

Diagnosing CRD faults with a pressure tester



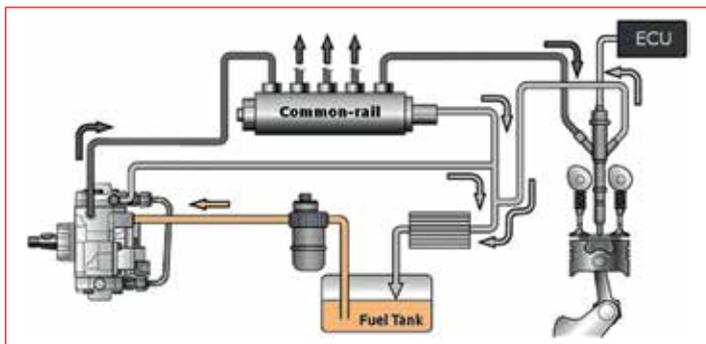
One result of the increasing market share of diesel vehicles is that we are seeing more and more pressure-related fault codes. With the high replacement cost of common-rail diesel (CRD) components it is important to make an efficient, accurate diagnosis.

As always the first step in any diagnosis is to record and clear, and operate vehicle until fault codes reset. Symptoms and fault recordings indicating a malfunction in the fuel system require tests of the low-pressure and high-pressure circuit prior to component replacements. These tests prove helpful in the majority of cases, even when an ECU shows no fault entries at all despite poor engine performance.

Determining which part of the system to test first – the high or the low-pressure circuit – depends on the nature of the problem and on accessibility to the fuel system.

Reading the pressures with a digital pressure tester while viewing live engine data with a scan tool is an invaluable process as this enables you to quickly rule in or out hydraulic/electrical system faults.

Low-Pressure Circuit (Pre Delivery)



The low-pressure side of a CRD fuel system

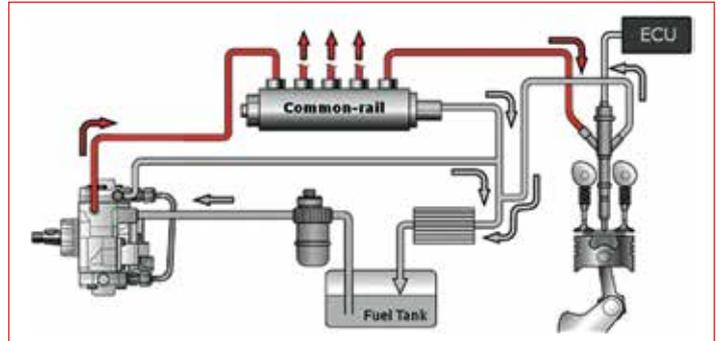
The low-pressure circuit (pre delivery) supplies filtered fuel to the injector pump. The lift pump (transfer pump) is typically located in the fuel tank (submerged electric pump) on the back of the injector pump (gear pump) or both in tank and on injector pump.

Testing the low-pressure side is imperative as any faults there will cascade to the high-pressure side. Testing the fuel pressure after the fuel filter before the injector pump will rule in or out faults. It is also a wise idea (time permitting) to test the pressure before and after the fuel filter to rule out flow blockages.

- Electric fuel pumps have to supply pressure ranging from 2.0 to 2.5 bar (29-36 psi) during the start-up.
- Systems using gear pumps (CP1 H and CP3) should deliver pressure between -0.10 and -0.20 bar (1.4-2.9 psi) in forward delivery.

- Irregularities in the low-pressure circuit directly affect the generation of high pressure.
- Measuring from each side of the fuel filter, a difference greater than 0.3 bar (4.3 psi) indicates the fuel filter needs to be replaced.

High-Pressure Circuit (Forward Delivery)



The high-pressure side of a CRD fuel system.

The high-pressure circuit (forward delivery) supplies pressurised fuel to the injector rail, typically with a maximum pressure of 1600 to 2000 bar (23,520-28,400 psi) and at idle 300 to 400 bar (4410-5880 psi).

The minimum amount of fuel pressure required for a CRD engine to start is on average between 200-300 bar.

Testing the high-pressure pump during start-up is especially useful when dealing with start problems. In this case, a test line is used to connect the pressure sensor module directly to the outlet of the high-pressure pump and then the engine is started.

An intact high-pressure pump by Bosch should have a pressure greater than or equal to 250 bar. The pressure-sensor module has an overflow valve limiting pressure to 500 bar. Testing common-rail pressure simply involves removing the high-pressure delivery line of an easily accessible injector and connecting the pressure sensor directly to the common rail via a test line.

After starting the engine, compare the displayed pressure readout with the corresponding actual value from the ECU diagnosis and thereby test the high-pressure sensor. If the actual value and the measured common-rail pressure differ from each other, then the common-rail pressure sensor needs to be replaced.

Bosch CRD max rail pressure

- Generation 1: up to 1350 bar (19,845 psi)
- Generation 2: up to 1600 bar (23,520 psi)
- Generation 3: up to 2000 bar (29,400 psi)

Denso CRD max rail pressure

- 1st generation: up to 1450 bar (21,315 psi)
- 2nd generation: up to 1800 bar (26,460 psi)

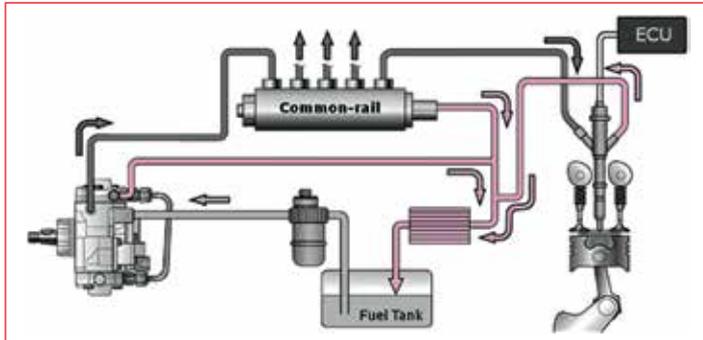
Delphi CRD max rail pressure

- Multec: up to 2000 bar (29,400 psi)
- Direct Acting CRD: up to 2000 bar (29,400 psi)

- Test the pressure between the injector pump and or at the fuel rail.
- Due to the extremely high pressure in a CRD system it is advised never to release the high-pressure side when the vehicle is running.

* While highly un-professional, technicians have been known to release injector lines to diagnose individual cylinder faults as the max system pressure can only be achieved in a closed system. When a high-pressure line is opened the rail pressure drops dramatically as the volume supplied by the high-pressure pump is not enough to overcome the volume of fuel lost via the disconnected injector/fuel line.

Low-Pressure Circuit (Fuel Return)



Common-rail fuel-supply system, return side.

In first-generation common rails the fuel-return pressure is the decisive factor in opening the safety valve in the high-pressure pump. They should deliver between 0.6 and 0.9 bar (8.7-13.0 psi). Third-generation common rails with Piezo injectors deliver a return pressure of 10 bar (145 psi).

* Test the pressure between the return collection pipe and fuel tank.

Performing a leak-fuel quantity comparison test is carried out by disconnecting the return line to the fuel injectors and installing piping (Piezo injectors require an additional special

CRD Leak-Fuel Quantity



Using small bottles and 8mm plastic tube to measure CRD leakback from injectors to return system.

adaption with pressure-holding valves that maintain a pressure of 10 bar in the return lines). The quantity-measuring device is directly hooked up to the return connection of the injectors.

When removing the return line on the injector be careful not to damage the connection. Disconnecting the line to the fuel injector also requires proper means of doing so without damaging it.

Once the return-quantity measuring device is hooked up the engine is started and the return quantity is measured on all cylinders. Here it is important that the quantities of the individual cylinders increase at the same rate. Any difference higher than that requires the injectors with the largest return quantities to be either repaired or replaced.

Approximately 20mL per injector over a two-minute period would be considered within tolerance.

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