

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

[2009 Chevrolet Aveo](#) | [Aveo, Wave, G3, Barina \(VIN S/T\) Service Manual](#) | [Engine](#) | [Engine Controls and Fuel - 1.2L](#) | [Specifications](#) | **Document ID: 2038770**

Ignition System Specifications

Application	Specification	
	Metric	English
Ignition Sequence	1-3-4-2	1-3-4-2
Ignition Timing	4°- 5° (BTDC)	
Ignition Type	Direct Ignition System	
Spark Plug Gap	0.8-0.9 mm	0.031-0.035 in
Spark Plug Maker	Selim Tech	
Spark Plug Type	RA7YC	

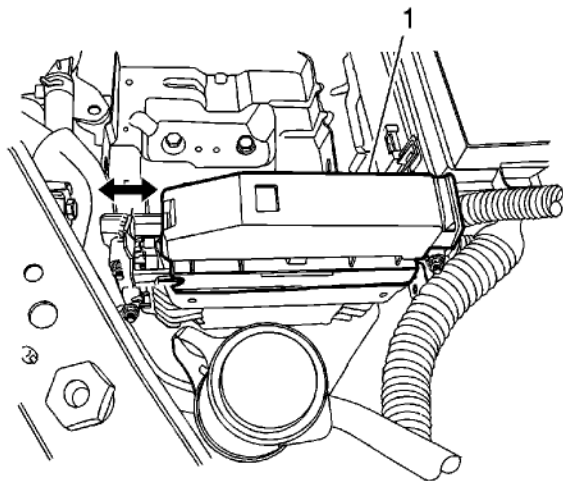
Fastener Tightening Specifications

Application	Specifications	
	Metric	English
Accessory Mounting Bracket Bolts	37 N·m	27 lb ft
Camshaft Position Sensor Bolt	12 N·m	106 lb in
Crankshaft Position (CKP) Sensor Bolt	6.5 N·m	58 lb in
Engine Control Module (ECM) Nuts	7 N·m	62 lb in
Engine Coolant Temperature Sensor	17.5 N·m	13 lb ft
Evaporative Emission Canister Bracket Retaining Bolt	8 N·m	71 lb in
Evaporative Emission Canister Flange Bolt	20 N·m	16 lb ft
Evaporative Emission Canister Purge Solenoid Bracket Bolt	5 N·m	44 lb in
Evaporative Emission Vent Solenoid Bolt	8.5 N·m	75 lb in
Exhaust Gas Recirculation Retaining Bolts	30 N·m	22 lb ft
Exhaust Gas Recirculation Retaining Bolts	22 N·m	16 lb ft
Exhaust Gas Recirculation Retaining Nuts	10 N·m	89 lb in
Fuel Filter Bracket Bolt	4 N·m	35 lb in
Fuel Pressure Regulator Retaining Screw	12 N·m	106 lb in
Fuel Pump Retaining Bolts	4 N·m	35 lb in
Fuel Tank Retaining Bolts	20 N·m	15 lb ft
Fuel Rail Bolt	25 N·m	18 lb ft
Heated Oxygen Sensor (HO2S)	42 N·m	31 lb ft
Idle Air Control Valve Retaining Bolts	3 N·m	27 lb in
Ignition Coil Bolt	10 N·m	89 lb in
Knock Sensor (KS) Bolt	20 N·m	15 lb ft
Map Sensor Retaining Bolts	10 N·m	89 lb in
Oil Pressure Switch Fitting	30 N·m	22 lb ft
Spark Plug Cover Bolts	3 N·m	27 lb in
Throttle Body Nuts	10.5 N·m	93 lb in
Throttle Position Sensor Retaining Bolts	3 N·m	24 lb in

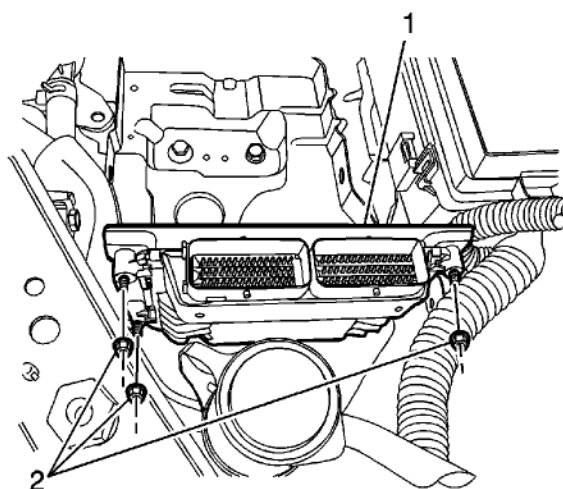
Engine Control Module Replacement

Removal Procedure

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



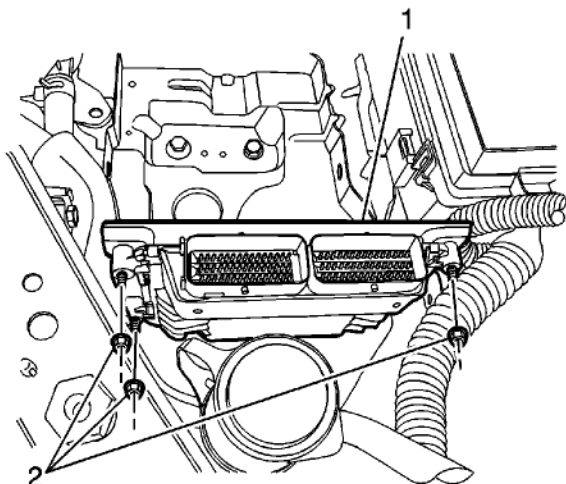
1. Disconnect the negative battery cable.
2. Pull the ECM connector lever.
3. Disconnect the ECM connector (1).



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4. Remove the ECM bracket retaining nuts (2).
5. Remove the ECM (1).

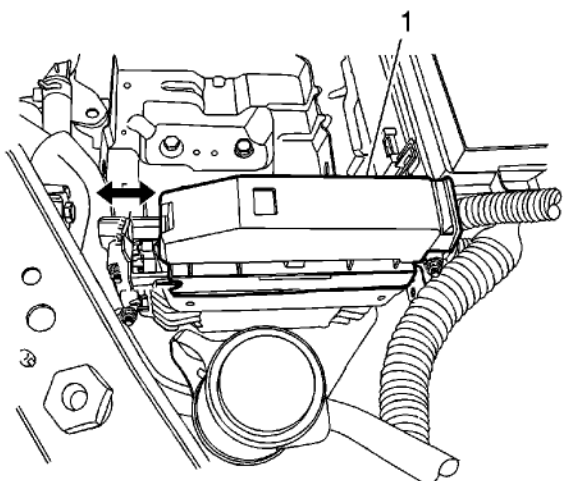
Installation Procedure



1. Install the ECM (1).

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

2. Install the ECM bracket retaining nuts (2) and tighten to **7 N·m (62 lb in)**.

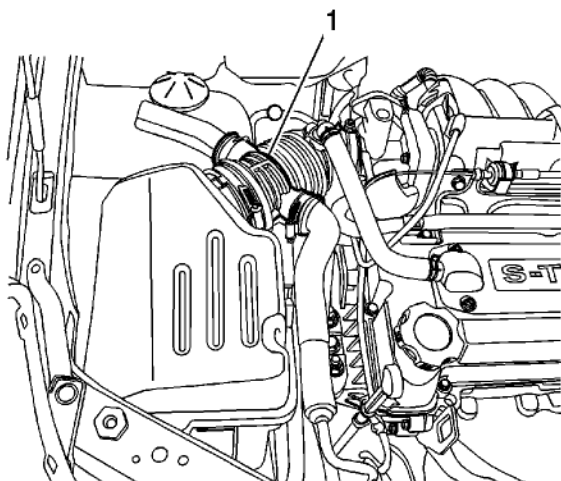


3. Connect the ECM connector (1).
4. Push the ECM connector lever.

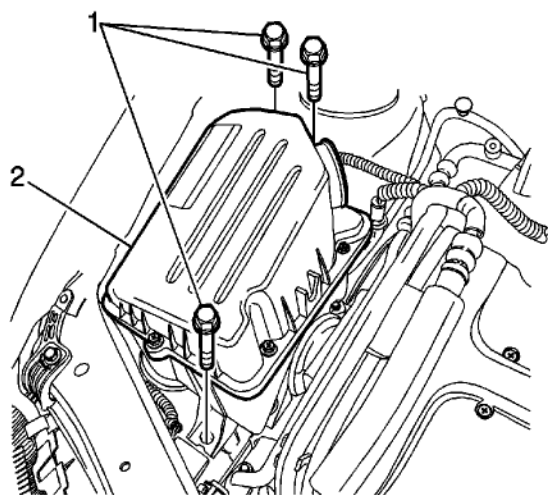
5. Connect the negative battery cable.

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).

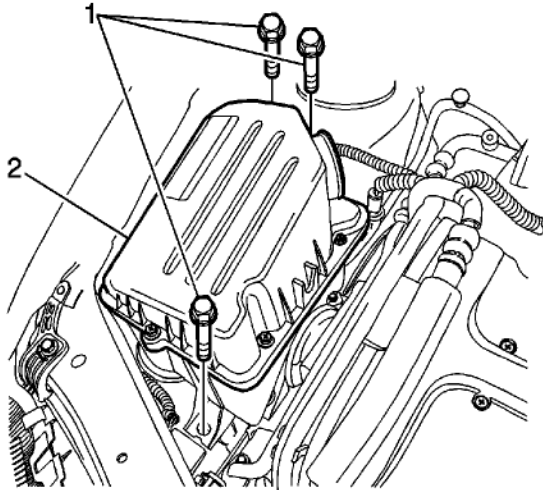


4. Remove the air cleaner assembly bolts (1).

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5. Remove the air cleaner assembly (2).

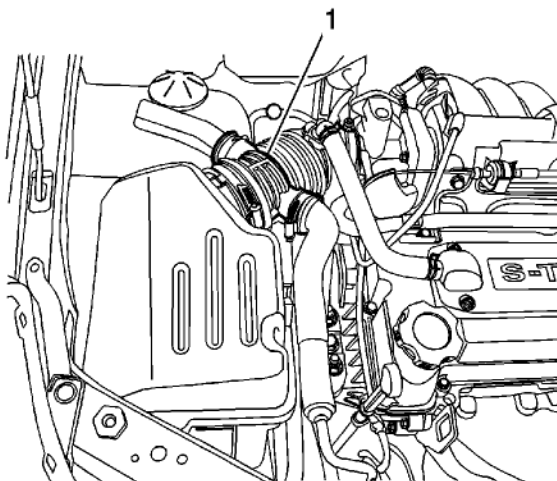
Installation Procedure



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](#)

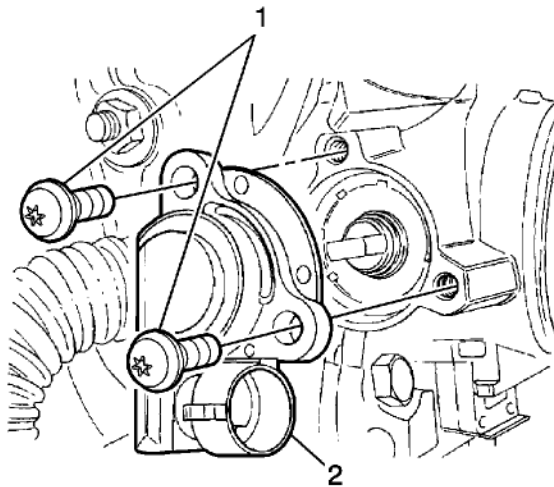
[Connection.](#)

Throttle Position Sensor Replacement

Removal Procedure

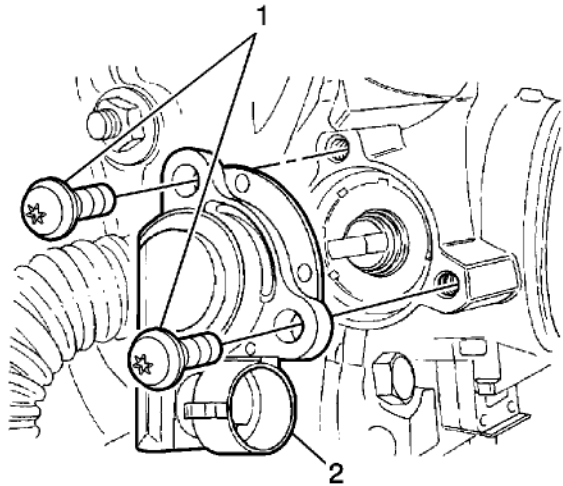
Warning: Refer to [Battery Disconnect Warning](#) in the Preface section.

1. Disconnect the battery negative cable. Refer to [Battery Negative Cable Disconnection and Connection](#).
2. Remove the air cleaner assembly. Refer to [Air Cleaner Assembly Replacement](#)
3. Disconnect the throttle position sensor (TPS) connector



4. Remove the TPS retaining bolts (1).
5. Remove the TPS (2).

Installation Procedure



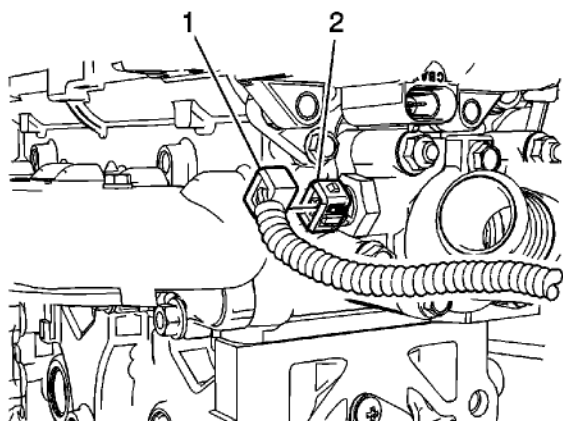
1. Install the TPS (2).

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

2. Install the TPS retaining bolts (1) and tighten to **2.7 N·m (23.9 lb in)**.
3. Connect the TPS connector.
4. Install the air cleaner assembly. Refer to [Air Cleaner Assembly Replacement](#)
5. Connect the battery negative cable. Refer to [Battery Negative Cable Disconnection and Connection](#).

Engine Coolant Temperature Sensor Replacement

Removal Procedure



Note: Use care when handling the ECT sensor. Damage to the sensor will affect the proper operation of the fuel injection system.

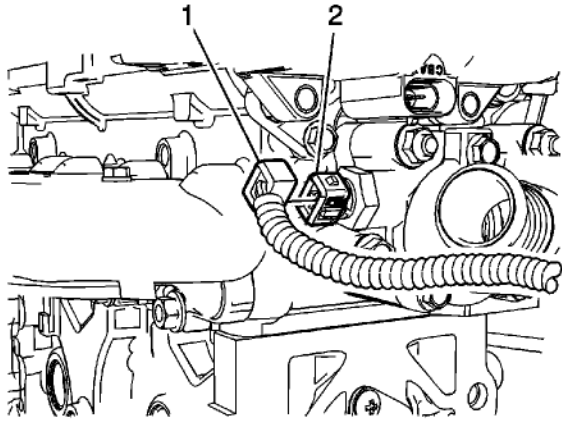
1. Relieve the coolant system pressure and remove the coolant. Refer to [Cooling System Draining and Filling](#)

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 engine coolant temperature (ECT) sensor connector (1).
4. Carefully remove the ECT sensor (2).

Installation Procedure

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

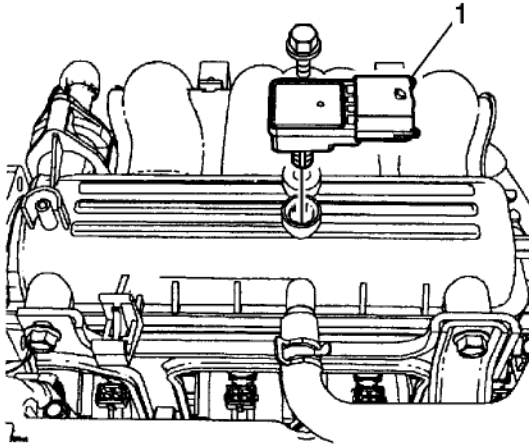


1. Install the ECT sensor (2) and tighten to **17.5 N·m (12.9 lb ft)**.
2. Connect the engine coolant temperature (ECT) sensor connector (1).
3. Connect the battery negative cable. Refer to [Battery Negative Cable Disconnection and Connection](#).
4. Fill the cooling system. Refer to [Cooling System Draining and Filling](#).

Manifold Absolute Pressure Sensor Replacement

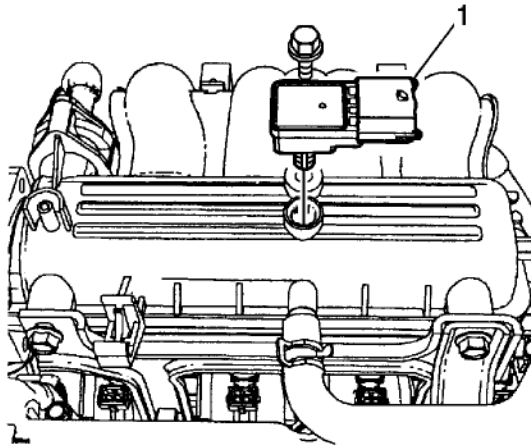
Removal Procedure

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



1. Disconnect the negative battery cable.
2. Disconnect the T-MAP sensor connector.
3. Remove the T-MAP sensor retaining bolt.
4. Remove the T-MAP sensor (1).

Installation Procedure



1. Install the T-MAP sensor (1).

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

2. Install the T-MAP sensor retaining bolt and tighten to **10 N·m (89 lb in)**.
3. Connect the T-MAP sensor connector.
4. Connect the negative battery cable.

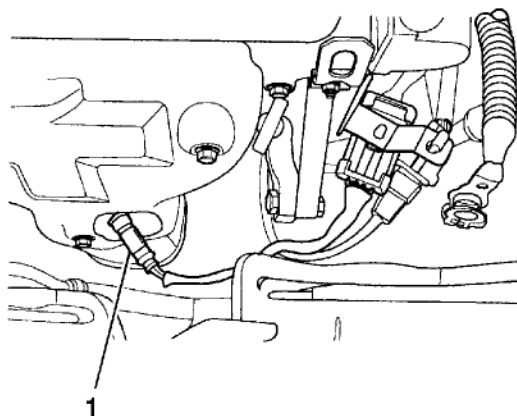
Heated Oxygen Sensor Replacement - Sensor 1

Special Tools

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

Removal Procedure

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



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

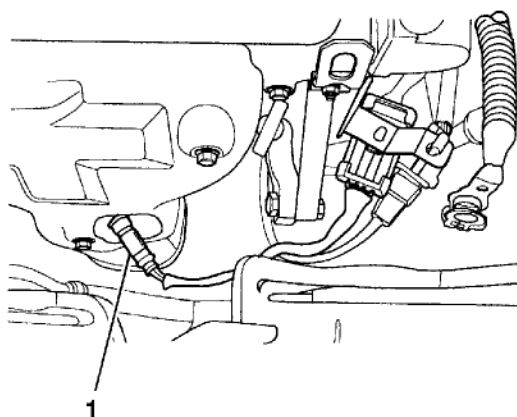
Caution: Refer to [Heated Oxygen and Oxygen Sensor Caution](#) in the Preface section.

2. Disconnect the front heated oxygen sensor (HO2S1) connector.

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

3. Carefully remove the HO2S1 (1) by using [EN-48259](#) from the exhaust manifold.

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.

2. Install the HO2S1 (1) into the exhaust manifold and tighten to **42 N·m (31 lb ft)**.
3. Connect the HO2S1 connector.
4. Connect the battery negative cable. Refer to [Battery Negative Cable Disconnection and Connection](#).

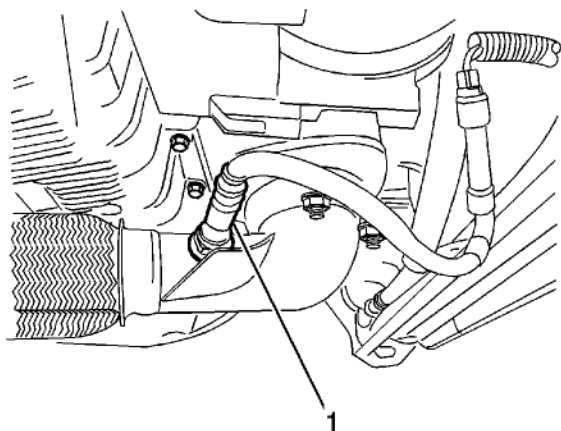
Heated Oxygen Sensor Replacement - Sensor 2

Special Tools

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

Removal Procedure

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



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

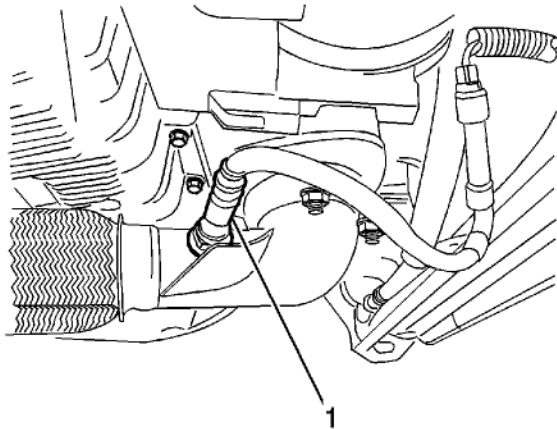
Caution: Refer to [Heated Oxygen and Oxygen Sensor Caution](#) in the Preface section.

2. Disconnect the electrical connector.

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

3. Carefully remove the HO2S2 (1) by using the [EN-48259](#).

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.

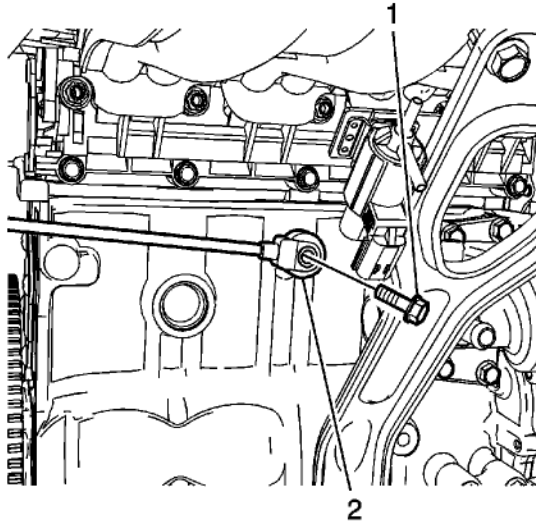
Caution: Refer to [Fastener Caution](#) in the Preface section.

2. Install the HO2S2 (1) into the exhaust front pipe and tighten the oxygen sensor to **42 N·m (31 lb ft)**.
3. Connect the HO2S2 connector.
4. Connect the battery negative cable. Refer to [Battery Negative Cable Disconnection and Connection](#).

Knock Sensor Replacement

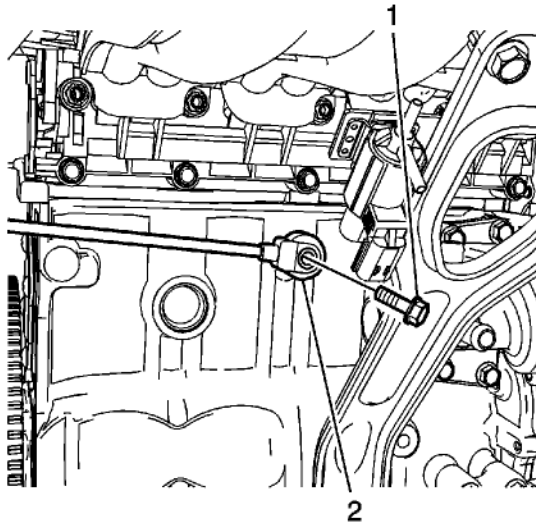
Removal Procedure

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. Disconnect the electrical connector at the knock sensor.
3. Remove the knock sensor retaining bolt (1) from the engine block.
4. Remove the knock sensor (2).

Installation Procedure



1. Install the knock sensor (2).

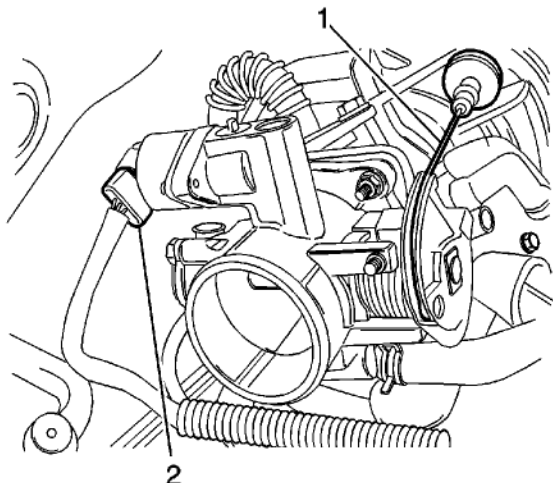
Caution: Refer to [Fastener Caution](#) in the Preface section.

2. Install the knock sensor retaining bolt (1) and tighten to 20 N·m (15 lb ft).
3. Connect the electrical connector at the knock sensor.
4. Connect the battery negative cable. Refer to [Battery Negative Cable Disconnection and Connection](#).

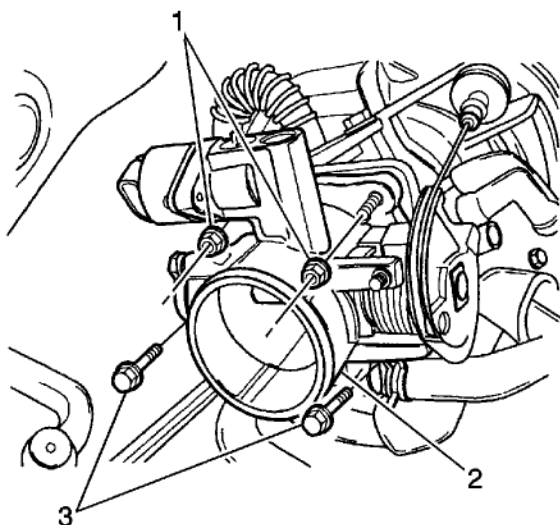
Throttle Body Assembly Replacement

Removal Procedure

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



1. Disconnect the battery negative cable. Refer to [Battery Negative Cable Disconnection and Connection](#).
2. Remove the air cleaner assembly. Refer to [Air Cleaner Assembly Replacement](#)
3. Disconnect the throttle cable (2).
4. Disconnect the throttle position sensor (TPS) and IACV connectors (1).
5. Disconnect the coolant inlet and outlet hose.



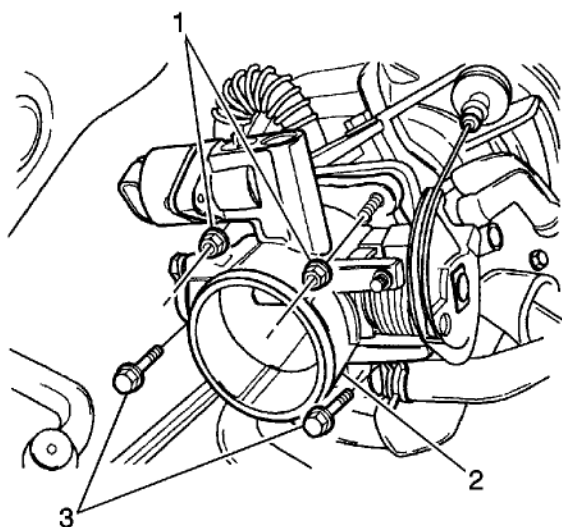
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Note: Cover the entrance of the intake manifold after removing the throttle body to prevent any dirt from entering.

6. Remove the throttle body retaining bolts (3) and nuts (1).
7. Remove the throttle body (2) with the gasket.

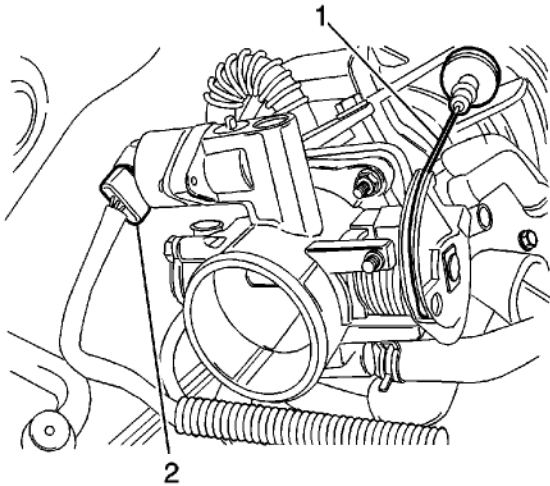
Installation Procedure



1. Install the throttle body (2) with the NEW throttle body gasket.

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

2. Install the throttle body retaining bolts (3) and nuts (1) and tighten to **10.5 N·m (7.7 lb ft)**.



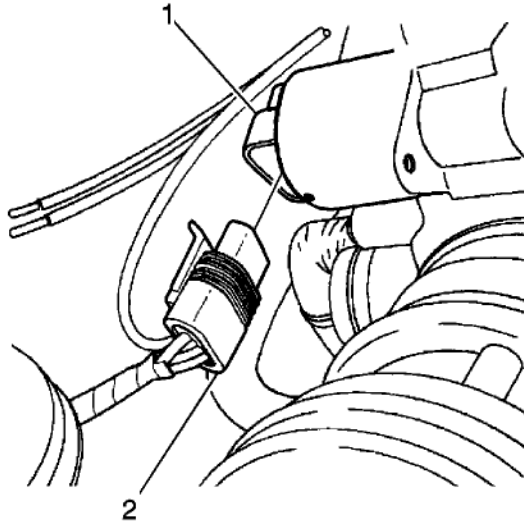
Note: After connecting the throttle cable, check that the throttle valve is closed fully.

3. Connect the throttle cable (2).
4. Connect the throttle position sensor (TPS) and the IACV connectors (1).
5. Connect the coolant hose.
6. Connect the battery negative cable. Refer to [Battery Negative Cable Disconnection and Connection](#).

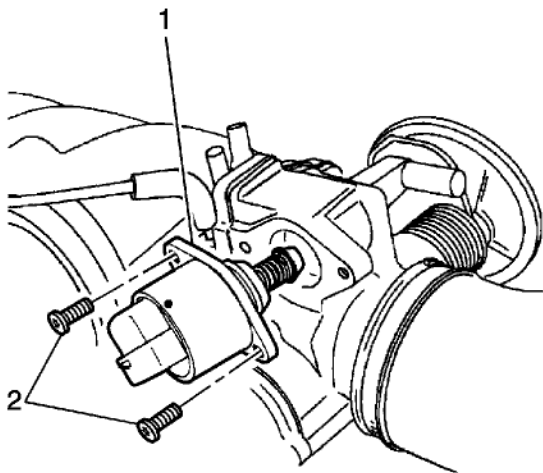
Idle Air Control Valve Replacement

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 idle air control valve (IACV) connector (2).

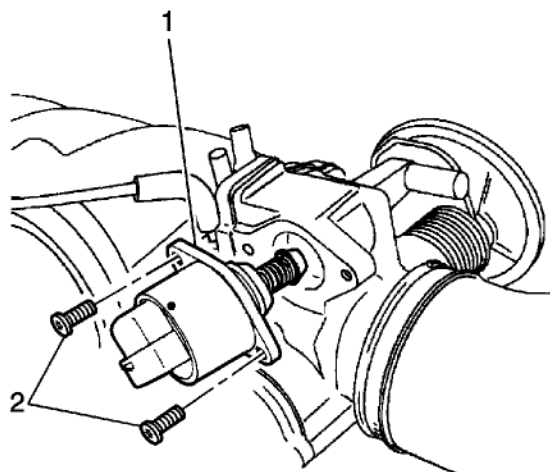


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Note: Clean the IAC valve O-ring seal area, the pintle valve seat and the air passage with a suitable fuel system cleaner. Do not use methyl ethyl ketone.

3. Remove the IACV retaining bolts (2).
4. Remove the IACV (1).

Installation Procedure

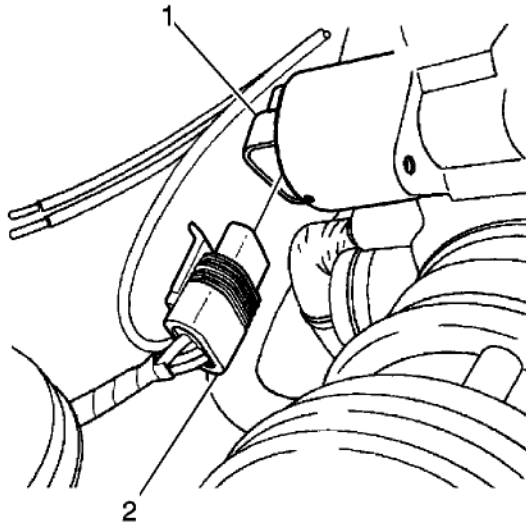


Note: If installing a new IAC valve, be sure to replace it with an identical part. On IACV that have been in service, do not push on the valve pintle. The force required to move the pintle may damage the threads on the worm drive.

1. Install the new O-ring seal with the IACV (1).

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

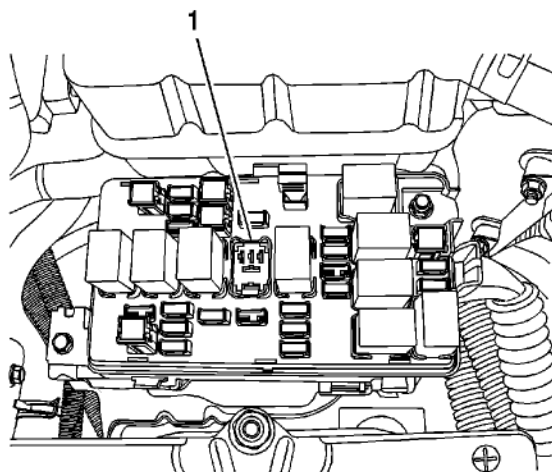
2. Install the IACV retaining bolts (2) and tighten to **3 N·m (27 lb in)**.



3. Connect the IACV connector (2).
4. Connect 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.



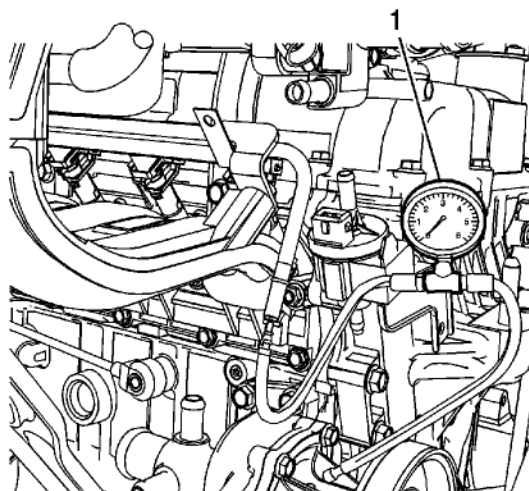
1. Remove the fuel cap.
2. Remove the fuel pump fuse (1) from the engine fuse block.
3. Start the engine and allow the engine to stall.
4. Crank the engine for an additional 10 seconds.

Fuel Pressure Gage Installation and Removal

Special Tools

[DW100-010](#) Fuel Pressure Gage

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



1. Relieve the fuel pressure. Refer to [Fuel Pressure Relief](#).
2. Remove the air cleaner assembly. Refer to [Air Cleaner Assembly Replacement](#).
3. Install the [DW100-010](#).
4. Measure the fuel pressure.

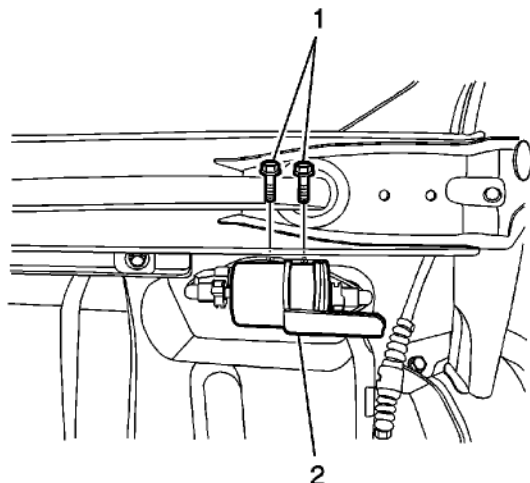
Fuel Pressure Specification

380 kPa (battery voltage: 13.2V)

Fuel Filter Replacement

Removal Procedure

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

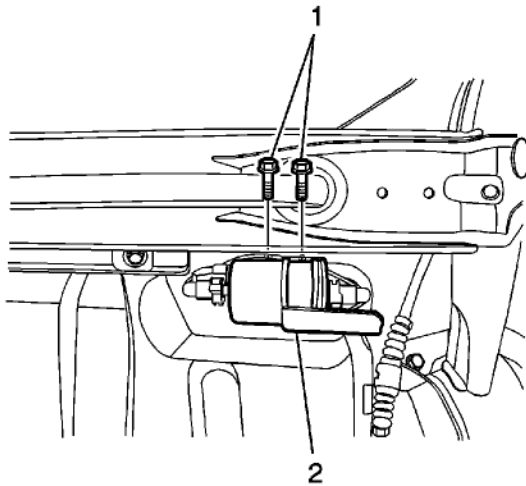


1. Relieve the fuel pressure. Refer to [Fuel Pressure Relief](#).

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 Draining

Warning: Gasoline or gasoline vapors are highly flammable. A fire could occur if an ignition source is present. Never drain or store gasoline or diesel fuel in an open container, due to the possibility of fire or explosion. Have a dry chemical (Class B) fire extinguisher nearby.

1. Loosen the fuel filler cap.
2. Remove the fuel sender assembly. Refer to [Fuel Sender Assembly Replacement](#).
3. Use a hand operated pump device in order to drain the fuel through the fuel sender assembly opening on the fuel tank.

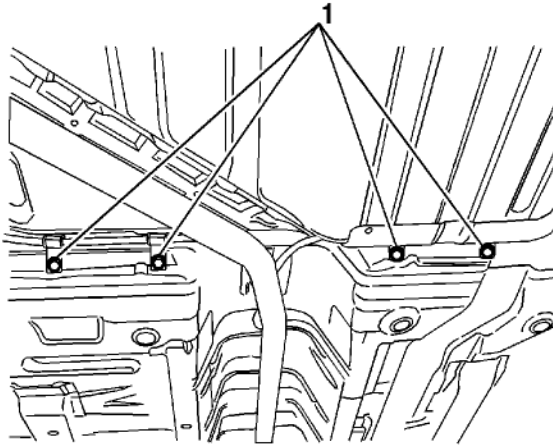
Note: If you are removing the fuel tank do not connect the fuel or vapor lines. Do not connect the electrical connectors or install the access panel.

4. Install the fuel sender assembly to the fuel tank. Refer to [Fuel Sender Assembly Replacement](#).
5. Tighten the fuel filler cap.

Fuel Tank Replacement

Removal Procedure

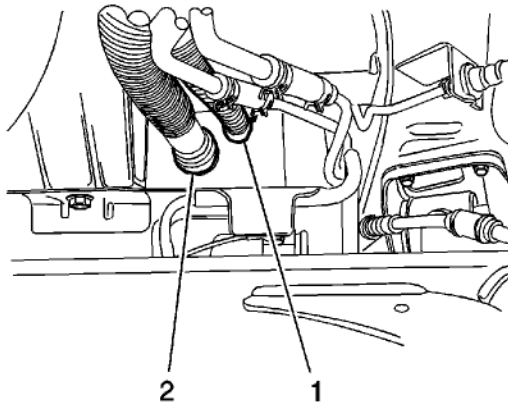
Caution: Refer to [Fuel Pressure Caution](#) in the Preface section.



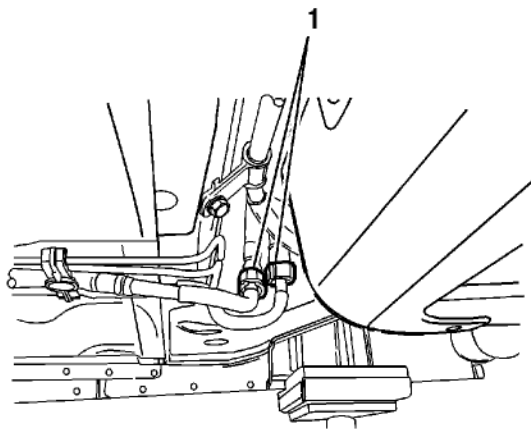
1. Relieve the fuel pressure. Refer to [Fuel Pressure Relief](#).

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

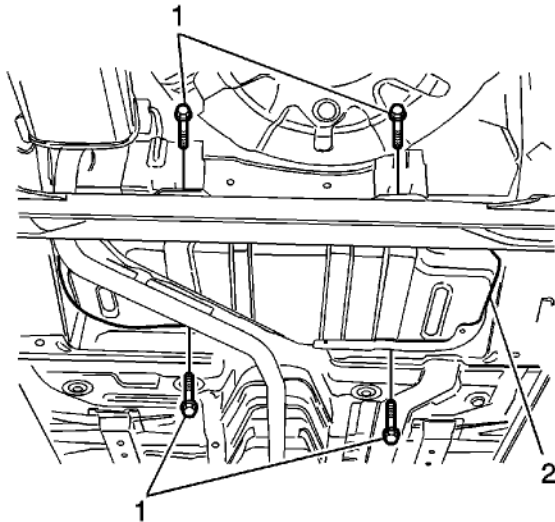
2. Disconnect the battery negative cable. Refer to [Battery Negative Cable Disconnection and Connection](#).
3. Drain the fuel tank.
4. Disconnect the parking brake cable retainer clamps (1) and the support along the fuel tank to provide clearance for the tank.



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

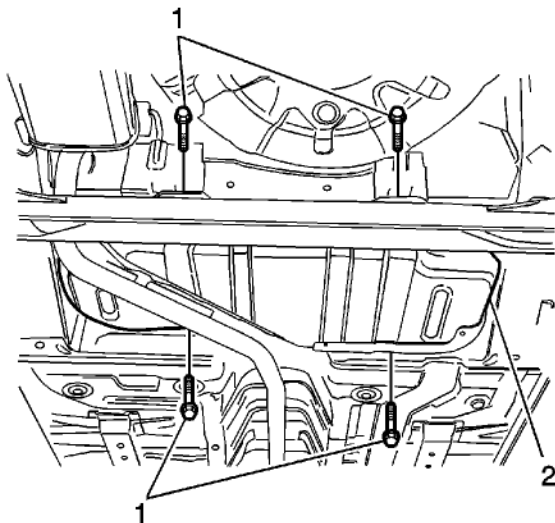


9. Disconnect the fuel pump harness connector at the right rear corner of the fuel tank.
10. Disconnect the fuel inlet line (1) near the right front of the fuel tank.
11. Disconnect the wiring harness clips and the fuel line clips as needed.



12. Support the fuel tank.
13. Remove the fuel tank retaining bolts (1).
14. Carefully lower the fuel tank (2).
15. Remove the fuel tank (2).
16. Transfer any parts as needed.

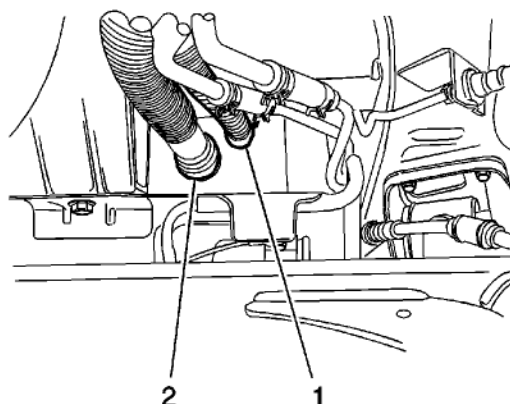
Installation Procedure



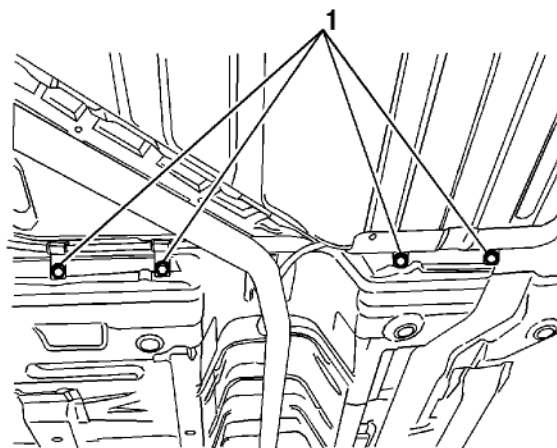
1. Raise the fuel tank (2) into position.

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

2. Install the fuel tank mounting bolts (1) and tighten to **20 N·m (15 lb ft)**.



3. Connect the fuel outlet line.
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 and tighten 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.

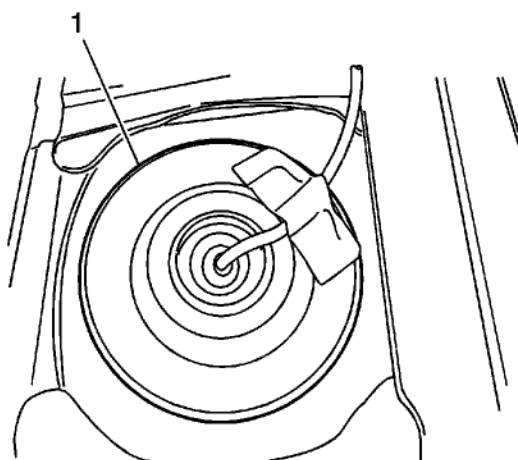
Fuel Sender Assembly Replacement

Special Tools

EN-49090 Remover/Installer - Fuel Pump Lock Ring

Removal Procedure

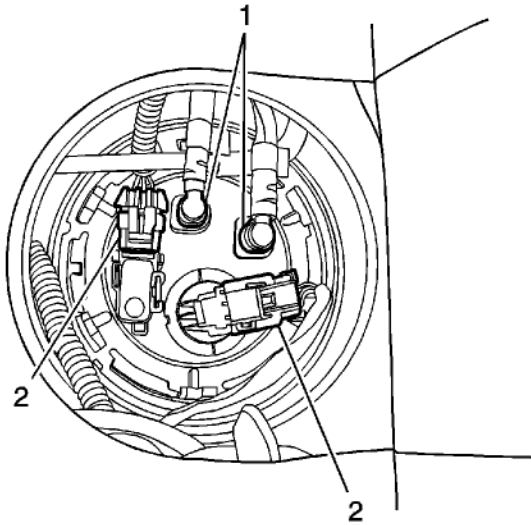
Caution: Refer to [Fuel Pressure Caution](#) in the Preface section.



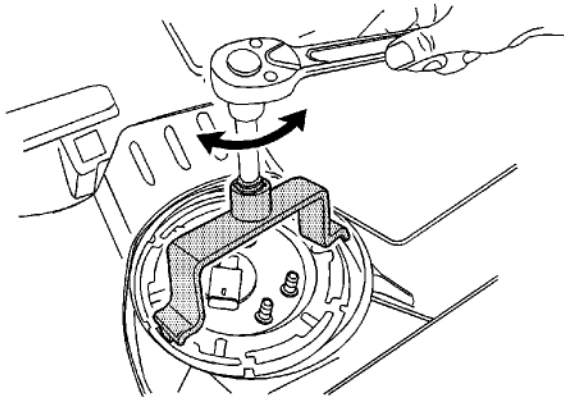
1. Relieve the fuel pressure.

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

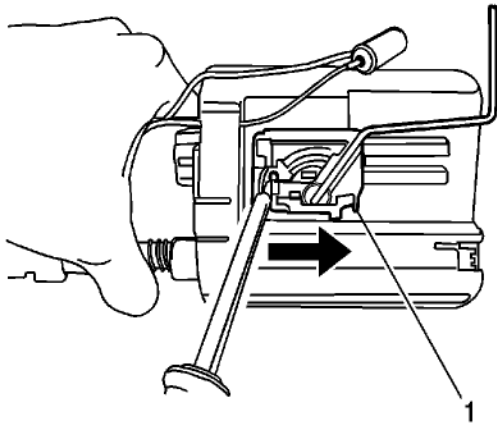
2. Disconnect the battery negative cable. Refer to [Battery Negative Cable Disconnection and Connection](#).
3. Remove the rear seat. Refer to [Rear Seat Replacement](#).
4. Remove the fuel pump access cover (1).



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

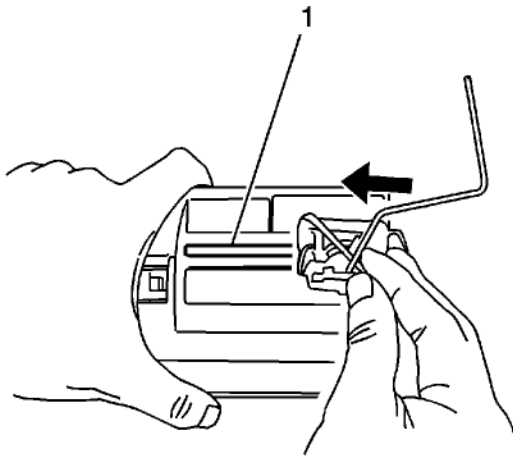


7. Remove the fuel pump lock ring by using EN-49090.
8. Remove the fuel pump.
9. Disconnect the insulator.



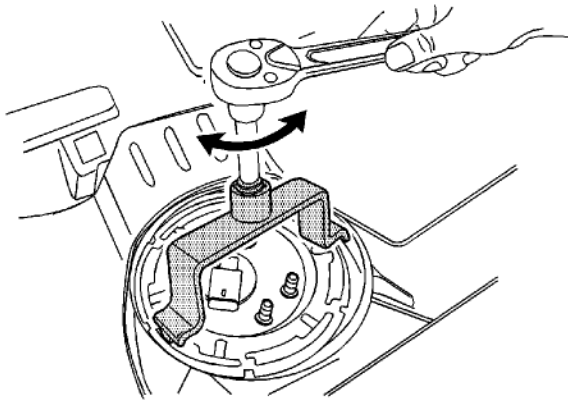
10. Remove the fuel sender assembly (1).

Installation Procedure

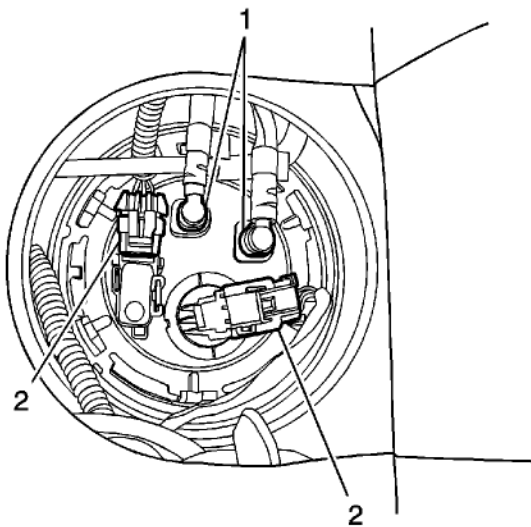


Note: Be careful to install the fuel sender to fuel pump housing exactly. If not installed exactly, fuel indicating may be incorrect.

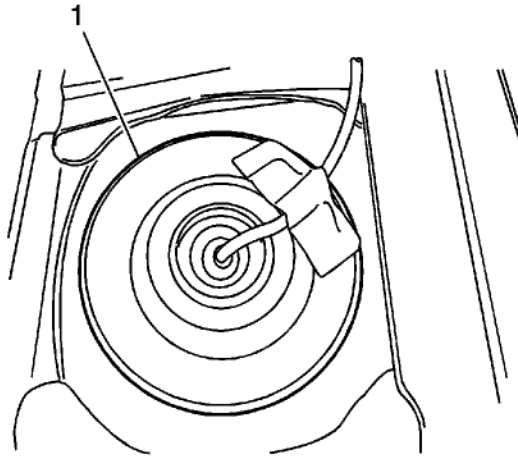
1. Install the fuel sender assembly (1).
2. Connect the fuel sender insulator.



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



5. Connect the electrical connectors (2) at the fuel pump assembly.
6. Connect the fuel outlet 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](#).

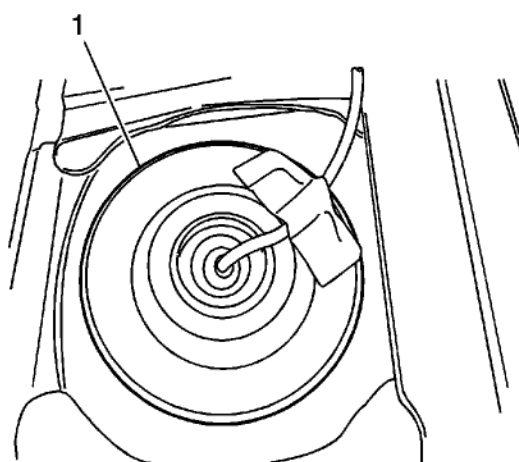
Fuel Pump Replacement

Special Tools

EN-49090 Remover/Installer - Fuel Pump Lock Ring

Removal Procedure

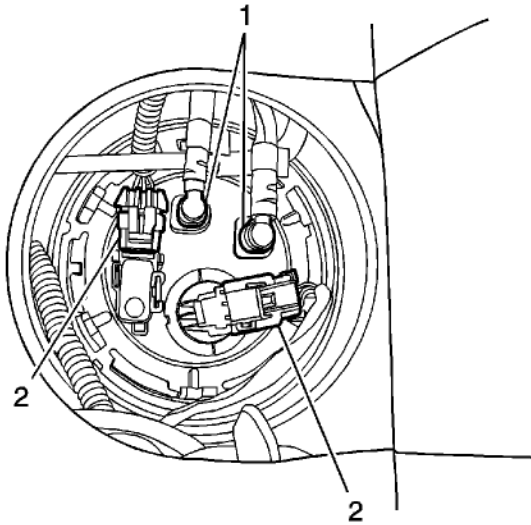
Caution: Refer to [Fuel Pressure Caution](#) in the Preface section.



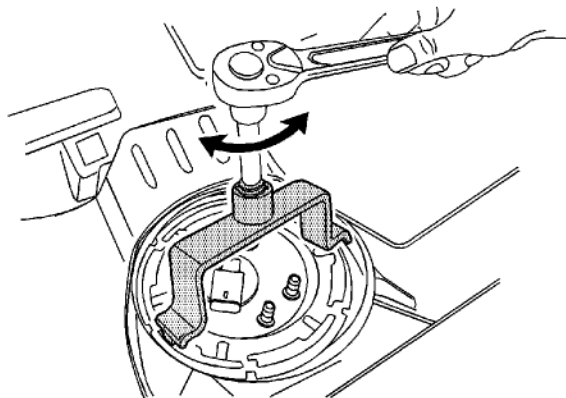
1. Relieve the fuel pressure. Refer to [Fuel Pressure Relief](#)

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

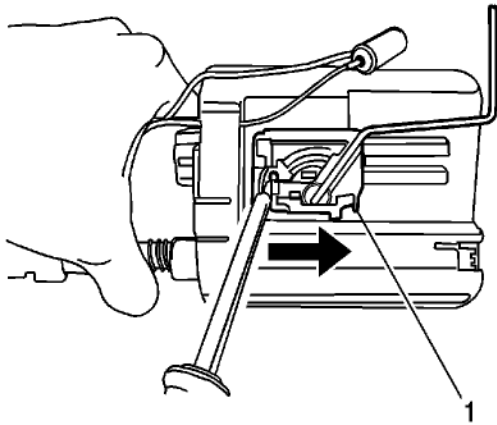
2. Disconnect the battery negative cable. Refer to [Battery Negative Cable Disconnection and Connection](#).
3. Remove the rear seat. Refer to [Rear Seat Replacement](#)
4. Remove the fuel pump access cover (1).



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

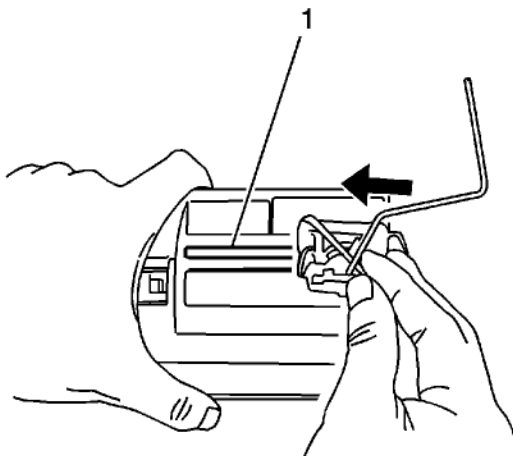


7. Remove the fuel pump lock ring by using EN-49090.
8. Remove the fuel pump.
9. Disconnect the insulator.



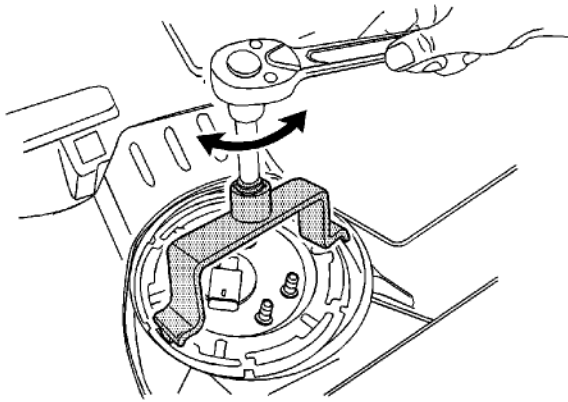
10. Remove the fuel sender assembly (1).

Installation Procedure

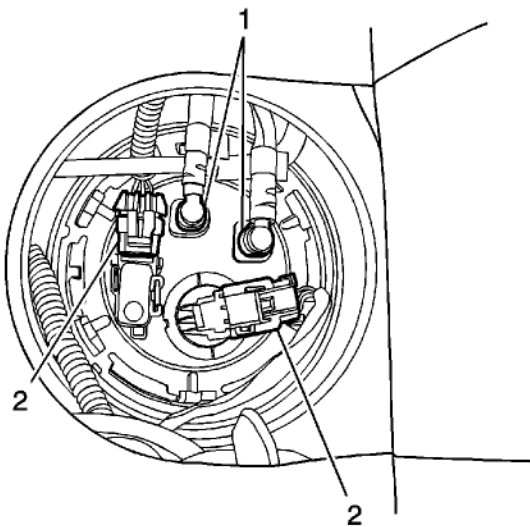


Note: Be careful to install the fuel sender to fuel pump housing exactly. If not installed exactly, fuel indicating may be incorrect.

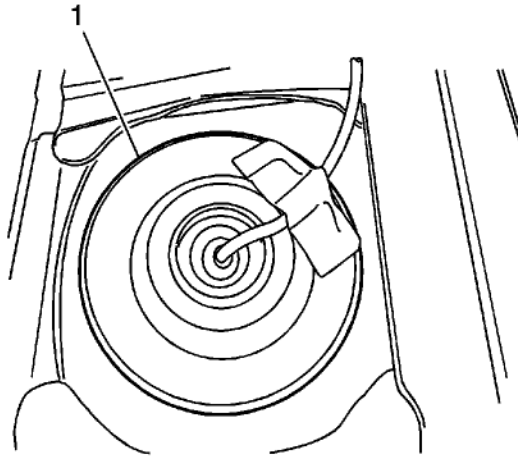
1. Install the fuel sender assembly (1).
2. Connect the fuel sender insulator.



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



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

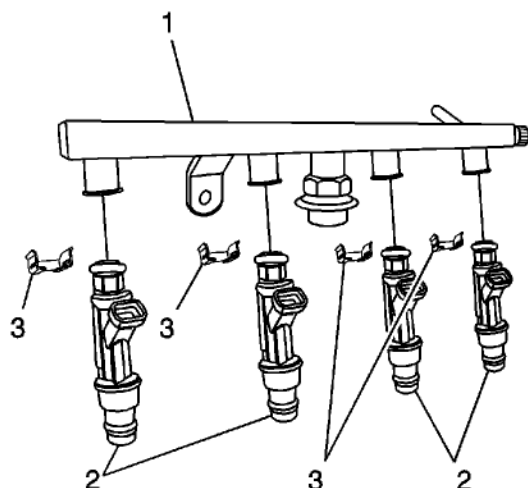
Removal Procedure

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

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

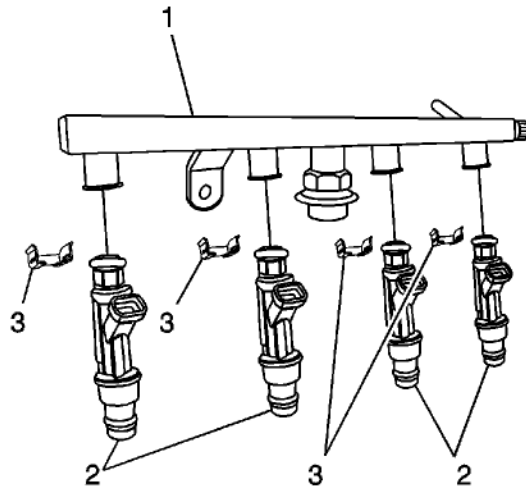
Caution: Refer to [Fuel Pressure Caution](#) in the Preface section.

2. Relieve the fuel pressure. Refer to [Fuel Pressure Relief](#).
3. Remove the air cleaner assembly. Refer to [Air Cleaner Assembly Replacement](#).
4. Disconnect the quick connector fuel feed line from the fuel rail.
5. Disconnect the wiring harness from the upper side of the fuel rail.
6. Disconnect the fuel injector harness connector.
7. Remove the fuel rail mounting bolts.
8. Remove the fuel rail with the fuel injectors attached.



9. Remove the fuel injector retainer clips (3).
10. Remove the fuel injectors (2) by pulling down and out.
11. Discard the fuel injector O-rings.

Installation Procedure



Note: Different injectors are calibrated for different flow rates. When ordering new fuel injectors, be certain to order the identical part number that is inscribed on the old injector.

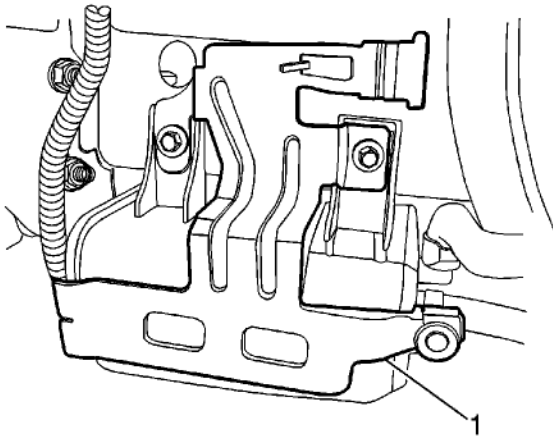
1. Install the new O-rings on the fuel injectors (2).
2. Install the retainer clip (3) after installing injectors on the fuel rail (1).
3. Install the fuel rail and injector assembly to the intake manifold.

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

4. Install the fuel rail retaining bolts and tighten to **10 N·m (7.3 lb ft)**.
5. Connect the fuel injector harness connectors.
6. Connect the harness on the upper side of the fuel rail.
7. Connect the quick connector fuel feed line on the fuel rail.
8. Install the air cleaner assembly. Refer to [Air Cleaner Assembly Replacement](#)
9. Connect the battery negative cable. Refer to [Battery Negative Cable Disconnection and Connection](#).

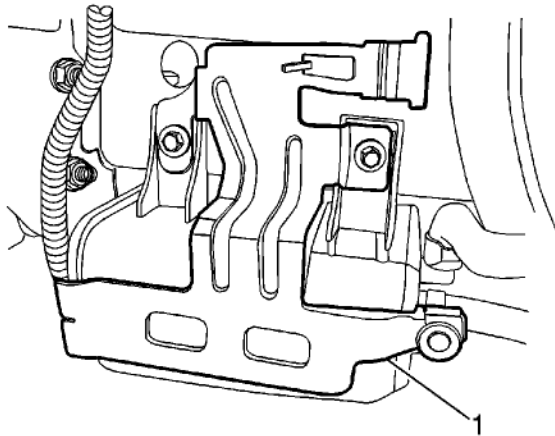
Evaporative Emission Canister Replacement

Removal Procedure



1. Remove the EVAP canister vent solenoid valve.
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).

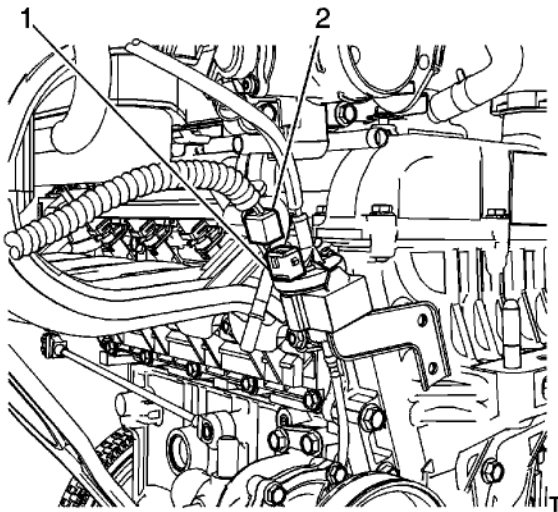
Caution: Refer to [Fastener Caution](#) in the Preface section.

2. Install the EVAP canister bracket retaining bolt and tighten to **8 N·m (71 lb in)**.
3. Connect the inlet and outlet hose to the EVAP canister.
4. Install the EVAP canister vent solenoid valve.

Evaporative Emission Canister Purge Solenoid Valve Replacement

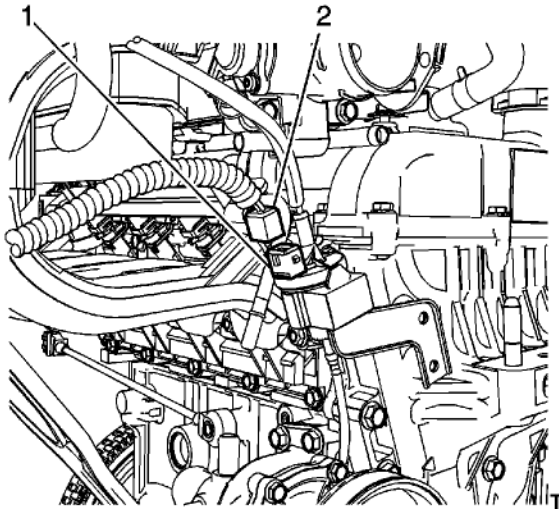
Removal Procedure

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. Remove the air cleaner assembly. Refer to [Air Cleaner Assembly Replacement](#).
3. Disconnect the EVAP canister purge solenoid connector (2).
4. Disconnect the EVAP canister purge solenoid inlet and outlet hose.
5. Remove the EVAP canister purge solenoid (1) from the bracket.

Installation Procedure

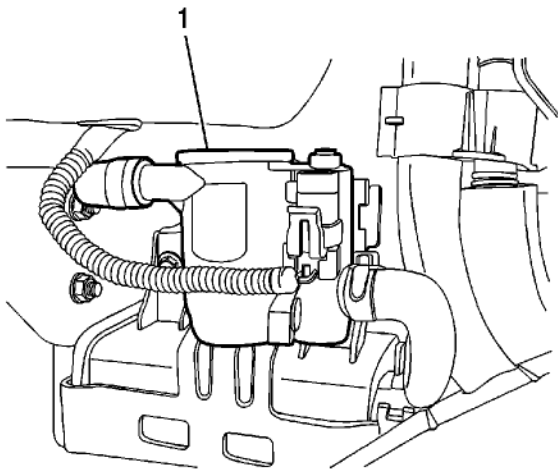


1. Install the EVAP canister purge solenoid (1) to the bracket.
2. Connect the EVAP canister purge solenoid inlet and outlet hose.
3. Connect the EVAP canister purge solenoid connector (2).
4. Install the air cleaner assembly. Refer to [Air Cleaner Assembly Replacement](#).
5. Connect the battery negative cable. Refer to [Battery Negative Cable Disconnection and Connection](#).

Evaporative Emission Canister Vent Solenoid Valve Replacement

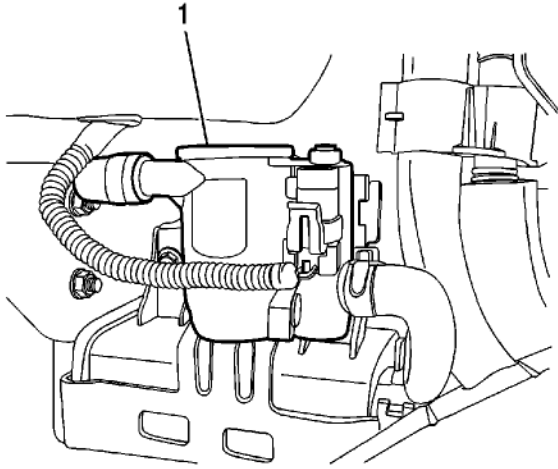
Removal Procedure

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

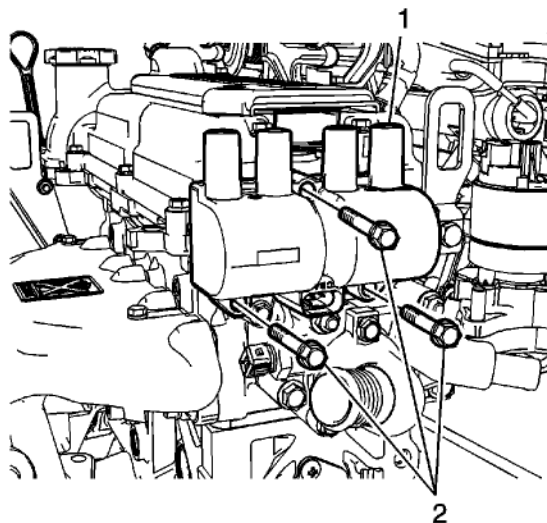


1. Install the EVAP canister vent assembly (1) pushing it to the right side.
2. Connect the EVAP canister vent hose.
3. Connect the EVAP canister vent solenoid valve connector.
4. Connect the battery negative cable. Refer to [Battery Negative Cable Disconnection and Connection](#).

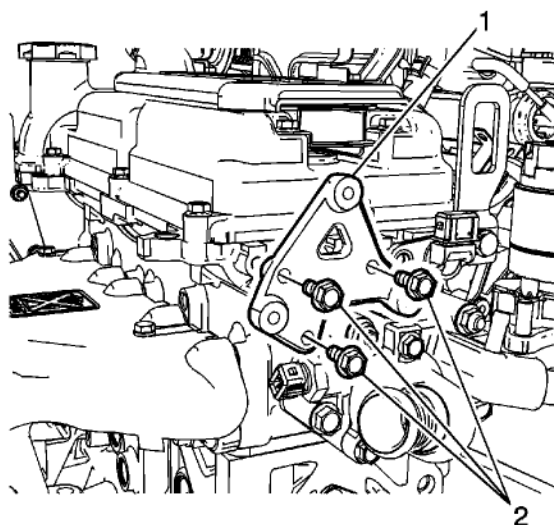
Ignition Coil Replacement

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 ignition cables.
3. Disconnect the ignition cable harness connector.
4. Remove the ignition coil retaining bolts (2).
5. Remove the ignition coil (1).

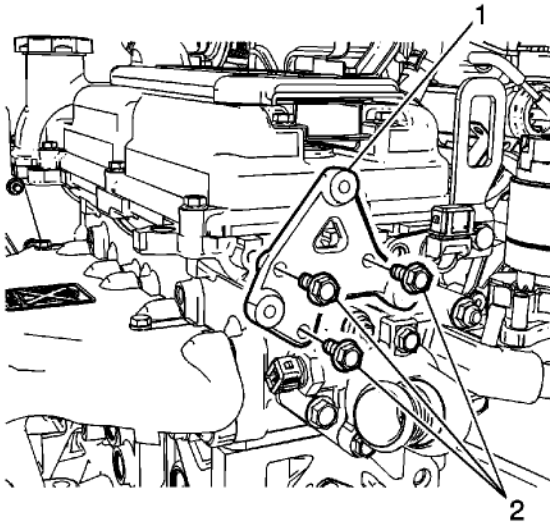


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6. Remove the ignition coil bracket retaining bolts (2).
7. Remove the ignition coil bracket (1).

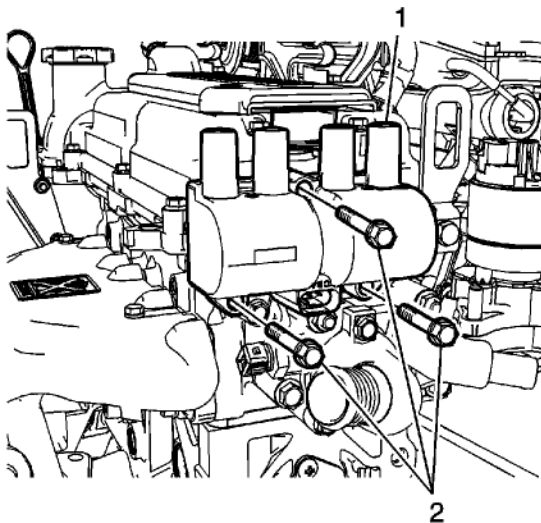
Installation Procedure



1. Install the ignition coil bracket (1).

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

2. Install the ignition coil bracket retaining bolts (2) and tighten to 10 N·m (7.3 lb ft).





3. Install the ignition coil (1).
4. Install the ignition coil retaining bolts (2) and tighten to **10 N·m (7.3 lb ft)**.
5. Connect the ignition coil harness connector.
6. Connect the ignition cables.
7. Connect the battery negative cable. Refer to [Battery Negative Cable Disconnection and Connection](#).

Spark Plug Wire Inspection

Spark plug wire integrity is vital for proper engine operation. A thorough inspection will be necessary to accurately identify conditions that may affect engine operation. Inspect for the following conditions:

1. Correct routing of the spark plug wires. Incorrect routing may cause cross-firing.
2. Any signs of cracks or splits in the wires.
3. Inspect each boot for the following conditions:
 - Tearing
 - Piercing
 - Arcing
 - Carbon tracking
 - Corroded terminal

If corrosion, carbon tracking, or arcing are indicated on a spark plug wire boot or on a terminal, replace the wire and the component connected to the wire.

Spark Plug Wire Replacement

Removal Procedure

1. Turn OFF the ignition.
2. Disconnect the spark plug wire at each spark plug.
 - Twist each spark plug boot 1/2 turn before removing.
 - Pull only on the boot or use a tool designed for this purpose in order to remove the wire from each spark plug.
3. Disconnect the spark plug wire from the coil.
 - Twist each spark plug boot 1/2 turn before removing.
 - Pull only on the boot or use a tool designed for this purpose in order to remove the wires from the coil.

Installation Procedure

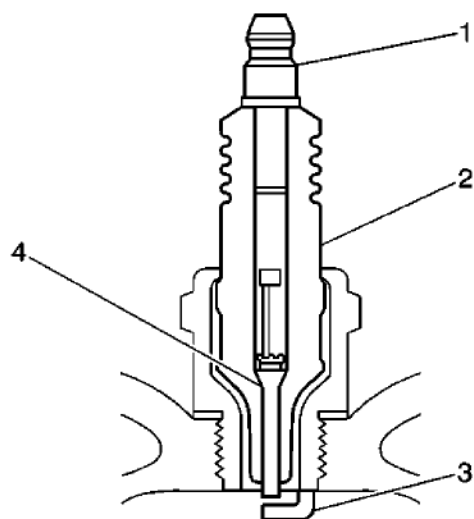
1. Install the spark plug wire on the coil.
2. Install the spark plug wire at each spark plug.
3. Inspect the wires for proper installation:
 - Push down on each boot in order to inspect the seating.
 - Reinstall any loose boot.
 - Wire routing must be kept intact during service and followed exactly when wires have been disconnected or when replacement of the wires is necessary. Failure to route the wires correctly can lead to radio interference and crossfire of the plugs, or shorting of the leads to the ground.
 - Any time the spark plug wires or boots are installed on the spark plugs, new dielectric grease needs to be applied inside the boot.

Spark Plug Inspection

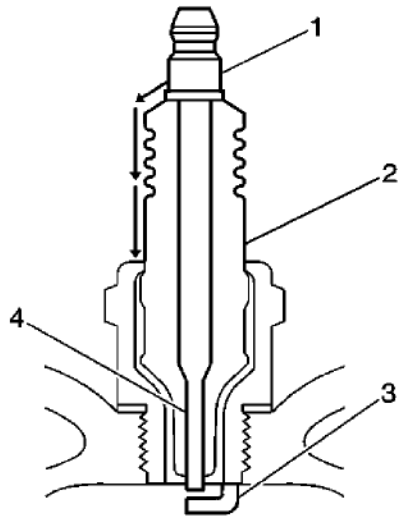
Spark Plug Usage

- 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

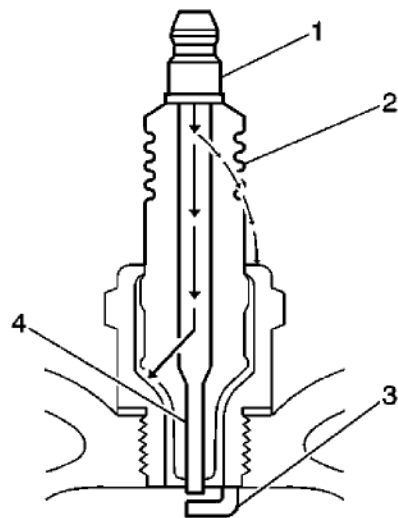
Spark Plug Inspection



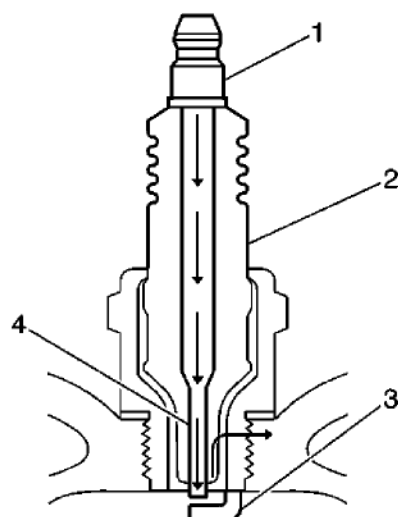
1. Inspect the terminal post (1) for damage.
 - Inspect for a bent or broken terminal post (1).
 - Test for a loose terminal post (1) by twisting and pulling the post. The terminal post (1) should NOT move.



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.

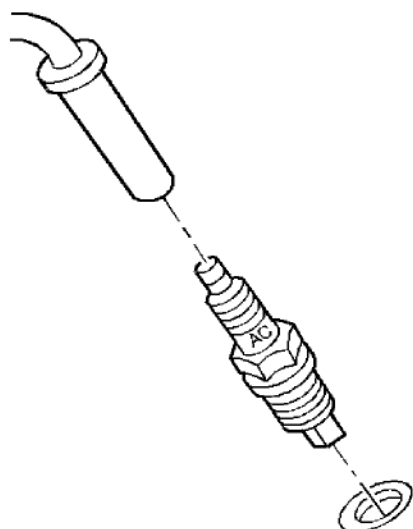
Spark Plug Replacement

Removal Procedure

Caution: Observe the following service precautions:

- Allow the engine to cool before removing the spark plugs. Attempting to remove spark plugs from a hot engine can cause the spark plugs to seize. This can damage the cylinder head threads.
- Clean the spark plug recess area before removing the spark plug. Failure to do so can result in engine damage due to dirt or foreign material entering the cylinder head, or in contamination of the cylinder head threads. Contaminated threads may prevent proper seating of the new spark plug.
- Use only the spark plugs specified for use in the vehicle. Do not install spark plugs that are either hotter or colder than those specified for the vehicle. Installing spark plugs of another type can severely damage the engine.

1. Turn OFF the ignition.



2. Remove the spark plug wires from the spark plugs. Refer to [Spark Plug Wire Replacement](#).
3. Remove the spark plugs from the engine.

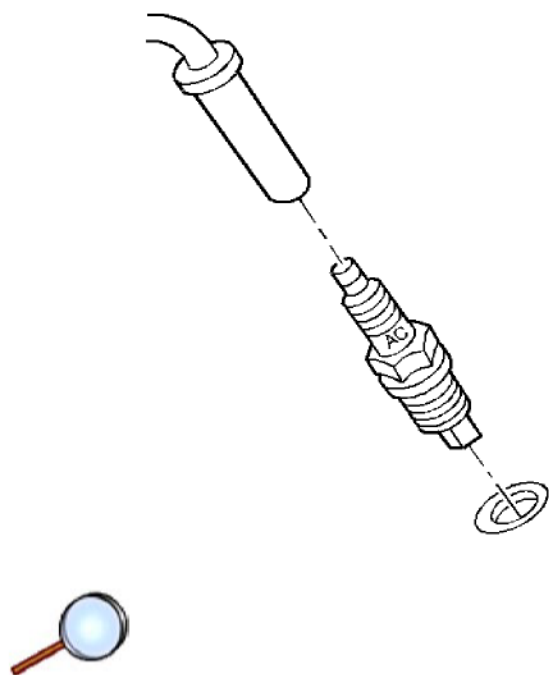
Installation Procedure

Caution: It is important to check the gap of all new and reconditioned spark plugs before installation. Pre-set gaps may have changed during handling. Use a round wire feeler gauge to be sure of an accurate check, particularly on used plugs. Installing plugs with the wrong gap can cause poor engine performance and may even damage the engine.

1. Gap the spark plugs to the specifications.

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



Caution: Be sure plug threads smoothly into cylinder head and is fully seated. Use a thread chaser if necessary to clean threads in cylinder head. Cross-threading or failing to fully seat spark plug can cause overheating of plug, exhaust blow-by, or thread damage. Follow the recommended torque specifications carefully. Over or under-tightening can also cause severe damage to engine or spark plug.

2. Install the spark plugs to the engine.

Tighten

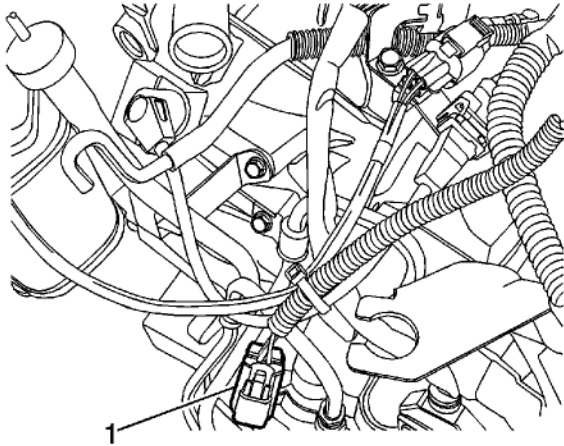
Tighten the spark plugs to 25 N·m (18 lb ft).

3. Install the spark plug wires to the spark plugs. Refer to [Spark Plug Wire Replacement](#).

Crankshaft Position Sensor Replacement

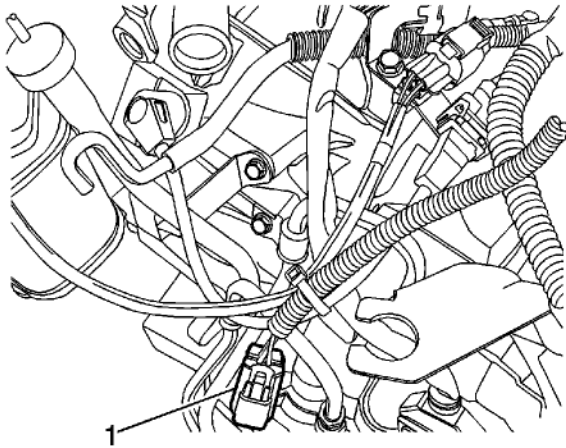
Removal Procedure

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. Disconnect the crankshaft position (CKP) sensor connector (1).
3. Remove the CKP sensor retaining bolt.
4. Remove the CKP sensor.

Installation Procedure



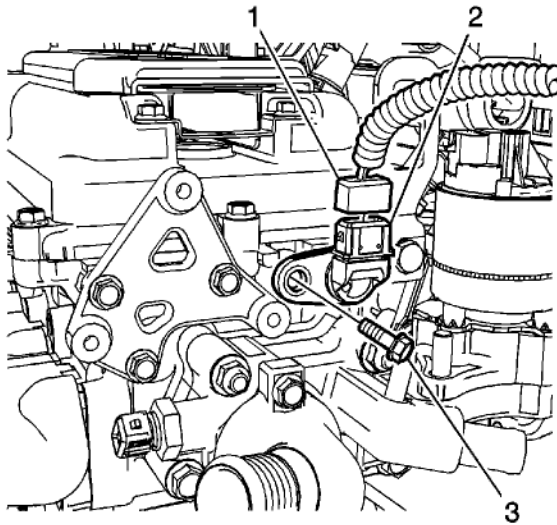
1. Install the CKP sensor.

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

2. Install the CKP sensor retaining bolt and tighten to **6.5 N·m (58 lb in)**.
3. Connect the crankshaft position (CKP) sensor connector (1).
4. Connect the battery negative cable. Refer to [Battery Negative Cable Disconnection and Connection](#).

Camshaft Position Sensor Replacement

Removal Procedure

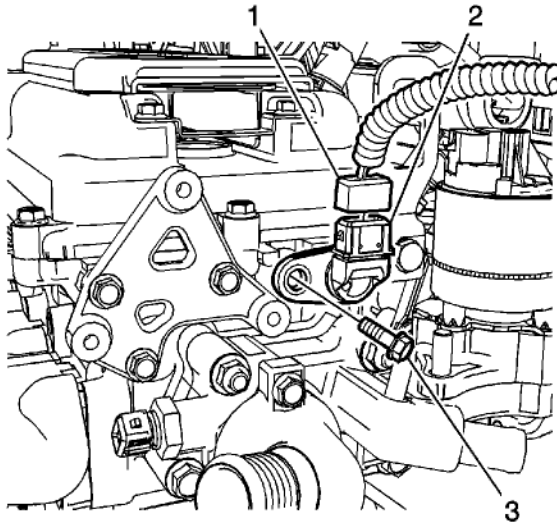


Note: A small amount of engine oil may be lost after removal of the camshaft position sensor.

1. Remove the ignition coil.
2. Disconnect the sensor electrical connector (1).
3. Remove the camshaft position (CMP) sensor bolt (3) and sensor (2).

Installation Procedure

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

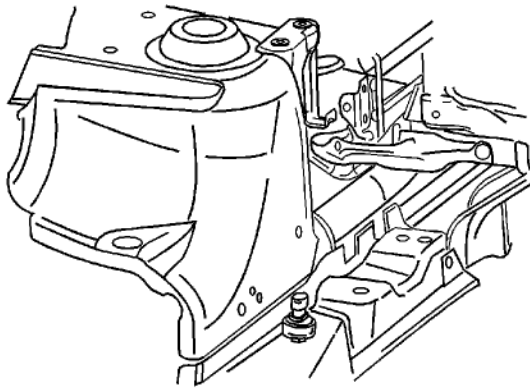


1. Install the CMP sensor (2) and bolts (3) and tighten to **12 N·m (106 lb in)**.
2. Connect the sensor electrical connector (1).
3. Install the ignition coil.

Rough Road Sensor Replacement

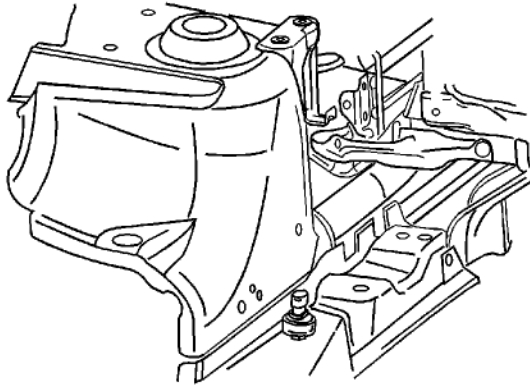
Removal Procedure

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 rough road sensor electrical connector and remove the rough road sensor.

Installation Procedure

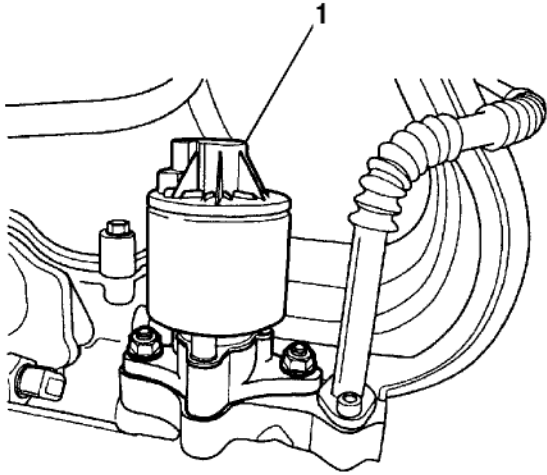


1. Install the rough road sensor and connect the electrical connector.
2. Connect the battery negative cable. Refer to [Battery Negative Cable Disconnection and Connection](#).

Exhaust Gas Recirculation Valve Replacement

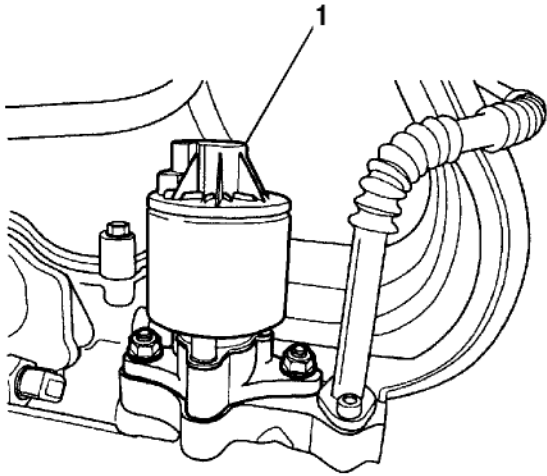
Removal Procedure

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 EGR valve electrical connector.
3. Remove the nuts and the EGR valve (1)

Installation Procedure



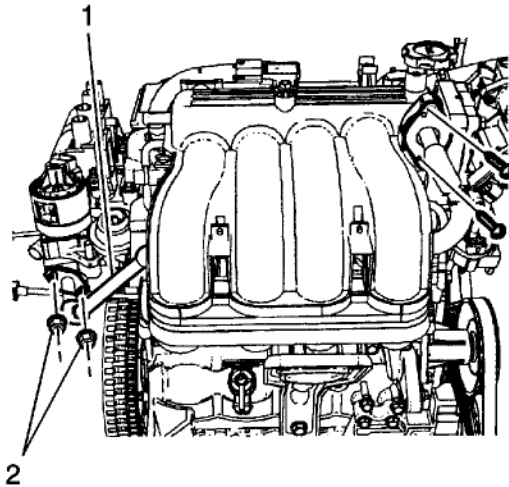
1. Clean the mating surface.
2. Install a new EGR valve gasket.

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

3. Install the EGR valve (1) with the retaining nuts and tighten to 30 N·m (22 lb ft).
4. Connect the EGR valve electrical connector.
5. Connect the battery negative cable. Refer to [Battery Negative Cable Disconnection and Connection](#).

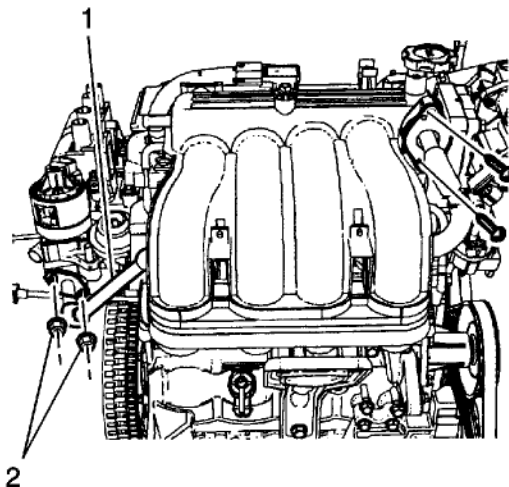
Exhaust Gas Recirculation Valve Pipe Replacement

Removal Procedure



1. Remove the EGR pipe retaining bolt from the intake manifold.
2. Remove the EGR pipe retaining nuts (2) from the coolant outlet case.
3. Remove the EGR pipe (1).

Installation Procedure





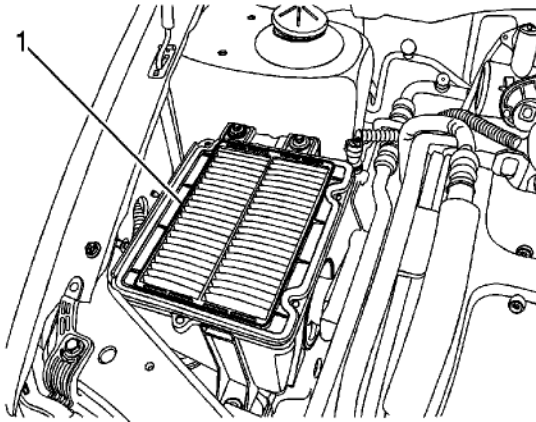
1. Install the EGR pipe (1).
2. Install and tighten the EGR pipe retaining nuts (2) from the coolant outlet case.

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

3. Install and tighten the EGR pipe retaining bolt from the intake manifold.
 - Tighten the exhaust gas recirculation pipe retaining nuts to **10 N·m (89 lb in)**.
 - Tighten the exhaust gas recirculation pipe retaining bolts to **22 N·m (16.2 lb in)**.

Air Cleaner Element Replacement

Removal Procedure

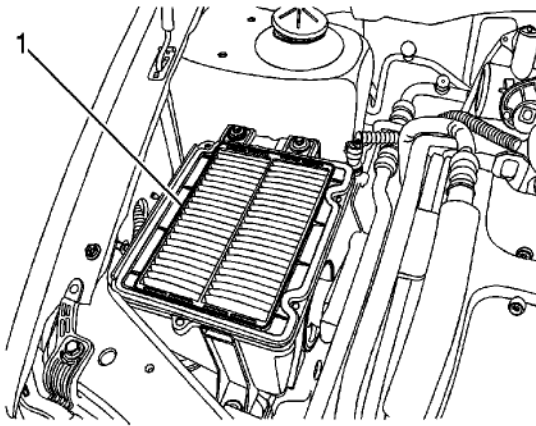


1. Remove the air filter upper housing.
2. Remove the air filter element (1).

Installation Procedure

1. Install the air filter element (1).

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



2. Replace the air filter upper housing bolts and tighten to **2 N·m (1.5 lb ft)**.

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.