DTC	P0420	Catalyst System Efficiency Below Threshold (Bank 1)

DTC	P0430	Catalyst System Efficiency Below Threshold (Bank 2)

HINT:
- If DTC P0420 is displayed, check the bank 1 catalyst.
- If DTC P0430 is displayed, check the bank 2 catalyst.
- Bank 1 includes cylinder No. 1, but bank 2 does not. Cylinder No. 1 is located in the front part of the engine, opposite the transmission.

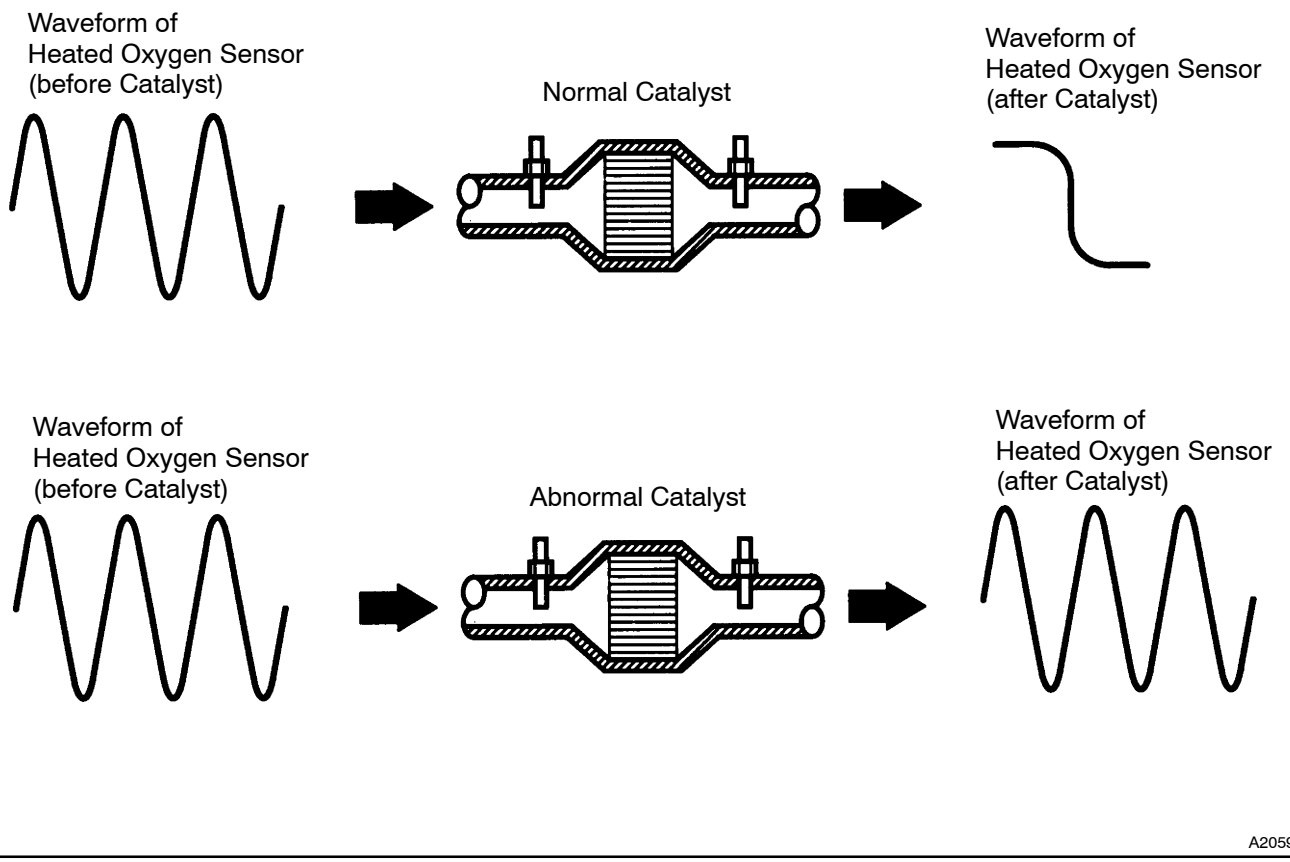
CIRCUIT DESCRIPTION

The ECM uses Heated Oxygen Sensors (HO2Ss) mounted before and after the three–way catalyst (TWC) to monitor its' efficiency. The front sensor sends pre–catalyst air–fuel information to the ECM. The rear sensor sends post–catalyst information to the ECM. The ECM compares these two signals to judge the efficiency of the catalyst and the catalyst's ability to store oxygen. During normal operation, the TWC stores and releases oxygen as needed. The capacity to store oxygen results in a low variation in the post–TWC exhaust stream as shown on the next page.

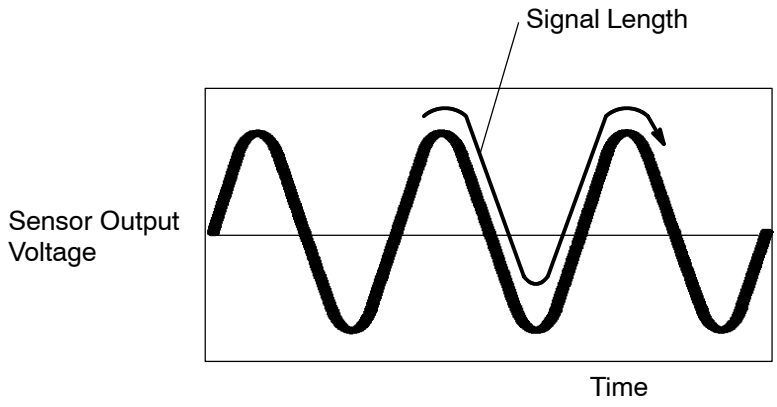
If the catalyst is functioning normally, the waveform of the HO2S (sensor 2) slowly switches between RICH and LEAN. If the catalyst is deteriorated, the waveform will alternate frequently between RICH and LEAN. As the catalyst efficiency degrades, its ability to store oxygen is reduced and the catalyst output becomes more variable.

When running the catalyst monitor, the ECM begins to measure the signal length of the HO2S (sensor 1) and HO2S (sensor 2). The ECM calculates the rate of signal length of the HO2S (sensor 1) and HO2S (sensor 2) (catalyst deterioration level). If the catalyst deterioration level exceeds the threshold, the ECM interprets this as a catalyst malfunction. The ECM illuminates the MIL (2 trip detection logic) and sets a DTC.

The monitor runs after:
- The engine is warmed up (Engine Coolant Temperature (ECT) is 75°C (167°F) or more).
- The vehicle is driven at approximately 60 to 100 km/h (37 to 63 mph) for 15 minutes.



Heated Oxygen Sensor Signal Length

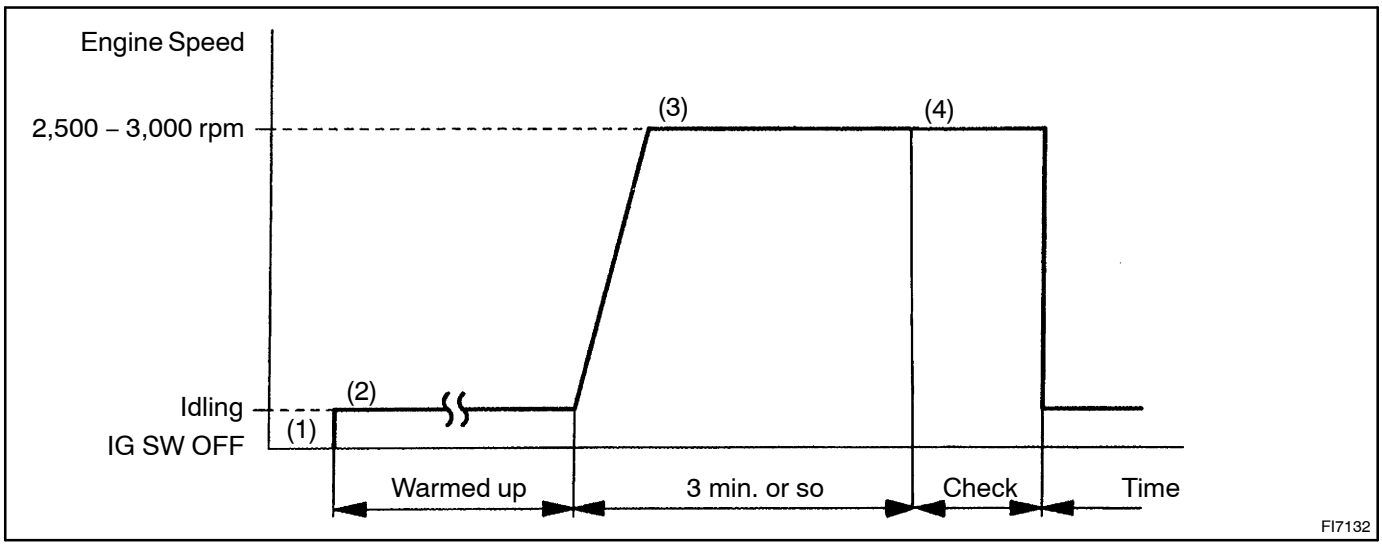


DTC No.	DTC Detecting Condition	Trouble Area
P0420 P0430	After engine and catalyst are warmed up, and while vehicle is driven within set vehicle and engine speed range; Waveforms of rear HO2S alternates frequency between Rich and Lean (2 trip detection logic)	• Gas leakage on exhaust system • Heated oxygen sensor (bank 1, 2 sensor 1, 2) • Three–way catalytic converter

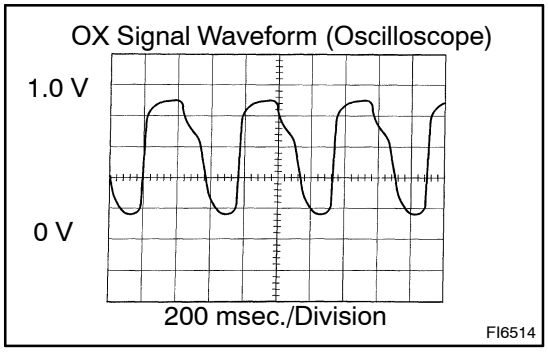
HINT:

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

CONFIRMATION ENGINE RACING PATTERN



(a) Connect the hand–held tester to the DLC3, or connect the probe of the oscilloscope between terminals OXL1, OXL2, OXR1, OXR2 and E1 of the engine control ECU connector.
(b) Start the engine and warm it up with all accessories switched OFF until engine coolant temperature is stable.
(c) Race the engine at 2,500 – 3,000 rpm for about 3 minutes.
(d) After confirming that the waveform of the heated oxygen sensor (bank 1, 2 sensor 1 (OX1A, OX2A)), oscillate around 0.5 V during feedback to the engine control ECU, check the waveform of the heated oxygen sensor (bank 1, 2 sensor 2 (OX1B, OX2B)).



HINT:
If there is a malfunction in the system, the waveform of the heated oxygen sensor (bank 1, 2 sensor 2 (OX1B, OX2B)) is almost the same as that of the heated oxygen sensor (bank 1, 2 sensor 1 (OX1A, OX2A)) on the left.
There are some cases where, even though a malfunction exists, the MIL may either light up or not light up.

INSPECTION PROCEDURE

HINT:
Read freeze frame data using the hand–held tester. 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, as well as other data from the time when a malfunction occurred.

1	**Are there any other codes (besides DTC P0420 or P0430) being output?**

PREPARATION:
(a) Connect the hand–held tester to the DLC3.
(b) Turn the ignition switch ON and push the hand–held tester main switch ON.
(c) When using hand–held tester, enter the following menus: DIAGNOSIS / OBD/MOBD / DTC INFO / CURRENT CODES.

CHECK:
Read the DTC using the hand–held tester.

RESULT:

Display (DTC Output)	Proceed to
"P0420 and/or P0430"	A
"P0420 or P0430" and other DTCs	B

HINT:
If any other codes besides "P0420 and/or P0430" are output, perform the troubleshooting for those DTCs first.

B → **Go to relevant DTC chart (See page DI–19).**

A

2	**Check gas leakage on exhaust system.**

NG → **Repair or replace exhaust gas leakage point.**

OK

3	**Check heated oxygen sensor (bank 1, 2 sensor 1).**

HINT:
Refer to the hint following the end of this flowchart.

NG → **Replace heated oxygen sensor.**

OK

4	**Check heated oxygen sensor (bank 1, 2 sensor 2).**

HINT:
Refer to the hint following the end of this flowchart.

NG → **Replace heated oxygen sensor.**

OK

Replace the front and rear three–way catalytic converter in the bank a malfunction is detected.

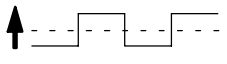
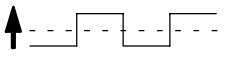
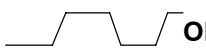
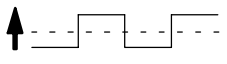
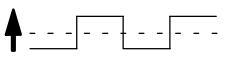
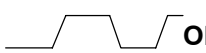
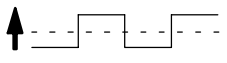
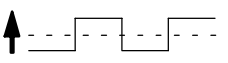
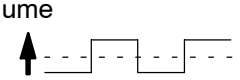
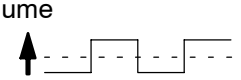
HINT:
Hand–held tester only:
The narrowing down the trouble area is possible by performing ACTIVE TEST of the following ”A/F CONTROL” (Heated oxygen sensor or another can be distinguished).
(a) Perform ACTIVE TEST by hand–held tester (A/F CONTROL).
HINT:
”A/F CONTROL” is the ACTIVE TEST which changes 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 / OBD/MOBD / 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 0.55 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 a maximum 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 0.55 V Less than 0.4 V  **OK**	Injection volume +25 % –12.5 %  Output voltage More than 0.5 V Less than 0.4 V  **OK**	—
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 Less than 0.4 V  **OK**	Sensor 1: front sensor (sensor 1, heater, sensor 1 circuit)
Case 3	Injection volume +25 % –12.5 %  Output voltage More than 0.55 V Less than 0.4 V  **OK**	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 (sensor 1 and 2).

For displaying the graph indication, enter ”ACTIVE TEST / A/F CONTROL / USER DATA” then select ”O2S B1S1 and O2S B1S2” by pressing ”YES” button and push ”ENTER” button before pressing ”F4” button.

NOTICE:

If the vehicle is short of fuel, the air–fuel ratio becomes LEAN and DTCs P0133 and/or P0153 will be recorded, and the MIL then comes on.

- Read freeze frame data using the hand–held tester. 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.