

## HK: Variable Camshaft Timing (VCT)

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### HK1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

**Note:** These DTCs may be accompanied by other DTCs. Diagnose all camshaft position (CMP) sensor DTCs first. If no CMP sensor related DTCs are present, continue to follow diagnosis for the DTC. If any CMP DTCs are present, GO to Pinpoint Test [DR](#). If no CMP DTCs are present, continue to follow this test.

Are DTCs P0010, P0011, P0012, P0016, P0018, P0020, P0021, P0022, P052A, P052B, P052C or P052D present?

Yes	No
For DTCs P0010 or P0020, GO to <a href="#">HK2</a> . For all others, GO to <a href="#">HK16</a> .	For symptoms without DTCs, GO to <a href="#">HK16</a> . For all others, GO to Section 4, <a href="#">Diagnostic Trouble Code (DTC) Charts and Descriptions</a> .

### HK2 DTCS P0010 OR P0020: CHECK FOR VCT DTCS

**Note:** The engine should be at operating temperature before running the self-test.

- Clear the DTCs.
- Carry out the KOER self-test.

Are DTCs P0010 or P0020 present?

Yes	No
For KOER DTC P0010, GO to <a href="#">HK4</a> . For KOER DTC P0020, GO to <a href="#">HK10</a> .	GO to <a href="#">HK3</a> .

### HK3 CARRY OUT A THOROUGH WIGGLE TEST ON THE VCT HARNESS

- Carry out a thorough wiggle test on the VCT harness.
- Carry out the KOER self-test.

Are DTCs P0010 or P0020 present?

Yes	No
For KOER DTC P0010, GO to <a href="#">HK4</a> . For KOER DTC P0020, GO to <a href="#">HK10</a> .	GO to Pinpoint Test <a href="#">Z</a> .

### HK4 CHECK THE VCT1 SOLENOID RESISTANCE

- Ignition OFF.

- VCT1 Solenoid connector disconnected.
- Measure the resistance between:

( + ) VCT1 Solenoid Connector, Component Side	( - ) VCT1 Solenoid Connector, Component Side
VCT1	VPWR

Is the resistance between 5 - 14 ohms?

Yes	No
GO to <a href="#">HK5</a> .	INSTALL a new VCT1 solenoid. REFER to the Workshop Manual Section 303-14, Electronic Engine Controls.  CLEAR the DTCs. REPEAT the self-test.

## HK5 CHECK THE VCT1 SOLENOID FOR INTERNAL SHORTS

- Measure the resistance between:

( + ) VCT1 Solenoid Connector, Component Side	( - )
VCT1	Ground

Is the resistance greater than 10K ohms?

Yes	No
GO to <a href="#">HK6</a> .	INSTALL a new VCT1 solenoid. REFER to the Workshop Manual Section 303-14, Electronic Engine Controls.  CLEAR the DTCs. REPEAT the self-test.

## HK6 CHECK THE VPWR CIRCUIT FOR AN OPEN IN THE HARNESS

- Ignition ON, engine OFF.
- Measure the voltage between:

( + ) VCT1 Solenoid Connector, Harness Side	( - )
VPWR	Ground

Is the voltage greater than 10 V?

Yes	No
GO to <a href="#">HK7</a> .	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

## HK7 CHECK THE VCT1 CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Ignition OFF.
- PCM connector disconnected.
- Ignition ON, engine OFF.

- Measure the voltage between:

<b>( + ) VCT1 Solenoid Connector, Harness Side</b>	<b>( - )</b>
VCT1	Ground

Is the voltage less than 1 V?

<b>Yes</b>	<b>No</b>
GO to <a href="#">HK8</a> .	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

### HK8 CHECK THE VCT1 CIRCUIT FOR AN OPEN IN THE HARNESS

- Ignition OFF.
- Measure the resistance between:

<b>( + ) VCT1 Solenoid Connector, Harness Side</b>	<b>( - ) PCM Connector, Harness Side</b>
VCT1	VCT1

Is the resistance less than 5 ohms?

<b>Yes</b>	<b>No</b>
GO to <a href="#">HK9</a> .	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

### HK9 CHECK THE VCT1 CIRCUIT FOR A SHORT TO GND IN THE HARNESS

- Measure the resistance between:

<b>( + ) VCT1 Solenoid Connector, Harness Side</b>	<b>( - )</b>
VCT1	Ground

Is the resistance greater than 10K ohms?

<b>Yes</b>	<b>No</b>
GO to <a href="#">HK20</a> .	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

### HK10 DTC P0020: CHECK THE VCT2 SOLENOID RESISTANCE

- Ignition OFF.
- VCT2 Solenoid connector disconnected.
- Measure the resistance between:

<b>( + ) VCT2 Solenoid Connector, Component Side</b>	<b>( - ) VCT2 Solenoid Connector, Component Side</b>
VCT2	VPWR

Is the resistance between 5 - 14 ohms?

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Yes	No
GO to <a href="#">HK11</a> .	INSTALL a new VCT2 solenoid. REFER to the Workshop Manual Section 303-14, Electronic Engine Controls.  CLEAR the DTCs. REPEAT the self-test.

## HK11 CHECK THE VCT2 SOLENOID FOR INTERNAL SHORTS

- Measure the resistance between:

( + ) VCT2 Solenoid Connector, Component Side	( - )
VCT2	Ground

Is the resistance greater than 10K ohms?

Yes	No
GO to <a href="#">HK12</a> .	INSTALL a new VCT2 solenoid. REFER to the Workshop Manual Section 303-14, Electronic Engine Controls.  CLEAR the DTCs. REPEAT the self-test.

## HK12 CHECK THE VPWR CIRCUIT FOR AN OPEN IN THE HARNESS

- Ignition ON, engine OFF.
- Measure the voltage between:

( + ) VCT2 Solenoid Connector, Harness Side	( - )
VPWR	Ground

Is the voltage greater than 10 V?

Yes	No
GO to <a href="#">HK13</a> .	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

## HK13 CHECK THE VCT2 CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Ignition OFF.
- PCM connector disconnected.
- Ignition ON, engine OFF.
- Measure the voltage between:

( + ) VCT2 Solenoid Connector, Harness Side	( - )
VCT2	Ground

Is the voltage less than 1 V?

Yes	No
	REPAIR the short circuit. CLEAR the DTCs.

GO to [HK14](#).

REPEAT the self-test.

## HK14 CHECK THE VCT2 CIRCUIT FOR AN OPEN IN THE HARNESS

- Ignition OFF.
- Measure the resistance between:

( + ) VCT2 Solenoid Connector, Harness Side	( - ) PCM Connector, Harness Side
VCT2	VCT2

Is the resistance less than 5 ohms?

Yes	No
GO to <a href="#">HK15</a> .	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

## HK15 CHECK THE VCT2 CIRCUIT FOR A SHORT TO GND IN THE HARNESS

- Measure the resistance between:

( + ) VCT2 Solenoid Connector, Harness Side	( - )
VCT2	Ground

Is the resistance greater than 10K ohms?

Yes	No
GO to <a href="#">HK20</a> .	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

## HK16 CONTINUOUS DTCS P0011, P0012, P0016, P0018, P0021, P0022, P052A, P052B, P052C OR P052D: CHECK THE OPERATION OF THE VCT SYSTEM

**Note:** Some vehicles require higher RPMs and loads to actuate the VCT system than others. The VCTADVERR PID should be close to zero whether actuating or not. During rapid VCT movements, the VCTADVERR PID may momentarily deviate from zero. In addition, normal deviation may momentarily move to the end of the scale on a rapid acceleration.

**Note:** For a symptom based concern, monitor all applicable PIDs during this step.

- For DTCs P0011, P0012, P0016, P052A or P052B.
- Access the PCM and monitor the VCTADV and VCTADVERR PIDs.
- For DTCs P0018, P0021, P0022, P052C or P052D.
- Access the PCM and monitor the VCTADV2 and VCTADVERR2 PIDs.
- Drive the vehicle while exercising the throttle to generate VCT movement.

Does the VCTADV PID indicate VCT movement while the VCTADVERR PID maintain close to zero?

Yes	No
Unable to duplicate or identify the concern at this time.	If the engine runs rough at idle and KOER or Continuous Memory DTCs are present: GO to <a href="#">HK18</a> .

For all others, GO to [HK17](#).

## HK17 CHECK THE FUNCTIONALITY OF THE VCT SYSTEM

- Ignition OFF.
- For DTCs P0011, P0012, P0016, P052A or P052B.
- VCT1 Solenoid connector disconnected.
- Ignition ON, engine running.
- Connect a 5 amp fused jumper wire between the following:

Point A VCT1 Solenoid Connector, Component Side	Point B Vehicle Battery
VCT1	Negative terminal

- Connect a 5 amp fused jumper wire between the following:

Point A VCT1 Solenoid Connector, Component Side	Point B Vehicle Battery
VPWR	Positive terminal

- For DTCs P0018, P0021, P0022, P052C or P052D.
- VCT2 Solenoid connector disconnected.
- Ignition ON, engine running.
- Connect a 5 amp fused jumper wire between the following:

Point A VCT2 Solenoid Connector, Component Side	Point B Vehicle Battery
VCT2	Negative terminal

- Connect a 5 amp fused jumper wire between the following:

Point A VCT2 Solenoid Connector, Component Side	Point B Vehicle Battery
VPWR	Positive terminal

Does the engine reduce speed, run rough or stall with the jumper connected?

Yes	No
The concern is not present at this time.  The concern may have been caused by an oil flow restriction which was removed by opening the VCT solenoid.  CLEAR the DTCs. REPEAT the self-test.	GO to <a href="#">HK18</a> .

## HK18 CHECK THE FUNCTIONALITY OF THE VCT SOLENOID

- Ignition OFF.
- For DTCs P0011, P0012, P0016, P052A or P052B.
- VCT1 Solenoid connector disconnected.
- Connect a 5 amp fused jumper wire between the following:

Point A VCT1 Solenoid Connector, Component Side	Point B Vehicle Battery
VCT1	Negative terminal

- Connect a 5 amp fused jumper wire between the following:

Point A VCT1 Solenoid Connector, Component Side	Point B Vehicle Battery
VPWR	Positive terminal

- Listen for an audible click in the VCT solenoid.
- For DTCs P0018, P0021, P0022, P052C or P052D.
- VCT2 Solenoid connector disconnected.
- Connect a 5 amp fused jumper wire between the following:

Point A VCT2 Solenoid Connector, Component Side	Point B Vehicle Battery
VCT2	Negative terminal

- Connect a 5 amp fused jumper wire between the following:

Point A VCT2 Solenoid Connector, Component Side	Point B Vehicle Battery
VPWR	Positive terminal

- Listen for an audible click in the VCT solenoid.
- Repeat as necessary to verify the VCT solenoid click.

#### Does the VCT solenoid click?

Yes	No
GO to <a href="#">HK19</a> .	INSTALL a new VCT solenoid. REFER to the Workshop Manual Section 303-14, Electronic Engine Controls. CLEAR the DTCs. REPEAT the self-test.

### HK19 CHECK THE BASE ENGINE OIL PRESSURE

- Check the base engine oil pressure. Refer to the Workshop Manual Section 303-00, Engine System, Oil Pressure Test.

#### Are any concerns present?

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	INSTALL a new VCT phaser as necessary. REFER to the Workshop Manual Section 303-01 Engine, Timing Drive Components. CLEAR the DTCs. REPEAT the self-test.

### HK20 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.

- Carry out the PCM self-test and verify the concern is still present.

**Is the concern still present?**

<b>Yes</b>	<b>No</b>
INSTALL a new PCM. REFER to Section 2, <a href="#">Flash Electrically Erasable Programmable Read Only Memory (EEPROM)</a> , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

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