

Chapter 2

Engine repair procedures

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Degrees of difficulty

Easy, suitable for
novices with little
experience



Fairly easy, suitable
for beginners with
some experience



Fairly difficult,
suitable for competent
DIY mechanics



Difficult, suitable for
experienced DIY
mechanics



Very difficult,
suitable for expert DIY
or professional



Specifications

General

Type	Four cylinder, in-line, four-stroke, overhead camshaft, compression-ignition, mounted transversely and inclined 30° to rear. Transmission mounted on left-hand end of engine.
Codes	
Yes, BX and C10	910 7 - 1074
BX Turbo	910 7T01 - A66
BX non-Turbo	910 9 - 10705 or 1068 - XU5 BAU
Engine size	
XU5 7	1700 cc
XU5 9	1995 cc
Number of cylinders	4
Bore and stroke	
XU5 7 and XU5 7T0	85.0 x 88.0 mm
XU5 9 and XU5 BAU	85.0 x 88.0 mm
Compression ratio	
XU5 7	10.5 : 1
XU5 7T0	10.5 : 1
XU5 9	10.5 : 1
XU5 BAU	10.5 : 1
Compression pressure (engine hot, cranking speed)	
Minimum	18 bar
Normal	25 to 30 bar
Maximum difference between any two cylinders	5 bar
Maximum torque (BDC)	
XU5 7	11.0 Nm at 2700 rpm
XU5 7T0	18.0 Nm at 2700 rpm
XU5 9	11.8 Nm at 2600 rpm
XU5 BAU	12.0 Nm at 2600 rpm
Maximum power (BDC)	
XU5 7	45.5 kW at 4000 rpm
XU5 7T0	66.0 kW at 4300 rpm
XU5 9	47.0 kW at 4000 rpm
XU5 BAU	51.0 kW at 4000 rpm

Maximum speed:	
Except XJD 77E models:	
No load	5150 rpm
Loaded	4600 rpm
XJD 77E models:	
No-load	4800 rpm
Loaded	4200 rpm
Timing order	1-3-4-2 (No 1 at flywheel end)

Cylinder block

Cylinder bore diameter:	
XJD 7 and XJD 77E	80.000 to 80.018 mm
	or
XJD 9 and XJD 9A	83.000 to 83.018 mm
	or
	83.000 to 83.040 mm

Pistons and piston rings

Piston diameter:	
XJD 7 and XJD 77E	79.93 ± 0.008 mm
	or
	79.98 ± 0.008 mm
XJD 9 and XJD 9A	82.930 ± 0.008 mm
	or
	82.980 ± 0.008 mm

Piston ring end gaps (fitted)

Top compression	0.20 to 0.40 mm
2nd compression	0.15 to 0.35 mm
Oil scraper	0.10 to 0.30 mm
Connecting rod small end bush inner diameter	25.907 to 25.920 mm
Maximum weight difference between any two pistons	2.5 g
Maximum piston protrusion difference between any two pistons	0.12 mm

Crankshaft

Endfloat	0.07 to 0.32 mm
Maximum journal/crankpin out-of-round	0.007 mm

Cylinder head

Warp limit	0.07 mm subject to crankshaft turning freely
Perforating limit (see text)	0.40 mm
Swirl chamber protrusion	0 to 0.03 mm

Valves

Seat angle (included):	
Except XJD 77E models:	
Inlet	120°
Exhaust	90°
XJD 77E models:	
Inlet and exhaust	90°
Valve recess below cylinder head:	
Inlet	0.50 to 1.05 mm
Exhaust	0.50 to 1.45 mm

Valve clearances (cold):

XJD 7 181-A	Inlet	0.10 to 0.25 mm	Exhaust	0.25 to 0.40 mm
XJD 9 190 and XJD 9 192		0.15 to 0.25 mm		0.35 to 0.45 mm
XJD 7 18A		0.15 ± 0.08 mm		0.30 ± 0.08 mm

Valve timing:

XJD 7 models (at 1.0 mm clearance):	
Inlet opens	8° BTDC
Inlet closes	48° ABDC
Exhaust opens	58° BBDC
Exhaust closes	12° ATDC
XJD 77E models (at 0.8 mm clearance):	
Inlet opens	4° 30' BTDC
Inlet closes	28° ABDC
Exhaust opens	38° BBDC
Exhaust closes	4° ATDC
XJD 9A models (at 0.8 mm clearance):	
Inlet opens	4° BTDC
Inlet closes	33° ABDC
Exhaust opens	43° BBDC
Exhaust closes	0° (TDC)

Camshaft

Endfloat	0.07 to 0.16 mm
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Lubrication system**Oil pressure**

Except XJ60 718 models (at engine temperature of 80°C/176°F)

Minimum	2.0 bar at 800 rpm
Maximum	3.5 to 3.0 bar at 4000 rpm
XJ60 718 models (at 80°C/176°F)	3.4 bar at 2000 rpm

Oil pressure switch—operating pressure:

On	0.58 to 0.64 bar
Off	0.8 bar maximum

Oil pump

Type	Two gear
Pressure relief valve opens	4.0 bar
Clearance between gear faces and housing	0.12 mm
Clearance between gear faces and housing	0.026 mm

Torque wrench settings

	Nm	lbf ft
Big end bearing cap	50	37
Camshaft bearing cap	18	13
Camshaft sprocket	35	26
Camshaft pulley bolt:		
Stage 1	40	30
Stage 2	plus 60° or to 150	plus 60° or to 110

Cylinder head bolts:**Pre-September 1988:**

Stage 1	30	22
Stage 2	60	44
Stage 3 Loosen 1/4 turn then	60	44
Stage 4 (after 10 mins at 2000 rpm, Loosen 1/4 turn)	70	52

From September 1988 (as per the text):

Stage 1	30	22
Stage 2	70	52
Stage 3	Angle tighten a further 120°	

Engine mounting, left hand:

Covers nut	26	20
Bowl nuts	18	13
Covers stud to transmission	58	43
Engine mounting bracket, right-hand lower	18	13

Engine mounting bracket, right-hand upper:

To engine	35	26
To mounting rubber	28	21

Flywheel/beltplate:

Front housing	55	41
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Injection pump bracket	28	21
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Lower belt mounting	35	26
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Main bearing cap	70	52
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Oil cooler	66	50
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Oil gallery plug	28	21
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Oil pressure switch	28	21
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Oil pump cover	6	4
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Oil pump mounting	13	10
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Pump pulley to camshaft	28	21
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Ramp	18	13
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Ramp oil drain bracket	0	0.0
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Timing belt intermediate roller	18	13
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Timing belt tensioner	18	13
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Timing cover, lower	12	9
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Valve cover	2	1.5
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1 Description - general

The engine is of four-cylinder overhead camshaft design, mounted transversely and inclined 30° to the rear, with the transmission mounted on the left-hand side. Both the block and the cylinder head are of cast iron.

A toothed timing belt drives the camshaft, injection pump and water pump. Bucket tappets are fitted between the camshaft and valves, and valve clearance adjustment is by means of shims/screws.

The camshaft is supported by three bearings machined directly in the cylinder head.

The crankshaft runs in five main bearings of the usual shell type. Inboard is controlled by thrustwashers either side of No 2 main bearing.

The pistons are selected to be of matching weight, and incorporate fully floating gudgeon pins retained by circlips.

The oil pump is chain driven from the front of the crankshaft. An oil cooler is fitted to the 1.8 engine.

During 1985, a 1700 cc Turbo diesel (the X25 TTE) was introduced to the 50 range of models.

2 Compression and leakdown test - description and interpretation

Note: A compression tester specifically designed for diesel engines must be used for this test.

Compression test

Description

1 When engine performance is down, or if rattling occurs which cannot be attributed to the injection or fuel systems, a compression test can provide diagnostic clues as to the engine's condition. If the test is performed regularly, it can give warning of trouble before any other symptoms become apparent.

2 A compression tester specifically intended

for diesel engines must be used, because of the higher pressures this type of engine produces. The tester is connected to an adapter that screws into the glow plug or injector top. It is unlikely to be worthwhile buying such a tester for occasional use, but it may be possible to borrow or hire one. If not, have the test performed by a garage, or dealer.

3 Unless specific instructions to the contrary are supplied with the tester, observe the following points:

- The battery must be in a good state of charge, the air filter must be clean, and the engine must be at normal operating temperature.
- All the injectors or glow plugs should be removed before starting the test. If removing the injectors, also remove the air shaft washers, otherwise they may be damaged.
- The stop control must be disconnected, to prevent the engine from running or fuel from being discharged.
- There is no need to hold the accelerator pedal down during the test, because the diesel engine will not start.
- The actual compression pressure measured are not as important as the balance between cylinders. Values are given in the Specifications.
- The cause of poor compression is less easy to establish on a diesel engine than a petrol driven one. The effect of introducing air into the cylinders (over heating) is not conclusive, because there is a risk that all the air in the test chamber or in the recess on the piston crown instead of passing to the rings. However, the following can be used as a rough guide to diagnosis.

Interpretation

7 All cylinders should produce very similar pressures. Any difference greater than that specified indicates the existence of a fault. Note that the compression should build up quickly in a healthy engine. Low compression on the first stroke, followed by gradually increasing pressure on successive strokes, indicates worn piston rings. A low compression reading on the first stroke, which does not build up during successive strokes,

indicates leaking valves or a blown head gasket (a cracked head could also be the cause). Deposits on the undersides of the valve heads can also cause low compression.

8 A low reading from two adjacent cylinders is almost certainly due to the head gasket being blown between them. The presence of coolant in the engine oil will confirm this.

9 If the compression reading is unusually high, the cylinder head surface, valves and pistons are probably coated with carbon deposits. If this is the case, the cylinder head should be removed and de-carbonated.

Leakdown test

Description

10 A leakdown test measures the rate at which compressed air fed into the cylinder is lost. It is an alternative to a compression test, and in many ways is better, since the escaping air provides easy identification of where pressure loss is occurring (piston rings, valves or head gasket).

11 The equipment needed for leakdown testing is unlikely to be available to the home mechanic. If poor compression is suspected, have the test performed by a suitably equipped garage.

3 Major operations possible with the engine in the vehicle

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

- Timing belt - removal and refitting
- Camshaft - removal and refitting
- Cylinder head - removal and refitting
- Camshaft oil seals - removal
- Crankshaft oil seals - removal
- Pump - removal and refitting
- Oil pump - removal and refitting
- Pistons and connecting rods - removal and refitting
- Flywheel/clutchplate - removal and refitting.

For almost any job involving work on the top of the engine (for example valve clearance adjustment) the intercooler must be removed. This is described in Chapter 4.



4.11 Right-hand engine mounting bracket



4.12a Throttle cover front clip (early models) ...



4.12b ... and spring clips

4 Timing belt - removal, refitting and tensioning

Removal

1 The timing belt drives the camshaft, injection pump, and water pump from a toothed sprocket on the front of the crankshaft. If it breaks, it causes the pistons to float to fill the valve heads and result in an expensive repair.

2 The timing belt should be removed at the intervals specified in Chapter 1. However, if it is contaminated with oil or if it is at all noisy in operation (a "scrapping" noise due to uneven wear) it should be replaced earlier. Where a Bosch injection pump is fitted, excessive play in the front bearing can wear the sides of the timing belt.

3 On V6a models apply the handbrake. On BX models check the rear wheels and release the handbrake, or the handbrake operates on the front wheels.

4 On manual transmission models jack up the front right-hand corner of the vehicle until the wheel is just clear of the ground. Support the vehicle on an axle stand and engage 4th or 5th gear. This will create the engine to be turned easily by turning the right-hand wheel. On automatic transmission models use an open-ended spanner on the crankshaft pulley bolt.

5 Remove the engine splash guard from under the right-hand front wheel arch.

6 Disconnect the battery negative lead.

7 Loosen the alternator pivot and adjustment bolts then unscrew the tension belt until it is possible to slip the divider from the pulleys.

8 With 4th or 5th gear selected on manual transmission models have an assistant depress the fanclutch pedal, then unscrew the crankshaft pulley bolt. On BX models the fanclutch may be applied instead of the fanclutch pedal to hold the crankshaft stationary. On automatic transmission models unfasten the transmission cover and lock the starter ring gear. Note that the belt is extremely tight.

9 Slide the pulley from the front of the crankshaft. Unfasten the bottom timing cover.



Using a metal drift to enter the TDC hole in the flywheel

10 Support the weight of the engine using a hoist or trolley jack.

11 Unscrew the nuts and remove the right-hand engine mounting bracket (see Illustration).

12 Pull up the front clip (early models), release the spring clips, and withdraw the timing cover sections (see Illustrations). Note that the spring clips are not fitted to later models, which have a modified cover and fasteners.

13 Turn the engine by means of the front right-hand wheel or crankshaft pulley bolt until the three belt holes in the camshaft and injection pump sprockets are aligned with the corresponding holes in the engine front plate.

14 Insert an 8.0 mm diameter metal driver rod or drill through the special hole in the left-hand rear flange of the cylinder block by the starter motor. Then carefully turn the engine either way until the rod enters the TDC hole in the flywheel (see Tool Fig).

15 Insert three 100 bolts through the holes in the camshaft and injection pump sprockets and screw them into the engine front plate finger tight (see Illustration).

16 Loosen the timing belt tensioner pivot nut and adjustment bolt, then turn the bracket anti-clockwise to release the tension and refasten the adjustment bolt to hold the tensioner in the relaxed position. It is vital to use a 1/2-inch-square drive extension in its hole provided to turn the bracket against the spring tension.

17 Mark the timing belt with an arrow to indicate its normal direction of turning then



4.10 Holding camshaft and injection pump sprockets in position using 100 bolts

- 9. 10 and 11 A80 bolts
- 10. Tensioner pivot nut
- 11. Tensioner adjustment bolt

remove it from the camshaft, injection pump, water pump and crankshaft sprockets.

Refitting

18 Inspect the belt for cracks, fraying, and damage to the teeth. Pay particular attention to the roots of the teeth. If any damage is evident or if the belt is contaminated with oil it must be replaced and any oil be removed.

19 Begin refitting by locating the timing belt on the crankshaft sprocket, making sure that, where applicable, the rubber arrow is facing the correct way.

20 Hold the timing belt engaged with the crankshaft sprocket then feed it over the other and onto the injection pump, camshaft, and water pump sprockets and over the tensioner roller. To ensure correct engagement, locate only a few teeth on the injection pump sprocket before feeding the timing belt onto the camshaft sprocket leaving the belt not yet fully engaged with the crankshaft



4.18A Fitting the timing belt over the injection pump sprocket . . .



4.18B . . . the camshaft sprocket . . .



4.18C . . . and the water pump sprocket

sprocket. Locate the timing belt fully onto the sprockets (see *Illustration 1*).

Tensioning

21 With the pivot nut loose, slacken the tensioner adjustment bolt while holding the bracket against the spring tension. Slowly release the bracket until the roller presses against the timing belt. Retighten the adjustment bolt.

22 Remove the bolts from the camshaft and injection pump sprockets. Remove the metal cover nut from the cylinder block.

23 Rotate the engine two complete turns in its normal direction. Do not rotate the engine backwards as the timing belt must be kept tight between the crankshaft, injection pump and camshaft sprockets.

24 Loosen the tensioner adjustment bolt to allow the tensioner spring to push the roller against the timing belt, then tighten both the adjustment bolt and pivot nut.

25 Recheck the engine timing as described in paragraphs 13 and 14 then remove the metal cover nut.

26 Refit the three timing cover sections and secure with the special clip and spring clip.

27 Refit the right-hand engine mounting bracket and tighten the nuts.

28 Remove the relay lock or hole.

29 Slide the pulley onto the front of the crankshaft.

30 Apply three drops of locking fluid on the threads of the crankshaft pulley bolt then insert it and tighten to the specified torque while holding the crankshaft stationary using the method described in paragraph 6.

31 Refit the alternator drivebelt and tension it as described in Chapter 7.

32 Reconnect the battery negative lead.



5.12 Battery support bracket, also showing left-hand engine transmission mounting



5.13 C-clamp tool 7008-T1 for holding the tensioner plunger

33 Refit the engine splash-guard under the right-hand front wheel arch.

34 Lower the vehicle to the ground.

5 Timing belt tensioner - removal and refitting

Removal

1 On 500 models apply the handbrake. On 501 models chock the rear wheels and release the handbrake.

2 On manual transmission models jack up the front right-hand corner of the vehicle until the wheel is just clear of the ground. Support the vehicle on an axle stand and engage 4th or 5th gear so that the engine may be rotated by turning the right-hand wheel. On automatic transmission models use an open-ended spanner on the crankshaft pulley bolt.

3 Support the weight of the engine using a hoist or trolleyjack.

4 Uncover the nuts and remove the right-hand engine mounting bracket.

500 models

5 Remove the battery and the tray, then unbolt the support bracket (see *Illustration*).

6 Uncover the nut from the left-hand engine mounting and remove the rubber mounting.

7 Move the engine and transmission to the left as far as possible and support it in the position.

All models

8 Put up the special clip, release the spring clip and withdraw the two timing cover sections.

9 Turn the engine by means of the front right-hand wheel or crankshaft pulley bolt until the three belt holes in the camshaft and injection pump sprockets are aligned with the corresponding holes in the engine front plate.

10 Insert an 8.8 mm diameter metal screw rod or drill through the special hole in the left-hand rear flange of the cylinder block by the starter motor. Then carefully turn the engine either way until the rod enters the TDC hole in the flywheel.

11 Insert three M8 bolts through the holes in the camshaft and injection pump sprockets and screw them into the engine front plate finger-tight.

12 Loosen the timing belt tensioner pivot nut and adjustment bolt, then turn the bracket and clockwise until the adjustment bolt is in the middle of the slot and retighten the bolt. If available use a 3 inch square drive extension in the bolt provided to turn the bracket against the spring tension.

13 A tool must now be obtained to hold the tensioner plunger in the mounting bracket. Citroën tool 7008-T1 (see *Illustration*) is designed to slide in the two lower belt holes of the mounting bracket and it should be quite easy to fabricate a similar tool out of sheet metal using long bolts instead of metal screw rods.

14 Uncover the two lower bolts then fit the

special tool. Grease the inner surface of the tool to prevent any damage to the end of the tensioner plunger.

15 Uncover the pivot nut and adjustment bolt and withdraw the tensioner bracket, complete with roller.

16 Unbolt the engine mounting bracket noting that the uppermost bolt is on the inside face of the engine front plate.

17 Compress the tensioner plunger into the mounting bracket, remove the special tool then withdraw the plunger and spring.

Refitting

18 Refitting is a reversal of removal, but refer to Section 4, paragraphs 21 to 25 for details of the timing belt adjustment procedure.

5 Timing belt intermediate roller - removal and refitting

Removal

1 Follow the procedure given in paragraphs 1 to 12 of Section 5.

2 Remove the engine splash-guard from under the right-hand front wheel arch.

3 Disconnect the battery negative lead on 501 models.

4 Loosen the alternator pivot and adjustment bolts then uncover the tension bolt until it is possible to slip the drivebelt from the pulleys.

5 With 4th or 5th gear selected on manual transmission models have an assistant depress the footbrake pedal, then uncover the crankshaft pulley bolt. On 501 models the handbrake may be applied instead of the footbrake pedal to hold the crankshaft stationary. On automatic transmission models unbolt the transmission cover and lock the starter ring gear.

6 Slide the pulley from the front of the crankshaft.

7 Unbolt the lower timing cover.

8 Remove the spacer from the stud for the upper timing cover sections. Note the position of the stud then uncover and remove it.

9 Uncover the remaining bolts securing the intermediate roller bracket to the cylinder block, noting that the upper bolt also secures the engine mounting bracket.

10 Slightly loosen the remaining engine mounting bracket bolts then slide out the intermediate roller and bracket.

11 Unbolt the lower timing cover.

12 Remove the spacer from the stud for the upper timing cover sections. Note the position of the stud then uncover and remove it.

13 Uncover the remaining bolts securing the intermediate roller bracket to the cylinder block, noting that the upper bolt also secures the engine mounting bracket.

14 Slightly loosen the remaining engine mounting bracket bolts then slide out the intermediate roller and bracket.

15 Unbolt the lower timing cover.

16 Remove the spacer from the stud for the upper timing cover sections. Note the position of the stud then uncover and remove it.

17 Uncover the remaining bolts securing the intermediate roller bracket to the cylinder block, noting that the upper bolt also secures the engine mounting bracket.

18 Slightly loosen the remaining engine mounting bracket bolts then slide out the intermediate roller and bracket.

19 Unbolt the lower timing cover.

20 Remove the spacer from the stud for the upper timing cover sections. Note the position of the stud then uncover and remove it.

21 Uncover the remaining bolts securing the intermediate roller bracket to the cylinder block, noting that the upper bolt also secures the engine mounting bracket.

22 Slightly loosen the remaining engine mounting bracket bolts then slide out the intermediate roller and bracket.

23 Unbolt the lower timing cover.



7.7 Disconnect carburetor hose (1.8 engine)



7.8a. Unbolt the valve cover ...



7.8b ...and remove the gasket



7.8A Special log (provided) for holding the camshaft



7.8B Removing the camshaft sprocket



7.9 Using a puller to remove the pump plunger from the camshaft



7.10 The 2037 marking must line up at the timing belt end



7.10A Fitting a camshaft and bearing cap



7.10B Areas on camshaft and bearing cap to apply sealing compound

7 Camshaft - removal and refitting



Removal

- 1 Follow the procedure given in paragraphs 1 to 12 of Section 2.
- 2 Remove the timing belt from the camshaft sprocket and be fit to one side without bending it excessively.
- 3 Unscrew the M8 bolt holding the camshaft sprocket to the timing pulley.
- 4 Where applicable, remove the oil filler cap/breather from the valve cover and position it to one side.
- 5 On BX models disconnect the battery negative lead and disconnect the air inlet hose from the inlet manifold and air cleaner.

- 6 Loosen the pivot and adjustment bolts of the hydraulic high pressure pump (BX models), or vacuum pump (V6a models), until the unit upwards, and disconnect the gasket from the pulley.

7 On the 1.8 engine, disconnect the carburetor ventilation hose from the valve cover (see *Illustration*).

- 8 Unbolt and remove the valve cover. Remove the gasket (see *Illustrations*).

9 Hold the camshaft stationary with a spanner on the special log between the 3rd and 4th cams or by using a lever in the sprocket holes then unscrew the camshaft sprocket bolt and withdraw the spanner (see *Illustrations*). Remove the Woodruff key if it is loose. Do not rotate the camshaft otherwise the valves will strike the pistons of cylinders 1 and 4. If necessary turn the engine one quarter turn to position all the pistons halfway

down the cylinders to prevent any damage. However, release the timing belt from the injection pump/sprocket first.

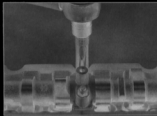
10 Mark the position of the camshaft bearing caps numbering them from the flywheel and animating the marks on the manifold side.

11 Progressively unscrew the nuts then remove the bearing caps.

12 Lift the camshaft and withdraw it through the front engine plate. Remove the oil seal from the timing end of the camshaft.

13 Hold the camshaft stationary with a spanner on the special log between the 3rd and 4th cams, then unscrew the bolt and remove the pump plunger from the flywheel end of the camshaft. Use a puller if it is tight (see *Illustration*). Recover the Woodruff key if it is loose.

14 Remove the oil seal from the flywheel end of the camshaft.



7.20A Tightening the camshaft bearing cap nuts

15 Clean all the components including the bearing surfaces in the cylinder head. Examine the components carefully for wear and damage, in particular check the surface of the cams for scoring and pitting. Renew components as necessary and obtain new oil seals.

Refitting

16 Begin reassembly by lubricating the cams and bearing journals with engine oil.

17 Locate the camshaft on the cylinder head, passing it through the engine front plate and with the tips of cams 4 and 6 facing downwards and resting on the bucket tappets. The cast DIST marking on the camshaft should be at the timing belt end of the cylinder head (see illustration) and the key slot for the camshaft sprocket should be facing upwards.

18 Fit the centre bearing cap the correct way round as previously noted then screw on the nuts and tighten them two or three turns.

19 Apply sealing compound to the end bearing caps on the areas as shown. Fit them in the correct positions and tighten the nuts two or three turns (see illustrations).

20 Tighten all the nuts progressively to the specified torque making sure that cams 4 and 6 remain facing downwards (see illustration). Check that the camshaft endfloat is as given in the Specifications using feeler blades (see illustration). The only answer if it is not correct is to renew the cylinder head.

21 If the original camshaft is being refitted and it is known that the valve clearances are correct, go on to paragraph 22, otherwise check and adjust the valve clearances as described in Section 8. Note that as the timing belt is disconnected at this stage, the crankshaft must be turned one quarter turn either way from the TDC position so that all the pistons are halfway down the cylinders. This will prevent the valves striking the pistons when the camshaft is rotated. Release the timing belt from the injection pump sprocket while turning the engine as the timing bolts are still in position.

22 Smear the lips of the oil seals with oil then fit them over each end of the camshaft, open end first, and press them in until flush with the end faces of the end caps. Use an M10 bolt,



7.20B Checking the camshaft endfloat

washers and a socket to press in the oil seals (See Haynes Hint).

23 Fit the Woodruff key and pump pulley to the flywheel end of the camshaft, insert the bolt and tighten it while holding the camshaft stationary.

24 Fit the Woodruff key and camshaft sprocket to the timing end of the camshaft. Apply locking fluid to the threads then insert the bolt and tighten it to the specified torque while holding the camshaft stationary.

25 Refit the valve cover, together with a new gasket, and tighten the bolts.

26 Refit the crankcase ventilation hose.

27 Locate the drivebelt on the camshaft pulley and hydraulic pump (BX models), or vacuum pump pulley (Visa models). Press the pump downwards until the deflection of the belt midway between the two pulleys is approximately 5.0 mm under firm thumb pressure. Tighten the adjustment bolt followed by the pivot bolt.

28 On BX models reconnect the battery negative lead and the air inlet hose.

29 Refit the oil filler cap/breather.

30 Align the holes and refit the MB timing bolt to the camshaft sprocket.

31 If the crankshaft was turned a quarter turn from TDC as in paragraphs 9 and 21, turn the crankshaft back the quarter turn so that pistons 1 and 4 are again at TDC. Do not turn the engine more than a quarter turn otherwise pistons 2 and 3 will pass their TDC positions and will strike valves 4 and 6.

32 Refit the TDC dowel rod to the flywheel.

33 Refit and adjust the timing belt, referring to Section 4, paragraphs 20 to 25. The remaining procedure is a reversal of removal.

8 Valve clearances - checking and adjustment

Checking

1 On Visa models apply the handbrake. On BX models check the rear wheels and release the handbrake.

2 On manual transmission models jack up the front right-hand corner of the vehicle until the wheel is just clear of the ground. Support the vehicle on an axle stand and engage 4th or



Using a socket and bolt to fit a camshaft oil seal

5th gear so that the engine may be rotated by turning the right-hand wheel. On automatic transmission models use an open-ended spanner on the crankshaft pulley bolt.

3 Disconnect the battery negative lead.

4 Remove the oil filler cap/breather and position it to one side.

5 On BX models disconnect the air inlet hose from the inlet manifold and air cleaner.

6 Disconnect the crankcase ventilation hose from the valve cover.

7 Unbolt and remove the valve cover. Remove the gasket.

8 On a piece of paper draw the outline of the engine with the cylinders numbered from the flywheel end and also showing the position of each valve, together with the specified valve clearance. Above each valve draw two lines for noting (1) the actual clearance and (2) the amount of adjustment required.

9 Turn the engine until the inlet valve of No 1 cylinder (nearest the flywheel) is fully closed and the apex of the cam is facing directly away from the bucket tappet.

10 Using feeler blades measure the clearance between the base of the cam and the bucket tappet (see illustration). Record the clearance on line (1).

11 Repeat the measurement for the other seven valves, turning the engine as necessary so that the cam lobe in question is always facing directly away from the particular bucket tappet.

12 Calculate the difference between each measured clearance and the desired value and record it on line (2). Since the clearance is different for inlet and exhaust valves make sure that you are aware which valve you are dealing with. The valve sequence from either end of the engine is:

Inlet - Exhaust - Exhaust - Inlet - Inlet - Exhaust - Exhaust - Inlet

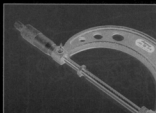
13 If all the clearances are within tolerance, refit the valve cover using a new gasket if necessary. If any clearance measured is outside the specified tolerance, adjustment must be carried out as described below.

Adjustment

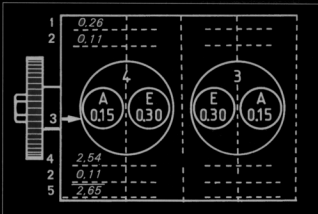
14 Remove the camshaft as described in Section 7.



8.10 Checking the valve clearances with feeler blades



8.15 Checking the shim thickness with a micrometer



8.17 Example of valve shim thickness calculation
A Inlet E Exhaust

15 Withdraw the first bucket tappet and its shim. Be careful that the shim does not fall out of the tappet. Clean the shim and measure its thickness with a micrometer (see illustration).

16 Refer to the clearance recorded for the valve concerned. If the clearance was more than the amount required the shim thickness must be increased by the difference recorded (2), if too small the thickness must be decreased.

17 Draw three more lines beneath each valve on the calculation paper as shown (see illustration). On line (4) note the measured thickness of the shim then add or deduct the difference from line (2) to give the final shim thickness required on line (5).

18 Shims are available in thicknesses between 2.225 mm and 3.025 mm in steps of 0.025 mm, and between 3.100 mm and 3.550 mm in steps of 0.075 mm. Clean new shims before measuring or fitting them.

19 Repeat the procedure given in paragraphs 15 to 17 on the remaining valves keeping each tappet identified for position.

20 When reassembling, oil the shim and fit it

on the valve stem first with the size marking facing downwards then oil the bucket tappet and lower it onto the shim. Do not raise the tappet after fitting as the shim may become dislodged.

21 When all the tappets are in position with their shims, refit the camshaft referring to Section 7, but recheck the clearances to make sure they are correct.

9 Cylinder head - removal and* refitting

Removal

1 On Visa models apply the handbrake. On BX models chock the rear wheels and release the handbrake.

2 On manual transmission models jack up the front right-hand corner of the vehicle until the wheel is just clear of the ground. Support the vehicle on an axle stand and engage 4th or 5th gear so that the engine may be rotated by

turning the right-hand wheel. On automatic transmission models use an open-ended spanner on the crankshaft pulley bolt.

3 Drain the cooling system as described in Chapter 1.

4 Disconnect the battery negative lead.

5 Remove the air cleaner as described in Chapter 4. On turbo models, remove the intercooler, as described in Chapter 4.

6 Support the weight of the engine using a hoist or trolley jack.

7 Unscrew the nuts and remove the right-hand engine mounting bracket.

8 Pull up the special clip, release the spring clips and withdraw the two timing cover sections.

9 Turn the engine by means of the front right-hand wheel or crankshaft pulley bolt until the three bolt holes in the camshaft and injection pump sprockets are aligned with the corresponding holes in the engine front plate.

10 Insert an 8.0 mm diameter metal dowel rod or a drill through the special hole in the left-hand rear flange of the cylinder block by the starter motor. Then carefully turn the engine either way until the rod enters the TDC hole in the flywheel.

11 Insert three M8 bolts through the holes in the camshaft and injection pump sprockets and screw them into the engine front plate finger-tight.

12 Loosen the timing belt tensioner pivot nut and adjustment bolt, then turn the bracket anti-clockwise to release the tension and retighten the pivot nut to hold the tensioner in the released position. If available use a 3/4 inch square drive extension in the hole provided to turn the bracket against the spring tension.

13 Remove the timing belt from the camshaft sprocket and tie it to one side without bending it excessively.

14 Unscrew the M8 bolt holding the camshaft sprocket in the timing position. Also unscrew the tensioner adjustment bolt, and the two upper bolts from the engine mounting bracket.

15 At this stage the right-hand engine mounting bracket may be temporarily refitted and the hoist or trolley jack removed.

16 Disconnect the heater hose from the flywheel end of the cylinder head.

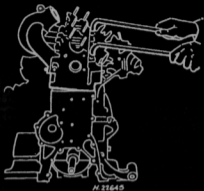
17 Disconnect the two small hoses from the thermostat housing then unbolt the housing from the cylinder head and position it to one side.

18 Remove the oil filler cap/breather and position it to one side. On BX models disconnect the air inlet hose from the inlet manifold.

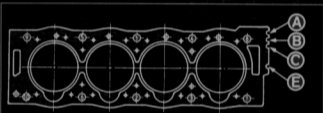
19 If applicable, disconnect the turbo oil feed and return pipes. Refer to Chapter 4, for details.

20 Loosen the pivot and adjustment bolts of the hydraulic high pressure pump (BX models), or vacuum pump (Visa models), swivel the unit upwards, and disconnect the drivebelt from the pulleys.

21 Disconnect the crankcase ventilation hose from the valve cover.



9.30 Releasing the cylinder head using angled dowel rods



9.37 Head gasket thickness identification notches

- $A = 1.49 \text{ mm (0.059 in)}$
 $A + B = 1.61 \text{ mm (0.063 in)}$
 $A + B + C = 1.73 \text{ mm (0.068 in)}$
 $E = 1.7 \text{ engine identification}$

22 Unbolt and remove the valve cover. Remove the gasket.

23 Unscrew the union nuts securing the injection pipes to the injectors and fuel injection pump, and remove the pipes as two assemblies.

24 Unbolt the left-hand engine lifting bracket.

25 Disconnect the wiring from the glow plugs.

26 Disconnect the fuel return pipes from the injection pump.

27 Hold the camshaft stationary with a spanner on the special lug between the 3rd and 4th cams or by using a lever in the sprocket holes, then unscrew the camshaft sprocket bolt and withdraw the sprocket. Recover the Woodruff key if it is loose. Do not rotate the camshaft otherwise the valves will strike the pistons of Nos 1 and 4 cylinders. If necessary release the timing belt from the injection pump sprocket and turn the engine one quarter turn in either direction to position

all the pistons halfway down the cylinders to prevent any damage.

28 Unscrew the exhaust manifold to downpipe bolts. Recover the springs.

29 Progressively unscrew the cylinder head bolts in the reverse order to that shown for tightening (refer to paragraph 41). Remove the washers.

30 Release the cylinder head from the cylinder block and location dowel by rocking it. The Citroën tool for doing this consists simply of two metal dowel rods with 90° angled ends (see illustration).

31 Lift the cylinder head from the block and remove the gasket.

32 Do not dispose of the old gasket until a new one has been obtained. The correct thickness of gasket is determined after measuring the protrusion of the pistons at TDC.



9.34 Checking the piston protrusion

Refitting

33 Clean the gasket faces of the cylinder head and cylinder block, preferably using a soft blunt instrument to prevent damage to the mating surfaces. Clean the threads of the cylinder head bolts and the corresponding holes in the cylinder block.

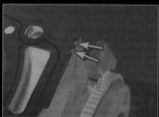
34 Check that the timing belt is clear of the injection pump sprocket, then turn the engine until pistons 1 and 4 are at TDC. Position a dial test indicator on the cylinder block and zero it on the block face. Transfer the probe to the centre of piston 1 then slowly turn the crankshaft back and forth past TDC noting the highest reading on the indicator (see illustration). Record this reading.

35 Repeat this measurement procedure on piston 4 then turn the crankshaft half a turn (180°) and repeat the procedure on pistons 2 and 3.

36 If a dial test indicator is not available, piston protrusion may be measured using a straight-edge and feeler blades or vernier calipers, however, these methods are inevitably less accurate and cannot therefore be recommended.

37 Ascertain the greatest piston protrusion measurement and use this to determine the correct cylinder head gasket from the following chart:

Piston protrusion	Gasket identification
0.54 to 0.65 mm	1 notch or 1 hole
0.65 to 0.77 mm	2 notches or 2 holes
0.77 to 0.82 mm	3 notches or 3 holes



9.39 Cylinder head gasket identification notches (arrowed)



9.41A Cylinder head bolt with spiral grooving on its shank



9.41C Angle-tightening a cylinder head bolt, using a commercially-available angle gauge

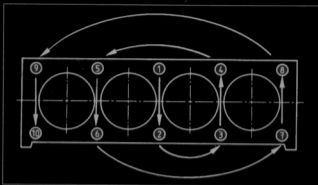


9.70 Retightening the cylinder head bolts

Note that the notch on the centre line of the gasket (see illustration) identifies the gasket for use only on the 1.7 engine (type XJD 7) and has no significance for the gasket thickness. The head gasket for the turbo engine is identified by having two notches on the centre-line.

38 Turn the crankshaft clockwise (viewed from the timing belt end) until pistons 1 and 4 pass bottom dead centre (BDC) and start to rise, then position them halfway up their bores. Pistons 2 and 3 will also be at their mid-way positions, but descending their bores.

39 Fit the correct gasket the right way round on the cylinder block with the identification notches or holes at the flywheel/driveplate end (see illustration). Make sure that the location dowel is in place at the timing end of the block.



9.41B Cylinder head bolt tightening sequence

40 Lower the cylinder head onto the block.

41 Models produced after September 1986 are fitted with revised cylinder head bolts and have a different tightening procedure. The later (angle-tightened) type, bolts can be identified by having a coarse spiral grooving on the upper shank - early-type bolts have a plain shank (see illustration). Grease the threads and contact faces of the cylinder head bolts, then insert them, together with their washers, and tighten them in the sequence shown (see illustration), in stages as given in Specifications. If using the angle tightening method in the final Stage, retightening after warm-up is not necessary (see illustration).

42 Recheck the valve clearances, referring to Section 8 and adjust them as necessary. Do this even if the clearances have been adjusted with the cylinder head removed, as there may be minor differences.

43 Lubricate the exhaust manifold-to-downpipe contact surfaces with heat resistant grease, then reconnect them and fit the bolts, together with the springs, cups and self-locking nuts. On 1.9 engines the bolts incorporate a shoulder to ensure that the springs are compressed correctly. However, on 1.7 engines, tighten the nuts progressively until approximately four threads are visible and the springs are compressed to 22.0 mm in length.

44 Check that the Woodruff key is in place on the camshaft then fit the camshaft sprocket and bolt. Tighten the bolt to the specified torque while holding the camshaft stationary with a spanner on the special lug between the 3rd and 4th cams.

45 Turn the camshaft until the tips of cams 4 and 6 (counting from the flywheel end) are facing downwards.

46 Turn the crankshaft a quarter turn clockwise until pistons 1 and 4 are at TDC, and fit the TDC dowel rod to the flywheel. Do

not turn the crankshaft anti-clockwise otherwise pistons 2 and 3 will pass their TDC positions and will strike valves 4 and 6.

47 Align the hole and refit the MB timing bolt to the camshaft sprocket.

48 Refit the valve cover, together with a new gasket.

49 Apply locking fluid to the threads then refit and tighten the two upper bolts to the right-hand engine mounting bracket. Also refit the tensioner adjustment bolt and tighten it. Loosen the tensioner pivot nut.

50 Refit and adjust the timing belt, referring to Section 4, paragraphs 20 to 25.

51 Reconnect the fuel return pipes to the injection pump.

52 Reconnect the glow plug wiring.

53 Refit the left-hand engine lifting bracket.

54 Refit the injection pipes and tighten the union nuts.

55 Reconnect the crankcase ventilation hose to the valve cover.

56 Locate the drivebelt on the camshaft pulley and hydraulic pump (BX models) or vacuum pump (V6a models) pulley. Press the pump downwards until the deflection of the belt midway between the two pulleys is approximately 5.0 mm under firm thumb pressure. Tighten the adjustment bolt followed by the pivot bolt.

57 On BX models reconnect the air inlet hose to the inlet manifold.

58 Refit the oil filler cap/breather.

59 Clean the thermostat housing mating faces then refit it, together with a new gasket, and tighten the bolts. Refit the two small hoses.

60 Reconnect the heater hose to the cylinder head.

61 Refit the timing cover sections.

62 Refit the right-hand engine mounting bracket and tighten the nuts. Remove the hoist or trolley jack.

63 Refit the air cleaner (Chapter 4).

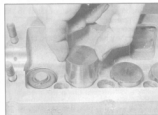
- 64** Reconnect the battery negative lead.
- 65** Refill the cooling system (Chapter 1).
- 66** Lower the vehicle to the ground.
- 67** On Turbo models, after refitting and before initial start-up, prime the turbo lubrication circuit by disconnecting the stop solenoid lead at the fuel pump, and cranking the engine on the starter for three ten-second bursts.
- 68** On pre-September 1986 models carry out the following including paragraphs 69 and 70. Before retightening the head bolts, run the engine at 3000 rpm for 10 minutes then switch off the ignition and let the engine cool for at least 3½ hours.
- 69** Remove the filler cap from the cooling system expansion tank to release any remaining pressure, then refit it.
- 70** Working on each cylinder head bolt in turn in the correct sequence first loosen the bolt 90° then retighten to the final torque given in the Specifications (see illustration).

10 Cylinder head - dismantling, overhaul and reassembly

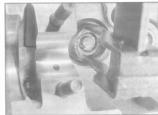


Dismantling

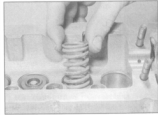
- 1 With the head removed as described in the previous Section remove the camshaft, referring to Section 7.
- 2 Withdraw the bucket tappets, together with their respective shims, keeping them all identified for location (see illustration).



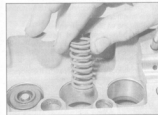
10.2 Removing the bucket tappets



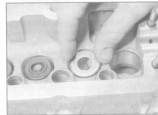
10.6A Depress the retainer with a valve spring compressor and remove the collets, retainer ...



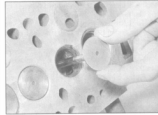
10.6B ... large valve spring ...



10.6C ... small valve spring ...



10.6D ... spring seat ...



10.6E ... and valve

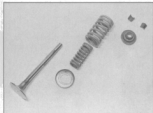
- 3 Disconnect the remaining leak off pipes and unscrew the injectors. Remove the special washers.
- 4 Disconnect the wiring and unscrew the glow plugs.
- 5 Unscrew the nuts and bolts, and remove the inlet and exhaust manifolds from the cylinder head. Remove the exhaust manifold gaskets. The turbocharger, if applicable, may be removed with the manifolds.
- 6 Using a valve spring compressor, depress one valve spring retainer to gain access to the collets. The valves are deeply recessed, so the end of the compressor may need to be extended with a tube or box section with a "window" for access. Remove the collets and release the compressor. Recover the retainer, large and small valve springs, and the spring seat, then withdraw the valve from the cylinder head (see illustrations). Repeat the procedure to remove the other seven valves, keeping each valve and components identified for position. Remove the timing probe blank if necessary.
- 7 Dismantling of the cylinder head is now complete. Refer to Section 11 for decarbonisation procedures.

Overhaul

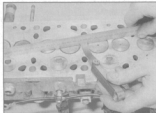
- 8 Clean all the components and examine them for wear. Obtain new gaskets for the cylinder head, manifolds, valve cover and thermostat housing. Inspect the head for cracks or other damage.
- 9 Check the head gasket face for distortion (warp) using a straight-edge and feeler blades

diagonally and along the edge (see illustration). Do not position the straight-edge over the swirl chambers, as they may be proud of the cylinder head face. Distortion more than that specified may be corrected by machining ("skimming") within a specified limit. This is a specialist's job; the valve seats and swirl chambers must also be machined, and washers fitted under the valve springs. A head that cannot be reclaimed by machining, or any head in which the camshaft does not turn freely, must be renewed.

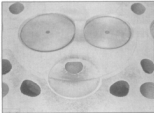
- 10 Inspect the valve seats and swirl chambers for burning or cracks (see illustration). Both can be renewed but the work should be entrusted to a specialist.
- 11 Using a dial test indicator check that the swirl chamber protrusion is within the limits given in the Specifications (see illustrations).
- 12 Check each valve for straightness, freedom from burning or cracks, and for an acceptable fit in its guide. Excessive play in the guide may be caused by wear in either component. Measure the valve stem with a micrometer, or try the fit of a new valve, if available, to establish whether it is the valve or the guide that is worn.
- 13 The valve guides can be renewed, but this is a job for a specialist.
- 14 Minor surface pitting or carbon build-up on the valve heads and seats may be removed by grinding, but if refacing or recutting is required, consideration must be given to the final height of the valve head in relation to the cylinder head surface. A dial test indicator will be required to check that the



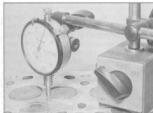
10.6F Valve components



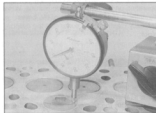
10.9 Checking the head gasket face for distortion



10.10 This swirl chamber shows the initial stages of cracking and burning



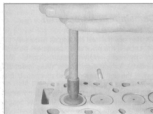
10.11A Zero the dial test indicator ...



10.11B ... then check the swirl chamber protrusion



10.14 Checking the valve head height



10.16 Grinding in the valves

clean away all traces of grinding paste, first with a paraffin-soaked rag then with clean dry rags, finally with compressed air if available. Do not overlook the valve guides. It will be obvious that even a small quantity of grinding paste remaining in the engine could cause extremely rapid wear.

19 Examine the valve springs for signs of fatigue and if possible compare their length with a new spring. It is worth renewing all the springs if the engine has completed a high mileage.

20 Examine the tappets and their bores for scoring or other damage.

21 Examine the camshaft bearing surfaces in the cylinder head and bearing caps. Also examine the camshaft, referring to Section 7.

22 Inspect the studs for the manifolds and camshaft bearing caps. Renew them if necessary by using a proprietary stud extractor, or lock two nuts together on the exposed threads. Studs that have come out by mistake should be cleaned up and refitted using thread locking fluid.

Reassembly

23 Begin reassembly by oiling a valve stem and inserting it into its guide. With the cylinder head on its side, fit the spring seat followed by the two springs (either way up) and the retainer.

24 Compress the springs with the compressor and fit the collets. A smear of grease on the collets will hold them in place on the valve stem groove. Carefully release the compressor and remove it.

25 Repeat the procedure to fit the other

seven valves. Refit the timing probe blank if removed.

26 Refit the inlet and exhaust manifolds with new gaskets and progressively tighten the nuts.

27 Insert and tighten the heater plugs to the specified torque (Chapter 4). Reconnect the wiring.

28 Insert and tighten the injectors with their washers to the specified torque (Chapter 4). Reconnect the leak off pipes.

29 Oil and insert the bucket tappets, together with their respective shims, making sure that they are fitted in the correct locations, and with the size markings downwards. Make a note of the shim thickness fitted at each position, if not already done, for reference when checking the valve clearances.

30 Refit the camshaft, referring to Section 7.

11 Cylinder head and pistons - decarbonisation

Decarbonisation

1 With the cylinder head removed as described in Section 9, the carbon deposits should be removed from the valve heads and surrounding surfaces of the head. Use a blunt scraper or wire brush and take care not to damage the valve heads.

2 Where a more thorough job is to be carried out, the cylinder head should be dismantled as described in the previous Section so that the valves may be ground in and the parts



valve head is within the specified limits (see illustration).

15 New or refaced valves and seats should be ground together as follows (the coarse paste may be omitted if the fit is already good).

16 Invert the head and support it securely. Smear a little coarse grinding paste around the sealing area of the valve head. Insert the valve in its guide and grind it to the seat using a valve grinding stick and rubber sucker. The stick is held between the hands and rotated first in one direction then in the opposite direction (see illustration). Lift the valve occasionally to redistribute the grinding paste.

17 Wipe the paste from the valve and seat occasionally to check progress. When the sealing faces are unbroken and all pitting is removed, repeat the procedure using fine grinding paste.

18 After all the valves have been ground in,



cleaned, brushed and blown out after the manifolds have been removed. Also clean the manifolds, particularly the exhaust manifold where an accumulation of carbon is most likely.

3 Before grinding-in a valve, remove the carbon and deposits completely from its head and stem. With an inlet valve this is usually simply a matter of scraping off the carbon with a blunt knife and finishing with a wire brush. With an exhaust valve the deposits are much harder to remove. One method of cleaning valves quickly is to mount them in the chuck of an electric drill using a piece of card or foil to protect the surface of the stem. A scraper or wire brush may then be used carefully to remove the carbon.

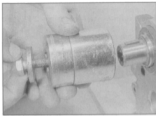
4 An important part of the decarbonising operation is to remove the carbon deposits from the piston crowns. To do this, turn the crankshaft so that two pistons are at the top of their stroke and press some grease between these pistons and the cylinder walls. This will prevent carbon particles falling down into the piston ring grooves. Cover the other two bores and the cylinder block internal oil and water channels with newspaper taped down securely.

5 Using a blunt scraper remove all the carbon from the piston crowns, taking care not to score the soft alloy. Thoroughly clean the combustion spaces that are recessed in the piston crowns.

6 Remove the newspaper then rotate the crankshaft half a turn and repeat the cleaning



12.26 Fitting the timing belt end oil seal to the crankshaft with a plastic protector



12.8 Socket, bolt and washer for fitting the camshaft oil seals

operation on the remaining two pistons. Wipe away the grease from the top of the bores.

7 Finally clean the top surface of the cylinder block.

12 Oil seals - renewal

Note: The procedures described here are for renewal with the engine in the vehicle - with the engine removed, the steps taken to gain access may be ignored.

Camshaft (timing belt end)

1 Follow the procedure given in paragraphs 1 to 12 of Section 5.

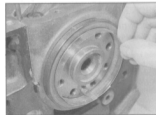
2 Remove the timing belt from the camshaft sprocket and tie it to one side without bending it excessively.

3 Unscrew the M8 bolt holding the camshaft sprocket in the timing position.

4 Hold the camshaft sprocket stationary using a large screwdriver (or similar tool), through two of the holes. A tool may be made out of flat metal bar and two long bolts (see Haynes Hint). Alternatively a strap wrench as used for removing oil filters may be used to hold the sprocket.

5 Unscrew the bolt and withdraw the sprocket from the camshaft. Do not rotate the camshaft otherwise the valves will strike the pistons of Nos 1 and 4 cylinders. Recover the Woodruff key if it is loose.

6 Pull out the oil seal using a hooked instrument.



12.33A Fitting the flywheel end oil seal to the crankshaft with a plastic protector



12.18 Camshaft oil seal flush with the end face of the cylinder head

7 Clean the oil seal seating.

8 Smear the lip of the new oil seal with oil then fit it over the end of the camshaft, open end first, and press it in until flush with the end face of the cylinder head. Use an M10 bolt, washers and a socket to press it in (see illustration).

9 Fit the Woodruff key (if removed) and the camshaft sprocket to the camshaft, insert the bolt and tighten it while holding the camshaft stationary.

10 Refit the M8 timing bolt to the camshaft sprocket.

11 Refit and adjust the timing belt, referring to Section 4, paragraphs 20 to 25. The remaining procedure is a reversal of removal.

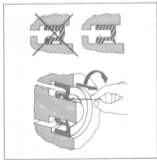
Camshaft (flywheel end)

12 Remove the air cleaner.

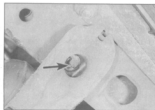
13 Remove the inlet ducting as necessary.

14 Loosen the pivot and adjustment bolts of the hydraulic high pressure pump (BX models), or vacuum pump (Visa models), swivel the unit upwards, and disconnect the drivebelt from the pulleys.

15 Unscrew the centre bolt and remove the pump pulley from the camshaft. If the centre bolt is very tight it will be necessary to remove the timing covers and hold the camshaft sprocket stationary while the bolt is loosened (to prevent damage to the timing belt). Recover the Woodruff key if it is loose.



12.33B Correct fitting of the crankshaft flywheel end oil seal



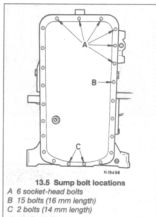
13.4A Crossmember front bolt (arrowed) ...



13.6 Removing the sump



13.4B ... and rear bolts (arrowed) on BX models



13.5 Sump bolt locations

- A 6 socket-head bolts
B 15 bolts (16 mm length)
C 2 bolts (14 mm length)

16 Pull out the oil seal using a hooked instrument.

17 Clean the oil seal seating.

18 Smear the lip of the new oil seal with oil then fit it over the end of the camshaft, open end first, and press it in until flush with the end face of the cylinder head (see illustration). Use a bolt, washers and a socket to press it in.

19 Refit the Woodruff key (if removed) and the pump pulley to the camshaft and tighten the centre bolt.

20 Locate the drivebelt on the camshaft pulley and pump pulley then press the pump downwards until the deflection of the belt midway between the two pulleys is approximately 5.0 mm under firm thumb pressure. Tighten the adjustment bolt followed by the pivot bolt.

21 Refit the air cleaner.

22 Refit the inlet ducting.

Crankshaft (timing belt end)

23 Remove the timing belt as described in Section 4.

24 Slide the timing belt sprocket from the crankshaft and recover the Woodruff key if it is loose.

25 Note the fitted depth then pull the oil seal from the housing using a hooked instrument. Alternatively drill a small hole in the oil seal and use a self-tapping screw to remove it.

26 Clean the housing and crankshaft then dip the new oil seal in engine oil and press it in (open end first) to the previously noted depth. A piece of thin plastic is useful to prevent damage to the oil seal (see illustration).

27 Refit the Woodruff key and timing belt sprocket.

28 Refit the timing belt, referring to Section 4.

Crankshaft (flywheel end)

29 Remove the flywheel/driveplate as described in Section 16.

30 Using vernier calipers measure the fitted depth of the oil seal and record it.

31 Pull out the oil seal using a hooked instrument. Alternatively drill a small hole in the oil seal and use a self-tapping screw to remove it.

32 Clean the oil seal seating and crankshaft flange.

33 Dip the new oil seal in engine oil, locate it on the crankshaft open end first, and press it in squarely to the previously noted depth using a metal tube. A piece of thin plastic is useful to prevent damage to the oil seal. When fitted note that the outer lip of the oil seal must point outwards; if it is pointing inwards use a piece of bent wire to pull it out (see illustrations).

34 Refit the flywheel/driveplate, referring to Section 16.

13 Sump - removal and refitting

Removal

1 Chock the rear wheels then jack up the front of the car and support on axle stands (see "Jacking and vehicle support").

2 Position a container beneath the engine. Unscrew the drain plug and allow the oil to drain from the sump.

3 Wipe clean the drain plug and refit it.

4 On BX models unbolt the crossmember beneath the sump (see illustrations).

5 Note the location of the sump bolts (see illustration), then unscrew them.

6 Remove the sump and gasket (see illustration). The sump will probably be stuck in position in which case it will be necessary to cut it free using a thin knife.

Refitting

7 Clean all remains of gasket from the sump and block and wipe dry.

8 Apply a little sealing compound where the front housing abuts the block on both sides.

9 Position a new gasket on the sump then lift the sump into position and insert the bolts in their correct locations.

10 Tighten the bolts evenly to the specified torque.

11 Refit the crossmember on BX models.

12 Lower the car to the ground and refill the engine with the correct quantity and grade of oil.

14 Oil pump - removal, inspection and refitting

Note: From July 1987, the oil pump spacer and location dowel are no longer fitted. The height of the pump is increased to compensate. A new pump may be fitted in place of an old one, provided that the spacer and dowel are discarded. Thicker washers must be fitted under the heads of the oil pump bolts. On A&A engines, a thin spacer is still fitted between the oil pump and the block.

Removal

1 Remove the timing belt as described in Section 4.

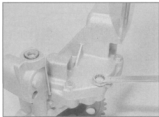
2 Slide the timing belt sprocket from the crankshaft and recover the Woodruff key if it is loose.

3 Remove the sump as described in Section 13.

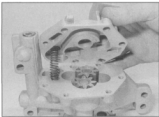
4 Unscrew the bolts and remove the front oil seal housing. Remove the gasket.

5 Unscrew the three bolts securing the oil pump to the crankcase. Identify them for position as all three are of different lengths.

6 Withdraw the L-shaped spacer from beneath the oil pump, if applicable.



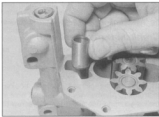
14.9A Unscrew the oil pump bolts ...



14.9B ... separate the halves ...



14.9C ... and remove the relief valve spring ...



14.9D ... and plunger

7 Remove the location dowel (if fitted) and disengage the oil pump sprocket from the chain. Withdraw the oil pump.

8 Remove the chain and sprocket from the nose of the crankshaft and recover the Woodruff key if it is loose.

9 Remove the six bolts which hold the two halves of the oil pump together. Separate the halves, being prepared for the release of the relief valve spring and plungers (see illustrations).

10 If necessary remove the strainer by prising

off the cap, then clean all components (see illustrations).

Inspection

11 Inspect the gears and the housings for wear and damage. Check the endfloat of the gears using a straight-edge and feeler blades, also check the clearance between the tip of the gear lobes and the housing (see illustrations). If any of these clearances exceeds the specified limit, renew the pump. Note that except for the relief valve spring and plunger, individual components are not available.

12 If the pump is to be renewed it is wise to renew the chain and the crankshaft sprocket also.

Refitting

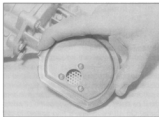
13 Lubricate the gears with engine oil then reassemble the oil pump in reverse order and tighten the six bolts evenly to the specified torque.

14 Locate the Woodruff key on the nose of the crankshaft and refit the sprocket, teeth end first. Engage the chain with the sprocket.

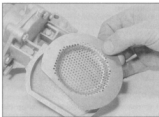
15 Prise the oil seal from the front housing. Refit the housing to the cylinder block, together with a new gasket, and tighten the bolts evenly to the specified torque.

16 Fit a new oil seal to the housing, referring to Section 12.

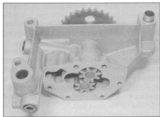
17 Check that the location dowel is fitted to the block. Engage the oil pump sprocket with the chain and slide the L-shaped spacer into position, making sure that its open end engages the dowel.



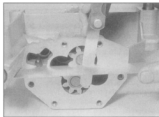
14.10A Removing the oil pump cap ...



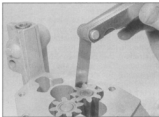
14.10B ... and strainer



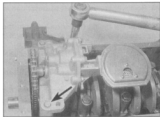
14.11A Oil pump rotors and housing



14.11B Checking the rotor endfloat



14.11C Checking the rotor side clearance



14.18 Tightening the oil pump mounting bolts (longest bolt arrowed)



15.5 Removing a big-end bearing cap

18 Insert the bolts in their correct locations. The longest bolt through the dowel and the next longest by the oil return hole. Tighten the bolts evenly to the specified torque (see illustration).

19 Refit the sump, referring to Section 13.
20 Refit the Woodruff key and timing belt sprocket.

21 Refit the timing belt, referring to Section 4.

15 Pistons and connecting rods - removal and refitting

Removal

1 Remove the cylinder head as described in Section 9.

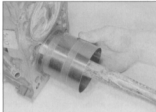
2 Remove the oil pump as described in Section 14.

3 If there is a pronounced wear ridge at the top of any bore, it may be necessary to remove it with a scraper or ridge reamer to avoid piston damage during removal. Such a ridge may indicate that reboring is necessary, which will entail new pistons in any case.

4 Check that each connecting rod and cap is marked for position and, if not, mark them with a centre punch on the oil filter side, number one at the flywheel end.

5 Turn the crankshaft to bring pistons 1 and 4 to BDC (bottom dead centre). Unscrew the nuts from No 1 piston big-end bearing cap, then take off the cap and recover the bottom half bearing shell (see illustration).

6 Using a hammer handle push the piston up



15.13 Using a hammer handle to tap the piston through the ring compressor

through the bore and remove it from the block. Loosely refit the shell bearings and cap to ensure correct reassembly.

7 Remove No 4 piston in the same manner then turn the crankshaft 180° to bring pistons 2 and 3 to BDC (bottom dead centre) and remove them.

8 If new piston rings are to be fitted to old bores, the bores must be deglazed to allow the new rings to bed-in properly. Protect the big-end journals by wrapping them in masking tape, then use a piece of coarse emery paper to produce a cross-hatch pattern in each bore. A flap wheel in an electric drill may be used, but beware of spreading abrasive dust. When deglazing is complete wash away all abrasive particles and unwrap the big-end journals.

Refitting

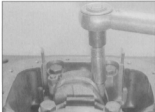
9 Begin refitting by laying out the assembled pistons and rods in order, with the bearing shells, connecting rod caps and nuts.

10 Arrange the piston ring gaps 120° from each other.

11 Clean the bearing shells, caps and rods then press the shells into position so that the locating tangs engage in the grooves.

12 Oil the bores, pistons, crankpins and shells. Fit a piston ring compressor to No 1 piston. With Nos 1 and 4 crankpins at BDC insert No 1 piston in the bore nearest the flywheel, making sure that the clover leaf cut-out on the piston crown is towards the oil filter side of the engine.

13 Using a hammer handle tap the piston through the ring compressor and into the bore (see illustration). Guide the connecting rod



15.14 Tightening the big-end bearing cap nuts

onto the crankpin and fit the cap, together with its shell bearing, making sure it is the correct way round.

14 Fit the nuts and tighten them to the specified torque (see illustration). Turn the crankshaft to check for free movement.

15 Repeat the procedure to fit the other three pistons.

16 Refit the oil pump, referring to Section 14.

17 Refit the cylinder head, referring to Section 9.

16 Flywheel/driveplate - removal and refitting

Removal

1 Either remove the engine and transmission and separate them (Sections 19, 20 and 21), or remove the transmission alone as described in the appropriate main manual.

2 On manual transmission models make alignment marks then slacken the clutch pressure plate bolts progressively and remove the pressure plate and driven plate (see illustration).

3 Hold the flywheel/driveplate stationary with a screwdriver or bar inserted between the teeth of the starter ring gear and the transmission location dowel, then unscrew and remove the bolts and lift the flywheel/driveplate from the crankshaft. Alignment marks are not required as there is a location dowel on the crankshaft flange. Obtain new bolts for reassembly.



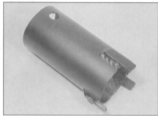
16.2 Removing the clutch pressure plate and driven plate



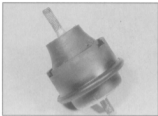
16.6A Apply locking fluid to the flywheel bolts ...



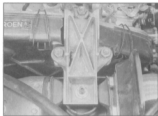
16.6B ... and tighten them to the specified torque



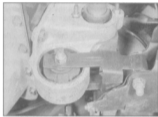
17.2A Home-made tool for unscrewing the engine mounting rubber



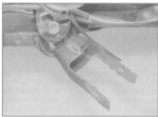
17.2B Engine mounting rubber showing slots



17.3 Right-hand engine mounting bracket (BX models)



17.12A Lower engine mounting and torque link (Visa models)



17.12B Lower engine mounting torque link (BX models) - top view with engine removed

Refitting

- 4 Begin refitting by cleaning the mating surfaces of the crankshaft and flywheel/driveplate.
- 5 Locate the flywheel/driveplate on the crankshaft dowel.
- 6 Apply locking fluid to the threads of the bolts, insert them, and tighten them to the specified torque while holding the flywheel/driveplate stationary (see illustrations).
- 7 On manual transmission models refit the clutch driven and pressure plates.
- 8 Refit the transmission and the engine, if removed.

17 Engine/transmission mountings - removal and refitting

Right-hand mounting

Removal

- 1 Support the engine with a hoist or with a trolley jack and block of wood beneath the sump.
- 2 Make up a tool similar to that shown, to engage with the slots in the rim of the rubber (see illustrations). Assuming that the rubber is being renewed, the new component can be used as a guide when making the tool. Unscrew the old rubber from the body using the tool.
- 3 Unscrew the nuts and remove the right-hand mounting bracket, noting the location of any shims (see illustration).

Refitting

4 Refitting is a reversal of removal. Tighten the rubber firmly to the body using the tool, to the specified torque. With the weight of the engine on the mounting, the clearance between the mounting bracket and each rubber stop should be 1.0 ± 0.7 mm. If necessary adjust the clearance by means of shims positioned under the stops.

Left-hand mounting

Removal

- 5 Support the transmission with a hoist or with a trolley jack and block of wood.
- 6 Remove the air cleaner and trunking.
- 7 Remove the battery and battery tray.
- 8 Unscrew the nut and remove the rubber mounting. Also unscrew the nuts or bolts and remove the mounting bracket.
- 9 If necessary unscrew the mounting stud from the transmission casing.

Refitting

10 Refitting is a reversal of removal, but before fitting the mounting stud, clean the threads and apply a little locking fluid. Tighten the nuts and bolts to the specified torque.

Lower mounting

Removal

- 11 Jack up the front of the car and support on axle stands (see "Jacking and vehicle support").
- 12 Unscrew and remove both bolts from the torque link and withdraw the link (see illustrations).

Refitting

- 13 Drive or press the mounting from the housing.
- 14 Drive or press the new mounting into position then refit the torque link and tighten the bolts to the specified torque.
- 15 Lower the car to the ground.

18 Engine, methods of removal - general

General

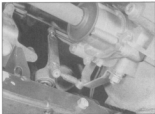
The engine is removed together with the transmission by lifting upwards from the engine compartment. On BX models the engine and transmission are lifted at a very steep angle and a hoist with sufficient height will therefore be necessary.

It is possible to remove the transmission alone from under the vehicle, after which it would, in theory, be possible to remove the engine from above. However, this method is not recommended as it involves the extra work of disconnecting the transmission which, if required is best carried out with the engine and transmission removed from the vehicle.

19 Engine and transmission (Visa models) - removal and refitting

Removal

- 1 Remove the bonnet.
- 2 Apply the handbrake then jack up the front of the vehicle and support on axle stands (see "Jacking and vehicle support").
- 3 Drain the cooling system as described in Chapter 1.
- 4 Unscrew the drain plug from the rear of the differential housing drain the oil into a container, then refit and tighten the drain plug.
- 5 Remove the bolts securing the front track control arms to the stub axle carriers.
- 6 Using a lever between the anti-roll bar and track control arm, lever the balljoints from the bottom of the stub axle carriers.
- 7 Have an assistant pull the left-hand wheel



19.18 Gearchange control rods (Viva models)

outwards while the left-hand driveshaft is levered from the differential side gear.

8 Loosen the two nuts retaining the right-hand driveshaft intermediate bearing in the bracket bolted to the rear of the cylinder block and turn the bolt heads through 90° to release the bearing.

9 Have an assistant pull the right-hand wheel outwards while the right-hand driveshaft is removed from the differential side gear.

10 Unbolt the intermediate bearing bracket from the cylinder block, also unscrew and remove the bolt securing the torque link to the underbody.

11 Tie the right-hand driveshaft and intermediate bearing bracket towards the rear.

12 Remove the battery and tray, and unbolt the support.

13 Drain the engine oil if required.

14 Remove the air cleaner, together with the inlet hoses and the hose to the oil separator.

15 Unscrew and remove the exhaust manifold-to-downpipe bolts, together with the springs and collars.

16 Disconnect the coolant hoses from the engine.

17 Unbolt the securing clamp and remove the cooling system expansion tank.

18 Disconnect the gearchange control rods (see illustration). Also disconnect the reverse cable where fitted.

19 Disconnect the vacuum hose from the brake vacuum servo unit.

20 Refer to Chapter 7 and remove the brake master cylinder.

21 Disconnect the fuel supply and return hoses from the injection pump.

22 Disconnect the wiring from the following components:

- a) Starter motor
- b) Oil pressure switch
- c) Alternator
- d) Water temperature switch
- e) Glow plugs
- f) Stop solenoid on the injection pump
- g) Diagnostic socket
- h) Transmission earth cable
- i) Reverse lamp switch

23 Disconnect the speedometer cable from the transmission.

24 Disconnect the clutch cable.

25 Disconnect the accelerator cable from the

injection pump.

26 Connect a hoist to the engine lifting brackets so that the engine and transmission may be lifted in a horizontal position. Take the weight of the assembly.

27 Unscrew the nuts and remove the right-hand engine mounting bracket.

28 Unscrew the nut from the left-hand engine mounting and remove the rubber mounting. Also unbolt the support bracket.

29 Position a piece of hardboard over the radiator to protect it when the engine is being removed.

30 Raise the engine and transmission assembly, making sure that the surrounding components in the engine compartment are not damaged. When clear of the front panel withdraw the assembly and lower it to the ground.

31 If the vehicle must be moved with the engine and transmission out, reconnect the track control arms and balljoints to the stub axle carriers and support the driveshafts with wire so that they can rotate without damage.

Refitting

32 Refitting is the reversal of the removal procedure, but note the following additional points:

- a) Use a final drive oil seal protector (Chapter 6) when inserting the right-hand driveshaft. Remove the protector when the driveshaft is fitted
- b) Refill the transmission and engine with oil
- c) Adjust the accelerator and fast idle cables, referring to Chapter 4
- d) Tighten the exhaust manifold-to-downpipe bolts, referring to Section 9, paragraph 43
- e) Refit the engine/transmission mountings, referring to Section 17
- f) Adjust the clutch cable
- g) Refill the cooling system (Chapter 1)
- h) Check the injection pump timing if necessary



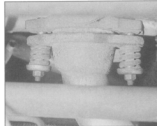
20.8 Front anti-roll bar link rod and nut

20 Engine and transmission (BX models) - removal and refitting

Removal

Note: The procedure described here is for manual transmission models. The procedure for automatic transmission models is similar.

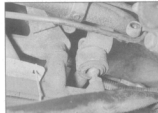
- 1 Remove the bonnet.
- 2 Chock the rear wheels and release the handbrake.
- 3 Jack up the front of the vehicle and support on axle stands (see "Jacking and vehicle support"). Remove the front wheels.
- 4 Place the ground clearance control to minimum height. Loosen the hydraulic pressure regulator release screw one and a half turns to release the pressure from the hydraulic system. Do not remove the screw otherwise the sealing ball will fall out.
- 5 Drain the cooling system as described in Chapter 1.
- 6 Unscrew the drain plugs from the transmission and differential housing and drain the oil/fluid into a container, then refit and tighten the drain plugs. Also drain the engine oil if required.
- 7 Unscrew the nut from the left-hand front suspension lower balljoint. Using a balljoint separator tool release the suspension arm.
- 8 Unscrew the nut from the top of the left-hand link rod for the front anti-roll bar, then lower the suspension arm (see illustration).
- 9 Have an assistant pull the left-hand wheel outwards while the left-hand driveshaft is levered from the differential side gear.
- 10 On models manufactured before July 1984 the left-hand differential side gear must be supported using a dowel, preferably wooden. If this precaution is not taken, the side gears may become misaligned when the right-hand driveshaft is removed.
- 11 Remove the right-hand driveshaft completely.
- 12 Unscrew and remove the exhaust manifold-to-downpipe bolts, together with the springs and collars (see illustration).



20.12 Exhaust manifold-to-downpipe bolts, springs and collars



20.13 Heater hose connection at the bulkhead



20.14C ... and rear rod (BX models)

13 Disconnect the heater hoses from the engine and bulkhead (see illustration).

14 Disconnect the gearchange control rods, including the rearmost rod from the intermediate lever (see illustrations). Turn



20.14A Disconnecting the gearchange lower rod ...

both intermediate levers so that they are parallel with the steering gear. Disconnect the reverse cable where applicable.

15 Remove the battery, air cleaner and the supporting lug (see illustrations).

16 Remove the radiator as described in Chapter 3, and disconnect the top hose from the thermostat housing (see illustration).

17 Disconnect the clutch cable and recover the pushrod.

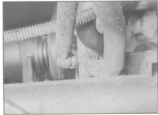
18 Disconnect the speedometer cable at the bulkhead (see illustration).

19 Disconnect the battery earth cable from the transmission (see illustration).

20 Disconnect the accelerator cable from the injection pump.

21 Pull apart the wiring connectors located beneath the battery support bracket (see illustration).

22 Disconnect the supply wiring from No 2 glow plug.



20.14B ... upper rod ...

23 Where applicable disconnect the tachometer wiring from the harness.

24 Disconnect the fuel supply and return hoses from the injection pump (see illustration).

25 Unbolt and remove the fuel filter.

26 Disconnect the high pressure pump suction pipe and the return pipe from the fluid reservoir and plug the open holes to prevent the ingress of dust and dirt. Release the pipe from the clip (see illustration).

27 On manual steering models disconnect the fluid return pipe from the pressure regulator, also disconnect the coiled fluid supply pipe and release it from the clips (see illustration). Plug all pipe ends.

28 On power steering models disconnect the overflow return pipe from the pressure regulator, also disconnect the fluid supply pipe from the output distributor. Unbolt the pressure regulator and output distributor and



20.15A Disconnecting the battery leads



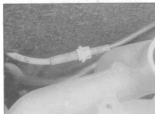
20.15B Removing the battery clamp



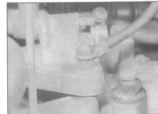
20.15C Air cleaner supporting lug (arrowed)



20.16 Disconnecting the top hose from the thermostat housing



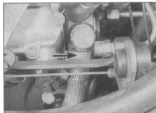
20.18 Speedometer cable connection at the bulkhead



20.19 Battery earth cable on the transmission



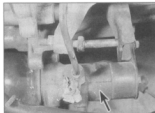
20.21 Engine harness wiring connectors beneath the battery support bracket



20.24 Injection pump fuel supply hose (arrowed)



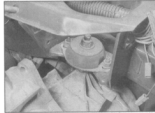
20.26 Hydraulic pipe retaining clip (BX models)



20.27 Hydraulic pressure regulator (arrowed) with return pipe port plugged (BX models)



20.30 Engine lower mounting and torque link (BX models)



20.31 Left-hand engine mounting (BX models)



20.33 Protect the hydraulic height corrector with a piece of hardboard



20.34 Lifting the engine and transmission assembly - note the support plate (arrowed) for the left-hand mounting

Refitting

36 Refitting is the reversal of the removal procedure, but note the following additional points:

- Use a final drive oil seal protector (Chapter 6) when inserting the right-hand driveshaft. Remove the protector when the driveshaft is fitted
- Refill the transmission and engine with oil
- Adjust the accelerator and fast idle cables, referring to Chapter 4
- Refit the engine/transmission mountings, referring to Section 17
- On manual transmission models adjust the clutch cable
- Refill the cooling system (Chapter 1)
- Prime the hydraulic high pressure pump as described in the BX main manual
- Check the injection pump timing if necessary

37 On turbo models, prime the turbo lubrication circuit before start-up by disconnecting the stop solenoid lead at the fuel pump and cranking the engine on the starter for three ten-second bursts.

21 Engine and transmission - separation



- With the engine and transmission removed from the vehicle clean away all external dirt.
- Slacken the bolts and remove the TDC sensor (see illustration). Remove the bolts

tie the assembly to the electric cooling fan.

29 Connect a hoist to the engine lifting brackets so that the engine and transmission assembly will assume an angle of 45° when lifted (with the engine uppermost). Take the weight of the assembly.

30 Unscrew and remove the front bolt from the torque link beneath the engine (see illustration).

31 Unscrew the nut from the left-hand engine mounting and remove the rubber mounting (see illustration). To prevent the mounting stub subsequently falling below the mounting bracket it is advisable though not essential, to position a loose fitting metal plate on the stud and refit the nut.

32 Unscrew the nuts and remove the right-hand engine mounting bracket.

33 Place a piece of hardboard over the

hydraulic height corrector to the right of the torque link to protect the dust cover (see illustration).

34 Raise the engine and transmission assembly, making sure that the surrounding components in the engine compartment are not damaged (see illustration). When clear of the front panel withdraw the assembly and lower it to the ground.

35 If the vehicle must be moved with the engine and transmission out, reconnect the left-hand front suspension lower balljoint, also temporarily refit the right-hand driveshaft. Support the driveshafts with wire so that they can rotate without damage. Note that the wheel bearings can be damaged if the vehicle is moved without the driveshafts in position.



21.2 Removing the TDC sensor



21.3 Reversing lamp switch and wiring



21.4 Transmission bottom cover



21.6A Extended hexagon for pump adjustment link (BX models)



21.6B Socket-headed rear transmission bolt (arrowed)



21.7A Removing the hydraulic pressure pump (BX models)



21.7B Hydraulic line and bracket (BX models)

water-soluble grease solvent or similar product. Keep dirt and water out of vulnerable components such as the fuel injection pump and the alternator.

2 When possible the engine should be dismantled on a workbench or strong table. If an engine dismantling stand is available, so much the better. Avoid working directly on a concrete floor, as grit presents a serious problem. If there is no alternative to working on the floor, cover it with an old piece of lino or carpet.

3 As well as the usual selection of tools, have available some wooden blocks for propping up the engine. A notebook and pencil will be needed, as will a couple of segmented boxes or a good supply of plastic bags and labels.

4 A waterproof marker pen is useful for making alignment marks, without having to use to punches or chisels, however, take care that the marks are not erased during cleaning.

5 Whenever possible, refit nuts, washers etc. to the components from where they were removed. This makes reassembly much simpler.

6 Spills of oil, fuel and coolant are bound to occur during dismantling. Have rags and newspapers handy to mop up the mess.

7 Do not throw away old gaskets immediately, but save them for comparison with new ones or for use as patterns if new gaskets have to be made.

8 Before starting reassembly, make sure that all parts are clean and that the new components required have been obtained. A full set of oil seals and gaskets must be bought - refer to Section 9 for selection of the correct head gasket.

9 Renew any nuts, bolts or studs with damaged threads.

10 A dial test indicator and stand (preferably magnetic) will be needed, also an oil can filled with clean engine oil to lubricate working parts as they are assembled.

11 Small quantities of grease, thread locking compound, anti-seize compound and various types of sealant will be called for.

12 Have available a good quantity of lint-free rags for wiping excess oil off hands and engine parts.

and withdraw the sensor holder.

3 Disconnect the wiring and unbolt the starter motor using a hexagon key. Also disconnect the wiring from the reversing lamp switch (see illustration).

4 Unbolt the bottom cover from the transmission (see illustration).

5 On automatic transmission models unscrew the bolts securing the torque converter to the driveplate. Turn the engine as required to bring the bolt heads into view.

6 Note the location of the hydraulic pressure pump (BX) or vacuum pump (Visa), the coolant tube, the hydraulic line, and the transmission retaining bolts. The pump adjustment link is attached to an extended hexagon, and the rearmost transmission bolt has a socket head (see illustrations).

7 Remove the drivebelt and unbolt the hydraulic pressure pump or vacuum pump

bracket. Where applicable unbolt the bracket for the hydraulic line (see illustrations).

8 Support the engine then unscrew the bolts and lift the transmission from the engine. On automatic transmission models make sure that the torque converter is kept in full engagement with the transmission. On BX models the hydraulic pressure regulator may remain attached to the transmission.

22 Engine overhaul - preparation

Note: Many components are specific to Turbo models. Although the parts may appear to be the same they are not all interchangeable.

1 Clean the engine thoroughly using a





23.2A Removing the front timing cover section . . .



23.2B . . . and the rear timing cover section



23.3A Diagnostic socket wiring connector



23.3B Temperature sensors and wiring



23.4 Diagnostic socket and mounting bolt



23.5 Removing the pump pulley from the flywheel end of the camshaft

23 Engine overhaul - dismantling



Note: Refer to Section 22, before this procedure.

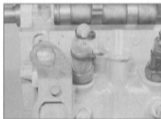
- 1 If not already done, drain the engine oil.
- 2 Pull up the special clip, release the spring clips, and withdraw the two timing cover sections (see illustrations).
- 3 Disconnect the wiring from the following components and identify each wire for location:
 - a) Alternator
 - b) Oil pressure switch
 - c) Diagnostic socket (if fitted) (see illustration)
 - d) Temperature sensor(s) (see illustration)
 - e) Oil level sensor

- 4 Unbolt and remove the diagnostic socket and bracket where fitted (see illustration).
- 5 Unscrew the bolt and withdraw the pump pulley from the flywheel end of the camshaft (see illustration). If it is tight due to corrosion, use a two or three-legged puller to remove it. Recover the Woodruff key.

- 6 Note the location of the fuel pipes from the injection pump to the injectors then unscrew the union nuts and remove the pipe assemblies. Cover the pipe ends, the injectors and the injection pump outlets to prevent entry of dust and dirt. Small plastic bags and elastic bands are ideal for this (see illustrations).



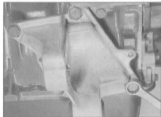
23.6A Fuel pipe locations (arrowed)



23.6B Small plastic bags can be used to protect the injectors from dust and dirt

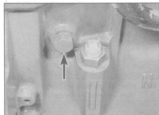


23.8A Engine lifting bracket



23.8B Lower rear engine mounting bracket - also supports right-hand driveshaft

- 7 Pull the leak-off hoses from the injectors.
 8 Unbolt the engine lifting bracket from the cylinder head. Also unbolt the lower rear engine mounting bracket (see illustrations).
 9 Remove the alternator (Chapter 5) and bracket.
 10 Unscrew the oil filter cartridge using a strap wrench if necessary.
 11 On the 1.9 engine disconnect the hoses from the oil cooler. Unscrew the centre stud and remove the oil cooler from the block. Disconnect the oil cooler hoses.
 12 Disconnect the bottom hose from the water pump inlet.
 13 Disconnect the crankcase ventilation hoses from the valve cover and sump inlet. Remove the clip and slide the oil separator from the dipstick tube.
 14 Remove the oil filler cap and ventilation hose if fitted.



23.16A Oil level sensor location in the cylinder block. Coolant drain plug (arrowed) is adjacent



23.19 Removing the oil pressure switch



23.21A Removing the water pump inlet

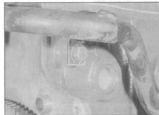
- 15 Unscrew the bolts and remove the inlet manifold from the cylinder head. There are no gaskets.
 16 Unscrew the nuts and withdraw the exhaust manifold and gaskets from the studs, complete with turbo, if applicable.
 17 Slacken the bolt and remove the clamp from the end of the fast idle cable. Unscrew the locknut and remove the fast idle outer cable from the bracket on the injection pump.
 18 Unscrew and remove the oil level sensor from the cylinder block, if fitted (see illustrations). Unscrew the oil temperature sensor, if fitted. This can be found just above the oil filter.
 19 Unscrew and remove the oil pressure switch (see illustration).
 20 Unbolt the thermostat housing from the cylinder head, complete with the fast idle thermo-unit and temperature sensor(s) (see



23.16B Removing the oil level sensor



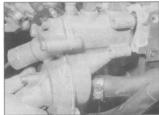
23.20A Unscrew the bolts . . .



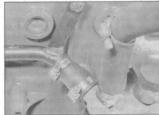
23.21B Coolant tube mounting on the front of the cylinder block

illustrations).

- 21 Unbolt the water pump inlet and remove the gasket. Also unbolts the coolant tube from the cylinder block (see illustrations).
 22 Unscrew the nuts securing the inlet bracket to the sump. Remove the bracket and gasket (see illustrations).
 23 Have an assistant hold the flywheel/driveplate stationary with a screwdriver or bar inserted between the teeth of the starter ring gear and the transmission location dowel, then unscrew the crankshaft pulley bolt. Slide the pulley from the front of the crankshaft (see illustration).
 24 Unbolt the bottom timing cover (see illustration).
 25 Turn the engine by the flywheel/driveplate until the three bolt holes in the camshaft and injection pump sprockets are aligned with the corresponding holes in the engine front plate.
 26 Insert an 8.0 to 8.5 mm diameter metal dowel rod or twist drill through the special hole in the left-hand rear flange of the cylinder block. Then carefully turn the engine either way until the rod enters the TDC hole in the flywheel/driveplate.
 27 Insert three M8 bolts through the holes in the camshaft and injection pump sprockets and screw them into the engine front plate finger tight.
 28 Loosen the timing belt tensioner pivot nut and adjustment bolt, then turn the bracket anti-clockwise to release the tension and retighten the adjustment bolt to hold the tensioner in the released position.
 29 Mark the timing belt with an arrow to indicate its normal direction of turning then



23.20B . . . and remove the thermostat housing



23.21C Coolant tube mounting on the front of the cylinder block



23.23 Removing the crankshaft pulley



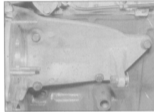
23.24 Bottom timing cover (arrowed)



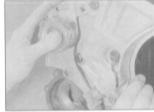
23.31A Unscrew the nut ...



23.31B ... and remove the injection pump sprocket



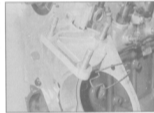
23.36 Injection pump mounting bracket



23.37 Removing the tensioner arm and roller



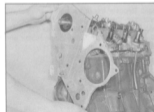
23.38 Removing the tensioner plunger and spring



23.39A Right-hand engine mounting bracket



23.39B Timing belt intermediate roller and bracket



23.40 Removing the engine front plate

remove it from the camshaft, injection pump, water pump, and crankshaft sprockets.

30 Unbolt and remove the valve cover. Remove the gasket.

31 With the injection pump sprocket held stationary by the timing bolts, unscrew the

central nut to release the sprocket from the pump shaft taper. Remove the timing bolts and the pump sprocket with its nut and puller, and recover the Woodruff key if it is loose (see illustrations). The puller is incorporated in the sprocket by means of the plate bolted over the nut, and the nut has an outer shoulder that bears against the plate.

32 Similarly unscrew the bolt from the camshaft sprocket and withdraw the sprocket.

33 Slide the sprocket from the crankshaft and recover the Woodruff key if it is loose.

34 Unscrew the bolts and remove the water pump from the cylinder block. Remove the gasket.

35 Mark the injection pump in relation to the mounting bracket. Unscrew the nuts and bolt and withdraw the injection pump.

36 Unbolt and remove the mounting bracket (see illustration).

37 Unscrew the timing belt tensioner adjustment bolt and pivot nut. A tool may now be used to hold the tensioner plunger as described in Section 5 while the tensioner arm and roller is removed. However, it is possible to remove the arm and roller by keeping the arm pressed against the plunger (see illustration).

38 Remove the plunger and spring (see illustration).

39 Unscrew the bolts and remove the engine mounting bracket and the timing belt intermediate roller and bracket (see illustrations).

40 Unbolt the engine front plate (see illustration).

41 Progressively unscrew the cylinder head bolts in the reverse order to that shown in illustration 9.41B. Remove the washers.

42 Release the cylinder head from the cylinder block and location dowel by rocking



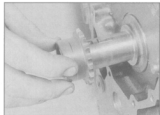
23.46 Withdrawing the oil pump spacer



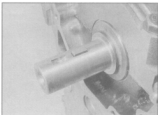
23.47 Removing the oil pump



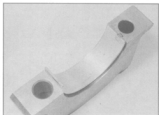
23.48 Removing the crankshaft front oil seal housing



23.49A Slide off the oil pump sprocket ...



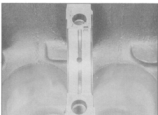
23.49B ... and remove the Woodruff key



23.56 Main bearing cap and lower half bearing shell



23.57A Lift out the crankshaft ...



23.57B ... and remove the upper half bearing shells

it. Lift the head from the block and remove the gasket.

43 Remove the clutch if applicable then hold the flywheel/driveplate stationary with a screwdriver or bar inserted between the teeth of the starter ring gear and the transmission location dowel. Then unscrew and remove the bolts and lift the flywheel/driveplate from the crankshaft.

44 Invert the engine and unbolt the sump. Remove the gasket.

45 Unscrew the three bolts securing the oil pump to the crankcase. Identify them for position as all three are of different lengths.

46 Withdraw the L-shaped spacer from beneath the oil pump (if fitted) (see illustration).

47 Remove the location dowel (if fitted), and disengage the oil pump sprocket from the chain. Withdraw the oil pump (see

illustration).

48 Unscrew the bolts and remove the front oil seal housing (see illustration). Remove the gasket.

49 Remove the oil pump chain followed by the sprocket. Recover the Woodruff key if it is loose (see illustrations).

50 Check that each connecting rod and cap is marked for position and, if not, mark them with a centre punch on the oil filter side, number one at the flywheel end.

51 Position the cylinder block either on its side or on the flywheel end.

52 Turn the crankshaft to bring pistons 1 and 4 to BDC (bottom dead centre). Unscrew the nuts from No 1 piston big-end bearing cap then take off the cap and recover the bottom half bearing shell.

53 Using a hammer handle push the piston up through the bore and remove it from the

block. Loosely refit the shell bearings and cap to ensure correct reassembly.

54 Remove No 4 piston in the same manner then turn the crankshaft 180° to bring pistons 2 and 3 to BDC and remove them.

55 The main bearing caps should be numbered 1 to 5 from the flywheel end. If not, mark them accordingly. Also note the fitted depth of the rear oil seal.

56 Invert the engine then unbolt and remove the main bearing caps. Recover the lower half bearing shells keeping them with their respective caps (see illustration). Also recover the thrustwashers.

57 Lift out the crankshaft. Discard the rear oil seal. Recover the upper half bearing shells and keep them together with their respective caps, however, identify them as the upper shells (see illustrations). Also recover and identify the upper thrustwashers.

24 Engine overhaul - reassembly

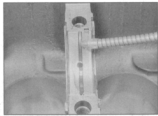
Note: Refer to Section 22, before this procedure.

1 Position the block upside down on the bench. Wipe clean the main bearing shell seats in the block and caps.

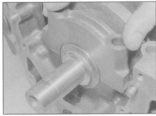
2 Wipe any protective coating from the new bearing shells. Fit the top half main bearing shells (with the oil grooves) to their seats in the block. Make sure that the locating tangs on the shells engage with the recesses in the seats.



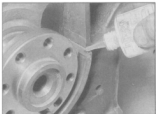
24.3 No 2 main bearing and thrustwashers



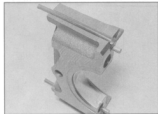
24.4 Oiling the main bearing shells



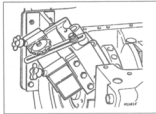
24.8 Fitting No 5 main bearing cap



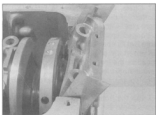
24.9 Applying thread locking fluid to the No 1 main bearing cap joint face



24.10A Sealing strips fitted to No 1 main bearing cap



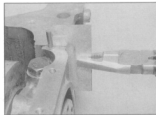
24.10B Using the special tool to fit No 1 main bearing cap



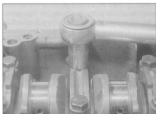
24.11A Slide the No 1 main bearing cap and metal strips into position ...



24.11B ... insert the bolts ...



24.11C ... then carefully pull out the metal strips



24.12 Tightening the main bearing bolts

- 3 Fit the thrustwashers on each side of No 2 main bearing, grooved side outwards. Use a smear of grease to hold them in position (see illustration).
- 4 Lubricate the top half shells and lower the

crankshaft into position (see illustration).

5 Fit the plain bottom half main bearing shells to their caps, making sure that the locating tangs engage with the recesses. Oil the shells.

6 Fit the thrustwashers on each side of No 2 main bearing cap using a smear of grease to hold them in position.

7 Before fitting the caps check that the crankshaft endfloat is within the specified limits using a dial test indicator on the crankshaft nose.

8 Fit the main bearing caps Nos 2 to 5 to their correct locations (see illustration) and the right way round (the bearing shell tang locations in the block and caps must be on the same side). Insert the bolts loosely.

9 Apply a small amount of thread locking fluid to the No 1 main bearing cap face on the block around the sealing strip holes (see illustration).

10 Press the sealing strips in the grooves on each side of No 1 main bearing cap (see illustration). It is now necessary to obtain two thin metal strips of 0.25 mm thickness or less to prevent the strips moving when the cap is being fitted. Citroën garages use the tool shown (see illustration) which acts as a clamp, however, metal strips can be used provided all burrs that may damage the sealing strips are first removed.

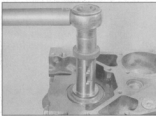
11 Oil both sides of the metal strips and hold them on the sealing strips. Fit the No 1 main bearing cap, insert the bolts loosely, then carefully pull out the metal strips with a pair of pliers in a horizontal direction (see illustrations).

12 Tighten the main bearing bolts evenly to the specified torque (see illustration).

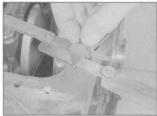
13 Check that the crankshaft rotates freely - there must be no tight spots or binding.



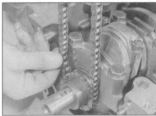
24.14 Fitting the crankshaft rear oil seal with a plastic protector



24.23 Checking the crankshaft turning torque



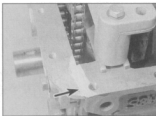
24.24 Cutting the sealing strips on No 1 main bearing cap



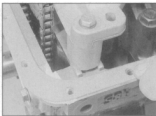
24.25 Fitting the chain to the oil pump sprocket



24.26 Tightening the front oil seal housing bolts



24.30A Apply sealing compound here . . .



24.30B . . . then fit the new sump gasket

14 Dip the new rear oil seal in engine oil, locate it on the crankshaft open end first, and press it squarely to the previously noted depth using a metal tube slightly less than 102 mm diameter. A piece of thin plastic is useful to prevent damage to the oil seal (see illustration). Make sure that the outer lip of the oil seal points outwards and if necessary use a piece of bent wire to pull it out.

15 Position the cylinder block either on its side or on the flywheel end.

16 Lay out the assembled piston and rods in order with the bearing shells, connecting rod caps and nuts.

17 Check that the piston ring gaps are arranged 120° from each other.

18 Clean the bearing shells, caps and rods then press the shells into position so that the locating tangs engage in the grooves.

19 Oil the bores, pistons, crankpins and shells. Fit a piston ring compressor to No 1

piston. With Nos 1 and 4 crankpin at BDC insert No 1 piston in the bore at the flywheel end, making sure that the clover leaf cut-out on the piston crown is towards the oil filter side of the engine.

20 Using a hammer handle tap the piston through the ring compressor and into the bore. Guide the connecting rod onto the crankpin and fit the cap, together with its shell bearing, making sure it is the correct way round.

21 Fit the nuts and tighten them to the specified torque. Turn the crankshaft to check for free movement.

22 Repeat the procedure to fit the other three pistons.

23 Temporarily refit the pulley bolt to the nose of the crankshaft then, using a torque wrench, check that the torque required to turn the crankshaft does not exceed 41 Nm (30 lbf ft) (see illustration). Any excessive tightness

must be investigated before proceeding.

24 Using feeler blades and a knife, cut the sealing strips on No 1 main bearing cap to 1.0 mm above the sump gasket mating surface (see illustration).

25 Fit the Woodruff key to the groove in the crankshaft and refit the oil pump sprocket, teeth end first. Engage the chain with the sprocket and tie it up or to one side so that it remains engaged (see illustration).

26 Prise the oil seal from the front housing. Check that the two dowels are located in the front of the cylinder block then refit the front housing, together with a new gasket, and tighten the bolts evenly to the specified torque (see illustration).

27 Check that the dowel is fitted to the bottom of the block. Engage the oil pump sprocket with the chain and slide the L-shaped spacer under the pump, making sure that its open end engages the dowel.

28 Insert the oil pump bolts in their correct location, the longest bolt through the dowel and the next longest by the oil return hole. Tighten the bolts evenly to the specified torque.

29 Dip the front oil seal in engine oil then press it into the front housing until flush with the outer face.

30 Apply a little sealing compound where the front housing abuts the block on both sides. Position a new gasket on the block and refit the sump (see illustrations). Note the correct location of the bolts as shown, in illustration 13.5. Tighten the bolts evenly to the specified torque. Remove the sump drain plug, renew the washer, then refit and tighten the plug.

31 Locate the flywheel/driveplate on the crankshaft dowel.

32 Apply locking fluid to the threads of the bolts, insert them, and tighten them to the specified torque while holding the flywheel/driveplate stationary with a screwdriver or bar inserted between the teeth of the starter ring gear and the transmission location dowel.

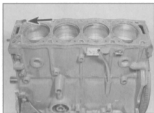
33 Position the cylinder block upright on the bench.

34 Check that the cylinder head bolt holes in the block are clear preferably using an M12 x 1.5 tap (see illustration).

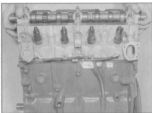
35 Locate the correct cylinder head gasket



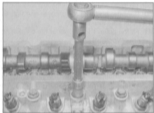
24.34 Cleaning the cylinder head bolt holes with a tap



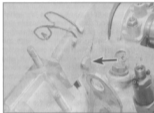
24.35 Head gasket fitted to cylinder block with location dowel arrowed



24.36 Lowering the cylinder head onto the block



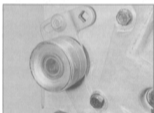
24.39 Tighten the cylinder head bolts to the specified torque



24.41 Inner bolt location for the engine mounting bracket (arrowed)



24.42A Turn the tensioner bracket anti-clockwise . . .



24.42B . . . and tighten the bolt to hold the tensioner in the released position



24.46 Fitting the sprocket to the crankshaft



24.47 Tightening the camshaft sprocket bolt with the timing bolt in position

(see Section 9) on the block the right way round with the identification notches or holes at the flywheel/driveplate end. Check that the location dowel is fitted (see illustration).

36 Turn the crankshaft clockwise (from timing belt end) until pistons 1 and 4 pass BDC and begin to rise. Then position them halfway up their bores. Pistons 2 and 3 will also be at their mid-way positions, but descending their bores. The Woodruff key groove on the nose of the crankshaft will be at the 9 o'clock position.

37 Check that the camshaft is set to TDC with the Woodruff key position facing upwards and the tips of cams 4 and 6 resting on the bucket tappets.

38 Lower the cylinder head onto the block (see illustration).

39 Grease the threads and contact faces of the cylinder head bolts, then insert them and tighten them in the sequence shown in

illustration 9.41B in three stages as given in Specifications (see illustration).

40 Recheck the valve clearances, referring to Section 8 and adjust them if necessary. Do this even if the clearances have been adjusted with the cylinder head removed as there may be minor differences.

41 Refit the engine front plate followed by the timing belt intermediate roller and bracket, and the engine mounting bracket. Tighten all the bolts. Do not forget the mounting bracket bolt on the inside face of the engine front plate (see illustration).

42 Insert the timing belt tensioner spring and plunger in the mounting bracket. Press the tensioner arm against the plunger and refit the bracket and roller onto the pivot stud. Alternatively compress the plunger with the tool described in Section 5. Fit the adjustment bolt and pivot nut, and tighten the bolt with the tensioner in the released position (ie

spring compressed) (see illustrations).

43 Refit the injection pump mounting bracket and tighten the bolts.

44 Refit the injection pump, align the previously made marks then tighten the nuts followed by the bolt.

45 Refit the water pump together with a new gasket and tighten the bolts to the specified torque (Chapter 3).

46 Locate the Woodruff key in the groove then slide the sprocket onto the front of the crankshaft (see illustration).

47 Fit the camshaft sprocket to the camshaft. Apply locking fluid to the threads then insert and tighten the bolt to the specified torque. The sprocket may be held stationary by fitting the timing bolt through the special hole (see illustration).

48 Unbolt the special puller from the injection pump sprocket. Check that the Woodruff key is in place then refit the sprocket and tighten



24.48 Tightening the injection pump sprocket bolt with the timing bolts in position



24.49 Tightening the special puller to the injection pump sprocket



24.55 Tightening the tensioner adjustment bolt



24.60 Bottom timing cover fitted

the nut (see illustration).

49 Bolt the special puller onto the sprocket (see illustration).

50 Refit the valve cover, together with a new gasket, and tighten the bolts.

51 Insert the three M8 timing bolts through the holes in the camshaft and injection pump sprockets and screw them into the engine front plate fingertight.

52 Insert an 8.0 to 8.5 mm diameter metal dowel rod through the special hole in the left-hand rear flange of the cylinder block. Then turn the crankshaft slowly clockwise (from the timing belt end) until the rod enters the TDC hole in the flywheel/driveplate. It is only necessary to turn the crankshaft a quarter turn as Nos 1 and 4 pistons are already halfway up their bores. Do not turn the crankshaft more than this otherwise pistons 2

and 3 will strike valves 4 and 6.

53 Locate the timing belt on the crankshaft sprocket making sure where applicable that the rotation arrow is facing the correct way.

54 Hold the timing belt engaged with the crankshaft sprocket then feed it over the roller and onto the injection pump, camshaft, and water pump sprockets and over the tensioner roller. To ensure correct engagement locate only a half width on the injection pump sprocket before feeding the timing belt onto the camshaft sprocket, keeping the belt taut and fully engaged with the crankshaft sprocket. Locate the timing belt fully onto the sprockets.

55 With the pivot nut loose, slacken the tensioner adjustment bolt while holding the bracket against the spring tension, then slowly release the bracket until the roller presses against the timing belt. Retighten the adjustment bolt (see illustration).

56 Remove the bolts from the camshaft and injection pump sprockets. Remove the metal dowel rod from the cylinder block.

57 Rotate the engine two complete turns in its normal direction. Do not rotate the engine backwards as the timing belt must be kept tight between the crankshaft, injection pump and camshaft sprockets.

58 Loosen the tensioner adjustment bolt to allow the tensioner spring to push the roller against the timing belt, then tighten both the adjustment bolt and pivot nut.

59 Recheck the engine timing by turning the engine until the sprocket bolt holes are aligned, and check that the metal dowel rod

can be inserted into the flywheel/driveplate.

60 Refit the bottom timing cover and tighten the bolts (see illustration).

61 Fit the pulley to the front of the crankshaft over the Woodruff key.

62 Apply locking fluid to the threads of the pulley bolt. Then insert it and tighten to the specified torque while an assistant holds the flywheel/driveplate stationary with a screwdriver inserted between the teeth of the starter ring gear and the transmission location dowel. Note that after tightening to the initial torque, the bolt must be angle tightened a further 60° that is the equivalent of one flat on the bolt head. Alternatively mark the flat extremities on the socket together with a starting datum on the pulley (see illustrations).

63 Locate a new gasket on the side of the sump, refit the inlet bracket, and tighten the nuts evenly.

64 Refit the water pump inlet together with a new gasket and tighten the bolts.

65 Bolt the coolant tube to the cylinder block and fit the hoses.

66 Refit the thermostat housing, together with a new gasket, and tighten the bolts.

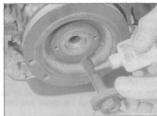
67 Insert the oil pressure switch in the block and tighten.

68 Insert the oil level sensor and tighten.

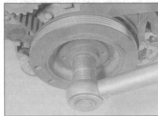
69 Refit the fast idle cable to the injection pump, referring to Chapter 4.

70 Refit the exhaust manifold, together with new gaskets, and tighten the nuts evenly.

71 Refit the inlet manifold and tighten the bolts evenly. There are no gaskets.



24.62A Apply locking fluid to the crankshaft pulley bolt before fitting it



24.62B Tightening the crankshaft pulley bolt



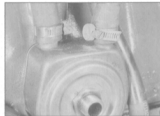
24.62C Markings necessary in order to angle-tighten the crankshaft pulley bolt by 60°



24.73 Oil separator located on the dipstick tube (1.9 engine)



24.75A Oil cooler . . .



24.75B . . . and coolant hose connections



24.81 Tightening the pump pulley bolt on the camshaft

72 Refit the oil filler cap and ventilation hose if fitted.

73 Slide the oil separator onto the dipstick tube (see illustration) and secure with the clip. Reconnect the crankcase ventilation hoses to the valve cover and sump inlet.

74 Reconnect the bottom hose to the water pump inlet.

75 On the 1.9 engine reconnect the oil cooler hoses and refit the oil cooler, tightening the centre stud to the specified torque (see illustrations).

76 Smear a little engine oil on the sealing ring of the oil filter cartridge then refit it and tighten by hand only.

77 Refit the alternator (Chapter 5).

78 Refit the engine lifting bracket to the cylinder head, also refit the lower rear engine mounting bracket.

79 Reconnect the leak off hoses to the injectors.

80 Refit the fuel pipe assemblies to the injectors and injection pump and tighten the union nuts to the specified torque (Chapter 4).

81 Slide the pump pulley onto the flywheel end of the camshaft. Insert the bolt and tighten it to the specified torque (see illustration).

82 Where applicable refit the diagnostic socket and bracket and tighten the bolt.

83 Reconnect the wiring harness to the following components:

- Alternator
- Oil pressure switch
- Diagnostic socket (if fitted)
- Temperature sensor(s)
- Oil level sensor

84 Refit the two timing cover sections and press down the special clip and spring clips to secure.

85 Refit the clutch on manual transmission models.

25 Engine overhaul examination and renovation - general

1 With the engine completely dismantled, all components should be cleaned and examined as detailed in the appropriate Sections of this Chapter.

2 Most components can be cleaned with rags, a soft brush and paraffin, or some other solvent. Do not immerse parts with oils in solvent since it can be very difficult to remove and if left will contaminate the oil. Clean oilways and water channels with a piece of wire and blow through with compressed air if available.

3 When faced with a borderline decision whether to renew a particular part, take into consideration the expected future life of the engine and the degree of trouble or expense that will be caused if the part fails before the next overhaul.

4 If extensive overhauling is required, estimate the likely cost and compare it with the cost of a complete reconditioned engine. The difference may not be great, and the reconditioned engine will have a guarantee.

26 Engine components - overhaul

Cylinder block and bores

Overhaul

1 Check the cylinder block casting for any damage or cracking.

2 If necessary unscrew the two plugs from the rear of the block and from the flange beneath the oil filter location, and clean the oil gallery. Refit and tighten the plugs on completion. The water channels may be cleaned by removing the inspection plate from the rear of the block. On Turbo models,

remove the piston cooling jets. Clean them and inspect them for damage or wear and replace them if necessary.

3 Check the core plugs for signs of leakage and if necessary renew them. It may be possible to remove the old plugs by drilling a small hole and using a self-tapping screw to pull them out. Alternatively, use a hammer to drive a chisel through the old plugs and prise them out. Clean the seating then apply a little sealing compound and tap the new plug into position with the flat face of a hammer. Spread the core plug by striking the centre with a ball face hammer.

4 If cracks in the block are suspected it may be necessary to have it crack-tested professionally. There are various ways of doing this, some involving special dyes and chemicals, some using ultrasonic or electromagnetic radiation.

5 Bore wear is indicated by a wear ridge at the top of the bore. For accurate assessment a bore micrometer is required, however, a rough measurement can be made by inserting feeler blades between a piston (without rings) and the bore wall. Compare the clearance at the bottom of the bore, which should be unworn, with that just below the wear ridge. No wear limits are specified, but out-of-round or taper more than 0.1 mm would normally be considered grounds for a rebore. Scuffs, scores and scratches must also be taken into account.

6 If reboring is undertaken the machine shop will normally obtain the oversize pistons and rings at the same time.

7 Where the degree of wear does not justify a rebore, the fitting of proprietary oil control rings may be considered.

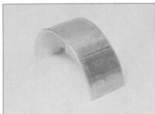
Crankshaft and bearings

Overhaul

8 Check the crankshaft for damage or excessive wear.

9 Examine the bearing shells for wear and scratches on the working surfaces. New shells should be fitted in any case, unless the old ones are obviously in perfect condition and are known to have covered only a nominal mileage (see illustration). Refitting used shells is false economy.

10 Examine the bearing journals on the



26.9 Big-end bearing shell

crankshaft for scoring or other damage, which if present will probably mean that grinding or renewal is necessary. If a micrometer is available, measure the journals in several places to check for out-of-round and taper. No limits are specified but typically 0.025 mm is the maximum acceptable.

11 Note that the crankshaft may already have been reground, and that the makers only specify one stage of grinding.

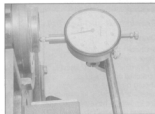
12 Main and big-end bearing clearances can be measured using Plastigage thread. The journal and bearing shell are wiped dry before placing the thread across the journal. After tightening the bearing cap onto the Plastigage it is removed and a special gauge used to determine the running clearance. The makers do not specify any clearances but typically it would be between 0.025 and 0.050 mm.

13 Check the crankshaft endfloat using a feeler blade between the No 2 thrustwashers and crankshaft web. If this is more than the specified amount obtain new thrustwashers. Alternatively a dial gauge on the end of the crankshaft may be used for the check (see illustration).

Pistons, piston rings and connecting rods

Overhaul

14 The piston rings may be removed from each piston with the aid of some old feeler blades or similar thin metal strips. Carefully spread the top ring just far enough to slide the blades in between the ring and the piston, then remove the ring and blades together (see



26.13 Checking the crankshaft endfloat

Haynes Hint). Be careful not to scratch the piston with the ends of the ring.

15 Repeat the process to remove the second and third rings, using the blades to stop the rings falling into the empty grooves. Note that the third ring incorporates an expander. Always remove the rings from the top of the piston. Keep each set of rings with its piston if the old rings are to be re-used.

16 Measure the end gaps of the rings by fitting them, one at a time, to their bores. Check the gaps with the rings either at the extreme top or bottom of the bores, where the wear is minimum, using feeler blades (see illustration).

17 If the rings are renewed the bores must be deglazed as described in Section 15.

18 Examine the pistons for damage, in particular for burning on the crown and for scores or other signs of "picking-up" on the skirts and piston ring lands. Scorch marks on the sides show that blow-by has occurred.

19 If the pistons pass this preliminary inspection clean all the carbon out of the ring grooves using a piece of old piston ring. Protect your fingers - piston rings are sharp. Do not remove any metal from the ring grooves.

20 Roll each ring around its groove to check for tight spots. Any excessive clearance not due to worn rings must be due to piston wear and, unless the piston can be machined to accept special rings, renewal is required.

21 If renewing pistons without reboring make sure that the correct size is obtained. Piston class is denoted by either an "A1" mark or no mark at all on the centre of the crown. The identical code appears also on the corner of the cylinder block at the timing belt end. The piston weight class is stamped on the crown and must be identical on all pistons in the same engine.

22 To separate a piston from its connecting rod, prise out the circlips and push out the gudgeon pin (see illustrations). Hand pressure is sufficient to remove the pin. Identify the piston and rod to ensure correct reassembly.

23 Wear between the gudgeon pin and the connecting rod small-end bush can be cured by renewing both the pin and bush. Bush

renewal, however, is a specialist job because press facilities are required and the new bush must be reamed accurately.

24 New gudgeon pins and circlips are supplied when buying new pistons. The connecting rods themselves should not be in need of renewal unless seizure or some other major mechanical failure has occurred.

25 Reassemble the pistons and rods. Make sure that the pistons are fitted the right way round - the clover leaf cut-out on the crown must face the same way as the shell bearing cut-out in the connecting rod. Oil the gudgeon pins before fitting them (see illustrations). When assembled, the piston should pivot freely on the rod.

26 Fit the piston rings using the same technique as for removal. Fit the bottom ring first and work up. When fitting the oil control ring first insert the expander then fit the ring with its gap positioned 180° from the expanders gap. Arrange the gaps of the upper two rings 120° either side of the oil control ring gap. Make sure that No 2 ring is fitted the correct way round (see illustration).

Flywheel/driveplate

Overhaul

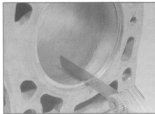
27 Examine the clutch mating surface of the flywheel for scoring or cracks. Light grooving or scoring may be ignored. Surface cracks or deep grooving can sometimes be removed by specialist machining, provided not too much metal is taken off, otherwise the flywheel must be renewed.

28 Inspect the flywheel/driveplate for damage or cracks and renew it if necessary.

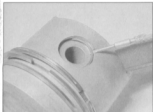
29 Inspect the starter ring gear for damaged or missing teeth. It is not possible to obtain a genuine Citroën ring gear separate from the flywheel/driveplate, and if damaged it may therefore be necessary to renew the complete flywheel/driveplate. However, some motor factors may be able to supply one, in which case the old ring gear should be drilled and split with a cold chisel to remove it. The new ring gear must be heated then quickly tapped onto the flywheel/driveplate and allowed to cool naturally. The temperature to which the ring gear must be heated is critical - too little heat and the ring gear may not fit or may even jam halfway on. Too much heat and the



Removing the piston rings with an old feeler blade



26.16 Measuring the piston ring end gaps


26.22A Prising out the gudgeon pin circlip

temper of the metal may be lost causing it to wear rapidly in use. The correct temperature is normally attached to the new ring gear, however, the average DIY mechanic may prefer to leave the job to a garage or engineering works.

30 The makers recommend that the flywheel/driveplate bolts only are renewed at overhaul, however, it would be prudent to also renew the cylinder head bolts especially if they have been tightened more than once.

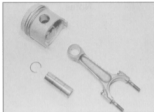
27 Engine and transmission - reconnection

1 On automatic transmission models make sure that the torque converter is fully engaged with the transmission and remains so during the reconnection procedure.

2 Support the engine then lift the transmission into position. On manual transmission models turn the unit as required until the splined input shaft enters the clutch driven plate.

3 Push the transmission onto the location dowels and insert the bolts in their correct locations as previously noted. Tighten the bolts to the specified torque (Chapter 6).

4 Refit the hydraulic pressure pump or vacuum pump bracket and tighten the bolts. Refit the adjustment link. Slip the drivebelt over the pulleys then swivel the pump to tension the drivebelt and tighten the link bolt and pivot bolt. When correctly tensioned the


26.22B Piston and connecting rod components

belt deflection under firm thumb pressure mid-way between the pulleys should be approximately 5.0 mm.

5 Where applicable, refit the hydraulic line bracket and tighten the bolt.

6 On automatic transmission models align the driveplate and torque converter bolt holes, and insert and tighten the bolts.

7 Refit the bottom cover and tighten the bolts.

8 Refit the starter motor, tighten the bolts, and reconnect the wiring.

9 Refit the TDC sensor and holder and tighten the bolts. When the TDC sensor is fitted new it incorporates three legs that are 1.0 mm long and these automatically set the sensor 1.0 mm from the flywheel/driveplate. When fitting an old sensor the legs should be filed off - the unit can then be fully inserted until it touches the flywheel/driveplate and then withdrawn by 1.0 mm before tightening the bolts.

28 Initial start-up after engine overhaul - general

1 Check that the oil, coolant and fuel have all been replenished and that the battery is well charged.

2 On early models fitted with a Roto-diesel fuel filter unscrew the plunger.

3 Switch on the ignition to energise the stop solenoid then actuate the pump on the fuel filter until resistance is felt. Retighten the plunger where necessary.

4 Fully depress the accelerator pedal, turn


26.25A Correct piston and connecting rod assembly

the ignition key to position "M" and wait for the preheating warning light to go out.

5 Start the engine. Additional cranking may be necessary to bleed the fuel system before the engine starts.

6 Once started keep the engine running at a fast tickover. Check that the oil pressure light goes out, then check for leaks of oil, fuel and coolant.

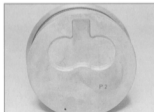
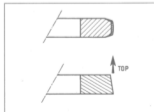
7 On pre-September 1986 models, if all is well, continue to run the engine at 3000 rpm for 10 minutes then switch off the ignition and let the engine cool for at least 3½ hours.

8 Remove the filler cap from the cooling system expansion tank to release any remaining pressure, then refit it.

9 Working on each cylinder head bolt in turn in the correct sequence first loosen the bolt 90° then retighten to the final torque given in the Specifications.

10 If any new parts have been fitted, the engine should be treated as new and run in at reduced speeds and loads for the first 600 miles (1000 km) or so. After this mileage it is beneficial to change the engine oil and oil filter.

11 Have the injection pump timing and idling speed checked and adjusted as described in Chapter 4.


26.25B Pushing the gudgeon pin into the piston

26.25C Clover leaf cut-out on the piston crown

26.26 Piston ring cross sections