SECTION 4

FUEL CONTROL SYSTEM

TBI MODEL 220 - V6 OR V8 ENGINE
TBI MODEL 700 - L4 ENGINE

CONTENTS

calculates the air/fuel ratio (injector on-time) based on the signal from the O_2 sensor. This allows the air/fuel ratio to stay very close to 14.7:1.

Acceleration Mode

The ECM looks at rapid changes in throttle position and manifold pressure, and provides extra fuel.

Deceleration Mode

When deceleration occurs, the fuel remaining in the intake manifold can cause excessive emissions and backfiring. Again, the ECM looks at changes in throttle position and manifold pressure and reduces the amount of fuel. When deceleration is very fast, the ECM can cut off fuel completely for short periods.

Battery Voltage Correction Mode

When battery voltage is low, the ECM can compensate for a weak spark delivered by the distributor by:

- Increasing injector on time of fuel delivered
- Increasing the idle rpm
- Increasing ignition dwell time

Fuel Cutoff Mode

No fuel is delivered by the injectors when the ignition is "OFF." This prevents dieseling. Also, fuel is not delivered if no reference pulses are seen from the distributor, which means the engine is not running. Fuel cutoff also occurs at high engine rpm, to protect internal engine components from damage.

FUEL CONTROL OPERATION

The fuel control system (Figure 4-2) consists of the following components:

- Throttle Body Injection (TBI) unit
- Fuel pump
- Fuel pump relay
- Fuel tank
- Accelerator control
- Fuel lines
- Fuel filters
- Evaporative emission control system

The fuel control system has an electric fuel pump, located in the fuel tank on the gage sending unit. It pumps fuel to the throttle body through the fuel supply line, then through an in-line fuel filter. The pump is designed to provide pressurized fuel at about

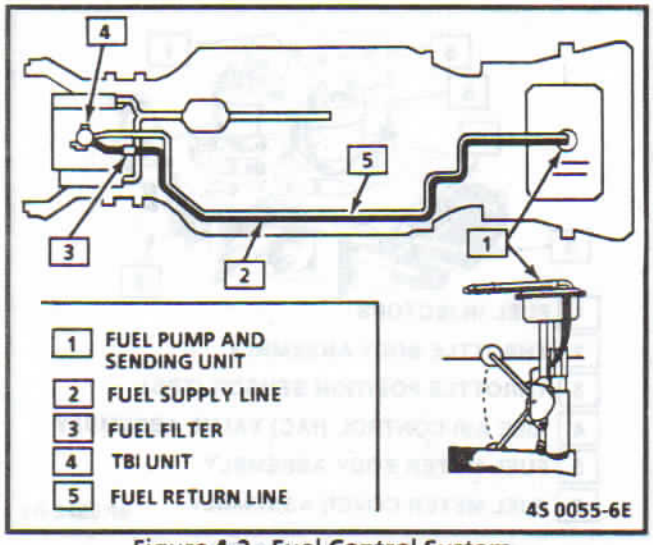

Figure 4-2 - Fuel Control System

125 kPa (18 psi). On vehicles with two fuel tanks, there is an electric fuel pump and gage sending unit in each fuel tank.

A pressure regulator in the TBI keeps fuel available to the injectors at a constant pressure between 62 and 90 kPa (9 and 13 psi). Fuel in excess of injector needs is returned to the fuel tank by a separate line.

The ECM controls the injectors that are located in the fuel meter body assembly of the TBI. The injectors deliver fuel in one of several modes, described above.

In order to properly control the fuel supply, the fuel pump is operated by the ECM through the fuel pump relay and oil pressure switch (see "Fuel Pump Electrical Circuit").

MODEL 220 TBI UNIT

Model 220, used on V6 and V8 engines (Figure 4-3), consists of three major casting assemblies:

- Fuel meter cover with:
  - Pressure regulator
- Fuel meter body with:
  - Fuel injectors
- Throttle body with:
  - Idle Air Control (IAC) valve
  - Throttle Position Sensor (TPS)

MODEL 700 TBI UNIT

Model 700, used on the L4 engine (Figure 4-4), is made up of two major casting assemblies:

- Fuel meter assembly with:
  - Pressure regulator
  - Fuel injector
- Throttle body with:
  - Idle Air Control (IAC)
  - Throttle Position Sensor (TPS)

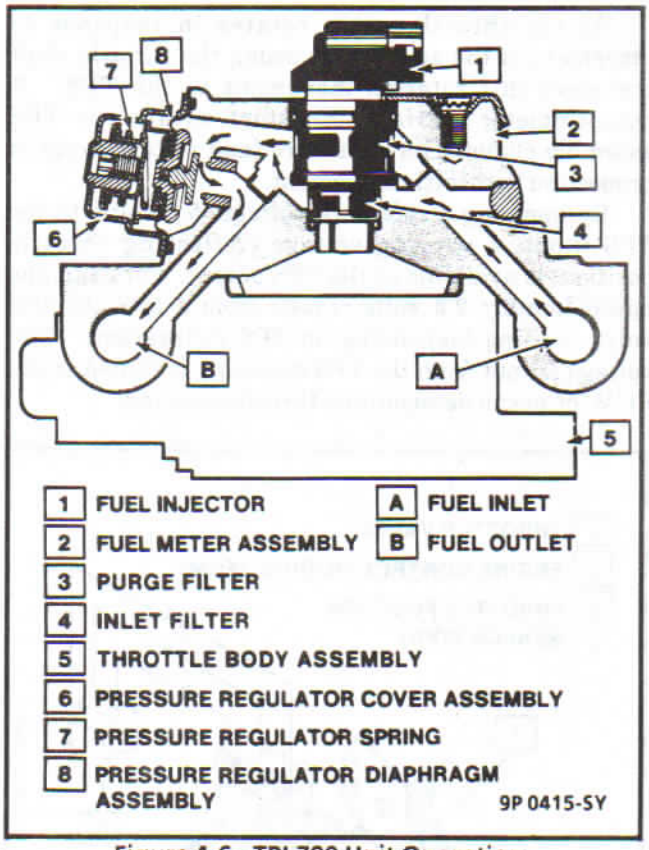

Figure 4-6 - TBI 700 Unit Operation

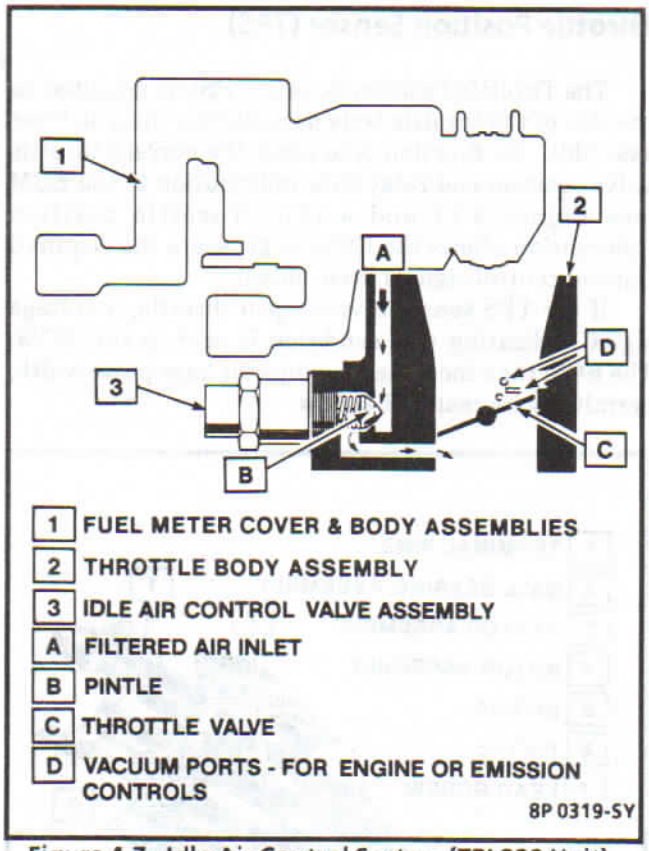

Figure 4-7 - Idle Air Control System (TBI 220 Unit)

This movement controls airflow around the throttle plate, which in turn, controls engine idle speed, either cold or hot. IAC valve pintle position counts can be seen using a "Scan" tool. 0 counts correspond to a fully closed passage, while 140 counts or more (depending on the application) corresponds to full flow.

- Actual or "controlled" idle speed is obtained by the ECM positioning the IAC valve pintle. Resulting idle speed is generated from the total idle air flow (IAC/passage + PCV + throttle valve + vacuum leaks).
- Controlled idle speed is always specified for normal operating conditions. Normal operating condition is coolant temperature in operating range, the A/C is "OFF," manual transmission is in neutral or automatic transmission in drive with proper Park/Neutral switch adjustment. A high or low coolant temperature, or A/C clutch engaged may signal the ECM to change the IAC counts.
- The minimum idle air rate is set at the factory with a stop screw. This setting allows enough air flow by the throttle valves to cause the IAC valve pintle to be positioned a calibrated number of steps (counts) from the seat during normal controlled idle operation. The IAC counts will be higher than normal on an engine with less than 500 miles, or an engine operating at high altitude or an engine with an accessory load such as the alternator, A/C, power steering or hydra-boost brakes activated.

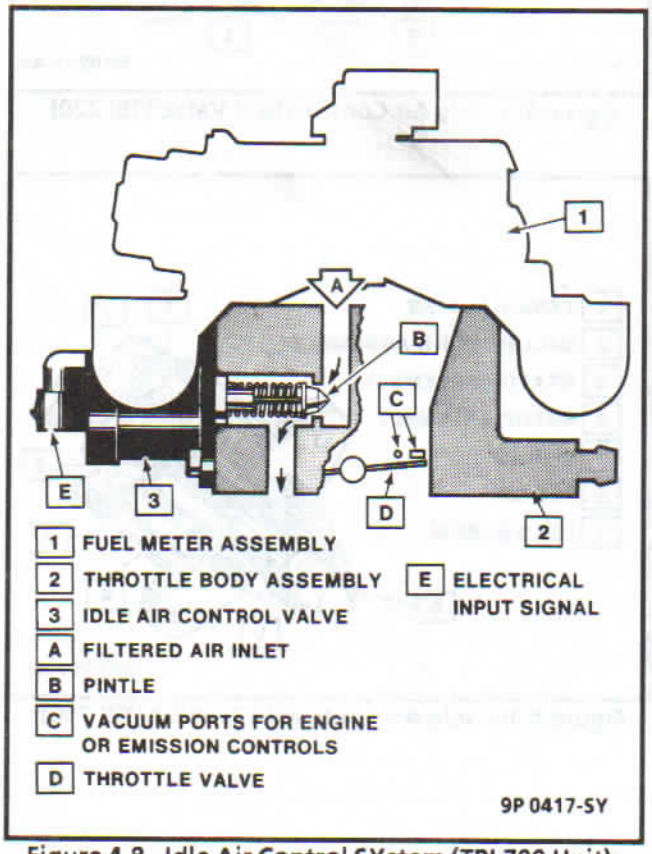

Figure 4-8 - Idle Air Control SYstem (TBI 700 Unit)

FUEL PUMP CIRCUIT

The fuel pump is a turbine type, low pressure electric pump, mounted in the fuel tank. Fuel is pumped at a positive pressure (above 62 kPa or 9 psi) from the fuel pump through the in-line filter to the pressure regulator in the TBI unit (see Figure 4-13). Excess fuel is returned to the fuel tank through the fuel return line.

The fuel pump is attached to the fuel gage sender assembly. A fuel strainer is attached to the fuel pump inlet line and prevents dirt particles from entering the fuel line and tends to separate water from the fuel.

On vehicles with two fuel tanks, there is an electric fuel pump and gage sending unit in each tank.

Vapor lock problems are reduced when using an electric pump because the fuel is pushed from the tank under pressure rather than being pulled under vacuum, a condition that produces vapor.

When the key is first turned "ON" without the engine running, the ECM turns a fuel pump relay "ON" for two seconds. This builds up the fuel pressure quickly. If the engine is not started within two seconds, the ECM shuts the fuel pump "OFF" and waits until the engine starts. As soon as the engine is cranked, the ECM turns the relay "ON" and runs the fuel pump.

On the 5.7L engine in the G van and all other 5.7L or 7.4L engines in vehicles over 8500 GVW, a fuel module will override the ECM and the fuel pump will run for approximately twenty seconds. The fuel module corrects a hot restart (vapor lock) during a high ambient condition.

When the engine is cranking or running, the ECM receives distributor reference pulses which in turn energize the fuel injectors.

As a backup system to the fuel pump relay, the fuel pump can also be turned on by an oil pressure switch. When the engine oil pressure reaches about 28 kPa (4psi), through cranking and the fuel pump relay does not complete the circuit, the oil pressure switch will close to complete the circuit to run the fuel pump.

An inoperative fuel pump relay can result in long cranking times, particularly if the engine is cold. The oil pressure switch will turn on the fuel pump as soon as oil pressure reaches about 28 kPa (4 psi).

FUEL FILTER

In-line Filter

CAUTION: To reduce the risk of fire and personal injury, it is necessary to allow fuel pressure to bleed off before servicing fuel system components. (See "Fuel System Pressure Relief Procedure.")

The in-line filter is located in the fuel feed line. It prevents dirt from entering the TBI unit.

In-Tank Filter

A woven plastic filter is located on the lower end of the fuel pickup tube in the fuel tank. The filter prevents dirt from entering the fuel line and, also, stops water, unless the filter becomes completely submerged in water. This filter is self-cleaning and normally requires no maintenance. Fuel stoppage, at this point, indicates that the fuel tank contains an abnormal amount of sediment or water; the tank should, therefore, be thoroughly cleaned.

FUEL AND VAPOR PIPES

The fuel feed and return pipes and hoses extended from the fuel pump and sender to the TBI unit. They are secured with clamps and are routed along the frame side member.

The vapor pipe and hoses extend from fuel pump and sender unit to the evaporative emission control vapor canister.

FUEL TANK

The fuel tank, at the rear of the underbody, is held in place by two metal straps. Anti-squeak pieces are used on top of the tank to reduce rattles.

Filler Neck

To help prevent refueling with leaded gasoline, the fuel filler neck on a gasoline engine vehicle has a built-in restrictor and deflector. The opening in the restrictor will only admit the smaller unleaded gas nozzle spout, which must be fully inserted to bypass the deflector. Attempted refueling with a leaded gas nozzle, or failure to fully insert the unleaded gas nozzle, will result in gasoline splashing back out of the filler neck.

Fuel Filler Cap

The fuel tank filler neck is equipped with a screw-type cap. The threaded part of the cap requires

If it is stuck closed, too little air will be allowed in the manifold, and idle speed will be too low. If it is stuck part way open, the idle may be rough, and will not respond to engine load changes.

The minimum air rate is set at the factory with a stop screw. The stop screw should not be adjusted unless a replacement throttle body assembly (that has not been preset at the factory) is installed or the minimum air rate does not meet specifications.

An incorrect readjustment with a high minimum air rate will cause the IAC valve pintle to constantly bottom on its seat and may result in early IAC valve failure. A minimum air rate that is too low may result in a no-start condition in cold weather, a stall after start or a stall during deceleration, because of poor air/fuel distribution through the throttle bore. Throttle valve sticking may also occur.

Vacuum leaks will cause the IAC valve pintle to be "stepped" closer to the seat or to be closed against its seat in an attempt to maintain controlled idle speed.

Throttle Position Sensor (TPS)

Refer to SECTION "3" for diagnosis of the throttle position sensor.

Driveability Symptoms

Refer to SECTION "2", for additional fuel control diagnosis.

FUEL PUMP CIRCUIT

Refer to system diagnosis in SECTION "3", for fuel pump diagnosis.

An inoperative fuel pump would cause a no start condition. A fuel pump which does not provide enough pressure can result in poor performance. (See "Fuel System Pressure Test" procedure).

Fuel Pump Relay

Refer to fuel pump relay circuit check in SECTION "3", for fuel pump relay diagnosis.

An inoperative fuel pump relay can result in long cranking times, particularly if the engine is cold. The oil pressure switch will turn on the fuel pump as soon as oil pressure reaches about 28 kPa (4psi).

Oil Pressure Switch

Refer to fuel pump relay circuit check in SECTION "3", for oil pressure switch diagnosis.

Fuel Module

Refer to the diagnosis section in SECTION "3" for fuel module check.

Fuel Filter

The diagnosis of the fuel filter is covered in SECTION "3", as part of the fuel system diagnosis.

A plugged fuel filter may cause a restricted fuel delivery, or a no start condition.

Fuel Pipes and Hoses

The diagnosis of gasoline odor may be a condition of a leaking fuel feed, or return pipe or hose. Fuel pipes that are pinched, plugged, or mis-routed may cause restricted fuel delivery.

Fuel Tank

The diagnosis of gasoline odor may be a condition of leaking fuel tank, filler neck, or filler cap.

A defective filler cap, a plugged or pinched vapor pipe can cause a collapsed fuel tank.

Loose mounting straps, or foreign material in tank, may be the cause of a rattle at the fuel tank.

ACCELERATOR CONTROL

Check for correct cable routing, or binding, and correct as necessary.

EVAPORATIVE EMISSION CONTROL

Refer to SECTION "5", for diagnosis of the Evaporative Emission Control System.

IDLE AIR CONTROL (IAC) SYSTEM CHECK

ALL ENGINES EXCEPT 2.5L

NOTE: IF A REPAIR HAS BEEN MADE REFER TO THE IAC RESET PROCEDURE ON THE FACING PAGE BEFORE RETESTING.

1. • IGNITION "OFF," CONNECT IAC DRIVER * TO IAC VALVE.
   • SET PARKING BRAKE, BLOCK WHEELS, A/C "OFF."
   • IDLE ENGINE IN PARK (A/T) OR NEUTRAL (M/T).
   • INSTALL "SCAN" TOOL AND DISPLAY RPM.
   • WITH IAC DRIVER, EXTEND AND RETRACT IAC VALVE.
   • ENGINE RPM SHOULD DECREASE AND INCREASE AS IAC IS CYCLED.

- RPM CHANGES
- NO RPM CHANGE
  - • CHECK IAC PASSAGES.
  - • IF OK, REPLACE IAC.

2. • RPM SHOULD CHANGE SMOOTHLY WITH EACH FLASH OF THE IAC DRIVER LIGHT FROM 700 RPM TO ABOUT 1500 RPM.
   DOES IT?

- YES
- NO
  - • CHECK IAC PASSAGES.
  - • IF OK, REPLACE IAC.

3. • INSTALL APPROPRIATE IAC NODE LIGHT * IN ECM HARNESS.
   • CYCLE IAC DRIVER AND NOTE LIGHTS.
   • BOTH LIGHTS SHOULD CYCLE RED AND GREEN BUT NEVER "OFF" AS RPM IS CHANGED OVER ITS RANGE.
   DO THEY?

- NO
  - IF CIRCUIT(S) DID NOT TEST GREEN AND RED, CHECK FOR:
    • FAULTY CONNECTOR TERMINAL CONTACTS.
    • OPEN CIRCUITS INCLUDING CONNECTIONS.
    • CIRCUITS SHORTED TO GROUND OR VOLTAGE.
    • FAULTY ECM CONNECTION OR ECM.
    REPAIR AS NECESSARY AND RETEST.
- YES
  - • USING THE OTHER CONNECTOR ON THE IAC DRIVER PIGTAIL, CHECK RESISTANCE ACROSS IAC COILS.
  - • SHOULD BE 40 TO 80 OHMS BETWEEN IAC TERMINALS "A" TO "B" AND "C" TO "D".
    - OK
      - • CHECK RESISTANCE BETWEEN IAC TERMINALS "B" AND "C" AND "A" AND "D".
      - • SHOULD BE INFINITE.
        - OK
          - IDLE AIR CONTROL VALVE AND CIRCUIT OK. REFER TO "DIAGNOSTIC AIDS" ON FACING PAGE.
        - NOT OK
          - REPLACE IAC VALVE AND RETEST.
    - NOT OK
      - REPLACE IAC VALVE AND RETEST.

* IAC DRIVER AND NODE LIGHT REQUIRED KIT
222-L FROM: CONCEPT TECHNOLOGY, INC.
J 37027 FROM: KENT-MOORE, INC.

CLEAR CODES, CONFIRM "CLOSED LOOP" OPERATION, NO "SERVICE ENGINE SOON" LIGHT, PERFORM IAC RESET PROCEDURE AND VERIFY CONTROLLED IDLE SPEED IS CORRECT.

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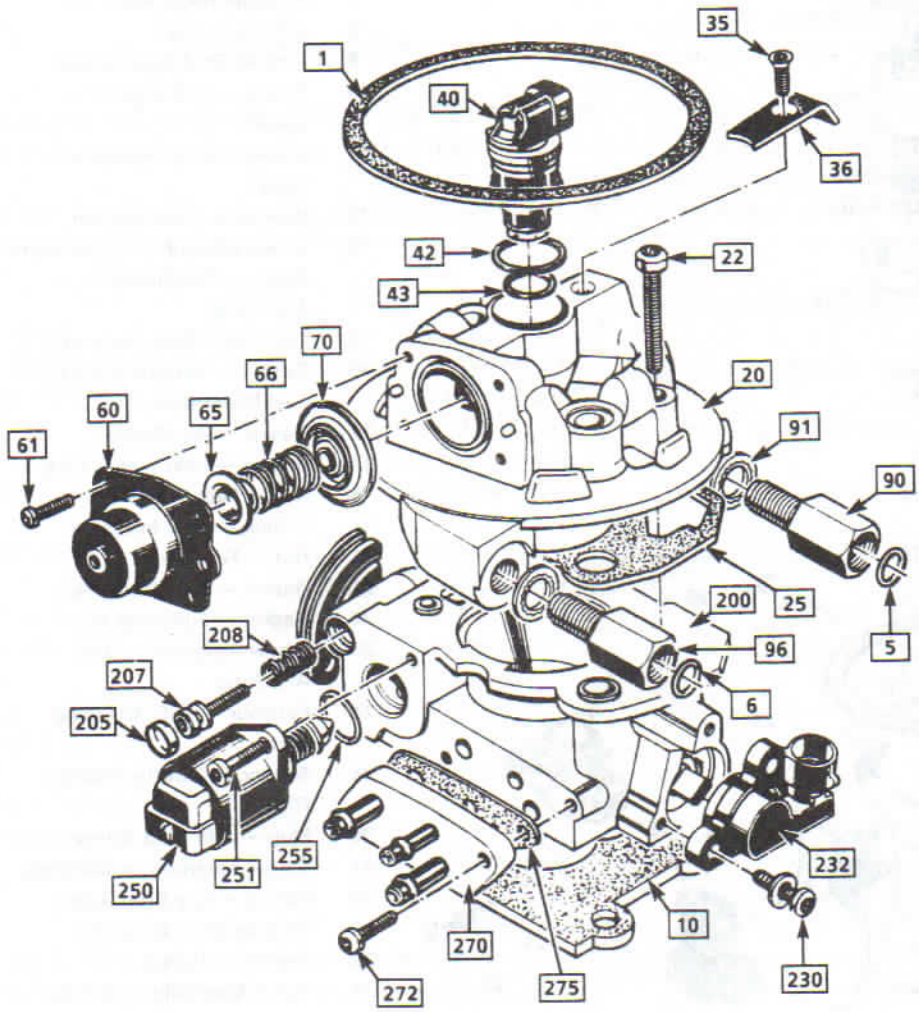
•8S 4652-6E



MODEL 700 TBI

- 1 Gasket – Air Cleaner
- 5 O – Ring – Fuel Line Inlet Nut
- 6 O – Ring – Fuel Line Outket Nut
- 10 Gasket – Flange
- 20 Fuel Meter Assembly
- 22 Screw – Fuel Meter Body Attaching
- 25 Gasket – Fuel Meter Body to Throttle Body
- 35 Screw – Injector Retainer
- 36 Retainer – Injector
- 40 Fuel Injector
- 42 O – Ring – Fuel Injector – Upper
- 43 O – Ring – Fuel Injector – Lower
- 60 Pressure Regulator Cover Assembly
- 61 Screw – Pressure Regulator Attaching
- 65 Seat – Spring
- 66 Spring – Pressure Regulator
- 70 Pressure Regulator Diaphragm Assembly
- 90 Nut – Fuel Inlet
- 91 Seal – Fuel Nut
- 96 Nut – Fuel Outlet
- 200 Throttle Body Assembly
- 205 Plug – Idle Stop Screw
- 207 Screw & Washer Assembly – Idle Stop
- 208 Spring – Idle Stop Screw
- 230 Sensor – Throttle Position (TPS)
- 232 Screw & Washer Assembly TPS Attaching
- 250 Idle Air Control Valve (IACV)
- 251 Screw – IACV Attaching
- 255 O – Ring – IACV
- 270 Tube Module Assembly
- 272 Screw – Tube Module Assembly Attaching
- 275 Gasket – Tube Module Assembly

9S 7769-6E

Figure 4-14 - Model 700 TBI Parts Identification (L-4 Engine)

Fuel System Pressure test

A fuel system pressure test is part of several of the Diagnostic Charts and Symptom checks. To perform this test, follow this procedure:

1. Turn engine "OFF" and relieve fuel pressure following above procedure.
2. Plug THERMAC vacuum port if required on TBI.
3. Uncouple fuel supply flexible hose in engine compartment. Install fuel pressure gage J 29658A/BT 8205 and adapter J 2968A-85 between steel line and flexible hose.
4. Tighten gage in line to ensure no leaks occur during testing.
5. Connect negative battery terminal.
6. Start engine and observe fuel pressure reading. It should be 62-90 kPa (9-13 psi). If not, refer to CHART A-6 in Section "3" diagnosis.
7. Relieve fuel pressure.
8. Remove fuel pressure gage.
9. Install new O-ring on fuel feed line.
10. Reinstall fuel line.
11. Reconnect negative battery terminal.
12. Start engine and check for fuel leaks.
13. Remove plug from vacuum port if installed, and install air cleaner with new gasket.

Cleaning and Inspection

All TBI component parts, with the exception of those noted below, should be cleaned in a cold immersion cleaner such as Carbon X (X-55) or equivalent.

NOTICE: The throttle position sensor (TPS), idle air control (IAC) valve, pressure regulator diaphragm assembly, fuel injectors or other components containing rubber, should NOT be placed in a solvent or cleaner bath. A chemical reaction will cause these parts to swell, harden or distort. Do not soak the throttle body with the above parts attached. If the throttle body assembly requires cleaning, soak time in the cleaner should be kept to a minimum. Some models have hidden throttle shaft dust seals that could lose their effectiveness by extended soaking.

1. Clean all metal parts thoroughly and blow dry with shop air. Be sure that all fuel and air passages are free of dirt or burrs.
2. Inspect mating casting surfaces for damage that could affect gasket sealing.

Thread Locking Compound

Service repair kits are supplied with a small vial of thread locking compound with directions for use. If material is not available, use Loctite 262, or GM part number 10522624, or equivalent.

NOTICE: In precoating screws, do not use a higher strength locking compound than recommended, since to do so could make removing the screw extremely difficult, or result in damaging the screw head.

MODEL 220 AND 700 TBI UNITS Replacement (Figures 4-16 through 4-20)

Remove or Disconnect

1. THERMAC hose from engine fitting (ST Series).
2. Air cleaner, adapter, and gaskets. Discard gasket.
3. Electrical connectors - idle air control valve, throttle position sensor, and fuel injectors. (On TBI 220 units, squeeze plastic tabs on injectors and pull straight up.)
4. Grommet with wires from throttle body.
5. Throttle linkage, return springs(s), transmission control cable, and cruise control (wherever applicable).
6. Vacuum hoses, noting positions of hoses.
7. Inlet and outlet fuel line nuts, using back up wrench J 29698-A or BT 8251-A.

CAUTION: **Refer to "Fuel Pressure Relief Procedure" (above), before disconnecting fuel lines.**

8. Fuel line O-rings from nuts and discard.
9. TBI mounting hardware.
10. TBI unit from intake manifold.

NOTICE: To prevent damage to the throttle valve, it is essential that the unit be placed on a holding fixture, before performing service.

11. TBI flange (Manifold mounting) gasket.

NOTICE: Stuff the manifold opening with a rag, to prevent material from entering the engine, and remove the old gasket material from surface of intake manifold.

Inspect

- Manifold bore for loose parts and foreign material.
- Intake manifold sealing surface for cleanliness.

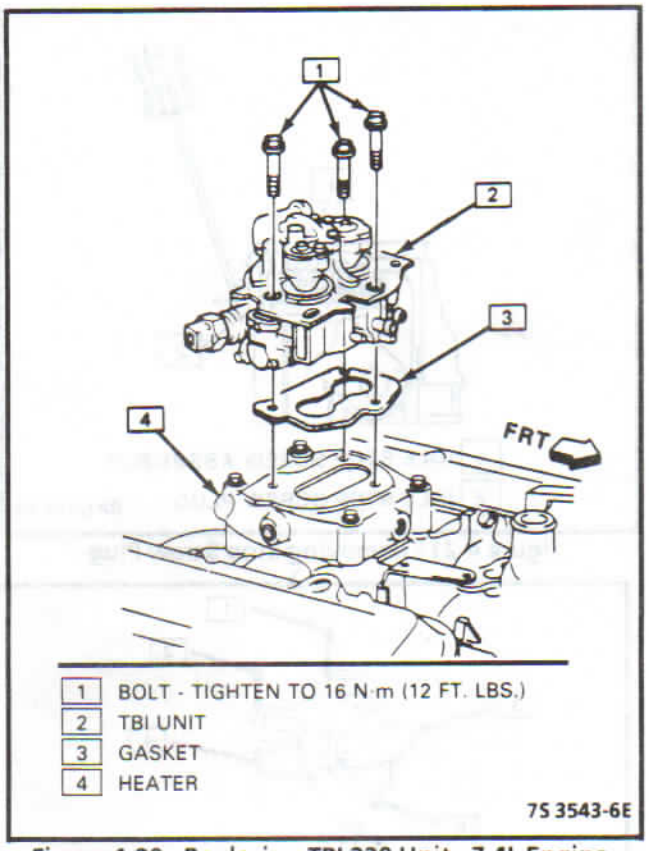


Figure 4-20 - Replacing TBI 220 Unit - 7.4L Engine

Install or Connect

1. New TBI flange (Manifold mounting) gasket.
2. TBI with mounting hardware.

Tighten

- Hardware on 2.5L engine, 17.0 N·m (12.5 lb. ft.).
- Hardware on 2.8L engine, 25.0 N·m (18.0 lb. ft.).
- Hardware on 4l.;3L, 5.0L, 5.7L, and 7.4L engines, 16.0 N·m (12.0 lb. ft.).

3. New O-rings on fuel line nuts.
4. Fuel line inlet and outlet nuts by hand.

Tighten

- Fuel line nut to 26.0 N·m (20.0 lb. ft). (Use back-up wrench to prevent TBI nuts from turning,)

5. Vacuum hoses and bracket.
6. Throttle linkage, return springs(s), transmission control cable, and cruise control (wherever applicable).
7. Grommet, with wire harness, to throttle body.
8. Electrical connectors, making sure connectors are fully seated and latched.
9. Check to see if accelerator pedal is free, by depressing pedal to the floor and releasing, while engine is "OFF."
10. With engine "OFF," and ignition "ON," check for leaks around fuel line nuts.
11. Air cleaner, adapter, and new gaskets.
12. Start engine and check again for fuel leaks.

Controlled Idle Speed Check

Before performing this check, there should be no codes displayed, idle air control system has been checked and ignition timing correct.

1. Set parking brake and block drive wheels.
2. Connect a "Scan" tool to the ALDL connector with tool in Open Mode.
3. Start engine and bring it to normal operating temperature.
4. Check for correct state of Park/Neutral switch on "Scan" tool.
5. Check specifications chart at the end of this section for controlled idle speed and IAC valve pintle position (counts).
6. If within specifications, the idle speed is being correctly controlled by the ECM.
7. If not within specifications, refer to "Rough, Unstable or Incorrect Idle, Stalling" in SECTION "2" and review information at the beginning of this check.

Minimum Idle Speed Check

1. Check controlled idle speed and perform idle air control system check first.
2. Set parking brake and block drive wheels.
3. Start engine and bring it to normal operating temperature (85°-100°C). Turn engine "OFF."
4. Remove air cleaner, adapter and gaskets. On ST Series vehicle, leave THERMAC hose connected. Check that the throttle lever is not being bound by the throttle, TV or cruise control cables.
5. With IAC valve connected, ground the diagnostic terminal (ALDL connector).
6. Turn "ON" ignition, do not start engine. Wait at least 10 seconds (this allows IAC valve pintle to extend and seat in throttle body).
7. With ignition "ON," engine stopped, test terminal still grounded, disconnect IAC valve electrical connector. (This disables IAC valve in seated position). Remove ground from diagnostic terminal. Care should be taken to pull the connector straight out so that the moment of electrical disconnect is the same for all the pins. Otherwise the pintle may move as the connector is removed.
8. Connect a "Scan" tool to the ALDL connector and place in open mode.
9. Start engine. With transmission in neutral, allow engine rpm to stabilize.
10. Check rpm against specifications at the end of this section. Disregard IAC counts on "Scan" tool with the IAC disconnected. If the engine has less than

Tighten

- Screw assemblies to 3.0 N·m (28.0 lb. in.).

4. Electrical connectors to fuel injectors.
5. With engine "OFF," and ignition "ON," check for leaks around gasket and fuel line couplings.

FUEL INJECTOR ASSEMBLY - TBI 220 (Figures 4-23 to 4-27)

Each fuel injector (see Figure 4-23) is serviced as a complete assembly only.

NOTICE: Use care in removing the fuel injectors to prevent damage to the electrical connector terminals, the injector filter, and the fuel nozzle. The fuel injector is serviced as a complete assembly only. Also, since the injectors are electrical components, they should not be immersed in any type of liquid solvent or cleaner as damage may occur.

Remove or Disconnect

1. Electrical connectors to fuel injectors. (Squeeze plastic tabs and pull straight up.)
2. Fuel meter cover assembly, following above procedure.
3. With fuel meter cover gasket in place to prevent damage to casting, use a screwdriver and fulcrum to carefully lift out each injector (Figure 4-24).
4. Lower (small) O-rings from nozzle of injectors and discard.
5. Fuel meter cover gasket and discard.
6. Upper (large) O-rings and steel backup washers from top of fuel injector cavity and discard.

Inspect

- Fuel injector filter for evidence of dirt and contamination. If present, check for presence of dirt in fuel lines and fuel tank.

Important

- The TBI unit installed on a 4.3L V6 engine in a C or K series truck has two DIFFERENT fuel injectors (with two DIFFERENT flow rates). Injectors having part number 5235134 (color coded Orange and Green) should be installed on the throttle lever side. Those with part number 5235342 (Pink and Brown) go on the TPS side (Figure 4-25).

Be sure to replace the injector with one having an identical part number. Injectors from other models can also fit in TBI model 220, but are calibrated for different flow rates. (See Figure 4-26 for part number location).

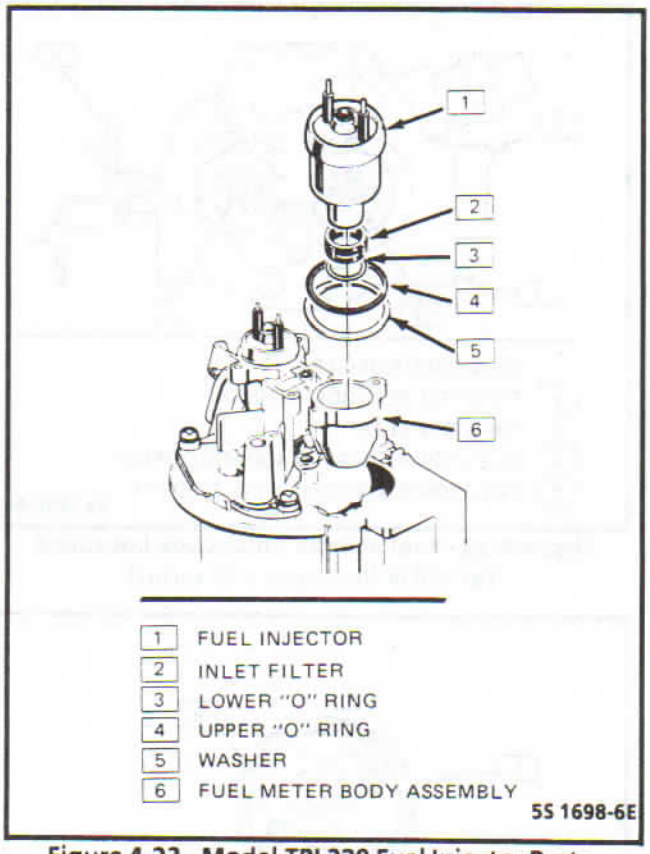


Figure 4-23 - Model TBI 220 Fuel Injector Parts

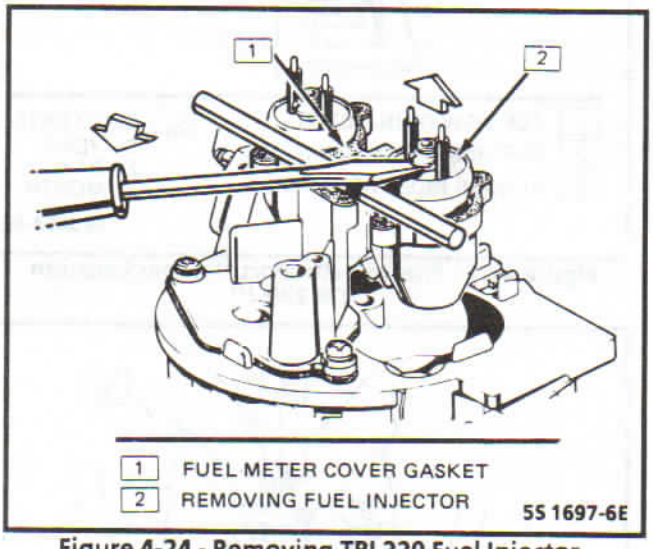


Figure 4-24 - Removing TBI 220 Fuel Injector

Install or Connect

1. Lubricate new lower (small) O-rings with automatic transmission fluid and push on nozzle end of injector until it presses against injector fuel filter.
2. Steel injector backup washer in counterbore of fuel meter body.

Important

- Be sure to install the injectors in their proper location. The Orange and Green color coded injector (part number 5235134) should be installed on the throttle lever side. The Pink and Brown color coded one (part number 5235342) goes on the TPS side (Figure 4-25).

5. Fuel meter cover gasket.
6. Fuel Meter cover, following above procedure.
7. Electrical connectors to fuel injectors.
8. With engine "OFF" and ignition "ON," check for fuel leaks.

FUEL METER BODY ASSEMBLY - TBI 220 (Figure 4-28)

Remove or Disconnect

1. Electrical connections to fuel injectors. (Squeeze plastic tabs and pull straight up.)
2. Fuel meter cover assembly, (See previous procedure).
3. Fuel meter cover assembly, following above procedure.
4. Fuel injectors, following above procedure.
5. Fuel inlet and return lines. Discard O-rings.
6. Fuel inlet and outlet nuts and gaskets from the fuel meter body assembly. Discard gaskets.

Important

- Note locations of nuts, for proper reassembly later. Inlet nut has a larger passage than outlet nut.

7. Fuel meter body to throttle body attaching screw assemblies.
8. Fuel meter body assembly from throttle body assembly.
9. Throttle body to fuel meter body gasket and discard.

Install or Connect

1. New throttle body to fuel meter body gasket. Match cut-out portions in gasket with openings in throttle body.
2. Fuel meter body assembly on throttle body assembly.
3. Fuel meter body-to-throttle body attaching screw assemblies, precoated with appropriate locking compound.

Tighten

- Screw assemblies to 4.0 N·m (30.0 lb. in.)

4. Fuel inlet and outlet nuts with new gaskets to fuel meter body assembly.

Tighten

- Inlet nut to 40.0N·m (30.0 lb. ft).
- Outlet nut to 29.0 N·m (21.0 lb. ft).

5. Fuel inlet and return lines and new O-rings. (Use back-up wrench J 29698-A or BT 8251-A to keep TBI nuts from turning.)

Tighten

- Fuel lines to 23N·m (17 lb. ft.).

6. Injectors, with new upper and lower O-rings in fuel meter body assembly.
7. Fuel meter cover gasket, fuel meter outlet gasket, and pressure regulator seal.
8. Fuel meter cover assembly.
9. Long and short fuel meter cover attaching screw assemblies, coated with appropriate thread locking compound.

Tighten

- Screw assemblies to 3.0 N·m (27.0 lb. in.)

10. Electrical connectors to fuel injectors.
11. With engine "OFF," and ignition "ON," check for leaks around fuel meter body, gasket and around fuel line nuts.

THROTTLE POSITION SENSOR (TPS)-TBI 220 (Figure 4-29)

Important

- On 2.8L 9V-6) engines, the TPS is adjustable, and is supplied with attaching screw retainers. On all other engines, it is non-adjustable, without retainers. In addition, on 2.8L (V-6) and 7.4 (V8) engines, the TPS has a horizontal electrical connector; whereas, on all other engines, the connector is a vertical one. Since these TPS configurations can be mounted interchangeable, be sure to order the correct one for your engine with the identical part number of the one being replaced.

Remove or Disconnect

1. Electrical connector.
2. Two TPS attaching screw assemblies and retainers, (if applicable).
3. TPS from throttle body assembly.

NOTICE: The TPS is an electrical component and must not be soaked in any liquid cleaner or solvent, as damage may result.

Install or Connect

1. TPS on throttle body assembly, while lining up TPS lever with TPS drive lever on throttle body.
2. Two TPS attaching screw assemblies.

Tighten

- Screw assemblies to 2.0 N·m (18.0 lb. in).

3. Electrical connector.

Measure (If Installing a New IAC Valve) (Figure C2-24)

- Distance between tip of IAC valve pintle and mounting flange.
  - If greater than 28mm, use finger pressure to slowly retract the pintle. The force required to retract the pintle of a *new* valve will not cause damage to the valve.

Important

- No physical adjustment of the IAC valve assembly is required after installation. The IAC valve pintle is reset by turning the ignition "ON" for ten seconds and then "OFF." The ECM then resets the pintle to the correct position. Proper idle regulation should result. No physical adjustment of the IAC valve assembly is required after installation. The IAC valve pintle is reset by the ECM, which causes the valve pintle to seat in the throttle body. The ECM then has a reset procedure to set the correct pintle position. Proper idle regulation should result.

Install or Connect

1. IAC valve into throttle body as follows:
   - Thread-mounted valve - Install with new gasket.
   - Flange-mounted valve - Install with new lubricated O-ring, using attaching screw assemblies.

NOTICE: New IAC valves have been reset at the factory and should be installed in the throttle body in an "as is" condition, without any adjustment.

Tighten

- Thread-mounted IAC valve assembly to 18.0 N·m (13.0 lb. ft.) with 32 mm (1 - $\frac{1}{4}$") wrench.
- Flange-mounted attaching screw assemblies to 3.2 N·m (28.0 lb. in.)

2. Electrical connector to IAC valve.
3. Reset IAC valve pintle position:
   a. Turn ignition "ON" for five seconds.
   b. Turn ignition "OFF" for ten seconds.
   c. Start engine and check for proper idle operation.

THROTTLE BODY ASSEMBLY-TBI 220

Remove or Disconnect

1. TBI unit, as described above.
2. Fuel meter body-to-throttle body attaching screw assemblies.
3. Fuel meter body assembly.
4. Throttle body-to-fuel meter body gasket and discard.

Disassemble

- TPS from old throttle body, according to previous instructions, for reuse on new throttle body. (The IAC valve does not have to be removed, since a new one comes with replacement throttle body.)

Assemble

- TPS onto replacement throttle body assembly, according to previous instructions.

Install or Connect

1. New throttle body-to-fuel meter body gasket.
2. Fuel meter body assembly on throttle body assembly.
3. Fuel meter body-throttle attaching screw assemblies that have been coated with locking compound.

Tighten

- Attaching screw assemblies to 4.0 N·m (3.50 lb. in.)

4. TBI unit onto intake manifold, as previously described.

TBI 700 COMPONENT SERVICE

FUEL INJECTOR ASSEMBLY-TBI 700 (Figures 4-32 through 4-34)

The fuel injector (see Figure 4-32) is serviced only as a complete assembly.

NOTICE: Use care in removing injector, to prevent damage to the electrical connector on top of the injector, and nozzle. Also, because the fuel injector is an electrical component, it should not be immersed in any type of liquid solvent or cleaner, as damage may occur.

Remove or Disconnect

1. Electrical connector to fuel injector.
2. Injector retainer screw and retainer.
3. Using a fulcrum, place a screwdriver blade under ridge opposite connector end and carefully pry injector out (see Figure 4-33).
4. Remove upper and lower O-rings from injector and in fuel injector cavity and discard.

Important

- Be sure the electrical connector end on the injector is parallel to casting support rib and facing in the general direction of the cut-out in the fuel meter body for the wire grommet.

3. Injector retainer, using appropriate thread locking compound on retainer attaching screw.
4. Electrical connect or to fuel injector.

Tighten

- Injector retainer attaching screw to 3.0 N·m (27.0 lb. in.).

5. With engine "OFF" and ignition "ON," check for fuel leaks.

PRESSURE REGULATOR ASSEMBLY (Figure 4-35)

NOTICE: To prevent leaks, the pressure regulator diaphragm assembly must be replaced whenever the cover is removed.

Remove or Disconnect

1. Four pressure regulator attaching screws, while keeping pressure regulator compressed.

CAUTION: **The pressure regulator contains a large spring under heavy compression. Use care when removing the screws to prevent personal injury.**

2. Pressure regulator cover assembly.
3. Pressure regulator spring.
4. Spring seat.
5. Pressure regulator diaphragm assembly.

Inspect

- Pressure regulator seat in fuel meter body cavity for pitting, nicks, or irregularities. (Use magnifying glass if necessary.) If any of above is present, the whole fuel body casting must be replaced.

Install or Connect

1. New pressure regulator diaphragm assembly, making sure it is seated in groove in fuel meter body.
2. Regulator spring seat and spring into cover assembly.
3. Cover assembly over diaphragm, while aligning mounting holes.

NOTICE: Use care while installing the pressure regulator to prevent misalignment of diaphragm and possible leaks.

4. Four screw assemblies that have been coated with appropriate thread locking compound, while maintaining pressure on regulator spring.

Tighten

- Attaching screw assemblies to 2.5 N·m (22.0 lb. in.).

5. With engine "OFF" and ignition "ON," check for fuel leaks.

FUEL METER ASSEMBLY (Figure 4-14)

Remove or Disconnect

1. Electrical connector from fuel injector.
2. Grommet with wires from fuel meter assembly.
3. Inlet and outlet fuel line nuts, using backup wrench J 29698-A, or BT 8251-A.
4. Fuel line O-rings from nuts and discard.
5. TBI mounting hardware.
6. Two fuel meter body attaching screws.
7. Fuel meter assembly from throttle body assembly.
8. Fuel meter body to throttle body gasket and discard.

Install or Connect

1. New fuel meter body to throttle body gasket. Match cut-out portions of gasket with openings in throttle body assembly.
2. Fuel meter assembly.
3. Two fuel meter body attaching screws that have been coated with appropriate locking compound.

Tighten

- Attaching screws to 6.0 N·m (53 lb. in.).

4. Throttle body injection unit mounting hardware.

Tighten

- Mounting hardware to 17 N·m (12 lb. ft.).

5. New O-rings on fuel line nuts.
6. Fuel line inlet and outlet nuts by hand.

Tighten

- Inlet and outlet nuts to 27 N·m (20 lb. ft.). (Use back-up wrench J 29698-A, or BT 8251-A to keep TBI nuts from turning.)

7. Grommet with wires to fuel meter assembly.
8. Electrical connector to fuel injector, making sure it is fully seated and latched.
9. With engine "OFF" and ignition "ON," check for leaks around fuel line nuts.

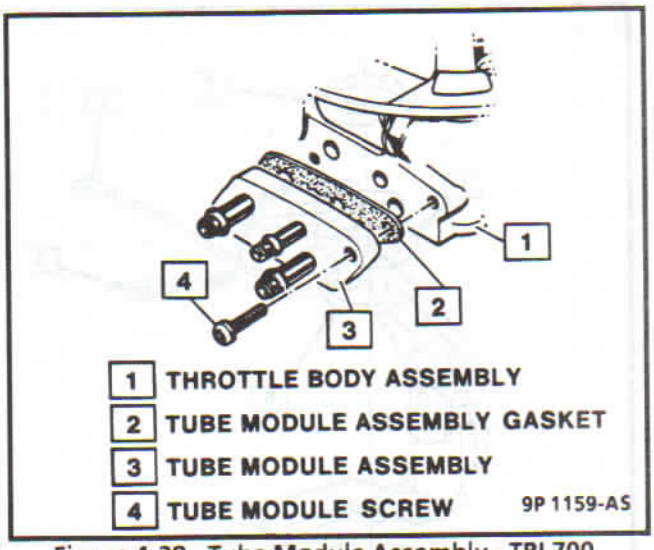


Figure 4-38 - Tube Module Assembly - TBI 700

Important

- No physical adjustment of the IAC valve assembly is required after installation. The IAC valve pintle is reset by the ECM. which causes the valve pintle to seat in the throttle body. The ECM then has a reset procedure to set the correct pintle position. Proper idle regulation should result.

Measure (If Installing a New IAC Valve) (Figure C2-18)

- Distance between tip of IAC valve pintle and mounting surface.
  - If greater than 28mm, use finger pressure to slowly retract the pintle. The force required to retract the pintle of a new valve will not cause damage to the valve. This may be done electrically using an IAC/ISC Motor Tester (J 37027 or BT 8256K) on valves that have been removed during service.

Install or Connect

1. Lubricate new O-ring with transmission fluid and install on IAC valve.
2. IAC valve to throttle body.
3. IAC valve attaching screw assemblies that have been coated with appropriate thread locking compound.

Tighten

- Screw assemblies to 3.2 N·m (28.0 lb. in.).

4. Electrical connector to idle air control valve.
5. Reset IAC valve pintle position.
   a. Depress accelerator pedal slightly.
   b. Start and run engine for five seconds.
   c. Turn ignition "OFF" for ten seconds.
   d. Restart engine and check for proper idle operation.

TUBE MODULE ASSEMBLY (Figure 4-39)

Remove or Disconnect

1. Tube module assembly attaching screws.
2. Tube module assembly.
3. Tube module assembly gasket and discard.

Clean

- Old gasket material from surface of throttle body assembly to insure proper seal of new gasket.

Install or Connect

1. New tube module assembly gasket.
2. Tube module assembly.
3. Tube module assembly attaching screws. That have been coated with appropriate thread locking compound.

Tighten

- Screw assemblies to 3.0 N·m (28.0 lb. in.).

THROTTLE BODY ASSEMBLY (Figure 4-14)

NOTICE: Procedures related to replacement of the individual components below have been described previously and should be followed, or damage could occur.

Remove or Disconnect

1. Throttle body injection (TBI) unit, as described below.
2. Fuel meter body-to-throttle body attaching screw and washer assemblies.
3. Fuel meter assembly.
4. Fuel meter body to throttle body gasket and discard.

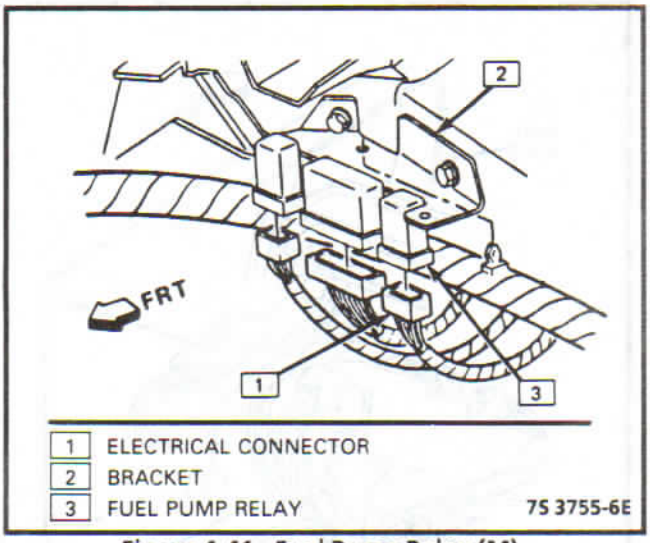


Figure 4-41 - Fuel Pump Relay (M)

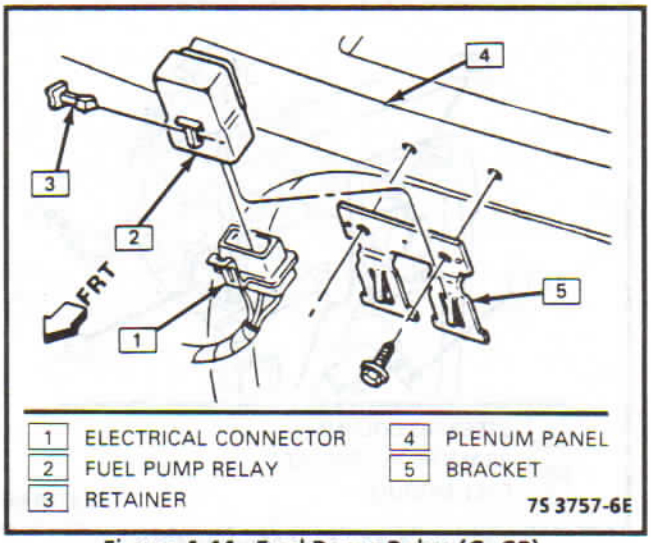


Figure 4-44 - Fuel Pump Relay (G, GP)

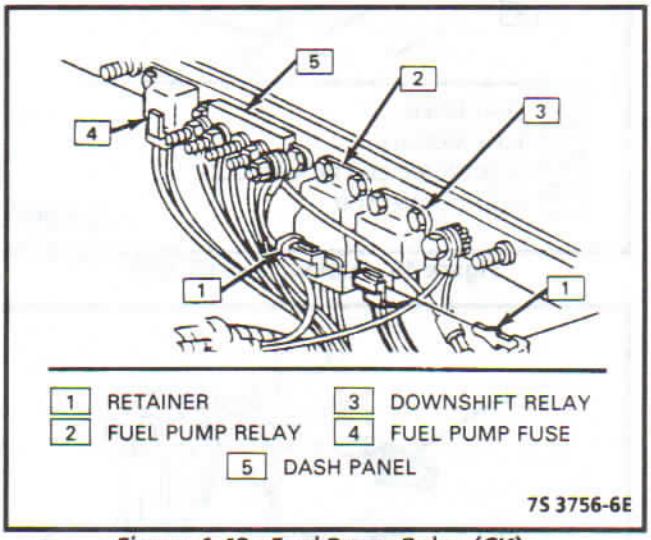


Figure 4-42 - Fuel Pump Relay (CK)

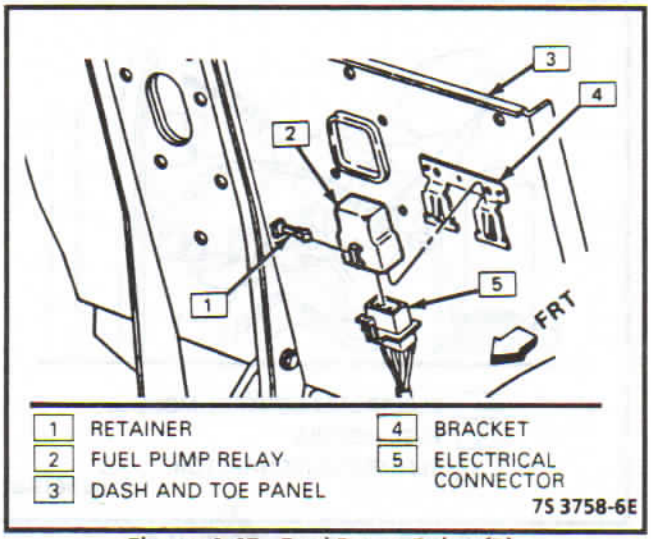


Figure 4-45 - Fuel Pump Relay (P)

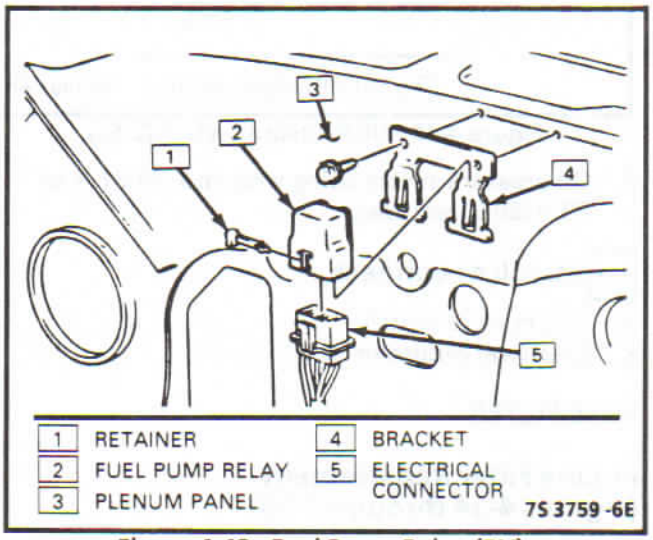


Figure 4-43 - Fuel Pump Relay (RV)

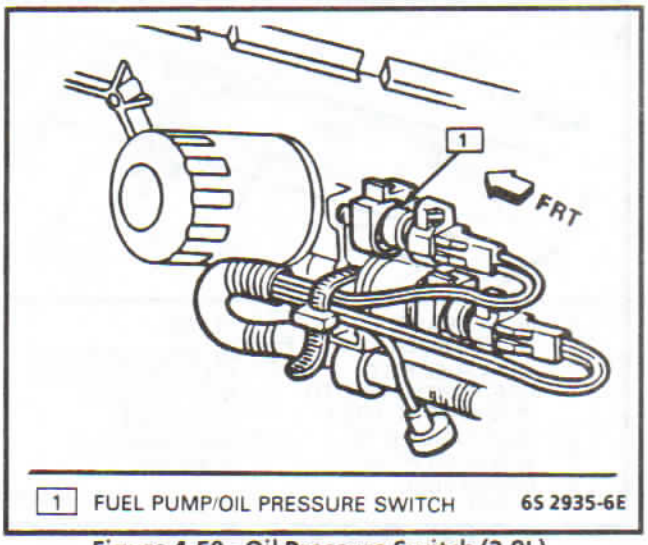
FUEL PUMP RELAY (Figure 4-40 through 4-45)

Remove or Disconnect

1. Protective cover (CK).
2. Retainer, if installed.
3. Electrical connector.
4. Relay by depressing bracket clip at rear of relay, or removing bolts from retaining bracket.

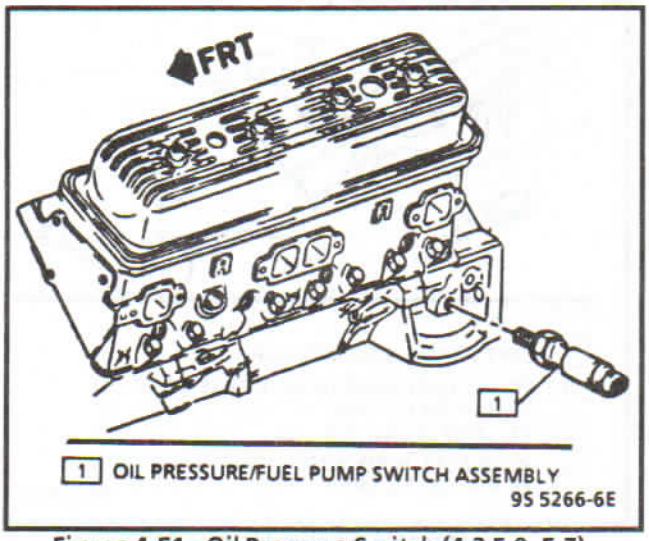
Install or connect

1. Relay.
2. Electrical connector.
3. Retainer.
4. Protective cover (CK).



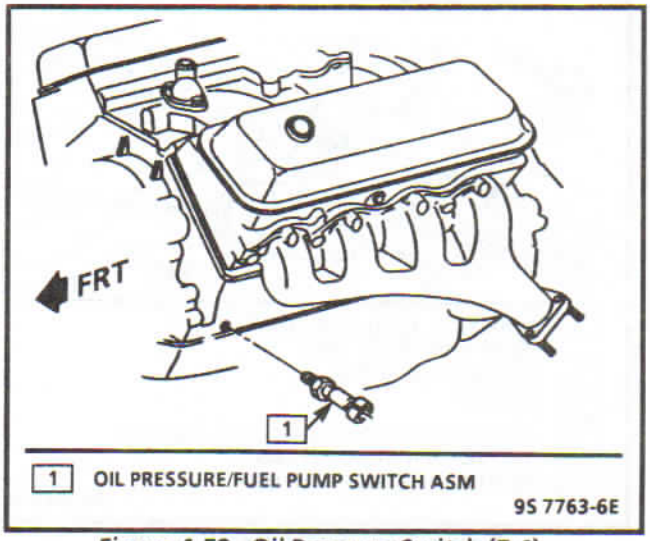
1 FUEL PUMP/OIL PRESSURE SWITCH 6S 2935-6E

Figure 4-50 - Oil Pressure Switch (2.8L)



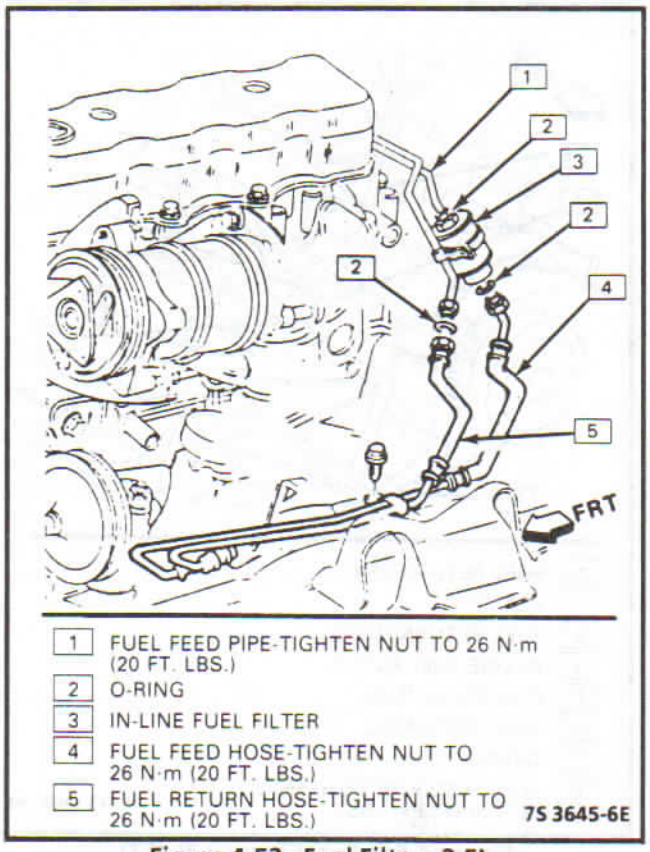
1 OIL PRESSURE/FUEL PUMP SWITCH ASSEMBLY 9S 5266-6E

Figure 4-51 - Oil Pressure Switch (4.3 5.0, 5.7)



1 OIL PRESSURE/FUEL PUMP SWITCH ASM 9S 7763-6E

Figure 4-52 - Oil Pressure Switch (7.4)



1 FUEL FEED PIPE-TIGHTEN NUT TO 26 N·m (20 FT. LBS.)
2 O-RING
3 IN-LINE FUEL FILTER
4 FUEL FEED HOSE-TIGHTEN NUT TO 26 N·m (20 FT. LBS.)
5 FUEL RETURN HOSE-TIGHTEN NUT TO 26 N·m (20 FT. LBS.) 7S 3645-6E

Figure 4-53 - Fuel Filter - 2.5L

2. Fuel feed nuts.
3. Clamp bolt.
4. Filter and clamp.
5. Clamp from filter.

Install or connect

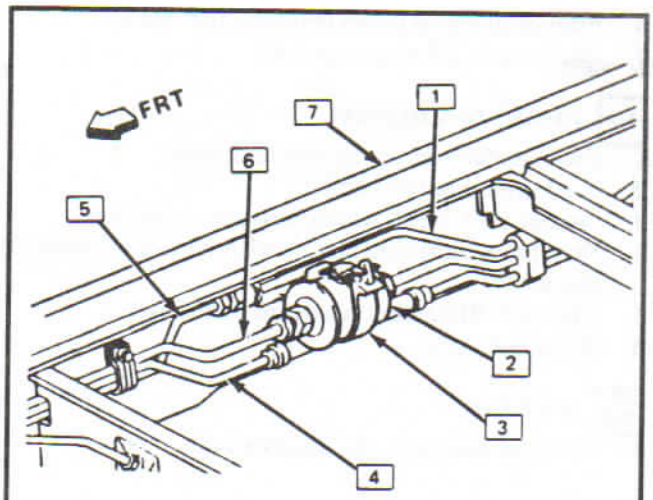
1. Clamp to filter.
2. Clamp bolt.
3. Fuel feed nuts.
4. Fuel filler cap.

In-Tank Filter Replacement

Refer to fuel pump replacement, if the in-tank filter required service.

AUXILIARY FUEL TANK CONTROL

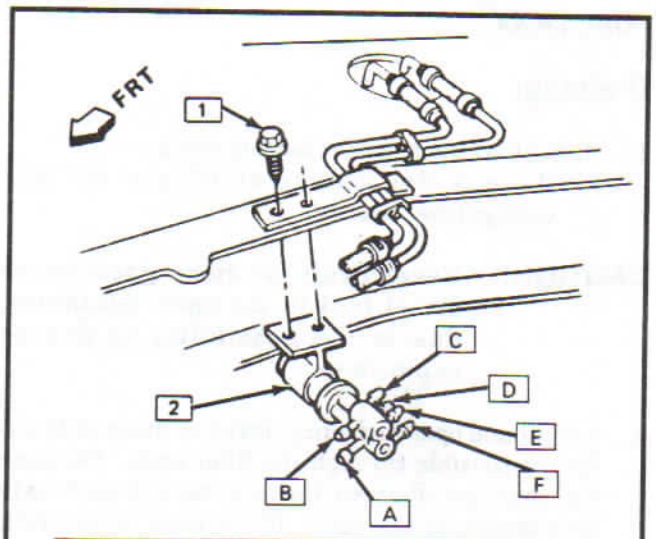
The auxiliary fuel tank is controlled by a selector valve and meter switch and selector switch. The diagnosis of these components are part of the fuel pump circuit diagnosis and can be found in SECTION "3".



1 REAR FUEL FEED PIPE-TIGHTEN NUT TO 26 N·m (20 FT. LBS.)
2 IN-LINE FUEL FILTER
3 BRACKET
4 VAPOR PIPE
5 FUEL RETURN PIPE
6 INTERMEDIATE FUEL FEED PIPE-TIGHTEN NUT TO 26 N·m (20 FT. LBS.)
7 RIGHT FRAME SIDE MEMBER

7S 3648-6E

Figure 4-59 - Fuel Filter (G)



1 BOLT — TIGHTEN TO 18 N·m (12 LBS. FT.)
2 FUEL TANK SELECTOR VALVE
A FUEL FEED
B FUEL RETURN
C RH FUEL RETURN — PINK
D RH FUEL FEED — ORANGE
E LH FUEL RETURN — BLUE
F LH FUEL FEED — YELLOW

7S 3843-6E

Figure 4-60 - Selector Valve - (RV)

Selector Valve and Meter Switch (Figure 4-60)

Remove or Disconnect

1. Battery.
2. Hose shield, if required.
3. Electrical connector from valve and switch.
4. Fuel feed and return hose. Note position and color of hoses.
5. Selector valve and meter switch from frame.

Install and Connect

1. Selector valve and meter switch.
2. Fuel feed and return hoses.
3. Electrical connector.
4. Hose shield.
5. Battery.

FUEL HOSE AND PIPE ASSEMBLIES

Materials

Fuel Lines - These are welded steel tubes, meeting GM Specifications 124-M, or its equivalent. The fuel feed line is 3/8" diameter and the fuel return line is 5/16" diameter. Do not use copper or aluminum tubing to replace steel tubing. Those materials do not have satisfactory durability to withstand normal vehicle vibration.

Coupled hose - These are not to be repaired and are replaced only as an assembly.

Uncoupled Hose - Use only reinforced furl resistant hose, made of "Fluoroelastomer" material. Do not use a hose within 4 inches (100 mm) of any part of the exhaust system, or within 10 inches (254 mm) of the catalytic converter. The hose's inside diameter must match the outside diameter of the steel tubing.

Clamps - These are stainless steel, screw bank-type clamps, #2494772, or equivalent.

Fuel Line Repair

1. Cut a piece of fuel hose 4 inches (100 mm) longer than the section of line to be removed. If more than 6 inches (152 mm) is to be removed, use a combination of steel pipe and hose. The hose length should not be more than 10 inches total.
2. Cut a section of the pipe to be replaced with a tube cutter. Use the first step of a double flaring tool to form a bead on the ends of the pipe and, also, on the new section of pipe, if used.
3. Slide the hose clamps onto the pipe and push the hose 2 inches (51 mm) onto each portion of the fuel pipe. Tighten a clamp on each side of the repair.
4. Secure fuel line to the frame.

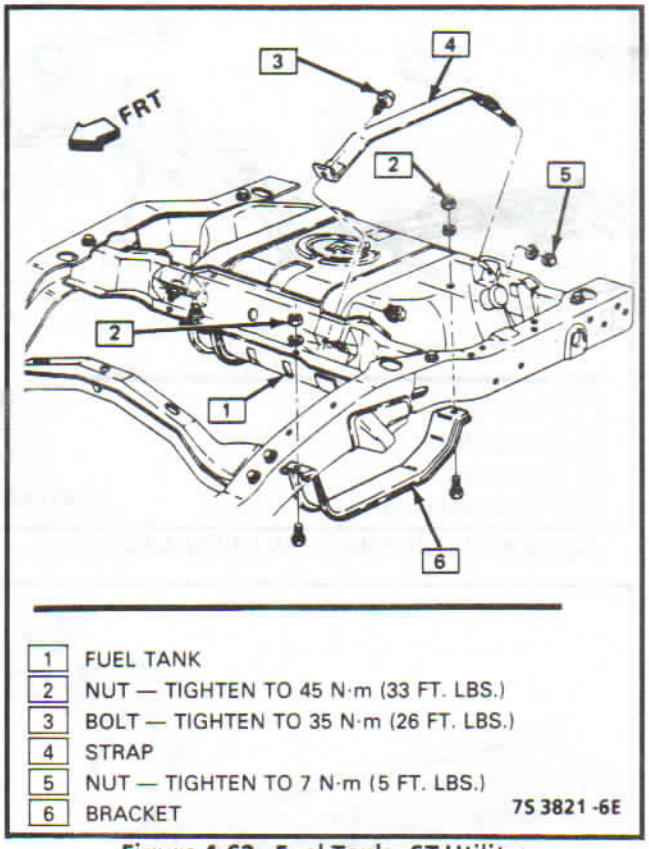


Figure 4-62 - Fuel Tank - ST Utility

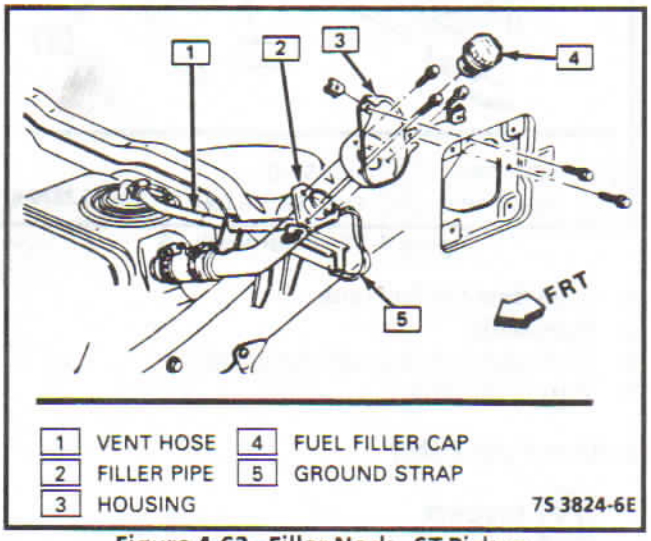


Figure 4-63 - Filler Neck - ST Pickup

- Refer to the emulsifying agent specifications for the mixture ratio.
- Agitate the mixture for ten minutes.
- Drain the tank completely.
- Fill the tank with water, until it overflows.
- Completely flush out any remaining mixture.
- Drain the fuel tank.
- Use an explosion meter (if available) to check for a negative reading.
- Perform the required service work.

4. Repair fuel tank.

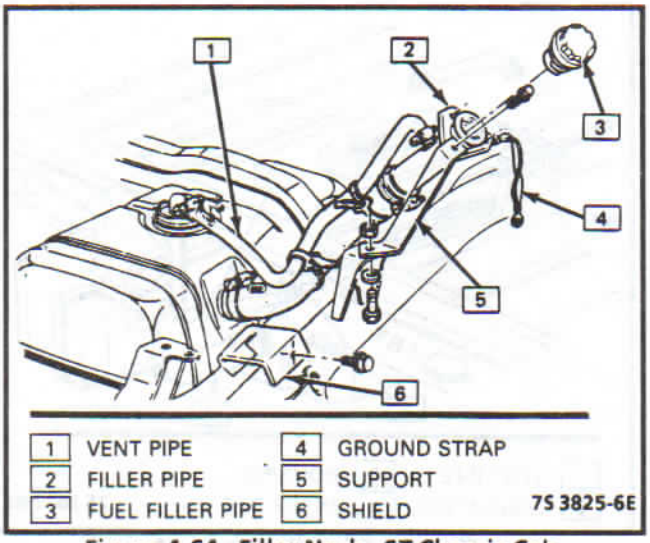


Figure 4-64 - Filler Neck - ST Chassis Cab

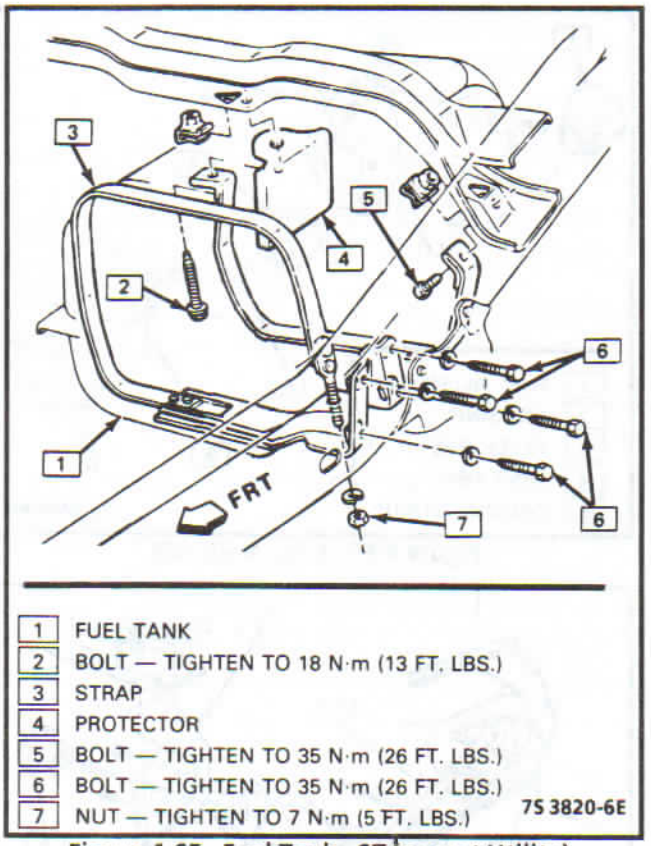


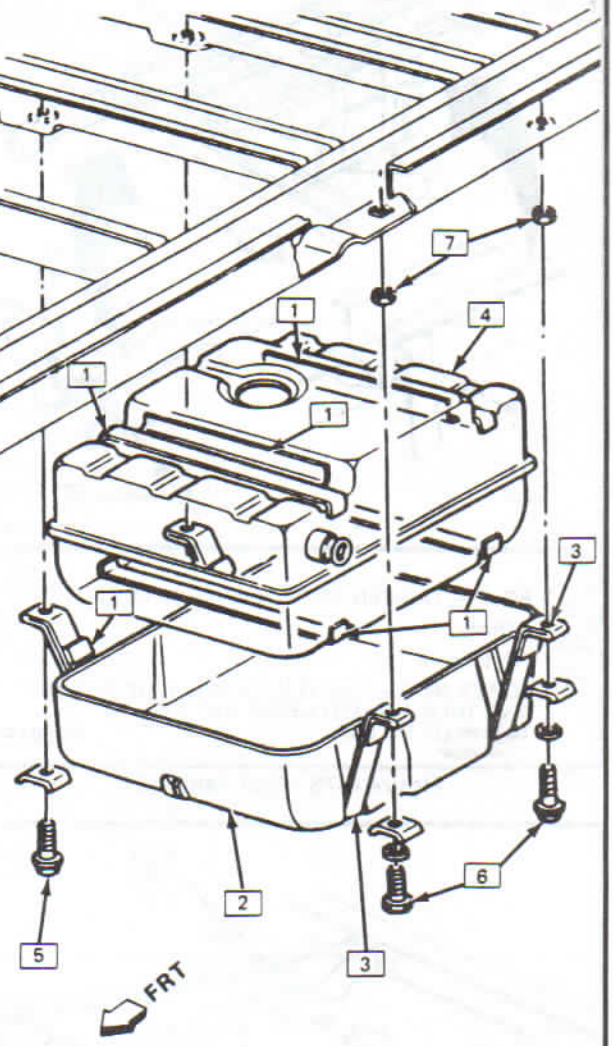
Figure 4-65 - Fuel Tank - ST (except Utility)

5. Fuel gage sending and pump unit.
6. Fuel tank into vehicle.

FUEL SYSTEM CLEANING

Remove or Disconnect

1. Negative battery cable.
2. Engine harness connector on the distributor.
   - Have a dry chemical (Class B) fire extinguisher near the work area.
3. Fuel system pressure (2.5L engine only)



COMPLETELY INSTALL ONE STRAP PRIOR TO INSTALLATION OF THE SECOND STRAP, HOWEVER, THE TANK MUST REMAIN SUPPORTED UNTIL ALL FOUR BOLTS ARE TORQUED TO SPECIFICATIONS.

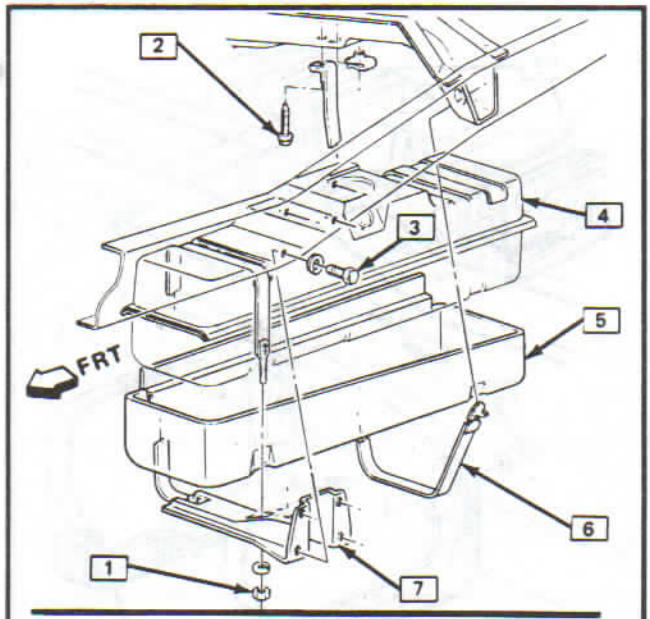
1. INSULATOR
2. LOWER SHIELD
3. STRAP
4. FUEL TANK

INSTALLATION SEQUENCE

5. BOLT — TIGHTEN TO 35 N·m (26 FT. LBS.)
6. BOLT — TIGHTEN TO 3.4 N·m (30 IN. LBS.)
7. NUT — TIGHTEN TO 35 N·m (26 FT. LBS.)

7S 3819-6E

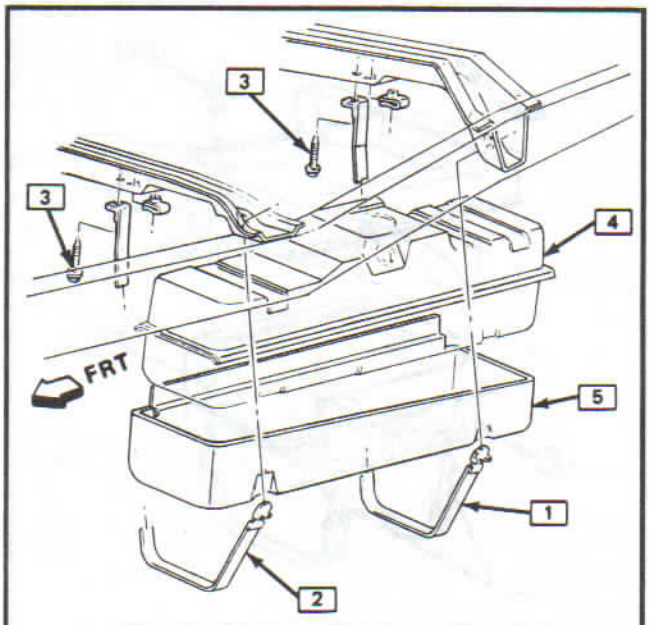
Figure 4-71 - Fuel Tank - M



1. NUT — TIGHTEN TO 12 N·m (10 FT. LBS.)
2. BOLT — TIGHTEN TO 12 N·m (10 FT. LBS.)
3. BOLT — TIGHTEN TO 33 N·m (24 FT. LBS.)
4. FUEL TANK
5. SHIELD
6. REAR STRAP
7. FRONT STRAP

7S 3829-6E

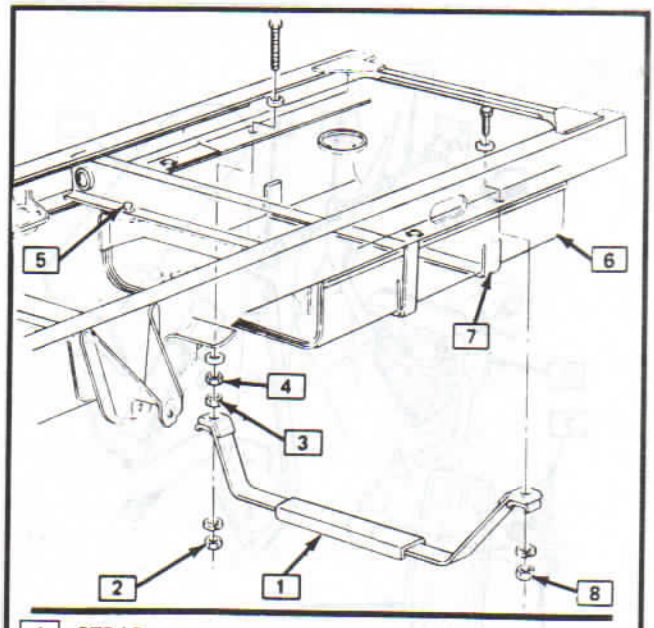
Figure 4-72 - Fuel Tank - CK Chassis Cab



1. REAR STRAP
2. FRONT STRAP
3. BOLT — TIGHTEN TO 12 N·m (10 FT. LBS.)
4. FUEL TANK
5. SHIELD

7S 3830-6E

Figure 4-73 - Fuel Tank - CK (except Chassis Cab)



1 STRAP
2 LOWER NUT — TIGHTEN TO 12 N·m (10 FT. LBS.), THEN TIGHTEN MIDDLE NUT 3 TO 58 N·m (42 FT. LBS.) AND THEN TIGHTEN LOWER AND UPPER NUT 4 TO 58 N·m (42 FT. LBS.)
5 NUT — TIGHTEN TO 58 N·m (42 FT. LBS.)
6 FUEL TANK
7 INSULATOR
8 NUT — TIGHTEN TO 58 N·m (42 FT. LBS.)
7S 3841-6E

Figure 4-78 - Fuel Tank - P (42)

NOTICE: Care should be taken not to fold over or twist the strainer, when installing the sending unit, as this will restrict fuel flow.

2. Fuel gage sender and pump unit, with a new seal into the fuel tank.
3. Fuel tank.
4. Disconnect the fuel feed line at the front of the vehicle.
5. Hose to the fuel feed line at the front of the vehicle and insert the other end of the hose into a 3.8 liter (one gallon) fuel can.
6. Negative battery cable.
7. Twenty three liters (six gallons) of clean fuel into the fuel tank.
8. Energize fuel pump relay, to operate the fuel pump, until two liters (1/2 gallon) of fuel flows into the fuel can. this will purge the fuel pump.
9. Fuel line, at the front of the vehicle.
10. Engine harness connector to the distributor.
    - Check all connections, for leaks, and tighten all hose clamps.

Leak Test

If fuel is leaking, from the tank, the tank should be replaced. Make sure that the fuel lines are not leaking onto the tank.

1. Remove the fuel tank.
2. Drain the tank.
3. Plug all of the outlets.
4. Apply 7 to 10 kPa (1 to 1½ psi) air pressure through the vent tube.
5. Test for leaks, with a soap solution, or by submersion.
6. Replace the tank, if a leak is found.

ACCELERATOR CONTROL

Accelerator Control Cable (Figures 4-79 through 4-81)

There are no linkage adjustments. The throttle cable must be replaced with an identical replacement part.

All linkages and cables must be checked, to assure free movement, with no rubbing, chafing, or binding.

The throttle must operate freely, without binding between full closed and side open throttle.

Observe the following, when performing service on the accelerator control cable.

- The retainer must be installed with the tanks secured over the head of the stud.
- The conduit fitting, at both ends of the cable, must have the locking tanks expanded and locked into the attaching holes.
- The braided portion of the cable must not come into contact with the front of dash sealer during replacement.
- Flexible components (hoses, wires, conduit, etc.) must not be routed within 50 mm (2 inches) of the moving parts of the accelerator linkage, unless routing is positively controlled.

Remove or Disconnect

1. Retainer from throttle lever stud or on 2.5L release cable from pulley.
2. Retainer locking tangs from support bracket.
3. Retainer from accelerator pedal rod or release cable from rod.
4. Retainer locking tanks from dash panel.

Install or Connect

1. Retainer to dash panel.
2. Retainer to accelerator pedal rod or connect cable in rod slot.
3. Retainer to support bracket.
4. Retainer to throttle lever stud or connect cable to pulley.

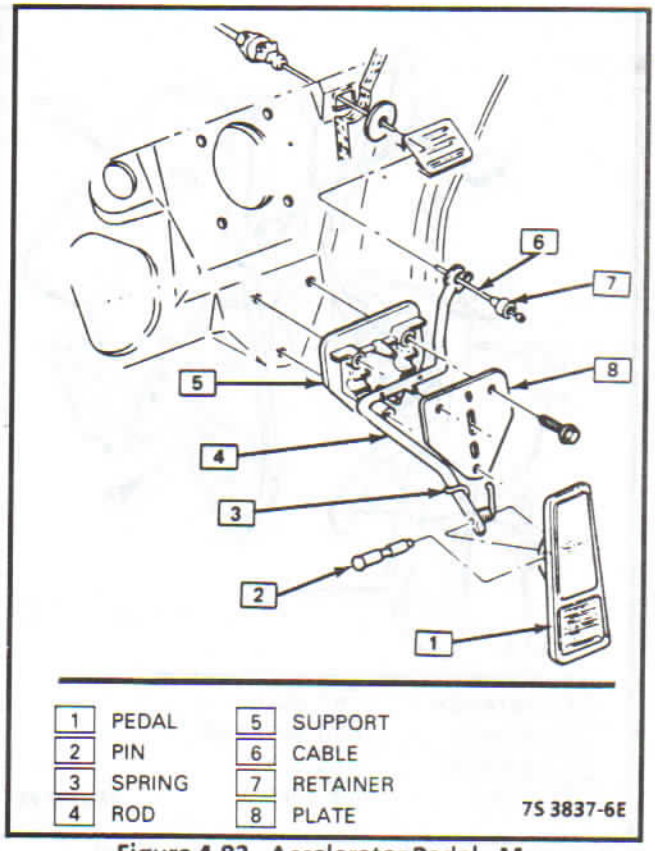


Figure 4-83 - Accelerator Pedal - M

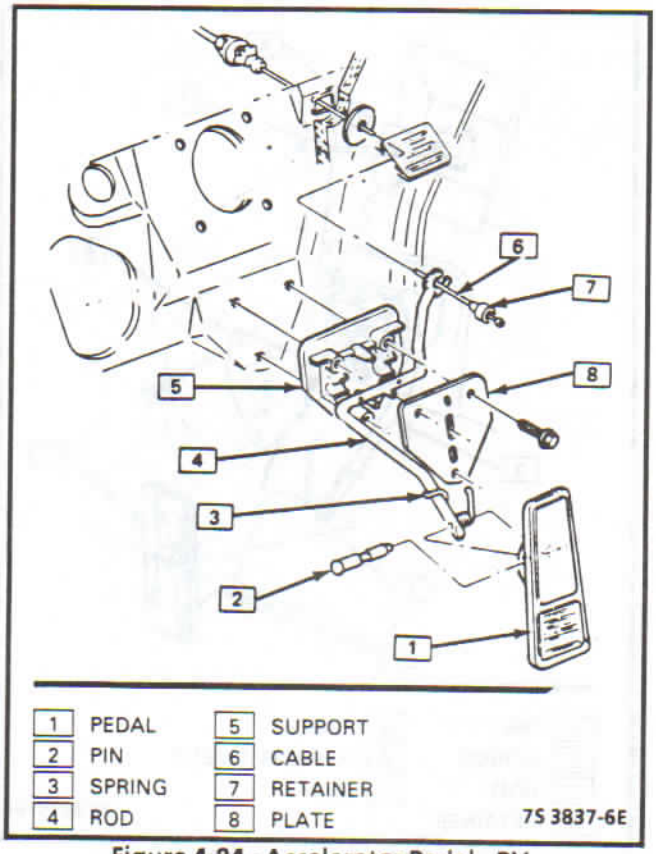


Figure 4-84 - Accelerator Pedal - RV

Accelerator Pedal (Figures 4-82 through 4-88)

The accelerator pedal controls the throttle, through a cable. There are not linkage adjustment. The throttle cable must be replaced with an identical replacement part.

All linkages and cables must be checked, to assure free movement with no rubbing, chafing, or binding. The throttle must operate freely, without binding, between full closed and wide open throttle.

Observe the following, when performing service on the accelerator pedal.

- The mounting surface between the support and the dash panel, must be free of insulation. The carpet and padding in the pedal and tunnel area must be positioned to lay flat and be free of wrinkles and bunches.
- Slip the accelerator control cable through the slot in the rod, before installing the retainer in the rod. Make sure it is seated properly. Use care in pressing retainer into the hole, so the cable if not kinked, or damaged.
- The linkage must operate freely, without binding, between closed throttle and full throttle.
- Wire, hoses, cable, and other flexible components, must not be placed within 13 mm (0.52 inch) of the cable or rod, at any point, in their travel.

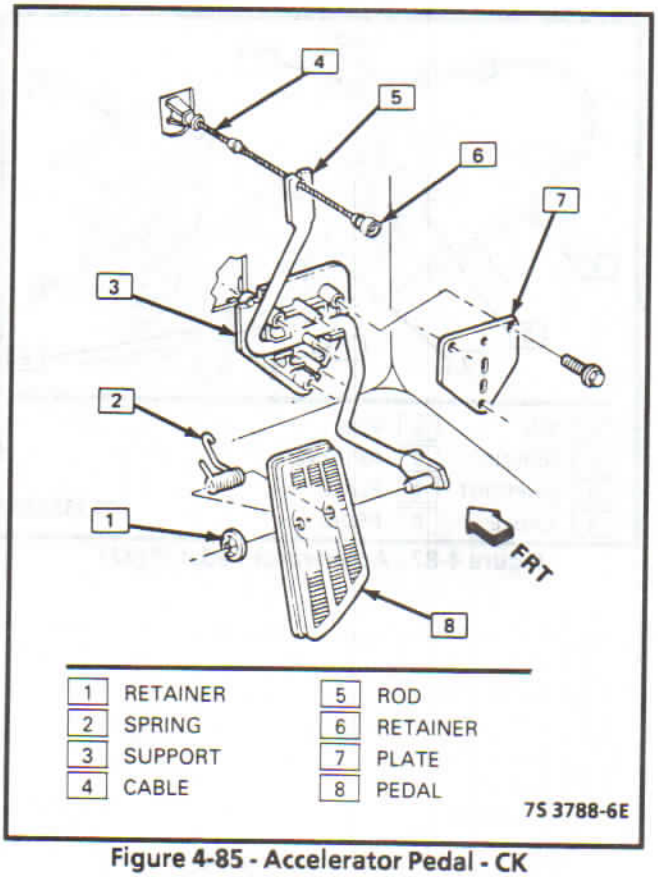


Figure 4-85 - Accelerator Pedal - CK

1990 CONTROLLED IDLE SPEED

Engine	Transmission	Gear (D/N)	Idle Speed (RPM)	IAC Counts*	Open/Closed Loop**
2.5L	Man.	N	900(S) 800(M)	5-20	CL
	Auto.	D	800(S) 750(M)	15-40	CL
2.8L	Man.	N	800	5-20	OL
4.3L (under 8500 GVW)	Man.	N	550	2-20	CL
	Auto.	D	537	10-25	CL
	Auto.(1)	D	500	5-30	CL
	Man.(1)	N	600	5-30	CL
	Auto.(2)	D	588	10-25	CL
4.3L (over 8500 GVW)	Man.	N	650	12-30	CL
	Auto.	D	650	20-35	CL
5.0L	Man.	N	600	5-30	OL
	Auto	D	500	5-30	OL
	Auto.(3)	D	500	5-30	CL
5.7L (under 8500 GVW)	Man.	N	600	5-30	OL
	Auto.	D	525	5-30	CL
5.7L (over 8500 GVW)	Man.		600	5-30	OL
	Man.(4)	N	600	5-30	CL***
	Auto.	D	550	5-30	CL
7.4L	Man.	N	800	5-30	OL
	Auto.	D	750	5-30	OL

* Add 2 counts for engines with less than 500 miles. Add 2 counts for every 1000 ft. above sea level (4.3 L and V8). Add 1 count for every 1000 ft. above sea level (2.5L and 2.8 L).

** Let engine idle until proper fuel control status (open/closed loop) is reached.

*** Switches to open loop after 3 min.

(1) 4.3 ST series.

(2) 4.3L HIGH-OUTPUT ML VAN SERIES

(3) 3 speed Auto in a C10 Pickup w/ Fed. emissions and no AIR system.

(4) G van or Suburban with a single catalytic converter.

MINIMUM IDLE SPEED

Engine	Transmission	Gear (D/N)	Engine Speed (RPM)**	Open/Closed Loop*
2.5L	Man.	N	600 ± 50	CL
	Auto.	N	500 ± 50	CL
2.8L	Man.	N	700 ± 50	OL
4.3L (under 8500 GVW)	Man.	N	400-525	CL
	Auto.	D	400 ± 50	CL
	Auto.(1)	D	475 ± 50	CL
4.3L (Over 8500 GVW)	Man.	N	400-525	CL
	Auto.	D	400 ± 50	CL
5.0L	Man.	N	500 ± 25	OL
	Auto.	D	425 ± 25	CL
5.7L (under 8500 GVW)	Man.	N	500 ± 25	OL
	Auto.	D	425 ± 25	CL
5.7L (over 8500 GVW)	Man.	D	550 ± 25	CL
	Auto.	N	450 ± 25	CL
7.4L	Man.	D	700 ± 25	OL
	Auto.	N	625 ± 25	OL

* Let engine idle until proper fuel control status (open/closed loop) is reached.

** If the engine has less than 500 miles or is checked at altitudes above 1500 feet, the idle rpm with a seated IAC valve should be lower than valves above.

(1) 4.3L High-Output ML Van Series

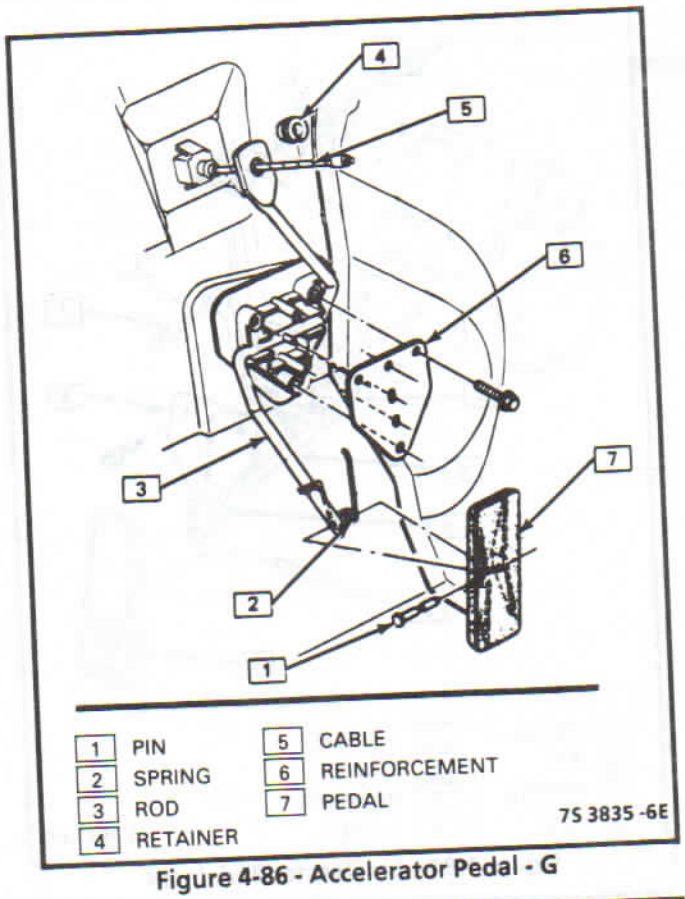


Figure 4-86 - Accelerator Pedal - G

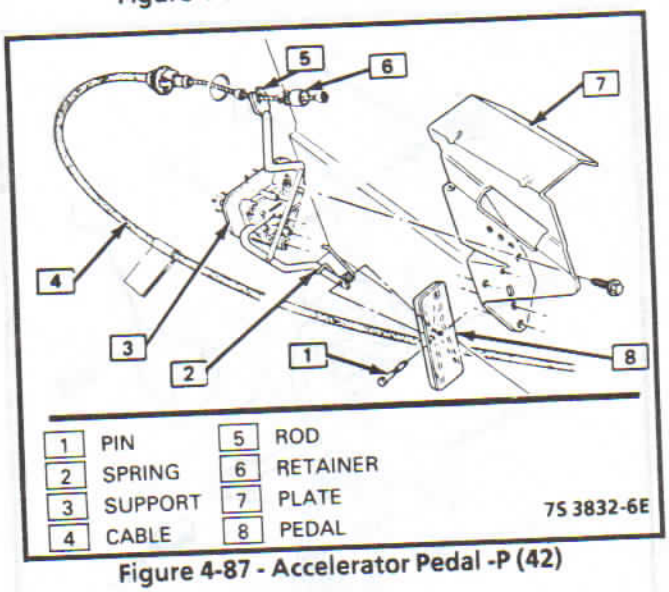


Figure 4-87 - Accelerator Pedal -P (42)

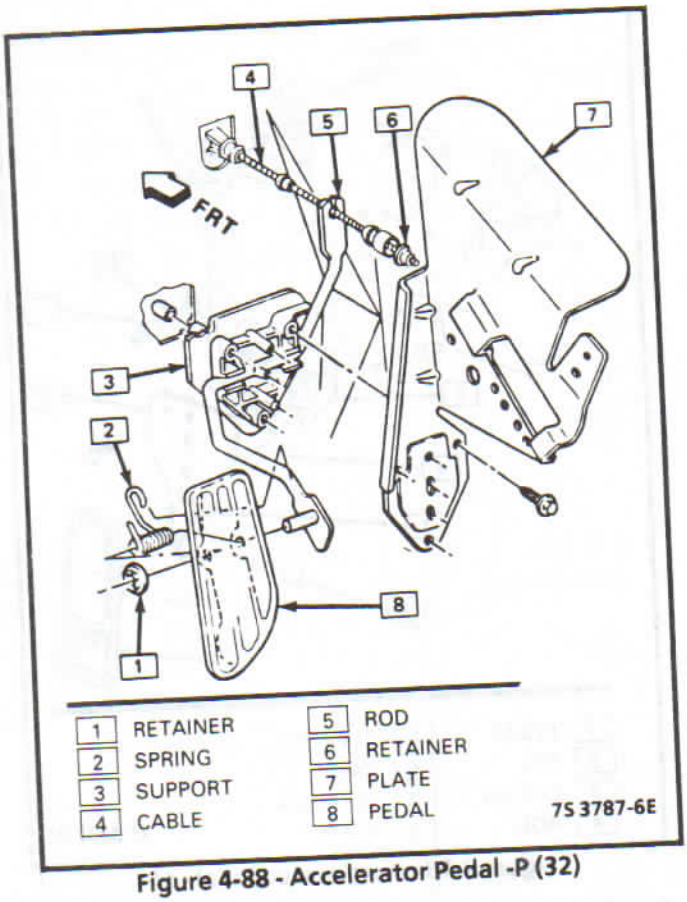


Figure 4-88 - Accelerator Pedal -P (32)

PARTS INFORMATION

PART NAME	GROUP
Cover, w/Regulator, Fuel Meter: Part of Meter Kit, Fuel	3.734
Injector, Fuel: Part of Pump, Fuel (In Tank)	3.774
Relay, Fuel Pump	3.990
Switch, Oil Press.	1.800
Throttle Body Injection Unit	3.725
Valve Asm, Idle Air Control: Part of Control Kit, Idle Air Valve	3.820

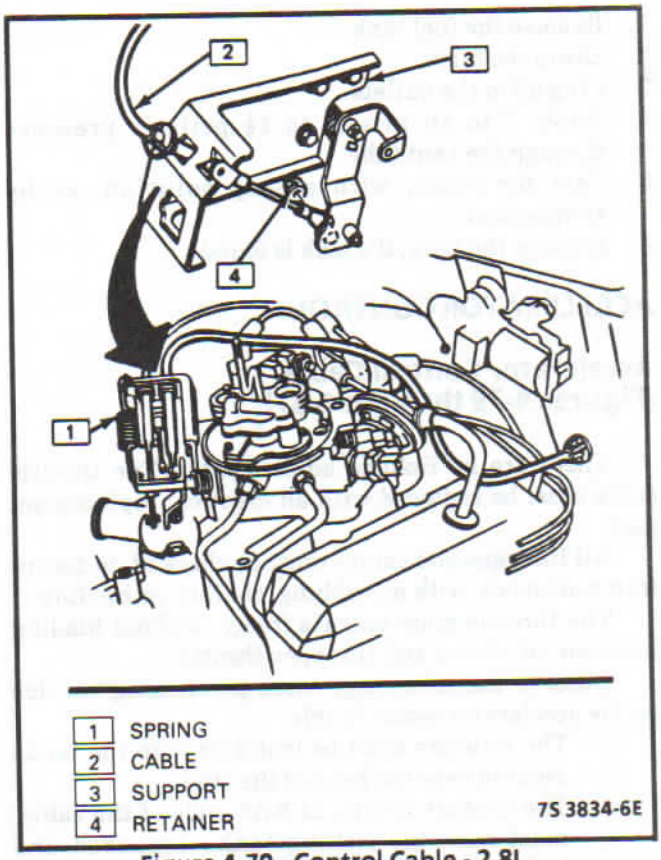


Figure 4-79 - Control Cable - 2.8L

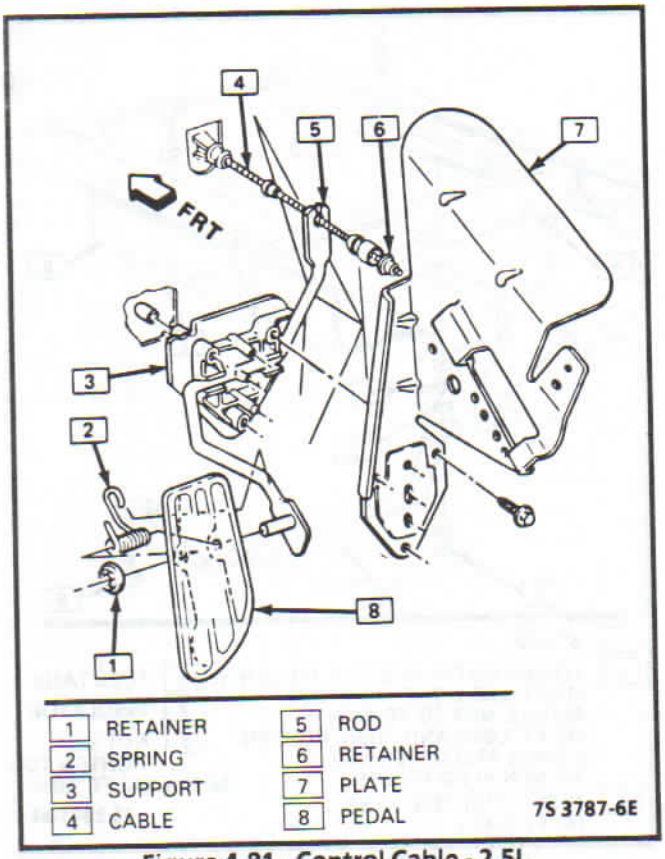


Figure 4-81 - Control Cable - 2.5L

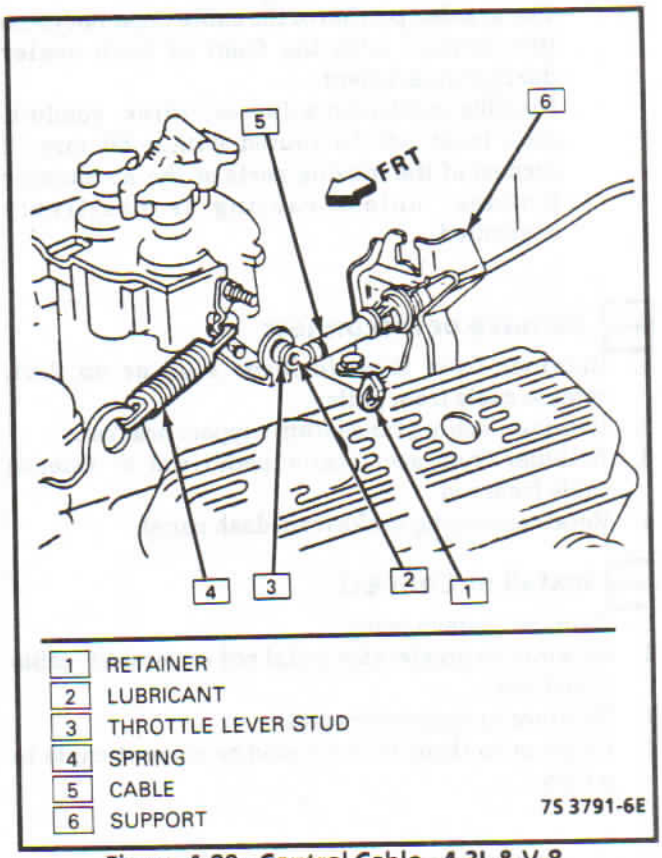


Figure 4-80 - Control Cable - 4.3L & V-8

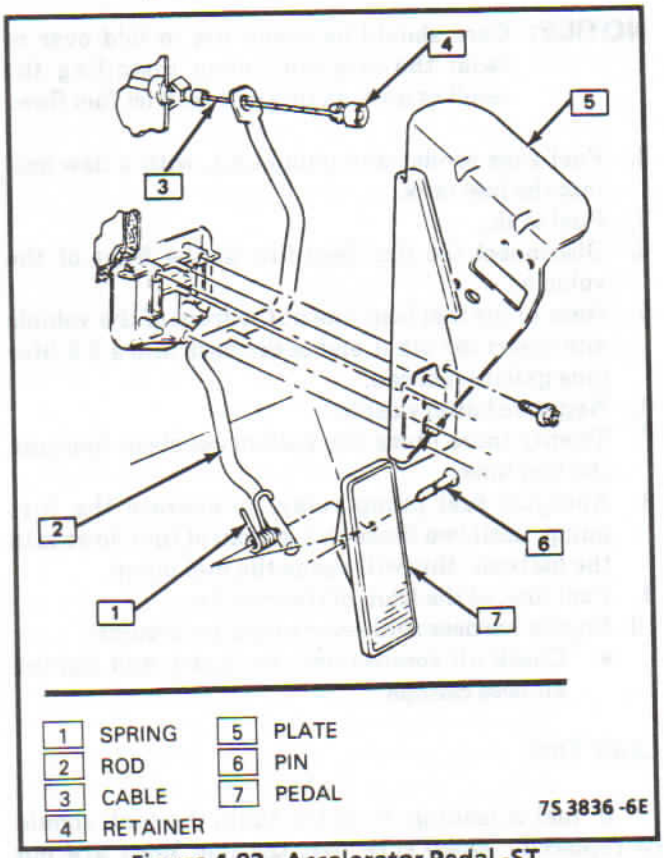
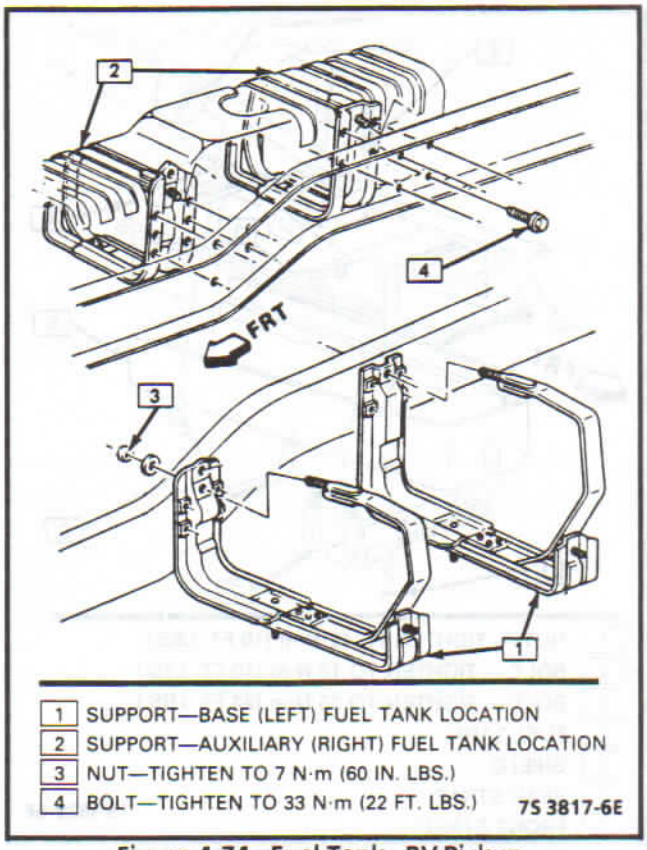


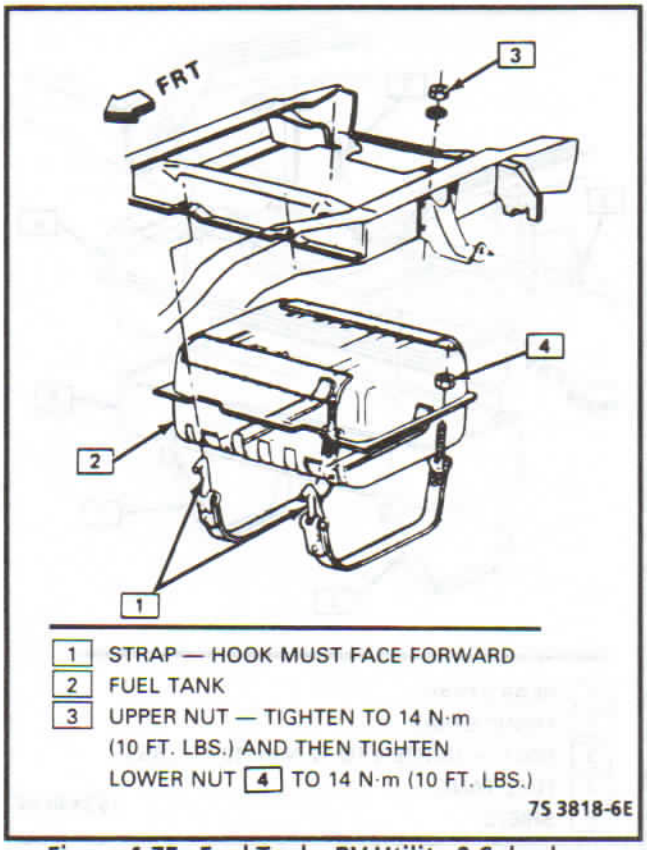
Figure 4-82 - Accelerator Pedal -ST



1 SUPPORT—BASE (LEFT) FUEL TANK LOCATION
2 SUPPORT—AUXILIARY (RIGHT) FUEL TANK LOCATION
3 NUT—TIGHTEN TO 7 N·m (60 IN. LBS.)
4 BOLT—TIGHTEN TO 33 N·m (22 FT. LBS.)

7S 3817-6E

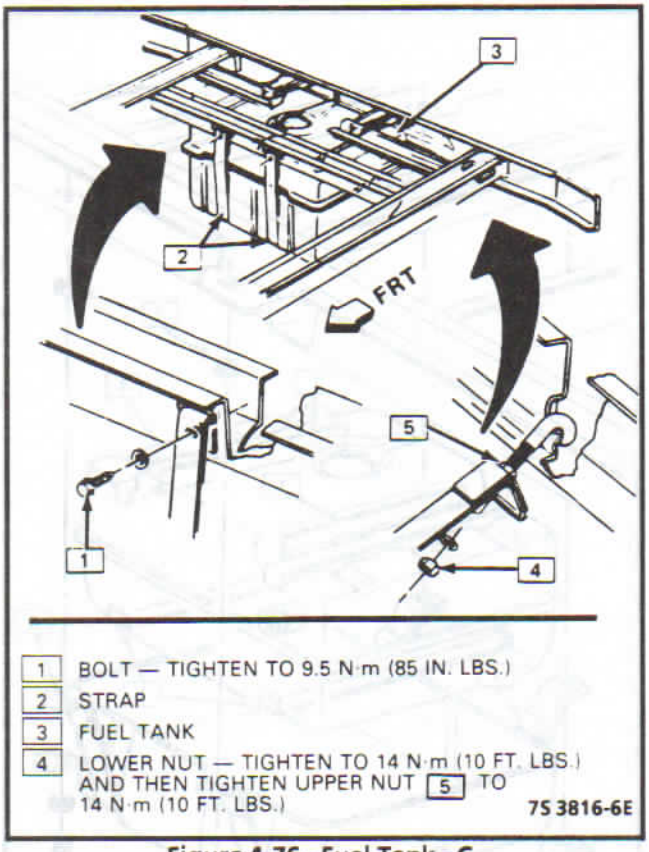
Figure 4-74 - Fuel Tank - RV Pickup



1 STRAP — HOOK MUST FACE FORWARD
2 FUEL TANK
3 UPPER NUT — TIGHTEN TO 14 N·m (10 FT. LBS.) AND THEN TIGHTEN LOWER NUT 4 TO 14 N·m (10 FT. LBS.)

7S 3818-6E

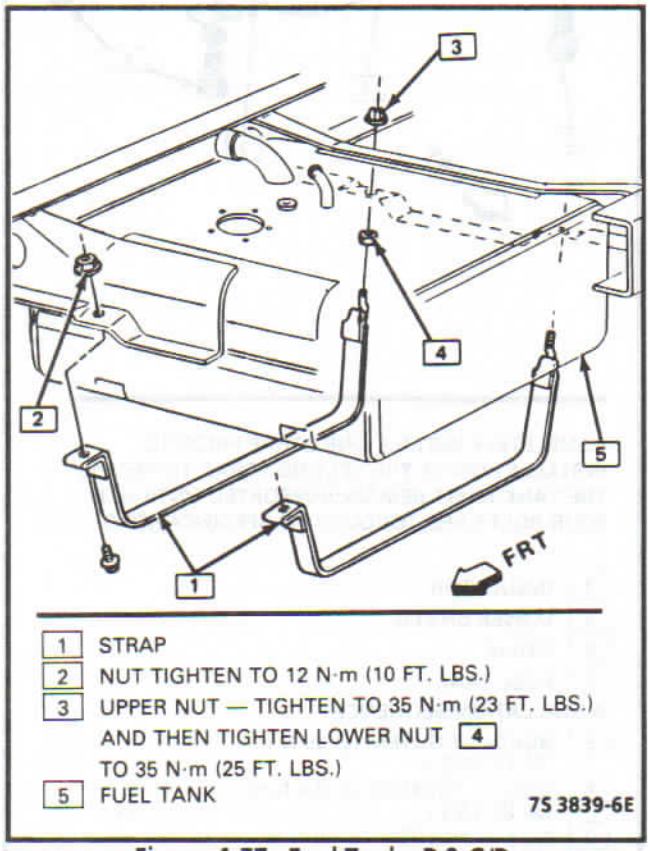
Figure 4-75 - Fuel Tank - RV Utility & Suburban



1 BOLT — TIGHTEN TO 9.5 N·m (85 IN. LBS.)
2 STRAP
3 FUEL TANK
4 LOWER NUT — TIGHTEN TO 14 N·m (10 FT. LBS.) AND THEN TIGHTEN UPPER NUT 5 TO 14 N·m (10 FT. LBS.)

7S 3816-6E

Figure 4-76 - Fuel Tank - G



1 STRAP
2 NUT TIGHTEN TO 12 N·m (10 FT. LBS.)
3 UPPER NUT — TIGHTEN TO 35 N·m (23 FT. LBS.) AND THEN TIGHTEN LOWER NUT 4 TO 35 N·m (25 FT. LBS.)
5 FUEL TANK

7S 3839-6E

Figure 4-77 - Fuel Tank - P & G/P

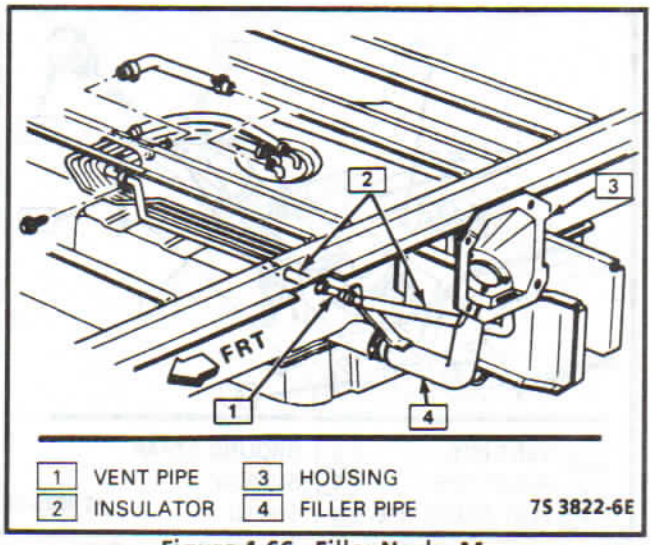


Figure 4-66 - Filler Neck - M

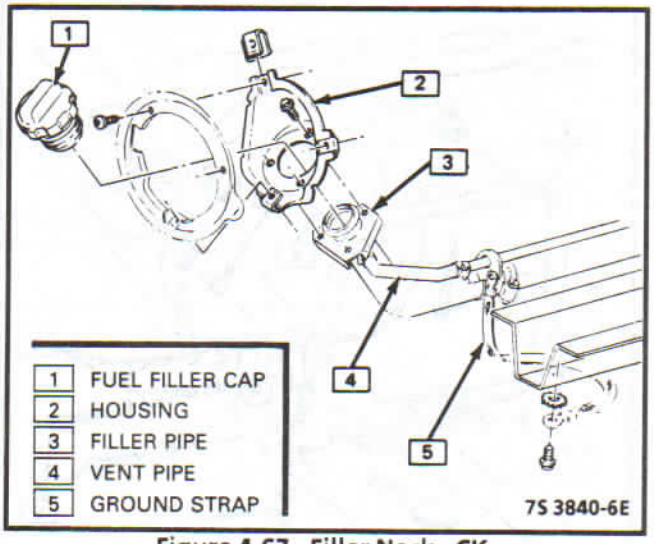


Figure 4-67 - Filler Neck - CK

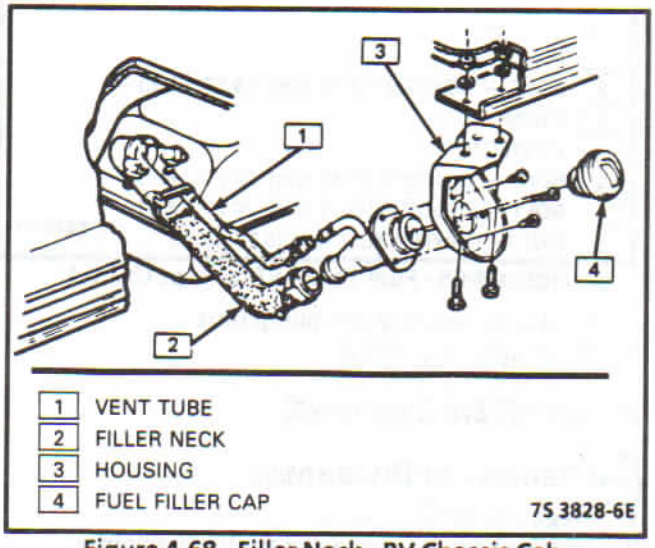


Figure 4-68 - Filler Neck - RV Chassis Cab

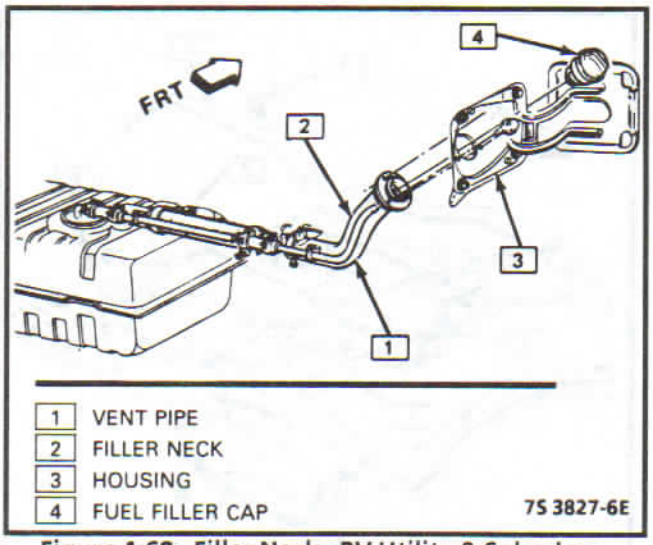


Figure 4-69 - Filler Neck - RV Utility & Suburban

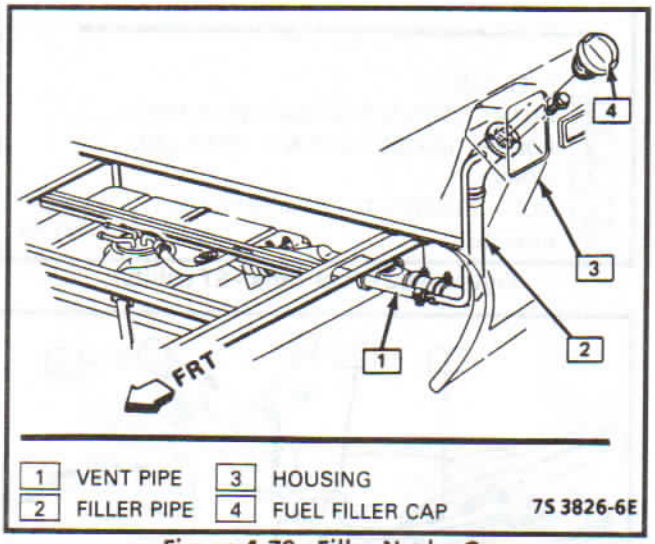


Figure 4-70 - Filler Neck - G

4. Fuel from the fuel tank.
5. Fuel tank.
6. Fuel gage sending and pump unit.
7. Purge fuel tank.

In-Line Fuel Filter

Inspect

- In-Line fuel filter, for contamination.
- Replace the filter, if it is plugged.

Clean

- Fuel lines, by applying air pressure in the opposite direction of fuel flow.

Install or Connect

1. New strainer (if necessary) on the fuel gage sending and pump unit.

FUEL TANK

Draining

1. Disconnect the negative battery cable.
   - Have a dry chemical (Class B) fire extinguisher nearby.

CAUTION: Never drain or store gasoline or diesel fuel in an open container, due to the possibility of fire or explosion.

2. Use a hand operated pump device to drain as much fuel as possible through the filler neck. On some fuel tank installations, the filler neck is too long to gain access to the fuel. If the tank is not full, disconnect filler neck nose, at the fuel tank, to gain access to the fuel.
   Alternate method:
   a. Disconnect fuel feed pipe and attach a hand operated pump device.
   b. Energize the fuel pump relay.
   c. With fuel pump running, operate hand pump to remove fuel.
3. After servicing fuel tank, install removed hose, lines, and fuel filler cap.

Replacement
Figures (4-61 through 4-78)

Remove or Disconnect

1. Fuel from the fuel tank.
2. Clamps from filler neck hose and vent line.
3. Fuel tank retaining straps.
   - Support the fuel tank.
4. Sender unit wires, hoses, and ground strap.
   - Lower the fuel tank to gain access.
5. Fuel tank from the vehicle.
6. Fuel sender and pump from the fuel tank.
7. Purge tank, if being repaired.

Install or Connect

1. Fuel sender and pump into fuel tank.
2. Fuel tank into the vehicle.
3. Sender unit wires, hoses, and ground straps.
4. Fuel tank retaining straps with insulator strips in place.
5. Clamp to filler neck hose and vent line.
6. Bolts and nuts.

Tighten

- Bolts, as shown in the illustrations.

Purging

The fuel tank should be purged, before being repaired.

Remove or Disconnect

1. Fuel tank from the vehicle.
2. Fuel gage sending and pump unit.
3. All remaining fuel from the tank.

Inspect

- Fuel tank for any remaining fuel.

Install or Connect

1. Tap water into the tank,
   - Move the tank to the flushing area (wash rack.)
   - Agitate the water vigorously, and then, drain it.
2. Gasoline emulsifying agent into the tank.
   - Use an available emulsifying agent, such as Product-Sol No. 913, or equivalent.
3. Water to the fuel tank.

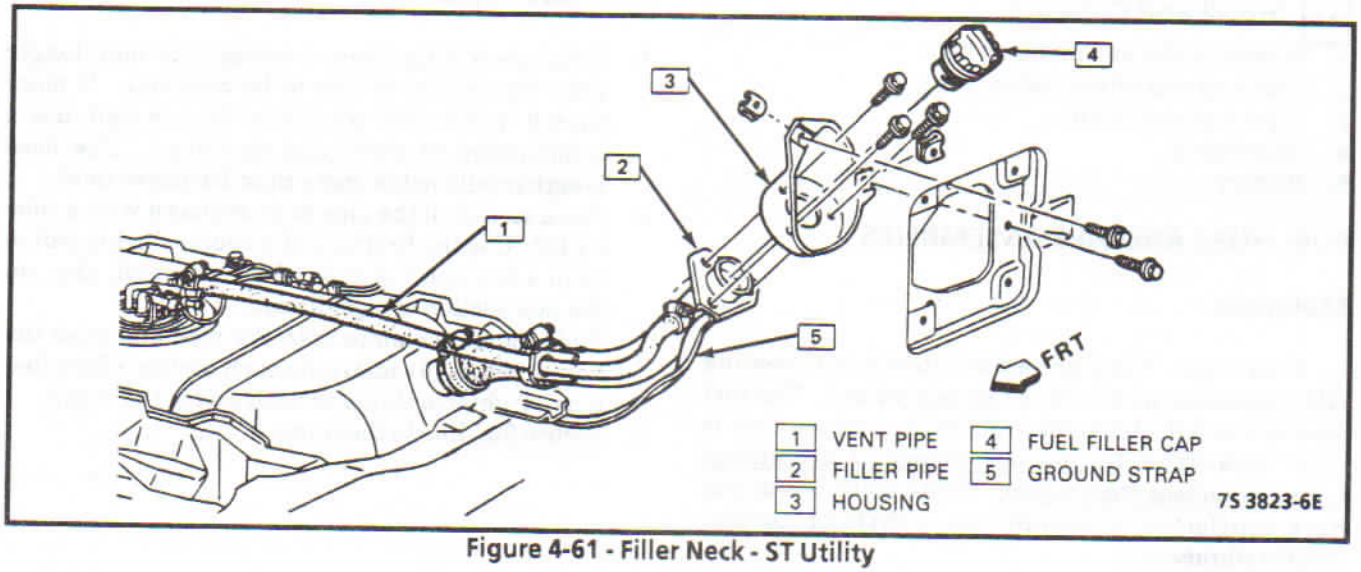
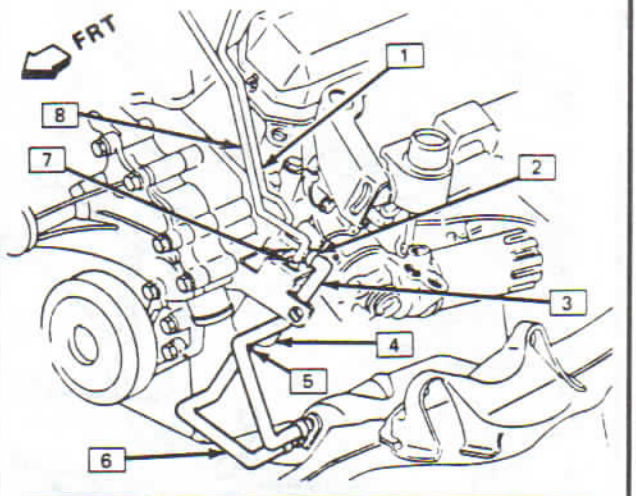


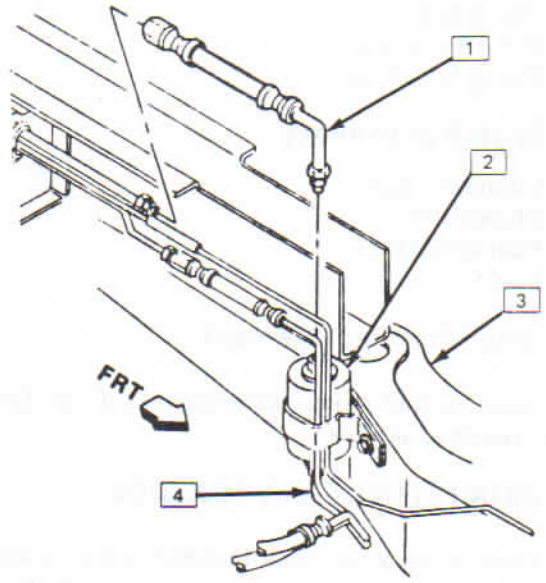
Figure 4-61 - Filler Neck - ST Utility



1. FUEL RETURN PIPE
2. CLAMP
3. FUEL RETURN HOSE
4. IN-LINE FUEL FILTER
5. CLAMP (DOUBLE)
6. FUEL FEED HOSE
7. O-RING
8. FUEL FEED PIPE-TIGHTEN NUT TO 26 N·m (20 FT. LBS.)

7S 3646-6E

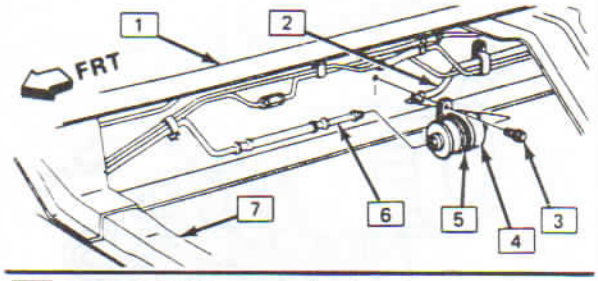
Figure 4-54 - Fuel Filter - 2.8L (ST)



1. FUEL FEED PIPE-TIGHTEN NUT TO 26 N·m (20 FT. LBS.)
2. IN-LINE FUEL FILTER
3. LEFT FRAME SIDE MEMBER
4. FRONT FUEL FEED PIPE-TIGHTEN NUT TO 26 N·m (20 FT. LBS.)

7S 3647-6E

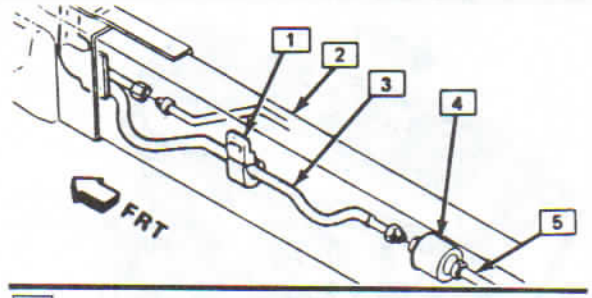
Figure 4-55 - Fuel Filter - 4.3L (M)



1. RIGHT FRAME SIDE MEMBER
2. REAR FUEL FEED PIPE-TIGHTEN NUT TO 26 N·m (20 FT. LBS.)
3. BOLT-TIGHTEN TO 16 N·m (24 FT. LBS.)
4. IN-LINE FUEL FILTER
5. CLAMP
6. INTERMEDIATE FUEL FEED PIPE-TIGHTEN NUT TO 26N·m (20 FT. LBS.)
7. TRANSMISSION SUPPORT

7S 3644-6E

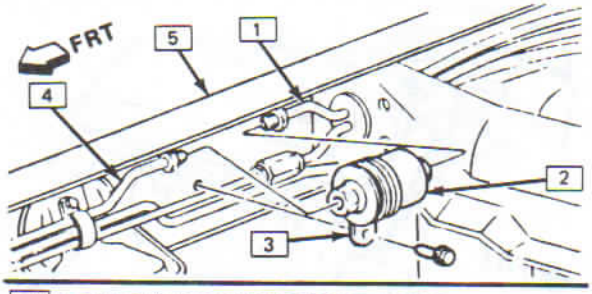
Figure 4-56 - Fuel Filter (RV)



1. CLIP
2. LEFT FRAME SIDE MEMBER
3. FRONT FUEL FEED HOSE-TIGHTEN NUT TO 26 N·m (20 FT. LBS.)
4. IN-LINE FUEL FILTER
5. REAR FUEL FEED HOSE-TIGHTEN NUT TO 26 N·m (20 FT. LBS.)

7S 3650-6E

Figure 4-57 Fuel Filter (CK)



1. REAR FUEL FEED PIPE-TIGHTEN NUT TO 26 N·m (20 FT. LBS.)
2. IN-LINE FUEL FILTER
3. CLAMP
4. INTERMEDIATE FUEL FEED PIPE-TIGHTEN NUT TO 26 N·m (20 FT. LBS.)
5. RIGHT FRAME SIDE MEMBER

7S 3649-6E

Figure 4-58 - Fuel Filter (P & G/P)

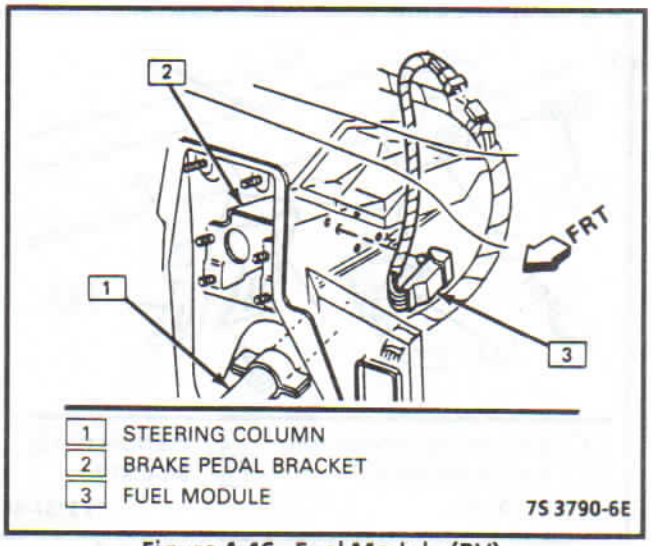


Figure 4-46 - Fuel Module (RV)

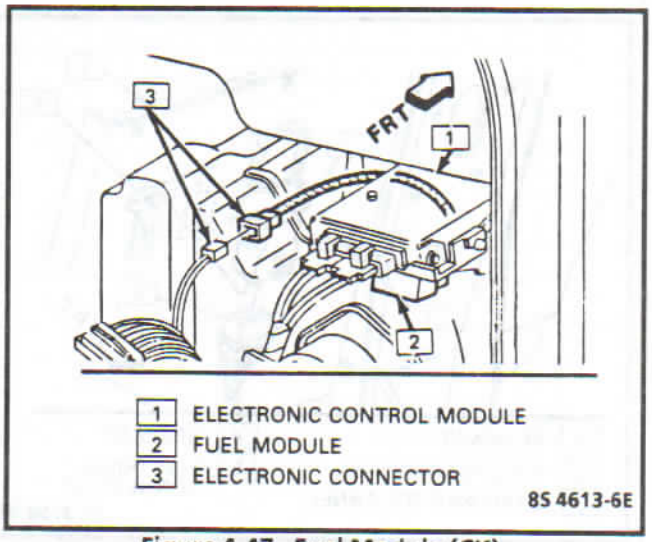


Figure 4-47 - Fuel Module (CK)

FUEL MODULE (Figures 4-46 through 4-48)

Remove or Disconnect

1. Fuel module housing.
2. Open housing cover.
3. Fuel module board.

Install or connect

1. Fuel module board.
2. Close cover.
3. Fuel module housing.

OIL PRESSURE SWITCH (Figures 4-49 through 4-52)

Remove or Disconnect

1. Electrical connector.

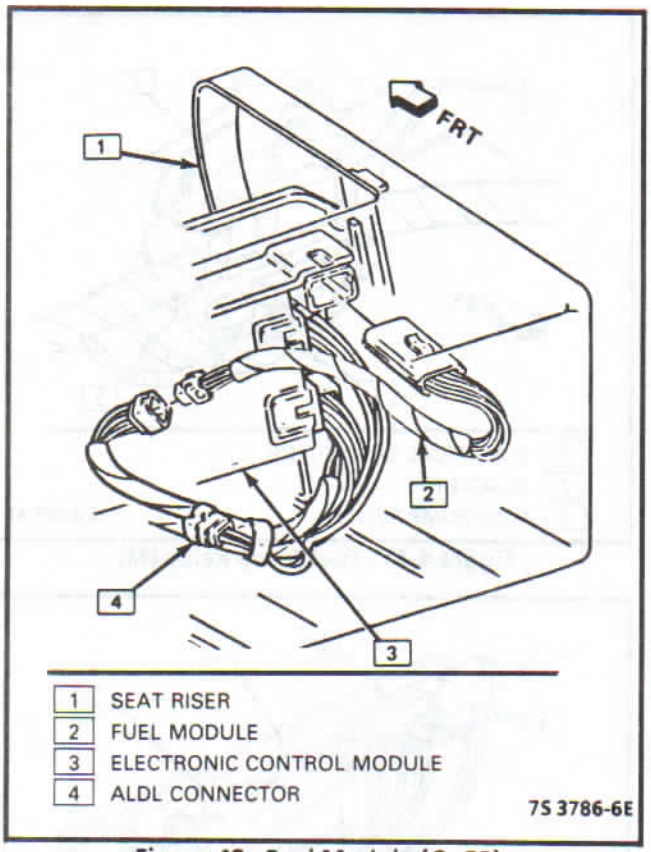


Figure 48 - Fuel Module (G, GP)

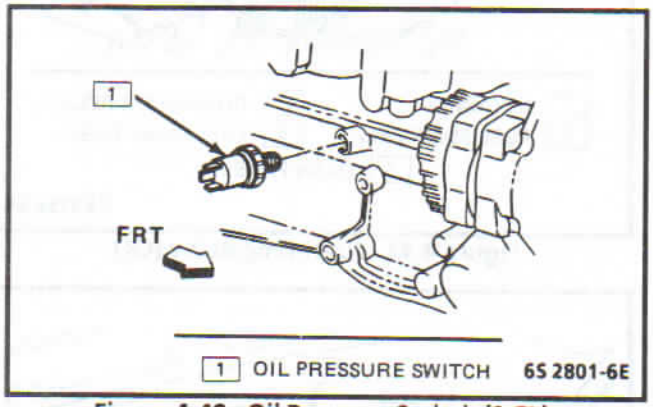


Figure 4-49 - Oil Pressure Switch (2.5L)

2. Oil pressure switch using wrench J 28687-A or BT 8220 if required.

Install or connect

1. Oil pressure switch.
2. Electrical connector.

FUEL FILTER

In-Line Filter Replacement (Figures 4-54 through 4-60)

Remove or Disconnect

- On 2.5L engine, relieve fuel system pressure.

1. Fuel filler cap.

Disassemble

- TPS, IAC valve and tube module assembly from old throttle body assembly, according to previous instructions.

Assemble

- TPS, IAC valve, and tube module assembly onto replacement throttle body assembly, according to previous instructions.

Install or Connect

1. New fuel meter body to throttle body gasket.
2. Fuel meter assembly on throttle body assembly.
3. Fuel meter body-to-throttle body attaching screws coated with appropriate thread-locking compound.

Tighten

- Screws to 6.0 N·m (53 lb. in.)

4. TBI unit onto engine, as described below.
5. Check minimum idle speed of engine as described below.

FUEL PUMP (Figure 4-39)

Remove or Disconnect

1. Relieve full system pressure (2.5L Engine only).
2. Raise the vehicle on a hoist.
3. Negative battery cable.
4. Fuel tank.
5. Sender unit and pump by turning the cam lock counterclockwise using tool J 36608 or J 24187.
6. Fuel pump from the sending unit.
   - Pull the fuel pump up into the attaching hose while pulling outward from the bottom support.
   - Do not damage the rubber insulator or the strainer.

Inspect

1. Fuel pump attaching hose for signs of deterioration.
2. Rubber sound insulation at the bottom of the pump.

Install or Connect

1. Fuel pump assembly into the attaching hose.

NOTICE: Care should be taken not to fold over or twist the strainer, when installing the sending unit as this will restrict fuel flow.

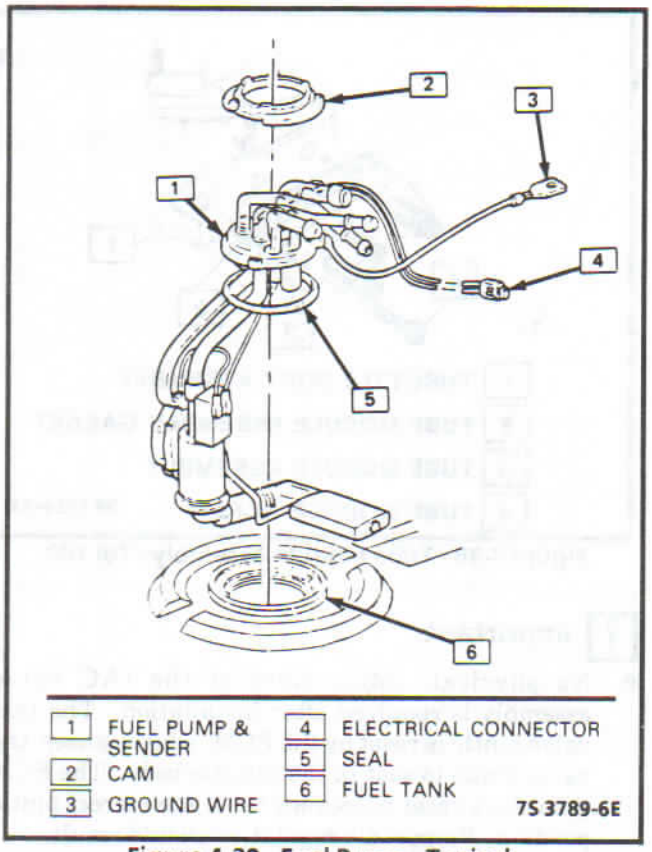


Figure 4-39 - Fuel Pump - Typical

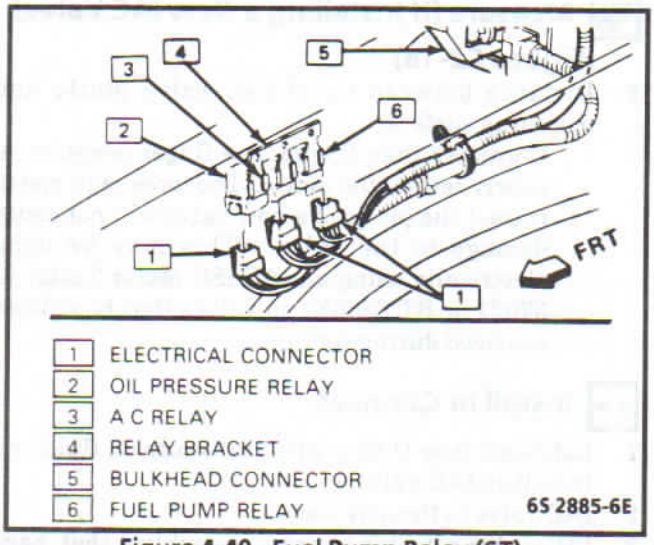


Figure 4-40 - Fuel Pump Relay (ST)

2. Sending unit and fuel pump assembly into the fuel tank.
   - Use a new O-ring seal.
3. Cam lock assembly.
   - Turn the cam lock clockwise to lock it.
4. Fuel tank.
5. Negative battery cable.

THROTTLE POSITION SENSOR (Figure 4-36)

Remove or Disconnect

1. Electrical connector from TPS.
2. Screw assemblies and TPS.

NOTICE: The throttle position sensor is an electrical component, and should not be immersed in any type of liquid solvent or cleaner, as damage may result.

Install or Connect

1. With throttle valve in normally closed position, install TPS on throttle shaft and rotate counterclockwise to align mounting holes.
2. Attaching screw and washer assemblies.

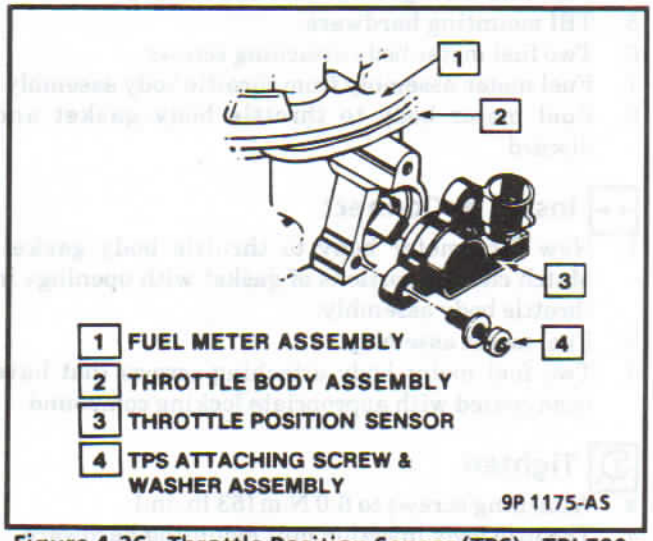


Figure 4-36 - Throttle Position Sensor (TPS) - TBI 700

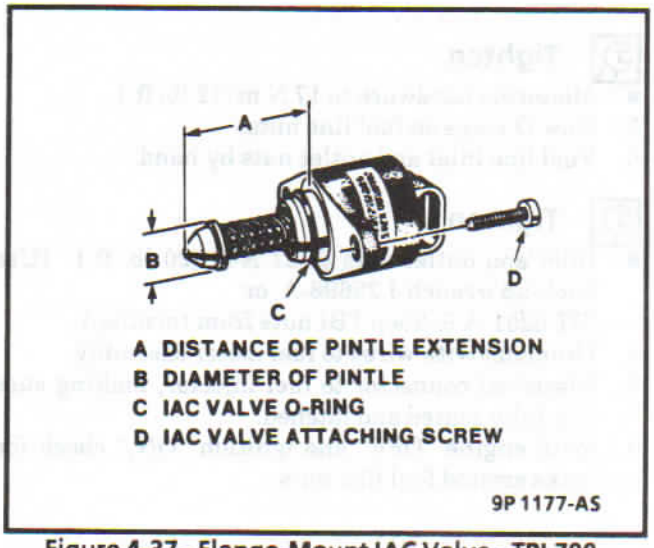


Figure 4-37 - Flange-Mount IAC Valve - TBI 700

Tighten

- Screw assemblies to 2.0 N·m (18.0 lb. in.)

3. Electrical connector to TPS.
4. Check for TPS output as follows:
   - Connect ALDL scanner to read TPS output voltage.
   - With ignition "ON" and engine stopped, TPS voltage should be less than 1.25 volts. If more than 1.25 volts, replace TPS.

IDLE AIR CONTROL (IAC) VALVE (Figure 4-37)

NOTICE: The IAC valve is an electrical component and must not be soaked in any liquid cleaner or solvent. Otherwise damage could result. On IAC valves that have been in service: Do Not push or pull on the IAC valve pintle. The force required to move the pintle may damage the threads on the worm drive.

Important

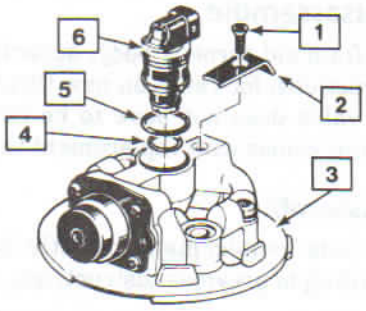
- On TBI Model 700, the IAC valve is flange-mounted, with dual taper, 10 mm diameter pintle. If replacement is necessary, only an IAC valve identified with the correct part number (having the appropriate pintle shape and diameter) should be used.

Remove or Disconnect

1. Electrical connector from IAC valve.
2. Screw assemblies and IAC valve.
3. IAC valve O-ring and discard.

Cleaning and Inspection

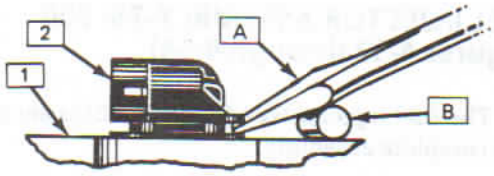
- Both original and replacement IAC valves have a special factory applied thread-locking compound applied to the screw threads. If the valve removed from the throttle body is being reinstalled, Do Not remove thread-locking compound that may remain on the threads.
- Clean IAC valve gasket sealing surface, pintle valve seat and air passage.
  - Use carburetor cleaner to remove carbon deposits. Do not use a cleaner that contains methyl ethyl keytone, an extremely strong solvent, and not necessary for this type of deposit.
  - Shiny spots on the pintle or seat are normal, and do not indicate misalignment or a bent pintle shaft.
  - If air passage has heavy deposits, remove throttle body for complete cleaning.



1 INJECTOR RETAINER SCREW
2 INJECTOR RETAINER
3 FUEL METER ASSEMBLY
4 FUEL INJECTOR O-RING (LOWER)
5 FUEL INJECTOR O-RING (UPPER)
6 FUEL INJECTOR ASSEMBLY

9P 1173-AS

Figure 4-32 - Fuel Injection Parts (TBI 700)



1 FUEL METER BODY
2 FUEL INJECTOR
A SCREWDRIVER
B FULCRUM

7S 3419-6E

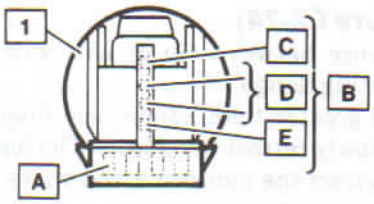
Figure 4-33 - Removing TBI 700 Fuel Injector

Inspect

- Fuel injector filter for evidence of dirt and contamination. If present, check for presence of dirt in fuel lines and fuel tank.

Important

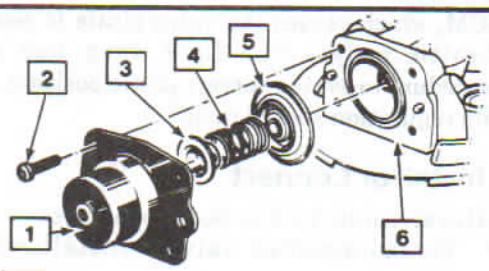
- Be sure to replace the injector with an identical part. Injectors from other models can fit in the Model 700 TBI, but are calibrated for different flow rates. (See Figure 4-34 for part number location.)



1 FUEL INJECTOR (TOP VIEW)
A PART NUMBER
B BUILD DATE CODE
C MONTH
1-9 (JAN -SEPT)
O,N,D (OCT,NOV,DEC)
D DAY
E YEAR

8P 0913-AS

Figure 4-34 - Fuel Injector Part Number Location TBI 700



1 PRESSURE REGULATOR COVER ASSEMBLY
2 PRESSURE REGULATOR ATTACHING SCREW
3 SPRING SEAT
4 PRESSURE REGULATOR SPRING
5 DIAPHRAGM ASSEMBLY
6 FUEL METER ASSEMBLY

9P 1171-AS

Figure 4-35 - TBI 700 Pressure Regulator

Install or Connect

1. Lubricate new upper and lower O-rings with automatic transmission fluid and place them on injector. (Make sure upper O-ring is in groove and lower one is flush up against filter.)
2. Injector assembly, pushing it straight into fuel injector cavity.

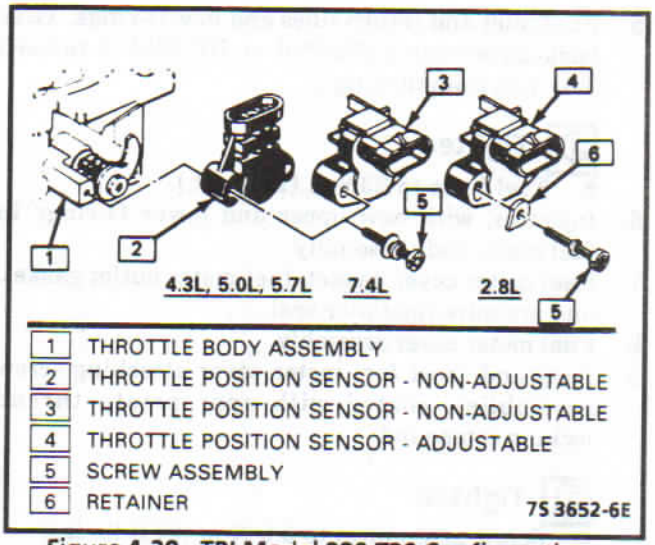


Figure 4-29 - TBI Model 220 TPS Configuration

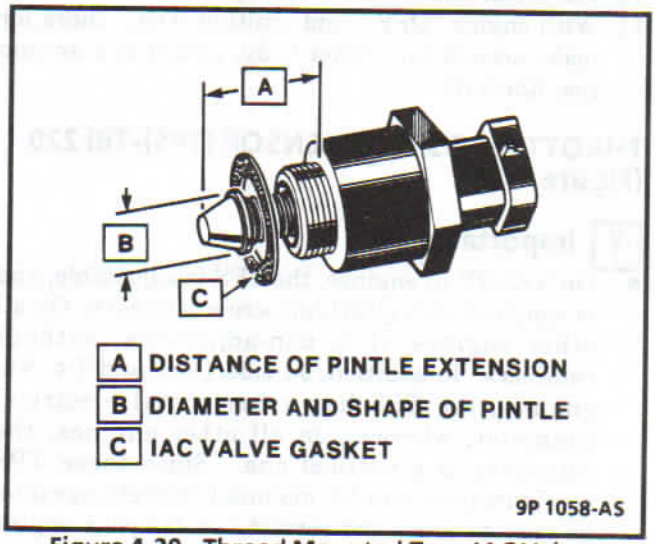


Figure 4-30 - Thread Mounted Type IAC Valve

4. Check for TPS output as follows:
   - Connect ALDL scanner to read TPS output voltage.
   - With ignition "ON" and engine stopped, TPS voltage should be less than 1.25 volts. If more than 1.25 volts, replace TPS.

IDLE AIR CONTROL (IAC) VALVE-TBI 220 (Figures 4-30 and 4-31)

NOTICE: The IAC valve is an electrical component and must not be soaked in any liquid cleaner or solvent. Otherwise damage could result.

Important

- All IAC valves on TBI Model 220 units (except those on the 7.4L engine) are thread-mounted and have a dual taper, 10 mm diameter, pintle. On the 7.4L engine, the IAC valve is flange-mounted and has a 12mm diameter, dual taper pintle. Any replacement of an IAC valve must have the correct part number, with the appropriate pintle taper and diameter for proper seating of the valve in the throttle body.

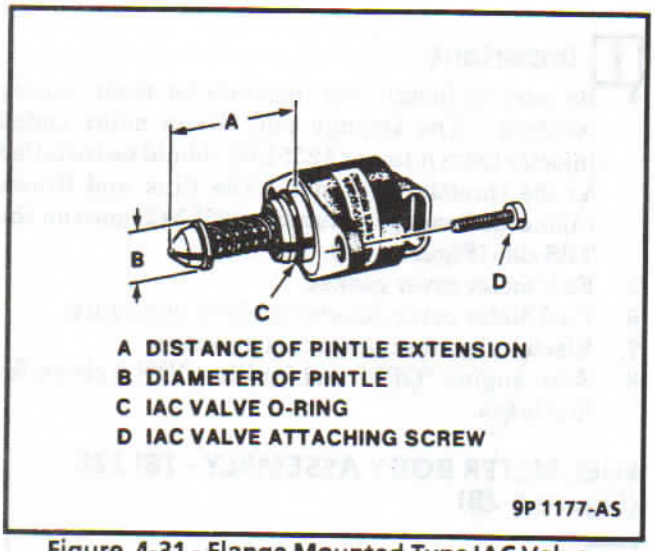


Figure 4-31 - Flange Mounted Type IAC Valve

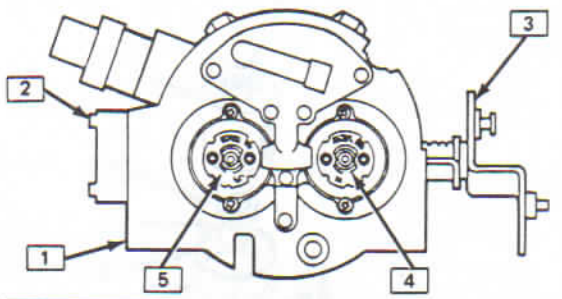
Remove or Disconnect

1. Electrical connector.
2. IAC valve.
   - On thread mounted units, use a 32 mm (1¼") wrench (Figure 4-30).
   - On flange-mounted units, remove screw assemblies (Figure 4-31)
3. IAC valve gasket or O-ring and discard.

Clean

- Thread mounted valve - Old gasket material from surface of throttle body assembly to insure proper seal of new gasket.
- Flange-mounted valve - IAC valve surfaces on throttle body to assure proper seal of new o-ring and contact of IAC valve flange.

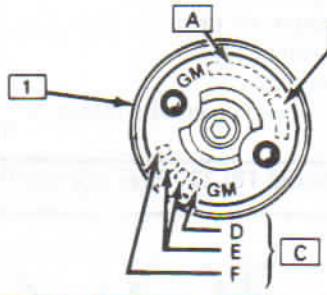
NOTICE: If the IAC valve was removed during service, it's operation may be tested electrically with the IAC/ISC Motor Tester (J 37027 or BT 8256K). However, if the valve pintle is extended electrically, it must also be retracted electrically. Before installing an IAC valve, measure the distance between the tip of the valve pintle and the mounting surface.If the dimension is greater than 28 mm (1.10 inches), it must be reduced to prevent damage to the valve. This may be done electrically using an IAC/ISC motor tester (J 37027 or BT 8256K).



1 TBI MODEL NUMBER
2 THROTTLE POSITION SENSOR
3 THROTTLE LEVER
4 INJECTOR P/N 5235134 (ORANGE/GREEN)
5 INJECTOR P/N 5235342 (PINK/BROWN)

8S 3999-6E

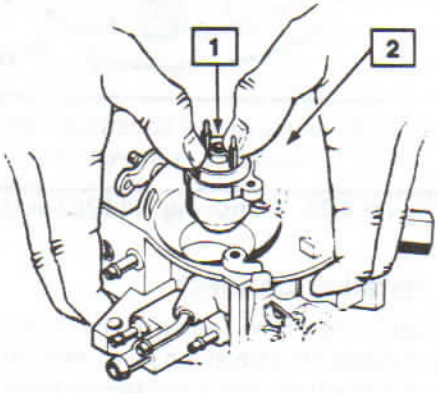
Figure 4-25 - Fuel Injector Color Code Locations TBI 220 (4.3L Engine C/K Series)



1 TOP VIEW OF INJECTOR
A PART IDENTIFICATION NUMBER
B VENDOR INDENTIFICATION
C BUILD DATE
D - YEAR
E - DAY
F - MONTH

7S 3653-6E

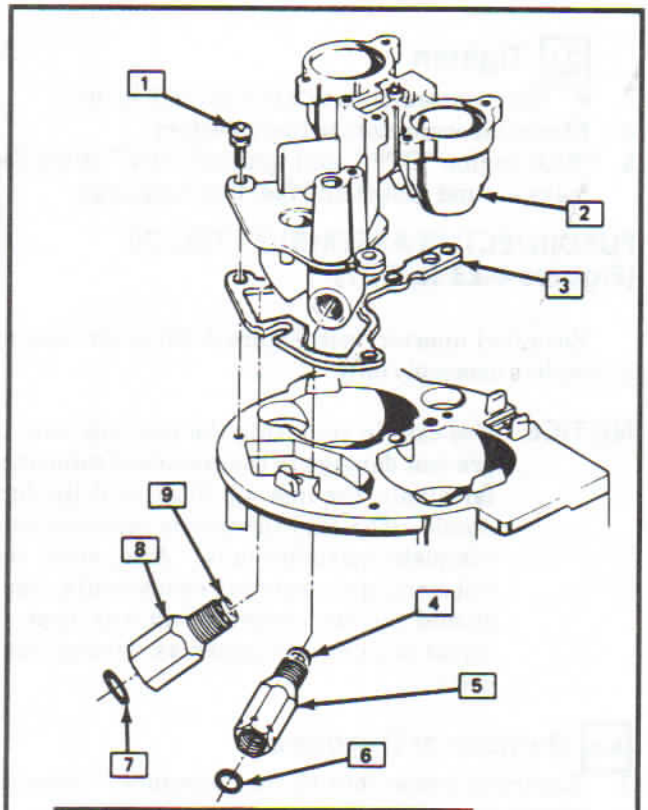
Figure 4-26 - Fuel Injector Port Number Lacation TBI 220



1 FUEL INJECTOR ASSEMBLY
2 FUEL METER BODY ASSEMBLY

8P 0923-6E

Figure 4-27 - Installing Fuel Injector - TBI 220



1 ATTACHING SCREW ASSEMBLY
2 FUEL METER BODY ASSEMBLY
3 GASKET
4 OUTLET NUT GASKET
5 OUTLET NUT
6 OUTLET "O" RING
7 INLET "O" RING
8 INLET NUT
9 INLET NUT GASKET

7S 3654-6E

Figure 4-28 - Fuel Meter Body Assembly - TBI 220

3. Lubricate new upper (large) O-ring with automatic transmission fluid and install directly over the backup washer. Be sure O-ring is seated properly and is flush with top of fuel meter body surface.

NOTICE: Backup washers and O-rings must be installed before injectors, or improper seating of large O-ring could cause fuel to leak.

4. Injector, align raised lug on each injector base with notch in fuel meter body cavity. Push down on injector until it is fully seated in fuel meter body (Figure 4-27). (Electrical terminals of injector should be parallel with throttle shaft).

500 miles or is checked at altitudes above 1500 feet, the idle rpm with a seated IAC valve should be lower than valves above.

11. If the minimum idle air rate is within specifications, no further check is required.
12. If the minimum idle air rate is not within specifications, perform the following procedures:
13. If present, remove stop screw plug by piercing it with an awl, then applying leverage (see Figure 4-21). The screw is covered to discourage unauthorized adjustments.
14. With engine at normal operating temperature (85°-100°C), adjust stop screw to obtain nominal rpm per specifications with seated IAC valve.
15. Turn ignition "OFF" and reconnect IAC valve electrical connector.
16. Disconnect "Scan" tool or tachometer.
17. Use silicon sealant or equivalent to cover stop screw hole.
18. Install air cleaner, adapter and gasket.
19. Reset IAC Valve, refer to "Idle Air Control Valve," SECTION "4".

TBI 220 COMPONENT SERVICE
FUEL METER COVER ASSEMBLY- TBI 220 (Figure 4-22)

The fuel meter cover assembly contains the fuel pressure regulator assembly. The regulator has been adjusted at the factory and should only be serviced as a complete preset assembly.

CAUTION: **DO NOT remove the four screws securing the pressure regulator to the fuel meter cover. The fuel pressure regulator includes a large spring under heavy compression which, if accidentally released, could cause personal injury. Disassembly might also result in a fuel leak between the diaphragm and the regulator container.**

Remove or Disconnect

1. Electrical connectors to fuel injectors. (Squeeze plastic tabs and pull straight up.)
2. Long and short fuel meter cover screw assemblies.
3. Fuel meter cover assembly.

NOTICE: DO NOT immerse the fuel meter cover (with pressure regulator) in cleaner, as damage to the regulator diaphragm and gasket could occur.

4. Fuel meter outlet gasket and pressure regulator seal. Discard gaskets and seal.

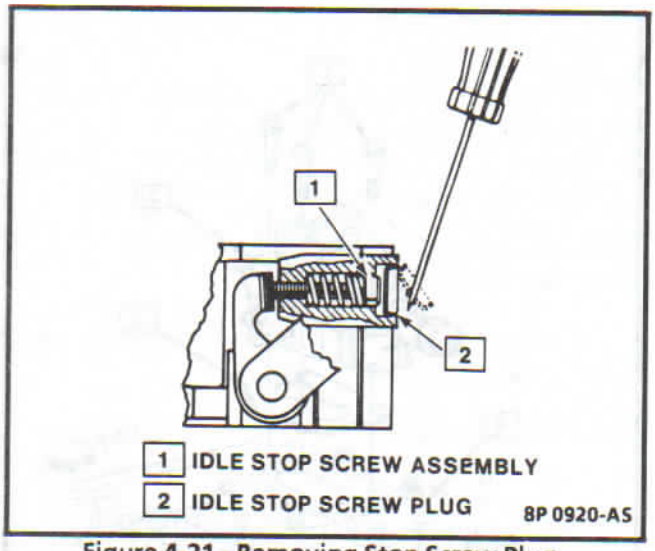


Figure 4-21 - Removing Stop Screw Plug

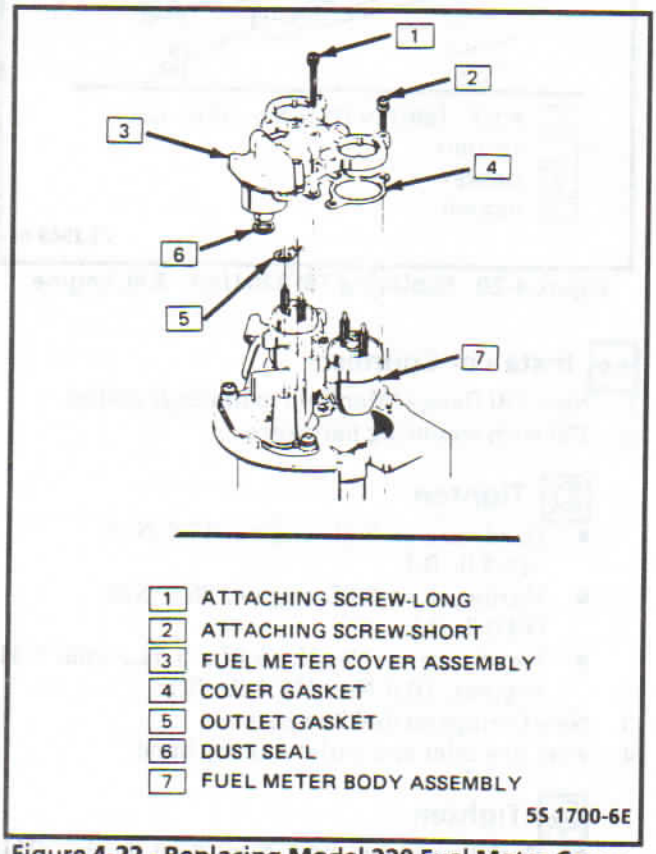


Figure 4-22 - Replacing Model 220 Fuel Meter Cover

Inspect

- For dirt, foreign material and casting warpage.

Install or Connect

1. New pressure regulator seal, fuel meter outlet passage gasket, and cover gasket.
2. Fuel meter cover assembly.
3. Attaching screw assemblies, precoated with appropriate locking compound to threads. (Short screws are next to injectors.)

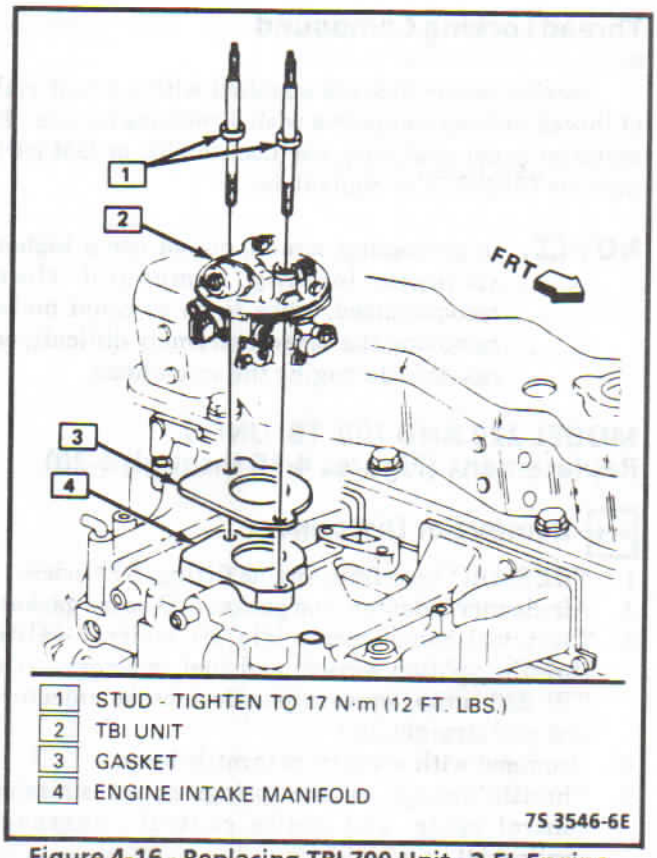


Figure 4-16 - Replacing TBI 700 Unit - 2.5L Engine

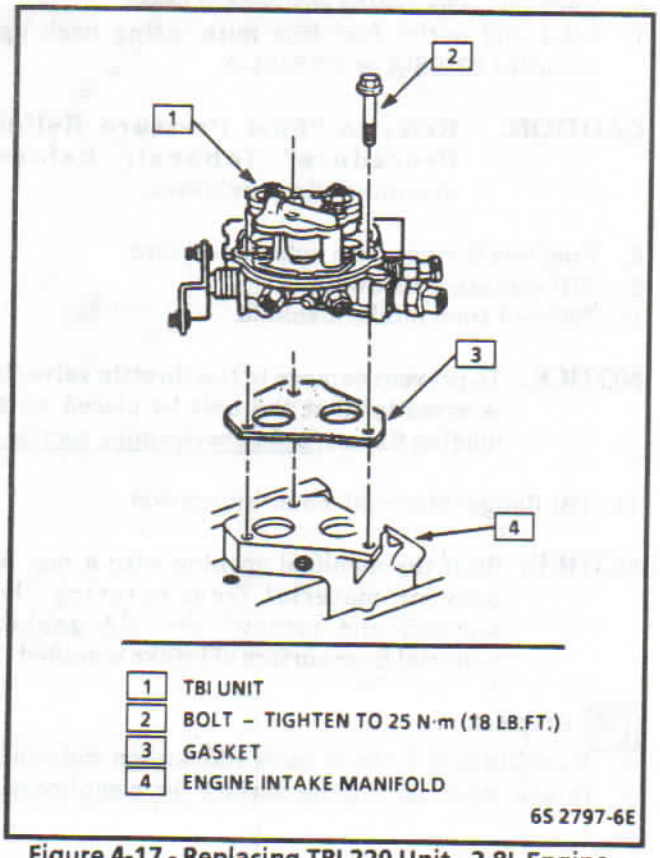


Figure 4-17 - Replacing TBI 220 Unit - 2.8L Engine

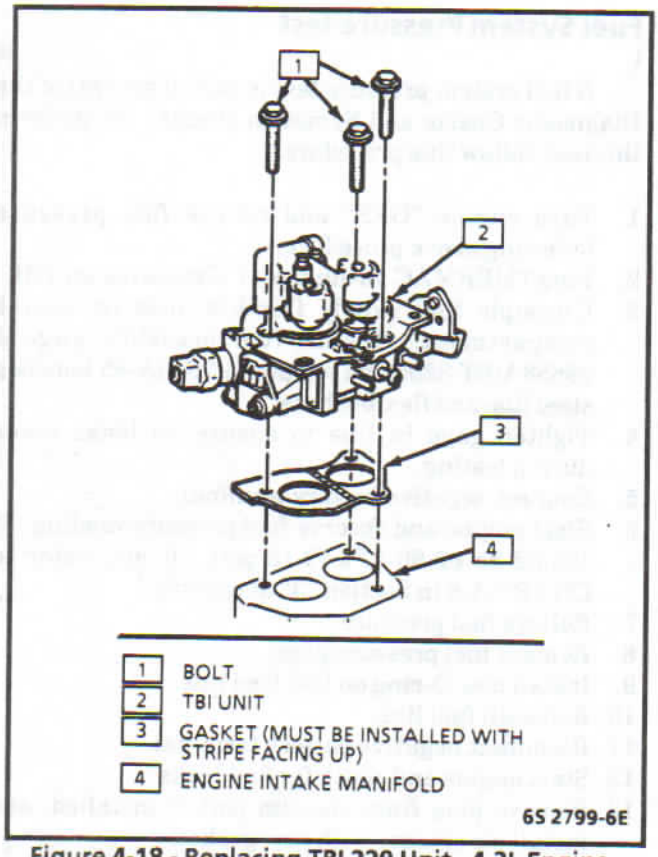


Figure 4-18 - Replacing TBI 220 Unit - 4.3L Engine

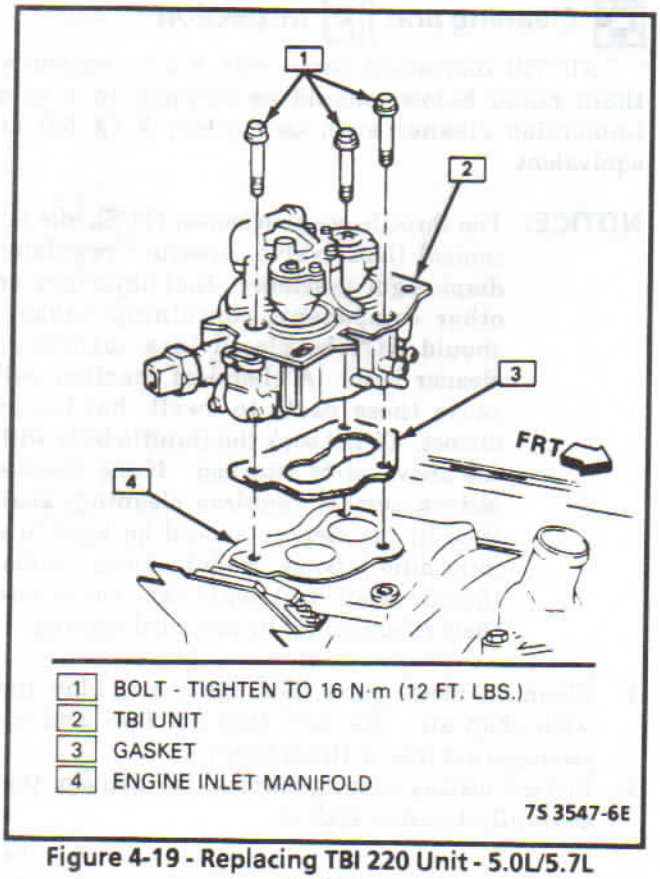
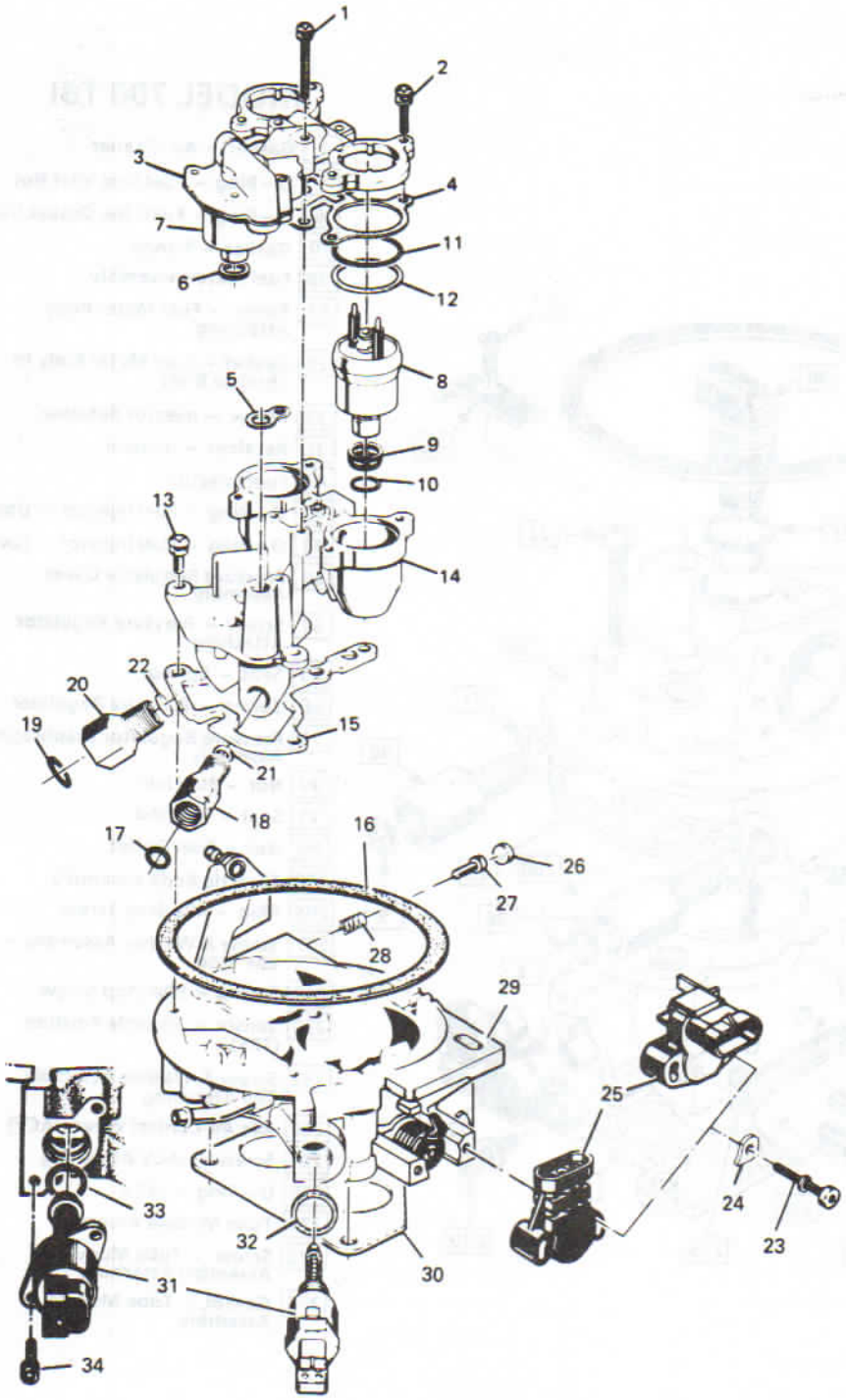


Figure 4-19 - Replacing TBI 220 Unit - 5.0L/5.7L Engine



Model 220 TBI

1 Screw Assembly — Fuel Meter Cover Attaching — Long
2 Screw Assembly — Fuel Meter Cover Attaching — Short
3 Fuel Meter Cover Assembly
4 Gasket — Fuel Meter Cover
5 Gasket — Fuel Meter Outlet
6 Seal — Pressure Regulator
7 Pressure Regulator
8 Injector — Fuel
9 Filter — Fuel Injector Inlet
10 O-ring — Fuel Injector — Lower
11 O-ring — Fuel Injector — Upper
12 Washer — Fuel Injector
13 Screw Assembly — Fuel Meter Body — Throttle Body Attaching
14 Fuel Meter Body Assembly
15 Gasket — Throttle Body to Fuel Meter Body
16 Gasket — Air Cleaner
17 O-Ring — Fuel Return Line
18 Nut — Fuel Outlet
19 O-Ring — Fuel Inlet Line
20 Nut — Fuel Inlet
21 Gasket — Fuel Outlet Nut
22 Gasket — Fuel Inlet Nut
23 Screw Assemcly — TPS Attaching
24 Retainer — TPS Attaching Screw
25 Sensor — Throttle Position (TPS)
26 Plug — Idle Stop Screw
27 Screw Assembly — Idle Stop
28 Spring — Idle Stop Screw
29 Throttle Body Assembly
30 Gasket — Flange
31 Valve Assembly — Idle Air Control (IAC)
32 Gasket — Idle Air Control Valve Assembly
33 O-Ring — IACV
34 Screw Assembly — IACV Attaching

7S 3658-6E

Figure 4-15 - Model 220 TBI Parts Identification (V-6 and V-8 Engine)

ON-VEHICLE SERVICE

GENERAL SERVICE MANUAL

CAUTION:

- **To prevent personal injury or damage to the vehicle as the result of an accidental start, disconnect and reconnect the negative battery cable before and after service is performed (except for those tests where battery voltage is required).**
- **To minimize the risk of fire, and personal injury, disconnect negative battery cable and relieve the fuel system pressure (where applicable) before servicing the fuel system. (See "Fuel Pressure Relief Procedure," below.)**
- **Also, catch any fuel that leaks out when disconnecting the fuel lines by covering the fittings with a shop cloth. Place the cloth in an approved container when work is complete.**

The following is general information required when working on the fuel system:

- Always keep a dry chemical (Class B) fire extinguisher near the work area.
- Fuel pipe fittings require new O-rings when assembling.
- All fuel pipe must meet the GM Specification 124-M, or its equivalent.
- All fuel hose must meet GM Specification 6163-M or its equivalent.
- Do not replace fuel pipe with fuel hose.
- Always allow fuel pressure to bleed off before servicing any fuel system components.
- Do not do any repairs on the fuel system until you have read the instructions and checked the pictures relating to that repair.
- Observe all Notices and Cautions.

All gasoline engines are designed to use only unleaded gasoline to maintain proper emission control system operation. Its use will also minimize spark plug fouling and extend engine oil life. Using leaded gasoline can damage the emission control system and could result in loss of emission warranty coverage.

All vehicles covered in the manual are equipped with and evaporative emission system. The purpose of the system is to minimize the escape of fuel vapors to the atmosphere. Information on this system will be found in SECTION "5".

The TBI unit repair procedures cover component replacement with the unit on the vehicle. However, throttle body replacement requires that the complete unit be removed from the engine.

Refer to the disassembled views (Figure 4-14 and 4-15) for identification of parts during repair procedures. Service repair of individual components is performed without removing the TBI unit from the engine. If removed, it is essential that care is taken to prevent damage to the throttle valve or sealing surface while performing any service.

Whenever service is performed on a TBI or any of its components, first remove the air cleaner, adapter (if applicable), and air cleaner gaskets. Discard the gaskets and replace them with new ones before replacing the air cleaner after service is complete.

When disconnecting the fuel lines, be sure to use a backup wrench (J 29698-A, or BT 8251-A, or equivalent) to keep the TBI nuts from turning.

Fuel Pressure Relief Procedure

The TBI Model 200 for V6 and V8 engines contains a constant bleed feature in the pressure regulator that relieves pressure.

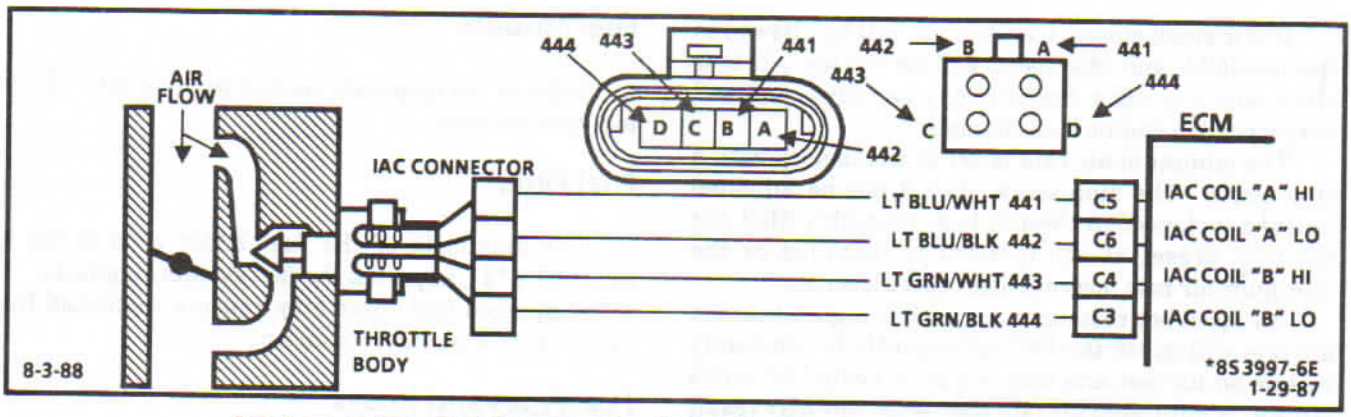
However, on L4 engines, the TBI Model 700 does not contain a constant bleed feature to relieve pressure.

TBI MODEL 700

1. Place transmission selector in park (neutral on manual transmissions), set parking brake, and block drive wheels.
2. Loosen fuel filler cap to relieve tank pressure.
3. Disconnect three terminal electrical connector at fuel tank.
4. Start engine and allow to run a few seconds until it stops from lack of fuel.
5. Engage starter for three seconds to dissipate fuel pressure in lines. Fuel connections are now safe for servicing.
6. Disconnect negative battery terminal to avoid possible fuel discharge if an accidental attempt is made to start the engine.
7. After service, reconnect connector at fuel tank, tighten fuel filler cap and reinstall negative battery cable.

TBI MODEL 220

1. Disconnect negative battery terminal to avoid possible fuel discharge if an accidental attempt is made to start the engine.
2. Loosen fuel filler cap to relieve tank vapor pressure.
3. The internal constant bleed feature of TBI Model 220 relieves fuel pump system pressure when the engine is turned "OFF." Therefore, no further pressure relief procedure is required.



IDLE AIR CONTROL (IAC) SYSTEM CHECK

ALL ENGINES EXCEPT 2.5L

Circuit Description:

The ECM controls idle rpm with the IAC valve. To increase idle rpm, the ECM moves the IAC valve away from it's seat, allowing more air to pass by the throttle plate. To decrease rpm, it moves the IAC valve toward it's seat, reducing air flow by the throttle plate. A "Scan" tool will read the ECM commands to the IAC valve in counts. The higher the counts, the more air allowed (higher idle). The lower the counts, the less air allowed (lower idle).

Test Description: Numbers below refer to circled numbers on the diagnostic chart.

1. The IAC tester is used to extend and retract the IAC valve. Valve movement is verified by an engine speed change. If no change in engine speed occurs, the valve can be retested when removed from the throttle body.
2. This step checks the quality of the IAC movement in step 1. Between 700 rpm and about 1500 rpm, the engine speed should change smoothly with each flash of the tester light in both extend and retract. If the IAC valve is retracted beyond the control range (about 1500 rpm), it may take many flashes in the extend position before engine speed will begin to drop. This is normal on certain engines, fully extending IAC may cause engine stall. This may be normal.
3. Steps 1 and 2 verified proper IAC valve operation while this step checks the IAC circuits. Each lamp on the node light should flash red and green while the IAC valve is cycled. While the sequence of color is not important if either light is "OFF" or does not flash red and green, check the circuits for faults, beginning with poor terminal contacts.

IAC VALVE RESET PROCEDURE

- Ignition "OFF" for 10 seconds
- Start and run engine for 5 seconds
- Ignition "OFF" for 10 seconds

Diagnostic Aids:

A slow, unstable, or fast idle may be caused by a non-IAC system problem that cannot be overcome by the IAC valve. Out of control range IAC "Scan" tool counts will be above 60 if idle is too low, and zero counts if idle is too high. The following checks should be made to repair a non-IAC system problem.

- Vacuum Leak (High Idle)
  If idle is too high, stop the engine. Fully extend (low) IAC with tester.
  Start engine. If idle speed is above 800 rpm, locate and correct vacuum leak including PCV system. Also check for binding of throttle blade or linkage.
- System too lean (High Air/Fuel Ratio)
  The idle speed may be too high or too low. Engine speed may vary up and down and disconnecting the IAC valve does not help. Code 44 may be set "Scan" O_2 voltage will be less than 300 mV (.3 volts). Check for low regulated fuel pressure water in the fuel or a restricted injector.
- System too rich (Low Air/Fuel Ratio)
  The idle speed will be too low. "Scan" tool IAC counts will usually be above 80. System is obviously rich and may exhibit black smoke in exhaust.
  "Scan" tool O_2 voltage will be fixed above 800 mV (.8 volts).
  Check for high fuel pressure, leaking or sticking injector. Silicone contaminated O_2 sensors "Scan" voltage will be slow to respond.
- Throttle body - Remove IAC and inspect bore for foreign material.
- Refer to "Rough, Unstable, Incorrect Idle or Stalling" in SYMPTOMS (SECTION B).
- If intermittent, poor driveability in idle symptoms are resolved by disconnecting the IAC, carefully recheck connections, valve terminal resistance, or replace IAC.
- A/C Compressor or relay failure - See A/C diagnosis if circuit is shorted to ground. If the relay is faulty, idle problem may exist.
- Refer to "Rough, Unstable, Incorrect Idle or Stalling," in SECTION "2".

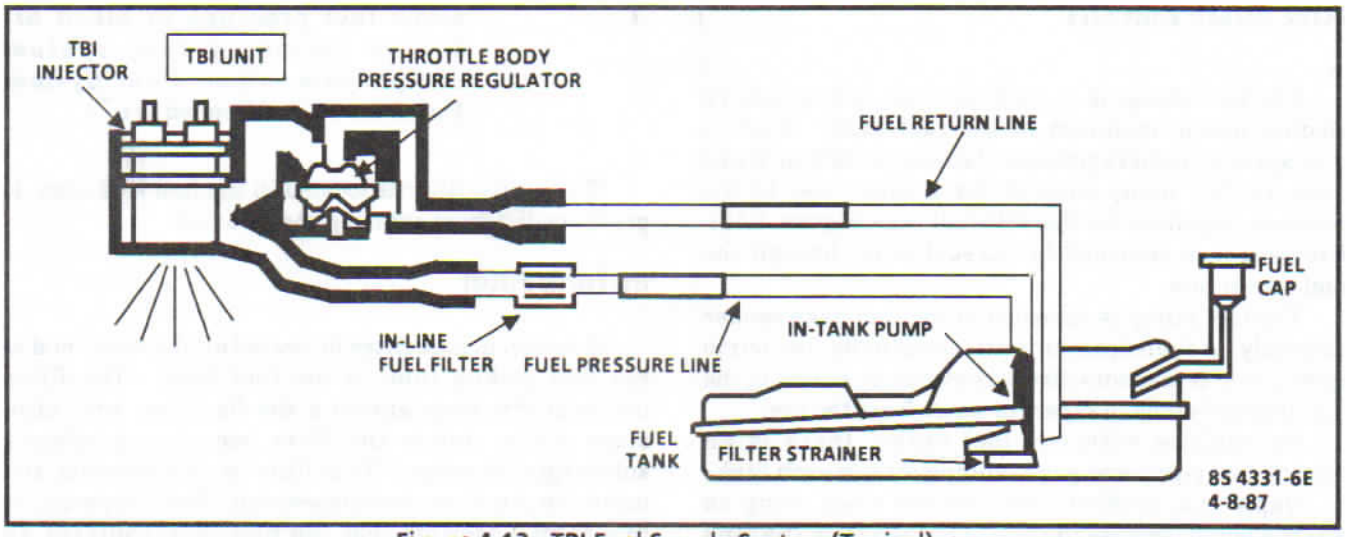


Figure 4-13 - TBI Fuel Supply System (Typical)

several turns counterclockwise to remove. The long threaded area was designed to allow any remaining fuel tank pressure to escape, while the cap was being removed. A built-in torque-limiting device prevents overtightening. To install, turn the cap clockwise until a clicking noise is hear. This signals that the correct torque has been reached and the cap is fully seated.

ACCELERATOR CONTROL

The accelerator control system is a control cable type, attached to an accelerator pedal assembly.

EVAPORATIVE EMISSION CONTROL

The system transfers fuel vapors from the fuel tank into a vapor canister and then vapors are purged into the intake manifold air flow and consumed in combustion. Refer to SECTION "5", for additional information, diagnosis, and on-vehicle service.

DIAGNOSIS

FUEL CONTROL

The diagnosis of fuel control and the TBI unit is in SECTION "3", because the computer command control system controls fuel delivery. This system has a built in diagnostic system in the ECM to indicate a failed circuit. This section will explain the system check and the codes related to fuel control.

The fuel control can be the reason that the engine cranks, but will not run and the diagnosis is, also, in SECTION "3". If diagnosis indicates that the engine will not run because there is a fuel delivery problem, the diagnosis of the fuel system is, also, included in SECTION "3".

Fuel Injectors

Testing the fuel injector circuit is in CHART A-3 and additional diagnosis in CHART A-4 in SECTION "3".

A fuel injector which does not open may cause a no-start condition. An injector which is stuck partly open, could cause loss of pressure after sitting, so long crank times would be noticed on some engines. Also, dieseling could occur because some fuel could be delivered to the engine after the key is turned "OFF."

Pressure Regulator

Testing the pressure regulator circuit is in CHART A-3 and A-4, in SECTION "3".

If the pressure regulator in the TBI supplies pressure which is too low (below 62 kPa or 9 psi), poor performance could result. If the pressure is too high, excess emissions and unpleasant exhaust odor may result.

Idle Air Control

The diagnosis of idle air control can be found in Code 35, SECTION "3", for the 2.5L engine and in this section for all other engines.

If the IAC valve is disconnected or connected with the engine running, the idle rpm may be wrong. In this case, the IAC valve may be reset by turning the engine "OFF" for ten seconds and then re-starting the engine.

The IAC valve affects only the idle characteristics of the engine. If it is open fully, too much air will be allowed to the manifold and idle speed will be high.

Throttle Position Sensor (TPS)

The Throttle Position Sensor (TPS), is mounted on the side of the throttle body opposite the throttle lever assembly. Its function is to sense the current throttle valve position and relay that information to the ECM (see Figure 4-11 and 4-12). Throttle position information allows the ECM to generate the required injector control signals (base pulse).

If the TPS senses a wide open throttle, a voltage signal indicating this condition is sent to the ECM. The ECM then increases the injector base pulse width, permitting increased fuel flow.

As the throttle valve rotates in response to movement of the accelerator pedal, the throttle shaft transfers this rotation movement to the TPS. A potentiometer (variable resistor) within the TPS assembly changes its resistance (and voltage drop) in proportion to throttle movement.

By applying a reference voltage (5.0 volts) to the TPS input, a varying voltage (reflecting throttle position) is available at the TPS output. For example, approximately 2.5 volts results from a 50% throttle valve opening (depending on TPS calibration). The voltage output from the TPS assembly is routed to the ECM for use in determining throttle position.

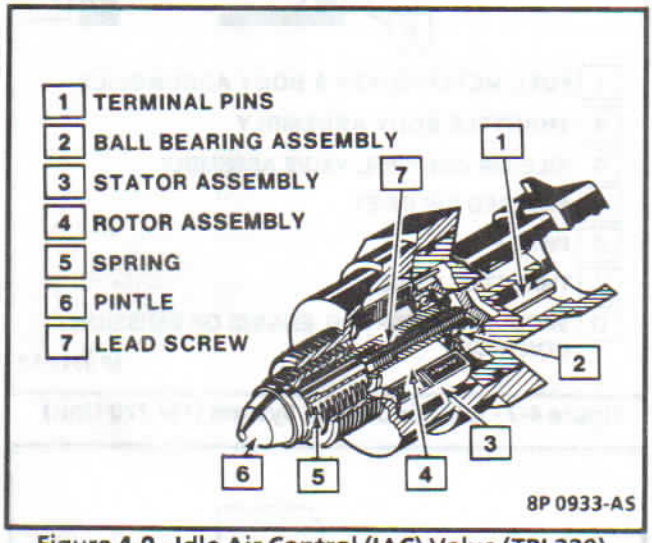


Figure 4-9 - Idle Air Control (IAC) Valve (TBI 220)

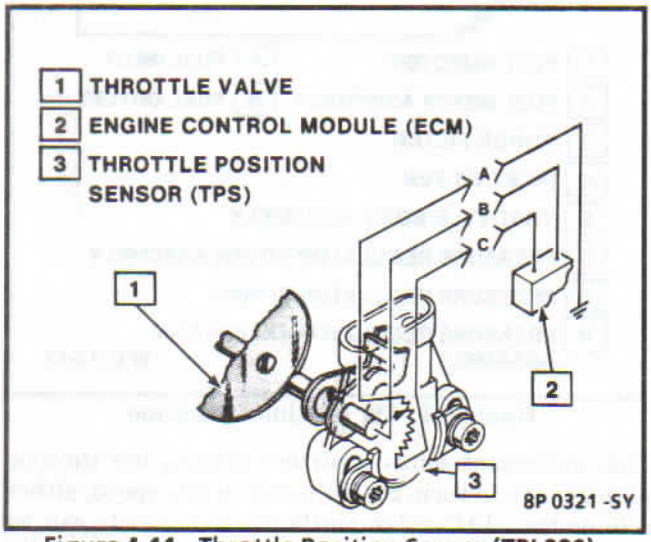


Figure 4-11 - Throttle Position Sensor (TBI 220)

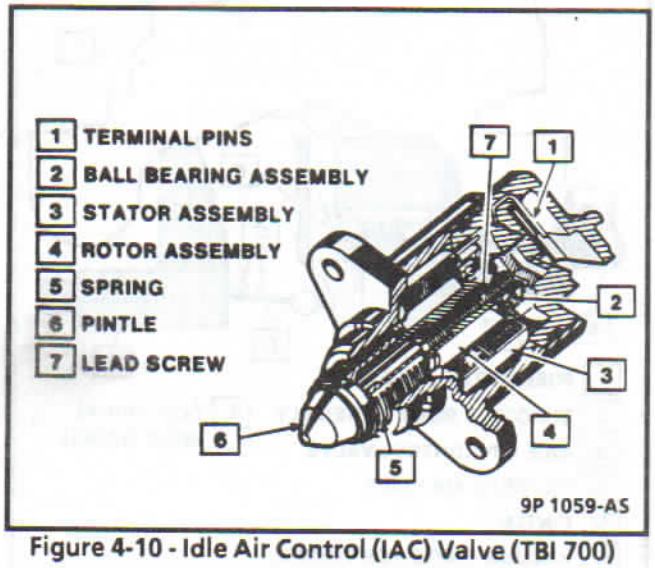


Figure 4-10 - Idle Air Control (IAC) Valve (TBI 700)

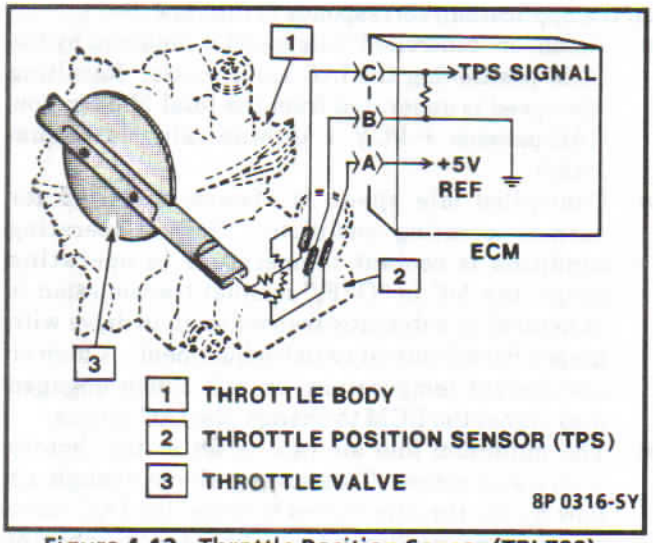


Figure 4-12 - Throttle Position Sensor (TBI 700)

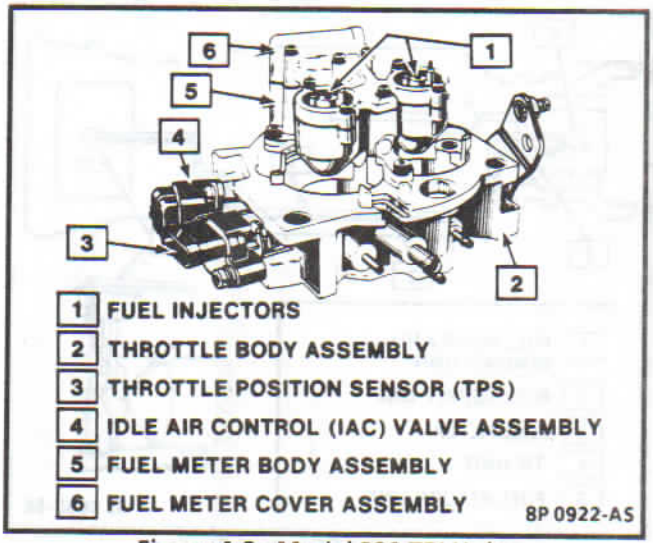


Figure 4-3 - Model 220 TBI Unit

Vacuum Ports

The throttle body portion of both TBI units may contain ports located above, or below the throttle valve. These ports generate the vacuum signals for the Exhaust Gas Recirculation (EGR) valve, MAP sensor, and the canister purge system.

Fuel Injector(s)

The fuel injectors (Figure 4-5 and 4-6) are solenoid-operated devices, controlled by the ECM. The ECM turns on the solenoid, which lifts a normally closed ball valve off a seat. Fuel, under pressure, is injected in a conical spray pattern at the walls of the throttle body bore above the throttle valve.
The fuel which is not used by the injectors passes through the pressure regulator before being returned to the fuel tank.

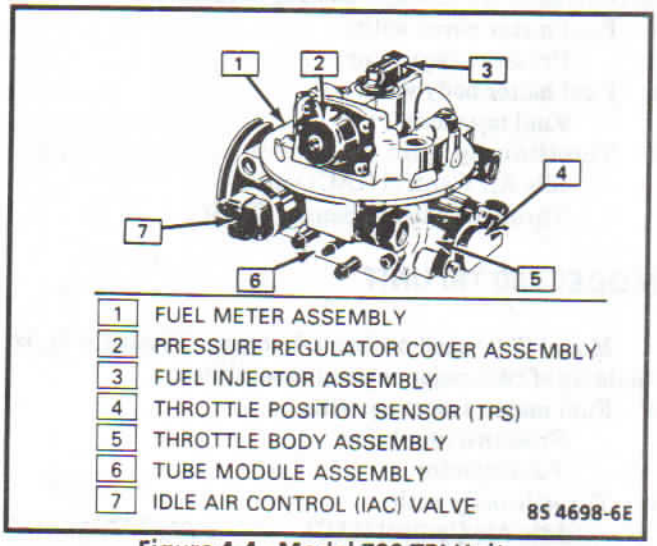


Figure 4-4 - Model 700 TBI Unit

Pressure Regulator

The pressure regulator (see Figure 4-5 and 4-6) is a diaphragm-operated relief valve with injector pressure on one side and air cleaner pressure on the other. The function of the regulator is to maintain a constant pressure at the injectors at all times, by controlling the flow in the return line (by means of a calibrated bypass).

The pressure regulator on a TBI 220 unit is serviced as part of the fuel meter cover and should not be disassembled.

The pressure regulator on a TBI 700 unit is serviced as part of the fuel meter assembly and can be disassembled.

Idle Air Control System

All engine idle speeds are controlled by the ECM through the Idle Air Control (IAC) valve mounted on the throttle body (Figures 4-7 or 4-8). The ECM sends voltage pulses to the IAC motor windings causing the IAC motor shaft and pintle to move "IN" or "OUT" a given distance (number of steps) for each pulse, (called counts).

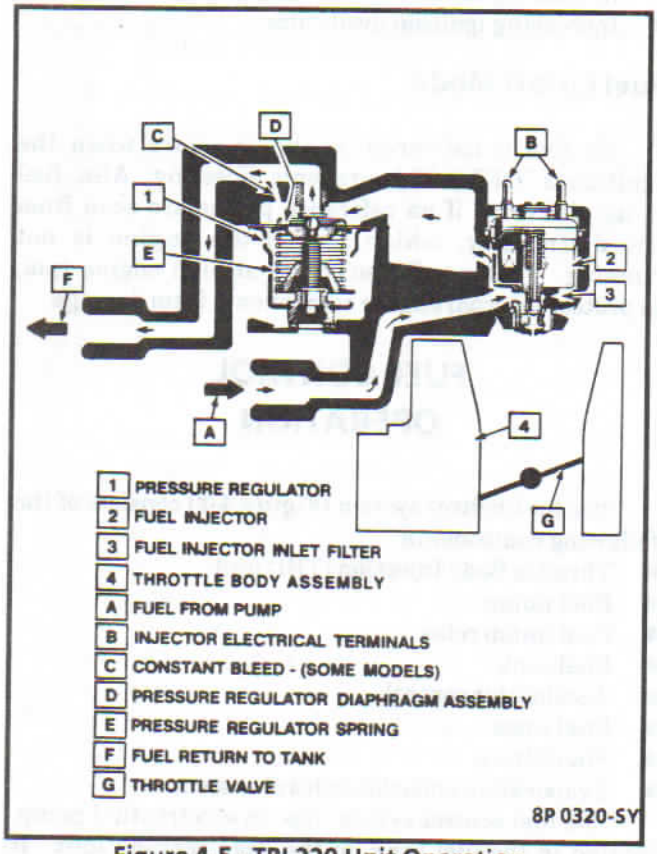


Figure 4-5 - TBI 220 Unit Operation

GENERAL DESCRIPTION

PURPOSE

The fuel control system is controlled by an Electronic Control Module (ECM) located in the passenger compartment. The ECM is the control center of the computer command control system found in Section "3" which provides additional information about fuel control and deliver.

The basic function of the fuel control system is to control fuel delivery to the engine. Fuel is delivered to the engine by a Throttle Body Injection (TBI) unit.

The main control sensor is the Oxygen (O_2) sensor, which is located in the exhaust manifold. The O_2 sensor tells the ECM the amount of oxygen in the exhaust gas, and the ECM changes the air/fuel ratio to the engine by controlling the fuel injector. A 14.7:1 air/fuel ratio is required for efficient catalytic converter operation. Because the constant measuring and adjusting of the air/fuel ratio, the fuel injection system is called a "Closed Loop" system (Figure 4-1).

MODES OF OPERATION

The ECM monitors voltages from several sensors to determine how much fuel to give the engine. The fuel is delivered under one of several conditions called "modes." All the modes are controlled by the ECM.

Starting Mode

When the key is first turned "ON," the ECM turns on the fuel pump relay for two seconds, and the fuel pump builds up pressure to the TBI unit. The ECM checks the coolant temperature sensor, Throttle Position Sensor (TPS), Manifold Absolute Pressure (MAP) sensor, and crank signal, then determines the proper air/fuel ratio for starting. This ranges from 1:5:1 at -36°C (-33°F) to 14.7:1, at 94°C (201°F) running temperature.

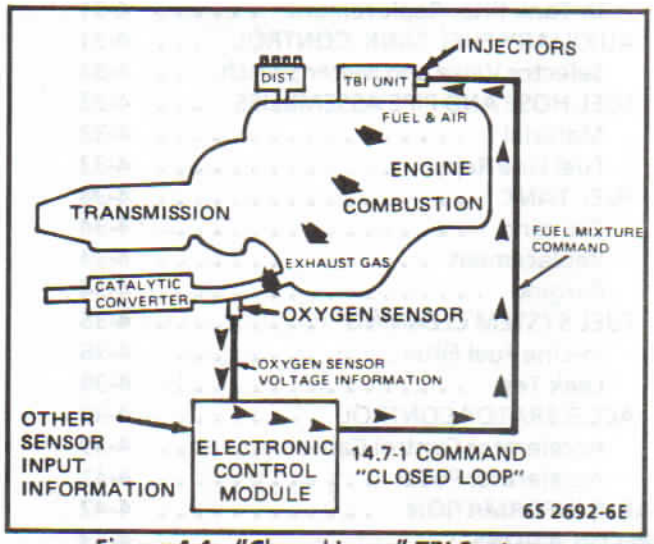


Figure 4-1 - "Closed Loop" TBI System

The ECM controls the amount of fuel delivered in the starting mode by changing how long the injector is turned "ON" and "OFF." This is done by "pulsing" the injector for very short times.

Clear Flood Mode

If the engine floods, clear it by pushing the accelerator pedal down all the way. The ECM then pulses the injector at a 20:1 air/fuel ratio, and holds this injector rate as long as the throttle stays wide open, and the engine is below 600 rpm. If the throttle position becomes less than 80%, the ECM returns to the starting mode.

Run Mode

The Run mode has two conditions called "Open Loop" and "Closed Loop."

Open Loop

When the engine is first started, and it is above 400 rpm, the system goes into "Open Loop" operation. In "Open Loop," the ECM ignores the signal from the O_2 sensor, and calculates the air/fuel ratio based on inputs from the coolant temperature and MAP sensors.

The system stays in "Open Loop" until the following conditions are met:

1. The O_2 sensor has varying voltage output, showing that it is hot enough to operate properly. (This depends on temperature.)
2. The coolant temperature sensor is above a specified temperature.
3. A specific amount of time has elapsed after starting the engine.

The 7.4L engine is designed to operate "Open Loop" at idle. The system will go to "Closed Loop" when the rpm is increased and all conditions above are met. A normal functioning system may go into open loop at idle if O_2 sensor temperature drops below the minimum requirement to produce voltage fluctuation.

Closed Loop

The specific values for the above conditions vary with different engines, and are stored in the Programmable Read Only Memory (PROM). When these conditions are met, the systems goes into "Closed Loop" operation. In "Closed Loop," the ECM