

78 FUEL-INJECTION COMPONENTS AND OPERATION

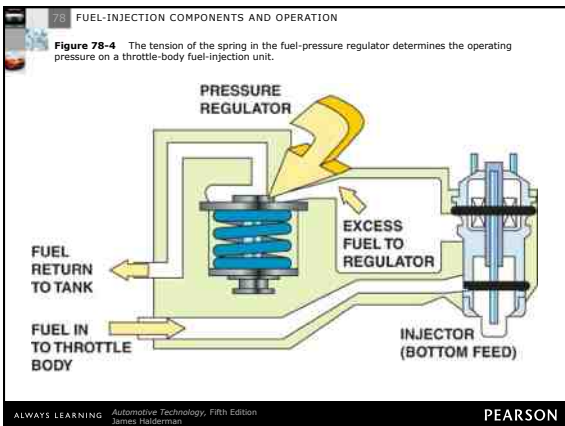
TECH TIP

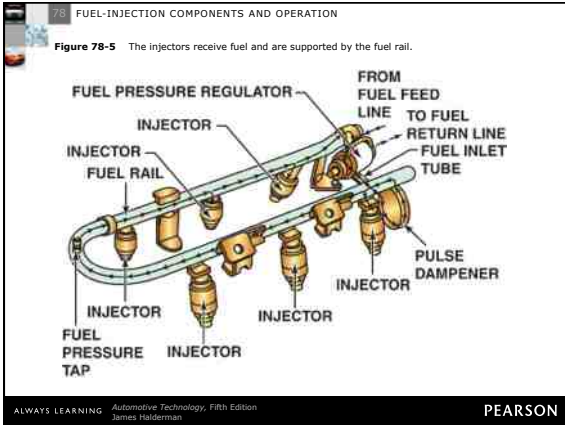
"Two Must-Do's"

For long service life of the fuel system always do the following:

1. Avoid operating the vehicle on a near-empty tank of fuel. The water or alcohol that may be in the tank becomes more concentrated when the fuel level is low. Dirt that settles near the bottom of the fuel tank can be drawn through the fuel system and cause damage to the pump and injector nozzles.
2. Replace the fuel filter at regular service intervals.

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FREQUENTLY ASKED QUESTION

How Do the Sensors Affect the Pulse Width?

The base pulse width of a fuel injection system is primarily determined by the value of the IOP or MAP sensor and engine speed (RPM). However, the PCM relies on the input from many other sensors to modify the base pulse width as needed. For example:

- **TP Sensor.** This sensor causes the PCM to command up to 100% of base pulse width if the accelerator pedal is depressed rapidly to the floor. It can also reduce the pulse width by about 70% if the throttle is rapidly closed.
- **ECT.** The value of this sensor determines the temperature of the engine coolant, which determines the base pulse width, and can account for up to 80% of the adjusting factors.
- **BARO.** The BARO sensor compensates for altitude and adds up to about 10% under high-pressure conditions and subtracts as much as 20% from the base pulse width at high altitudes.
- **IAT.** The intake air temperature is used to modify the base pulse width based on the temperature of the air entering the engine. It is usually capable of adding as much as 20% if very cold air is entering the engine or reduce the pulse width by up to 20% if very hot air is entering the engine.
- **O2S.** This is one of the main modifiers to the base pulse width and can add or subtract up to about 20% to 25% or more, depending on the oxygen output activity.

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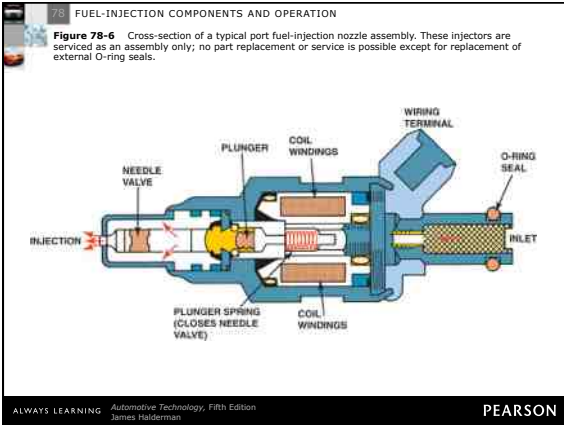
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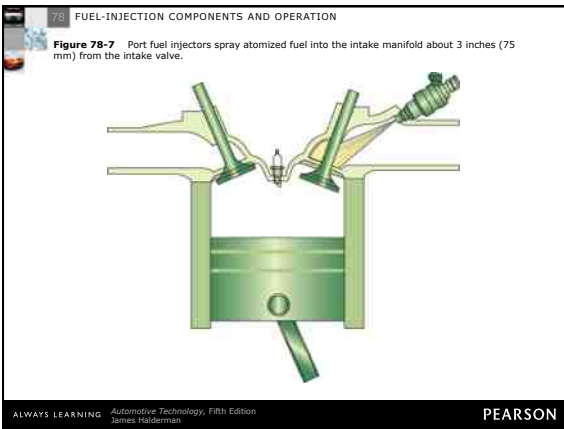
FREQUENTLY ASKED QUESTION

How Can It Be Determined If the Injection System Is Sequential?

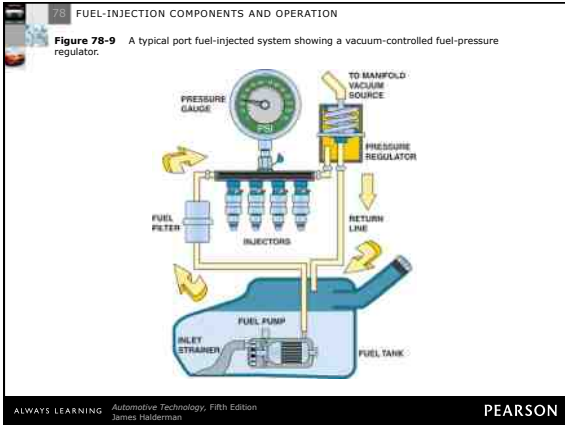
Look at the color of the wires at the injectors. If a sequentially fired injector is used, then one wire color (the pulse wire) will be a different color for each injector. The other wire is usually the same color because all injectors receive voltage from some source. If a group- or batch-fired injection system is being used, then the wire colors will be the same for the injectors that are group fired. For example, a V-6 group-fired engine will have three injectors with a pink and blue wire (power and pulse) and the other three will have pink and green wires.

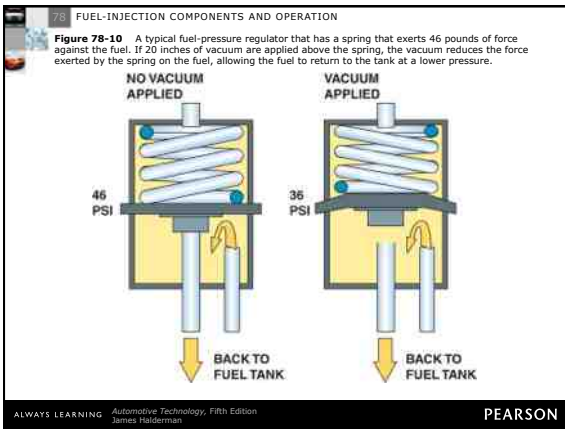
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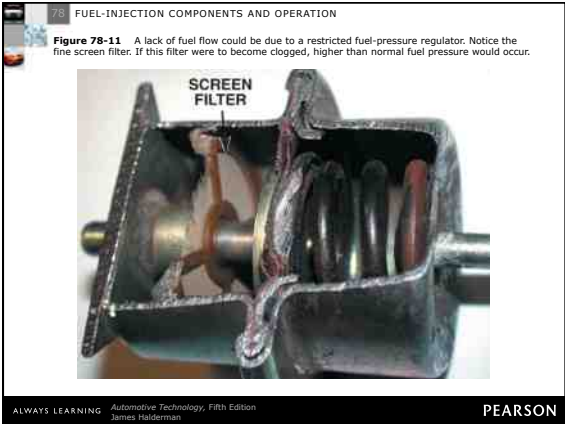
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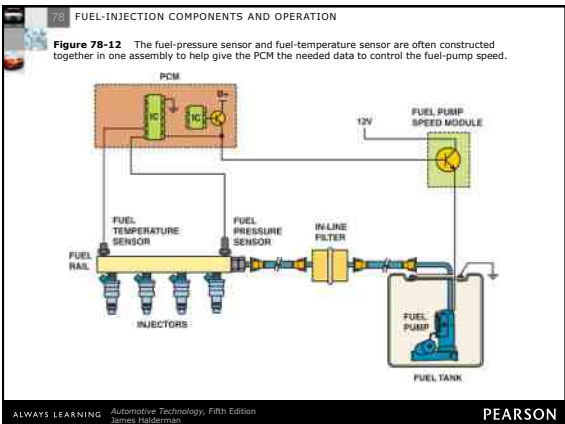
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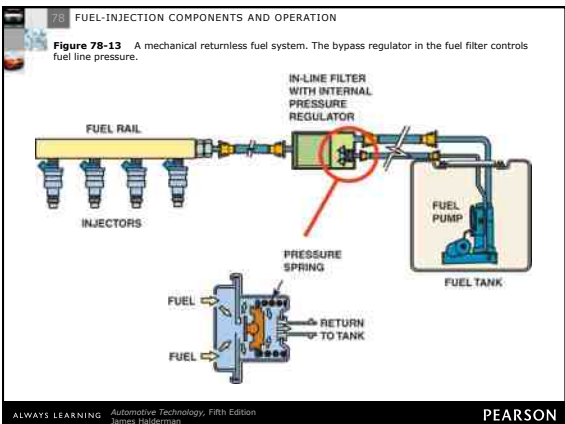
Don't Forget the Regulator

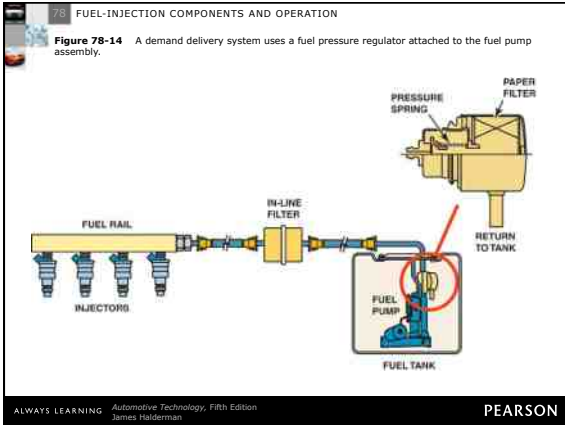
Some fuel-pressure regulators contain a 10-micron filter. If this filter becomes clogged, a lack of fuel flow would result. ● SEE FIGURE 78-11.

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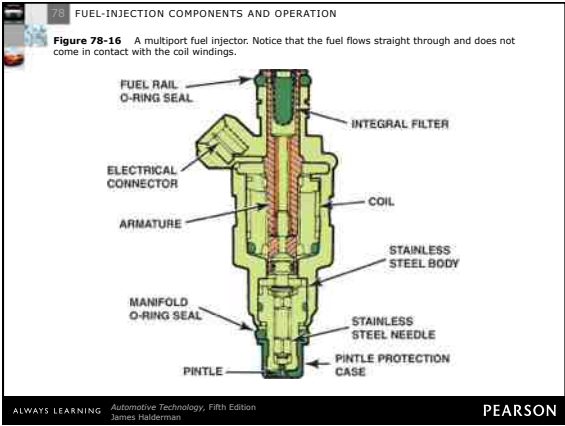
FREQUENTLY ASKED QUESTION

Why Are Some Fuel Rails Rectangular Shaped?

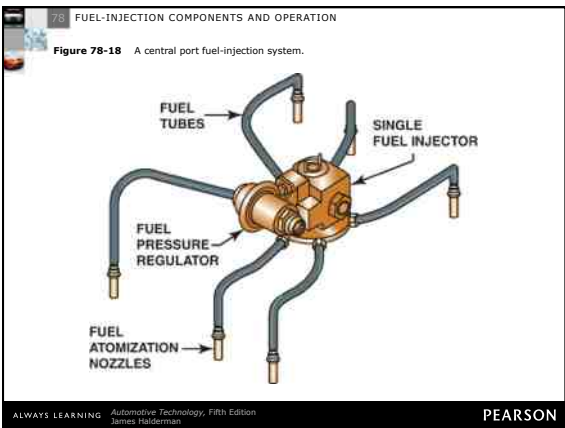
A port fuel-injection system uses a pipe or tubes to deliver fuel from the fuel line to the intended fuel injectors. This pipe or tube is called the **fuel rail**. Some vehicle manufacturers construct the fuel rail in a rectangular cross-section. **SEE FIGURE 78-15.** The sides of the fuel rail are able to move in and out slightly, thereby acting as a fuel pulsator evening out the pressure pulses created by the opening and closing of the injectors to reduce underhood noise. A round cross-section fuel rail is not able to deform and, as a result, some manufacturers have had to use a separate dampener.

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FREQUENTLY ASKED QUESTION

How Can the Proper Injector Size Be Determined?
 Most engine want to increase the output of fuel to increase engine performance. Injector sizing can sometimes be a challenge, especially if the size of injector is not known. In most cases, manufacturers publish the rating of injectors in gallons of fuel per hour (GPH). The one is figured with the injector field open at 3 bars (43 PSI). An engine has a combustion chamber that larger flow injectors have a higher maximum flow rating. Here is a formula to calculate injector sizing when changing the mechanical characteristics of an engine.

Flow rate = $\text{liters} \times \text{BHP/Cil of cylinders} \times \text{maximum duty cycle (\% of on-time of the injector)}$

- **liters** is the projected horsepower. (As needed.)
- **BHP/Cil** is brake-specific fuel consumption or cylinder per horsepower hour. Calculated values are used for this. (2.4 to 3.0 GPH, in most cases, start on the low side for naturally aspirated engines and the high side for engines with forced induction.)
- **# of cylinders** is actually the number of injectors being used.
- **Maximum duty cycle** is considered at 0.8 (80%). Above this, the injector may overheat, lose consistency, or not work at all.

For example:
 5.7 liter V-6 @ 240 hp = 0.85 GPH cylinders \times 6
 = 34.37 GPH injectors required

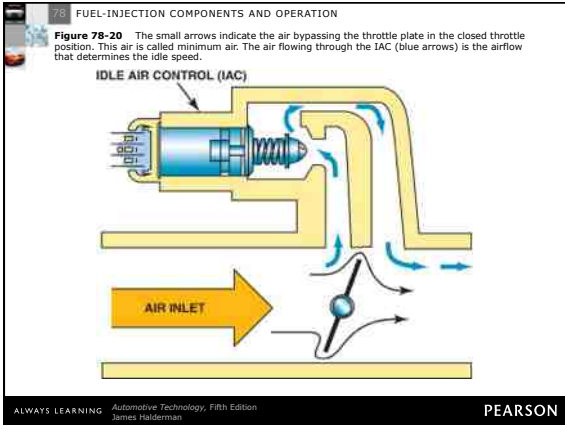
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FREQUENTLY ASKED QUESTION

What is Battery Voltage Correction?
 Battery voltage correction is a program built into the PCM that causes the injector pulse width to increase if there is a drop in electrical system voltage. Lower battery voltage would cause the fuel injectors to open slower than normal and the fuel pump to run slower. Both of these conditions can cause the engine to run leaner than normal if the battery voltage is low. Because a lean air-fuel mixture can cause the engine to overheat, the PCM compensates for the lower voltage by adding a percentage to the injector pulse width. This richer condition will help prevent serious engine damage. The idle speed is also increased to turn the alternator faster if low battery voltage is detected.

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? **FREQUENTLY ASKED QUESTION**

Why Does the Idle Air Control Valve Use Milliamperes?

Some Chrysler vehicles, such as the Dodge minivan, use linear solenoid idle air control valves (LSIAC). The PCM uses regulated current flow through the solenoid to control idle speed and the scan tool display is in milliamperes (mA).

Closed position = 180 to 200 mA
 Idle = 300 to 450 mA
 Light cruise = 500 to 700 mA
 Fully open = 900 to 950 mA

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