FUEL SYSTEM DIAGNOSIS

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1. OVERVIEW

When the Diagnostic Trouble Code (DTC) is detected through scan tool, it’s necessary to check the transfer and high pressure fuel lines in fuel system before replacing the components.

If the trouble continues even after the trouble has been fixed with scan tool, must perform the fuel pressure test.

Below schematic diagram shows the specifications of pressure, flow mass and temperature in fuel system.
2. FUEL PRESSURE SYSTEM

Pressure/Volume Consumption in System

Conservation of fuel pressure/volume (rail) for proper system operation

Pressure/Volume Displacement from Pump

Pump capacity for supplying the required target pressure/volume

Injector back leak volume

Fuel injection volume

Conservation of fuel pressure/volume (rail) for proper system operation
Example of Too Much Injector Back leak

Too Much Injector Back leak
When the injector cannot be sealed due to entering the foreign materials

Example:
1. Foreign materials in fuel
2. Burnt out or worn high pressure pump
3. Mechanical damage in inside of injector
Example of Pressure/Volume Loss in Pump

Pressure/Volume Loss in High Pressure Pump
When the required target pressure/volume cannot be delivered due to fuel supply line or pump damage

Example:
1. Air in fuel supply line
2. Excessive vacuum pressure in fuel supply line (-300 mbar)
3. Burnt out or mechanically damaged pump
4. Supply fuel with increased temperature ( > 65°C)
3. FUEL SYSTEM PRESSURE TEST

- Test Tool Kit

For High Pressure Line

For Transfer Line
Prerequisite
1. Check the connections in fuel supply lines.
2. Check the fuel level in fuel tank.
3. Check if the air exists in fuel supply lines (air bubbles in fuel supply lines or fuel with air bubbles).
4. Check the fuel supply lines for leaks (transfer and high pressure).
5. Check if the specified fuel is used.
6. Check the fuel filter for contamination and abnormality.

Fuel System Test Process

FLOWCHART

Determine DTC

DTC Detected?

Yes

Fuel system related DTC: P1252, P1253, P1254...P0251

No

High pressure fuel related problem

Check and repair transfer and H/P fuel system

Check fuel filter and H/P fuel system

Diagnose and repair according to the detected DTC

NOTICE

- If more than one DTC have been detected, check the wiring harness for open or short first.
- Check the transfer fuel system and fuel filter before proceeding the high pressure fuel system check in next page.
4. FUEL SYSTEM CHECK PROCESS

**Initial Check**
- Transfer fuel system (air in system), specified fuel used
- Fuel leaks, fuel filter
- Diagnostic Trouble Code
- Wiring harness
- Abnormal noise from injector

**No Abnormality in Initial Check?**

- No: Check and repair
- Yes: Proceed to subsequent checks

**Check fuel rail pressure (refer to 4-1)**
When cranking engine for 5 seconds after disconnecting IMV connector, is the rail pressure over 1,050 bar?

- Yes: Proceed to subsequent checks
- No: **Check transfer fuel system (refer to 4-2)**
  Install the transparent tube between fuel filter and priming pump. Check the transfer fuel system for clogged or air bubbles. Check if the vacuum pressure is proper.

- *Thoroughly clean the components before installation*

**Check the injector back leak volume**

**Method 1**
**Static Test for Injector Back leak Volume (refer to 4-3)**
(with engine cranking but not running)
- Place an empty plastic container under the return of injector:
  - Remove IMV and injector connectors, crank for 5 seconds, and check the injector back leak volume. The fuel length in tube should be over 20 cm.

**Method 2**
**Dynamic Test for Injector Back leak Volume (refer to 4-4)**
(with engine running)
1. Warm up engine (coolant temp.: over 60°C), place an empty plastic container under the return of injector, and start engine.
2. Run the engine for 30 seconds at idle speed, perform: fuel system pressure leakage test” with Scan-i, and check the fuel level in container. It should be over 38 ml.

**High Pressure Pump Test (refer to 4-5)**
Install the closed rail into high pressure pump at outlet port. Remove IMV connector and crank engine for 5 seconds. Is the pressure over 1,050 bar?

- Yes: Proceed to subsequent checks
- No: **Replace the injector**
  Enter new injector C2I data into ECU after replacing the injector

**Perform the initial check again.**

**Replace high pressure pump**
4-1. High Pressure System Pressure Test

**Fuel Rail Pressure Test**

1. Disconnect the fuel rail pressure sensor connector and IMV connector.

2. Install the pressure tester in tool kit to the fuel rail pressure sensor connector.

3. Crank the engine for 5 seconds (twice).
   1) Read the maximum pressure displayed on the tester.
   2) If the maximum pressure is below 1,050 bar, refer to “Fuel System Check Process” section.
How To Use Pressure Tester

1. Check if the “TEST?” is displayed on the display when pressing the “TEST” button.

2. The maximum pressure will be displayed when pressing the button while cranking the engine (around 4 seconds elapsed from 5 seconds).

NOTE
- The fuel rail pressure can be measured through the scan tool.
4-2. Transfer Fuel System Test

Test Procedures

1. All wiring harnesses, connectors and fuel lines should be installed properly and the engine should be ready to start.

2. Prepare the special tools for transfer fuel system test and thoroughly clean the system.

3. Disconnect the key connector for connecting the priming pump to fuel filter and install both connectors of the special tool to the fuel pump and the priming pump hoses.

4. Start the engine and visually check the transfer line for clogged and air bubbles while running the engine at idle speed.

5. If the fuel flows are not smooth or air bubbles are found in fuel lines, locate the leaking area and correct it.
4-3. Static Test for Injector Back leak Volume

1. Remove the injector return hose and seal the openings with screw type caps (included in tool kit).

2. Install the hoses from back leak test containers to return nipples of injector.

3. Disconnect the IMV connector in H/P pump and the fuel pressure sensor connector.
4. Crank the engine twice with 5 seconds of interval.
5. Check if the back leak volume meets the specification.

<table>
<thead>
<tr>
<th>Specified value</th>
<th>Below 20 cm</th>
</tr>
</thead>
</table>

NOTE
- If the measured value is out of specified value, replace the injector.
4-4. Dynamic Test for Injector Back leak Volume

1. Start the engine and warm up until the coolant temperature reaches to 60°C.
2. Remove the injector return hose and seal the openings with screw type caps (included in tool kit).

3. Install the hoses from back leak test containers to return nipples of injector.
4. Start the engine and let it run for 30 seconds at idle speed.
5. Launon injector leak detection cycles with SCAN-100.

6. Check if the back leak volume meets the specification.

| Specified value | Below 38 ml |
4-5 High Pressure Pump Test

1. Prepare the special tools for high pressure pump test and thoroughly clean the system.

2. Remove the high pressure fuel supply pipe and install the closed rail delivered with tool kit.

<table>
<thead>
<tr>
<th>Specified value</th>
<th>40 Nm</th>
</tr>
</thead>
</table>

The figure is to show the test method. However, the actual test operation should be done while the high pressure pump is installed in vehicle.

3. Install the opposite end of the closed rail into the fuel rail for test.

<table>
<thead>
<tr>
<th>Specified value</th>
<th>40 Nm</th>
</tr>
</thead>
</table>

4. Remove the high pressure fuel return hose and install the transparent tube between the high pressure pump and the return port of fuel rail for test.
5. Connect the digital tester connector into the sensor connector of fuel rail for test.
6. Disconnect the IMV connector and the fuel rail pressure sensor connector.
7. Check if the measured value on the digital tester meets the specified value.

| Specified value | Over 1,050 bar |
PRESSURE LEAKAGE TEST WITH SCAN-100

1. When performing the static test for injector back leak Volume, the fuel pressure leakage test with SCAN-100 should be done simultaneously. And, the fuel pressure leakage test with SCAN-100 can be done separately.

2. Test Conditions:
   1) No defective or faulty sensors and components in fuel system: checked by Scan-100
   2) Coolant temperature: over 60°C

3. The diagnosis procedures with SCAN-100 are as below:

   1) Install the SCAN-100 to the diagnostic connector. Select “DIAGNOSTICS” and press “ENTER” in “MAIN MENU” screen. Select “STAVIC” and press “ENTER” in “VEHICLE SELECTION” screen.

   2) Select “ECU” and press “ENTER” in “CONTROL UNIT SELECTION” screen.

   3) Select “LEAK DETECTION” and press “ENTER” in “FUNCTION SELECTION” screen.
4) If there are not any troubled conditions in “TEST CONDITION” screen, press “ENTER”.