DIB1U–01

DTC	P0171	System too Lean (Bank 1)

DTC	P0172	System too Rich (Bank 1)

CIRCUIT DESCRIPTION

The fuel trim is related to the feedback compensation value, not to the basic injection time. The fuel trim includes the short–term fuel trim and the long–term fuel trim. The 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. Comparing it with the ideal theoretical value, the ECM reduces fuel volume immediately if the air–fuel ratio is RICH and increases fuel volume if it is LEAN. The long–term fuel trim compensates for the deviation from the central value of the short–term fuel trim which is stored up by each engine tolerance, and the deviation from the central value due to the passage of time and changes of environment. If both the short–term fuel trim and the long–term fuel trim exceed a certain value, it is detected as a malfunction and the MIL 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 LEAN side (2 trip detection logic)	• Air induction system • Injector blockage • Mass air flow meter • Engine coolant temp. sensor • Fuel pressure • Gas leakage in exhaust system • Open or short in A/F sensor (bank 1 sensor 1) circuit • A/F sensor (bank 1 sensor 1) • PCV valve and hose • PCV hose connection • EFI main relay • A/F sensor heater and relay circuit
P0172	When air fuel ratio feedback is stable after warming up engine, fuel trim is considerably in error on RICH side (2 trip detection logic)	• Injector leak or blockage • Mass air flow meter • Engine coolant temp. sensor • Ignition system • Fuel pressure • Gas leakage in exhaust system • Open or short in A/F sensor (bank 1 sensor 1) circuit • A/F sensor (bank 1 sensor 1) • EFI main relay • A/F sensor heater and relay circuit

HINT:

- When 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. The MIL then comes on.
- If the total of the short–term fuel trim value and long–term fuel trim value is within ± 35 % (75˚C) or more), the system is functioning normally.
- The A/F sensor (bank 1 sensor 1) output voltage and the short–term fuel trim value can be read using the OBD II scan tool or the hand–held tester.

- The ECM controls the voltage of the AF1+ and AF1– terminals of the ECM to the fixed voltage. Therefore, it is impossible to confirm the A/F sensor output voltage without the OBD II scan tool or the hand–held tester.
- OBD II scan tool (excluding hand–held tester) displays the one fifth of the A/F sensor (bank 1 sensor 1) output voltage which is displayed on the hand–held tester.

WIRING DIAGRAM

Refer to DTC P0134 on page DI–278.

INSPECTION PROCEDURE

HINT:

Hand–held tester only:

The narrowing down the trouble area is possible by performing ACTIVE TEST of the following ”A/F CONTROL” (A/F sensor, heated oxygen sensor or another can be distinguished).

Perform ACTIVE TEST by hand–held tester (A/F CONTROL).

HINT:

”A/F CONTROL” is an ACTIVE TEST which change the injection volume to –12.5 % or +25 %.

(1) Connect the hand–held tester to the DLC3 on the vehicle.
(2) Turn the ignition switch ON.
(3) Warm up the engine with the engine speed at 2,500 rpm for approx. 90 sec.
(4) Select the item ”DIAGNOSIS/ENHANCED OBD II/ACTIVE TEST/ A/F CONTROL”.
(5) Perform ”A/F CONTROL” when idle condition (press the ← or → button).

Result:

A/F sensor reacts in synchronizing with increase and decrease of injection volume (+25 % → rich output: Less than 3.0 V, –12.5 % → lean output: More than 3.35 V)

Heated oxygen sensor reacts in synchronizing with increase and decrease of injection volume (+25 % → rich output: More than 0.55 V, –12.5 % → lean output: Less than 0.4 V)

NOTICE:

However, there is a few second delay in the A/F sensor output. And there is about 20 seconds delay in the heated oxygen sensor.

	Output voltage of A/F sensor (sensor 1)	Output voltage of heated oxygen sensor (sensor 2)	Mainly suspect trouble area
Case 1	Injection volume +25 % –12.5 % Output voltage More than 3.35 V Less than 3.0 V **OK**	Injection volume +25 % –12.5 % Output voltage More than 0.55 V Less than 0.4 V **OK**	—
Case 2	Injection volume +25 % –12.5 % Output voltage No reaction **NG**	Injection volume +25 % –12.5 % Output voltage More than 0.55 V Less than 0.4 V **OK**	A/F sensor (A/F sensor, heater, A/F sensor circuit)
Case 3	Injection volume +25 % –12.5 % Output voltage More than 3.35 V Less than 3.0 V **OK**	Injection volume +25 % –12.5 % Output voltage No reaction **NG**	Heated oxygen sensor (heated oxygen sensor, heater, heated oxygen sensor circuit)
Case 4	Injection volume +25 % –12.5 % Output voltage No reaction **NG**	Injection volume +25 % –12.5 % Output voltage No reaction **NG**	Extremely rich or lean of the actual air–fuel ratio (Injector, fuel pressure, gas leakage in exhaust system, etc)

The following procedure of A/F CONTROL enable that to check its output (show its graph indication) of A/F sensor and heated oxygen sensor.
To display the graph indication. Select and push the ”YES or NO” button 2 data ”AFS B1S1 and O2S B1S2” or ”AFS B2S1 and O2S B2S2” and press button ”4” after selecting ”ACTIVE TEST/ A/F CONTROL/USER DATA”.
HINT:

- A low A/F sensor voltage could be caused by a rich air fuel mixture. Check for conditions that would cause the engine to run rich.
- A high A/F sensor voltage could be caused by a lean air fuel mixture. Check for conditions that would cause the engine to run lean.
- Read freeze frame data using the hand–held tester or the OBD II scan tool, as 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 (See page SF–1).

NG → Repair or replace.

OK

2	Check connection of PCV valve and hose

NG → Repair or replace PCV valve and hose

OK

3	Check injector injection (See page SF–19).

NG → Replace injector.

OK

4	Check mass air flow meter (See page SF–26) and engine coolant temperature sensor (See page SF–54).

NG → Repair or replace.

OK

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

NG → Repair or replace.

OK

6	**Check fuel pressure (See page SF–5).**

NG → **Check and repair fuel pump, pressure regulator, fuel pipe line and filter (See page SF–1).**

OK

7	**Check gas leak on exhaust system.**

NG → **Repair or replace.**

OK

8	**Connect the OBDII scan tool or hand–held tester and read value for voltage output of A/F sensor.**

PREPARATION:

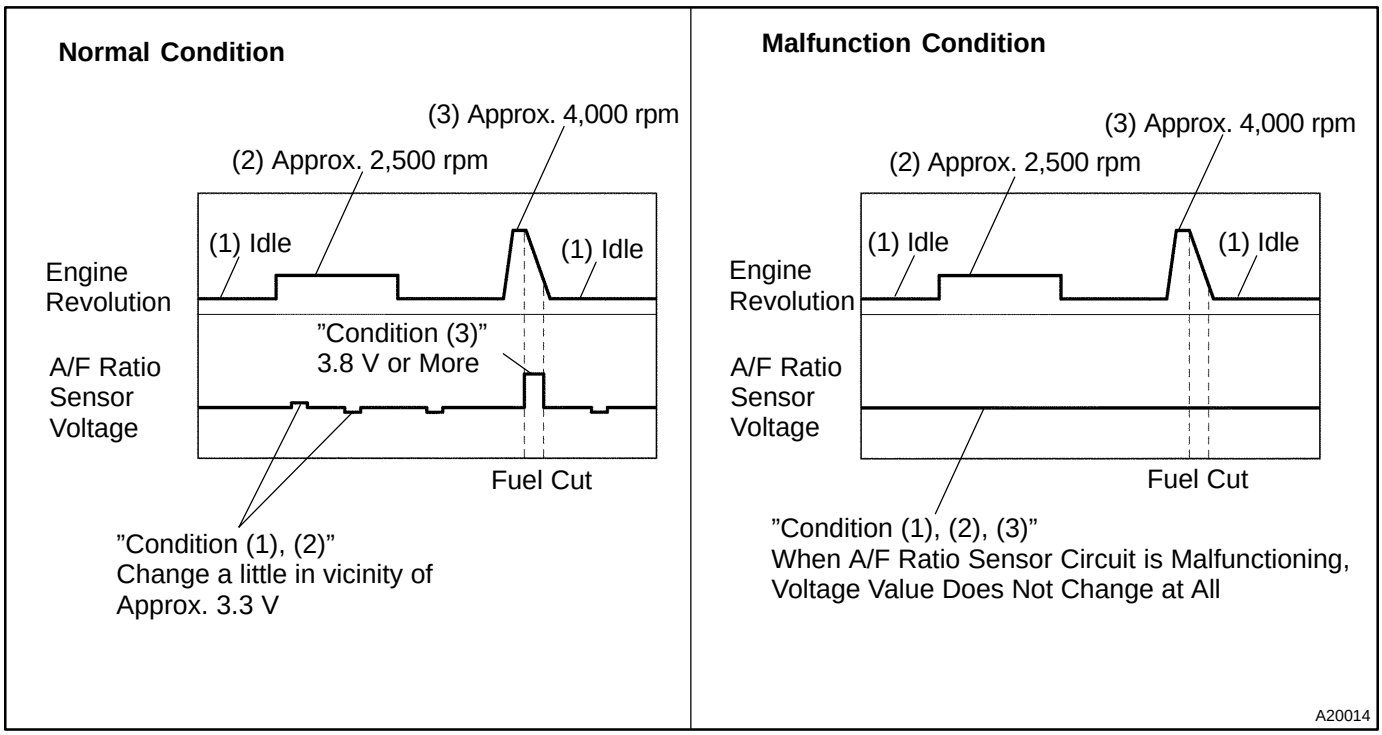
(a) Connect the hand–held tester or the OBD II scan tool to the DLC 3.
(b) Warm up the A/F sensor (bank 1 sensor 1) with the engine at 2,500 rpm for approximately 90 seconds.
(c) Read A/F sensor voltage on the OBD II scan tool or hand–held tester.

CHECK:

(a) Hand–held tester only:
Select the ”DIAGNOSIS/ENHANCED OBD II/SNAPSHOT/MANUAL SNAPSHOT/USER DATA” mode on the hand–held tester.
(b) Select ”AFS B1 S1/ENGINE SPD” and press button ”YES”.
(c) Monitor the A/F sensor voltage carefully.
(d) Check the A/F sensor voltage under the condition as follows.
(1) Allow engine to idle for 30 seconds.
(2) Engine is racing at approx. 2,500 rpm (when engine revolution is not suddenly changed).
(3) Raise the engine speed to 4,000 rpm and release the accelerator pedal fully closed quickly.

OK:

Standard:
Condition (1) and (2)
Voltage change a little in the vicinity of 3.3 V (0.66 V)* (between approx. 3.1 – 3.5 V) as shown in the illustration.
Condition (3)
A/F ratio sensor voltage increase to 3.8 V (0.76 V)* or more during engine deceleration (when fuel cut) as shown in the illustration.



HINT:

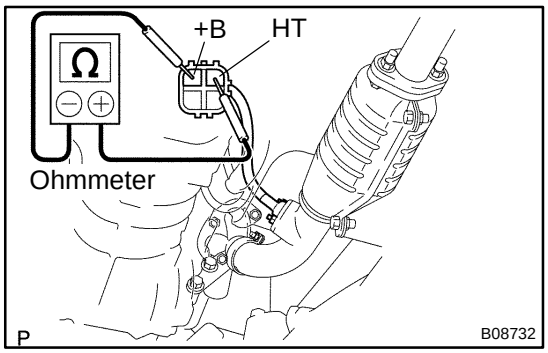
- Whenever the output voltage of the A/F sensor remains at approx. 3.3 V (0.660 V)* (see dwg. 2) under any conditions as well as the above conditions, the A/F sensor may have an open–circuit. (This will happen also when the A/F sensor heater has an open–circuit.)
- Whenever the output voltage of the A/F sensor remains at a certain value of approx. 3.8 V (0.76 V)* or more, or 2.8 V (0.56 V)* or less (see dwg. 2) under any conditions as well as the above conditions, the A/F sensor may have a short–circuit.
- The ECM will stop fuel injection (fuel cut) during engine deceleration. This will cause a lean condition and should result in a momentary increase in A/F ratio sensor voltage.
- The ECM must establish a closed throttle position learned value to perform fuel cut. If the battery terminal has been disconnected, the vehicle must be driven over 10 mph to allow the ECM to relearn the closed throttle position.
- When the vehicle is driven:
  In the case that the output voltage of the A/F sensor is below 2.8 V (0.76 V)* during fuel enrichment (for example, when the vehicle tries to overtake another vehicle on a highway, the vehicle speed is suddenly increased with the accelerator pedal fully depressed), the A/F sensor are functioning normally.
- The A/F sensor is a current output element, and therefore the current is converted into voltage inside the ECM. If measuring voltage at connectors of A/F ratio sensor or ECM, you can obtain a constant voltage.

*: When using the OBD II scan tool (excluding hand–held tester).

OK	**Go to step 16.**

NG

9	Check resistance of A/F sensor heater.



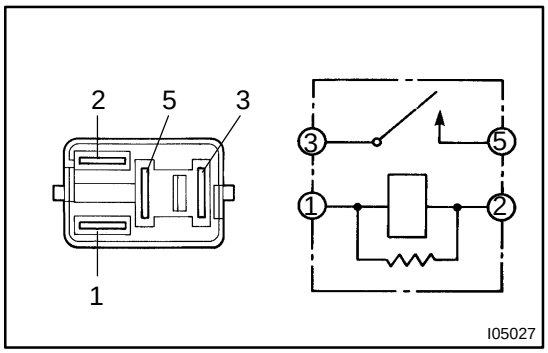
PREPARATION:
Disconnect the sensor connector.
CHECK:
Using an ohmmeter, measure the resistance between terminals +B and HT.
OK:

at 20°C (68°F)	0.8 – 1.4 Ω
at 800°C (1,472°F)	1.8 – 3.2 Ω

NG → **Replace A/F sensor.**

OK

10	Check EFI main relay (Marking : EFI).



PREPARATION:
Remove the EFI main relay from RB No. 2.
CHECK:
Inspect the EFI main relay.
OK:

Condition	Tester connection	Specified condition
Constant	1 – 2	Continuity
	3 – 5	No continuity
Apply B+ between terminals 1 and 2.	3 – 5	Continuity

NG → **Replace EFI main relay**

OK

11	Check for open and short in harness and connector between ECM and A/F sensor (bank 1 sensor 1) (See page IN–28).

NG → **Repair or replace harness or connector.**

OK

12	Replace A/F sensor.

GO

13	Perform confirmation driving pattern (See page DI–421).

GO

14	Is there DTC P0171 or P0172 being output again?

YES → Check and replace ECM (See page IN–28) and perform confirmation driving pattern (See page DI–421).

NO

15	Did vehicle run out of fuel in past?

NO → Check for intermittent problems (See page DI–218).

YES

DTC P0171 or P0172 is caused by shortage of fuel.

16	Perform confirmation driving pattern (See page DI–421).

GO

17	Is there DTC P0171 or P0172 being output again?

NO → Go to step 20.

YES

18	Replace A/F sensor.

GO

19	Are there DTC P0171 and/or P0172 being output again ?

YES → Check and replace ECM (See page IN–28) and perform confirmation driving pattern (See page DI–421).

NO

20	Did vehicle run out of fuel in past?

NO → Check for intermittent problems (See page DI–218).

YES

DTC P0171 or P0172 is caused by shortage of fuel.