DIC27–02

DTC	P0133	Oxygen Sensor Circuit Slow Response (Bank 1 Sensor 1)

DTC	P0153	Oxygen Sensor Circuit Slow Response (Bank 2 Sensor 1)

CIRCUIT DESCRIPTION

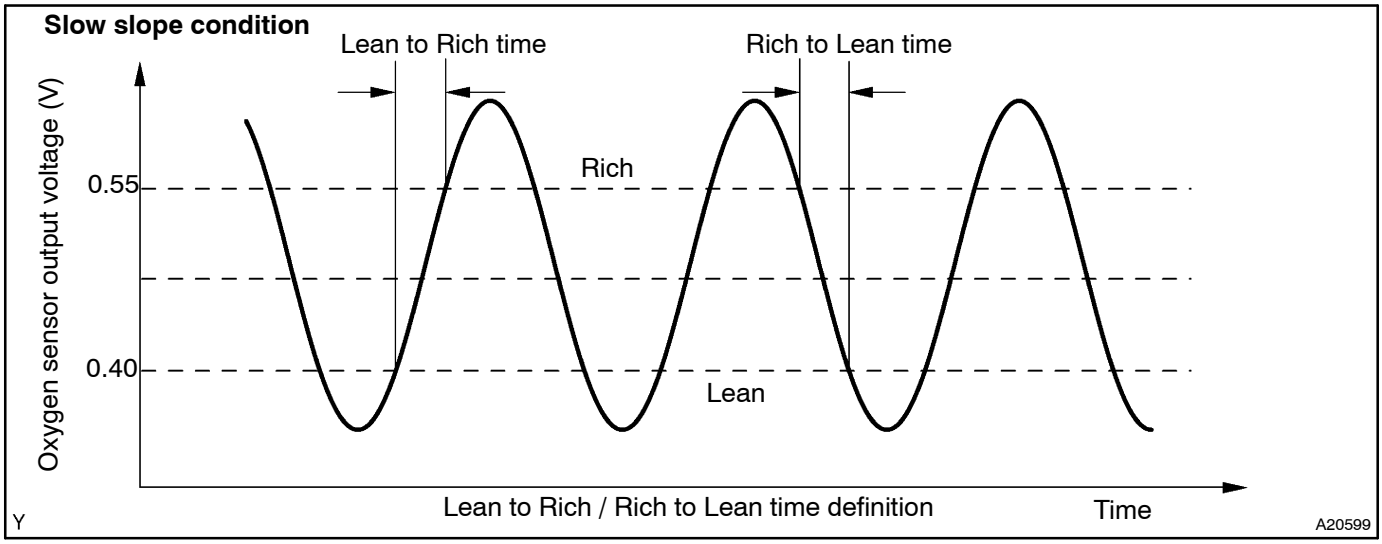
Refer to DTC P0031 on page DI–35.

DTC No.	DTC Detecting Condition	Trouble Area
P0133 P0153	Voltage of Heated Oxygen Sensor (HO2S) sensor 1 does not switch between Lean and Rich for 0.9 seconds (2 trip detection logic) Lean: 0.4 V or less Rich: 0.55 V or more	• Open or short in front heated oxygen sensor circuit • Front heated oxygen sensor • Front heated oxygen sensor heater • EFI or ECD relay • Air induction system • Fuel pressure • Injector • Engine control ECU

HINT:

- Bank 1 refers to bank that includes cylinder No. 1.
- Bank 2 refers to bank that does not includes cylinder No. 1.
- Sensor 1 refers to the sensor closer to the engine assembly.

MONITOR DESCRIPTION



The engine control ECU uses the heated oxygen sensor information to regulate the air–fuel ratio close to a stoichiometric ratio. This maximizes the catalytic converter's ability to purify the exhaust gases. The sensor detects oxygen levels in the exhaust gas and sends this signal to the engine control ECU.

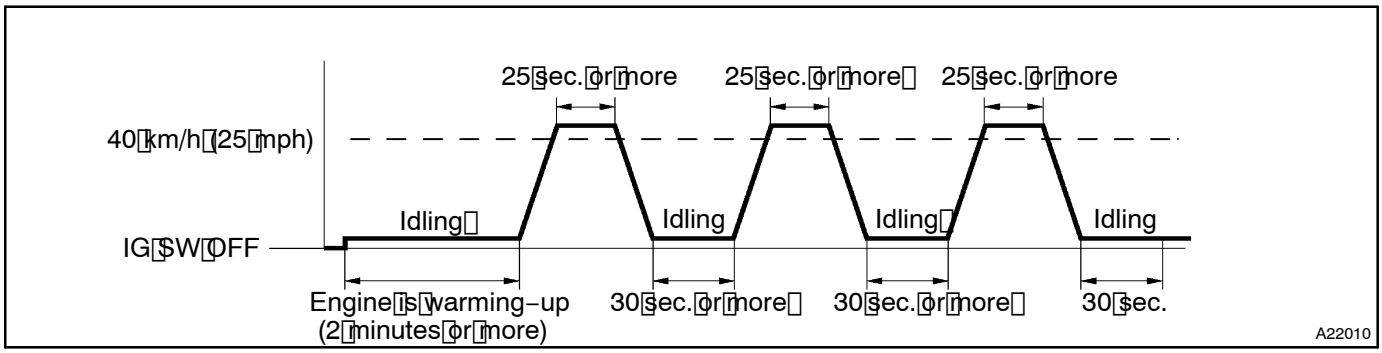
The inner surface of the sensor element is exposed to outside air. The outer surface of the sensor element is exposed to exhaust gas. The sensor element is made of platinum coated zirconia and includes an integrated heating element. The heated oxygen sensor has the characteristic whereby its output voltage changes suddenly in the vicinity of the stoichiometric air–fuel ratio. The heated oxygen sensor generates waveforms of a voltage between 0 V and 1 V in response to the oxygen concentration in exhaust gas. When the output voltage of the heated oxygen sensor is 0.55 V or more, the engine control ECU judges that the air–fuel ratio is RICH. When it is 0.40 V or less, the engine control ECU judges that the air–fuel ratio is LEAN.

The engine control ECU monitors the response feature of the heated oxygen sensor. If the response time of the heated oxygen sensor output status change from RICH to LEAN or vice versa becomes longer, the engine control ECU interprets this as a malfunction in the heated oxygen sensor and sets a DTC.

WIRING DIAGRAM

Refer to DTC P0031 on page DI–35.

CONFIRMATION DRIVING PATTERN



(a) Connect the hand–held tester to the DLC3.
(b) Switch from normal mode to check mode (see page DI–3).
(c) Allow the engine to idle until the Engine Coolant Temperature (ECT) reaches 75°C (167°F).
(d) Allow the vehicle to run at 40 km/h (25 mph) or more for 25 seconds or more.
(e) Allow the engine to idle for 30 seconds or more. Perform steps (d) and (e) at least 3 times.
(f) Allow the engine to idle for 30 seconds.

HINT:

If a malfunction exists, the check engine warning light will be illuminated on the multi–information display during step (f).

NOTICE:

If the conditions in this test are not strictly followed, you should perform steps (d) and (e).
If you do not have the Intelligent Tester II, turn the ignition switch OFF after performing steps from (c) to (f), then perform steps from (c) to (f) 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” (Heated oxygen sensor or another can be distinguished).

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

HINT:

”A/F CONTROL” is the ACTIVE TEST which changes 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 approximately 90 seconds.
(4) Select the item ”DIAGNOSIS / OBD/MOBD / ACTIVE TEST / A/F CONTROL”.
(5) Perform ”A/F CONTROL” with the engine in an idle condition (press the right or left button).

RESULT:

Heated oxygen sensor reacts in accordance with increase and decrease of injection volume
+25 % → rich output: More than 0.5 V
–12.5 % → lean output: Less than 0.4 V

NOTICE:
However, there is a few second delay in the sensor 1 (front sensor) output. And there is a maximum 20 seconds delay in the sensor 2 (rear sensor).

	Output voltage of heated oxygen sensor (sensor 1: front sensor)	Output voltage of heated oxygen sensor (sensor 2: rear sensor)	Mainly suspect trouble area
Case 1	Injection volume +25 % –12.5 % Output voltage More than 0.55 V Less than 0.4 V **OK**	Injection volume +25 % –12.5 % Output voltage More than 0.5 V Less than 0.4 V **OK**	—
Case 2	Injection volume +25 % –12.5 % Output voltage Almost no reaction **NG**	Injection volume +25 % –12.5 % Output voltage More than 0.5 V Less than 0.4 V **OK**	Sensor 1: front sensor (sensor 1, heater, sensor 1 circuit)
Case 3	Injection volume +25 % –12.5 % Output voltage More than 0.55 V Less than 0.4 V **OK**	Injection volume +25 % –12.5 % Output voltage Almost no reaction **NG**	Sensor 2: rear sensor (sensor 2, heater, sensor 2 circuit)
Case 4	Injection volume +25 % –12.5 % Output voltage Almost no reaction **NG**	Injection volume +25 % –12.5 % Output voltage Almost no reaction **NG**	Extremely rich or lean of the actual air–fuel ratio (Injector, fuel pressure, gas leakage in exhaust system, etc.)

The following A/F CONTROL procedure enables the technician to check and graph the voltage output of the heated oxygen sensors (sensor 1 and 2).
For displaying the graph indication, enter ”ACTIVE TEST / A/F CONTROL / USER DATA” then select ”O2S B1S1 and O2S B1S2” by pressing ”YES” button and push ”ENTER” button before pressing ”F4” button.
NOTICE:
If the vehicle is short of fuel, the air–fuel ratio becomes LEAN and DTCs P0133 and/or P0153 will be recorded, and the MIL then comes on.

- Read freeze frame data using the hand–held tester. 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.
- A high heated oxygen sensor (sensor 1) voltage (0.55 V or more) could be caused by a rich air fuel mixture. Check for conditions that would cause the engine to run rich.
- A low heated oxygen sensor (sensor 1) voltage (0.4 V or less) could be caused by a lean air fuel mixture. Check for conditions that would cause the engine to run lean.

1	**Are there any other codes (besides DTC P0133 or P0153) being output?**

PREPARATION:

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

(b) Turn the ignition switch ON and push the hand–held tester main switch ON.

(c) When using hand–held tester, enter the following menus: DIAGNOSIS / OBD/MOBD / DTC INFO / CURRENT CODES.

CHECK:

Read the DTC using the hand–held tester.

RESULT:

Display (DTC Output)	Proceed to
"P0133 and/or P0153"	A
"P0133 or P0153" and other DTCs	B

HINT:

If any other codes besides "P0133 and/or P0153" are output, perform the troubleshooting for those DTCs first.

B → **Go to relevant DTC chart (See page DI–19).**

A

2	**Check output voltage of heated oxygen sensor during idling.**

PREPARATION:

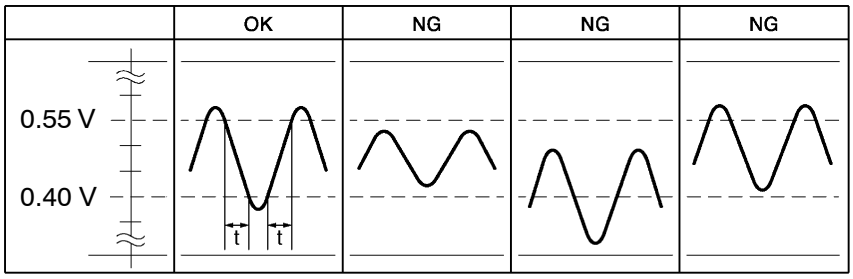
(a) Warm up the heated oxygen sensor with the engine speed at 2,500 rpm for approximately 90 seconds.
(b) Connect the hand–held tester to the DLC3.
(c) When using hand–held tester, enter the following menu: DIAGNOSIS / OBD/MOBD / DATA LIST / ALL / O2S B1 S1 or B2 S1.

CHECK:

Check the output voltage of the heated oxygen sensor while idling the hand–held tester.

OK:

Heated oxygen sensor output voltage:
Alternates between less than 0.40 V and more than 0.55 V, and period of "t" must exist less than 0.9 seconds (See the following table).



N

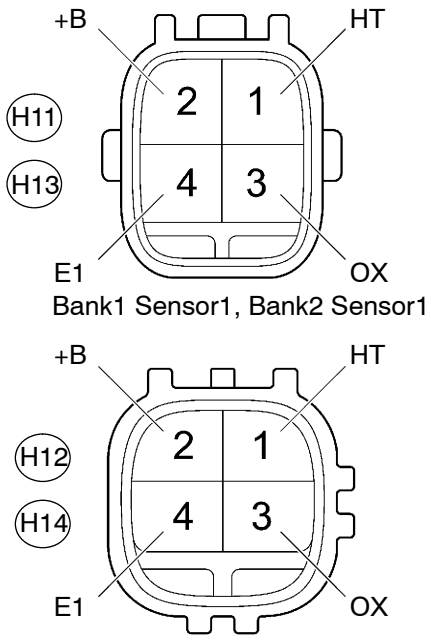
A20315

OK	Go to step 9.

NG

3	Check resistance of heated oxygen sensor heater.

Components Side:



PREPARATION:

Disconnect the H11, H12, H13 or H14 heated oxygen sensor connector.

CHECK:

Measure resistance between terminals of the heated oxygen sensor.

OK:

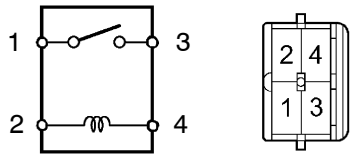
Tester Connection	Specified Condition
HT (H11–1) – +B (H11–2)	11.7 to 14.3 Ω (20°C)
HT (H12–1) – +B (H12–2)	11.7 to 14.3 Ω (20°C)
HT (H13–1) – +B (H13–2)	11.7 to 14.3 Ω (20°C)
HT (H14–1) – +B (H14–2)	11.7 to 14.3 Ω (20°C)

NG → **Replace heated oxygen sensor.**

OK

4	Check EFI or ECD relay.

EFI or ECD Relay



PREPARATION:

Remove the EFI or ECD relay from the engine room R/B.

CHECK:

Inspect the EFI or ECD relay.

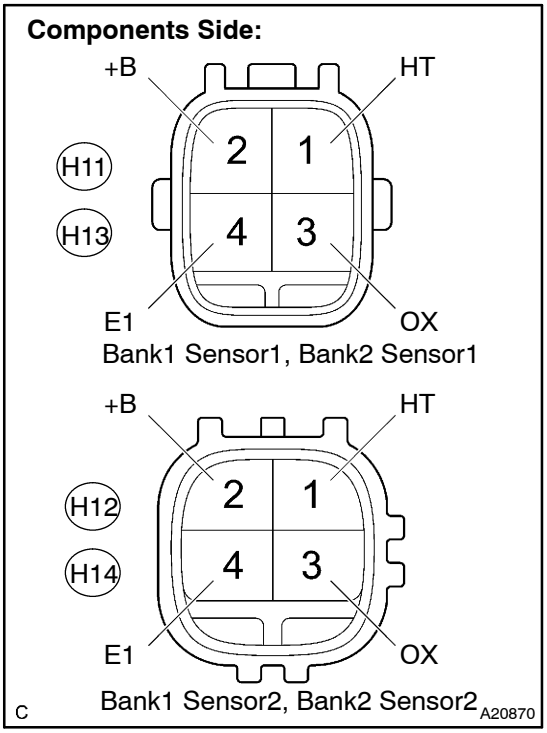
OK:

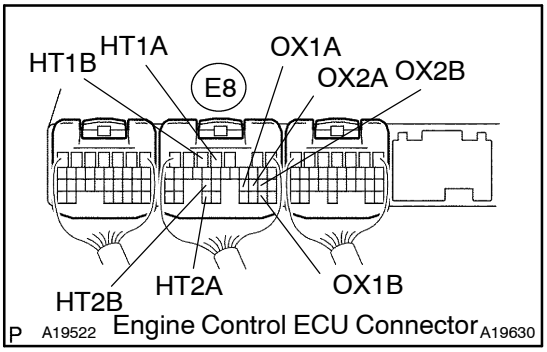
Terminal No.	Condition	Specified Condition
1 – 3	Usually	10 kΩ or higher
	Apply B+ between terminals 2 and 4	Below 1 Ω

NG → **Replace EFI or ECD relay.**

OK

5	**Check for open and short in harness and connector between engine control ECU and heated oxygen sensor.**





PREPARATION:

(a) Disconnect the H11, H12, H13 or H14 heated oxygen sensor connector.

(b) Disconnect the E8 engine control ECU connector.

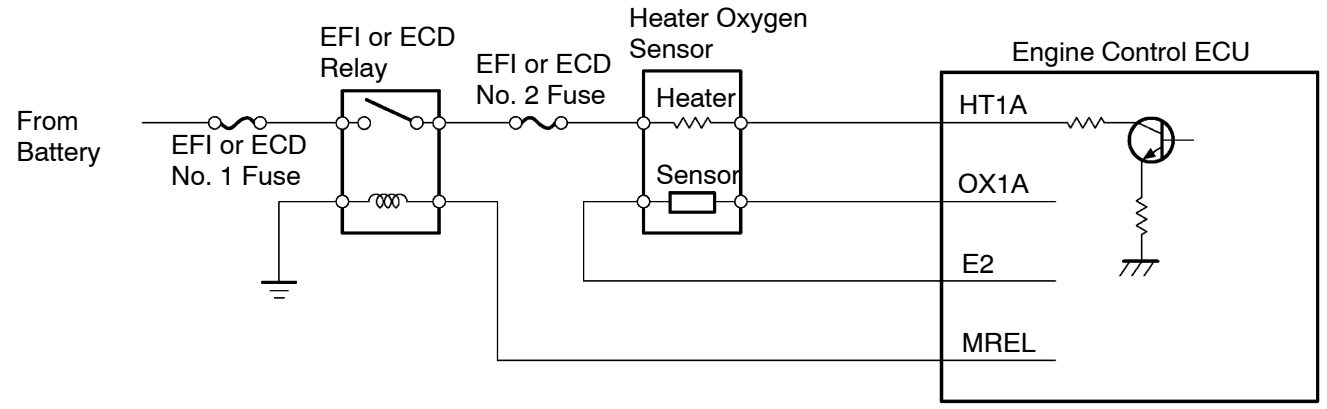
CHECK:

Measure the resistance between the wire harness side connectors.

OK:

Tester Connection	Specified Condition
OX (H11–3) – OX1A (E8–23)	Below 1 Ω
HT (H11–1) – HT1A (E8–4)	Below 1 Ω
OX (H12–3) – OX1B (E8–29)	Below 1 Ω
HT (H12–1) – HT1B (E8–5)	Below 1 Ω
OX (H13–3) – OX2A (E8–22)	Below 1 Ω
HT (H13–1) – HT2A (E8–33)	Below 1 Ω
OX (H14–3) – OX2B (E8–21)	Below 1 Ω
HT (H14–1) – HT2B (E8–25)	Below 1 Ω
OX (H11–3) or OX1A (E8–23) – Body ground	10 kΩ or higher
HT (H11–1) or HT1A (E8–4) – Body ground	10 kΩ or higher
OX (H12–3) or OX1B (E8–29) – Body ground	10 kΩ or higher
HT (H12–1) or HT1B (E8–5) – Body ground	10 kΩ or higher
OX (H13–3) or OX2A (E8–22) – Body ground	10 kΩ or higher
HT (H13–1) or HT2A (E8–33) – Body ground	10 kΩ or higher
OX (H14–3) or OX2B (E8–21) – Body ground	10 kΩ or higher
HT (H14–1) or HT2B (E8–25) – Body ground	10 kΩ or higher

Reference (Bank 1 Sensor 1 System Drawing)



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

OK

6	**Check air induction system (See Pub. No. RM630E, page FI–1).**

CHECK:

Check the air induction system for vacuum leaks.

NG	**Repair or replace air induction system.**

OK

7	**Check fuel pressure (See Pub. No. RM630E, page FI–1).**

CHECK:

Check the fuel pressure (high or low pressure).

NG	**Check and repair fuel pump, pressure regulator, fuel pipe line and filter (See Pub. No. RM630E, page FI–7).**

OK

8	Check injector injection (See Pub. No. RM630E, page FI–24).

NG → Replace injector.

OK →

Replace heated oxygen sensor.

9	Perform confirmation driving pattern.

HINT:
Clear all DTCs prior to performing the confirmation driving pattern.

Go →

10	Is there DTC P0133 or P0153 being output again?

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

YES →

Replace heated oxygen sensor.