DTC	P2237/28	OXYGEN SENSOR PUMPING CURRENT CIRCUIT/OPEN (FOR A/F SENSOR)(BANK 1 SENSOR 1)

DTC	P2238/28	OXYGEN SENSOR PUMPING CURRENT CIRCUIT LOW (FOR A/F SENSOR)(BANK 1 SENSOR 1)

DTC	P2239/28	OXYGEN SENSOR PUMPING CURRENT CIRCUIT HIGH (FOR A/F SENSOR)(BANK 1 SENSOR 1)

DTC	P2240/21	OXYGEN SENSOR PUMPING CURRENT CIRCUIT/OPEN (FOR A/F SENSOR)(BANK 2 SENSOR 1)

DTC	P2241/21	OXYGEN SENSOR PUMPING CURRENT CIRCUIT LOW (FOR A/F SENSOR)(BANK 2 SENSOR 1)

DTC	P2242/21	OXYGEN SENSOR PUMPING CURRENT CIRCUIT HIGH (FOR A/F SENSOR)(BANK 2 SENSOR 1)

DTC	P2251/28	OXYGEN SENSOR REFERENCE GROUND CIRCUIT/OPEN (FOR A/F SENSOR)(BANK 1 SENSOR 1)

DTC	P2252/28	OXYGEN SENSOR REFERENCE GROUND CIRCUIT LOW (FOR A/F SENSOR)(BANK 1 SENSOR 1)

DTC	P2253/28	OXYGEN SENSOR REFERENCE GROUND CIRCUIT HIGH (FOR A/F SENSOR)(BANK 1 SENSOR 1)

DTC	P2254/21	OXYGEN SENSOR REFERENCE GROUND CIRCUIT/OPEN (FOR A/F SENSOR)(BANK 2 SENSOR 1)

DTC	P2255/21	OXYGEN SENSOR REFERENCE GROUND CIRCUIT LOW (FOR A/F SENSOR) (BANK 2 SENSOR 1)

DTC	P2256/21	OXYGEN SENSOR REFERENCE GROUND CIRCUIT HIGH (FOR A/F SENSOR) (BANK 2 SENSOR 1)

CIRCUIT DESCRIPTION

HINT:

These DTCs are recorded when A/F sensor has a malfunction, although the caption is oxygen sensor.

Refer to DTC P2195 on page 05–182.

DTC No.	DTC Detecting Condition	Trouble Area
P2237/28 P2240/21	A/F sensor circuit (bank 1 sensor 1)	HINT : Main trouble area • Open or short in A/F sensor circuit
	Conditions (a) and (b) continue for 5.0 sec. or more : (a) AF+ ≦ 0.5 V (b) AF+ > 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
	Conditions (a) and (b) continue for 5.0 sec. or more : (a) (AF+) – (AF–) ≦ 0.1 V (b) (AF+) – (AF–) > 0.8 V	
P2238/28 P2241/21	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+ ≦ 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–) ≦ 0.1 V	
P2239/28 P2242/21	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+ > 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–) > 0.8 V	
P2251/28 P2254/21	Conditions (a) and (b) continue for 5.0 sec. or more : (a) AF– ≦ 0.5 V (b) AF– > 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
P2252/28 P2255/21	Condition (a) continues for 5.0 sec. or more : (a) AF– ≦ 0.5 V	
P2253/28 P2256/21	Condition (a) continues for 5.0 sec. or more : (b) AF– > 4.5 V	

HINT:

- DTC P2237/28, P2238/28, P2239/28, P2251/28, P2252/28 and P2253/28 means malfunction related to the bank 1 A/F sensor circuit.
- DTC P2240/21, P2241/21, P2242/21, P2254/21, P2255/21 and P2256/21 means malfunction related to the bank 2 A/F sensor circuit.
- 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 P2195 on page 05–182.

INSPECTION PROCEDURE

HINT:

Hand–held tester only:

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

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

HINT:

”A/F CONTROL” is an 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 approx. 90 sec.
(4) Select the item ”DIAGNOSIS / OBD/MOBD / ACTIVE TEST / A/F CONTROL”.
(5) Perform ”A/F CONTROL” when 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:

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.

	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 0.4V **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 0.4V **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 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.)

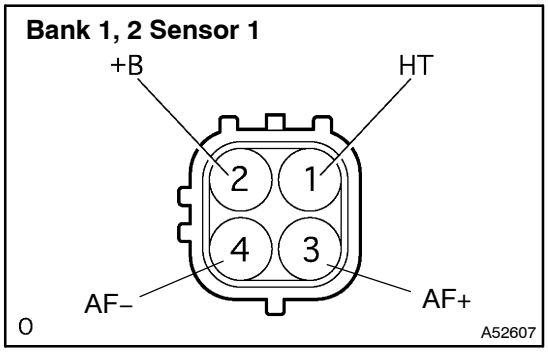
The following procedure of A/F CONTROL enables the user to check its output (show its graph indication) of A/F sensor and heated oxygen sensor.

For displaying the graph indication, enter ”ACTIVE TEST/ A/F CONTROL/USER DATA”, then select ”AFS B1S1 and O2S B1S2” or ”AFS B2S1 and O2S B2S2” by pressing ”YES” button and push ”ENTER” button before pressing ”F4” button.

HINT:

- If DTC P2237/28, P2238/28, P2239/28, P2251/28, P2252/28 or P2253/28 is displayed, check the bank 1 sensor 1 circuit.
- If DTC P2240/21, P2241/21, P2242/21, P2254/21, P2255/21 or P2256/21 is displayed, check the bank 2 sensor 1 circuit.
- Read freeze frame data using the hand–held tester, 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 INSPECT AIR FUEL RATIO SENSOR(RESISTANCE OF A/F SENSOR HEATER)

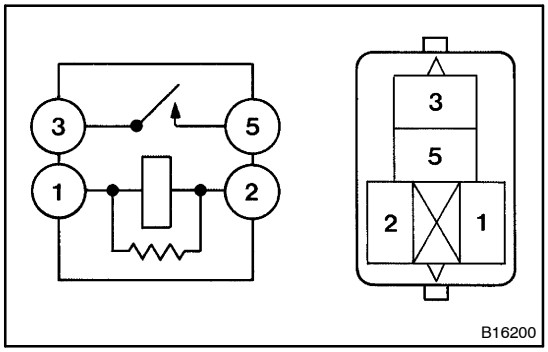


(a) Disconnect the A/F sensor connector.
(b) Measure resistance between terminals HT and +B of the A/F sensor.
Resistance: 1.8 to 3.4 Ω (20°C)

NG → **REPLACE AIR FUEL RATIO SENSOR**

OK

2 INSPECT AIR FUEL RATIO SENSOR HEATER RELAY



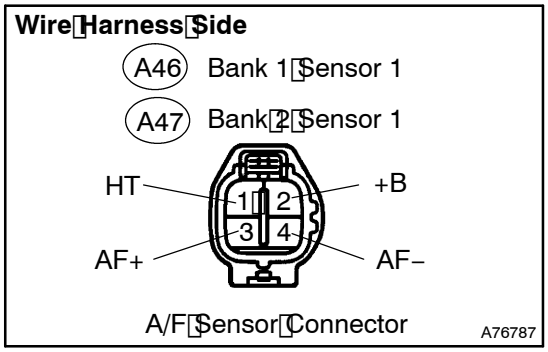
(a) Remove the A/F sensor heater relay from the engine room R/B.
(b) Inspect the A/F senor heater relay.
Standard:

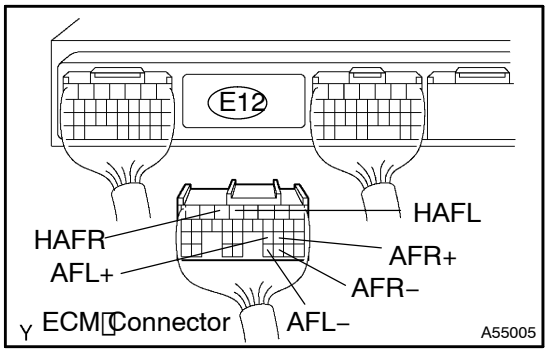
Terminal No.	Specified condition
1 – 2	Continuity
3 – 5	No Continuity
	Continuity (Apply battery voltage terminals 1 and 2)

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

OK

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





(a) Disconnect the A46 or A47 A/F sensor connector.
(b) Disconnect the E12 ECM connector.
(c) Check for continuity between the wire harness side connectors.

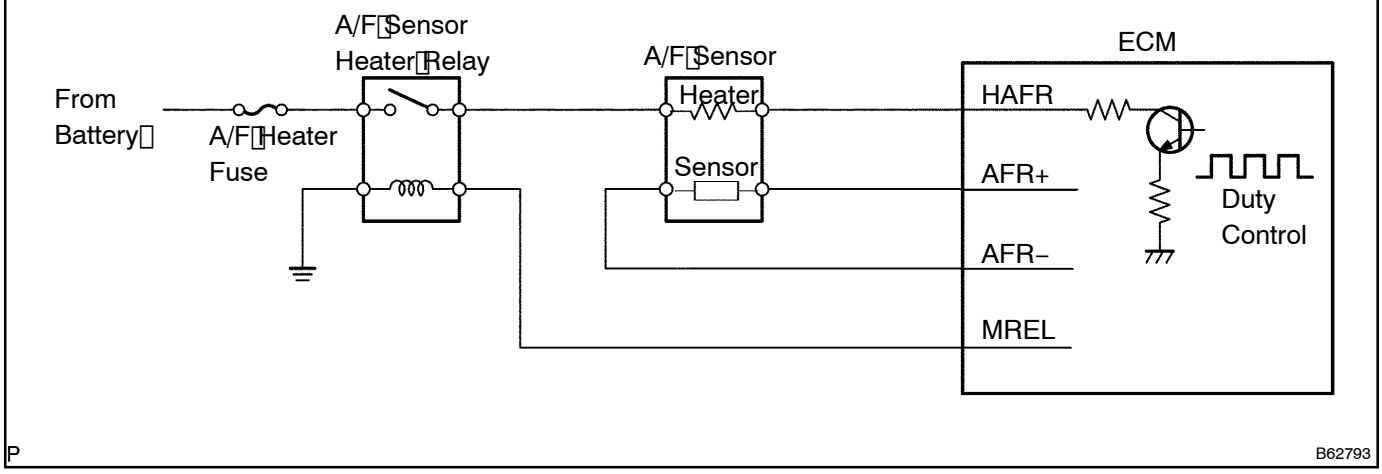
Standard (Check for open):

Symbols (Terminal No.)	Specified condition
AF+ (A46–3) – AFR+ (E12–22)	Continuity
AF– (A46–4) – AFR– (E12–30)	
HT (A46–1) – HAFR (E12–5)	
AF+ (A47–3) – AFL+ (E12–23)	
AF– (A47–4) – AFL– (E12–31)	
HT (A47–1) – HAFL (E12–4)	

Standard (Check for short):

Symbols (Terminal No.)	Specified condition
AF+ (A46–3) or AFR+ (E12–22) – Body ground	No continuity
AF– (A46–4) or AFR– (E12–30) – Body ground	
HT (A46–1) or HAFR (E12–5) – Body ground	
AF+ (A47–3) or AFL+ (E12–23) – Body ground	
AF– (A47–4) or AFL– (E12–31) – Body ground	
HT (A47–1) or HAFL (E12–4) – Body ground	

Reference (Bank 1 Sensor 1 System Drawing)



NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK →

CHECK AND REPLACE ECM (See page 01–35)