DTC	P0016	Crankshaft Position - Camshaft Position Correlation (Bank 1 Sensor A)

DTC	P0017	Crankshaft Position - Camshaft Position Correlation (Bank 1 Sensor B)

DTC	P0018	Crankshaft Position - Camshaft Position Correlation (Bank 2 Sensor A)

ES

DTC	P0019	Crankshaft Position - Camshaft Position Correlation (Bank 2 Sensor B)

DESCRIPTION

Refer to DTC P0335 (See page ES-220).

DTC No.	DTC Detection Condition	Trouble Area
P0016	Deviations in crankshaft and camshaft position sensor (for intake camshaft) 1 signals (2 trip detection logic)	• Mechanical system (Timing chain has jumped teeth or chain stretched) • ECM
P0017	Deviations in crankshaft and camshaft position sensor (for exhaust camshaft) 1 signals (2 trip detection logic)	
P0018	Deviations in crankshaft and camshaft position sensor (for intake camshaft) 2 signals (2 trip detection logic)	
P0019	Deviations in crankshaft and camshaft position sensor (for exhaust camshaft) 2 signals (2 trip detection logic)	

MONITOR DESCRIPTION

DTC P0016 and P0018

The ECM optimizes the valve timing by using the VVT (Variable Valve Timing) system to control the intake camshaft. The 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 regulates the oil pressure applied to the VVT controller. The VVT controller can advance or retard the intake camshaft. The ECM calibrates the intake valve timing by setting the intake camshaft to the most retarded angle while the engine is idling. The ECM closes the OCV to retard the cam. The ECM stores this value as the VVT learning value. When the difference between the target and actual intake valve timings is 5° CA (Crankshaft Angle) or less, the ECM stores it.

If the VVT learning value matches the following conditions, the ECM determines the existence of a malfunction in the VVT system, and sets the DTC.

- The VVT learning value: Less than 18.5° CA, or more than 43.5° CA.
- The above condition continues for 18 seconds or more.

This DTC indicates that the intake camshaft has been installed toward the crankshaft at an incorrect angle, caused by factors such as the timing chain having jumped a tooth.

This monitor begins to run after the engine has idled for 5 minutes.

DTC P0017 and P0019

The ECM checks valve timing (VVT learning value) on the exhaust side while the engine is running at a low speed, in order to monitor the gap between current and target valve timings on the exhaust side. The VVT learning value is calculated from the positions of the camshaft and crankshaft. The camshaft will come to the most retarded position when the engine is running at a low speed. If the camshaft position is normal, the VVT learning value should be within the specified range. If the VVT learning value is not within the specified range, the ECM determines this as a malfunction.

MONITOR STRATEGY

Related DTCs	P0016: Deviation in crankshaft position sensor signal and camshaft position sensor signal (Bank 1) P0017: Deviation in crankshaft position sensor signal and camshaft position sensor signal (Bank 1 Sensor 2) P0018: Deviation in crankshaft position sensor signal and camshaft position sensor signal (Bank 2) P0019: Deviation in crankshaft position sensor signal and camshaft position sensor signal (Bank 2 Sensor 2)
Required Sensors / Components (Main)	P0016 and P0018: VVT actuator P0017 and P0019: Timing chain/belt
Required Sensors / Components (Related)	P0016 and P0018: Camshaft position sensor, Crankshaft position sensor P0017 and P0019: None
Frequency of Operation	Once per driving cycle
Duration	Less than 60 seconds
MIL Operation	2 driving cycles
Sequence of Operation	None

ES

TYPICAL ENABLING CONDITIONS

All:

The monitor will run whenever these DTCs are not present	P0011, P0012 (VVT System 1-Advance, Retard), P0021, P0022 (VVT System 2-Adavance, Retard), P0115, P0116, P0117, P0118 (ECT Sensor)

P0016 and P0018:

Engine RPM	500 to 1000 rpm

P0017 and P0019:

VVT feedback mode	Executing
VVT	Maximum advanced position
Engine RPM	500 to 1000 rpm

TYPICAL MALFUNCTION THRESHOLDS

P0016 and P0018:

One of the following conditions is met:	Condition 1 or 2
1. VVT learning value at maximum retarded valve timing	Less than 18.5° CA
2. VVT learning value at maximum retarded valve timing	More than 43.5° CA

P0017 and P0019:

One of the following conditions is met:	Condition 1 or 2
1. VVT learning value	Less than 77° CA
2. VVT learning value	More than 102° CA

WIRING DIAGRAM

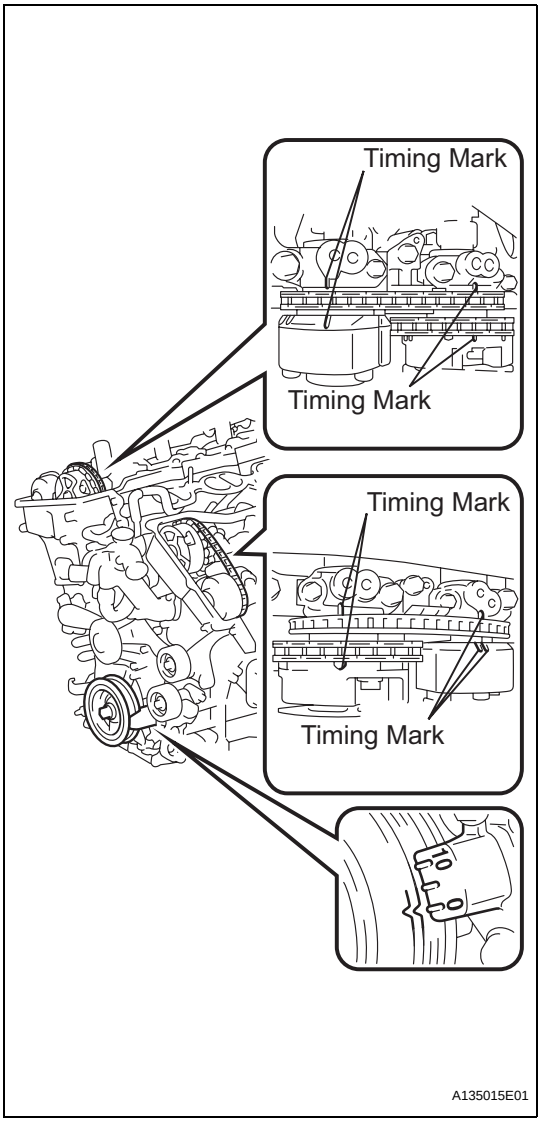
Refer to DTC P0335 (See page ES-222).

INSPECTION PROCEDURE

HINT:

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.

1	CHECK VALVE TIMING (CHECK FOR LOOSE AND A JUMPED TOOTH OF TIMING CHAIN)



(a) Remove the cylinder head covers RH and LH.
(b) Turn the crankshaft to align the matchmarks of the crankshaft.
(c) Align the notch of the crankshaft pulley to the "0" position.
(d) Check if the matchmarks of the camshaft pulley and camshaft bearing cap align.
(e) Turn the crankshaft clockwise by 360° if the matchmarks do not align. Check if they align once again.

OK:

The matchmarks of the camshaft pulley and the camshaft bearing cap align when the notch of the crankshaft pulley is in the "0" position.

NOTICE:

After replacing the ECM or adjusting intake valve timing, confirm that the DTC output does not recur.

(f) Confirm that the DTC output does not recur.
(1) Connect the intelligent tester to the DLC3.
(2) Turn the ignition switch to the ON position.
(3) Turn the tester on.
(4) Clear the DTCs (See page ES-39).
(5) Select the check mode using the tester (See page ES-43).
(6) Start the engine and warm it up.
(7) Allow the engine to idle for 1 minute or more, and then drive the vehicle for 1 minute or more.
(8) Confirm that no DTC is set using the tester.

NG → **ADJUST VALVE TIMING (REPAIR OR REPLACE TIMING CHAIN)**

OK

REPLACE ECM (See page ES-498)