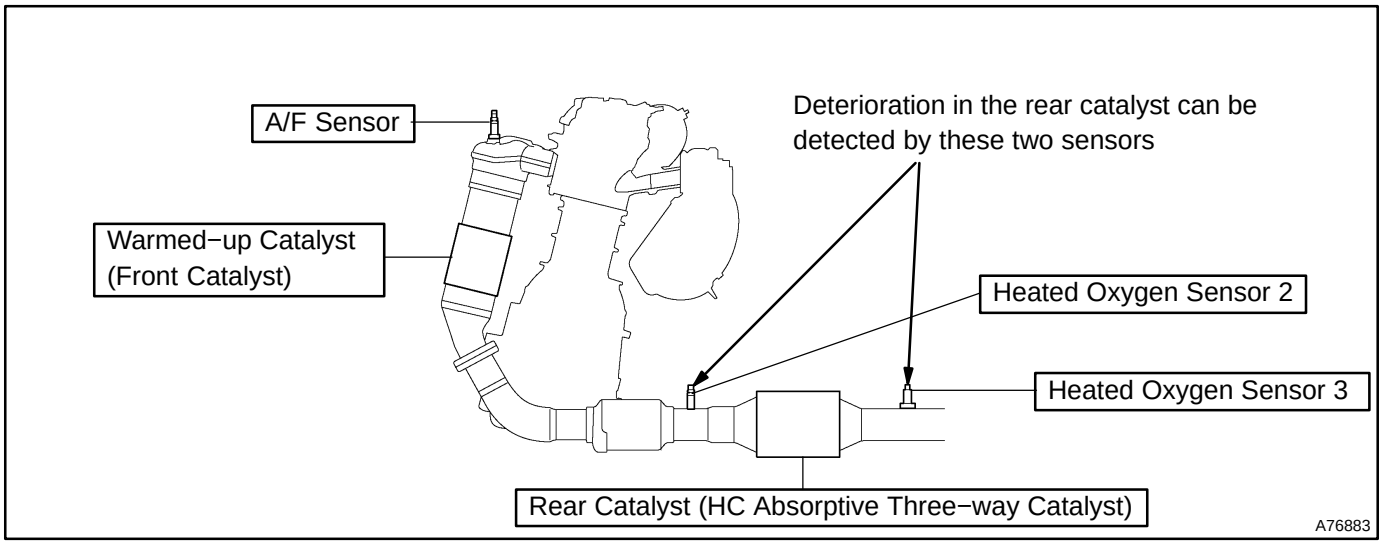
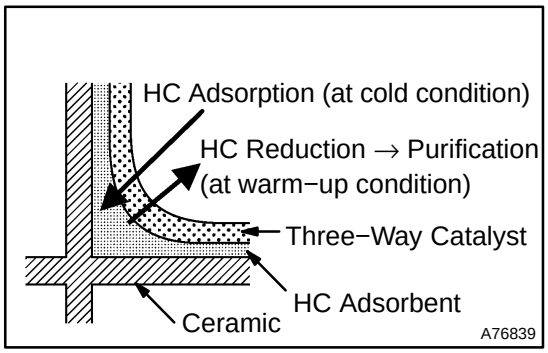
DTC	P2423	TOYOTA−HCAC−SYSTEM (BANK 1)

HINT:
This DTC has been added to meet the requirement for Partial Zero Emission Vehicle (PZEV) (see page 05−350).

CIRCUIT DESCRIPTION

Hydrocarbon Absorptive Catalyst (HCAC) system consists of the Three−way Catalyst (TWC) and two heated oxygen sensors. The TWC has a character of absorbing hydrocarbons (HC) emitted soon after the engine start. The two heated oxygen sensors, sensor 2 and sensor 3, are used to detect deterioration in the TWC. The HCAC system is installed in the lower part of the exhaust system, after the front catalyst.

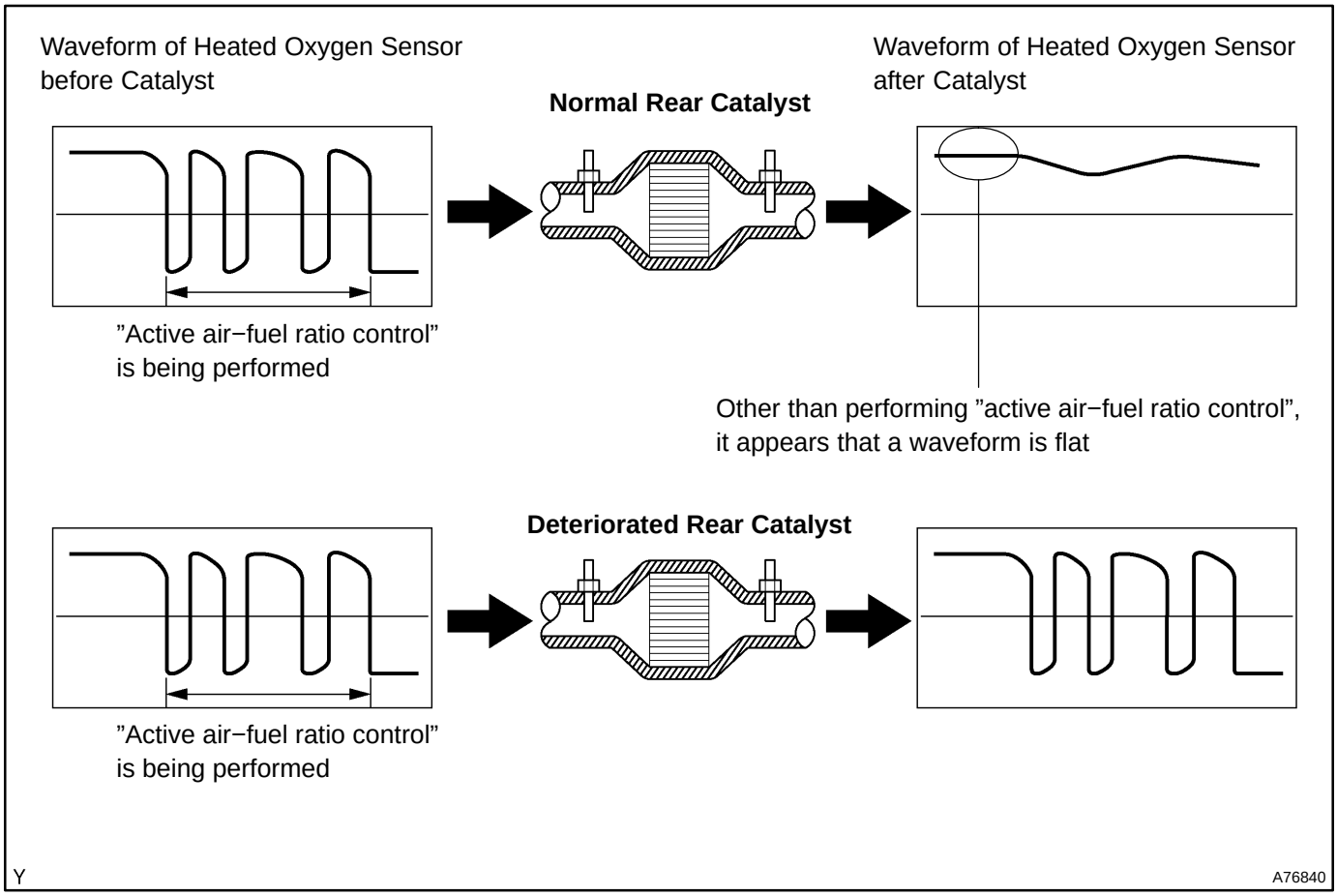




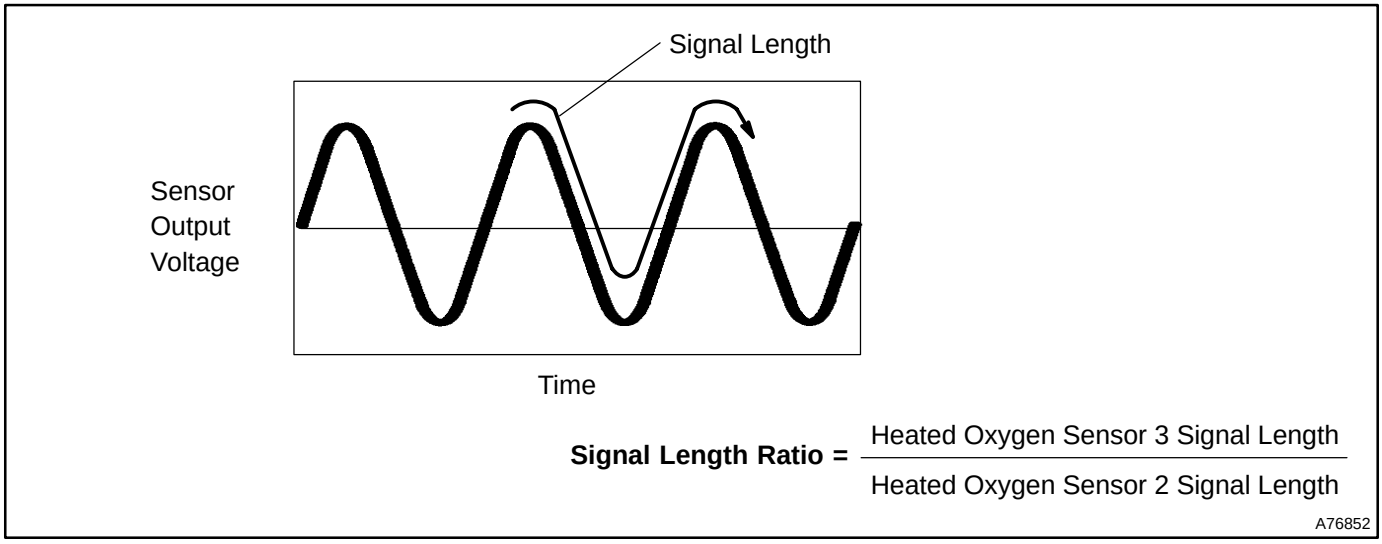
The ceramic portion of this catalyst is coated with the HC adsorbent* material. The TWC material is coated on top of the HC adsorption layer.
*: Adsorption is similar to absorption except that the material (in this case HC molecules) adhere to a surface rather than being absorbed into it.

While ”active air−fuel ratio control” for detecting the front catalyst deterioration is performed, the ECM determines if the rear catalyst has deteriorated as well.
The ECM compares the waveforms of the heated oxygen sensors located before and after the rear catalyst to determine if the catalyst capacity has deteriorated.

If the catalyst is functioning normally, the waveform of the heated oxygen sensor 3 indicates RICH and LEAN alternation more slowly than the waveform of the heated oxygen sensor 2 located before the catalyst. If both waveform variation rates are similar, indicates that the catalyst capacity has deteriorated.



When running the monitor, the ECM compares the signals of sensor 2 and sensor 3 over a specific time to determine the TWC efficiency. The ECM calculates the signal length of both sensors and uses them to obtain the signal length ratio by the following formula. (*note: there is the formula in a diagram below this test) The signal length ratio is compared with the failure threshold by the ECM.



DTC No.	DTC Detection Condition	Trouble Area
P2423	”Signal Length Ratio” is greater than 0.75	• HC adsorb three−way catalyst (inside exhaust front pipe) • Gas leakage in exhaust system • Heated oxygen sensor 2 (bank 1 sensor 2) • Heated oxygen sensor 3 (bank 1 sensor 3)

MONITOR STRATEGY

Related DTCs	P2423: Rear catalyst has deteriorated
Required sensors/ components (Main)	Heated oxygen sensor
Required sensors/ components (Related)	ECT sensor, IAT sensor, Engine speed sensor, MAF meter, Park/Neutral position switch
Frequency of operation	Once per driving cycles
Duration	About 30 seconds
MIL operation	2 − 6 driving cycles
Sequence operation	Front catalyst monitoring is completed and heated oxygen sensor 3 monitoring detected ”PASS”.

TYPICAL ENABLING CONDITION

Criteria for running DTC Conditions:

The monitor will run whenever this DTC is not present	See page 05−360
Front catalyst monitor detecting	Complete
Heated oxygen sensor 3 status	Activated
Heated oxygen sensor 3 pass determination	Pass detection

TYPICAL MALFUNCTION THRESHOLDS

Catalyst deterioration ratio level condition: Signal length ratio	0.75 or more

MODE 06 DATA

Refer to page 05−369 for detailed information.

TID $0D: Hydro−carbon (HC) absorber deterioration

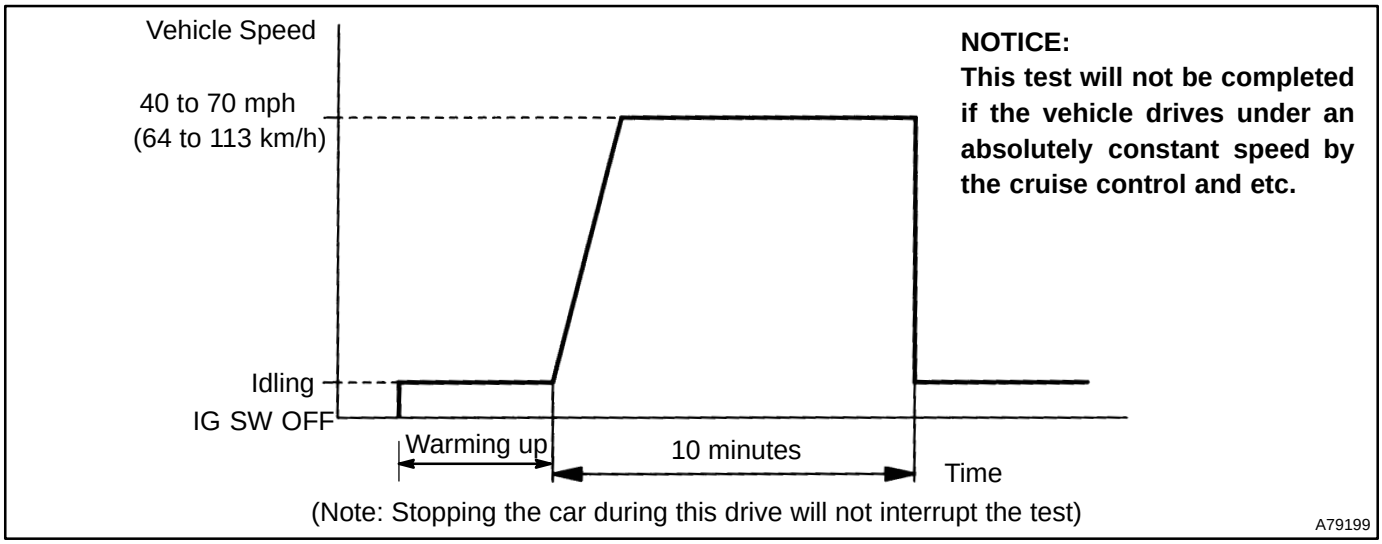
TLT	CID	Unit Conversion	Description of Test Data	Description of Test Limit
0	$01	Multiply by 0.0078 (no dimension)	HC absorber deterioration level determined by waveforms of HO2S 2 and 3	Malfunction criteria for HC absorber deterioration

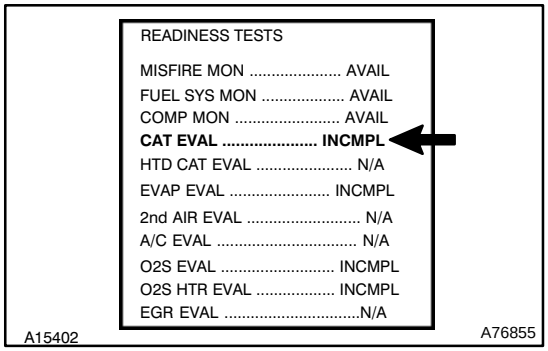
CONFIRMATION DRIVING PATTERN FOR READINESS MONITOR

PURPOSE (See page 05−371)

HINT:

Performing this confirmation pattern will activate the catalyst monitoring by the ECM. This is very useful for verifying the completion of a repair.





(a) Clear the DTCs.
  (1) Disconnect the battery cable or remove the EFI and ETCS fuses for 60 seconds or more.

(b) Connect the hand−held tester to the DLC3.

(c) Enter the following menus: DIAGNOSIS / CARB OBD II / READINESS TESTS and check that CAT EVAL is INCMPL (incomplete).

(d) Drive the vehicle according to the confirmation driving pattern. Note the state of the Readiness Tests. They will change to COMPL (complete) as the CAT evaluation monitors operate.

(e) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / DTC INFO / PENDING CODES and check if any DTC (any pending code) is set.

If the READINESS CODE of ”CAT EVAL” was ”INCMPL” and any DTC (include pending codes) was not set, extend the driving time.

NOTICE:

If you do not have the hand−held tester, perform again the same confirmation driving pattern after turning off the ignition switch upon finishing the first confirmation driving pattern.

PERFORM A/F CONTROL

HINT:

Hand−held tester only:

Narrowing down the trouble area is possible by performing the ”A/F CONTROL” ACTIVE TEST (heated oxygen sensor or other trouble areas can be distinguished).

(a) Perform ACTIVE TEST using the hand−held tester (A/F CONTROL).

HINT:

”A/F CONTROL” is an ACTIVE TEST which changes the injection volume −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 by running the engine at 2,500 rpm for approximately 90 seconds.
(4) Enter ALL from 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 0.55 V
−12.5 % → lean output: Less than 0.4 V

NOTICE:

There is about 20 seconds delay in the heated oxygen sensor 2 (O2S B1S2) output and there is about 2 minute delay in the heated oxygen sensor 3 (O2S B1S3) output.

	Output voltage of heated oxygen sensor 2: (O2S B1S2)	Output voltage of heated oxygen sensor 3: (O2S B1S3)	Mainly suspect trouble area
Case 1	Injection volume +25 % −12.5 % Output voltage More than 0.55 V Less than 0.4V **OK**	Injection volume +25 % −12.5 % Output voltage More than 0.55 V Less than 0.4V **OK**	Rear catalyst (If both waveforms (heated oxygen sensor 2 and heated oxygen sensor 3) change at similar rate, it indicates that the catalyst performance has deteriorated)
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 Less than 0.4V **OK**	Heated oxygen sensor 2 (sensor 2, heater, sensor 2 circuit)
Case 3	Injection volume +25 % −12.5 % Output voltage More than 0.55 V Less than 0.4V **OK**	Injection volume +25 % −12.5 % Output voltage Almost No reaction **NG**	Heated oxygen sensor 3 (sensor 3, heater, sensor 3 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 to technician to check and graph the voltage outputs of both the Heated Oxygen Sensor 2 and Heated Oxygen Sensor 3.
For displaying the graph indication, enter ”DIAGNOSIS / ENHANCED OBD II / ACTIVE TEST / A/F CONTROL / USER DATA”, then select ”AFS B1S1 and O2S B1S2” by pressing ”YES” button and push ”ENTER” button before pressing ”F4” button.

INSPECTION PROCEDURE

HINT:
Read freeze frame data using 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	CHECK OTHER DTC OUTPUT (IN ADDITION − DTC P2423)

(a) Read the DTC using the hand−held tester or the OBD II scan tool.
Result:

Display (DTC output)	Proceed to
Only P2423 is output	A
P2423 and other DTCs are output	B

HINT:
If any other codes besides P2423 are output, perform the troubleshooting for those DTCs first.

B → GO TO RELEVANT DTC CHART (See page 05−390)

A

2	CHECK FOR EXHAUST GAS LEAKAGE

NG → REPAIR OR REPLACE EXHAUST GAS LEAKAGE POINT

OK

3	CHECK HEATED OXYGEN SENSOR (BANK 1 SENSOR 2) (See page 05−403)

NG → REPLACE HEATED OXYGEN SENSOR

OK

4	CHECK HEATED OXYGEN SENSOR (BANK 1 SENSOR 3) (See page 05−421)

NG → REPLACE HEATED OXYGEN SENSOR

OK

REPLACE THREE−WAY CATALYTIC CONVERTER (ONLY REAR CATALYST)

HINT:
DTC P2423 indicates deterioration in the rear catalyst.
When only this DTC is present, replace the rear catalyst only. (Replacing the front catalyst is not needed.)