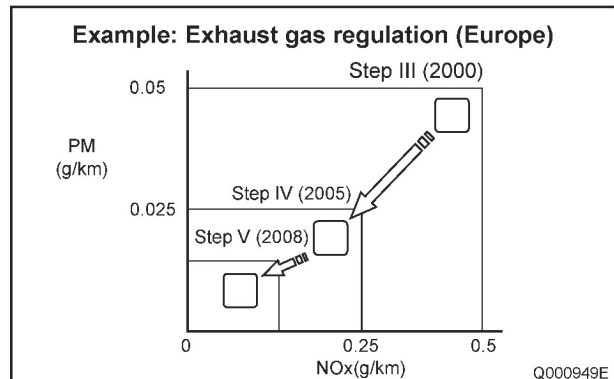


2. OUTLINE

2-1. OUTLINE OF SYSTEM

- The common rail system was developed primarily to cope with exhaust gas regulations for diesel engines, and aimed for 1. further improved fuel economy; 2. noise reduction; and 3. high power output.
- This Common Rail System meets the Step III Stage of the European Emission Regulations as shown in the figure on the right.



A. System Characteristics:

The common rail system uses a type of accumulation chamber called a rail to store pressurized fuel, and injectors that contain electronically controlled solenoid valves to spray the pressurized fuel into the cylinders. Because the engine ECU controls the injection system (including the injection pressure, injection rate, and injection timing), the system is unaffected by the engine speed or load. This ensures a stable injection pressure at all times, particularly in the low engine speed range, and dramatically decreases the amount of black smoke ordinarily emitted by a diesel engine during start-up and acceleration. As a result, exhaust gas emissions are cleaner and reduced, and higher power output is achieved.

a. Injection Pressure Control

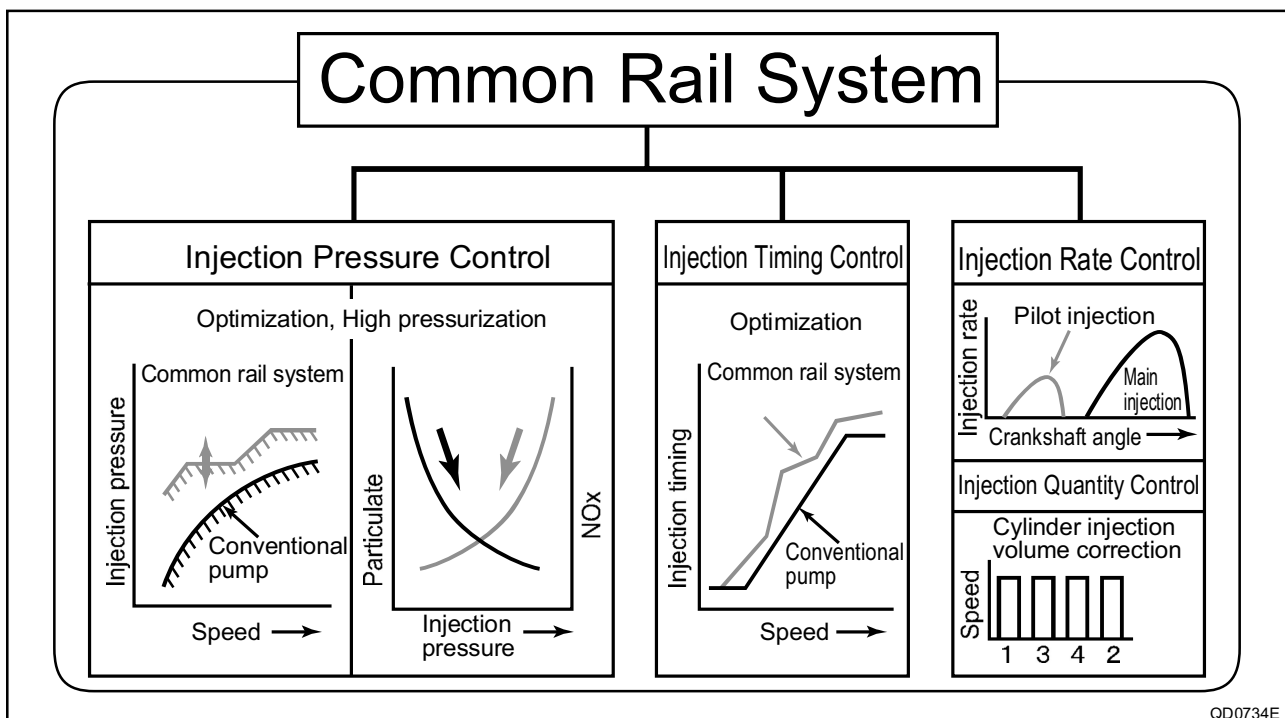
- Enables high-pressure injection, even in the low engine speed range.
- Optimizes control to minimize particulate matter and NOx emissions.

b. Injection Timing Control

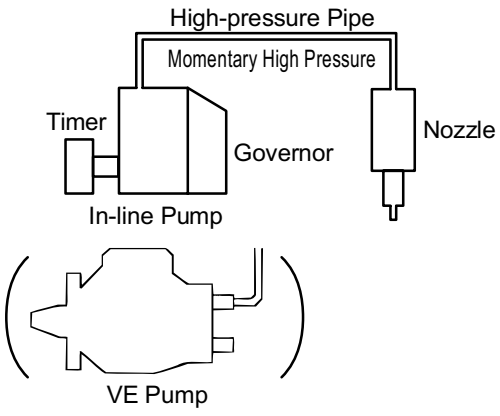
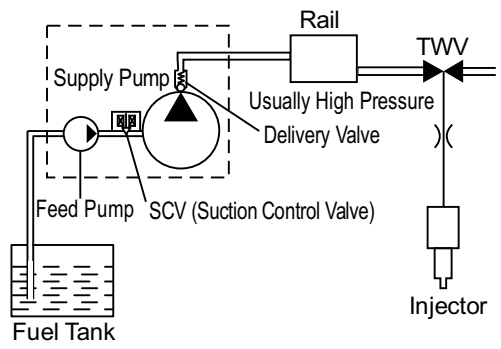
Optimally controls the timing to suit driving conditions.

c. Injection Rate Control

Pilot injection control sprays a small amount of fuel before the main injection.



B. Comparison to the Conventional System

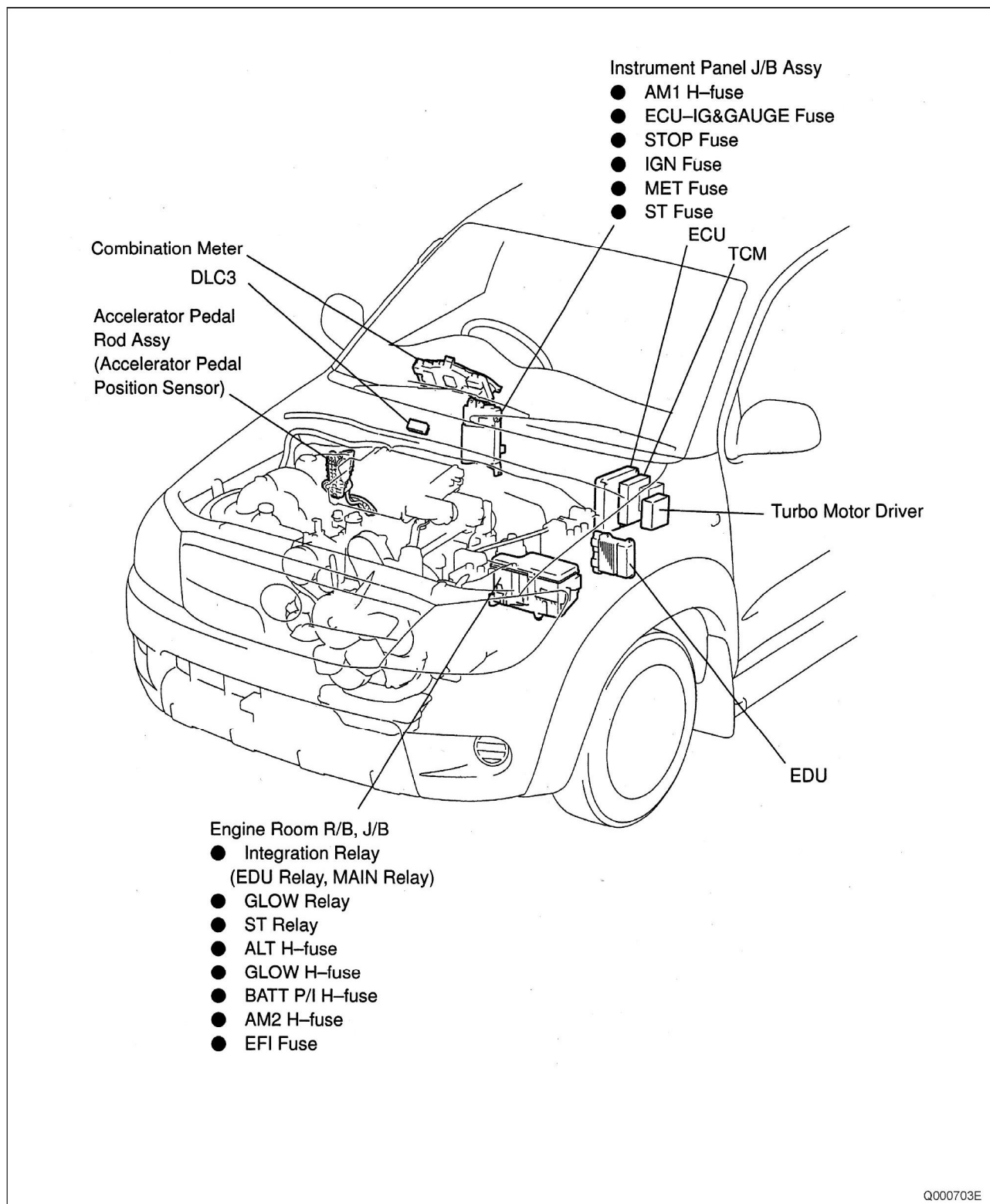
System	In-line, VE Pump	Common Rail System
		
Injection Quantity Control	Pump (Governor)	Engine ECU, Injector (TWV)* ¹
Injection Timing Control	Pump (Timer)	Engine ECU, Injector (TWV)* ¹
Rising Pressure	Pump	Engine ECU, Supply Pump
Distributor	Pump	Engine ECU, Rail
Injection Pressure Control	Dependent upon Speed and Injection Quantity	Engine ECU, Supply Pump (SCV)* ²

*1 TWV: Two Way Valve *2 SCV: Suction Control Valve QD2341E

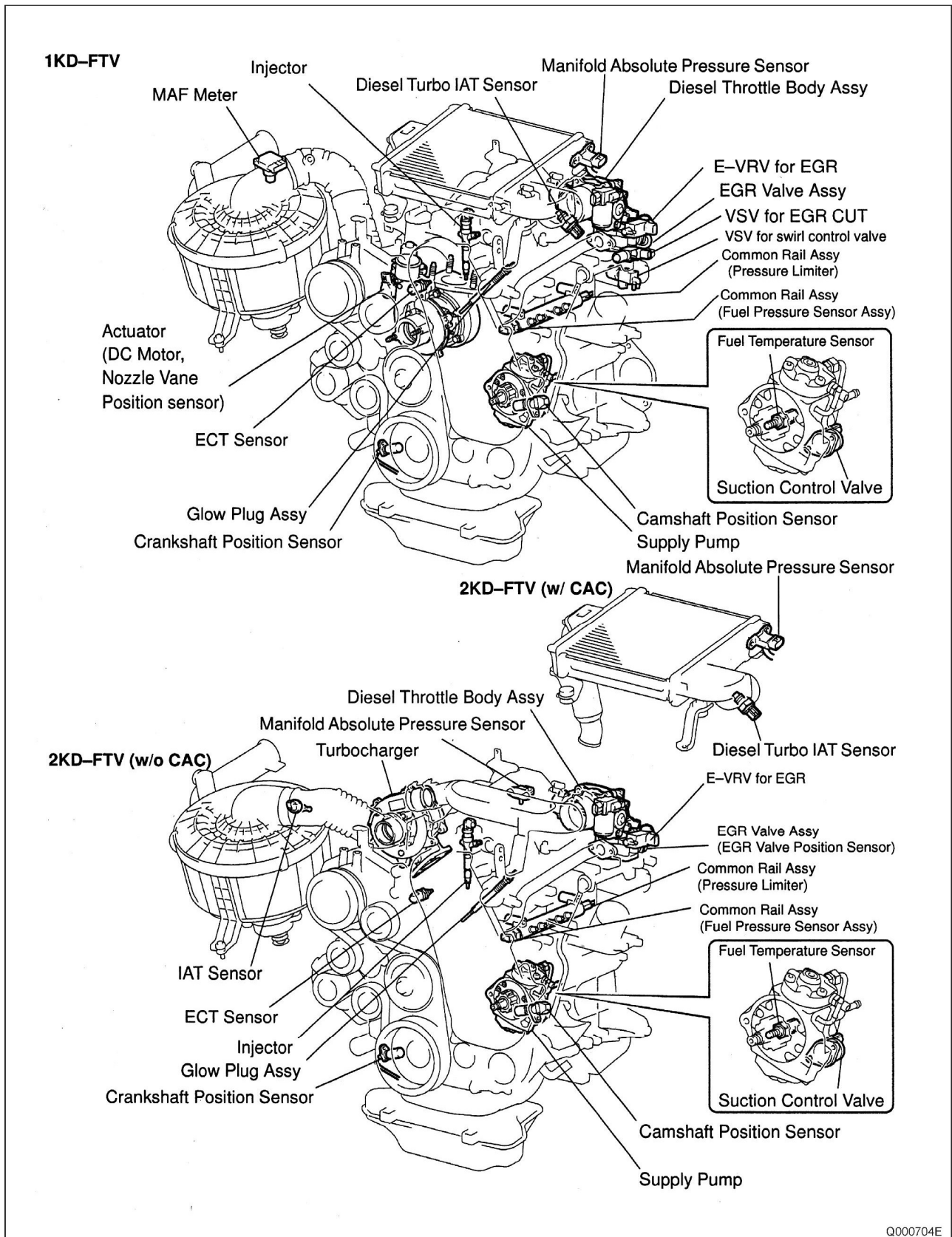
2-2. SYSTEM CONFIGURATION

A. Main System Components

a. Location (1)



b. Location (2)

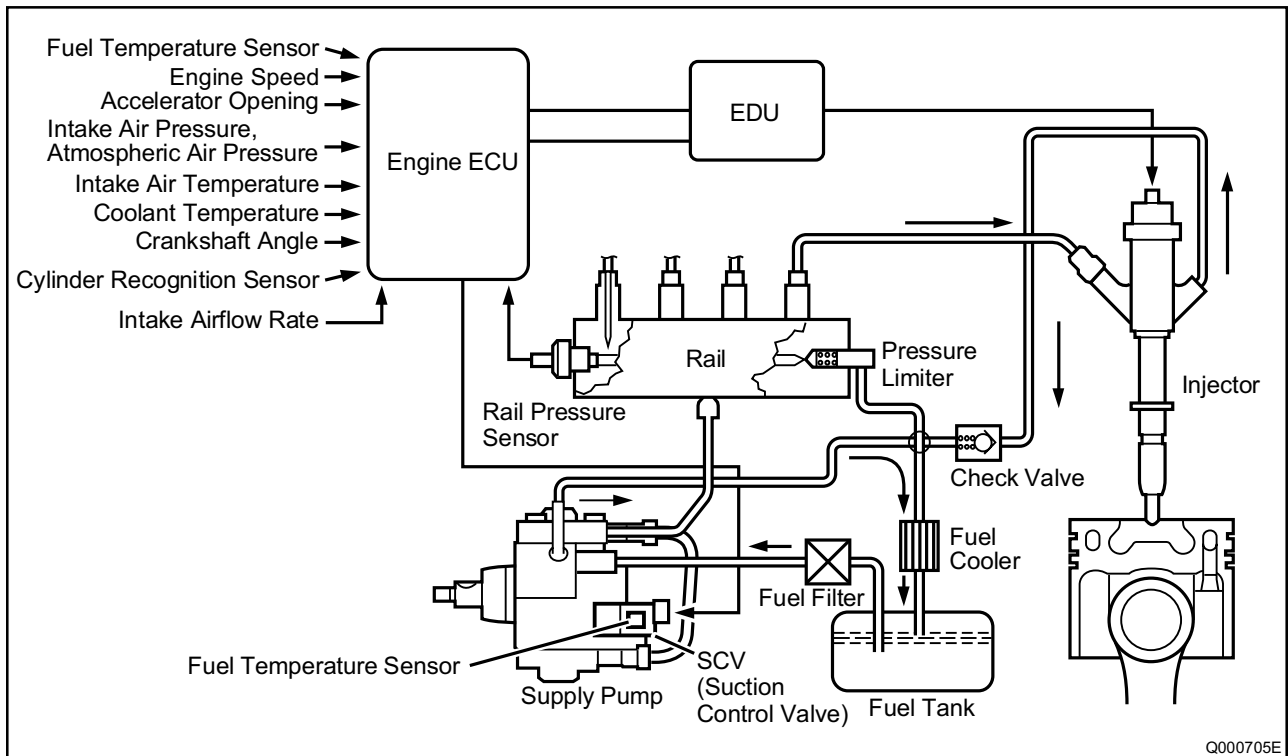


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B. Outline of Composition and Operation

a. Composition

The common rail system consists primarily of a supply pump, rail, injectors, and engine ECU.



b. Operation

(1) Supply pump (HP3)

The supply pump draws fuel from the fuel tank, and pumps the high pressure fuel to the rail. The quantity of fuel discharged from the supply pump controls the pressure in the rail. The SCV (Suction Control Valve) in the supply pump effects this control in accordance with the command received from the ECU.

(2) Rail

The rail is mounted between the supply pump and the injector, and stores the high-pressure fuel.

(3) Injector (X2 revised type)

This injector replaces the conventional injection nozzle, and achieves optimal injection by effecting control in accordance with signals from the ECU. Signals from the ECU determine the length of time and the timing in which current is applied to the injector. This in turn, determines the quantity, rate and timing of the fuel that is injected from the injector.

(4) Engine ECU

The engine ECU calculates data received from the sensors to comprehensively control the injection quantity, timing and pressure, as well as the EGR (exhaust gas recirculation).

C. Fuel System and Control System

a. Fuel System

This system comprises the route through which diesel fuel flows from the fuel tank to the supply pump, via the rail, and is injected through the injector, as well as the route through which the fuel returns to the tank via the overflow pipe.

b. Control System

In this system, the engine ECU controls the fuel injection system in accordance with the signals received from various sensors. The components of this system can be broadly divided into the following three types: (1) Sensors; (2) ECU; and (3) Actuators.

(1) Sensors

Detect the engine and driving conditions, and convert them into electrical signals.

(2) Engine ECU

Performs calculations based on the electrical signals received from the sensors, and sends them to the actuators in order to achieve optimal conditions.

(3) Actuators

Operate in accordance with electrical signals received from the ECU. Injection system control is undertaken by electronically controlling the actuators. The injection quantity and timing are determined by controlling the length of time and the timing in which the current is applied to the TWV (Two-Way Valve) in the injector. The injection pressure is determined by controlling the SCV (Suction Control Valve) in the supply pump.

