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	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)

CIRCUIT DESCRIPTION

Refer to DTC P0031 on page 05–47.

DTC No.	DTC Detecting Condition	Trouble Area
P2238	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 sec. or more : (a) AF+ less than 0.5 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 sec. or more : (a) (AF+) – (AF–) less than 0.1 V	
P2239	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 sec. or more : (a) AF+ greater 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 sec. or more : (a) (AF+) – (AF–) greater than 0.8 V	
P2252	Condition (a) continues for 5.0 sec. or more : (a) AF– less than 0.5 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
P2253	Condition (a) continues for 5.0 sec. or more : (b) AF– greater than 4.5 V	

WIRING DIAGRAM

Refer to DTC P0031 on page 05–47.

INSPECTION PROCEDURE

HINT:

Malfunctioning areas can be found using the Active Test / A/F Control operation. The A/F Control operation can help to determine whether the heated oxygen sensor and other potential trouble areas are malfunctioning.

(a) Perform the Active Test using the intelligent tester II.

HINT:

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

(1) Connect the intelligent tester II to the DLC3.
(2) Start the engine and turn the intelligent tester II ON.
(3) Warm up the engine by running the engine at 2,500 rpm for approximately 3 minutes.
(4) On the intelligent tester II, select the following menu items: Powertrain / Engine and ECT / Active Test / A/F Control.
(5) Select the following monitor items: AFS B1 S1 and O2S B1 S2.
(6) Perform the A/F Control operation with the engine in an idling 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:
There is a few seconds delay in the A/F sensor output and there is about 20 seconds delay in the heated oxygen sensor output.

	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 actual air–fuel ratio (Injector, fuel pressure, gas leakage in exhaust system, etc.)

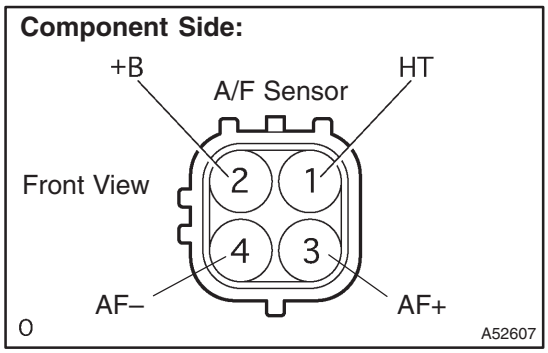
The following A/F Control procedure enables the technician to check and graph the voltage output of both the sensors.

NOTICE:
If the vehicle is short of fuel, the air–fuel ratio becomes lean and the heated oxygen sensor DTCs are recorded, and the MIL then illuminates.

HINT:

- If different DTCs related to different systems that have terminal E2 as the ground terminal are output simultaneously, terminal E2 may have an open circuit.
- Read freeze frame data using the intelligent tester II. Freeze frame data record the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, 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.
- 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.

1 INSPECT AIR FUEL RATIO SENSOR(RESISTANCE OF A/F SENSOR HEATER)



(a) Disconnect the A48 Air–Fuel Ratio (A/F) sensor connector.

(b) Measure the resistance according to the value(s) in the table below.

Standard:

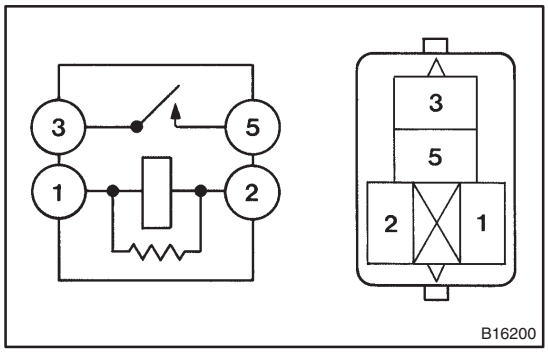
Tester Connections	Specified Conditions
HT (1) – +B (2)	Between 1.8 Ω and 3.4 Ω at 20°C (68°F)
HT (1) – AF– (4)	10 kΩ or higher

(c) Reconnect the A/F sensor connector.

NG → **REPLACE AIR FUEL RATIO SENSOR**

OK

2 INSPECT AIR FUEL RATIO SENSOR HEATER RELAY



(a) Remove the A/F sensor heater relay from the engine room R/B.

(b) Check the A/F sensor heater relay resistance.

Standard:

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

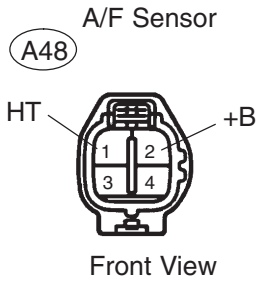
(c) Reinstall the A/F sensor heater relay.

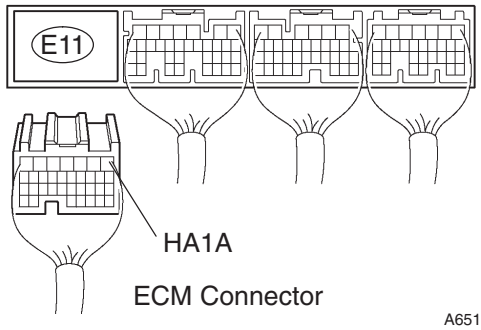
NG → **REPLACE AIR FUEL RATIO SENSOR HEATER RELAY**

OK

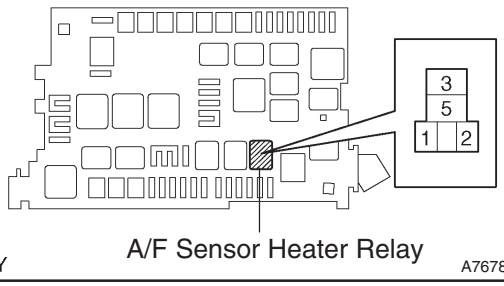
3 CHECK HARNESS AND CONNECTOR(ECM – A/F SENSOR)

Wire Harness Side:





Engine Room R/B



(a) Check the harness and the connectors between the ECM and the A/F sensor.
(1) Disconnect the A48 A/F sensor connector.
(2) Disconnect the E11 ECM connector.
(3) Measure the resistance according to the value(s) in the table below.

Standard (Check for open):

Tester Connection	Specified Condition
HT (A48–1) – HA1A (E11–1)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
HT (A48–1) or HA1A (E11–1) – Body ground	10 kΩ or higher

(4) Reconnect the A/F sensor connector.
(5) Reconnect the ECM connector.

(b) Check the harness and the connectors between the A/F sensor and A/F heater relay.
(1) Disconnect the A48 A/F sensor connector.
(2) Remove the A/F sensor heater relay from the engine room R/B.
(3) Measure the resistance according to the value(s) in the table below.

Standard (Check for open):

Tester Connection	Specified Condition
+B (A48–2) – A/F heater relay (3)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
+B (A48–2) or A/F heater relay (3) – Body ground	10 kΩ or higher

(4) Reconnect the A/F sensor connector.
(5) Reinstall the A/F sensor heater relay.

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

OK

REPLACE ECM (See page 10–12)