Fuel System Diagnosis - High Pressure Side

Diagnostic Instructions

- Perform the Diagnostic System Check - Vehicle prior to using this diagnostic procedure.
- Review Strategy Based Diagnosis for an overview of the diagnostic approach.
- Diagnostic Procedure Instructions provides an overview of each diagnostic category.

Circuit/System Description

The G18 High Pressure Fuel Pump is located at the front of the engine valley and is engine driven by the camshaft gear. Fuel is drawn by the fuel supply pump from the primary fuel tank and delivered through the diesel fuel conditioning module to the high pressure pump. The Engine Control Module (ECM) controls the fuel rail pressure using two pulse width modulated fuel rail pressure regulators. Q18A Fuel Pressure Regulator 1 is located on the fuel injection pump and meters the amount of fuel that enters the high pressure side of the pump. From the high pressure pump, the fuel moves to the two fuel rails through a high pressure metal line. The fuel rails distribute high pressure fuel to all 8 fuel injectors. The ECM varies the pulse width modulated voltage to the Q18B Fuel Pressure Regulator 2 to relieve excessive fuel pressure which returns to the fuel tank. When the ignition is OFF, Q18B Fuel Pressure Regulator 2 opens to bleed off the pressure in the fuel rail.

The ECM commands Q18B Fuel Pressure Regulator 2 to control fuel pressure at idle and commands Q18A Fuel Pressure Regulator 1 to control fuel pressure when engine speeds are above 1700 RPM. Under certain conditions both regulators are used to control fuel pressure. The actual and desired fuel pressures should be within 690 kPa (100 psi) during all engine operating modes.

Diagnostic Aids

- Running The vehicle out of fuel may cause erratic fuel pressure and driveability concerns.
- An inoperative fuel transfer pump or insufficient flow at the fuel transfer pump may cause erratic fuel pressure and driveability concerns. (w/dual fuel tanks)
- A low fuel condition may cause driveability concerns.
- Water or contaminated fuel may cause driveability concerns. Refer to Contaminants-in-Fuel Diagnosis.
- When ambient temperatures are below 0°C (32°F), the fuel tank pickup screen may be iced over from water in the fuel tank.
- High fuel injector return flow may cause fuel pressure control concerns.
- The addition of fuel system enhancements, such as auxiliary fuel tanks or add on fuel filters may relate to driveability complaints.
- Voltage below B+ being supplied to fuel pressure regulator 2 high control circuit may cause a no start condition and low fuel rail pressure.

Reference Information

Schematic Reference

Engine Controls Schematics

Connector End View Reference

Component Connector End Views

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Component View Reference

Powertrain Component Views

Description and Operation

Fuel System Description

Electrical Information Reference

- Circuit Testing
- Connector Repairs
- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs

Scan Tool Reference

Control Module References for scan tool information.

Special Tools

- CH-48027 Digital Pressure Gauge
- CH-50375 Fuel Injector Return Line Adaptor
- CH-50377-A Fuel Injector Return Line Plug

Circuit/System Testing

Note:

- If you were not referred to this test from another diagnostic, do not perform this procedure.
- Only perform this test when the fuel temperature is warmer than 18°C (65°F).

1. Ignition OFF.
2. Verify there are no external leaks or damage to the fuel return and supply lines.
   ⇒ If external leaks or damage is found
   Refer to Fuel Leak Diagnosis.
   ⇓ If no external leaks or damage is found
3. Install the CH-48027 Digital Pressure Gauge to the fuel system service port near the front of the engine.
4. Engine cranking or idling.
5. Verify that the CH-48027 Digital Pressure Gauge displays between 1 and 6 in Hg vacuum.
   ⇒ If not between 1 and 6 in Hg vacuum
   Inspect for a restricted fuel filter, kinked, or restricted fuel supply lines. Refer to Fuel System Diagnosis for further diagnosis.
   ⇓ If between 1 and 6 in Hg vacuum
   
   Note: If the vehicle is not equipped with dual fuel tanks, skip to step 8.
6. Verify the fuel transfer pump operation. (if equipped with dual fuel tanks)
7. Command the Fuel Pump Relay ON with a scan tool. Verify that you hear or feel the K23A Fuel Pump Relay click and the G12 Fuel Pump running when you command the Fuel Pump Relay ON.
   ⇒ If the K23A Fuel Pump Relay does not click or the G12 Fuel Pump does not run
   Refer to DTC P2636.
If the K23A Fuel Pump Relay clicks and the G12 Fuel Pump runs

**Note:** Steps 8–10 must to be repeated on the opposite bank in order to test all 8 fuel injectors.

8. Ignition OFF, disconnect 4 of the glow plug harness connector nuts on one bank; remove the 4 glow plugs.

9. Hold a clean rag over the glow plug holes.

**Caution:** Do not crank the engine using the ignition switch, as the fuel injectors and the glow plug circuits will be energized and engine damage may result.

10. Using a remote start switch, crank the engine for 6 compression strokes. No fuel vapor should be emitted onto the rag. (Repeat steps 6–8 for opposite bank)

⇒ **If fuel vapor is emitted onto the rag**

Replace the appropriate Q17 Fuel Injectors.

⇒ **If fuel vapor is not emitted onto the rag**

11. Remove the fuel pressure regulator 2 return hose and plug the hose to prevent fuel leakage.

12. Install a section of rubber fuel hose on the fuel pressure regulator 2 outlet and place the loose end of hose into a clean fuel container.

13. Perform the applicable test listed below:

ENGINE NO START:

**Note:** For intermittent no start or no start with ambient temperatures below –6° C (21° F). The fuel pressure regulator 2 outlet volume test must be performed while the no start condition is present or incorrect diagnosis may occur.


13.2. Observe the volume of fuel from fuel pressure regulator 2. The volume of fuel should be less than 10 ml (0.4 oz).

⇒ If greater than 10 ml (0.4 oz), replace the Fuel Injection Fuel Rail Assembly — Bank 2 (Left Side).

⇒ If less than 10 ml (0.4 oz)

**Note:**

Perform the following two sub-steps for each injector.

Complete the following two sub-steps on all the fuel injectors before performing any repairs.

13.3. Disconnect the electrical connector and the fuel return line from one of the fuel injectors. Install the *CH-50377-A* Fuel Injector Return Line Plug to the return line to prevent leakage.

13.4. Engine Cranking for 15 seconds, verify no fuel leaks from the fuel injector.

⇒ If fuel leaks from the fuel injector, replace the fuel injector.

⇒ If no fuel leaks from the fuel injector

13.5. Disconnect the harness connector at the fuel pressure regulator 2.

13.6. Crank the engine for 15 second.

13.7. Verify a steady flow of fuel comes out of the fuel pressure regulator 2 outlet.

⇒ If there is not a steady flow of fuel, replace the G18 High Pressure Fuel Pump.

⇒ If there is a steady flow of fuel.

13.8. Install the fuel pressure regulator 2 return line.

13.9. Install the *CH-50375* Fuel Injector Return Line Adaptor with a gauge to a fuel injector return line.


13.11. Verify the injector return line pressure is greater than 3 bar (43 psi).
⇒ If less than 3 bar (43 psi), refer to Fuel Return System Diagnosis for further diagnosis.
↓ If greater than 3 bar (43 psi)

13.12. Test the fuel injector return flow, refer to Fuel Injector Diagnosis.
⇒ If a faulty fuel injector is found, replace the appropriate fuel injector.
↓ If the fuel injectors test normal


ENGINE STARTS:

Note: Measure only the amount of fuel that leaks after the engine has reached 1800 RPM.


13.2. Increase engine speed to 1800 RPM for 15 seconds.

13.3. Observe the volume of fuel from fuel pressure regulator 2. The volume of fuel should be less than 10 ml (0.4 oz).
⇒ If greater than 10 ml (0.4 oz), replace the Fuel Injection Fuel Rail Assembly — Bank 2 (Left Side).
↓ If less than 10 ml (0.4 oz)

13.4. Install the fuel pressure regulator 2 return line.

Note:
This procedure must be performed at idle and at 1800 RPM.
When commanding fuel rail pressure at idle the maximum achievable pressure will be approximately 120 MPa (17404 psi).

13.5. Command the fuel pressure incrementally through the entire fuel pressure range with a scan tool. The Fuel Rail Pressure Sensor and the Desired Fuel Rail Pressure parameters should be within 690 kPa (100 psi) for the entire fuel pressure range.
⇒ If the fuel rail pressure parameters at idle is within 690 kPa (100 psi) and is not within 690 kPa (100 psi) at 1800 RPM, replace the Q18A Fuel Pressure Regulator 1.
⇒ If the fuel rail pressure parameters at idle is not within 690 kPa (100 psi) but is within 690 kPa (100 psi) at 1800 RPM, replace the Q18B Fuel Pressure Regulator 2.
⇒ If the fuel rail pressure parameters is not within 690 kPa (100 psi) at idle and at 1800 RPM, replace the G18 High Pressure Fuel Pump.
↓ If the fuel rail pressure parameters is within 690 kPa (100 psi) for the entire fuel pressure range

13.6. Install the CH-50375 Fuel Injector Return Line Adaptor with a gauge to a fuel injector return line.

13.7. Engine idling.

13.8. Verify the injector return line pressure is greater than 3 bar (43 psi).
⇒ If less than 3 bar (43 psi), refer to Fuel Return System Diagnosis for further diagnosis.
↓ If greater than 3 bar (43 psi)

13.9. Test the fuel injector return flow, refer to Fuel Injector Diagnosis.
⇒ If a faulty fuel injector is found, replace the appropriate fuel injector.
↓ If the fuel injectors test normal

13.10. Replace the G18 High Pressure Fuel Pump.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the repair.

• Fuel Injection Fuel Rail Assembly Replacement - Bank 2.
• **Fuel Injection Pump Replacement** for the High Pressure Fuel Pump.
• **Fuel Injector Replacement**.
• **Fuel Pressure Regulator Replacement** for Fuel Pressure Regulator 1.
• **Fuel Pressure Relief Valve Replacement** for Fuel Pressure Regulator 2.