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## How a Diesel Works

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Although today's diesel engines are extremely advanced, diesels are not a new technology. In 1892, Rudolf Diesel obtained the German patent for diesel engines. Gasoline engines of that time were very inefficient and Rudolf intended to produce a more economical combustion engine. Today's advanced diesels are among the most efficient combustion engines.

The main differences between gasoline and diesel engines are:

Gasoline engines take in a mixture of gas and air, compress it and ignite the mixture with a spark. Diesel engines take in just air, compress it and then inject fuel into the compressed air. The heat of the compressed air ignites the air/fuel mixture.

Gasoline engines have compression ratios between 8:1 and 12:1, while diesel engine compression ratios are between 14:1 and 25:1. The higher compression ratio of the diesel engine leads to better efficiency and power.

To create combustion you need three elements: heat or pressure, fuel and oxygen. When you consider four-stroke gasoline engines, air and fuel are drawn into a cylinder through the intake valve during a piston down stroke, the piston compresses the charge during an up stroke, there is an explosion ignited by the spark plug pushing the piston down and the spent gasses escape through the exhaust valve on the next up stroke of the piston. A diesel engine works much the same except that there is no spark to ignite the air/fuel charge.

In some cold-start circumstances when the air/fuel charge cannot be brought up to combustion temperatures, diesels require a glow plug. A glow plug works like a heated wire and raises the air temperature inside the cylinder for cold-start, after which it turns off.

Most gasoline engines use port fuel injection, in which the fuel is injected just outside the cylinder into the intake manifold. Diesel engines utilize direct injection in which the fuel is introduced directly into the cylinder itself.

Diesel fuel is heavier for better lubrication and evaporates much more slowly than gasoline - its boiling point is higher than water. Diesel fuel is part of the answer to the fuel economy puzzle because it contains more energy per gallon than gasoline. On average, one gallon (3.8 L) of diesel fuel contains approximately  $155 \times 10^6$  joules (147,000 BTU), while one gallon of gasoline contains  $132 \times 10^6$  joules (125,000 BTU).

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