



Chapter 2 Part C:

CVH engines

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Degrees of difficulty

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

1.6 litre engine

Note: Unless otherwise stated, the Specifications for the 1.6 litre CVH engine are as given for the 1.8 litre (R2A type) which follow.

General

Engine code	L6B
Bore	79.960 mm
Stroke	79.520 mm
Cubic capacity	1596 cc
Compression ratio	9.0 :1
Compression pressure at starter motor speed	12.2 to 14.3 bars
Maximum continuous engine speed	6000 rpm
Maximum engine power (DIN)	59 kW at 5500 rpm
Maximum engine torque (DIN)	121 Nm at 3500 rpm

Cylinder bore diameter

Standard class 1	79.940 to 79.950 mm
Standard class 2	79.950 to 79.960 mm
Standard class 3	79.960 to 79.970 mm
Standard class 4	79.970 to 79.980 mm
Oversize class A	80.230 to 80.240 mm
Oversize class B	80.240 to 80.250 mm
Oversize class C	80.250 to 80.260 mm

2C•2 CVH engines

Crankshaft

Endfloat	0.09 to 0.30 mm (0.004 to 0.012 in)
Main bearing running clearance	0.011 to 0.058 mm
Main bearing journal diameter:	
Standard	57.980 to 58.000 mm
Undersize 0.25	57.730 to 57.750 mm
Undersize 0.50	57.480 mm
Undersize 0.75	57.230 to 57.250 mm
Main bearing thrustwasher thickness:	
Standard	2.301 to 2.351 mm
Oversize	2.491 to 2.541 mm
Big-end bearing running clearance	0.006 to 0.060 mm
Big-end bearing journal diameter:	
Standard	47.890 to 47.910 mm
Undersize 0.25	47.640 to 47.660 mm
Undersize 0.50	47.390 to 47.410 mm
Undersize 0.75	47.140 to 47.160 mm
Undersize 1.00	46.890 to 46.910 mm

Pistons and piston rings

Piston diameter:	
Standard class 1	79.915 to 79.925 mm
Standard class 2	79.925 to 79.935 mm
Standard class 3	79.935 to 79.945 mm
Standard class 4	79.945 to 79.955 mm
Oversize class A	80.205 to 80.215 mm
Oversize class B	80.215 to 80.225 mm
Oversize class C	80.225 to 80.235 mm
Piston ring end gap:	
Top and centre rings	0.300 to 0.500 mm (0.012 to 0.020 in)
Bottom (oil control) ring	0.250 to 0.400 mm (0.010 to 0.016 in)

Camshaft

Endfloat	0.050 to 0.150 mm (0.002 to 0.006 in)
Thrustplate thickness	4.990 to 5.010 mm (0.1966 to 0.1974 in)
Bearing journal diameter:	
Bearing No 1	44.750 mm
Bearing No 2	45.000 mm
Bearing No 3	45.250 mm
Bearing No 4	45.500 mm
Bearing No 5	45.750 mm

Valves

Valve timing:	
Inlet opens	4° ATDC
Inlet closes	32° ABDC
Exhaust opens	38° BBDC
Exhaust closes	10° BTDC
Valve spring free length:	
Colour code blue/blue	47.200 mm
Colour code white/blue	45.400 mm
Inlet valve stem diameter:	
Standard	8.025 to 8.043 mm
Oversize 0.20	8.225 to 8.243 mm
Oversize 0.40	8.425 to 8.443 mm
Exhaust valve stem diameter:	
Standard	7.999 to 8.017 mm
Oversize 0.20	8.199 to 8.217 mm
Oversize 0.40	8.399 to 8.417 mm

Lubrication system

Oil type	Multigrade engine oil, viscosity range SAE 10W/30 to 20W/50, to API SG/CD or better
Oil capacity:	
With filter	3.5 litres (6.2 pints)
Without filter	3.25 litres (5.7 pints)
Oil pump clearances:	
Outer rotor-to-body	0.060 to 0.190 mm (0.002 to 0.007 in)
Inner rotor-to-outer rotor	0.050 to 0.180 mm (0.002 to 0.007 in)
Rotor endfloat	0.014 to 0.100 mm (0.001 to 0.004 in)

Torque wrench settings

	Nm	lbf ft
Main bearing cap bolts	90 to 100	66 to 74
Connecting rod (big-end bearing cap) bolts	30 to 36	22 to 27
Crankshaft pulley bolt	100 to 115	74 to 85
Camshaft sprocket bolt	54 to 59	40 to 44
Flywheel bolts	82 to 92	61 to 68
Oil pump bolts	8 to 11	6 to 8
Oil pump cover bolts	8 to 12	6 to 9
Sump bolts (in two stages)	5 to 8	4 to 6
Rocker arm nuts	25 to 29	18 to 21
Cylinder head bolts:		
Stage 1	20 to 40	15 to 30
Stage 2	40 to 60	30 to 44
Stage 3	Angle-tighten a further 90°	
Stage 4	Angle-tighten a further 90°	
Camshaft cover bolts	6 to 8	4 to 6
Timing cover bolts	9 to 11	7 to 8
Timing belt tensioner bolts	16 to 20	12 to 15
Oil pick-up tube/strainer-to-oil pump bolts	8 to 12	6 to 9
Oil pick-up tube/strainer-to-cylinder block bolt	17 to 23	13 to 17
Camshaft thrustplate bolts	9 to 13	7 to 10
Crankshaft rear oil seal housing bolts	8 to 11	6 to 8

1.8 litre (R2A type) engine**General**

Engine type	Four-cylinder, in-line, single overhead camshaft
Firing order	1-3-4-2
Engine code	R2A
Bore	80.00 mm
Stroke	88.00 mm
Cubic capacity	1769 cc
Compression ratio	9.3:1
Compression pressure at starter motor speed	11 to 13 bar
Maximum continuous engine speed	5850 rpm
Maximum engine power (DIN)	66 kW at 5250 rpm
Maximum engine torque (DIN)	147 Nm at 3000 rpm

Cylinder bore diameter

Standard class 1	79.940 to 79.950 mm
Standard class 2	79.950 to 79.960 mm
Standard class 3	79.960 to 79.970 mm
Standard class 4	79.970 to 79.980 mm
Standard class 5	79.980 to 79.990 mm
Standard class 6	79.990 to 80.000 mm
Oversize class A	80.000 to 80.010 mm
Oversize class B	80.010 to 80.020 mm
Oversize class C	80.020 to 80.030 mm

Crankshaft

Endfloat	0.10 to 0.20 mm (0.004 to 0.008 in)
Main bearing running clearance	0.028 to 0.067 mm
Main bearing journal diameter:	
Standard	53.980 to 54.000 mm
Undersize 0.25	53.730 to 54.750 mm
Undersize 0.50	53.480 to 53.500 mm
Undersize 0.75	53.230 to 53.250 mm
Centre main thrust bearing shell width:	
Standard	28.825 to 28.875 mm
Undersize 0.15	28.675 to 28.725 mm
Big-end bearing running clearance	0.020 to 0.065 mm
Big-end bearing journal diameter:	
Standard	43.890 to 43.910 mm
Undersize 0.25	43.640 to 43.660 mm
Undersize 0.50	43.390 to 43.410 mm
Undersize 0.75	43.140 to 43.160 mm
Undersize 1.00	42.890 to 42.910 mm

Pistons and piston rings

Piston diameter:	
Standard class 1	79.910 to 79.920 mm
Standard class 2	79.920 to 79.930 mm
Standard class 3	79.930 to 79.940 mm
Standard class 4	79.940 to 79.950 mm
Standard class 5	79.950 to 79.960 mm
Standard class 6	79.960 to 79.970 mm
Oversize class A	79.970 to 79.980 mm
Oversize class B	79.980 to 79.990 mm
Oversize class C	79.990 to 80.000 mm

Camshaft

Endfloat	0.15 to 0.20 mm (0.006 to 0.008 in)
Thrustplate thickness	4.99 to 5.01 mm (0.1966 to 0.1974 in)
Bearing journal diameter	45.7625 to 45.7375 mm

Valves

Valve timing:	
Inlet opens	22° BTDC
Inlet closes	54° ABDC
Exhaust opens	64° BBDC
Exhaust closes	12° ATDC
Valve spring free length	47.20 mm (1.86 in)
Inlet valve stem diameter:	
Standard	8.025 to 8.043 mm
Oversize 0.38	8.405 to 8.423 mm
Oversize 0.76	8.825 to 8.843 mm
Exhaust valve stem diameter (standard)	7.996 to 8.017 mm

Lubrication system

Oil type	Multigrade engine oil, viscosity range SAE 10W/30 to 20W/50, to API SG/CD or better
Oil capacity:	
With filter	4.0 litres (7.0 pints)
Without filter	3.5 litres (6.2 pints)
Oil filter	Champion C104
Oil pump clearances:	
Outer rotor to body	0.074 to 0.161 mm (0.003 to 0.006 in)
Inner rotor to outer rotor	0.050 to 0.180 mm (0.002 to 0.007 in)
Rotor endfloat	0.013 to 0.070 mm (0.0005 to 0.0028 in)

Torque wrench settings

	Nm	lbf ft
Main bearing cap bolts	90 to 108	66 to 80
Big-end bearing caps:		
With retaining nuts	26 to 34	19 to 25
With retaining bolts	35 to 41	26 to 30
Crankshaft pulley bolt	110 to 130	81 to 96
Camshaft sprocket bolt	95 to 115	70 to 85
Flywheel bolts	73 to 91	54 to 67
Oil pump bolts	11 to 16	8 to 12
Oil pump cover bolts	9 to 12	7 to 9
Sump bolts:		
M6 bolts	8 to 11	6 to 8
M8 bolts	20 to 30	15 to 22
Sump drain plug	20 to 30	15 to 22
Rocker arm bolts	23 to 30	17 to 22
Cylinder head bolts:		
Stage 1	40 to 60	30 to 44
Stage 2	Slacken bolts by half a turn	
Stage 3	40 to 60	30 to 44
Stage 4	Tighten through a further 90°	
Stage 5	Tighten through a further 90°	
Camshaft cover bolts	8 to 11	6 to 8
Timing cover bolts	8 to 11	6 to 8
Timing cover nuts	5 to 7	4 to 5
Timing belt tensioner bolts	23 to 30	17 to 22
Oil pick-up tube/strainer-to-oil pump bolts	10 to 13	7 to 9
Camshaft thrustplate bolts	9 to 13	6 to 9
Crankshaft rear oil seal housing bolts	20 to 30	15 to 22

1.8 litre (R6A type) engine

Note: Unless otherwise stated, the Specifications for this later version of the 1.8 litre CVH engine are as given for the earlier R2A type above.

General

Engine code	R6A
Maximum continuous engine speed	5700 rpm
Maximum engine power (DIN)	64 kW at 5200 rpm
Maximum engine torque (DIN)	145 Nm at 3000 rpm

Valve timing

Inlet opens	24° BTDC
Inlet closes	116° BTDC
Exhaust opens	110° ATDC
Exhaust closes	18° ATDC

1 General information

1.6 litre engine

The 1.6 litre CVH engine was introduced in September 1991, to replace the 1.6 litre SOHC engine used previously in the Sierra range. The engine is broadly similar to the 1.8 litre (R2A type) CVH engine described below. The main differences are outlined in the following paragraphs.

The centre main bearing is fitted with thrustwashers to control crankshaft endfloat, instead of a flanged bearing shell.

The hydraulic cam followers operate in a similar manner to those described for the 1.8 litre (R2A) engine but no rollers are fitted, and the base of each cam follower is in direct contact with the cam profile.

A distributorless ignition system is used and a blanking plate is therefore fitted to the cylinder head in place of the distributor drive. The electric fuel pump is mounted in the fuel tank.

A comprehensive emissions control system is fitted, comprising Central Fuel Injection (CFI), a sophisticated engine management system, a crankcase ventilation system, a catalytic converter, and a pulseair system (to reduce exhaust gas emissions).

Unless otherwise stated, all procedures are as described for the 1.8 litre (R2A) engine.

1.8 litre (R2A type) engine

The CVH (Compound Valve angle, Hemispherical combustion chambers) engine is of four-cylinder, in-line, single overhead camshaft type. The engine was introduced to replace the 1.8 SOHC engine previously used in the range.

The crankshaft incorporates five main bearings. The centre main bearing has a flanged bearing shell (thrust bearing) fitted to the cylinder block to control crankshaft endfloat.

The camshaft is driven by a toothed belt and operates the compound angled valves via roller type hydraulic cam followers, which eliminates the need for valve clearance adjustment. The cam followers operate in the following way. When the valve is closed, pressurised engine oil passes through ports in the body of the cam follower and the plunger into the cylinder feed chamber. From this chamber, oil flows through a ball type non-return valve into the pressure

chamber. The tension of the coil spring causes the plunger to press the rocker arm against the valve and to eliminate any free play.

As the cam lifts the cam follower, the oil pressure in the pressure chamber increases and causes the non-return valve to close the port to the feed chamber. As oil cannot be compressed, it forms a rigid link between the body of the cam follower, the cylinder and the plunger which then rise as one component to open the valve.

The clearance between the body of the cam follower and the cylinder is accurately designed to meter a specific quantity of oil as it escapes from the pressure chamber. Oil will only pass along the cylinder bore when pressure is high during the moment of valve opening. Once the valve has closed, the escape of oil will produce a small amount of free play and no pressure will exist in the pressure chamber. Oil from the feed chamber can then flow through the non-return valve into the pressure chamber so that the cam follower cylinder can be raised by the pressure of the coil spring, thus eliminating any play in the arrangement until the valve is operated again.

As wear occurs between rocker arm and valve stem, the quantity of oil which 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.

To reduce valve clatter when the engine is started, a small plastic stand pipe retains oil inside the plunger. When the engine is started, the reservoir in the plunger (and via the non-return valve, the pressure chamber) are immediately filled with oil. This reduces the noise often associated with hydraulic cam followers as they pressurise with oil after engine start-up.

The cam follower rollers run in needle bearings, which greatly reduces friction as the rollers follow the cam profile.

The distributor and fuel pump are driven directly from the camshaft and the oil pump is driven directly from the front of the crankshaft.

The cylinder head is of crossflow design, with the inlet manifold mounted on the right-hand side and the exhaust manifold mounted on the left-hand side.

Lubrication is by means of a bi-rotor pump

which draws oil through a strainer located inside the sump and forces it through a full-flow filter into the oil galleries where it is distributed to the crankshaft and camshaft. The big-end bearings are supplied with oil via internal drillings in the crankshaft. The undersides of the pistons are supplied with oil from drillings in the big-ends. The hydraulic cam followers are supplied with oil from the camshaft bearings via short passages in the cylinder head.

A semi-closed crankcase ventilation system is employed whereby piston blow-by gases are drawn from the crankcase, through the camshaft cover via an external vent hose, out to an oil separator built into the base of the air cleaner.

1.8 litre (R6A type) engine

The 1.8 litre (R6A type) CVH engine, introduced in March 1992, is a further development of the earlier 1.8 litre (R2A type) unit described above. Apart from minor engineering modifications to provide increased fuel economy, reliability and power output, the engine is mechanically identical to the earlier version.

In common with the 1.6 litre unit, a distributorless ignition system is used, together with a comprehensive emissions control system comprising Central Fuel Injection (CFI), a sophisticated engine management system, a crankcase ventilation system, a catalytic converter, and additionally, an exhaust gas recirculation (EGR) system.

Unless otherwise stated, all procedures are as described for the 1.8 litre (R2A type) engine.

2 Engine oil and filter - renewal

Refer to Section 2, Chapter 2, Part A.

3 Crankcase ventilation system - inspection and maintenance

Refer to Chapter 1, Section 35.

4 Compression test

Refer to Section 5, Chapter 2, Part A.

5 Major operations possible with the engine in the vehicle

- Removal of the cylinder head
- Removal of the camshaft
- Removal of the timing belt and sprockets
- Removal of the engine mountings
- Removal of the clutch and flywheel
- Removal of the crankshaft oil seals

6 Major operations requiring engine removal

- Removal of the sump
- Removal of the oil pump
- Removal of the pistons/connecting rods
- Removal of the big-end bearings
- Removal of the crankshaft main bearings
- Removal of the crankshaft

7 Method of engine removal

Refer to Section 8, Chapter 2, Part A.

8 Engine - removal leaving manual gearbox in vehicle

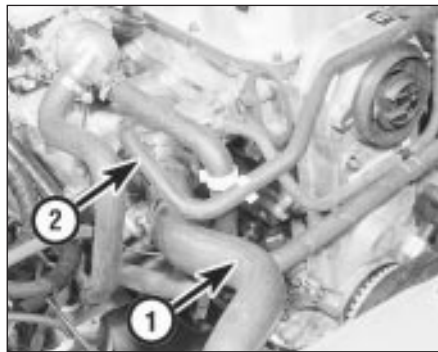
Note: A suitable hoist and lifting tackle will be required for this operation.

1.8 litre (R2A type)

- Disconnect the battery negative lead.
- Remove the bonnet.
- Remove the air cleaner.
- Disconnect the cooling fan wiring plug, then unscrew the retaining nuts and washers and withdraw the fan shroud and cooling fan assembly.
- Drain the cooling system.
- Disconnect the coolant hoses from the coolant pump elbow, and detach the heater hose from the clip on the front of the timing cover.
- Disconnect the upper radiator hose and the expansion tank hose from the thermostat housing (see illustration).

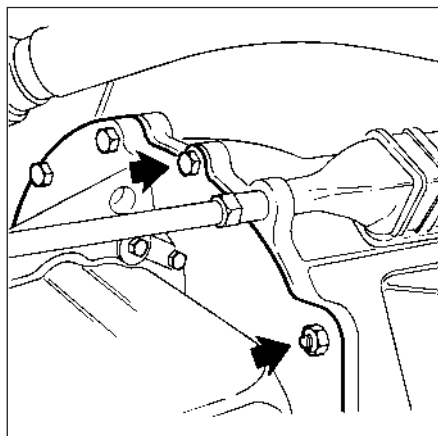


8.22a Earth strap location under engine-to-gearbox bolt - 1.8 litre (R2A)



8.7 Disconnect the upper radiator hose (1) and the expansion tank hose (2) from the thermostat housing - 1.8 litre (R2A)

- Disconnect the heater hose from the automatic choke.
- Disconnect the brake servo vacuum hose from the inlet manifold (see illustration).
- Disconnect the throttle damper solenoid vacuum pipes (noting their locations) from the throttle damper and the carburettor "T"-piece connector.
- Disconnect the engine management module vacuum pipe from the inlet manifold.
- Disconnect the fuel hoses from the carburettor and fuel pump, and plug the ends of the hoses to minimise petrol spillage. Take adequate fire precautions.
- Disconnect the throttle cable.
- Disconnect the HT leads from the coil and spark plugs, unclip the leads from the camshaft cover, and remove the distributor cap, rotor arm and housing.
- Disconnect the wiring from the following components:
 - Alternator
 - Starter motor
 - Oil pressure warning lamp switch
 - Temperature gauge sender
 - Engine coolant temperature sensor
 - Automatic choke
 - Cooling fan switch
 - Crankshaft speed/position sensor
 - Engine earth strap to battery tray



8.22b Remove the two bolts (arrowed) from the engine adapter plate - 1.8 litre (R2A)



8.9 Disconnecting the brake servo vacuum hose from the inlet manifold - 1.8 litre (R2A)

- Unscrew and remove the top engine-to-gearbox bolts which are accessible from the engine compartment.
- Apply the handbrake (if not already done), jack up the front of the vehicle and support on axle stands (see "Jacking and Vehicle Support").
- Drain the engine oil into a container.
- Remove the starter motor.
- Remove the exhaust downpipe.
- Unscrew the two nuts securing the engine mountings to the crossmember. Recover the washers.
- Unscrew and remove the remaining engine-to-gearbox bolts, noting the location of the earth strap (see illustration), and remove the two bolts from the engine adapter plate (see illustration).
- Working inside the vehicle, place a wooden block under the clutch pedal to raise it fully against its stop which will hold the automatic adjuster pawl clear of the toothed quadrant.
- Disconnect the clutch cable from the release arm, and pass the cable through the bellhousing. Remove the clip securing the clutch cable to the right-hand engine mounting bracket. Note the cable routing for use when refitting.
- Lower the vehicle to the ground, and support the gearbox with a trolley jack using a block of wood between the jack and the gearbox to spread the load.
- Make a final check to ensure that all relevant wires, pipes and hoses have been disconnected to facilitate engine removal.
- Attach a suitable hoist to the engine lifting brackets located at the front and rear of the cylinder head, and carefully take the weight of the engine. The engine should be supported horizontally, ie do not allow it to tilt front to rear.
- Raise the engine until the engine mounting studs are clear of the crossmember, then pull the engine forwards to disconnect it from the gearbox. Ensure that the gearbox is adequately supported, and take care not to strain the gearbox input shaft. It may be necessary to rock the engine a little to release it from the gearbox.



8.29 Lifting the engine from the vehicle - 1.8 litre (R2A)

29 Once clear of the gearbox, lift the engine from the vehicle, taking care not to damage the radiator fins (see illustration).

1.6 and 1.8 litre (R6A type)

- 30 Proceed as described in paragraphs 1 to 5.
- 31 Disconnect the coolant hoses from the thermostat housing, noting their locations.
- 32 Disconnect the lower radiator hose from the coolant pump elbow and, where applicable, disconnect the heater hose from the T-piece on the lower radiator hose.
- 33 On 1.6 engines, disconnect the coolant hose from the central fuel injection (CFI) unit.
- 34 Disconnect the brake servo vacuum hose from the inlet manifold by carefully pressing the clip on the inlet manifold connector into the manifold using a screwdriver, and withdrawing the hose.
- 35 Disconnect the vacuum hoses from the inlet manifold, noting their locations.
- 36 On 1.6 litre engines, disconnect the two hoses from the pulse-air system check valves (see illustration).
- 37 Gradually loosen the fuel inlet pipe union on the CFI unit, to relieve the pressure in the fuel system. Be prepared for fuel spray, and take adequate fire precautions. Once the pressure has reduced, disconnect the fuel inlet and return hoses. Plug the ends of the hoses to minimise petrol spillage.
- 38 Disconnect the throttle cable, if necessary.
- 39 Disconnect the wiring from the following components, as applicable.

Alternator

Starter motor

Oil pressure warning lamp switch

Temperature gauge sender

Engine coolant temperature sensor

Inlet air temperature sensor

Ignition coil

Throttle stepper motor

Throttle position sensor

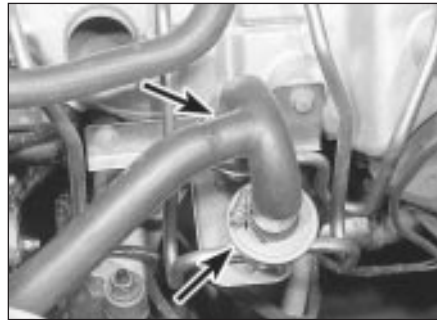
Fuel injector

Cooling fan switch

Air charge temperature sensor

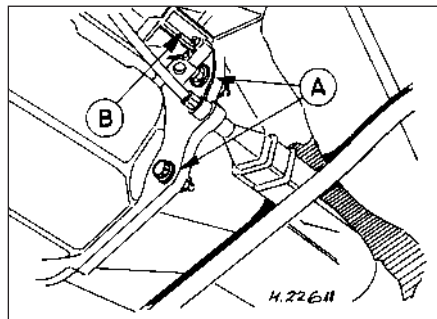
Engine earth strap to battery tray

- 40 On 1.8 litre engine models with power steering, slacken the power steering pump pulley bolts, then remove the alternator/power steering pump drivebelt. Remove the pulley, unbolt the power steering pump from its bracket, and move it clear of the engine.



8.36 Pulse-air system check valves (arrowed) - 1.6/1.8 litre (R6A)

- 41 Unscrew and remove the top engine-to-gearbox bolts which are accessible from the engine compartment.
- 42 Apply the handbrake (if not already done), jack up the front of the vehicle and support it on axle stands (see "Jacking and Vehicle Support").
- 43 Drain the engine oil into a suitable container.
- 44 Remove the starter motor.
- 45 Disconnect the exhaust gas oxygen sensor wiring connector, then remove the exhaust downpipe.
- 46 Disconnect the wiring plug from the crankshaft speed/position sensor.
- 47 Unscrew the two nuts securing the engine mountings to the crossmember. Recover the washers.
- 48 Unscrew and remove the remaining engine-to-gearbox bolts, noting the location of the earth strap and any wiring brackets, and remove the two bolts from the engine adapter plate (see illustration).
- 49 Unscrew the securing bolt, and remove the crankshaft speed/position sensor shroud (where fitted).
- 50 On 1.6 litre engines, working inside the vehicle, place a wooden block under the clutch pedal to raise it fully against its stop. This will hold the automatic adjuster pawl clear of the toothed quadrant. Disconnect the clutch cable from the release arm, and pass the cable through the bellhousing. Note the cable routing for use when refitting.
- 51 Proceed as shown in paragraphs 25 to 29.



8.48 Engine adapter plate bolts (A) and crankshaft speed/position sensor shroud (B) - 1.6 litre

9 Engine - removal leaving automatic transmission in vehicle

Note: A suitable hoist and lifting tackle will be required for this operation.

- 1 Proceed as described in Section 8, paragraphs 1 to 15 inclusive. Additionally, if applicable disconnect the kickdown cable from the carburettor.
- 2 Unscrew and remove the top engine-to-transmission bolts which are accessible from the engine compartment. Note the location of the vacuum pipe bracket and transmission dipstick tube bracket.
- 3 Proceed as described in Section 8, paragraphs 17 to 21 inclusive.
- 4 Working through the starter motor aperture, unscrew the four torque converter-to-driveplate nuts. It will be necessary to turn the crankshaft using a suitable spanner on the crankshaft pulley bolt in order to gain access to each nut in turn through the aperture.
- 5 Unscrew and remove the remaining engine-to-transmission bolts, noting the location of the earth strap, and remove the two bolts from the engine adapter plate. Where applicable pull the blanking plug from the adapter plate.
- 6 Lower the vehicle to the ground and support the transmission with a trolley jack, using a block of wood between the jack and the transmission to spread the load.
- 7 Make a final check to ensure that all relevant wires, pipes and hoses have been disconnected to facilitate engine removal.
- 8 Attach a suitable hoist to the engine lifting brackets located at the front and rear of the cylinder head, and carefully take the weight of the engine. The engine should be supported horizontally, ie do not allow it to tilt front to rear.
- 9 Raise the engine until the engine mounting studs are clear of the crossmember, then pull the engine forwards to disconnect it from the transmission. Ensure that the torque converter is held firmly in place in the transmission housing, otherwise it could fall out resulting in fluid spillage and possible damage. It may be necessary to rock the engine a little to release it from the transmission.
- 10 Once clear of the transmission, lift the engine from the vehicle, taking care not to damage the radiator fins.

10 Engine/manual gearbox assembly - removal and separation

Note: A suitable hoist and lifting tackle will be required for this operation.

1.8 litre (R2A type)

Removal

- 1 Proceed as described in Section 8, paragraphs 1 to 15 inclusive.
- 2 Working inside the vehicle, unscrew the gear lever knob and remove the centre

console. Where a full-length console is fitted, it is only necessary to remove the front tray.

3 Detach the outer gaiter from the retaining frame and withdraw it over the gear lever.

4 Release the clips and remove the gaiter retaining frame and inner gaiter.

5 Using a suitable Torx key, remove the screws securing the gear lever to the gearbox extension housing, and withdraw the gear lever. Note how the base of the gear lever locates over the selector shaft.

6 Jack up the vehicle and support on axle stands (see "Jacking and Vehicle Support"). Ensure that there is sufficient working room beneath the vehicle.

7 To improve access, disconnect the exhaust downpipe from the manifold and remove the exhaust system.

8 Remove the propeller shaft.

9 Where applicable bend back the locktabs, then unscrew the two bolts securing each of the two anti-roll bar U-clamps to the vehicle underbody. Lower the anti-roll bar as far as possible.

10 Proceed as described in Section 8, paragraphs 23 and 24.

11 Drain the engine oil into a container.

12 Unscrew the two nuts securing the engine mountings to the crossmember. Recover the washers.

13 Disconnect the wiring from the reversing lamp switch.

14 Remove the retaining circlip, and withdraw the speedometer cable from the gearbox extension housing.

15 Support the gearbox with a trolley jack, using a block of wood between the jack and the gearbox to spread the load.

16 Unscrew the four bolts securing the gearbox crossmember to the vehicle underbody. Unscrew the central bolt securing the crossmember to the gearbox and remove the crossmember. Note the position of the earth strap, where applicable. Recover the mounting cup and where applicable the exhaust mounting bracket and heat shield.

17 Make a final check to ensure that all relevant wires, pipes and hoses have been disconnected to facilitate removal of the engine/gearbox assembly.

18 Attach a hoist to the engine lifting brackets located at the front and rear of the cylinder head. Arrange the lifting tackle so that the engine/gearbox assembly will assume a steep angle of approximately 40° to 45° as it is being removed.

19 Raise the engine/gearbox so that the engine mounting studs are clear of the crossmember, then ease the assembly forwards, at the same time lowering the trolley jack which is supporting the gearbox. Lift the assembly from the vehicle, taking care not to damage the surrounding components.

20 With the engine/gearbox assembly removed, temporarily reconnect the anti-roll bar to the underbody if the vehicle is to be moved.

Separation

21 To separate the engine from the gearbox, proceed as follows.

22 Remove the starter motor.

23 Support the engine and gearbox horizontally on blocks of wood.

24 Unscrew and remove the engine-to-gearbox bolts, noting the location of the earth strap, and remove the two bolts from the engine adapter plate.

25 Pull the engine and gearbox apart, taking care not to strain the gearbox input shaft. It may be necessary to rock the units slightly to separate them.

1.6 and 1.8 litre (R6A type)

26 Proceed as described in paragraphs 30 to 40 inclusive of Section 8.

27 Proceed as described in paragraphs 2 to 25 inclusive of Section 10, noting the following points.

28 Disconnect the wiring from the vehicle speed sensor mounted on the gearbox before removing the engine/gearbox assembly.

29 Note that on 1.6 litre engines, the crankshaft speed/position sensor shroud (which is secured by a single bolt) must be removed before separating the engine from the gearbox.

11 Engine/automatic transmission assembly - removal and separation



Note: A suitable hoist and lifting tackle will be required for this operation. Any suspected faults in the automatic transmission should be referred to a Ford dealer or automatic transmission specialist before removal of the unit, as the specialist fault diagnosis equipment is designed to operate with the transmission in the vehicle.

Removal

1 Proceed as described in Section 8, paragraphs 1 to 15 inclusive, but additionally, where applicable disconnect the kickdown cable from the carburettor.

2 Jack up the vehicle and support on axle stands (see "Jacking and Vehicle Support"). Ensure that there is sufficient working room beneath the vehicle.

3 To improve access, disconnect the exhaust downpipe from the manifold and remove the exhaust system.

4 Remove the propeller shaft.

5 Where applicable bend back the locktabs, then unscrew the two bolts securing each of the two anti-roll bar U-clamps to the vehicle underbody. Lower the anti-roll bar as far as possible.

6 Unscrew the unions and disconnect the fluid cooler pipes from the transmission. Plug the open ends of the pipes and the transmission to prevent dirt ingress and fluid leakage. Remove the fluid cooler pipe bracket from the engine mounting bracket and place it to one side.

7 Remove the two clips securing the selector rod, and detach the selector rod from the manual selector lever, and the selector lever on the transmission.

8 If applicable, disconnect the kickdown cable from the transmission and withdraw the cable.

9 Disconnect the wiring from the starter inhibitor/reversing lamp switch, the lock-up clutch and where applicable the kickdown solenoid.

10 Remove the securing screw, and disconnect the speedometer cable from the transmission extension housing. Plug the opening in the transmission to prevent dirt ingress.

11 Disconnect the vacuum pipe from the vacuum diaphragm unit, and unclip the pipe from its securing bracket on the transmission housing.

12 Drain the engine oil into a container.

13 Unscrew the two nuts securing the engine mountings to the crossmember. Recover the washers.

14 Support the transmission with a trolley jack using a block of wood between the jack and the transmission to spread the load.

15 Unscrew the four bolts securing the transmission crossmember to the vehicle underbody. Note the position of the earth strap, where applicable. Unscrew the central bolt securing the crossmember to the transmission and remove the crossmember. Recover the mounting cup and the exhaust mounting bracket.

16 Make a final check to ensure that all relevant wires, pipes and hoses have been disconnected to facilitate removal of the engine/transmission assembly.

17 Attach a suitable hoist to the engine lifting brackets located at the front and rear of the cylinder head. Arrange the lifting tackle so that the engine/transmission assembly will assume a steep angle of approximately 40° to 45° as it is being removed.

18 Raise the engine/transmission so that the engine mounting studs are clear of the crossmember, then ease the assembly forwards, at the same time lowering the trolley jack which is supporting the transmission. Lift the assembly from the vehicle, taking care not to damage surrounding components.

19 With the engine/transmission assembly removed, temporarily reconnect the anti-roll bar to the underbody if the vehicle is to be moved.

Separation

20 To separate the engine from the transmission, proceed as follows.

21 Remove the starter motor.

22 Support the engine and transmission horizontally on blocks of wood.

23 Working through the starter motor aperture, unscrew the four torque converter-to-driveplate nuts. It will be necessary to turn the crankshaft using a suitable spanner on the crankshaft pulley bolt in order to gain access to each nut in turn through the aperture.

24 Unscrew and remove the engine-to-transmission bolts, noting the locations of the earth strap, vacuum pipe bracket, and transmission dipstick tube bracket. Remove the two bolts from the engine adapter plate, and where applicable pull the blanking plug from the adapter plate.

25 Pull the engine and transmission apart, ensuring that the torque converter is held

firmly in place in the transmission housing, otherwise it could fall out resulting in fluid spillage and possible damage. It may be necessary to rock the units slightly to separate them.

12 Engine - refitting (manual gearbox in vehicle)

1.8 litre (R2A type)

- Reverse the procedure described in Section 8, noting the following points.
- Before attempting to refit the engine, check that the clutch friction disc is centralised. This is necessary to ensure that the gearbox input shaft splines will pass through the splines in the centre of the friction disc.
- Check that the clutch release arm and bearing are correctly fitted, and lightly grease the input shaft splines.
- Check that the engine adapter plate is correctly positioned on its locating dowels.
- Reconnect the clutch cable to the release arm, ensuring that it is routed as noted during removal.
- Fill the engine with the correct grade and quantity of oil.
- Fill the cooling system.
- Check and if necessary adjust the tension of the alternator drivebelt.
- Adjust the throttle cable.

1.6 and 1.8 litre (R6A type)

- Reverse the procedure described in Section 8, noting the points made above.

13 Engine - refitting (automatic transmission in vehicle)

- Reverse the procedure described in Section 9, noting the following points.
- Check that the engine adapter plate is correctly positioned on its locating dowels.
- As the torque converter is only loosely engaged in the transmission, care must be taken to prevent the torque converter from falling out forwards. When the torque converter hub is fully engaged with the fluid pump drivegear in the transmission, distance "A" in illustration 2.24 of Chapter 7B must be as specified. Incorrect installation of the torque converter will result in damage to the transmission.
- As the engine is installed, guide the torque converter studs through the holes in the driveplate. When the engine is positioned flush with the engine adapter plate and the transmission housing, check that the torque converter is free to move axially a small amount before refitting and tightening the engine-to-transmission bolts.
- Do not tighten the torque converter-to-driveplate nuts until the lower engine-to-transmission bolts have been fitted and tightened.
- Fill the engine with the correct grade and quantity of oil.

- Fill the cooling system.
- Check and if necessary adjust the tension of the alternator drivebelt.
- Adjust the throttle cable.
- If applicable, adjust the kickdown cable.

14 Engine/manual gearbox assembly - reconnection and refitting

1.8 litre (R2A type)

- Reverse the procedure described in Section 10, noting the following points.
- Before attempting to reconnect the engine to the gearbox, check that the clutch friction disc is centralised. This is necessary to ensure that the gearbox input shaft splines will pass through the splines in the centre of the friction disc.
- Check that the clutch release arm and bearing are correctly fitted, and lightly grease the input shaft splines.
- Check that the engine adapter plate is correctly positioned on its locating dowels.
- Reconnect the clutch cable to the release arm, ensuring that it is routed as noted during removal.
- Fill the engine with the correct grade and quantity of oil.
- Fill the cooling system.
- Check and if necessary top-up the gearbox oil level.
- Check and if necessary adjust the tension of the alternator drivebelt.
- Adjust the throttle cable.

1.6 and 1.8 litre (R6A type)

- Reverse the procedure described in Section 10, noting the points made above. Ensure that the vehicle speed sensor wiring plug is reconnected.

15 Engine/automatic transmission assembly - reconnection and refitting

- Reverse the procedure described in Section 11, noting the following points.
- Check that the engine adapter plate is correctly positioned on its locating dowels.
- As the torque converter is only loosely engaged in the transmission, care must be taken to prevent the torque converter from falling out forwards. When the torque converter hub is fully engaged with the fluid pump drivegear in the transmission, distance "A" in illustration 2.24 of Chapter 7B must be as specified. Incorrect installation of the torque converter will result in damage to the transmission.
- As the engine and transmission are reconnected, guide the torque converter studs through the holes in the driveplate. When the engine is positioned flush with the engine adapter plate and the transmission housing, check that the torque converter is free to move axially a small amount before

- refitting and tightening the engine-to-transmission bolts.
- Do not tighten the torque converter-to-driveplate nuts until the lower engine-to-transmission bolts have been fitted and tightened.
 - Reconnect and adjust the selector rod.
 - Fill the engine with the correct grade and quantity of oil.
 - Fill the cooling system.
 - Check and if necessary top-up the transmission fluid level.
 - Check and if necessary adjust the tension of the alternator drivebelt.
 - Adjust the throttle cable.
 - Where applicable, adjust the kickdown cable.

16 Engine mountings - renewal

- The engine mountings incorporate hydraulic dampers and must be renewed if excessive engine movement is evident.
- Working in the engine compartment, unscrew the central nuts securing the engine mounting brackets to the tops of the mountings. Recover the washers.
- Apply the handbrake, jack up the front of the vehicle and support on axle stands (see "Jacking and Vehicle Support").
- Working underneath the vehicle, remove the central nuts securing the mountings to the crossmember. Recover the washers.
- Raise the engine using a suitable hoist and lifting tackle attached to the engine lifting brackets on the cylinder head, or a jack and interposed block of wood under the sump, until the mountings can be withdrawn.
- Fit the new mountings, then lower the engine onto them. Note that the locating pins on the mountings must engage with the corresponding holes in the engine mounting brackets (see illustration).
- Fit the nuts and washers securing the mountings to the crossmember and tighten the nuts.
- Lower the vehicle to the ground and fit the nuts and washers securing the engine mounting brackets to the mountings. Tighten the nuts.



16.6 Locating pin on mounting must engage with hole (arrowed) in engine mounting bracket

17 Engine dismantling, examination, renovation and reassembly - general information

1.8 litre (R2A type)

Dismantling

1 It is best to mount the engine on a dismantling stand, but if this is not available, stand the engine on a strong bench at a comfortable working height. Failing this, it will have to be stripped down on the floor.

2 Cleanliness is most important, and if the engine is dirty, it should be cleaned with paraffin while keeping it in an upright position.

3 Avoid working with the engine directly on a concrete floor, as grit presents a real source of trouble.

4 As parts are removed, clean them in a paraffin bath. However, do not immerse parts with internal oilways in paraffin as it is difficult to remove, usually requiring a high pressure hose. Clean oilways with nylon pipe cleaners.

5 It is advisable to have suitable containers available to hold small items according to their use, as this will help when reassembling the engine and also prevent possible losses.

6 Always obtain a complete set of new gaskets for use during engine reassembly, but retain the old gaskets with a view to using them as a pattern to make a replacement if a new one is not available.

7 Where possible, refit securing nuts, bolts and washers to their locations after removing the relevant components. This will help to protect the threads and will also prevent possible losses.

8 Retain unserviceable components in order to compare them with the new components supplied.

9 A suitable Torx socket will be required to remove the oil pump cover securing screws.

10 Before dismantling the main engine components, the following externally mounted ancillary components can be removed:

Inlet manifold and carburettor
Exhaust manifold
Fuel pump and operating pushrod
Alternator
Spark plugs
Oil pressure warning lamp switch (see illustration)
Oil filter
Dipstick
Engine mounting brackets
Clutch
Alternator mounting bracket
Crankshaft speed/position sensor
Engine lifting brackets

Examination and renovation

11 Refer to Section 18 in Chapter 2, Part A.

Reassembly

12 To ensure maximum life with minimum trouble from a rebuilt engine, not only must everything be correctly assembled, but it must



17.10 Removing the oil pressure warning lamp switch - 1.8 litre (R2A)

also be spotlessly clean. All oilways must be clear, and locking washers and spring washers must be fitted where indicated. Oil all bearings and other working surfaces thoroughly with engine oil during assembly.

13 Before assembly begins, renew any bolts or studs with damaged threads.

14 Gather together a torque wrench, oil can, clean rag, and a set of engine gaskets and oil seals, together with a new oil filter.

15 If they have been removed, new cylinder head bolts, big-end bolts/nuts and new flywheel bolts will be required.

16 After reassembling the main engine components, refer to paragraph 10 and refit the ancillary components listed. Delicate items such as the alternator may be left until after the engine has been refitted.

1.6 and 1.8 litre (R6A type)

Dismantling

17 Refer to paragraphs 1 to 9 inclusive.

18 Before dismantling the main engine components, the following ancillary components can be removed:

Inlet manifold and CFI unit.
Exhaust manifold .
Alternator.
Spark plugs and HT leads.
Ignition coil and mounting bracket.
Oil pressure warning lamp switch.
Oil filter.
Dipstick and tube.
Engine mounting brackets.
Clutch.
Alternator mounting bracket.



18.3 Withdrawing the crankshaft pulley - 1.8 litre (R2A)

Crankshaft speed/position sensor.
Engine lifting brackets.
Crankcase ventilation hose.

Examination and renovation

19 Refer to Section 18 in Chapter 2, Part A.

Reassembly

20 Refer to paragraphs 12 to 16 but note that new rocker arm nuts will be required, if they have been removed.

18 Timing belt and sprockets - removal and refitting



Note: *The belt tension should be checked using Ford special tool No 21-113 after refitting. A suitable puller may be required to remove the sprockets. If the camshaft sprocket is removed, a new retaining bolt must be used on refitting, and suitable sealant (Loctite 74 or 274, or Omnifit 30M blue) will be required to coat the bolt threads.*

1.8 litre (R2A type)

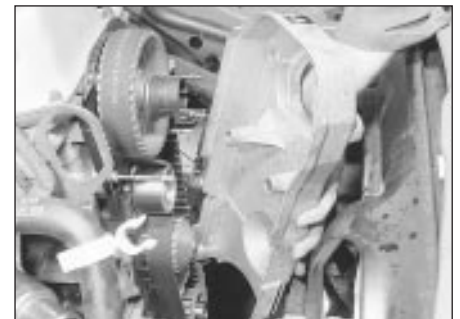
Removal

1 If the engine is in the vehicle, carry out the following operations:

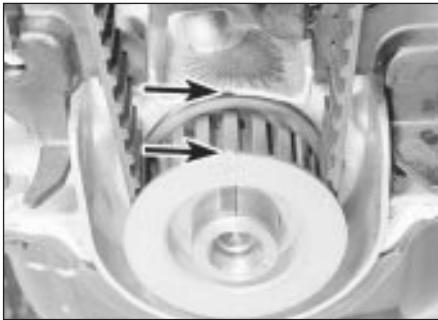
- Disconnect the battery negative lead*
- Remove the alternator drivebelt*
- Remove the distributor cap, rotor arm and housing*
- Disconnect the wiring plug from the crankshaft speed/position sensor*
- Unclip the coolant hoses from the timing cover, and position them across the top of the camshaft cover out of the way*
- If desired for improved access, remove the fan shroud and cooling fan assembly, although this is not essential*

2 Slacken the crankshaft pulley bolt. Prevent the crankshaft from turning by engaging top gear (manual gearbox only) and having an assistant apply the brake pedal hard, or by removing the starter motor and jamming the ring gear teeth with a lever.

3 Remove the bolt and washer and withdraw the pulley (**see illustration**). If the pulley will not come off easily, refit the bolt part way and use a puller, but take care not to damage the sensor toothed disc.



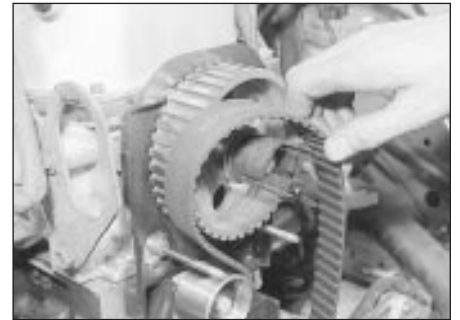
18.5 Withdrawing the timing cover - 1.8 litre (R2A)



18.6a TDC lug on crankshaft sprocket aligned with notch in oil pump flange - 1.8 litre (R2A)



18.6b TDC pointer on camshaft sprocket aligned with dot on cylinder head - 1.8 litre (R2A)



18.8 Withdrawing the timing belt - 1.8 litre (R2A)

4 Unscrew the two timing cover securing nuts, and recover the earth tag and the coolant hose clip.

5 Unscrew the two securing bolts and withdraw the timing cover (see illustration).

6 Refit the crankshaft pulley bolt, and using a socket on the bolt, turn the engine clockwise until the TDC (top dead centre) lug on the crankshaft sprocket is uppermost, and in line with the notch in the oil pump flange, and the pointer on the camshaft sprocket is aligned with the dot on the cylinder head front face (see illustrations).

7 Loosen the two timing belt tensioner bolts, press the tensioner to the left against the spring tension, and tighten the two bolts to retain the tensioner in the released position.

8 Mark the running direction of the belt if it is to be re-used, then slip it off the sprockets,

and withdraw the belt (see illustration).

9 If desired, the camshaft and crankshaft sprockets can be removed as follows, otherwise proceed to paragraph 19. The coolant pump sprocket is integral with the pump and cannot be removed separately.

10 Unscrew the crankshaft pulley bolt, preventing the crankshaft from turning as before if necessary, then remove the crankshaft sprocket. Refit the bolt part way and use a puller if necessary. Recover the Woodruff key from the end of the crankshaft and remove the thrustwasher (see illustrations).

11 Unscrew the camshaft sprocket bolt while holding the sprocket stationary with a 41 mm ring spanner. Alternatively, make up a tool similar to that shown for tightening the bolt and hold the sprocket using two bolts

engaged in the sprockets holes. Recover the distributor rotor shaft which is held in place by the camshaft sprocket bolt (see illustration).

12 Remove the camshaft sprocket, refitting the bolt part way and using a puller if necessary (see illustration).

13 If desired, the timing belt backplate can be removed by lifting it from the studs (see illustration) and the timing belt tensioner and coolant pump can be removed.

14 If required, the camshaft oil seal can be removed using self-tapping screws and a pair of grips. A new seal can be fitted using a suitable tube drift to press it into place. Lubricate the seal lips with clean engine oil before installation.

Refitting

15 Refit the sprockets as follows.



18.10a Remove the crankshaft sprocket ...



18.10b ... the Woodruff key ...



18.10c ... and the thrustwasher - 1.8 litre (R2A)



18.11 Removing the camshaft sprocket bolt and distributor rotor shaft - 1.8 litre (R2A)



18.12 Using a puller to remove the camshaft sprocket - 1.8 litre (R2A)



18.13 Removing the timing belt backplate - 1.8 litre (R2A)



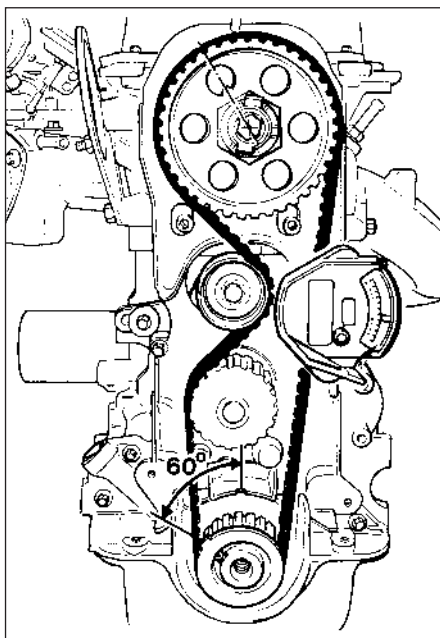
18.17 Tightening the camshaft sprocket bolt. Hold the sprocket stationary using an improvised tool with two bolts engaged in the sprocket holes - 1.8 litre (R2A)

16 Where applicable, refit the timing belt tensioner and coolant pump, locate the timing belt backplate over the studs, then fit the camshaft sprocket and the distributor rotor shaft.

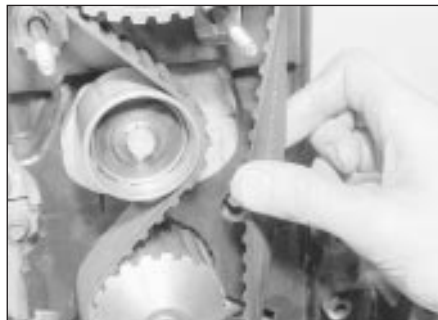
17 The camshaft sprocket bolt must be coated with sealant before installation. The manufacturers recommend Loctite 74 or 274, or Omnifit 30M blue. With the sealant applied, insert the bolt, hold the camshaft sprocket stationary as during removal, and tighten the bolt to the specified torque (see illustration).

18 Refit the thrustwasher with the convex side facing forwards, and refit the Woodruff key, then refit the crankshaft sprocket with the "FRONT" mark facing forwards.

19 Fit the timing belt over the crankshaft sprocket, but do not engage it with the other sprockets yet. Be careful not to kink the belt, and if the old belt is being refitted, observe the previously noted running direction.



18.27 No 1 cylinder at 60° BTDC for checking of timing belt tension - 1.8 litre (R2A)



18.25 Twisting the timing belt to assess its tension - 1.8 litre (R2A)

20 Make sure that the TDC pointer on the camshaft sprocket is still aligned with the dot on the cylinder head front face.

21 Check that the TDC lug on the crankshaft sprocket is still in line with the notch in the oil pump flange. If necessary, refit the crankshaft pulley bolt, if not already done, and using a socket on the bolt, turn the crankshaft by the shortest possible route to align the lug and notch.

22 Starting at the crankshaft and working in an anti-clockwise direction, fit the timing belt over the camshaft sprocket, round the tensioner roller, and over the coolant pump sprocket.

23 Slacken the tensioner bolts, allow the tensioner roller to rest against the belt, then tighten the tensioner bolts.

24 Refit the crankshaft pulley bolt, if not already done, and using a socket on the bolt, turn the engine through two revolutions in a clockwise direction (to bring No 1 cylinder back to TDC), then turn the crankshaft 60° anti-clockwise (No 1 cylinder at 60° BTDC).

25 The belt tension should now be checked by applying Ford tension gauge, tool No 21-113 to the longest belt run. Desired gauge readings are:

Used belt - 4 to 6

New belt - 10 to 11

If the tension gauge is not available, a rough guide is that the belt tension is correct when the belt can be twisted 90° in the middle of the longest run with the fingers using moderate pressure (see illustration). In this case, the vehicle should be taken to a Ford dealer so that the belt tension can be checked using the special gauge at the earliest opportunity.

26 If adjustment of belt tension is necessary, turn the crankshaft clockwise to bring No 1 cylinder to TDC, then slacken the tensioner bolts and move the tensioner to increase or decrease the belt tension. Tighten the tensioner bolts to the specified torque.

27 Turn the crankshaft 90° clockwise past TDC, then anti-clockwise back to the 60° BTDC position (No 1 cylinder at 60° BTDC). Check the belt tension again (see illustration).

28 Repeat the procedure given in paragraphs 26 and 27 until the belt tension is correct.

29 Refit the timing cover and secure with the two bolts and nuts. Ensure that the earth tag and the coolant hose clip are fitted under the relevant nuts (see illustration).

30 Unscrew the crankshaft pulley bolt, then refit the crankshaft pulley and the bolt and washer. Tighten the crankshaft pulley bolt to the specified torque, preventing the crankshaft from turning as described in paragraph 2.

31 If the engine is in the vehicle, reverse the operations described in paragraph 1.

1.6 and 1.8 litre (R6A type)

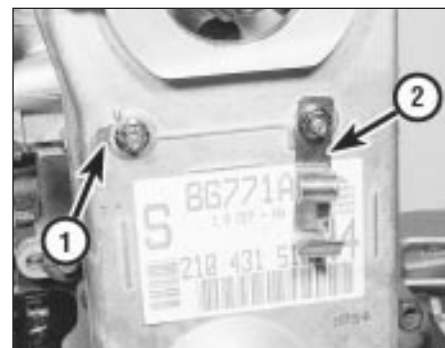
32 If the engine is in the vehicle, carry out the following operations.

- a) Disconnect the battery negative lead.
- b) Remove the alternator drivebelt.
- c) Disconnect the HT leads from the spark plugs, noting their locations; detach the HT lead bracket from the camshaft cover, and position the leads out of the way.
- d) Move the coolant hoses from the front of the timing cover, and position them across the top of the camshaft cover out of the way.
- e) If desired for improved access, remove the fan shroud and the cooling fan assembly, although this is not essential.

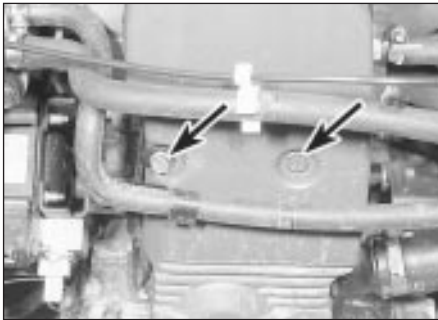
33 Proceed as described in paragraphs 2 to 30 inclusive, noting the following differences for the 1.6 litre engine (see illustrations).

- a) There is no sensor toothed disc on the crankshaft pulley.
- b) A two-piece timing cover is fitted, consisting of upper and lower sections, each secured by two bolts. No earth tag or coolant hose clip is fitted to the bolts.
- c) The TDC datum on the oil pump takes the form of a lug instead of a notch.
- d) There is no distributor rotor shaft fitted to the camshaft sprocket bolt.
- e) There is no timing belt backplate.

34 On completion, if the engine is in the vehicle, reverse the operations given in paragraph 32.



18.29 Earth tag (1) and coolant hose clip (2) locations on timing cover - 1.8 litre (R2A)



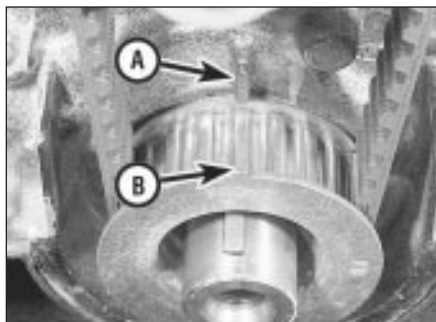
18.33a Upper timing cover securing bolts (arrowed) - 1.6/1.8 litre (R6A)



18.33b Removing the upper timing cover - 1.6/1.8 litre (R6A)



18.33c Removing the lower timing cover - 1.6/1.8 litre (R6A)



18.33d Oil pump TDC lug (A) and crankshaft sprocket lug (B) - 1.6/1.8 litre (R6A)

19 Cylinder head - removal and refitting (engine in vehicle)



Note: Refer to the note at the beginning of Section 20 before proceeding.

1.8 litre (R2A type)

Removal

- 1 Disconnect the battery negative lead.
- 2 Drain the cooling system.
- 3 Disconnect the heater coolant hose from the coolant pump elbow, and the coolant bypass hose from the left-hand side of the cylinder head, then unclip the hoses from the timing cover and move them to one side out of the way (see illustrations).
- 4 Remove the air cleaner.

5 Disconnect the HT leads from the spark plugs and coil, identifying them for position if necessary, unclip the leads from the camshaft cover, then remove the distributor cap, rotor arm and housing. Remove the spark plugs.

6 Disconnect the cylinder head earth lead from the battery tray.

7 The cylinder head can be removed either with or without the manifolds. If desired, the inlet manifold can be unbolted and moved to one side, leaving the wires, hoses, pipes and cables connected, but care must be taken not to strain any of the wires, hoses, pipes or cables.

8 Unscrew the three securing nuts and disconnect the exhaust downpipe from the manifold flange. Recover the gasket.

9 If desired, remove the exhaust manifold.

10 If the inlet manifold is to be removed with the cylinder head, disconnect all relevant

wires, hoses, pipes and cables, otherwise unbolt the manifold and move it to one side, ensuring that it is adequately supported (see illustration).

11 If desired, remove the fuel pump and operating pushrod.

12 Proceed as described in Section 20 to complete cylinder head removal.

Refitting

13 With the cylinder head refitted as described in Section 20, proceed as follows.

14 Where applicable, refit the fuel pump and operating pushrod.

15 Refit the manifolds and/or reconnect all wires, hoses, pipes and cables, as applicable.

16 Reconnect the exhaust downpipe to the manifold, using a new gasket.

17 Reconnect the earth lead to the battery tray.

18 Refit the spark plugs, then refit the distributor cap, rotor arm and housing, and reconnect the HT leads.

19 Refit the air cleaner.

20 Reconnect the coolant hoses to the coolant pump elbow and the cylinder head, and locate them in the clip on the timing cover.

21 Fill the cooling system.

22 Reconnect the battery negative lead.

1.6 and 1.8 litre (R6A type)

Removal

23 Disconnect the battery negative lead.

24 Drain the cooling system.

25 Disconnect the coolant hoses from the thermostat housing, and the bypass hose from the left-hand side of the cylinder head, then move them to one side out of the way.

26 Remove the air cleaner.

27 Disconnect the HT leads from the spark plugs, identifying them for position if necessary. Unclip them from the camshaft cover, and move them to one side out of the way.

28 Remove the spark plugs.

29 Disconnect the cylinder head earth lead from the battery tray.

30 The cylinder head can be removed either with or without the manifolds. If desired, the inlet manifold can be unbolted and moved to one side (after unbolting the dipstick tube),



19.3a Disconnecting the heater coolant hose from the coolant pump elbow - 1.8 litre (R2A)



19.3b Coolant bypass hose connection at cylinder head - 1.8 litre (R2A)



19.10 Withdraw the inlet manifold - 1.8 litre (R2A)



19.31 Disconnecting the exhaust gas oxygen sensor wiring connector - 1.6/1.8 litre (R6A)

leaving the wires, hoses, pipes and cables connected. However, care must be taken not to strain any of the wires, hoses or cables.

31 Disconnect the exhaust gas oxygen sensor wiring connector (see illustration) then unscrew the three securing bolts and disconnect the exhaust downpipe from the manifold flange. Recover the gasket.

32 If desired, remove the exhaust manifold.

33 If the inlet manifold is to be removed with the cylinder head, disconnect all relevant wires, hoses, pipes and cables, otherwise unbolt the manifold and move it to one side, ensuring that it is adequately supported.

34 Note the information given in paragraphs 18 to 21 inclusive of Section 20.

Refitting

35 With the cylinder head refitted, proceed as follows.

36 Refit the manifolds and/or reconnect all wires, hoses, pipes and cables as applicable.

37 Reconnect the exhaust downpipe to the manifold using a new gasket, and reconnect the exhaust gas oxygen sensor wiring connector.

38 Reconnect the earth lead to the battery tray.

39 Refit the spark plugs and reconnect the HT leads.

40 Refit the air cleaner.

41 Reconnect the coolant hoses to the thermostat housing and cylinder head.

42 Fill the cooling system.

43 Reconnect the battery negative lead.



20.4 Remove the camshaft cover and gasket - 1.8 litre (R2A)

20 Cylinder head - removal and refitting (engine removed)

Note: *The cylinder head bolts must always be renewed after slackening, and a new cylinder head gasket and camshaft cover gasket must be used on refitting. If the engine has recently run, the cylinder head must be allowed to cool to room temperature before it is removed.*

1.8 litre (R2A type)

Removal

1 With the manifolds removed, proceed as follows.

2 Remove the timing belt, camshaft sprocket, and timing belt backplate.

3 Disconnect the crankcase ventilation hose from the camshaft cover.

4 Unscrew the nine securing bolts and remove the camshaft cover and gasket (see illustration).

5 Unscrew the ten cylinder head bolts half a turn at a time in the reverse order to that shown for tightening.

6 With the bolts removed, lift the cylinder head from the block (see illustration). If the cylinder head is stuck, tap it free with a wooden mallet. Do not insert a lever into the joint between the cylinder head and block as this may result in damage to the mating faces. Place the cylinder head on blocks of wood to prevent damage to the valves.



20.6 Withdraw the cylinder head bolts and lift the cylinder head from the block - 1.8 litre (R2A)

7 Recover the gasket, and the locating dowels if they are loose (see illustration).

Refitting

8 Commence refitting as follows.

9 Turn the crankshaft so that No 1 piston is approximately 20.0 mm (0.8 in) before TDC. This precaution will prevent any damage to open valves.

10 Make sure that the mating faces of the cylinder block and cylinder head are perfectly clean, then refit the locating dowels to the block where applicable, and locate a new gasket over the dowels with the red sealing bead and the "1.8" mark uppermost (see illustrations). Do not use jointing compound.

11 Turn the camshaft so that the TDC pointer on the camshaft sprocket is aligned with the dot on the cylinder head front face.

12 Lower the cylinder head onto the gasket, making sure that the locating dowels engage.

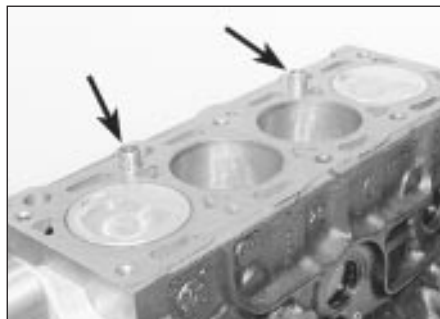
13 Insert the new cylinder head bolts into their locations in the cylinder head, then tighten the bolts in the order shown to the five stages given in the Specifications (see illustrations).

14 Fit a new camshaft cover gasket to the cylinder head, ensuring that the gasket locates correctly over the edges of the cylinder head (see illustration).

15 Refit the camshaft cover and tighten the bolts evenly, ensuring that the studded bolts which retain the HT lead clips are refitted to their correct positions (see illustration).



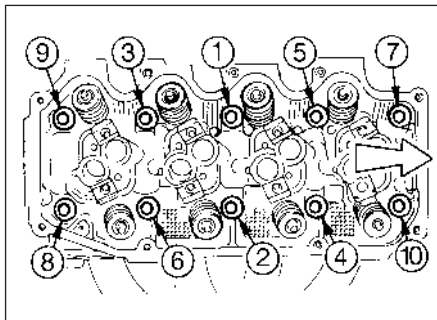
20.7 Recover the cylinder head gasket - 1.8 litre (R2A)



20.10a Fit the locating dowels (arrowed) to the block . . .



20.10b . . . then locate a new gasket with the red sealing bead and "1.8" mark uppermost - 1.8 litre (R2A)



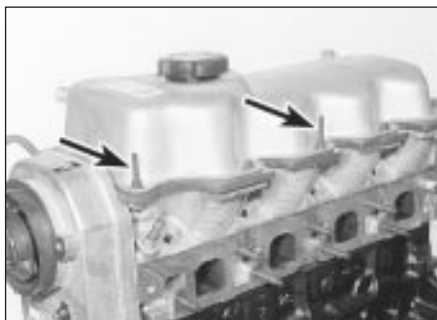
20.13a Cylinder head bolt tightening sequence - 1.8 litre (R2A)



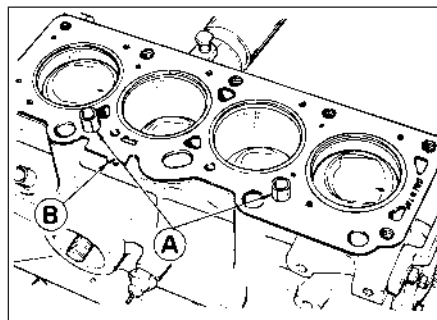
20.13b Tighten the cylinder head bolts using an angle gauge - 1.8 litre (R2A)



20.14 Ensure that the camshaft cover gasket locates over the edges of the cylinder head - 1.8 litre (R2A)

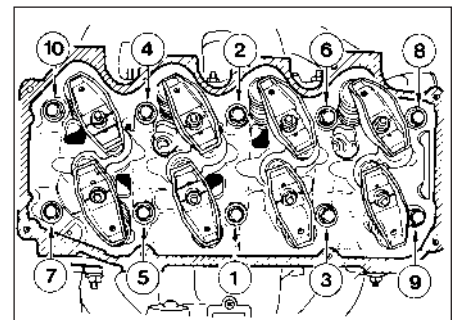


20.15 Fit the camshaft cover, ensuring that the studded bolts (arrowed) are correctly located - 1.8 litre (R2A)



20.20a Cylinder head gasket correctly located - 1.6 litre

A Locating dowels B Identification teeth



20.20b Cylinder head bolt tightening sequence - 1.6 litre

16 Reconnect the crankcase ventilation hose to the camshaft cover.

17 Refit the timing belt backplate, camshaft sprocket and timing belt.

1.6 and 1.8 litre (R6A type)

18 With the manifolds removed, proceed as follows.

19 Remove the timing belt.

20 Proceed as shown in paragraphs 3 to 16 inclusive, noting the following differences for the 1.6 litre engine only:

- a) Unscrew the cylinder head bolts in the reverse order to that shown for tightening.
- b) The cylinder head gasket is identified by a single tooth on its edge, and the gasket must be fitted with the tooth nearest the

oil filter end of the engine, as shown (see illustration).

c) Tighten the cylinder head bolts in the order shown (see illustration), to the four stages given in the Specifications at the beginning of this Chapter.

d) Ignore the reference to the studded camshaft cover bolts.

21 On completion, refit the timing belt.

21 Cylinder head - dismantling and reassembly

Note: A valve spring compressor will be required during this procedure. New valve stem oil seals should be used on reassembly.

1.8 litre (R2A type)

Dismantling

1 With the cylinder head removed, remove the camshaft.

2 Using a valve spring compressor, compress one of the valve springs until the split collets can be removed from the grooves in the valve stem. Release the compressor and remove the cap and spring, identifying them for location. If the cap is difficult to release, do not continue to tighten the compressor, but gently tap the top of the tool with a hammer. Always make sure that the compressor is firmly located on the valve head and the cap (see illustrations).

3 Prise the oil seal from the valve stem, and remove the spring seat, then withdraw the valve (see illustrations).



21.2a Compress the valve spring . . .



21.2b . . . to free the split collets . . .



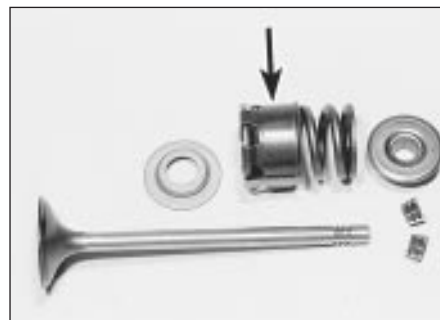
21.2c . . . then remove the cap and spring - 1.8 litre (R2A)



21.3a Remove the spring seat . . .



21.3b . . . and valve - 1.8 litre (R2A)



21.4 Inlet valve components. Spring damper arrowed - 1.8 litre (R2A)

4 Repeat the procedure given in paragraphs 2 and 3 for the remaining valves, keeping all components identified for location so that they can be refitted in their original positions. Note that the inlet valve springs are fitted with metal dampers. The damper is an integral part of the spring and cannot be removed (see illustration).

Reassembly

5 Commence reassembly by lubricating the valve stems and guides with SAE 80/90 hypoid oil, then insert the valves into their original guides.

6 Refit the spring seats over the valve stems.
7 Wrap a thin layer of adhesive tape over the collet grooves of each valve, then smear the new oil seals with a little hypoid oil and slide them down the valve stems onto the spring seats. Use a suitable metal tube to seat the seals, then remove the adhesive tape from the valves (see illustration).

8 Working on each valve in turn, fit the valve spring and cap, then compress the spring using the valve spring compressor and fit the split collets to the groove in the valve stem. Release the compressor and tap the end of the valve stem with a soft-faced mallet to settle the components. If the original components are being refitted, ensure that they are refitted in their original locations.

9 Refit the camshaft.

1.6 and 1.8 litre (R6A type)

10 Proceed as described in paragraphs 1 to 9 inclusive, but note that no dampers are fitted to the inlet valve springs on the 1.6 litre engine.



21.7 Seat each new valve seal using a metal tube - 1.8 litre (R2A)



23.9a Hydraulic cam follower oil port (arrowed) - 1.8 litre (R2A)



23.9b Cam follower supply hole (arrowed) in cylinder head - 1.8 litre (R2A)

22 Cylinder head - inspection and renovation

Refer to Section 23, Chapter 2, Part A but pay particular attention to the note at the beginning of the Section as all CVH engines are fitted with hardened valve seats.

23 Camshaft and cam followers - removal, inspection and refitting



Note: A new camshaft oil seal and new rocker arm securing nuts should be used when refitting.

1.8 litre (R2A type)

Removal

- 1 Remove the cylinder head.
- 2 Unscrew the securing bolts and remove the rocker arm guides, rocker arms, and cam follower guide retainers, then lift out the cam follower guides and the cam followers. Keep all components in the correct order so that each component can be refitted in the original position if it is to be re-used. It is advisable to store the cam followers upright in an oil bath until they are to be refitted. Ensure that the depth of oil is sufficient to fully cover the cam followers.
- 3 Prise out the camshaft oil seal, taking care not to damage the surface of the camshaft. If necessary use self-tapping screws and a suitable pair of grips to withdraw the seal.

4 Unscrew the two securing bolts and withdraw the camshaft thrustplate from the front of the cylinder head.

5 Carefully withdraw the camshaft from the front of the cylinder head, taking care not to damage the bearings. If necessary, loosely refit the camshaft sprocket and bolt to aid removal.

Inspection

6 Examine the surfaces of the camshaft journals and lobes, and the cam follower rollers for wear. If wear is excessive, considerable noise would have been noticed from the top of the engine when running, and a new camshaft and followers must be fitted. It is unlikely that this level of wear will occur unless a considerable mileage has been covered. Note that the cam followers cannot be dismantled for renewal of individual components.

7 Check the camshaft bearings in the cylinder head for wear. If excessive wear is evident, it may be possible to have the head machined by a suitably equipped engineering workshop to enable a camshaft with oversize bearing journals to be fitted. The only other course of action available is renewal of the cylinder head.

8 Check the cam follower bores in the cylinder head for wear. If excessive wear is evident, the cylinder head must be renewed.

9 Check the cam follower oil ports and the oil holes in the cylinder head for obstructions (see illustrations).

Refitting

10 Commence refitting by lubricating the camshaft, bearings and thrustplate with



23.10 Refitting the camshaft - 1.8 litre (R2A)



23.11a Refit the camshaft thrustplate . . .



23.11b . . . and tighten the securing bolts - 1.8 litre (R2A)



23.14 Using a special tool to fit the camshaft oil seal - 1.8 litre (R2A)

hypoid oil, then carefully insert the camshaft from the front of the cylinder head, taking care not to damage the bearings (see illustration).

11 Locate the thrustplate in the camshaft groove, then refit the bolts and tighten them. Note that the stamped number on the thrustplate should face forwards (see illustrations).

12 Using a dial test indicator if available, or feeler blades, check that the camshaft endfloat is within the limits given in the Specifications. If not, renew the thrustplate and re-check. If this does not bring the endfloat within limits, the camshaft must be renewed.

13 Remove the thrustplate bolts, coat the threads with sealing compound, then refit and tighten the bolts.

14 Smear the lip of the new camshaft oil seal with clean engine oil, then fit the seal using the camshaft sprocket bolt and a suitable tool

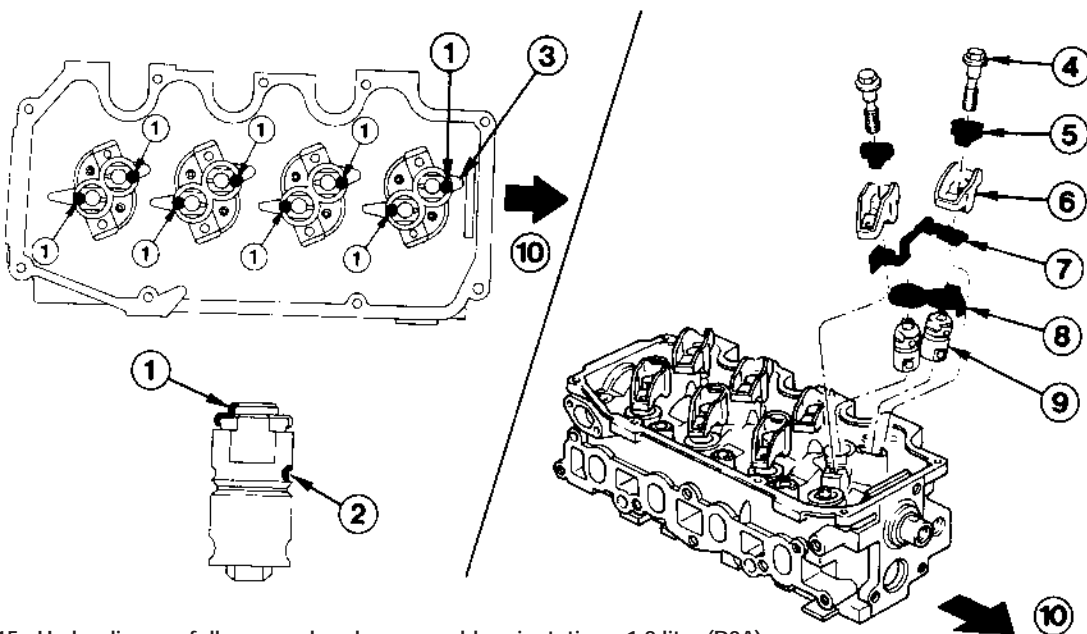
similar to that shown (see illustration). Draw the seal into position so that it rests on the shoulder.



The tool can be improvised using a metal tube of suitable diameter and a large washer or metal disc.

15 Lubricate the cam followers with hypoid oil, refit them to their original locations, with the colour marking pointing to the oil feed hole in the cylinder head. The oil feed port in the cam follower should be opposite the oil feed hole in the cylinder head (see illustrations).

16 Lubricate the tops of the cam followers, then refit the four cam follower guides to their



23.15a Hydraulic cam follower and rocker assembly orientation - 1.8 litre (R2A)

- 1 Cam follower colour markings
- 2 Oil port in cam follower
- 3 Oil supply hole in cylinder head
- 4 Securing bolt

- 5 Rocker arm guide
- 6 Rocker arm
- 7 Cam follower guide retainer - stepped end to inlet side

- 8 Cam follower guide - stepped end to exhaust side
- 9 Cam follower
- 10 Front of engine



23.15b Refit the cam followers . . .



23.16 . . . guides . . .



23.17 . . . and retainers - 1.8 litre (R2A)

original locations with their "stepped" ends pointing towards the exhaust side of the cylinder head (see illustration).

17 Refit the four cam follower guide retainers to their original locations with their "stepped" ends pointing towards the inlet side of the cylinder head (see illustration).

18 Temporarily refit the camshaft sprocket, and turn the camshaft so that the TDC pointer on the sprocket is aligned with the dot on the cylinder head front face (ie the pointer is at the 12 o'clock position).

19 Refit rocker arms Nos 1, 2, 4 and 5 together with their rocker arm guides and securing bolts, to their original locations (see illustration). Lubricate the contact faces of the rocker arms and guides and the valve stems with hypoid oil, and ensure that the guides seat correctly in their locations in the cylinder head (see illustration). Tighten the securing bolts to the specified torque.

20 Turn the camshaft through 180° so that the camshaft sprocket keyway is aligned with the dot on the cylinder head front face (ie the TDC pointer on the sprocket is at the 6 o'clock position) (see illustration).

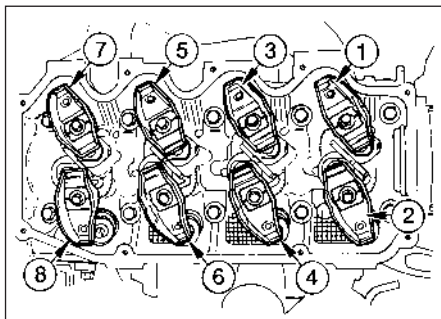
21 Repeat the procedure given in paragraph 19 for rocker arms Nos 3, 6, 7 and 8.

22 Remove the camshaft sprocket and refit the cylinder head.

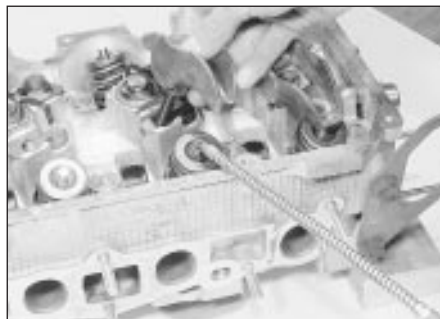
1.6 and 1.8 litre (R6A type)

Removal

23 Remove the cylinder head.



23.19a Rocker arm numbering sequence - 1.8 litre (R2A)



23.19b Lubricate the valve stem contact faces and refit the rocker arms and guides - 1.8 litre (R2A)

thrustplate must face the front of the engine.

31 Using a dial test indicator (if available) or feeler blades, check that the camshaft endfloat is within the limits given in the Specifications. If not, renew the thrustplate and re-check. If this does not bring the endfloat within limits, the camshaft must be renewed.

32 Smear the lip of the new camshaft oil seal with clean engine oil, then refit the seal using the camshaft sprocket bolt and a suitable tool. The tool can be improvised using a metal tube of suitable diameter and a large washer or metal disc. Draw the seal into position so that it rests on the shoulder.

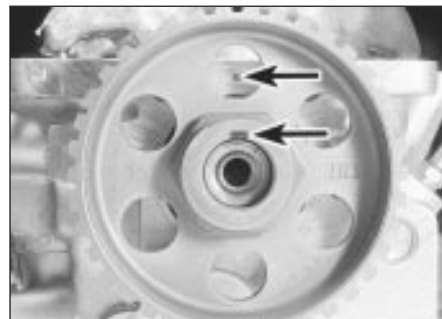
33 Lubricate the cam followers with hypoid oil, then refit them to their original locations in the cylinder head.

34 Before each rocker arm is fitted and its (new) nut tightened, it is essential to ensure that the relevant cam follower is positioned at its lowest point (in contact with the cam base circle, not the tip of the cam lobe). Turn the camshaft (by means of the camshaft sprocket bolt if necessary) as necessary to achieve this.

35 Lubricate the tops of the cam followers, then refit the spacer plates, rocker arms and rocker arm guides to their original locations.

36 Secure the rocker arms using new nuts tightened to the specified torque, bearing in mind the point made in paragraph 34.

37 Refit the cylinder head.



23.20 Camshaft sprocket keyway aligned with dot on cylinder head - 1.8 litre (R2A)

24 Flywheel/driveplate - removal, inspection and refitting

Note: New flywheel securing bolts must be used on refitting.

1.8 litre (R2A type)

1 Refer to Section 26, Chapter 2, Part A but also note the following points.

2 The flywheel/driveplate securing bolts must be renewed when refitting, and the new bolts are supplied ready-coated with threadlocking compound (see illustration).

3 The ring gear cannot be renewed independently of the flywheel/driveplate. If the ring gear is badly worn or has missing teeth, a new flywheel/driveplate must be fitted.

1.6 and 1.8 litre (R6A type)

4 Refer to Section 26, Chapter 2, Part A, noting the following points.

5 If the engine is in the vehicle, refer to Chapter 6 when removing the clutch.

6 The flywheel securing bolts must be renewed when refitting, and the new bolts are supplied ready-coated with thread-locking compound.

7 The ring gear cannot be renewed independently of the flywheel. If the ring gear is badly worn or has missing teeth, a new flywheel must be fitted. Similarly, the flywheel must be renewed if the crankshaft speed/position sensor toothed disc is damaged.

25 Crankshaft front oil seal - renewal

1.8 litre (R2A type)

1 Remove the timing belt and the crankshaft sprocket and thrustwasher.

2 Withdraw the oil seal using an oil seal removal tool or by drilling the oil seal outer face and using self-tapping screws and a pair of grips.

3 Clean the oil seal housing, then smear the lip of a new oil seal with clean engine oil.

4 Fit the oil seal using the crankshaft pulley bolt and a suitable tool similar to that shown (see illustration).



25.5 Crankshaft front oil seal (arrowed) located in oil pump housing - 1.8 litre (R2A)



24.2 Using an improvised tool to hold the flywheel stationary while tightening the securing bolts - 1.8 litre (R2A)

HAYNES HINT A tool can be improvised to fit the crankshaft front oil seal by using a metal tube of suitable diameter and a large washer or metal disc. Do not attempt to drive the seal home using a tube drift.

5 As the seal is drawn into position, the inner edge of the seal may be damaged as it passes over the end of the shaft. To prevent this, as soon as the seal begins to locate in the housing remove the tools being used to fit the seal, and carefully work the inner edge of the seal over the end of the crankshaft, using a small screwdriver or similar blunt tool. The seal can then be pushed home using the tools described previously (see illustration).

6 Refit the thrustwasher, crankshaft sprocket and timing belt.

1.6 and 1.8 litre (R6A type)

7 Remove the timing belt, and the crankshaft sprocket and thrustwasher.

8 Proceed as described in paragraphs 2 to 4 inclusive.

9 Refit the thrustwasher, crankshaft sprocket and timing belt.

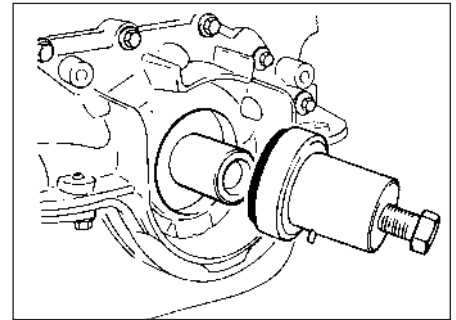
26 Crankshaft rear oil seal - renewal

1 Remove the flywheel/driveplate.

2 Prise out the oil seal. If necessary, drill the outer face of the oil seal and use self-tapping



26.2 Crankshaft rear oil seal location (arrowed)



25.4 Using a special tool to fit the crankshaft front oil seal - 1.8 litre (R2A)

screws and a pair of grips to withdraw the seal (see illustration).

3 Clean the oil seal housing, then fit the new oil seal using two flywheel/driveplate securing bolts and a tool similar to that shown (see illustration). A suitable tool can be improvised using a narrow strip of metal sheet bent to form a circle of the correct diameter, and a large metal disc with appropriate holes drilled to allow the flywheel/driveplate securing bolts to pass through. Make sure that the seal lip faces into the engine and lightly smear the lip with clean engine oil.

4 Refit the flywheel/driveplate.

27 Sump - removal and refitting

Note: A new gasket and new sump bolts must be used when refitting, and suitable sealant will be required (available from a Ford dealer). Note that it is preferable to keep the engine upright until the sump has been removed to prevent sludge from entering the engine internals.

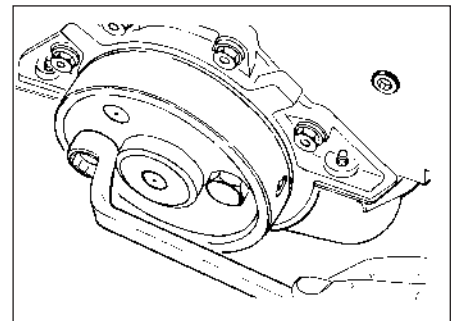
1.8 litre (R2A type)

Removal

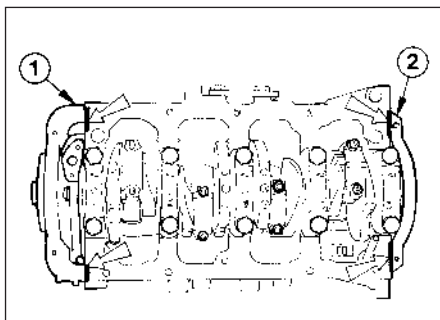
1 With the engine removed, proceed as follows.

2 Remove the flywheel/driveplate and the engine adapter plate.

3 Unscrew the fourteen securing bolts and withdraw the two reinforcing strips and the sump. If the sump is stuck, carefully tap it sideways to free it. Do not prise between the mating faces.



26.3 Using a special tool to fit the crankshaft rear oil seal - 1.8 litre (R2A)



27.6 Apply sealing compound to the areas shown before fitting the sump gasket - 1.8 litre (R2A)

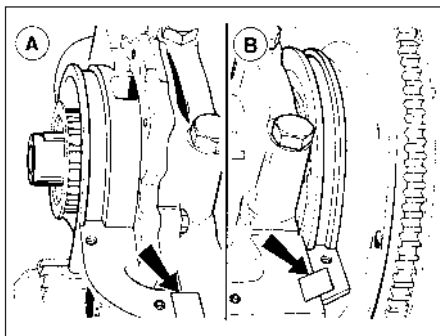
- 4 Recover the gasket.
- 5 Thoroughly clean the mating faces of the cylinder block and sump.

Refitting

- 6 Commence refitting by applying sealing compound (available from a Ford dealer) to the cylinder block, oil pump housing and crankshaft rear oil seal housing mating faces at the points shown (see illustration). Note that the sump must be fitted within ten minutes of applying the sealing compound.
- 7 Fit a new gasket, ensuring that it engages correctly in the grooves in the crankshaft rear oil seal carrier and the oil pump housing (see illustration).
- 8 Locate the sump on the gasket and loosely fit the securing bolts.
- 9 Tighten all the bolts slightly to obtain a light and even gasket preload.
- 10 Tighten the bolts to the specified torque in the sequence shown (see illustration). Note that the ten M8 bolts and the four M6 bolts are tightened to different torques.
- 11 Refit the engine adapter plate and the flywheel/driveplate.

1.6 and 1.8 litre (R6A type)

Note: The following procedure applies to the 1.6 litre CVH engine. For the 1.8 litre (R6A



27.18 Apply sealing compound at the points arrowed before refitting the sump - 1.6 litre

- A Oil pump/cylinder block joint
- B Crankshaft rear oil seal housing/cylinder block joint



27.7 Ensure that the gasket locates correctly on the oil pump housing - 1.8 litre (R2A)

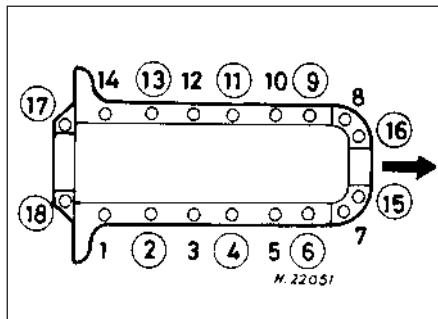
type) engine, proceed as described above for the 1.8 litre (R2A type).

Removal

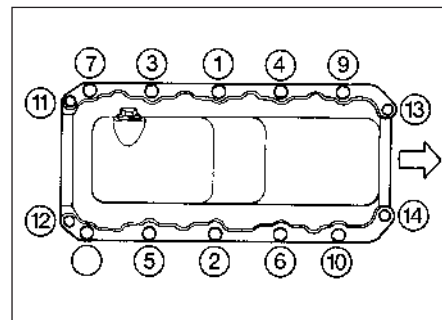
- 12 Sump removal and refitting is easier if the engine is removed from the vehicle. However, if the engine is in the vehicle, proceed as follows. If the engine has been removed from the vehicle, proceed to paragraph 15.
- 13 Remove the clutch.
- 14 Drain the engine oil into a suitable container.
- 15 Remove the flywheel and the engine adapter plate.
- 16 Unscrew the eighteen securing bolts and withdraw the sump. If the sump is stuck, carefully tap it sideways to free it. Do not prise between the mating faces. Recover the gasket.
- 17 Thoroughly clean the mating faces of the cylinder block and sump.

Refitting

- 18 Apply sealing compound to the joints between the oil pump and the cylinder block, and the crankshaft rear oil seal housing and the cylinder block, as shown (see illustration).
- 19 Without applying any further sealer, locate the gasket into the grooves of the oil pump and the rear oil seal housing. To hold the gasket in position, studs can be inserted temporarily in the bolt hole positions circled in the illustration indicating the bolt tightening sequence. Make sure that the gasket spacing pins are seated correctly.



27.21 Sump bolt tightening sequence - 1.6 litre
Arrow indicates front of engine



27.10 Sump bolt tightening sequence - 1.8 litre (R2A)

- 20 Locate the sump on the gasket, taking care not to displace the gasket, then loosely fit the securing bolts. With the sump in position, where applicable remove the studs from the bolt holes, and loosely fit the remaining securing bolts.

- 21 Tighten the bolts to the torque given in the Specifications at the beginning of this Chapter, in two stages, and in the sequence shown (see illustration).

- 22 Refit the engine adapter plate and the flywheel.

- 23 If the engine is in the vehicle, refit the clutch. Refill the engine with oil.

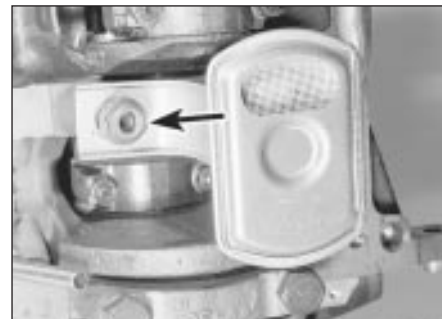
28 Oil pump - removal and refitting



Note: New oil pump and oil pick-up tube gaskets should be used when refitting.

Removal

- 1 With the engine removed, proceed as follows.
- 2 Remove the timing belt, crankshaft sprocket and thrustwasher.
- 3 Remove the sump.
- 4 Unscrew and remove the nut securing the oil strainer/pick-up tube to No 4 main bearing cap (see illustration).
- 5 Using a suitable Allen key, unscrew the two bolts securing the oil pick-up tube to the oil pump, and withdraw the oil strainer/pick-up tube. Recover the washers and gasket (see illustration).



28.4 Oil strainer/pick-up tube securing nut (arrowed) on No 4 main bearing cap



28.5 Removing the oil pick-up tube from the oil pump

6 Unscrew and remove the six securing bolts, and withdraw the oil pump over the front of the crankshaft. Recover the gasket.

Refitting

7 Commence refitting by prising the crankshaft front oil seal from the pump housing.

8 Prime the pump by injecting clean engine oil into it and turning it by hand.

9 Using a new gasket, fit the oil pump over the front of the crankshaft, ensuring that the central rotor engages with the flats on the crankshaft (see illustration). Fit the securing bolts, and using a straight-edge, ensure that the bottom face of the oil pump is aligned with the bottom face of the cylinder block before finally tightening the bolts.

10 Using a new gasket, fit the oil pick-up tube to the oil pump and secure with the two bolts.



29.2 Remove the oil pump cover



29.3 Lifting out the oil pump inner rotor



28.9 Refitting the oil pump

11 Refit the oil strainer/pick-up tube securing nut to No 4 main bearing cap.

12 Refit the sump.

13 Fit the crankshaft front oil seal using a suitable tool.

14 Refit the thrustwasher, crankshaft sprocket and timing belt.

29 Oil pump - dismantling, inspection and reassembly

1.8 litre (R2A type)

1 If oil pump wear is suspected, check the cost and availability of new parts and the cost of a new pump. Examine the pump as described in this Section and then decide whether renewal or repair is the best course of action.

2 Using a suitable Torx socket, unscrew the seven securing bolts and remove the oil pump cover (see illustration).

3 Mark the rotor faces so that the rotors can be refitted in their original positions, then lift the rotors from the pump housing (see illustration).

4 Unscrew the pressure relief valve plug and withdraw the spring and plunger (see illustration).

5 Thoroughly clean all parts in petrol or paraffin and wipe dry using a non-fluffy rag.

6 Commence reassembly by lubricating the relief valve plunger. Fit the plunger and spring, and screw the plug into place.

7 Lubricate the rotors and fit them, observing



29.4 Unscrew the pressure relief valve plug and withdraw the spring and plunger

the marks made when dismantling, if applicable.

8 The necessary clearances may now be checked using a machined straight-edge (such as a good steel rule) and a set of feeler blades. The critical clearances are between the lobes of the centre rotor and convex faces of the outer rotor; between the outer rotor and pump body; and between both rotors and the cover plate (endfloat). The serviceable clearances are given in the Specifications.

9 Endfloat can be measured by placing a straight-edge across the pump body and measuring the clearance between the two rotors and the straight-edge using feeler blades.

10 Refit the pump cover and tighten the securing bolts.

11 Prime the pump before refitting.

1.6 and 1.8 litre (R6A type)

12 The procedure is as described above but refer to the Specifications at the beginning of this Chapter for the rotor clearances.

30 Pistons and connecting rods - removal and refitting

1.8 litre (R2A type)

Removal

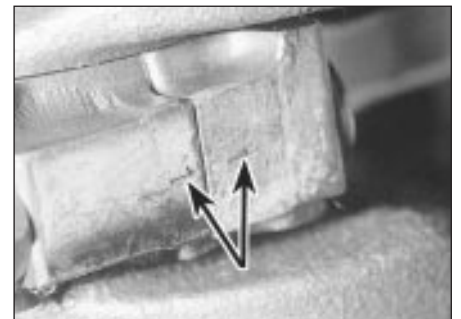
1 With the engine removed from the vehicle, remove the sump and the cylinder head.

2 Check the big-end caps for identification marks and if necessary use a centre-punch to identify the caps and connecting rods (see illustration).

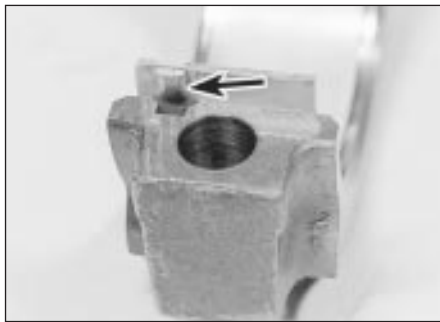
3 Turn the crankshaft so that No 1 crankpin is at its lowest point, then unscrew the nuts or bolts and tap off the cap. Keep the bearing shells in the cap and connecting rod.

4 Using the handle of a hammer, push the piston and connecting rod up the bore and withdraw from the top of the cylinder block. Loosely refit the cap to the connecting rod.

5 Repeat the procedure in paragraphs 3 and 4 on No 4 piston and connecting rod, then turn the crankshaft through half a turn and repeat the procedure on Nos 2 and 3 pistons and connecting rods.



30.2 Big-end cap and connecting rod identification marks (arrowed) - 1.8 litre (R2A)



30.8 Bearing shell lug (arrowed) must engage with groove in big-end cap - 1.8 litre (R2A)



30.10a Cut-out (arrowed) in piston crown . . .



30.10b . . . and lug (arrowed) on piston skirt must face the front of the engine

Refitting

6 Commence refitting as follows.

7 Clean the backs of the bearing shells and the recesses in the connecting rods and big-end caps.

8 Press the bearing shells into the connecting rods and caps in their correct positions and oil them liberally. Note that the lugs must be adjacent to each other (see illustration).

9 Lubricate the cylinder bores with engine oil.

10 Fit a ring compressor to No 1 piston then insert the piston and connecting rod into No 1 cylinder. With No 1 crankpin at its lowest point, drive the piston carefully into the cylinder with the wooden handle of a hammer, and at the same time guide the connecting rod onto the crankpin. The piston must be fitted with the cut-out in the piston crown (and the lug on the piston skirt), facing the front of the engine, with the oil hole in the connecting rod on the inlet manifold side of the engine (see illustrations).

11 Oil the crankpin, then fit the big-end bearing cap in its previously noted position, and tighten the nuts or bolts to the specified torque.

12 Check that the crankshaft turns freely.

13 Repeat the procedure given in paragraphs 11 to 12 inclusive on the remaining pistons.

14 Refit the cylinder head and the sump.



30.10c Connecting rod oil hole (arrowed) must face inlet manifold side of engine - 1.8 litre (R2A)



30.10d Fitting a piston and connecting rod into the cylinder bore - 1.8 litre (R2A)

1.6 and 1.8 litre (R6A type)

15 The procedure is as described above, noting the following points:

- a) On the 1.6 litre engine, when refitting a piston/connecting rod assembly, the piston must be fitted with the arrow on the piston crown and the cast pip on the piston skirt facing the front (timing belt end) of the engine (see illustration).
- b) On the 1.6 litre engine, the big-end bearing caps locate on dowels in the connecting rods, and can only be fitted in one position.

the pistons (see illustration). Note that the oil control ring is in three sections.

HAYNES HINT *The use of two or three old feeler blades will be helpful in preventing the rings dropping into empty grooves.*

4 Before fitting the piston rings, clean out the piston ring grooves using a piece of old piston ring as a scraper. Be careful not to scratch the aluminium surface of the pistons. Protect your fingers - piston ring edges are sharp. Also probe the groove oil return holes.

5 Fit the oil control ring sections with the spreader ends abutted opposite the front of the piston. The side ring gaps should be 25 mm (1.0 in) either side of the spreader gap. Fit

31 Pistons and connecting rods - examination and renovation



1.8 litre (R2A type)

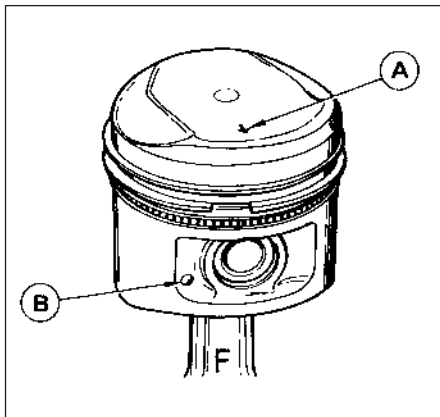
1 Examine the pistons for ovality, scoring, and scratches. Check the connecting rods for wear or damage.

2 The gudgeon pins are an interference fit in the connecting rods, and if new pistons are to be fitted to the existing connecting rods the work should be carried out by a Ford dealer who will have the necessary tooling. Note that the oil hole in the connecting rod must be located on the right-hand side of the piston (the cut-out in the piston crown and the lug on the piston skirt face forwards).

3 If new rings are to be fitted to the existing pistons, expand the old rings over the top of



31.3 Using an old feeler gauge to aid the fitting of a piston ring - 1.8 litre (R2A)



30.15 The arrow (A) and the cast pip (B) must face the front of the engine - 1.6 litre



32.6 Checking crankshaft endfloat - 1.8 litre (R2A)

the tapered lower compression ring with the "TOP" mark towards the top of the piston and the gap 150° from the spreader gap, then fit the upper compression ring with the gap 150° on the other side of the spreader gap. Note that the compression rings are coated with a molybdenum skin which must not be damaged.

1.6 and 1.8 litre (R6A type)

6 Proceed as described in paragraphs 1 to 5 inclusive, but note the following differences for the 1.6 litre engine.

7 Before fitting the new rings to the pistons, insert them into the relevant cylinder bore and use a feeler blade to check that the end gaps are within the limits given in the Specifications at the beginning of this Chapter. Check the end gaps with the ring at the top and the bottom of the cylinder bore.



32.13a Rear main bearing shell in cylinder block - 1.8 litre (R2A)

8 Fit the oil control ring sections with the spreader ends abutted opposite the front of the piston, making sure that the ends do not overlap. The side ring gaps should be offset 120° either side of the spreader gap. Fit the tapered lower compression ring with the "TOP" mark uppermost and the gap 120° from the spreader gap, then fit the upper compression ring with the gap 120° on the other side of the spreader gap. Note that the compression rings are coated with a molybdenum disulphide skin, which must not be damaged.

32 Crankshaft and main bearings - removal and refitting

1.8 litre (R2A type)

Removal

1 With the engine removed from the vehicle, remove the timing belt, crankshaft sprocket and thrustwasher.

2 Remove the pistons and connecting rods. If no work is to be done on the pistons and connecting rods, there is no need to push the pistons out of the cylinder bores.

3 Remove the oil pump and pick-up tube.

4 Unscrew the four securing bolts and remove the crankshaft rear oil seal housing.

5 Check the main bearing caps for identification marks and if necessary use a centre-punch to identify them.

6 Before removing the crankshaft, check that the endfloat is within the specified limits by



32.13b Centre main thrust bearing shell in cylinder block - 1.8 litre (R2A)

inserting a feeler blade between the centre crankshaft web and the thrust bearing shell (see illustration). This will indicate whether a new thrust bearing shell is required.

7 Unscrew the bolts and tap off the main bearing caps complete with bearing shells.

8 Lift the crankshaft from the crankcase.

9 Extract the bearing shells, keeping them identified for location.

Refitting

10 Commence refitting as follows.

11 Wipe the bearing shell locations in the crankcase with a soft, non-fluffy rag.

12 Wipe the crankshaft journals with a soft, non-fluffy rag.

13 If the old main bearing shells are to be renewed (not to do so is a false economy, unless they are virtually new) fit the five upper halves of the main bearing shells to their location in the crankcase. Note the flanged thrust bearing shell should be fitted to the centre bearing location (see illustrations).

14 Identify each main bearing cap and place in order. The number is cast on to the cap and an arrow is also marked which should point towards the front of the engine.

15 Wipe the cap bearing shell location with a soft non-fluffy rag.

16 Fit the bearing half shell onto each main bearing cap.

17 Lubricate the crankshaft journals and the upper and lower main bearing shells with clean engine oil.

18 Carefully lower the crankshaft into the crankcase (see illustration).

19 Lubricate the crankshaft main bearing journals again, then fit No 1 bearing cap. Fit the two securing bolts but do not tighten yet.

20 Fit the rear bearing cap, then the centre bearing cap, but as before do not tighten the bolts yet.

21 Fit the intermediate bearing caps and securing bolts, noting that the studded bolt which retains the oil strainer/pick-up tube fits on the inlet manifold side of No 4 bearing cap. Again, do not tighten the bolts yet.

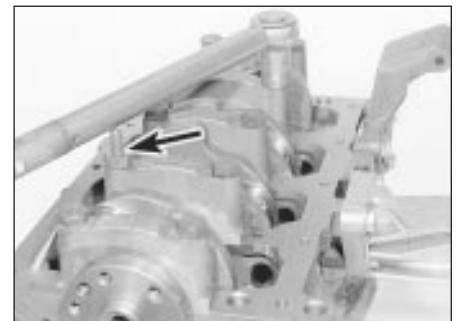
22 Check that the arrows on the bearing caps all point towards the front of the engine, and lightly tighten all the bearing cap bolts, then finally tighten the bolts in a progressive manner to the specified torque (see illustrations).



32.18 Lowering the crankshaft into the crankcase - 1.8 litre (R2A)



32.22a The arrows on the bearing caps must point towards the front of the engine - 1.8 litre (R2A)



32.22b Tightening a main bearing cap bolt. Note studded bolt location (arrowed) on No 4 bearing cap - 1.8 litre (R2A)



32.25 Fit the crankshaft rear oil seal housing and tighten the securing bolts - 1.8 litre (R2A)

23 Check that the crankshaft rotates freely. Some stiffness is to be expected with new components, but there must be no tight spots or binding.

24 Check that the crankshaft endfloat is within the specified limits by inserting a feeler blade between the centre crankshaft web and the thrust bearing cap.

25 Lubricate the oil seal lip with clean engine oil, then carefully fit the crankshaft rear oil seal housing. Using a straight-edge, ensure that the bottom face of the oil seal housing is aligned with the bottom face of the cylinder block before finally tightening the securing bolts (see illustration).

26 Carefully prise the crankshaft front oil seal from the oil pump housing, then refit the oil pump, oil strainer/pick-up tube and crankshaft front oil seal.

27 Refit the pistons and connecting rods.

28 Refit the thrustwasher, crankshaft sprocket and timing belt.

1.6 and 1.8 litre (R6A type)

29 Proceed as described above, noting the following point:

On the 1.6 litre engine, note that thrustwashers are used at the centre main bearing (one each side of the bearing) instead of a thrust bearing shell to control crankshaft endfloat. Oversize thrustwashers are available to compensate for wear if necessary. The thrustwashers should be fitted with the oil grooves visible



34.1 Removing the crankcase ventilation baffle

33 Crankshaft and bearings - examination and renovation



1.8 litre (R2A type)

1 Examine the bearing surfaces of the crankshaft for scratches or scoring and, using a micrometer, check each journal and crankpin for ovality. Where this is found to be in excess of 0.0254 mm (0.001 in) the crankshaft will have to be reground and undersize bearings fitted.

2 Crankshaft regrinding should be carried out by a suitable engineering works, who will normally supply the matching undersize main and big-end shell bearings.

3 Note that undersize bearings may already have been fitted either in production or by a previous repairer. Check the markings on the backs of the old bearing shells, and if in doubt take them along when buying new ones.

4 If the crankshaft endfloat is more than the maximum specified amount, a new thrust bearing shell should be fitted to the centre main bearing.

5 An accurate method of determining bearing wear is by the use of Plastigage. The crankshaft is located in the main bearings (and big-end bearings if necessary) and the Plastigage filament located across the journal which must be dry. The cap is then fitted and the bolts/nuts tightened to the specified torque. On removal of the cap the width of the filament is checked with a plastic gauge and

the running clearance compared with that given in the Specifications.

6 If the spigot bearing in the rear of the crankshaft requires renewal extract it with a suitable puller. Alternatively fill it with heavy grease and use a close fitting metal dowel driven into the centre of the bearing. Drive the new bearing into the crankshaft with a soft metal drift.

1.6 and 1.8 litre (R6A type)

7 Proceed as described above but note that if the crankshaft endfloat is more than the maximum specified amount, new thrustwashers should be fitted to the centre main bearing.

34 Cylinder block and bores - examination and renovation



Refer to Section 36, Chapter 2, Part A but note that the crankcase ventilation baffle should be removed from its location at the rear of the cylinder block and cleaned if necessary (see illustration).

35 Initial start-up after overhaul or major repair

Refer to Section 37, Chapter 2, Part A.