DI6WR–03

DTC	P0171	System too Lean (Fuel Trim)

DTC	P0172	System too Lean (Fuel Trim)

CIRCUIT DESCRIPTION

Fuel trim is related to the feedback compensation value, not to the basic injection time. Fuel trim includes short–term fuel trim and long–term fuel trim.

Short–term fuel trim is the short–term fuel compensation used to maintain the air–fuel ratio at its ideal theoretical value. The signal from the A/F sensor is approximately proportional to the existing air–fuel ratio, and engine ECU comparing it with the ideal theoretical value, the engine ECU reduces the fuel volume immediately if the air–fuel ratio is rich but increases fuel volume if it is lean.

Long–term fuel trim compensates for the deviation from the central value of the short–term fuel trim stored up by each engine tolerance, and also the deviation from the central value due to the passage of time and changes of environment, as well.

If both the short–term fuel trim and long–term fuel trim exceed a certain value, it is detected as a malfunction and the check engine warning light (CHK ENG) lights up.

DTC No.	DTC Detection Condition	Trouble Area
P0171	When air fuel ratio feedback is stable after warming up engine, fuel trim is considerably in error on RICH side (2 trip detection logic)	• Air induction system • Injector blockage • Air flow meter • Engine water temperature sensor • Fuel pressure • Gas leakage on exhaust system • Open or short in A/F sensor (bank 1 sensor 1) circuit • A/F sensor (bank 1 sensor 1) • Engine ECU
P0172	When air fuel ratio feedback is stable after warming up engine, fuel trim is considerably in error on LEAN side (2 trip detection logic)	• Injector leak, blockage • Air flow meter • Engine water temperature sensor • Ignition system • Fuel pressure • Gas leakage on exhaust system • Open or short in A/F sensor (bank 1 sensor 1) circuit • A/F sensor (bank 1 sensor 1) • Engine ECU

HINT:

- When the DTC P0171 is recorded, the actual air–fuel ratio is on the LEAN side. When DTC P0172 is recorded, the actual air–fuel ratio is on the RICH side.
- If the vehicle runs out of fuel, the air–fuel ratio is lean and DTC P0171 is recorded. Check the engine warning light (CHK ENG) then comes on.
- If the total of the short–term fuel trim value and long–term fuel trim value is within ±35 % (80°C (176°F) or more), the system is functions normally.
- The A/F sensor (bank 1 sensor 1) output voltage and the short–term fuel trim value can be read using the hand–held tester.
- The engine ECU controls the voltage of the AFL– and AFL+ terminals of the engine ECU to the fixed voltage. Therefore, it is impossible to confirm the A/F sensor output voltage without the hand–held tester.

WIRING DIAGRAM

Refer to DTC P0125 on page DI–52.

INSPECTION PROCEDURE

HINT:

Read freeze frame data using the hand–held tester. Because freeze frame data records the engine conditions when a malfunction is detected. When troubleshooting, it is useful for determining whether the vehicle was running or stopped, the engine was warmed up or not, the air–fuel ratio was lean or rich, etc. at the time of the malfunction.

1	**Check air induction system.**

NG → **Repair or replace.**

OK

2	**Check injector injection.**

NG → **Replace injector.**

OK

3	**Check air flow meter (See page DI–23) and engine water temperature sensor (See page DI–37).**

NG → **Repair or replace.**

OK

4	**Check for spark and ignition (See page IG–1).**

NG → **Repair or replace.**

OK

5	**Check fuel pressure (See page FI–1 of Pub. No. RM652E).**

NG → **Check and repair fuel pump, fuel pipe line and filter (See page FI–1 of Pub. No. RM652E).**

OK

6	**Check gas leakage on exhaust system.**

NG → **Repair or replace.**

OK

7	**Check output voltage A/F sensor (bank 1 sensor 1).**

PREPARATION:

(a) Connect the hand–held tester to the DLC3.

(b) Warm up the A/F sensor with the engine speed at 2,500 rpm for approximately 90 seconds.

CHECK:

Read the voltage value of the A/F sensor on the screen of the hand–held tester when performing all the following conditions.

HINT:

The voltage of the AFL+ terminal of the engine ECU is fixed at 3.3 V and AFL– terminal is fixed at 3.0 V. Therefore it is impossible to check the A/F sensor output voltage at the terminals (AFL+/AFL–) of the engine ECU.

OK:

Condition	A/F Sensor Voltage value
Engine idling	• Not remains at 3.30 V • Not remains at 3.8 V or more • Not remains at 2.8 V or less
Engine racing	
Driving at engine speed 1,500 rpm or more and vehicle speed 40 km/h (25mph) or more, and operating throttle valve open and close	

HINT:

- When the fuel is abundant, there is a case that the output voltage of the A/F sensor is below 2.8 V. This is considered normal.
- When the fuel is cut, there is case that the output voltage of the A/F sensor is above 3.8 V. This is considered normal.
- If the output voltage of the A/F sensor remains at 3.30 V even after performing all the above conditions, the A/F sensor circuit may be open.
- If the output voltage of the A/F sensor remains at 3.8 V or more, or 2.8 V or less even after performing all the above conditions, the A/F sensor circuit may be short.

OK	Go to step 9.

NG

8	Check for open and short in harness and connector between engine ECU and A/F sensor (bank 1 sensor 1) (See page FI–2).

NG	Repair or replace harness or connector.

OK

Replace A/F sensor.

9	Perform confirmation driving pattern (See page DI–106).

Go

10	Is there DTC P0171 or P0172 being output again?

YES	Check and replace engine ECU (See page IN–19).

NO

11	**Did vehicle run out of fuel in past?**

NO → **Check for intermittent problems (See page DI–3).**

YES

DTC P0171 or P0172 is caused by shortage of fuel.