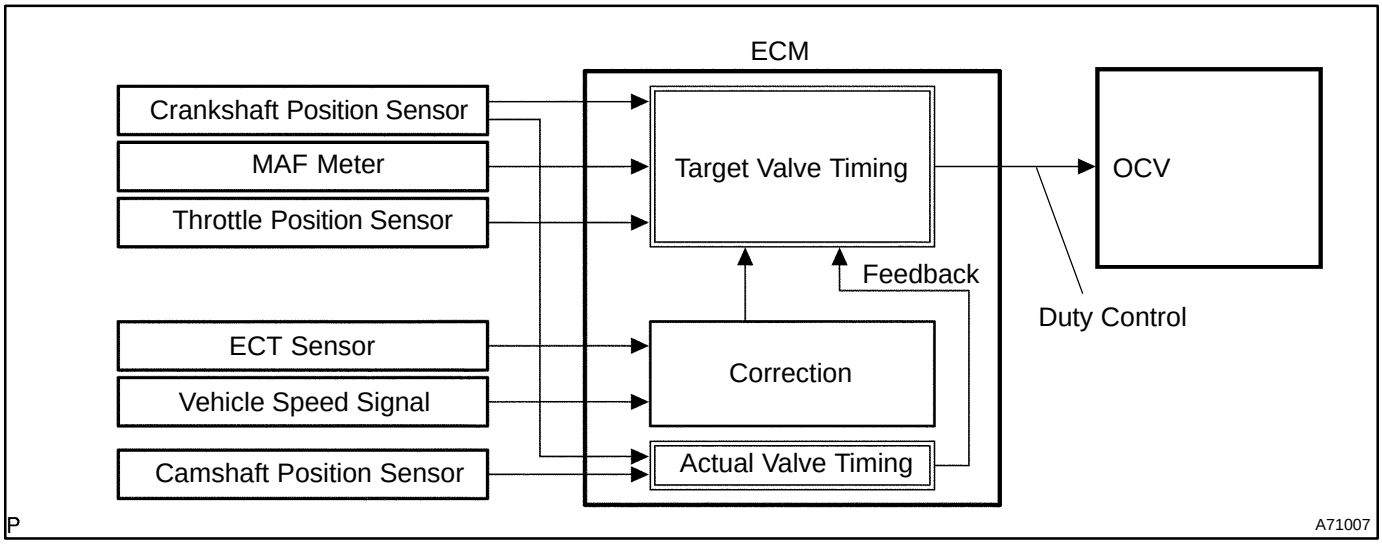
DTC	P0010	CAMSHAFT POSITION ”A” ACTUATOR CIRCUIT (BANK 1)

DTC	P0020	CAMSHAFT POSITION ”A” ACTUATOR CIRCUIT (BANK 2)

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 several sensors. The VVT controller regulates the intake camshaft angle using oil pressure through the OCV. As result, the relative position between the camshaft and the crankshaft is optimized. Also, the engine torque improves, fuel economy improves, and exhaust emissions decrease. The ECM detects the actual valve timing using signals from the camshaft position sensor and the crankshaft position sensor. The ECM performs feedback control and verifies target valve timing.



DTC No.	DTC Detection Condition	Trouble Area
P0010 P0020	Open or short in OCV circuit (1 trip detection logic)	• Open or short in OCV circuit • OCV • ECM

MONITOR DESCRIPTION

After the ECM sends the ”target” duty−cycle signal to the OCV, the ECM monitors the OCV current to establish an ”actual” duty−cycle. When the actual duty−cycle ratio varies from the target duty−cycle ratio, the ECM sets a DTC.

MONITOR STRATEGY

Related DTCs	P0010: VVT OCV (Bank 1) Range Check P0020: VVT OCV (Bank 2) Range Check
Required sensors / components (Main)	VVT OCV
Required sensors / components (Related)	−
Frequency of operation	Continuous
Duration	1 second
MIL operation	Immediate
Sequence operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever these DTCs are not present	See page 05−507
Battery voltage	11 to 13 V
Target duty ratio for the OCV	Less than 70 %
Starter	OFF
Current cut status for the OCV	Not cut

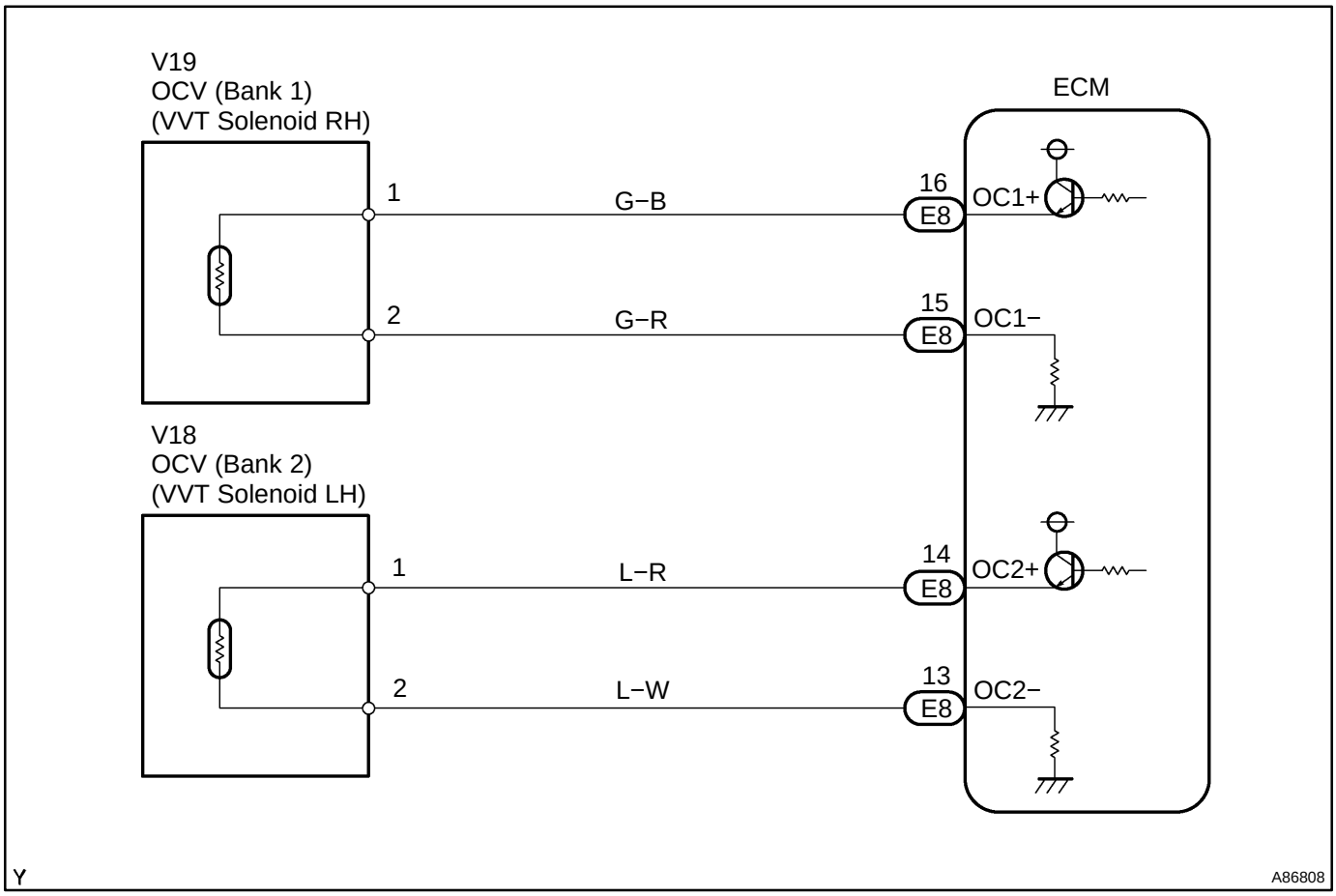
TYPICAL MALFUNCTION THRESHOLDS

Either of the following conditions is met:	Condition 1 or 2
1. OCV duty ratio	100 % (always ON) despite the target duty ratio is less than 70 %
2. OCV duty ratio when ECM supplies current to OCV	3 % or less despite the ECM supplying the current to the OCV

COMPONENT OPERATING RANGE

VVT OCV duty ratio	3 to 100 %

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

- If DTC P0010 is displayed, check the bank 1 VVT system circuit.
- If DTC P0020 is displayed, check the bank 2 VVT system circuit.
- 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, 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, and other data from the time the malfunction occurred.

Hand−held tester:

1	**PERFORM ACTIVE TEST BY HAND−HELD TESTER (OCV OPERATION)**

(a) Connect the hand−held tester to the DLC3.
(b) Start the engine and warm it up.
(c) Turn the ignition switch ON and push the hand−held tester main switch ON.
(d) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / ACTIVE TEST / VVT CTRL B1 or VVT CTRL B2.
(e) Using the hand−held tester, operate the OCV and check the engine speed.
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 05−500)**

NG

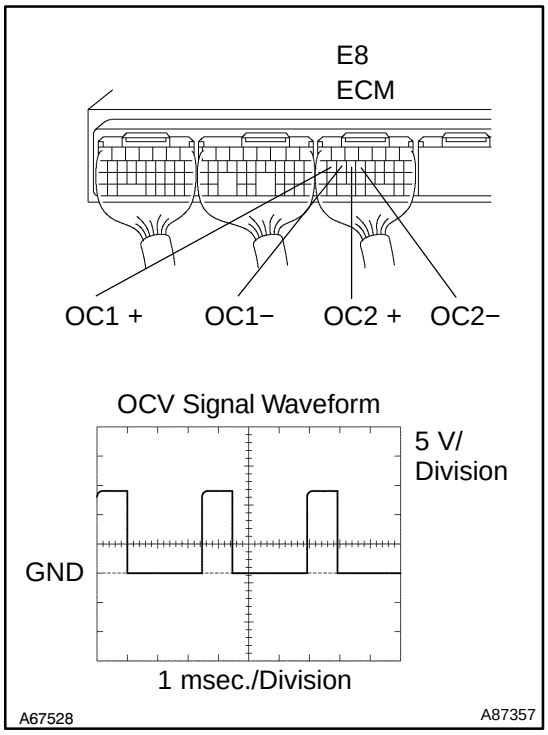
2	**INSPECT CAMSHAFT TIMING OIL CONTROL VALVE ASSY (See page 10−13)**

OK: OCV has no contamination and moves smoothly.

NG → **REPLACE CAMSHAFT TIMING OIL CONTROL VALVE ASSY**

OK

3 CHECK ECM (OCV SIGNAL)



(a) During idling, check the waveform of the ECM connector using the oscilloscope.

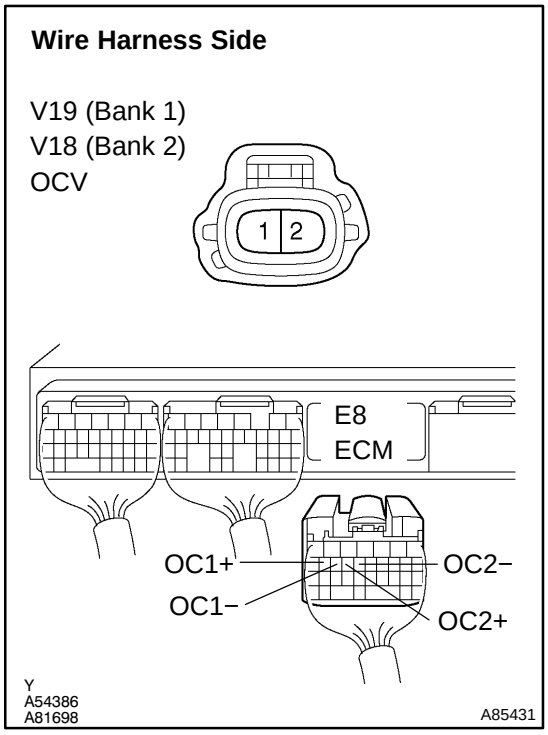
Standard:

Tester Connection	Specified Condition
E8−16 (OC1+) − E8−15 (OC1−) E8−14 (OC2+) − E8−13 (OC2−)	Correct waveform is as shown

NG → **REPLACE ECM (See page 10−25)**

OK

4 CHECK WIRE HARNESS (OCV−ECM)



(a) Disconnect the V18 or V19 OCV connector.
(b) Disconnect the E8 ECM connector.
(c) Check the resistance of the wire harness side connectors.

Standard:

Tester Connection	Specified Condition
V19−1 (OCV) − E8−16 (OC1+) V19−2 (OCV) − E8−15 (OC1−) V18−1 (OCV) − E8−14 (OC2+) V18−2 (OCV) − E8−13 (OC2−)	Below 1 Ω
V19−1 (OCV) or E8−16 (OC1+) − Body ground V19−2 (OCV) or E8−15 (OC1−) − Body ground V18−1 (OCV) or E8−14 (OC2+) − Body ground V18−2 (OCV) or E8−13 (OC2−) − Body ground	10 kΩ or higher

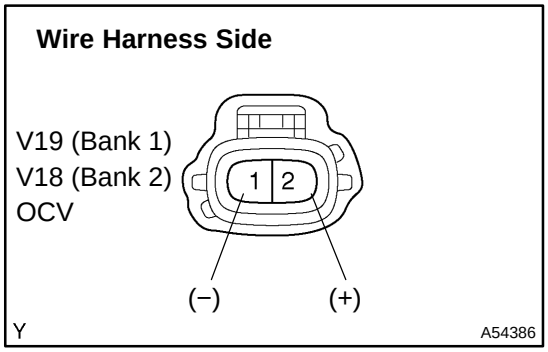
NG → **REPAIR OR REPLACE HARNESS AND CONNECTOR**

OK

CHECK FOR INTERMITTENT PROBLEMS (See page 05−500)

OBD II scan tool (excluding hand−held tester):

1	CHECK CAMSHAFT TIMING OIL CONTROL VALVE ASSY (OCV OPERATION)

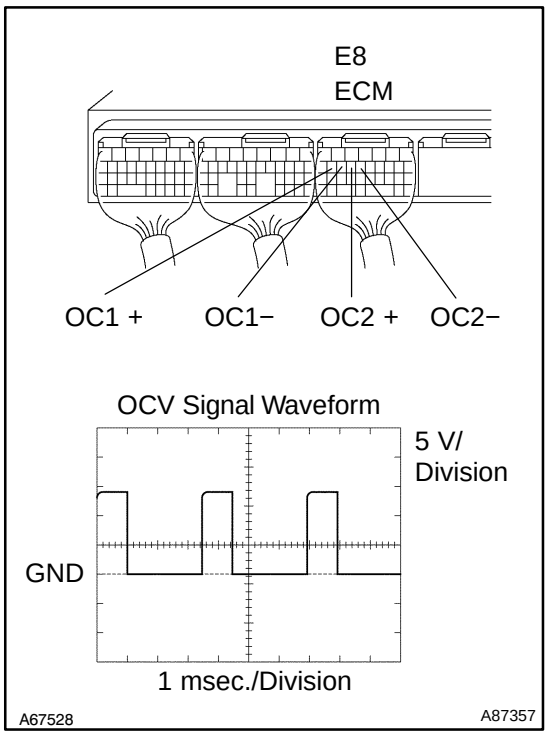


(a) Disconnect the V18 or V19 OCV connector.
(b) Apply positive battery voltage between the terminals of the OCV.
(c) Check the engine speed.
OK:
Engine speed is rough idle or engine is stalled.
(d) Reconnect the OCV connector.

NG → **REPLACE CAMSHAFT TIMING OIL CONTROL VALVE ASSY**

OK

2	CHECK ECM (OCV SIGNAL)



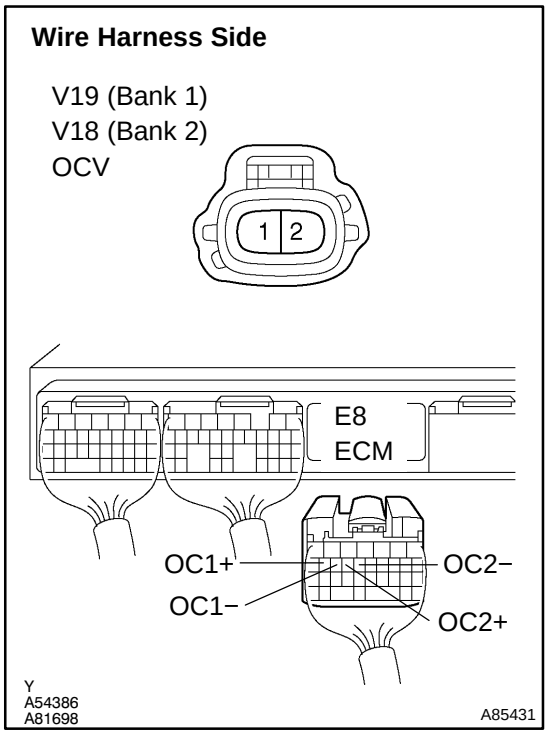
(a) During idling, check the waveform of the ECM connector using the oscilloscope.
Standard:

Tester Connection	Specified Condition
E8−16 (OC1+) − E8−15 (OC1−) E8−14 (OC2+) − E8−13 (OC2−)	Correct waveform is as shown

NG → **REPLACE ECM (See page 10−25)**

OK

3 CHECK WIRE HARNESS (OCV−ECM)



(a) Disconnect the V18 or V19 OCV connector.
(b) Disconnect the E8 ECM connector.
(c) Check the resistance of the wire harness side connectors.

Standard:

Tester Connection	Specified Condition
V19−1 (OCV) − E8−16 (OC1+) V19−2 (OCV) − E8−15 (OC1−) V18−1 (OCV) − E8−14 (OC2+) V18−2 (OCV) − E8−13 (OC2−)	Below 1 Ω
V19−1 (OCV) or E8−16 (OC1+) − Body ground V19−2 (OCV) or E8−15 (OC1−) − Body ground V18−1 (OCV) or E8−14 (OC2+) − Body ground V18−2 (OCV) or E8−13 (OC2−) − Body ground	10 kΩ or higher

NG → **REPAIR OR REPLACE HARNESS AND CONNECTOR**

OK →

CHECK FOR INTERMITTENT PROBLEMS (See page 05−500)