

DTC	P0136	Oxygen Sensor Circuit Malfunction (Bank 1 Sensor 2)
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DTC	P0156	Oxygen Sensor Circuit Malfunction (Bank 2 Sensor 2)
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CIRCUIT DESCRIPTION

Refer to DTC P0031 on page [DI-53](#).

DTC No.	DTC Detecting Condition	Trouble Area
P0136 P0156	The following condition (a) or (b) continues 300 sec. or more. (a) During driving with the engine warmed up, heated oxygen sensor output does not change. (b) Heated oxygen sensor output is very low most of the time.	• Open or short in heated oxygen sensor circuit • Heated oxygen sensor • Heated oxygen sensor heater • EFI or ECD relay

HINT:

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

MONITOR DESCRIPTION

The ECM monitors the rear heated oxygen sensor in the following 3 items:

- (1) If the rear heated oxygen sensor voltage changes between Rich and Lean while the vehicle is running (repeating acceleration and deceleration). If not, the ECM interprets this as a malfunction, illuminates the MIL, and then sets DTC.
- (2) If the rear heated oxygen sensor voltage does not remain at less than 0.05 V for a long time while the vehicle is running. If not, the ECM interprets this as a malfunction, illuminates the MIL, and then sets DTC.
- (3) If the sensor's voltage drops to below 0.2 V (extremely Lean status) immediately when the vehicle decelerates and the fuel cut is working. If not, the ECM interprets this to mean the sensor's response feature has deteriorated, illuminates the MIL, and then sets DTC.

MONITOR STRATEGY

Related DTCs	P0136	Heated rear oxygen sensor output voltage (Crack) (Bank 1)
		Heated rear oxygen sensor output voltage (Bank 1)
		Heated rear oxygen sensor slow response (Bank 1)
	P0156	Heated rear oxygen sensor output voltage (Crack) (Bank 2)
		Heated rear oxygen sensor output voltage (Bank 2)
		Heated rear oxygen sensor slow response (Bank 2)
Required sensors/components	Main sensors/components	Heated rear oxygen sensor
	Related sensors/components	Mass air flow meter, Vehicle speed sensor
Frequency of operation	Once per drive cycle	
Duration	300 sec.	
MIL operation	2 driving cycles	
Sequence of operation	None	

TYPICAL ENABLING CONDITIONS

Output voltage:

Item	Specification
All following conditions A to B are met	
A. Pass/Fail detection in this driving cycle	Not detected
B. Engine	Running
C. Time after engine start	0 sec. or more
D. One of the following condition is met	
1. Cumulative time while oxygen sensor heater is on	22 sec. or more
At once or more oxygen sensor voltage	0.2 V or more

Output voltage (Check):

Item	Specification
"First" condition is met when the following condition met	
Engine	Running
"Second" condition is met when the following conditions are all met.	
1. "First" condition	Met
2. Vehicle speed	3 km/h (1.9 mph) or more
3. Sub-feedback	Executing
4. Time after sub-feedback start	0.5 sec. or more
5. Idle	OFF
6. Fuel cut	OFF
7. Time after fuel cut ON to OFF	40 sec. or more
8. Intake air amount	0.7 g/rev or more
9. Pass/fail detection in this driving cycle	Not detected
10. Following sensor active condition A or B is met	

A. Cumulative time while oxygen sensor heater is ON	0 sec. or more
B. At once or more sensor output voltage	0 V or more

Voltage during fuel cut:

Item	Specification
All following condition are met	
Rear oxygen sensor voltage before the fuel cut operation	0.2 V or more
Engine coolant temperature	75°C (167°F) or more
Fuel cut	Continues
Pass/fail detection in this driving cycle	Not detected

TYPICAL MALFUNCTION THRESHOLDS**Output voltage:**

Detection Criteria	Threshold
All following condition are met	
A. Number of oxygen sensor voltage swishing (When the sensor signal crossed both the minimum voltage and maximum voltage)	0 times (Maximum voltage 0.5 V or more, Minimum voltage less than 0.4)
B. Cumulative rear oxygen sensor Monitor time (*1)	240 sec. or more
*1: Monitor time counted while all following conditions are met	
1. Engine coolant temperature	75°C or more
2. Sub-feedback	Executing

Output voltage (check):

Detection Criteria	Threshold
All following conditions A to E are met	
A. Cumulative rear oxygen sensor monitor time (*1)	5 min. or more
B. Cumulative rear oxygen sensor output is in Area 1	3 min. or more
C. Cumulative rear oxygen sensor output is in Area 4	Less than 1 min.
D. Cumulative rear oxygen sensor output is in Area 3 (*3) and Area 4 (*4)	Less than 2 min.
E. Maximum rear O2 sensor rich time (*5)	Less than 20 sec.
*1: "Second" condition	Met
*2: Time is counted when the following conditions 1 and 2 are met	
1. Rear O2 sensor voltage	Less than 0.05 V
2. "Second" condition	Met
*3: Time is counted when the following conditions 1 and 3 are met	
1. Rear O2 sensor voltage	0.45 V or more
2. Rear O2 sensor voltage	Less than 0.7 V
3. "Second" condition	Met
*4: Time is counted when the following conditions 1 and 2 are met	
1. Rear O2 sensor voltage	0.7 V or more
2. "Second" condition	Met
*5: Rear O2 sensor rich time is counted when the following conditions 1 and 2 are met	
1. "Second condition"	Met
2. Rear O2 sensor voltage	0.45 V or more

COMPONENT OPERATING RANGE:

Parameter	Standard Value
Heated oxygen sensor voltage	0 to 1 V

O2S TEST RESULT

Refer to page [DI-3](#) for detailed information.

Rear HO2S voltage monitor

If the HO2S sensor voltage is out of the standard value, the ECM interprets this as a malfunction.

TEST ID	Description of TEST DATA	Conversion Factor	Unit
\$07	Minimum rear HO2S voltage	N/A	V
\$08	Maximum rear HO2S voltage	N/A	V

If the time required to change is out of the standard value, the ECM interprets this as a malfunction.

TEST ID	Description of TEST DATA	Conversion Factor	Unit
\$31	Time to change from Lean (<0.4 V) to Rich (≥ 0.5 V)	N/A	sec.
\$32	Time to change from Rich (≥ 0.5 V) to Lean (<0.4 V)	N/A	sec.

Rear HO2S slow response monitor

If the elapsed time is out of the standard value, the ECM interprets this as a malfunction.

TEST ID	Description of TEST DATA	Conversion Factor	Unit
\$37	Until rear HO2S voltage drops to 0.2 V after fuel-cut starting	N/A	sec.

Rear HO2S element monitor

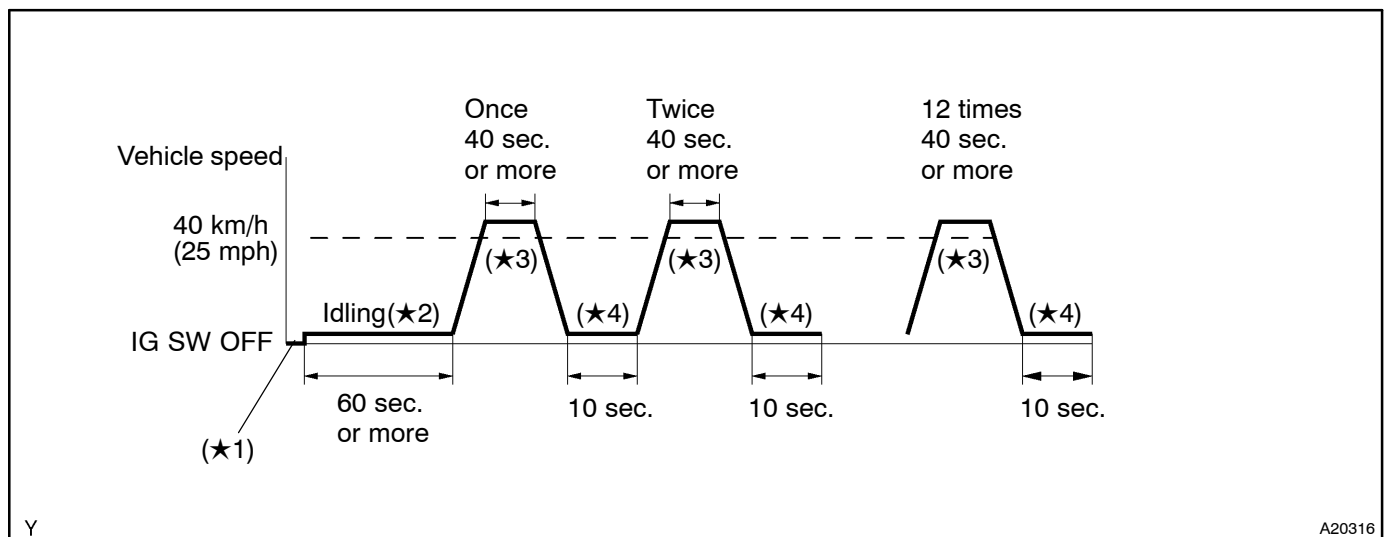
If all the values (\$81, \$84, \$85 and \$87) are out of the standard values, the ECM interprets this as a malfunction.

TEST ID	Description of TEST DATA	Conversion Factor	Unit
\$81	Percentage of monitoring time when the HO2S voltage is less than 0.05 V	Multiply 0.3906	%
\$84	Percentage of monitoring time when the HO2S voltage is more than 0.7 V	Multiply 0.3906	%
\$85	Time when the HO2S voltage is 0.45 V or more	Multiply 0.2621	sec.
\$87	Percentage of monitoring time when the HO2S voltage is 0.45 V or more	Multiply 0.3906	%

WIRING DIAGRAM

Refer to DTC P0031 on page [DI-53](#).

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 mode (See page DI-3). (★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 4. and 5. for 12 times.

HINT:

If a malfunction exists, the MIL will light up on the multi-information display during step 6.

NOTICE:

If the conditions in this test are not strictly followed, a malfunction detection will not occur. If you do not have a hand-held tester, turn the ignition switch OFF after performing steps from 3 to 6, then perform steps from 3 to 6 again.

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 the 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 approximately 90 seconds.
- (4) Select the item "DIAGNOSIS / ENHANCED OBD II / ACTIVE TEST / A/F CONTROL".
- (5) Perform "A/F CONTROL" with the engine in an idle condition (press the right or left button).

RESULT:

Heated oxygen sensor reacts in accordance with increase and decrease of injection volume

+25 % → rich output: More than 0.5 V

-12.5 % → lean output: Less than 0.4 V

NOTICE:

However, there is a few seconds 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 +25 % -12.5 % Output voltage More than 0.5 V OK Less than 0.4 V	Injection volume +25 % -12.5 % Output voltage More than 0.5 V OK Less than 0.4 V	—
Case 2	Injection volume +25 % -12.5 % Output voltage Almost no reaction NG	Injection volume +25 % -12.5 % Output voltage More than 0.5 V OK Less than 0.4 V	Sensor 1: front sensor (sensor 1, heater, sensor 1 circuit)
Case 3	Injection volume +25 % -12.5 % Output voltage More than 0.5 V OK Less than 0.4 V	Injection volume +25 % -12.5 % Output voltage Almost no reaction NG	Sensor 2: rear sensor (sensor 2, heater, sensor 2 circuit)
Case 4	Injection volume +25 % -12.5 % Output voltage Almost no reaction NG	Injection volume +25 % -12.5 % Output voltage Almost no reaction NG	Extremely rich or lean of the actual air-fuel ratio (Injector, fuel pressure, gas leakage in exhaust system, etc.)

The following A/F CONTROL procedure enables the technician to check and graph the voltage output of the heated oxygen sensors.

For displaying the graph indication, first enter "ACTIVE TEST / A/F CONTROL / USER DATA," then select "02S B1S1 and 02S B1S2" by pressing "YES" button, and push "ENTER" button before pressing "F4" button.

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. 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	Are there any other codes (besides DTC P0136 or P0156) being output?
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PREPARATION:

- (a) Connect the hand-held tester or the OBD II scan tool to the DLC3.
- (b) Turn the ignition switch ON and push the hand-held tester or OBD II scan tool main switch ON.
- (c) When using hand-held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / DTC INFO / CURRENT CODES.

CHECK:

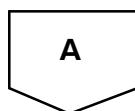
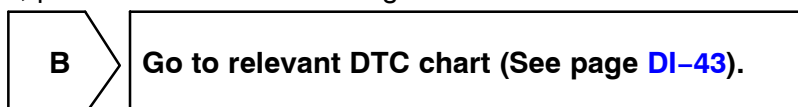
Read the DTC using the hand-held tester or the OBD II scan tool.

RESULT:

Display (DTC Output)	Proceed to
P0136	A
"P0136" and other DTCs	B

HINT:

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



2	Check output voltage of heated oxygen sensor.
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PREPARATION:

- (a) Connect the OBD II scan tool or the hand-held tester to the DLC3.
- (b) After warming up the engine, run the engine at 2,500 rpm for 3 minutes.
- (c) When using hand-held tester, enter the following menu: DIAGNOSIS / ENHANCED OBD II / DATA LIST / ALL / O2S B2 S1 or B2 S2.

CHECK:

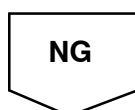
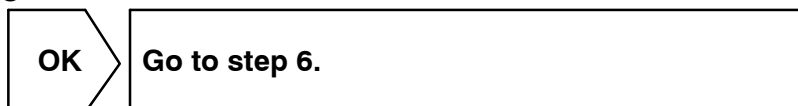
Read the voltage output of the heated oxygen sensor when the engine speed is suddenly increased.

HINT:

Quickly accelerate the engine to 4,000 rpm 3 minutes by using the accelerator pedal.

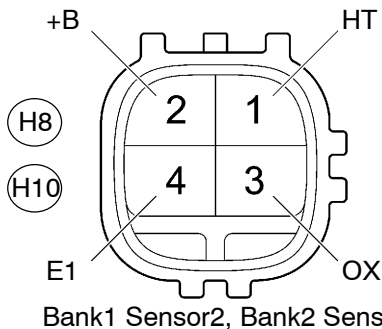
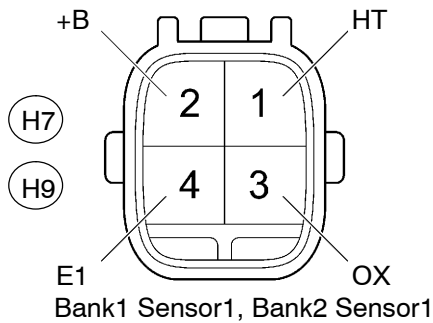
OK:

Heated oxygen sensor output voltage: Alternates from 0.4 V or less to 0.5 V or more.



3 Check resistance of heated oxygen sensor heater.

Components Side:



PREPARATION:

Disconnect the H7, H8, H9 or H10 heated oxygen sensor connector.

CHECK:

Measure resistance between terminals of the heated oxygen sensor.

OK:

Tester Connection	Specified Condition
HT (H7-1) - +B (H7-2)	11 to 16 Ω (20°C)
HT (H8-1) - +B (H8-2)	11 to 16 Ω (20°C)
HT (H9-1) - +B (H9-2)	11 to 16 Ω (20°C)
HT (H10-1) - +B (H10-2)	11 to 16 Ω (20°C)

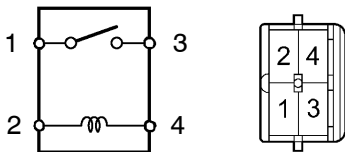
NG

Replace heated oxygen sensor.

OK

4 Check EFI or ECD relay.

EFI or ECD Relay



PREPARATION:

Remove the EFI or ECD relay from the engine room R/B.

CHECK:

Inspect the EFI or ECD relay.

OK:

Terminal No.	Condition	Specified Condition
2 - 4	Constant	Continuity
1 - 3	Usually	No Continuity
	Apply B+ between terminals 2 and 4	Continuity

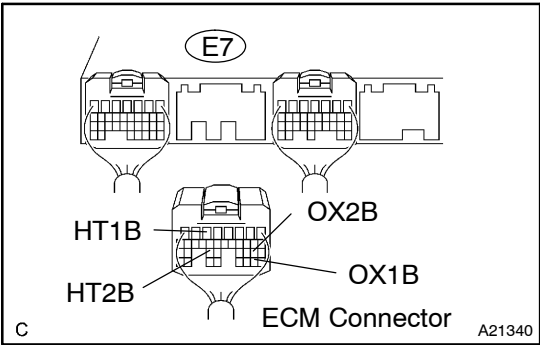
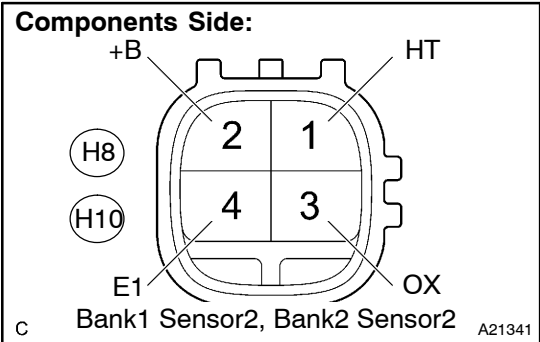
NG

Replace EFI or ECD relay.

OK

5

Check for open and short in harness and connector between ECM and heated oxygen sensor.



PREPARATION:

- (a) Disconnect the H8 or H10 heated oxygen sensor connector.
- (b) Disconnect the E7 ECM connector.

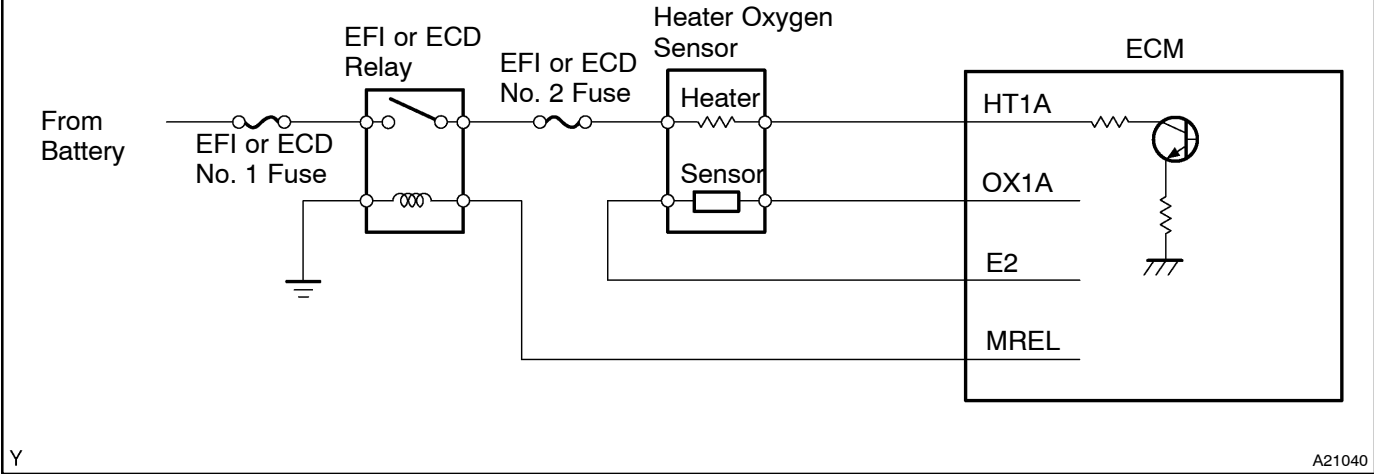
CHECK:

Measure the resistance between the wire harness side connectors.

OK:

Tester Connection	Specified Condition
OX (H8-3) - OX1B (E7-29)	Below 1 Ω
HT (H8-1) - HT1B (E7-5)	Below 1 Ω
OX (H10-3) - OX2B (E7-21)	Below 1 Ω
HT (H10-1) - HT2B (E7-25)	Below 1 Ω
OX (H8-3) or OX1B (E7-29) - Body ground	10 k Ω or higher
HT (H8-1) or HT1B (E7-5) - Body ground	10 k Ω or higher
OX (H10-3) or OX2B (E7-21) - Body ground	10 k Ω or higher
HT (H10-1) or HT2B (E7-25) - Body ground	10 k Ω or higher

Reference (Bank 1 Sensor 1 System Drawing)



NG

Repair or replace harness or connector.

OK

Replace heated oxygen sensor.

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

Go

7	Is the DTC P0136 or P0156 being output again?
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NO	Check for intermittent problems.
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YES

Replace heated oxygen sensor.