DTC	P0031/28	OXYGEN (A/F) SENSOR HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 1)

DTC	P0032/28	OXYGEN (A/F) SENSOR HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 1)

DTC	P0051/21	OXYGEN (A/F) SENSOR HEATER CONTROL CIRCUIT LOW (BANK 2 SENSOR 1)

DTC	P0052/21	OXYGEN (A/F) SENSOR HEATER CONTROL CIRCUIT HIGH (BANK 2 SENSOR 1)

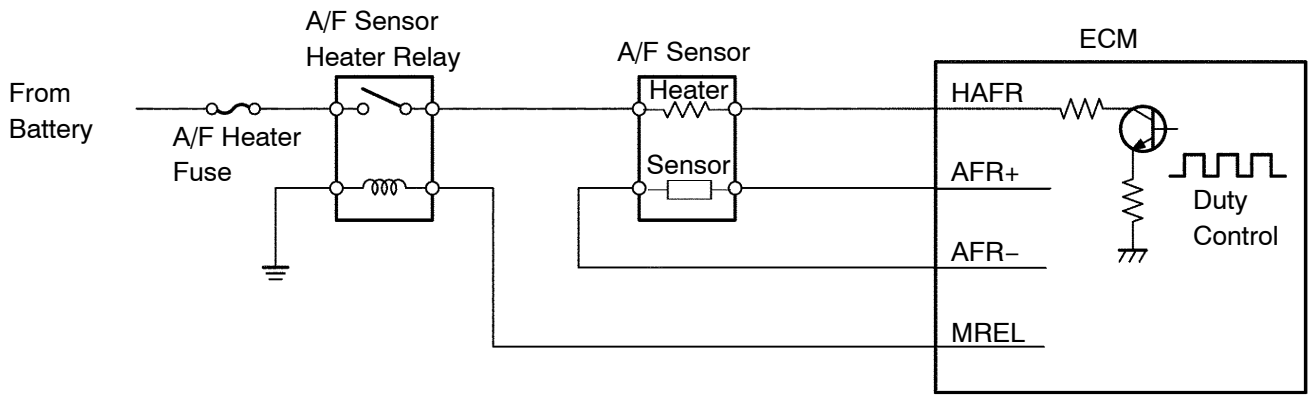
HINT:
This DTC is related to the air–fuel ratio (A/F) sensor, although the caption is heated oxygen sensor.

CIRCUIT DESCRIPTION

Refer to DTC P2195 on page 05–182.

HINT:
The ECM provides a pulse width modulated control circuit to adjust current through the heater. The A/F sensor heater circuit uses a relay on the B+ side of the circuit.

Reference (Bank 1 Sensor 1 System Drawing)



DTC No.	DTC Detection Condition	Trouble Area
P0031/28 P0051/21	Heated current is 0.8 A or less when the heater operates (1 trip detection logic)	• Open or short in the heater circuit of A/F sensor • A/F sensor heater • A/F sensor heater relay • ECM
P0032/28 P0052/21	When the heater operates, heated current exceeds 19.7 A (1 trip detection logic)	

HINT:

- Bank 1 refers to the bank that includes cylinder No.1.
- Bank 2 refers to the bank that does not include cylinder No.1.
- Sensor 1 refers to the sensor closest to the engine assembly.
- Sensor 2 refers to the sensor farthest away from the engine assembly.

WIRING DIAGRAM

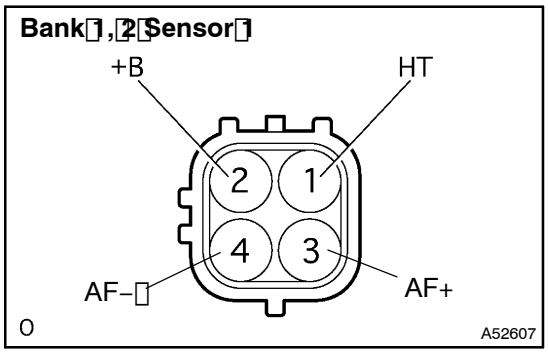
Refer to DTC P2195 on page 05–182.

INSPECTION PROCEDURE

HINT:

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(HEATER RESISTANCE)



(a) Disconnect the A/F sensor connector.

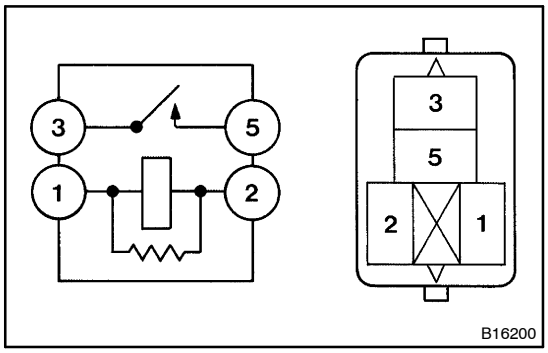
(b) Measure resistance between the terminals HT and +B of the A/F sensor.

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 sensor heater relay.

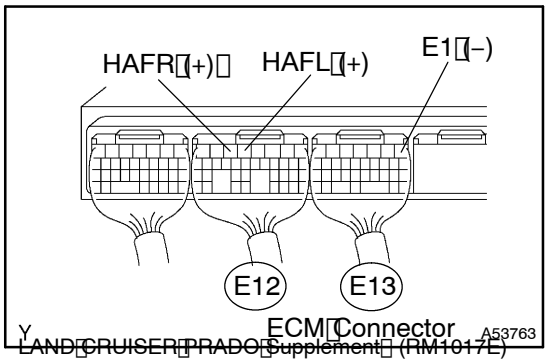
Standard:

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

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

OK

3 INSPECT ECM(HAFR OR HAFL VOLTAGE)



(a) Turn the ignition switch ON.

(b) Measure the voltage between the applicable terminals of the E12 and E13 ECM connectors.

Standard:

Symbols (Terminal No.)	Specified condition
HAFR (E12–5) – E1 (E13–1)	9 to 14 V
HAFL (E12–4) – E1 (E13–1)	

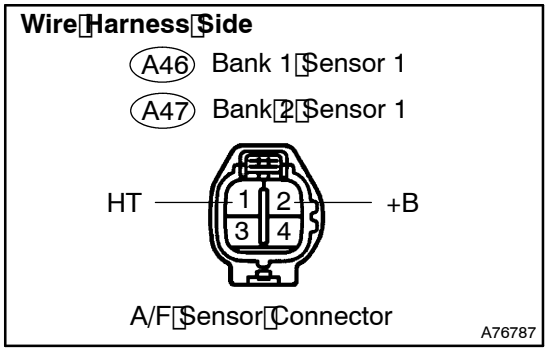
HINT:

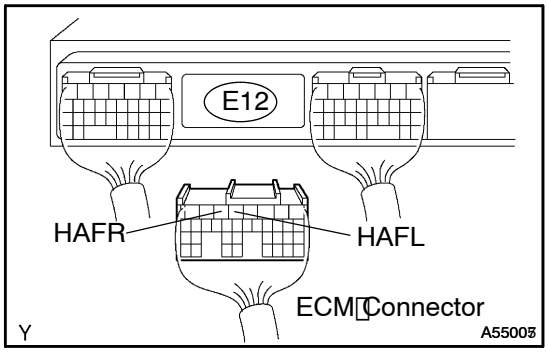
- The HAFR means the A/F sensor bank 1 sensor 1.
- The HAFL means the A/F sensor bank 2 sensor 1.

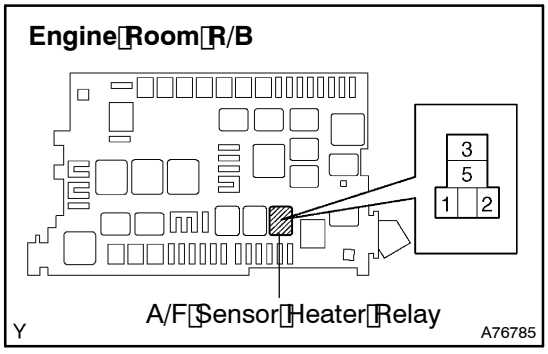
OK	CHECK AND REPLACE ECM (See page 01–35)

NG

4 CHECK HARNESS AND CONNECTOR (A/F SENSOR – ECM, A/F SENSOR – A/F SENSOR HEATER RELAY)







(a) Check the harness and the connector between the ECM and the A/F sensor connectors.

(1) Disconnect the A46 or A47 A/F sensor connector.

(2) Disconnect the E12 ECM connector.

(3) Check for continuity between the wire harness side connectors.

Standard (Check for open):

Symbols (Terminal No.)	Specified condition
HT (A46–1) – HAFR (E12–5)	Continuity
HT (A47–1) – HAFL (E12–4)	

Standard (Check for short):

Symbols (Terminal No.)	Specified condition
HT (A46–1) or HAFR (E12–5) – Body ground	No continuity
HT (A47–1) or HAFL (E12–4) – Body ground	

(b) Check the harness and the connector between the A/F sensor connector and the A/F sensor heater relay.

(1) Disconnect the A46 or A47 A/F sensor connector.

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

(3) Check for continuity between the wire harness side connectors.

Standard (Check for open):

Symbols (Terminal No.)	Specified condition
+B (A46–2) – A/F sensor heater relay (3)	Continuity
+B (A47–2) – A/F sensor heater relay (3)	

Standard (Check for short):

Symbols (Terminal No.)	Specified condition
+B (A46–2) or A/F sensor heater relay (3) – Body ground	No continuity
+B (A47–2) or A/F sensor heater relay (3) – Body ground	

NG	REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

CHECK AND REPLACE ECM (See page 01–35)