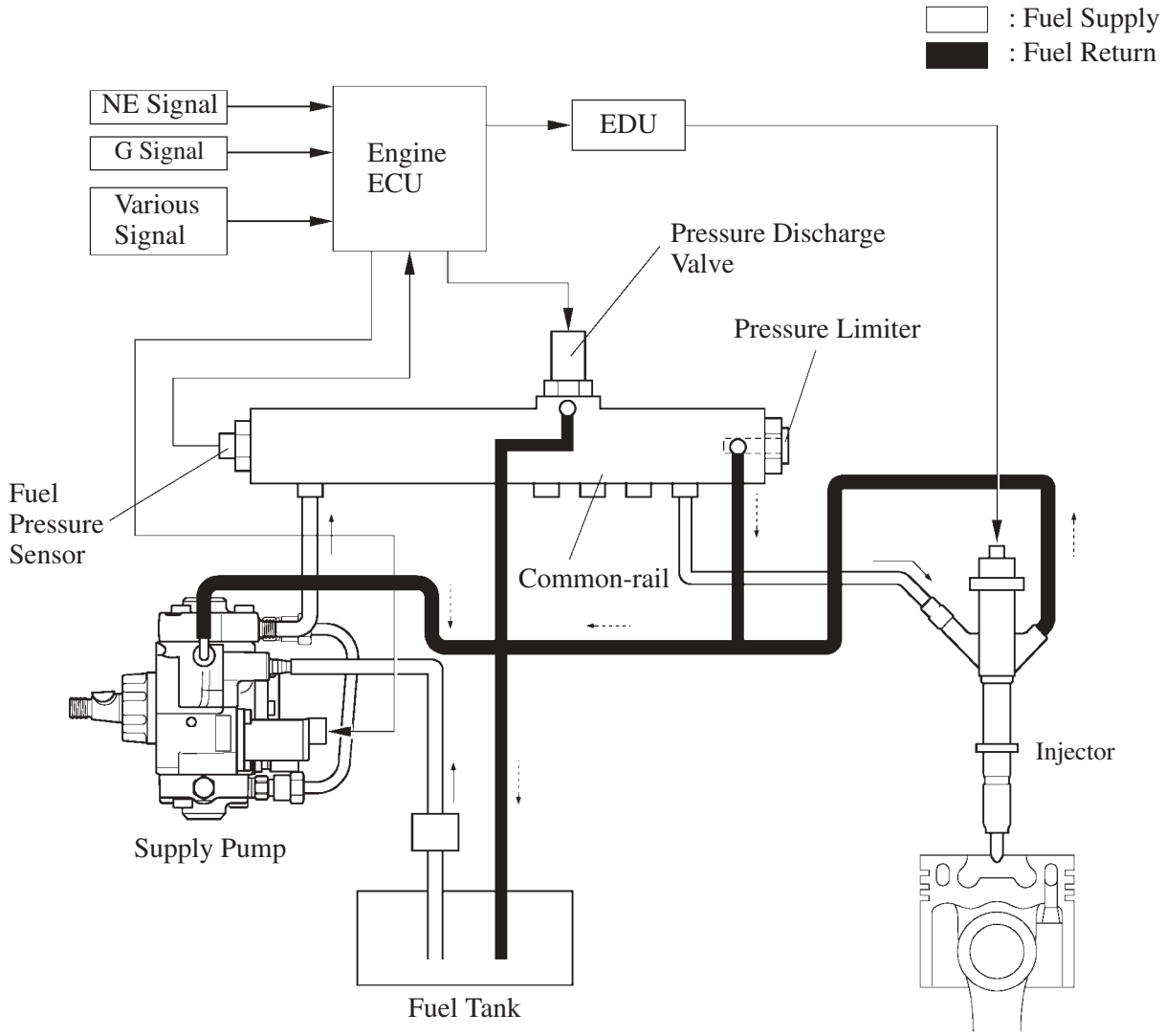
■FUEL SYSTEM

1. General

A common-rail system has been adopted in the fuel injection system. In this system, the highly pressurized fuel that is supplied by the supply pump is stored in the common-rail, and the engine ECU sends signals to the injectors via the EDU (Electronic Driver Unit) in order to control the injection timing and injection volume.

- HP3 type supply pump, which is compact and lightweight, has been newly adopted.
- A pressure discharge valve has been newly adopted.
- Compact and saving electric injectors are used.
- For details of fuel pressure control, refer to see page 59.

▶ System Diagram ◀



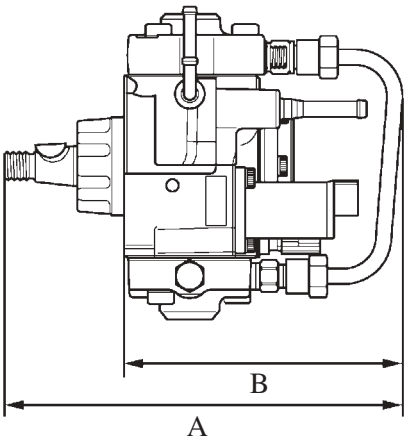
Service Tip

If the tank runs out of fuel, or when the fuel filter or fuel piping, etc., is replaced, air can get into the fuel system. Therefore, in such a case, it is necessary to use a priming pump integrated with a fuel filter to bleed the air out of the fuel system before starting the engine.

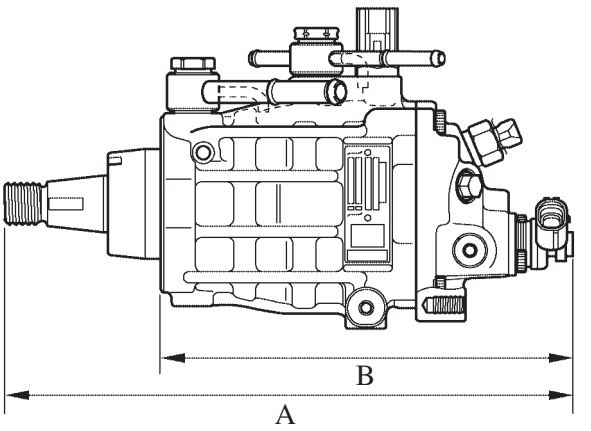
2. Supply Pump

General

The conventional, 4-plunger, HP2 (Inner Cam) type supply pump of the 1KD-FTV engine has been changed to a 2-plunger, HP3 (Outer Cam) type. As a result, the pump has been made more compact and its overall length has been shortened.



HP3 Type 224EG10



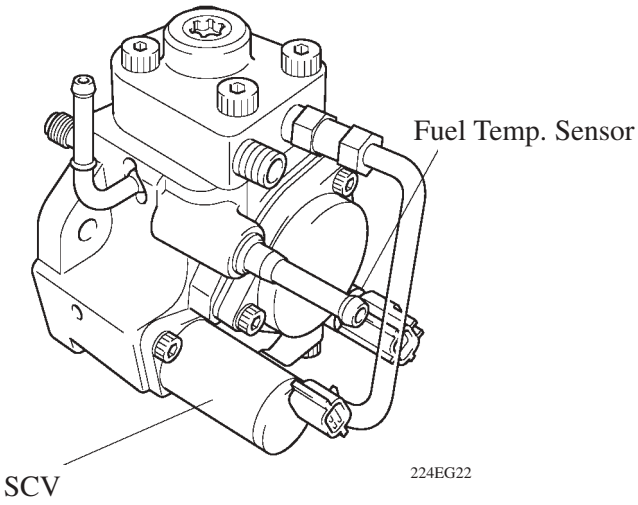
HP2 Type 224EG21

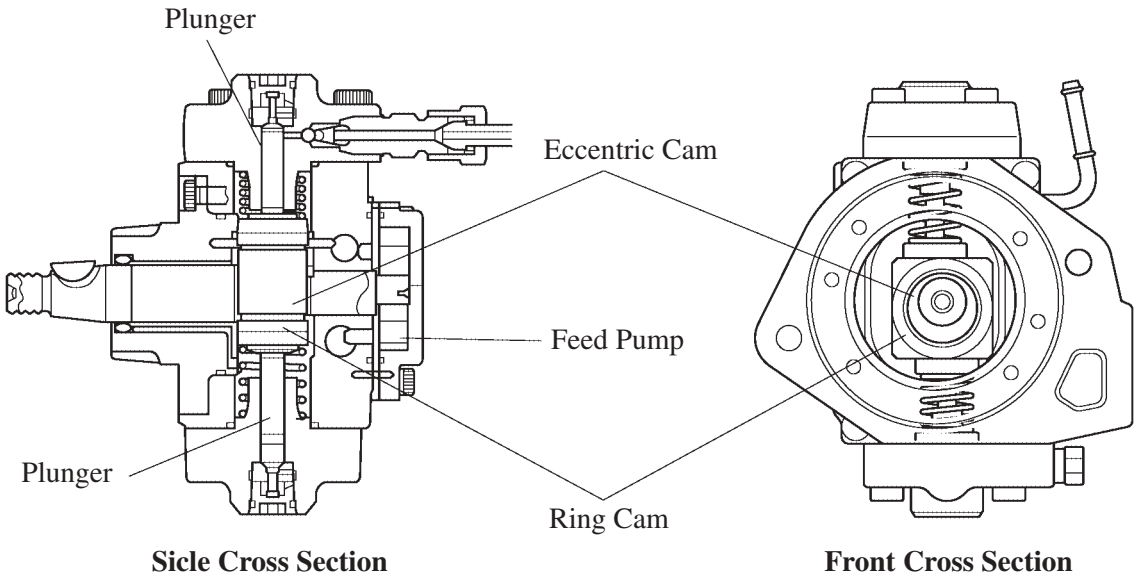
▶ Specification ◀

Engine			2KD-FTV	1KD-FTV
Type			HP3 (Outer Cam)	HP2 (Inner Cam)
A	Length	mm (in.)	201.5 (7.93)	252.0 (9.92)
B	Length	mm (in.)	140.3 (5.52)	182.1 (7.17)
Suction Control Valve			1	2
Plunger			ø8.5 x 2	ø7 x 4
Weight		g (lb.)	3800 (8.38)	6040 (13.32)

Construction

- The supply pump mainly consists of a pump body (eccentric cam, ring cam, two plungers) SCV, fuel temperature sensor, and a feed pump.
- The 2 plungers in the pump body are placed opposite each other outside of the ring cam.



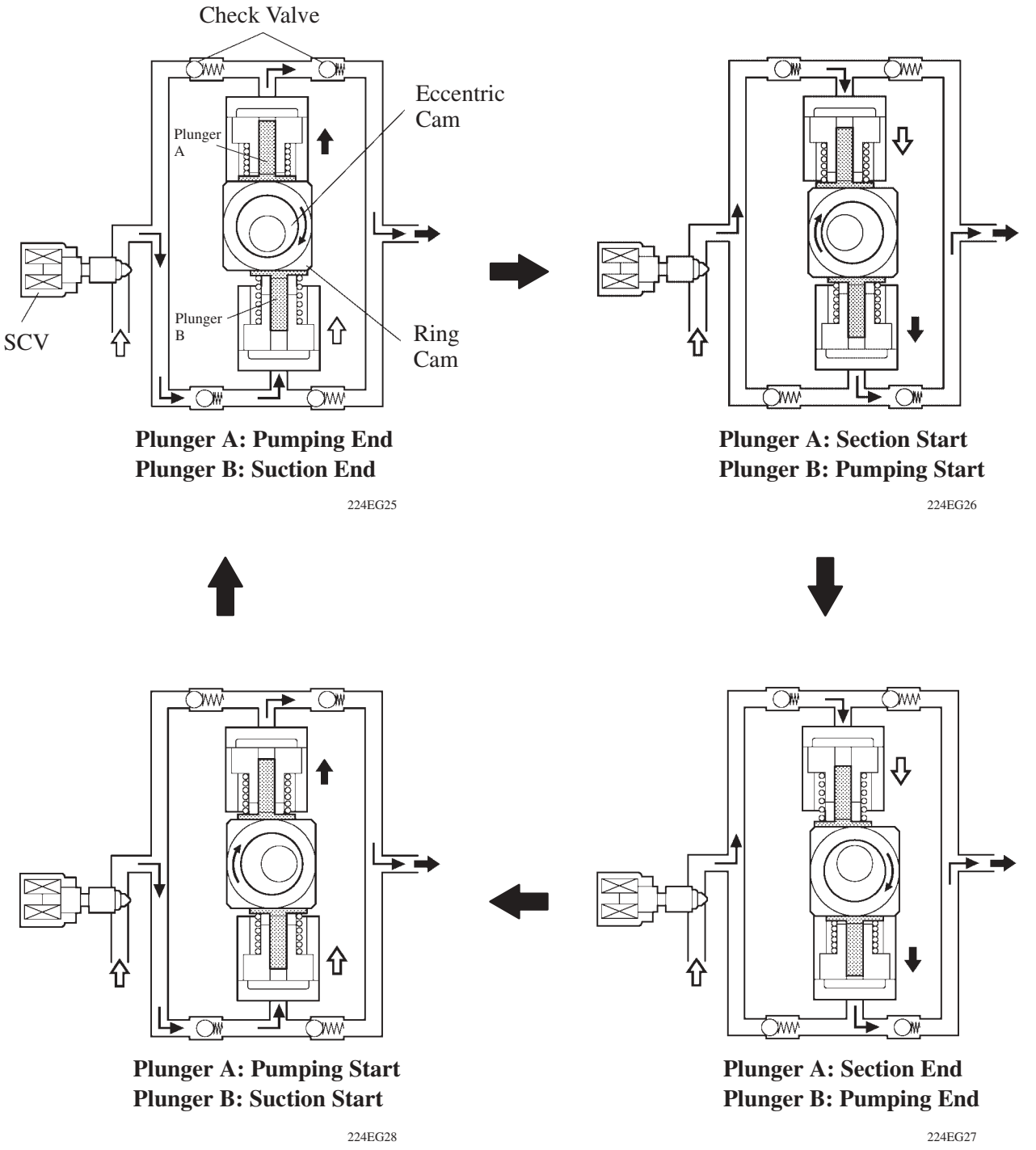


▶ Function of Component ◀

Components		Function
Feed Pump		Pumps fuel to two plungers.
Regulator Valve		Regulates fuel pressure in pump.
Suction Control Valve		Controls volume of fuel drawn in to plungers.
Pump Body	Eccentric Cam	Drives ring cam.
	Ring Cam	Drives two plungers.
	Plunger	Effects suction and pumping of fuel.
Delivery Valve		Pumps fuel to common-rail.

Operation

Due to the rotation of the eccentric cam, the ring cam pushes plunger A upward as illustrated below. The force of the spring pulls plunger B (which is located opposite plunger A) upward. As a result, plunger B draws fuel in, and plunger A pumps fuel at the same time.



Plunger A: Pumping End
Plunger B: Suction End

224EG25

Plunger A: Section Start
Plunger B: Pumping Start

224EG26

Plunger A: Pumping Start
Plunger B: Suction Start

224EG28

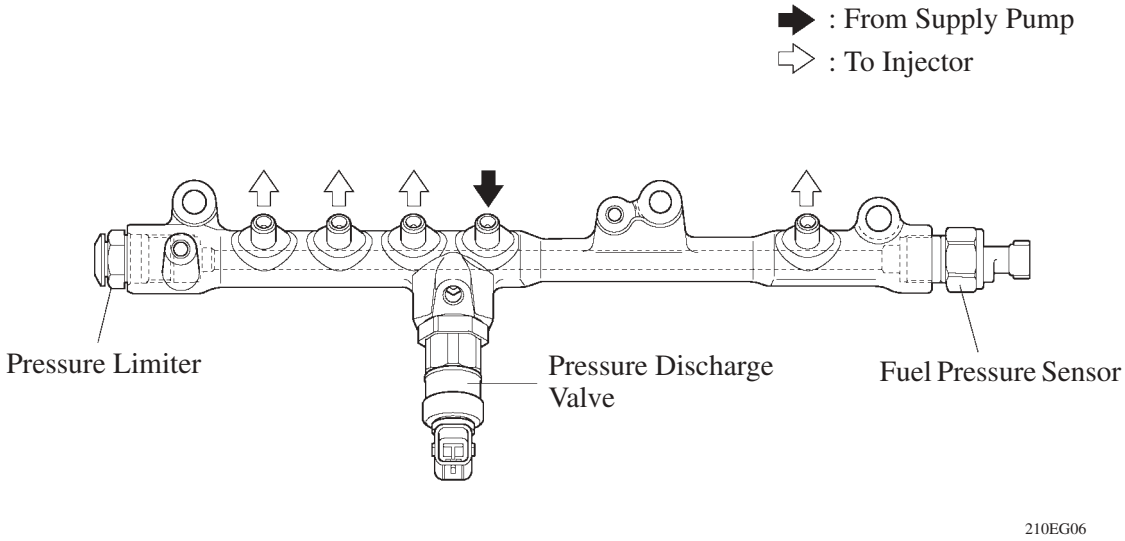
Plunger A: Section End
Plunger B: Pumping End

224EG27

3. Common-Rail

By storing fuel at a high pressure (30 to 135 MPa), the driving torque during the pumping of the fuel under high load conditions has been restrained, thus reducing the vibration and noise of the fuel injection system.

- In addition to the fuel pressure control on the 1KD-FTV engine in which the suction control valve controls the fuel pumping volume, on 2KD-FTV engine, the fuel pressure control to control the fuel discharging volume by the pressure discharge valve has been added to realize more precise fuel pressure control.
- The fuel pressure sensor calculates the fuel pressure and outputs the resultant signal to the engine ECU.
- When the pressure in the common-rail is abnormally high, the pressure limiter leaks the fuel to the fuel tank to reduce pressure.



Service Tip

- Fuel pressure sensor has its sealing portion plastic-deformed in order to keep sealing performance, so do not reuse it after disassembling.
- Do not disassemble the pressure limiter and pressure discharge valve because its operating pressure has been adjusted after assembly.
- If parts that affect the alignment has been changed, make sure to replace the pipe with a new one as well. The parts that require the replacement of a pipe are listed below.
  Injection Pipe: Injector, Common-Rail, Cylinder Head
  Fuel Inlet Pipe: Supply Pump, Common-Rail, Cylinder Block, Water Pump, Cylinder Head
- Refer to the 2KD-FTV Engine Repair Manual (Pub. No. RM907E).

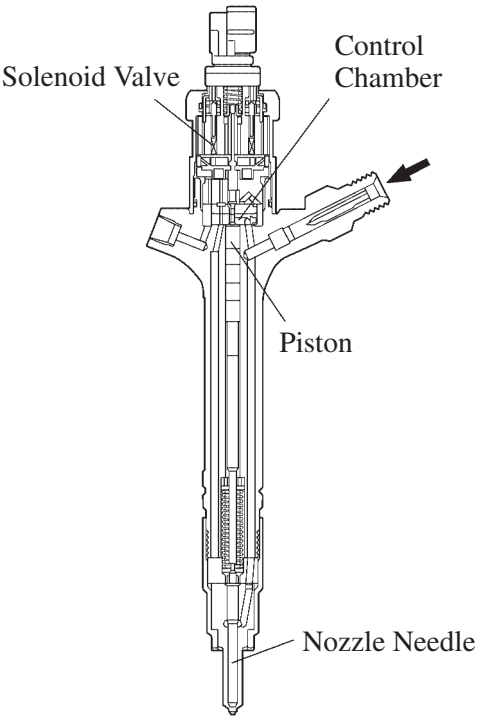
4. Injector

General

- An injector consists of a nozzle needle, piston, and solenoid valve.
- High voltage (125 V) is used particularly when the valve is open in order to open the nozzles.

▶ Specification ◀

Injection Hole	6
Injection Pressure	135 MPa (1377 kgf/cm^2)



210EG05

Operation

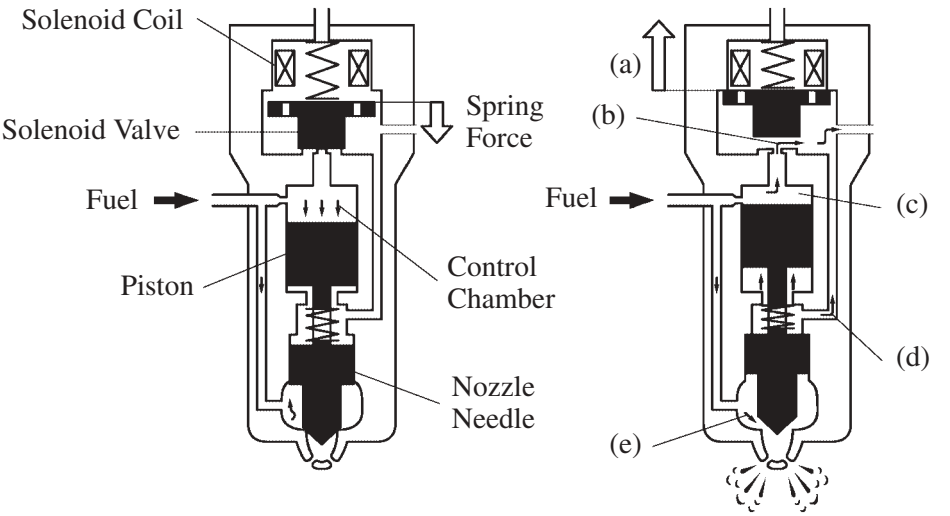
(a) When electrical current is applied to the solenoid coil, it pulls the solenoid valve up.

(b) The orifice of the control chamber opens, allowing the fuel to flow out.

(c) The fuel pressure in the control chamber drops.

(d) Simultaneously, fuel flows from the orifice to the bottom of the piston and raises the piston up (to enhance response).

(e) As a result, the piston raises the nozzle needle to inject fuel.



No Injection (Solenoid Valve OFF)

Injection (Solenoid Valve ON)

201EG36