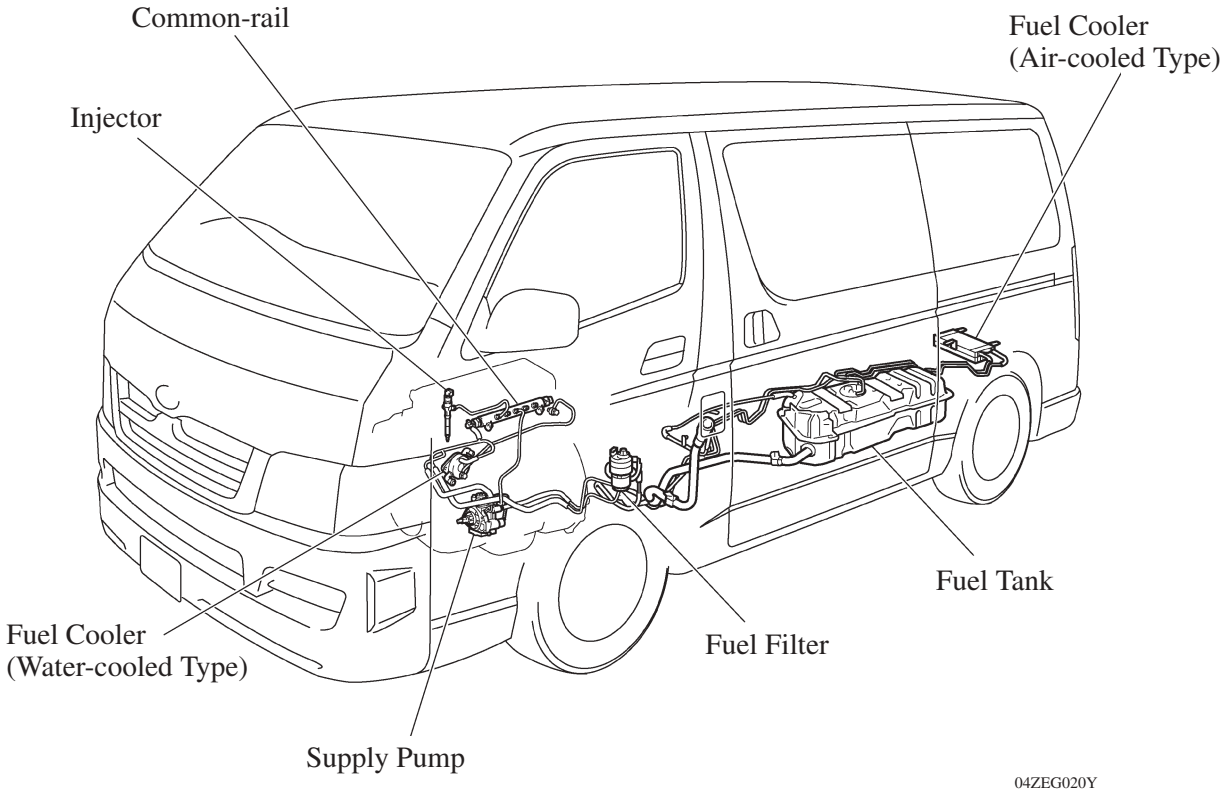
■FUEL SYSTEM

1. General

- A common-rail system is used in the fuel injection system.
- An HP3 type supply pump, which is compact and lightweight, is used.
- An injector compensation value and a QR code are printed on the injector to realize high-precision control.
- A fuel filter warning switch, which turns ON/OFF when the internal vacuum of the fuel filter increases, is provided in the fuel filter.
- 2 fuel coolers are used in the fuel return path.

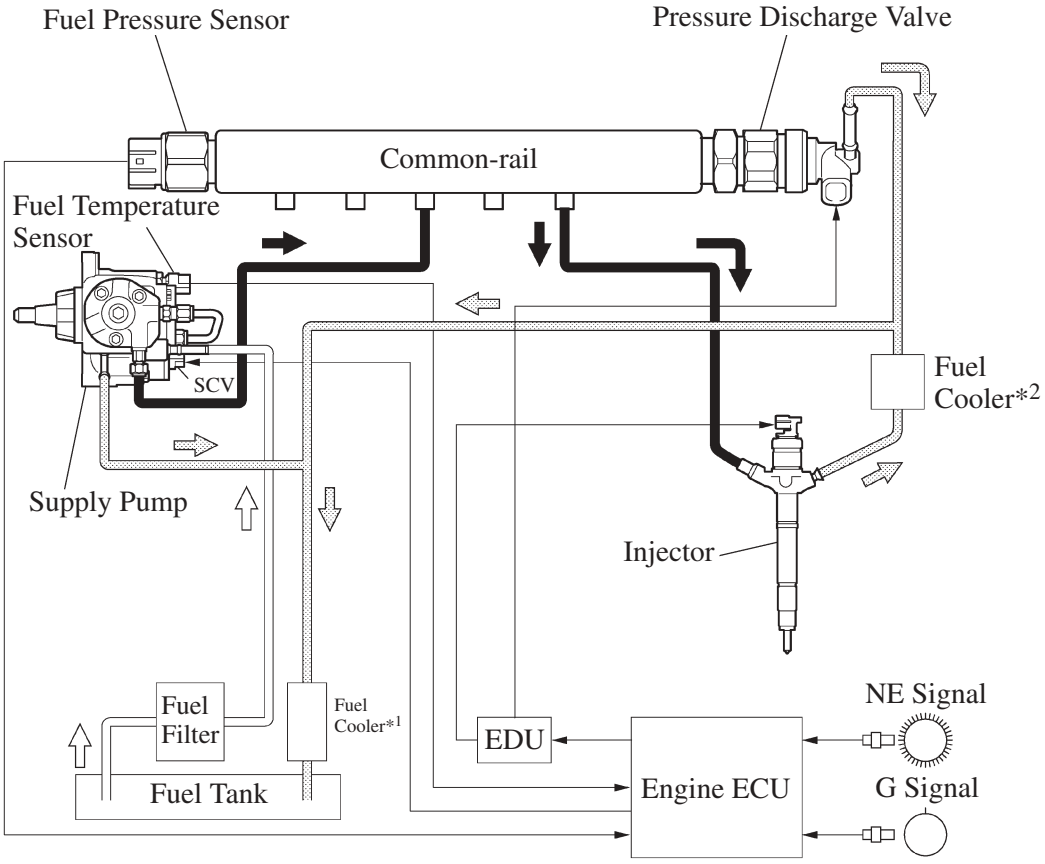


2. Common-rail System

General

In this system, the high-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.
Fuel pressure is controlled in accordance with fuel pumping volume that is controlled by the SCV (Suction Control Valve) in the supply pump and fuel discharge volume that is controlled by the pressure discharge valve in order to realize accurate fuel pressure control. The SCV and pressure discharge valve are controlled by the engine ECU via the EDU.
For details of these control systems, see pages 68.

▶ System Diagram ◀



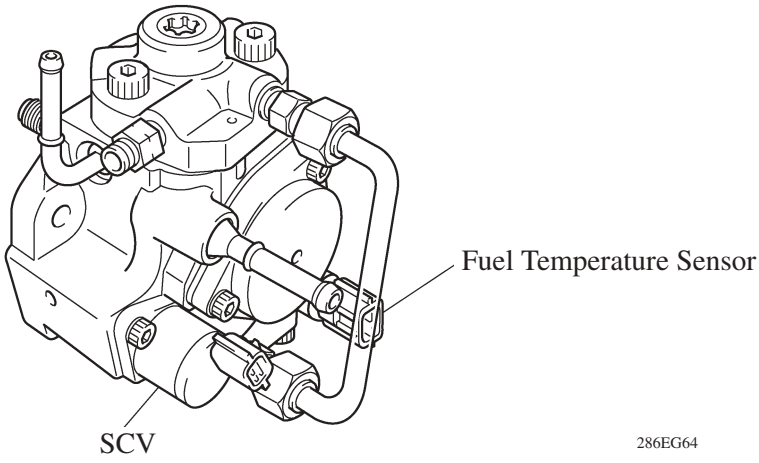
032EG13Y

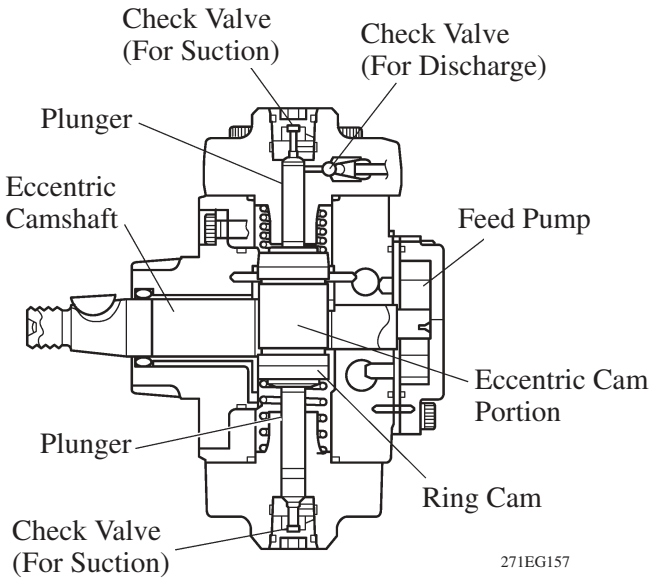
*1: Air-cooled Type
*2: Water-cooled Type

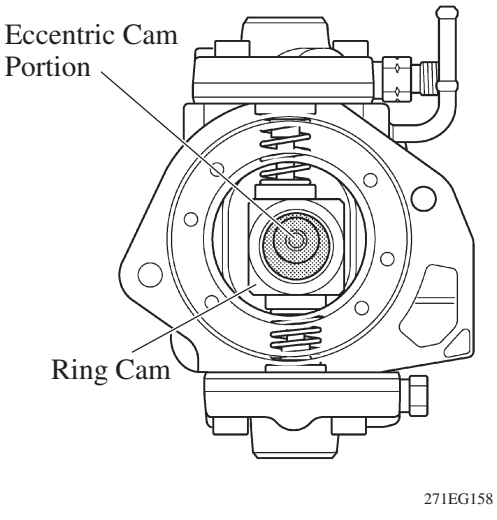
Supply Pump

1) General

- The supply pump consists of an eccentric camshaft, a ring cam, two plungers, four check valves, a SCV (Suction Control Valve), a fuel temperature sensor, and a feed pump.
- The two plungers are placed opposite to each other outside of the ring cam.







▶ Function of Components ◀

Components		Function
Feed Pump		Pumps fuel to two plungers.
Regulator Valve		Regulates fuel pressure in pump.
Suction Control Valve		Controls volume of fuel drawn into 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.

Service Tip

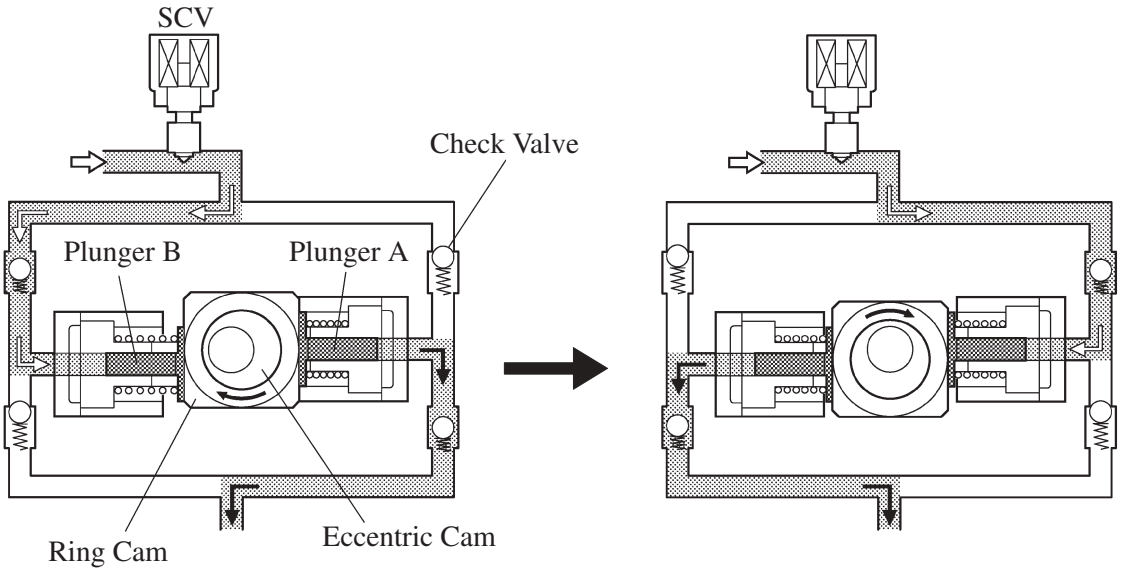
The engine ECU learns and memorizes the pump discharge volume variances associated with the individual differences in the supply pumps. Therefore, make sure to perform the operation described below after replacing the supply pump. For details, refer to the Hiace Repair Manual (Pub. No. RM04Z0E).

- Connect an intelligent tester II to the DLC3 connector and use the tester to reset the learned value. Alternatively, connect the SST (09843-18040) to the TC and CG terminals of the DLC3 connector, and leave the ignition switch ON for approximately 3 minutes to reset the learned value.
- After resetting, start the engine, allow it to idle* for approximately 1 minute, and turn the ignition switch OFF to enable the engine to memorize the learned value.

*: The engine water temperature should be 60°C (140°F) or more, and the fuel temperature should be 20°C (68°F) or more.

2) Operation

- Due to the rotation of the eccentric cam, the ring cam pushes the plunger A upward as illustrated below. The force of the spring pulls the plunger B (which is located opposite the plunger A) downward. As a result, the plunger B draws fuel in, and the plunger A pumps fuel at the same time.
- The SCV controls the volume of fuel that is drawn into the plungers in accordance with the signals from the engine ECU.

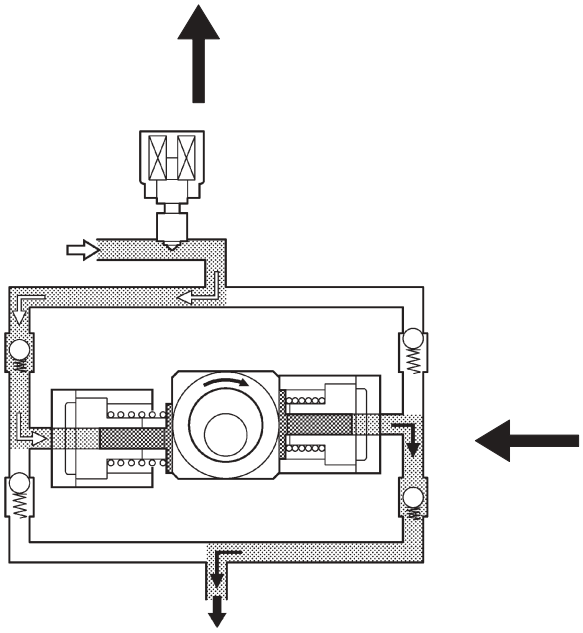


Plunger A: Pumping End
Plunger B: Suction End

002CV29Y

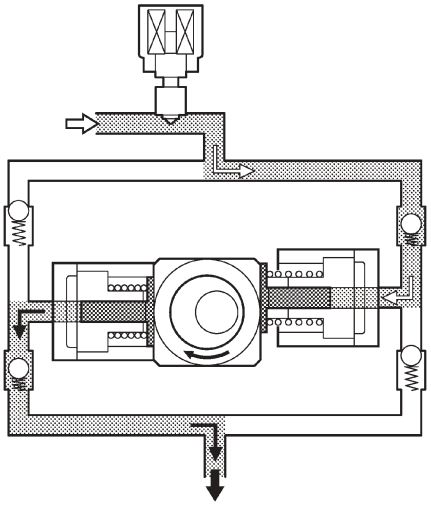
Plunger A: Suction Start
Plunger B: Pumping Start

002CV30Y



Plunger A: Pumping Start
Plunger B: Suction Start

002CV32Y

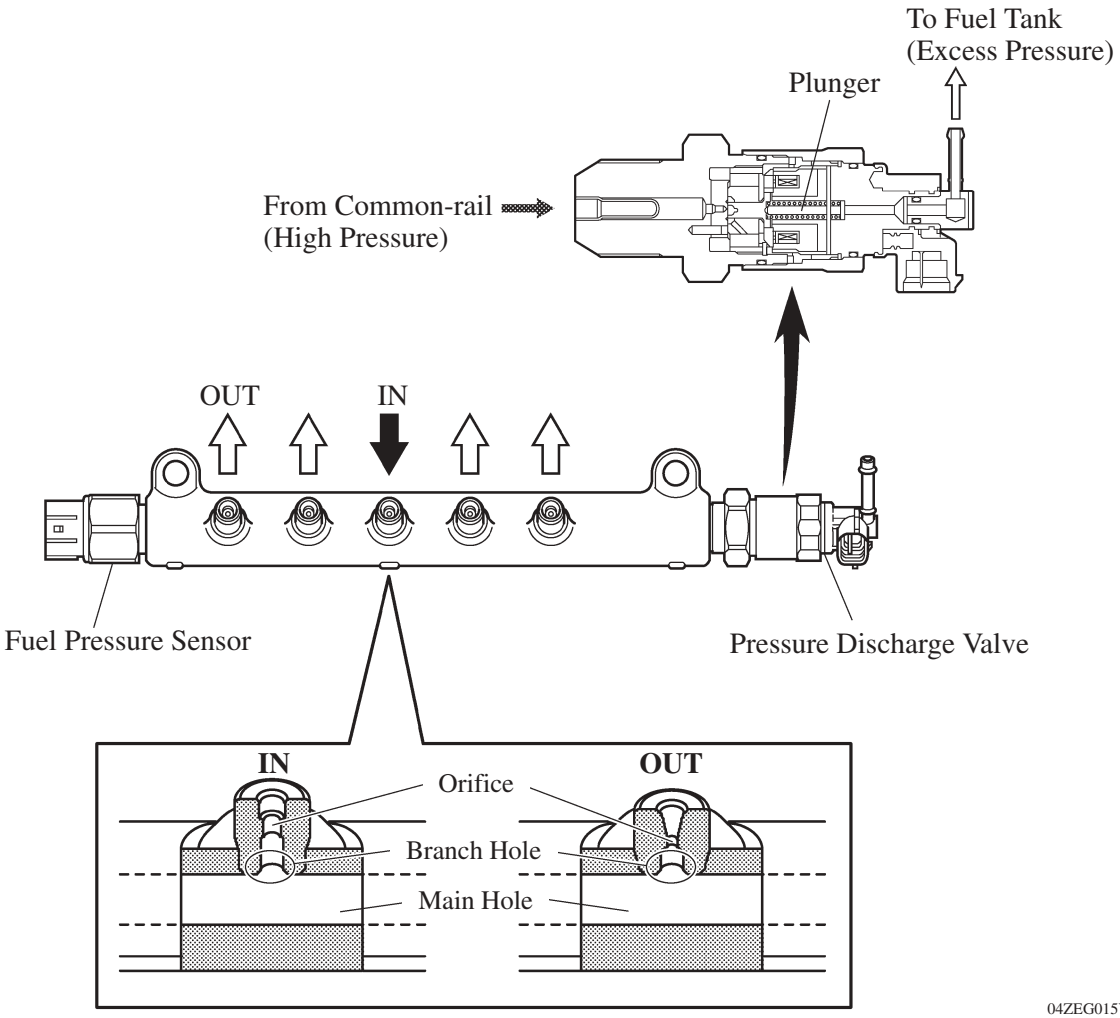


Plunger A: Suction End
Plunger B: Pumping End

002CV31Y

Common-rail

- The function of the common-rail is to store the fuel that has been pressurized by the supply pump. The common-rail is equipped with a fuel pressure sensor, which detects the fuel pressure in the common-rail, and a pressure discharge valve, which regulates the fuel pressure.
- Internally, the common-rail contains a main hole and five branch holes that intersect the main hole. Each branch hole functions as an orifice that dampens the fluctuation of the fuel pressure.
- In the pressure discharge valve, the plunger opens and closes in accordance with the actuation signals from the EDU. Thus, it regulates pressure by releasing excess pressure from the common-rail. In addition, it has a pressure reduction function in case of emergency.
- For details on the fuel pressure sensor, see page 62.



Service Tip

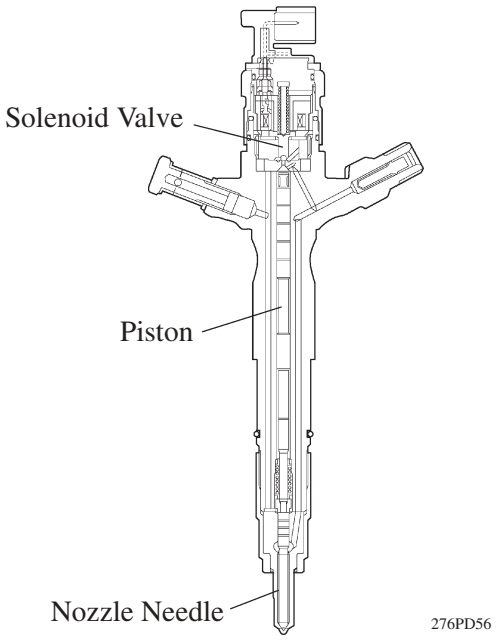
- The fuel pressure sensor has its sealing portion plastic-deformed in order to keep sealing performance, so do not reuse it after disassembling.
- If any part that affects the alignment has been changed, make sure to replace the pipe with a new one as well. The parts that require the replacement of 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

For details, refer to the Hiace Repair Manual (Pub. No. RM04Z0E).

Injector

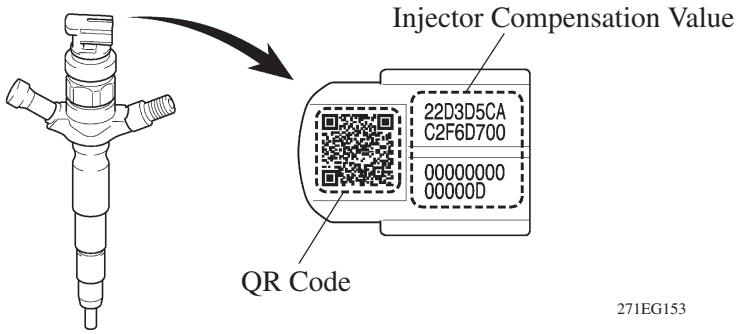
1) General

- An injector consists of a nozzle needle, piston, and solenoid valve.
- An injector compensation value and QR (Quick Response) code containing encoded characteristics of the injector are printed on each injector.
- The injector compensation value and QR code contain various pieces of information regarding the injector, such as model code, injection volume correction, and injection timing correction values.



Service Tip

- If the engine ECU is replaced, use the intelligent tester II and input the injector compensation values of all 4 injectors. If one of the injectors is replaced, input the injector compensation value of the replaced injector. Then, the proper compensation will be made so that the injection volume precision prior to the replacement will remain unchanged. For details, refer to the Hiace Repair Manual (Pub. No. RM04Z0E).
- The QR code, which requires a special scan tool, is not used at TOYOTA dealers.



— REFERENCE —

What is QR (Quick Response) Code?

- *QR code, a matrix symbology consisting of an array of nominally square cells, allows omni-directional, high-speed reading of large amounts of data.*
- *QR code encodes many types of date such as numeric, alphanumeric, kanji, kana and binary code. A maximum of 7,089 characters (numeric) can be encoded.*
- *QR code (2D code) contains information in the vertical and horizontal direction, whereas a bar code contains data in one direction only. QR code (2D code) holds a considerably greater volume of information than a bar code.*

2) Operation

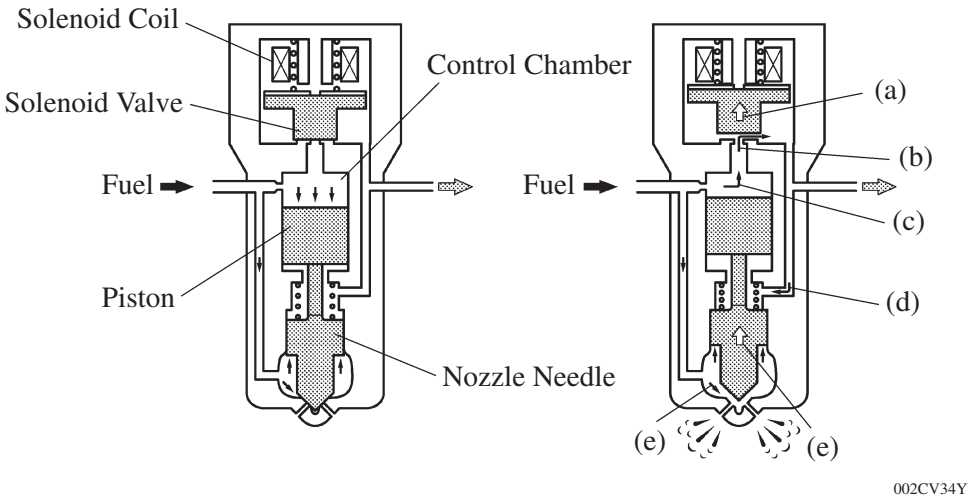
(a) When electrical current is applied to the solenoid coil, it pulls the solenoid valve up.

(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).

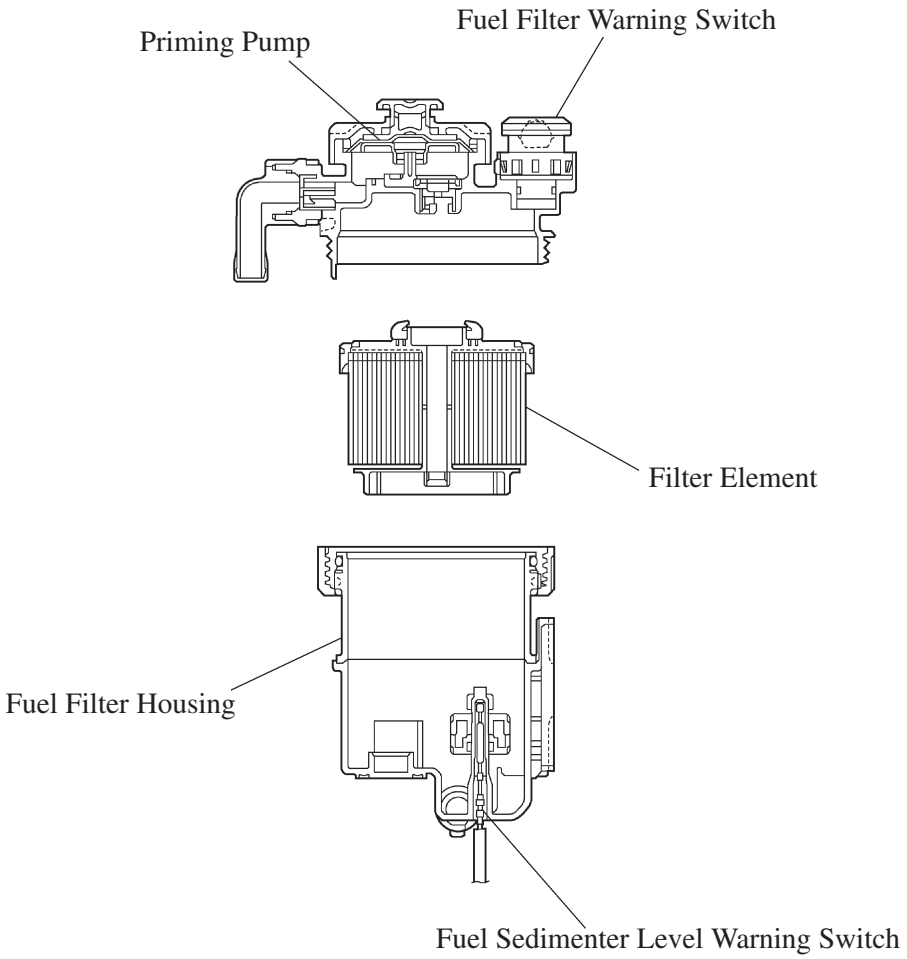
(e) As a result, the piston raises the nozzle needle to inject fuel.



3. Fuel Filter

General

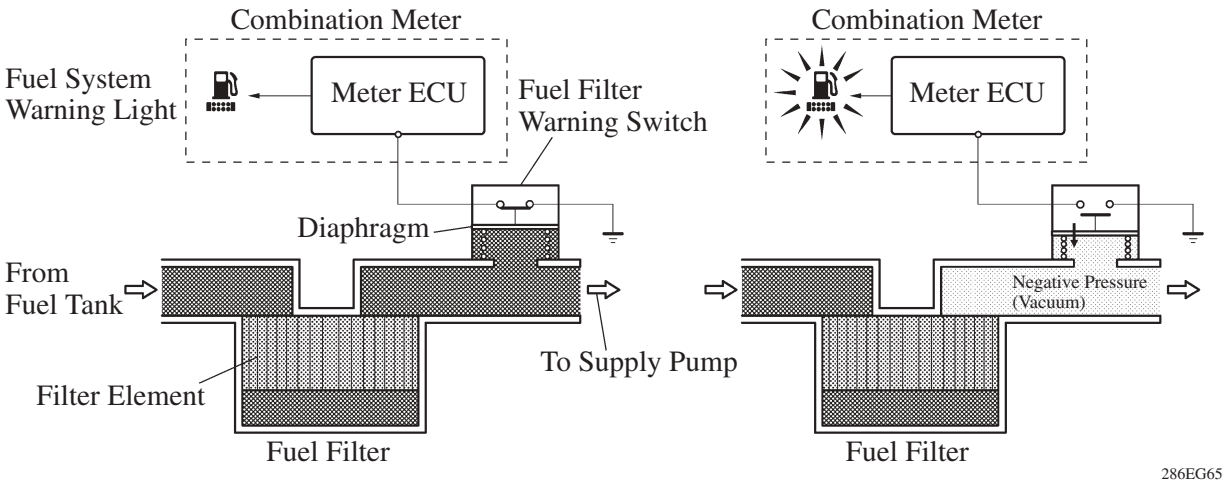
- A fuel filter consists of a fuel filter element integrated with the fuel filter housing.
- A fuel filter warning switch is provided in the fuel filter.



04ZEG026Y

Fuel Filter Warning Switch

- A fuel filter warning switch, which turns ON/OFF when the internal vacuum of the fuel filter increases, is provided in the fuel filter. This switch, which turns OFF when the internal vacuum of the fuel filter increases to a predetermined level, is connected by wire to the meter ECU.
- When the meter ECU detects that the internal vacuum of the fuel filter has increased (by way of the fuel filter warning switch OFF signal), it determines that the fuel filter has become clogged. Then, it illuminates the fuel system warning light on the combination meter to urge the driver to replace the fuel filter.

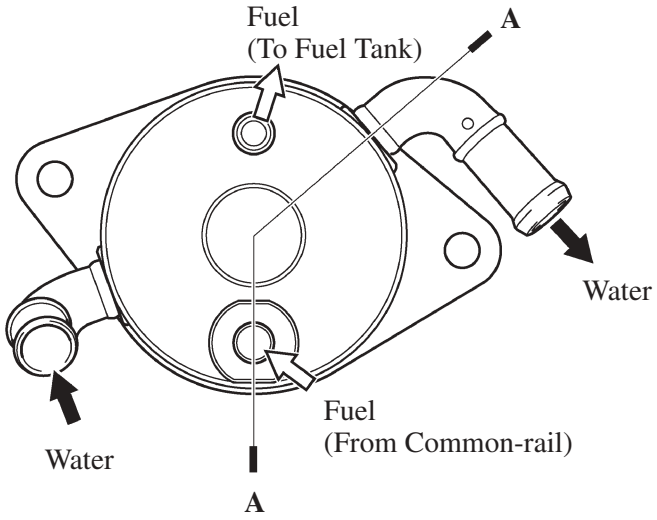


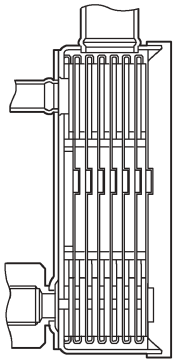
Normal Fuel Filter **Fuel Filter Clogged Up**

4. Fuel Cooler

The two types of the fuel coolers are used; one is the water-cooled type, and the other is the air-cooled type. These fuel coolers, which are provided in the fuel return path, cool the return fuel that has reached a high temperature as a result of the pumping of the supply pump. This prevents the reduction in fuel viscosity that is caused by the rise in fuel temperature, and improves the reliability of the fuel system.

▶ Water-cooled Type Fuel Cooler ◀

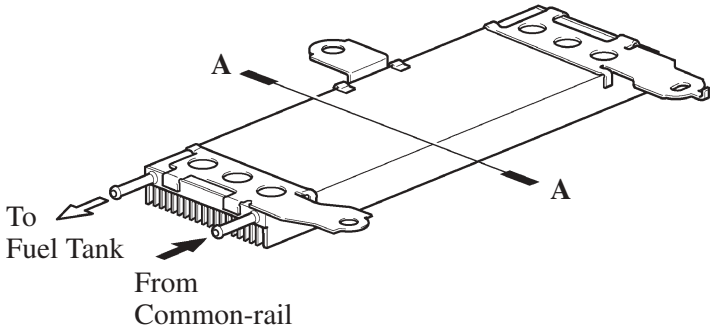


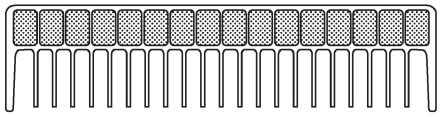


A – A Cross Section

032EG21Y

▶ Air-cooled Type Fuel Cooler ◀





A – A Cross Section

286EG21