

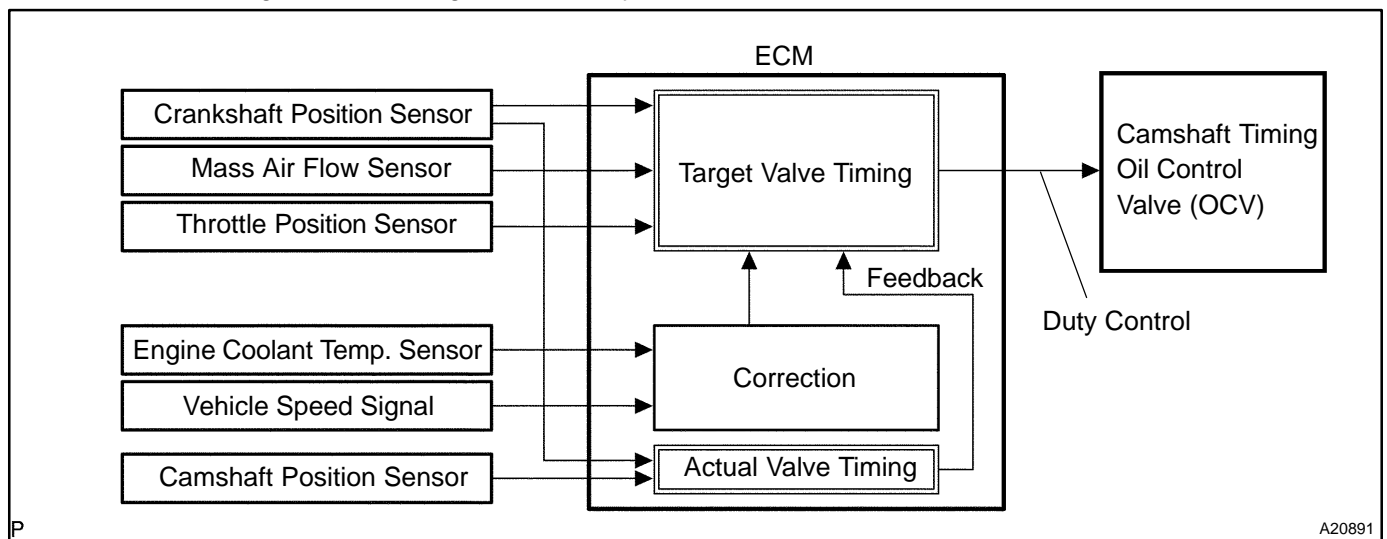
CIRCUIT INSPECTION

DTC	P0010	Camshaft Position "A" Actuator circuit (Bank 1)
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DTC	P0020	Camshaft Position "A" Actuator circuit (Bank 2)
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CIRCUIT DESCRIPTION

The Variable Valve Timing (VVT) system includes the ECM, the Oil Control Valve (OCV) and the VVT controller. The ECM sends a target "duty-cycle" control signal to the OCV. This control signal, applied to the OCV, regulates the oil pressure supplied to the VVT controller. Camshaft timing control is performed based on engine operation conditions such as intake air volume, throttle position and engine coolant temperature. The ECM controls the OCV, based on the signals output from the sensors. The VVT controller regulates the intake camshaft angle using oil pressure through the OCV. As a result, the relative position between the camshaft and the crankshaft is optimized, and the engine torque improves, fuel economy improves, and exhaust emissions decrease under overall driving conditions. Also, the ECM detects the actual valve timing using signals from the camshaft position sensor and the crankshaft position sensor, and performs feedback control. This is how target valve timing is verified by the ECM.



DTC No.	DTC Detecting Condition	Trouble Area
P0010 P0020	Open or short in OCV circuit	<ul style="list-style-type: none"> • Open or short in OCV circuit • OCV • ECM

MONITOR DESCRIPTION

After the ECM sends the "target" duty-cycle signal to the OCV (Oil Control Valve), the ECM monitors the OCV current to establish an "actual" duty-cycle. When the actual duty-cycle ratio varies from the target duty-cycle, the ECM sets a DTC.

MONITOR STRATEGY

Related DTCs	P0010	VVT oil control valve bank 1 range check
	P0020	VVT oil control valve bank 2 range check
Required sensors/components	OCV	
Frequency of operation	Continuous	
Duration	1 sec.	
MIL operation	Immediate	
Sequence of operation	None	

TYPICAL ENABLING CONDITIONS

Item	Specification	
	Minimum	Maximum
The monitor will run whenever this DTC not present	See page DI-437	
All of the following conditions are met	–	
Starter	OFF	
Ignition switch	ON	
Time after ignition switch OFF to ON	0.5 seconds	–

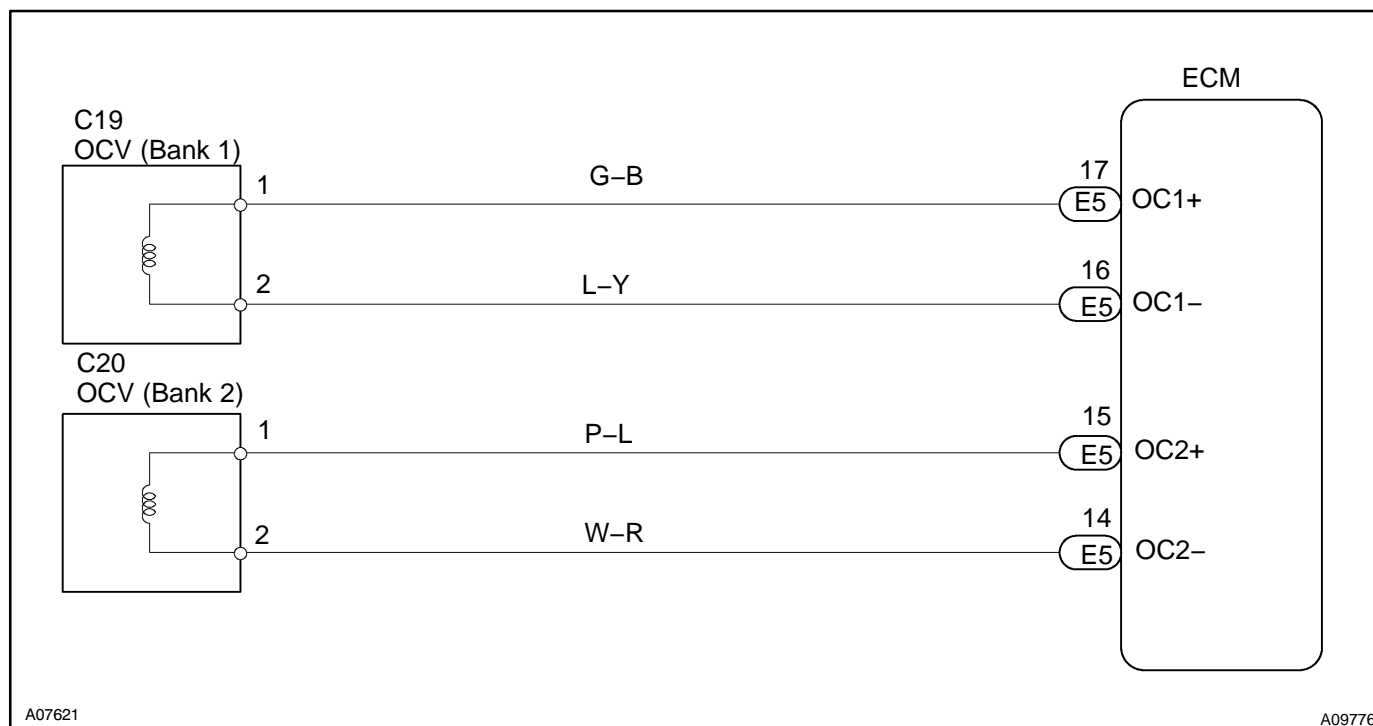
TYPICAL MALFUNCTION THRESHOLDS

Detection Criteria	Threshold
One of the following conditions is met:	Condition A, B or C
A. All of the following conditions are met:	Condition (a), (b) , and (c)
(a) Battery voltage	11 V or more, and less than 13 V
(b) Target duty ratio	Less than 70 %
(c) Output signal duty ratio	100 % or more
B. All of the following conditions are met:	Condition (a), (b) , and (c)
(a) Battery voltage	13 V or more
(b) Target duty ratio	Less than 80 %
(c) Output signal duty ratio	100 % or more
C. Both of the following conditions are met:	Condition (a) and (b)
(a) Current cut status	Not cut
(b) Output signal duty ratio	3% or less

COMPONENT OPERATING RANGE

Parameter	Standard Value
OCV current	3 to 100 %

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

- If DTC P0010 displayed, check left bank OCV circuit.
- If DTC P0020 displayed, check right bank OCV circuit.
- Read freeze frame data using hand-held tester. Because freeze frame records the engine conditions when the 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 OCV circuit.**PREPARATION:**

- (a) Connect the hand-held tester to the DLC3.
- (b) Start the engine and warm it up.
- (c) Turn the ignition switch to ON and turn the hand-held tester ON.

CHECK:

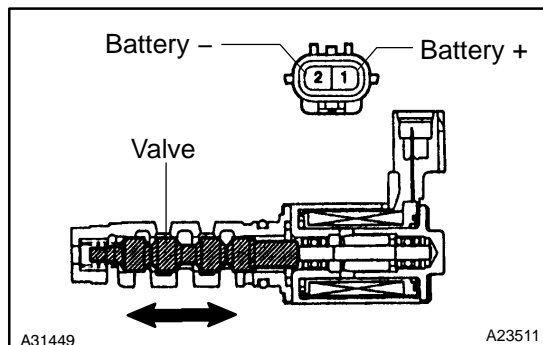
- (a) Select the item: DIAGNOSIS / ENHANCED OBD II / ACTIVE TEST / VVT CTRL B1 or VVT CTRL B2.
- (b) Using the hand-held tester, operate the OCV and check the engine speed.

OK:**Standard:**

Tester Operation	Specified Condition
OCV is OFF	Normal engine speed
OCV is ON	Rough idle or engine stall

OK

Check for intermittent problems
(See page [DI-430](#)).

NG**2 Check operation of OCV.****PREPARATION:**

- (a) Start the engine and warmed it up.
- (b) Disconnect the OCV connector.
- (c) Apply battery positive voltage between the terminals of the OCV.

CHECK:

Check the engine speed.

OK:

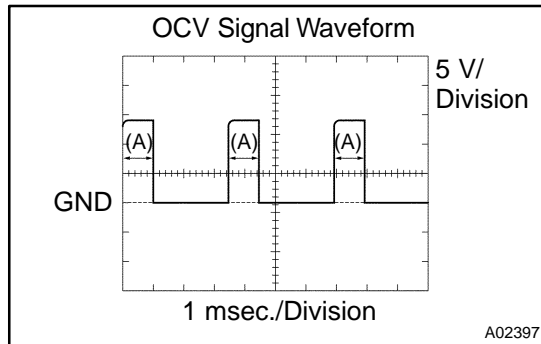
Rough idle or engine stalled.

NG

Replace OCV.

OK

3 Check voltage between terminals OC1+ and OC1-, OC2+ and OC2- of ECM connector.



CHECK:

- (a) Inspection using the oscilloscope.
- (b) During idling, check the waveform between the specified terminals of the E5 ECM connector.

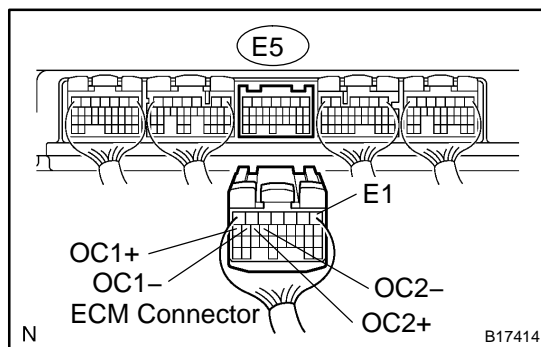
HINT:

The waveform frequency (A) is lengthened as the engine speed becomes higher.

OK:

Standard:

The correct waveform is as shown.

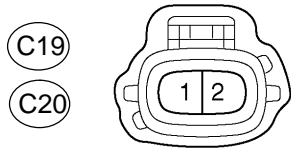


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Replace ECM (See page [SF-82](#)).

OK

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Check for open and short in harness and connector between OCV and ECM.**Wire Harness Side**

OCV Connector

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PREPARATION:

- (a) Disconnect the C19 or C20 OCV connector.
- (b) Disconnect the E5 ECM connector.

CHECK:

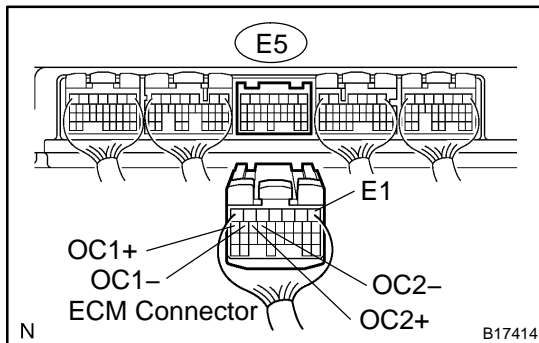
- (a) Check for resistance between the wire harness side connectors.

OK:**Standard (Check for open):**

Symbols (Terminal No.)	Specified condition
OCV (C19-1) – OC1+ (E5-17)	Below 1 Ω
OCV (C19-2) – OC1- (E5-16)	Below 1 Ω
OCV (C20-1) – OC2+ (E5-15)	Below 1 Ω
OCV (C20-2) – OC2- (E5-14)	Below 1 Ω

Standard (Check for short):

Symbols (Terminal No.)	Specified condition
OCV (C19-1) or OC1+ (E5-17) – E1 (E5-1)	10 k Ω or higher
OCV (C19-1) or OC1- (E5-16) – E1 (E5-1)	10 k Ω or higher
OCV (C20-1) or OC2+ (E5-15) – E1 (E5-1)	10 k Ω or higher
OCV (C20-1) or OC2- (E5-14) – E1 (E5-1)	10 k Ω or higher



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NG**Repair or replace harness or connector.****OK**

**Check for intermittent problems
(See page [DI-430](#)).**