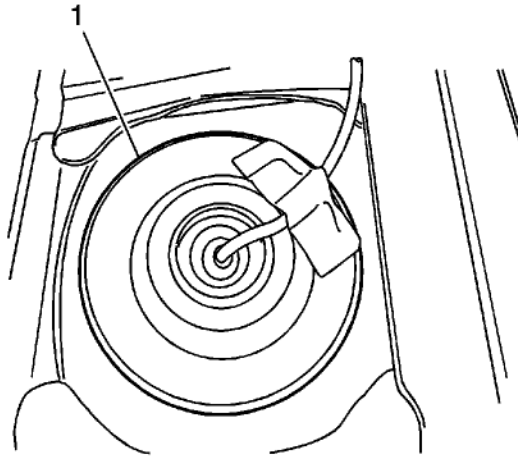
1. Install the fuel sender assembly. Align marks (1).
2. Connect the fuel sender insulator.



3. Install the fuel pump to fuel tank.
4. Install the fuel pump lock ring by using *EN-49090* ring .



5. Connect the electrical connectors (2) at the fuel pump assembly.
6. Connect the fuel lines (1).



7. Install the fuel pump access cover (1).
8. Connect the battery negative cable. Refer to [Battery Negative Cable Disconnection and Connection](#).
9. Perform an operational check of the fuel pump.
10. Install the rear seat. Refer to [Rear Seat Replacement](#).

Fuel Injection Fuel Rail Assembly Replacement

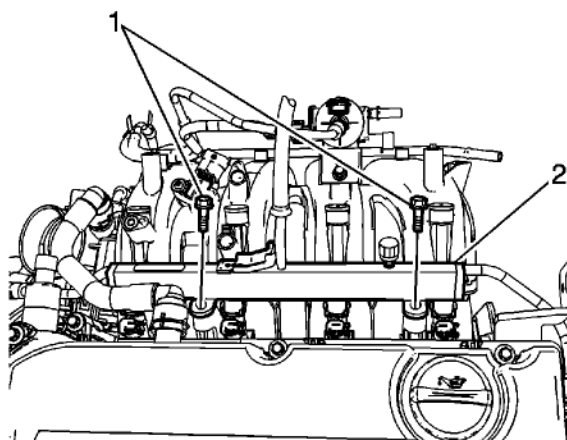
Removal Procedure

Caution: Refer to [Fuel Pressure Caution](#) in the Preface section.

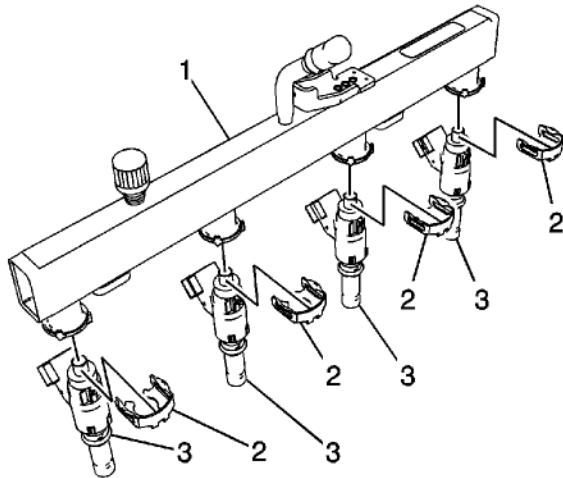
1. Relieve the fuel pressure system. Refer to [Fuel Pressure Relief](#).

Warning: Refer to [Battery Disconnect Warning](#) in the Preface section.

2. Disconnect the battery negative cable. Refer to [Battery Negative Cable Disconnection and Connection](#).
3. Disconnect the injector connectors.

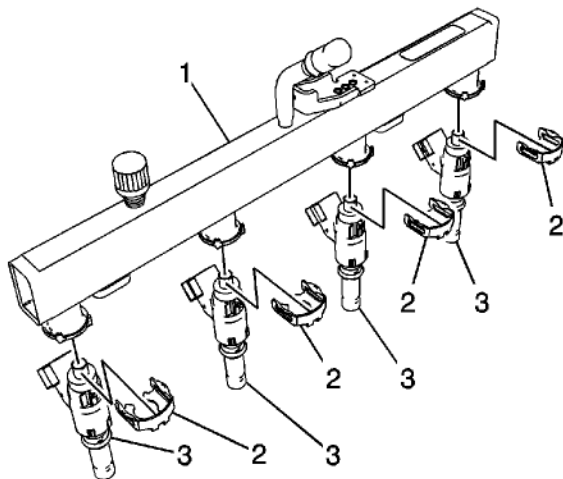


4. Disconnect the fuel line from the fuel rail.
5. Remove the fuel rail bolts (1).
6. Remove the fuel rail (2) with the injectors.

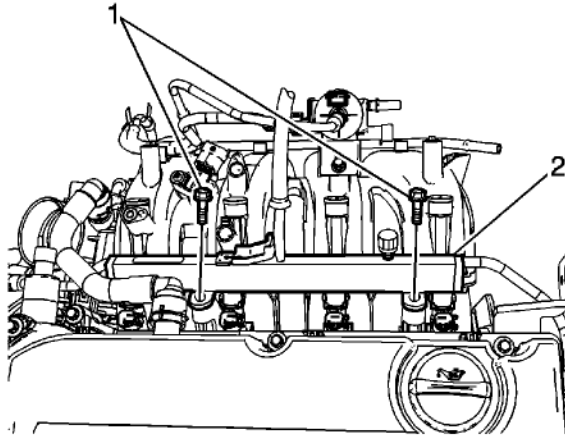


7. Detach the fuel injector retainer clips (2).
8. Detach the fuel injectors (3) by pulling down and out.
9. Discard the fuel injector O-rings.

Installation Procedure



1. Install the fuel injector O-rings.
2. Connect fuel injectors (3) to the fuel rail (1).
3. Install the fuel injector retainer clips (2).



4. Install the fuel rail (2) with the injectors to the intake manifold.

Caution: Refer to [Fastener Caution](#) in the Preface section.

5. Install the fuel rail bolts (1).

Tighten

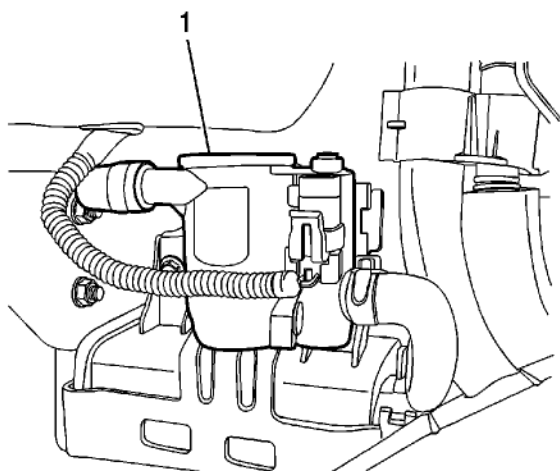
Tighten the fuel rail tightening bolt to 8 N·m (70.8 lb in).

6. Connect the fuel line from the fuel rail and put a dust cap to avoid strange materials.
7. Connect the fuel injector connectors.
8. Connect the battery negative cable. Refer to [Battery Negative Cable Disconnection and Connection](#).

Evaporative Emission Canister Vent Solenoid Valve Replacement

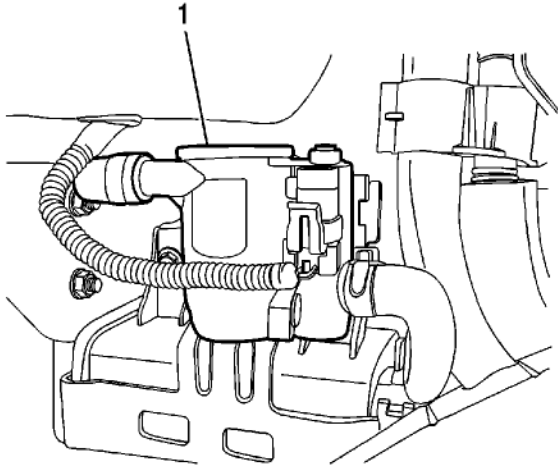
Removal Procedure

Warning: Refer to [Battery Disconnect Warning](#) in the Preface section.



1. Disconnect the battery negative cable. Refer to [Battery Negative Cable Disconnection and Connection](#).
2. Disconnect the EVAP canister vent solenoid valve connector.
3. Disconnect the EVAP canister vent hose.
4. Remove the EVAP canister vent assembly (1) pushing it to the left side.

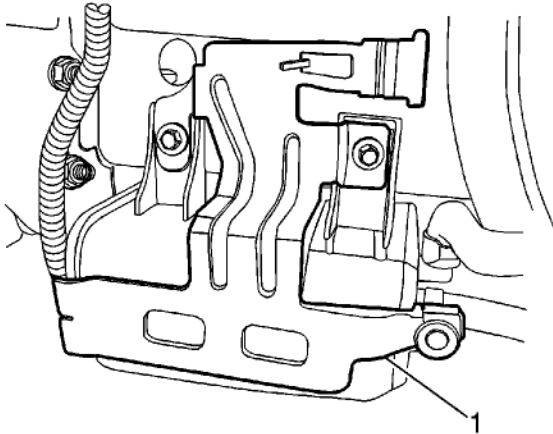
Installation Procedure



1. Install the EVAP canister vent assembly (1) pushing it to the right side.
2. Connect the EVAP canister vent hose.
3. Connect the EVAP canister vent solenoid valve connector.
4. Connect the battery negative cable. Refer to [Battery Negative Cable Disconnection and Connection](#).

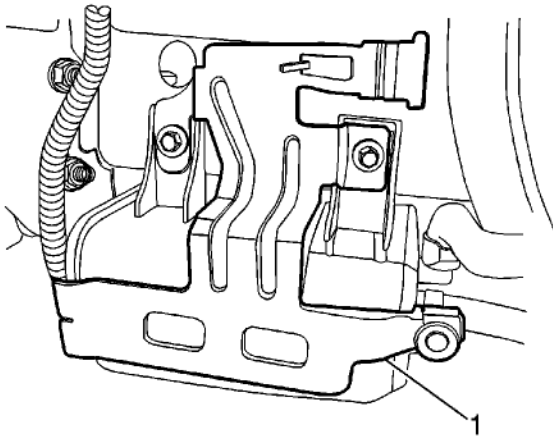
Evaporative Emission Canister Replacement

Removal Procedure



1. Remove the EVAP canister vent.
2. Disconnect the inlet and outlet hose from the EVAP canister.
3. Remove the EVAP canister bracket retaining bolt.
4. Remove the EVAP canister (1).

Installation Procedure



1. Install the EVAP canister (1).

Caution: Refer to [Fastener Caution](#) in the Preface section.

2. Install the EVAP canister bracket retaining bolt.

Tighten

Tighten evaporative emission canister bracket retaining bolt to 8 N·m (71 lb in).

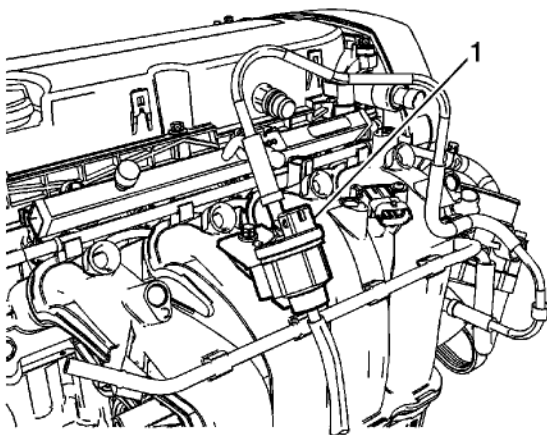
3. Connect the inlet and outlet hose to the EVAP canister.
4. Install the EVAP canister vent.

Evaporative Emission Canister Purge Solenoid Valve Replacement

Removal Procedure

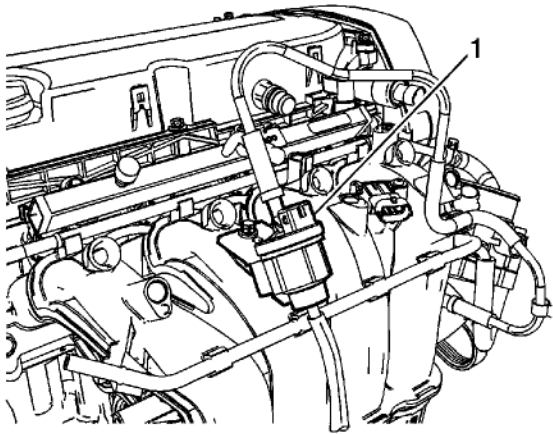
Warning: Refer to [Battery Disconnect Warning](#) in the Preface section.

Caution: Refer to [Fuel Pressure Caution](#) in the Preface section.



1. Disconnect the battery negative cable. Refer to [Battery Negative Cable Disconnection and Connection](#).
2. Disconnect the EVAP canister purge valve upper and lower hoses.
3. Disconnect the EVAP canister purge valve connector.
4. Detach the EVAP canister purge valve (1).

Installation Procedure



1. Install the EVAP canister purge valve (1).
2. Connect the EVAP canister purge valve connector.
3. Connect the EVAP canister purge valve upper and lower hoses.
4. Connect the battery negative cable. Refer to [Battery Negative Cable Disconnection and Connection](#).

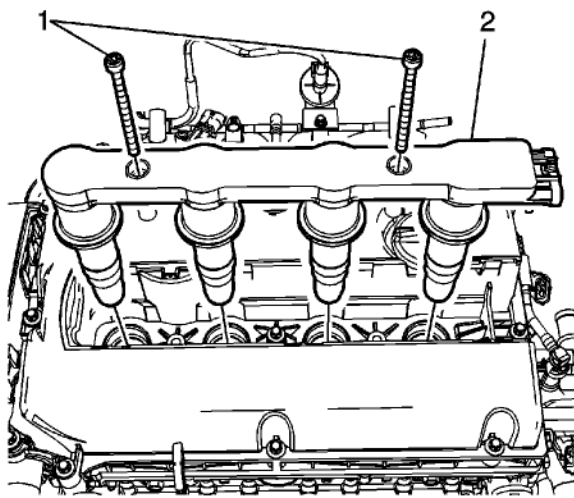
Ignition Coil Replacement

Special Tools

[KM-6009](#) Remover/Installer

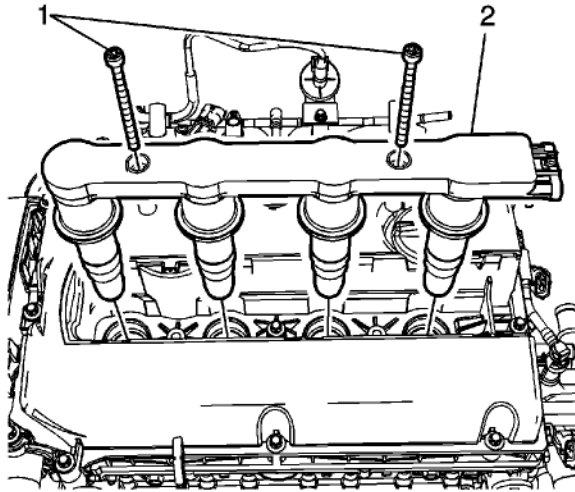
Removal Procedure

Warning: Refer to [Battery Disconnect Warning](#) in the Preface section.



1. Disconnect the battery negative cable. Refer to [Battery Negative Cable Disconnection and Connection](#).
2. Detach the ignition coil cover.
3. Disconnect the ignition coil connector.
4. Remove the ignition coil bolts (1).
5. Install the [KM-6009](#).
6. Remove the ignition coil (2).

Installation Procedure



1. Install the ignition coil (2).

Caution: Refer to [Fastener Caution](#) in the Preface section.

2. Install the ignition coil bolts (1).

Tighten

Tighten the ignition coil bolts to 8 N·m (70.8 lb in).

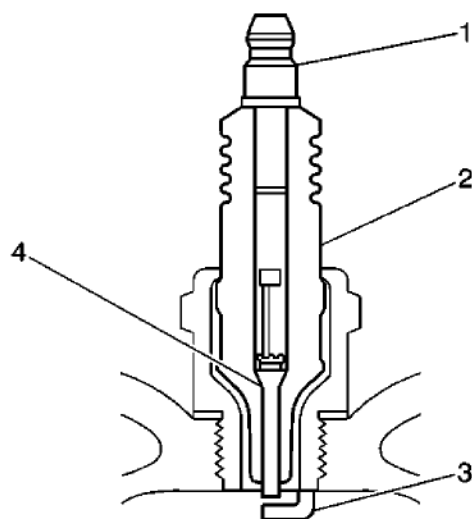
3. Connect the ignition coil connector.
4. Install the ignition coil cover.
5. Connect the battery negative cable. Refer to [Battery Negative Cable Disconnection and Connection](#).

Spark Plug Inspection

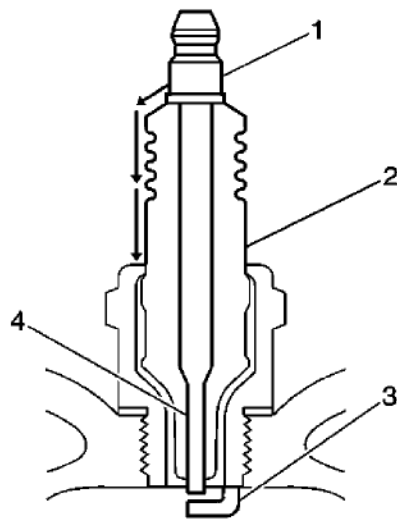
Spark Plug Usage

- Ensure that the correct spark plug is installed. An incorrect spark plug causes driveability conditions.
- Ensure that the spark plug has the correct heat range. An incorrect heat range causes the following conditions:
 - Spark plug fouling--Colder plug
 - Pre-ignition causing spark plug and/or engine damage--Hotter plug

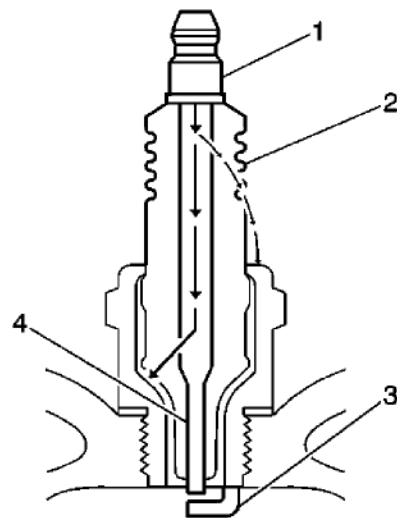
Spark Plug Inspection



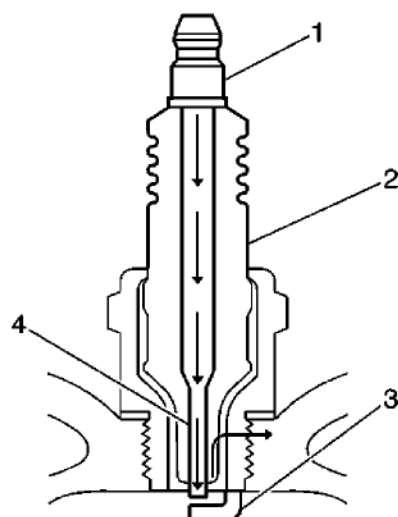
1. Inspect the terminal post (1) for damage.
 - Inspect for a bent or broken terminal post (1).
 - Test for a loose terminal post (1) by twisting and pulling the post. The terminal post (1) should NOT move.



2. Inspect the insulator (2) for flashover or carbon tracking, soot. This is caused by the electrical charge traveling across the insulator (2) between the terminal post (1) and ground. Inspect for the following conditions:
 - Inspect the spark plug boot for damage.
 - Inspect the spark plug recess area of the cylinder head for moisture, such as oil, coolant, or water. A spark plug boot that is saturated causes arcing to ground.



3. Inspect the insulator (2) for cracks. All or part of the electrical charge may arc through the crack instead of the electrodes (3, 4).



4. Inspect (3) for evidence of improper arcing.
 - Measure the gap between the center electrode (4) and the side electrode (3) terminals. An excessively wide electrode gap can prevent correct spark plug operation.
 - Inspect for the correct spark plug torque. Insufficient torque can prevent correct spark plug operation. An over torqued spark plug, causes the insulator (2) to crack.
 - Inspect for signs of tracking that occurred near the insulator tip instead of the center electrode (4).
 - Inspect for a broken or worn side electrode (3).
 - Inspect for a broken, worn, or loose center electrode (4) by shaking the spark plug.
 - A rattling sound indicates internal damage.
 - A loose center electrode (4) reduces the spark intensity.
 - Inspect for bridged electrodes (3, 4). Deposits on the electrodes (3, 4) reduce or eliminates the gap.
 - Inspect for worn or missing platinum pads on the electrodes (3, 4), if equipped.
 - Inspect for excessive fouling.
5. Inspect the spark plug recess area of the cylinder head for debris. Dirty or damaged threads can cause the spark plug not to seat correctly during installation.

Spark Plug Visual Inspection

- Normal operation--Brown to grayish-tan with small amounts of white powdery deposits are normal combustion by-products from fuels with additives.
- Carbon fouled--Dry, fluffy black carbon, or soot caused by the following conditions:
 - Rich fuel mixtures
- Leaking fuel injectors
- Excessive fuel pressure
- Restricted air filter element
- Incorrect combustion

- Reduced ignition system voltage output
- Weak coils
- Worn ignition wires
- Incorrect spark plug gap
 - Excessive idling or slow speeds under light loads can keep spark plug temperatures so low that normal combustion deposits may not burn off.
- Deposit fouling--Oil, coolant, or additives that include substances such as silicone, very white coating, reduces the spark intensity. Most powdery deposits will not effect spark intensity unless they form into a glazing over the electrode.

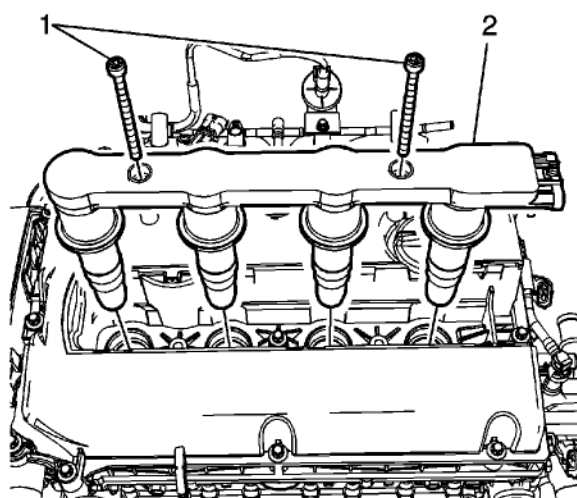
Spark Plug Replacement

Special Tools

[KM-6009](#) Remover/Installer

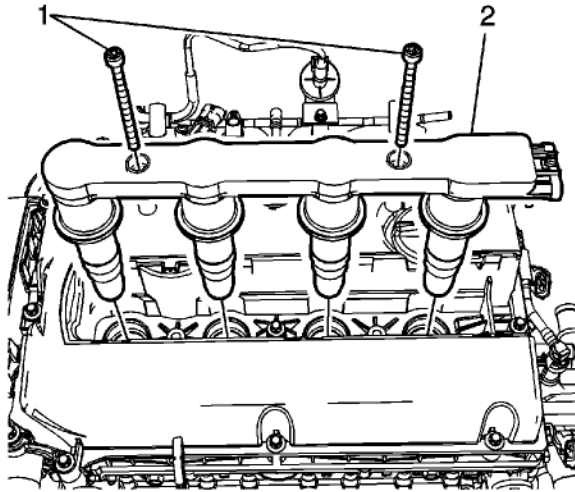
Removal Procedure

Warning: Refer to [Battery Disconnect Warning](#) in the Preface section.



1. Disconnect the battery negative cable. Refer to [Battery Negative Cable Disconnection and Connection](#).
2. Detach the ignition coil cover.
3. Disconnect the ignition coil connector.
4. Remove the ignition coil bolts (1).
5. Install the [KM-6009](#).
6. Remove the ignition coil (2).
7. Remove the spark plugs.

Installation Procedure



1. Install The spark plugs.
2. Install the ignition coil (2).

Caution: Refer to [Fastener Caution](#) in the Preface section.

3. Install the ignition coil bolts (1).

Tighten

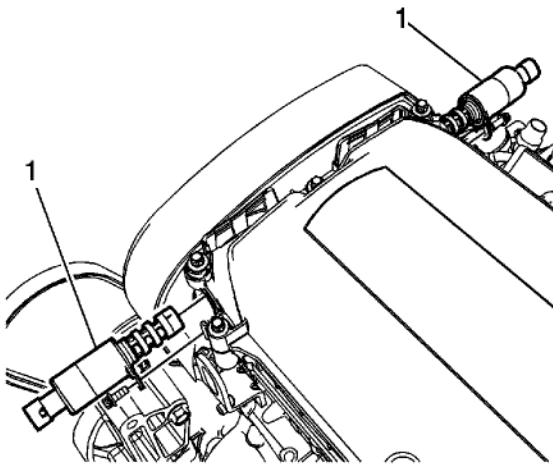
Tighten the ignition coil bolts (1) to 8 N·m (70.8 lb in).

4. Connect the ignition coil connector.
5. Install the ignition coil cover.
6. Connect the battery negative cable. Refer to [Battery Negative Cable Disconnection and Connection](#).

Camshaft Position Actuator Solenoid Valve Replacement

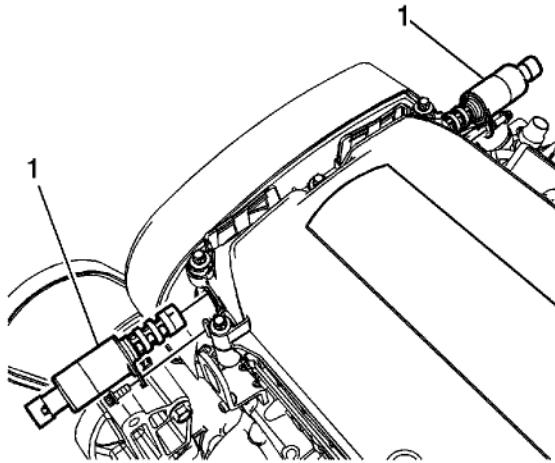
Removal Procedure

Warning: Refer to [Battery Disconnect Warning](#) in the Preface section.



1. Disconnect the battery negative cable. Refer to [Battery Negative Cable Disconnection and Connection](#).
2. Disconnect the camshaft position actuator valve connectors.
3. Remove the camshaft position actuator valve bolt.
4. Remove the camshaft position actuator valve (1) and seal.

Installation Procedure



1. Install the camshaft position actuator valve (1) and seal. Coat seal with clean engine oil prior to installation.

Caution: Refer to [Fastener Caution](#) in the Preface section.

2. Install the camshaft position actuator valve bolt.

Tighten

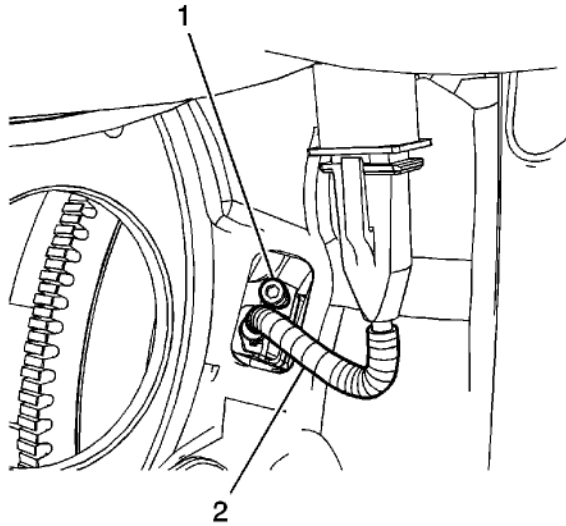
Tighten the camshaft position actuator valve bolt to 6 N·m (53 lb in).

3. Connect the camshaft position actuator valve connectors.
4. Connect the battery negative cable. Refer to [Battery Negative Cable Disconnection and Connection](#).

Crankshaft Position Sensor Replacement

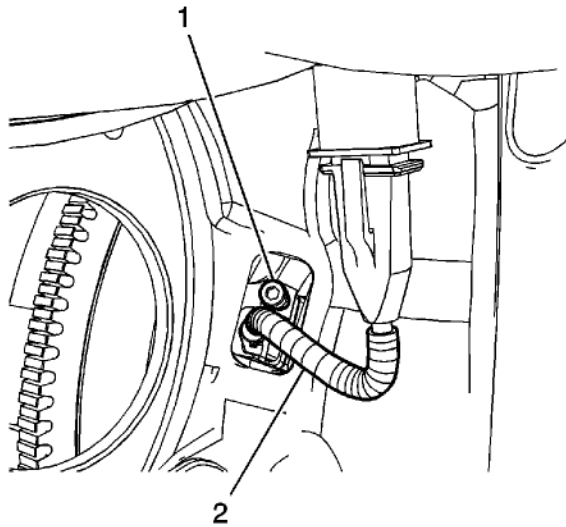
Removal Procedure

Warning: Refer to [Battery Disconnect Warning](#) in the Preface section.



1. Disconnect the battery negative cable. Refer to [Battery Negative Cable Disconnection and Connection](#).
2. Remove the starter. Refer to [Starter Motor Replacement](#).
3. Remove the CKP sensor bolt (1).
4. Remove the CKP sensor (2).

Installation Procedure



1. Install the CKP sensor (2).

Caution: Refer to [Fastener Caution](#) in the Preface section.

2. Install the CKP sensor bolt (1).

Tighten

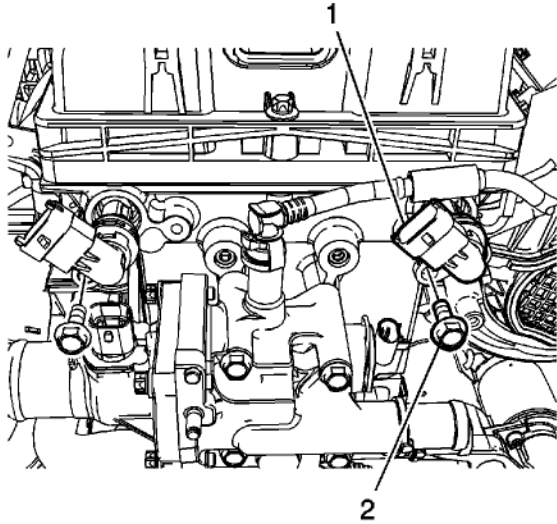
Tighten the CKP sensor bolt (1) to 4.5 N·m (39.8 lb in).

3. Install the starter. Refer to [Starter Motor Replacement](#).
4. Disconnect the battery negative cable. Refer to [Battery Negative Cable Disconnection and Connection](#).

Camshaft Position Sensor Replacement

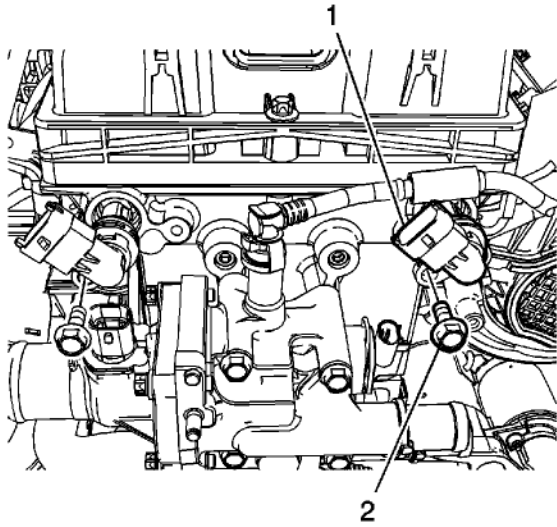
Removal Procedure

Warning: Refer to [Battery Disconnect Warning](#) in the Preface section.



1. Disconnect the battery negative cable. Refer to [Battery Negative Cable Disconnection and Connection](#).
2. Disconnect the CMP sensor connectors.
3. Remove the CMP sensor bolt (2).
4. Remove the CMP sensor (1).

Installation Procedure

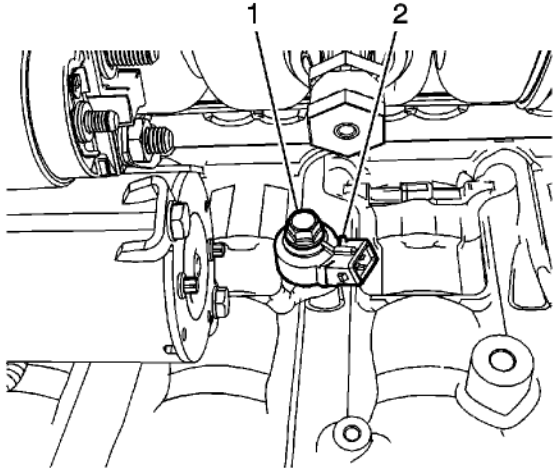


1. Install the CMP sensor (1).
2. Install the CMP sensor bolt (2).
3. Connect the CMP sensor connectors.
4. Connect the battery negative cable. Refer to [Battery Negative Cable Disconnection and Connection](#).

Knock Sensor Replacement

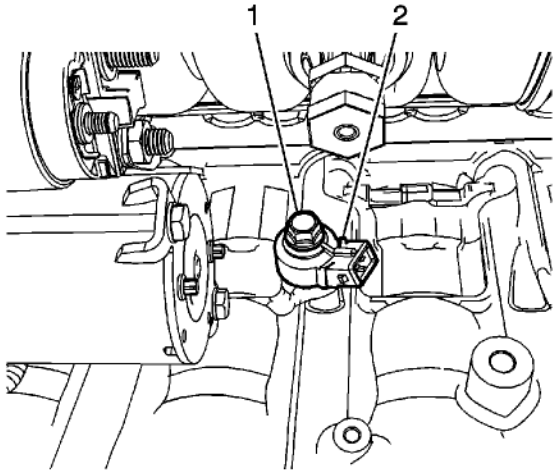
Removal Procedure

Warning: Refer to [Battery Disconnect Warning](#) in the Preface section.



1. Disconnect the battery negative cable. Refer to [Battery Negative Cable Disconnection and Connection](#).
2. Remove the knock sensor bolt (1).
3. Remove the knock sensor (2).

Installation Procedure



1. Install the knock sensor (2).

Caution: Refer to [Fastener Caution](#) in the Preface section.

2. Install the knock sensor bolt (1).

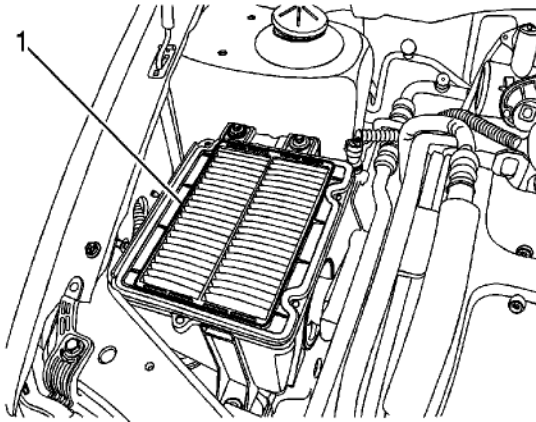
Tighten

Tighten the knock sensor bolt (1) to 20 N·m (14.7 lb ft).

3. Connect the battery negative cable. Refer to [Battery Negative Cable Disconnection and Connection](#).

Air Cleaner Element Replacement

Removal Procedure



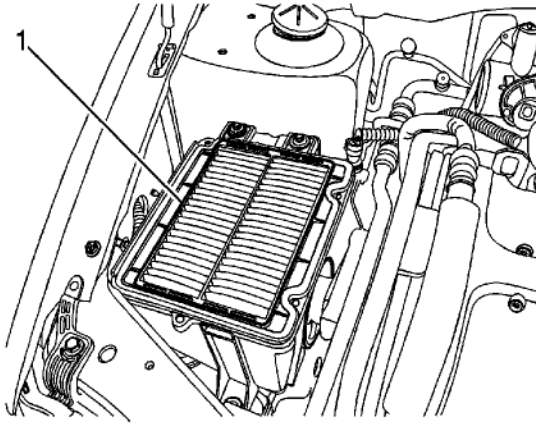
1. Remove the air filter upper housing.

Note: Before replacing a new one, check the maintenance interval and the quality of the air cleaner element.

2. Replace the air filter element (1).

Installation Procedure

Caution: Refer to [Fastener Caution](#) in the Preface section.



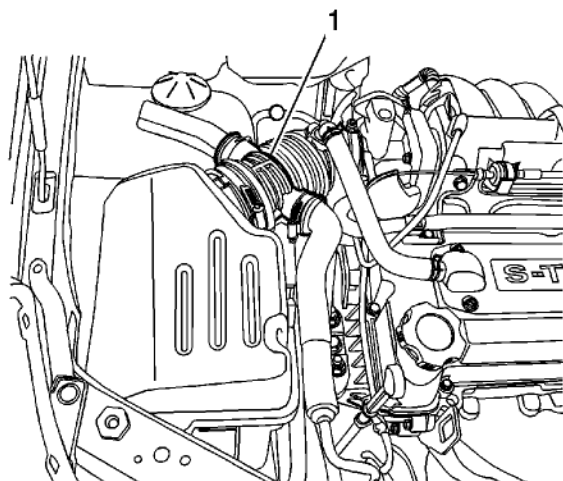
1. Install the air filter element (1).
2. Install the air filter upper housing.

Tighten

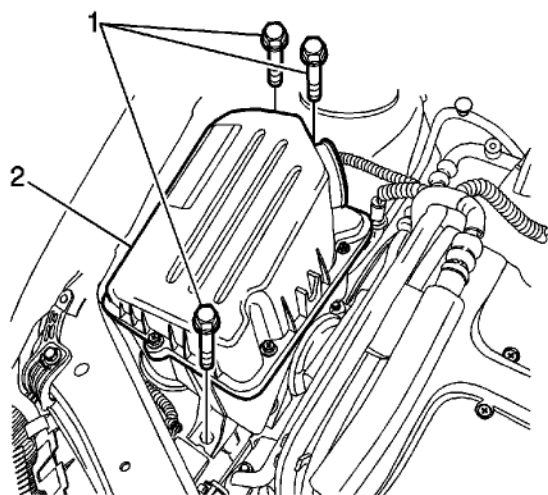
Tighten the air filter upper housing bolts to 2 N·m (1.5 lb ft).

Air Cleaner Assembly Replacement

Removal Procedure



1. Disconnect the battery negative cable. Refer to [Battery Negative Cable Disconnection and Connection](#).
2. Disconnect the breather hose.
3. Loosen the clamp and disconnect outlet tube (1).

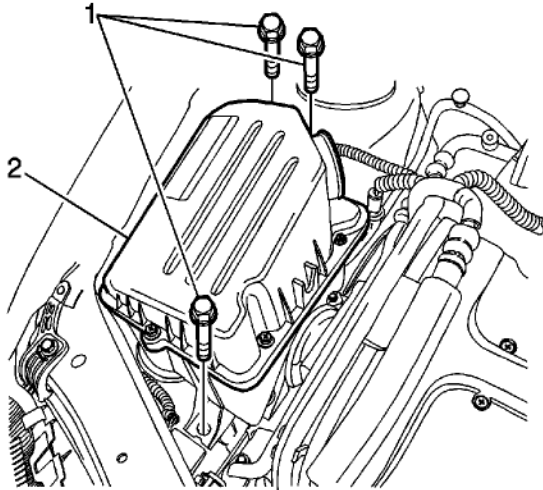


4. Remove the air cleaner assembly bolts (1).

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5. Remove the air cleaner assembly (2).

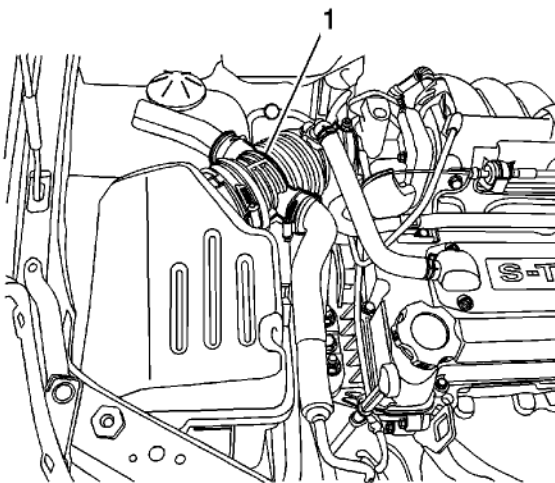
Installation Procedure



1. Install the air cleaner assembly (2).

Caution: Refer to [Fastener Caution](#) in the Preface section.

2. Install the air cleaner assembly bolts (1) and tighten to **6 N·m (4.4 lb ft)**.



3. Connect the air cleaner outlet tube (1) and tighten the clamp.
4. Connect the breather hose.
5. Connect the battery negative cable. Refer to [Battery Negative Cable Disconnection and](#)

[Connection.](#)