

Variable Camshaft Timing (VCT)

PART 8-4

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DESCRIPTION AND OPERATION

The variable camshaft timing system consists of two major components, the VCT unit and sprocket assembly and the VCT housing and solenoid assembly.

The VCT system is designed to improve both low and high speed engine performance, engine idle quality and exhaust emissions. It is a two position system operating on the drive sprocket for the camshaft. It provides movement of 10° on the camshaft (equivalent to 20° rotation on the crankshaft) between the retarded and advanced positions.

VARIABLE CAMSHAFT TIMING (VCT) UNIT (FIG 2)

NOTE: This unit is supplied as an assembled unit, at no time should all four bolts connecting the VCT to the sprocket be loosened.

The VCT unit turns the camshaft in relation to the timing chain in order to retard or advance the timing. The VCT unit itself consists of an inner sleeve which is separated from the body by a ring piston and two ring gears. The inner sleeve provides the connection to the camshaft via a single bolt and a locating dowel pin. The ring gears engage in opposing helical splines on both the VCT body and the inner sleeve. Engine oil pressure moves the ring gears and piston to turn the inner sleeve in the advanced timing position and a return spring retards the position when the engine oil pressure is removed. Additional springs absorb rotational and axial backlash to reduce both wear and noise caused by switching between positions.

HOUSING AND SOLENOID ASSEMBLY

An oil supply line supplies this assembly with oil from the engine. The housing also has two holes for oil flow. The flow is controlled by the solenoid where the de-energised state closes the solenoid shuttle valve feeding the VCT and allows oil to drain from the VCT through the housing. When the solenoids are energised the solenoid positions the shuttle valve to direct engine oil to the VCT unit, the pressure then overcomes the force of the return spring in the VCT unit and moves the gears and ring piston to the advanced position.

DIAGNOSIS AND TESTING

Fault with the VCT unit is detected using the New Generation Star (NGS) Tester. The NGS will log a trouble code if the Variable Camshaft Unit is failing to switch. (Diagnostic Trouble Code P1380).

If the VCT system is stuck in advanced mode it may be diagnosable by a roughness at idle. However if the VCT system is failing to switch to advanced mode the performance of the vehicle may only reduce at a load which would usually cause operation. The result of this is simply that the engine will perform as if no VCT system had been installed.

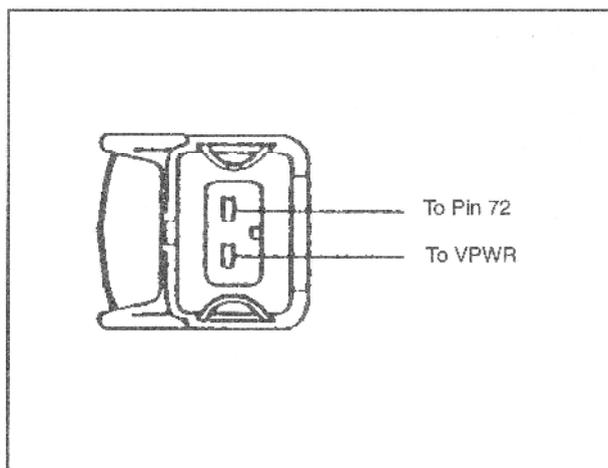


FIG. 1. - VCT Solenoid Connector

If trouble code P1380 is received using the NGS the following testing should be carried out.

TEST STEP	RESULT	ACTION TO TAKE
A1		
<ul style="list-style-type: none"> Using the NGS run an Active Command Output Test in "All On" mode listening for VCT solenoid activity (It may be necessary to disconnect the A/C Clutch to hear the VCT solenoid) Is the solenoid switching? 	Yes  No 	Go to A4 Go to A2
A2		
<ul style="list-style-type: none"> Whilst in "All On" mode check the status of the "CAMDCH" PID Has the EEC commanded to solenoid to open? 	Yes  No 	Go to A3 Check the operation of EEC. Rectify and Retest
A3		
<ul style="list-style-type: none"> Measure the voltage across the VCT solenoid connector in both modes (ie "All On" and "All Off") The voltage should be supply with the solenoid on and zero with the solenoid off. Are the voltages correct? 	Yes  No 	Replace solenoid. Retest Check the wiring from the EEC to the solenoid for a short or open circuit. Rectify and retest
A4		
<ul style="list-style-type: none"> Check for oil leaks, oil level and oil pressure Is this all OK? 	Yes  No 	Go to A5 Rectify and Retest.
A5		
<ul style="list-style-type: none"> Check the seal of the VCT housing to VCT unit Is the seal OK? 	Yes  No 	Go to A6 Rectify and Retest.
A6		
<ul style="list-style-type: none"> Check oil supply path to the VCT unit for line blockages or leaks Is the oil supply OK? 	Yes  No 	Replace VCT unit Rectify and Retest.

REMOVAL AND INSTALLATION

VARIABLE CAMSHAFT TIMING HOUSING AND SOLENOID ASSEMBLY

Removal

1. Disconnect solenoid connector from assembly
2. Remove accessory belt guard
3. Remove oil supply line at VCT banjo bolt and remove thermostat housing attaching bolt that attaches VCT oil pipe to the thermostat housing
4. Remove the brake booster vacuum lines, throttle/cruise control cables, air intake assembly and PCV valve
5. Remove the rocker cover assembly
6. Remove VCT housing and solenoid assembly bolts and slide the assembly off the dowel pins

Installation

The installation process is the reverse of the removal process.

VARIABLE CAMSHAFT TIMING UNIT

Removal

1. Remove the fresh air duct and fan mounting bolts also the top radiator bolts on automatic vehicles
2. Lift the fan assembly out of the vehicle
3. Disconnect the solenoid connector
4. Remove the accessory belt guard
5. Remove the High Tension Leads
6. Remove the brake booster vacuum lines, throttle/cruise control cables, air intake assembly and PCV valve
7. Remove the rocker cover assembly
8. Remove spark plugs
9. Remove accessory belt
10. Remove power steering pump
11. Remove the power steering bracket
12. Time the engine to cylinder 1 TDC with two yellow chain links at the chains highest point and either side of the mark on the VCT sprocket
13. Remove oil supply line at VCT banjo bolt and remove thermostat housing attaching bolt that attaches VCT oil pipe to the thermostat housing.
14. Remove VCT housing and solenoid assembly bolts and slide the assembly off the dowel pins.
15. Holding sprocket and camshaft firmly in position, remove the centre VCT to camshaft bolt. (Tension for installation is 120Nm)
16. Remove chain tensioner and guide bolts.

NOTE: From here on it is important to ensure that the timing of the engine is not altered as this will alter the repositioning process for the VCT unit.

17. Remove the rocker gear assembly

18. Remove the bottom VCT to sprocket bolt.

NOTE: DO NOT LOOSEN ANY OF THE OTHER BOLTS OR REMOVE THE VCT UNIT FROM THE SPROCKET AS THE POSITIONING OF THIS UNIT ON THE SPROCKET IS VITAL FOR ENGINE TIMING AND PERFORMANCE.

19. Lift the rear of the camshaft and slide rearward in order to get camshaft thrust washer over the cylinder head thrust groove. Remove the camshaft.

20. Ensuring not to drop the chain into the engine, roll the VCT and sprocket assembly off the chain and secure the chain to prevent it from dropping.

Installation

NOTE: When installing the VCT assembly it is important that the sprocket timing mark is repositioned between the two yellow links.

All of the removed parts should be reinstalled in the reverse order of that listed for the removal process.

NOTE: Connect the VCT/ sprocket assembly to the Camshaft with a torque of 120Nm.

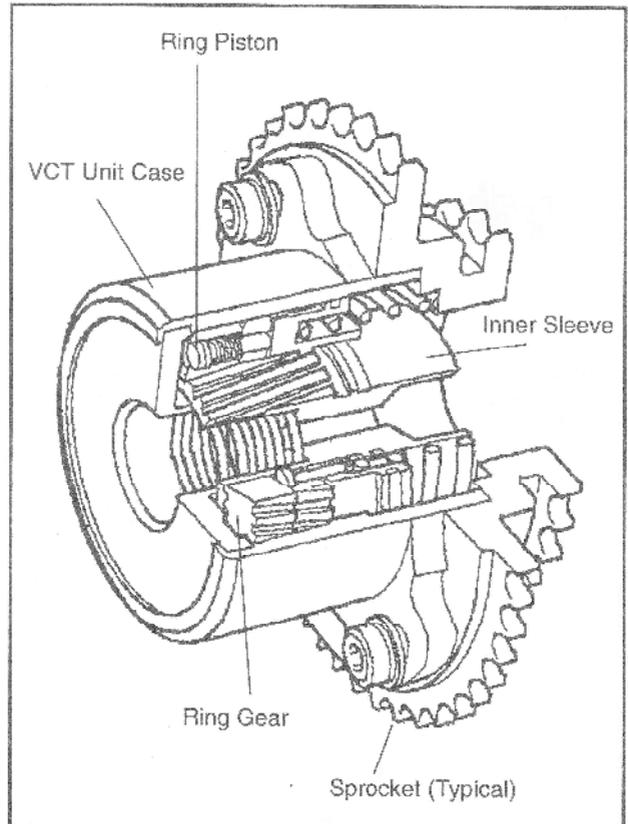


Fig 2 – VCT assembly (Typical - not Falcon Sprocket)

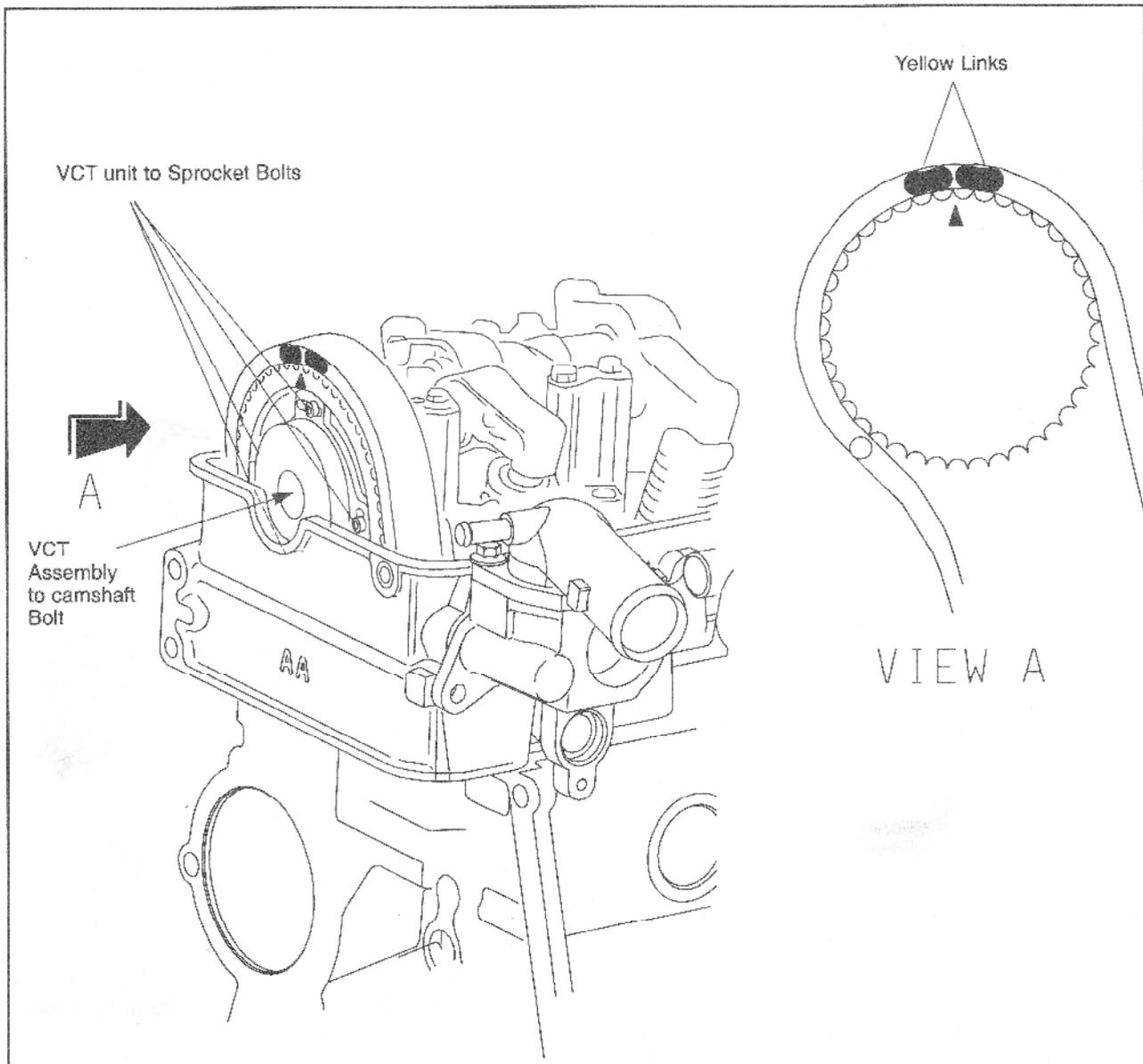


Fig. 3 - Correct Chain Timing of VCT Unit and Sprocket Assembly

NOTE: Use the Crankshaft Damper to ensure cylinder 1 is at TDC.