Chapter 2 Part A
Engine in-car repair procedures

Contents

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

Cylinder numbers (front to rear)	1-2-3-4-5-6
Firing order	1-5-3-6-2-4
Displacement:	
3.2 litre engine	3239 cc
3.6 litre engine	3590 cc
4.0 litre engine	3980 cc
Bore	91.0 mm (3.583 inches)
Stroke:	
3.2 litre engine	83.0 mm (3.268 inches)
3.6 litre engine	92.0 mm (3.622 inches)
4.0 litre engine	102.0 mm (4.016 inches)

Camshafts and lifters

Journal diameter	26.9370 to 26.9494 mm (1.0605 to 1.0610 inches)
Bearing oil clearance	0.037 to 0.063 mm (0.0014 to 0.0024 inch)
Runout limit	0.0406 mm (0.0016 inch)
Lobe lift (maximum variation between lobes)	0.0127 mm (0.005 inch)
Valve lifter	
Diameter	33.34 to 33.35 mm (1.3126 to 1.3130 inches)
Oil clearance	0.020 to 0.050 mm (0.0008 to 0.0020 inch)
Valve clearances	0.30 to 0.36 mm (0.012 to 0.014 inch)

Oil pump

Outer rotor to body clearance, maximum	0.2 mm (0.0079 inch)
Outer rotor OD	69.774 to 69.825 mm (2.7470 to 2.7490 inches)
Rotor thickness, inner and outer	27.962 to 27.975 mm (1.1008 to 1.1013 inches)
Clearance over rotors, maximum	0.1 mm (0.0039 inch)

Torque wrench settings*	Nm	lbf ft
Camshaft bearing cap bolts	23 to 27	16 to 20
Camshaft sprocket bolts	23 to 27	16 to 20
Crankshaft damper-to-crankshaft bolt		
3.2 and 3.6 litre	204	151
4.0 litre	180 to 220	133 to 162
Crankshaft pulley to damper bolts	23 to 27	16 to 20
Crankshaft rear oil seal retainer bolts	23 to 27	16 to 20
Crankshaft sensor bolts	23 to 27	16 to 20
Cylinder head bolts		
Step 1	60	44
Step 2	Tighten an additional 90° (1/4 turn)	
Driveplate bolts	123 to 149	91 to 110
Engine mounts		
To engine block	49 to 66	36 to 39
To chassis	22 to 24	16 to 18
Exhaust manifold heat shield fasteners	23 to 27	16 to 20
Exhaust manifold nuts	23 to 27	16 to 20
Intake manifold nuts	23 to 27	16 to 20
Oil pump bolts	23 to 27	16 to 20
Sump bolts	23 to 27	16 to 20
Sump bolts, adapter to pan	49 to 54	36 to 40
Timing chain cover	23 to 27	16 to 20
Valve cover screws	10 to 12	7 to 9

***Note:** *Refer to Part B for additional specifications*

1 General information

This Part of Chapter 2 is devoted to in-car repair procedures for the in-line six-cylinder engines. All information concerning engine removal and refitting and engine block and cylinder head overhaul can be found in Part B of this Chapter.

The following repair procedures are based on the assumption that the engine is installed in the car. If the engine has been removed from the car and mounted on a stand, many of the steps outlined in this Part of Chapter 2 will not apply. We have photographed some in-car engine procedures with the engine on a stand for photographic purposes.

The Specifications included in this Part of Chapter 2 apply only to the procedures contained in this Part. Part B of Chapter 2 includes the Specifications necessary for cylinder head and engine block rebuilding.

2 Repair operations possible with the engine in the car

Many repair operations can be accomplished without removing the engine from the car.

Clean the engine compartment and the exterior of the engine with some type of degreaser before any work is done. It will make the job easier and help keep dirt out of the internal areas of the engine.

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

If vacuum, exhaust, oil or coolant leaks develop, indicating a need for gasket or seal renewal, the repairs can generally be made with the engine in the car. The intake and exhaust manifold gaskets, crankshaft oil seals and cylinder head gasket are all accessible with the engine in place (although rear oil seal renewal involves removal of the transmission). The sump is difficult for a home mechanic to replace without a hoist and other specialised equipment, since the front suspension, steering and crossmember must be lowered to allow enough clearance for sump removal. If such equipment is not available, the alternative would be to remove the engine for renewal of the sump or oil pump. **Note:** *We assume that the home mechanic does not have access to the specialised equipment, and have photographed our subject engine out of the car for some procedures.*

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

Since the cylinder head can be removed with the engine in-car, camshaft and valve component servicing can also be accomplished. Renewal of the timing chains and sprockets is also possible with the engine in-car.

3 Top Dead Centre (TDC) for number one piston - locating

Note: *The following procedure is based on the assumption that the distributor is correctly installed. If you are trying to locate TDC to refit the distributor correctly, piston position must be determined by feeling for compression at the number one spark plug hole, then aligning the ignition timing marks (see paragraph 8).*

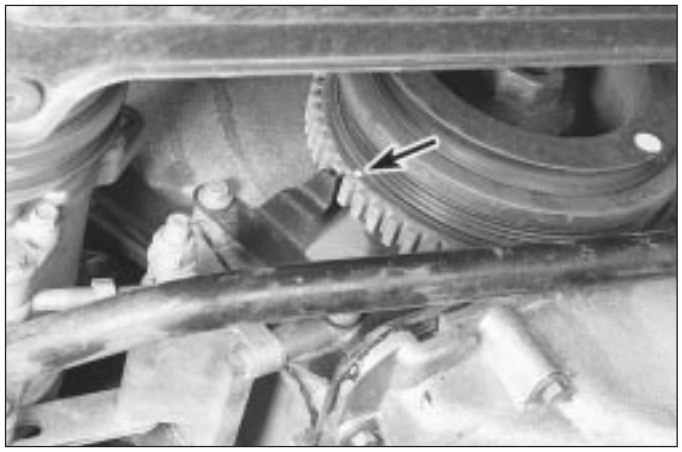
1 Top Dead Centre (TDC) is the highest point in the cylinder that each piston reaches as it travels up the cylinder bore. Each piston reaches TDC on the compression stroke and again on the exhaust stroke, but TDC generally refers to piston position on the compression stroke.

2 Positioning the piston(s) at TDC is an essential part of many procedures such as camshaft and timing chain/sprocket removal and distributor removal.

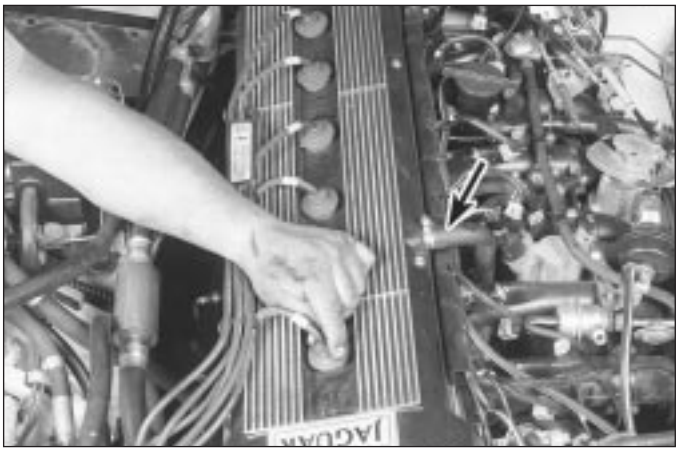
3 Before beginning this procedure, be sure to place the transmission in Neutral and apply the handbrake or block the rear wheels. Also, disable the ignition system by detaching the coil wire from the centre terminal of the distributor cap and grounding it on the engine block with a jumper wire. Remove the spark plugs (see Chapter 1).

4 In order to bring any piston to TDC, the crankshaft must be turned using one of the methods outlined below. When looking at the timing chain end of the engine, normal crankshaft rotation is clockwise.

a) The preferred method is to turn the crankshaft with a socket and ratchet



3.8 Align the mark on the crankshaft sensor ring (arrowed) with the bottom edge of the pointer on the front cover



4.2 Disconnect the PCV hose (arrowed) from the valve cover, then pull the spark plug leads out by their boots, not the leads

attached to the bolt threaded into the front of the crankshaft. Apply pressure on the bolt in a clockwise direction only. Never turn the bolt anti-clockwise.

b) A remote starter switch, which may save some time, can also be used. Follow the instructions included with the switch. Once the piston is close to TDC, use a socket and ratchet as described in the previous paragraph.

c) If an assistant is available to turn the ignition switch to the Start position in short bursts, you can get the piston close to TDC without a remote starter switch. Make sure your assistant is out of the car, away from the ignition switch, then use a socket and ratchet as described in Paragraph a) to complete the procedure.

5 Note the position of the terminal for the number one spark plug lead on the distributor cap. If the terminal isn't marked, follow the plug lead from the number one cylinder spark plug to the cap.

6 Use a felt-tip pen or chalk to make a mark on the distributor body directly under the number one terminal (see Chapter 5).

7 Detach the cap from the distributor and set it aside (see Chapter 1 if necessary).

8 Turn the crankshaft until the small triangle cast into the front edge of the crankshaft sensor ring is aligned with the bottom edge of the timing pointer located at the front of the engine **(see illustration)**.

9 Look at the distributor rotor - it should be pointing directly at the mark you made on the distributor body. If so, you are at TDC for number 1 cylinder.

10 If the rotor is 180° off, the number one piston is at TDC on the exhaust stroke.

11 To get the piston to TDC on the compression stroke, turn the crankshaft one complete revolution (360°) clockwise. The rotor should now be pointing at the mark on the distributor. When the rotor is pointing at the number one spark plug lead terminal in the distributor cap and the ignition timing marks are aligned, the number one piston is at TDC on the compression stroke. **Note:** *If it's impossible to align the ignition timing marks when the rotor is pointing at the mark on the distributor body, the timing chain may have jumped the teeth on the pulleys or may have been installed incorrectly*.

12 After the number one piston has been positioned at TDC on the compression stroke, TDC for any of the remaining cylinders can be located by turning the crankshaft and following the firing order. Mark the remaining spark plug lead terminal locations on the distributor body just like you did for the number one terminal, then number the marks to correspond with the cylinder numbers. As you turn the crankshaft, the rotor will also turn. When it's pointing directly at one of the marks on the distributor, the piston for that particular cylinder is at TDC on the compression stroke.

4 Valve cover - removal and refitting

Removal

1 Disconnect the battery negative cable.

Caution: If the stereo in your vehicle is equipped with an anti-theft system, make sure you have the correct activation code before disconnecting the battery.

2 Detach the PCV hose from the valve cover **(see illustration)**.

3 Remove the spark plug leads from the spark plugs, handling them by the boots and not pulling on the wires.

4 Remove the valve cover mounting screws, then detach the valve cover and gasket from the cylinder head. If the valve cover is stuck to the cylinder head, bump the end with a wood block and a hammer to jar it loose. If that doesn't work, try to slip a flexible putty knife between the cylinder head and valve cover to break the seal.

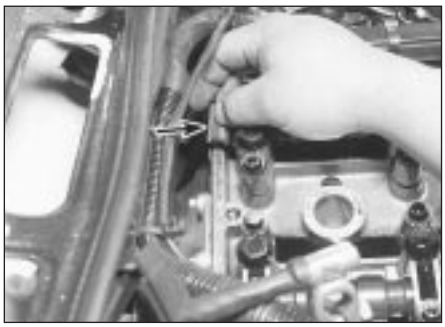
Caution: Don't pry at the valve cover-to-cylinder head joint or damage to the sealing surfaces may occur, leading to oil leaks after the valve cover is reinstalled.

Refitting

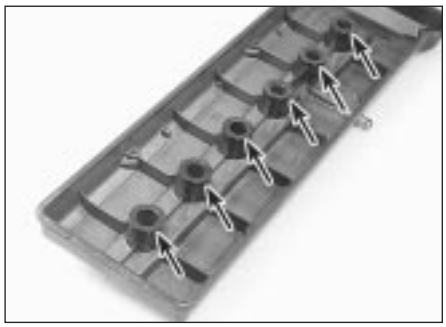
5 The mating surfaces of the cylinder head and valve cover must be clean when the valve cover is installed. If there's residue or oil on the mating surfaces when the valve cover is installed, oil leaks may develop.

6 Apply RTV sealant around the two half-circle rubber plugs at the rear of the cylinder head **(see illustration)**.

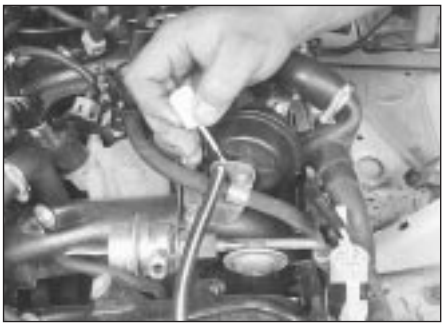
7 Using a new gasket and spark plug tube seals, refit the valve cover **(see illustration)**.



4.6 Apply RTV sealant to the half-circle plugs and insert them into the cylinder head before refitting the valve cover



4.7 Press the valve cover gasket into the groove around the valve cover and fit a new set of spark plug tube seals (arrowed)



5.3 The various hoses should be marked to ensure correct refitting

5.6a Remove the oil filler tube bracket nuts (arrowed) . . .

5.6b . . . pull the tube up to dislodge it from the housing - it won't come out, but can be removed with the intake manifold

5.7a Remove the ground strap from the front stud (arrowed), and the engine wiring harness clips from the other studs

5.7b Remove the intake manifold bolts/ nuts and remove the intake manifold - the upper fasteners are studs/nuts, while the lower row are bolts (two arrowed)

5.9 Refit the new intake manifold gasket over the studs (arrowed) refit the manifold

8 Tighten the screws to the torque listed in this Chapter's Specifications in three or four equal steps.
9 Refit the remaining components, start the engine and check for oil leaks.

5 Intake manifold - removal and refitting

Removal

1 Disconnect the negative cable from the battery.
Caution: If the stereo in your vehicle is equipped with an anti-theft system, make sure you have the correct activation code before disconnecting the battery.
2 Refer to Chapter 4 to remove the accelerator and cruise-control linkage, safely relieve the fuel system pressure, and disconnect the fuel supply lines.
3 Label or mark and detach the PCV and vacuum hoses connected to the intake manifold, **(see illustration)**.
4 The intake manifold can be removed with the injectors and fuel rail still in place. Disconnect the electrical connectors at each injector (label them first for reassembly). If the injectors are to be removed from the intake manifold, refer to Chapter 4.
5 Refer to Chapter 4 and remove the throttle body.
6 Remove the three nuts retaining the oil filler tube bracket, then pull the tube up as far as possible **(see illustrations)**.
7 Remove the ground strap and intake manifold mounting nuts/bolts, then detach the intake manifold from the engine **(see illustrations)**.

Refitting

8 Clean the mating surfaces of the intake manifold and the cylinder head mounting surface with lacquer thinner or acetone. If the gasket shows signs of leaking, have the manifold checked for warpage at an automotive machine workshop and resurfaced if necessary.
9 Refit a new gasket, then position the intake manifold on the cylinder head and refit the nuts/bolts **(see illustration)**.
10 Tighten the nuts/bolts in three or four equal steps to the torque listed in this Chapter's Specifications. Work from the centre out towards the ends to avoid warping the manifold.
11 Refit the remaining parts in the reverse order of removal.
12 Before starting the engine, check the throttle linkage for smooth operation.
13 Run the engine and check for coolant and vacuum leaks.
14 Road test the car and check for proper operation of all accessories, including the cruise control system.

6 Exhaust manifolds - removal and refitting

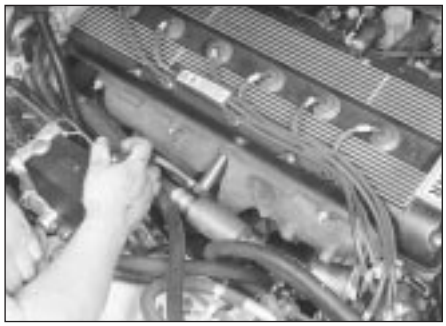
Warning: The engine must be completely cool before beginning this procedure.

Removal

1 Disconnect the negative cable from the battery.
Caution: If the stereo in your vehicle is equipped with an anti-theft system, make sure you have the correct activation code before disconnecting the battery.
2 On 1990 and later models, disconnect the EGR pipe and remove the EGR valve from the top of the exhaust manifold (see Chapter 6).
3 Apply penetrating oil to the exhaust manifold mounting nuts/bolts, and the nuts retaining the exhaust pipes to the manifolds. After the nuts have soaked, remove the nuts retaining the exhaust pipes to the manifolds and the lower bolt from the heat shield **(see illustration)**.
4 Remove the heat shield from the exhaust manifolds **(see illustration)**.
5 Disconnect the electrical connector to the oxygen sensor. Unless the oxygen sensor is being renewed, leave the sensor in place.
6 Remove the nuts/bolts and detach the manifolds and gaskets **(see illustration)**.

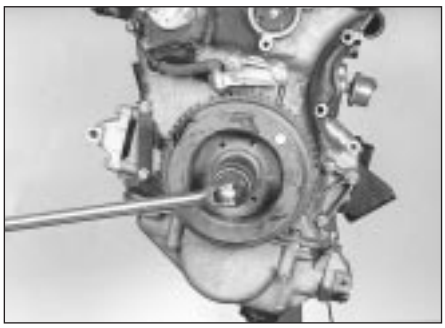
6.3 Remove nuts (small arrows) retaining the exhaust pipe to the manifold flanges; two for each pipe - larger arrow indicates one heat shield bolt accessible from below

6.4 Remove the upper heat shield bolts (arrowed)



6.6 Remove the bolts and nuts and remove the front and rear exhaust manifolds

6.8 Refit new gaskets in position over the studs with the markings facing out



7.4 Use a large breaker bar and the appropriate size socket to remove the crankshaft pulley bolt

7.5 After removing the centre bolt, remove the crankshaft damper with a two-bolt puller - be careful not to damage the sensor ring

Refitting

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

8 Position new gaskets over the cylinder head studs **(see illustration)**. **Note:** *The marks on the gasket should face out (away from the cylinder head) and the arrow should point toward the rear of the engine.*

9 Refit the manifolds and thread the mounting nuts/bolts into place.

10 Working from the centre out, tighten the nuts/bolts to the torque listed in this Chapter's Specifications in three or four equal steps.

11 Refit the remaining parts in the reverse order of removal.

12 Run the engine and check for exhaust leaks.

7 Crankshaft front oil seal - renewal

1 Disconnect the negative cable from the battery.

Caution: If the stereo in your vehicle is equipped with an anti-theft system, make sure you have the correct activation code before disconnecting the battery.

2 Refer to Chapter 1 and remove the accessory drive belts.

3 Refer to Chapter 3 and remove the fan shroud and fan clutch assembly.

4 Remove the crankshaft damper bolt with a socket and large breaker bar **(see illustration)**. To hold the crankshaft stationary, remove the flywheel inspection cover (see Chapter 8) and wedge a large screwdriver into the flywheel ring gear teeth.

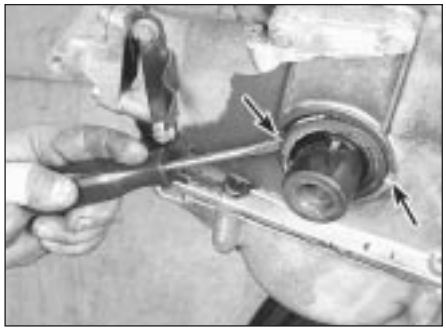
Warning: The damper bolt is under considerable torque, so be sure the socket is firmly in place and that your hands are not in danger of hitting anything sharp.

5 Use a bolt-type damper puller (available at most car accessory outlets) to remove the crankshaft damper **(see illustration)**.

7 Remove the Woodruff key from the crankshaft keyway **(see illustration)**.

8 Carefully pry the seal out of the front cover with a screwdriver or seal-removal tool **(see illustration)**. Don't scratch the bore or

7.7 Carefully tap one end the Woodruff key up and out from the crankshaft keyway, then grasp it with a pair of locking pliers and pull it the rest of the way out - be careful not to damage the key or keyway



7.8 Remove the crankshaft seal with a screwdriver or seal puller - there are two slots (arrowed) in the cover which allow you to pry behind the seal

7.9 Remove the spacer from the end of the crankshaft and clean it thoroughly

7.11 Drive the new seal squarely into the front cover with a large socket or section of pipe - do not remove the plastic refitting guide (arrowed) until the seal is installed

damage the crankshaft in the process (if the crankshaft is damaged, the new seal will end up leaking).

9 The crankshaft seal rides on a spacer that slips over the front of the crankshaft. Slip the spacer off and clean the varnish off the seal surface **(see illustration)**.

10 Clean the bore in the cover and coat the outer edge of the new seal with engine oil or multi-purpose grease. Apply moly-base grease to the seal lip.

11 Lubricate the spacer with clean engine oil and refit it onto the crankshaft. Using a socket with an outside diameter slightly smaller than the outside diameter of the seal, carefully drive the new seal into place with a hammer **(see illustration)**. Make sure it's installed squarely and driven in to the same depth as the original. If a socket isn't available, a short section of large-diameter pipe will also work.

Note: *The new seal comes with a plastic installer guide. Do not remove this guide until refitting is completed. The guide keeps the seal lip properly oriented over the crankshaft*.

12 Refit the Woodruff key, then refit the damper. Tighten the damper bolt to the torque listed in this Chapter's Specifications.

Note: *The damper bolt can be used to pull the damper back onto the crankshaft, but make sure the damper is perfectly aligned with the Woodruff key.*

13 The rest of the assembly is the reverse of the removal procedure.

14 Run the engine and check for oil leaks at the front seal.

8 Timing chains and sprockets - removal, inspection and refitting

Caution: If the timing chain broke during engine operation, the valves may have come in contact with the pistons, causing damage. Check the valve clearance (see Section 10) before removal of the cylinder head - bent valves usually will have excessive clearance, indicating damage that will require machine workshop work to repair.

Note 1: *This procedure requires that the sump be removed* (see Section 12). *In a professional workshop, this would be performed as an in-car procedure with specialised tools to remove the front suspension. Given the equipment available to the average home mechanic, this alternate procedure requires removal of the engine from the car.*

Note 2: *If your engine is a 4.0 litre, built after serial number 9J160552, and you're experiencing an engine rattle on cold starts that disappears after the engine is warmed up, the problem could be a defective upper tensioner. A newly designed replacement upper tensioner is available from the dealer and should solve the problem. It can be installed easily without pulling the cylinder head or front cover, or can be installed during a chain removal procedure*.

Removal

1 Disconnect the negative cable from the battery.

Caution: If the stereo in your vehicle is equipped with an anti-theft system, make sure you have the correct activation code before disconnecting the battery.

2 Block the rear wheels and set the handbrake.

3 Refer to Part B of this Chapter for engine removal procedures.

4 Refer to Section 4 and remove the valve cover.

5 Refer to Section 3 and position the engine at TDC for cylinder number 1, then mark and remove the distributor (see Chapter 5).

6 Refer to Section 11 and remove the cylinder head. After cylinder head removal, the upper timing chain will be loosely retained by the two upper chain guides, which are retained by refitting a large rubber band (see Section 10).

Caution: Do not rotate the crankshaft with the upper timing chain disconnected and the cylinder head and camshafts in place, or damage could result from piston-to-valve contact.

7 Some models may be equipped with a hydraulic pump used for the brake servo/hydraulic self-levelling suspension system. If equipped, it will be mounted to the front cover. Models not equipped with this option will have a flat block-off plate over the hole. If equipped with the pump, refer to Chapters 9 and 10 for procedures to reduce the high pressure in the brake servo system and to depressurise the self-levelling system. Before removing the engine, unbolt the pump from the front cover and set it aside without disconnecting the hoses **(see illustration)**.

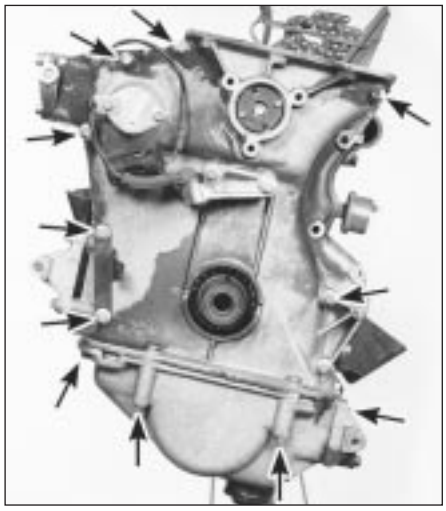
8 Refer to Section 7 and remove the crankshaft pulley and damper. Refer to Section 12 for removal of the sump.

9 If equipped with the hydraulic pump, remove the coupling disc and unbolt the drive coupling from the intermediate shaft **(see illustrations)**.

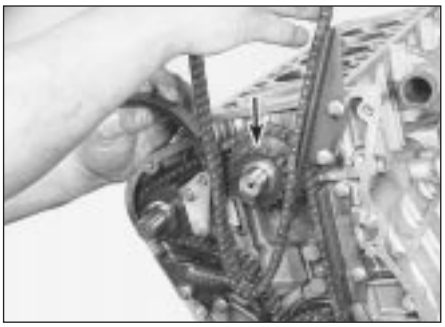
8.7 Unbolt the hydraulic pump (arrowed) from the front cover, without disconnecting the hoses

8.9a Pull the hydraulic pump coupling disc (arrowed) off the drive coupling . . .

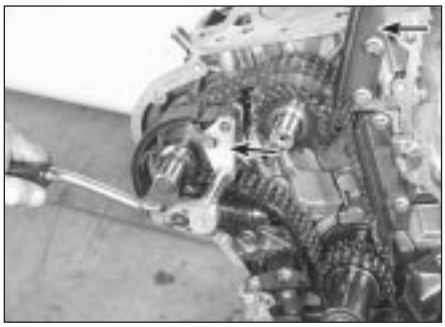
8.9b . . . and unbolt the drive coupling (arrowed) from the intermediate shaft



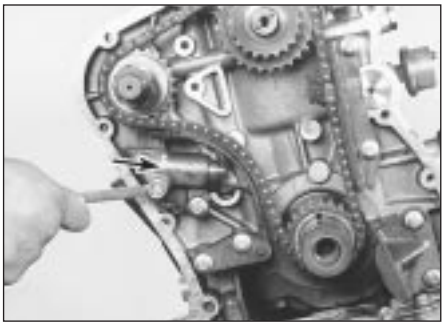
8.10 Remove the front cover-to-engine block and the sump-to-cover bolts (arrowed)



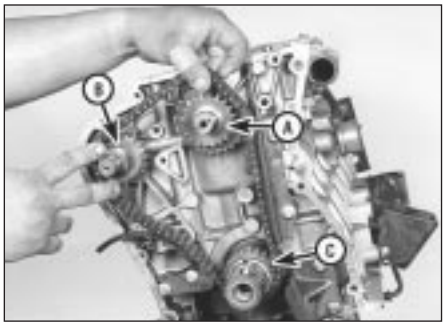
8.11 Remove the upper timing chain from the intermediate sprocket (arrowed)



8.12 Unbolt and remove the upper chain guide (right arrow) and the upper chain tensioner guide (left arrow)



8.13 Remove the two bolts and remove the lower timing chain tensioner (arrowed)



8.15 Remove the lower timing chain from the intermediate sprocket (A), the auxiliary shaft sprocket (B) and the crankshaft sprocket (C)

8.16 Apply paint marks on the crankshaft, crankshaft sprocket and the engine block (arrowed) to indicate TDC position

10 Remove the front cover-to-engine block bolts **(see illustration)**. **Note:** *Two of the front cover bolts are water pump assembly bolts. Refer to Chapter 3 for water pump removal, although only the two bolts that attach to the engine block need be removed.*

11 Release the rubber band from the upper tensioners and remove the upper timing chain **(see illustration)**.

12 Remove the upper chain guides **(see illustration)**.

13 Unbolt and remove the lower timing chain tensioner **(see illustration)**.

14 Refer to Section 13 for removal of the oil pump sprocket and drive chain.

15 Remove the lower timing chain from the intermediate sprocket, auxiliary shaft sprocket and the crankshaft sprocket **(see illustration)**.

16 Before proceeding any further, apply timing marks on the crankshaft and the engine block, allowing you to locate TDC position without the crankshaft pulley in place **(see illustration)**.

Inspection

17 Examine the sprockets for signs of wear or damage. Renew the timing chain if obvious wear or damage is noted or if it is the least bit questionable. **Note:** *If there is wear or damage noticed in any of the sprockets or chains, the entire set must be renewed, i.e. new chains and new sprockets*.

18 Correct any problems which contributed to chain failure prior to refitting of a new chain.

19 Check the chain guides for grooves, chips or wear in the contact surface. Clean and inspect the upper and lower tensioners.

Refitting

20 Remove all dirt, oil and grease from the timing chain area at the front of the engine.

21 Recheck the crankshaft timing marks to be sure they are properly aligned **(see illustration 8.16)**.

22 Refit the lower timing chain on the crankshaft, intermediate-shaft and auxiliary-shaft sprockets. The chain should be lubricated with engine oil.

8.23a Add oil to the reservoir in the lower tensioner . . .

8.23b . . . and refit the tensioner against the guide - after it's installed, push the tensioner guide back and forth a few times to prime the tensioner

23 Clean and lubricate the lower tensioner. Fill the lower tensioner oil reservoir with engine oil and refit it on the engine block, aligning the notch in the tensioner with the lug on the back of the guide **(see illustrations)**. This should remove all slack from the lower timing chain. If not, push the lower tensioner guide back and forth a few times to prime the tensioner.

24 Refit the upper chain tensioner guide and mounting bracket to the engine block.

Caution: Before fully tightening the mounting bracket to the engine block, make sure the mount and chain guide are clear of the lower chain, auxiliary sprocket and intermediate sprocket. If necessary, position the mount for clearance before tightening the mounting bolts.

25 Refit the oil pump drive chain and sprocket to the crankshaft (see Section 13).

26 Refit the upper chain fixed guide to the engine block and place the upper timing chain over the intermediate sprocket and auxiliary shaft sprocket, draping the excess chain over the top of the fixed guide. Lubricate the chain and sprockets with clean engine oil.

27 Gather the loose portion of the upper timing chain and place it between the upper guides. Use a large rubber band to hold the two guides snugly around the chain (**see Section 11**).

28 If necessary, renew the intermediate shaft seal **(see illustrations)**.

29 Apply a thin coat of RTV sealant to the engine side of the front cover and RTV sealant to the oil-pan mating surface (bottom of the front cover), then refit the front cover. **Note:** *Make sure the top surface of the cover aligns with the top surface of the engine block, by checking with a straightedge* **(see illustration)**.

30 Refer to Section 11 for refitting of the cylinder head and Section 10 for refitting of the camshafts and connection of the upper timing chain to the two camshaft sprockets.

31 The remainder of the refitting is the reverse of the removal procedure. If your car is equipped with the hydraulic/self-levelling suspension, refit the drive coupling and coupling disc to the intermediate shaft **(see illustrations 8.9a and 8.9b)**. Coat the mounting surface of the pump with RTV sealant and make sure the tang on the pump aligns with the slot in the intermediate shaft before bolting the pump to the front cover. Refer to Section 7 for refitting of the crankshaft spacer, damper and puller.

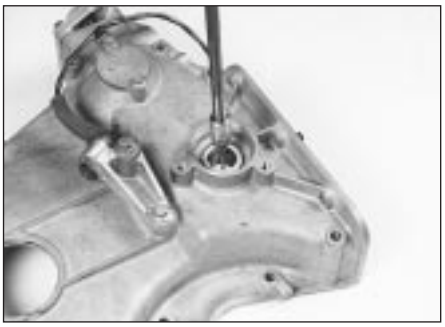
Caution: DO NOT start the engine until you're absolutely certain that the timing chains are installed correctly. Serious and costly engine damage could occur if the chains are installed wrong.

32 Run the engine and check for proper operation.

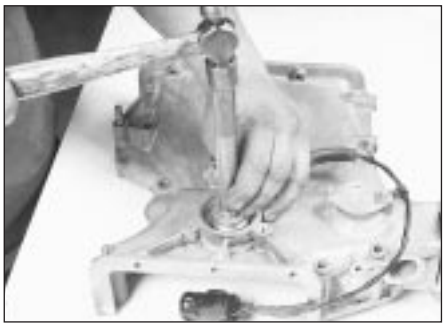
9 Auxiliary shaft - renewal

Caution: If the stereo in your vehicle is equipped with an anti-theft system, make sure you have the correct activation code before disconnecting the battery.

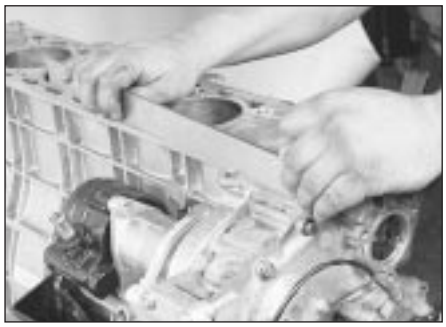
1 Refer to Chapter 10 and remove the power steering pump, without disconnecting the hoses. Remove the plastic power steering pump drive coupling disc.



8.28a Drill a small hole in the intermediate shaft seal, thread a sheet metal screw into it and use a small slide-hammer pull the seal out of the cover



8.28b Drive the new seal in with a seal-driver or socket, to the same depth as the original seal

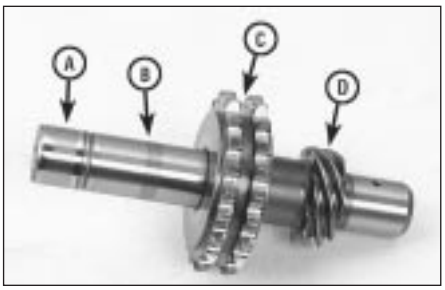


8.29 Bolt the front cover on hand tight, use a straightedge to make sure the cover's top surface is level with the top of the engine block, then tighten the cover bolts

9.3 Use a screwdriver to hold the drive coupling (arrowed) stationary while removing the bolt

9.4 Remove the auxiliary shaft seal with a small slide-hammer puller

9.5 Use snap-ring pliers to remove the snap ring (arrowed) from the shaft - note the three internal hex-head bolts retaining the housing to the engine block



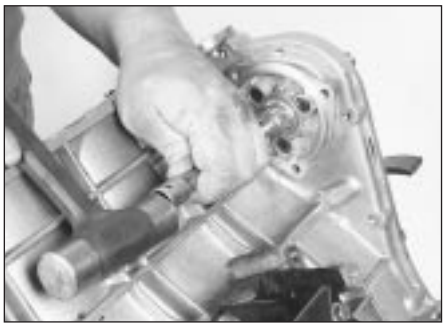
9.8 Inspect these areas of the auxiliary shaft for wear

A Oil seal surface
B Bearing journal
C Sprocket
D Distributor drive

9.9 Refit the auxiliary shaft rear housing with a new gasket, aligning the oil slot (arrowed) with the housing

9.10 Refit the washer before replacing the snap-ring

2 Refer to Section 8 and remove the front cover and upper and lower timing chains.
3 Remove the power steering drive coupling from the auxiliary shaft **(see illustration)**.
4 Use a small drill to drill holes in the oil seal, then use a slide-hammer puller to remove the seal from the rear of the auxiliary shaft housing **(see illustration)**.
Caution: Drill straight and carefully to avoid damaging the auxiliary shaft.
5 Use a pair of snap-ring pliers to remove the snap ring from the rear of the auxiliary shaft **(see illustration)**.
6 Pull the auxiliary shaft out toward the front of the engine.
7 Remove the three internal hex-head bolts and the auxiliary shaft housing.
8 Examine the surface of the auxiliary shaft, it's sprocket, and the distributor drive-gear. If there is noticeable wear or damage, replace the auxiliary shaft assembly with a new one **(see illustration)**.
9 If the auxiliary shaft housing has been removed, clean it, scrape away the old gasket material from the housing and the engine block and refit the housing with a new gasket **(see illustration)**.
10 Clean the auxiliary shaft, lubricate it with engine oil and refit it through the front of the block, then refit the washer **(see illustration)**. Refit the snap-ring **(refer to illustration 9.4)**.
11 The new oil seal for the rear of the auxiliary shaft comes with a plastic refitting sleeve that keeps the seal lip from folding back during refitting. Keep this sleeve in place until the seal is fully installed. Tap the new seal into the housing with a hammer and appropriate-size socket until the seal is flush, then remove the plastic sleeve **(see illustration)**.
12 The remainder of the refitting is the reverse of removal. **Note:** *When refitting the distributor* (see Chapter 5)*, use a new O-ring to prevent oil leaks at the distributor*.
13 Run the engine and check for oil leaks at the power steering pump-to-housing interface.



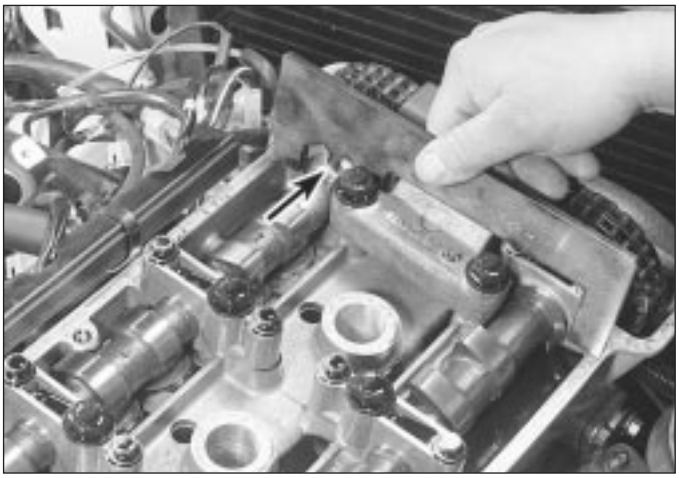
9.11 Tap the seal squarely into the bore with a socket until the seal is flush with the housing, then remove the plastic fitting sleeve

10 Camshafts and valve lifters - removal, inspection and refitting

Removal

Note: *The renewal of the camshafts requires the use of several special tools. Read through the procedure and acquire the special tools, or their equivalent, before beginning work.*
1 Remove the valve cover (see Section 4).
2 Refer to Section 3 and position the engine at TDC for number 1 cylinder.
3 Refer to Chapter 5 and remove the distributor cap and set it aside along with the spark plug leads. Mark the positions of the distributor body and rotor.
4 Using a feeler gauge, measure and record the clearance between the intake and exhaust camshaft lobes and the lifters for cylinder number 1 **(see illustration)**. Rotate the crankshaft until the next cylinder in the firing order is at TDC and check and record the valve clearance for that cylinder. Following the firing order, check and record the valve clearance for the remaining valves with the appropriate cylinder at TDC.
5 Return the engine to TDC for cylinder number 1. Using the special tool (Jaguar tool no. 18G 1433), check the position of each

10.4 Measure the valve clearance with a feeler gauge inserted between the heel of the camshaft lobe and the lifter

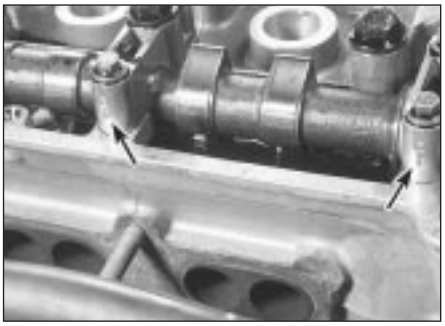


10.5 Position the camshaft alignment tool over each camshaft - the projection on the tool only fits into the slot on the camshafts when they are at TDC - flip the tool over to check the other camshaft

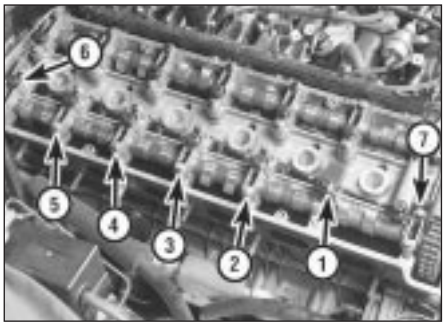
10.7 Loosen this bolt (arrowed) and swing the clamp away from the tensioner, then use pliers to pull the valve out

10.10a As each cap is removed . . .

10.10b . . . replace it with the special spacer block (arrowed) and tighten the cylinder head bolt to 53 Nm (39 lbf ft)



10.11a Each of the camshaft bearing caps are stamped with I (intake) or E (exhaust) and a number (arrowed)



10.11b After cap no. 2 is replaced with a spacer, repeat the procedure for the other caps in the sequence shown - after cap 5, loosen caps 6 and 7 alternately until valve spring pressure is relieved

camshaft to ensure that they are truly at TDC **(see illustration)**. It may be necessary to rotate the crankshaft slightly, to allow the tool to fit into the slot. Once the camshafts are positioned, DO NOT rotate the crankshaft further.

6 Check the TDC marks made on the distributor body and refer to Chapter 5 for removal of the distributor. **Note:** *Plug the distributor hole with a rag to keep out dirt*.

7 Locate the upper timing chain tensioner on the right front of the cylinder head. Loosen the bolt on the clamp and swing the clamp away from the tensioner return valve, then remove the valve **(see illustration)**.

8 Remove the tensioner bolts and pull out the tensioner.

9 The camshaft bearing caps are each retained by three bolts (the two front caps on each camshaft have only two bolts), of which one is a cylinder head bolt that threads into the engine block. If the camshafts are being removed as a step in cylinder head removal, the following steps involving spacer blocks are not required, just remove the bolts and caps, then remove the camshafts. If the procedure is being used for camshaft removal or adjustment of the lifter shims, the procedure must be followed exactly to maintain the cylinder head gasket seal.

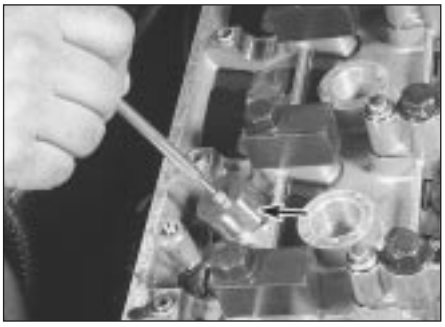
10 To maintain a good seal on the cylinder head gasket, if the cylinder head is not being removed, a spacer block (Jaguar tool no. 18G 1435) is used to replace each camshaft bearing cap as it is removed. Begin by unbolting and removing intake cap no. 2. Remove the large cylinder head bolt first, then the cap bolts. Without delay, refit a spacer block, with the cylinder head bolt, and tighten it to 53 Nm (39 lbf ft) **(see illustrations)**.

11 Repeat paragraph 10 with the remainder of the intake camshaft caps in sequence. After cap 5 in the sequence, loosen the front and rear caps alternately until valve spring pressure is relieved from the camshaft **(see illustrations)**. **Note:** *No spacer blocks are required with the number 1 camshaft caps*.

10.12 Bend back the locking tabs (arrowed) and remove the camshaft sprocket bolts

10.13 Remove the two bolts and the upper timing chain guide (arrowed)

10.14 Pull the inner sprocket from the outer sprocket of each camshaft



10.17 A magnet can be used to remove the lifters (arrowed)

10.18 The valve adjustment shims (arrowed) fit into a pocket in the valve spring retainer - use a magnet to remove the shims and keep them with their respective lifters

10.20 Measure the bearing journals with a micrometer to check diameter - measure at several places around the journal to check for taper or out-of-round

12 Remove the four bolts in each camshaft inner sprocket **(see illustration)**. The bolts are secured by sheetmetal "washer" plates. Bend down the locking tabs with a hammer and screwdriver tip to remove the bolts.

Caution: Stuff rags below the sprockets while removing the bolts to prevent a bolt from falling down into the front cover.

13 Remove the two bolts retaining the upper chain guide to the cylinder head **(see illustration)**.

14 Pull the inner sprockets from each camshaft **(see illustration)**. Each camshaft sprocket is comprised of an inner and outer, each with a set of fine splines that lock them together. The outer sprockets, with the teeth, can rotate on the camshafts until the inner sprocket bolts are tightened.

15 Pull the outer sprockets from the camshafts and allow the chain slacken.

16 At this point the camshafts can be carefully lifted straight up and off the cylinder head. Take care not to nick any of the lobes or journals during removal.

17 Use a magnet to remove the lifters, keeping them in order in a divided, numbered box **(see illustration)**. They **must** be returned to their original location if reusing the original camshafts!

18 Removing the lifters exposes the adjusting shims, sitting in a pocket in each valve spring retainer **(see illustration)**. Keep the shims with their matching lifters. Measure the thickness of each shim with a micrometer and record the measurements.

Inspection

19 After the camshaft has been removed from the engine, cleaned with solvent and dried, inspect the bearing journals for uneven wear, pitting and evidence of seizure. If the journals are damaged, the bearing surfaces in the cylinder head and caps may be damaged as well, requiring renewal of the cylinder head.

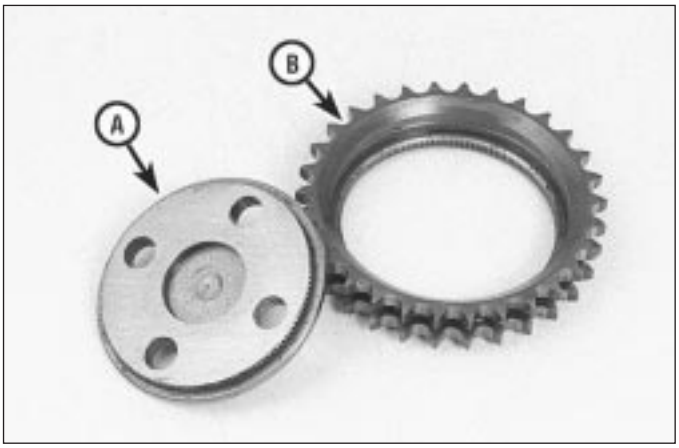
20 Measure the bearing journals with a micrometer to determine if they are excessively worn or out-of-round **(see illustration)**. Compare the measurements to Specifications.

21 Check the camshaft lobes for heat discolouration, score marks, chipped areas, pitting and uneven wear. Measure the lobe heights with a micrometer and record the measurements **(see illustrations)**. If there is variance of more than 0.005-inch, the camshaft and lifters must be renewed. If the lobes are in good condition, the camshaft can be reused.

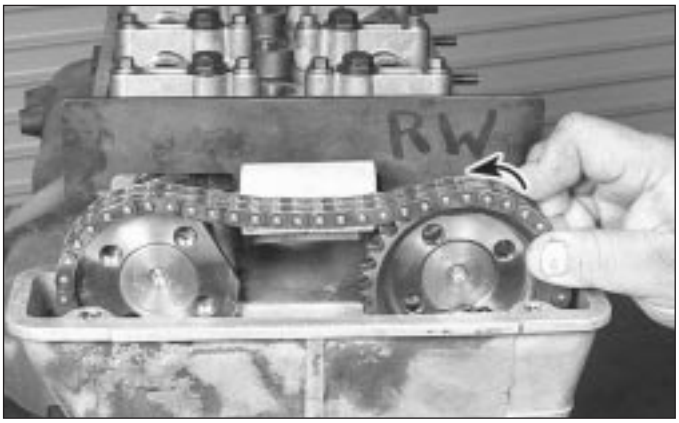
22 Inspect the top, bottom and side surfaces of the lifters for wear, grooving or scoring. If the lifters are damaged, the camshaft and its lifters must be renewed as a set.

10.21a Measure the camshaft lobe at its greatest dimension . . .

10.21b . . . and subtract the camshaft lobe diameter at its smallest dimension to obtain the lobe lift



10.27a Each camshaft sprocket is comprised of two sections, an inner (A) and outer (B) that are splined together



10.27b Push the outer sprocket over the intake camshaft until it locks in place - then turn the sprocket left to remove chain slack at the right

Refitting

23 If the valve clearance for any valve is incorrect, as measured in paragraph 4, refit a thicker or thinner shim on that valve. For example, if the clearance had been too large by 0.004-inch (compared to the recommended clearance in the Specifications), replace the existing shim there with a new one that is 0.004-inch thicker. If the clearance was too small, use a shim that is smaller than the original. Shims are identified alphabetically, in sizes from 0.085-inch (designated size A, the smallest) to 0.108-inch (designated size X, the thickest).

24 Lubricate the lifters with a thin coat of moly-based lubricant on the top, bottom and sides and refit them in their original positions.

25 Lubricate the camshafts with moly-based grease on the journals and lobes and lay them carefully in their bearing saddles.

26 Using NEW cylinder head bolts, replace the spacers, one at a time, with the bearing caps and bolts. Tighten the cap bolts, then the cylinder head bolts to the torque listed in this Chapter's Specifications. The front cap should be installed first, then cap number 7, then alternately tighten the first and last caps to bring the camshaft down evenly. Next refit caps 4, 2, 3, 5, and 6.

27 Align the intake camshaft with the special camshaft positioning tool as described in paragraph 5. Engage the outer sprocket with the chain, slip the sprocket over the end of the camshaft, then turn it until there is no slack in the chain to the right of the camshaft sprocket (facing the front of the engine). Now align the inner sprocket with the camshaft until the bolt holes align and mesh the splines between the two sprocket halves **(see illustrations)**. Tighten the inner sprocket bolts to the camshaft and bend the locking sheetmetal tabs over the bolts.

28 Keeping the slack in the chain to the left of the exhaust camshaft, refit the exhaust camshaft outer sprocket, meshed with the chain, over the end of the exhaust camshaft. Insert the timing chain tensioner tool (Jaguar tool no. 18G 1436) at the upper tensioner mounting point **(see illustration)**. **Note:** *The chain tensioner tool applies pressure to the upper timing chain to simulate the effect of the tensioner, which is operated by engine oil pressure when the engine is running*.

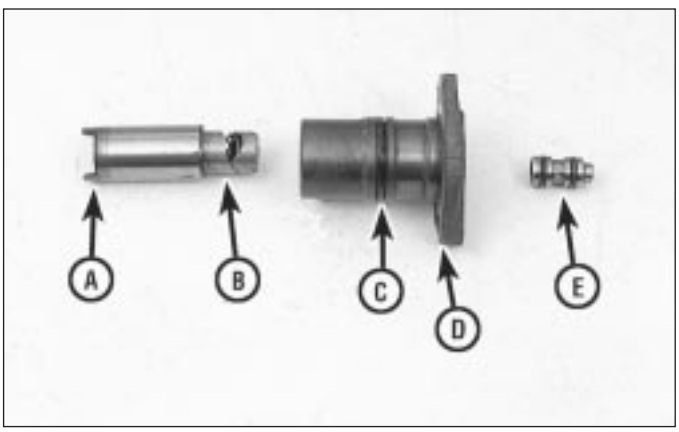
29 Align the exhaust camshaft to TDC with the special timing gauge tool. Tighten the centre bolt in the tensioner tool to 4 to 6 Nm. When the chain is tensioned, align the inner exhaust sprocket with the bolt holes in the camshaft, engage the splines between the two sprocket halves and secure the sprocket with the bolts and locking tabs. Refit the clip to secure the two sprocket halves together.

30 Clean the tensioner gasket surface, fit a new gasket and O-rings, push the ratchet down and twist it to maintain the fully retracted position, and refit the tensioner in place of the tensioning tool **(see illustration)**. **Note:** *Align the slot in the end of the tensioner straight up and down to fit over the tang on the back of the chain tensioner guide*.

31 Rotate the engine and recheck that all valve clearance measurements are now correct (see paragraph 4).

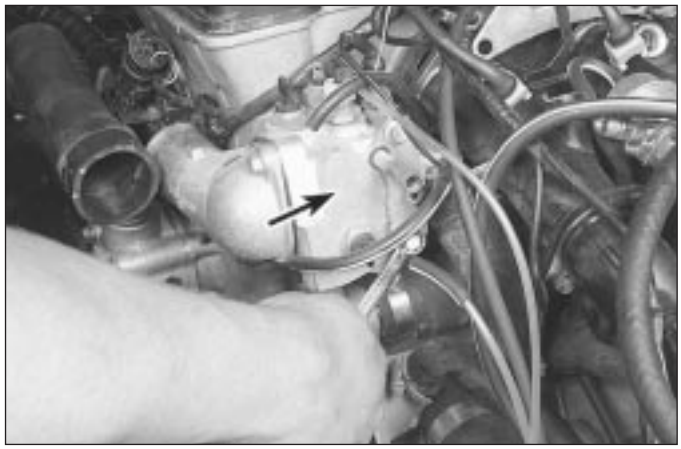
32 The remainder of refitting is the reverse of the removal procedure. **Note:** *When refitting the distributor, use a new O-ring where it fits into the engine block*.

10.28 The special tensioning tool simulates the operation of the oil-driven tensioner - apply 4 to 6 Nm (36 to 48 inch-pounds) pressure on the centre bolt (arrowed)

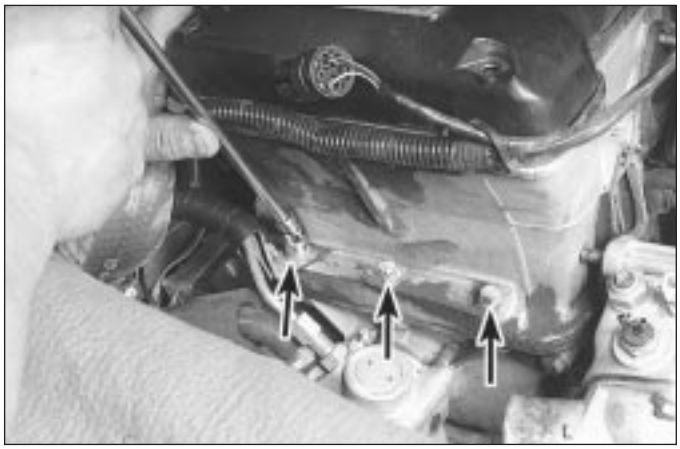


10.30 Upper timing chain tension components

A Notch (to align with tang on guide)
B Tensioner ratchet
C O-ring
D Gasket
E valve (with O-rings)



11.10 Disconnect the hoses and remove the bolts to separate the coolant housing (arrowed) from the cylinder head



11.11 Remove the bolts (arrowed) securing the cylinder head to the front cover

11 Cylinder head - removal and refitting

Note: *The engine must be completely cool before beginning this procedure.*

Removal

1 Disconnect the battery negative cable.
Caution: If the stereo in your vehicle is equipped with an anti-theft system, make sure you have the correct activation code before disconnecting the battery.
2 Drain the coolant from the engine block and radiator (see Chapter 1).
3 Drain the engine oil and remove the oil filter (see Chapter 1).
4 Remove the bonnet for easier access, if necessary (see Chapter 11).
5 Remove the intake manifold (see Section 5).
6 Remove the exhaust manifolds (Section 6).
7 Remove the valve cover (see Section 4).
8 Refer to Section 3 and Position the engine at TDC for cylinder number 1. Remove the distributor (see Chapter 5).
9 Remove the camshafts and sprockets (see Section 10). Place the upper chain between the two upper chain guides and wrap a large rubber band around the two guides, retaining the chain and guides.
10 Remove the coolant housing from the cylinder head **(see illustration)**.
11 Remove the cylinder head-to-front cover bolts **(see illustration)**.
12 Using a socket and breaker bar, loosen the cylinder head bolts in quarter-turn increments until they can be removed by hand. Loosen the cylinder head bolts using the opposite of the recommended tightening sequence **(see illustration 11.23)** to avoid warping or cracking the cylinder head.
13 Lift the cylinder head off the engine block. If it's stuck, very carefully pry up at the transmission end, beyond the gasket surface.
Caution: Though the cylinder head is aluminium, it is still heavy, large and awkward to handle. To avoid damaging the body during removal, use an engine hoist to lift the cylinder head out of the engine compartment, or have an assistant help you.
14 With the cylinder head on a workbench, remove all external components from the cylinder head to allow for thorough cleaning and inspection. See Chapter 2, Part B, for cylinder head servicing procedures.

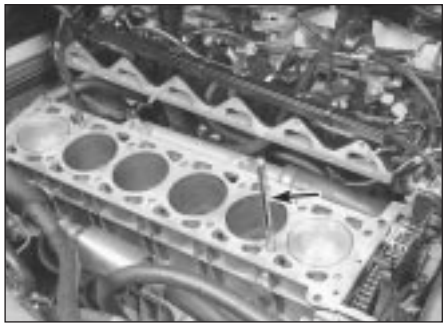
Refitting

15 The mating surfaces of the cylinder head and engine block must be perfectly clean when the cylinder head is installed.
16 Use a gasket scraper to remove all traces of carbon and old gasket material, then clean the mating surfaces with lacquer thinner or acetone. If there's oil on the mating surfaces when the cylinder head is installed, the gasket may not seal correctly and leaks could develop. When working on the engine block, stuff the cylinders with clean workshop rags to keep out debris. Use a vacuum cleaner to remove material that falls into the cylinders.
Caution: Use care when cleaning the cylinder head gasket surface. The cylinder head and engine block are aluminium and can be easily damaged by using sharp scraping tools. Gasket removal solvents are available from car accessory outlets and may be useful for safe removal of gasket material.
17 Check the engine block and cylinder head mating surface for nicks, deep scratches and damage from coolant corrosion. If damage is slight, it can be removed with a file; if it's excessive, machining may be the only alternative. See Part B of this Chapter for procedures and criteria concerning the repair of corrosion damage.
18 Use a tap of the correct size to chase the threads in the cylinder head bolt holes, then clean the holes with compressed air - make sure that nothing remains in the holes.

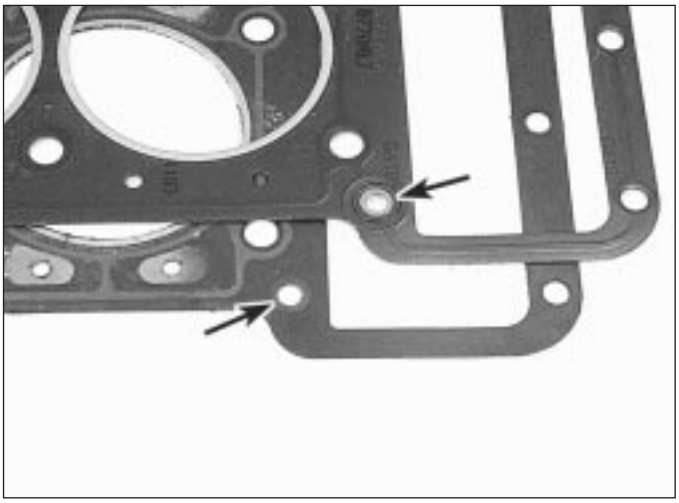
Warning: Wear eye protection when using compressed air!

19 Remove the rear cover from the cylinder head. Clean the gasket surface and refit the cover with a new gasket **(see illustration)**. Place the side of the gasket with the sealer bead against the cylinder head, do not use sealant on this gasket.
20 Fabricate two alignment studs from the old head bolts. Cut off the heads, then slot the ends with a hacksaw **(see illustration)**. New cylinder head bolts must be used when refitting the head.

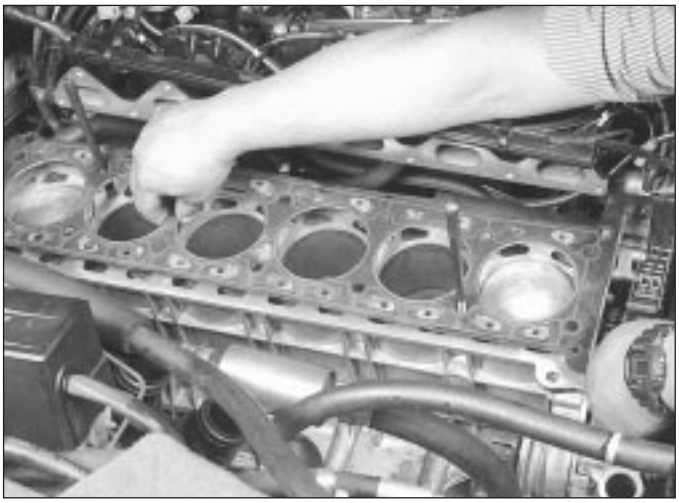
11.19 Remove the rear cover from the cylinder head, clean the gasket surfaces and refit the cover with a new gasket (arrowed) - note that the printed-on sealer bead is placed against the cylinder head



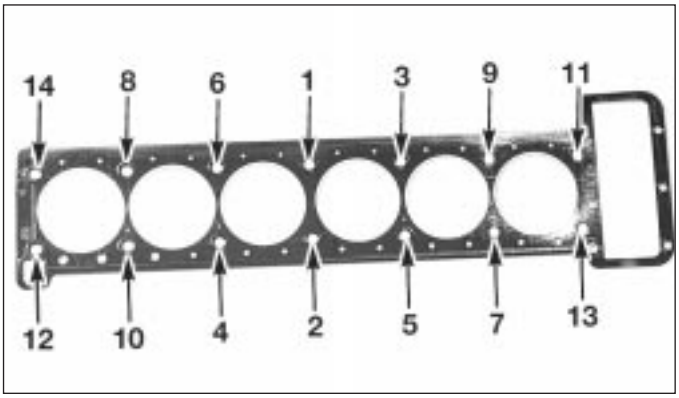
11.20 Fabricate two alignment studs from old cylinder head bolts and refit them in the engine block - after the cylinder head is installed, remove the two studs



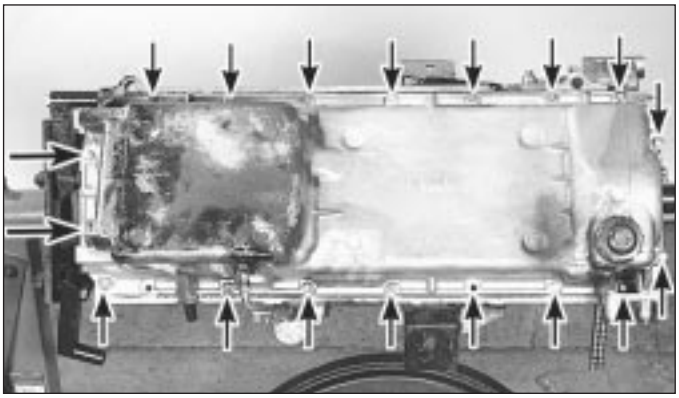
11.21a Only use a head gasket with the improved oil transfer seal (right arrow) - the older style (left arrow) is prone to oil leaks



11.21b Place the new head gasket over the dowels in the engine block - note the markings for UP or TOP printed on the gasket



11.23 Cylinder head bolt TIGHTENING sequence



12.3 Remove the sump bolts (arrowed)

21 There are variations in cooling holes in some models. Before refitting the cylinder head gasket, carefully check all of the passages and bolt holes in the new cylinder head gasket to be sure it matches your engine block. Also make sure the new cylinder head gasket you're using is equipped with the improved oil transfer hole seal **(see illustration)**. Position the cylinder head gasket over the dowel pins in the engine block, make sure TOP is facing up **(see illustration)**.

22 Carefully place the cylinder head on the engine block without disturbing the gasket.

23 Refit NEW cylinder head bolts and following the recommended sequence, tighten the bolts in two steps to the torque listed in this Chapter's Specifications **(see illustration)**. Step 2 of the tightening sequence requires the bolts to be tightened and additional 90°. An angle-torque attachment for your torque wrench is available at car accessory outlets. This tool provides precision when the angle-torque method is required and its use is highly recommended. If the tool is not available, paint a mark on the edge of each cylinder head bolt and tighten the bolt until the mark is 90¡ from the starting point. After the cylinder head bolts are tightened, tighten the cylinder head-to-timing-cover bolts.

24 The remaining refitting steps are the reverse of removal. Refer to Section 10 for replacing the camshaft sprockets and adjusting the timing chain and tensioner. Refill the cooling system (see Chapter 1).

25 Run the engine and check for oil or coolant leaks. Adjust the ignition timing (see Chapter 5) and road test the car.

12 Sump - removal and refitting

Removal

1 Note: *The sump cannot be removed with the engine in the chassis without lowering the front suspension and crossmember. This is a difficult procedure for the home mechanic without a vehicle hoist and some other specialised tools. The other alternative requires the engine be removed from the car and mounted on a stand, as we have illustrated here. Refer to Part B of this Chapter for engine removal procedures.*

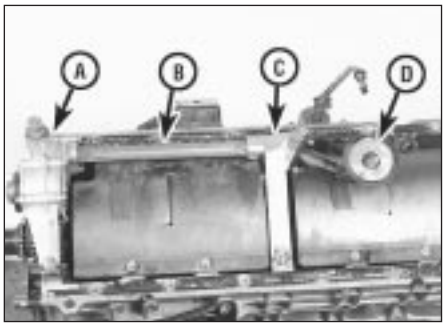
2 Drain the engine oil and remove the oil filter (see Chapter 1).

3 Remove the bolts and detach the sump **(see illustration).**

4 If it's stuck, pry it loose very carefully with a small screwdriver or putty knife **(see illustration)**. Don't damage the mating surfaces of the pan and engine block or oil leaks could develop.

12.4 Pry at the recess in the front of the sump to break the gasket seal - insert a putty knife, if necessary, between the sump and engine block

12.8 Remove the bolts (arrowed) and the sheetmetal baffle plate - clean the sump area of the sump with the baffle removed



12.9 Lubrication system components

A Oil pump
B Transfer tubes
C Transfer housing
D Oil pump pickup

12.10 Apply a bead of RTV sealant around the perimeter of the sump mounting flange, be sure to run the bead around the outside all bolt the holes

Refitting

5 Remove all traces of old gasket material and sealant from the engine block and sump. Clean the mating surface with lacquer thinner or acetone.

Caution: Do not use a sharp scraping tool. Both the sump and the engine block are aluminium and could be easily damaged.

6 Make sure the threaded bolt holes in the engine block and bellhousing are clean.

7 Inspect the flange of the sump for any cracks, pits or scratches that could cause an oil leak.

8 Remove the baffle plate at the rear of the sump **(see illustration)**. Clean the sump area and the baffle, then refit the baffle.

9 Inspect the oil pump pickup tube for cracks, or foreign material blocking the screen **(see illustration)**.

10 Apply a bead of RTV sealant to the sump flange **(see illustration)**. **Note:** *The sump must be installed within 5 minutes of sealer application.*

11 Carefully position the sump on the engine block and push it toward the transmission adapter plate as you press it against the engine block. Loosely refit four bolts, two on each side of the sump. Tighten the four bolts in a criss-cross pattern to the torque listed in this Chapter's Specifications, then loosen each bolt 90°.

12 Refit the two engine adapter-to-sump bolts. Tighten the two bolts to the torque listed in this Chapter's Specifications, then loosen each one 180°.

13 Refit the remainder of the sump-to-engine block bolts hand tight until all are installed, then tighten them to the torque listed in this Chapter's Specifications. Lastly, tighten the two adapter-to-sump bolts to the torque listed in this Chapter's Specifications.

Caution: Failure to follow this tightening procedure could stress or possibly crack the adapter plate.

14 The remainder of refitting is the reverse of removal. Be sure to add oil and refit a new oil filter.

15 Run the engine and check for oil pressure and leaks.

13 **Oil pump** - removal, inspection and refitting

Removal

1 Remove the sump (see Section 12).

2 Unbolt the oil pickup tube and oil transfer housing from the engine block **(see illustration)**. **Note:** *Have a drain pan under the transfer housing, as oil may drip out when the housing is loosened from the engine block.*

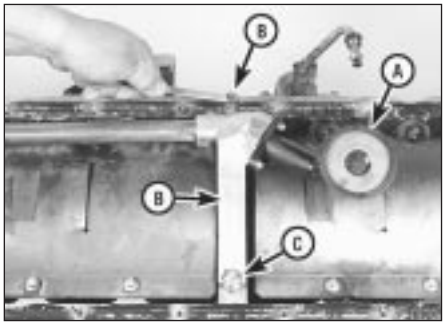
3 Carefully pull the transfer housing and transfer tubes to the rear to separate them from the oil pump body.

4 Bend back the locking tabs and remove the three bolts retaining the oil pump drive sprocket to the oil pump **(see illustration)**. Pull the chain and sprocket from the front of the pump. **Note:** *There are shims between the sprocket and the pump. Collect them while pulling off the sprocket*.

5 Remove the bolts and detach the oil pump from the engine**.**

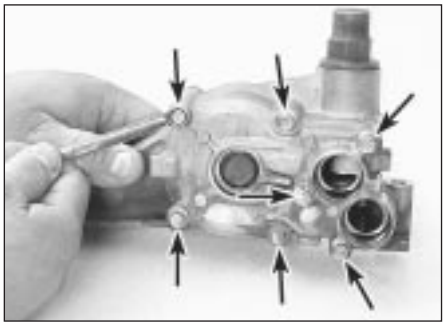
6 Remove all traces of sealant and old gasket material from the oil pump body and engine block, then clean the mating surfaces with lacquer thinner or acetone.

7 Remove the screws and separate the front and rear pump covers from the body. Lift out the drive and driven rotors **(see illustrations)**. **Note:** *Mark the front face of each rotor before removing them.*

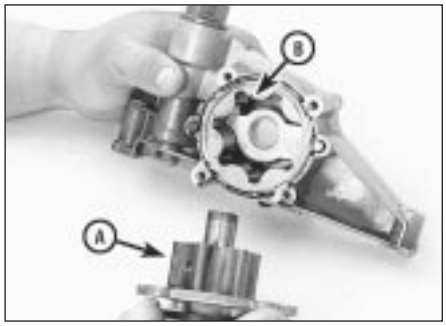


13.2 Unbolt the oil pump pickup (A) and the bolts (B) retaining the transfer assembly (C) to the engine block

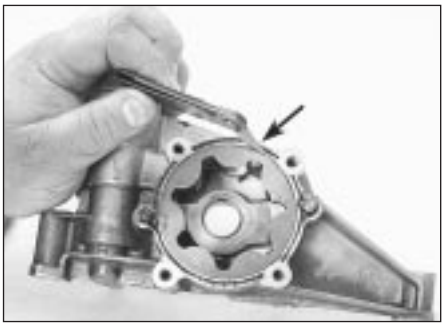
13.4 Pry back the locking tabs and remove the three bolts retaining the oil pump drive sprocket to the pump



13.7a Remove the bolts and separate the front and rear pump covers

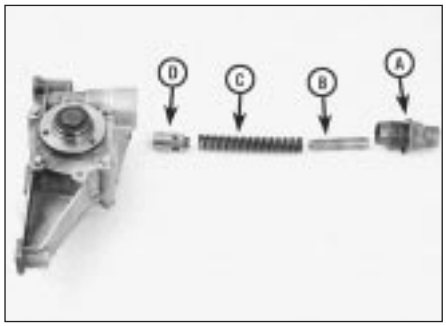


13.7b Remove the outer rotor (A) and inner rotor (B)



13.9 Measure the outer rotor-to-body clearance with feeler gauges (arrowed)

13.10 With a straightedge held tight to the pump surface, measure the clearance over the rotors with feeler gauges



13.11 Oil pressure relief valve components

A Relief valve cap
B Tube
C Spring
D Valve

Inspection

8 Clean and dry the pump body and both rotors. Measure the outside diameter of the outer rotor and thickness of both rotors.

9 Place the outer rotor into the pump body and use feeler gauges to measure the clearance between the outer rotor and the body **(see illustration)**.

10 Place a straightedge across the pump body and measure between the straightedge and the rotors to check the over-the-rotor clearance **(see illustration)**. Compare your measurements to this Chapter's Specifications and renew the oil pump if any are beyond the maximum allowable.

11 Remove the oil pressure relief valve cap. Remove and clean the relief valve components **(see illustration)**.

12 Clean all components with solvent and inspect them for wear and damage. If excessive wear, damage or if any clearance is beyond the Specifications, renew the entire pump as an assembly.

13 Check the oil pressure relief valve piston sliding surface and valve spring. If either the spring or the valve is damaged, they must be renewed as a set.

Refitting

14 Lubricate the drive and driven rotors with clean engine oil and place them in the case with the marks facing out. Apply a thin coat of anaerobic sealant (Loctite 510 or 518) to the gasket flange and refit the cover **(see illustration)**.

15 Lubricate the oil pressure relief valve piston with clean engine oil and refit the valve components into the oil pump body **(see illustration 13.11)**.

16 Apply a thin coat of anaerobic sealant (Loctite 510 or 518) to the oil pump-to-engine block-mounting surface, position the oil pump body against the engine block and refit the mounting bolts, tightening the bolts to the torque listed in this Chapter's Specifications. Follow a criss-cross pattern when tightening the bolts to avoid warping the oil pump body.

17 If using the original oil pump, refit the original sprocket shim pack **(see illustration)**. If a new pump is installed, start off with a 0.38 mm (0.015-inch) thick shim pack, refit the drive sprocket and align the sprocket as follows.

18 Use a straightedge to check the alignment of the oil pump sprocket with the crankshaft sprocket **(see illustration)**. If they are not aligned, increase or decrease the shim pack at the oil pump sprocket until alignment is correct, then secure the oil pump sprocket bolts by bending up the sheetmetal tabs. **Note:** *You may be able to use all or part of the original shim pack from the original oil pump (if a new pump is being fitted). If required, shims are available in 0.127 mm (0.005 inch), 0.254 mm (0.010 inch) and 0.508 mm (0.020 inch) sizes.*

19 Fit new O-rings to each end of the transfer tubes and refit the tubes into the transfer housing. **Note:** *Use petroleum jelly to lubricate the O-rings*.

20 Apply a thin coat of RTV sealant to the engine block-mounting surface of the transfer housing. Lift the transfer housing and tubes into place and push the front of the tubes in the back of the oil pump, until you can start the transfer housing-to-engine block bolts. Tighten the bolts to the torque listed in this Chapter's Specifications.

21 Refit the remaining parts in the reverse order of removal.

22 Add oil, start the engine and check for oil pressure and leaks.

23 Recheck the engine oil level.

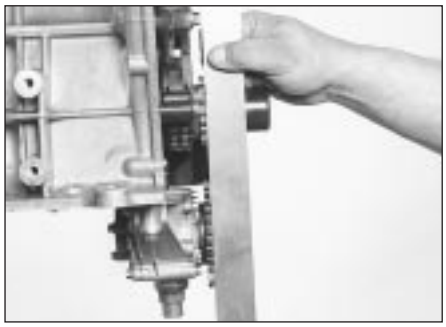
14 Driveplate - removal and refitting

Removal

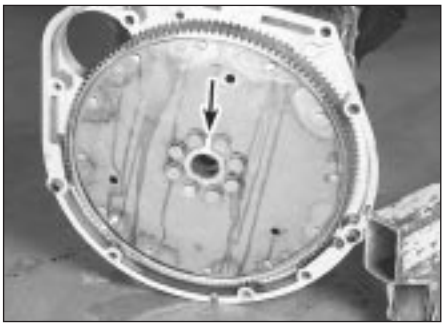
1 Raise the car and support it securely on axle stands, then refer to Chapter 7 and remove the transmission. If it's leaking, now would be a very good time to renew the front pump seal/O-ring.

13.14 Apply a thin coat anaerobic sealant (Loctite 510 or 518) to the pump cover sealing surface

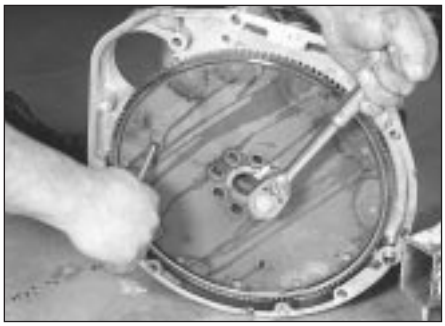
13.17 Refit the original shim pack (arrowed) if the original pump is being used - if a new pump is being installed, refit a 0.38 mm (0.015-inch) shim pack



13.18 Check the oil pump and crankshaft sprocket alignment with a straightedge - add or subtract shims until the sprockets are aligned for smooth chain operation



14.2 Mark the driveplate and the crankshaft so they can be reassembled in the same relative position



14.3 Use a screwdriver to secure the flywheel while the bolts are removed

14.4 Pry off the driveplate spacer - if a driveplate is replaced, the spacer should be replaced also

2 Use a centre punch or paint to make alignment marks on the driveplate and crankshaft to ensure correct alignment during refitting **(see illustration)**.

3 Remove the bolts that secure the driveplate to the crankshaft. If the crankshaft turns, wedge a screwdriver through a hole in the driveplate to keep it from turning **(see illustration)**.

4 Remove the driveplate from the crankshaft. A spacer is located behind the driveplate **(see illustration)**. Pry it off and store it with the driveplate.

Warning: The ring-gear teeth may be sharp, wear gloves to protect your hands when handling the driveplate.

Refitting

5 Clean the driveplate to remove grease and oil. Inspect the surface for cracks. Check for cracked and broken ring gear teeth. **Note:** *If there is any damage to the driveplate, replace the driveplate with a new driveplate, a new spacer and new bolts. Improved parts are available as a set from the dealer.*

6 Clean and inspect the mating surfaces of the driveplate and the crankshaft. If the crankshaft rear seal is leaking, renew it before refitting the driveplate (see Section 15).

7 Position the driveplate against the crankshaft. Be sure to align the marks made during removal. Some models may have an alignment dowel or staggered bolt holes to ensure correct refitting. Before refitting the bolts, apply thread-locking compound to the bolt threads.

8 Wedge a screwdriver in the ring gear teeth to keep the driveplate from turning and tighten the bolts to the torque listed in this Chapter's Specifications. Follow a criss-cross pattern and work up to the final torque in three or four steps.

9 The remainder of refitting is the reverse of the removal procedure.

15 Crankshaft rear oil seal - renewal

1 The transmission adapter plate and driveplate must be removed from the car for this procedure (see Chapter 7).

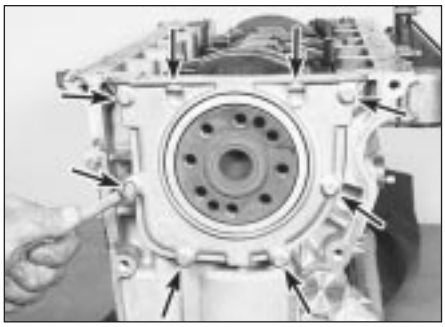
2 Remove the bolts, and detach the oil seal retainer. Remove the gasket material from the block and the seal retainer **(see illustration)**.

3 Position the oil seal and retainer assembly between two wood blocks on a workbench and drive the old seal out from the backside **(see illustration)**.

4 The new seal must be driven into the retainer plate from the engine side. Drive the new seal into the retainer with a wood block or a section of pipe slightly smaller in diameter than the outside diameter of the seal **(see illustration)**. The seal should be driven in only until it is flush with the transmission side of the retainer.

Caution: The new seal comes with a special plastic refitting sleeve inserted in the seal. It is designed to allow the seal to slide over the end of the crankshaft without displacing the seal lip. Do NOT remove this plastic sleeve until the retainer and seal have been installed on the engine.

5 Lubricate the seal area of the crankshaft with engine oil. Apply a bead of RTV sealant to the sealing surface of the retainer **(see illustration)**.

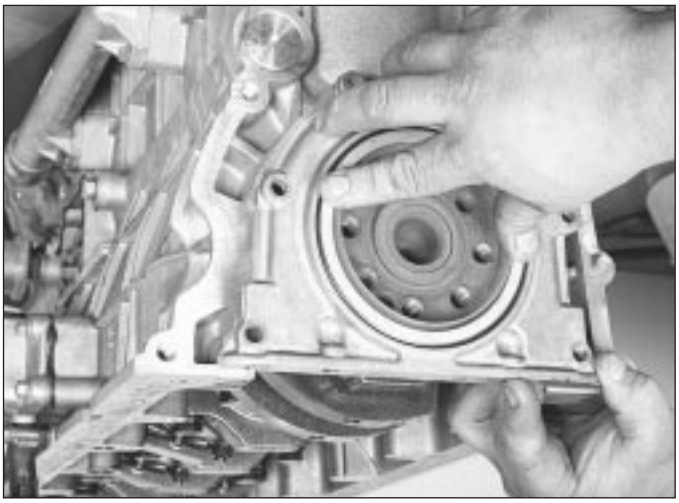


15.2 Remove the bolts (arrowed) and the crankshaft rear oil seal retainer from the back of the engine block

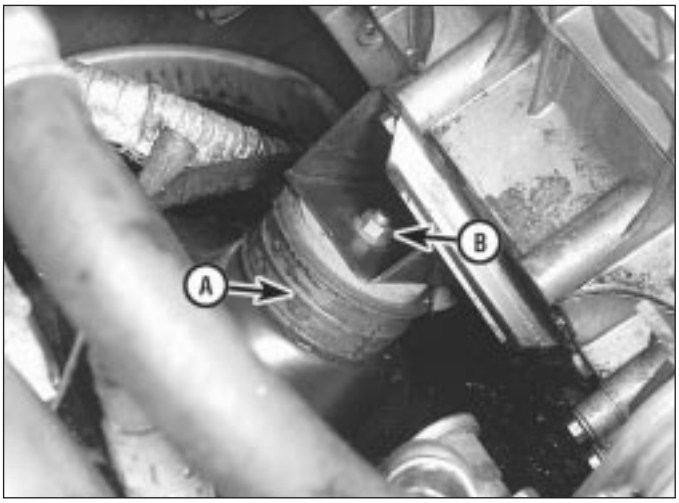
15.3 After removing the retainer assembly from the engine block, support it between two wood blocks and drive out the old seal with a drift punch and hammer

15.4 Drive the new seal into the retainer with a wood block

15.5 Apply RTV sealant to the sealing surface



15.6 Refit the retainer and oil seal onto the crankshaft



16.9 Front engine mount (A) and retaining nut to engine bracket (B)

6 Slowly and carefully press the seal and retainer squarely onto the crankshaft **(see illustration)**. The plastic sleeve may be pushed out as the retainer seats on the engine block. Remove the plastic sleeve.
7 Refit and tighten the retainer bolts to the torque listed in this Chapter's Specifications.
8 The remaining steps are the reverse of removal.

16 Engine mounts - check and renewal

1 Engine mounts seldom require attention, but broken or deteriorated mounts should be renewed immediately or the added strain placed on the driveline components may cause damage or wear.

Check

2 During the check, the engine must be raised to remove the weight from the mounts.
3 Raise the car and support it securely on axle stands, then position a jack under the engine sump. Place a large wood block between the jack head and the sump, then carefully raise the engine just enough to take the weight off the mounts. Do not position the wood block under the drain plug.

Warning: DO NOT place any part of your body under the engine when it's supported by a jack!

4 Check the front mounts to see if the rubber is cracked, hardened or separated from the metal plates. Sometimes the rubber will split down the centre.
5 Check for relative movement between the mount plates and the engine or frame (use a large screwdriver or pry bar to attempt to move the mounts). If movement is noted, lower the engine and tighten the mount fasteners.
6 Rubber preservative should be applied to the mounts to slow deterioration.

Renewal

7 Disconnect the battery negative cable.
Caution: If the stereo in your vehicle is equipped with an anti-theft system, make sure you have the correct activation code before disconnecting the battery.
8 Raise the car and support it securely on axle stands. Support the engine as described in paragraph 3.
Caution: Ensure the cooling fan doesn't hit the shroud as the engine is raised.
9 To remove either engine mount, remove the nut from the engine bracket, then raise the engine **(see illustration)**.
10 From underneath the car, lower the steering gear (see Chapter 10) for access to the nut retaining the insulator to the chassis bracket.
11 Refitting is the reverse of removal. Use thread-locking compound on the mount bolts/nuts and be sure to tighten them securely.
12 See Chapter 7 for transmission mount renewal.