

Chapter 2 Part A:

1.2 litre engine in-car repair procedures

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Degrees of difficulty

Easy, suitable for novice with little experience



Fairly easy, suitable for beginner with some experience



Fairly difficult, suitable for competent DIY mechanic



Difficult, suitable for experienced DIY mechanic



Very difficult, suitable for expert DIY or professional



Specifications

General

Engine code*	182.B2.000
Bore	70.8 mm
Stroke	78.86 mm
Capacity	1242 cc
Compression ratio	10.2:1
Firing order	1-3-4-2
No 1 cylinder location	Timing belt end of engine

*Note: See 'Vehicle Identification numbers' for the location of code marking on the engine.

Lubrication system

Oil pump type	Bi-rotor driven from front of crankshaft
Outer rotor-to-housing clearance	0.100 to 0.210 mm
Axial clearance	0.025 to 0.070 mm

Camshafts

Drive	Toothed belt to exhaust camshaft, gear drive to inlet camshaft
No of bearings	3
Camshaft bearing journal diameters:	
No 1 bearing	35.000 to 35.015 mm
No 2 bearing	48.000 to 48.015 mm
No 3 bearing	49.000 to 49.015 mm
Camshaft bearing journal running clearance	0.030 to 0.070 mm
Camshaft endfloat	0.15 to 0.34 mm

Cylinder head extensions

Camshaft bearing diameters:	
No 1 bearing	35.045 to 35.070 mm
No 2 bearing	48.045 to 48.070 mm
No 3 bearing	49.045 to 49.070 mm
Hydraulic tappet diameter	28.353 to 28.370 mm
Hydraulic tappet bore diameter	28.400 to 28.421 mm
Hydraulic tappet running clearance	0.046 to 0.051 mm

Torque wrench settings	Nm	lbf ft
Air conditioning compressor mounting bracket-to-block	50	37
Auxiliary drivebelt pulley bolts	22	16
Big-end (connecting rod) bearing cap bolts	41	30
Camshaft bearing caps	15	11
Camshaft gears	120	89
Camshaft sprocket	120	89
Crankshaft sprocket centre bolt (left-hand thread):		
Stage 1	20	15
Stage 2	Angle-tighten a further 90°	
Cylinder head:		
Stage 1	20	15
Stage 2	30	22
Stage 3	Angle-tighten a further 90°	
Stage 4	Angle-tighten a further 90°	
Cylinder head extension to cylinder head	15	11
Dipstick tube nut and bolt	9	7
Engine/transmission mountings:		
Mounting brackets to transmission:		
M10 bolts	50	37
M12 bolts	85	63
Mounting through-bolts	80	59
Mountings to bodyshell	32	24
Right-hand mounting bracket to block	50	37
Right-hand mounting reaction rod	28	21
Exhaust manifold nuts	27	20
Flywheel*	44	32
Inlet manifold nuts	15	11
Main bearing cap bolts:		
Stage 1	40	30
Stage 2	Angle-tighten a further 90°	
Oil pressure switch	32	24
Oil pump bolts	9	7
Sump bolts	10	7
Timing belt tensioner nut	25	18

*Although not specifically recommended by FIAT, use locking fluid.

1 General information

Using this Chapter

Chapter 2 is divided into five Parts: A to E. Repair operations that can be carried out with the engine in the vehicle are described in Parts A to D. Part E covers the removal of the engine/transmission as a unit, and describes the engine dismantling and overhaul procedures.

In Parts A to D, the assumption is made that the engine is installed in the vehicle, with all ancillaries connected. If the engine has been removed for overhaul, the preliminary dismantling information which precedes each operation may be ignored.

Engine description

The 1.2 litre engine is a water-cooled, double overhead camshaft, in-line four-cylinder unit, with cast-iron cylinder block and aluminium-alloy cylinder head. The unit is mounted transversely at the front of the vehicle, with the transmission bolted to the left-hand side of the engine.

The cylinder head houses the eight inlet

and eight exhaust valves, which are closed by single coil springs, and which run in guides pressed into the cylinder head. The two camshafts are housed in a cylinder head extension which is bolted to the top of the cylinder head. The exhaust camshaft is driven by a toothed timing belt and in turn drives the inlet camshaft via a pair of gears located at the left-hand end of the cylinder head extension. The camshafts each have three bearings, and actuate the valves directly via self-adjusting hydraulic tappets mounted in the cylinder head extension.

The crankshaft is supported by five main bearings, and endfloat is controlled by the thrust flanges fitted to the upper half of the centre main bearing shell.

Engine coolant is circulated by a pump, driven by the timing belt. For details of the cooling system, refer to Chapter 3.

Lubricant is circulated under pressure by a pump, driven from the front of the crankshaft. Oil is drawn from the sump through a strainer, and then forced through an externally-mounted, replaceable screw-on filter. From there, it is distributed to the cylinder head and cylinder head extension, where it lubricates the camshaft journals and tappets, and also to the crankcase, where it lubricates the main bearings, connecting rod big and small-ends,

gudgeon pins and cylinder bores. Oil jets are fitted to the base of each cylinder bore - these spray oil onto the underside of the pistons, to improve cooling.

Repair operations possible with the engine in the car

The following work can be carried out with the engine in the car:

- Auxiliary drivebelt - removal and refitting (refer to Chapter 1).*
- Oil pump and pick-up tube assembly - removal, inspection and refitting.*
- Timing belt and covers - removal and refitting.*
- Timing belt tensioner and sprockets - removal and refitting.*
- Cylinder head - removal and refitting*.*
- Cylinder head extension - removal and refitting.*
- Camshaft and tappets - removal and refitting.*
- Camshaft oil seal - renewal.*
- Crankshaft oil seals - renewal.*
- Flywheel - removal, inspection and refitting.*
- Engine mountings - inspection and renewal.*
- Sump - removal and refitting.*

*Cylinder head dismantling procedures are detailed in Chapter 2E.

Note 1: It is possible to remove the pistons and connecting rods (after removing the cylinder head and sump) without removing the engine. However, this is not recommended. Work of this nature is more easily and thoroughly completed with the engine on the bench, as described in Chapter 2E.

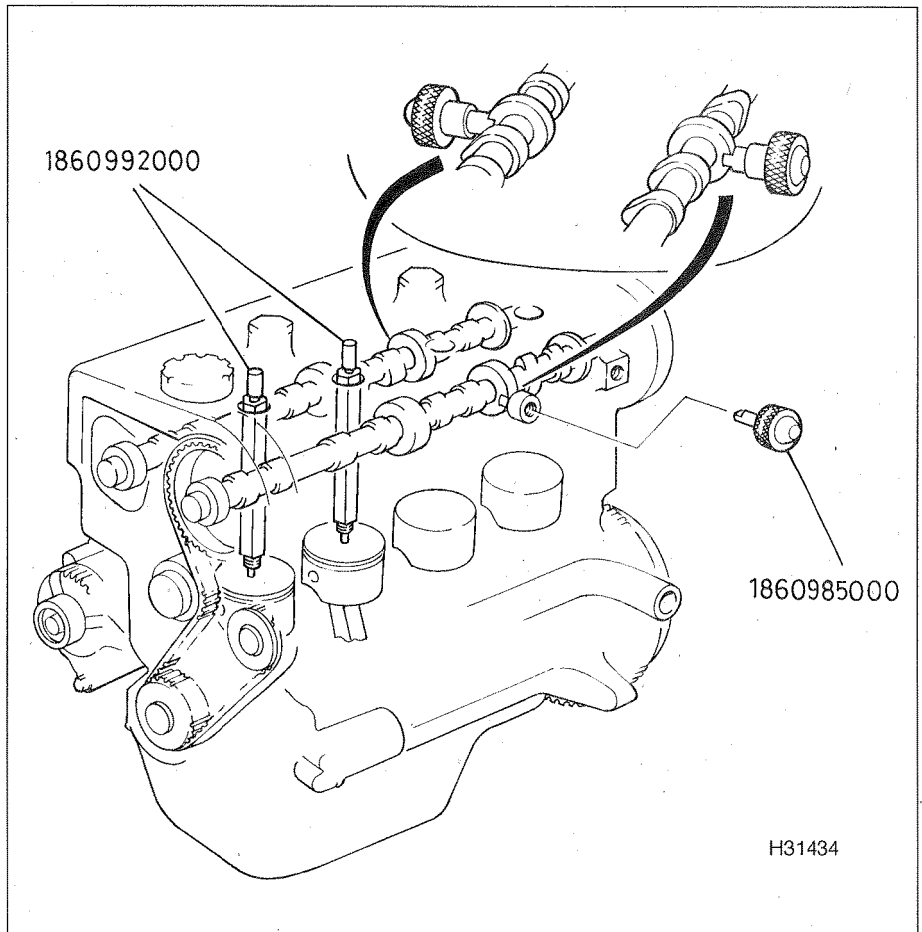
Note 2: Many of the procedures in this Chapter entail the use of numerous special tools. Where possible, suitable alternatives are described with details of their fabrication. Before starting any operations on the engine, read through the entire procedure first to familiarise yourself with the work involved, tools to be obtained and new parts that may be necessary.

2 Engine assembly/ valve timing holes - general information and usage

Note: Do not attempt to rotate the engine whilst the camshafts are locked in position. If the engine is to be left in this state for a long period of time, it is a good idea to place suitable warning notices inside the vehicle, and in the engine compartment. This will reduce the possibility of the engine being accidentally cranked on the starter motor, which is likely to cause damage with the locking tools in place.

1 To accurately set the valve timing for all operations requiring removal and refitting of the timing belt, timing holes are drilled in the camshafts and cylinder head extension. The holes are used in conjunction with camshaft locking tools and crankshaft positioning rods to lock the camshafts when all the pistons are positioned at the mid-point of their stroke. This arrangement prevents the possibility of the valves contacting the pistons when refitting the cylinder head or timing belt, and also ensures that the correct valve timing can be obtained. The design of the engine is such that there are no conventional timing marks on the crankshaft or camshaft sprockets to indicate the normal TDC position. Therefore, for any work on the timing belt, camshafts or cylinder head, the locking and positioning tools must be used.

2 The special FIAT tools for setting the camshafts and pistons consist of two rods which slide in sleeves that are screwed into No 1 and No 2 cylinder spark plug holes. The rods are pushed down to contact the pistons, and the crankshaft is then turned until both rods protrude from their sleeves by the same amount. With the crankshaft correctly set, two camshaft locking pins are used, one for the inlet camshaft and one for the exhaust camshaft. The pins are screwed into holes on each side of the cylinder head extension so that they engage with slots machined in the camshafts. The arrangement of the FIAT special tools are shown (see illustrations). The tool numbers are as follows:



2.2a Arrangement of FIAT special tools for setting the piston position and locking the camshafts

Camshaft locking tools - 1860985000

Piston positioning tool - 1860992000

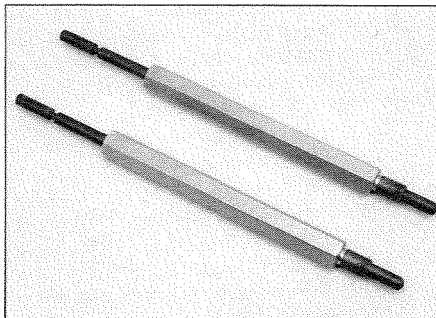
3 Although the special FIAT tools are relatively inexpensive and should be readily available from FIAT dealers, it is possible to fabricate suitable alternatives, with the help of a local machine shop, as described below. Once the tools have been made up, their usage is described in the relevant Sections of this Chapter where the tools are required.

Camshaft locking tool fabrication

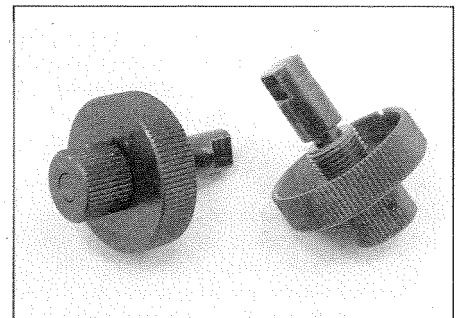
4 Remove the air cleaner, inlet air duct and resonator as described in Chapter 4B.

5 Unscrew the sealing plug from the front face of the cylinder head extension.

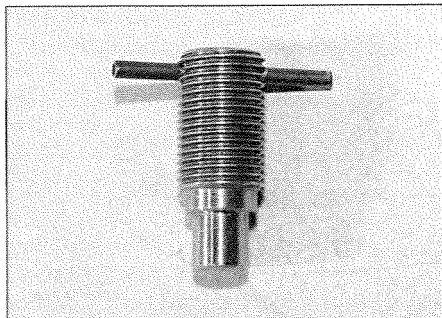
6 Using the sealing plug as a pattern, obtain a length of threaded dowel rod or two suitable bolts to screw into the sealing plug hole. With



2.2b FIAT special tool for setting piston position ...



2.2c ... and locking the camshafts



2.6a To make an alternative camshaft locking tool . . .

the help of a machine shop or engineering works, make up the camshaft locking tools by having the dowel rod or bolts machined to the dimensions shown (see illustrations). Note that two will be needed, one for each camshaft.

Crankshaft setting tool fabrication

7 To make the crankshaft setting tools, four old spark plugs will be required, together with four lengths of dowel rod. The length of each dowel rod is not critical, but it must be long enough to protrude about 100 mm above the top of the cylinder head extension when resting on top of a piston located half way down its bore. What is critical, however, is that all four dowel rods must be **exactly** the same length.

8 Break off the ceramic upper section of each plug, and remove the centre electrode and earth tip. The easiest way to do this is to mount each spark plug in a vice (after removing the ceramic upper plug section) and drill a hole down through the centre of the plug. The diameter of the drill bit should be the same as the diameter of the dowel rod to be used. When finished, you should have four spark plug bodies and four equal-length dowel rods which will slide through the centre of the spark plugs.

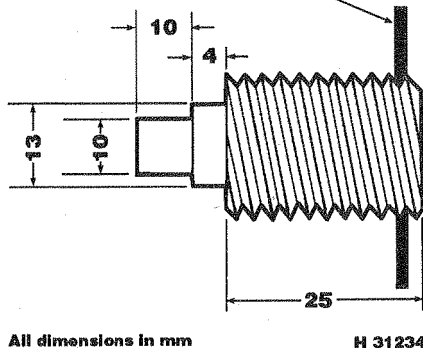
3 Cylinder compression test

1 When engine performance is down, or if misfiring occurs which cannot be attributed to the ignition or fuel systems, a compression test can provide diagnostic clues as to the engine's condition. If the test is performed regularly, it can give warning of trouble before any other symptoms become apparent.

2 The engine must be fully warmed-up to normal operating temperature, the battery must be fully charged, and all the spark plugs must be removed (Chapter 1). The aid of an assistant will also be required.

3 Disable the ignition system by disconnecting the LT wiring plug to the ignition coil unit.

Suitable roll pin for fitting / removing tool



2.6b . . . have suitable dowel rods or bolts machined to the dimensions shown

4 Fit a compression tester to the No 1 cylinder spark plug hole - the type of tester which screws into the plug thread is to be preferred.

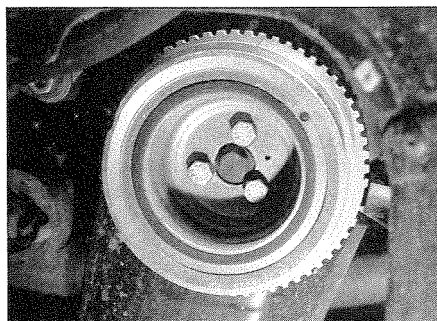
5 Have the assistant hold the throttle wide open, and crank the engine on the starter motor; after one or two revolutions, the compression pressure should build up to a maximum figure, and then stabilise. Record the highest reading obtained.

6 Repeat the test on the remaining cylinders, recording the pressure in each.

7 All cylinders should produce very similar pressures; any excessive difference indicates the existence of a fault. Note that the compression should build up quickly in a healthy engine; low compression on the first stroke, followed by gradually increasing pressure on successive strokes, indicates worn piston rings. A low compression reading on the first stroke, which does not build up during successive strokes, indicates leaking valves or a blown head gasket (a cracked head could also be the cause).

8 If the pressure in any cylinder is very low, carry out the following test to isolate the cause. Introduce a teaspoonful of clean oil into that cylinder through its spark plug hole and repeat the test.

9 If the addition of oil temporarily improves the compression pressure, this indicates that



4.8 Undo the three bolts and remove the crankshaft pulley from the sprocket

bore or piston wear is responsible for the pressure loss. No improvement suggests that leaking or burnt valves, or a blown head gasket, may be to blame.

10 A low reading from two adjacent cylinders is almost certainly due to the head gasket having blown between them; the presence of coolant in the engine oil will confirm this.

11 If one cylinder is about 20 percent lower than the others and the engine has a slightly rough idle, a worn camshaft lobe could be the cause.

12 On completion of the test, refit the spark plugs and reconnect the ignition LT wiring plug.

4 Timing belt and covers - removal and refitting

General information

1 The function of the timing belt is to drive the camshafts and coolant pump. Should the belt slip or break in service, the valve timing will be disturbed and piston-to-valve contact will occur, resulting in serious engine damage.

2 The timing belt should be renewed at the specified intervals (see Chapter 1), or earlier if it is contaminated with oil, or if it is at all noisy in operation (a scraping noise due to uneven wear).

3 If the timing belt is being removed, it is a wise precaution to check the condition of the coolant pump at the same time (check for signs of coolant leakage). This may avoid the need to remove the timing belt again at a later stage, should the coolant pump fail.

4 Before carrying out this procedure, it will be necessary to obtain or fabricate suitable camshaft locking tools and piston positioning tools as described in Section 2. The procedures contained in this Section depict the use of the home-made alternative tools described in Section 2, which were fabricated in the Haynes workshop. If the manufacturers tools are being used instead, the procedures are virtually identical. Do not attempt to remove the timing belt unless the special tools or their alternatives are available.

Removal

5 Disconnect the battery negative terminal (refer to *Disconnecting the battery*).

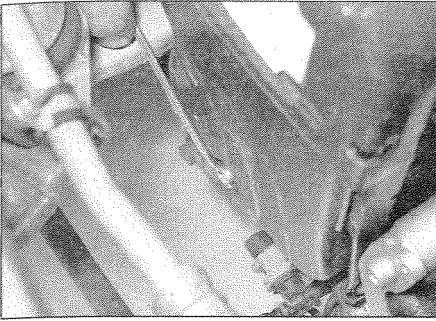
6 Remove the auxiliary drivebelts as described in Chapter 1.

7 Remove the air cleaner, inlet air duct and resonator as described in Chapter 4B.

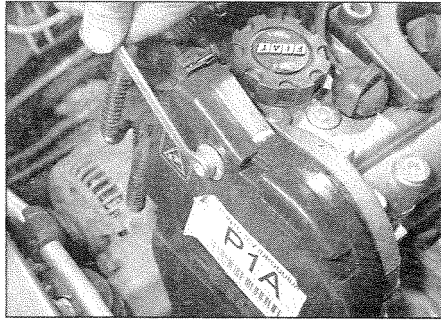
8 Undo the three bolts and remove the crankshaft pulley from the sprocket (see illustration).

9 Undo the retaining bolt in the centre of the lower timing cover (see illustration).

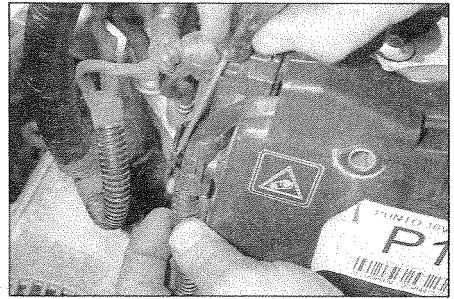
10 Undo the upper timing cover upper retaining bolt, and the rear retaining bolt located above the alternator (see illustration).



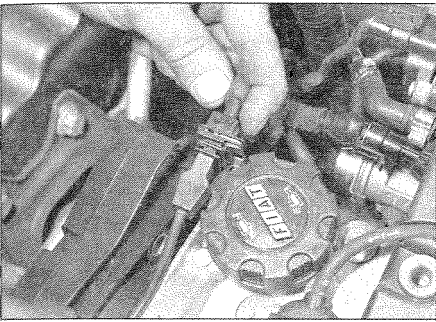
4.9 Undo the retaining bolt in the centre of the lower timing cover



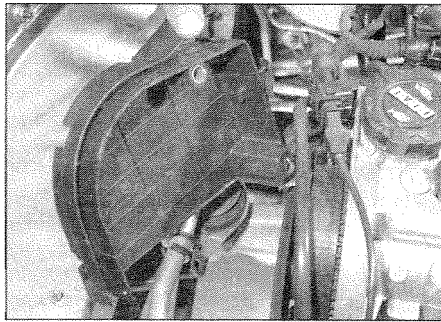
4.10 Undo the upper timing cover upper retaining bolt, and the rear retaining bolt



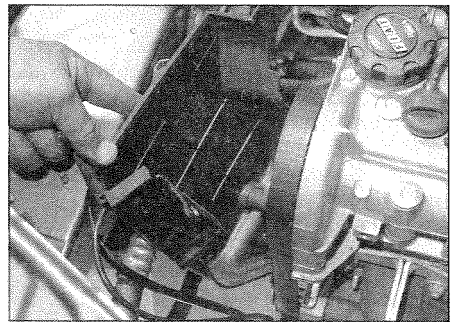
4.11a Release the crankshaft TDC sensor wiring from the clip on the upper timing cover ...



4.11b ... then slide the wiring plug and socket from the timing cover slot



4.12a Remove the upper ...



4.12b ... and lower timing covers

11 Release the crankshaft TDC sensor wiring from the clip on the upper timing cover, then withdraw the cover slightly and slide the wiring plug and socket from the timing cover slot (**see illustrations**).

12 Release the TDC sensor wiring from the periphery of the upper and lower timing covers, and remove both covers (**see illustrations**).

13 Free the accelerator inner cable from the throttle cam, remove the outer cable spring clip, then pull the outer cable out from its mounting bracket rubber grommet.

14 From the side of the throttle body, disconnect the wiring connectors from the throttle potentiometer and the idle control stepper motor. Disconnect the coolant temperature sensor wiring connector located in the inlet manifold below the throttle body,

and disconnect the brake servo vacuum hose.

15 Disconnect the wiring connectors for the fuel injector harness and the intake air temperature/pressure sensor, then disconnect the fuel pressure regulator vacuum hose and the EVAP purge valve hose.

16 Undo the two bolts securing the plastic inlet manifold upper section to the lower section. Release the spark plug HT lead from the location groove in the manifold upper section, then lift the upper section, complete with throttle body, off the engine. Recover the O-rings from the manifold ports.

17 Unscrew the two bolts securing the fuel rail assembly to the inlet manifold lower section, then carefully pull the injectors from the manifold. Lift the fuel rail and injector assembly, with fuel hoses still connected, and position it to one side.

18 Undo the bolts securing the engine management ECU mounting brackets to the body, and move the ECU to one side without disconnecting the wiring connector.

19 Remove the spark plugs as described in Chapter 1.

20 Unscrew the two sealing plugs from the front and rear of the cylinder head extension to enable the camshaft locking tools to be inserted.

21 Screw the spark plug bodies of the home-made piston positioning tools into each spark plug hole, and insert the dowel rods into each body. To keep the dowel rods vertical, locate a suitable washer or similar over the rod and into the recess at the top of the spark plug hole. In the photos shown here, an old valve stem oil seal housing was used, but anything similar will suffice (**see illustrations**).



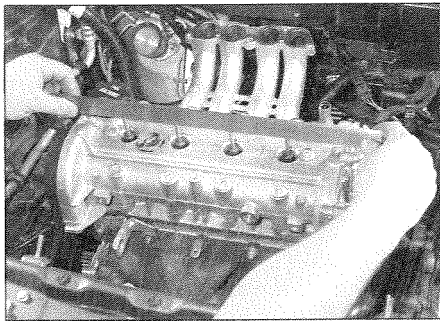
4.21a Screw the spark plug bodies of the home-made piston positioning tools into each spark plug hole ...



4.21b ... place a suitable washer or similar into the recess to keep the dowel rod vertical ...



4.21c ... then insert the dowel rods

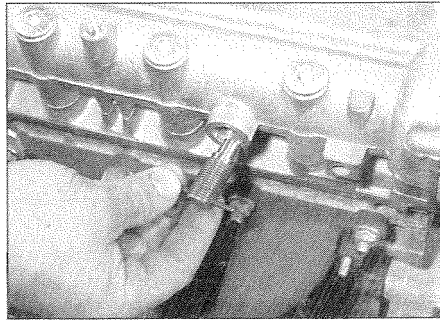


4.22 Place a straight edge along the top of the rods and turn the crankshaft until the straight edge contacts all four rods

22 Using a socket on the crankshaft sprocket centre bolt, turn the crankshaft in the normal direction of rotation until all four dowel rods are protruding from the top of the cylinder head extension by the same amount. As the engine is turned, two of the rods will move up, and two will move down until the position is reached where they are all at the same height. The best way to check this is to place a straight-edge along the top of the rods and turn the crankshaft very slowly until the straight-edge contacts all four rods (*see illustration*).

23 When all four rods are at the same height, all the pistons will be at the mid-point of their stroke. Using a screwdriver or similar inserted into the front timing hole in the cylinder head extension, check that the timing slot in the exhaust camshaft is approximately aligned with the timing hole. If the camshaft slot cannot be felt, turn the crankshaft through one complete revolution and realign the dowel rods using the straight-edge. Check again for the camshaft slot. Note that, although the pistons can be at the mid-point of their stroke twice for each cycle of the engine, the camshaft slots will only be positioned correctly once per cycle.

24 With the pistons correctly set, it should now be possible to screw in the camshaft locking tools into the timing holes in the cylinder head extension. To provide the necessary degree of timing accuracy, the machined ends of the locking tools are a very close fit in the slots machined in the



4.24a Screw in the camshaft locking tools into the timing holes in the cylinder head extension

camshafts. To allow the tools to be screwed fully into engagement, it may be necessary to move the crankshaft in one direction or another very *slightly* until the tools are felt to engage fully (*see illustrations*).

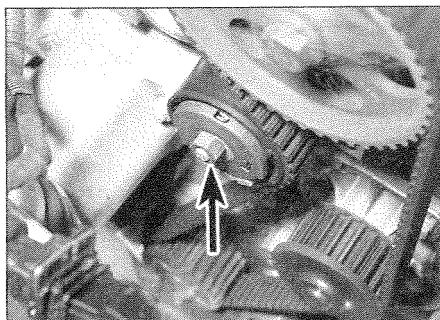
25 Release the nut on the timing belt tensioner to release the tension on the belt (*see illustration*).

26 If the timing belt is to be re-used, use white paint or chalk to mark the direction of rotation on the belt (if markings do not already exist), then slip the belt off the sprockets (*see illustration*). Note that the crankshaft must not be rotated whilst the belt is removed.

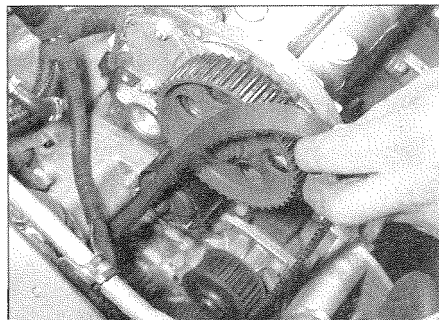
27 Check the timing belt carefully for any signs of uneven wear, splitting, or oil contamination. Pay particular attention to the roots of the teeth. Renew it if there is the slightest doubt about its condition. If the engine is undergoing an overhaul, renew the belt as a matter of course, regardless of its apparent condition. The cost of a new belt is nothing compared with the cost of repairs, should the belt break in service. If signs of oil contamination are found, trace the source of the oil leak and rectify it. Wash down the engine timing belt area and all related components, to remove all traces of oil.

Refitting

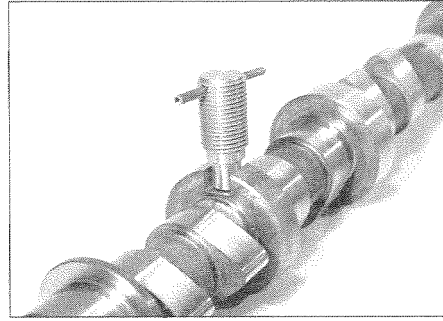
28 Before refitting, thoroughly clean the timing belt sprockets. Check that the tensioner pulley rotates freely, without any sign of roughness. If necessary, renew the tensioner pulley as described in Section 5.



4.25 Release the nut on the timing belt tensioner (arrowed)



4.26 Slip the timing belt off the sprockets



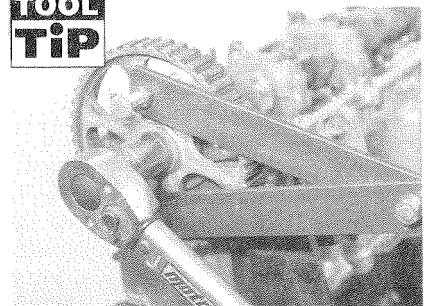
4.24b The tools engage in the camshaft slots when fitted (shown removed for clarity)

29 The camshaft sprocket retaining bolt must now be slackened to allow the sprocket to move as the timing belt is refitted and tensioned. To hold the sprocket stationary while the retaining bolt is loosened, make up a tool as follows and engage it with the holes in the sprocket (*see Tool Tip*). With the sprocket held, slacken the retaining bolt.

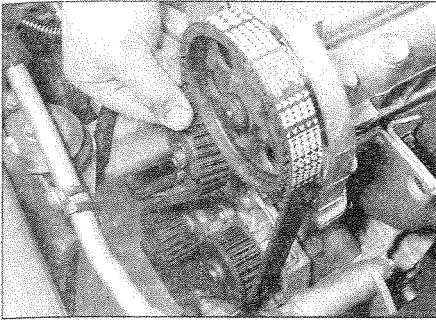
30 Check that the pistons are still correctly positioned at the mid-point of their stroke and that the camshafts are locked with the locking tools.

31 Ensuring that the direction markings on the timing belt point in the normal direction of engine rotation, engage the timing belt with the crankshaft sprocket first, then place it around the coolant pump sprocket and the camshaft sprocket (*see illustration*). Finally slip the belt around the tensioner pulley.

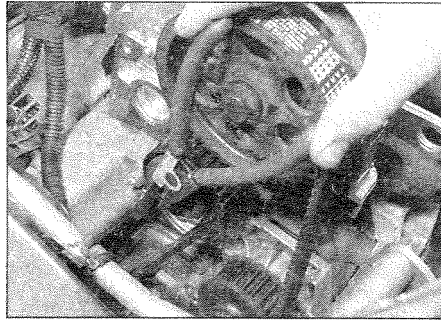
TOOL TIP



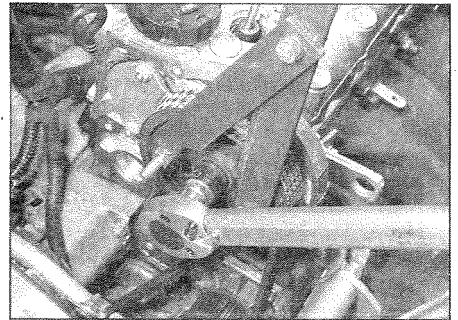
To make a camshaft sprocket holding tool, obtain two lengths of steel strip about 6 mm thick by 30 mm wide or similar, one 600 mm long, the other 200 mm long (all dimensions approximate). Bolt the two strips together to form a forked end, leaving the bolt slack so that the shorter strip can pivot freely. At the end of each 'prong' of the fork, secure a bolt with a nut and a locknut, to act as the fulcrums; these will engage with the cut-outs in the sprocket, and should protrude by about 30 mm



4.31 Fit the new belt around the sprockets observing the direction markings



4.32 Using right-angled circlip pliers, turn the tensioner pulley to fully tension the belt



4.33 Holding the camshaft sprocket with the tool described previously while tightening the sprocket bolt

32 Insert the jaws of a pair of right-angled circlip pliers (or similar) into the two holes on the front face of the tensioner pulley (**see illustration**). Rotate the pulley to tension the belt until the belt is quite taut. Maintain the effort applied to the tensioner pulley, then tighten the pulley retaining nut.

33 Tighten the camshaft sprocket retaining bolt to the specified torque while holding the camshaft stationary using the method described previously (**see illustration**).

34 Remove the piston positioning tools and camshaft locking tools, and turn the crankshaft through two complete turns in the normal direction of rotation.

35 Slacken the tensioner pulley retaining nut and reposition the tensioner to align the mobile indicator with the fixed reference mark on the pulley face (**see illustration**). Hold the pulley in this position, and tighten the retaining nut to the specified torque.

36 Turn the crankshaft through a further two complete turns in the normal direction of rotation. Check that the timing is correct by refitting the piston positioning tools and camshaft locking tools as described previously.

37 When all is correct, remove the setting and locking tools and refit the sealing plugs to the cylinder head extension, using new O-rings if necessary. Tighten the plugs securely.

38 Refit the spark plugs as described in Chapter 1.

39 Refit the ECU and secure with the mounting bolts.

40 Renew the injector O-ring seals, smear them with a little Vaseline, then locate the injectors and fuel rail onto the inlet manifold lower section. Secure the fuel rail with the two retaining bolts.

41 Refit the inlet manifold upper section using new sealing O-rings if necessary, and secure with the two bolts.

42 Reconnect the wiring connectors for the fuel injector harness and the intake air temperature/pressure sensor, then connect the fuel pressure regulator vacuum hose and the EVAP purge valve hose.

43 Reconnect the wiring connectors for the throttle potentiometer, idle control stepper motor and coolant temperature sensor. Reconnect the brake servo vacuum hose.

44 Refit and adjust the accelerator cable as described in Chapter 4B.

45 Refit the upper and lower timing belt covers together with the TDC sensor wiring.

46 Refit the crankshaft pulley and tighten the three retaining bolts securely.

47 Refit the air cleaner, inlet air duct and resonator as described in Chapter 4B.

48 Refit the auxiliary drivebelts as described in Chapter 1, then reconnect the battery negative terminal.

5 Timing belt tensioner and sprockets - removal and refitting

Timing belt tensioner

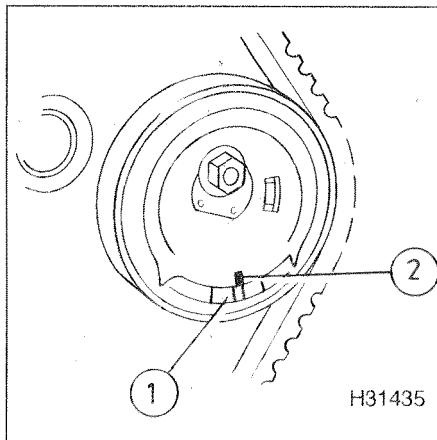
Removal

1 Remove the timing belt as described in Section 4.

2 Completely unscrew the tensioner nut and slide the tensioner off the mounting stud.

Inspection

3 Wipe the tensioner clean, but do not use solvents that may contaminate the bearings.



4.35 Position the tensioner so that the mobile indicator (1) is aligned with the fixed reference mark (2)

Spin the tensioner pulley on its hub by hand. Stiff movement or excessive freeplay is an indication of severe wear; the tensioner is not a serviceable component, and should be renewed.

Refitting

4 Slide the tensioner pulley over the mounting stud and fit the securing nut.

5 Refit the timing belt as described in Section 4.

Exhaust camshaft sprocket

Removal

6 Remove the timing belt as described in Section 4.

7 Unscrew the bolt and slide the sprocket from the end of the camshaft.

Inspection

8 With the sprocket removed, examine the camshaft oil seal for signs of leaking. If necessary, refer to Section 6 and renew it.

9 Check the sprocket teeth for damage.

10 Wipe clean the sprocket and camshaft mating surfaces.

Refitting

11 Locate the sprocket on the end of the camshaft, then refit the retaining bolt finger-tight only at this stage.

12 Refit the timing belt as described in Section 4.

Crankshaft sprocket

Removal

13 Remove the timing belt as described in Section 4.

14 Working beneath the engine, unbolt and remove the flywheel lower cover, then hold the flywheel stationary preferably using a tool which engages the flywheel starter ring gear. Alternatively, have an assistant engage a wide-bladed screwdriver with the starter ring gear.

15 Unscrew the crankshaft sprocket retaining bolt, and slide the sprocket off the end of the crankshaft. The sprocket may have an integral location key on its inner face, or a

separate key which locates in a groove in the crankshaft nose may be fitted.

Inspection

16 With the sprocket removed, examine the crankshaft oil seal for signs of leaking. If necessary, refer to Section 7 and renew it.

17 Check the sprocket teeth for damage.

18 Wipe clean the sprocket and crankshaft mating surfaces.

Refitting

19 Slide the sprocket onto the crankshaft, making sure it engages the integral key or separate key. Refit the bolt and washer, and tighten the bolt to the specified torque while holding the crankshaft stationary using the method described in paragraph 14.

20 Refit the timing belt as described in Section 4.

6 Camshaft oil seal - renewal

1 Remove the timing belt and camshaft sprocket as described in Sections 4 and 5.

2 Punch or drill a small hole in the oil seal. Screw a self-tapping screw into the hole, and pull on the screws with pliers to extract the seal.

3 Clean the seal housing, and polish off any burrs or raised edges, which may have caused the seal to fail in the first place.

4 Lubricate the lips of the new seal with clean engine oil, and drive it into position until it seats on its locating shoulder. Use a suitable tubular drift, such as a socket, which bears only on the hard outer edge of the seal. Take care not to damage the seal lips during fitting. Note that the seal lips should face inwards.

5 Refit the camshaft sprocket and timing belt as described in Sections 5 and 4.

7 Crankshaft oil seals - renewal

Front (right-hand side) oil seal

1 The front oil seal is located in the oil pump on the front of the crankshaft. Remove the timing belt as described in Section 4 and the crankshaft sprocket as described in Section 5.

2 Using a hooked instrument, remove the oil seal from the oil pump casing, taking care not to damage the surface of the crankshaft.

3 Clean the seating in the housing and the surface of the crankshaft. To prevent damage to the new oil seal as it is being fitted, wrap some adhesive tape around the end of the crankshaft and lightly oil it.

4 Dip the new oil seal in oil, then offer it up to the oil pump casing, making sure that the sealing lips are facing inwards.

5 Using a suitable tubular drift, drive the oil seal squarely into the casing. Remove the adhesive tape.

6 Refit the crankshaft sprocket and timing belt with reference to Sections 5 and 4.

Rear (left-hand side) oil seal

Note: The following paragraphs describe renewal of the rear oil seal leaving the housing in position. Refer to Chapter 2E for details of removing the housing.

7 Remove the flywheel as described in Section 11.

8 Using a suitable hooked instrument, remove the oil seal from the rear oil seal housing taking care not to damage the surface of the crankshaft.

9 Clean the seating in the housing and the surface of the crankshaft. Check the crankshaft for burrs which may damage the sealing lip of the new seal, and if necessary use a fine file to remove them.

10 Dip the new seal in clean engine oil and carefully locate it over the crankshaft rear flange, making sure that it is the correct way round (lips facing inwards).

11 Progressively tap the oil seal into the housing, keeping it square to prevent distortion. A block of wood is useful for this purpose.

12 Refit the flywheel (see Section 11).

8 Cylinder head extension - removal and refitting

Removal

1 Remove the timing belt as described in Section 4.

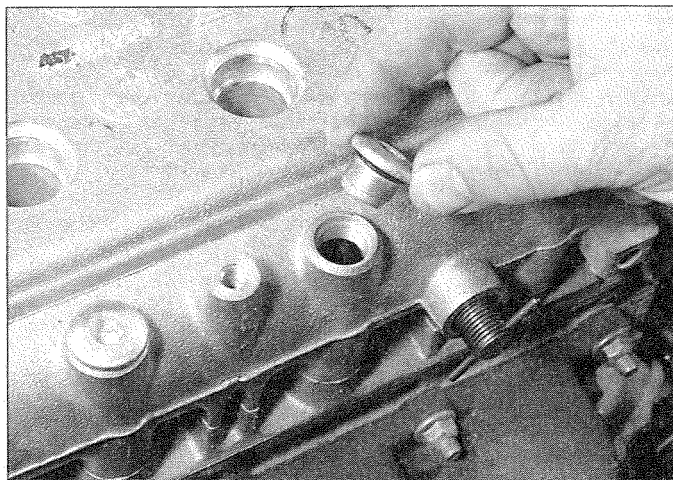
2 Identify the HT leads for position, then disconnect them from the coil HT terminals.

3 Disconnect the LT wiring plug from the ignition coil unit, then unscrew the mounting bolts and remove the ignition coil assembly from the end of the cylinder head extension.

4 Undo the bolt and remove the resonator support bracket from the top of the cylinder head extension.

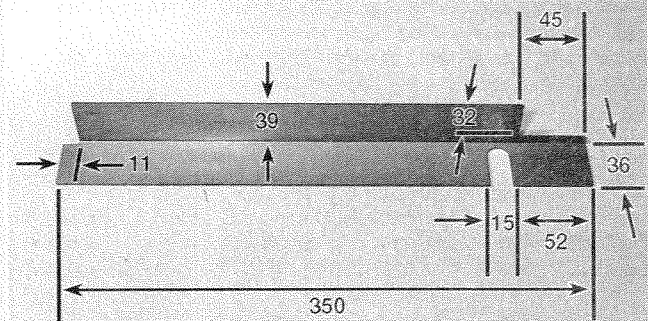
5 Unscrew the protective caps covering the cylinder head extension retaining bolts (see illustration).

6 To retain the tappets in place as the cylinder head extension is removed, FIAT special tool No 1860988000 will be required. This tool is two strips of suitably slotted thin metal angle bracket which slip between the cylinder head extension and cylinder head mating faces as the extension is lifted off. The tool holds the tappets in place in the extension, allowing the assembly to be withdrawn without fouling the inlet and exhaust valves. The tools are relatively inexpensive and readily available from FIAT dealers. Suitable alternatives can be fabricated, if desired, using thin metal angle strip cut to the dimensions shown (see Tool Tip).

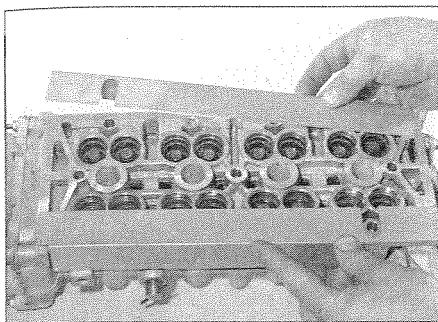


8.5 Unscrew the protective caps covering the cylinder head extension retaining bolts

TOOL TIP



To make a cam follower retaining tool, obtain two lengths of thin metal angle and cut both to the dimensions (in mm) shown



8.8a Lift the cylinder head extension slightly and insert the tools (shown with cylinder head removed for clarity) . . .

7 Progressively slacken and remove the bolts securing the cylinder head extension to the cylinder head.

8 Lift the cylinder head extension up very slightly, keeping it square to the cylinder head. Slip the tools in place to hold the tappets, then lift the extension off the cylinder head (see illustrations). Recover the gasket between the two assemblies.

9 Dismantling and inspection procedures for the cylinder head extension and camshafts are given in Section 9.

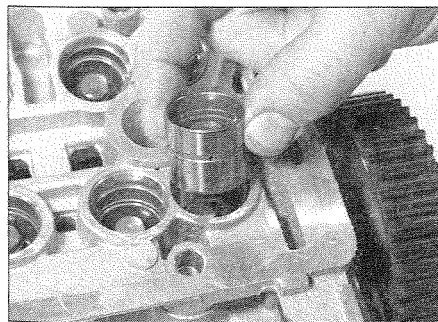
Refitting

10 Ensure that the mating faces of the cylinder head and extension are thoroughly cleaned, with all traces of old gasket removed, then locate a new gasket on the cylinder head (see illustration).

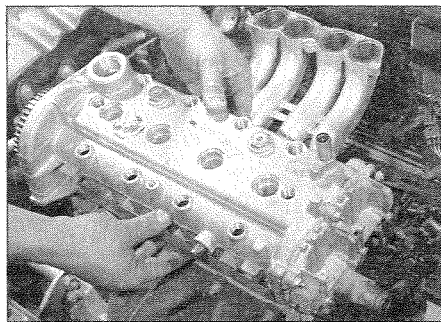
11 Locate the tappet retaining tools in position, then lower the extension assembly onto the cylinder head. When all the tappets have engaged their respective valves, remove the tools.

12 Refit the retaining bolts and tighten them progressively to pull the extension down onto the cylinder head. Do this slowly and carefully - the valve springs will be compressed during this operation, and it is essential to keep the extension square and level as the bolts are tightened. Once all the bolts are initially tightened, progressively tighten them further to the specified torque (see illustration).

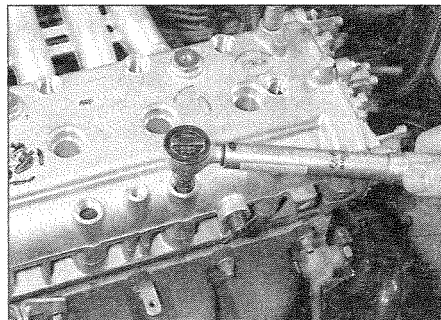
13 If necessary, renew the O-ring seals on the protective caps covering the cylinder head extension retaining bolts (see illustration).



9.3 Remove the cam followers from their locations in the cylinder head extension



8.8b . . . then remove the cylinder head extension



8.12 Refit the cylinder head extension retaining bolts and tighten them to the specified torque

Refit the caps and tighten them securely.

14 Refit the resonator support bracket to the top of the cylinder head extension.

15 Refit the ignition coil assembly and reconnect the wiring.

16 Refit the timing belt as described in Section 4.

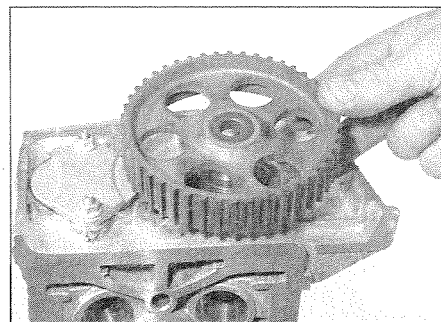
9 Camshafts and tappets - removal, inspection and refitting

Removal

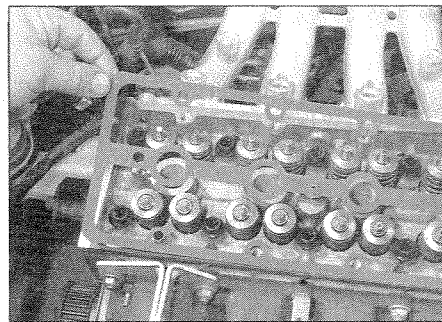
1 Remove the cylinder head extension as described in Section 8.

2 Place the assembly upside-down on a bench, and lift off the tappet retaining tools.

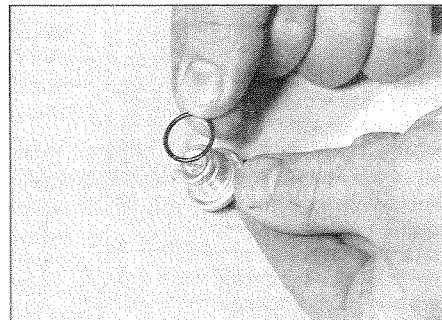
3 Remove the tappets from their locations in



9.5a Remove the camshaft sprocket . . .



8.10 Locate a new gasket on the cylinder head



8.13 Renew the O-ring seals on the protective caps covering the cylinder head extension retaining bolts

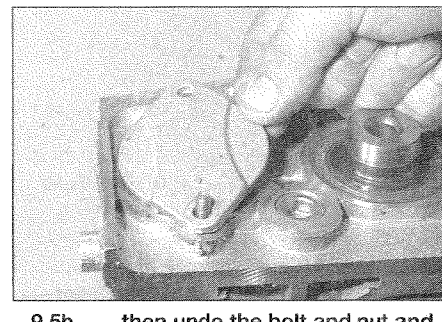
the cylinder head extension, and place them in an oil-tight compartmented box labelled 1 to 8 (inlet) and 1 to 8 (exhaust) (see illustration). Alternatively, place them into individual storage jars or containers, suitably marked. Fill the box or the jars with clean engine oil until each tappet is just submerged.

4 Undo the camshaft sprocket retaining bolt while holding the sprocket with a suitable tool as described in Section 4.

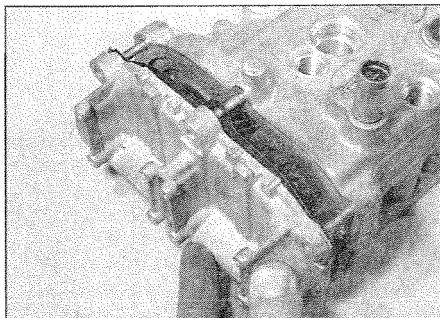
5 Remove the camshaft sprocket, then undo the bolt and nut and remove the cover plate over the inlet camshaft (see illustrations).

6 At the other end of the cylinder head extension, undo the nuts and remove the end cover (see illustration). Recover the gasket.

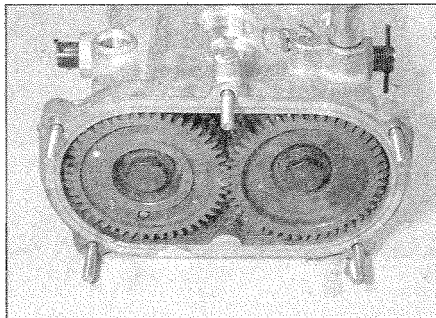
7 Undo the two bolts securing the camshaft drive gears to the inlet and exhaust camshafts (see illustration). The camshaft locking tools used in the timing belt removal procedure



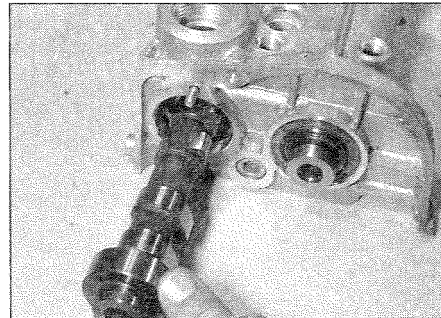
9.5b . . . then undo the bolt and nut and remove the cover plate over the inlet camshaft



9.6 Undo the nuts and remove the end cover



9.7 Undo the two bolts securing the camshaft drive gears to the inlet and exhaust camshafts



9.9 Carefully remove the inlet camshaft from the cylinder head extension

(which should still be in place) are sufficient to prevent the camshafts rotating while the gear retaining bolts are undone. Remove the bolts and withdraw the camshaft gears.

8 Remove the camshaft locking tools.

9 Carefully remove the inlet camshaft from the cylinder head extension (see illustration). Suitably mark the camshaft IN to avoid confusion when refitting.

10 Punch or drill a small hole in the exhaust camshaft oil seal. Screw a self-tapping screw into the hole, and pull on the screw with pliers to extract the seal (see illustration).

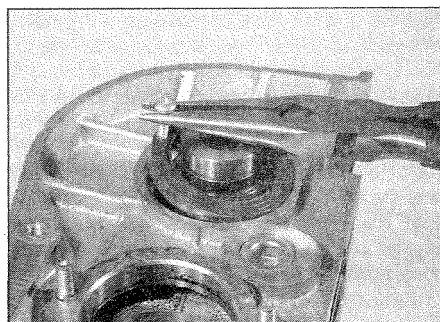
11 Carefully remove the exhaust camshaft from the cylinder head extension (see illustration). Suitably mark the camshaft EX to avoid confusion when refitting.

Inspection

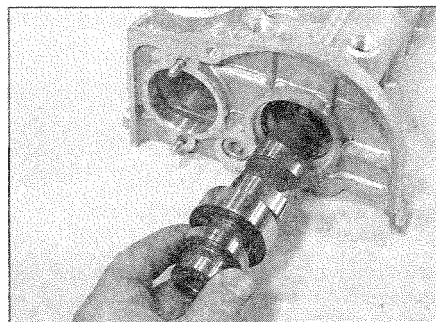
12 Examine the camshaft bearing surfaces

and cam lobes for signs of wear ridges and scoring. Renew the camshaft if any of these conditions are apparent. Examine the condition of the bearing surfaces, both on the camshaft journals and in the cylinder head extension. If the head extension bearing surfaces are worn excessively, the extension will need to be renewed. If suitable measuring equipment is available, camshaft bearing journal wear can be checked by direct measurement.

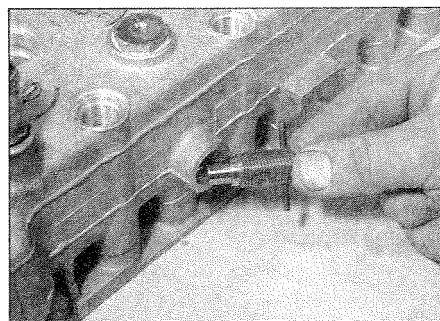
13 Examine the tappet bearing surfaces which contact the camshaft lobes for wear ridges and scoring. Renew any tappet on which these conditions are apparent. If a tappet bearing surface is badly scored, also examine the corresponding lobe on the camshaft for wear, as it is likely that both will be worn. Renew worn components as necessary.



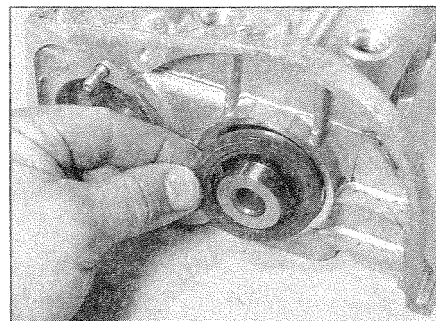
9.10 Extract the exhaust camshaft oil seal . . .



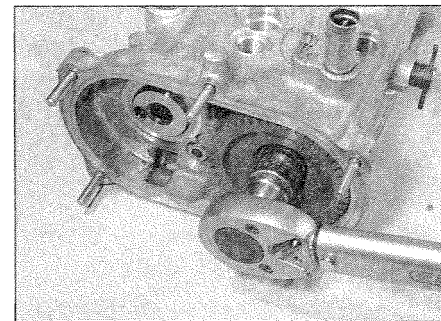
9.11 . . . then remove the exhaust camshaft from the cylinder head extension



9.15 Refit the camshaft locking tools



9.16 Fit a new exhaust camshaft oil seal



9.17 Tighten the inlet camshaft drive gear retaining bolt to the specified torque

Refitting

14 Liberally lubricate the camshaft journals and cylinder head extension bearings, then locate both camshafts in position. Note that the exhaust camshaft is nearest to the front facing side of the engine.

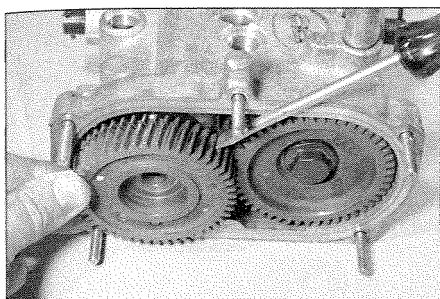
15 With the camshafts in position, rotate them as necessary until the camshaft locking tools can be re-inserted (see illustration).

16 Lubricate the lips of a new exhaust camshaft oil seal with clean engine oil, and drive it into position until it seats on its locating shoulder (see illustration). Use a suitable tubular drift, such as a socket, which bears only on the hard outer edge of the seal. Take care not to damage the seal lips during fitting. Note that the seal lips should face inwards.

17 Refit the inlet camshaft drive gear and retaining bolt, then tighten the bolt to the specified torque (see illustration).

18 Refit the exhaust camshaft drive gear to the exhaust camshaft. As the gear is being fitted, it will be necessary to align the anti-backlash inner gear teeth using a screwdriver to enable the teeth of both the gears to mesh (see illustration).

19 At this stage, it is advisable to check the camshaft endfloat using a dial gauge mounted on the cylinder head extension, with its probe in contact with the camshaft being checked. Move the camshaft one way, zero the gauge, then move the camshaft as far as it will go the other way. Record the reading on the dial gauge, and compare the figure with that given



9.18 Refit the exhaust camshaft drive gear while aligning the anti-backlash inner gear teeth

in the Specifications. Repeat on the other camshaft. If either of the readings exceeds the tolerance given, a new cylinder head extension will probably be required.

20 Locate a new gasket on the cylinder head extension end cover, then wrap round the protruding tangs on the gasket to retain it in position (see illustrations).

21 Locate the end cover on the cylinder head extension, and secure with the retaining nuts securely tightened.

22 Locate a new O-ring on the inlet camshaft cover plate, then apply RTV gasket sealant to the cover plate contact face (see illustrations). Fit the cover plate and secure with the nut and bolt.

23 Refit the camshaft sprocket, and secure with the retaining bolt tightened finger-tight only at this stage.

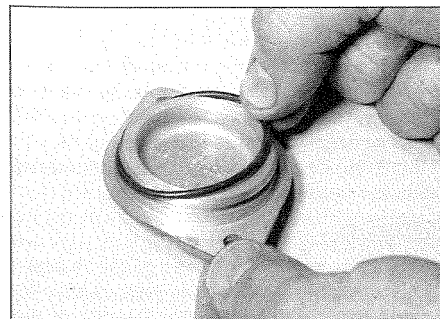
24 Liberally lubricate the tappets and place them in position in their respective cylinder head extension bores (see illustration).

25 Locate the tappet retaining tools in position and refit the cylinder head extension as described in Section 8.

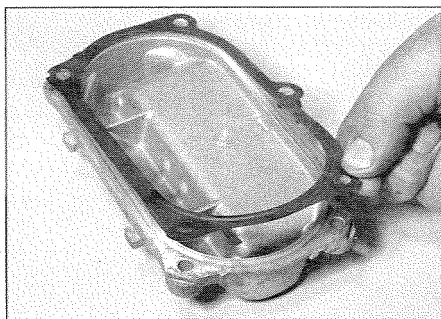
10 Cylinder head - removal and refitting

Removal

Note: The cylinder head bolts are of special splined design and a FIAT tool should be obtained to unscrew them. A Torx key will not fit however in practise it was found that a



9.22a Locate a new O-ring on the inlet camshaft cover plate ...



9.20a Locate a new gasket on the cylinder head extension end cover ...

close-fitting Allen key could be used as an alternative.

1 Drain the cooling system as described in Chapter 1.

2 Remove the cylinder head extension as described in Section 8.

3 Disconnect the radiator hose from the thermostat housing on the left-hand end of the cylinder head.

4 Disconnect the heater hose from the outlet at the rear of the cylinder head.

5 Disconnect the coolant temperature sensor and temperature gauge sensor wiring plugs from the left-hand end of the cylinder head.

6 Undo the engine oil dipstick tube bracket retaining bolt, and the two bolts securing the wiring harness support clips to the inlet manifold lower section.

7 Undo the retaining nuts, and separate the exhaust system front pipe from the exhaust manifold flange.

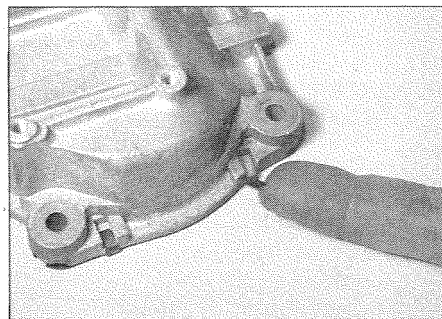
8 Check that nothing remains attached to the cylinder head likely to impede removal. It is assumed that the head will be removed complete with exhaust manifold and inlet manifold lower section.

9 Unscrew the cylinder head bolts half a turn at a time in the reverse order to that shown in illustration 10.25a. When the bolts are free, remove them from their locations..

10 Lift the cylinder head from the block. If it is stuck tight, rock the head to break the joint by means of the manifolds. On no account drive levers into the gasket joint, nor attempt to tap the head sideways, as it is located on positioning dowels.



9.22b ... then apply RTV gasket sealant to the cover plate contact face



9.20b ... then wrap round the protruding tangs to retain the gasket

11 Remove and discard the cylinder head gasket.

12 If necessary, refer to Chapter 2E for cylinder head dismantling and inspection procedures.

Preparation for refitting

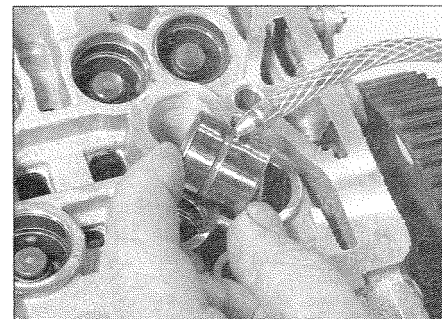
13 The mating faces of the cylinder head and cylinder block must be perfectly clean before refitting the head. Use a hard plastic or wooden scraper to remove all traces of gasket and carbon; also clean the piston crowns.

14 Take particular care when cleaning the piston crowns, as the soft aluminium alloy is easily damaged.

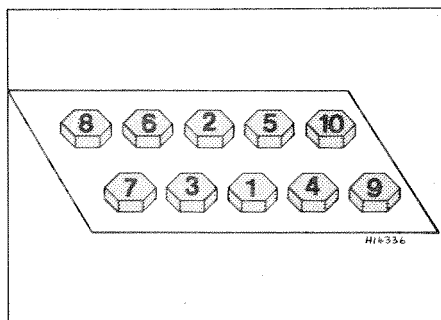
15 Make sure that the carbon is not allowed to enter the oil and water passages - this is particularly important for the lubrication system, as carbon could block the oil supply to the engine's components. Using adhesive tape and paper, seal the water, oil and bolt holes in the cylinder block.

16 To prevent carbon entering the gap between the pistons and bores, smear a little grease in the gap. After cleaning each piston, use a small brush to remove all traces of grease and carbon from the gap, then wipe away the remainder with a clean rag. Clean all the pistons in the same way.

17 Check the mating surfaces of the cylinder block and the cylinder head for nicks, deep scratches and other damage. If slight, they may be removed carefully with a file, but if excessive, machining may be the only alternative to renewal.



9.24 Lubricate the cam followers and place them in position in their respective bores



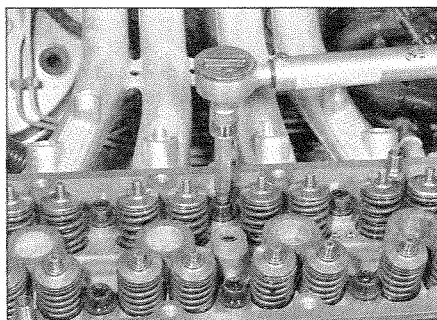
10.25a Cylinder head bolt tightening sequence

18 If warpage of the cylinder head gasket surface is suspected, use a straight-edge to check it for distortion. Refer to Part E of this Chapter if necessary.

19 Check the condition of the cylinder head bolts, and particularly their threads, whenever they are removed. Wash the bolts in a suitable solvent, and wipe them dry. Check each bolt for any sign of visible wear or damage, renewing them if necessary.

Refitting

20 Before refitting the assembled cylinder head, make sure that the head and block mating surfaces are perfectly clean, and that the bolt holes in the cylinder block have been mopped out to clear any oil or coolant. If the



10.25b Tighten the cylinder head bolts to the Stage 1 torque setting ...

bolt holes have any significant amount of liquid in them, the block could be cracked by hydraulic pressure when the head bolts are tightened.

21 The new gasket should not be removed from its plastic bag until required for use. Fit the gasket dry - no grease or sealant should be used.

22 Place the gasket on the cylinder block so that the word ALTO (TOP) can be read from above.

23 Lower the cylinder head onto the block so that it locates on the positioning dowels.

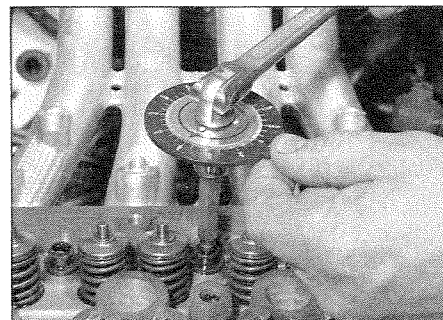
24 Ensure that the cylinder head bolts are cleaned of all debris, and check the threads for signs of damage. Especially if it is known that the bolts have been removed previously, it is advisable to renew all ten bolts as a set, rather than risk the bolts shearing when tightened.

25 Lightly oil the bolt threads. Screw the bolts in finger-tight, and tighten them in the sequence shown to the Stage 1 torque (see illustrations).

26 When all ten bolts have been tightened to the Stage 1 torque, go round again in sequence and tighten to the Stage 2 torque.

27 Again working in sequence, tighten the bolts through the specified Stage 3 angle. Note that 90° is equivalent to a quarter-turn or right-angle, making it easy to judge by noting the initial position of the socket handle. If available, use an angle gauge fitted to the socket handle for maximum accuracy.

28 With all ten bolts tightened to Stage 3, go round once more and tighten all bolts in sequence to the Stage 4 angle.



10.25c ... then through the Stage 2 and Stage 3 angle

29 Further refitting is a reversal of removal. Ensure that all wiring and hoses are correctly routed and securely reconnected. Refer to Section 4 when refitting the timing belt, and to Chapter 1 when refitting the spark plugs and auxiliary drivebelt, and when refilling the cooling system.

11 Flywheel - removal, inspection and refitting

Removal

1 Remove the transmission as described in Chapter 7A, and the clutch as described in Chapter 6.

2 Mark the position of the flywheel with respect to the crankshaft using a dab of paint. Note that on some models although there is only one location dowel on the flywheel, there are two holes in the end of the crankshaft and it is therefore possible to locate the flywheel 180° out.

3 The flywheel must now be held stationary while the bolts are loosened. A home-made locking tool may be fabricated from a piece of scrap metal and used to lock the ring gear. Bolt the tool to one of the transmission bellhousing mounting holes (see Tool Tip).

4 Support the flywheel as the bolts are loosened - the flywheel is very heavy. Unscrew and remove the mounting bolts, take off the spacer plate, then lift off the flywheel (see illustrations).

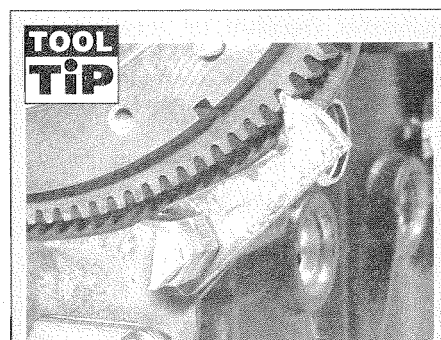
Inspection

5 If the flywheel's clutch mating surface is deeply scored, cracked or otherwise damaged, the flywheel must be renewed. However, it may be possible to have it surface-ground; seek the advice of a FIAT dealer or engine reconditioning specialist.

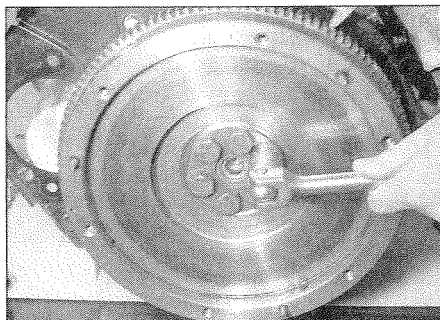
6 If the ring gear is badly worn or has missing teeth, the flywheel must be renewed.

Refitting

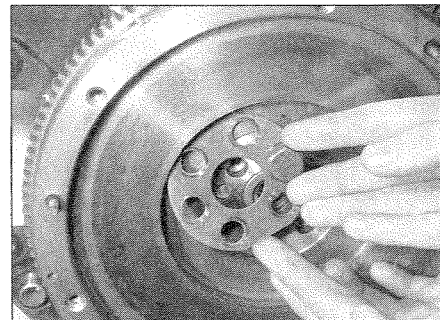
7 Clean the mating surfaces of the flywheel and crankshaft. Remove any remaining locking compound from the threads of the crankshaft holes, using the correct-size tap, if available.



TOOL TIP
To lock the flywheel, make up a pointed tool to engage the ring gear teeth, and bolt it to the engine using one of the bellhousing bolts



11.4a Unscrew the flywheel bolts ...



11.4b ... and remove the spacer plate



HINT If a suitable tap is not available, cut two slots down the threads of one of the old bolts with a hacksaw, and use the bolt to remove the locking compound from the threads.

8 Clean the flywheel bolt threads, then apply a suitable thread-locking compound to the threads of each bolt.

9 Offer up the flywheel onto the crankshaft, using the alignment marks made during removal; engage the dowel and fit the retaining bolts (together with the spacer plate) (see illustrations).

10 Lock the flywheel using the method employed on dismantling, and tighten the retaining bolts to the specified torque.

11 Refit the clutch as described in Chapter 6, and the transmission as described in Chapter 7A.

12 Engine mountings - inspection and renewal



Inspection

1 Jack up the front of the vehicle and support on axle stands (see *Jacking and vehicle support*).

2 Check the mounting rubbers to see if they are cracked, hardened or separated from the metal at any point; renew the mounting if any such damage or deterioration is evident.

3 Check that all the mounting's fasteners are securely tightened; use a torque wrench to check if possible.

4 Using a large screwdriver or a crowbar, check for wear in the mounting by carefully levering against it to check for free play. Where this is not possible enlist the aid of an assistant to move the engine/transmission back and forth, or from side to side, while you watch the mounting. While some free play is to be expected even from new components, excessive wear should be obvious. If excessive free play is found, check first that the fasteners are correctly secured, then renew any worn components as described below.

Renewal

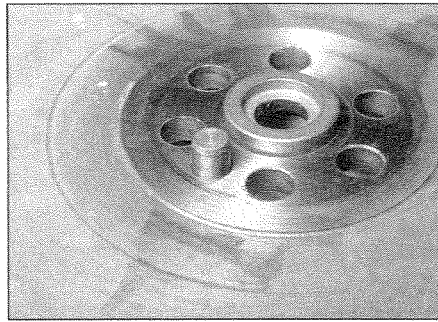
Right-hand mounting

5 Raise the front of the vehicle and support on axle stands (see *Jacking and vehicle support*).

6 Place a trolley jack beneath the right-hand side of the engine, with a block of wood on the jack head. Raise the jack until it is supporting the weight of the engine.

7 Unscrew the through-bolt and nut securing the reaction rod to the engine mounting bracket.

8 Lower the engine sufficiently to disengage the reaction rod from the mounting, then remove the bolts securing the mounting to the body, and remove it.



11.9a Location dowel on the flywheel

9 Locate the new mounting on the body, then insert the mounting-to-body bolts and tighten by hand.

10 Raise the engine and locate the reaction rod on the mounting. Refit the through-bolt and nut, tighten to the specified torque, then tighten the mounting-to-body bolts.

11 Remove the trolley jack and lower the vehicle to the ground.

Left-hand/rear mounting

12 Raise the front of the vehicle and support on axle stands (see *Jacking and vehicle support*).

13 Place a trolley jack beneath the transmission, with a block of wood on the jack head. Raise the jack until it is supporting the weight of the engine/transmission.

14 Unscrew the through-bolt securing the transmission bracket to the mounting, and recover the washers.

15 Unscrew the two bolts securing the left-hand mounting to the body.

16 Lower the transmission sufficiently to remove the mounting from the transmission bracket.

17 Locate the new mounting in position, and loosely refit the mounting-to-body bolts.

18 Raise the engine/transmission and refit the through-bolt securing the bracket to the mounting. Tighten the bolt to the specified torque, then tighten the mounting-to-body bolts.

19 Remove the trolley jack and lower the vehicle to the ground.

Front mounting

20 Raise the front of the vehicle and support on axle stands (see *Jacking and vehicle support*).

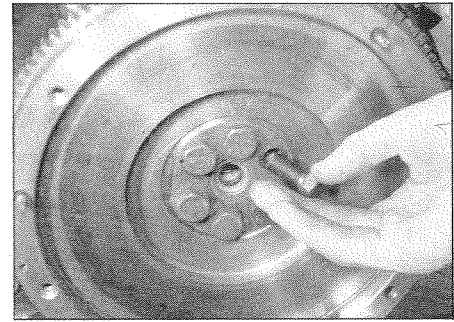
21 Place a trolley jack beneath the engine/transmission flange, with a block of wood on the jack head. Raise the jack until it is supporting the weight of the engine and transmission.

22 Working from below, unscrew the nut securing the bracket to the mounting.

23 Lower the engine sufficiently to disengage the bracket from the mounting, then remove the bolts securing the mounting to the body, and remove it.

24 Locate the new mounting on the body, then insert the mounting-to-body bolts and tighten by hand.

25 Raise the engine and locate the bracket on the mounting. Refit the nut and tighten to



11.9b Inserting the flywheel bolts

the specified torque, then tighten the mounting-to-body bolts.

26 Remove the trolley jack and lower the vehicle to the ground.

13 Sump - removal and refitting



Removal

1 Jack up the front of the vehicle and support on axle stands. Drain the engine oil.

2 Unscrew the sump securing nuts and bolts, and pull the sump downwards to remove it. The joint sealant will require cutting with a sharp knife to release the pan.

3 The sump is located on four studs, which may unscrew from the crankcase when the nuts are loosened - this poses no great problem, and the studs can be refitted if they are in good condition. To screw a stud back into position, lock two nuts against each other on the stud threads, then use one of the nuts to tighten the stud firmly.

Refitting

4 Clean away all old gasket material, from the sump pan and from the base of the block.

5 Apply a bead of RTV silicone instant gasket 3 mm in diameter to the sump flange. The bead of sealant should pass around the inside of the sump bolt holes.

6 Fit the sump, screw in the fixing bolts and nuts, and tighten securely in a diagonal sequence.

7 Wait one hour for the gasket compound to harden before filling with oil.

8 Lower the vehicle to the ground and fill the engine with oil (see Chapter 1). Check the oil level after running the engine for a few minutes, as described in *Weekly checks*.

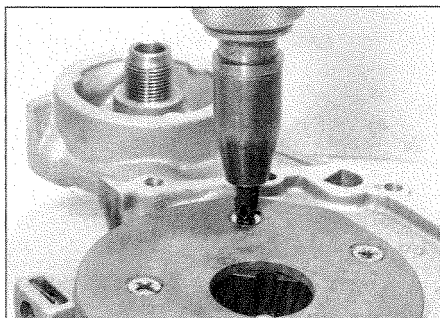
14 Oil pump and pick-up tube - removal and refitting



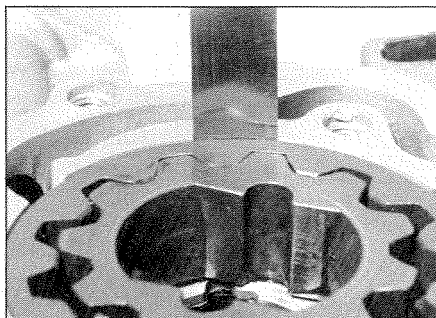
Removal

1 Drain the engine oil and remove the sump as described in Section 13.

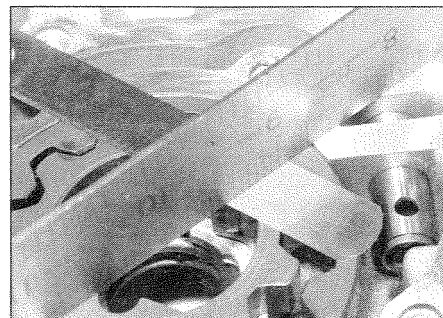
2 Unbolt and remove the oil pick-up/filter screen assembly. Note the sealing O-ring.



14.8 Using an impact screwdriver to remove the oil pump rear cover plate screws



14.9a Measuring oil pump outer gear-to-pump housing clearance



14.9b Measuring oil pump gear endfloat

3 Unscrew and remove the oil filter cartridge (see Chapter 1).

4 Remove the timing belt as described in Section 4.

5 Remove the crankshaft sprocket as described in Section 5.

6 Extract the oil pump fixing bolts, noting their locations (there is one long bolt, and four short ones with washers). Withdraw the pump and remove the gasket.

Inspection

7 The oil pump incorporates a pressure relief valve, which can be removed for examination by unscrewing the plug and pulling out the spring and valve.

8 If pump wear is suspected, check the gears in the following way. Extract the five fixing screws and remove the rear cover plate. The

screws are very tight, and will probably require the use of an impact screwdriver (see illustration).

9 Check the clearance between the outer gear and the pump housing using feeler blades. Check the gear endfloat by placing a straight-edge across the pump body, and checking the gap between the straight-edge and gear face (see illustrations). If the clearances are outside the specified tolerance, renew the oil pump complete.

10 If the pump is unworn, refit the rear cover plate and tighten the screws fully.

11 Apply air pressure from a tyre pump to the oil pump oil ducts, to clear any sludge or other material. If any solvents are used, the pump must be allowed to dry thoroughly before refitting.

12 Prime the pump by pouring clean engine

oil into its inlet duct, at the same time turning the oil pump inner gear with your fingers.

13 Lever out the oil seal, and drive a new one squarely into the oil pump casing. Lubricate the oil seal lips (see illustrations).

Refitting

14 Clean all traces of old gasket from the pump and the mating surfaces on the cylinder block.

15 Bolt the pump into position, using a new joint gasket (see illustrations). Insert the longer bolt into the position noted on removal, and tighten all to the specified torques.

16 Bolt on the oil pick-up assembly using a new sealing washer.

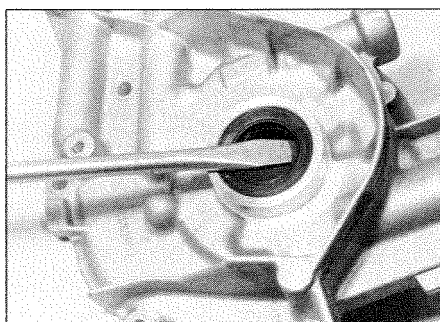
17 Refit the crankshaft sprocket as described in Section 5.

18 Fit and tension the timing belt as described in Section 4.

19 Fit the sump as described in Section 13.

20 Screw on a new oil filter cartridge, and fill the engine with oil (see Chapter 1).

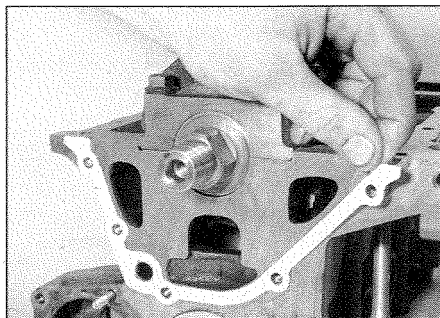
21 Run the engine for a few minutes, then check and top-up the oil level as described in *Weekly checks*.



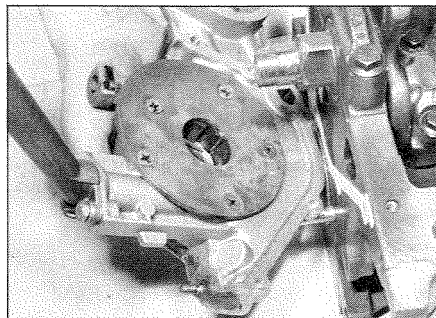
14.13a Removing the oil pump oil seal (crankshaft front oil seal)



14.13b Using a socket to fit a new oil seal to the oil pump



14.15a Using a new gasket ...



14.15b ... refit the oil pump

15 Oil pressure switch - removal and refitting

Removal

1 The oil pressure switch is located on the oil pump housing at the front of the engine block, behind the oil filter.

2 Disconnect the switch wiring connector.

3 Unscrew the switch from the oil pump, and remove it.

4 Clean the switch location as far as possible. If the switch is to be refitted, clean its threads.

5 Examine the switch for signs of cracking or splits. If the top part of the switch is loose, this is an early indication of impending failure.

Refitting

6 Apply a smear of sealant to the threads of the switch, then screw it into place and tighten to the specified torque.

7 Reconnect the switch wiring on completion.