# Chapter 2 Part B:
# Engine repair procedures - 1.05 and 1.3 litre post August 1985

***The following information is a revision of, or supplementary to, that contained in Part A of this Chapter***

## Contents



## Degrees of difficulty

**Easy,** suitable for novice with little experience 

**Fairly easy,** suitable for beginner with some experience 

**Fairly difficult,** suitable for competent DIY mechanic 

**Difficult,** suitable for experienced DIY mechanic 

**Very difficult,** suitable for expert DIY or professional 

2B

## Specifications

### General

| | |
|---|---|
| Code: | |
| 1.05 litre | HZ |
| 1.3 litre | MH |
| 1.3 litre | NZ |
| 1.3 litre | 2G |

### Cylinder head

| | |
|---|---|
| Minimum dimension after machining (skimming) | 135.6 mm |

### Camshaft

| | |
|---|---|
| Maximum run-out | 0.01 mm |
| Maximum radial play | 0.10 mm |

### Valves

| | |
|---|---|
| Maximum seat width | 2.2 mm |
| Head diameter: | |
| Inlet | 36.0 mm |
| Exhaust | 29.0 mm |
| Valve length: | |
| Inlet | 98.9 mm |
| Exhaust | 99.1 mm |

### Hydraulic tappets

| | |
|---|---|
| Maximum free travel | 0.1 mm |

### Valve timing

| **Nil valve clearance at 1.0 mm valve lift** | **MH/NZ/2G** | **HZ** |
|---|---|---|
| Inlet opens | 12°ATDC | 5°ATDC |
| Inlet closes | 28°ABDC | 29°ABDC |
| Exhaust opens | 25°BBDC | 33°BBDC |
| Exhaust closes | 9°BTDC | 9°BTDC |

## Lubrication system

| | |
|---|---|
| Pump gear teeth backlash: | |
| New | 0.05 mm |
| Wear limit | 0.20 mm |
| Pump gear teeth axial play (wear limit) | 0.15 mm |
| Pump chain drive deflection | 1.5 to 2.5 mm |

## Torque wrench settings

| | Nm | lbf ft |
|---|---|---|
| Camshaft sprocket bolt | 80 | 59.0 |
| Timing belt cover: | | |
| Upper bolt | 10 | 7.3 |
| Lower bolt | 20 | 14.7 |
| Camshaft bearing cap nuts: | | |
| Stage 1 | 6 | 4.4 |
| Stage 2 | Tighten by further 90° | |
| Number 5 cap screws | 10 | 7.3 |
| Cylinder head bolts: | | |
| Stage 1 | 40 | 29.5 |
| Stage 2 | 60 | 44.3 |
| Stage 3 | Tighten by further 180° | |
| Oil pump bolts | 20 | 14.7 |
| Stay bracket bolts | 10 | 7.3 |
| Strainer assembly to pump body | 10 | 7.3 |
| Socket-headed screws in sump (new) | 8 | 5.9 |
| Crankshaft sprocket bolt (oiled) - 1986-on: | | |
| Stage 1 | 90 | 66 |
| Stage 2 | Tighten by further 180° | |
| Flywheel bolt (with shoulder) | 100 | 74 |

## 1 General information

The 1.05 and 1.3 litre engines produced since August 1985 have a redesigned cylinder head which incorporates hydraulic “bucket” type tappets in place of the previously fitted “rocker finger” tappets.

The oil pump has also been changed from the previously fitted crescent type to a gear type which is driven by chain from the crankshaft.

Additionally, different ancillary components are fitted such as the carburettor and distributor.

Unless otherwise given in the following Sections, all servicing procedures are as given in Part A of this Chapter for the pre-August 1985 1.05 and 1.3 litre engines.

## 2 Cylinder head - removal

The procedure for removing the cylinder head is basically the same as described in Part A of this Chapter but note the following:

*a) The valve cover is different, being held in place by three bolts **(see illustration)***

*b) There is a plastic oil shield located at the distributor end of the engine **(see illustration)***

*c) The fuel and coolant pipes differ, depending on model*

*d) Spring type re-usable hose clips may be fitted. These are removed by pinching the ends together to expand the clip and then sliding it down the hose*

*e) The clips on the fuel hoses are designed to be used only once, so obtain new ones or replace them with screw type clips*

## 3 Camshaft oil seal - renewal

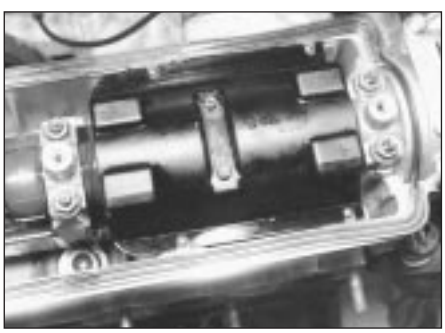
**1** This is a straightforward task if the camshaft is removed but it is possible to renew the oil seal without removing the camshaft.

**2** A VW special tool exists for this job **(see illustration)** but if it is not available, the old seal will have to be removed by securing self-tapping screws into it and pulling it out with pliers. Note which way round it is fitted.

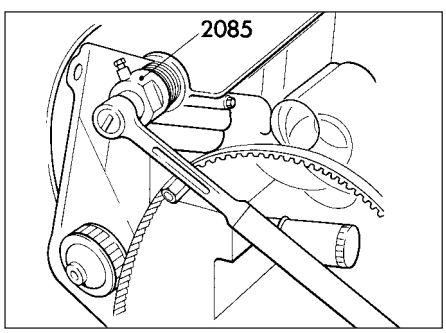
**3** Whichever method is used, the timing cover and camshaft sprocket will have to be removed. Slacken the coolant pump bolts to release the tension in the timing belt.

**4** Lightly oil the new seal and slide onto the camshaft. Use a suitable socket and a bolt in the end of the shaft to press the new seal home. Push it in as far as it will go.

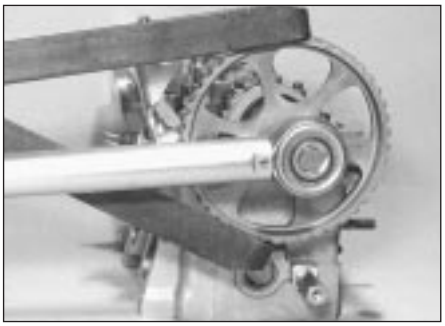
**2.1a Valve cover**



**2.1b Plastic oil shield**




**3.2 Renewing camshaft oil seal using VW tool 2085**



**4.5 Two lengths of metal used to lock camshaft sprocket**

## 4 Camshaft - removal

**1** Unscrew the nuts and bolts from the valve cover and remove the cover together with the gasket and reinforcement strips.
**2** Turn the engine until the indentation in the camshaft sprocket appears in the TDC hole in the timing cover and the notch in the crankshaft pulley is aligned with the TDC pointer on the front of the oil pump. Now turn the crankshaft one quarter of a turn anti-clockwise so that none of the pistons are at TDC.
**3** Unbolt and remove the timing cover, noting that the dipstick tube and earth lead are fitted to the upper bolts. On some later 1.3 litre models, it is necessary to remove the crankshaft pulley to remove the lower timing belt cover.
**4** Loosen the coolant pump retaining bolts, then turn the pump body clockwise to release the tension from the timing belt. Remove the timing belt from the camshaft sprocket.
**5** Devise a method to prevent the camshaft turning and remove the sprocket bolt **(see illustration)**. Remove the camshaft sprocket and where applicable, the Woodruff key.
**6** The camshaft bearing caps must be refitted in their original locations and the same way round. They are usually numbered but mark them if necessary, to ensure correct refitting.
**7** Remove bearing caps Nos 5, 1 and 3, in that order. Now undo the nuts holding 2 and 4 in a diagonal pattern and the camshaft will lift them up as the pressure of the valve springs is exerted. When they are free, lift the caps off.
**8** If the caps are stuck, give them a sharp tap with a soft-faced mallet to loosen them. Do not try to lever them off with a screwdriver.
**9** Lift out the camshaft complete with the oil seal.

## 5 Cylinder head - dismantling and overhaul

***Caution: If new tappets are fitted, the engine must not be started after fitting for approximately 30 minutes, or the valves will strike the pistons.***

### Cylinder head

**1** If the valve seats are badly pitted or eroded they can be reworked but this is a specialist job best left to a VW dealer or engine overhaul specialist.
**2** Similarly, if the head is warped, its surfaces can be skimmed, again by specialist engineers.
**3** If it is found that there are cracks from the valve seats or valve seat inserts to the spark plug threads, the cylinder head may still be serviceable. Consult your VW dealer for advice.

### Hydraulic bucket tappets

**4** With the camshaft removed, lift out the tappets one by one, ensuring that they are kept in their correct order and can be returned to their original bores **(see illustration)**.
**5** Place them, cam contact surface down, on a clean sheet of paper as they are removed.
**6** Inspect the tappets for wear (indicated by ridging on the clean surface), pitting and cracks.
**7** Tappets cannot be repaired and if worn, must be renewed.
**8** Before fitting the tappets, lubricate all parts liberally with clean engine oil and slip each tappet back into its original bore.

### Valves

**9** With the camshaft and tappets removed, use a valve spring compressor with a deep reach to compress the valve springs. Remove the two cotters and release the compressor and springs.
**10** Lift out the upper spring seat **(see illustration)**.
**11** Remove the outer and inner valve springs **(see illustrations)**.
**12** Lift out the valve **(see illustration)**.
**13** The valves should be inspected as described in Part A of this Chapter, Section 11.
**14** Valves must be renewed if they are worn and be ground in the normal manner.
**15** If possible, check the valve spring lengths against new ones. Renew the whole set if any are too short.
**16** Refitting is a reversal of removal.

### Valve stem oil seals

**17** The valve stem oil seals should be renewed whenever the valves are removed, by prising them from the ends of the valve guides **(see illustration)**.



**5.4 Removing an hydraulic bucket tappet**

**5.10 Removing valve spring upper seat**

**5.11a Removing an outer valve spring**

**5.11b Removing an inner valve spring**

**5.12 Removing a valve**

**5.17 A valve stem oil seal**

**18** With the seals removed, the lower spring seats can also be lifted out for cleaning. Press the new seals onto the ends of the valve guides.

## 6 Timing belt and sprockets - removal

As from August 1986, the crankshaft sprocket incorporates a lug for engagement with the groove in the crankshaft, replacing the Woodruff key arrangement described in Part A if this Chapter.

When tightening the crankshaft sprocket bolt, observe the specified stages.

## 7 Oil pump - removal and examination

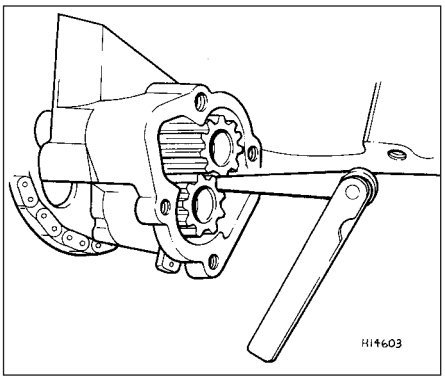
**Note:** *The oil pump can be removed with the engine still in the vehicle*

**1** Drain the engine oil.

**2** Disconnect the exhaust downpipe and the inboard end of the right-hand driveshaft to permit sump removal.

**3** Remove the sump.

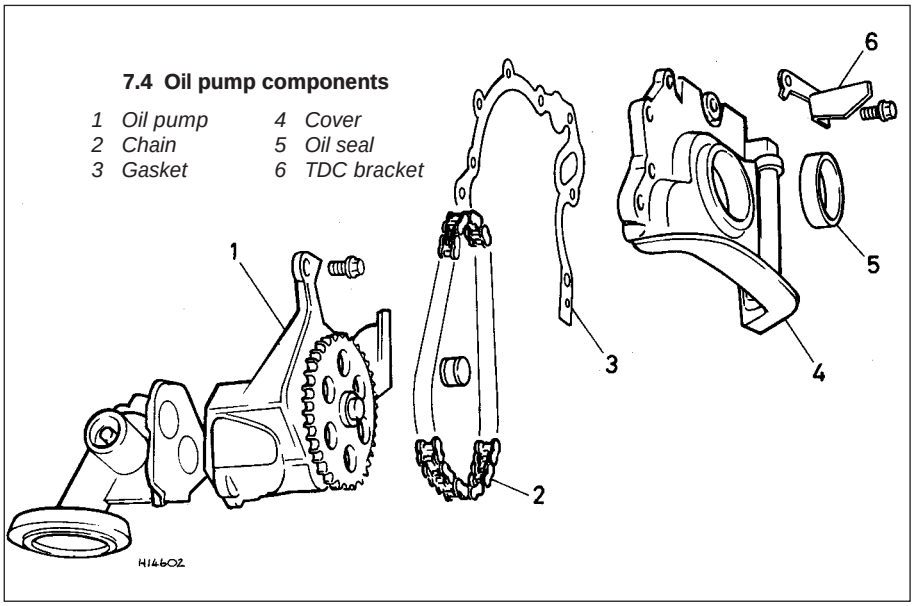
**4** If it is only desired to check backlash in the pump gears, this can be done by removing the cover and strainer assembly from the back of the pump **(see illustration)**.




**7.5a Checking oil pump backlash**

**7.4 Oil pump components**

*1 Oil pump*
*2 Chain*
*3 Gasket*
*4 Cover*
*5 Oil seal*
*6 TDC bracket*




**5** Check backlash and axial play against the specified tolerances **(see illustrations)**.

**6** If the tolerances are exceeded then the oil pump must be renewed.

**7** To remove the pump, first remove the following components:

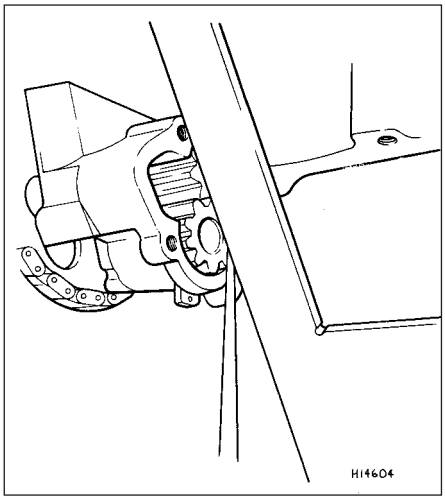
*a) Camshaft drivebelt (timing belt)*
*b) Alternator drivebelt*
*c) Crankshaft pulley*
*d) Lower timing belt cover*
*e) Front cover and TDC setting bracket*

**8** If they are still in position, remove the bolts holding the rear stay bracket.

**9** Remove the two bolts holding the pump to the cylinder block.

**10** This will release the tension on the chain and allow the pump to be removed.

**11** If sufficient slack in the chain cannot be achieved by this method, then slide the pump, chain and crankshaft drive sprocket forward together.




**7.5b Checking oil pump axial play**

**12** Check the chain and teeth of the drive sprockets and renew any parts which are worn.

**13** If a new pump is being fitted, renew all associated parts at the same time.

## 8 Camshaft - examination

**1** Clean the camshaft in solvent, then inspect its journals and cam peaks for pitting, scoring, cracking and wear.

**2** The camshaft bearings are machined directly into the cylinder head and the bearing caps.

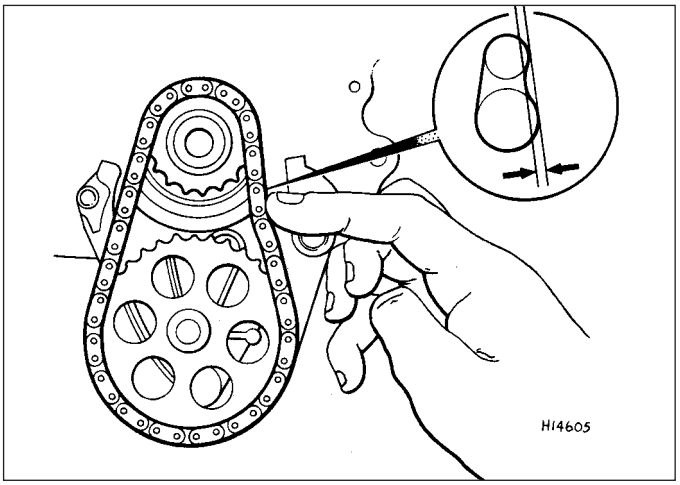
**3** Radial play in the bearings can be measured using the Plastigage method. Compare the results with the specified dimension.

**4** If wear is evident, consult your VW dealer.

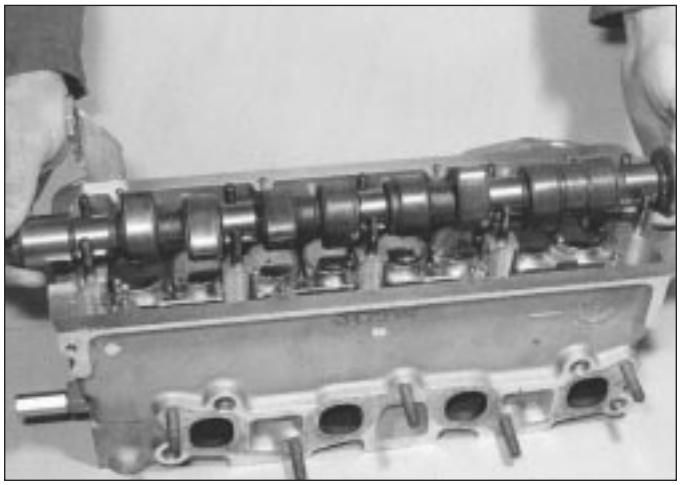
**5** To check camshaft endfloat, refit the camshaft using only number 3 bearing cap.

**6** Set up a dial test indicator or use feeler blades to measure the endfloat **(see illustration)**. If the endfloat is greater than that specified, consult your VW dealer.

**8.6 Measuring camshaft endfloat**




**9.1 Checking oil pump drive chain tension**



**10.2 Refitting the camshaft**

## 9 Oil pump - refitting

Refitting is a reversal of removal, but bear in mind the following points:

*a) Use new gaskets on all components.*
*b) Lubricate all new parts liberally with clean engine oil.*
*c) If the small plug in the front cover is at all damaged, renew it.*
*d) Fit a new crankshaft oil seal to the cover. The oil seal can be prised out and a new one pressed fully home.*
*e) The chain is tensioned by moving the pump housing against its mounting bolts.*
*f) With light finger pressure exerted on the chain, deflection should be as specified **(see illustration)**.*
*g) Whenever the sump is removed with the engine in situ, the two hexagon screws in the sealing flange at the flywheel end should be replaced by socket-headed screws and spring washers, and tightened to the specified torque setting.*

## 10 Camshaft - refitting

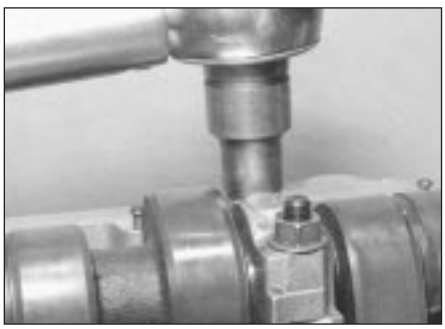
**1** Lubricate the bucket tappets, the camshaft journals and the camshaft liberally with clean engine oil.
**2** Place the camshaft in position on the cylinder head **(see illustration)**.
**3** Fit a new camshaft oil seal **(see illustration)**.
**4** Refit the bearing caps, ensuring that they are the right way and in their correct position (they should be numbered 1 to 5, readable from the exhaust manifold side of the head).
**5** Thread on the cap retaining nuts loosely, then tighten the nuts on Nos. 2 and 4 caps in a diagonal sequence to the Stage 1 torque figure specified **(see illustration)**.
**6** Tighten the nuts on caps 1, 3 and 5 to the Stage 1 torque.
**7** Once all nuts have been tightened to the Stage 1 torque, tighten all nuts a further 90° (Stage 2). Fit and tighten No. 5 cap screws to the correct torque.
**8** Refit the Woodruff key into its slot in the camshaft, where applicable. Fit the camshaft sprocket and tighten the bolt to the specified torque **(see illustration)**.
**9** If the work is being carried out in the engine compartment, follow the procedure given in Part A of this Chapter, Section 35, paragraphs 9 to 18.
**10** Ignore any reference to the oil spray tube and be sure to refit the oil shield at the distributor end of the camshaft before the valve cover is refitted.
**11** If the cylinder head is out of the vehicle, it will obviously have to be refitted before the timing belt can be reconnected.

## 11 Cylinder head - refitting

**1** Clean all traces of old gasket from the cylinder block and cylinder head faces, taking great care not to mark the gasket surfaces.
**2** Using a new gasket, fit the inlet manifold **(see illustrations)**.

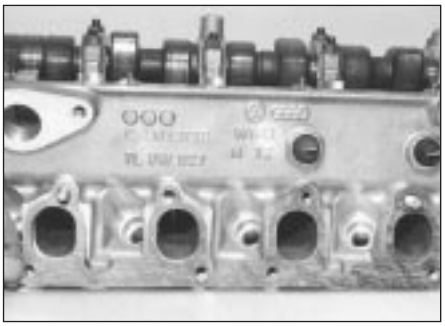


**10.3 Camshaft oil seal**



**10.5 Tightening a camshaft bearing cap nut**

**10.8 Fitting the camshaft sprocket bolt**



**11.2a Fitting a new inlet manifold gasket**

**11.2b Fitting inlet manifold complete with carburettor**

**11.3 Refitting oil pressure switch**

**3** If they have been removed, refit the oil pressure switches, using new copper sealing washers **(see illustration)**.
**4** Refit the thermostat housing, using a new O-ring **(see illustration)**.

**11.4 O-ring (arrowed) in thermostat housing**

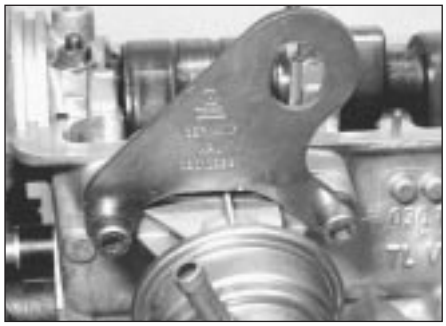
**5** Refit the coolant hoses, ensuring that they are connected up in the correct position **(see illustration)**.
**6** Lubricate the fuel pump plunger with clean engine oil and slip it into its housing in the cylinder head **(see illustration)**.

**11.5 Coolant hoses in position**

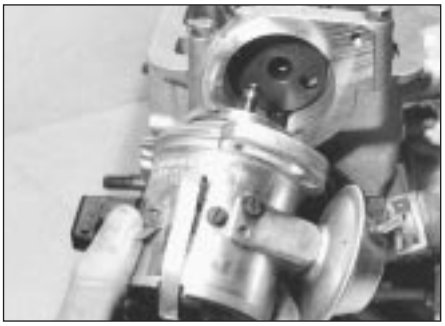
**7** Refit the fuel pump and fit and tighten the bolts, not forgetting the engine lifting eye **(see illustrations)**.
**8** Slide the distributor into position and ensure that it goes fully home **(see illustration)**. Hand-tighten the retaining bolts.
**9** Fit the distributor rotor arm **(see illustration)**.
**10** Fit the distributor cap and connect up the earth lead **(see illustration)**.
**11** Check the timing marks on the cylinder head and camshaft sprocket are lined up.
**12** Note that none of the pistons should be at TDC when refitting the cylinder head.
**13** Position a new cylinder head gasket on the cylinder block **(see illustration)**.
**14** Lower the cylinder head gently into position. Special guides are used by the manufacturer both to line up the gasket and

**11.6 Fitting fuel pump plunger (arrowed)**

**11.7a Fitting fuel pump**



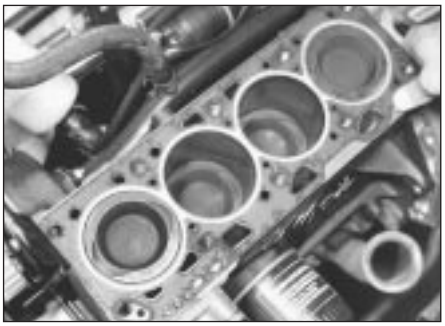
**11.7b Location of engine lifting eye**



**11.8 Refitting ignition distributor**

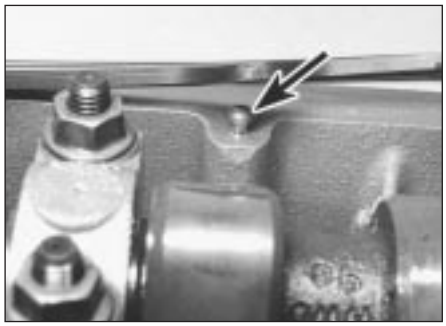
**11.9 Fitting rotor arm**

**11.10 Fitting distributor cap and earth lead**



**11.13 Cylinder head gasket in position**

**11.17 Plastic oil shield correctly located**



**11.18 Locating dowel for valve cover gasket (arrowed)**

guide the cylinder head into position but this can be done using suitable sized rods inserted in two cylinder head bolt holes.

**15** Install the cylinder head bolts. Refer to Part A of this Chapter for the tightening sequence but use the torque figures and stages given in the *Specifications* of this Chapter.

**16** It is not necessary to retighten the bolts after a period of service, as is normally the case.

**17** Refit the plastic oil shield **(see illustration)**.

**18** Using a new rubber sealing gasket properly located over the dowels, refit the valve cover **(see illustration)**.

**19** Fit a new gasket to the exhaust manifold **(see illustration)**.

**20** Fit the exhaust manifold, tightening its nuts securely, then fit the hot air shroud **(see illustration)**.

**21** Connect up the exhaust downpipe and any other exhaust brackets loosened during removal.

**22** Refit all remaining hoses of the cooling system and fuel system, referring to the relevant Chapter where necessary.

**23** Refit all electrical connections disturbed during dismantling (distributor, carburettor, oil pressure and coolant temperature switches, inlet manifold preheater, etc.) **(see illustrations)**. Do not forget the earth lead under the inlet manifold nut.

**24** Refit the distributor vacuum hose.

**25** With reference to Part A of this Chapter, Section 37, refit the timing belt and covers.

**26** Refit the throttle cable.

**27** Refit the spark plugs, air cleaner and associated pipework and electrical leads.

**28** Check oil and coolant levels, replenishing as necessary, then adjust the ignition timing.

## 12 Hydraulic bucket tappets - checking free travel

**1** Start the engine and run it until the radiator cooling fan has switched on once.

**2** Increase engine speed to about 2500 rpm for about two minutes.

**3** Irregular noises are normal when starting but should become quiet after a few minutes running.

**4** If the valves are still noisy, carry out the following check to identify worn tappets.

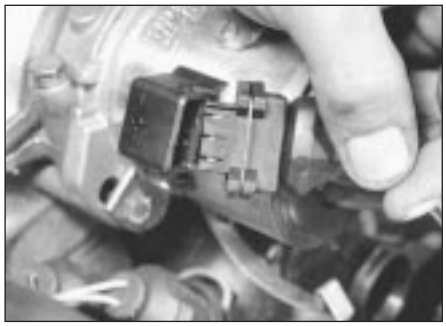
**5** Stop the engine and remove the valve cover from the cylinder head.

**6** Turn the crankshaft clockwise by using a wrench on the crankshaft pulley securing bolt, until the cam of the tappet to be checked is facing upward and is not exerting any pressure on the tappet.



**11.19 Fitting a new exhaust manifold gasket**

**11.20 Fitting hot air shroud**



**11.23a Ignition distributor electrical connection**

**11.23b Coolant temperature switch/sender electrical connection**

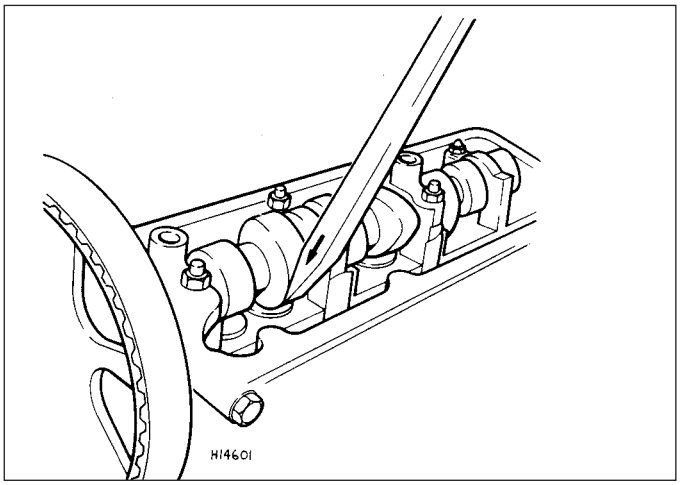
**11.23c Oil pressure switch electrical connection**

**11.23d Earth lead under inlet manifold bolt head**

**7** Press the tappet down using a wooden or plastic wedge **(see illustration)**.
**8** If free travel of the tappet exceeds that specified, the tappet must be renewed.

## 13 Engine - adjustments after major overhaul

If the valve tappets have been renewed, it is essential that no attempt to restart the engine is made for a minimum period of 30 minutes after installation. Failure to observe this precaution may result in engine damage caused by the valves contacting the pistons.




**12.7 Checking hydraulic tappet free travel**