FUEL DELIVERY SYSTEM

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FUEL DELIVERY SYSTEM

- Creating and maintaining a correct air-fuel mixture requires a properly functioning fuel and air **delivery system.**
- Fuel delivery (and return) systems use many if not all of the following components to make certain that fuel is available under the right conditions to the fuel-injection system:
  - Fuel storage tank, filler neck, and gas cap
  - Fuel tank pressure sensor
  - Fuel pump
  - Fuel filter(s)
  - Fuel delivery lines and fuel rail
  - Fuel pressure regulator
  - Evaporative emission controls
  - Fuel return line

FUEL TANKS

- A vehicle fuel tank is made of corrosion-resistant steel or polyethylene plastic.
- Some models, such as sport utility vehicles (SUVs) and light trucks, may have an auxiliary fuel tank.

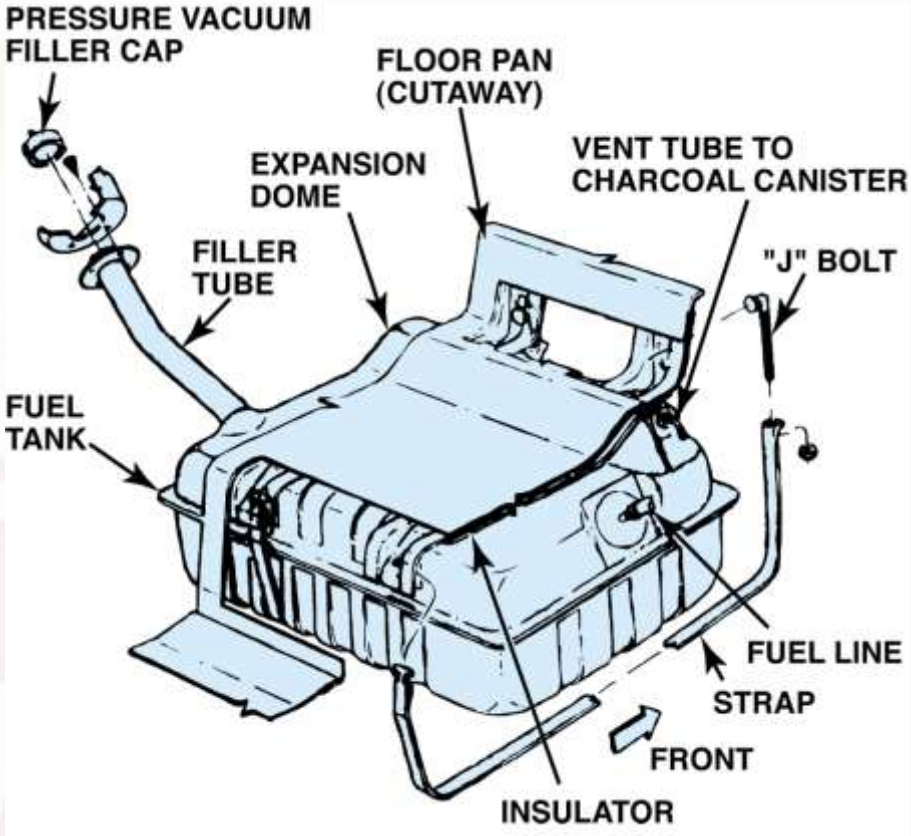

FIGURE 33-1 A typical fuel tank installation.

FUEL TANKS

- **Tank Location and Mounting**
- **Filler Tubes**
- **Pressure-Vacuum Filler Cap**
- **Fuel Pickup Tube**
- **Tank Venting Requirements**
- **Rollover Leakage Protection**

FUEL TANKS

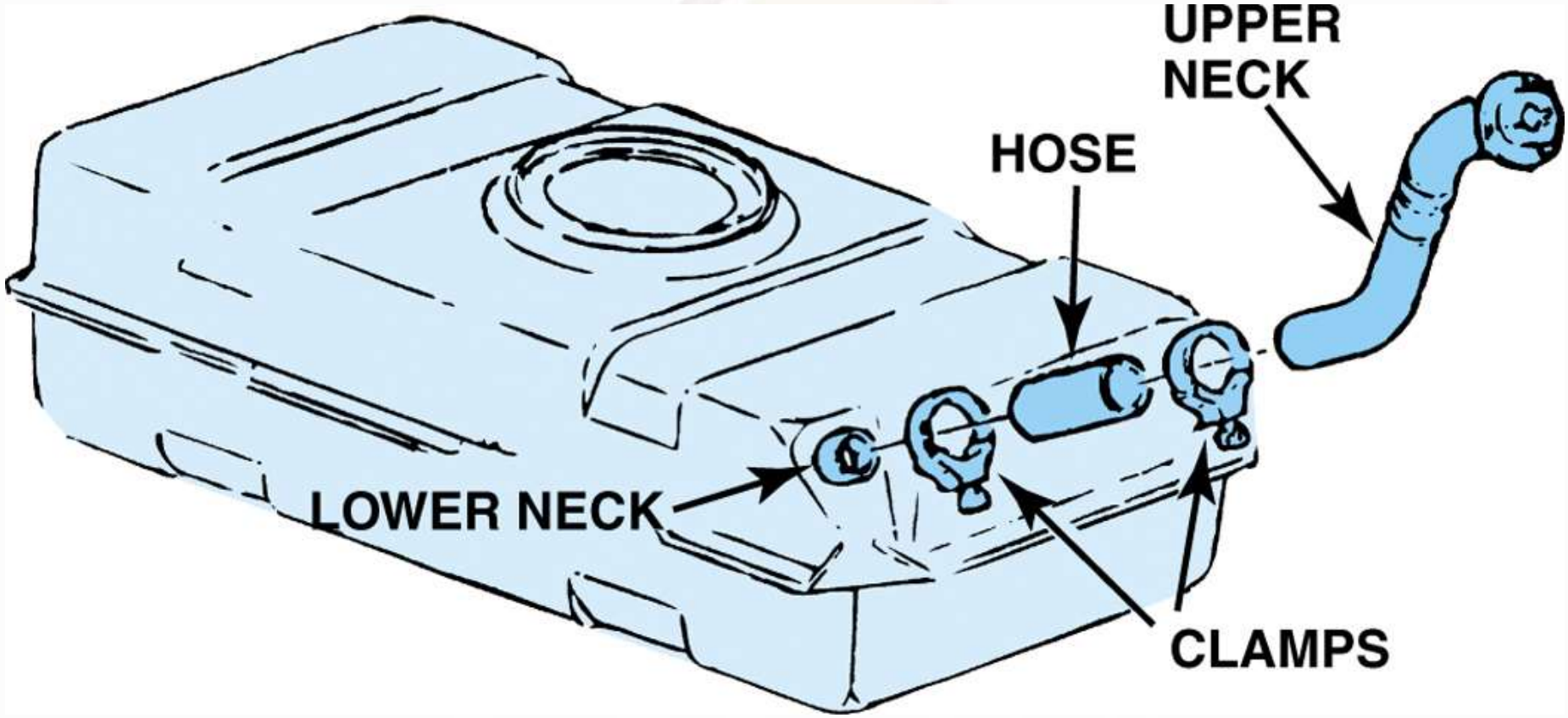

FIGURE 33-2 A three-piece filler tube assembly.

FUEL TANKS

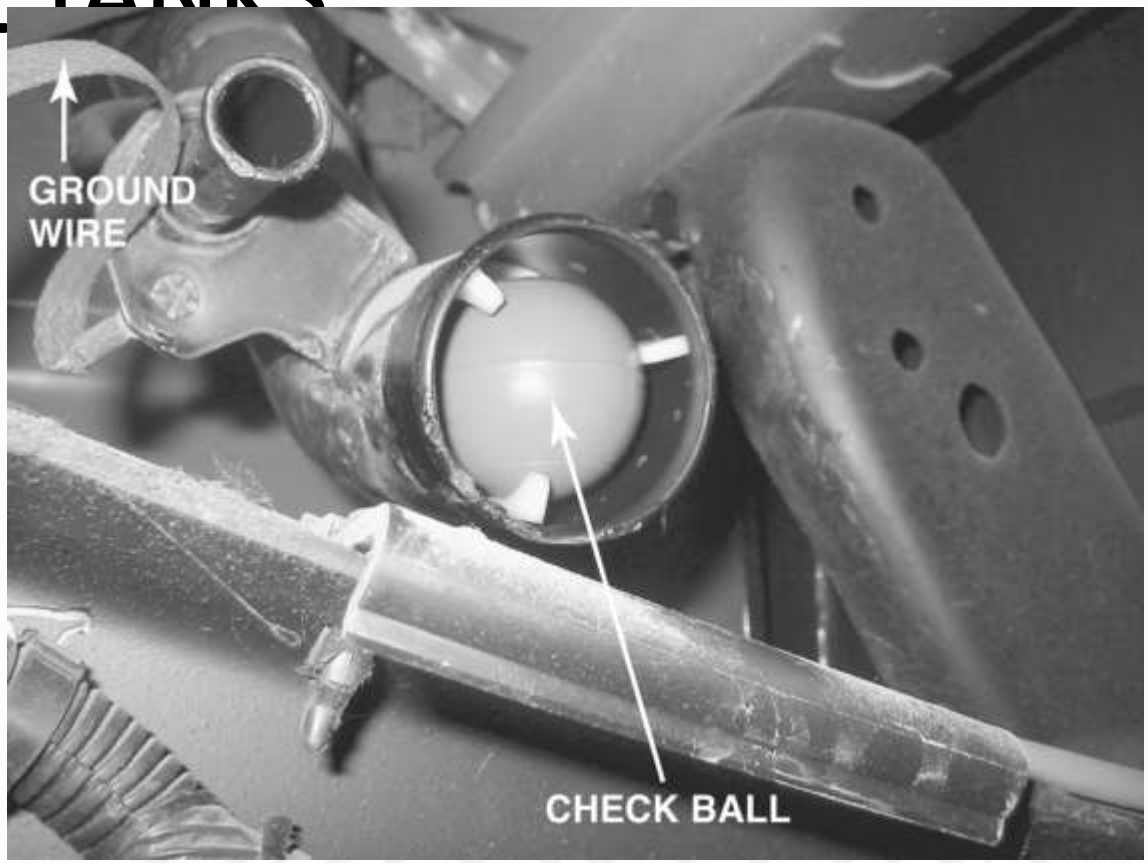

FIGURE 33-3 A view of a typical filler tube with the fuel tank removed. Notice the ground strap used to help prevent the buildup of static electricity as the fuel flows into the plastic tank. The check ball looks exactly like a ping-pong ball.

FUEL TANKS

FIGURE 33-4 Vehicles equipped with onboard refueling vapor recovery usually have a reduced size fill tube.

FUEL TANKS

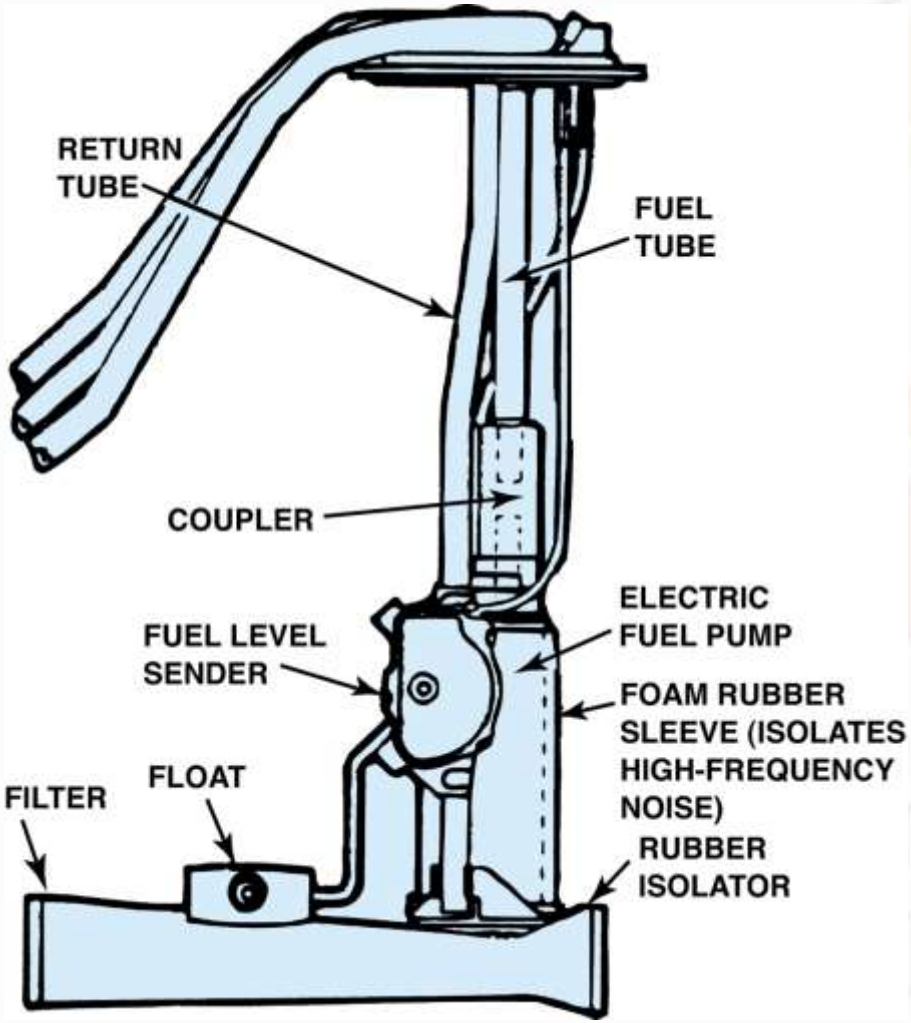

FIGURE 33-5 The fuel pickup tube is part of the fuel sender and pump assembly.

FU

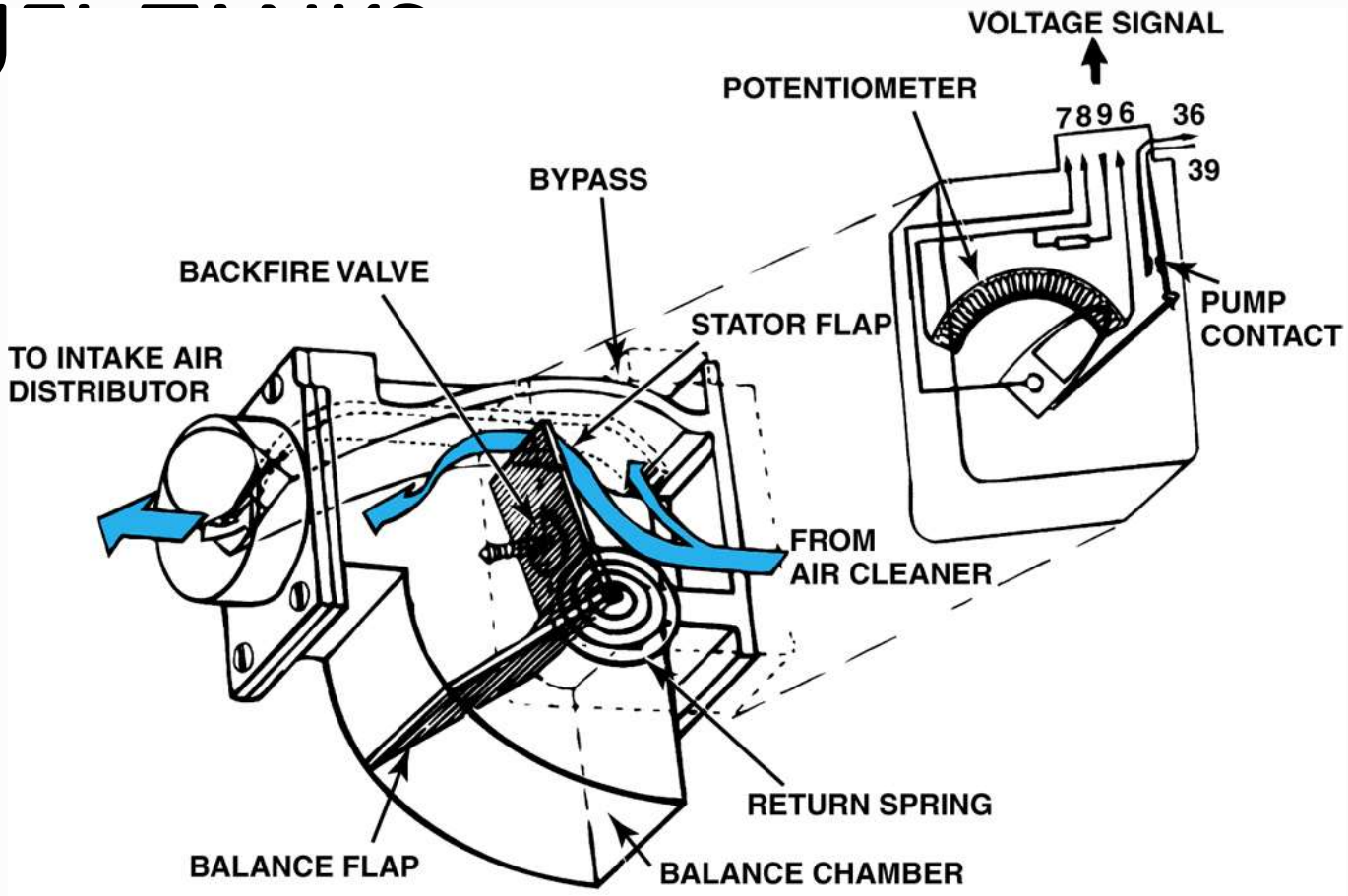

FIGURE 33-6 On some vehicles equipped with an airflow sensor, a switch is used to energize the fuel pump. In the event of a collision, the switch opens and the fuel flow stops.

FUEL TANKS

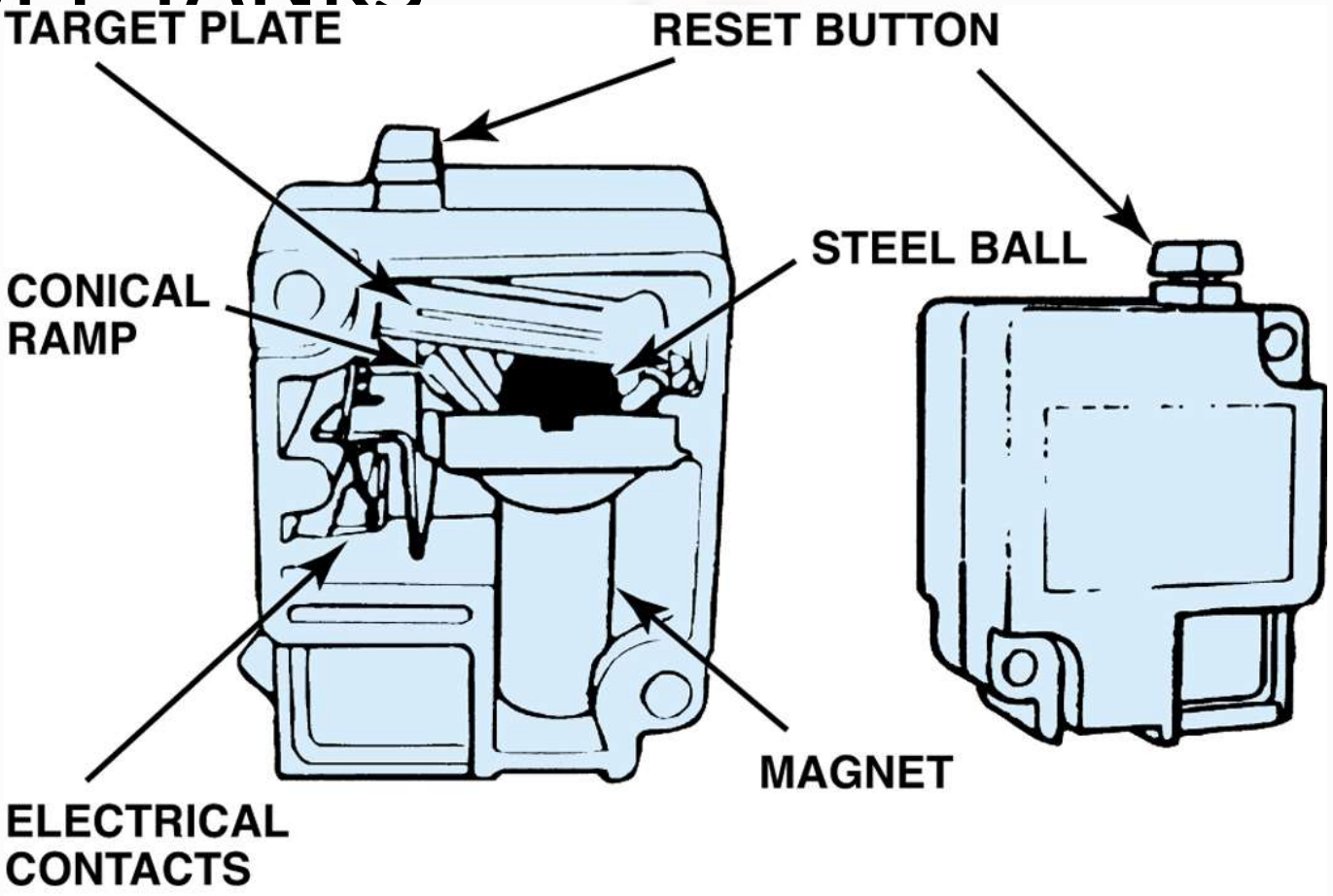

FIGURE 33-7 Ford uses an inertia switch to turn off the electric fuel pump in an accident.

FUEL LINES

- Fuel and vapor lines made of steel, nylon tubing, or fuel-resistant rubber hoses connect the parts of the fuel system.
- Fuel lines supply fuel to the throttle body or fuel rail.
- They also return excess fuel and vapors to the tank.
- Depending on their function, fuel and vapor lines may be either rigid or flexible.
- Fuel lines must remain as cool as possible.

FUEL LINES

- **Rigid Lines**
- **Flexible Lines**
- **Fuel Line Mounting**
- **Fuel-Injection Lines and Clamps**
- **Fuel-Injection Fittings and Nylon Lines**
- **Fuel Line Layout**

FUEL LINES

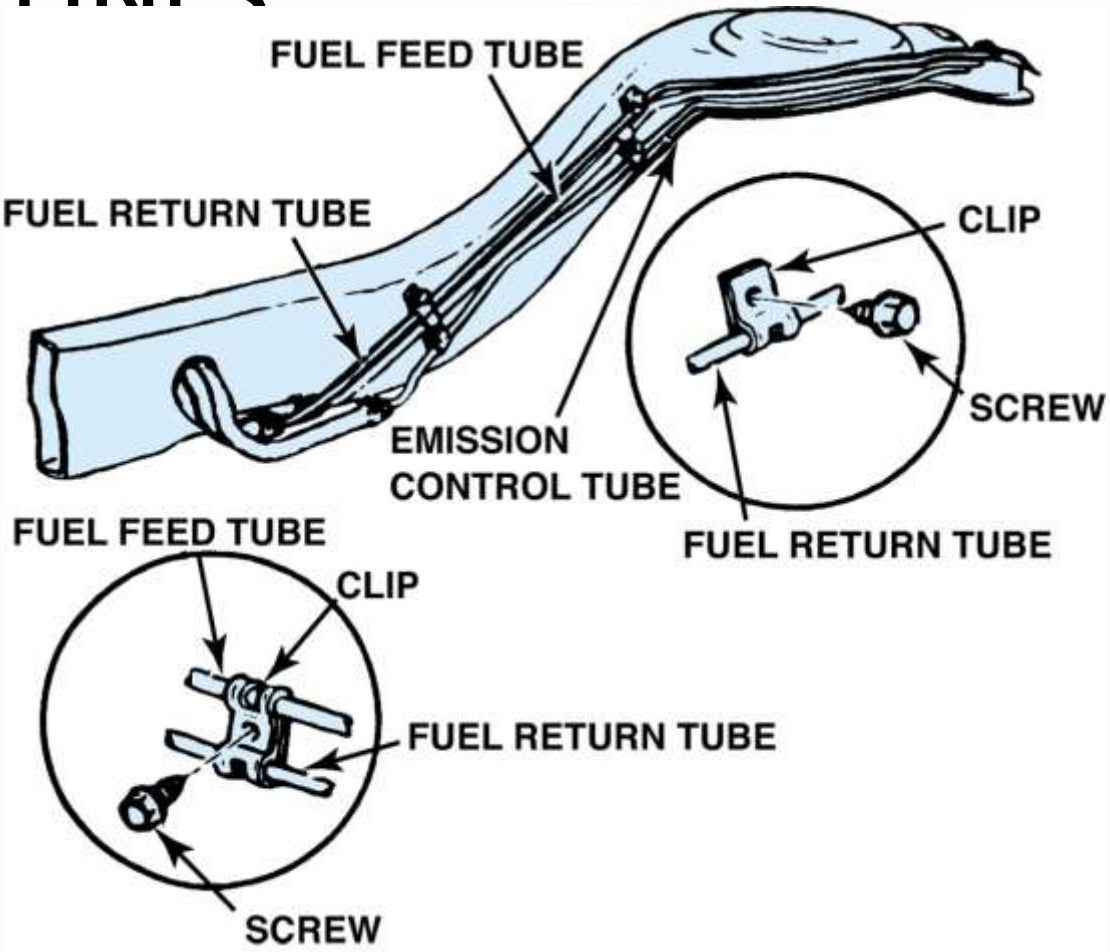

FIGURE 33-8 Fuel lines are routed along the frame or body and secured with clips.

FUEL LINES

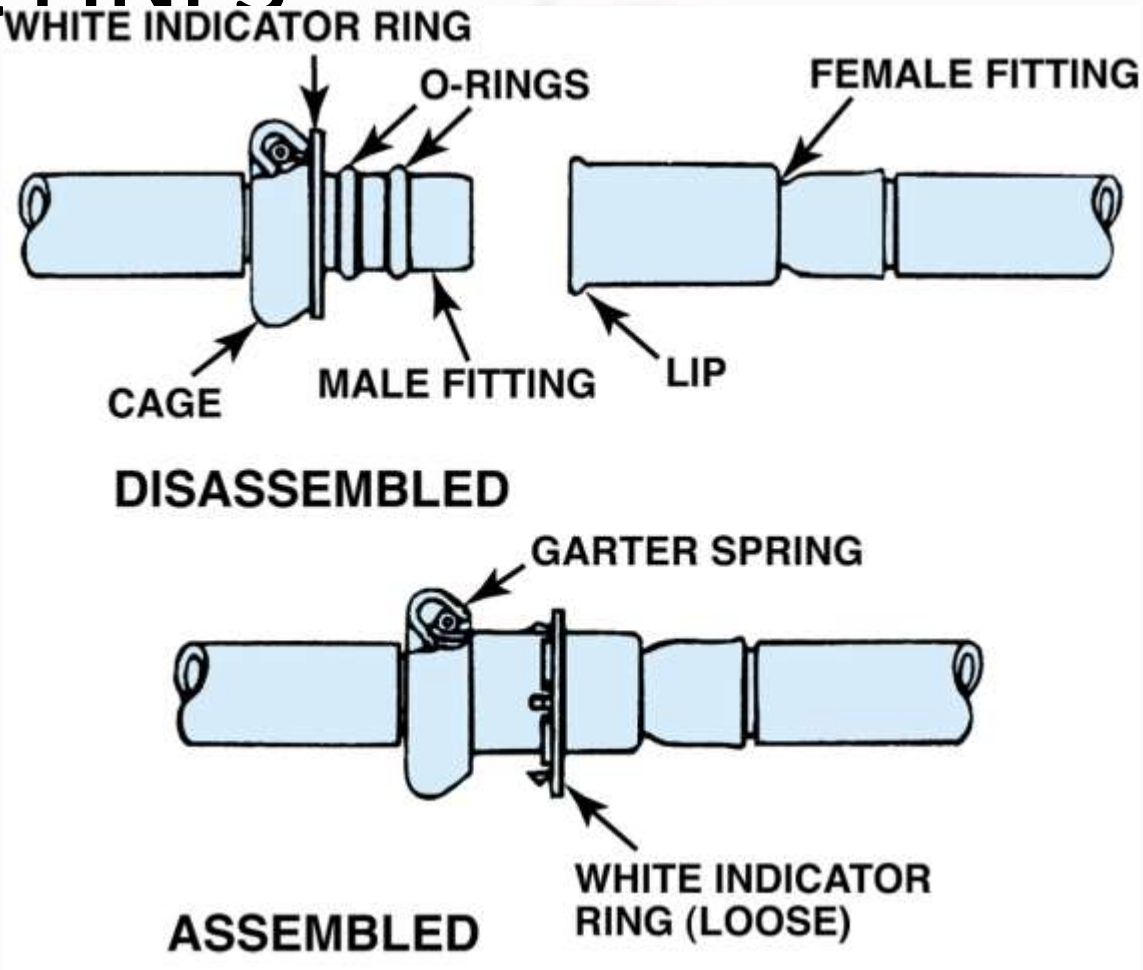

FIGURE 33-9 Some Ford metal line connections use spring-locks and O-rings.

FUEL LINES

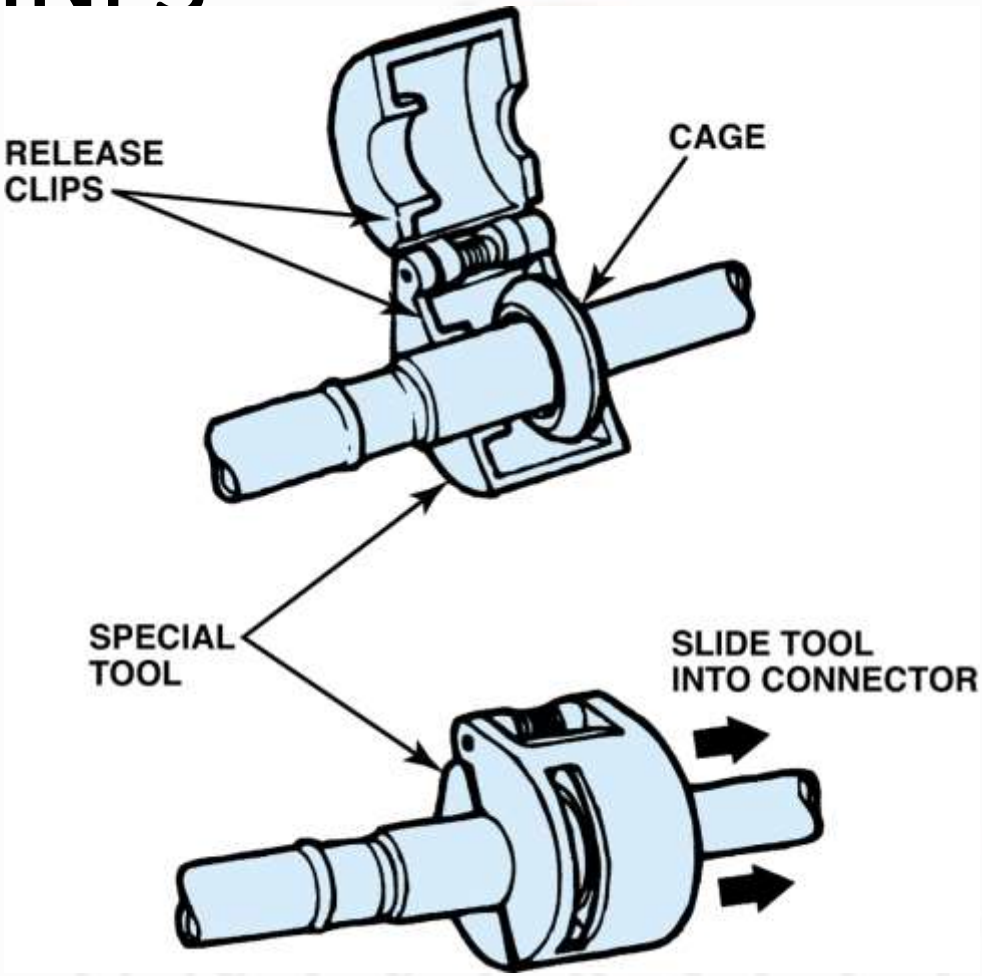

FIGURE 33-10 Ford spring-lock connectors require a special tool for disassembly.

FUEL LINES

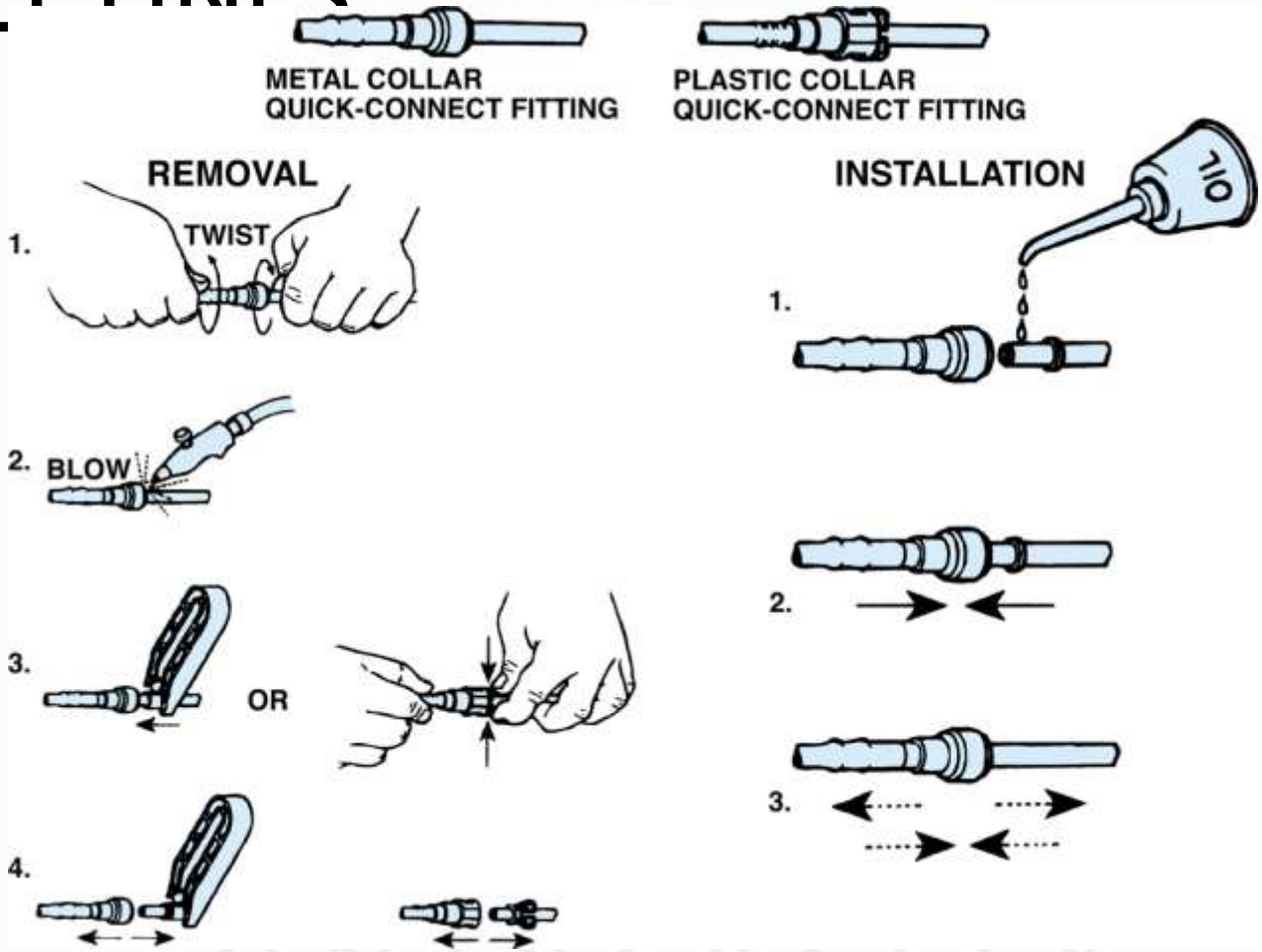

FIGURE 33-11 Typical quick-connect service stops.

ELECTRIC FUEL PUMPS

- The electric fuel pump is a pusher unit. When the pump is mounted in the tank, the entire fuel supply line to the engine can be pressurized.
  - Because the fuel, when pressurized, has a higher boiling point, it is unlikely that vapor will form to interfere with fuel flow.

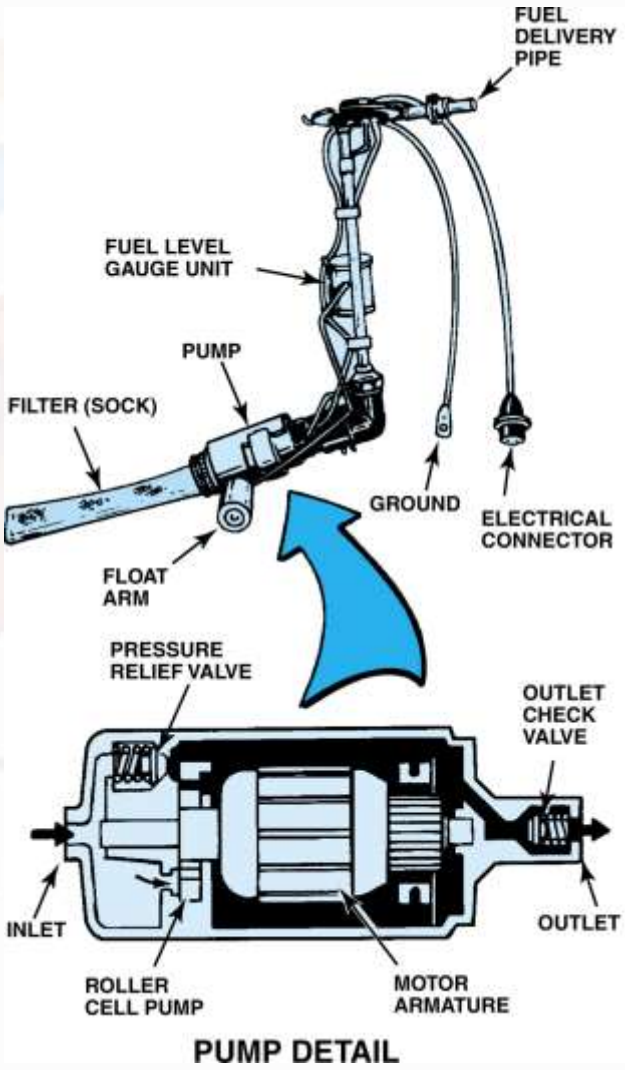

FIGURE 33-12 A roller cell-type electric fuel pump.

ELECTRIC FUEL PUMPS

- **Positive Displacement Pump**
- **Hydrokinetic Flow Pump Design**
- **Modular Fuel Sender Assembly**
- **Electric Pump Control Circuits**
- **Chrysler**
- **General Motors**
- **Fords**
- **Pump Pulsation Dampening**
- **Variable Speed Pumps**

ELECTRIC FUEL PUMPS

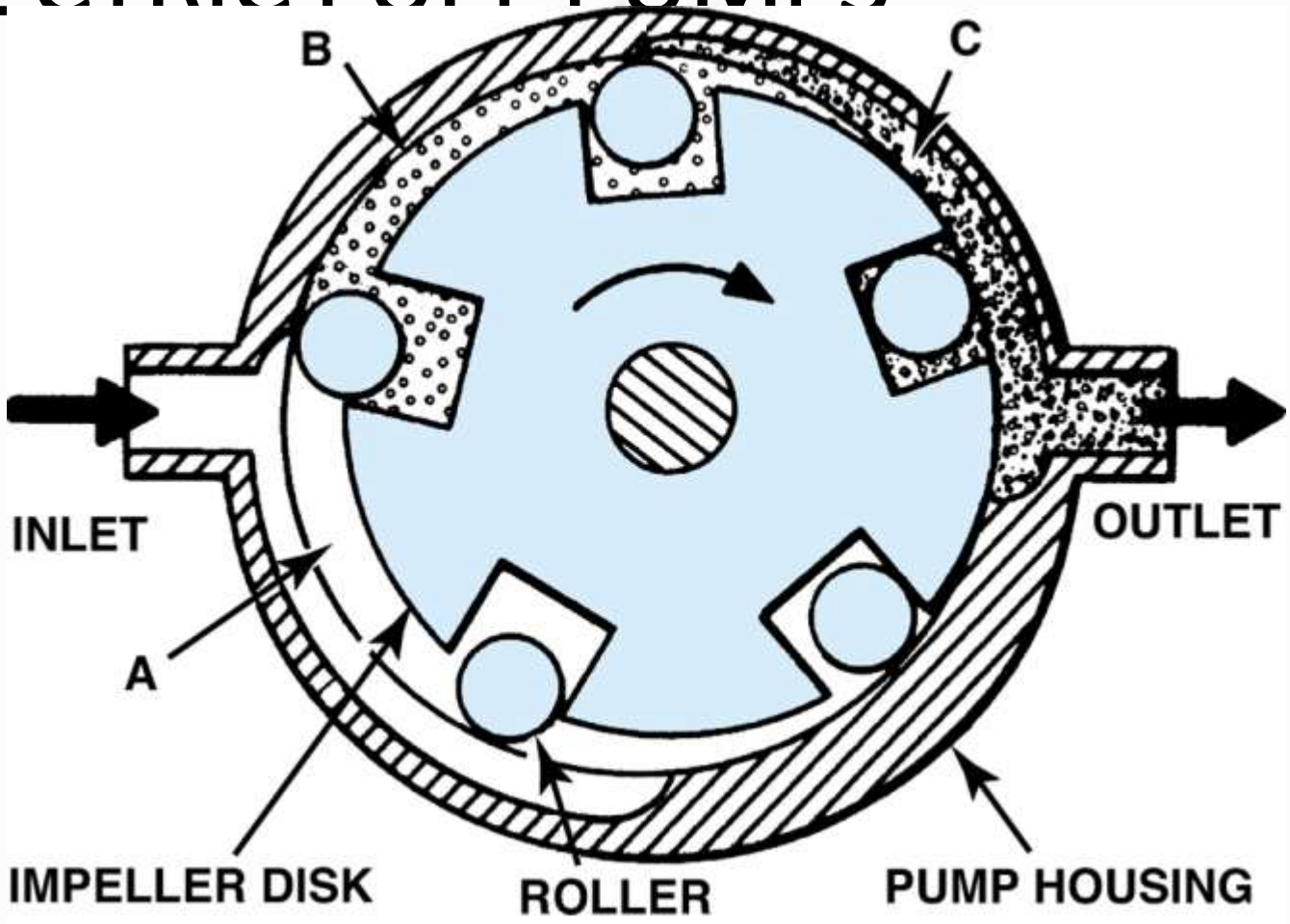

FIGURE 33-13 The pumping action of an impeller or rotary vane pump.

ELECTRIC FUEL PUMPS

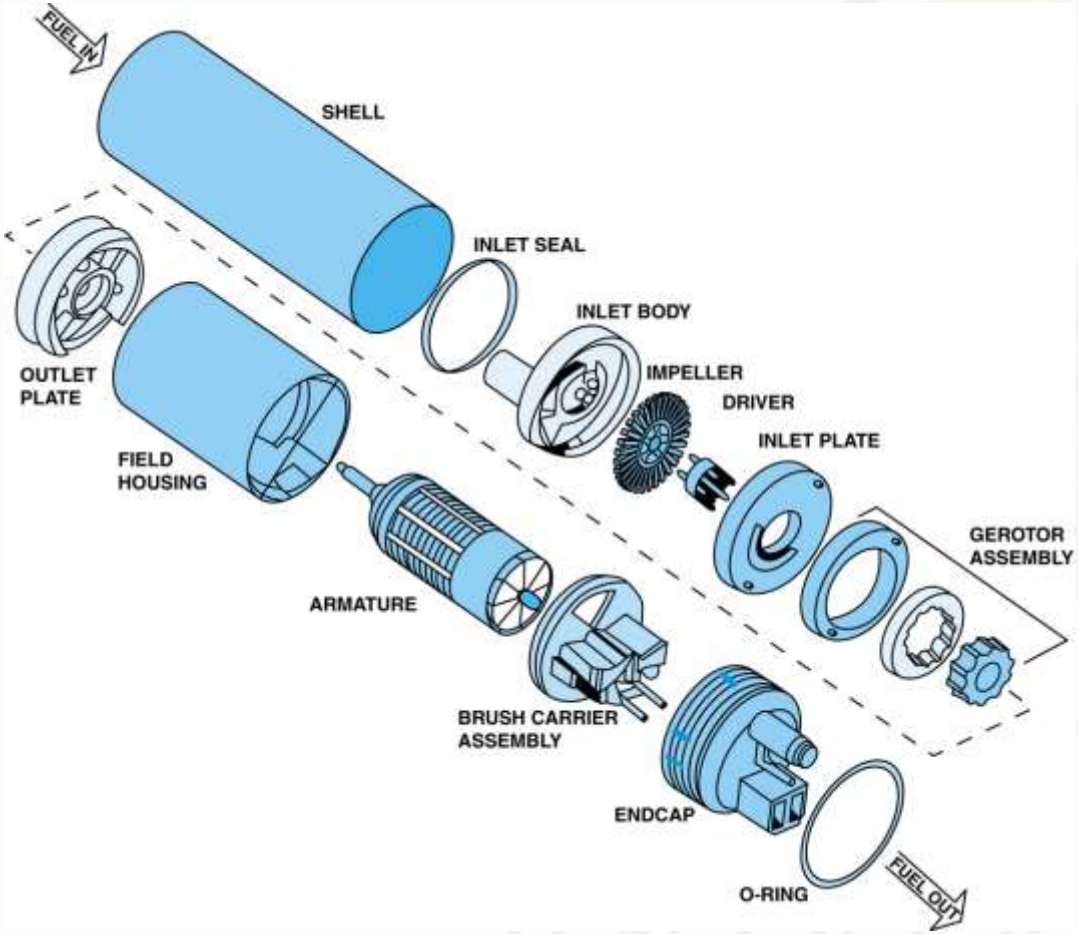

FIGURE 33-14 An exploded view of a gerotor electric fuel pump.

ELECTRIC FUEL PUMPS

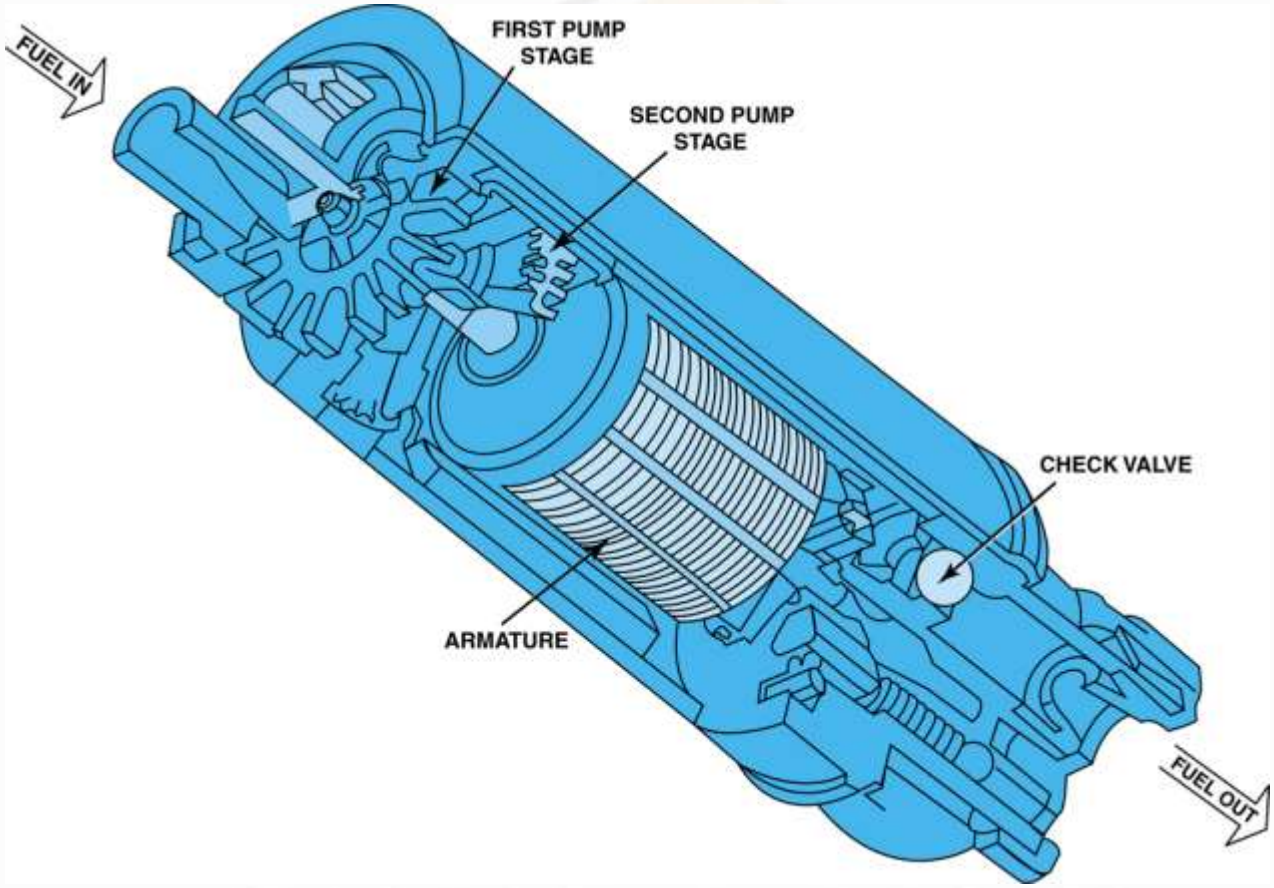

FIGURE 33-15 A cutaway view of a typical two-stage turbine electric fuel pump.

ELECTRIC FUEL PUMPS

FIGURE 33-16 A typical fuel pump model assembly, which includes the pickup strainer and fuel pump, as well as the fuel-pressure sensor and fuel level sensing unit.

ELECTRIC FUEL PUMPS

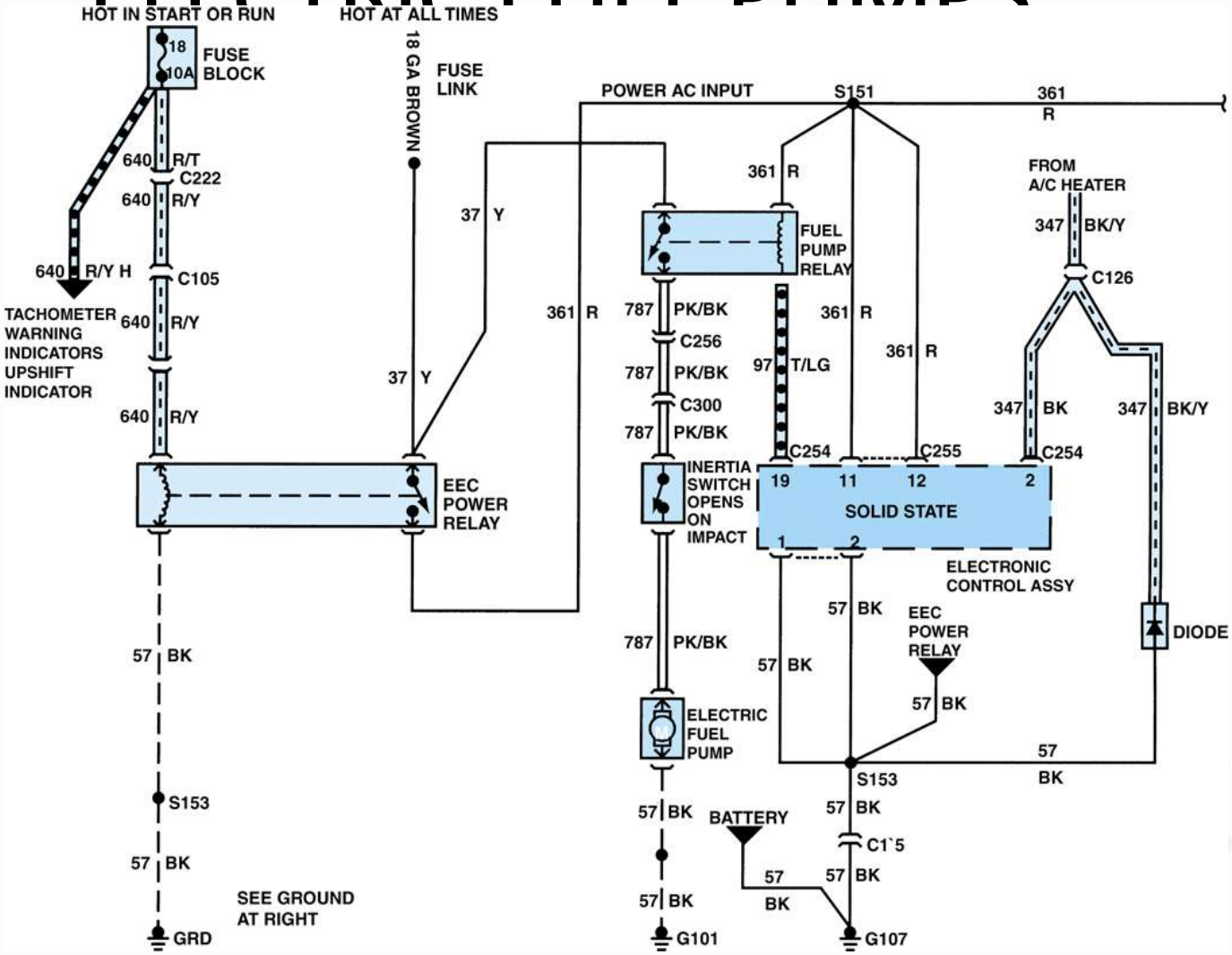

FIGURE 33-17 A schematic showing that an inertia switch is connected in series between the fuel pump relay and the fuel pump.

ELECTRIC FUEL PUMPS

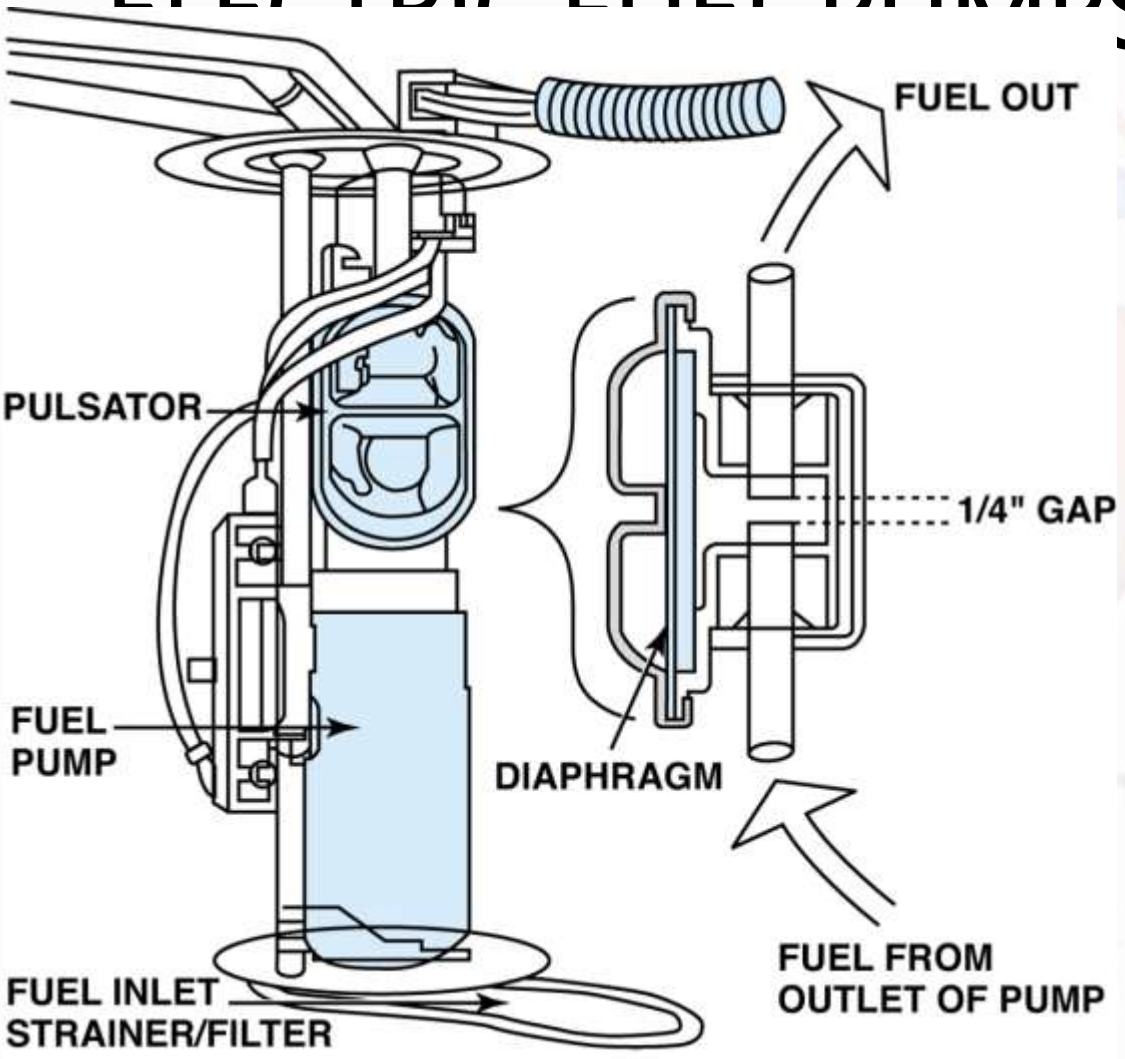

FIGURE 33-18 A typical fuel pulsator used mostly with roller vanetype pumps to help even out the pulsation in pressure that can cause noise.

FUEL FILTERS

- Despite the care generally taken in refining, storing, and delivering gasoline, some impurities get into the automotive fuel system.
- Fuel filters remove dirt, rust, water, and other contamination from the gasoline before it can reach the fuel injectors.
- Most fuel filters are designed to filter particles that are 10 to 20 microns or larger in size.

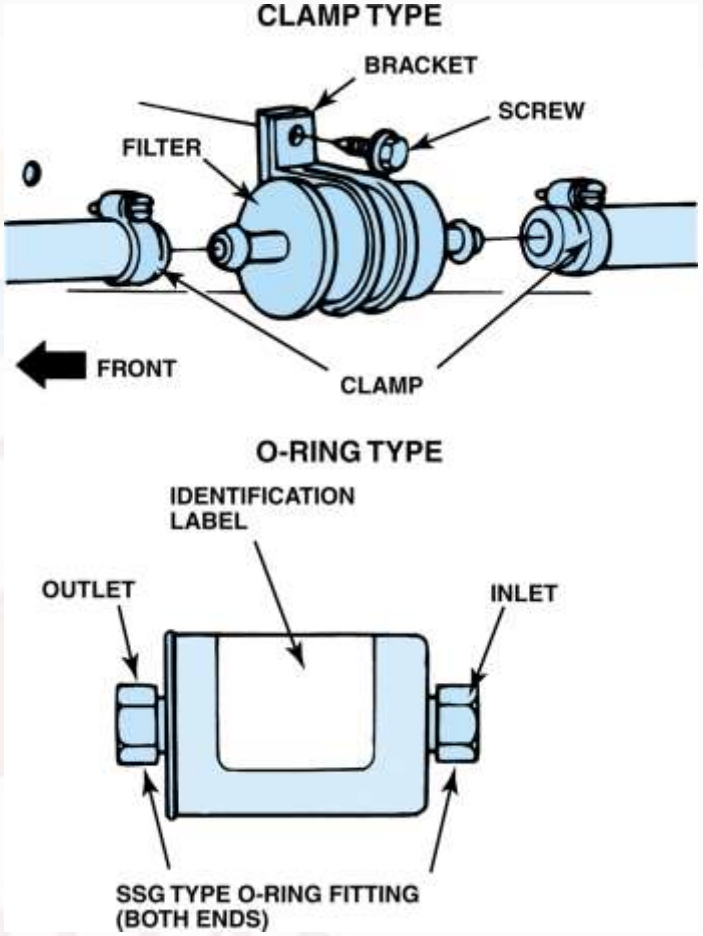

FIGURE 33-19 Inline fuel filters are usually attached to the fuel line with screw clamps or threaded connections. The fuel filter must be installed in the proper direction or a restricted fuel flow can result.

BE SURE THAT THE FUEL FILTER IS INSTALLED CORRECTLY

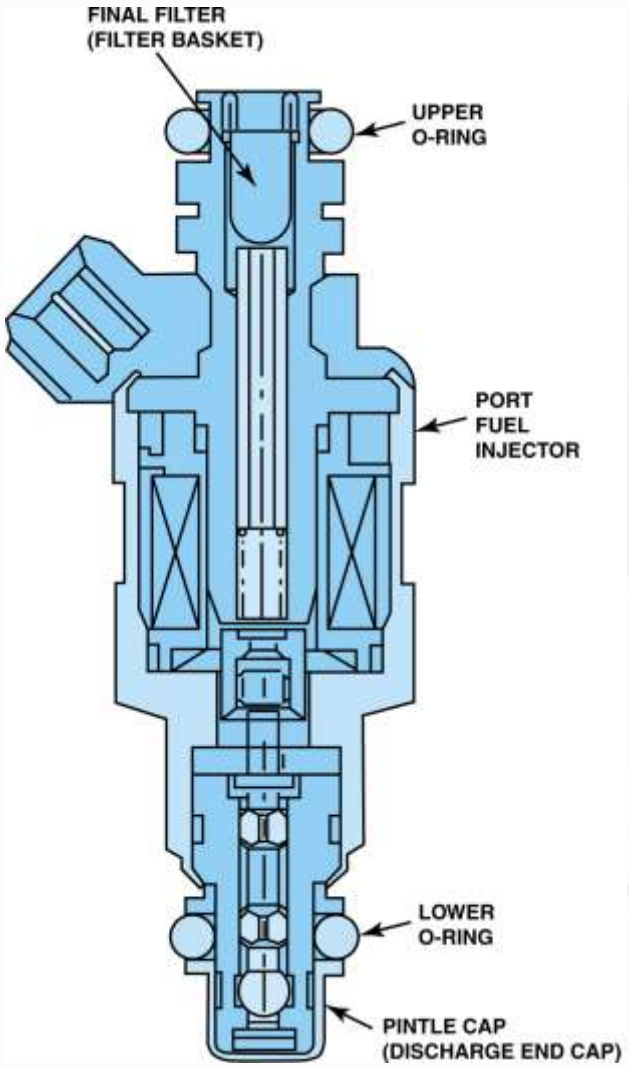

FIGURE 33-20 The final filter, also called a **filter basket,** is the last filter in the fuel system.

THE EAR TEST

(a)

(b)

FIGURE 33-21 (a) A funnel helps in hearing if the electric fuel pump inside the gas tank is working. (b) If the pump is not running, check the wiring and current flow before going through the process of dropping the fuel tank to remove the pump.

FUEL PUMP TESTING

- Fuel pump testing includes many different tests and procedures.
  - Even though a fuel pump can pass one test, it does not mean that there is not a fuel pump problem.
- **Testing Fuel-Pump Pressure**
- **Rest Pressure Test**
- **Dynamic Pressure Test**
- **Testing Fuel-Pump Volume**

FUEL PUMP TESTING

FIGURE 33-22 The Schrader valve on this General Motors 3800 V-6 is located next to the fuel-pressure regulator.

FUEL PUMP TESTING

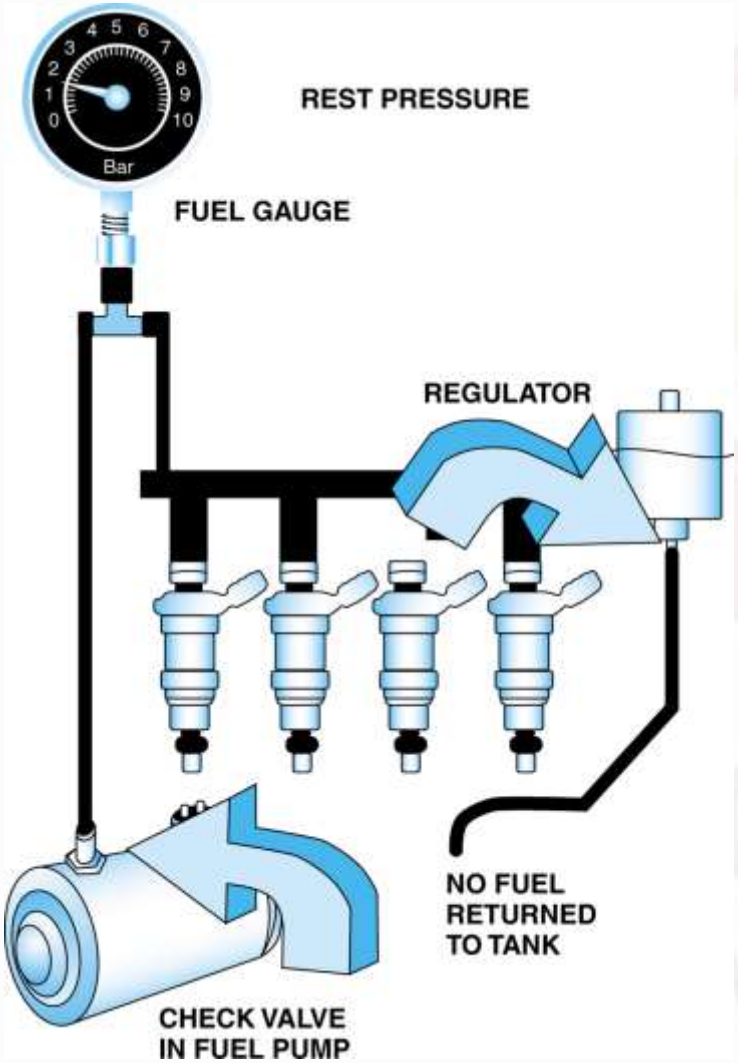

FIGURE 33-23 The fuel system should hold pressure if the system is leak free.

FUEL PUMP TESTING

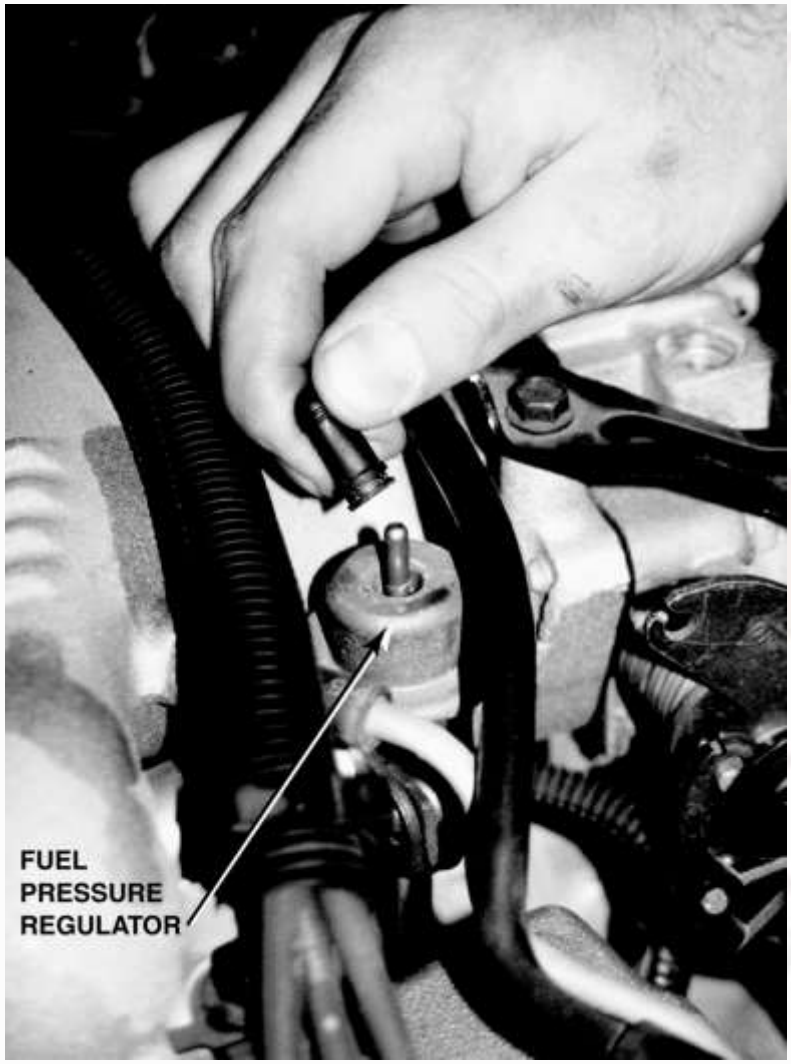

FIGURE 33-24 If the vacuum hose is removed from the fuel-pressure regulator when the engine is running, the fuel pressure should increase. If it does not increase, then the fuel pump is not capable of supplying adequate pressure or the fuel-pressure regulator is defective. If gasoline is visible in the vacuum hose, the regulator is leaking and should be replaced.

THE FUEL-PRESSURE STETHOSCOPE TEST

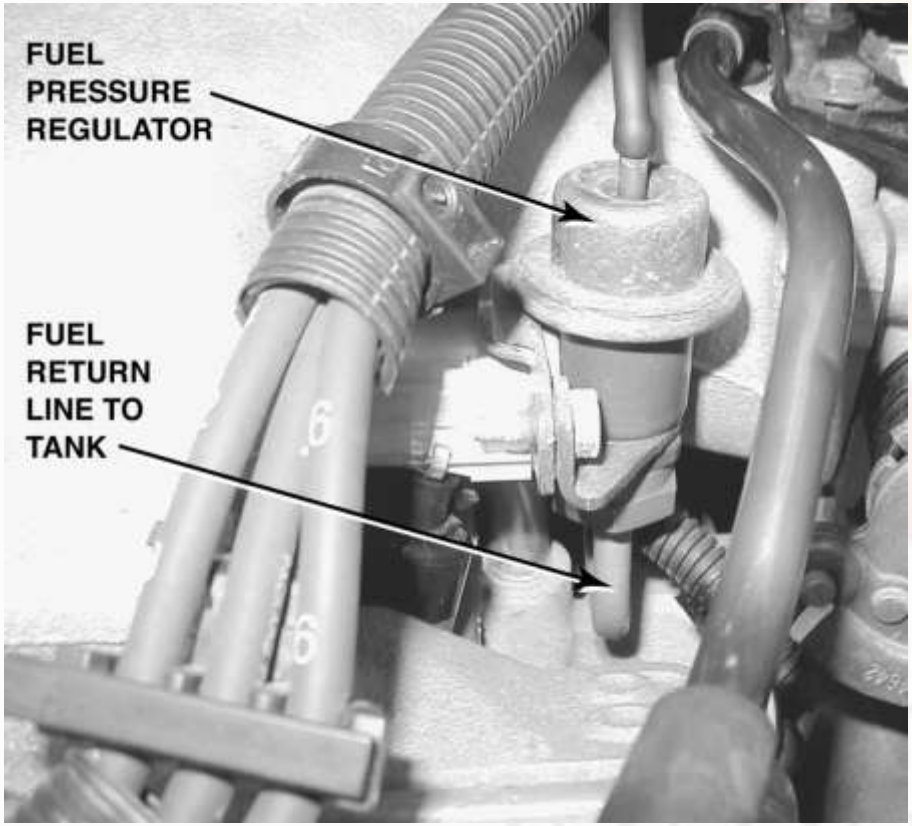

FIGURE 33-25 Fuel should be heard returning to the fuel tank at the fuel return line if the fuel pump and fuel-pressure regulator are functioning correctly.

FUEL PUMP TESTING

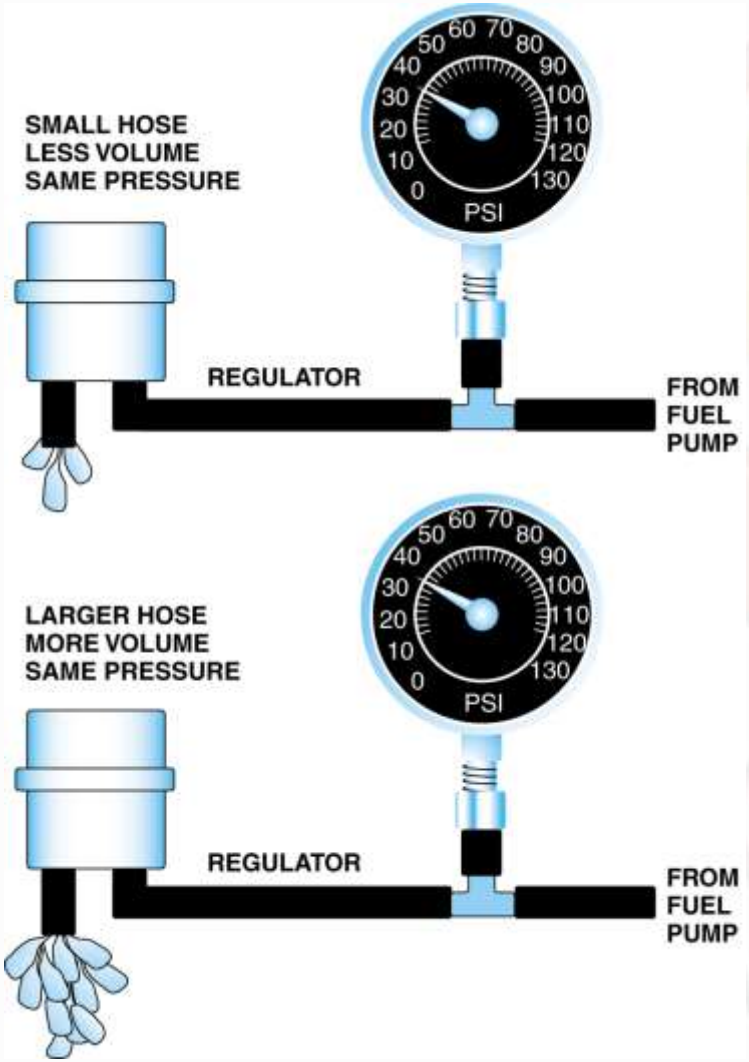

FIGURE 33-26 A fuel-pressure reading does not confirm that there is enough fuel volume for the engine to operate correctly.

FUEL PUMP TESTING

FIGURE 33-27 A fuel system tester connected in series in the fuel system so all of the fuel used flows through the meter which displays the rate-of-flow and the fuel pressure.

REMOVE THE BED TO SAVE TIME?

- The electric fuel pump is easier to replace on many General Motors pickup trucks if the bed is removed.
- Access to the top of the fuel tank, where the access hole is located, for the removal of the fuel tank sender unit and pump is restricted by the bottom of the pickup truck bed.
- Rather than drop the tank, it is often much easier to use an engine hoist or a couple of other technicians to lift the bed from the frame after removing only a few fasteners.

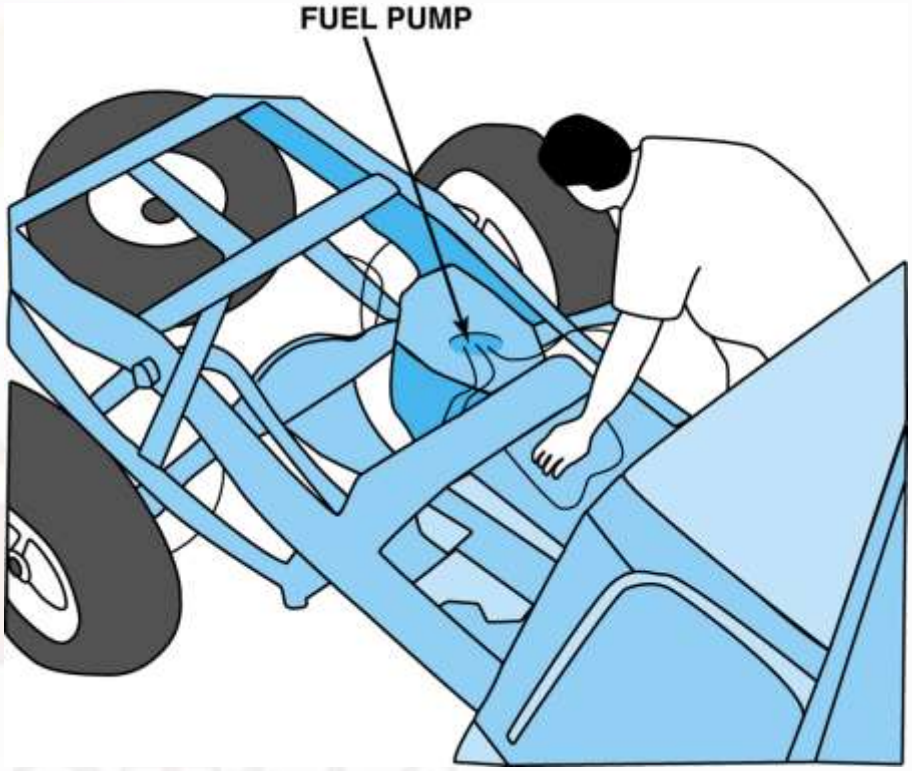

FIGURE 33-28 Removing the bed from a pickup truck makes gaining access to the fuel pump a lot easier.

FUEL-PUMP CURRENT DRAW TEST

- Another test that can and should be performed on a fuel pump is to measure the current draw in amperes.
  - This test is most often performed by connecting a digital multimeter set to read DC amperes and test the current draw.

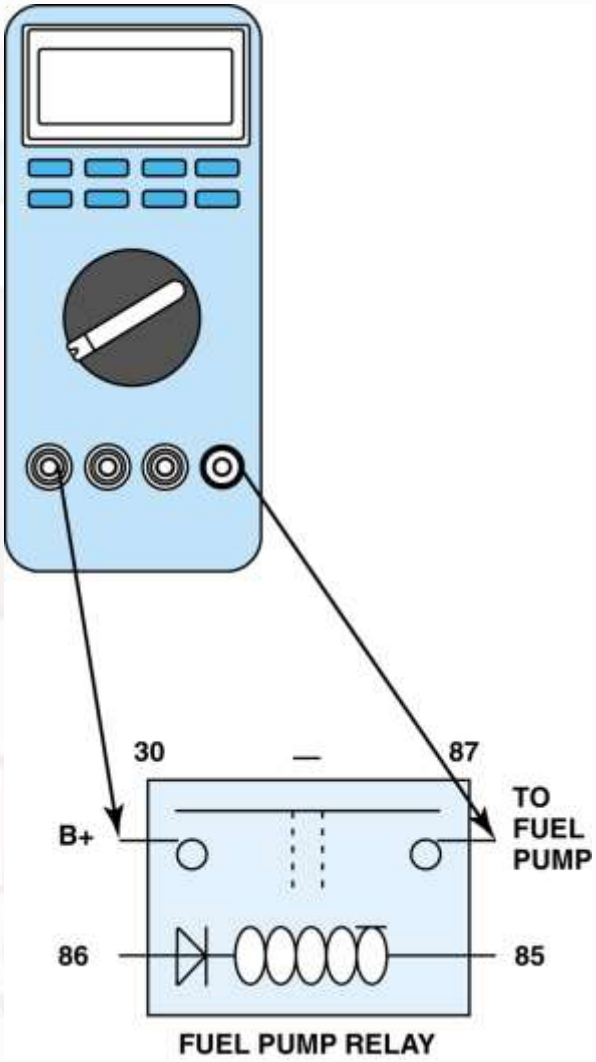

FIGURE 33-29 Hookup for testing fuel-pump current draw on any vehicle equipped with a fuel-pump relay.

FUEL-PUMP REPLACEMENT

- The following recommendations should be followed whenever replacing an electric fuel pump.
  - The fuel-pump strainer (sock) should be replaced with the new pump.
  - If the original pump had a defector shield, it should always be used to prevent fuel return bubbles from blocking the inlet to the pump.
  - Always check the interior of the fuel tank for evidence of contamination or dirt.
  - Double-check that the replacement pump is correct for the application.

SUMMARY

1. The fuel delivery system includes the following items:
   - Fuel tank
   - Fuel pump
   - Fuel filter(s)
   - Fuel lines
2. A fuel tank is either constructed of steel with a tin plating for corrosion resistance or polyethylene plastic.
3. Fuel tank filler tubes contain an anti-siphoning device.
4. Accident and rollover protection devices include check valves and inertia switches.
5. Most fuel lines are made of nylon plastic.

SUMMARY

6. Electric fuel pump types include: roller cell, gerotor, and turbine.
7. Fuel filters remove particles that are 10 to 20 microns or larger in size and should be replaced regularly.
8. Fuel pumps can be tested by checking:
   - Pressure
   - Volume
   - Pump motor speed (RPM) as determined by current ramping
   - Specified current draw

REVIEW QUESTIONS

1. What are the two materials used to construct fuel tanks?
2. What are the three most commonly used pump designs?
3. What is the proper way to disconnect and connect plastic fuel line connections?
4. Where are the fuel filters located in the fuel system?
5. What accident and rollover devices are installed in a fuel delivery system?
6. What four methods can be used to test a fuel pump?

CHAPTER QUIZ

1. The first fuel filter in the sock inside the fuel tank normally filters particles larger than _____.
   a) 0.001 to 0.003 in.
   b) 0.010 to 0.030 in.
   c) 10 to 20 microns
   d) 70 to 100 microns

CHAPTER QUIZ

1. The first fuel filter in the sock inside the fuel tank normally filters particles larger than _____.
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   c) 10 to 20 microns
   d) 70 to 100 microns

CHAPTER QUIZ

2. If it is tripped, which type of safety device will keep the electric fuel pump from operating?
   a) Rollover valve
   b) Inertia switch
   c) Anti-siphoning valve
   d) Check valve

CHAPTER QUIZ

2. If it is tripped, which type of safety device will keep the electric fuel pump from operating?
   a) Rollover valve
   b) Inertia switch
   c) Anti-siphoning valve
   d) Check valve

CHAPTER QUIZ

3. Fuel lines are constructed from _____.
   a) Seamless steel tubing
   b) Nylon plastic
   c) Copper and/or aluminum tubing
   d) Both a and b are used

CHAPTER QUIZ

3. Fuel lines are constructed from _____.
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   d) Both a and b are used

CHAPTER QUIZ

4. Which is not a commonly used type of fuel pump design?
   a) Gerotor
   b) Pulsating
   c) Rotor cell
   d) Turbine

CHAPTER QUIZ

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   a) Gerotor
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CHAPTER QUIZ

5. A good fuel pump should be able to supply how much fuel per minute?
   a) 1⁄4 pint
   b) 1⁄2 pint
   c) 1 pint
   d) 0.6 to 0.8 gallons

CHAPTER QUIZ

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CHAPTER QUIZ

6. Technician A says that fuel pump modules are spring-loaded so that they can be compressed to fit into the opening. Technician B says that they are spring-loaded to allow for expansion and contraction of plastic fuel tanks. Which technician is correct?
   a) Technician A only
   b) Technician B only
   c) Both Technicians A and B
   d) Neither Technician A nor B

CHAPTER QUIZ

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   c) Both Technicians A and B
   d) Neither Technician A nor B

CHAPTER QUIZ

7. Most fuel filters are designed to remove particles larger than _____.
   a) 10 microns
   b) 20 microns
   c) 70 microns
   d) 100 microns

CHAPTER QUIZ

7. Most fuel filters are designed to remove particles larger than _____.
   a) 10 microns
   b) 20 microns
   c) 70 microns
   d) 100 microns

CHAPTER QUIZ

8. The amperage draw of an electric fuel pump is higher than specified. All of the following are possible causes *except* _____.
   a) Corroded electrical connections at the pump motor
   b) Clogged fuel filter
   c) Restriction in the fuel line
   d) Defective fuel pump

CHAPTER QUIZ

8. The amperage draw of an electric fuel pump is higher than specified. All of the following are possible causes *except* _____.
   a) Corroded electrical connections at the pump motor
   b) Clogged fuel filter
   c) Restriction in the fuel line
   d) Defective fuel pump

CHAPTER QUIZ

9. A fuel pump is being replaced for the third time. Technician A says that the gasoline could be contaminated. Technician B says that wiring to the pump could be corroded. Which technician is correct?
   a) Technician A only
   b) Technician B only
   c) Both Technicians A and B
   d) Neither Technician A nor B

CHAPTER QUIZ

9. A fuel pump is being replaced for the third time. Technician A says that the gasoline could be contaminated. Technician B says that wiring to the pump could be corroded. Which technician is correct?
   a) Technician A only
   b) Technician B only
   c) Both Technicians A and B
   d) Neither Technician A nor B

CHAPTER QUIZ

10. A fuel filter has been accidentally installed backwards. What is the most likely result?
    a) Nothing will be noticed
    b) Reduced fuel economy
    c) Lower power at higher engine speeds and loads
    d) Fuel system pulsation noises may be heard

CHAPTER QUIZ

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Thank you