

Chapter 2 Part B:

CVH engine - in-car engine repair procedures

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2B

Degrees of difficulty

Easy, suitable for novice with little experience 	Fairly easy, suitable for beginner with some experience 	Fairly difficult, suitable for competent DIY mechanic 	Difficult, suitable for experienced DIY mechanic 	Very difficult, suitable for expert DIY or professional 
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Specifications

General

Engine type	Four-cylinder, in-line overhead camshaft
Engine code:	
1.4 litre engine:	
Carburettor models	FUH
CFi fuel-injected models	F6F
1.6 litre engine:	
Carburettor models	LUK, LUJ
EFi fuel-injected models	LJE, LJF
Capacity:	
1.4 litre engine	1392 cc
1.6 litre engine	1596 cc
Bore:	
1.4 litre engine	77.42 mm
1.6 litre engine	79.96 mm
Stroke:	
1.4 litre engine	74.30 mm
1.6 litre engine	79.52 mm
Compression ratio:	
1.4 litre engine	8.5:1
1.6 litre engine:	
Carburettor models	9.5:1
EFi fuel-injected models	9.75:1
Firing order	1-3-4-2 (No 1 cylinder at timing belt end)
Direction of crankshaft rotation	Clockwise (seen from right-hand side of vehicle)

Cylinder head

Hydraulic tappet bore inside diameter 22.235 to 22.265 mm

Camshaft

Camshaft bearing journal diameter:

Bearing 1	44.75 mm
Bearing 2	45.00 mm
Bearing 3	45.25 mm
Bearing 4	45.50 mm
Bearing 5	45.75 mm
Camshaft bearing journal-to-cylinder head running clearance	0.033 to 0.058 mm
Camshaft endfloat	0.05 to 0.13 mm
Camshaft thrust plate thickness	4.99 to 5.01 mm

Lubrication

Engine oil type/specification	See Chapter 1
Engine oil capacity	See Chapter 1
Oil pressure:	
Idling	1.0 bar
At 2000 rpm	2.8 bars
Oil pump clearances:	
Outer rotor-to-body	0.060 to 0.190 mm
Inner rotor-to-outer rotor	0.05 to 0.18 mm
Rotor endfloat	0.014 to 0.100 mm

Torque wrench settings

	Nm	lbf ft
Oil pump	8 to 11	6 to 8
Oil pump cover	8 to 12	6 to 8
Oil pump pick-up to cylinder block	17 to 23	12 to 17
Oil pump pick-up to pump	8 to 12	6 to 8
Oil cooler threaded sleeve to cylinder block	55 to 60	40 to 44
Engine oil drain plug	21 to 28	15 to 21
Rear oil seal housing	8 to 11	6 to 8
Flywheel	82 to 92	60 to 68
Cylinder head bolts:		
Stage 1	24 to 40	25 to 30
Stage 2	40 to 60	30 to 44
Stage 3	Angle-tighten a further 90°	
Stage 4	Angle-tighten a further 90°	
Crankshaft pulley bolt	100 to 115	74 to 85
Camshaft thrust plate	9 to 13	7 to 10
Camshaft toothed belt sprocket	54 to 59	40 to 44
Timing belt tensioner	16 to 20	12 to 15
Rocker studs in cylinder head	18 to 23	13 to 17
Rocker arms	25 to 29	18 to 21
Rocker cover	6 to 8	4 to 6
Inlet manifold	16 to 20	12 to 15
Exhaust manifold	14 to 17	10 to 12
Timing belt cover	9 to 11	7 to 8
Oil pressure switch	18 to 22	13 to 16

Note: Refer to Part D of this Chapter for remaining torque wrench settings.

1 General information

How to use this Chapter

This Part of Chapter 2 is devoted to repair procedures possible while the engine is still installed in the vehicle, and includes only the Specifications relevant to those procedures. Similar information concerning the 1.3 litre HCS engine, and on the 1.6 and 1.8 litre Zetec engines, will be found in Parts A and C of this Chapter respectively. Since these procedures

are based on the assumption that the engine is installed in the vehicle, if the engine has been removed from the vehicle and mounted on a stand, some of the preliminary dismantling steps outlined will not apply.

Information concerning engine/transmission removal and refitting, and engine overhaul, can be found in Part D of this Chapter, which also includes the Specifications relevant to those procedures.

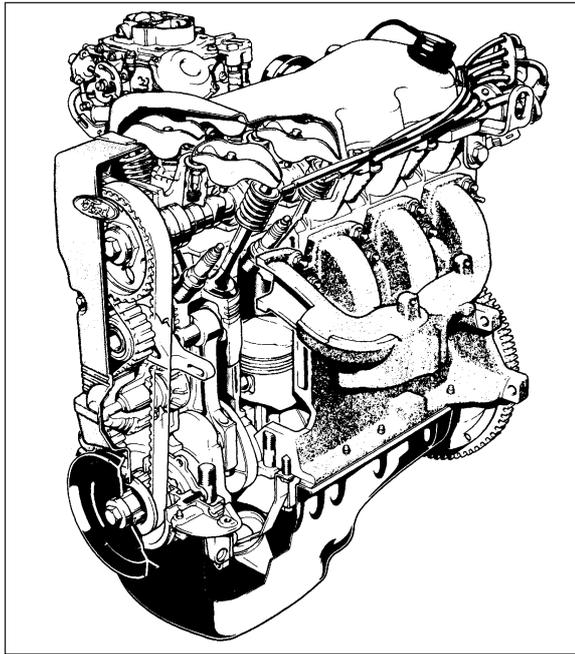
General description - CVH engine

The 1.4 and 1.6 litre CVH (Compound Valve angle, Hemispherical combustion chambers)

engines are of four-cylinder, in-line, overhead camshaft type, mounted transversely together with the transmission at the front of the vehicle (**see illustration**).

The crankshaft is supported in five split-shell type main bearings within the cast-iron crankcase. The connecting rod big-end bearings are split-shell type, and the pistons are attached by interference-fit gudgeon pins. Each piston has two compression rings and one oil control ring.

The cylinder head is of light alloy construction, and supports the camshaft in five bearings. Camshaft drive is by a toothed composite rubber timing belt, which is driven



1.3 Cutaway view of the CVH engine

by a sprocket on the front end of the crankshaft. The timing belt also drives the water pump, which is mounted below the cylinder head.

Hydraulic cam followers (tappets) operate the rocker arms and valves (see illustration). The tappets are operated by pressurised engine oil. When a valve closes, the oil passes through a port in the body of the cam follower, through four grooves in the plunger and into the cylinder feed chamber. From the chamber, the oil flows to a ball-type non-return valve and into the pressure chamber. The tension of the coil spring causes the plunger to press against the valve, and so eliminates any free play. As the cam lifts the follower, the oil pressure in the pressure chamber is increased, and the non-return valve closes off the port feed chamber. This in turn provides a rigid link between the cam follower, the cylinder and the plunger. These then rise as a unit to open the valve. The cam follower-to-cylinder clearance allows the specified quantity of oil to pass from the pressure chamber, oil only being allowed past the cylinder bore when the pressure is high during the moment of the valve opening. When the valve closes, the escape of oil will produce a small clearance, and no pressure will exist in the pressure chamber. The feed chamber oil then flows through the non-return valve and into the pressure chamber, so that the cam follower cylinder can be raised by the pressure of the coil spring, eliminating free play until the valve is operated again.

As wear occurs between the rocker arm and the valve stem, the quantity of oil that flows into the pressure chamber will be slightly more than the quantity lost during the expansion cycle of the cam follower.

Conversely, when the cam follower is compressed by the expansion of the valve, a slightly smaller quantity of oil will flow into the pressure chamber than was lost.

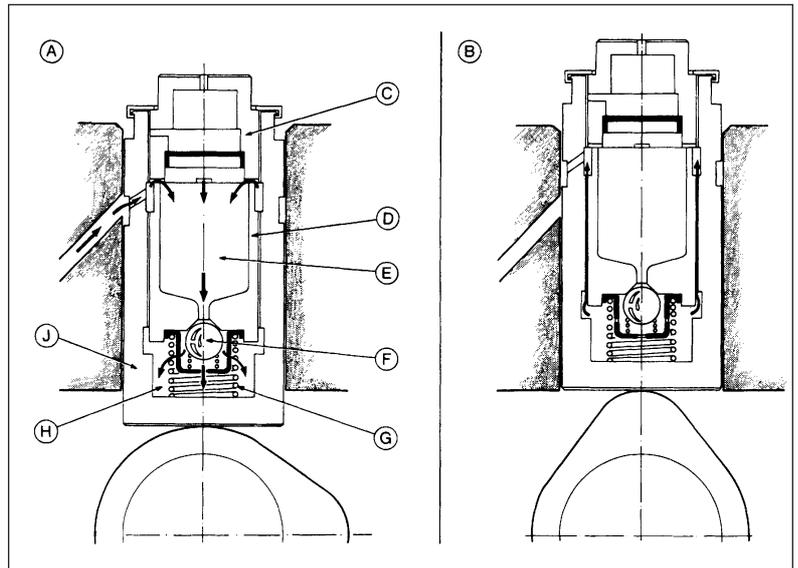
A rotor-type oil pump is mounted on the timing cover end of the engine, and is driven by a gear on the front end of the crankshaft (see illustration). A full-flow type oil filter is fitted, and is mounted on the side of the crankcase.

Valve clearances - general

It is necessary for a clearance to exist between the tip of each valve stem and the valve operating mechanism, to allow for the expansion of the various components as the engine reaches normal operating temperature.

On most older engine designs, this meant that the valve clearances (also known as "tappet" clearances) had to be checked and adjusted regularly. If the clearances were allowed to be too slack, the engine would be very noisy, its power output would suffer, and its fuel consumption would increase. If the clearances were allowed to be too tight, the engine's power output would be reduced, and the valves and their seats could be severely damaged.

The CVH engine employs hydraulic tappets which use the lubricating system's oil pressure automatically to take up the clearance between each camshaft lobe and its respective valve stem. Therefore, there is no need for regular checking and adjustment of the valve clearances. However, it is **essential** that only good-quality oil of the recommended viscosity and specification is used in the engine, and that this oil is always changed at the recommended intervals. If this



1.6 Sectional views showing operation of the hydraulic tappets

A Valve closed

D Cylinder

G Coil spring

B Valve open

E Feed chamber

H Pressure chamber

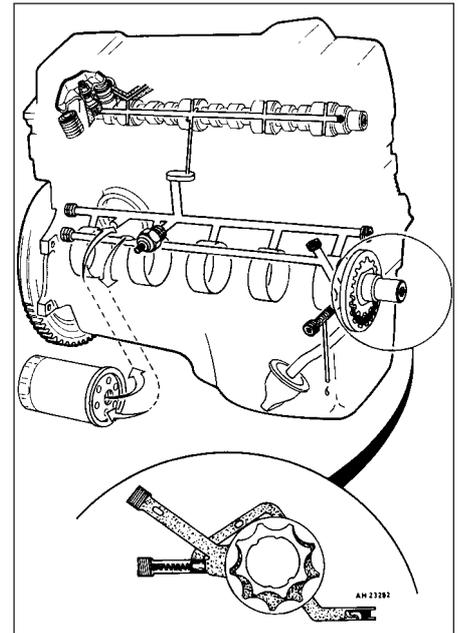
C Plunger

F Non-return valve

J Body

advice is not followed, the oilways and tappets may become clogged with particles of dirt, or deposits of burnt (inferior) engine oil, so that the system cannot work properly; ultimately, one or more of the tappets may fail, and expensive repairs may be required.

On starting the engine from cold, there will be a slight delay while full oil pressure builds up in all parts of the engine, especially in the tappets; the valve components, therefore, may well "rattle" for about 10 seconds or so, and then quieten. This is a normal state of affairs, and is nothing to worry about,



1.8 CVH engine lubrication circuit

provided that all tappets quieten quickly and stay quiet.

After the vehicle has been standing for several days, the valve components may “rattle” for longer than usual, as nearly all the oil will have drained away from the engine’s top-end components and bearing surfaces. While this is only to be expected, care must be taken not to damage the engine under these circumstances - avoid high-speed running until all the tappets are refilled with oil and operating normally. With the vehicle stationary, hold the engine at no more than a fast idle speed (maximum 2000 to 2500 rpm) for 10 to 15 minutes, or until the noise ceases. Do not run the engine at more than 3000 rpm until the tappets are fully recharged with oil and the noise has ceased.

If the valve components are thought to be noisy, or if a light rattle persists from the top end after the engine has warmed up to normal operating temperature, take the vehicle to a Ford dealer for expert advice. Depending on the mileage covered and the usage to which each vehicle has been put, some vehicles may be noisier than others; only a good mechanic experienced in these engines can tell if the noise level is typical for the vehicle’s mileage, or if a genuine fault exists. If any tappet’s operation is faulty, it must be renewed (Section 13).

2 Repair operations possible with the engine in the vehicle

The following major repair operations can be accomplished without removing the engine from the vehicle:

- a) *Compression pressure - testing.*
- b) *Cylinder head rocker cover - removal and refitting.*
- c) *Timing belt - removal, refitting and adjustment.*
- d) *Camshaft oil seal - renewal.*
- e) *Camshaft - removal and refitting.*
- f) *Cylinder head - removal and refitting.*
- g) *Crankshaft oil seals - renewal.*
- h) *Sump - removal and refitting.*
- i) *Pistons/connecting rods - removal and refitting.*
- j) *Flywheel - removal, inspection and refitting.*
- k) *Engine/transmission mountings - removal and refitting.*

Clean the engine compartment and the exterior of the engine with a suitable degreasant before any work is done. It will make the job easier, and will help to keep dirt out of the internal areas of the engine.

Depending on the components involved, it may be helpful to remove the bonnet, to improve access to the engine as repairs are performed (refer to Chapter 11 if necessary). Cover the front wings, to prevent damage to the paint; special covers are available, but an old bedspread or blanket will also work.



4.6A Crankshaft pulley notch (arrowed) aligned with the TDC (0) mark on the timing belt cover



4.6B Camshaft sprocket timing mark aligned with the TDC mark on the front face of the cylinder head

If vacuum, exhaust, oil or coolant leaks develop, indicating a need for component/gasket or seal replacement, the repairs can generally be made with the engine in the vehicle. The inlet and exhaust manifold gaskets, sump gasket, crankshaft oil seals and cylinder head gasket are all accessible with the engine in place.

Exterior components such as the inlet and exhaust manifolds, the sump, the oil pump, the water pump, the starter motor, the alternator and the fuel system components can be removed for repair with the engine in place.

Since the cylinder head can be removed without lifting out the engine, camshaft and valve component servicing can also be accomplished with the engine in the vehicle, as can renewal of the timing belt and toothed pulleys.

In extreme cases caused by a lack of necessary equipment, repair or renewal of piston rings, pistons, connecting rods and big-end bearings is possible with the engine in the vehicle. However, this practice is not recommended, because of the cleaning and preparation work that must be done to the components involved, and because of the amount of preliminary dismantling work required - these operations are therefore covered in Part D of this Chapter.

3 Compression test - description and interpretation

Refer to Section 3 in Part A of this Chapter.

4 Top Dead Centre (TDC) for No 1 piston - locating

1 Top dead centre (TDC) is the highest point of the cylinder that each piston reaches as the crankshaft turns. Each piston reaches its TDC position at the end of its compression stroke, and then again at the end of its exhaust stroke. For the purpose of engine timing, TDC

on the compression stroke for No 1 piston is used. No 1 cylinder is at the timing belt end of the engine. Proceed as follows.

2 Undo the two retaining bolts and remove the upper timing belt cover.

3 Apply the handbrake, then raise the vehicle at the front end and support it on axle stands.

4 Undo the retaining bolts, and remove the cover from the underside of the crankshaft pulley.

5 Fit a spanner onto the crankshaft pulley bolt, and turn the crankshaft in its normal direction of rotation (clockwise, viewed from the pulley end) to the point where the crankshaft pulley timing notch is aligned with the TDC (0) timing mark on the timing belt cover. Turning the engine will be much easier if the spark plugs are removed first (see Chapter 1).

6 Although the crankshaft is now in top dead centre alignment, with piston Nos 1 and 4 at the top of their stroke, the No 1 piston may not be on its compression stroke. To confirm that it is, check that the timing pointer on the camshaft sprocket is exactly aligned with the TDC mark on the front face of the cylinder head (**see illustrations**). If the pointer is not aligned, turn the crankshaft pulley one further complete turn, and all the markings should now align.

7 With the engine set at No 1 piston on TDC compression, refit the crankshaft pulley cover, lower the vehicle and refit the upper timing belt cover.

5 Cylinder head rocker cover - removal and refitting

Removal

1 Disconnect the battery negative (earth) lead (refer to Chapter 5, Section 1).

2 On 1.4 litre engines, and 1.6 litre carburettor engines, remove the air cleaner unit as described in Chapter 4. Disconnect the crankcase ventilation hose from the rocker cover.

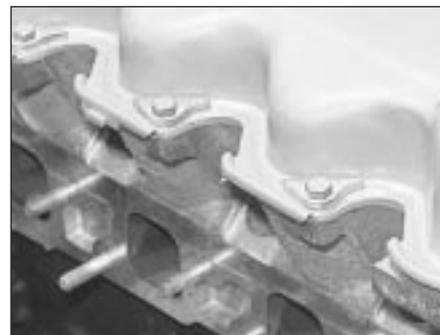
3 On 1.6 litre EFi engines, disconnect the HT leads from the spark plugs, then detach them



5.3 Air inlet duct-to-rocker cover attachment bolt on 1.6 litre EFI fuel-injected engine



5.9A Fitting a new gasket to the rocker cover



5.9B Rocker cover retaining bolts and plate washers

from the air inlet duct and the rocker cover. Position them out of the way. Loosen off the retaining clips, and detach the air inlet hose and the breather hose from the air inlet duct. Also detach the crankcase breather hose from the rocker cover. Undo the two retaining bolts, and remove the air inlet duct from the top of the rocker cover (see illustration).

4 Undo the two bolts retaining the upper half of the timing belt cover, and remove it.

5 Referring to Chapter 4 for details, disconnect the accelerator cable from the throttle linkage and from the adjuster bracket above the rocker cover. Position the cable out of the way.

6 Where applicable, disconnect the choke cable from the carburettor, referring to Chapter 4 for details.

7 Unscrew and remove the rocker cover retaining bolts and washers, then lift the cover from the cylinder head. Note that a new rocker cover gasket will be needed on refitting.

Refitting

8 Before refitting the rocker cover, clean the mating surfaces of both the cylinder head and the cover.

9 Locate the new gasket in position, then fit the cover retaining bolts and washers. Ensure that the grooves in the plate washers are facing upwards as they are fitted (see illustrations). Tighten the cover retaining

bolts to the specified torque wrench setting. Refer to Chapter 4 for details on reconnecting the accelerator cable, choke cable, air inlet duct and air cleaner (as applicable).

10 Refit the timing belt cover and reconnect the battery earth lead.

6 Inlet manifold - removal and refitting



Warning: Petrol is extremely flammable, so take extra precautions when disconnecting any part of the fuel system. Don't smoke, or allow naked flames or bare light bulbs in or near the work area. Don't work in a garage where a natural gas appliance (such as a clothes dryer or water heater) is installed. If you spill petrol on your skin, rinse it off immediately. Have a fire extinguisher rated for petrol fires handy, and know how to use it.

Removal

1 A single-piece cast-aluminium inlet manifold is used on all CVH engines except 1.6 EFI models, which have a two-piece manifold comprising an upper and lower section bolted together.

2 On CFI and EFI models, depressurise the fuel system as described in Chapter 4.

3 Disconnect the battery negative (earth) lead (refer to Chapter 5, Section 1).

4 Remove the carburettor or CFI unit (as applicable) as described in Chapter 4.

5 On EFI models, remove the air inlet duct and disconnect the accelerator cable from the throttle linkage (see Chapter 4).

6 On EFI models, remove the fuel injectors and fuel rail (see Chapter 4).

7 Noting their locations, disconnect the coolant, vacuum and breather hoses from the manifold.

8 Disconnect the wiring multi-plugs from the engine sensors at the inlet manifold.

9 Undo the retaining bolts, and withdraw the manifold from the cylinder head. Note the location of the engine lifting bracket and earth lead, where fitted (see illustration). Remove the gasket.

10 With the manifold removed, clean all traces of the old gasket from the mating surfaces of the manifold and the cylinder head.

Refitting

11 Refitting is the reversal of removal. Use a new gasket, and tighten the retaining bolts to the specified torque (see illustration). Refit the remainder of the components with reference to the appropriate Chapters of this manual.

7 Exhaust manifold - removal, inspection and refitting

Note: Never work on or near a hot exhaust system and in particular, the catalytic converter (where fitted).

Removal

1 The exhaust manifold is secured to the cylinder head by studs and nuts, and is similarly attached to the exhaust downpipe. A metal shroud is bolted to the manifold, to direct exhaust-heated air into the air inlet system when the engine is cold. Access to the exhaust manifold retaining nuts is



6.9 Inlet manifold retaining bolt securing the engine lifting bracket and earth lead



6.11 Always use a new gasket (arrowed) when refitting the inlet manifold



7.1A Removing the hot-air shroud from the 1.6 litre carburettor engine



7.1B Hot-air shroud removal from the 1.6 litre EFI fuel injected engine



7.4 Removing the exhaust manifold

gained by first removing the shroud (see illustrations).

2 On vehicles equipped with a pulse-air system, remove the pulse-air piping as described in Chapter 6.

3 Support the exhaust downpipe on a jack or suitable blocks, and undo the down pipe-to-manifold retaining nuts. Separate the pipe from the manifold, and remove the gasket. On catalytic converter-equipped vehicles, take care not to stretch the oxygen sensor wiring, where applicable; if necessary, disconnect the sensor's multi-plug.

4 Undo the retaining nuts and withdraw the manifold from the cylinder head studs (see illustration). Remove the manifold gasket.



7.9A Fit a new gasket to the exhaust manifold . . .



7.9B . . . and manifold-to-exhaust downpipe connection

Inspection

5 Use a scraper to remove all traces of old gasket material and carbon deposits from the manifold and cylinder head mating surfaces. If the gasket was leaking, have the manifold checked for warpage at an automotive machine shop, and have it resurfaced if necessary.

6 Provided both mating surfaces are clean and flat, a new gasket will be sufficient to ensure the joint is gastight. Do not use any kind of exhaust sealant upstream of the catalytic converter (where applicable).

7 Note that, on some models, the downpipe is secured to the manifold by two bolts, with a coil spring, spring seat and self-locking nut on each. On refitting, tighten the nuts until they stop on the bolt shoulders; the pressure of the springs will then suffice to make a gastight joint.

8 Do not overtighten the nuts to cure a leak - the bolts will shear; renew the gasket and the springs if a leak is found. The bolts themselves are secured by spring clips to the manifold, and can be renewed easily if damaged.

Refitting

9 Refit the manifold in the reverse order of removal, using new gaskets throughout (see illustrations). Tighten the retaining bolts to their specified torque wrench settings - see paragraph 8 above. Ensure that all adjacent



8.6 Using a suitable bar to lock the flywheel ring gear

wiring and hoses are clear of the exhaust system and manifold, and on completion check the system joints for any signs of leaks.

8 Crankshaft pulley - removal and refitting



Removal

1 Disconnect the battery negative (earth) lead (refer to Chapter 5, Section 1).

2 Apply the handbrake, then raise the vehicle at the front end, and support it on axle stands.

3 Unbolt and remove the cover from the underside of the crankshaft pulley.

4 Remove the auxiliary drivebelt as described in Chapter 1.

5 If timing belt renewal is also intended, set the engine at TDC as described in Section 4 before removing the crankshaft pulley and retaining bolt.

6 To prevent the crankshaft from turning as the pulley bolt is loosened off, remove the starter motor as described in Chapter 5, and then jam the starter ring gear using a suitable lever (see illustration).

7 Unscrew and remove the crankshaft pulley retaining bolt and its washer. Withdraw the pulley from the front end of the crankshaft (see illustration). If necessary, lever it free using a pair of diagonally-opposed levers positioned behind the pulley.



8.7 Crankshaft pulley removal

Refitting

8 Refit in the reverse order of removal. Tighten the pulley retaining bolt to the specified torque setting, and refer to Chapter 1 for details on refitting the auxiliary drivebelt.

9 On completion, reconnect the battery earth lead.

9 Timing belt covers - removal and refitting



Removal

1 Disconnect the battery negative (earth) lead (refer to Chapter 5, Section 1).

2 Undo the two retaining bolts and remove the upper timing belt cover (see illustration).

3 Refer to the previous Section for details, and remove the crankshaft pulley.

4 Unscrew the two bolts securing the lower timing belt cover, and remove it (see illustration).

Refitting

5 Refit in the reverse order of removal. Tighten the cover retaining bolts to the specified torque wrench setting.

6 On completion, reconnect the battery earth lead.

10 Timing belt - removal, refitting and adjustment



Removal

1 Referring to the previous Sections for details, remove the rocker cover, the crankshaft pulley and the timing belt covers.

2 Check that the crankshaft is set with the No 1 piston at TDC (on its compression stroke) before proceeding. If necessary, refer to Section 4 for further details.

3 To check the timing belt for correct adjustment, proceed as described in paragraph 12 below. To remove the belt, proceed as follows.

4 Loosen off the two bolts securing the timing



9.2 Upper timing belt cover removal



9.4 Lower timing belt cover removal

belt tensioner. Using a large screwdriver, prise the tensioner to one side to release the timing belt tension. Secure the tensioner in this position by retightening the bolts (see illustration).

5 If the original timing belt is to be refitted, mark it for direction of travel and also the exact tooth engagement positions on all sprockets. Slip the belt from the camshaft, water pump and crankshaft sprockets (see illustration). Whilst the timing belt is removed, avoid any excessive movement of the sprockets, otherwise the piston crowns and valves may come into contact and be damaged.

6 If the belt is being removed for reasons other than routine renewal, check it carefully for any signs of uneven wear, splitting, cracks (especially at the roots of the belt teeth) or contamination with oil or coolant. Renew the belt if there is the slightest doubt about its condition. As a safety measure, the belt must be renewed as a matter of course at the intervals given in Chapter 1; if its history is unknown, the belt should be renewed irrespective of its apparent condition whenever the engine is overhauled.

Refitting

7 Before refitting the belt, check that the crankshaft is still at the TDC position, with the small projection on the belt sprocket front flange aligned with the TDC mark on the oil pump housing (see illustration). Also ensure that the camshaft sprocket is set with its TDC

pointer aligned with the corresponding timing mark on the cylinder head. If necessary, adjust the sprockets slightly. As previously mentioned, avoid any excessive movement of the sprockets whilst the belt is removed.

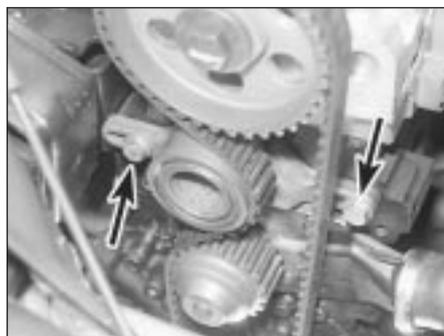
8 Engage the timing belt teeth with the teeth of the crankshaft sprocket, and then pull the belt vertically upright on its right-hand run. Keep it taut, and engage it with the teeth of the camshaft sprocket. If the original belt is being refitted, check that the belt's direction of travel is correct, and realign the belt-to-sprocket marks made during removal, to ensure that the exact original engagement positions are retained. When the belt is fully fitted on the sprockets, check that the sprocket positions have not altered.

9 Carefully manoeuvre the belt around the tensioner, and engage its teeth with the water pump sprocket, again ensuring that the TDC positions of the crankshaft and camshaft are not disturbed as the belt is finally located.

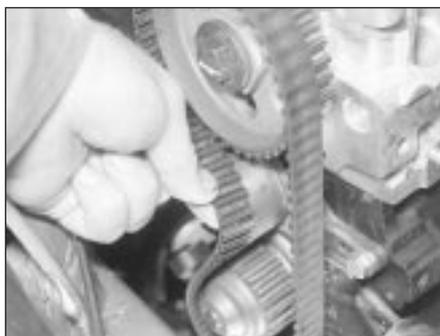
10 Refit the lower timing belt cover, and tighten its retaining bolts to the specified torque setting. Refit the crankshaft pulley, and tighten its retaining bolt to the specified torque setting.

11 To take up belt slack, loosen off the tensioner and move it towards the front of the car to apply an initial tension to the belt. Secure the tensioner in this position, then remove the flywheel ring gear locking device.

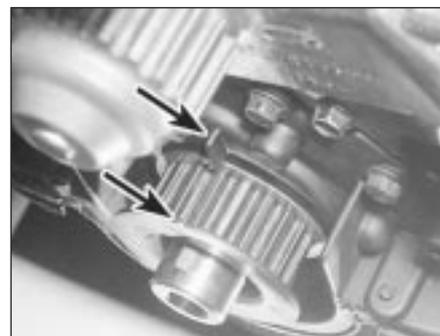
12 Rotate the crankshaft through two full revolutions in (the normal direction of travel), returning to the TDC position (camshaft



10.4 Timing belt tensioner retaining bolts (arrowed)



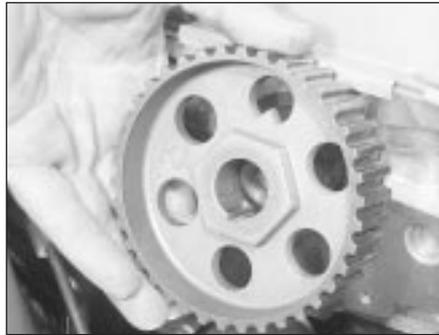
10.5 Timing belt removal



10.7 Sprocket and oil pump housing TDC marks in alignment



10.13 Checking the tension of the timing belt



11.13A Refit the camshaft sprocket . . .



11.13B . . . and tighten the retaining bolt to the specified torque whilst retaining the sprocket as shown

sprocket-to-cylinder head). Check that the crankshaft pulley notch is aligned with the TDC (0) mark on the lower half of the timing belt cover.

13 Grasp the belt between the thumb and forefinger, at the midway point between the crankshaft and camshaft sprockets on the right-hand side. If the belt tension is correct, it should just be possible to twist the belt through 90° at this point (see illustration). To adjust the belt, loosen off the tensioner retaining bolts, move the tensioner as required using a suitable screwdriver as a lever, then retighten the retaining bolts. Rotate the crankshaft to settle the belt, then recheck the tension. It may take two or three attempts to get the tension correct. On completion, tighten the tensioner bolts to the specified torque wrench setting.

14 It should be noted that this setting is approximate, and the belt tension should be rechecked by a Ford dealer with the special tensioner-setting tool at the earliest opportunity.

15 Refit the starter motor (refer to Chapter 5).

16 Refit the rocker cover (see Section 5) and the upper timing belt cover (see Section 9).

17 Refit the auxiliary drivebelt, adjust its tension as described in Chapter 1, then refit the crankshaft pulley lower cover.

18 Refit the air cleaner and the air inlet ducting.

19 On completion, reconnect the battery earth lead.

11 Timing belt tensioner and sprockets - removal, inspection and refitting



Tensioner

1 Set the engine at TDC for No 1 piston as described in Section 4, then refer to Section 9 and remove the timing belt upper cover.

2 Loosen off the two bolts securing the timing belt tensioner. Using a large screwdriver, prise the tensioner to one side to release the timing belt tension.

3 Remove the tensioner bolts, and withdraw the tensioner from behind the timing belt.

4 Check the condition of the tensioner, ensuring that it rotates smoothly on its bearings, with no signs of roughness or excessive free play. Renew the tensioner if in doubt about its condition.

5 To refit the tensioner, first check that the engine is still positioned at TDC for No 1 piston, with both the camshaft and crankshaft sprocket timing marks correctly aligned as described in Section 4.

6 Refit the tensioner, guiding it in position around the timing belt, and secure with the two bolts. Move the tensioner towards the front of the car, to apply an initial tension to the belt. Secure the tensioner in this position.

7 Adjust the timing belt tension as described in Section 10, paragraphs 12 to 14.

8 Refit the timing belt upper cover on completion.

Camshaft sprocket

9 Set the engine at TDC for No 1 piston as described in Section 4, then refer to Section 9 and remove the timing belt upper cover.

10 Loosen off the two bolts securing the timing belt tensioner. Using a large screwdriver, prise the tensioner to one side to release the timing belt tension. Slip the timing belt off the camshaft sprocket.

11 Pass a bar through one of the holes in the camshaft sprocket to prevent the camshaft from rotating, then unscrew and remove the sprocket retaining bolt. Note that this bolt must be renewed when refitting the camshaft sprocket. Remove the sprocket, noting the Woodruff key fitted to the camshaft; if the key is loose, remove it for safekeeping.

12 Check the condition of the sprocket, inspecting carefully for any wear grooves, pitting or scoring around the teeth.

13 Install the Woodruff key, then fit the camshaft sprocket with a new retaining bolt. The threads of the bolt should be smeared with thread-locking compound prior to fitting. Tighten the retaining bolt to the specified torque wrench setting (see illustrations).

14 Check that the engine is still positioned at TDC for No 1 piston, with both the camshaft and crankshaft sprocket timing marks correctly aligned as described in Section 4.

15 Slip the timing belt over the camshaft sprocket, then move the tensioner towards the front of the car to apply an initial tension to the belt. Secure the tensioner in this position.

16 Adjust the timing belt tension as described in Section 10, paragraphs 12 to 14.

17 Refit the timing belt upper cover on completion.

Crankshaft sprocket

18 Remove the timing belt as described in Section 10.

19 The crankshaft sprocket can now be withdrawn. If it is a tight fit on the crankshaft, a puller or two large screwdrivers can be used to release its grip. Withdraw the thrustwasher and the Woodruff key from the crankshaft.

20 Check the condition of the sprocket, inspecting carefully for any wear grooves, pitting or scoring around the teeth.

21 Refit the thrustwasher with its curved side facing outwards, followed by the Woodruff key.

22 Lubricate the oil seal and the crankshaft sprocket with engine oil, then position the sprocket on the crankshaft with its thrust face facing outwards.

23 Using the auxiliary drivebelt pulley and its retaining bolt, draw the sprocket fully into position on the crankshaft. Remove the pulley.

24 Refit the timing belt as described in Section 10.

12 Camshaft oil seal - renewal



1 Remove the camshaft sprocket as described in the previous Section.

2 The oil seal is now accessible for removal. Note its direction of fitting, then using a suitable screwdriver or a tool with a hooked end to lever and extract the seal from its housing (but take care not to damage the housing with the tool) (see illustration).

3 Check that the housing is clean before fitting the new seal. Lubricate the lips of the seal and the running faces of the camshaft with clean engine oil. Carefully locate the seal



12.2 Camshaft front oil seal removal



12.3 Using a socket to tap the camshaft oil seal into place



13.5A Undo the rocker arm retaining nut . . .

over the camshaft, and drive it squarely into position using a suitable tube or a socket (see illustration). An alternative method of fitting is to draw it squarely into position using the old sprocket bolt and a suitable distance piece.

4 With the seal fully inserted in its housing, refit the camshaft sprocket as described in the previous Section.

this Chapter, and remove the timing belt upper cover and the rocker cover.

3 On carburettor models, refer to Chapter 4 and remove the fuel pump.

4 Detach, unbolt and remove the ignition coil, its support bracket and the interference capacitor from the end of the cylinder head, as described in Chapter 5.

5 Undo the retaining nuts and remove the guides, rocker arms and spacer plates (see illustrations). Keep the respective components in their original order of fitting by marking them with a piece of numbered tape, or by using a suitable sub-divided box.

6 Withdraw the hydraulic tappets, again keeping them in their original fitted sequence. The tappets should be placed in an oil bath while removed (see illustrations).

7 Unbolt and remove the lower cover beneath the crankshaft pulley, then with a spanner engaged on the crankshaft pulley bolt, turn the crankshaft over to set the engine on TDC. Refer to Section 4 for details.

8 Remove the camshaft sprocket as described in Section 11.

9 Extract the camshaft oil seal as described in Section 12.

10 Before removing the camshaft and its thrust plate, check and take note of the amount of camshaft endfloat, using a dial gauge or feeler gauges. With the camshaft endfloat measured and noted, unscrew the two retaining bolts and then extract the camshaft thrust plate from its pocket at the front end of the cylinder head (see illustrations).

2B

13 Camshaft, rocker arms and tappets - removal, inspection and refitting

Removal

- 1 Disconnect the battery negative (earth) lead (refer to Chapter 5, Section 1).
- 2 Refer to the appropriate earlier Sections in



13.5B . . . withdraw the guide . . .



13.5C . . . followed by the rocker arm . . .



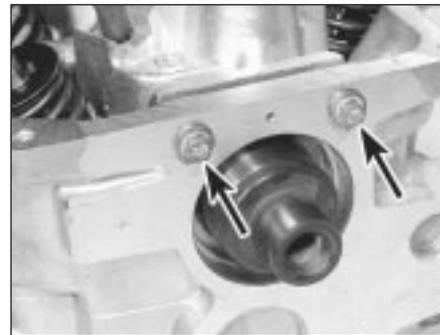
13.5D . . . and spacer plate



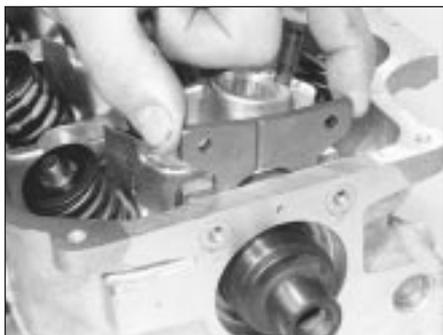
13.6A Removing a hydraulic tappet



13.6B Store tappets in clearly-marked container filled with oil to prevent oil loss



13.10A Undo the two retaining bolts (arrowed) . . .



13.10B . . . and lift out the camshaft thrust plate



13.11A Pierce the centre of the blanking plug . . .



13.11B . . . and lever it out of the cylinder head

11 At the rear end of the cylinder head, pierce the camshaft blanking plug with a suitable tool, and then lever it out of its aperture (see illustrations).

12 Withdraw the camshaft from the cylinder head at the rear (ignition coil) end (see illustration). Take care not to damage the bearings in the cylinder head as the shaft is withdrawn.

Inspection

13 Clean and inspect the various components removed for signs of excessive wear.

14 Examine the camshaft bearing journals and lobes for damage or wear. If evident, a new camshaft will be required.

15 Compare the previously-measured camshaft endfloat with that specified. If the

endfloat is outside of the specified tolerance, the thrust plate must be renewed.

16 The camshaft bearing bore diameters in the cylinder head should be measured and checked against the tolerances specified. A suitable measuring gauge will be required for this, but if this is not available, check for excessive movement between the camshaft journals and the bearings. If the bearings are found to be unacceptably worn, a new cylinder head is the only answer, as the bearings are machined directly into the head.

17 It is seldom that the hydraulic tappets are badly worn in the cylinder head bores but again, if the bores are found to be worn beyond an acceptable level, the cylinder head must be renewed.

18 If the contact surfaces of the cam lobes show signs of depression or grooving, they cannot be renovated by grinding, as the hardened surface will be removed and the overall length of the tappet(s) will be reduced. The self-adjustment point of the tappet will be exceeded as a result, so that the valve adjustment will be affected, resulting in noisy operation. Therefore, renewal of the camshaft is the only remedy in this case.

19 Inspect the rocker arm contact surfaces for excessive wear, and renew if necessary (see illustration).



13.12 Withdraw the camshaft from the cylinder head

Refitting

20 Refitting the camshaft and its associated components is a reversal of the removal

procedure, but note the following special points.

21 Lubricate the camshaft bearings, the camshaft and the thrust plate with clean engine oil prior to fitting them. As the camshaft is inserted, take care not to damage the bearings in the cylinder head. Refer to the Specifications for the thrust plate retaining bolt torque. When the thrust plate bolts are tightened, make a final check to ensure that the camshaft endfloat is as specified.

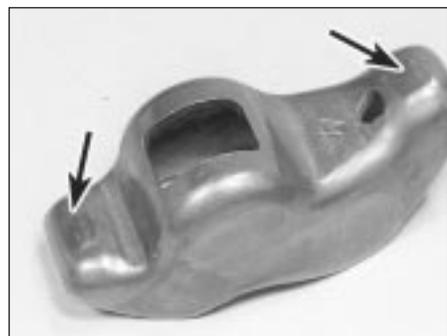
22 A new front oil seal must be fitted after the camshaft has been installed (see previous Section for details). It will also be necessary to insert a new blanking plug into the rear end of the cylinder head. Drive it squarely into position so that it is flush with the head (see illustration).

23 Refer to the procedure in Section 11 when refitting the camshaft sprocket.

24 Refit and tension the timing belt as described in Section 10.

25 Lubricate the hydraulic tappets with hypoid oil before refitting them into their original locations in the cylinder head.

26 Lubricate and refit the rocker arms and guides in their original sequence, use new nuts and tighten them to the specified torque setting (see illustration). It is essential before each rocker arm is installed and its nut tightened, that the respective cam follower is positioned at its lowest point (in contact with the cam base circle). Turn the cam (using the



13.19 Inspect the rocker arm contact points indicated for excessive wear



13.22 Driving a new blanking plug into position



13.26 Lubricate the rocker arm assemblies as they are refitted

crankshaft pulley bolt) as necessary to achieve this.

27 Fit a new rocker cover gasket. To ensure that a good seal is made, check that its location groove is clear of oil, grease or any pieces of old gasket. When in position, tighten the cover retaining bolts to the specified torque setting. Ensure that the cover bolt plate washers are correctly orientated, with their grooves facing upwards.

28 Refit the remaining components with reference to the relevant Sections in this Chapter or elsewhere in the manual.

29 On completion, reconnect the battery earth lead.

14 Cylinder head - removal and refitting



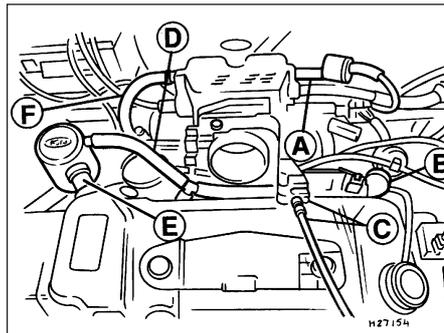
Warning: Petrol is extremely flammable, so take extra precautions when disconnecting any part of the fuel system. Don't smoke, or allow naked flames or bare light bulbs in or near the work area. Don't work in a garage where a natural gas appliance (such as a clothes dryer or water heater) is installed. If you spill petrol on your skin, rinse it off immediately. Have a fire extinguisher rated for petrol fires handy, and know how to use it.

Removal

1 On fuel-injected engines, depressurise the fuel system as described in Chapter 4.

2 Disconnect the battery negative (earth) lead (refer to Chapter 5, Section 1).

3 Whenever you disconnect any vacuum lines, coolant and emissions hoses, wiring loom connectors, earth straps and fuel lines as part of the following procedure, always label them clearly, so that they can be correctly reassembled. Masking tape and/or a



14.7 Vacuum hoses and throttle cable connections on the 1.6 litre EFI fuel injected engine

- A Hose to MAP sensor
- B Crankcase ventilation breather hose
- C Throttle cable and clip
- D Oil trap hose and T-piece connector
- E Hose to oil trap
- F Hose to carbon canister solenoid valve

touch-up paint applicator work well for marking items. Take instant photos, or sketch the locations of components and brackets.

4 Remove the rocker cover as described in Section 5.

5 Loosen off the retaining clips and disconnect the upper coolant hose, the expansion tank hose and the heater hose from the thermostat housing. Also disconnect the heater hose from the inlet manifold.

6 On CFI models, disconnect the heated coolant hose from the injector unit.

7 On EFI models, disconnect the following (see illustration):

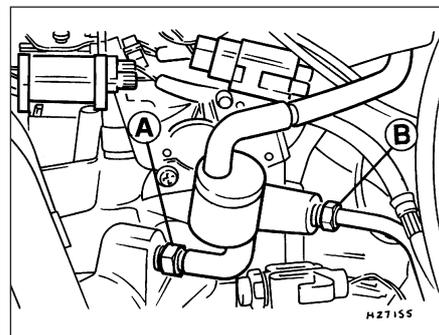
- a) The MAP sensor vacuum hose from the inlet manifold upper section.
- b) The carbon canister solenoid valve vacuum hose from the inlet manifold upper section.
- c) The oil trap vacuum hose at the "T" piece connector.
- d) The brake servo vacuum hose from the inlet manifold upper section by pressing in the clamp ring and simultaneously pulling the hose free from the connection.
- e) The coolant hose from the injector intermediate flange and at the thermostat housing.

8 Disconnect the following fuel supply/return hoses. Plug the hoses and connections, to prevent fuel spillage and the possible ingress of dirt.

- a) On carburettor models, disconnect the fuel supply hose from the pump and the return hose from the carburettor.
- b) On CFI models, pull free and detach the fuel return hose from the injection unit and the supply hose at the connector.
- c) On EFI models, detach the fuel supply hose from the fuel rail. Disconnect the return line from the fuel pressure regulator.

9 On CFI models, disconnect the brake servo vacuum hose from the inlet manifold, the MAP sensor vacuum hose from the sensor, and the carbon canister connecting hose at the injection unit (see illustration).

10 Noting their connections and routings, disconnect the following wiring connectors or multi-plugs from the following items, where applicable:



14.9 Vacuum hose to the MAP sensor (A) and the brake servo unit (B) on the 1.4 litre CFI fuel-injected engine

- a) Temperature gauge sender unit.
- b) DIS ignition coil.
- c) Coolant temperature sensor.
- d) Cooling fan thermostatic switch.
- e) Carburettor.
- f) Radio earth lead.
- g) Road speed sensor.
- h) Engine wiring loom.
- i) Inlet air temperature sensor.

11 On CFI models, detach the throttle control motor, throttle position sensor and injector lead multi-plugs (see illustration).

12 Where still attached, disconnect the HT leads from the DIS ignition coil and the spark plugs.

13 Loosen off the timing belt tensioner retaining bolts, and move the tensioner to release the tension from the drivebelt. Support the belt, and move it clear of the camshaft sprocket.

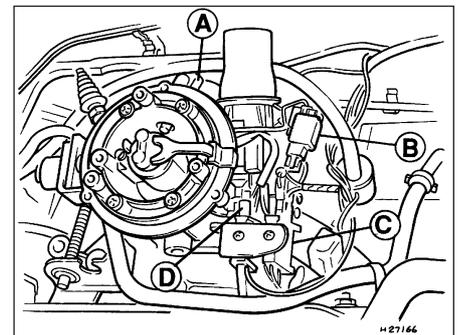
14 Apply the handbrake, then raise the vehicle at the front end, and support it on axle stands.

15 Unscrew the retaining nuts and detach the exhaust downpipe from the manifold. Remove the gasket; note that a new one must be fitted on reassembly. Tie the downpipe up to support it. Where applicable, disconnect the pulse-air supply hose from the check valve. Noting their connections (to ensure correct reassembly), disconnect the appropriate system vacuum hoses at the PVS (three port vacuum switch) under the inlet manifold.

16 Before it is released and removed, the cylinder head must first have cooled down to room temperature (about 20°C).

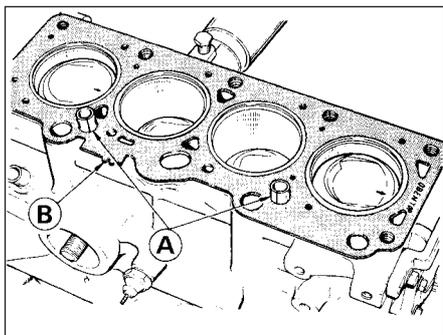
17 Unscrew the cylinder head retaining bolts progressively in the reverse order to that shown for tightening (see illustration 14.23C). The cylinder head bolts must be discarded and new bolts obtained for refitting the cylinder head.

18 Remove the cylinder head complete with its manifolds. If necessary, grip the manifolds and rock it free from the location dowels on the top face of the cylinder block. Do not



14.11 Wiring connections to be detached on the 1.4 litre CFI fuel injected engine

- A Coolant temperature sensor
- B Throttle plate control motor
- C Throttle position sensor
- D Injector



14.19 Cylinder head location dowels (A) and gasket identification teeth (B)



14.21 Position No 1 piston 20 mm down the bore



14.22A Fit the cylinder head gasket with the "OBEN/TOP" marking upwards . . .

attempt to tap it sideways or lever between the head and the block top face.

19 Remove the cylinder head gasket. This must always be renewed; it is essential that the correct type is obtained. Save the old gasket, so that the identification marks (teeth) can be used when ordering the new one (see illustration).

Refitting

20 Before refitting the cylinder head, the mating surfaces of both the head and the cylinder block must be perfectly clean, and the locating dowels must be in position. Clean the retaining bolt holes of oil. In extreme cases, it is possible for oil and coolant left in the bolt holes to crack the head due to the hydraulic effect when the bolts are inserted.



14.22B . . . and locate it over the dowels

21 To prevent the possibility of the valves and pistons coming into contact as the head is fitted, turn the crankshaft over to position No 1 piston approximately 20 mm below its TDC position in the bore (see illustration).

22 Locate the cylinder head gasket on the top face of the cylinder block, locating it over the dowels. Ensure that the gasket is fitted the correct way up, as indicated by its "OBEN-TOP" marking (see illustrations).

23 Lower the cylinder head into position, ensuring that it fits over the locating dowels, then insert the new retaining bolts. Hand-tighten the bolts initially, then tighten them in the order shown in the four stages to the specified torque setting (see illustrations). After the first two stages, mark the bolt heads with a dab of quick drying paint, so that the paint spots all face the same direction. Now tighten all the bolts in the sequence to the Stage 3 setting, by tightening them through the specified angle. Finally, angle-tighten all the bolts through the Stage 4 angle.

24 If all the bolts have been tightened equally, all of the paint spots should be facing the same direction. The bolts do not require any further tightening.

25 The camshaft toothed belt pulley should be positioned so that its TDC index mark pointer is in alignment with the TDC index spot mark on the front end face of the cylinder head (see illustration 4.6B).

26 Now turn the crankshaft pulley to bring its TDC notch in alignment with the TDC (0)

indicator on the front face of the timing belt cover, taking the shortest route (not vice-versa) (see illustration 4.5A).

27 Refit the timing belt over the camshaft sprocket, and then tension the belt as described in Section 10.

28 The remainder of the refitting procedures are a reversal of the removal. Refer to the appropriate Sections both in this Chapter, and in Chapters 3 and 4 for specific details when reconnecting the engine, cooling system and fuel system components.

29 On completion, check that the engine oil level is correct, and refill the cooling system as described in Chapter 1.

30 Check that all wiring connections are securely and correctly made, and reconnect the battery on completion.

15 Sump - removal and refitting



Removal

1 Disconnect the battery negative (earth) lead (refer to Chapter 5, Section 1).

2 Drain the engine oil as described in Chapter 1.

3 Check that the handbrake is fully applied, then raise the vehicle at the front end, and support it on axle stands.

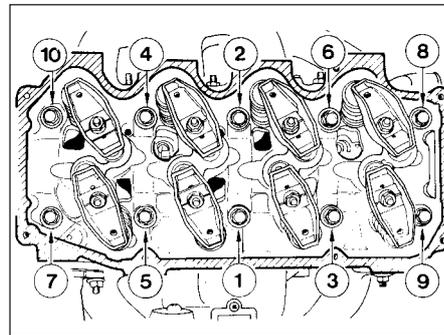
4 On models fitted with a controlled catalytic converter, pull free the oxygen sensor lead



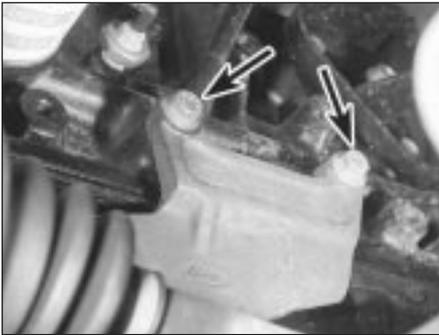
14.23A Lower the cylinder head into position



14.23B Insert the new cylinder head bolts



14.23C Cylinder head bolt tightening sequence



15.6A Auxiliary bracing bracket-to-engine bolts (oil filter side) - 1.6 litre engine only



15.6B Auxiliary bracing bracket removal from the starter motor side of the engine - 1.6 litre engine only



15.7 Removing the clutch cover plate

multi-plug, and disconnect it. If the engine has been recently run, take particular care against burning when working in the area of the catalytic converter.

5 Undo the retaining nuts, and detach the exhaust downpipe from the manifold. The flange gasket must be renewed when reconnecting. Where applicable, also detach the downpipe at the rear of the catalytic converter, and release it from the front mounting.

6 On 1.6 litre engines, undo the retaining bolts and remove the engine-to-transmission auxiliary bracing brackets (see illustrations).

7 Undo the retaining bolts, and remove the clutch cover plate from the front face of the bellhousing (see illustration).

8 Progressively unscrew the sump retaining bolts and remove them. Support and lower the sump pan, taking care not to spill any oil remaining in it as it is removed (see illustration). If the sump is stuck to the base of the crankcase, prise it free using screwdriver, but take care not to damage the sump flange face. If it is really stuck in position, check first that all of the bolts are removed, then cut around the sump gasket with a sharp knife to help in freeing the joint.

9 After the sump is removed, further oil will almost certainly continue to drip down from within the crankcase, some old newspapers

positioned underneath will soak up the spillage whilst the sump is removed.

10 Clean the sump of old oil and sludge, using paraffin or a suitable engine cleaner solution. Clean any traces of old gasket and sealer

from the mating faces of the sump and the crankcase.

Refitting

11 Smear a suitable sealing compound onto the junctions of the crankcase-to-oil seal carrier at the rear and the crankcase-to-oil pump housing at the front on each side (see illustrations).

12 Insert a new rubber seal in the groove in the rear oil seal carrier and the oil pump case. As an aid to correct sump alignment when refitting it, screw ten M6 studs into the cylinder block, in the positions circled in illustration 15.14.

13 Fit a new gasket over the studs. Fit the sump into position, ensuring that the raised spacers sit in the gasket. Insert the bolts into the available holes, and finger-tighten them only at this stage. Now remove the studs and fit the remaining bolts, again finger-tight.

14 Tighten the sump bolts in a progressive, numerical sequence to the specified torque wrench setting (see illustration).

15 Fit the sump drain plug with a new sealing washer, and tighten it to the specified torque wrench setting.

16 Refit the clutch cover plate.

17 Reconnect the exhaust downpipe as described in Chapter 4.

18 On completion, lower the vehicle, and fill the engine with oil as described in Chapter 1. Reconnect the battery.

16 Oil pump - removal and refitting



Removal

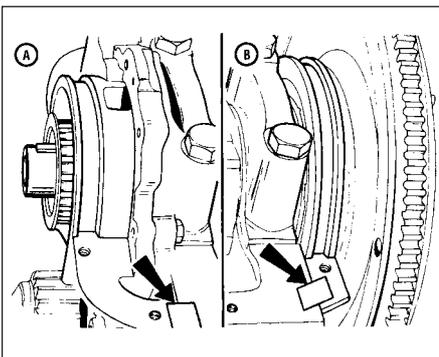
1 Disconnect the battery negative (earth) lead (refer to Chapter 5, Section 1).

2 Remove the auxiliary drivebelt (see Chapter 1).

3 Remove the crankshaft pulley (Section 8), the timing belt covers (Section 9), the timing



15.8 Removing the sump from the engine

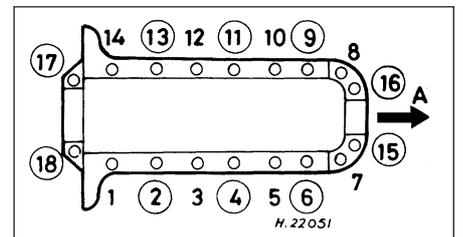


15.11A Sealing compound application points prior to refitting the sump

A Crankcase-to-oil pump housing
B Crankcase-to-rear oil seal carrier



15.11B Applying sealant to the oil pump-to-crankcase joint



15.14 Sump bolt tightening sequence

A Crankshaft pulley end of engine
Circled numbers indicate locations of studs for correct sump alignment (see text)



16.4 Removing the oil inlet pipe



16.8 Prime the oil pump prior to fitting



16.9A Refit the oil pump

belt, crankshaft sprocket and thrustwasher (Sections 10 and 11), and the sump (Section 15).

4 Unscrew the retaining nut/bolts and remove the oil pick-up pipe (see illustration).

5 Unbolt and withdraw the oil pump from the front face of the engine. Clean the oil pump for inspection. Refer to Section 17 for the inspection procedures. The oil seal in the oil pump housing should always be renewed (Section 18).

Refitting

6 Before refitting the oil pump and the associated fittings, clean off the respective mating faces. A new oil pump gasket must be obtained, as well as the seals and gaskets for

the other associated components to be refitted.

7 When refitting the oil pump, precautionary measures must be taken to avoid the possibility of damaging the new oil seal as it is engaged over the shoulder and onto its journal on the crankshaft. Extract the Woodruff key from the groove in the crankshaft, then cut a plastic guide which will furl over and protrude beyond the shoulder of the seal journal on the crankshaft. This will allow the seal to ride over the step, and avoid damaging the seal lip as it is pushed into position on the crankshaft.

8 If a new oil pump is being fitted or the old pump is to be re-used after cleaning and inspection, first prime the pump by squirting clean engine oil into it, and simultaneously rotating the drivegear a few times (see illustration).

9 Align the pump gear flats with those on the crankshaft, then fit the oil pump. Check that the sump mating faces of the oil pump and the base of the crankcase are flush each side, then tighten the retaining bolts to the specified torque setting. Remove the protective guide (see illustrations).

10 Refit the oil pick-up tube to the oil pump, using a new gasket. Refer to the Specifications for the tightening torque details.

11 Slide the thrustwasher onto the front end of the crankshaft, then insert the Woodruff key into position in the groove in the crankshaft (see illustration). The key must be located with its flat edge parallel with the line of the

crankshaft, to ensure that the crankshaft sprocket slides fully into position as it is being refitted.

12 Refit the sump, crankshaft sprocket, the timing belt, timing belt cover and drivebelt pulley (as described in the appropriate earlier Sections of this Chapter). Refit and adjust the drivebelt as described in Chapter 1.

13 On completion, lower the vehicle and reconnect the battery.

17 Oil pump - dismantling, inspection and reassembly



1 The oil pump fitted is a low-friction rotor-type, driven from the front end of the crankshaft. Where a high-mileage engine is being reconditioned, it is recommended that a new oil pump is fitted.

2 To inspect the rotor assembly, first remove the pump from the engine (Section 16), then undo the retaining screws and remove the cover plate (see illustration). Remove the O-ring seal.

3 Clean the rotors and the inside of the pump housing, then visually inspect the various components for signs of excessive wear and scoring. Check the pump components for wear using feeler gauges in the same manner as that described in Part A of this Chapter, Section 16. Refer to the accompanying illustrations, and to the Specifications Section at the start of Part B (see illustrations).



16.9B With the oil pump refitted, remove the protective guide (arrowed)



16.11 Locating the Woodruff key into the groove in the crankshaft



17.2 Oil pump cover plate retaining screws (arrowed)



17.3A Outer rotor-to-oil pump body clearance check



17.3B Outer-to-inner rotor clearance check



17.3C Rotor endfloat check



17.4 Inner and outer rotor matchmarks (arrowed)

4 When reassembling the pump, ensure that the inner (driving) and outer (driven) rotors are located with the corresponding indented matchmarks facing the same way (see illustration).

18 Crankshaft oil seals - renewal



Front oil seal

- 1 Disconnect the battery negative (earth) lead (refer to Chapter 5, Section 1).
- 2 Apply the handbrake, then raise the vehicle at the front end, and support it on axle stands.
- 3 Remove the auxiliary drivebelt as described in Chapter 1.
- 4 Remove the crankshaft pulley (Section 8), the timing belt covers (Section 9), the timing belt (Section 10) and crankshaft sprocket, Woodruff key and thrustwasher (Section 11).
- 5 The oil seal is now accessible for removal from the front face of the oil pump housing (see illustration). To withdraw the seal, a hooked tool will be required; if available, use Ford special tool No 21-096. Take care not to damage the oil pump housing during removal. As it is removed, note the fitted orientation of the seal in its housing.
- 6 Clean the oil pump housing and the crankshaft stub, then lubricate the lips of the new seal and the crankshaft front stub with clean engine oil.



18.5 Crankshaft front oil seal - seen from below (arrowed)



18.18 Rear oil seal removal



18.19 Rear oil seal installation - housing mounted in a vice with protected jaws

7 The oil seal should be drawn into position using the Ford special tool No 21-093A. Failing this, use a tube of suitable diameter, with the crankshaft pulley bolt and washers. Do not hammer the seal into position. To protect the seal lips as it is fitted onto the crankshaft, cut a thin sheet of plastic to suit and furl it round the front of the crankshaft, over the journal shoulder (see illustration 17.18 in Part C of this Chapter).

8 When the seal is fully fitted, remove the special tool (or fabricated tool) and withdraw the plastic protector. Check that the crankshaft is still at the TDC position and refit the Woodruff key, thrustwasher and sprocket. Refit and tension the timing belt, then refit the timing belt cover and crankshaft pulley as described in the appropriate Sections earlier in this Chapter.

9 Refit and adjust the auxiliary drivebelt as described in Chapter 1.

10 On completion, lower the vehicle and reconnect the battery.

Rear oil seal

11 With the engine or transmission removed from the vehicle for access, remove the clutch as described in Chapter 8.

12 Remove the flywheel/driveplate as described in Section 20.

13 If available, use Ford tool No 21-151 or a suitable clawed tool to extract the seal from its housing. If the seal housing is removed from the rear face of the engine, the seal can

be removed as described in paragraph 18. As it is removed, note the direction of fitting, and take care not to damage the seal housing as the seal is extracted.

14 Clean the seal housing, the crankshaft rear flange face, and the flywheel/driveplate mating surfaces.

15 One of two possible methods may be used to insert the new oil seal, depending on the tools available.

16 If Ford special service tool No 21-095 is available, lubricate the seal lips of the seal and its running face on the crankshaft with clean engine oil. Position the seal (correctly orientated) into the special tool, then draw the seal into the housing using two flywheel/driveplate securing bolts so that the seal is against the stop.

17 If the correct Ford service tool is not available, it will be necessary to remove the oil seal carrier housing. To do this, first remove the sump as described in Section 15, then unscrew the seal housing retaining bolts and remove the housing from the rear face of the crankcase.

18 Drive the old seal from the housing by carefully tapping it from its aperture using a suitable punch as shown (see illustration). As it is removed, note the direction of fitting, and take care not to damage the seal housing as the seal is extracted.

19 New gaskets will be required for the seal housing and sump during reassembly. Clean the mating faces of the seal housing, the crankcase and sump. Insert the new seal



20.2 Flywheel retaining bolts

squarely into its housing. To avoid damaging the seal or the housing, place a flat piece of wood across the face of the seal, and carefully tap or draw the seal into place (see **illustration**). Do not allow the seal to tilt in the housing as it is being fitted.

20 Lubricate the running surface on the crankshaft and the oil seal lip with clean engine oil. Locate a new gasket onto the rear face of the crankcase, and refit the oil seal housing and seal. To avoid damaging the lips of the seal as it is passed over the end of the crankshaft, cut a thin sheet of plastic to suit and furl it round the rear flange of the crankshaft so that it protrudes, and press the seal over it. With the seal in position, withdraw the plastic protector. Centralise the seal on the shaft, check that the housing-to-sump flange faces are flush to the sump face on the

base of the crankcase, then insert and tighten the housing retaining bolts to the specified torque.

21 Refit the sump with reference to Section 15.

22 Refit the flywheel/driveplate as described in Section 20.

23 Refit the clutch as described in Chapter 8.

24 Refit the engine or transmission, as applicable.

19 Engine/transmission mountings - renewal



The procedures for renewing the engine/transmission mountings on the CVH engine are much the same as those described for the HCS engine in Part A of this Chapter. Refer to Part A for details.

20 Flywheel/driveplate - removal, inspection and refitting



Removal

1 Access to the flywheel (manual transmission) or driveplate (automatic transmission) is gained by first removing the transmission (Chapter 7). On manual transmission models, remove the clutch (Chapter 8).

2 Unscrew and remove the six flywheel/driveplate retaining bolts (see **illustration**), and carefully withdraw the flywheel/driveplate from the rear face of the crankshaft. Take care not to drop the flywheel, as it is heavy. Note that the retaining bolts must be renewed when refitting.

Inspection

3 The inspection procedures for the flywheel/driveplate are the same as those described for the HCS engine in Part A of this Chapter, but note that the grinding procedures do not apply to automatic transmission models (the driveplate cannot be reground).

Refitting

4 Check that the mating faces of the flywheel/driveplate and crankshaft are clean before refitting.

5 Smear the new retaining bolt threads with thread-locking compound. Fit the flywheel/driveplate into position on the rear end face of the crankshaft. Check that all of the bolt holes in the flywheel/driveplate are in exact alignment with the corresponding bolt holes in the crankshaft, then insert the bolts and tighten them in a progressive sequence to the specified torque wrench setting.

6 Refit the clutch (manual transmission models) as described in Chapter 8.

7 Refit the transmission (according to type) as described in Chapter 7.