






Chapter 2 Part A:

OHV engine

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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 
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Specifications

General

Maker's designation	12 SC
Bore x stroke	79.0 x 61.0 mm
Cubic capacity	1196 cc
Compression ratio	9.0: 1

Valve clearances (warm)

Inlet	0.15 mm
Exhaust	0.25 mm

Cylinder head

Identification mark	E
Valve seat width:	
Inlet	1.25 to 1.50 mm
Exhaust	1.60 to 1.85 mm
Overall height	81 ± 0.25 mm

Valves and guides

	Inlet	Exhaust
Overall length	99.3 mm	101.1 mm
Head diameter	32 mm	29 mm
Stem diameter (nominal, ± 0.005 mm):		
Standard	7.005 mm	6.995 mm
Oversize 1	7.080 mm	7.060 mm
Oversize 2	7.155 mm	7.135 mm
Oversize A	7.255 mm	7.235 mm
Valve guide bore (± 0.01 mm):		
Standard	7.035 mm	
Oversize 1	7.110 mm	
Oversize 2	7.185 mm	
Oversize A	7.285 mm	
Valve clearance in guide:		
Inlet	0.015 to 0.045 mm	
Exhaust	0.035 to 0.065 mm	
Sealing face angle	44°	

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Camshaft

Radial run-out	0.03 mm max
Endfloat	0.17 to 0.43 mm
Cam lift	6.45 mm

Pistons and bores

	Diameters	Marking
Production size 1	78.95 mm	5
	78.96 mm	6
	78.97 mm	7
	78.98 mm	8
	78.99 mm	99
Production size 2	79.00 mm	00
	79.01 mm	01
	79.02 mm	02
	79.03 mm	03
	79.04 mm	04
Production size 3	79.05 mm	05
	79.06 mm	06
	79.07 mm	07
	79.08 mm	08
	79.09 mm	09
Production size 4	79.10 mm	1
	79.47 mm	79.47/7 +0.5
	79.48 mm	79.48/8 +0.5
	79.49 mm	79.49/9 +0.5
	79.50 mm	79.50/0 + 0.5
Pistons clearance in bore	0.1 to 0.3 mm estimated	
Bore out-of-round and taper	0.013 mm max	

Piston rings

Quantity (per piston)	2 compression, 1 oil control (scraper)
Thickness:	
Compression	2.0 mm
Oil control	5.0 mm
End gap:	
Compression	0.30 to 0.45 mm
Oil control	0.40 to 1.40 mm
Ring gap offset	180° (see text)
Ring vertical clearance in groove	Not specified - typically 0.06 mm

Gudgeon pins

Length	65 mm
Diameter	20 mm
Clearance in piston	0.0015 to 0.0195 mm
Clearance in connecting rod	None (interference fit)

Crankshaft and bearings

Number of main bearings	3	
Main bearing journal diameters - standard:		
Front	53.997 to 54.010 mm	
Centre and rear	54.007 to 54.020 mm	
Centre journal width - standard	29.000 to 29.052 mm	
Main bearing shell identification - standard:	Colour code	Embossed code
Front, top	Brown	1 ON or 701-N
Front, bottom	Brown	1 UN or 702-N
Centre, top	Brown	20+UN or 705-N
Centre, bottom	Green	20+UN or 725-N
Rear, top	Green	631-N
Rear, bottom	Green	635-N
Main bearing shell identification - standard journal, oversize housing:		
Front, top	U1 -OB	
Front, bottom	U1-U	
Centre, top and bottom	U	
Rear, top	U3-OB	
Rear, bottom	U3-U	
Big-end bearing journal diameter - standard	4.971 to 44.987 mm	
Big-end bearing shell identification - standard	None	
Main and big-end bearing undersizes	0.25 mm production and service; 0.50 mm service only	

Main bearing shell identification - 0.25 undersize:		
Front, top	Brown-blue	1 OA or 006-A
Front, bottom	Brown-blue	1 UA or 008-A
Centre, top	Brown-blue	20+UA or 014-A
Centre, bottom	Brown	20+UA or 034-A
Rear, top	Green-blue	632-A
Rear, bottom	Green-blue	636-A
Main bearing shell identification - 0.50 undersize:		
Front, top	Brown-black	1 OB or 027 B
Front, bottom	Brown-black	1 U or 029 B
Centre, top	Brown-black	2 OB 0.35 B
Centre, bottom	Green-black	2 UB 035 B
Rear, top	None	3 OB 0,50
Rear, bottom	None	3 U 0,50
Big-end bearing shell identification:		
0.25 undersize	A	
0.50 undersize	B	
Main and big-end bearing journal out-of-round	0.006 mm max	
Main and big-end bearing journal taper	0.01 mm max	
Crankshaft endfloat	0.09 to 0.20 mm	
Connecting rod endfloat	0.02 to 0.06 mm	
Main bearing running clearance:		
Front	0.020 to 0.046 mm	
Centre	0.010 to 0.036 mm	
Rear	0.010 to 0.032 mm estimated	
Big-end bearing running clearance	0.11 to 0.24 mm	
Crankshaft radial run-out (at centre journal, shaft in block)	0.03 mm max	
Flywheel		
Ring gear run-out	0.5 mm max	
Refinishing limit - depth of material which may be removed from clutch friction surface	0.3 mm max	
Lubrication system		
Oil pump tolerances:		
Teeth backlash	0.1 to 0.2 mm	
Teeth projection	0.04 to 0.10 mm	
Oil pressure at idle (engine warm)	1.5 bar	
Torque wrench settings		
	Nm	lbf ft
Flywheel bolts (Use new bolts every time):		
Stage 1	35	26
Stage 2	Angle-tighten a further 50° to 90°	
Main bearing caps	62	46
Big-end bearing caps	27	20
Sump bolts (with locking compound)	5	4
Cylinder head bolts (use new bolts every time):		
Stage 1	25	18
Stage 2	Angle-tighten a further 60°	
Stage 3	Angle-tighten a further 60°	
Stage 4	Angle-tighten a further 60°	
Camshaft sprocket	40	30
Crankshaft pulley	40	30
Engine mounting bracket, RH:		
To block (use sealant on lower bolt)	20	15
To damping pad	40	30
Engine mountings to body:		
LH rear	65	48
RH rear	40	30
Sump drain plug	45	33
Oil pump mounting bolts	20	15

1 General description

The engine is of four-cylinder, in-line overhead valve type, mounted transversely at the front of the car.

The crankshaft is supported in three shell type main bearings. Thrustwashers are incorporated in the centre main bearing to control crankshaft endfloat.

The connecting rods are attached to the crankshaft by horizontally split shell type big-end bearings, and to the pistons by

gudgeon pins which are an interference fit in the connecting rod small-end bore. The aluminium alloy pistons are of the slipper type and are fitted with three piston rings: two compression rings and an oil control ring.

The camshaft is chain driven from the crankshaft and operates the rocker arms via

tappets and short pushrods. The inlet and exhaust valves are each closed by a single valve spring and operates in guides, integral with the cylinder head. The valves are actuated directly by the rocker arms.

Engine lubrication is by a gear type oil pump. The pump is mounted beneath the crankcase and is driven by a camshaft, as are the distributor and fuel pump.

Many of the engine component retaining bolts are of the socket-headed type and require the use of Torx type multi-tooth keys or socket bits for removal. These are readily available from retail outlets and should be obtained if major dismantling or repair work is to be carried out on the engine.

2 Compression test - description and interpretation

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 ignition HT coil lead from the distributor cap and earthing it on the cylinder block. Use a jumper lead or similar wire to make a good connection.

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

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; a difference of more than 2 bars between any two cylinders indicates 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). Deposits on the undersides of the valve heads can also cause low compression.

8 Although Vauxhall do not specify exact compression pressures, as a guide, any cylinder pressure of below 10 bars can be considered as less than healthy. Refer to a Vauxhall dealer or other specialist if in doubt

as to whether a particular pressure reading is acceptable.

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

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

11 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.

12 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.

13 If the compression reading is unusually high, the combustion chambers are probably coated with carbon deposits. If this is the case, the cylinder head should be removed and decarbonised.

14 On completion of the test, refit the spark plugs and reconnect the ignition system.

3 Operations possible with the engine in the car

The following operations may be carried out without having to remove the engine:

- a) *Adjustment of the valve clearances.*
- b) *Removal and refitting of cylinder head.*
- c) *Removal and refitting of sump.*
- d) *Removal and refitting of oil pump.*
- e) *Removal and refitting of the timing gear components.*
- f) *Removal and refitting of pistons and connecting rods.*
- g) *Removal and refitting of the flywheel.*
- h) *Removal and refitting of the engine/transmission mountings.*

4 Operations requiring engine removal

The following operations can only be carried out after removal of the engine:

- a) *Removal and refitting of the camshaft and tappets.*
- b) *Removal and refitting of the crankshaft and main bearings.*
- c) *Removal and refitting of the crankshaft rear oil seal.*

5 Engine dismantling and reassembly - general information

1 If the engine has been removed from the car for major overhaul, or if individual components have been removed for repair or renewal, observe the following general hints on dismantling and reassembly.

2 Drain the oil into a suitable container and then thoroughly clean the exterior of the engine using a degreasing solvent or paraffin. Clean away as much of the external dirt and grease as possible before dismantling.

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

4 Avoid working with the engine or any of the components directly on a concrete floor, as grit presents a real source of trouble.

5 Wherever possible, work should be carried out with the engine or individual components on a strong bench. If the work must be done on the floor, cover it with a board or sheets of newspaper.

6 Have plenty of clean, lint-free rags available and also some containers or trays to hold small items. This will help during reassembly and also prevent possible losses.

7 Always obtain a complete set of gaskets if the engine is being completely dismantled, or all those necessary for the individual component or assembly being worked on. Keep the old gaskets with a view to using them as a pattern to make a replacement if a new one is not available.

8 If possible refit nuts, bolts and washers in their locations after removal; this helps to protect the threads and avoids confusion or loss.

9 During reassembly thoroughly lubricate all the components, where this is applicable, with engine oil, but avoid contaminating the gaskets and joint mating faces.

10 Where applicable, the following Sections describe the removal, refitting and adjustment of components with the engine in the car. If the engine has been removed from the car, the procedures described are the same except for the disconnection of hoses, cables and linkages, and the removal of components necessary for access, which will already have been done.

6 Ancillary components - removal and refitting

If the engine has been removed from the car for complete dismantling, the following externally mounted ancillary components should be removed. When the engine has been reassembled these components can be refitted before the engine is installed in the car, as setting up and adjustment is often easier with the engine removed. The removal and refitting sequence need not necessarily follow the order given:

- a) *Alternator (Chapter 5A).*
- b) *Distributor and spark plugs (Chapters 1 and 5).*
- c) *Inlet and exhaust manifolds and carburettor (Chapter 4A).*
- d) *Fuel pump (Chapter 4A).*
- e) *Water pump and thermostat (Chapter 3).*
- f) *Clutch assembly (Chapter 6).*

7 Valve clearances - adjustment



1 This adjustment should be carried out with the engine at its normal operating temperature. If it is being done after overhaul when the engine is cold, repeat the adjustment after the car has been driven a few kilometres when the engine will then be hot.

2 Begin by removing the air cleaner, as described in Chapter 4A.

3 Mark the spark plug leads to ensure correct refitting and then pull them off the spark plugs.

4 Disconnect the engine breather hoses at the rocker cover (see illustration).

5 Undo the four bolts securing the rocker cover to the cylinder head and lift off the shaped spreader washers.

6 Withdraw the rocker cover from the cylinder head. If it is stuck give it a tap with the palm of your hand to free it.

7 Turn the engine by means of the crankshaft pulley bolt, or by engaging top gear and pulling the car forward, until No 1 piston is approaching TDC on the firing stroke. This can be checked by removing No 1 spark plug and feeling for compression with your fingers as the engine is turned, or by removing the distributor cap and checking the position of the rotor arm which should be pointing to the No 1 spark plug lead segment in the cap. The ignition timing marks on the pulley and timing cover must be aligned (see illustration).

8 With the engine in this position the following valves can be adjusted - counting from the timing cover end of the engine.

1 exhaust

2 inlet

3 inlet

5 exhaust

9 Now turn the engine crankshaft through one complete revolution and adjust the following remaining valves:

4 exhaust

6 inlet

7 inlet

8 exhaust

10 As each clearance is being checked, slide a feeler blade of the appropriate size, as given in the Specifications, between the end of the



7.10 Checking a valve clearance



7.4 Removing the breather hose from the rocker cover

valve stem and the rocker arm (see illustration). Adjust the clearance by turning the rocker arm retaining nut using a socket or ring spanner until the blade is a stiff sliding fit.

11 It is also possible to check and adjust the clearances with the engine running. This is done in the same way, but each valve is checked in turn. It will of course be necessary to refit the plug leads and No 1 spark plug if this method is adopted. To reduce oil splash place a piece of cardboard, suitably cut to shape, between the pushrod side of the rocker arms and the edge of the cylinder head.

12 After adjustment remove all traces of old gasket from the cylinder head mating face and renew the rocker cover gasket if it is cracked or perished.

13 Refit the rocker cover and secure with the retaining bolts and shaped spreader washers.

14 Refit the spark plug and plug leads, reconnect the engine breather hoses and refit the air cleaner, as described in Chapters 1 and 4.

8 Cylinder head - removal and refitting



Removal

1 Make sure that the engine is cold before commencing operations to avoid any chance of the head distorting.

2 Disconnect the battery negative terminal

3 Drain the cooling system, as described in Chapter 1, and remove the air cleaner, as described in Chapter 4A.

4 From behind the engine, undo the two bolts securing the exhaust front pipe to the manifold. Remove the bolts and tension springs; then separate the pipe joint from the manifold.

5 Slacken the retaining clip and disconnect the radiator top hose from the thermostat housing in the water pump.

6 Slacken the alternator mounting and adjustment arm bolts, move the alternator towards the engine and slip the drivebelt off the pulleys.

7 Slacken the retaining clips and disconnect the heater hose and radiator bottom hose from the water pump.



7.7 Ignition timing marks (arrowed) in alignment

8 Disconnect the other heater hose at the cylinder head outlet after slackening the retaining clip.

9 Undo the union nut and disconnect the brake servo vacuum hose from the inlet manifold.

10 Note the location of the plug leads to aid refitting and pull them off the spark plugs. Disconnect the HT lead at the coil, undo the distributor cap retaining screws and remove the cap and leads.

11 Refer to Chapter 4A and disconnect the choke and accelerator cables from the carburettor. Detach the distributor vacuum advance pipe.

12 Disconnect the fuel hose from the carburettor and plug its end after removal.

13 Disconnect the engine breather hoses from the rocker cover.

14 Undo the three socket-headed screws securing the inlet manifold to the cylinder head. Note the spark plug lead support brackets fitted to the two end retaining bolts.

15 Lift the inlet manifold complete with carburettor from the cylinder head and recover the gasket.

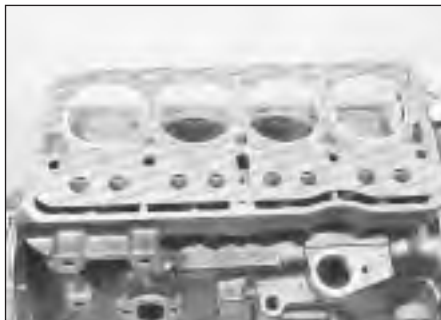
16 Undo the four bolts and shaped spreader washers and lift off the rocker cover.

17 Slacken the rocker arm retaining nuts, move the rocker arms to one side and lift out the pushrods (see illustration). Keep the pushrods in order after removal.

18 Undo the cylinder head retaining bolts, half a turn at a time in the reverse sequence to that shown in illustration 8.26. Unscrew the bolts fully and remove them. Obtain new bolts for use when refitting.



8.17 Removing the pushrods



8.24 Fitting a cylinder head gasket

19 Lift the cylinder head from the block. If it is stuck, tap it free with a soft-faced mallet. Do not insert a lever into the gasket joint - you may damage the mating surfaces.

20 With the cylinder head removed, recover the gasket.

21 If the cylinder head has been removed for decarbonising or for attention to the valves or springs, reference should be made to Sections 9 and 10.

Refitting

22 Before refitting the cylinder head, ensure that the cylinder block and head mating faces are spotlessly clean and dry with all traces of old gasket removed. Use a scraper and wire brush to do this, but take care to cover the water passages and other openings with masking tape or rag to prevent dirt and carbon falling in. Remove all traces of oil and water from the bolt holes, otherwise hydraulic pressure created by the bolts being screwed in could crack the block or give inaccurate torque settings. Ensure that the bolt threads are clean and dry.

23 When all is clean, screw two guide studs into the cylinder block. These can be made from the two old cylinder head bolts by cutting off their heads and sawing a screwdriver slot in their ends.

24 Locate a new gasket in position on the block as shown (see illustration). Do not use any jointing compound on the gasket

25 Lower the cylinder head carefully into position. Screw in new bolts finger tight, remove the guide pins and screw in the two remaining bolts.

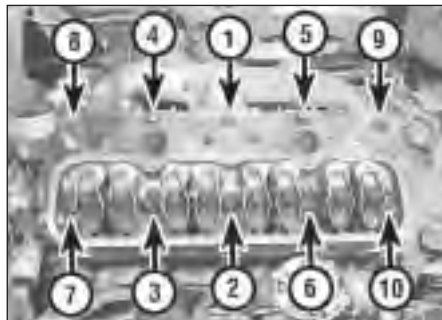
26 Tighten the cylinder head bolts in the order shown (see illustration) to the first stage specified torque. Now tighten the bolts through three further stages as given in the Specifications. No further retightening will be required.

27 Refit the pushrods, making quite sure that each one is located in its tappet.

28 Reposition the rocker arms over the ends of the pushrods and then adjust the valve clearances, as described in Section 7.

29 Place a new gasket in position and refit the inlet manifold and carburettor (see illustration).

30 Refit the rocker cover, using a new



8.26 Cylinder head bolt tightening sequence

gasket, and secure with the four bolts and spreader washers.

31 Refit the heater hoses and radiator hoses to the outlets on the water pump and cylinder head.

32 Refit the fuel hose to the carburettor, the vacuum advance pipe to the distributor and the breather hoses to the rocker cover.

33 Refit and adjust the accelerator and choke cables, as described in Chapter 4A.

34 Refit the brake servo vacuum hose to the inlet manifold.

35 Refit the distributor cap and reconnect the plug leads and coil lead.

36 Slip the drivebelt over the pulleys and adjust its tension, as described in Chapter 1.

37 Reconnect the exhaust front pipe to the manifold and tighten the bolts to compress the tension springs.

38 Refill the cooling system as described in Chapter 1, refit the air cleaner as described in Chapter 4A and connect the battery negative terminal.

9 Cylinder head - overhaul

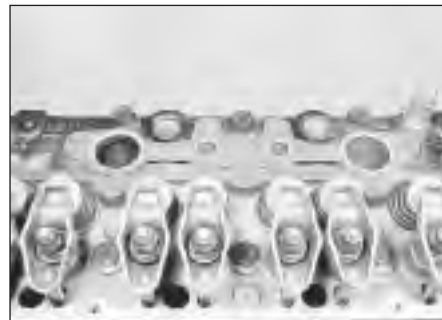
1 Unscrew the rocker arm retaining /adjustment nuts and withdraw the rocker arms from the studs. Keep them in order as they are removed.

2 To remove the valves, the springs will have to be compressed to allow the split collets to be released from the groove in the upper section of the valve stems. A valve spring compressor will therefore be necessary.

3 Locate the compressor to enable the forked end of the arm to be positioned over the valve spring collar whilst the screw part of the clamp is situated squarely on the face of the valve.

4 Screw up the clamp to compress the spring and release the pressure of the collar acting on the collets. If the collar sticks, support the head and clamp frame and give the end of the clamp a light tap with a hammer to help release it.

5 Extract the two collets and then release the tension of the clamp. Remove the clamp, withdraw the collar and spring and extract the valve. Remove the valve stem seals and the exhaust valve rotators.



8.29 Inlet manifold gasket in position

6 As they are released and removed, keep the valves in order so that if they are to be refitted they will be replaced in their original positions in the cylinder head. A piece of stiff card with eight holes punched in it is a sure method of keeping the valves in order.

7 Examine the head of the valves for pitting and burning, especially the heads of the exhaust valves. The valve seating should be examined at the same time. If the pitting on valve and seat is very slight, the marks can be removed by grinding the seats and valves together with coarse, and then fine, valve grinding paste.

8 Where bad pitting has occurred to the valve seats it will be necessary to recut them and fit new valves. The latter job should be entrusted to the local agent or engineering works. In practice it is very seldom that the seats are so badly worn. Normally it is the valve that is too badly worn for refitting, and the owner can easily purchase a new set of valves and match them to the seats by valve grinding.

9 Valve grinding is carried out as follows. Smear a trace of coarse carborundum paste on the seat face and apply a suction grinder tool to the valve head. With a semi-rotary motion, 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, lifting and turning the valve to redistribute the 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 valve and valve seat faces, the grinding operation is complete.

10 Scrape away all carbon from the valve head and the valve stem. Carefully clean away every trace of grinding compound; take great care to leave none in the ports or in the valve guides. Clean the valves and valve seats with a paraffin-soaked rag, then with a clean rag and finally, if an air line is available, blow the valves, valve guides and valve ports clean.

11 Check that all valve springs are intact. If any one is broken, all should be renewed. Check the free height of the springs against new ones. If some springs are not within



9.15 Fitting a valve to its guide



9.17 Fitting an exhaust valve rotator



9.18a Fit the valve spring . . .

specification, replace them all. Springs suffer from fatigue and it is a good idea to renew them even if they look serviceable.

12 Check that the oil supply holes in the rocker arm studs are clear.

13 The cylinder head can be checked for warping either by placing it on a piece of plate glass or using a straight-edge and feeler blades. Slight distortion may be corrected by having the head machined to remove metal from the mating face.

14 Valve guide renewal is necessary if the valve stem clearance in the guide exceeds that specified. Renewal, or reaming to accept oversize valves, should be left to a GM dealer.

15 Commence reassembly by lubricating a valve stem and inserting it into its guide (see illustration).

16 Fit the valve stem oil seal, using the protective sleeve supplied with the new seals over the valve stem to avoid damage.



9.20 Compress the spring and fit the collets



9.24a Fitting a rocker arm . . .



9.24b . . . and its pivot ball



9.18b . . . followed by the spring collar

Lubricate the sleeve and push on the seal, ring downwards. Recover the sleeve.

17 On exhaust valves, fit the valve rotator (see illustration).

18 Fit the valve spring and collar, with the recessed part of the collar inside the spring (see illustrations).

19 Place the end of the spring compressor over the collar and valve stem and, with the screw head of the compressor over the valve head, screw up the clamp until the spring is compressed past the groove in the valve stem. Then put a little grease round the groove.

20 Place the two halves of the split collar (collets) into the groove with the narrow ends pointing towards the spring (see illustration). The grease will hold them in the groove.

21 Release the clamp slowly and carefully, making sure that the collets are not dislodged from the groove. When the clamp is fully released the top edges of the collets should be in line with each other. Give the top of each spring a smart tap with a soft-faced mallet when assembly is complete to ensure that the collets are properly settled.

22 Repeat the above procedure for the other 7 valves.

23 The rocker gear can be refitted with the head either on or off the engine. The only part of the procedure to watch is that the rocker nuts must not be screwed down too far or it will not be possible to refit the pushrods.

24 Next put the rocker arm over the stud followed by the pivot ball (see illustrations). Make sure that the spring fits snugly round the rocker arm centre section and that the two

bearing surfaces of the interior of the arm and the ball face, are clean and lubricated with engine oil.

25 Oil the stud thread and fit the nut with the self-locking collar uppermost (see illustration). Screw it down until the locking collar is on the stud.

10 Cylinder head and pistons - decarbonising



1 This can be carried out with the engine either in or out of the car. With the cylinder head removed, carefully use a wire brush and blunt scraper to clean all traces of carbon deposits from the combustion spaces and the ports. The valve head stems and valve guides should also be freed from any carbon deposits. Wash the combustion spaces and ports down with petrol and scrape the cylinder head surface free of any foreign



9.25 Fit the nut with the self-locking collar uppermost



11.7 Insert the cork strips in the main bearing cap grooves

matter with the side of a steel rule or a similar article.

2 If the engine is installed in the car, clean the pistons and the top of the cylinder bores. If the pistons are still in the block, then it is essential that great care is taken to ensure that no carbon gets into the cylinder bores as this could scratch the cylinder walls or cause damage to the piston and rings. To ensure this does not happen, first turn the crankshaft so that two of the pistons are at the top of their bores. Stuff rag into the other two bores or seal them off with paper and masking tape. The waterways should also be covered with small pieces of masking tape to prevent particles of carbon entering the cooling system and damaging the water pump.

3 Press a little grease into the gap between the cylinder walls and the two pistons which are to be worked on. With a blunt scraper carefully scrape away the carbon from the piston crown, taking great care not to scratch the aluminium. Also scrape away the carbon from the surrounding lip of the cylinder wall. When all carbon has been removed, scrape away the grease which will now be contaminated with carbon particles, taking care not to press any into the bores. To assist prevention of carbon build-up the piston crown can be polished with a metal polish. Remove the rags or masking tape from the other two cylinders and turn the crankshaft so that the two pistons which were at the bottom are now at the top. Place rag or masking tape in the cylinders which have been decarbonised and proceed as just described. Decarbonising is now complete.



12.2b . . . and remove the oil pump



11.9 Refitting the sump

11 Sump - removal and refitting

Removal

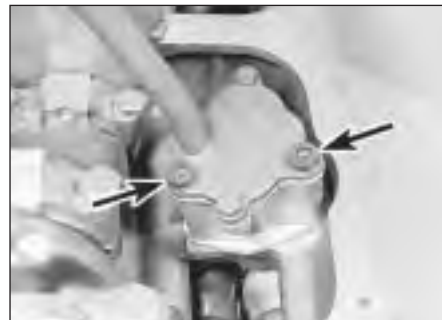
- 1 Jack up the front of the car and securely support it on axle stands (see "*Jacking and Vehicle Support*").
- 2 Drain the engine oil into a suitable container (Section 2) and refit the plug after draining.
- 3 Undo the bolts securing the flywheel cover plate and side support braces and remove the cover.
- 4 Undo the retaining bolts and lift away the sump. It will probably be necessary to tap the sump from side to side with a hide or plastic mallet to release the joint face.

Refitting

- 5 Thoroughly clean the sump in paraffin or a suitable solvent and remove all traces of external dirt and internal sludge. Scrape away all traces of old gasket from the sump and crankcase faces and ensure that they are clean and dry. Also clean the bearing cap grooves.
- 6 Apply a thick bead of jointing compound to the crankcase flange and at the joints of the front and rear main bearing caps
- 7 Position the cork side gaskets on the crankcase flanges and then insert the cork and sealing strips to the main bearing cap grooves (see illustration).
- 8 Apply a further bead of jointing compound to the gasket faces and to the gasket joints at the bearing caps.



13.3a Removing the oil pump driving gear . . .



12.2a Undo the two socket-headed bolts (arrowed) . . .

9 Refit the sump (see illustration) and secure it in place with the retaining bolts which should be progressively tightened in a diagonal sequence.

10 Refit the flywheel cover plate, lower the car and fill the engine with oil as described in Chapter 1.

12 Oil pump - removal and refitting

Removal

- 1 Remove the sump. as described in Section 11.
- 2 Undo the two socket-headed bolts and withdraw the pump from the crankcase (see illustrations).

Refitting

3 Refitting the pump is the reverse sequence to removal, but engage the pump shaft in the distributor driveshaft slot, and tighten the retaining bolts to the specified torque.

13 Oil pump - overhaul

- 1 Remove the oil pump, as described in Section 12.
- 2 Undo the two pump cover bolts and lift off the cover and oil pick-up tube. Remove the cover gasket.
- 3 Take out the driving gear and driven gear (see illustrations).



13.3b . . . and the driven gear



13.4 Oil pump and pressure relief valve components

4 Undo the large nut on the side of the housing and remove the sealing washer and oil pressure relief spring and ball valve (see illustration).

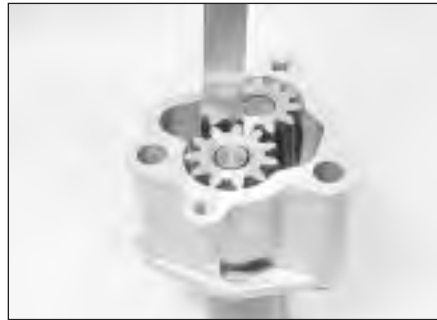
5 Clean all the parts in paraffin and dry with a lint-free cloth.

6 Inspect the pump gears, housing, cover and relief valve ball for scoring, scuff marks or other signs of wear and renew the pump if these signs are evident.

7 If the pump condition is satisfactory, check the pump clearances as follows.

8 Using a feeler blade, check the backlash between the gear teeth. Place a straight-edge across the top edge of the gears and check their projection. If any of the clearances exceeds the tolerances given in the Specifications, renew the pump (see illustration).

9 If the clearances are satisfactory, refit the



13.8 Check the pump gear teeth backlash

relief valve assembly and assemble the pump gears. Fill the pump with oil and refit the cover using a new gasket. Tighten the cover securing bolts and refit the pump.

14 Timing gear components - removal and refitting

Removal

1 For greater access remove the front right-hand wheel trim and slacken the wheel bolts. Jack up the front of the car, support it securely on axle stands (see "Jacking and Vehicle Support") and remove the roadwheel.

2 Undo the four retaining bolts and remove the clutch access plate at the base of the bellhousing (see illustration).

3 Slacken the alternator mounting and adjustment arm bolts, move the alternators



14.2 Clutch access plate

towards the engine and slip the drivebelt off the pulleys.

4 Lock the flywheel by wedging a screwdriver between the ring gear teeth and the side of the bellhousing.

5 Using a socket or spanner undo the crankshaft pulley retaining bolt and withdraw the pulley.

6 Undo the bolts securing the timing cover to the front of the engine and lift off the cover.

7 Withdraw the oil slinger from the crankshaft, noting which way round it is fitted (see illustration).

8 Temporarily refit the pulley and turn the crankshaft until the crankshaft sprocket keyway is uppermost and the timing marks on the two sprockets are in alignment (see illustration). Remove the pulley.

9 Undo the two retaining bolts and remove the timing chain tensioner. One of two types of tensioner may be fitted: simple spring-operated, or oil pressure assisted. With the oil pressure assisted type, restrain the thrust pad to prevent premature ejection of the tensioner components (see illustration).

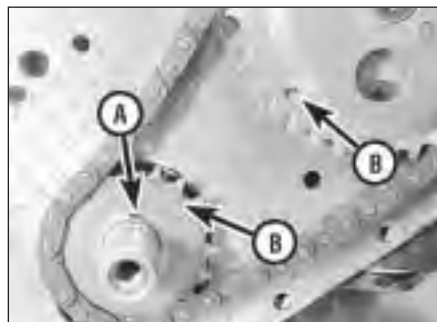
10 Undo the camshaft sprocket retaining bolt and remove the bolt and washer (see illustration). Place a screwdriver through one of the sprocket holes and in contact with the camshaft retaining plate behind the sprocket to stop it turning as the bolt is undone.

11 Withdraw the camshaft sprocket and crankshaft sprocket from their respective locations, using a screwdriver as a lever if necessary, then remove the sprockets complete with chain (see illustration).

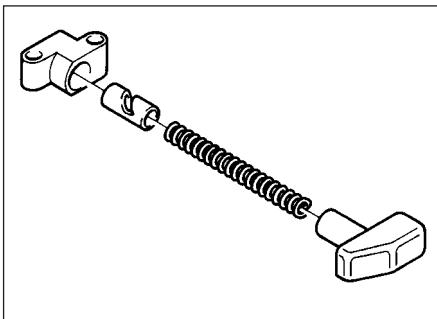
12 Thoroughly clean all the components in



14.7 Crankshaft oil slinger



14.8 Crankshaft sprocket keyway (A) and sprocket timing marks (B)



14.9 Timing chain tensioner - oil pressure assisted type



14.10 Camshaft sprocket retaining bolt and washer



14.11 Removing the sprockets and timing chain