

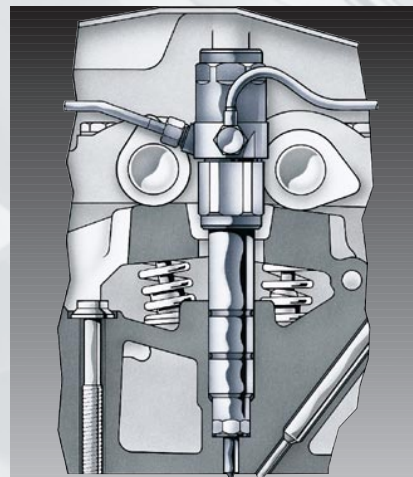
Engine management

Common Rail System

Common Rail injection contributes to clean and economical diesels

Conventional injection systems rely on design concepts featuring synchronized pressure generation and injection. The accumulator concept behind Bosch's Common Rail system departs from convention by breaking the direct link between pressurization and injection. Fuel for the individual cylinders flows from a shared accumulator element, or fuel rail, in which the system consistently maintains ideal internal pressure levels.

The Common Rail system consists of the fuel rail (accumulator), injectors with rapid-action solenoid elements and an electronic control system that separates the pressure generation and injection processes to abolish mutual constraints. The electronic control system regulates the combustion process by selecting line pressure, injection timing and flow duration from the program map.



Injector for a Common Rail system in a 4-valve engine ▶

The nozzle holder gives way to a dedicated injector for each cylinder

The heart of this system is the single, solenoid-equipped injector assigned to each cylinder. The ECU governs the injection process by transmitting an optimally-timed trigger pulse to the solenoid. Actual flow quantities are defined by the injector nozzle's spray aperture, the solenoid's opening duration and the rail pressure, which can extend up to 1350 bar on passenger-car powerplants, and as high as 1400 bar on engines for heavy commercial vehicles.

Pressurization in the passenger-car injection system is the job of a high-pressure radial-piston pump, while an in-line pump with flow control discharges the same function in commercial-vehicle applications. The system can vary the sensor-monitored rail pressure to reflect the engine's instantaneous operating conditions. Here, the rail pressure is continually monitored by a sensor.

Limitless latitude to adapt injection pressure for improved combustion

Separating the pressurization and injection processes extends the latitude available for shaping the

injection and combustion processes individually. Injection timing and pressure can be selected from any point in the program map, allowing high injection pressures and optimal combustion under all conditions, even at very low engine speeds.

Pilot injection for lower noise and exhaust emissions

The system relies on a dual-triggering strategy for the sequential solenoid activation that characterizes the pilot-injection process. The prime benefit is a reduction in acoustic emissions.

Existing engine configurations will accept common-rail technology without major modifications: the high-pressure pump replaces the standard injection pump, while the injector simply assumes the place of the nozzle holder in the cylinder head. Bosch Common Rail systems have been in production cars since 1997.

Common Rail systems with piezo actuators

Bosch is already developing further Common Rail generations with still higher pressure potentials. These new systems apply piezo actuators instead of solenoid valves. This permits even more precise control of multiple injection.

Common Rail systems (seen here in a version for automotive diesels) represent an economical option, even for existing power-plants ▼

