DTC	P0136	OXYGEN SENSOR CIRCUIT MALFUNCTION (BANK 1 SENSOR 2)

DTC	P0156	OXYGEN SENSOR CIRCUIT MALFUNCTION (BANK 2 SENSOR 2)

HINT:

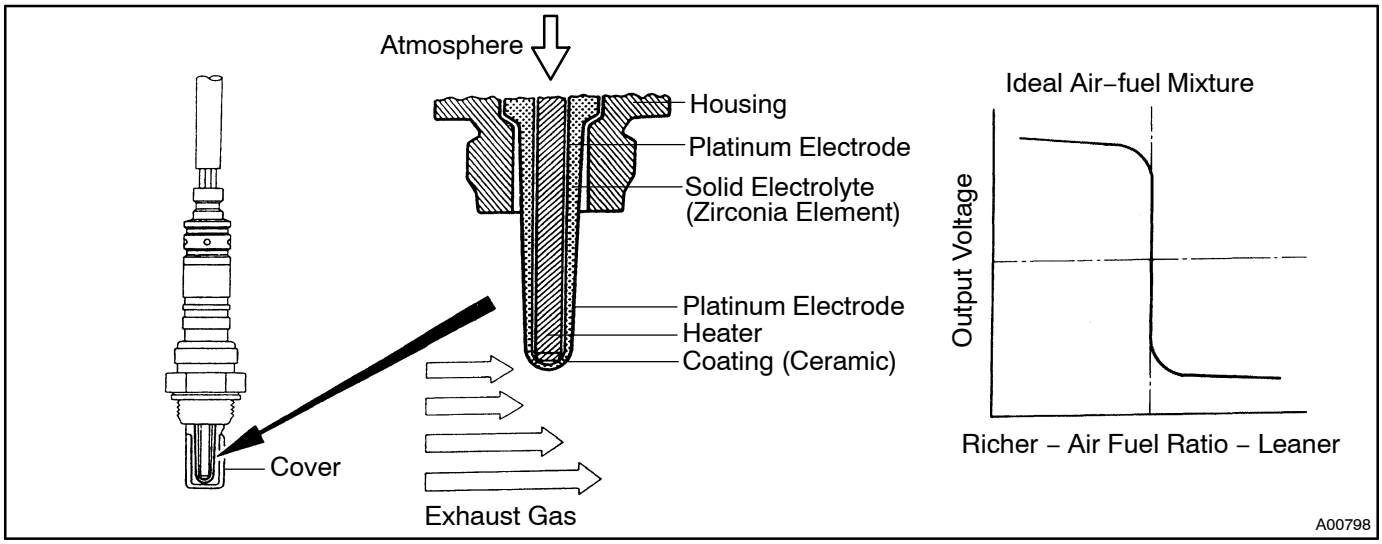
- Bank 1 refers to the bank that includes cylinder No. 1.
- Bank 2 refers to the bank that does not include cylinder No. 1.
- Cylinder No. 1 is located in the front part of the engine, opposite the transmission.
- Sensor 2 refers to the sensor farthest away from the engine body.

CIRCUIT DESCRIPTION

The Heated Oxygen Sensor (HO2S) is used to monitor oxygen concentration in the exhaust gas. For optimum catalytic converter operation, the air–fuel mixture must be maintained near the ideal stoichiometric ratio. The HO2S output voltage changes suddenly in the vicinity of the stoichiometric ratio. The ECM adjusts the fuel injection time so that the air–fuel ratio is nearly stoichiometric. The HO2S generates a voltage between 0.1 and 0.9 V in response to oxygen concentration in the exhaust gas.

If the oxygen concentration in the exhaust gas increases, the air–fuel ratio is called LEAN. The HO2S voltage drops below 0.45 V, which informs the ECM of the LEAN condition.

If oxygen is not in the exhaust gas, the air–fuel ratio is called RICH. The HO2S voltage increases above 0.45 V, which informs the ECM of the RICH condition.



DTC No	DTC Detection Condition	Trouble Area
P0136 P0156	One of the following conditions (a), (b) and (c) : (a) HO2S (sensor 2) voltage remains Lean (below 0.4 V) or Rich (above 0.5 V) while the vehicle is repeating acceleration and deceleration for 4 to 8 minutes. (b) HO2S (sensor 2) voltage remains extremely low for a long time. (c) HO2S (sensor 2) voltage does not drop to below 0.2 V immediately when fuel–cut starting.	• Open or short in HO2S (sensor 2) circuit • HO2S (sensor 2) • HO2S (sensor 2) heater • EFI MAIN relay

MONITOR DESCRIPTION

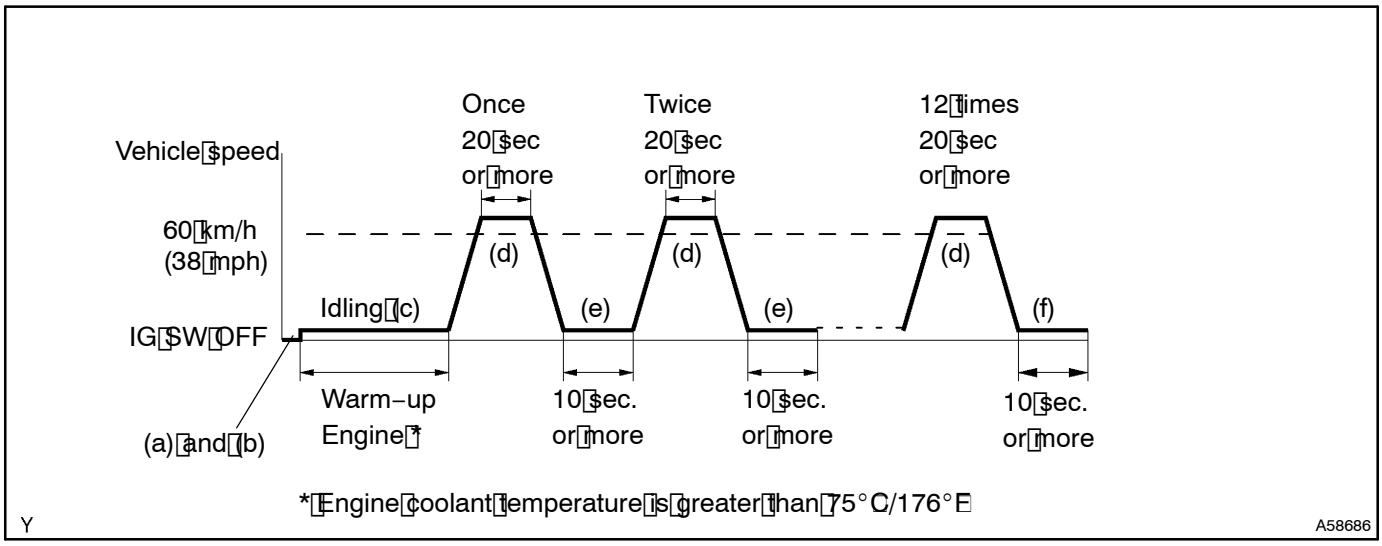
The ECM monitors the HO2S (sensor 2) by checking to make sure:

- The HO2S voltage does not remain Rich (above 0.5 volts) or Lean (below 0.4 volts) while the vehicle is accelerating and decelerating for 4 to 8 minutes. If the voltage remains either Rich or Lean, the ECM interprets this as a malfunction, illuminates the MIL and sets a DTC.
- The HO2S voltage does not remain at less than 0.05 V for a long time while the vehicle is running. If the voltage remains at less than 0.05 V for a long time, the ECM interprets this as a malfunction, illuminates the MIL and sets a DTC.
- The sensor's voltage drops to below 0.2 V (extremely Lean status) immediately when the vehicle decelerates and fuel–cut is operating. If the voltage does not drops to below 0.2 V, the ECM determine that the sensor's response feature has deteriorated, illuminates the MIL and sets a DTC.

WIRING DIAGRAM

Refer to DTC P0031 on page 05–54.

CONFIRMATION DRIVING PATTERN



(a) Connect the Intelligent Tester II to the DLC3.
(b) Switch from normal mode to check mode (see page 05–27).
(c) Warm up the engine until the engine coolant temperature reaches to 75°C (167°F).
(d) Drive the vehicle at 60 km/h (38 mph) or more for 20 seconds or more.
(e) Allow the engine to idle for 10 seconds or more.
(f) Perform steps (d) to (e) at least 12 times.

HINT:

If a malfunction exists, the MIL is illuminated during step (f).

NOTICE:

If the conditions in this test are not strictly followed, detection of a malfunction will not occur. If you do not have the Intelligent Tester II, turn the ignition switch OFF after performing steps from (c) to (f), then perform steps from (c) to (f) again.

INSPECTION PROCEDURE

HINT:

It is possible the malfunctioning area can be found using the active test ”Control the injection volume A/F sensor” operation. The active test can determine if the HO2S or othe potential trouble areas are malfunctioning or not.

The injection volume can be switched to –12.5 % (decrease) or +25 % (increase) by the active test.

The active test procedure enables a technician to check and graph the voltage outputs of the HO2Ss.

Procedure:

(a) Connect the Intelligent Tester II to the DLC3 on the vehicle.

(b) Turn the ignition switch ON.

(c) Warm up the engine by running the engine at 2,500 rpm for approximately 90 seconds.

(d) Enter the following menus: Active Test/ Control the injection volume A/F sensor.

(e) Perform the active test at the engine idling.

Standard:

The HO2S 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:

The HO2S (sensor 1) output has a few seconds of delay and the HO2S (sensor 2) output has a maximum of 20 seconds of delay.

If the vehicle is short of fuel, the air–fuel ratio becomes LEAN and the DTCs will be recorded.

Case	HO2S Voltage (Sensor 1)	HO2S Voltage (Sensor 2)	Main Suspected Trouble Area
1	Injection Volume +25 % –12.5 % HO2S Voltage 0.55 V or more Below 0.4 V **OK**	Injection Volume +25 % –12.5 % HO2S Voltage 0.5 V or more Below 0.4 V **OK**	–
2	Injection Volume +25 % –12.5 % HO2S Voltage Almost no reaction **NG**	Injection Volume +25 % –12.5 % HO2S Voltage 0.5 V or more Below 0.4 V **OK**	HO2S (sensor 1) HO2S heater (sensor 1)
3	Injection Volume +25 % –12.5 % HO2S Voltage 0.55 V or more Below 0.4 V **OK**	Injection Volume +25 % –12.5 % HO2S Voltage Almost no reaction **NG**	HO2S (sensor 2) HO2S heater (sensor 2)
4	Injection Volume +25 % –12.5 % HO2S Voltage Almost no reaction **NG**	Injection Volume +25 % –12.5 % HO2S Voltage Almost no reaction **NG**	Injector Fuel Pressure Exhaust Gas Leak etc. (Air–Fuel ratio is extremely Lean or Rich)

HINT:
Read freeze frame data using the Intelligent Tester II. Freeze frame data records the engine conditions when a 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.

1	CHECK OTHER DTC OUTPUT

(a) Connect the Intelligent Tester II to the DLC3.
(b) Turn the ignition switch ON and push the tester's main switch ON.
(c) Enter the following menus: Enter/ Power train/ Engine and ECT/ DTC/ Current DTC.
(d) Read the DTCs.
Result:

Display (DTC output)	Proceed to
P0136 or P0156	A
P0136 or P0156 and other DTCs	B

HINT:
If any other codes besides P0136 or P0156 are output, perform the troubleshooting for those DTCs first.

B → **GO TO RELEVANT DTC CHART** (See page 05–36)

A

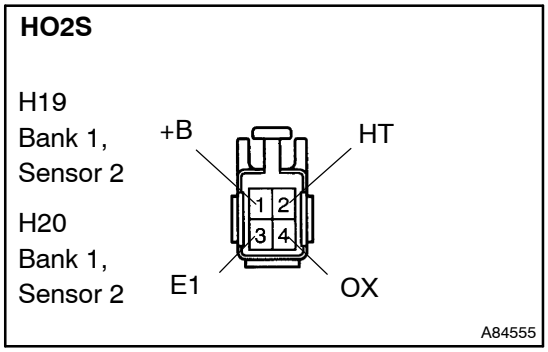
2	READ VALUE OF INTELLIGENT TESTER II (HO2S VOLTAGE)

(a) Connect the Intelligent Tester II to the DLC3.
(b) Enter the following menus: Enter/ Diagnosis/ OBD·MOBD/ Power train/ Engine and ECT/ Data List/ All Data/ O2S B1S2 (B2S2).
(c) Allow the engine to run at 2,500 rpm for 3 minutes.
(d) Depress the accelerator pedal quickly to fully open until the engine rpm reaches 4,000 rpm 3 times.
OK: HO2S voltage alternates from below 0.4 V to 0.5 V or more.

OK → **Go to step 6**

NG

3 INSPECT HEATED OXYGEN SENSOR (HEATER RESISTANCE)



(a) Disconnect the H19, H20 HO2S connector.

(b) Measure the resistance between the terminals of the HO2S.

Standard:

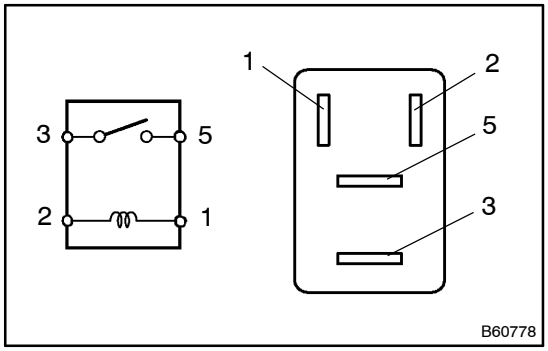
Tester Connection	Specified Condition
H19–2 (HT) – H19–1 (+B)	5 to 10 Ω at 20°C (68°F)
H19–2 (HT) – H19–3 (E1)	10 kΩ or higher
H20–2 (HT) – H20–1 (+B)	5 to 10 Ω at 20°C (68°F)
H20–2 (HT) – H20–3 (E1)	10 kΩ or higher

(c) Reconnect the HO2S connector.

NG → **REPLACE HEATED OXYGEN SENSOR**

OK

4 INSPECT EFI MAIN RELAY



(a) Remove the EFI MAIN relay from the engine room Relay block (R/B).

(b) Measure the resistance of the EFI MAIN relay.

Standard:

Tester Connection	Specified Condition
3 – 5	10 kΩ or higher
3 – 5	Below 1 Ω (apply battery voltage to terminals 1 and 2)

(c) Reinstall the EFI MAIN relay.

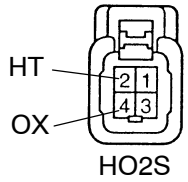
NG → **REPLACE EFI MAIN RELAY**

OK

5 CHECK WIRE HARNESS

Wire Harness Side

H19 Bank 1 Sensor 2
H20 Bank 2 Sensor 2



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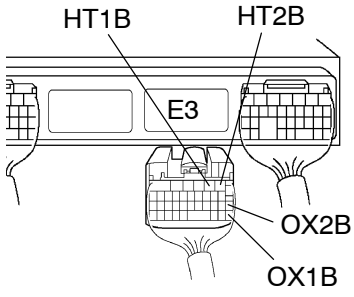
ECM



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(a) Disconnect the H19 and H20 HO2S connectors.
(b) Disconnect the E3 ECM connector.
(c) Measure the resistance between the wire harness side connectors.

Standard:

Tester Connection	Specified Condition
H19–4 (OX) – E3–28 (OX1B)	Below 1 Ω
H19–2 (HT) – E3–2 (HT1B)	Below 1 Ω
H20–4 (OX) – E3–17 (OX2B)	Below 1 Ω
H20–2 (HT) – E3–1 (HT2B)	Below 1 Ω
H19–4 (OX) or E3–28 (OX1B) – Body ground	10 kΩ or higher
H19–2 (HT) or E3–2 (HT1B) – Body ground	10 kΩ or higher
H20–4 (OX) or E3–17 (OX2B) – Body ground	10 kΩ or higher
H20–2 (HT) or E3–1 (HT2B) – Body ground	10 kΩ or higher

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

OK

REPLACE HEATED OXYGEN SENSOR

6 PERFORM CONFIRMATION DRIVING PATTERN

HINT:
Clear all DTCs prior to performing the confirmation driving pattern.

NEXT

7 READ OUTPUT DTC

Display (DTC output)	Proceed to
P0136 or P0156	A
No output	B

B → **CHECK FOR INTERMITTENT PROBLEMS** (See page 05–11)

A

REPLACE HEATED OXYGEN SENSOR