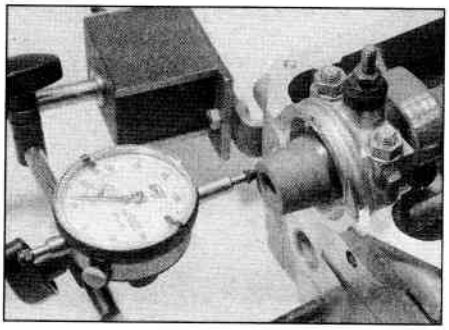
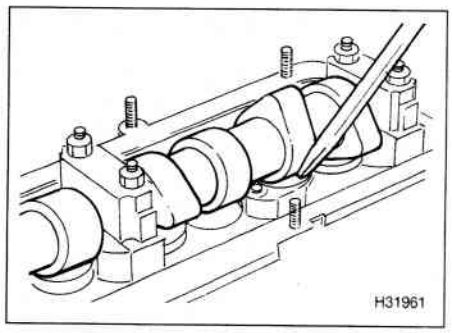


11.17 Checking camshaft endfloat using a DTI gauge

17 To measure the camshaft endfloat, temporarily refit the camshaft to the cylinder head, then fit Nos 1 and 5 bearing caps and tighten the retaining nuts to the specified torque setting. Anchor a DTI gauge to the timing belt end of the cylinder head **(see illustration)**. Push the camshaft to one end of the cylinder head as far as it will travel, then rest the DTI gauge probe on the end face of the camshaft, and zero the gauge. Push the camshaft as far as it will go to the other end of the cylinder head, and record the gauge reading. Verify the reading by pushing the camshaft back to its original position and checking that the gauge indicates zero again.
Note: *The hydraulic tappets must* ***not*** *be fitted whilst this measurement is being taken.*
18 Check that the camshaft endfloat measurement is within the limit listed in the Specifications. If the measurement is outside the specified limit, wear is unlikely to be confined to any one component, so renewal of the camshaft, cylinder head and bearing caps must be considered.
19 The camshaft bearing running clearance should now be measured. This will be difficult to achieve without a range of micrometers or internal/external expanding calipers, measure the outside diameters of the camshaft bearing surfaces and the internal diameters formed by the bearing caps (and shell bearings where applicable) and the bearing locations in the cylinder head. The difference between these two measurements is the running clearance.
20 Compare the camshaft running clearance measurements with the figure given in the Specifications; if any are outside the specified tolerance, the camshaft, cylinder head and bearing caps (and shell bearings where applicable) should be renewed.
21 Inspect the hydraulic tappets for obvious signs of wear or damage, and renew if necessary. Check that the oil holes in the tappets are free from obstructions.



12.8 Press down on the tappet using a wooden or plastic instrument

Refitting

22 Remove the crankshaft locking tool and rotate the crankshaft 90° anti-clockwise. This will lower the pistons and guard against any possibility of the valves contacting the piston crowns.
23 Smear some clean engine oil onto the sides of the hydraulic tappets, and offer them into position in their original bores in the cylinder head. Push them down until they contact the valves, then lubricate the camshaft lobe contact surfaces.
24 Lubricate the camshaft and cylinder head bearing journals (and shell bearings where applicable) with clean engine oil.
25 Carefully lower the camshaft into position in the cylinder head making sure that the cam lobes for No 1 cylinder are pointing upwards.
Note: *The camshaft and crankshaft must not be rotated for at least 30 minutes after tightening the bearing caps.*
26 Refit a new camshaft oil seal on the front of the camshaft. Make sure that the closed end of the seal faces the camshaft sprocket end of the camshaft, and take care not to damage the seal lip. Locate the seal against the seat in the cylinder head.
27 Oil the upper surfaces of the camshaft bearing journals (and shell bearings where applicable), then fit Nos 2 and 4 bearing caps. Ensure that they are fitted the right way round and in the correct locations (see paragraph 6), then progressively tighten the retaining nuts in a diagonal sequence to the specified torque. Note that as the nuts are tightened, the camshaft will be forced down against the pressure of the valve springs.
28 Fit bearing caps 1, 3 and 5 over the camshaft and progressively tighten the nuts to the specified torque. Note that it may be necessary to locate No 5 bearing cap by tapping lightly on the end of the camshaft.
29 Refit the camshaft sprocket as described in Section 9.
30 Carry out the unit injector basic setting procedure as described in Chapter 4B.
31 Refit and tension the timing belt as described in Section 8.
32 Refit the brake tandem pump as described in Chapter 4B.

12 Hydraulic tappets – testing

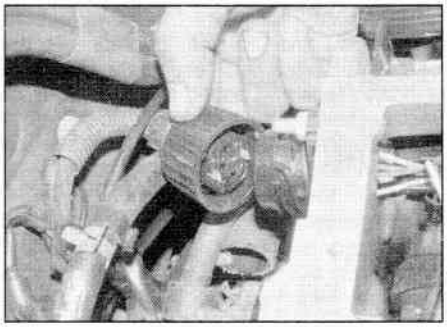
Warning: After fitting hydraulic tappets, wait a minimum of 30 minutes (or preferably, leave overnight) before starting the engine, to allow the tappets time to settle, otherwise the valve heads will strike the pistons.

1 The hydraulic tappets are self-adjusting, and require no attention whilst in service.
2 If the hydraulic tappets become excessively noisy, their operation can be checked as described below.
3 Start the engine, and run it until it reaches normal operating temperature, increase the engine speed to approximately 2500 rpm for 2 minutes.
4 If any hydraulic tappets are heard to be noisy, carry out the following checks.
5 Remove the camshaft cover as described in Section 5.
6 Using a socket or spanner on the crankshaft sprocket bolt, turn the crankshaft until the tip of the camshaft lobe above the tappet to be checked is pointing vertically upwards.
7 Using feeler blades, check the clearance between the top of the tappet and the cam lobe. If the play is in excess of 0.1 mm, renew the relevant tappet. If the play is less than 0.1 mm, or there is no play, proceed as follows.
8 Press down on the tappet using a wooden or plastic instrument **(see illustration)**. If free play in excess of 1.0 mm is present before the tappet contacts the valve stem, renew the relevant tappet.
9 On completion, refit the camshaft cover as described in Section 5.

13 Camshaft oil seals – renewal

Right-hand oil seal

1 Remove the timing belt as described in Section 8.
2 Remove the camshaft sprocket and hub, as described in Section 9.
3 Drill two small holes into the existing oil seal, diagonally opposite each other. Take great care to avoid drilling through into the seal housing or camshaft sealing surface. Thread two self-tapping screws into the holes, and using a pair of pliers, pull on the heads of the screws to extract the oil seal.
4 Clean out the seal housing and the sealing surface of the camshaft by wiping it with a lint-free cloth. Remove any swarf or burrs that may cause the seal to leak.
5 Do not lubricate the lip and outer edge of the new oil seal, push it over the camshaft until it is positioned in place above its housing. To prevent damage to the sealing lips, wrap some adhesive tape around the end of the camshaft.
6 Using a hammer and a socket of suitable diameter, drive the seal squarely into its housing. **Note:** *Select a socket that bears only on the hard outer surface of the seal, not the inner lip which can easily be damaged.*
7 Refit the camshaft sprocket and its hub, as described in Section 9.
8 Refit and tension the timing belt as described in Section 8.



14.6 Disconnect the central connector for the injectors

Left-hand oil seal

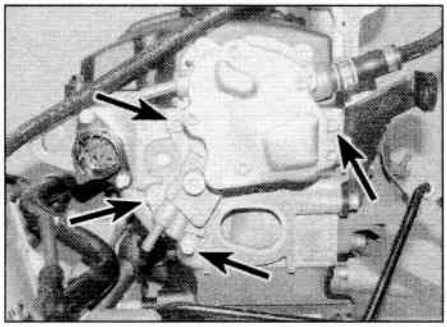
9 The left-hand camshaft oil seal is formed by the brake tandem pump seal. Refer to Chapter 9 for details of brake vacuum pump removal and refitting.

14 Cylinder head – removal, inspection and refitting

Note: *The cylinder head must be removed with the engine cold. New cylinder head bolts and a new cylinder head gasket will be required on refitting, and suitable studs will be required to guide the cylinder head into position – see text.*

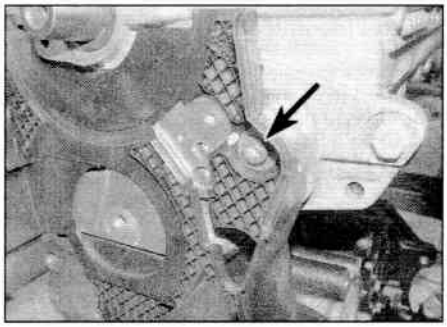
Removal

1 Disconnect the battery negative lead and remove the engine top cover. Remove the soundproofing material from the valve cover.
Note: *Before disconnecting the battery, refer to 'Disconnecting the battery' at the rear of this manual.*
2 Drain the cooling system and engine oil as described in Chapter 1B.
3 Disconnect the MAF sensor and remove the air filter, air filter housing and intake pipe from the inlet manifold.
4 With reference to Chapters 11 and 12, remove the windscreen cowl panel and the bulkhead panel. Access can be improved further by removing the wiper motor and linkage assembly.
5 Unbolt the coolant expansion tank and fuel filter support bracket. Remove the side panels from the battery tray. Access can be further improved by removing the battery.
6 At the left-hand end of the cylinder head, disconnect the wiring plug form the coolant temperature sensor, remove the spring clips and remove the coolant hoses. Disconnect the wiring plug from the end of the cylinder head **(see illustration)**.
7 Unplug the wiring connector from the manifold absolute pressure sensor (MAP) and remove the pipe. Remove the intercooler pipe.
8 Disconnect the wiring plug from the fuel temperature sensor, and then remove the fuel and vacuum lines from the tandem pump. Plug and seal the fuel lines. Alternatively leave

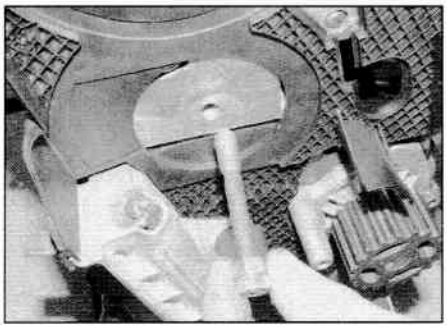


14.8 Undo the four tandem pump retaining bolts (arrowed)

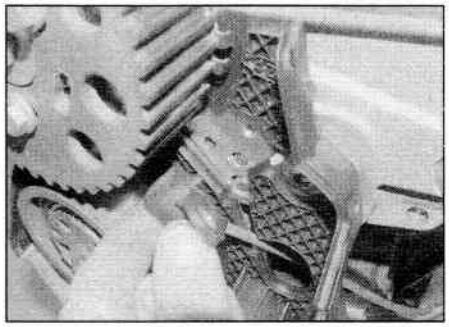
the pipes connected and remove the tandem pump complete with the pipework **(see illustration)**.
9 At the rear of the engine, remove the vacuum lines from the EGR valve and the anti-shudder valve.
10 At the front of the engine, remove the glow plug wiring loom, the camshaft position sensor wiring plug and the vacuum hose(s) from the vacuum reservoir.
11 Remove the camshaft cover as described in Section 5 and then remove the intake pipe and crankcase ventilation pipe from the turbocharger.
12 Jack up and support the front of the vehicle. Remove the engine undershield.
13 Disconnect the turbocharger oil return line and remove the support bracket.
14 Support the flexible section of the exhaust pipe and then remove it from the manifold. On vehicles fitted with and EGR cooler, remove



14.18a Where applicable, undo the bolt (arrowed) from the inner cover . . .

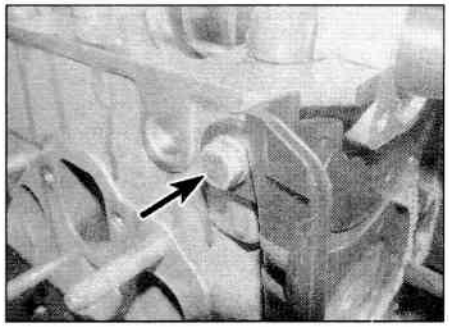


14.19 Using two nuts locked together to unscrew the tensioner mounting stud

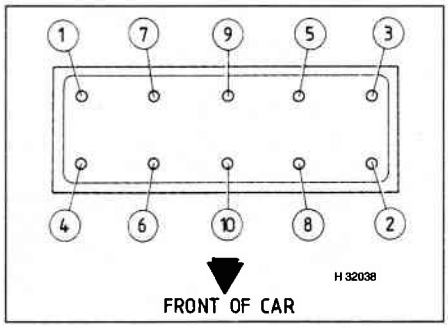


14.16 Unscrew the bolt and remove the camshaft position sensor

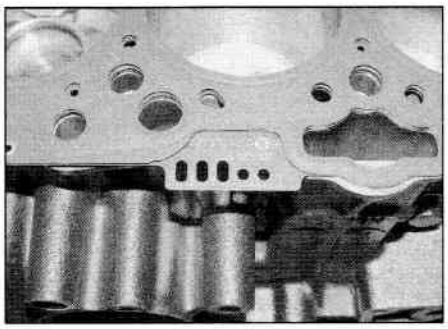
the hose and disconnect the EGR pipe from the exhaust manifold.
15 On engines fitted with and EGR cooler (engine codes ASZ and AUY) loosen the inlet manifold bolts and remove the inlet manifold.
16 Remove the timing belt as described in Section 8 and then unbolt and remove the camshaft sensor **(see illustration)**.
17 Remove the camshaft sprocket and timing belt tensioner as described in Section 9.
18 Where applicable, unscrew the bolt(s) securing the rear timing belt cover to the cylinder head **(see illustrations)**.
19 Using two suitable nuts locked together, unscrew the timing belt tensioner mounting stud from the cylinder head **(see illustration)**.
20 Unbolt and remove the turbocharger oil supply pipe.
21 Progressively slacken the cylinder head bolts, by one turn at a time, in order **(see illustration)**. Check that nothing remains



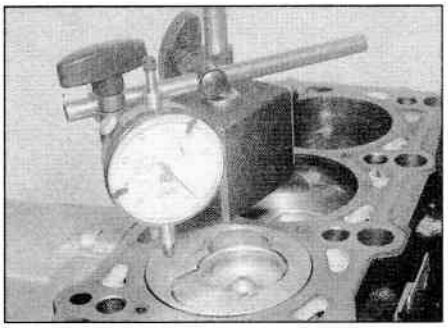
14.18b . . . and the one (arrowed) on the side of the cover



14.21 Cylinder head bolt slackening sequence



14.26 The thickness of the cylinder head gasket can be identified by notches or holes



14.29 Measuring the piston projection at TDC using a dial gauge

connected and then remove the cylinder head bolts.

22 With all the bolts removed, lift the cylinder head from the block, together with the manifolds and turbocharger. If the cylinder head is stuck, tap it with a soft-faced mallet to break the joint. **Do not** insert a lever into the gasket joint.

23 Lift the cylinder head gasket from the block. Do not discard the gasket at this stage, as it will be required when determining the thickness of the new gasket required.

24 If desired, the manifolds can be removed from the cylinder head with reference to Chapter 4B (inlet manifold) or 4C (exhaust manifold).

Inspection

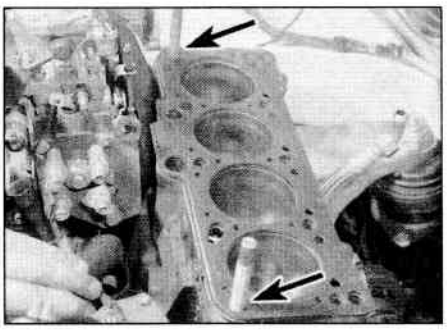
25 Dismantling and inspection of the cylinder head is covered in Chapter 2C.

Cylinder head gasket selection

Note: *A dial test indicator (DTI) will be required for this operation.*

26 Examine the old cylinder head gasket for manufacturer's identification markings **(see illustration)**. These will be in the form of holes or notches, and a part number on the edge of the gasket. Unless new pistons have been fitted, the new cylinder head gasket must be of the same type as the old one. In this case, purchase a new gasket, and proceed to paragraph 33.

27 If new piston assemblies have been fitted as part of an engine overhaul, or if a new short engine is to be fitted, the projection of the piston crowns above the cylinder head mating face of the cylinder block at TDC must be measured. This measurement is used to determine the thickness of the new cylinder head gasket required.



14.41 Two of the old head bolts (arrowed) can be used as cylinder head alignment guides

28 Anchor a dial test indicator (DTI) to the top face (cylinder head gasket mating face) of the cylinder block, and zero the gauge on the gasket mating face.

29 Rest the gauge probe on No 1 piston crown, and turn the crankshaft slowly by hand until the piston reaches TDC. Measure and record the maximum piston projection at TDC **(see illustration)**.

30 Repeat the measurement for the remaining pistons, and record the results.

31 If the measurements differ from piston-to-piston, take the highest figure, and use this to determine the thickness of the head gasket required as follows.

Gasket identification

Piston projection	Number of holes/ notches
0.91 to 1.00 mm	1
1.01 to 1.10 mm	2
1.11 to 1.20 mm	3

32 Purchase a new gasket according to the results of the measurements.

Refitting

Note: *If an exchange cylinder head, complete with camshaft, is to be fitted, the manufacturers recommend the following:*

a) Lubricate the contact surfaces between the tappets and the cam lobes before fitting the camshaft cover.
b) Do not remove the plastic protectors from the open valves until immediately before fitting the cylinder head.
c) Renew the engine coolant.

33 The mating faces of the cylinder head and block must be perfectly clean before refitting the head. Use a scraper to remove all traces of gasket and carbon, also clean the tops of the pistons. Take particular care with the aluminium surfaces, as the soft metal is easily damaged.

34 Make sure that debris is not allowed to enter the oil and water passages – this is particularly important for the oil circuit, as carbon could block the oil supply to the camshaft and crankshaft bearings. Using adhesive tape and paper, seal the water, oil and bolt holes in the cylinder block.

35 To prevent carbon entering the gap between the pistons and bores, smear a little grease in the gap. After cleaning a piston, rotate the crankshaft to that the piston moves down the bore, then wipe out the grease and carbon with a cloth rag. Clean the other piston crowns in the same way.

36 Check the head and block for nicks, deep scratches and other damage. If slight, they may be removed carefully with a file. More serious damage may be repaired by machining, but this is a specialist job.

37 If warpage of the cylinder head is suspected, use a straight-edge to check it for distortion, as described in Chapter 2C.

38 Ensure that the cylinder head bolt holes in the crankcase are clean and free of oil. Syringe or soak up any oil left in the bolt holes. This is most important in order that the correct bolt tightening torque can be applied, and to prevent the possibility of the block being cracked by hydraulic pressure when the bolts are tightened.

39 Turn the crankshaft anti-clockwise all the pistons at an equal height, approximately halfway down their bores from the TDC position (see Section 4). This will eliminate any risk of piston-to-valve contact as the cylinder head is refitted.

40 Where applicable, refit the manifolds with reference to Chapters 4B and/or 4C.

41 To guide the cylinder head into position, screw two long studs (or old cylinder head bolts with the heads cut off, and slots cut in the ends to enable the bolts to be unscrewed) into the cylinder block **(see illustration)**.

42 Ensure that the cylinder head locating dowels are in place in the cylinder block, then fit the new cylinder head gasket over the dowels, ensuring that the part number is uppermost. Where applicable, the OBEN/TOP marking should also be uppermost. **Note:** *Only remove the gasket from its packaging immediately prior to fitting.*

43 Lower the cylinder head into position on the gasket, ensuring that it engages correctly over the guide studs and dowels.

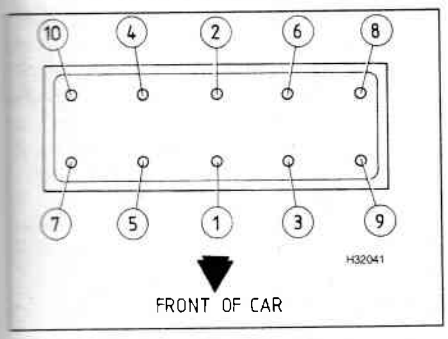
44 Fit the new cylinder head bolts to the eight remaining bolt locations, and screw them in as far as possible by hand.

45 Unscrew the two guide studs from the exhaust side of the cylinder block, then screw in the two remaining new cylinder head bolts as far as possible by hand.

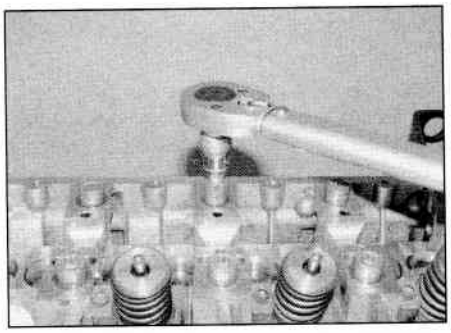
46 Working progressively, in sequence, tighten all the cylinder head bolts to the specified Stage 1 torque **(see illustrations)**.

47 Again working progressively, in sequence, tighten all the cylinder head bolts to the specified Stage 2 torque.

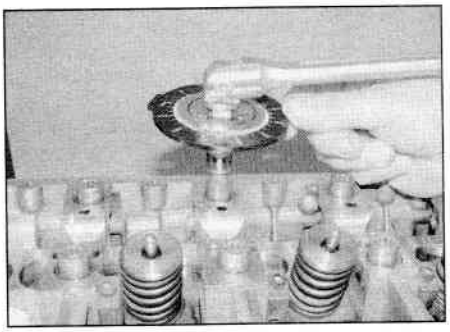
48 Tighten all the cylinder head bolts, in sequence, through the specified Stage 3 angle **(see illustration)**.



14.46a Cylinder head bolt tightening sequence



14.46b Using a torque wrench to tighten the cylinder head bolts



14.48 Angle-tighten the cylinder head bolts

49 Finally, tighten all the cylinder head bolts, in sequence, through the specified Stage 4 angle.

50 After finally tightening the cylinder head bolts, turn the camshaft so that the cam lobes for No 1 cylinder are pointing upwards.

51 The remainder of the refitting procedure is a reversal of the removal procedure, bearing in mind the following points.

a) *Refit the camshaft cover with reference to Section 5.*

b) *Use new sealing rings when reconnecting the turbocharger oil return pipe to the cylinder block.*

c) *Reconnect the exhaust front section to the exhaust manifold, with reference to Chapter 4C.*

d) *Refit the timing belt tensioner with reference to Section 8.*

e) *Refit the camshaft sprocket as described in Section 9, and refit the timing belt as described in Section 8.*

f) *Refill the cooling system and engine oil as described in Chapter 1B.*

15 Sump – removal and refitting

Note: *Ford sealant YM2J-19G204-AA (or equivalent) will be required to seal the sump on refitting.*

Removal

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

2 Remove the securing screws and withdraw the engine undershield.

3 Drain the engine oil as described in Chapter 1B.

4 Disconnect the wiring connector from the oil level/temperature sender in the sump **(see illustration)**.

5 Slacken and remove the bolts securing the sump to the cylinder block, and the bolts securing the sump to the transmission casing, then withdraw the sump. If necessary, release the sump by tapping with a soft-faced hammer.

6 If desired, unbolt the oil baffle plate from the cylinder block.

Refitting

7 Begin refitting by thoroughly cleaning the mating faces of the sump and cylinder block. Ensure that all traces of old sealant are removed.

8 Where applicable, refit the oil baffle plate, and tighten the securing bolts.

9 Ensure that the cylinder block mating face of the sump is free from all traces of old sealant, oil and grease, and then apply a 2.0 to 3.0 mm diameter thick bead of silicone sealant to the sump **(see illustration)**. Note that the sealant should be run around the inside of the bolt holes in the sump. The sump must be fitted within 5 minutes of applying the sealant.

10 Offer the sump up to the cylinder block, then refit the sump-to-cylinder block bolts, and lightly tighten them by hand, working progressively in a diagonal sequence. **Note:** *If the sump is being refitted with the engine and transmission separated, make sure that the sump is flush with the flywheel/driveplate end of the cylinder block.*

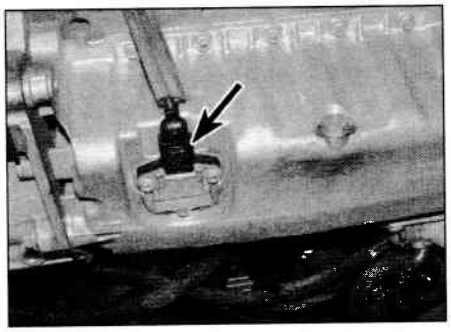
11 Refit the sump-to-transmission casing bolts, and tighten them lightly, using a socket.

12 Again working in a diagonal sequence, *lightly* tighten the sump-to-cylinder block bolts, using a socket.

13 Tighten the sump-to-transmission casing bolts to the specified torque.

14 Working in a diagonal sequence, progressively tighten the sump-to-cylinder block bolts to the specified torque.

15 Refit the wiring connector to the oil level/temperature sender (where fitted), then refit the engine undershield(s), and lower the vehicle to the ground.



15.4 Disconnect the wiring plug (arrowed) from the sender

16 Allow at least 30 minutes from the time of refitting the sump for the sealant to dry, then refill the engine with oil, with reference to Chapter 1A.

16 Oil pump and drive chain – removal, inspection and refitting

Oil pump

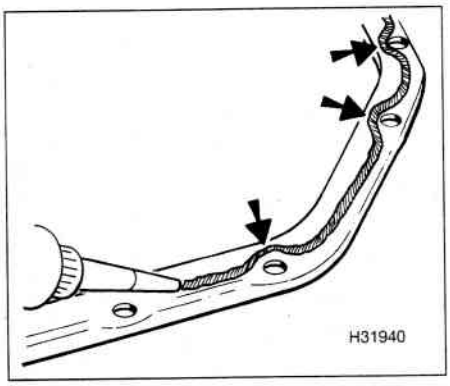
Removal

1 Remove the sump as described in Section 15.

2 Where applicable, unscrew the securing bolts, and remove the oil baffle from the cylinder block.

3 Unscrew and remove the three mounting bolts, and release the oil pump from the dowels in the crankcase **(see illustration)**. Unhook the oil pump drive sprocket from the chain and withdraw the oil pump and oil pick-up pipe from the engine. Note that the tensioner will attempt to tighten the chain, and it may be necessary to use a screwdriver to hold it in its released position before releasing the oil pump sprocket from the chain.

4 If desired, unscrew the flange bolts and remove the suction pipe from the oil pump. Recover the O-ring seal. Unscrew the bolts and remove the cover from the oil pump. **Note:** *If the oil pick-up pipe is removed from the oil pump, a new O-ring will be required on refitting.*



15.9 Apply the sealant around the inside of the bolt holes

Inspection

5 Clean the pump thoroughly, and inspect the gear teeth/rotors for signs of damage or wear. If evident, renew the oil pump.

6 Unscrew the retaining bolt and slide off the sprocket (note that the sprocket can only be fitted in one position).

Refitting

7 Prime the pump with oil by pouring oil into the pick-up pipe aperture while turning the driveshaft.

8 Refit the cover to the oil pump and tighten the bolts securely. Where applicable, refit the pick-up pipe to the oil pump, using a new O-ring seal, and tighten the securing bolts.

9 If the drive chain, crankshaft sprocket and tensioner have been removed, delay refitting them until after the oil pump has been mounted on the cylinder block. If they have not been removed, use a screwdriver to press the tensioner against its spring to provide sufficient slack in the chain to refit the oil pump.

10 Engage the oil pump sprocket with the drive chain, then locate the oil pump on the dowels. Refit and tighten the three mounting bolts to the specified torque.

11 Where applicable, refit the drive chain, tensioner and crankshaft sprocket using a reversal of the removal procedure.

12 Refit the oil baffle, and tighten the securing bolts.

13 Refit the sump as described in Section 15.

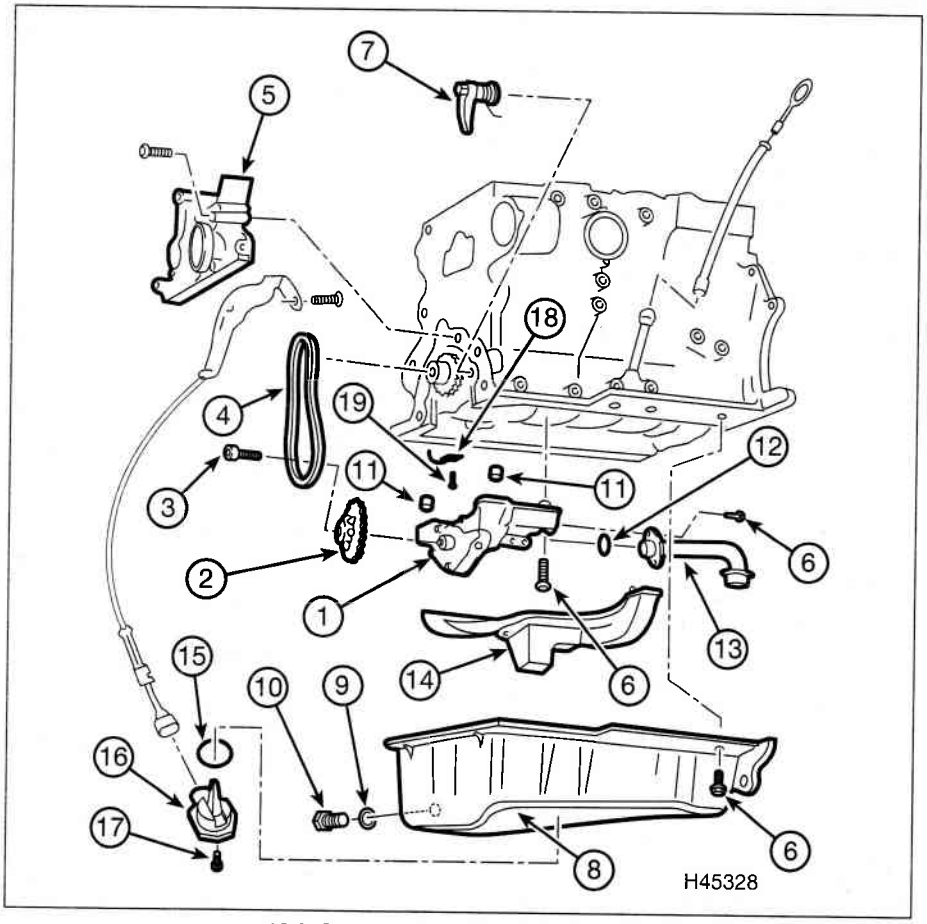
Drive chain and sprockets

Note: *Ford sealant YM2J-19G204-AA (or equivalent) will be required to seal the crankshaft oil seal housing on refitting, and it is advisable to fit a new crankshaft oil seal.*

Removal

14 Proceed as described in paragraphs 1 and 2.

15 To remove the oil pump sprocket, unscrew the securing bolt, then pull the sprocket from the pump shaft, and unhook it from the drive chain.



16.3 Sump and oil pump components

1 *Oil pump*
2 *Oil pump sprocket*
3 *Bolt*
4 *Oil pump drive chain*
5 *Crankshaft oil seal housing*
6 *Bolt*
7 *Drive chain tensioner*
8 *Sump*
9 *Seal*
10 *Sump drain plug*
11 *Dowels*
12 *O-ring*
13 *Oil pick-up pipe*
14 *Oil baffle*
15 *Seal*
16 *Oil level/temperature sender*
17 *Bolt*
18 *Oil spray jet*
19 *Bolt*

16 To remove the chain, remove the timing belt as described in Section 8, then unbolt the crankshaft oil seal housing from the cylinder block. Unbolt the chain tensioner from the cylinder block, then unhook the chain from the sprocket on the end of the crankshaft.

17 The oil pump drive sprocket is a press-fit on the crankshaft, and cannot easily be removed. Consult a Ford dealer or engine repair specialist for advice if the sprocket is worn or damaged.

Inspection

18 Examine the chain for wear and damage. Wear is usually indicated by excessive lateral play between the links, and excessive noise in operation. It is wise to renew the chain in any case if the engine is to be overhauled. Note that the rollers on a very badly worn chain may be slightly grooved. If there is any doubt as to the condition of the chain, renew it.

19 Examine the teeth on the sprockets for wear. Each tooth forms an inverted V. If worn, the side of each tooth under tension will be slightly concave in shape when compared with the other side of the tooth (ie, the teeth will have a hooked appearance). If the teeth appear worn, the sprocket should be renewed.

Refitting

20 If the oil pump has been removed, refit the oil pump as described previously in this Section before refitting the chain and sprocket.

21 Refit the chain tensioner to the cylinder block, and tighten the securing bolt to the specified torque. Make sure that the tensioner spring is correctly positioned to pretension the tensioner arm.

22 Engage the oil pump sprocket with the chain, then engage the chain with the crankshaft sprocket. Use a screwdriver to press the tensioner against its spring to provide sufficient slack in the chain to engage the sprocket with the oil pump. Note that the sprocket will only fit in one position.

23 Refit the oil pump sprocket bolt, and tighten to the specified torque.

24 Fit a new crankshaft oil seal to the housing, and refit the housing as described in Section 18.

25 Where applicable, refit the oil baffle, and tighten the securing bolts.

26 Refit the sump as described in Section 15.

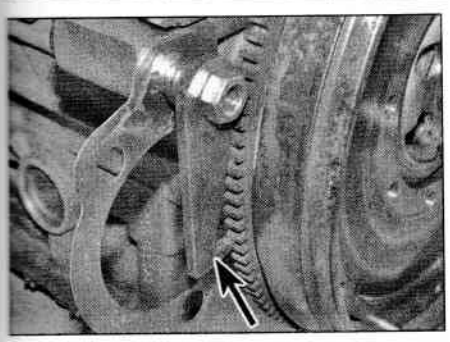
17 Flywheel/driveplate – removal, inspection and refitting

Note: *New flywheel/driveplate securing bolts will be required on refitting.*

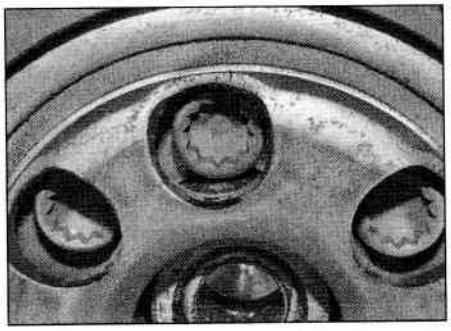
Removal

1 On manual transmission models, remove the gearbox (see Chapter 7A) and clutch (see Chapter 6).

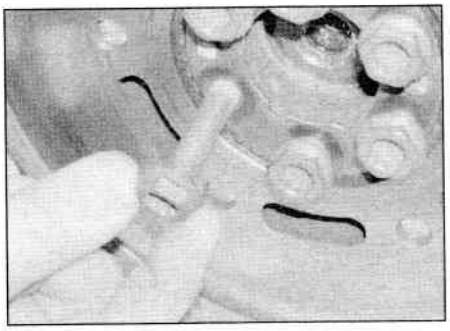
2 On automatic transmission models, remove



17.3a A fabricated tool can be used (arrowed) to hold the flywheel stationary



17.3b Align the bolts on models fitted with a dual mass flywheel . . .



17.3c . . . and remove them (solid flywheel shown)

the automatic transmission as described in Chapter 7B.

3 The flywheel/driveplate bolts are offset to ensure correct fitment. Unscrew the bolts while holding the flywheel/driveplate stationary. Temporarily insert a bolt in the cylinder block, and use a screwdriver to hold the flywheel/driveplate, or make up a holding tool **(see illustrations)**.

4 Lift the flywheel/driveplate from the crankshaft **(see illustration)**. If removing a driveplate, note the location of the shim (where applicable – between the driveplate and the crankshaft), and the spacer under the securing bolts. Recover the engine-to-transmission plate if it is loose.

Inspection

5 Check the flywheel/driveplate for wear and damage. Examine the starter ring gear for excessive wear to the teeth. If the driveplate or its ring gear are damaged, the complete driveplate must be renewed. The flywheel ring gear, however, may be renewed separately from the flywheel, but the work should be entrusted to a Ford dealer or suitably-equipped local garage. If the clutch friction face is discoloured or scored excessively, it may be possible to regrind it, but this work should be entrusted to an automotive machine shop.

6 On vehicles fitted with an automatic transmission install the driveplate, minus the shim and using the old bolts. Working through the torque converter mounting holes measure the distance from the front of the plate to the engine block. Measure the distance at three positions and calculate the average distance. This must figure must be between 19.5 mm and 21.1 mm. Renew the driveplate if these specifications are not met.

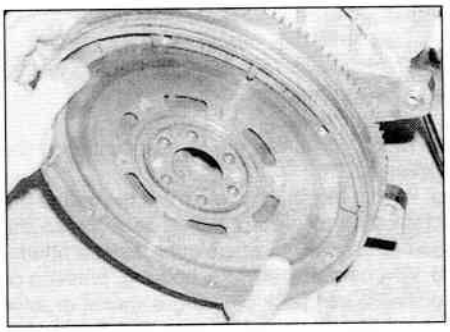
7 Where a dual mass flywheel is fitted it must be renewed if there is any evidence of fluid or grease on the flywheel or clutch components. The following procedures are given for guidance only. If in doubt as to the condition of the flywheel a professional inspection is recommended. If the assembly passes all the checks listed and there was no juddering from the clutch when taking up the drive, the flywheel can be refitted. However if the vehicle has covered a high mileage and especially if the vehicle is on its second new clutch, then it would be prudent to renew the dual mass flywheel.

Warpage

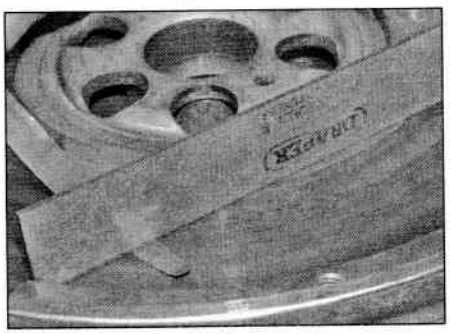
Check the drive surface for any signs of warpage or damage **(see illustration)**. The flywheel will normally warp like a bowl – ie, higher at the circumference. If the warpage is more than 4.0 mm consider renewing the flywheel.

Free rotational movement

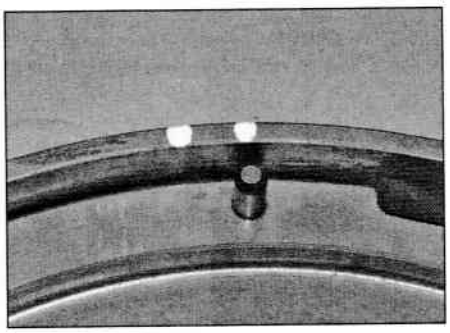
This is the distance the drive surface of the flywheel can be turned independently of the flywheel primary element, using finger pressure only. Move the drive surface in one direction and make a mark where the locating pin aligns with the flywheel edge. Move the drive surface in the other direction (finger pressure only) and make another mark **(see illustration)**. The total of free movement should not exceed 10 mm. If it is more, consider renewing the flywheel.



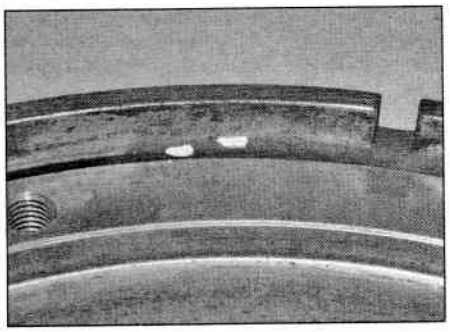
17.4 Remove the flywheel



17.7a Flywheel warpage check – see text



17.7b Flywheel free rotational movement check alignment marks – see text



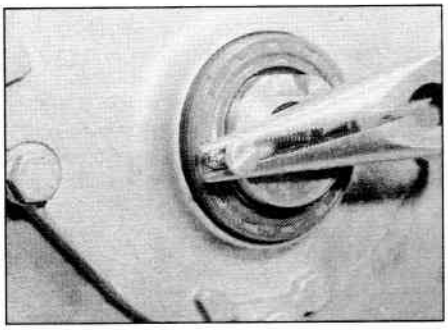
17.7c Flywheel lateral movement check marks – see text

Total rotational movement

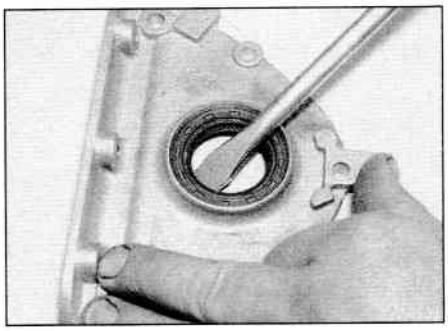
This is the total distance the drive surface can be turned independently of the flywheel primary elements. Insert two bolts into the clutch pressure plate damper unit mounting holes and, with the crankshaft flywheel held stationary, user a pry bar between the bolts and use some effort to move the drive surface fully in one direction. Make a mark where the locating pin aligns with the flywheel edge. Now force the drive surface fully in the opposite direction, and make another mark. The total rotational movement should not exceed 44.0 mm. If it does have the flywheel professionally inspected.

Lateral movement

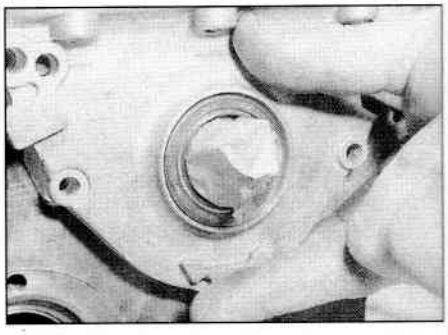
The lateral movement (up and down) of the drive surface in relation to the primary element of the flywheel should not exceed 2.0 mm, if it does the flywheel may need renewing. This can be checked by pressing the drive surface



18.2 Removing the crankshaft oil seal using self-tapping screws



18.3 Prising the oil seal from the crankshaft oil seal housing



18.9 Slide the oil seal housing over the end of the crankshaft

down on one side into the flywheel (flywheel horizontal) and making an alignment mark between the drive surface and the inner edge of the primary elements. Now press down on the opposite side of the drive surface and make another mark above the original one. The difference between the two marks is the lateral movement **(see illustration)**.

Refitting

8 Refitting is a reversal of removal, bearing in mind the following points.

a) Ensure that the engine-to-transmission plate is in place before fitting the flywheel/driveplate.

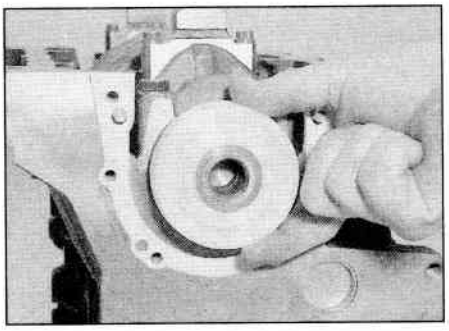
b) On automatic transmission models fit the shim before installing the driveplate.

c) On automatic transmission models, the raised pip on the spacer under the securing bolts must face the torque converter.

d) Use new bolts when refitting the flywheel or driveplate, and coat the threads of the bolts with locking fluid before inserting them. Tighten the securing bolts to the specified torque.

18 Crankshaft oil seals – renewal

Note 1: *The oil seals are a PTFE (Teflon) type and are fitted dry, without using any grease or oil. These have a wider sealing lip and have been introduced instead of the coil spring type oil seal.*



18.17 Locate the crankshaft oil seal fitting tool over the end of the crankshaft

Note 2: *If the oil seal housing is removed, suitable sealant (Ford YM2J-19G204-AA or equivalent) will be required to seal the housing on refitting.*

Right-hand oil seal

1 Remove the timing belt as described in Section 8, and the crankshaft sprocket with reference to Section 9.

2 To remove the seal without removing the housing, drill two small holes diagonally opposite each other, insert self-tapping screws, and pull on the heads of the screws with pliers **(see illustration)**.

3 Alternatively, to remove the oil seal complete with its housing, proceed as follows.

a) Remove the sump as described in Section 15. This is necessary to ensure a satisfactory seal between the sump and oil seal housing on refitting.

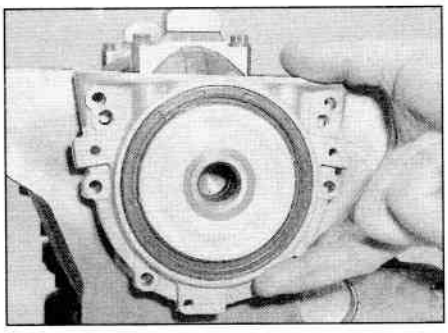
b) Unbolt and remove the oil seal housing.

c) Working on the bench, lever the oil seal from the housing using a suitable screwdriver. Take care not to damage the seal seating in the housing ***(see illustration)***.

4 Thoroughly clean the oil seal seating in the housing.

5 Wind a length of tape around the end of the crankshaft to protect the oil seal lips as the seal (and housing, where applicable) is fitted.

6 Fit a new oil seal to the housing, pressing or driving it into position using a socket or tube of suitable diameter. Ensure that the socket or tube bears only on the hard outer ring of the seal, and take care not to damage the seal lips. Press or drive the seal into position until it is seated on the shoulder in the housing. Make sure that the closed end of the seal is facing outwards.



18.19a Fit the oil seal/housing assembly over the end of the crankshaft . . .

7 If the oil seal housing has been removed, proceed as follows, otherwise proceed to paragraph 11.

8 Clean all traces of old sealant from the crankshaft oil seal housing and the cylinder block, then coat the cylinder block mating faces of the oil seal housing with a 2.0 to 3.0 mm thick bead of sealant (Ford YM2J-19G204-AA or equivalent). Note that the seal housing must be refitted within 5 minutes of applying the sealant.

Caution: DO NOT put excessive amounts of sealant onto the housing as it may get into the sump and block the oil pick-up pipe.

9 Refit the oil seal housing, and tighten the bolts progressively to the specified torque **(see illustration)**.

10 Refit the sump as described in Section 15.

11 Refit the crankshaft sprocket with reference to Section 9, and the timing belt as described in Section 8.

Left-hand oil seal

12 Remove the flywheel/driveplate as described in Section 17.

13 Remove the sump as described in Section 15. This is necessary to ensure a satisfactory seal between the sump and oil seal housing on refitting.

14 Unbolt and remove the oil seal housing, complete with the oil seal.

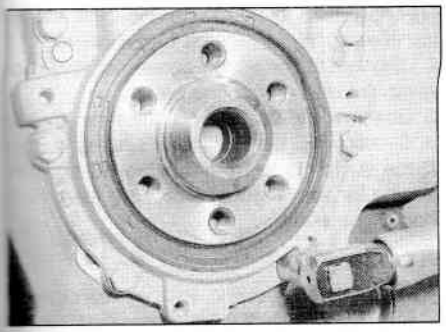
15 The new oil seal will be supplied ready-fitted to a new oil seal housing.

16 Thoroughly clean the oil seal housing mating face on the cylinder block.

17 New oil seal/housing assemblies are supplied with a fitting tool to prevent damage to the oil seal as it is being fitted. Locate the tool over the end of the crankshaft **(see illustration)**.

18 If the original oil seal housing was fitted using sealant, apply a thin bead of suitable sealant (Ford YM2J-19G204-AA or equivalent) to the cylinder block mating face of the oil seal housing. Note that the seal housing must be refitted within 5 minutes of applying the sealant.

Caution: DO NOT put excessive amounts of



18.19b . . . then tighten the securing bolts to the specified torque

sealant onto the housing as it may get into the sump and block the oil pick-up pipe.

19 Carefully fit the oil seal/housing assembly over the end of the crankshaft, then refit the securing bolts and tighten the bolts progressively, in a diagonal sequence, to the specified torque **(see illustrations)**.

20 Remove the oil seal protector tool from the end of the crankshaft.

21 Refit the sump as described in Section 15.

22 Refit the flywheel/driveplate as described in Section 17.

19 Engine/transmission mountings – inspection and renewal

Refer to Section 13 in Chapter 2A for the basic procedure, however, note that the rear engine mounting is different.

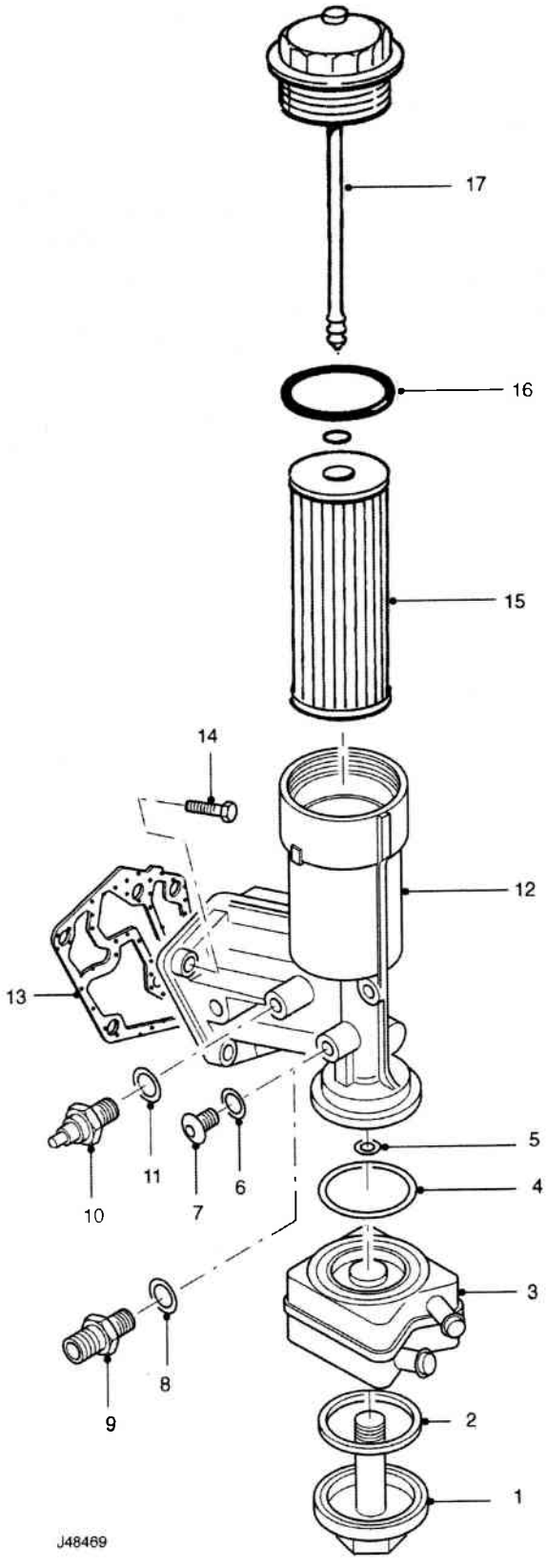
20 Engine oil cooler – removal and refitting

Note: *New sealing rings will be required on refitting.*

Removal

1 The oil cooler is mounted under the oil filter housing on the front of the cylinder block **(see illustration)**.

2 Position a container beneath the oil filter to catch escaping oil and coolant.



20.1 Oil filter and oil cooler mounting details

1 *Oil cooler securing plate*
2 *O-ring*
3 *Oil cooler*
4 *O-ring*
5 *O-ring*
6 *Sealing washer*
7 *Sealing plug*
8 *Sealing washer*
9 *Drain tap*
10 *Oil pressure warning light switch*
11 *Sealing washer*
12 *Oil filter housing*
13 *Gasket*
14 *Bolt*
15 *Oil filter*
16 *O-ring*
17 *Oil filter cover*

3 Clamp the oil cooler coolant hoses to minimise coolant spillage, then remove the clips, and disconnect the hoses from the oil cooler. Be prepared for coolant spillage.
4 Unscrew the oil cooler securing plate from the bottom of the oil filter housing, then slide off the oil cooler. Recover the O-rings from the top and bottom of the oil cooler.

Refitting

5 Refitting is a reversal of removal, bearing in mind the following points:

a) Use new oil cooler O-rings.

b) Tighten the oil cooler securing plate to the specified torque.

c) On completion, check and if necessary top-up the oil and coolant levels.

21 Oil pressure relief valve – removal, inspection and refitting

1 The oil pressure relief valve is part of the oil filter hosing assembly. If a fault develops the complete assembly must be renewed.

22 Oil pressure warning light switch – removal and refitting

Removal

1 The oil pressure warning light switch is fitted to the right-hand side of the oil filter housing **(see illustration 20.1)**. Remove the engine top cover(s) to gain access to the switch.
2 Disconnect the wiring connector and wipe clean the area around the switch.
3 Unscrew the switch from the filter housing and remove it, along with its sealing washer. If the switch is to be left removed from the engine for any length of time, plug the oil filter housing aperture.

Refitting

4 Examine the sealing washer for signs of damage or deterioration and if necessary renew.
5 Refit the switch, complete with washer, and tighten it to the specified torque.
6 Securely reconnect the wiring connector then check and, if necessary, top-up the engine oil as described in *Weekly checks*. On completion, refit the engine top cover(s).