

DTC	P0037	OXYGEN SENSOR HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 2)
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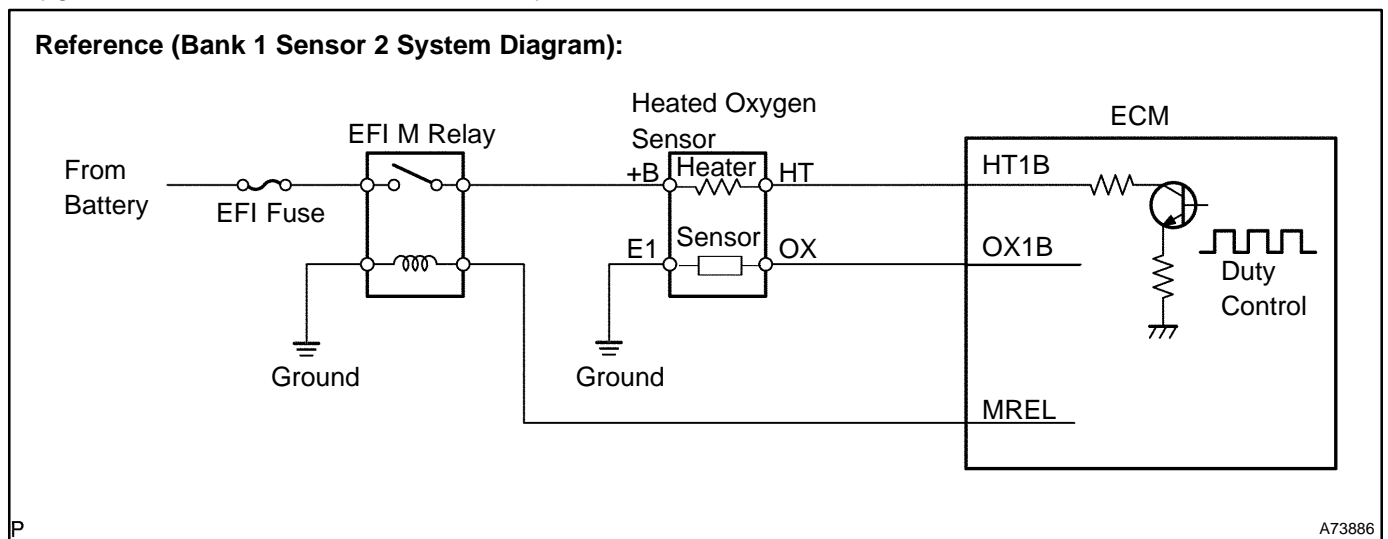
DTC	P0038	OXYGEN SENSOR HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 2)
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CIRCUIT DESCRIPTION

Refer to DTC P0136 on page 05-125.

HINT:

The ECM provides a pulse width modulated control circuit to adjust current through the heater. The heated oxygen sensor heater circuit uses a relay on the +B side of the circuit.



DTC No.	DTC Detection Condition	Trouble Area
P0037	Heater current is 0.25 A or less when the heater operates with +B greater than 11.5 V (1 trip detection logic)	<ul style="list-style-type: none"> • Open or short in heater circuit of the heated oxygen sensor • Heated oxygen sensor heater • EFI M relay (integration relay) • ECM
P0038	When the heater operates, heater current exceeds 2 A (1 trip detection logic)	<ul style="list-style-type: none"> • Short in heater circuit of the heated oxygen sensor • Heated oxygen sensor heater • EFI M relay (integration relay) • ECM

HINT:

- Sensor 1 refers to the sensor mounted before the TWC and is located near the engine assembly.
- Sensor 2 refers to the sensor mounted after the TWC and is located far from the engine assembly.

MONITOR DESCRIPTION

The sensing portion of the heated oxygen sensor has a zirconia element which is used to detect oxygen concentration in the exhaust gas. If the zirconia element is at the proper temperature and difference of the oxygen concentration between the inside and outside surfaces of sensor is large, the zirconia element will generate voltage signals. In order to increase the oxygen concentration detecting capacity in the zirconia element, the ECM supplements the heat from the exhaust with heat from a heating element inside the sensor. When current in the sensor is out of the standard operating range, the ECM interprets this as a fault in the heated oxygen sensor and sets a DTC.

Example:

The ECM will set a high current DTC if the current in the sensor is more than 2 A when the heater is OFF. Similarly, the ECM will set a low current DTC if the current is less than 0.25 A when the heater is ON.

MONITOR STRATEGY

Related DTCs	P0037: Heated oxygen sensor heater current bank 1 sensor 2 (low current) P0038: Heated oxygen sensor heater current bank 1 sensor 2 (high current)
Required sensors/components	Main sensors: Heated oxygen sensor Related sensors: Vehicle speed sensor
Frequency of operation	Continuous
Duration	0.3 second
MIL operation	1 driving cycle
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

P0037:

The monitor will run whenever the following DTCs are not present	See page 05-20
Either of the following conditions is met:	A or B
A. Following conditions are met:	1, 2, 3, 4 and 5
1. Time after engine start	250 seconds or more, and 500 seconds or less
2. Battery voltage	More than 10.5 V
3. Vehicle speed	Less than 55.9 mph (90 km/h)
4. Misfire	Not detected
5. Pass/Fail detection in this driving cycle	Not detected
B. Following conditions are met:	1, 2, 3, 4 and 5
1. Time after engine start	500 seconds or more
2. Battery voltage	More than 10.5 V
3. Vehicle speed	24.8 mph (40 km/h) or more
4. Misfire	Not detected
5. Pass/Fail detection in this driving cycle	Pass and fail detection has not occurred yet

P0038:

The monitor will run whenever the following DTCs are not present	See page 05-20
Intrusive heating	OFF

TYPICAL MALFUNCTION THRESHOLDS

P0037:

Heated oxygen sensor heater current	Less than 0.25 A (at 0.3 second after heater is turned ON)
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P0038:

Heated oxygen sensor heater current	More than 2 A (while supplemental heating is OFF)
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COMPONENT OPERATING RANGE

Heated oxygen sensor heater current (after engine is warmed up)	0.4 to 1.0 A (at idle and battery voltage 11 to 14 V)
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MONITOR RESULT (MODE 06 DATA)

Heated oxygen sensor heater:

Test ID/Comp ID	Description of Test Data	Description of Test Limit	Conversion Factor (Unit)
\$04/\$82	Maximum heated oxygen sensor heater current	Maximum threshold heater current to detect heated oxygen sensor malfunction	Multiply by 0.000076 (A)

Refer to page 05-26 for detailed information on Checking Monitor Status.

WIRING DIAGRAM

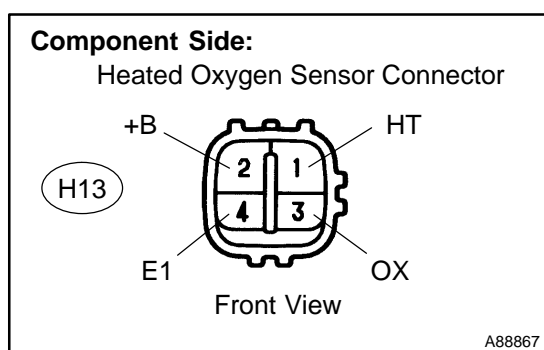
Refer to DTC P0136 on page 05-125.

INSPECTION PROCEDURE

HINT:

- If 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 hand-held tester or the OBD II scan tool. Freeze frame data records the engine condition when 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.
- When DTC P0038 is detected, proceed to step 4 if the heater resistance is in normal range.

1 INSPECT HEATED OXYGEN SENSOR(HEATER RESISTANCE)



- Disconnect the H13 heated oxygen sensor connector.
- Measure the resistance between the terminals of the heated oxygen sensor connector.

Standard (Bank 1 sensor 2):

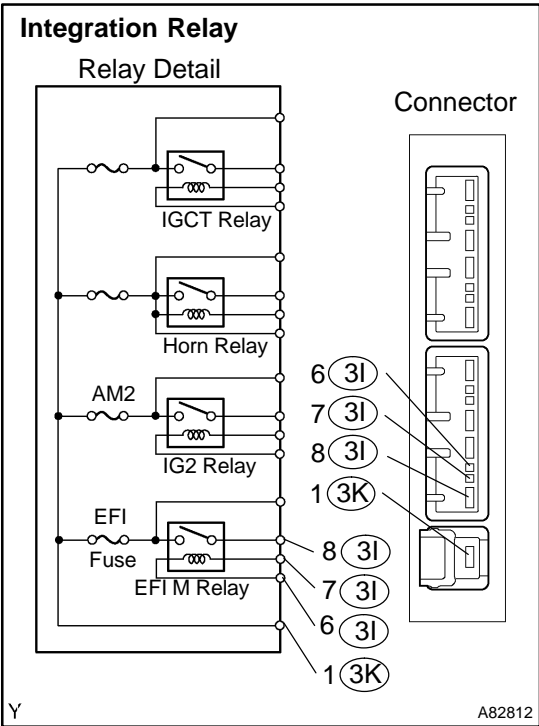
Tester Connection	Resistance
HT (H13-1) – +B (H13-2)	11 to 16 Ω at 20°C (68°F)
HT (H13-1) – E1 (H13-4)	10 kΩ or higher

- Reconnect the heated oxygen sensor connector.

NG → REPLACE HEATED OXYGEN SENSOR

OK

2 INSPECT INTEGRATION RELAY(EFI M RELAY)



- (a) Remove the integration relay from the engine room R/B.
- (b) Inspect the EFI M relay.

Standard:

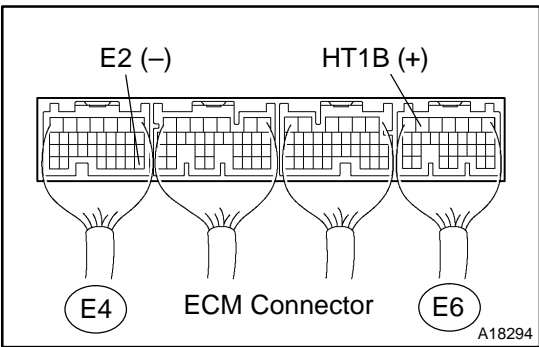
Tester Connection	Specified Condition
(3K-1) - (3I-8)	10 kΩ or higher
(3K-1) - (3I-8)	Below 1 Ω (Apply battery voltage to terminals 3I-6 and 3I-7)

- (c) Reinstall the integration relay.

NG → REPLACE INTEGRATION RELAY

OK

3 INSPECT ECM(HT1B VOLTAGE)



- (a) Turn the power switch ON (IG).
- (b) Measure the voltage between the applicable terminals of the E4 and E6 ECM connectors.

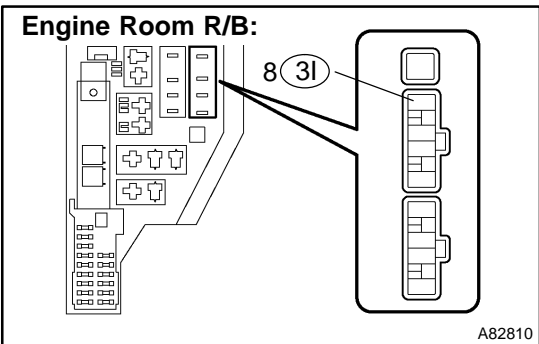
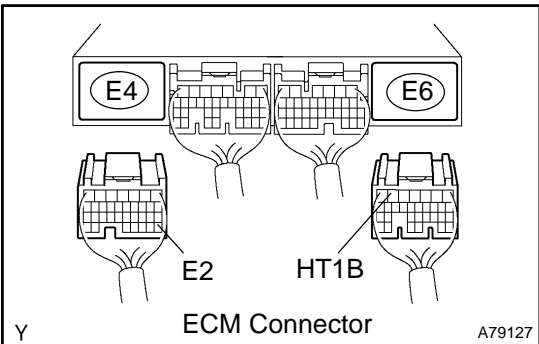
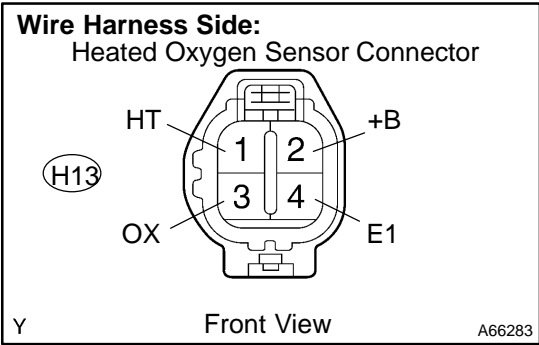
Standard:

Tester Connection	Specified Condition
HT1B (E6-6) - E2 (E4-28)	9 to 14 V

OK → REPLACE ECM (See page 10-24)

NG

4 CHECK HARNESS AND CONNECTOR(HEATED OXYGEN SENSOR - ECM, HEATED OXYGEN SENSOR - EFI M RELAY)



- (a) Check the harness and the connectors between the ECM and the heated oxygen sensor connectors.
 - (1) Disconnect the H13 heated oxygen sensor connector.
 - (2) Disconnect the E4 and E6 ECM connectors.
 - (3) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
HT (H13-1) - HT1B (E6-6)	Below 1 Ω
E1 (H13-4) - E2 (E4-28)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
HT (H17-2) or HT1B (E6-6) - Body ground	10 kΩ or higher
HT (H13-1) - +B (H13-2)	10 kΩ or higher

- (4) Reconnect the heated oxygen sensor connector.
- (5) Reconnect the ECM connectors.
- (b) Check the harness and the connectors between the heated oxygen sensor connector and the EFI M relay.
 - (1) Disconnect the H13 heated oxygen sensor connector.
 - (2) Remove the integration relay from the engine room R/B.
 - (3) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
+B (H13-2) - EFI M relay (3I-8)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
+B (H13-2) or EFI M relay (3I-8) - Body ground	10 kΩ or higher

- (4) Reconnect the heated oxygen sensor connector.
- (5) Reinstall the integration relay.

NG REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

REPLACE ECM (See page 10-24)