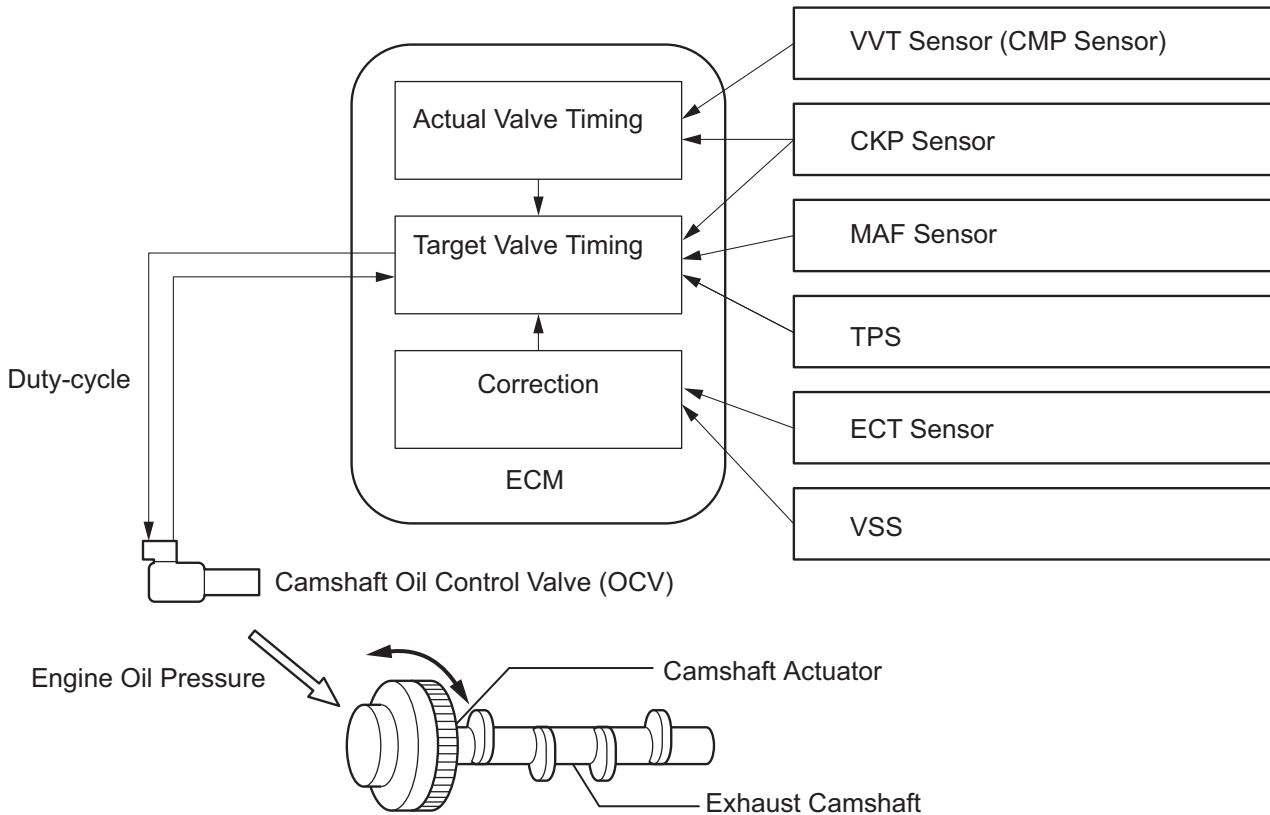


<b>DTC</b>	<b>P0014</b>	<b>Camshaft Position "B" - Timing Over-Advanced or System Performance (Bank 1)</b>
<b>DTC</b>	<b>P0015</b>	<b>Camshaft Position "B" - Timing Over-Retarded (Bank 1)</b>
<b>DTC</b>	<b>P0024</b>	<b>Camshaft Position "B" - Timing Over-Advanced or System Performance (Bank 2)</b>
<b>DTC</b>	<b>P0025</b>	<b>Camshaft Position "B" - Timing Over-Retarded (Bank 2)</b>

**ES****DESCRIPTION****HINT:**

If DTC P0014, P0015, P0024 or P0025 is present, check the VVT (Variable Valve Timing) system. The Variable Valve Timing (VVT) system includes the ECM, OCV and VVT controller. The ECM sends a target duty-cycle control signal to the OCV. This control signal regulates the oil pressure supplied to the VVT controller. Camshaft timing control is performed according to engine operating conditions such as the intake air volume, throttle valve position and engine coolant temperature. The ECM controls the OCV based on the signals transmitted by several sensors. The VVT controller regulates the exhaust camshaft angle using oil pressure through the OCV. As a result, the relative positions of the camshaft and crankshaft are optimized, the engine torque and fuel economy improve, and the exhaust emissions decrease under overall driving conditions. The ECM detects the actual exhaust valve timing using signals from the camshaft and crankshaft position sensors, and performs feedback control. This is how the target exhaust valve timing is verified by the ECM.

VVT System



Y

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DTC No.	DTC Detection Condition	Trouble Area
P0014 P0024	Advanced cam timing: With warm engine and engine speed of between 500 rpm and 4,000 rpm, all conditions (a), (b) and (c) are met (2 trip detection logic): (a) Difference between target and actual exhaust valve timing more than 5°CA (Crankshaft Angle) for 4.5 seconds (b) Current exhaust valve timing fixed (timing changes less than 5°CA in 5 seconds) (c) Variations in VVT controller timing more than 19°CA of maximum delayed timing (advanced)	<ul style="list-style-type: none"> <li>• Valve timing</li> <li>• Oil control valve (OCV) for exhaust camshaft</li> <li>• OCV filter</li> <li>• Exhaust camshaft</li> <li>• ECM</li> </ul>
P0015 P0025	Retarded cam timing: With warm engine and engine speed of between 500 rpm and 4,000 rpm, all conditions (a), (b) and (c) are met (1 trip detection logic): (a) Difference between target and actual exhaust valve timing more than 5°CA (Crankshaft Angle) for 4.5 seconds (b) Current exhaust valve timing fixed (timing changes less than 5°CA in 5 seconds) (c) Variations in VVT controller timing more than 19°CA or less of maximum delayed timing (retarded)	<ul style="list-style-type: none"> <li>• Valve timing</li> <li>• OCV for exhaust camshaft</li> <li>• OCV filter</li> <li>• Exhaust camshaft</li> <li>• ECM</li> </ul>

## MONITOR DESCRIPTION

- The ECM optimizes the exhaust valve timing using the VVT (Variable Valve Timing) system to control the exhaust camshaft. The VVT system includes the ECM, Oil Control Valve (OCV) and VVT controller.
- The ECM sends a target duty-cycle control signal to the OCV. This control signal regulates the oil pressure supplied to the VVT controller. The VVT controller can advance or retard the exhaust camshaft.

If the difference between the target and actual exhaust valve timing is large, and changes in actual exhaust valve timing are small, the ECM interprets this as the VVT controller stuck malfunction and sets a DTC.

Example:

A DTC is set when the following conditions A, B and C are met:

A The difference between the target and actual exhaust valve timing is more than 5°CA (Crankshaft Angle) and the condition continues for more than 4.5 seconds (Procedure "A").

B It takes 5 seconds or more to change the valve timing by 5°CA (Procedure "B").

C After above procedures "A" and "B" are met, the OCV is forcibly activated 63 times or more.

- DTCs P0014 and P0024 (Advanced Cam Timing) are subject to 1 trip detection logic.
- DTCs P0015 and P0025 (Retarded Cam Timing) are subject to 2 trip detection logic.  
These DTCs indicate that the VVT controller cannot operate properly due to OCV malfunctions or the presence of foreign objects in the OCV.
- The monitor will not run unless the following conditions are met:
  - The engine is warm (the engine coolant temperature is 75°C [167°F] or more).
  - The vehicle has been driven at more than 40 mph (64 km/h) for 3 minutes.
  - The engine has idled for 3 minutes.

**ES**

## MONITOR STRATEGY

Related DTCs	P0014: Advanced camshaft timing (bank 1) P0015: Retarded camshaft timing (bank 1) P0024: Advanced camshaft timing (bank 2) P0025: Retarded camshaft timing (bank 2)
Required sensors / components (Main)	VVT OCV and VVT Actuator
Required sensors / components (Related)	Crankshaft position sensor, Camshaft position sensor and Engine coolant temperature sensor
Frequency of operation	Once per driving cycle
Duration	Within 10 seconds
MIL operation	Advanced camshaft timing (bank 1): Immediate Advanced camshaft timing (bank 2): Immediate Retarded camshaft timing (bank 1): 2 driving cycles Retarded camshaft timing (bank 2): 2 driving cycles
Sequence of operation	None

## TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs are not present	P0100 - P0103 (MAF sensor) P0115 - P0118 (ECT sensor) P0125 (insufficient ECT for closed loop) P0335 (CKP sensor) P0340 (VVT sensor) P0351 - P0356 (igniter)
Battery voltage	11 V or more
Engine RPM	500 to 4,000 rpm
Engine coolant temperature	75 to 100°C (167 to 212°F)

## TYPICAL MALFUNCTION THRESHOLDS

### Advanced camshaft timing:

Valve timing	No change
--------------	-----------

Valve timing	Advanced position
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**Retarded camshaft timing:**

Valve timing	No change
Valve timing	Retarded position

**WIRING DIAGRAM**

Refer to DTC P0013 (see page [ES-88](#)).

**INSPECTION PROCEDURE**

HINT:

Abnormal bank	Advanced timing over (Valve timing is out of specified range)	Retarded timing over (Valve timing is out of specified range)
Bank 1	P0014	P0015
Bank 2	P0024	P0025

- If DTC P0014 or P0015 is displayed, check the bank 1 VVT system for exhaust camshaft circuit.
- Bank 1 refers to the bank that includes cylinder No. 1.
- If DTC P0024 or P0025 is displayed, check the bank 2 VVT system for exhaust camshaft circuit.
- Bank 2 refers to the bank that does not include cylinder No. 1.
- Read freeze frame data using the intelligent tester. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air-fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction (See page [ES-40](#)).

**ES**

<b>1</b>	<b>CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO DTC P0014, P0015, P0024 OR P0025)</b>
----------	--

- (a) Connect the intelligent tester to the DLC3.
- (b) Turn the ignition switch ON and turn the tester ON.
- (c) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / DTC INFO / CURRENT CODES.
- (d) Read DTCs.

**Result**

Display (DTC output)	Proceed to
P0014, P0015, P0024 or P0025	<b>A</b>
P0014, P0015, P0024 or P0025 and other DTCS	<b>B</b>

HINT:

If any DTCs other than P0014, P0015, P0024 or P0025 are output, troubleshoot those DTCs first.

<b>B</b>	<b>GO TO DTC CHART</b>
----------	------------------------

<b>A</b>
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<b>2</b>	<b>PERFORM ACTIVE TEST BY INTELLIGENT TESTER (OPERATE OCV)</b>
----------	--

- (a) Connect the intelligent tester to the DLC3.
- (b) Turn the tester ON.
- (c) Warm up the engine.

- (d) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / ACTIVE TEST / VVT CTRL B1 or VVT CTRL B2.
- (e) Check the engine speed while operating the Oil Control Valve (OCV) using the tester.

OK

Tester Operation	Specified Condition
OCV OFF	Normal engine speed
OCV ON	Engine idles roughly or stalls (soon after OCV switched from OFF to ON)

NG

Go to step 4

OK

3

CHECK WHETHER DTC OUTPUT RECURS (DTC P0014, P0015, P0024 OR P0025)

ES

- (a) Connect the intelligent tester to the DLC3.
- (b) Turn the tester ON.
- (c) Clear DTCs (See page [ES-39](#)).
- (d) Warm up the engine.
- (e) Switch the ECM from normal mode to check mode using the tester (See page [ES-42](#)).
- (f) Drive the vehicle for more than 10 minutes.
- (g) Read DTCs using the tester.

OK:

No DTC output.

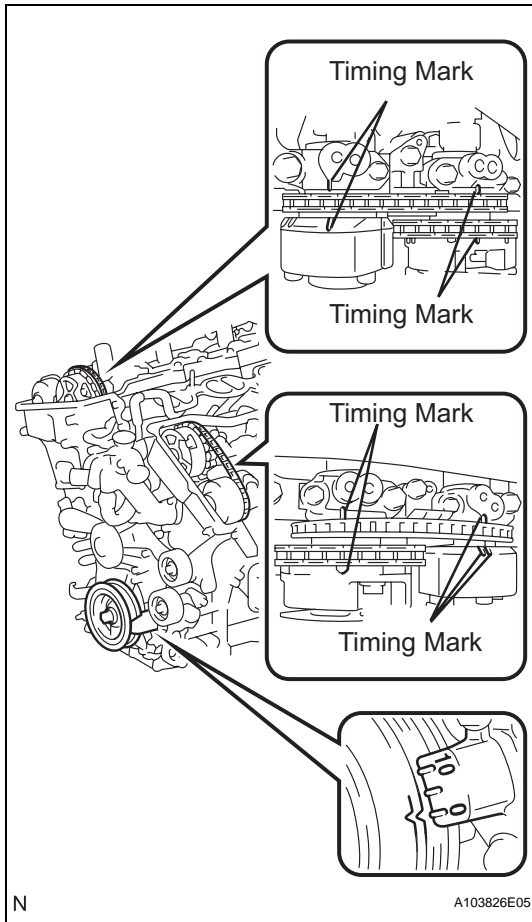
NG

Go to step 4

OK

END

#### 4 CHECK VALVE TIMING (CHECK FOR LOOSE AND JUMPED TEETH ON TIMING CHAIN)



- Remove the cylinder head cover RH and LH.
- Turn the crankshaft pulley, and align its groove with the timing mark "0" of the timing chain cover.
- Check that the timing marks of the camshaft timing gears are aligned with the timing marks of the bearing cap as shown in the illustration. If not, turn the crankshaft 1 revolution (360°), then align the marks as above.

**OK:**

**Timing marks on crankshaft timing gears are aligned as shown in the illustration.**

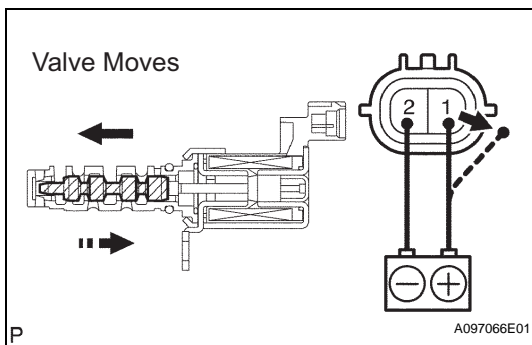
- Reinstall the cylinder head cover.

**NG**

**ADJUST VALVE TIMING**

**OK**

#### 5 INSPECT CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY (OCV FOR EXHAUST CAMSHAFT)



- Remove the OCV.
- Measure the resistance between the terminals of the OCV.  
**Standard resistance:**  
**6.9 to 7.9  $\Omega$  at 20°C (68°F)**
- Apply the positive battery voltage to terminal 1 and negative battery voltage to terminal 2. Check the valve operation.

**OK:**

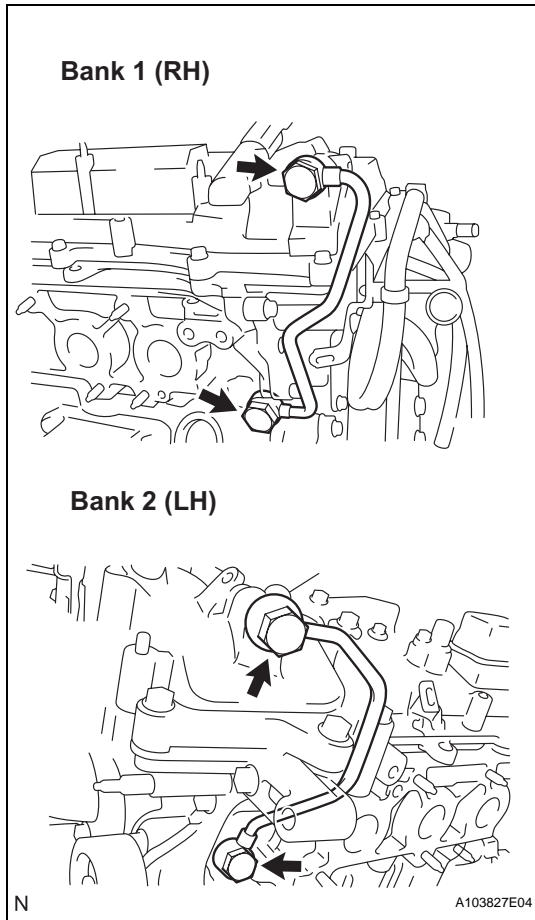
**Valve moves quickly.**

- Reinstall the OCV.

**NG**

**REPLACE CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY**

**OK**

**6 INSPECT OIL CONTROL VALVE FILTER AND PIPE**

- (a) Remove the oil pipe No. 1 or No. 2.
- (b) Remove the oil control valve filter.
- (c) Check that the filter and pipe are not clogged.

**OK:****Filter is not clogged.**

- (d) Reinstall the oil control valve filter.
- (e) Reinstall the oil pipe No. 1 or No. 2.

**NG****CLEAN OIL CONTROL VALVE FILTER AND PIPE****OK****7 REPLACE EXHAUST CAMSHAFT****NEXT****8 CHECK WHETHER DTC OUTPUT RECURS**

- (a) Connect the intelligent tester to the DLC3.
- (b) Turn the tester ON.
- (c) Clear DTCs.
- (d) Warm up the engine.
- (e) Switch the ECM from normal mode to check mode using the intelligent tester (see page [ES-42](#)).
- (f) Drive the vehicle for more than 10 minutes or more.
- (g) Read output DTCs using the intelligent tester.

**OK:****No DTC output.**

HINT:

DTC P0014, P0015, P0024 or P0025 is output when foreign objects in engine oil are caught in some parts of the system. These codes will stay registered even if the system returns to normal after a short time. These foreign objects are then captured by the oil filter, thus eliminating the source of the problem.

