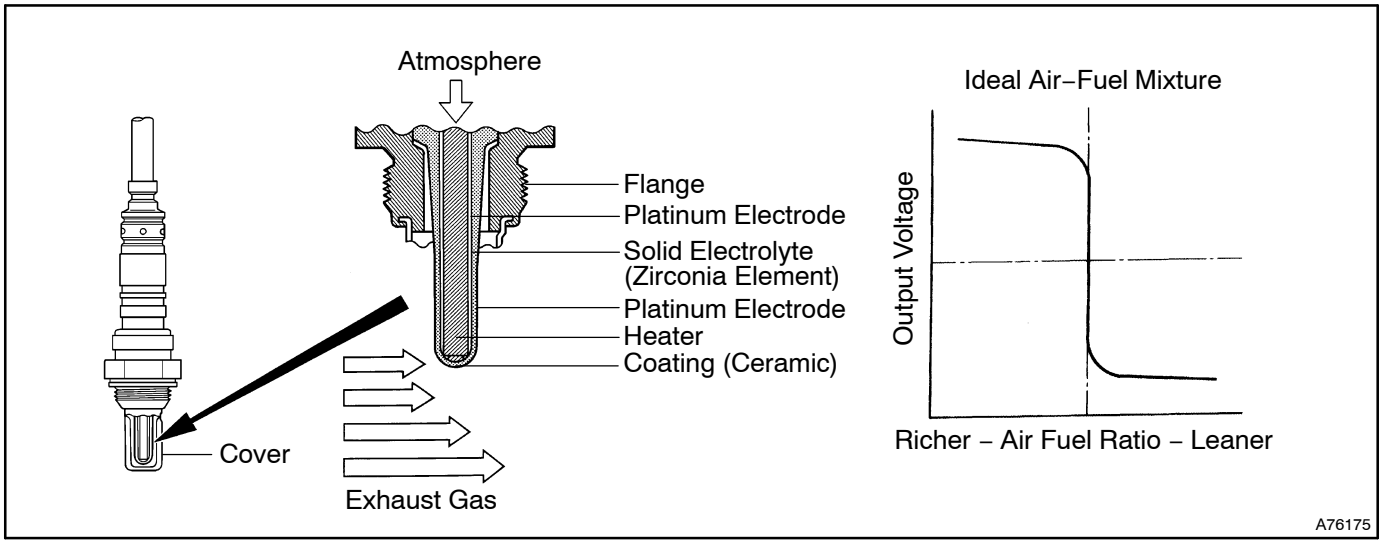
| DTC | P0130/21 | OXYGEN SENSOR CIRCUIT (BANK 1 SENSOR 1) |
|---|---|---|

## CIRCUIT DESCRIPTION

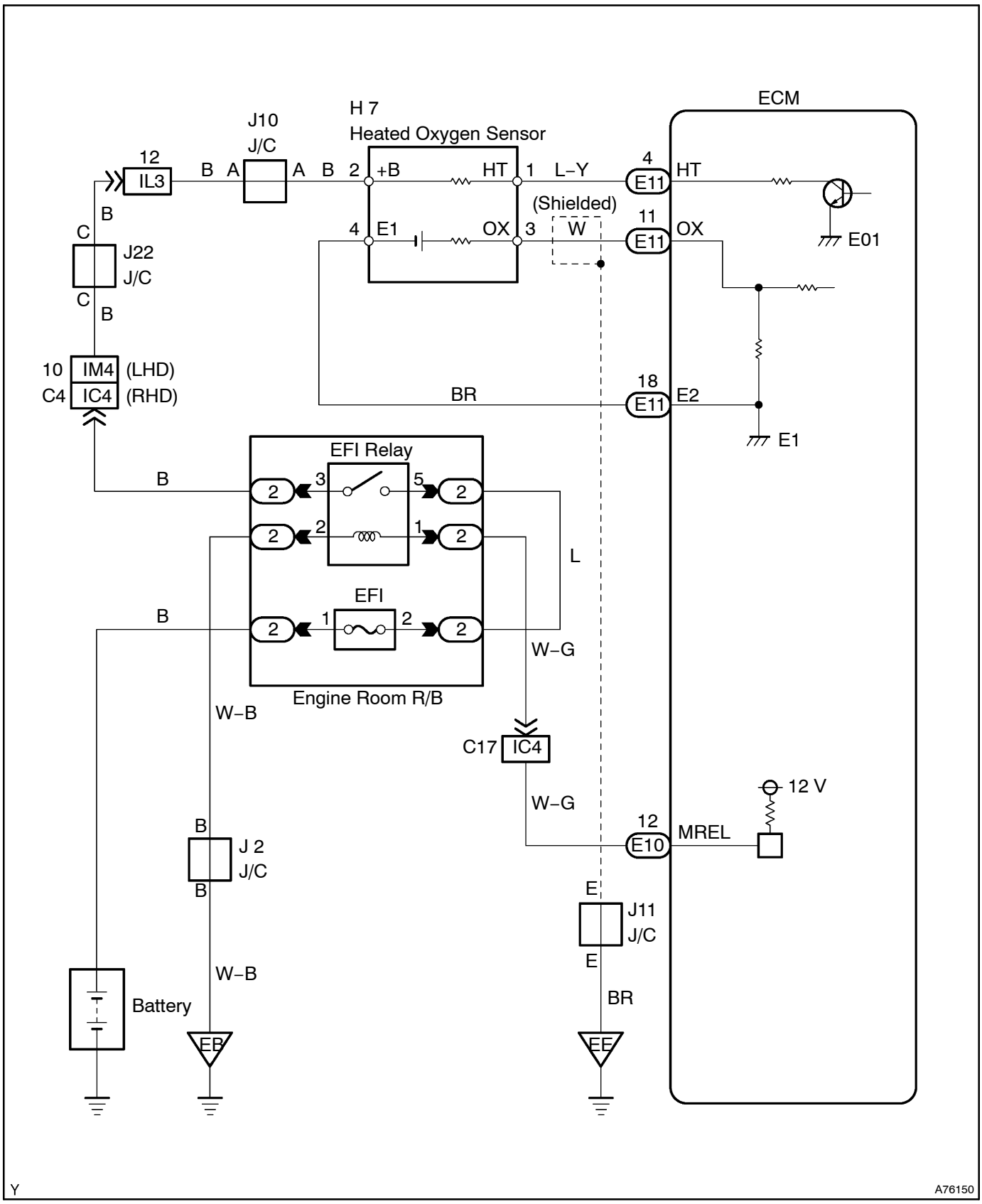
To obtain a high purification rate for the CO, HC and NOx components of the exhaust gas, a three–way catalytic converter is used, but for the most efficient use of the three–way catalytic converter, the air–fuel ratio must be precisely controlled so that it is always close to the stoichiometric air–fuel ratio.
The heated oxygen sensor has the characteristic where by its output voltage changes suddenly in the vicinity of the stoichiometric air–fuel ratio. This is used to detect the oxygen concentration in the exhaust gas and provide the ECM with feedback to control of the air–fuel ratio.
When the air–fuel ratio becomes LEAN, the oxygen concentration in the exhaust gas increases. And the heated oxygen sensor informs the ECM of the LEAN condition (small electromotive force: < 0.45 V).
When the air–fuel ratio is RICHER than the stoichiometric air–fuel ratio, the oxygen concentration in the exhaust gas is reduced. And the heated oxygen sensor informs the ECM of the RICH condition (large electromotive force: > 0.45 V). The ECM judges by the electromotive force from the heated oxygen sensor whether the air–fuel ratio is RICH or LEAN and controls the injection time accordingly. However, if the malfunction of the heated oxygen sensor causes an output of abnormal electromotive force, the ECM becomes unable to perform the accurate air–fuel ratio control.
The heated oxygen sensor is include a heater which heats the zirconia element. The heater is controlled by the ECM. When the intake air volume is low (the temperature of the exhaust gas is low), current flows to the heater in order to heat the sensor for the accurate oxygen concentration detection.



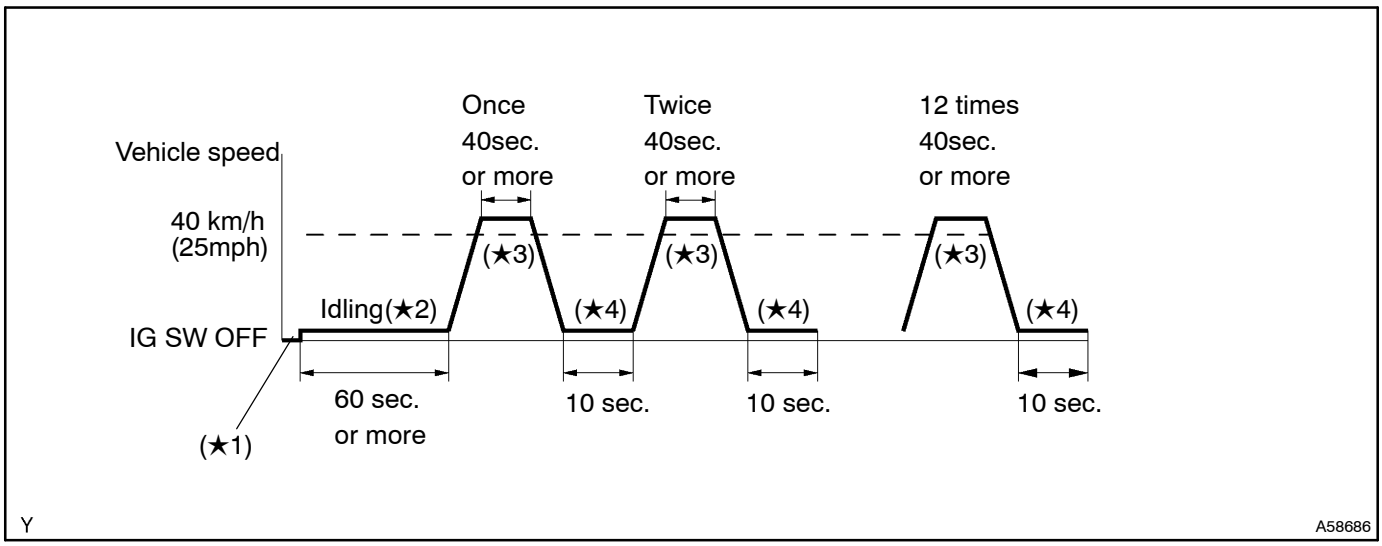

| DTC No | DTC Detecting Condition | Trouble Area |
|---|---|---|
| P0130/21 | After engine is warmed up, heated oxygen sensor output does not indicate RICH (≧ 0.45 V) even once when condition (a), (b), (c) and (d) continue for at least 15 sec.:<br>(a) Engine speed: 1,000 rpm or more<br>(b) Vehicle speed: 40 – 100 km/h (25 – 62 mph)<br>(c) Throttle valve is not fully closed<br>(d) 80 sec. or more after starting engine | • Open or short in heated oxygen sensor circuit<br>• PCV hose<br>• Air induction system<br>• Fuel pressure<br>• Heated oxygen sensor<br>• Fuel injector<br>• Gas leakage in exhaust system<br>• ECM |

HINT:
After confirming DTC P0130/21, use the hand–held tester to confirm the output voltage of the heated oxygen sensor from the ”DIAGNOSIS/ENHANCED OBD II/DATA LIST/ALL DATA”. If voltage output of heated oxygen sensor is less than 0.1 V, the heated oxygen sensor circuit may be open or short.

# WIRING DIAGRAM



## CONFIRMATION DRIVING PATTERN




1. **Connect the hand–held tester to the DLC3. (★1)**
2. **Switch the hand–held tester from the normal mode to the check (test) mode (See page 05–86). (★1)**
3. **Start the engine and let the engine idle for 60 seconds or more. (★2)**
4. **Drive the vehicle at 40 km/h (25 mph) or more for 40 seconds or more. (★3)**
5. **Let the engine idle for 10 seconds or more. (★4)**
6. **Perform steps (★3) to (★4) 12 times. (★5)**

HINT:

If a malfunction exists, the CHECK ENG will light up on the multi information display during step (★5).

**NOTICE:**

**If the conditions in this test are not strictly followed, detection of the malfunction will not be possible.**

**If you do not have a hand–held tester, turn the ignition switch OFF after performing steps from (★2) to (★5), then perform steps from (★2) to (★5) again.**

# INSPECTION PROCEDURE

HINT:

- Read freeze frame data using the hand–held tester, as freeze frame data records the engine conditions when the 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.
- If different DTCs that are related to different systems are output simultaneously while terminal E2 is used as a ground terminal, terminal E2 may be open.

## When using hand–held tester:

| | |
|---|---|
| 1 | CHECK OTHER DTC OUTPUT (BESIDES P0130/21) |

**RESULT:**

| DTC | Proceed to |
|---|---|
| Only P0130/21 is output | A |
| Other DTCs are output besides P0130/21 | B |

HINT:

If any other codes besides P0130/21 is output, perform the troubleshooting for that DTC first.

B → GO TO RELEVANT DTC CHART (See page 05–94)

A

| | |
|---|---|
| 2 | READ VALUE OF HAND–HELD TESTER (OUTPUT VOLTAGE OF HEATED OXYGEN SENSOR) |

(a) Warm up the engine to the normal operating temperature above 75°C (169°F).

(b) Read the output voltage of the heated oxygen sensor when the engine is suddenly raced.

**Standard:**

**Heated oxygen sensor outputs a RICH signal (0.45 V or more) at least once**

HINT:

Perform a quick racing to 4,000 rpm 3 times by using the accelerator pedal.

OK → Go to step 11

NG

| | |
|---|---|
| 3 | CHECK CONNECTION OF PCV HOSE |

NG → REPAIR OR REPLACE PCV HOSE

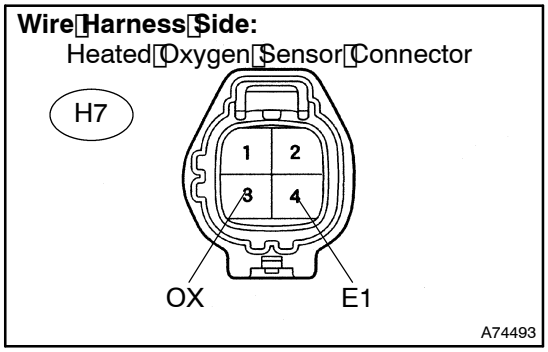
OK

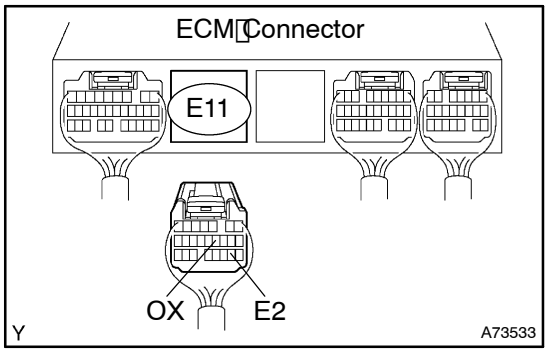
| | |
|---|---|
| 4 | INSPECT HEATED OXYGEN SENSOR (See page 12–5) |

NG → REPLACE HEATED OXYGEN SENSOR

OK

| 5 | CHECK HARNESS AND CONNECTOR (HEATED OXYGEN SENSOR ⇔ ECM) |
|---|---|




(a) Disconnect the H7 heated oxygen sensor connector.
(b) Disconnect the E11 ECM connector.
(c) Check the continuity between the wire harness side connectors.

**Standard (Check for open):**

| Symbols (terminal No.) | Specified condition |
|---|---|
| OX (H7–3) ⇔ OX (E11–11) | Continuity |
| E1 (H7–4) ⇔ E2 (E11–18) | |

**Standard (Check for short):**

| Symbols (terminal No.) | Specified condition |
|---|---|
| OX (H7–3) or OX (E11–11) ⇔ Other terminal and body ground | No continuity |

NG → CHECK AND REPLACE HARNESS OR CONNECTOR

OK

| 6 | CHECK WHETHER MISFIRE IS OCCURRED OR NOT BY MONITORING DTC AND DATA LIST |
|---|---|

NG → CHECK FOR SPARK AND IGNITION

OK

| 7 | CHECK AIR INDUCTION SYSTEM |
|---|---|

NG → REPAIR OR REPLACE AIR INDUCTION SYSTEM

OK

| 8 | CHECK FUEL PRESSURE (See page 11–4) |
|---|---|

NG → REPAIR OR REPLACE FUEL SYSTEM

OK

| | |
|---|---|
| 9 | INSPECT FUEL INJECTOR ASSY (INJECTION VOLUME) (See page 11–6) |

NG → REPLACE FUEL INJECTOR ASSY (See page 11–11)

OK

| | |
|---|---|
| 10 | CHECK FOR EXHAUST GAS LEAKS |

NG → REPAIR OR REPLACE EXHAUST GAS LEAKAGE POINT

OK

REPLACE HEATED OXYGEN SENSOR

| | |
|---|---|
| 11 | PERFORM CONFIRMATION DRIVING PATTERN |

(a) Clear the DTC. (See page 05–86)
(b) Warm up the heated oxygen sensor by a driving test to check the system.
HINT:
Refer to CONFIRMATION DRIVING PATTERN.

GO

| | |
|---|---|
| 12 | READ OUTPUT DTC (DTC P0130/21 IS OUTPUT AGAIN) |

**RESULT:**

| DTC | Proceed to |
|---|---|
| Only P0130/21 is output | A |
| Other DTCs are output besides P0130/21 | B |

A → REPLACE HEATED OXYGEN SENSOR

B

| | |
|---|---|
| 13 | CONFIRM VEHICLE RAN OUT OF FUEL IN PAST |

(a) Confirm if the vehicle ran out of fuel or not in the past.
HINT:
There is no problem, if DTC P0130/21 is not output after the CONFIRMATION DRIVING PATTERN. This means that the ECM records DTC P0130/21 because of the running out of fuel in the past.

YES → CHECK FOR INTERMITTENT PROBLEMS (See page 05–86)

YES

DTC IS CAUSED BY RUNNING OUT OF FUEL

## When not using hand-held tester:

| 1 | CHECK OTHER DTC OUTPUT (BESIDES P0130/21) |
|---|---|

**RESULT:**

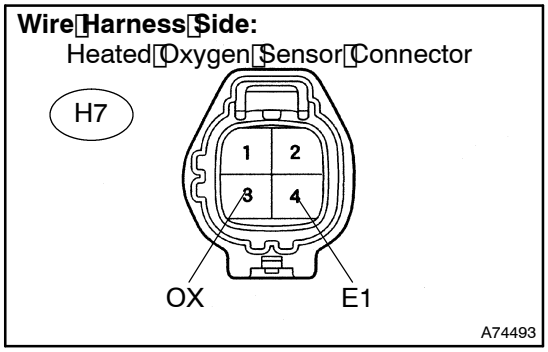
| DTC | Proceed to |
|---|---|
| Only P0130/21 is output | A |
| Other DTCs are output besides P0130/21 | B |

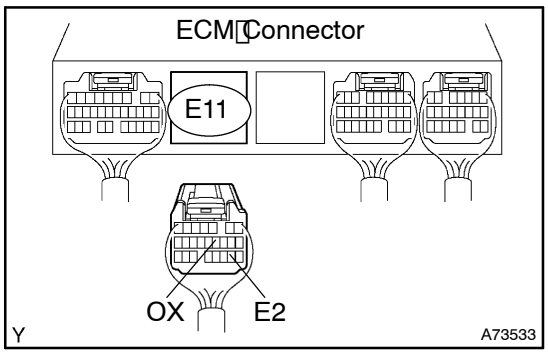
HINT:
If any other codes besides P0130/21 is output, perform the troubleshooting for that DTC first.

**B** → **GO TO RELEVANT DTC CHART (See page 05–94)**

**A**

| 2 | CHECK HARNESS AND CONNECTOR (HEATED OXYGEN SENSOR ⇔ ECM) |
|---|---|




(a) Disconnect the H7 heated oxygen sensor connector.
(b) Disconnect the E11 ECM connector.
(c) Check the continuity between the wire harness side connectors.

**Standard (Check for open):**

| Symbols (terminal No.) | Specified condition |
|---|---|
| OX (H7–3) ⇔ OX (E11–11) | Continuity |
| E1 (H7–4) ⇔ E2 (E11–18) | |

**Standard (Check for short):**

| Symbols (terminal No.) | Specified condition |
|---|---|
| OX (H7–3) or OX (E11–11) ⇔ Other terminal and body ground | No continuity |

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

**OK**

**REPLACE HEATED OXYGEN SENSOR**