

REMOVAL, OVERHAUL & INSTALLATION

2001 Chevrolet Camaro

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, 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.

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 (GASOLINE). Disconnect negative battery cable. Remove accessory drive belt from supercharger pulley.

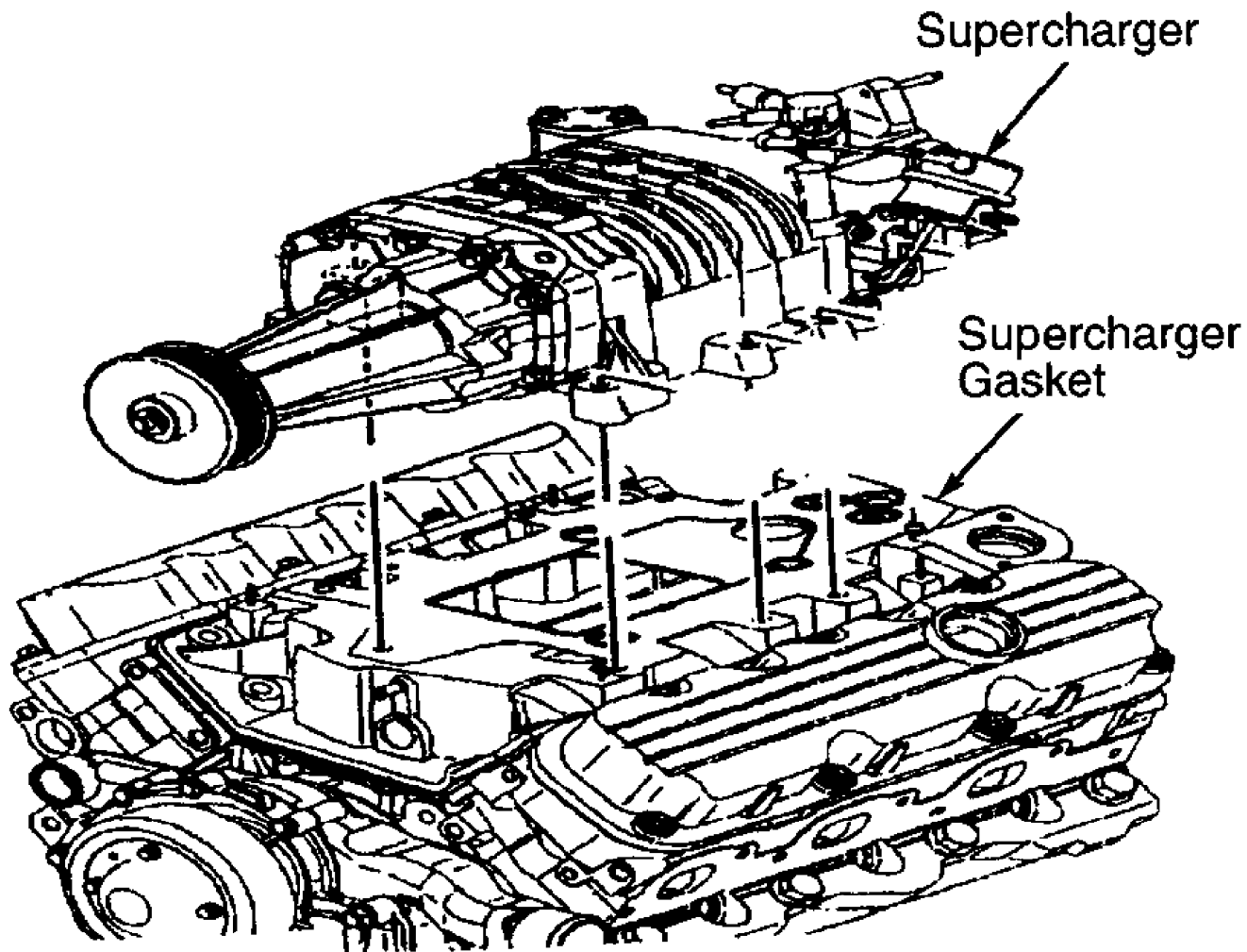
2) Remove fuel injector sight shield. Disconnect fuel lines

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.



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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

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

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 Figs. 3-6. For Corvette sensor locations, see Figs. 7-9.

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.

Installation

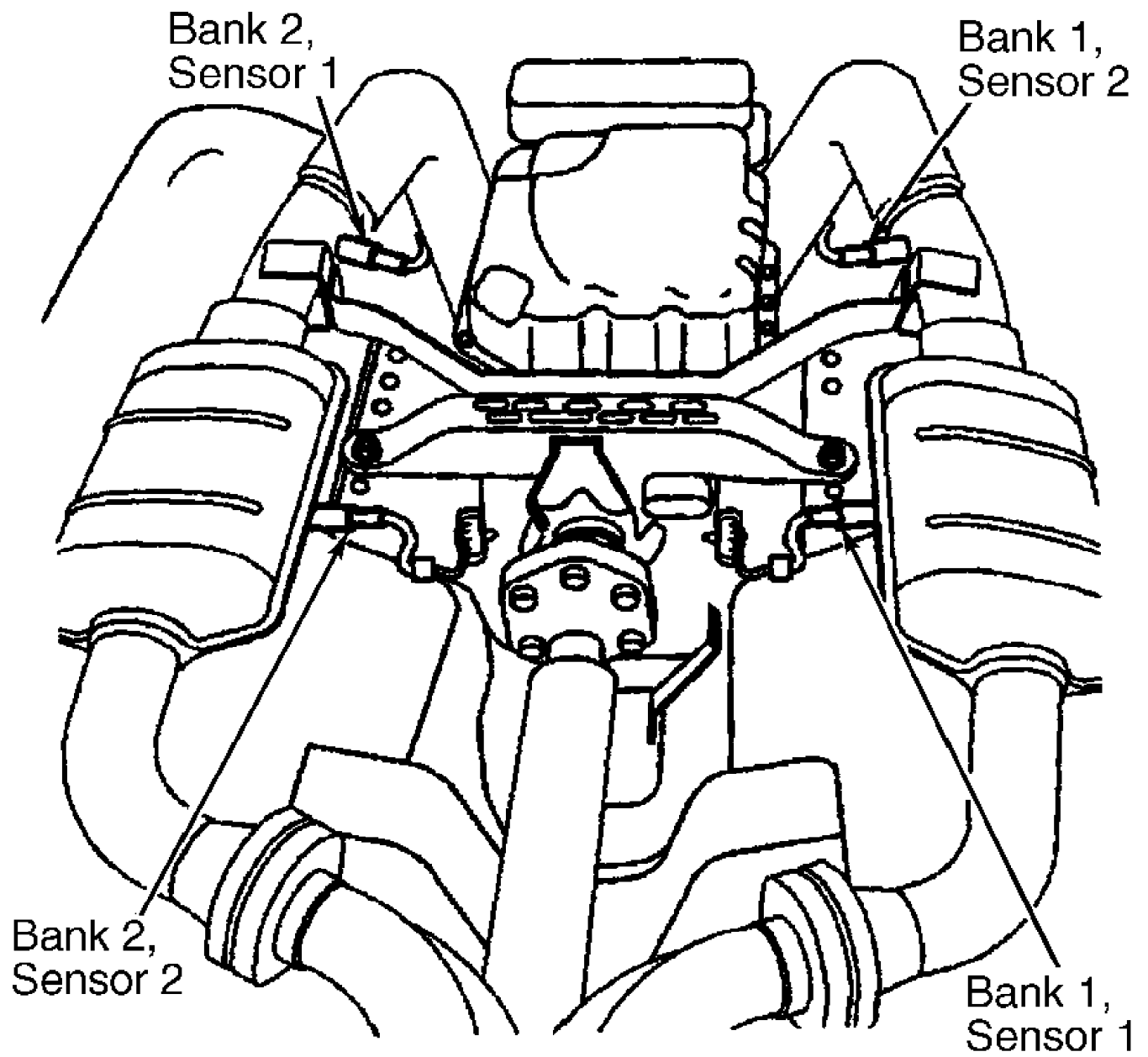
1) Whenever an oxygen sensor is removed, coat threads with anti-seize compound before installation. New oxygen sensors already have this compound applied to threads.

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

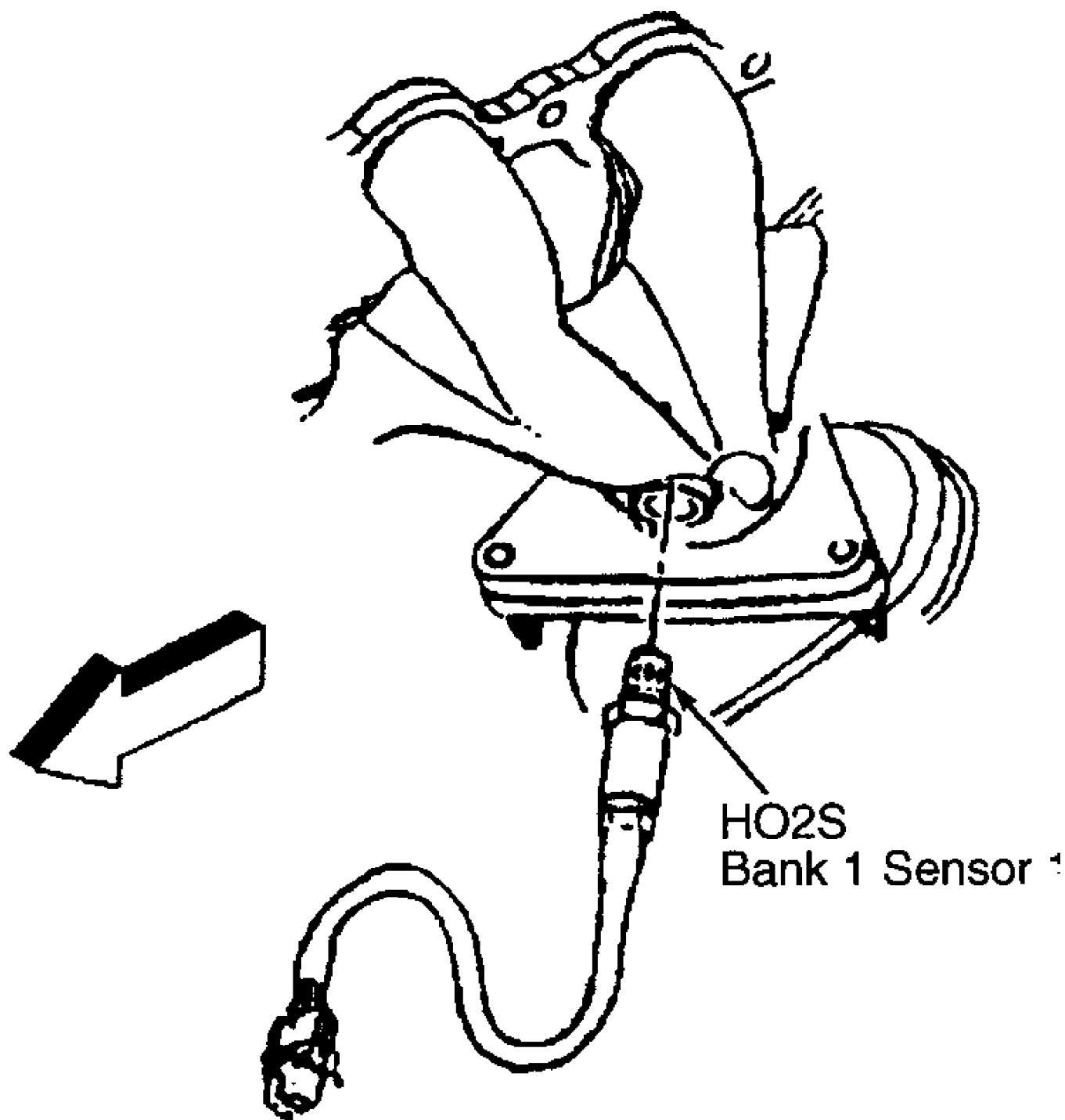
Application	Location
1.3L	
Sensor 1	On Exhaust Manifold
Sensor 2	On Exhaust Pipe
1.8L	
Sensor 1	On Exhaust Pipe
Sensor 2	Under Passenger Floor
1.9L	
Sensor 1	On Exhaust Manifold
Sensor 2	On Exhaust Pipe
2.2L & 2.4L	
Sensor 1	On Exhaust Manifold
Sensor 2	On Exhaust Pipe
2.2L (Saturn)	
Sensor 1	On Exhaust 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 Figs. 2 - 9.



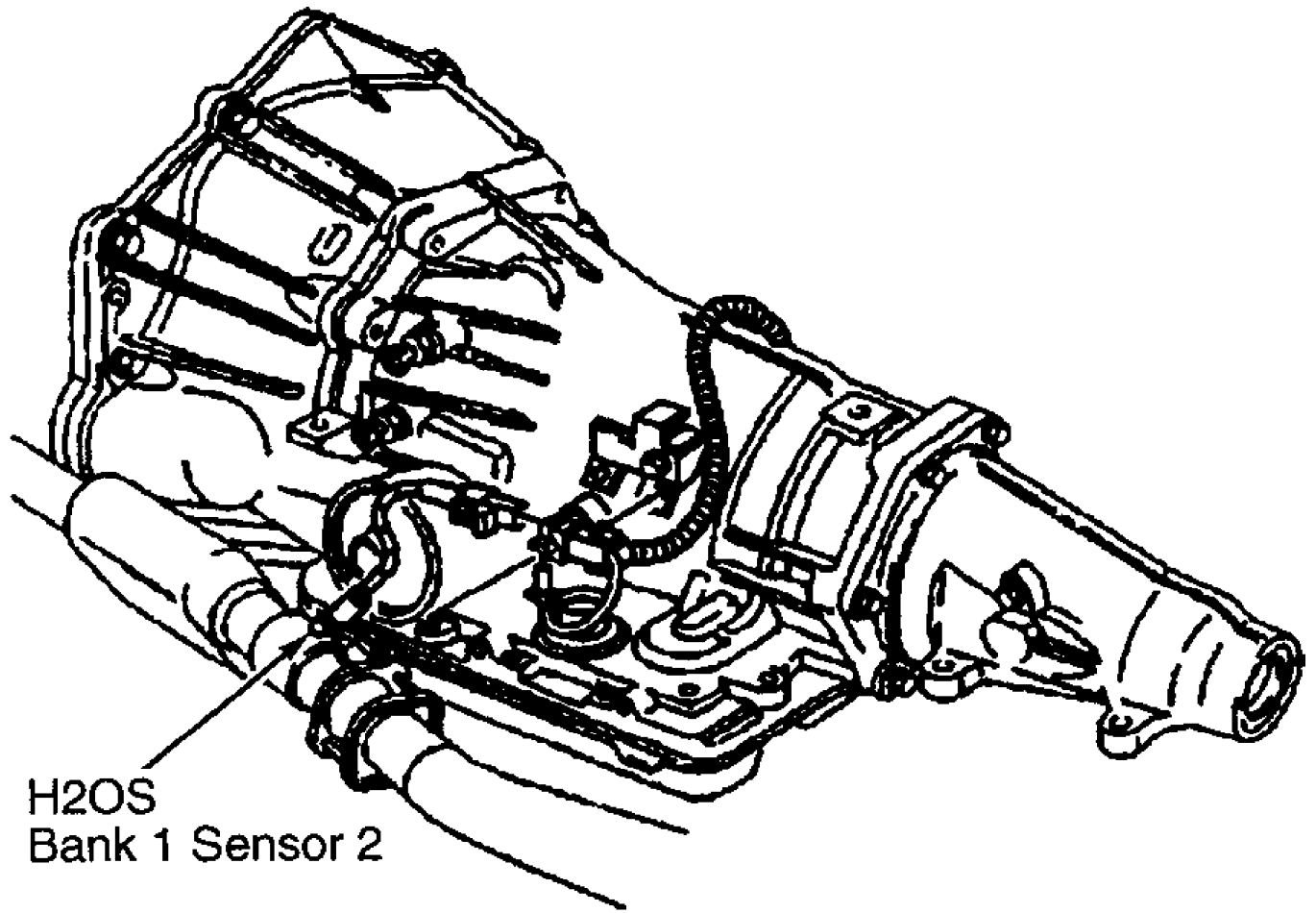
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Fig. 2: Locating Heated Oxygen Sensors (Catera)
Courtesy of General Motors Corp.



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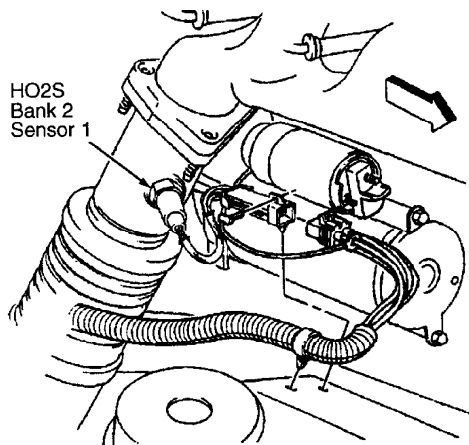
Fig. 3: Locating Bank 1 Sensor 1 Heated Oxygen Sensor (5.7L - Camaro & Firebird)
Courtesy of General Motors Corp.



H2OS
Bank 1 Sensor 2

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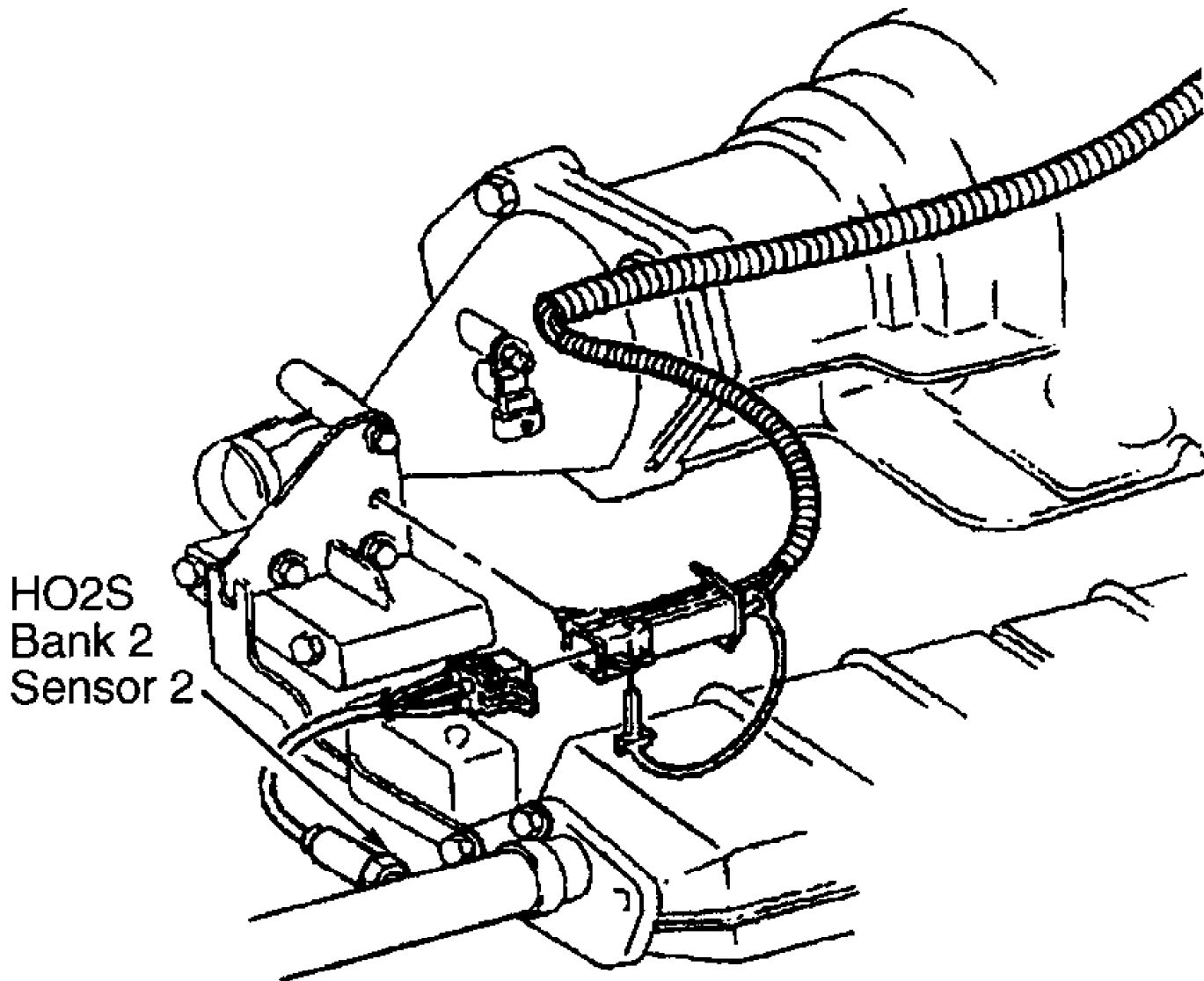
Fig. 4: Locating Bank 1 Sensor 2 Heated Oxygen Sensor (5.7L - Camaro & Firebird)
Courtesy of General Motors Corp.



HO2S
Bank 2
Sensor 1

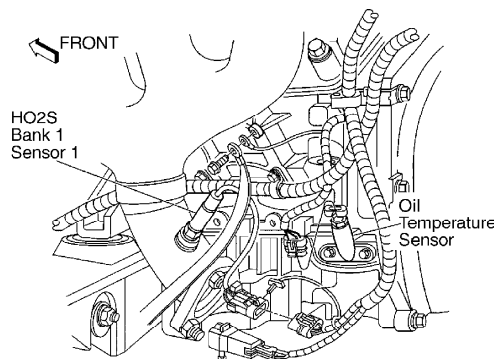
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Fig. 5: Locating Bank 2 Sensor 1 Heated Oxygen Sensor (5.7L - Camaro & Firebird)
Courtesy of General Motors Corp.



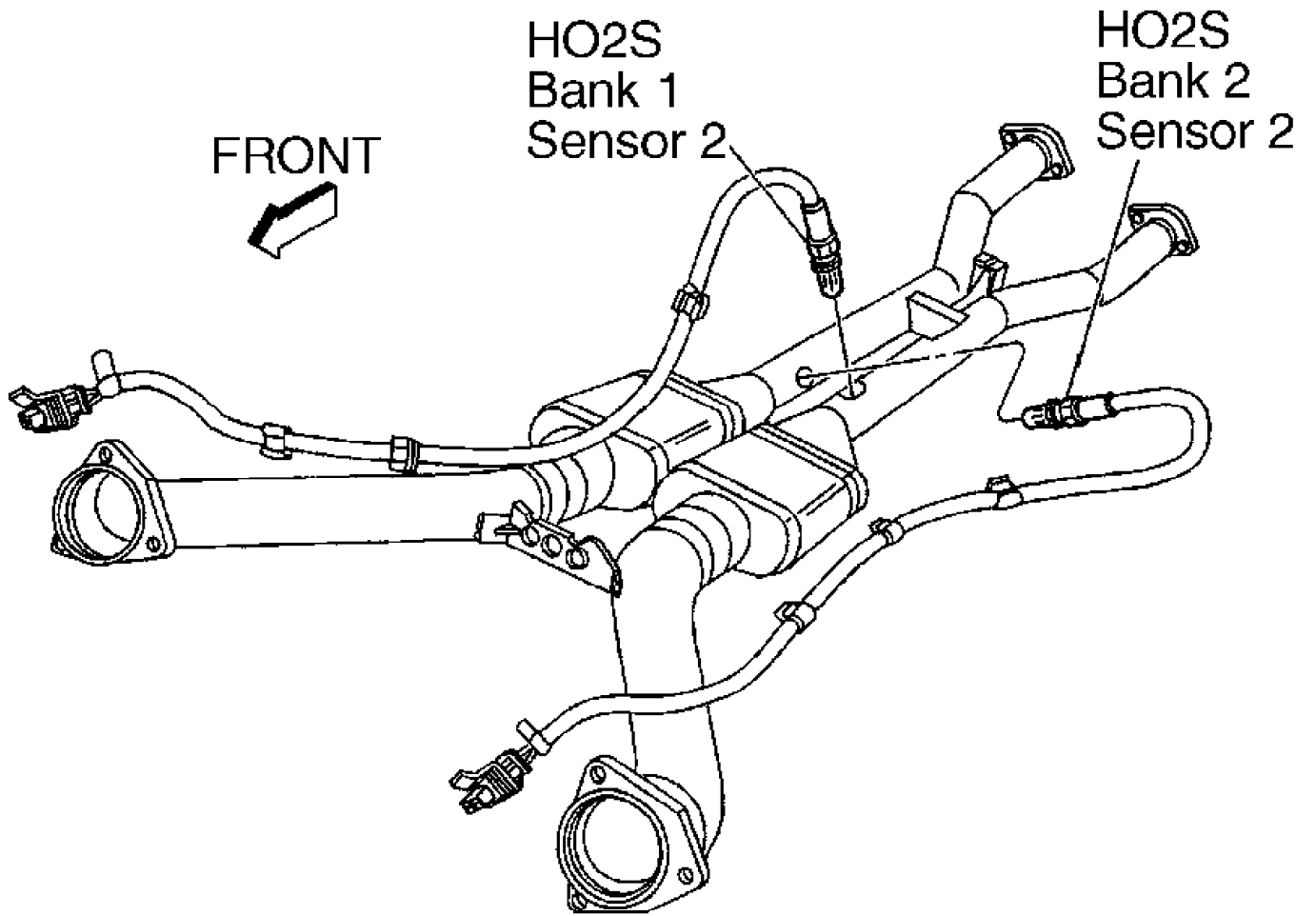
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Fig. 6: Locating Bank 2 Sensor 2 Heated Oxygen Sensor (5.7L - Camaro & Firebird)
 Courtesy of General Motors Corp.



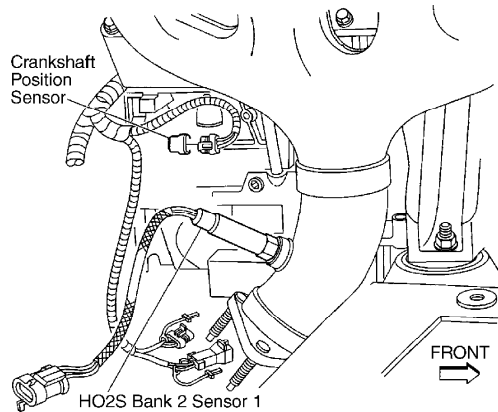
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Fig. 7: Locating Bank 1 Sensor 1 Heated Oxygen Sensor (Corvette)
 Courtesy of General Motors Corp.



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Fig. 8: Locating Bank 1 Sensor 2 & Bank 2 Sensor 2 Heated Oxygen Sensors (Corvette)
 Courtesy of General Motors Corp.



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Fig. 9: Locating Bank 2 Sensor 1 Heated Oxygen Sensor (Corvette)
 Courtesy of General Motors Corp.

COOLING SYSTEM

COOLING SYSTEM BLEEDING

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

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

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 SYSTEM

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.

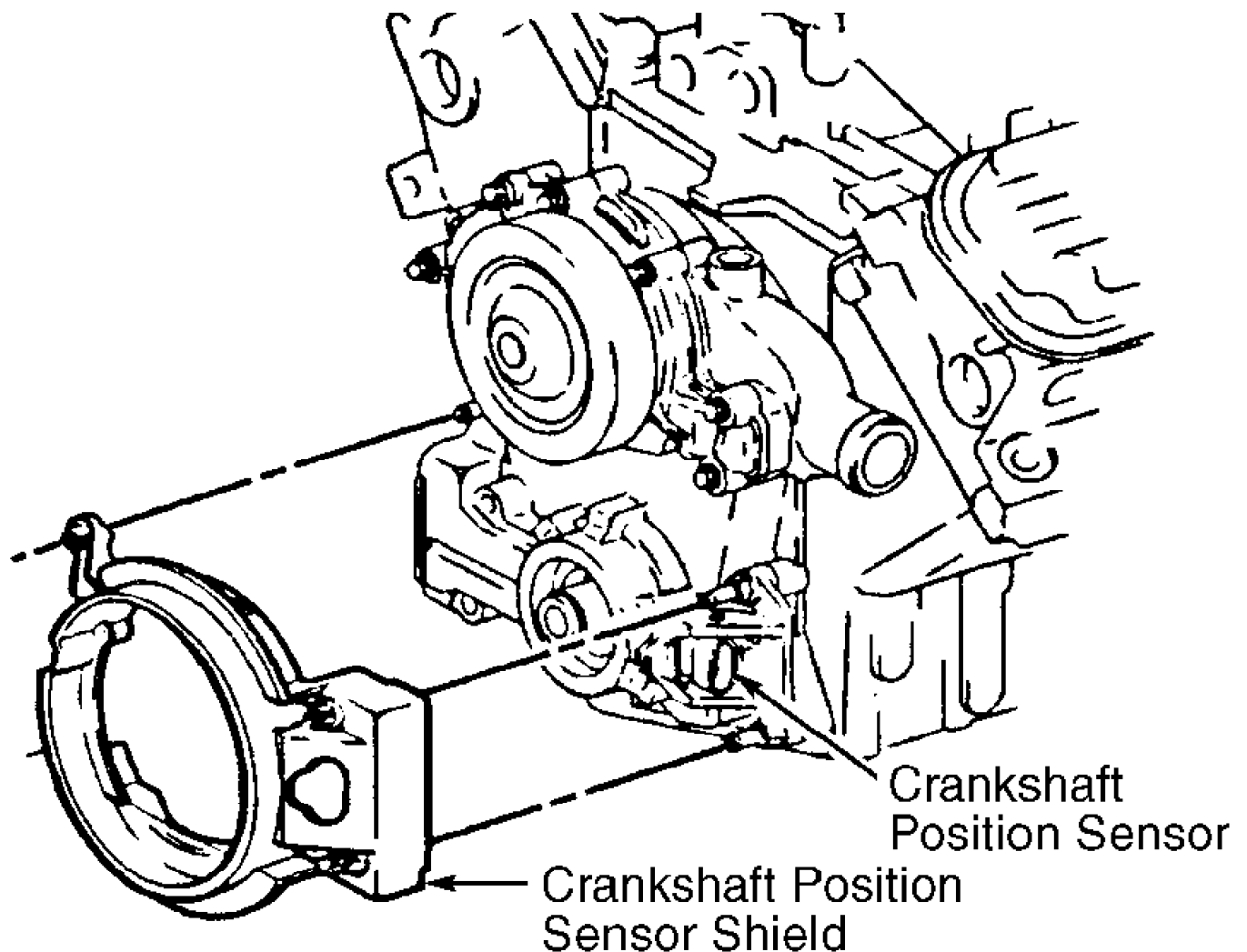
CRANKSHAFT POSITION SENSOR (C3I)

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. 10. 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.



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Fig. 10: Removing Crankshaft Position Sensor Shield (C3I)
 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 (C3I)

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 (C3I)

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. 11. 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.

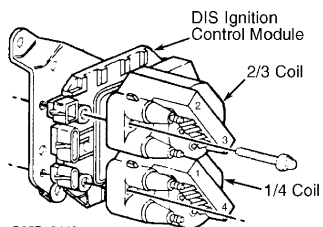
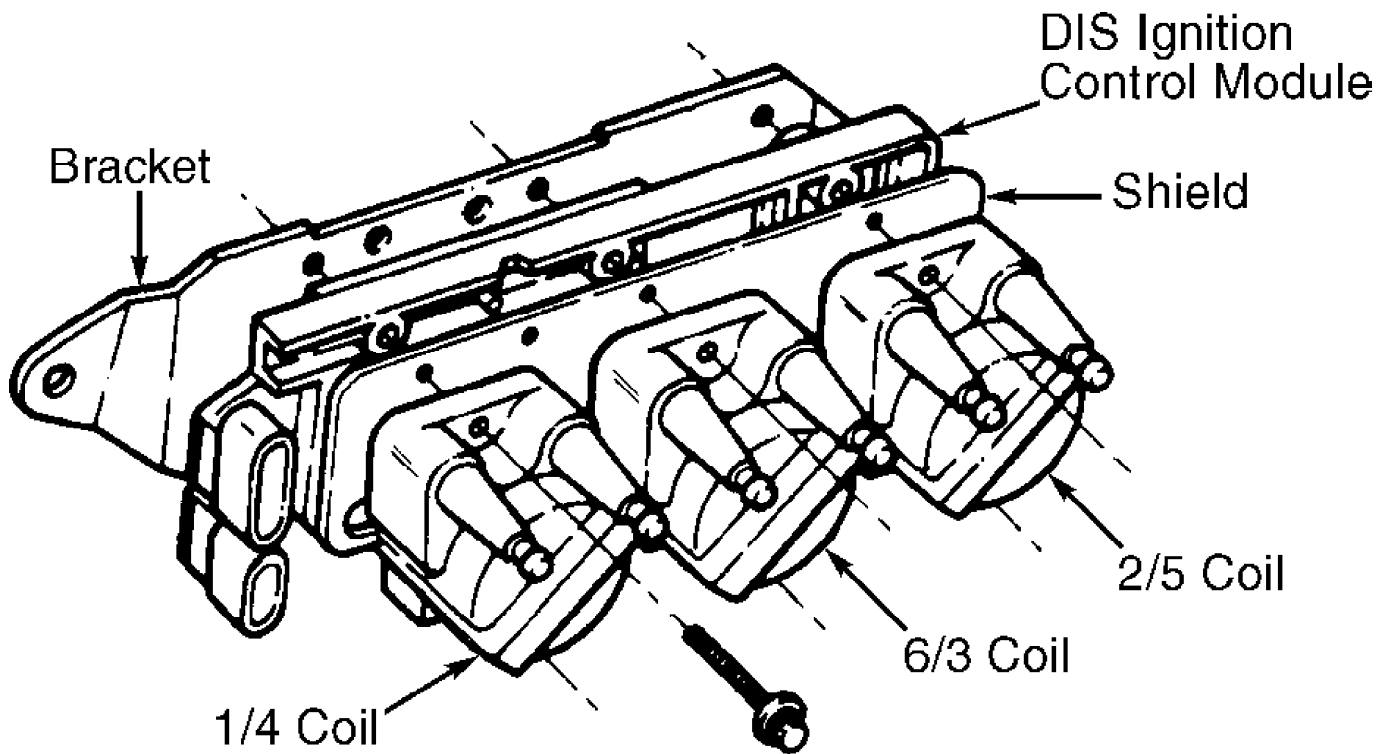


Fig. 11: Locating Distributorless Ignition Control Module Components (2.2L Shown; 1.9L Is Similar)
Courtesy of General Motors Corp.



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Fig. 12: Locating Distributorless Ignition Control Module Components (3.1L & 3.4L)

Courtesy of General Motors Corp.

IGNITION CONTROL MODULE (IDI)

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.

Removal (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.

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.

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.

Installation

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

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

Removal & Installation (3.5L)

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.

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

Removal & Installation (4.0L & 4.6L)

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

FUEL SYSTEM PRESSURE RELEASE (CNG)

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

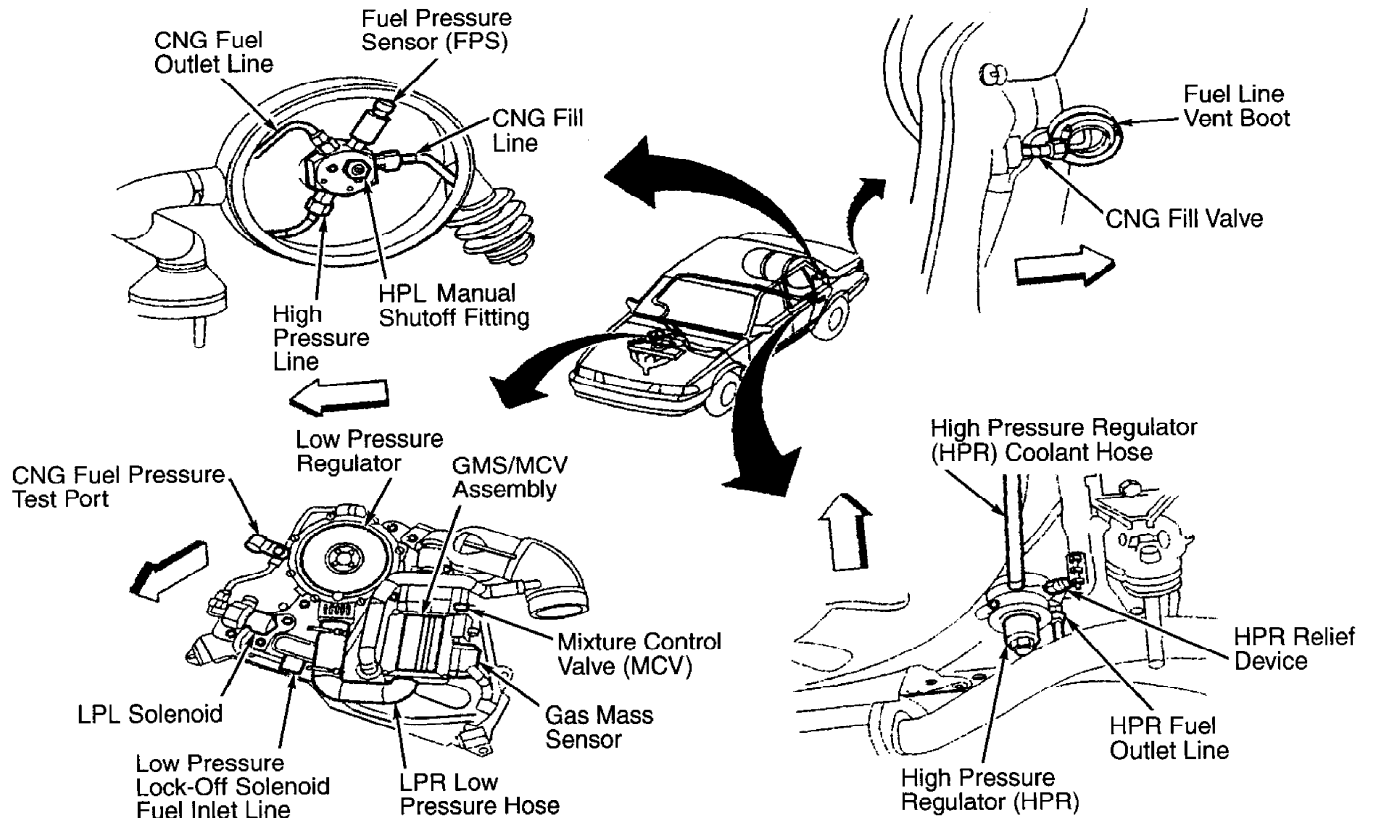
NOTE: Replace all "O" rings that are disconnected or loosened.

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. 13. 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.



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Fig. 13: Identifying CNG Fuel System Components
Courtesy of General Motors Corp.

FUEL SYSTEM PRESSURE RELEASE (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

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

Removal (2.2L - Cavalier)

1) Relieve fuel system pressure. See FUEL SYSTEM PRESSURE RELEASE (CNG). 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. 13.

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.

FUEL PUMP

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

Removal & Installation (Except 1.3L, 1.8L, 3.0L & 4.6L)

1) Fuel pump is located in fuel tank and is integral with fuel sending unit assembly. Fuel pump must be replaced with fuel sending unit as an assembly. Relieve fuel system pressure. See CRANKSHAFT (24X) POSITION SENSOR (DIS). Disconnect negative battery cable.

2) Raise and support vehicle. Disconnect fuel lines and harness connections at fuel tank. Remove fuel tank. Remove fuel sending unit assembly retaining ring or cam lock ring. Lift fuel sending unit assembly from fuel tank. To install, reverse removal procedure using NEW "O" ring and gasket.

Removal & Installation (1.3L)

1) Fuel pump is located in fuel tank and is integral with fuel sending unit assembly. Remove fuel tank from vehicle. Disconnect harness connector from fuel sending unit assembly. Remove clamp and disconnect fuel vapor hose from fuel vapor pipe.

2) Disconnect quick-connect fuel feed and fuel return lines. Remove 6 fuel sending unit hold-down bolts and remove fuel sending unit assembly from fuel tank. Disconnect fuel level sensor harness connector. Depress fuel level sensor retaining tab and slide sensor down to remove from fuel sending unit assembly.

3) Using a screwdriver, release 3 snap catches and remove lower assembly end cap. Remove fuel pump cushion. Disconnect harness connectors from fuel pump. Remove fuel pump from fuel sending unit assembly.

4) 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.

Removal & Installation (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 (GASOLINE). 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.

3) 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.

4) 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.

5) 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.

Removal & Installation (3.0L)

1) Fuel pump is located in fuel tank and is integral with fuel sending unit assembly. Relieve fuel system pressure. See CRANKSHAFT (24X) POSITION SENSOR (DIS). Disconnect negative battery cable.

2) Raise and support vehicle. Disconnect fuel lines and harness connections at fuel tank. Remove fuel tank. Remove fuel sending unit assembly cam lock ring. Lift fuel sending unit assembly from fuel tank.

3) Disconnect fuel pump harness connector and hose clamp. Push in release tabs on fuel pump and lift off sending unit assembly. To install, reverse removal procedure using NEW "O" ring and gasket.

Removal & Installation (4.6L)

1) Disconnect negative battery cable. Relieve fuel system pressure. See CRANKSHAFT (24X) POSITION SENSOR (DIS). Raise and support vehicle. Remove the fuel sender assembly.

2) Remove fuel tank pressure sensor. Disconnect fuel pump electrical connector. Remove fuel level sensor electrical connector retaining clip. Remove fuel pump.

3) Push in release tabs on fuel pump and lift off sending unit assembly. To install, reverse removal procedure using NEW "O" ring and gasket.

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 (GASOLINE). 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 (GASOLINE). 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 (GASOLINE). 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 (GASOLINE). 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 (GASOLINE). 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 (GASOLINE). 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 (GASOLINE). 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 (GASOLINE). 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 (GASOLINE). 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 TANK PRESSURE SENSOR

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

Relieve fuel system pressure. See

CRANKSHAFT (24X) POSITION SENSOR (DIS). 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

CRANKSHAFT (24X) POSITION SENSOR (DIS). 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 (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.

HIGH PRESSURE FUEL REGULATOR (CNG)

NOTE: Procedures apply only to Cavalier models equipped with Bi-Fuel engine components.

Removal

1) Relieve fuel pressure. See

FUEL SYSTEM PRESSURE RELEASE (CNG). 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. 13.

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.

LOW PRESSURE FUEL REGULATOR (CNG)

NOTE: Procedures apply only to Cavalier models equipped with Bi-Fuel engine components.

Removal & Installation

Relieve fuel pressure. See FUEL SYSTEM PRESSURE RELEASE (CNG). Disconnect negative battery cable. Disconnect fuel lines and plug openings. See Fig. 13. 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.

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 (GASOLINE). 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 (GASOLINE). 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. 14. 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 (GASOLINE). 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 Figs. 15, 19, 20, 22 and 23. 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 CNG - Cavalier)

Relieve fuel pressure. See FUEL SYSTEM PRESSURE RELEASE (CNG). 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 (GASOLINE). Disconnect negative battery cable. Remove air cleaner outlet resonator. Remove fuel rail bracket. See Fig. 17. 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.

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

Removal (2.2L - Saturn)

1) Relieve fuel pressure. See FUEL SYSTEM PRESSURE RELEASE (GASOLINE). 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. 16.

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 (GASOLINE). 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. 18. 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 (GASOLINE). 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. 21. 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 (GASOLINE). 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 (GASOLINE). 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. 24. Remove injectors from fuel rail. Remove injector "O" rings and seals, and discard.

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.

Installation

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)

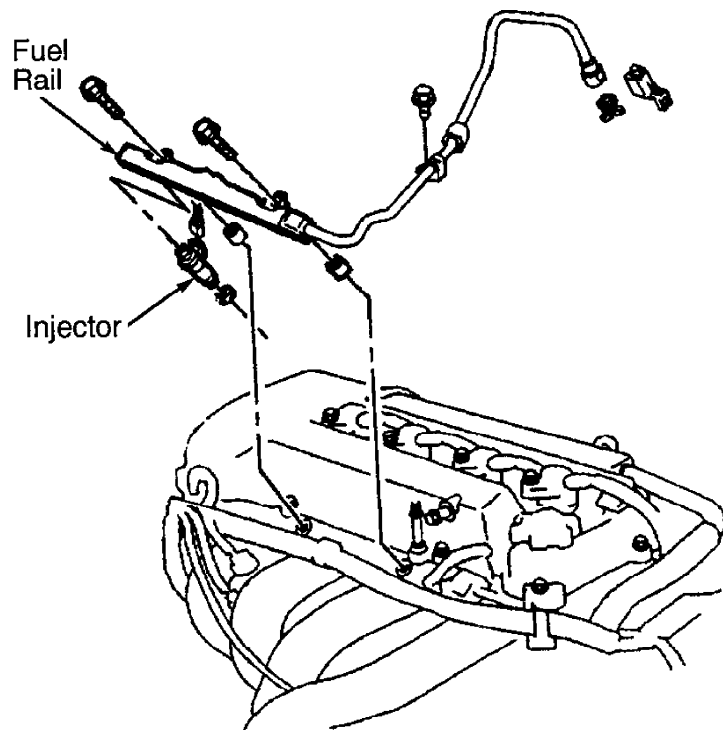
1) Relieve fuel pressure. See FUEL SYSTEM PRESSURE RELEASE (GASOLINE). Disconnect negative battery cable. Remove resonator and resonator bracket. Disconnect quick-connect fitting at fuel rail inlet and return lines.

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. 25. Remove injector-to-fuel rail retaining clip. Remove injector from fuel rail. Remove injector "O" rings and discard.

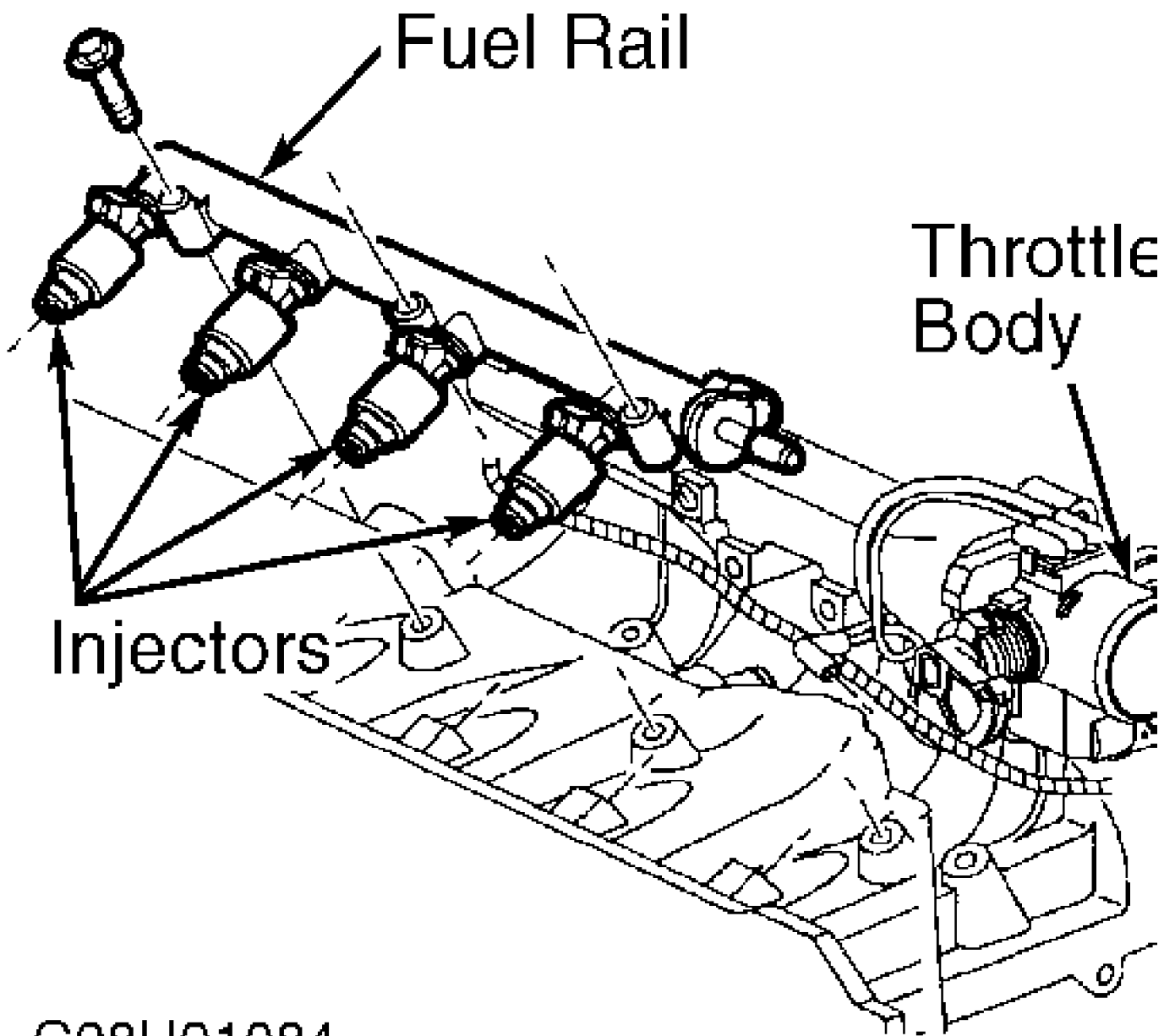
Installation

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.



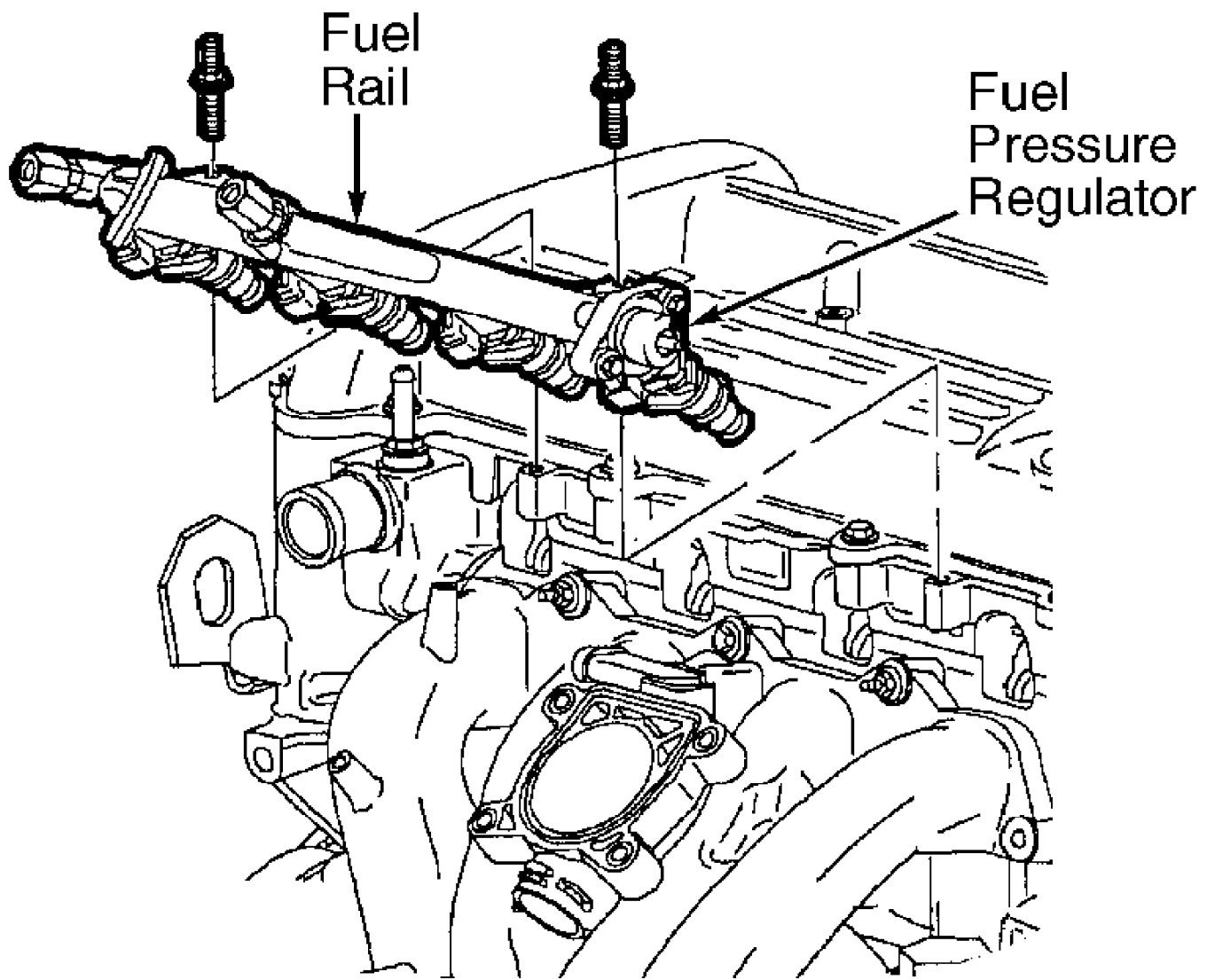
G00056050

Fig. 14: Locating Fuel Rail Assembly Components (1.8L)
Courtesy of General Motors Corp.



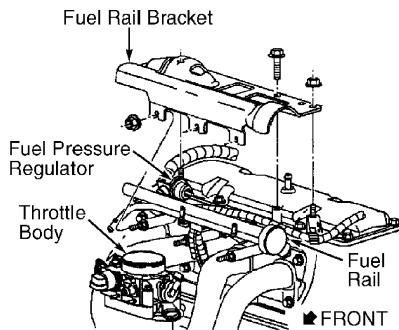
G98H01084

Fig. 15: Locating Fuel Rail Assembly Components (1.9L - VIN 7 Shown; VIN 8 Is Similar)
Courtesy of General Motors Corp.

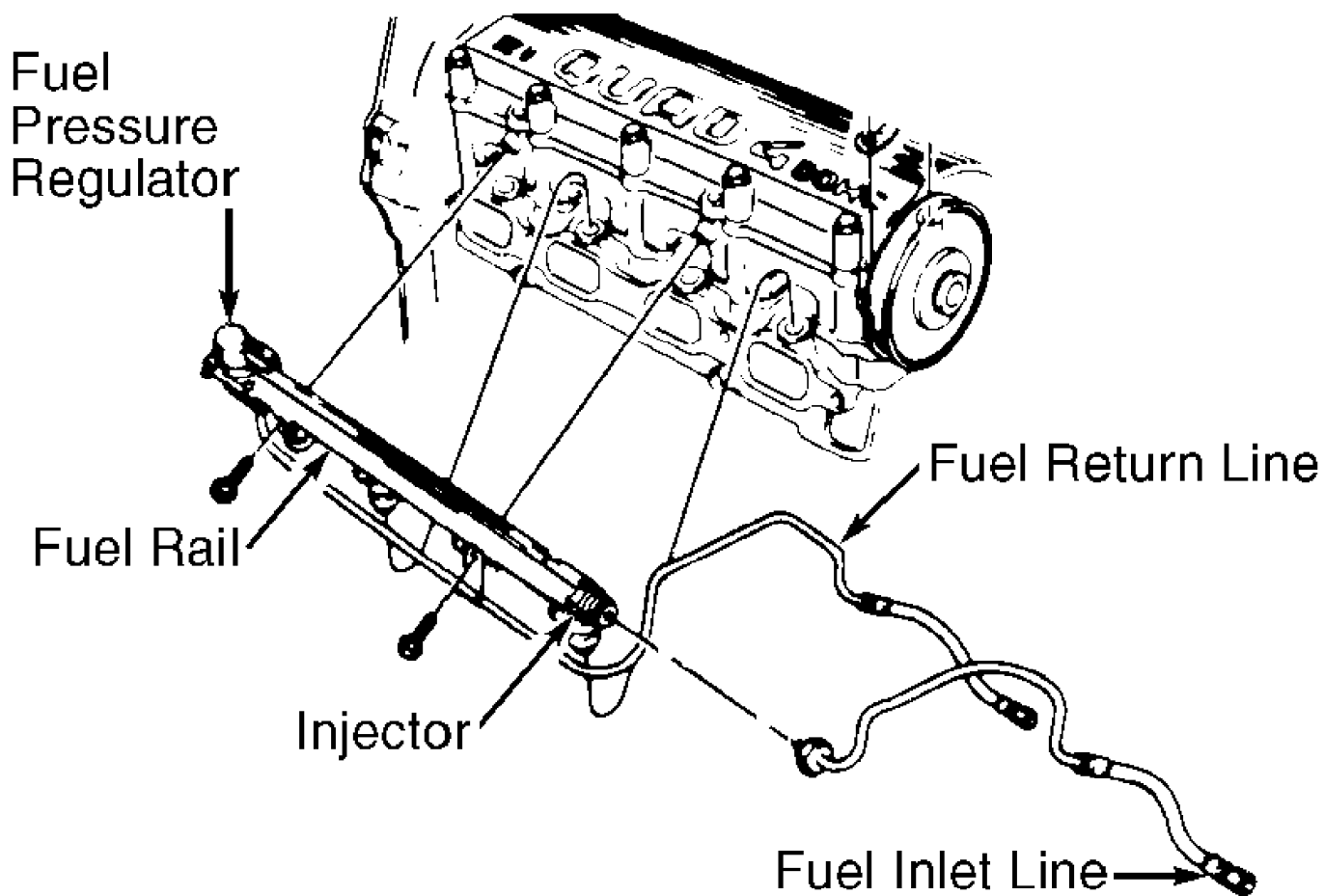


G00012669

Fig. 16: Locating Fuel Rail Assembly Components (2.2L - VIN F)
 Courtesy of General Motors Corp.

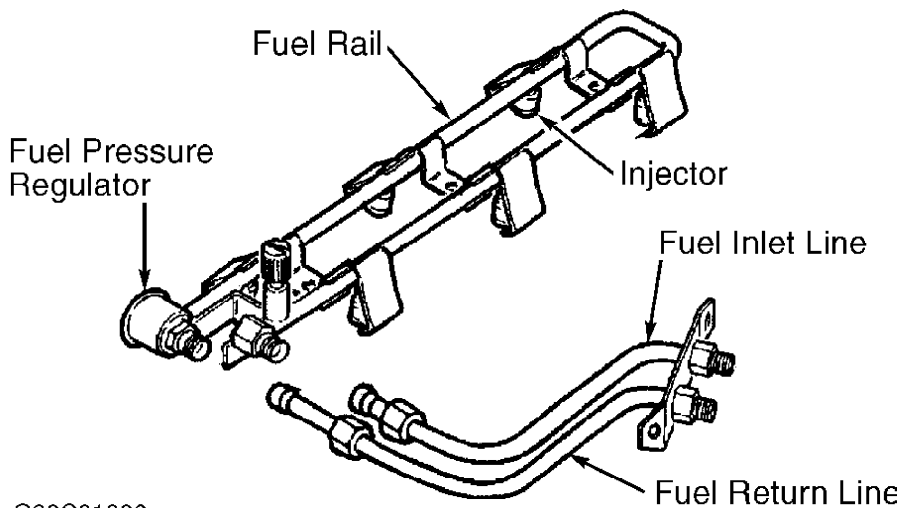


G98A01085
 Fig. 17: Locating Fuel Rail Assembly Components (2.2L - VIN 4)
 Courtesy of General Motors Corp.



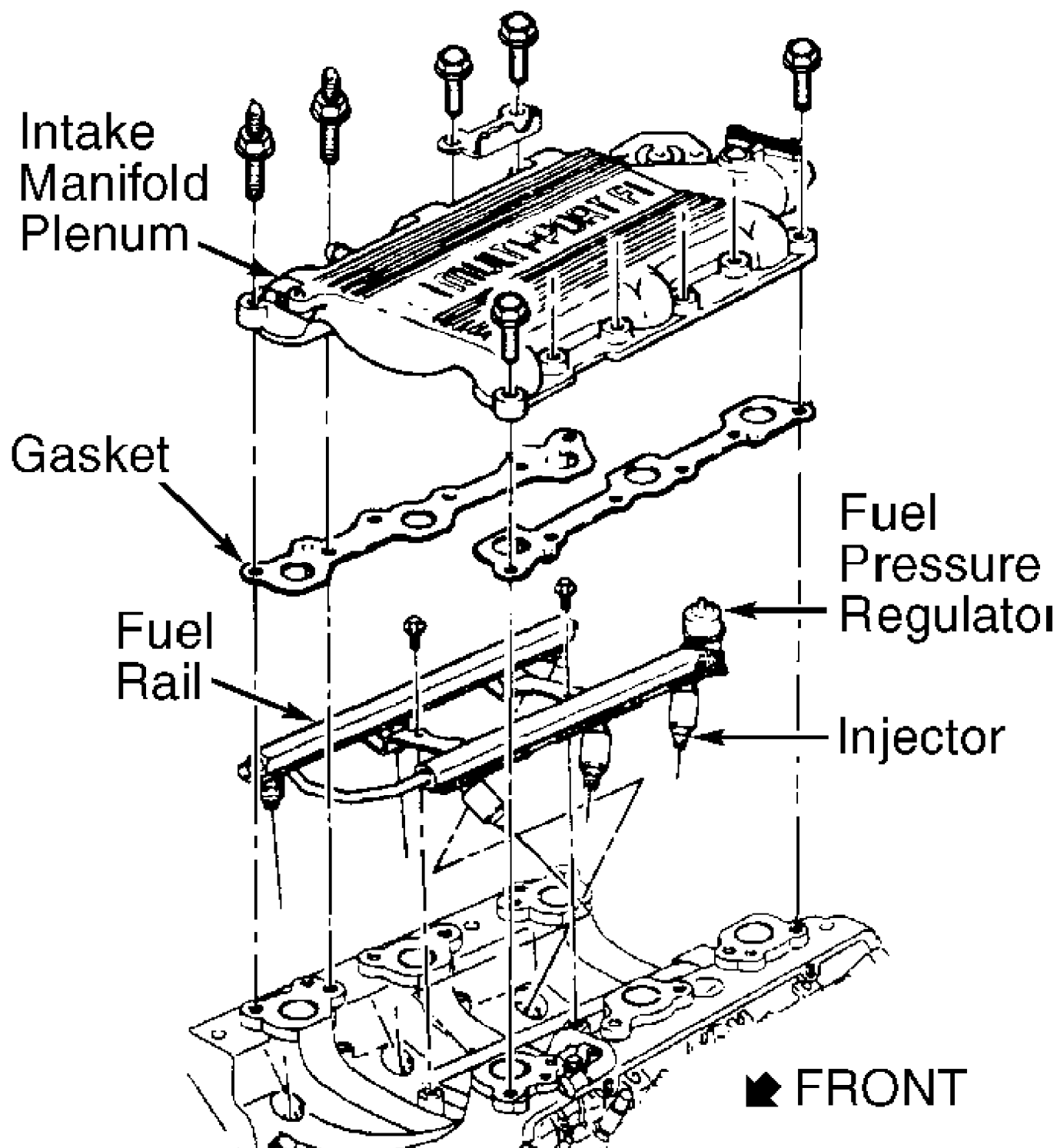
G95F13446

Fig. 18: Locating Fuel Rail Assembly Components (2.4L - VIN T)
 Courtesy of General Motors Corp.



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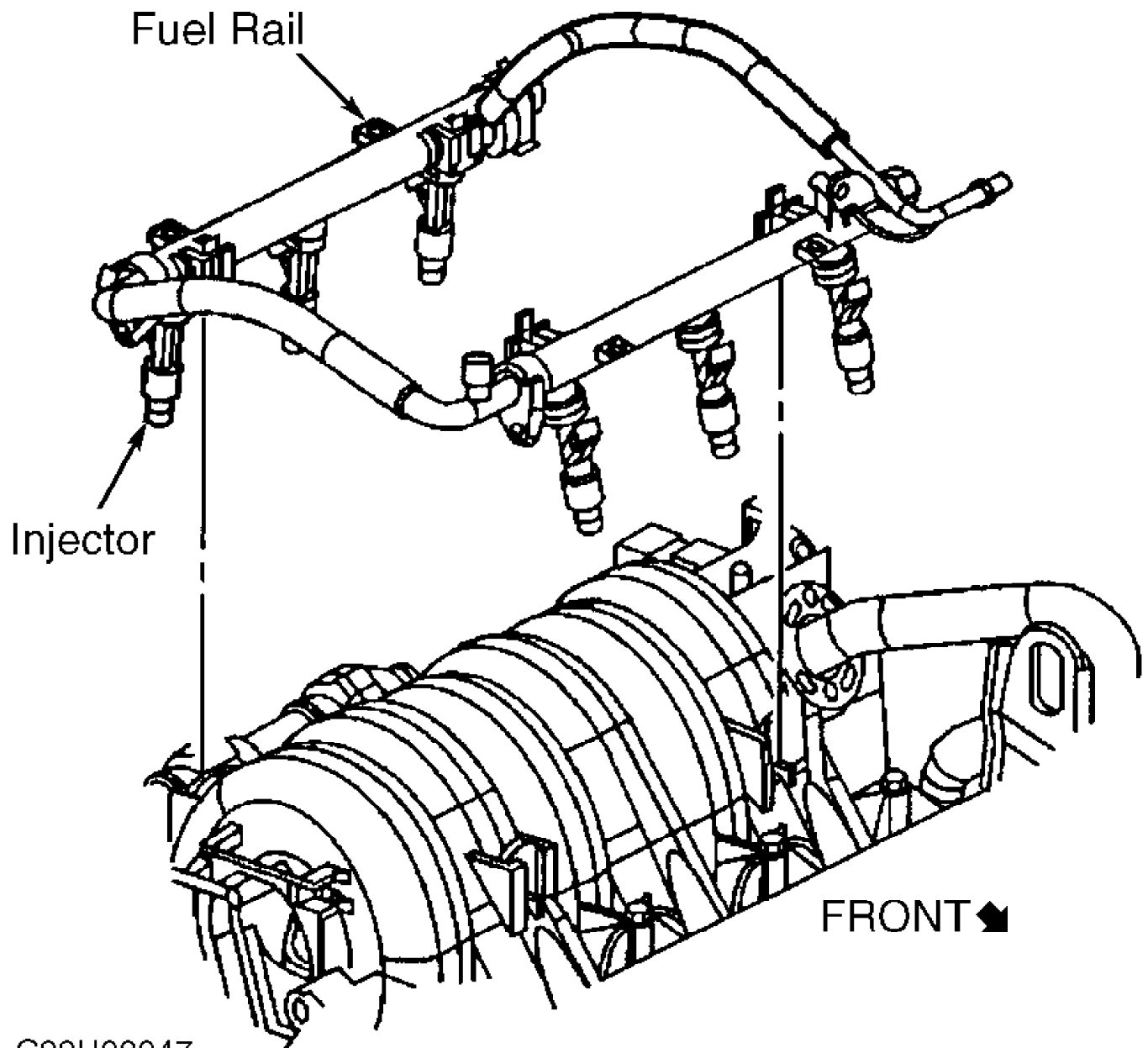
Fig. 19: Locating Fuel Rail Assembly Components (3.0L - VIN R)
 Courtesy of General Motors Corp.



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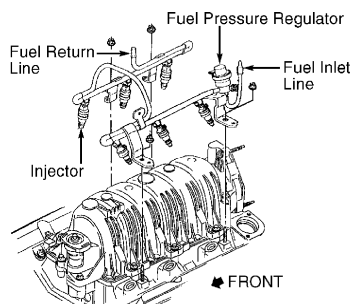
Fig. 20: Locating Fuel Rail Assembly Components (3.1L - VIN M & 3.4L - VIN E)

Courtesy of General Motors Corp.



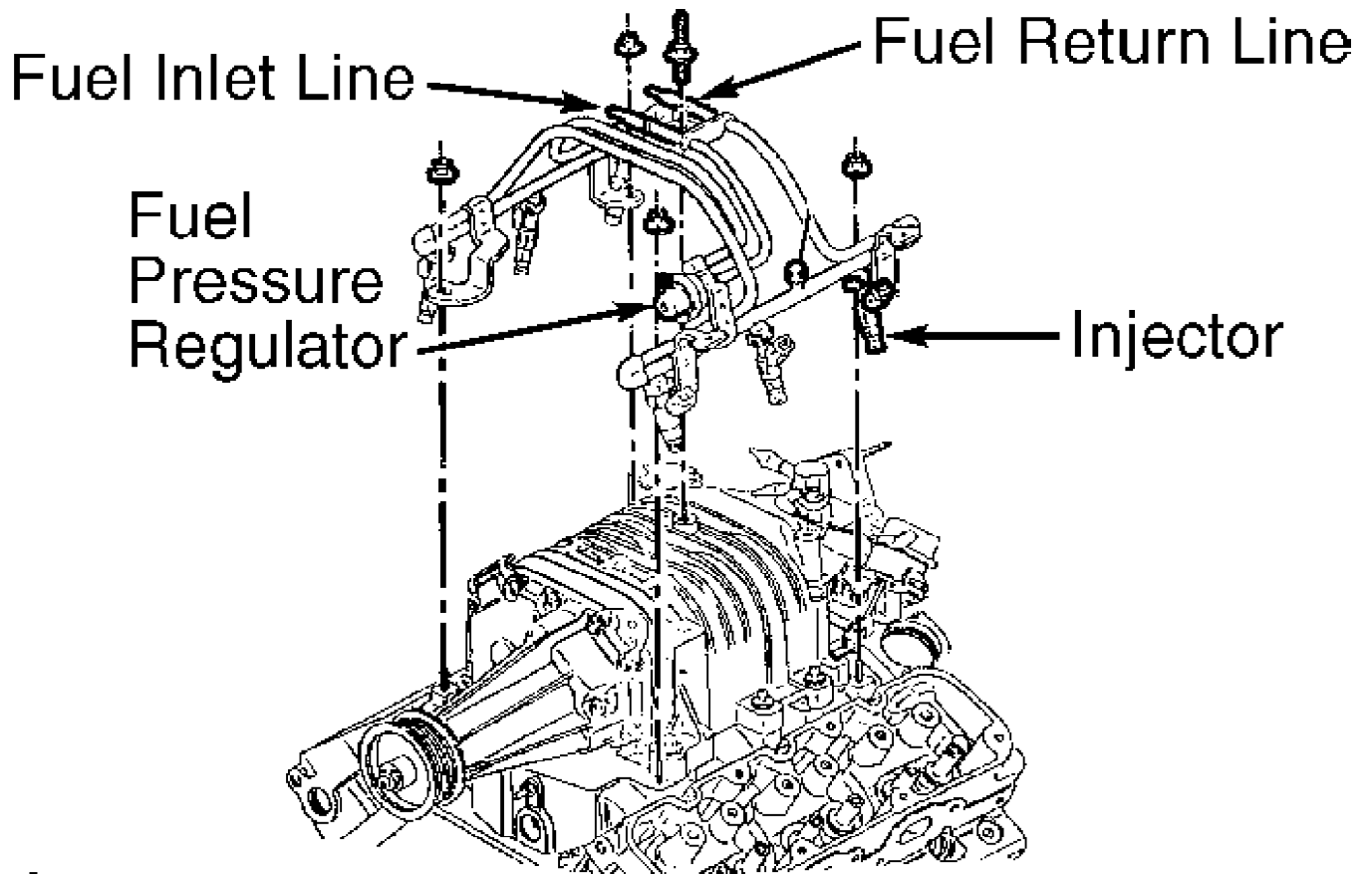
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Fig. 21: Locating Fuel Rail Assembly Components (3.5L - VIN H)
 Courtesy of General Motors Corp.



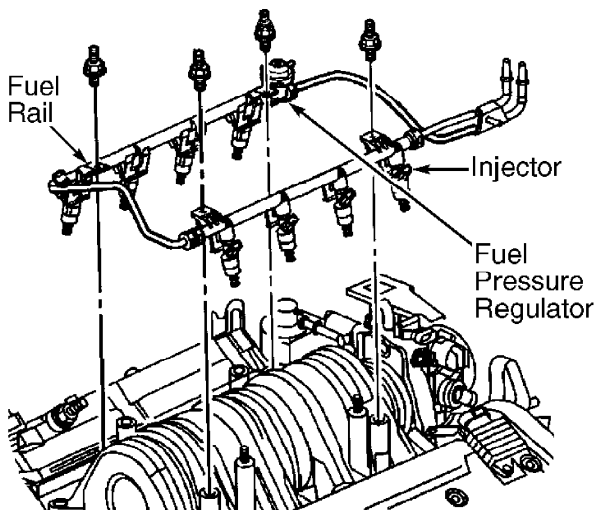
G95J35005

Fig. 22: Locating Fuel Rail Assembly Components (3.8L - VIN K)
 Courtesy of General Motors Corp.



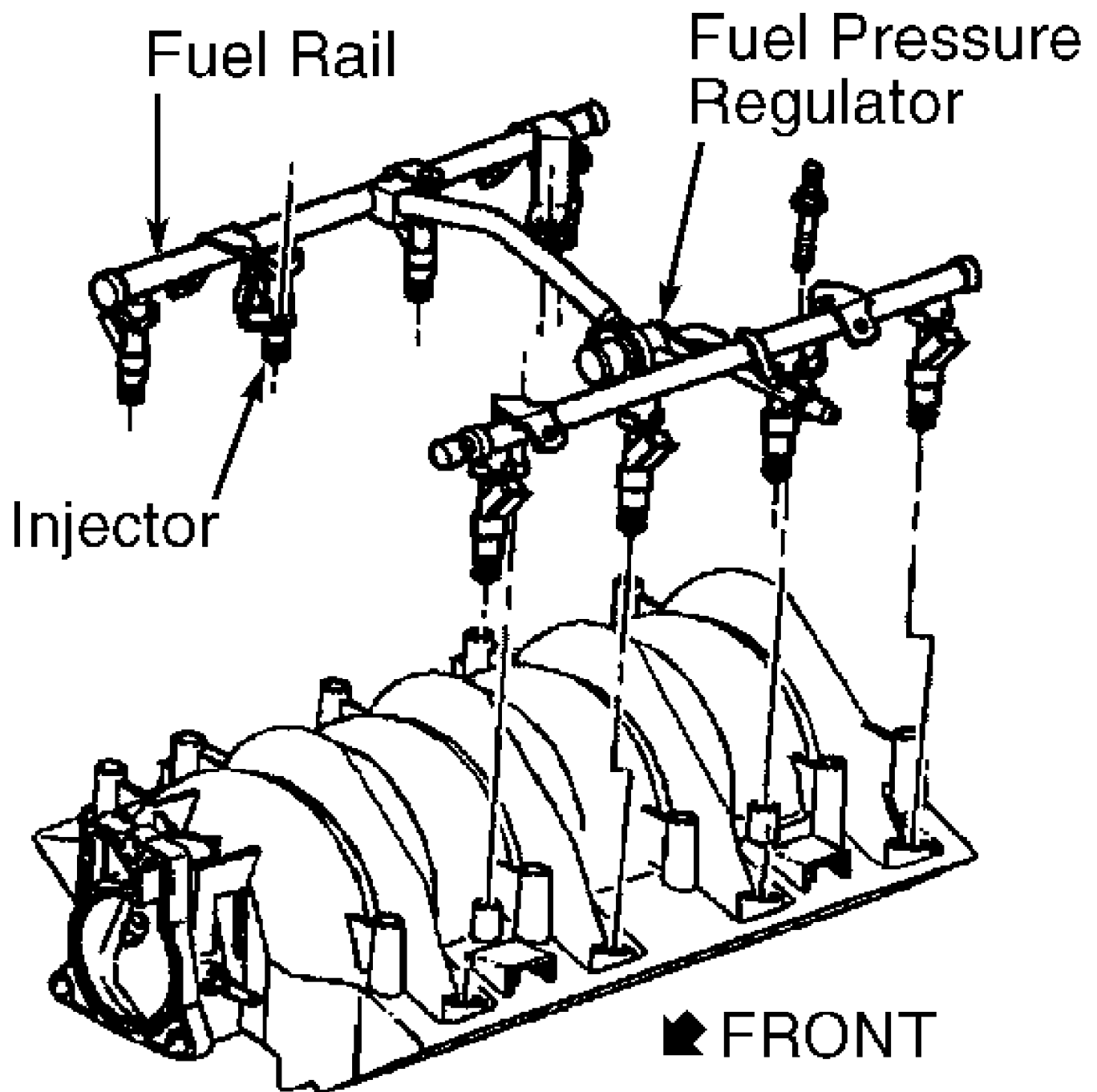
G95I35004

Fig. 23: Locating Fuel Rail Assembly Components (3.8L - VIN 1)
 Courtesy of General Motors Corp.



G00012670

Fig. 24: Locating Fuel Rail Assembly Components (4.0L - VIN C &
 4.6L - VIN Y & 9)
 Courtesy of General Motors Corp.



G98E01087

Fig. 25: Locating Fuel Rail Assembly Components (5.7L)
Courtesy of General Motors Corp.

IDLE AIR CONTROL VALVE

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.

Removal (Except 1.3L & 1.8L)

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

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.

Installation

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 INSTALLATION.

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. 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.

THROTTLE BODY

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

Removal

1) Relieve fuel pressure. See FUEL SYSTEM PRESSURE RELEASE (GASOLINE). 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.

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

Installation

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

Application	Ft. Lbs. (N.m)
Accelerator Pedal Position (APP) Sensor (3.0L)	16 (22)
Camshaft Position Sensor Bolt	18 (25)
Charcoal Canister Filter Bolt (1.8L)	13 (18)
Crankshaft Position Sensor Bolt	
3.8L	22 (30)
5.7L	18 (25)
CNG Module Bracket Bolt	18 (25)
CNG Fuel Inlet Fitting	18 (25)
EGR Tube (4.6L)	
Bolt	18 (25)
Nut	44 (60)
Fuel Inlet Fitting (CNG)	18 (25)
Fuel Outlet Fitting (CNG)	35 (48)
Fuel Line Fitting-To-Fuel Rail	
2.2L (Except Saturn) & 2.4L	20 (27)
3.0L	11 (15)
Fuel Inlet & Return Line Nut	
2.4L	22 (30)
3.1L & 3.4L	13 (18)
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)
Harmonic Balancer Bolt	
3.1L & 3.4L	76 (103)
3.8L	(3) 110 (149)
Idle Air Control (IAC) 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)
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)
	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)
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)
Charcoal Canister Filter Bracket Bolt	
	67 (7)
Crankshaft Position Sensor Bolt/Nut	
1.3L, 2.2L, 2.4L & 4.6L	89 (10)
1.8L	78 (8.8)
1.9L	80 (9)
3.0L	71 (8)
3.5L	80 (9)
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)
Fuel Filter/Pressure Regulator Bracket Nut (Corvette)	
	40 (4.5)
Fuel Pressure Regulator Screw	
1.3L	71-106 (8-12)
1.9L	71 (8)
2.2L	
Cavalier & Sunfire	53 (6)
Saturn	44 (5)
2.4L	84 (9.5)
3.1L & 3.4L	75 (8.5)
Fuel Sending Unit Assembly Hold-Down Bolt	
1.3L	89 (10)
1.8L	35 (4)
Idle Air Control (IAC) 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)
Ignition Coil Bolt	
1.3L	89 (10)
1.8L	80 (9)
Ignition Coil Housing-To-Cover Screw (2.4L)	
	35 (4)
Ignition Coil-To-Module Screw	
3.1L & 3.4L	40 (4.5)
3.5L	10 (1.1)
3.8L	44 (5)
Ignition Control Module/Coil Pack Mounting Bolt	
1.9L	62 (7)
2.2L	
Cavalier & Sunfire	35 (4)
Saturn	89 (10)
2.4L	35 (4)
3.5L	53-106 (6-12)
4.0L	62 (7)
4.6L	80 (9)
Ignition Control Module/Coil Pack-To-Bracket Nut (3.8L)	
	71 (8)

Intake Manifold Cover Nut (4.6L)	27	(3)
Intake Manifold Plenum Bolt (3.0L)	71	(8)
Fuel Tank Pressure Sensor		
1.3L	11-18	(1.2-2.0)
2.4L	84	(9.5)
3.0L	18	(2)
3.4L	76	(8.5)
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 (TP) Sensor Screw		
1.3L, 1.9L, 3.1L, 3.4L, 3.8L & 5.7L	18	(2)
1.8L	31	(3.5)
2.2L & 2.4L	18	(2)
3.5L & 4.6L	20	(2.3)
4.0L	27	(3)
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) - Plus an additional 76 degrees.
-