GENERAL MOTORS ELECTRONIC FUEL INJECTION – DUAL UNIT

Chevrolet
Camaro (5.0L)
Corvette (5.7L)
Pontiac
Firebird (5.0L)

THROTTLE BODY APPLICATION

Application	Rochester Throttle Body No. Man. Trans.	Auto. Trans.
5.0L (305")		
Nationwide	17082054	17082054
5.7L (350")		
Nationwide	17082055	17082055

THROTTLE BODY IDENTIFICATION

The throttle body identification number is on the front mounting flange on the throttle lever side of the throttle body. Code letters are stamped on the throttle body at external tube locations to identify vacuum hose connections.

DESCRIPTION

The General Motors dual unit (cross-fire) Electronic Fuel Injection (EFI) system consists of 9 major sub-assemblies: Fuel supply system, Throttle Body Injector (TBI) assembly, Idle Air Control (IAC) system, Electronic Control Module (ECM), Electronic Spark Timing (EST), Electronic Spark Control (ESC), Hood Louver Control (HLC), data sensors and emission controls.

Fuel is supplied to engine through electronically pulsed (timed) injector valves located in separate throttle bodies on top of intake manifold (1 for each bank). The ECM controls amount of fuel metered through injector valves based upon engine demand and efficiency information. The ECM is a digital electronic computer which receives and computes signals from various data sensors.

NOTE – *Primary sub-systems which affect fuel system operation will be covered in this article: Fuel supply system, TBI assembly, IAC system, ECM, HLC and data sensors. Because of the interrelated functions of the Computer Command Control (CCC) system (the ECM is the "brain"), refer to "GENERAL MOTORS COMPUTER COMMAND CONTROL SYSTEM" in Computerized Engine Controls section for more information.*

OPERATION

FUEL SUPPLY SYSTEM

An electric fuel pump (located inside fuel tank as an integral part of fuel gauge sending unit) supplies fuel under pressure to the fuel pressure compensator on the front TBI unit. From the fuel pressure compensator on the front unit, fuel enters the pressure regulator of the rear TBI unit. A fuel pump relay located on left side of engine compartment (behind driver's seat on Corvette) controls fuel pump operation. When the ignition switch is turned on, the fuel pump relay activates the fuel pump for 1½-2 seconds to prime the injectors. If the ECM does not receive reference pulses from the distributor after this period, the ECM deactivates the fuel pump circuit. The fuel pump circuit will be activated again through the relay when the ECM receives distributor reference pulses.

NOTE – *Power to relay from battery is provided when oil pressure is above 4 psi. If pump relay malfunctions, engine could still be started after oil pressure has reached 4 psi.*

THROTTLE BODY INJECTOR (TBI) ASSEMBLIES

Each TBI assembly is composed of 2 castings: a throttle body with a valve to control air flow, and a fuel body with an integral pressure regulator (rear unit) or pressure compensator (front unit) and fuel injector. The throttle body casting may contain ports to generate vacuum signals for EGR valve, MAP sensor and canister purge system.

The pressure regulator is a diaphragm-operated relief valve with injector pressure on one side and air cleaner pressure on the other side. The pressure regulator maintains a constant pressure drop (about 10 psi) across both injectors throughout all engine operating conditions by controlling the return of excess fuel to tank. See *Fig. 1*. The pressure compensator is of similar design as the pressure regulator. The compensator makes up for the momentary fuel pressure drop between the front and rear TBI units to maintain consistent operating pressures.

Each fuel injector is a solenoid-operated device controlled by the ECM. Fuel is supplied at the lower end of the injector by the fuel supply system. The ECM activates the solenoid which lifts a normally closed ball valve off its seat. Fuel under pressure is injected in a conical spray pattern at the walls of the throttle bore above the throttle valve. Excess fuel passes through the pressure compensator of the front unit, to the pressure regulator of the rear unit and is returned to tank.

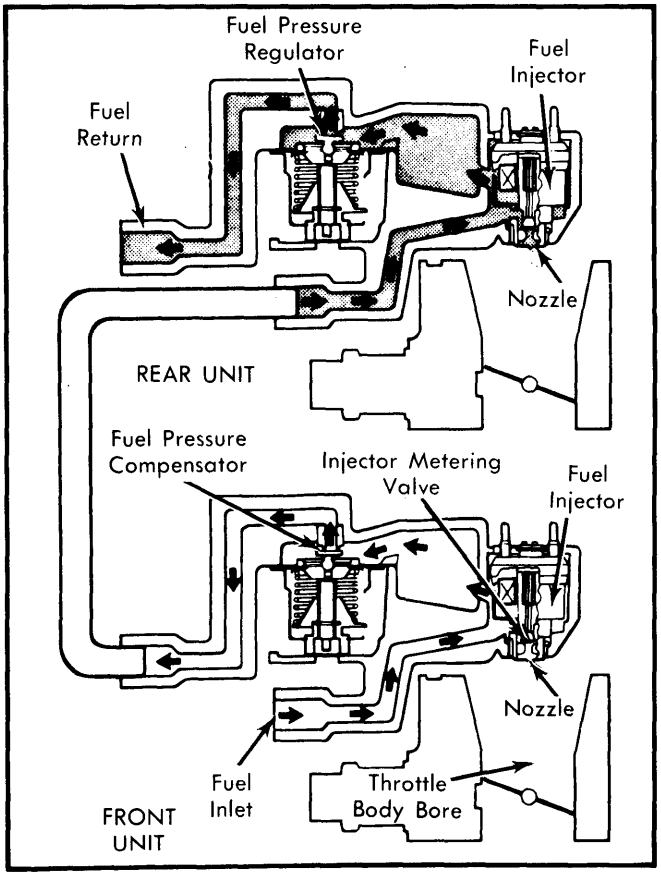


Fig. 1 Sectional View of Throttle Body Assemblies

GENERAL MOTORS ELECTRONIC FUEL INJECTION – DUAL UNIT (Cont.)

IDLE AIR CONTROL (IAC) SYSTEM

The IAC system consists of an electrically controlled motor which positions the IAC valve in the air by-pass channel around the throttle plate of each TBI unit. The ECM calculates the desired position of each IAC valve based upon battery voltage, coolant temperature, engine load and engine speed. It controls idle speed while preventing stalls due to engine load changes.

If engine speed is lower than desired, the ECM activates the motor to retract the IAC valve. When the IAC valve is retracted, more air is diverted around the throttle plate, increasing engine speed. If engine speed is higher than desired, the ECM activates the motor to extend the IAC valve. When the IAC valve is extended, less air is diverted around the throttle plate, decreasing engine speed. If engine speed falls below a preset speed and the throttle plate is closed, the ECM senses a near-stall condition. To prevent stalling, the ECM will calculate an IAC valve position based upon barometric pressure.

ELECTRONIC CONTROL MODULE (ECM)

The ECM is located behind instrument panel (driver's seat on Corvette) and is the "brain" of the EFI system and Computer Command Control system. Information from all data sensors is received and processed by the ECM to produce proper pulse duration for each injector, correct idle speed and proper spark timing. The ECM performs calculations to control the following EFI operating conditions: Engine start, engine flooding, engine running, fuel enrichment during acceleration, lean fuel mixture during deceleration, fuel cutoff and battery voltage correction.

During engine starts, the first signal sent to the injectors is a "prime" pulse. This pulse charges the intake manifold with fuel during or just prior to engine starting. This pulse width (injector "on" time) is not synchronized with HEI distributor reference pulses. Prime pulses will be delivered for a length of time dependent upon coolant temperature. After delivering prime pulses, the ECM will deliver a pulse for each distributor reference pulse received. The air/fuel ratio is determined by the ECM based upon throttle position and coolant temperature. The lower the coolant temperature, the longer the injector pulse width (richer air/fuel ratio). The higher the coolant temperature, the shorter the injector pulse width (leaner air/fuel ratio).

During engine flooding, the driver must depress the accelerator pedal enough to set the wide open throttle position. At this position, the ECM calculates the injector pulse width equal to an air/fuel ratio of 20:1. This air/fuel ratio will be maintained as long as the throttle remains wide open and engine speed is below 600 RPM. If throttle position becomes less than 80 percent, the ECM changes injector pulse width to that used during engine starting.

When the engine is running above 600 RPM, the ECM operates in the open loop mode. In open loop, the ECM calculates the injector pulse width based upon coolant temperature and manifold absolute pressure (MAP). The engine will remain in open loop operation until the oxygen sensor reaches operating temperature, coolant temperature reaches a preset temperature and a specific period of time elapses after engine start. When all these conditions are met, the ECM operates in the closed loop mode. In closed loop, the ECM controls the injector pulse width according to oxygen sensor signals, maintaining the air/fuel ratio at 14.7:1. In either mode, the injectors are pulsed alternately for each distributor reference pulse.

Fuel enrichment during acceleration is provided by the ECM. Sudden opening of the throttle plates causes a rapid increase in MAP. The pulse width is directly equal to MAP, throttle position and coolant temperature. The higher the MAP and wider the throttle angle, the wider the pulse width (richer mixture). During enrichment, the injector pulses are not in proportion with distributor reference signals. Any reduction in throttle angle will cancel fuel enrichment.

During deceleration, the air/fuel mixture must be leaner. The ECM calculates the injector pulse width similar to that during fuel enrichment. Fuel output is reduced due to fuel remaining in the intake manifold. During sudden deceleration, when MAP, throttle position and engine speed are at preset specifications, injection stops, to remove fuel from the engine. This deceleration fuel cutoff overrides the normal deceleration mode. During either deceleration mode, the injector pulses are not in proportion to distributor reference signals.

Battery voltage corrections by the ECM are performed during all operating modes of the EFI system. As battery voltage decreases, the ECM increases the injector pulse width with a correction factor stored in the ECM's memory.

The Hood Louver Control (HLC) system is controlled by the ECM. When engine coolant temperature and throttle position meet preset specifications, the ECM activates the HLC relay which opens the hood louver to allow additional air into engine.

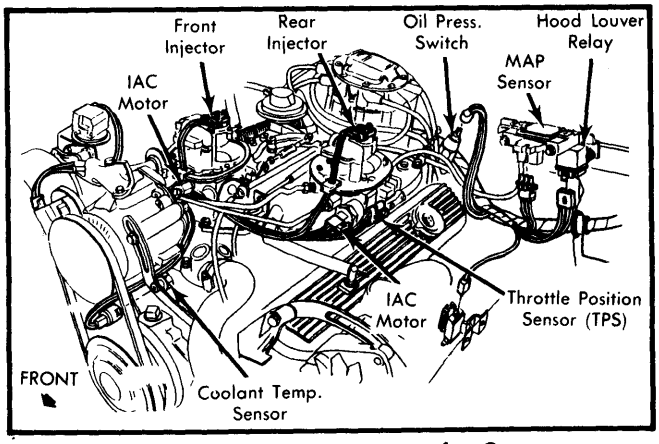


Fig. 2 Component Location for Corvette

DATA SENSORS

Each sensor furnishes an electrical signal to ECM, modifying injector pulse to conform to engine operating conditions. These sensors are as follows:

Coolant Temperature Sensor (CTS) – The CTS is located in the thermostat housing. This sensor is a variable resistance type which transmits an electrical signal (proportionate to engine temperature) to the ECM.

Oxygen Sensor – The oxygen sensor is mounted in the exhaust manifold, directly behind the cross-over pipe. This sensor is similar to a small battery. The voltage output of the sensor indicates to the ECM the amount of oxygen in the exhaust gases. The ECM corrects the air/fuel ratio (according to signals received by the oxygen sensor) only when the system is operating in closed loop.

GENERAL MOTORS ELECTRONIC FUEL INJECTION – DUAL UNIT (Cont.)

CAUTION – *No attempt should be made to measure oxygen sensor voltage output. Current drain of conventional voltmeter could permanently damage sensor. Do not connect jumper wire, test leads or other electrical connectors to sensor.*

Manifold Absolute Pressure (MAP) Sensor – The MAP sensor is mounted on the left side of the engine compartment. This sensor is a variable resistance type which has a vacuum hose connected to the throttle body. The sensor monitors changes in intake manifold pressure which result from engine load and speed changes. As MAP changes, the electrical resistance of the sensor changes. The ECM uses the resistance value of the sensor to control injector pulse width.

Vehicle Speed Sensor (VSS) – The VSS is mounted behind the speedometer in the instrument cluster. This sensor provides the ECM with pulses to determine vehicle speed. This information is used by the ECM to control the IAC system.

NOTE – *Vehicle should not be driven without the VSS installed or speedometer cable disconnected.*

Throttle Position Sensor (TPS) – The TPS is mounted on side of rear throttle body and is connected to throttle shaft. A throttle rod connects both the front and rear throttle body units to ensure throttle valve of each unit is positioned the same. This sensor converts throttle angle to an electrical signal for use by the ECM to determine engine fuel requirements.

Engine RPM Reference – The "R" terminal of the HEI module is used to send engine RPM signals to ECM.

NOTE – *More sensors are used by the ECM to control engine performance and other systems. Refer to "GENERAL MOTORS COMPUTER COMMAND CONTROL SYSTEM" in Computerized Engine Controls section for more information.*

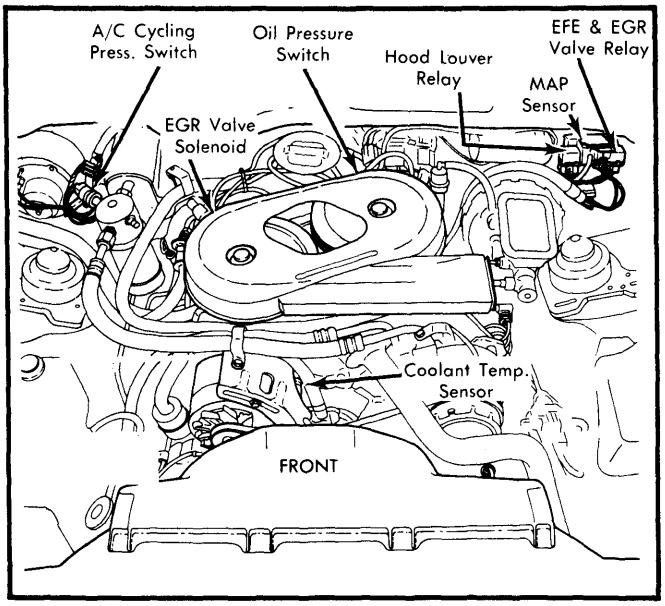


Fig. 3 Component Location for Camaro and Firebird

TROUBLE SHOOTING & DIAGNOSIS

NOTE – *Diagnosis of fuel system should begin with determining fuel system pressure. Before performing any test on the fuel system, pressure must be released from the system.*

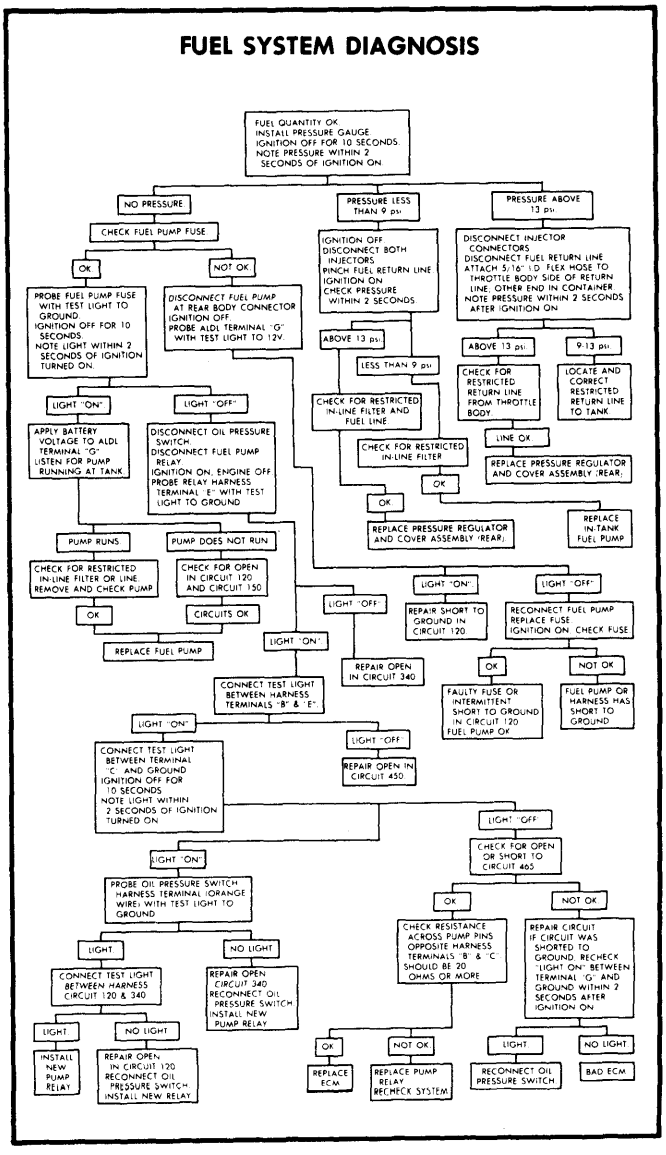
FUEL SYSTEM PRESSURE TEST

1) Remove "FUEL PUMP" fuse from fuse block in passenger compartment. Crank engine. Engine will start and run until fuel supply remaining in fuel lines is used. Engage starter again for about 3 seconds to ensure all fuel is out of lines. Turn ignition off and replace fuse.

2) Remove air cleaner and plug thermal vacuum port on throttle body. Remove steel fuel line between front and rear throttle body units. When removing fuel line, always use 2 wrenches. Install a fuel pressure gauge (J-29658 or equivalent) between throttle body units.

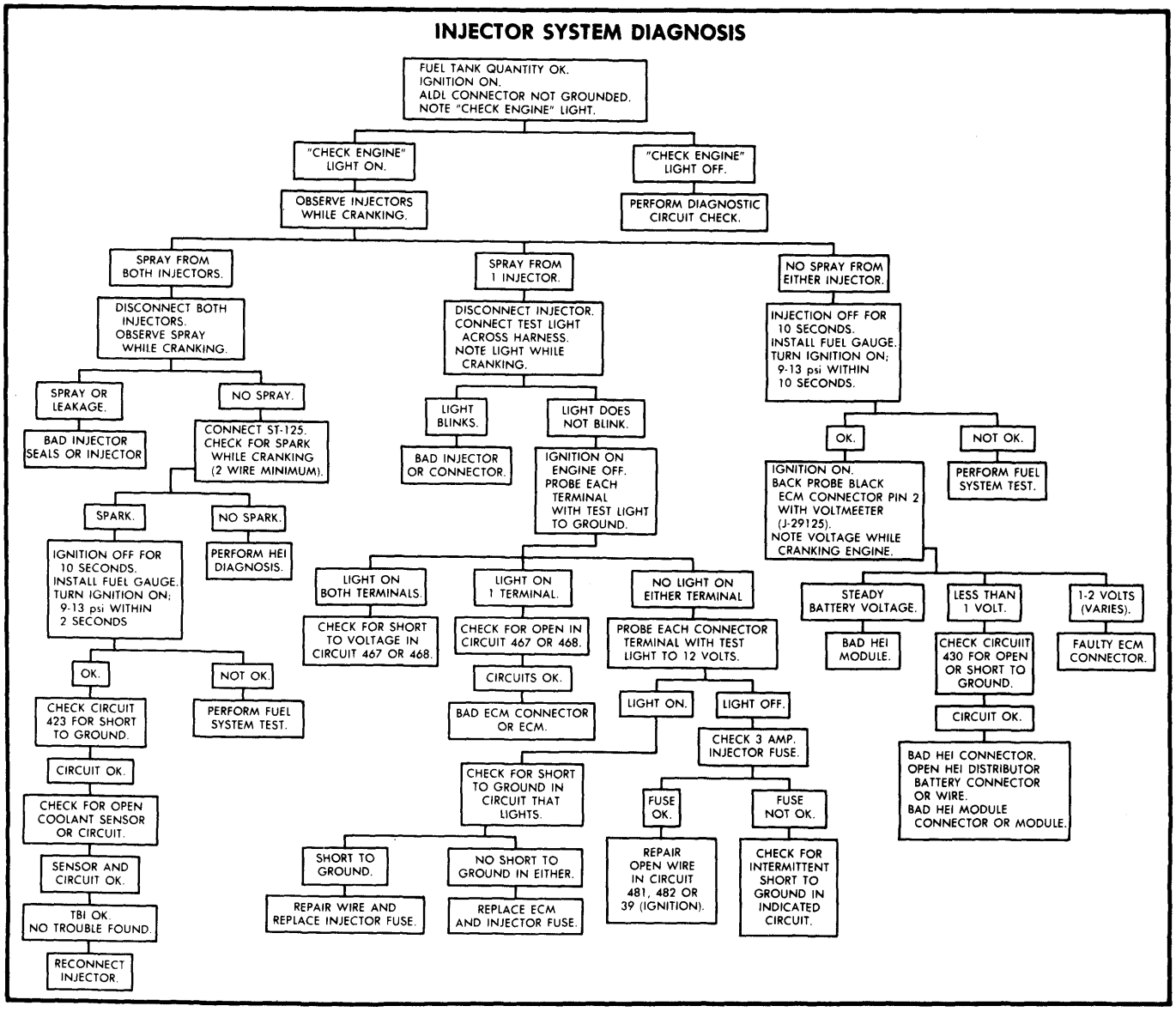
3) Start car and observe fuel pressure reading. Use Fuel System Diagnosis chart if pressure is not between 9-13 psi. Use Injector System Diagnosis chart if pressure is between 9-13 psi.

4) Depressurize fuel system as described in step **1)**. Remove fuel pressure gauge and reinstall steel line between throttle bodies. Start car and watch for leaks. Remove plug from throttle body thermal vacuum port and reinstall air cleaner.



GENERAL MOTORS ELECTRONIC FUEL INJECTION – DUAL UNIT (Cont.)

INJECTOR SYSTEM DIAGNOSIS



HESISTATES, SLUGGISH, SAGS OR POOR MILEAGE

1) Visually check MAP hose for leaks or restriction and TPS for sticking or binding. Ensure fuel pressure is steady 9-13 psi at all operating ranges. Ensure base timing is correct.

2) With injector connectors disconnected, check for fuel leakage from injectors while cranking. Check for open HEI ground (circuit 453). Check fuel injector fuel filters for blockage. Check TBI balance adjustment. See *appropriate article in TUNE-UP SERVICE PROCEDURES.*

3) Check A/C compressor control and torque converter clutch (TCC) system. *Refer to "GENERAL MOTORS COMPUTER COMMAND CONTROL SYSTEM" in Computerizd Engine Controls section for testing procedures.*

CUTS OUT OR STALLS

1) Check for intermittent open or short to ground in the following circuits: 5 volt reference (416), HEI reference (430), fuel pump circuit (120), injector drive circuits (467 and 468), IAC drive circuits (441, 442, 443 or 444).

2) Check for restricted fuel filter. Ensure fuel pressure is 9-13 psi at all operating ranges. Inspect fuel injector "O" rings for damage. Ensure steel back-up washer is located beneath large "O" ring of each injector.

SURGE

Check for intermittent open or short to ground in the following circuits: transmission converter clutch (420 and 422), HEI bypass (424), EST (423). Perform EGR diagnosis. *Refer to "GENERAL MOTORS COMPUTER COMMAND CONTROL SYSTEM" in Computerized Engine Controls section for testing procedures.*

HARD STARTING (HOT OR COLD)

1) Check for high resistance in coolant sensor circuit. Visually check TPS for sticking or binding. Ensure fuel pressure is 9-13 psi at all operating ranges.

GENERAL MOTORS ELECTRONIC FUEL INJECTION – DUAL UNIT (Cont.)

2) Check fuel pump relay. Disconnect oil pressure switch. If engine cranks but will not start, perform fuel system diagnosis (at point where fuel pump fuse proves okay).

3) Check injectors. With injector harness connectors disconnected, check for fuel leakage while cranking.

4) Check cranking circuit. *Refer to "GENERAL MOTORS COMPUTER COMMAND CONTROL SYSTEM" in Computerized Engine Controls section for testing procedure.*

REMOVAL & INSTALLATION

ELECTRONIC CONTROL MODULE (ECM)

NOTE – *Location of ECM varies between model application. ECM is located in passenger compartment behind driver's seat (Corvette) or under instrument panel (Camaro and Firebird).*

Removal & Installation – Disconnect negative battery cable. Disconnect 2 electrical connectors from ECM. Remove ECM mounting hardware and ECM. To install, reverse removal procedure.

FUEL PUMP RELAY

Removal & Installation – Fuel pump relay is located behind driver's seat (Corvette) and in engine compartment, on firewall near left fender panel (Camaro and Firebird). Remove electrical connector, mounting screws and relay. To install, reverse removal procedure.

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR

Removal & Installation – MAP sensor is located in engine compartment, on firewall near left fender panel on all models. Remove vacuum hose, mounting screws and MAP sensor. To install, reverse removal procedure.

VEHICLE SPEED SENSOR (VSS)

Removal & Installation – Remove instrument cluster and speedometer assembly. Disconnect VSS from speedometer. Disconnect VSS electrical connector and remove VSS. To install, reverse removal procedure.

COOLANT TEMPERATURE SENSOR (CTS)

Removal & Installation – Disconnect electrical connector and remove CTS. To install, reverse removal procedure.

OXYGEN SENSOR

NOTE – *Oxygen sensor may be difficult to remove when engine temperature is below 120°F (48°C). Excessive force may damage threads.*

Removal & Installation – Disconnect electrical connector. Do not attempt to remove single wire from oxygen sensor. Carefully back sensor out of cross-over pipe. Handle sensor with care and do not allow dirt or other foreign matter to contact louvered end of sensor. To install, reverse removal procedure.

NOTE – *Before installing a used sensor, coat threads with liquid graphite compound containing glass beads (special anti-seize compound).*

FUEL PUMP

Removal & Installation – Disconnect negative battery cable. Remove pressure from fuel lines as described under Fuel Pump Pressure Test. Remove fuel lines. Lower fuel tank. Remove attaching screws and fuel pump. To install, reverse removal procedure.

THROTTLE BODY ASSEMBLIES

Removal – **1)** Relieve pressure from fuel lines as explained under Fuel Pump Pressure Test. Remove air cleaner. Disconnect electrical connectors from injectors, IAC motors and TPS. Disconnect and identify all vacuum lines.

2) Remove throttle cable and transmission detent cable. Remove throttle rod from between front and rear throttle body units. Remove cruise control cable (if equipped). Disconnect fuel lines from each throttle body unit using 2 wrenches. Remove throttle body-to-manifold bolts. Remove each throttle body unit as an assembly.

Installation – To install, reverse removal procedure and note the following: Ensure throttle body assemblies and intake manifold sealing surfaces are clean. Always use new throttle body-to-manifold gaskets.

NOTE – *Throttle body units must be installed in original position. Do not interchange front and rear units.*

ADJUSTMENTS

THROTTLE POSITION SENSOR (TPS)

See *appropriate article in TUNE-UP SERVICE PROCEDURES.*

MINIMUM IDLE SPEED

See *appropriate article in TUNE-UP SERVICE PROCEDURES.*

OVERHAUL

DISASSEMBLY

NOTE – *Before performing any service on throttle body assembly, it is essential that throttle body be placed on a holding fixture (J-9789-118, BT 30-15 or equivalent) to prevent damage to throttle valve. Disassembly of each throttle body unit is the same. DO NOT interchange components between front and rear units. Mark and identify each component for identification.*

Fuel Meter Cover – **1)** Remove 5 cover-to-meter body screws and lock washers. Lift off fuel meter cover with fuel pressure regulator assembly (rear unit) or fuel pressure compensator assembly (front unit) attached. Remove cover gaskets. See *Fig. 4.*

CAUTION – *Do not remove 4 screws attaching pressure regulator (compensator) to fuel meter cover. The regulator (compensator) includes a spring under heavy tension which may cause personal injury if released. Fuel meter cover and pressure regulator (compensator) are serviced as an assembly only. Do not immerse assembly in any type of cleaning solvent.*

2) Remove fuel pressure regulator dust seal from fuel meter body of rear unit.

GENERAL MOTORS ELECTRONIC FUEL INJECTION – DUAL UNIT (Cont.)

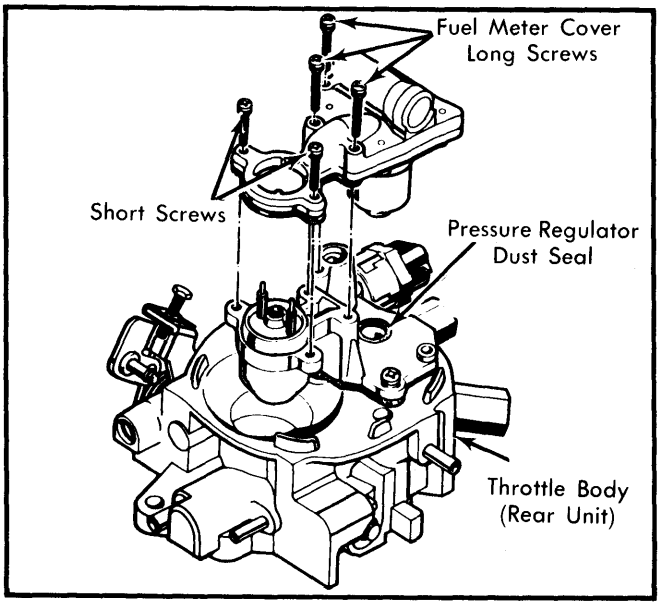


Fig. 4 Removing Fuel Meter Cover Assembly

Fuel Injector – 1) Using a pair of pliers, gently grasp center collar of injector between electrical connectors. Carefully pull injector out with a twisting motion. *See Fig. 5*

NOTE – *Use care in removing injector to prevent damage to electrical connectors, fuel filter and nozzle. Injector is serviced as complete assembly only. Injectors are not interchangeable between front and rear units.*

2) Carefully rotate injector filter back and forth to remove from base of injector. Remove large "O" ring and steel backup washer at top of injector cavity in fuel meter body. Remove small "O" ring at bottom of injector cavity.

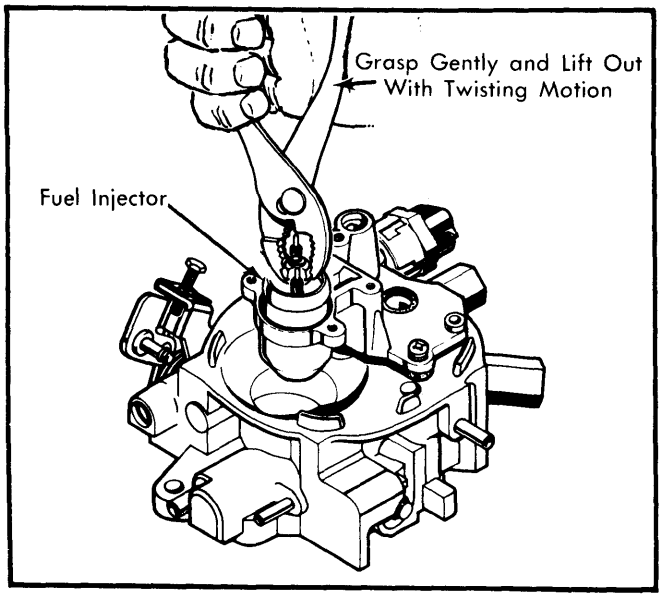


Fig. 5 Removing Fuel Injector Assembly

Fuel Meter Body – Remove fuel inlet and outlet nuts and gaskets from fuel meter body. Remove air cleaner stud (if equipped). Remove 3 fuel meter body-to-throttle body screws and lock washers. Remove fuel meter body and gasket.

Throttle Body – 1) Disassembly of throttle body unit for immersion in cleaning solvent requires removal of TPS (rear unit) and IAC assemblies. Throttle valve screws are staked in position and should not be removed. If necessary to remove TPS, continue as follows:

NOTE – *TPS assembly is preset at the factory and retaining screw is spot-welded in position.*

2) Using a ¼" drill, drill completely through TPS screw access hole in base of rear throttle body unit to remove spot weld. *See Fig. 6.*

3) Remove and discard TPS attaching screws. Remove lock washers, retainers and TPS from throttle body. If necessary, remove TPS actuator lever-to-throttle shaft screw. Remove IAC assembly and gasket from each throttle body with a 1¼" wrench.

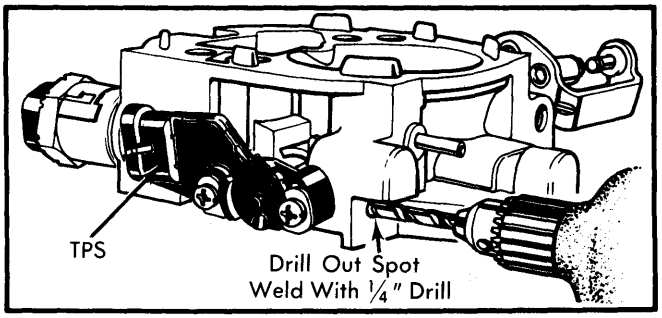


Fig. 6 Removing TPS Assembly (Rear Unit Only)

CLEANING & INSPECTION

1) Clean all metal parts in a cold immerion-type cleaner and blow dry with compressed air.

2) Do not immerse TPS, IAC, fuel meter cover and pressure regulator (compensator) assembly, fuel injector, fuel filter, rubber parts and diaphragms in cleaner.

3) Inspect mating surfaces for damage that may prevent gasket sealing. Repair or replace components which may be cause of problems listed under Trouble Shooting and Diagnosis.

REASSEMBLY

Throttle Body – Place throttle body on holding fixture. Install IAC assembly with new gasket. Tighten securely. Install TPS actuator lever by aligning flats on lever with flats on end of shaft. Do not install TPS until complete assembly of rear throttle body assembly.

NOTE – *Before installing IAC assembly, measure distance that valve extends from motor housing. Measuring from end of housing to end of cone, distance should not exceed 1⅛" (28 mm). If not to specification, push pintle inward (IAC valve with collar on electrical connector) or compress pintle retaining spring toward IAC body while turning pintle inward with a clockwise motion (IAC valve without collar on connector). On IAC valves without collar, return spring to original position with straight portion of spring end aigned with flat surface under pintle head.*

GENERAL MOTORS ELECTRONIC FUEL INJECTION – DUAL UNIT (Cont.)

Fuel Meter Body – 1) Install fuel meter body gasket on throttle body. Cutout portions of gasket must match cutouts on throttle body. Install fuel meter body on gasket.

2) Apply thread locking compound (supplied in service kit) on 3 attaching screws. Install lock washers and screws. Tighten screws. Install fuel inlet and outlet nuts with new gaskets.

Fuel Injector – 1) Using a slight twisting motion, install fuel injector filter on nozzle end of injector until seated against injector base.

NOTE – *Filter is cone-shaped. Large end of filter points up toward injector electrical connectors. Filter should cover raised rib at base of injector.*

2) Lubricate "O" rings with lithium grease (or equivalent). Push small "O" ring on nozzle end of injector until seated against injector fuel filter. Install steel back-up washer in recess in injector cavity of fuel meter body. Install large "O" ring directly above back-up washer. Press "O" ring down in cavity recess until flush with top of fuel meter body casting surface. See *Fig. 7*.

NOTE – *"O" rings and back-up washer must be installed in this manner. Do not attempt to seat "O" rings and washer after injector is placed in cavity.*

3) Using a pushing/twisting motion, install injector in cavity. Align raised lug on injector base with notch in fuel meter body. Push down on injector to center "O" ring in bottom of cavity and to seat injector. Injector is correctly installed when lug on injector is seated in fuel meter body notch and electrical connections are parallel to throttle shaft in throttle body.

NOTE – *Ensure injectors and components are installed in their original throttle body. Do not interchange components between front and rear units.*

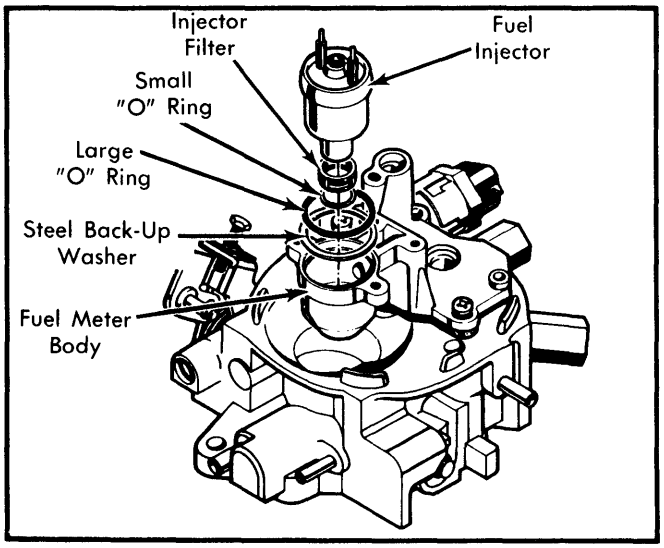


Fig. 7 Installing Fuel Injector

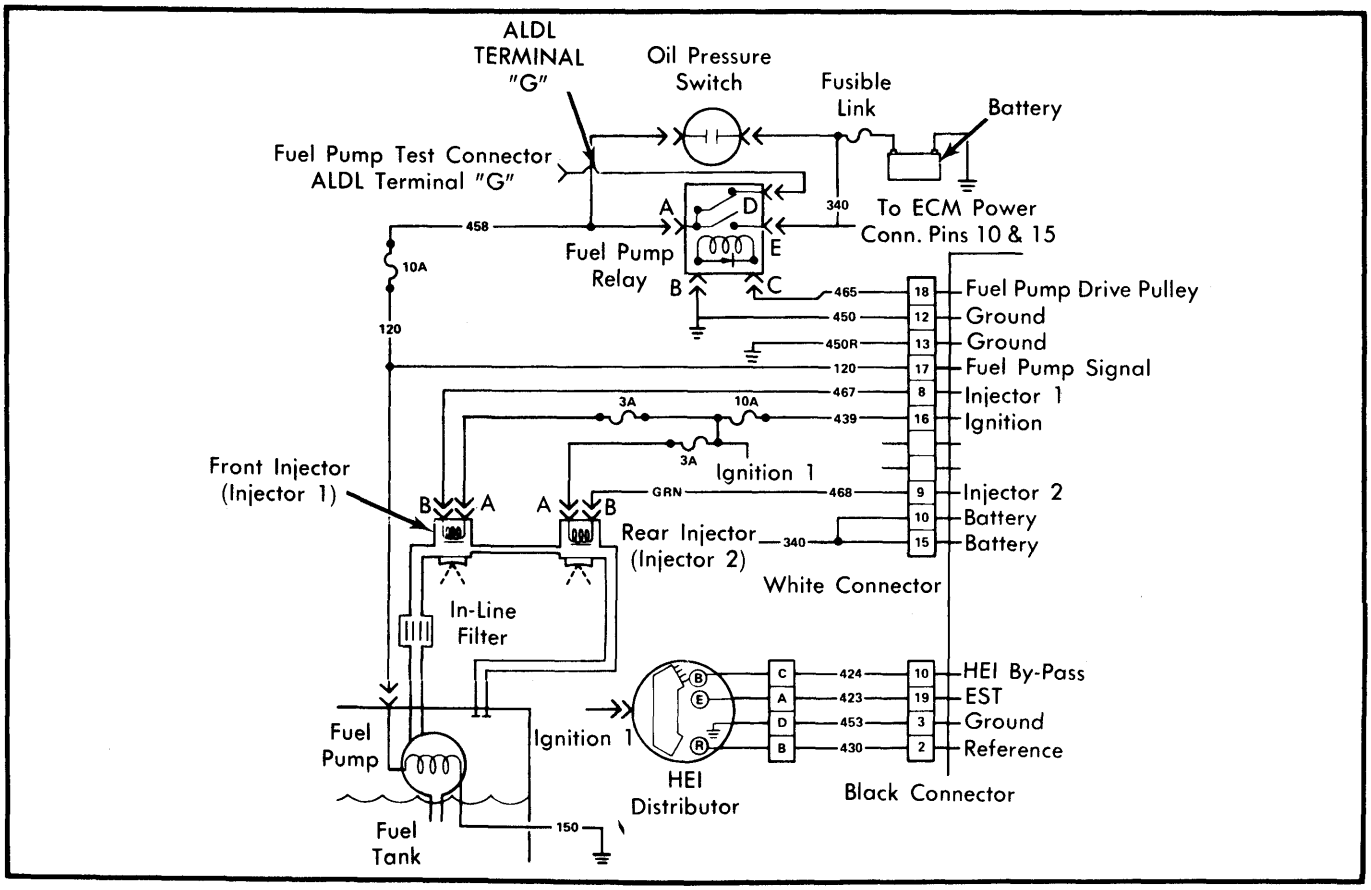


Fig. 8 Fuel Injection System Wiring Diagram

GENERAL MOTORS ELECTRONIC FUEL INJECTION – DUAL UNIT (Cont.)

Fuel Meter Cover – 1) Install new fuel pressure regulator dust seal in fuel meter body recess in rear unit. Install new fuel return passage gasket. Install new fuel meter cover gasket on fuel meter body.

2) Install fuel meter cover with pressure regulator on rear unit. Install fuel meter cover with pressure compensator on front unit. Apply thread locking compound (supplied in service kit) to 5 cover screws. Install lock washers and screws (2 short screws go next to injector). Tighten screws.

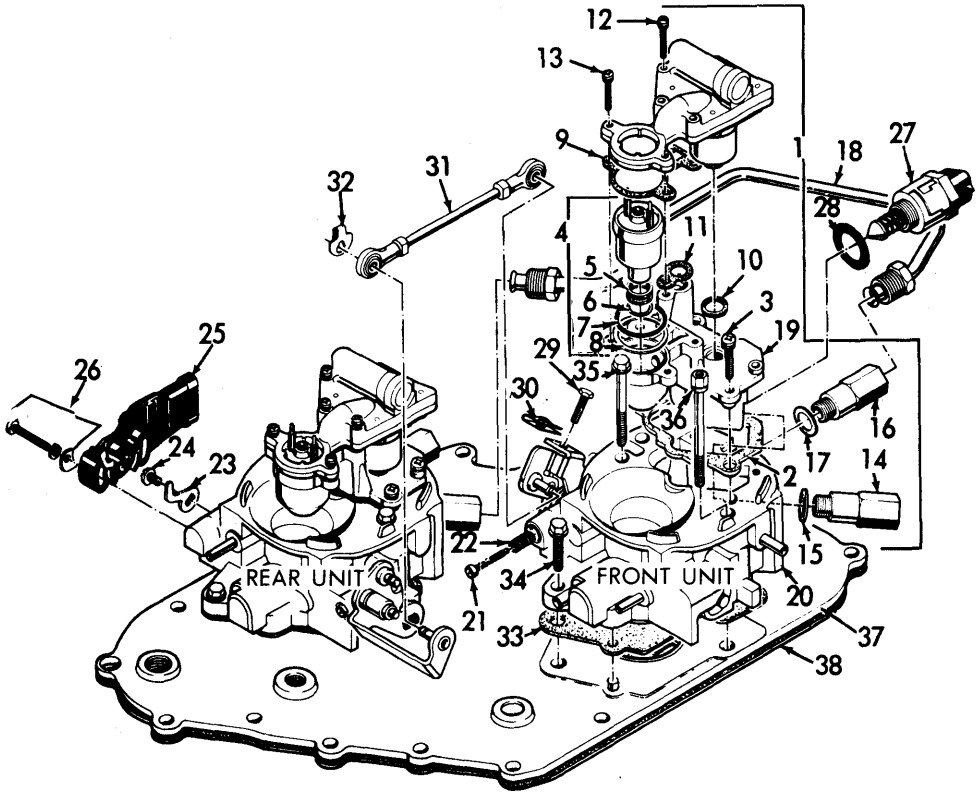
NOTE – *Pressure regulator has a taller regulator "can" than the compensator assembly.*

Throttle Position Sensor (TPS) – Place throttle valve in normal closed idle position. Install TPS on rear throttle body with pick-up lever above throttle actuator lever tang. Install retainer, lock washers and 2 new attaching screws (coated with locking compound).

NOTE – *TPS adjustment must be done with throttle body installed on vehicle. See appropriate article in TUNE-UP SERVICE PROCEDURES.*

TIGHTENING SPECIFICATIONS

Application	Ft. Lbs. (N·m)
Coolant Sensor	18-22 (25-30)
Oxygen Sensor	30 (41)
Throttle Body-to-Manifold Bolts	10-14 (14-19)
Idle Air Control (IAC) Assembly	13 (18)
Fuel Inlet and Outlet Nuts	22 (30)



NOTE: Parts not common between front and rear units are marked – (F) – Front; (R) – Rear

1. Fuel Meter Assembly
2. Fuel Meter Body Gasket
3. Attaching Screws (3)
4. Fuel Injector Assembly
5. Injector Nozzle Filter
6. Small "O" Ring
7. Large "O" Ring
8. Steel Back-Up Washer
9. Fuel Meter Cover Gasket
10. Pressure Regulator Dust Seal (R)
11. Fuel Meter Outlet Gasket
12. Long Screws (3)
13. Short Screws (2)
14. Fuel Inlet Nut
15. Fuel Inlet Nut Gasket
16. Fuel Outlet Nut
17. Fuel Outlet Nut Gasket
18. Fuel Tube
19. Fuel Meter Body Assy.
20. Throttle Body Assy.
21. Idle Stop Screw
22. Idle Stop Screw Spring
23. TPS Lever (R)
24. TPS Lever Screw (R)
25. Throttle Position Sensor (TPS) (R)
26. TPS Retainer Kit (R)
27. Idle Air Control Valve (IAC)
28. IAC-to-TBI Gasket
29. Idle Balance Screw
30. Idle Balance Clip (Service Only)
31. Throttle Rod Assy.
32. Throttle Rod Clip (2)
33. TBI Mounting Gasket
34. Short TBI Bolts (2)
35. Long TBI Bolts (2)
36. TBI & Air Cleaner Stud Bolts (2)
37. Inlet Manifold Cover
38. Manifold Cover Gasket

Fig. 9 Exploded View of Rochester Dual Unit (Crossfire) Throttle Body Assembly (Exploded View of Front Unit is Typical for Rear Unit)