| DTC | P0171 | SYSTEM TOO LEAN (BANK 1) |
|---|---|---|

| DTC | P0172 | SYSTEM TOO RICH (BANK 1) |
|---|---|---|

| DTC | P0174 | SYSTEM TOO LEAN (BANK 2) |
|---|---|---|

| DTC | P0175 | SYSTEM TOO RICH (BANK 2) |
|---|---|---|

## CIRCUIT DESCRIPTION

The fuel trim is related to the feedback compensation value, not to the basic injection time. The fuel trim includes the short-term fuel trim and the long-term fuel trim.

The short-term fuel trim is the short-term fuel compensation used to maintain the air-fuel ratio at its ideal theoretical value. The signal from the heated oxygen sensor indicates whether the air-fuel ratio is RICH or LEAN compared to the ideal theoretical value, triggering a reduction in the fuel volume if the air-fuel ratio is RICH, and an increase in the fuel volume if it is LEAN.

The long-term fuel trim is the overall fuel compensation carried out in long-term to compensate for a continual deviation of the short-term fuel trim from the central value, due to individual engine differences, wear overtime and changes in the using environment.

If both the short-term fuel trim and the long-term fuel trim are LEAN or RICH beyond a certain value, it is detected as a malfunction and the MIL lights up.

| DTC No. | DTC Detection Condition | Trouble Area |
|---|---|---|
| P0171<br>P0174 | When air-fuel ratio feedback is stable after warming up engine, fuel trim is considerably in error on LEAN side<br>(2 trip detection logic) | • Air induction system<br>• Injector blockage<br>• Mass air flow meter<br>• Engine coolant temp. sensor<br>• Fuel pressure<br>• Gas leakage in exhaust system<br>• Open or short in heated oxygen sensor (bank 1, 2 sensor 1) circuit<br>• Heated oxygen sensor (bank 1, 2 sensor 1)<br>• Heated oxygen sensor heater (bank 1, 2 sensor 1)<br>• EFI relay<br>• PCV valve and hose<br>• PCV hose connection<br>• ECM |
| P0172<br>P0175 | When air-fuel ratio feedback is stable after warming up engine, fuel trim is considerably in error on RICH side<br>(2 trip detection logic) | • Injector leak, blockage<br>• Mass air flow meter<br>• Engine coolant temp. sensor<br>• Ignition system<br>• Fuel pressure<br>• Gas leakage in exhaust system<br>• Open or short in heated oxygen sensor (bank 1, 2 sensor 1) circuit<br>• Heated oxygen sensor (bank 1, 2 sensor 1)<br>• ECM |

HINT:

- When DTC ”P0171 or P0174” is recorded, the actual air-fuel ratio is on the LEAN side. When DTC ”P0172 or P0175” is recorded, the actual air-fuel ratio is on the RICH side.
- If the vehicle runs out of fuel, the air-fuel ratio is LEAN and DTC ”P0171 or P0174” is recorded. The MIL then comes on.

- If the total of the short-term fuel trim value and long-term fuel trim value is within ± 25 % (75 °C) or more, the system is functioning normally.

## WIRING DIAGRAM

Refer to DTC P0130 on page 05-60 .

## INSPECTION PROCEDURE

HINT:

Hand-held tester only:

The narrowing down the trouble area is possible by performing ACTIVE TEST of the following ”A/F CONTROL” (heated oxygen sensor or another can be distinguished).

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

HINT:

”A/F CONTROL” is an ACTIVE TEST which changes the injection volume to -12.5 % or +25 %.

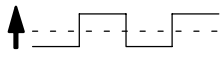
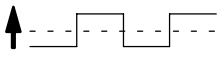
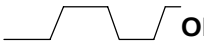
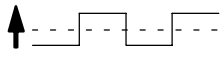
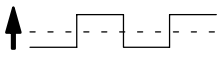
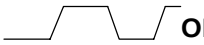
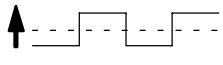
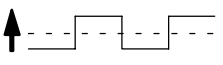
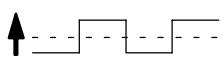
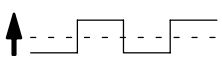
(1) Connect the hand-held tester to the DLC3 on the vehicle.
(2) Turn the ignition switch ON.
(3) Warm up the engine with the engine speed at 2,500 rpm for approx. 90 sec.
(4) Select the item ”DIAGNOSIS/ENHANCED OBD II/ACTIVE TEST/ A/F CONTROL”.
(5) Perform ”A/F CONTROL” when idle condition (press the right or left button).

**Result:**

**Heated oxygen sensor reacts in synchronizing 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:**

**However, there is a few second delay in the sensor 1 (front sensor) output. And there is about 20 seconds delay in the sensor 2 (rear sensor).**

| | Output voltage of heated oxygen sensor (sensor 1: front sensor) | Output voltage of heated oxygen sensor (sensor 2: rear sensor) | Mainly suspect trouble area |
|---|---|---|---|
| Case 1 | Injection volume<br>+25 %<br>-12.5 %<br>  <br>Output voltage<br>More than 0.55 V<br>Less than 0.4V<br>  <br>**OK** | Injection volume<br>+25 %<br>-12.5 %<br>  <br>Output voltage<br>More than 0.55 V<br>Less than 0.4V<br>  <br>**OK** | — |
| Case 2 | Injection volume<br>+25 %<br>-12.5 %<br>  <br>Output voltage<br>No reaction<br><br>**NG** | Injection volume<br>+25 %<br>-12.5 %<br>  <br>Output voltage<br>More than 0.55 V<br>Less than 0.4V<br>  <br>**OK** | Sensor 1: front sensor (sensor 1, heater, sensor 1 circuit) |
| Case 3 | Injection volume<br>+25 %<br>-12.5 %<br>  <br>Output voltage<br>More than 0.55 V<br>Less than 0.4V<br>  <br>**OK** | Injection volume<br>+25 %<br>-12.5 %<br>  <br>Output voltage<br>No reaction<br><br>**NG** | Sensor 2: rear sensor (sensor 2, heater, sensor 2 circuit) |
| Case 4 | Injection volume<br>+25 %<br>-12.5 %<br>  <br>Output voltage<br>No reaction<br><br>**NG** | Injection volume<br>+25 %<br>-12.5 %<br>  <br>Output voltage<br>No reaction<br><br>**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 enable that to check its output (show its graph indication) of heated oxygen sensor.

To display the graph indication. Select and push the ”YES or NO” button 2 data ”O2S B1S1 and O2S B1S2” or ”O2S B2S1 and O2S B2S2” and press button ”4” after selecting ”ACTIVE TEST/ A/F CONTROL/USER DATA”.

HINT:

- If different DTCs that are related to different system are output simultaneously while terminal E2 is used as a ground terminal, terminal E2 may be open.
- Read freeze frame data using the hand−held tester or the OBD II scan tool, 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.
- A high heated oxygen sensor (sensor 1) voltage (0.55 V or more) could be caused by a rich air fuel mixture. Check for conditions that would cause the engine to run rich.
- A low heated oxygen sensor (sensor 1) voltage (0.4 V or less) could be caused by a lean air fuel mixture. Check for conditions that would cause the engine to run lean.

| 1 | CHECK AIR INDUCTION SYSTEM |
|---|---|

(a) Check the vacuum leaks in air induction system.

NG → REPAIR OR REPLACE AIR INDUCTION SYSTEM

OK

| 2 | CHECK CONNECTION OF PCV HOSE (See page 12-3 ) |
|---|---|

NG → REPAIR OR REPLACE PCV HOSE

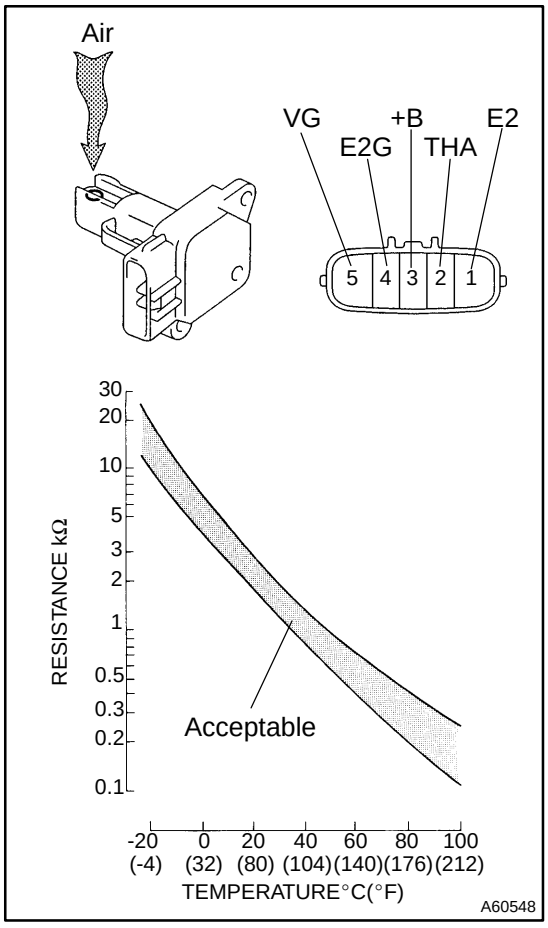
OK

| 3 | INSPECT FUEL INJECTOR ASSY(INJECTION AND VOLUME) (See page 11-7 ) |
|---|---|

NG → REPLACE FUEL INJECTOR ASSY

OK

| 4 | INSPECT MASS AIR FLOW METER |
|---|---|




(a) Output voltage inspection.
  (1) Apply battery voltage across terminals +B and E2G.
  (2) Connect the positive (+) tester prove to terminal VG, and negative (-) tester prove to terminal E2G.
  (3) Blow air into the mass air flow meter, and check that the voltage fluctuates.

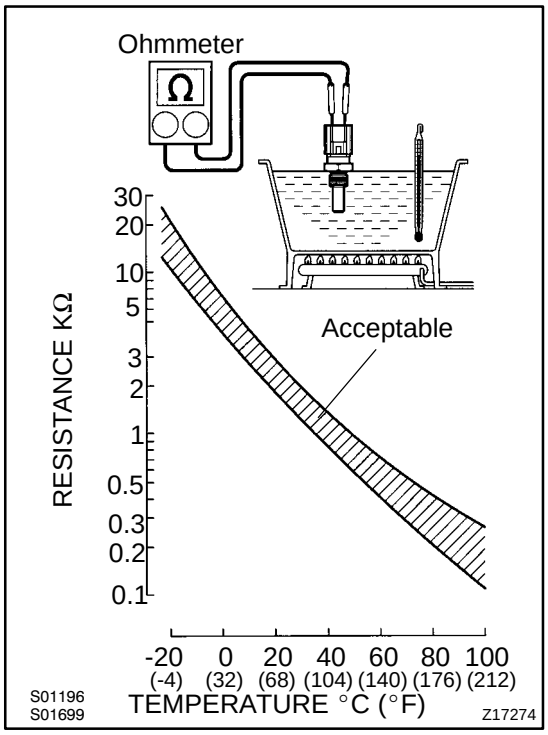
(b) Resistance inspection.
  (1) Measure the resistance between terminals THA and E2.

**Resistance:**
**12.5 - 16.9 kΩ at -20°C (-4 °F)**
**2.19 - 2.67 kΩ at 20°C (68°F)**
**0.50 - 0.68 kΩ at 60°C (140°F)**

NG → REPLACE MASS AIR FLOW METER

OK

| 5 | INSPECT ENGINE COOLANT TEMPERATURE SENSOR(RESISTANCE) |
|---|---|




(a) Measure the resistance between terminals.
**Resistance:**
**Approx. 20 °C (68 °F) 2.32 - 2.59 kΩ**
**Approx. 80 °C (176 °F) 0.310 - 0.326 kΩ**

**NOTICE:**
**In case of checking the engine coolant temperature sensor in the water, be careful not to allow water to go into the terminals, and after checking, wipe out the sensor.**

**NG** → **REPLACE ENGINE COOLANT TEMPERATURE SENSOR**

**OK**

| 6 | CHECK FOR SPARK AND IGNITION (See page 18-1 ) |
|---|---|

**NG** → **REPAIR OR REPLACE**

**OK**

| 7 | CHECK FUEL PRESSURE (See page 11-5 ) |
|---|---|

(a) Check the fuel pressure (high or low pressure).

**NG** → **CHECK AND REPLACE FUEL SYSTEM**

**OK**

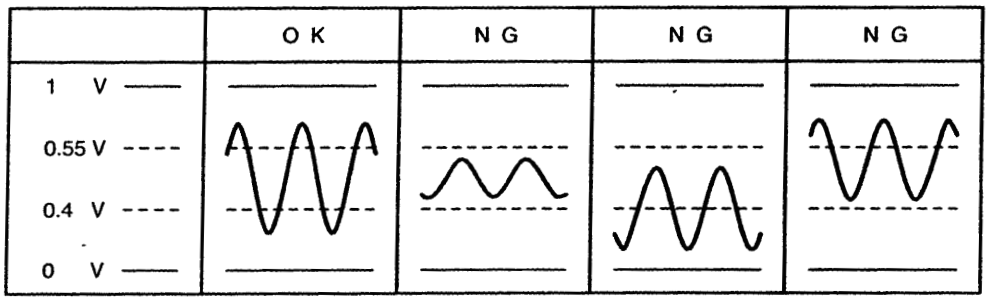
| 8 | CHECK FOR EXHAUST GAS LEAKAGE |
|---|---|

**NG** → **REPAIR OR REPLACE EXHAUST GAS LEAKAGE POINT (See page 15-2 )**

**OK**

| 9 | READ VALUE OF HAND-HELD TESTER OR OBD II SCAN TOOL(OUTPUT VOLTAGE OF HEATED OXYGEN SENSOR (BANK 1, 2 SENSOR 1)) |
|---|---|

(a) Warm up the heated oxygen sensor with the engine speed at 2,500 rpm for approximately 90 seconds.
(b) Read the output voltage of the heated oxygen sensor during idling.
**Heated oxygen sensor output voltage:**
**Alternates repeatedly between less than 0.4 V and more than 0.55 V (See the following table).**

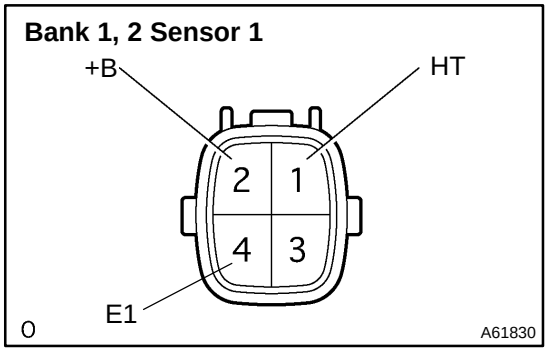


P18349

**OK** → **Go to step 17**

**NG**

| 10 | INSPECT HEATED OXYGEN SENSOR(HEATER RESISTANCE) |
|---|---|



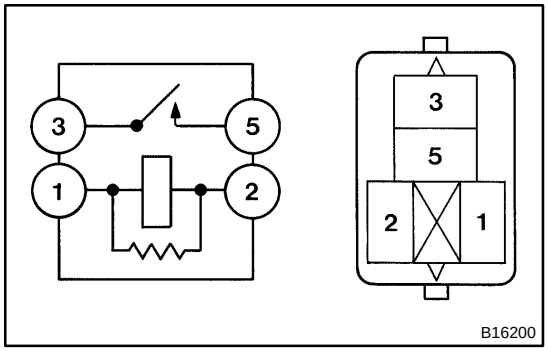

(a) Measure the resistance between the terminals of the heated oxygen sensor connector.
**Standard (Bank 1, 2 sensor 1):**

| Terminal No. | Resistance |
|---|---|
| 1 (HT) ⇔ 2 (+B) | 11 - 16 Ω at 20 °C (68 °F) |
| 1 (HT) ⇔ 4 (E1) | No Continuity |

**NG** → **REPLACE HEATED OXYGEN SENSOR**

**OK**

| 11 | INSPECT EFI RELAY |
|---|---|




(a) Remove the EFI relay from the engine room R/B.
(b) Inspect the EFI relay.
**Standard:**

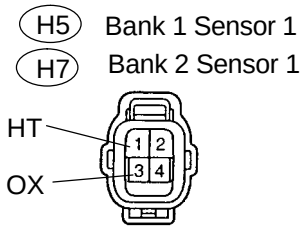
| Terminal No. | Condition | Specified condition |
|---|---|---|
| 1 ⇔ 2 | Constant | Continuity |
| 3 ⇔ 5 | Usually | No Continuity |
| | Apply B+ between Terminals 1 and 2 | Continuity |

**NG** → **REPLACE EFI RELAY**

**OK**

| 12 | CHECK HARNESS AND CONNECTOR(HEATED OXYGEN SENSOR - ECM) |
|---|---|

**Wire Harness Side**




Heated Oxygen Sensor Connector

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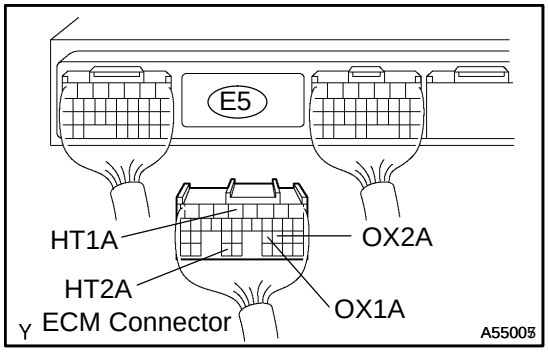



(a) Disconnect the H5 or H7 heated oxygen sensor connector.

(b) Disconnect the E5 ECM connector.

(c) Check the continuity between the wire harness side connectors.

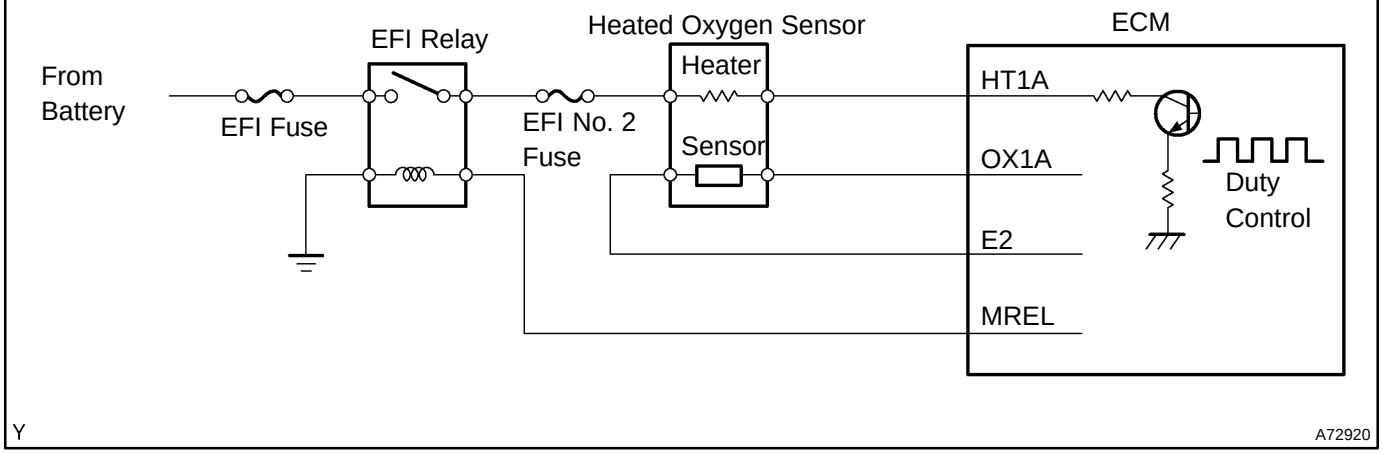
**Standard (Check for open):**

| Symbols (Terminal No.) | Specified condition |
|---|---|
| OX (H5-3) ⇔ OX1A (E5-23) | Continuity |
| HT (H5-1) ⇔ HT1A (E5-4) | |
| OX (H7-3) ⇔ OX2A (E5-22) | |
| HT (H7-1) ⇔ HT2A (E5-33) | |

**Standard (Check for short):**

| Symbols (Terminal No.) | Specified condition |
|---|---|
| OX (H5-3) or OX1A (E5-23) ⇔ Body ground | No continuity |
| HT (H5-1) or HT1A (E5-4) ⇔ Body ground | |
| OX (H7-3) or OX2A (E5-22) ⇔ Body ground | |
| HT (H7-1) or HT2A (E5-33) ⇔ Body ground | |

**Reference (Bank 1 Sensor 1 System Drawing)**




NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

| 13 | REPLACE HEATED OXYGEN SENSOR |
|---|---|

GO

| 14 | PERFORM CONFIRMATION DRIVING PATTERN (See page 05-60 ) |
|---|---|

GO

| 15 | READ OUTPUT DTC(DTC P0171, P0172, P0174 AND/OR P0175 ARE OUTPUT AGAIN) |
|---|---|

(a) Read the DTC using the hand-held tester or the OBD II scan tool.
**Result:**

| Display (DTC output) | Proceed to |
|---|---|
| DTC "P0171, P0172, P0174 and/or P0175" are not output again | A |
| DTC "P0171, P0172, P0174 and/or P0175" are output again | B |

**B** → **CHECK AND REPLACE ECM (See page 01-35 ) AND PERFORM CONFIRMATION DRIVING PATTERN (See page 05-60 )**

**A**

| 16 | CONFIRM VEHICLE RUNS OUT OF FUEL IN PAST |
|---|---|

**NO** → **CHECK FOR INTERMITTENT PROBLEMS (See page 05-5 )**

**YES**

**DTC IS CAUSED BY RUNNING OUT OF FUEL (DTCS P0171, P0172, P0174 AND/OR P0175)**

| 17 | PERFORM CONFIRMATION DRIVING PATTERN (See page 05-60 ) |
|---|---|

**GO**

| 18 | READ OUTPUT DTC(DTC P0171, P0172, P0174 AND/OR P0175 ARE OUTPUT AGAIN) |
|---|---|

(a) Read the DTC using the hand-held tester or the OBD II scan tool.
**Result:**

| Display (DTC output) | Proceed to |
|---|---|
| DTC "P0171, P0172, P0174 and/or P0175" are output again | A |
| DTC "P0171, P0172, P0174 and/or P0175" are not output again | B |

**B** → **Go to step 21**

**A**

| 19 | REPLACE HEATED OXYGEN SENSOR |
|---|---|

**GO**

| 20 | READ OUTPUT DTC(DTC P0171, P0172, P0174 AND/OR P0175 ARE OUTPUT AGAIN) |
|---|---|

(a) Read the DTC using the hand-held tester or the OBD II scan tool.

**Result:**

| Display (DTC output) | Proceed to |
|---|---|
| DTC "P0171, P0172, P0174 and/or P0175" are not output again | A |
| DTC "P0171, P0172, P0174 and/or P0175" are output again | B |

**B** → **CHECK AND REPLACE ECM (See page 01-35 ) AND PERFORM CONFIRMATION DRIVING PATTERN (See page 05-60 )**

**A**

| 21 | CONFIRM VEHICLE RUNS OUT OF FUEL IN PAST |
|---|---|

**NO** → **CHECK FOR INTERMITTENT PROBLEMS (See page 05-5 )**

**YES**

**DTC IS CAUSED BY RUNNING OUT OF FUEL (DTCS P0171, P0172, P0174 AND/OR P0175)**