

**DENSO**  
**HEAVY DUTY**

## DIESEL COMMON RAIL SYSTEMS





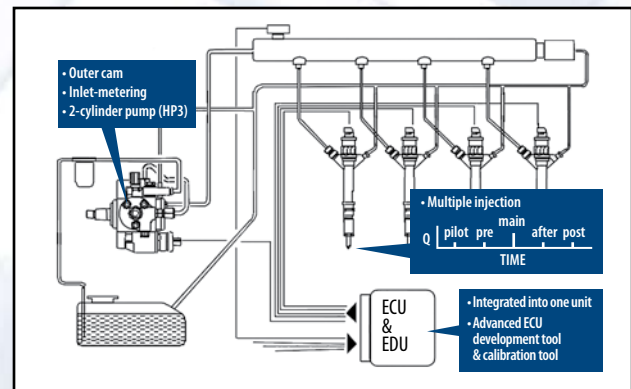
DENSO's leadership in diesel common rail technology is unsurpassed in the industry. In 1995, DENSO launched the world's first diesel common rail injection system for trucks. The following year, it began supplying diesel common rail injection systems for passenger cars.

**Diesel engines with DENSO's common rail system are:**

- **Faster** – By injecting fuel at 1800 bar (26,000 psi), regardless of engine speed, DENSO's common rail system produces higher power and more low-end torque.
- **Quieter** – The injectors can deliver fuel at intervals of 0.4 milliseconds, which allows up to five injections per cylinder per combustion cycle. This reduces diesel engine noise at idle.
- **Cleaner** – The combination of high fuel pressure and precise control of fuel combustion through multiple injections reduces emissions, particulate matter and nitrogen oxides.

With DENSO's 1800-bar common rail system, engine torque is increased by 35 percent, engine power is increased by 24 percent and low idle noise is decreased by 6.5 dB on a 2.0-liter diesel engine, as compared with DENSO's conventional model.

In the U.S., DENSO's system is available for medium and heavy duty task applications.



**How the Common Rail System Works:**

The injectors that provide fuel to the cylinders are attached to a single tube (the common rail). They can deliver 1800-bar injection pressure, the highest in the industry, with multiple injection capacity in 0.4 milliseconds per combustion cycle, the shortest in the industry. DENSO's common rail system employs five injections:

- The pilot injection, occurring well before ignition, provides time for fuel and air to mix.
- The “pre” injection shortens the ignition delay during the main injection and, as a result, reduces the generation of nitrogen oxide (NOx), noise and engine vibration.
- The main injection provides the fuel for combustion and power.
- The “after” injection occurs a split second after the main injection and re-burns any remaining particulate matter (PM).
- The “post” injection helps manage the temperature of the exhaust gases, which makes the exhaust processing in the engine's after-treatment cycle more effective.



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