Torque wrench settings	Nm	lbf ft
Balance shaft chain idler sprocket	25	18
Balance shaft sprockets	22	16
Big-end bearing cap nuts:		
Stage 1	20	15
Stage 2	Angle-tighten a further 70°	
Camshaft bearing cap	15	11
Camshaft sprockets	63	46
Crankshaft pulley bolt	175	129
Cylinder head bolts:		
Stage 1	40	30
Stage 2	60	44
Stage 3	Angle-tighten a further 90°	
Cylinder head cover	15	11
Driveplate	95	70
Engine oil drain plug	25	18
Engine-to-transmission bolts	70	52
Flywheel	80	59
Front engine mounting:		
Bracket to engine	47	35
Torque arm to body	121	89
Torque arm to bracket	47	35
Left-hand transmission mounting:		
Mounting nut	85	63
Mounting to body	60	44
Bracket to transmission:		
Manual	40	30
Automatic	84	62
Main bearing cap bolts:		
Stage 1	20	15
Stage 2	Angle-tighten a further 70°	
Oil cooler hose unions	8	6
Piston cooling jet	18	13
Plug for camshaft chain tensioner	22	16
Plug for oil cooler thermostat	60	44
Plug for oil pressure reducing valve	30	22
Rear engine mounting:		
Bracket to transmission	84	62
Mounting to subframe	26	19
Mounting nut	26	19
Right-hand engine mounting:		
Mounting-to-inner wing bolts	47	35
Mounting-to-bracket-to=engine bolts	47	35
Mounting-to-bracket nut	105	77
Sump bolts	22	16
Timing chain tensioner body	63	46
Timing chain tensioner spring plug	22	16
Timing cover bolts	22	16

1 General information

How to use this Chapter

This Part of Chapter 2 describes those repair procedures that can reasonably be carried out on the engine while it remains in the car. If the engine has been removed from the car, and is being dismantled as described in Part C, any preliminary dismantling procedures can be ignored.

Note that, while it may be possible physically to overhaul items such as the piston/connecting rod assemblies while the engine is in the car, such tasks are not normally carried out as separate operations. Usually, several additional procedures (not to mention the cleaning of components and oilways) have to be carried out. For this reason, all such tasks are classed as major overhaul procedures, and are described in Part C of this Chapter.

Part C describes the removal of the engine/transmission from the vehicle, and the full overhaul procedures that can then be carried out.

Engine description

The engine is of in-line four-cylinder, double-overhead camshaft (DOHC), 16-valve type, mounted transversely at the front of the car with the transmission attached to its left-hand end. The Saab 9-5 is fitted with 1985 cc or 2290 cc engine versions, which have balance shafts that are situated in the cylinder block to smooth out vibrations. All engines are fuel-injected using a Saab-manufactured 'Trionic' engine management system.

The crankshaft runs in five main bearings. Thrustwashers are fitted to the centre main bearing (upper half only) to control crankshaft endfloat.

The connecting rods rotate on horizontally split bearing shells at their big ends. The pistons are attached to the connecting rods by fully-floating gudgeon pins, which are retained in the pistons by circlips. The aluminium-alloy pistons are fitted with three piston rings – two compression rings and an oil control ring.

The cylinder block is of cast-iron, and the cylinder bores are an integral part of the cylinder block. The intake and exhaust valves are closed by coil springs, and operate in guides pressed into the cylinder head. The valve seat inserts are also pressed into

cylinder head, and can be renewed separately if worn. There are four valves per cylinder.

The camshafts are driven by a single-row timing chain, and they operate the 16 valves via hydraulic cam followers. The hydraulic cam followers maintain a predetermined clearance between the cam lobe and the end of the valve stem, using hydraulic chambers and a tension spring. The followers are fed with oil from the main engine lubrication circuit.

The balance shafts are driven in counter-rotation by a small single-row chain from a sprocket on the front of the crankshaft. The run of the balance shaft chain is controlled by two fixed guide rails and an idler sprocket. The chain is located on the outside of the main camshaft timing chain, with its tension being controlled by a dedicated oil pressure-driven tensioner.

Lubrication is by means of a bi-rotor oil pump, driven from the front of the crankshaft and located in the timing cover. A relief valve in the timing cover limits the oil pressure at high engine speeds by returning excess oil to the sump. Oil is drawn from the sump through a strainer and, after passing through the oil pump, is forced through an externally-mounted filter and oil cooler into galleries in the cylinder block/crankcase. From there, the oil is distributed to the crankshaft (main bearings), balance shafts, camshaft bearings and hydraulic cam followers. It also lubricates the water-cooled turbocharger and the crankcase-mounted piston cooling jets. The big-end bearings are supplied with oil via internal drillings in the crankshaft, while the camshaft lobes and valves are lubricated by splash, as are all other engine components.

Repairs with engine in car

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

a) *Compression pressure – testing.*
b) *Cylinder head cover – removal and refitting.*
c) *Camshaft oil seals – renewal.*
d) *Camshafts – removal, inspection and refitting.*
e) *Cylinder head – removal and refitting.*
f) *Cylinder head and pistons – decarbonising (refer to Part C of this Chapter).*
g) *Sump – removal and refitting.*
h) *Oil pump – removal, overhaul and refitting.*
i) *Crankshaft oil seals – renewal.*
j) *Flywheel/driveplate – removal, inspection and refitting.*
k) *Engine/transmission mountings – inspection and renewal.*

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 1A). The aid of an assistant will also be required.

3 Disable the ignition system by disconnecting the wiring plug from the Direct Ignition cartridge.

4 To prevent unburnt fuel from being supplied to the catalytic converter, the fuel pump must also be disabled by removing the relevant fuse and/or relay; see Chapter 4A as applicable for further details.

5 Fit a compression tester to the No 1 cylinder spark plug hole – the type of tester which screws into the plug thread must be used to obtain accurate readings.

6 Have the assistant depress the accelerator pedal fully, 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.

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

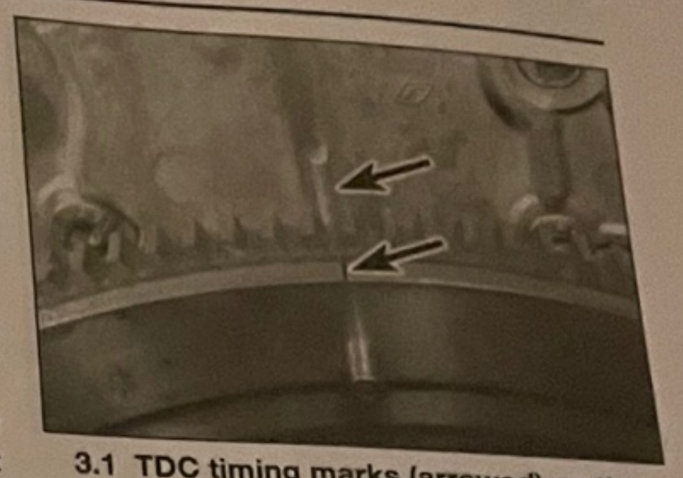
8 All cylinders should produce very similar pressures; a difference of more than 2 bars between any two cylinders indicates a fault. Note that the compression should build-up quickly in a healthy engine; low compression on the first stroke, followed by gradually increasing pressure on successive strokes, 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 cylinder head could also be the cause). Deposits on the undersides of the valve heads can also cause low compression.

9 Saab specify that the expected compression pressures required are 12 bars for the B205 (1985 cc) engine and 14 bars for the B235 (2290 cc) engine. Any cylinder pressure of below 10 bars for the B205 engine or 12 bars for the B235 engine can be considered as less than healthy. Refer to a Saab dealer or other specialist if in doubt as to whether a particular pressure reading is acceptable.

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

11 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.

12 A low reading only 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.



3.1 TDC timing marks (arrowed) on the flywheel and engine backplate

13 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.

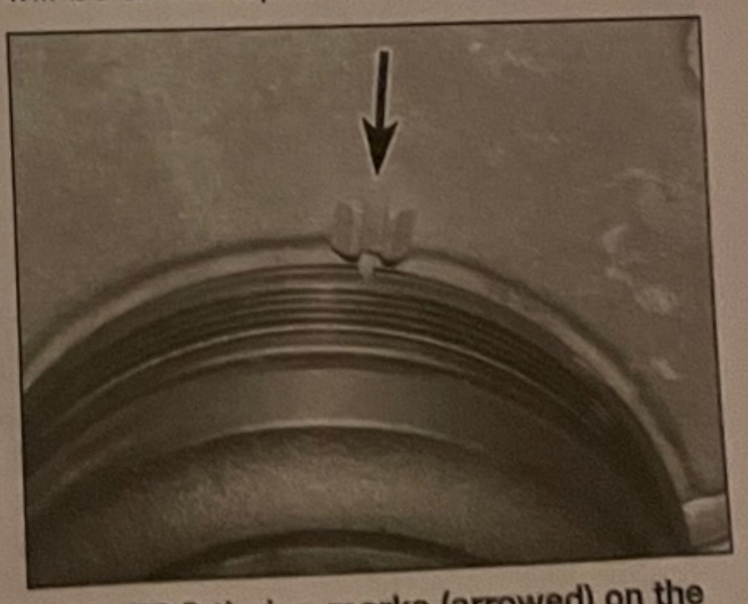
14 On completion of the test, refit the spark plugs and reconnect the ignition system and fuel pump as necessary.

3 Top dead centre (TDC) for No 1 piston – locating

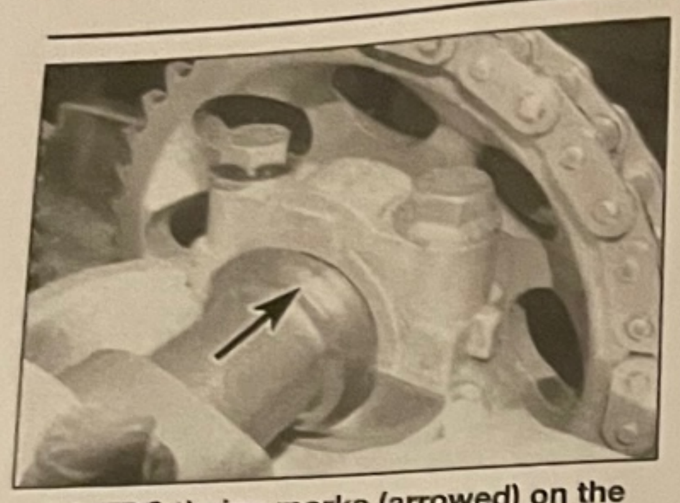
1 TDC timing marks are provided in the form of a slot machined into the crankshaft pulley and a corresponding bar cast into the timing chain cover. In addition, TDC marks are provided on the flywheel and oil seal housing – these are useful if the engine is being dismantled on the bench **(see illustration)**. **Note:** *With the timing marks correctly aligned, piston Nos 1 (at the timing chain end of the engine) and 4 (at the flywheel end of the engine) will be at top dead centre (TDC), with piston No 1 on its compression stroke.*

2 For access to the crankshaft pulley bolt, jack up the front of the car and support on axle stands (see *Jacking and vehicle support*). Remove the right-hand front wheel, then remove the screws and detach the inspection cover from the right-hand wheel arch liner.

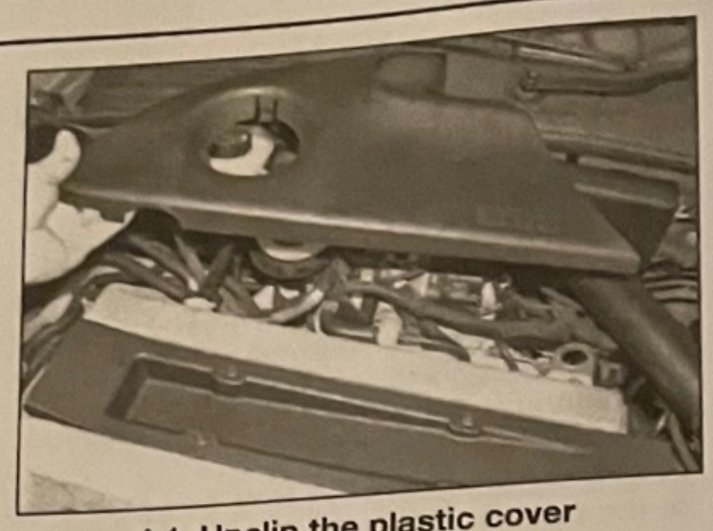
3 Using a socket on the crankshaft pulley, turn the engine until the TDC slot in the crankshaft pulley is aligned with the slot on the timing cover **(see illustration)**. No 1 piston (at the timing chain end of the engine) will be at the top of its compression stroke.



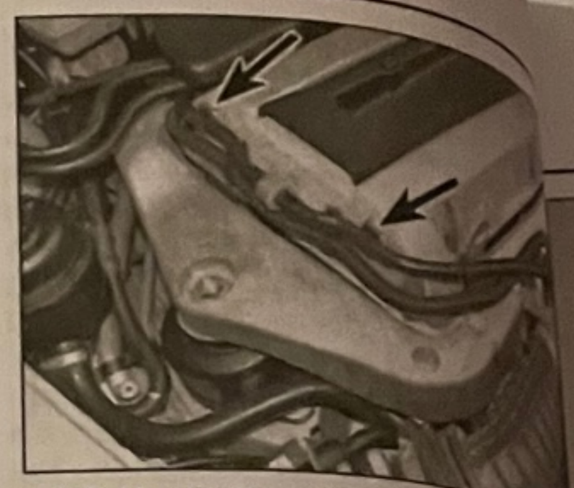
3.3 TDC timing marks (arrowed) on the timing chain cover and crankshaft pulley



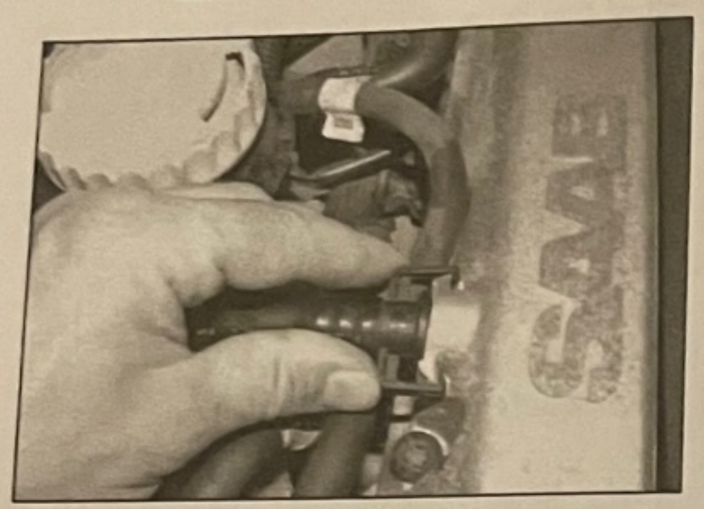
3.5 TDC timing marks (arrowed) on the camshaft and bearing cap



4.1 Unclip the plastic cover



4.2 Unclip the wiring and hose from securing clips (arrowed)



4.3 Disconnect the breather hose from the cover

4.4a Disconnecting the wiring connector from the ignition cartridge . . .

The compression stroke can be confirmed by removing the No 1 spark plug, and checking for compression with a finger over the plug hole as the piston approaches the top of its stroke. No compression indicates that the cylinder is on its exhaust stroke and is therefore one crankshaft revolution out of alignment.

4 Remove the cylinder head cover with reference to Section 4.

5 Check that the TDC marks at the sprocket ends of the camshafts are aligned with the corresponding TDC marks on the camshaft bearing caps **(see illustration)**. If necessary, turn the crankshaft to bring the marks into alignment.

4 Cylinder head cover – removal and refitting

Removal

1 Open the bonnet and unclip the plastic cover away from the intake manifold **(see illustration)**.

2 Unclip the wiring and crankcase breather pipe from the right-hand end of the cylinder head cover **(see illustration)**.

3 Disconnect the crankcase breather hose from the cover, by releasing the securing clip (and where applicable, the vacuum hose) and then position them to one side **(see illustration)**.

4 Disconnect the wiring connector, then remove the screws and remove the ignition cartridge from the centre of the cylinder head cover – refer to Chapter 5B, Section 3, if necessary **(see illustrations)**.

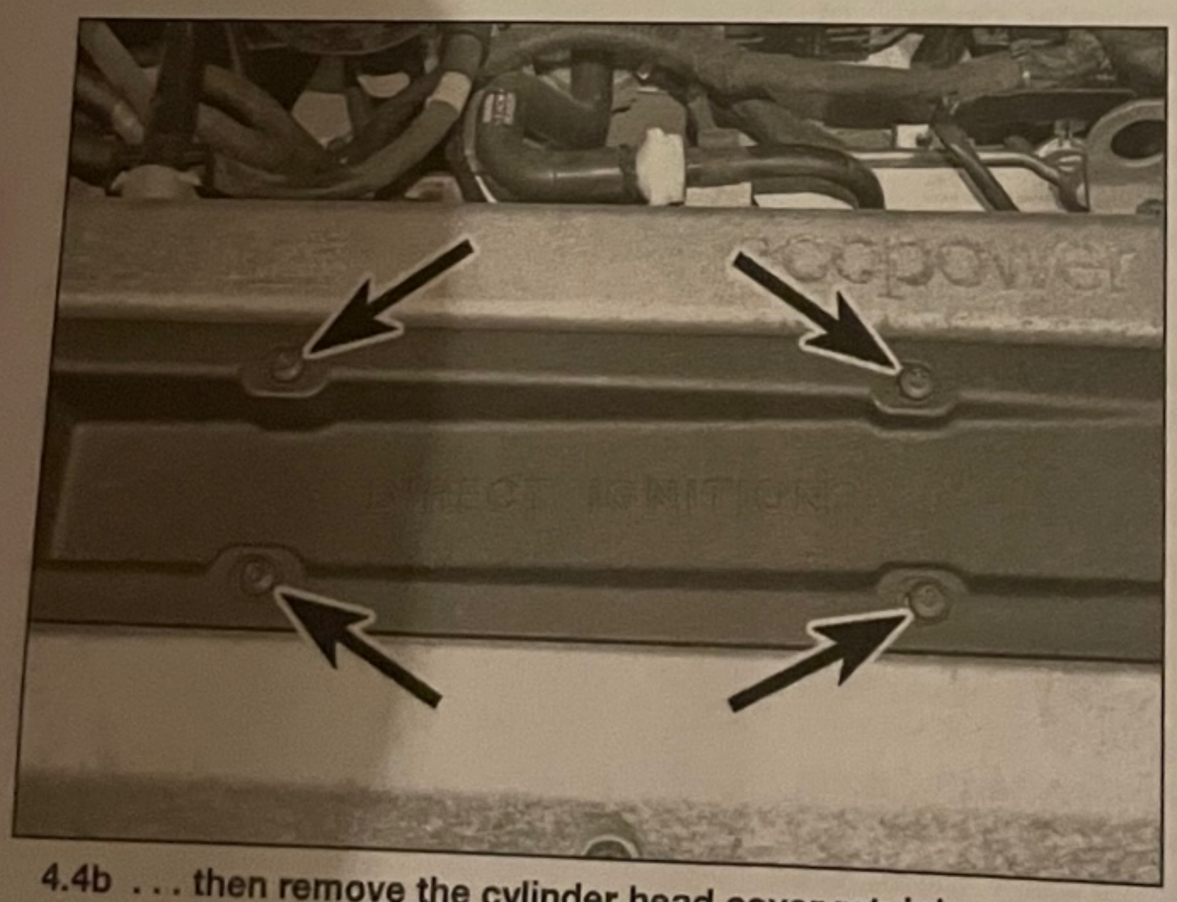
5 Unbolt and remove the cylinder head cover and remove the gasket. If the cover is stuck, tap it gently with the palm of your hand to free it.

Refitting

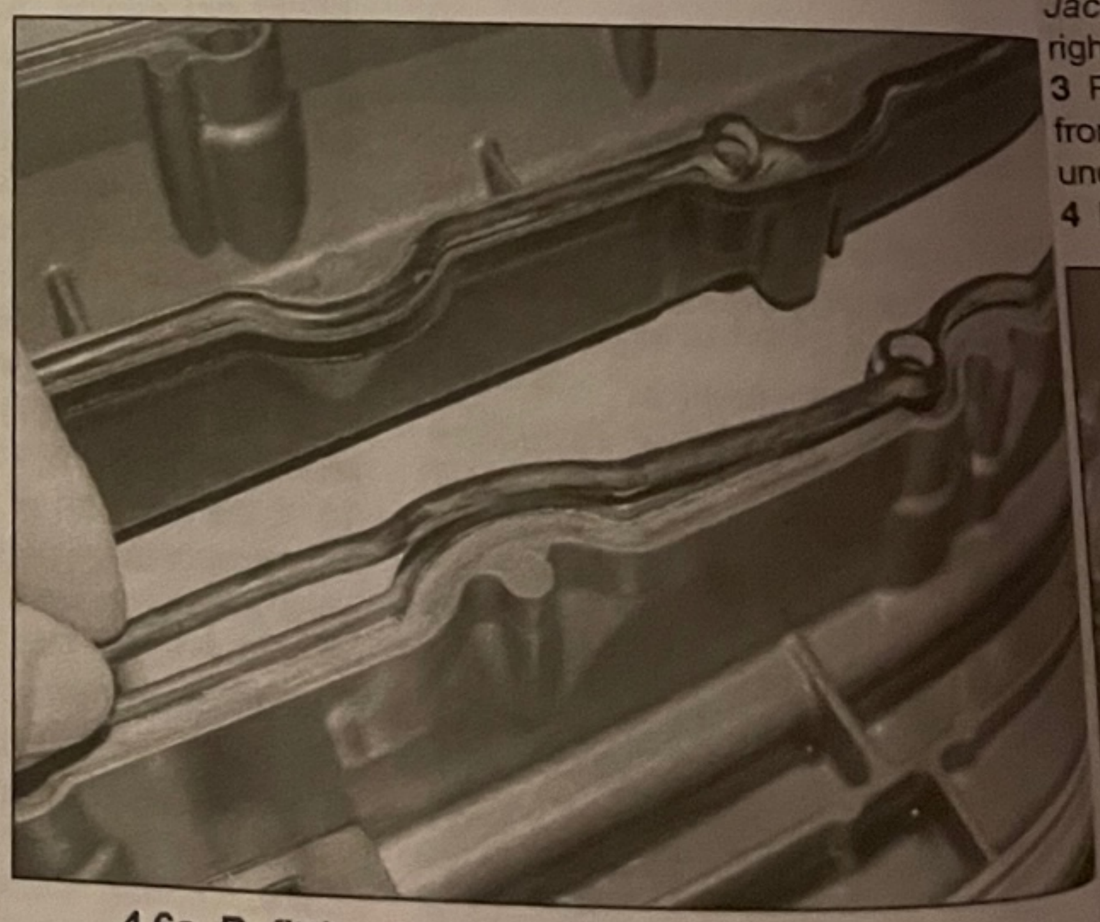
6 Clean the contact surfaces of the cylinder head cover and cylinder head. Locate the gasket securely in the groove in the cylinder head cover. **Note:** *The gasket is in two parts – inner and outer gaskets* **(see illustration)**.

7 Refit the cylinder head cover, and insert the securing bolts. Tighten the bolts progressively and in sequence **(see illustration)** until all the bolts are tightened to the specified torque.

8 Reconnect the crankcase breather hose (and where applicable, the vacuum hose) to the cylinder head cover.

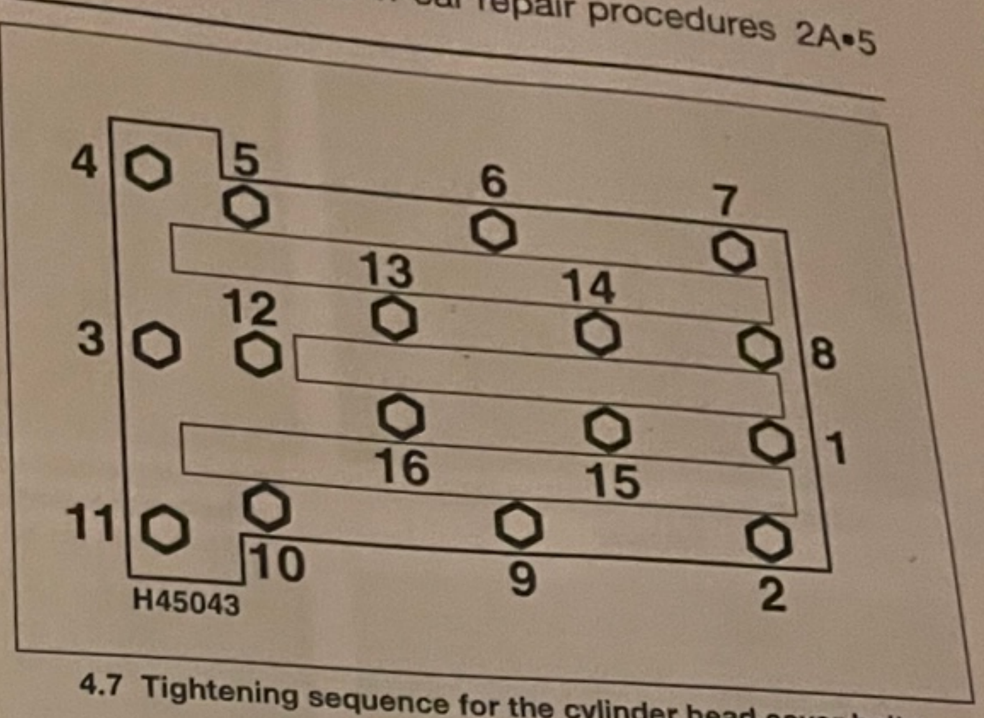


4.4b . . . then remove the cylinder head cover retaining screws (arrowed)



4.6a Refitting the cylinder head cover inner gasket . . .

4.6b . . . and outer gasket, securely in the groove



4.7 Tightening sequence for the cylinder head cover bolts

9 Refit the direct ignition cartridge to the centre of the cylinder head cover, and tighten the screws, refer to Chapter 5B if necessary.

10 Refit the engine upper cover.

5 Camshafts and hydraulic cam followers – removal, inspection and refitting

Note: *The following procedure describes removal and refitting of the camshafts and hydraulic cam followers with the cylinder head in position in the car. If necessary, the work can be carried out on the bench, with the cylinder head removed from the engine. In this case, start the procedure at paragraph 8, after removing the cylinder head.*

Removal

1 Open the bonnet, and clean the engine around the cylinder head.

2 Apply the handbrake, then jack up the front of the car and support on axle stands (see *Jacking and vehicle support*). Remove the right-hand front wheel.

3 Remove the screws, and withdraw the front wing moulding and wheel arch liner from under the right-hand front wing.

4 Remove the battery cover then disconnect the battery negative lead, and position the lead away from the battery terminal.

5 Unbolt and remove the cylinder head cover as described in Section 4.

6 Using a socket on the crankshaft pulley, turn the engine until the TDC slot in the crankshaft pulley is aligned with the timing bar on the timing cover. If necessary, refer to Section 3 for more information. Check also that the TDC marks on the sprocket ends of the camshafts are aligned with the corresponding TDC marks on the camshaft bearing caps.

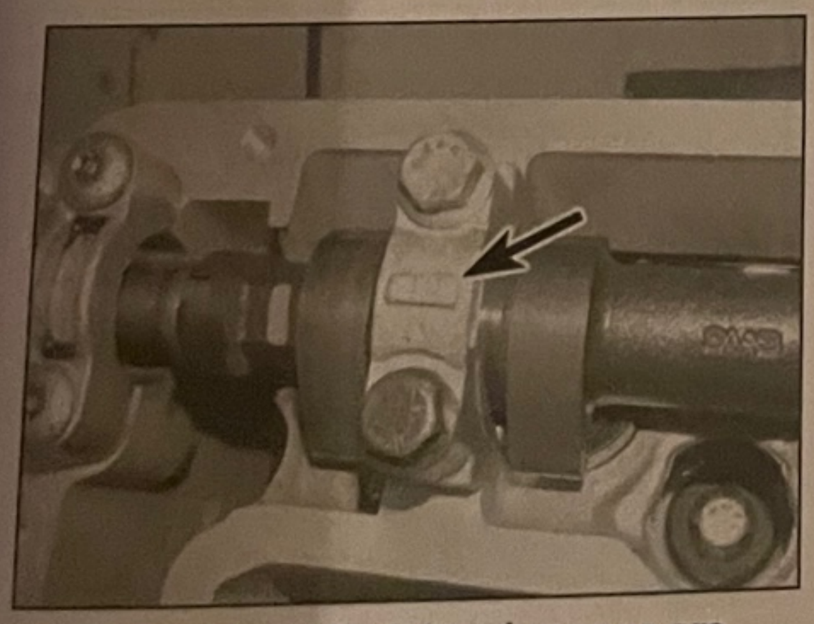
7 Unscrew the bolt on the idler sprocket and remove the timing chain tensioner, use a 27 mm socket after removing the plug with spring and pushrod.

8 While holding each camshaft stationary with a spanner on the special flats at the transmission end of the camshaft, unscrew the bolts, then withdraw the sprockets and allow them to rest on the timing chain guides. Note that the sprockets have projections which engage with cutouts in the ends of the camshafts. The timing chain cannot come off the crankshaft sprocket, since there is a guide located below the sprocket.

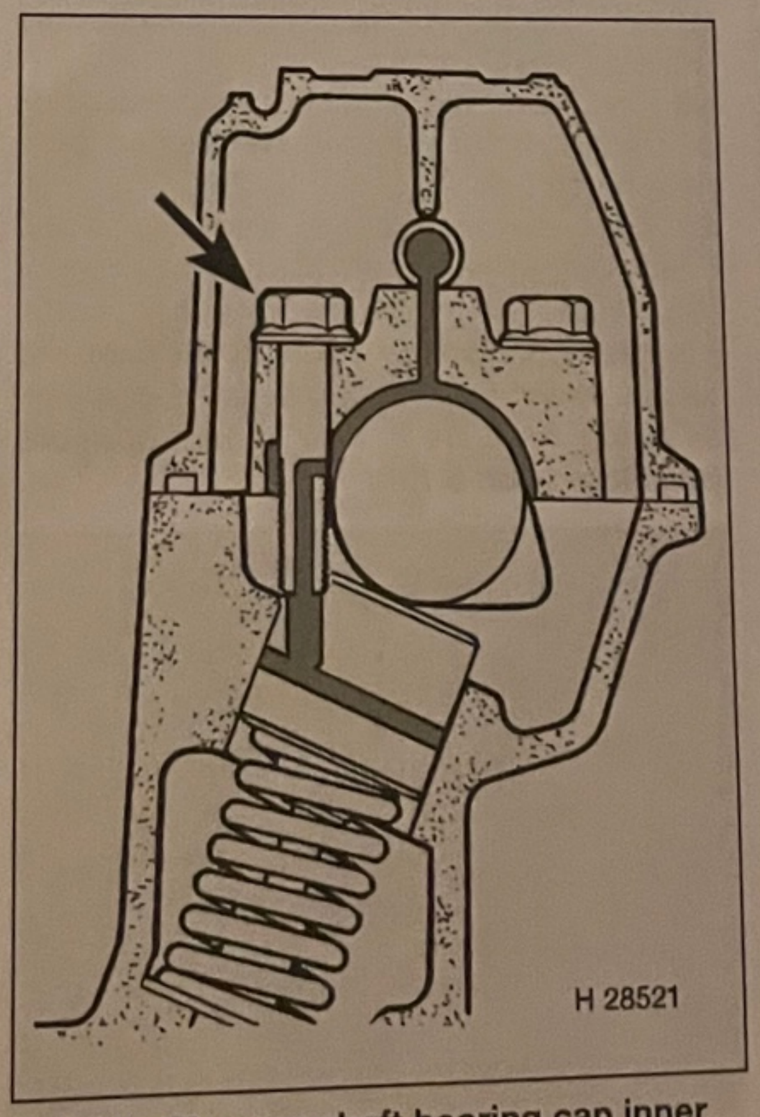
9 Check that the camshaft bearing caps and the camshafts are identified for position. They have stamped markings on the caps – do not mix up these when refitting, 1 to 5 for the intake side and 6 to 10 for the exhaust side **(see illustration)**.

10 Progressively unscrew the bearing cap bolts, so that the caps are not stressed unduly by the valve springs. Ensure that the bearing caps closest to the open valves are removed last, to avoid stressing the camshaft unduly. Fully remove the bolts and lift off the caps, then lift the camshafts from the cylinder head. Note that the bearing cap inner bolts (except at the timing chain end) have black heads, and incorporate drillings for the oil supply to the hydraulic cam followers; always make sure that the correct bolts are fitted **(see illustrations)**. Keep the camshafts carefully identified for location.

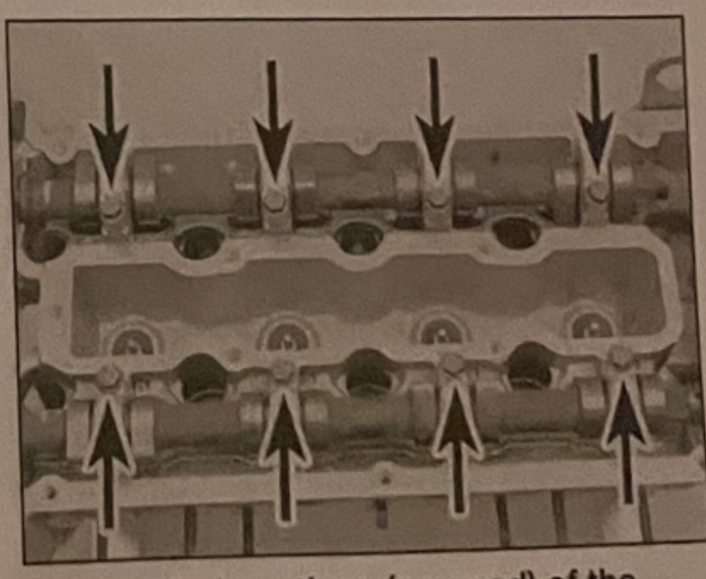
11 Obtain sixteen small, clean plastic containers, and number them 1i to 8i (intake)



5.9 The camshaft bearing caps are marked for position (arrowed – No 10 bearing cap)

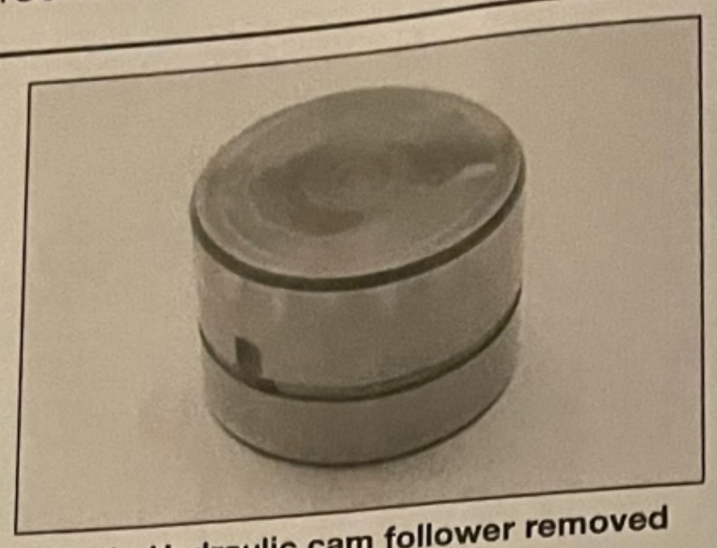


5.10a The camshaft bearing cap inner bolts (arrowed) are hollow for the oil supply to the hydraulic cam followers



5.10b Locations (arrowed) of the black-headed inner bearing cap bolts incorporating oil drillings

5.11a Removing a hydraulic cam follower



5.11b Hydraulic cam follower removed from the cylinder head. Store cam followers in an oil bath while removed

and 1e to 8e (exhaust). Alternatively, divide a larger container into sixteen compartments, similarly marked for the intake and exhaust camshafts. Using a rubber sucker or a magnet, withdraw each hydraulic cam follower in turn, and place it in its respective container **(see illustrations)**. **Do not** interchange the cam followers. To prevent the oil draining from the hydraulic cam followers, pour fresh oil into the containers until it covers them.

Caution: Take great care to avoid scratching the cylinder head bores as the followers are withdrawn.

Inspection

12 Examine the camshaft bearing surfaces and cam lobes for signs of wear ridges and scoring. Renew the camshaft if any of these conditions are apparent. Examine the condition of the bearing surfaces on the camshaft journals, in the camshaft bearing caps, and in the cylinder head. If the head or cap bearing surfaces are worn excessively, the cylinder head will need to be renewed. If the necessary measuring equipment is available, camshaft bearing journal wear can be checked by direct measurement and comparison with the specifications given.

13 Camshaft endfloat can be measured by locating each camshaft in the cylinder head, refitting the sprockets, and using feeler blades between the shoulder on the front of the camshaft and the front bearing surface on the cylinder head.

14 Check the hydraulic cam followers where they contact the bores in the cylinder head for wear, scoring and pitting. Occasionally, a hydraulic cam follower may be noisy and require renewal, and this will have been noticed when the engine was running. It is not easy to check a cam follower for internal damage or wear once it has been removed; if there is any doubt, the complete set of cam followers should be renewed.

15 Clean the internal drillings of the hollow camshaft bearing cap bolts, to ensure oil supply to the hydraulic cam followers.

Refitting

16 Lubricate the bores for the hydraulic cam followers in the cylinder head, and the followers themselves, then insert them in their original positions **(see illustration)**.

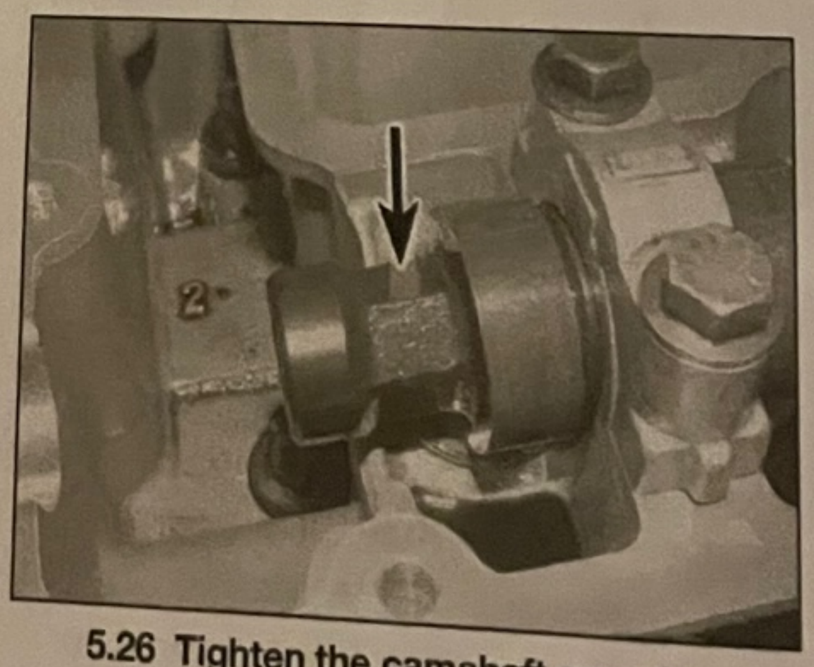
17 Lubricate the bearing surfaces of the camshafts in the cylinder head.

18 Locate the camshafts in their correct positions in the cylinder head, so that the valves of No 1 cylinder (timing chain end) are closed, and the valves of No 4 cylinder are 'rocking'.

19 The timing marks on the sprocket ends of the camshafts should be aligned **(see illustration 3.5)**.

20 Lubricate the bearing surfaces in the bearing caps, then locate them in their correct positions and insert the retaining bolts. Progressively tighten the bolts to the specified torque. **Note:** *Ensure that the black-coloured oil supply bolts are in their correct positions* ***(see illustration 5.10b)***.

5.16 Oiling a hydraulic cam follower prior to fitting



5.26 Tighten the camshaft sprocket retaining bolts, using a spanner on the camshaft flats (arrowed) to hold it stationary

21 Check that each camshaft is at its position – the timing marks are located front of the camshafts, and must be aligned the mark on the bearing caps – see Sect

22 Check that the TDC slot in the cran pulley is aligned with the timing bar timing cover **(see illustration 3.3)**.

23 Locate the sprockets on the cam fitting the exhaust one first, followed b intake one. Do not fully tighten the bolts stage. Check that the timing chain is co located on the guides and sprockets.

24 Refit the timing chain tensioner reference to Chapter 2C.

25 Using a socket on the crank pulley, rotate the engine two complete clockwise, then check that the TDC marks are still correctly aligned.

26 Fully tighten the camshaft spro retaining bolts to the specified torque, holding them stationary with a spanner o special flats provided **(see illustration)**.

27 Clean the contact surfaces of the cyl head cover and cylinder head. Refit the cyl head cover with reference to Section 4.

28 Refit the inspection cover or DI ign cartridge to the centre of the cylinder h cover, and tighten the securing screws.

29 Reconnect the crankcase breather hos

30 Refit the front wing moulding and wh arch liner under the right-hand front wing tighten the screws.

31 Refit the right-hand front wheel, and lo the car to the ground.

32 Reconnect the battery negative lead refit the covers to the battery and the engi

6 Cylinder head – removal and refitting

Removal

1 Open the bonnet, and clean the engi around the cylinder head. Run the engine idling speed and remove the fuel pump fu (passenger compartment – fuse number check in Chapter 12 for exact location of fu for your model. Turn the ignition off after engine has stopped, there will then be no pressure in the fuel lines. Refit the fuse.

2 Apply the handbrake, then jack up the fr of the car and support on axle stands (*Jacking and vehicle support*). Remove t right-hand front wheel and remove the low engine cover.

3 Remove the battery cover and disconn the battery negative lead, and position t lead away from the battery terminal.

4 Remove the retaining screws, and withdr the wheel arch liner from under the right-ha front wing.

5 Drain the cooling system, with reference Chapter 1A.

6 Remove the oil filler cap/dipstick and unc the intake manifold cover away from the inta manifold.

7 Support the engi side, then undo remove the right-ha assembly from information see Se

8 With reference remove the mass gaiter from the back the rubber wiring plug from (see illustration remove the turb intercooler-to-th Cover the turbo prevent the ingr

9 Press down release the cra air intake hose

10 Unbolt and from the front head (see illus

11 Release th charge air pip of the cylinde from the end the bypass v sensor connec vacuum hose hose by the c

12 Refer to auxiliary drive

13 Remove (referring to alternator b illustration)

14 Disconn

7 Support the engine under the right-hand side, then undo the retaining bolts and remove the right-hand upper engine mounting assembly from the vehicle. For further information see Section 13.

8 With reference to Chapter 4A, Section 14, remove the mass airflow sensor and rubber gaiter from the engine compartment. Pull back the rubber cover and disconnect the wiring plug from the charge air control valve **(see illustration)**. Release the hose clips and remove the turbocharger-to-intercooler and intercooler-to-throttle body intake air ducts. Cover the turbocharger port with a cloth to prevent the ingress of debris.

9 Press down on the red securing clip to release the crankcase breather pipe from the air intake hose **(see illustrations)**.

10 Unbolt and remove the engine lifting eye from the front right-hand side of the cylinder head **(see illustration)**.

11 Release the securing clips and remove the charge air pipe from across the left-hand end of the cylinder head. Undo the retaining bolt from the end of the cylinder head. Disconnect the bypass valve and pressure/temperature sensor connectors. Disconnect the bypass valve vacuum hose. Plug the throttle body and the hose by the charge air cooler **(see illustrations)**.

12 Refer to Chapter 1A and remove the auxiliary drivebelt.

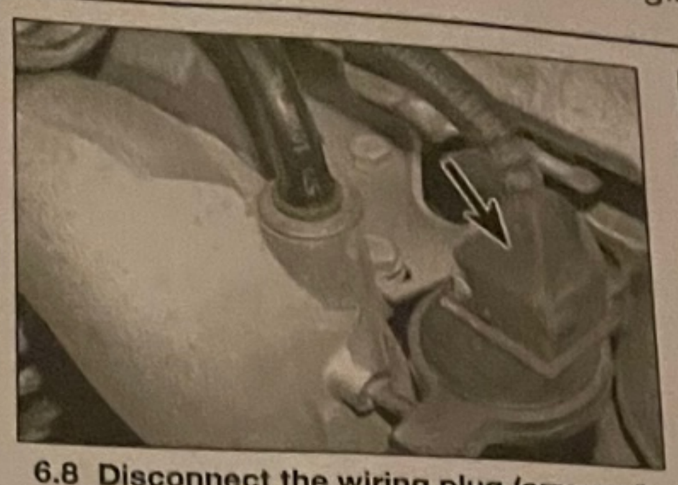
13 Remove the alternator to one side (referring to Chapter 5A), and then unbolt the alternator bracket from the cylinder head **(see illustration)**.

14 Disconnect the wiring connector from the temperature sensor in the left-hand end of the cylinder head.

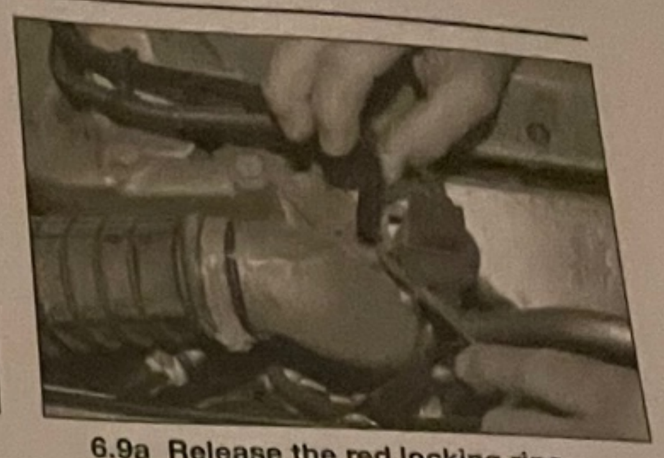
15 Slacken the hose clips and disconnect the coolant hoses from the cylinder head.

16 Unbolt the cover from the throttle body lever, and disconnect the throttle cable from the throttle body **(see illustration)**.

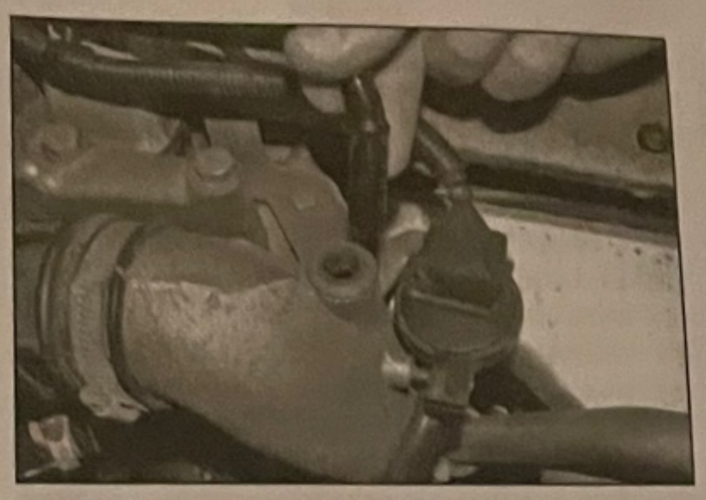
17 Unbolt the support bracket and release the engine oil dipstick tube and dipstick from the cylinder head.



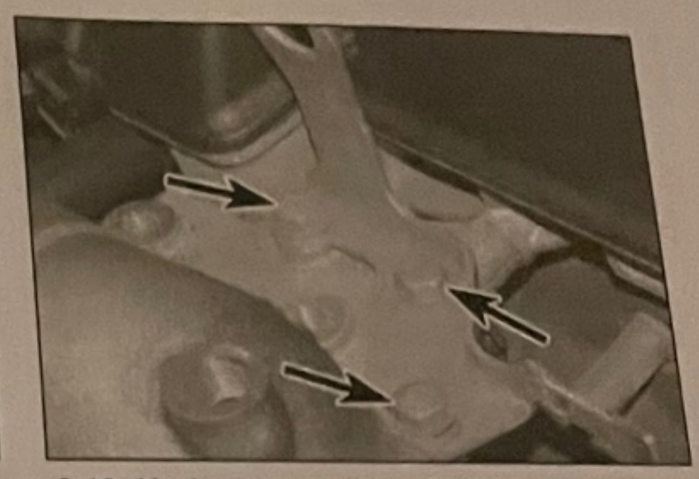
6.8 Disconnect the wiring plug (arrowed) from the charge air control valve



6.9a Release the red locking ring . . .



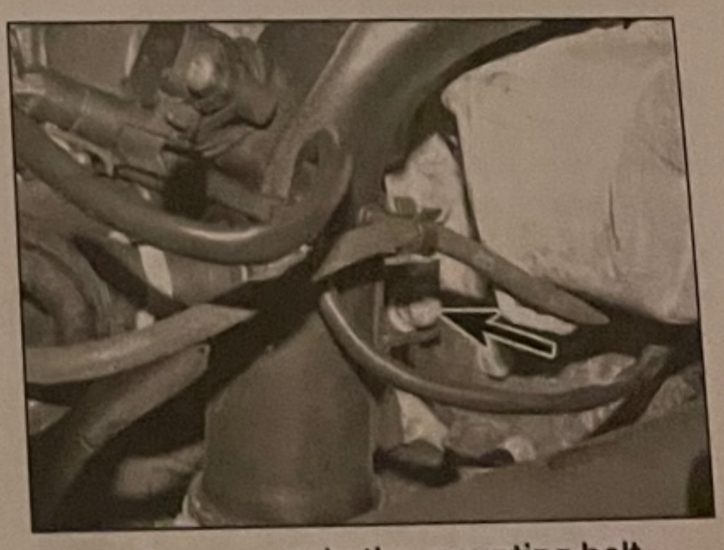
6.9b . . . and remove the crankcase breather pipe



6.10 Undo the retaining bolts (arrowed) to remove the engine lifting eye

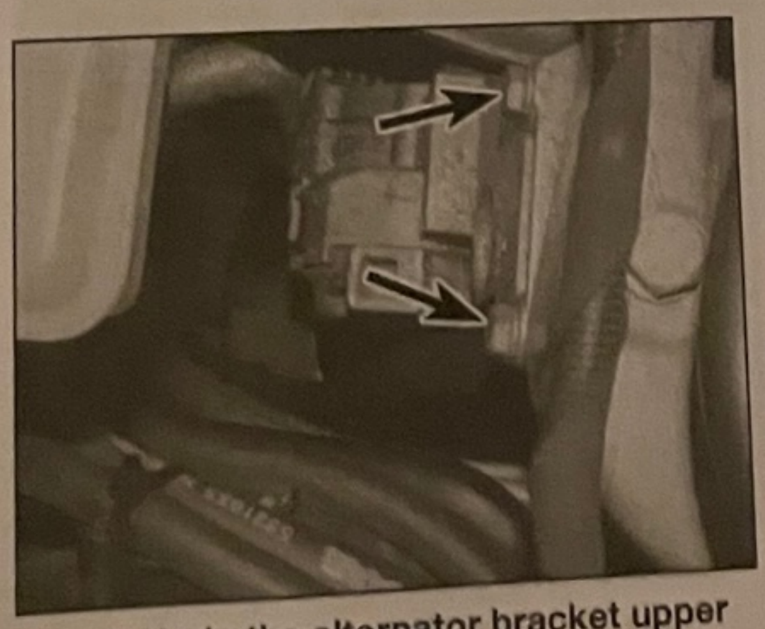
6.11a Slacken the retaining clip (arrowed) . . .

6.11b . . . remove the retaining clips (arrowed) . . .

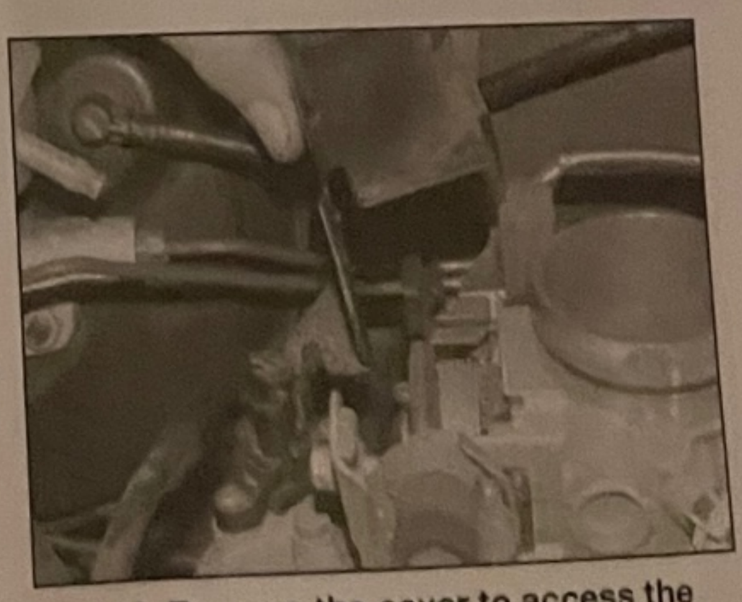


6.11c . . . undo the mounting bolt (arrowed) . . .

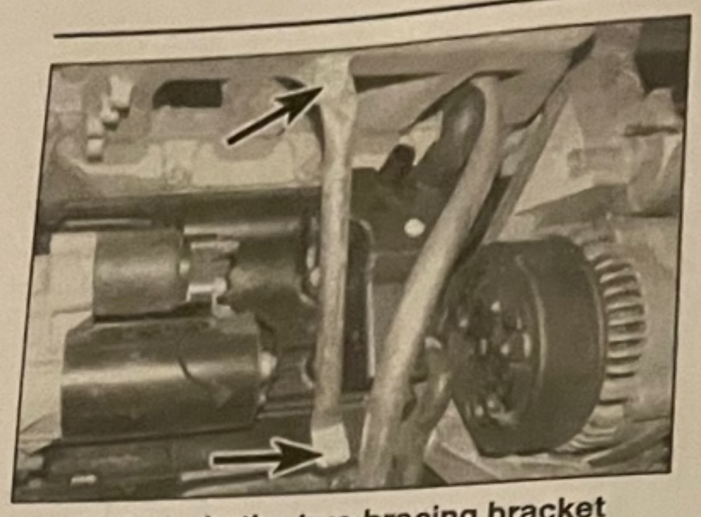
6.11d . . . then disconnect the sensor wiring connector (arrowed) and vacuum pipe (arrowed)



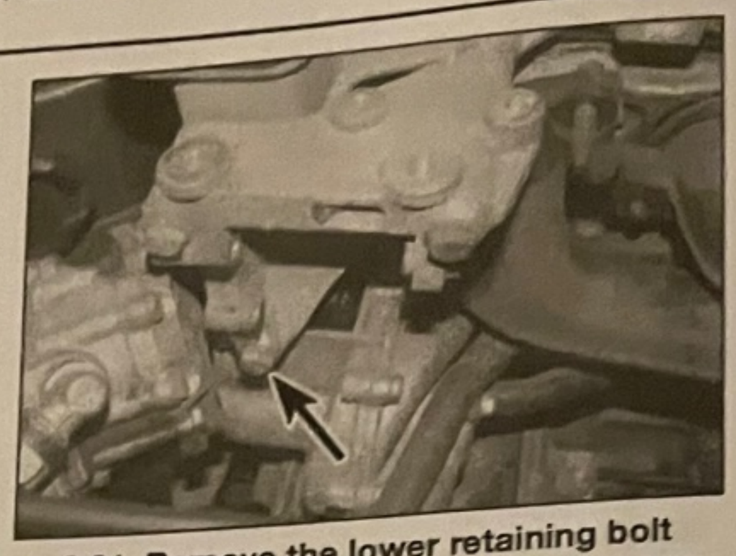
6.13 Undo the alternator bracket upper mounting bolts (arrowed)



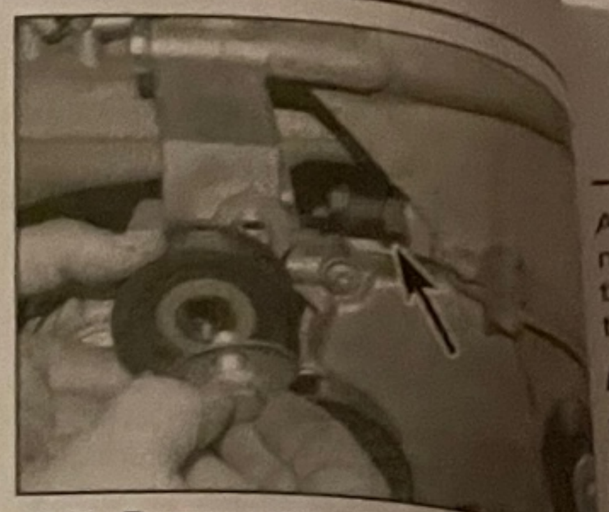
6.16 Remove the cover to access the throttle linkage/cable



6.19 Undo the two bracing bracket retaining bolts (arrowed)



6.21 Remove the lower retaining bolt (arrowed) from the power steering pump bracket



6.26 Remove the idler roller, then slide and remove the timing chain tensioner (arrowed)

18 Slacken the hose clips and disconnect the hoses from the throttle body.

19 From under the vehicle, unbolt and remove the intake manifold bracing bracket from the rear of the engine **(see illustration)**.

20 Refer to Chapter 4A and remove the exhaust heat shield, then unbolt the exhaust system front pipe from the turbocharger.

21 Unbolt the power steering pump from its mountings, with reference to Chapter 10, and secure to one side using nylon cable ties or similar. Note that there is no need to disconnect the hydraulic fluid hoses from the pump. Slacken and remove the lower retaining bolt in the power steering pump bracket **(see illustration)**.

22 Unbolt and remove the rear engine lifting eye from the intake manifold and move the wiring harness bracket to one side. Refer to Chapter 4A and remove the intake manifold from the cylinder head.

23 Unbolt and remove the cylinder head cover, and remove the gasket with reference to Section 4. If the cover is stuck, tap it gently with the palm of your hand to free it. If necessary, remove all four spark plugs, as described in Chapter 1A.

24 Using a socket on the crankshaft pulley, turn the engine until the TDC mark on the crankshaft pulley is aligned with the timing mark on the timing cover, and No 1 piston (at the timing chain end of the engine) is at the top of its compression stroke. If necessary, refer to Section 3 for more information. Check also that the TDC marks on the sprocket ends of the camshafts are aligned with the corresponding TDC marks on the camshaft bearing caps.

25 While holding each camshaft stationary with a spanner on the special flats at the flywheel/driveplate end of the camshaft, slacken the bolts **(see illustration 5.26)**. Do not remove them at this stage.

26 Unscrew the bolt on the idler roller and remove the timing chain tensioner **(see illustration)**, use a 27 mm socket after removing the plug with spring and pushrod.

27 Unscrew the camshaft sprocket retaining bolts, then disengage the sprockets from the chain and remove from the engine. Fit a rubber band/cable-tie around the chain guides to prevent the chain from dropping down.

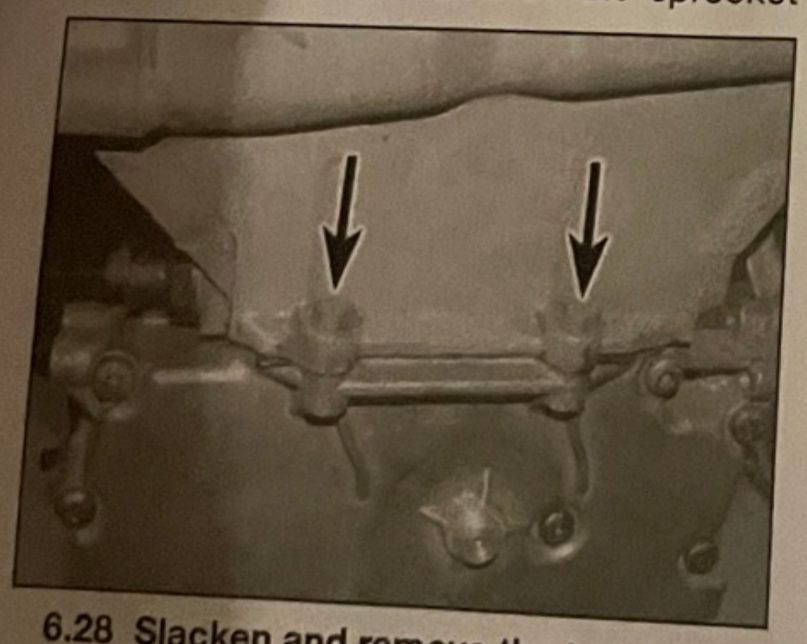
28 Unscrew and remove the two bolts securing the timing cover to the cylinder head **(see illustration)**.

29 Working in the **reverse** sequence **(see illustration 6.44)**, progressively slacken the ten cylinder head bolts by half a turn at a time, until all bolts can be unscrewed by hand. The bolts require the use of a Torx socket to unscrew them, as they have six external splines.

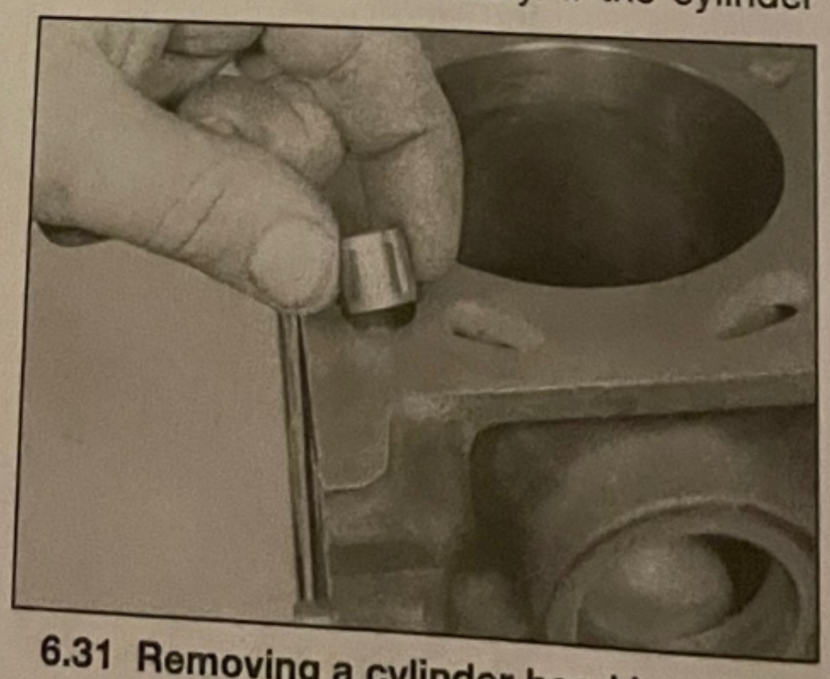
30 With all the cylinder head bolts removed, check that the timing chain is positioned so that the pivoting chain guide will not obstruct removal of the head. Lift the cylinder head directly from the top of the cylinder block and place it on a clean workbench, without damaging the mating surface. If necessary, enlist the help of an assistant, since the cylinder head is quite heavy. If the cylinder head is stuck, try rocking it slightly to free it from the gasket – **do not** insert a screwdriver or similar tool between the gasket faces otherwise the gasket mating faces will be damaged. The head is located on dowels, do not try to free it by tapping it sideways.

31 Remove the gasket from the top of the block, noting the two locating dowels. If the locating dowels are a loose fit, remove them and store them with the head for safe-keeping **(see illustration)**. Do not discard the gasket, it may be needed for identification purposes.

32 If the cylinder head is to be dismantled for overhaul, remove the camshafts as described in Section 5.



6.28 Slacken and remove the two bolts (arrowed) securing the timing cover to the cylinder head



6.31 Removing a cylinder head locating dowel

Preparation for refitting

33 The mating faces of the cylinder head and cylinder block must be perfectly clean before refitting the head. Use a hard plastic or wooden scraper to remove all traces of gasket and carbon; also clean the piston crowns. Take particular care during the cleaning operations as the soft aluminium alloy is damaged easily. Also, make sure that the carbon is not allowed to enter the oil and water passages – this is particularly important for the lubrication system, as carbon could block the oil supply to the engine's components. Using adhesive tape and paper, seal the water, oil and bolt holes in the cylinder block. After cleaning each piston, use a small brush to remove all traces of grease and carbon from the gap, and then wipe away the remainder with a clean rag. Clean all the pistons in the same way.

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

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

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

Although Saab does not specify that the bolts must be renewed, it is strongly recommended that the bolts be renewed as a complete set if the engine has completed a high mileage.

Refitting

37 Where removed, refit the camshafts with reference to Section 5.

38 Wipe clean the mating surfaces of the cylinder head and cylinder block/crankcase. Check that the two locating dowels are in position on the cylinder block.

39 Position a new gasket on the cylinder block surface; making sure that it is fitted the correct way round.

40 Check that each camshaft is at its TDC position – the timing marks are located on the front of the camshaft, and must be aligned with the marks on the bearing caps – see Section 3.

41 Rotate the crankshaft one quarter of a turn away from TDC; this will position all four pistons part-way along their bores, keeping them out of the way during cylinder head refitting.

42 Check that the timing chain is located correctly on the chain guides, and then carefully lower the cylinder head onto the block, aligning it with the locating dowels.

43 Apply a smear of grease to the threads, and to the underside of the heads, of the cylinder head bolts. Insert the bolts, and screw them in finger-tight.

44 Working progressively and in sequence, tighten the cylinder head bolts to their Stage 1 torque setting, using a torque wrench **(see illustration)**.

45 Using the same sequence, tighten the cylinder head bolts to their Stage 2 torque setting.

46 With all the cylinder head bolts tightened to their Stage 2 setting, working again in the given sequence, angle-tighten the bolts further through the specified Stage 3 angle, using a socket and extension bar. It is recommended that an angle-measuring gauge be used during this stage of the tightening, to ensure accuracy **(see illustration)**.

47 Rotate the crankshaft through one quarter of a turn back to its TDC position (see Section 3).

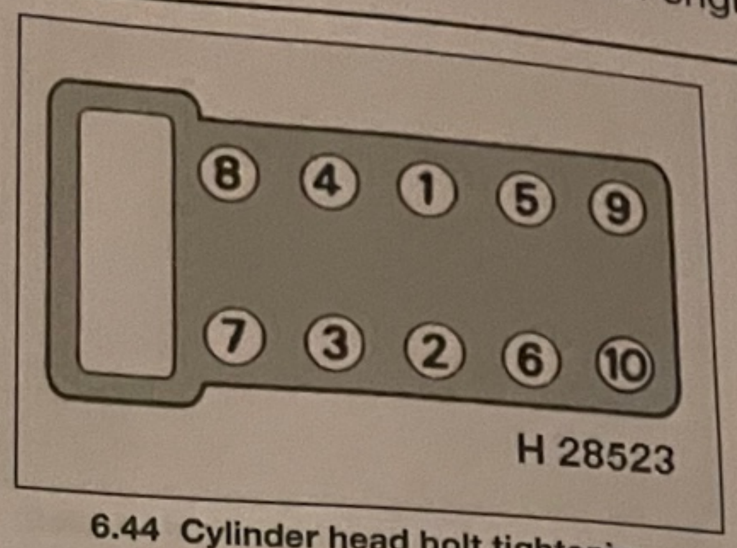
48 Insert and tighten the two bolts securing the timing cover to the cylinder head.

49 With reference to Section 3, check that the camshafts are both aligned at their respective TDC positions. Engage the camshaft sprockets with the timing chain (with reference to Chapter 2C, Section 10, if necessary) and then locate the sprockets on the camshafts, fitting the intake one first, followed by the exhaust one. Do not fully tighten the bolts at this stage. Check that the timing chain is correctly located on the guides and sprockets.

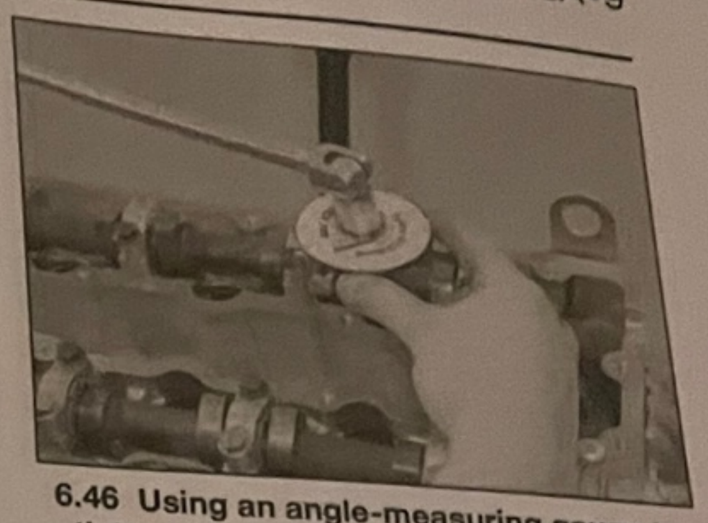
50 Refit the timing chain tensioner with reference to Chapter 2C, Section 11, if necessary.

51 Using a socket on the crankshaft pulley, rotate the engine two complete turns clockwise, then check that the TDC timing marks are still correctly aligned.

52 Fully tighten the camshaft sprocket retaining bolts to the specified torque, while holding each camshaft stationary, using a spanner on the special flats machined into the transmission end of each shaft.



6.44 Cylinder head bolt tightening sequence



6.46 Using an angle-measuring gauge to tighten the cylinder head bolts through their Stage 3 angle

53 Refit the cylinder head cover as described in Section 4, then refit the spark plugs with reference to Chapter 1A.

54 Refit the intake manifold with reference to Chapter 4A. Bolt the engine lifting eyelets and the wiring harness support bracket in position.

55 Reconnect the coolant hoses for the throttle body, thermostat housing and cabin heater to their respective ports on the cylinder head, tightening the hose clips securely.

56 Position the engine oil dipstick tube against the cylinder head and secure it with the retaining bolt.

57 Reconnect the vacuum and crankcase breather hoses to the cylinder head cover.

58 With reference to Chapter 4A, refit the exhaust system front pipe to the turbocharger and tighten the bolts to the specified torque.

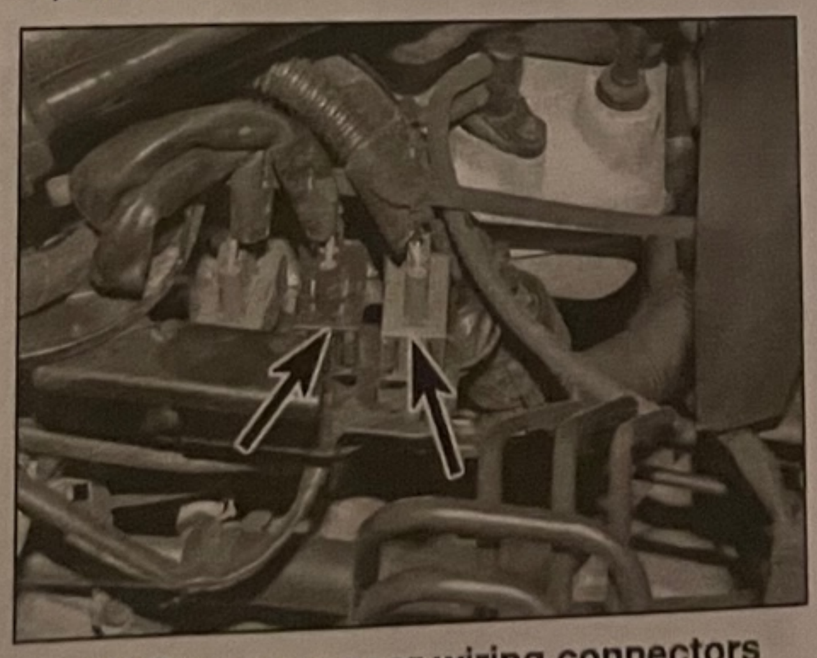
59 Refit the power steering pump with reference to Chapter 10.

60 Refit the alternator with reference to Chapter 5A, then refit the auxiliary drivebelt with reference to Chapter 1A.

61 Refit the intake air ducting and mass airflow meter with reference to Chapter 4A.

62 Refit the turbocharger crankcase breather pipe, then refit the intercooler-to-throttle body intake air ducts.

63 Refit the cover panel to the top of the intake manifold and insert the oil filler cap/dipstick.



7.4 Oxygen sensor wiring connectors (arrowed) – model with two oxygen sensors fitted

64 Reconnect the battery negative lead and refit the battery cover.

65 Refit the central panel under the radiator, followed by the right-hand front wing wheel arch liner and moulding.

66 Refit the right-hand front wheel, and lower the car to the ground.

67 Refill the cooling system (see Chapter 1A).

68 Start the engine, observing the precautions given in Chapter 2C, Section 23.

7 Sump – removal and refitting

Removal

1 Firmly apply the handbrake, and then jack up the front of the car and support it on axle stands (see *Jacking and vehicle support*). Remove the battery cover and disconnect the negative lead.

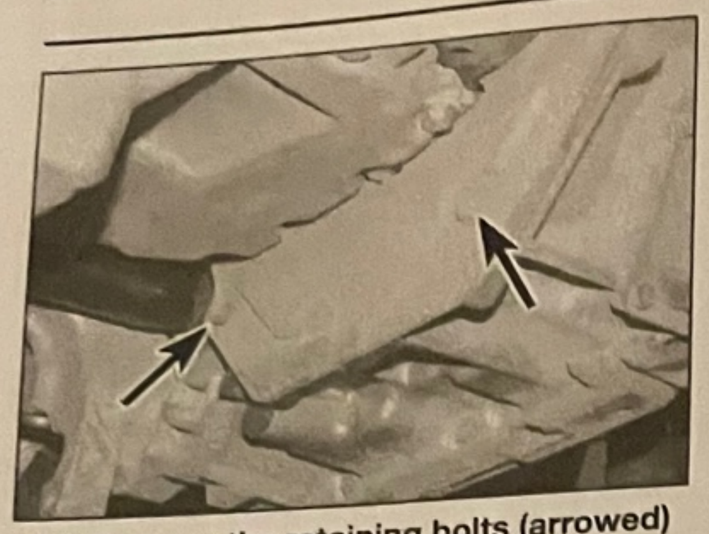
2 Remove both front roadwheels, and undo the securing screws and lower the undershield from under the vehicle.

3 Remove the engine upper cover then drain the engine oil, clean and refit the engine oil drain plug, tightening it to the specified torque. Remove the dipstick from its tube and place clean rag over the engine oil filler neck to prevent the ingress of debris. If the engine is nearing its service interval when the oil and filter are due for renewal, it is recommended that the filter is also removed, and a new one fitted. After reassembly, the engine can then be refilled with fresh oil. Refer to Chapter 1 for further information.

4 Unplug the oxygen sensor wiring connectors located on a bracket at the left-hand end of the cylinder head **(see illustration)**.

5 With reference to Chapter 4A, unbolt the exhaust system front pipe from the turbocharger. Unbolt the front pipe from its support bracket and withdraw it from the underside of the engine compartment. **Note:** *the flexible section of the exhaust pipe MUST NOT be put under excessive strain, as it may cause it to leak and eventually break.*

6 Undo the retaining bolts and remove the flywheel cover plate from the transmission end of the sump **(see illustration)**.



7.6 Remove the retaining bolts (arrowed) and remove the cover plate

7 Where applicable, disconnect the crankcase breather hose from the rear of the sump.

8 Progressively unscrew and remove the bolts securing the sump to the cylinder block, leaving one or two bolts in position to prevent the sump falling.

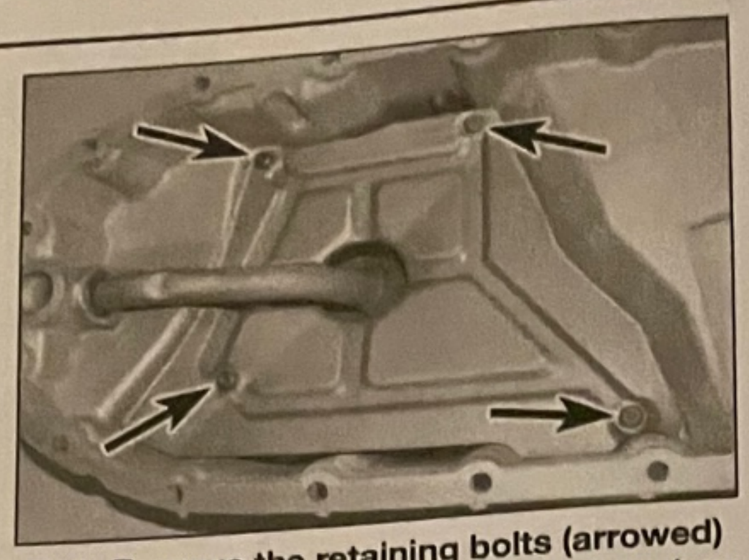
9 Remove the remaining bolts, and lower the sump to the ground. Break the joint between the sump and crankcase by striking the sump with the palm of your hand.

10 It may be necessary to use a lever between the inner wing panel and the crankshaft pulley to move the engine to the left for the sump to be removed.

11 While the sump is removed, take the opportunity to check the oil pump pick-up/strainer for signs of clogging or damage **(see illustration)**.

Refitting

12 Clean all traces of sealant from the mating surfaces of the cylinder block/crankcase and sump, then use a clean rag to wipe out the sump and the engine's interior.



7.11 Remove the retaining bolts (arrowed) to remove the oil pump pick-up and strainer

13 Ensure that the sump and cylinder block/crankcase mating surfaces are clean and dry, then apply a bead of suitable sealant approximately 1mm thick to the sump flange **(see illustration)**.

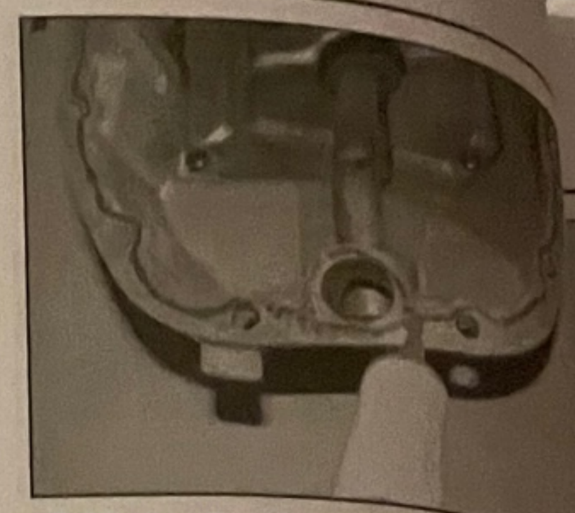
14 Offer up the sump and refit its retaining bolts, tightening them progressively to the specified torque.

15 Refer to Chapter 4A and refit the exhaust system front pipe. Apply a suitable anti-seize agent to the front pipe-to-turbocharger securing nut studs, and tighten the nuts to the specified torque. Fit the front pipe-to-support bracket securing bolt and tighten it securely.

16 Refit the flywheel cover plate to the transmission end of the sump.

17 Refit the undershield(s) to the front of the vehicle and tighten the securing screws.

18 Refit both front roadwheels and lower the vehicle to the ground.



7.13 Apply a bead of sealant to the ... flange

19 Reconnect the oxygen sensor wiring ... connectors.

20 Refill the engine with the correct ... and grade of oil as described in Chap... then clean and refit the dipstick/filler ca...

21 Start the engine and allow it to wa... Check around the sump mating surfa... signs of leakage.

8 Oil pump – removal, inspection and refitting

Removal

1 Apply the handbrake, then jack up the ... of the car and support on axle stands (... *Jacking and vehicle support*). Remove the right-hand front wheel.

2 Undo the securing screws and withdraw ... wheel arch liner from under the wing, then ... the power steering pipe from the subframe.

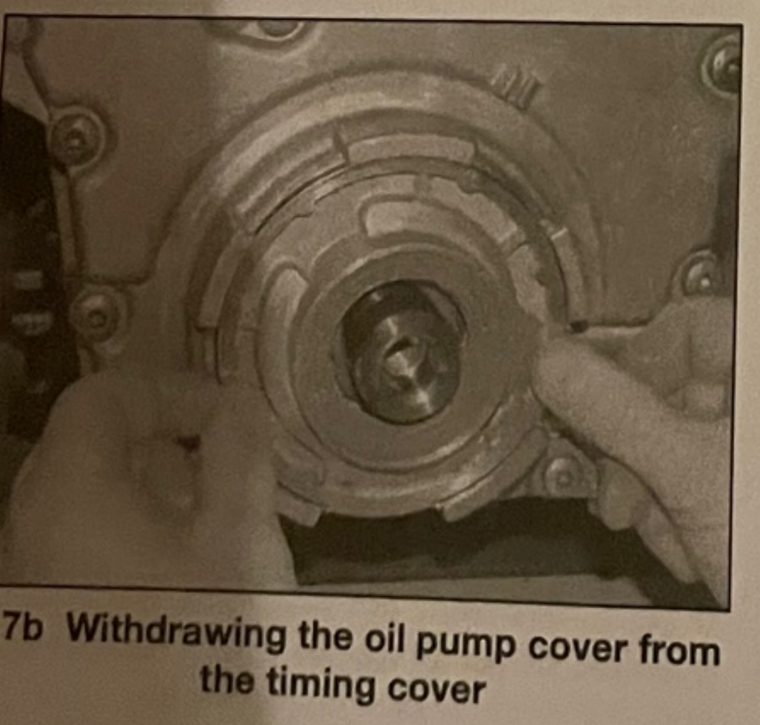
3 Support the engine under the right-... side, then undo the retaining bolts ... remove the right-hand upper engine mou... assembly from the vehicle.

4 Remove the auxiliary drivebelt ... reference to Chapter 1A.

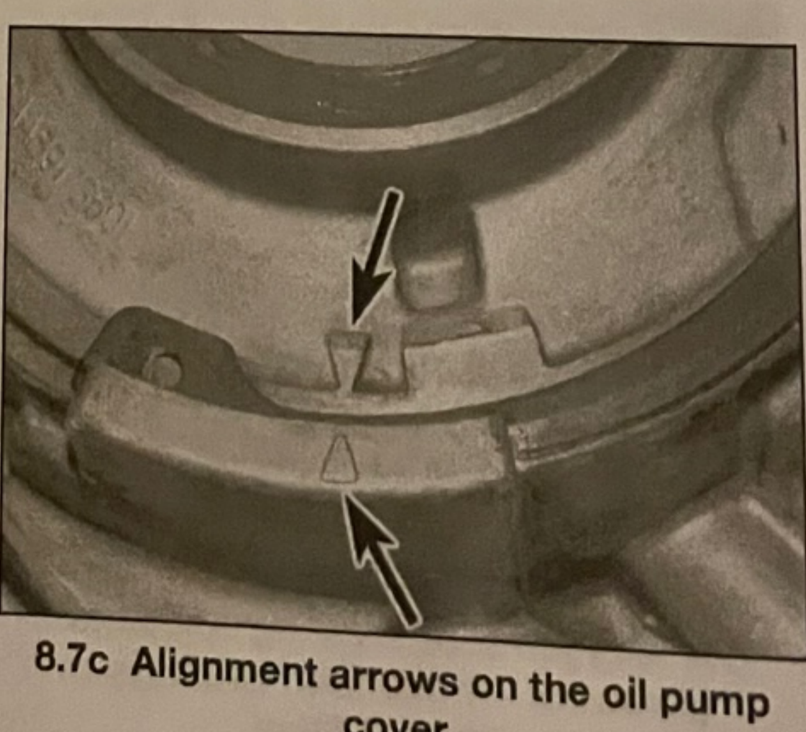
5 Slacken the centre bolt from the crank... pulley. To do this, the crankshaft must be ... stationary using one of the following meth... On manual transmission models, have ... assistant depress the brake pedal and e... 4th gear. Alternatively, remove the fly... cover or starter motor as described in ... ter 5A, then insert a stout flat-bladed ... driver through the transmission bellh... and engage it with the starter ring ... prevent the crankshaft turning. On au... transmission models, use the latter ... only.

6 Remove the crankshaft pulley b... then withdraw the crankshaft pulley ... from the end of the crankshaft. If ... careful use of two levers may be requ... **illustration)**.

7 Extract the large circlip, and then ... the oil pump cover from the timing c... that the circlip has a high tension, a ... pair of circlip pliers will be required to ... it. Also note the alignment arrows on ... and timing cover **(see illustrations)**



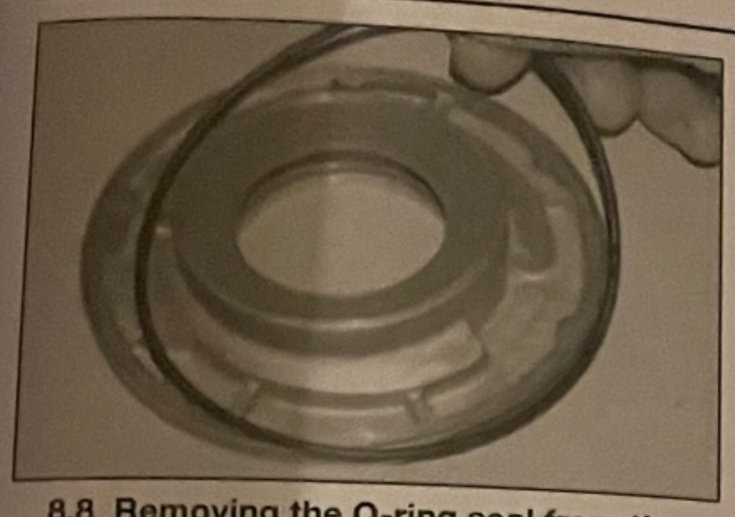
8.6 Remove the crankshaft pulley bolt and withdraw the crankshaft pulley



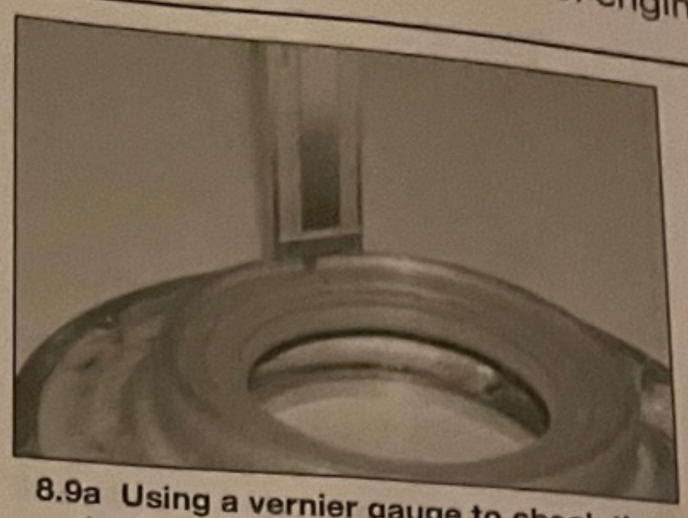
8.7a Using circlip pliers to remove the oil pump cover circlip

8.7b Withdrawing the oil pump cover from the timing cover

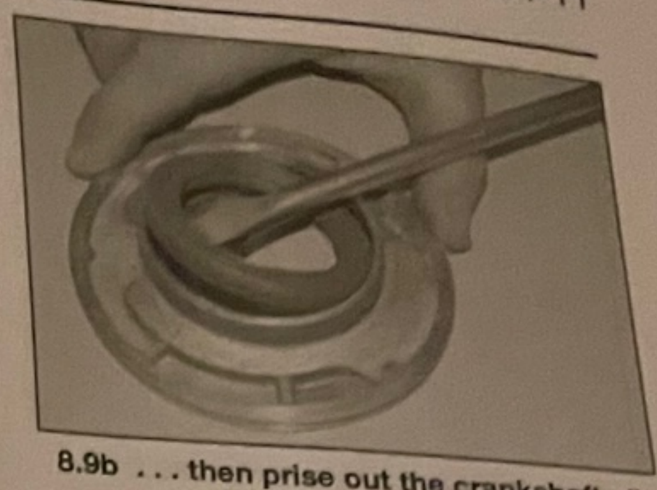
8.7c Alignment arrows on the oil pump cover



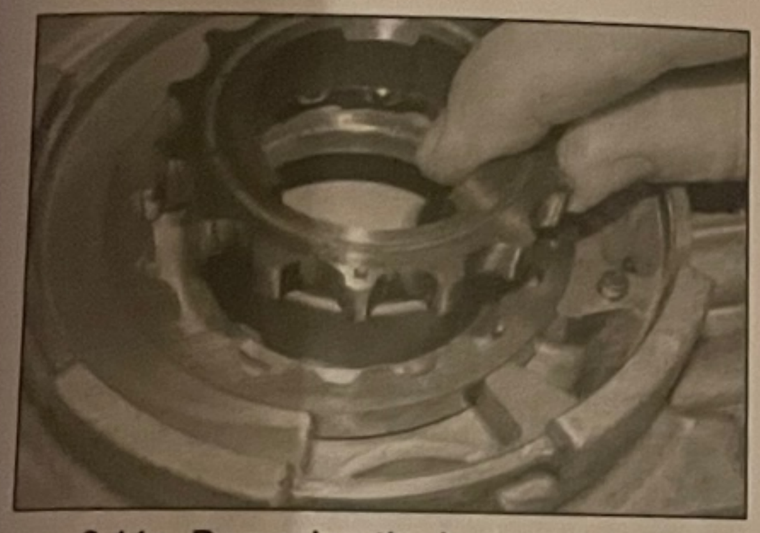
8.8 Removing the O-ring seal from the groove in the oil pump cover



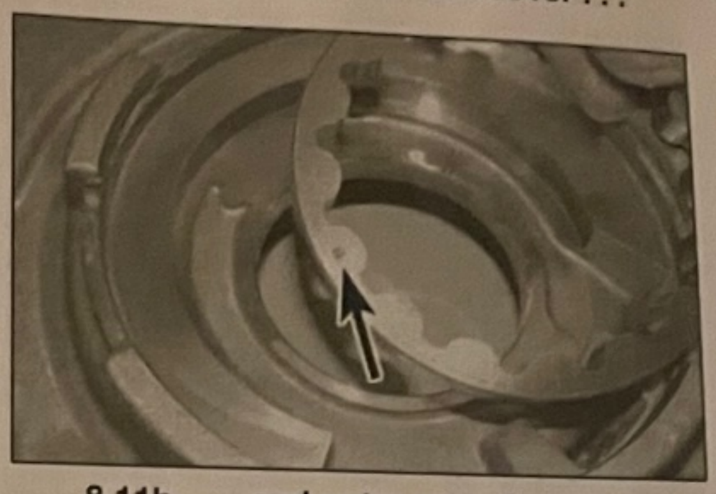
8.9a Using a vernier gauge to check the depth of the oil seal in the cover . . .



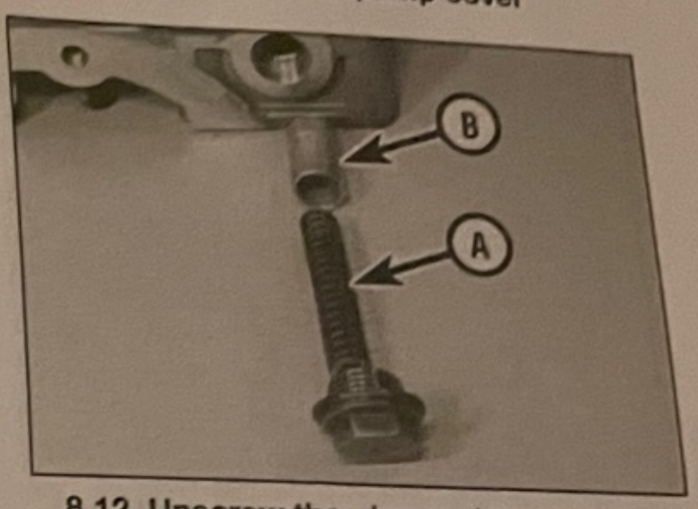
8.9b . . . then prise out the crankshaft oil seal from the oil pump cover



8.11a Removing the inner rotor . . .



8.11b . . . and outer rotor from the timing cover. Note that the position mark (arrowed) is facing outwards



8.12 Unscrew the plug and remove the relief valve spring (A) and plunger (B)

8 Remove the O-ring seal from the groove in the cover **(see illustration)**.

9 Note the position of the crankshaft oil seal in the oil pump cover, then prise it out with a screwdriver **(see illustrations)**.

Inspection

10 Wipe clean the inner faces of the pump rotors, and identify them for position with a marker pen. It is important that the rotors remain in their correct original positions on reassembly. Note that the outer rotor position is identified by the punch hole facing outwards.

11 Remove the rotors from the timing cover (oil pump body), keeping them identified for position **(see illustrations)**.

12 Unscrew the plug, and remove the relief valve spring and plunger, noting which way round they are fitted **(see illustration)**. Recover the plug washer.

13 Clean all components, and examine them for wear and damage. Examine the pump rotors and body for signs of wear ridges and scoring. Using a feeler blade check the clearance between the outer rotor and the timing cover, with reference to the Specifications **(see illustration)**. If worn excessively, the complete pump assembly must be renewed.

14 Examine the relief valve plunger for signs of wear or damage, and renew if necessary. The condition of the relief valve spring can only be measured by comparing it with a new one; if there is any doubt about its condition, it should also be renewed.

15 If there are any signs of dirt or sediment in the oil pump, it will be necessary to remove the sump (see Section 7), and clean the pick-up/strainer.

16 Insert the relief valve plunger and spring, then refit the plug together with a new washer, and tighten the plug.

17 Lubricate the rotors with fresh engine oil, then insert them in the oil pump body in their original positions. The rotors must be positioned with the identification mark facing outwards, see paragraph 11.

Refitting

18 Wipe clean the oil seal seating in the oil pump casing, then drive a new oil seal into the casing **(see illustration)**, making sure that it enters squarely and is fitted in the previously-noted position.

19 Fit a new O-ring seal, then insert the oil pump in the timing cover, making sure that the alignment arrows point to each other. Refit the large circlip in the groove with its chamfer facing outwards, and the opening facing downwards.

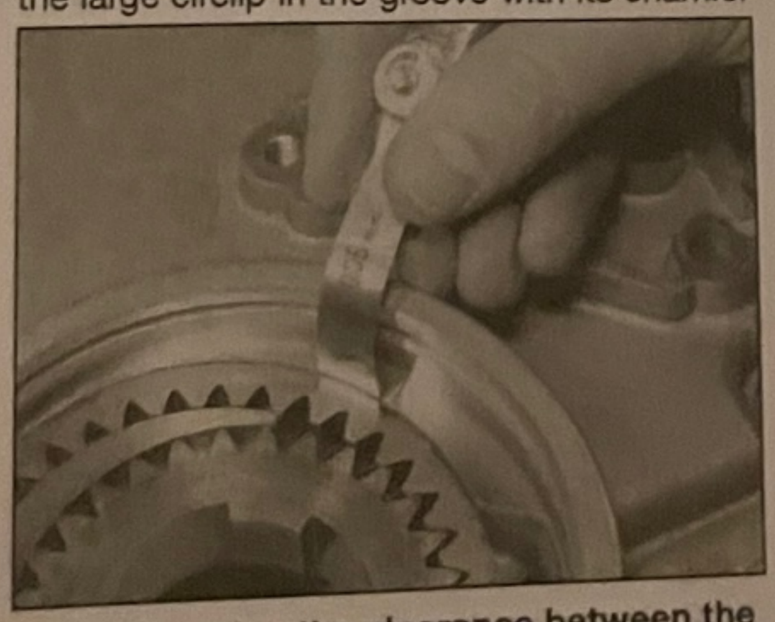
20 Locate the crankshaft pulley and hub on the end of the crankshaft. Insert the centre bolt and tighten it to the specified torque, holding the crankshaft stationary using one of the methods described in paragraph 5.

21 Refit the auxiliary drivebelt with reference to Chapter 1A.

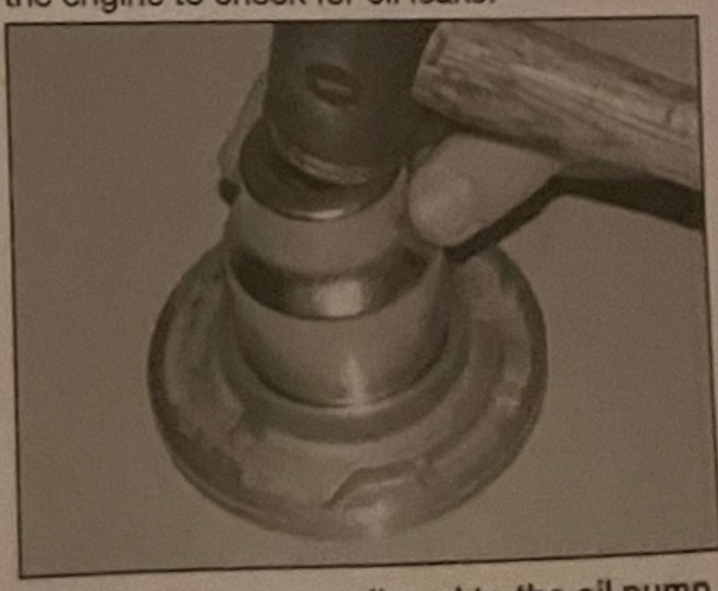
22 Refit the wing liner and moulding, and tighten the screws.

23 Refit the right-hand front wheel, and lower the car to the ground.

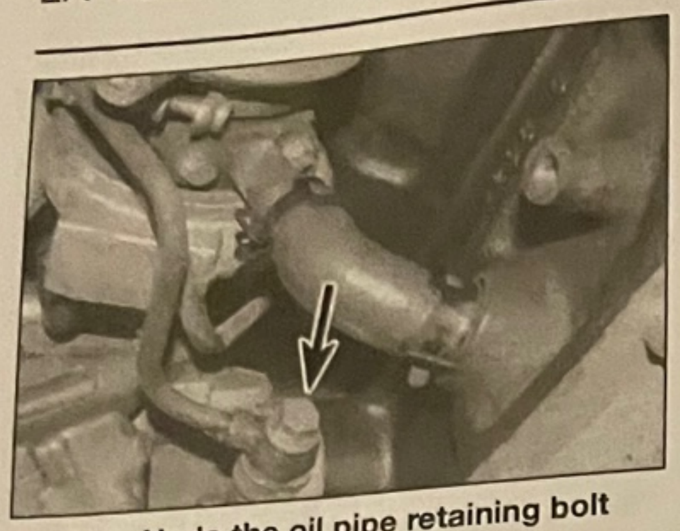
24 Before running the engine, disconnect the ignition wiring harness to the DI ignition cartridge to disable the ignition system (see Chapter 5B), then remove the fuel pump fuse (see Chapter 12). Crank the engine on the starter motor until oil pressure is restored and the oil pressure warning light is extinguished. Restore the ignition and fuel systems, and run the engine to check for oil leaks.



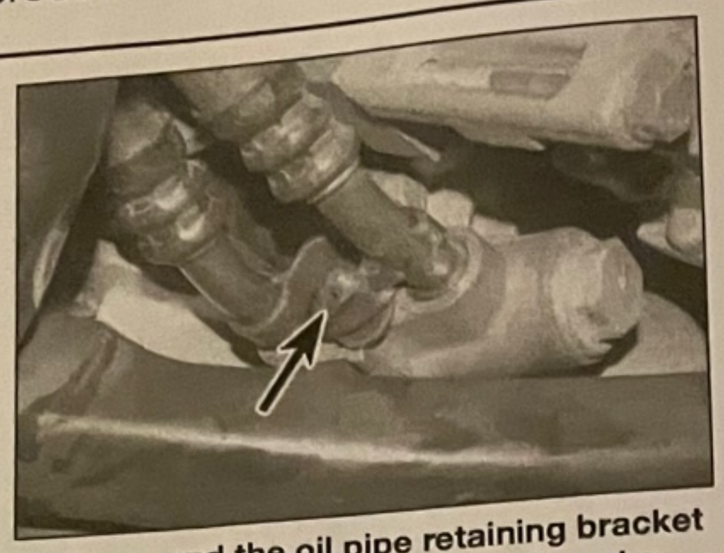
8.13 Checking the clearance between the oil pump outer rotor and the timing cover



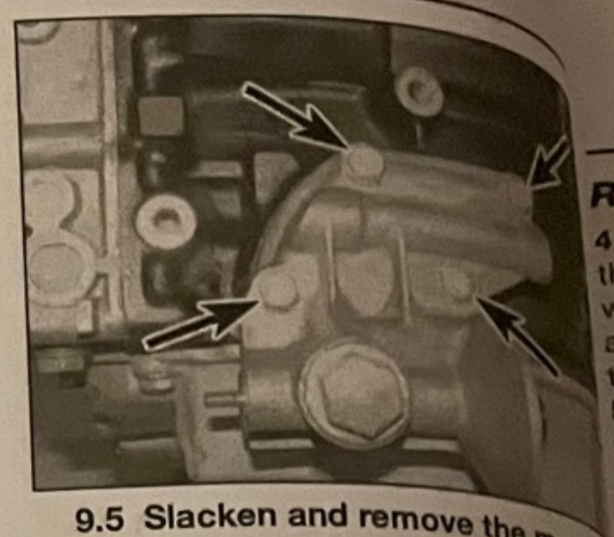
8.18 Fitting a new oil seal to the oil pump cover



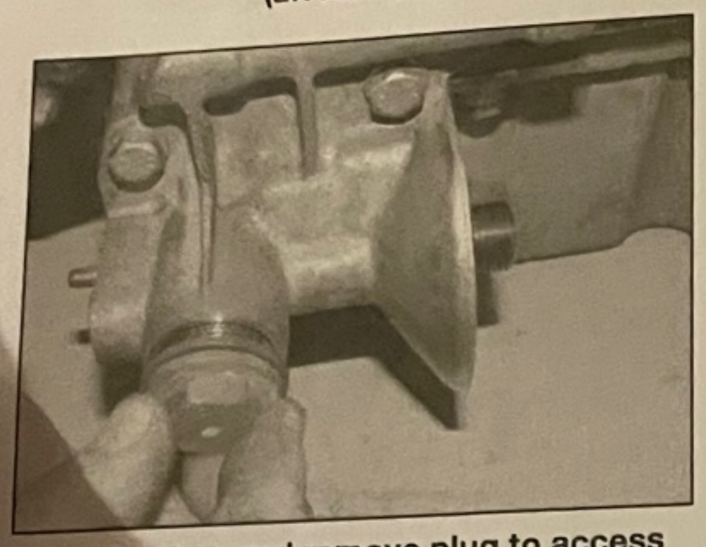
9.4a Undo the oil pipe retaining bolt (arrowed) . . .



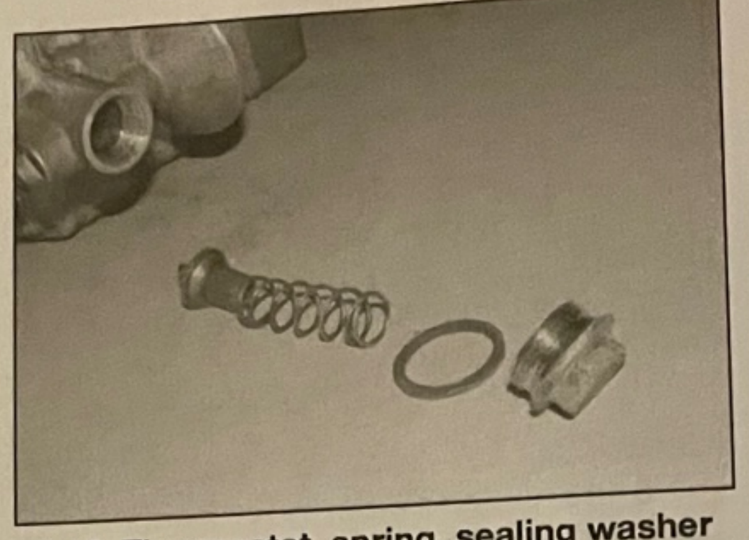
9.4b . . . and the oil pipe retaining bracket and nut (arrowed) from the oil cooler



9.5 Slacken and remove the mountin bolts (arrowed) to remove the oil coo



9.9 Slacken and remove plug to access thermostat



9.10 Thermostat, spring, sealing washer and securing bolt/plug

9 Oil cooler and thermostat – removal and refitting

Oil cooler/adapter

Removal

1 An oil cooler/adapter is fitted between the oil filter and cylinder block. If the engine is nearing its service interval when the oil and filter are due for renewal, it is recommended that the filter is removed, and a new one fitted. After reassembly, the engine can then be refilled with fresh oil. Refer to Chapter 1A for further information.

2 Drain the engine oil as described in Chapter 1A, then refit and tighten the drain plug.

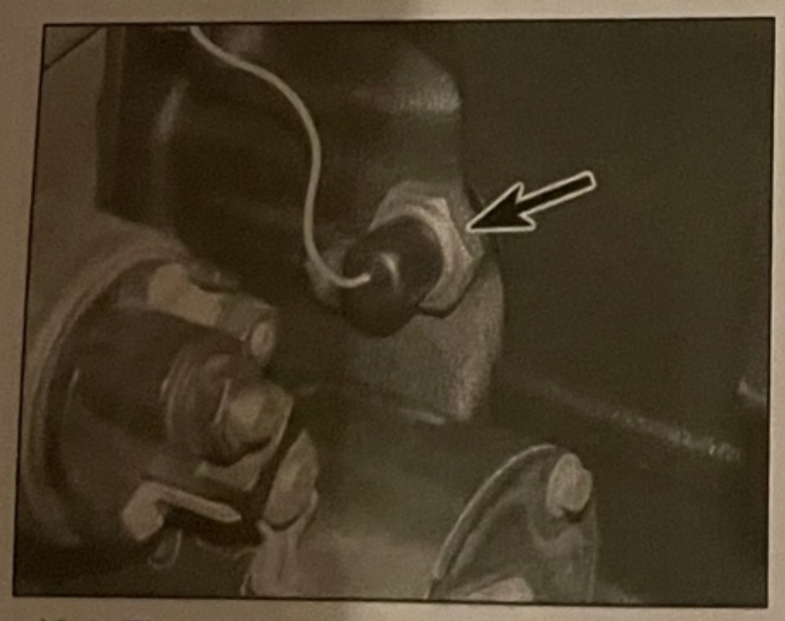
3 Jack up the front of the car and support it securely on axle stands (see *Jacking and vehicle support*). Slacken and withdraw the securing screws, and remove the front lower cover/spoiler.

4 Position a suitable container beneath the oil cooler on the right-hand side front of the engine compartment. Unscrew the unions from the top and bottom of the oil cooler **(see illustrations)**. Allow any oil to drain into the container.

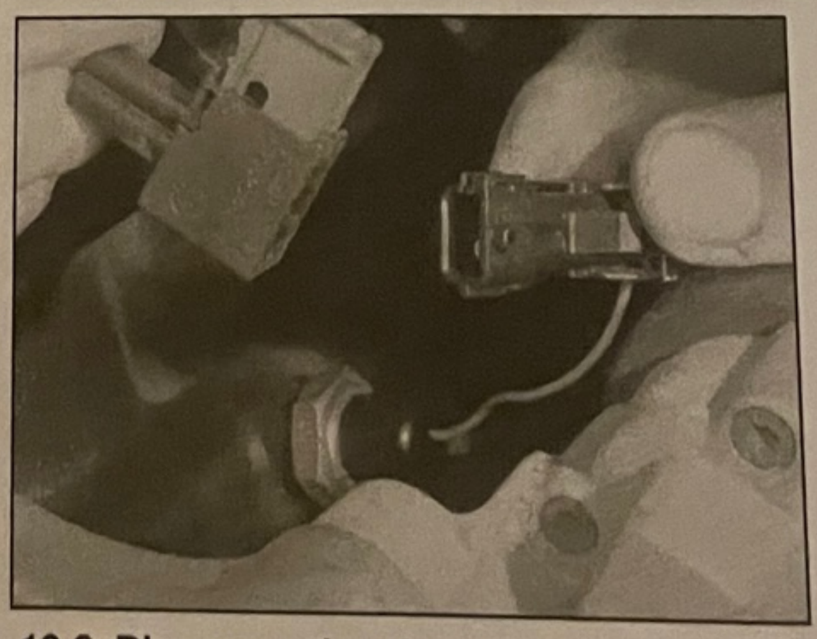
5 Unscrew the mounting bolts and remove the oil cooler from the engine compartment **(see illustration)**.

Refitting

6 Refitting is a reversal of removal, but tighten the unions to the specified torque. Fill the engine with oil with reference to Chapter 1A. On completion, start the engine and run it at a fast idle speed for several minutes, to allow the oil to fill the oil cooler. Check and if necessary top-up the engine oil level with reference to *Weekly checks*.



10.1 The oil pressure switch (arrowed) is screwed into the rear of the cylinder block



10.2 Disconnecting the wiring from the oil pressure switch

Thermostat

Removal

7 The oil temperature thermostat is mou on the right-hand side front of the oil cooler/adapter.

8 Drain the engine oil as described in Ch ter 1A, then refit and tighten the drain plug

9 Position a suitable container beneath thermostat, then unscrew the plug, rec the seal/washer and allow the surplus o run into the container **(see illustration)**.

10 Withdraw the thermostat and spring the filter adapter **(see illustration)**.

Refitting

11 Fit the new thermostat into the adapter, ensuring that the flange rests on machined recess in the housing.

12 Slide the spring into position, then fit seal/washer to the plug and screw the into the filter housing, tightening it to correct torque.

13 Fill the engine with oil with reference Chapter 1A. On completion, start the eng and run it at a fast idle speed for seve minutes, then check around the thermos plug for signs of leakage. Check the eng oil level and top-up if necessary (see We *checks*).

10 Oil pressure warning light switch – removal and refitting

Removal

1 The oil pressure switch is screwed into rear of the cylinder block, beneath the int manifold and behind the starter motor **illustration)**. First jack up the front of the and support on axle stands (see *Jacking vehicle support*).

2 Trace the wiring back from the switch disconnect the wiring block connector **illustration)**.

3 Unscrew the switch from the cylind block; be prepared for slight loss of oil **illustration)**. If the switch is to be left remo for any length of time, plug the hole, to pre the entry of debris.

Refitting

4 Wipe clean the the location apertu wire into the hole an attempt to clean the internal compo

5 Insert the switch tighten it securely

6 Reconnect t connector.

7 Start the engin lower the car to oil level and top *checks*).

11 Cranksh renewal

Right-han

Note: *This pr seal in situ. the oil pump the engine.*

1 Apply the front of the (see *Jackin* the right-ha screws an Where app pipe from t

2 Support side, the remove th assembly Section 1

3 Remo reference

4 Unscr from the cranksh one of transm depress

Alterna or star then i the be preve transm only.

5 Pu end of tw

6 N hou pris

Alte opp sel the An co th Se

Refitting

4 Wipe clean the threads of the switch and the location aperture. Do not insert tools or wire into the hole at the tip of the switch, in an attempt to clean it out; as this may damage the internal components.
5 Insert the switch into the cylinder block and tighten it securely.
6 Reconnect the switch wiring block connector.
7 Start the engine and check for leakage, then lower the car to the ground. Check the engine oil level and top-up if necessary (see *Weekly checks*).

11 Crankshaft oil seals – renewal

Right-hand oil seal

Note: *This procedure explains the fitting of the seal in situ. See Section 8 for the removal of the oil pump cover and renewing the seal off the engine.*
1 Apply the handbrake, then jack up the front of the car and support on axle stands (see *Jacking and vehicle support*). Remove the right-hand front wheel, undo the securing screws and withdraw the wheel arch liner. Where applicable, unclip the power steering pipe from the subframe.
2 Support the engine under the right-hand side, then undo the retaining bolts and remove the right-hand upper engine mounting assembly from the vehicle (with reference to Section 13).
3 Remove the auxiliary drivebelt with reference to Chapter 1A.
4 Unscrew and remove the centre bolt from the crankshaft pulley. To do this, the crankshaft must be held stationary using one of the following methods. On manual transmission models, have an assistant depress the brake pedal and engage 4th gear. Alternatively, remove the flywheel cover plate or starter motor as described in Chapter 5A, then insert a flat-bladed screwdriver through the bellhousing and jam the starter ring gear to prevent the crankshaft turning. On automatic transmission models, use the latter method only.
5 Pull the crankshaft pulley and hub from the end of the crankshaft. If it is tight, careful use of two levers may be required.
6 Note the fitted depth of the oil seal in its housing, then using a screwdriver, carefully prise the oil seal from the oil pump casing. Alternatively, punch or drill two small holes opposite each other in the seal. Thread a self-tapping screw into each hole, and pull on the screw heads with pliers to extract the seal. Another method is to remove the oil pump cover as described in Section 8, and remove the oil seal on the bench (see illustrations in Section 8).
7 Clean the seating in the oil pump casing, then lubricate the lips of the new oil seal with clean engine oil, and locate it squarely on the oil pump casing. Make sure that the closed side is facing outwards. Using a suitable tubular drift (such as a socket), which bears only on the hard outer edge of the seal, tap the seal into position, to the same depth in the casing as the original was prior to removal.
8 Locate the crankshaft pulley and hub on the end of the crankshaft. Insert the centre bolt and tighten it to the specified torque, holding the crankshaft stationary using one of the methods described in paragraph 4.
9 Refit the auxiliary drivebelt with reference to Chapter 1A, then refit the engine mounting assembly.
10 Refit the wheel arch liner front section and moulding, and tighten the screws.
11 Refit the right-hand front wheel, and lower the car to the ground.

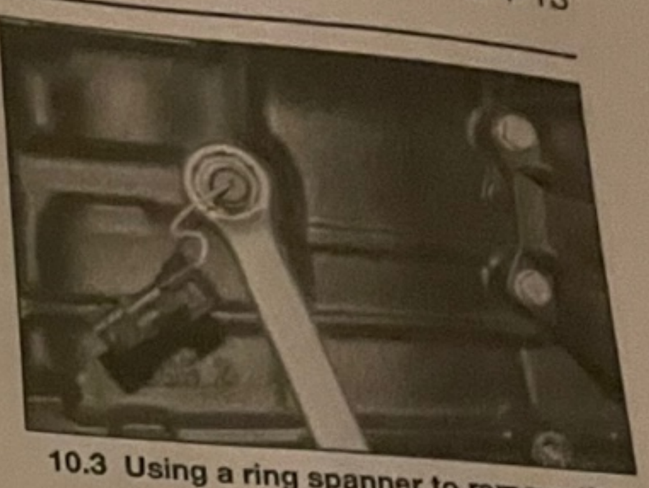
Left-hand oil seal

12 Remove the flywheel/driveplate as described in Section 12.
13 Make a note of the fitted depth of the seal in its housing. Punch or drill two small holes opposite each other in the seal. Thread a self-tapping screw into each hole, and pull on the screw heads with pliers to extract the seal. Alternatively, use a screwdriver to prise out the oil seal.
14 Clean the seal housing, then lubricate the lips of the new seal with clean engine oil, and carefully locate the seal on the end of the crankshaft.
15 Using a suitable tubular drift, which bears only on the hard outer edge of the seal, drive the seal into position, to the same depth in the housing as the original was prior to removal.
16 Wipe clean the oil seal, then refit the flywheel/driveplate as described in Section 12.

12 Flywheel/driveplate – removal, inspection and refitting

Removal

1 Remove the transmission as described in Chapter 7A or 7B.
2 On manual transmission models, remove the clutch assembly as described in Chapter 6.
3 Prevent the flywheel/driveplate from turning by jamming the ring gear teeth with a wide-bladed screwdriver or similar tool. Alternatively, bolt a metal link between the flywheel/driveplate (using the clutch or torque converter bolt holes) and the cylinder block/crankcase.
4 Unscrew and remove the retaining bolts, remove the locking tool, then remove the flywheel/driveplate from the crankshaft flange. Note that the unit is located by a dowel pin, and must be fitted correctly.



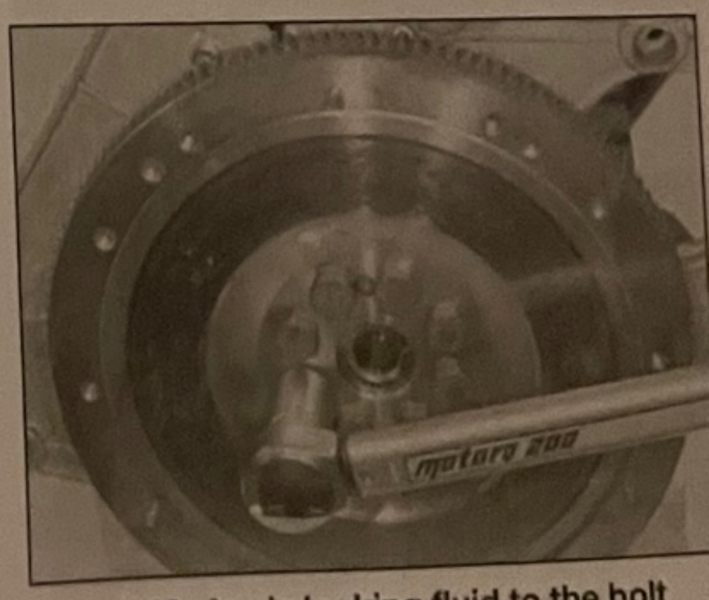
10.3 Using a ring spanner to remove the oil pressure switch

Inspection

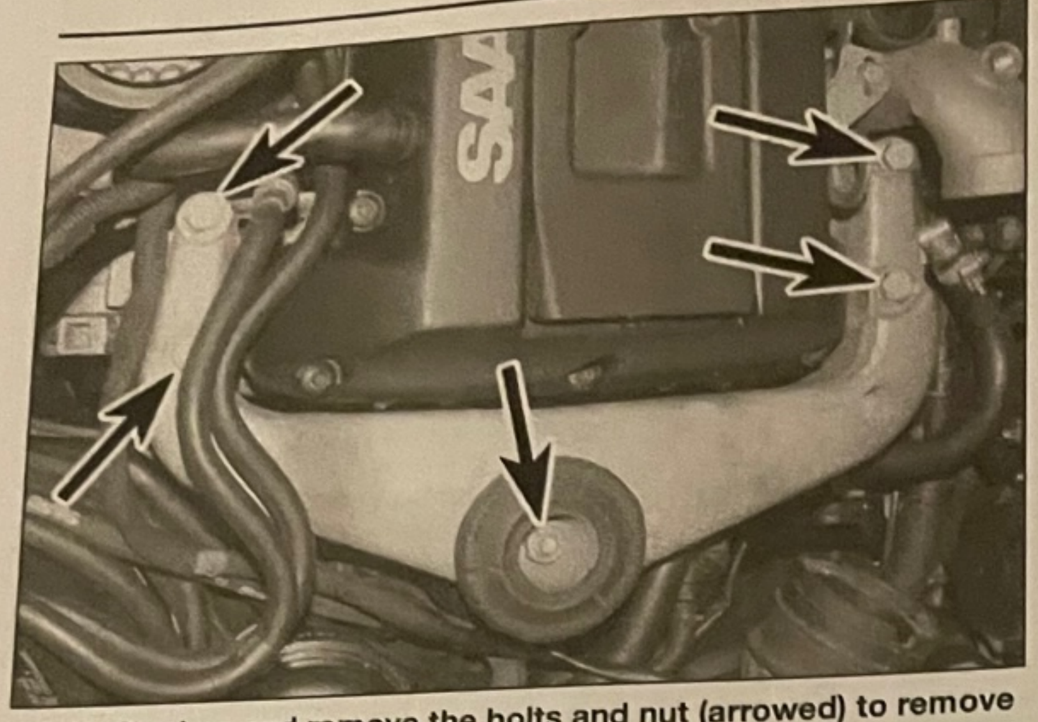
5 On manual transmission models, if the flywheel's clutch mating surface is deeply scored, cracked or otherwise damaged, the flywheel must be renewed. However, it may be possible to have it surface-ground; seek the advice of a Saab dealer or engine reconditioning specialist.
6 Similarly check the condition of the driveplate on automatic transmission models.
7 If the ring gear is badly worn or has missing teeth, it may be possible to renew it. This job is best left to a Saab dealer or engine reconditioning specialist. The temperature to which the new ring gear must be heated for installation is critical and, if not done accurately, the hardness of the teeth will be destroyed.

Refitting

8 Clean the mating surfaces of the flywheel/driveplate and crankshaft. Clean the threads of the retaining bolts and the crankshaft holes.
9 Ensure that the locating dowel is in position, then offer up the flywheel and locate it on the dowel.
10 Apply locking fluid to the threads of the retaining bolts. Insert and tighten them to the specified torque, holding the flywheel/driveplate stationary using one of the methods described in paragraph 3 **(see illustration)**.
11 On manual transmission models, refit the clutch assembly as described in Chapter 6.
12 Refit the transmission with reference to Chapter 7A or 7B.



12.10 Apply locking fluid to the bolt threads, and tighten to the specified torqu



13.10 Slacken and remove the bolts and nut (arrowed) to remove the engine mounting bracket

13.11 Unclip the hose from the retaining clip (arrowed) under the engine mounting

13 Engine/transmission mountings – inspection and renewal

Inspection

1 For improved access, raise the front of the car and support it securely on axle stands (see *Jacking and vehicle support*).

2 The engine mountings are located at the front right-hand side, the left-hand side of the transmission under the battery tray, at the rear of the engine and, on some models, a torque arm mounting at the front.

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

4 Check that all the mounting's fasteners are securely tightened.

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

Renewal

Right-hand mounting

6 Apply the handbrake, then jack up the front of the car and support on axle stands (see *Jacking and vehicle support*). Remove the right-hand front wheel.

7 Remove the screws, and withdraw the right-hand front wing plastic moulding and front wheel arch liner.

8 Remove the securing screws and detach the plastic undershield from under the engine.

9 Position a trolley jack underneath the engine and raise the jack head until it is just taking the weight of the engine. Ensure that the jack head does not bear on the underside of the sump, use a block of wood between the sump and the jack head. Alternatively, position a lifting beam across the engine bay and support the engine by the lifting eyelet located at the rear right-hand side of the cylinder head.

10 Undo the bolts securing the engine mounting bracket to the engine and the retaining nut on the top of the engine mounting **(see illustration)**. Take care to avoid straining the other engine mountings as you do this.

11 Withdraw the engine mounting bracket from the vehicle, unclipping the power steering hose from its retaining clip **(see illustration)**. Undo the three retaining bolts and remove the engine mounting from the inner wing panel.

12 Fit the new mountings using a reversal of the removal procedure, making sure that all bolts/nuts are tightened to the correct torque.

Left-hand mounting

13 Apply the handbrake, then jack up the front of the car and support on axle stands (see *Jacking and vehicle support*).

14 Remove the battery cover and disconnect the battery leads (negative first), and position the leads away from the battery terminals.

15 Remove the securing screws and detach the plastic undershield from under the engine.

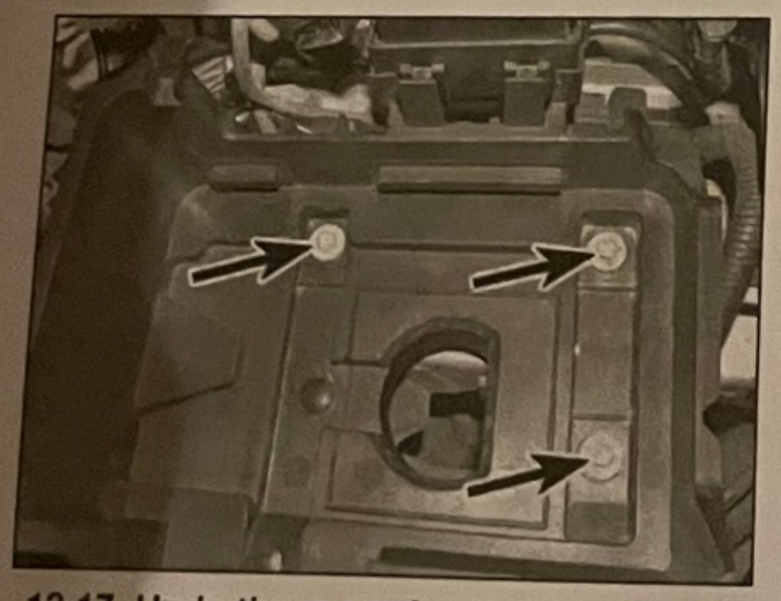
16 Position a trolley jack underneath the transmission and raise the jack head until it is just taking the combined weight of the engine and transmission. On models with automatic transmission, ensure that the jack head does not bear on the underside of the transmission sump; use a block of wood between the sump and the jack head. Alternatively, position a lifting beam across the engine bay and support the engine by the lifting eyelet located at the rear left-hand side of the cylinder head.

17 Undo the securing nut and remove the battery from the vehicle (disconnect the vent hose, where applicable), slacken and remove the retaining bolts and withdraw the battery tray from the vehicle **(see illustration)**.

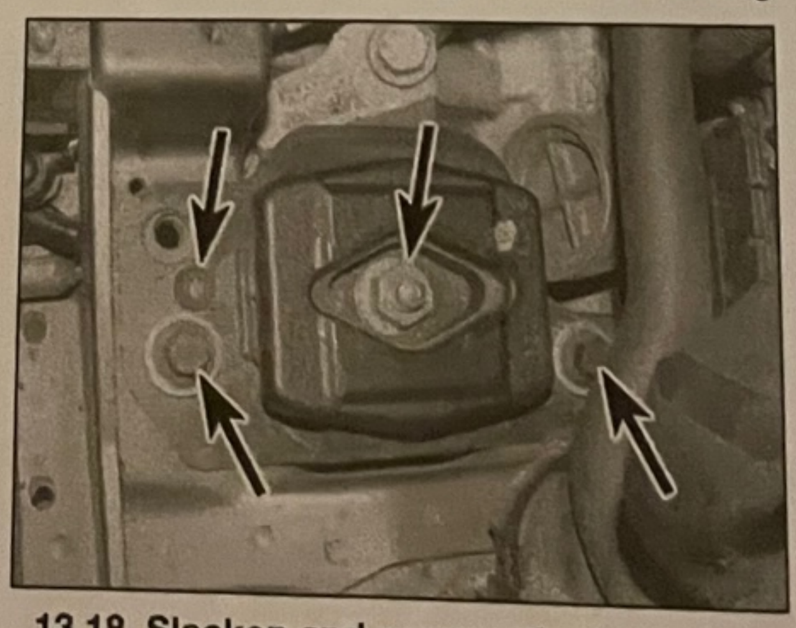
18 Unscrew the bolts securing the engine transmission mounting bracket to the bodywork and the centre nut from the mounting **(see illustration)**. Make sure the transmission is supported, taking care to avoid straining the other engine mountings as you do this.

19 Withdraw the mounting from the inner wing panel and transmission. Where applicable, disconnect the clutch hydraulic hose from the mounting bracket.

20 If required the transmission mounting



13.17 Undo the mounting bolts (arrowed) to remove the battery tray



13.18 Slacken and remove the bolts, nut and retaining screw (arrowed) to remove the engine mounting bracket

bracket can then be withdrawn from the transmission by removing the retaining bolts from the transmission casing.

21 Fit the new mounting using a reversal of the removal procedure, making sure that the nuts are tightened to the correct torque.

Rear mounting

22 Mount a lifting beam across the engine compartment, in-line with the front suspension turrets. Attach the jib to the engine lifting eyelet at the left hand end of the cylinder head. Raise the jib until the beam just starts to take the weight of the engine.

23 Remove the battery cover and disconnect the battery leads (negative first), and position the leads away from the battery terminals. Remove the engine upper cover.

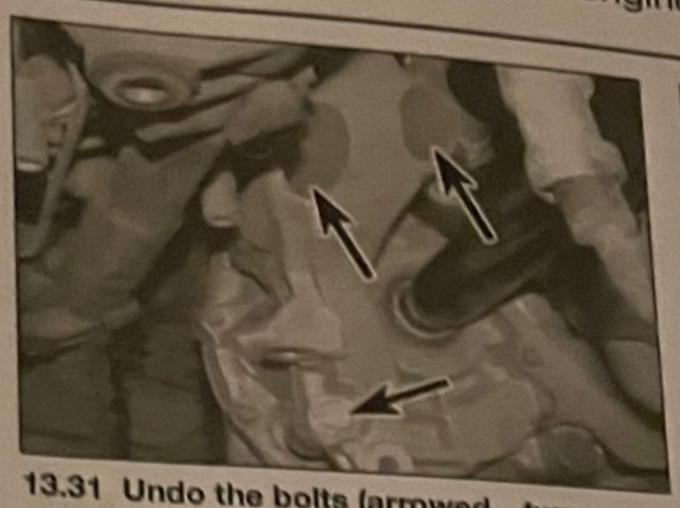
24 On manual models, release the stay for the gearchange linkage from the rear engine mounting bracket.

25 Undo the upper nut and bolts securing the rear engine mounting to the subframe.

26 Disengage the bypass pipe and valve from the turbo intake pipe, then undo the retaining bolts and remove the exhaust manifold heat shield.

27 Unplug the oxygen sensor wiring at the connector, located on a bracket at the left hand end of the cylinder head and release it from any cable ties.

28 Ensure that the lifting beam is supporting the engine and transmission adequately, then slacken and withdraw the rear engine mounting centre bolts.



13.31 Undo the bolts (arrowed – two upper bolts inside housing) to remove the rear engine mounting bracket

29 Raise the front of the vehicle and support it securely on axle stands (see *Jacking and vehicle support*). Remove both front roadwheels.

30 With reference to Chapter 4A, unbolt the exhaust system front pipe from the turbocharger. Unbolt the front pipe from its support bracket and withdraw it from the underside of the engine compartment. **Note:** *the flexible section of the exhaust pipe MUST NOT be put under excessive strain, as it may cause it to leak and eventually break.*

31 Unbolt the engine mounting bracket from the rear of the transmission casing and remove it from the engine compartment complete with engine mounting **(see illustration)**.

32 Fit the new mounting using a reversal of the removal procedure, making sure that the nuts are tightened to the correct torque.

13.35 Slacken and remove the bolts (arrowed) on the front engine mounting/ torque arm

Front mounting

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

34 Remove the securing screws and detach the plastic undershield from under the engine.

35 Slacken and remove the two nuts and bolts securing the torque arm mounting to the transmission and subframe **(see illustration)**. It can then be withdrawn from the vehicle.

36 If required the transmission mounting bracket can then be withdrawn from the transmission by removing the retaining bolts from the transmission casing.

37 Fit the new mounting using a reversal of the removal procedure, making sure that the nuts are tightened to the correct torque.