

# Chapter 2 Part A:

## Engine repair procedures - 1.05 and 1.3 litre pre August 1985

### Contents

|   |    |  |    |
|---|----|--|----|
| Camshaft - examination and renovation                 | 27 | Flywheel - examination and renovation                              | 25 |
| Camshaft - refitting                                  | 35 | Flywheel - refitting   | 33 |
| Camshaft - removal                                    | 10 | Flywheel - removal   | 13 |
| Crankshaft and bearings - examination and renovation  | 21 | General information  | 1  |
| Crankshaft and main bearings - refitting              | 29 | Major operation only possible after removal of engine from vehicle | 3  |
| Crankshaft and main bearings - removal                | 18 | Major operations possible with engine in vehicle                   | 2  |
| Crankshaft oil seals - renewal                        | 14 | Method of engine removal   | 4  |
| Cylinder block/crankcase - examination and renovation | 22 | Oil filter - renewal   | 19 |
| Cylinder head - dismantling and overhaul              | 11 | Oil pump - examination and renovation                              | 24 |
| Cylinder head - reassembly                            | 34 | Oil pump - refitting   | 31 |
| Cylinder head - refitting                             | 36 | Oil pump - removal   | 16 |
| Cylinder head - removal                               | 9  | Pistons and connecting rods - examination and renovation           | 23 |
| Engine dismantling - general information              | 7  | Pistons and connecting rods - refitting                            | 30 |
| Engine reassembly - general information               | 28 | Pistons and connecting rods - removal                              | 17 |
| Engine - adjustments after major overhaul             | 41 | Sump - refitting   | 32 |
| Engine ancillary components - removal                 | 8  | Sump - removal   | 15 |
| Engine ancillary components and gearbox - refitting   | 39 | Timing belt and sprockets - examination and renovation             | 26 |
| Engine - refitting                                    | 40 | Timing belt and sprockets - refitting                              | 37 |
| Engine - removal                                      | 5  | Timing belt and sprockets - removal                                | 12 |
| Engine/gearbox - separation                           | 6  | Valve clearances - checking and adjustment                         | 38 |
| Examination and renovation - general information      | 20 |  |    |

2A

### Degrees of difficulty

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

### Specifications

#### General

|  |  |
|--|--|
| Type   | Four-cylinder in-line, water cooled, overhead camshaft |
| Code:  |  |
| 1.05 litre   | GN   |
| 1.3 litre  | HK   |
| Firing order   | 1-3-4-2 (No 1 at camshaft sprocket end)                |
| Displacement:  |  |
| 1.05 litre   | 1043 cc  |
| 1.3 litre  | 1272 cc  |
| Bore:  |  |
| 1.05 litre   | 75.0 mm  |
| 1.3 litre  | 75.0 mm  |
| Stroke:  |  |
| 1.05 litre   | 59.0 mm  |
| 1.3 litre  | 72.0 mm  |
| Compression ratio:                                       |  |
| 1.05 litre   | 9.5 to 1   |
| 1.3 litre  | 9.5 to 1   |
| Compression pressure:                                    |  |
| New  | 8 to 10 bar  |
| Minimum  | 7.0 bar  |
| Maximum permissible difference between any two cylinders | 3.0 bar  |

## 2A•2 Engine repair procedures - 1.05 and 1.3 litre pre August 1985

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### Crankshaft

|  |                           |
|--|---------------------------|
| Main journal:                          |                           |
| Standard diameter                      | 54.0 mm                   |
| Undersizes                             | 53.75, 53.50 and 53.25 mm |
| Crankpin:                              |                           |
| Standard diameter                      | 42 mm                     |
| Journal undersizes                     | 41.75, 41.50 and 41.25 mm |
| Endfloat:                              |                           |
| Maximum                                | 0.20 mm                   |
| Minimum                                | 0.07 mm                   |
| Main bearing maximum running clearance | 0.17 mm                   |

### Connecting rods

|                           |          |
|---------------------------|----------|
| Big-end:                  |          |
| Maximum running clearance | 0.095 mm |
| Maximum endfloat          | 0.40 mm  |

### Pistons

|   |          |
|---|----------|
| Clearance in bore:                                |          |
| Maximum   | 0.07 mm  |
| Minimum   | 0.03 mm  |
| Diameter:   |          |
| Standard  | 74.98 mm |
| Oversize:   |          |
| 1st oversize                                      | 75.23 mm |
| 2nd oversize                                      | 75.48 mm |
| 3rd oversize                                      | 75.98 mm |
| Wear limit (10 mm from base/ right angles to pin) | 0.04 mm  |

### Piston rings

|                             |                 |
|-----------------------------|-----------------|
| Maximum clearance in groove | 0.15 mm         |
| End gap:                    |                 |
| Compression rings           | 0.30 to 0.45 mm |
| Oil scraper ring            | 0.25 to 0.40 mm |

### Gudgeon pin

|               |                  |
|---------------|------------------|
| Fit in piston | Push fit at 60°C |
|---------------|------------------|

### Cylinder head

|                                   |        |
|-----------------------------------|--------|
| Maximum allowable face distortion | 0.1 mm |
|-----------------------------------|--------|

### Camshaft

|                           |         |
|---------------------------|---------|
| Run-out at centre bearing | 0.02 mm |
| Endfloat                  | 0.15 mm |

### Valves

|                          |          |
|--------------------------|----------|
| Seat angle               | 45°      |
| Head diameter:           |          |
| Inlet                    | 34.0 mm  |
| Exhaust                  | 28.1 mm  |
| Stem diameter:           |          |
| Inlet                    | 7.97 mm  |
| Exhaust                  | 7.95 mm  |
| Standard overall length: |          |
| Inlet                    | 110.5 mm |
| Exhaust                  | 110.5 mm |

### Valve guides

|   |        |
|---|--------|
| Maximum valve rock (stem flush with guide): |        |
| Inlet                                       | 1.0 mm |
| Exhaust                                     | 1.3 mm |

### Valve timing

#### Nil valve clearance at 1.0 mm valve lift

|                |          |
|----------------|----------|
| 1.05 litre:    |          |
| Inlet opens    | 9° ATDC  |
| Inlet closes   | 13° ABDC |
| Exhaust opens  | 15° BBDC |
| Exhaust closes | 11° BTDC |

|                      |          |
|----------------------|----------|
| 1.3 litre:           |          |
| Inlet opens .....    | 3° BTDC  |
| Inlet closes .....   | 38° ABDC |
| Exhaust opens .....  | 41° BBDC |
| Exhaust closes ..... | 3° BTDC  |

### Valve clearances

|               |                 |
|---------------|-----------------|
| Warm:         |                 |
| Inlet .....   | 0.15 to 0.20 mm |
| Exhaust ..... | 0.25 to 0.30 mm |
| Cold:         |                 |
| Inlet .....   | 0.10 to 0.15 mm |
| Exhaust ..... | 0.20 to 0.25 mm |

### Lubrication

|   |  |
|---|--|
| System type .....                                   | Wet sump, pressure feed, full flow filter    |
| Lubricant type/specification/capacity .....         | Refer to "Lubricants, fluids and capacities" |
| Filter type .....                                   | Champion C101/C160                           |
| Pump type .....                                     | Eccentric gear driven by crankshaft          |
| Pressure (2000 rpm with oil temperature 80°C) ..... | 2.0 bar minimum                              |

### Torque wrench settings

|   | Nm                              | lbf ft |
|---|---------------------------------|--------|
| Engine to gearbox .....                       | 55                              | 41     |
| Exhaust pipe to manifold .....                | 25                              | 18     |
| Flywheel bolts .....                          | 75                              | 55     |
| Clutch bolts .....                            | 25                              | 18     |
| Sump bolts .....                              | 20                              | 15     |
| Sump drain plug .....                         | 30                              | 22     |
| Main bearing cap bolts .....                  | 65                              | 48     |
| Oil pump bolts .....                          | 10                              | 7      |
| Connecting rod big-end cap nuts (oiled):      |                                 |        |
| Stage 1 .....                                 | 30                              | 22     |
| Stage 2* .....                                | Tighten further 1/4 turn (90°)  |        |
| Oil suction pipe to pump .....                | 10                              | 7      |
| Oil relief valve plug .....                   | 25                              | 18     |
| Oil pressure sender switch .....              | 25                              | 18     |
| Timing cover .....                            | 10                              | 7      |
| Valve cover .....                             | 10                              | 7      |
| Camshaft sprocket bolt .....                  | 80                              | 59     |
| Crankshaft sprocket/pulley nut .....          | 80                              | 59     |
| Coolant pump bolts .....                      | 10                              | 7      |
| Distributor flange bolts .....                | 20                              | 15     |
| Cylinder head bolts (engine cold):            |                                 |        |
| Stage 1 .....                                 | 40                              | 30     |
| Stage 2 .....                                 | 60                              | 44     |
| Stage 3 .....                                 | Tighten further 1/2 turn (180°) |        |
| Engine mountings (with oiled threads):        |                                 |        |
| <i>Refer to illustrations 40.1a and 40.1b</i> |                                 |        |
| (a) M8 .....                                  | 25                              | 18     |
| (a) M10 .....                                 | 45                              | 33     |
| (b) .....                                     | 35                              | 26     |
| (c) .....                                     | 45                              | 33     |
| (d) .....                                     | 50                              | 37     |
| (e) .....                                     | 60                              | 44     |
| (f) .....                                     | 70                              | 52     |
| (g) .....                                     | 80                              | 59     |

\* When checking the connecting rod-to-crankshaft journal radial clearance using Plastigage, tighten only to 30Nm (22 lbf ft).

## 1 General information

The 1.05 and 1.3 litre engines are of four-cylinder, in-line, overhead camshaft type, mounted transversely at the front of the vehicle. The transmission is attached to the left-hand side of the engine.

The crankshaft is of five bearing type and separate thrustwashers are fitted to the central main bearing to control crankshaft endfloat.

The camshaft is driven by a toothed belt which also drives the coolant pump. The toothed belt is tensioned by moving the coolant pump in its eccentric mounting. The valves are operated from the camshaft by rocker fingers which pivot on ball-head studs. The distributor

is driven by the camshaft and is located on the left-hand end of the cylinder head.

The oil pump is of the eccentric gear type driven from the end of the crankshaft.

The cylinder head is of crossflow design, with the inlet manifold at the rear and the exhaust manifold at the front.

The crankcase ventilation system is of the positive type and consists of an oil separator on the rear (coolant pipe side) of the cylinder

block, connected to the air cleaner by a rubber hose. Vacuum from the air cleaner provides a partial vacuum in the crankcase and the piston blow-by gases are drawn through the oil separator and into the engine combustion chambers.

## 2 Major operations possible with engine in vehicle

The following operations can be carried out without having to remove the engine from the vehicle:

- a) Removal and servicing of the cylinder head, camshaft and timing belt
- b) Removal of the flywheel and crankshaft rear oil seal (after removal of the gearbox)
- c) Removal of the sump
- d) Removal of the piston/connecting rod assemblies (after removal of the cylinder head and sump)
- e) Renewal of the crankshaft front and rear oil seals and the camshaft front oil seal
- f) Renewal of the engine mountings
- g) Removal of the oil pump

## 3 Major operation only possible after removal of engine from vehicle

The following operation can only be carried out after removal of the engine from the vehicle:

- a) Renewal of crankshaft main bearings

## 4 Method of engine removal

1 The engine, together with the gearbox, must be lifted from the engine compartment and the engine separated from the gearbox on the bench. Two people will be needed.

2 A hoist of 150 kg capacity will be needed to lift the engine approximately 1 metre. If the hoist is not portable, then sufficient room must be left behind the vehicle to push it back out of the way so that the engine may be lowered. Blocks will be needed to support the engine after removal.

3 Ideally the vehicle should be over a pit. If this is not possible then the body must be supported on axle stands (see "Jacking and vehicle support") so that the front wheels may be turned to undo the driveshaft nuts. The left-hand shaft is accessible from above but the right-hand shaft must be undone from underneath. Removal of the gearshift linkage can only be done from underneath, as can removal of the exhaust pipe bracket. When all tasks are complete, lower the vehicle back onto its wheels.

4 A set of splined keys will be required to remove and refit the socket-head bolts used to secure certain items, such as the cylinder head bolts.

5 Draining of oil and coolant is best done away from the working area if possible. This saves the mess made by spilled oil in the place where you must work.

6 If an air conditioning system is fitted, observe the precautions listed in Chapter 3.

## 5 Engine - removal



1 Disconnect the battery negative lead.

2 Remove the bonnet.

3 Drain the engine coolant and remove the radiator, complete with cooling fan unit.

4 Remove the air cleaner unit.

5 Loosen the clip and disconnect the top hose from the thermostat housing.

6 Place a container beneath the engine then unscrew the sump drain plug and drain the oil - see Chapter 1. When complete, clean the drain plug and washer and refit it to the sump.

7 Identify the fuel supply and return hoses then disconnect them from the fuel pump (see illustration) and fuel reservoir/carburettor. Plug the hoses to prevent fuel leakage.

8 Loosen the clip and disconnect the bottom hose from the coolant pipe at the rear of the engine.

9 Disconnect the accelerator cable and, where applicable, the choke cable.

10 Disconnect the heater hoses from the thermostat housing and rear coolant pipe.

11 Detach the following connections, identifying each lead as it is disconnected to avoid confusion on reassembly:

- a) The oil pressure switches on the rear (carburettor side) of the cylinder head
- b) Inlet manifold preheating element line connector
- c) Thermo-switch leads (coolant hose intermediate piece)
- d) Distributor HT and LT leads
- e) Starter motor
- f) Temperature sender unit (thermostat housing)
- g) Fuel cut-off solenoid valve on carburettor
- h) Earth strap to gearbox

12 Detach the wiring loom from the location clip on the bottom hose and fold back out of the way.

13 Disconnect and unclip the vacuum hoses from the distributor and inlet manifold as necessary.

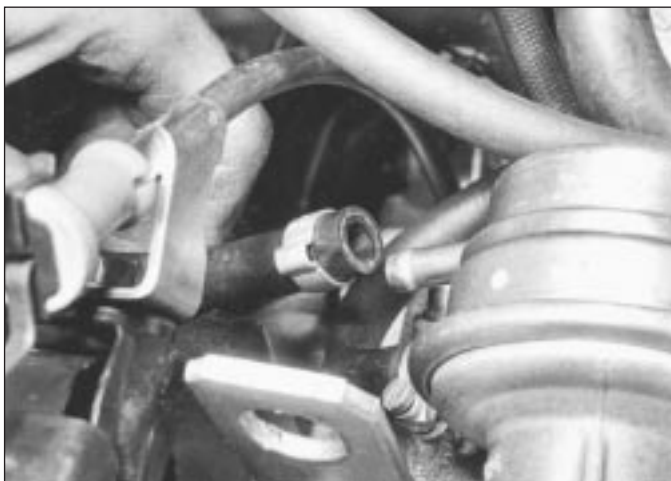
14 Disconnect the clutch cable (see illustration).

15 Disconnect the exhaust downpipe from the exhaust manifold.

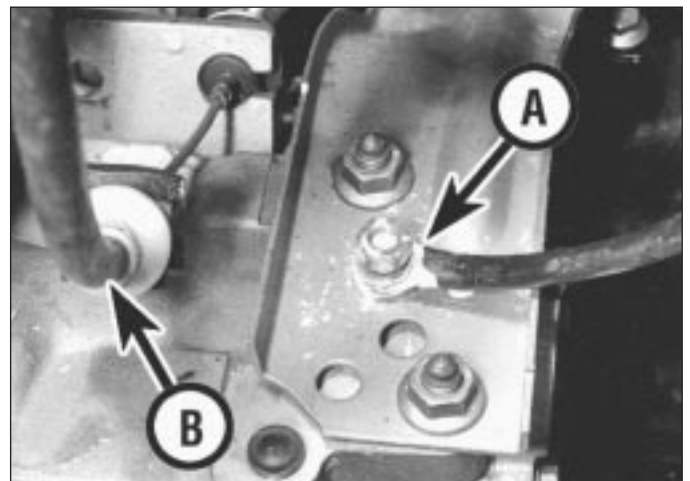
16 Disconnect the speedometer cable from the gearbox and place it on one side.

17 Apply the handbrake then jack up the front of the vehicle and support it on axle stands (see "Jacking and vehicle support").

18 Remove the screw from the shift rod coupling and ease the coupling from the rod (see illustration). The screw threads are coated with a liquid locking agent and if



5.7 Detach hoses from fuel pump



5.14 Earth lead (A) and clutch cable (B)



5.18 Shift rod coupling screw



5.21 Reversing light switch



5.23 Engine lifting eye

difficulty is experienced, it may be necessary to heat up the coupling with a blowlamp whilst observing the necessary fire precautions. Note that once removed this screw should be renewed.

19 Note its orientation then withdraw the shift rod coupling.

20 Unbolt the exhaust steady bracket from the downpipe and clutch housing/starter motor.

21 Detach the reversing light switch lead (see illustration).

22 Unbolt the driveshafts from the drive flanges and tie them to one side with wire.

23 Attach a suitable hoist to the engine lifting eye brackets (one at each end of the cylinder head on the carburettor side) (see illustration). Take the weight of the engine/gearbox unit.

24 Working from above, undo the three engine mounting/bearer retaining bolts (underneath the carburettor) (see illustration).

25 Undo and remove the gearbox mounting bolt (rear left side of engine compartment).

26 Undo and remove the front engine mounting bolt and then remove the bolts securing the bracket to the engine. Withdraw the mounting (see illustrations).



5.24 Engine mounting/bearer - right-hand



5.26a Undo front mounting through-bolt

27 Before lifting out the engine/gearbox unit, get an assistant to hold the engine steady and help guide it clear of surrounding components as it is removed.

28 Lift the engine/gearbox unit from the engine compartment (see illustration) while turning it as necessary to clear the internally mounted components. Make sure that all wires, cables and hoses have been disconnected.

29 Lower the unit onto a workbench or large piece of wood placed on the floor.

## 6 Engine/gearbox - separation



2A

1 The engine/gearbox unit must be supported so that the gearbox can be eased away from it. Either support the engine on blocks so that the gearbox overhangs the bench, or do the job while the engine and gearbox are on the hoist.

2 Detach the lead from the alternator then unclip the lead from the locating clips on the sump side walls.



5.26b Unbolt and remove mounting unit



5.28 Lifting out engine/gearbox unit

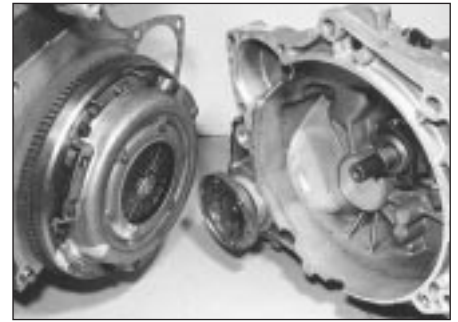




6.3 Starter motor and exhaust support bracket



6.6a Undo securing bolts (recessed bolt shown) . . .



6.6b . . . then separate engine and transmission

3 Because the rear bearing of the starter armature is in the bellhousing, it is necessary to remove the starter before separating the engine and gearbox. If not already removed when unbolting the starter motor, also detach the exhaust pipe support bracket (**see illustration**).

4 Detach the coolant pipe at its flange on the rear side of the coolant pump and at the clutch housing.

5 Undo the clutch housing belly plate bolt and withdraw the plate.

6 Undo and remove the remaining engine-to-gearbox securing bolts then pull the gearbox free. Do not insert wedges or you will damage the facing. Tap the gearbox gently and wriggle it off the two dowels which locate it. The intermediate plate will remain in position (**see illustrations**).



8.1a Lift the mounting away

### 7 Engine dismantling - general information

1 If possible, mount the engine on a stand for the dismantling procedure, but failing this, support it in an upright position with blocks of wood.

2 Cleanliness is most important. 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. Do not immerse parts with internal oilways in paraffin as it is difficult to remove. Clean oilways with nylon pipe cleaners.

5 Obtain suitable containers to hold small items. This will help when reassembling the engine and also prevent possible loss.

6 Obtain complete sets of gaskets when the engine is being dismantled 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 When possible, refit nuts, bolts and washers in their location after being removed. This helps to protect the threads and will also be helpful when reassembling the engine.

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

### 8 Engine ancillary components - removal



With the engine removed from the vehicle and separated from the gearbox, the externally mounted ancillary components should now be removed before dismantling begins. The removal sequence need not necessarily follow the order given:

- a) Alternator and drivebelt
- b) Inlet manifold and carburettor
- c) Exhaust manifold
- d) Distributor
- e) Fuel pump
- f) Thermostat
- g) Clutch
- h) Crankcase ventilation hose
- i) Distributor cap and spark plugs
- j) Oil filter
- k) Engine mountings (**see illustrations**)
- l) Dipstick (**see illustration**)
- m) Oil pressure switches
- n) Coolant temperature thermo-switch
- o) Alternator mounting bracket and engine earth lead
- p) Engine rear coolant pipe (**see illustration**)



8.1b Right-hand rear mounting viewed from above



8.1c Engine dipstick and tube



8.1d Removing engine rear coolant pipe

## 9 Cylinder head - removal

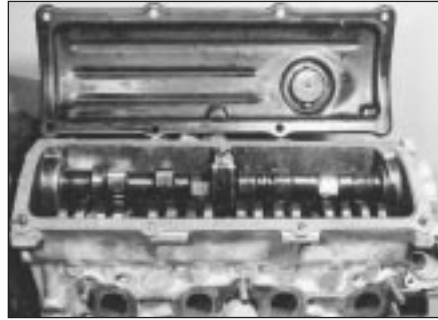


1 If the engine is still in the vehicle, first carry out the following operations:

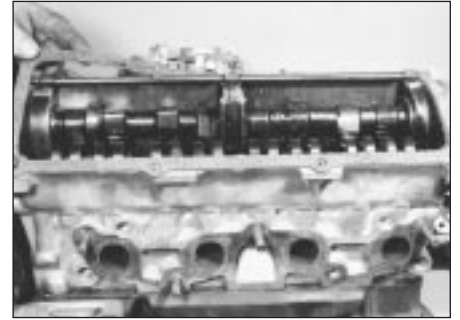
- a) Disconnect the battery negative lead
- b) Remove the air cleaner and fuel pump
- c) Drain the cooling system and remove the top hose and thermostat
- d) Remove the distributor and spark plugs
- e) Remove the inlet and exhaust manifolds. If necessary, this can be carried out with the cylinder head on the bench
- f) Disconnect the wiring from the coolant temperature sender and oil pressure switch

2 Unscrew the nuts and bolts from the valve cover and remove the cover together with the gasket and reinforcement strips (see illustrations).

3 Turn the engine until the indentation in the camshaft sprocket appears in the TDC hole in the timing cover and the notch in the crankshaft pulley is aligned with the TDC pointer on the front of the oil pump (see illustrations). Now turn the crankshaft one quarter of a turn anti-clockwise so that none of the pistons are at TDC.



9.2a Removing valve cover . . .



9.2b . . . and gasket

4 Unbolt and remove the timing cover (see illustration), noting that the dipstick tube and earth lead are fitted to the upper bolts. On some later 1.3 litre models, it is necessary to remove the crankshaft pulley to remove the lower timing belt cover. Pull the dipstick tube from the cylinder block.

5 Using a socket through the hole in the camshaft sprocket, unscrew the timing cover plate upper retaining bolt.

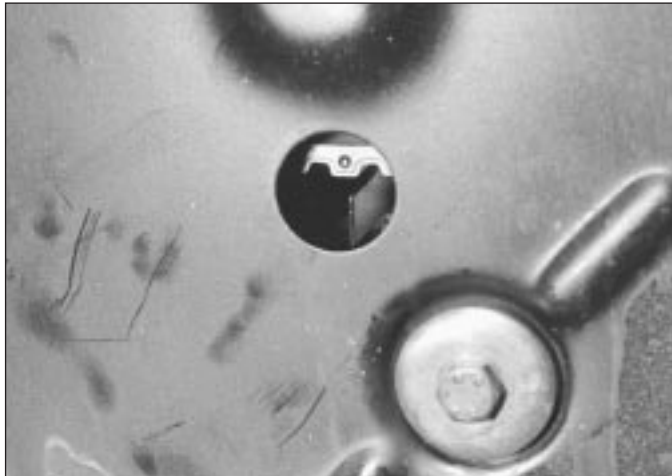
6 Loosen the coolant pump retaining bolts, then turn the pump body clockwise to release the tension from the timing belt. Remove the timing belt from the camshaft sprocket.

7 Remove the bolts and withdraw the timing cover plate, followed by the coolant pump if required.

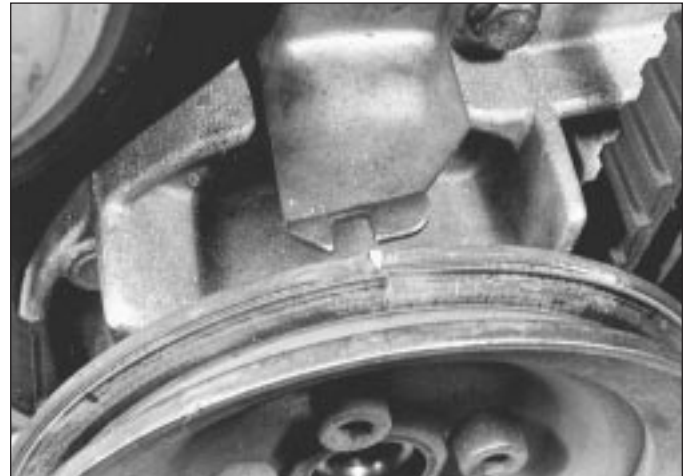
8 Using a splined key, unscrew the cylinder head bolts half a turn at a time in the reverse order to that shown for tightening. Note the location of the engine lifting hooks.

9 Lift the cylinder head from the block (see illustration). If it is stuck, tap it free with a wooden mallet. Do not insert a lever as damage will occur to the joint faces.

10 Remove the gasket from the cylinder block (see illustration).



9.3a TDC mark on camshaft sprocket and pointer



9.3b Crankshaft pulley notch aligned with TDC pointer



9.4 Removing timing cover



9.9 Removing cylinder head . . .



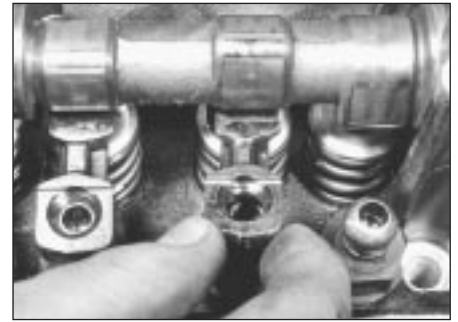
9.10 . . . and gasket



10.7 Removing oil spray tube



10.8 Removing a cam follower clip



10.9 Removing a cam follower

## 10 Camshaft - removal



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

- a) Disconnect the battery negative lead
- b) Remove the air cleaner and fuel pump
- c) Remove the distributor and spark plugs

2 If the cylinder head is still fitted to the engine, first carry out the procedure described in paragraphs 3 to 6 inclusive.

3 Unscrew the nuts and bolts from the valve cover and remove the cover together with the gasket and reinforcement strips.

4 Turn the engine until the indentation in the camshaft sprocket appears in the TDC hole in the timing cover and the notch in the

crankshaft pulley is aligned with the TDC pointer on the front of the oil pump. Now turn the crankshaft one quarter of a turn anti-clockwise so that none of the pistons are at TDC.

5 Unbolt and remove the timing cover, noting that the dipstick tube and earth lead are fitted to the upper bolts. On some later 1.3 litre models, it is necessary to remove the crankshaft pulley to remove the lower timing belt cover.

6 Loosen the coolant pump retaining bolts, then turn the pump body clockwise to release the tension from the timing belt. Remove the timing belt from the camshaft sprocket.

7 Prise the oil spray tube from the top of the cylinder head (see illustration).

8 Note how the cam follower clips are fitted then prise them from the ball-studs (see illustration).

9 Identify each cam follower for location then remove each one by levering with a screwdriver. Make sure that the peak of the relevant cam is pointing away from the follower first by turning the camshaft as necessary (see illustration).

10 Unscrew the camshaft sprocket bolt and remove the spacer (see illustration). The sprocket can be held stationary using a metal bar with two bolts, with one bolt inserted in a hole and the other bolt resting on the outer rim of the sprocket.

11 Tap the sprocket from the camshaft with a wooden mallet and prise out the Woodruff key.

12 Using feeler blades, check the camshaft endfloat by inserting the blade between the end of the camshaft and distributor flanges (see illustration). If it is more than the amount specified, the components will have to be checked for wear and renewed as necessary.

13 Using an Allen key, unscrew the bolts and remove the distributor flange (see illustration). Remove the gasket.

14 Carefully slide the camshaft from the cylinder head, taking care not to damage the three bearing surfaces as the lobes of the cams pass through them (see illustration).

15 Prise the camshaft oil seal from the cylinder head (see illustration).



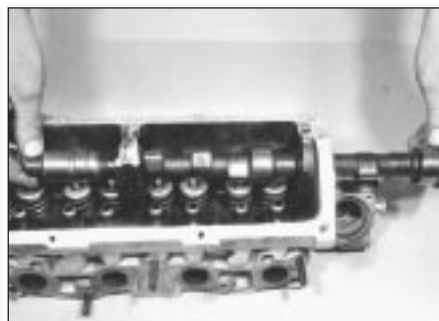
10.10 Removing camshaft sprocket bolt (early type sprocket shown)



10.12 Checking camshaft endfloat



10.13 Removing distributor flange



10.14 Withdrawing camshaft

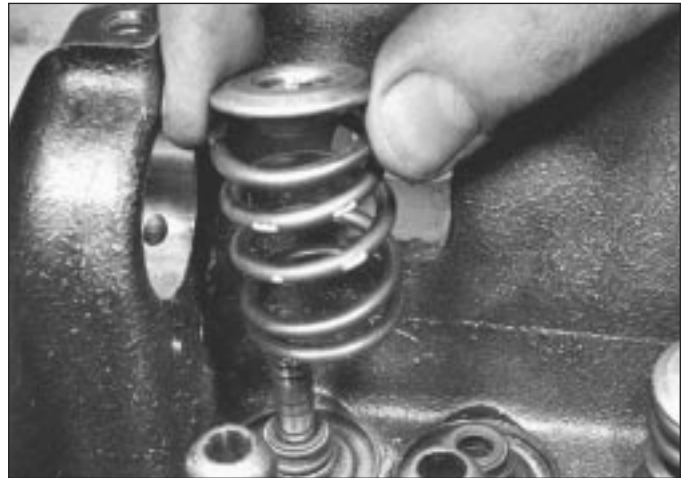


10.15 Removing camshaft oil seal





11.2a Compressing a valve spring to remove split collets



11.2b Removing valve springs and retainers . . .

## 11 Cylinder head - dismantling and overhaul



### Dismantling

- 1 Remove the cylinder head and camshaft, as described in the previous Sections.
- 2 Using a valve spring compressor, compress each valve spring in turn until the split collets can be removed. Release the compressor and remove the retainers and springs (see illustrations). If the retainers are difficult to remove, 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 held firmly over the retainer.
- 3 Remove each valve from the cylinder head, keeping them identified for location.
- 4 Prise the valve seals from the valve guides and remove the lower spring seats (see illustration).
- 5 Do not remove the cam follower ball-studs unless they are unserviceable. They are likely to be seized in the head.

### Overhaul

- 6 Use a scraper to carefully remove any carbon from the cylinder head. Remove all traces of gasket then wash the cylinder head thoroughly in paraffin and wipe dry.
- 7 Use a straight-edge and feeler blade to check that the cylinder head mating surface is not distorted. If it is, then it must be resurfaced by a suitably equipped engineering works. If the cylinder head face is to be resurfaced, this will necessitate the valve seats being re-cut so that they are recessed deeper by an equivalent amount to that machined from the cylinder head. This is necessary to avoid the possibility of the valves coming into contact with the pistons and causing serious damage and is a task to be entrusted to a suitably equipped engine recondition specialist. (see illustration).

8 Examine the valve heads for pitting and burning. Renew any valve which is badly burnt. Examine the valve seats at the same time. If the pitting is very slight, it can be removed by grinding the valve heads and seats together with coarse, then fine, grinding paste. Note that the exhaust valves should not be re-cut, they should be renewed if the sealing face is excessively grooved as a result of regrinding.

9 Where excessive pitting has occurred, the valve seats must be re-cut or renewed by a specialist.

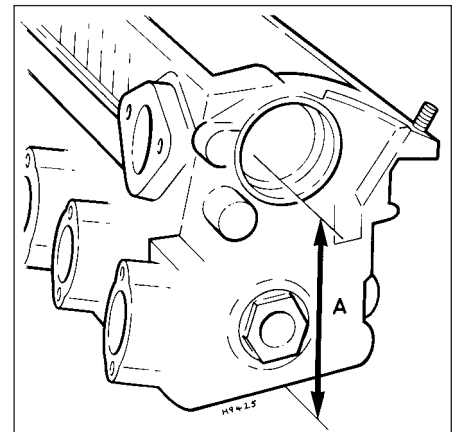
10 Valve grinding is carried out as follows. Place the cylinder head upside down on a bench with a block of wood at each end. Smear a trace of coarse carborundum paste on the seat face and press a suction grinding tool onto the valve head. With a semi-rotary action, grind the valve head to its seat, lifting the valve occasionally to redistribute the grinding paste. When a dull matt even surface is produced on both the valve seat and the valve, wipe off the paste and repeat the process with fine carborundum paste as before. A light spring placed under the valve head will greatly ease this operation. When a smooth unbroken ring of light grey matt finish is produced on both the valve and seat, the grinding operation is complete.



11.4 . . . and valve spring lower seats

11 Scrape away all carbon from the valve head stem and clean away all traces of grinding compound. Clean the valves and seats with a paraffin-soaked rag, then wipe with a clean rag.

12 Check for wear in the valve guides. This may be detected by fitting a new valve in the guide and checking the amount that the rim of the valve will move sideways when the top of the valve stem is flush with the top of the valve guide. The rock limit for the inlet valve is 1.0 mm and 1.3 mm for the exhaust valve. This can be measured with feeler blades if you use a clamp as a datum but it must be with a new valve. If the rock is at or below this limit with your old valve then this indicates that the existing guide(s) do not need renewal. Check each valve guide in turn but note that the inlet and exhaust valve stem dimensions differ, so do not get them confused. If the rock exceeds the limit with a new valve, this will indicate the need for new valve guides as well. The removal and refitting of new guides is a task which must be entrusted to a specialist.



11.7 Measure cylinder head depth between points indicated

Minimum allowable depth a = 119.3 mm

2A

**13** If possible, compare the length of the valve springs with new ones and renew them as a set if any are shorter.

**14** If the engine is still in the vehicle, clean the piston crowns and cylinder bore upper edges but make sure that no carbon drops between the pistons and bores. To do this, locate two of the pistons at the top of their bores and seal off the remaining bores with paper and masking tape. Press a little grease between the two pistons and their bores to collect any carbon dust which can be wiped away when the piston is lowered. To prevent carbon build-up, polish the piston crown with metal polish but remove all traces of the polish afterwards.

## 12 Timing belt and sprockets - removal



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

- a) Disconnect the battery negative lead
- b) Remove the air cleaner
- c) Remove the alternator drivebelt

**2** Turn the engine until the indentation in the camshaft sprocket appears in the TDC hole in the timing cover and the notch in the crankshaft pulley is aligned with the TDC pointer on the front of the oil pump.

**3** Unbolt and remove the timing cover, noting that the dipstick tube and earth lead are fitted to the upper bolts. On some later 1.3 litre models, it is necessary to remove the crankshaft pulley to remove the lower timing belt cover.

**4** Loosen the coolant pump retaining bolts, then turn the pump body clockwise to release the tension from the timing belt. Remove the timing belt from the camshaft sprocket (see illustration).

**5** Using an Allen key, unbolt the pulley from the crankshaft sprocket then remove the timing belt.

**6** To remove the camshaft sprocket, unscrew the bolt and remove the spacer. Tap off the sprocket and remove the Woodruff key. Do not turn the camshaft. The sprocket can be held stationary using a metal bar with two bolts, with one bolt inserted through a



13.2 One method of holding the flywheel stationary



12.4 Releasing timing belt from camshaft sprocket

sprocket hole and the other bolt resting on the outer rim.

**7** To remove the crankshaft sprocket, unscrew the bolt and lever the sprocket from the crankshaft (see illustration). Do not turn the crankshaft otherwise the pistons may touch the valve heads. Hold the crankshaft stationary with a lever inserted in the starter ring gear (remove the starter as applicable). Remove the Woodruff key.

## 13 Flywheel - removal



**1** Remove the clutch.

**2** Hold the flywheel stationary with a lever or angle iron (see illustration) engaged with the starter ring gear.

**3** Unscrew the bolts and lift the flywheel from the crankshaft (see illustration).

**4** Remove the engine plate from the cylinder block (see illustration).

**5** The flywheel bolts must be renewed once they are removed.

## 14 Crankshaft oil seals - renewal



### Front seal

**1** Remove the crankshaft sprocket.

**2** If available, use VW tool 2085 to remove the seal from the oil pump housing. Removal of



13.3 Removing flywheel



12.7 Removing crankshaft sprocket bolt and washer

the seal with the engine and oil pump in position in the vehicle can prove difficult without the special tool. In this instance, an alternative method is to drill two holes, diagonally opposed to each other in the seal, insert two self-tapping screws and then pull on the screws using grips to withdraw the seal. If using this method, care must be taken not to drill into the housing.

**3** If the oil pump is removed from the engine, the seal can be prised out and a new item fitted - see illustration 31.1.

**4** Clean the recess in the oil pump.

**5** Smear a little clean engine oil on the lip and outer edge of the new seal, then fit it with VW tool 10-203 or by tapping it in with a suitable metal tube.

**6** Refit the crankshaft sprocket.

### Rear seal

**7** Remove the flywheel.

#### Method 1

**8** Drill two diagonally opposite holes in the seal. Insert two self-tapping screws and pull out the seal with grips.

**9** Clean the recess in the housing.

**10** Smear a little clean engine oil on the lip and outer edge of the new seal then tap it into the housing using a suitable metal tube

**11** Refit the flywheel.

#### Method 2

**12** Remove the sump.

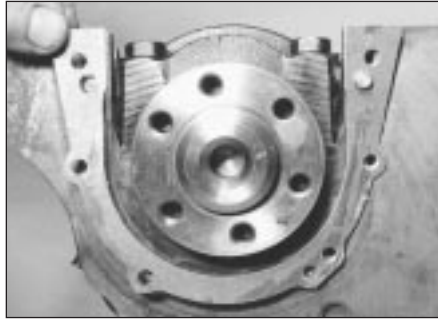
**13** Unscrew the bolts and withdraw the housing from the dowels on the cylinder block. Remove the gasket (see illustrations).



13.4 Removing engine plate



14.13a Withdrawing crankshaft rear oil seal housing . . .



14.13b . . . and gasket



14.14 Remove crankshaft rear oil seal from housing

14 Support the housing and drive out the oil seal (see illustration).

15 Clean the recess in the housing.

16 Smear a little clean engine oil on the lip and outer edge of the new seal then tap it into the housing using a block of wood (see illustration).

17 Clean the mating faces then refit the housing, together with a new gasket, and tighten the bolts evenly in diagonal sequence.

18 Refit the sump and flywheel.

### 15 Sump - removal



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

- a) Jack up the front of the vehicle and support it on axle stands (see "Jacking and vehicle support"). Apply the handbrake
- b) Disconnect the right-hand side driveshaft and the exhaust system
- c) Unclip the alternator wire from the sump (see illustration)
- d) Drain the engine oil into a suitable container. Clean the drain plug and washer and refit it, tightening to the specified torque

2 Unscrew the bolts and withdraw the sump from the cylinder block (see illustration). If it is stuck, lever it away or cut through the gasket with a knife.

3 Scrape the gasket from the sump and cylinder block.

### 16 Oil pump - removal



1 Remove the timing belt and crankshaft sprocket.

2 Remove the sump.

3 Unbolt and remove the pick-up tube and strainer from the oil pump and cylinder block. Remove the flange gasket (see illustration).

4 Unscrew the bolts and withdraw the oil pump from the dowels on the front of the cylinder block. Note that the timing pointed bracket is located on the two upper central bolts and the timing belt guard on the two left-hand side bolts. Remove the gasket (see illustrations).

2A



14.16 Installing new crankshaft rear oil seal



15.1 Alternator wire clip on sump



15.2 Removing the sump



16.3 Removing oil pump pick-up tube and strainer



16.4a Removing oil pump . . .



16.4b . . . and gasket





17.4 Checking connecting rod endfloat



17.5 Piston crown showing arrow which points to timing belt end of engine



17.7 Withdrawing a big-end cap

## 17 Pistons and connecting rods - removal



- 1 Remove the cylinder head.
- 2 Remove the sump.
- 3 Unbolt and remove the pick-up tube and strainer from the oil pump and cylinder block. Remove the flange gasket.
- 4 Using a feeler blade, check that the connecting rod big-end endfloat on each crankpin is within the specified limits (see illustration). If not, the components must be checked for wear and renewed as necessary.
- 5 Check the big-end caps and connecting rods for identification marks, if necessary use a centre punch to mark them for location and position. Note that the cut-outs in the connecting rods and caps face the timing belt end of the engine. The arrows on the piston crown also face the timing belt (see illustration).
- 6 Turn the crankshaft so that No 1 crankpin is at its lowest point.
- 7 Unscrew the big-end nuts and tap free the cap, together with its bearing shell (see illustration).
- 8 Using the handle of a hammer, tap the piston and connecting rod from the bore and withdraw it from the top of the cylinder block (see illustration).
- 9 Loosely refit the cap to the connecting rod.
- 10 Repeat the procedure given in paragraphs 7 to 9 on No 4 piston and connecting rod, then turn the crankshaft through half a turn



18.3 Checking crankshaft endfloat

## 18 Crankshaft and main bearings - removal



- 1 Disconnect the connecting rods from the crankshaft. It is not essential to remove the pistons or, therefore, to remove the cylinder head.
- 2 Remove the oil pump and the rear oil seal housing.
- 3 Using a feeler blade, check that the crankshaft endfloat is within the specified limits (see illustration). Insert the feeler blade between the centre crankshaft web and the thrustwashers. This will indicate whether new thrustwashers are required or not.
- 4 Check that the main bearing caps are identified for location and position. There should be a cast number in the crankcase ventilation pipe/coolant pipe side of the caps, numbered from the timing belt end of the engine (see illustration).
- 5 Unscrew the bolts and tap the main bearing caps free. Keep the bearing shells and where fitted, the thrustwashers identified for position.
- 6 Lift the crankshaft from the crankcase and remove the remaining bearing shells and thrustwashers. Keep them identified for position (see illustration).



18.4 Crankshaft main bearing cap numbering



17.8 Removing a piston

## 19 Oil filter - renewal



Refer to Chapter 1, Section 18

## 20 Examination and renovation - general information

With the engine completely stripped, clean all the components and examine them for wear. Each part should be checked and where necessary renewed or renovated, as described in the following Sections. Renew main and big-end shell bearings as a matter of course, unless you know that they have had little wear and are in perfect condition



18.6 Removing crankshaft



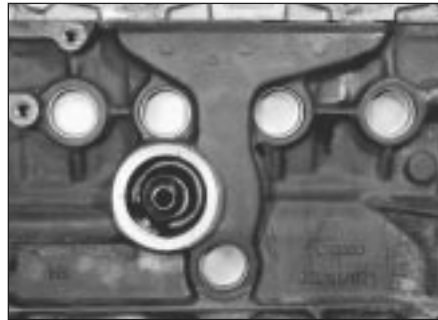
## 21 Crankshaft and bearings - examination and renovation



1 Examine the bearing surfaces of the crankshaft for scratches or scoring. Using a micrometer, check each journal and crankpin for ovality. Where this is found to be in excess of 0.17 mm, the crankshaft will have to be reground and undersize bearings fitted.

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

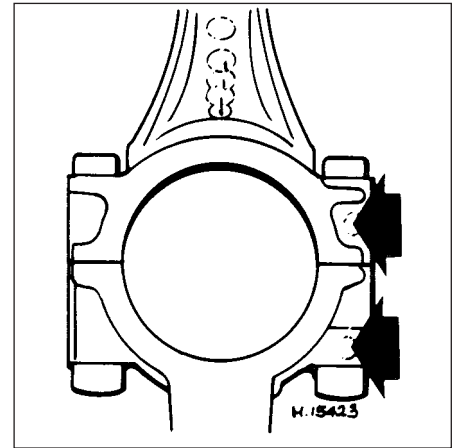
3 If crankshaft endfloat is more than the maximum specified amount, new centre main bearing shells with side flanges will have to be fitted to replace the thrustwashers. These are usually supplied together with the main and big-end bearings on a reground crankshaft.



22.6 Core plugs in cylinder block

cylinder block for cracks and damage and use a piece of wire to probe all oilways and waterways to ensure that they are unobstructed.

6 Check the core plugs for leaks and security (see illustration).



23.2 Indentations on big-end bearings (arrowed) must face same way as arrow on piston crown

## 22 Cylinder block/crankcase - examination and renovation



1 The cylinder bores must be examined for taper, ovality, scoring and scratches. Start by examining the top of the bores. If these are worn, a slight ridge will be found which marks the top of the piston ring travel. If the wear is excessive, the engine will have had a high oil consumption rate accompanied by blue smoke from the exhaust.

2 If available, use an inside dial gauge to measure the bore diameter just below the ridge and compare it with the diameter at the bottom of the bore, which is not subject to wear. If the difference is more than 0.15 mm, the cylinders will normally require reboring with new oversize pistons fitted.

3 If cylinder bore wear does not exceed 0.20 mm, special oil control rings and pistons can be fitted to restore compression and stop the engine burning oil.

4 If new pistons are being fitted to old bores, it is essential to roughen the bore walls slightly with fine glasspaper to enable the new piston rings to bed in properly.

5 Thoroughly examine the crankcase and

## 23 Pistons and connecting rods - examination and renovation



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

2 To remove the pistons from the connecting rods, first mark the two components in relation to each other. The indentation on the bearing end of the connecting rod faces the same way as the arrow on the piston crown (see illustration).

3 Prise out the circlips then dip the piston in hot water. Press out the gudgeon pin and separate the piston from the connecting rod.

4 Assemble the pistons in reverse order.

5 If new rings are to be fitted to the original pistons, expand the old rings over the top of the pistons by using three old feeler blades to prevent the rings dropping into empty grooves.

6 Before fitting the new rings, insert each of them into the cylinder bore approximately 15.0 mm from the bottom and check that the end gaps are as specified (see illustration).

7 When fitting the rings to the pistons, ensure that the TOP markings face towards the

piston crown and arrange the end gaps at 120° intervals (see illustration). Using a feeler blade, check that the clearance of each ring in its groove is within the limits specified (see illustration).

## 24 Oil pump - examination and renovation



**Note:** The manufacturer does not supply any clearances for checking oil pump gear wear, so the pump must be assumed to be in good order provided that oil pressure is as specified. Pressure can only be checked with the engine assembled and the task should be entrusted to a VW garage. A visual examination of the oil pump can be made as follows:

1 Using an Allen key, unscrew the relief valve plug and extract the spring and plunger (see illustrations).

2 Using an impact screwdriver, remove the cross-head screws and withdraw the cover from the pump (see illustration).

3 Remove the rotors, noting that the indentation on the outer rotor faces the cover (see illustrations).



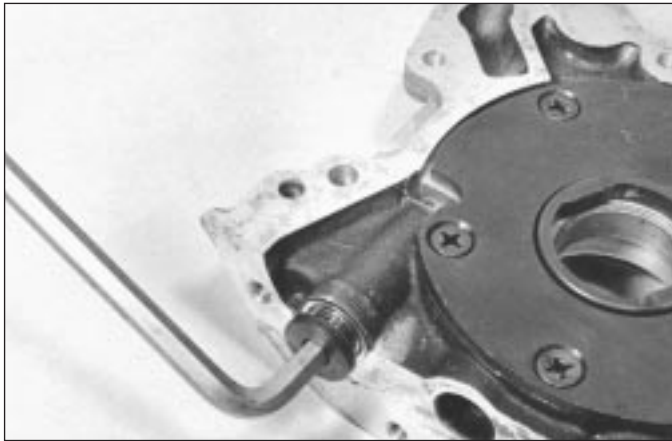
23.6 Checking piston ring gaps



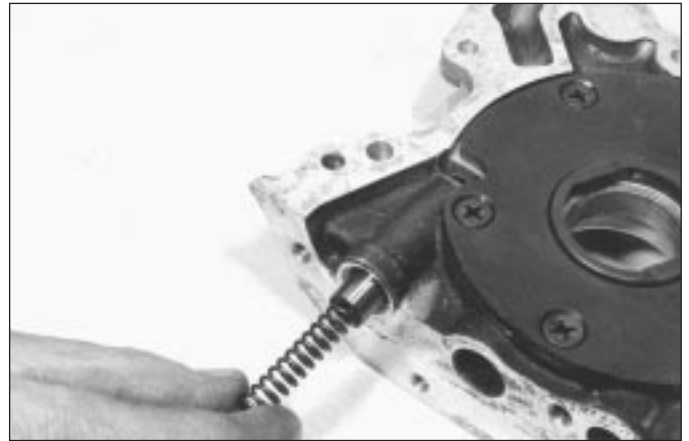
23.7a Space ring gaps at 120° intervals



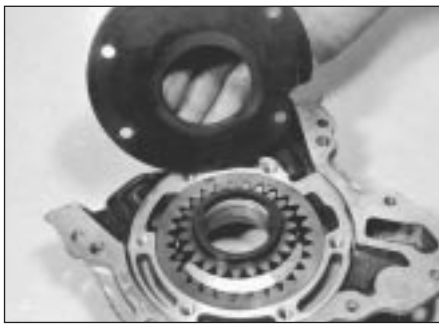
23.7b Checking piston ring-to-groove wall clearance



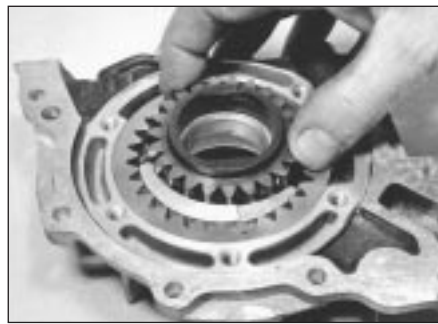
24.1a Unscrew relief valve plug . . .



24.1b . . . and remove spring and plunger



24.2 Removing oil pump cover . . .



24.3a . . . and rotors



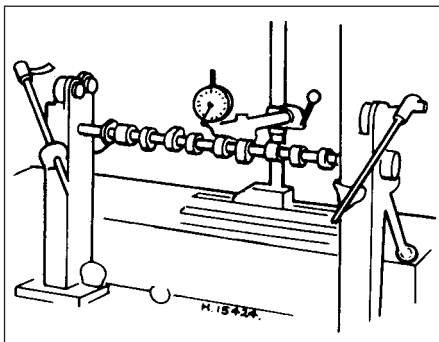
24.3b Outer rotor indentation (arrowed) must face cover

4 Clean the components in paraffin and wipe dry, then examine them for wear and damage. If evident, renew the oil pump complete but if in good order, reassemble the pump in reverse order and tighten the screws and plug.

## 25 Flywheel - examination and renovation



- 1 A damaged flywheel must be renewed.
- 2 Inspect the starter ring teeth. If these are chipped or worn it is possible to renew the starter ring. This means heating the ring until it may be separated from the flywheel, or



27.2 Checking camshaft run-out

alternatively splitting it. A new ring must then be shrunk on. If you know how to do this and you can get a new ring, then the job can be done but it is beyond the capacity of most owners.

3 Serious scoring on the flywheel clutch facing again requires a new flywheel. Do not attempt to clean the scoring off with a scraper or emery.

## 26 Timing belt and sprockets - examination and renovation



- 1 The timing belt should be renewed as a matter of course at 40 000 miles (60 000 km), see Chapter 1.
- 2 The full length of the timing belt must be checked for signs of uneven wear, splitting or oil contamination. Renew the belt if there is the slightest doubt about its condition.
- 3 The camshaft and crankshaft sprockets do not normally require renewal as wear takes place very slowly.

## 27 Camshaft - examination and renovation



Examine the camshaft bearing surfaces, cam lobes and followers for wear. If wear is excessive, renew the camshaft and followers.

Check the camshaft run-out by turning it between fixed centres with a dial gauge on the centre journal. If the run-out exceeds that specified, renew the shaft (see illustration).

## 28 Engine reassembly - general information

To ensure maximum life with minimum trouble from a rebuilt engine, adhere to the following:

- a) Ensure that all components are spotlessly clean
- b) Ensure that all oilways are clear
- c) Ensure lockwashers are fitted where indicated
- d) Lubricate all bearings and other working surfaces thoroughly with clean engine oil during assembly
- e) Renew any bolts or studs with damaged threads.
- f) Gather together a torque wrench, oil can and some clean rags
- g) Obtain a set of engine gaskets and oil seals, together with a new oil filter



29.2 Fitting centre main bearing shell



29.3 Thrustwasher location on centre main bearing



29.4 Fitting centre main bearing cap

## 29 Crankshaft and main bearings - refitting



1 Clean the backs of the bearing shells and the bearing recesses in the cylinder block and main bearing caps.

2 Press the main bearing shells into the cylinder block and caps and oil them liberally (see illustration).

3 Where thrustwashers are being refitted (instead of a shouldered type No 3 main bearing shell, a plain shell is used), smear the washers with grease and stick them into position on the side of the centre main bearing and its cap (see illustration). The washers must be fitted so that their oilways face away from the bearings in the block and cap.

4 Lower the crankshaft into position, then fit the main bearing caps in their previously noted positions (see illustration). Note that the bearing shell lugs are adjacent to each other.

5 Insert the bolts and tighten them evenly to the specified torque. Check that the crankshaft rotates freely then check that the endfloat is within the specified limits by inserting a feeler blade between the centre crankshaft web and the thrustwashers or bearing shoulder, as applicable.

6 Refit the rear oil seal bearing and oil pump and reconnect the connecting rods.

hammer and at the same time, guide the connecting rod into the crankpin. Make sure that the arrow on the piston crown faces the timing belt end of the engine.

5 Fit the big-end bearing cap in its previously noted position then fit the nuts and tighten them evenly to the specified torque.

6 Check that the crankshaft turns freely and use a feeler blade to check that the connecting rod endfloat is within the specified limits.

7 Repeat the procedure given in paragraphs 3 to 5 for No 4 piston and connecting rod, then turn the crankshaft through half a turn and repeat the procedure for No 2 and 3 pistons.

8 If the engine is in the vehicle, refit the oil pump pick-up tube and strainer, the sump and the cylinder head.

## 30 Pistons and connecting rods - refitting



1 As mentioned during removal, the manufacturers recommend that the connecting rod bolts be renewed. Assemble the new bolts to the rods.

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

3 Press the big-end bearing shells into the connecting rods and caps in their correct positions and oil them liberally (see illustration).

4 Fit a ring compressor to No 1 piston then insert the piston and connecting rod into No 1 cylinder (see illustration). With No 1 crankpin at its lowest point, drive the piston carefully into the cylinder with the wooden handle of a

## 31 Oil pump - refitting



1 Renew the oil seal in the oil pump housing (see illustration).

2 Locate a new gasket on the dowels on the front of the cylinder block.

3 Locate the oil pump on the block, making sure that the inner rotor engages the flats on the crankshaft.

4 Insert the bolts, together with the timing pointer bracket and timing belt guard, then tighten them evenly to the specified torque (see illustration).



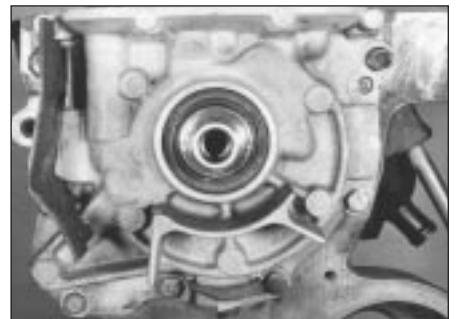
30.3 Correct location of tabs on big-end bearings (arrowed)



30.4 Using a piston ring compressor

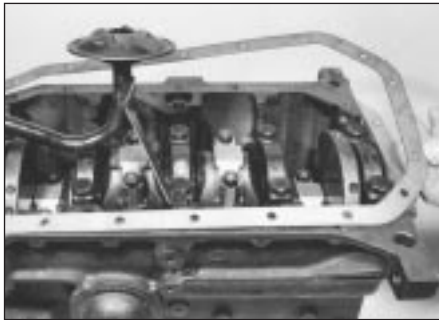


31.1 Prising out oil pump oil seal



31.4 Fitted location of oil pump





32.3 Fitting sump gasket

- 5 Locate a new gasket on the flange face then fit the pick-up tube and strainer. Insert the bolts and tighten them to the specified torque.
- 6 Refit the sump, timing belt and sprocket.

### 32 Sump - refitting



- 1 If applicable (ie. the engine has been dismantled), refit the crankshaft rear oil seal and housing.
- 2 Clean the mating faces of the sump and cylinder block.
- 3 Locate the new gasket on the block (see illustration) then fit the sump. Insert the sump bolts and tighten them evenly in diagonal sequence to the specified torque. If required, the two bolts at the flywheel end of the sump



34.3 Locate plastic sleeve on valve stem . . .



34.4 . . . then fit the new oil seal

can be replaced by socket-headed bolts to facilitate their removal with the engine in the vehicle. Note that the tightening torque for the replacement bolts is 8 Nm (6 lbf ft).

- 4 If the engine is in the vehicle, replenish it with oil, fasten the alternator wire to the sump clip and lower the vehicle to the ground.

### 33 Flywheel - refitting



- 1 Locate the engine plate on the cylinder block dowels.
- 2 Clean the mating faces of the flywheel and crankshaft then locate the flywheel in position. Note that the bolt holes only align in one position as they are offset.
- 3 Apply locking fluid to the threads of new bolts (see illustration) then insert and tighten them in a diagonal sequence to the specified torque while holding the flywheel stationary.
- 4 Refit the clutch.

### 34 Cylinder head - reassembly



- 1 Fit the valves into their correct locations in the cylinder head.
- 2 Working on each valve at a time, locate the valve spring lower seat in position.
- 3 Before fitting each valve seal, locate the special plastic sleeve provided in the gasket set over the valve stem in order to prevent damage to the seal (see illustration).
- 4 Slide each new seal over the valve stem and press it firmly onto the guide using a metal tube (see illustration). Remove the plastic sleeve.
- 5 Fit the spring and retainer over each valve stem, then compress the spring with the compressor and insert the split collets. Release the compressor and remove it.
- 6 Refit the camshaft.



35.5 Method of tightening camshaft sprocket bolt

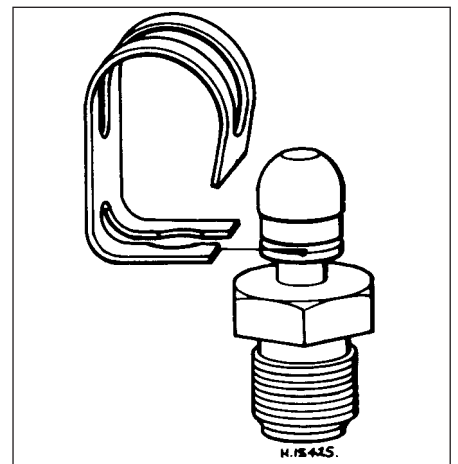


33.3 Applying liquid locking fluid to flywheel bolts

### 35 Camshaft - refitting



- 1 Smear a little clean engine oil on the lip and outer edge of the camshaft oil seal then drive it squarely into the cylinder head with a block of wood.
- 2 Oil the camshaft bearing surfaces then slide the camshaft into position, taking care not to damage the oil seal.
- 3 Fit the distributor flange, together with a new gasket, and tighten the socket-head bolts.
- 4 Using a feeler blade, check that the camshaft endfloat is as specified.
- 5 Fit the Woodruff key then fit the sprocket to the camshaft followed by the spacer and bolt. Tighten the bolt while holding the sprocket stationary with a metal bar and two bolts (see illustration).
- 6 Fit the cam followers by turning the camshaft so that the relevant cam lobe peak is pointing away from the valve, then tap the follower between the valve stem and cam and onto the ball-stud.
- 7 Slide the cam follower clips into the grooves on the ball studs and locate the upper ends on the cam followers (see illustration).



35.7 Cam follower clip and groove in ball-stud





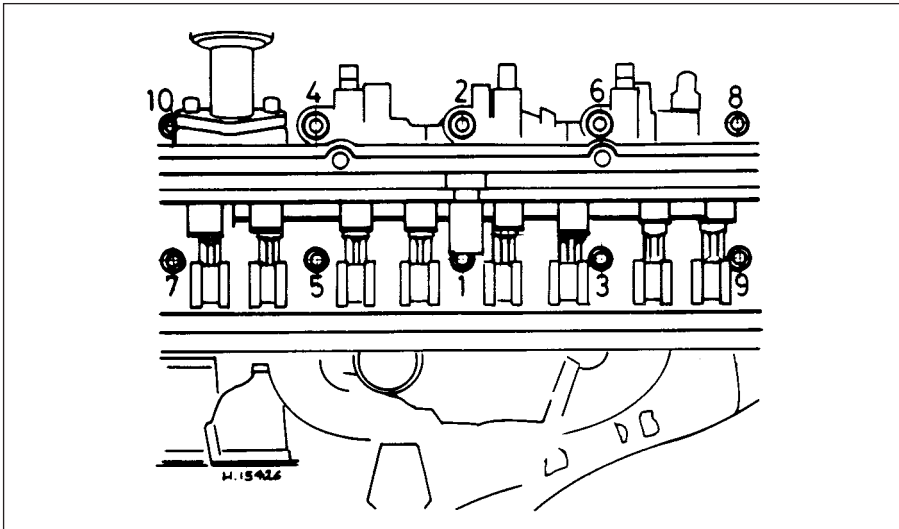
35.9 Camshaft sprocket (later type) with index mark aligned with timing cover TDC pointer



36.2 Correct fitting of cylinder head gasket

- 8 Adjust the valve clearances.
- 9 Turn the camshaft so that the indentation in the sprocket is pointing downwards and in line with the pointer on the timing cover plate (see illustration).
- 10 Turn the crankshaft a quarter of a turn clockwise so that the notch in the crankshaft pulley is aligned with the TDC pointer on the front of the oil pump.
- 11 Fit the timing belt to the camshaft sprocket and coolant pump.
- 12 Using a screwdriver in the coolant pump,

- turn the pump anti-clockwise and tension the timing belt until it can just be turned through 90° with the thumb and forefinger midway between the camshaft sprocket and coolant pump.
- 13 Tighten the coolant pump bolts when the belt tension is correct and check the timing marks are still aligned.
- 14 Fit the dipstick tube to the cylinder block.
- 15 Fit the timing cover, insert the bolts with the earth lead and dipstick tube bracket, then tighten the bolts.



36.4 Cylinder head bolt tightening sequence



36.9 Fitting crankshaft sprocket and timing belt



36.13 Tensioning timing belt

- 16 Press the oil spray tube into the top of the cylinder head.
- 17 Refit the valve cover with a new gasket, locate the reinforcement strips and tighten the nuts and bolts.
- 18 If the engine is in the vehicle, reverse the preliminary procedures given in Section 10.

### 36 Cylinder head - refitting



- 1 Position Nos 1 and 4 pistons at TDC then turn the crankshaft a quarter of a turn anti-clockwise so that neither of the pistons is at TDC.
- 2 Ensure that the faces of the cylinder head and block are perfectly clean then locate the new gasket on the block, making sure that all oil and coolant holes are visible. The gasket part number should be uppermost (see illustration).
- 3 Lower the cylinder head onto the gasket then insert the bolts together with the engine lifting hooks.
- 4 Using a splined key, tighten the bolts in the stages given in *Specifications*, using the sequence shown (see illustration).
- 5 Refit the coolant pump, if applicable.
- 6 Fit the timing cover plate and insert the coolant pump bolts loosely.
- 7 If required, refit the camshaft.
- 8 Refit and tighten the timing cover plate upper retaining bolt.
- 9 If applicable, refit the crankshaft sprocket and timing belt to the crankshaft (see illustration).
- 10 Turn the camshaft so that the indentation in the sprocket is aligned with the pointer on the timing cover plate.
- 11 Turn the crankshaft a quarter of a turn clockwise so that the notch in the crankshaft pulley (temporarily refit if necessary) is aligned with the TDC pointer on the front of the oil pump.
- 12 Fit the timing belt to the camshaft sprocket and coolant pump.
- 13 Using a screwdriver in the coolant pump, turn the pump anti-clockwise and tension the timing belt until it can just be turned through 90° with the thumb and forefinger midway between the camshaft sprocket and coolant pump (see illustration).
- 14 Tighten the coolant pump bolts when the tension is correct and check that the timing marks are still aligned.
- 15 Fit the dipstick tube to the cylinder block.
- 16 Fit the timing cover, insert the bolts with the earth lead and dipstick tube bracket and tighten the bolts.
- 17 Refit the valve cover with a new gasket, locate the reinforcement strips and tighten the nuts and bolts.
- 18 If the engine is in the vehicle, reverse the preliminary procedures given in Section 9.

### 37 Timing belt and sprockets - refitting



- 1 Fit the Woodruff key in the crankshaft and tap the sprocket into position .
- 2 Insert the bolt and tighten it to the specified torque while holding the crankshaft stationary with a lever in the starter ring gear.
- 3 Fit the Woodruff key to the camshaft then fit the sprocket followed by the spacer and bolt. Tighten the bolt while holding the sprocket stationary with a metal bar and two bolts.
- 4 Locate the timing belt on the crankshaft sprocket then fit the pulley. Insert the bolts and tighten them with an Allen key.
- 5 Turn the camshaft so that the indentation in the sprocket is aligned with the pointer on the timing cover plate. Check that the notch in the crankshaft pulley is aligned with the TDC pointer on the front of the oil pump
- 6 Fit the timing belt to the camshaft sprocket and coolant pump.
- 7 Using a screwdriver in the coolant pump, turn the pump anti-clockwise and tension the timing belt until it can just be turned through 90° with the thumb and forefinger midway between the camshaft sprocket and coolant pump.
- 8 Tighten the coolant pump bolts when the belt tension is correct and check that the timing marks are still aligned.
- 9 Fit the timing cover, insert the bolts with the earth lead and dipstick tube bracket, then tighten the bolts.
- 10 If the engine is in the vehicle, reverse the preliminary procedures given in Section 12.

### 38 Valve clearances - checking and adjustment



- 1 The valve clearances can be checked and adjusted with the cylinder head removed (prior to refitting after overhaul) or in the normal manner described in Section 12 of Chapter 1.
- 2 There are two specified valve clearance settings, these being for a cold (cylinder head removed) or warm (engine in vehicle) engine condition.
- 3 If the valve clearances are adjusted with the engine cold, recheck the clearances again after 600 miles (900 km) with the engine at its normal operating temperature.

### 39 Engine ancillary components and gearbox - refitting



- Refer to Section 8 and refit the listed ancillary components.  
 Refit the gearbox to the engine, reversing the procedures described in Section 6.

### 40 Engine - refitting



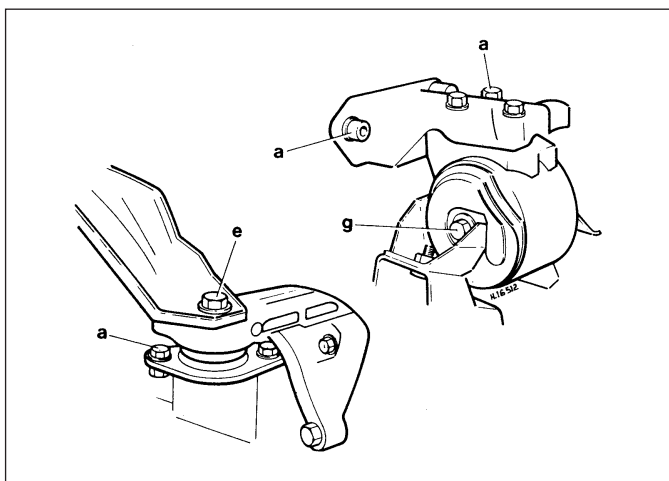
- Reverse the removal procedure given in Section 5 but note the following additional points:
- a) *When lowering the engine/gearbox unit into the vehicle, ensure that the driveshafts are aligned with the flanges*
  - b) *Assemble the engine mountings loosely initially and tighten them only after the unit is central without straining the mountings (see illustrations)*

- c) *Adjust the clutch*
- d) *Adjust the accelerator cable and, where applicable, the choke cable*
- e) *Refill the engine with oil and coolant*

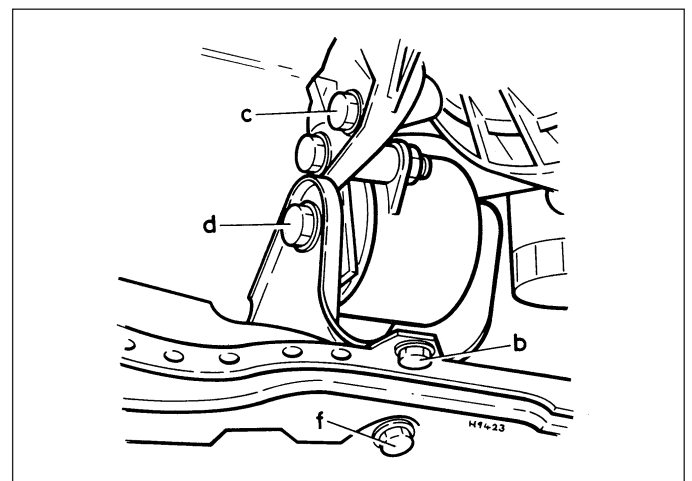
### 41 Engine - adjustments after major overhaul



- 1 With the engine/gearbox unit fitted to the vehicle, make a final check to ensure that everything has been reconnected and that no rags or tools have been left in the engine compartment.
- 2 If new pistons or crankshaft bearings have been fitted, turn the carburettor engine speed screw in about half a turn to compensate for the initial tightness of the new components.
- 3 Fully pull out the choke (manual choke models) and start the engine. This may take a little longer than usual as the fuel pump and carburettor float chamber may be empty.
- 4 As soon as the engine starts, push in the choke to the detent. Check that the oil pressure light goes out.
- 5 Check the oil filter, fuel hoses and coolant hoses for leaks.
- 6 Run the engine to normal operating temperature, then adjust the slow running (idle).
- 7 If new pistons or crankshaft bearings have been fitted, the engine must be run-in for the first 500 miles (750 km). Do not operate the engine at full throttle or allow the engine to labour in any gear.
- 8 Although not strictly essential, it is good practice to change the engine oil and filter after the initial running-in period. This will get rid of the small metallic particles which are produced by new components bedding in to each other.



40.1a Engine mounting bolt identification - see Specifications for torque settings



40.1b Engine/transmission mounting bolt identification - see Specifications for torque settings