






Chapter 2 Part C:

Engine repair procedures - 1.6 and 1.8 litre 8 valve

Contents

Camshaft - removal, examination and refitting	10	Intermediate shaft - examination and renovation	26
Crankshaft and bearings - examination and renovation	22	Intermediate shaft - refitting	31
Crankshaft and main bearings - refitting	30	Intermediate shaft - removal	16
Crankshaft and main bearings - removal	15	Major operations only possible after removal of engine from vehicle	3
Cylinder block/crankcase - examination and renovation	23	Major operations possible with engine in vehicle	2
Cylinder head - dismantling and overhaul	12	Method of engine removal	4
Cylinder head - refitting	34	Oil cooler - removal and refitting	18
Cylinder head - removal	11	Oil filter - renewal	17
Engine - adjustments after major overhaul	39	Oil filter mounting - removal and refitting	19
Engine - refitting	37	Oil pump - examination and renovation	25
Engine - removal	5	Oil seals - renewal	20
Engine ancillary components - removal	8	Pistons and connecting rods - examination and renovation	24
Engine ancillary components refitting	36	Pistons and connecting rods - refitting	32
Engine dismantling - general information	7	Pistons and connecting rods - removal	14
Engine reassembly - general information	29	Sump and oil pump - removal and refitting	13
Engine/gearbox - separation and reconnection	6	Timing belt and sprockets - examination and renovation	28
Examination and renovation - general information	21	Timing belt and sprockets - refitting	35
Flywheel/driveplate - examination and renovation	27	Timing belt and sprockets - removal	9
General information	1	Valve clearances - checking and adjustment (pre August 1985)	33
Hydraulic bucket tappets - checking free travel (from August 1985)	38		

Degrees of difficulty

Easy , suitable for novice with little experience 	Fairly easy , suitable for beginner with some experience 	Fairly difficult , suitable for competent DIY mechanic 	Difficult , suitable for experienced DIY mechanic 	Very difficult , suitable for expert DIY or professional 
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2C

Specifications

General

Type	Four-cylinder in-line, water cooled, overhead camshaft
Code:	
1.6 litre:	
Without catalytic converter	EZ
With catalytic converter	RF
1.8 litre:	
Jetronic - fuel injection	EV
Carburettor	GU
GTi - January 1987 on:	
Without catalytic converter	PB, GU
With catalytic converter	RH, RP, PF
Firing order	1-3-4-2 (No 1 at camshaft sprocket end)
Displacement:	
1.6 litre	1595 cc
1.8 litre	1781 cc
Bore:	
1.6 litre	81.0 mm
1.8 litre	81.0 mm
Stroke:	
1.6 litre	77.4 mm
1.8 litre	86.4 mm
Compression ratio:	
1.6 litre	9.0 to 1
1.8 litre	
Code RP	9.0 to 1
All other codes	10.0 to 1

2C•2 Engine repair procedures - 1.6 and 1.8 litre 8 valve

Compression pressure:

1.6 litre:	
New	9 to 12 bar
Minimum	7.5 bar
Maximum permissible difference between any two cylinders	3.0 bar
1.8 litre:	
New	10 to 13 bar
Minimum	7.5 bar
Maximum permissible difference between any two cylinders	3.0 bar

Crankshaft

Main journal:	
Standard diameter	54.0 mm
Undersizes	53.75, 53.50 and 53.25 mm
Crankpin:	
Standard diameter	47.80 mm
Journal undersizes	47.55, 47.30 and 47.05 mm
Endfloat:	
Maximum	0.25 mm
Minimum	0.07 mm
Main bearing maximum running clearance	0.17 mm

Connecting rods

Big-end:	
Maximum running clearance	0.012 mm
Maximum endfloat	0.37 mm

Pistons

Clearance in bore:	
Maximum	0.07 mm
Minimum	0.03 mm
Diameter:	
Standard	80.98 mm
Oversize:	
1st oversize	81.23 mm
2nd oversize	81.48 mm
Wear limit (10 mm from base/ right angles to pin)	0.04 mm

Piston rings

Maximum clearance in groove	0.15 mm
End gap:	
Compression rings	0.30 to 0.45 mm
Oil scraper ring:	
1 part	0.25 to 0.40 mm
2 part	0.25 to 0.45 mm
3 part	0.25 to 0.50 mm
Maximum end gap	1.0 mm

Gudgeon pin

Fit in piston	Push fit at 60°C
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Intermediate shaft

Maximum endfloat	0.25 mm
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Cylinder head

Maximum allowable face distortion	0.1 mm
Minimum height	132.6 mm

Camshaft

Run-out at centre bearing	0.01 mm
Endfloat	0.15 mm

Valves

Seat angle	45°
Head diameter:	
Inlet:	
Codes PB, PF	40.0 mm
All other codes	38.0 mm
Exhaust	33.0 mm

Stem diameter:	
Inlet	7.97 mm
Exhaust	7.95 mm
Standard overall length*:	
Inlet:	
Codes EZ, EV, GU	98.70 mm
All other codes	91.0 mm
Exhaust:	
Codes EZ, EV, GU	98.50 mm
Codes PB, PF, RP	90.95 mm
All other codes	90.80 mm

* **Caution:** Check with manufacturer on valve dimensions before renewing

Valve guides

Maximum valve rock (stem flush with guide):	
Inlet	1.0 mm
Exhaust	1.3 mm

Hydraulic tappets

Maximum free travel	0.1 mm
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Valve timing

Nil valve clearance at 1.0 mm valve lift

1.6 litre (code EZ - shim bucket tappets):	
Inlet opens	5° BTDC
Inlet closes	21° ABDC
Exhaust opens	41° BBDC
Exhaust closes	3° BTDC
1.6 litre (code EZ - hydraulic tappets - August 1985 to March 1986):	
Inlet opens	3° BTDC
Inlet closes	19° ABDC
Exhaust opens	27° BBDC
Exhaust closes	5° BTDC
1.6 litre (code EZ - hydraulic tappets - March 1986 on):	
Inlet opens	TDC
Inlet closes	22° ABDC
Exhaust opens	28° BBDC
Exhaust closes	6° BTDC
1.6 litre (code RF):	
Inlet opens	TDC
Inlet closes	22° ABDC
Exhaust opens	28° BBDC
Exhaust closes	6° BTDC
1.8 litre (code GU - shim bucket tappets)	
Inlet opens	1° BTDC
Inlet closes	37° ABDC
Exhaust opens	42° BBDC
Exhaust closes	2° ATDC
1.8 litre (code GU - hydraulic tappets - August 1985 to March 1986)	
Inlet opens	3° BTDC
Inlet closes	33° ABDC
Exhaust opens	41° BBDC
Exhaust closes	5° BTDC
1.8 litre (code GU - hydraulic tappets - March 1986 on):	
Inlet opens	2° BTDC
Inlet closes	34° ABDC
Exhaust opens	44° BBDC
Exhaust closes	8° BTDC
1.8 litre (code EV):	
Inlet opens	2° BTDC
Inlet closes	45° ABDC
Exhaust opens	45° BBDC
Exhaust closes	8° BTDC
1.8 litre (codes PB, PF):	
Inlet opens	3° ATDC
Inlet closes	43° ABDC
Exhaust opens	37° BBDC
Exhaust closes	3° ATDC

Valve timing (continued)**Nil valve clearance at 1.0 mm valve lift**

1.8 litre (code RH):

Inlet opens	2° BTDC
Inlet closes	34° ABDC
Exhaust opens	44° BBDC
Exhaust closes	8° BTDC

1.8 litre (code RP - pre July 1988):

Inlet opens	2° ATDC
Inlet closes	38° ABDC
Exhaust opens	40° BBDC
Exhaust closes	4° BTDC

1.8 litre (code RP - August 1988 on):

Inlet opens	5° BTDC
Inlet closes	41° ABDC
Exhaust opens	37° BBDC
Exhaust closes	1° BTDC

Valve clearances

Warm:

Inlet	0.20 to 0.30 mm
Exhaust	0.40 to 0.50 mm

Cold:

Inlet	0.15 to 0.25 mm
Exhaust	0.35 to 0.45 mm

Lubrication

System type	Wet sump, pressure feed, full flow filter
Lubricant type/specification/capacity	Refer to " <i>Lubricants, fluids and capacities</i> "
Filter type	Champion C101/C160
Pump type	Twin gear, driven by intermediate shaft together with distributor
Pressure (2000 rpm with oil temperature 80°C)	2.0 bar minimum

Torque wrench settings

	Nm	lbf ft
Engine to gearbox:		
M10	45	33
M12	75	55
Exhaust manifold nuts	25	18
Exhaust pipe to manifold	10	7
Flywheel/driveplate bolts	20	15
Clutch pressure plate/washer bolts (renew)	100	74
Sump bolts	20	15
Sump drain plug	30	22
Main bearing cap bolts	65	48
Connecting rod big-end cap nuts:		
Stage 1	30	22
Stage 2*	Further tighten 1/4 turn (90°)	
Oil pump bolts	10	7
Oil pressure switch	25	18
Oil filter flange bolts	25	18
Front seal flange bolts:		
Small	20	15
Large	10	7
Intermediate shaft flange bolts	25	18
Camshaft bearing cap nuts (in sequence)	20	15
Camshaft sprocket bolt	80	59
Valve cover nuts	10	7
Belt tensioner pulley	45	33
Crankshaft sprocket bolt (oiled)	200	148
Intermediate shaft sprocket bolt	80	59
V-belt pulley	20	15
Timing cover	10	7
Rear cover lower bolts	30	22
Rear cover top bolt	10	7
Coolant pump bolts	20	15
Fuel pump bolts	20	15
Distributor clamp bolt	25	18

Cylinder head bolts (engine cold)	As for 1.05 and 1.3 litre engines	
<i>Refer to illustration 5.25b. Also 40.1a and 40.1b in Part A of this Chapter.</i>		
a) M8	25	18
a) M10	45	33
b)	35	26
c)	45	33
d)	50	37
e)	60	44
f)	70	52
g)	80	59

* When checking the connecting rod-to-crankshaft journal radial clearance using Plastigage, tighten only to 30Nm (22 lbf ft).

1 General information

The 1.6 and 1.8 litre 8-valve engines are of four-cylinder, in-line, overhead camshaft design, mounted transversely at the front of the vehicle. The transmission is attached to the flywheel end of the engine.

The crankshaft is of five main bearing type, its endfloat being controlled by a shouldered centre bearing or by half thrustwashers located each side of the centre bearing.

The camshaft is driven by a toothed belt which is tensioned by a tensioner on an eccentric bearing. On engines manufactured before August 1985, the valves are operated by bucket type cam followers in direct contact with the camshaft. From August 1985, all engines are fitted with a redesigned cylinder head incorporating hydraulic bucket tappets in place of the previous shim bucket tappets. Camshaft bearing No. 4 is deleted on all single camshaft engines. In order to identify the type of tappets fitted, a sticker is normally affixed to the valve cover indicating that valve clearance adjustment is neither necessary nor possible.

An intermediate shaft (driven by the toothed timing belt) drives the distributor and oil pump and on carburettor equipped engines, the fuel pump.

The oil pump is of twin gear type, driven from the intermediate shaft and incorporates a pressure relief valve.

The aluminium cylinder head is of conventional design with the inlet and exhaust manifolds mounted on the rear side (as viewed with the engine in the vehicle).

The crankcase ventilation system comprises a hose from the flywheel end of the valve cover to the side of the air cleaner.

On fuel injection equipped engines, there is a hose to the air inlet manifold and a hose to the air cleaner from a three-way connector on the valve cover.

2 Major operations possible with engine in vehicle

The following operations can be carried out without having to remove the engine from the vehicle:

- a) Removal and servicing of the cylinder head, camshaft and timing belt
- b) Renewal of the crankshaft rear oil seal (after removal of the transmission, driveplate or clutch as applicable)
- c) Removal of the sump and oil pump
- d) Removal of the piston/connecting rod assemblies (after removal of the cylinder head and sump)
- e) Renewal of the crankshaft front oil seal, intermediate shaft front oil seal and camshaft front oil seal
- f) Renewal of the engine mountings

3 Major operations only possible after removal of engine from vehicle

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

- a) Renewal of crankshaft main bearings
- b) Removal and refitting of the crankshaft
- c) Removal and refitting of the intermediate shaft

4 Method of engine removal

1 The engine, together with the gearbox, must be lifted from the engine compartment, then the engine separated from the gearbox on the bench. Two people will be needed.

2 A hoist of 150 kg capacity will be needed to lift the engine approximately 1 metre. If the hoist is not portable and the engine is lifted, then sufficient room must be left behind the vehicle to push it back out of the way so that the engine may be lowered. Blocks will be needed to support the engine after removal.

3 Ideally, the vehicle should be over a pit. If this is not possible then the body must be supported on axle stands (see "Jacking and vehicle support") so that the front wheels may be turned to undo the driveshaft nuts. The left-hand shaft is accessible from above but the right-hand shaft must be undone from underneath. Removal of the gearshift linkage can only be done from underneath, as can exhaust downpipe-to-manifold detachment.

4 The exhaust downpipe-to-manifold flange connection is secured by special spring clips rather than bolts or studs and nuts. When

disconnecting and reconnecting the joint, it will be necessary to use VW tool no. 3049A. Without this tool, detachment and certainly reconnection of the joint and clips is virtually impossible, so make arrangements to borrow or hire the tool in advance.

5 The only other special tools required will be a set of splined key wrenches which will be needed to remove and refit the socket-head bolts used to secure certain items such as the cylinder head bolts.

6 Draining of oil and coolant is best done away from the working area if possible. This saves the mess made by spilled oil in the place where you must work.

7 Although not listed as an optional fitting on UK models, an air conditioning system may have been fitted. Where this is the case, the following precautions must be taken when handling refrigerant lines or system components:

- a) Do not stress or bend flexible hose lines to a radius of less than 101 mm
- b) Flexible hose lines must be correctly located, must not chafe against adjacent components and must be kept well clear of the exhaust manifold and downpipe
- c) All metal tubing lines must be kept free of kinks and must be handled with care
- d) Do not disconnect any of the air conditioning supply lines
- e) Do not weld or apply heat in the vicinity of the air conditioning lines or equipment
- f) If any part of the system is to be detached then it must first be depressurised by your VW dealer or a competent air conditioning systems engineer. The only exception is the removal and fitting of the compressor drivebelt which can be achieved in the same manner as for the alternator drivebelt

5 Engine - removal



Carburettor equipped

- 1 Disconnect the battery negative lead.
- 2 Remove the bonnet.
- 3 Drain the engine coolant.
- 4 Position a suitable container beneath the engine, undo the sump drain plug and drain the engine oil - see Chapter 1. On completion clean the drain plug and refit it. Renew the O-ring.



5.8a Oil pressure switch location in rear of cylinder head



5.8b Oil pressure switch location in filter mounting



5.8c Earth strap to gearbox

5 Remove the radiator, together with the cooling fan. On models manufactured after 1986, remove the front panel before removing the radiator.

6 Remove the air cleaner unit then disconnect the throttle cable at the carburettor. Position the cable out of the way.

7 Where power steering is fitted, remove the hydraulic pump drivebelt. Unbolt the pump, belt tensioner and fluid reservoir and tie them to one side of the engine compartment.

8 Disconnect the following wiring connections, identifying each lead as it is detached to avoid confusion on reassembly:

- a) Alternator lead
- b) Oil pressure switch lead(s) at cylinder head (see illustrations) and oil filter bracket
- c) Inlet manifold preheater thermo-switch lead
- d) Choke cover thermo-switch lead (where applicable)
- e) Ignition HT and LT leads
- f) Choke cover lead separate connector
- g) Coolant temperature sender unit lead
- h) Earth strap to gearbox (see illustration) and multi-function switch to gearbox
- i) Starter motor leads

9 Disconnect the fuel supply hose from the fuel pump and the fuel return hose (to the fuel tank). Plug the hoses to prevent fuel leakage.

10 Disconnect the coolant and heater hoses from the engine.



5.24 Engine rear bearer



5.25a Engine/gearbox unit front mounting

11 On manual gearbox models, disconnect the clutch cable.

12 Disconnect the following items from around the carburettor. Identify the connections where necessary to avoid confusion on reassembly:

- a) Thermotime valve
- b) Idle/overrun cut-off valve
- c) Inlet manifold preheater separator connector
- d) Part throttle channel heater separate connector

13 Disconnect the speedometer cable from the transmission.

14 Disconnect and remove the vacuum reservoir.

15 Disconnect the brake vacuum servo hoses and the vacuum hoses from the inlet manifold.

16 Undo and remove the gearbox mounting bolt.

17 Raise and support the vehicle on axle stands (see "Jacking and vehicle support"), allowing sufficient clearance to work underneath.

18 Disconnect the manual gearbox linkage.

19 On automatic transmission models, select P (Park) then disconnect the throttle and selector cables from the transmission.

20 Disconnect the driveshafts from the gearbox and tie them up out of the way.

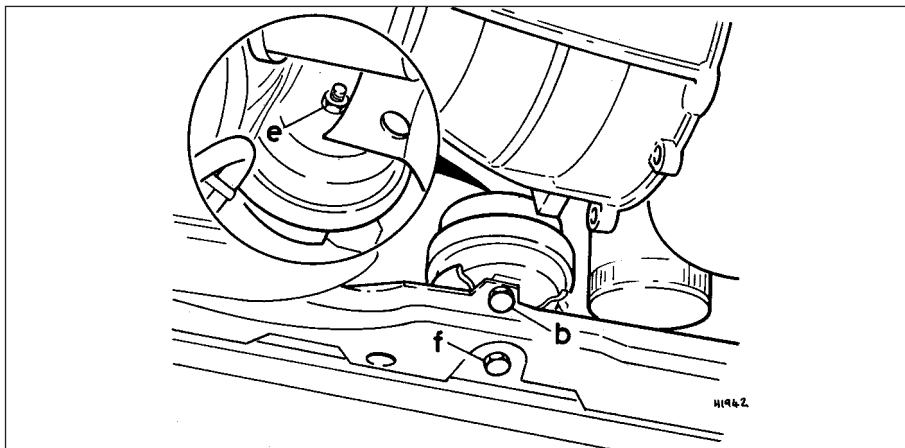
21 To disconnect the exhaust manifold to downpipe connection, VW tool no. 3049A will be required. Although it may be possible to prise the clips free to separate this joint, the tool will definitely be required to refit the springs.

22 The vehicle can now be lowered, the remaining removal operations being from above.

23 Attach a suitable sling and hoist to the engine/gearbox unit and take its weight.

24 Disconnect the rear engine bearer by undoing the three bolts (see illustration).

25 The engine/gearbox unit front mounting must now be detached by unscrewing and removing the single through-bolt. It may be necessary to further lift, lower or twist the unit to allow the through-bolt to be withdrawn (see illustration). Note that from December 1984, the front mounting is changed from the bonded rubber type to a 'hydro' type with damping action (see illustration).



5.25b Hydro-type front engine mounting

Refer to Specifications for fastener torque wrench settings b, e and f

26 The engine/gearbox unit is now ready for lifting out but first make a final check that all cables, wiring and hoses are clear.

27 Have an assistant at hand to help guide the unit clear of the surrounding components in the engine compartment as it is lifted out. The unit will have to be twisted slightly as it is raised. Once clear of the vehicle, lower it to the work surface.

Fuel injection equipped

28 On fuel injection equipped engines, the removal procedure closely follows that given for carburettor equipped engines. However, disregard those items concerning detachment of the carburettor and associated items. The following injection equipment items will need to be disconnected instead. Refer to Chapter 4 for further details:

29 Disconnect the wires from the warm-up valve (green connector) (see illustration).

30 Disconnect the wiring to the cold start valve (blue connector).

31 Disconnect the wiring to the auxiliary air valve.

32 Disconnect the throttle cable at the fast idle cam and bracket but do not remove the securing clip (see illustration).

33 Remove the cold start valve but leave the fuel lines connected. Place out of the way.

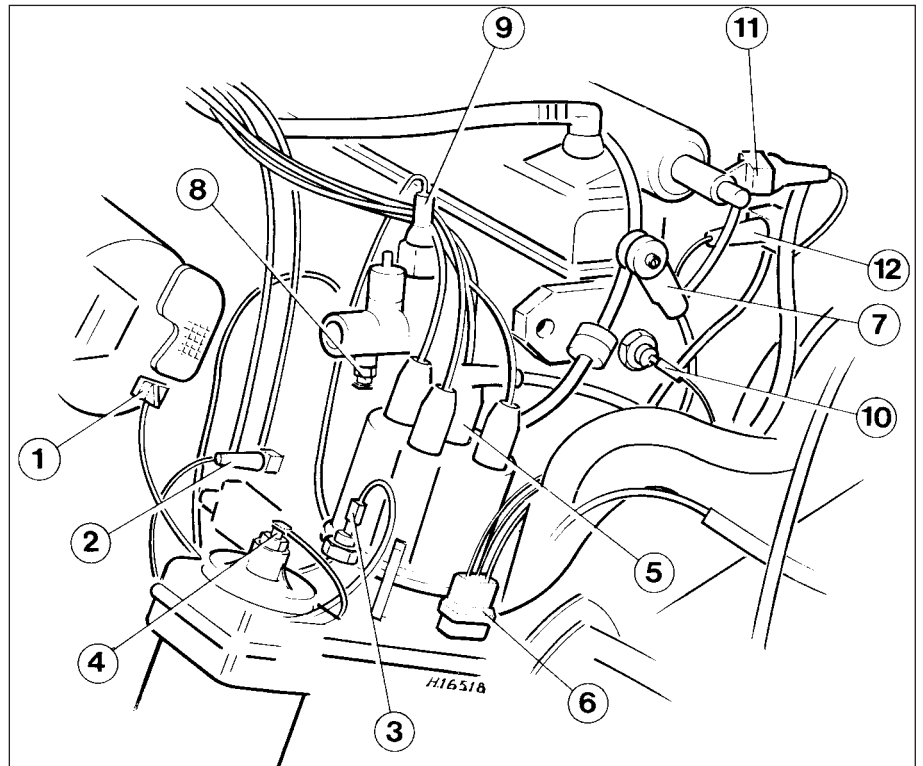
34 Disconnect the air inlet pipe at the flexible ducting attached to the throttle housing.

35 Disconnect the vacuum hoses from the inlet manifold and vacuum booster.

36 Leaving the fuel lines connected, undo the retaining bolts and withdraw the warm-up valve from the cylinder block. Position out of the way.

37 Detach the injectors from the cylinder head and plug the holes. Disconnect the injector lines from the locating bracket on the throttle housing and fold them out of the way.

38 Detach the vacuum hoses to the throttle housing T-piece connector location clip at the



5.29 Wiring connections to be detached - fuel injection models

- | | | |
|-------------------------------|-------------------------------------|--------------------------------|
| 1 Alternator | 5 Distributor HT cable (terminal 4) | 9 Thermostime switch |
| 2 Warm-up valve | 6 Hall sender (distributor) | 10 0.3 bar oil pressure switch |
| 3 1.8 bar oil pressure switch | 7 Vacuum switch | 11 Cold start valve |
| 4 Oil temperature sender | 8 Coolant temperature sender | 12 Auxiliary air valve sender |

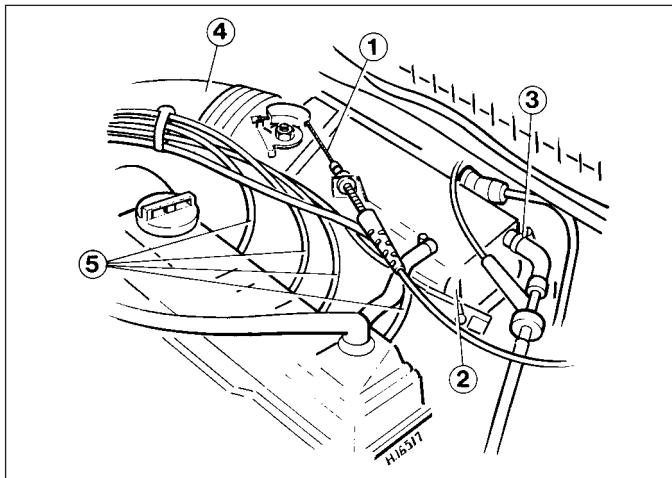
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bulkhead. Fold the hoses back out of the way.

39 Disconnect the oil temperature switch sender lead (see illustration).

40 When lifting out the engine/gearbox unit, greater care will have to be taken in manoeuvring the unit from the engine

compartment due to the close proximity of the air inlet manifold to the bulkhead. The unit will need to be pulled forwards first then twisted and lifted.



5.32 Fuel injection components to be detached

- | | | |
|--------------------|-------------------|-------------|
| 1 Throttle cable | 3 Vacuum hoses | 5 Injectors |
| 2 Cold start valve | 4 Air intake pipe | |



5.39 Oil temperature sender (arrowed)

6 Engine/gearbox - separation and reconnection



This procedure is fully described in Chapter 7, Parts A or B, as applicable. It is only necessary to refer to those paragraphs pertinent to the particular method being used. The engine must be supported on blocks, or alternatively the gearbox can be separated with the engine still on the hoist.

7 Engine dismantling - general information

Refer to Section 7 in Part A of this Chapter.

8 Engine ancillary components - removal



With the engine removed from the vehicle and separated from the transmission, the externally mounted ancillary components can be removed prior to engine dismantling. The removal sequence need not necessarily follow the order given:

- a) Alternator and drivebelt
- b) Inlet manifold and carburettor or inlet manifold and throttle housing (fuel injection)
- c) Exhaust manifold
- d) Fuel pump
- e) Warm-up valve (fuel injection), if still attached
- f) Distributor
- g) Oil filter with cooler (where applicable) and filter mounting
- h) Oil pressure and coolant temperature and sensor switches

- l) Coolant pump and coolant hose connectors from cylinder block and head. New O-rings will be required
- j) Clutch then intermediate plate (manual gearbox)
- k) Driveplate, noting location of spacer and shim(s) (automatic transmission)

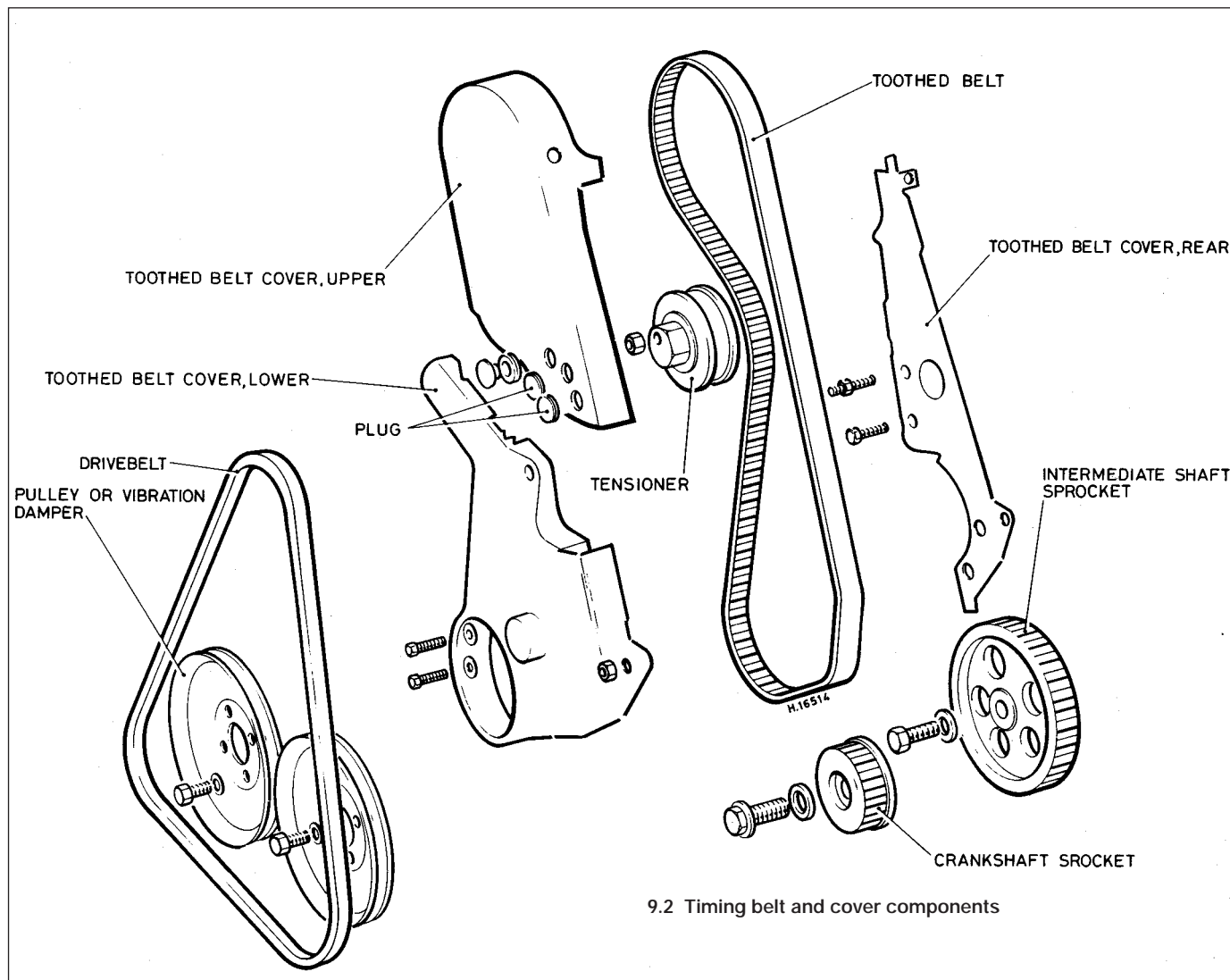
9 Timing belt and sprockets - removal



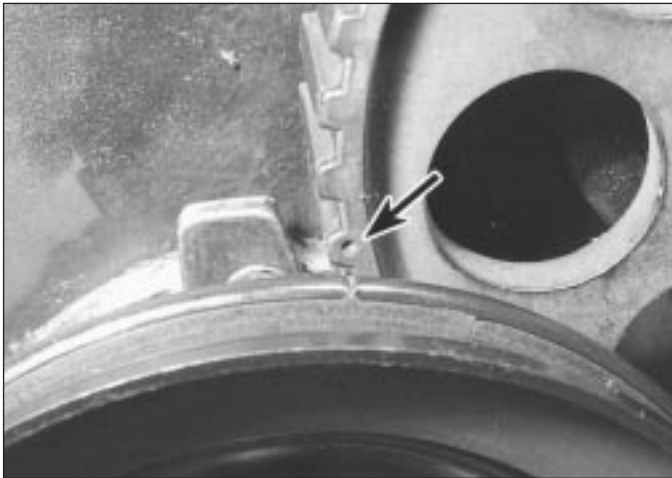
1 If the engine is still in the vehicle, first carry out the following operations:

- a) Disconnect the battery earth lead
- b) Remove the alternator drivebelt
- c) Unbolt and remove the coolant pump pulley

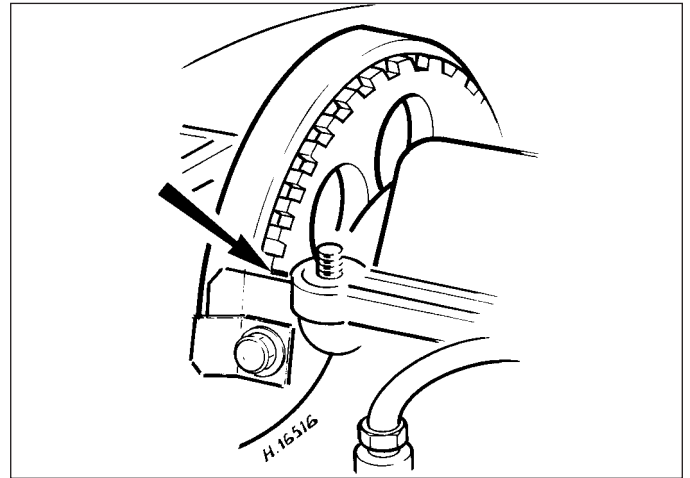
2 Depending on type, undo the retaining bolt(s)/nut(s), release the retaining clips and remove the upper timing cover (see illustration). On some engines it will be necessary to remove the bung from the front



9.2 Timing belt and cover components



9.6 Intermediate sprocket timing mark (arrowed) aligned with notch in crankshaft pulley



9.7a Camshaft sprocket timing mark (arrowed) with No 1 cylinder at TDC on compression

face of the cover to allow access to the Allen type retaining screw recessed within the cover. On other engines, the retaining screw can be seen but its key slot is deeply recessed (access to it being made via the hole in the centre of the screw surround).

3 Unscrew the nuts and bolts from the valve cover and remove the cover together with the gasket and reinforcement strips. Detach the crankcase emission hose(s) from the rocker cover.

4 Mark the relative positions of the crankshaft pulley and crankshaft sprocket, then undo the four socket-head bolts and withdraw the pulley.

5 Unbolt and withdraw the lower timing cover.

6 The engine must now be set for timing. Temporarily refit the crankshaft pulley. On the intermediate sprocket for the timing belt one tooth has a centre-punch mark. Turn the engine until this mates with a notch on the V-belt pulley bolted to the crankshaft sprocket (see illustration). To turn the engine over, remove the spark plugs then fit a suitable spanner onto the crankshaft sprocket retaining bolt and turn it in the direction of engine rotation.

7 When these marks match, look at the sprocket on the camshaft. One tooth of this has a centre-punch mark. This should be level

with the valve cover flange (see illustration). Having turned the engine until these marks agree, now look at the cams for No 1 cylinder (nearest the timing belt). They will both be in the 'valve closed' position (see illustration). Now look through the hole in which the TDC sensor goes where the timing marks show on the periphery of the flywheel and note the reading.

8 Before removing the timing drivebelt, check its correct tension. If held between the finger and thumb halfway between the intermediate shaft and the camshaft it should be just possible to twist it through 90° (see illustration). If it is too slack, adjust it by slackening the bolt holding the eccentric cam on the tensioner wheel. If you are satisfied it can be adjusted to the correct tension, remove it and examine it for wear. Now is the time to order a new one if necessary.

9 Loosen the tensioner then withdraw the timing belt from the camshaft, intermediate and crankshaft sprockets.

10 Each of the timing belt sprockets is secured by a central bolt and washer. The

intermediate, camshaft and crankshaft sprocket (the latter in particular) securing bolts are tightened to a substantial torque and the sprockets will therefore need to be firmly held when undoing the bolts.

11 To remove the camshaft sprocket, unscrew the bolt with the sprocket held stationary by inserting a suitable metal bar through a sprocket hole and resting it on the valve cover face of the cylinder head, but take care not to damage the face. Remove the bolt and spacer washer then withdraw the sprocket, tapping it free if necessary. Check the fit of the Woodruff key in the camshaft, it must be renewed if loose in its groove. Lever out the Woodruff key and keep it with the sprocket.

12 To remove the crankshaft sprocket, hold the crankshaft stationary with a lever jammed in the starter ring gear (remove the starter motor as applicable). Do not allow the crankshaft to turn or the pistons may touch the valve heads. Unscrew the retaining bolt and remove it, together with the spacer washer, then lever the sprocket free from the crankshaft. Check the fit of the Woodruff key (if fitted) in the crankshaft, it must be renewed if loose in its groove. Lever out the Woodruff key and keep it with the crankshaft sprocket.

13 The intermediate shaft sprocket is removed in a similar manner to that for the camshaft sprocket.

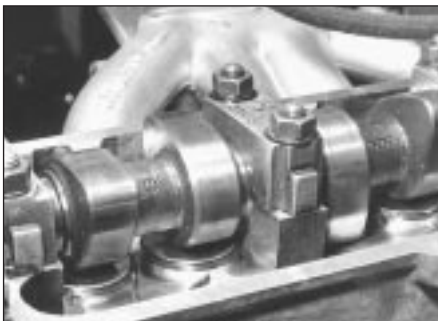
10 Camshaft - removal, examination and refitting



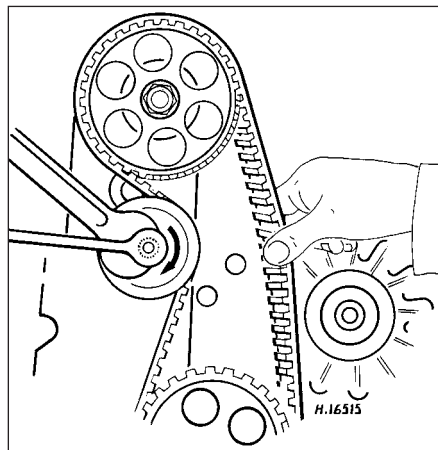
Removal

1 To remove the camshaft with the engine in the vehicle, first carry out the following operations:

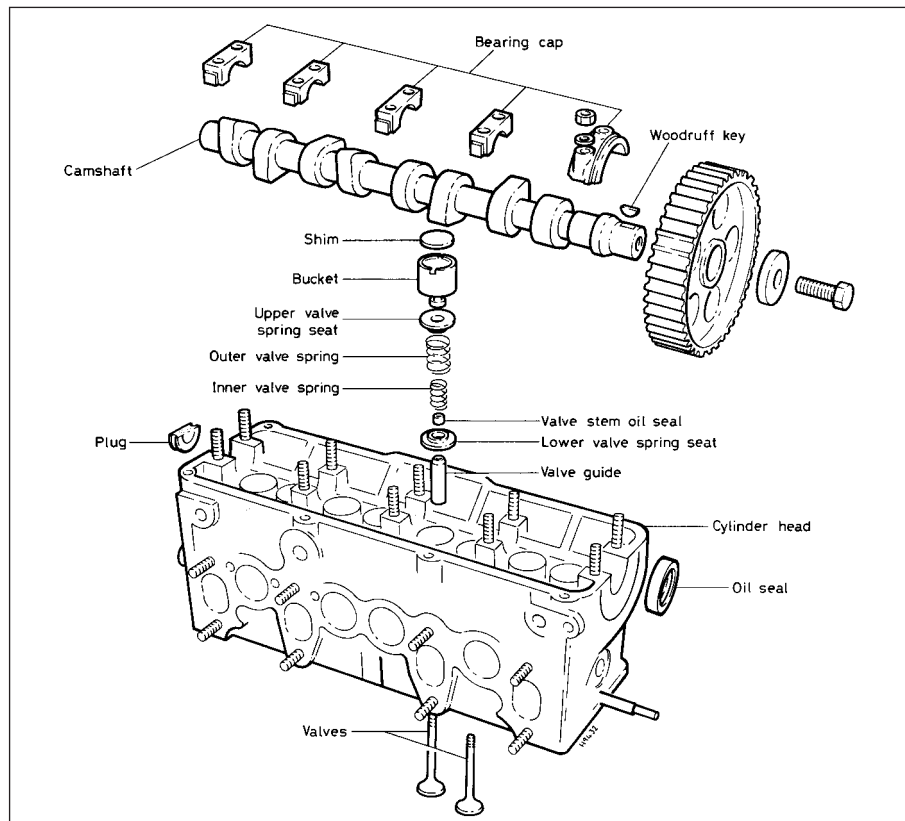
- a) Remove the timing cover and valve cover, then disconnect the timing belt from the camshaft sprocket



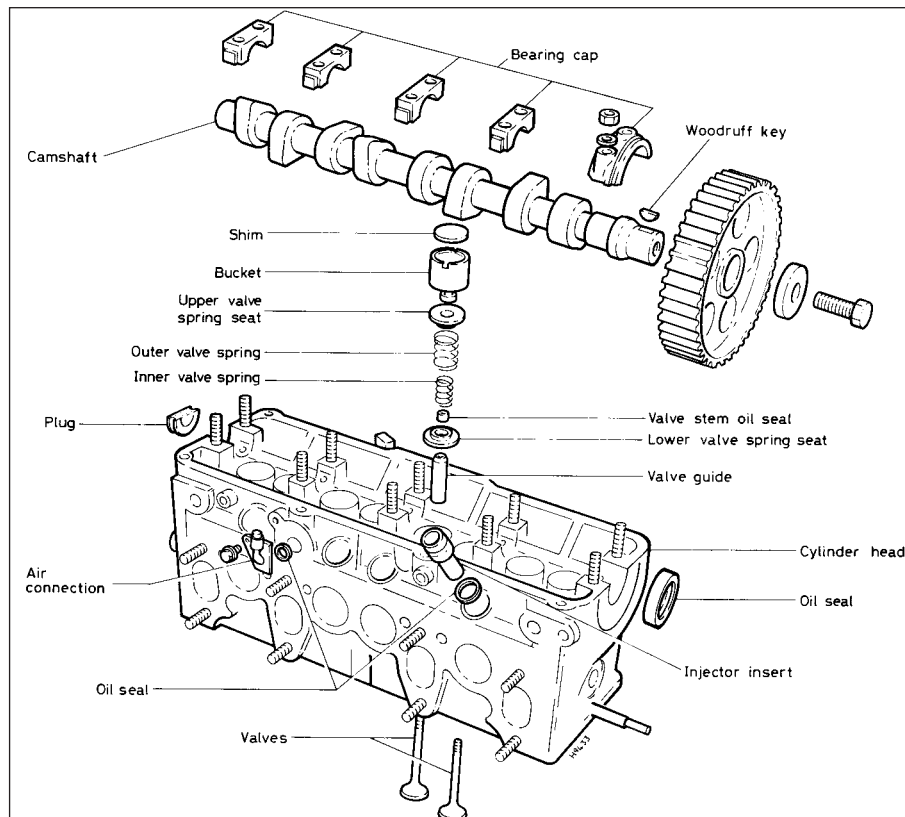
9.7b No. 1 cylinder cam lobes in valve closed position



9.8 Timing belt tension check method



10.2a Cylinder head and camshaft components - carburettor engine



10.2b Cylinder head and camshaft components - fuel injection engine

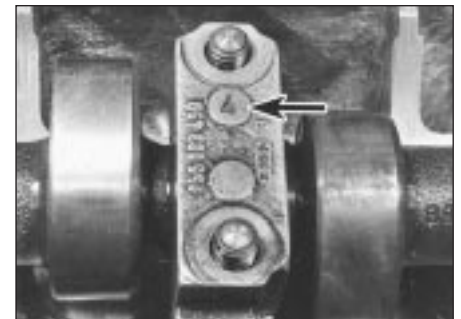
b) If the camshaft oil seal is to be renewed then the camshaft timing sprocket must be removed

2 Remove the camshaft bearing caps (see illustrations), making a careful note of their fitted positions for reference when refitting. The caps are numbered (see illustration) but mark the side nearest the front of the cylinder head. No. 1 cap is the one with a small oil seal on it.

3 Remove cap nos. 5, 1 and 3 in that order. Now undo the nuts holding 2 and 4 in a diagonal pattern. The camshaft will lift the caps up as the pressure of the valve springs is exerted. When they are free, lift the caps off along with the camshaft. The oil seal on the front end of the camshaft will come with it. Depending on tappet type, proceed as follows:

Shim bucket tappets

4 The tappet buckets are now exposed and may be lifted out (see illustration). Take each one out in turn, prising the little disc out of the bucket by inserting a small screwdriver either side and lifting the disc away. On its reverse, each disc is engraved with a size (eg. 3.75). This is its thickness number. Note the number and then clean the disc and refit it, number side down. There are eight of these and they must not be mixed up. On assembly, each disc must go back into the bore from whence it came. This problem exists also for the valves, so a container for each valve assembly



10.2c Camshaft bearing cap number (arrowed)



10.4 Tappet bucket and shim

and tappet is required. Label the containers 1 to 8, as follows:

Containers 1 and 2 will be No 1 cylinder exhaust and inlet respectively

Containers 3 and 4 will be No 2 cylinder exhaust and inlet respectively

Containers 5 and 6 will be No 3 cylinder inlet and exhaust respectively

Containers 7 and 8 will be No 4 cylinder inlet and exhaust respectively

5 Note the thickness of all tappet clearance discs from Nos. 1 to 8 for use during reassembly.

Hydraulic bucket tappets

6 Lift out the tappets one by one, ensuring that they are kept in their correct order and can be returned to their original bores.

7 Place them, cam contact surface down, on a clean sheet of paper as they are removed.

8 Inspect the tappets for wear (indicated by ridging on the clean surface), pitting and cracks.

9 Tappets cannot be repaired and if worn, must be renewed.

Examination

10 Refer to Section 27 in Part A of this Chapter whilst noting that on exchange engines or cylinder heads, the camshaft is supplied with bearing shells instead of running directly in the head and bearing caps. Exchange units supplied by VW may have an undersized camshaft with corresponding bearing shells. Where this is the case, the camshaft will have a yellow paint spot on it and the journal diameter will be 25.75 mm. An unmarked camshaft supplied with bearing shells will be of standard size with a journal diameter of 26.00 mm.

Refitting

11 Refer to Section 12.

11 Cylinder head - removal



All engines

1 If the cylinder head is being removed with the engine out of the vehicle, proceed from paragraph 17. If the cylinder head is being removed with the engine in the vehicle, it is best removed with the inlet and exhaust manifolds. The manifolds can then be detached after removal of the cylinder head but note that a special tool is required to release (and subsequently reconnect) the exhaust downpipe-to-manifold flange retaining clips. A splined key will also be required to undo and tighten the cylinder head bolts.

2 Disconnect the battery earth lead. Drain the cooling system, then disconnect the cooling and heater hoses from the cylinder head.

3 Disconnect the thermostat and oil pressure lead connections.

4 On carburettor models, remove the air cleaner unit.

5 Disconnect the alternator from the cylinder head attachment brackets and remove the drivebelt.

6 If removing the manifolds with the cylinder head, disconnect the vacuum hose from the inlet manifold and the accelerator cable (and choke cable if applicable) from the carburettor.

7 Disconnect the HT leads from the spark plugs.

Fuel injection equipped engines

8 Detach the injector lines from the cylinder head and location clips and fold them back out of the way.

9 Disconnect the inlet duct at the flexible hose connection to the throttle valve housing.

10 Detach the vacuum hoses to the throttle valve housing and at the three-way connector on the bulkhead side of the cylinder head. Fold back and secure the hoses out of the way.

11 Disconnect the auxiliary air valve lead from the underside of the inlet manifold and the auxiliary air valve hose to the flexible hose on the throttle valve housing.

12 Disconnect the servo vacuum hose from the green connector on the flexible hose on the throttle housing.

13 If air conditioning is fitted, detach the hoses from the auxiliary air valve and tube connections.

14 Detach the MFI hose at the servo hose valve connection.

15 Detach the wiring connector from the cold start valve.

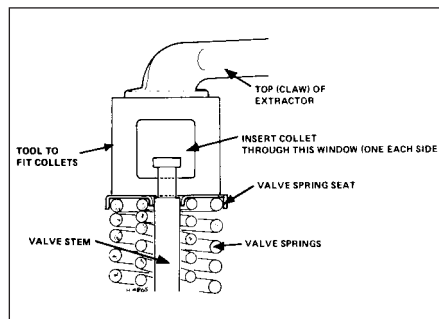
All engines

16 Remove the timing cover and valve cover, then disconnect the timing belt from the camshaft sprocket.

17 Remove the camshaft.

18 Remove the cylinder head bolts. These are recessed in the well of the cylinder head and are socket-head bolts. They must be removed using the correct splined tool.

19 The cylinder head bolts must be unscrewed in a progressive manner and in the reverse sequence to that shown for tightening.



12.2 Improved tool used to remove and refit collets to valve stems

20 When all ten bolts have been removed, lift the head from the cylinder block. It may need a little tapping to loosen it but do not try to prise it loose by hammering in wedges. Lift off the gasket and, if the engine is not being dismantled, clean the piston crowns and block face. Note that the cylinder head bolts must not be re-used, a new set will need to be obtained when ordering the cylinder head gasket set.

12 Cylinder head - dismantling and overhaul



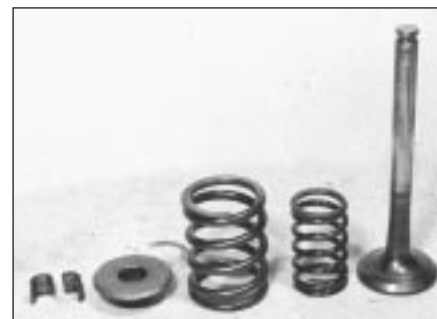
1 Using a wire brush, scraper and steel wool, clean all carbon from the combustion chambers, valve faces and exhaust ports. Remove the spark plugs for cleaning.

2 The valves are not easy to get out unless a suitable valve spring compressor is available. Because the collets and spring caps are set so far down in the head, a long claw is necessary on the compressor and it must be split sufficiently to enable the collets to be removed and inserted. If such a tool is not to hand then find a piece of steel tube of about 25 mm inside diameter which will fit over the valve stem and press down the spring cover (see illustration). The length will depend on the size of the compressor so fit the compressor over the head fully extended, measure the distance between the claw and the valve spring seat and cut the tube to a suitable length.

3 The next step is to cut two windows of suitable size (approx. 25 mm long and 16 mm wide) in opposite sides of the tube. The tube may then be used with the compressor to extract the collets from each valve stem in turn. Place the valve, springs, collets and seats with the tappet in the appropriate receptacle, keeping them strictly together for refitting in the valve guide from which they were taken (see illustration).



If your fingers are too big, put a blob of grease on the collet and pick it up with a small screwdriver, then insert it into the slot on the valve stem.



12.3 Valve springs, cap and collets



12.12a Inserting a valve into the cylinder head



12.12b Locating valve springs and cap . . .



12.12c . . . and valve collets

4 The valve springs must be renewed if they are damaged, distorted, or known to have covered a high mileage. If in doubt as to their condition, have your VW dealer check them for compression efficiency using a calibrated valve spring compressor.

5 The valves should be cleaned and checked for signs of wear or burring. Where this has occurred, the inlet valve may be reground on a machine at a dealer. Exhaust valves must not be reground on the machine but ground in by hand. On engines fitted with hydraulic tappets, valves should not be re-cut as this will adversely affect the operation of the tappets.

6 Wear in the valve guides may be detected by fitting a new valve in the guide and checking the amount that the rim of the valve will move sideways when the top of the valve stem is flush with the top of the valve guide. The valve rock limits are given in the *Specifications*. New valve guides must be fitted and reamed by your VW dealer.

7 Do not spend too long grinding in the valves. If the valve seat and valve are not satisfactory after 15 minutes then you will probably do more harm than good by going on. Make sure both surfaces are clean, smear grinding paste onto the valve evenly and using a suction cup, work the valve with an oscillating motion lifting the valve away from the seat occasionally to stop ridging. Clean the seat and valve frequently and carry on until there is an even grey band on both seat and valve then wipe off all the paste.

8 The surface of the head must be checked with a straight-edge and feeler blade. Place

the straight-edge along the centre of the machined face of the head. Make sure there are no ridges at the extreme ends and measure the clearance with feelers between each combustion chamber head. This is the area where the narrowest part of the cylinder head gasket comes and where the gasket is most likely to fail. If the straight-edge is firmly in place and feelers in excess of 0.1 mm can be put between the head and the straight-edge, then the head should be taken to a dealer for servicing or replacement.

9 If the cylinder head shows signs of cracking, have it inspected by your VW dealer to assess its condition for reuse.

10 VW recommend that the valve stem oil seals should always be renewed to prevent possible high oil consumption. Pulling off the old seal is simple with pliers. With a packet of new oil seals is a small plastic sleeve. This is fitted over the valve stem and lubricated. The seal should then be pushed over the plastic sleeve until it seats on the guide. This should be done with VW tool 10 204 which fits snugly round the outside of the seal and pushes it on squarely. If the seal is assembled without the plastic sleeve, it will be damaged and oil consumption will become excessive.

11 Before reassembling the cylinder head, check the condition of the camshaft.

12 When all components have been examined, then assembly of the head may commence. Insert the valve in the correct guide, fit the inner seat, valve springs and outer cap, assemble the valve spring compressor and possibly the small tube and compress the valve spring until the collets

may be assembled to the valve stem (see illustrations).

13 Assemble the second collet and holding them carefully together in place, ease off the compressor until the spring seats the collets home. Remove the compressor, put a rag over the valve stem and tap the stem with a hammer. This is to ensure that the collets are seated correctly. If they are they will not come out. Repeat until all eight valves are in position in the cylinder head.

14 Refit the tappets in the bores from which they came, lubricating them liberally with clean engine oil (see illustration). Lubricate the camshaft bearing surfaces with oil and fit the camshaft, positioned so that No 1 cylinder cams point upwards.

15 Fit a new oil seal at the sprocket end, lubricate the bearings, set the shaft in position and install bearing caps Nos 2 and 4, tightening the nuts in a diagonal pattern until the shaft is in place (see illustration). Now install the other bearing caps, making sure they are the right way round (marks towards the drive pulley) and tighten the caps down using a diagonal pattern to the specified torque. Install a new rubber seal at the opposite end to the sprocket.

16 On engines equipped with shim bucket tappets, adjust the valve clearances.

13 Sump and oil pump - removal and refitting



Modification: From August 1985, a larger sump is fitted thereby increasing engine oil capacity. If renewing the sump, ensure that one of identical capacity is fitted

Removal

1 If the engine is in the vehicle then drain the engine oil. Note that the sump plug has an O-ring which must be renewed (see illustration).

2 Undo the sump retaining bolts and remove the sump from the lower face of the crankcase. Remove the sump gasket which must also be renewed.

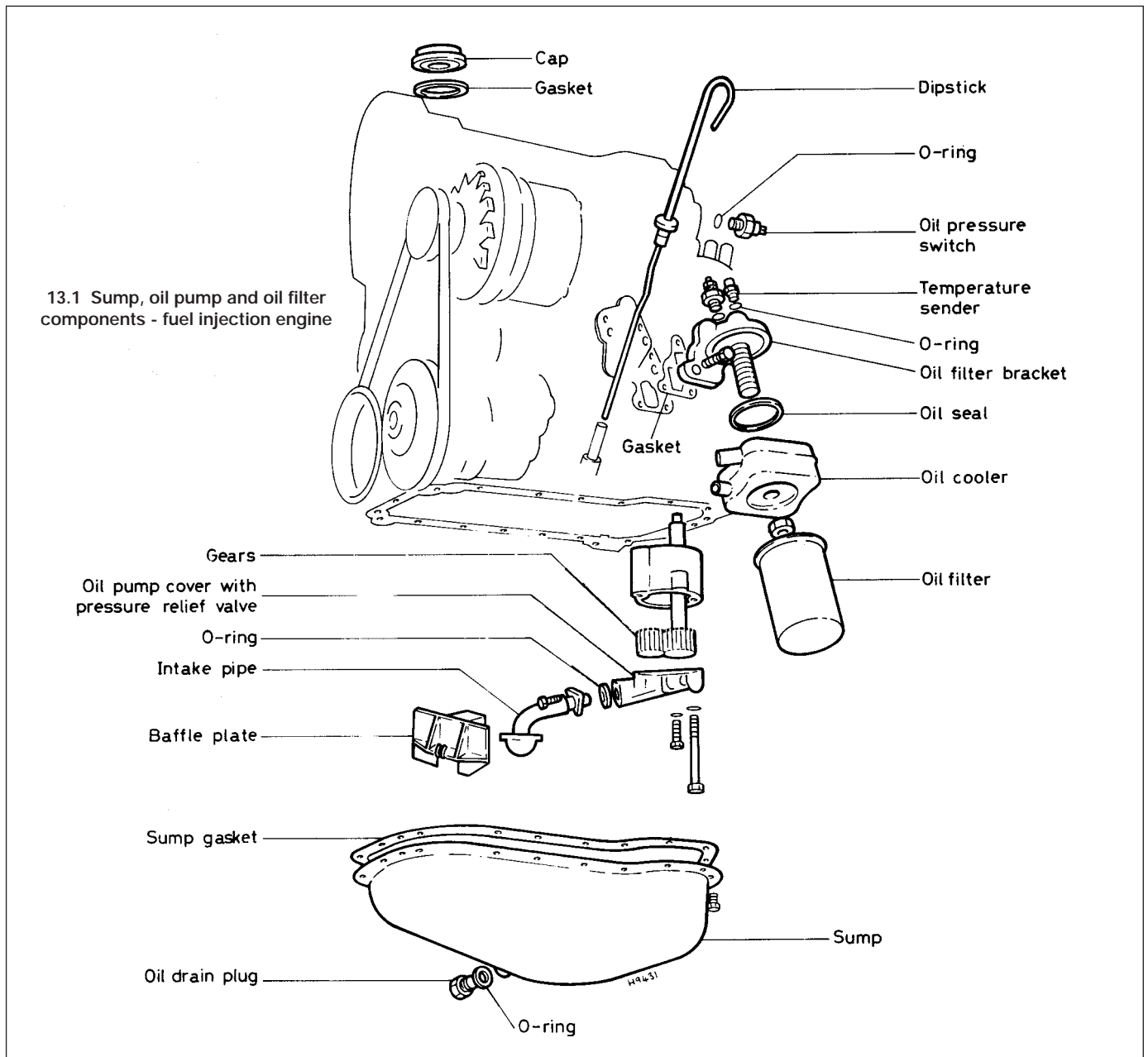
3 To remove the oil pump, undo the two retaining bolts and lower the pump unit,



12.14 Fit the tappet buckets



12.15 Fit the bearing caps



13.1 Sump, oil pump and oil filter components - fuel injection engine

2C

complete with the oil pick-up pipe and strainer.

Refitting

- 4 To refit the pump, ensure that the mating faces are clean, locate it in position and fit and tighten the securing bolts to the specified torque.
- 5 Locate the new sump gasket but do not apply an adhesive sealant. Refit the sump and tighten the retaining bolts evenly to the specified torque.
- 6 Refit the oil drain plug with O-ring and tighten it to the specified torque.

14 Pistons and connecting rods - removal

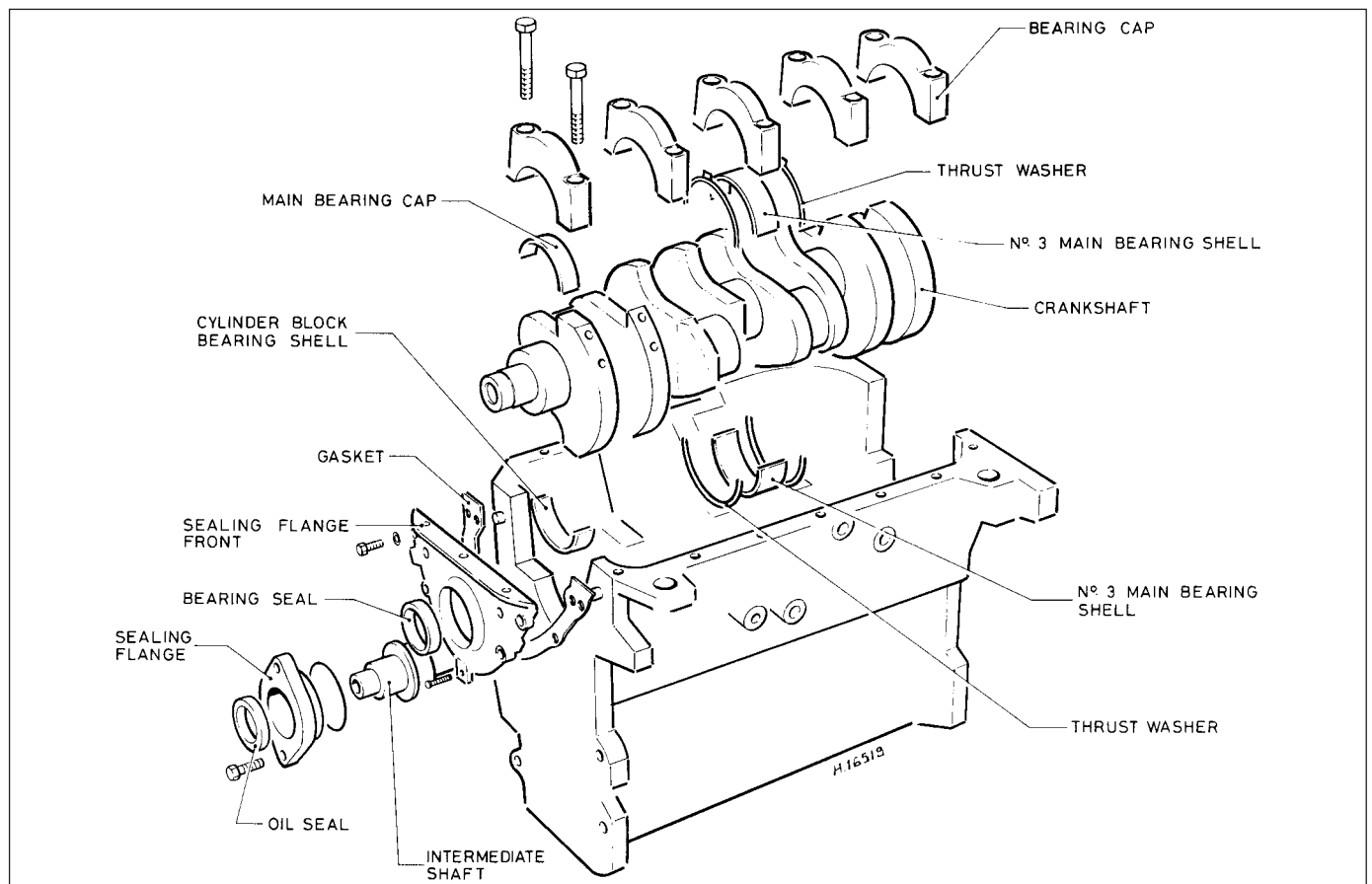


- 1 Remove the cylinder head.
- 2 Remove the sump.
- 3 Unscrew the two oil pump retaining bolts then lower and remove the pump, complete with oil pick-up pipe from the crankcase. Place it on one side for cleaning and inspection.
- 4 The piston and connecting rod removal procedure now follows that given for the smaller engine variants in Part A of this Chapter.

15 Crankshaft and main bearings - removal



- 1 Disconnect the pistons and connecting rods from the crankshaft. Note that, although the engine has to be removed to remove the crankshaft, the cylinder head, pistons and connecting rods can be left in position.
- 2 At the flywheel end, undo and remove the six bolts securing the oil seal flange to the crankcase (see illustration). Withdraw the flange, seal and gasket.
- 3 Examine the main bearing caps. It will be



15.2 Crankshaft and cylinder block components

seen that the caps are numbered 1 to 5 and that the number is on the side of the engine opposite the oil pump position. Identify these numbers. If they are obscured, then mark the caps in the same way as the connecting rod caps. Before removing the caps, push the crankshaft to the rear and check the endfloat using a feeler blade between the thrustwasher flanges on No 3 main bearing and the crankshaft web (see illustration). It must not exceed the specified maximum.

4 Remove the bearing cap retaining bolts, remove the bearing caps and lift out the thrustwashers from each side of the centre main bearing.

5 Lift out the crankshaft and then remove the top half bearing shells. If the main bearings are not being renewed, make sure the shells are identified so that they go back into the same bearing cap the same way round

3 Remove the fuel pump on carburettor models and the ignition distributor.

4 Before removing the intermediate shaft, check that the endfloat does not exceed the maximum specified amount.

5 Undo the two sealing flange retaining bolts then withdraw the intermediate shaft, complete with sealing flange (see illustrations).

6 Withdraw the sealing flange from the intermediate shaft. The oil seal within the flange and the O-ring must be renewed on reassembly.

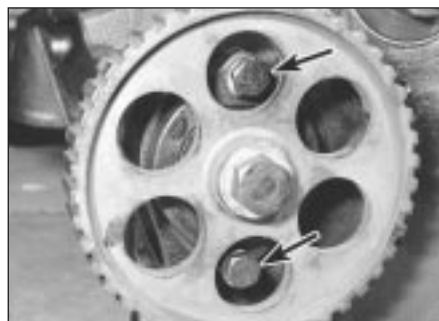
16 Intermediate shaft - removal



1 The intermediate shaft can only be withdrawn from the crankcase with the engine removed from the vehicle.
2 Remove the timing belt.



15.3 Checking crankshaft endfloat at No. 3 main bearing



16.5a Intermediate shaft retaining flange bolts (arrowed)



16.5b Withdrawing intermediate shaft

17 Oil filter - renewal



Refer to Chapter 1, Section 18

18 Oil cooler - removal and refitting



1 On fuel injection models, an oil cooler is fitted between the oil filter cartridge and mounting bracket. The cooler must be renewed if the engine oil has been contaminated with metal particles, such as might be the case following total or partial engine seizure. Renew it anyway if it is likely to contain any other harmful contaminant.

2 To remove the cooler, first remove the oil filter cartridge.

3 Drain the cooling system and disconnect the coolant hoses from the cooler.

4 Remove the cooler retaining nut and the cooler. The O-ring between the cooler and mounting must be renewed.

5 Refitting is a reversal of the removal procedure. Wipe clean the sealing faces of the cooler and mounting and smear the O-ring with clean engine oil.

6 On completion, top-up the engine oil and coolant levels. Start the engine and check for any signs of leaks.

19 Oil filter mounting - removal and refitting



1 Remove the oil filter and on fuel injection models, the oil cooler.

2 Disconnect the oil pressure switch lead, undo the oil filter mounting securing bolts and withdraw the mounting and gasket.

3 The oil pressure switch can be unscrewed from the top face of the mounting if required. Renew the switch O-ring.

4 Refitting is a reversal of the removal procedure. Renew the mounting gasket.

20 Oil seals - renewal



Note: The following procedures were all carried out with the engine in the vehicle

Crankshaft seals

Flywheel/driveplate end

1 On manual gearbox models, remove the clutch and pressure plate. On automatic transmission models, remove the transmission then unbolt the driveplate from the crankshaft, noting the location of the spacer and shim(s).

2 Carefully prise out the oil seal with a screwdriver or strong wire and wipe clean the recess (**see illustration**).

3 Fill the space between the lips of the new seal with multi-purpose grease, then drive it squarely into the housing using a block of wood or suitable metal tubing. If at all possible, use VW fitting sleeve No. 2003 to avoid damage to the oil seal lip.

4 Refit the driveplate or clutch.

Timing belt end

5 Remove the alternator, together with its drivebelt.

6 Remove the timing belt cover and timing belt, ensuring that the timing marks are correctly aligned.

7 Unscrew the bolt from the front of the crankshaft, withdraw the pulley and sprocket and remove the Woodruff key. On manual gearbox models, if the belt is difficult to loosen, have an assistant engage top gear and apply the brakes. On automatic transmission models, remove the starter model and restrain the driveplate ring gear with a suitable lever.

8 Prise out the oil seal or extract it with VW tool No. 2085, then wipe clean the recess (**see illustration**).

9 Fill the space between the lips of the new seal with multi-purpose grease, then drive it squarely into the housing using a block of wood or suitable metal tubing. If available use VW fitting sleeve No. 3083.

10 The remaining refitting procedure is a reversal of removal. Ensure that the timing marks are aligned before refitting the timing belt and tensioning it.

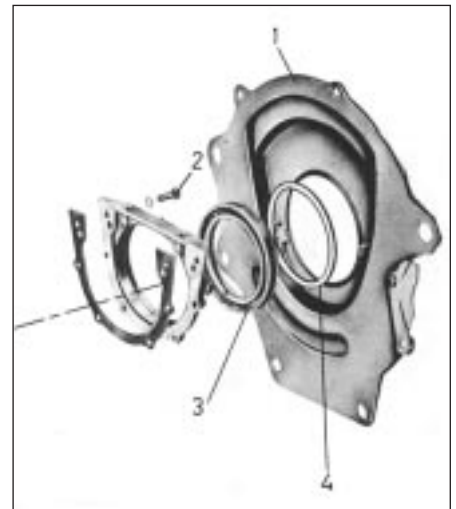
Camshaft front seal

11 Remove the alternator together with its drivebelt.

12 Remove the timing belt cover and timing belt, ensuring that the timing marks are correctly aligned.

13 Hold the camshaft sprocket stationary with a screwdriver inserted through one of its holes, then unscrew the bolt and remove the washer, sprocket and Woodruff key.

14 Prise out the oil seal or alternatively,



20.2 Flywheel end crankshaft oil seal components

- 1 Intermediate plate
2 Bolt
3 Oil seal
4 Sealing ring (not fitted to all models)

extract it with VW tool No. 2085, then wipe clean the recess.

15 Fill the space between the lips of the new seal with multi-purpose grease, then drive it squarely into the cylinder head using a block of wood or suitable metal tubing. If available, use VW fitting sleeve No. 10-203.

16 The remaining refitting procedure is a reversal of removal. Ensure that the timing marks are aligned before refitting the timing belt and tensioning it.

Intermediate shaft seal

17 Remove the alternator together with its drivebelt.

18 Remove the timing belt cover and timing belt, ensuring that the timing marks are correctly aligned.

19 Hold the intermediate shaft sprocket stationary with a screwdriver inserted through one of its holes, then unscrew the bolt and remove the washer, sprocket and Woodruff key.

20 Renew the oil seal.

21 The remaining refitting procedure is a reversal of removal. Ensure that the timing marks are aligned before refitting the timing belt and tensioning it.

21 Examination and renovation - general information

Refer to Section 20 in Part A of this Chapter.

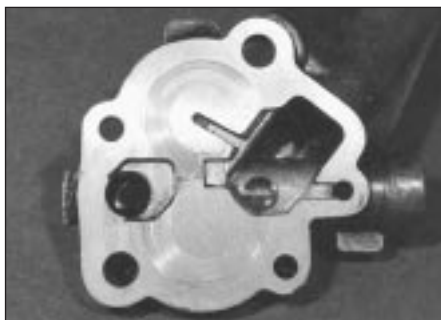
22 Crankshaft and bearings - examination and renovation



Refer to Section 21 in Part A of this Chapter.



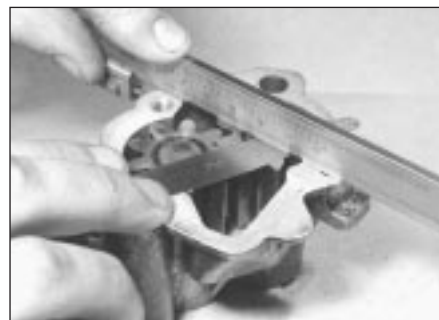
20.8 VW tool 2085 for removing crankshaft oil seal (timing belt end) and camshaft oil seal



25.2 Examine face of oil pump cover for scoring



25.3 Checking oil pump gear backlash



25.4 Checking oil pump gear endfloat

23 Cylinder block/crankcase - examination and renovation



Refer to Section 22 in Part A of this Chapter.

24 Pistons and connecting rods - examination and renovation



Refer to Section 23 in Part A of this Chapter.

25 Oil pump - examination and renovation



1 With the oil pump on the bench, prise off the cap with a screwdriver and clean the strainer gauze in fuel. Refit the gauge and press on the cap.

2 Remove the two small bolts and take the cover away from the body. Examine the face of the cover (see illustration). As seen in the

illustration, the gears have marked the cover. If the depth of this marking is significant, then the face of the cover must be machined flat again.

3 Remove the gears and wash them with the body in clean paraffin. Dry and reassemble the gears, lubricating them with clean engine oil. Measure the backlash between the gears with a feeler blade (see illustration). This should be 0.05 to 0.20 mm.

4 Now place a straight-edge over the pump body along the line joining the centre of the two gears and measure with a feeler blade the axial clearance between the gears and the straight-edge (see illustration). This must not exceed 0.15 mm.

5 If all is well, check that the shaft is not slack in its bearings and reassemble the pump for fitting to the engine.

6 If there is any doubt about the pump, it is recommended that a replacement be obtained. Once wear starts in a pump it progresses rapidly. In view of the engine damage that may follow a loss of oil pressure, skimping the oil pump repair is a false economy.

26 Intermediate shaft - examination and renovation



1 Check the fit of the intermediate shaft in its bearing. If there is excessive play, the shaft must be compared with a new one. If the shaft is in good order but the bearings in the block are worn, then seek expert advice.

2 Check the surface of the cam which drives the fuel pump (where applicable). If serious ridging is present, a new shaft is indicated.

3 Check the teeth of the distributor drivegear for scuffing or chipping. Check the condition of the timing belt sprocket.

4 It is unlikely that damage to the shaft has happened but if it has, seek advice from a VW dealer.

5 There is an oil seal in the flange for the intermediate shaft. This may need renewal if there are signs of leakage. To do this, remove the timing belt sprocket and withdraw the flange from the shaft. The oil seal may now be prised out and a new one pressed in. Always fit a new O-ring on the flange before assembling it to the cylinder block.

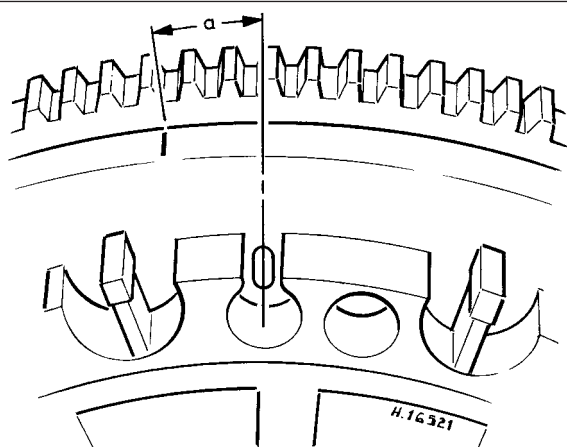
27 Flywheel/driveplate - examination and renovation



1 Inspect the starter ring teeth. If these are chipped or worn then renew the starter ring. This means heating the ring until it may be withdrawn from the flywheel, or alternatively, splitting it. A new one must then be shrunk on. If you know how to do this and you can get a new ring then the job can be done but it is beyond the capacity of most owners.

2 Serious scoring on the flywheel clutch facing requires a new flywheel. Do not attempt to clean the scoring off with a scraper or emery. The face must be machined.

3 If it is necessary to fit a new flywheel, the ignition timing mark must be made by the owner. The new flywheel has only the TDC mark as an O on the outer face. Punch or scribe the appropriate timing mark for your model to the left of the TDC mark at the appropriate distance (see illustration).



27.3 Flywheel/driveplate ignition timing marks

- Engine code EZ (1.6)-flywheel $a = 37.0$ mm 18° BTDC
- Engine code EZ (1.6)-driveplate: $a = 42.0$ mm 18° BTDC
- Engine code EV (1.8) - flywheel: $a = 12.5$ mm 6° BTDC
- Engine code GU (1.8) - flywheel $a = 37.0$ mm 18° BTDC
- Engine code GU (1.8) - driveplate: $a = 42.0$ mm 18° BTDC



30.3a Fitting flanged type centre main bearing into crankcase



30.3b Fitting alternative type centre main bearing into crankcase . . .



30.3c . . . together with thrustwashers



30.3d Fitting flanged type centre main bearing to cap



30.3e Fitting centre bearing and separate thrustwashers to cap



30.3f Ensure that ends of bearing are flush with joint face

4 On automatic transmission models, check the driveplate as described for the flywheel. It will also be necessary to mark a new driveplate for ignition timing.

aperture in the rear end of the crankshaft. It may already have been removed by the supplier, but check anyway.

the crankshaft in the crankcase.

5 Fit the main bearing caps (with centre main bearing thrustwashers if applicable) in their correct positions (see illustration).

6 Fit the bolts to the bearing caps and tighten the bolts of the centre cap to the specified torque, then check that the crankshaft rotates freely.

7 Working out from the centre, tighten the remaining bearing caps in turn, checking that the crankshaft rotates freely after each bearing has been tightened.

8 Check that the endfloat of the crankshaft is within specifications by inserting feeler blades between the crankshaft and the centre bearing thrust face/washer while levering the crankshaft first in one direction and then in the other.

9 Lubricate the rear of the crankshaft and using a new gasket, install the rear oil seal and flange. Tighten the six bolts (see illustration).

28 Timing belt and sprockets - examination and renovation



Refer to Section 26 in Part A of this Chapter. The information given also applies to the intermediate shaft sprocket.

29 Engine reassembly - general information

Refer to Section 28 in Part A of this Chapter.

30 Crankshaft and main bearings - refitting



Note: If it is difficult to rotate the crankshaft, check that the bearing shells are seated properly and that the bearing cap is in the correct way round. Rotation will only be difficult if something is incorrect and the fault must be found. Dirt on the back of a bearing shell is sometimes the cause of a tight main bearing.

1 If a new crankshaft is being fitted to automatic transmission models, the needle roller bearing supplied and fitted by the manufacturer will need to be removed from its



30.5 Fitting main bearing caps



30.9 Fitting crankshaft rear oil seal and flange

10 Lubricate the front of the crankshaft and fit the front oil seal and flange with a new gasket. Tighten the bolts to the correct torque.

31 Intermediate shaft - refitting



Lubricate the intermediate shaft with clean engine oil then install it in the block.

Fit the O-ring and flange, together with the oil seal, then tighten the bolts. Note that the oil hole must be at the bottom of the flange.

32 Pistons and connecting rods - refitting



Proceed as described in Section 30, Part A of this Chapter, paragraphs 2 to 7 inclusive. When refitting the big-end nuts, oil the threads.

On completion, check the endfloat of each connecting rod in a similar manner to that described for checking the crankshaft endfloat.

33 Valve clearances - checking and adjustment (pre August 1985)



1 If a new or reconditioned cylinder head, complete with camshaft, is being fitted, then the valve clearances will have been preset.

2 Valve clearances can be checked and adjusted with the cylinder head removed (prior to refitting after overhaul) or in the normal manner described in Section 12 of Chapter 1.

3 There are two specified valve clearance settings, these being for a cold (cylinder head removed) or warm (engine in vehicle) engine condition.

4 If valve adjustment is made with the engine cold, then it must be checked again with the engine at normal operating temperature (ie. coolant above 35°C). If the cylinder head has been overhauled, then it should be checked again, hot, after 600 miles (900 km).

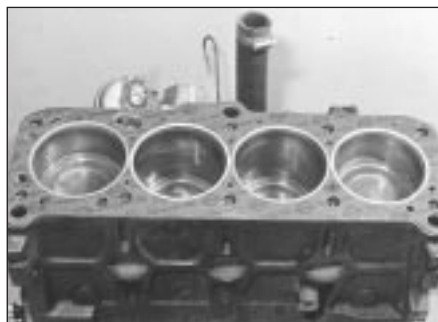
34 Cylinder head - refitting



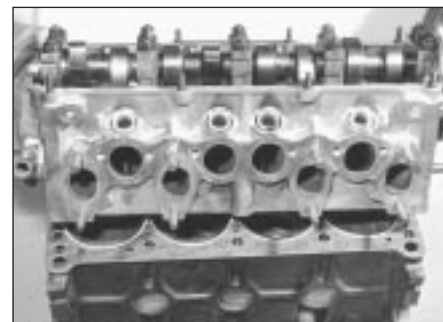
Note: New cylinder head retaining bolts must be used on refitting

1 Clean the top face of the block. Clean and inspect the bores and lubricate them with clean engine oil. Turn the crankshaft so that the pistons are in the mid-cylinder position.

2 The engine number is stamped on an inclined surface between No. 3 and No. 4 cylinders on the side above the distributor.



34.2 Cylinder head gasket located on block



34.3a Lowering cylinder head onto block

Using this as a datum, install a new cylinder head gasket so that the word 'OBEN' on the gasket is over this datum point and on the top side of the gasket (**see illustration**).

3 Lower the cylinder head into position, locating onto the centring pins where fitted (**see illustration**). If the cylinder block does not have centring pins, initially refit new No. 8 and No. 10 cylinder head bolts. Do not use jointing compound. Check that the gasket is seating correctly and fit the remainder of the new bolts. Following the sequence shown, tighten the bolts until the head is firmly held. Using a torque wrench, tighten the bolts in stages to the specified torque following the same sequence (**see illustration**).

4 The cylinder head will not need further tightening.

35 Timing belt and sprockets - refitting



1 Fit the Woodruff key into its groove in the intermediate shaft then refit the sprocket to the front of the shaft. Locate the spacer washer onto the bolt then fit and tighten the bolt to the specified torque wrench setting. Hold the sprocket stationary when tightening by inserting a screwdriver through one of its holes and jamming it against the cylinder block.

2 Locate the Woodruff key (if applicable) to the groove at the front of the crankshaft then

refit the timing belt sprocket onto the shaft. Lubricate the retaining bolt with oil, locate the spacer washer onto the bolt then fit and tighten it to the specified torque wrench setting. When tightening the bolt, prevent the crankshaft from turning by using the same method as that for its removal.

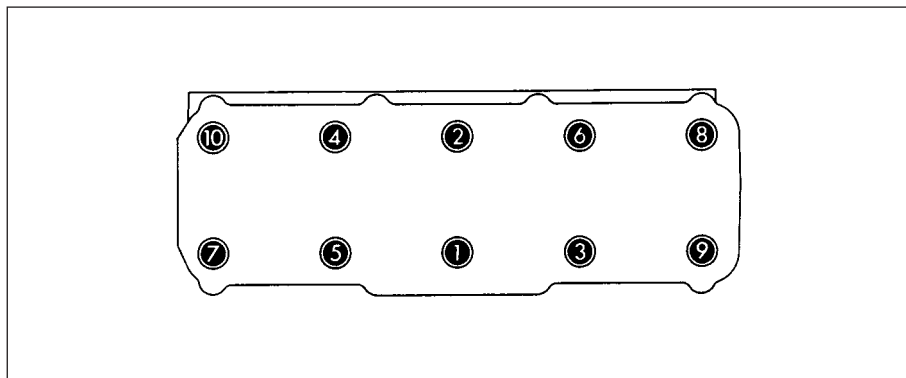
3 Locate the Woodruff key into its groove on the front of the camshaft then refit the camshaft sprocket. Refit the retaining bolt together with the spacer washer and tighten to the specified torque wrench setting. Hold the sprocket stationary when tightening by inserting a screwdriver through one of its holes and jamming it against the cylinder block or head.

4 If removed, refit the timing belt rear cover. Apply locking compound to the stud thread.

5 Locate the crankshaft pulley onto the sprocket (aligning the marks made previously) using one bolt to secure it temporarily.

6 Turn the camshaft sprocket so that the lobes of No. 1 cylinder cams are pointing upwards and the mark on the camshaft sprocket is aligned with the valve cover - **see illustration 9.7a**.

7 Rotate the crankshaft sprocket and the intermediate shaft sprocket until the dot on the intermediate sprocket and the mark on the V-belt pulley coincide. Install the timing belt tensioner loosely and then the timing belt. Making sure the marks are still in place, put a spanner on the adjuster and tighten the belt until it will twist only 90 degrees when held between the finger and thumb halfway



34.3b Cylinder head bolt tightening sequence

between the camshaft and intermediate shaft sprockets. Tighten the eccentric adjuster nut to the specified torque - **see illustration 9.8.**

8 Unbolt and remove the crankshaft V-belt pulley.

9 Fit the lower timing cover then refit the crankshaft V-belt pulley and tighten its retaining bolts to the specified torque.

10 Locate the new valve cover gasket on the cylinder head, the seal to the No. 1 camshaft bearing cap and the half round grommet into its location at the rear end of the cylinder head.

11 Fit the valve cover into position, locate the reinforcement strips then refit and tighten the retaining nuts evenly to the specified torque.

12 Refit the upper timing belt cover.

36 Engine ancillary components - refitting



1 On automatic transmission models, refit the driveplate together with any shims originally located between the crankshaft and the plate. Fit the washer on the transmission side of the driveplate, ensuring that the chamfered side of the washer faces towards the driveplate. Use new bolts and tighten them to the specified torque setting then using vernier calipers, check the distance between the driveplate and the cylinder block as shown (**see illustration**) at three positions. If the clearance is not between 30.5 and 32.1 mm, remove the driveplate, fit shims of suitable thickness between the driveplate and the crankshaft, then refit the driveplate assembly and recheck the clearance. If the engine is a new or reconditioned short block replacement, check that the bore in the rear end does not contain a needle roller bearing. If it does, then remove the bearing as this is for manual gearbox models only.

2 On manual gearbox models, refit the clutch together with the intermediate plate.

3 Refit the inlet and exhaust manifolds.

4 Refit the coolant pump and all hoses to the engine.

5 Refit the alternator and drivebelt.

6 Refit the oil pressure switch to the cylinder head or filter mounting as applicable, using a new washer or O-ring. Tighten to the specified torque.

7 Fit the oil filter mounting to the cylinder block, together with a new gasket and tighten the bolts. On models fitted with an oil cooler, refit the supply and return hoses to their correct unions.

8 Fit the oil filter.

9 Refit the distributor.

10 On carburettor models, refit the fuel pump.

11 On fuel injection models, refit the warm-up valve (if the hoses were disconnected).

12 Refit the coolant temperature sender unit and the thermotime switch with new O-rings.

13 Refit the spark plugs, if not already done.

14 Refit the gearbox/transmission to the engine.

37 Engine - refitting



To refit the engine/transmission, reverse the removal procedures but note the following:

- a) When lowering the unit into the engine compartment, align the driveshafts with the flanges prior to attaching the respective mountings
- b) Assemble the engine mountings loosely initially and tighten them only after the unit is central without straining the mountings
- c) Adjust the clutch cable (manual gearbox)
- d) Adjust the throttle and selector cables (automatic transmission)
- e) Reconnect and adjust the gear selector linkages (manual gearbox)
- f) Adjust the throttle and choke cables
- g) Refill the cooling system
- h) Refill the engine with the correct grade and quantity of oil
- i) Where necessary, retension the power steering pump drivebelt and replenish the system fluid

38 Hydraulic bucket tappets - checking free travel (from August 1985)



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.

7 Press the tappet down using a wooden or plastic wedge.

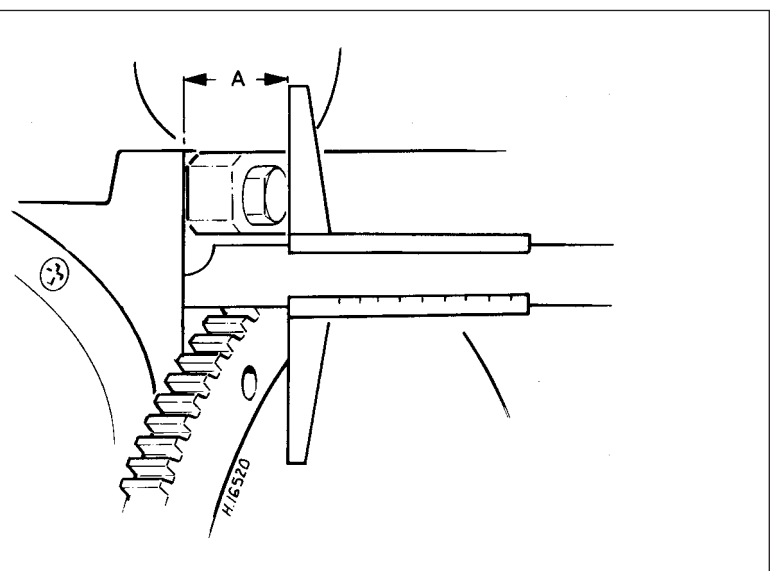
8 If free travel of the tappet exceeds that specified, the tappet must be renewed.

39 Engine - adjustments after major overhaul



Refer to Section 41 in Part A of this Chapter.

If new hydraulic bucket tappets have been fitted, 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.



36.1 Checking driveplate-to-cylinder block dimension (A) using vernier calipers

