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Service Information Bulletin

SUBJECT	DATE
Operation of the Fuel System - Two-Filter Fuel System	May 2013

Additions, Revisions, or Updates

Publication Number / Title	Platform	Section Title	Change
DDC-SVC-MAN-0082	DD Platform	Operation of the Fuel System	Updated fuel pressure information.

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2 Operation of the Fuel System

The low pressure fuel pump, which is a gear pump, supplies fuel to the low pressure fuel circuit. When the engine is started, the fuel pump pulls fuel from the fuel tank and delivers it to the fuel filter module. The fuel flows from the fuel filter module to the fuel heat exchanger (if equipped), located on the Motor Control Module (MCM). The electronic components of the MCM are cooled via the fuel heat exchanger (if equipped). The fuel in the fuel filter module first passes into the fuel prefilter where debris particles greater than 100 microns are filtered out. A check ball, which is located at the fuel inlet of the fuel prefilter housing, prevents emptying of the suction line to the fuel tank.

The fuel, which has been cleaned by the fuel prefilter, passes out of the fuel filter module to the low pressure fuel pump. From there, the fuel is delivered back into the fuel filter module and to the coalescer/final filter. The water in the fuel is separated by the coalescer (water separator) and begins to fall into the water accumulator. If the water level in the water accumulator reaches its maximum level, this will be detected by the water-in-fuel sensor. The MCM transmits an appropriate message for illuminating the indicator lamp. At this point, the indicator lamp will inform the driver that the separated water needs to be drained off. The coalescer/final filter also filters out fine-grained contaminants greater than 3 to 5 microns.

A supply fuel temperature sensor, located on the high pressure fuel flange, detects the current fuel temperature. The MCM interprets this information and uses it for fuel mass calculations.

Designed into the coalescer/final filter element is a ventilation bore that allows trapped air to escape. For example, if air is trapped in the coalescer/final filter element due to replacement of a filter element, the trapped air will escape through the ventilation bore and vent lines into the fuel accumulator. From there, the air is then dissipated into the fuel tank. Once all of the contaminants have been filtered out, the fuel is delivered out of the fuel filter module to the quantity control valve. The high pressure fuel pump pressurizes the fuel up to 900 bar (13,053 psi) for KM59 GEN1 systems, and 1150 bar (18,854 psi) for KM63 GEN2 systems, and feeds it to the fuel rail. The excess fuel from the quantity control valve and high pressure fuel pump is routed past the two-stage valve. The excess fuel is then routed to the fuel accumulator.

The two-stage valve has a number of tasks:

- It closes at pressures in the low pressure circuit below 3 bar relative to high pressure pump backflow pressure to ensure best filling under cranking speed where low pressure pump flow is low.
- It guarantees lubrication of the high pressure fuel pump components if the pressure in the low pressure circuit is above 3 bar relative to high pressure pump backflow pressure. The lubrication path is fully open at 3.5 bar.
- It ensures that in overrun conditions the pressure at the inlet to the high pressure pump is limited by opening of the backflow path. This function avoids pressures above burst pressure level of the filter module. If the pressure at the high pressure pump inlet exceeds 4.7 bar relative to backpressure, excess fuel is routed to the return path.

If the maximum rail pressure is exceeded, the pressure limiting valve opens and passes the excess fuel to the fuel return. The KM59 GEN1 system opens at 1280 bar. The KM63 GEN2 system opens at 1500 bar. If the system pressure drops below 3 bar (43 psi) due to the opened pressure limiting valve, part of the excess fuel is taken from the fuel return from the pressure limiting valve to be used for lubrication of the high pressure fuel pump. The head pressure required to do this is generated by the throttle valve, which is located upstream of the fuel accumulator. The excess and warmed fuel from the amplifier circuits of each individual fuel injector is routed through a passage within the cylinder head. This fuel is fed via the amplifier fuel return line through the fuel cooler, throttle, and finally a regulator. This fuel is fed to the fuel filter module in front of the prefilter. The fuel cooler serves to lower the temperature of the fuel to about 120°C. The throttle valve in the amplifier fuel return line dampens pressure peaks which occur during activation of the fuel injector amplifiers.

The excess fuel for the fuel injector needle valves is also routed through a bore in the cylinder head. The fuel return from the fuel injector needle valves flows through a regulator and into the fuel accumulator. The regulator has the task of regulating back pressure of about 1 bar (14.5 psi) relative to back pressure while the engine is running. The fuel accumulator is part of the returned fuel, and delivers fuel directly upstream of the fuel prefilter in the fuel low pressure circuit.

The fuel quantity is determined by the throttle valve and the regulator in the fuel return bypass. This returned fuel leads to a lower suction load for the low pressure fuel pump. The remaining fuel from the fuel accumulator is led back to the fuel tank. The assembly valve in the fuel return prevents fuel leaking out when disassembling the fuel line between the fuel tank and the fuel filter module.