DTC	P2238	OXYGEN SENSOR PUMPING CURRENT CIRCUIT LOW (FOR A/F SENSOR)(BANK 1 SENSOR 1)

DTC	P2239	OXYGEN SENSOR PUMPING CURRENT CIRCUIT HIGH (FOR A/F SENSOR)(BANK 1 SENSOR 1)

DTC	P2241	OXYGEN SENSOR PUMPING CURRENT CIRCUIT LOW (FOR A/F SENSOR)(BANK 2 SENSOR 1)

DTC	P2242	OXYGEN SENSOR PUMPING CURRENT CIRCUIT HIGH (FOR A/F SENSOR)(BANK 2 SENSOR 1)

DTC	P2252	OXYGEN SENSOR REFERENCE GROUND CIRCUIT LOW (FOR A/F SENSOR)(BANK 1 SENSOR 1)

DTC	P2253	OXYGEN SENSOR REFERENCE GROUND CIRCUIT HIGH (FOR A/F SENSOR)(BANK 1 SENSOR 1)

DTC	P2255	OXYGEN SENSOR REFERENCE GROUND CIRCUIT LOW (FOR A/F SENSOR)(BANK 2 SENSOR 1)

DTC	P2256	OXYGEN SENSOR REFERENCE GROUND CIRCUIT HIGH (FOR A/F SENSOR)(BANK 2 SENSOR 1)

HINT:

- Although the title (DTC description) says ”oxygen sensor”, this DTC is related to the ”A/F sensor”.
- DTC P2238, P2239, P2252 and P2253 refer to the malfunction related to the bank 1 A/F sensor circuit.
- DTC P2241, P2242, P2255 and P2256 refer to the malfunction related to the bank 2 A/F sensor circuit.

CIRCUIT DESCRIPTION

Refer to DTC P0031 on page 05–42.

DTC No.	DTC Detecting Condition	Trouble Area
P2238 P2241	A/F sensor circuit low (bank 1 sensor 1)	HINT: Main trouble area • Open in A/F sensor circuit
	Condition (a) continues for 5.0 seconds or more: (a) AF+ is 0.5 V or less	• Open or short in A/F sensor circuit • A/F sensor • A/F sensor heater • A/F sensor heater relay • A/F sensor heater and relay circuit • ECM
	Condition (a) continues for 5.0 seconds or more: (a) (AF+) – (AF–) is 0.1 V or less	
P2239 P2242	A/F sensor circuit high (bank 1 sensor 1)	HINT: Main trouble area • Short in A/F sensor circuit
	Condition (a) continues for 5.0 seconds or more: (a) AF+ is more than 4.5 V	• Open or short in A/F sensor circuit • A/F sensor • A/F sensor heater • A/F sensor heater relay • A/F sensor heater and relay circuit • ECM
	Condition (a) continues for 5.0 seconds or more: (a) (AF+) – (AF–) is more than 0.8 V	
P2252 P2255	Condition (a) continues for 5.0 seconds or more: (a) AF– is 0.5 V or less	• Open or short in A/F sensor circuit • A/F sensor • A/F sensor heater • A/F sensor heater relay • A/F sensor heater and relay circuit • ECM
P2253 P2256	Condition (a) continues for 5.0 seconds or more: (a) AF– is more than 4.5 V	

HINT:

- Bank 1 refers to the bank that includes cylinder No. 1.
- Bank 2 refers to the bank that includes cylinder No. 2.

WIRING DIAGRAM

Refer to DTC P0031 on page 05–42.

INSPECTION PROCEDURE

HINT:

Hand–held tester only:

It is possible the malfunctioning area can be found using the ACTIVE TEST A/F CONTROL operation. The A/F CONTROL operation can determine if the A/F sensor, heated oxygen sensor or other potential trouble areas are malfunctioning or not.

(a) Perform the ACTIVE TEST A/F CONTROL operation.

HINT:

The A/F CONTROL operation lowers the injection volume 12.5% or increases the injection volume 25%.

(1) Connect the hand–held tester to the DLC3 on the vehicle.

(2) Turn the ignition switch ON.

(3) Warm up the engine by running the engine at 2,500 rpm for approximately 90 seconds.

(4) Enter the following menus: 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:

A/F sensor reacts in accordance with increase and decrease of injection volume:

+25 % → rich output: Less than 3.0 V

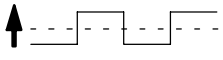
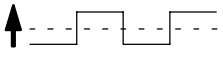
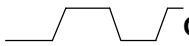
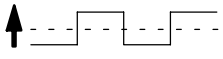
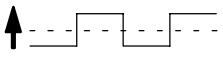
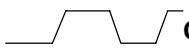
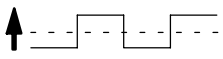
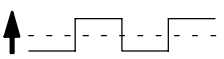
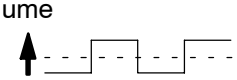
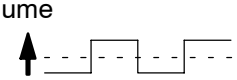
–12.5 % → lean output: More than 3.35 V

Heated oxygen sensor reacts in accordance with increase and decrease of injection volume:

+25 % → rich output: More than 0.55 V

–12.5 % → lean output: Less than 0.4 V

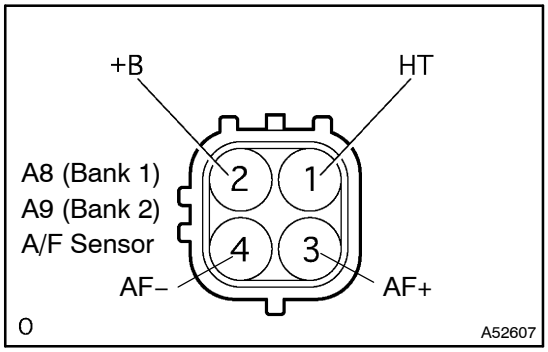
NOTICE:
The A/F sensor output has a few seconds of delay and the heated oxygen sensor output has about 20 seconds of delay at maximum.

	Output voltage of A/F sensor (sensor 1)	Output voltage of heated oxygen sensor (sensor 2)	Mainly suspected 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 0.4V  **OK**	—
Case 2	Injection volume +25 % –12.5 %  Output voltage Almost No reaction **NG**	Injection volume +25 % –12.5 %  Output voltage More than 0.55 V Less than 0.4V  **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 3.0V  **OK**	Injection volume +25 % –12.5 %  Output voltage Almost No reaction **NG**	Heated oxygen sensor (heated oxygen sensor, heater, heated oxygen sensor 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 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 outputs of both the A/F sensor and the heated oxygen sensor.
For displaying the graph, enter ”ACTIVE TEST / A/F CONTROL / USER DATA”, select ”AFS B1S1 and O2S B1S2” by pressing ”YES” and push ”ENTER”. Then press ”F4”.
HINT:

- If DTC P2238, P2239, P2251 or P2253 is displayed, check the bank 1 sensor 1 circuit.
- If DTC P2241, P2242, P2255 or P2256 is displayed, check the bank 2 sensor 1 circuit.
- Read freeze frame data using the hand–held tester or the OBD II scan tool. Freeze frame data records the engine conditions when a malfunction is detected. When troubleshooting, freeze frame data can help determine if the vehicle was running or stopped, if the engine was warmed up or not, if the air–fuel ratio was lean or rich, and other data from the time the malfunction occurred.

1 INSPECT AIR FUEL RATIO SENSOR (HEATER RESISTANCE)



(a) Disconnect the A8 or A9 A/F sensor connector.
(b) Check the resistance of the A/F sensor terminals.

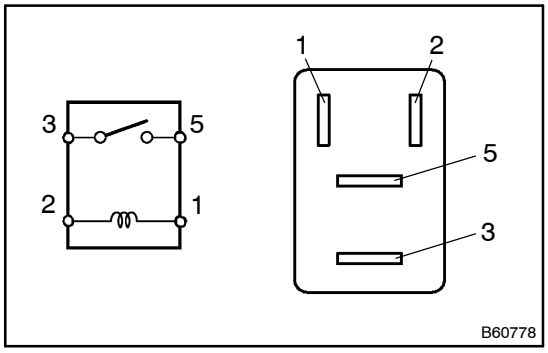
Standard:

Tester Connection	Condition	Specified Condition
1 (HT) – 2 (+B)	20°C (68°F)	1.9 to 3.0 Ω
1 (HT) – 2 (+B)	750°C (1,382°F)	5.0 to 8.4 Ω

NG → **REPLACE AIR FUEL RATIO SENSOR**

OK

2 INSPECT RELAY (A/F)



(a) Remove the A/F relay from the engine room R/B.
(b) Check the resistance of the A/F relay.

Standard:

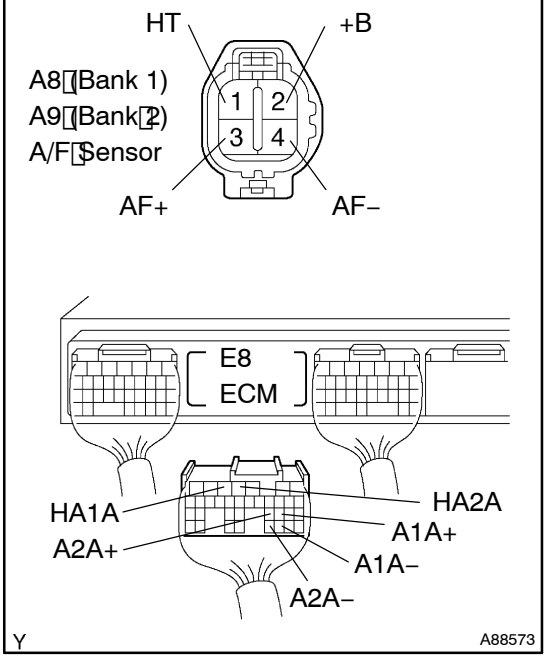
Tester Connection	Specified Condition
3 – 5	10 kΩ or higher
3 – 5	Below 1 Ω (when battery voltage is applied to terminals 1 and 2)

NG → **REPLACE AIR FUEL RATIO SENSOR HEATER RELAY**

OK

3 CHECK WIRE HARNESS (HEATER RESISTANCE)

Wire Harness Side

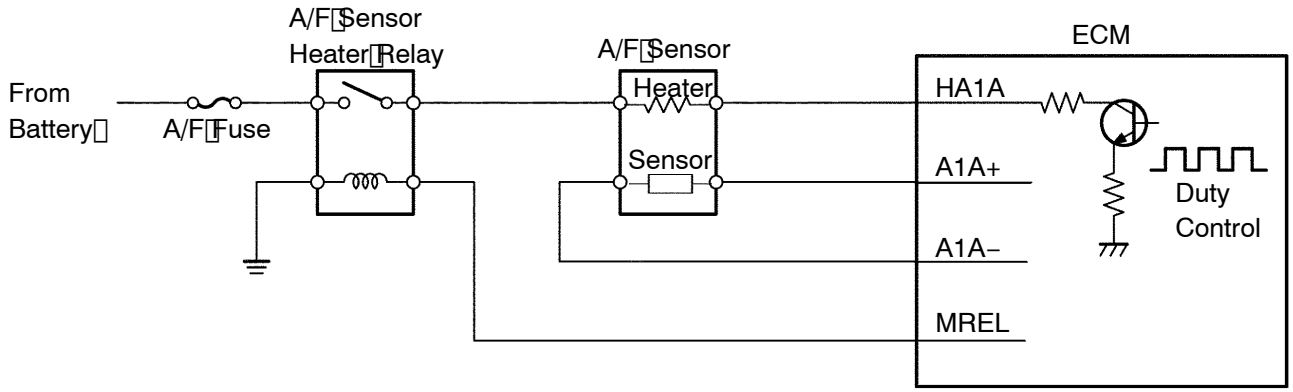


(a) Disconnect the A8 or A9 A/F sensor connector.
(b) Disconnect the E8 ECM connector.
(c) Check the resistance of the wire harness side connectors.

Standard:

Tester Connection	Specified Condition
A8–3 (AF+) – E8–22 (A1A+) A8–4 (AF–) – E8–30 (A1A–) A8–1 (HT) – E8–5 (HA1A) A9–3 (AF+) – E8–23 (A2A+) A9–4 (AF–) – E8–31 (A2A–) A9–1 (HT) – E8–4 (HA2A)	Below 1 Ω
A8–3 (AF+) or E8–22 (A1A+) – Body ground A8–4 (AF–) or E8–30 (A1A–) – Body ground A8–1 (HT) or E8–5 (HA1A) – Body ground A9–3 (AF+) or E8–23 (A2A+) – Body ground A9–4 (AF–) or E8–31 (A2A–) – Body ground A9–1 (HT) or E8–4 (HA2A) – Body ground	10 kΩ or higher

Reference (Bank 1 Sensor 1 System Drawing)



NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK →

REPLACE ECM (See page 10–13)