

[2009 Chevrolet Aveo](#) | [Aveo, Wave, G3, Barina \(VIN S/T\) Service Manual](#) | [Engine](#) | [Engine Controls and Fuel - 1.4L \(LDT\)](#)
[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

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| [Specifications](#) | Document ID: 2043994

Ignition System Specifications

Application	Specification	
	Metric	English
Ignition Sequence	1-3-4-2	1-3-4-2
Ignition Timing (at idle)	6° (BTDC)	
Ignition Type	Direct Ignition System	
Spark Plug Gap	1.0-1.1 mm	0.039-0.043 in
Spark Plug Maker	Woojin NGK	
Spark Plug Type	ZFR6U-11	

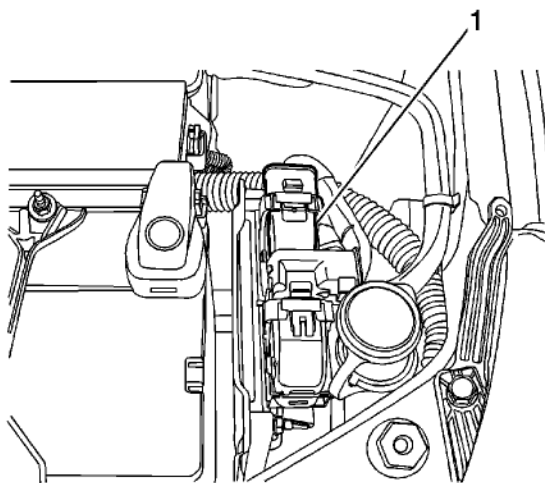
Fastener Tightening Specifications

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

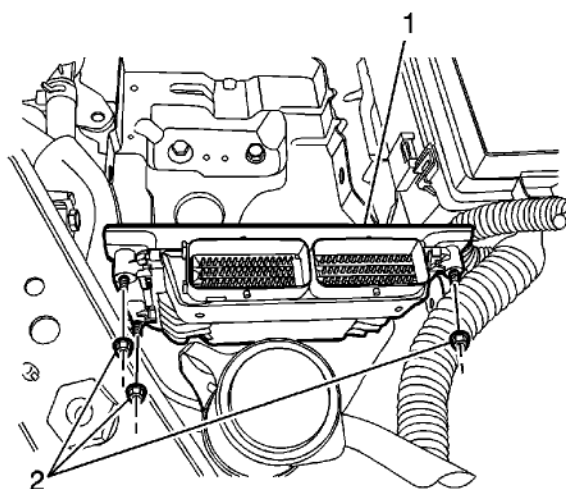
Engine Control Module Replacement

Removal Procedure

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



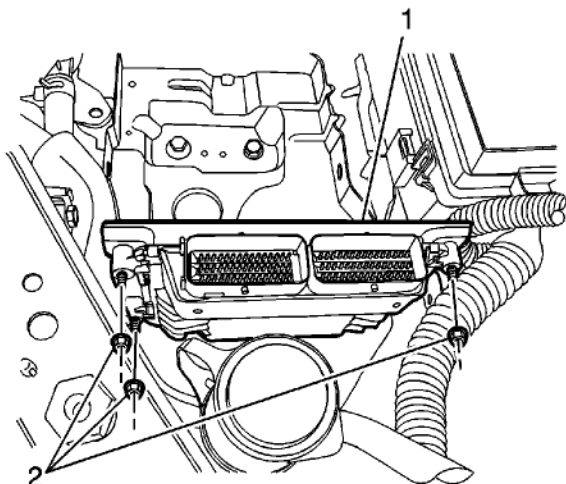
1. Disconnect the battery negative cable. Refer to [Battery Negative Cable Disconnection and Connection](#).
2. Unlock the ECM connector locking lever (1).



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

Installation Procedure



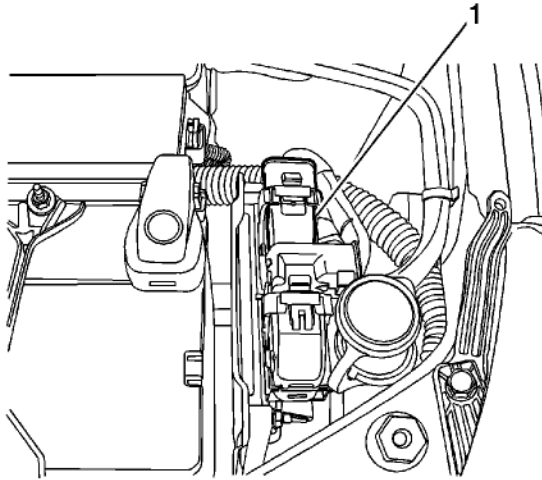
1. Install the ECM (1).

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

Important: If the crankshaft position variation learn procedure has not learned, a false misfire could be detected and DTC P0300 may set. If sent here from DTC P0300, proceed with the crankshaft position variation learn procedure.

1. Monitor the engine control module (ECM) for DTCs with a scan tool. If other DTCs are set, except DTC P0300, or P0315, refer to [Diagnostic Trouble Code \(DTC\) List - Vehicle](#) for the applicable DTC.
2. Select the crankshaft position variation learn procedure with a scan tool.
3. The scan tool instructs you to perform the following:
 - 3.1. Accelerate to wide open throttle (WOT).
 - 3.2. Release throttle when fuel cut-off occurs.
 - 3.3. Observe fuel cut-off for applicable engine.
 - 3.4. Engine should not accelerate beyond calibrated RPM value.
 - 3.5. Release throttle immediately if value is exceeded.
 - 3.6. Block drive wheels.
 - 3.7. Set parking brake.
 - 3.8. DO NOT apply brake pedal.
 - 3.9. Cycle ignition from OFF to ON.
 - 3.10. Apply and hold brake pedal.
 - 3.11. Start and idle engine.
 - 3.12. Turn A/C OFF.

Vehicle must remain in Park or Neutral.

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

- Crankshaft position (CKP) sensors activity--If there is a CKP sensor condition, refer to the applicable DTC.
 - Camshaft position (CMP) signal activity--If there is a CMP signal condition, refer to the applicable DTC.
 - 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.
4. Enable the CKP system variation learn procedure with the scan tool and perform the following:

Important: While the CKP variation learn procedure is in progress, hold the throttle at WOT for 5 fuel-cutoffs. The learn procedure must determine there has been 5 fuel-cutoffs to properly perform the test.

- Accelerate to WOT.

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- Hold throttle while fuel cut-off occurs.
5. 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.
 6. Turn OFF the ignition for 30 seconds after the learn procedure is completed successfully.

The CKP system variation learn procedure is also required when the following service procedures have been performed, regardless of whether or not DTC P0315 is set:

- An engine replacement
- An ECM replacement
- A harmonic balancer replacement
- A crankshaft replacement
- A CKP sensor replacement
- Any engine repairs which disturb the crankshaft to CKP sensor relationship.

Idle Learn

The Idle Learn Procedure listed below must be performed whenever the following occurs:

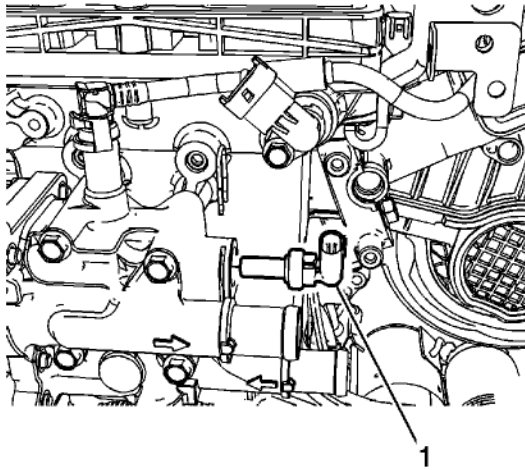
- The throttle body assembly is replaced
 - The throttle body is cleaned
 - The engine control module (ECM) is replaced
 - The idle air control valve (IAC) is replaced
 - Power disconnection (battery cable, ECM fuse, etc.) (Delphi ECM only)
1. Turn the ignition ON.
 2. Turn the ignition OFF for 15 seconds.
 3. Turn the ignition ON for 5 seconds.
 4. Turn the ignition OFF for 15 seconds.
 5. Start the engine in park/neutral.
 6. Allow the engine to run until the engine coolant temperature is greater than 85°C (185°F).
 7. Turn the A/C ON for 10 seconds, if equipped.
 8. If the vehicle is equipped with an automatic transaxle, apply the parking brake. While pressing the brake pedal, place the transaxle in drive (D) for 10 seconds.
 9. Turn the A/C OFF for 10 seconds, if equipped.
 10. If the vehicle is equipped with an automatic transaxle, while pressing the brake pedal, place the transaxle in park/neutral.
 11. Turn the ignition OFF. The idle learn procedure is complete.

Engine Coolant Temperature Sensor Replacement (ECT 1)

Removal Procedure

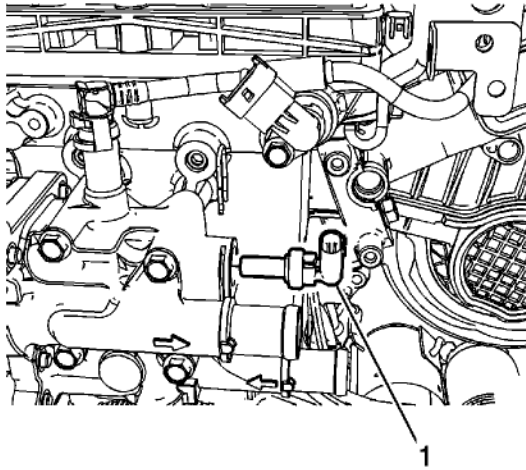
Warning: Refer to [Battery Disconnect Warning](#) in the Preface section.

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

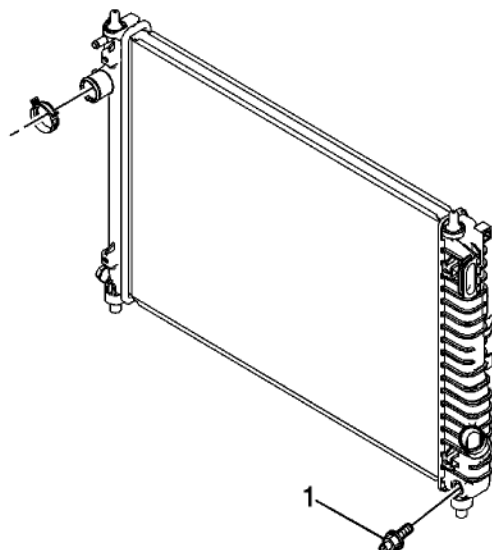


1. Install the ECT (1) to the coolant distributor.
2. Install the ECT retaining clip.
3. Connect the ECT sensor connector.
4. Refill the engine coolant. Refer to [Cooling System Draining and Filling](#).
5. Connect the battery negative cable. Refer to [Battery Negative Cable Disconnection and Connection](#).

Engine Coolant Temperature Sensor Replacement (ECT 2)

Removal Procedure

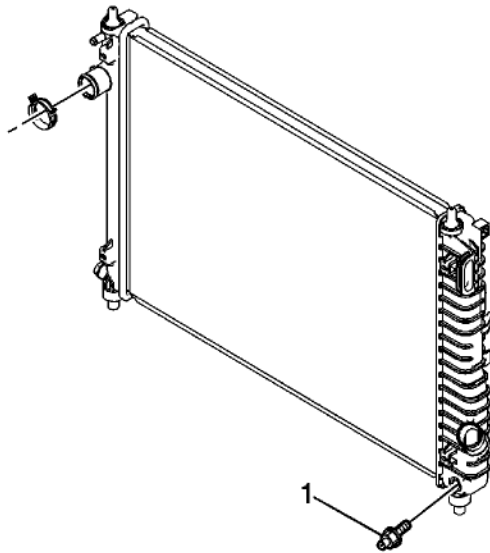
Warning: Refer to [Battery Disconnect Warning](#) in the Preface section.



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

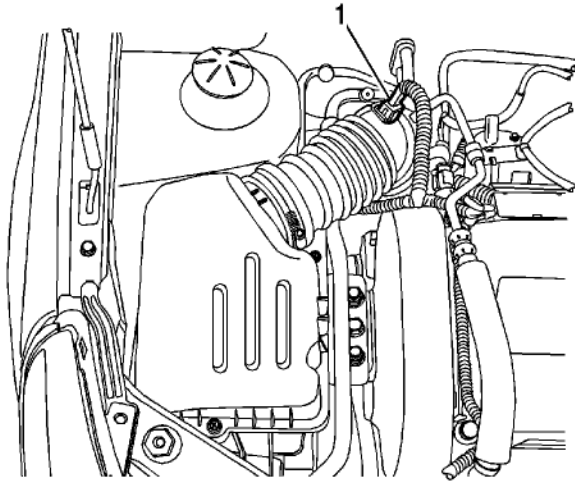
Tighten the ECT 2 sensor to 20 N·m (15 lb ft).

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](#).

Intake Air Temperature Sensor Replacement

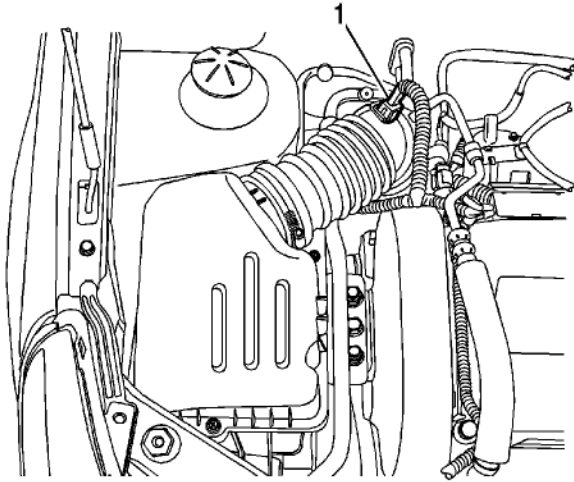
Removal Procedure

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 intake air temperature (IAT) sensor connector (1).
3. Remove the IAT sensor.

Installation Procedure

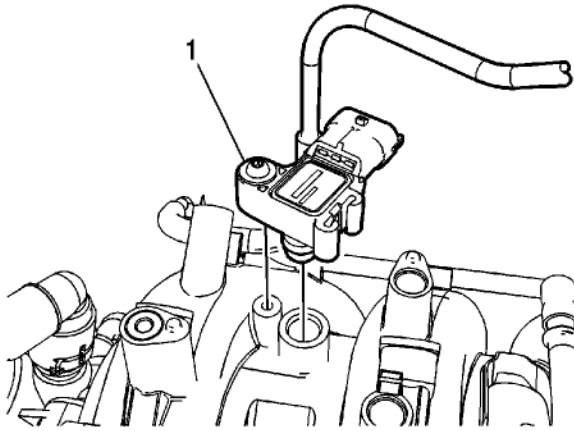


1. Install the IAT sensor.
2. Connect the IAT sensor connector (1).
3. Connect the battery negative cable. Refer to [Battery Negative Cable Disconnection and Connection](#).

Manifold Absolute Pressure Sensor Replacement

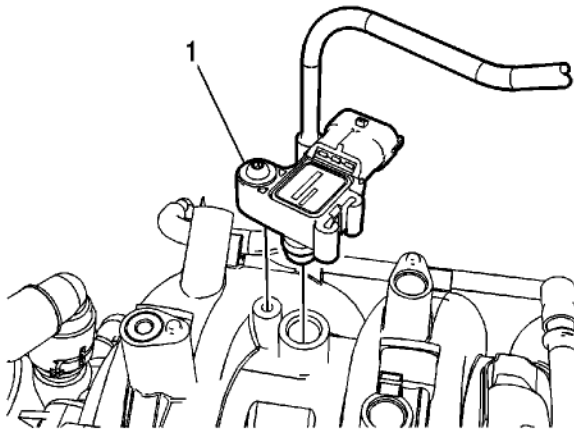
Removal Procedure

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

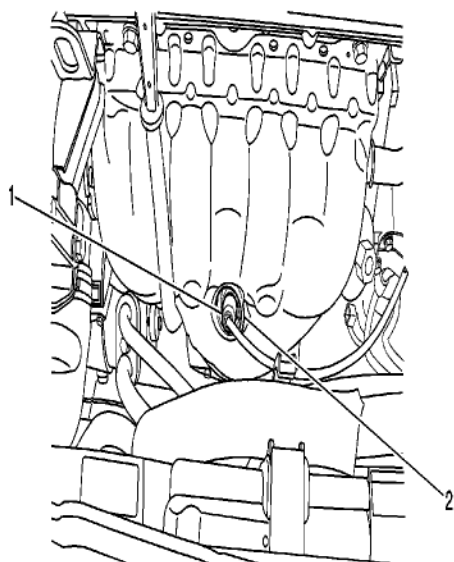
Special Tools

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

Removal Procedure

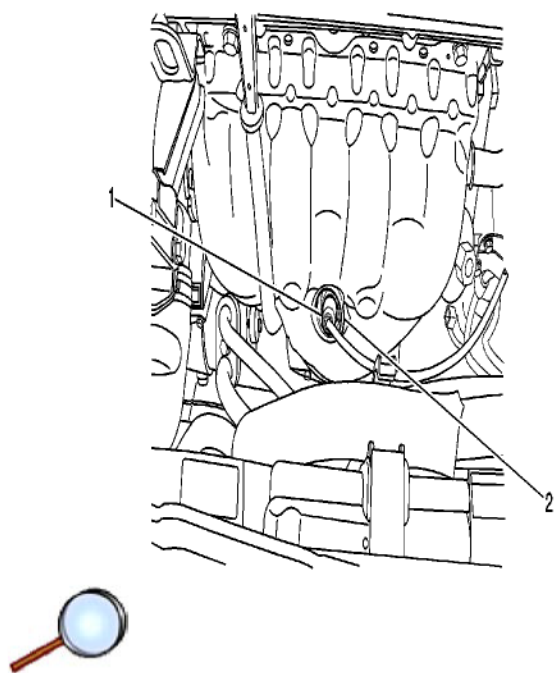
Warning: Refer to [Battery Disconnect Warning](#) in the Preface section.

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

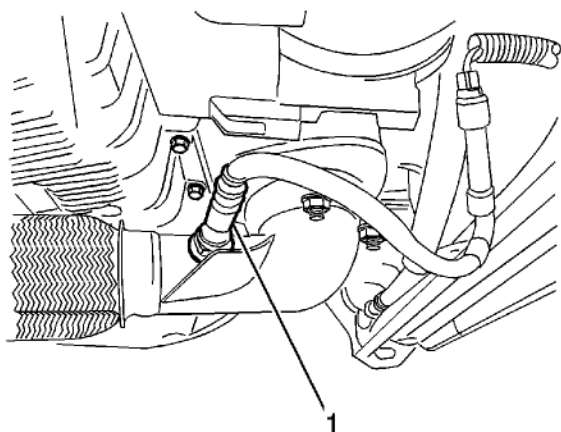
Special Tools

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

Removal Procedure

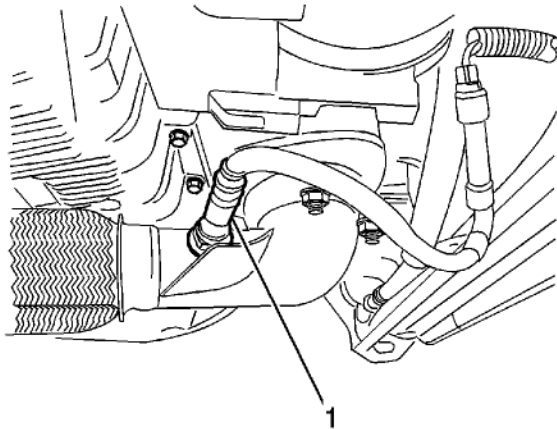
Warning: Refer to [Battery Disconnect Warning](#) in the Preface section.

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

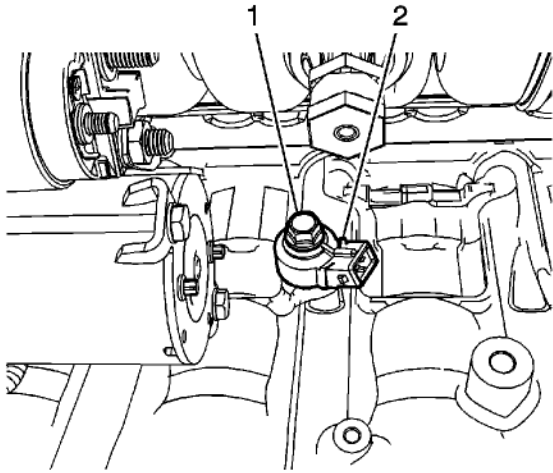
Tighten the HO2S1 to 40 N·m (29.5 lb ft).

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

Knock Sensor Replacement

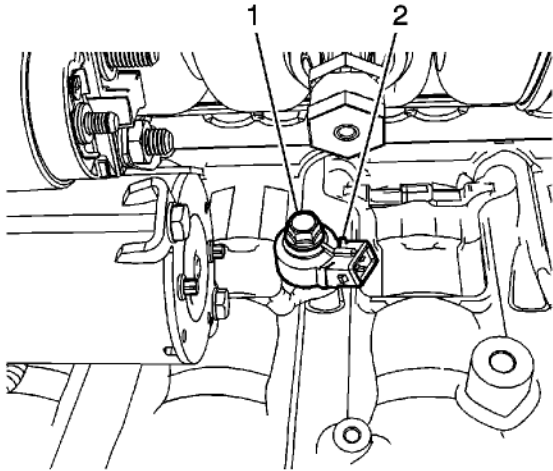
Removal Procedure

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).

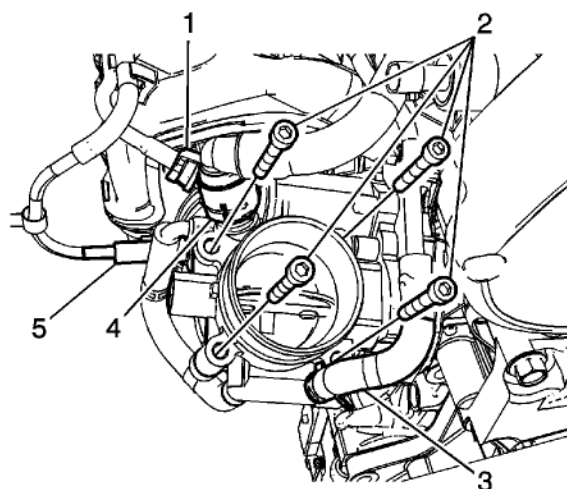
3. Connect the battery negative cable. Refer to [Battery Negative Cable Disconnection and Connection](#).

Throttle Body Assembly Replacement

Removal Procedure

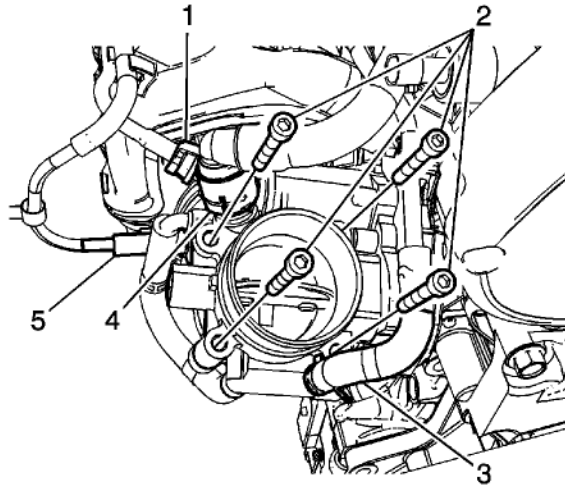
Warning: Refer to [Battery Disconnect Warning](#) in the Preface section.

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).

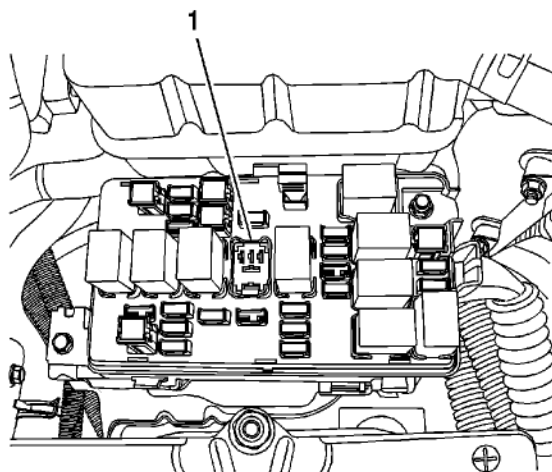
Tighten

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.



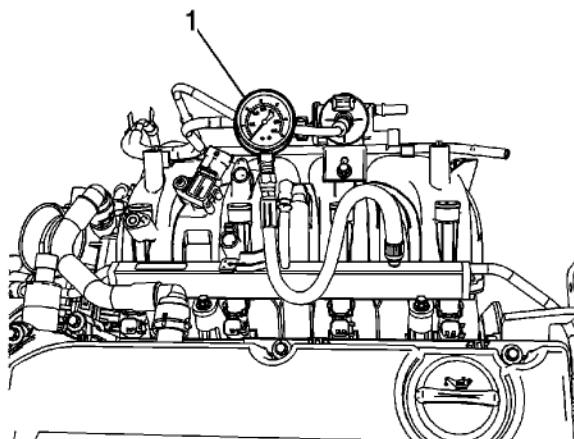
1. Remove the fuel cap.
2. Remove the fuel pump fuse (1) from the engine fuse block.
3. Start the engine and allow the engine to stall.
4. Crank the engine for an additional 10 seconds.

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.

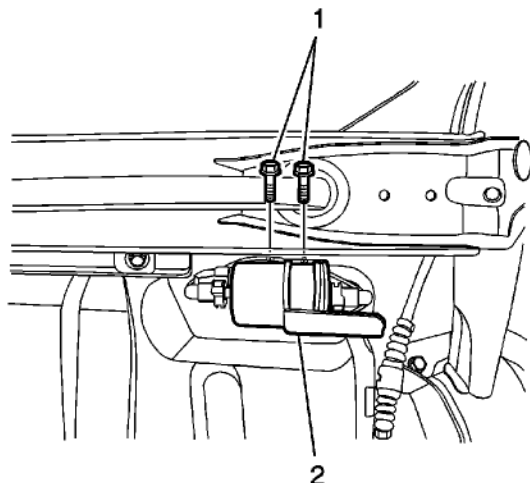
Specification

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

Fuel Filter Replacement

Removal Procedure

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

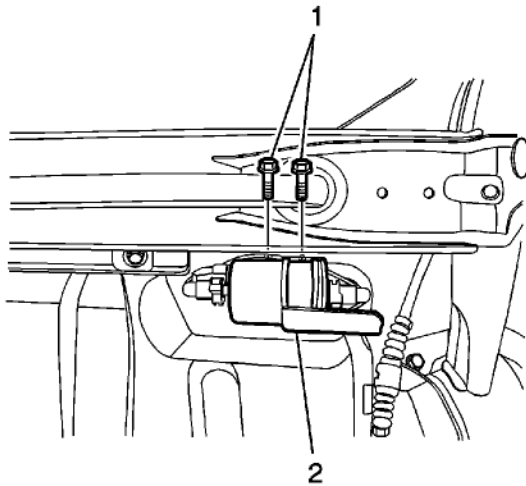


1. Relieve the fuel pressure. Refer to [Fuel Pressure Relief](#).

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

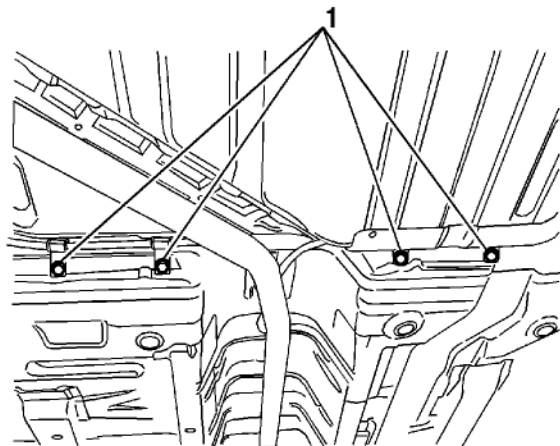


1. Install the fuel filter (2).
2. Install the fuel filter bracket bolts (1).
3. Connect the inlet/outlet quick connector lines.
4. Connect the battery negative cable. Refer to [Battery Negative Cable Disconnection and Connection](#).

Fuel Tank Replacement

Removal Procedure

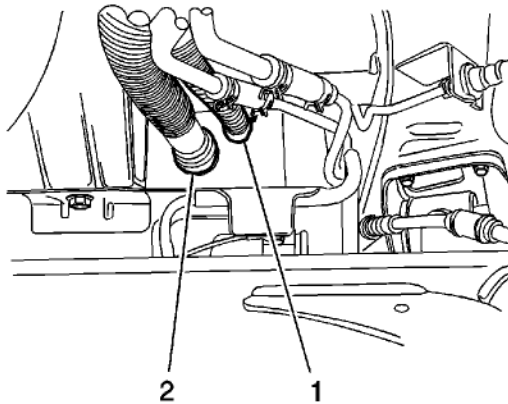
Caution: Refer to [Fuel Pressure Caution](#) in the Preface section.



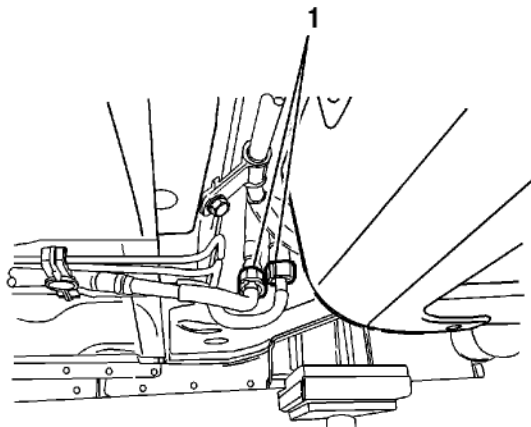
1. Relieve the fuel pressure. Refer to [Fuel Pressure Gage Installation and Removal](#).

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

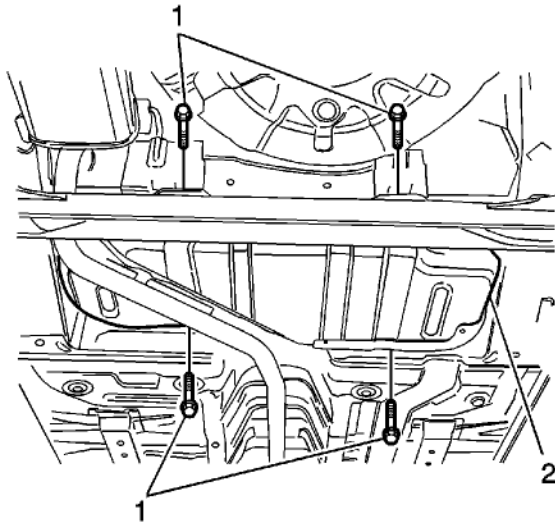
2. Disconnect the battery negative cable. Refer to [Battery Negative Cable Disconnection and Connection](#).
3. Drain the fuel tank.
4. Disconnect the parking brake cable retainer clamps (1) and the support along the fuel tank to provide clearance for the tank.



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.

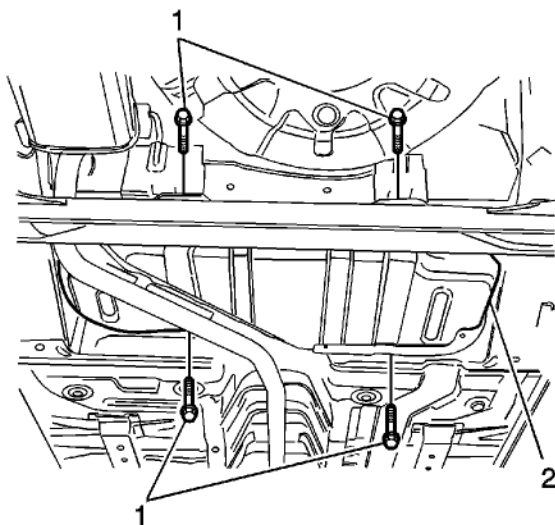


11. Support the fuel tank.
12. Remove the fuel tank retaining bolts (1).
13. Carefully lower the fuel tank.
14. Remove the fuel tank.

Installation Procedure

1. Raise the fuel tank into position.

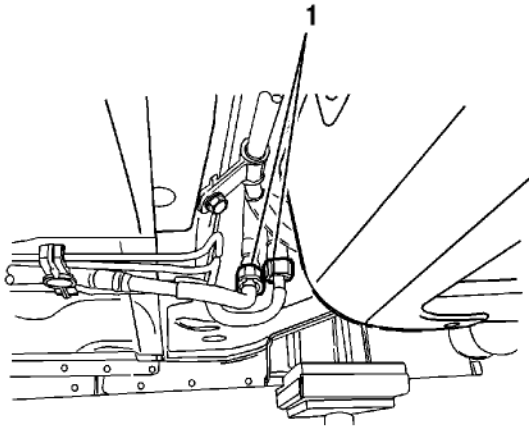
Caution: Refer to [Fastener Caution](#) in the Preface section.



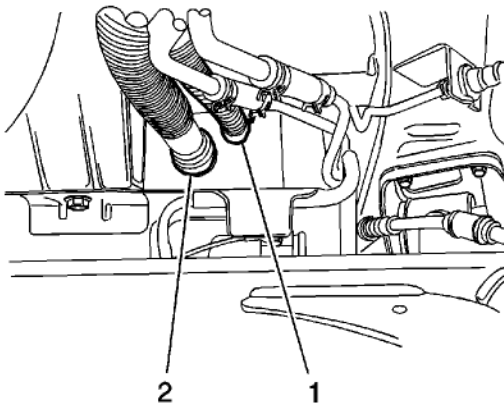
2. Install the fuel tank mounting bolts (1).

Tighten

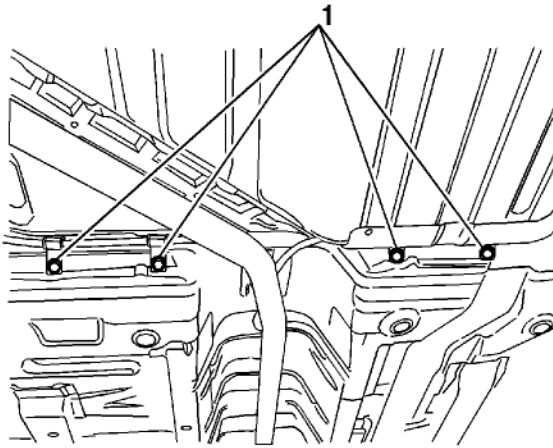
Tighten the fuel tank retaining bolts to 20 N·m (15 lb ft).



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.

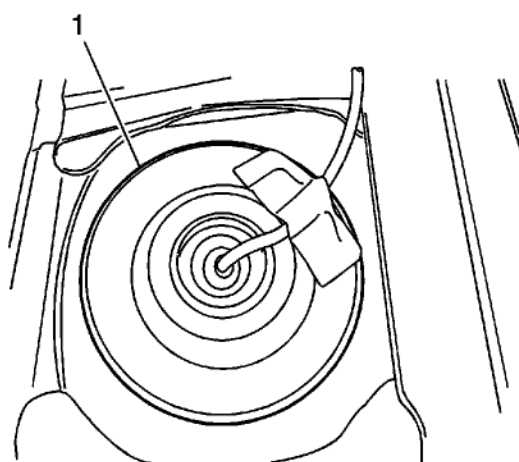
Fuel Sender Assembly Replacement

Special Tools

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

Removal Procedure

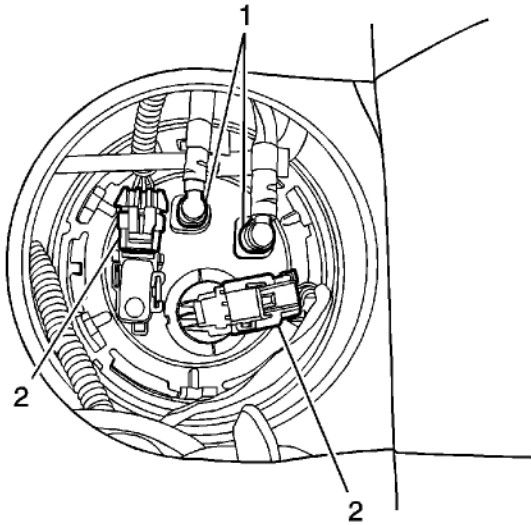
Caution: Refer to [Fuel Pressure Caution](#) in the Preface section.



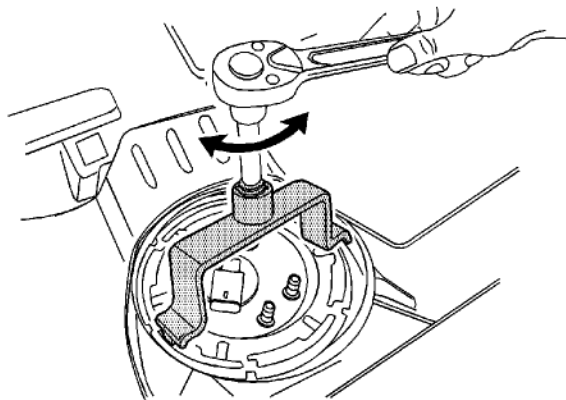
1. Relieve the fuel pressure. Refer to [Fuel Pressure Relief](#).

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

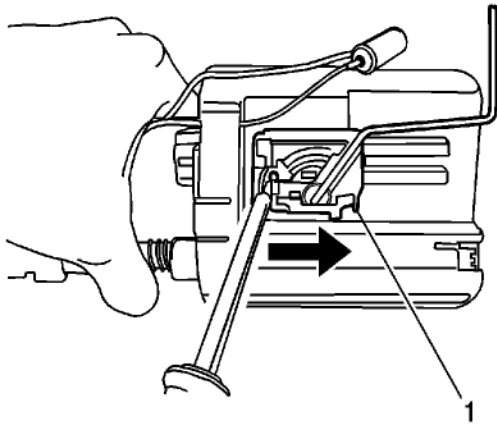
2. Disconnect the battery negative cable. Refer to [Battery Negative Cable Disconnection and Connection](#).
3. Remove the rear seat. Refer to [Rear Seat Replacement](#).
4. Remove the fuel pump access cover (1).



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

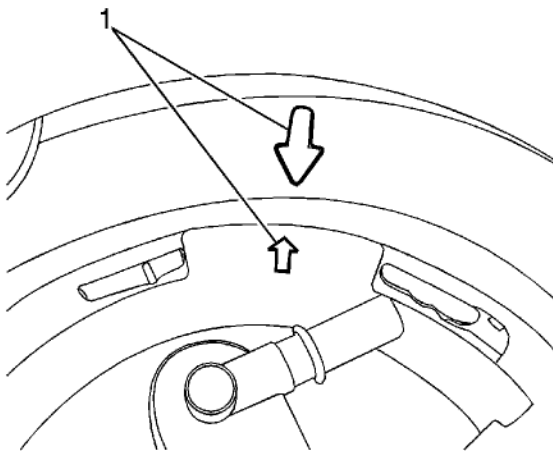


7. Remove the fuel pump lock ring by using *EN-49090* ring .
8. Remove the fuel pump.
9. Disconnect the insulator.



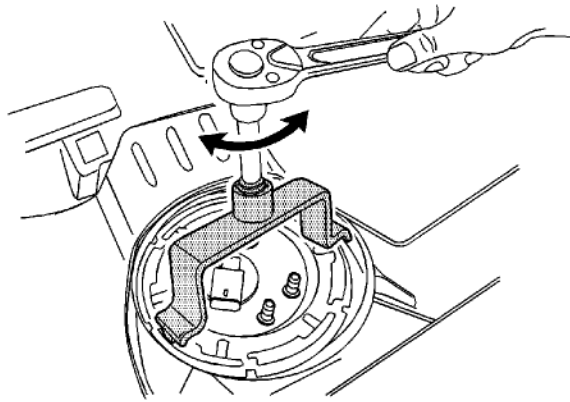
10. Remove the fuel sender assembly (1).

Installation Procedure

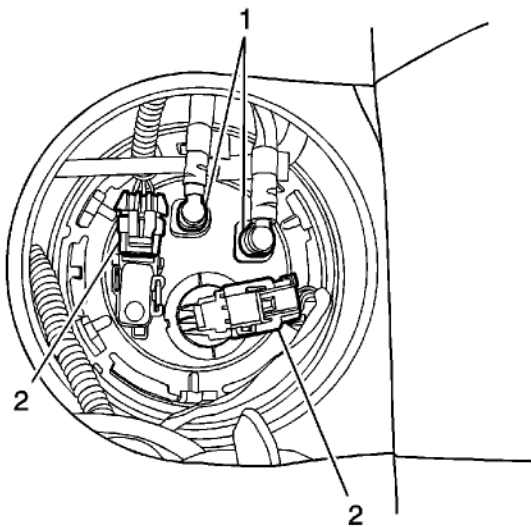


Note: Be careful to install the fuel sender to fuel pump housing exactly. If not installed exactly, fuel indicating may be incorrect.

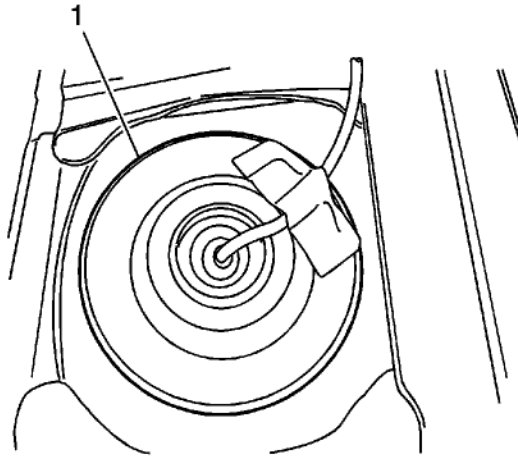
1. Install the fuel sender assembly. Align marks (1).
2. Connect the fuel sender insulator.



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](#).

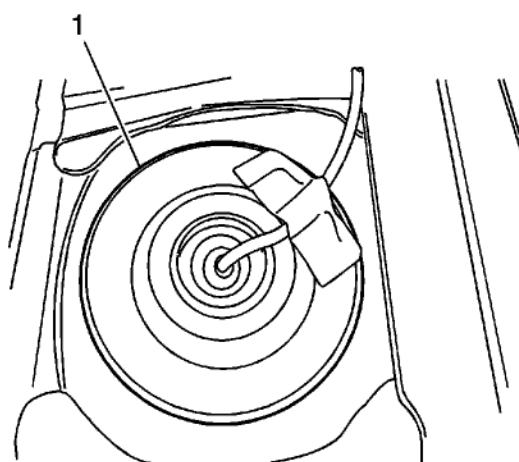
Fuel Pump Replacement

Special Tools

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

Removal Procedure

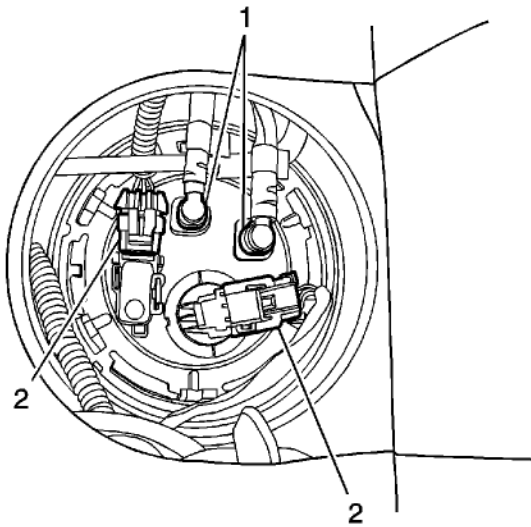
Caution: Refer to [Fuel Pressure Caution](#) in the Preface section.



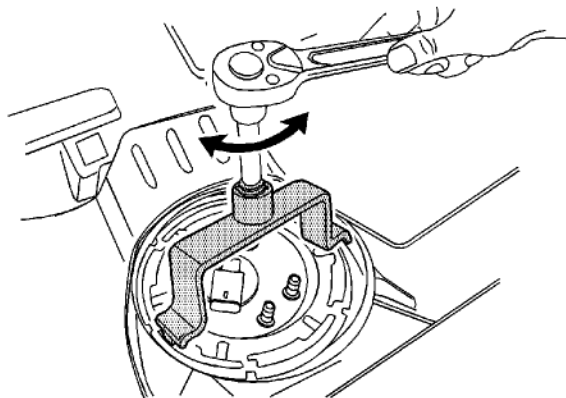
1. Relieve the fuel pressure. Refer to [Fuel Pressure Relief](#).

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

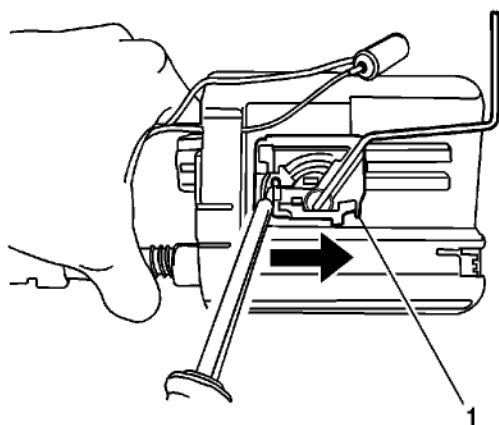
2. Disconnect the battery negative cable. Refer to [Battery Negative Cable Disconnection and Connection](#).
3. Remove the rear seat. Refer to [Rear Seat Replacement](#).
4. Remove the fuel pump access cover (1).



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

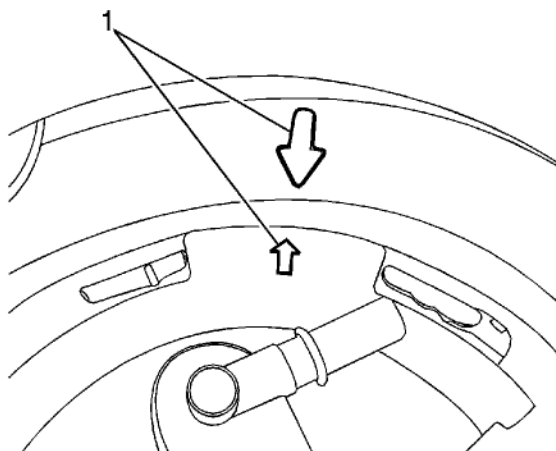


7. Remove the fuel pump lock ring by using *EN-49090* ring .
8. Remove the fuel pump.
9. Disconnect the insulator.



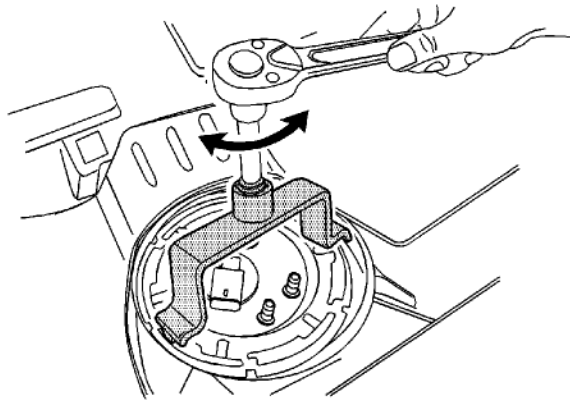
10. Remove the fuel sender assembly (1).

Installation Procedure

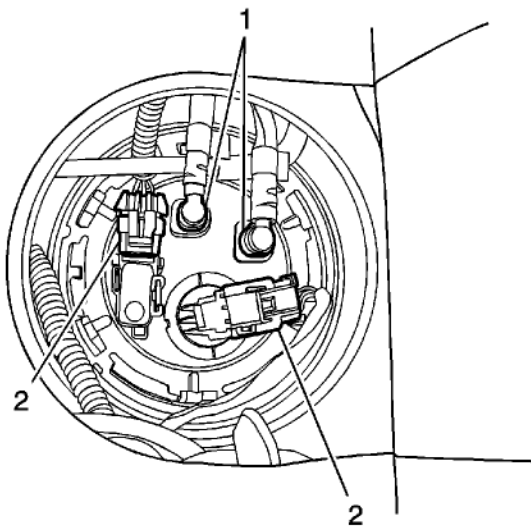


Note: Be careful to install the fuel sender to fuel pump housing exactly. If not installed exactly, fuel indicating may be incorrect.

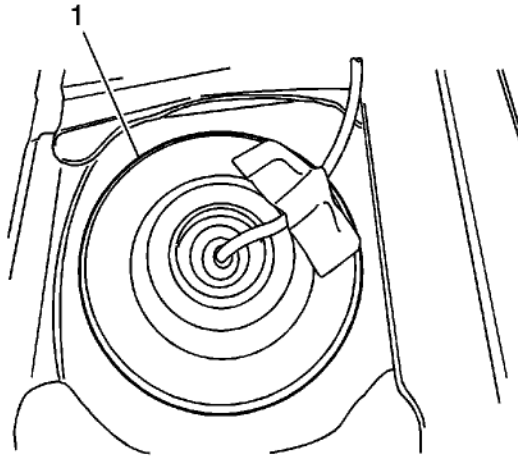
1. Install the fuel sender assembly. Align marks (1).
2. Connect the fuel sender insulator.



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

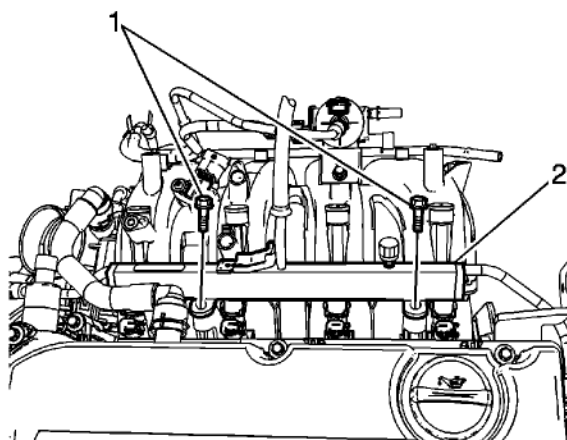
Removal Procedure

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

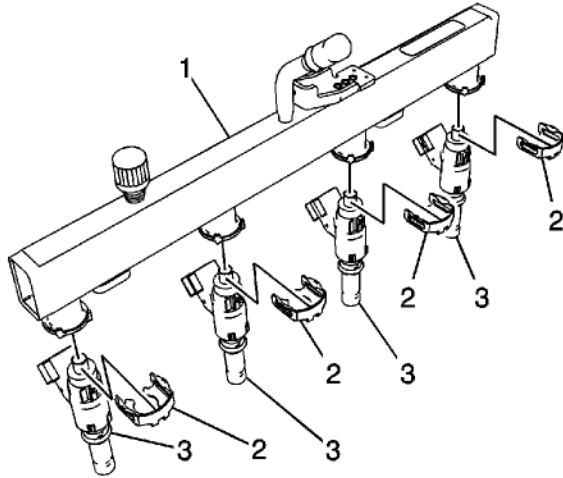
1. Relieve the fuel pressure system. Refer to [Fuel Pressure Relief](#).

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.

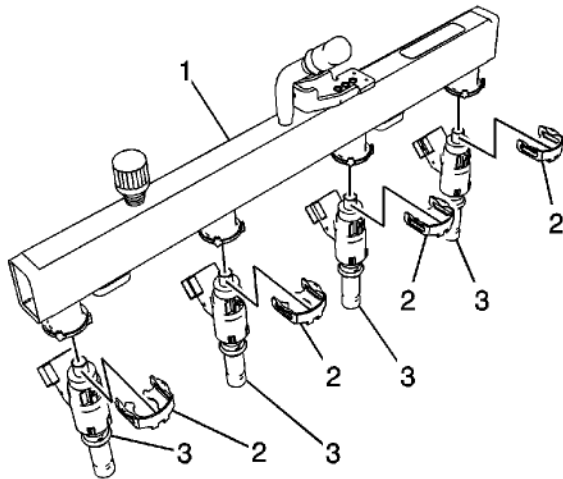


4. Disconnect the fuel line from the fuel rail.
5. Remove the fuel rail bolts (1).
6. Remove the fuel rail (2) with the injectors.

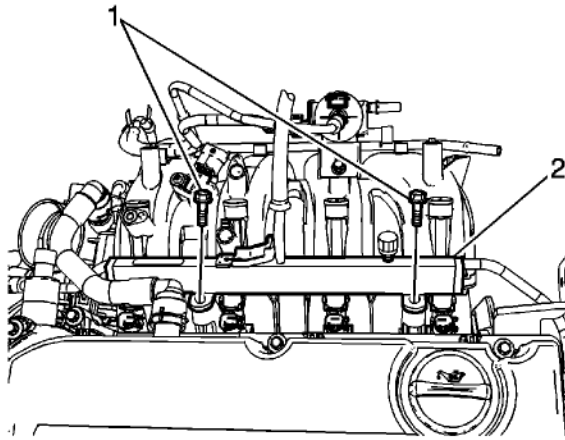


7. Detach the fuel injector retainer clips (2).
8. Detach the fuel injectors (3) by pulling down and out.
9. Discard the fuel injector O-rings.

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).

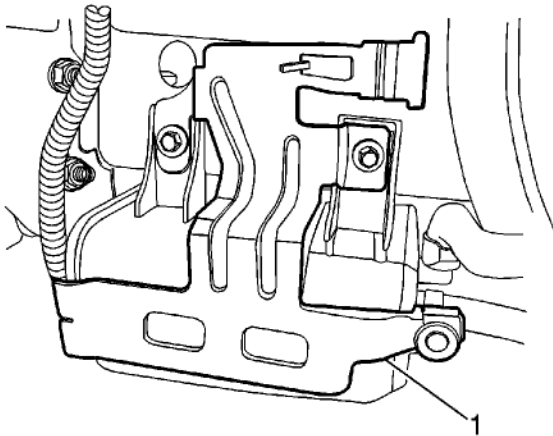
Tighten

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](#).

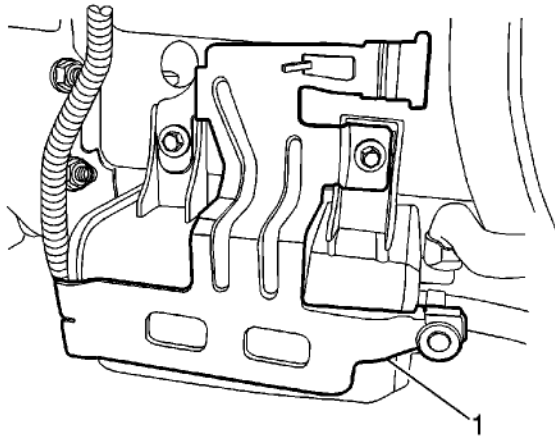
Evaporative Emission Canister Replacement

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).

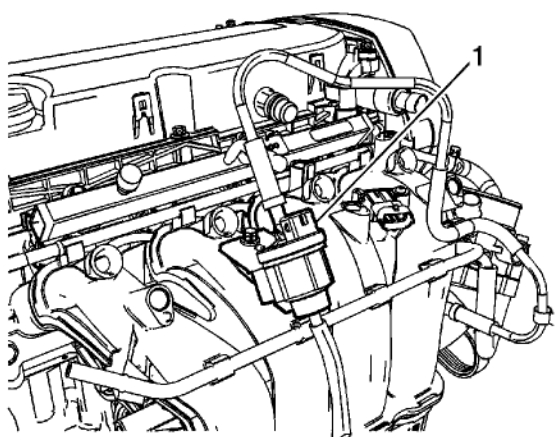
3. Connect the inlet and outlet hose to the EVAP canister.
4. Install the EVAP canister vent.

Evaporative Emission Canister Purge Solenoid Valve Replacement

Removal Procedure

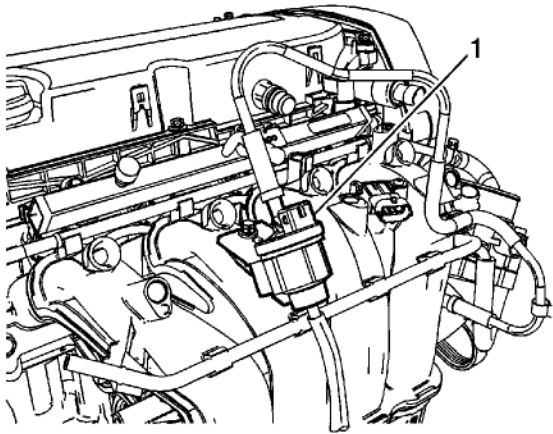
Warning: Refer to [Battery Disconnect Warning](#) in the Preface section.

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

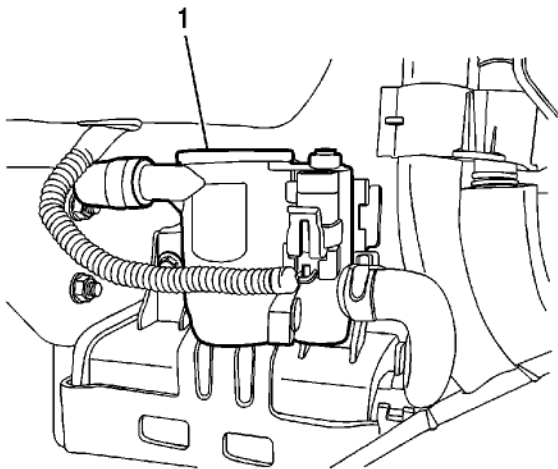


1. Install the EVAP canister purge valve (1).
2. Connect the EVAP canister purge valve connector.
3. Connect the EVAP canister purge valve upper and lower hoses.
4. Connect the battery negative cable. Refer to [Battery Negative Cable Disconnection and Connection](#).

Evaporative Emission Canister Vent Solenoid Valve Replacement

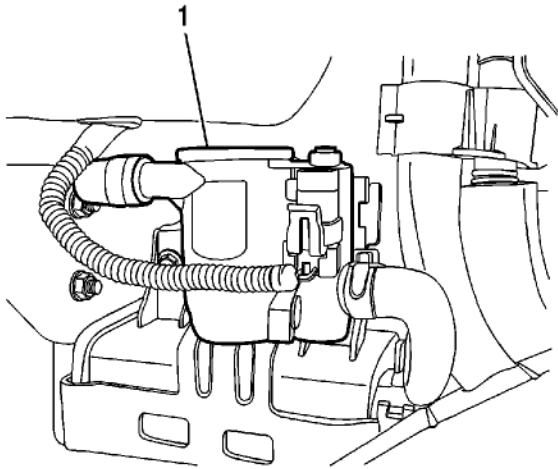
Removal Procedure

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](#).

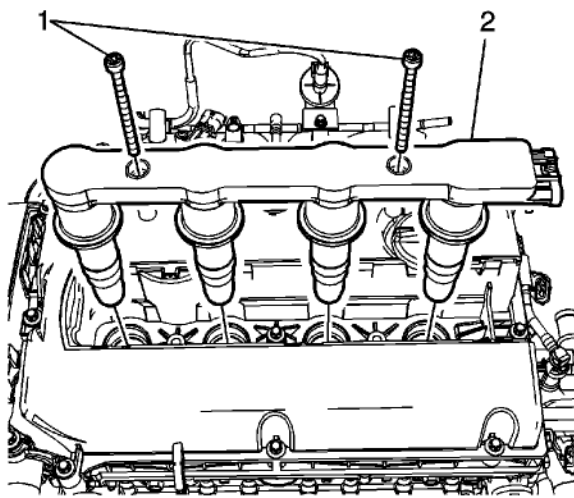
Ignition Coil Replacement

Special Tools

[KM-6009](#) Remover/Installer

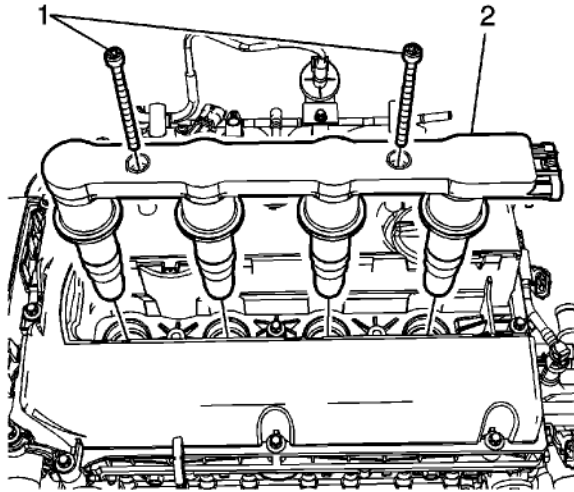
Removal Procedure

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).

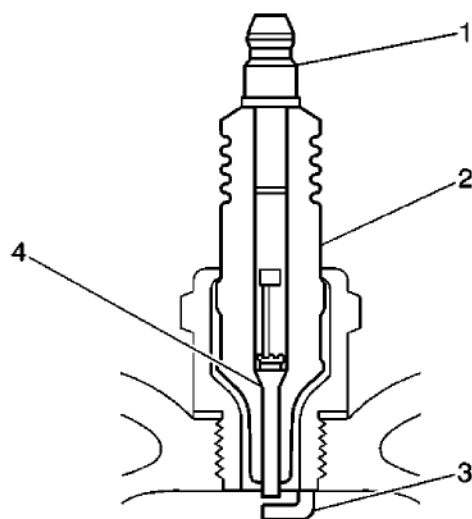
3. Connect the ignition coil connector.
4. Install the ignition coil cover.
5. Connect the battery negative cable. Refer to [Battery Negative Cable Disconnection and Connection](#).

Spark Plug Inspection

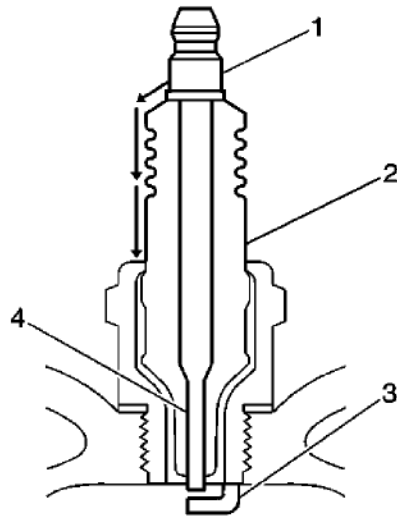
Spark Plug Usage

- 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

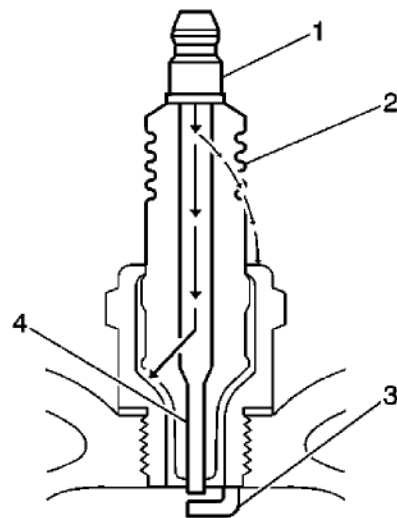
Spark Plug Inspection



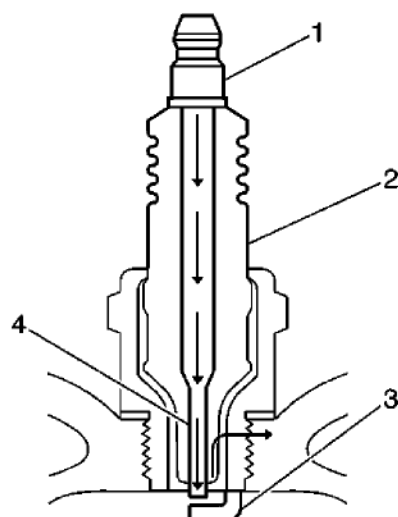
1. Inspect the terminal post (1) for damage.
 - Inspect for a bent or broken terminal post (1).
 - Test for a loose terminal post (1) by twisting and pulling the post. The terminal post (1) should NOT move.



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.

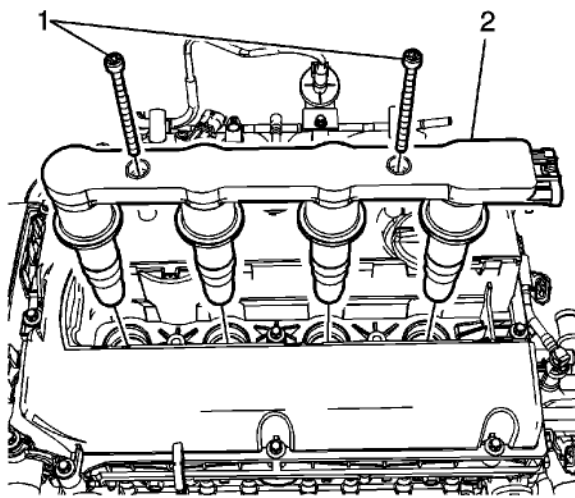
Spark Plug Replacement

Special Tools

[KM-6009](#) Remover/Installer

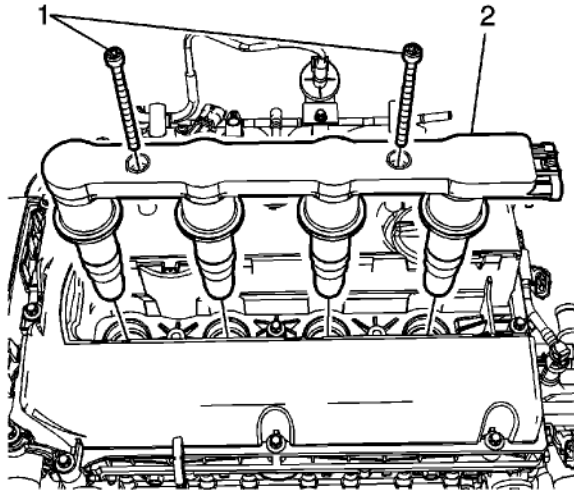
Removal Procedure

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

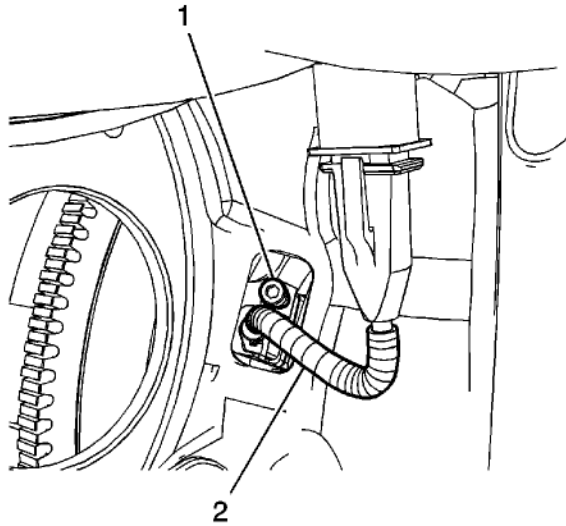
Tighten the ignition coil bolts (1) to 8 N·m (70.8 lb in).

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](#).

Crankshaft Position Sensor Replacement

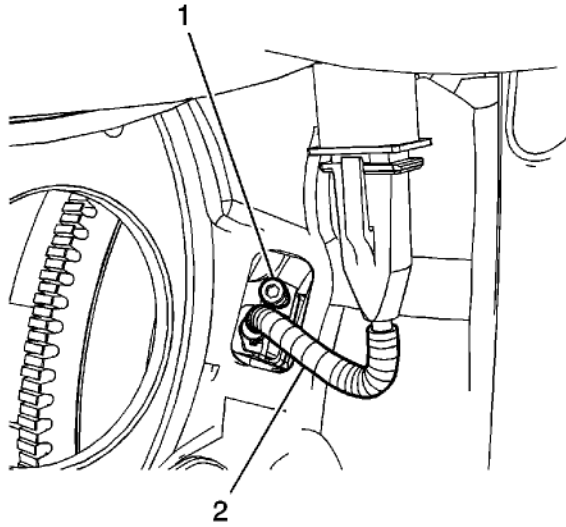
Removal Procedure

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

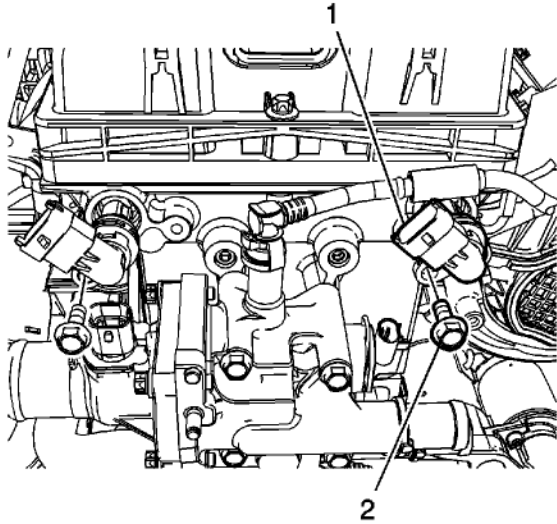
Tighten the CKP sensor bolt (1) to 4.5 N·m (39.8 lb in).

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

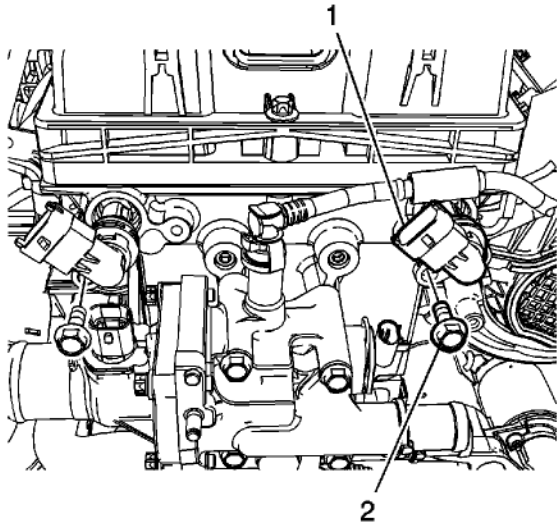
Removal Procedure

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

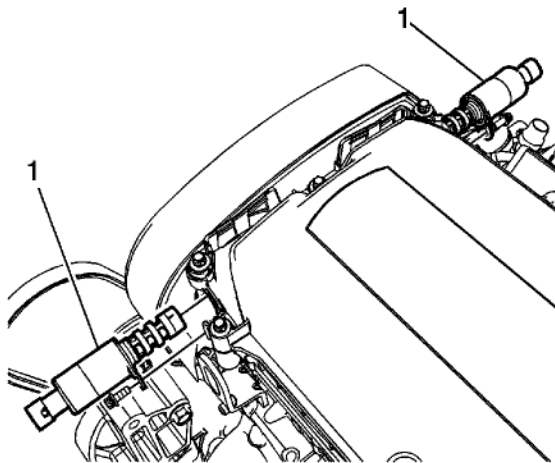


1. Install the CMP sensor (1).
2. Install the CMP sensor bolt (2).
3. Connect the CMP sensor connectors.
4. Connect the battery negative cable. Refer to [Battery Negative Cable Disconnection and Connection](#).

Camshaft Position Actuator Solenoid Valve Replacement

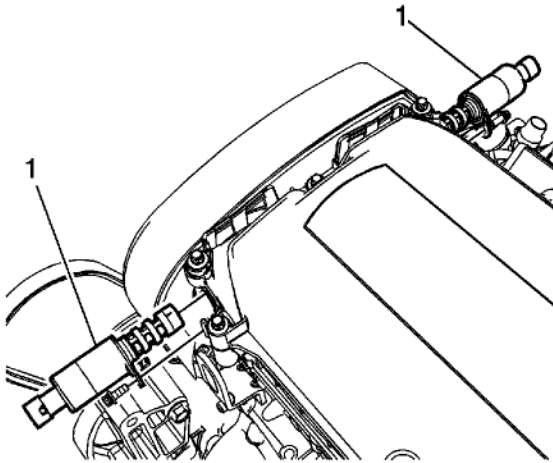
Removal Procedure

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

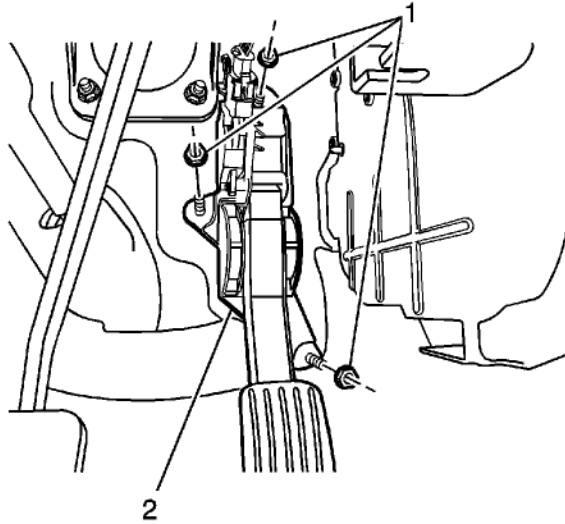
Tighten the camshaft position actuator valve bolt to 6 N·m (53 lb in).

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

Accelerator Pedal Position Sensor Replacement

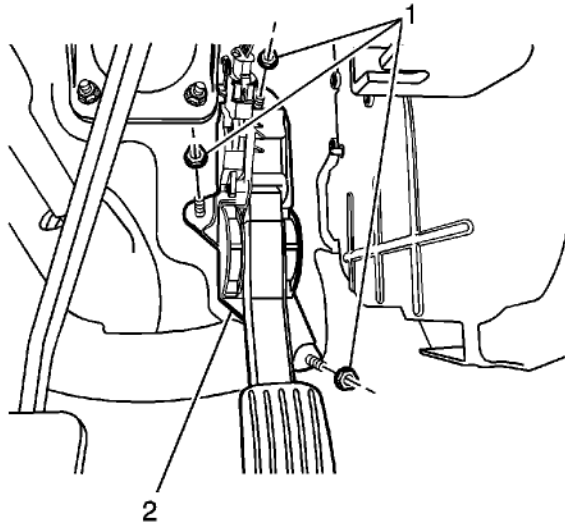
Removal Procedure

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).

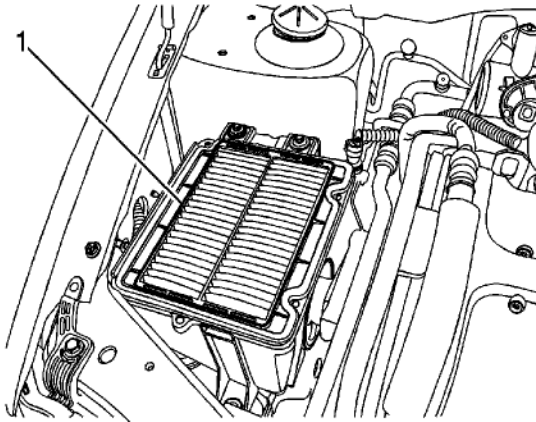
Tighten

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](#).

Air Cleaner Element Replacement

Removal Procedure



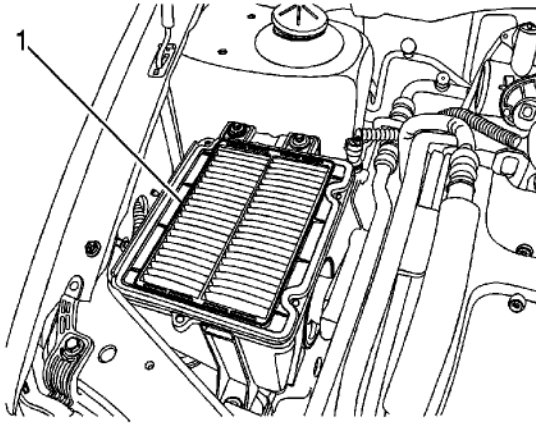
1. Remove the air filter upper housing.

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.



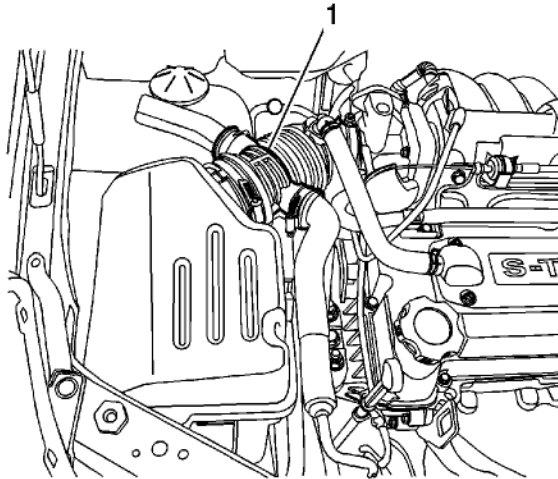
1. Install the air filter element (1).
2. Install the air filter upper housing.

Tighten

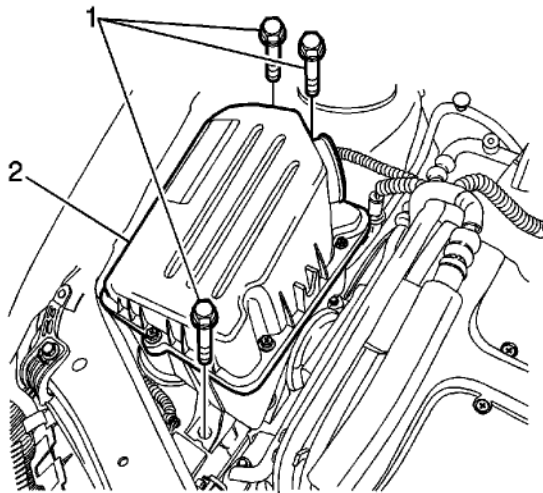
Tighten the air filter upper housing bolts to 2 N·m (1.5 lb ft).

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).

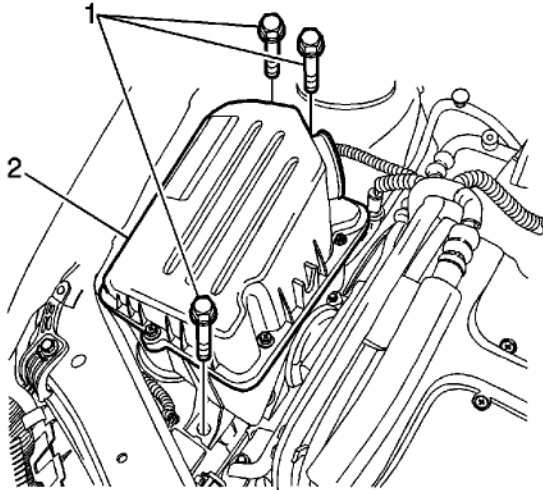


4. Remove the air cleaner assembly bolts (1).

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5. Remove the air cleaner assembly (2).

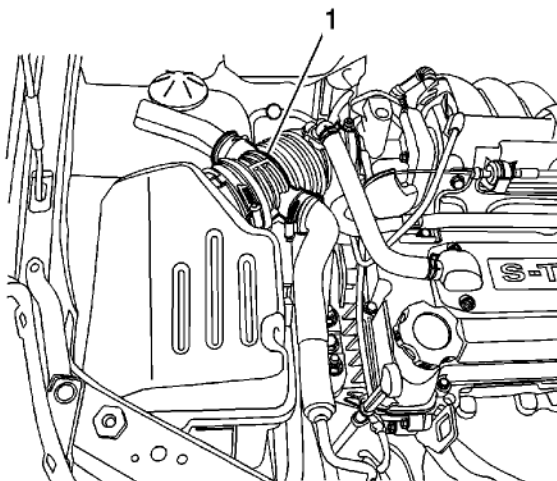
Installation Procedure



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.](#)