

■ FUEL SYSTEM

1. General

- A common-rail system is used in the fuel injection system.
- An HP4 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.

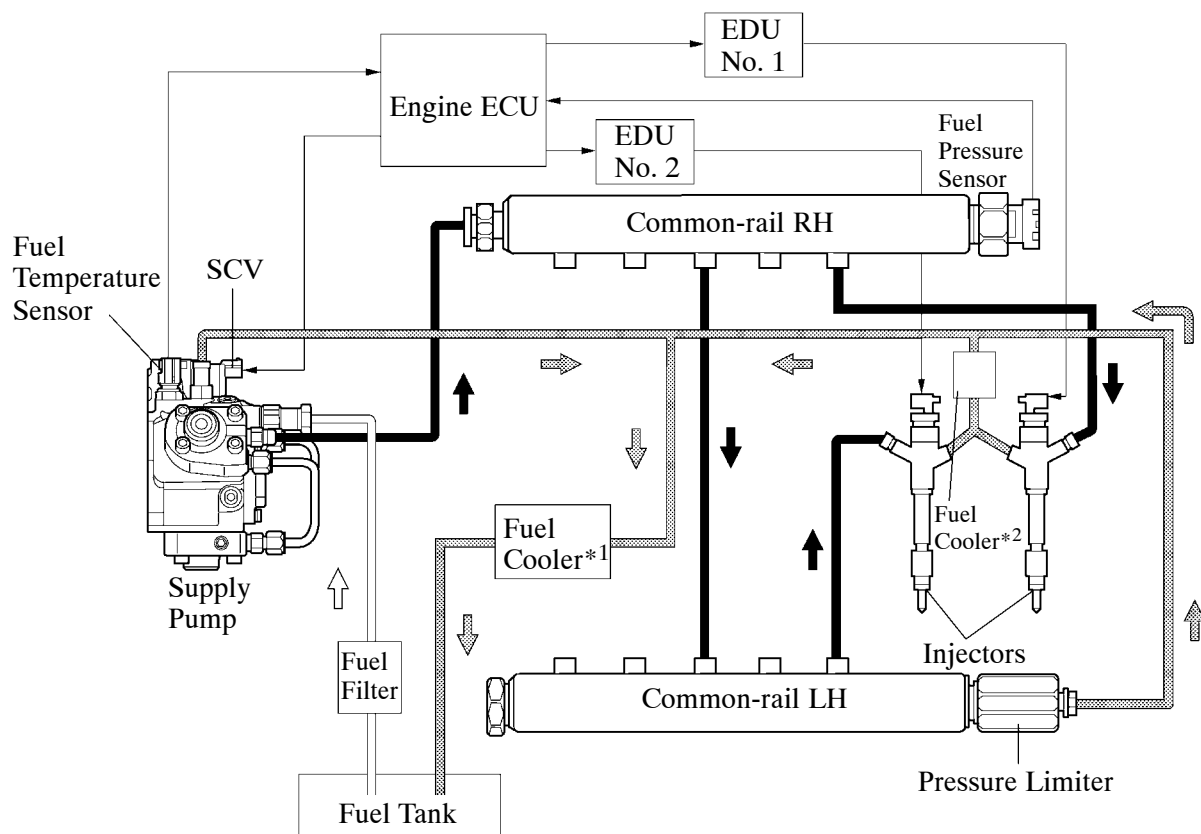
2. Common-rail System

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.

► System Diagram ◀



➡ : High Pressure Fuel

➡ : Return Fuel

➡ : Suctioned Fuel

*1: Air-cooled Type

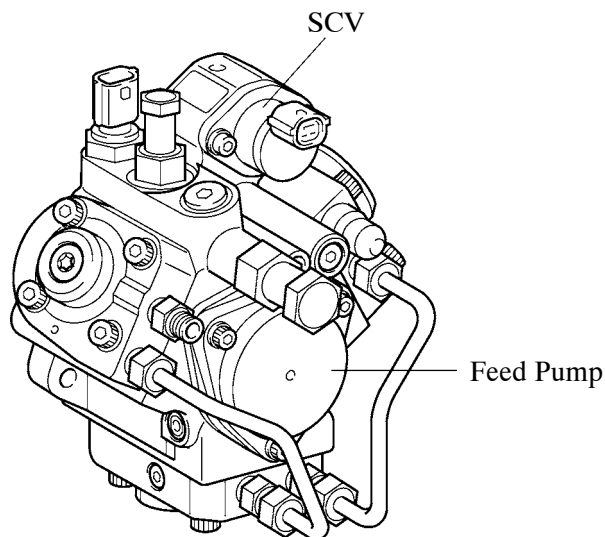
*2: Water-cooled Type

3. Supply Pump

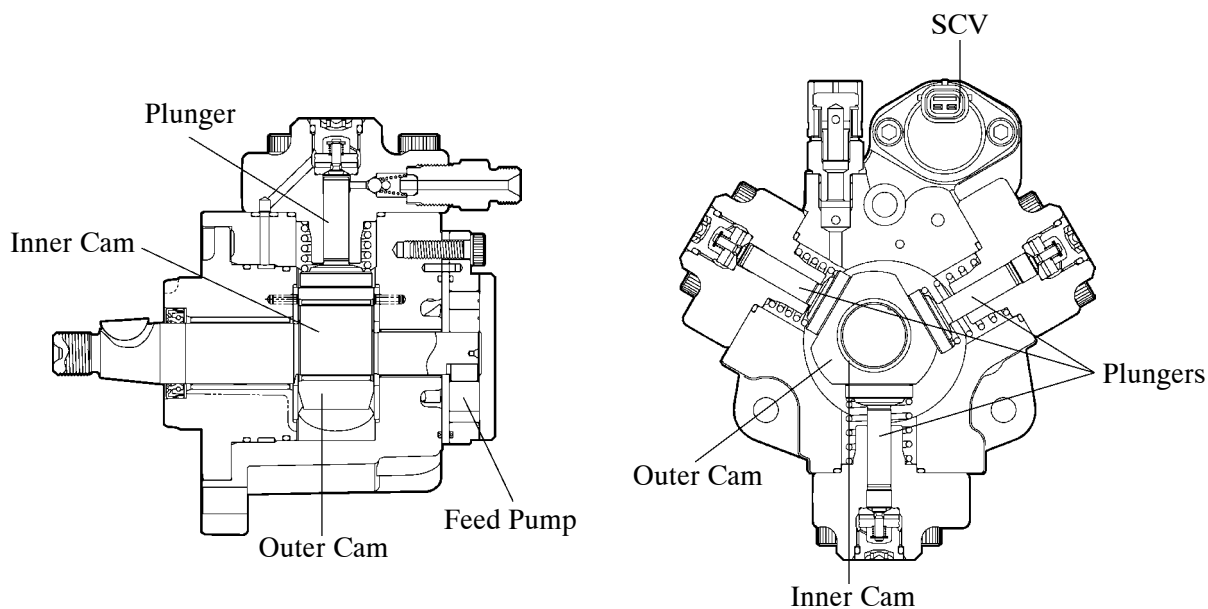
General

The supply pump consists of an inner cam (eccentric cam), outer cam (polygon ring), and three plungers, SCV (Suction Control Valve), and a feed pump. Each plunger is placed outside of the outer cam.

- Feed pump pumps fuel to three plungers.
- SCV controls volume of fuel drawn into plungers.
- Inner cam drives outer cam.
- Outer cam drives three plungers.
- Plunger pressurizes fuel.



058EG22Y

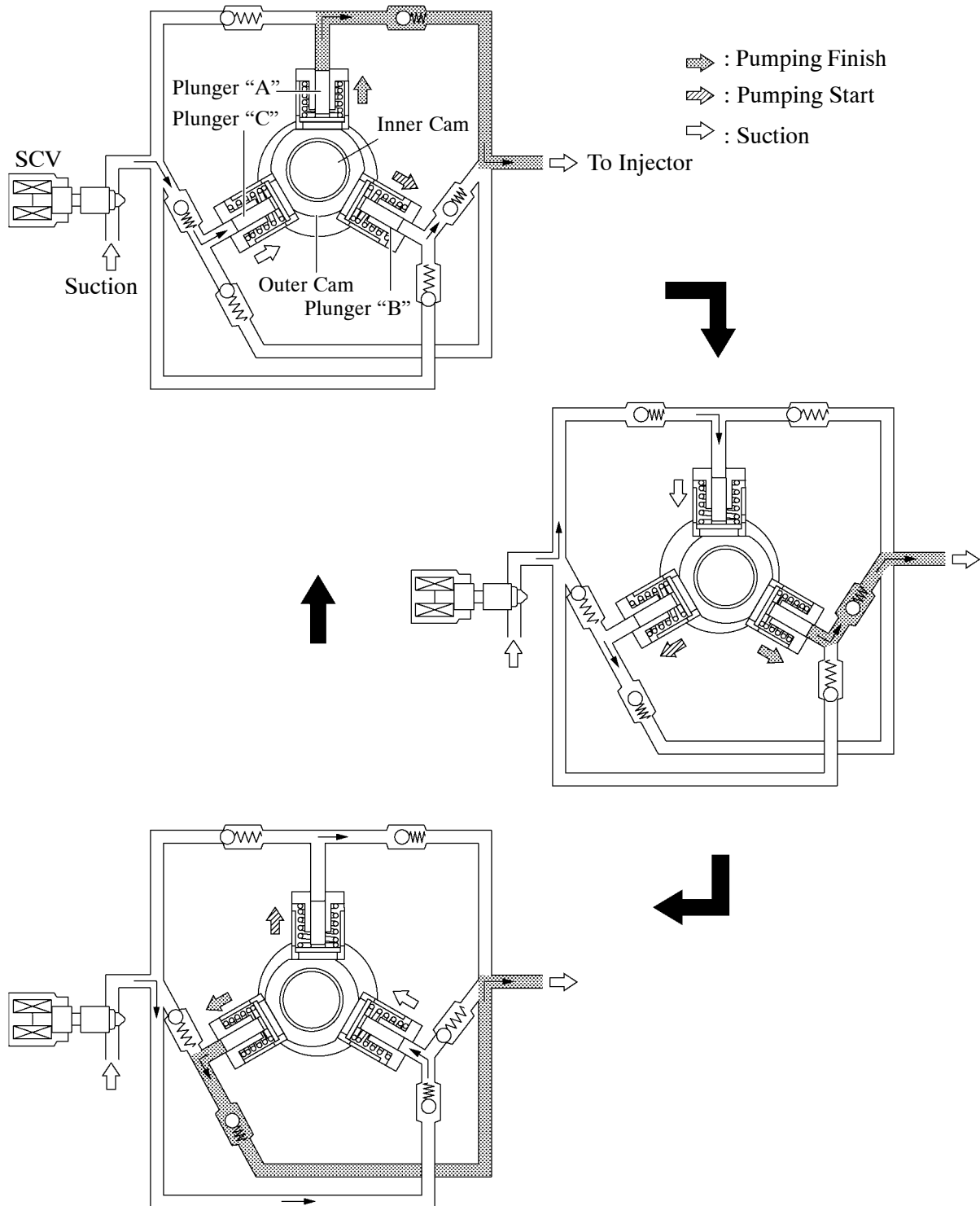


058EG23Y

058EG24Y

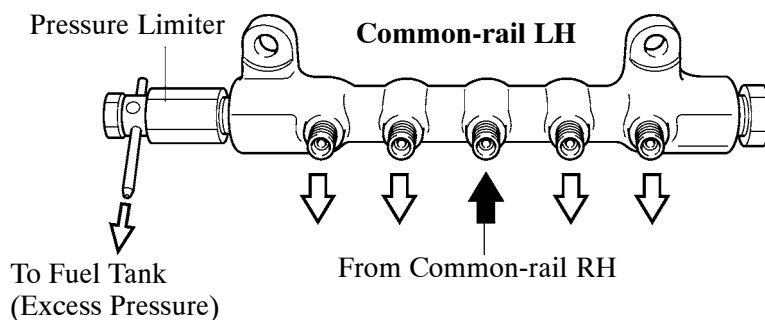
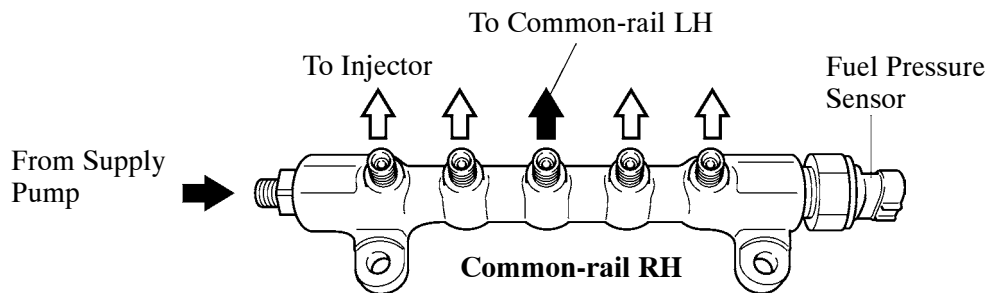
Operation

Due to the rotation of the inner cam (eccentric cam), the outer cam pushes plunger “A” upward as illustrated below. The force of the spring pulls plungers “B” and “C”. As a result, plungers “B” and “C” draw fuel in, and plunger “A” pumps fuel at the same time.



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 provided with a fuel pressure sensor, which detects the fuel pressure in the common-rail, and a pressure limiter that mechanically relieves the pressure in case the internal pressure of the common-rail rises abnormally.
- 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.
- The fuel pressure sensor outputs a signal that represents the fuel pressure in the common-rail to the engine ECU in order to constantly regulate the fuel at an optimal pressure.



058EG52Y

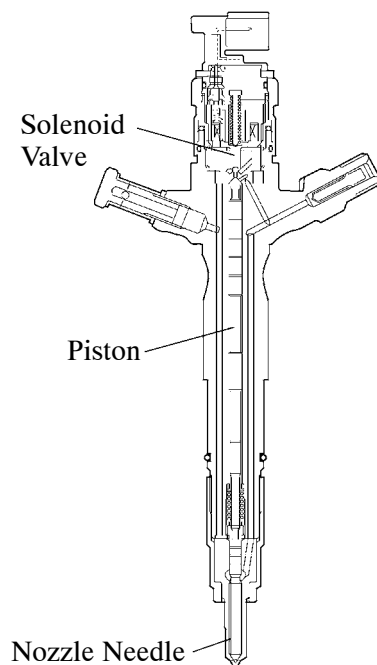
Service Tip

- Fuel pressure sensor has its sealing portion plastic-deformed in order to keep sealing performance, so do not reuse it after disassembling.
- The fuel pressure sensor and pressure limiter are supplied as a set with the common-rail.
- Do not disassemble the pressure limiter.
- If parts that affect the alignment have 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 and Intake Manifold
 Fuel Inlet Pipe: Supply Pump, Common-rail, Cylinder Head and Intake Manifold
 For details, refer to the Land Cruiser Repair Manual (Pub. No. RM0580E).

Injector

1) General

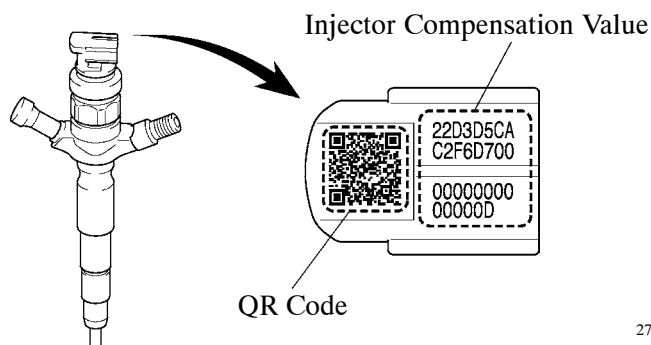
- An injector consists of a nozzle needle, piston, and solenoid valve.
- An injector compensation value and QR (Quick Response) code containing encoded characteristics of the injector are printed on each injector.
- The injector compensation value and QR code contain various pieces of information regarding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



276PD56

Service Tip

- If the engine ECU is replaced, use the intelligent tester II and input the injector compensation values of all 8 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 Land Cruiser Repair Manual Supplement (Pub. No. RM0580E).
- The QR code, which requires a special scan tool, is not used at TOYOTA dealers.



271EG153

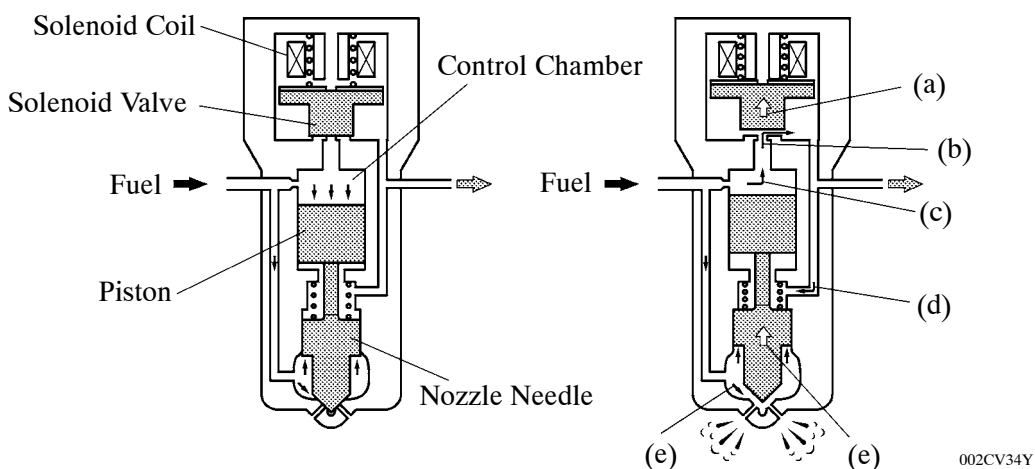
— REFERENCE —

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 data 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

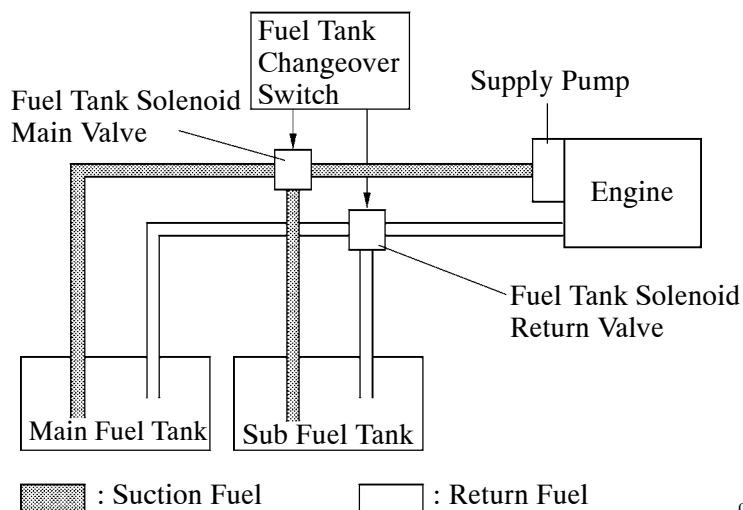
- (a) When electrical current is applied to the solenoid coil, it pulls the solenoid valve up.
- (b) The orifice of the control chamber opens, allowing the fuel to flow out.
- (c) The fuel pressure in the control chamber drops.
- (d) Simultaneously, fuel flows from the orifice to the bottom of the piston and raises the piston up (to enhance response).
- (e) As a result, the piston raises the nozzle needle to inject fuel.



002CV34Y

4. Sub Fuel Tank System

- On the model with a sub fuel tank, a solenoid valve switches the fuel passage between the main fuel tank and the sub fuel tank.
- Turning the fuel tank changeover switch ON operates the fuel tank solenoid main valve and the fuel tank solenoid return valve and switches the passage to the sub fuel tank.

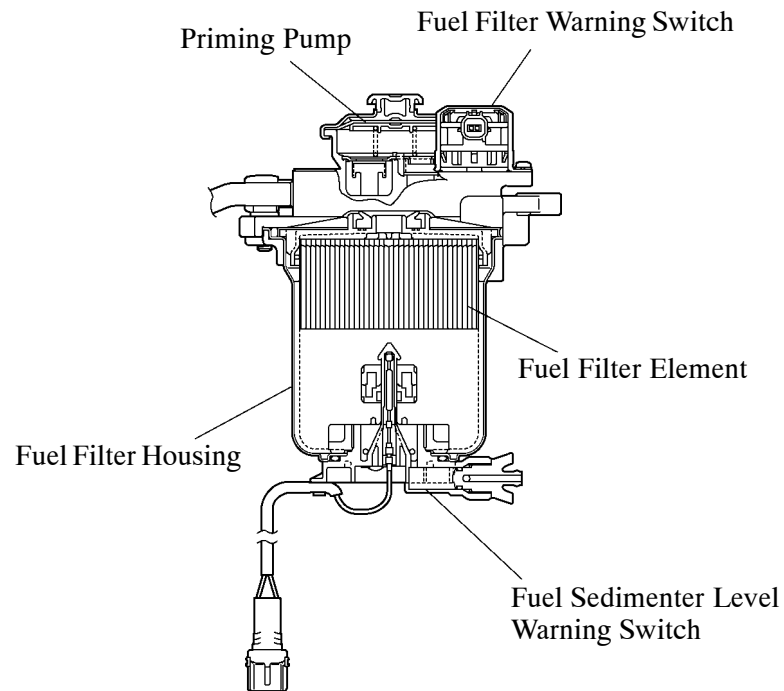


058EG43Y

5. Fuel Filter

General

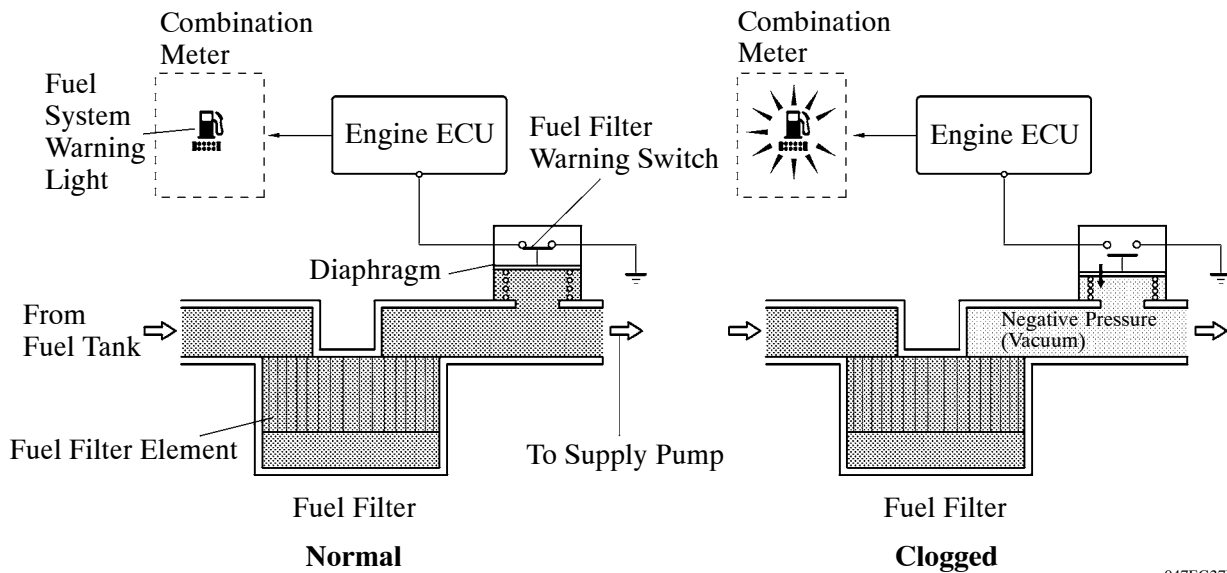
- A fuel filter consists of a fuel filter element integrated with the fuel filter housing.
- A fuel filter warning switch is provided in the fuel filter.



058EG66Y

Fuel Filter Warning Switch

- A fuel filter warning switch, which turns ON/OFF when the internal vacuum of the 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 engine ECU.
- When the engine 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.

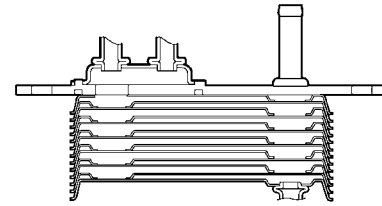
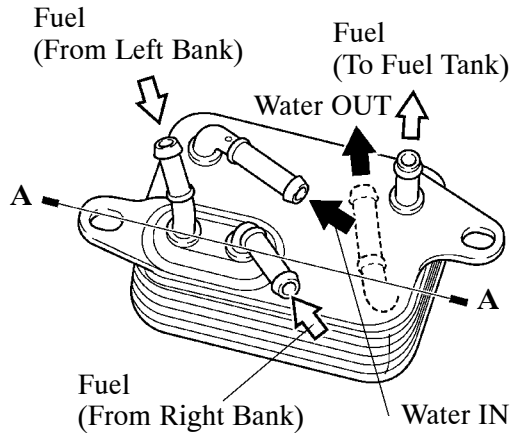


047EG37Y

6. 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.

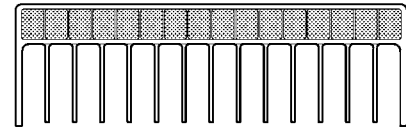
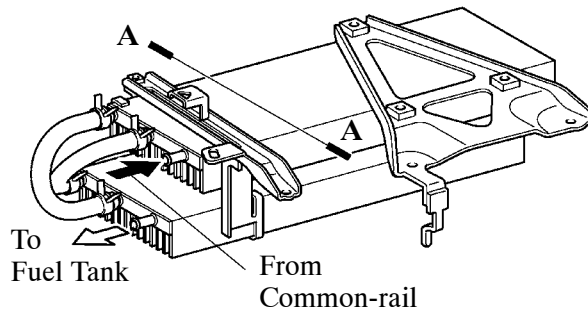
► Water-cooled Type Fuel Cooler ◀



A – A Cross Section

058EG53Y

► Air-cooled Type Fuel Cooler ◀



A – A Cross Section

058EG54Y