DIB29–01

DTC	P0136	Oxygen Sensor Malfunction (Bank 1 Sensor 2)

CIRCUIT DESCRIPTION

To obtain a high purification rate for the CO, HC and NOx components of the exhaust gas, a three–way catalytic converter is used, but for the most efficient use of the three–way catalytic converter, the air–fuel ratio must be precisely controlled so that it is always close to the stoichiometric air–fuel ratio.

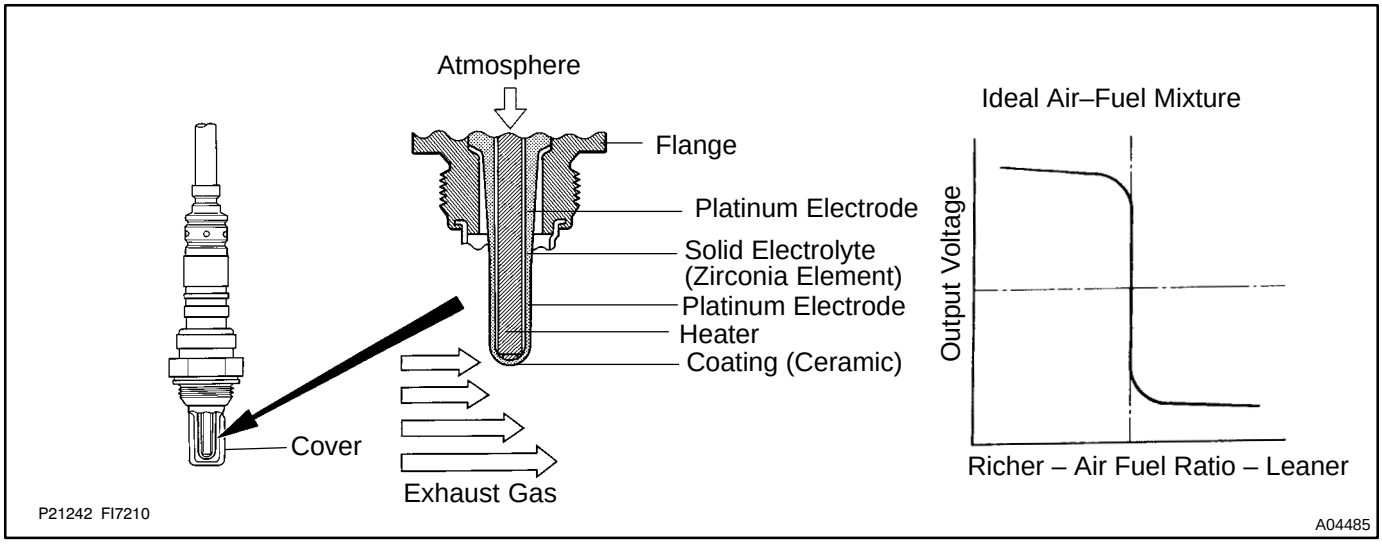
The oxygen sensor has the characteristic whereby its output voltage changes suddenly in the vicinity of the stoichiometric air–fuel ratio. This is used to detect the oxygen concentration in the exhaust gas and provide feedback to the computer for control of the air–fuel ratio.

When the air–fuel ratio becomes LEAN, the oxygen concentration in the exhaust increases and the oxygen sensor informs the ECM of the LEAN condition (small electromotive force: < 0.45 V).

When the air–fuel ratio is RICHER than the stoichiometric air–fuel ratio the oxygen concentration in the exhaust gas in reduced and the oxygen sensor informs the ECM of the RICH condition (large electromotive force: > 0.45V).

The ECM judges by the electromotive force from the oxygen sensor whether the air–fuel ratio is RICH or LEAN and controls the injection time accordingly. However, if malfunction of the oxygen sensor causes output of abnormal electromotive force, the ECM is unable to perform accurate air–fuel ratio control.

The oxygen sensors include a heater which heats the zirconia element. The heater is controlled by the ECM. When the intake air volume is low (the temp. of the exhaust gas is low) current flows to the heater to heat the sensor for accurate oxygen concentration detection.



DTC No.	DTC Detection Condition	Trouble Area
P0136	Voltage output of heated oxygen sensor remains at 0.4 V or more to 0.6 V or less when vehicle is driven at 40 km/h (25 mph) or more after engine is warmed up (2 trip detection logic)	• Open or short in heated oxygen sensor circuit • Heated oxygen sensor

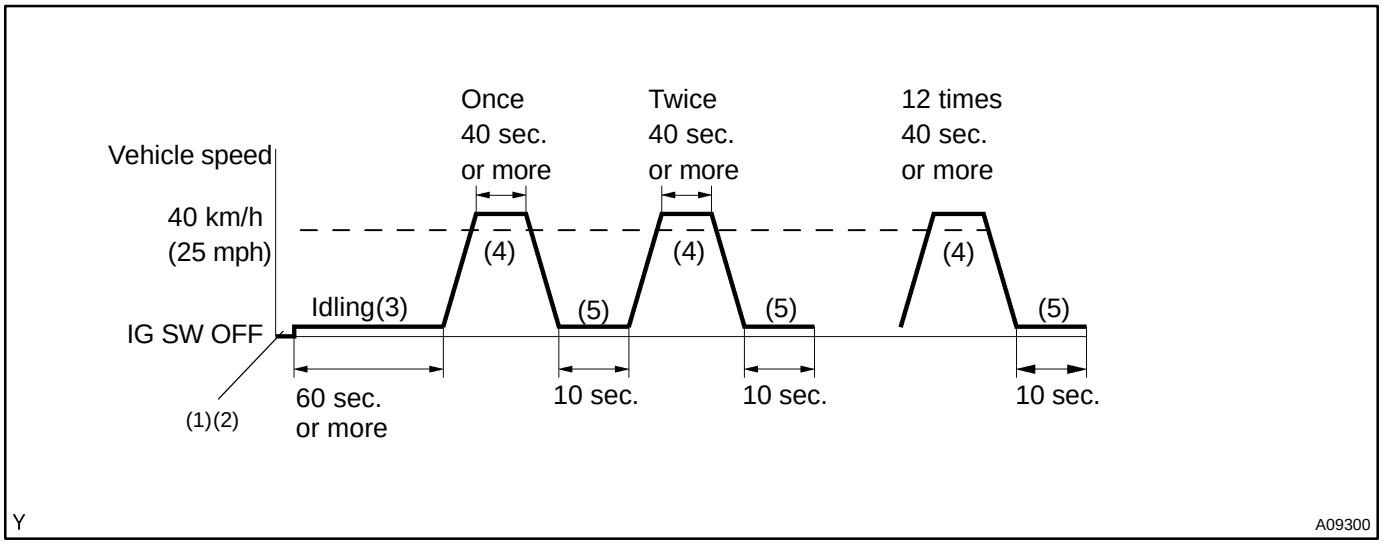
HINT:

- Sensor 1 refers to the sensor closest to the engine body.
- Sensor 2 refers to the sensor farthest from the engine body.

WIRING DIAGRAM

Refer to DTC P0134 on page DI–50.

CONFIRMATION DRIVING PATTERN



(1) Connect the hand–held tester to the DLC3.
(2) Switch the hand–held tester from the Normal Mode to the Check (Test) Mode (See page DI–3).
(3) Start the engine and let the engine idle for 60 seconds or more.
(4) Drive the vehicle at 40 km/h (25 mph) or more for 40 seconds or more.
(5) Let the engine idle for 10 seconds or more.
(6) Preform steps (4) to (5) 12 times.

HINT:
If a malfunction exists, the MIL will light up on the combination meter during step (6).
NOTICE:
If the conditions in this test are not strictly followed, detection of the malfunction will not be possible. If you do not have a hand–held tester, turn the ignition switch OFF after performing steps (3) to (6), then perform steps (3) to (6) again.

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:
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	**Are there any other codes (besides DTC P0136) being output?**

YES → **Go to relevant DTC chart (See page DI–16).**

NO

2	**Check for open and short in harness and connector between ECM and heated oxygen sensor (See page IN–28).**

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

OK

3	**Check output voltage of oxygen sensor.**

PREPARATION:

(a) Connect the hand–held tester or OBD II scan tool to the DLC3.
(b) Warm up the engine to normal operating temperature.
(c) Select the item ” DIAGNOSIS/ENHANCED OBD II/DATA LIST/ALL/O2S B1 S2 ”.

CHECK:

Read the voltage output of the heated oxygen sensor when the engine is suddenly raced.
HINT:
Perform quick racing to 3,000 rpm 6 times using the accelerator pedal.

OK:

Heated oxygen sensor output voltage: Alternates from 0.4 V or less to 0.6 V or more.

OK → **Check that each connector is properly connected.**

NG

Replace oxygen sensor.