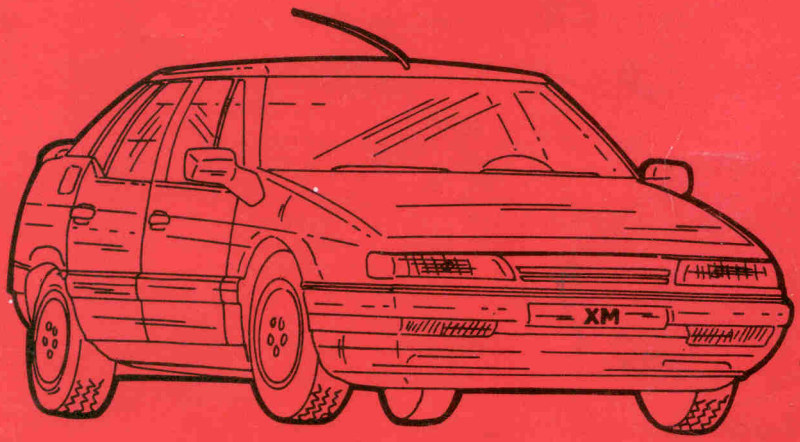
POCKET MECHANIC

VEHICLE MANUAL

CITROËN XM

Diesel and Turbodiesel



2088, 2138 AND 2446 c.c.
TO 1997

ADJUSTMENTS • TUNE-UP
REPAIRS • OVERHAULS
SERVICING • FAULT FINDING

PETER RUSSEK
MANUALS

TEXT PRINTED ON 100%
RE-CYCLED PAPER

POCKET MECHANIC CITROËN XM

DIESEL/TURBO DIESEL 2088, 2138 and 2446 c.c. ENGINES TO 1997

COVERING:

BY PETER RUSSEK

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WITH FAULT FINDING SECTION AT END OF MANUAL

No liability can be accepted for any Inaccuracies or Omissions in this workshop manual, or for personal injuries, arising from the use of this manual, although every possible care has been taken to make it as complete and accurate as possible. Every care has also been taken to prevent personal injury or damage to equipment when working on the vehicle. We have tried to cover all models produced to the day of publication, but are unable to refer to all modifications and changes for certain markets or up-dating of models. The manual has been compiled to include models to approx. June 1997 and includes the latest changes.

PREFACE

Small though this Workshop Manual is in size, it lacks no detail in covering the whole of the servicing and repair of the Citroen XM with 2088 c.c. and 2446 c.c. diesel and turbo diesel engines, as applicable. The earlier engines belong to the "family" of "XUD11" engines. The later 2446 c.c. engine (DK5), introduced during 1995 is a new engine. The engine is fitted in transverse direction into the engine compartment. The transmission, either a five-speed unit or an automatic transmission, is located underneath the engine.

Brief, easy-to-follow instructions are given, free from all necessary complication and repetition, yet containing all the required technical detail and information, and many diagrams and illustrations.

Compiled and illustrated by experts, this manual provides a concise source of helpful information, all of which has been cross-checked for accuracy to the manufacturer's official service and repair procedures. Where special tools are required, these are identified in the text if absolutely necessary and we do not hesitate to advise you if we feel that the operation cannot be properly undertaken without the use of such tools. Whenever possible, alternative tools or make- shift tools are mentioned to carry out specific operations. If alternative methods are given, these have been tested in practice and have been found satisfactory for the job described.

The readers own judgement must ultimately decide just what work he will feel able to undertake, but there is no doubt, that with this manual to assist him, there will be many more occasions where the delay, inconvenience and the cost of having the car off the road can be avoided or minimised.

The manual is called "Pocket Mechanic" and produced in a handy glove-pocket size with the aim that it should be kept in the vehicle whilst you are travelling. Many garage mechanics themselves use these publications in their work and if you have the manual with you in the car you will have an invaluable source of reference which will quickly repay its modest initial cost.
A fault finding (trouble shooting) section is included at the end of the manual and all items listed are taken from actual experience, together with the necessary remedies to correct faults and malfunctioning of certain parts.

0. INTRODUCTION

Our "Pocket Mechanics" are based on easy-to-follow step-by- step instructions and advice which enables you to carry out many jobs yourself. Moreover, you now have the means to avoid these frustrating delays and inconveniences which so often result from not knowing the right approach to carry out repairs which are often of a comperatively simple nature.

Whilst special tools are required to carry out certain operations we show you in this manual the essential design and construction of such equipment whenever possible to enable you, in many cases, to improvise or use alternative tools. Experience shows that it is advantageous to use only genuine parts since these give you the assurance of a first class job — **Always buy your spare parts from a Citroën dealer.**

0.0. General Information

The Citroën XM vehicles covered in this publication, are fitted with the engines specified on the previous page, but various engine types have been used in models covered in this publication. We have tried to cover as many engines as possible, but not all may be fitted to vehicles registered in the United Kingdom. Section 1.0 gives a list of all engines covered. The transmission is flange- mounted to the rear of the engine.

The main features of the "XUD11" engines are a cast-iron cylinder block with integrated cylinder bores and a five bearing crankshaft. A light-alloy cylinder head, with five bearings for the camshaft is fitted. Each cylinder has two inlet valves and one exhaust valve. The two inlet valves increase the engine performance by improving the filling of the cylinders. The cylinder head is made up of two sections, with the upper section carrying the camshaft and the lower section housing the valve gear.

The timing mechanism consists of an overhead camshaft, driven by a toothed belt. Hydraulic valve tappets are fitted. Differences between the non-turbo engine and the turbo engine will be given when applicable.

The "DK5" (2446 c.c.) engine has basically the same characteristics. Any differences between the "XUD11" and the "DK5" engine will be given when applicable.

0.1. Identification

Fig. 0.1. shows a view of the vehicle with the location of the different type identification plates.

The manufacturers plate is located on the right-hand side of the engine compartment. The serial number consists of 17 numbers and letters. It also contains the total permissible weight, total permissible weight with trailer, the max. load onto the front axle and the max. load onto the rear axle. The serial number is also stamped into the body panel on the right-hand wing, below the windscreen, indicated by (13) in the illustration.

The engine type and engine serial numbers are stamped into plates, attached to the engine. Engine type and serial number are given in a single plate.

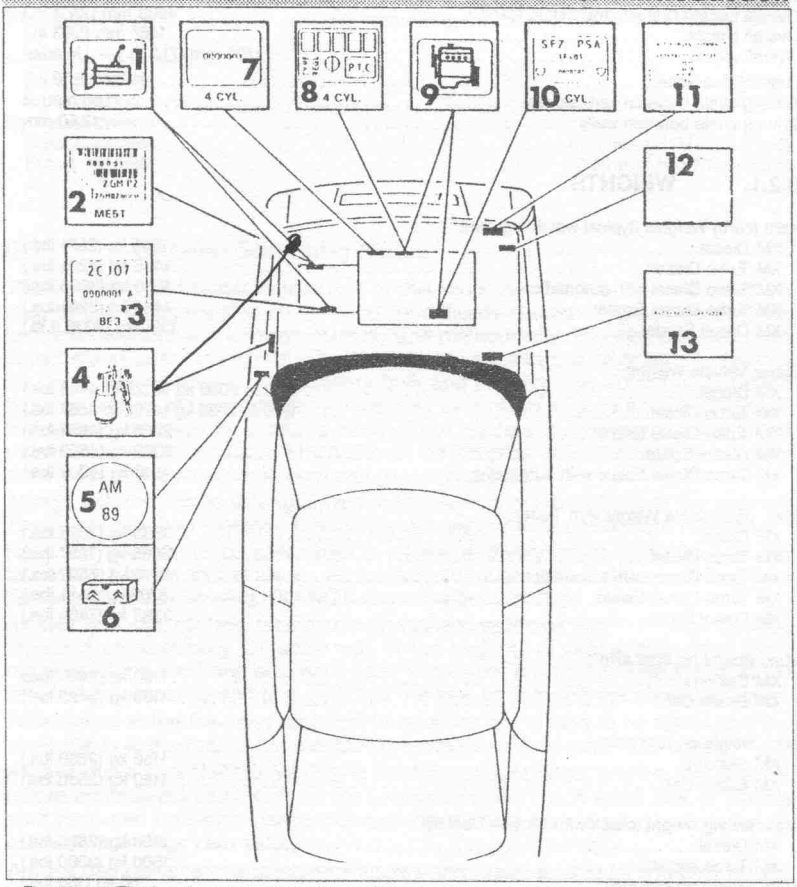


Fig. 0.1. — The location of the various type identification plates and serial numbers of the XM.

1 Transmission identification
2 Transmission number (ME5T)
3 Transmission number (BE3)
4 Paint code
5 Model year code
6 Spare part reference code
7 Engine serial number (4-cyl.)
8 Engine plate (4-cylinder)
9 Engine identification
10 Engine plate (V6)
11 Type identification plate
12 Body indentification
13 Chassis number

0.2. General Characteristics

0.2.0. DIMENSIONS

Wheelbase: ..... 2850 mm (113.25 in.)
Front track: ..... 1520 mm (60.4 in.)
Rear track: ..... 1447 mm (57.4 in.)

Overall Length (Saloon and Estate Car): ..... 4963 mm (197.2 in.)
Overall Height: ..... 1467 mm (58.3 in.)
Overall width: ..... 1794 mm (71.3 in.) — Unladen

Ground clearance: ..... 141 mm (5.56 in.)
Turning circle between kerb stones: ..... 11.66 metres
Turning circle between walls: ..... 12.50 mm

0.2.1. WEIGHTS

Kerb (curb) Weights (typical weights given):
- XM Diesel: ..... 1305 kg (2871 lbs.)
- XM Turbo Diesel: ..... 1455 kg (3201 lbs.)
- XM Turbo Diesel with automatic: ..... 1380 kg (3036 lbs.)
- XM Turbo Diesel Estate: ..... 1455 kg (3201 lbs.)
- XM Diesel Estate: ..... 1380 kg (3036 ft.lb.)

Gross Vehicle Weight:
- XM Diesel: ..... 1830 to 2030 kg (4026 to 4466 lbs.)
- XM Turbo Diesel: ..... 1910 to 2085 kg (4202 to 4587 lbs.)
- XM Turbo Diesel Estate: ..... 2205 kg (4851 lbs.)
- XM Diesel Estate: ..... 2095 kg (4609 lbs.)
- XM Turbo Diesel Estate with automatic: ..... 1910 kg (4202 lbs.)

Max. permissible Weight with Trailer:
- XM Diesel: ..... 3330 kg (7326 lbs.)
- XM Turbo Diesel: ..... 3585 kg (7887 lbs.)
- XM Turbo Diesel with automatic: ..... 3410 kg (7502 lbs.)
- XM Turbo Diesel Estate: ..... 3705 kg (8151 lbs.)
- XM Diesel Estate: ..... 3395 kg (7469 lbs.)

Max. weight on front axle::
- XM Saloons: ..... 1100 kg (2420 lbs.)
- XM Estate Car: ..... 1100 kg (2420 lbs.)

Max. weight on rear axle:
- XM Saloons: ..... 1150 kg (2530 lbs.)
- XM Estate Car: ..... 1150 kg (2530 lbs.)

Max. towing weight (ckeck with Citroën Dealer):
- XM Diesel ..... 1300 kg (2860 lbs.)
- XM Turbo diesel: ..... 1500 kg (3300 lbs.)

Max. weight on roof rack: ..... 80 kg (165 lbs.)

0.2.2. FILLING CAPACITIES

Fuel tank: ..... 80 litres
Cooling system:
- With manual transmission: ..... 9.6 litres (17 pts. approx.)
- With automatic transmission: ..... 10.0 litres (18 pts. approx.)
- DK5 engine (2.5 litres): ..... 13.0 litres (23 pts. approx.)

Engine:
- Without oil filter: ..... 5.1 litres
- With oil filter: ..... 5.8 litres
- DK5 engine (2.5 litre) — Without oil filter: ..... 7.5 litres
- DK5 engine (2.5 litre) — With oil filter: ..... 8.0 litres

Between "Max.." and "Min." marks on oil dipstick:
- XUD11/DK5 engines: ..... 2.8/3.0 litres

Transmission: ..... 1.8 litres (BE3), 1.85 litres (ME5 T), 2.2 litres (MG5TB)

Automatic Transmission:
Total capacity: ..... 7.5 litres
Fluid change: ..... 2.4 litres
Hydraulic system:
Saloon models: ..... 5.3 litres (LHM Plus Fluid)
Estate models: ..... 6.0 litres (LHM PLus Fluid)

0.3. General Servicing Notes

The servicing and repair instructions in this Workshop Manual are laid out in an easy-to-follow step-by-step fashion and no difficulty should be encountered if the text and diagrams are followed carefully and methodically. The intention has been to include all possible technial data that may be required and, in order this this can be done without adding unnecessary bulk and expense, we do not repeat each time the simple and obvious steps necessary to conform to good engineering practice. It may, however, be useful to many of our readers to summarise a few of the more important procedures which should be adopted at all times, and to briefly draw your attention to some points of general interest.

Always use the torque settings given in the various main sections of the manual. These are grouped together in separate sub-sections for convenient reference.

Bolts and nuts should be assembled in a clean and very lightly oiled condition and faces and threads should always be inspected to make sure that they are free from damage, burrs or scoring. DO NOT degrease bolts or nuts.

All joint washers, gaskets, tabs and lock washers, split pins and "O" rings must be replaced on assembly. Oil seals will, in the majority of cases, also need to be replaced, if the shaft and seal have been separated. Always lubricate the lip of the seal before assembly and take care that the seal lip is facing the correct direction.

References to the left-hand and right-hand sides are always to be taken as if the observer is at the rear of the car, facing forwards, unless otherwise stated.

Always make sure that the vehicle is adequately supported, and on firm ground, before commencing any work on the underside of the car. A small jack or a make shift prop can be highly dangerous and proper axle stands are an essential requirement for your own safety.

Always use genuine manufacturer's spares and replacements for the best results.

Since the manufacturer uses metric units when building the cars it is recommended that these are used for all precise units. Inch conversions are given in most cases but these are not necessarily precise conversions, being rounded off for the unimportant values.

Removal and installation instructions, in this Workshop Manual, cover the steps to take away or put back the unit or part in question. Other instructions, usually headed "Servicing", will cover the dismantling and repair of the unit once it has been stripped from the vehicle. It is pointed out that the major instructions cover a complete overhaul of all parts but, obviously, this will not always be necessary and should not be carried out needlessly.

There are a number of variations in unit parts on the range of vehicles covered in this Workshop Manual. We strongly recommend that you take care to identify the precise model, and the year of manufacture, before obtaining any spares or replacement parts.

The front wheel drive of the Citroën XM range of vehicles has a number of fea-

tures which provide much easier servicing and adjustment than will be found on many conventional vehicles. It is recommended that the reader should familiarise himself with these features. With the aid of the instructions given in this Workshop Manual we feel that there is little in the way of overhaul and servicing that cannot be undertaken with confidence.

The following abbreviations are sometimes used in the text and should be noted:

Std.: To indicate sizes and limits of components as supplied by the manufacturer. Also to indicate the production tolerances of new unused parts.

O/S Parts supplied as Oversize or Undersize, or recommended limits for such parts, to enable them to be used with worn or re-machined mating parts. O/S

U/S indicates a part that is larger than Std. size. U/S may indicate a bore of a bushing or female part that is smaller than Std.

Max.: Where given against a clearance or dimension indicates the maximum allowable. If in excess of the value given it is recommended that the appropriate part is fitted.

TIR: Indicates the Total Indicator Reading as shown by a dial indicator (dial gauge).

HT: High Tension (ignition) wiring or terminals.

TDC: Top Dead Centre (No. 1 piston on firing stroke).

MP: Multi-Purpose grease.

0.4. Jacking-up of the Vehicle

Due to the construction of the vehicle, a jack and/or chassis stands should only be placed under the vehicle as follows:

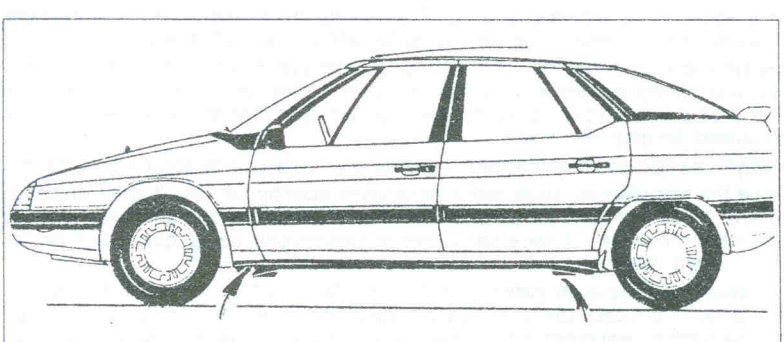


Fig. 0.2. — The arrows show where a jack or chassis stands can be placed underneath the vehicle.

To jack up the vehicle place a mobile jack underneath the side of the body, underneath the points shown by the arrows in Fig. 0.2. Either a mobile or a hydraulic jack can be used, but a piece of wood should be inserted between jack head and chassis/body. Chassis stands can be placed underneath the same locations, but again should be protected by inserting some soft material (rubber if possible) to protect the body work. The vehicle jack can be used in accordance with the in-

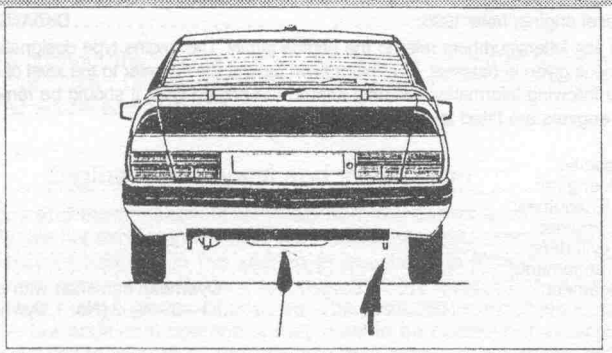


Fig. 0.3. — A jack can be placed under the bracket shown by the R.H. arrow (on both sides of the vehicle). A chassis stand can be placed under the vehicle at the position shown by the centre arrow.

structions. To jack up the rear of the vehicle it is possible to apply a mobile jack underneath the towing brackets shown in Fig. 0.3. Chassis stands can then be placed underneath the centre of the vehicle as shown by the arrow in the middle of the illustration.

Apply the handbrake when jacking up or engage a gear, to prevent the vehicle from rolling off the jack.

Always use secure chassis stands when working underneath the vehicle and only place them underneath the side members of the body, either at the front or at the rear, i.e. immediately at the ends of the body sills, as shown. Always make sure that the ground where you place the jack, is not too soft.

Ramps are perhaps the best solution to carry out operations underneath the vehicle.

0.5. Towing the Vehicle

The following precaution must be taken when a vehicle with hydro-pneumatic suspension is towed:

- The hydro-pneumatic suspension must be under pressure when the vehicle is being towed, as otherwise serious damage may result. It is possible to push the vehicle with de-pressurised suspension system on level ground.

1. ENGINES

1.0. Main Features

Fitted Engine Type (see note next page):

Diesel engine, from Sept. 1989: XUD11.A (P9A)
Turbo diesel engine, from Nov. 1989: XUD11.ATE (P8A)
Turbo diesel engine, from June 1990: ..... XUD11.ATE/Y (PHZ) *
Turbo diesel engine, from 1993: XUD11.ATE/L (P8A)
Turbo diesel engine, from 1995: XUD11.BTE (P8C)

0. Engines

Turbo diesel engine, from 1995: ..... DK5ATE/L (THY)

Note: The first letters/numbers refer to the engine family. The engine type designation of the actual engine is given in brackets. The information behind the "/" refer to the level of emission control. The following information will only refer to the engine type. It should be remembered that not all engines are fitted to vehicles marketed in the U.K.

Engine Capacity::
- XUD P9A engine: ..... 2138 c.c.
- Other XUD engines: ..... 2088 c.c.
- DK5 ATE engine: ..... 2446 c.c.

Number of cylinders: 4
Cylinder arrangement: ..... In-line
Valve arrangement: ..... Overhead camshaft with belt drive
Firing order: ..... 1—3—4—2 (No. 1, flywheel side)

Cylinder Bore:
- 2138 c.c. ..... 86.0 mm (3.4168 in.)
- 2088 c.c.: ..... 85.0 mm (3.3771 in.)
- 2446 c.c.: ..... 92.0 mm (3.6552 in.)

Piston Stroke:
- 2138 c.c. ..... 92.0 mm (3.6552 in.)
- 2088 c.c.: ..... 92.0 mm (3.6552 in.)
- 2446 c.c.: ..... 92.0 mm (3.6552 in.)

Compression Ratio:
- 2138 c.c.: ..... 22.5 : 1
- 2088 c.c.: ..... 21.5 : 1
- 2446 c.c.: ..... 22.0 : 1

Max. Power (DIN):
- 2138 c.c.: ..... 83 BHP/60 kW (DIN) at 4600 rpm
- 2088 c.c.: ..... 110 BHP/80 kW (DIN) at 4300 rpm
- 2446 c.c.: ..... 130 BHP/94.5 kW (DIN) at 4300 rpm

Max. Torque (approx.):
- 2138 c.c.: ..... 14.5 kgm (104.4 ft.lb.) at 2000 rpm
- 2088 c.c.: ..... 25.3 kgm (182.2 ft.lb.) at 2000 rpm
- 2446 c.c.: ..... 30.0 kgm (216.0 ft.lb.) at 2000 rpm

Oil Pressure:
- XUD11 engines: ..... 2.5 kg/sq.cm. (35.5 psi.) at 2000 rpm (oil temperature 80° C)
- DK5 engine: ..... 3.0 kg/sq.cm. (42.6 psi.) at 2000 rpm

Fuel injection type: ..... See relevant chapter

Valve Timing	P9A Engine	P8A/PHZ/DK5 Engine
Inlet valve opens:	13° BTDC	13° BTDC
Inlet valve closes:	46° ABDC	32° ABDC
Exhaust valve opens:	56° BBDC	56° BBDC
Exhaust valve closes:	12° ATDC	12° ATDC

Above opening and closing angles are given with a theoretical valve clearance of 0 mm.

BTDC = Before top dead centre
ATDC = After top dead centre
BBDC = Before bottom dead centre
ATDC = After top dead centre

Valve clearances: ..... Hydraulic tappets, not adjustable

Note: Throughout the engine section the engine will either be referred to as "XUD 11" or "DK5". Differences within a particular engine group will be given by quoting the actual engine type.

1.1. Engine — Removal and Installation

The engine and transmission is removed from the car as a complete unit. Some operations are not explained in detail in the following instructions, but are given under the relevant heading in the section in question. To remove the engine and transmission, proceed as follows, but note that the description is split into the "XUD11" and "DK5" groups of engines. The instructions are given in general for all models, but additional operations may have to be carried out as applicable, as it is not possible to refer to all models, injection systems, etc. It can be assumed that the information is based on the original XM diesel version.

1.1.0. XUD 11 ENGINE

- Slacken the wheel nuts of the front wheels and jack up the front of the vehicle. The wheels must be hanging free. Remove both wheels.
- Release the pressure from the hydraulic system. To do this, place the manual height control lever into the "low" position and open the drain plug by 1 to 1 ½ turns. Under no circumstances remove the plug. Refer to Section 8.1.3.0 for further detail. Wait until the vehicle is as low as possible.
- Disconnect the negative and the positive cable of the battery and remove the battery from the vehicle.
- Place the bonnet into vertical position against the windscreen, but take care not to damage the windscreen wipers or to damage the paint work of the bonnet with the wipers.
- Remove the air cleaner and the air suction hose.
- Remove the fluid reservoir for the hydraulic system as described in the relevant section, taking the necessary precautions.
- Remove the control unit box cover.
- Remove the wheel brace and its support.
- Standing on front of the car, work on the R.H. side and remove the supply box, the pre-heater control unit and on the inside of the wing panel the diesel fuel filter.
- Disconnect the two starter motor wires from the supply box (front right), two sensors (behind the fuel filter location), two connectors (to the right of the cover saying "12 V Diesel"), the connectors from the hydractive suspension control unit (on the L.H. side of the engine compartment) one relay and the connectors from the ABS control unit (again on the L.H. side). The locations are given as seen, when standing in front of the engine compartment.
- Disconnect the air ducts (one on the left near the control unit box, one on the right, front R.H. corner) and a pipe from the sensor.
- Remove the battery tray. One screw must be removed at the front from underneath the tray and one screw at the rear.
- Remove the complete control unit compartment on the L.H. side.

- Drain the oil from the transmission.
- Remove both drive shafts from the transmission as described in Section 4.1.
- Drain the cooling system. Refer to the "Cooling" system for further details.
- Use a socket with extension and unscrew the nuts securing the exhaust downpipe to the exhaust manifold.
- Undo the hose clamp and remove the hose from the bottom of the radiator.

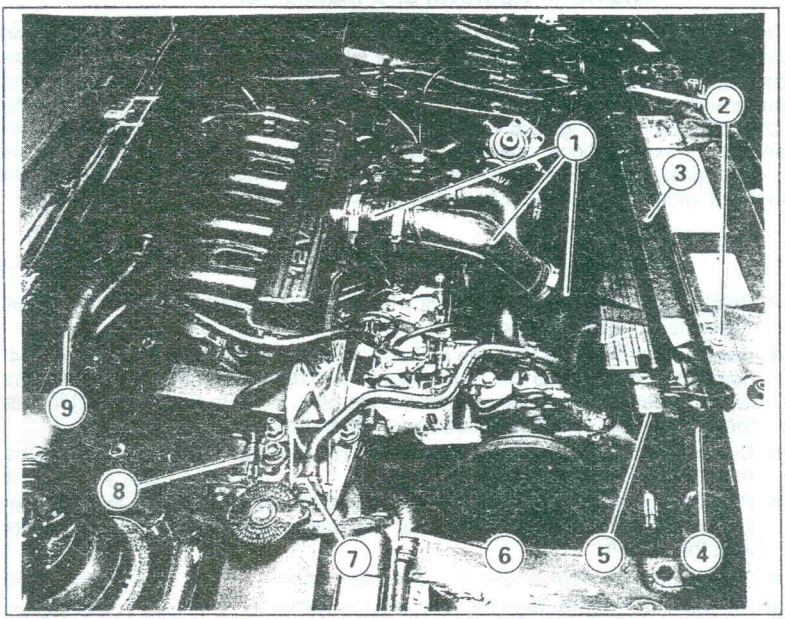


Fig. 1.1. — Details for the removal of the engine. The numbers are referred to in the text.

- Use a screwdriver and carefully lever the three gearchange linkage ball joint sockets off the ball joints on the levers.

The next operations are carried out in the engine compartment, with reference to Fig. 1.1, again as seen standing in fromt of the vehicle:

- Remove the two hose clamps and remove the air ducts (1). A further air duct is located on the R.H. side.
- Remove the water hoses after opening the hose clamps. The hoses shown in Fig. 1.1 are identified with (6), (7) and (8). Also remove the upper radiator hose and one smaller hose below.
- Disconnect the thermal switch lead from the radiator.
- Remove the two screws (2) in the illustration and remove the crossmember (3).
- Remove the radiator (5) and the air-to-air heat exchanger (4).
- Unscrew the four bolts securing the pulley at the lower end of the engine, remove the pulley and take off the high pressure pumpe drive belt.
- Remove the two heater hoses. One hose is located at position (9) in the illustra-

tion, the other one is located on the other side of the engine, next to the cylinder head. Also in this area disconnect the speed sensor connector and the speedometer cable.

- Disconnect the clutch cable from the lever on the transmsission by pulling the lever towards the rear.
- Find and disconnect the fuel pipes, one on the L.H. side of the cylinder head cover, the other one on the other side.
- On the R.H. side, on top of the transmission, disconnect the cable from the reversing light switch and the earth cable.
- Disconnect the feed cable from the glow plugs.
- Disconnect the suction pipes from the high pressure pump. Altogether four pipes must be disconnected. Remove the brackets where fitted.
- Place suitable slings around the engine and transmission and hook to a hoist or crane and lift up the assembly until just under tension.
- Remove the engine mountings in accordance with the instructions in Section 1.1.3. On the L.H. side slacken the bolt and nut inserted vertically from underneath and remove the bolt and nut securing the torque strut to the bracket. Remove the engine mounting on the L.H. side (standing in front of the vehicle). Remove two bolts and take out the torque strut, remove a nut in the centre of the mounting carrier bracket (where it is connected to the rubber mount) and then unscrew the mounting carrier bracket. Underneath the bracket remove the nut in the centre of the gearbox carrier and then unscrew the carrier.
- Lift the engine and transmission out of the engine compartment, tilting it as necessary to clear all component parts inside the engine compartment. On the gearbox side there is a hose which must be disconnected as soon as it is accessible. Make absolutely sure that none of the connections, cables, linkages, pipes, etc. can get caught in the engine or transmission and that none of the connections have been overlooked. Never use force to overcome a hesitant assembly during the lifting operation. Always check for the reason of the difficulties.

The installation of the engine and transmission is a reversal of the removal procedure. The engine can only be fitted together with the transmission. Note the following points:

- Lower the engine/transmission assembly into the approximate position. Connect the hose at the front face of the cylinder block (on the left) before the engine is fully lowered.
- Remove the upper mounting bracket with the engine mounting bracket (refer to Section 1.1.3) the tighten the mounting carrier and the nut in the centre of the rubber mounting to the values given in Figs. 1.6 or 1.7. Refit the torque rod and then tighten the complete engine mounting in accordance with the values given in the illustrations. Fit the rubber cover over the mounting after installation. The ropes/chains and the lifting tackle can now be removed.
- Refit the bolts to the torque strut underneath the engine and tighten the nut of the horizontally inserted bolt to 5.0 kgm (36 ft.lb.) and the nut of the vertically inserted bolt to 8.5 kgm (61 ft.lb.).
- Refit the two drive shafts in the manner described in Section 4.0.
- Fill and bleed the cooling system as described in the "Cooling" section.
- Lower the vehicle to the ground and pressurise the hydraulic system. Tighten the wheel nuts.

- Check the adjustment of the clutch mechanism and refill the transmission before the vehicle is taken to the road. Always check the oil level in the engine — just in case.

1.1.1. DK5 ENGINE

Engine and transmission are removed together as one assembly. The "power plant" is heavy, i.e. a hoist of adequate strength is essential before the unit can be lifted out of the vehicle. Note that the hydraulic fluid reservoir must be removed, i.e. first refer to the relevant section to read the prparatory work necessary to carry out this operation.

- Slacken the wheel nuts of the front wheels and jack up the front of the vehicle. The wheels must be hanging free. Remove both wheels.
- Release the pressure from the hydraulic system. To do this, place the manual height control lever into the "low" position and open the drain plug by 1 to 1 ½ turns. Under no circumstances remove the plug. Refer to Section 8.1.3.0 for further detail. Wait until the vehicle is as low as possible.
- Unscrew the battery trim cover. The cover is secured at two points, i.e. one attachment at the front side and one, marked by an arrow towards the air cleaner. A screwdriver is used to release the attachments.

  Disconnect the negative and the positive cable of the battery and remove the battery from the vehicle.
- Remove the protective plate under the engine and the protective plates under the wheel arches.

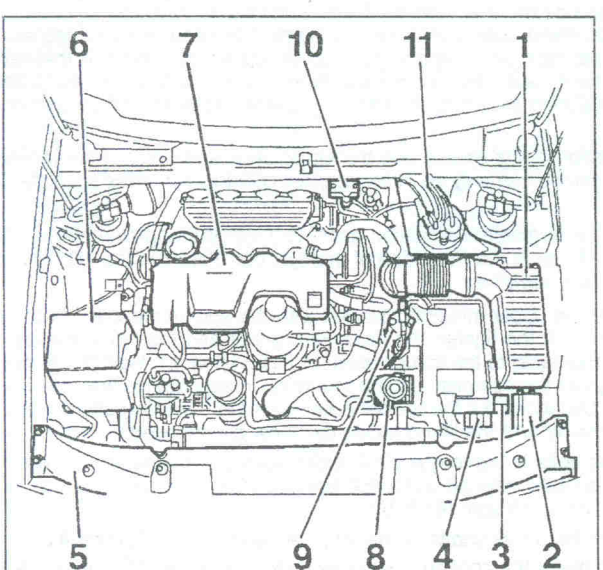


Fig. 1.2. — Details for the removal and installation of the DK5 engine. The numbers are referred to in the text.

- Drain the transmission and the cooling system (see relevant chapters).

Remove the following hoses by referring to Fig. 1.3: (1), (3), (4) and (5). Special hoses clamps are used which must be opened with a pair of pliers. Also disconnect theair conditioning condensor (4) from the cooling radiator (2). The radiator can now be removed. Unscrew the A/C compressor and place it to one side.

- Disconnect all electrical cables between the body and the power unit. As these are to numerous to mention you will have to proceed systematically to find all connections.
- Remove the clutch slave cylinder from the transmission.

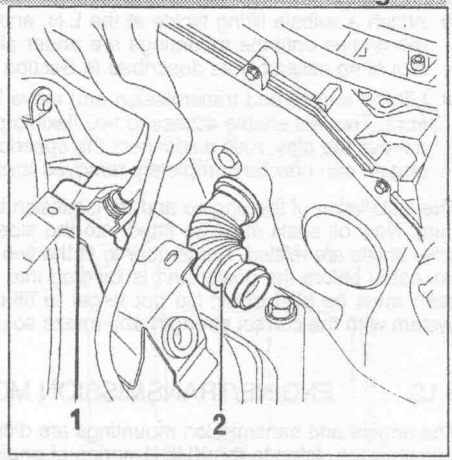


Fig. 1.3. — Removal of the connector (1) and the sleeve (2) referred to in the text.

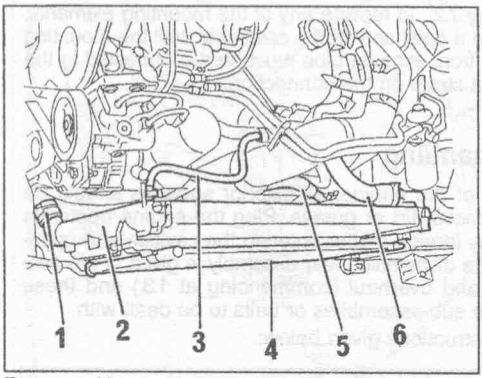


Fig. 1.4. — View from above, with the location of the various hoses and the radiator. The numbers are referred to in the text.

The cylinder is screwed into the transmission and must be twisted by one quarter of a turn in anticlockwise direction to remove it. After removal cover the open cylinder in suitable manner (a piece of plastic, attached with tape). A special sleeve is used in the workshop.

- From the LHM filter head disconnect the fluid return hoses and the pressure regulator return hose.2
- Locate and disconnect the fuel inlet and rteurn pipes. Immediately above there is an electro-magnetic valve. Remove it.
- Disconnect two union nuts from the hydraulic pipes and remove two screws securing the clamps.
- Remove the drive shafts as described in the relevant section.
- Disconnect the speedometer sensor connector and unscrew the exhaust pipe from the turbo charger.
- Remove the locking clips from the speed control cables and disconnect the speed control linkage ball joint. This may not be easy. The workshop uses a wedge-shaped fork which is driven between ball joint and lever. Hitting with a hammer will split the connection. Remove the other joint in the same manner.

- Attach a suibale lifting tackle at the L.H. and R.H. sides of the engine and lift the engine until the mountings are under slight tension. Remove the engine mounting assembly as described in Section 1.1.3.
- Lift the engine and transmission and move it about 20 cm (6 in.) towards the front. This will enable access to two flexible pipes. Undo the hose clamps and remove the pips. Also disconnect the speedometer cable from its bracket. The engine can now be completely removed towards the front.

The installation of the engine and transmission is a reversal of the removal procedure. New oil seals must be fitted into the sides of the transmission before the drive shafts are refitted. Remember to fit the two flexible pipes and the speed control cable before the power unit is lowered into the mountings. The hydraulic system must be bled of air. Do not forget to fill the transmission. Fill the cooling system with the correct strength anti-freeze solution.

1.1.3. ENGINE/TRANSMISSION MOUNTINGS

The engine and transmission mountings are different on models with BE3, ME 5T transmission, fitted to the XUD11 series of engines and on models with the DK5 engine (2446 c.c.). Figs. 1.6 and 1.7 show the suspension of engine and transmission together with the tightening torques in the case of the XUD11 engines, Fig. 1.8 shows the mountings of the DK5 engine. The "mdaN" values are the values in "kgm". To obtain "ft.lb." multiply by 7.2. To replace any of the mounting elements, support the engine/transmission on a hoist and lift the assembly until the mounting in question is free of tension. The front exhaust pipe must be disconnected in the case of the DK5 engine to prevent strain on the connection.

1.2. Engine — Dismantling

Before commencing dismantling of the engine, all exterior surfaces should be cleaned as far as possible, to remove dirt or grease. Plug the engine openings with clean cloth first to prevent any foreign matter entering the cavities and openings. Detailed information on engine dismantling and assembly is given in the sections dealing with the servicing and overhaul (commencing at 1.3.) and these should be followed for each of the sub-assemblies or units to be dealt with.

Follow the general dismantling instructions given below:

- Dismantling must be carried out in an orderly fashion to ensure that parts, such as valves, pistons, bearing caps, shells and so on, are replaced in the same positions as they occupied originally. Mark them clearly, but take care not to scratch or stamp on any rotating or bearing surfaces. A good way to keep the valves in order is by piercing them through an upside-down cardboard box and writing the number against each valve, as shown in Fig. 1.5. Segregate

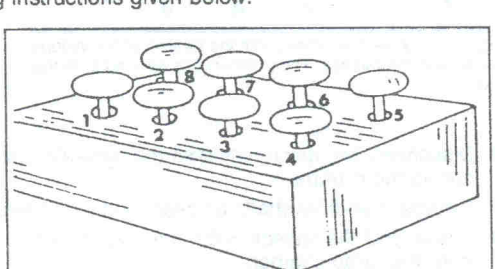


Fig. 1.5. — Segregate valves as shown.

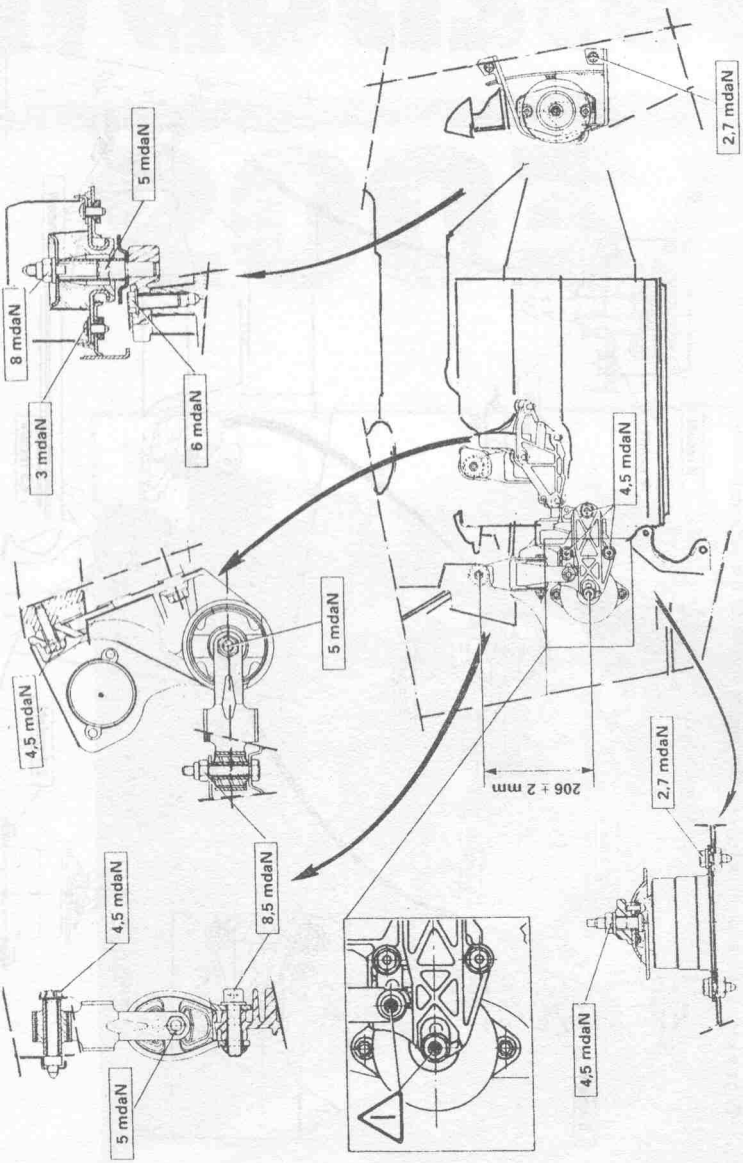


Fig. 1.6. — Engine and transmission mountings (XUD11 engine with BE3 transmission).

Fig. 1.7. — Engine and transmission mountings (XUD11 engine with ME5T transmission).

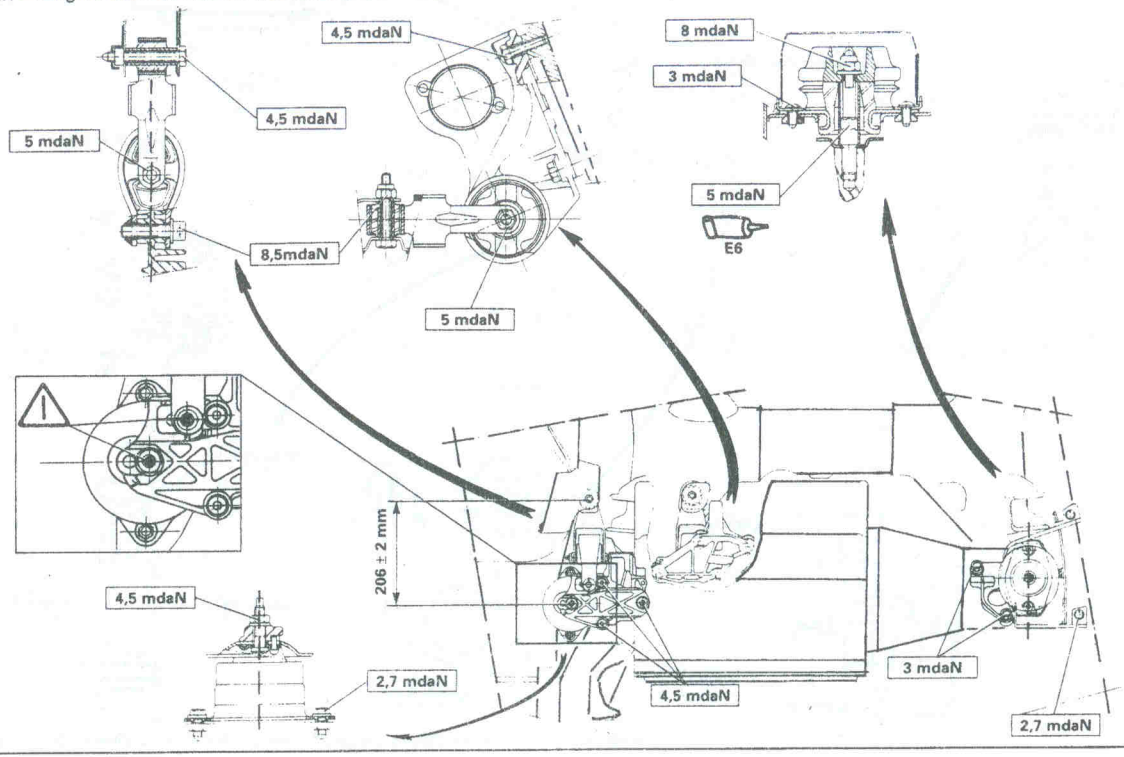
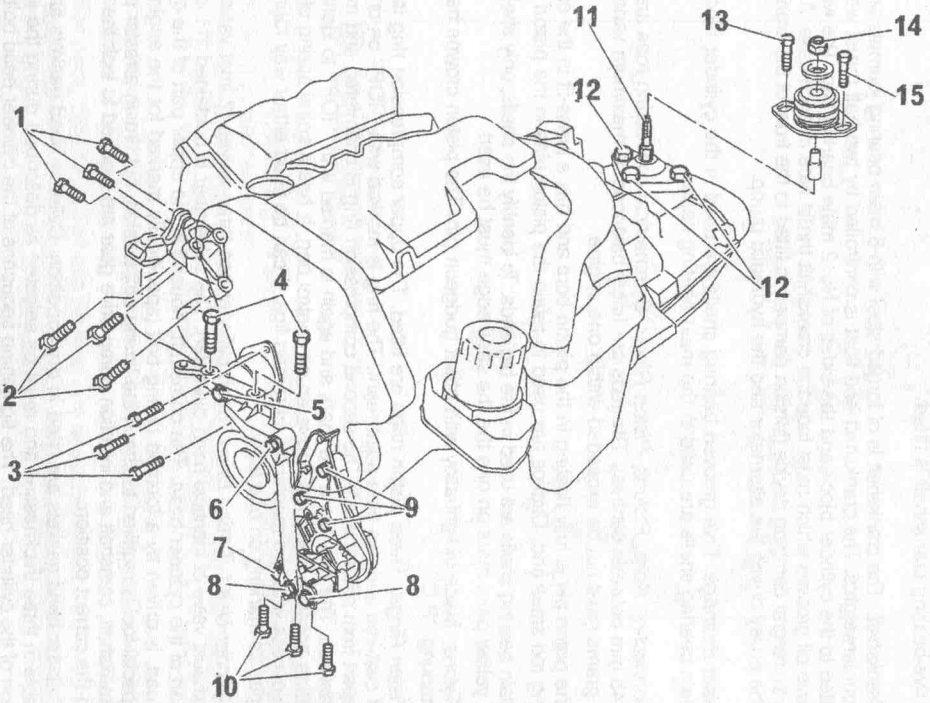


Fig. 1.8. — Engine and transmission mountings (DK5 engine).



1 5.0 kgm (36 ft.lb.)
2 5.5 kgm (40 ft.lb.)
3 3.0 kgm (22 ft.lb.)
4 5.0 kgm (36 ft.lb.)
5 9.0 kgm (52 ft.lb.)
6 11.0 kgm (79.5 ft.lb.)
7 6.0 kgm (43.5 ft.lb.)
8 11.0 kgm (79.5 ft.lb.)
9 5.5 kgm (40 ft.lb.)
10 5.0 kgm (36 ft.lb.)
11 5.0 kgm (36 ft.lb.)
12 5.0 kgm (36 ft.lb.7
13 2.0 kgm (14.5 ft.lb.)
14 6.5 kgm (47 ft.lb.7
15 2.0 kgm (14.5 ft.lb.)

together the springs and retainers with collets for each valve, if possible in small plastic bags for each individual valve.

- If a proper engine dismantling stand is not available, it will be useful to make up wooden support blocks to allow access to both the top and bottom faces of the engine. The cylinder head, once removed from the block, should be supported by a metal strap, screwed to the manifold face and secured by two nuts onto the manifold studs.

Before describing the general dismantling of the engine it may be of interest to know something about the design of the two engine groups.

XUD Engine without Turbo Charger

Cylinder Block: A cast-iron cylinder block with integral cylinder liners (bores) and a five-bearing crankshaft is fitted.

Crankshaft: The crankshaft is of forged steel with 5 main bearing journals and four counterweights. The crankshaft end float is controlled by two half thrust washers, fitted to the cylinder block and the sides of No. 2 main bearing cap. The washers have oil grooves which must face the crankshaft thrust face in each case. A pulley with integral damping device (torsion damper) is fitted to the front of the crankshaft. The pulley drives the alternator and the hydraulic pump.

Main Bearings: Five grooved bearing shells are used in the cylinder block, five plain bearing shells are used in the main bearing caps.

Connecting Rods, Pistons, Piston Rings: Symmetrical connecting rods are used (145 mm between centres). The rods are finely balanced. A maximum variation of 4 grams must not be exceeded within one engine.

The piston pin is fully floating in the piston bore and has a press-fit in the connecting rod small end. Circlips are used to retain the piston pins in the piston bores.

Plain bearing shells are used in the big ends. To identify the shells, only shells with a yellow paint mark on one the the shell edge must be used.

Pistons: Made of light-alloy with offset gudgeon pin. The piston crowns have the marking "P C".

Piston Rings: Three piston rings are fitted. The upper compression ring is made of cast-iron and has blue paint mark. The ring is marked with "TOP" on one side (apart from other marks). The second compression ring is chamfered and made of cast-iron. The ring has a red mark and again is marked with "TOP" to identify the fitting position. The third ring is an oil control ring. It has a spiral spring of 3 mm thickness with two machined, chromed lips. It can be fitted either way round, despite its marking on one side.

Cylinder Head, Timing Drive: Each cylinder has three valves (2 inlet valves, one exhaust valve of identical head diameter). The valve gear is contained in the lower part of the cylinder head. The camshaft, housed in the upper part of the cylinder head, is driven by a toothed timing belt (specifically marked for the engine). No special tool is required to check the timing belt tension, but timing arrester pins for crankshaft, camshaft and injection pump drive gear are required to lock the engine in the correct position.

Cylinder head gaskets are fitted in dry condition. Cylinder head gaskets are available in three thicknesses and must be selected as described during the installation of the cylinder head. The tightening sequence of the cylinder head bolts must

be observed (refer to specific section). Cylinder head bolts will stretch after they have been used several times. If their length is less than 145 mm between the underside of the head and the end of the thread, new bolts must be fitted. The washers underneath the bolt heads must always be replaced.

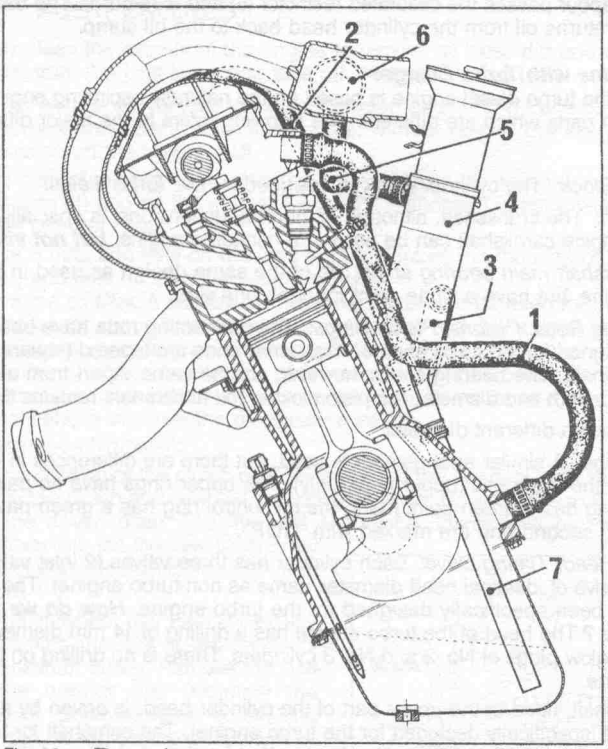


Fig. 1.9. — The crankcase vapour recycling system. The numbers are referred to in the description below.

Crankcase Vapour Recycling System: The vapour in the crankcase is re-routed into the combustion system. Fig. 1.9 shows how the system is arranged. It consists of the following component parts:

- The pressure balance pipe (1) connects the crnkcase to the camshaft housing.
- The connection hose (2) is fitted between the oil trap and the camshaft cover vent.
- The connecting pipe (3) is fitted between the oil trap and the cylinder block connection.
- Oil filler neck, dipstick and oil trap (4) form one assembly.
- The connecting pipe (5) is fitted between the oil trap and the inlet manifold. A calibrated restriction (6) is in the inlet manifold.
- Oil filler pipe (7).

The recycling system operates as follows:

- The connecting pipe (5) on the inlet manifold enables oil fumes from the cylinder head and the cylindert block to be absorbed (through pipes 2 and 3). A proportion of the oil vapour is drawn in directly via the filler pipe (7), the remaining vapour passes the calibrated restrictor (6) and is re-burnt. The balance pipe (1) returns oil from the cylinder head back to the oil sump.

XUD Engine with Turbo Charger

Although the turbo diesel engine is based on the naturally aspirating engine, there are certain parts which are different. The following refers to the major differences.

Cylinder Block: The cylinder block is designed for the Turbo diesel.

Crankshaft: The crankshaft, although of identical dimensions, is specially treated. A turbo engine carnkshaft can be used in a non-turbo engine, ***but not visa-versa.***

The crankshaft main bearing shells are of the same design as used in the non-turbo engine, but have a white paint mark on one side.

Connecting Rods, Pistons, Piston Rings: The connecting rods have been specifically designed for the turbo engine. Their small ends are tapered (square on non-turbo engines). The bearing shells, however, are the same. Apart from a different piston pin length and diameter, the piston-to-con rod attachment remains the same.

Pistons have a different diameter.

Piston Rings: A similar arrangement is used, but there are differences in the markings and the thickness (upper rings only). The upper rings have no paint mark, the 2nd ring has a green paint mark, the oil control ring has a green paint mark. Upper and second ring are marked with "TOP".

Cylinder Head, Timing Drive: Each cylinder has three valves (2 inlet valves, one exhaust valve of identical head diameter, same as non-turbo engine). The cylinder head has been specifically designed for the turbo engine. ***How do we find the difference ?*** The head of the turbo engine has a drilling of 14 mm diamewter between the glow plugs of No. 2 and No. 3 cylinders. There is no drilling on the standard engine.

The camshaft, fitted in the upper part of the cylinder head, is driven by a toothed timing belt (specifically designed for the turbo engine). The camshaft for the turbo engine is marked with "TE" on the flywheel end or has a drilling at the top and bottom (only one drilling on the non-turbo engine). The valve lift is different.

No special tool is required to check the timing belt tension, but timing arrester pins for crankshaft, camshaft and injection pump drive gear are required to lock the engine in the correct position.

Cylinder head gaskets are specially designed for the turbo engine and fitted in dry condition. Cylinder head gaskets are available in three thicknesses (different to non-turbo engines) and must be selected as described during the installation of the cylinder head. The tightening sequence of the cylinder head bolts must be observed. ***The tightening sequence of the cylinder head bolts is different on the turbo engine.***

The crankcase vapour recycling system is arranged in the same manner as described for the non-turbo engine. Fig. 1.9 and the description on the top of this page also applies to the turbo ewngine.

There are differences in the lubrication system between the two engine types.

The following text describes the general dismantling of the two engine types. Specific instructions for the removal of a certain parts can be found in the following sections.

1.2.0. XUD11 ENGINES

Thoroughly clean the exterior of the engine to remove all loose dirt and oil. Brush away all dirt from the joint faces and take off the transmission unit.

- Drain the engine oil, remove the bolts between engine and transmission and remove the transmission from the engine, without resting the weight of the transmission on the clutch shaft.
- On one side of the engine remove the inlet chamber. Remove the row of bolts on one side (3) and on the opposite side (2). Withdraw the complete housing from the cylinder head.
- Remove 6 nuts and take off the inlet manifold tubes (on the side of the turbo charger) and take off together with the gasket.
- Remove the oil filter. A suitable oil filter wrench should be used for this operation. Accessory shops have these as a stock item und it is a good investment to purchase one, as it is needed more than once in a life time of an engine. The oil filter is located on the side of the engine. The part below the oil filter is the oil cooler. Unscrew the nut in the centre of the oil cooler and remove it. Immediately above unscrew the oil pressure switch.
- Withdraw the oil dipstick
- Mark the position of the clutch plate in relation to the flywheel by punching two marks in the clutch and flywheel on opposite points. Unscrew the clutch and remove the driven plate. The flywheel should be counterheld by inserting a screwdriver into the flywheel teeth or by means of a toothed sector, as shown in Fig. 1.10.
- With the flywheel still held as explained, slacken the bolt in the inside of the crankshaft pulley. Remove the bolt with the washer and withdraw the crankshaft pulley/damper. A sticking pulley can be removed with two tyre levers, inserted opposite each other.
- Remove the timing belt guards at the front of the engine. 6 screws must be removed. Swivel the upper cover by a quarter of a turn to the right to remove it. Also remove the cover over the injection pump drive gear on the right-hand front (engine seen from the front).
- Unscrew the engine mounting bracket from the front face of the engine (4 bolts/nuts) and withdraw the bracket.

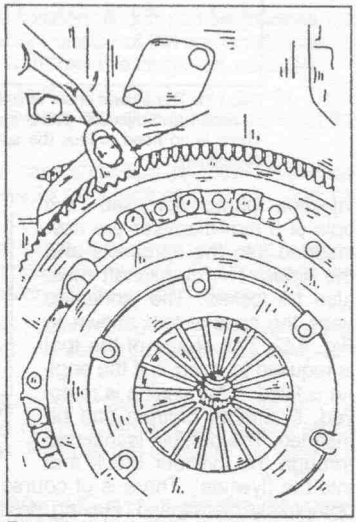


Fig. 1.10. — Locking the flywheel against rotation. Insert a toothed sector (arrow) into the starter ring gear teeth.

The next operation is the removal of the timing belt. The crankshaft, the camshaft and the injection pump drive sprocket must be locked against rotation in order not to

upset the timing position of the engine. First rotate the crankshaft until the two holes shown in Fig. 1.11 are in line with the respective bores below the camshaft and

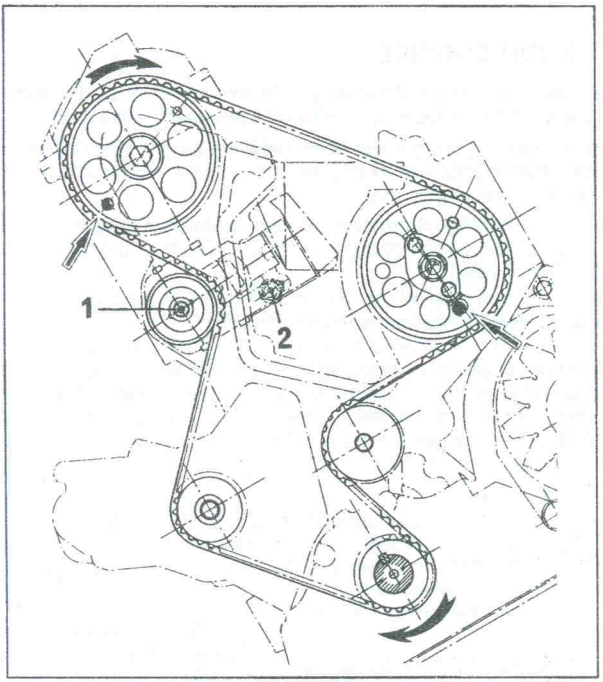


Fig. 1.11. The arrows show where the 8 mm bolts must be inserted to lock camshaft and injection pump sprocket during removal of the timing belt. There is no need to lock the sprockets if the engine is being dismantled completely.

injection pump sprocket. Two bols of 8 mm diameter are now inserted into the sprockets and the holes. The crankshaft must also be locked. The workshop uses the special tool shown in Fig. 1.12. The shape of the tool is required to insert it, if the engine is fitted. If the engine is removed, a straight drift/pin can be inserted. The drift/pin is inserted through the cylinder block and into the flywheel. There is of course no need for this operation, if the engine is completely dismantled. Having prepared the engine as described, proceed as follows:

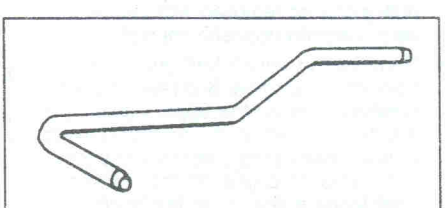


Fig. 1.12. — The special rod (Tool No. 7014-T.J.) is used to lock the crankshaft in the timing position. A removed engine facilitates the operation.

- Refer to Fig. 1.12 and slacken the nut (1). Again there are no problems when

the engine is removed. If the engine is fitted to the vehicle, the operation must be carried out through the access hole in the engine mounting.

- Slacken the screw (2) in Fig. 1.12 with a 5 mm Allen key and apply an open-ended spanner (10 mm A/F) to the eccentric adjuster. Turn the adjuster in clockwise direction to slacken the toothed belt, push the tensioning roller towards the outside and tighten the nut (1) in the new position of the tensioning roller.
- Mark the running direction of the timing belt, if the old belt is to be fitted (or just in case) and take the belt of the various sprockets.
- Remove the various hoses and pipes from the side of the engine.
- On the flwheel side remove three hoses.
- Disconnect the an operating cable from the lever and detach the cable from the injection pump. Unscrew the injector pipes and remove them. Two pipes are clamped together in pairs and can be removed together.
- Remove 11 screws and remove the cylinder head cover.
- Remove the cylinder head as described in Section 1.4.0.1 for the engine in question.
- *On the diesel version* remove the water housing on the front end of the engine (throw away the gasket) and unscrew the water pump (throw away the gasket).
- *On the turbo diesel version* unscrew the turbo charger (6 bolts) and remove it together with the gasket (throw away the gasket).
- Unscrew the water housing on the front end of the engine and remove it (throw away the gasket).
- Unscrew the timing belt tensioning roller. The crankshaft timing gear can be removed from the crankshaft. Use tyre levers, inserted at opposite points, to remove a sticking timing gear.
- Lock the camshaft timing sprocket against rotation. A drift can be inserted into one of the sprocket holes and placed against the side of the camshaft housing. Slacken and remove the centre bolt and withdraw the camshaft sprocket.
- Remove the injection pump. You will have to find the attachment points. There is one at the rear, three at the front. Also remove the aluminium bracket at the front.
- Remove the eight flywheel bolts (hold the crankshaft against rotation) and carefully take off the flywheel. Use a rubber mallet on a sticking flywheel. Take care not to drop it.
- Turn the engine upside down, with the oil sump uppermost, but take care, as oil still inside of the cylinder block will immediately run out. There are various versions, depending on the equipment which will be briefly referred to:
- *In the case of a diesel engine without A/C system* remove 19 hexagonal head bolts and four socket head screws (around one corner). Free the oil sump and remove it. Take off the gasket.
- *In the case of a diesel engine with A/C system* remove 20 screws around the oil sump, one additional screw at one end of the sump and two screws where the compressor mounting lugs are located. Remove the oil sump (no gasket is fitted).
- *In the case of a turbo diesel engine without A/C system* remove 19 screws around the circumference of the sump and four socket head screws on one side (around the corner). Also on this oil sump remove the oil level indicator sensor (2 screws) and withdraw. Lift off the sump together with the gasket.

- *In the case of a turbo diesel engine with A/C system* proceed as described for the diesel engine with A/C system, but remove the oil level indicator sensor (2 screws). Again no gasket is used.
- Facing the side with the oil pump drive chain, unscrew the six screwws securing the front cover. Remove the cover from the cylinder block. The crankshaft front oil seal can be removed from the cover (always replace, if the cover has been removed).
- Remove the three bolts securing the oil pump to the lower face of the cylinder block. Lift the oil pump and remove it towards the end, at the same time withdrawing the pump sprocket from the end of the crankshaft. Fig. 1.13 shows where the pump is fitted to the cylinder block.

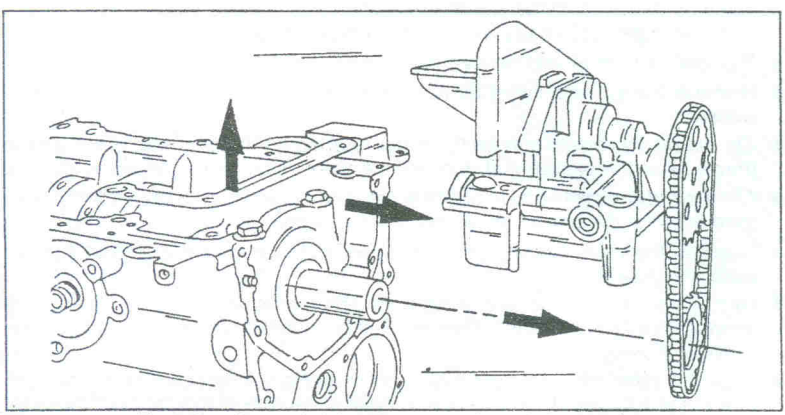


Fig. 1.13. — Removal of the oil pump together with the sprocket.

- Remove the big end bearing cap nuts and remove the bearing caps, mark each bearing cap and the connecting rod with a centre punch and then remove the caps one after the other. Two big end bearings must be at bottom dead centre at one time to facilitate the removal. Take off the bearing shells and keep them together with the respective bearing caps. Remove each piston and connecting rod. Push the pistons out of the cylinder liners using a hammer handle, if required.
- Mark each bearing cap and the cylinder block on one side at opposite points, using a centre punch or a spot of paint and unscrew the main bearing caps. Remove the bearing caps one after the other and immediately place the bearing shell into the respective cap.
- Lift out the crankshaft and remove the upper bearing shells. Keep each shell together with the matching shell and the bearing cap for the particular bearing. Remove the crankshaft end float thrust washers from the side of the second bearing from the flywheel end. Also remove the flywheel side oil seal from the end of the crankshaft. Fig. 1.14 shows the parts of the crankshaft after removal. In the cylinder block remain the five bearing shells and two further thrust washers for the control of the crankshaft end float.
- Four oil jets are fitted to the turbo diesel engine, which can be unscrewed if required (always necessary during complete overhaul).

1.2.2. DK5 ENGINE

The dismantling follows in general the instructions for the XUD11 engine. Specific instructions for the removal of certain component parts, i.e. timing belt, cylinder head, drive belt (front of engine) and oil pump are described under their own heading and should be referred to when necessary.

1.3. Engine — Assembly

This section covers the general re-assembly procedures and further detailed information on servicing and overhaul is given in the sections commencing at **1.4**. The general instructions below should be followed at all times and are in general valid for all engines.

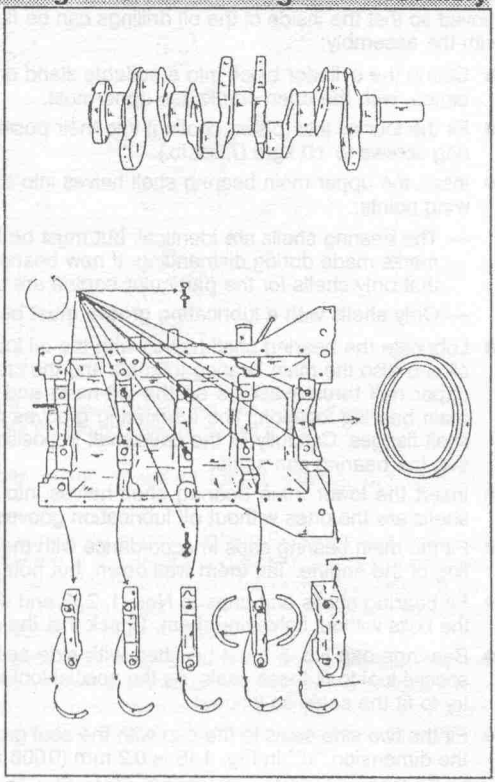


Fig. 1.14. — View of the crankshaft together with crankshaft bearings and thrust washers.

- Take care to keep all parts in as clean a condition as possible. Benches, tools and rugs should be kept free of swarf, dirt and all other foreign matter. When installing any part that slides or rotates, be sure to apply a thin film of clean engine oil. Do this **before** the parts are assembled and not afterwards.
- Use new gaskets and renew all lock washers and plates, damaged bolts and nuts. Self-locking nuts and bolts must be replaced if instructed. All oil seals should automatically be replaced if the rotating part has been removed.
- Follow the specific tightening torque values which are either given in the following text or listed in Section **1.5.**, but take care to check torque values for the engine in question. It is most important that all torque figures are checked before a nut or bolt is tightened. Guess work is not good enough.
- Certain locking agents, sealing compounds and other liquids used during assembly are given as specified by Citroën. We therefore recommend to try and obtain the correct compounds or to make sure any alternative is suitable.
- With all parts serviced and/or overhauled as necessary, the assembly sequence should be as described. The instructions are based on the original XUD11 engine. Any differences for the DK5 engine are described under their own heading.

To thoroughly clean the cylinder block, the main oil gallery oil plugs should be re-

moved so that the inside of the oil drillings can be flushed out. Proceed as follows with the assembly:

- Clamp the cylinder block into a suitable stand or place the block onto a work bench, with the open crankcase uppermost.
- Fit the four oil jets (piston cooling) into their position and tighten the four securing screws to 1.0 kgm (7.2 ft.lb.).
- Insert the upper main bearing shell halves into the crankcase, noting the following points:
  - — The bearing shells are identical, but must be fitted in accordance with their marks made during dismantling. If new bearing shells are fitted, make sure that only shells for the particular engine are obtained.
  - — Only shells with a lubricating groove must be used.
- Lubricate the bearing shell halves with the oil lubricating grooves with engine oil and also the main bearing journals and the crankpin journals. Place the two upper half thrust washers on the left-hand and right-hand side of the No. 2 main bearing location. The lubricating grooves must face towards the crankshaft flanges. Carefully lift the crankshaft in position and rotate it a few times so that the bearing can settle.
- Insert the lower main bearing shell halves into the main bearing caps. The shells are the ones without oil lubrication gooves.
- Fit the main bearing caps in accordance with the marks made during dismantling of the engine. Tap them well down, but note the following points:
- Fit bearing shells and caps to Nos. 1, 2, 3 and 4 bearing locations and insert the bolts without tightening them. Check that the cap locating dowels are fitted.
- Bearings cap No. 5 must be fitted with side seals. Citroën workshops use a special tool to fit these seals. As the special tool is most probably not available, try to fit the seals as follows:
- Fit the two side seals to the cap with the seal groove outwards and check that the dimension "d" in Fig. 1.15 is 0.2 mm (0.008 in.).
- Smear a thin coat of engine oil on the bearing faces of No. 5 main bearing cap press the seals into the bearing cap grooves. The seals must be lubricated with engine oil.
- Fit the bearing shell into the cap and oil the shells and the side seals.
- Screw two studs into the cylinder block (in place of the bearing cap bolts) and place the bearing cap over the studs. The area where the bearing cap is resting on the cylinder block must be coated with a good sealing compound (left and right). Use two pieces of aluminium foil between side seal and cap on each side and carefully tap home the cap, checking at the same time that the seals cannot move (Fig. 1.16).
- Remove the two foil strips and the studs and screw in the main bearing cap bolts.

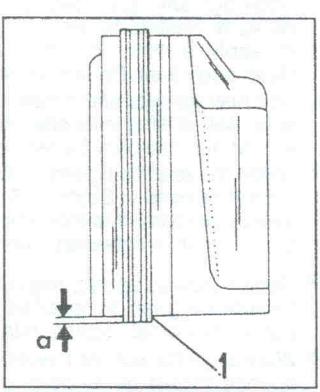


Fig. 1.15. — The side seals (1) for the front and rear main bearing caps must be proud on each side (a) by the dimension given in the text.

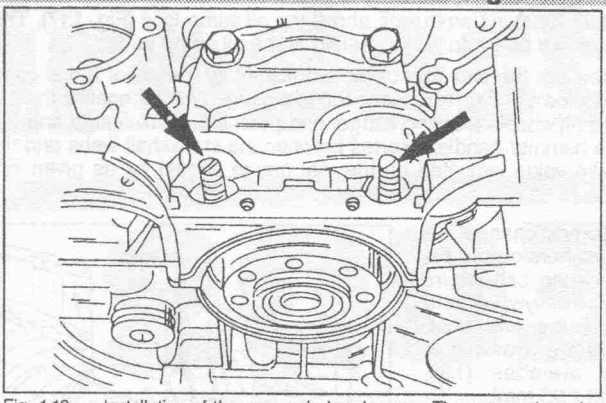


Fig. 1.16. — Installation of the rear main bearing cap. The arrows show the two studs in position. On the left and right are the two foil strips.

- Tighten all bearing cap bolts to the specified torque setting, but note the differences:
  - — In the case of a naturally aspirating engine, tighten the bolts to a torque of 7.0 kgm. Commence tightening at the centre and work towards the outsides and tighten in several stages to the final torque. Rotate the crankshaft a few times to check for binding. The crankshaft can be freed off slightly by hitting the bearing caps with a rubber or plastic mallet.
  - — In the case of a turbo engine, tighten all bolts from the centre towards the outside to 1.5 kgm (11 ft.lb.). From the final position tighten the bolts a further 60°. If a graduated disc is available (refer to the refitting of the cylinder head) tighten the bolts to the 60° setting. Otherwise remember that 90° is a quarter of a turn.
- Use a sharp knife and cut the end of the side seals to leave approx. 0.5 - 0.7

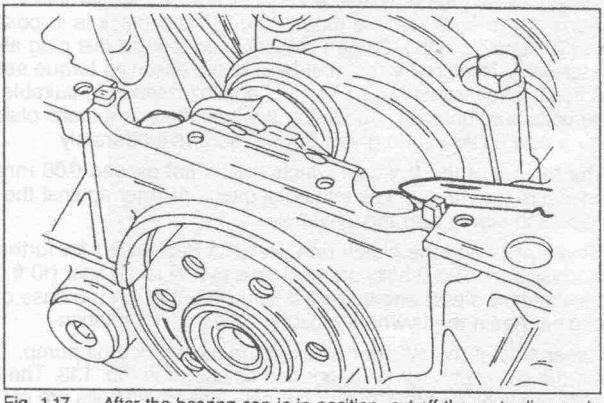


Fig. 1.17. — After the bearing cap is in position, cut-off the protruding ends of the side seals on each side of the cap.

mm (0.02 - 0.028 in.) protrusion above the oil sump face (Fig. 1.17). The protruding ends will give additional sealing at the oil sump ends.

- Next measure the end float of the crankshaft by means of a dial gauge, attached as shown in Fig. 1.18. Place the dial gauge plunger against the crankshaft end face (flywheel mounting flange) and push the crankshaft to and fro by means of a hammer handle, inserted between the crankshaft webs and the crankcase. The value indicated on the dial gauge should be as given in Section 1.4.3.0.

If necessary, change the thrust washers on the second bearing cap, counted from the flywheel end to rectify the end float. Washers are available in various oversizes (1.95, 2.00 and 2.05 mm).

- Fit the oil seal to the rear of the crankshaft, taking care not to damage it. Take care that the outer sealing lip is not folded towards the inside. If necessary use a small wire hook, insert it between sealing lip and crankshaft journal and pull the lip towards the outside.
- Fit the pistons and connecting rods as described later on.

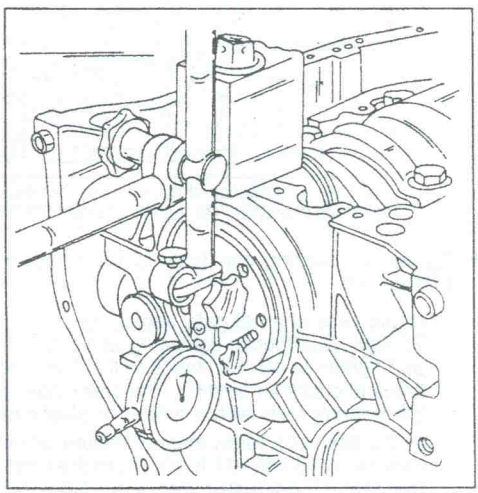


Fig. 1.18. — Checking the crankshaft end float with a dial gauge. The dial gauge needle is resting against the crankshaft flange.

- Fit the flywheel. New flywheel bolts should be used. A dowel pin in the crankshaft end and a hole in the flywheel ensure correct location. Make sure that the plug in the cylinder block is in position and tightened (3.8 kgm/27.5 ft.lb.). Citroën prescribes to replace this plug after it has been unscrewed. Tighten the flywheel bolts to the specified torque setting of 5 kgm (36 ft.lb.). The flywheel must be held against rotation in suitable manner when the bolts are tightened. Above the flywheel there is a small plate. Fit the plate with a new gasket and tighten the two screws moderately.
- Check the run-out of the flywheel which should not exceed 0.06 mm (0.0024 in.). To measure the run-out, place the dial gauge plunger against the flywheel friction face and slowly turn the flywheel.
- Fit the driven plate and the clutch unit. Refer to Section 2.1 for further details of clutch installation. The 6 bolts are tightened evenly to 1.3 kgm (10 ft.lb.) in the case of a standard diesel engine or 2.0 kgm (14.5 ft.lb.) in the case of a turbo diesel engine. Again the flywheel must be held against rotation.
- On the other side of the cylinder block fit the assembled oil pump. The drive chain and the sprocket must be in position as shown in Fig. 1.13. The three securing bolts are tightened to 1.3 kgm, but note that not all bolts are of the same length. Looking at the drive chain, fit the longest bolt (80 mm long) to the right-

hand side and the shortest bolt (65 mm) to the left-hand side. The remaining bolt has a length of 70 mm.

- Fit the front cover over the cylinder block and the crankshaft. The cover/block sealing faces must be coated with sealing compound ("Formajoint" is used by Citroën). Four bolts of 35 mm in length are used at the bottom, two bolts of 18 mm in length. All bolts are tightened to 1.2 kgm (8.5 ft.lb.).
- Fit the new front oil seal. Lubricate the sealing lip and the outside of a new seal with engine oil and carefully drive it in position until flush with the outside of the cover.
- Fit the oil sump, noting the different versions that can be encountered:
  - — If the vehicle is fitted with an air conditioning system and a standard diesel engine, coat the cylinder block face with sealing compound (Auto Joint) and lower the sump in position. The sump is secured with 23 screws. 20 have a length of 22 mm, but one is only 20 mm long. The latter screw is fitted in the centre of the two mounting lugs on the sump. Two further screws of 40 mm in length are fitted near the upper mounting lugs for the compressor mounting on the oil sump. All screws are tightened to 1.6 kgm (11 ft.lb.).
  - — If a plain oil sump is fitted but there is no A/C system, place a new oil sump gasket in position (no sealing compound) and position the oil sump over the cylinder block. The 23 screws are tightened to 1.6 kgm (11 ft.lb.), but again screws of different length are used. The two centre screws on the small sides of the sump and the centre screw on one of the long sides of the sump (the side towards you when the timing side is on the right) have a length of 16 mm. The others are 20 mm long. Make sure to separate the screws accordingly. The four screws around one corner of the sump (flywheel end) have socket heads.
  - — In the case of a turbo diesel engine without A/C system, place a new dry sump gasket in position and tighten the 23 screws to 1.6 kgm (11 ft.lb.). The arrangement of the bolts is the same as on a standard diesel engine without A/C system. Fit the oil level indicator sensor and tighten the two screws to 1.0 kgm (7 ft.lb.).
  - — In the case of a turbo diesel engine with A/C system, coat the sealing face on the cylinder head with sealing compound (see above) asnd lower the sump in position. The arrangement of the screws is the same as already given for an engine without A/C system. All screws are tightened to 1.6 kgm (11 ft.lb.).
- Fit the oil cooler, with the two water hose connectors towards the top, insert the sleeve nut and tighten the nut to 5.8 kgm (42 ft.lb.). Also fit the oil pressure switch (3 kgm(21 ft.lb.).
- Coat the new oil filter sealing ring with engine oil, tighten the filter against the oil cooler until handtight and from this position tighten the filter a further ¾ of a turn, using both hands.
- In the case of a standard diesel engine fit a new gasket for the water pump, fit the pump in position and tighten the five bolts to 1.2 kgm (8.5 ft.lb.). Insert the thermostat into the thermostat housing (the side with the spring towards the inside), place the housing cover in position and tighten the three screws to 2.3 kgm (16.5 ft.lb.). Fit the thermostat housing with a new gasket and tighten the two screws with 2.0 kgm (14.5 ft.lb.).
- In the case of a turbo diesel engine fit a new gasket between the thermostat housing and the water pump and screw the two parts together (2.0 kgm/14.5

ft.lb.). Apply a bead of sealing compound onto the flat face of the housing (around the square opening). Insert the thermostat into the housing (the side with the spring towards the outside) and fit the housing cover. Tighten the 3 screws to 2.0 kgm (14.5 ft.lb.). Refit the housing to the cylinder block and tighten the 3 screws to 2.0 kgm (14.5 ft.lb.). Fit the water pump and tighten the 6 screws to 1.0 kgm (7.2 ft.lb.).

- Refit the cylinder head as described under the relevant heading (Section 1.4). A "Torx 55" insert is required to tighten the cylinder head bolts. Cylinder head bolts must be tightened to a certain angle after the initial tightening torque, i.e. a graded disc may be helpful to do the job. Also note the differences between a standard diesel engine and the turbo diesel engine.
- Lubricate a new camshaft oil seal with engine oil (sealing lip and outside) and fit the seal into the cylinder head and over the shaft. Use a piece of tube of the same diameter as the oil seal to drive the seal in position. After the seal has been fitted, slide the camshaft timing gearwheel over the shaft (without dislodging the Woodruff key) and fit the bolt with washer. Tighten the bolt to 5.0 kgm (36 ft.lb.). The camshaft timing gear must be held against rotation. Fig. 1.19 shows a suitable method. Underneath the camshaft gear, towards the left, you will find a plug. If this has been removed, fit a new one. The plug is tightened to 3.8 kgm (27.5 ft.lb.).
- Refit the timing belt tensioner roller. Tighten the bolt to 3.7 kgm (27.5 ft.lb.).
- Fit the Woodruff key into the crankshaft and, without dislodging the key, drive the crankshaft timing gear over the end of the shaft.
- Refit and tension the timing belt as described in Section 1.4.4., but note the following points:

  Camshaft timing gearwheel and crankshaft must be locked against movement or rotation whilst the timing belt is fitted. This is carried out by inserting a locking pin into the camshaft gearwheel and the injection pump drive wheel and another one into the crankshaft.

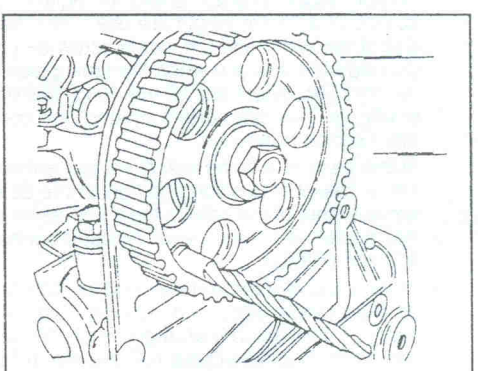


Fig. 1.19. — Lock the camshaft sprocket against rotation when tightening the sprocket securing bolt. A washer is fitted underneath the bolt head.

  Additionally, the correct tensioning of the timing demands a step-for-step procedure to ensure a damage-free operation of the engine after it is started for the first time.
- Time the injection pump as described under the relevant heading. Note that special tools will be required.
- Place the rocker cover in position. Tighten the 11 rocker cover screws to 0.8 kgm (6 ft.lb.).
- Fit the four injectors and tighten them to 9.0 kgm (65 ft.lb.). New sealing rings are used under the injectors. Note that a long socket is required.

- Fit the four leak-off pipes between the injectors. Loosely attach the four injection pipes with their union nuts and tighten the union nuts at both ends to 2.5 kgm (18 ft.lb.).
- Fit all disconnected water hoses, pipes, turbo charger, etc. to the outside of the engine. The engine mounting bracket is tightened to 2.7 kgm (19.5 ft.lb.). Note that a pin in the cylinder head must engage with a hole in the mounting bracket.
- Fit the three protective covers. The screw below the engine mounting bracket is tightened to 1.8 kgm (13 ft.lb.), the remaining 5 screws to 1.0 kgm (7.2 ft.lb.).
- Fit the crankshaft pulley/damper over the crankshaft end. Coat the bolt threads with thread locking compound (Frenbloc), counterhold the crankshaft against rotation and tighten the bolt in three stages. First tighten the bolt to 4.0 kgm (30 ft.lb.) and from this position a further 60°. Use a torque wrench and tighten the bolt to 17 + 3 kgm (122.5 + 21 ft.lb.).
- Refit the induction pipe assembly with a new gasket. Tighten the 6 bolts to 2.3 kgm (14 ft.lb.). Fit the inlet chamber in position. Tighten the row of three screws to 1.0 kgm (7.2 ft.lb.) and the two other screws to 0.5 kgm (3.5 ft.lb.).

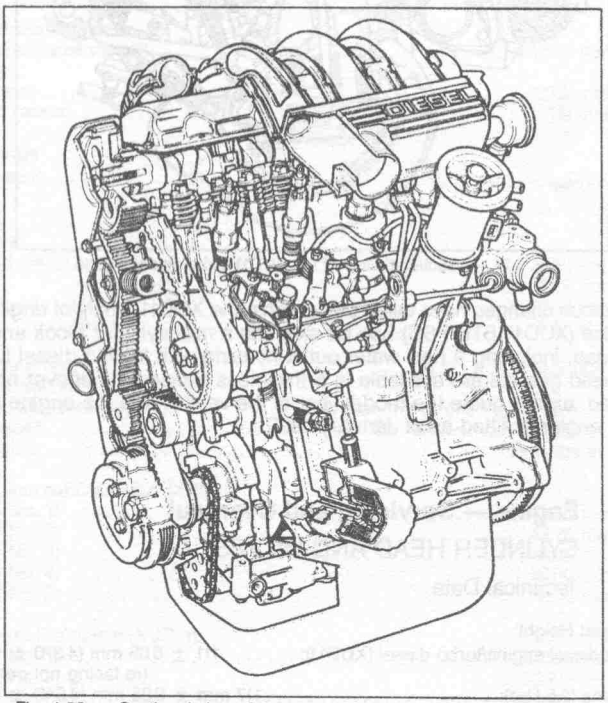


Fig. 1.20. — Sectional view of the assembled turbodiesel engine (XUD).

Figs. 1.20 and 1.21 show sectional views of the XUD11 turbo engine, with the location of some of the parts encountered during dismantling and assembly.

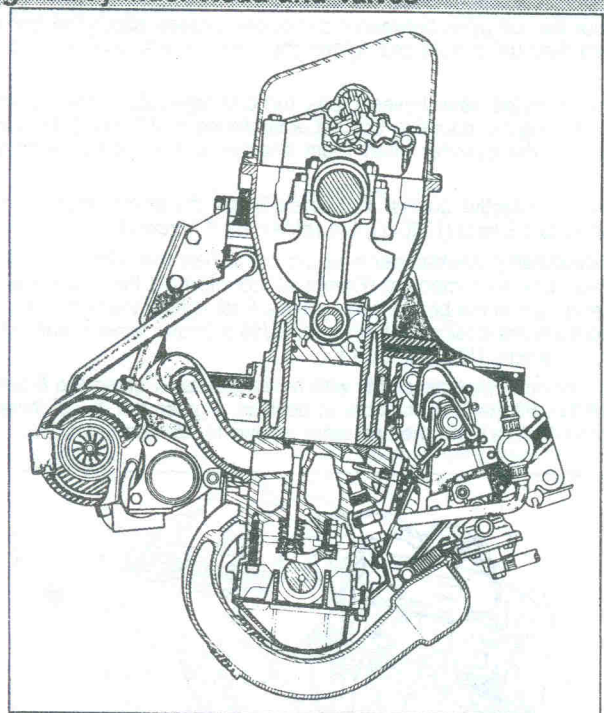


Fig. 1.21. — Sectional view of the XUD11 turbo diesel engine.

NOTE: Various changes have taken place within the XUD11 family of engines. The latest engine (XUD11 BTE/P8C) has for example a new cylinder block and a new cylinder head, including a new water outlet housing with built-in diesel fuel filter. Cylinder head gaskets are available in 5 thickness classes. Whenever new parts are required, always quote the model year of the vehicle and the engine number. The latest engine is fitted as of January 1995.

1.4. Engine — Servicing and Overhaul

1.4.0. CYLINDER HEAD AND VALVES

1.4.0.0. Technical Data

Cylinder Head Height:

Standard diesel engine/turbo diesel (XUD11): ..... 111 ± 0.05 mm (4.370 ± 0.002 in.)
(re-facing not permissible)

DK5 engine (2.5 litre): ..... 117 mm ± 0.05 mm (4.649 ± 0.002 in.)
(re-facing not permissible)

Max. distortion of gasket face:

XUD11 engines: ..... 0.05 mm (0.002 in.)

DK5 engine: ..... 0.03 mm (0.001 in.)

Valve Guides

Nominal Outside Diameter:
- XUD11/DK5 engines — Standard: 13.000 mm (0.517 in.)
- — 1st repair size: 13.290 mm (0.528 in.)
- — 2nd repair size: 13.590 mm (0.540 in.)

Inside diameter — All engines, all valves: 8.02 mm (0.386 in.)

Inside Diameter of Guide Locating Bores in Head:
- All engines — Standard: 12.981 mm (0.516 in.)
- — 1st repair size: 13.211 mm (0.525 in.)
- — 2nd repair size: 13.511 mm (0.537 in.)

Valve guide protrusion into combustion chamber: See Section 1.4.0.3

Valve Seats

Valve Seat Angles:
- All engines, all valves: 90°

Valves

Valve seat angle: See above

Stem diameter — All engines, inlet: 8.005 mm (0.318 in.)
- — All engines, exhaust: 7.975 mm (0.317 in.)

Valve head Diameters:
- Inlet and exhaust valves: 33.90 mm (1.347 in.)

Valve length:
- Inlet valves: 122.3 mm (4.890 in.)
- Exhaust valves: 121.9 mm (4.843 in.)

Valve Springs

Wire Diameter: 3.5 mm (0.139 in.)

Camshaft

Cam Height:
- Standard diesel — Inlet: 5.36 mm (0.213 in.)
- — Exhaust: 5.28 mm (0.210 in.)
- Turbo diesel — Inlet: 4.84 mm (0.192 in.)
- — Exhaust: 5.28 mm (0.210 in.)

Camshaft end float: 0.13 - 0.21 mm (0.005 - 0.008 in.)

Camshaft Marking:
- Standard diesel engine: No marking or one "dot" mark in end flange
- Turbo diesel: "TE" or two "dot" marks in end flange
- DK5 engine: Drillings in end flange

Camshaft Journal Diameters (XUD11):
- Bearing No. 1: 42.55 mm (1.691 in.)
- Bearing No. 2: 43.70 mm (1.736 in.)
- Bearing No. 3: 44.85 mm (1.782 in.)
- Bearing No. 4: 46.00 mm (1.828 in.)
- Bearing No. 5: 47.15 mm (1.873 in.)

Bearing Bore Diameters (XUD11):
- Bearing No. 1: 42.565 mm (1.691 in.)
- Bearing No. 2: 43.715 mm (1.737 in.)
- Bearing No. 3: 44.865 mm (1.782 in.)
- Bearing No. 4: 46.015 mm (1.828 in.)
- Bearing No. 5: 47.165 mm (1.874 in.)

Protrusion of pre-chambers: 0 to 0.03 mm (0 to 0.0012 in.)

Valve Clearances: ..... Not applicable

Valve Timing: ..... See Page 10

Specific Details applicable to P9A Engine

Camshaft identification: ..... See Page 35, "Camshaft Marking"
Cylinder head gasket: ..... Three thicknesses, 1.50, 1.60 and 1.70 mm, cylinder head bolt length 145 mm
Valves: ..... Valve head diameters as on Page 35
Timing belt: ..... 25.4 mm wide, 144 teeth, marked P9A

Specific Details applicable to P8A/P8B/PHZ Engine

Camshaft identification: ..... See Page 35, "Camshaft Marking"
Cylinder head gasket: ..... Three thicknesses, 1.43, 1.54 and 1.64 mm, cylinder head bolt length 145 mm
Valves: ..... Refer to Page 35
Timing belt: ..... Specific to turbo diesel engine

Specific Details applicable to DK5 Engine

Camshaft identification: ..... See page 35, "Camshaft Marking"
Cylinder head gasket: ..... One thickness, 1.60 mm, cylinder head bolt length 162.5 mm (10 mm thread) and 153.5 mm (12 mm thread)
Valve timing: ..... With balance shafts for quieter running

1.4.0.1. Removal/Installation (engine fitted) and Overhaul

The removal of the cylinder head has already been described during the dismantling of the engine, after the engine has been removed from the vehicle. The following gives a short description on the removal of the cylinder head when it is only necessary to change the gasket, grind-in the valve (top overhaul), etc. which can be carried out with the engine in position, but note that the instructions are given in general for the two engine groups.

XUD11 Engines

The removal and installation of the cylinder head on these engines is a straightforward operation, but remember that the timing belt must be correctly fitted and tensioned. The R.H. front end of the vehicle should be raised to work inside the wheel arch. First drain the cooling system by opening the radiator and the cylinder block drain plug. Collect the anti-freeze if required. Remove the turbo charger if fitted. Proceed as follows:

- Remove the front wheel and the splash shield inside the wheel arch.
- Remove the glow plugs to facilitate the rotation of the engine.
- Disconnect all leads and wires from the cylinder head.
- Remove in the following order: the air filter, inlet manifold, exhaust manifold, drive belt of the power-assisted steering, drive belt for the alternator and the timing belt cover. Disconnect all vacuum hoses and leads between engine and body which appear to be in the way.
- Remove the timing belt as described later on.
- The remaining operations are the same as described in Section **1.2.** for the XUD11 engine.

The installation of the cylinder head is carried out in reverse order to the removal procedure. The following text only described the tightening of the cylinder head

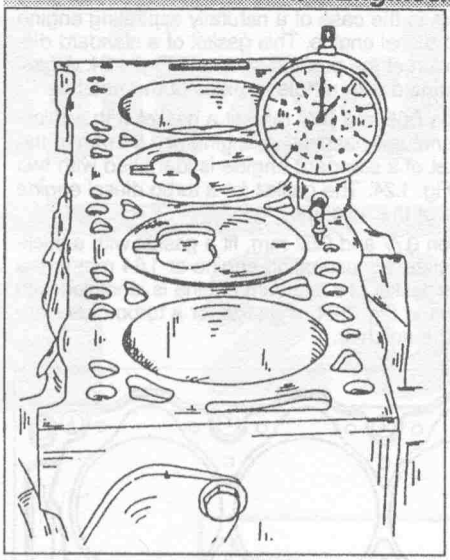


Fig. 1.22. — Measuring the protrusion of the piston above the cylinder block face. The stylus is placed onto the surface and set to "zero"

Set the dial gauge to "Zero" in this position (Fig. 1.22).

- Leave the dial gauge holder in position on the block face and swing the stylus over the piston, as far as possible to the centre, as shown in Fig. 1.23. Read the indicated value on the dial gauge and make a note to which piston it applies.
- Measure the remaining pistons in the same manner, always rotating the crankshaft until each piston is at top dead centre position. Write down each value.
- The greatest dimension determines the thickness of the cylinder head gasket, but the difference between two of the pistons must not exceed 0.12 mm (0.0047 in.).

The protrusion must now be evaluated as follows:

- If the greatest dimension is between 0.54 and 0.65 mm, fit a

bolts, but note that a "Torx 55" socket insert is required to tighten the bolts. There are also differences between the various engines which must be followed as applicable:

Standard/Turbo Diesel Engines

Cylinder head gaskets are available in different thicknesses and the gasket to be used depends on the protrusion of the piston above the cylinder block face. To check the protrusion, rotate the crankshaft until each piston in turn is at top dead centre position. Measure the amount the piston end is above the cylinder block face (protrusion) as follows:

- Place a dial gauge with a suitable holder onto the well cleaned cylinder block face and place the gauge stylus next to the piston to be measured onto the cylinder block face.

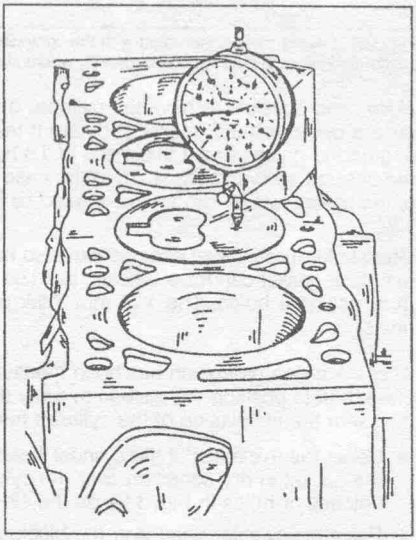


Fig. 1.23. — Measuring the protrusion of the pistons above the cylinder block face. The stylus is placed onto the piston face, as far as possible near the centre of the piston crown.

gasket with a thickness of 1.50 mm in the case of a naturally aspirating engine or 1.43 mm, in the case of a turbo diesel engine. This gasket of a standard diesel engine is identified with one notch at the position shown in Fig. 1.24. A gasket for a turbo diesel engine is marked with a hole in place of the notches.

- If the greatest dimension is beween 0.65 and 0.77 mm, fit a gasket with a thickness of 1.60 mm, in the case of a naturally aspirating engine or 1.54 mm in the case of a turbo diesel. This gasket of a standard engine is identified with two notches at the position shown in Fig. 1.24. The gasket for a turbo diesel engine is marked with two holes in place of the notches.
- If the greatest dimension is between 0.77 and 0.82 mm, fit a gasket with a thickness of 1.70 mm in the case of a naturally aspirating engine or 1.64 mm in the case of a turbo diesel engine. This gasket of s standard engine is identified with three notches at the position shown in Fig. 1.24. A gasket for a turbo diesel engine has three holes in place of the notches.

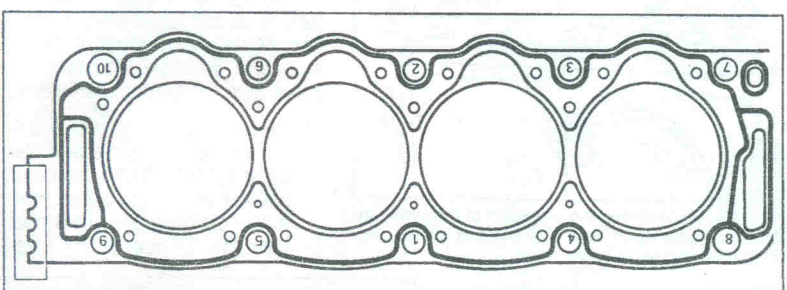


Fig. 1.24. View of the cylinder head with the tightening sequence. Visible on the right is the identification marking of the cylinder head gasket, where either notches (as shown) or holes can be found.

Note: It is possible to have the cylinder block face re-ground by 0.2 mm. In this case a cylinder head gasket of different thickness must be used. On a standard engine the gasket has a thickness of 1.8 mm and is marked with four notches at the position shown in Fig. 1.24. In the case of a turbo diesel engine the thickness of the gasket is 1.74 mm and is marked by five holes at the position shown in Fig. 1.24.

Gaskets for turbo diesel engines can also have different identifications, i.e. the 1.43 mm thick gasket can have 2 holes, the 1.54 mm thick gasket 3 holes, the 1.64 mm thick gasket 4 holes. The 1.74 mm thick gasket, mentioned above, has the five holes.

After the piston protrusion has been measured and the gasket selected, rotate the crankshaft to position the pistons midway down the cylinder bores before proceeding with the installation of the cylinder head.

- Select the thickness of the cylinder head gasket as described above and place the gasket in dry condition over the cylinder block face, with the identification notches or holes in Fig. 1.24 on the side of the flywheel.
- Place the cylinder head over the block at an angle to observe the engagement of the locating dowel. Once engagement has taken place, lower the front of the cylinder head over the second dowel.
- Check the length of the cylinder head bolts. Replace the bolts if they are longer

than 145.0 mm. Measure between the underside of the bolt head and the end of the thread. Lubricate the bolt heads and washers and the thread with engine oil. Fit the cylinder head bolts and tighten the bolts in the order shown in Fig. 1.24, but note the difference on non-turbo and turbo engines. Additionally there is a difference on the turbo engine, depending on the shape of the cylinder head bolts. A "Torx" head insert is required to tighten the bolts:

On **non-turbo engines** tighten the bolts in the order shown in two stages:

- Tighten all bolts to 7.0 kgm (50.5 ft.lb.).
- After all bolts are tightened, tighten each bolt in the tightening sequence by 150°.

On **turbo diesel engines** refer to Fig. 1.25 and tighten the cylinder head bolts in two stages, if the cylinder head bolts have the shape shown in the upper view in two stages:

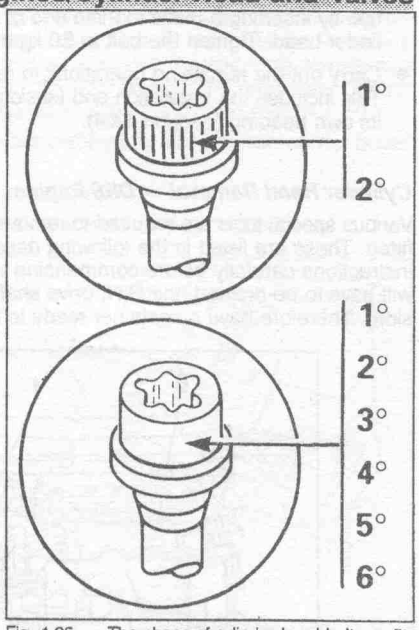


Fig. 1.25. — The shape of cylinder head bolts as fitted to XUD11 engines. Tighten the bolts in accordance with their appearance.

- Tighten all bolts in the order shown to 7.0 kgm (50.5 ft.lb.).
- From this position tighten the bolts in the order shown by a further 140°

If the cylinder head bolts have the appearance shown in the lower view of Fig. 1.25, tighten the bolts in 6 stages:

- Tighten the bolts in the order shown in Fig. 1.24 to 7.0 kgm (50.5 ft.lb.).
- Tighten all bolts in the order shown in Fig. 1.24 a further 140°.
- After completed installation of the cylinder head allow the engine to run until operating temperature is reached and then switch off.
- Allow the engine to cool down for 3 ½ hours.
- Slacken each cylinder head bolt in the order shown in Fig. 1.24 and re-tighten it to 7.0 kgm (50.5 ft.lb.). Bolts must be slackened one at a time.
- Tighten each cylinder head bolt in the order shown a further 140°.

Note: The 140° angle is difficult to obtain and must be estimated by considering that 180° is half a turn and 90° is a quarter of a turn. The angle is therefore somewhere between the two positions. Ideally a graduated disc should be used to obtain the correct angle.

- Fit the camshaft timing gearwheel. The gearwheel must be held against rota-

tion by inserting a metal rod into one of the holes and resting it against the cylinder head. Tighten the bolt to 5.0 kgm (36 ft.lb.).

- Carry out the remaining operations in reverse order to the removal procedure. This includes the installation and tensioning of the timing belt, described under its own heading (Section 1.4.4).

Cylinder Head Removal — DK5 Engine

Various special tools are required to remove the cylinder head when the engine is fitted. These are listed in the following description and we advise you to read the instructions carefully before commencing with the removal. The transmission oil will have to be drained (the R.H. drive shaft must be removed from the transmission). Therefore have a container ready to receive the oil. Proceed as follows:

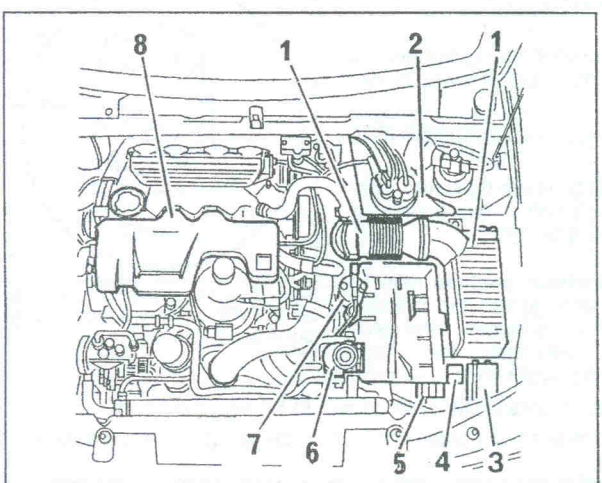


Fig. 1.26. — Details for the removal of the cylinder head. The numbers are referred to in the text.

- Place the front end of the vehicle on chassis stands, with the wheels hanging down under their own weight.
- Unclip the battery trim cover from the three attachment point. Two are located at the front side end and one marked by an arrow towards the air cleaner. Use a screwdriver to remove the trim cover.
- Remove in the following order: the battery, the protective plate underneath the engine, the R.H. front wheel, the covering panel underneath the R.H. front wheel arch, the R.H. front mud shield.
- Place the tray/container underneath the transmission and drain the transmission oil.
- Drain the cooling system as described in the "Cooling" section.
- Remove the R.H. drive shaft as described in Section 4.1.
- Remove the turbo charger (see relevant heading).

- For the next operations refer to Fig. 1.26 and remove in the following order: The air cleaner together with the air inlet tube (1), the LHM fluid reservoir (2) as described in the respective section. Remove the securing screws and place the following units to one side: the fuse box (3), the pre-heater control unit (5), the diesel fuel priming pump (6) and the dehydrator reservoir (7).
- Unclip the electrical harnesses from the battery tray and the fuse carrier boxes (4) from the cooling fan unit.
- Remove the battery tray and the trim cover (8).
- Remove the water pump drive belt as described for the DK5 engine.
- Referring to Fig. 1.27 remove the air intake tube (1) and disconnect the fuel inlet and return pipes (2) from the pre-heater.
- Remove the two coolant hoses (3). The hose clamps must be opened with a pair of pliers. In emergency, the special hose clamps can be replaced by screw-type Jubilee clips. Withdraw the connectors at positions (4) in Fig. 1.27.
- Take off the clamp band (1) in Fig. 1.28, disconnect the hoses from the coolant expansion tank (again a pair of pliers is required) and remove the expansion tank.

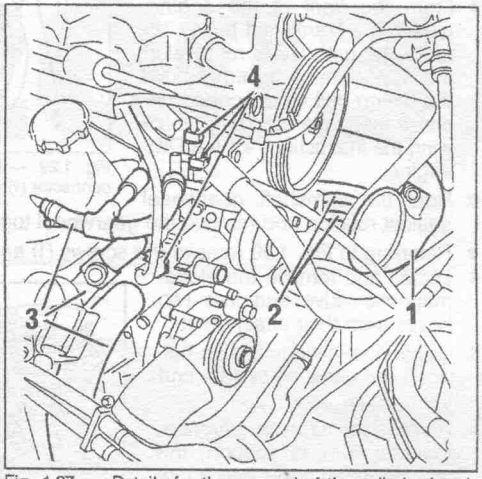


Fig. 1.27. — Details for the removal of the cylinder head. The numbers are referred to in the text.

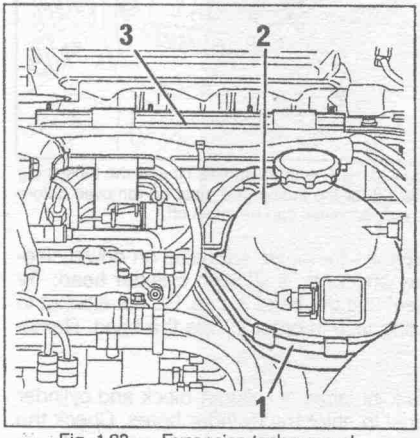


Fig. 1.28. — Expansion tank removal.

- Separate the wiring harness from the harness support (3) in Fig. 1.28 and remove the harness support.
- Unscrew the injector pipes at both ends and remove them from cylinder head and injection pump.
- Disconnect the injector fuel return pipe (leak-off pipe), the two heater plug cables and the connector from the No. 3 cylinder injector.
- Remove the electronic control unit from the storage tray and remove the tray.
- The next operation must be carried out by referring to the illus-

tration shown overleaf. First remove the trim cover (1) and then the connector fixing screws. Rotate the intake sleeve (2) by 1/4 of a turn and remove it.

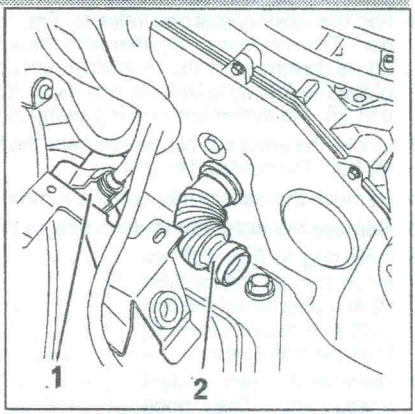


Fig. 1.29. — Removal of the connector cover and connector (1) and the air hose (2).

- Unclip the electrical harnesses and remove the accessory drive belt as described for the DK5 engine (Section "Cooling System").
- From the front of the engine, next to the crankshaft pulley, remove the roller. After removal of the upper timing cover, remove the timing belt as described under a separate heading, following the instructions for the DK5 engine.
- Hold the camshaft gearwheel against rotation and remove the gearwheel together with its fixing plate.
- Referring to Fig. 1.30 remove the screws (1) and the tensioner roller (2).
- Locate and remove the elctromagnetic valve and free two hoses from their attachment.
- Disconnect the connection between the exhaust) system and the cylinder head.
- Remove the air intake chamber together with its support, the cylinder head cover and a closing plate on one side of the cylinder head.
- Remove the flexible retainer.
- Slacken the cylinder head bolts in reverse order to the tightening sequence shown in Fig. 1.31. Note that bolts of 10 mm diameter and 12 mm diameter are used. Bolts 1 to 14 have the 12 mm diameter; bolts 15 to 22 have the 10 mm diameter.

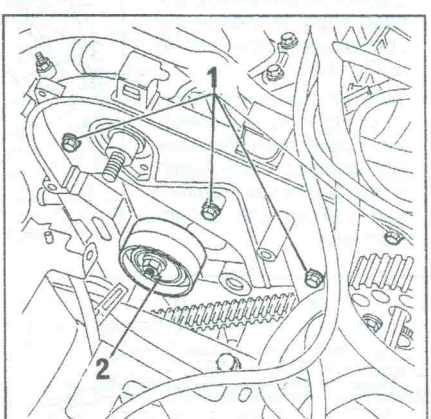


Fig. 1.30. — The three screws (1) and the tensioning roller (2) for the timing belt must be removed before the cylinder head can be taken off.

- The cylinder head can now be lifted off. As the head is located on dowel sleeves (at two opposite corners) you may encounter a sticking cylinder head. Try to rock the head to and fro until you feel that the head is free. Do not attempt to insert a screwdriver between the sealing face in order to free the head. Remove the cylinder head gasket.

Before fitting the cylinder head clean the joint faces of cylinder block and cylinder head. Do not allow rests of gasket material to enter the cylinder bores. Check the sealing face of the head for distortion (next section). It is advisable to carefully re-

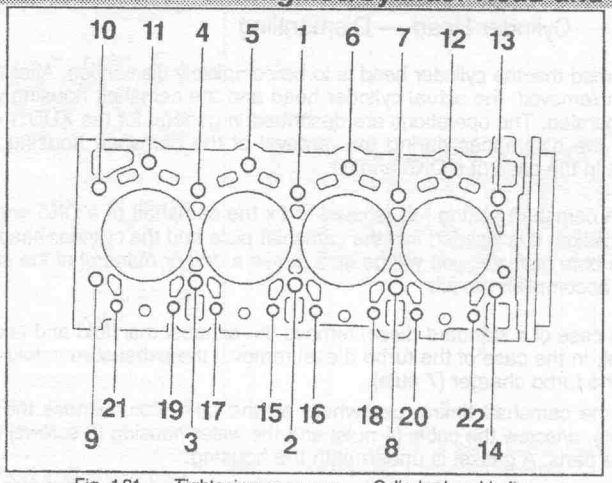


Fig. 1.31. — Tightening sequence — Cylinder head bolts.

cut the cylinder head bolt bores in the cylinder block, but use the correct taps (M10 x 150 and M12 x 150). If compressed air is available, cover-up important openings and blow away foreign matter.

Proceed as follows with the installation of the cylinder head, noting that only one cylinder head gasket is available.

- Measure the length of the cylinder head bolts before re-using them. The 10 mm bolts must not be longer than 162.5 mm, 12 mm bolt must not exceed 153.5 mm in length. If the bolts are in good condition, clean their threads (wire brush) and coat them with graphited grease.
- Check that the two locating dowels are in the cylinder block face (two opposite corners), check once more that all foreign matter has been removed and place the gasket in position (correct way round).
- Lower the cylinder head in position and insert the two sets of bolts. Tighten all bolts finger-tight.
- Refer to Fig. 1.31 and tighten the bolts (1) to (14) in the order shown to 5.0 kgm (36 ft.lb.). These are the 12 mm bolts.
- Tighten bolts (15) to (22) in the order shown to 3.5 kgm (25 ft.lb.). These are the 10 mm bolts.
- Without using a torque wrench, tighten each bolt in the full order (1) to (22) to an angle of 120°. A graduated disc is useful, otherwise judge the angle, based on the fact that a quarter of a turn represents 90°. *This completes the tightening of the bolts, as re-tightening is not necessary.*
- The remaining operations are carried out in reverse order to the removal procedure, but note the more important tightening torques for some of the parts. Fit the timing belt as described later on for the DK5 engine:

Flexible retainer (mounting): ..... 5.0 kgm (36 ft.lb.)
Closing plate: ..... 1.5 kgm (11 ft.lb.)
Cylinder head cover and air reservoir: ..... 0.8 kgm (6 ft.lb.)
Camshaft timing gearwheel: ..... 4.3 kgm (31 ft.lb.)

1.4.0.2. Cylinder Head — Dismantling

It is assumed that the cylinder head is to be completely dismantled. After the head has been removed, the actual cylinder head and the camshaft housing will have to be separated. The operations are described in general for the XUD11 engines, but note the differences during the removal of the camshaft housing and the camshaft in the case of a DK5 engine.

NOTE: A camshaft setting rod is used to fix the camshaft of a DK5 engine in a certain position. It is inserted into the camshaft plate and the cylinder head. By studying the bore diameter, you will be able to use a drift or mandrel of the same diameter to accomplish the job.

- In the case of a standard diesel remove the exhaust manifold and take off the gasket, in the case of the turbo diesel removal the exhaust manifold together with the turbo charger (7 nuts).
- With the camshaft timing gearwheel on the L.H. side, remove the plate (2 screws), unscrew the cable (4 nuts) and the water housing (3 screws) and take off the parts. A gasket is underneath the housing.
- Unscrew the injectors. Normally a special socket is used, otherwise you will need a box spanner.
- Remove the parts at one end of the head (plate, adaptor housing, elbow).
- Hold the camshaft gearwheel against rotation (see Fig. 1.19), unscrew the centre bolt and remove the gearwheel (sprocket).
- Unscrew and remove the timing belt tensioning roller from the face of the cylinder head. To remove the stud, screw on two nuts, lock them against each other and apply an open-ended spanner to the lower nut to unscrew the stud. The roller can now be removed.

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- Unscrew the 16 camshaft housing bolts evenly across in several stages, remove a socket head plug from the end face of the cylinder head (gearwheel end) lift off the camshaft housing.
- Use a screwdriver and lever out the oil seal. At the end opposite the gearwheel, on the inner face of the cylinder head you will see two screws. Remove them and take out the camshaft keeper plate (thrust plate). The camshaft can now be removed from the bearing bores in the cylinder head.

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- Remnove the sprocket (pulley) from both ends of the camshaft in conventional manner.
- Refer to Fig. 1.32 and remove the bolts (1). Slacken the bolts in several turns from the outside towards the inside and take off the camshaft bearing housing (2).
- Remove the oil seals from both ends of the camshaft bearing housing (screwdriver).
- Remove the camshaft keeper plate at one side of the cylinder head and slide out the camshaft.

The valves, valve springs, etc. are removed in a similar manner on all engines:

- A valve lifter is needed to remove the valves from the cylinder head (Fig. 1.33). Valve lifters are now available from most tool hire companies and there should be no problem obtaining one. It is also possible to remove the valves by placing a piece of wood into the combustion chamber, to support the valve head, and then to proceed as follows:

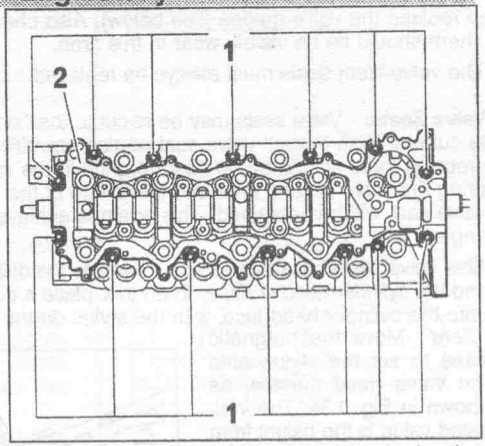


Fig. 1.32. — The location of the camshaft bearing housing bolts (1). The housing is removed upwards.

- Use a piece of tube, the same diameter as the valve spring cap and place the tube over the valve spring. With a hammer give s short and sharp blow onto the tube. The valve springs will be compressed and the valve cotter halves remain inside the tube. The operation may be slightly tricky, due to the inclination of the valves.

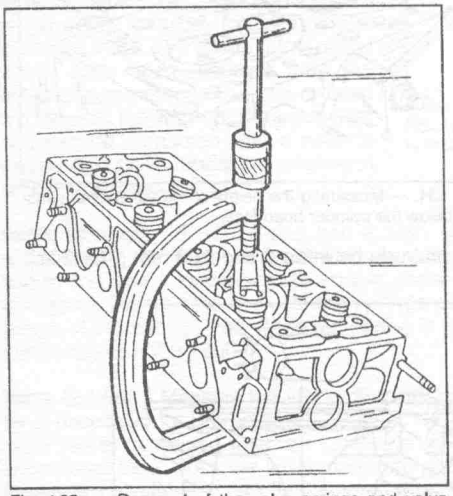


Fig. 1.33. — Removal of the valve springs and valve with a valve spring compressor.

- Take the parts off the valve and withdraw the valve from the other side. Remove the valve stem seals from the ends of the valve guides, using a pair of pliers or a screwdriver. Mark the valves. This is best done by piercing them through the bottom of an upside-down cardboard box and writing the valve number next to each valve. No. 1 valve is the one nearest to the timing end of the engine. Always keep the valves of each cylinder segerated.

1.4.0.3. Cylinder Head and Valves — Overhaul

Valves: Check the valve faces for wear or grooving. If the wear is only slight, regrind the valves to their appropriate angle in a valve grinding machine. All valves have the same angle.

Check the valve stem diameters and in this connection the inside diameters of the valve guides. If there is a deviation from the nominal values, it may be necessary

to replace the valve guides (see below). Also check the end of the valve stems. There should be no visible wear in this area.

The valve stem seals must always be replaced.

Valve Seats: Valve seats may be re-cut to their original angle with the appropriate cutters. Note that all valve seat angles are 90°. If this operation is carried out properly, there should be no need to grind-in the valves. Use correction cutters to bring the valve seating area into the centre of the valve seat. Make sure that the valve seat width is obtained. This again is achieved by using cutters of different angles.

After valve seats have been re-cut, measure the distance between the valve heads and the cylinder head surface. To do this, place a dial gauge with a magnetic base onto the cylinder head face, with the stylus on the surface, and set the gauge to "Zero". Move the magnetic base to set the stylus onto the valve head surface, as shown in Fig. 1.34. The indicated value is the height from the valve head to the cylinder head face. If this is not 0,7 mm (0.028 in.) in the case of the inlet valves or 1.1 mm (0.044 in.) in the case of the exhaust valves, replace the cylinder head. Fig. 1.35 shows the measurement in a diagram.

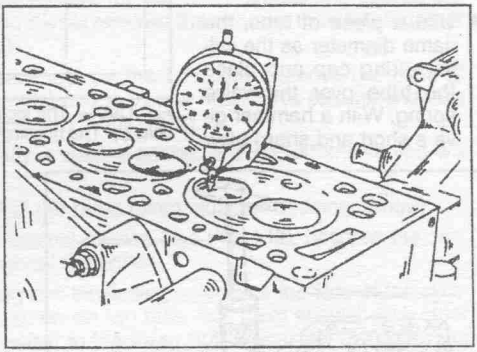


Fig. 1.34. — Measuring the height of the valve head surfaces below the cylinder head face.

Carry out the same measurement on the pre-chamber inserts. To do this, place the stylus onto the end of the pre-chamber insert. The insert must protrude between 0 and 0.03 mm (0.0012 in.).

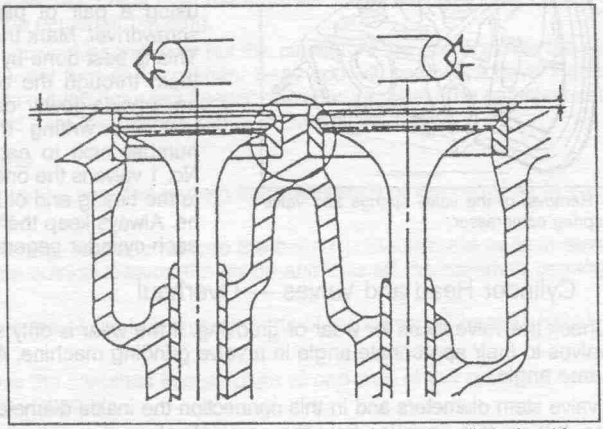


Fig. 1.35. — Diagram showing the valve heads below the cylinder head face.

The measurement is carried out as shown in Fig. 1.36.

Valves should be ground into re-cut valve seats. To this, coat the valve seat with fine lapping compound and use a suction tool. Move the valve backwards and forwards.

Ever so often lift the suction tool, move it forward by ¼ of a turn and continue grinding. Work the seat until an uninterrupted ring is visible around the face of the valve. After grinding-in, clean the cylinder head, and even more important the inside of the valve guide bores thoroughly. Any lapping paste inside the cylinder head will accelerate the wear of the new parts.

Use a pencil and mark across the valve seat closely spaced. Drop the valve into the respective valve guide and turn the valve by 90°, using the suction tool, applying slight pressure to the tool. Remove the valve and check if the pencil marks have been removed from the entire circumference. The gap created will indicate the width of the valve seat and can be measured with a ruler or caliper. Otherwise repeat the grinding-in until this is the case.

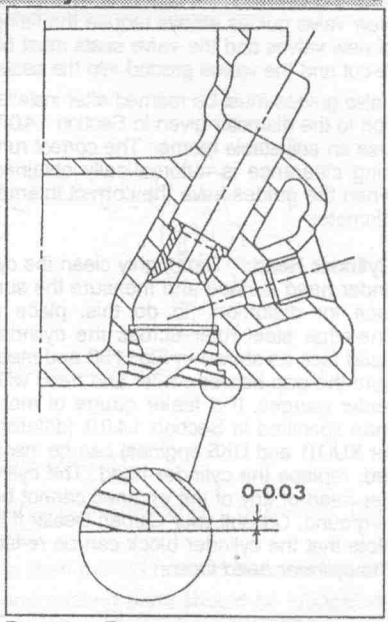


Fig. 1.36. — The protrusion of the pre-chambers is measured at the position shown.

Valve Springs: If the engine has a high mileage, always replace the valve springs as a set. To check a valve spring, place the old spring and a new spring end to end over a long bolt (with washer under bolt head) and fit a nut (again with a washer). Tighten the nut until the springs are under tension and measure the length of the two springs. If the old spring is shorter by more than 10%, replace the complete spring set.

Valve Guides: Measure the inside diameter of the guides. As an inside micrometer is necessary for this operation, which is not always available, you can insert the valve into its guide and withdraw it until the valve head is approx. level with the cylinder head face. Rock the valve to and fro and check for play. Although no exact values are available, it can be assumed that the play should not exceed 1.0 - 1.2 mm (0.04 - 0.047 in.).

Valve guides are available with oversize outside diameter (see Section 1.4.0.0.) and the locating bores in the cylinder head must be bored out to take the new guides. Drive out the guide with a suitable mandrel. The cylinder head should be heated in boiling water to facilitate the operation. Measure the protruding end of the guide before driving the old guide out and drive in the new guide to obtain the same dimension. To do this, refer to Fig. 1.37 and establish dimension "L", measured from the face of the cylinder head to the inner end of the valve guide. This dimension is 41.0 mm on all XUD11 engines. No information are available at present for the DK5 engine.

New valve guides always require the fitting of new valves and the valve seats must be re-cut and the valves ground into the seats.

Valve guides must be reamed after installation to the diameter given in Section 1.4.0.0. Use an adjustable reamer. The correct running clearance is automatically obtained when the guides have the correct internal diameter.

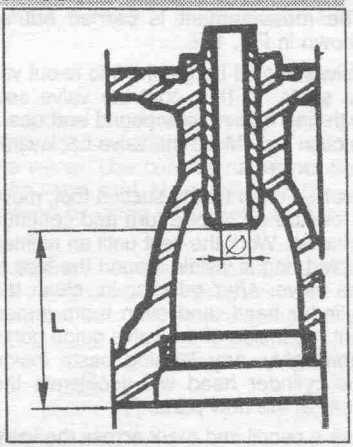


Fig. 1.37. — Dimension "L" determines the correct fitting depth of the valve guides (same dimension for inlet and exhaust valves).

Cylinder Head: Thoroughly clean the cylinder head surface and measure the surface for distortion. To do this, place a fine-edge steel ruler across the cylinder head face as shown in Fig. 1.38 and measure the gap between ruler and head with feeler gauges. If a feeler gauge of more than specified in Section 1.4.0.0. (different for XUD11 and DK5 engines) can be inserted, replace the cylinder head. The cylinder head of any of the engines cannot be re-ground. Consult your Citroën Dealer if in doubt about the extent of the distortion. Note that the cylinder block can be re-faced — *not to be confused with re-facing the cylinder head face.*

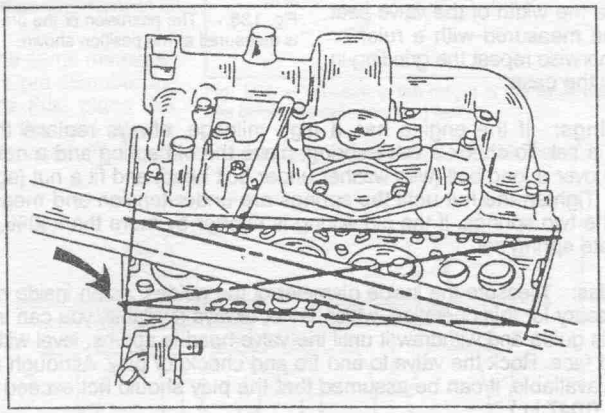


Fig. 1.38. — Checking the cylinder head gasket face for distortion.

Camshaft: Place the camshaft with the two outer bearing journals into "V" blocks or clamp the shaft into a lathe and apply a dial gauge to the centre. Slowly rotate the camshaft and read off the indication of the dial gauge. If the run-out of the shaft is more than 0.01 mm, replace the shaft, as it is bent (see Fig. 1.39).

Check the bearing journals for visible wear. If none is found, measure the shaft journal diameters. Each journal has a different diameter, as given in Section 1.4.0.0.

Check the camshaft end float. Either replace the keeper plate or the camshaft.

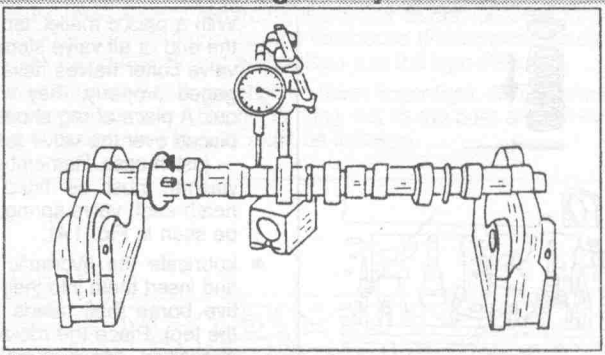


Fig. 1.39. — Camshafts can be checked for run-out as shown.

1.4.0.4. Cylinder Head — Assembly (XUD11)

The assembly of the cylinder head is a reversal of the dismantling procedure. The following points should be noted in particular:

- If a new head is fitted, transfer the parts from the old head to the new head.
- Thoroughly clean all parts. All sliding and rotating parts should be lubricated with oil.
- Insert the well oiled valves into the respective valve guides. If the original valves are used, fit them to the same valve guides; if the valves have been ground-in, make sure that the valve is fitted to the valve seat in which it has been ground-in.
- Assemble the valves. First place the valve spring seat over the cylinder head and push the valve stem seals over the valve stems and valve guides, as shown in Fig.1.40. Fit the valve springs and the upper valve spring cup to the valve spring and compress the spring with a valve spring compressor, as shown in Fig. 1.33. When the valve stem end protrudes from the valve spring cup, insert the two valve cotter halves with a pair of pointed pliers. Slowly release the valve spring compressor, checking continuously that the cotter halves are kept in position.

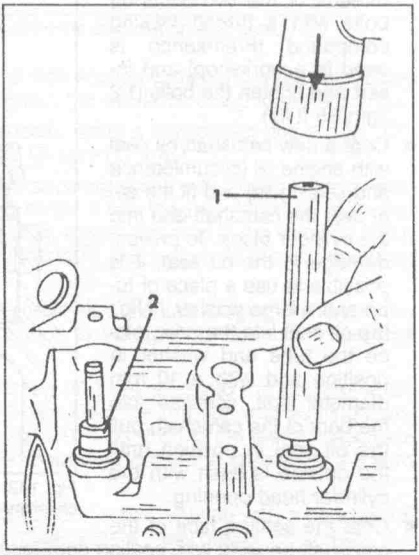


Fig. 1.40. — Fitting a valve stem oil seal (2) with a suitable tube (1). — *Danger of damage.*

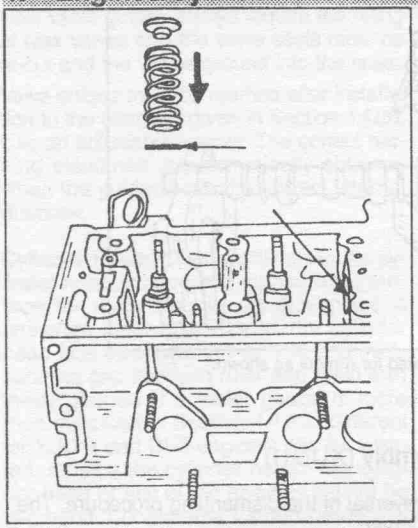


Fig. 1.41. — Fitting the component parts of a valve. Note the washer underneath each valve spring.

With a plastic mallet, tap against the end of all valve stems. If the valve cotter halves have not engaged properly, they will jump out. A piece of rag should be replaced over the valve stem ends — just in case. Remember that a washer must be fitted underneath each valve spring, as can be seen in Fig. 1.41.

- Lubricate the hydraulic tappets and insert them into their respective bores (ball heads towards the top). Place the rocker levers in position, again as marked during removal. Compare the assembled rocker lever/tappet arrangement with Fig. 1.42. Place this part of the cylinder head to one side until later.
- Coat the bearing journals and the cams with engine oil and insert the camshaft into the bearing bores. Rotate the camshaft a few times. Fit the keeper plate to one end. Coat the threads of the two securing bolts with a thread locking compound (Frenetanch is used in a workshop) and insert and tighten the bolts (1.2 kgm/8.5 ft.lb.).
- Coat a new camshaft oil seal with engine oil (circumference and sealing lip) and fit the seal over the camshaft and into the cylinder block. To prevent damage to the oil seal, it is possible to use a piece of tube and a large washer. "Nip" the oil seal into the bore, place the tube and washer in position and with a 10 mm diameter bolt, screwed into the bore of the camshaft, pull the oil seal in position until the outside is flush with the cylinder head opening.

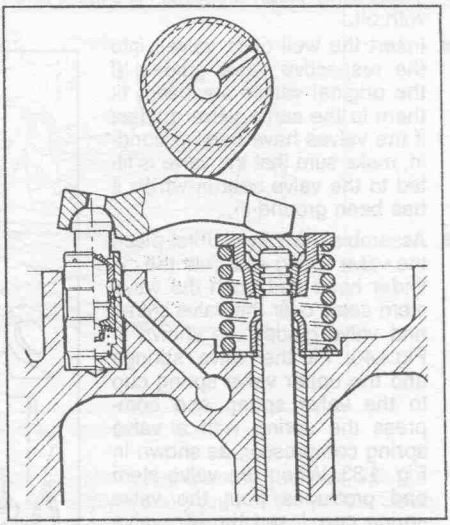


Fig. 1.42. — Sectional view of the valve operating mechanism.

- Coat the sealing face of the camshaft housing with sealing compound (the workshop uses Autojoint Blue). Turn the camshaft until the Woodruff key in the shaft is in line with the cylinder head face (90° to a vertical line) and carefully place the camshaft housing over

the cylinder head without disturbing the rocker levers. Coat the threads of the socket head screw with thread locking compound (Frenetanch), screw it into the bore below the camshaft end and tighten it to 2.5 kgm (18 ft.lb.).

- Insert the 16 housing bolts and tighten them finger-tight. All bolts must be tightened in several steps to 2.5 kgm (18 ft.lb.), but as the bolts are not evenly spaced, the sequence in Fig. 1.43 must be followed.

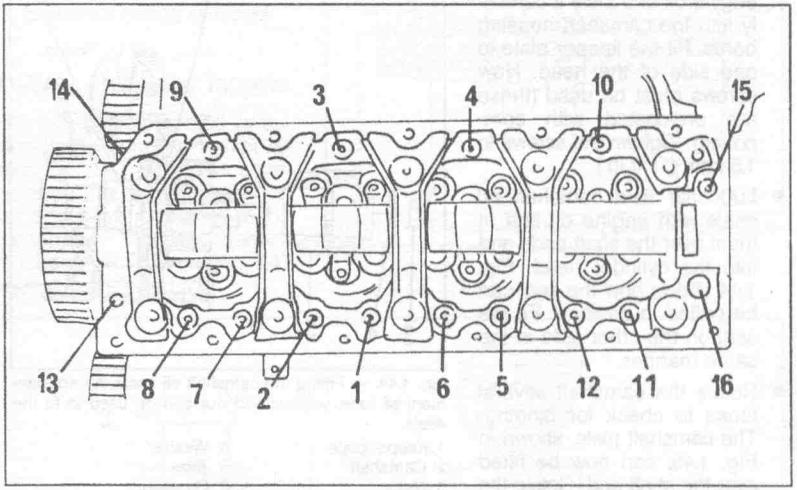


Fig. 1.43. — Tightening sequence for the camshaft housing bolts.

- Coat the opening on the cylinder head with sealing compound (Auto Joint Blue) and fit the plate and the bracket. Tighten the two bolts to 2.0 kgm (14.5 ft.lb.).
- Fit the housing and the elbow underneath, using a new gasket and a new "O" sealing ring. Tighten the five bolts to 1.5 kgm (11 ft.lb.).
- Coat the thread of the tensioning roller securing screw with thread locking compound, slide it through the roller and screw it into the cylinder head. With the two nuts still on the other end of the stud, tighten the stud to 1.0 kgm (7.2 ft.lb.). Remove the two nuts used to install the stud and loosely fit the two securing nuts.
- Fit the camshaft timing sprocket over the shaft without dislodging the key, fit the bolt with the washer and tighten the bolt to 4.3 kgm (31 ft.lb.). The sprocket must be prevented from turning.
- If removed, fit the temperature switches and the plug into the cooling water housing on the side of the cylinder head. Coat the threads with sealing compound. Each one is tightened to 1.5 kgm (11 ft.lb.). Also fit the thermostatic capsule (threads coated with sealing compound). Tighten the capsule to 2.5 kgm (18 ft.lb.).
- Fit the parts to the side of the cylinder head: water housing with a new gasket (3 screws, 1.4 kgm/10 ft.lb.), cover plate with a new gasket (2 screws, 1.2 kgm/8.5 ft.lb.), four glow plugs and their connecting lead (4 nuts, hand-tight).
- Fit the exhaust manifold with a new gasket (7 nuts, 2.0 kgm (14.5 ft.lb.).

1.4.0.5. Cylinder Head — Assemby (DK5)

The assembly of the cylinder head follows in general the previous description, as far as the valves are concerned. The following text refers mainly to the installation of the camshaft:

- Lubricate the camshaft with engine oil and slide it carefully into the camshaft housing bores. Fit the keeper plate to one side of the head. New screws must be used (these are pre-coated with compound). Tighten the screws to 1.5 kgm (11 ft.lb.).
- Lubricate new camshaft oil seals with engine oil and fit them over the shaft ends and into the cylinder head. Fig. 1.44 shows how the seal can be pulled in position. Fit the seal on the other side in the same manner.
- Rotate the camshaft several times to check for binding. The camshaft plate, shown in Fig. 1.45, can now be fitted over the shaft end. Rotate the plate to the position shown and insert the locating rod to lock the shaft in position. The camshaft housing must be fitted in this position, otherwise the valves will touch the pistons. Remove the camshaft plate and the locating rod and fit the housing to the cylinder head. The upper contact face of the cylinder head is now coated with sealing compound (Auto Joint Blue).
- Lower the camshaft housing over the cylinder block (camshaft must not move) and insert the securing bolts. Tighten them finger-tight. In the order shown in Fig. 1.46 and in several stages tighten the bolts in the order 1 to 14 to 2.0 kgm (14.5 ft.lb.).
- Fit the closing plate. Tighten

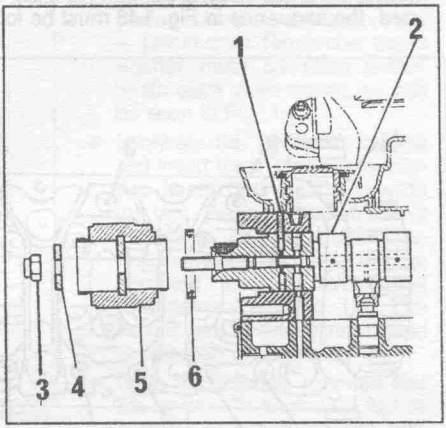


Fig. 1.44. — Fitting the camshaft oil seals. An arrangement of tube, washer and nut can be used to fit the seals.

1 Keeper plate
2 Camshaft
3 Nut
4 Washer
5 Tube
6 Oil seal

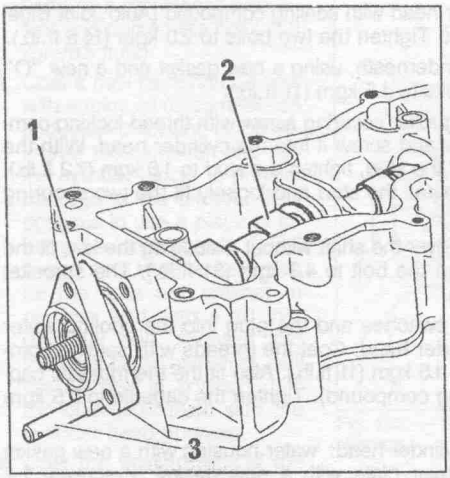


Fig. 1.45. — Fitting the camshaft of the DK5 engine. Provisionally fit the camshaft plate (1) and insert the locating rod (3). This will position the camshaft (2).

the screws to 1.5 kgm (11 ft.lb.).

- Fit the cylinder head cover (0.8 kgm/6 ft.lb.).
- Fit the camshaft plate with a new nut (4.3 kgm/31 ft.lb.). The same applies to the camshaft timing sprocket.

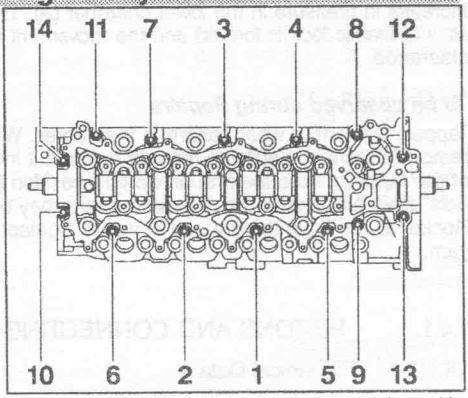


Fig. 1.46. — The camshaft housing bolts are tightened in the sequence shown (DK5 engine).

1.4.0.6. Hydraulic Tappets

The valves are operated by automatically adjusted rocker levers. Fig. 1.42 shows the arrangement of a tappet, rocker lever and valve in relation to the camshaft. The mechanism functions as follows. Fig. 1.47 should be referred to:

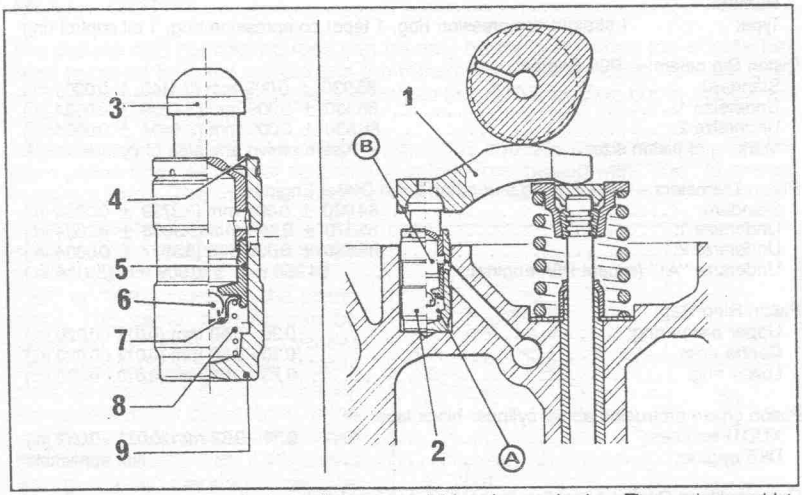


Fig. 1.47. — Sectional view of a hydraulic tappet and the rocker mechanism. The numbers and letters are referred to in the text.

During the automatic adjustment phase

When the valve clearance is excessive, the spherical pivot (3) and the piston (5) rise under the action of the spring (8). This causes a depression in the lower chamber (A) which opens the ball valve (6). The difference in pressure between the two chambers (A) and (B) is equalised and the ball valve (6) returns to its seat under the action of the spring (7). The two chambers are now isolated.

During the Compression phase

As soon as the pointed end of the cam pushes down the rocker lever, there is an

increase in pressure in the lower chamber (A). The ball valve is forced onto its seat, a hydraulic lock is formed and the movement is transferred to the valve without clearance.

To be observed during Repairs

Tappets will form a wear pattern in their bores. Whenever more than one tappet is removed, mark it in suitable manner to insert it into the original bore. After removal of the tappets, store them in an upright position (as they are fitted). Wear on tappets takes place on the ball heads, where they operate against the rocker levers. Rocker levers have three areas of wear: Contact points on tappet, valve end and cam.

1.4.1. PISTONS AND CONNECTING RODS

1.4.1.0. Technical Data

Piston pin fit: ..... Floating fit in piston and connecting rod
Piston assembly direction: ..... See Fig. 1.48

Piston Rings:
Number: 3
Type: ..... 1 straight compression ring, 1 taper compression ring, 1 oil control ring

Piston Diameters — P9A Engine:
Standard: ..... 85.930 ± 0.009 mm (3.4140 ± 0.0004 in.)
Undersize 1: ..... 86.180 ± 0.009 mm (3.4239 ± 0.0004 in.)
Undersize 2: ..... 86.530 ± 0.009 mm (3.4404 ± 0.0004 in.)
Marking of piston size: ..... Piston crown and side of cylinder block

Piston Diameters — P8A Engine and other Turbo Diesel Engines:
Standard: ..... 84.920 ± 0.009 mm (3.3739 ± 0.0004 in.)
Undersize 1: ..... 85.170 ± 0.009 mm (3.3838 ± 0.0004 in.)
Undersize 2: ..... 85.520 ± 0.009 mm (3.3977 ± 0.0004 in.)
Undersize "A1" (except P8A engine): ..... 84.950 mm ± 0.009 mm (3.4136 in.)

Piston Ring Gap:
Upper piston ring: ..... 0.30 - 0.50 mm (0.012 - 0.020 in.)
Centre ring: ..... 0.30 - 0.50 mm (0.012 - 0.020 in.)
Lower ring: ..... 0.25 - 0.50 mm (0.010 - 0.020 in.)

Piston crown protrusion above cylinder block face:
XUD11 engines: ..... 0.54 - 0.82 mm (0.021 - 0.032 in.)
DK5 engine: ..... Not applicable

Cylinder Head Gasket Allocation (turbo diesel in brackets):

Piston Protrusion	Gasket Thickness
0.54 - 0.65 mm	1.50 mm (1.43 mm)
0.65 - 0.77 mm	1.60 mm (1.54 mm)
0.77 - 0.82 mm	1.70 mm (1.64 mm)

With re-ground block face:
Diesel engine: ..... 1.80 mm
Turbo diesel engine: ..... 1.74 mm
Head gasket thickness — DK5 engine: ..... 1.60 mm

Cylinder head gasket markings: ..... See Section 1.4.0.1
Type of marking — Diesel engine: ..... Notches
— Turbo diesel: ..... Holes

Piston pin diameter:
XUD11 diesel engine: ..... 26.0 — 0.006 mm (1.033 — 0.00022 in.)
XUD11 turbo diesel engine: ..... 30.0 — 0.006 mm (1.192 ± 0.00022 in.)
Piston pin length:
XUD11 diesel engine: ..... 65.0 mm (2.582 in.)
XUD11 turbo diesel engine: ..... 71.5 mm (2.841 in.)
Small end bore diameter:
XUD11 diesel engine: ..... 26.0 +0.020/0.007 mm (1.033 +0.0008/0.0003 in.)
XUD11 turbo diesel engine: ..... 30.0 +0.020/0.007 mm (1.192 + 0.00087/0.0003 in.)
Connecting rod length, centre to centre: ..... 145.0 mm (5.76 in.)

Big End Bearings:
Type: ..... Shell type
Material: ..... Aluminium-tin

Thickness of Big End Bearing Shells:
Standard: ..... 1.827 mm (0.0726 in.)
Undersize: ..... 1.997 mm (0.0793 in.)

Crankpin diameters: ..... See under "Crankshaft"

1.4.1.1. General

The pistons and connecting rods can be only be replaced when the engine has been removed from the vehicle and the transmission disconnected from the engine. The following information apply mainly to the XUD11 engine, but in priciple are valid for the DK5 engine.

Each piston is fitted with two compression rings and one oil control ring. The second piston ring has a taper section and is therefore marked with "Top" to prevent incorrect fitting. The marking must be visible from above.

Pistons are available in two grading sizes. A code number in the centre of the piston crown (either "A1", "R1" or "R2") indicates the piston class. The same marking can be found on the side of the cylinder block and only comperable pistons must be fitted to a specific bore. Also marked in the piston bore is the weight class. All pistons must have the same weight. Fig. 1.48 shows where these markings can be found.

Piston pins are fitted 0.5 mm off-centre into the piston. It is therefore of importance that a piston is fitted correctly into the cylinder bore.

Piston rings are available in oversizes in the same grade as the pistons. Replacing a piston, therefore, requires the fitting of new pistons rings. Piston rings are colour-coded.

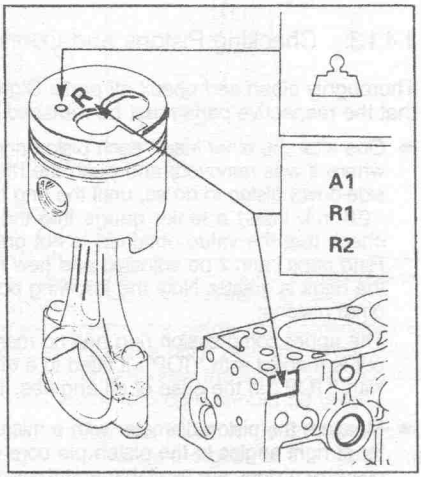


Fig. 1.48. — Piston crowns and cylinder block are marked with the size class. The weight symbol shows the weight class of the piston.

1.4.1.2. Dismantling Pistons and Connecting Rods

No special tools are necessary to dismantle the pistons and connecting rods. Securing rings are used to hold the piston pins in position. Proceed as follows to dismantle:

- Use a pair of piston ring pliers and remove the piston rings one after another from the crown end of the piston, as shown in Fig. 1.49. If no piston ring pliers are available, use three thin metal strips and slide the rings over the strips to remove them one by one. One of the strips must be placed underneath the piston ring ends to avoid scratches.
- Remove the securing rings out of the two piston pin bores. Either use a small screwriver or a pair of circlip pliers for this operation.

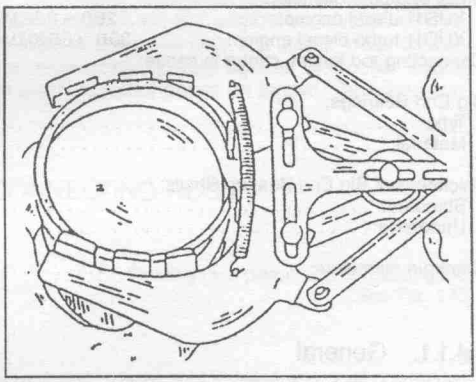


Fig. 1.49. — Removal or installation of piston rings with a pair of piston ring pliers.

- Use a stepped mandrel to drive out the piston pin. Hold the piston in one palm of the hand whilst the pin is removed. If the piston pin has a tight fit, heat the piston in warm water.

1.4.1.3. Checking Pistons and Connecting Rods

Thoroughly clean and check all parts. Signs of seizure, scratches or wear mean that the respective parts must be replaced.

- One after the other insert each piston ring into the top of the cylinder bore (from where it was removed) and push the ring squarely into the bore, using an upside-down piston to do so, until the ring is inserted by approx. 15 to 20 mm (0.5 - 0.8 in.). Insert a feeler gauge into the gap between the two ring ends and check that the value obtained is not greater than specified in Section 1.4.0.0. Ring gaps cannot be adjusted and new rings must be fitted if the gap of any of the rings is greater. Note the following points if new piston rings are fitted to original pistons:

  The upper compression ring has no markings if fitted to a turbo diesel engine, but is marked with "TOP", if fitted to a diesel engine. The centre ring is marked with "TOP" in the case of all engines. The oil control ring has no marking.

- Measure the piston diameter with a micrometer. Apply the jaws of the micrometer at right angles to the piston pin bore at the bottom of the piston skirt. Three oversize pistons are available and the cylinder bores can be re-bored to accept the new pistons.
- To check the piston running clearance measure the cylinder bore diameter with

an internal micrometer. Bores are measured in longitudinal and transverse direction and in three different depths of the cylinder bore. The resulting measurements will give the smallest and the largest diameter. Deduct the piston diameter from the bore diameter. The difference is the running clearance which should be between 0.062 - 0.078 mm (0.0024 -0.0031 in.). New pistons must be fitted if a greater difference is established.

- Check piston pins and the bores in the pistons for wear. Piston pins must have a sliding fit in the pistons and connecting rod small ends, with the parts well oiled. Note that the piston pins are not the same for all engines (see Section 1.4.1.0).

1.4.1.4. Assembling Pistons and Connecting Rods

It is assumed that all parts have been checked as described in the last section and parts have been replaced as necessary. The connecting rods should be checked for twist or distortion. A special jig is available for this operation and we recommend that the con rods are taken to a dealer to have them checked.

Lubricate the piston pins, piston pin bores and small end bores of the connecting rods and assemble the parts in accordance with Fig. 1.50, i.e. the cut-out in the piston bowl must be on the same side as the locating tabs of the connecting rod bearing shells.

Fit one of the piston pin securing rings into the piston pin bore. Check that the ring is engaged fully in its groove.

Insert the connecting rod into the piston, align the small end bore and the piston bore and insert the piston pin, using thumb pressure only. Check once more the correct relationship of piston and connecting rod with Fig. 1.50 and fit the second securing ring to the other side of the piston. Check the securing ring for proper fit.

Assemble the remaining piston and connecting rods in the same manner.

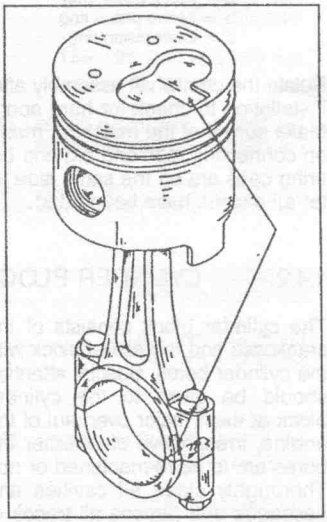


Fig. 1.50. — Correct assembly of pistons and connecting rods.

Fit the piston rings over the pistons, using a pair of piston ring pliers, as shown in Fig. 1.49. The centre rings must be fitted so that the marking "Top" can be read from above after the rings have been fitted. The same applies to the upper piston ring of a standard diesel engine. If a piston ring compressor is not available, use three thin metal strips and slide the rings over the strips. Slide the rings to the level of the ring groove and then withdraw the strips. The ring will spring into the groove. Pistons rings break easily and care should be taken.

Generously lubricate the piston rings and arrange the piston rings on the outside of the piston skirt in accordance with Fig. 1.51. Arrange the gaps of the upper ring and the centre ring 120° to the expander ring gap.

Lubricate the pistons with engine oil and place the assemblies to one side for installation in the cylinder block. A piston ring compressor is required to fit the

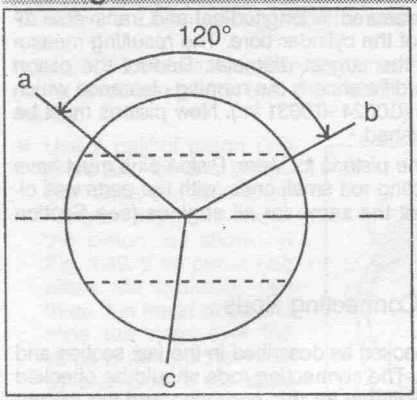


Fig. 1.51. — Correct arrangement of the piston ring gaps.

a = upper piston ring
b = centre piston ring
c = lower piston ring

Rotate the crankshaft assembly after installation to check for hard spots. Make sure that the matching marks on connecting rods and big end bearing caps are on the same side after all pistons have been fitted.

1.4.2. CYLINDER BLOCK

The cylinder block consists of the crankcase and the actual block with the cylinder bores. Special attention should be given to the cylinder block at each major overhaul of the engine, irrespective of whether the bores are to be re-machined or not. Thoroughly clean all cavities and passages and remove all traces of foreign matter from the joint faces. If any machining or honing of the bores has taken place, it is essential that all swarf is removed before assembly of the engine takes place.

Measurement of the cylinder bores should be made in conjunction with the data given in Section 1.4.1.0., noting the difference diameters of size classes R1, R2 and, if applicable A1. These apply to both engine types covered. A limit of +0.018 mm is permissible.

pistons (see Fig. 1.52). The installation of the pistons and connecting rods is carried out as follows:

Lubricate the pistons with oil and insert them into their cylinder bores. Suitable clamps must be used to compress the piston rings, used as shown in Fig. 1.52. Insert the pistons so that the arrows in the piston crown points in the correct direcftion. After all piston/connecting rod assemblies have been inserted, check from above that the recesses in the piston crowns are pointing to the correct side (see Fig. 1.50).

First tighten the nuts to 2.0 kgm (14.5 ft.lb.). After all nuts have been tightened, as prescribed, angle-tighten each nut by 70°. Either estimate the angle or use a angulated disc.

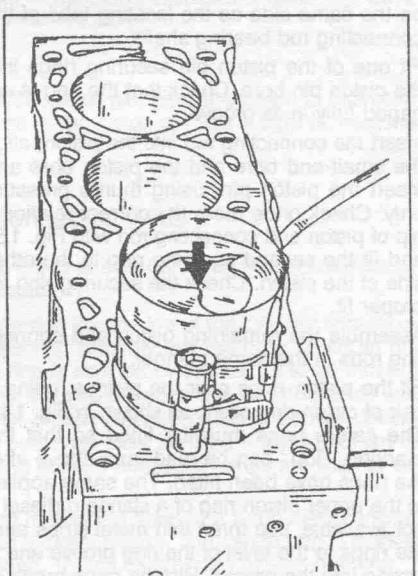


Fig. 1.52. — Fitting a piston. Note the correct position of the piston bowl.

Before it is decided to re-bore the cylinders, make sure that the engine has not previously been re-bored, if you do not know its history from new. Bores should be measured in both transverse and longitudinal planes and at three positions down the bore. The worst measurement must be taken when deciding the wear of an individual bore.

Measure the gasket face of the cylinder block in similar manner as shown in Fig. 1.38 for the cylinder head. If feeler gauge of more than 0.05 mm (0.0002 in.) can be inserted, the block is distorted. Re-machining of the gasket face is permissible on most engines. We recommend to visit an engine shop, familiar with Citroën diesel engines.

1.4.3. CRANKSHAFT AND FLYWHEEL

1.4.3.0. Technical Data

Number of main journals: 5

Main Bearings:
- Type: ..... Shell type
- Material: ..... Aluminium-tin

Thrust washer thicknesses: ..... 1.85, 1.95, 2.00 and 2.05 mm

Main Bearing Journal Diameter:
- Nominal diameter: ..... 59.981 - 60.000 mm (2.3615 - 2.3622 in.)
- Repair diameter: ..... 59.681 - 59.700 mm (2.3496 - 2.3503 in.)

Crankpin Diameter:
- Nominal diameter: ..... 49.984 - 50.000 mm (1.9679 - 1.9685 in.)
- Repair diameter: ..... 49.684 - 49.700 mm (1.9561 - 1.9567 in.)

Main Bearing Shell Thickness:
- Nominal size: ..... 1.842 mm (0.0732 in.)
- Repair size: ..... 1.992 mm (0.0791 in.)

Crankpin Bearing Shell Thickness:
- Nominal size: ..... 1.827 mm (0.0726 in.)
- Repair size: ..... 1.997 mm (0.0793 in.)

Connecting Rods:
- Bore of small end bore (after fitting bush): ..... See Page 55
- Bore of big end bore: ..... 53.695 - 53.708 mm (2.1333 - 2.1338 in.)

Length between centres: ..... 145.0 mm (5.76 in.)

Max. flywheel run-out: ..... 0.06 mm (0.003 in.)

1.4.3.1. General

The removal of the crankshaft is described in Section 1.2. The crankshaft runs in five shell bearings. Main bearing and crankpin journals can be re-ground to one undersize to fit oversize bearing shells.

The crankshaft end float is controlled by half thrust washers, fitted to the second bearing from the flywheel end. An oil seal is fitted to the front and rear ends of the crankshaft. The front seal is inserted into a removable carrier. The rear end of the crankshaft is sealed by side seals, fitted to each side of the rear main bearing cap.

1.4.3.2. Checking the Crankshaft End Float

Check the end float of the crankshaft before it is removed from the crankcase. The resulting value can then be used to correct the end float during the installation of the shaft, by fitting oversize thrust washers. Check the end float as described below:

- Attach a dial gauge with a suitable bracket to the cylinder block end face and place the dial gauge onto the shaft as shown in Fig. 1.18 on Page 30. Push the crankshaft in the direction of the arrow, using a screwdriver, and set the gauge to "Zero".
- Push the crankshaft into the other direction and read off the value on the dial gauge. The standard value is between 0.12 - 0.32 mm (0.005 - 0.0127 in.). Write down the value for installation reference.
- Remove the dial gauge. The crankshaft can now be removed.

1.4.3.3. Inspection of Parts

Thoroughly clean the crankshaft, paying particular attention to the oilways. Check the crankshaft for visible damage to the journals (seizure, nicks, etc.). Use a micrometer to measure the main bearing and crankpin journals at various points. From the measurements evaluate if a particular journals is out of round or tapered. Each journal must be fully round, within a tolerance of 0.007 mm.

If facilities are available, the crankshaft should be inspected for run-out at the centre journal. To do this, place the two end journals into "V" blocks and apply a dial gauge to the centre bearing journals as shown in Fig. 1.53. Slowly rotate the crankshaft and read off the dial gauge. Note that the value on the gauge must be divided by "2" to obtain the correct value. This must not exceed 0.02 mm (0.001 in.).

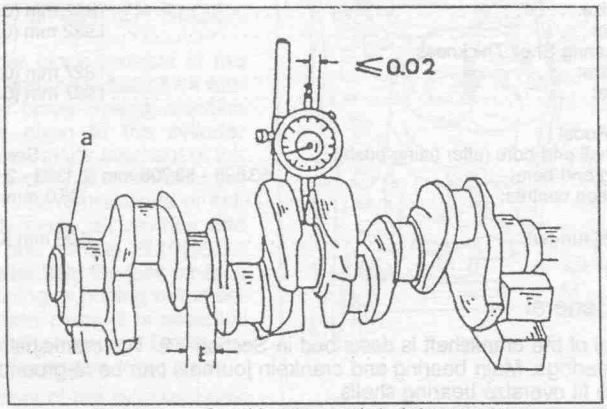


Fig. 1.53. — Checking the crankshaft for run-out.

1.4.3.4. Crankshaft — Installation

The installation of the crankshaft is described in conjunction with the assembly of

the engine in Section 1.3. On Page 29 you will find the tightening torques and tightening sequence of the standard and turbo diesel engines.

1.4.4. TIMING MECHANISM

The component parts of the timing mechanism can be removed with the engine fitted to the vehicle, but a quick look at the confined space may change your mind. The operations are, however, described in the following text, but note he differences between thge XUD11 and DK5 engines.

The timing belt can also be partially removed, i.e. lifted from the camshaft timing gear, when the following operations are necessary:

- Removal and installation of the cylinder head.
- Removal and installation of the camshaft.
- Removal and installation of the oil pump drive sprocket and the oil pump drive chain.
- Removal and installation of the water pump.

The following operations describe the complete removal and installation of the timing gear components, but note that some special tools must be available to lock the crankshaft, the camshaft and the injection pump drive gear in the timing position. Camshaft and injection pump can be locked with bolts of 8 mm diameter and a length of 40 mm. The crankshaft is locked by inserting the rod, already shown in Fig. 1.12. The shape of the rod is required to insert it in the confined space into the cylinder block and the flywheel. — *Refer to Page 67 for a XUD11 BTE engine.*

Timing Belt Replacement — XUD11 Engines (except XUD11 BTE)

- Disconnect the battery earth cable.
- Jack up the right-hand front of the vehicle, remove the front wheel and place a chassis stand underneath the body. Engage the 5th gear to be able to rotate the crankshaft during later operations.
- Remove the wheel and remove the protector inside the front wheel. If a sound insulator is fitted, remove it.
- If in the way, remove the electronic control unit and the electrical harness.
- With a suitable clamp, clamp off the coolant hose between the cylinder head and the coolant expansion tank and then disconnect the hose from the cylinder head.
- Disconnect the fuel pipes and push them to one side.
- Place trolley jack underneath the engine (suitable wooden plank between jack head and oil sump) and lift the whole assembly to take the load off the engine mountings.
- Remove the high pressure pump drive belt.
- Remove the upper engine mounting, two nuts and the guide roller.
- Remove a flexible pipe near the filler cap from the clamp.
- With the gear engaged, slacken the crankshaft pulley bolt. Remove the crankshaft pulley from the end of the shaft. Either try two tyre levers or use a universal two- or tree-arm puller to withdraw the pulley.
- Refer to Fig. 1.54 and remove the parts shown in the illustration. These are:

The timing cover (1), the timing cover (2) after pushing the flexible pipe out of the way and the timing cover (3).

- Slightly raise the engine with a rope and a hoist and remove the lower engine mounting bracket near the timing cover, shown by (4) in Fig. 1.54. Refit the crankshaft pulley without the thrust washer after the operations above have been carried out.
- Insert the locking rod into the cylinder block and the flywheel in the manner shown in Fig. 1.55. Turn the crankshaft to and fro until the rod has entered.
- Obtain the 8 mm x 40 mm bolts, mentioned above. Insert one of the bolts at position (1) in Fig. 1.56 into the camshaft timing gearwheel and another one at positions (2) into the injection pump drive gear. Screw the bolts into the threads behind the respective gearwheel. The timing mechanism is now locked in position.

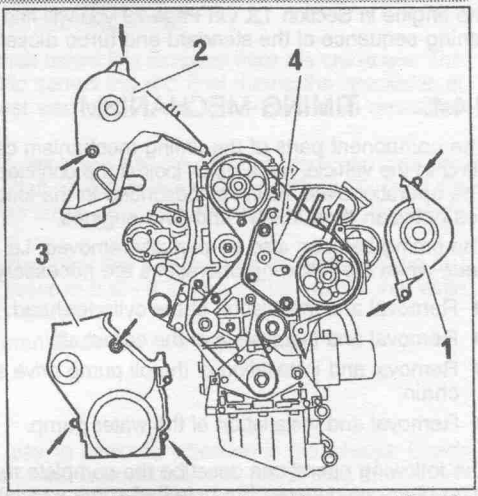


Fig. 1.54. — The parts 1 to 4 must be removed from the front end of the engine to gain access to the timing belt. The numbers are referred to in the text.

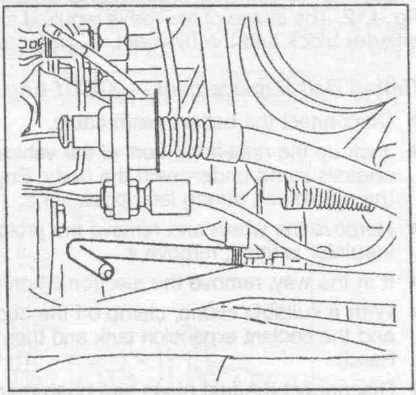


Fig. 1.55. — The locking rod (peg) for the flywheel is inserted in the position shown.

The next step is the removal of the timing belt. This requires the undoing of the tensioning roller and the adjustment eccentric. Proceed as follows:

- Refer to Fig. 1.57 and slacken the nut (1) securing the tensioning roller. Slacken the nut (2) with a 10 mm open-ended spanner. The inner bolt (3) will, however, turn during the removal of the nut and an Allen key of 5 mm A/F must be inserted into the bolt end to prevent it from rotating.
- Move the adjustment eccentric (4) away from the timing belt. This will move the tensioning roller. Keep the roller in the new position and tighten the nut (1) to lock it.
- If the same belt is refitted, mark its running direction on the outside of the belt. This can easily be done with a felt pen. "Paint" an arrows into the flat side of the belt.

- If required, remove the crankshaft timing gear from the end of the crankshaft and remove the Woodruff key. Otherwise check the condition of the gearwheel teeth. The same applies, of course, to the two other sprockets/gearwheels.

NOTE: A specific key is used in the crankshaft, to locate the timing sprocket, before a certain engine number. If the timing belt is being replaced, we suggest to enquire at your dealer about the key, referred to as "after sales" key. The new key will "key" the oil pump drive gear together with the crankshaft sprocket.

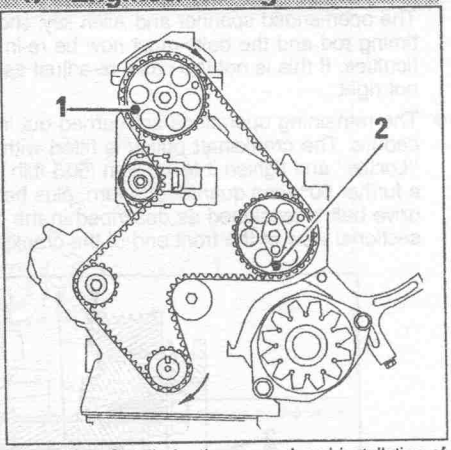


Fig. 1.56. — Details for the removal and installation of the timing belt. Insert the 8 mm bolts at positions (1) and (2).

Proceed as follows with the installation and the tensioning of the timing belt:

- If removed, fit the new crankshaft sprocket key (see note above) and and drive the crankshaft sprocket over the end of the shaft.
- Place the timing belt over the sprockets in the following order (noting the marked arrow if the original belt is used): the injection pump sprocket, the guide roller, the crankshaft sprocket, the water pumpe drive wheel, the camshaft sprocket and the tensioning roller. Make sure that all teeth engage properly.

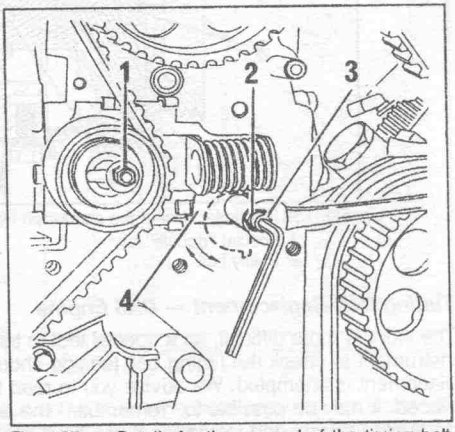


Fig. 1.57. — Details for the removal of the timing belt (XUD11). The numbers are referred to in the text.

- Remove the timing rod from the flywheel and the two 8 mm bolts and slacken the nut (1) in Fig. 1.57. The tensioning roller will now push against the timing belt. Turn the crankshaft by two turns *in the normal direction of rotation, never reverse* and check that the crankshaft is back in the correct position. There is no need to re-insert the rod/bolts, a check is enough.
- Tighten the nut (1) in Fig. 1.57 to 1.0 kgm (7.2 ft.lb.) and again turn the crankshaft by two turns in the normal direction of rotation and re-check the timing position.
- Slacken the nut (1) by one turn and then tighten it again to 1.0 kgm (7.2 ft.lb.).
- Without moving the belt, tighten the nut (2) and the bolt (3) to 1 kgm (7.2 ft.lb.).

The open-ended spanner and Allen key, shown in Fig. 1.57, must be used. The timing rod and the bolts must now be re-inserted and must locate without difficulties. If this is not the case, re-adjust as described above, as something is not right.

- The remaining operations are carried out in reverse order to the removal procedure. The crankshaft pulley is fitted with a new washer. Coat the bolt with "Loctite" and tighten it to 7.0 kgm (50.5 ft.lb.). From this position tighten the bolt a further 60° (one quartter of a turn, plus half of the next quarter of a turn). The drive belt is tensioned as described in the relevant section. Fig. 1.58 shows a sectional view of the front end of the crankshaft when the special key is used.

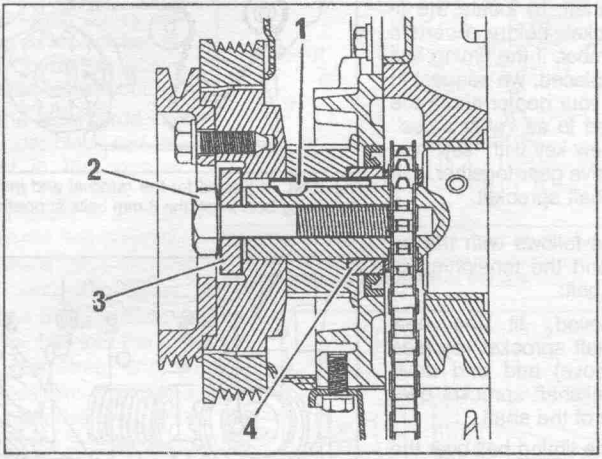


Fig. 1.58. Sectional view of the crankshaft front end with the special key.

1 Special "double" key
2 Pulley bolt
3 Washer (always replace)
4 Oil pump drive pinion

Timing Belt Replacement — DK5 Engine

The work is more difficult, as a special tool to tension the timing belt and a special instrument to check the timing belt tension should be available, before the belt replacement is attempted. We advise you to read the instructions first. If a belt is replaced, it may be possible to "remember" the tension of the fitted belt by gripping it between thumb and forefinger. If you have replaced a timing belt before, you will be able to re-adjust the tension of the new belt without any problems, but remember the confined space you are working in. Proceed as follows:

- Proceed in a similar manner as described on page 61 until the engine has the appearance shown in Fig. 1.59. Remove the roller (1), the upper timing cover (2), the crankshaft pulley (3) and the lower timing cover (4). Turn the crankshaft in the normal direction of rotation until the timing locking rod can be inserted through the cylinder block into the flywheel, as shown in Fig. 1.55.
- Lock the camshaft sprocket and the injection pump drive gearwheel as shown in Fig. 1.60. Special pegs are prescribed, but you will be able to use bolts or rods of suitable diameter.
- Suspend the engine assembly on a hoist or a hand crane and remove the strut

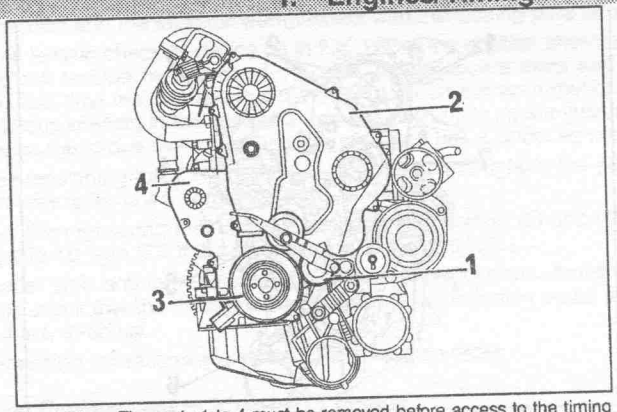


Fig. 1.59. — The parts 1 to 4 must be removed before access to the timing belt is possible (see text).

and the mounting bracket in front of the pulleys. Also remove two bolts from the bracket in front of the injection pump drive gedar and the belt tensioner roller.

- Slacken the securing nut in the front face of the tensioner roller. The roller will move, releasing the timing belt. The belt can now be lifted off. It may be necessary to lower the engine slightly to remove the belt.

A few preparation jobs are necessary before the belt can be refitted:

- Check that all rollers can be rotated easily. Replace any which appear to be sticking.

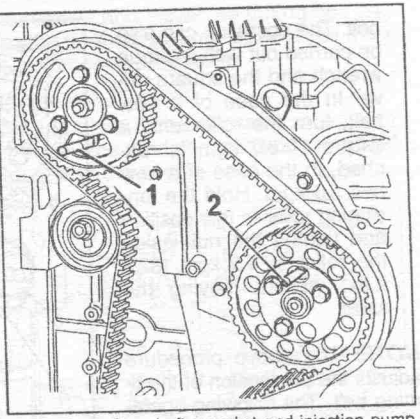


Fig. 1.60. — Camshaft sprocket and injection pump drive gear are locked with pegs (1) and (2).

- Refer to Fig. 1.61 on the next page and slacken the bolts securing the camshaft sprocket and the injection pump sprocket (bolts 2 and 4). Hand-tighten the bolts again and then unscrew them by 1/6 of a turn.
- Turn the two sprockets (1) and 3) fully clockwise in their elongated holes.
- Place the timing belt over the induvidual elements in the following order. First place the belt over the crankshaft timing sprocket, hold it in position and then route it over the guide roller (5), the injection pump drive wheel (3), camshaft sprocket (1) and finally the tensioner roller (7). The geawheels may have to be moved slightly to engage the teeth.
- The belt tension checking instrument shown in Fig. 1.62 must now be placed against the timing belt in the centre between the camshaft and injection pump sprockets. The tensioning roller has a square hole and a suitable square drive must be inserted (special lever 5711-T.E). Move the lever and with it the roller to tension the belt until the instrument shows 107 units (new belt) or 80 units (old

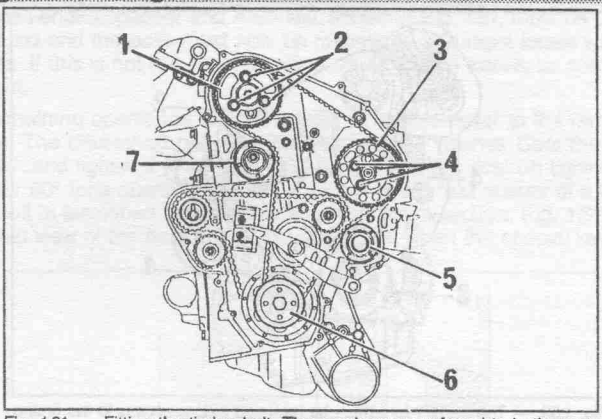


Fig. 1.61. — Fitting the timing belt. The numbers are referred to in the text.

belt. The operation can also be carried out with a torque wrench and the square drive. In the case of a new belt, turn the roller until a torque of 8.0 kgm is reached, in the case of a new belt 5.0 kgm. Hold the tensioning roller in this position and tighten the nut inside the roller to 4.5 kgm (32.5 ft.lb.) without moving the roller.

NOTE: The above procedure adjusts the pre-tension of the timing belt. The following operations will establish the final tension of the belt.

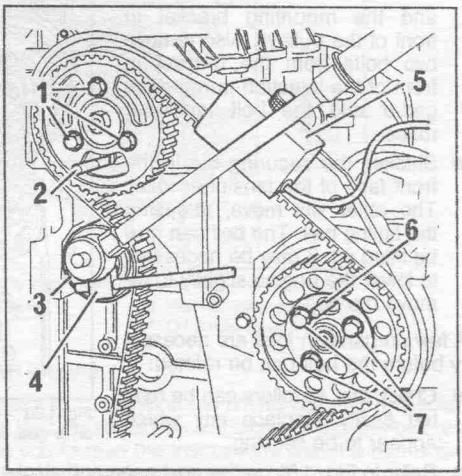


Fig. 1.62. Details for the tensioning of the timing belt.
1 Camshaft sprocket bolts
2 Locking pin
3 Tensioning roller
5 Measuring instrument
6 Locking pin
7 Securing bolts

- Remove the instrument (5) in Fig. 1.62 and then tighten the screws (2) and (4) in Fig. 1.61. Both sets of screws are first tightened to 1.0 kgm (7.2 ft.lb.) and then to 2.5 kgm (18 ft.lb.).
- Remove all special tools from the engine, as used.
- Rotate the engine by 10 revolutions and arrest the flywheel by inserting the locking rod through the cylinder block. The crankshaft must be rotated in the normal direction of rotation until the rod engages.
- Slacken the bolts (2) and (4) in Fig. 1.61, hand-tighten them and then slacken them by 1/6 of a turn.
- Move the tensioner roller to release the belt completely and lock the cam-

shaft sprocket and the injection pump wheel with the locking pins or bolts.

- Apply the tension checking device (5) in Fig. 1.62 in the position shown and adjust the belt tension by means of the lever or the square drive and torque wrench. This time the indications must be 58 units on the instrument (3.0 kgm on the torque wrench) in the case of a new belt or 51 units on the instrument or 2.5 kgm on the torque wrench in the case of a used belt. Correct as necessary.
- Hold the tensioning roller in the tensioned position and tighten the nut in the centre of the roller to 4.5 kgm (32.5 ft.lb.).
- Remove the measuring instrument and tighten the screws (2) and (4) in Fig. 1.61, first to 1.0 kgm (7.2 ft.lb.) and then to 2.5 kgm (18 ft.lb.).
- Remove all tools and turn the crankshaft by two full revolutions. Arrest the flywheel and check that the timing holes in camshaft and injection pump sprockets align. If not, re-adjust.
- The remaining operations are carried out in reverse order.

Timing Belt Replacement — XUD11 BTE Engine

This is engine type P8C, fitted since 1995. Due to various modifications, there are also some differences in the procedure to remove and install the timing belt and associated parts. As before you will require the flywheel locking tool and the M8 x 40 mm bolts to lock the timing gearwheels. zproceed as follows:

- Disconnect the battery earth cable and engage 5th gear.
- Jack up the R.H. front end of the vehicle and place a chassis stand underneath the side of the body. Remove the front wheel, the mud shield inside the wheel arch and the sound insulator from underneath the engine.
- Remove the electronic control unit housing and push the housing and the cable harness to one side, where it cannot be in the way.
- Refer to Fig. 1.63 and remove the support (1). Use suitable clamps to clamp off the hose (2) and disconnect it from the engine.
- Disconnect the flexible diesel fuel pipes.
- Place a jack underneath the engine assembly and lift it up until the engine mountings are under tension. Otherwise it is possible to employ a lifting tackle with a chain or rope to lift the engine.

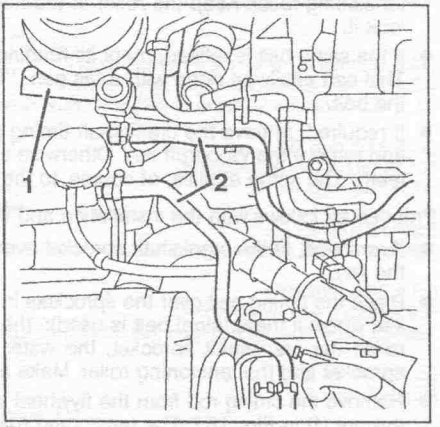


Fig. 1.63. — Remove the support (1) and disconnect the hose (2).

- Remove the complete engine mounting opposite the timing cover. Remove four bolts inserted from the top and the horizontally inserted bolt and nut.
- Remove a bolt on the high pressure pump, release the tension of the alternator drive belt and take off the belt.
- Remove two nuts and take off the guide roller.

- Remove a flexible pipe near the filler cap from the clamp.
- With the gear engaged, slacken the crankshaft pulley bolt. Remove the crankshaft pulley from the end of the shaft. Either try two tyre levers or use a universal two- or tree-arm puller to withdraw the pulley.
- Refer to Fig. 1.54 and remove the parts shown in the illustration. These are: The timing cover (1), the timing cover (2) after pushing the flexible pipe out of the way and the timing cover (3).
- Slightly raise the engine with a rope and a hoist and remove the lower engine mounting bracket near the timing cover, shown by (4) in Fig. 1.54.
- Insert the locking rod into the cylinder block and the flywheel in the manner already shown in Fig. 1.55. Turn the crankshaft to and fro until the rod has entered.
- Obtain the 8 mm x 40 mm bolts, mentioned above. Insert one of the bolts at position (1) in Fig. 1.56 into the camshaft timing gearwheel and another one at positions (2) into the injection pump drive gear. Screw the bolts into the threads behind the respective gearwheel. The timing mechanism is now locked in position.

The next step is the removal of the timing belt. This requires the undoing of the tensioning roller and the adjustment eccentric. Proceed as follows:

- Refer to Fig. 1.57 and slacken the nut (1) securing the tensioning roller. Slacken the nut (2) with a 10 mm open-ended spanner. The inner bolt (3) will, however, turn during the removal of the nut and an Allen key of 5 mm A/F must be inserted into the bolt end to prevent it from rotating.
- Move the adjustment eccentric (4) away from the timing belt. This will move the tensioning roller. Keep the roller in the new position and tighten the nut (1) to lock it.
- If the same belt is refitted, mark its running direction on the outside of the belt. This can easily be done with a felt pen. "Paint" an arrows into the flat side of the belt.
- If required, remove the crankshaft timing gear from the end of the crankshaft and remove the Woodruff key. Otherwise check the condition of the gearwheel teeth. The same applies, of course, to the two other sprockets/gearwheels.

Proceed as follows with the installation and the tensioning of the timing belt:

- If removed, fit the crankshaft sprocket over the end of the shaft guiding it over the key.
- Place the timing belt over the sprockets in the following order (noting the marked arrow if the original belt is used): the injection pump sprocket, the guide roller, the crankshaft sprocket, the water pumpe drive wheel, the camshaft sprocket and the tensioning roller. Make sure that all teeth engage properly.
- Remove the timing rod from the flywheel and the two 8 mm bolts and slacken the nut (1) in Fig. 1.57. The tensioning roller will now push against the timing belt. Turn the crankshaft by two turns *in the normal direction of rotation, never reverse* and check that the crankshaft is back in the correct position. There is no need to re-insert the rod/bolts, a check is enough.
- Tighten the nut (1) in Fig. 1.57 to 1.0 kgm (7.2 ft.lb.) and again turn the crankshaft by two turns in the normal direction of rotation and re-check the timing position.
- Slacken the nut (1) by one turn (the spring will take up any slack) and then tigh-

ten it again to 1.0 kgm (7.2 ft.lb.). Without moving the belt, tighten the nut (2) and the bolt (3) to 1 kgm (7.2 ft.lb.). The open-ended spanner and Allen key, shown in Fig. 1.57, must be used. The timing rod and the bolts must now be re-inserted and must locate without difficulties. If this is not the case, re-adjust as described above, as something is not right.

- The remaining operations are carried out in reverse order to the removal procedure. The crankshaft pulley is fitted with a new washer. Coat the bolt with "Loctite" and tighten it to 7.0 kgm (50.5 ft.lb.). From this position tighten the bolt a further 60° (one quarter of a turn, plus half of the next quarter of a turn). The drive belt is tensioned as described in the relevant section.

1.5. Engine — Tightening Torque Values

Cylinder Head Bolts — Non-Turbo Engines:
1st stage: ..... Tighten to 7.0 kgm (50.5 ft.lb.)
2nd stage: ..... Tighten bolts in order by a further 140°

Cylinder Head Bolts — XUD 11 Turbo Diesel Engines — With serrated bolt heads:
1st stage: ..... Pre-tighten to 7.0 kgm (50.5 ft.lb.)
2nd stage: ..... Angle-tighten in order by a further 140°

Cylinder Head Bolts — XUD Turbo Diesel Engines — With plain bolt heads:
1st stage: ..... 7.0 kgm (50.5 ft.lb.)
2nd stage: ..... Angle-tighten in order by a further 140°
3rd stage: ..... Allow engine to reach operating temperature
4th stage: ..... Allow engine to cool for 3 ½ hours
5th stage: .... Slacken each bolt by 90° (¼ of a turn) and re-tighten to 7 kgm (50.5 ft.lb.)
6th stage: ..... Angle-tighten in order by 140°

Cylinder Head Bolts — DK5 Engine (see Fig. 1.31):
1st stage: ..... Tighten bolts (1) to (14) to 5.0 kgm (36 ft.lb.)
Tighten bolts (15) to (22) to 3.5 kgm (18 ft.lb.)
2nd stage: ..... Tighten bolts (1) to (22) in order by a further 120 ± 5°
Big end bearing caps::
1st stage: ..... 2.0 kgm (14.5 ft.lb.)
2nd stage: ..... Angle-tighten by a further 70°
Main bearing caps — Standard diesel engine: ..... 7.0 kgm (50.5 ft.lb.)
Main Bearing Caps — Turbo diesel engine:
1st stage: ..... 1.5 kgm (11 ft.lb.)
2nd stage: ..... Angle-tighten by a further 60°
Crankshaft pulley/damper:
1st stage: ..... 7.0 kgm (50.5 ft.lb.)
2nd stage: ..... Angle-tighten by a further 60°
Flywheel bolts (always replace): ..... 5.0 kgm (36 ft.lb.), coat bolt threads with "Loctite"
Camshaft timing gearwheel:
XUD11 engines, bolt: ..... 4.3 kgm (31 ft.lb.)
DK5 engine, camshaft plate, nut: ..... 4.3 kgm (31 ft.lb.)
Camshaft timing gearwheel to camshaft plate (DK5):
1st stage: ..... 1.0 kgm (7.2 ft.lb.)
2nd stage: ..... 2.5 kgm (18 ft.lb.)
Injection pump drive wheel securing screws: ..... As camshaft gearwheel
Camshaft housing to cylinder head (XUD11): ..... 2.5 kgm (18 ft.lb.)
Camshaft housing to cylinder head (DK5): ..... 2.0 kgm (14.5 ft.lb.)
Oil sump: ..... 1.6 kgm (12 ft.lb.)
Cylinder head cover: ..... 0.8 kgm (6 ft.)
Water pump: ..... 1.6 kgm (9.5 ft.lb.)
Oil pump bolts: ..... 1.3 kgm (9.5 ft.lb.)

Injectors	9.0 kgm (63 ft.lb.)
Glow plugs	2.2 kgm (16 ft.lb.)
Injection pipe union nuts	2.5 kgm (18 ft.lb.)
Crankshaft pulley to timing gearwheel	2.7 kgm (19.5 ft.lb.)
Camshaft housing closing plate (XUD11)	1.4 kgm (10 ft.lb.)
Oil gallery plug (camshaft wheel side)	3.8 kgm (27.5 ft.lb.)
Oil splash jets (piston cooling)	1.0 kgm (7.2 ft.lb.)
Front oil seal husing (XUD11)	1.0 kgm (7.2 ft.lb.)
Oil level indicator sensor in sump (Turbo diesel)	1.0 kgm (7.2 ft.lb.)
Oil gallery plug (flywheel side, XUD11)	3.8 kgm (27.5 ft.lb.)
Clutch bolts:	
Standard diesel engine	1.3 kgm (9.5 ft.lb.)
Turbo diesel engine	2.0 kgm (14.5 ft.lb.)
Oil cooler adaptor	2.8 kgm (20.1 ft.lb.)
Oil cooler to adaptor	5.8 kgm (42 ft.lb.)
Injection pump console	2.0 kgm (14.5 ft.lb.)
Water housing to cylinder head (XUD11)	2.3 kgm (16.5 ft.lb.)
Engine mounting bracket (lower)	2.7 kgm (19.5 ft.lb.)
Thermo switches	1.5 kgm (11 ft.lb.)
Thermostatic capsule	2.5 kgm (18 ft.lb.)
Glow plug leads	0.4 kgm (3 ft.lb.)
Exhaust manifold	2.0 kgm (14.5 ft.lb.)
Inlet manifold	2.3 kgm (16.5 ft.lb.)
Air intake housing	1.0 kgm (upper row), 0.5 kgm (lower row)
Engine/Transmission Mountings	See relevant illustration

1.6. Exhaust System

Fig. 1.64 shows the component parts of the exhaust system of a model with naturally aspirating diesel engine without catalytic converter together with the applicable tightening torques. The rear exhaust mounting must be removed to replace the rear silencer and the front silencer with the exhaust pipe. The front exhaust pipe can be removed after disconnecting it from the exhaust manifold and slackening the clamp at the front of the rear silencer. Note that the rear silencer is not the same on all model years. The same applies to the catalytic converter. Check before replacement. Coat the threads of the bolts securing the exhaust pipe to the manifold with sealing compound.

Models with turbo diesel engine have a similar layout, but the rear parts of the system have a different shape. Again the catalytic converter is not the same on all engines. The system fitted together with a DK5 engine consists of a front pipe, a front silencer (only models without catalytic converter), the catalytic converter, an intermediate silencer with a connecting pipe and a rear silencer.

Check the rubber suspension mountings after the system has been removed. Make sure that the mountings are in good condition before refitting. The system must be fitted free of tension to prevent early failure of the rubber mountings.

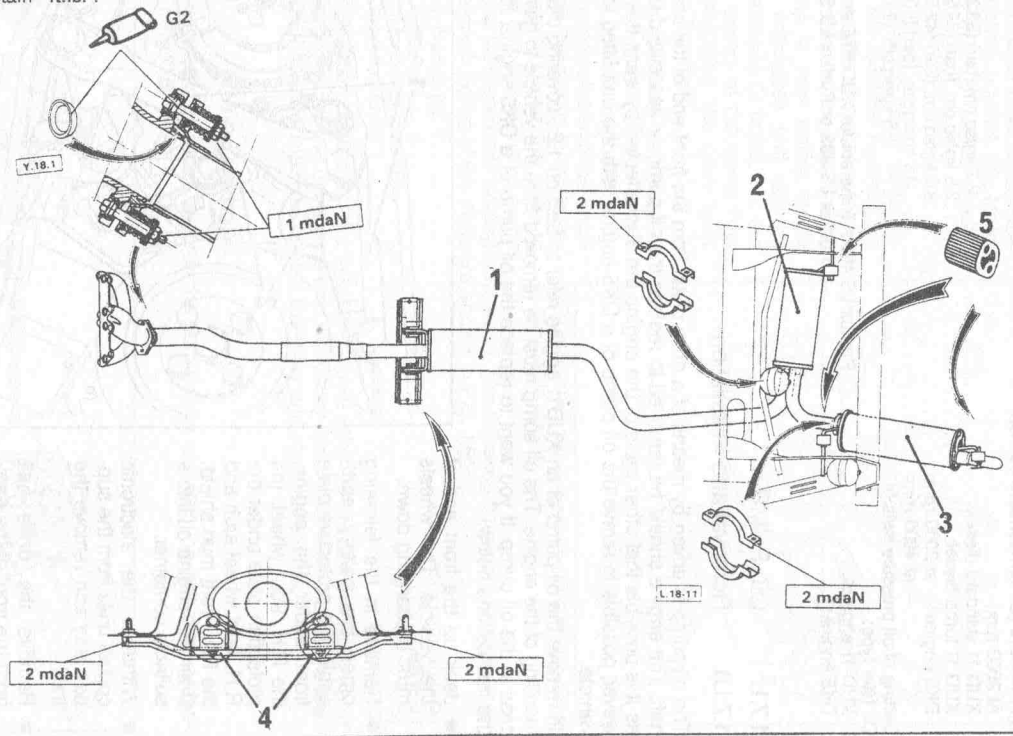
1.7. Lubrication System

1.7.0. TECHNICAL DATA

Engine Sump capacity	Refer to Section 0.2.2, Page 6
Oil type	Total oil for diesel engines

Fig. 1.64. — The layout of the exhaust system. The term "mdaN" can be read as "kgm". Multyply by "7.2" to obtain "ft.lb.".

1 Pre-silencer
2 Main silencer
3 Rear seilencer
4 Silencer mounting
5 Rubber suspension



Oil Pressure (Oil Temperature 90° C):

At 2000 rpm:	
XUD 11 standard diesel:	2.7 kg/sq.cm (bar) (38.3 psi.)
XUD 11 turbo diesel:	2.5 kg/sq.cm. (bar) (35.5 psi.)
DK5 engine — at 2000 rpm:	3.0 kg/sq.cm. (bar) (42.5 psi.)
— at 4000 rpm:	3.5 kg/sq.cm. (bar) (50 psi.)
Setting of oil pressure switch:	0.5 kg/sq.cm. (7.1 psi.)
Oil filter type:	
XUD 11 engines:	Purflux LS 468 A (different for XUD BTE engine)
DK5 engine:	Purflux LS 483 or Purflux LS 520 C

1.7.1. OIL PUMP

1.7.1.0. Removal and Installation

The oil pump is driven by means of a drive chain from the front end of the crankshaft. The engine should be removed to replace the oil pump or associated parts, as it is possible that other parts of the engine are also affected by wear. It is, however, possible to remve the oil pump of a DK5 engine with the unit fitted to the vehicle.

To remove the oil pump of an XUD11 engine refer to Section 1.2., covering the dismantling of the engine. The oil sump must be removed from the vehicle to gain access to the oil pump. If you want to replace the oil pump of a DK5 engine, follow the instructions below.

- Jack up the front end of the vehicle. The wheels must be hanging down.
- Remove in the following order: the battery earth cable, the protective plate from under the engine, the R.H. front wheel, the protection plate under the R.H. front wheel arch and the R.H. front mud shield. Drain the engine oil into a suitable container.
- Withdraw the electronic control units from the support tray and remove the tray.
- Remove the drive belt from the front of the engine (Section "Cooling System").
- Place a jack underneath the engine and lift it up until it is under slight tension or use a hoist, hand crane or similar anbd lift the engine with ropes or chains.

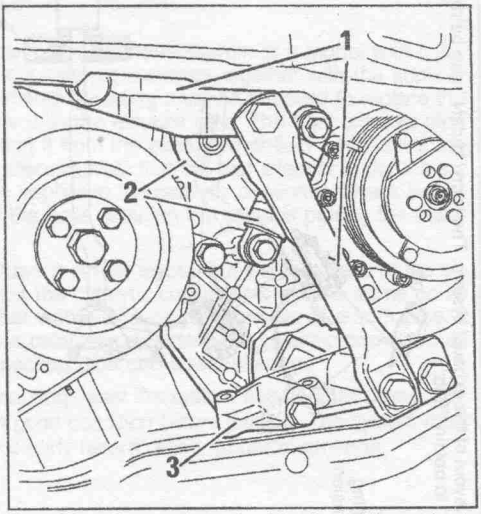


Fig. 1.65. — Remove the parts at the front of the engine to gain access to the oil pump.

- Refer to Fig. 1.65 and remove the parts of the engine mounting (1), the automa-

tic tensioner roller (2) and the mounting bracket (3). Make sure that the engine is sufficiently supported.

- Remove the cover underneath the flywheel housing, lift the engine as necessary and remove the oil sump. The oil pump is now visible inside the crankcase and can be unscrewed (3 bolts). Lift out the pump, at the same time disengaging the drive gear from the chain.

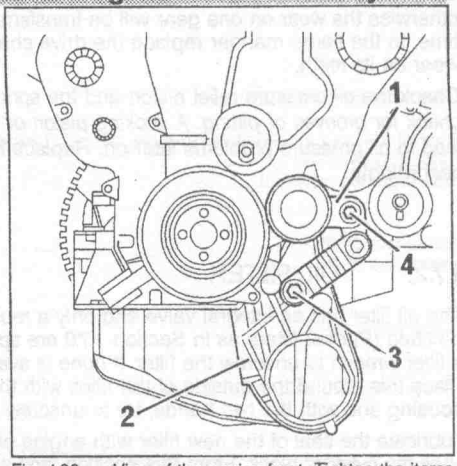


Fig. 1.66. — View of the engine front. Tighten the items as specified in the text.

The installation is a reversal of the removal procedure. Check that the dowel is in position, engage the sprocket with the chain and refit the pump to the cylinder block. Tighten the bolts to 1.0 kgm (7.2 ft.lb.). The oil sump face must be coated with sealing compound. The following tightening torques must be observed. Some of the parts are shown in Fig. 1.66:

Mounting bracket (2): . . . . . 5.5 kgm (40 ft.lb.)
Bolt (4) of strut: . . . . . 2.3 kgm (16.5 ft.lb.)
Bolt (4) of tensioner roller (1): . . . . . 7.0 kgm (50.5 ft.lb.)
Engine mounting parts: . . . . . See Fig. 1.8

After installation disconnect the injection double relay (to prevent the firing-up of the engine) and rotatne the engine with the starter motor until the oil pressure warning light has gone out. Re-connect the relay and start the engine.

1.7.1.1. Pump Overhaul

To dismantle the oil pump, unscrew the pump cover and strip the unit in accordance with Fig. 1.67.

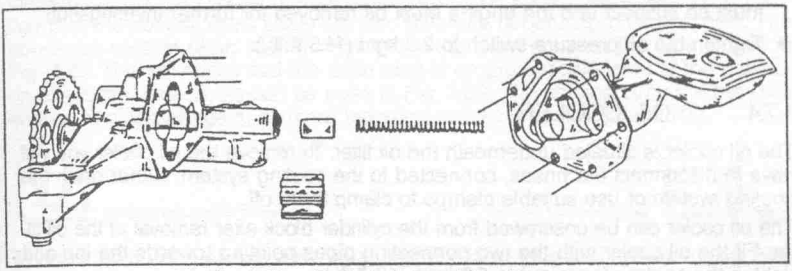


Fig. 1.67. — Exploded view of the oil pump.

Check the gearwheels for the pump and also the drive gear on the crankshaft. If one of the pump gears is worn on the teeth, both gears should be replaced, as

otherwise the wear on one gear will be transferred to the other one in a very short time. In the same manner replace the drive chain, if the sprocket shows signs of wear on its teeth.

Check the oil pressure relief piston and the spring. Clean out the piston bore and check for grooves or pitting. A sticking piston or one with excessive clearance will lead to oil pressure problems later on. Replace the piston, spring or the oil pump accordingly.

1.7.2. OIL FILTER

The oil filter has an integral valve and only a replacement with such a valve must be fitted (Purflux filters as in Section 1.7.0 are specified). To remove the filter, use a filter wrench to unscrew the filter. If none is available, try a piece of emery cloth. Place this around the outside of the filter, with the abrasive side towards the filter housing and with the two hands, try to unscrew the filter.

Lubricate the seal of the new filter with engine oil and tighten the filter until it touches the cylinder block. From this position, and with the hands only, tighten the filter by a further ¼ of a turn.

Unscrew the filter once more, re-tighten it until it touches the cylinder block and now tighten it a further ½ to ¾ of a turn. These instructions must be adhered to in order to obtain a perfect seal.

1.7.3. CHECKING THE OIL PRESSURE

If a suitable adaptor to screw into the thread for the oil pressure switch is available, the oil pressure can be checked as follows:

- Run the engine until the oil temperature has reached 90° C and then idle the engine for 5 minutes after the cooling fan has switched on.
- Switch off the engine. Run the engine at idle speed and then at the speeds given in Section 1.7.0. Refer to the same section for the correct pressures.
- If the oil pressure is below the values given, it may be necessary to carry out an oil change. Re-check the pressure. If the pressure is still low, the oil pump must be suspect and the engine must be removed for further investigation.
- Tighten the oil pressure switch to 2.0 kgm (14.5 ft.lb.).

1.7.4 OIL COOLER

The oil cooler is situated underneath the oil filter. To remove the oil cooler you will have to disconnect the hoses, connected to the cooling system. Either drain the cooling system or use suitable clamps to clamp them off.

The oil cooler can be unscrewed from the cylinder block after removal of the oil filter. Fit the oil cooler with the two connecting pipes pointing towards the top and tighten the centre sleeve nut to 5.8 kgm (42 ft.lb.).

The outside of the oil cooler should be coated with sealing compound before the oil filter is refitted. Re-connect the water hoses to the oil cooler. Check the cooling level after installation, if coolant has been lost.

1.8. Cooling System

1.8.0. TECHNICAL DATA

Type of system: ..... Sealed, with expansion tank
System capacity:
XUD 11 engines: ..... 9.6 litres (17.0 Imp. pts.)/10.0 litres (18 pts.) — See Page 6
DK5 engine: ..... 13.0 litres (23.0 pts.)
Water pump: ..... Impeller, not repairable

Anti-freeze contents:
Down to —15° C: ..... 28 % anti-freeze
Down to —30° C: ..... 50 % anti-freeze

Thermostat:
Location: ..... Water outlet elbow
Opening temperature:
Without turbo charger: ..... 85° C
With turbo charger: ..... 80° C or 85° C, depending on transmission
Fully open ..... 101° C

Electric Cooling Fan — Without Turbo Charger:
Cutting-in temperature: ..... 95° C
Cutting-out temperature: ..... 90° C

Electric Cooling Fan — With Turbo Charger:
Cutting-in temperature — First speed: ..... 92° C (84° C with automatic)
Cutting-in temperature — Second speed: ..... 97° C (88° C with automatic)
Cutting-out temperature — First Speed: ..... 87° C (79° C with automatic)
Cutting-out temperature — Second Speed: ..... 92° C (83° C with automatic)

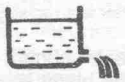
Water Temperature Warning Switch:
Opens at: ..... 118° C (warning lamp flashes)
112° C ("Stop" lamp lights up)

1.8.1. DRAINING AND REFILLING

The cooling system should be refilled in the following manner to avoid air locks. All engines are fitted with bleed screws for the cooling system, which must be open during the filling of the system. The diagrams on the following pages show where these bleed screws are located on some of the engines. These are shown with the following symbol. As not all possible versions can be shown, we would like to mention that the coolant drain plugs are also different, depending on the engine. The non-turbo version of an XUD11 engine has the drain point on the side shown in Fig. 1.68. You will notice that the drain plug is on the opposite side of the radiator on the turbo version, as can be seen in Fig. 1.69. The cooling circuit of the DK5 engine is different again, as more bleeding screws are used (Fig. 1.70.).

Symbol for bleeder screws

Symbol for drain points



To drain the cooling system remove the radiator drain plug and the drain plug fitted into the cylinder block. A square drive wrench is required to remove the plug in the case of a DK5 engine.

Before filling the system close the engine and radiator drain plugs and set the

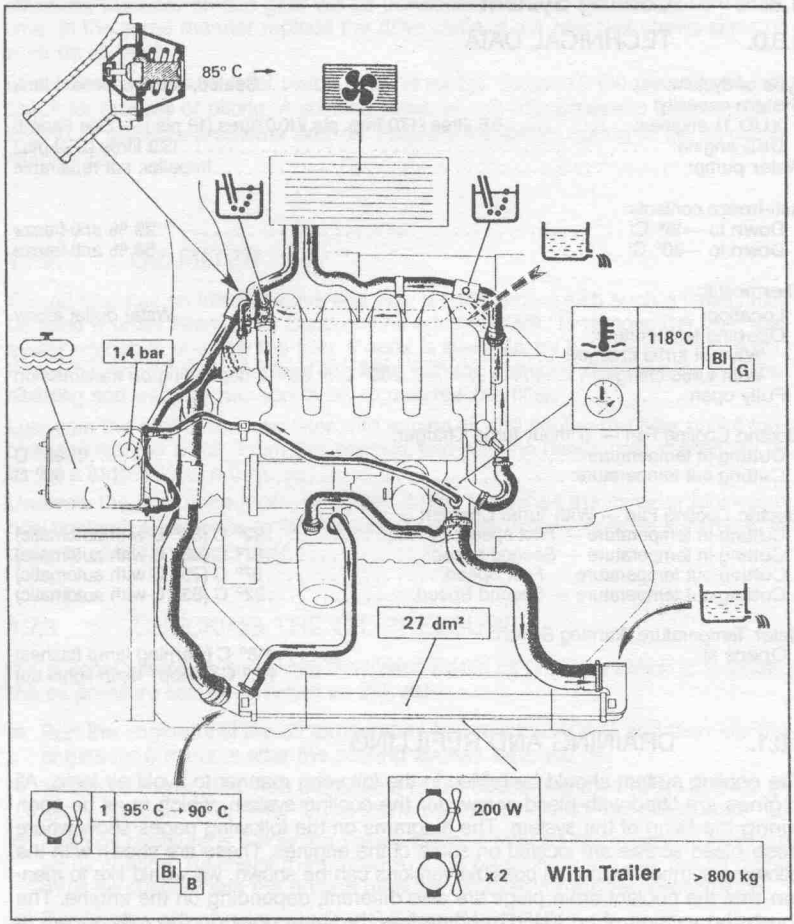


Fig. 1.68. — Cooling system diagram of a standard diesel engine with manual transmission. There are differences if an A/C system is fitted:

Two 200 watts electric cooling fans are fitted

Where the single 118° C temperature switch is fitted, there are additional switches for the temperature warning light, the overheating warning light and the temperature switch for the radiator fans. The latter is a two-stage switch (see Section 1.8.0 for opening/closing temperatures).

heater control to the "On" position. Use only anti-freeze suitable for the engine. The bleed screws must be opened to allow the free draining of the coolant and, more important, the correct filling of the system. The screws are located at different positions on the DK5 engine, but are at the same positions on all XUD11 engines, irrespective if a standard diesel or turbo diesel engine is fitted.

Fill the cooling system of all models through the opening of the expansion chamber. Fill the system with the correct anti-freeze mixture. Half water and half anti-

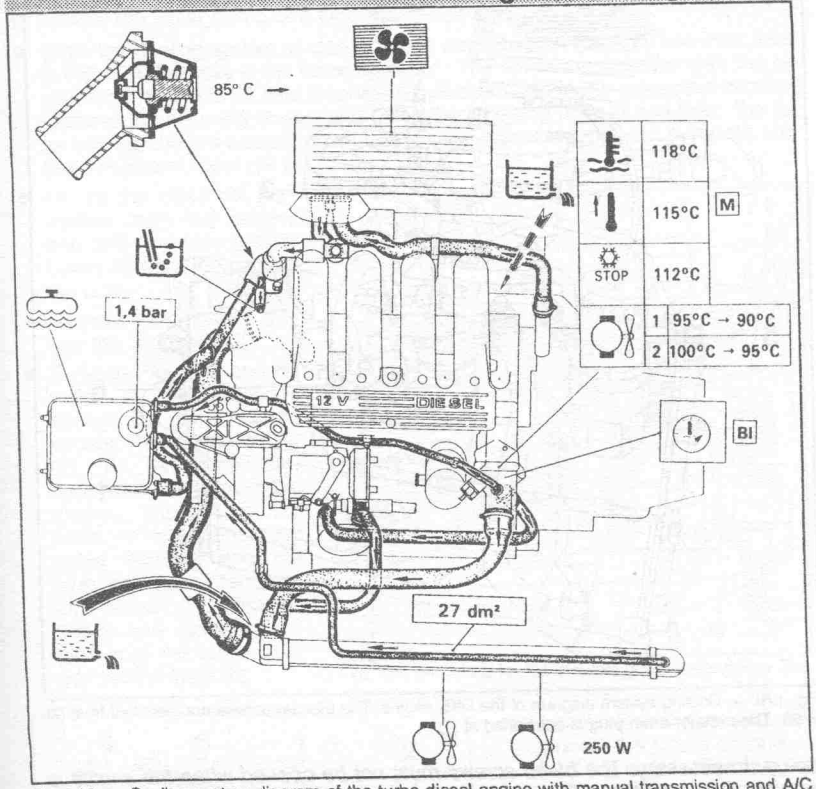


Fig. 1.69. — Cooling system diagram of the turbo diesel engine with manual transmission and A/C system. On models without A/C system, the following differences will be found:

Only the 118° C temperature switch is fitted at the position shown. Temperature warning light (flashing) and overheating "STOP" light switch are not fitted. All switches are colour-coded for easy identification.

The two-stage cooling fan temperature switch can be found at the same position as shown in Fig. 1.68 and not as shown in the diagram.

freeze will protect the system to —37° C. The previously openened bleed screws must be still open. The filling operation must continue until the coolant flows out of the bleed screw(s). Now close the bleed screws.

In the case of an XUD11 engine start the engine and run at 2000 rpm for two minutes (without fitting the filler cap). If necessary add coolant up to the filler neck and fit the filler cap. Re-start the engine and let it run until the fan (or the fans) cuts-in. Stop the engine and allow to cool down. If necessary fill in additional coolant to the "Max" level mark on the expansion tank and refit the cap.

In the case of a DK5 engine start the engine and run it with 1500 rpm. Maintain this speed until the fans have started and stopped three times. Then switch off the engine and allow it to cool down. Re-check the coolant level in the reservoir and

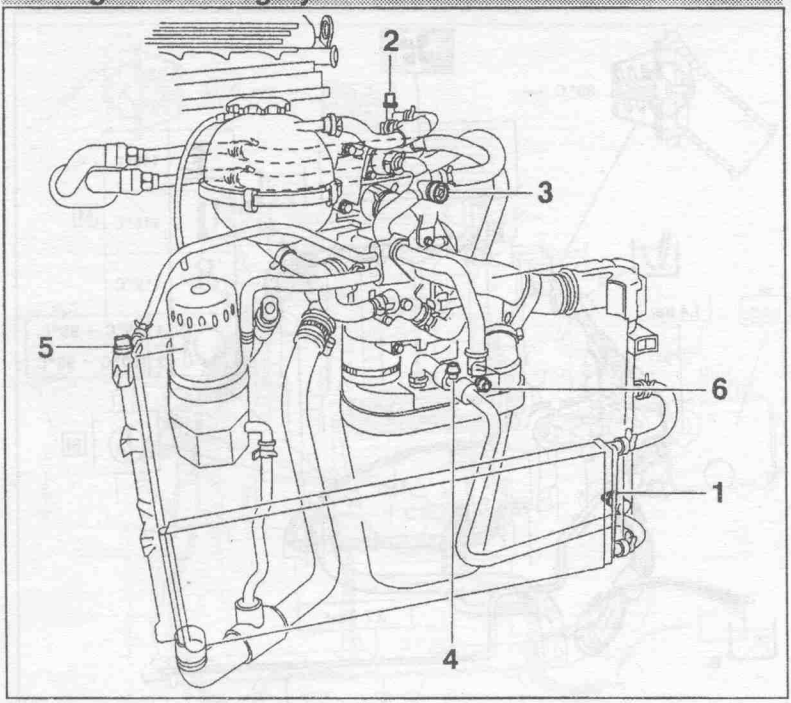


Fig. 1.70. — Cooling system diagram of the DK5 engine. The bleeder screws are identified from (2) to (6). The radiator drain plug is positioned at (1).

top-up if necessary. *The bleed screws must not be opened when the engine is running.* Finally refit the filler cap. Note that the coolant should be changed once every two or three years to retain its properties.

1.8.2. WATER PUMP

The water pump cannot be repaired or serviced. If the pump is faulty or leaking it should be replaced with a new unit.

Before attempting to replace the water pump note the following:

- The water pump of the ***XUD11 engines*** cannot be seen from the outside of the engine as it is behind the timing belt cover. It is driven by the timing belt. Removal of the pump involves therefore the removal, installation and tensioning of the timing belt. Refer to Section 1.4.4.2 and remove the timimg belt (it can be left hanging over the remaining timing gears) until the water pump can be unbolted. The pump is fitted with a gasket which must always be replaced. Tighten the bolts to 1.5 kgm (11 ft.lb.).
- The water pump of the ***DK5 engine*** is visible from the exterior of the engine and is driven by a poly-V-belt with automatic adjustment. The water pump is situated at the front of the engine.

To remove the water pump of a DK5 engine, proceed as follows:

- Drain the cooling system as described as described on Page 75 and than refer to Fig. 1.71. Remove in the following order: The air cleaner together with the air inlet tube (1), the LHM fluid reservoir (2) as described in the respective section. Remove the securing screws and place the following units to one side: the fuse box (3), the pre-heater control unit (5), the diesel fuel priming pump (6) and the dehydrator reservoir (7).
- Unclip the electrical harnesses from the battery tray and the fuse carrier boxes (4) from the cooling fan unit.
- Remove the battery tray and the trim cover (8).
- Refer to Fig. 1.72 and remove at the locations shown the air pressure sensor (1) and the screw (2). Tilt the accelerator support (3) away from the engine. Disconnect the hose (4) from the coolant outlet housing and the plug from the air temperature sensor (5). Free the hoses and electrical cables from the turbo charger section pipe (6).

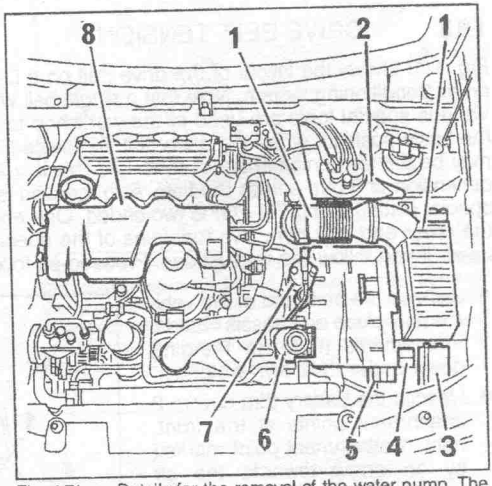


Fig. 1.71. — Details for the removal of the water pump. The numbers are referred to in the text.

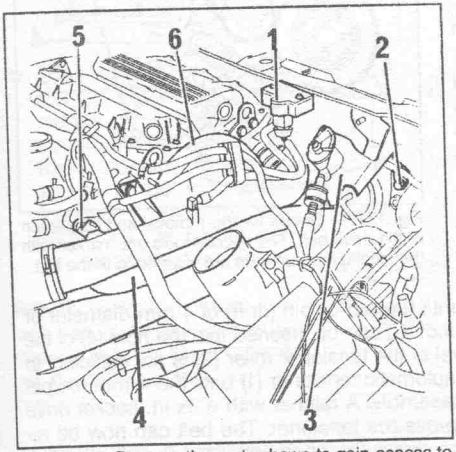


Fig. 1.72. — Remove the parts shown to gain access to the water pump. Numbers are referred to in the text.

- Remove four screws and disconnect the hoses on one side of the engine. Remove the rigid suction pipe from the turbo charger.
- Remove the water pump drive belt. To do this, slacken the bolt in the centre of the tensioner pulley and on the left of the pulley tighten the visible screw. This will move the pulley away from the belt. Take the belt off the pulleys as soon as it is possible.
- The water pump can now be unscrewed from the cylinder head.

Before installation clean the joint faces of old sealing compound and coat the gasket contact faces with a thin layer of sealing compound. The installation of the pump is a reversal og the removal procedure, noting the following points:

- The water pump bolts are tightened to 1.0 kgm.
- Refit the water pump drive belt and tension it in accordance with the instructions in Section 1.8.3. Rotate the crankshaft by three revolutions in the direction of rotation and re-check the belt tension.
- After installation and/or connection of the items shown in Figs. 1.71 and 1.72 fill and bleed the the cooling system as already described.

1.8.3. DRIVE BELT TENSION

Fig. 1.73 shows the layout of the drive belt on a DK5 engine with compressor for an air conditioning system. Note that a single belt with automatic tensioner is used. Various special tools are used in the workshop to set the automatic tensioner to the basic position, when the drive belt is replaced. The most difficult to improvise may be the tensioning spanner 5714-T.S. This is a lever with a square drive with a dimension of 6 mm across the flats. Also required ist an angled 6 mm Allen key. A special setting tool (5714-T.Q) is two-ended. One end has a rod of 4 mm diameter, the other end of 2 mm. Two rods/pins of the specified diameter can perhaps be used, if you follow the instructions. Proceed as follows to remove the belt:

- Jack up the front end of the vehicle and place on chassis stands. The wheels must be hanging down under their own weight.
- Unsclip the battery trim cover: 2 attachment points at the front, right, 1 attachment point marked by an arrow towards the air cleaner. A screwdriver is used to unclip the fastening.
- Disconnect the battery earth terminal.
- Remove the R.H. front wheel and remove the panels inside the wheel arch until the belt is free to be reached. Remove the strut (1), shown in Fig. 1.65.
- Referring to Fig. 1.73, slacken the screw (3). The 6 mm Allen key (A) is required (special key 5714-T.R).

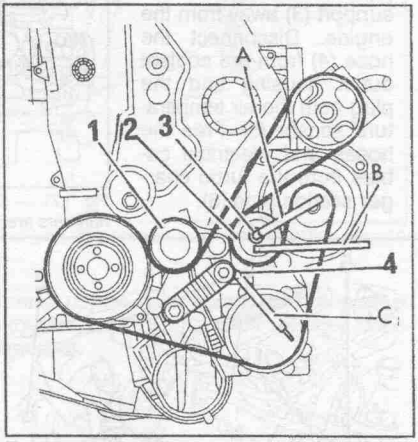


Fig. 1.73. — Details for the removal and installation of the drive belt. The special tools are marked with the letters, the numbers are referred to in the text.

- Operate the roller tensioner (2) until the rod or pin (drift) of 4 mm diameter or the respective side of the special tool (C) can be inserted into the hole (4) of the automatic tensioner (1). If the travel of the tensioner roller (2) is not sufficient to slacken the drive belt, move the automatic tensioner (1) until the 4 mm rod/pin (C) can be inserted to lock the assembly. A ratchet with a ⅜ in. socket drive and an extension is required to move the tensioner. The belt can now be removed. Fig. 1.74 on the next page shows the operation.

NOTE: It is possible that the belt can snap at some time during the life of the vehicle. This will mean that the automatic tensioner (1) is "out of position" and must be reset as described above to insert the 4 mm rod/pin/drift (see Fig. 1.74).

The installation of the drive belt is carried out as follows:

- Check that all rollers can be turned easily by hand and place the belt over the pulleys and rollers in accordance with Fig. 1.73. Make sure that the belt engages properly into the pulley grooves.
- Refer to Fig. 1.73 and operate the tensioner roller (2) with the special tool (B), i.e. the 6 mm square spanner, until the 4 mm rod/pin (C) can be removed.
- Hold the tensioner (2) in this position and tighten the screw (3) in the centre with the 6 mm Allen key. The tooque is given with 3.2 kgm (23 ft.lb.), can however not be applied with the Allen key, i.e. you will have to estimate the value.
- Turn the crankshaft 5 turns in the normal direction of rotation. Why 5 turns ?. The belt will have moved by one complete turn.
- The other side of the special tool (C) or the 2 mm rod/pin must now be inserted into the hole (4) of the automatic tensioner (1). If the tool cannot be inserted, re-adjust the tension from the beginning, as something it not right.

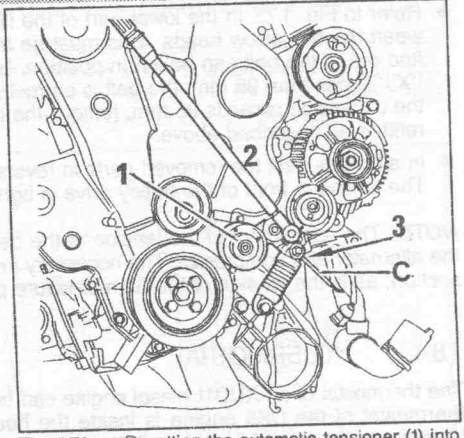


Fig. 1.74. — Resetting the automatic tensioner (1) into the locked position, if the belt is broken or the travel of the tensioner roller is not sufficient. Use a 3/8 in. socket drive with ratchet and extension is inserted as shown and operate the tensioner until the tool (C), i.e. the 4 mm rod, can be inserted into hole (3).

NOTE: How do I know, if a belt has stretched, i.e. outlived its service life. Proceed as described below to find out.

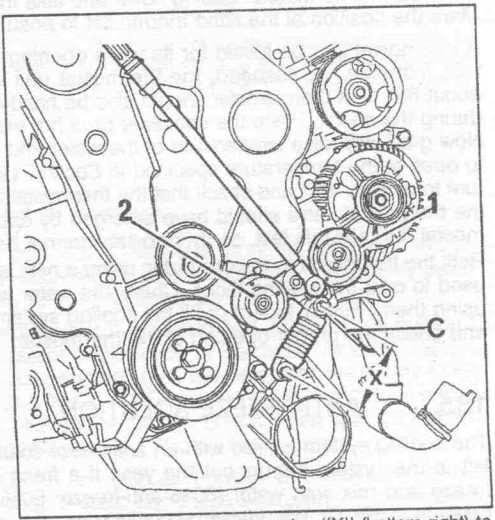


Fig. 1.75. — Measure the dimension "X" (bottom right) to check if a drive belt can be re-used. Follow the description in the text.

- Fit the belt in the manner described above. If the locking pin cannot be removed, use the 3/8 in. square drive and the extension as shown in Fig. 1.75 until the pin (C) can be withdrawn. As above, turn the crankshaft by 5 turns.

- Refer to Fig. 1.75. In the lower part of the illustration you will see the "X" between the two arrow heads. This must be measured. From the result you will find out, if the belt can be left in position, i.e. re-used, or must be replaced. If "X" is less than 98 mm, the belt is correctly tensioned and the job is done; if the dimension exceeds 98 mm, remove the belt and replace it. The belt is then refitted as described above.
- In all cases, refit the removed parts in reverse order to the removal procedure. The tie rod in front of the pulley drive is tightened to 11.0 kgm (80 ft.lb.).

NOTE: The adjustment of the tension of the belts of an XUD11 engine applies to the alternator and compressor. The necessary instructions are given in the relevant section, as is the tension of the high-pressure pump belt.

1.8.4. THERMOSTAT

The thermostat of an XUD11 diesel engine can be seen in Figs. 1.68 and 1.69. The thermostat of the DK5 engine is inside the housing, immediately above the oil filter/oil cooler assembly. Although the attachment is different on all engines covered, the basic principle remains the same.

To remove a thermostat, drain the cooling system and disconnect the hose from the thermostat housing connection. There is no need to drain the system completely. It is enough if the water level is below the height of the thermostat.

Unscrew the thermostat housing cover and take the thermostat out of the opening. Mark the position of the fitted thermostat to ensure installation as originally fitted.

A thermostat can be tested for its valve opening and closing temperature. To do this, immerse, i.e. suspend, the thermostat unit with a piece of wire in water at about 80° C. A thermometer should also be handy to check the water temperature during the check. Place the container on a hot plate. The valve should be closed. Now gradually raise temperature of the water and check that the thermostat starts to open at the temperature specified in Section 1.8.0. Increase the water temperature to around 100° and check that the thermostat is fully open. At this temperature the thermostat valve should have emerged by approx. 8.0 mm. Replace the thermostat if it fails this test, as thermostats cannot be repaired.

Refit the thermostat in reverse order, using a new seal. Sealing compound must be used to coat the sealing faces. Check the water hose and hose clamp before re-using them. Finally top-up or fill the cooling system. Drive the vehicle a few miles and check the proper opening of the thermostat.

1.8.5. ANTI-FREEZE SOLUTION

The cooling system is filled with an anti-freeze solution and this mixture should be left in the system throughout the year. If a fresh mixture is prepared, use anti-freeze and mix with water (50% anti-freeze; 50% water will protect the system down to —30° C). We advise you only to use the anti-freeze marketed by Citroën Dealers, as this solution has been specially formulated for use with your engine. If the system is topped-up with plain water, remember that the anti-freeze solution will be diluted. It is always best to mix anti-freeze with water, even when topping-up.

1.8.6. COOLING SYSTEM TEMPERATURE SWITCHES

Fan Temperature Switch: The switch is fitted to the rear of the lower radiator part or in the case of the turbo diesel XUD11 engine at the position shown in Fig. 1.69. The switch has the function to switch the cooling fan on and off in accordance with the coolant temperature, depending on the engine in one or two stages.

To replace the switch, drain the cooling system, withdraw the cable connector plug and unscrew the switch. The installation is a reversal of the removal procedure. Make sure the sealing washer is in good condition. Refill the cooling system and check the proper operation of the fan.

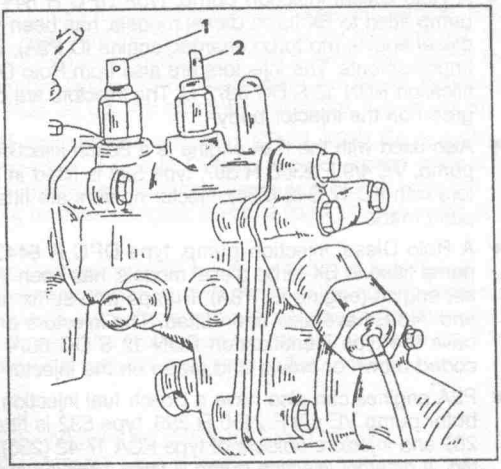


Fig. 1.76. — The position of the two temperature switches in the water housing. Both switches and the plug are tightened to 1.5 kgm. The termostatic capsule on the right is tightened to 2.5 kgm (18 ft.lb.).

Coolant Temperature Switches: These switches are fitted into the water housing as shown in Fig. 1.76, together with the thermostatic sensor (capsule) for the fast idle speed of the injection pump. Removal and installation is straight forward. Check the sealing washers before fitting the switch(es). Follow the tightening torque given in Fig. 1.76.

1.9. Diesel Fuel Injection System

Absolute cleanliness is essential during any repairs or work on the diesel fuel injection system, irrespective of the nature of the work in question. Thoroughly clean union nuts before unscrewing any of the injection pipes.

The fuel injection pump cannot repaired or overhauled and an exchange pump or a new pump must be fitted in case of malfunction or damage. Various injection pumps have been fitted to the XUD11 engines over the years and we will try to list them below for reference. The latest XUD 11 BTE engine is fitted with a so-called "EPIC" system from Lucas. The DK5 engine uses a Bosch pump with full electronic management system, other engines use a "Roto-Diesel" pump.

The adjustment of the injection timing and also the removal and installation of the injection pump requires certain special tools and these operations should not be undertaken if these are not available. The following text describes these operations, in case that the listed special tools can be obtained or hired.

Diesel engines either operate with direct injection or indirect injection. The Citroën diesel engine operates with indirect injection, i.e. the fuel is injected into a pre-chamber in the cylinder head which is in connection with the combustion chamber. The combustion is initiated in the pre-chamber and the resulting pressure increase

directs the burning fuel particles into the main combustion chamber, where it is fully burnt.

The following injection pumps will be found in the XM diesel models covered in this publication. Some further useful data are given at the end of the general description.:

- A Roto Diesel injection pump, type DPC R 844 3B 740 A, derived from the pump fitted to BX turbo diesel models, has been fitted to the XM with standard diesel engine (no turbo charger, engine ID P9A), with certain modifications and improvements. The injectors are also from Roto Diesel and have the type identification RDN 12 S DC 6872 C. The injectors are colour-coded blue or blue and green on the injector body.
- Also used with the P9A engine is a Bosch injection system. A Bosch distributor pump, VE 4/9 F 2300 R 397, type 533 is fitted in this case. DNOSD 289 injectors with KC 17 S42 (234) injector holders are fitted, colour-coded with a violet paint mark.
- A Roto Diesel injection pump, type DPC R 8443 B 740 A, derived from the pump fitted to BX turbo diesel models, has been fitted to the XM with turbo diesel engine (engine ID P8A). Pumps with suffix numbers 742 A, 744 B, 745 B and 748 E have also been fitted. The injectors are also from Roto Diesel and have the type identification RDN 12 S DC 6874 C. The injectors are colour-coded brown or brown and green on the injector holder.
- P8A engines can also have a Bosch fuel injection system. In this case a distributor pump VE 4/9 F 2150 R 396, type 532 is fitted. Injectors of type DNOSD 289 and injectore holders of type KCA 17 42 (235), colour-coded brown, are fitted. A different injection pump is fitted when an automatic transmission is installed. The pump number is VE 4/9 F 2150 R 396-1 in this case.
- PHZ engines have a Bosch fuel injection system with a different injection pump. Fitted is a VE 4/9 F 2150 R 281, type 531 pump. Injectors are of type DNOSD 299, injector holders KCA 17 S 42 (218), colour-coded blue. Again a different pump is allocated when an automatic transmission is fitted, the end number changing to 281/1.
- New injection pumps were fitted at the end of 1991 with the introduction of the P8A/XUD11 ATE engine (non-turbo) and the P9A/XUD 11A engine (turbo diesel). The Roto Diesel/Lucas injection pump has now the type identification DPC R 8443 B 748 E (non-turbo) or DPC R 8443 B 735 D. The injectors remained unchanged, including their colour coding (see above).
- In order to meet the new EU emission standards, XM's were fitted with the new P8A/XUD11 ATE/L diesel engine at some time during 1993. These engines are fitted with a Bosch injection pump, type VE4/9 F 2150 R 474, type 531 if a manual transmission is fitted or VE4/9 F 2150 R 474-1, type 531, if an automatic transmission is fitted. The injectors are also made by Bosch, type DNOSD 299 is fitted, with KCA 17 S 42 (218) injector holders.
- The P8C/XUD11 BTE engine (turbo) introduced in 1995 is fitted with a Lucas EPIC diesel injection system (EPIC = Electronically Programmed Injection Control). The pump has the marking XUDLP01 and R8640A042A. The new pump incorporates a fuel delivery control valves (in place of load lever, linkage, springs), a solenoid for the injection advance, a fuel cut-off solenoid and various sensors for pump temperature, rotor position, cam position, etc. The injectors are the same for all cylinders (RDNOSDC6751H), but not the injector holders. The reason for this is the inclusion of needle lift sensor for No. 4 cylinder. Injec-

tor holders for Nos 1 to 3 cylinders are identical (LCR6734302H, orange mark), the injector holder for No. 4 cylinder has the identification LDC002R01AD3 (blue mark). A turbo charger from Garret (type TB 0251) is used with this engine (earlier XUD11 turbo diesel engines use a Mitsubishi turbo charger).

- The injection system of the DK5 engine operates electronically, uses a Bosch VP36 pump and has an electronic control unit. As in the case of the latest XUD11 turbo diesel engine, different injector holders and on this engine, also different injectors are used. This time the cylinder No. 3 is the odd one out. Injectors for cylinders Nos. 1, 2 and 4 are of the type DNOSD312, the injector for cylinder No. 3 has the number DNOSD316. The injector holder for cylinders Nos. 1, 2 and 4 is of type KCE 30 S5, the one for cylinder No. 3 KCE 30 S7.
- **Fuel filters:** Most XUD11 engines use a Purflux CP 31 ADKLEA or a Roto Diesel FLS 648 filter, irrespective, if a Roto Diesel/Lucas or Bosch system is used. The XUD11 BTE (P8C) engine has a new diesel fuel filter (Lucas 911 or 910 from 1997, filters cannot be interchanged) which is fitted into the water outlet housing.

As you will see from the above description it will be very difficult to describe all systems in full detail. From the following pages you will, however, be able to carry out certain operations and adjustments if you have some experience with diesel fuel systems. Remember that in all cases the timing belt will have to be removed. The instructions for the XUD11 and DK5 engines are given in Section 1.4.4.

1.9.0. PRECAUTIONS WHEN WORKING ON DIESEL INJECTION SYSTEMS

Whenever repairs are carried out on a diesel fuel injection system, whatever the extent, observe the greatest cleanliness, apart from the following points:

- Only carry out work on diesel injection systems under the cleanest of conditions. Work in the open air should only be carried out when there is no wind, to prevent dust entering open connections.
- Before removal of any union nut clean all around it with a clean cloth.
- Removed parts must only be deposited on a clean bench or table and must be covered with a sheet of plastic or paper. Never use fluffy shop rags to clean parts.
- All open or partially dismantled parts of the injection system must be fully covered or kept in a cardboard box, if the repair is not carried out immediately.
- Check the parts for cleanliness before installation.
- Never use an air line to clean the exterior of the engine when connections of the injection system are open. With the availability of air compressors which can be plugged into a cigar lighter socket, you may be tempted to use air for cleaning.
- Take care not to allow diesel fuel in contact with rubber hoses or other rubber parts. Immediately clean such a hose if it should happen accidently.
- If you attempt adjustments, remember that Roto Diesel/Lucas and Bosch pumps are adjusted in a different manner. Make sure you read the relevant instructions. We suggest you read the section in question first, before you decide if you are able to carry it out, depending on the availability of equiment (revolution counter, as an example).

1.9.1. USEFUL TECHNICAL DATA — QUICK REFERENCE

The following gives a list of Lucas (ROTO DIESEL) or Bosch diesel injection equipment fitted to the various engines. Some of the data are for reference only, whereas others are either important or useful:

XUD11 P9A Engine

Lucas Diesel Injection Pump: ..... See Page 84
Static setting (cyl. No. 4): ... Value engraved in lever, top of pump, metal tag, marked PMH

Dynamic timing at Idle Speed:
- Engine running at 650 rpm: ..... 14° before top dead centre
- Engine running at 700 rpm: ..... 13° before top dead centre
- Engine running at 750 rpm: ..... 12.5 ° before top dead centre

Idle speed: ..... 675 ± 25 rmp
Fast idle speed: ..... 950 ± 50 rpm
Max. governed speed (no-load condition): ..... 5150 ± 125 rpm
Max. governed speed (load condition): ..... 4600 ± 80 rpm
Injector carriers (holder): ..... See previous description
Injectors: ..... See previous description
Pressure setting of injectors: ..... 130 ± 5 bar

XUD11 P9A Engine with Bosch Equipment

Bosch fuel fuel injection pump: ..... See Page 84
Static setting (cyl. No. 4):
- Engine at ..... Top dead centre, timing hole
- Pump at: ..... 0.76 mm

Dymanic timing (at 700 rpm): ..... 13° before top dead centre
Idle speed: ..... 675 ± 25 rmp
Fast idle speed: ..... 975 ± 50 rpm
Max. governed speed (no-load condition): ..... 5150 ± 125 rpm
Max. governed speed (load condition): ..... 4600 ± 80 rpm
Injector carriers (holders): ..... See Page 84
Injectors: ..... See Page 84
Pressure setting ..... 140 ± 5 bars

XUD11 P8A Engine with Lucas Equipment

Lucas Diesel Injection Pump: ..... See Page 84
Static setting (cyl. No. 4): ... Value engraved in lever, top of pump, metal tag, marked PMH

Dynamic timing at Idle Speed:
- Engine running at 650 rpm: ..... 14° before top dead centre
- Engine running at 700 rpm: ..... 13.5° before top dead centre
- Engine running at 750 rpm: ..... 12.8 ° before top dead centre

Idle speed: ..... 675 ± 25 rmp
Fast idle speed: ..... 950 ± 50 rpm
Max. governed speed (no-load condition): ..... 5150 ± 125 rpm
Max. governed speed (load condition): ..... 4300 ± 80 rpm
Injector carriers (holder): ..... See Page 84
Injectors: ..... See Page 84
Pressure setting of injectors: ..... 150 ± 5 bar

XUD11 P8A Engine with Bosch Equipment

Bosch fuel fuel injection pump: ..... See Page 84
Static setting (cyl. No. 4):
- Engine at ..... Top dead centre, timing hole
- Pump at: ..... 0.84 mm

Dymanic timing (at 700 rpm): ..... 13.5° before top dead centre
Idle speed: ..... 675 ± 25 rmp
Fast idle speed: ..... 900 ± 50 rpm
Max. governed speed (no-load condition): ..... 5150 ± 125 rpm
Max. governed speed (load condition): ..... 4300 ± 80 rpm
Injector carriers (holders): ..... See Page 84
Injectors: ..... See Page 84
Pressure setting ..... 150 ± 5 bars

XUD11 P8A Engine with Bosch Equipment and Automatic Transmission

Bosch fuel fuel injection pump: ..... See Page 84
Static setting (cyl. No. 4):
Engine at ..... Top dead centre, timing hole
Pump at: ..... 0.84 mm
Dymanic timing (at 700 rpm): ..... 13.5° before top dead centre
Idle speed: ..... 725 ± 25 rmp
Fast idle speed: ..... 900 ± 50 rpm
Max. governed speed (no-load condition): ..... 5150 ± 125 rpm
Max. governed speed (load condition): ..... 4300 ± 80 rpm
Injector carriers (holders): ..... Same as with M/T, see Page 84
Injectors: ..... Same as with M/T, see Page 84
Pressure setting ..... 150 ± 5 bars

XUD11 PHZ Engine with Bosch Equipment and Manual Transmission

Bosch fuel fuel injection pump: ..... See Page 84
Static setting (cyl. No. 4):
Engine at ..... Top dead centre, timing hole
Pump at: ..... 0.88 mm
Dymanic timing (at 700 rpm): ..... 15° before top dead centre
Idle speed: ..... 675 ± 25 rmp
Fast idle speed: ..... 900 ± 50 rpm
Max. governed speed (no-load condition): ..... 5150 ± 125 rpm
Max. governed speed (load condition): ..... 4300 ± 80 rpm
Injector carriers (holders): ..... See Page 84
Injectors: ..... See Page 84
Pressure setting ..... 175 ± 5 bars

XUD11 PHZ Engine with Bosch Equipment and Automatic Transmission

Bosch fuel fuel injection pump: ..... See Page 84
Static setting (cyl. No. 4):
Engine at ..... Top dead centre, timing hole
Pump at: ..... 0.88 mm
Dymanic timing (at 700 rpm): ..... 15° before top dead centre
Idle speed: ..... 725 ± 25 rmp
Fast idle speed: ..... 900 ± 50 rpm
Max. governed speed (no-load condition): ..... 5150 ± 125 rpm
Max. governed speed (load condition): ..... 4300 ± 80 rpm
Injector carriers (holders): ..... See Page 84
Injectors: ..... See Page 84
Pressure setting ..... 175 ± 5 bars

XUD11 ATE P8A and P9A 11 A Engines

Lucas Diesel Injection Pump: ..... See Page 84
Static setting (cyl. No. 4): ... Value engraved in lever, top of pump, metal tag, marked PMH

Dynamic timing at Idle Speed:
Engine running at 700 rpm: ..... 13° (Turbo), 13.5° (non-turbo) before top dead centre
Idle speed: ..... 675 ± 25 rpm

Fast idle speed:	950 ± 50 rpm
Max. governed speed (no-load condition):	5150 ± 125 rpm
Max. governed speed (load condition):	4600 ± 80 rpm
Injector carriers (holder):	As previous engines
Injectors:	As previous engines
Pressure setting of injectors:	130 ± 5 bar

XUD11 ATE/L P8A Engine with Bosch Equipment

Bosch fuel fuel injection pump:	See Page 84
Static setting (cyl. No. 4):	
Engine at	Top dead centre, timing hole
Pump at:	0.88 mm
Dymanic timing (at 700 rpm):	15° before top dead centre
Idle speed:	675 ± 25 rmp
Fast idle speed:	900 ± 50 rpm
Max. governed speed (no-load condition):	5150 ± 125 rpm
Max. governed speed (load condition):	4300 ± 80 rpm
Injector carriers (holders):	See Page 84
Injectors:	See Page 84
Pressure setting	175 ± 5 bars

DK5 2.5 litre Engine

Bosch Diesel Injection Pump:	See Page 84, VE R520 535
Static setting at TDC:	Not adjustable
Dynamic timing at Idle Speed:	4° (not adjustable)
Idle speed:	820 rpm (not adjustable by normal means)
Max. governed speed (no-load condition):	5150 rpm (not adjustabLE)
Max. governed speed (load condition):	4430 rpm (not adjustable)
Injector carriers (holder):	See Pages 84 and 85
Injectors:	See Pages 84 and 85
Pressure setting of injectors:	170 - 175 bars

1.9.2 LATER XM XUD11 DIESEL ENGINES

If you know earlier Citroën diesel injection systems, you will find some differences in the new XUD 11 BTE diesel engine, introduced during 1995. Lets have a look at some of these:

Fuel Filter and Fuel Heater Housing: The filtration and fuel heating functions are integral with the engine. The fuel is heated by the engine cooling system, at the water outlet housing. A thermostatic element, shown in the sectional view of Fig. 1.77, controls the quantity of fuel to be heated. The heating takes place in accordance with the outside temperatures. If the temperature is below 15° C, the temperature element lifts off its seat "a". The fuel can enter via "c", flows via "d", is heated by the water housing and then passes to the filter via "e" and "b". As the temperature rises to between 15 and 35° C, the thermostatic valve is only partly open. Only part of the fuel flows as described above, the remaining fuel passes directly from "c" to "b".

The delivery circuit incorporates an automatic priming and bleeding system. A bleed valve is fitted for this purpose.

Exhaust Recirculating (EGR) System: This system is fitted to engines with catalytic converter. The system reduces the emissions of oxides of nitrogen (NOx) by returning part of the exhaust gases to the air intake system. The exhaust gases are returned under certain conditions, i.e. depending on the engine coolant tempera-

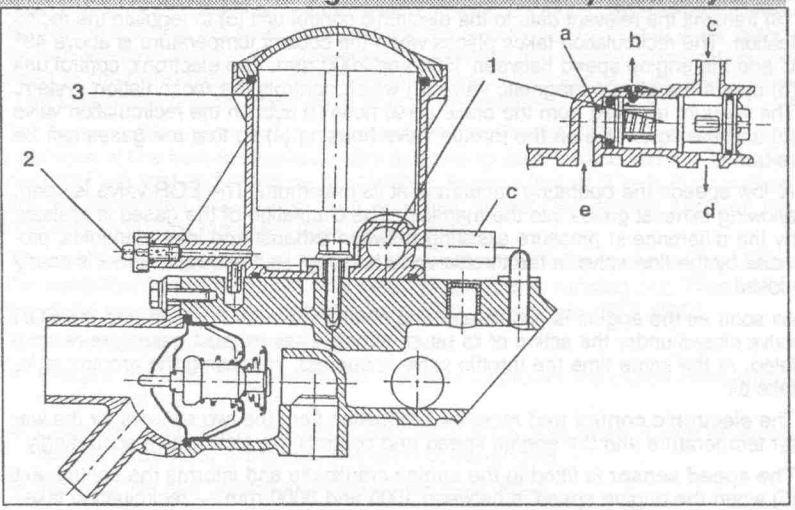


Fig. 1.77. — Sectional view of the fuel filter and fuel heating system.
1 Thermostatic element 2 Bleed screw 3 Fuel filter element

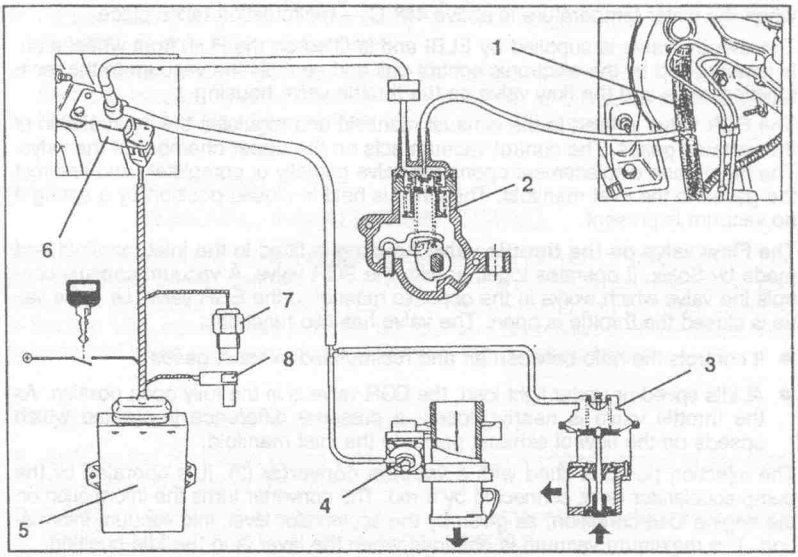


Fig. 1.78. — Layout of the exhaust recirculation (EGR) system. The numbers are referred to in the text.

tures and the engine speed and of the the position of the accelerator pedal. Two sensors, shown in Fig. 1.79, for the coolant temperature (7) and the engine speed

(8) transmit the relevant data to the electronic control unit (5) to regulate the recirculation. The recirculation takes places when the coolant temperature is above 48° C and the engine speed between 1500 and 2000 rpm. The electronic control unit (5) opens the electro-magnetic valve (6) which controls the recirculation system. The vacuum received from the brake servo hose (1) acts on the recirculation valve (3) and the flow valve on the throttle valve housing (4) so that the gases can be re-burnt.

At low speeds the operating vacuum is at its maximum. The EGR valve is open, allowing exhaust gases into the manifold. The circulation of the gases is assisted by the difference in pressure exsisting between exhaust and inlet manifolds, provided by the flow valve in the throttle valve housing, i.e. the throttle valve is nearly closed.

As soon as the engine is accelerated the control vacuum drops off and the EGR valve closes under the action of its return spring. Less exhaust gases are recirculated. At the same time the throttle valve is opened, increasing the amount of intake air.

The **electronic control unit** receives information from the two sensors for the water temperature and the engine speed and controls the elctro-valve accordingly.

The speed sensor is fitted to the engine crankcase and informs the control unit (5) when the engine speed is between 1500 and 3000 rpm — recircluation takes place.

The **water temperature switch** is supplied by Jaeger snd is fitted in the engine water outlet housing (see cooling system diagrams). It informs the control unit when the water temperature is above 48° C — recirculation takes place.

The **electro-valve** is supplied by ELBI and is fitted on the R.H. front wheel arch. Is is energised by the electronic control unit and controls the vacuum to the recirculating valve and the flow valve on the throttle valve housing.

The **EGR valve** is fitted to the exhaust manifold and regulates the recirculation of the exhaust gases. The control vacuum acts on the upper chamber of the valve. The membrane displacement opens the valve partially or completely and re-direct the gases to the inlet manifold. The valve is held in closed position by a spring if no vacuum is present.

The **Flow valve on the throttle valve housing** is fitted to the inlet manifold and made by Solex. It operates together with the EGR valve. A vacuum capsule controls the valve which works in the opposite manner to the EGR valve, i.e. if the valve is closed the throttle is open. The valve has two functions:

- It controls the ratio between air and recirculated exhaust gases
- At idle speed or under light load, the EGR valve is in the fully open position. As the throttle valve is nearly closed, a pressure difference is created which speeds up the flow of exhaust gases to the inlet manifold.

The injection pump is fitted with a **vacuum converter** (2). It is operated by the pump accelerator lever, connected by a rod. The converter turns the information on the engine load condition, as given by the accelerator lever, into vacuum information. The maximum vacuum is obtained when the lever is in the idle position.

1.9.3. FUEL FILTER

The fuel filter should be replaced approx. every 18,000 miles, but must be drained

once every 6000 miles to empty the water collected through condensation. This is approximate. When the water level reaches the electrodes of a built-in water detector, the warning lamp in the dashboard is earthed and lights-up, indicating the need to drain the filter. The external filter of the XUD engines is located on the R.H. side of the engine, standing in front of the vehicle.

Two types of filters are used. In the case of the ROTO DIESEL filter, the electrical operation of the bulb is checked every time the ignition is switched on. The warning light will light-up for approx. 1.5 seconds, to show that all is well. Purflux filters are not fitted with this feature. The fuel filter of the DK5 engine contains the checking circuit for the water detector and bulb.

To drain the water, open the screw at the side or the bottom of the filter. Allow the water/fuel to drain off until only clean diesel fuel is running out. Then close the drain screw. *No water detector from 1997 model year (BTE P8C).*

To replace the filter insert, proceed as follows:

- Place a thick rag underneath the fuel filter to protect the clutch mechanism from diesel fuel.
- Open the drain screw and allow the fuel to drain completely. Catch as much fuel as possible to avoid contamination of the engine.
- Remove the four screws and take off the filter cover.
- Remove the filter element out of the canister. The sealing ring is either located in the cover or the canister. Remove the seal.
- Clean out the filter canister and fit a new element.
- Fit the sealing ring and refit the cover. The four screws must be coated with "Loctite". Evenly tighten the screws.
- Close the drain screw and start the engine. Operate the priming pump to fill the filter and injection system. Bleeding is not required, as this takes place automatically. *New fuel filter from 1997 for XUD11 BTE (P8C) engine.*

1.9.4. INJECTION PUMP REMOVAL, INSTALLATION, TIMING

The timing adjustment of the injection pump requires the use of special tools. The injection pump should, therefore, only be removed if these can be obtained to carry out the job. Either a Roto-Diesel (Lucas) or Bosch pump can be fitted, as listed in Section 1.9.1, but note that modified pumps have been fitted over the years. This is important when replacing a pump. Remove the pump as follows:

1.9.4.0. Roto-Diesel (Lucas) Pump (XUD11)

- Jack up the R.H. side of the vehicle and place a chassis stand underneath the side of the body. Disconnect the battery.
- If ABS or hydractive suspension is fitted, disconnect the electronic control unit(s) (ECU) and remove the ECU compartment.
- Remove the road wheel and the protector from inside the wheel arch.
- Remove the large air intake hose leading from the front of the engine to the air chamber (open the hose clamps) and then remove the air chamber. On the turbo version disconnect the connecting hose from the overfueling

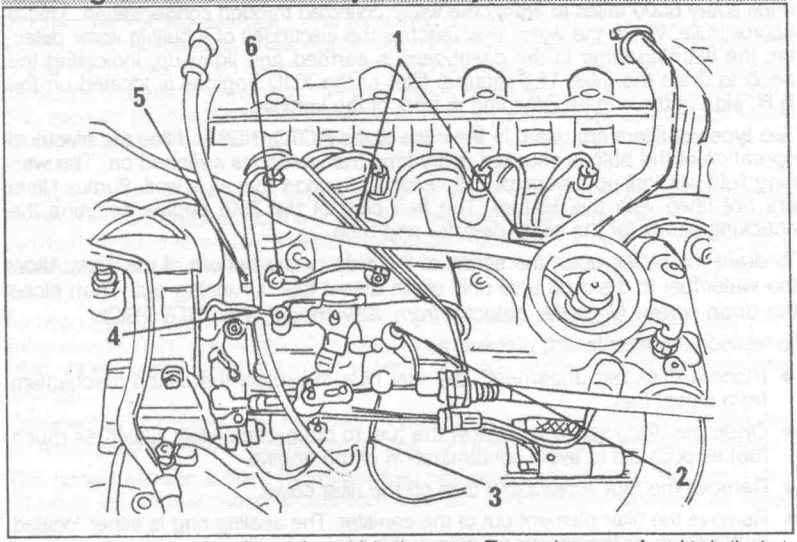


Fig. 1.79. — Removal of Roto Diesel (Lucas) injection pump. The numbers are referred to in the text.

circuit. On the R.H. side remove the guide roller underneath the engine mounting and the cover immediately below.

- Refer to Fig. 1.79, locate the accelerator cable and disconnect it. Also disconnect the fast idle cable.
- Disconnect the fuel feed pipe (3) and the fuel return pipe (5) in Fig. 1.79 and the overflow return pipe (4) from the injectors.
- Disconnect the supply to the electric shut-off solenoid (2), the injector feed pipes (1) and the glow plug connector (6) from the No. 4 cylinder.
- Block the engine with the timing rod, inserted into the flywheel (Fig. 1.55). In this crankshaft position insert two timing bolts (8 mm x 40 mm) into the injection pump drive gear at the positions

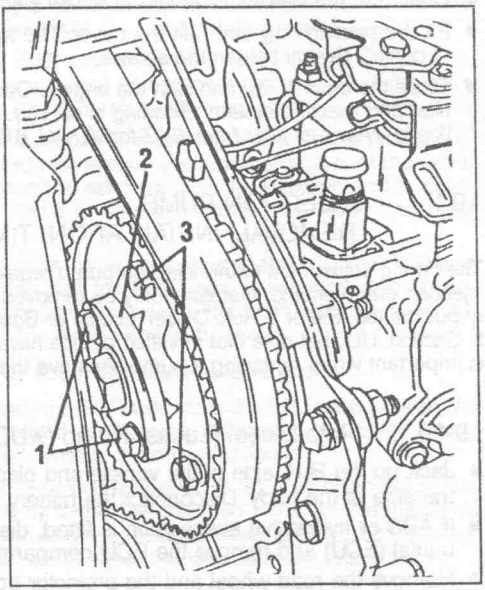


Fig. 1.80. — View of the injection pump drive gear, showing the flange securing bolts (1), the drive gear extracting flange (2) and the two arrester bolts (3) for the drive gear (M8 x 1.25 thread.

(2) and (3) in Fig. 1.80. Screw the bolts fully home without tightening them.

- Slacken the nut securing the pump drive gear until the gearwheel starts moving, i.e. the gearwheel will come away from the shaft. A restraining tool must be used to hold the drive gear against rotation. Use a ring spanner to slacken the bolt.
- Still using the restaining tool, slacken the two flange securing bolts in front of the drive gear.
- Remove the three pump attachment bolts and the rear attachment bolts and tilt the pump towards the outside. Fully remove the two flange securing bolts, take off the flange remove the pump by completely unscrewing the pump wheel securing nut.

The installation of the pump is carried out as follows:

- Fit the key into the pump shaft, place the pump in position and engage the drive gear with the key in the shaft. Make absolutely sure that the key is engaged with the groove. Use a small mirror to ascertain. Push the pump fully home and tighten the shaft nut to 5.0 kgm (36 ft.lb.). Due to the space restriction if may be difficult to apply a socket and a torque wrench. A good guess is therefore vital.
- Fit the pump securing nuts to the flange side of the pump and fit the rear mounting, without tightening them at this stage. Remove the two timing bolts from the drive gear and the locting rod out of the flywheel.

The injection pump must now be adjusted as follows, but it must be noted that apart from special tools some knowledge is required to set the pump to the correct timing position. Provided that these conditions are met, proceed as follows:

A short description will enable you to understand the mechanics of the adjustment. On each rotor of the pump there is a round peg "c" in Fig. 1.81, the position of which has been accurately determined by the manufacturer. The injection pump timing position is determined by the measurement "X" in Fig. 1.71, when the piston of No. 4 cylinder is at top dead centre position. This dimension is engraved into the lever at the top of the pump. These are the engines with electro-magnetic timing system, which enables the timing to be advanced by approx. 3° during the warm-up period of the engine. The dimension is different for each pump, i.e. the value behind the comma can vary. Provided that the necessary tools and experience are available, proceed as follows, noting that the description also covers the checking of the timing when the pump is fitted. Ignore operations already carried out, when the pump is being installed. **Note that older pumps and the new pumps, and/ or the injectors, cannot be interchanged, unless specified on Page 84.**

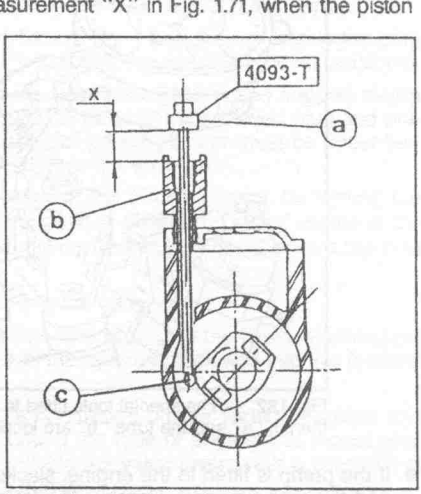


Fig. 1.81. — Sectional view of the injection pump (refer to text).

- If the engine has been rotated in the meantime, reset it to the top dead centre position in the No. 4 cylinder by inserting the locking pin for the flywheel and the two timing bolts into pump drive gear bores.
- Remove the glow plug No. 4 from the cylinder head.
- Remove the plug from the injection pump (to the left of the large angled hose) and insert the timing pin of tool 4093-T, shown in Fig. 1.71. The pin must be against the tube "b". If this is not the case, rotate the crankshaft in a clockwise direction (seen from the drive end). These operations have already been carried out, if the injection pump is being refitted. If the injection timing is being checked, fit the tools shown in Fig. 1.82 and set the dial gauge to "Zero", noting the position of the small needle.
- Slowly rotate the engine until the needle of the dial indicator starts moving. The locking pin for the flywheel should now enter the flywheel, when inserted as shown shown already earlier in Fig. 1.55. This pin has two ends and depending on the equipment must be inserted to be more or less in a horizontal position or the cranked end is inserted and the pin is in a vertical position, towards the top. The locking pin is inserted under the connecting hoses between the starter motor and the solenoid.
- Read off the dial gauge. This should show the value engraved on the plastic disc in the lever at the top of the pump (for example 5,70). If the reading is within 0.04 mm plus or minus, there is no need for adjustments; if the reading is outside the limits, adjust the timing of the pump.

Depending if the pump is being refitted or if the pump is fitted, proceed as follows with the adjustment:

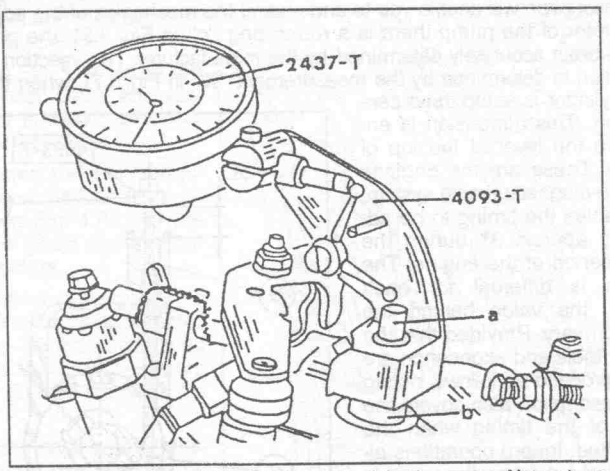


Fig. 1.82. — The special tools fitted to the injection pump. Note where the pin "a" and the tube "b" are located.

- If the pump is fitted to the engine, slacken the three front pump securing nuts and the rear suppoort. Remove the injector pipe union nuts (protect the alternator against diesel fuel spillage). If the pump is being refitted, slacken the nuts

enough for the pump to be rotated.

- In all cases turn the pump away from the engine to the limit of the slot in the mounting flange.
- Slowly turn the pump back towards the engine until the dial gauge need shows the timing value (value "X") for the pump in question, with a tolerance of 0.02 mm plus or minus.
- Without moving the pump, tighten the three nuts at the front to to 1.8 kgm (13 ft.lb.) and the rear support to 2.2 kgm (15 ft.lb.).
- Remove the locking pin from the rear of the crankcase and rotate the crankshaft by two turns.
- Re-check the timing in the manner described above. Remove the timing tools and refit the blanking plug.
- Tighten the injection pipe connections to 2.5 kgm (18 ft.lb.).
- Refit the glow plug into the No. 4 cylinder and tighten to 2.2 kgm (16 ft.lb.). and lower the vehicle to the ground.
- Depress the accelerator pedal and start the engine. Check the running of the engine and carry out the adjustments described in Section 1.9.7 as necessary.

1.9.4.1. Bosch Injection Pump (XUD11 Engines)

The removal of the injection pump is carried out in a similar manner as described for the Roto-Diesel pump. The timing adjustment, however, is completely different and must be carried out as follows. It is assumed that the R.H. front wheel is jacked up and the 5th speed engaged. The engine must be in the timing position:

- Remove the TDC plug from position the cylinder head.
- If an EGR system is fitted, disconnect two vacuum pipes from the top of the injection pump (the white coloured part on the R.H. side of the pump).
- Remove the injection pipes from cylinders No. 1 and 2 and remove the plug from the rear of the injection pump (in between the injection pipe connections).
- Fit the dial gauge 3089-T with the extension bar 2438-T. and support clamp 7010-T. to the rear of the injection pump in place of the removed plug and pre-load the dial gauge by 1.0 mm, i.e. the dial gauge plunger must be under tension. Fig. 1.83 shows how the special tools are arranged.
- Establish the top dead centre position of the No. 4 cylinder by turning the crankshaft to and fro until the maximum lift is obtained, i.e. the needle of the gauge shown in Fig. 1.83 no longer moves. The stylus should have a pre-load of approx. 1 mm.
- Set the dial gauge to "Zero" by turning the outer ring.
- Turn the engine in the normal direction of rotation until the flywheel timing pin can be inserted as through the hole in the cylinder block and into the flywheel as shown in Fig. 1.55.
- Check the dial gauge reading. This is different on the various engines and must be taken from Section 1.9.1, noting the type of engine and model year, where applicable. If the reading is outside the value given, with a tolerance of plus or minus 0.03 mm, re-time the pump.
- Remove the pump attachments at the front (arrows, Fig. 1.83) and at the rear

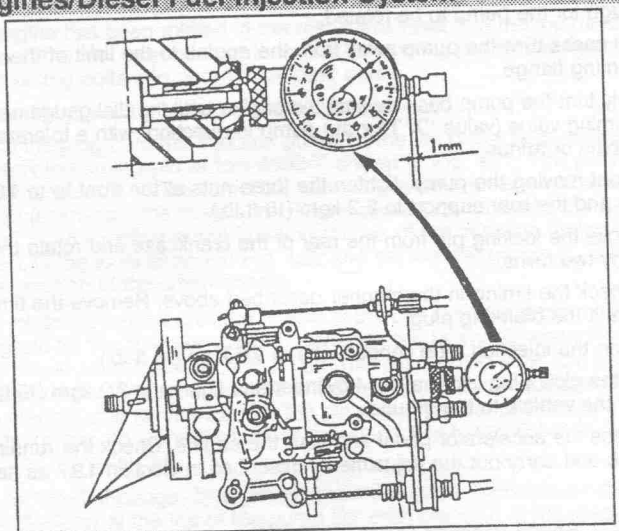


Fig. 1.83. — Tools fitted to the rear of the Bosch injection pump to adjust the injection timing. The arrows point to the securing screws.

and rotate the pump towards the outside, away from the engine.

- Turn the pump body slowly towards the engine until the dial gauge indicates the value given in Section 1.9.1. Tighten the pump attachments in this position. The front mounting nuts are tightened to 1.8 kgm (13 ft.lb.), the rear mounting to 2.2 kgm (15 ft.lb.). Observe the dial gauge needle during the tightening of the pump. The needle must not move.
- Re-check the pump timing as previously described and remove the tools. Refit the inspection plugs into the cylinder head and the rear of the pump. Tighten the injector pipe union nuts to 2.5 kgm (18 ft.lb.). Finally refit the glow plug (tighten to 2.2 kgm/15.0 ft.lb.) and the timing belt cover. Note the tightening torques for the TDC plug (3.0 kgm/22 ft.lb) and the pump timing hole plug (1.5 kgm/11 ft.lb.). All other operations are carried out in reverse order.
- Start the engine. Check the running of the engine and carry out the adjustments described for the Bosch system (Section 1.9.7.) as necessary.

1.9.4.2. Bosch Injection Pump (DK5 Engine)

The locking rod for the flywheel and the two timing pins (or bolts) must be available to remove the pump. The timing belt must be partially removed as described in the relevant section for the DK5 engine. You will find that the removal and installation is easier than described for the XUD11 diesel engines, as not setting is necessary.

- Place the front end of the vehicle on chassis stands, with the wheels hanging down under their own weight.
- Unclip the battery trim cover from the three attachment point. Two are located

at the front side end and one marked by an arrow towards the air cleaner. Use a screwdriver to remove the trim cover.

- Remove the timing belt in the manner described until it can be lifted off the camshaft sprocket.
- Take off the clamp band (1) in Fig. 1.84, disconnect the hoses from the coolant expansion tank (again a pair of pliers is required) and remove the expansion tank and place it to one side.

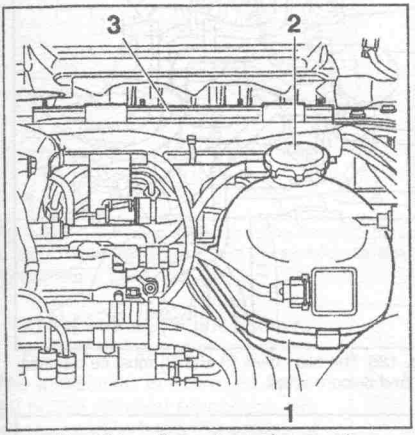


Fig. 1.84. — Expansion tank removal.

- Separate the wiring harness from the harness support (3) in Fig. 1.84 and remove the harness support.
- Unscrew the injector pipes at both ends and remove them from cylinder head and injection pump.
- Disconnect all electrical and mechanical components from the injection pump.
- Refer to Fig. 1.85 and remove the pump securing screws (1).
- Remove the pump attachment at the rear and remove the injection pump.

The installation of the injection pump is a reversal of the removal order, but note the following points:

- Fit the injection pump in position and tighten the pump securing screws (1) in Fig. 1.85 to 2.25 kgm (16.5 ft.lb.). The rach attachment of the pump is tightened to the same torque.
- Refit the injector pipes with the union nuts and tighten them to 2.5 kgm (18 ft.lb.).
- Re-connect the electrical and mechanical components to the injection pump.
- Refit the wiring harness support (3) in Fig. 1.84.
- Clip the electrical harnesses and flexible hoses in place to the harness support.
- Refit the expansion tank (2) in Fig. 1.84.

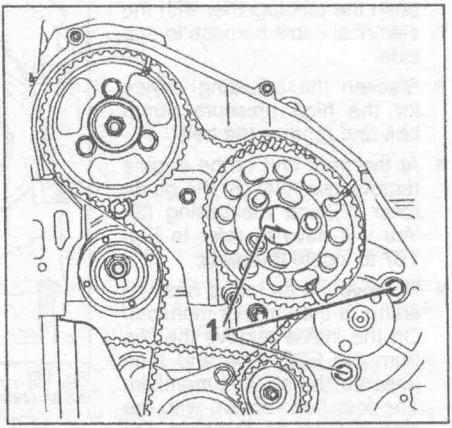


Fig. 1.85. — The 3 bolts secure the injection pump at the front. There is a further attachment at the rear of the pump.

- Refit the timing belt as described in the relevant section.
- Bleed the fuel system and re-connect the battery.

1.9.4.3. Lucas "EPIC" Injection Pump (XUD11 BTE Engine)

Again we stress, that a certain amount of experience is useful to remove the pump. The special tool mentioned during the replacement of the timing belt, i.e. the locking rod for the flywheel must be available. Additional you will need an extractor flange for the injection pump drive gear, a cranked ring spanner (13 mm A/F) and clamps to clamp off certain coolant hoses. A suitable two- or three-arm puller may be suitable, but there is the danger that the drive gear is damaged. The following text describes the procedure using the special tools:

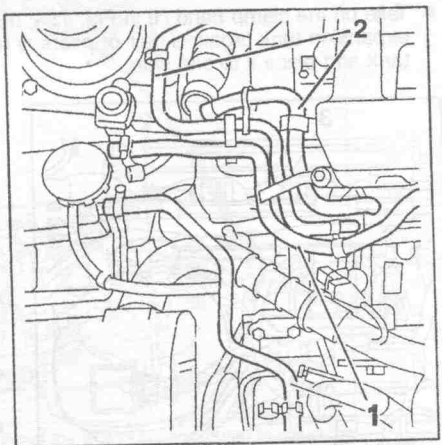


Fig. 1.86. The two hoses (1) and (2) must be clamped-off and disconnected.

- Jack up the R.H. side of the front end of the vehicle and support it on stands. Remove the wheel, the sound insulation from under the engine and the splash shield inside the wheel arch.
- Refer to Fig. 1.86 and clamp off the coolant hoses (1) and (2), open the hose clips and then disconnect the hoses.
- Remove the ECU housing and push the unit together with the electrical cable harness to one side.
- Slacken the adjusting device for the high pressure pump belt and remove the belt.
- At the front end of the engine remove two nuts (1), the guide roller (2) and the casing (3). You will have to refer to Fig. 1.87 to locate the parts.

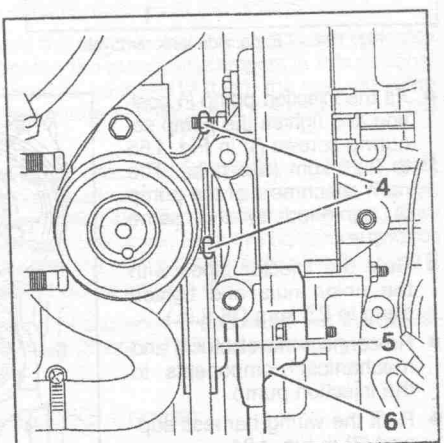


Fig. 1.87. — The parts referred to in the text are located as shown.
1 Nuts 2 Guide roller 3 Casing

- Remove the air intake hose leading to the air inlet manifold. On the inside remove the clip from the EGR pipe and then unscrew the air inlet manifold. The four bolts shown with the arrows must be removed. On the R.H. side disconnect the inlet pressure pipe (4). The connector for the needle lift sensor must also be connected.
- Refer to Fig. 1.89 and connect in the following order: The wiring harness (1), the flexible pipe (2), the diesel fuel inlet pipe (3), the fuel return pipe (4) and

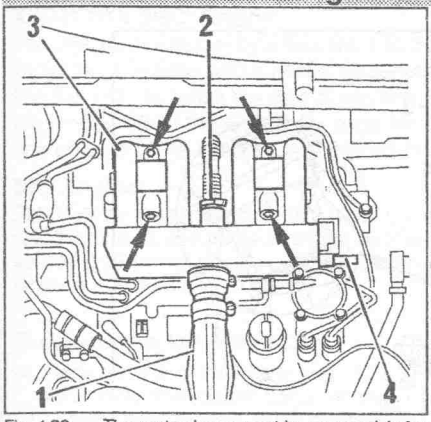


Fig. 1.88. — The parts shown must be removed (refer to text). The arrows show where the air inlet manifold is secured.

the return pipe (5). After all connections have been located in Fig. 1.89, lock the flywheel as described during the removal of the timing belt. The engine must be rotated by applying a ring spanner or socket to the crankshaft pulley bolt until the locking rod can be inserted into the flywheel. Fig. 1.55 shows where this takes place.

- Lock the injection pump drive gear in the manner shown in Fig. 1.80 by inserting two M8 x 1.25 bolts. Fit the drive pinion extraction flange with the two screws (1 in Fig. 1.80) and slacken the nut in the centre until the drive wheel is free of the shaft.
- The injection pump can now be removed from the engine. 3 nuts at the front and 1 bolt at the rear hold the pump in position.

The installation is a straight reversal of the removal procedure. We recommend to have the setting of the pump checked at the earliest opportunity.

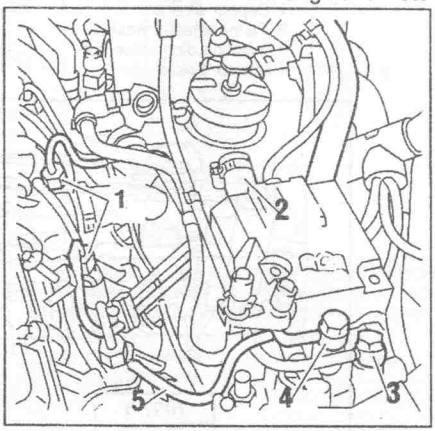


Fig. 1.89. — Remove the parts in the order shown.

1.9.5. INJECTOR HOLDERS AND INJECTORS

1.9.5.0. Removal and Installation

Before removing an injector holder or injector remember that parts of different manufacturers cannot be interchanged. Most engines with Bosch equipment use the same injector holders and injectors, but different parts are fitted to later models. If Lucas equipment is fitted, check the information on pages 84 and 85. Remove as follows. See Page 101 for certain engines:

- Disconnect the fuel injection pipe. A ring spanner with a cut-out should be used for this operation. Withdraw the spill oil hoses from the injector. Unscrew the injector holder. Either a 27 mm box spanner or special tool 7007-T is used for this operation (5710-T for DK5). Remove the flame-arrester washer and the copper washer from the injector holder. Both must be replaced during installation.

The installation is a reversal (see also next page). Fit the flame-arrester washer (2) in Fig. 1.90 with the curved face towards the top and fit the new copper washer (1). Tighten the injector holders to 9.0 kgm (65 ft.lb.) with the tool mentioned above, as applicable). Fig. 1.91 shows the the shape of the tool to be used. Tighten the

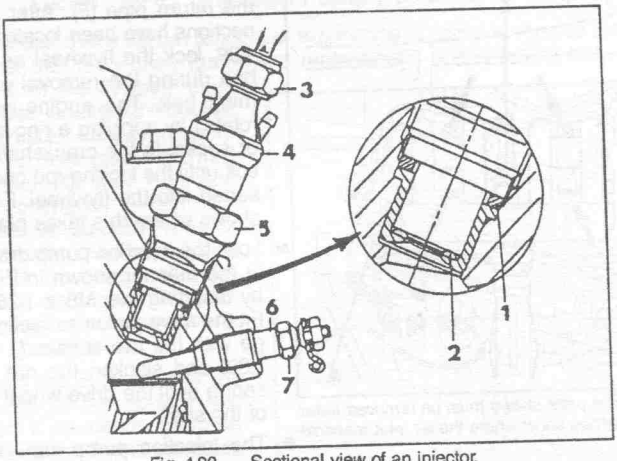


Fig. 1.90. — Sectional view of an injector.

1 Copper washer
2 Flame-arrester washer
3 Injection pipe union nut
4 Injector holder
5 27 mm hexagon
6 Glow plug
7 Glow plug hexagon

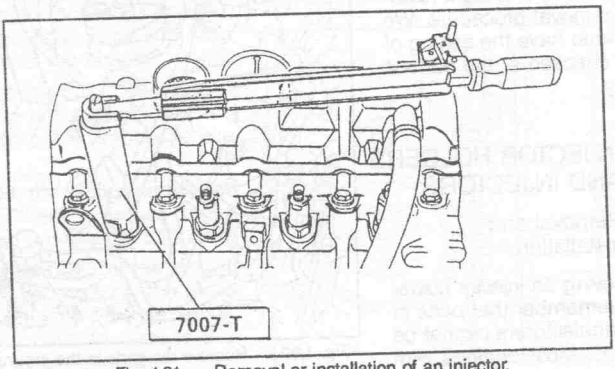


Fig. 1.91. — Removal or installation of an injector.

injector pipe union nut to 2.5 kgm (18 ft.lb.). As already explained, there is no need to bleed the fuel system.

NOTE: The injection pressure of the injectors should only be tested in a specialist shop. Never attempt to carry out this operation yourself. Different injectors have been fitted over the years. As already mentioned, do not mix old and new, as the injection pressure of the injectors are not the same on all engines.

To find a faulty injector, unscrew the union nuts one after the other at the injector connection and start the engine. Run the engine at increased speed. If the engine noise does not change after a certain injection pipe has been disconnected, the faulty injector has been found.

XUD11 BTE (P8C) Engine

The injector holders in cylinders No. 1 to 3 are identical. The injector holder in cylinder No. 4 is fitted with a needle lift sensor, to indicate the start of injection, enabling the ECU to sense the start of injection. The No. 4 injector holder is the one on the timing side of the engine. On page 84 you will find the numbers and identification colours of the injectors and injector holders.

DK5 Engine

The injector holders in cylinders Nos. 1, 2 and 4 are identical. The injector holder No. 3 has a lift sensor, recognised by the cable connected to the holder. The lift sensor determines the start of the injection. A sectional view of this injector can be seen in Fig. 1.92.

To gain access to the injectors:

- Remove the cover (8) in Fig. 1.71 and undo the clamp band for the coolant header tank. Push the tank to one side.
- Separate the wiring harnesses from the harness support and remove the support.
- Remove the header tank securing bracket.
- Disconnect the fuel feed and return pipes. Also disconnect the connector from No. 3 cylinder injector.
- Remove the injector holder with the special socket given on Page 99 and remove the sealing washer. The washer must always be replaced. Refit the injector in reverse order.

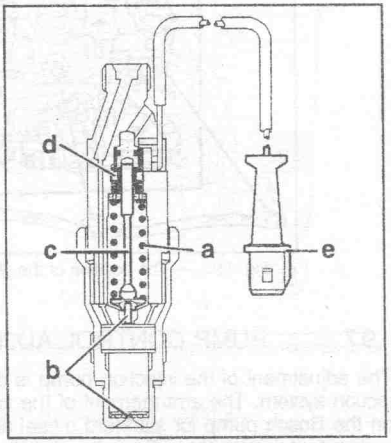


Fig. 1.92. — Sectional view of the No. 3 injector holder fitted to the DK5 engine. The No. 4 injector holder of the XUX11 BTE engine is similar.

a Spring
b Injector needle
c Magnetic core
d Ignition coil
e 2-way connector

1.9.6. GLOW PLUGS

The glow plugs receive electrical current when the ignition switch is turned to the glow position. Without going into detail, it can be said thet theplugs receive a voltage of at least 11.5 volts and are heated within seconds to a an approx. temperature of up to 1100° C. The glow time depends on the temperature of the engine and may be between 25 seconds during very cold temperatures and 2 seconds during the summer months. If the engine is not started immediately, the power supply is interrupted and will be operated once more when the key is turned into the glow position.

Because of the high temperatures it is quite possible that one of the glow plugs burns out. Glow plugs can also be damaged through faulty injectors, wrong injection times and low injection pressure. Plugs are made by Beru, Bosch or Valeo, depending on the equipment and the engine. It is, therefore, imperative to quote the engine and engine number when a plug is replaced. The DK5 engine uses Bosch or Beru glow plugs.

NOTE: There is a difference in the tightening torque of the glow plugs fitted to the DK5 engine. Bosch plugs are tightened to 2.5 kgm (18 ft.lb.), Beru plugs are tightened to 2.0 kgm (14.5 ft.lb.).

The plugs are located at the positions shown in Fig. 1.93 (general view). Remove the nuts from the ends of the plugs and unscrew the plug in question. A socket with extension and ratchet should be used to remove the plugs. Tighten the new plug to 2.2 kgm (15 ft.lb.), with the exception of the DK5 engine (see note above).

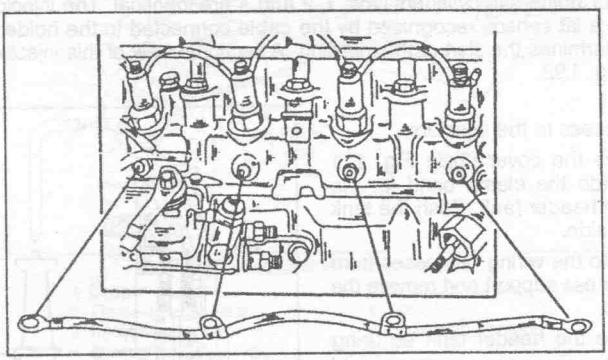


Fig. 1.92. — The position of the glow plugs and the connector lead.

1.9.7. PUMP CONTROL ADJUSTMENTS

The adjustment of the injection pump is different for the Roto-Diesel and Bosch injection system. The arrangement of the various adjusting elements is also different on the Bosch pump for standard diesel and turbo-charged diesel engines. The following text covers the different systems.

1.9.7.0. Bosch Injection Pump

Refer to Figs. 1.94 for the following operations, but note the differences between standard diesel and turbo diesel engines, when applicable:

- When the engine is cold, make sure that the lever (3) is against its stop by pushing it in the direction of the arrow on the screw (1) of the fast idle. If necessary adjust the cable (9) by means of the cable adjuster (2), moving up the outer sleeve (6) as necessary.
- Run the engine to operating temperature, check that the fast idle control cable (9) at the front of the pump is slack (this is the cable coming out of the thermostatic control capsule). Switch off the engine. Fully depress the accelerator pedal (ask a helper) and check that the lever (8) is resting against the stop screw (7). If this is not the case, adjust the accelerator cable at position (B).
- Slacken the screw (5) until the lever (8) no longer contacts the outside of the screw (4). Adjust the screw (4) after slackening the locknut until the idle speed given in Section 1.9.1 obtained (differences between standard and turbo diesel engines). Re-tighten the locknut. Adjust the idle speed approx. 50 rpm higher,

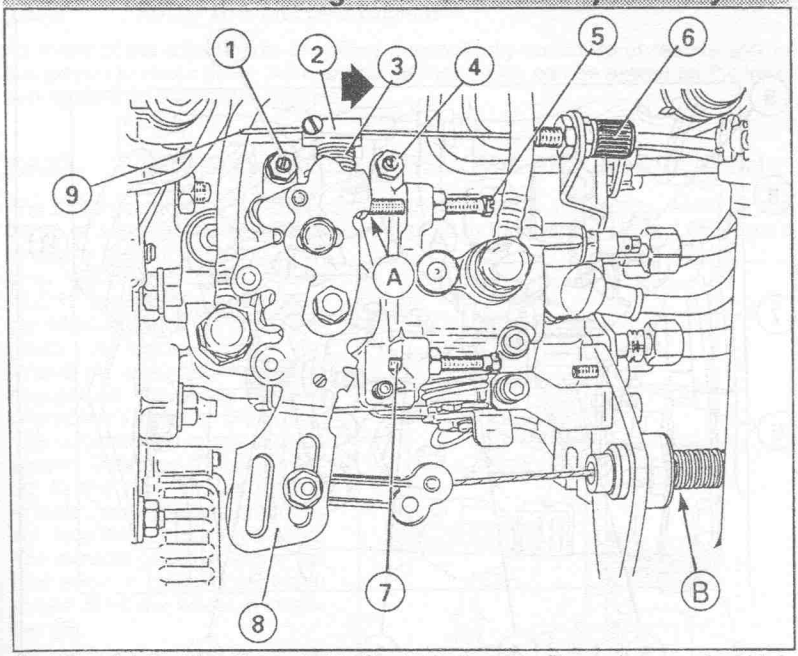


Fig. 1.93. — Details of the adjustment of the Bosch injection pump. The numbers are referred to in the text.

if an air conditioning system or automatic transmission is fitted.

- Obtain a shim of 1.0 mm (3 mm, non-turbo) and insert this shim (A) between lever (8) and stop screw (5). Adjust the stop screw (5) after slackening the locknut, until the speed obtained exceeds the idle speed by 20 - 50 rpm or the engine runs with 900 rpm ± 50 rpm. This is the anti- stalling adjustment.
- To adjust the fast idle speed, bring the lever (1) against the stop and, if necessary, adjust the stop until a fast idle speed of 950 ± 50 rpm is obtained (900 rpm, turbo diesel).

1.9.7.1. Roto-Diesel Pump

Refer to Fig. 1.94 for all operations:

- With the engine cold, check that the lever (7) is against its stop by pushing it in the direction of the arrow. If this is not the case, adjust the tension of the operating cable (5) by means of the adjusting screw (6). Complete the adjusting of the cable at the outer sleeve (2).
- Warm up the engine to operating temperature to check the fast idle speed. Check that the cable (5) is slack. If this is not the case, the thermostatic sensor in the water outlet could be at fault. There should be a difference of more than 6 mm (¼ in.) in the length of the cable when the engine is cold and when the

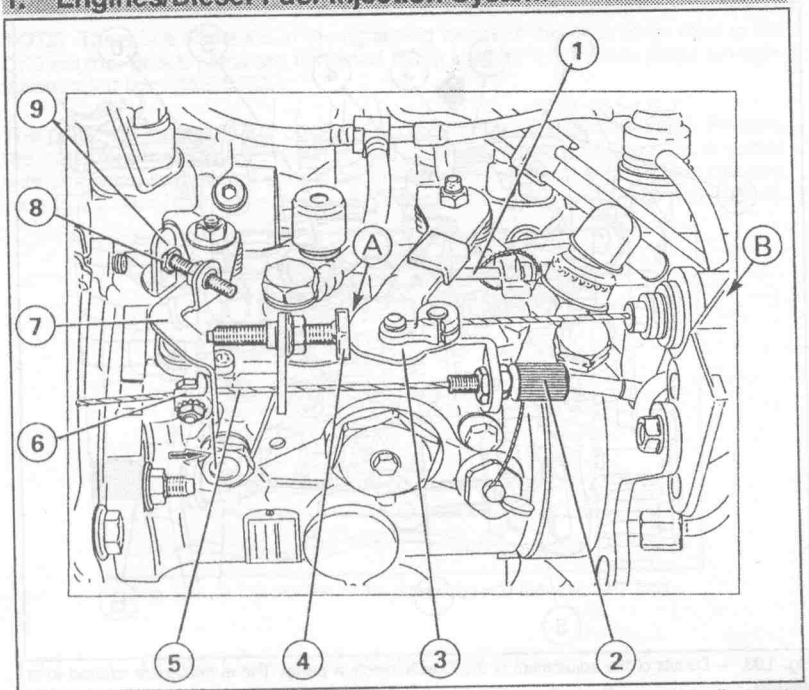


Fig. 1.94. — View of the Roto-Diesel injection pump with details of the pump control adjustments. The numbers are referred to in the text.

engine is warm. Measure the length accordingly before proceeding. This will take, of course, a while before the engine is cooled-down again.

- First adjust the accelerator control cable (above the fast idle control cable). To do this, check that the lever (3) is against its stop (1). If this is not the case, move the clip (B) at the end of the cable attachment to adjust the cable. Make sure the the idle lever (3) is against the stop (4).
- The next adjustment concerns the anti-stall device. The engine must be running for this check. Obtain a 4 mm thick shim and insert it between the lever (3) and the stop screw (4) at position (A). Set the engine speed in this condition to 1300 - 1700 rpm by using the stop screw (4) after slackening the locknut.
- Set the idle speed to the value given in Section 1.9.0. by turning the stop screw (8) after slackening the locknut. Set the speed 50 rpm higher if an air conditioning system or automatic transmission is fitted. Re-tighten the locknut.
- The deceleration of the engine, i.e. the return to the idle speed should now be checked. To do this, run the engine with 3000 rpm and then release the accelerator lever. If the deceleration is too fast (engine stalls at times), unscrew the stop screw (4) by ¼ of a turn; if the deceleration is too slow (engine does not return to idle in a reasonable time), turn the stop screw (4) by a further ¼ of a turn inwards. In both cases the locknut must of course be slackened. After adjustments have been carried out, re-check the idle speed.

1.9.7.2. XUD11 BTE and DK5 Engines

As many of the adjustments are either automatically controlled or require special equipment to check them, there are no settings which can be altered on the injection system on the above engines.

1.9.10 TURBO CHARGER — REMOVAL AND INSTALLATION

The turbo charger is a separate component mounted on the engine, which by meanms of a turbine increases the amount of air in the cylinders. Fig. 1.95 shows a sectional view of the turbo charging system as fitted to an XUD11 engine. The turbo charger fitted to the range of XM engines is either made by Mitsubishi or Garret. The turbo charger is made up of two chambers. Chamber (A) in Fig. 1.95 is connected to the exhaust system, chamber (B) is connected to the inlet air. Two turbine wheels, one in each chamber, are mounted on a single shaft. The exhaust gases drive the turbine wheel in chamber (A) which in turn drive the wheel in chamber (B).

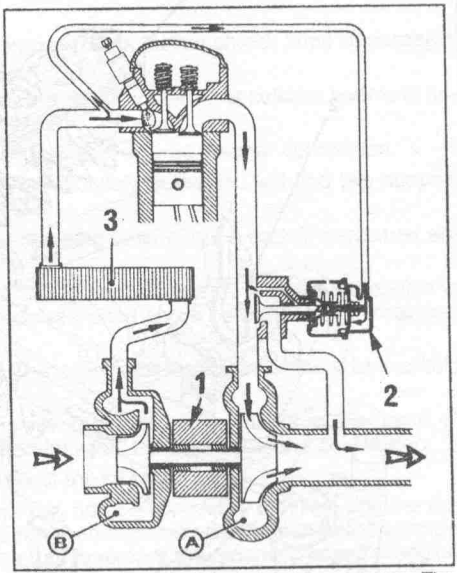


Fig. 1.95. — Layout of the turbu charger system. The two chambers (A) and (B) are referred to in the text.
1 Turbo charger 2 Waste gate valve 3 Intercooler

The waster gate valve (2) is a regulating valve which protects the system from excess pressure. When the preset maximum inlet pressure is reached, the valve will open, allowing the excess exhaust gases to by-pass the tubo charger.

After the air has passed through the turbo charger is will be very hot. An Air-to-Air heat exchanger (intercooler) (3) cools the air before it enters the engine. This increases the density of the inlet air and thereby increases the performance of the engine.

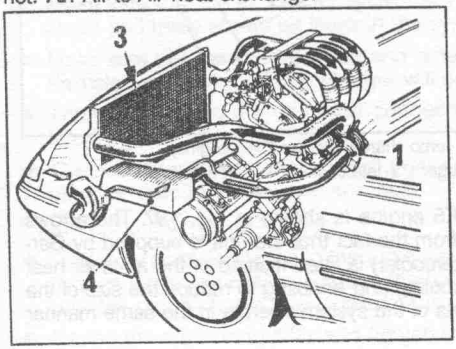


Fig. 1.96. — The location of some of the component parts of the turbo charger system. (4) indicates the air cleaner, the remaining numbers are as in Fig. 1.95

The turbo charger is lubricated under pressure from the engine lubrication system. A pipe connected to the oil sump and the

turbo charger serves to supply the oil. There is also an oil return line for unused oil.

You will, of course, know that a hot engine should idle for a few moments before it is switched off. Failure to observe this precaution could lead to turbo charger failure due to lack of lubrication.

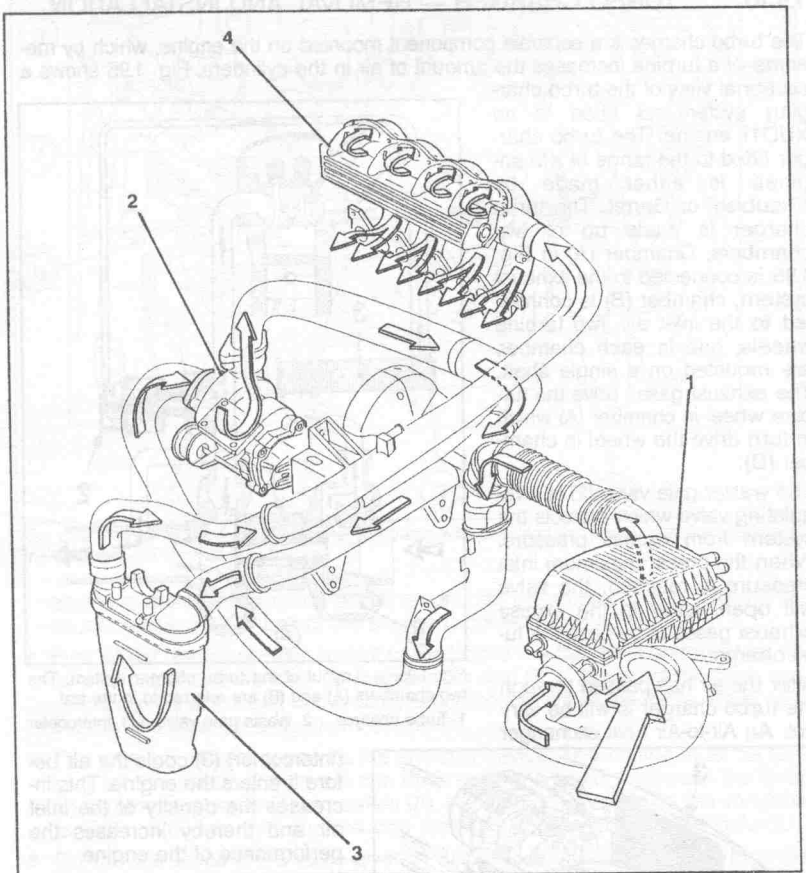


Fig. 1.97. — Layout of the turbo charger system (DK5 engine).
1 Air cleaner 2 Turbo charger 3 Intercooler 4 Inlet manifold

The turbo charger system of the DK5 engine is shown in Fig. 1.97. The arrows show the direction of air flow. Apart from the fact that the unit is supplied by Garret, a water-to-air heat exchanger (intercooler) is fitted instead of the air-to-air heat exchanger, providing better inlet air cooling and enabling to reduce the size of the unit. The remaining commponent parts of the system operate in the same manner as described for the other engines.

Due to the different layout of the system, there are also differences in the removal and installation of the turbo charger.

XUD11 Engines (except XUD11 BTE)

The vehicle must be resting on chassis stands to reach some of the attachments to be removed or disconnected from underneath. Disconnect the battery earth cable and then proceed as described below. You will need a special 16 mm socket with a universal joint to reach the securing bolts for the turbo charger from underneath, to facilitate the job. A piece of hardwood, 50 mm thick, must also be ready.

- In the engine compartment locate and disconnect the air feed pipe attachments.
- From underneath the vehicle remove the protection shield, fitted underneath the engine.
- Disconnect the two upper connecting rods from the gear selector lever and separate the shaft from the ball joint.
- Disconnect the exhaust pipe flange from the turbo charger connection.
- Look around the turbo charger. Immediately below you will find two support brackets. Unscrew and remove them.
- Slacken the three turbo charger securing bolts with the socket mentioned above, without removing them fully.
- Remove the torque rod bolt and tilt the engine forward. To retain the engine in position, insert the piece of wood mentioned above between the gearbox and the subframe.
- Disconnect the air supply lines. The upper pipe is secured to the inlet manifold tube.
- Follow the oil feed pipe and unscrew the union nut on the turbo charger. A 17 mm A/F spanner is required. Carefully pull the pipe out of the connection.
- Below the turbo charger disconnect the oil return pipe.
- The turbo charger securing bolts can now be completely removed and the unit lifted out. The turbo charger is removed together with the exhaust downpipe, you will have to rotate it by half a turn to remove the assembly from the engine.

The installation of the turbo charger is a reversal of the removal procedure, but the following points must be noted before the turbo charger is refitted:

- Make sure that the air cleaner system is in good order, i.e. the filter element is clean and there are no air leaks in the system.
- Make sure that the air inlet circuit and exhaust manifold is free of foreign matter. Particles entering the turbo charger will destroy it.
- Thoroughly clean the oil circuit connections. Use new sealing rings where fitted.
- The securing bolts for the turbo charger are heat resistant. Only use bolts supplied by Citroën if new bolts are used.

Fit the turbo charger as follows:

- Fit the exhaust down-pipe to the turbo charger (2.2 kgm/16 ft.lb.)) and place the turbo charger in position. Engage the turbo with the valve facing forward and turn the unit by half a turn to position it.
- Fit the three securing bolts and tighten them to 5.5 kgm (40 ft.lb.).

- Re-locate the oil feed pipe, screw in the two union nuts and tighten them to 2.0 kgm (14.5 ft.lb.). One union nuts is fitted to the turbo charger, the other one at the bottom end of the pipe.
- Re-connect the air hose to the two turbo charger elbows and attach them with the clamps. Fit the lower air pipe.
- Re-connect the exhaust to turbo charger joint. Evenly tighten the flange connection to 1.0 kgm (7.2 ft.lb.).
- Re-connect the gear change selector rods.
- Re-connect the oil return pipe with a new seal. 6 mm screws are tightened to 1.0 kgm, 8 mm bolts to 2.0 kgm.
- Disconnect the fuel pump solenoid wire and crank the engine until the oil pressure warning light goes off. This will charge the turbo charger with oil before it is driven by the engine. Start the engine and allow to idle for at least 30 seconds before the engine speed is increased. Check all air, gas and oil pipe connections for leaks.

XUD11 BTE Engine

The turbo charger securing bolts and the oil inlet pipe union nut are difficult to reach. To undo the turbo charger nuts a socket (16 mm A/F) and a universal joint is required. The union nut is best reached with a so-called "Crowfoot" wrench. The following operations assumes that these tools are available.

- Jack up the front end of the vehicle and disconnect the battery earth cable. Remove the R.H. front wheel, the mud shield inside the wheel arch and the sound insulator from underneath the engine.
- Refer to Fig. 1.88 and remove the air intake hose (1), the EGR pipe clip (2) and the inlet manifold (3). The location of the bolts are shown by the arrows.
- Disconnect the flexible pipe of inlet pressure (4).
- Disconnect the turbo charger suction sleeve and outlet hoses. Both hoses are, apart from the hose clamps, secured with a nut at one end.
- The union securing the oil inlet pipe must now be slackened. This is where the "Crowfoot" spanner comes into action. Place the spanner (2) in Fig. 1.98 around the union nut and insert an extension withs quare drive from above over the spanner.
- Disconnect the gearchange rods from the transmission and remove the shaft from the central pivot.
- Separate the exhaust pipe connection.
- Remove the catalytic converter and the shaft connecting the lever to the gearbox.
- Refer to Fig. 1.99 for the next

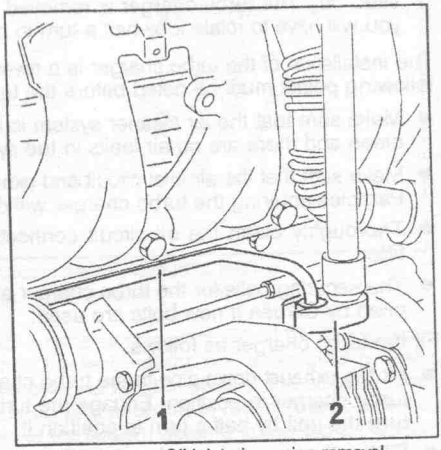


Fig. 1.98. — Oil inlet pipe union removal.

operations. Remove in the order given the oil return pipe clamp (1), the turbo charger outlet elbow (2), remove the five bolts securing the support bracket (3), the three bolts securing the support bracket (4) and undo the bolts and nuts (5). Also remove the heat protection shield above the steering.

- Locate the three turbo charger securing bolts, using the 16 mm socket with the universal joint and remove the turbo charger.

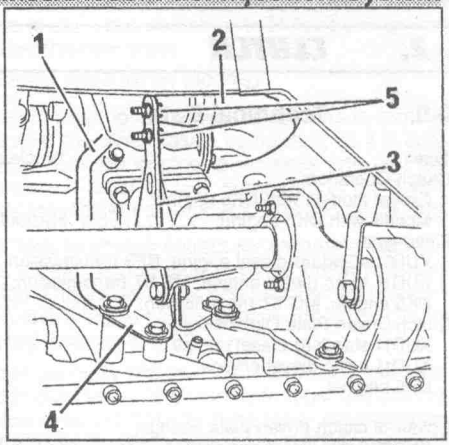


Fig. 1.99. — Removal details for the turbo charger (DK5). The numbers are referred to in the text.

The installation of the turbo charger is a reversal of the removal procedure. The following tightening torques must be noted:

- Fit the three turbo charger bolts and tighten them to 5.5 kgm (40 ft.lb.).
- Fit the turbo charger elbow (2) in Fig. 1.99 with a new seal and tighten to 2.2 kgm (16 ft.lb.).
- Fit the brackets (3) and (4) in Fig. 1.99. Tighten the bolts to 2.5 kgm (18 ft.lb.). The bolts (5) of support bracket (3) are tightened last.
- Fit the shaft connecting the lever to the gearbox (1.0 kgm /7.2 ft.lb.).
- Fit the catalytic converter. Use a new clamp and tighten to 2.5 kgm (18 ft.lb.). Tighten the ball joint to 1.0 kgm (7.2 ft.lb.).
- The oil inlet pipe union is tightened to 2.0 kgm (14 ft.lb.). The spanner shown in Fig. 1.98 must be used.

1.9.11. AIR CLEANER SYSTEM

Fig. 1.96 shows where the air cleaner and the air intake and outlet hoses of the turbo charger system of a XUD11 turbo diesel engine are located. In the case of a standard diesel, the air intake hose from the air cleaner is connected directly to the air inlet chamber on the engine.

Fig. 1.97 shows the position of the air cleaner on the R.H. side in the case of a DK5 engine. The air intake hose is connected between the air cleaner housing and the turbo charger inlet duct.

The replacement of the air cleaner element can take place by referring to the illustrations. The element should be replaced every 18,000 miles.

Not all engines use the same air cleaner element. Always obtain a new element for the engine in question.

If you remove the air cleaner element for any reason other than replacing it, blow through it with an air line to remove particles of dust from the surfaces of the air cleaner element.

2. CLUTCH

2.0. Technical Data

Type: ..... Single plate, dry clutch with diaphragm spring
Clutch Operation:
Except models with DK5 engine: ..... Mechanical, by cable
Models with DK5 engine: ..... Hydraulic operation, master and slave cylinder
Fitted type:
XUD11 standard diesel engine, BE3 transmission: ..... LUK
XUD11 turbo diesel engine, ME 5T transmission: ..... Valeo 235 CP 5650
DK5 engine, MG 5T transmission: ..... Valeo 242 DT 6500 TS
Clutch Driven Plate Dimensions:
XUD11 standard diesel engine: ..... 215 x 145 mm
XUD11 turbo diesel engine: ..... 228.6 x 155 mm
DK5 engine: ..... 242 x 162 mm

Colour of clutch driven plate springs:
XUD11 turbo diesel engine: ..... 2 x white, 2 x mauve, 2 x orange marks
XUD11 turbo diesel engine (P8C): ..... 2 x pale blue, 2 x dark brown, 2 x orange
DK5 engine: ..... 2 x blue, 2 x black

Release bearing: ..... Ball-type, constantly resting on diaphragm plate of clutch
Release bearing on DK5 engine attached to clutch pressure plate
Clutch pedal adjustment: ..... Automatic on R.H. drive, mechanical and hydraulic control

2.1. Clutch Unit

2.1.0. CHECKING THE CLUTCH OPERATION

The clutch can be checked for proper operation when fitted to the vehicle. To do this, proceed as described below:

Start the engine and allow to idle. Depress the clutch pedal and wait approx. 3 secs. Engage the reverse gear. If grating noises can be heard from the transmission, it can be assumed that the clutch or driven plate needs replacement, as the driven plate no longer connects the clutch pressure plate with the flywheel.

To check the clutch for signs of slipping, drive the vehicle until the clutch and transmission have reached their operating temperature. Stop the vehicle, firmly apply the handbrake and engage the 3rd gear. Keep the clutch pedal fully depressed and accelerate the engine to approx. 3000 - 4000 rpm. Release the clutch pedal suddenly. The clutch operates satisfactorily if the engine stalls immediately.

2.1.1. REMOVAL AND INSTALLATION

The clutch can be replaced with the engine in the vehicle, when an XUD11 engine is fitted, but note the following:

Model with DK5 engine (2.5 litre turbo diesel)

The clutch release bearing is fitted to the clutch pressure plate and will have to be removed if the clutch unit is replaced. This operation requires special tools and a hydraulic press. We recommend that the replacement of the clutch is carried out in a workshop. As the release bearing should always be replaced when a new

clutch unit is fitted, you may be able to ask your workshop to fit the bearing and clutch unit together after you obtained the new parts.

Proceed as follows to remove the clutch (valid for all models):

Refer to the section on the transmission and follow those instructions to remove the gearbox. There is no need to remove the transmission completely, as it is sufficient to withdraw it far enough away from the engine to unscrew and refit the clutch, driven plate, etc. The transmission must be well supported in the "withdrawn" position. Whichever way the tranmission is removed, proceed as follows:

Mark the clutch cover and flywheel face to ensure correct re- assembly. Remove the clutch bolts carefully, a little at a time. The engine must be prevented from rotating when the bolts are slackened. Otherwise use a ring spanner and place it over the bolt heads and hit it with a short, sharp blow to loosen the bolts. Do not allow grease or oil to get on the lining faces or any other part.

The installation of the clutch requires normally the use of an alignment mandrel. Due to the two different transmissions used in the XM range you must use the correct one. Just in case you can borrow one: Nr. 7011 for a normally aspirating engine, 4062-T or 4062-T.B. for an XUD11 turbo diesel engine or 5712-T for a DK5 engine. If a centrering mandrel is not available, a spare clutch shaft (for the transmission in question) can also be used. If neither of the above is available, and tools cannot be obtained, it is possible to line up the clutch disc in the inside of the flywheel by inserting a drift of the diameter of the spline bore. The end of the drift should either have a spigot which fits into the crankshaft bearing bore or in emergency have a pointed end so that this can be centred in the bore. There is also the option of an alignment mandrel kit from a tool hire company. One of the mandrels will fit your clutch plate hub. Note that the long end of the clutch driven plate hub must face towards the rear, away from the flywheel.

Offer up the clutch assembly to the flywheel and centre the disc by inserting the mandrel into the flywheel bearing. Tighten the bolts carefully, a little at a time, working in a diagonal manner, to a torque setting of 1.5 kgm (11 ft.lb.) in the case of a standard diesel engine or 2.0 kgm (14.5 ft.lb.) in the case of all turbo diesel engines (incl. DK5).

When installing the clutch, take the opportunity to inspect the flywheel face and the input shaft bearing.

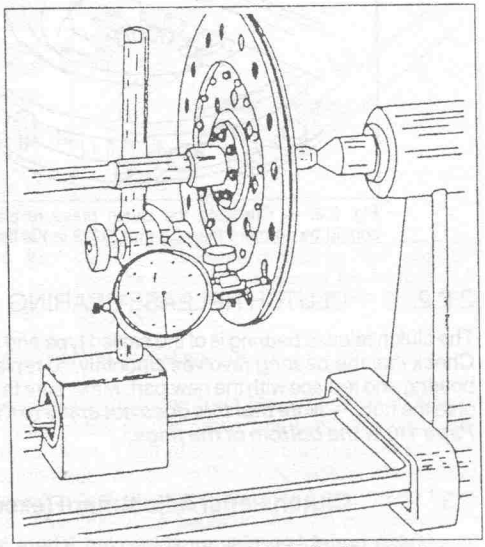


Fig. 2.1. — Checking a clutch disc for run-out.

2.2. Servicing

The cover assembly — pressure plate and diaphragm spring — must not be dismantled. Replace, if necessary with a complete assembly from

your dealer, quoting the year of manufacture and the chassis number. Clutch units and driven plates are sometimes changed to make them more efficient. If a later unit is interchangeable, always endevour to fit the latest type.

Inspect the driven plate and the linings, replacing the complete plate, if the linings are worn down close to the rivets. A driven plate with the linings contaminated with grease or oil cannot be cleaned successfully and should also be replaced. Note that different driven plates are fitted, depending on the engine in question. Apart from the diameter there are also different torsion springs in the centre hub. These are marked with a colour spot for ease of identification. Refer to Section 2.0 or consult your parts supplier. All rivets should be tight and the torsion springs should be sound and unbroken. Check the condition of the driven plate splines. Clamp the driven plate between the centres of a lathe and apply a dial gauge to the outside of the plate as shown in Fig. 2.1., at a diameter of 175.0 mm (6.4 in.). The max. run-out of the driven plate should be no more than 0.4 mm (0.016 in.).

Check the rivet fastening of the clutch pressure plate and replace the plate, if loose rivets can be detected.

Place a straight edge (steel ruler) over the friction face of the pressure plate and insert feeler gauges between the ruler and the surface. If the gap at the innermost spot of the friction face is no more than 0.3 mm (0.012 in.), the plate can be reused. Fig. 2.2. shows this check.

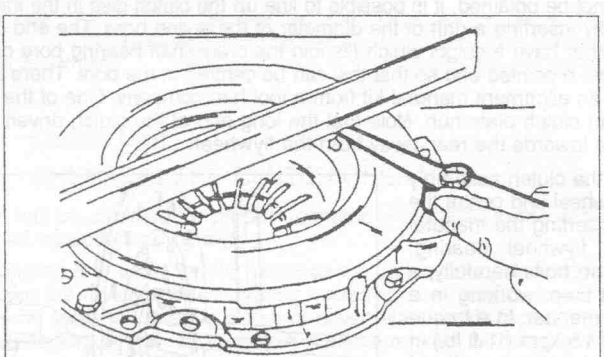


Fig. 2.2. — Checking the clutch pressure plate for distortion. The gap should be no more than 0.3 mm (0.012 in.) at the point shown.

2.2.2. CLUTCH RELEASE BEARING

The clutch release bearing is of the sealed type and must not be placed in any solvent. Check that the bearing revolves smoothly. To replace the bearing, press off the old bearing and replace with the new part. Make sure that the bearing is pressed squarely onto the hub. — ***Note that this does not apply to the clutch of a DK5 engine — See Page 110 at the bottom of the page.***

2.3. Clutch Pedal Adjustment (except 2.5 Litre Turbo)

The clutch pedal free play must be zero. There is no clutch pedal adjustment in the sense of "adjustment", as the play is taken up automatically with each opera-

tion of the clutch pedal. This arrangement is specific to R.H.D. models and also incorporates a relay lever, mounted on the bulhead, a connecting cable and a pedal fitted with a so-called assisting device, which means that the pedal pressure is reduced when depressing the clutch pedal. Sometime during 1995, however, a clutch control mechanism without the assisting device and automatic wear adjustment have been introduced. On these models note the following:

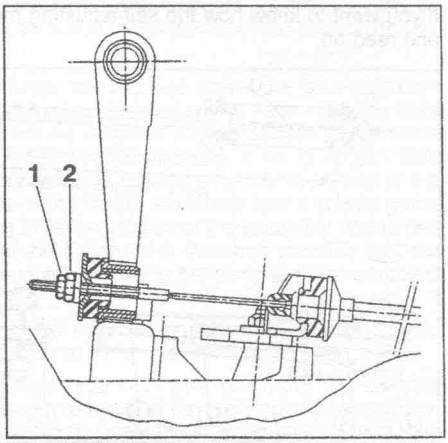


Fig. 2.3. — The adjusting nuts, i.e. locknut (1) and adjusting nut (2) are used to adjust the clutch pedal.

Only the travel of the clutch pedal is adjusted, there are no adjustments on the clutch release lever. If a new clutch cable has been fitted, operate the clutch pedal at least 30 times to allow the clutch control components to settle. To adjust the clutch pedal, refer to Fig. 2.3 and slacken the locknut (2) at the end of the clutch cable (two open-ended spanners required) and adjust the nut (1) until dimension "X" in Fig. 2.4 is between 145 and 155 mm. Note that the clutch pedal travel must not be less than 145 mm. You measure the difference between the pedal height in rest position "L1" in Fig. 2.4 and the pedal height in the "fully depressed" position "L2". Measure from the edge of the pedal to the floor panel. After any adjustment, operate the clutch pedal again approx. 30 times to settle the mechanism.

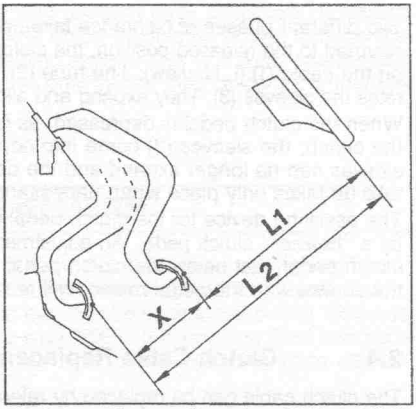


Fig. 2.4. — Measure dimensions "L1" and "L2" from the points shown. Deduct the value of "L1" from the value of "L2" to obtain the clutch pedal travel "X".

After the adjustment has been obtained, lock the two nuts against each other without disturbing the position of the adjusting nut (1).

NOTE: As a reference point measure the distance from the underside of the rim of the steering wheel to the top of the pedal (to the rubber pad) with the pedal fully depressed and write down the dimension. Then release the clutch pedal and measure between the top of the clutch pedal rubber to the underside of the steering wheel rim (the same point where the first measurement has been taken from). Again write down the dimension. The difference between the two measurements must now between 145 to 155 mm, but as already mentioned, never leave the adjustment below 145 mm.

2. Clutch

If you want to know how the self-adjusting mechanism operates, refer to Fig. 2.5 and read on.

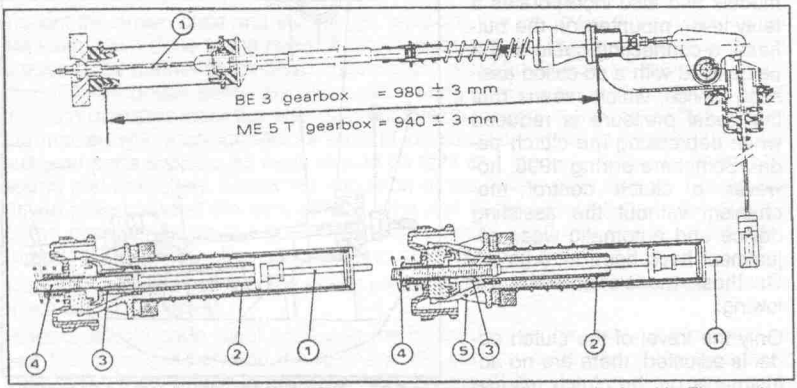


Fig. 2.5. — Schematic view of the self-adjusting mechanism fitted into the clutch cable. The numbers are referred to in the text.

Two different phases of clearance take-up take place. When the clutch pedal has returned to the released position, the clutch release lever on the transmission pulls on the cable (1) (L.H. view). The tube (2), which is activated by the cable (1) operates the sleeves (3). They expand and allow the threaded section (4) to turn freely.

When the clutch pedal is depressed, as is the case during the disengagement of the clutch, the sleeves (3) come into contact with the cone (5) (R.H. view). The sleeves can no longer expand and the device is locked in the new position. The take-up takes only place when neceesary.

The assisting device for the clutch pedal operation can outlive its days, indicated by a "heavier" clutch pedal. An adjustment is, however, possible. At the top of the clutch pedal, just below the clutch pedal shaft, there are two screws. Tightening the screws with the pedal raised, will reset the device.

2.4. Clutch Cable Replacement

The clutch cable can be replaced by referring to Fig. 2.5. As you can see from the illustration, a model with the BE3 gearbox (standard diesel) and a model with ME 5 T transmission (turbo diesel) require a different clutch cable. Always purchase a clutch cable with engine type and number and chassis number at the ready. Either the cable with the built-in adjusting device or the connecting cable may require replacement. The replacement requires that both cables must be disconnected from the relay lever and from the other end, i.e. the clutch release lever or the clutch pedal, depending which cable is replaced.

2.5. Hydraulic Clutch Operation

Models with the 2.5 Litre turbo diesel engine have a hydraulic clutch control, with slave cylinder, accessible from the engine compartment and a master cylinder, accessible from the passenger side. This is, however, not the conventional system,

used in other vehicles. It is therefore practically impossible to replace the slave or master cylinder with make-shift tools, as it is a comprehensive job and for the following reasons rather complicated:

- Battery, air cleaner, LHM fluid reservoir, the two fuse boxes, the glow-plug control unit, the diesel fuel priming pump, the electrical wiring harnesses, the bonnet pull cable, the battery tray must be removed to gain access to the slave cylinder. Although the cylinder is removed by turning it 1/8 of a turn anti-clockwise, you need a special tool which is pushed over the open end of the cylinder. Inside the cylinder there is the thrust rod which has a plastic guide clip. This guide clip is fitted during initial installation of the assembly and is broken during the first application of the clutch. Is is therefore possible that the borken off piece can drop into the clutch, requiring the removal of the complete assembly.
- The hydraulic pipe for the clutch control is joined together by means of a quick-fit union. Again a special tool is required to release the union.
- To remove the clutch master cylinder you will have to remove the steering wheel and the airbag, followed by the removal of the steering column support bracket (again a special tool is required to locate the steering bearing) and then the complete clutch pedal bracket. The cylinder is removed by turning it 1/8 of a turn anti-clockwise.
- A new slave cylinder is supplied in 2 fluid pre-filled parts, which are connected to the system by means of the quick-fit union mentioned above, to allow the fluid to transfer the fluid into the remaining system. This is a pretty complicated operation and we are of the opinion that only trained mechanics are at this stage able to accomplish the job.

3. MANUAL TRANSMISSION

All models covered in this manual are fitted with a five speed transmission, but not all vehicle are fitted with the same transmission. The "ME 5T" transmission, used with the XUD11 turbo diesel engine has also been changed during 1996 and is now identified as type "ME 5TB". The type "BE3" transmission fitted to a vehicle with standard diesel engine has a new ratio for the 2nd gear since approx. April 1993.

3.0. Technical Data

Type: ..... 5-speed gearbox, type "BE3" fitted to standard diesel models, type "ME 5T" or "ME 5TB" fitted to turbo diesel models. Transmission type "MG 5T" fitted to vehicles with 2.5 litre turbo diesel. All transmissions together with final drive in one housing.

Gearbox Transmission Type Identification (as available, not all U.K.):
Standard diesel engine: .....2 CJ 05 to Aug. 1991, 20 CJ 88 from Sept. 1991
XUD11 turbo diesel engine: 2 GM 04 or 2 GM 03 to Aug. 1991, 2 GM 16 from Sept. 1991
XUD11 turbo diesel, Estate: .....2 GM 09
DK5 turbo diesel engine: .....20 KM 02

Gear Ratios:

1st gear:
- BE 3 transmission: 3.455 : 1
- ME 5T transmission: 3.416 : 1
- MG 5T transmission: 3.416 : 1

2nd gear:
- BE 3 transmission: 1.850 : 1
- BE 3 transmission — from Apr. 1993: 1.870 : 1
- ME 5T transmission: 1.944 : 1
- MG 5T transmission: 1.864 : 1

3rd gear:
- BE 3 transmission: 1.280 : 1
- ME 5T transmission: 1.125 : 1
- MG 5T transmission: 1.176 : 1

4th gear:
- BE 3 transmission: 0.969 : 1
- ME 5T transmission: 0.882 : 1
- MG 5T ytransmisssion: 0.860 : 1

5th gear:
- BE 3 transmission: 0.757 : 1
- ME 5T transmission: 0.673 : 1
- MG 5T transmission: 0.642 : 1

Reverse gear:
- BE 3 transmission: 3.33 : 1
- ME 5T transmission: 3.154 : 1
- MG 5T transmission: 2.417 : 1

Lubrication:

- Type: 75 W/80 W
- Capacity — BE 3 transmission: Approx 2.0 litres (3.8 Imp. pts.)
- — ME T5 transmission: Approx. 1.85 litres (3.3 Imp. pts.) (2.2 litres/3.9 Imp. pts. from 1995)
- — MG 5T transmission: 2.2 litres (3.9 Imp. pts.)
- Oil change: Not necessary, filled for life
- Oil level check: Every 36,000 miles

Final Drive Ratios:
- BE 3 transmission: 3.938 : 1
- MT 5T transmission: 3.933 : 1
- MG 5T transmission: 4.063 : 1

3.1. Removal and Installation

The transmission may have to be removed to replace the clutch or clutch driven plate, apart from a replacement of the transmission. A suitable hoist or small hand crane is required to lift the engine in order to remove the transmission mounting. The operation is fairly complex as many parts must be removed in the engine compartment to gain access to the transmission attachments, connections, etc. The LHM fluid reservoir must be removed. This will leave the hydraulic system exposed. The Citroën workshop uses a special tool to protect the system against entry of foreign matter. The tool consists of a container to insert the filter head (which must be removed from the reservoir) and a cover plate to cover the reservoir. You will have to take your own precautions to prevent entering of dirt, etc. Proceed as follows for the model in question. Note that the complete engine and transmission assembly must be removed if the 2.5 litre turbo diesel engine is fitted. The transmission is then separated from the engine.

Models with XUD11 Engine

The instructions are given for all models. There may be differences in the location of certain parts on some of the models. Following the removal instructions for the engine together with the transmission in Section 1 (Engine) will give you further help to locate certain parts.

- Jack up the vehicle with the front wheels hanging down. Remove the front wheels.
- Disconnect the battery negative and positive cables and remove the battery.
- Remove the complete air cleaner. Depressurise the hydraulic system.

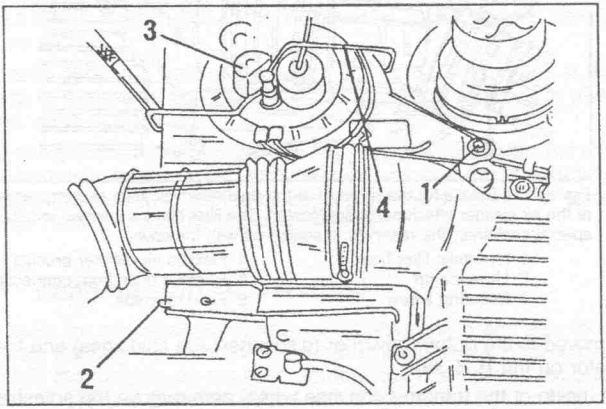


Fig. 3.1. — Details for the removal of the LHM fluid reservoir (see text).

- Refer to Fig. 3.1 and remove the fluid reservoir assembly. We would like to repeat that you must take all possible precautions to prevent contamination of the hydraulic system. Remove the screw (1) and a spring clip (2) and disengage the spring clip (4) across the hydraulic filter head. The filter head must now be lifted out and placed into the Citroën container, as can be seen on the L.H. side of Fig. 3.2. The cover, part of the special tool, is placed over the hydraulic fluid reservoir and secured in position with the large clip. The reservoir can now be removed.
- Locate the main harness and the reversing light switch on the transmission and separate the connector plug.
- Looking at the top of the battery, near the R.H. rear corner locate two pipes.
- Remove the clamps around the battery case and remove two relays. One is next to the rubber protector, the other one at the front L.H. side of the battery carrier. The battery carrier must now be removed, as can the rubber protector.
- Disconnect the battery negative cable from its connection at the other end, the clutch cable and the speedometer cable.
- Disconnect the connector plug from the flywheel sensor on the transmission housing, if one is fitted. Also locate the connector from the speedometer drive and withdraw it.
- Disconnect the three gearchange linkages from the side of the transmission. A screwdriver is used carefully to prise off the ball joint sockets.
- Remove the starter motor securing bolts and remove the starter motor. Also to

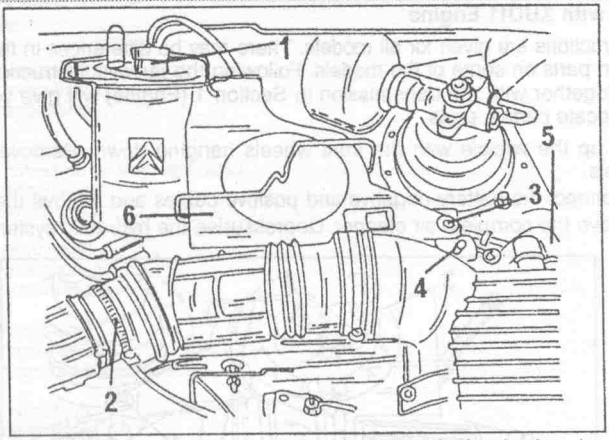


Fig. 3.2. — Details for the removal of the fluid reservoir, also showing where the air cleaner attachments are located. The filter head is inserted into the special container; the reservoir is sealed off with the cover.

1 Hydraulic filter head
2 Hose clamp
3 Securing screw
4 Flexible air cleaner bracket
5 Remove hose from connection
6 Fluid reservoir

be removed is the output governor (disconnect the fluid lines) and the pressure regulator on the R.H. side.

- In the inside of the transmission-side wheel arch remove the splash shield and the vertical strut.
- Remove the drive shafts (Section 4.1). Drain the transmission oil first.
- From underneath the transmission unscrew the flywheel cover.
- Attach chains or ropes to the hanger brackets of the engine and the other ends to a hoist or hand-crane and place a mobile jack underneath the transmission to keep it in position during the following operations.
- Remove the engine support mounting on the transmission side of the engine. To do this, remove the two bolts, the nut in the centre of the vertical shaft, five bolts securing the metal cover and the metal cover. The stud in the centre must also be removed in order to obtain enough clearance for the transmission removal. Check once more that the engine and transmission are well supported before the mounting is removed.
- Remove the bolts between engine and transmission and withdraw the transmission, still resting on the jack, from the engine.

Note: The transmission can either be left on the jack as described above, if only the clutch must be replaced, or is lowered and removed.

The installation is a reversal of the removal procedure. Note the following points as you go along:

- Once the transmission has been removed after a long time of service it is always a good precaution to replace the clutch release bearing. The same, of course, applies to the clutch and driven plate. Lubricate the thrust bearing guide pin and the gear selector shaft with grease.

- Check that the two dowel sleeves are in position in the cylinder block mounting face. They must not have been left in the transmission.
- Push the transmission against the engine, engaging the clutch with the clutch drive shaft. Have the engine rotated by a helper (pulling the fan belt to and fro should be enough) whilst the engagement is accomplished. Fit the transmission to engine bolts and tighten them evenly to 4.0 kgm (30 ft.lb.). The starter motor can be fitted during the same operation. The torque is the same.
- Refit the power unit mountings as described during the installation of the engine. The threads of the stud must be coated with "Loctite" or similar. The stud must be tightened to 10 kgm (72 ft.lb.). In the workshop a long socket is used to apply a torque wrench (No. 7115). Without this socket you will have to guess the torque setting.
- Fit the metal plate and tighten the bolts to 2.7 kgm (19 ft.lb.) and fit the remaining parts of the mounting. The individual tightening torques are given in the exploded views in Section 1.
- Fit or re-connect the remaining parts in reverse order. Take care not to contaminate the hydraulic system when the fluid reservoir and the filter head are refitted. Secure the reservoir with the spring clip on one side and the screw on the other side. Finally fill the transmission with oil.

3.2. Transmission — Overhaul

As special tools are necessary to overhaul the transmission and also the differential, apart from the fact that three different transmissions are fitted to the models covered in this manual, we do not intent to describe the dismantling and assembling of the unit. If faults are experienced with the transmission or final drive unit, we recommend to fit an exchange unit or have the original assembly overhauled. If you intent to fit a second-hand transmission at some stage double check that the transmission is suitable for your particular vehicle. You not necessarily need the latest version, but the gear ratios and the final drive ratio have been adapted to the power of the engine and must therefore be retained. Remember that there have been changes in the internal components of certain transmissions.

3.3. Transmission Oil

All transmission types are filled for life with the oil given in Section 3.0. It is, however, a well known fact that transmissions sometimes develop small oil leaks, not always visible and for this reason the oil level should be checked every 36,000 miles and, if required, corrected. Any unusual oil leak, of course, requires a more frequent oil check and the necessary corrective measure to cure the leak. Leaks can occur on the exits of the drive shafts, for example.

The oil filler/oil level check plug is fitted into the rear end of the transmission, where the cover is fitted to the transmission case, in the case of a vehicle with XUD11 engine or next to the entry of one of the drive shafts on one side of the engine, if a DK5 2.5 litre engine is fitted. Either a hexagonal-head plug or an internal socket plug (Allen key required) is used. To check the oil level insert the forefinger into the plug opening. The oil must be felt. Otherwise top-up with the recommended oil. You will need a grease gun, filled with oil, to fill in the oil. Finally clean and refit the plug. The tightening torque is 2.0 kgm (14.5 ft.lb.), in the vcase of a transmission with XUD11 engine or 2.7 kgm (19.5 ft.lb.7, if a DK5 engine is fitted.

3.4. Automatic Transmission

An automatic transmission, type ZF 4 HP 18 is available for models with turbo diesel engine as alternative to the manual transmission. The transmission consists of a torque converter, comprising three elements, an epicyclic gear train, providing four forward gears and one reverse. A hydraulic unit ensures the automatic control of gear changes. A gear-type oil pump, permanently driven by the converter impeller, supplies the hydraulic unit and the the converter and provides lubrication for the gear train.

A centrifugal hydraulic regulator, driven by the counter-shaft depends on the drive wheel rotation and actuates under the action of the centrifugal force the balance weights, which transform the speed signal into a pressure signal by fluid lamination. This pressure, which is analysed in the hydraulic unit, will determine the gear changes.

Due to the complexity of the automatic transmission, only carry out the operations described below. All other matters should be referred to a specialised workshop with the necessary equipment and experience in dealing with automatic transmissions.

3.4.0. TECHNICAL DATA

Make and type: ..... ZF, type 4 HP 18
Transmission Identification Code:
XUD11 engines:
P8A engine: ..... 2 GZ 87 to Sept. 1991, 2 GZ 5 A from Oct. 1991
PHZ engine: ..... 2 GZ 91 to Sept. 1991, 2 GZ 5A from Oct. 1991
P8Z engine from 1996: ..... 20 GZ 7D
P8B engine: ..... 20 GZ 7D
Number of speeds: ..... 4 forward, one reverse

Torque Converter:
Make: ..... Fichtel and Sachs
Type: ..... 260 mm diameter with hub damper
Converter stall speed: ..... 2300 rpm
Torque multiplication: ..... 2.4 : 1

Gear Ratios (approx.):
1st speed: ..... 2.58 : 1
2nd speed: ..... 1.41 : 1
3rd speed: ..... 1.00 : 1
4th speed: ..... 0.74 : 1
Reverse speed: ..... 2.88 : 1

Axle Ratio: ..... 3.571 : 1 (21/75 teeth)

Lubrication:
Oil grade: ..... Total Dexron D 20 356
Capacity: ..... 7.8 litres (total capacity)
Fluid necessary after draining transmission: ..... 2.7 litres
Oil change intervals: ..... 12,000 miles
Filter cleaning intervals (workshop): ..... 60,000 miles

Idle Speed Adjustment (selector lever in "P"):
All engines: ..... 50 rpm more than specified on Pages 84 and 85

3.4.1. REMOVAL AND INSTALLATION

The removal of the transmission on its own is not possible. The engine and transmission must be removed from the vehicle as explained in the relevant sections for different engines. The transmission can then be removed from the engine. As the power unit will most probably be suspended on the hoist, lower it as far as possible so it just touches the ground. Then remove the transmission as follows:

- Locate the kick-down cable on the throttle valve housing, undo the cable bracket and turn the operating segment against the tension of the spring until the cable end can be disengaged.
- Remove the hydraulic compoenents mounted on the transmission and release the pipes. The flywheel or T.D.C. sensor is fitted at the top of the engine/transmission housing and must be removed.
- From the bottom of the assembly remove the panel covering the converter housing opening. You will have to lift the power unit accordingly to reach the screws.
- The the starter motor ring gear must now be prevented from rotating to remove the drive plate to converter bolts. Lower the engine and transmission so that it just touches the ground. Three bolts must be removed. Turn the crankshaft by applying a socket to the crankshaft pulley nut or bolt, depending on the engine until the first of the bolts appears in the opening. Ask the helper to insert the blade of strong screwdriver into the teeth. Apply a socket with extension to the drive plate bolt and proceed to unscrew the bolt. The crankshaft will rotate until the screwdriver stops against the cylinder block. The bolt can now be slackened. Rotate the engine and proceed in the same manner to remove the remaining bolts. Note that the converter can drop out of the housing when the transmission is removed. Follow the advice given below.
- Remove the starter motor shield and the starter motor.
- The transmission can now be removed from the engine, but remember that the unit is fairly heavy. Injuries must be avoided under all circumstances. Make sure that the engine oil sump is sitting fairly solid on the floor and remove the four bolts securing the transmission to the cylinder block.
- Withdraw the transmission slowly until it disengages from the engine and move it away slowly. As this takes place observe the converter inside the transmission, i.e. always push it back into the housing if it tries to move out.
- After the transmission is removed make up a fairly strong metal strip. One end of the strip must have a hole, big enough to fit a starter motor bolt. Bolt this side to the centre starter motor bolt hole, place the other end of the metal strip across the torque converter and then tighten the bolt and nut. The metal strip will now push against the converter and keeps it in position.

The installation of the transmission is a reversal of the removal procedure, but note the following points. First check that the converter is fitted correctly.

- Push the converter fully into the housing. The converter has a centering ball joint at the outside. The tip of the ball joint must protrude 9 mm beyond the outer face. Place a steel ruler across the mounting face and check that this is the case.
- Coat the friction ring for the centre of the drive plate with grease and insert it. Make sure that the two dowel sleeves are fitted at the top of the cylinder block mounting face.
- Join the transmission to the engine and insert the four bolts. Tighten the bolts gradually, always check that the gap closes equally. Finally tighten the bolts to

6.0 kgm (43.5 ft.lb.), again going equally around the circumference of the transmission.

- Refit the drive plate-to-converter bolts in reverse order to the removal. Tighten the bolts gradually, i.e. the crankshaft must be rotated several times. The final torque is 6.5 kgm (47 ft.lb.).
- Carry out the remaining operations in reverse order to the removal procedure.

3.4.2. TRANSMISSION FLUID

Fluid Level Check: The fluid level of the automatic transmission must be checked when the fluid has its operating temperature (80° C), with the engine running and the selector lever in the "Park". Change the lever through the gears before placing it in the "Park" position.

The fluid dipstick has two markings, a "Min" mark and a "Max." mark. The level should be near the "Max" mark when the fluid is hot. Only when, in emergency, the fluid level is checked in cold condition, should the fluid level be around the "Min" mark.

Fluid Change: The initial fluid changes will already have been carried out during the warranty time of the vehicle, i.e. your first fluid change should not be taking place before at least 24,000 miles havew been covered. A drain plug is fitted to the bottom of the transmission and must be removed with a square-headed wrench to drain the oil. Do this when the fluid is hot to facilitate the draining. Most of the fluid will, however, remain in the transmission and only approx. 2.0 to 2.5 litres (around 4 pts.) will be required to re-fill the transmission. Tighten the drain plug to 4.5 kgm (32.5 ft.lb.). Fill the fluid through the guide tube for the dipstick.

Drive the vehicle for a while, re-check the fluid level and top- up if necessary.

Every 60,000 miles the filter at the bottom of the transmission should be cleaned. A blanking plug is fitted to the bottom of the oil sump, held in position by three screws. If you carry out the filter cleaning remember that most of the fluid is contained in the oil sump (apart from the fluid in the converter) and a large container must be placed under the transmission before the plug is unscrewed. Remove the cover and withdraw the filter. Both the filter and the magnet on the inside of the cover must be thoroughly cleaned. Replace the two sealing rings (one on the filter and one on the cover). Tighten the screws to 1.0 kgm (7.2 ft.lb.).

4. DRIVE SHAFTS

The drive shafts of the XM have a so-called tri-axe constant velocity joint, which can slide on inner splines and a none-sliding homokinetical C.V. joint on the wheel side. The nut at the ends of the drive shafts are tightened to a very high torque and secured in position by peening over the metal of the nut.

A few general points should be noted when dealing with the drive shafts of the different models:

- The drive shafts of models with naturally aspirating diesel engine, i.e. with the BE3 transmission, have four annular grooves in the cente of the shafts, near the outer ends. The L.H. drive shaft is secured in the differential side gear by means of a spring.

- The drive shaft of models fitted with turbo diesel engine are identified by having a plain shaft between the C.V. joints, i.e. no grooves are machined. The L.H. drive shaft is secured by a spring in the differential side gear.
- The "solid" drive shafts fitted to models with ME 5T transmission and automatic transmission have been replaced by "tubular" shafts with the introduction of the 1996 models. The drive shaft diameter on the road wheel side has been increased (from 30 mm to 40 mm). *This is important when a drive shaft is replaced.*

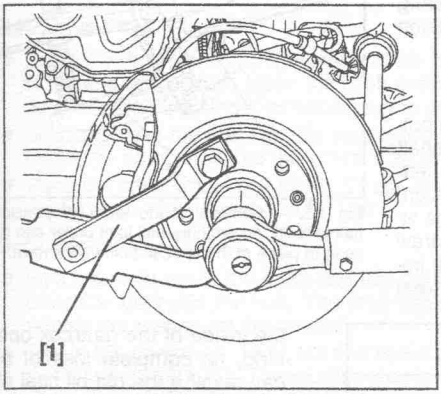


Fig. 4.1. — Counterholding the wheel hub during removal of a drive shaft nut. Arrange the tool lever (1) on the other side when the nut is tightened.

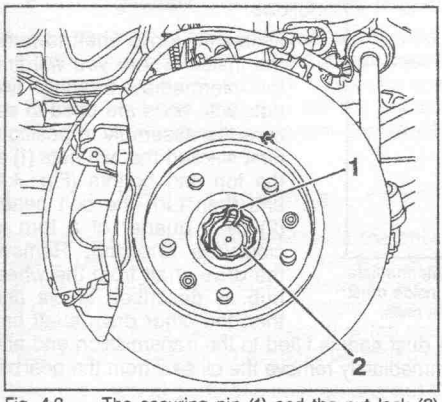


Fig. 4.2. — The securing pin (1) and the nut lock (2) must be removed before the drive shaft nut can be slackened.

- A toothed rotor is fitted to each drive shaft if the vehicle has an ABS system.
- The C.V. joints are filled with grease, but different amounts are used (see Section 4.1).

4.0. Drive Shaft — Removal and Installation

It should be noted that the oil seal for the drive shaft in the gearbox housing must be replaced if a drive shaft is removed, irrespective what type of repairs are being carried out. The nut at the end of the drive shaft is tightened with a very high torque and subsequently secured with a nut lock and a locking clip, inserted into a hole in the drive shaft end. **If the nut is slackened or tightened when the vehicle is resting on chassis stands, take the necessary precautions — Safety first.**

- Jack up the front of the vehicle, with the wheels hanging free and remove the wheel. Remove the oil drain plug from the bottom of the transmission and drain the oil into a suitable container. If ABS is fitted, remove the sensor for the wheel speed from the axle.
- Counterhold the wheel hub in suitable manner, remove the securing pin (1) in Fig. 4.2 out of the drive shaft end, remove the nut lock (2) and and slacken the nut with a 35 mm socket. Normally a fixture as shown in Fig. 4.1. is used to restrain the hub. Otherwise screw two wheel bolts back into place and insert a tyre lever between the bolts

to hold the hub. It may be advisable to screw the wheel nuts over the threads to prevent thread damage.

- From the bottom of the suspension ball joint remove the nut as far as the end of the stud thread and using a suitable puller, as for example shown in Fig. 4.3, separate the ball joint stud from the steering knuckle. Release the suspension arm from the steering knuckle.

To remove the L.H. drive shaft:

- Pull the swivel joint towards the outside until the end of the drive shaft end is free and withdraw the left-hand shaft out of the transmission. Push the steering knuckle to one side as far as possible to withdraw the shaft. As already mentioned, immediately remove the oil seal from the inside of the gearbox opening, as complete loss of oil can result if the old oil seal allows oil to run past it.

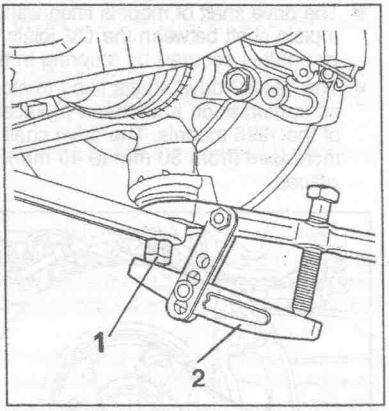


Fig. 4.3. — Removal of the lower suspension ball joint (1). An ordinary ball joint puller can be used in place of the special puller (2) shown.

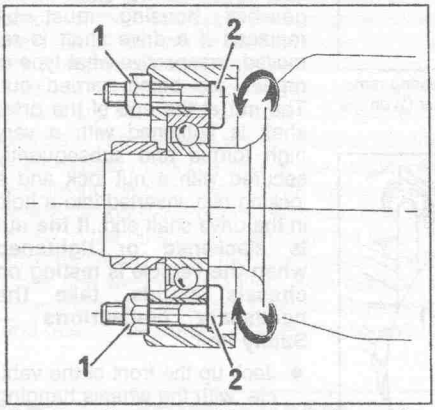


Fig. 4.4. — The two nuts (1) secure the intermediate shaft bearing. The bolt heads (2) on the inside must be rotated by a quarter of a turn to free the bolts.

Remove the R.H. drive shaft as follows:

- Follow the drive shaft towards the inside. There you will find the intermediate bearing. Two nuts with bolts are used to secure the assembly in position. First slacken the two nuts (1) at the top and bottom (Fig. 4.4) and then turn the bolt heads (2) by a quarter of a turn in clockwise direction. Remove the drive shaft from the wheel hub as described above and then the other drive shaft half from inside the transmission. A dust seal is fitted to the transmission end and can be removed and re-used. Immediately remove the oil seal from the gearbox opening.

NOTE: A protective plate underneath the engine must be removed, if one is fitted.

Thoroughly clean the area around the differential outlet opening. Lubricate a new oil seal and drive it into the transmission opening until flush with the housing. Use a suitable mandrel to drive the seals into the transmission, taking care not to damage them. Lurbicate the oil seal lips with grease.

Fit the two drive shafts as described on the next page.

L.H. Drive Shaft

- Insert the drive shaft into the differential side gear splines. Take care not to damage the oil seal during installation. Rotate the shaft as necessary in order to engage the splines.
- Pull the steering knuckle towards the outside and insert the drive shaft into the steering knuckle and wheel hub. Push the steering knuckle back in position.
- Fit the suspension arm ball joint into the bottom of the steering knuckle. Fit a new self-locking nut to the ball joint stud and tighten it to 4.5 kgm (32.5 ft.lb.).

R.H. Drive Shaft

- Insert the drive shaft into the intermediate bearing and fit the rubber dust seal to the end of the shaft. Insert the shaft end into the splines of the differential side gear, again rotating it as necessary to obtain the engagement.
- Slightly grease the intermediate bearing outer track and insert it into its recess. Insert the drive shaft into the wheel hub as far as it will go.
- Place the offset wheel bolt heads (2) against the bearing outer track and tighten the two nuts (1) in Fig. 4.4 to 1.0 kgm (7.2 ft.lb.).

Both Shafts:

- Fit a new hub nut to the shaft end and tighten the nut as much as possible to draw the shaft into the hub. The final tightening should take place when the wheels are resting on the ground.
- Top-up the gearbox oil level, but first make sure that the drain plug is tightened to 4.5 kgm (32.5 ft.lb.). The oil filler plug is located on the side of the pressed steel cover (MG 5T transmission next to the drive shaft outlet). A square-headed key is required to remove the plug (BE3 and ME 5T transmission). Insert the finger into the hole. As soon as the oil level is reached, there is enough oil in the gearbox. Tighten the level plug to 2.2 kgm (16 ft.lb.).
- Refit the front wheels and lower the vehicle to the ground. Tighten the hub nut to 35 kgm (252 ft.lb.). Fit the nut lock over the tightened nut and insert the securing clip (see Fig. 4.2). If it cannot be immediately, remove the nutlock, tighten the nut a little more and refit the nut lock and the securing clip. Make sure the clip is fully inserted. Tighten the wheel bolts to the specified torque

4.1. Spider Couplings

Replacement of the rubber bellows is the only servicing operation recommended. Wear or damage to the shaft or joints will call for the unit to be replaced. Note that the replacement of the rubber bellows should only be carried out with the special service kit supplied by Citroen dealers. This kit contains the essential measure of grease which must be used. Note that the parts of the constant velocity joints are matched and must on no account be mixed or interchanged.

Clean the internal parts of all old grease but DO NOT use solvents.

The replacement of the rubber boot on the wheel side also requires the replacement of the rubber boot on the gearbox side. Proceed as follows to replace the rubber boot(s):

Clamp the drive shaft into a vice, using soft-metal jaws and remove the rubber boot clamps. Cut-off the edge of the slide joint cover with a hacksaw, bend over the outside edge and remove it from the joint housing. Take care not to damage

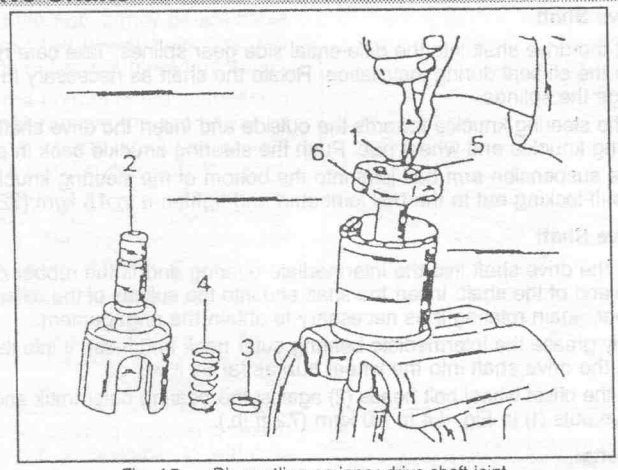


Fig. 4.5. — Dismantling an inner drive shaft joint.

1 Mark position of spider to drive shaft
2 Slide joint housing
3 Sealing washer
4 Spring
5 Spider securing snap ring
6 Spider rollers secured with rubber band

the housing. The cover must always be replaced, as it will be damaged during removal.

Remove the slide joint housing from the shaft and, using paint, mark the spider assembly and the shaft at opposite points to assure assembly in the same position. Use a rubber band and wind around the bearing rollers to prevent them from coming off the journals.

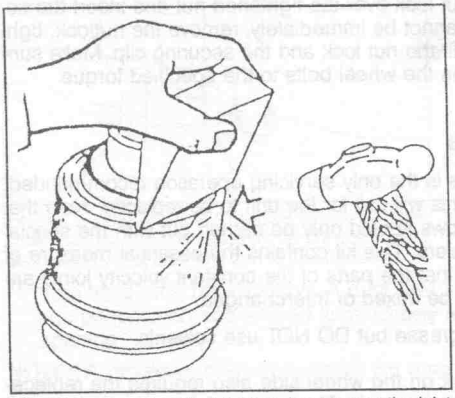


Fig. 4.6. — Securing the joint housing cover to the joint housing.

Remove the snap ring from the end of the shaft and press the shaft through the spider assembly. Hold the drive shaft from underneath. The snap ring must always be replaced. Remove the rubber boot from the shaft.

Remove the rubber boot from the shaft and remove the rubber boot for the outer joint.

Thoroughly clean all parts and check for wear. Check the spider assembly assembly for damage to the needle bearings and washer. Replace parts as necessary.

Assembly is a reversal of the removal procedure. Grease a new "O" sealing ring and fit in position. To secure the slide joint cover, bend the edge over the joint housing on the entire circumference. Place a wooden wedge over the joint as shown in Fig. 4.6 and bend the edge over the joint housing. The wedge will prevent damage to the housing.

Slide a new rubber boot with the small clamp band over the shaft and clamp the drive shaft into a vice, using soft-metal jaws. Slide the spider assembly over the shaft (with the chamfer on the inside leading) in accordance with the marks made during dismantling.

Drive the spider assembly in position, using a soft-metal hammer and fit the snap ring. The rounded-off side of the snap ring faces the spider assembly.

Fill the joint with 150 g (BX3 transmission) or 300 g (ME 5 T transmission) of the recommended Citroen grease and attach the rubber boot with the larger clamp band. Take care that all air has been removed from the inside of the boot. To do this, insert a thin metal rod (for example a screwdriver blade) between the boot and the joint) and press the rubber boot together.

Refit the rubber boot to the outer joint, filling the joint with 130 g (BE 3) or 160 g (ME 5 T) of the recommended Citroen grease. Wipe off all surplus grease.

NOTE: Remember that shafts for standard and turbo diesel engine models are not the same, although both appear to be identical at first glance.

4.2. Intermediate Bearing

The intermediate bearing can be replaced after the R.H. drive shaft has been removed as described above. Unscrew the intermediate bearing bracket from the cylinder block. If the bearing has not come away together with the drive shaft, remove it together with the oil seal out of the bracket. A press is used for this operation.

Fit the new bearing and the oil seal to the bearing bracket and fit the intermediate bearing bracket to the cylinder block. Refit the drive shaft as described in Section 4.0 and finally tighten the bracket nuts (always use new self-locking nuts) to a tightening torque of 1.0 kgm (7.2 ft.lb.).

5. STEERING

5.0. Technical Data

Steering type: ..... Rack and pinion steering, power-assisted
Number of pinion teeth: 9
Number of rack teeth: 34
Steering ratio: ..... 15.6 : 1

Front Wheel Alignment:
Camber — Standard suspension: ..... 0° ± 30' (not adjustable)
— Hydroactive Suspension: ..... —15 ' ± 30'(not adjustable)
Castor: ..... 2° 30' ± 30' (not adjustable)
King pin inclination — Standard suspension: ..... 13° 14' (not adjustable)
— Hydroactive suspension: ..... 13° 28' (not adjustable)
Toe-out: ..... 0 - 3 mm (0.012 in.)

Steering Lock Angle:
Inner wheel: ..... 44° 18' — not adjustable
Outer wheel: ..... 33° 30' — not adjustable

Turning Circle: ..... 12.5 m (between walls), 11.66 mm (between kerbs)

5.1. Steering Box

The power steering assembly is shown in Fig. 5.1. It consists of a flow distributor, a control valve integral with the steering rack pinion and a hydraulic cylinder, mounted below the steering rack. The steering is mounted as shown in Fig. 5.2.

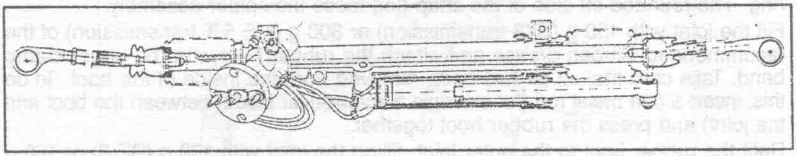


Fig. 5.1. — Sectional view of the power-assisted steering. The hydraulic cylinder is located below the steering rack.

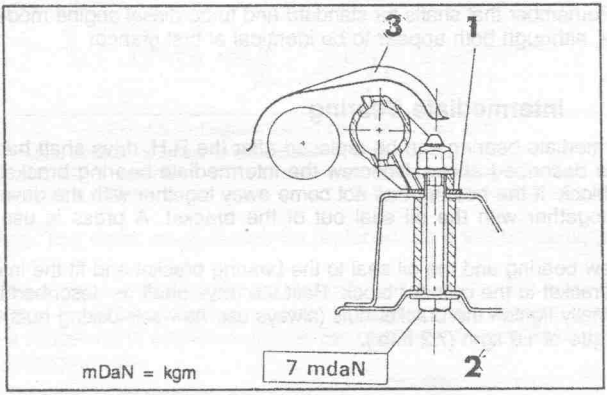


Fig. 5.2. — Sectional view of the steering attachment. Note the thrust washers (1) under the bolts (2). The heat shield (3) must be removed.

The flow distributor distributes the flow of the hydraulic fluid between the main hydraulic circuit for the suspension and the brake system and the steering circuit. It limites the pressure in the steering system.

The control valve is fitted is fitted to the steering pinion and control the supply pressure in the steering system in accordance with the force on the steering wheel.

The hydraulic cylinder transfers the hydraulic pressure created inside the steering onto the track rods and thereby to the wheels.

5.1.0. REMOVAL AND INSTALLATION

- Jack up the front end of the vehicle and place stands underneath the body so that the front wheels are hanging down. The front wheels must be removed to obtain more operating space to disconnect the track rod ball joints.
- Open the pressure release screw and rotate the steering wheel from lock to lock to eject the fluid from the steering system.
- Remove the felt material coating from under the lower trim of the instrument panel.

5. Steering/Removal

Refer to Fig. 5.3 for the following operations:

- Remove the clamp bolt (1) securing the intermediate shaft (2) to the steering column shaft to free the connection. Also remove the clamp bolt (3) to free the flexible steering coupling from the steering pinion (rotary valve).

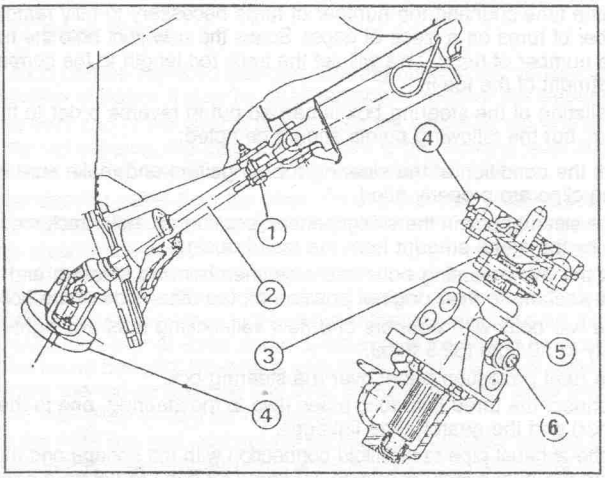


Fig. 5.3. — Details for the removal and installation of the steering. The numbers are referred to in the text.

- Withdraw the steering coupling (4) from the steering pinion (5).
- Disconnect the gearchange linkages from the transmission and push the long gear selector shaft to one side.

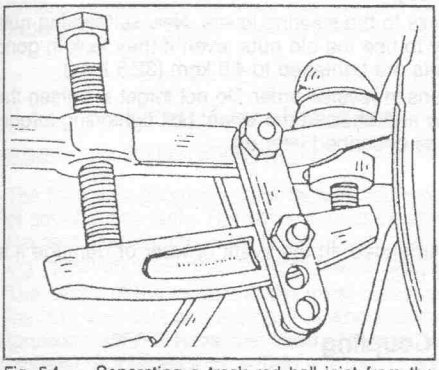


Fig. 5.4. — Separating a track rod ball joint from the steering lever with a ball joint puller.

- Separate the exhaust manifold connection. The exhaust assembly must be tied to the underside of the body. Do not allow it to hang down on its rubber mountings.
- Disconnect the pipes connected to the steering unit. Do not unscrew, however, the connection (6) in Fig. 5.3. Underneath there is a valve which could be destroyed during installation or even get lost.
- Remove the nuts securing the track rod ball joints to the steering lever and, using a suitable ball joint puller as shown in Fig. 5.4, separate the ball joint connection. It may be better to leave the nuts on the ball joint studs to protect the threads.
- Remove the heat shield above the steering unit and locate the two steering

mounting bolts. These are located inside two openings in the crossmember. On the nut-side of the bolts there are two thrust washers which must be retrieved before the bolts are removed. Mark the position of the washers and shims for installation as they must be refitted to their original position.

If the track rod joints are to be removed, slacken the locknut and unscrew the joint, at the same time counting the number of turns necessary to fully remove it. Write the number of turns on a piece of paper. Screw the new joint onto the track rod by the same number of turns. This will set the track rod length to the correct value for the adjustment of the toe-in.

The installation of the steering box is carried out in reverse order to the removal procedure, but the following points should be noted:

- Check the condition of the steering rubber gaiters and make sure that the retaining clips are properly fitted.
- Set the steering box in the straight-ahead position, i.e. both track rods must protrude by the same amount from the rack housing.
- Insert the two mounting bolts into crossmember and steering and fit the two thrust washers to their original position on the other side of the bolts.
- Fit the two bolts with washers and new self-locking nuts and tighten the nuts equally to 7.0 kgm (52.5 ft.lb.).
- Fit the heat protection panel over the steering box.
- Re-connect the three hydraulic pipes (two to the steering, one to the hydraulic cylinder) and the gearchange linkages.
- Refit the exhaust pipe to manifold connection with the springs and the washers. Tighten the nuts evenly across to 1.0 kgm (7.2 ft.lb.) to obtain a good seal.
- Turn the two steering knuckles into the straight-ahead position and turn the steering wheel until the single spoke is in its normal direction. In this position re-connect the flexible steering coupling with the rotary valve (steering pinion) and the intermediate shaft with the steering column shaft. The coupling is tightened to 2.0 kgm (14.5 ft.lb.), the steering shaft conenction to 2.3 kgm (16.5 ft.lb.). tighten the bolt to 1.4 kgm (11 ft.lb.).
- Re-connect the track rod ball joints to the steering levers. New self-locking nuts must always be used. Never try to use the old nuts, even if they look in good condition — Safety first. The nuts are tightened to 4.5 kgm (32.5 ft.lb.).
- Carry out the remaining operations in reverse order. Do not forget to tighten the pressure regulator release screw and observe the wheel bolt tightening torque. Check and/or adjust the toe-in as described later on.

5.1.1. SERVICING

The steering box should not be dismantled. In the event of wear or damage it is necessary to obtain a replacement unit.

5.2. Steering Flexible Coupling

The flexible coupling can be changed without removing the steering from the vehicle, it must, however, be removed from its attachment to lower it.

Remove two bolts securing the steering. Lower the steering and remove the bolts securing the flexible coupling to rotary valve (steering pinion) and the flange of the steering shaft. Withdraw the coupling.

The installation is a reversal of the removal procedure. Tighten the coupling to the rotary valve to 2.0 kgm (14.5 ft.lb.). Tighten the steering mounting bolts as described in Section 5.1.

5.3. Track Rods

The track rods can be replaced with the steering fitted to the vehicle, but due to the confinement of space it may be of advantage to remove the steering.

Jack up the front end of the vehicle and remove the wheel on the side in question. Unscrew the nut securing the track rod ball joint to the steering lever and, using a puller as shown in Fig. 5.4, disconnect the track rod ball joint.

Remove the steering gaiter from the track rod and from the steering box (open the wire clip by bending the ends together) and withdraw it along the track rod.

Thoroughly clean the connection of the track rod on the steering rack to find the lock plate and bend back the lock plate with a chisel or strong screwdriver. The track rod is connected by means of the actual inner ball joint to the steering rack. Citroën workshops use a special tool to remove the ball joint housing, but a pair of mole grip pliers or a pair of water pump pliers should be able to separate the connection. The round ball joint housing is very strong and the risk of damage is very little. Unscrew the rod as soon as it is free. Remove the lock plate and the plate washer. The lock plate should be replaced.

To remove the track rod end, slacken the locknut and unscrew the ball joint, at the same time counting the number of turns necessary to do this. Refit the new ball joint the same number of turns.

If the track rod is replaced, attach it to the steering rack and tighten the ball joint housing as tight as possible with a pair of mole grips. Bend over the lock plate to secure the inner ball joint in position. Do not forget the plate washer between the ball joint housing and the steering rack.

Smear the steering rack with the recommended grease and attach the steering gaiters. Re-connect the track rod ball joint to the steering lever, using a new self-locking nut, and tighten the nut to 4.5 kgm (32.5 ft.lb.).

5.4. Front Axle Geometry

5.5.0. INTRODUCTION

The front axle geometry must be checked when the vehicle is empty, with 1 gallon of petrol in the tank. The vehicle must be at its correct heights at the front and at the rear. The engine must be idling and the vehicle must be in the "normal driving" position when the measurements are carried out.

The height of the vehicle at the front, measured between the rear crossmember of the front axle unit and the point of wheel contact with the ground, must be 144 mm (provided 195/70 tyres are fitted, 149 mm with 205/60 tyres, as used on other models). A tolerance of +10 to —7 mm is acceptable.

The height of the vehicle at the rear is measured from the point where the rear silent block mounting is resting on the body underfloor and the ground where the vehicle is resting on. Again different values apply, i.e. 431 mm for models 195/70 tyres and 436 mm for models with 205/60 tyres (for example XM with V6 engine). The tolerance values are the same as given for the height at the front.

5.4.1. CASTOR ANGLE

The castor angle cannot be adjusted. The angle can be measured with a conventional instrument and should be as given in Section 5.0. Note that models with standard suspension and hydroactive suspension have the same setting. To be precise, the value is 3' less on a model with hydroactive suspension, but this deviation can only be detected electronically. A tolerance of plus or minus 30' is permissible. If the obtained values are outside the limits, you can assume that there is some kind of distortion in the front suspension. In this case, have the front suspension checked professionally.

5.4.2. CAMBER ANGLE

Check the camber of the two wheels with a camber gauge. The difference between the two sides must not exceed 1º. The correct camber figures are given in Section 5.0, but this time there is a difference between a standard and a hydroactive suspension, the latter having a "minus camber". A tolerance of plus or minus 30' is permissble.

The camber angle cannot be adjusted and if values outside the figures quoted are obtained, have the front wheel geometry checked at your Citroën Dealer. Distortion is the likely cause of different readings.

5.4.3. TOE-IN OF FRONT WHEELS

Measure the toe-in of the front wheels with a conventional tracking gauge. Drive the vehicle onto level ground and place the front wheels in the straight-ahead position. Place the tracking gauge against the front of the two wheel rims and set the scale of the gauge to zero. Mark the spots where the pointers of the gauge contact the rim edges with chalk and remove the gauge.

Push the vehicle forward by half a turn of the wheels and apply the tracking gauge at the rear, with the pointers in line with the chalk marks. Bring the pointers in contact with the rim edge and read off the indication.

If the values given in Section 5.0. are not obtained, adjust the toe-in as follows:

- Slacken the locknut near the inner end of the track rod on both sides of the vehicle and turn the two track rods by the same amount. The spoke of the steering wheel will be dislodged from its centre position, if this is not observed.
- Re-check the toe-in setting. Tighten the locknuts to 4.5 (32.5 ft.lb.) after the adjustment.

5.5. Hydraulic Steering Cylinder

The hydraulic cylinder is fitted below the steering and can be removed separately. If the steering appears heavy, although the remaining systems of the vehicle (suspension, brakes) are working properly, you may have to replace the cylinder. The cylinder is bolted to the steering box and one of the track rods. Fig. 5.5 shows a view of the fitted steering with the cylinder. The pipes connected to the cylinder must be removed. Take good care not to allow foreign matter to get into the pipe ends. Tighten the hydraulic cylinder bolts/nuts to 5.0 kgm (36 ft.lb.), but note that stronger bolts are fitted since the end of 1992. If the washer underneath the damper is 3 mm thick, tighten the bolts to 9.0 kgm (65.5 ft.lb.).

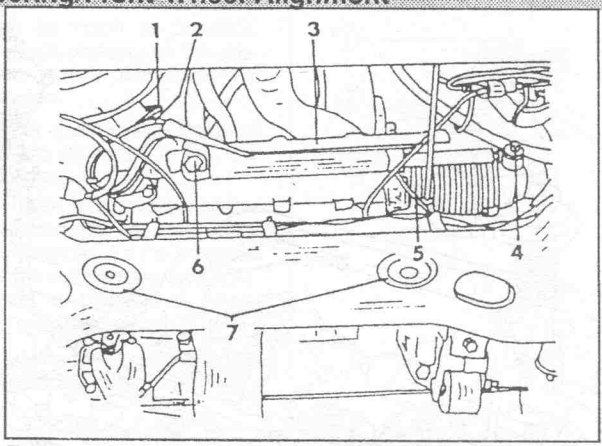


Fig. 5.5. — Details for the removal and installation of the power-assisted steering.

1 Pipe for hydraulic cylinder
2 Pipe for hydraulic cylinder
3 Heat protection panel
4 Mounting bolt (cylinder)
5 Return pipe for overflow
6 Mounting bolt (cylinder)
7 Steering mounting bolts

5.6. Tightening Torque Values

Tightening torque values for the steering are given together with the parts for the front and rear suspensions on Page 164.

6. FRONT AXLE AND SUSPENSION

6.0. Introduction

The front suspension consists of two McPerson struts with a self-levelling, hydropneumatic, independent suspension, consisting of a suspension cylinder for each side of the front axle. The lower end of the spring strut is connected to the swivel hubs by a clamp bolt. The lower suspension arm is connected to the swivel joint by means of a ball joint. The inner ends of the suspension arms are attached to the front crossmember.

A stabiliser or anti-roll bar is connected between the suspension arms and is attached to the underside of the vehicle. The bar diameter is not the same for all models.

Either a standard or a so-called hydractive suspension can be fitted (refer to the new option on page 135). Fig. 6.1 shows the assembled standard suspension.

We would like to point out immediately an important modification to the front subframes and the body shell concerning the mounting (bearings) of the stabiliser.

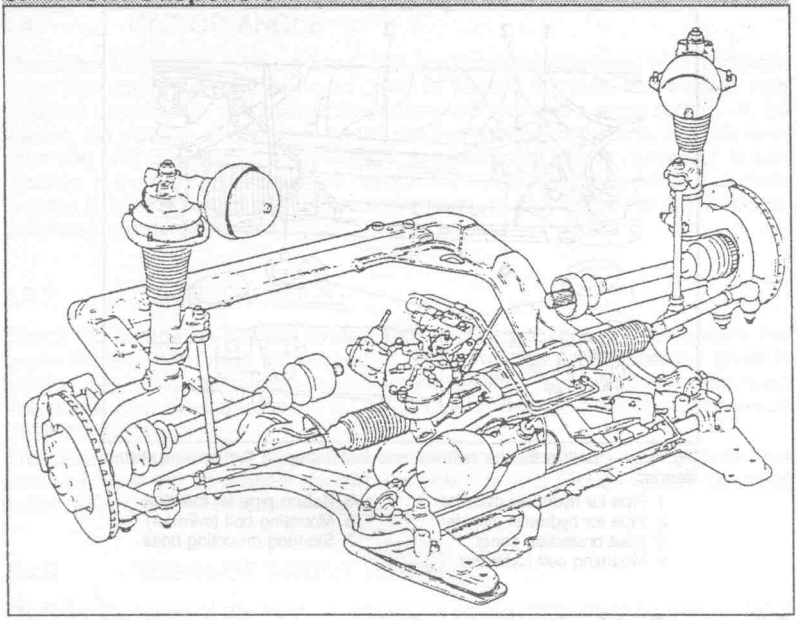


Fig. 6.1. — View of the assembled front axle and front suspension.

The four bolts securing the stabiliser bar bearing to the body have been enlarged from 10 mm to 12 mm. The same applies to the cages nuts in the body shell. The holes in the stabiliser bar bearings have been enlarged accordingly. The large washers previously fitted underneath the bolts (not on all models) are no longer fitted. The tightening torque of the new bolts has been increased. If the bearings for the stabiliser bar are to be replaced at same stage, make sure to obtain the correct parts.

The drive shaft is supported by one single bearing inside the swivel joint. A sectional view of the suspension together with the tightening torque values is shown in Fig. 6.2.

A brief description of the hydractive wheel suspension is given under its own heading. Useful data are given at the end of this section.

6.1. Front Suspension Struts

6.1.0. SUSPENSION SPHERES — REMOVAL AND INSTALLATION

A chain wrench (similar as used for oil filter removal) is required to remove the suspension spheres. Provided that this can be obtained, proceed as follows:

- Place the front end of the vehicle on chassis stands, with the wheels hanging free and remove the wheel on the side in question. Set the height control lever into "low" position; release the pressure by opening the pressure release screw on the pressure regulator (see in Section 8.). To drain the suspension

cylinder as much as possible, place a jack underneath the suspension arm to compress the suspension.

- Place the chain wrench around the sphere, as shown in Fig. 6.3, and unscrew it.

The installation is a reversal of the removal procedure. The seal must always be replaced. Fit the pressure sphere to the suspension and tighten as much as possible by hand. Close the pressure release screw.

Start the engine and set the manual height control lever into the "high" position.

6.1.1. SUSPENSION UNIT REMOVAL AND INSTALLATION

A chain wrench (similar as used for oil filter removal) is required to remove the suspension sphere. Provided that this can be obtained, proceed as follows:

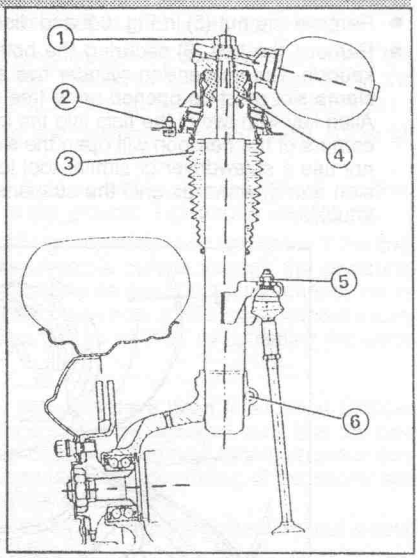


Fig. 6.2. — Sectional view of the front suspension on one side. The numbers refer to the tightening torque values.

1 = 4.5 kgm (32.5 ft.lb.) 4 = Rubber stop
2 = 2.0 kgm (14.5 ft.lb.) 5 = 3.0 kgm (22 ft.lb.)
3 = Rubber sleeve 6 = 5.2 kgm (36.5 ft.lb.)

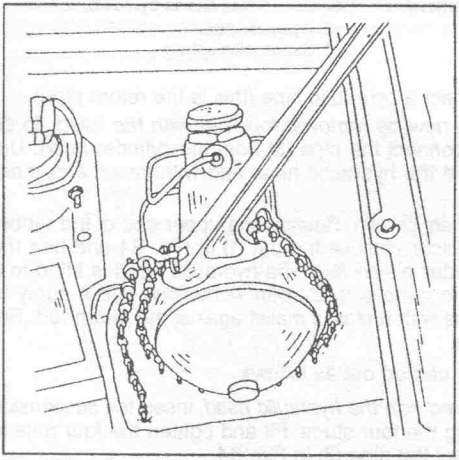


Fig. 6.3. — Remove a suspension sphere with a chain wrench. Tighten the sphere with the hands only.

- Place the front end of the vehicle on chassis stands, with the wheels hanging free and remove the wheel on the side in question. Set the manual height control lever into the "low" position and release the pressure by opening the pressure release screw on the pressure regulator (see also in Section 8.). To drain the suspension cylinder as much as possible, place a jack underneath the suspension arm to compress the suspension.
- Remove the suspension sphere as described in the last section. The suspension unit can now be removed in one of two ways either with or without the suspension cylinder head. Proceed as follows:

- Remove the nut (5) in Fig. 6.2 and disconnect the stabiliser bar linkage.
- Remove the bolt (6) securing the bottom end of the cylinder to the steering knuckle. The suspension cylinder has a tight fit in the steering knuckle and the clamp slot must be opened-up to free the cylinder. To do this, insert an 8 mm Allen key with two of the flats into the clamp slot and rotate the key by 90°. The corners of the hexagon will open the slot far enough to release the tension. Do not use a screwdriver or similar tool to prise the slot apart. Push the suspension arm downwards until the suspension cylinder end is free of the steering knuckle.

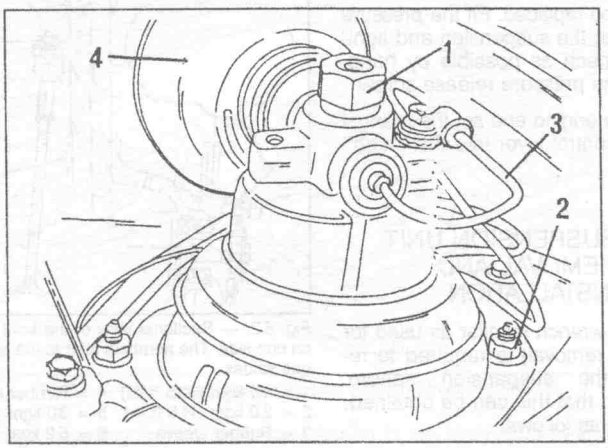


Fig. 6.4. — Details for the removal and installation of suspension cylinders.

1 Nut, 4.5 kgm
2 Nuts, 2.0 kgm
3 Hydraulic pipe
4 Suspension sphere

- Near the rubber boot disconnect a hydraulic pipe (this is the return pipe).
- *The suspension cylinder can now be removed together with the head.* To do this, refer to Fig. 6.4 and disconnect the pipe (3) from the cylinder head. Unscrew the four nuts (2) around the hydraulic head and withdraw the cylinder from below.
- *The cylinder can be removed on its own.* Release the upper end of the rubber boot from underneath the vehicle, remove the nut (1) in Fig. 6.4 and free the hydraulic head from the cylinder piston rod. The hydraulic head is fitted to a cone and it may be difficult to remove it. Citroën workshops use a spray to detach the cone. Try a few taps with a plastic mallet against the piston rod. Remove the cylinder from below.

The installation of the cylinder is carried out as follows:

- *If the cylinder has been removed with the hydraulic head*, insert the suspension cylinder from above, engaging the four studs. Fit and tighten the four nuts to 2.0 kgm (14.5 ft.lb.). Re-connect the pipe (3) in Fig. 6.4.
- *If the cylinder has been removed without the hydraulic head*, check that the rebound stop (item "4", Fig. 6.2) is fitted over the piston rod and lubricate the cone and the sealing area with engine oil. Coat the threads of the piston rod with "Loctite" and insert the cylinder from below. Fit and tighten the nut (1) in

Fig. 6.4 with 4.5 kgm (32.5 ft.lb.). Fit the rubber boot at the upper end.

- With the clamp slot of the steering knuckle opened as described, insert the lower end of the cylinder, with the rib centred in the clamp slot. Push the cylinder fully home and tighten the bolt (6) in Fig. 6.2 to 5.2 kgm (36.5 ft.lb.).
- Re-connect the stabiliser bar linkage and tighten the nut (5) in Fig. 6.2 to 3.0 kgm (22 ft.lb.).
- Re-connect the return pipe, set the height control lever to the "High" position, fit the wheel and lower the vehicle to the ground. Tighten the wheel bolts.
- Start the engine, operate the manual heigt adjusting lever and check if the suspension operates correctly when the lever is moved through the positions. Check all connections for leaks, i.e. moisture on any of the pipe connections indicates a bad seal. Carefully tighten the union nuts a little more, without excessive force. Leaking joints can, however, not be rectified by tightening the union nuts.

Modifications: New front suspension cylinders have been fitted since October 1991. When a cylinder or a sphere support must be replaced, note that the new cylinders can be fitted to existing sphere supports. *The new sphere supports cannot, however, be fitted to the earlier suspension cylinder.* Fitting of the earlier and the later type cylinder on the same vehicle is permitted.

Note for Hydractive Suspension: The pipe (3) in Fig. 6.4 is fitted without a seal. Tighten the connection to 3.3 kgm (22 ft.lb.).

6.2. Front Height Correctors

6.2.0. REMOVAL

Release the hydraulic pressure by opening the drain screw on the pressure regulator and set the manual height control lever into the "low" position.

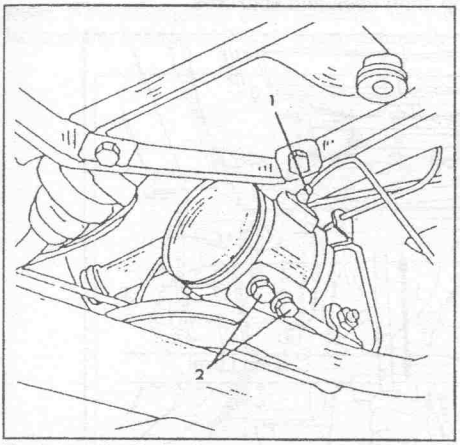


Fig. 6.5. — Details for the removal and installation of a front height corrector.

1. Feed pipe to suspension 2. Mounting bolts

Refer to Figs. 6.5 and 6.6, showing the shape of the height corrector. Disconnect the feed pipe (1) to the front suspension as well as the high pressure feed pipe (4).

Remove the two securing bolts (2) in Fig. 6.5 and swivel the height corrector so that the rubber exhaust pipe (5) and the overflow return pipe (3) can be removed from the height corrector. Withdraw the corrector from its mounting position.

6.2.1. INSTALLATION

Fit the height corrector into the approximate position and re- connect the overflow

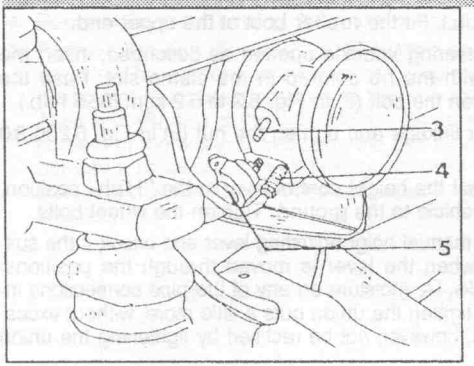


Fig. 6.6. — Details for the removal and installation of a front height corrector.

3 Rubber exhaust hose
4 High pressure pipe
5 Overflow return pipe

return pipe (3) and the rubber exhaust pipe (5) in Fig. 6.6 to the corrector. Tighten the hose clip of the latter. Start the thread of the union nuts of pipes (4) and (1), using new seals, and tighten the nuts as far as possible.

Fit the two mounting bolts and tighten the height corrector in position. Finally tighten the two union nuts fully.

Start the engine and check all connections for leaks. To do this, set the height control lever into the position "High".

6.2.2. CHECKING AND ADJUSTING THE AUTOMATIC HEIGHT CONTROL

If the height corrector has been replaced it is always considered a good practice to check the operation of the automatic height control. Proceed as follows:

- Check the tyre pressures alround and correct if necessary.
- Start the engine, run at idle speed and set the manual height control lever into position "normal driving" and release the handbrake.
- Lift the vehicle as far as possible by hand and release when it is no longer possible to lift it. The vehicle will drop, then rises and stabilises.

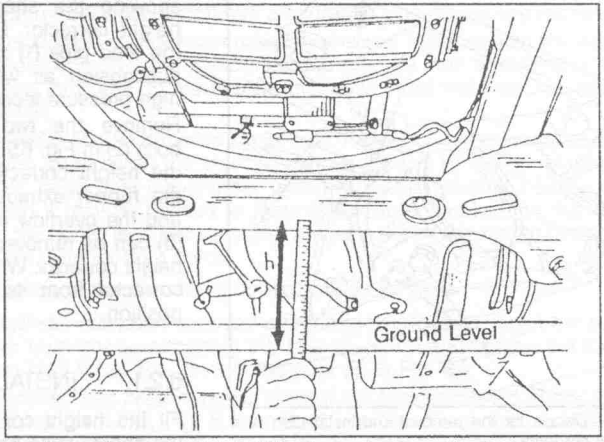


Fig. 6.7. — Measure the height "h" between the ground level and the lower face of the rear crossmember of the front axle.

6. Front Suspension

- Measure the height between the front axle rear crossmember and the surface on which the vehicle is standing. This dimension should be 144 mm in the case of a vehicle with 195/70 tyres (149 mm with 205/60 tyres). The difference is due to the dimensions of the different tyres fitted to the model range. The measurement is carried out as shown in Fig. 6.7.
- Push the vehicle downwards as far as it will go and then release. Measure the height as described above. The two measurements taken will give you the average which must be as given above. A tolerance of +10.0 to —7.0 mm is permissible before any adjustments are necessary.
- If the height is outside the values given, rotate the collar of the height corrector on the anti-roll bar, shown by the arrow in Fig. 6.9. One is situated near the round globe, the other one near the exhaust tube. Retighten the clamps to 1.4 kgm (11 ft.lb.).

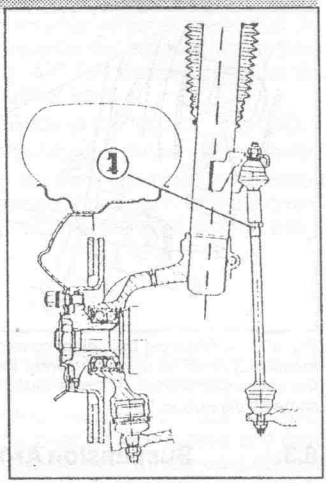


Fig. 6.8. — The nut (1) must be slackened in order to shorten or lengthen the stabiliser linkage.

- Locate the height corrector and check that there is a clearance of 1.0 mm (0.04 in.) between the height corrector ball end and its location in the lever of the height control.
- Check the heights once more. The difference between the two sides must be within minus 2.0 mm to plus 2.0 mm. If necessary adjust the setting by adjusting the adjustable linkage between suspension cylinder and stabiliser bar after slackening the locknut (1) in Fig. 6.8. Tighten the locknut to 3.0 kgm (22 ft.lb.) after the heights have been re-checked.

Note: If the linkage has been replaced, set the length between the two mounting faces of the linkage to 345 ± 5 mm before fitting it.

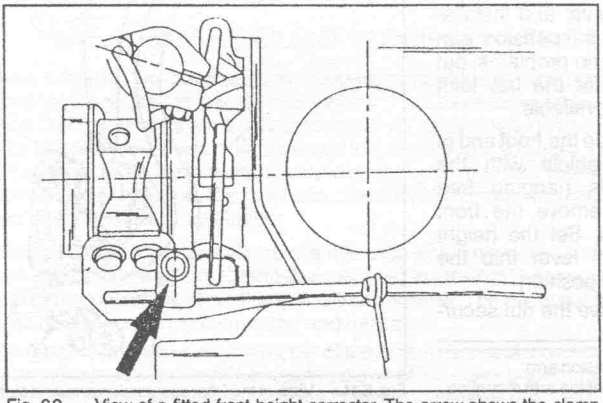


Fig. 6.9. — View of a fitted front height corrector. The arrow shows the clamp for the adjustment of the automatic height control.

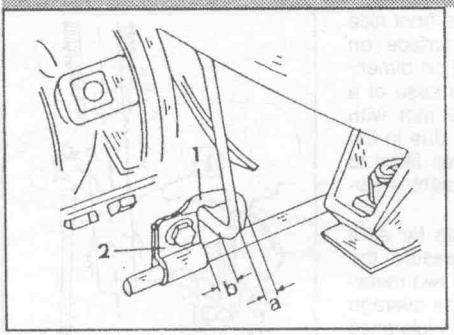


Fig. 6.10. — Adjusting the height corrector linkage. The bracket (2) must be moved ti centre the control rod in the opening of bracket (1). Dimension "a" must be the same as dimension "b".

6.2.3. ADJUSTING THE MANUAL HEIGHT CONTROL

The automatic height control must be adjusted as described above. Start the engine and set the manual control lever into the "normal driving" position.

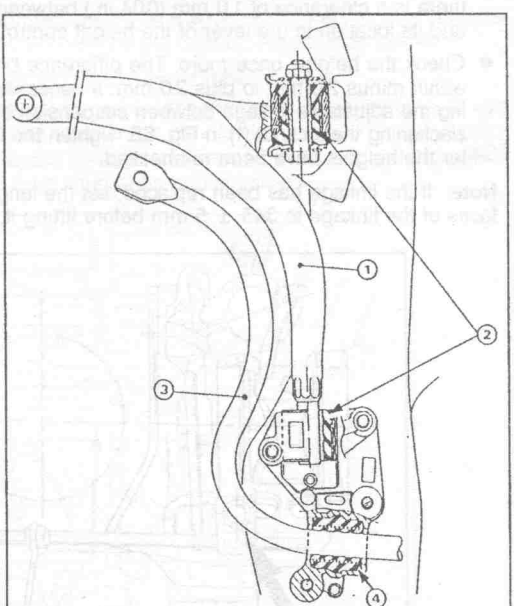
Refer to Fig. 6.10 and move the bracket (2) until the corrector control rod is in the centre of the elongated opening (1). Re-tighten the bolt. The distance "a" in the illustration must be the same as distance 'b'.

6.3. Suspension Arms

6.3.0. REMOVAL

The L.H. and R.H. suspension arms are mounted in flexible rubber bushes on the subframe. The front of each arm is secured by a single bolt and nut; the rear of the suspension arms are secured by a bearing cap, secured by two bolts. The outer end of the arms is connected to the steering knuckle (swivel joint) by means of a ball joint. Fig. 6.11 shows the attachment of a suspension arm together with the stabiliser bar (3) and the stabiliser bar bearing (4). The removal and installation of a suspension arm presents no problems, but a puller for the ball joint must be available.

- Jack up the front end of the vehicle with the wheels hanging free and remove the front wheel. Set the height control lever into the "low" position.
- Remove the nut secur-



1 Suspension arm
2 Suspension arm mounting
3 Stabiliser bar
4 Stabiliser bar bearing

Fig. 6.11. — View of the front suspension arm and stabiliser bar attachments see from below.

ing the ball joint to the bottom of the steering knuckle as far as the end of the thread and using a suitable ball joint puller separate the ball joint shank from the steering knuckle as already shown in Fig. 4.2. The illustration shows the special puller. Take care not to damage the rubber boot.

- Remove the nuts securing the anti-roll bar linkage at the top ("5", Fig. 6.2).
- Remove the bearing cap securing the rear end of the suspension arm (2 bolts).
- Remove the bolt (pivot pin) and nut securing the front end of the suspension arm and carfully drive the pivot pin out of the suspension arm and the cross-member bracket. Move the arm to and fro to remove the pivot pin if it has a tight fit. Lift out the suspension arm.

6.3.1. INSTALLATION

The nuts for the arm pivot pin, the suspension ball joint and the stabiliser bar linkage are self-locking and must always be replaced. Proceed as follows:

- Insert the suspension arm into the front bearing bracket and place the other end into the rear bearing bracket. Lubricate the pivot pin with grease and drive the bolt in position, from the inside towards the outside. Fit the new nut and tighten it finger-tight.
- Fit the rear bearing cap with the two bolts. Hand-tighten the bolts.
- Align the arm in horizontal position and tighten the mountings. First tighten the nut of the front pivot bolt to 8.5 kgm (62 ft.lb.) and then tighten the two bolts securing the rear bearing cap to 3.5 kgm (26 ft.lb.). The two latter bolts must be tightened in turn until the torque is reached.
- Clean the ball joint shank of grease or oil and insert the ball joint into the steering knuckle. Fit the new nut and tighten to 4.0 kgm (22 ft.lb.).
- Re-connect the stabiliser bar link with the attachment parts to the suspension cylinder and fit the new nut. Tighten the nut to 3.0 kgm (21 ft.lb.). The torque will tension the rubber parts for their operating condition.
- Refit the wheel and lower the vehicle onto the ground and tighten the wheel bolts. Set the height control lever to the "Normal" drive position.

6.3.2. REPLACING THE SILENT BLOCK MOUNTINGS

A single bush is fitted to the rear mounting, a two-piece bush to the front mounting. Normally special tools are used to replace the bushes. If you have removed a suspension arm and find that the bushes require replacement we recommend to remove the second arm as well and have the bushes replaced in a workshop. If you have, however, an assortment of press tools, pullers, etc. at your disposal, you may try it yourself. The following information will help you. We must add, that the bushes must be refitted to a predetermined position during installation:

- The two-piece front bush as a flange at either side which must be removed before the bush can be pressed out. Clamp the suspension arm into a vice and cut off the flange at either side of the mounting eye with a hacksaw. The press out the remainder of the bush or use a good mandrel and hammer.
- The rear bush is pressed over a pivot pin of the arm. The use of a two- or three-arm universal puller would do the job. Place the claws of the puller underneath the bush and screw the centre spindle against the pivot pin to remove the bush.
- First fit the rear bush under a press. Carry out the press operation slowly to ob-

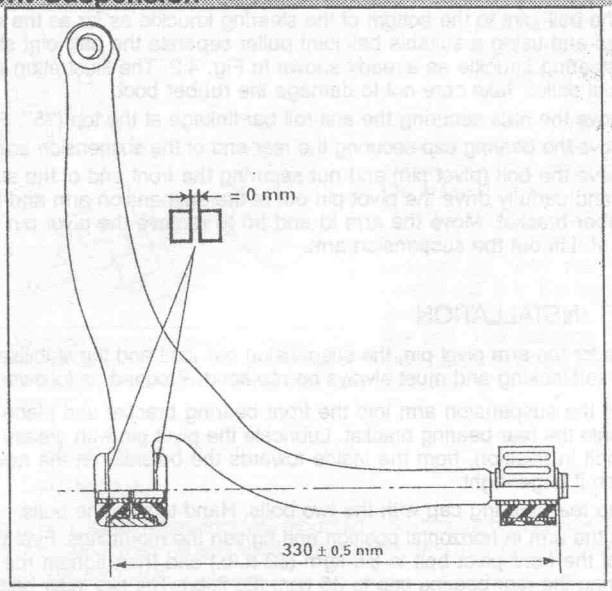


Fig. 6.12. — The suspension arm bushes must be fitted in accordance with the dimension shown. The flanges of the front bush halves must be pressed tight against the mounting eye of the arm.

tain the dimension shown in Fig. 6.12. Measure from the end face of the front suspension arm mounting eye to the end face of the fitted bush. Use a metric steel tape to measure. Coating the inside of the bush with soapy water will help installation.

- The two halves of the front bush should be pulled in position. Push the first bush half in by hand as far as possible, place a washer over the bush end and another washer over the arm mounting eye on the other side and pull the bush in position, using a long bolt and a nut. Two sockets of suitable diameter, with the large side facing the bush flange, will also do the job. Tighten the nut until the bush flange is fully against the suspension arm. Important is not to damage the bush during installation. Remove the nut, bolt and washers (sockets) and fit the other bush half in the same manner from the other side. Again the use of soapy water will facilitate the installation.

6.4. Steering Knuckle

6.4.0. REMOVAL

- Jack up the front end of the vehicle, with the wheels hanging free and remove the wheel on the side in question.
- Open the pressure regulator bleed screw (See Section 8) and set the manual height control lever into the "low" position.
- Release the handbrake but make sure the vehicle is adequately secured against movement.

- Remove the front wheel.
- Locate the cable connectors for the brake pad wear indicators and disconnect them.
- Remove the securing clip and the nut lock from the drive shaft nut and slacken the nut with a 35 mm socket. Counterhold the wheel hub in suitable manner; for example screw in two of the wheel bolts and insert a bar between the two bolt. Screw the bolts in as far as possible so that the bar can rest against the bolt heads, not against the threads.
- Referring to Fig. 6.13 remove the bolts (1) securing the brake hose bracket. If the vehicle is fitted with ABS you will find a screw (2) which secures the wheel speed sensor. Remove the screw and take out the sensor. Protect the sensor against contamination or damage. Also remove the protector (3).
- Disconnect the handbrake cable from the brake caliper and remove the brake caliper cylinder as described in section "Brakes". Lift off the brake caliper cylinder and tie it with a piece of wire to the front suspension to prevent it from hanging down on the brake hose. The brake caliper mounting bracket must also be removed as it straddles the brake disc. The two mounting bracket bolts are located at the inside, one at the top and one at the bottom. First remove the two brake pads (mark their position).

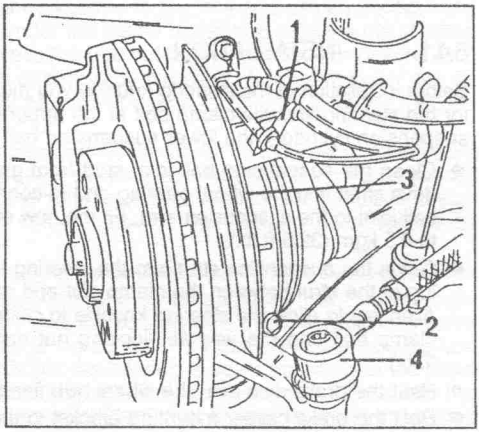


Fig. 6.13. — View of the fitted steering knuckle (with ABS).
1 Brake hose bracket
2 Speed sensor screw
3 Protection panel
4 Track rod ball joint

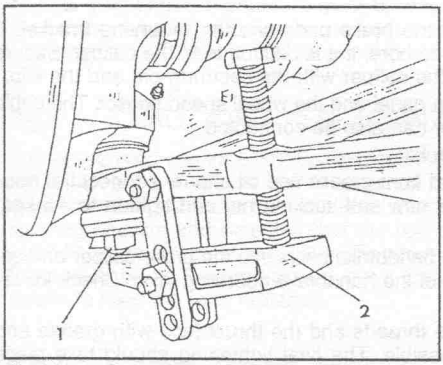


Fig. 6.14. — Separating the suspension ball joint from the steering knuckle. Leave the nut (1) in position when using the puller (2).

- Remove the two brake disc from the hub flange.
- Undo the ball joint nut and screw it to the end of the thread. Use a suitable ball joint puller, as shown in Fig. 6.14, and separate the ball joint connection from the steering knuckle. Take care not to damage the rubber boot.
- Disconnect the track rod ball joint in a similar manner from the steering lever, again taking care not to damage the rubber boot.

- Pull the steering knuckle towards the outside until the end of the drive shaft is free of the steering knuckle.
- Remove the clamp bolt and nut connecting the suspension strut to the steering knuckle. Insert a strong screwdriver carefully into the slot and pry the slot apart until the steering knuckle can be withdrawn downwards and out of the suspension strut. Otherwise insert an angles 8 mm Allen key with the flats into the slots and rotate the allen key by 90°. The corners of the hexagon will open the slot sufficiently enough to free the steering knuckle.

6.4.1. INSTALLATION

Before installation of the steering knuckle you must purchase new self-locking nuts for the steering knuckle clamp bolt at the upper end (where it is connected to the suspension cylinder), the lower suspension ball joint and the track rod ball joint.

- Clean the suspension ball joint stud from grease or oil, insert the end of the drive shaft into the wheel bearing and re-connect the steering knuckle with the ball joint to the suspension arm. Fit the new self-locking nut and tighten the nut to 4.5 kgm (32.5 ft.lb.).
- Guide the suspension strut into the steering knuckle to its stop, with the guide lug of the strut between the clamp slot and release the screwdriver or turn the Allen key to allow the steering knuckle to clamp the suspension cylinder. Fit the clamp bolt and the new self-locking nut and tighten the nut to 5.2 kgm (37 ft.lb.).
- Refit the brake disc over the wheel hub flange.
- Refit the brake caliper mounting bracket to the steering knuckle. The two bolts are tightened to 10.5 kgm (76 ft.lb.). You must use a socket and torque wrench for this operation. Fit the two brake pads in accordance with the marks made before removal. **Do not interchange the brake pads if all four have been removed).**
- Position the brake caliper over the brake pads and the mounting bracket. If necessary push the piston into its bore, if it is difficult to fit the caliper. Secure the lower end of the caliper of the caliper with the securing pin and the clip.
- If ABS is fitted refit the protection panel and the wheel speed sensor. The cable for the brake pad wear indicator can also be connected.
- Fit the brake hose retaining bracket.
- Clean the track rod ball joint stud from grease and oil and re- connect the track rod to the steering lever. Use a new self- locking nut and tighten to 4.5 kgm (32.5 ft.lb.).
- Guide the rubber gaiter and the handbrake cable into the brake caliper and engage the cable end into the eye of the handbrake operating lever. Check for secure attachment.
- Fit the drive shaft nut. Coat the threads and the thrust face with grease and tighten the nut as much as possible. The final tightening should take place when the wheel is back on the ground.
- Lower the vehicle onto its wheels and tighten the wheel nuts to 9.0 kgm (65 ft.lb.). The drive shaft nut must now be tightened. The tightening torque is 32.0 kgm (231 ft.lb.). Lock the placing the nut lock over the drive shaft nut and secure the nut lock by inserting the securing clip into nut lock and drive shaft.
- Re-tighten the bleed screw of the pressure indicator. Check the operation of the brake system before driving off.

6.4.2. REPLACEMENT OF WHEEL BEARINGS

The wheel bearing cannot be replaced with the steering knuckle fitted to the vehicle, i.e. the steering knuckle must be removed as described above and then removed in a vice. Proceed as follows:

- Clamp the steering knuckle into a vice and remove the large bearing circlip from the rear of the steering knuckle.
- Remove the wheel hub from the steering knuckle. There are two possibilities of doing it. Either leave the steering knuckle in the vice and use an impact hammer with a suitable adaptor under the inside of the hub or place the steering knuckle under a press and press the hub out of the knuckle. The bearing race will remain on the wheel hub and must be removed. A two-arm puller can be used, the claws of which must be thin enough to be inserted between the race and the hub flange.
- Use a suitable mandrel and press or drive the wheel bearing out of the steering knuckle. As the removal takes place from the outside towards the inside you will have to place a suitable piece of tube underneath the steering knuckle to support it during the removal. Once removed, the bearing must always be replaced.
- Thoroughly clean the wheel hub flange and the inside of the steering knuckle.
- To refit the new bearing, a piece of tube of the same diameter as the outer bearing race should be used. Press the bearing race into the steering knuckle, this time from the inside towards the outside. The outside of the bearing race must be free of grease. Check that the bearing is seated properly in the steering knuckle and secure the assembly with the retaining circlip. If the circlip has been bent during removal, replace it. Check that the circlip enters the groove on the entire circumference.
- Fit the wheel hub to the bearing under a press. To do this, place the hub flange onto the press table and press the steeringt knuckle/bearing assembly over the hub. This time the pressure must be applied to the inner bearing race, i.e. a suitable tube must be used as press mandrel. The steering knuckle is now ready to be refitted to the suspension strut.

6.4.3. BALL JOINT REPLACEMENT

The suspension ball joint can be replaced individually without replacing the steering knuckle. As a special tool is required to remove and refit the ball joint we recommend to have the joint replaced in a workshop. If you have removed the steering knuckle and detected that the ball joint has excessive clearance (there must be a certain amount of stiffness when the shank is moved to and fro and there must be no "up-and-down" play), take the removed steering knuckle to a dealer to have the joint replaced.

6.5. Front Anti-roll Bar

6.5.0. REMOVAL AND INSTALLATION

- Jack up the front of the vehicle with the wheels hanging free and place stands underneath the sides of the body. Remove the wheels.
- Open the pressure regulator drain plug to release the hydraulic pressure.
- Remove the anti-roll bar links by unscrewing the nuts at the upper ends.

- Set the manual height control lever to the "low" position.
- Tie a piece of strong string to one of the wheel bolts (screw it into the hub), lift up the steering knuckle as far as possible (place a jack underneath the assembly) and tie the other end of the string to a suitable point in the engine compartment to keep the steering knuckle as high as possible. Take care that the string cannot damage the paint work of the wings by placing a thick rag between wing and string. Carry out this operation on both sides of the vehicle.
- Set the manual height control lever into the "normal running" position.
- Loosen the collar of the automatic control on the anti-roll bar and disconnect it from the height corrector.
- Slacken the clamp collars on the anti-roll bar.
- Remove the nuts securing the stabiliser bar linkages at the top and bottom and remove the mounting parts and the linkages.
- Remove the bolt securing the bearings (4) in Fig. 6.11 on the sub-frame and remove the parts of the anti-roll bar.
- Guide the anti-roll bar out of the vehicle. It may take a few tries to remove it.

The installation of the anti-roll bar is a reversal of the removal procedure, but the following points should be noted:

- The diameter of the anti-roll bar is not the same on all vehicles. Check against the model and chassis number.
- Refer to Page 134 and check on the modification of the stabiliser bar bearings. Originally 10 mm bolts without washers were fitted. These are tightened to 4.5 kgm (32.5 ft.lb.). During some stage of production 10 mm bolts with washers were used. Tighten these bolts to 8.0 kgm (58 ft.lb.). From approx. Sept. 1991 new 12 mm bolts are used, together with the other modifictions given on Page 134. The bolts are fitted without washer and tightened to 11.0 kgm (80 ft.lb.).
- Refit the linkages at the top and bottom. The nuts are tightened to 3.0 kgm (22 ft.lb.).
- Refit the wheels, lower the vehicle onto the ground and tighten the wheel nuts.

6.6. Hydractive Suspension

We will mention the hydromatic suspension just briefly, mainly for those owners who bought their XM second-hand and sometimes have not the necessary information. Since model year 1995 the "Hydractive 2" suspension is fitted, a brief description of which will also be given.

In order to adapt to the varying road conditions, the suspension is controlled by a computer. The computer evaluates the information from a number of sensors to monitor the actions of the driver and analyses the reactions of the suspension. As you will know there are two settings, AUTO and SPORT. In the automatic (AUTO) position the vehicle will alternate between the *SOFT* state, i.e. soft springing and damping and the *FIRM* state, stiff springing and increased damping, giving optimum roadholding and safety. The *FIRM* state can be selected by a switch. Mechanically a third sphere and two dampers are added to the hydraulic circuit of each axle, resulting in the softer springing and damping. The whole operation is controlled by an electro-magnetic valve, overseen by the computer. The valve is fitted to a bracket on the R.H. rear section on the front subframe. These are some of the hydraulic components. A layout diagram of the system is shown in Fig. 6.15. The following component parts are connected to the electrical system:

6. Front Suspension

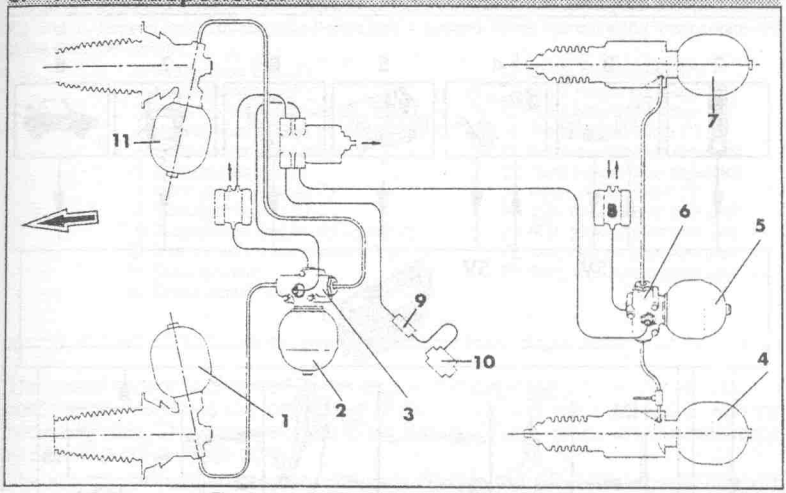


Fig. 6.15. — Layout of the Hydractive system.

1 L.H. front suspension unit
2 Additional sphere, front
3 Front stiffness regulator
4 L.H. rear suspension unit
5 Additional sphere, rear
6 Rear stiffness regulator
7 R.H. rear suspension unit
8 Rear height regulator
9 Filter
10 Safety valve
11 R.H. front suspension sphere

The electronic control unit is manufactured by Valeo and is fitted in a ventilated housing on the R.H. wheel arch in the engine compartment. The E.C.U. controls the electrical supply to the solenoid valve in response to the information received from the various sensors and, of course, from the mode switch. Sensors supply information about steering movement and steering angle, vehicle speed, accelerator pedal movement, brake pressure and body movement.

The mode switch next to the gearchange lever can be switched into the "Sport" mode at speeds above 18 mp/h. This will be indicated by a warning light above the revolution counter. The "Auto" mode will bring the system into the "soft ride" mode, but will change between "soft" and "firm" in accordance with information received from the sensors.

You will, of course, know about the function of the warning light in the top L.H. corner of the instrument panel.

Some information of the various sensors many of you won't know. Ignore, if you know how your Hydractive system operates:

The *steering movement and angle sensor* is fitted close to the steering wheel. The steering angle is compared to the max. permitted speed. If at certain speeds the steering angle exceeds a predetermined value, the suspension will be switched into the "Firm" mode. When the steering wheel is returned, the system switches back into the "Soft" mode. A similar principle applies to the rotational speed of the steering wheel. If the rotational speed exceeds a certain degree value per second, the system is switched to the "Firm" mode. The system is switched back to the "soft" mode, if the rotational speed is reduced, even if the same road speed is retained.

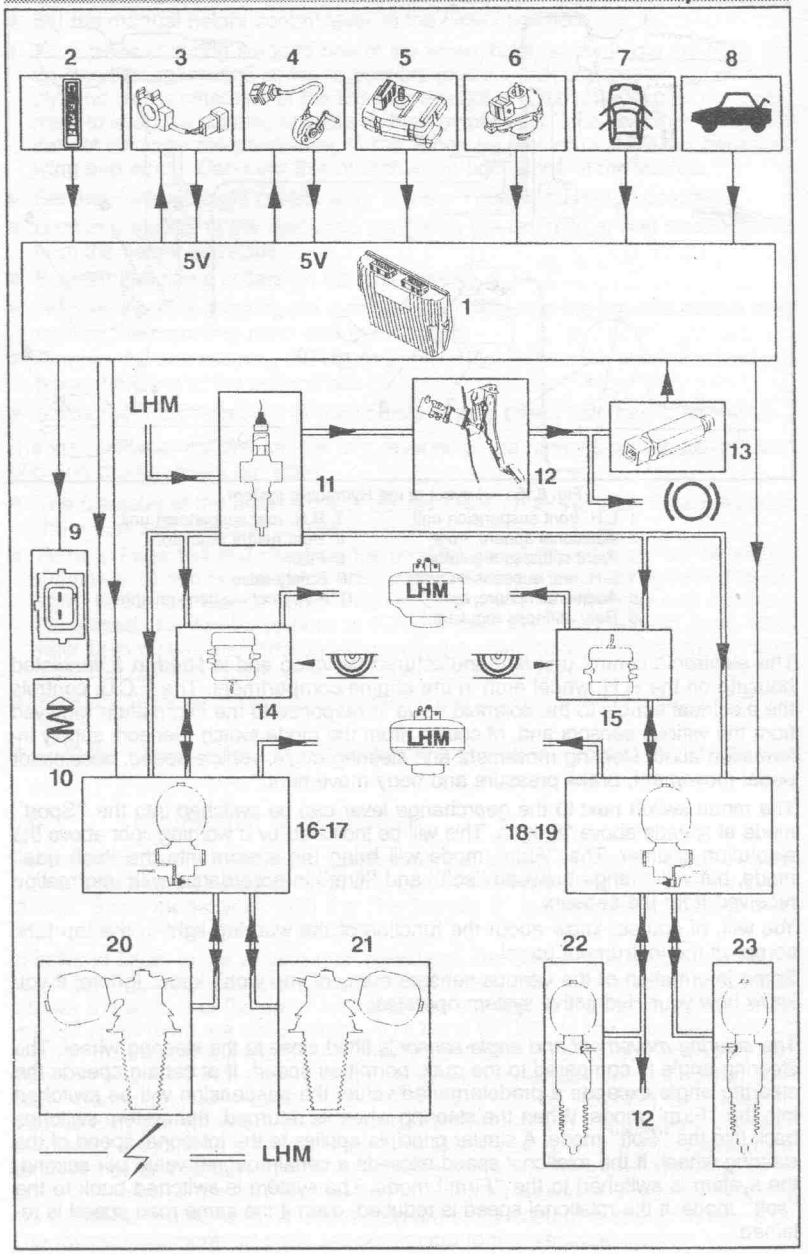

2
3
4
5
6
7
8
5V
5V
1
LHM
11
12
13
9
LHM
14
15
LHM
10
16-17
18-19
20
21
22
23
12
LHM

Fig. 6.16. — Legend for circuit diagram (Hydractive II system). Items marked with (*) are connected to the electrical system.

1 Suspension ECU (*)
2 Suspension switch (*)
3 Steering wheel sensor (*)
4 Acceleration sensor (*)
5 Body movement sensor (*)
6 Distance sensor (*)
7 Door pillar switches (*)
8 Boot light switch (*)
9 Suspension diagnostic socket (*)
10 Instrument cluster (warning light *)
11 Security valve
12 Brake control valve
13 Brake pressure switch
14 Front height corrector
15 Rear height corrector
16 Front electro valve (*)
17 Front suspension regulator
18 Rear suspension regulator
19 Rear electro valve (*)
20 L.H. front suspension unit
21 R.H. front suspension unit
22 L.H. rear suspension unit
23 R.H. rear suspension unit

The *speed sensor* is mounted in the engine compartment on the transmission. It continuously monitores the road speed of the vehicle and feeds the E.C.U. with the necessary data. The suspension switches into the "Firm" mode when acceleration or deceleration exceeds 0.3 g.

The *accelerator pedal movement sensor* is fitted to the accelerator pedal support. The sensor works on a principle of time delay during the depressing of the pedal and switches the system into the "Firm" or "Soft" mode accordingly.

The *brake pressure sensor* is fitted to the L.H. front of the subframe. If the road speed is greater than 18 m.p.h. and the pressure on the brake pedal exceeds 35 bars, the system will switch into the "Firm" mode.

The *body movement sensor* is mounted on a bracket fitted to the R.H. side of the front subframe. The sensor responds to the inclination of the body and to the speed at which the inclination takes place. The sensor operates via the movement of the stabiliser bar.

6.6.0. HYDRACTIVE 2 SUSPENSION

Compared to the earlier suspension, the following modifications have been carried out. Fig. 6.16 shows a diagram of the system.

- The hydractive suspension Mk. 1 has an automatic suspension and a sport suspension (switch marked AUTO and SPORT). The Mk. 2 suspension has a normal suspension and a sport suspension (switch marked NORM and SPORT). On the suspension Mk. 1, the change-over from the "soft" to the "firm" state takes place automatically.
- On the earlier version, one electro-valve controls the "soft"/"firm" states. The later version has 2 stiffness regulators with integrated electro-valve.
- The earlier version has two stiffness regulators, one for the front and one for the rear. The electro-valves of the later version are operated simultaneously.
- The steering wheel sensor mentioned in the previous section is made-up of two parts. A single-piece sensor is fitted to the later suspension.

The suspension has two stiffness states and two damping states (soft/firm). The suspension mode changes are controlled by the following elements: steering wheel angle, steering wheel speed, braking, accelerator pedal position and the vertical movement of the body. The setting of the sensors are continuously compared with pre-set values (parameters) which vary with the vehicle speed.

As soon as a parameter value exceeds the threshold, a change to the "firm mode"

occurs. The suspension will return to the "soft mode" when the parameter value is once more lower than the threshold and after a delay.

The brain of the system is an electronic control unit (ECU). It is connected to the system by means of two 15-pin connectors (black and white colour). The ECU controls the two electro-valves, which in turn switch the suspension from the "firm" to the "soft" state and vice versa. The ECU also monitors the components of the system: sensors, actuating motors, electronic connections, suspension ECU, supply system and the functional operation of the system. A fault detection program inside the unit will store in memory any defects developed so that they can easily be diagnosed with the necessary equipment. If a fault exists in the system, the warning light will illuminate for 3 seconds every time the ignition is switched on. If the vehicle is operated with the fault in the system, the light will "flash" for 3 seconds and each time the ignition is switched on.

The suspension switch in the vehicle enables to choose between the "normal" position (NORM) and the "Sport" position (SPORT). The switch is closed in the "Normal" position and open in the "Sport" position. The warning light indicates the following conditions:

- With the switch set to the "Normal" position, the warning light does not illuminate.
- If the side and tail lamp are switched on, the warning light is slightly illuminated.
- With the switch set to the "Sport" position, the warning light is illuminated.

The *vehicle speed sensor* informs the ECU of the vehicle speed.

The *steering wheel angle sensor* is operated by the steering column. Having evaluated and processed a signal by the ECU, it will perform the following:

- It determines the direction of the steering wheel rotation.
- It calculates the rotational speed of the steering wheel.
- It determines the straight-ahead position, if the vehicle speed exceeds 18 mph.
- It calculates the angular position of the steering wheel in relation to the straight-ahead position.
- Compares the detected value with the vahicle speed.
- Gives instructions, if the conditions are right, to change the suspension system to the "firm" mode.

The suspension switch-over to the "firm" mode is achieved by comparing:

- the steering wheel rotational speed in relation to the vehicle speed.
- the rotational angle of the steering wheel in relation to the vehicle speed.

The *acceleration sensor* consists of a potentiometer, linked mechanically to the accelerator pedal. The voltage supplied to the sensor is converted in accordance with the position of the pedal. Having processed the signal, the ECU will do the following:

- determines the pedal depressed and released speed.
- compares the value detected with the speed of the vehicle.
- Gives instructions, if the conditions are right, to change the suspension system to the "firm" mode.

The switch-over of the suspension is achieved by comparing:

- the accelerator pedal depressed speed in relation to the speed of the vehicle.

- the accelerator released speed in relation to the speed of the vehicle.

The *body movement sensor* consists of a crown wheel with 45 teeth and an electronic sensor. The sensor is mounted to the front subframe, to the right of the front heigt corrector. The sensor operates via the movement of the stabiliser bar (anti-roll bar). Having supplied a signal to the ECU, the latter will do the following:

- determines the direction of rotation of the crown wheel.
- calculates the vehicle speed.
- determines the average height and re-adjusts it.
- compares the value detected with the speed of the vehicle.
- Gives instructions, if the conditions are right, to change the suspension system to the "firm" mode. The suspension switch-over to the "firm" mode is achieved by comparing the movement value with the vehicle speed. The electronics will correct the system if one of the road wheels (rims) are damaged or a poor road face is encountered.

The *brake pressure switch* is hydraulically linked with the brake pedal. The ECU advises the suspension to change to "firm" state when the vehicle speed exceeds 15 mph and the pressure in the brake system is above 3 bars.

The *door and boot switches* are fitted to prevent jolting of the vehicle when one of the doors are open. The ECU supplies the electro valves with a signal, thus inducing "soft" state.

Fig. 6.17 shows the layout of the hydraulic components of the hydractive system. The item numbers are the same as given above. Following is a short description:

- The two suspension electro valves (16) and (19) are controlled simultaneously by the ECU. They supply the suspension regulators (17) and (18) with LHM fluid.
- If the electro valve is energised, the ECU controls the operation of the electro valve and the suspension regulator is at supply pressure.
- If the eklectro valve is at the rest position, the ECU does not control the operation of the electro valve and the suspension regulator is linked with the hydraulic fluid reservoir. Both valves are identical.

The *suspension regulators (17) and (18)* modify the state of the suspension according to the "firm" or "soft" state imposed by the electro valves (16) and (19) and in accordance to the height correctors (14) and (15) which adjust the body height in relation to the ground. Front and rear regulator and electro valve assemblies are identical. The pneumatic units are different.

The hydractive suspension comprises 6 spheres. Each suspension unit has one pnuematic unit, each suspension regulator has one pneumatic unit. Two dampers are incorporated in each regulator. The suspension units operate in a different manner, depending if "soft" state or "firm" state is present. Without going into full detail, the following will occur:

- When the electro valves are supplied, the suspension switches to the "soft" mode. In this condition the additonal suspension sphere is connected. In condition "soft damping" the fluid circulates in the two dampers inside the regulators. A further condition, referred to as "soft anti-roll" the two suspension units are linked.
- When the electro valves are not supplied, the suspension switches to the "firm" state. The additional sphere is islotated, the dampers are isolated and there is no connection between the suspension units.

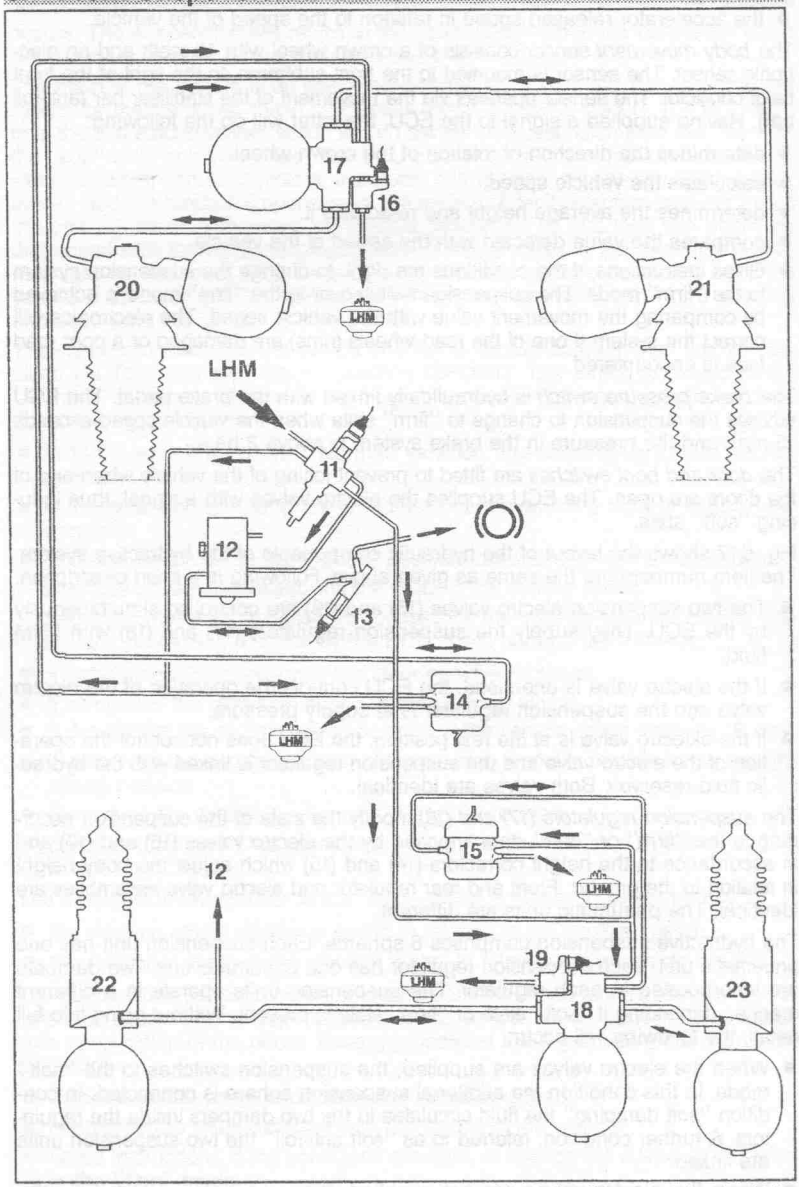


Fig. 6.17. — The connection of the various component parts of the hydraulic system belonging to the hydractive II suspension system. The item numbers are the same as given on Page 149.

6.6.1. ADDITIONAL REPAIRS ON THE SYSTEM

Apart from the front stiffness regulator and the solenoid valve the suspension is constructed in a similar manner as the standard suspension.

The stiffness regulator can be recognised by the sphere fitted to it. The vehicle must be placed on stands to reach the assembly fitted with a bracket to the L.H. front subframe. The hydraulic system must be depressurised before the regulator can be removed. Four pipes are connected to the regulator. Find the union nuts and slacken them, without unscrewing them at this stage. Remove the three nuts from the bracket and one bolt and then unscrew the pipe union nuts. Note that two pipes have a seal which must always be replaced. The sphere can be unscrewed from the regulator. The seal between the two parts must also be replaced. The hydraulic pipes are located in plastic clips and must be secured after installation of the regulator. **A new regulator is fitted after February 1993 to the original system.**

Fit the regulator with the three studs to the bracket and first attach the pipes, using the new seals where necessary. Do not tighten the union nuts at this stage.

Tighten the three nuts securing the regulator to the bracket and then tighten the pipe connections. The connection of the large pipe routed around the crossmember and the one opposite on the other side are tightened to 3.0 kgm (22 ft.lb.), the two other ones to 0.8 kgm (6.5 ft.lb.). Fit the securing screw on the crossmember. Push the hydraulic pipes into their plastic clips.

Refit the sphere with a new seal and tighten it hand-tight. Finally close the bleed screw to re-pressurise the hydraulic system.

The solenoid (electro-valve) is located on a bracket on the R.H. rear section of the front subframe. Cables and pipes must be disconnected before the valve can be removed.

6.7. SC/MAC System

The above system ensures that the vehicle maintains a constant ground clearance, i.e. it limits the sinking of the of the suspension when the vehicle is stationary, with the engine is switched off. The system can be fitted to vehicles with and without hydractive suspension. The following additional parts are fitted to the vehicle:

To the front suspension:

- a SC/MAC valve. The valve is located at the R.H. front of the vehicle, on a bracket mounted at the rear of the subframe.
- a height corrector
- two suspension cylinders
- an electro valve/regulator assembly for the hydractive suspension.

To the rear suspension:

- a SC/MAC valve. The valve is located on the rear axle crossmember.
- a SC/MAC sphere. The sphere is located at the L.H. rear of the vehicle, on the rear axle crossmember. The sphere has a capacity of 400 c.c. and a pressure of 50 bars.
- a height corrector
- two suspension cylinders
- an electro valve/regulator assembly for the hydractive suspension.

Also modified is the hydraulic supply circuit. A so-called 6+2 piston high pressure pump is fitted instead of a 5-piston, distributing the hydraulic fluid to the steering

and suspension/braking circuit. A security valve is fitted, ensuring that the front brake circuit is fed first. The flow distributor has been deleted.

There is a special procedure to de-pressurise the system, depending if the engine is running or not running. As the special test bench and an adaptor is required to de-pressurise the system when the engine is stationary, only the instruction with the engine running is given:

- With the preasure regulator bleed screw tightened, start the engine.
- Set the height control to the low position in order to empty the suspension units.
- Wait for a while until the vehicle is in the lowest position and then unscrew the pressuere regulator bleed screw by one turn.

6.8. Useful Data

Gas pressure in front suspension spheres (see Fig. 6.18):

Saloons — Without hydractive suspension (1):	70 bar (+5/—25 bar)
Saloons, Diesel — With hydractive suspension (1):	55 bar (+5/—20 bar)
Saloons, Turbodiesel — With hydractive suspension (1):	50 bar (+5/—20 bar)
Estate models — Without hydractive suspension (1):	75 bar (+5/—25 bar)
Estate models — With hydractive suspension (1):	50 bar (+5/—20 bar)
Gas pressure in central sphere (hydractive suspension — 2):	70 bar (+5/—25 bar)

Gas pressure in rear suspension spheres (see Fig. 6.18):

All models, without hydractive suspension (4):	40 bar (+5/—15 bar)

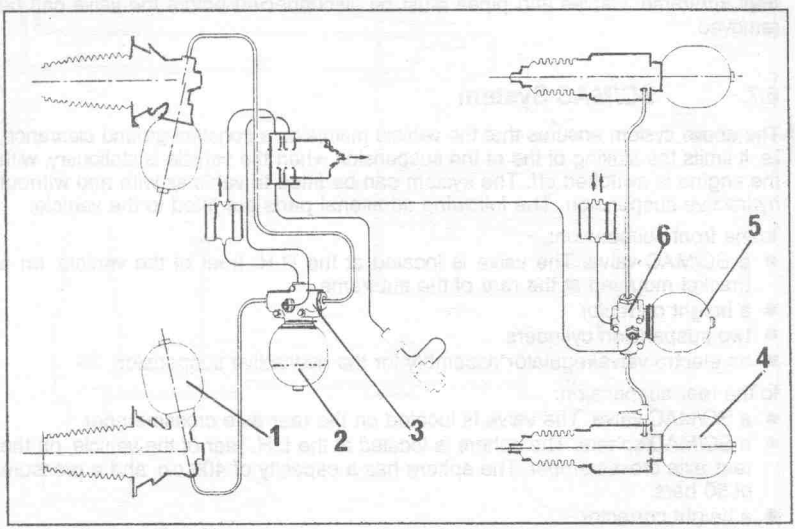


Fig. 6.18. Layout of the different suspension spheres with hydractive suspension. Models with standard suspension only have spheres (1) and (4).

1 Front suspension sphere
2 Front central sphere
3 Front stiffness regulator
4 Rear suspension sphere
5 Rear central sphere
6 Rear stiffness regulator

Saloons, all diesel models (4):	30 bar (+5/—10 bar)
Estates, all diesel models (4):	40 bar (+5/-15 bar)
Central sphere — Saloons (5):	50 bar (+5/—20 bar)
— Estates (5):	40 bar (+5/—15 bar)

Filling capacity of Suspension Spheres:	
Suspension spheres — All models:	400 c.c.
Central (additional sphere) — Front:	70 bar (+5/—25 bar)
— Rear — Saloon:	50 bar (+5/—20 bar)
Central (additional sphere) — Rear — Estates:	40 bar (+5/—15 bar)

Filling capacity of central (additional) sphere:	
Front:	500 c.c.
Rear — Saloons:	400 c.c.
— Estates:	500 c.c.

Diameter of piston rod — Front:	22.0 mm, 25,0 mm from 1995
Diameter of piston rod — Rear — Saloons:	35.0 mm
— Rear — Saloons from 1995:	37.0 mm
— Rear — Estates:	42,5 mm
Suspension unit diameter, all models:	40.0 mm

Anti-roll Bar Diameter, Front:	
Standard diesel models, Saloon:	23 mm
Turbo diesel models, Saloons:	24.0 mm
All Estate models:	25.0 mm

Anti-roll Bar Diameter, Rear:	
Standard diesel models to May 1991:	19.5 mm
Standard diesel models from June 1991:	21.0 mm
Turbo diesel models to May 1991:	21.0 mm
Turbo diesel models from June 1991:	22.0 mm
Estate models:	22.5 mm

Vehicle height, front:	
With 195/70 tyres:	144 mm
With 205/60 tyres:	149 mm
Measuring point and conditions:	See Section 6.2.2

Note: The above data also includes details of the rear suspension. Missing data are given on the next page.

7. REAR AXLE AND REAR SUSPENSION

7.0. Short Description

The rear suspension is independently sprung with trailing arms and hydropneumatic suspension. The two suspension arms articulate on the pivot pins through taper roller bearings. Each suspension arm is resting on the piston of a suspension cylinder. An anti-roll bar (different diameter for the various models, see above connects the two suspension arms and controls the rear height corrector. The rear axle is attached to the body by four silent-bloc bushes. Fig. 7.1. shows a view of the assembled rear suspension when a Hydractive system is fitted, i.e. the axle has the additional sphere for the system regulation. ***The suspension has been***

7. Rear Suspension

changed from model year 1995. Changes have taken place in the following areas, with some of the data already given in Section 6.7:

- The piston rod diameter has been increased to 25 mm, if an XUD11 ATE (or later engine) or a DK5 engine is fitted.
- The piston rod diameter has been increased from 35 to 37 mm in the case of Saloon models. The old diameter has been retained for Estate models.
- The SC/MAC system, described on pages 153 and 154 has been introduced on models with DK5 engine (2.5 litre).

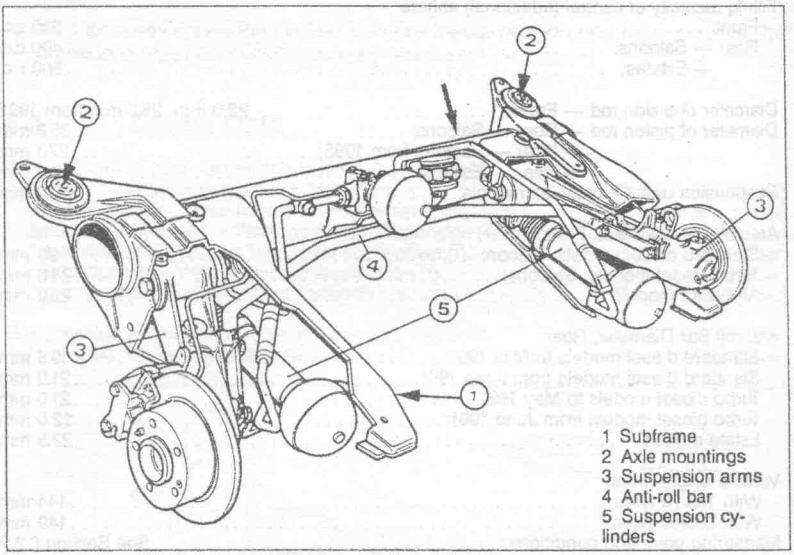


Fig. 7.1. — View of the assembled rear axle and suspension parts of a model with Hydactive suspension. The additional sphere is shown in the centre.

7.0. Technical Data

Gas pressure in suspension spheres:	
Standard suspension:	40 bar
Hydractive suspension:	30 bar
Additional rear sphere:	50 bar (Estate = 40 bar)
Filling capacity of suspension spheres:	400 c.c. (Estate = 500 c.c.)
Diameter of suspension cylinder:	35 mm (37 mm from 1995), Estate = 42.5 mm, all years
Vehicle height, rear:	
195/70 tyres:	431 mm
205/60 tyres:	436 mm
Measuring points and conditions:	See Section 7.2.1
Wheel Alignment:	
Toe-in (not adjustable):	0.5 to 6.5 mm
Camber (not adjustable):	0° 50' ± 20'
Anti-roll bar diameter:	See previous page

7.1. Rear Suspension Assembly

7.1.0. REPLACEMENT OF A SUSPENSION SPHERE

A chain wrench, similar as used for the removal and installation of an oil filter, is required to remove the suspension sphere from the suspension cylinder. Proceed as follows:

- Jack up the rear end of the vehicle with the rear wheels hanging down and place chassis stands underneath the sides of the body. Remove the rear wheels.
- Release the drain plug on the pressure regulator and set the height control lever into the "low" position. To drain as much fluid as possible out of the hydraulic system, place a jack underneath the rear suspension and jack up as far as possible. This will compress the cylinder and push out the fluid. Refer to page 154 to release the pressure on a model with SC/MAC system refer to Page 154.
- Apply the chain wrench as shown in Fig. 7.2. and unscrew the sphere. Fully remove the sphere by hand.

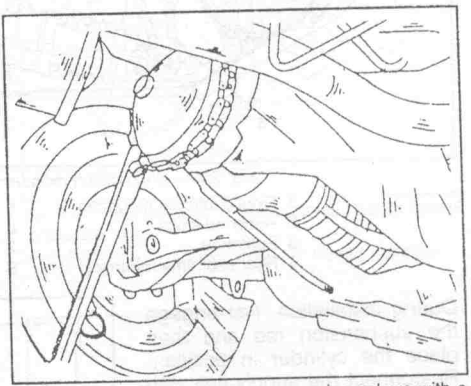


Fig. 7.2. — Removal of a rear suspension sphere with a chain wrench.

- Fit the new sphere with a new seal, lubricated with oil. The seating area for the sphere on the suspension cylinder should be greased. Tighten the sphere by hand as tight as possible. Start the engine and set the manual height control lever into the "high" position. Check the suspension system for leaks.

7.1.1. REPLACEMENT OF A SUSPENSION CYLINDER

Fig. 7.3 shows a side view of the fitted suspension cylinder.

- Jack up the rear end of the vehicle with the wheels hanging free and place chassis stands underneath the sides of the body. Remove the suspension sphere as described in the last section.
- From the end of the cylinder disconnect the cylinder supply pipe union nut (2, Fig. 7.4).
- At the larger end of the rubber gaiter there are two pipes. One is the overflow return pipe and the other one the vent pipe. Both must be disconnected.
- Using a screwdriver pry out the retaining clip for the suspension cylinder rod where is connected to the suspension arm.
- At the sphere connection end you will find a wire clip (1, Fig. 7.4) which must be removed to free the cylinder. The cylinder can now be removed. With the suspension arm hanging free, guide the suspension rod between the stop and the rear part of the sub-frame and withdraw the cylinder.

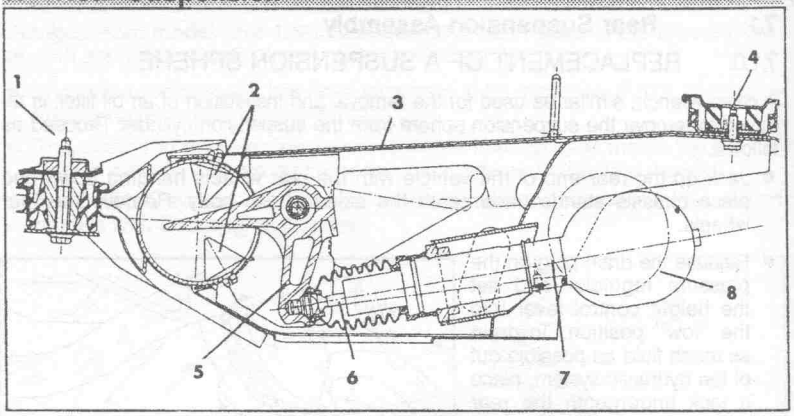


Fig. 7.3. — Suspension cylinder in fitted position.

1 Front subframe mounting
2 Rebound stops
3 Subframe
4 Rear subframe mounting
5 Suspension arm
6 Piston push rod
7 Suspension cylinder
8 Suspension sphere

During installation, first engage the suspension rod and then place the cylinder in position. Re-connect the supply line with a new seal and re-connect the overflow return pipe and the vent pipe to their original connections, near the fitting position of the rubber gaiter. Fit the retaining clip for the suspension rod at the suspension arm end and the wire clip (1) in Fig. 7.4 to the sphere end.

Grease the cylinder support face "a" in Fig. 7.4 and fit the suspension sphere with a new seal and tighten the sphere as tight as possible by hand.

Refit the rear wheel, lower the vehicle to the ground and tighten the wheel nuts. Place the height adjusting lever into the "high" position, start the engine and check the connected pipes for leaks.

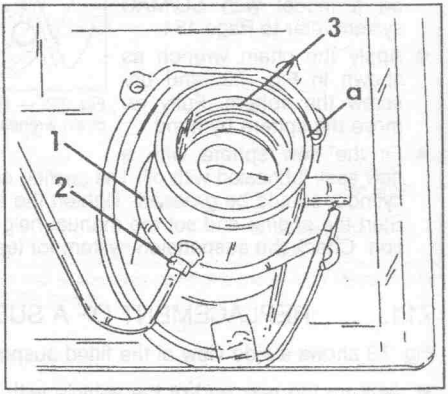


Fig. 7.4. — End view of a suspension cylinder after removal of the sphere.

1 Wire clip
2 Feed pipe connection
3 Suspension cylinder

7.2. Height Correctors

7.2.0. REMOVAL AND INSTALLATION

The removal and installation of a rear height corrector is carried out in the same

manner as has been described for the front height correctors with the difference that the return pipe is made of steel instead of rubber. Refer to the relevant sections. The vehicle heights must be checked and if necessary adjusted after a height corrector has been replaced.

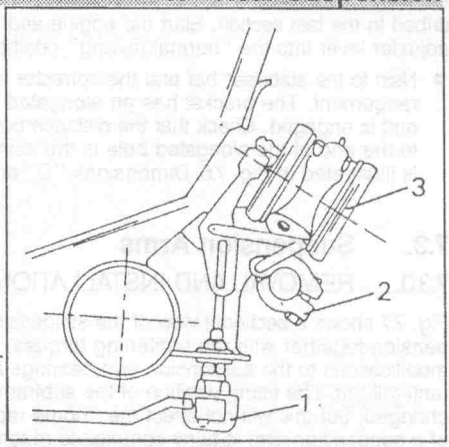


Fig. 7.5. — Arrangement of the automatic height control at the rear axle.

1 Ball joint 2 Clamp collar 3 Height corrector

7.2.1. CHECKING AND ADJUSTING THE AUTOMATIC HEIGHT CONTROL

The conditions for the check and adjustment are the same as described in Section 6.2.2. for the front axle. The vehicle height is measured from the ground to the body. Place the end of a steel tape against the flat surface next to the rear subframe mounting (silent block mounting), i.e. just in front of the suspension sphere. Fig. 7.3 shows the point where the steel tape must be applied with the arrow. The height should be should be 431 mm (applicable to 195/70 tyres). A tolerance from +10 to —7 mm is permissible before adjustments are required.

The adjustment is carried out by rotating the clamp collar on the rear anti-roll bar (stabiliser bar). A play of at least 1.0 mm (0.04 in.) must be observed between the ball joint and the bottom of its recess. Fig. 7.5 shows a sectional view of the connections at the rear axle.

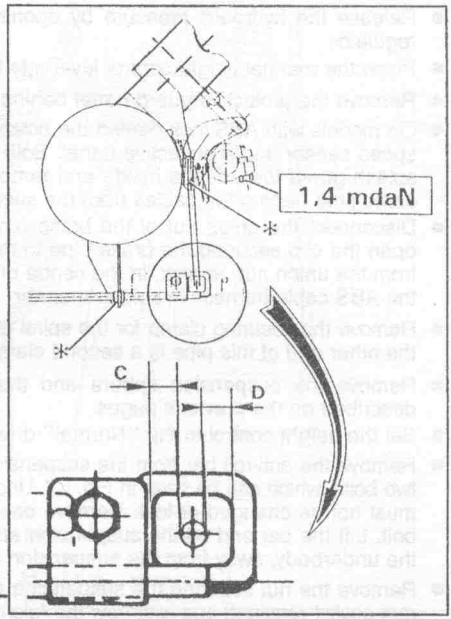


Fig. 7.6. — The arrangement of the height corrector together with the stabiliser bar clamp and the control rod engagement. The enlaged view shows how the control rod must be centred.

7.2.2 CHECKING AND ADJUSTING THE MANUAL HEIGHT CONTROL

First check and adjust the automatic height adjustment as des-

cribed in the last section. Start the engine and allow to idle. Set the manual height adjuster lever into the "normal driving" position. Proceed as follows:

- Next to the stabiliser bar and the corrector control rod you will find a bracket arrangement. The bracket has an elongated opening into which the control rod end is engaged. Check that the distance between the outside of the control rod to the end of the elongated hole is the same on both sides. The arrangement is illustrated in Fig. 7.6. Dimensions "C" and "D" must be the same.

7.3. Suspension Arms

7.3.0. REMOVAL AND INSTALLATION

Fig. 7.7 shows a sectional view of the suspension arm on one side of the rear suspension together with the tightening torques. As you can seen there have been modifications to the suspension arm bearings and the attachment of the stabiliser (anti-roll bar. The fitting position of the subframe mounting bearing has also been changed, but this will not affect the "home repairer" in most cases. The removal of a suspension arm is fairly complex to reach the actual attachment of the arm. Remove a suspension arm as follows:

- Jack up the rear end of the vehicle with the wheels hanging down, place chassis stands under the sides of the body and remove the wheel on the side in question.
- Release the hydraulic pressure by opening the drain plug in the pressure regulator.
- Place the manual height control lever into the "low" position.
- Remove the protective guard panel behind the brake disc.
- On models with ABS look behind the brake disc where you will find the wheel speed sensor and a protective panel. Both must be removed. Push the brake splash guard towards the inside and remove the wheel speed sensor, at the same time freeing the cables from the securing clips.
- Disconnect the union nut of the brake pipe from the rear brake caliper and open the clip securing the brake pipe to the suspension arm (follow the pipe from the union nut, approx. in the centre of the arm). On ABS models release the ABS cable harness in similar manner.
- Remove the securing clamp for the spiral pipe (near the arm fulcrum bolt). On the other end of this pipe is a second clamp.
- Remove the suspension sphere and the suspension cylinder as already described on the previous pages.
- Set the height control to the "Normal" driving position.
- Remove the anti-roll bar from the suspension arm. The bar end is secured by two bolts, which can be seen in Fig. 7.7. Under each bolt there are shims which must not be changed or lost. Remove each bolt and leave the shims on the bolt. Lift the bar end off the suspension arm and tie it with a piece of wire to the underbody, away from the suspension arm.
- Remove the nut securing the suspension arm fulcrum shaft at the inside (24 mm socket required) and withdraw the fulcrum shaft, if necessary with a pair of pliers or a pair of grips.
- Move the arm into the position shown in Fig. 7.8 and withdraw it from the rear suspension.

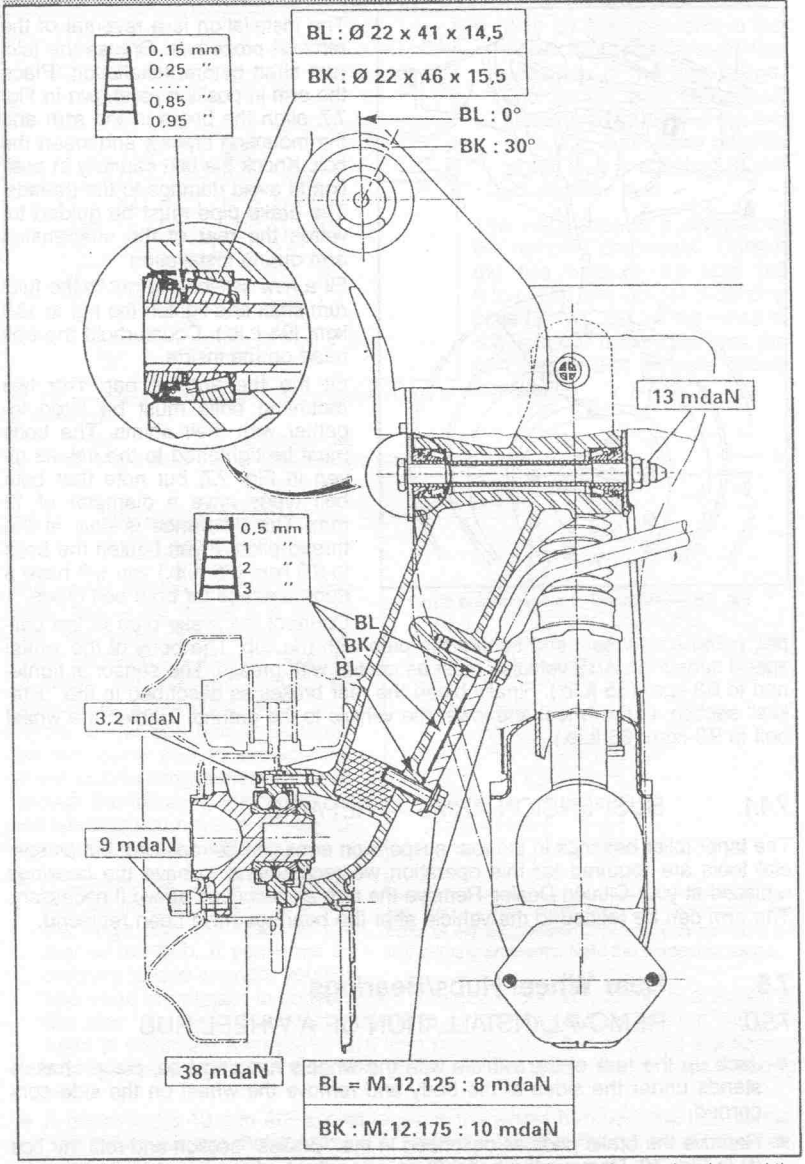


Fig. 7.7. — Sectional view of a suspension arm. Note the modifications to the arm bearing and the anti-roll bar attachments, marked with "BL" (Saloon) and "Bk" (Estate) respectively. Affected are also the tightening torques for the anti-roll bar attachments. The small ladder signifies where shims must be inserted. Also note the fulcrum shaft nut is located at the inside.

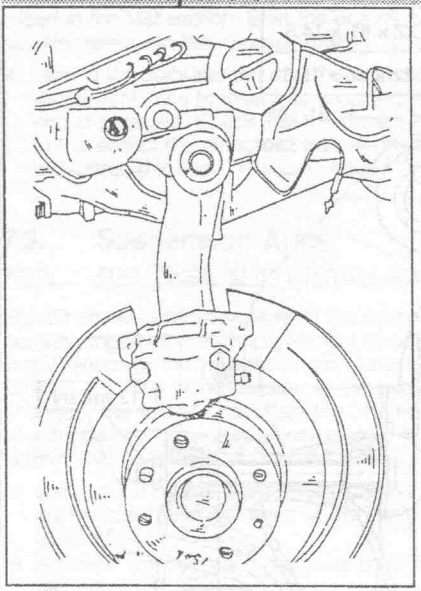


Fig. 7.8. — Removal of a suspension arm.

The installation is a reversal of the removal procedure. Grease the fulcrum shaft before installation. Place the arm in position as shown in Fig. 7.7, align the bores in the arm and the mounting bracket and insert the bolt. Knock the bolt carefully in position to avoid damage to the threads. The brake pipe must be guided towards the rear of the suspension arm during installation.

Fit a new self-locking nut to the fulcrum shaft and tighten the nut to 13.0 kgm (94 ft.lb.). Counterhold the bolt head on the inside.

Fit the the anti-roll bar. The two mounting bolts must be fitted together with their shims. The bolts must be tightened to the values given in Fig. 7.7, but note that both bolt types have a diameter of 12 mm. The difference is only in the thread pitch. If you tighten the bolts to 9.0 kgm (65 ft.lb.) you will have a good average for both bolt types.

Connect the brake pipe to the caliper, using a new seal and secure the pipe with the clip. The body of the wheel speed sensor on ABS vehicles must be coated with grease. The sensor is tightened to 0.8 kgm (6.5 ft.lb.). Finally bleed the rear brakes as described in the "Brakes" section, fit the wheel and lower the vehicle to the ground. Tighten the wheel bolt to 9.0 kgm (65 ft.lb.).

7.4.1. SUSPENSION ARMS — REPAIRS

The taper roller bearings in the rear suspension arms can be replaced, but as special tools are required for this operation we recommend to have the bearings replaced at your Citroën Dealer. Remove the arm as described above if necessary. The arm can be refitted to the vehicle after the bearings have been replaced.

7.5. Rear Wheel Hubs/Bearings

7.5.0. REMOVAL/INSTALLATION OF A WHEEL HUB

- Jack up the rear of the vehicle with the wheels hanging free, place chassis stands under the sides of the body and remove the wheel on the side concerned.
- Remove the brake pads as described in the "Brakes" section and refit the bolt (1) in Fig. 7.9. Remove the bolts (2) securing the brake caliper to the rear axle. Also remove the screws (4) securing the brake disc to the hub and remove the disc, if necessary by tapping it with a soft-faced mallet.
- If an ABS system is fitted, remove the speed sensor for the rear wheel.

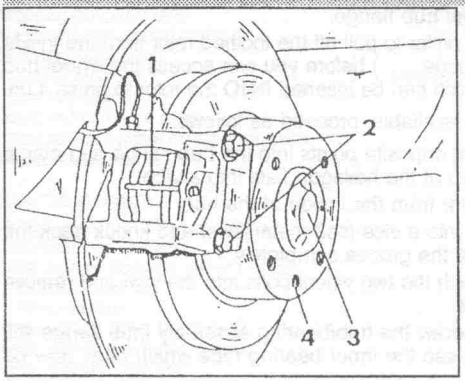


Fig. 7.9. — Details for the removal and installation of a rear wheel hub.

1 Bolt
2 Caliper bolts
3 Grease cap
4 Disc securing screws

- With an Allen key remove the wheel hub bolts through the openings in the hub flange. The flange must be rotated as required to remove the five bolts. Fig. 7.10 shows how the wheel hub is attached to the suspension arm.

The installation is a reversal of the removal procedure. Tighten the five bolts to 3.2 kgm (22 ft.lb.). The two caliper mounting bolts (2, Fig. 7.9) are tightened to 4.2 kgm (30 ft.lb.). Lubricate the bolt heads and threads before installation.

7.5.1. WHEEL BEARING REPLACEMENT

The wheel hub is made up of two parts, one is the wheel hub flange and the other one is the actual wheel hub with the integral bearing, i.e. hub and bearing must be replaced as a complete item.

Before we tell you how to separate the two parts and to replace the wheel hub/bearing assembly, read through the following information to see whether you have all the equipment required. You will need:

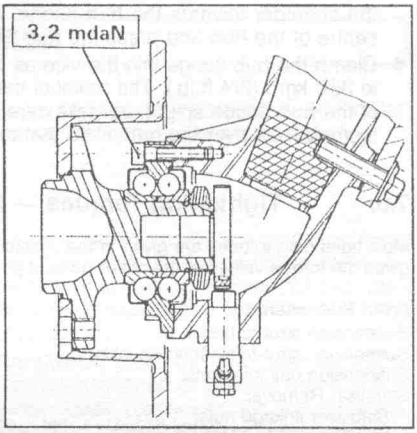


Fig. 7.10. — The wheel hubs are attached by five bolts to the suspension arm and can be removed without any problems. Note the tightening torque.

- A large socket to fit a 52 mm A/F (across flats) to remove and refit the large hub nut fitted to the rear of the hub. If you have an ordinary torque wrench, you will also need an adaptor to convert the 1 in. square normally found in a socket of this size into a more conventional 1/2 in. drive. Your torque wrench will also need to withstand a torque of 38.0 kgm (approx. 275 ft.lb.). As the slackening and tightening of the nut must take place in a vice, you will also need a strong vice.
- A press and a 40 mm A/F socket to press the wheel hub over the hub flange. The socket assures that the pressure is evenly aplied to the centre of the wheel bearing.
- A puller to pull the wheel hub off the wheel hub flange. The inner bearing race will remain on the wheel hub flange and must also be removed with a puller.
- A blunt drift, preferably with the tip rounded off, to peen the metal of a NEW

nut into the groove of the wheel hub flange.

- If ABS is fitted you will need a puller to pull off the toothed rotor from the inside of the hub (see Section 9.7.1, page) before you can access the wheel hub nut and a suitable mandrel, which can be inserted INTO the rotor to press it on.

Provided the above equipment is available, proceed as follows:

- Screw two of the wheel bolts at opposite points into the hub flange and clamp the wheel bolt HEADS with two of the hexagon flats into a vice.
- If fitted, pull-off the toothed rotor from the inside of the hub.
- Clamp the wheel hbub flange into a vice (soft-metal jaws) and knock back the edge of the bearing nut to free the groove completely.
- Clamp the wheel hub flange with the two wheel bolts into the vice and remove the nut with the 52 mm socket.
- Use a suitable puller and withdraw the hub/bearing assembly (hub flange still in vice). After removal you will see the inner bearing race which must now be pulled off.
- Thoroughly clean the hub flange. The new hub/flange assembly must be fitted as received, i.e. do not remove the inner part.
- Place the hub flange under the press and slide the hub over the spigot, with the shoulder towards the hub flange. Use the 40 mm socket, place over the centre of the hub and press the hub fully home.
- Clamp the hub flange into the vice as before, fit a new nut and tighten the nut to 38.0 kgm (274 ft.lb.). The metal of the nut must then be peened into the slot of the hub flange spigot, but take care not to split the metal. If fitted press the toothed rotor over the hub. Note that the rotors have been changed (June 91).

7.6. Tightening Torques — Suspension/Steering

Most tightening torques are given in the chapters on the previous pages. The following only gives the torque values of the major parts. If possible use a "kgm" torque wrench.

Front Suspension

Suspension strut to body:	2.0 kgm (14.5 ft.lb.)
Suspension strut to steering knuckle:	5.2 kgm (37 ft.lb.)
Suspension ball joint nuts:	4.0 kgm (29 ft.lb.)
Stabiliser Removal:	
Stabiliser linkage nuts:	3.0 kgm (22.0 ft.lb.)
Stabiliser linkage locknut:	3.0 kgm (22 ft.lb.)
Stabiliser bearing-to-subframe bolts:	
10 mm bolts, no washer:	4.5 kgm (32.5 ft.lb.7
10 mm bolts, with washer, to Sept. 1991:	8.0 kgm (57.5 ft.lb.)
12 mm bolt, from Sept. 1991:	13.0 kgm (94.0 ft.lb.)
Sub-frame bolts:	
Bolts without washer:	4.5 kgm (32.5 ft.lb.7
Bolts with washer:	8.0 kgm (57.5 ft.lb.)
Suspension arm fulcrum bolt nut (front):	8.5 kgm (61.2 ft.lb.)
Suspension arm bearing cap bolts:	3.5 kgm (25 ft.lb.7
Track rod ball joint nuts:	4.5 kgm (32.5 ft.lb.)
Front caliper mounting bracket to steering knuckle:	10.5 kgm (76 ft.lb.)
Front drive shaft nut:	32.0 kgm (216 ft.lb.)
Wheel bolts:	9.0 kgm (65.0 ft.lb.)

Steering

Steering box mounting:	7.0 kgm (50.5 ft.lb.)

Steering coupling disc:	2.0 kgm (14.5 ft.lb.)
Universal joint clamp bolts:	2.3 kgm (14.5 ft.lb.)
Steering wheel nut:	3.0 kgm (22 ft.lb.)
Steering cylinder:	Refer to Page 132, depending on model year
Track rod locknut:	4.5 kgm (32.5 ft.lb.7
Track rod ball joint nuts:	4.5 kgm (32.5 ft.lb.)
Track rod ball joints on steering rack:	5.0 kgm (36 ft.lb.7
Hydraulic pipes:	See "Hydraulic System"

Rear Suspension

Suspension arm fulcrum shafts:	13.0 kgm (94 ft.lb.)
Stabiliser bar clamps:	See Fig. 7.7
Rear axle to body (at sphere end):	
Without washer:	3.0 kgm (22 ft.lb.7
With washer:	4.0 kgm (22 ft.lb.)
Rear axle to body (front end):	6.0 kgm (43.5 ft.lb.)
Rear hub to suspension arm:	3.2 kgm (22 ft.lb.)
Rear hub/bearing nut:	38.0 kgm (274 ft.lb.)
Rear brake calipers:	4.7 kgm (32.9 ft.lb.)
Wheels bolts:	9.0 kgm (65.0 ft.lb.)

8. HYDRAULIC SYSTEM

It is considered that before embarking on any repairs, it is necessary to be familiar with the various components which make up the system and their function.

8.0. Hydraulic Fluid

The special green fluid "LHM" used in the hydraulic circuits is a fluid of mineral origin, similar to engine oil. Use of different fluid would lead to complete deterioration of the installation. The capacity of the system is approx. 5.3 litres (9.5 Imp. pts.) in the case of Saloon models or 6.0 litres (10.7 Imp. pts) in the case of Estate models.

The appropriate hydraulic components are painted green or have green identification marks and must only be replaced by parts painted or marked green in the same way. All rubber components, i.e. joints, hoses, diaphragm, etc. are of special quality for use with LHM fluid and are identified by their white or green colour.

Important are the connections on the fluid reservoir. If ever any of them are disconnected refer to Fig. 8.1 for their purpose (only R.H.D. models given):

- (1) is the inlet port of the high-pressure pump.
- Connection (2) is a return connection from the flow distributor and steering control valve (power steering).
- Connection (3) is the return connection from the brake control valve or the hydraulic block, on vehicles with ABS.
- Connection (4) is the overflow return from the height correctors, suspension cylinders, security valve, steering and the pressure regulator.
- Connection (5) is the return flow from the height correctors.
- Connection (6) closed off with a plug if a standard suspension is fitted. It receives the return from the electro-valve if a Hydractive suspension is fitted.
- (7) is the fluid level indicator.

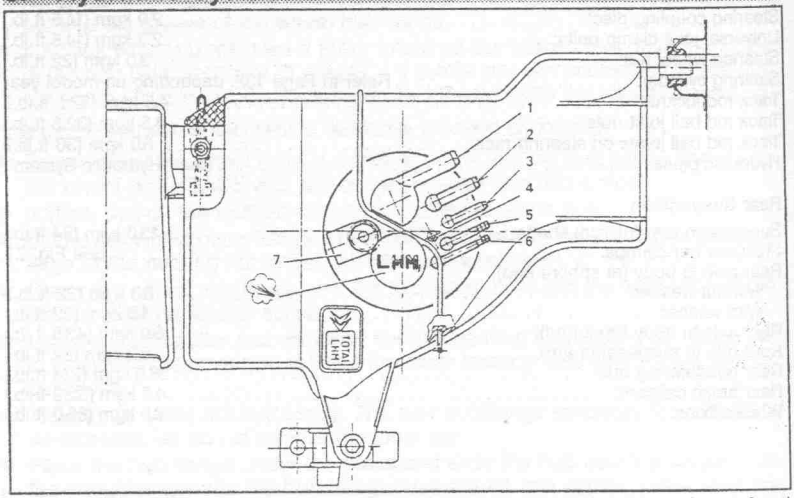


Fig. 8.1. — Top view of the hydraulic fluid (LMH) reservoir showing the various connections, referred to in Section 8.0.

8.0.0. GENERAL LAYOUT OF THE SYSTEM (Figs. 8.2 and 8.3)

Different system layouts are fitted to models covered in this manual, depending if an ABS system is fitted or not. The two illustrations show the systems without ABS. Basically what takes place is: The hydraulic fluid is pumped from the high pressure pump (2), through the pressure flow regulator (10) and the pressure regulator (3) to a safety valve (4). One line leads to the front suspension spheres (23) and (24) via the front height corrector (20). The remaining line feeds the front brakes (42) and (43) through the upper ports in the brake control valve (40). The rear brakes (44) and (45) are fed from the rear height corrector (21) via the lower ports in the brake valve. The above numbers refer to Fig. 8.2.

The layout of the Hydractive system is shown in Fig. 8.3. The routing of the pipes, lines, etc. are similar as for the standard suspension, but the extra items, i.e. a line filter (31), the solenoid valve (32), the front suspension height regulator (33), the rear height regulator (34) and a 3-way union with pressure switch (35 bar) are included as shown. Items not numbered are identical to Fig. 8.2.

Details of the new hydractive 2 system have already been given in Section 6.6.0. on pages 149 to 152.

8.1. High Pressure Source

The high pressure source consists of the following main components:

— The hydraulic reservoir
— The high pressure pump (which generates the pressure). Note that not all models use the same pump, as it has been changed from a 5 piston pump to a so-called 6+2 piston pump on certain models.
— The max. and min. pressure regulator (cut-out and cut-in)

Fig. 8.2. — Layout of the hydraulic system when a standard suspension is fitted (annotations cont. in Fig. 8.3).

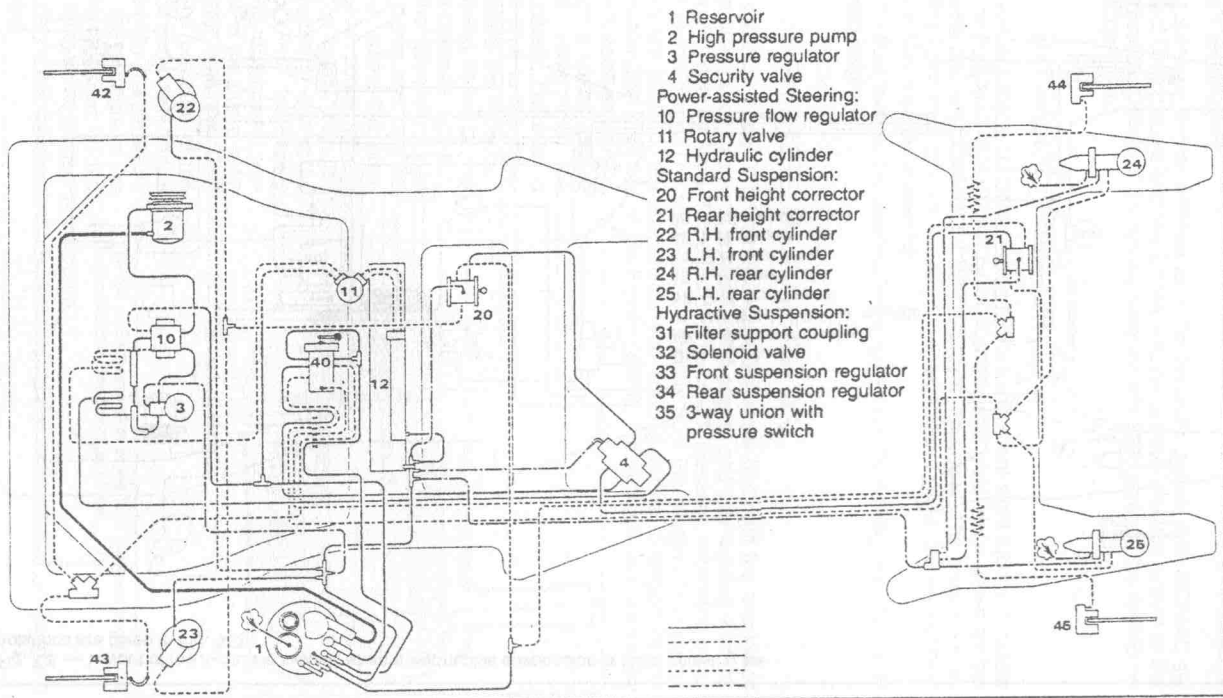
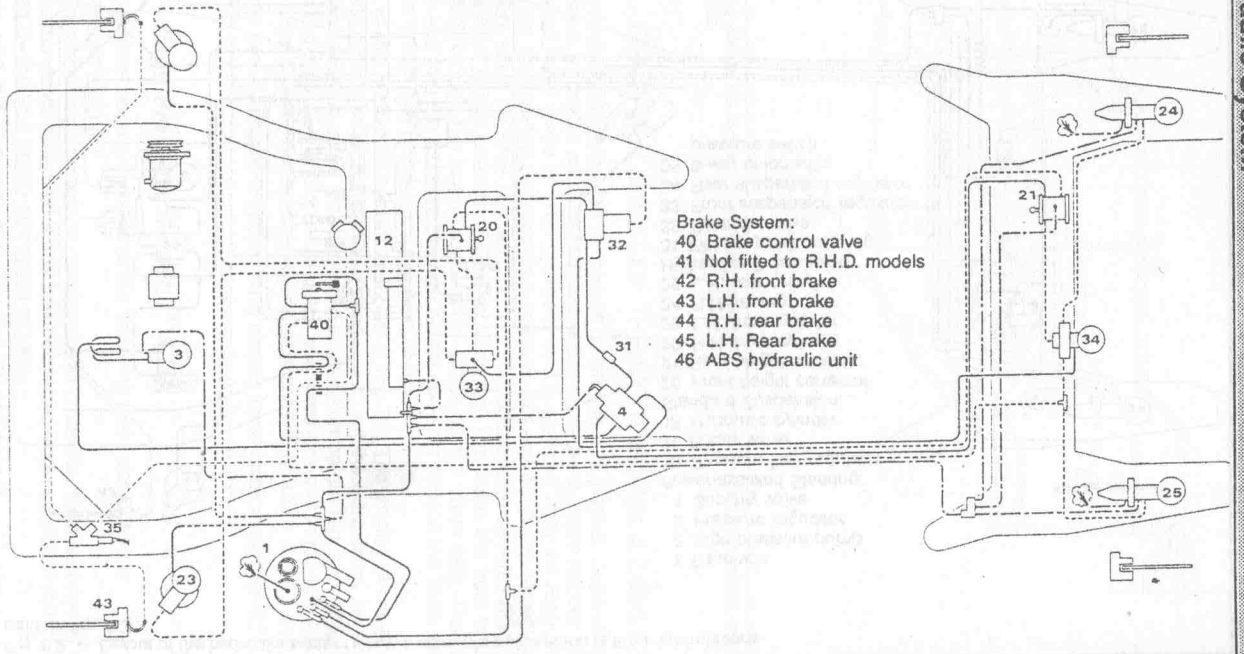


Fig. 8.3. — Layout of the hydraulic system when a Hydractive suspension is fitted (missing annotations are given in Fig. 8.2).



— The main accumulator

There are, of course, further differences in the hydraulic system if an SC/MAC system is fitted. Only models with the 2.5 litre engine is fitted with this feature at the time of publication. Details of the system have already been given in the section on the front suspension.

8.1.0. HYDRAULIC RESERVOIR

The reservoir is a metal container which has a transparent sight tube to facilitate checking the fluid level. It is divided by an internal baffle plate which allows for the liquid to settle and which prevents it from turbulent movement. The reservoir is located at the front L.H. side in the engine compartment, near the suspension sphere. The filler cap has a breather.

To check the fluid level in the reservoir, the engine must be running and the car at its maximum height.

8.1.1. HIGH PRESSURE PUMP (Fig. 8.3.)

The high pressure pump is driven by means of a drive belt from the crankshaft pulley. The drive pulley has been adapted to the engine and only a pulley with the same diameter must be fitted. The pump is a so-called five-piston volumetric pump or a 6 x 2 piston pump. The term "6 x 2" derives from the design of the pump. Two stages are used for the suspension and braking system, 6 stages for the steering system.). In the case of the 5-piston pump, the hydraulic is drawn in by four bores in each piston and fed through a spring loaded non-return valve into the hydraulic circuit. There is no theoretical limit to the maximum pressure, the maximum pressure being limited by means of the pressure regulator. Priming the five-piston high pressure pump can only be carried out when the pressure release screw of the regulator is open. Fig. 8.4 shows a sectional view of the pump for the technically minded. Fig. 8.5 shows a sectional view of the pump is fitted together with the DK5 engine. The pressure of the suspension and brake circuits is regulated by the pressure regulator, the pressure of the steering is regulated by the pressure relief valve located in the pump.

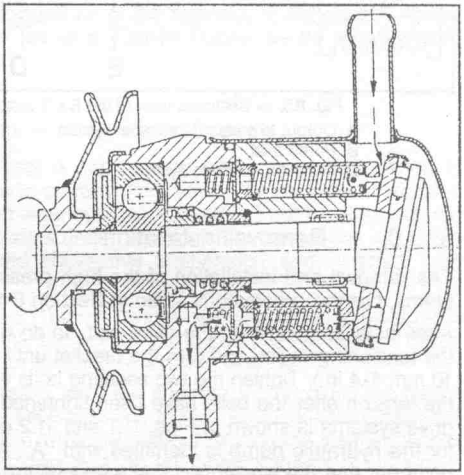


Fig. 8.4. — Sectional view of the high pressure pump. The arrows indicate the direction of flow.

The flow distributor, used with the 5-piston pump has been deleted on the 6 x 2 piston pump.

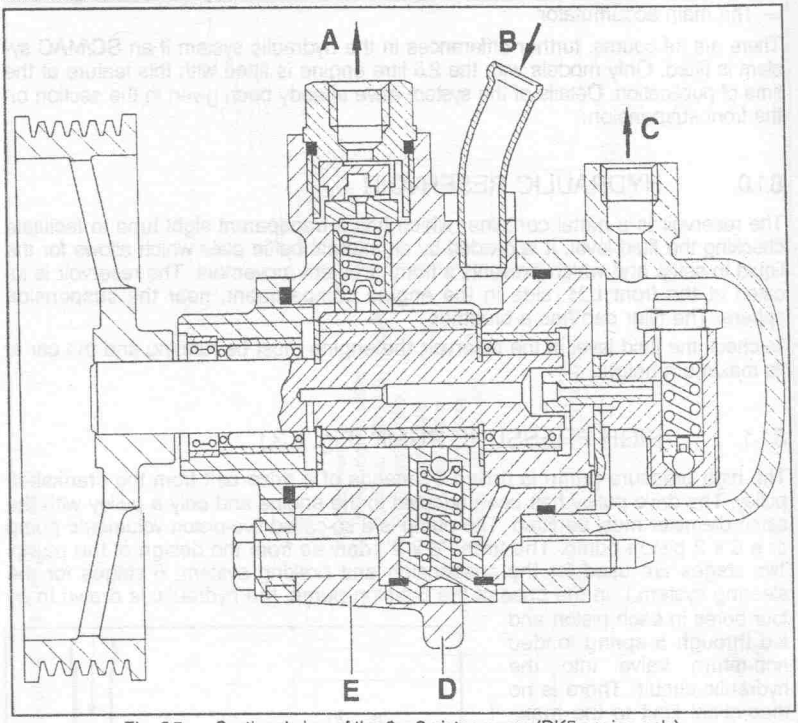


Fig. 8.5. — Sectional view of the 6 x 2 piston pump (DK5 engine only).

A Output to suspension/brake system
B Pump inlet
C Output to steering system
D 6-piston stage
E 2-piston stage

8.1.1.0. Removal/Installation

The removal and installation of the high pressure pump presents no major problems, but the precautions listed in Section 8.4. must be taken at all times.

After installation tension the drive belt. To do this, slacken the two bolts securing the tensioning pulley and turn the bracket until the belt can be deflected by about 10 mm (0.4 in.). Tighten the two securing bolts without moving the pump. Re-check the tension after the bolts have been tightened. The belt layout of two of the belt drive systems is shown in Figs. 11.1 and 11.2 on Page 192. In each case the belt for the hydraulic pump is identified with "A". A toothed V-belt is used. We must point out that the workshop uses a special tension checking tool.

Fill the pump via the suction line with hydraulic fluid. Slacken the pressure release screw in the pressure regulator without removing it fully. Start the engine and quickly connect the suction line to the pump. As soon as fluid movement can be felt in the return pipe (thick pipe), close the pressure release screw in the pressure regulator.

8.1.2. MAIN ACCUMULATOR

The function of the main accumulator is to improve the operational flexibility by supplying fluid rapidly in the event of a major demand and by avoiding frequent opening and closing of the pressure regulator valve. The pressure regulator is built together with the accumulator and has the function to maintain the pressure of the system between 140 to 175 bar. The accumulator has a capacity of 400 c.c. and an inflation pressure of 62 kg/sq.cm. (889 psi.).

8.1.2.0. Removal and Installation

The removal and installation of the main accumulator and the pressure regulator is carried out from underneath the vehicle. The operations are straight forward and present no major difficulties. The precautions given in Section 8.4. must be observed at all times. Release the pressure in the hydraulic system by opening the drain screw of the pressure regulator without unscrewing it and set the manual height adjusting lever into the "low" position.

8.1.3. PRESSURE REGULATOR (CUT-OUT/CUT-IN)

The pressure regulator is located underneath the vehicle, fitted to the main accumulator. The function of the pressure regulator is:

a) To prevent excess pressure in the circuit by cutting off the supply and bypassing the pump delivery back into the fluid reservoir.

b) To restore the supply of fluid when the pressure reserve falls to the pre-set level. The cut-in and cut-out pressure of the regulator is adjusted by shims. The adjustment should be left to a Citroën Dealer as he will be more familiar with the procedure.

8.1.3.0. Releasing the Pressure in he Hydraulic System

The pressure regulator is fitted with a drain screw which must be opened to release the pressure in the hydraulic system. This screw, the location of which is shown in Fig. 8.5, must be opened whenever work is carried out that involves the disconnection of hydraulic components under pressure. The operations are different for models with standard and Hydractive suspension and, if fitted, with SC/MAC system:

Standard Suspension: The screw (1) must be opened without unscrewing it to prevent the steel ball underneath the screw from falling out. Set the manual height control lever into the "low" position before the screw is opened.

Models with Hydractive Suspension With the engine running place the height control to the "Low" position and set the switch to the "Auto" position. Start the engine and allow it to run for approx. 1 minute, without rotating the steering wheel. This will allow the suspension cylinders and the adidtional spheres to link up.

Models with SC/MAC system: With the preasure regulator bleed screw tightened, start the engine. Set the height control to the low position in order to empty the suspension units. Wait for a while until the vehicle is in the lowest position and then unscrew the pressuere regulator bleed screw by one turn.

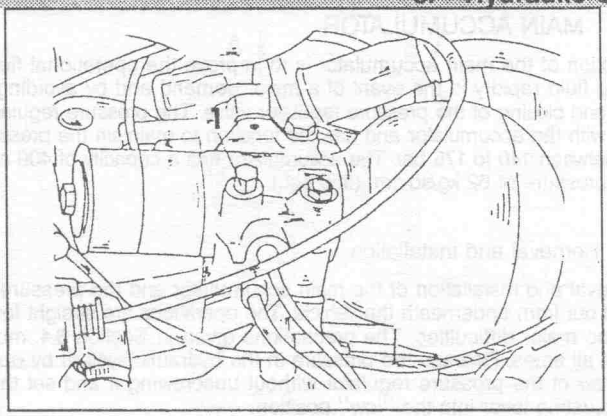


Fig. 8.6. — The location of the drain plug (1) to release the pressure in the hydraulic system (underneath the vehicle).

8.2. The Suspension Hydraulic Circuit

The hydro-pneumatic suspension is achieved by the combination of a liquid and gas in the circuit. The gas forms the flexible element of the suspension and the function of the liquid is to make the connection between the various components. The body is supported, one at each wheel, which consists of a sphere and a cylinder. The spheres which are similar to the main accumulator described, have inside them a gas under pressure. Threaded onto the sphere is a cylinder complete with a piston which is operated by fluid from the hydraulic circuit. The cylinder is secured to the body by bolts. The piston is attached to the suspension arm by means of a rod.

The shock absorber is clinched into the sphere and cannot be removed separately.

8.2.0. SHOCK ABSORBERS

The shock absorbers are double-acting and absorb the shocks by blocking the fluid from the sphere to the cylinder and visa versa. Flexible plate valves block the flow passages.

A calibrated hole which allows the fluid to flow in both directions, reduces the effect of the shock absorber during minor shocks.

8.2.1. HEIGHT CORRECTION

(a) Height Correctors

The height correctors allow the ground clearance to be maintained constant, whatever the load being carried. There are two correctors, one at the front and one at the rear, supplied from the pressure source. They are controlled by a mechanical system which forms the automatic height control. A hand- operated mechanical control acts simultaneously on both automatic controls.

The height corrector adopts the following attitudes, according to the position of the distributor shaft:

— Suspension cylinders in communication with the pressure source.
— Suspension cylinders in communication with the reservoir.
— Suspension cylinders isolated from the pressure source and reservoir (neutral position).

(b) Automatic Height Control

The ball joint of the height corrector is actuated by a slotted bar which is connected to the anti-roll bar through rods and clamps. The anti-roll bar is attached to the suspension arms, thus movement of these arms result in a torque on the bar.

The location of the height correctors on the body and the clamps on the anti-roll bars is adjusted so that, when the body is in the normal running position, they exert no force on the distributor shafts of the height correctors which is, therefore, in the neutral position.

When the load increases the body gets lower, the anti-roll bar is subjected to torque and this is transmitted through the clamp and rods to the distributor shaft which is moved to the inlet position, thus connecting the suspension spheres with the pressure source.

As the fluid passes into the spheres, the body rises and as a result the anti-roll bar is subjected to torque in the opposite direction so that the rods return the height corrector distributor shaft to the neutral position. The body thus returns to its normal height. When the load decreases, the process is reversed.

When the variations in suspension movement are of very short duration, the height corrector does not operate due to the limited torque transmitted by the anti-roll bars.

(c) Manual Height Control

The principle of operation is as follows: When the manual control lever is moved from the normal running position, the longitudinal rod transmits this movement to the height correctors via the rods and slotted bars.

The distributor shaft of the height correctors moves from the neutral to the inlet positions, thus communicating the spheres to the pressure source. This causes the body to rise and as a result the anti-roll bars are subject to a torque and the movement is transmitted from the clamps on the bars via the short rods to the slotted bars in the opposite direction to that exerted when the position of the lever of the manual height control is altered.

When both movements are balanced, the height corrector distributor shafts will return to the neutral position and the body height will stabilise at the new setting. The pressure is the same as it was previously, but the volume of fluid in the suspension cylinder is greater, therefore, the body height will be greater.

8.3. Brake Hydraulic Circuit

The front and rear brake circuits are separate. The rear brake circuit is fed by the rear suspension; the front brake circuit is fed from the main accumulator.

The system is controlled by a brake valve which feeds pressure to the front brakes before the rear. Because the brake circuit is fed from the rear suspension circuit, the braking pressure will be limited in proportion to the load in the vehicle.

The pressures in the brake circuits are in proportion to the travel of the brake pedal. In addition, the pressure in the rear brake circuit varies as the rear suspension pressure does, i.e. to maintain constant height the suspension fluid pressure when the load in the car is greater.

8.4. Work on the Hydraulic System

8.4.0. PRECAUTIONS TO BE TAKEN

a) Carefully clean the area of work, the unions and the unit to be removed. Disconnect the lead from the negative terminal of the battery. Only use petrol or white spirit for cleaning.

b) Release the pressure in the circuits as described on page 171.

8.4.1. PRECAUTIONS DURING REMOVAL OF PARTS

a) Blank off the metal pipes with plugs and rubber tubes with round pins of the correct diameter.

b) Blank off the openings of components with plugs of the correct diameter. Plugs and pins must be carefully cleaned before insertion.

8.4.2. PRECAUTIONS DURING INSTALLATION

a) Cleaning

Steel pipes must be blown through with compressed air. Rubber tubes and joints must be washed in petrol or white spirit and then dried with compressed air.
Hydraulic units must also be cleaned with petrol or white spirit and blown through with compressed air. **Renew all joints during installation**.

b) Lubrication

Joints and internal parts must be lightly oiled before fitting (use mineral fluid "LHM" only). If parts in contact with hydraulic units have to be greased, use a mineral-based only (as employed for drive shafts or roller bearings).

c) Installation

Only use joints of quality compatible with the mineral fluid "LHM".
To connect a union, proceed as follows (see Fig. 8.7):

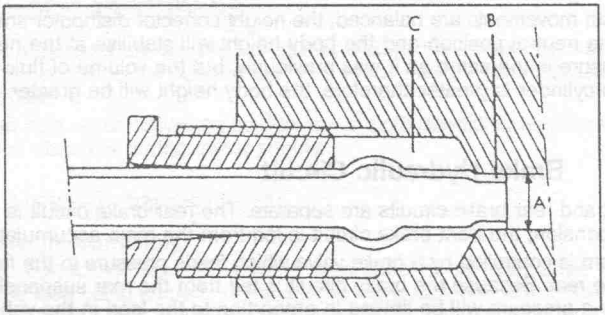


Fig. 8.7. — Installation of a union. For reference a, b and c, see text below and on next page.

Locate the sleeve seal "a" lightly coated with "LHM" fluid. This sleeve seal should be back from the end of the pipe "b". Centre the pipe in the housing by lining it up with the

axis of the hole, avoiding all stress. Ensure that the end "b" of the pipe enters into the small bore "c". Start the union nut by hand.

Tighten the nut moderately. Excessive force could cause a leak because of the deformation of the pipe.

3.5 mm pipe (with seal): . . . . . 0.8 - 0.9 kgm (5.8 - 6.6 ft.lb.)
4.5 mm pipe (with seal): . . . . . 0.8 - 0.9 kgm (5.8 - 6.6 ft.lb.)
6.0 mm pipe (with seal): . . . . . 0.9 - 1.1 kgm (6.6 - 8.0 ft.lb.)
6.0 mm pipe (without seal): . . . . . 1.3 kgm (9.0 ft.lb.)
10.0 mm pipe (without seal): . . . . . 3.0 kgm (21.5 ft.lb.)

To connect a rubber tube, a rubber ring of suitable diameter has to be positioned between the tube and the hose clip.

8.4.3. CHECKS OF COMPLETION OF WORK

a) Check the unions for leaks.
b) Check the clearance between the pipes. The pipes must not touch one another or any component nor may any other unit, whether fixed or moveable, exert stress on them.

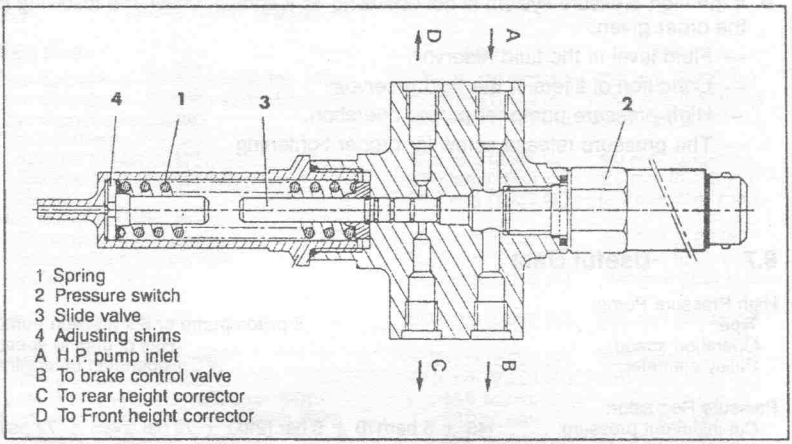


Fig. 8.8. — Sectional view of the safety valve.

8.5. Safety Valve

The purpose of the safety valve is to isolate the wheel suspension from the main accumulator when the pressure in the hydraulic system is below the safety limit, thereby ensuring sufficient pressure for the operation of the brake system. The suspension is isolated from the system when the pressure drops below 80 bar (1136 psi.) and is re-connected to the system when the pressure has increased once more to 100 bar (1420 psi.). Fig. 8.8 shows a sectional view of the safety valve, showing the individual connections. Replace the valve as follows:

- Release the pressure in the system as described in Section 8.4.0.
- Disconnect the rubber overflow return pipe from the end of the valve.

- Remove the union nut from the inlet and outlet pipes of the safety valve. Mark where each pipe is connected to prevent mistakes during installation. Plug the pipe ends in suitable manner to prevent entry of dirt.
- Disconnect the electrical lead from the pressure switch.
- Remove the valve securing screw and remove the valve from its mounting.

The installation is a reversal of the removal procedure.

8.6. Checks in case of Faults

Before carrying out any operations on the hyudraulic systems always check the following:

- Check that all moveable parts of the hydraulic system are free to move without binding.
- Check that the system is under pressure. To do this, start the engine and open the pressure release screw on the pressure regulator. A "hissing" noise must be heard. After closing the screw, the pressure regulator should close, indicated by a reduced running noise of the high pressure pump.
- If the high pressure system is not operating as it should, check the following in the order given.
  - — Fluid level in the fluid reservoir.
  - — Condition of filters in the fluid reservoir.
  - — High pressure pump for proper operation.
  - — The pressure release screw for proper tightening.

8.7. Useful Data

High Pressure Pump:
Type: ..... 5-piston pump or 6 x 2 piston pump
Operation speed: ..... Half of engine speed
Pulley diameter: ..... Depending on engine

Pressure Regulator:
Cut-in/cut-out pressure: ..... 145 ± 5 bar/170 ± 5 bar (2103 ± 72 psi./2465 ± 72 ps.i)
Adjusting shims for cut-in pressure: ..... 0.30 and 0.70 mm
Adjusting shims for cut-out pressure: ..... 0.30 mm
Pressure alteration for 0.30 mm shim: ..... 3 bar (42.5 psi.)
Pressure alteration for 0.70 mm shim: ..... 7 bar (99.5 psi.)

Main Accumulator:
Capacity: ..... 0.4 litres (0.7 Imp. pts.)
Calibration pressure: . 62 bar (899 psi.), tolerance + 2 bar (29 psi.) to —32 bar (464 psi.)

Safety Valve
Cut-out pressure of suspension: ..... min. 80 bar (1136 psi.)
Cut-in pressure: ..... max. 100 bar (1420 psi.)

Fluid Reservoir:
Capacity: ..... 5.3 litres (Saloons), 6.0 litres (Estate)
Fluid type: . . . Green LHM fluid, different makes suitable, Total LHM Plus recommended

9. BRAKE SYSTEM

9.0. Description

Disc brakes allround, front inboard on the transmission outlet shafts, rear outboard, adjacent to the wheel hubs.

The front brakes are fed with hydraulic pressure from the main accumulator and are protected by the safety valve. The rear brakes are fed from the separate rear suspension circuit. The pressure in the rear brake circuit varies in accordance with the load on the vehicle.

The brake valve is operated by a conventional brake pedal and incorporates regulating valves in tandem which ensure that the front brakes are applied before the rear brakes.

The parking brake is hand-operated and is independent of the main braking system. A lever/cable system and a cable operate separate calipers, acting on the front disc brakes.

9.1. Technical Data

Main Brake	Front	Rear
Disc diameter — Saloons to March 1991:	276 mm (10.965 in.)	224 mm (8.900 in.)
Disc diameter — Saloons from March 1991:	283 mm (11.142 in.)	224.0 mm (8.900 in.)
Disc diameter — Estate:	283 mm (11.142 in.)	251.0 mm (9.972 in.)
Disc thickness:		
Saloons to March 1991:	22.0 mm (0.874 in.)	9.0 mm (0.358 in.)
Saloons from March 1991:	26.0 mm (1.033 in.)	9.0 mm (0.358 in.)
Estate:	26.0 mm (1.033 in.)	12.0 mm (0.477 in.)
Disc thickness, min. worn:		
Saloons to March 1991	20.0 mm (0.790 in.)	7.0 mm (0.28 in.)
Saloons from March 1991	24.00 mm (0.945 in.)	7.0 mm (0.28 in.)
Estate:	24.0 mm (0.945 in.)	10.0 mm (0.39 in.)
Max. run-out of discs:	0.05 mm (0.002 in.)	0.05 mm (0.002 in.)
Piston diameter (Saloons):	57.0 mm (2.224 in.)	33.0 mm (1.311 in.)
Piston diameter (Estate)	57.0 mm (2.224 in.)	40.0 mm (1.589 in.)
Surface of single pad, to March 1991:	45.0 sq.cm.	17.00 sq.cm.
Surface of single pad, from March 1991:	50.0 sq.cm.	17.0 sq.cm.
Surface of single pad, Estate:	50.0 sq.cm.	35.0 sq.cm.
Original pad thickness, Saloons and Estate:	12.0 mm (0.477 in.)	11.4 mm (0.453 in.)
Min. pad thickness:	3.0 mm (0.12 in.)	2.0 mm (0.08 in.)
Variation of brake disc thickness, max.:	0.1 mm, measured at eight different points	

Brake Pad material:
- Front — To March 1991: ..... Abex 349 or Textar 441 (asbestos-free)
- — From March 1991: ..... Abex 349 or Abex 949 (asbestos-free)
- Rear — Saloons to model year 1992: ..... Abex 349
- — Saloons to model year1991: ..... Textar T441 (asbestos-free)
- — Saloons from model year 1991: ..... Abex 949 (asbestos-free)
- — Saloons and Estates from model year 1992: ..... Abex 949 (asbestos-free)

Brake Pad Identification:
- Saloons, to March 1991: ..... 116.0 mm (4.601 in.) long
- Saloons from March 1991 and Estates: ..... 119.0 mm (4.728 in.) long

9.2. Front Brake Calipers

9.2.0. RENEWAL OF FRONT BRAKE PADS

- Jack up the front of the vehicle with the wheels hanging down, place chassis stands underneath the sides of the body and remove the two front wheels.
- Disconnect the leads of the pad wear indicators.
- Push the handbrake operating lever towards the inside and grip the end of the handbrake cable with a pair of pliers. Disengage the cable from the slot in the lever and then release the cable guide from its location on the caliper.
- At the lower end of the caliper remove the securing pin with a pair of pliers and knock out the retaining pin. Take care not to drop the small clip in the centre of the pin, as this will be free as soon as the retaining pin passes.

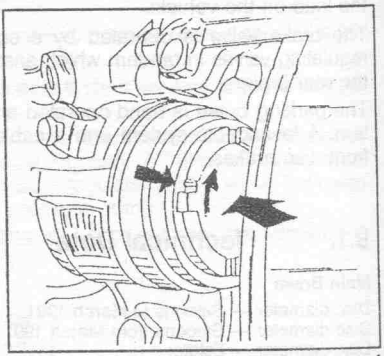


Fig. 9.1. — The arrows show the movement of the piston to push it back into the bore.

- Push the caliper piston back into its bore. To do this, the piston must be rotated and at the same time pushed in. Two screwdrivers can be used for this operation. Insert the blade of one screwdriver into the slots of the piston end face and with the other screwdriver push the piston inwards. Take care not to damage the piston or caliper. The screwdriver must not be applied against the brake disc to push back the piston, as the disc may be damaged. Fig. 9.1. shows a diagram of the operation.

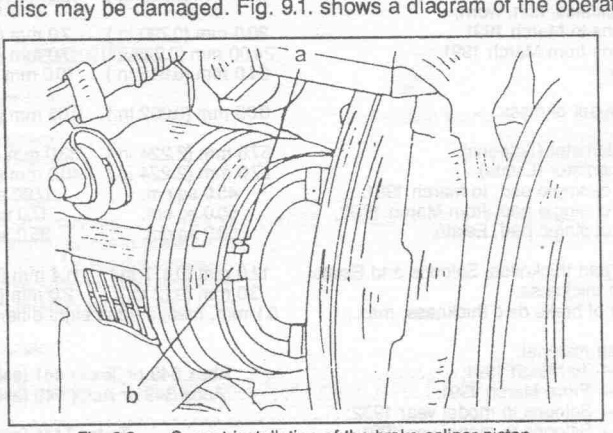


Fig. 9.2. — Correct installation of the brake caliper piston.
a Identification mark b 7 mm piston groove

NOTE: The brake pads on all models must be replaced as a set of four, as otherwise the brakes may pull to one side. Do not interchange pads from one side to the other.

After the piston has been reset as far as possible, turn it into the position shown in Fig. 9.2, i.e. the mark "a" must be horizonally with, above or below the piston groove "b", which at the same time is parallel with the level of the bleeder screw.

Fit the brake pads into the caliper. A protective "stick-on" cover is attached to the brake pad lining and must be removed first. The peg at the back of the metal plate must be inserted into the piston groove "b" in Fig. 9.2. There must be a gap of 1.0 mm (0.04 in.) between the disc and the brake pad. This play can be measured by inserting a feeler gauge of the thickness given. If necessary push the piston further into its bore as described above, again using the two screwdrivers. **Note that two different types of brake pads are used. Only the pads of Estate models have not been changed. Make sure you obtain the correct pads.**

Carefully lower the brake caliper cylinder over the inserted brake pads without damaging the edges and insert the retaining pin. Fit the clip in the centre during this operation. Secure the retaining pin with the clip.

Insert the handbrake cable into its guide and re-connect the handbrake operating lever. Check that the footbrake and handbrake are operating properly. Re-connect the cable to the pad wear indicator connector.

Refit the wheels and lower the vehicle to the ground. Tighten the wheels bolts to 9.0 kgm (65 ft.lb.).

The following points must be observed when brake pads are replaced:

- Only replace brake pads in sets and never interchange pads from one side to the other in order to compensate for brake pad wear. Observe the min. thickness given in Section 9.0. Also replace brake pads if this thickness is nearly approached.
- If moist areas can be seen near the piston surroundings, check the rubber dust seals of the cylinder. In this case overhaul the cylinder or have it overhauled, as the internal sealing ring is no longer sealing the piston in the bore.
- Never use compressed air to clean out the brake pad openings. Older brake pads contained asbestos — Health risk !. Clean with petrol only.
- Only use Citroën brake pads or Citroën-approved brake pads — the correct ones. Alternative brake pads may be less expensive, but Citroën pads last longer.
- The "brake fluid" used in the brake system is mineral-based. Use of petrol will therefore not damage the rubber seals.
- After brake pads have been refitted, pressurise the hydraulic system and operate the brake pedal a few times to set the brake pads against the discs. New pads have to "bed" in for the first few miles and the necessary care should be taken when the vehicle is taken on the road for the first time.

9.2.0. REPLACING A BRAKE DISC

The brake disc of Saloon models have been changed (and with it the brake calipers), i.e. two different thicknesses can be found on the XM range. Estate models are fitted with the thicker discs. The brake caliper have been adapted to the larger brake discs. The removal and installation of a brake disc is carried out as follow, irrespective of the type of disc fitted:

- Remove the brake pads as described in the last section.
- Remove the two bolts securing the brake caliper mounting bracket from the inside of the caliper unit (one at the top, one at the bottom) and lift off the unit.

The caliper cylinder will come away from the guide pin (1) in Fig. 9.3. This pin must never be removed. Use piece of wire and tie the caliper to the front suspension. It must allowed to hang down on the brake hose.

- Unscrew the two disc securing screws from the front face of the hub (cross-headed screwdriver) and remove the disc.

Brake discs can be re-machined as long as the min. thickness given in Section 9.0 has not been reached. Make sure you use a workshop with experience in re-grinding discs.

The installation of the disc is a reversal of the removal procedure. The two caliper bracket mounting bolts must be tightened to 10.5 kgm (75 ft.lb.).

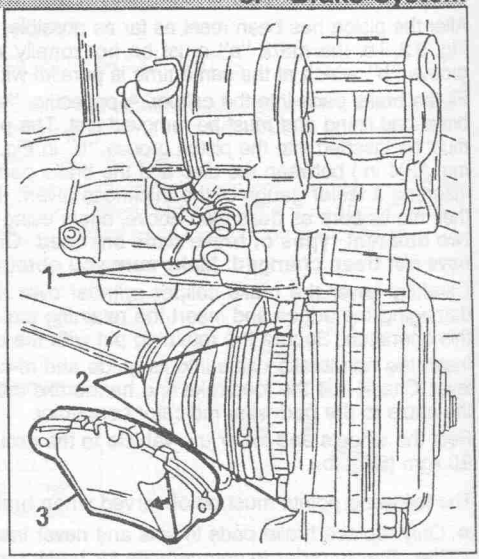


Fig. 9.3. — View of a front brake assembly. The caliper is swivelled up on the guide pin (1). The caliper bracket is secured by bolts (2). Note how the protection of the brake pad (3) is peeled off.

After installation check the brake disc for run-out. Do do this, place a dial gauge with a suitable stand next to the brake disc and piace the dial gauge plunger near the outer edge against the disc face. To eliminate all other clearance find two nuts with 14 mm threads and fit two of the wheel bolts into the hub flange. Tighten the bolts. This will simulate a fitted wheel. Rotate the disc slowly and read off the dial gauge. The max. permissible deflection is 0.05 mm under these conditions.

9.2.1. BRAKE CALIPER — REMOVAL AND INSTALLATION

Jack up the front of the vehicle with the wheels hanging down, place chassis stands underneath the sides of the body and remove the wheel on the side in question.

Slacken the bleeder screw of the pressure regulator from underneath the vehicle without unscrewing it fully.

Set the manual height control lever into the "low" position.

Unscrew the union nut securing the brake pipe to the brake hose, carefully withdraw the pipe and close off the end of the pipe by pushing a bleeder screw cap over the end (clean the cap first).

Remove the brake hose out of the bracket. To do this, remove the spring plate with a pair of pliers and then withdraw the hose.

Remove the brake caliper cylinder as described during the removval of the brake pdas and withdraw the caliper from the guide pin. Fig. 9.3 shows the caliper swivelled upwards before removal.

The installation of the brake caliper is carried out in reverse order to the removal procedure. Bleed the brake system after installation.

9.2.2. BRAKE CALIPERS — OVERHAUL

A special tool is required to completely dismantle the front calipers, in order to compress the fitted spring discs. For this reason repair work on the calipers should be limited to replace the cylinder seal. Enquire if repair sets are available.

- Using a screwdriver, remove the outer dust cover from the caliper opening and eject the piston with air. A foot pump with a suitable connector should be sufficient to blow out the piston. Otherwise take the brake caliper to a garage forecourt. Place a piece of wood into the caliper opening to prevent the piston from hitting the metal.
- Use a blunt instrument and remove the cylinder sealing ring out of the cylinder groove, as shown in Fig. 9.5.

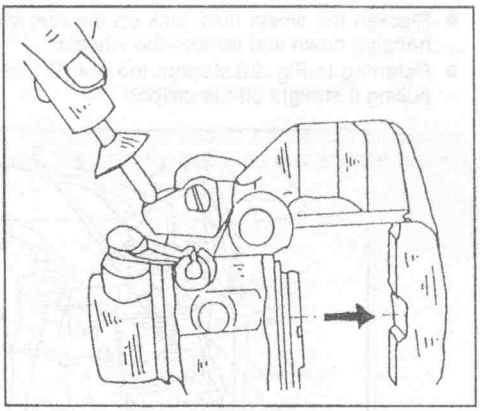


Fig. 9.4. — Blowing the piston out of a caliper.

Thoroughly clean all parts with petrol or a similar liquid. Check the piston and the cylinder bore for excessive wear or grooves. A damaged cylinder bore requires the replacement of the complete brake cylinder. The slide bushes and the rubber boots can also be replaced, but we feel that this operation should be left to a qualified Citroën mechanic, as special tools are necessary for the removal and installation of the slide bushes. The rubber bushes can be pressed off with a screwdriver. The difficult part is the removal of the two-part bush assembly in the swivel eye.

The brake caliper should also be replaced if the handbrake self-adjusting mechanism has shown signs of malfunction, as a further dismantling of the caliper is not recommended.

Assemble the caliper as follows:

- Coat the cylinder bore and a new cylinder sealing ring with green LHM fluid and insert the sealing ring into the cylinder groove. Screw the pistons into the cylinder as described during the replacement of the brake pads, i.e. the horizontal cut-out must be in line with the

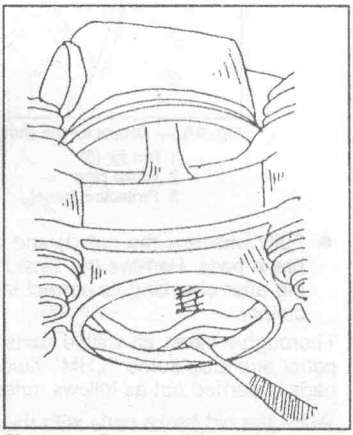


Fig. 9.5. — Removal of the sealing ring.

bleeder screw, as already shown in Fig. 9.2. Use a screwdriver with a 7 mm square blade to turn the piston.

- Coat the outside dust seal with the grease supplied in the repair kit and fit to piston and cylinder.
- Clean the assembled caliper from fluid or and grease and refit it to the steering knuckle as described earlier on. The brake system must be bled of air as described in Section 9.5 after completed installation.

9.3. Rear Disc Brakes

9.3.0. REPLACING THE BRAKE PADS

As in the case of the front brakes, only a complete set of brake pads must be fitted to prevent the brake from pulling to one side. Remove the pads as follows:

- Slacken the wheel nuts, jack up the rear end of the vehicle with the wheels hanging down and remove the wheels.
- Referring to Fig. 9.6 slacken the nut (1) and remove the covering plate (3) by pulling it straight off the caliper.

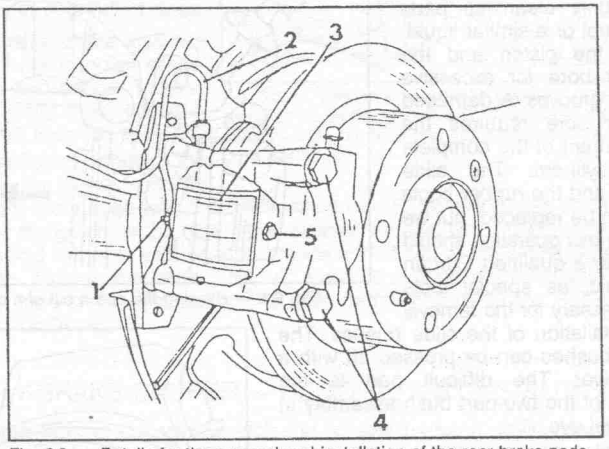


Fig. 9.6. — Details for the removal and installation of the rear brake pads.

1 Nut for (5)
2 Brake pipe
3 Protection panel
4 Brake caliper bolts
5 Brake pad bolt

- Fully unscrew the nut (1) and carefully knock out the bolt (5), releasing the brake pads. Remove the tensioning spring from the inside of the caliper opening after checking its correct installation. Withdraw the brake pads out of the caliper.

Thoroughly clean all visible parts from brake dust, etc. Clean the pistons with petrol and drop some "LHM" fluid onto the pistons. The installation of the brake pads is carried out as follows, referring to Figs. 9.6 and 9.7:

- Fit the old brake pads with the securing bolt, but without the spring, into the brake caliper and push the pistons into their bores by pressing against the

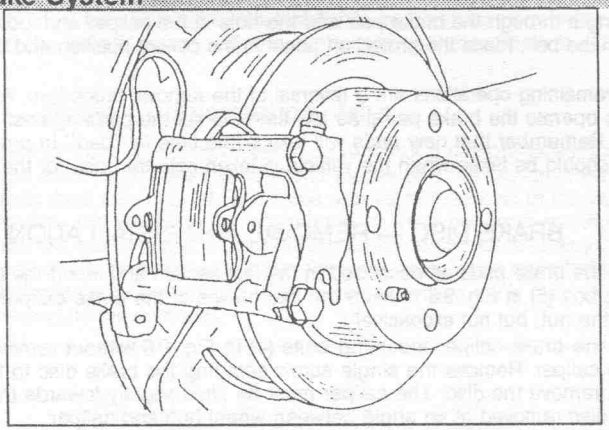


Fig. 9.7. — The two brake pads in fitted position, just before removal.

brake pads with a screwdriver. The screwdriver should not be applied against the brake disc to prevent damage. Remove the securing bolt and the two old brake pads.

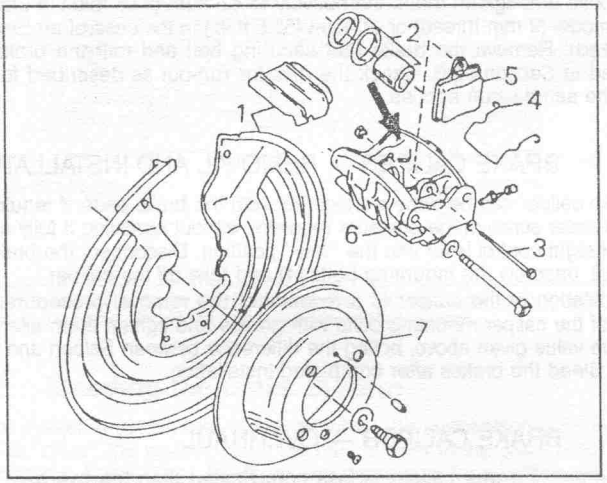


Fig. 9.8. — The component parts of a rear brake caliper.

1 Protection panel
2 Piston and seal
3 Brake pad securing bolt
4 Tensioning spring
5 Brake pad
6 Brake caliper
7 Brake disc

- Insert the new outer brake pad and partially insert the securing bolt (5) in Fig. 9.7. Then fit the second brake pad together with the tensioning spring. Make sure the spring is in its original position. Fully insert the pad securing bolt,

guiding it through the brake pad and the hole in the caliper and loosely fit the nut to the bolt. Place the protection panel in the correct position and tighten the nut.

- The remaining operations are a reversal of the removal procedure. After installation operate the brake pedal as few times to set the pads against the brake disc. Remember that new pads will take some time to "bed" in properly and care should be taken when the vehicle is taken onto the road for the first time.

9.3.1. BRAKE DISC — REMOVAL AND INSTALLATION

Remove the brake pads as described in the last section and insert the brake pad securing bolt (5) in Fig. 9.6 to keep the two halves of the brake caliper together. Tighten the nut, but not excessively.

Slacken the brake caliper mounting bolts (4) in Fig. 9.6 without removing them from the caliper. Remove the single screw securing the brake disc to the wheel hub and remove the disc. The caliper must be tilted slightly towards the outside and the disc removed at an angle between wheel hub and caliper.

Brake discs can be re-ground to the min. dimension given in Section 9.0. Have the operation carried out by an experienced engineer as both sides must be parallel within very small tolerances.

The installation of the rear brake disc is a reversal of the removal procedure. Tilt the caliper as necessary to insert the disc between caliper and hub. Fit the two caliper bolts and tighten them alternatively to 4.5 kgm (32.5 ft.lb.) in the case of a Saloon model (9 mm thread) or 7.0 kgm (52.5 ft.lb.) in the case of an Estate car (10 mm thread). Remove the brake pad securing bolt and refit the brake pads as described in Section 9.3.0. Check the disc for run-out as described for the front discs. The same value applies.

9.3.2. BRAKE CALIPER — REMOVAL AND INSTALLATION

The brake caliper can be removed together with the brake pads, if required. Slacken the bleeder screw in the pressure regulator without removing it fully and set the manual height control lever into the "low" position. Disconnect the brake pipe (2) in Fig. 9.6, unscrew the mounting bolts (4) and take off the caliper.

The installation of the caliper is a reversal of the removal procedure. Coat the threads of the caliper mounting bolts with grease and tighten them alternatively to the torque value given above, noting the difference between Saloon and Estate car models. Bleed the brakes after completed installation.

9.3.3. BRAKE CALIPER — OVERHAUL

The overhaul of a rear caliper is less complicated than the overhaul of a front caliper. To remove the piston, clamp the two halves of the brake caliper together with the centre bolt. Apply an air line to the brake hose connection to blow out the piston. A piece of wood must be placed into the caliper opening to prevent damage to the piston. After the two caliper halves have been separated remove the two sealing rings and the small seals in the fluid bores carefully with a small screwdriver. The seals must always bew replaced. Fig. 9.14 shows an exploded view of the caliper for reference.

The assembly is a reversal of the dismantling procedure. Push the piston down to

the bottom of its bore to facilitate the installation of the brake pads. After assembly fit together the caliper halves with the centre bolt until the caliper is refitted.

9.4. Brake Compensation Valve

The removal of the brake compensation valve is not a straight forward operation, as amongst other operations the cowl end pieces and the crossmember and the bonnet struts must be removed. The same applies to the repair of the valve. It can be overhauled, but we strongly recommend to have the work carried out in a garage. You will also find that a failure of the brake control valve is very rare. If you ever have to disconnect hydraulic pipes from the valve, mark them before disconnecting to facilitate the installation. Fig. 9.9 shows where each brake pipe is connected, shown by the symbols.

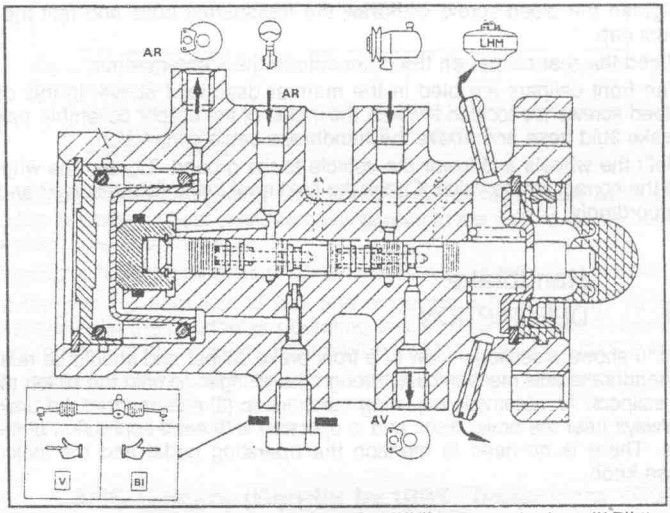


Fig. 9.9. View of the brake compensating valve. "AV" indicates the front, "AR" the rear. The steering symbol refers to L.H.D. and R.H.D. vehicles.

9.5. Bleeding the Brake System

The brake system must be bled of any air when the suspension is in the "HIGH" position. To "clear" the system, move the control lever in the given order to the following positions. Low—high—low-high. The operations for a vehicle with ABS are slightly different. In the case of all models bleed the system in the following order: R.H. rear, L.H. rear, R.H. front, L.H. front. Proceed as follows:

- Jack up the vehicle with the wheels hanging free and remove the road wheels.
- If ABS is fitted, remove the two panels on the inside of the wheel arch on the timing side of the engine. The hydraulic valve block for the ABS installation will be exposed on the L.H. side of the support strut. Near the upper end, left and right of the reference plate (marked "Bendix") you will find two Allen-headed screws. These are bleed screws. Start the engine and open the two bleed

screws. Have a helper to depress the brake pedal. The fluid will be seen coming out of the two screw openings. Have the pedal depressed for a few seconds and then released. Tighten the two screws (approx. 1.0 kgm/7 ft.lb.). Unfortunately the fluid cannot be "channelled" into a container so you will have to catch it by placing a larger container underneath the valve block.

The remaining operations are the same for all models:

- Connect a length of transparent hose onto the R.H. rear caliper bleed screw (remove the dust cap first) and insert the other ends of the hoses into a clean container, partly filled with fluid. If you don't know where the screw is, it is vertically inserted near the upper caliper mounting bolt.
- Ask a second person to depress the brake pedal and start the engine.
- Slowly open the bleed screw on the caliper and allow the fluid to run out until no more air bubbles are visible in the transparent hose.
- Tighten the bleed screw, withdraw the transparent hose and refit the rubber dust cap.
- Bleed the rear caliper on the other side in the same manner.
- The front calipers are bled in the manner described above. In this case the bleed screws are located towards the inside of the caliper assembly, next to the brake fluid hose and above the handbrake cable connection.
- Refit the wheels and lower the vehicle to the ground. Tighten the wheel bolts to the correct torque value. Check the fluid level in the fluid reservoir and top-up accordingly.

9.6. Handbrake

9.6.0. DESCRIPTION

Fig. 9.10 shows a sectional view of a front brake caliper and should be referred to. The handbrake acts mechanically through the plunger (2) onto the piston (4) of the front calipers. An automatic adjusting mechanism (3) ensures that the brake pads are always near the brake discs and is operated with each application of the brake pedal. There is no need to mention the operating pedal and the locking and release knob.

9.6.1. ADJUSTING THE HANDBRAKE CABLES

Attention: Never adjust the handbrake at the cables in order to compensate the handbrake travel at the lever. An automatic adjustment system in the caliper pistons will take-up any play when the handbrake pedal travel reaches a certain value. Reset the take-up by running the engine and, with the handbrake pedal in the rest position, operate the main brake pedal. Release the main pedal and operate the handbrake pedal. 4 to 12 "clicks" should be heard before the wheels are locked.

When the handbrake cable has been replaced, adjust the handbrake cables as follows to their basic setting:

- Operate the main brake pedal a few times in order to set the brake pads against the brake discs.
- Set the handle to the locked position and depress the handbrake pedal to the 4th notch. Locate the two nuts on handbrake cable anchorage, slacken the

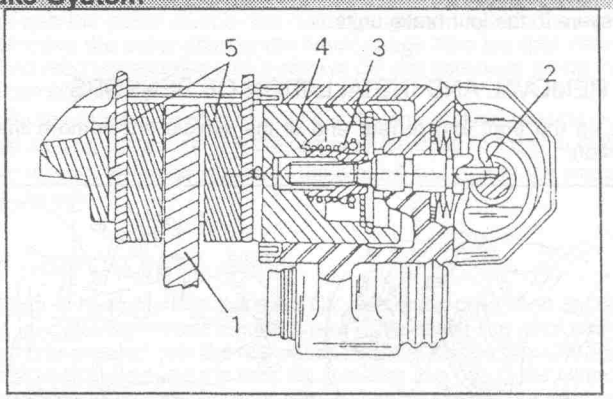


Fig. 9.10. — Sectional view of a front brake caliper with details of the handbrake mechanism.

1 Brake disc
2 Operating plunger
3 Adjuster mechanism
4 Brake caliper piston
5 Brake pads

locknuts and turn the adjusting nuts. Make sure that the compensator lever located in the exhaust heat shield remains square to the vehicle, i.e. do not adjust one side more than the other.

- Release the handle and check that the pedal returns to its rest position.
- Turn the steering from lock to lock and move the vehicle through its heights whilst checking the handbrake operating levers of each caliper. There should be no movement of the levers. Tighten the locknut to 2.0 kgm (14.5 ft.lb.).
- Depress the pedal several times and check that it always returns to the rest position. The front wheels should be locked when the pedal is depressed between the 6th and the 12th notch.

9.7. ABS System (Bendix to 1995, Teves from 1996)

The above system can be fitted optionally or is a standard fitment. The system consists of hydraulic and electronic component parts which operate in conjunction with the normal braking system. Apart from the additional parts there are also differences in the layout of the hydraulic system.

A hydraulic control unit is fitted to the L.H. front wheel arch. Its circuit is inserted between the brake compensating valve and the feed for the front and rear brakes. The control unit supplies the brakes with the hydraulic fluid, depending on the requirements of the brakes.

The speed sensor for the front and rear wheel speeds and an ABS control unit operate electronically. One speed sensor is fitted to each wheel, into the steering knuckle in the case of the front wheels and into the rear axle arm in the case of the rear wheels. The sensors monitor the speed of each wheel at any given moment and transmit a signal to the electronic control unit. The latter is fitted in the engine compartment in the E.C.U. housing on the R.H. wheel arch. In accordance with the information supplied by the four wheel speed sensors, the electronic control unit sends a current to the hydraulic control unit electro-valves, thus controlling

the pressure to the four brake units.

9.7.0. REMOVAL AND INSTALLATION OF SENSORS

- Jack up the front end of rear end of the vehicle and remove the wheel in question.

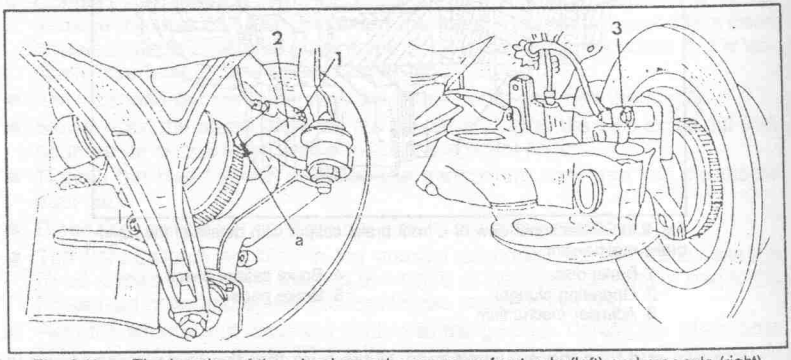


Fig. 9.11. — The location of the wheel speed sensors on front axle (left) and rear axle (right).
1 Front securing screw 2 Adjusting screw 3 Rear securing screw

- Disconnect the connector plug for the electrical lead and free the lead from the securing clamp.
- Remove the sensor securing screw and withdraw the sensor from the steering knuckle or the rear axle arm.

The installation is a reversal of the removal procedure. The front sensor must be adjusted during installation. A gap of 0.5 mm must be obtained at point "a" in Fig. 9.11 between the tip of the sensor and the toothed wheel on the drive shaft, when the front sensor is re-fitted. To adjust the gap, refer to Fig. 9.12:

- Fit the wheel sensor with a paper shim "a" of the thickness given above into the steering knuckle. Fully slacken the adjusting screw (1).
- Coat the threads of the securing screw (2) with thread locking compound, fit the screw and tighten to 1.0 kgm (7.2 ft.lb.). A feeler gauge of 0.5 mm can also be inserted between the tip of the sensor and the toothed ring.
- Push the sensor into

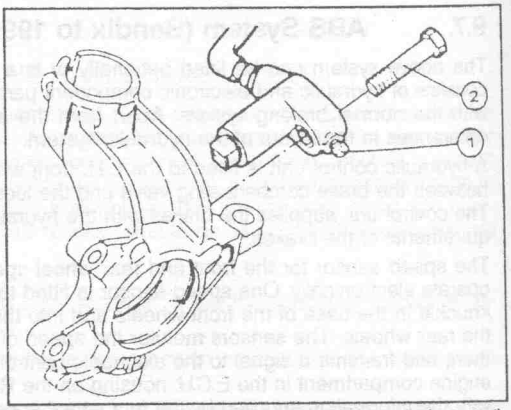


Fig. 9.12. — Adjusting a front wheel speed sensor (refer to text).

contact with the paper shim or the feeler gauge and tighten the screw to 0.3 kgm. Remove the paper shim or the feeler gauge from the gap. *New sensors (front and rear) are supplied with a shim of 0.5 mm thickness, giving the correct clearance when fitted.*

When fitting the rear wheel sensor, coat the threads of the screw (3) in Fig. 9.11 with thread locking compound. Fit the screw and tighten to 1.0 kgm (7.2 ft.lb.).

Fit the rear wheels, lower the vehicle to the ground and tighten the wheel bolts to the correct torque.

9.7.1. REPLACING A ROTOR

The front rotor is machined into the outer C.V. joint of the drive shaft and cannot be replaced, i.e. a damaged rotor means a new drive shaft. The rotor has 48 teeth. The rear rotor is pressed over the rear wheel hub and can be replaced. An internal thread (M20 x 200) is cut into the rotor. By screwing in a bolt of the same diameter it will be possibe to remove the rotor with a suitable puller. The rotor is pressed over the wheel hub. A mandrel must be inserted into the inside of the rotor, NOT against the rotor teeth. A new rotor has been fitted since Oct. 1991, having a different tooth form. The new rotor can be fitted to older models.

9.8. Brakes — Tightening Torques

Front brake caliper bolts:	10.5 kgm (76 ft.lb.)
Rear brake calipers:	
Saloons:	4.5 kgm (32.5 ft.lb.)
Estates:	7.0 kgm (50.5 ft.lb.)
Brake valve:	2.0 kgm (14.5 ft.lb.)
Wheel nuts:	9.0 kgm (65 ft.lb.)

10. WHEELS AND TYRES

Tyre pressures and the condition of the tyres should be checked once a week. Remember that the tyre is the only contact with the road surface.

Inspect the tyre walls for cracks, splits or bad damage. If the tyres are worn on one side, in most cases on the outside, check the front wheel alignment. Normally the toe-in setting will need adjustment.

Excessive wear on both sides of the tyre indicates driving with an under-inflated tyre. Excessive wear in the centre of the tread indicates an over-inflated tyre.

Damage can also be caused by sharp objects or contact with kerb stones. A clear tread pattern should always be visible. **Do not drive with tyres if the depth of the tread is less than 1.6 mm.**

Check the tyre pressures once a week in accordance with the figures given in the next section. If the tyres lose more than 2 psi. per week, then the tyre has a puncture or the seal on the wheel rim is damaged. Take the faulty wheel to a tyre specialist. Always keep the valve caps in place as these will prevent leakage of air from the valves. Do not forget to replace them after you have checked the tyre pressures.

Punctures may occur slowly over night or suddenly whilst driving. If the latter is the case do not panic. Try to keep the steering wheel straight and if possible come to rest without braking. Drive onto the hard shoulder of the road (or as far as possible to the road side if there is no hard shoulder). Sudden movement will cause a skid. When you have stopped the car change the deflated wheel with the spare.

NOTE: Use a warning triangle a good distance behind the vehicle when changing a wheel on a public road. Also switch on the hazard warning light. Do not forget to collect the warning triangle after the wheel change.

10.1. Technical Data

Rim Sizes:
- Standard diesel engine models: ..... 5 ½ J.15 - H2 5.40
- Turbo diesel engine models: ..... 6 J.15 - H2 5.45
- Light-alloy wheels: ..... 6 J.15 CH 5.45/5.43

Tyre sizes fitted:
- Standard diesel engine models: ..... MXL 175/70 R15 86 T or MXV2 185/65 R15 87 H
- Turbo diesel engine models: ..... MXV2 185/65 R15 91 H

Tyre Pressures: ..... Check sticker on door pillar or Driver's Handbook

11. ELECTRICAL SYSTEM

11.0. Battery

Voltage: ..... 12 volts, negative earth
Type: ..... AC Delco L300A or L3450L, depending on model
Battery Electrolyte Readings: ..... Battery condition indicator
- Green spot: ..... Battery charged
- Sight glass obscured: ..... Battery needs charging
- Sight glass clear: ..... Battery electrolyte low

11.0.0 Battery Care

The 12 volts battery consists of six cells, made-up of positive and negative plates, surrounded by a sulfuric acid solution. The battery provides the current to start the engine, for the glow plug and fuel cut-off system and other equipment fitted to the injection pump, the lighting of the vehicle and other current consumers.

The following maintenance operations should be carried out at regular intervals to extend the life of the battery and to always keep it at its peak performance.

- Check the battery level once a week. If the battery case is translucent, the level can be seen through the case. Otherwise the filler plugs will have to be removed for inspection. If the electrolyte is below the separator plates, add distilled water. Do not over-fill the battery and wipe away any spilled water before replacing the filler plugs. Tap water must not be used to top-up the battery. If a sealed battery is fitted, use the sight glass provided and check in accordance with the information given below.
- Delco batteries incorporate a battery checker, which enables an easy check of

the battery condition. If a green spot can be seen there is no further need for attention, i.e. the battery is sufficiently charged. If the battery checker turns dark, the battery must be re-charged. If the checker turns a light colour, electrolyte is missing in the battery.

- If frequent topping-up is necessary, it may be that the battery is over-charged by the alternator and the latter should be checked accordingly. A cracked battery case can also be the cause.
- The battery cables should always be firmly clamped and the battery terminals must be free of corrosion to ensure good electrical conduct. Corroded areas can be cleaned with a soda solution and a wire brush. A thin coating of petroleum jelly should be smeared on battery posts before cables are re-connected.
- Check the gravity of the electrolyte in each cell using a hydrometer. This is an indication of the charge condition of the battery. All cells should give the same reading and if there is a great variation in one cell, then either the electrolyte in the cell is weak due to being topped-up with distilled water or that cell is defective. In this case, a new battery must be fitted.
- The battery can be charged with a home-charger, but follow the instructions of the manufacturer to avoid damage to the battery.

Note that the following will happen when the battery is disconnected:

- The fault codes stored in the memory of the electronic control units for the anti-block braking system will be lost.
- The radio security code will have to be known and set in order to return the radio to service.

11.2. Alternator

11.2.0. TECHNICAL DATA

Types fitted: . . . . . Valeo or Mitsubishi (with built-in electronic regulator)
Voltage - All: . . . . . 14 volts

11.1.1. PRECAUTIONS WITH ALTERNATORS

(a) Do not run the alternator unless connected to the battery.

(b) Before connecting the alternator, ensure that the battery is correctly connected.

(c) Do not check the operation of the alternator by short- circuiting either the positive or the energising terminals and earth.

(d) Take care not to reverse the leads connected to the regulator.

(e) Do not attempt to re-energise the alternator. This is never necessary and in any case would damage both the alternator and the regulator.

(f) Do not connect a battery charger to the battery and never carry out any arc welding (or spot welding) on the car chassis unless both the positive and negative leads are disconnected from the battery.

(g) Alternators are not the same for models without air conditioning system and for models with air conditioning system. Also quote the engine type and engine number when a new or exchange alternator is obtained. Always check with the information available from Citroën parts lists.

11.1.2. ALTERNATOR — SERVICING

The alternator requires no lubrication since the ball bearings are pre-packed and sealed. Keep the outside of the alternator free from oil or dirt by wiping over occasionally with a dry cloth.

The brushes operate on plain rings and the life of the brushes and slip rings can be expected to be quite long.

Servicing and testing of the alternator requires special test equipment and it is recommended that such work is entrusted to a Citroën Dealer.

11.1.3. DRIVE BELT

The alternator drive belt should always be kept at the proper tension. Alternators rotate at high speed and the belt tension is important for proper operation. The first sign of a slipping fan belt is a squealing noise during sudden acceleration either during driving off or from low speeds to higher speeds.

In the event of the alternator not charging properly it is certainly a first step to check that the drive belt is not stretched, cracked or defective.

The belt drive for models with and without air conditioning system is shown in Figs. 11.1 and 11.2. For the purpose of tensioning the alternator belt, belt "B" applies. The tension of the alternator or alternator/compressor drive belt is adjusted by means of the adjusting screw (3). Citroën workshops use a special tool to check the belt tension in kgm. As this is most probably not available, you will have to judge "a good tension". Take care not to overtension the belt (damage to alternator bearings). Proceed as follows:

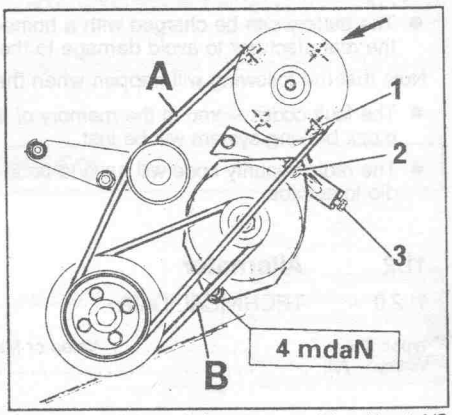


Fig. 11.1. — Drive belt layout on models without A/C system. Bolt (1) is used to adjust the belt of the hydraulic pump (A). Bolt (3) and nut (2) are employed to adjust the tension of the alternator belt (B).

- With the belt in position, tighten the bolt at the bottom of the alternator to 4.0 kgm (30 ft.lb.).
- Use the screw (3) in the illustrations and tighten the screw until the alternator has moved out sufficiently until the belt can be moved to and fro with a deflection of approx. 8 to 10 mm.
- Tighten the nut (2) at the upper end of the alternator.
- Rotate the crankshaft by three turns and re-check the tension. Carry out an additional adjustment, if not satisfied.

NOTE: If you are not absolutely sure if the belt is tensioned correctly, it may be a good step to have the belt checked in a Citroën workshop.

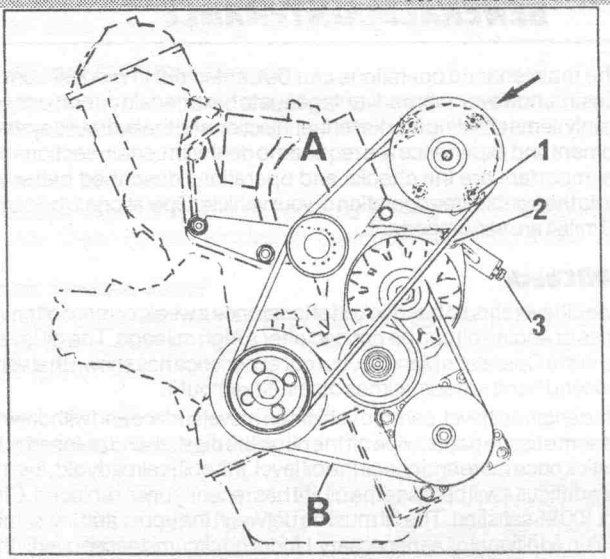


Fig. 11.2. — Layout of the drive belts on a model with A/C system. Bolt (1) is used to adjust the belt of the hydraulic pump (A). Bolt (3) and nut (2) are employed to adjust the tension of the alternator and compressor belt (B).

NOTE: The adjustment of the tension of the drive belt of a DK5 2.5 litre engine is described earlier on in Section 1.8.3 (Page 80).

11.2. Starter Motor

Type: ..... Direct current, series wound with solenoid switch
Manufacturer: ..... Valeo

11.1.1. SERVICING

Routine servicing of the starter motor should include attention to the brush gear to ensure that the brushes are not worn.

Clean the commutator with fuel or grease solvent but do not allow any to get on the windings. If necessary, sandpaper of a fine grade can be used to clean the commutator or the segments can be re-skimmed on a lathe. Note that the mica must always be undercut.

A full check of the electrical characteristics of the starter motor will require test instruments to check the armature and field coils for open circuits or short circuits to ground. We recommend to have the starter motor checked in a specialist workshop and not to undertake the operations yourself.

Try to obtain an exchange starter motor if the old one is no longer serviceable.

12. GENERAL MAINTENANCE

Most of the maintenance operations can be carried out in modest surroundings. Sometimes it is, however, more advantageous to have certain operations seen to at a dealer, mainly items affecting the diesel fuel injection and the hydraulic system, as special equipment and experience are required to deal with certain sections of the vehicle. More important are the checks and operations described below which will contribute to the trouble-free operation of your vehicle. Operations to be carried out after 20,000 miles are very important.

Engine Oil Check

The engine oil level should be checked at least once a week, or more often when continuous loss of engine oil can be noticed after a high mileage. The oil level check is described in the Operater's Manuals, but our experience has shown that vehicles purchased second hand are sometimes obtained without it.

To check the engine oil level, park the vehicle on a level surface and withdraw the oil dipstick. Use some tissue paper, wipe off the oil on the dipstick and re-insert it. Withdraw the oil dipstick once more and check the oil level. If the oil is already old, it will be clearly seen. More difficult it will be to see the oil, if it has recently been replaced. Check once more if not 100 % satisfied. The oil must be between the upper and lower mark on the dipstick. Fill in additional oil as necessary. Under no circumstances overfill the engine, thinking that it is better to be on the safe side. Do not forget to replace the filler cap after topping-up — it has happened. **Use only engine oil for diesel engines.**

Checking Brake Lights

The operation of the brake lights should be checked at regular intervals. Drive backwards in front of the garage door or similar and depress the brake pedal. The glow of the lamps will be seen in the outside mirror. Replace the bulb if one light is not working; check the brake light switch if both are not working.

Checking Lighting

Check all lights, including the horn, once a week. Tail lights and reversing light are best checked in the dark against a garage door. Otherwise have a second person checking the rear end of the vehicle whilst the brake lights are checked.

Tyre Pressures

Check the tyre pressures at regular intervals, specially before going on a longer trip. The tyre pressures will be given in the Owner's manual and are also given on a sticker on the vehicle. Note that the rear tyres should be inflated slightly more, if the vehicle is fully laden.

Here and then take the opportunity to check the depth of the tyre tread. Remember that the latest regulation require a minimum depth of 1.6 mm. Tread wear indicator bars spaced around the tyre show when the minimum legal limit is reached.

Coolant Level

The cold coolant must be in line with the mark on the radiator tank. If necessary, top-up with anti-freeze solution when the engine is cold. If the engine is hot, allow the en-

gine to cool down before opening the expansion tank cap.

Engine Oil and Oil Filter Change

The engine oil and the oil filter should be changed in accordance with the instructions in the Owner's Handbook.

Air Cleaner

The air cleaner element should be replaced at least every 20,000 miles; earlier if necessary. Clean out the air cleaner casing before fitting a new element.

Hydraulic System Level

Ever so often check the fluid level in the reservoir for the hydraulic system. Remember that suspension, steering and the brake system depend on it. Use LHM fluid (green colour) only to top-up the reservoir.

Inspection every 20,000 miles

The following should be checked every 20,000 miles: Lighting system, hazard warning lights, indicator lamps, horn, windscreen and windscreen washer operation, battery (check electrolyte level and if necessary add destilled water), coolant (check anti-freeze strength and correct if necessary), drive belts (check condition and re-tension if necessary), change engine oil and oil filter, check brake system in general for leaks or damage, check exhaust system for leaks or damage, check track rod ends for excessive play, check transmission, final drive and drive shafts for leaks, check front and rear brake linings, check brake fluid level, check headlamp adjustment or have it checked.

FAULT FINDING SECTION

The following section lists some of the more common faults that can develop in a motor car. The section is divided into various categories and it should be possible to locate faults or damage by referring to the assembly group of the vehicle in question.

The faults are listed in no particular order and their causes are given a number. By referring to this number it is possible to read off the possible cause and to carry out the necessary remedies, if this is within the scope of your facilities.

ENGINE FAULTS

Engine will not crank:	1, 2, 3, 4
Engine cranks, but will not start:	5, 6, 7, 8
Engine cranks very slowly:	1, 2, 3
Engine starts, but cuts out:	5, 6, 9, 10
Engine misfires in the lower speed ranges:	5, 6, 9, 11
Engine misfires in the higher speed ranges:	5, 6, 11, 12
Continuous misfiring:	5, 6, 7, 10 to 15, 21, 22
Max. revs not obtained:	5, 6, 12, 22
Faulty idling:	5, 6, 8 to 11, 13, 15, 16, 21 and 22
Lack of power:	3, 5 to 11, 13 to 15, 22
Lack of acceleration:	5 to 8, 12, 14 to 16
Lack of max. speed:	5 to 8, 10, 12, 13 to 15, 22
Excessive fuel consumption:	3, 5, 6, 15, 16
Excessive oil consumption:	16 to 19
Low compression:	7, 11 to 13, 16, 20 to 22

CAUSES AND REMEDIES

1. Fault in the starter motor or its connection. Refer to "Electrical Faults".
2. Engine oil too thick. This can be caused by using the wrong oil, low temperatures or using oil not suitable for the prevailing climates. Depress the clutch whilst starting (models with manual transmission). Otherwise refill the engine with the correct oil grade. Use only oil suitable for diesel engines (for example TOTAL DIESEL).
3. Moveable parts of the engine not run-in. This fault may be noticed when the engine has been overhauled. It may be possible to free the engine by adding oil to the fuel for a while.
4. Mechanical fault. This may be due to seizure of the piston(s), broken crankshaft, connecting rods, clutch or other moveable parts of the engine. The engine must be stripped for inspection.
5. Faults in the glow plug system. Refer to "Glow Plug Faults".
6. Faults in the fuel system. Refer to "Fuel Faults".
7. Incorrect valve timing. This will only be noticed after the engine has been re-assembled after overhaul and the timing belt has been replaced incorrectly. Re- dismantle the engine and check the timing marks on the timing gear wheels.
8. Compression leak due to faulty closing of valves. Check valve clearances. See also under (7) or leakage past worn piston rings or pistons. Cylinder

head gasket blown.

9. Entry of air at inlet manifold, due to split manifold or damaged gasket. Correct as necessary.
10. Restriction in exhaust system, due to damaged exhaust pipes, dirt in end of exhaust pipe(s), kinked pipe(s), or collapsed silencer. Repair as necessary.
11. Worn valves or valve seats, no longer closing the valves properly. Top overhaul of engine is asked for.
12. Sticking valves due to excessive carbon deposits or weak valve springs. Top overhaul is asked for.
13. Cylinder head gasket blown. Replace gasket and check block and head surfaces for distortion.
14. Camshaft worn, not opening or closing one of the valves properly, preventing proper combustion. Check and if necessary fit new camshaft.
15. Incorrect valve (tappet) clearance. Re-adjust.
16. Cylinder bores, pistons or piston rings worn. Overhaul is the only cure. Fault may be corrected for a while by adding "Piston Seal Liquid" into the cylinders, but will re-develop.
17. Worn valve guides and/or valve stems. Top overhaul is asked for.
18. Damaged valve stem seals. Top overhaul is asked for.
19. Leaking crankshaft oil seal, worn piston rings or pistons, worn cylinders. Correct as necessary.
20. Loose glow plugs, gases escaping past threads, or plug sealing washer damaged. Correct.
21. Cracked cylinder or cylinder block. Dismantle, investigate and replace block.
22. Broken, weak or collapsed valve spring(s). Top overhaul is asked for.

TURBOCHARGER FAULTS

Turbo charger leaks:	1
Turbo charger faulty:	2
Air dump valve faulty:	3
Boost pressure enrichment in injection pump leaking	4

Causes and Remedies

1. Check the following parts of the turbo charger system for correct sealing: Air hose between turbo charger and intake manifold or intake manifold and cylinder head, flanges of intake manifold, clamp on air dump valve loose or sealing faulty, air leaks between exhaust manifold and cylinder head or around turbo charger.
2. Have the charging pressure (boost pressure) checked at your Dealer. If the boost pressure is too high and the control line to the wastegate is not blocked, loose or leaking, renew the turbo charger as the wastegate is defective.
3. If the boost pressure is too low, remove the hose from the air dump valve and plug-up. If the boost pressure is now available, replace the air dump valve.
4. Disconnect the hose to the boost pressure enrichment device and seal off the

end. Re-check the boost pressure, which should now drop by approx. 0.5 bar because the boost pressure enrichment is not functioning. If the boost pressure does not drop off, renew the injection pump, as the boost pressure enrichment device is not operating. If the boost pressure increases despite the boost pressure enrichment being sealed off, this indicates a leak a leak at the boost pressure enrichment valve, The injection pump must be replaced.

GLOW PLUG FAULTS

Check a suspect glow plug as follows:

- Remove the glow plug lead from the rear glow plug and from the remaining plugs the bus bars.
- Connect a 12 volts test lamp to the plus terminal of the battery and with the other lead of the lamp touch in turn the connecting threads of each glow plug. The faulty plug is detected when the test lamp does not light up.

LUBRICATION SYSTEM FAULTS

The only problem the lubrication system should give is excessive oil consumption or low oil pressure, or the oil warning light not going off.

Excessive oil consumption can be caused by worn cylinder bores, pistons and/or piston rings, worn valve guides, worn valve stem seals or a damaged crankshaft oil seal or leaking gasket on any of the engine parts. In most cases the engine must be dismantled to locate the fault.

Low oil pressure can be caused by a faulty oil pressure gauge, sender unit or wiring, a defective relief valve, low oil level, blocked oil pick-up pipe for the oil pump, worn oil pump or damaged main or big end bearings. In most cases it is logical to check the oil level first. All other causes require the dismantling and repair of the engine.

If the oil warning light stays on, switch off the engine IMMEDIATELY, as delay could cause complete seizure within minutes.

COOLING SYSTEM FAULTS

Common faults are: Overheating, loss of coolant and slow warming-up of the engine:

Overheating:

1. **Lack of coolant:** Open the coolant filler cap with care to avoid injuries. Never pour cold water into an overheated engine. Wait until engine cools down and pour in coolant whilst engine is running.
2. **Radiator core obstructed by leaves, insects, etc.:** Blow with air line from the back of the radiator or with a water hose to clean.
3. **Cooling fan not operating:** Check fan for proper cut-in and cut-out temperature. If necessary change the temperature switch or see your Citroën Dealer.
4. **Thermostat sticking:** If sticking in the closed position, coolant can only circulate within the cylinder head or block. Remove thermostat and check as

described in section "Cooling".

5. **Water hose split:** Identified by rising steam from the engine compartment or the front of the vehicle. Slight splits can be repaired with insulation tape. Drive without expansion tank cap to keep the pressure in the system down, to the nearest service station.
6. **Water pump belt torn:** Replace and tension belt (no applicable to XM).
7. **Water pump inoperative:** Overhaul or replace water pump.
8. **Cylinder head gasket blown:** Replace the cylinder head gasket.

Loss of Coolant:

1. **Radiator leaks:** Slight leaks may be stopped by using radiator sealing compound (follow the instructions of the manufacturer). In emergency a raw egg can be cracked open and poured into the radiator filler neck.
2. **Hose leaks:** See under 5, "Overheating".
3. **Water pump leaks:** Check the gasket for proper sealing or replace the pump.

Long Warming-up Periods:

1. **Thermostat sticking in the open position:** Remove thermostat, check and if necessary replace.

FUEL SYSTEM FAULTS

Engine is difficult to start or does not start	1 to 13
Engine starts, but stops soon afterwards:	14 to 20
Engine misfires continuously:	1 to 13
Bad idling:	14 to 20
Black, white or blue exhaust smoke	21 to 29
Lack of power:	30 to 39
Excessive fuel consumption:	40 to 47

Causes and Remedies

1. Fuel tank empty. Refuel.
2. Pre-glowing time too short. Operate until warning light goes "off".
3. Cold starting device not operating.
4. Glow plug system inoperative. Refer to "Glow Plug Faults".
5. Electro-magnetic cut-off device, loose or no current. Check cable to cut-off at top of injection pump. Ask a second person to operate ignition key and check if a "click" is heard. Either interrupted current supply or defective cut-off device.
6. Air in fuel system. Operate starter motor until fuel is delivered.
7. Fuel supply faulty. Slacken the injection pipes at injectors, and check if fuel is running out. Other faults: kinked, blocked or leaking injection pipes, blocked fuel filter, tank breathing system blocked. Wrong fuel for cold temperatures.
8. Injection pipes refitted in wrong order after repair.
9. Injection timing of pump out of phase: Have the adjustment checked and corrected.

10. One or more injectors faulty, dirty or incorrect injection pressure. Have injectors repaired or replace them.
11.1. Injection pump not operating properly. Fit an exchange pump.
12. Valve clearance incorrectly adjusted (after engine repairs). Adjust correctly (not applicable to XM).
13. Compression pressures too low. See item "8" under "Engine Faults".
14. Idle speed not properly adjusted. Adjust.
15. Throttle cable not properly adjusted or sticking. Re-adjust or free-off.
16. Fuel hose between filter and pump not tightened properly. Tighten connections.
17. Rear mounting of injection pump loose or cracked. Tighten or replace.
18. See items 6, 7, 9, 11, 12 and 13
19. Engine mounting not tightened properly or worn. Tighten or replace.
20. Sticking accelerator pedal. Free-off pedal.
21. Engine not at operating temperature. Check exhaust smoke colour again when engine is warm.
22. Too much acceleration at low revs. Use individual gears in accordance with acceleration.
23. Air cleaner contaminated. Clean or replace.
24. Fuel filter contaminated. Replace.
25. Max. speed adjustment incorrect.
26. Injectors are dripping. Have them checked or replace faulty ones.
27. Injector nozzles sticking or broken. Replace injector.
28. Injection pressure too low. Have injectors checked and adjusted.
29. See items 9, 11, 12 and 13
30. Throttle cable travel restricted. Re-adjust. Check that floor mats cannot obstruct pedal movement.
31. Throttle cable not correctly adjusted. Re-adjust.
32. Operating lever loose on pump. Re-tighten.
33. Max. speed not obtained. Re-adjust max. speed or have it adjusted.
34. Injector pipes restricted in diameter (near connections). Disconnect pipes and check that diameter is at least 2.0 mm (0.08 in.).
35. Heat protection sealing gaskets under injectors not sealing or damaged. Remove injectors and check. Replace if necessary.
36. Injection pressure of injectors wrong. Have them re-adjusted.
37. See items 6, 7, 9, 11 and 13
38. See item 20.
39. See items 23, 24, 26 and 27.
40. Road wheels dragging. Brakes seized or wheel bearings not running freely.
41. Engine not running "free". Refers to new or overhauled engine.
42. Fuel system leaking. Check hoses, pipes, filter, injection pump, etc. for leaks.
43. Fuel return line blocked. Clean with compressed air if possible.
44. Idle speed too high. Re-adjust.
45. Max. speed too high. Re-adjust.

46. See items 10, 11, 12 and 13.
47. See items 24, 26, 27 and 28.

CLUTCH FAULTS

Clutch slipping:	1, 2, 3, 4, 5
Clutch will not disengage fully:	4, 6 to 12, 14
Whining from clutch when pedal is depressed:	13
Clutch judder:	1, 2, 7, 10 to 13
Clutch noise when idling:	2, 3
Clutch noise during engagement:	2

Causes and Remedies

1. Insufficient clutch free play at pedal. Adjust in accordance with instructions in section "Clutch" (if applicable).
2. Clutch disc linings worn, hardened, oiled-up, loose or broken. Disc distorted or hub loose. Clutch disc must be replaced.
3. Pressure plate faulty. Replace clutch.
4. Air in hydraulic system (only applicable to models with hydraulic clutch control). Low fluid level in clutch cylinder reservoir.
5. Insufficient play at clutch pedal and clutch release linkage (the latter in the case of mechanical operation). Adjust as described.
6. Excessive free play in release linkage (only for cable and linkage operated clutch). Adjust or replace worn parts.
7. Misalignment of clutch housing. Very rare fault, but possible on transmissions with separate clutch housings. Re-align to correct.
8. Clutch disc hub binding on splines of main drive shaft (clutch shaft) due to dirt or burrs on splines. Remove clutch and clean and check splines.
9. Clutch disc linings loose or broken. Replace disc.
10. Pressure plate distorted. Replace clutch.
11. Clutch cover distorted. Replace clutch.
12. Fault in transmission or loose engine mountings.
13. Release bearing defective. Remove clutch and replace bearing.
14. Bend clutch release lever. Check lever and replace or straighten, if possible.

- The above faults and remedies are for hydraulic and mechanical clutch operation and should be read as applicable to the model in question, as the clutch fault finding section is written for all types of clutch operation. Ignore clutch play adjustments, if the clutch pedal is self-adjusting.

STEERING FAULTS

Steering very heavy:	1 to 6
Steering very loose:	5, 7 to 9, 11 to 13
Steering wheel wobbles:	4, 5, 7 to 9, 11 to 16
Vehicle pulls to one side:	1, 4, 8, 10, 14 to 18

Steering wheel does not return to centre position:	1 to 6, 18
Abnormal tyre wear:	1, 4, 7 to 9, 14 to 19
Knocking noise in column:	6, 7, 11, 12

Causes and Remedies

1. Tyre pressures not correct or uneven. Correct.
2. Lack of lubricant on rack and pinion steering.
3. Stiff steering linkage ball joints. Re-grease if provisions are made for it, otherwise replace ball joints in question.
4. Incorrect steering wheel alignment. Correct as necessary.
5. Steering needs adjustment or have steering adjusted.
6. Steering column bearings too tight or seized or steering column bent. Correct as necessary.
7. Steering linkage joints loose or worn. Check and replace joints as necessary.
8. Front wheel bearings worn, damaged or loose. Re-adjust bearing play or replace the bearings if no results can be obtained.
9. Front suspension parts loose. Check and correct.
10. Wheel nuts loose. Re-tighten.
11. Steering wheel loose. Re-tighten nut (only with separate steering wheel).
12. Steering gear mounting loose. Check and tighten.
13. Steering gear worn. Although it may be possible to overhaul the steering, the fitting of a replacement steering could be the solution.
14. Steering damper (not on XM) defective or loose.
15. Wheels not properly balanced or tyre pressures uneven. Correct pressures or balance wheels.
16. Suspension cylinders not working.
17. Brakes are pulling to one side. See under "Brake Faults".
18. Suspension out of alignment. Have the complete suspension checked by a dealer.
19. Improper driving. We don't intend to tell you how to drive and are quite sure that this is not the cause of the fault.

BRAKE FAULTS

The following hints do not take into consideration any faults that may have developed in the hydraulic system. We strongly advise to have faults diagnosed and rectified by a Citroën Workshop.

Brake Failure: Brake shoe linings or pads excessively worn, incorrect brake fluid (after overhaul), insufficient brake fluid, fluid leak, brake control valve defective, caliper failure. Remedies are obvious in each instance.

Brakes Ineffective: Shoe linings or pads worn, incorrect lining material, linings contaminated, air in brake system (bleed brakes), leak in pipes or cylinders.

Brakes pull to one side: Shoes or linings worn, incorrect linings or pads, contaminated linings, discs scored, fluid pipe blocked, unequal tyre pressures, brake caliper mounting loose, wheel bearings not properly adjusted, wheel brake cylinder seized. Remedy as necessary.

Brake pedal spongy: Air in hydraulic system. System must be bled of air.

Pedal travel too far: Linings or pads worn, discs scored, brake control valve or wheel brake cylinders defective, system needs bleeding. Rectify as necessary.

Loss of brake pressure: Fluid leak, air in system, leak in master or wheel brake cylinders. Place vehicle on dry ground and depress brake pedal. Check where fluid runs out and rectify as necessary.

Brakes binding: Piston in brake caliper seized, handbrake adjusted too tightly. Rectify as necessary.

Handbrake ineffective: Brake shoe pads worn, operating lever seized, handbrake needs adjustment. Rectify as necessary.

Excessive pedal pressure required: Brake pads worn, pads contaminated, brake control valve or wheel brake cylinders seized. Rectify as necessary.

Brakes squealing: Brake shoe pads worn so far that metal is grinding against disc. Remove and replace.

ELECTRICAL FAULTS

Starter motor failure:	2 to 5, 8, 9
No starter motor drive:	1 to 3, 5 to 7
Slow cranking speed:	1 to 3
Charge warning light remains on:	3, 10, 12
Charge warning light does not come on:	2, 3, 9, 11, 13
Headlamp failure:	2, 3, 11, 13, 14
Battery needs frequent topping-up:	11
Direction indicators not working properly:	2, 3, 9, 13, 14
Battery frequently discharged:	3, 10, 11, 12

Causes and Remedies

1. Tight engine. Check and rectify.
2. Battery discharged or defective. Re-charge battery or replace if older than 2 years.
3. Interrupted connection in circuit. Trace and rectify.
4. Starter motor pinion jammed in flywheel. Release.
5. Also 6, 7 and 8. Starter motor defective, no engagement in flywheel, pinion or flywheel worn or solenoid switch defective. Correct as necessary.
9. Ignition/starter switch inoperative. Replace.
10. drive belt loose or broken. Adjust or replace.
11. Regulator defective. Adjust or replace.
12. Generator inoperative. Overhaul or replace.
13. Bulb burnt out. Replace bulb.
14. Flasher unit defective. Replace unit.

Wiring Diagram Legend

Not all items are fitted to every model.

1 Warning lamps central display
5 Front cigarette lighter
6 Rear cigarette lighter
10 Ignition distributor
15 Alternator
20 L.H. horn
21 R.H. horn
35 Battery
40 Instrument cluster
4 ABS hydraulic block
45 Ignition coil
50 Supply connector box
53 Water temperature control unit
54 Bulb failure detection unit
55 Central door locking control unit
58 Remote control door lock
62 Earth connection box
100 Spark plugs
130 Light-on audible warning
140 ABS control unit
142 Injection control unit
143 Suspension control unit
150 Front anti-knock sensor
151 Rear anti-knock sensor
152 Engine speed sensor
153 Body movement sensor
155 L.H. front wheel ensor
156 R.H. front wheel sensor
157 L.H. rear wheel sensor
158 R.H. rear wheel sensor
159 Steering wheel sensor
160 T.D.C. sensor
170 Flasher unit
180 Additional air control
183 Air blower control
210 Light switch
211 L.H. switch (illumination, direction indicator, horn)
212 R.H. switch (front and rear screenwipers)
Parking selector switch
215 Rear view mirror switch
270 H.T. coil suppressor
299 Horn switch
300 Ignition switch
301 Glovebox light switch
302 Luggage boot light switch
305 Driver's door locking switch
306 Passenger's door locking switch
307 L.H. rear door locking switch
308 R.H. rear door locking SW
310 L.H. front door switch
311 R.H. front door switch
312 L.H. rear door switch
313 R.H. rear door switch
314 Reversing light switch
315 Handbrake switch
316 Engine coolant low level warning switch
317 Hydraulic fluid level switch
318 Throttle butterfly switch
319 Brake light switch
320 Rotary switch
321 Tailgate locking switch
326 Starter motor switch
340 Air flow meter
350 Starter motor
375 Ignition distributor
380 to 383 Door sill lighting
385 Front ashtray lighting
386 Rear ashtray lighting
387 Ashtray lid lighting
389 Luggage boot light
391 L.H. number plate light
392 R.H. number plate light
393 Engine comp. lighting
394 Heater control lighting
429 Fuel pump cut-out valve
430 Canister discharge valve
431 Fast idle solenoid valve
432 Idling actuator
434 Canister solenoid valve
435 Float chamber solenoid
436 Idle cut-off solenoid
441 Vacuum advance solenoid valve
480 L.H. rear lamp
481 R.H. rear lamp
482 L.H. front fog lamp
483 R.H. front fog lamp
484 L.H. rear fog lamp
485 R.H. rear fog lamp
486 L.H. dipped beam
487 R.H. dipped beam
488 L.H. front flasher lamp
489 R.H. front flasher lamp
490 L.H. rear flasher lamp
491 R.H. rear flasher lamp
492 L.H. side lamp
493 R.H. side lamp
494 L.H. rear stop/tail lamp
495 R.H. rear stop/tail lamp
496 L.H. tail light (tailgate)
497 R.H. tail light (tailgate)
498 L.H. reversing light
499 R.H. reversing light
500 L.H. flasher repeater
501 R.H. flasher repeater
502 L.H. headlamp
503 R.H. headlamp
504 L.H. brake light
505 R.H. brake light
550 L.H. front loudspeaker
551 R.H. front loudspeaker
554 L.H. rear loudspeaker
555 R.H. rear loudspeaker
570 Injector
587 Front fog light switch
588 Rear fog light switch
589 Hazard warning lamp switch
590 Driver's window winder switch
591 Passenger's window winder switch, driver's door
592 Passenger's window winder switch, passenger's door
597 Heated rear window switch
608 Headlamp adjusting device switch
650 Fuel gauge
670 Brake pressure switch
671 Engine oil pressure switch
672 Hydraulic pressure switch
680 Ignition module
681 Air blower control module
694 Windscreen wiper motor
695 Rear windscreen wiper switch
696 L.H. front window winder motor
697 R.H. front window winder motor
698 L.H. rear window winder switch
699 R.H. rear window winder switch
703 Drivers door locking motor
704 Pass. door locking motor
705 LH rear door locking MOT
706 RH rear door locking MOT
708 Boot lid locking MOT
720 Engine cooling fan, L.H.
721 Engine cooling fan, R.H.
742 Central interior lamp
750 L.H. front brake pads
751 R.H. front brake pads
755 Petrol pump
756 Headlamp washer pump
757 Windscreen washer pump
758 Rear screen W/Pump
765 Radio
770 Throttle spindle potentiometer

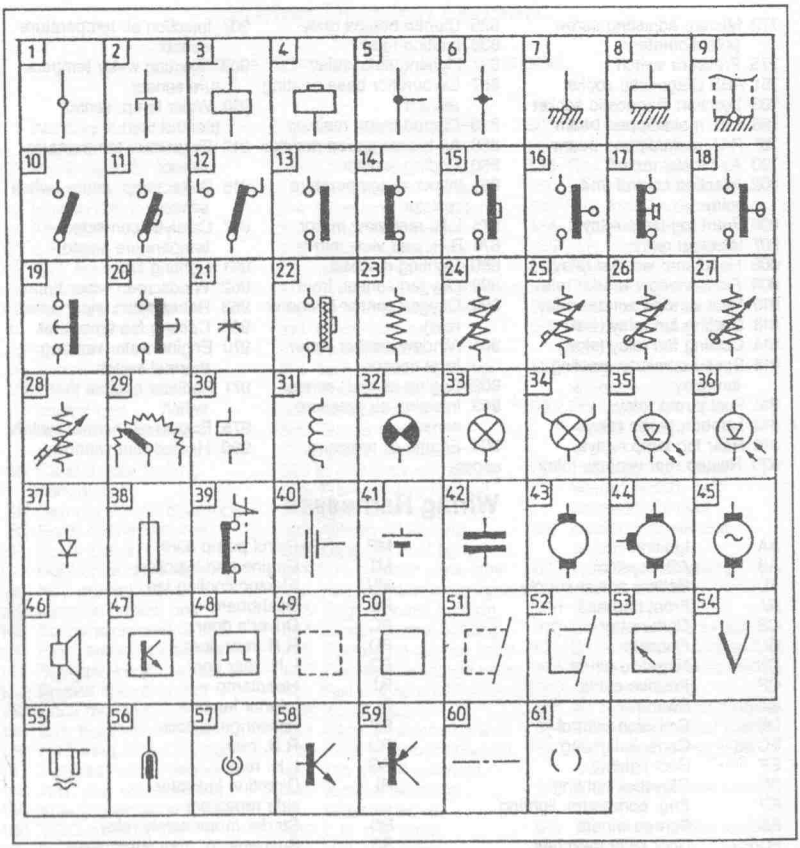
772 Mixture adjusting screw potentiometer
775 Pressure switch
781 ABS Diagnostic socket
783 Injection diagnostic socket
786 L.H. main/dipped beam
787 R.H. main/dipped beam
790 Air blower motor
802 Injection control unit relay
806 Front fog lamp relays
807 Injection relay
808 Headlamp washer relay
809 Front window winder relay
810 Rear window winder relay
813 Cooling fan relay (fast)
814 Cooling fan relay (slow)
815 Speed converter cooling fan relay
816 Fuel pump relay
818 Lambda probe relay
819 Rear fog lamp relays
820 Heated rear window relay
825 Dipped beams relay
836 Ignition relay
837 Lighting timer relay
857 Carburettor base heating resistor
858 Dipped beam resistor
859 Air blower speed resistor
860 Coding resistor
861 Intake air temperature resistor
875 L.H. rear view mirror
876 R.H. rear view mirror
880 Lighting rheostat
899 Oxygen sensor, front
900 Oxygen sensor (alone or rear)
901 Window washer water level sensor
902 Engine oil level sensor
903 Injection air pressure sensor
904 Engine oil pressure sensor
907 Injection air temperature sensor
909 Injection water temperature sensor
910 Water temp. sensor (control unit)
912 Evaporator temperature sensor
915 Water temperature switch sensor
917 Catalytic converter temperature sensor
961 Lighting timer
962 Windscreen wiper timer
963 Rear screen wiper timer
964 Cooling fan timer unit
970 Engine water warning thermal switch
971 Radiator coolant thermal switch
975 Engine oil thermal switch
990 Heated rear window

Wiring Harnesses

AA	Ignition
AB	ABS system
AL	Battery power supply
AV	Front harness
CB	Carburettor
CL	Console
CN	Negative cable
CP	Positive cable
CT	Switch
DP	Emission control
EC	Console lighting
EF	Boot lighting
EG	Glovebox lighting
EP	Eng. compartm. lighting
ES	Screen wipers
FD/FG	Door pillar switches
FP	Handbrake
FR	Rear lamps
HB	Interior
HY	Hydraulics
JC/JM	Injection (body/engine)
JN/JT	Injection/Injector
LP	Fuel pump junction
MB	Junction box earth
MF	Lamps earth
MP	Petrol pump earth
MT	Engine and injection
MV	Electric cooling fan
PB	Dashboard
PC	Driver's door
PD	R.H. rear door
PG	L.H. rear door
PJ	Headlamp
PL	Interior lamp
PP	Passenger's door
RD	R.H. rear
RG	L.H. rear
RL	Direction indicator side repeaters
RS	Starter motor safety relay
SB	Suspension, front subframe
SM	Suspension, engine
ST	Suspension, dashboard
TJ	Headlamp adjustment device switch
UD	R.H. brake pad wear
UG	L.H. brake pad wear
VC	Differential lock warning lamp
VD	R.H. side tailgate
VG	L.H. side tailgate

Explanation symbols in Wiring Diagrams (see Page 206)

1 Socket connection
2 Pin conenction
3 Connector connection
4 Connector connection
5 Junction not to be dismantled
6 Junction not to be dismantled (with other connection possibilities)
7 Socket earth
32 Warning lamp
33 Light bulb
34 Double-filament bulb
35 Light emitting diode
36 Photo diode
37 Diode
38 Fuse
39 Thermal circuit breaker

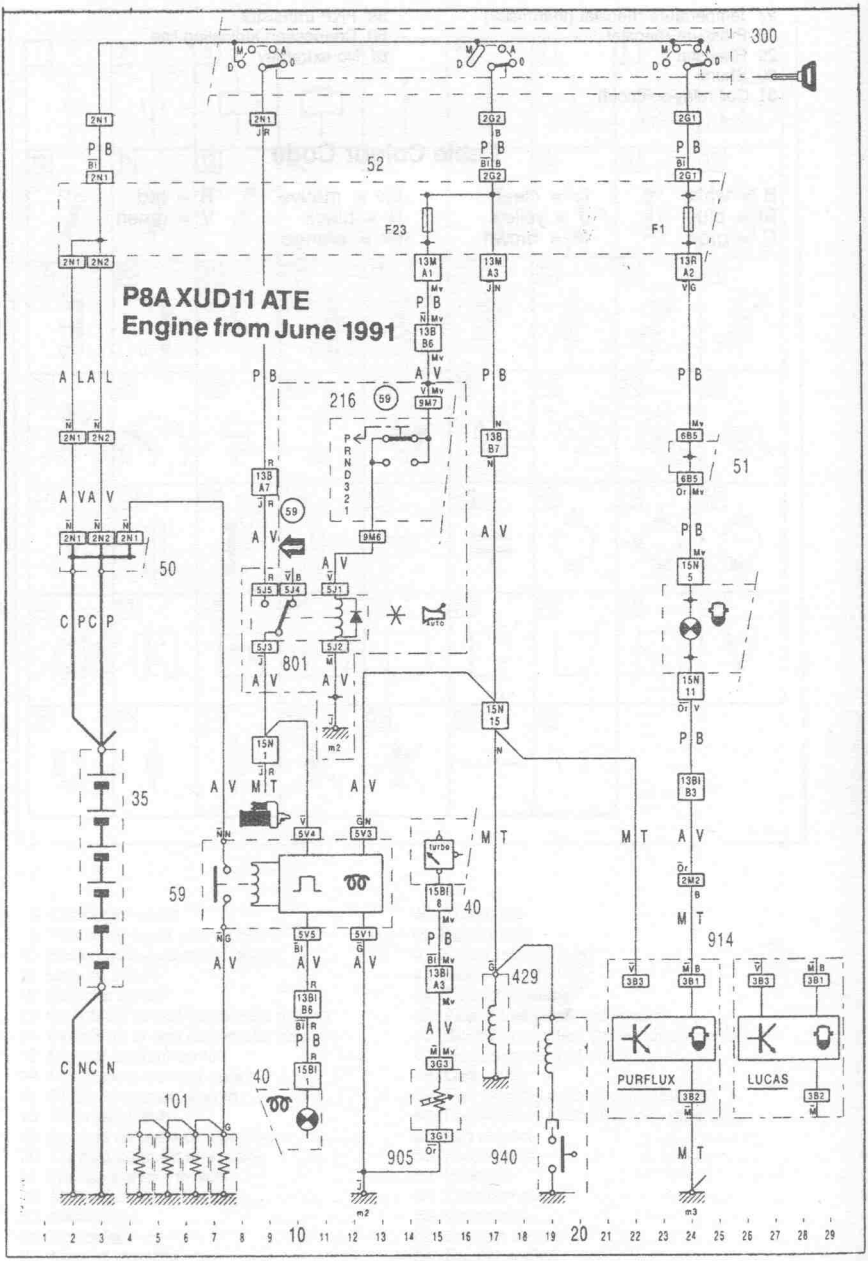


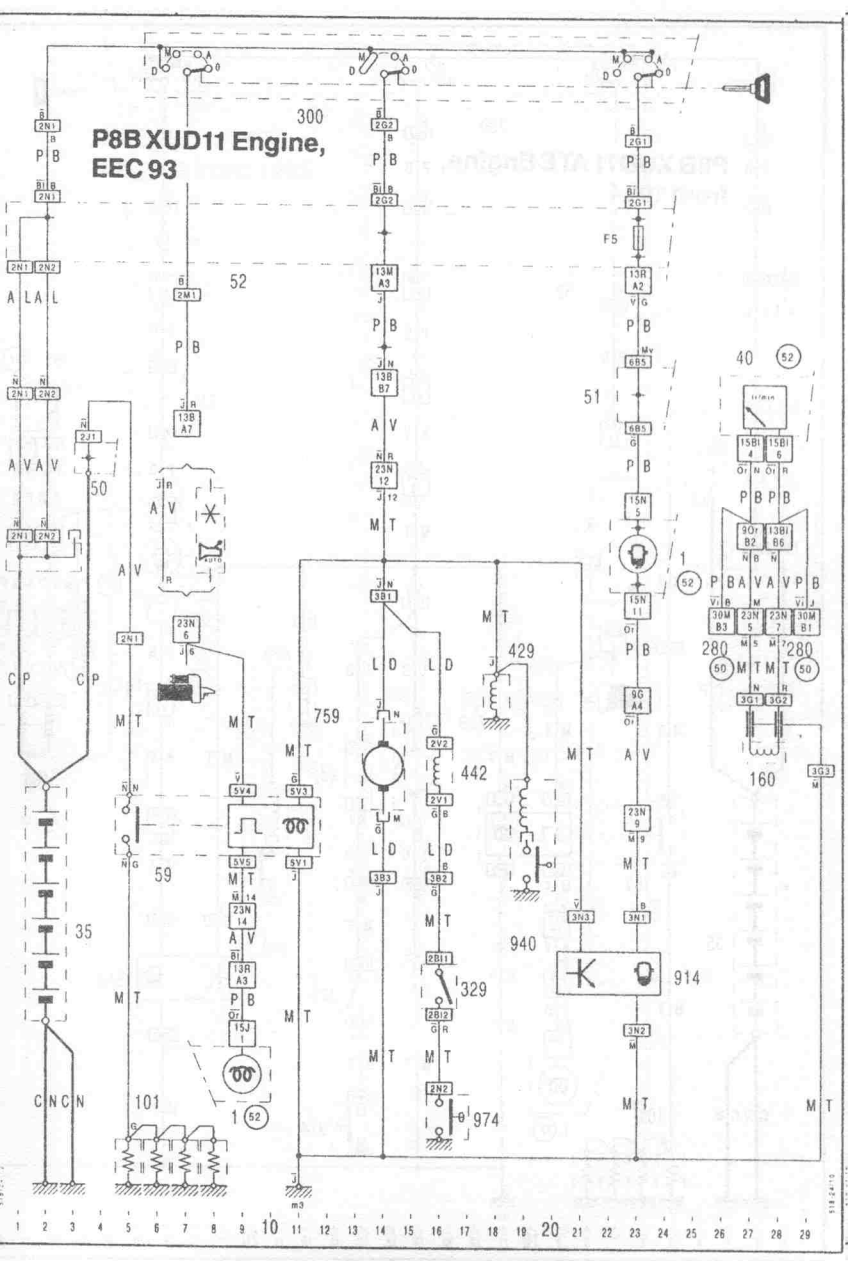
8 Connector earth
9 Part body earth connection
10 Switch (non-automatic return)
11 Manual switch
12 Selector switch
13 Switch on at rest (automatic return)
14 Switch off at rest (automatic return)
15 Manual contact switch
16 Mechanical contact switch
17 Pressure contact switch
18 Thermal switch
19 Contact delayed on opening
20 Contact delayed on closing
21 Friction contact switch
22 Manual contact switch
23 Resistance
24 Rheostat
25 Manual rheostat
26 Mechanical rheostat
40 Screening
41 Battery cell
42 Suppressor
43 Motor
44 2-speed motor
45 Alternative power generator
46 Sound equipment (horn, loudspeaker)
47 Electronic control unit
48 Delay unit
49 Part framing (with circuit diagram)
50 Part framing (without circuit diagram)
51 Part extract
52 Part extract
53 Indicator
54 Thermo-couple
55 Electrodes
56 Oxygen sensor
57 Supply socket
58 NPN transistor

27 Temperature rheostat (thermistor)
28 Pressure rheostat
29 Rheostat
30 Shunt
31 Coil relay-solenoid)
59 PNP transistor
60 Connection indicating line
61 No extremity

Cable Colour Code

B = white	Ic = clear	Mv = mauve	R = red
Bl = blue	J = yellow	N = black	V = green
G = grey	M = brown	Or = orange	


P8A XUD11 ATE
Engine from June 1991
300
52
F23
F1
216
59
801
50
51
35
59
40
914
PURFLUX
LUCAS
101
905
940
429
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29


P8B XUD11 Engine,
EEC 93
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101
759
442
429
940
329
974
914
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8
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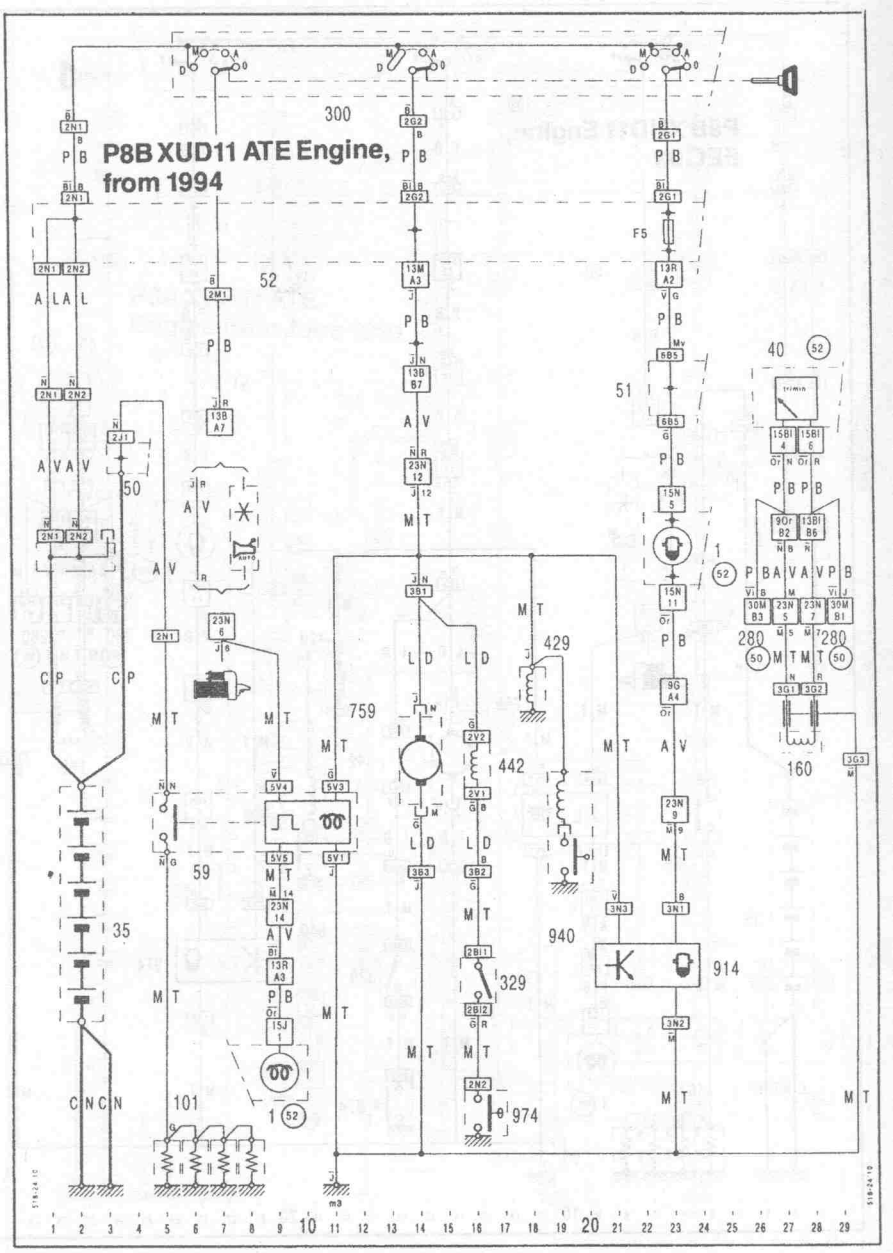
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300
52
51
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35
101
759
442
429
940
914
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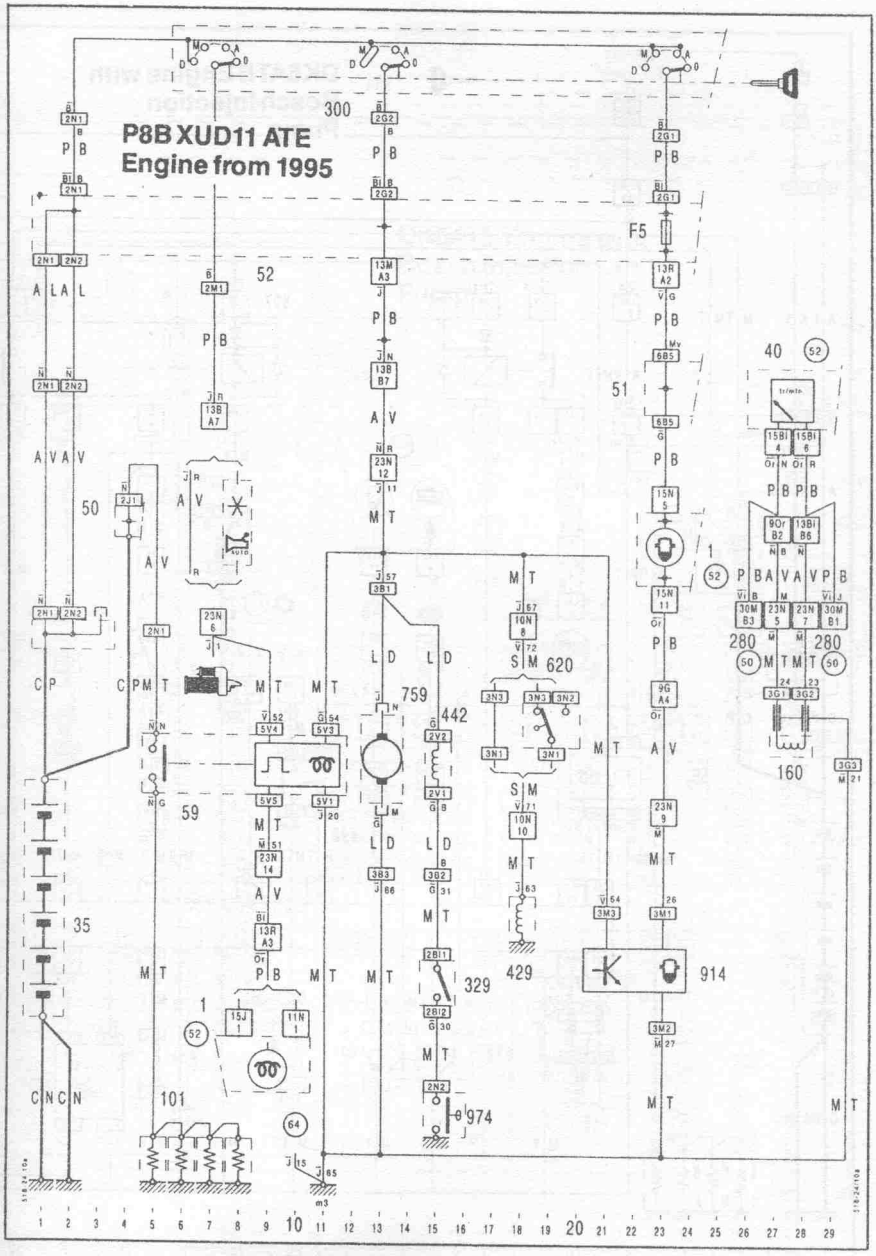
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29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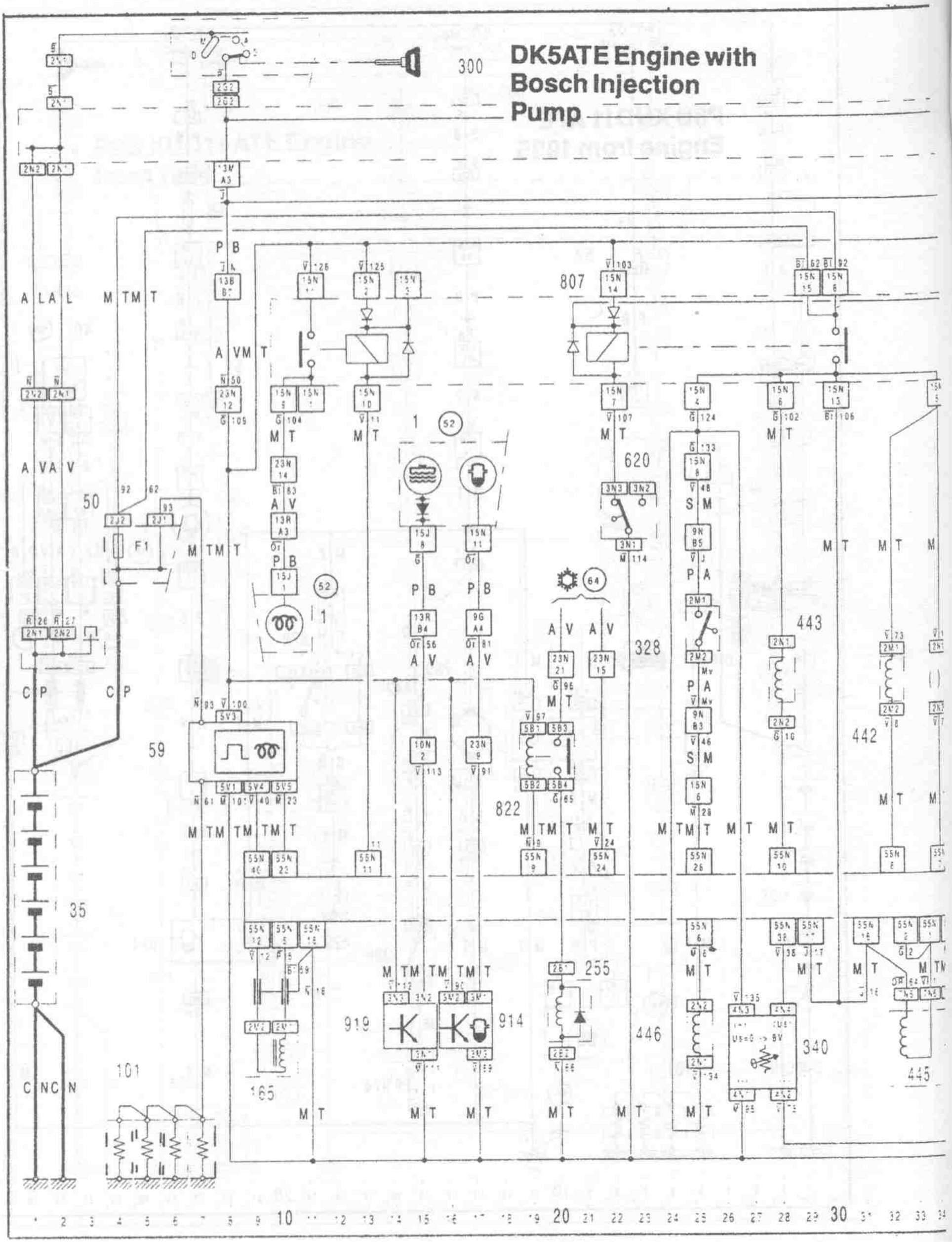
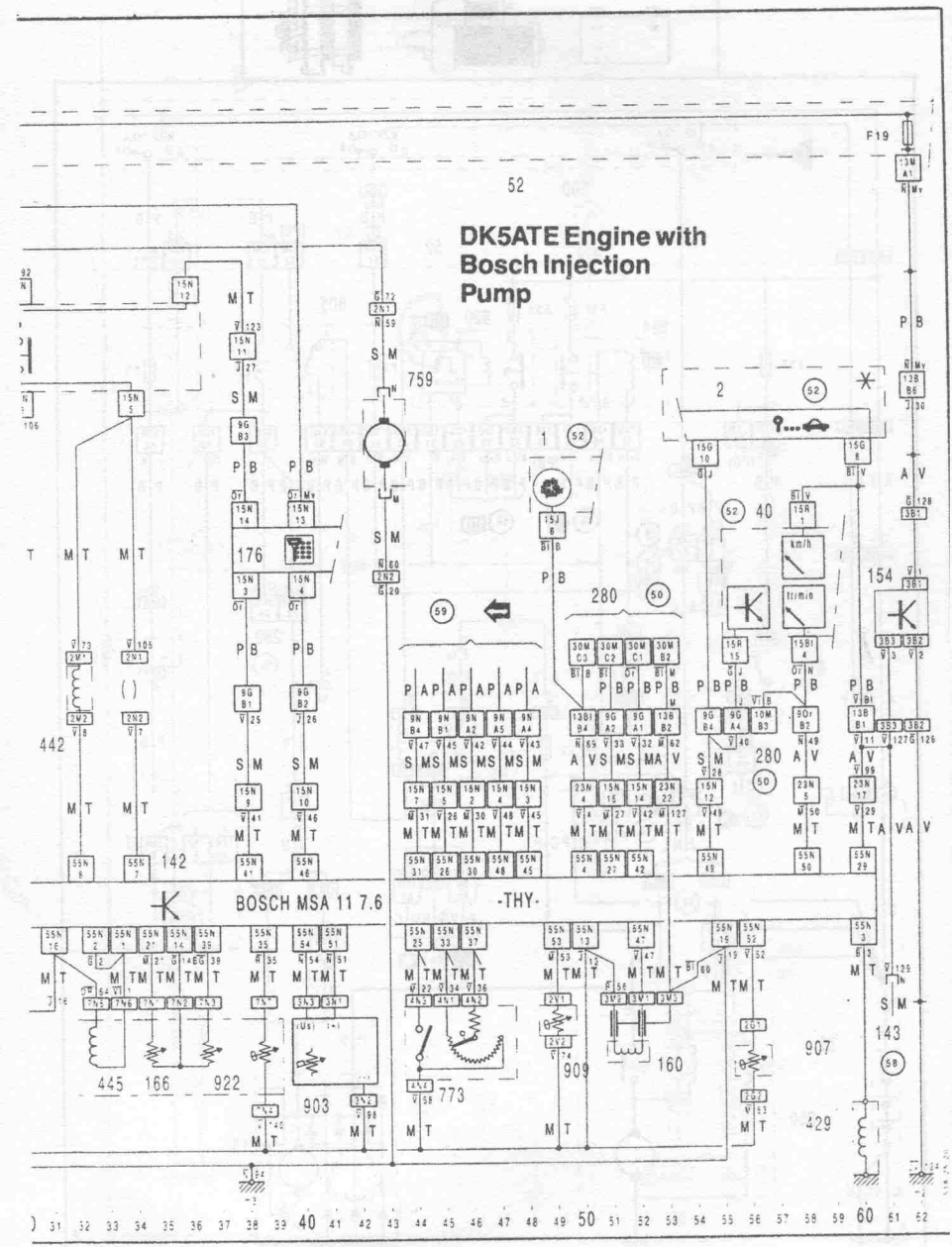
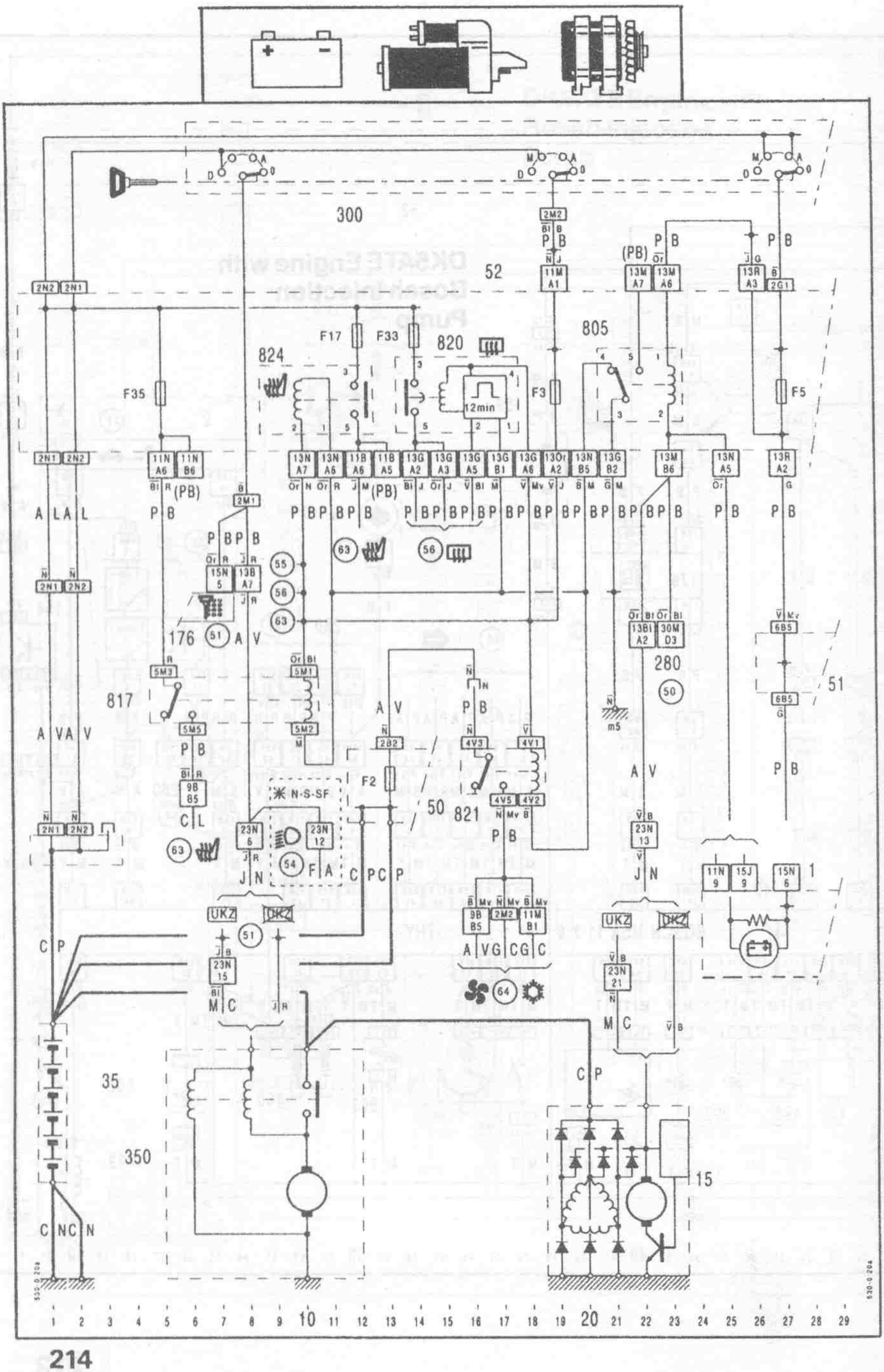
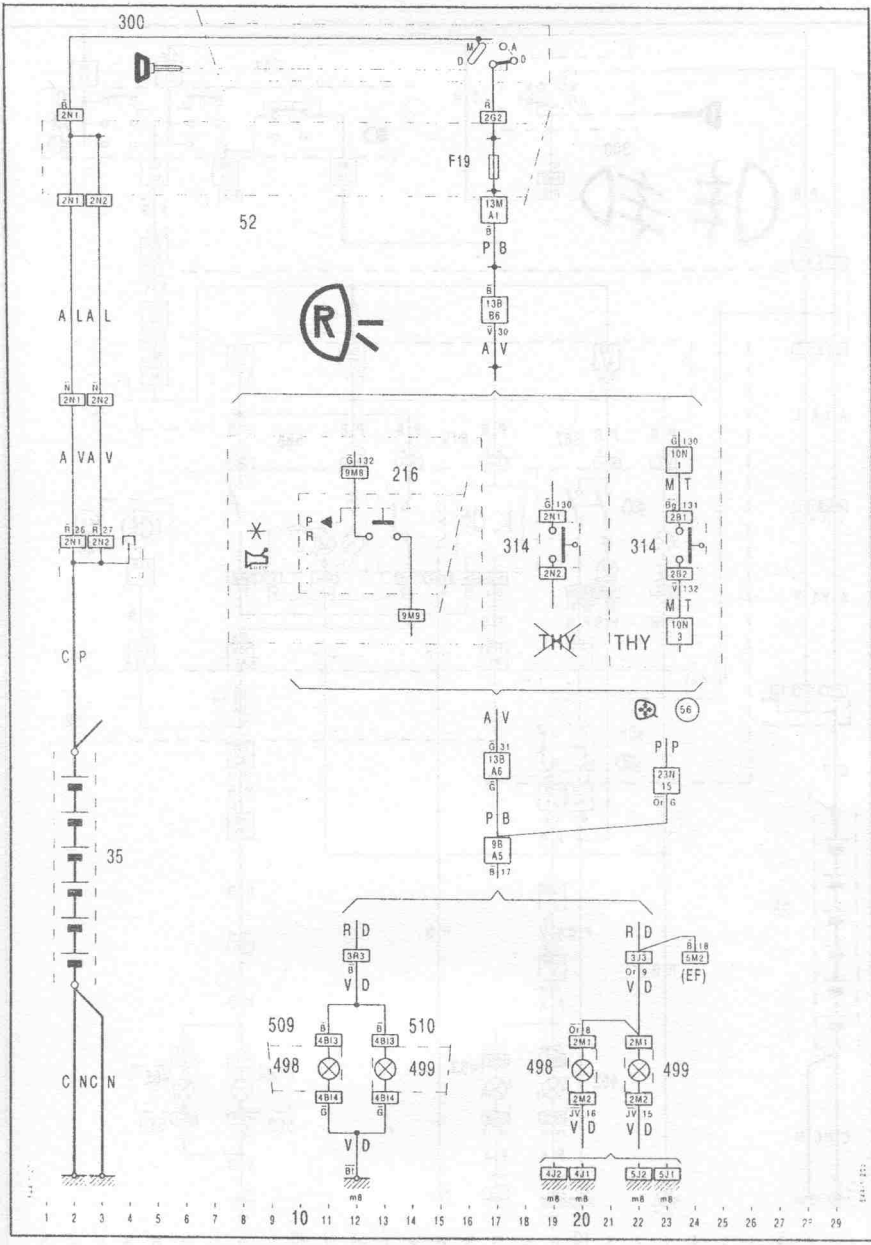
Engine from 1995
300
52
F5
51
40
50
35
59
101
759
442
620
429
329
914
974
160
280
280

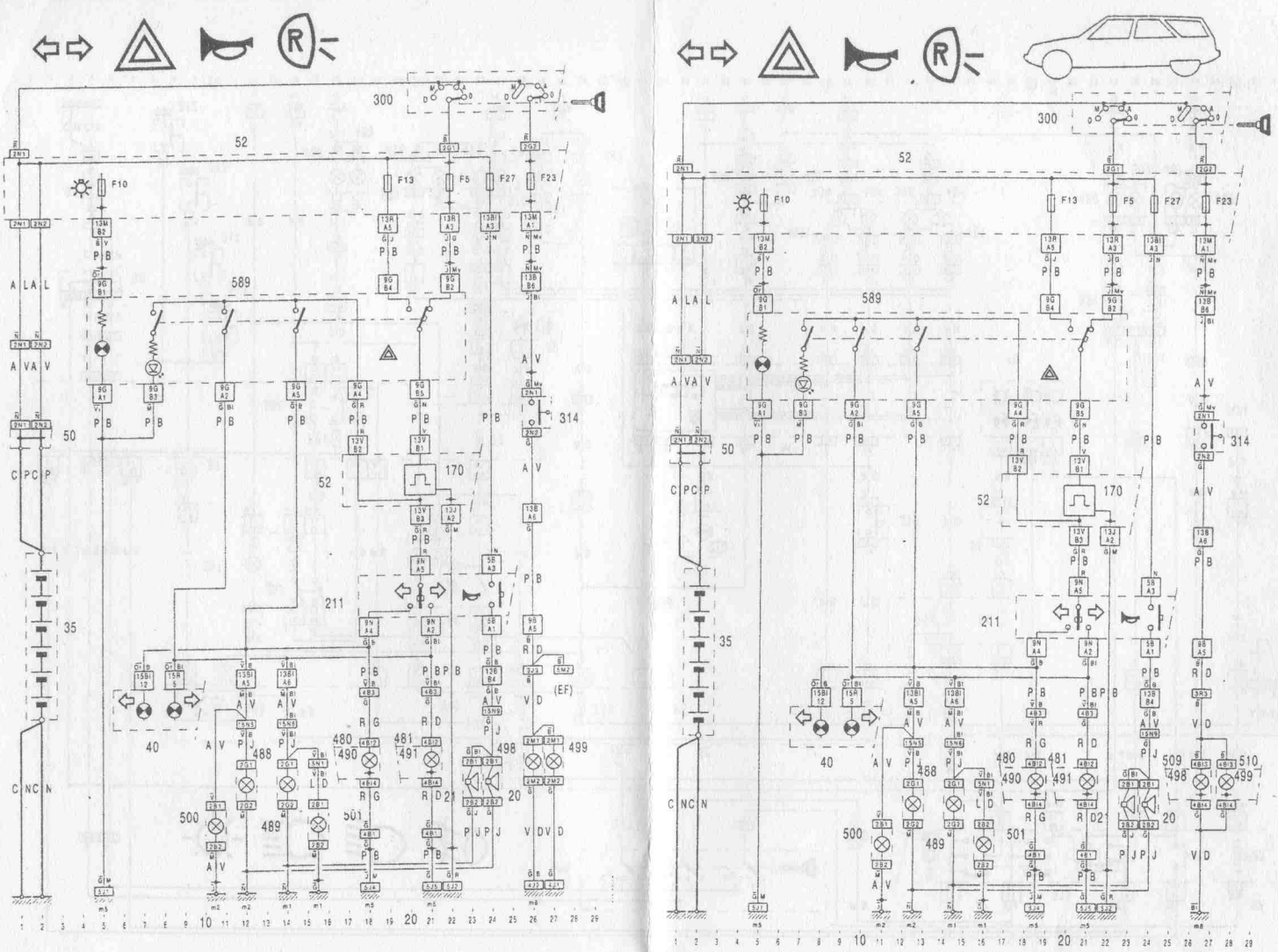
DK5ATE Engine with Bosch Injection Pump

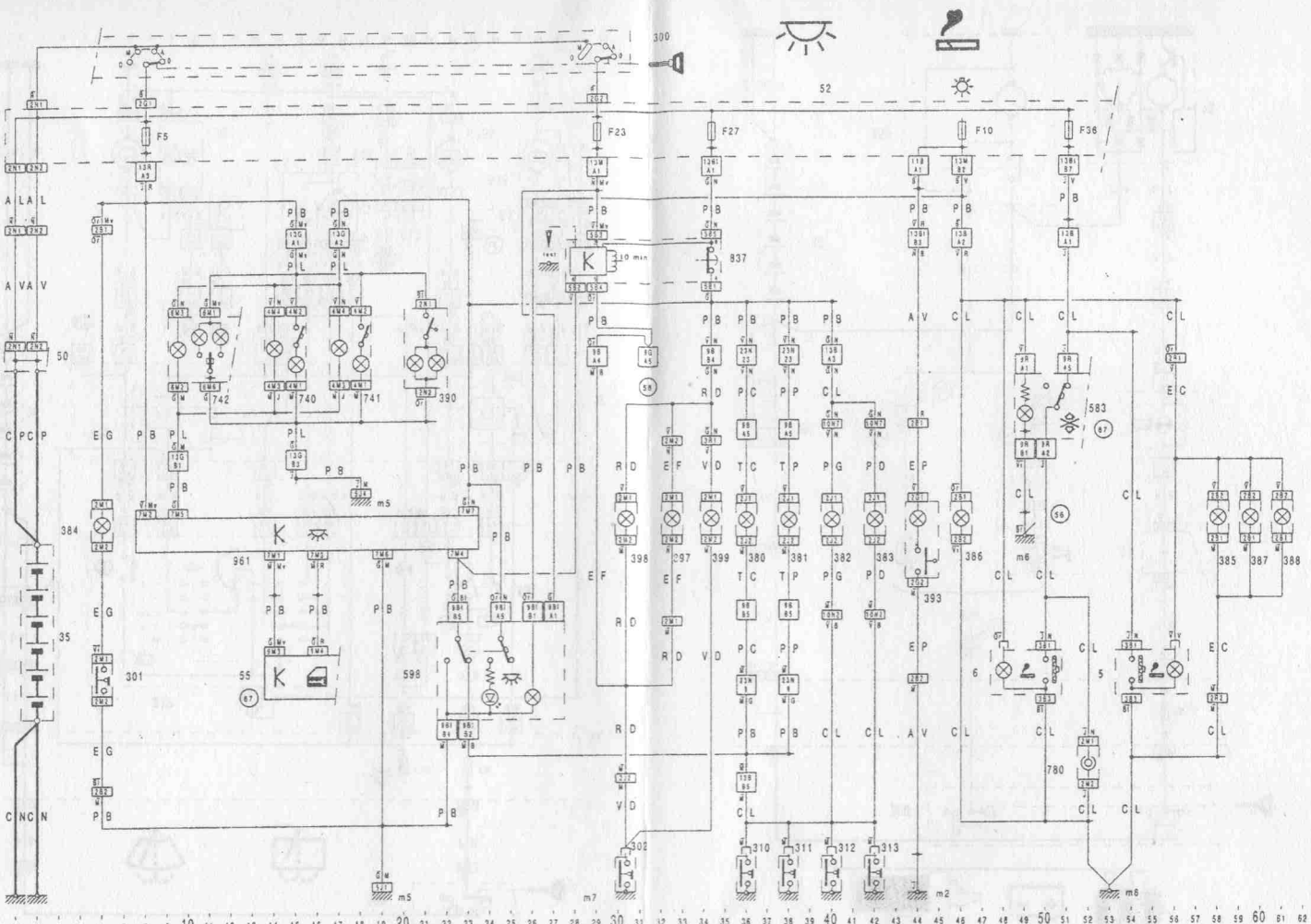


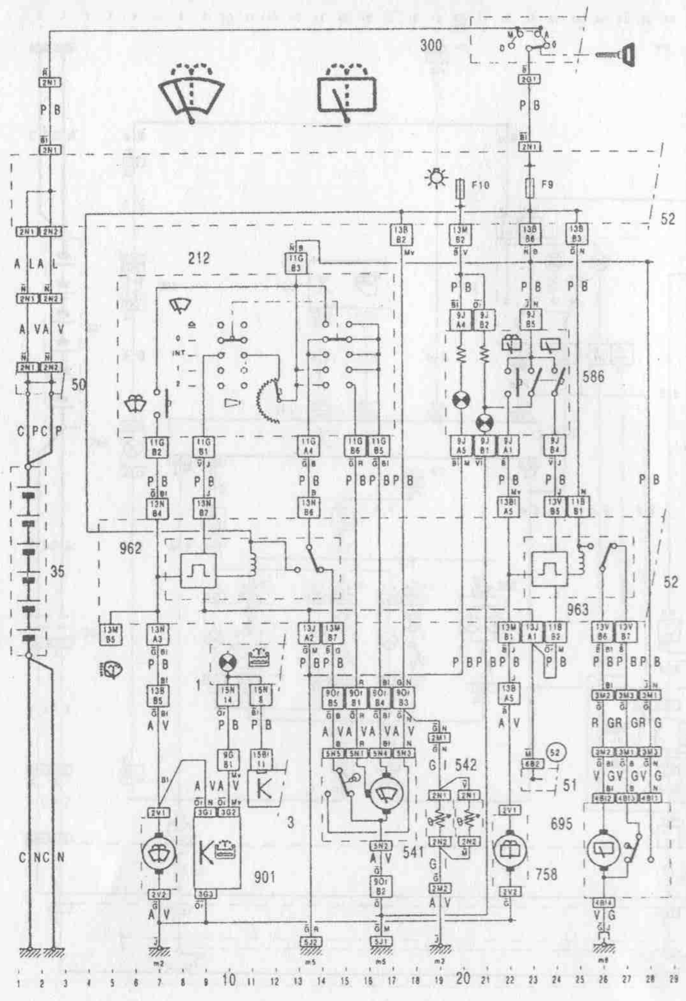

52
DK5ATE Engine with Bosch Injection Pump
759
176
442
142
445
166
922
903
773
909
160
907
429
143
154
280
BOSCH MSA 11 7.6
-THY-


300
52
824
F17
F33
820
12min
805
F35
F3
F5
(PB)
176
817
51
280
50
821
F2
N-S-SF
UKZ
35
350
15
64
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29


300
52
F19
216
314
314
THY
35
509
510
498
499
498
499
(EF)
56
A L A L
A V A V
C P
C N C N
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29


300
52
F10
F13
F5
F27
F23
589
A L A L
A V A V
50
C P C P
35
C N C N
314
170
211
40
500
489
488
490
480
491
481
498
499
509
510
501
20
(EF)


300
52
F5
F23
F27
F10
F36
A L A L
A V A V
C P C P
E G
C N C N
P B
P L
50
35
384
301
55
598
961
742
740
741
390
837
10 min
58
398
397
399
380
381
382
383
386
393
583
56
6
5
780
385
387
388
310
311
312
313
302
m5
m7
m2
m6
m8



300
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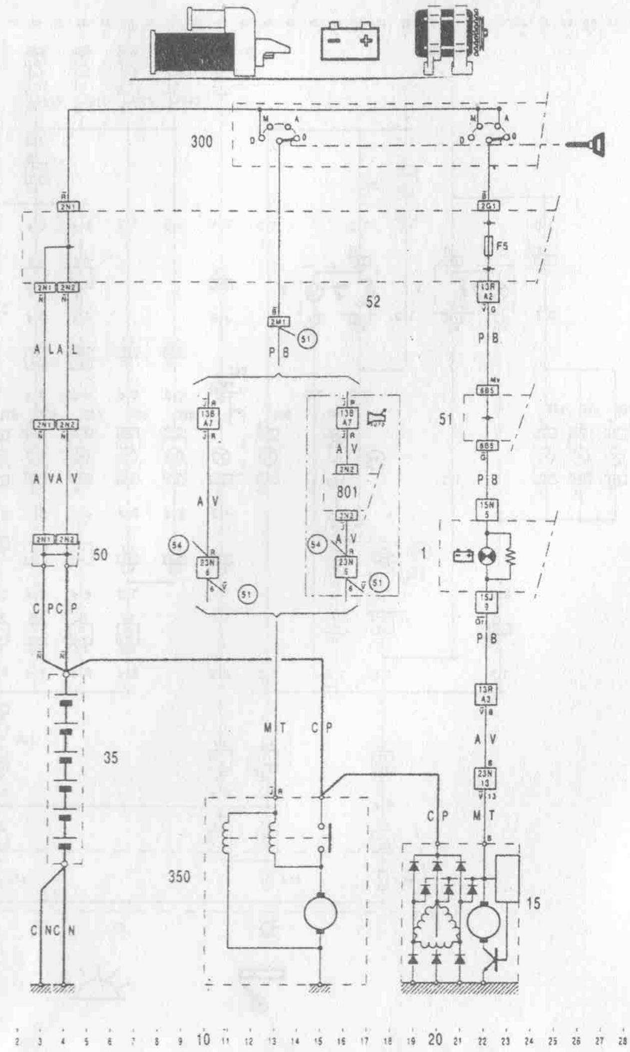
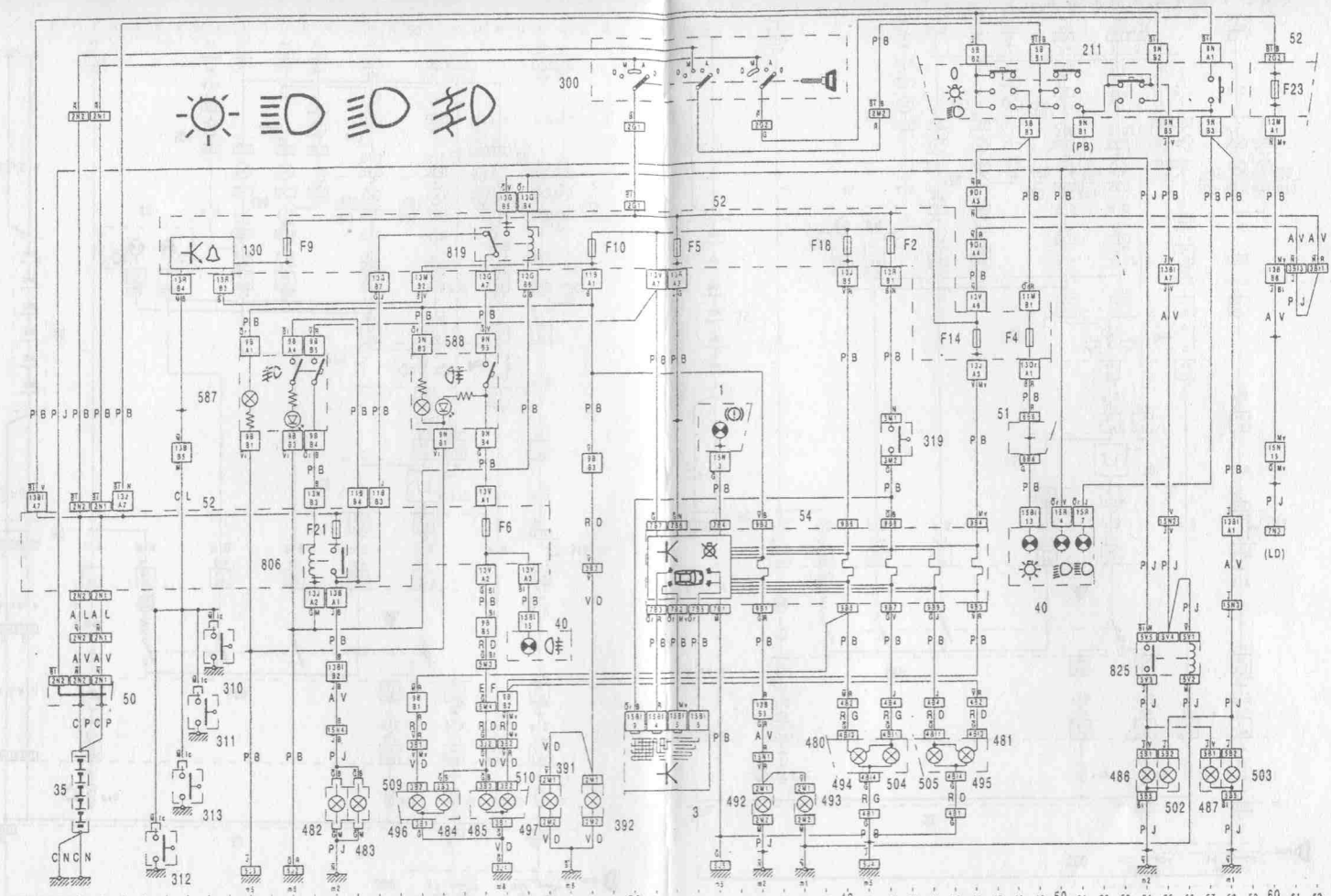
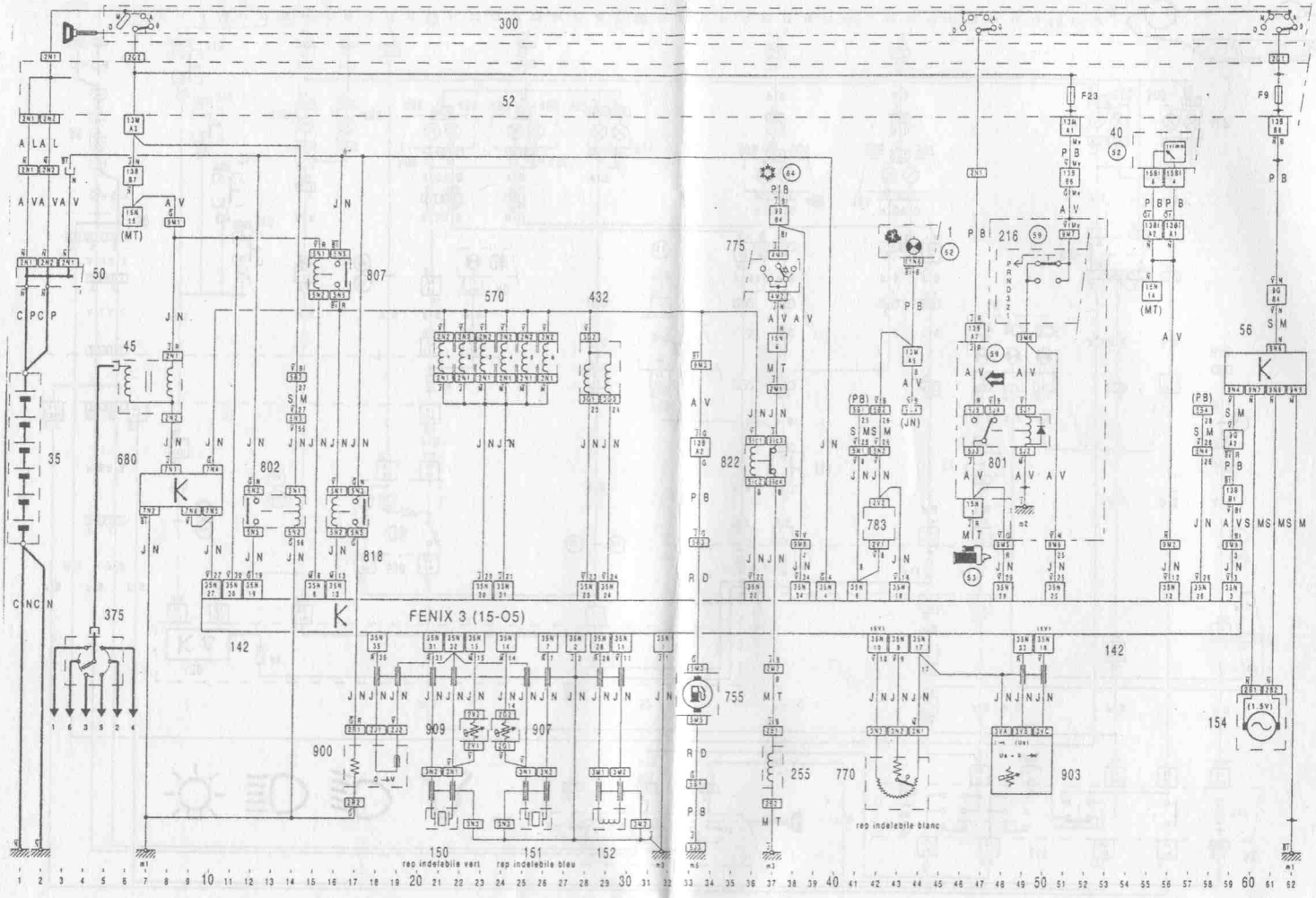
962
35
50
52
586
963
F9
F10
541
542
695
758
901
51
3
1



300
52
51
50
35
801
350
15
1
F5


300
211
(PB)
52
F23
130
F9
819
F10
F5
F18
F2
F14
F4
588
587
806
F21
F6
319
54
51
40
(LD)
825
310
311
313
312
50
35
CNCN
CPCP
482
483
509
496
484
485
510
497
391
392
3
492
493
480
494
504
505
481
495
486
502
487
503
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62


300
52
F23
F9
40
56
50
45
35
680
807
570
432
818
822
775
216
801
783
755
255
770
903
909
907
900
375
142
154
150
151
152
FENIX 3 (15-05)
rep indelebile vert
rep indelebile bleu
rep indelebile blanc
(MT)
(PB)
(JN)
(1.5V)
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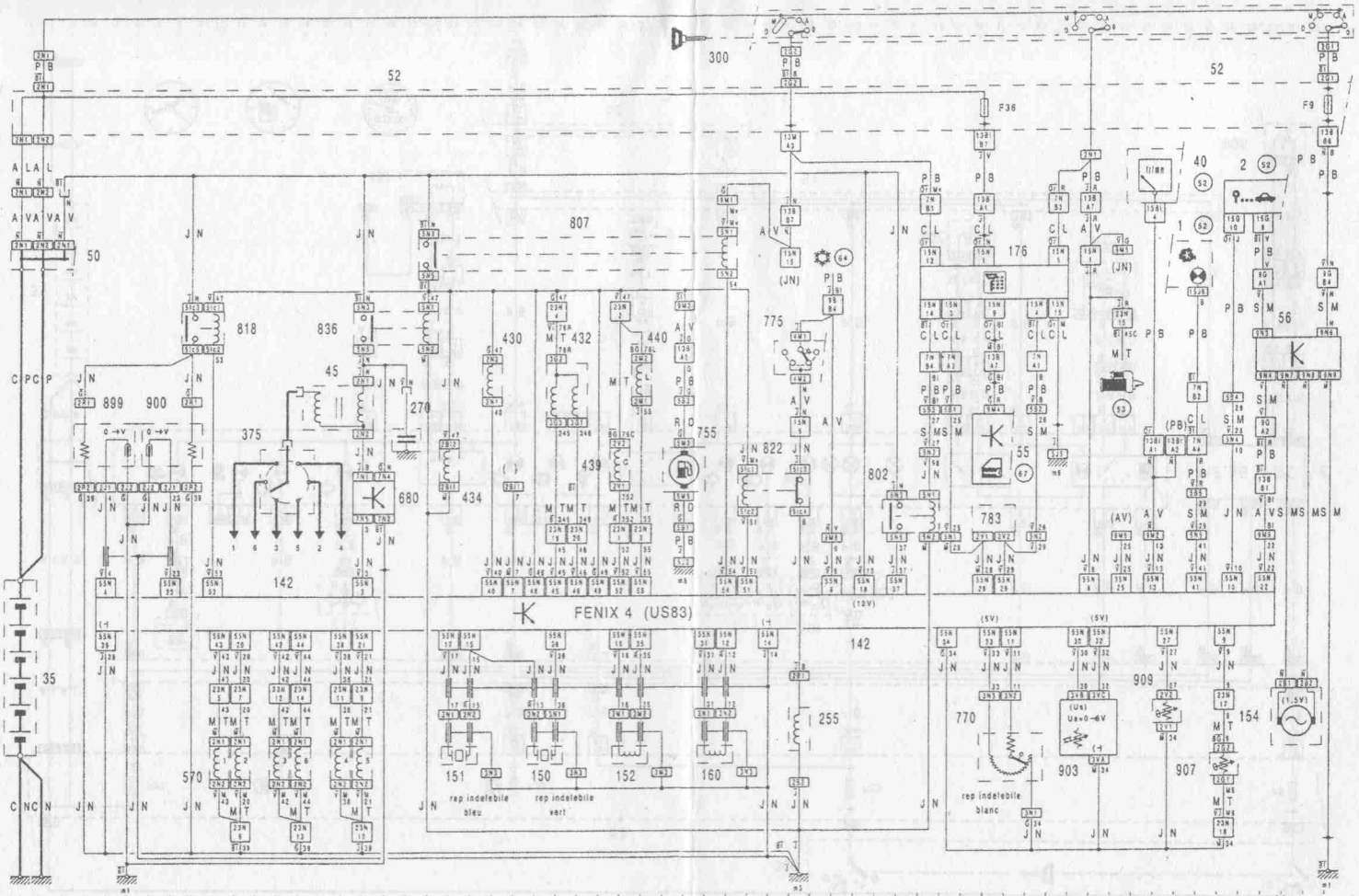
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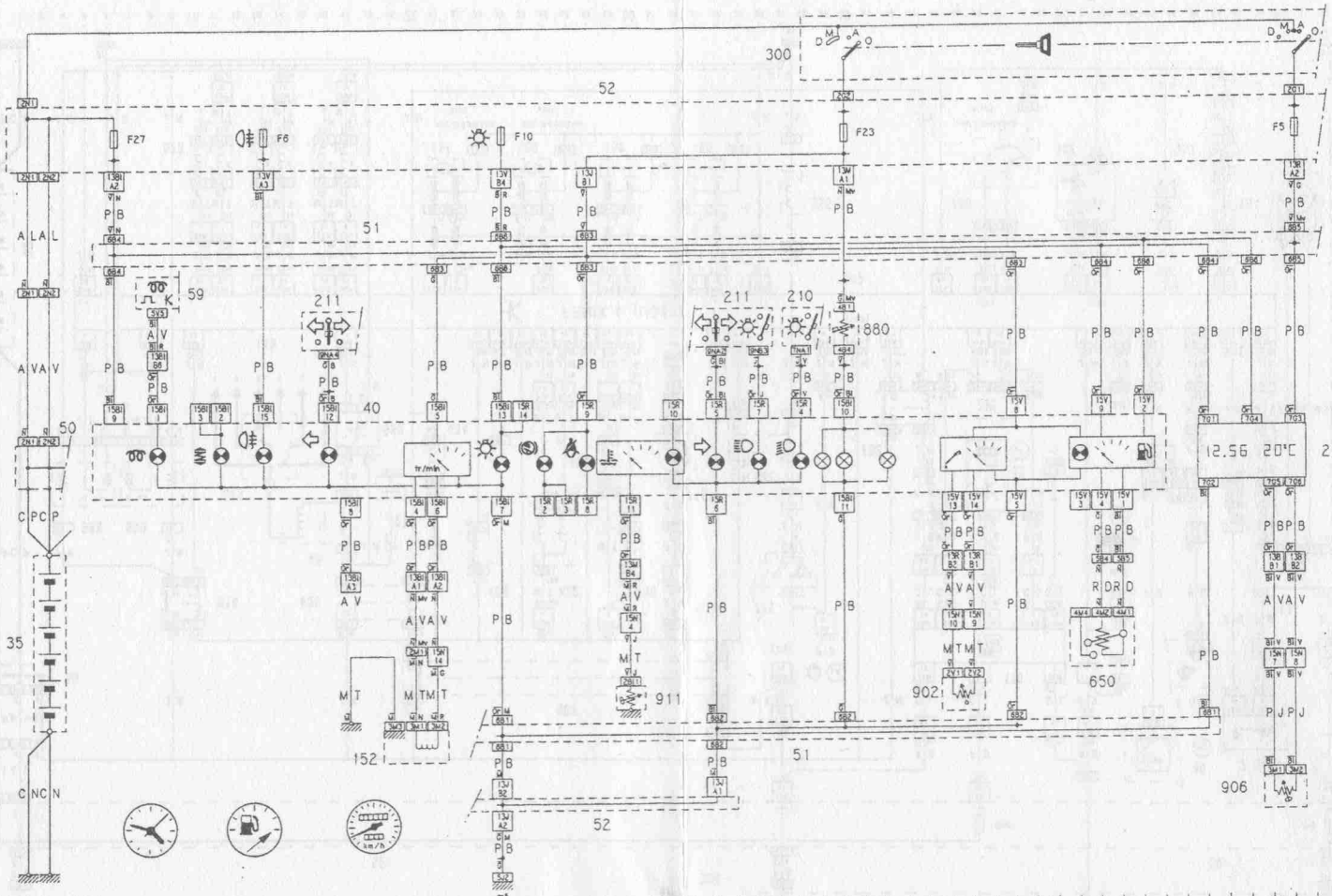
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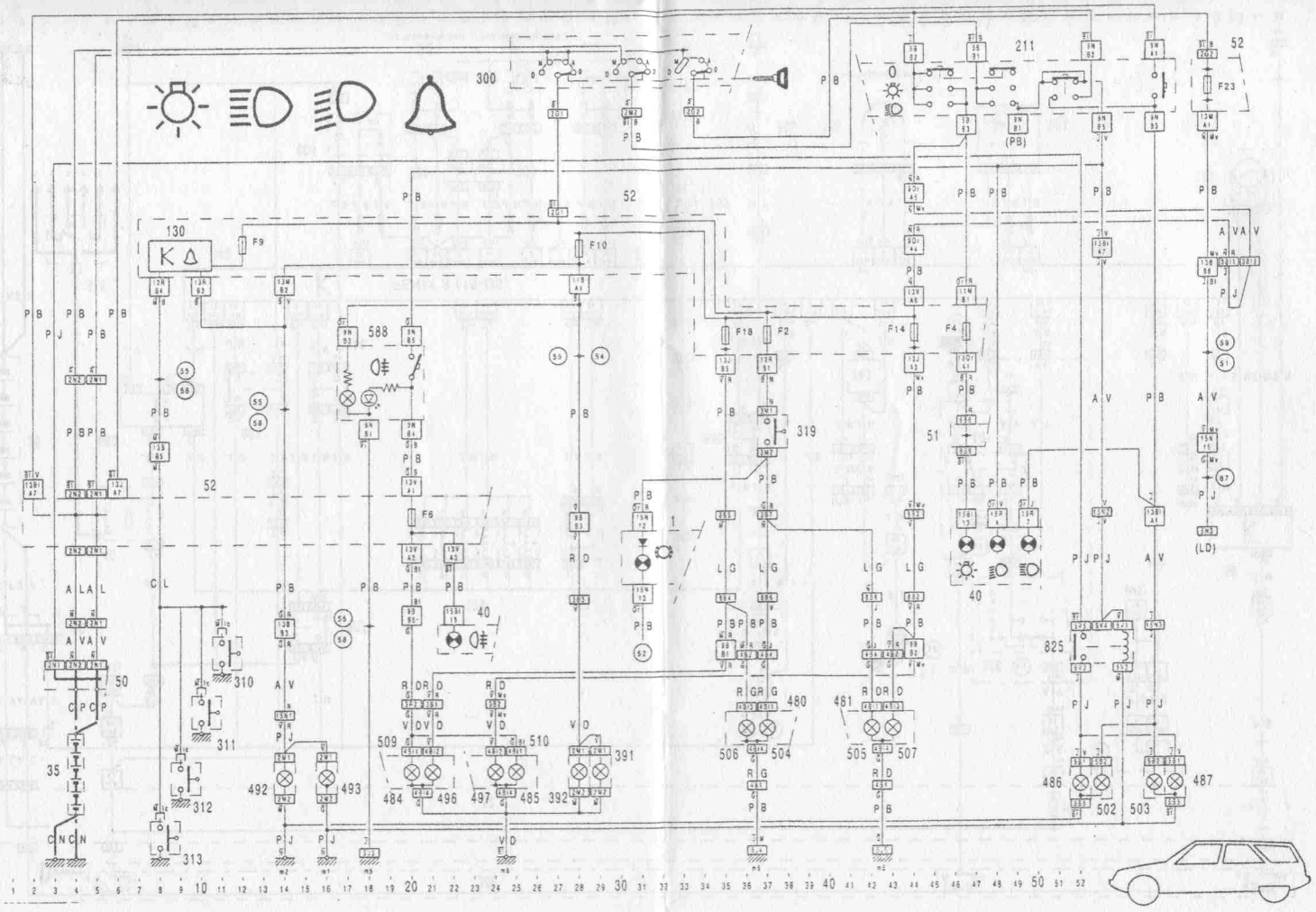
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THIS MANUAL COVERS:

CITROËN XM
DIESEL AND TURBODIESEL ENGINES
P8A XUD11 DIESEL ENGINE
P8A, PHZ, P8C XUD11 TURBODIESEL ENGINE
DK5 THY TURBODIESEL ENGINE
BOSCH, ROTO-DIESEL, LUCAS INJECTION
SALOON AND ESTATE MODELS
TO 1997

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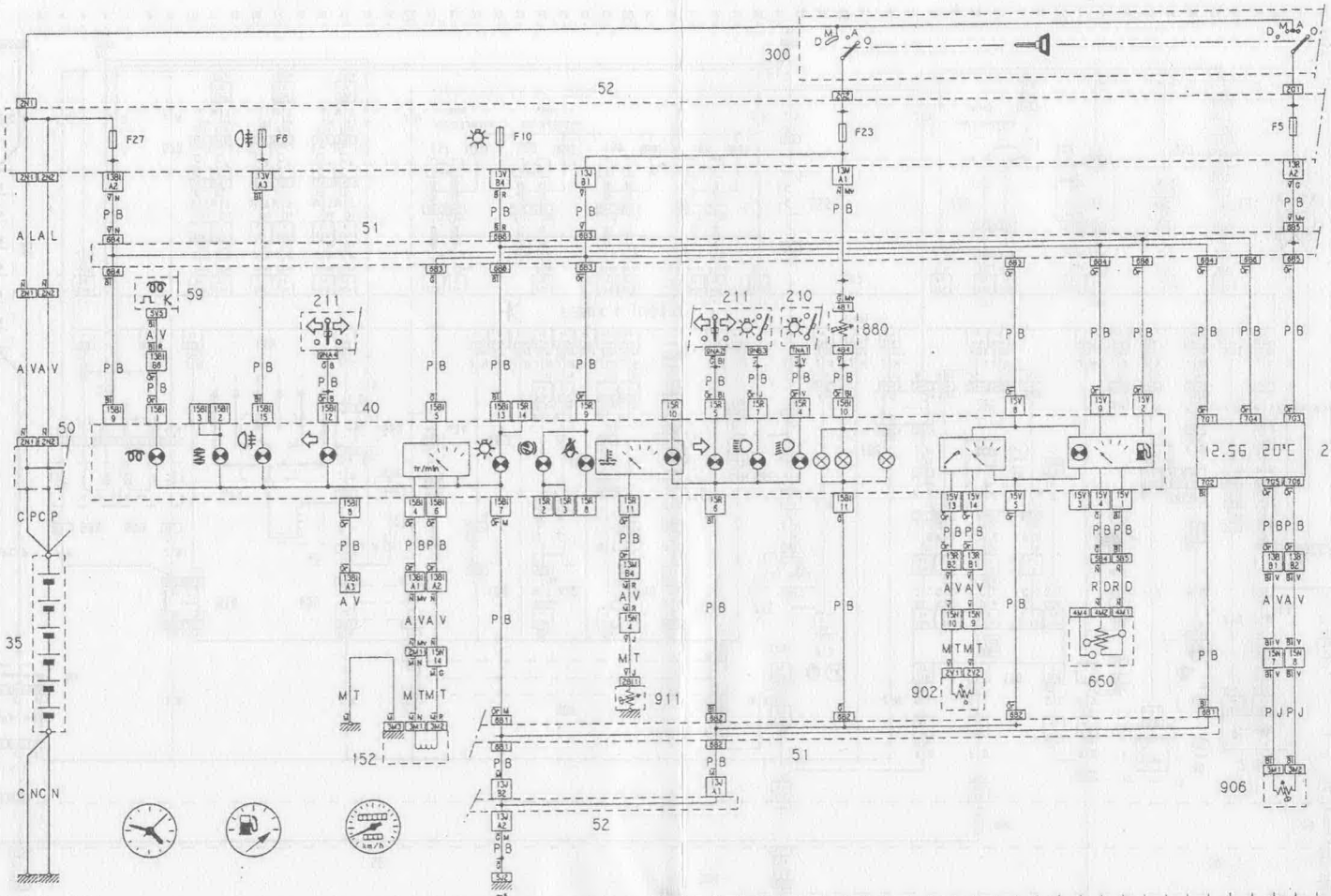
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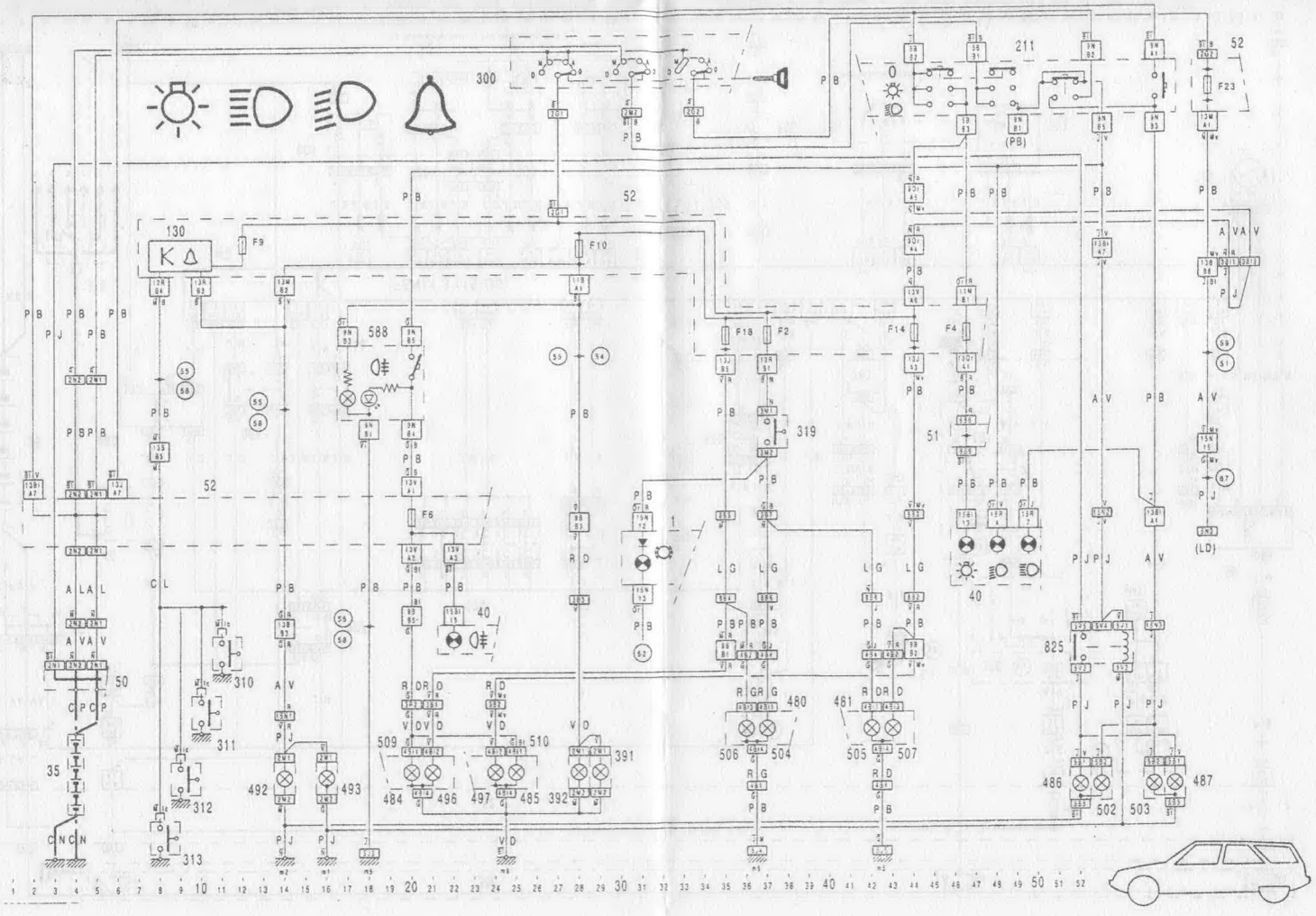
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