

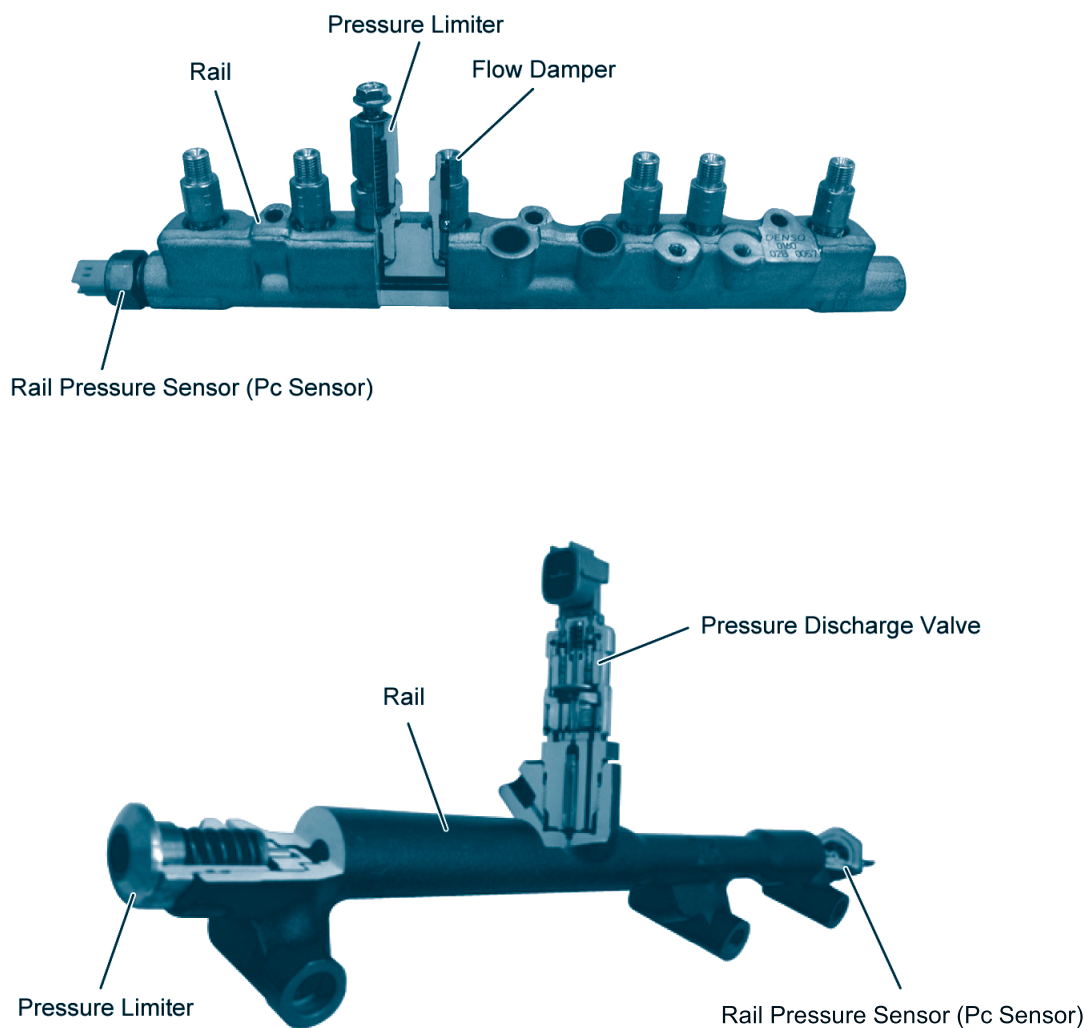
"Fundamentals of the Common Rail System" 7th Session:RAIL CONSTRUCTION AND OPERATION

In the last session the functions of the fuel supply pump were described.

In this session, the rail, which is installed between the supply pump and injectors will be described.

1 RAIL OUTLINE

- The rail acts to distribute the high pressure fuel generated by the supply pump to each cylinder injector.
- The rail shape varies depending on the type of vehicle. As a result the component parts also vary.
- In addition to the rail pressure sensor (Pc sensor) and pressure limiter components which are always installed, a flow damper or pressure discharge valve will be attached based on vehicle type.



2 CONSTRUCTION AND OPERATION OF COMPONENTS

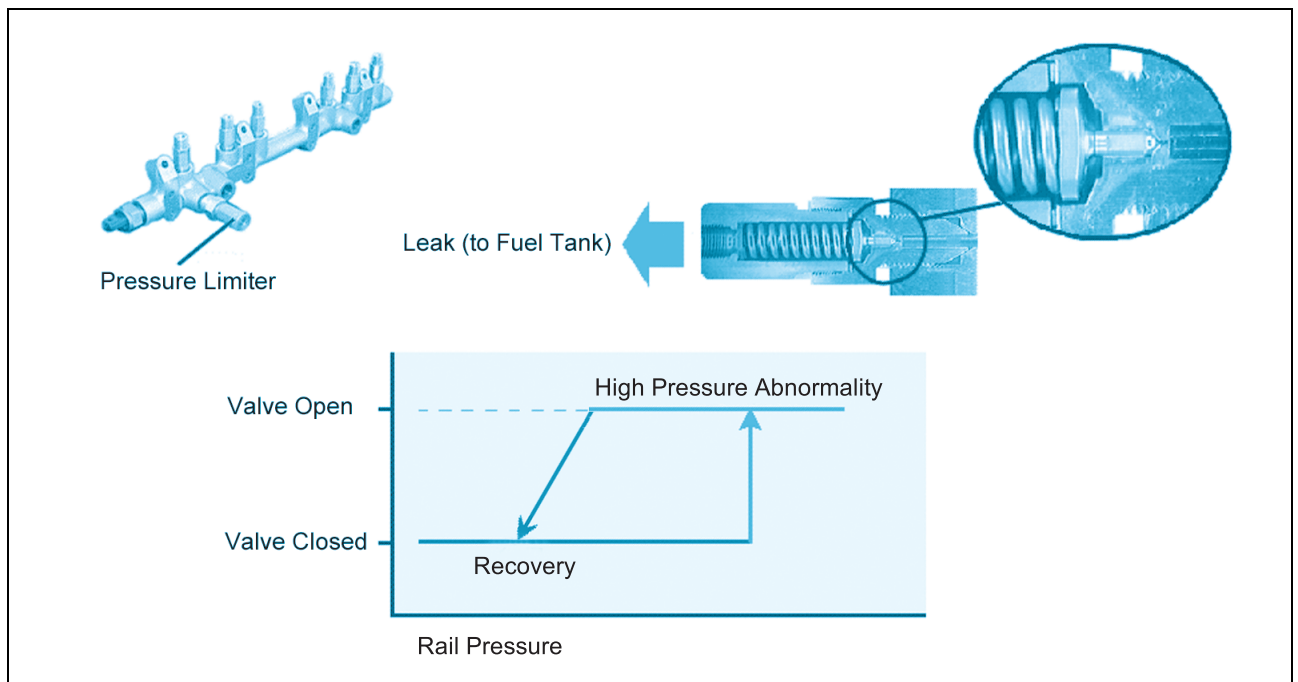
Component	Function
Rail	Accumulates high pressure fuel from the supply pump and distributes it to each cylinder injector.
Pressure Limiter	Opens when internal rail pressure becomes abnormally high.
Rail Pressure Sensor (Pc Sensor)	Detects fuel pressure inside the rail.
Flow Damper	Decreases pressure pulses in the rail. In addition, the flow damper shuts off the fuel path during an excess fuel discharge condition. Used primarily in large vehicle engines.
Pressure Discharge Valve	Controls fuel pressure inside the rail. Used primarily in passenger vehicle engines.

1 Pressure Limiter

- The pressure limiter opens during a high pressure abnormality to release excess pressure. When the internal rail pressure becomes excessive, the valve operates (opens), dropping pressure until it is maintained at the set value.
- The fuel released from the pressure limiter returns to the fuel tank.

Reference

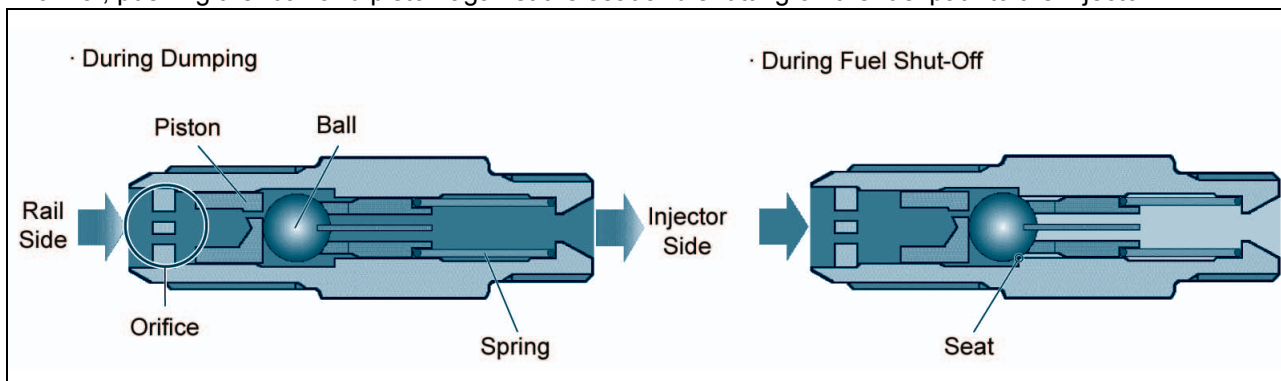
Depending on the vehicle type, the opening pressure for the pressure limiter is between approximately 140 and 230MPa.



"Fundamentals of the Common Rail System"

Piston and Ball Type Operation

- When pressure pulsations occur inside the high pressure piping, the pressure balance between the rail side and injector side is destroyed due to flow resistance at the orifice. When this occurs, the ball and piston move towards the injector side and absorb the pressure pulsations.
- Due to the rail side and injector side quickly balancing under normal pressure pulsations, the piston and ball return to the rail side under spring pressure.
- If an abnormality happens to occur on the injector side, the fuel orifice flow volume will become less than normal, pushing the ball and piston against the seat and shutting off the fuel path to the injector.

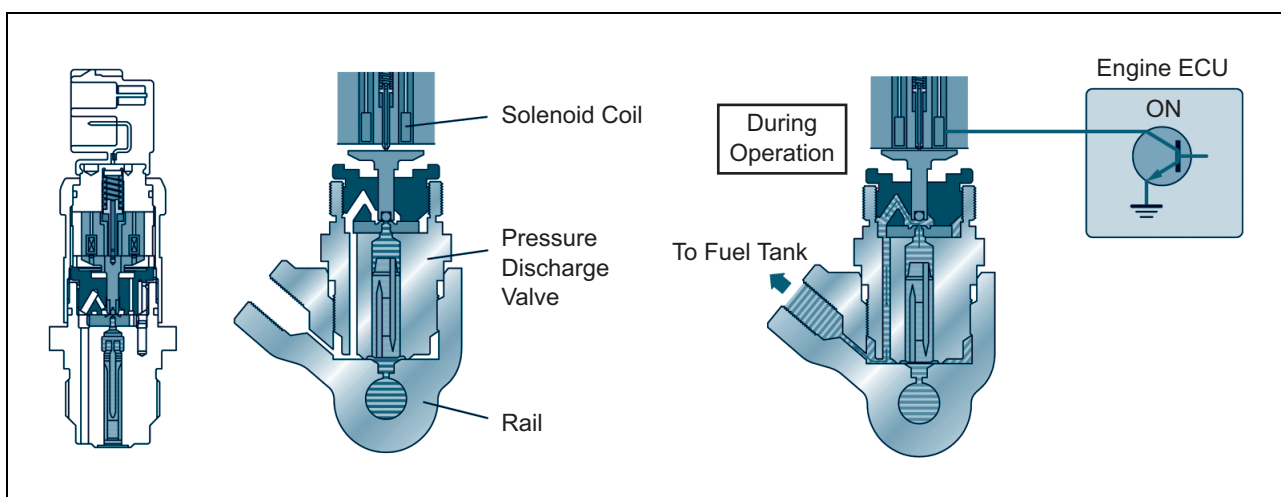


Piston Type Operation

The piston meets the valve seat directly, shutting off the fuel path. Operation of the piston type is identical to that of the piston and ball type.

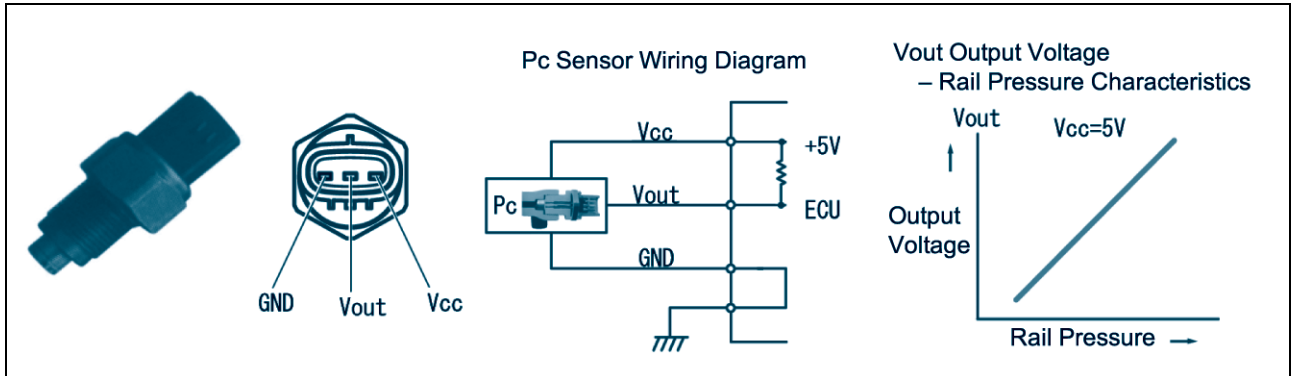
2 Pressure Discharge Valve

- The pressure discharge valve controls rail fuel pressure.
- When fuel pressure exceeds the specified pressure, or when the engine ECU determines that pressure has increased beyond the specified value, the pressure discharge valve solenoid coil is energized. This opens a valve path which leaks fuel back to the fuel tank, reducing pressure to the specified value.

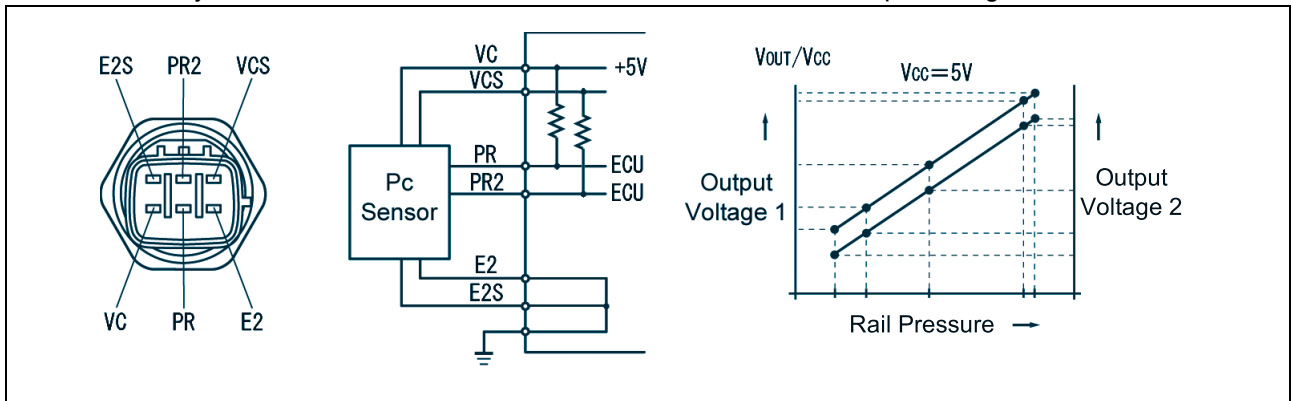


3 Rail Pressure Sensor (Pc Sensor)

- The rail pressure sensor (Pc sensor) is attached to the rail itself. It senses fuel pressure and sends a signal to the engine ECU.
- This sensor is a semiconductor type pressure sensor that shows a change in electrical resistance (called the piezoelectric resistance effect) when pressure is added to the silicon element.



- Two of these systems are in one sensor in case of a malfunction. The output voltages are offset.



4 Flow Damper

- The flow damper serves to decrease pulsations in the high pressure piping, and to supply constant pressure fuel to the injectors.
- In addition, it acts to shut off the fuel path and prevent abnormal fuel discharge caused by leak fuel from the injection piping and injectors.
- There are two types of flow dampers. One utilizes a piston and ball while the other uses only a piston.

