2001 ENGINE PERFORMANCE

Removal, Overhaul & Installation - Cars

MODEL IDENTIFICATION

Vehicle model is identified by fourth character of Vehicle Identification Number (VIN). VIN is stamped on metal pad on top of left end of instrument panel, near windshield. See **MODEL IDENTIFICATION** table.

MODEL IDENTIFICATION

Body Code (1)	Model
"C"	Park Avenue
"E"	Eldorado
"F"	Camaro & Firebird
"H"	Bonneville & LeSabre
"G"	Aurora
"J"	Cavalier (2) , Sunfire & Saturn ("L" Series)
"K"	DeVille & Seville
"M"	Metro
"N"	Alero, Grand Am & Malibu
"S"	Prizm
"V"	Catera
"W"	Century, Grand Prix, Impala, Intrigue, Lumina, Monte Carlo & Regal
"Y"	Corvette
"Z"	Saturn ("S" Series)

(1) Vehicle body code is fourth character of VIN.

(2) Cavalier is available with gasoline and gasoline/compressed natural gas 2.2L engines.

INTRODUCTION

CAUTION: When battery and some PCM input devices are disconnected, vehicle computer and memory systems may lose memory data. Driveability problems may exist until computer systems have completed a relearn cycle. See COMPUTER RELEARN PROCEDURES article in GENERAL INFORMATION before disconnecting battery.

This article covers removal, overhaul and installation procedures (when given by manufacturer). If component removal and installation is primarily an unbolt and bolt-on procedure, only a torque specification may be supplied.

AIR INDUCTION SYSTEMS

SUPERCHARGER

NOTE: Servicing of supercharger unit is limited to replacement only.

Removal (3.8L - VIN 1)

1. Relieve fuel pressure. See **FUEL SYSTEM PRESSURE RELEASE** . Disconnect negative battery cable. Remove accessory drive belt from supercharger pulley.

2. Remove fuel injector sight shield. Disconnect fuel lines from fuel rail. Disconnect vacuum hoses. Disconnect injector harness connectors. Disconnect harness connectors from front of supercharger. Remove fuel rail bolts. Remove fuel rail and injectors as an assembly. See **FUEL RAIL & INJECTORS** .
3. Disconnect harness connectors from IAC valve, TP sensor, MAP sensor, MAF sensor, EGR valve, boost control solenoid, and ECT sensor. Remove air intake duct from throttle body. Remove EGR pipe from supercharger. Disconnect throttle and cruise control cables. Remove boost pressure manifold and vacuum block. Remove cable bracket and tensioner bracket to supercharger mounting stud.

NOTE: Tensioner bracket-to-supercharger stud must be removed, or supercharger cannot be lifted high enough to clear lower intake manifold locator pins. See Fig. 1 .

4. Remove throttle body from supercharger. Remove supercharger-to-intake manifold bolts and remove supercharger. Remove supercharger gasket and coolant passage "O" rings.

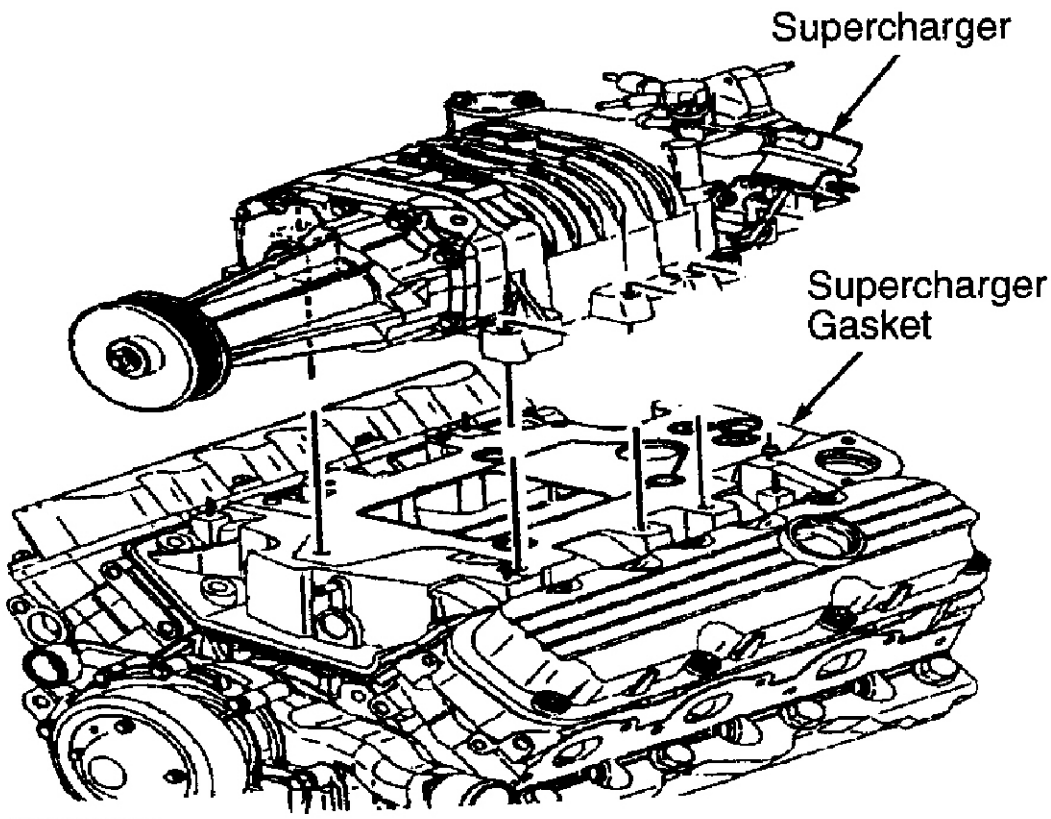


Fig. 1: Identifying Supercharger Components (3.8L - VIN 1)
Courtesy of GENERAL MOTORS CORP.

Installation

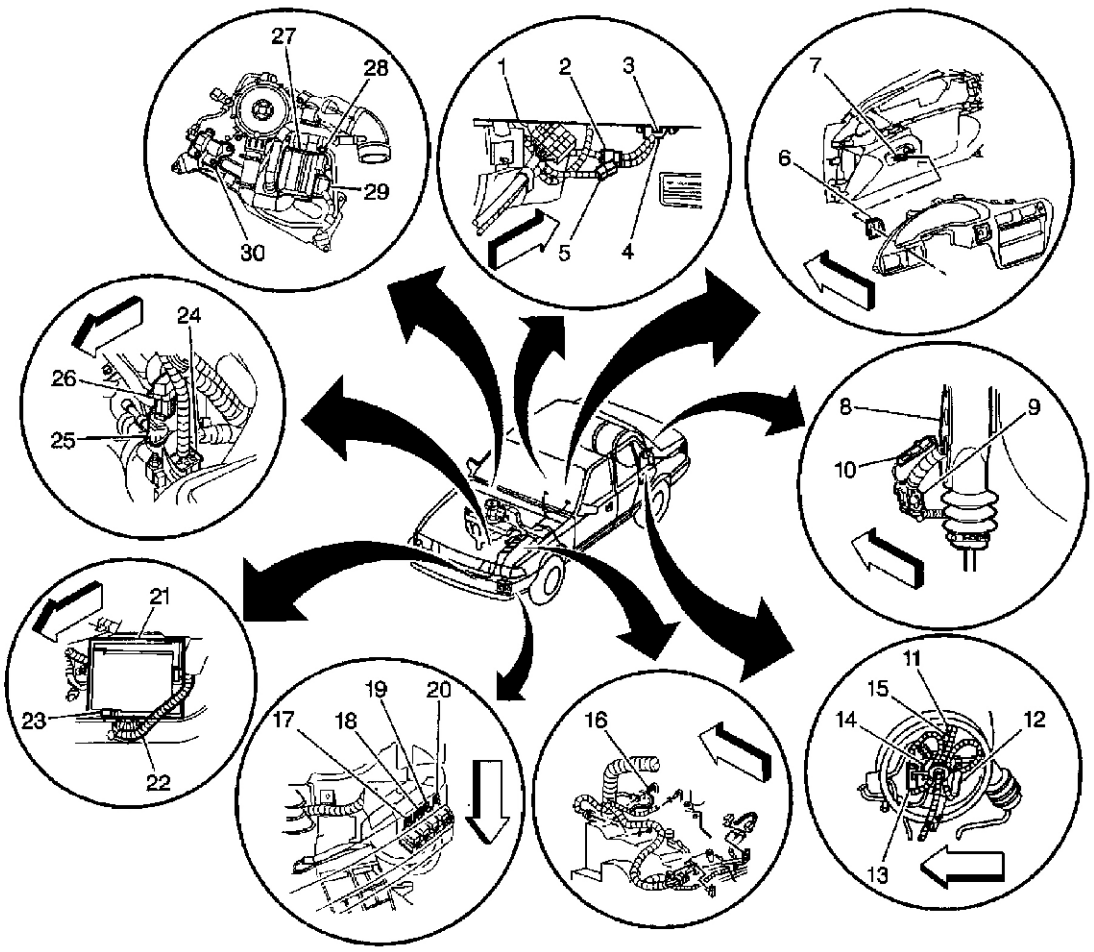
Ensure locator pins are in their proper location on intake manifold. Replace gaskets and "O" rings. DO NOT use any type of sealant on gasket. To complete installation, reverse removal procedure. Tighten supercharger-to-intake manifold bolts to 17 ft. lbs. (23 N.m). Tighten fuel rail retaining bolts to 89 INCH lbs. (10 N.m).

COMPUTERIZED ENGINE CONTROLS

ALTERNATIVE FUEL ENGINE CONTROL MODULE

Removal & Installation (2.2L - Cavalier - CNG)

1. Disconnect negative battery cable. Remove front fender liner as required to access bolts from front fascia to fender. Remove front fascia to fender bolts. Remove push-in retainers from top and center of fascia. Remove push-in retainers from bottom of fascia. Remove front bumper fascia from vehicle.
2. Remove AF ECU relay bracket bolt and relay bracket. See **Fig. 2** . Remove AF ECU. Disconnect electrical connectors from AF ECU. Remove nuts from ECU bracket studs and remove bracket.
3. Install AF ECU mounting bracket to mounting studs using stud nuts. Tighten mounting stud nuts to 89 INCH lbs. (10 N.m). Tighten AF ECU relay bracket bolt to 89 INCH lbs. (10 N.m). To complete installation, reverse removal procedure.



1. 23-Way In-Line Connector C200 Black
2. 10-Way In-Line Connector C251 Natural
3. Passthrough P001 (Not Shown)
4. Data Link Connector (DLC)
5. 10-Way In-Line Connector C250 Natural
6. Fuel Gauge Selector Switch/Fuel Indicator Lamp & Panel Dimmer Switch Assembly
7. Fuel Gauge Select Switch Connector C254
8. Passthrough P401
9. 6-Way In-Line Connector C450 Black
10. 1-Way In-Line Connector C454
11. Fuel Pressure Sensor Connector C452 Black
12. High Pressure Lock-Off Connector C453 Black
13. Fuel Temperature Sensor Connector C451 Gray
14. High Pressure Lock-Off (HPL) With Internal Fuel Temperature Sensor (FTS)
15. Fuel Pressure Sensor (FPS)
16. G112
17. Fuel Gauge Relay Connector C012
18. Lock-Off Relay Connector C011
19. AF Fuel Pump Relay Connector C007
20. Ignition Relay Connector C004
21. AF Engine Control Unit
22. AF Engine Control Unit Connector C001 Blue
23. AF Engine Control Unit Connector C002 White/Clear
24. 10-Way In-Line Connector C018 Black
25. 10-Way In-Line Connector C017 Gray
26. 6-Way In-Line Connector C019 Black
27. GMS/MCV Assembly
28. Mixture Control Valve Connector C021
29. Gas Mass Sensor Connector C010
30. Low Pressure Lock-Off Connector C014

G00070996

Fig. 2: Locating CNG Components
Courtesy of GENERAL MOTORS CORP.

ELECTRONICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY

Electronically Erasable Programmable Read Only Memory (EEPROM) is a permanent memory that is part of PCM. EEPROM cannot be replaced. EEPROM contains program and calibration information that PCM uses to control powertrain. If PCM is replaced, ensure NEW PCM software/calibration is correct and most recent version for vehicle. EEPROM must be programmed when NEW PCM is installed. Program EEPROM using latest software for that specific vehicle.

POWERTRAIN CONTROL MODULE

CAUTION: Electronic components used in control systems are designed to carry very low voltages. As little as a 30-volt charge created by static electricity can cause a total or degrading failure in PCM or other electronic components containing integrated circuits. Before servicing Powertrain Control Module (PCM), technician must ground himself and the work area to discharge static electricity.

CAUTION: Do not remove part from packaging until ready to install. Ground any static-proof package before opening. Do not touch electrical terminals of components unless properly grounded. Do not lay electrical components on car seat, carpeting or dashboard. Use electrostatic protection mat and ground strap whenever possible.

NOTE: Before replacing PCM, carefully inspect all wiring and control components. Failure to test for short circuits may result in repeated PCM failure due to shorts. To prevent internal damage to PCM, ensure ignition is off when connecting or disconnecting PCM harness connectors or any electrical components.

Removal & Installation (1.3L - "M" Body)

Turn ignition off. Disconnect negative battery cable. Open glove box. Apply pressure to sides of glove box to disengage 2 clips. Pull glove box down. Remove 3 bolts and PCM bracket. Disconnect harness connectors from PCM. Remove PCM. To install, reverse removal procedure.

Removal & Installation (1.8L - "S" Body)

1. Turn ignition off. Disconnect negative battery cable. Remove glove box. Remove console support bracket. Remove left lower finish panel and backing panel. Remove center finish panel. Remove radio.
2. Remove 2 bolts in rear console box. Remove 2 screws on sides of center console. Slide rear portion of center console back toward rear seats. Remove 2 upper screws on front position of console and remove front portion of console.
3. Disconnect harness connectors from PCM. Remove mounting bolts from PCM. Remove PCM. To install, reverse removal procedure.

Removal & Installation (1.9L - Saturn "S" Series)

Disconnect negative battery cable. Locate PCM. See **PCM LOCATION** table. Unlock 28-pin PCM harness connector and disconnect. Remove bolt from 80-pin PCM harness connector and disconnect. Remove PCM mounting bolts and remove PCM. To install, reverse removal procedure. Tighten PCM mounting bolts to 80 INCH lbs. (9 N.m). Tighten PCM harness connector bolt to 71 INCH lbs. (8 N.m). Program replacement PCM using appropriate equipment and latest software. See COMPUTER RELEARN PROCEDURES article in GENERAL INFORMATION.

Removal & Installation (2.2L & 2.4L - "J" & "N" Bodies)

Turn ignition off. Disconnect negative battery cable. Locate PCM. See **PCM LOCATION** table. Remove any necessary components to gain access to PCM. Disconnect harness connectors from PCM. Remove PCM mounting bolts (if equipped). Remove PCM. To install, reverse removal procedure. Transfer any necessary components (i.e., knock sensor module, etc.) to new PCM before installation. Program replacement PCM using appropriate equipment and latest software. See COMPUTER RELEARN PROCEDURES article in GENERAL INFORMATION.

Removal & Installation (2.2L, 3.0L, 3.1L, 3.4L, 3.5L, 3.8L, 4.0L, 4.6L & 5.7L)

Turn ignition off. Disconnect negative battery cable. Locate PCM. See **PCM LOCATION** table. Remove any necessary components to gain access to PCM. Disconnect harness connectors from PCM. Remove PCM mounting bolts (if equipped). Remove PCM. To install, reverse removal procedure. Transfer any necessary components (i.e., knock sensor module, etc.) to new PCM before installation. Program replacement PCM using appropriate equipment and latest software. See COMPUTER RELEARN PROCEDURES article in GENERAL INFORMATION.

PCM LOCATION

Application	Location
1.3L	Behind Glove Box
1.8L	Under Instrument Panel, Behind Center Console
1.9L	In Engine Compartment, Next To Battery
2.2L & 2.4L (Cavalier & Sunfire)	Inside Right Front Fender
2.2L (Saturn)	Behind Glove Box
2.4L (Alero & Grand Am)	Under Left Side Of Instrument Panel, Near Steering Column
3.0L (Catera)	On Left Side Of Engine Compartment, In ECM Housing
3.0L (Saturn)	Mounted On Left Rear Of Engine
3.1L (Century & Grand Prix)	On Left Side Of Engine Compartment, In Air Cleaner Assembly
3.1L (Malibu)	Under Left Side Of Instrument Panel, Near Steering Column
3.1L (Lumina)	On Right Side Of Engine Compartment, Forward Of Strut Tower
3.4L (Alero & Grand Am)	Under Left Side Of Instrument Panel, Near Steering Column
3.4L (Impala & Monte Carlo)	On Right Side Of Engine Compartment, In Air Cleaner Assembly
3.5L	On Left Side Of Engine Compartment, In Air Cleaner Assembly
3.8L (Bonneville, Grand Prix, LeSabre, Park Avenue & Regal)	On Left Side Of Engine Compartment, In Air Cleaner Assembly
3.8L (Camaro & Firebird)	On Right Side Of Engine Compartment, Rear Of Wheelhouse
3.8L (Impala & Monte Carlo)	On Right Side Of Engine Compartment, Inside Air Cleaner Assembly
4.0L	On Left Side Of Engine Compartment, In Air Cleaner Assembly
4.6L	In Left Front Corner Of Engine Compartment, Under Air Cleaner
5.7L (Camaro & Firebird)	On Right Side Of Engine Compartment, Rear Of Wheelhouse
5.7L (Corvette)	Behind Right Front Fender, Under Battery

ENGINE SENSORS & SWITCHES

CRANKSHAFT VARIATION LEARN PROCEDURE (AURORA)

CAUTION: Before performing the Crankshaft Position System Variation Learning

Procedure always set the vehicle parking brake and block the drive wheels in order to prevent personal injury. Release the throttle immediately when the engine starts to decelerate in order to eliminate over revving the engine. Once the learn procedure is completed, the control module will return engine control to the operator and the engine will respond to the throttle position.

Introduction

The crankshaft position system variation compensating values are stored in the PCM non-volatile memory after a learn procedure has been performed. If the actual crankshaft position system variation is not within the crankshaft position system variation compensating values stored in the powertrain control module (PCM), DTC P0300 may set.

The crankshaft position system variation learn procedure should be performed if any of the following conditions are true:

- DTC P1336 is not set.
- The PCM has been replaced.
- The PCM has been reprogrammed.
- The engine has been replaced.
- The crankshaft has been replaced.
- The crankshaft position (CKP) sensor has been replaced.

Crankshaft Variation Learn Procedure

NOTE: **The scan tool crankshaft position system variation learn function will be inhibited if the engine coolant temperature is less than 70°C (158°F). Allow the engine to warm to at least 70°C (158F) before attempting the Crankshaft Position System Variation Learn procedure. The crankshaft position system variation learn function will be inhibited if any powertrain DTCs other than DTC P1336 are set before or during the crankshaft position system variation learn procedure. Diagnose and repair any DTCs, if set.**

1. Set the parking brake. Block the drive wheels.
2. Close the hood. Start the engine and allow engine coolant temperature to reach at least 70°C (158°F). Turn OFF the engine, then turn the key to ON.
3. Select and enable the crankshaft position variation learn procedure with the Tech II, or equivalent, scan tool. Start the engine. Wait until instructed by the scan tool, then apply the brake pedal firmly.
4. Ensure that the transaxle is in Park. Increase accelerator pedal position until the CKP system variation learn fuel cut-off is reached at 4050 RPM for 3.5L, or 5150 RPM for 4.0L.
5. Release the accelerator pedal after the second fuel cut-off is reached. The crankshaft position system variation compensating values are learned when the RPM decreases back to idle. If the procedure terminates, check if vehicle is at normal operating temperature or any DTCs other than P1336 are set.
6. Observe the DTC status for DTC P1336. If the scan tool indicates that DTC P1336 ran and passed, the crankshaft position system variation learn procedure is complete. Use the scan tool to clear any DTCs. DTC P1336 will not automatically clear after a successful learn procedure. DTC P1336 will not clear from memory if the learn procedure was unsuccessful.

If the scan tool indicates that DTC P1336 failed or did not run, recheck for other DTCs that may have set during the procedure. If no DTCs other than P1336 are set, repeat the crankshaft position system variation learn

procedure. If the learn procedure will not pass, a mechanical engine problem may exist.

GAS MASS SENSOR/MIXTURE CONTROL VALVE (2.2L - CAVALIER - CNG)

NOTE: See GAS MASS SENSOR/MIXTURE CONTROL VALVE (2.2L - CAVALIER - CNG) under FUEL SYSTEMS.

OXYGEN SENSORS

NOTE: Oxygen sensor is mounted in exhaust pipe, below exhaust manifold and is equipped with a permanent pigtail which must remain intact when removing sensor.

Removal (1.3L, 1.8L, 1.9L, 2.2L, 2.4L, 3.0L, 3.1L & 3.4L - Sensor 1)

1. Ensure oxygen sensor is free of contaminants. DO NOT use cleaning solvents of any type. Oxygen sensor may be difficult to remove when engine temperature is less than 120°F (48°C). Excessive removal force may damage threads in exhaust manifold or pipe.
2. Disconnect negative battery cable. Disconnect harness connector from oxygen sensor. Carefully remove oxygen sensor from exhaust pipe.

Removal (1.8L - Sensor 2)

1. Ensure oxygen sensor is free of contaminants. DO NOT use cleaning solvents of any type. Oxygen sensor may be difficult to remove when engine temperature is less than 120°F (48°C). Excessive removal force may damage threads in exhaust manifold or pipe.
2. Disconnect negative battery cable. Remove front floor console. Pull back passenger side carpet from along console floor area. Disconnect oxygen sensor electrical connector. Remove oxygen sensor wiring from under floor heat duct.
3. Raise and support vehicle. Remove oxygen sensor wiring from body plug and floor pan. Carefully remove oxygen sensor from exhaust pipe.

Removal (3.5L - Sensor 2)

1. Ensure oxygen sensor is free of contaminants. DO NOT use cleaning solvents of any type. Oxygen sensor may be difficult to remove when engine temperature is less than 120°F (48°C). Excessive removal force may damage threads in exhaust manifold or pipe.
2. Raise and support vehicle. Disconnect negative battery cable. Remove oxygen sensor wiring harness heat shield. Disconnect oxygen sensor electrical connector. Carefully remove oxygen sensor from exhaust pipe.

Removal (3.8L - Sensor 1)

1. Ensure oxygen sensor is free of contaminants. DO NOT use cleaning solvents of any type. Oxygen sensor may be difficult to remove when engine temperature is less than 120°F (48°C). Excessive removal force may damage threads in exhaust manifold or pipe.
2. Remove fuel injector sight shield. Remove retaining clip. Disconnect oxygen sensor electrical connector. Carefully remove oxygen sensor from exhaust pipe.

Removal (3.8L - Sensor 2)

1. Ensure oxygen sensor is free of contaminants. DO NOT use cleaning solvents of any type. Oxygen sensor may be difficult to remove when engine temperature is less than 120°F (48°C). Excessive removal force may damage threads in exhaust manifold or pipe.
2. Raise and support vehicle. Remove splash shield. Disconnect retaining tab from connector. Disconnect

oxygen sensor electrical connector. Carefully remove oxygen sensor from exhaust pipe.

Removal (4.0L & 4.6L - Bank 1 Sensor 1)

1. Ensure oxygen sensor is free of contaminants. DO NOT use cleaning solvents of any type. Oxygen sensor may be difficult to remove when engine temperature is less than 120°F (48°C). Excessive removal force may damage threads in exhaust manifold or pipe.
2. Raise and support vehicle. Disconnect negative battery cable. Support rear of powertrain. Remove rear frame bolts. Lower frame 3". Disconnect rear oxygen sensor electrical connector. Remove rear oxygen sensor.

Removal (4.0L & 4.6L - Bank 1 Sensor 2)

1. Ensure oxygen sensor is free of contaminants. DO NOT use cleaning solvents of any type. Oxygen sensor may be difficult to remove when engine temperature is less than 120°F (48°C). Excessive removal force may damage threads in exhaust manifold or pipe.
2. Disconnect negative battery cable. Disconnect harness connector from oxygen sensor. Carefully remove oxygen sensor from exhaust pipe.

Removal (4.0L & 4.6L - Bank 2 Sensor 1)

1. Ensure oxygen sensor is free of contaminants. DO NOT use cleaning solvents of any type. Oxygen sensor may be difficult to remove when engine temperature is less than 120°F (48°C). Excessive removal force may damage threads in exhaust manifold or pipe.
2. Raise and support vehicle. Disconnect negative battery cable. Remove front splash shield. Disconnect front oxygen sensor. Remove oxygen sensor.

Removal (5.7L)

NOTE: Procedure applies to all oxygen sensors (4).

1. Ensure oxygen sensor is free of contaminants. DO NOT use cleaning solvents of any type. Oxygen sensor may be difficult to remove when engine temperature is less than 120°F (48°C). Excessive removal force may damage threads in exhaust manifold or pipe.
2. Raise and support vehicle. Disconnect oxygen sensor electrical connector. Carefully remove oxygen sensor. For Camaro and Firebird sensor locations, see **Fig. 4** -**Fig. 7** . For Corvette sensor locations, see **Fig. 8** -**Fig. 10** .

Installation

CAUTION: Correct torque of oxygen sensor is critical to prevent crushing glass beads in graphite anti-seize compound. Crushing glass beads will cause sensor to seize in exhaust manifold. This may necessitate replacement of exhaust manifold upon next removal.

1. Whenever an oxygen sensor is removed, coat threads with anti-seize compound before installation. New oxygen sensors already have this compound applied to threads.
2. Install oxygen sensor. Tighten oxygen sensor to specification. See **TORQUE SPECIFICATIONS** . Reconnect harness connector to oxygen sensor. Reconnect negative battery cable.

OXYGEN SENSOR LOCATIONS

Application	Location
1.3L	
Sensor 1	On Exhaust Manifold

Sensor 2	On Exhaust Pipe
1.8L	
Sensor 1	On Exhaust Pipe
Sensor 2	Under Passenger Floor
1.9L	
Sensor 1	On Exhaust Manifold
Sensor 2	On Exhaust Pipe
2.2L & 2.4L	
Sensor 1	On Exhaust Manifold
Sensor 2	On Exhaust Pipe
2.2L (Saturn)	
Sensor 1	On Exhaust Manifold
Sensor 2	On Exhaust Pipe
3.0L (Catera)	(1)
3.0L (Saturn)	
Sensor 1	On Exhaust Manifold
Sensor 2	On Exhaust Pipe
3.1L	
Sensor 1	On Exhaust Manifold
Sensor 2	On Exhaust Pipe
3.4L	
Sensor 1	On Exhaust Manifold
Sensor 2	On Exhaust Pipe
3.5L	
Sensor 1	On Exhaust Manifold
Sensor 2	On Exhaust Pipe
3.8L	
Sensor 1	On Exhaust Manifold
Sensor 2	On Exhaust Pipe
4.0L	
Bank 1 Sensor 1	Rear Exhaust Manifold
Bank 1 Sensor 2	On Exhaust Pipe
Bank 2 Sensor 1	Front Exhaust Manifold
4.6L	
Bank 1 Sensor 1	Rear Exhaust Manifold
Bank 1 Sensor 2	On Exhaust Pipe
Bank 2 Sensor 1	Front Exhaust Manifold
5.7L (Camaro & Firebird)	(1)
5.7L (Corvette)	(1)
(1) For oxygen sensor locations, see **Fig. 3** - **Fig. 10** .	

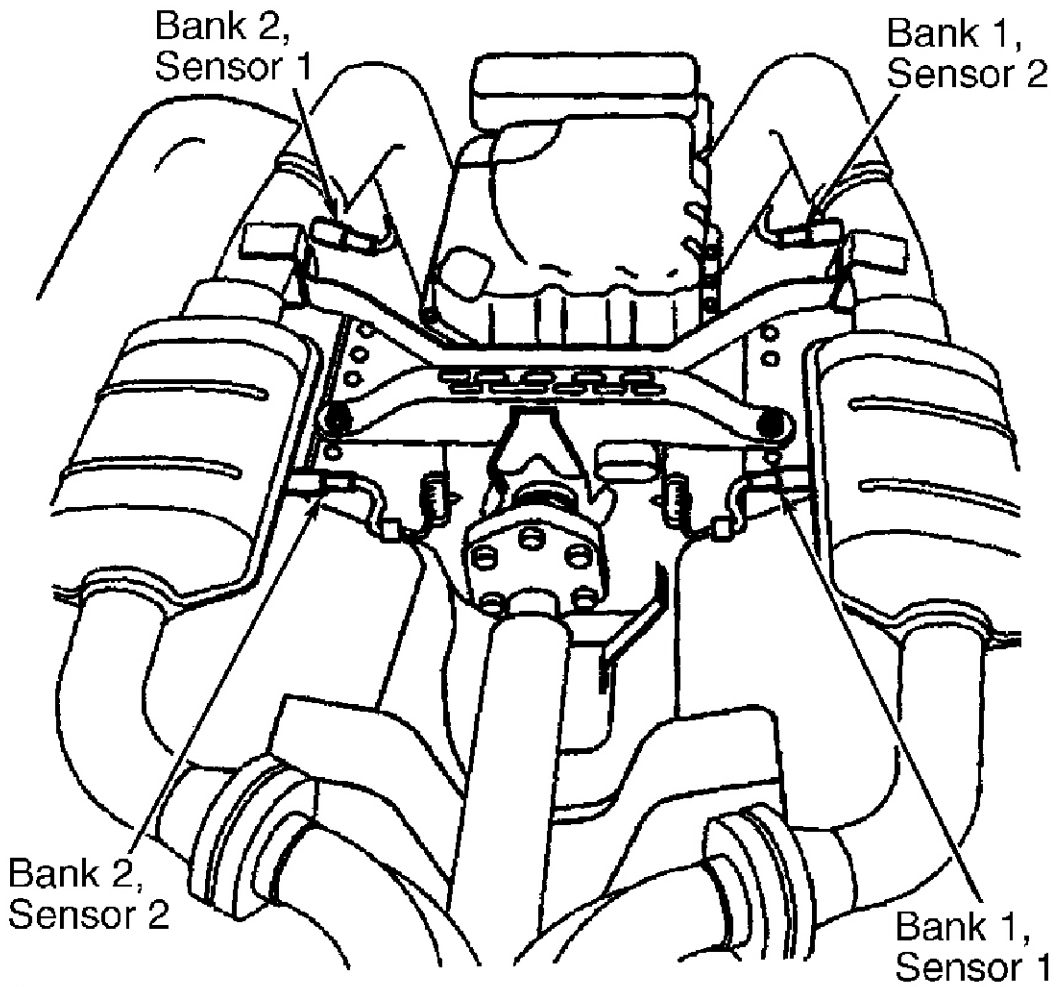


Fig. 3: Locating Heated Oxygen Sensors (Catera)
Courtesy of GENERAL MOTORS CORP.

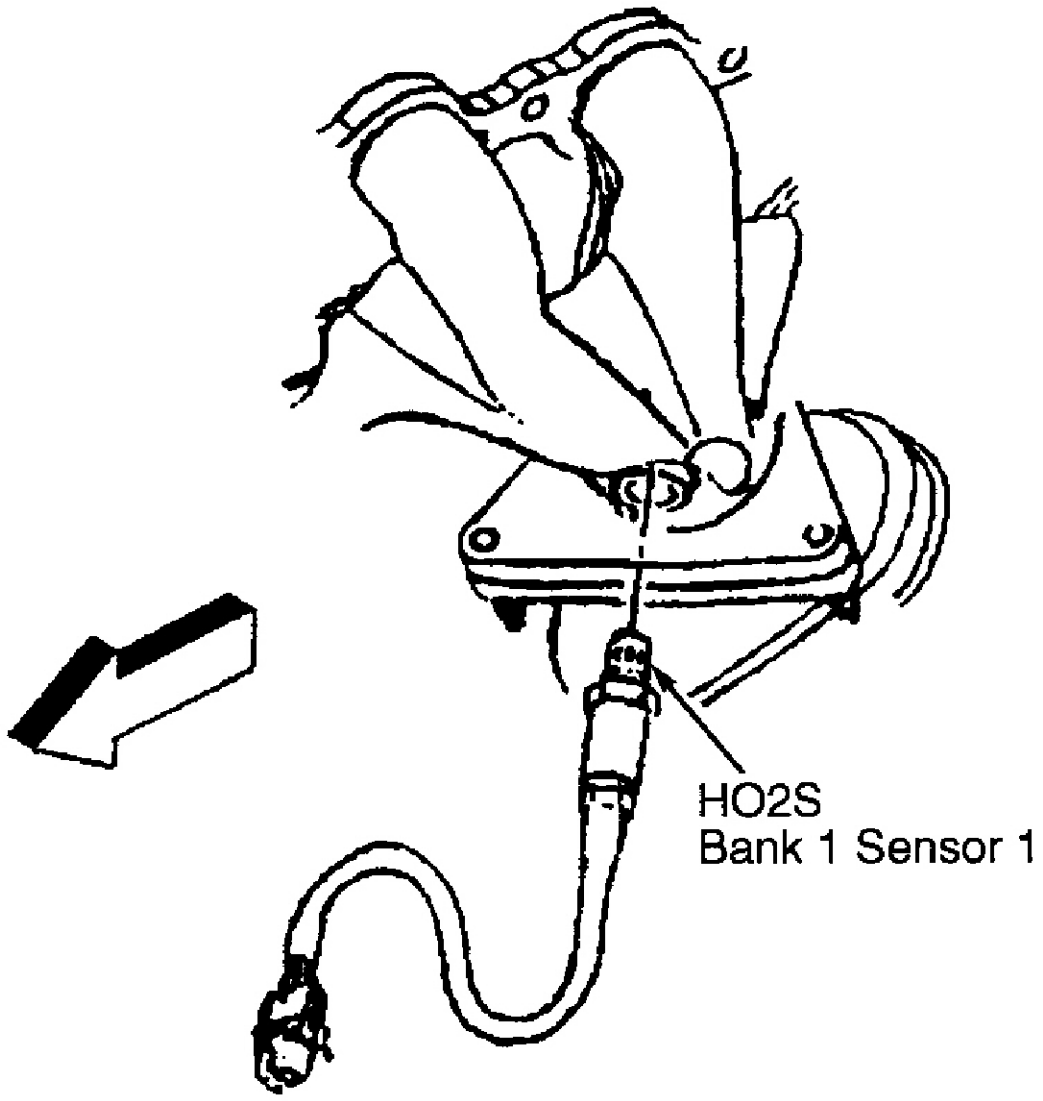


Fig. 4: Locating Bank 1 Sensor 1 Heated Oxygen Sensor (5.7L - Camaro & Firebird)
Courtesy of GENERAL MOTORS CORP.

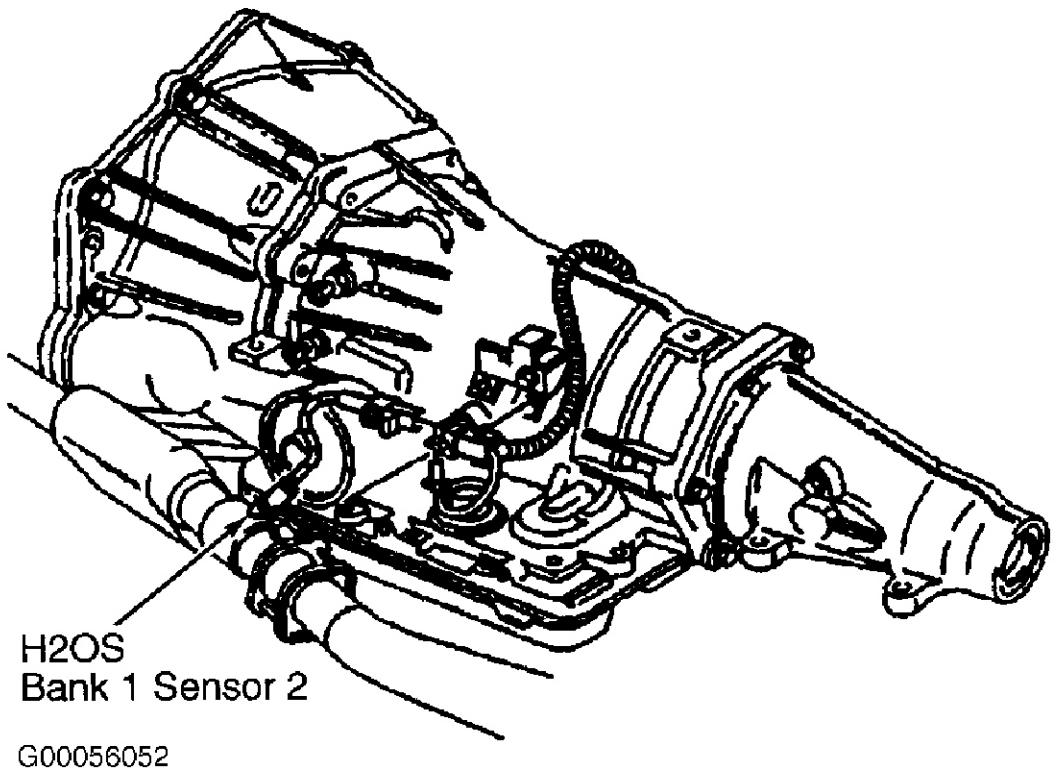


Fig. 5: Locating Bank 1 Sensor 2 Heated Oxygen Sensor (5.7L - Camaro & Firebird)
Courtesy of GENERAL MOTORS CORP.

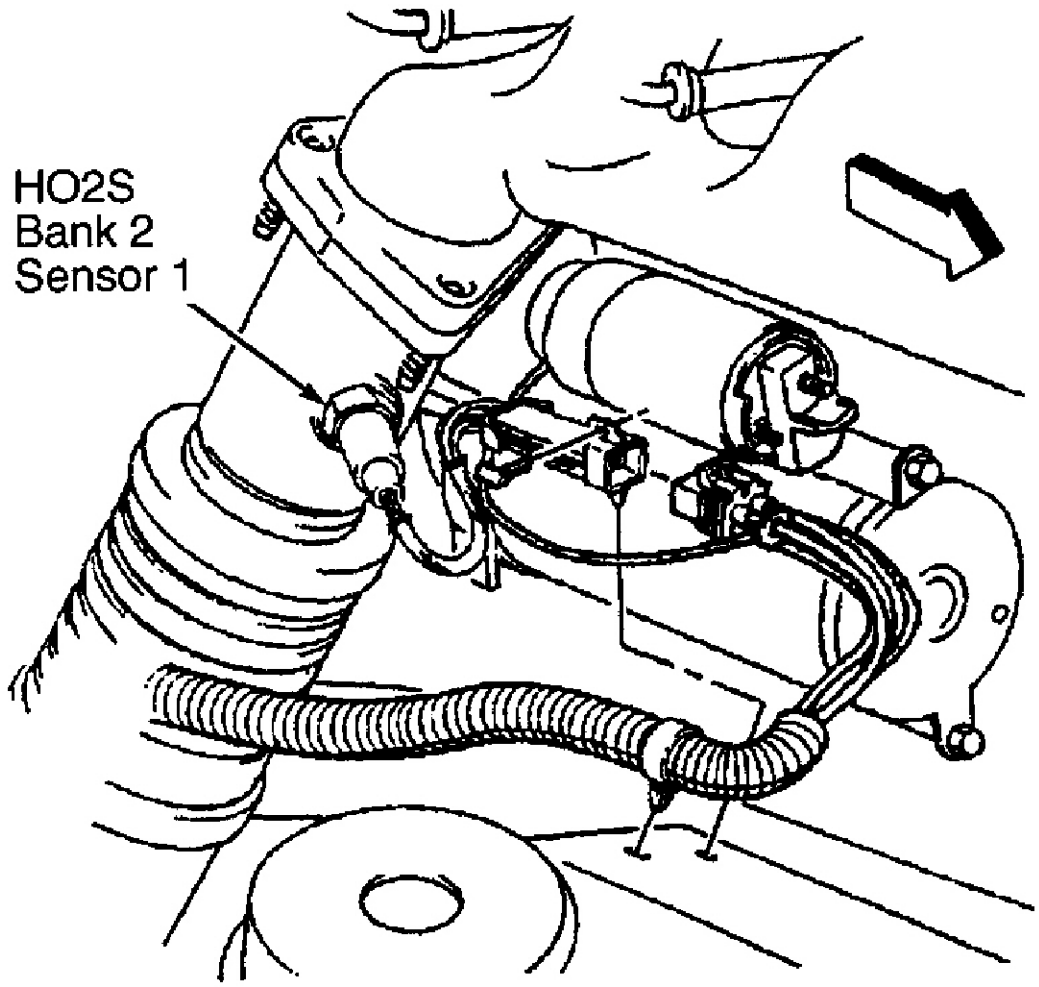


Fig. 6: Locating Bank 2 Sensor 1 Heated Oxygen Sensor (5.7L - Camaro & Firebird)
Courtesy of GENERAL MOTORS CORP.

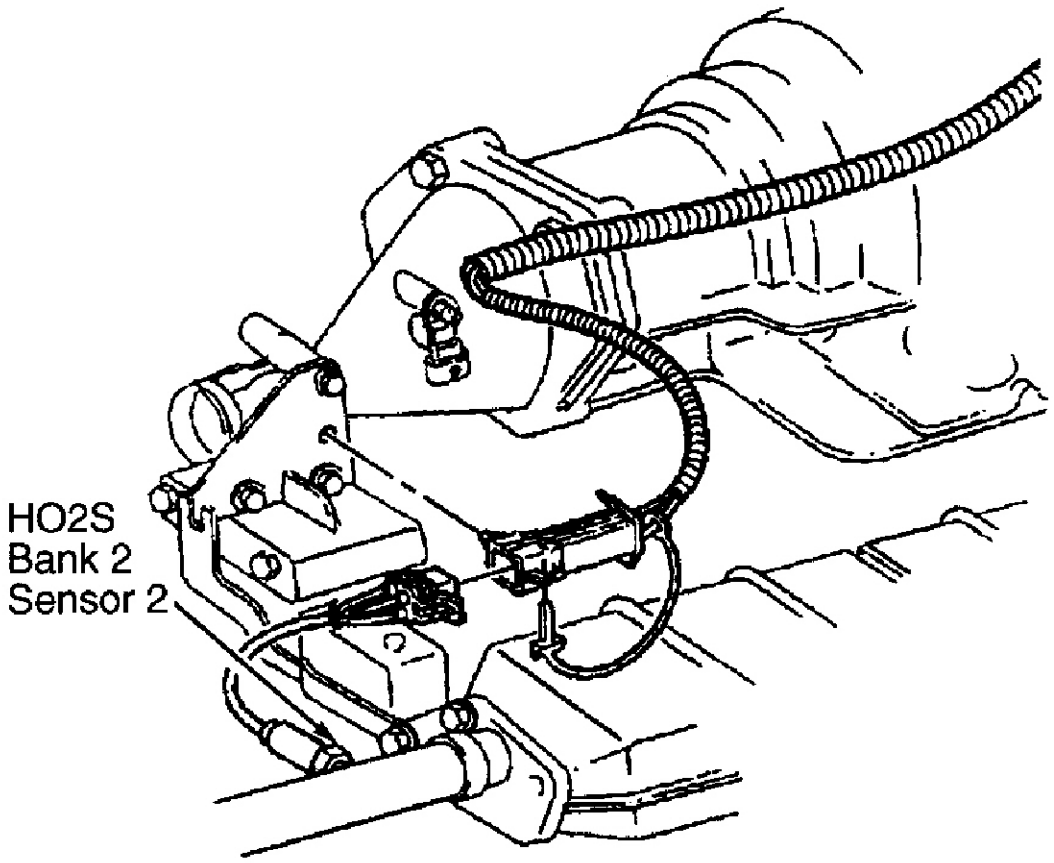


Fig. 7: Locating Bank 2 Sensor 2 Heated Oxygen Sensor (5.7L - Camaro & Firebird)
Courtesy of GENERAL MOTORS CORP.

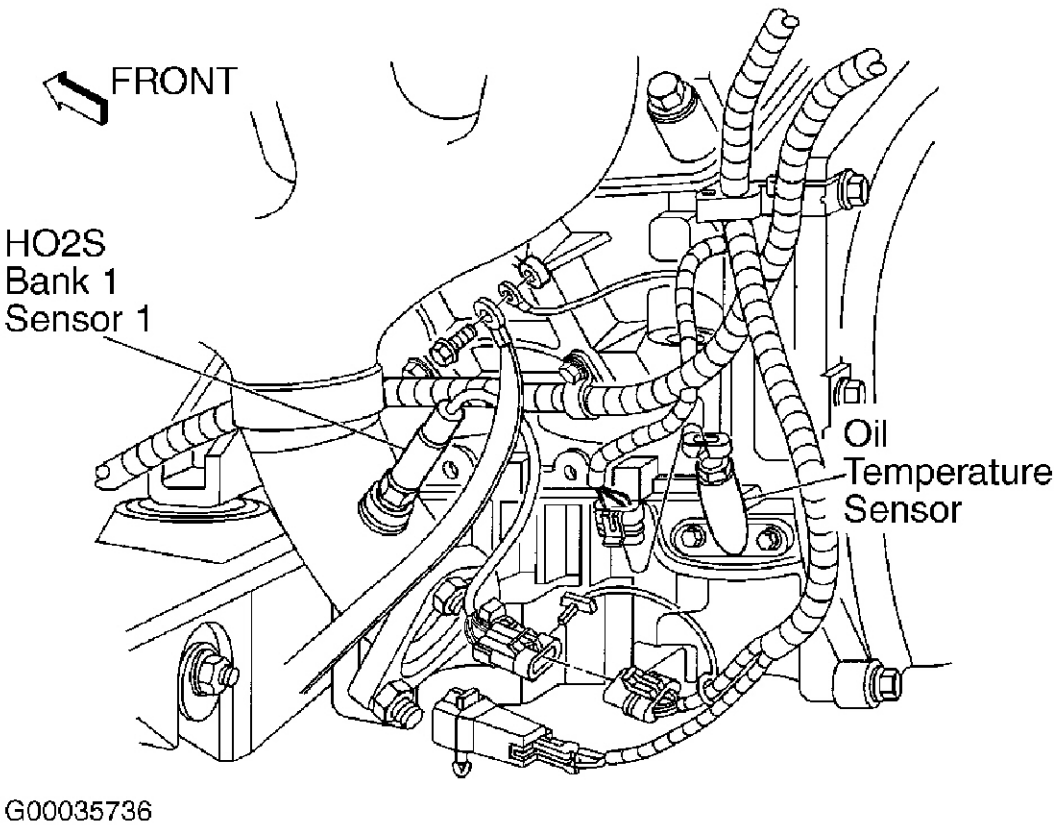


Fig. 8: Locating Bank 1 Sensor 1 Heated Oxygen Sensor (Corvette)

Courtesy of GENERAL MOTORS CORP.

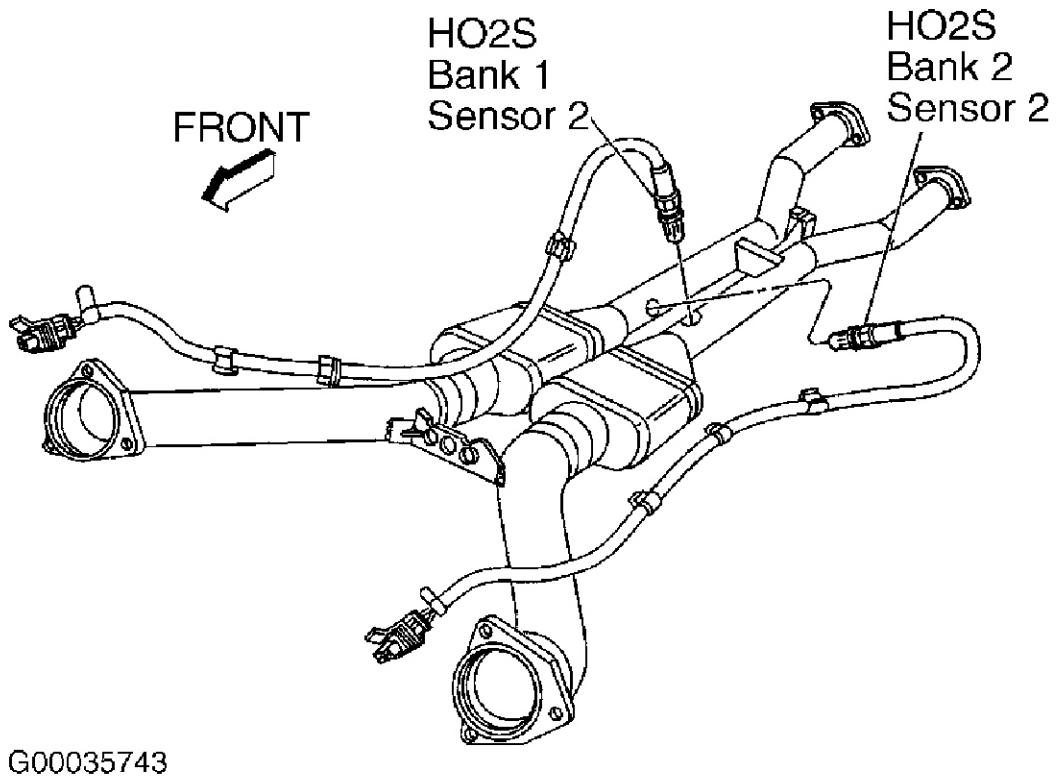


Fig. 9: Locating Bank 1 Sensor 2 & Bank 2 Sensor 2 Heated Oxygen Sensors (Corvette)
Courtesy of GENERAL MOTORS CORP.

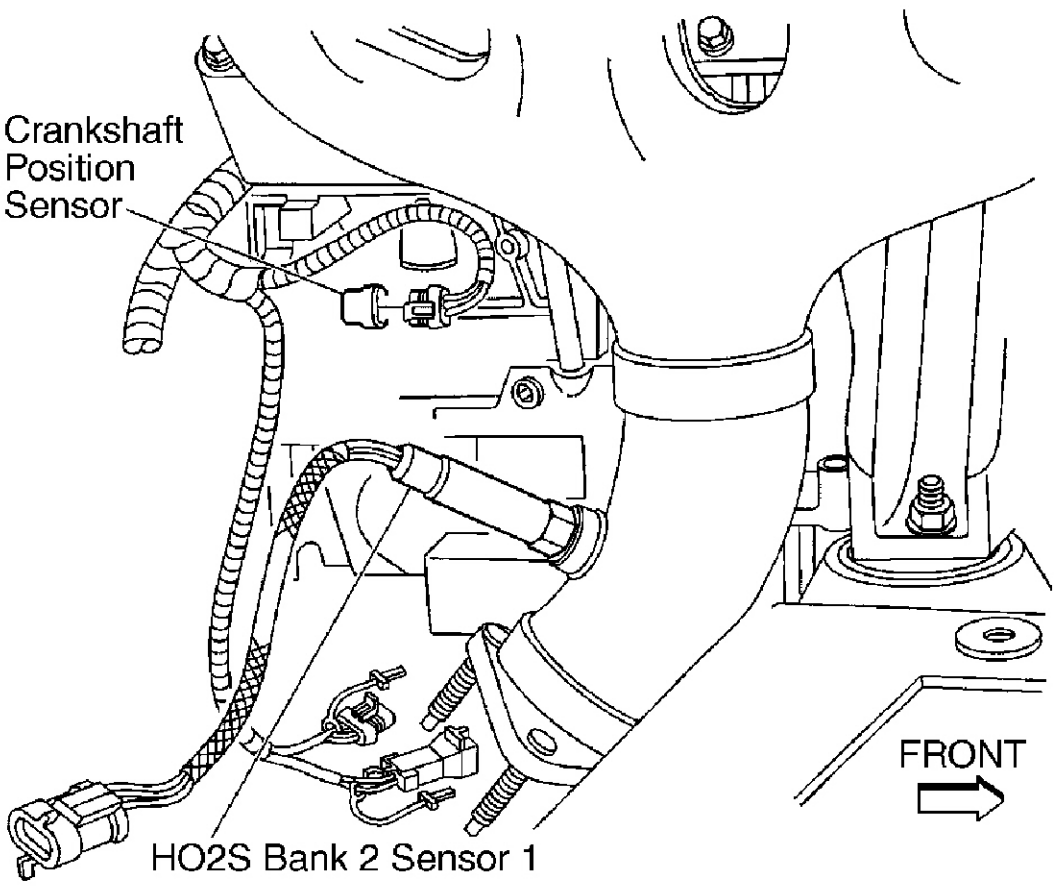


Fig. 10: Locating Bank 2 Sensor 1 Heated Oxygen Sensor (Corvette)
Courtesy of GENERAL MOTORS CORP.

COOLING SYSTEM

COOLING SYSTEM BLEEDING

(1.3L, 1.8L, 1.9L, 2.2L, 2.4L, 3.0L, 3.1L, 3.4L & 3.8L)

CAUTION: Avoid spilling coolant mixture on engine parts. Coolant may cause undue corrosion. If coolant is spilled during procedure, rinse area with clean water.

1. Fill radiator to base of radiator filler neck. Fill coolant reservoir to FULL mark on reservoir. On 2.4L models, open coolant air bleed valve until a continuous stream of coolant flows from valve. Install reservoir hose to reservoir cap. Operate engine until coolant reaches operating temperature. Operating temperature is reached when, hoses feel warm and when coolant flows through radiator.
2. Add coolant to radiator until coolant level reaches radiator filler neck. Install radiator cap.

(3.5L, 4.0L & 4.6L)

1. Refill cooling system. Start engine. Place heater and A/C control in any A/C mode except Max and temperature at highest setting. Allow engine to continue idling until lower radiator to water pump hose is hot. Turn engine off.
2. Allow engine to cool. Recheck fluid level. Add as necessary.

(5.7L - Camaro & Firebird)

1. Refill cooling system to half capacity with 100 percent concentration of coolant. Refill remaining system capacity with water, until fluid reaches bottom of filler neck.
2. Start engine. With pressure cap removed, idle engine until normal operating temperature is reached. Close air bleed screw when coolant is visible dripping from bleed screw. With engine still idling, add coolant to radiator until coolant level reaches bottom of fill neck. Install pressure cap.

(5.7L - Corvette)

1. Refill cooling system to half capacity with 100 percent concentration of coolant. Refill remaining system capacity with water, until fluid reaches bottom of filler neck.
2. Start engine and idle for one minute. Install surge tank cap. Raise RPM level to 3000 in 30 second intervals until normal operating temperature is reached. Turn off engine. Remove surge tank cap.
3. Start engine. Idle for one minute. Fill surge tank .5" (12.7 mm) above COLD FULL mark. Install surge tank cap. Raise RPM level to 3000 in 30 second intervals until normal operating temperature is reached. Turn off engine. Remove surge tank cap. Refill coolant as necessary, .5" (12.7 mm) above COLD FULL mark.

IGNITION SYSTEMS

CAMSHAFT POSITION SENSOR

Removal & Installation (1.8L)

Disconnect negative battery cable. Remove engine cover. Remove camshaft position sensor mounting bolt and remove camshaft position sensor. To install, reverse removal procedure. Tighten camshaft position sensor bolt to specification. See **TORQUE SPECIFICATIONS** .

Removal & Installation (1.3L, 1.9L, 2.4L, 3.8L, 4.0L & 4.6L)

Disconnect negative battery cable. Remove camshaft position sensor mounting bolt and remove camshaft position sensor. To install, reverse removal procedure. Tighten camshaft position sensor bolt to specification. See **TORQUE SPECIFICATIONS** .

Removal & Installation (2.2L)

Disconnect negative battery cable. Remove air cleaner outlet resonator. Remove camshaft position sensor mounting bolt and remove camshaft position sensor. To install, reverse removal procedure. Tighten camshaft position sensor bolt to specification. See **TORQUE SPECIFICATIONS** .

Removal & Installation (3.0L)

Disconnect negative battery cable. Remove A/C low pressure line bracket. Remove hold down bolts for wiring harness to intake plenum to gain access to the sensor. Remove camshaft position sensor mounting bolt and remove camshaft position sensor. To install, reverse removal procedure. Tighten camshaft position sensor bolt to specification. See **TORQUE SPECIFICATIONS** .

Removal & Installation (3.1L & 3.4L)

Disconnect negative battery cable. Remove power steering pump. Remove camshaft position sensor mounting bolt and remove camshaft position sensor. To install, reverse removal procedure. Tighten camshaft position sensor bolt to specification. See **TORQUE SPECIFICATIONS** .

Removal & Installation (3.5L)

Disconnect negative battery cable. Remove coolant recovery tank mounting nuts. Move coolant recovery tank aside. Remove camshaft position sensor mounting bolt and remove camshaft position sensor. To install, reverse removal procedure. Tighten camshaft position sensor bolt to specification. See **TORQUE SPECIFICATIONS** .

Removal & Installation (5.7L)

Disconnect negative battery cable. Remove intake manifold. Remove camshaft position sensor mounting bolt and remove camshaft position sensor. To install, reverse removal procedure. Tighten camshaft position sensor bolt to specification. See **TORQUE SPECIFICATIONS** .

CRANKSHAFT POSITION SENSOR (C^3 I)

Removal & Installation (3.8L)

1. Disconnect negative battery cable. Remove serpentine belt from crankshaft pulley. Raise vehicle on hoist. Remove right front tire and wheel assembly. Remove right inner fender access cover.
2. Using 28-mm socket, remove crankshaft harmonic balancer bolt. Using Balancer Remover (J-38197), remove harmonic balancer. Remove crankshaft position sensor shield (DO NOT use pry bar). See **Fig. 11** . Disconnect crankshaft position sensor harness connector. Remove crankshaft position sensor from engine block.
3. To install, reverse removal procedure. Apply Thread Sealer (GM 1052080) onto threads of harmonic balancer bolt. Tighten sensor and harmonic balancer bolts to specification. See **TORQUE SPECIFICATIONS** . Perform CRANKSHAFT POSITION (CKP) SENSOR VARIATION LEARN PROCEDURE. See COMPUTER RELEARN PROCEDURES article in GENERAL INFORMATION.

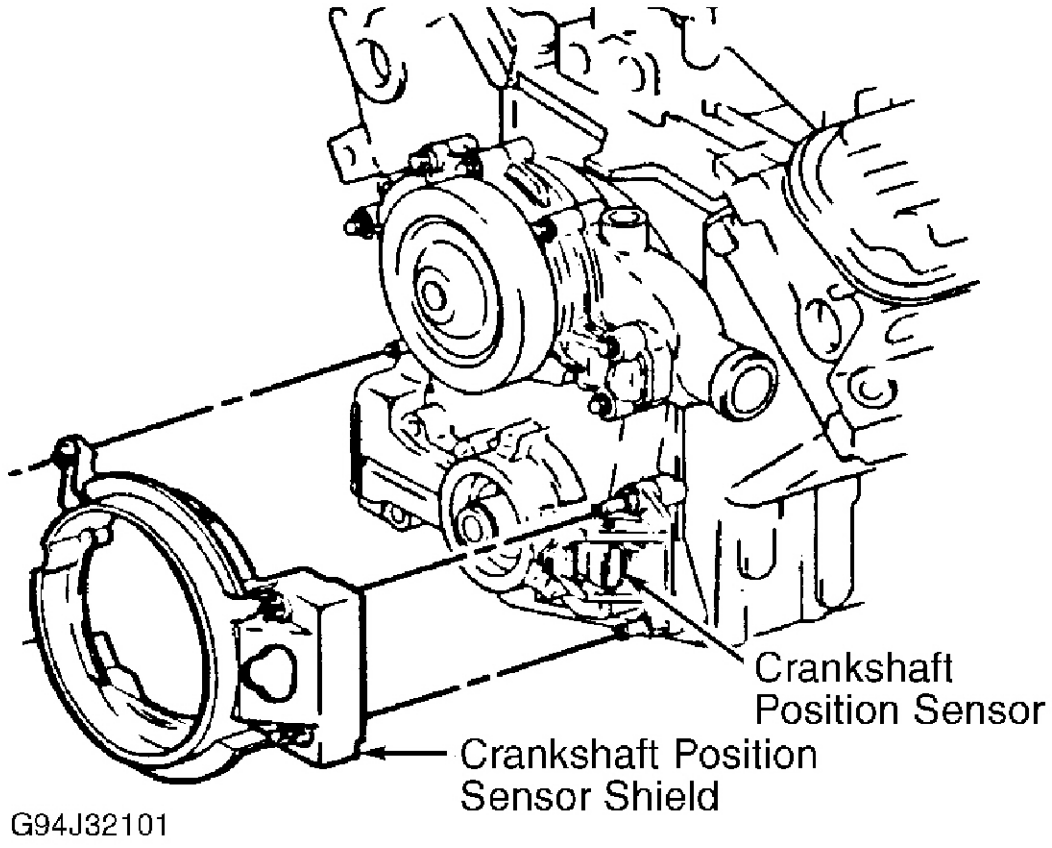


Fig. 11: Removing Crankshaft Position Sensor Shield (C^3 I)
Courtesy of GENERAL MOTORS CORP.

CRANKSHAFT POSITION SENSOR (DIS & IDI)

Removal & Installation (1.3L, 1.8L, 1.9L, 2.2L, 2.4L, 3.5L, 4.0L, 4.6L & 5.7L)

1. Disconnect negative battery cable. On 3.5L and 5.7L models, remove starter. On 4.0L and 4.6L models, remove oil filter adapter. On all models, disconnect harness connector from crankshaft position sensor. Remove crankshaft position sensor mounting bolt/nut and remove crankshaft position sensor.
2. Inspect crankshaft position sensor "O" ring for wear, cracks or other damage. Replace as necessary. Lubricate NEW "O" ring with engine oil before installing. To install, reverse removal procedure. Tighten crankshaft position sensor bolt/nut to specification. See **TORQUE SPECIFICATIONS** .

Removal & Installation (3.0L)

1. Disconnect negative battery cable. Disconnect harness connector from crankshaft position sensor. Attach piece of wire 36" (91 cm) long to crankshaft position sensor pigtail. Raise and support vehicle. Loosen oil cooler lines at engine block. Back out fittings far enough in order to gain sufficient clearance for sensor pigtail connector to pass between oil cooler lines and side of engine block.
2. Remove crankshaft position sensor connecting bolt. Remove crankshaft position sensor and "O" ring from engine block. Using wire attached to crankshaft position sensor pigtail, pass connector between lines and block at point of widest gap. Stop when pull wire is exposed at both ends of routing path.
3. Inspect crankshaft position sensor "O" ring for wear, cracks or other damage. Replace as necessary. Lubricate NEW "O" ring with engine oil before installing. To install, reverse removal procedure. Tighten crankshaft position sensor bolt/nut to specification. See **TORQUE SPECIFICATIONS** .

CRANKSHAFT (7X) POSITION SENSOR (DIS)

Removal & Installation (3.1L & 3.4L)

1. Disconnect negative battery cable. Turn steering wheel fully to left. Raise and support vehicle. Disconnect crankshaft position sensor harness connector. Remove crankshaft position sensor mounting bolt. Remove crankshaft position sensor from engine block.
2. Inspect crankshaft position sensor "O" ring for wear, cracks or other damage. Replace as necessary. Lubricate NEW "O" ring with engine oil before installing. To install, reverse removal procedure. Tighten crankshaft position sensor bolt to specification. See **TORQUE SPECIFICATIONS** .

CRANKSHAFT (24X) POSITION SENSOR (DIS)

Removal & Installation (3.1L & 3.4L)

1. Disconnect negative battery cable. Remove serpentine belt from crankshaft pulley. Raise and support vehicle.
2. Remove crankshaft harmonic balancer bolt. Using Balancer Remover (J-24420-B), remove harmonic balancer. Disconnect crankshaft position sensor harness connector. Remove crankshaft position sensor bolts. Remove crankshaft position sensor.
3. To install, reverse removal procedure. Apply Thread Sealer (GM 1052080) onto threads of harmonic balancer bolt. Tighten crankshaft position sensor and harmonic balancer bolts to specification. See **TORQUE SPECIFICATIONS** .

IGNITION COIL (DIS)

Removal & Installation (1.3L & 1.8L)

Disconnect negative battery cable. Remove spark plug wires from ignition coils. Disconnect harness connectors from ignition coils. Remove bolts attaching ignition coils to cylinder head. Remove ignition coils. To install, reverse removal procedure.

Removal & Installation (1.9L, 2.2L, 3.0L, 3.1L & 3.4L)

Disconnect negative battery cable. Remove spark plug wires from ignition coils. On 3.0L, remove screws attaching ignition coils to support bracket. On all models except 3.0L, remove nuts or screws attaching ignition coils to ignition control module. On all models, remove ignition coils. To install, reverse removal procedure.

IGNITION COIL (IDI)

Removal & Installation (2.4L)

1. Disconnect negative battery cable. Disconnect 11-pin harness connector. Remove 4 IDI cover assembly-to-camshaft housing bolts. Remove ignition system assembly from engine. Remove 4 coil housing-to-cover screws. Remove housing cover.
2. Disconnect coil harness connector from module. Remove ignition coil, contacts and seals from cover. To install, reverse removal procedure. Tighten screws and bolts to specification. See **TORQUE SPECIFICATIONS** .

Removal & Installation (3.5L, 4.0L, 4.6L & 5.7L)

NOTE: Ignition control module and ignition coil can not be serviced separately. Replace module and coil as an assembly.

For ignition coil removal and installation, see **IGNITION CONTROL MODULE (IDI)** .

IGNITION COIL (C^3 I)

Removal & Installation (3.8L)

Disconnect negative battery cable. Disconnect spark plug wires from coil pack. Remove 6 screws retaining coils to ignition control module. Remove ignition coils from module. To install, reverse removal procedure. Tighten retaining screws to specification. See **TORQUE SPECIFICATIONS** .

IGNITION CONTROL MODULE (C^3 I)

Removal & Installation (3.8L)

1. Disconnect negative battery cable. Disconnect 14-pin connector at ignition control module. Disconnect spark plug wires from coil pack. Remove 6 screws retaining coils to ignition control module. Remove ignition coils from module.
2. Remove screws and washers securing ignition control module to bracket. Remove ignition control module. To install, reverse removal procedure. Tighten retaining screws to specification. See **TORQUE SPECIFICATIONS** .

IGNITION CONTROL MODULE (DIS)

Removal & Installation (1.9L, 2.2L, 3.1L & 3.4L)

1. Disconnect negative battery cable. Disconnect connectors at ignition control module. See **Fig. 12** . Disconnect spark plug wires from coil pack. Remove coil pack/ignition control module assembly. For ignition control module location, see COMPONENT LOCATIONS in appropriate SYSTEM & COMPONENT TESTING article. Separate ignition coil(s) from ignition control module (if possible).
2. To install, reverse removal procedure. Tighten ignition control module mounting bolts/nuts. On 1.9L, ensure mounting bolt holes are clean of old sealant. Use NEW mounting bolts supplied with module. On all models, tighten mounting bolts/nuts to specification. See **TORQUE SPECIFICATIONS** .

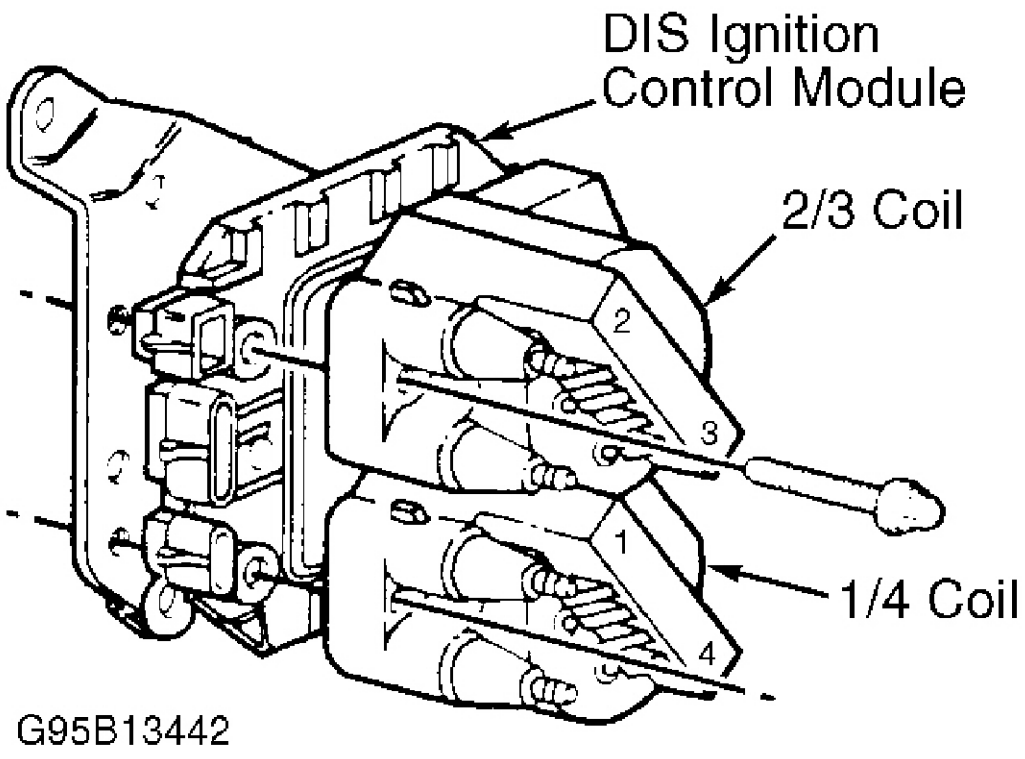


Fig. 12: Locating Distributorless Ignition Control Module Components (2.2L Shown; 1.9L Is Similar)
Courtesy of GENERAL MOTORS CORP.

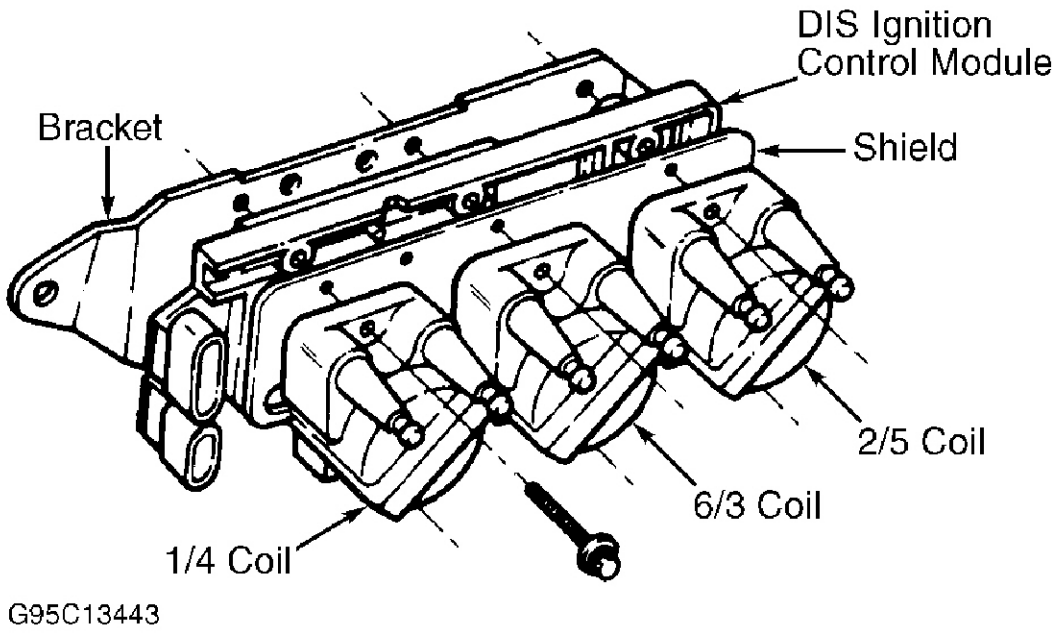


Fig. 13: Locating Distributorless Ignition Control Module Components (3.1L & 3.4L)
Courtesy of GENERAL MOTORS CORP.

IGNITION CONTROL MODULE (IDI)

Removal (2.4L)

CAUTION: If spark plug boots adhere to spark plugs, use Boot Remover (J-36011). Twist first, and then pull upward. Boots must be in place on housing before installing ignition system assembly, or damage may result.

1. Disconnect negative battery cable. Disconnect 11-pin harness connector. Remove 4 IDI cover assembly-to-camshaft housing bolts. Remove ignition system assembly from engine.
2. Remove 4 coil housing-to-cover screws. Remove housing cover. Remove coil harness connector from module. Remove module-to-cover screws. Remove module from cover.

Installation

NOTE: DO NOT wipe grease from module or coil if module is not being replaced. If installing a NEW module, spread silicone grease on metal face of module and on cover where module seats. Grease is included with NEW module and is necessary for module cooling purposes.

To install, reverse removal procedure. Tighten screws and bolts to specification. See **TORQUE SPECIFICATIONS** .

Removal & Installation (3.5L)

NOTE: Ignition control module and ignition coil can not be serviced separately. Replace module and coil as an assembly.

1. Disconnect negative battery cable. Disconnect electrical connector from ignition control module (ICM). Remove cover from coils. Remove ICM screws. Remove ignition control module.
2. To install, reverse removal procedure. Tighten screws to specification. See **TORQUE SPECIFICATIONS** .

Removal & Installation (4.0L & 4.6L)

NOTE: Ignition control module and ignition coil cannot be serviced separately. Replace module and coil as an assembly.

1. Disconnect negative battery cable. Remove fuel injector sight shield. Remove AIR control valve. Disconnect electrical connector from ignition control module (ICM). Remove cover from coils. Remove ICM screws. Remove ignition control module.
2. To install, reverse removal procedure. Tighten screws to specification. See **TORQUE SPECIFICATIONS** .

Removal & Installation (5.7L)

1. Disconnect negative battery cable. Remove fuel rail cover. Disconnect electrical connector from Ignition Control Module (ICM). Remove cover from coils. Remove ICM screws. Remove ignition control module.
2. To install, reverse removal procedure. Tighten screws to specification. See **TORQUE SPECIFICATIONS** .

KNOCK SENSORS

Removal & Installation (1.8L & 1.9L)

Disconnect negative battery cable. Remove intake manifold. See appropriate article in ENGINES. Disconnect knock sensor electrical connector. Remove knock sensor. To install, reverse removal procedure. Tighten knock sensor to specification. See **TORQUE SPECIFICATIONS** .

Removal & Installation (2.2L)

Disconnect negative battery cable. Remove air cleaner outlet resonator. Disconnect knock sensor electrical connector. Remove knock sensor. To install, reverse removal procedure. Tighten knock sensor to specification. See **TORQUE SPECIFICATIONS** .

Removal & Installation (2.4L)

Disconnect negative battery cable. Raise and support vehicle. Loosen knock sensor fastener. Disconnect knock sensor electrical connector. Remove knock sensor. To install, reverse removal procedure. Tighten knock sensor to specification. See **TORQUE SPECIFICATIONS** .

Removal & Installation (3.0L - Knock Sensor 1)

Disconnect negative battery cable. Disconnect knock sensor electrical connector. Remove generator and drive belt tensioner. Remove knock sensor pigtail from retaining clips on rear timing belt cover. Remove bolt in center of knock sensor. Remove knock sensor. To install, reverse removal procedure. Tighten knock sensor to specification. See **TORQUE SPECIFICATIONS** .

Removal & Installation (3.0L - Knock Sensor 2)

Disconnect knock sensor connector. Remove power steering pump pulley. Remove knock sensor pigtail from retaining clips. Attach scrap piece of wire about 36" (90 cm) to knock sensor pigtail. Remove left engine mount. Remove fastening bolts for engine mount bracket and remove bracket from block. Gently pull knock sensor pigtail through wiring conduit and out. Stop when the pull wire is free of conduit at both ends. Detach knock sensor from pull wire, leaving pull wire in place. To install, reverse removal procedure. Reroute knock sensor using pull wire left in place after removal. Tighten knock sensor to specification. See **TORQUE SPECIFICATIONS** .

Removal & Installation (3.1L & 3.4L)

Disconnect negative battery cable. Raise and support vehicle. Disconnect knock sensor electrical connector. Remove knock sensor. To install, reverse removal procedure. Tighten knock sensor to specification. See

TORQUE SPECIFICATIONS .

Removal & Installation (3.5L)

Disconnect negative battery cable. Remove right front wheel. Disconnect and reposition jumper harness connector. Disconnect knock sensor electrical connector. Remove knock sensor. To install, reverse removal procedure. Tighten knock sensor to specification. See **TORQUE SPECIFICATIONS** .

Removal & Installation (3.8L - Knock Sensor 1)

Disconnect negative battery cable. Drain cooling system. Raise and support vehicle. Disconnect knock sensor electrical connector. Remove knock sensor. To install, reverse removal procedure. Tighten knock sensor to specification. See **TORQUE SPECIFICATIONS** .

Removal & Installation (3.8L - Knock Sensor 2)

Disconnect negative battery cable. Drain cooling system. Raise and support vehicle. Remove splash shield bolts. Remove knock sensor heat shield. Disconnect knock sensor electrical connector. Remove knock sensor. To install, reverse removal procedure. Tighten knock sensor to specification. See **TORQUE SPECIFICATIONS** .

Removal & Installation (4.0L, 4.6L & 5.7L)

Disconnect negative battery cable. Remove intake manifold. See appropriate article in ENGINES. Disconnect knock sensor electrical connector. Remove knock sensor. To install, reverse removal procedure. Tighten knock sensor to specification. See **TORQUE SPECIFICATIONS** .

FUEL SYSTEMS

WARNING: Always relieve fuel pressure before disconnecting any fuel injection-related component. DO NOT allow fuel to contact engine or electrical components.

FUEL SYSTEM PRESSURE RELEASE

WARNING: Natural gas is highly flammable. To reduce risk of fire and personal injury, keep sparks, flames, and smoking materials away from vehicle while you perform Compressed Natural Gas (CNG) fuel system service. CNG system operates at pressures up to 3600 psi (24820 kPa). Relieve CNG fuel system pressure before servicing CNG fuel system components to reduce risk of fire and personal injury. Before servicing any electrical component, ignition must be in Off or Lock position and all electrical loads must be off, unless instructed otherwise in these procedures. If a tool or equipment could easily come in contact with a live exposed electrical terminal, also disconnect negative battery cable. Failure to follow these precautions may cause personal injury and/or damage to the vehicle or its components.

2.2L - Cavalier - CNG

NOTE: Replace all "O" rings that are disconnected or loosened.

1. Connect scan tool to Data Link Connector (DLC). Clear all existing DTC's. Start engine and verify engine is operating on CNG. Using scan tool, select High Pressure Lock-Off (HPL) output control. See **Fig. 14** . Close HPL and observe the Fuel Pressure Sensor parameter on scan tool. If Fuel Pressure Sensor parameter fails to decrease, go to next step. When engine stalls, turn ignition off. Remove CNG 20-amp fuse. Slowly open fuel line fittings in order to release remaining pressure.
2. Remove fuel tank cover dust plug. Close manual lock-down screw located on HPL manual shutoff fitting by

rotating the Allen screw clockwise until fully seated. Turn ignition off. Disconnect negative battery cable. Loosen fuel line fitting at Low Pressure Lock-Off (LPL) inlet port several turns. Do not remove fitting. If fuel is not venting with LPL inlet fitting loosened, relieve fuel line tension by pulling line away from LPL.

3. Loosen fuel line fitting at HPL inlet port several turns. Do not remove fitting. Relieve fuel line tension by pulling line away from HPL. Pressure is released when fuel line can be pulled away from HPL inlet port.

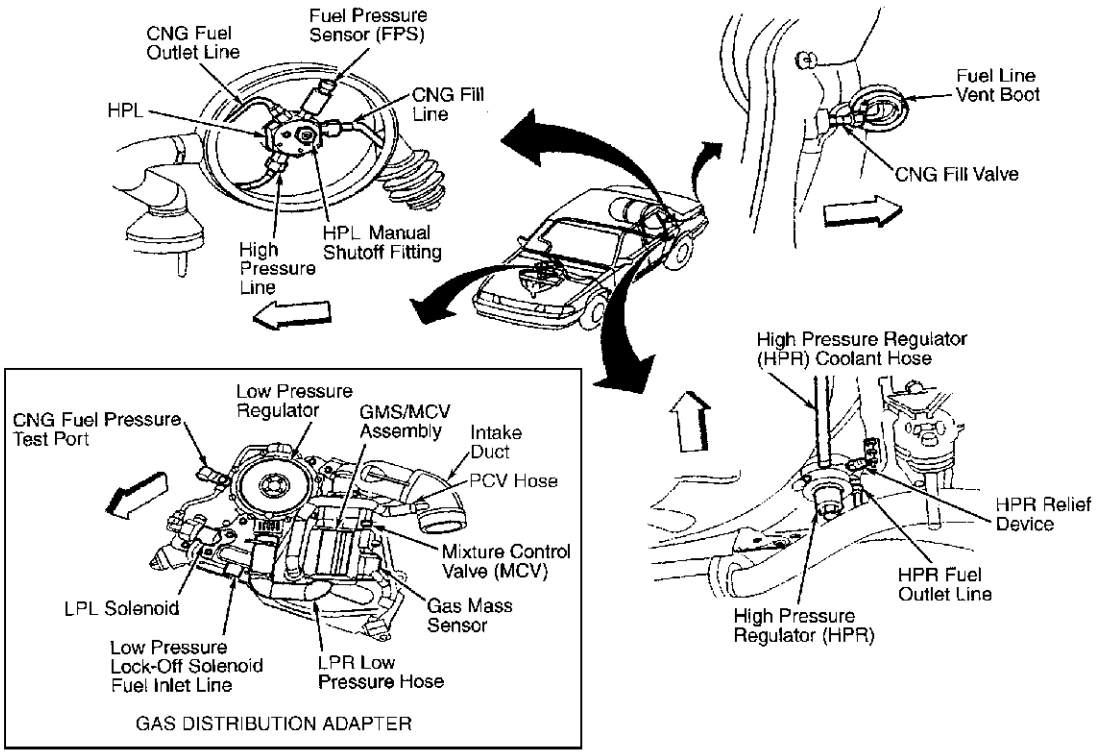


Fig. 14: Identifying CNG Fuel System Components
Courtesy of GENERAL MOTORS CORP.

Gasoline

WARNING: **Always relieve fuel pressure before disconnecting any fuel injection-related component. DO NOT allow fuel to contact engine or electrical components.**

Fuel system is under pressure. Pressure must be relieved prior to servicing fuel system. Fuel pressure may be relieved by using one of the following methods:

- On 1.3L and 1.8L, loosen fuel filler cap to relieve tank pressure (do not tighten at this time). On 1.3L and 1.8L, remove fuel pump relay. On all models, start and run engine until it stalls. Crank starter for 3 seconds to remove remaining fuel from fuel lines. Turn ignition off. Reinstall circuit opening relay or fuel pump relay. Disconnect negative battery cable to avoid possible fuel discharge in accidental attempt to start engine.
- On 1.9L, 3.0L, 3.1L, 3.4L, 3.5L, 3.8L, 4.0L, 4.6L and 5.7L, disconnect negative battery terminal. Loosen fuel filler cap. Install Fuel Pressure Gauge (J-34730-1A) on fuel pressure connector of fuel rail. Wrap shop towel around pressure connection when installing fuel pressure gauge to absorb fuel leakage. Install gauge bleed hose in container. Open bleed valve to bleed fuel pressure.
- On 2.2L and 2.4L Cavalier and Sunfire, loosen fuel filler cap to relieve tank pressure (do not tighten at this time). Disconnect fuel pump connector. Start and run engine until it stalls. Crank starter for 3 seconds to remove remaining fuel from fuel lines. Turn ignition off. Reconnect fuel pump connector. Disconnect negative battery cable to avoid possible fuel discharge in accidental attempt to start engine.
- On 2.2L Saturn, connect scan tool to Data Link Connector (DLC). Start engine. Using scan tool special tests function, select PCM/EC, and then select fuel delivery. Select FUEL PUMP and command fuel pump off. Engine will stall in 3-5 seconds. Turn ignition off.

CNG FUEL MODULE ASSEMBLY

Removal & Installation (2.2L - Cavalier - CNG)

WARNING: Natural gas is highly flammable. To reduce risk of fire and personal injury, keep sparks, flames, and smoking materials away from vehicle while you perform Compressed Natural Gas (CNG) fuel system service. CNG system operates at pressures up to 3600 psi (24820 kPa). Relieve CNG fuel system pressure before servicing CNG fuel system components to reduce risk of fire and personal injury. Before servicing any electrical component, ignition must be in Off or Lock position and all electrical loads must be off, unless instructed otherwise in these procedures. If a tool or equipment could easily come in contact with a live exposed electrical terminal, also disconnect negative battery cable. Failure to follow these precautions may cause personal injury and/or damage to the vehicle or its components.

NOTE: Module is located in left front corner of engine compartment.

1. Relieve fuel system pressure. See **FUEL SYSTEM PRESSURE RELEASE** . Disconnect negative battery cable. Remove throttle cables from retaining clip. Remove gas distribution adapter. Disconnect fuel inlet line from Low Pressure Lock-Off (LPL) solenoid. See **Fig. 14** .
2. Disconnect wiring harness connectors. Remove CNG fuel module assembly bracket nuts and bolts. To install, reverse removal procedure. Tighten all fasteners to specification. See **TORQUE SPECIFICATIONS** .

Disassembly & Reassembly

1. Remove fuel line between Low Pressure Lock-off (LPL) and Low Pressure Regulator (LPR). Loosen hose clamps on vapor hose between LPR and Gas Mass Sensor/Mixture Control Valve (GMS/MCV). Remove GMS/MCV and bracket from module bracket as an assembly. Remove LPR from module plate. Remove LPL and bracket from module bracket as an assembly.
2. To install, reverse removal procedure. Tighten LPL bracket nuts, LPR bolts and GMS/MCV bracket nuts to 108 INCH lbs. (12 N.m). Tighten hose clamps and fuel line fittings to 18 ft. lbs. (24 N.m).

FUEL GAUGE SELECT SWITCH

Removal & Installation (2.2L - Cavalier - CNG)

1. Disable SIR system. See appropriate AIR BAG RESTRAINT SYSTEMS article in ACCESSORIES & EQUIPMENT. Remove instrument panel trim pad. Remove defroster grille screw. Using a flat-bladed tool, remove defroster grille from Instrument Panel (IP) trim pad. Remove IP outer trim cover screws. Remove IP outer trim covers. Open glove compartment and remove right IP trim plate bezel. Remove IP trim pad screws and remove IP trim pad from IP carrier.
2. Remove screws from IP trim plate and remove IP accessory trim plate by pulling rearward to disengage retainers. Disconnect electrical connectors from trim plate. Remove fuel gage select switch from trim plate. To install, reverse removal procedure.

FUEL PUMP

CAUTION: Provide proper ventilation when working with fuel in enclosed areas where fuel vapors can collect. The lack of adequate ventilation may result in personal injury.

CAUTION: Always wear safety goggles when working with fuel in order to protect the

eyes from fuel splash.

CAUTION: Fuel vapors can collect while servicing fuel system parts in enclosed areas such as a trunk. To reduce the risk of fire and increased exposure to vapors, use forced air ventilation such as a fan set outside of the trunk. Plug or cap any fuel system openings in order to reduce fuel vapor formation. Clean up any spilled fuel immediately. Avoid sparks and any source of ignition. Use signs to alert others in the work area that fuel system work is in process.

CAUTION: 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.

NOTE: Clean all of the following areas before performing any disconnections in order to avoid possible contamination in the system. The fuel pipe connections. The hose connections. The areas surrounding the connections.

NOTE: DO NOT handle the fuel pump assembly by the fuel pipes. The amount of leverage generated by handling the fuel pipes could damage the joints.

NOTE: Replace the fuel sender "O" rings when re-installing the fuel pump in order to avoid damage to the fuel pump assembly.

NOTE: When installing fuel sending unit assembly, DO NOT fold or twist strainer. This will restrict fuel flow.

Removal (Bonneville, LeSabre & Park Avenue - 3.8L)

1. Relieve the fuel system fuel pressure. See **FUEL SYSTEM PRESSURE RELEASE** . Drain the fuel tank to at least 3/4 of full.

CAUTION: Remove the rear compartment floor trim to provide technician contact with the vehicle's metal surfaces. Failure to remove the rear compartment floor trim may cause a static electricity discharge to ignite any fuel vapor resulting in personal injury and vehicle damage.

NOTE: Remove the rear compartment floor trim to avoid damage from fuel spillage.

2. Remove the spare tire cover, the jack, and the spare tire. Remove the rear compartment trim. Remove the fuel pump access panel (1). See **Fig. 15** .
3. Clean all of the fuel pipe connections, hose connections and all of the areas surrounding the connections before disconnecting the connections in order to avoid possible contamination of the fuel system.

NOTE: Remove the rear compartment floor trim to avoid damage from fuel spillage.

4. Remove the quick-connect fittings at the fuel sender assembly. Disconnect the electrical connector from the fuel sender. Disconnect the electrical connector from the fuel tank pressure sensor.

CAUTION: The modular fuel sender will spring up when the retaining cam is removed. When removing the modular fuel sender assembly from the

fuel tank, the reservoir bucket on the fuel sender assembly is full of fuel. The fuel sender assembly must be tipped slightly during removal in order to avoid damage to the float. Place any remaining fuel into an approved container once the fuel sender assembly is removed from the tank.

5. Remove the fuel sender retaining cam, using the Fuel Sender Locknut Wrench (J-39765). Remove the fuel sender assembly and the "O" ring from the fuel tank. Discard the fuel sender assembly "O" ring. Clean and inspect the "O" ring sealing surfaces of the fuel sender assembly.

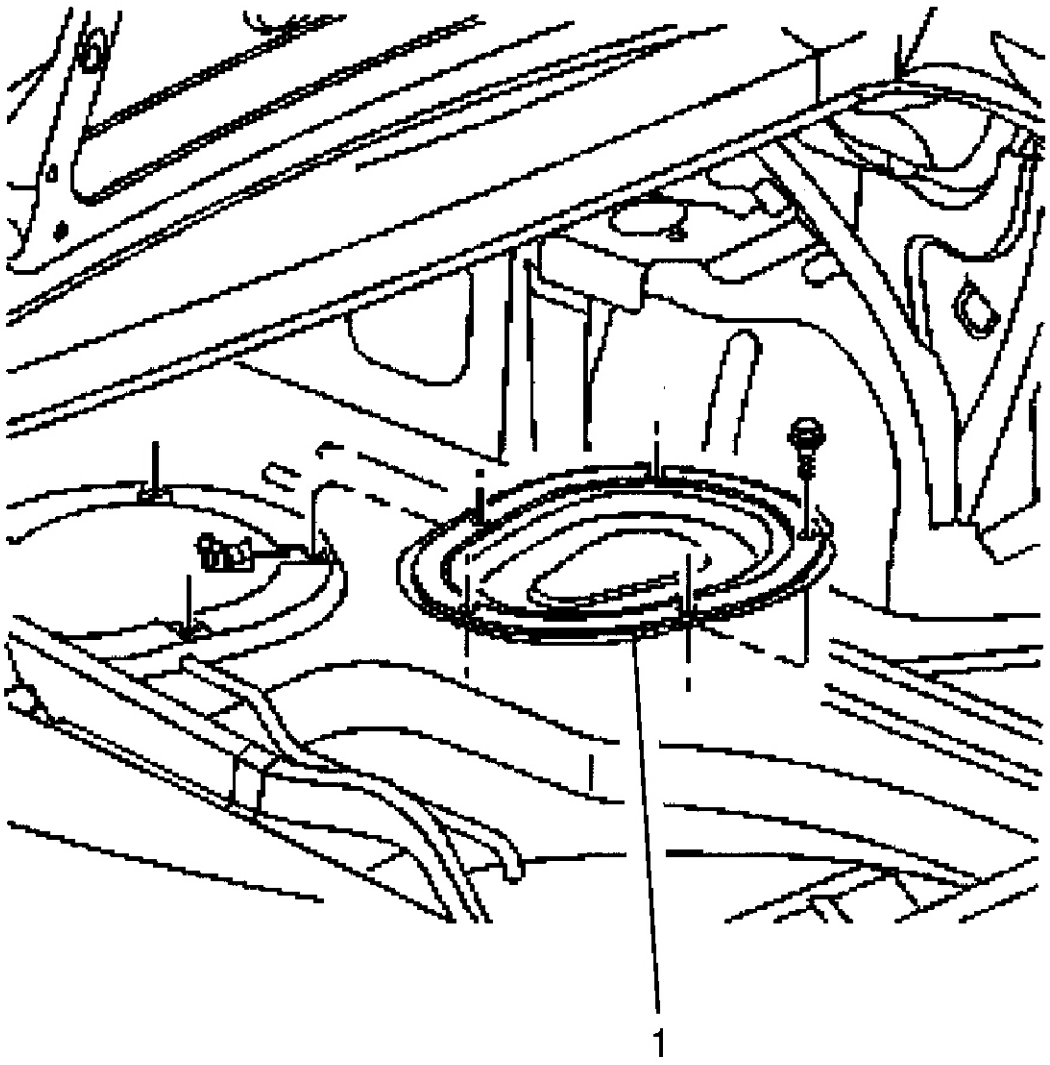


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Fig. 15: Removing/Installing Fuel Pump Access Panel (Bonneville, LeSabre & Park Avenue - 3.8L)
Courtesy of GENERAL MOTORS CORP.

Installation

CAUTION: Always replace the fuel pump "O" ring when reinstalling the fuel pump assembly.

NOTE: Always re-attach the fuel lines and fuel filter with all original type fasteners and hardware. DO NOT repair sections of fuel pipes.

NOTE: Use the correct fastener in the correct location. Replacement fasteners must be

the correct part number for that application. Fasteners requiring replacement or fasteners requiring the use of thread locking compound or sealant are identified in the service procedure. DO NOT use paints, lubricants, or corrosion inhibitors on fasteners or fastener joint surfaces unless specified. These coatings affect fastener torque and joint clamping force and may damage the fastener. Use the correct tightening sequence and specifications when installing fasteners in order to avoid damage to parts and systems.

1. Position the NEW "O" ring on the fuel tank.

CAUTION: Care should be taken not to fold over or twist the fuel pump strainer (4) when installing the fuel pump assembly, as this will restrict the fuel flow. Also, assure that the fuel pump strainer does not block full travel of float arm.

2. Install the fuel pump assembly and the retainer cam, using the Fuel Sender Locknut Wrench (J-39765). Install the quick-connect fittings at the fuel sender assembly.
3. Connect the electrical connector to the fuel tank pressure sensor. Connect the electrical connector to the fuel sender assembly.
4. Install the negative battery cable. Inspect for leaks. Turn ON the ignition switch for 2 seconds. Turn OFF the ignition switch for 10 seconds. Turn ON the ignition switch. Check for fuel leaks.
5. Install the fuel sender access panel. Tighten fasteners to specification. See **TORQUE SPECIFICATIONS** . Install the rear compartment floor trim.
6. Install the spare tire, the jack, and the spare tire cover. Add fuel to the fuel tank. Install the fuel filler cap.

Removal & Installation (Camaro & Firebird)

CAUTION: In order to reduce the risk of fire and personal injury that may result from a fuel leak, always replace the fuel sender gasket when reinstalling the fuel sender assembly.

CAUTION: Always maintain cleanliness when servicing fuel system components.

CAUTION: Drain the fuel from the fuel sender assembly into an approved container in order to reduce the risk of fire and personal injury. Never store the fuel in an open container.

NOTE: **DO NOT handle the fuel sender assembly by the fuel pipes. The amount of leverage generated by handling the fuel pipes could damage the joints.**

NOTE: **Cap the fittings and plug the holes when servicing the fuel system in order to prevent dirt and other contaminants from entering the open pipes and passages.**

NOTE: **Use the correct fastener in the correct location. Replacement fasteners must be the correct part number for that application. Fasteners requiring replacement or fasteners requiring the use of thread locking compound or sealant are identified in the service procedure. DO NOT use paints, lubricants, or corrosion inhibitors on fasteners or fastener joint surfaces unless specified. These coatings affect fastener torque and joint clamping force and may damage the fastener. Use the correct tightening sequence and specifications when installing fasteners in order**

to avoid damage to parts and systems.

1. Disconnect the negative battery cable. Relieve the fuel system pressure. See **FUEL SYSTEM PRESSURE RELEASE** .
2. Raise car on hoist. Drain fuel from fuel tank. Disconnect exhaust pipe at converter and rear hanger. Allow exhaust to hang over axle assembly.
3. Remove tailpipe and muffler heat shields. Remove fuel filler neck shield behind left rear tire. Remove rear suspension track bar and brace. Disconnect harness connector to fuel pump assembly.
4. Disconnect all fuel lines. Remove fuel line retaining bracket on left side and remove brake line clip from bracket.
5. Position support jack under axle assembly. Disconnect lower ends of shock absorbers. Disconnect rear stabilizer bar from frame (if equipped).
6. On models equipped with 2-piece driveshaft, remove center support bearing-to-rear axle torque arm bolts. On all models, remove rear axle torque arm-to-differential housing bolts/nuts. Wire end of rear axle torque arm aside. Remove driveshaft-to-differential yoke bolts/screws. Wire end of driveshaft aside.
7. Lower rear suspension as far as possible without damaging brake lines and cables and remove both coil springs. Remove fuel tank strap bolts. Remove fuel tank by rotating front of tank down and sliding to the right. Remove fuel pump assembly from fuel tank.

CAUTION: The fuel pump strainer must be in a horizontal position when the fuel sender is installed in the tank. When installing the fuel sender assembly, assure that the fuel pump strainer does not block full travel of the float arm.

8. Carefully fold the strainer to allow it to fit through the opening in the fuel tank. Make sure the strainer unfolds once it is placed in the tank.
9. To install, reverse removal procedure. Tighten all fasteners to specification. See **TORQUE SPECIFICATIONS** . Inspect for leaks. Turn ON the ignition for 2 seconds. Turn OFF the ignition for 10 seconds. Turn ON the ignition. Check for fuel leaks. On 5.7L models, perform the idle learn procedure. See **CAMARO & FIREBIRD** in COMPUTER RELEARN article in GENERAL INFORMATION.

Removal & Installation (Catera - 3.0L)

CAUTION: 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.

NOTE: Use the correct fastener in the correct location. Replacement fasteners must be the correct part number for that application. Fasteners requiring replacement or fasteners requiring the use of thread locking compound or sealant are identified in the service procedure. DO NOT use paints, lubricants, or corrosion inhibitors on fasteners or fastener joint surfaces unless specified. These coatings affect fastener torque and joint clamping force and may damage the fastener. Use the correct tightening sequence and specifications when installing fasteners in order to avoid damage to parts and systems.

1. Raise and suitably support the vehicle. Remove the right hand rear fascia bolts. Remove the rear frame support.
2. Disconnect the fuel feed line at the fuel filter and the return line near the fuel filter. Remove clamps from the fuel tank breather hose and EVAP hoses at the fuel tank near the fuel filter.

3. Disconnect the fuel tank breather hose and the EVAP hoses. Remove the fuel sender electrical connector retainer. Disconnect the fuel sender electrical connector. Remove the fuel filter retaining bolt from the bracket. Remove the EVAP vent valve retaining bolt from the bracket.
4. With the aid of an assistant, support the fuel tank. Remove the fuel tank retaining strap attaching bolts. Remove both fuel tank retaining straps. Lower the fuel tank.
5. Disconnect the electrical connectors from the fuel tank pressure sensor (6) and the fuel tank connection cover (2). See **Fig. 16** . Remove the fuel pressure (5) and return lines (1) from the tank connection cover and discard the clamps. Remove the air reference hose (3) from the fuel tank pressure sensor. Remove the fastener (4) securing the fuel tank pressure sensor to the fuel tank connection cover and remove the fuel tank pressure sensor.

CAUTION: DO NOT remove the steel band around fuel sender lock nut. This steel band does not require removal in order the loosen the fuel sender lock nut.

6. Remove the spring loaded clamp (1) around the fuel tank boot. See **Fig. 17** . Note the position of the clamp. The clamp must be reinstalled in the same position. Carefully pull the boot from the outer fuel tank housing.
7. Remove the fuel sender locking nut from the fuel tank by using the Fuel Tank Sender Wrench (J-42219-B) fuel tank sender wrench. See **Fig. 18** . Lift the fuel tank connection cover from the tank and position aside. Remove the fuel level sensor electrical connector (1) from the fuel tank connection cover. See **Fig. 19** .

CAUTION: Note the position of the fuel sender seal prior to removal. An incorrectly installed seal can cause fuel leaks or EVAP DTCs to set.

8. Unlock the fuel sensor by pressing the hook outward. Remove the fuel sensor by pulling upward on the hook to slide the unit from the fuel pump housing. Remove the fuel sender seal (lip) from the fuel tank opening. Carefully slide the seal over the wiring and hoses, then pull the seal over the fuel tank connection cover. Discard the seal.
9. Install the fuel level sender in the tank by positioning the float in first and sliding the unit into the slots in the side of the fuel reservoir. Push the unit down in the slot until the tab on the hook engages in the reservoir. Connect the fuel level sender electrical connector to the fuel tank connection cover.
10. Install a NEW lip seal on the tank as follows: Carefully pull the seal over the fuel tank connection cover. Slide the seal over the wires and hoses to the fuel tank opening. Fit the groove in the side of the seal into the lip in the fuel tank opening. Install the fuel tank connection cover on the fuel tank opening.
11. To complete installation, reverse removal procedure. Tighten all fasteners to specification. See **TORQUE SPECIFICATIONS** .

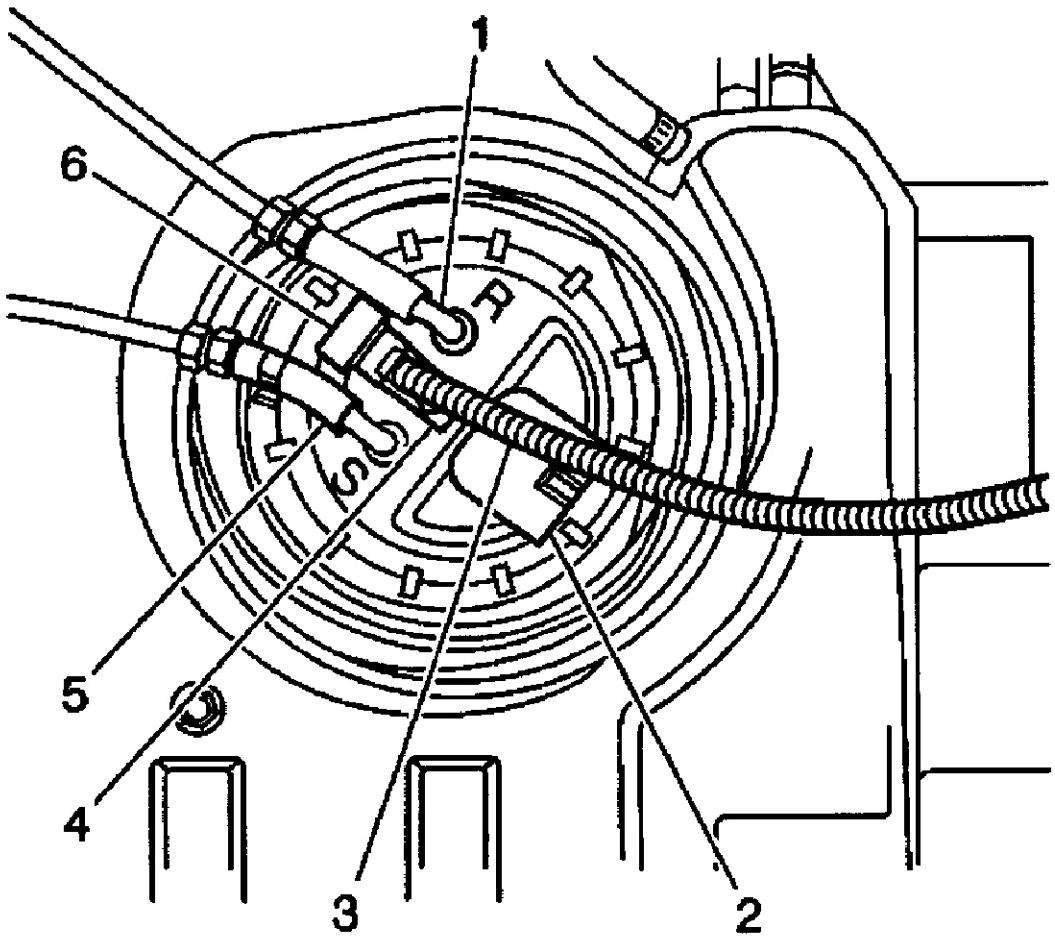


Fig. 16: Removing/Installing Fuel Sender Assembly Components (Catera - 3.0L)
Courtesy of GENERAL MOTORS CORP.

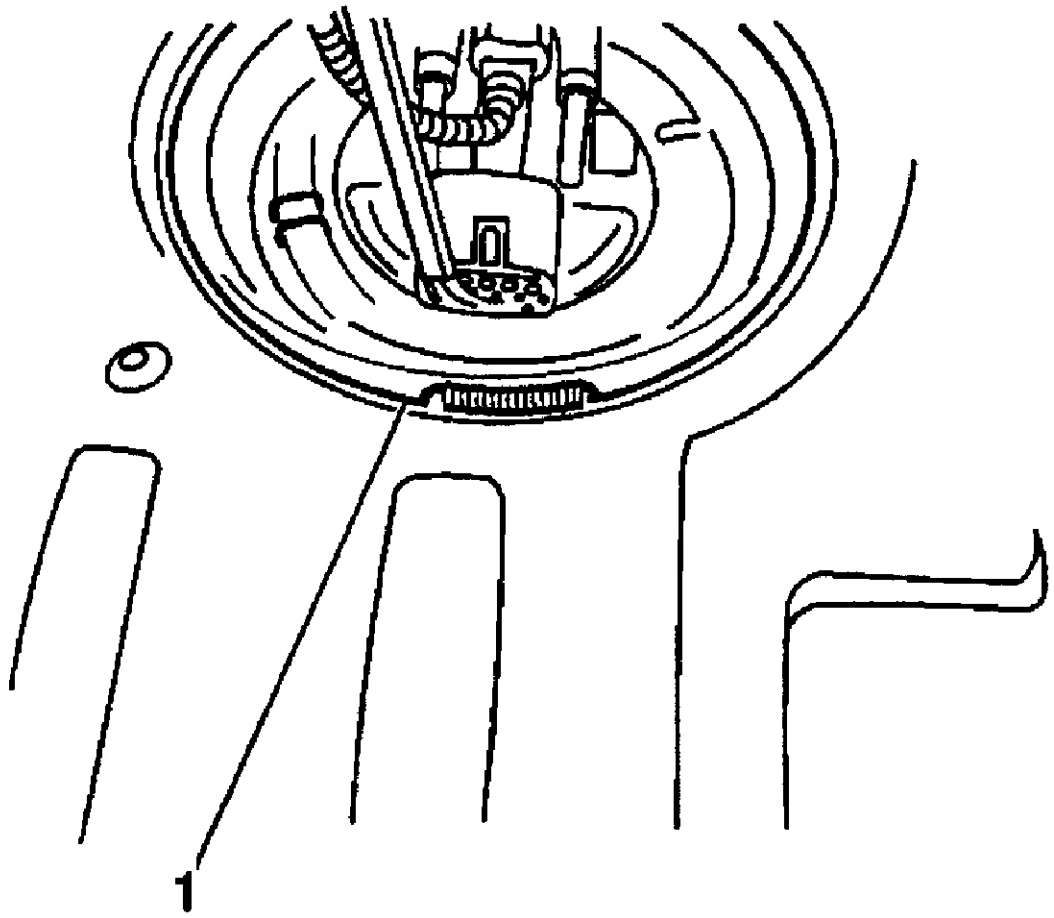


Fig. 17: Removing/Installing Spring Loaded Clamp (Catera - 3.0L)
Courtesy of GENERAL MOTORS CORP.

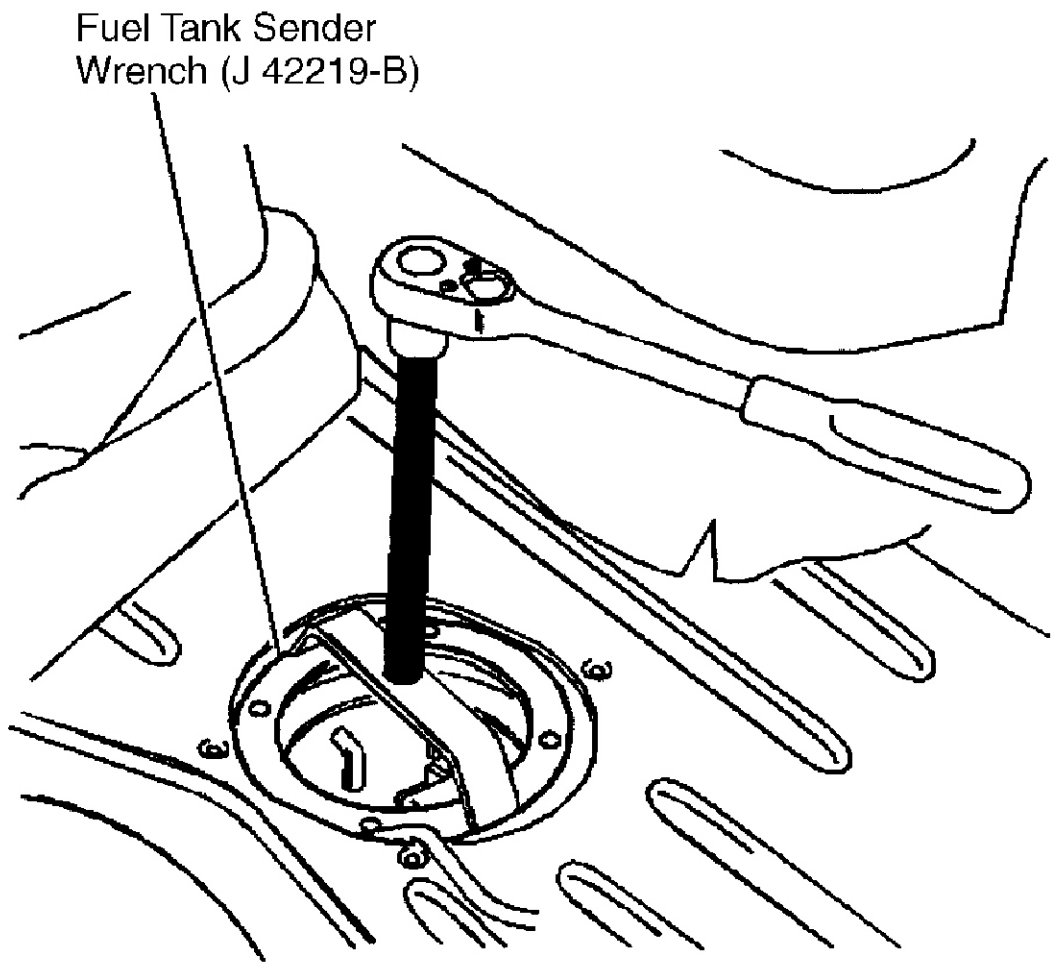


Fig. 18: Removing/Installing Fuel Sender Locking Nut From Fuel Tank (Catera - 3.0L)
Courtesy of GENERAL MOTORS CORP.

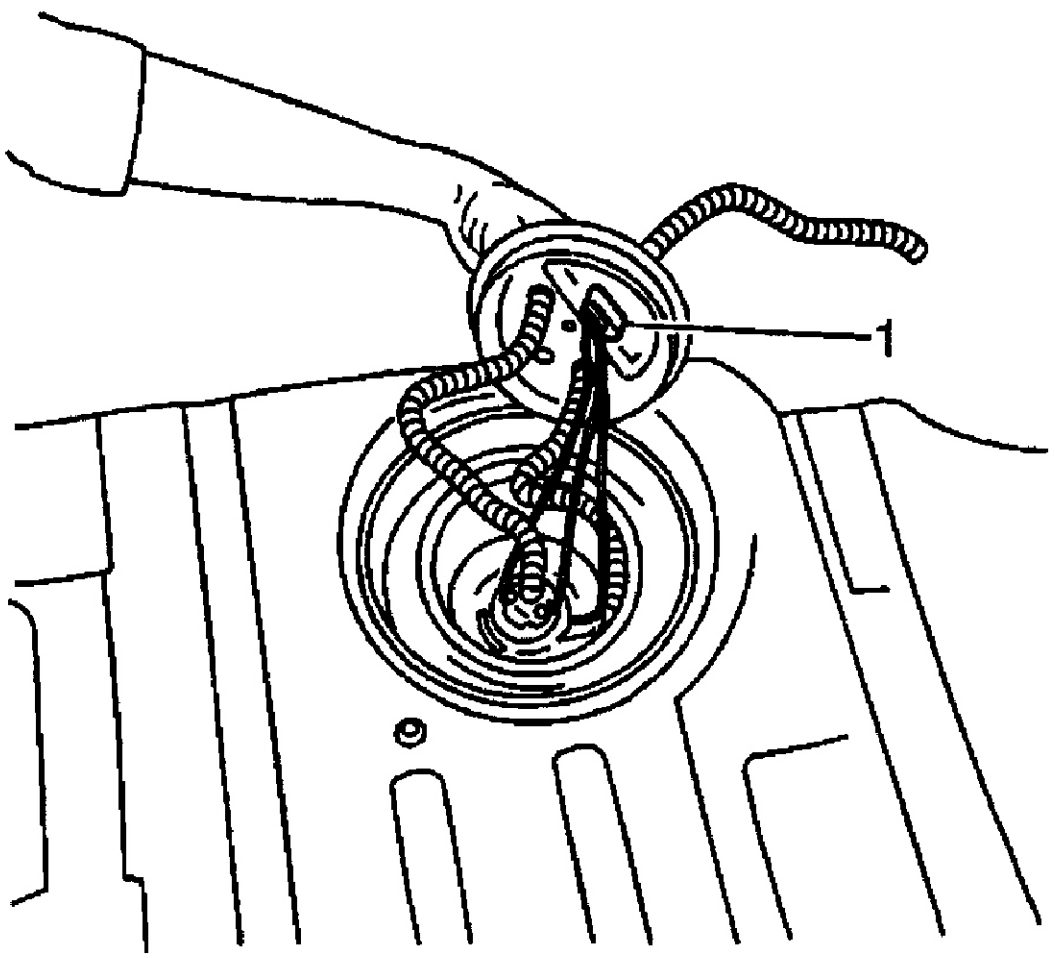


Fig. 19: Disconnecting/Connecting Fuel Level Sensor Electrical Connector (Catera - 3.0L)
Courtesy of GENERAL MOTORS CORP.

Removal & Installation (Cavalier & Sunfire - 2.2L & 2.4L)

CAUTION: In order to reduce the risk of fire and personal injury that may result from a fuel leak, always replace the fuel sender gasket when reinstalling the fuel sender assembly

CAUTION: Before servicing any electrical component, the ignition key must be in the OFF or LOCK position and all electrical loads must be OFF, unless instructed otherwise in these procedures. If a tool or equipment could easily come in contact with a live exposed electrical terminal, also disconnect the negative battery cable. Failure to follow these precautions may cause personal injury and/or damage to the vehicle or its components.

NOTE: The modular fuel sender assembly may spring up from its position. When removing the modular assembly from the fuel tank, be aware that the reservoir bucket is full of fuel. Tip the modular assembly slightly during removal to avoid damage to the float. Use a shop towel to absorb any leakage.

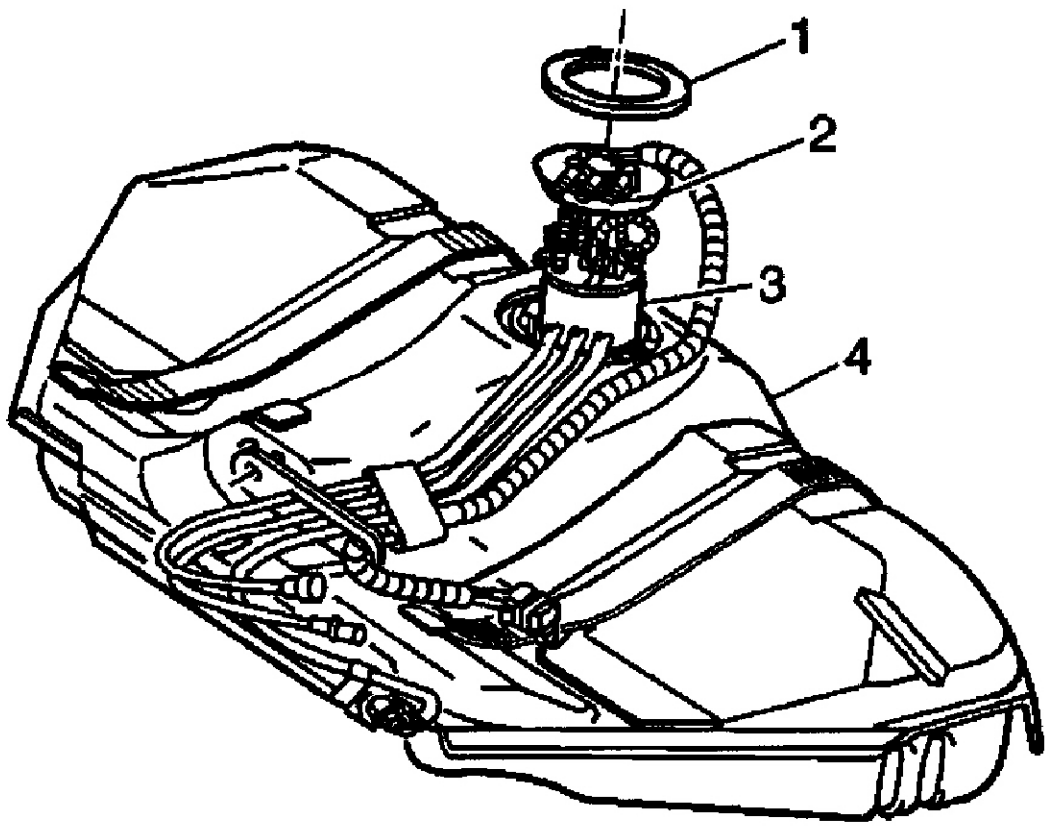
1. Disconnect the negative battery cable. Relieve the fuel system pressure. See **FUEL SYSTEM PRESSURE RELEASE** . Drain the fuel tank.
2. Raise and support the vehicle. Grasp the nylon fuel pipe quick-connect fitting. Twist the quick-connect fitting 1/4 turn in each direction to loosen any dirt within fitting. Repeat for the other nylon fuel pipe quick-connect

fitting. Using compressed air, blow out dirt from the quick-connect fittings at end of the fuel pipes. Disconnect the quick-connect fittings at the fuel tank.

3. Disconnect the quick-connect fitting at the fuel filter. Remove the quick connect fittings at the end of the fuel pipe and vapor pipes. Remove the muffler support bolts. Remove the exhaust rubber hangers. Allow exhaust system to rest on rear suspension. Remove the exhaust heat shield. Remove the hoses at the fuel tank from the filler, vent and vapor pipes.
4. With the aid of an assistant, support fuel tank and disconnect the 2 fuel tank retaining straps. With the aid of an assistant, lower the fuel tank. Remove the fuel tank pressure sensor electrical connector. Remove the fuel sender electrical connector. Remove the tank from the vehicle. See **Fig. 20** .
5. While holding the modular fuel sender assembly (3) down, remove the snap ring (1) from designated slots located on the retainer (2).
6. Install a NEW "O" ring on the modular fuel sender. Install the modular fuel sender to the fuel tank. Align the tab on front of the modular fuel sender with slot on front of the retainer snap ring. Slowly apply pressure to top of the spring loaded sender until the sender aligns flush with the retainer on tank.

CAUTION: Be sure that the snap ring is fully seated within the tab slots.

7. Insert the snap ring into the designated slots. Install the fuel tank. Lower the vehicle. Refill the fuel tank. Connect the negative battery cable.
8. Inspect for fuel leaks through the following steps. Turn the ignition switch to the ON position for two seconds. Turn the ignition switch to the OFF position for ten seconds. Turn the ignition switch to the ON position Check for fuel leaks.



G00255842

Fig. 20: Removing/Installing Fuel Sender Assembly (Cavalier, Lumina, Malibu & Sunfire - 2.2L, 2.4L & 3.1)
Courtesy of GENERAL MOTORS CORP.

Removal & Installation (Century, Grand Prix, Impala, Intrigue, Monte Carlo & Regal - 3.1L, 3.4L, 3.8L)

CAUTION: Fuel Vapors can collect while servicing fuel system parts in enclosed areas such as a trunk. To reduce the risk of fire and increased exposure to vapors: Use forced air ventilation such as a fan set outside of the trunk. Plug or cap any fuel system openings in order to reduce fuel vapor formation. Clean up any spilled fuel immediately. Avoid sparks and any source of ignition. Use signs to alert others in the work area that fuel system work is in process.

CAUTION: Always maintain cleanliness when servicing fuel system components.

CAUTION: Care should be taken not to fold over or twist the fuel pump strainer when installing the fuel sender assembly, as this will restrict fuel flow. Also, assure that the fuel pump strainer does not block full travel of float arm. Be sure that the fuel sender assembly retaining snap ring is fully seated within the tab slots on the fuel tank. Always replace the fuel sender "O" rings when reinstalling the fuel sender assembly.

NOTE: **Clean all of the following areas before performing any disconnections in order to avoid possible contamination in the system: The fuel pipe connections, the hose connections and the areas surrounding the connections.**

NOTE: **Always re-attach the fuel lines and fuel filter with all original type fasteners and hardware. DO NOT repair sections of fuel pipes.**

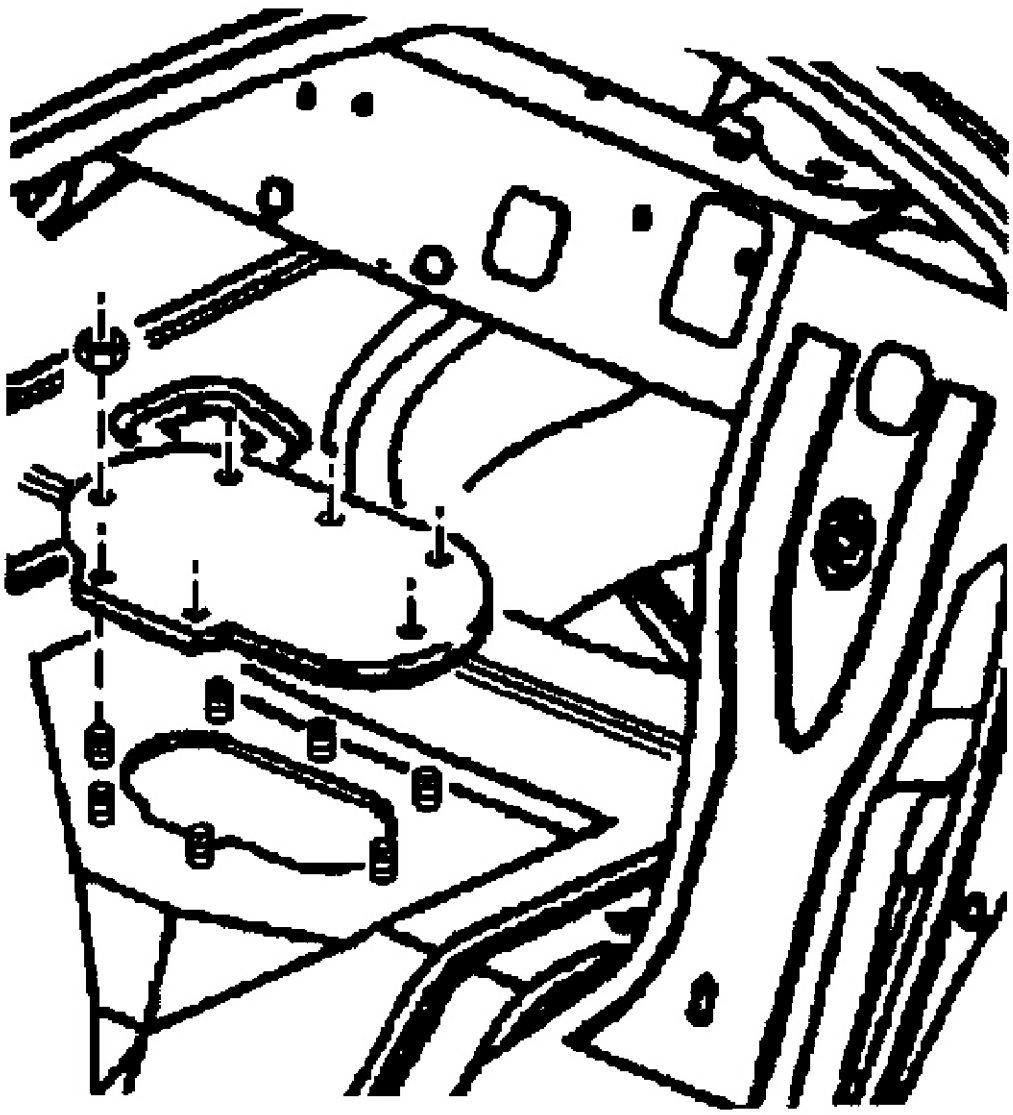
NOTE: **Use the correct fastener in the correct location. Replacement fasteners must be the correct part number for that application. Fasteners requiring replacement or fasteners requiring the use of thread locking compound or sealant are identified in the service procedure. DO NOT use paints, lubricants, or corrosion inhibitors on fasteners or fastener joint surfaces unless specified. These coatings affect fastener torque and joint clamping force and may damage the fastener. Use the correct tightening sequence and specifications when installing fasteners in order to avoid damage to parts and systems.**

1. Relieve the fuel system fuel pressure. See **FUEL SYSTEM PRESSURE RELEASE** . Disconnect the negative battery cable. Remove the spare tire cover, the jack, and the spare tire.
2. Remove the rear compartment trim panel. Remove the nuts retaining the fuel sender access panel. See **Fig. 21** . Remove the fuel sender access panel. Disconnect the fuel tank pressure sensor electrical connector. Disconnect the fuel sender electrical connector.

CAUTION: The modular fuel sender assembly will spring-up when the snap ring is removed.

3. Clean the fuel pipes, and fuel sender assembly to prevent possible fuel contamination during removal. Disconnect the quick-connect fittings at the fuel sender assembly. Remove the fuel sender retaining snap ring. See **Fig. 22** . Remove the modular fuel sender assembly.
4. Clean the fuel sender assembly "O" ring sealing surfaces. Inspect the fuel sender assembly "O" ring sealing surfaces.
5. To install, reverse removal procedure. Tighten all fasteners to specification. See **TORQUE SPECIFICATIONS** .

6. Inspect the fuel system for leaks by performing the following steps: Turn the ignition switch ON for 2 seconds. Turn the ignition switch OFF for 10 seconds. Turn the ignition switch ON. Inspect for fuel leaks.



G00255847

Fig. 21: Removing/Installing Fuel Sending Assembly Access Cover (Century, Grand Prix, Impala, Intrigue, Monte Carlo & Regal - 3.1L, 3.4L, 3.8L)
Courtesy of GENERAL MOTORS CORP.

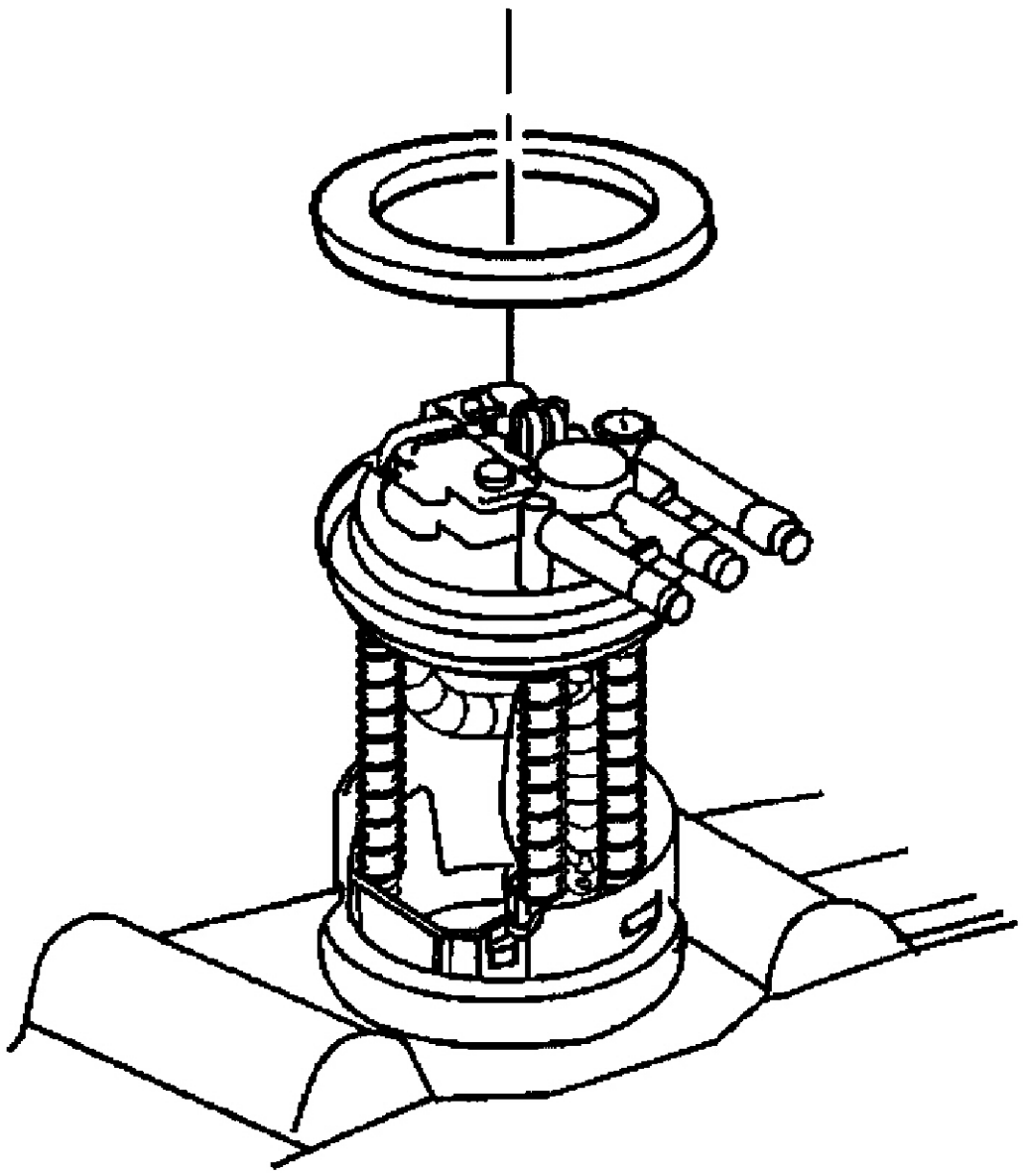


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Fig. 22: Removing/Installing Fuel Sender Retaining Snap Ring (Century, Grand Prix, Impala, Intrigue, Monte Carlo & Regal - 3.1L, 3.4L, 3.8L)
Courtesy of GENERAL MOTORS CORP.

Removal (Corvette - 5.7L)

CAUTION: Before servicing any electrical component, the ignition key must be in the OFF or LOCK position and all electrical loads must be OFF, unless instructed otherwise in these procedures. If a tool or equipment could easily come in contact with a live exposed electrical terminal, also disconnect the negative battery cable. Failure to follow these precautions may cause personal injury and/or damage to the vehicle or its components.

NOTE: Vehicle is equipped with 2 fuel tanks. The electric fuel pump attaches to the fuel sender assembly inside the left fuel tank. The fuel pump supplies fuel to the right fuel tank siphon jet pump in order to transfer fuel from the right fuel tank to the left fuel tank.

1. Disconnect the negative battery cable. Relieve the fuel system pressure. See **FUEL SYSTEM PRESSURE**

RELEASE .

2. Raise and support the vehicle. Remove the left rear wheel and tire assembly. Clean all of the fuel connections and the surrounding areas before disconnecting the fuel pipes in order to avoid possible contamination of the fuel system.
3. Drain the fuel tanks. Remove fuel tank shield bolt (2) and nut (3). See **Fig. 23** . Remove the fuel tank shield (1). Mark or identify each fuel pipe in order to aid in installing the pipes in their original positions.
4. Disconnect the quick-connect fittings from the fuel sender. Cap all of the fuel pipes. Disconnect the fuel sender electrical connector. Remove the fuel tank strap bolts (1), (2) and (4) while supporting fuel tank. See **Fig. 24** . Remove the fuel tank strap (3).
5. Support the fuel tank. Remove previously installed "break-away head" service bolts (if equipped) using a 5/16 inch open end wrench. Discard the fuel sender attaching bolts and use NEW bolts upon installation. Remove the float arm retaining clip and the float arm for the left fuel sender only. Carefully remove the fuel sender with the gasket.

Installation

CAUTION: In order to reduce the risk of fire and personal injury that may result from a fuel leak, always replace the fuel sender gasket and the fuel sender attaching bolts when reinstalling the fuel sender assembly.

NOTE: Use the correct fastener in the correct location. Replacement fasteners must be the correct part number for that application. Fasteners requiring replacement or fasteners requiring the use of thread locking compound or sealant are identified in the service procedure. DO NOT use paints, lubricants, or corrosion inhibitors on fasteners or fastener joint surfaces unless specified. These coatings affect fastener torque and joint clamping force and may damage the fastener. Use the correct tightening sequence and specifications when installing fasteners in order to avoid damage to parts and systems.

NOTE: Use the correct fastener in the correct location. Replacement fasteners must be the correct part number for that application. Fasteners requiring replacement or fasteners requiring the use of thread locking compound or sealant are identified in the service procedure. DO NOT use paints, lubricants, or corrosion inhibitors on fasteners or fastener joint surfaces unless specified. These coatings affect fastener torque and joint clamping force and may damage the fastener. Use the correct tightening sequence and specifications when installing fasteners in order to avoid damage to parts and systems.

1. To install the left fuel sender assembly, Install a NEW fuel pump strainer in the same position as noted during removal. Push on the outer edge of the strainer ferrule until the strainer is fully seated.

CAUTION: In order to reduce the risk of fire and personal injury that may result from a fuel leak, always replace the fuel sender gasket and the fuel sender attaching bolts when reinstalling the fuel sender assembly.

2. Install a NEW fuel sender gasket on the fuel sender. Fold the strainer three times so that the amount of space occupied by the strainer is about equivalent to the diameter of the fuel sender reservoir. See **Fig. 25** . Fold the long side of the strainer over (1 over 2). Fold 3 over 4 and hold the strainer in the folded position. Insert the fuel sender through the fuel tank opening. Release the strainer once the strainer is in the fuel tank. The strainer will spring back to its full position.
3. Continue inserting the fuel sender through the fuel tank opening. It may be necessary to rotate the fuel sender

in order to facilitate the installation. Look through the fuel tank opening to ensure that the long side of the strainer is visible. If the strainer is not visible, rotate the fuel sender clockwise and counterclockwise about 90 degrees. Rotating the fuel sender will free up the strainer. The strainer should become visible at the tank opening.

CAUTION: DO NOT bend or twist the float arm. Insert the float and the float arm into the fuel tank opening. Install the float arm retaining clip.

4. Align the fuel sender gasket tab (1) with the fuel sender cover mark (2). See **Fig. 26** . Align the fuel sender cover mark (2) with the fuel tank mark. Hand tighten the NEW "break-away head" fuel sender attaching bolts until finger tight.

CAUTION: Use NEW "break-away head" bolts upon installation. The upper hex head portion of the fuel sender attaching bolts is designed to shear off of the lower section of the bolt when the proper torque is reached. DO NOT tighten the bolts after the bolt heads have sheared off. A torque wrench or other special tools are not required. DO NOT use thread locking or other types of sealers or lubricants when installing these bolts and gasket.

5. Tighten the NEW "break-away head" fuel sender assembly attaching bolts in sequence until the upper hex head portion of the bolts shear off of the lower section. See **Fig. 27** . Connect the fuel sender fuel feed (1) pipe (jet pump to left tank), the fuel return rear pipe (2), and the fuel feed rear pipe (3). See **Fig. 28** .
6. Connect the fuel sender electrical connector. Install the fuel tank strap. Install the fuel tank strap bolts. See **Fig. 24** . Tighten the bolts to specification. See **TORQUE SPECIFICATIONS** .
7. Install the fuel tank shield (1). See **Fig. 23** . Install the fuel tank shield mount bolt (2). Install the fuel tank shield mount nut (3). Tighten the fuel tank shield mount bolt to specification. Tighten the fuel tank shield mount nut to specification.
8. Install the rear wheel and tire assembly. Tighten wheel lug nuts to specification. Lower the vehicle. Refill the fuel system. Install the fuel filler cap. Connect the negative battery cable. Inspect for leaks. Turn the ignition switch ON for 2 seconds. Turn the ignition switch OFF for 10 seconds. Turn the ignition switch ON. Inspect for fuel leaks.

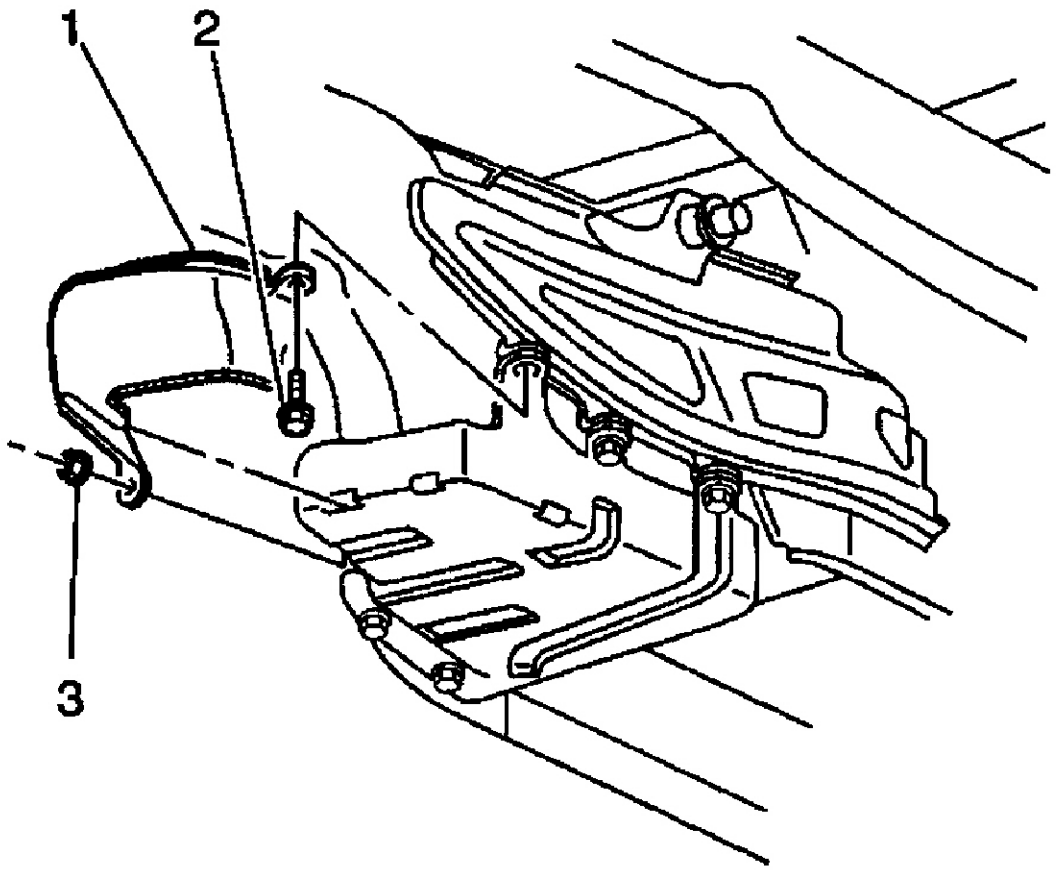

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Fig. 23: Removing/Installing Fuel Tank Shield - Left Tank (Corvette)
Courtesy of GENERAL MOTORS CORP.

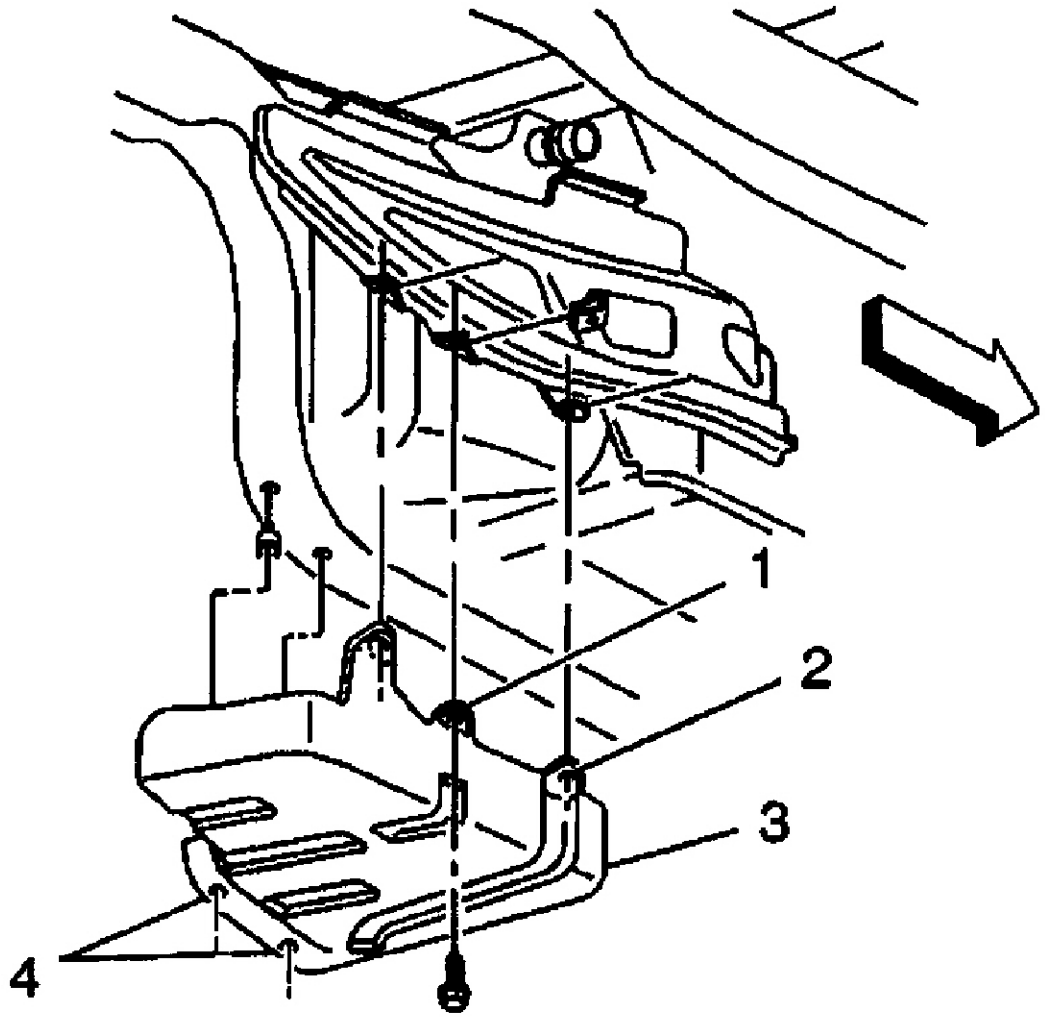

Fig. 24: Removing/Installing Fuel Tank Strap - Left Tank (Corvette)
Courtesy of GENERAL MOTORS CORP.

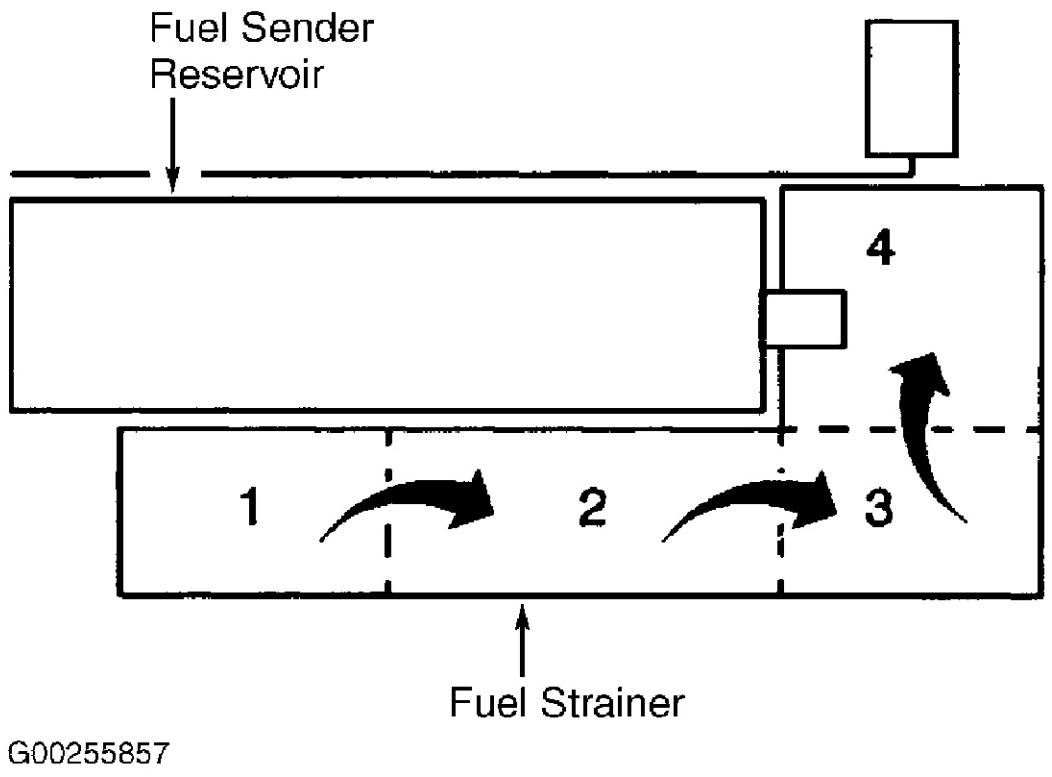

Fig. 25: Installing Fuel Sender Assembly Strainer - Left Tank (Corvette)
Courtesy of GENERAL MOTORS CORP.

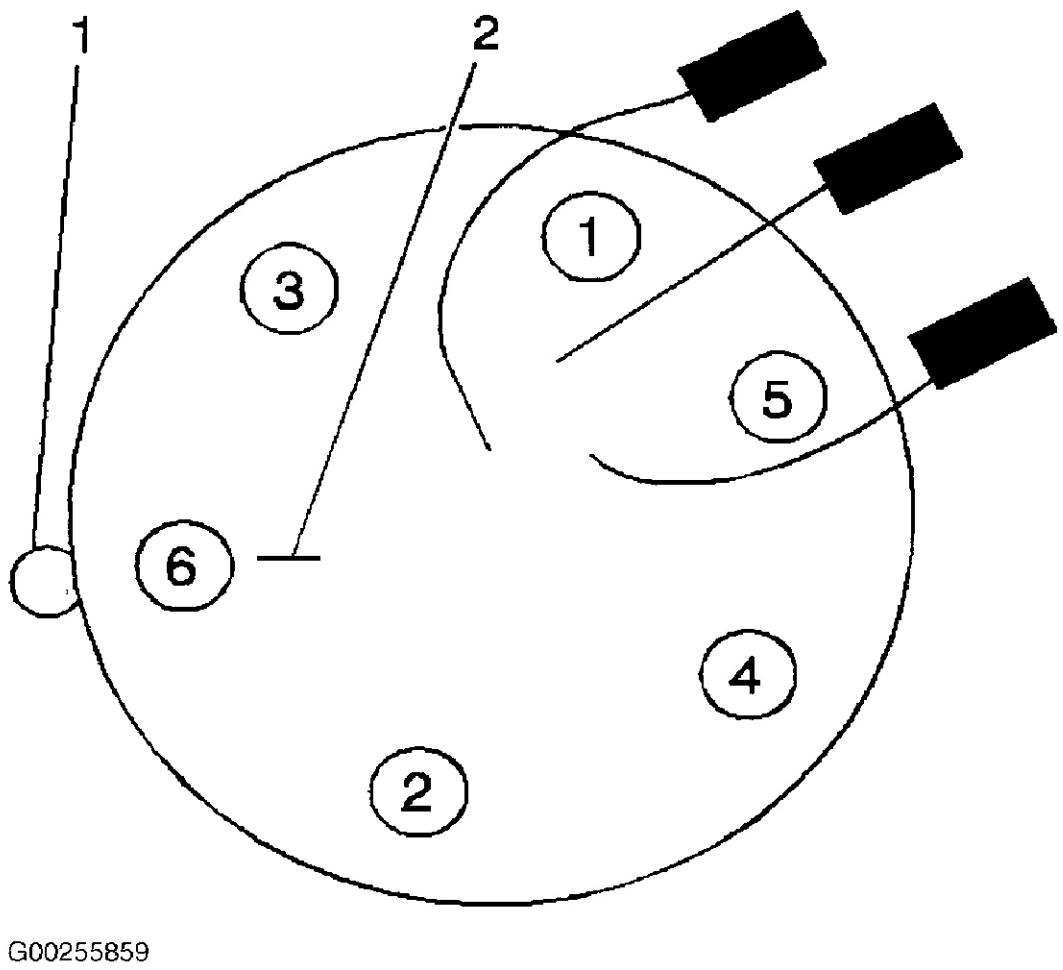

Fig. 26: Aligning Fuel Sender Gasket Tab With Fuel Sender Cover Mark - Left Tank (Corvette)

Courtesy of GENERAL MOTORS CORP.

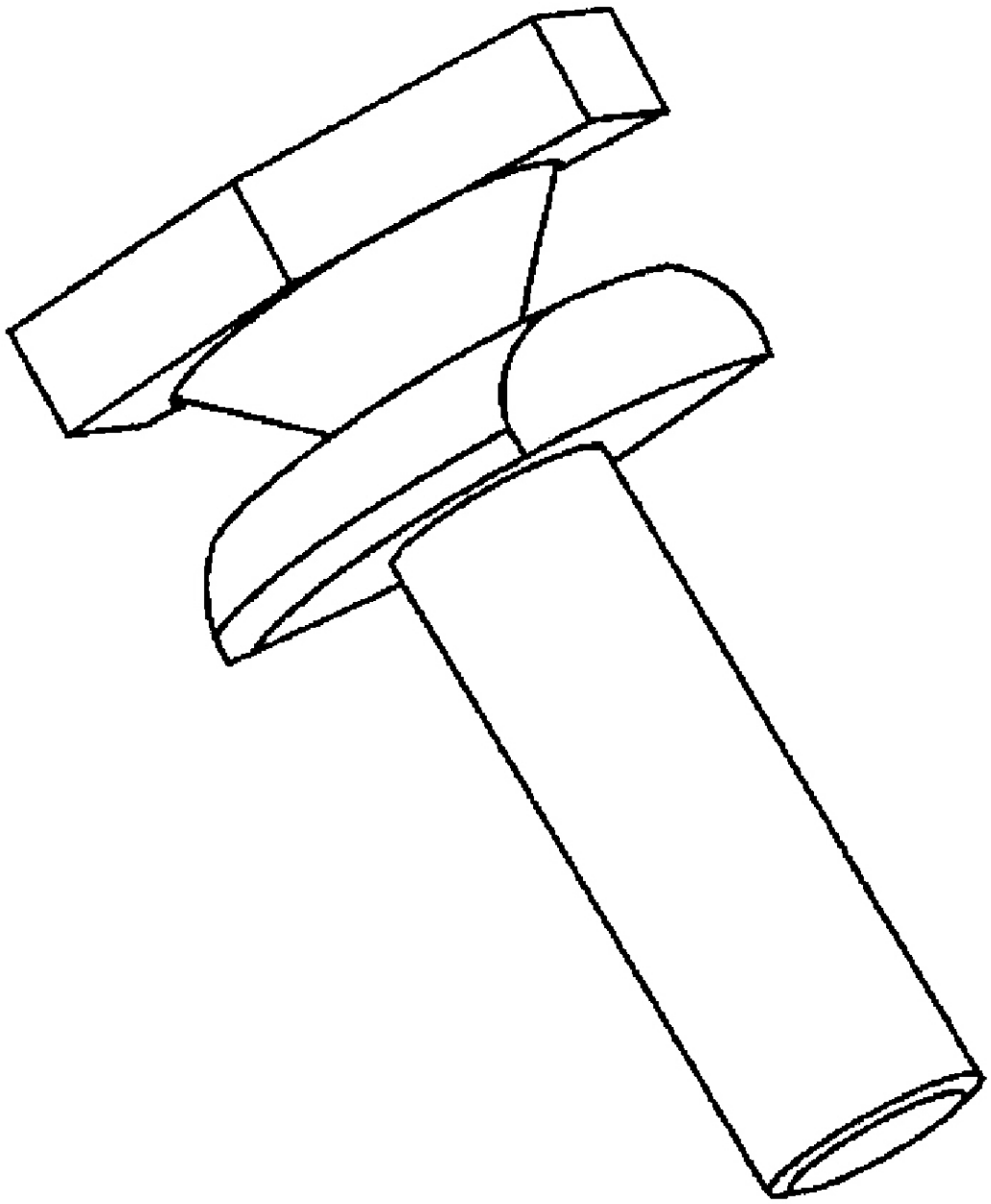

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Fig. 27: Identifying "Break-Away Head" Bolt (Corvette)
Courtesy of GENERAL MOTORS CORP.

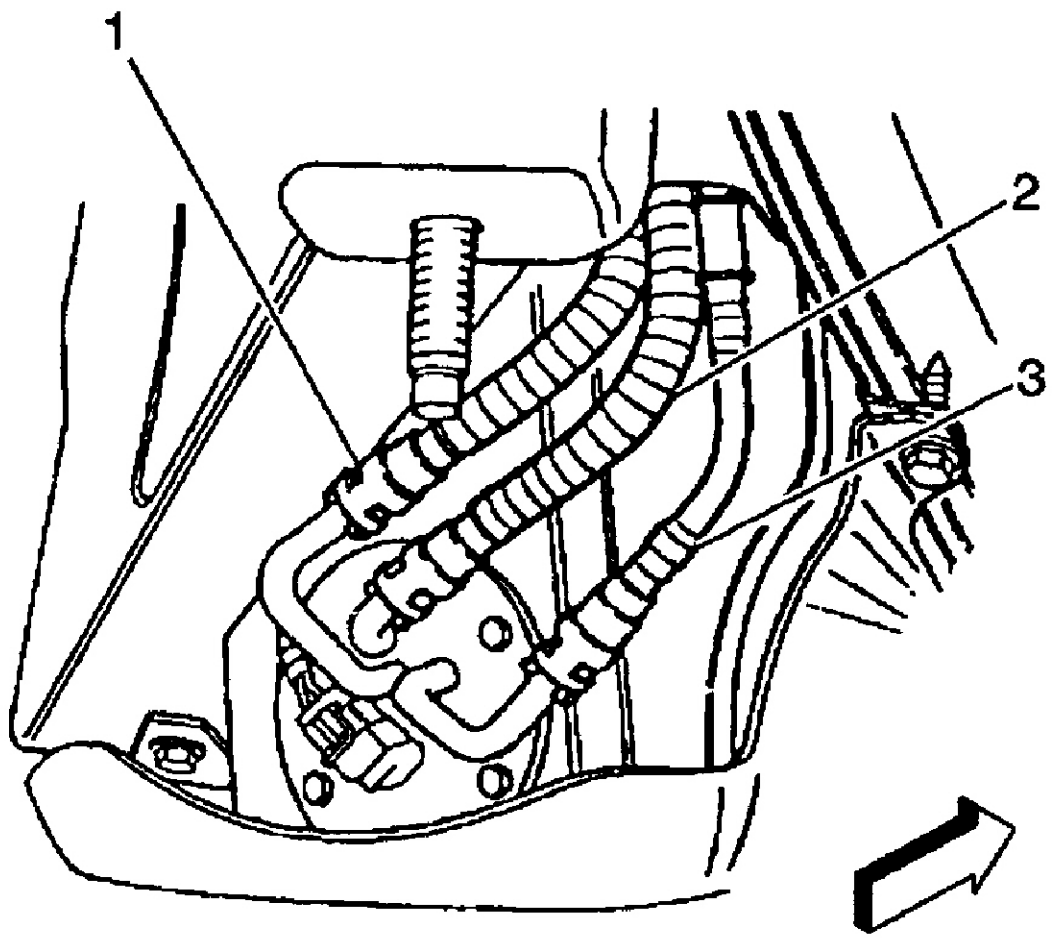

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Fig. 28: Connecting Fuel Sender Feed Pipe, Fuel Return Rear Pipe & Fuel Feed Rear Pipe - Left Tank (Corvette)
Courtesy of GENERAL MOTORS CORP.

Removal & Installation (Deville & Seville - 4.6L)

CAUTION: 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.

CAUTION: Always wear safety goggles when working with fuel in order to protect the eyes from fuel splash. Drain the fuel tank to at least 3/4 of a tank before removing the fuel sender retaining ring or fuel sender access panel in order to avoid possible fuel spillage. Failing to follow this procedure could result in personal injury.

NOTE: Clean all of the following areas before performing any disconnections in order to avoid possible contamination in the system: The fuel pipe connections The hose connections The areas surrounding the connections.

NOTE: DO NOT handle the fuel sender assembly by the fuel pipes. The amount of leverage generated by handling the fuel pipes could damage the joints. Always replace the fuel sender "O" ring when reinstalling the fuel sender assembly.

NOTE: Use the correct fastener in the correct location. Replacement fasteners must be the correct part number for that application. Fasteners requiring replacement or fasteners requiring the use of thread locking compound or sealant are identified in the service procedure. DO NOT use paints, lubricants, or corrosion inhibitors on fasteners or fastener joint surfaces unless specified. These coatings affect fastener torque and joint clamping force and may damage the fastener. Use the correct tightening sequence and specifications when installing fasteners in order to avoid damage to parts and systems.

1. Relieve the fuel system fuel pressure. See **FUEL SYSTEM PRESSURE RELEASE** . Drain the fuel tank to at least three-quarters of a tank full.

CAUTION: Remove the rear compartment floor trim to provide technician contact with the vehicle's metal surfaces. Failure to remove the rear compartment floor trim may cause a static electricity discharge to ignite any fuel vapor resulting in personal injury and vehicle damage.

2. Remove the spare tire cover, the jack, and the spare tire. Remove the rear compartment floor trim to avoid damage from fuel spillage.
3. Remove the rear compartment floor trim (1). Remove the bolts from the fuel sender access panel (2). See **Fig. 29** .

NOTE: In order to prevent damage, cover the fuel pipe fittings with a shop towel before disconnecting the fuel pipes or removal of the fuel sender retaining ring, in order to catch any fuel that may leak out. Place the towel in an approved container when procedure is completed.

4. Disconnect the quick-connect fittings at the fuel sender assembly. Disconnect the electrical connector at the fuel sender. Disconnect the electrical connector at the fuel tank pressure sensor.

CAUTION: When removing the fuel sender assembly from the fuel tank, the reservoir bucket on the fuel sender assembly is full of fuel. The fuel sender assembly must be tipped slightly during removal in order to avoid damage to the float. Place any remaining fuel into an approved container once the fuel sender assembly is removed from the fuel tank.

5. Remove the fuel sender retaining ring using the Fuel Sender Locknut Wrench (J-39765). See **Fig. 30** .

CAUTION: The fuel sender assembly will spring-up when the locking ring is removed.

6. Pull the fuel sender straight up while pumping the fuel from the reservoir. Clean the fuel sender assembly "O" ring sealing surfaces. Inspect the fuel sender assembly "O" ring sealing surfaces.

CAUTION: Always replace the fuel sender "O" ring when reinstalling the fuel sender assembly. Position the NEW fuel sender assembly "O" ring on the fuel tank. Care should be taken not to fold over or twist the fuel pump strainer when installing the fuel sender assembly, as this will restrict fuel flow. Also, assure that the fuel pump strainer does not block full travel of float arm.

7. Reinstall the fuel sender assembly and the fuel sender assembly retainer using the Fuel Sender Locknut

Wrench (J-39765) (1). Install the quick-connect fittings at the fuel sender assembly. Connect the electrical connector at the fuel tank pressure sensor. Connect the electrical connector at the fuel sender assembly. Connect the negative battery cable.

8. Inspect for leaks. Turn the ignition switch ON for 2 seconds. Turn the ignition switch OFF for 10 seconds. Turn the ignition switch ON. Check for fuel leaks. Reinstall the fuel sender access panel. Tighten the fuel sender access panel bolts to specification. See **TORQUE SPECIFICATIONS** .
9. Reinstall the rear compartment floor trim. Reinstall the spare tire, the jack, and the spare tire cover. Add fuel to the fuel tank. Install the fuel tank filler pipe cap. Install the rear seat cushion. Install the fuel injector sight shield to the engine. Install the fuel injector sight shield nuts. Tighten the nuts to specification.

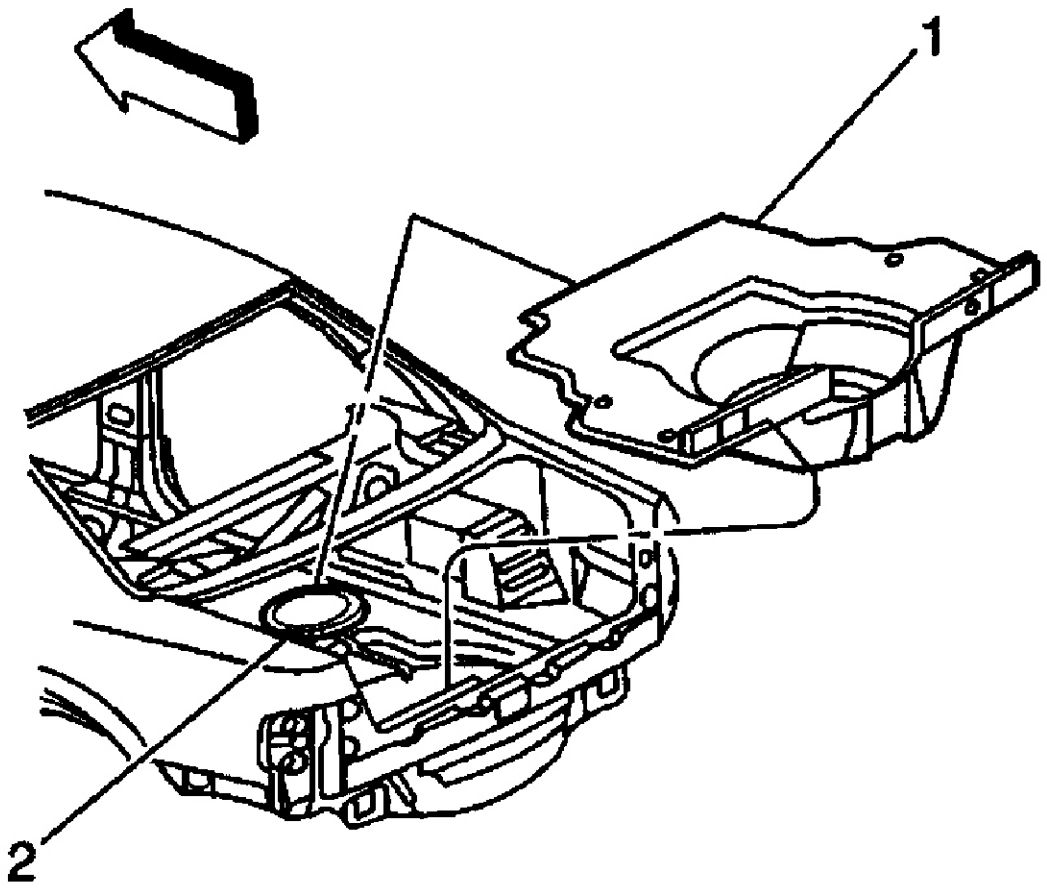

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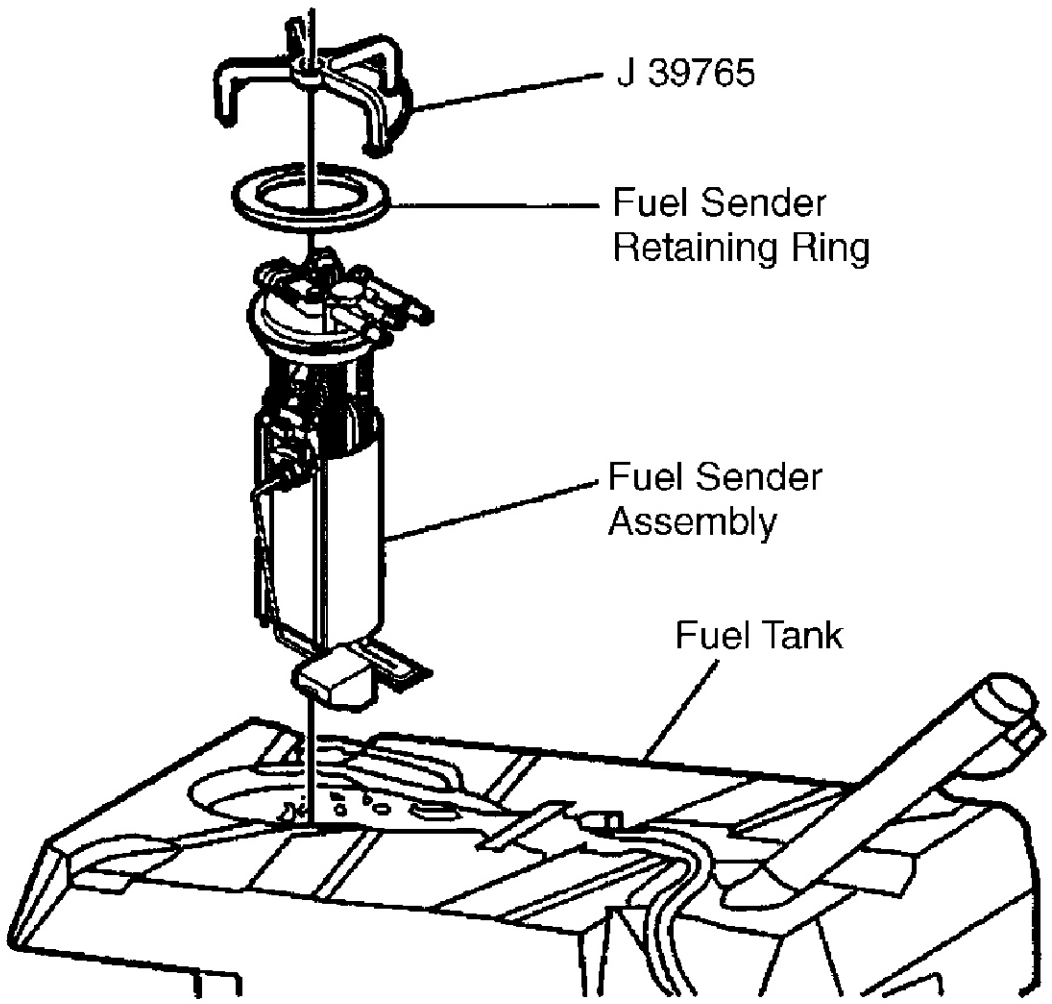
Fig. 29: Removing/Installing Rear Compartment Floor Trim & Fuel Sender Access Panel (Deville & Seville - 4.6L)
Courtesy of GENERAL MOTORS CORP.



G00255861

Fig. 30: Removing/Installing Fuel Sender Assembly (Deville & Seville - 4.6L)
Courtesy of GENERAL MOTORS CORP.

Removal & Installation (Eldorado)

1. Relieve the fuel system pressure. See **FUEL SYSTEM PRESSURE RELEASE** . Drain the fuel tank.
2. Raise and support the vehicle. Grasp the nylon fuel pipe quick-connect fitting. Twist the quick-connect fitting 1/4 turn in each direction to loosen any dirt within fitting. Repeat for the other nylon fuel pipe quick-connect fitting. Using compressed air, blow out dirt from the quick-connect fittings at end of the fuel pipes. Disconnect the quick-connect fittings at the fuel tank.
3. Disconnect the fuel feed pipe at the in-line fuel filter and return pipe near the in-line fuel filter. Disconnect the clamps at the fuel filler neck and fuel filler neck vent pipe at the fuel tank. Remove the fuel filler neck and fuel filler neck vent pipe from the fuel tank. Disconnect the fuel sender electrical connector. Remove the exhaust heat shield screws and reposition shield.
4. With the aid of an assistant, support fuel tank and disconnect the 2 fuel tank retaining straps. With the aid of an assistant, lower the fuel tank and disconnect the EVAP pipe.
5. Remove the fuel sender assembly from the fuel tank using Fuel Sender Lock Nut Wrench (J-39765).
6. Install a NEW "O" ring on the modular fuel sender. Install the modular fuel sender to the fuel tank using Fuel Sender Lock Nut Wrench (J-39765).
7. To install fuel tank, reverse removal procedure. Tighten fasteners to specification. See **TORQUE SPECIFICATIONS** .
8. Connect the negative battery cable. Inspect for fuel leaks using the following procedure: Turn ON the ignition, for 2 seconds. Turn OFF the ignition, for 10 seconds. Turn ON the ignition. Inspect for fuel leaks.

Removal & Installation (L100, L200, L300, LW200 & LW300 - 2.2L & 3.0L)

NOTE: Clean all fuel pipe and hose connections and surrounding areas before disassembling to avoid possible contamination of the fuel system. Spray the fuel pump module cam-lock ring tang with penetrating oil prior to attempting removal.

1. Remove fuel tank. Disconnect fuel lines from fuel pump module cover.

NOTE: To prevent retainer damage, DO NOT attempt to remove the retainer with a 12 inch or shorter ratchet/breaker bar. A 1/2 inch breaker bar (approximately 18 inches long) will easily loosen and remove the lock ring.

2. Use the Fuel Sending Unit Wrench (J-43827 2.2L; J-44017 3.0L) to remove the fuel pump module ring. See **Fig. 31** . To prevent bending of the sending unit float arm remove the sending unit first by pulling the retaining clip toward float arm and lift upward.

CAUTION: Always replace fuel pump module to tank "O" ring.

3. Carefully lift fuel pump straight up from fuel tank. To disengage fuel pump from fuel pump housing clips must be disabled at the same time. Discard fuel pump module to tank seal. Remove fuel pump housing by releasing the four retaining clips.
4. The retaining clips hold fuel pump housing to fuel pump housing bracket (mounted in bottom of tank). Disengage clip closest to the pump (where fuel return line attaches to fuel pump housing) by inserting a small flat blade screwdriver between the clip (on the housing) and the mounting bracket. Leave screwdriver wedged in place to prevent clip from reattaching as the other clips are being disabled.

CAUTION: Inspect the fuel tank for metal chips/debris.

5. Disengage the clip closest to the one disengaged in previous step (toward rear of tank). Use a second small flat blade screwdriver to disenable this clip. Remove all contaminants and replace in-line fuel filter before installing a NEW fuel pump assembly when debris is present. Stick one of the screwdrivers between the fuel pump housing and base of the fuel tank to prevent clips (previous steps) from re-engaging.
6. Remove second screwdriver from fuel tank. The next clip to be disengaged is at the rear most position. To disengage this clip tilt housing toward jet pump while releasing this clip. Once these clips have been disengaged push module (or roll the module) in the direction of the remaining clip that is engaged. This will force clip to disengage. Remove housing from tank.
7. To install, reverse removal procedure. Replace fuel pump module to tank "O" ring.

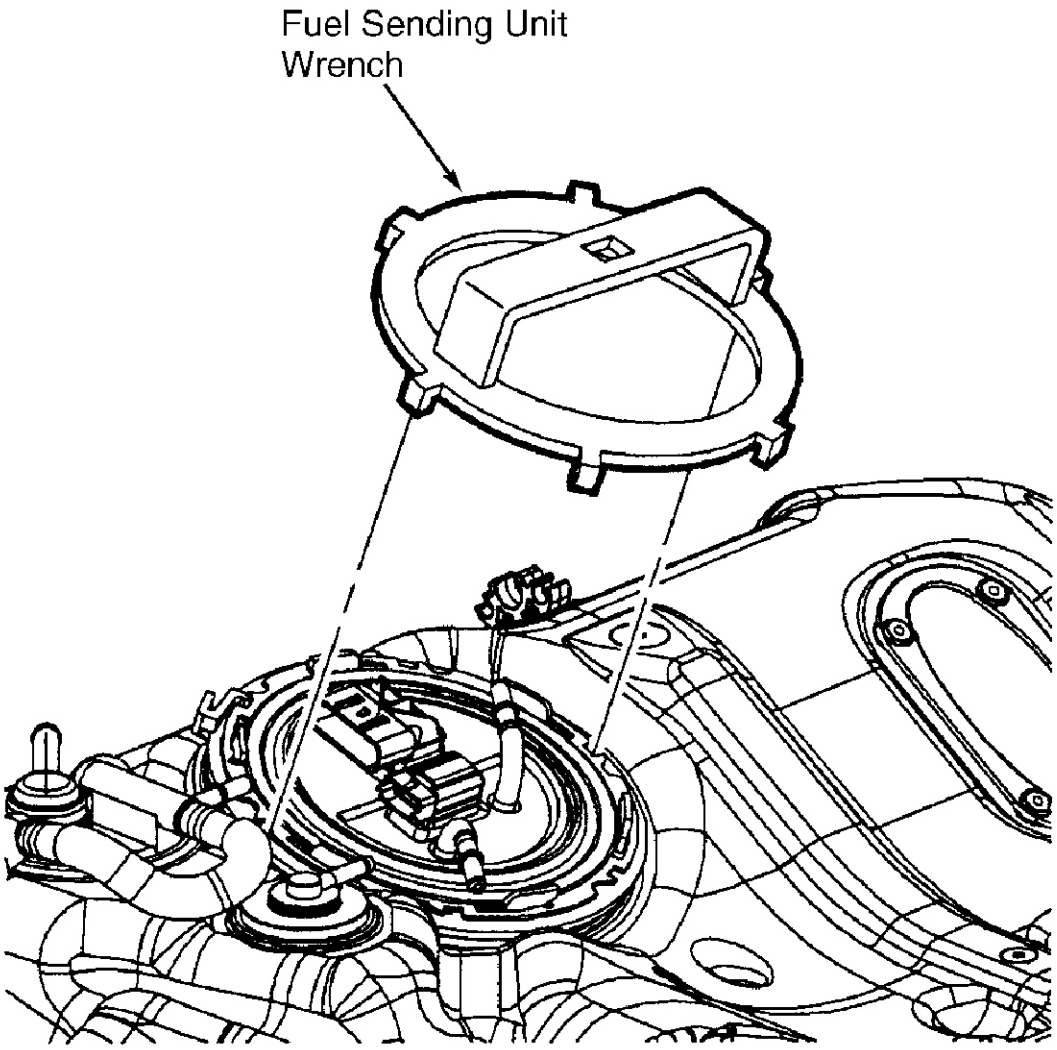


Fig. 31: Removing/Installing Fuel Pump Module Retaining Ring (L100, L200 & LW200 - 2.2L Shown; L300 & LW300 - 3.0L Is Similar)
Courtesy of GENERAL MOTORS CORP.

Removal & Installation (Lumina) - 3.1L)

CAUTION: In order to reduce the risk of fire and personal injury that may result from a fuel leak, always replace the fuel sender gasket when reinstalling the fuel sender assembly.

CAUTION: The modular fuel sender assembly may spring up from its position. When removing the modular fuel sender assembly from the fuel tank, be aware that the reservoir bucket is full of fuel. The reservoir must be tipped slightly during removal to avoid damage to the float. Discard the fuel sender "O" ring and replace the "O" ring with a NEW one.

CAUTION: Before servicing any electrical component, the ignition key must be in the OFF or LOCK position and all electrical loads must be OFF, unless instructed otherwise in these procedures. If a tool or equipment could easily come in contact with a live exposed electrical terminal, also disconnect the negative battery cable. Failure to follow these precautions may cause personal injury and/or damage to the vehicle or its components.

1. Relieve the fuel system pressure. See **FUEL SYSTEM PRESSURE RELEASE** . Drain the fuel tank.
2. Raise and support the vehicle. Remove the fuel tank filler EVAP hose from the fuel tank. Remove the fuel tank filler hose from the fuel tank. Disconnect the quick-connect fittings at the fuel tank.
3. Disconnect the modular fuel sender and the fuel tank pressure sensor electrical connectors. Remove the EVAP pipe from the connection at the front of the fuel tank. Remove the rubber exhaust pipe hangers in order to allow the exhaust system to drop slightly. Remove the exhaust pipe heat shield bolts and the exhaust pipe heat shield.
4. With the aid of an assistant, support the fuel tank, and remove the fuel tank strap attaching bolts. Lower the fuel tank enough in order to disconnect the fuel sender electrical connector and remove the fuel sender retaining clips. Disconnect the EVAP pipe to the rear of the fuel tank. Disconnect the EVAP pipe to the fuel sender assembly. Remove the fuel tank from the vehicle.
5. Carefully discard the reservoir fuel into an approved container. With the Fuel Sender Lock Nut Tool (J-39765), press down and rotate the cam lock ring until free of the fuel sender retaining tabs. Remove the modular fuel sender assembly. See **Fig. 20** . Remove the fuel level sensor.

CAUTION: Be sure that the cam lock ring is fully seated within the tab slots.

6. Install the fuel level sensor.
7. To install, reverse removal procedure. Install the NEW "O" ring on the fuel tank. Align the fuel lines parallel with the mark on the fuel tank. Slowly apply pressure to top of the spring loaded sender until the sender aligns flush with the retainer on tank.
8. Connect the negative battery cable. Inspect for fuel leaks using the following procedure: Turn ON the ignition, for 2 seconds. Turn OFF the ignition, for 10 seconds. Turn ON the ignition. Inspect for fuel leaks.

Removal & Installation (Malibu) - 3.1L)

1. Disconnect the negative battery cable. Relieve the fuel system pressure. See **FUEL SYSTEM PRESSURE RELEASE** . Drain the fuel tank.
2. Raise and support the vehicle. Disconnect the quick-connect fitting at the fuel filter. Disconnect the quick connect fittings at the end of the fuel lines. Remove the exhaust rubber hangers. Allow exhaust system to rest on rear axle. Remove the exhaust heat shield. Loosen the fuel tank filler hose clamp at the fuel tank.
3. Remove the hoses from the fuel tank filler, EVAP vent and EVAP vapor pipes. Disconnect the electrical harness from the multi-way rear body connector and fuel strap. With the aid of an assistant, support fuel tank and disconnect the two fuel tank retaining straps. Lower the fuel tank.
4. Disconnect the wiring harness from the modular fuel sender assembly and fuel tank pressure sensor. Disconnect the EVAP pipe and fuel pipe from the modular fuel sender and fill limiter vent valve.
5. Using Fuel Sender Lock Nut Tool (J-39765), press down and rotate the cam lock ring until free of the fuel sender retaining tabs. Remove the modular fuel sender assembly.
6. Install a NEW "O" ring on the fuel tank. Align the fuel lines parallel with the mark on the fuel tank. Slowly apply pressure to top of the spring loaded sender until the sender aligns flush with the retainer on the fuel tank. Install the cam lock ring using Fuel Sender Lock Nut Tool (J-39765). Be sure that the cam lock ring is fully seated within the tab slots.
7. To install the fuel tank, reverse removal procedure. Tighten fasteners to specification. See **TORQUE SPECIFICATIONS** . Lower the vehicle. Refill the fuel tank. Connect the negative battery cable.
8. Inspect for fuel leaks through the following steps. Turn the ignition switch to the ON position for two seconds. Turn the ignition switch to the OFF position for ten seconds. Turn the ignition switch to the ON position Check for fuel leaks.

Removal & Installation (Metro - 1.0L & 1.3L)

1. Fuel pump is located in fuel tank and is integral with fuel sending unit assembly. Relieve the fuel system pressure. See **FUEL SYSTEM PRESSURE RELEASE** . Drain the fuel tank. Remove the rear seat cushion from the vehicle.
2. Disconnect the fuel pump, the fuel level sensor, and the electrical connectors. See **Fig. 32** . Push the electrical connectors through the grommet in the floor of the vehicle. Raise and suitably support the vehicle. Remove right rear wheel/tire assembly. Remove rear stabilizer shaft assembly.
3. Remove 2 nuts and the resonator/muffler/tailpipe assembly from the front pipe/Three Way Catalytic Converter (TWC) assembly. Remove one bolt and the hanger from the pipe at the resonator. Remove three bolts and the hangers from the muffler. Turn the resonator/muffler/tailpipe assembly counterclockwise. Pull back the resonator/muffler/tailpipe assembly. Move the resonator/muffler/tailpipe assembly toward the wheel. Remove the resonator/muffler/tailpipe assembly.
4. Remove the clamp and the fuel filler hose from the fuel tank filler neck. Remove the clamp and the fuel breather hose from the fuel tank breather neck. Remove the clamp and the air inlet hose to the EVAP canister from the canister air inlet pipe, if necessary.
5. Remove the 2 bolts from the 2 parking brake cable brackets on the vehicle underbody. Move the cable aside. Remove the clamp and the EVAP canister vapor hose from the EVAP canister vapor pipe.
6. Disconnect the quick connect line from the fuel feed pipe. Disconnect the quick connect line from the fuel return pipe. Remove the 5 fuel tank mounting bolts and the fuel tank.
7. Remove 6 fuel sending unit hold-down bolts and remove fuel sending unit assembly from fuel tank. See **Fig. 33** . Disconnect fuel level sensor harness connector. Depress fuel level sensor retaining tab and slide sensor down to remove from fuel sending unit assembly.
8. To install, reverse removal procedure. Use NEW gasket on fuel sending unit assembly. Tighten fuel sending unit assembly hold-down bolts to specification. See **TORQUE SPECIFICATIONS** .

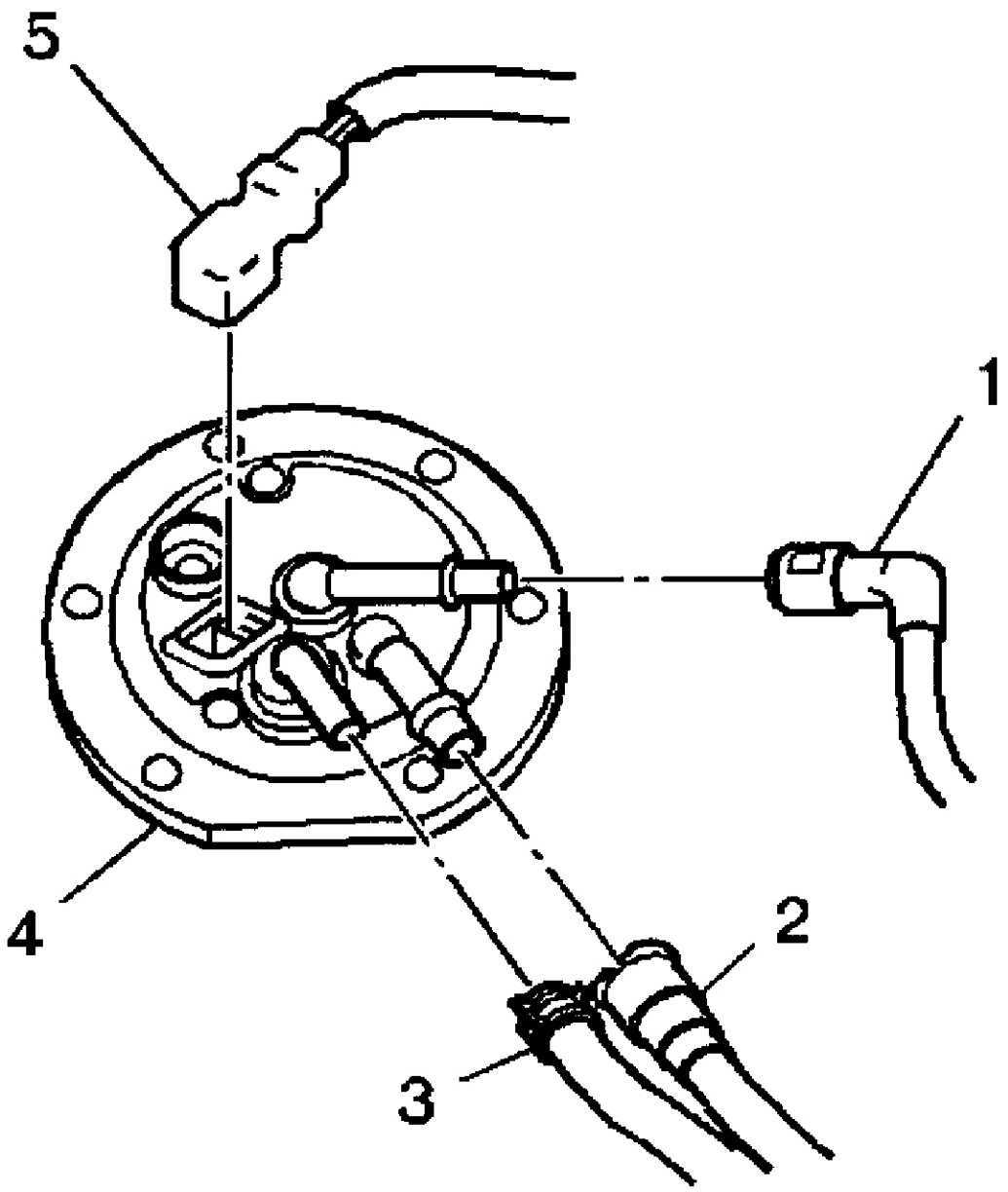


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Fig. 32: Disconnecting/Connecting Fuel Pump Assembly Electrical Connectors (Metro - 1.0L & 1.3L)
Courtesy of GENERAL MOTORS CORP.

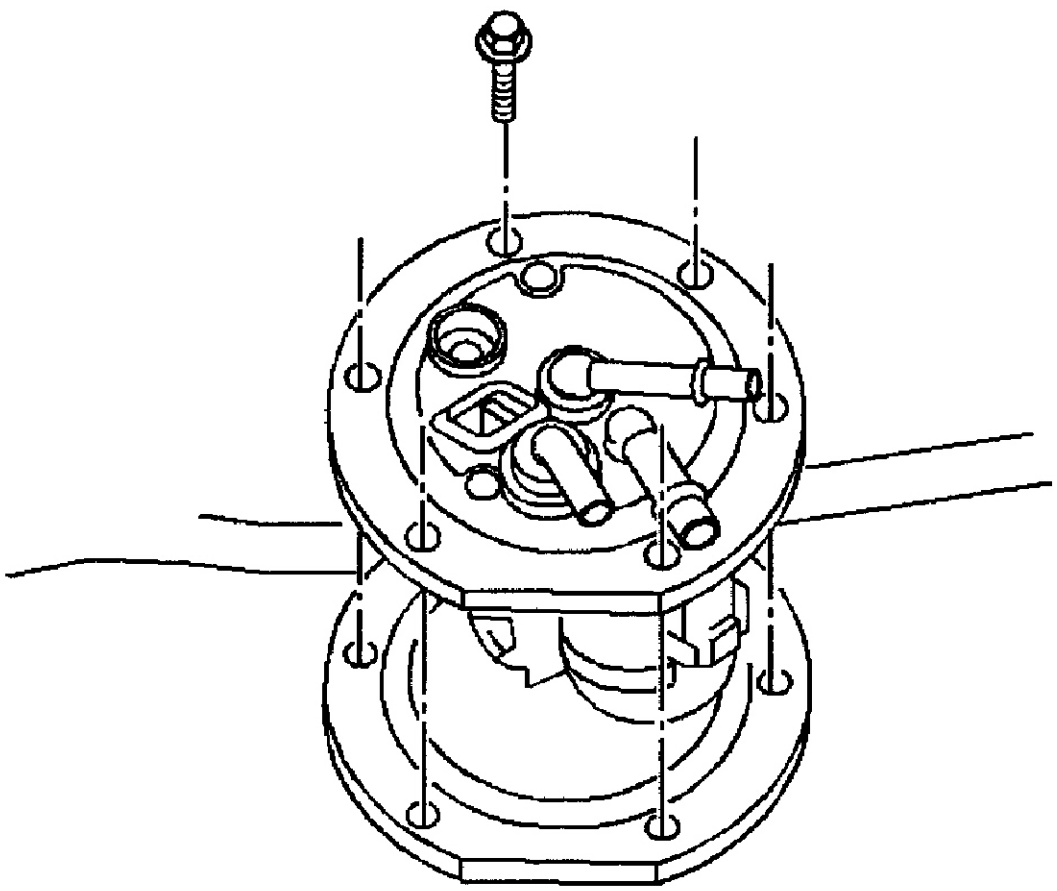

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Fig. 33: Removing/Installing Fuel Pump Assembly Screws (Metro - 1.0L & 1.3L)
Courtesy of GENERAL MOTORS CORP.

Removal & Installation (Prizm - 1.8L)

1. Fuel pump is located in fuel tank and is integral with fuel sending unit assembly. Relieve fuel pressure. See **FUEL SYSTEM PRESSURE RELEASE** . Disconnect negative battery cable. Remove rear seat bottom cushion. Remove the left side door opening sill plate. Fold back the carpet in order to maintain metal-to-metal contact while servicing the fuel sender assembly.
2. Remove fuel sending unit assembly access panel bolts and remove access panel. See **Fig. 34** .
3. Disconnect harness connector from fuel sending unit assembly. See **Fig. 35** . Remove the retaining clip from the fuel line fitting. Remove fuel pipe from top of fuel sending unit assembly.
4. Remove 8 fuel sending unit assembly hold-down bolts (2) and remove hold-down plate (1). See **Fig. 36** . Remove fuel sending unit assembly (1) and "O" ring (2) from fuel tank (3). See **Fig. 37** . Remove No. 2 fuel sending unit support and rubber cushion. Remove fuel pressure regulator. Remove fuel pump strainer hold-down clip and remove fuel pump strainer.
5. Remove No. 1 fuel sending unit support from fuel sending unit plate. Remove No. 1 fuel filter cushion from fuel filter. Disconnect harness connector from fuel pump. Remove fuel pump from fuel filter.
6. To install, reverse removal procedure. Use NEW "O" ring on fuel pressure regulator and fuel sending unit assembly. Tighten fuel sending unit assembly hold-down bolts to specification. See **TORQUE SPECIFICATIONS** .

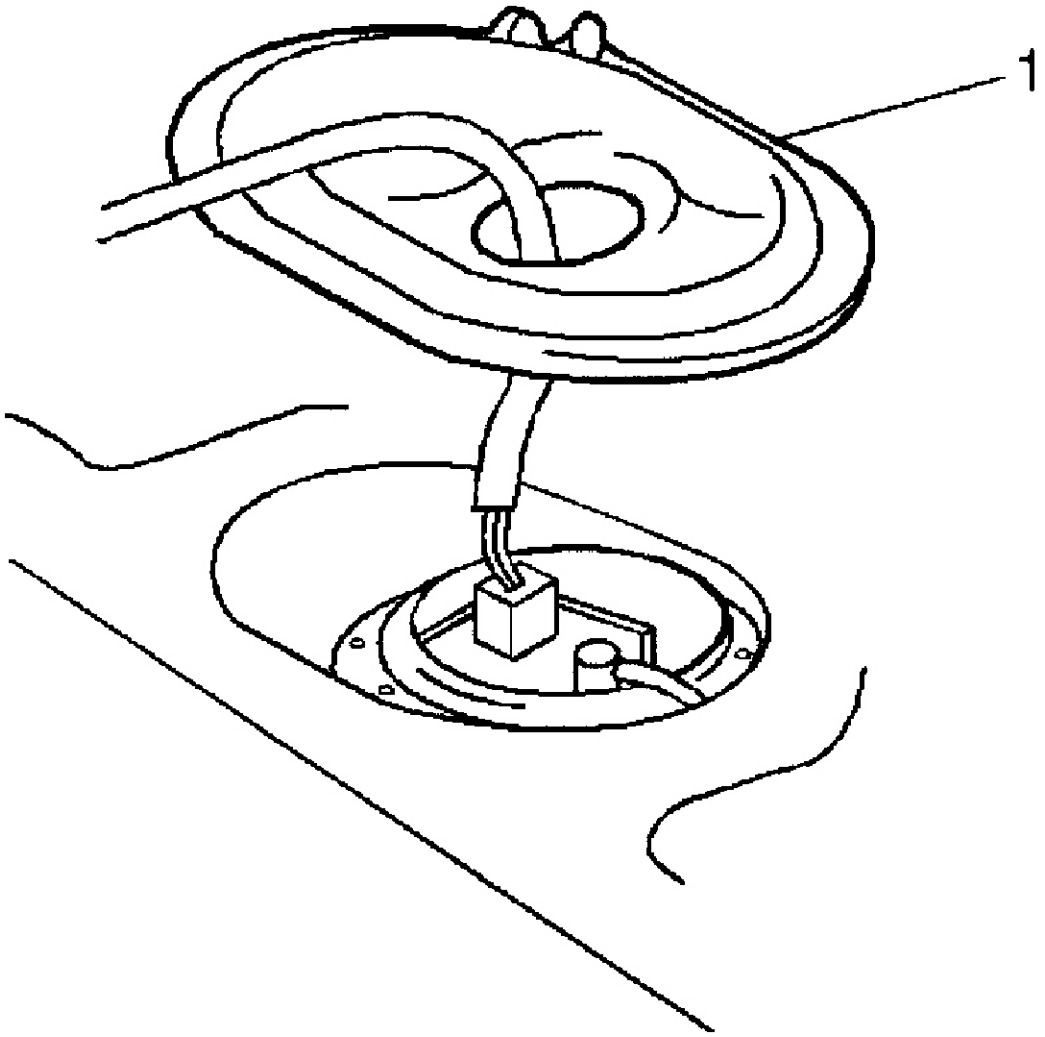

Fig. 34: Removing/Installing Access Panel (Prizm - 1.8)
Courtesy of GENERAL MOTORS CORP.

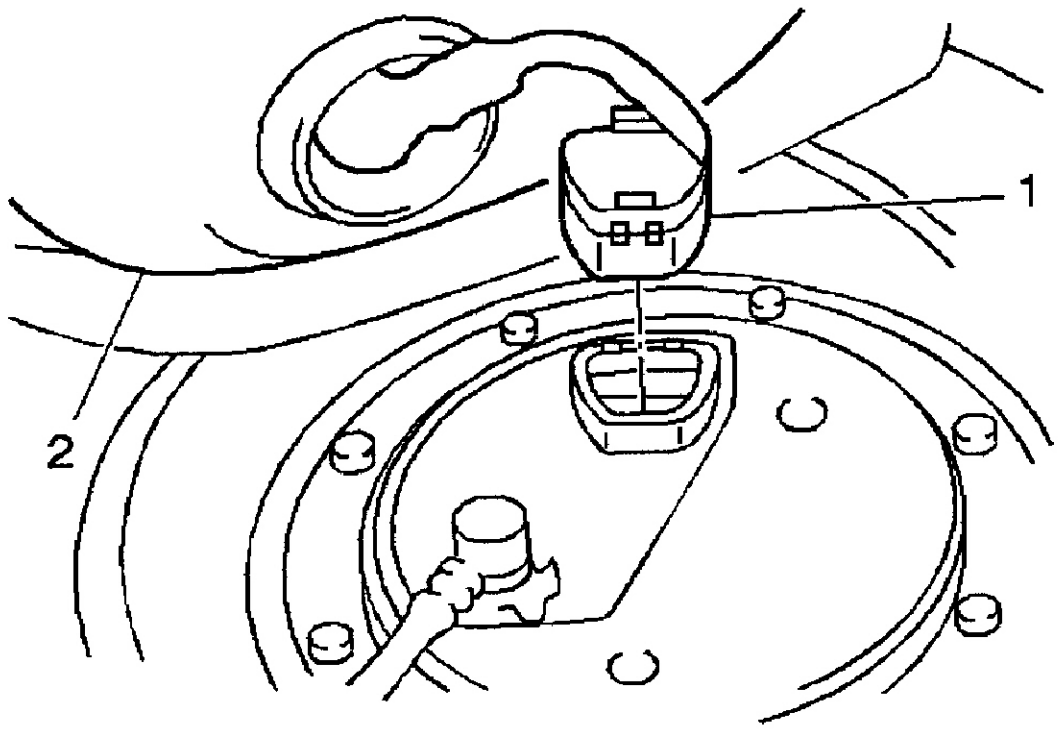

Fig. 35: Disconnecting/Connecting Fuel Sender Assembly Electrical Connector (Prizm - 1.8L)
Courtesy of GENERAL MOTORS CORP.

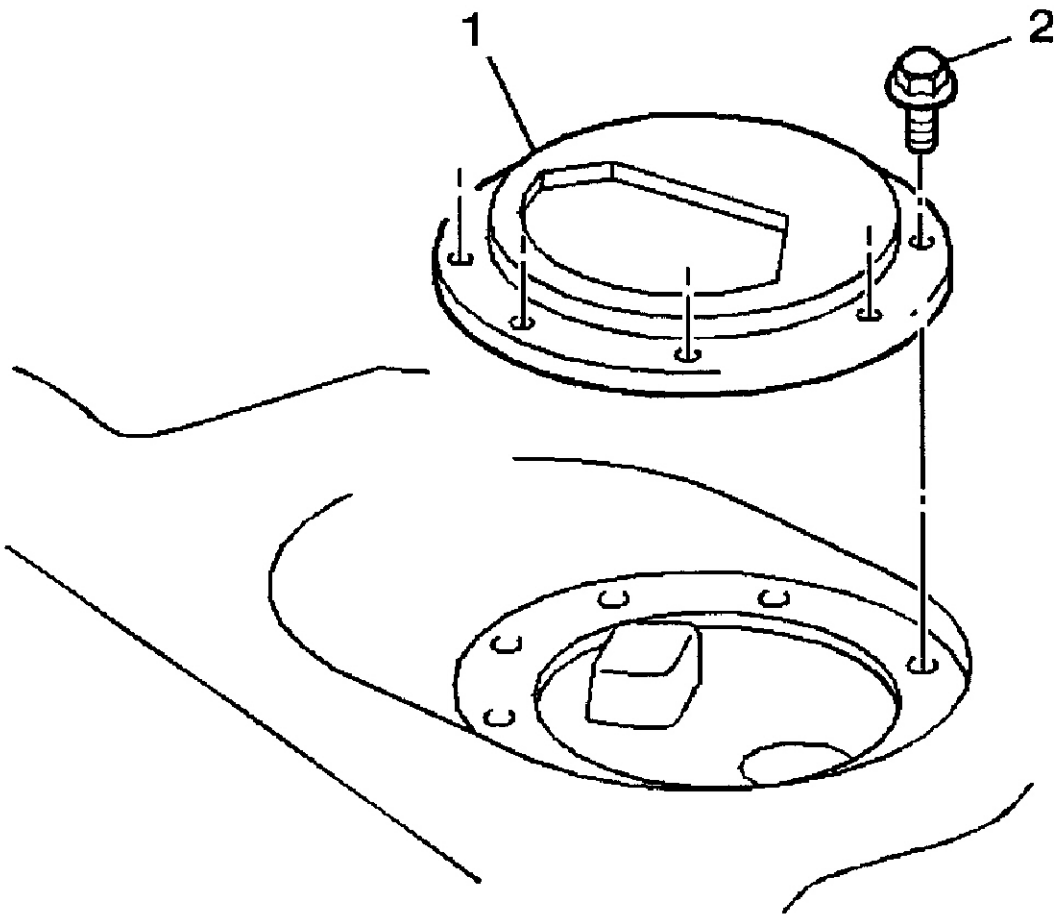

Fig. 36: Removing/Installing Fuel Sender Assembly Screws (Prizm - 1.8L)
Courtesy of GENERAL MOTORS CORP.

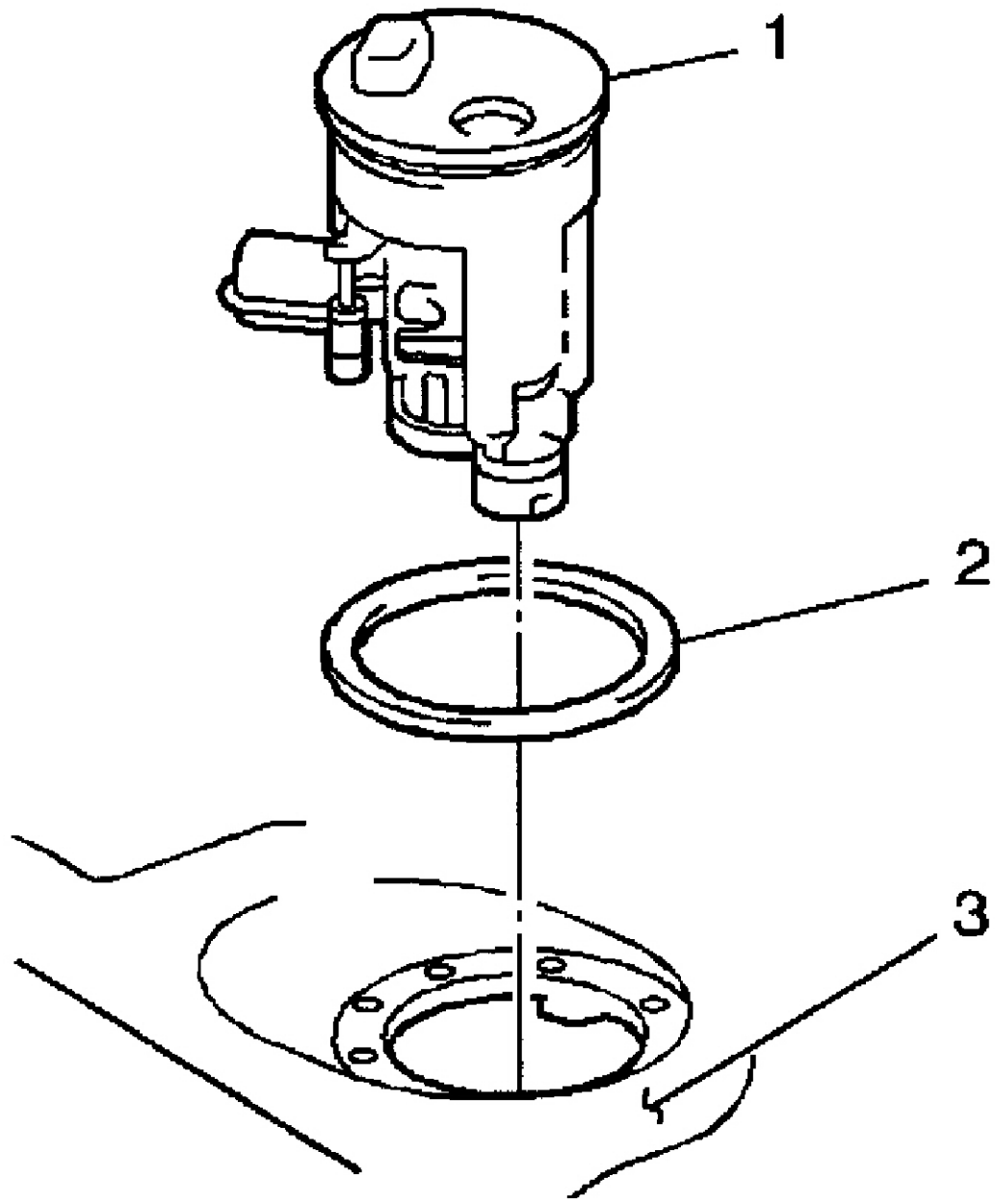

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Fig. 37: Removing/Installing Fuel Sender Assembly From Fuel Tank (Prizm - 1.8L)
Courtesy of GENERAL MOTORS CORP.

Removal & Installation (SC1, SC2, SL, SL1, SL2 & SW2 - 1.9L)

CAUTION: DO NOT allow smoking or the use of open flames in the area where work on the fuel or EVAP system is taking place. Anytime work is being done on the fuel system, disconnect the negative battery cable, except for those tests where battery voltage is required.

NOTE: Clean all fuel pipe and hose connections and surrounding areas before disassembling to avoid possible contamination of the fuel system. Spray the fuel pump module cam-lock ring tang with penetrating oil prior to attempting removal.

NOTE: Care must be taken not to bend or twist the fuel pump filter or sending unit float arm during removal or installation of the fuel pump module assembly. A damaged fuel pump filter restricts fuel flow to the pump and a bent sending unit arm will

not provide accurate readings. Care must be taken to assure the pump module is not dropped. A dropped pump can dislodged internal parts creating a noisy and/or leakage condition.

1. Remove the fuel tank. Disconnect the fuel feed and return lines from the filter/pressure regulator. Disconnect the fuel pump vapor line from the fuel tank vent pipe.

NOTE: To prevent retainer damage, DO NOT attempt to remove the retainer with a 12 inch or shorter ratchet/breaker bar. A 1/2 in. breaker bar (approximately 18 inches long) will easily loosen and remove the lock ring.

2.
3. Use the Fuel Tank Lock Ring Remover (SA9156E) and remove the fuel pump module retaining ring. See **Fig. 38** . To prevent bending of the sending unit float arm during removal, lift the pump module up slightly to disengage the orientation tabs in the tank and rotate the module 90 degrees clockwise until the fuel lines are facing the 1 o'clock position. 12 o'clock is front of tank.

NOTE: Care must be taken not to bend or twist the fuel pump filter or sending unit float arm during removal or installation of the fuel pump module assembly. A damaged fuel pump filter restricts fuel flow to the pump and a bent sending unit arm will not provide accurate readings. Care must be taken to assure the pump module is not dropped. A dropped pump can dislodged internal parts creating a noisy and/or leakage condition.

4. Carefully lift the fuel pump module, with the sending unit, straight up from the fuel tank until the bottom of the pump module is very close to the fuel tank opening. See **Fig. 39** . Then tilt the pump module about 45 degrees toward the right side of the tank and simultaneously lift it up and out of the tank opening watching that the level sender float arm is not being bent.

CAUTION: Always replace the fuel pump module-to-tank "O" ring whenever the assembly is removed. The correct seal is green in color. DO NOT use the older black seal.

5. Inspect the fuel tank for metal chips/debris. Remove all contaminants and replace the in-line fuel filter before installing a NEW fuel pump assembly when debris is present. Discard the fuel pump module-to-tank seal.
6. Verify that the float arm on the fuel level sender has not been bent by standing the fuel pump module on a flat, horizontal surface and measuring the distance from this surface and the bottom of the float. A 5/32 inch diameter drill can be used as a gage. See **Fig. 40** . The gage must freely pass between the float and the horizontal surface with no more than 1/16 inch clearance.
7. If the float arm requires repositioning to meet the clearance specification, assure that any bending is performed at the 90° bend near the level sender. The short section of the float arm going into the level sender must be supported so that bending does not take place at the level sender. Carefully install the fuel pump module with sending unit in the fuel tank by orienting the float to face the right side of the tank, tilting the pump module approximately 45°, and loading the float arm and pump into the tank opening.

CAUTION: If a NEW fuel pump module is being installed, make sure that the fuel level sender is installed on the module before installing into the fuel tank.

CAUTION: The fuel pump retaining ring cannot be properly installed if the pump flange locator tabs are not aligned with the slots in the tank.

8. Insert the pump module all the way down into the tank and then rotate 90° counterclockwise to align the module orientation tabs with slots in the tank opening. Correctly oriented, the lines from the pump module will be facing the 10 o'clock position. 12 o'clock is the front of tank. To install, reverse removal procedure.
9. Using the scan tool, perform the Service Bay Diagnostic Test for the evaporative emission system. This test will verify the integrity of the vapor handling areas of the fuel system.

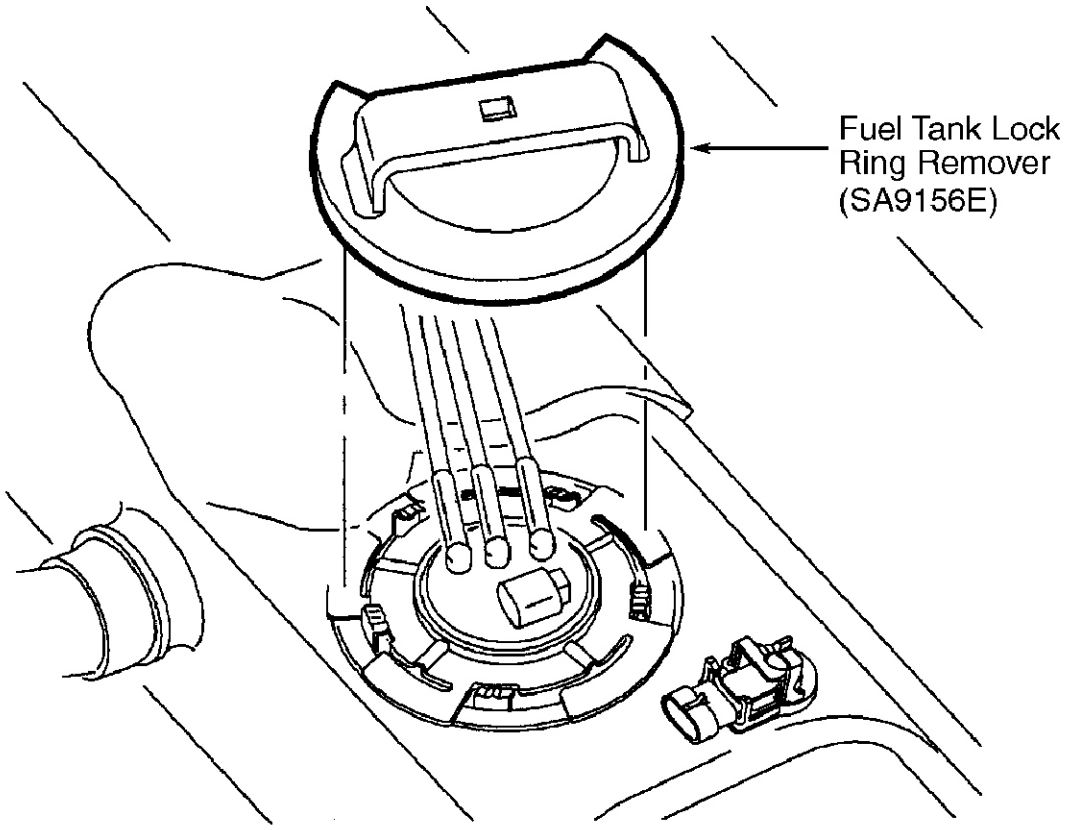

Fig. 38: Removing/Installing Fuel Pump Module Retaining Ring (SC1, SC2, SL, SL1, SL2 & SW2 - 1.9L)
Courtesy of GENERAL MOTORS CORP.

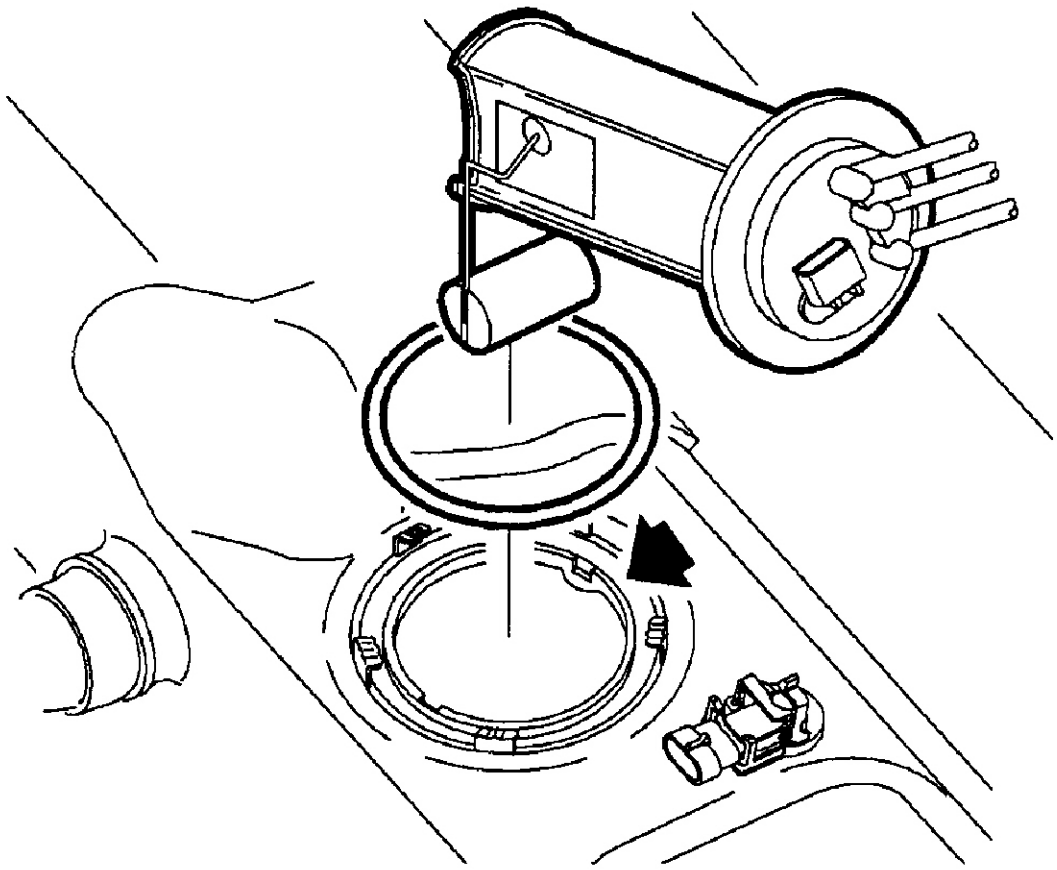

Fig. 39: Removing/Installing Fuel Pump Module From Fuel Tank (SC1, SC2, SL, SL1, SL2 & SW2 - 1.9L)
Courtesy of GENERAL MOTORS CORP.

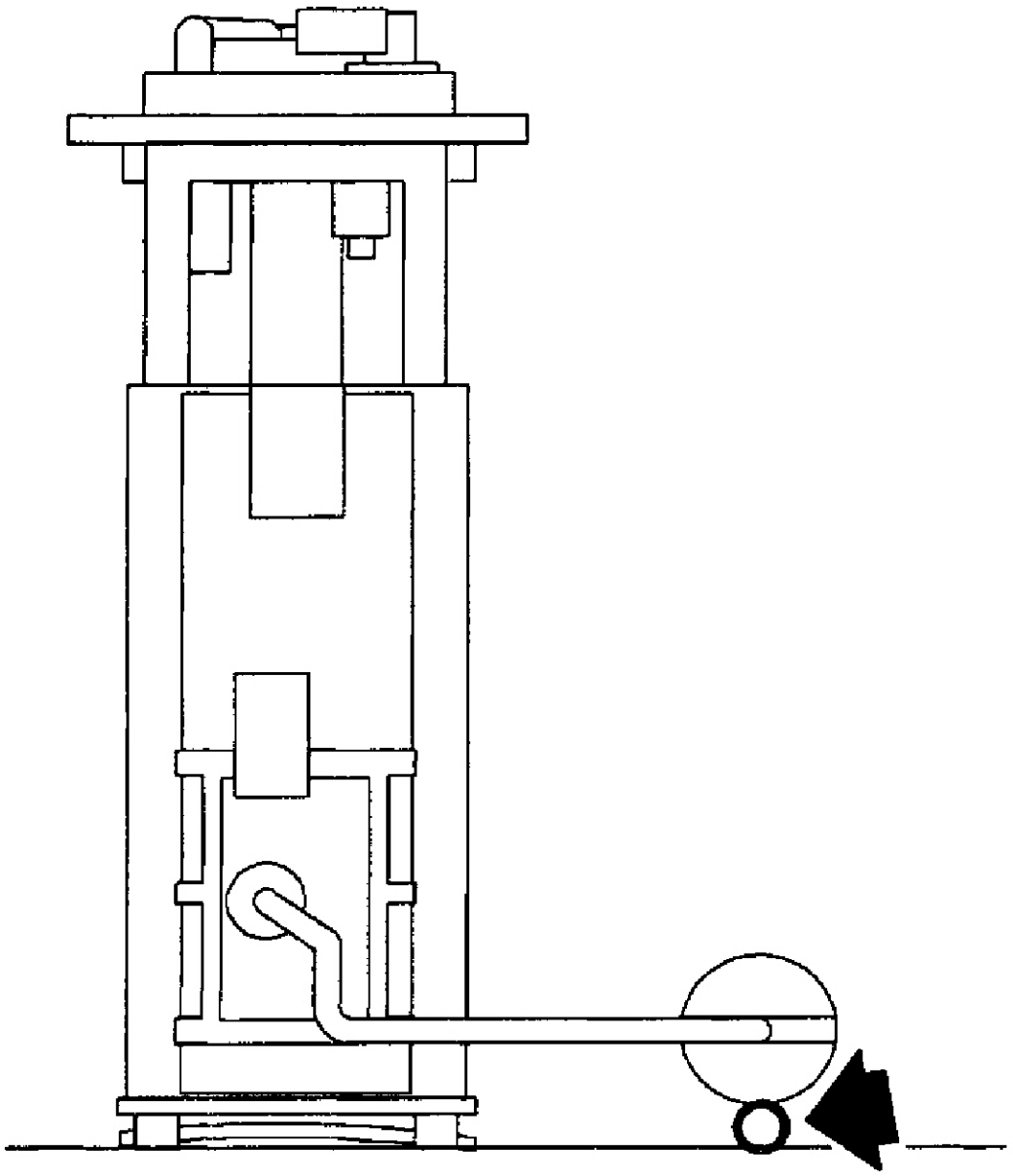

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Fig. 40: Verifying Float Arm Level (SC1, SC2, SL, SL1, SL2 & SW2 - 1.9L)
Courtesy of GENERAL MOTORS CORP.

FUEL PRESSURE REGULATOR (GASOLINE)

NOTE: **On 3.0L, fuel pressure regulator and fuel rail are serviced as an assembly only. DO NOT remove pressure regulator or pressure regulator cover from fuel rail. See FUEL RAIL & INJECTORS .**

Removal (1.3L)

Relieve fuel pressure. See **FUEL SYSTEM PRESSURE RELEASE** . Disconnect negative battery cable. Disconnect pressure regulator vacuum hose. Remove fuel return line from pressure regulator. Remove pressure regulator screws. Remove pressure regulator from fuel rail. Remove fuel inlet "O" ring from pressure regulator.

Installation

To install, reverse removal procedure. DO NOT reuse "O" ring. Lubricate NEW fuel inlet "O" ring with oil and install onto regulator. Tighten screws to specification. See **TORQUE SPECIFICATIONS** .

Removal (1.8L)

1. Fuel pressure regulator is located on fuel sending unit assembly, on bottom of fuel filter. Relieve fuel pressure. See **FUEL SYSTEM PRESSURE RELEASE** . Disconnect negative battery cable. Remove rear seat cushion. Remove 4 fuel sending unit assembly access panel bolts and remove access panel. Disconnect harness connector from fuel sending unit assembly.
2. Remove fuel pipe from top of fuel sending unit assembly. Remove 8 fuel sending unit assembly hold-down bolts and remove hold-down plate. Remove fuel sending unit assembly and "O" ring from fuel tank. Remove fuel pressure regulator from bottom of fuel filter.

Installation

To install, reverse removal procedure. Use NEW "O" ring onto fuel pressure regulator and fuel sending unit assembly. Tighten fuel sending unit assembly hold-down bolts to specification. See **TORQUE SPECIFICATIONS** .

Removal (1.9L)

1. Fuel pressure filter/regulator is located under vehicle, on left front side of fuel tank. Relieve fuel pressure. See **FUEL SYSTEM PRESSURE RELEASE** . Disconnect negative battery cable. Raise and support vehicle. Remove 2 fuel filter/pressure regulator bracket screws.

CAUTION: DO NOT damage fuel line bundle retaining clip. If retaining clip is damaged, fuel tank must be replaced. Retaining clip cannot be serviced separately.

2. Unlatch fuel line bundle retaining clip on left side of fuel tank. Disconnect EVAP purge line at 90-degree quick-connect fitting. Slide filter/regulator outlet out of support on fuel tank bracket. Disconnect fuel feed line at 90-degree quick-connect fitting.
3. Pivot filter/regulator down while moving mounting bracket out from under chassis brakelines. Disconnect fuel feed and return lines at quick-connect fitting on filter/regulator. DO NOT remove filter/regulator from bracket. Filter/regulator and bracket are serviced as an assembly.

Installation

To install, reverse removal procedure. Install NEW fuel line retainers into female portion of quick-connect fuel line fittings. Ensure chassis fuel feed and purge lines are routed on top of parking brake cable. Tighten screws to specification. See **TORQUE SPECIFICATIONS** .

Removal (2.2L & 2.4L - Alero, Cavalier, Grand Am & Sunfire)

1. Relieve fuel pressure. See **FUEL SYSTEM PRESSURE RELEASE** . Disconnect negative battery cable. Remove air cleaner outlet resonator (if necessary). Remove fuel rail bracket (if equipped). Disconnect pressure regulator vacuum hose. Remove fuel return line and "O" ring from pressure regulator. On 2.4L, remove fuel rail. See **FUEL RAIL & INJECTORS** .
2. On all models, remove pressure regulator screws. Remove pressure regulator from fuel rail. Remove pressure regulator retainer and spacer assembly from fuel rail (if equipped). Remove fuel inlet "O" ring from pressure regulator. Remove and discard filter screen if dirty.

Installation

To install, reverse removal procedure. DO NOT reuse "O" ring. Lubricate fuel inlet "O" ring with oil and install into regulator. Replace filter screen as necessary. Tighten screws to specification. See **TORQUE SPECIFICATIONS** .

Removal & Installation (2.2L - Saturn)

Relieve fuel pressure. See **FUEL SYSTEM PRESSURE RELEASE** . Disconnect vacuum line from fuel pressure regulator. Remove 2 retaining bolts and fuel pressure regulator. Discard "O" rings. To install, apply clean engine oil onto both NEW "O" rings. Install small "O" ring onto fuel pressure regulator and large "O" ring into fuel rail. Install fuel pressure regulator onto fuel rail and tighten retaining bolts to specification. See **TORQUE SPECIFICATIONS** . Reconnect vacuum line.

Removal (3.0L, 3.1L & 3.4L)

1. Relieve fuel pressure. See **FUEL SYSTEM PRESSURE RELEASE** . Disconnect negative battery cable. Remove intake manifold plenum and gaskets. Disconnect pressure regulator vacuum hose. Remove fuel return line and "O" ring from pressure regulator.
2. Remove fuel pressure regulator screws. Remove fuel pressure regulator from fuel rail. Remove pressure regulator retainer and spacer assembly from fuel rail, if equipped. Remove fuel inlet "O" ring from fuel pressure regulator. Remove and discard filter screen if dirty.

Installation

To install, reverse removal procedure. DO NOT reuse "O" ring. Lubricate NEW fuel inlet "O" ring with oil and install into regulator. Replace filter screen as necessary. Tighten screws to specification. See **TORQUE SPECIFICATIONS** .

Removal (3.5L, 3.8L, 4.0L & 4.6L)

Relieve fuel pressure. See **FUEL SYSTEM PRESSURE RELEASE** . Disconnect negative battery cable. On 3.5L, remove fuel injector sight shield. On all models, disconnect pressure regulator vacuum hose. Remove pressure regulator snap ring. Lift and twist pressure regulator from pressure regulator housing attached to fuel rail. Remove back-up "O" ring, large "O" ring, filter screen and small "O" ring from pressure regulator housing.

Installation

To install, reverse removal procedure. DO NOT reuse "O" rings. Lubricate NEW "O" rings with oil and install into regulator housing. Install snap ring.

Removal (5.7L - Camaro & Firebird)

Relieve fuel pressure. See **FUEL SYSTEM PRESSURE RELEASE** . Disconnect negative battery cable. Drain fuel tank. Remove fuel tank. Remove fuel sender assembly from fuel tank. Remove pressure regulator retaining ring. Remove pressure regulator from housing on fuel return pipe. Remove large "O" ring and small "O" ring from pressure regulator.

Installation

To install, reverse removal procedure. DO NOT reuse "O" rings. Lubricate NEW "O" rings with oil and install onto regulator. Replace filter screen as necessary. Install retaining ring.

Removal (5.7L - Corvette)

1. Relieve fuel pressure. See **FUEL SYSTEM PRESSURE RELEASE** . Disconnect negative battery cable. Raise and support vehicle. Lower left muffler (A/T only). Clean all fuel filter/pressure regulator connections to avoid fuel system contamination. Disconnect fuel feed pipe quick-connect fitting from fuel filter/pressure regulator. Disconnect fuel return pipe quick-connect fitting from fuel filter/pressure regulator.
2. Remove fuel filter/pressure regulator bracket mount nut. Disconnect fuel system ground strap from fuel filter/pressure regulator mounting stud. Disconnect fuel feed pipe from outlet side of fuel filter/pressure regulator. Remove fuel filter/pressure regulator and bracket from stud. Plug fuel pipes to prevent fuel system

contamination. Remove fuel filter/pressure regulator from bracket.

Installation

To install, reverse removal procedure. Install NEW plastic quick connector retainers onto fuel filter/pressure regulator. Remove plugs from fuel pipes. Tighten fuel filter/pressure regulator bracket nut to specification. See **TORQUE SPECIFICATIONS** .

FUEL RAIL & INJECTORS

NOTE: If injector is replaced, ensure replacement injector has the same part number as injector removed.

Removal (1.3L)

1. Relieve fuel pressure. See **FUEL SYSTEM PRESSURE RELEASE** . Disconnect negative battery cable. Remove PCV valve and hose from intake and valve cover. Remove 3 intake manifold brace bolts and remove brace from engine. Disconnect harness connectors from injectors.
2. Disconnect fuel pressure regulator vacuum hose. Disconnect and plug fuel feed hose from fuel rail inlet pipe. Disconnect and plug fuel return hose from fuel rail return pipe. Remove 2 fuel rail retaining bolts. Remove fuel rail from intake manifold. Remove injectors from fuel rail. Remove injector "O" rings and discard.

Installation

To install, reverse removal procedure. Coat NEW injector "O" rings with clean engine oil. Ensure injectors rotate smoothly and freely. If "O" ring is installed incorrectly, injector will bind. Tighten fuel rail retaining bolts to specification. See **TORQUE SPECIFICATIONS** . To complete installation, reverse removal procedure.

Removal (1.8L)

1. Relieve fuel pressure. See **FUEL SYSTEM PRESSURE RELEASE** . Disconnect negative battery cable. Disconnect 4 spark plug wires from 2 ignition coils. Disconnect PCV and breather hoses from valve cover. Remove nut and accelerator cable bracket from cylinder head.
2. Remove nuts and bolt from wire harness cover plate and remove cover plate. Disconnect harness connectors from injectors. See **Fig. 41** . Remove 2 bolts and pull back wiring harness. Disconnect and plug fuel line. Remove fuel line hold-down bolt.
3. Remove 2 fuel rail retaining bolts. Remove fuel rail from cylinder head. Remove 2 fuel rail spacers from cylinder head. Remove injectors from fuel rail. Remove injector "O" rings and discard.

Installation

To install, reverse removal procedure. Coat NEW injector "O" rings with clean engine oil. Ensure injectors rotate smoothly and freely. If "O" ring is installed incorrectly, injector will bind. Tighten fuel rail retaining bolts. See **TORQUE SPECIFICATIONS** . To complete installation, reverse removal procedure.

Removal (1.9L, 3.0L, 3.1L, 3.4L & 3.8L)

1. Relieve fuel pressure. See **FUEL SYSTEM PRESSURE RELEASE** . Disconnect negative battery cable. Remove air intake duct, if necessary. On 1.9L, disconnect throttle cable from throttle body lever. On 3.0L, 3.1L and 3.4L, remove intake manifold plenum and gaskets. On 3.8L, remove vacuum line from throttle body. Remove ignition coil wires.
2. On all models, disconnect vacuum hose at fuel pressure regulator. Disconnect and plug fuel return line at pressure regulator. Disconnect and plug fuel inlet line at fuel rail. Disconnect harness connectors from injectors.
3. Remove fuel rail retaining bolts. Remove fuel rail from intake manifold using equal force on both sides of

fuel rail. See **Fig. 42** , **Fig. 46** , **Fig. 47** , **Fig. 49** and **Fig. 50** . Remove injector-to-fuel rail retaining clip, if equipped. Remove injectors from fuel rail. Remove injector "O" rings and discard.

Installation

To install, reverse removal procedure. Coat NEW injector "O" rings with clean engine oil. Install injector-to-fuel rail retaining clip with open end facing injector harness connection. Position fuel rail on intake manifold. Push down on fuel rail to seat injectors into manifold. Tighten fuel rail retaining bolts to specification. See **TORQUE SPECIFICATIONS** . To complete installation, reverse removal procedure.

Removal (2.2L - Cavalier - CNG)

WARNING: **Natural gas is highly flammable. To reduce risk of fire and personal injury, keep sparks, flames, and smoking materials away from vehicle while you perform Compressed Natural Gas (CNG) fuel system service. CNG system operates at pressures up to 3600 psi (24820 kPa). Relieve CNG fuel system pressure before servicing CNG fuel system components to reduce risk of fire and personal injury. Before servicing any electrical component, ignition must be in Off or Lock position and all electrical loads must be off, unless instructed otherwise in these procedures. If a tool or equipment could easily come in contact with a live exposed electrical terminal, also disconnect negative battery cable. Failure to follow these precautions may cause personal injury and/or damage to the vehicle or its components.**

Relieve fuel pressure. See **FUEL SYSTEM PRESSURE RELEASE** . Disconnect negative battery cable. Remove CNG fuel controls assembly. See **CNG FUEL MODULE ASSEMBLY** . Remove fuel rail.

Installation

To install, reverse removal procedure. Coat NEW injector "O" rings with clean engine oil. Position injectors into fuel rail and install retaining clips. Tighten fuel rail retaining bolts. See **TORQUE SPECIFICATIONS** . To complete installation, reverse removal procedure.

Removal (2.2L Gasoline - Cavalier & Sunfire)

1. Relieve fuel pressure. See **FUEL SYSTEM PRESSURE RELEASE** . Disconnect negative battery cable. Remove air cleaner outlet resonator. Remove fuel rail bracket. See **Fig. 44** . Push in on injector connector clip and disconnect harness connectors from injectors.
2. Disconnect pressure regulator vacuum hose. Remove fuel return line and "O" ring from pressure regulator. Disconnect and plug fuel inlet line at fuel rail. Remove fuel rail attaching bolts and remove fuel rail assembly. Remove injector retaining clips and remove fuel injectors from fuel rail. Remove injector "O" rings and discard.

Installation

To install, reverse removal procedure. Coat NEW injector "O" rings with clean engine oil. Position injectors into fuel rail and install retaining clips. Tighten fuel rail retaining bolts. See **TORQUE SPECIFICATIONS** . To complete installation, reverse removal procedure.

Removal (2.2L - Saturn)

NOTE: **When fuel rail is removed for service, fuel injectors must be removed and all injector "O" rings must be replaced.**

1. Relieve fuel pressure. See **FUEL SYSTEM PRESSURE RELEASE** . Disconnect negative battery cable.

Remove air intake tube and fresh air tube. Disconnect fuel pressure regulator hose from throttle body and fuel rail. Disconnect fuel supply line and discard plastic retainer.

2. Remove throttle body. Remove throttle control cable bracket bolts. Disconnect cable from throttle lever and lay over intake manifold. Disconnect fuel injector electrical connectors. Remove fuel rail assembly mounting bolts. Carefully pull fuel rail back and upward to remove injectors from cylinder head ports. See **Fig. 43** .
3. Move fuel rail toward power steering pump and rotate injectors downward. Lift No. 1 injector and remove fuel rail. Remove fuel injector retaining clips and pull injectors from fuel rail. Remove injector "O" rings and discard.

Installation

1. Install NEW "O" rings lubricated with clean engine oil onto each injector. Install injectors onto fuel rail. With injectors pointing downward, lower fuel line end of fuel rail into cylinder head ports. Rotate injectors into horizontal position and align injectors with cylinder head ports.
2. Carefully push fuel injectors into cylinder head ports, ensuring they fully seat into cylinder head. Install fuel rail mounting bolts and tighten to specification. See **TORQUE SPECIFICATIONS** . To complete installation, reverse removal procedure using NEW fuel supply line plastic retainers.

Removal (2.4L)

1. Relieve fuel pressure. See **FUEL SYSTEM PRESSURE RELEASE** . Disconnect negative battery cable. Remove air cleaner outlet duct clamp. Remove air cleaner outlet duct from air cleaner resonator. Loosen air cleaner resonator clamp at throttle body. Remove resonator retaining bolts and nuts. Lift air cleaner resonator from throttle body.
2. Remove crankcase vent hose to bottom of resonator. Remove resonator. Disconnect vacuum hose at pressure regulator. Remove fuel rail attaching bolts. Disconnect camshaft position sensor harness connector. Push in on injector connector clip and disconnect harness connectors from injectors.
3. Using a wrench to hold fuel inlet fitting, disconnect and plug fuel inlet line at fuel rail. Lift fuel rail assembly from cylinder head. Loosen fuel return pipe retaining bracket screw. Rotate retaining bracket for removal of fuel return pipe. Remove fuel return pipe from pressure regulator.
4. Remove inlet and return pipe to fuel feed and return line connections. Remove inlet and return pipe assemblies and discard "O" rings. Remove fuel rail assembly. See **Fig. 45** . Remove injector-to-fuel rail retaining clip. Remove injector from fuel rail. Remove injector "O" rings and discard.

Installation

To install, reverse removal procedure. Lubricate NEW injector "O" rings with clean engine oil. Position injectors into fuel rail and install retaining clips. Install NEW injector-to-fuel rail retaining clip with open end facing injector harness connection. Tighten fuel rail retaining bolts. See **TORQUE SPECIFICATIONS** . To complete installation, reverse removal procedure.

Removal (3.5L)

1. Relieve fuel pressure. See **FUEL SYSTEM PRESSURE RELEASE** . Disconnect negative battery cable. Remove injector sight shield. Remove fuel feed pipe quick connect fitting by squeezing tabs and pulling lines apart. Remove return pipe quick connecting fitting from fuel rail. Remove vacuum line from fuel pressure regulator.
2. Remove crankcase ventilation valve hose. Remove throttle body vacuum port hose. Remove snap bracket on throttle body coolant tube. Remove engine electrical harness bolts from camshaft covers. Disconnect fuel injector harness connectors. Release 4 snap locking tabs on fuel rail assembly by pushing toward camshaft covers and lifting. Remove fuel rail assembly. See **Fig. 48** . Remove injector-to-fuel rail retaining clip. Remove injector from fuel rail. Remove injector "O" rings and discard.

Installation

To install, reverse removal procedure. Lubricate NEW injector "O" rings with clean engine oil. Position injectors into fuel rail and install retaining clips. Position fuel rail into intake manifold housing. Push down on rail to seat injectors into manifold housing. To complete installation, reverse removal procedure.

Removal (4.0L)

1. Relieve fuel pressure. See **FUEL SYSTEM PRESSURE RELEASE** . Disconnect fuel feed and return pipes from fuel rail. Disconnect fuel pressure regulator vacuum hose.
2. Disconnect Positive Crankcase Ventilation (PCV) air tube from cam cover. Disconnect PCV valve from cam cover. Remove fuel rail bracket retainer nut. Disconnect fuel injector electrical connectors from each fuel injector. Lay harness aside. Remove fuel rail attaching studs and fuel rail.

Installation

To install, reverse removal procedure. Lubricate NEW injector "O" rings with clean engine oil. Position injectors into fuel rail and install retaining clips. To complete installation, reverse removal procedure.

Removal (4.6L)

1. Relieve fuel pressure. See **FUEL SYSTEM PRESSURE RELEASE** . Disconnect negative battery cable. Remove intake manifold top cover. See appropriate article in ENGINES. Disconnect IAT and MAF sensor harness connectors. Remove air intake duct. Remove fuel rail quick-connect fittings. Remove fuel pressure regulator vacuum hose. Remove crankcase ventilation air tube.
2. Remove fuel rail end-bracket retaining nuts. Disconnect fuel injector electrical connectors. Set harness aside. Remove fuel rail bolts. Raise fuel injectors from intake manifold. Remove fuel rail and injector assembly. See **Fig. 51** . Remove injectors from fuel rail. Remove injector "O" rings and seals, and discard.

Installation

WARNING: **To reduce the risk of fire and personal injury, ensure fuel injector "O" rings are installed properly. If "O" rings are color coded, ensure Black "O" ring is positioned on upper portion of injector, and Brown "O" ring is positioned on lower portion of injector. The "O" rings are identical in size, but are made of different materials.**

To install, reverse removal procedure. Lubricate NEW injector "O" rings with clean engine oil. Position fuel rail into intake manifold housing. Push down on rail to seat injectors in manifold housing. Tighten fuel rail assembly and bracket bolts to specification. See **TORQUE SPECIFICATIONS** . To complete installation, reverse removal procedure.

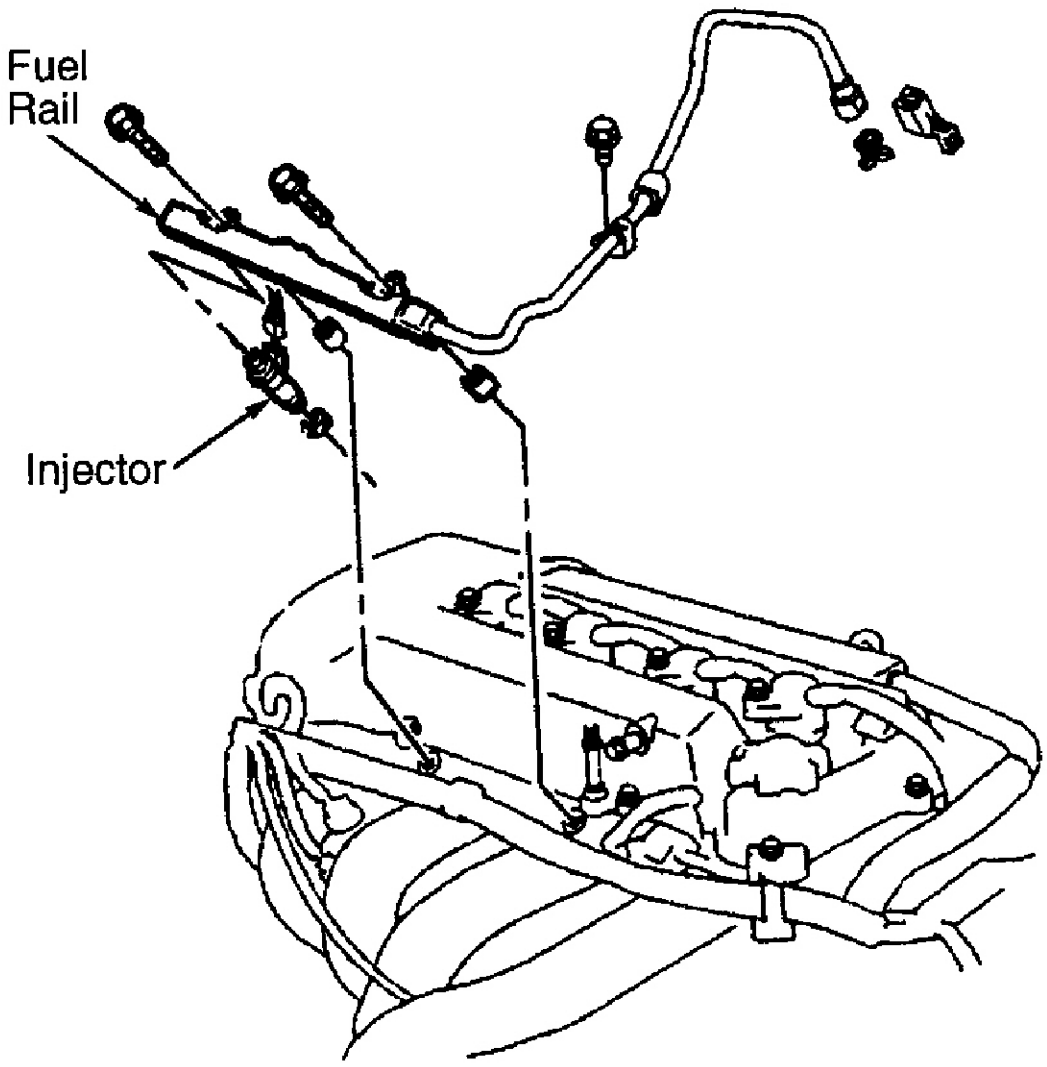
Removal (5.7L)

1. Relieve fuel pressure. See **FUEL SYSTEM PRESSURE RELEASE** . Disconnect negative battery cable. Remove resonator and resonator bracket. Disconnect quick-connect fitting at fuel rail inlet and return lines.
2. Disconnect accelerator cable from throttle body and accelerator cable bracket. Move accelerator cable aside. Disconnect vacuum hose at pressure regulator. Remove vacuum lines (mark for installation reference) as necessary to gain access to fuel rail and fuel lines. Remove electrical harness from routing clips on fuel rail.
3. Remove fuel line retaining bolt. Disconnect harness connectors from injectors. Remove fuel rail retaining bolts. Remove fuel rail from intake manifold using equal force on both sides of fuel rail. See **Fig. 52** . Remove injector-to-fuel rail retaining clip. Remove injector from fuel rail. Remove injector "O" rings and discard.

Installation

To install, reverse removal procedure. Lubricate NEW injector "O" rings with clean engine oil. Install injector-to-

fuel rail retaining clip on right side of injector harness connection. Position fuel rail onto intake manifold. Push down on rail to seat injectors in manifold. Tighten fuel rail retaining bolts. See **TORQUE SPECIFICATIONS** . To complete installation, reverse removal procedure.



G00056050

Fig. 41: Locating Fuel Rail Assembly Components (1.8L)
Courtesy of GENERAL MOTORS CORP.

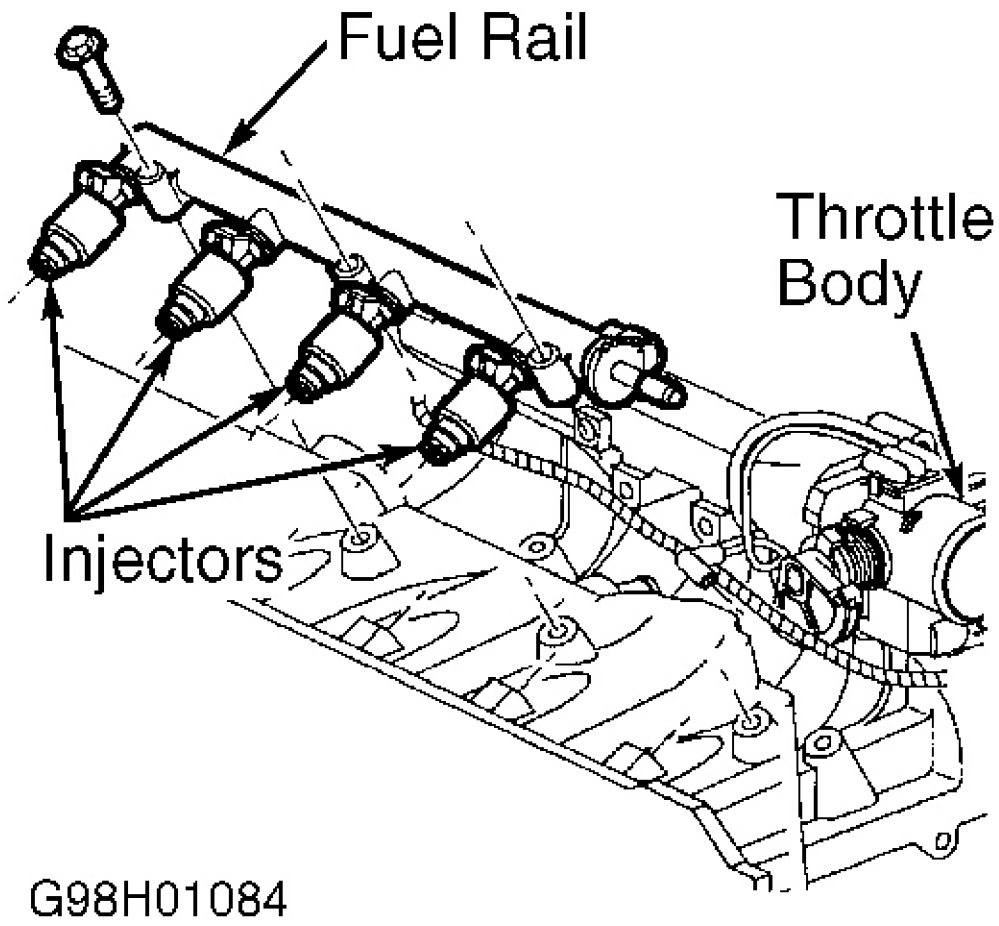


Fig. 42: Locating Fuel Rail Assembly Components (1.9L - VIN 7 Shown; VIN 8 Is Similar)
Courtesy of GENERAL MOTORS CORP.

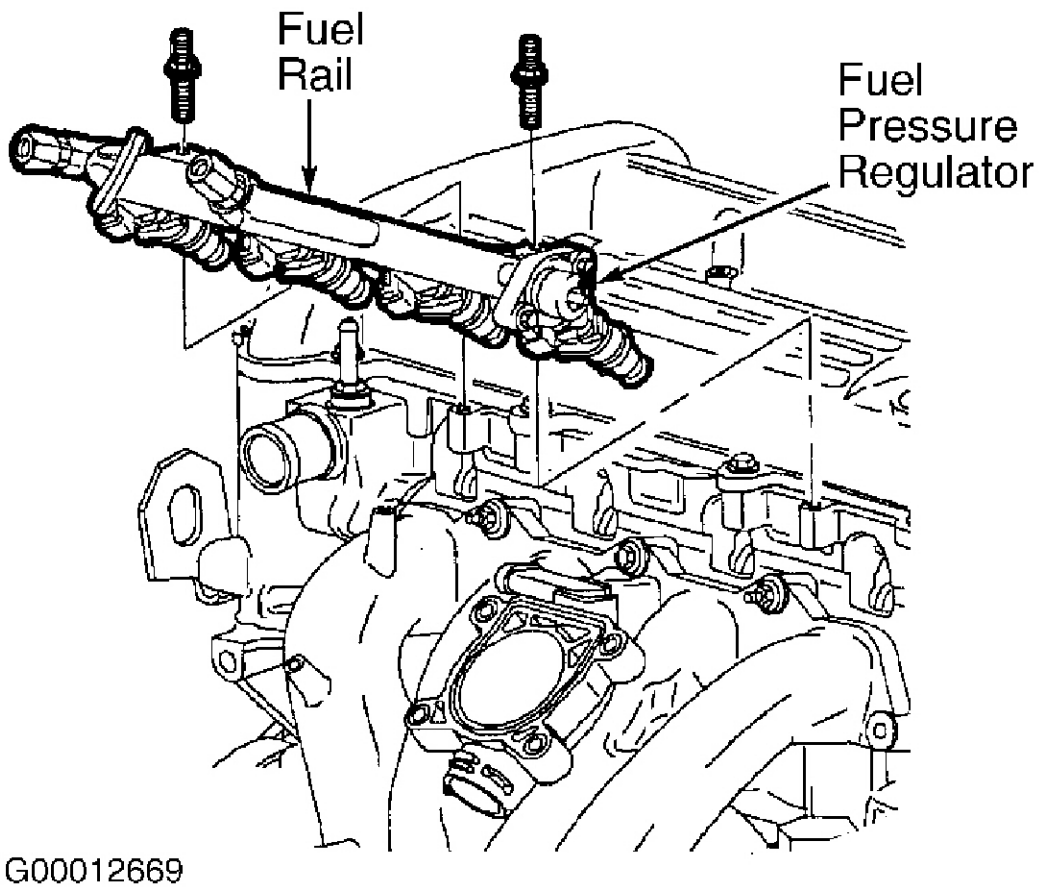


Fig. 43: Locating Fuel Rail Assembly Components (2.2L - VIN F)
Courtesy of GENERAL MOTORS CORP.

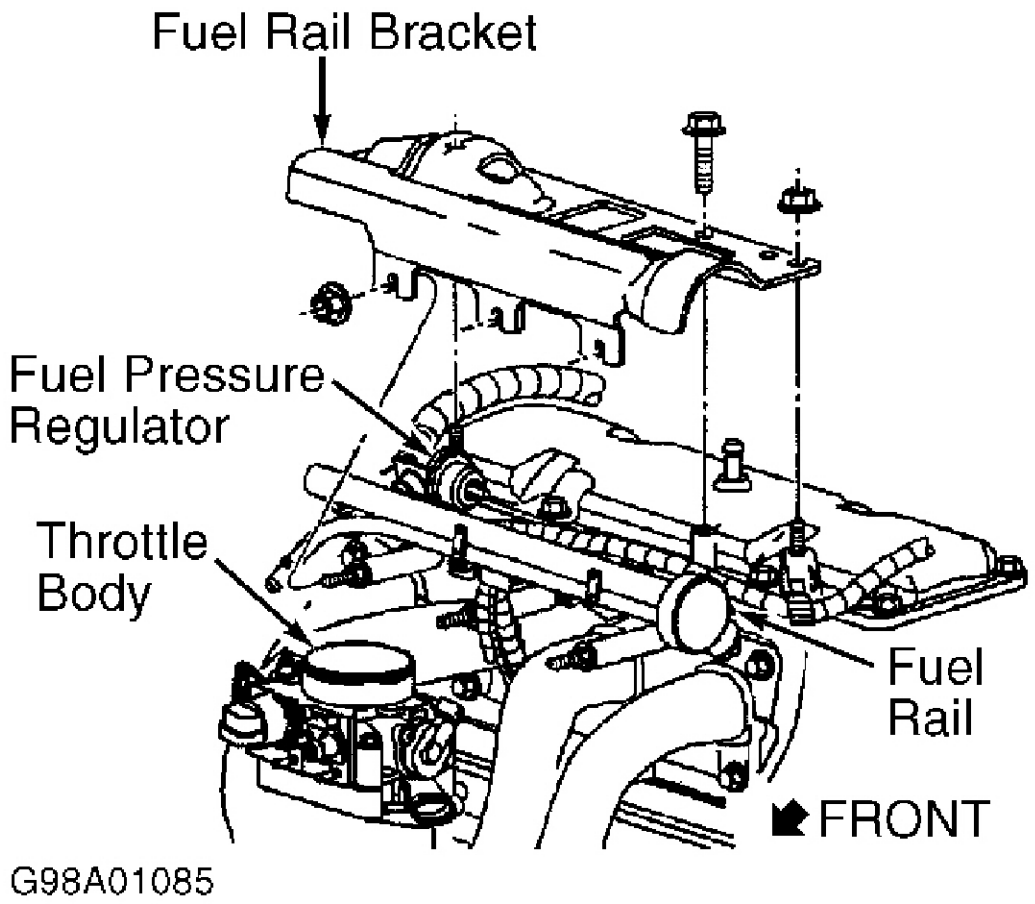


Fig. 44: Locating Fuel Rail Assembly Components (2.2L - VIN 4)
Courtesy of GENERAL MOTORS CORP.

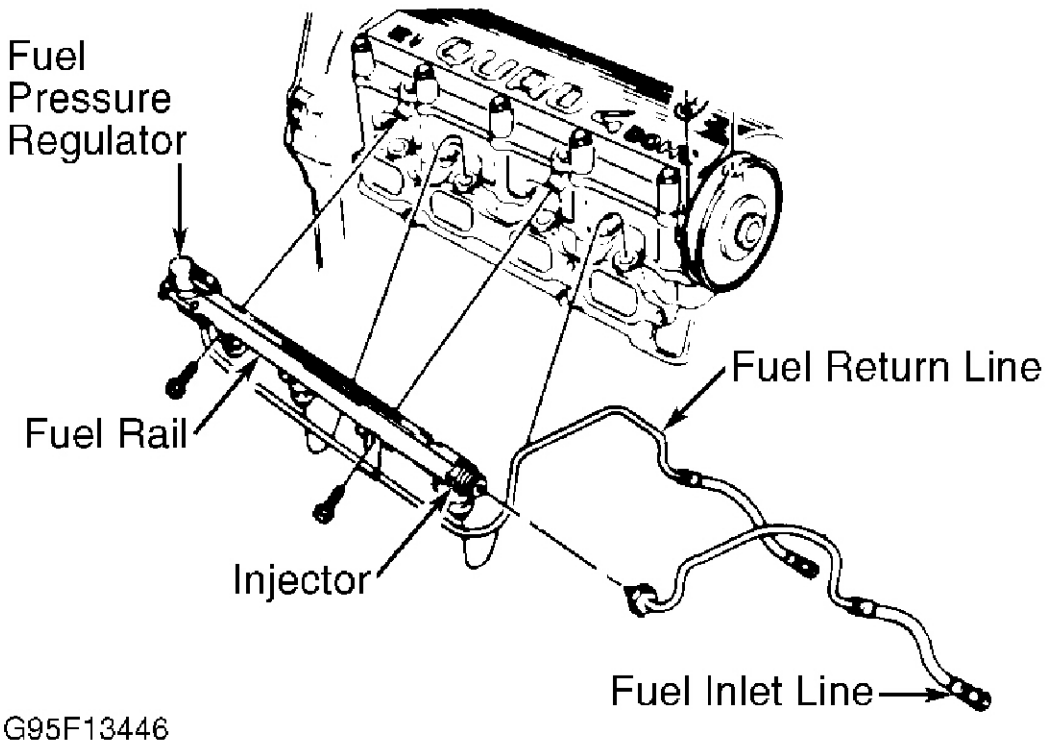


Fig. 45: Locating Fuel Rail Assembly Components (2.4L - VIN T)
Courtesy of GENERAL MOTORS CORP.

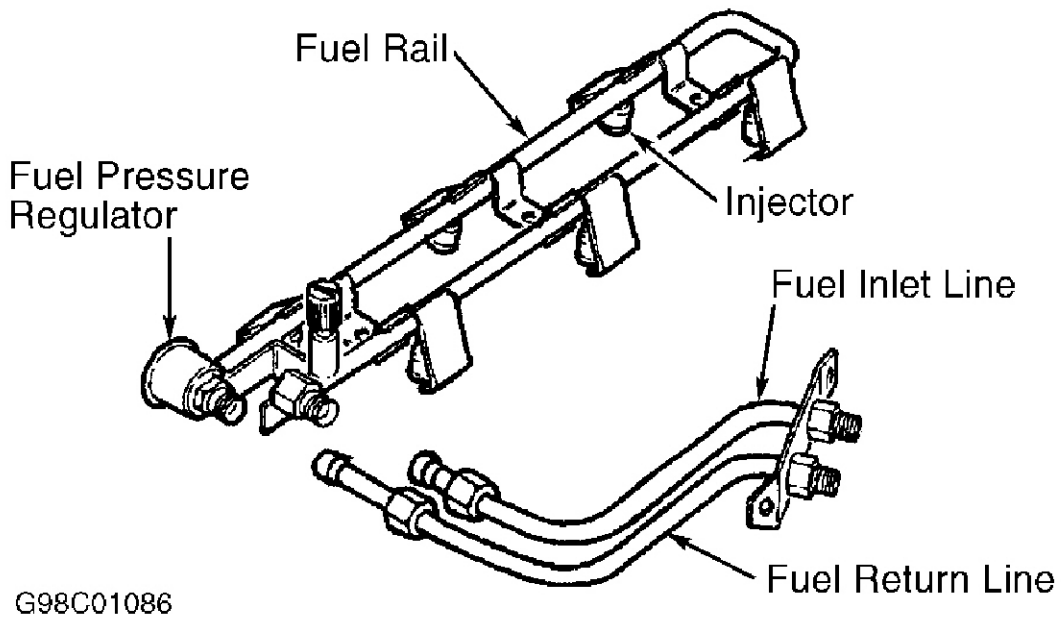


Fig. 46: Locating Fuel Rail Assembly Components (3.0L - VIN R)
Courtesy of GENERAL MOTORS CORP.

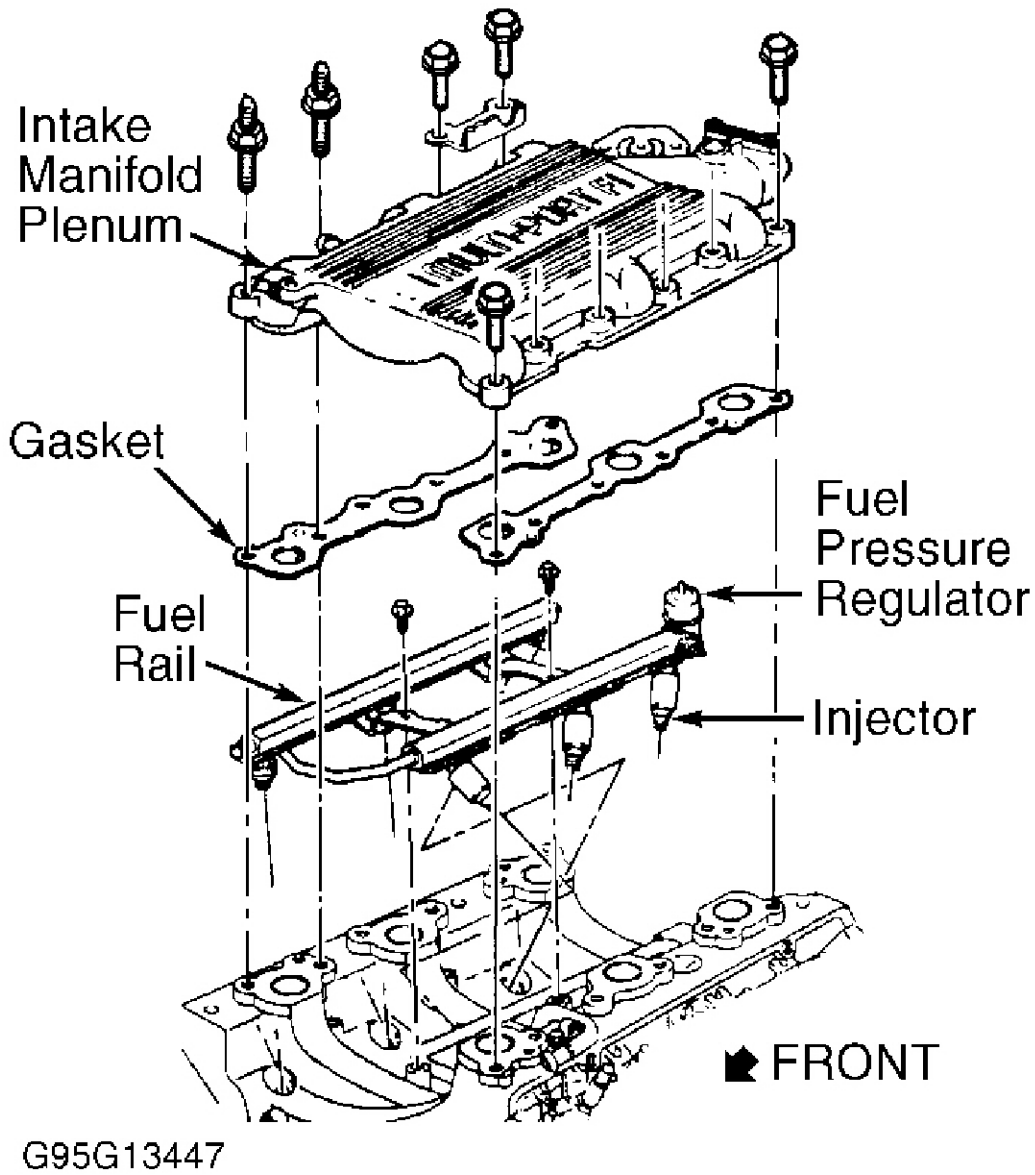


Fig. 47: Locating Fuel Rail Assembly Components (3.1L - VIN M & 3.4L - VIN E)
Courtesy of GENERAL MOTORS CORP.

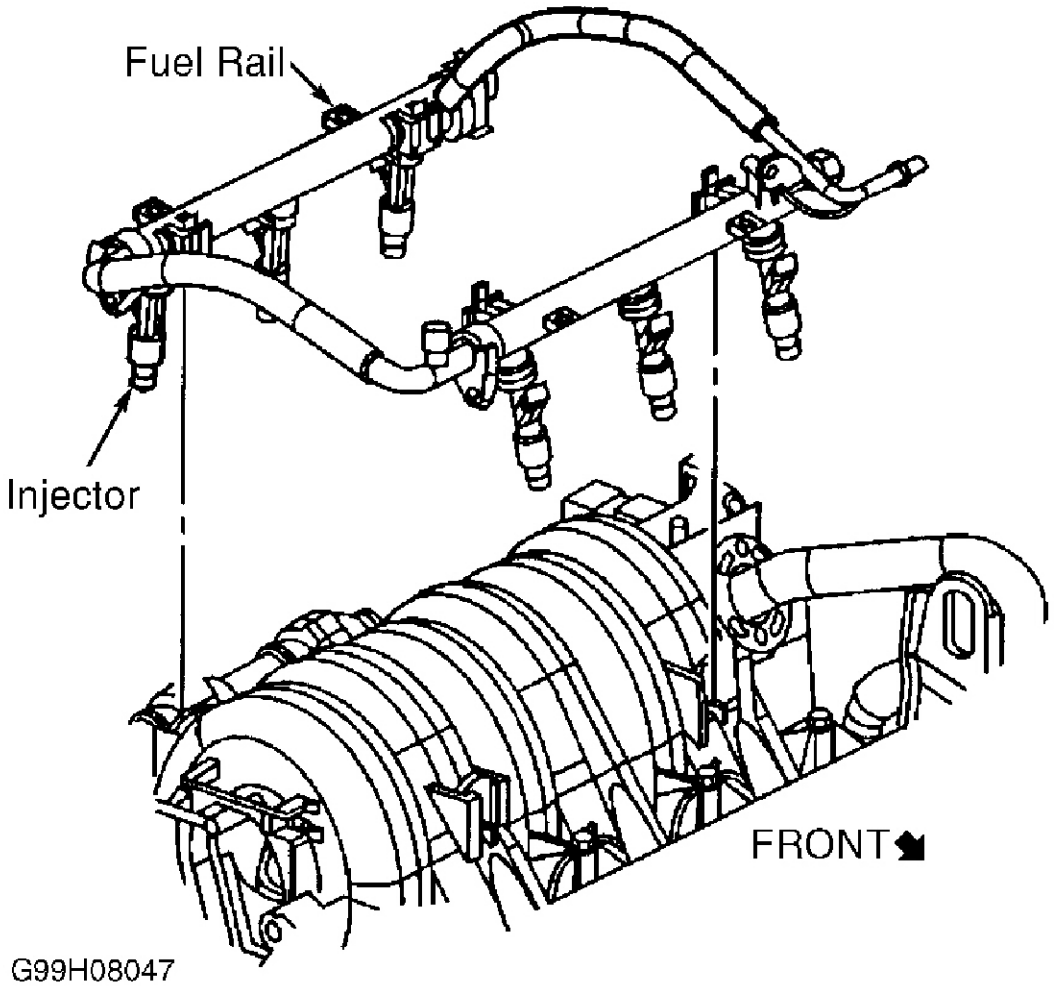


Fig. 48: Locating Fuel Rail Assembly Components (3.5L - VIN H)
Courtesy of GENERAL MOTORS CORP.

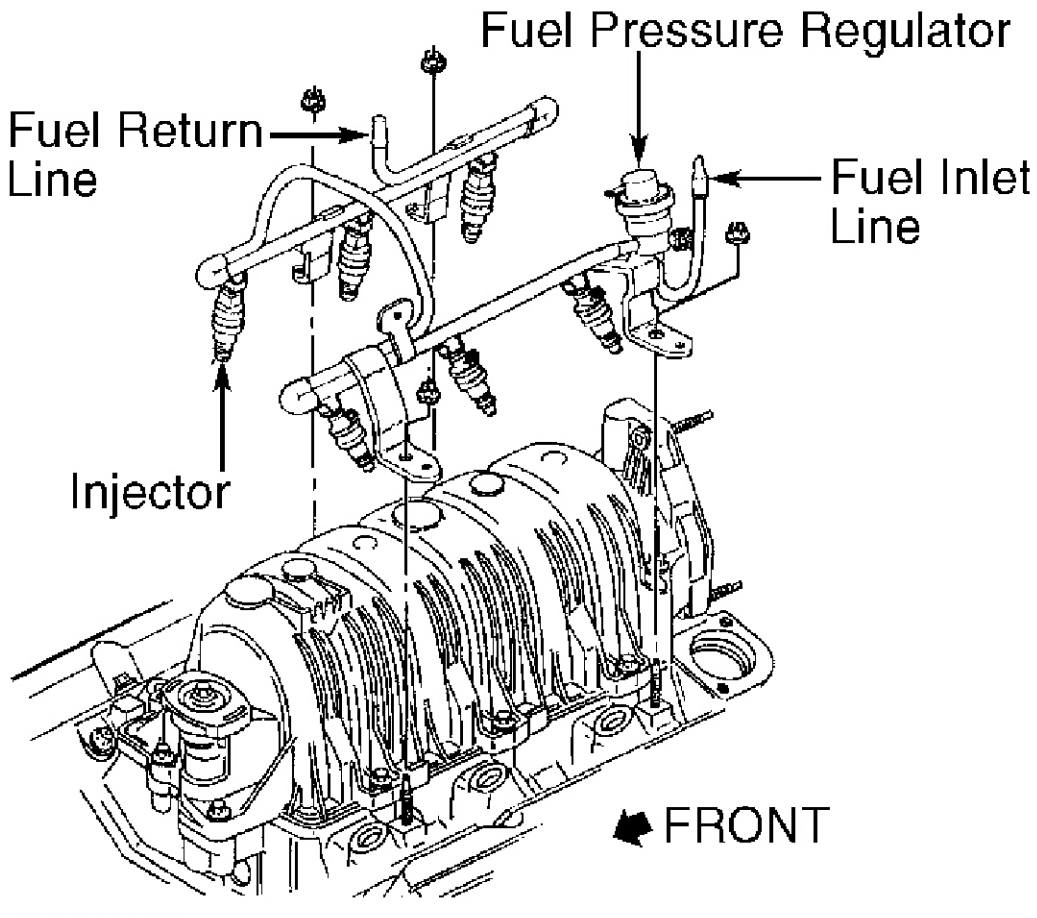


Fig. 49: Locating Fuel Rail Assembly Components (3.8L - VIN K)
Courtesy of GENERAL MOTORS CORP.

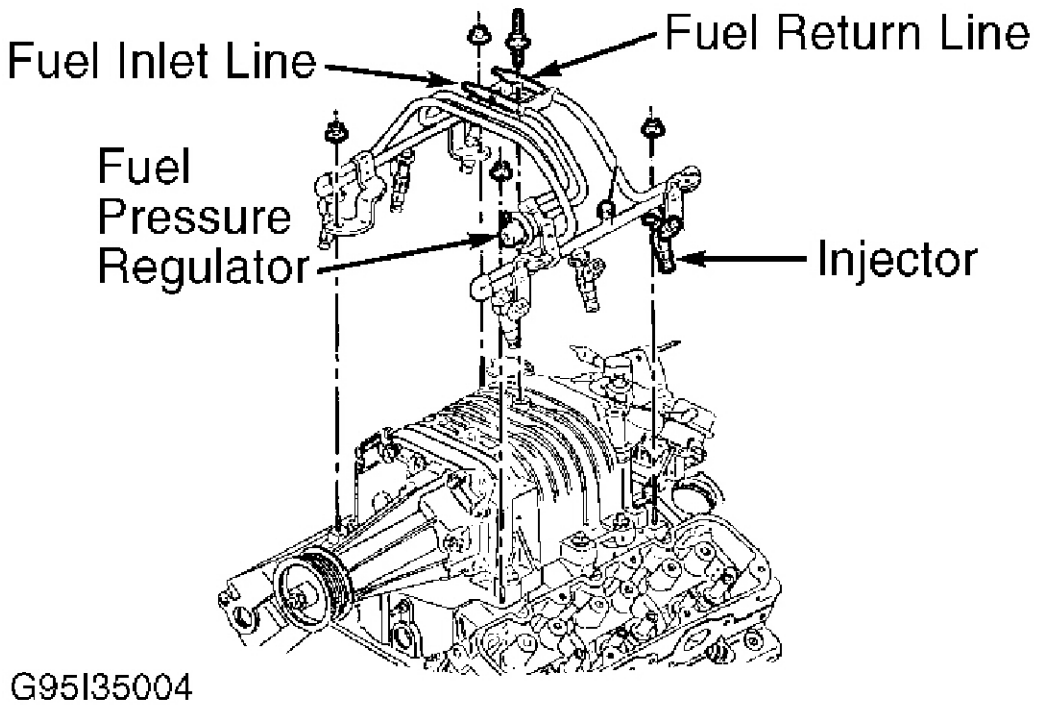


Fig. 50: Locating Fuel Rail Assembly Components (3.8L - VIN 1)

Courtesy of GENERAL MOTORS CORP.

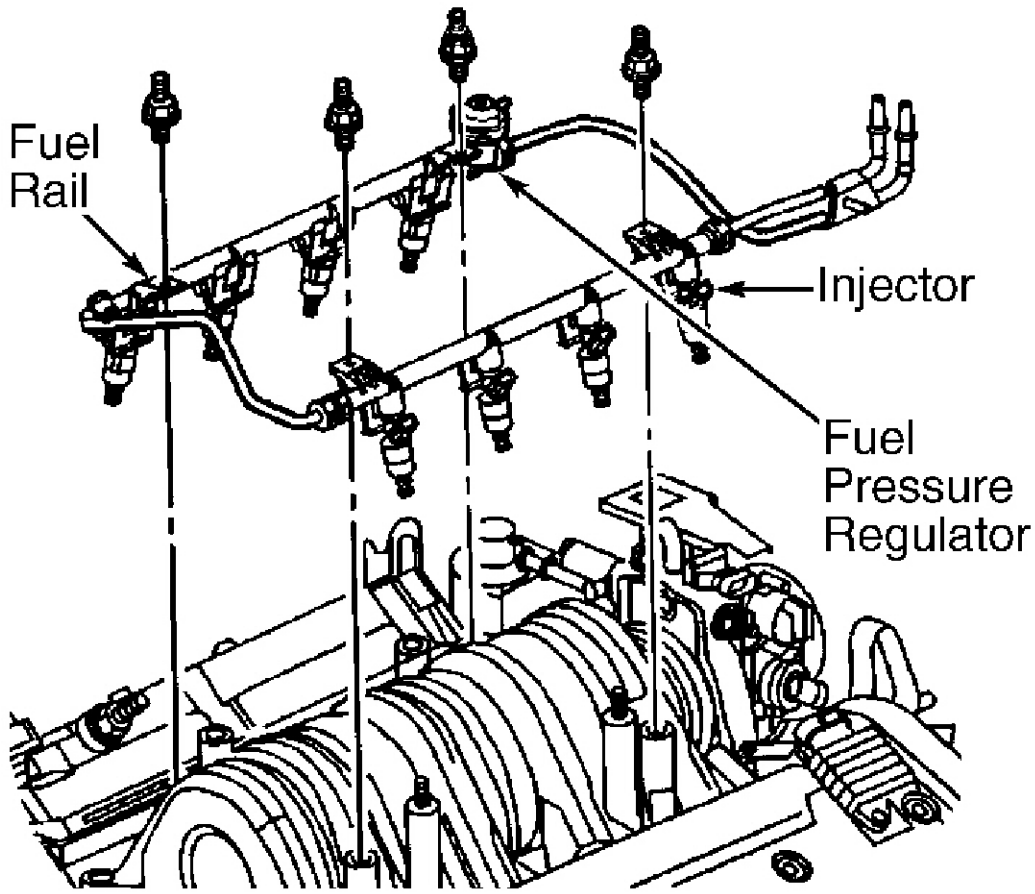


Fig. 51: Locating Fuel Rail Assembly Components (4.0L - VIN C & 4.6L - VIN Y & 9)
Courtesy of GENERAL MOTORS CORP.

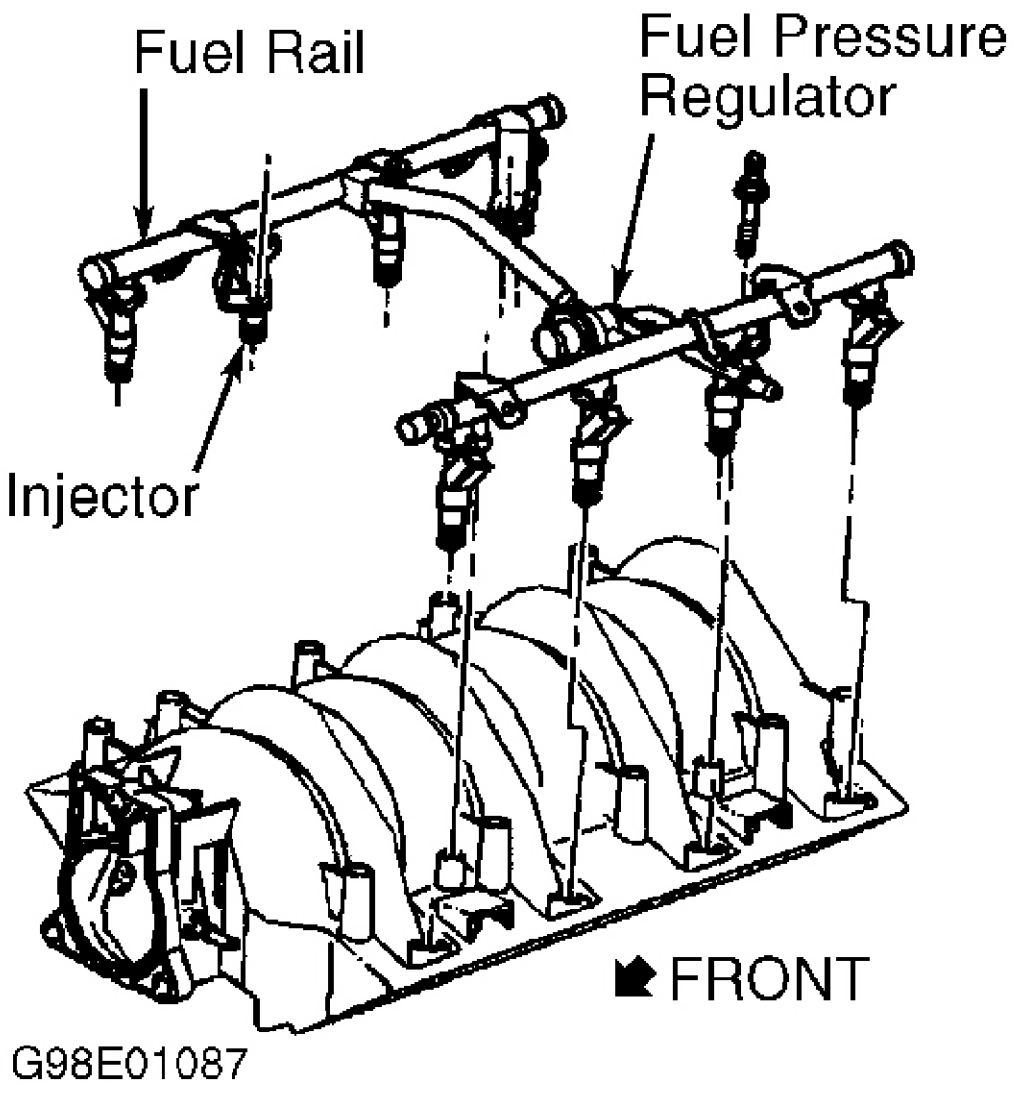


Fig. 52: Locating Fuel Rail Assembly Components (5.7L)
Courtesy of GENERAL MOTORS CORP.

FUEL TANK PRESSURE SENSOR

Removal & Installation (1.3L, 1.9L, 2.2L, 2.4L, 3.0L)

Relieve fuel system pressure. See **FUEL SYSTEM PRESSURE RELEASE** . Disconnect negative battery cable. Remove fuel tank. Disconnect fuel tank pressure sensor electrical connector. Remove fuel tank pressure sensor. To install, reverse removal procedure.

Removal & Installation (1.8L)

Relieve fuel system pressure. See **FUEL SYSTEM PRESSURE RELEASE** . Disconnect negative battery cable. Remove EVAP emission canister. Disconnect electrical connector from fuel tank pressure sensor. Disconnect pressure sensor nipple from calibrated orifice. Remove fuel tank pressure sensor from EVAP canister. To install, reverse removal procedure.

Removal & Installation (2.2L - Cavalier - CNG)

WARNING: **Natural gas is highly flammable. To reduce risk of fire and personal injury, keep sparks, flames, and smoking materials away from vehicle while you perform Compressed Natural Gas (CNG) fuel system service. CNG system**

operates at pressures up to 3600 psi (24820 kPa). Relieve CNG fuel system pressure before servicing CNG fuel system components to reduce risk of fire and personal injury. Before servicing any electrical component, ignition must be in Off or Lock position and all electrical loads must be off, unless instructed otherwise in these procedures. If a tool or equipment could easily come in contact with a live exposed electrical terminal, also disconnect negative battery cable. Failure to follow these precautions may cause personal injury and/or damage to the vehicle or its components.

1. Relieve CNG fuel system pressure. See **FUEL SYSTEM PRESSURE RELEASE** . Disconnect negative battery cable.
2. Remove spare tire cover, jack and tool kit. Remove spare tire. Remove bolts attaching tank cover and remove tank cover from trunk. Remove tank vent boot cover nuts and cover. Disconnect Fuel Pressure Sensor (FPS) electrical connector. See **Fig. 14** . Remove FPS from tank valve.
3. Install FPS using a new "O" ring. Lubricate "O" ring with petroleum jelly. Tighten FPS to 20 ft. lbs. (27 N.m). Connect FPS and HPL electrical connectors. Connect negative battery cable.
4. Start vehicle and check for CNG fuel leaks at each fitting using Leak Tester (J 41416). Install tank vent boot cover and nuts. Tighten tank vent boot cover nuts to 54 INCH lbs. (6 N.m). Install tank cover.

Removal & Installation (3.1L, 3.4L, 3.5L, 3.8L, 4.0L & 4.6L)

Disconnect negative battery cable. Remove trunk liner. Remove fuel sender access panel. Disconnect fuel tank pressure sensor electrical connector. Remove fuel tank pressure sensor. To install, reverse removal procedure.

Removal & Installation (5.7L)

Disconnect negative battery cable. Raise and support vehicle. Remove right rear wheel. Remove EVAP canister access cover. Disconnect fuel tank pressure sensor electrical connector. Remove fuel tank pressure sensor. To install, reverse removal procedure.

FUEL TEMPERATURE SENSOR

NOTE: Fuel temperature sensor is NOT serviceable separately from High Pressure Lock-Off (HPL) Solenoid. See LOCK-OFF SOLENOIDS (2.2L - CAVALIER - CNG) .

GAS MASS SENSOR/MIXTURE CONTROL VALVE (2.2L - CAVALIER - CNG)

WARNING: Before servicing any electrical component, ignition must be in Off or Lock position and all electrical loads must be off, unless instructed otherwise in these procedures. If a tool or equipment could easily come in contact with a live exposed electrical terminal, also disconnect negative battery cable. Failure to follow these precautions may cause personal injury and/or damage to the vehicle or its components.

1. Disconnect negative battery cable. Disconnect GMS/MCV electrical connectors. See **Fig. 14** . Remove throttle cables from retaining clip. Loosen vapor hose clamp at outlet of GMS/MCV. Remove 4 screws from GMS/MCV inlet elbow. Remove GMS/MCV bracket attaching nuts from isolators and remove GMS/MCV and bracket from module bracket. Remove GMS/MCV from bracket.
2. Install GMS/MCV to bracket. Tighten GMS/MCV-to-bracket nuts to 106 INCH lbs. (12 N.m). Install GMS/MCV and bracket to isolation mounts on module bracket. Tighten GMS/MCV-to-module bracket nuts to 33 INCH lbs. (3.7 N.m). Install GMS/MCV inlet elbow using NEW "O" ring. Tighten screws to 48 INCH lbs. (5.4 N.m). Tighten fuel clamp to 18 INCH lbs. (2 N.m). To complete installation, reverse removal procedure.

HIGH PRESSURE FUEL REGULATOR (2.2L - CAVALIER - CNG)

WARNING: Natural gas is highly flammable. To reduce risk of fire and personal injury, keep sparks, flames, and smoking materials away from vehicle while you perform Compressed Natural Gas (CNG) fuel system service. CNG system operates at pressures up to 3600 psi (24820 kPa). Relieve CNG fuel system pressure before servicing CNG fuel system components to reduce risk of fire and personal injury. Failure to follow these precautions may cause personal injury and/or damage to the vehicle or its components.

Removal (Regulator)

NOTE: Procedures apply only to Cavalier models equipped with bi-fuel engine components.

1. Relieve fuel pressure. See **FUEL SYSTEM PRESSURE RELEASE** . Lower rear seat. Loosen lower vent hose clamp. Pull vent hose from regulator. Disconnect the high pressure regulator-to-low pressure fuel line from regulator. See **Fig. 14** .
2. Remove high pressure regulator mounting nut. Raise and support vehicle. Install hose pinching clamps on coolant inlet and outlet lines at high pressure regulator. Remove coolant hoses from high pressure regulator. Disconnect fuel outlet line from high pressure regulator. Remove high pressure regulator.

Installation

To install, reverse removal procedure. Lubricate all "O" rings with petroleum jelly before installation. Tighten all fasteners to specification. See **TORQUE SPECIFICATIONS** . Check CNG system for leaks. Check and refill coolant as needed.

Removal & Installation (Filter)

1. Relieve CNG fuel system pressure. See **FUEL SYSTEM PRESSURE RELEASE** . Lower rear seat. Loosen lower vent hose clamp. Pull vent hose from regulator. Disconnect the High Pressure Regulator (HPR)-to-low pressure fuel line from regulator. See **Fig. 14** . Remove HPR inlet fitting, spring, filter and seal.
2. Install NEW seal, filter and spring. Install HPR inlet fitting using a new "O" ring. Lubricate "O" ring with petroleum jelly or equivalent. Tighten HPR inlet fitting to 35 ft. lbs. (48 N.m). Connect HPL to HPR fuel line to HPR using a new "O" ring seal. Lubricate O-ring with petroleum jelly or equivalent. Tighten fuel line fitting to 18 ft. lbs. (24 N.m). To complete installation, reverse removal procedure.

IDLE AIR CONTROL VALVE

Removal (Except 1.3L & 1.8L)

CAUTION: For calibration purposes, several different style Idle Air Control (IAC) valves are used. Ensure replacement valve has the same part number as original valve.

Disconnect harness connector from IAC valve. Remove IAC valve, gasket and "O" ring from throttle body assembly.

Installation

CAUTION: DO NOT manually extend or retract pintle if IAC valve has been in service, or damage to worm gear will result.

NOTE: Before installation, clean "O" ring sealing surface, pintle seat and air passage. If air passage has heavy deposits, remove throttle body for complete cleaning.

1. Inspect "O" ring for damage. Replace as necessary. If reusing IAC valve, DO NOT push or pull on pintle. Threads on worm gear will be damaged.
2. If replacing IAC valve, measure distance between tip of new IAC valve pintle and mounting flange. Distance should not exceed 1 1/8" (28 mm). If distance is more than specified, use finger pressure to slowly retract pintle. Lubricate "O" ring with clean engine oil.
3. Apply Thread Locking Compound (Loctite 262) onto IAC valve retaining screw threads. Install IAC valve onto throttle body. Tighten IAC valve retaining screws to specification. See **TORQUE SPECIFICATIONS** . Reconnect IAC valve harness connector.
4. To reset IAC valve pintle position, turn ignition on for 20 seconds. Turn ignition off for 10 seconds. Start engine and check for proper idle operation. Repeat procedure if proper idle operation is not obtained.

Removal & Installation (1.3L & 1.8L)

Remove throttle body assembly. See **THROTTLE BODY (SFI)** . Drain any remaining engine coolant. Remove 4 IAC valve screws and remove IAC valve from throttle body assembly. Install NEW rubber gasket onto throttle body assembly. Install IAC valve onto throttle body assembly and tighten IAC valve retaining screws to specification. See **TORQUE SPECIFICATIONS** . To complete installation, reverse removal procedure.

LOCK-OFF SOLENOIDS (2.2L - CAVALIER - CNG)

WARNING: Do not install this part if you can not completely refill the vehicle with CNG after a repair. Failure to properly leak-check system after part replacement may result in serious injury, death, or damage to vehicle or the part. Before servicing any electrical component, ignition must be in Off or Lock position and all electrical loads must be off, unless instructed otherwise in these procedures. If a tool or equipment could easily come in contact with a live exposed electrical terminal, also disconnect negative battery cable. Failure to follow these precautions may cause personal injury and/or damage to the vehicle or its components.

Removal (High Pressure)

1. Remove fuel tank cover from trunk. Relieve CNG fuel system pressure. See **FUEL SYSTEM PRESSURE RELEASE** . Disconnect negative battery cable. Remove tank vent cover nuts and cover. Disconnect 3 electrical connectors from High Pressure Lock-Off (HPL) solenoid. See **Fig. 14** .
2. Loosen fill valve boot clamp and peel back boot. Disconnect fill line at fill valve. Loosen clamp at tank vent boot and peel back boot to expose the union. Disconnect fill line at HPL and remove the line. Disconnect HPL to High Pressure Regulator (HPR) fuel line at the HPL. Disconnect pressure relief device line at HPL.
3. Remove trunk trim panel, cargo net, cargo net knobs and left wheel well carpet. Remove fuel fill line from fill valve to the union. Lower rear seat and loosen vent hose clamps at tank and HPR.
4. Pull vent hose from HPR. Disconnect HPL to HPR fuel line at HPR. Disconnect pressure relief device line from the HPR mounting ring. Remove lines and vent hose as an assembly. See **Fig. 53** .

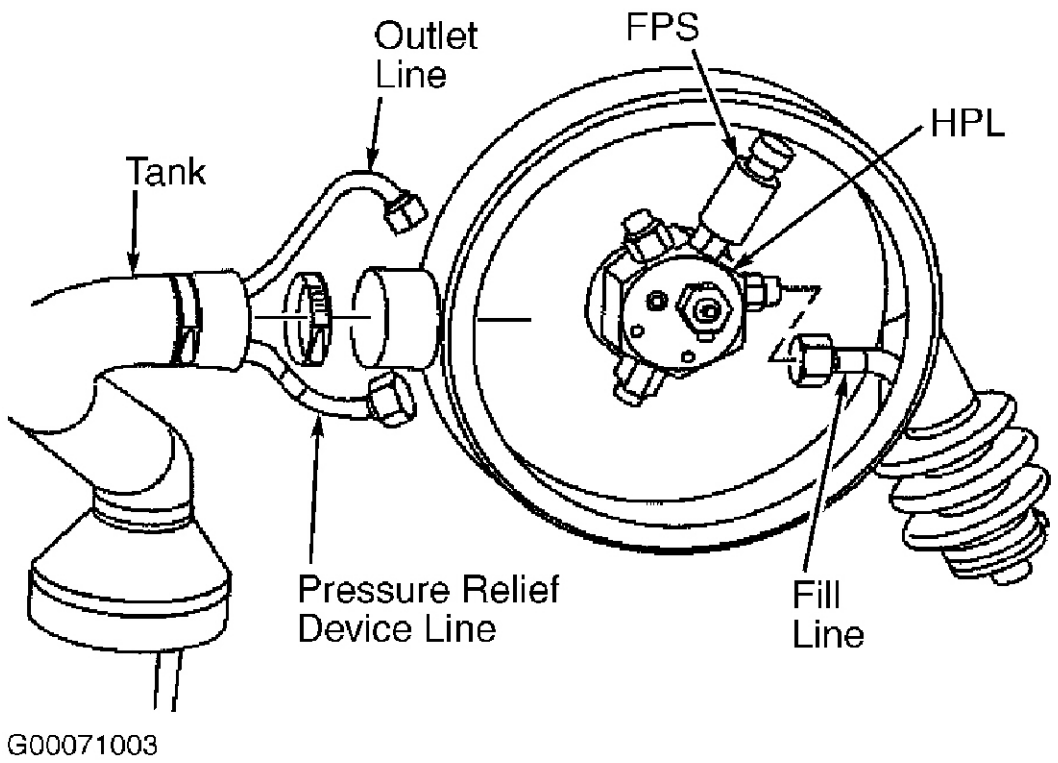


Fig. 53: Identifying High Pressure Lock-Off Solenoid & Components
Courtesy of GENERAL MOTORS CORP.

WARNING: **When venting a Compressed Natural Gas (CNG) fuel tank, take the following precautions to prevent fire and personal injury:**

- **Use proper grounding procedure to an earth ground to prevent a build-up of static electricity, which can lead to an electrical discharge.**
- **Use CNG Tank Vent Kit (J 42435) with a vent stack.**
- **Vent CNG fuel tank in a well ventilated work area.**
- **Keep sparks, flames, and smoking material away from vent area.**
- **Wear appropriate hearing protection during venting procedure. A sudden pressure loss from an uncontrolled gas leak can cause hearing damage.**

NOTE: **The manual valve opening tool can damage main seat of High Pressure Lock-off (HPL) solenoid if used improperly. Use this tool only when HPL is not in operation.**

5. Remove Fuel Pressure Sensor (FPS) from HPL and discard "O" ring. Install fitting and cap in FPS port. Install cap on fuel inlet fitting Leave relief port open. See **Fig. 54** . Connect vent hose to fuel outlet fitting and to vent stack. Connect ground strap (attached to vent hose) to HPL and vent stack ground.

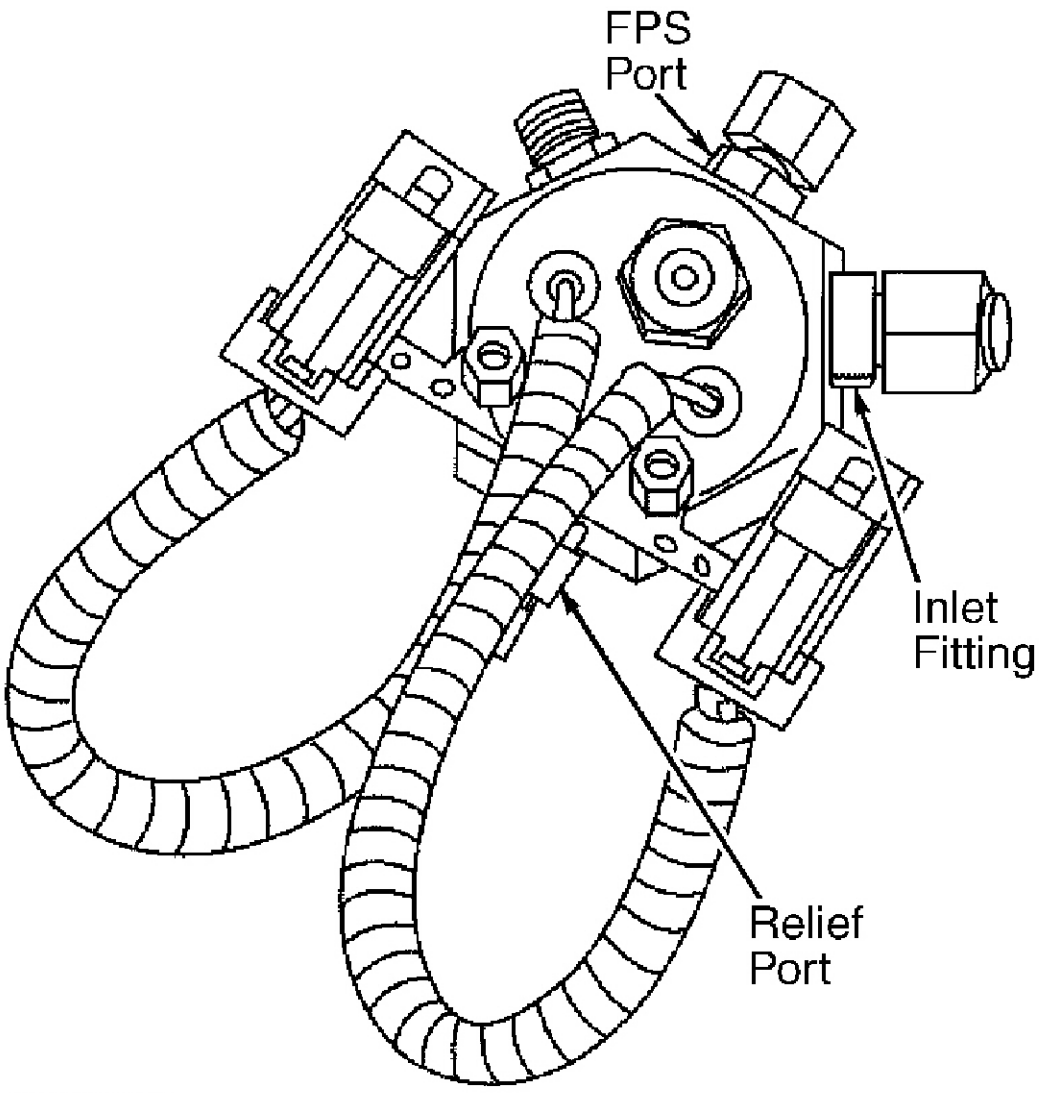


Fig. 54: Identifying HPL Fittings & Ports
Courtesy of GENERAL MOTORS CORP.

6. Before removing manual shut-off fitting from HPL, ensure manual lock-down screw is opened (fully seated counter-clockwise) and that no CNG is venting through vent line. Remove manual shut-off fitting from HPL. Before installing manual vent tool, count number of turns required to rotate tool from fully retracted to fully extended. When venting CNG tank ensure you rotate tool same number of turns. This will ensure HPL pilot valve is un-seated and tank is vented. Some pressure should always vent from CNG tank. Verify manual vent tool is in non-venting position with Allen screw fully seated counter-clockwise. Install manual vent tool into HPL port. See **Fig. 55** .

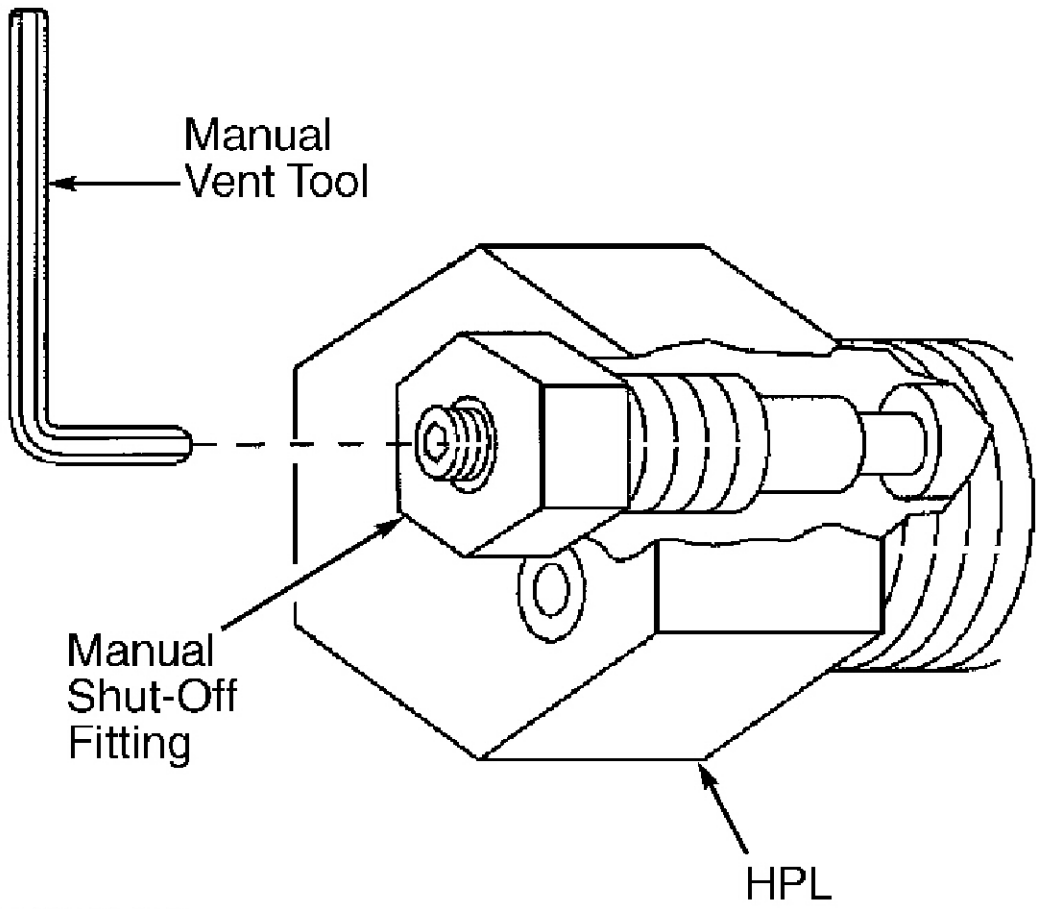


Fig. 55: Identifying Manual Vent Tool
Courtesy of GENERAL MOTORS CORP.

7. Slowly turn manual vent tool Allen screw clockwise until natural gas begins to vent. Allow CNG fuel tank to vent until pressure gauge reads 0 psi (0 kPa). If tank stops venting and pressure is indicated on gauge, check for frozen vent line fitting. If frozen, fitting will eventually thaw and fuel continue to vent. Do not leave tank unsupervised while venting.
8. After tank is completely vented, disconnect vent hose from HPL. Remove manual vent tool and all fittings. Remove fuel inlet fitting from HPL and discard "O" rings. Remove fuel outlet fitting from HPL and discard "O" rings. Remove HPL pressure relief device fitting from HPL and discard "O" rings. Using Crowfoot (J 43602), loosen HPL. See **Fig. 56** .

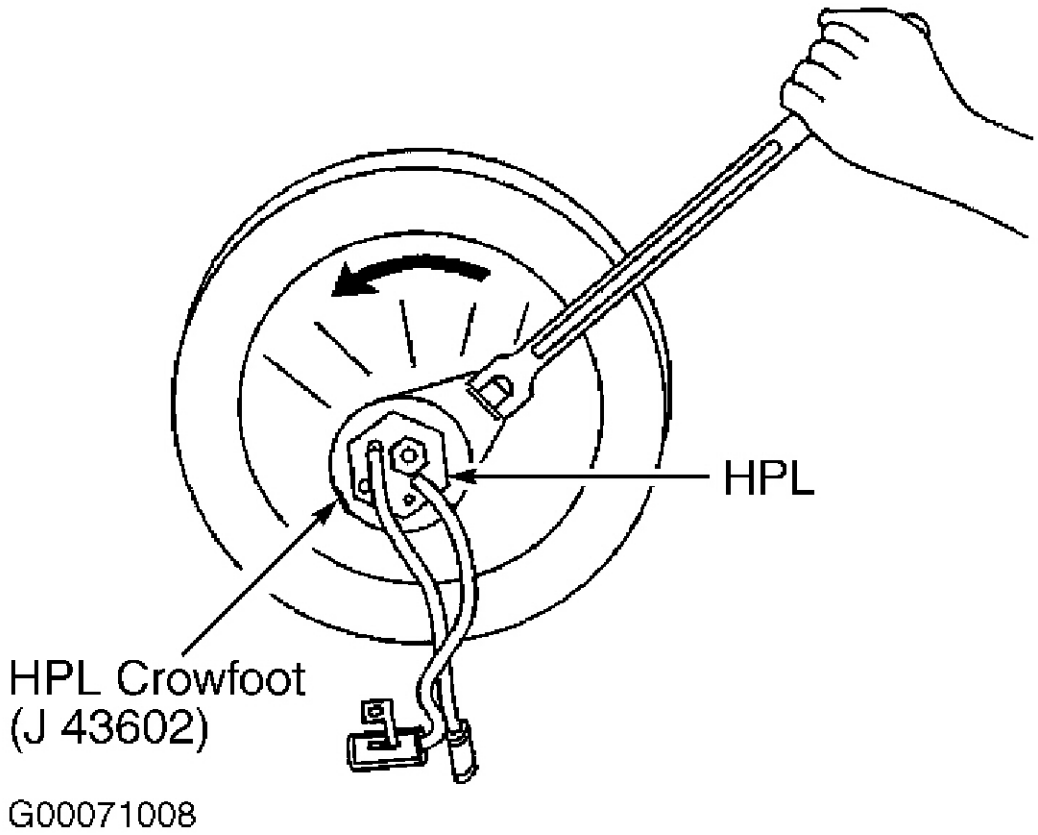


Fig. 56: Loosening HPL
Courtesy of GENERAL MOTORS CORP.

9. Remove spare tire bracket. Mark CNG tank in 2 places, approximately 180 degrees apart for reference. Remove tank strap nuts and bolts. Remove clevis and bridge pins. Remove tank straps. Position CNG Tank Restrainer (J 43133) into tank strap bolt holes. See **Fig. 57** .
10. Loop restrainer straps around tank and secure straps to the tool. Pull back restrainer to pull tank free from bracket. Pull back on straps to roll tank to upper level of restrainer. Use a lifting device and CNG Tank Lifting Apparatus (J 42309-B) to remove tank from vehicle. See **Fig. 57** . Unscrew and remove HPL and "O" ring from tank. Check inside of tank for debris or excess water accumulation. Clean fuel tank if necessary.

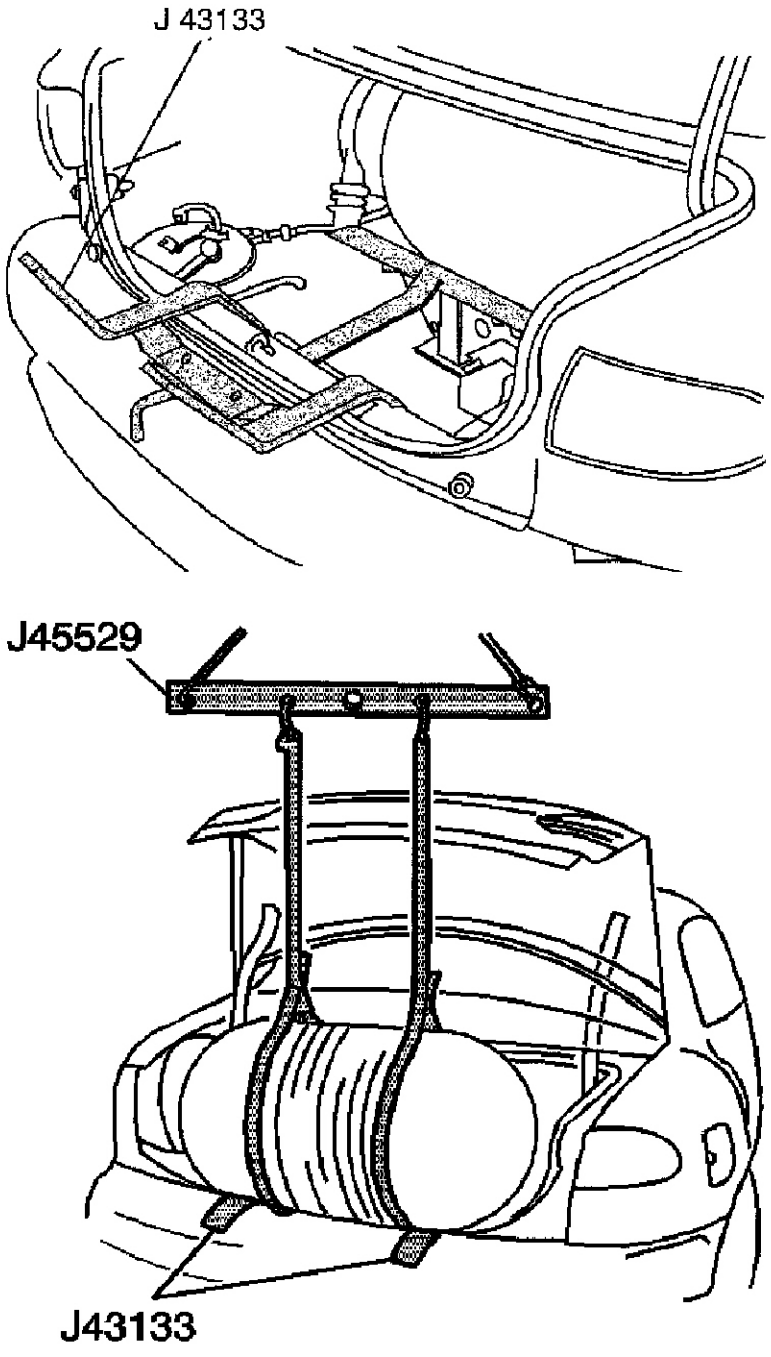


Fig. 57: Removing CNG Tank
Courtesy of GENERAL MOTORS CORP.

Installation

1. To install, reverse removal procedure. Use NEW "O" rings lubricated with petroleum jelly for all applications. Tighten tank strap nuts to 35 ft. lbs. (48 N.m). Tighten HPL to nominal torque of 225 ft. lbs. (305 N.m) at 0 degrees. Torque wrench and HPL crowfoot must be compensated for. To obtain proper dial reading, perform the following:
   - Multiply torque wrench length in inches by 305. Example for 18" torque wrench: 18 X 305 = 5490.
   - Add 3 to the length of torque wrench. Example for 18" torque wrench: 18 + 3 = 21.
   - Divide first value obtained, by second value obtained. The result will indicate amount of torque your wrench should tighten HPL to.

   Example for 18" torque wrench: 5490 divided by 21 equals 261.4. An 18" long torque wrench should tighten HPL to 193 ft. lbs. (261.4 N.m).

2. Verify alignment of HPL inlet port. Fitting should be at the 3 o'clock position. Adjust tank as necessary. Tank should be located 10.5" (26.7 cm) from left edge of left tank strap. Adjust tank as necessary. Tighten tank strap nuts to 35 ft. lbs. (48 N.m).
3. Tighten vent boot clamp to 18 INCH lbs. (2 N.m). Install fuel outlet fitting into HPL. Tighten fitting to 20 ft. lbs. (27 N.m). Install fuel inlet fitting into HPL. Tighten fitting to 35 ft. lbs. (48 N.m). Install FPS into HPL. Tighten fitting to 20 ft lbs. (27 N.m). Install pressure relief device fitting into HPL. Tighten fitting to 35 ft. lbs. (48 N.m).
4. Install pressure relief device line and HPL to HPR lines as an assembly. Tighten pressure relief device line fitting to 27 ft. lbs. (37 N.m). Tighten HPL to HPR fuel line fittings to 18 ft. lbs. (24 N.m). Install fill valve to union fill line. Tighten fittings to 27 ft. lbs. (37 N.m). Install union to HPL fill line. Tighten fittings to 27 ft. lbs. (37 N.m).

CAUTION: High Pressure Lock-off (HPR) solenoid seal is more likely to leak at a lower fuel pressure. Always perform fuel leak procedure exactly as specified. Failure to follow proper procedures may result in serious injury or damage to vehicle or the part.

5. Fill fuel tank in 3 stages as follow: 500 psi, 1500 psi and 3000 psi. Using CNG Leak Detector (J 41416), check for fuel leaks at HPL at EACH pressure. Check for fuel leaks at each serviced fitting. Position 4 hose clamps at vent boot, vent hose and fill valve boot. Install vent boot cover using NEW cover nuts. Tighten NEW vent boot cover nuts to 54 INCH lbs. (6 N.m). Install left side trunk carpet, cargo net knobs and cargo net. Install trunk trim. Attach information label supplied with replacement HPL in a visible location on head of tank. Install spare tire bracket and spare tire bracket bolts. Tighten spare tire bracket bolts to 20 ft. lbs. (27 N.m). Install tank cover.

Removal & Installation (Low Pressure)

1. Disconnect negative battery cable. Disconnect Low Pressure Lock-off (LPL) solenoid electrical connector. See **Fig. 14** . Remove harness clip from mounting bracket. Disconnect fuel lines and remove LPL outlet and inlet fittings. Remove LPL-to-bracket mounting bolts and remove LPL.
2. During installation, apply pipe thread sealant to threads of fuel inlet outlet fittings before installation. DO NOT use teflon tape. Use NEW "O" rings lubricated with petroleum jelly for all applications. Install LPL solenoid to bracket. Align LPL inlet fitting port to CNG fuel inlet line. Install LPL mounting bolts and tighten to 108 INCH lbs. (12 N.m). Install LPL inlet fitting and tighten finger-tight plus 1-3 turns. Install LPL outlet fitting. Align LPL outlet fitting to LPL to LPR line and tighten fuel outlet fitting finger-tight plus 1-3 turns. Connect fuel line inlet and outlet fittings and tighten to 18 ft. lbs. (24 N.m). Install harness clip to mounting bracket and connect LPL electrical connector. Connect negative battery cable. Start engine and check for CNG fuel leaks at each serviced fitting using CNG Leak Detector (J 41416).

LOW PRESSURE FUEL REGULATOR (2.2L - CAVALIER - CNG)

WARNING: Natural gas is highly flammable. To reduce risk of fire and personal injury, keep sparks, flames, and smoking materials away from vehicle while you perform Compressed Natural Gas (CNG) fuel system service. CNG system operates at pressures up to 3600 psi (24820 kPa). Relieve CNG fuel system pressure before servicing CNG fuel system components to reduce risk of fire and personal injury. Failure to follow these precautions may cause personal injury and/or damage to the vehicle or its components.

Removal & Installation

NOTE: Procedures apply only to Cavalier models equipped with bi-fuel engine components.

Relieve fuel pressure. See **FUEL SYSTEM PRESSURE RELEASE** . Disconnect negative battery cable. Disconnect fuel lines and plug openings. See **Fig. 14** . Remove low pressure fuel regulator. To install, reverse removal procedure. Tighten all fasteners to specification. See **TORQUE SPECIFICATIONS** . Check CNG system for leaks. Check and refill coolant as needed.

THROTTLE BODY

WARNING: **Ensure residual fuel pressure is relieved before working on throttle body.**

Removal

1. Relieve fuel pressure. See **FUEL SYSTEM PRESSURE RELEASE** . Disconnect negative battery cable. Remove air intake ducts. Disconnect and mark harness connections and vacuum hoses from throttle body. Disconnect control cables from throttle body.
2. Drain cooling system and remove coolant hoses to throttle body (if applicable). Remove throttle body retaining bolts. Remove throttle body and gasket.

Installation

NOTE: **Identification number is stamped on throttle body. Use identification number to order replacement components.**

1. To install, reverse removal procedure using NEW gasket. Tighten throttle body retaining bolts to specification. See **TORQUE SPECIFICATIONS** . Refill cooling system (if drained).
2. If installing NEW Idle Air Control (IAC) valve, ensure IAC pintle length setting is adjusted before installation (if applicable). See **IDLE AIR CONTROL VALVE** . Adjust idle speed and TP sensor (if removed, and if adjustable). See appropriate ON-VEHICLE ADJUSTMENTS article.

THROTTLE POSITION SENSOR

Removal & Installation (Except 1.3L & 1.8L)

1. Turn ignition off. Disconnect harness connector from Throttle Position (TP) sensor. Remove TP sensor retaining screws. Remove TP sensor from throttle body.
2. With throttle valve in closed position, install TP sensor on throttle body. Ensure TP sensor lever engages with drive lever on throttle shaft. Install retaining screws and harness connector. TP sensor is self-zeroing and is not adjustable.

Removal & Installation (1.3L & 1.8L)

1. Disconnect negative battery cable. Disconnect harness connector from TP sensor. Remove TP sensor retaining screws. Remove TP sensor from throttle body.
2. To install, mount TP sensor on throttle body with alignment slots slightly counterclockwise of body holes. Turn TP sensor clockwise to align holes and install retaining screws finger tight. To complete installation, reverse removal procedure. Adjust TP sensor. See appropriate ON-VEHICLE ADJUSTMENTS article. Tighten TP sensor retaining screws to specification. See **TORQUE SPECIFICATIONS** .

EMISSION SYSTEMS & SUB-SYSTEMS

CHARCOAL CANISTER

Removal & Installation (1.3L, 1.9L, 2.2L, 2.4L, 3.0L, 3.5L, 4.0L & 4.6L)

Raise and support vehicle. Disconnect hoses from charcoal canister filter. Remove charcoal canister filter attaching

bolts. Remove charcoal canister filter. To install, reverse removal procedure. Tighten bolts to specification. See **TORQUE SPECIFICATIONS** .

Removal & Installation (1.8L)

Raise and support vehicle. Remove muffler. Disconnect fill limiter vent valve hose from charcoal canister port by pinching both sides of hose connector. Disconnect hoses from charcoal canister filter. Disconnect electrical connector from charcoal canister filter. Remove charcoal canister filter attaching bolts. Remove charcoal canister filter. To install, reverse removal procedure. Tighten bolts to specification. See **TORQUE SPECIFICATIONS** .

Removal & Installation (3.1L, 3.4L & 3.8L)

Raise and support vehicle. Remove fuel tank. Disconnect hoses and vent pipes from charcoal canister filter. Release canister retaining strap. Remove charcoal canister filter. To install, reverse removal procedure. Tighten bolts to specification. See **TORQUE SPECIFICATIONS** .

Removal & Installation (5.7L)

Remove fuel tank. Disconnect hoses and vent pipes from charcoal canister filter. It may be necessary to bend bracket in order to remove the charcoal canister from bracket. To install, reverse removal procedure. Tighten bolts to specification. See **TORQUE SPECIFICATIONS** .

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Accelerator Pedal Position Sensor (3.0L)	16 (22)
Camshaft Position Sensor Bolt	18 (25)
Catalytic Converter Hanger Bolts/Screws (Camaro & Firebird)	30 (41)
Center Support Bearing-To-Rear Axle Torque Arm Bolts (Camaro & Firebird)	37 (50)
Charcoal Canister Filter Bolt (1.8L)	13 (18)
CNG Module Bracket Bolt	18 (25)
CNG Fuel Inlet Fitting	18 (25)
Crankshaft Position Sensor Bolt	
3.8L	22 (30)
5.7L	18 (25)
Driveshaft-To-Differential Yoke Bolts/Screws (Camaro & Firebird)	16 (22)
EGR Tube (4.6L)	
Bolt	18 (25)
Nut	44 (60)
EVAP Vent Valve-To-Bracket Bolt (Catera)	16 (22)
Exhaust Hanger Bolts (Metro)	11 (15)
Exhaust Muffler Support Bolts (Cavalier & Sunfire)	11 (15)
Fuel Inlet Fitting (CNG)	18 (25)
Fuel Inlet & Return Line Nut	
2.4L	22 (30)
3.1L & 3.4L	13 (18)
Fuel Line Fitting-To-Fuel Rail	
2.2L (Except Saturn) & 2.4L	20 (27)
3.0L	11 (15)
Fuel Outlet Fitting (CNG)	35 (48)

Fuel Rail Retaining Bolt	
1.3L	13-21 (18-28)
1.8L	13 (18)
1.9L	(1)
2.2L	
Cavalier & Sunfire	18 (25)
Saturn	(2)
2.4L	19 (26)
3.1L, 3.4L & 3.8L	(2)
Fuel Sending Unit Assembly Locknut (Catera)	37 (50)
Fuel Tank Ground Strap Bolt	
Catera	13 (18)
Saturn "L" Series (2.2L & 3.0L)	(3)
Fuel Tank Strap/Shield Bolts	
Camaro & Firebird	25 (34)
Catera	22 (30)
Cavalier & Sunfire	26 (35)
Corvette & Metro	18 (25)
Eldorado	34 (46)
Lumina	35 (47)
Malibu	30 (40)
Saturn	
"L" Series (2.2L & 3.0L)	15 (20)
"S" Series (1.9L)	35 (47)
Harmonic Balancer Bolt	
3.1L & 3.4L	76 (103)
3.8L	(4) 110 (149)
Idle Air Control Valve Bolt (1.8L)	14 (18.5)
Ignition Control Module Cover Bolt (2.4L)	16 (22)
Intake Manifold Brace Bolt (1.3L)	18-26 (25-35)
Intake Manifold Plenum Bolt (3.1L & 3.4L)	18 (25)
Knock Sensor	
1.8L	29 (39)
2.2L, 3.1L, 3.4L, & 3.8L	14 (19)
2.4L, 4.0L & 4.6L	18 (25)
3.0L & 5.7L	15 (20)
3.5L	11 (15)
Oxygen Sensor	
1.3L	30-37 (40-50)
1.8L	32 (44)
1.9L	33 (45)
2.2L	
Cavalier & Sunfire	30 (41)
Saturn	
O2S	22 (30)

HO2S	33 (45)
2.4L, 3.1L, 3.4L, 3.8L & 5.7L	30 (41)
3.0L	22 (30)
3.5L	27-34 (36-46)
4.0L & 4.6L	30 (40)
Parking Brake Cable Bracket Bolts (Metro)	11 (15)
Rear Axle Torque Arm-To-Differential Housing Bolts/Nuts (Camaro & Firebird)	97 (132)
Rear Axle Track Bar Brace-To-Body Bolts	
Camaro & Firebird	
Left Side	35 (47)
Right Side	61 (82)
Rear Axle Track Bar-To-Left Spring Seat Bolt/Nut	
Camaro & Firebird	
Bolt	87 (118)
Nut	55 (75)
Rear Axle Track Bar-To-Right Body Bracket Bolt/Nut (Camaro & Firebird)	61 (82)
Rear Exhaust Pipe-To-Catalytic Converter Outlet Flange Bolts/Screws (Camaro & Firebird)	18 (25)
Rear Shock Lower Mounting Nuts (Camaro & Firebird)	66 (90)
Rear Stabilizer Shaft End Link Nuts	
Camaro & Firebird	13 (17)
Metro	20 (28)
Rear Stabilizer Shaft End Link-To-Stabilizer Shaft Nuts (Metro)	38 (50)
Rear Stabilizer Shaft Insulator Clamp Nuts (Camaro & Firebird)	18 (24)
Rear Stabilizer Shaft Mounting Bracket Bolts (Metro)	19 (25)
Supercharger-To-Intake Manifold Bolt	17 (23)
Throttle Body Retaining Bolt	
1.3L	13-17 (18-23)
1.8L	15 (20)
1.9	
DOHC	(1)
SOHC	23 (31)
3.0L	16 (22)
3.1L & 3.4L	21 (28)
Wheel Lug Nuts	
Camaro & Firebird	89 (120)
Corvette	100 (140)
Metro	44 (60)
	INCH Lbs. (N.m)
Camshaft Position Sensor Bolt	
1.3L, 2.2L (Except Saturn), 2.4L, 3.1L, 3.4L, 3.8L 4.0L & 4.6L	89 (10)
1.8L	78 (8.8)
3.0L	71 (8.0)
3.5L	53-106 (6-12)
Charcoal Canister Filter Bolt	
1.3L, 1.9L, 2.2L, 2.4L & 3.0L	89 (10)

3.5L, 4.0L & 4.6L	53 (6.0)
Charcoal Canister Filter Bracket Bolt	67 (7.0)
Crankshaft Position Sensor Bolt/Nut	
1.3L, 2.2L, 2.4L & 4.6L	89 (10)
1.8L	78 (8.8)
1.9L	80 (9.0)
3.0L	71 (8.0)
3.5L	80 (9.0)
4.0L	89 (10)
Crankshaft (7X) Position Sensor Bolt (3.1L & 3.4L)	97 (11)
Crankshaft (24X) Position Sensor Bolt (3.1L & 3.4L)	89 (10)
CNG Module Flange Bolt	80 (9.0)
Exhaust Heat Shield	
Camaro & Firebird	18 (2.0)
Catera	35 (4.0)
Cavalier	
Bolts	18 (2.0)
Nuts	9 (1.0)
Saturn "L" Series (2.2L & 3.0L)	71 (8.0)
Fuel Filter/Pressure Regulator Bracket Nut (Corvette)	40 (4.5)
Fuel Pressure Regulator Screw	
1.3L	71-106 (8-12)
1.9L	71 (8.0)
2.2L	
Cavalier & Sunfire	53 (6.0)
Saturn	44 (5.0)
2.4L	84 (9.5)
3.1L & 3.4L	75 (8.5)
Fuel Sending Unit Access Panel Bolts	
Bonneville, Deville, LeSabre, Park Avenue & Seville	18 (2.0)
Century, Grand Prix, Impala, Intrigue, Monte Carlo & Regal	89 (10)
Prizm	(5)
Fuel Sending Unit Assembly Hold-Down Bolt	
1.3L	89 (10)
1.8L	35 (4)
Fuel Tank Fill Pipe Attaching Bolt	
Camaro & Firebird	89 (10)
Park Avenue	80 (9.0)
Saturn "L" Series (2.2L & 3.0L)	115 (13)
Fuel Tank Pressure Sensor	
1.3L	11-18 (1.2-2.0)
2.4L	84 (9.5)
3.0L	18 (2.0)
3.4L	76 (8.5)
Idle Air Control Valve Screw	
1.3L	29 (3.3)

1.9L, 2.2L, 2.4L, 3.1L, 3.4L, 3.5L, 3.8L, 4.6L & 5.7L	27 (3.0)
Ignition Coil Bolt	
1.3L	89 (10)
1.8L	80 (9.0)
Ignition Coil Housing-To-Cover Screw (2.4L)	35 (4.0)
Ignition Coil-To-Module Screw	
3.1L & 3.4L	40 (4.5)
3.5L	10 (1.1)
3.8L	44 (5.0)
Ignition Control Module/Coil Pack Mounting Bolt	
1.9L	62 (7.0)
2.2L	
Cavalier & Sunfire	35 (4.0)
Saturn	89 (10)
2.4L	35 (4.0)
3.5L	53-106 (6-12)
4.0L	62 (7.0)
4.6L	80 (9.0)
Ignition Control Module/Coil Pack-To-Bracket Nut (3.8L)	71 (8.0)
Intake Manifold Cover Nut (4.6L)	27 (3.0)
Intake Manifold Plenum Bolt (3.0L)	71 (8.0)
Rear Frame Support Retaining Bolts (Catera)	71 (8.0)
Throttle Body Retaining Bolt	
2.2L	
Cavalier & Sunfire	58 (6.5)
Saturn	89 (10)
2.4L	58 (6.5)
3.5L	89 (10)
3.8L	89 (10)
4.0L, 4.6L & 5.7L	106 (12)
Throttle Position Sensor Screw	
1.3L, 1.9L, 3.1L, 3.4L, 3.8L & 5.7L	18 (2.0)
1.8L	31 (3.5)
2.2L & 2.4L	18 (2.0)
3.5L & 4.6L	20 (2.3)
4.0L	27 (3.0)
Wire Harness Cover Plate (1.8L)	78 (8.8)

(1) Tighten to 106 INCH lbs. (12 N.m).

(2) Tighten to 89 INCH lbs. (10 N.m).

(3) Tighten to 40 INCH lbs. (4.5 N.m).

(4) Plus an additional 76 degrees.

(5) Information is not available from manufacturer.

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