

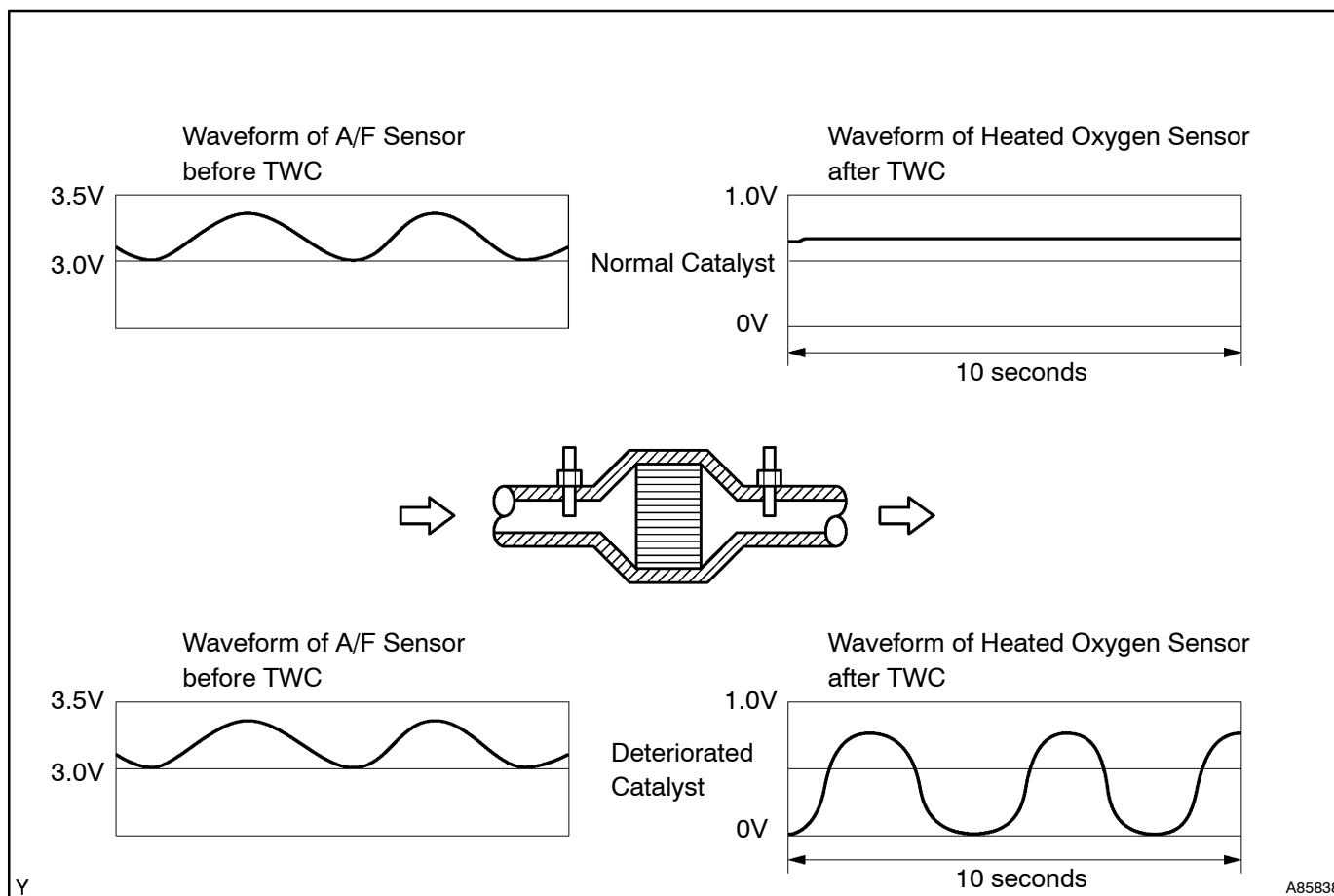
DTC	P0420	CATALYST SYSTEM EFFICIENCY BELOW THRESHOLD (BANK 1)
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CIRCUIT DESCRIPTION

The ECM uses 2 sensors located in front of and behind the Three-Way Catalytic Converter (TWC) to monitor its efficiency. The air-fuel ratio (A/F) sensor (sensor 1) sends pre-catalyst information to the ECM. The heated oxygen (O₂) sensor (sensor 2) 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 below.

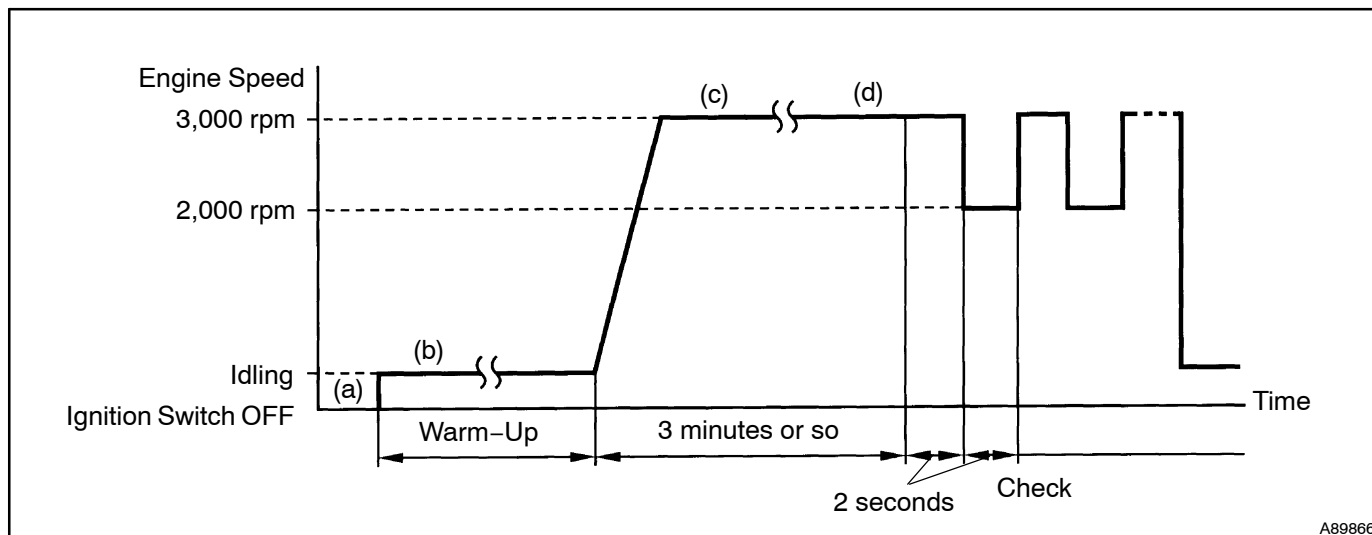
If the catalyst is functioning normally, the waveform of the O₂ sensor slowly switches between rich and lean. If the catalyst is deteriorated, the waveform will fluctuate frequently between rich and lean. As the catalyst efficiency degrades, its ability to store oxygen is reduced and the catalyst output becomes more variable. When running the monitor, the ECM compares sensor signals before and after the TWC over a specific amount of time to determine catalyst efficiency. The ECM begins by the comparison calculating the signal length for both sensors (using each output voltage of the sensors). If the O₂ sensor signal length is greater than the threshold (the threshold is calculated based on the A/F sensor signal length), the ECM concludes that the TWC is malfunctioning.

The ECM will turn on the MIL and the DTC will be set.



DTC No.	DTC Detection Condition	Trouble Area
P0420	After engine and catalyst are warmed up, and while vehicle is driven within set vehicle speed and engine speed range: Waveform of heated oxygen sensor frequently fluctuates between rich and lean (2 trip detection logic)	<ul style="list-style-type: none"> • Gas leakage in exhaust system • A/F sensor (sensor 1) • Heated oxygen sensor (sensor 2) • Three-way catalytic converter

CONFIRMATION ENGINE REVVING UP PATTERN



- Start the engine and warm it up with all the accessories switched OFF until the engine coolant temperature becomes stable.
- Run the engine at 2,500 to 3,000 rpm for about 3 minutes.
- Rev up the engine at 3,000 rpm for 2 seconds and 2,000 rpm for 2 seconds alternately.

INSPECTION PROCEDURE

HINT:

Read freeze frame data using the intelligent tester II. Freeze frame data record the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, 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(IN ADDITION TO DTC P0420)
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- Connect the intelligent tester II to the DLC3.
- Turn the ignition switch to ON and turn the intelligent tester II ON.
- Select the following menu items: Powertrain / Engine and ECT / DTC.
- Read DTCs.

Result:

Display (DTC Output)	Proceed To
P0420	A
P0420 and other DTCs	B

HINT:

If any other DTCs besides P0420 are output, perform troubleshooting for those DTCs first.

B

GO TO RELEVANT DTC CHART
(See page 05-29)

A

2 CHECK FOR EXHAUST GAS LEAKAGE

OK: No gas leakage.

NG

REPAIR OR REPLACE EXHAUST GAS
LEAKAGE POINT

OK

3 INSPECT AIR FUEL RATIO SENSOR (SENSOR 1) (See page 05-192)

NG

REPLACE AIR FUEL RATIO SENSOR

OK

4 INSPECT HEATED OXYGEN SENSOR (SENSOR 2) (See page 05-83)

OK: During air-fuel ratio feedback, the oxygen sensor output fluctuates between rich and lean.

NG

REPLACE HEATED OXYGEN SENSOR

OK

REPLACE THREE-WAY CATALYTIC CONVERTER (BOTH FRONT AND REAR TWC)

NOTICE:

On the damaged bank, replace both the front catalyst and rear catalyst.

HINT:

Intelligent tester II only:

Malfunctioning areas can be found by performing the Active Test / A/F Control operation. The A/F Control operation can determine if the A/F sensor, heated oxygen sensor or other potential trouble areas are malfunctioning or not.

(a) Perform Active Test using the intelligent tester II.

HINT:

The A/F Control operation lowers the injection volume by 12.5 % or increases the injection volume by 25 %.

- (1) Connect the intelligent tester II to the DLC3.
- (2) Start the engine and turn the intelligent tester II ON.
- (3) Warm up the engine by running the engine at 2,500 rpm for approximately 90 seconds.
- (4) On the intelligent tester II, select the following menu items: Powertrain / Engine and ECT / Active Test / A/F Control.
- (5) Select the following monitor items: AFS B1 S1 and O2S B1 S2.
- (6) Perform the A/F Control operation with the engine in an idling condition (press the right or left button).

Result:

The A/F sensor reacts in accordance with increase and decrease of the injection volume:

+25 % → Rich output: Less than 3.0 V

-12.5 % → Lean output: More than 3.35 V


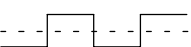



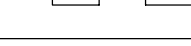

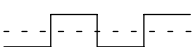


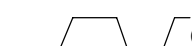


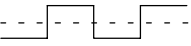


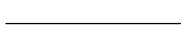

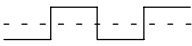


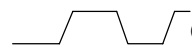


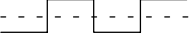



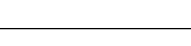

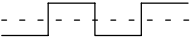




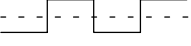


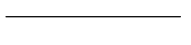

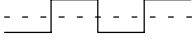


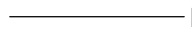
The heated oxygen sensor reacts in accordance with increase and decrease of the injection volume:

+25 % → Rich output: More than 0.55 V

-12.5 % → Lean output: Less than 0.4 V

NOTICE:

The A/F sensor output has a few seconds of delay and the heated oxygen sensor output has about 20 seconds of delay at maximum.

	Output Voltage of A/F Sensor (Sensor 1)	Output Voltage of Heated Oxygen Sensor (Sensor 2)	Main Suspect Trouble Area
Case 1	Injection volume +25 %   -12.5 %   Output voltage More than 3.35 V  OK Less than 3.0 V  OK	Injection volume +25 %   -12.5 %   Output voltage More than 0.55 V  OK Less than 0.4V  OK	—
Case 2	Injection volume +25 %   -12.5 %   Output voltage Almost no reaction  NG	Injection volume +25 %   -12.5 %   Output voltage More than 0.55 V  OK Less than 0.4V  OK	A/F sensor (A/F sensor, sensor heater, sensor circuit)
Case 3	Injection volume +25 %   -12.5 %   Output voltage More than 3.35 V  OK Less than 3.0V  OK	Injection volume +25 %   -12.5 %   Output voltage Almost no reaction  NG	Heated oxygen sensor (Heated oxygen sensor, sensor heater, sensor 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 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 both A/F sensor and heated oxygen sensor.

To display the graph, select the following menu items on the tester: View / Line graph.