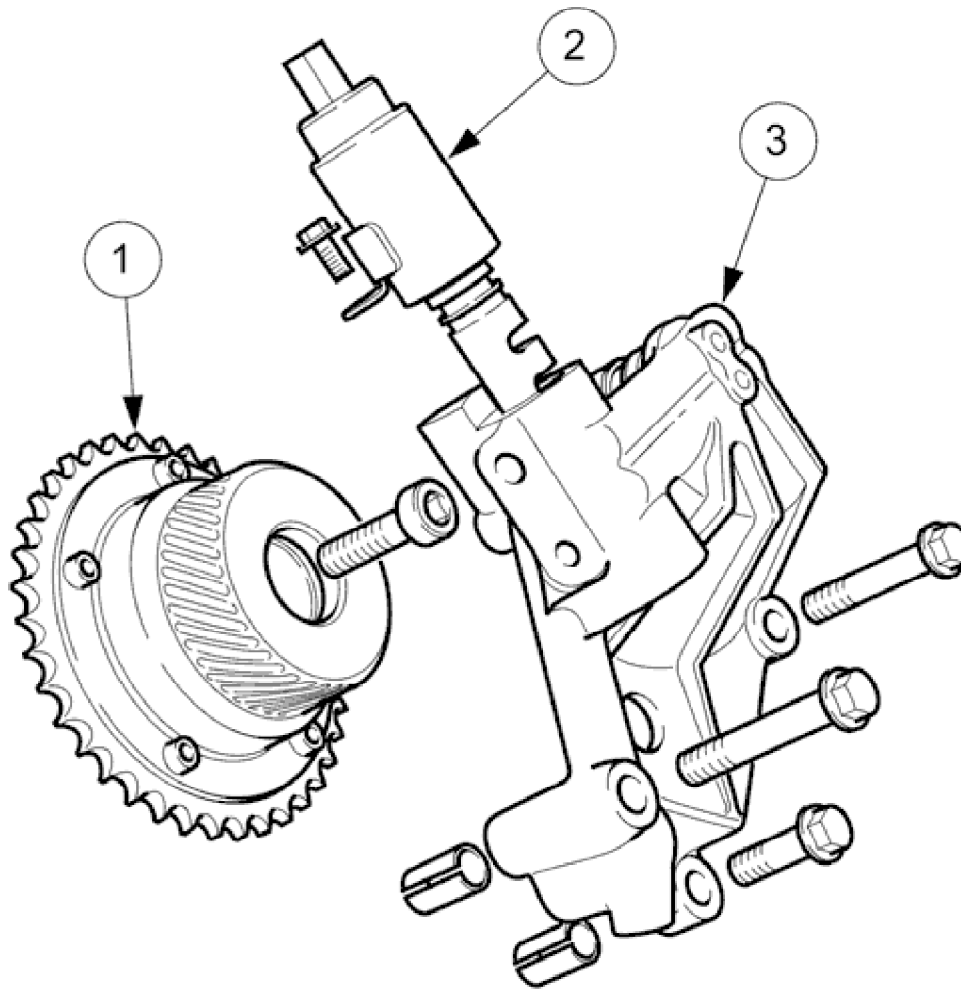


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Variable Valve Timing (VVT)



E33949

Parts List

Item	Description
1	Variable Valve Timing (VVT) Unit
2	Solenoid / Shuttle Valve
3	Bush Carrier

For each intake camshaft there is a variable valve timing unit, a bush carrier assembly and a solenoid / shuttle valve.

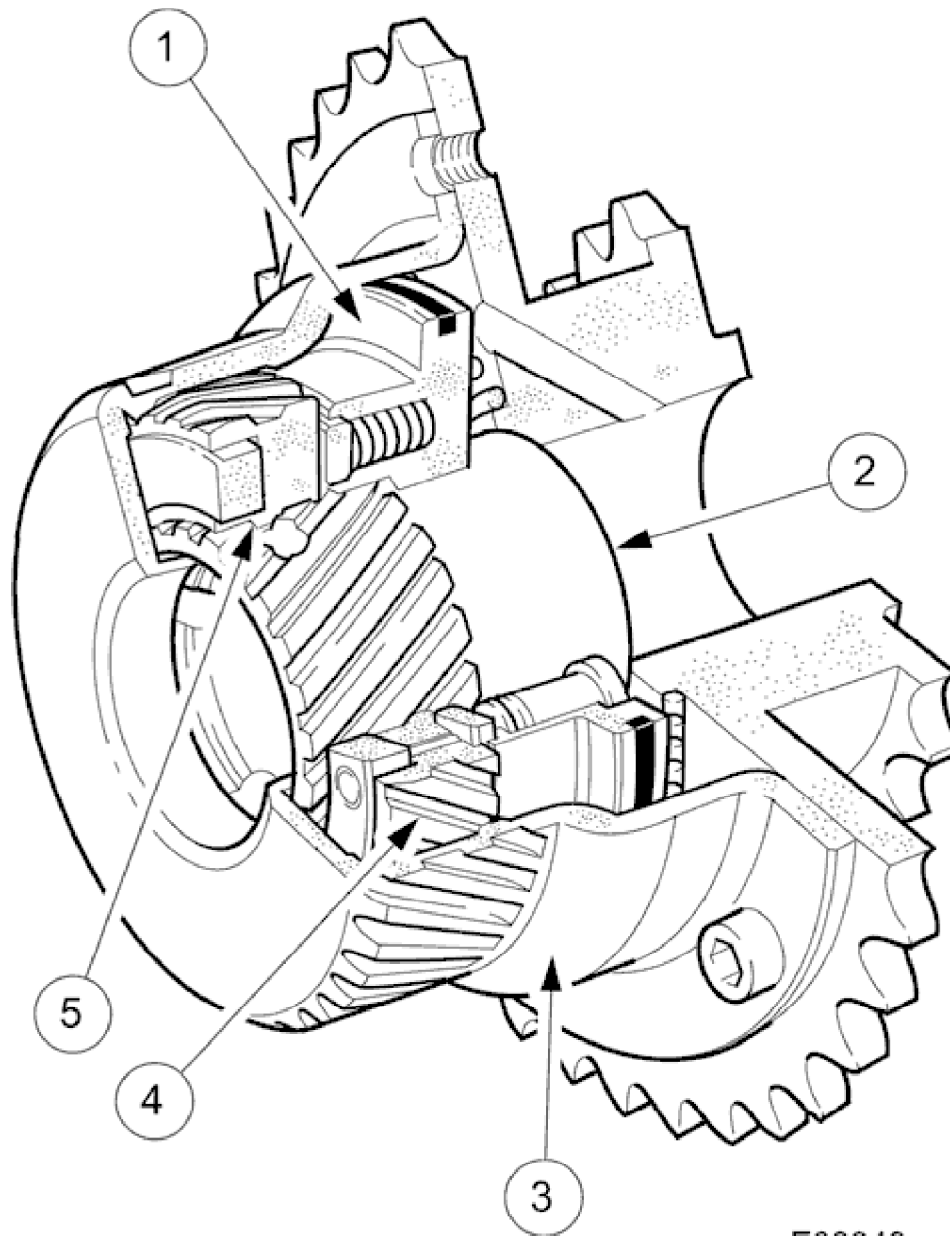
It is an infinitely variable system (within the prescribed operating range) operating on the intake camshafts only. There is the equivalent of 48° of crankshaft movement between the retarded and advanced positions. Engine oil pressure operates the system under the control of the ECM.

The variable valve timing system improves both low speed and high speed engine performance, engine idle quality and exhaust emissions. Engine idle is improved due to the ECM being able to retard the valve timing by an additional

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10° compared to the previous VVT system; this also reduces the internal EGR at idle, where it is not required. However, the internal EGR system is improved at normal engine running speeds to reduce NOx emission and eliminate the need for any external EGR system components.

Valve Timing Unit



E33948

Parts List

Item	Description
1	Ring Piston
2	Inner Sleeve
3	Body and Sprocket Assembly
4	Helical Gears - Piston to Body
5	Helical Gears - Piston to Inner Sleeve

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The valve timing unit turns the intake camshaft relative to the primary chain to advance or retard the timing.

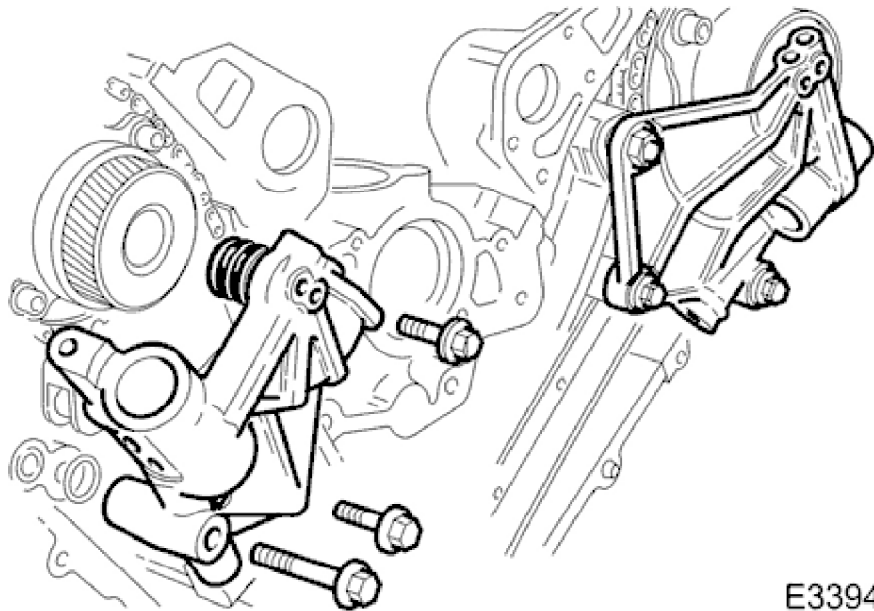
The unit consists of a body and sprocket assembly separated from an inner sleeve by a ring piston and two helical ring gears; the inner sleeve is bolted to the camshaft.

The two helical ring gears are part of the cylindrical extension of the piston, one gear on the outer bore (meshing with the helical gear which is on the inner bore of the body and sprocket assembly) and one on the inner bore (meshing with the inner sleeve).

As engine oil pressure moves the piston in the advance direction (to the right on the illustration) the helical ring gear on the outer bore of the piston causes the whole piston assembly to turn to the right as well as moving to the right. In the same way, the movement of the piston to the right, combined with the rotation caused by the outer helical gear assembly, causes the inner sleeve and hence the camshaft to rotate to the right in the advanced direction. The procedure is identical, but in the opposite direction for retarding the timing.

A light bias spring in the retard direction is provided along with anti-backlash springs.

Bush Carrier



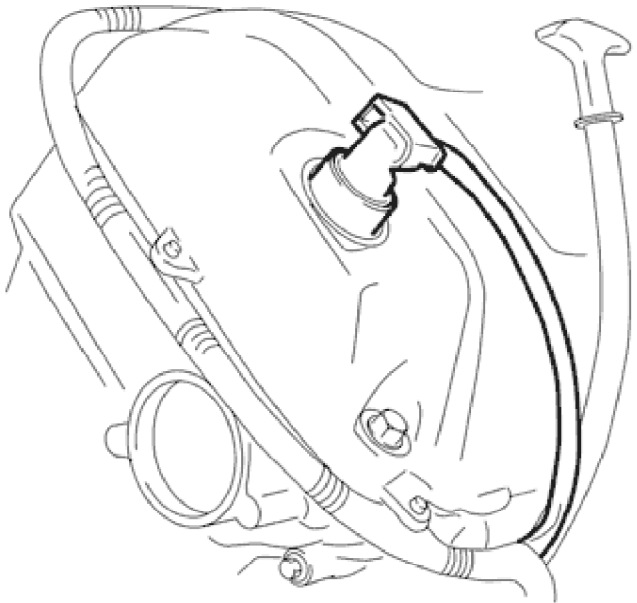
E33943

This contains the oil passages that link the engine oil supply from the cylinder block gallery to the variable valve timing (VVT) unit. A lug on the bush carrier locates in the central bore of the VVT unit.

Two hollow dowels at the bush carrier and cylinder block ensure that the lug is accurately located within the valve timing unit. O-rings seal the joint between the lug and the valve timing unit.

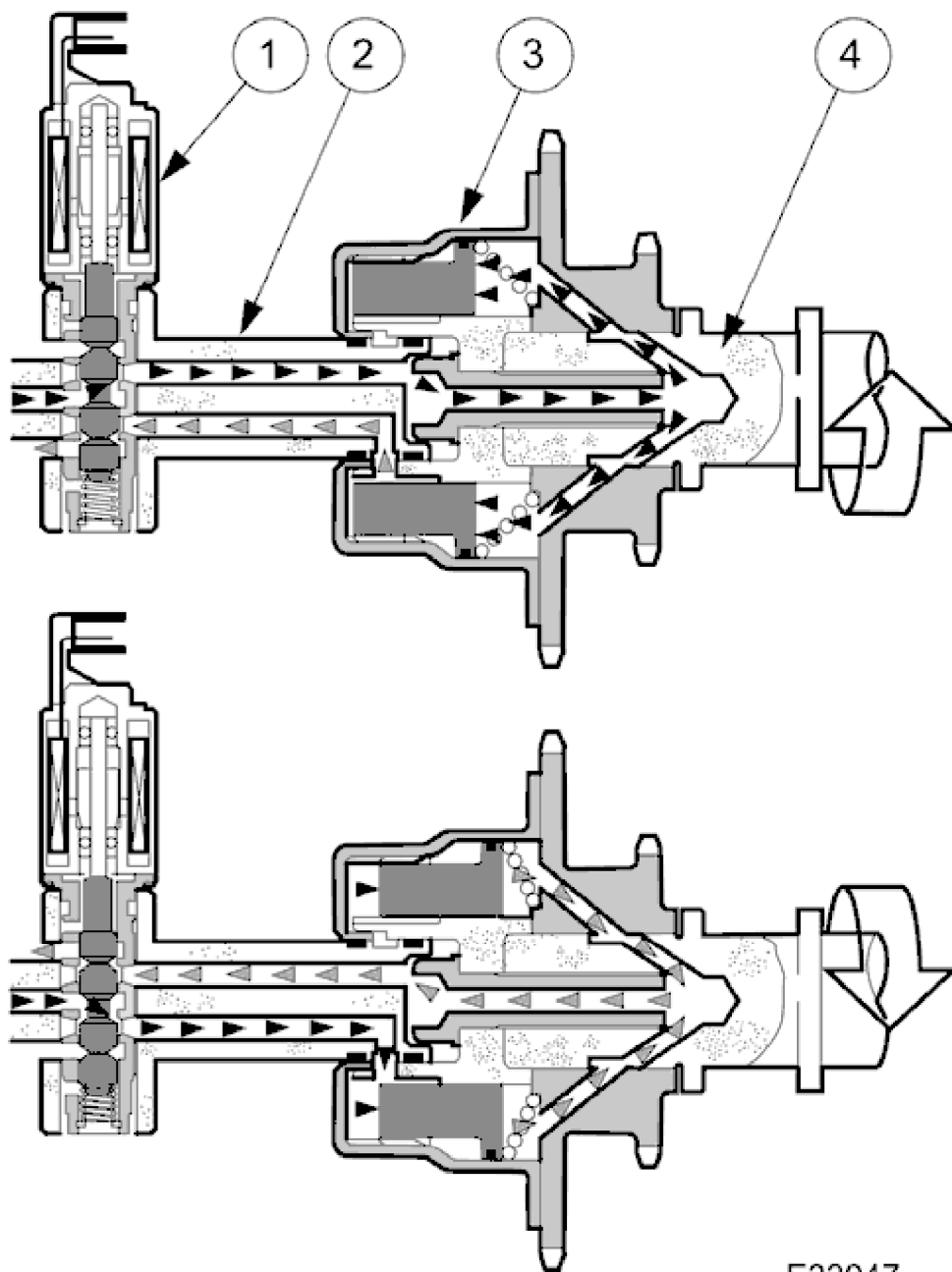
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Variable Valve Timing (VVT) Solenoid / Shuttle Valve



E33946

The VVT solenoid / shuttle valve assembly is bolted to the bush carrier and protrudes through the camshaft cover. Electrical connection to the solenoid is from the engine harness.



E33947

Parts List

Item	Description
1	Solenoid / Shuttle Valve Assembly
2	Bush Carrier
3	Variable Valve Timing Unit
4	Intake Camshaft

The valve timing solenoid controls the position of the shuttle valve relative to the two ports in the bush carrier.

The shuttle valve, depending on its position set by the solenoid at any instant, directs engine oil pressure to either the retard side or the advance side of the piston assembly.

The position of the solenoid / shuttle valve is controlled by a return spring and a 300 Hz pulse-width-modulated signal provided by the ECM.